International Telecommunication Union

Regional Radiocommunication Conference for planning of the digital terrestrial broadcasting service in parts of Regions 1 and 3, in the frequency bands 174-230 MHz and 470-862 MHz

First Session - Geneva, 2004

RRC ITU 2004

REPORT TO THE SECOND SESSION OF THE CONFERENCE

International Telecommunication Union

CONTENTS

RESOLUTION 1

Principles in establishing a new regional plan in the terrestrial broadcasting service in Region 1 (parts of Region 1 situated to the west of meridian 170° E and to the north of parallel 40° S, except the territories of Mongolia) and in the Islamic Republic of Iran, in the frequency bands 174-230 MHz and 470-862 MHz

The first session of the Regional Radiocommunication Conference (Geneva, 2004),

considering

a) that the European VHF/UHF Broadcasting Conference (Stockholm, 1961) adopted provisions relating to the use of the broadcasting service (sound and television) in the European Broadcasting Area for the bands between 41 MHz and 960 MHz, with the exception of the bands 68-73 MHz and 76-87.5 MHz;

b) that the Regional Administrative Conference for the Planning of VHF/UHF Television Broadcasting in the African Broadcasting Area and Neighbouring Countries (Geneva, 1989) adopted provisions and a related plan concerning the television broadcasting service in the bands 47-68 MHz, 174-230 MHz, 230-238 MHz, 246-254 MHz and 470-862 MHz, together with provisions for other primary and permitted services in the African Broadcasting Area and neighbouring countries;

c) Resolution 117 (Marrakesh, 2002) of the Plenipotentiary Conference, which determines the planning area for terrestrial television and sound broadcasting in the VHF and UHF bands;

d) Resolution 77 (Rev. Marrakesh, 2002) of the Plenipotentiary Conference, on future conferences and assemblies of the Union, which resolves that the second session of the Regional Radiocommunication Conference (RRC) will take place at the earliest in late 2005, and that the place and date are to be decided by Council after the first session of RRC;

e) Council Resolution 1185 (modified, 2003), which resolves that the first session of RRC will produce a report to the second session to include the technical basis for the work of the second session of RRC, the necessary bases to facilitate planning exercises prior to the second session, and the form in which the requirements of administrations should be submitted;

f) that some countries pertaining to the planning area, as defined by Resolution 117 (Marrakesh, 2002), are not contracting parties to the agreements referred to in *considering a)* and *b)* above,

resolves

1 to adopt the report annexed to this resolution, established at this session, relating to the basis for the work of the second session of RRC, the necessary bases to facilitate planning exercises prior to the second session, and the form in which the requirements of administrations should be submitted;

2 to invite the second session of RRC, in establishing the new regional agreement for the planning area and for the frequency bands referred to in the title of this resolution, and associated

frequency plans for terrestrial digital broadcasting in these frequency bands, to take into account the report referred to in *resolves* 1,

urges Member States of the planning area

to consider the report, as well as the other resolutions produced by this session, in their preparations for the second session,

instructs the Secretary-General

to bring this resolution, together with its annex as adopted by the first session of RRC, to the attention of the administrations of the planning area,

instructs the Director of the Radiocommunication Bureau

to provide the necessary assistance to administrations between the two sessions of the conference,

instructs the Chairman of this session of the conference

to transmit this resolution to the second session of the conference.

ANNEX

Report of the first session of the conference to the second session of the conference

Introduction to the report from the first session to the second session

Introduction

The European VHF/UHF Broadcasting Conference (Stockholm, 1961) adopted provisions (herein referred to as the ST61 Agreement) relating to the use of the broadcasting service (sound and television) in the European Broadcasting Area for the bands between 41 MHz and 960 MHz, with the exception of the bands 68-73 MHz and 76-87.5 MHz.

The Regional Administrative Conference for the Planning of VHF/UHF Television Broadcasting in the African Broadcasting Area and Neighbouring Countries (Geneva, 1989) adopted provisions and a related plan (herein referred to as the GE89 Agreement) concerning the television broadcasting service in the bands 47-68 MHz, 174-230 MHz, 230-238 MHz, 246-254 MHz and 470-862 MHz, together with provisions for other primary and permitted services in the African Broadcasting Area and neighbouring countries.

After several consultations initiated in 2000 regarding the convening of a regional radiocommunication conference (RRC) and the future planning of the broadcasting service in the bands 174-230 MHz (VHF) and 470-862 MHz (UHF), the Plenipotentiary Conference adopted Resolution 117 (Marrakesh, 2002), which determines the planning area for the regional radiocommunication conference relating to the planning of terrestrial digital television and sound broadcasting in these bands.

The Council, at its 2003 session, modified Resolution 1185 to take into account the decisions of the Plenipotentiary Conference and to establish the agendas of the two sessions of RRC.

Pursuant to Council Resolution 1185 (modified, 2003), this report is meant to provide the basis for the work of the second session of RRC, the necessary bases to facilitate planning exercises prior to the second session of RRC and the form in which the requirements of administrations should be submitted.

CHAPTER 1

Definitions

CONTENTS

The terms defined in the Radio Regulations are listed in Annex 1.1.

1.1 General terms

1.1.1 The Stockholm Agreement (1961) (ST61)

The "Regional Agreement for the European Broadcasting Area concerning the use of frequencies by the broadcasting service in the VHF and UHF bands" adopted by the European VHF/UHF Broadcasting Conference (Stockholm, 1961).

1.1.2 The Geneva Agreement (1989) (GE89)

The "Regional Agreement relating to the planning of VHF/UHF television broadcasting in the African Broadcasting Area and neighbouring countries" adopted by the Regional Administrative Conference for the planning of VHF/UHF television broadcasting (Geneva, 1989).

1.1.3 Planning area

The planning area covers Region 1 (No. 5.3 of the Radio Regulations) (parts of Region 1 situated to the west of meridian 170° E and to the north of parallel 40° S, except the territories of Mongolia) and the Islamic Republic of Iran.

1.2 Definition of radio stations and systems

1.2.1 Digital terrestrial television broadcasting (DTTB)

Digital television systems in the terrestrial broadcasting service which are described in Recommendation ITU-R BT.1306.

1.2.2 Digital video broadcasting – terrestrial (DVB-T)

A system in the terrestrial broadcasting service designated in Recommendation ITU-R BT.1306 as "Digital System B". For the full system specifications on "Digital broadcasting systems for television, sound and data services; framing structure, channel coding and modulation" see the bibliography section for System B in Appendix 2 to Annex 1 of the Recommendation.

1.2.3 Digital terrestrial sound broadcasting (DTSB)

Digital sound systems in the terrestrial broadcasting service which are described in Recommendation ITU-R BS.1114.

1.2.4 Terrestrial – digital audio broadcasting (T-DAB)

A system in the terrestrial broadcasting service designated in Annex 2 of Recommendation ITU-R BS.1114 as "Digital System A".

1.3 Frequency management terms

1.3.1 Frequency bands

Band III

Frequency range: 174-230 MHz.

Band IV

Frequency range: 470-582 MHz.

Band V

Frequency range: 582-862 MHz.

1.3.2 Coverage area

Coverage area of a broadcasting station, or a group of broadcasting stations in the case of a single frequency network (SFN, see definition in § 1.6.14), is the area where the wanted field strength is equal to or exceeds the usable field strength defined for specified reception conditions.

In defining the coverage area for each reception condition a three level approach is taken:

- *Level 1: Receiving location*

  The smallest unit is a receiving location; optimal receiving conditions will be found by moving the antenna up to 0.5 m in any direction.

  A receiving location is regarded as being covered if the level of the wanted signal is high enough to overcome noise and interference for a given percentage of the time.

- *Level 2: Small area coverage*

  The second level is a "small area" (typically 100 m by 100 m).

  In this small area the percentage of covered receiving locations is indicated.

- *Level 3: Coverage area*

  The coverage area of a broadcasting station, or a group of broadcasting stations, is made up of the sum of the individual small areas in which a given percentage (e.g. 70% to 99%) of coverage is achieved.

1.3.3 Service area

The part of the coverage area in which the administration has the right to demand that the agreed protection conditions be provided.

1.4 Definitions relating to propagation and field-strength[1] prediction

1.4.1 Refractive index; *n* (Recommendation ITU-R P.310)

Ratio of the speed of radio waves *in vacuo* to the speed in the medium under consideration.

[1] In the case of wideband digital signals where the spectral power density may not be constant across the occupied bandwidth, the term "field strength" is often replaced by the term "equivalent field strength". The equivalent field strength is the field strength of a single unmodulated RF carrier radiated with the same power as the total radiated power of the wideband digital signal. The terms "field strength" and "equivalent field strength" are used synonymously in this report.

1.4.2 Refractivity; *N* (Recommendation ITU-R P.310)

One million times the amount by which the refractive index n in the atmosphere exceeds unity.

1.4.3 *N*-unit (Recommendation ITU-R P.310)

A dimensionless unit in terms of which refractivity is expressed.

1.4.4 Standard refractivity gradient (Recommendation ITU-R P.310)

A standard value of vertical gradient of refractivity used in refraction studies, namely –40 N/km. This corresponds approximately to the median value of the gradient in the first kilometre of altitude in temperate regions.

1.4.5 Vertical refractivity gradient in the lowest atmospheric layer (Recommendation ITU-R P.453)

The statistics of the vertical gradient of refractivity, dN, in the lowest layer of the atmosphere (the lowest 65 m from the surface of the Earth) are important parameters for the estimation of propagation-associated effects such as ducting on transhorizon paths.

1.4.6 Reference refractivity gradient (Recommendation ITU-R P.1546)

The field-strength curves in Recommendation ITU-R P.1546 are considered to represent reference values, dN_0, of the vertical refractivity gradient for fields exceeded for a given percentage of time:

For fields exceeded for 50% time:	$dN_0 = -43.3$	N-units/km
For fields exceeded for 10% time:	$dN_0 = -141.9$	N-units/km
For fields exceeded for 1% time:	$dN_0 = -301.3$	N-units/km

1.4.7 Superrefraction (Recommendation ITU-R P.310)

Refraction for which the refractivity gradient is less (i.e. more negative) than the standard refractivity gradient.

1.4.8 Gaussian propagation channel

A channel which supports a propagation mode where only the wanted signal with no delayed signals is present at the receiver input, taking into account the Gaussian noise only.

1.4.9 Rayleigh propagation channel

A channel which supports a propagation mode where several statistically independent signals with different delay times, none of which is dominant, are present at the receiver input, taking into account the thermal noise. Rapid and severe variations of the input signal with locations are observed, caused by multipath propagation.

1.4.10 Ricean propagation channel

A channel which supports a propagation mode where a dominant wanted signal together with lower-level delayed signals are present at the receiver input, taking into account the thermal noise.

1.4.11 Effective transmitting antenna height (Recommendation ITU-R P.1546)

The "effective height" of the transmitting/base antenna is the height of the antenna above terrain height averaged between distances of 3 to 15 km in the direction of the receiving/mobile antenna. For land paths shorter than 15 km, where the information is available the method in Recommendation ITU-R P.1546 also takes account of the height of the transmitting/base antenna above the height of representative clutter (i.e. ground cover) at the location of the transmitting/base station.

1.4.12 Height loss correction factor

A correction in decibels applied to the predicted field strength at roof level when making a prediction for lower reception heights.

1.4.13 Location correction factor

The ratio, expressed in decibels, of the field strength exceeded for a given percentage of the receiving locations to the field strength exceeded for 50% of the receiving locations.

NOTE 1 – In the case of a single signal, where the statistical distribution parameters are known *a priori*, the location correction factor "C_l" for a given x% of locations is defined as the product of a distribution factor, μ, by the appropriate standard deviation of location variation, μ being equal to $Q_i(1 - x/100)$, which is the inverse complementary cumulative normal distribution function (see Table 5 of Recommendation ITU-R P.1546).

NOTE 2 – In this Report, the designation "location correction factor", unless otherwise stated, relates to outdoor locations, the standard deviation of the outdoor location variation of a wideband signal being taken as 5.5 dB, in accordance with Recommendation ITU-R P.1546.

NOTE 3 – In this Report, the designation "indoor location correction factor" represents the location correction factor at indoor locations, being defined as a combination of the outdoor location variation (see Note 2) with the building attenuation variation; provided these distributions are uncorrelated, the combined standard deviation is calculated by taking the square root of the sum of the squares of the individual standard deviations.

NOTE 4 – In this Report, the designation "combined location correction factor" represents the location correction factor in the case of a wanted signal and a nuisance signal; provided the distributions of the signals concerned are uncorrelated, the combined standard deviation of location variation for the wanted and the nuisance signals is calculated by taking the square root of the sum of the square of the standard deviation of the wanted signal and the square of the standard deviation of the nuisance signal.

1.4.14 Location distribution

The statistical distribution (typically log normal) over a specified area (typically a square with a side of 100 m to 200 m) of the more or less random variation of the received signal level with location due to terrain irregularities and the effect of obstacles in the near vicinity of the receiver location.

1.4.15 Location probability

Percentage of receiving locations where a given field strength is achieved or exceeded.

1.4.16 Mean building penetration loss

The ratio, expressed in decibels, between the mean field strength inside a building at a given height above ground level and the mean field strength outside the same building at the same height above ground level.

1.5 Definitions relating to radio equipment

1.5.1 Effective antenna aperture

The ratio of the power available at the receiving antenna terminals to the power flux-density of the appropriately polarized incident wave.

1.5.2 Feeder loss

The signal attenuation from the receiving antenna to the receiver's RF input.

1.6 Definitions relating to network planning

1.6.1 Allotment planning

In allotment planning, a specific channel is "given" to an administration to provide coverage over a defined area within its service area, called the allotment area. Transmitter sites and their characteristics are unknown at the planning stage and should be defined at the time of the conversion of the allotment into one or more assignments.

1.6.2 Assignment planning

In assignment planning, a specific channel is assigned to an individual transmitter site location with defined transmission characteristics (for example, radiated power, antenna height, etc.). At the completion of the assignment plan, the locations and characteristics of all transmitters are known and the transmitters can be brought into service without further coordination.

1.6.3 Test points

A test point is a geographically defined location at which specified calculations are carried out.

1.6.4 Nuisance field strength

The nuisance field strength (E_n), expressed in dB(μV/m), is the field strength for 50% of locations and for a given percentage of the time of an unwanted signal from any potential interfering source, to which has been added the relevant protection ratio in decibels.

NOTE 1 – Where relevant, the appropriate value in decibels of receiving antenna directivity or polarization discrimination must be taken into account.

NOTE 2 – Where there are several unwanted signals, a method for combination of individual nuisance field strengths shall be applied, such as the power sum method or some other appropriate method for signal summation, in order to obtain the resultant nuisance field strength.

1.6.5 Minimum usable field strength/Minimum field strength to be protected

Minimum value of the field strength necessary to permit a desired reception quality, under specified receiving conditions, in the presence of natural and man-made noise, but in the absence of interference from other transmitters.

NOTE 1 – The desired quality is determined in particular by the protection ratio against noise and by the percentage of time during which this protection ratio must be ensured.

NOTE 2 – The receiving conditions include, *inter alia*:

– the type of transmission and frequency band used;

– the receiving equipment characteristics (antenna gain, receiver characteristics, etc.);

– receiver operating conditions.

NOTE 3 – The term "minimum usable field strength" corresponds to the term "minimum field strength to be protected" which appears in many ITU texts and it also corresponds to the term "minimum median field strength", which appears in § 1.6.9 as the planning value E_{med} used for coverage by a single transmitter only.

1.6.6 Usable field strength

Minimum value of the field strength necessary to permit a desired reception quality, under specified receiving conditions, in the presence of natural and man-made noise and of interference, either in an existing situation or as determined by agreements or frequency plans.

NOTE 1 – The desired quality is determined in particular by the protection ratios against noise and interference for the percentage of time during which the required quality must be ensured.

NOTE 2 – The receiving conditions include, *inter alia*:

– the type of transmission and frequency band used;

– the receiving equipment characteristics (antenna gain, receiver characteristics, etc.);

– receiver operating conditions; where the receiver is mobile, a median field strength for multipath propagation must be considered.

NOTE 3 – The term “usable field strength” corresponds to the term “necessary field strength” which appears in many ITU texts.

NOTE 4 – The usable field strength is calculated by combining the individual nuisance field strengths (E_n) and the combined location correction factor. One of the individual nuisance field strength contributions is the minimum median field strength, (E_{med}), which represents the noise level.

1.6.7 Reference usable field strength (Recommendation ITU-R V.573)

The agreed value of the usable field strength that can serve as a reference or basis for frequency planning.

NOTE 1 – Depending on the receiving conditions and the quality required, there may be several reference usable field strength values for the same service.

NOTE 2 – Where there is no ambiguity, the term “reference field strength” may be used.

1.6.8 Minimum median power flux-density φ_{med} (dB(W/m^2))

The appropriate value of power flux-density for planning purposes to be used for coverage by a single transmitter only, being a value for 50% of locations and for 50% of the time at 10 m above ground level.

NOTE 1 – In this Report, the planning value (φ_{med}) depends on the median value of the minimum power flux-density (φ_{min}) at the receiving place which is required for a given percentage of locations and percentage of the time to ensure that the minimum signal level is achieved for the receiver to successfully decode the signal.

NOTE 2 – φ_{med} is calculated from the median value of the minimum power flux-density by adding, where relevant, appropriate correction factors expressed in decibels, such as allowance for man-made noise (P_{mmn}), established for the particular band of interest, height loss correction factor (L_h) and mean building penetration loss (L_b).

NOTE 3 – In the case of a single wanted signal, the “median value” referred to in Note 2 is obtained from the minimum power flux-density (φ_{min}) by adding the location correction factor (C_l) for a specified percentage of locations.

1.6.9 Minimum median field strength, E_{med} (dB(μV/m))

The appropriate value of minimum usable field strength for planning purposes to be used for coverage by a single transmitter only, being a value for 50% of locations and for 50% of the time at 10 m above ground level.

NOTE 1 – In this Report, the planning value E_{med} depends on the median value of the minimum field strength (E_{min}) at the receiving place which is required for a given percentage of locations and percentage of the time to ensure that the minimum signal level is achieved for the receiver to successfully decode the signal.

NOTE 2 – E_{med} can be calculated from the minimum median power flux-density φ_{med} (dB(W/m^2)) by adding 145.8, this value resulting from the free-space impedance, i.e. 10 log(120 π), from which has been subtracted the conversion factor from dB(V/m) to dB(μV/m), i.e. 20 log(10^{-6}).

1.6.10 Fixed reception

Fixed reception is defined as reception where a directional receiving antenna mounted at roof level is used.

It is assumed that near-optimal reception conditions (within a relatively small volume on the roof) are found when the antenna is installed.

In calculating the field strength for fixed antenna reception, a receiving antenna height of 10 m above ground level is considered to be representative for the broadcasting service. Other heights might be used for other services.

1.6.11 Portable reception

Portable reception is defined as:

– class A (outdoor), which means reception by a portable receiver with an attached or built-in antenna is used outdoors at no less than 1.5 m above ground level;

– class B (ground floor, indoor), which means reception by a portable receiver with an attached or built-in antenna is used indoors at no less than 1.5 m above floor level in rooms with the following characteristics:
  a) on the ground floor;
  b) with a window in an external wall.

Portable indoor reception on the first or higher floors will be regarded as class B reception with signal level corrections applied, although indoor ground floor reception is likely to be the most common case.

In both classes A and B, it is assumed that:

– optimal receiving conditions will be found by moving the antenna up to 0.5 m in any direction;

– the portable receiver is not moved during reception and large objects near the receiver are also not moved;

– extreme cases, such as reception in completely shielded rooms, are disregarded.

1.6.12 Mobile reception

Mobile reception is defined as reception by a receiver in motion. This could be a car receiver or handheld equipment with an antenna situated at no less than 1.5 m above ground level or floor level. The dominant factor with regard to local reception effects is thought to be due to fading in a Rayleigh channel. Fade margins are intended to offset these effects. Fade margins depend on the frequency and the velocity of the vehicle. The values of fade margins are derived from the differences between the required *C/N* ratio for a Gaussian channel and that for a Rayleigh channel.

1.6.13 Multifrequency network (MFN)

A network of transmitting stations using several RF channels.

1.6.14 Single frequency network (SFN)

A network of synchronized transmitting stations radiating identical signals in the same RF channel.

1.6.14.1 Large area SFN

An SFN which contains more than one high-power station together with any associated medium and low-power stations, usually with a composite coverage greater than about 10 000 km^2.

1.6.14.2 Mini SFN

One high-power station together with at least one (and probably several) associated medium or low-power stations.

1.6.14.3 Dense network

A network of low-power to medium-power stations.

1.6.14.4 National SFN

An SFN covering a whole country.

1.6.14.5 Regional or local SFN

An SFN covering part of a country.

1.6.15 SFN network gain

Increase of the wanted signal level at a specific receiving location due to simultaneous reception of multiple useful signals. This is a characteristic of orthogonal frequency division multiplex (OFDM) systems operating in an SFN.

1.6.16 Small allotment area

An allotment area with a perimeter of no more than 30 km.

1.6.17 Transmitting stations used in digital networks

1.6.17.1 High power station

A station with an e.r.p. greater than or equal to 10 kW.

1.6.17.2 Medium power station

A station with an e.r.p. greater than or equal to 50 W and less than 10 kW in Band III, or greater than or equal to 250 W and less than 10 kW in Band IV/V.

1.6.17.3 Low power station

A station with an e.r.p. less than 50 W in Band III, or less than 250 W in Band IV/V. However, in order to resolve cases of incompatibilities during the intersessional period, administrations concerned may agree bilaterally and/or multilaterally to use e.r.p. values for the UHF Band IV/V of not less than 100 W. These stations, once communicated to the Radiocommunication Bureau, need to be taken into account in the development of the draft plan(s) and at the second session.

1.6.18 Reference Planning Configuration (RPC)

An RPC is a representative combination of criteria and parameters to be used for frequency planning purposes.

1.6.19 Reference network

A generic network structure representing a real network, as yet unknown, for the purposes of a compatibility analysis. The main purpose is to determine the potential for and susceptibility to interference of typical digital broadcasting networks.

1.7 Definitions of existing and planned assignments and allotments of the broadcasting service and existing and planned assignments of other primary services

1.7.1 Existing and planned assignments and allotments of the broadcasting service

Existing and planned assignments and allotments of the broadcasting service are defined as follows.

- For the territories covered by the ST61 or the GE89 Agreements, or both:
  - analogue and digital[1, 2] assignments contained in the ST61 and/or GE89 Plans on 31 October 2005;
  - analogue and digital[1, 2] assignments successfully coordinated under the procedures of Article 4 of the ST61 and/or GE89 Agreements by 31 October 2005;
  - T-DAB allotments and assignments successfully coordinated by 31 October 2005 with all administrations affected, the territories of which are inside the RRC planning area[1, 2];
  - assignments recorded in the Master International Frequency Register (MIFR) by 31 December 1989 with a favourable finding with respect to the applicable provisions of the Radio Regulations, and without complaint of harmful interference received by the Radiocommunication Bureau;

[1] These digital assignments and allotments shall not be given more protection than other digital and analogue entries in the new plan.

[2] The criteria to be used for coordination of T-DAB with respect to other analogue and digital assignments and allotments of the broadcasting service and assignments of the other primary services are contained in § A.1.2.2 of the report. In this regard, these criteria are to be applied provisionally as part of Article 4 procedures of the ST61 and GE89 Agreements.

– analogue broadcasting assignments to be submitted to the Radiocommunication Bureau by Iraq within three months after the end of the first session of the conference under the procedure and conditions mentioned in Note 4 below.

For the territories not covered by the ST61 or the GE89 Agreements:

– analogue and digital[2] assignments successfully coordinated by 31 October 2005 with all administrations concerned belonging to the RRC planning area;

– assignments contained in the "RCC List"[3] successfully coordinated by 31 October 2005 with all affected[4] administrations, the territories of which are inside the RRC planning area.

NOTE 1 – Equitable access needs to be considered when taking into account existing and planned assignments of the broadcasting service.

NOTE 2 – In order to avoid undue constraints on the planning, there may be a need to encourage administrations to remove unnecessary entries from the plans.

NOTE 3 – It is to be noted that in Morocco, pursuant to RR No. 5.229, the band 162-230 MHz is allocated to the broadcasting service. Since channel M5 (170-177 MHz) is both concerned by the planning of this conference and outside the bands dealt with by the conference, it may require particular consideration in the planning.

NOTE 4

1) Iraq will submit by 28 August 2004 a list of its analogue broadcasting assignments to the Radiocommunication Bureau and other administrations concerned. The Radiocommunication Bureau will examine this list by applying the relevant procedures of the GE89 and the ST61 Agreements, identify the assignments of other administrations in the planning areas that are likely to be affected and send the results to the administrations concerned before the first planning exercise.

2) Iraq and the administrations concerned will make every possible effort to coordinate these assignments, in accordance with the provisions of the GE89 and the ST61 Agreements, as appropriate, taking into consideration the special situation of Iraq and allowing the Iraqi case to be tested before the finalization of the first planning exercise.

[3] This "list" of frequency assignments to television broadcasting stations has been produced by the countries in the extended planning area defined in Council Resolution 1185 (modified, 2003) and is set out in the annex to Circular Letter CR/209.

[4] The criteria to be used for coordination of the broadcasting assignments in the "RCC List" with respect to existing and planned analogue and digital assignments and allotments of the broadcasting service and existing and planned assignments of other primary services are contained in § A.1.2.4 of the report. These criteria are to be used by the Radiocommunication Bureau to ensure that coordination with all affected administrations has been successfully completed.

3) The assignments contained in the above-mentioned list will be taken into account in the planning exercise that will be performed in the intersessional period.

4) Those assignments in the list referred to above which are successfully coordinated with all administrations concerned, following step 2 above, will continue to be considered in the production of the draft plan. The uncoordinated assignments will be submitted to the second session of the conference for consideration and further action, as appropriate.

1.7.2 Existing and planned assignments of primary services other than broadcasting

The existing and planned assignments of primary services other than broadcasting are defined as follows:

– assignments notified to the Radiocommunication Bureau and recorded in the MIFR by 31 December 1989 with a favourable finding with respect to the applicable provisions of the Radio Regulations, and without complaint of harmful interference received by the Radiocommunication Bureau;

– assignments notified to the Radiocommunication Bureau and recorded or considered as being recorded in the MIFR between 31 December 1989 and 10 May 2004 with a favourable finding with respect to the applicable provisions of the Radio Regulations, and without complaint of harmful interference received by the Radiocommunication Bureau[5];

– assignments notified to the Radiocommunication Bureau after 10 May 2004 which have been successfully coordinated by 31 October 2005[6, 7].

NOTE 5 – Assignments of other primary services shall be brought into use pursuant to RR No. 11.24.

[5] These assignments should be examined with respect to the existing and planned broadcasting assignments and allotments in order to identify incompatibilities, which should be resolved between administrations concerned; existing bilateral and multilateral agreements between administrations concerned need to be taken into account. In case of incompatibility with respect to those assignments to other primary services not coordinated before the second session of the conference, the broadcasting assignments and allotments, when entered in the new analogue and digital plans, will bear no remark with respect to those assignments to other primary services with which there is an incompatibility. For the development of the draft plan and during the second session, the Radiocommunication Bureau shall take into account bilateral and multilateral agreements between administrations concerned, already existing or communicated to the Radiocommunication Bureau.

[6] Applicable coordination criteria and procedures are given in Resolution GT-PLEN/3.

[7] Such assignments should not claim more protection from digital assignments/allotments in the new plans than they already have from the relevant existing and planned assignments.

ANNEX 1.1

Definitions given in the Radio Regulations (Edition 2001) and complemented by explanations in Recommendations

Administration (RR No. 1.2)

African Broadcasting Area (ABA) (RR Nos. 5.10 to 5.13)

European Broadcasting Area (EBA) (RR No. 5.14)*

Broadcasting service (RR No. 1.38)

Broadcasting-satellite service (RR No. 1.39)

Fixed service (RR No. 1.20)

Mobile service (RR No. 1.24)

Mobile-satellite service (RR No. 1.25)

Land mobile service (RR No. 1.26)

Aeronautical mobile service (RR No. 1.32)

Aeronautical mobile-satellite service (RR No. 1.35)

Radionavigation service (RR No. 1.42)

Aeronautical radionavigation service (RR No. 1.46)

Radio astronomy service (RR No. 1.58)

Station (RR No. 1.61)

Terrestrial station (RR No. 1.62)

Broadcasting station (RR No. 1.85)

Allotment (of a radio frequency or radio frequency channel) (RR No. 1.17)

Assignment (of a radio frequency or radio frequency channel) (RR No. 1.18)

Radiation (RR No. 1.137)

Emission (RR No. 1.138)

Out-of-band emission (RR No. 1.144)

Spurious emission (RR No. 1.145)

Unwanted emissions (RR No. 1.146)

* The delegations of Armenia, Belarus, Georgia, Kyrgyzstan and the Russian Federation attending the first session of RRC are of the opinion that a modification to the definition of the European Broadcasting Area should be proposed to a future competent WRC.

Assigned frequency (RR No. 1.148)

Necessary bandwidth (RR. No. 1.152)

Power (RR No. 1.156)

Peak envelope power (of a radio transmitter) (RR No. 1.157)

Mean power (of a radio transmitter) (RR No. 1.158)

Carrier power (of a radio transmitter) (RR No. 1.159, Recommendation ITU-R V.573)

Gain of an antenna (RR No. 1.160)

Equivalent isotropically radiated power (e.i.r.p.) (RR No. 1.161, Recommendation ITU-R V.573)

Effective radiated power (e.r.p.) (in a given direction) (RR No. 1.162, Recommendation ITU-R V.573)

Antenna electrical characteristics (RR Appendix 4)

Attenuation (dB) of the horizontally polarized component at different azimuths (item 9NH)

Attenuation (dB) of the vertically polarized component at different azimuths (item 9NV)

Protection ratio (R.F.) (RR No. 1.170)

Interference (RR No. 1.166)

Permissible interference (RR No. 1.167)

ANNEX 1.2

Methods to identify administrations potentially affected by assignments or allotments in the broadcasting service and other primary services

A.1.2.1 Identification of the administrations whose analogue or digital assignments in the broadcasting service or assignments in other primary services may be affected by digital assignments recorded in the ST61 and GE89 Plans

Initial provisional studies of the Rules of Procedure of the Stockholm, 1961 Agreement (Part A2) and of the Geneva, 1989 Agreement (Part A6) indicate that the following approach may be used to protect the analogue broadcasting services and some other primary services from digital terrestrial broadcasting services, by applying the coordination distances as described below.

A.1.2.1.1 Coordination distances to assess the potential impact of DVB-T assignments on analogue television and comparison with the ST61/GE89 limiting distances

For the impact of DVB-T on analogue television, the minimum median field-strength values given in Recommendation ITU-R BT.417 have been used to calculate the values of maximum interfering field strength, and a protection ratio of 41 dB has been used (Recommendation ITU-R BT.1368), which leads to the maximum interfering field-strength values as tabulated below.

TABLE 1

Values of maximum interfering field strength (dB(μV/m)) for analogue television interfered with by DVB-T used to evaluate coordination distances

	Minimum median field-strength value (dB(μV/m))	Maximum interfering field strength (dB(μV/m)) $E_{max\ int}$
Band III	55	14
Band IV	65	24
Band V	70	29

The field-strength values are converted into coordination distances by applying Recommendation ITU-R P.1546 as described in Chapter 2 of the report to the second session, using 1 kW e.r.p. transmitters with 300 m effective antenna heights, but without taking into account terrain clearance angle.

Considering the information presented by the Radiocommunication Bureau, the only new digital assignments in the ST61/GE89 Plans or in the Master International Frequency Register are in Band IV/V. Consequently, the analysis has been conducted for 600 MHz only.

TABLE 2

Comparison of coordination distances (1 kW e.r.p., 300 m effective antenna height)

	Calculated coordination distances with Recommendation ITU-R P.1546 (1% of the time) (km)	**ST61 limiting distances (km)**	**GE89 limiting distances (km)(1)**
Case 1 (600 MHz, land)	130	220	150 to 180
Case 2(2) (600 MHz, warm sea)	670	Not given (>1 000 km)	650 to 750
Case 3(3) (600 MHz, cold sea)	500	980	

(1) For the GE89 distances, the distances related to Zone 1 (for land) and Zone 4 (for warm sea) are considered in this document for comparison. No comparison has been drawn for cold sea.

(2) For this case, the ST61 distances for comparison are taken from the "Mediterranean Sea" case.

(3) For this case, the ST61 distances for comparison are taken from the "sea in general" case.

Based on these results, it can be seen that, for the chosen cases, the calculated coordination distances are lower than the limiting distances provided by ST61 and GE89. It is envisaged that this will be generally valid (e.g. for other values of transmit powers and antenna heights).

It is therefore concluded that the distances provided by ST61 and GE89 can be used to identify administrations whose analogue assignments in the broadcasting service may be affected by digital assignments recorded in the ST61 and GE89 Plans.

A.1.2.1.2 Coordination distances to assess the potential impact of DVB-T assignments on other primary services

A.1.2.1.2.1 Reception of other primary services at ground level

It has been agreed that, in this case, limiting distances from ST61/GE89 can be used to identify administrations whose assignments to other primary services can potentially be affected by a digital assignment recorded in the ST61 and GE89 Plans.

A.1.2.1.2.2 Reception of other primary services on board aircraft

It has been concluded that, in this case, the coordination distances should be determined by line of sight using free-space propagation.

For the application of this method, it seems necessary to have a means to specify the reference points of the aircraft receiver area, which should be limited to the service area of the aeronautical land station, and shall be limited to the territory of the notifying administration responsible for the aeronautical radionavigation system.

As an example, the case of an aircraft at 10 000 m altitude will lead to line-of-sight distances around 450 km, which will depend upon the DVB-T antenna height.

A.1.2.2 Identification of the administrations whose analogue or digital assignments in the broadcasting service or assignments in other primary services may be affected by T-DAB allotments/assignments

A.1.2.2.1 Impact of T-DAB allotments/assignments on analogue or digital assignments in the broadcasting service

In order to identify the administrations whose analogue or digital assignments in the broadcasting service may be affected by T-DAB allotments/assignments, Recommendations ITU-R BS.1660, ITU-R BT.655 and ITU-R BT.1368 should be applied.

A.1.2.2.2 Impact of T-DAB allotments/assignments on assignments in other primary services

For assignments related to ground-based receiving stations from another primary service, distances from ST61/GE89 can apply to identify administrations potentially affected by T-DAB allotments/assignments.

For an airborne receiving station from another primary service, these distances will be determined with line of sight (see § A.1.2.1.2.2).

A.1.2.3 Identification of the administrations whose analogue or digital assignments in the broadcasting service may be affected by assignments in other primary services

It is proposed to use the same method as described in § A.1.2.1.2.

When the transmitting station of the other primary service is ground-based, distances from ST61/GE89 may be applied (see § A.1.2.1.2.1).

When the transmitting station of the other primary service is on board an aircraft, the distances will be determined with line of sight (see § A.1.2.1.2.2).

A.1.2.4 Identification of the administrations in the RRC planning area whose broadcasting and other primary services may be affected by the broadcasting analogue assignments contained in the "RCC List"

This case has not been studied in detail, but it is expected that the methods proposed in section 1 will be applicable as well.

A.1.2.5 Applicability to DVB-T allotments

In the case of DVB-T allotments, the combined effect of individual transmitters in the corresponding reference network should be considered (see § 5.3.1.2.6 of the report from the first to the second session of RRC).

CHAPTER 2

Propagation information

CONTENTS

2.1 General

Recommendation ITU-R P.1546-1 is the basis of a field-strength prediction method applicable for the broadcasting, land mobile, maritime mobile and certain fixed services (e.g. those using point-to-multipoint systems). The complete description of this method is provided in Annex 2.1 to this chapter. The method can be applied using either graphical or automated (computer) procedures. For the latter, tabulated values of the field strength curves are provided in Annex 2.2, along with detailed instructions for interpolation and extrapolation. The curves associated with these tabulated values are provided in Annex 2.3.

Predictions can be made for the following parameter ranges: frequency of 30 to 3 000 MHz; path distance of 1 to 1 000 km; percentage of time of 1 to 50%; and for transmitting antenna heights commensurate with the radiocommunication services concerned. The method draws a distinction between paths over land, cold seas and warm seas, makes due allowance for location variability for land area-service predictions and takes account of local clutter surrounding the receiving location.

Annex 2.1 provides the procedure for treating negative effective transmitting/base antenna heights and mixed-path propagation (i.e. those with combinations of land and sea). The method can be used with or without a terrain height database, although increased prediction accuracy would be expected when such data are available. However, due to the enormous increase in computation time, the use of terrain data in the context of RRC calculations is not foreseen.

For the prediction method applicable to airborne stations of the aeronautical radionavigation service, free-space propagation should be used if there is a line-of-sight path; otherwise, it is assumed that there is no signal. This is because, in general, the exact location of the aircraft is not known.

Administrations in the planning area, in particular those in regions of high refractivity and ducting zones, consider that Recommendation ITU-R P.1546-1 provides better propagation prediction methods than the methods previously used in Stockholm-61 and Geneva-89 Plans. However, any improvements in propagation prediction methods in the future should be taken into consideration during planning exercises and the second session of the conference. ITU-R is invited also, as a matter of urgency, to carry out the necessary studies and provide the results either to the Intersessional Planning Group (IPG) or to the second session of the conference.

2.2 Common elements for propagation prediction in the VHF and UHF bands

The tabulated values of field strength versus distance in Annex 2.2 should be used for the planning of the broadcasting service. They give, on the basis of statistics of measurement results and also of theoretical considerations, the field-strength value exceeded for 50% of locations for time percentages of 50%, 10% and 1%.

The data are given for various types of areas and climates, namely, land, cold sea and warm sea, and the method includes a procedure for extrapolating the data to areas subject to extreme superrefractivity.

Effective transmitting antenna height values should be provided by administrations. Terrain data information could be used to provide a set of effective height values for cases where the relevant administration is not able to supply such information and requests assistance in determining these values.

The definition of "effective height" of the transmitting/base antenna can be found in Annex 2.1.

Because of the very significant differences in propagation conditions for land and sea paths, a coastline must be included in the propagation prediction calculations to permit account to be taken of these differences in the calculation of interference levels.

Information on the type of propagation path, such as land, sea or mixed land-sea paths should be derived from digital maps providing the contours of the coastlines, such as the ITU digitized world map (IDWM) available from BR. Information on cold sea/warm sea divisions and geographic data for other propagation areas and path types is given in § 2.2.2 below.

2.2.1 Propagation curves and their application to geographical zones

The propagation curves represented in the figures in Annex 2.3 establish the relationship between the field strength and the path length. The effective height of the transmitting antenna is the characteristic parameter of each curve in the same figure. The use of the curve indicated as the maximum value is explained in Annex 2.1, § 2. The values obtained correspond to a receiving antenna height of 10 m over local ground in open area. The values are expressed in decibels relative to 1 μV/m (dB(μV/m)) for an e.r.p. of 1 kW in the direction of the reception point. The curves give the values of the field strength exceeded at 50% of locations and each figure corresponds to time percentages of 50%, 10% and 1% for one of the geographical zones defined below and shown on the map in the Fig. 2.1.

2.2.2 Geographical division

Zone 1: temperate and subtropical regions;

Zone 2: desert regions, displaying propagation conditions found in regions having low humidity and small annual variations in climate;

Zone 3: equatorial regions, displaying propagation conditions found in regions with hot and humid climates;

Zone 4: maritime regions, displaying propagation conditions found over warm seas and in one terrestrial zone (referred to as "coastal land" in Annex 2.1) at low altitude bordering warm seas, where superrefraction conditions occasionally occur (Caspian Sea and all the seas around the African continent are Zone 4 except Zones A and B designated below);

Zone 5: maritime regions, displaying propagation conditions found over cold seas;

Zone A: maritime zone at low latitudes, frequently displaying superrefractivity;

Zone B: maritime zone at low latitudes, displaying superrefractivity to a lesser extent than Zone A;

Zone C: maritime zone from the junction of the coastline of the Islamic Republic of Iran with its border to Pakistan westward along the coastlines of the Islamic Republic of Iran and of Iraq, through point 48° E, 30° N along the coastline of Kuwait, the eastern coastline of Saudi Arabia, the coastlines of Qatar, the United Arab Emirates and Oman down to the intersection with parallel 22° N;

Zone D: land strip of maximum depth of 100 km surrounding Zone C.

Table 1 provides all the information on the parameters used to derive the tabulated values (see Annex 2.3) and the curves (see Annex 2.3) for different propagation zones. The dN-values are based on vertical refractivity gradient data in the lowest 65 m of the atmosphere (see Recommendation ITU-R P.453).

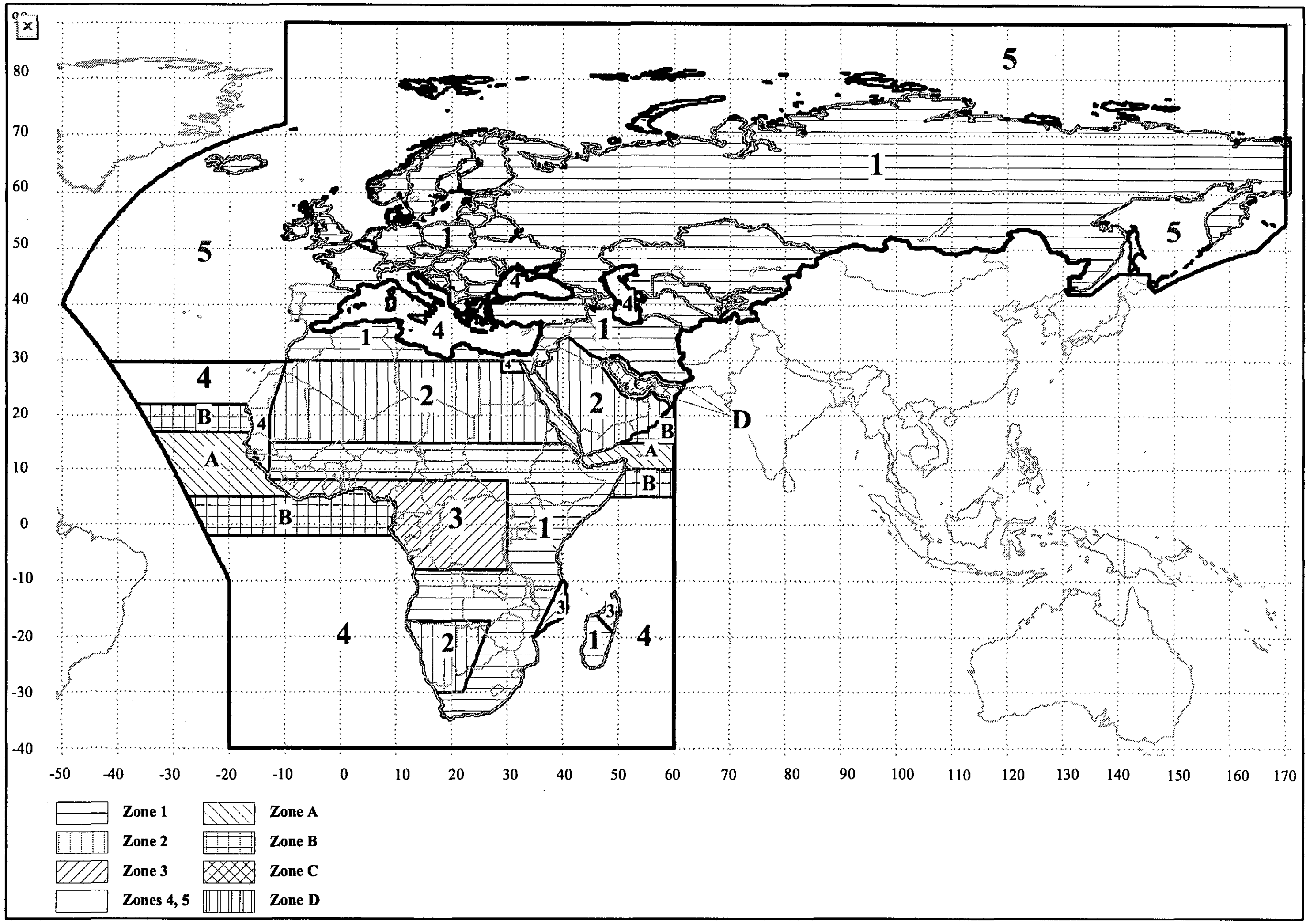
TABLE 1

Parameters used when deriving curves in Annex 2.3

Zone	Path type	Derived from zone type	Refractivity gradient, dN, not exceeded for		
			1% time	10% time	50% time
1	Land		–301.3	–141.9	–43.3
2	Land	1	–200.0	–110.0	–30.0
3	Land	1	–250.0	–130.0	–40.0
4	Sea		–301.3	–141.9	–43.3
5	Sea		–301.3	–141.9	–43.3
A	Sea	4	–1 150.0	–1 000.0	–720.0
B	Sea	4	–680.0	–500.0	–320.0
C	Sea	4	–1 233.0	–850.0	–239.0
D	Land	1	–694.0	–393.0	–120.0

FIGURE 2.1*

Geographical division of the planning area into propagation zones



* The map in Fig. 2.1 shall be modified as follows for the territory of Egypt:

- Egyptian territory **north of 30° N** to be considered as **Zone 1**;
- Egyptian territory **south of 30° N** to be considered as **Zone 2**;
- The whole of the Egyptian territory is to be excluded completely from **Zone 4**.

2.2.3 Receiving antenna height loss correction

For planning purposes, the ground cover at the receiver location is generally not known and, hence, a receiving antenna at a height of 10 m in open or suburban areas is assumed. To correct the predicted values for a receiving height of 1.5 m above ground level, a factor called "height loss" has been introduced.

For the conditions indicated in the previous paragraph, the "height loss" from 10 m to 1.5 m is given in § 3.3.2.1 or can be calculated using the method described in Annex 2.1, § 9.

2.2.4 Prediction of wanted field strengths

When predicting wanted field strengths for an individual transmitter-to-receiver path, it is appropriate to use the values for 50% of the time given in Annex 2.1, since those values are also applicable to the 99% time requirement for wanted signals. For the short distances involved, up to about 60 km, the difference in the field strength values for 50% and 99% of the time is negligible. However, there are differences in propagation over the various zones and it is thus necessary to take account of the nature of any individual propagation path.

2.2.5 Prediction of unwanted field strengths

During the planning and coordination processes, it is necessary to predict the level of interfering field strength produced in the service area of a station by another station. When calculating the level of interfering field strength, the time percentage curves in Annex 2.3 for the service area and propagation zone concerned should be used.

Ideally, the calculation should be made for points defining the service area of the station to be protected. However, in some circumstances, this may not be possible or necessary. Two cases can be distinguished:

2.2.5.1 Prediction for points defining the service area

Predictions of interfering field strengths would normally be made for points on the periphery of the service area of the station to be protected. It is preferable that points defining the edge of the service area be specified or that they be calculated on the basis of 36 equally spaced radials from the transmitter site. In the case where the boundary points are specified, rather than being calculated, there is no particular requirement that they be on equally spaced radials.

2.2.5.2 Prediction for the location of the transmitting site

In some cases it may not be possible or necessary to define the service area in the manner described in the preceding paragraph. An example of this would be where the station to be protected is a low-power station with a service area of very small radius. To define the service area and calculate interference levels at many points would involve unnecessary computation. In this case, the location of the transmitting station can be taken as representative of the service area to be protected, and the prediction of interfering field strength can be made for that point.

2.2.6 Location statistics

Within a small area of 100 m × 100 m to 200 m × 200 m there will be a random variation of field strength with location, which is due to local terrain irregularities and reflection from objects near the receiving location. The statistics of this type of variation may be characterized by a log-normal distribution of the field strengths. Recent measurements for digital signals have shown that for outdoor paths the standard deviation will be about 5.5 dB, depending to some extent on the environment surrounding the receiving location. Any values related to outdoor service in the remainder of this document will be based on a standard deviation of 5.5 dB. For indoor reception, the standard deviation will be larger (see also § 3.3.2.2).

Different percentages of locations can be calculated using the relevant multipliers given in Table 5 of Annex 2.1. For example, the difference for 50% and 95% of outdoor locations is taken to be 9 dB for the case where the standard deviation is 5.5 dB. This value takes no account of the inherent inaccuracies of any propagation prediction method.

In the case that the wanted signal is composed of several signals from different transmitters, the resulting standard deviation becomes variable, depending on the individual signal strengths. As a consequence, the difference between wanted signals for 50% and 70% or 95% of locations becomes variable. However, it always will be smaller than that of an individual signal. This item is dealt with in more detail with regard to single-frequency networks in § 5.3.1.2.5.

2.3 Propagation information for shared services

2.3.1 Compatibility between the broadcasting service and the fixed and mobile services

In the case of interference to or from the broadcasting service, the land mobile service or the fixed service, the propagation prediction method and the procedure described in Annex 2.1 are to be used in the VHF and UHF bands, taking into account the following information on transmitting and receiving antenna heights:

– ***Transmitter sited at a base station or other fixed location***

  The propagation prediction method described in Annex 2.1 should be used in the VHF and UHF bands for the effective height of the base station antenna.

– ***Transmitter of a mobile station in the land mobile service***

  The propagation prediction method described in Annex 2.1 should be used in the VHF and UHF bands for an effective transmitting antenna height of 1.5 m.

– ***Receiving antenna height gain***

  The procedure in Annex 2.1 should be used to take into account the effect of the height of the receiving antenna above ground level, irrespective of the polarization.

2.3.2 Compatibility between the broadcasting service and the aeronautical mobile and radionavigation services

In the case of interference to or from ground-based stations in the aeronautical mobile or aeronautical radionavigation services, the propagation prediction method described in Annex 2.1 should be used.

In the case of interference to or from airborne stations in the aeronautical mobile or aeronautical radionavigation services:

– the free-space propagation prediction model should be used in the case where there is a line-of-sight path between the transmitting and receiving antennas; and

– zero interference should be assumed in the case where there is no line-of-sight.

The free-space field strength relative to a half-wave dipole for 1 kW e.r.p. is given by:

$$E = 106.9 - 20 \log d$$

where:

E: free-space field strength (dB(μV/m))

d: distance (km) between transmitting and receiving antenna.

ANNEX 2.1

The propagation prediction method

A.2.1.1 Introduction

This Annex describes separate stages of the calculation. A step-by-step description of the procedure to be followed for the overall method is given in § A.2.1.15.

A.2.1.2 Maximum field-strength values

A field strength for any given propagation zone must not exceed a maximum value E_{max} given by the curve indicated as a maximum in each of the Figures in Annex 2.3. In the case of mixed paths, it will be necessary to calculate the maximum field strength by linear interpolation between the all-land and all-sea values. This is given by:

$$E_{max} = (d_l\, E_{ml} + d_s\, E_{ms})/d_{total} \qquad \text{dB}(\mu\text{V/m}) \qquad (1)$$

where:

E_{ml}: maximum value of field strength for relevant all-land path (dB(μV/m))

E_{ms}: maximum value of field strength for relevant all-sea path (dB(μV/m))

d_l: the total land distance (km)

d_s: the total sea distance (km)

d_{total}: the total path distance (km).

Any correction which increases a field strength shall not be allowed to produce values greater than these limits for the relevant family of curves. However, limitation to maximum values shall be applied only where indicated in § A.2.1.15.

A.2.1.3 Determination of transmitting/base antenna height, h_1

The transmitting/base antenna height, h_1, to be used in calculation depends on the type and length of the path and on various items of height information.

The effective height of the transmitting/base antenna, h_{eff}, is defined as its height in metres over the average level of the ground between the distances of 3 and 15 km from the transmitting/base antenna in the direction of the receiving/mobile antenna.

The value of h_1 to be used in calculation shall be obtained using the method given in § A.2.1.3.1, A.2.1.3.2 or in A.2.1.3.3 as appropriate.

A.2.1.3.1 Land paths shorter than 15 km

For land paths less than 15 km one of the following two methods shall be used.

A.2.1.3.1.1 Terrain information not available

If no terrain information is available for the purpose of propagation predictions, the value of h_1 is calculated according to path length d as follows:

$$h_1 = h_a \quad \text{m} \quad \text{for} \quad d \leq 3 \text{ km} \tag{2}$$

$$h_1 = h_a + (h_{eff} - h_a)(d - 3)/12 \quad \text{m} \quad \text{for } 3 \text{ km} < d < 15 \text{ km} \tag{3}$$

where h_a is the antenna height above ground (e.g. height of the mast).

A.2.1.3.1.2 Terrain information available

If terrain information is available for the purpose of propagation predictions:

$$h_1 = h_b \quad \text{m} \tag{4}$$

where h_b is the height of the antenna above terrain height averaged between $0.2d$ and d km.

A.2.1.3.2 Land paths of 15 km or longer

For these paths:

$$h_1 = h_{eff} \quad \text{m} \tag{5a}$$

A.2.1.3.3 Sea paths

For these paths:

$$h_1 = h_{eff} \quad \text{m} \tag{5b}$$

This propagation prediction method shall not be used in the case of an all-sea path for h_1 values less than 1 m.

A.2.1.4 Application of transmitting/base antenna height, h_1

The value of h_1 determines which curve or curves are selected from which to obtain field-strength values, and the interpolation or extrapolation which may be necessary. The following cases are distinguished.

A.2.1.4.1 Transmitting/base antenna height, h_1, in the range 10 to 3 000 m

If the value of h_1 coincides with one of the eight heights for which curves are provided, namely 10, 20, 37.5, 75, 150, 300, 600 or 1 200 m, the required field strength may be obtained directly from the plotted curves or the associated tabulations. Otherwise the required field strength shall be interpolated or extrapolated from field strengths obtained from two curves using:

$$E = E_{inf} + (E_{sup} - E_{inf}) \log (h_1/h_{inf}) / \log (h_{sup}/h_{inf}) \quad \text{dB}(\mu\text{V/m}) \tag{6}$$

where:

h_{inf}: 600 m if $h_1 > 1\,200$ m, otherwise the nearest nominal effective height below h_1

h_{sup}: 1 200 m if $h_1 > 1\,200$ m, otherwise the nearest nominal effective height above h_1

E_{inf}: field-strength value for h_{inf} at the required distance (dB(μV/m))

E_{sup}: field-strength value for h_{sup} at the required distance (dB(μV/m)).

The field strength resulting from extrapolation for $h_1 > 1\,200$ m shall be limited, if necessary, such that it does not exceed the maximum defined in § A.2.1.2.

This propagation prediction method shall not be used for $h_1 > 3\,000$ m.

A.2.1.4.2 Transmitting/base antenna height, h_1, in the range 0 to 10 m

The method when h_1 is less than 10 m depends on whether the path is over land or sea.

For a land path or a mixed path:

The procedure for extrapolating field strength at a required distance d km for values of h_1 in the range 0 to 10 m is based on smooth-Earth horizon distances (km) written as $d_H(h) = 4.1\sqrt{h}$, where h is the required value of transmitting/base antenna height h_1 (m).

For $d < d_H(h_1)$ the field strength is given by the 10 m height curve at its horizon distance, plus ΔE, where ΔE is the difference between field strengths for the 10 m height curve at distance d and at the h_1 horizon distance.

For $d \geq d_H(h_1)$ the field strength is given by the 10 m height curve at distance Δd beyond its horizon distance, where Δd is the difference between d and the h_1 horizon distance.

This is expressed in the following formulae where $E_{10}(d)$ is the field strength (dB(μV/m)) taken from the 10 m height curve for a distance d (km):

$$E = E_{10}(d_H(10)) + E_{10}(d) - E_{10}(d_H(h_1)) \qquad \text{dB}(\mu\text{V/m}) \qquad \text{for } d < d_H(h_1) \qquad (7a)$$

$$= E_{10}(d_H(10) + d - d_H(h_1)) \qquad \text{dB}(\mu\text{V/m}) \qquad \text{for } d > d_H(h_1) \qquad (7b)$$

If in equation (7b) $d_H(10) + d - d_H(h_1)$ exceeds 1 000 km, even though $d \leq 1\,000$ km, E shall be found from linear extrapolation for log (distance) of the curve, given by:

$$E = E_{inf} + (E_{sup} - E_{inf}) \log(d / D_{inf}) / \log(D_{sup} / D_{inf}) \qquad \text{dB}(\mu\text{V/m}) \qquad (7c)$$

where:

D_{inf}: penultimate tabulation distance (km)

D_{sup}: final tabulation distance (km)

E_{inf}: field strength at penultimate tabulation distance (dB(μV/m))

E_{sup}: field strength at final tabulation distance (dB(μV/m)).

Note that this propagation prediction method is not to be used for distances greater than 1 000 km. Equation (7c) shall be used only for extrapolating for $h_1 < 10$ m.

For an all-sea path:

Note that for an all-sea path, h_1 shall not be less than 1 m. The procedure requires the distance at which the path has 0.6 of the first Fresnel zone just unobstructed by the sea surface. This is given by:

$$D_{h_1} = D_{06}(f, h_1, 10) \quad \text{km} \tag{8a}$$

where the function D_{06} is defined in § A.2.1.14 and f is the required frequency.

If $d > D_{h_1}$ it will be necessary to also calculate the 0.6 of the first Fresnel clearance distance for a sea path where the transmitting/base antenna height is 20 m, given by:

$$D_{20} = D_{06}(f, 20, 10) \quad \text{km} \tag{8b}$$

where f is the required frequency.

The field strength for the required distance, d, and value of h_1, is then given by:

$$E = E_{max} \quad \text{dB}(\mu\text{V/m}) \qquad \text{for} \quad d \le D_{h_1} \tag{9a}$$

$$E = E_{D_{h_1}} + (E_{D_{20}} - E_{D_{h_1}}) \times \log(d / D_{h_1}) / \log(D_{20} / D_{h_1}) \quad \text{dB}(\mu\text{V/m}) \qquad \text{for} \quad D_{h_1} < d < D_{20} \tag{9b}$$

$$E = E'(1 - F_s) + E'' F_s \quad \text{dB}(\mu\text{V/m}) \qquad \text{for} \quad d \ge D_{20} \tag{9c}$$

where:

E_{max}: maximum field strength at the required distance given in § A.2.1.2

$E_{D_{h_1}}$: E_{max} for distance D_{h_1} as given in § A.2.1.2

$E_{D_{20}}$ = $E_{10}(D_{20}) + (E_{20}(D_{20}) - E_{10}(D_{20})) \log(h_1 / 10) / \log(20/10)$

$E_{10}(x)$: field strength for $h_1 = 10$ m interpolated for distance x (dB(μV/m))

$E_{20}(x)$: field strength for $h_1 = 20$ m interpolated for distance x (dB(μV/m))

E'= $E_{10}(d) + (E_{20}(d) - E_{10}(d)) \log(h_1/10) / \log(20/10)$ (dB(μV/m))

E'': field strength for distance d calculated using the method for land paths given above

F_S = $(d - D_{20}) / d$.

A.2.1.4.3 Negative values of transmitting/base antenna height, h_1

For land paths and mixed paths it is possible for the effective transmitting/base antenna height h_{eff} to have a negative value, since it is based on the average terrain height at distances from 3 km to 15 km. Thus h_1 may be negative.

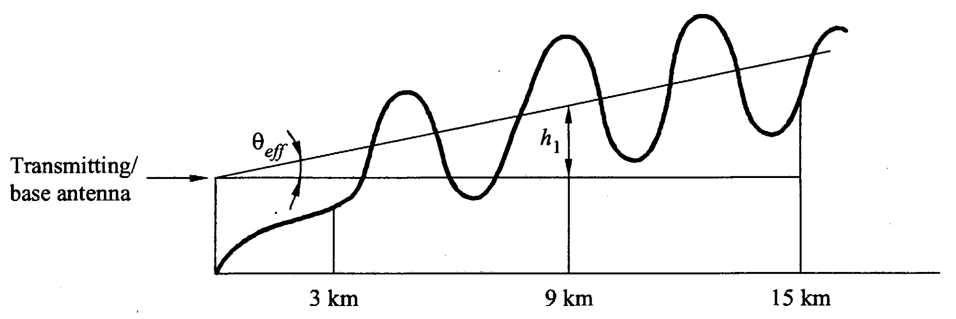
The procedure for negative values of h_1 is to obtain the field strength for $h_1 = 0$ as described in § A.2.1.4.2, and to calculate a correction based on the terrain clearance angle described in § A.2.1.10. The clearance angle is calculated as follows.

a) In cases where a terrain database is available, the terrain clearance angle from the transmitting/base antenna shall be calculated as the elevation angle of a line which just clears all terrain obstructions up to 15 km from the transmitting/base antenna in the direction of (but not going beyond) the receiving/mobile antenna. This clearance angle, which will have a positive value, shall be used instead of θ_{tca} in equation (23f) in the terrain clearance angle correction method given in § A.2.1.10 to obtain a correction, C_a which is added to the field strength obtained for $h_1 = 0$. It should be noted that using this method can result in a discontinuity in field strength at the transition around $h_1 = 0$.

b) In cases where a terrain database is not available, the (positive) effective terrain clearance angle, θ_{eff}, may be estimated assuming an obstruction of height h_1, calculated as in § A.2.1.3.1.1, at a distance of 9 km from the transmitting/base antenna. Note that this is used for all path lengths, even when less than 9 km. That is, the ground is regarded as approximating an irregular wedge over the range 3 km to 15 km from the transmitting/base antenna, with its mean value occurring at 9 km, as indicated in Fig. A.2.1-1. The value of θ_{eff} shall be used instead of θ_{tca} in equation (23f) in the terrain clearance angle correction method given in § 10 to obtain a correction, C_a, which is added to the field strength obtained for $h_1 = 0$. This correction is only to be applied if it results in a reduction of the field strength.

FIGURE A.2.1-1

Effective clearance angle for $h_1 < 0$



θ_{eff}: effective terrain clearance angle (positive)
h_1: transmitting/base antenna height used for calculation

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The effect of tropospheric loss can be taken into account by a correction, C_t, given by:

$$C_t = \max[C_a, C_{tropo}] \tag{10a}$$

where:

$$C_{tropo} = 30 \log\left[\frac{\theta_e}{\theta_e + \theta_{tca}}\right] \qquad (10b)$$

and:

$$\theta_e = \frac{180d}{a\pi k} \quad \text{degrees} \qquad (10c)$$

with:

- d: path length (km)
- a: 6 370 km, radius of the Earth
- k: 4/3, effective Earth radius factor for median refractivity conditions.

It is assumed that θ_{tca} has the value of 0.0 for an effective height of 0 m.

A.2.1.5 Interpolation of field strength as a function of distance

The Figures in Annex 2.3 show field strength plotted against distance, *d*, between 1 km and 1 000 km. No interpolation for distance is needed if field strengths are read directly from these curves. For greater precision, and for computer implementation, field strengths should be obtained from the associated tabulations (available from the BR). In this case, unless *d* coincides with one of the tabulation distances given in Table A.2.1-1, the field strength, E (dB(μV/m)), shall be linearly interpolated for the logarithm of the distance using:

$$E = E_{inf} + (E_{sup} - E_{inf}) \log (d / d_{inf}) / \log (d_{sup} / d_{inf}) \quad \text{dB}(\mu\text{V/m}) \qquad (11)$$

where:

- d: distance for which the prediction is required (km)
- d_{inf}: nearest tabulation distance less than d (km)
- d_{sup}: nearest tabulation distance greater than d (km)
- E_{inf}: field strength value for d_{inf} (dB(μV/m))
- E_{sup}: field strength value for d_{sup} (dB(μV/m)).

This propagation prediction method is not valid for values of *d* less than 1 km or greater than 1 000 km.

TABLE A.2.1-1

Values of distance (km) used in the tables of field strengths

1	14	55	140	375	700
2	15	60	150	400	725
3	16	65	160	425	750
4	17	70	170	450	775
5	18	75	180	475	800
6	19	80	190	500	825
7	20	85	200	525	850
8	25	90	225	550	875
9	30	95	250	575	900
10	35	100	275	600	925
11	40	110	300	625	950
12	45	120	325	650	975
13	50	130	350	675	1 000

A.2.1.6 Interpolation of field strength as a function of frequency

Field-strength values for a given required frequency shall be obtained by interpolating between the values for the nominal frequency values of 100 MHz, 600 MHz and 2 000 MHz. The required field strength, E, shall be calculated using:

$$E = E_{inf} + (E_{sup} - E_{inf}) \log(f / f_{inf}) / \log(f_{sup} / f_{inf}) \quad \text{dB}(\mu\text{V/m}) \qquad (12)$$

where:

f: frequency for which the prediction is required (MHz)

f_{inf}: lower nominal frequency (100 MHz if $f <$ 600 MHz, 600 MHz otherwise)

f_{sup}: higher nominal frequency (600 MHz if $f <$ 600 MHz, 2 000 MHz otherwise)

E_{inf}: field strength value for f_{inf} (dB(μV/m))

E_{sup}: field strength value for f_{sup} (dB(μV/m)).

A.2.1.7 Interpolation of field strength as a function of percentage time

Field strength values for a required percentage of the time between 1% and 50% shall be calculated by interpolation between the nominal values 1% and 10% or between the nominal values 10% and 50% using:

$$E = E_{sup} (Q_{inf} - Q_t) / (Q_{inf} - Q_{sup}) + E_{inf}(Q_t - Q_{sup}) / (Q_{inf} - Q_{sup}) \quad \text{dB}(\mu\text{V/m}) \qquad (13)$$

where:

$Q_t = Q_i(t/100)$

$Q_{inf} = Q_i(t_{inf}/100)$

$Q_{sup} = Q_i(t_{sup}/100)$

E_{inf}: field strength value for time percentage t_{inf} (dB(μV/m))

E_{sup}: field strength value for time percentage t_{sup} (dB(μV/m))

t: percentage of the time for which the prediction is required

t_{inf}: lower nominal percentage time

t_{sup}: upper nominal percentage time

where $Q_i(x)$ is the inverse complementary cumulative normal distribution function.

This propagation prediction method shall be used for field strengths exceeded for percentage times in the range 1% to 50% only. Extrapolation outside the range 1% to 50% time is not valid.

A method for the calculation of $Q_i(x)$ is given in § A.2.1.12.

A.2.1.8 Mixed paths

When paths occur over different propagation zones, e.g. land, sea, areas of different refractivity, the method given below shall be used for the following conditions:

a) for all frequencies and all percentages of the time and for those combinations of propagation zone which do not involve any land/sea or land/coastal land transitions, the following procedure for calculating the field strength shall be used:

$$E_{m,t} = \sum_i \frac{d_i}{d_T} E_{i,t} \tag{14}$$

where:

$E_{m,t}$: field strength for mixed path for t% of the time (dB(μV/m))

$E_{i,t}$: field strength for path in zone i equal in length to the mixed path for t% of the time (dB(μV/m))

d_i: length of path in zone i

d_T: length of total path;

b) for all frequencies and all percentages of time and for those combinations of propagation zone which involve only a single land propagation category and a single sea or coastal land propagation category, the following procedure for calculating the field strength shall be used:

$$E_{m,t} = (1 - A) \cdot E_{l,t} + A \cdot E_{s,t} \tag{15a}$$

where:

$E_{m,t}$: field strength for mixed path for t% of the time (dB(μV/m))

$E_{l,t}$: field strength for land path equal in length to the mixed path for t% of the time (dB(μV/m))

$E_{s,t}$: field strength for sea or coastal land path equal in length to the mixed path for t% of the time (dB(μV/m))

A: interpolation factor as given in § A.2.1.8.1;

c) for all frequencies and all percentages of time and for those combinations of three or more propagation zones which involve at least one land/sea or land/coastal land boundary, the following procedure for calculating the field strength shall be used:

$$E_{m,t} = \{1 - A\} \cdot \frac{\sum_{i=1}^{n_l} d_i E_{li,t}}{d_{lT}} + A \cdot \frac{\sum_{j=1}^{n_s} d_j E_{sj,t}}{d_{sT}} \tag{15b}$$ *

where:

$E_{m,t}$: field strength for mixed path for t% of the time (dB(μV/m))

$E_{li,t}$: field strength for land path i equal in length to the mixed path for t% of the time, $i = 1, ..., n_l$; n_l is the number of land zones traversed (dB(μV/m))

$E_{sj,t}$: field strength for sea or coastal land path j equal in length to the mixed path for t% of the time, $j = 1, ..., n_s$; n_s is the number of sea and coastal land zones traversed (dB(μV/m))

A: interpolation factor as given in § A.2.1.8.1 (note that the "Fraction of path over sea" is calculated as: d_{sT} / d_T)

d_i, d_j: length of path in zones i, j

d_{lT}: length of total land path $= \sum_{i=1}^{n_l} d_i$

* Note that equation (15b) reduces to equation (15a) in the case of mixed propagation paths which involve only a single land propagation category and a single sea or coastal land propagation category.

d_{sT}: length of total sea and coastal land path $= \sum_{j=1}^{n_s} d_j$

d_T: length of total propagation path $= d_{lT} + d_{sT}$.

A.2.1.8.1 The mixed path interpolation factor, A

The fraction of path over sea, F_s, used in Fig. A.2.1-2 is given by:

$$F_s = \frac{d_{sT}}{d_T} \tag{16}$$

where:

d_{sT}: length of total sea and coastal land path

d_T: length of total propagation path.

The interpolation factor[1], A, is given by:

$$A = F_s^V \tag{17}$$

The procedure to calculate V begins by deriving a field strength value for a given segment of the propagation path from the value obtained by assuming that that zone type extends over the whole path:

$$E_n(d_n) = E_n(d_T)\frac{d_n}{d_T} \tag{18}$$

where:

n: zone number

d_n: distance in zone type n (km)

d_T: total path length

$E_n(d_n)$: field strength value for distance d_n in zone type n (dB(μV/m))

$E_n(d_T)$: field strength value for distance d_T assumed to be all of zone type n (dB(μV/m)).

The field strength values for the individual land segments, $E_{ln}(d_{ln})$, are summed and the field strength values for the individual sea segments, $E_{sn}(d_{sn})$, are summed and each is divided by the fraction of the path over land and sea, respectively. The weighted difference, Δ, between these two summed results is given by:

[1] The interpolation factor is applied to all frequencies and to all time percentages. It must be noted that the interpolation is only applied to land-sea paths and not to land-land or sea-sea paths.

$$\Delta = \left\{ \frac{\sum_{n=1}^{N_s} E_{sn}}{\frac{d_{sT}}{d_T}} - \frac{\sum_{n=1}^{N_l} E_{ln}}{\frac{d_{lT}}{d_T}} \right\} \tag{19}$$

where:

E_{sn}: n-th sea section field strength value (dB(μV/m))
E_{ln}: n-th land section field strength value (dB(μV/m))
N_s and N_l: number of sea and land sections respectively
d_{sT} and d_{lT}: total sea and land path length respectively.

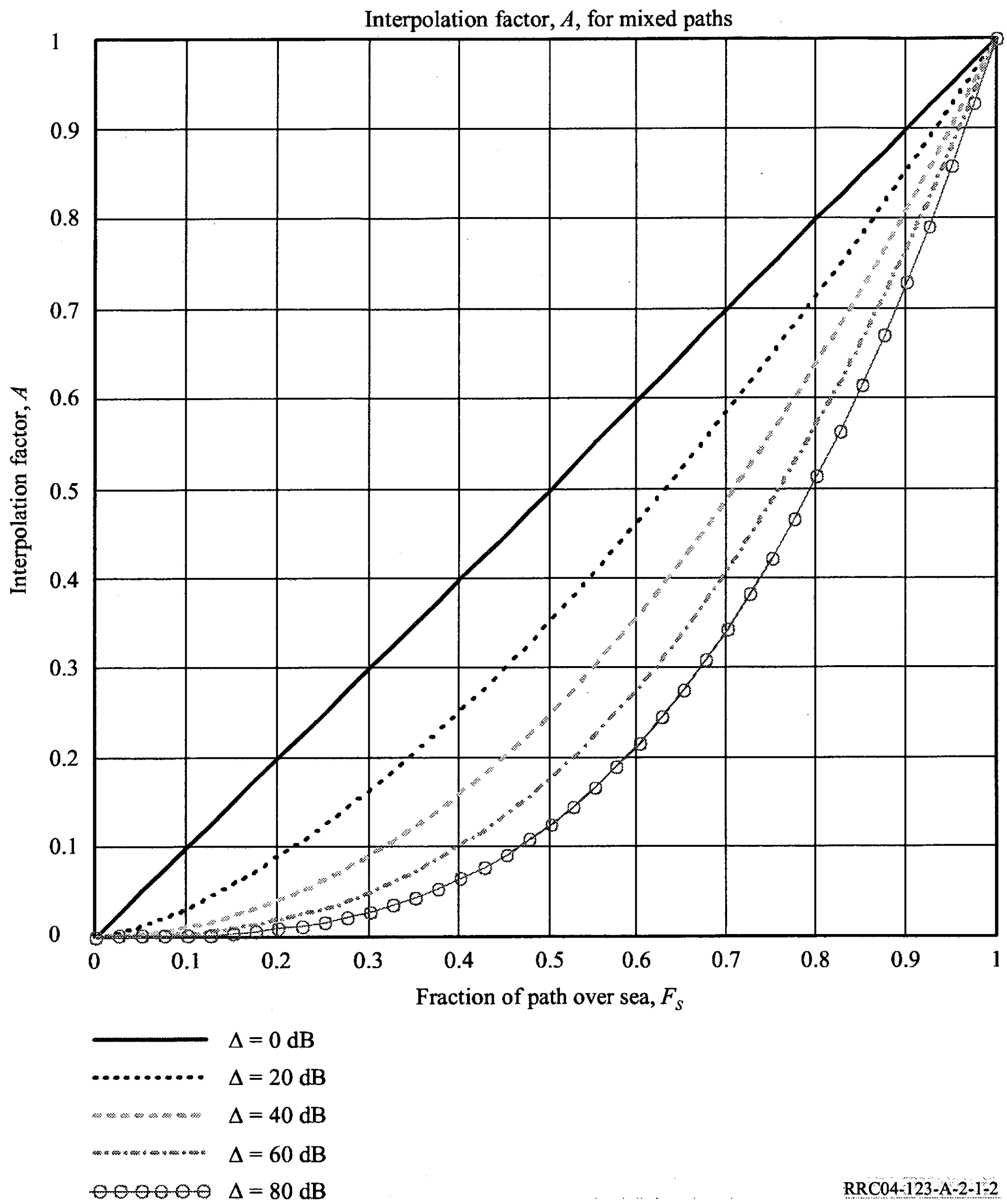
V is calculated using the expression:

$$V = \max\left[1.0, 1.0 + \frac{\Delta}{40.0}\right] \tag{20}$$

Figure A.2.1-2 shows $A(F_s)$ for various values of Δ.

FIGURE A.2.1-2

The mixed path interpolation factor, A, as a function of the fraction of path over sea, F_S, for various values of the weighted difference of sea and land field strengths, Δ



A.2.1.9 Correction for receiving/mobile antenna height

The field-strength values given by the land curves and associated tabulations in this propagation prediction method are for a reference receiving/mobile antenna at a height, R (m), representative of the height of the ground cover surrounding the receiving/mobile antenna, subject to a minimum height value of 10 m. For open and suburban area and also for sea paths the notional value of R is 10 m.

Where the site of the receiving/mobile antenna is on land, account shall first be taken of the elevation angle of the arriving ray by calculating a modified representative clutter height R' (m), given by:

$$R' = (1\,000\, d\, R - 15\, h_1)/(1\,000\, d - 15) \qquad \text{m} \qquad (21)$$

where h_1 and R are given in metres and the distance d is in kilometres.

Note that for $h_1 < 6.5d + R$, $R' \approx R$.

The value of R' must be limited, if necessary, such that it is not less than 1 m.

When the receiving/mobile antenna is in either a suburban or urban environment the correction is then given by:

$$\text{Correction} = 6.03 - J(\nu) \qquad \text{dB} \qquad \text{for } h_2 < R' \qquad (22a)$$

$$= K_{h_2} \log (h_2 / R') \qquad \text{dB} \qquad \text{for } h_2 \geq R' \qquad (22b)$$

where $J(\nu)$ is given by equation (23d),

and:

$$\nu = K_{nu} \sqrt{h_{dif} \theta_{clut}} \qquad (22c)$$

$$h_{dif} = R' - h_2 \qquad \text{m} \qquad (22d)$$

$$\theta_{clut} = \arctan (h_{dif} / 27) \qquad \text{degrees} \qquad (22e)$$

$$K_{h_2} = 3.2 + 6.2 \log (f) \qquad (22f)$$

$$K_{nu} = 0.0108 \sqrt{f} \qquad (22g)$$

f: required frequency (MHz).

Where the receiving/mobile antenna is on land in a rural or open environment, the correction is given by equation (22b) for all values of h_2.

Where the site of the receiving/mobile antenna is on the sea for $h_2 \geq 10$ m, the correction shall be calculated using equation (22b) with R' set to 10 m.

Where the site of the receiving/mobile antenna is on the sea for $h_2 < 10$ m, an alternative method shall be used, based upon the path lengths at which 0.6 of the first Fresnel zone is just clear of obstruction by the sea surface. An approximate method for calculating this distance is given in § A.2.1.14.

The distance, d_{10}, at which the path would just have 0.6 Fresnel clearance for the required value of h_1 and for $h_2 = 10$ m shall be calculated as $D_{06}(f, h_1, 10)$ in § A.2.1.14.

If the required distance is equal to or greater than d_{10}, then again the correction for the required value of h_2 shall be calculated using equation (22b) with R' set to 10 m.

If the required distance is less than d_{10}, then the correction to be added to the field strength E shall be calculated using:

$$\text{Correction} = 0.0 \quad \text{dB} \qquad \text{for} \quad d \le d_{h_2} \tag{22h}$$

$$= C_{10} \times \log(d / d_{h_2}) / \log(d_{10} / d_{h_2}) \,\text{dB} \qquad \text{for}\, d_{h_2} < d < d_{10} \tag{22j}$$

where:

C_{10}: correction for the required value of h_2 at distance d_{10} using equation (22b) with R' set to 10 m

d_{10}: distance at which the path just has 0.6 Fresnel clearance for $h_2 = 10$ m calculated as $D_{06}(f, h_1, 10)$ as given in § A.2.1.14

d_{h_2} : distance at which the path just has 0.6 Fresnel clearance for the required value of h_2 calculated as $D_{06}(f, h_1, h_2)$ as given in § A.2.1.14.

This correction shall not be used for receiving/mobile antenna heights, h_2, less than 1 m when the receiving site is on land or less than 3 m when on the sea.

A.2.1.10 Correction for terrain clearance angle

For land paths, and when the receiving/mobile antenna is on a land section of a mixed path, if greater precision is required for predicting the field strength for reception conditions in specific areas, e.g. in a small reception area, a correction may be made based on a terrain clearance angle. The terrain clearance angle, θ_{tca}, is given by:

$$\theta_{tca} = \theta - \theta_r \qquad \text{degrees} \tag{23a}$$

where θ is measured relative to the line from the receiving/mobile antenna which just clears all terrain obstructions in the direction of the transmitter/base antenna over a distance of up to 16 km but not going beyond the transmitting/base antenna. It is measured relative to the horizontal at the receiving/mobile antenna, being positive if the clearance line is above the horizontal. This is shown in Fig. A.2.1-3.

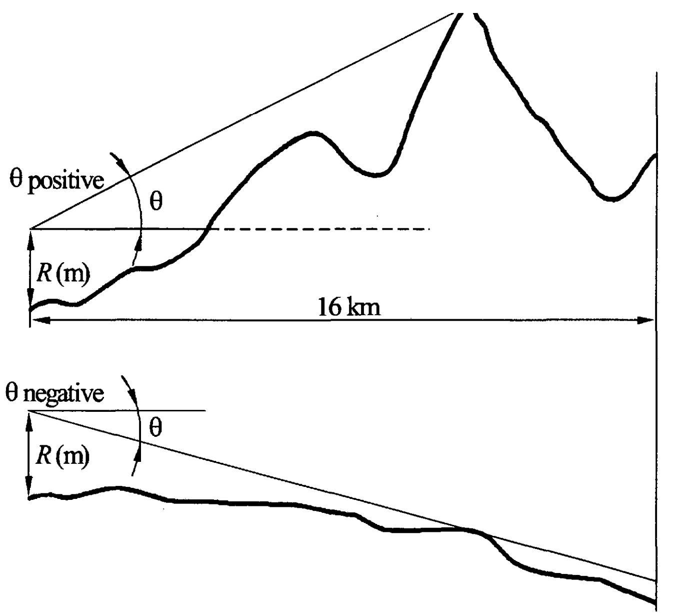
The reference angle θ_r is given by:

$$\theta_r = \arctan\left(\frac{h_{1s} - h_{2s}}{1\,000d}\right) \qquad \text{degrees} \qquad (23b)$$

where h_{1s} and h_{2s} are the height of transmitting/base and receiving/mobile antennas above sea level respectively.

FIGURE A.2.1-3

Terrain clearance angle



Where the relevant terrain clearance angle information is available, the correction to be added to the field strength is calculated using:

$$\text{Correction} = J(\nu') - J(\nu) \quad \text{dB} \qquad (23c)$$

where $J(\nu)$ is given by:

$$J(\nu) = \left[6.9 + 20\log\left(\left(\sqrt{(\nu - 0.1)^2 + 1} + \nu - 0.1\right)\right)\right] \qquad (23d)$$

$$\nu' = 0.036\sqrt{f} \qquad (23e)$$

$$\nu = 0.065\,\theta_{tca}\sqrt{f} \qquad (23f)$$

θ_{tca}: terrain clearance angle (degrees)

f: required frequency (MHz).

The correction is valid for clearance angle, θ_{tca}, in the range +0.55° to +40°.

The correction for $\theta_{tca} < +0.55°$ is the same as for $\theta_{tca} = +0.55°$.

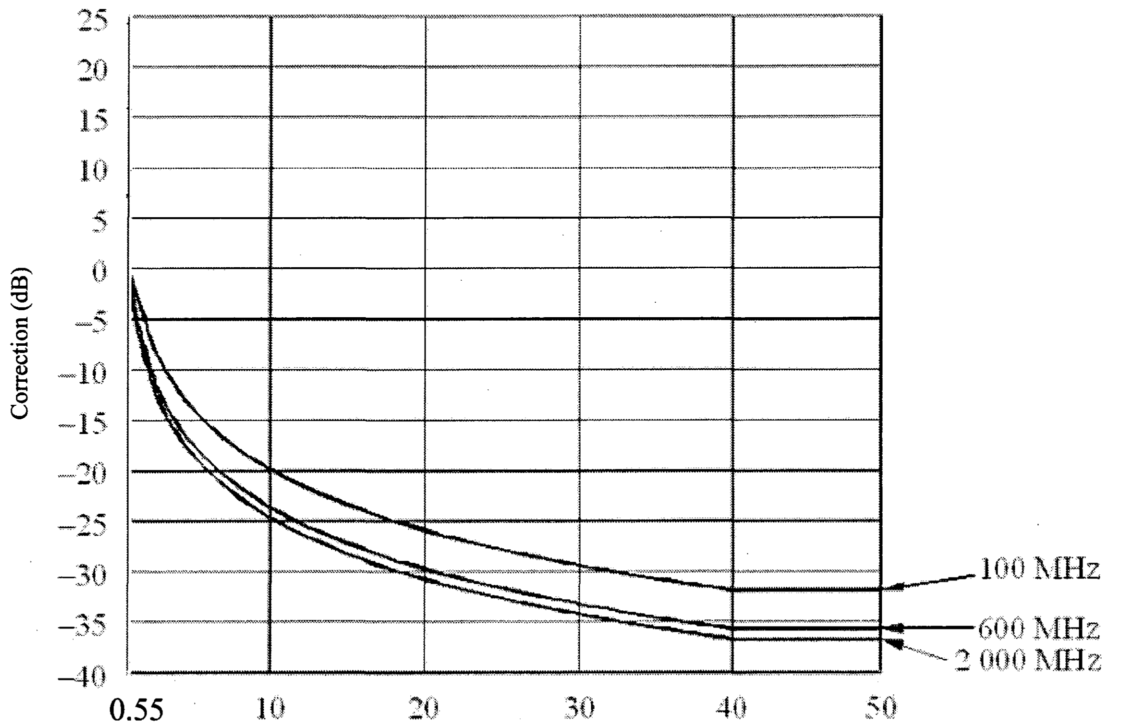
The correction for $\theta_{tca} > +40°$ is the same as for $\theta_{tca} = +40°$.

It should be noted that the land field strength curves take account of losses due to typical shielding of the receiving/mobile antenna by gently rolling terrain. Thus the terrain clearance angle corrections are zero at a small positive angle typical of receiving/mobile antenna positions.

Figure A.2.1-4 illustrates the terrain clearance angle correction for the nominal frequencies.

FIGURE A.2.1-4

Terrain clearance angle correction



A.2.1.11 Location variability in land area-coverage prediction

For receiving/mobile antenna locations on land the field strength E which will be exceeded for q% of locations is given by:

$$E(q) = E\,(\text{median}) + Q_i(q\,/\,100)\,\sigma_L(f) \quad \text{dB}(\mu\text{V/m}) \tag{24}$$

where:

$Q_i(x)$: inverse complementary cumulative normal distribution as a function of probability

σ_L: standard deviation of the Gaussian distribution of the local means in the study area.

Values of standard deviation for digital systems having a bandwidth less than 1 MHz and for analogue systems are given as a function of frequency by:

$$\sigma_L = K + 1.6 \log(f) \quad \text{dB} \tag{25}$$

where:

$K =$ 2.1 for mobile systems in urban locations

$=$ 3.8 for mobile systems in suburban locations or amongst rolling hills

$=$ 5.1 for analogue broadcasting systems

f: required frequency (MHz).

For digital systems having a bandwidth of 1 MHz or greater, a standard deviation of 5.5 dB shall be used at all frequencies.

The percentage of locations q can vary between 1% and 99%. This propagation prediction method shall not be used for percentage locations less than 1% or greater than 99%.

The location variability correction is not to be applied when the receiver/mobile location is on the sea.

A.2.1.12 An approximation to the inverse complementary cumulative normal distribution function

The following approximation to the inverse complementary cumulative normal distribution function, $Q_i(x)$, is valid for $0.01 \le x \le 0.99$:

$$Q_i(x) = T(x) - \xi(x) \qquad \text{if } x \le 0.5 \tag{26a}$$

$$Q_i(x) = -\{\,T(1-x) - \xi(1-x)\,\} \qquad \text{if } x > 0.5 \tag{26b}$$

where:

$$T(x) = \sqrt{[-2\ln(x)]} \tag{26c}$$

$$\xi(x) = \frac{[(C_2 \cdot T(x) + C_1) \cdot T(x)] + C_0}{[(D_3 \cdot T(x) + D_2) \cdot T(x) + D_1] \cdot T(x) + 1} \tag{26d}$$

$$C_0 = 2.515517$$

$$C_1 = 0.802853$$

$$C_2 = 0.010328$$

$$D_1 = 1.432788$$

$$D_2 = 0.189269$$

$$D_3 = 0.001308$$

Values given by the above equations are given in Table A.2.1-2.

TABLE A.2.1-2

Approximate inverse complementary cumulative normal distribution values

$q\%$	$Q_i(q/100)$	$q\%$	$Q_i(q/100)$	$q\%$	$Q_i(q/100)$	$q\%$	$Q_i(q/100)$
1	2.327	26	0.643	51	–0.025	76	–0.706
2	2.054	27	0.612	52	–0.050	77	–0.739
3	1.881	28	0.582	53	–0.075	78	–0.772
4	1.751	29	0.553	54	–0.100	79	–0.806
5	1.645	30	0.524	55	–0.125	80	–0.841
6	1.555	31	0.495	56	–0.151	81	–0.878
7	1.476	32	0.467	57	–0.176	82	–0.915
8	1.405	33	0.439	58	–0.202	83	–0.954
9	1.341	34	0.412	59	–0.227	84	–0.994
10	1.282	35	0.385	60	–0.253	85	–1.036
11	1.227	36	0.358	61	–0.279	86	–1.080
12	1.175	37	0.331	62	–0.305	87	–1.126
13	1.126	38	0.305	63	–0.331	88	–1.175
14	1.080	39	0.279	64	–0.358	89	–1.227
15	1.036	40	0.253	65	–0.385	90	–1.282
16	0.994	41	0.227	66	–0.412	91	–1.341
17	0.954	42	0.202	67	–0.439	92	–1.405
18	0.915	43	0.176	68	–0.467	93	–1.476
19	0.878	44	0.151	69	–0.495	94	–1.555
20	0.841	45	0.125	70	–0.524	95	–1.645
21	0.806	46	0.100	71	–0.553	96	–1.751
22	0.772	47	0.075	72	–0.582	97	–1.881
23	0.739	48	0.050	73	–0.612	98	–2.054
24	0.706	49	0.025	74	–0.643	99	–2.327
25	0.674	50	0.000	75	–0.674		

A.2.1.13 Equivalent basic transmission loss

When required, the basic transmission loss equivalent to a given field strength is given by:

$$L_b = 139 - E + 20 \log f \quad \text{dB} \tag{27}$$

where:

- L_b: basic transmission loss (dB)
- E: field strength (dB(μV/m)) for 1 kW ERP (dB(μV/m))
- f: required frequency (MHz).

A.2.1.14 An approximation of the 0.6 Fresnel clearance path length

The path length which just achieves a clearance of 0.6 of the first Fresnel zone over a smooth curved Earth, for a given frequency and antenna heights h_1 and h_2, is given approximately by:

$$D_{06}\,(f, h_1, h_2) = \frac{D_f \cdot D_h}{D_f + D_h} \quad \text{km} \tag{28}$$

where:

D_f: frequency-dependent term

$$= 0.0000389\, f\, h_1 h_2 \quad \text{km} \tag{28a}$$

D_h: asymptotic term defined by horizon distances

$$= 4.1(\sqrt{h_1} + \sqrt{h_2}) \quad \text{km} \tag{28b}$$

f: required frequency (MHz)

h_1, h_2: antenna heights above smooth Earth (m).

In the above equations, the value of h_1 must be limited, if necessary, such that it is not less than zero. Moreover, the resulting value of D_{06} must be limited, if necessary, such that it is not less than 0.001 km.

A.2.1.15 Procedure for the application of this propagation prediction method

The step-by-step procedure given below is intended to be applied to values derived from the field strength versus distance tables (see Annex 2.2). It may, however, also be applied to values obtained from the curves, in which case the distance interpolation procedure of Step 8.1.5 is not needed.

Step 1: Determine the type of the propagation path as land, cold sea or warm sea. If the path is mixed then determine two path types which are regarded as first and second propagation types. If the path can be represented by a single type then this is regarded as the first propagation type and the mixed-path method given in Step 11 is not required.

Step 2: For any given percentage of time (in the range 1% to 50%), determine two nominal time percentages as follows:

– if the required percentage of the time is > 1% and < 10%, the lower and higher nominal percentages are 1% and 10%, respectively;

– if the required percentage of the time > 10% and < 50%, the lower and higher nominal percentages are 10% and 50%, respectively.

If the required percentage of time is equal to 1% or 10% or 50%, this value shall be regarded as the lower nominal percentage time and the interpolation process of Step 10 is not required.

Step 3: For any required frequency (in the range 174 to 862 MHz) determine two nominal frequencies as follows:

– where the required frequency < 600 MHz, the lower and higher nominal frequencies are 100 and 600 MHz, respectively;

– where the required frequency > 600 MHz, the lower and higher nominal frequencies are 600 and 2 000 MHz, respectively.

If the required frequency equals 100 or 600 MHz, this value shall be regarded as the lower nominal frequency and the interpolation process of Step 9 is not required.

Step 4: Determine the lower and higher nominal distances from Table A.2.1-1 closest to the required distance. If the required distance coincides with a value in Table A.2.1-1, this shall be regarded as the lower nominal distance and the interpolation process of Step 8.1.5 is not required.

Step 5: For the first propagation type follow Steps 6 to 10.

Step 6: For the lower nominal percentage time follow Steps 7 to 9.

Step 7: For the lower nominal frequency follow Step 8.

Step 8: Obtain the field strength exceeded at 50% locations for a receiving/mobile antenna at the height of representative clutter, *R*, above ground for the required distance and transmitting/base antenna height as follows:

Step 8.1: For a transmitting/base antenna height h_1 equal to or greater than 10 m, follow Steps 8.1.1 to 8.1.5:

Step 8.1.1: Determine the lower and higher nominal h_1 values using the method given in § 4.1. If h_1 coincides with one of the nominal values 10, 20, 37.5, 75, 150, 300, 600 or 1 200 m, this shall be regarded as the lower nominal value of h_1 and the interpolation process of Step 8.1.6 is not required.

Step 8.1.2: For the lower nominal value of h_1 follow Steps 8.1.3 to 8.1.5.

Step 8.1.3: For the lower nominal value of distance follow Step 8.1.4.

Step 8.1.4: Obtain the field strength exceeded at 50% locations for a receiving/mobile antenna at the height of representative clutter, *R*, for the required values of distance, *d*, and transmitting/base antenna height, h_1.

Step 8.1.5: If the required distance does not coincide with the lower nominal distance, repeat Step 8.1.4 for the higher nominal distance and interpolate the two field strengths for distance using the method given in § A.2.1.5.

Step 8.1.6: If the required transmitting/base antenna height, h_1, does not coincide with one of the nominal values, repeat Steps 8.1.3 to 8.1.5 and interpolate/extrapolate for h_1 using the method given in § A.2.1.4.1. If necessary, limit the result to the maximum given in § A.2.1.2.

Step 8.2: For a transmitting/base antenna height h_1 less than 10 m, determine the field strength for the required height and distance using the method given in § A.2.1.4.2. If h_1 is less than zero, the method given in § A.2.1.4.3 shall also be used.

Step 9: If the required frequency does not coincide with the lower nominal frequency, repeat Step 8 for the higher nominal frequency and interpolate the two field strengths using the method given in § A.2.1.6. If necessary, limit the result to the maximum field strength as given in § A.2.1.2.

Step 10: If the required percentage of the time does not coincide with the lower nominal percentage time, repeat Steps 7 to 9 for the higher nominal percentage of the time and interpolate the two field strengths using the method given in § A.2.1.7.

Step 11: If the prediction is for a mixed path, follow the procedure given in § A.2.1.8.

Step 12: Correct the field strength for receiving/mobile antenna height h_2 using the method given in § A.2.1.9.

Step 13: If information on the terrain clearance angle at a receiving/mobile antenna location on land is available, correct the field strength for terrain clearance angle at the receiver/mobile using the method given in § A.2.1.10.

Step 14: If the field strength at a receiving/mobile antenna location on land exceeded at a percentage of locations other than 50% is required, correct the field strength for the required percentage of locations using the method given in § A.2.1.11.

Step 15: If necessary limit the resulting field strength to the maximum given in § A.2.1.2.

Step 16: If required, convert field strength to equivalent basic transmission loss for the path using the method given in § A.2.1.13.

ANNEX 2.2

Tabulated values of field strength

Values of field strength (dB(μV/m)) against distance (km) corresponding to the family of propagation curves given in Annex 2.3 are provided in tabulated form and may be accessed from the ITU web page at:

http://www.itu.int/ITU-R/conferences/rrc/rrc-04/index.asp

The detailed instructions for interpolation of these tabulated values are provided in § 5, 6 and 7 of Annex 2.1 to this Chapter.

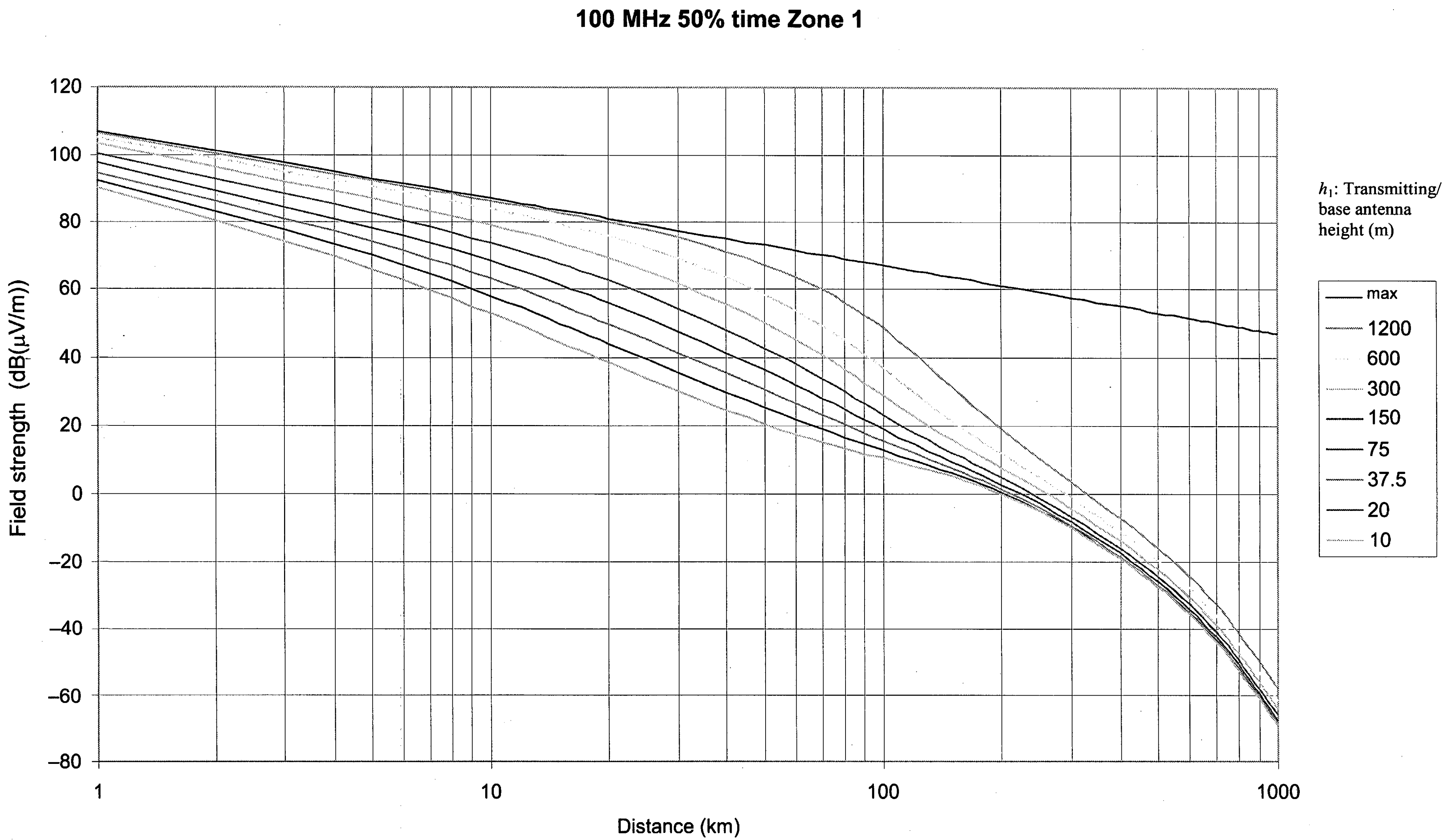
ANNEX 2.3

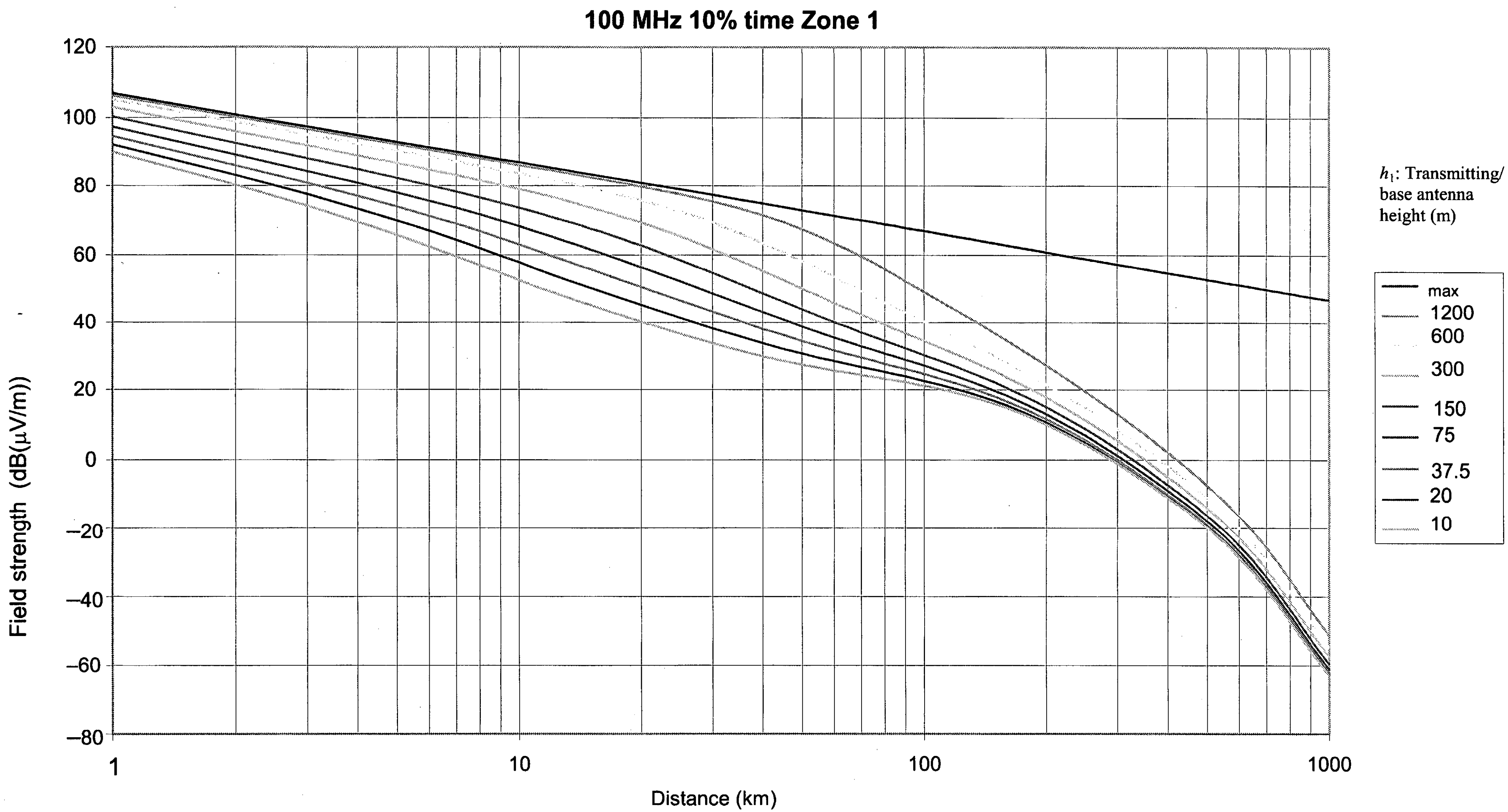
Propagation curves

The propagation curves shown in the figures are used, together with the map shown in § 2.2.2, for the planning of the broadcasting service. They give, on the basis of statistics derived from measurement results, and also of theoretical considerations, the field-strength value exceeded for 50% of locations for time percentages of 50%, 10% and 1%.

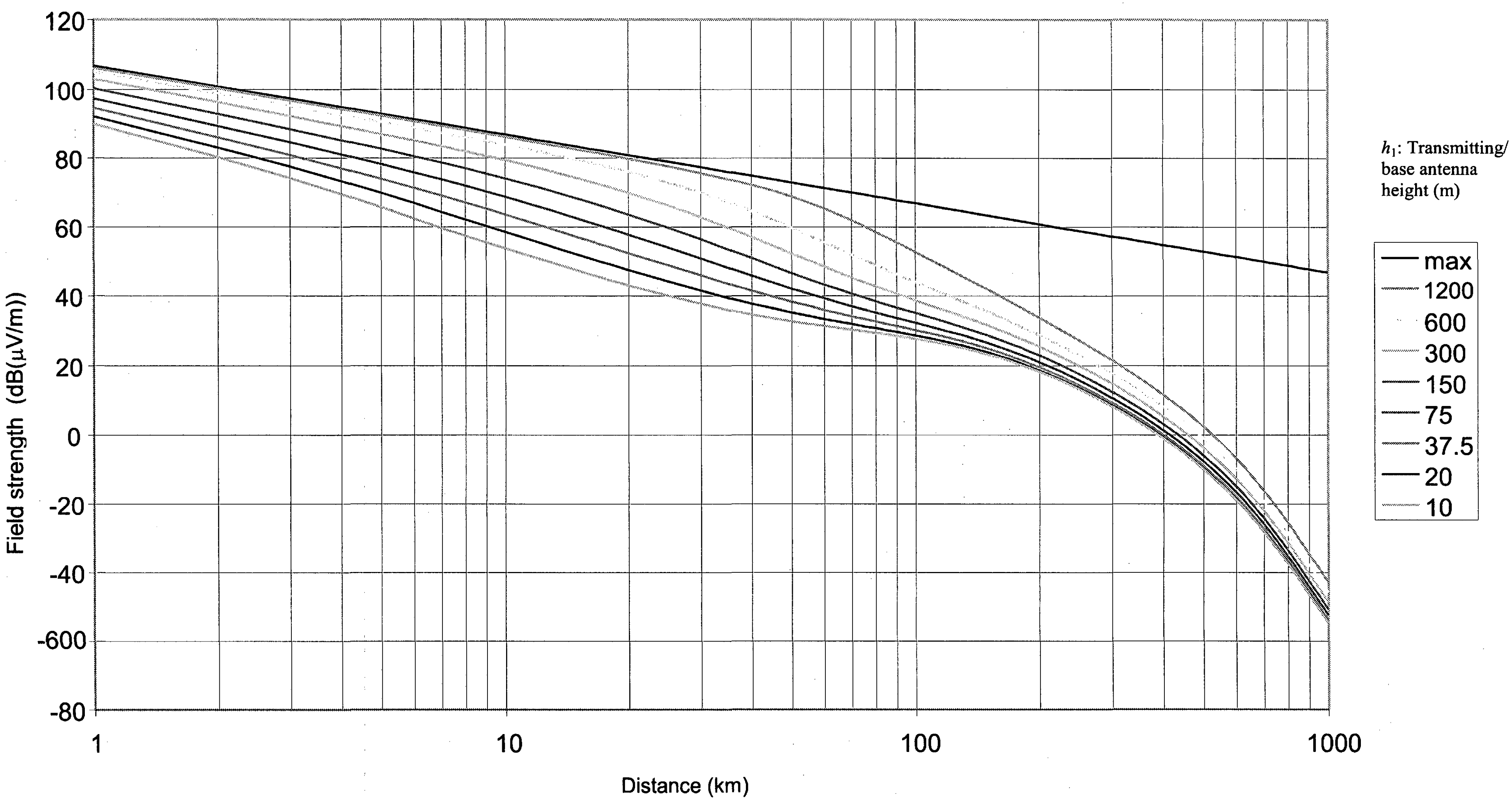
The values obtained correspond to a receiving antenna height of 10 m over local ground in open area. The values are expressed in decibels relative to 1 μV/m (dB(μV/m)) for an e.r.p. of 1 kW in the direction of the reception point. The curves give the values of the field strength exceeded at 50% of locations and each figure corresponds to time percentages of 50%, 10% and 1% for each of the geographical zones.

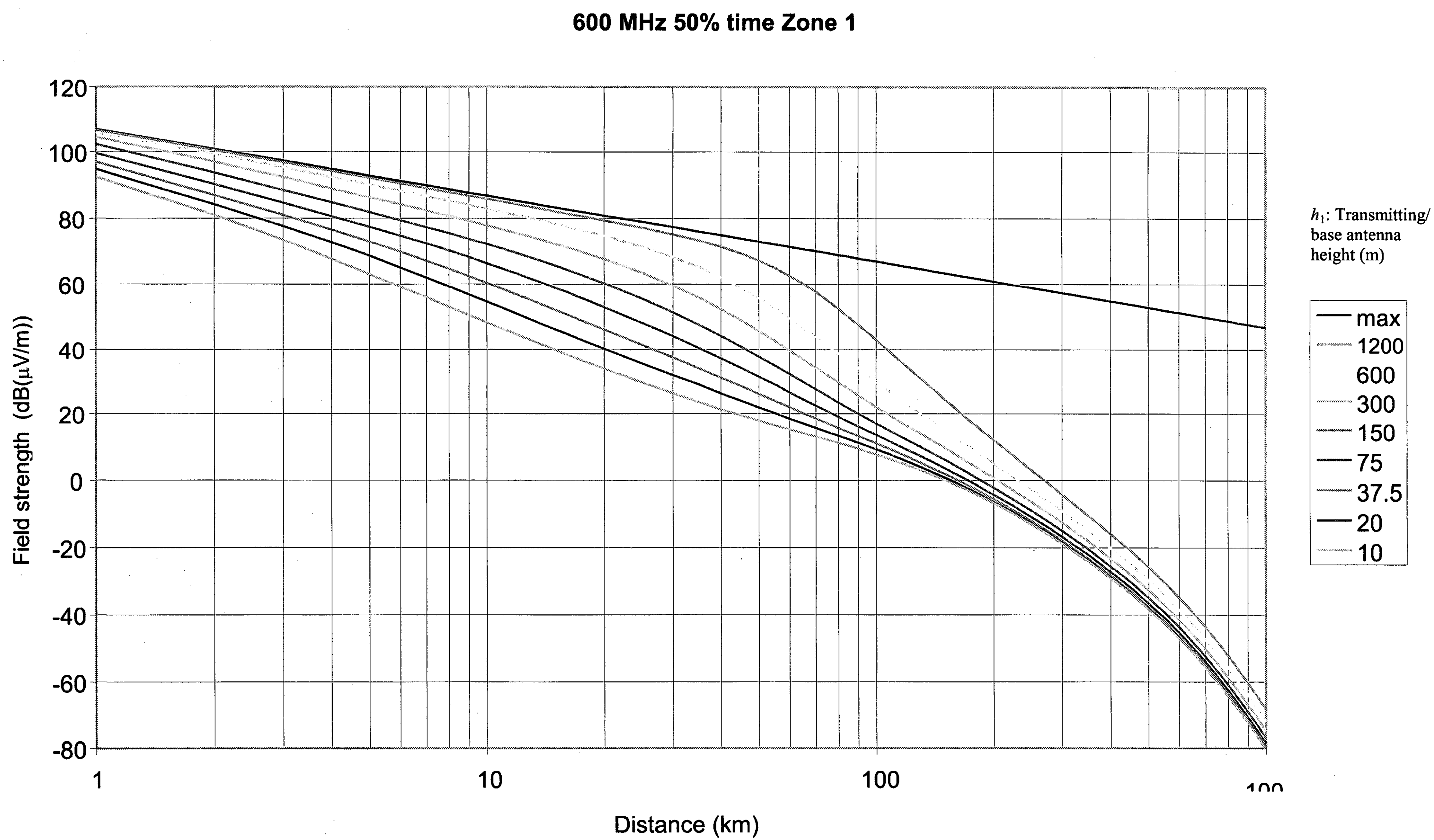
The data are given for various types of areas and climates, namely land, cold sea, warm sea, and areas subject to extreme superrefractivity (see § 2.2.2).


100 MHz 50% time Zone 1
Field strength (dB(μV/m))
Distance (km)
120
100
80
60
40
20
0
−20
−40
−60
−80
1
10
100
1000
h1: Transmitting/
base antenna
height (m)
max
1200
600
300
150
75
37.5
20
10

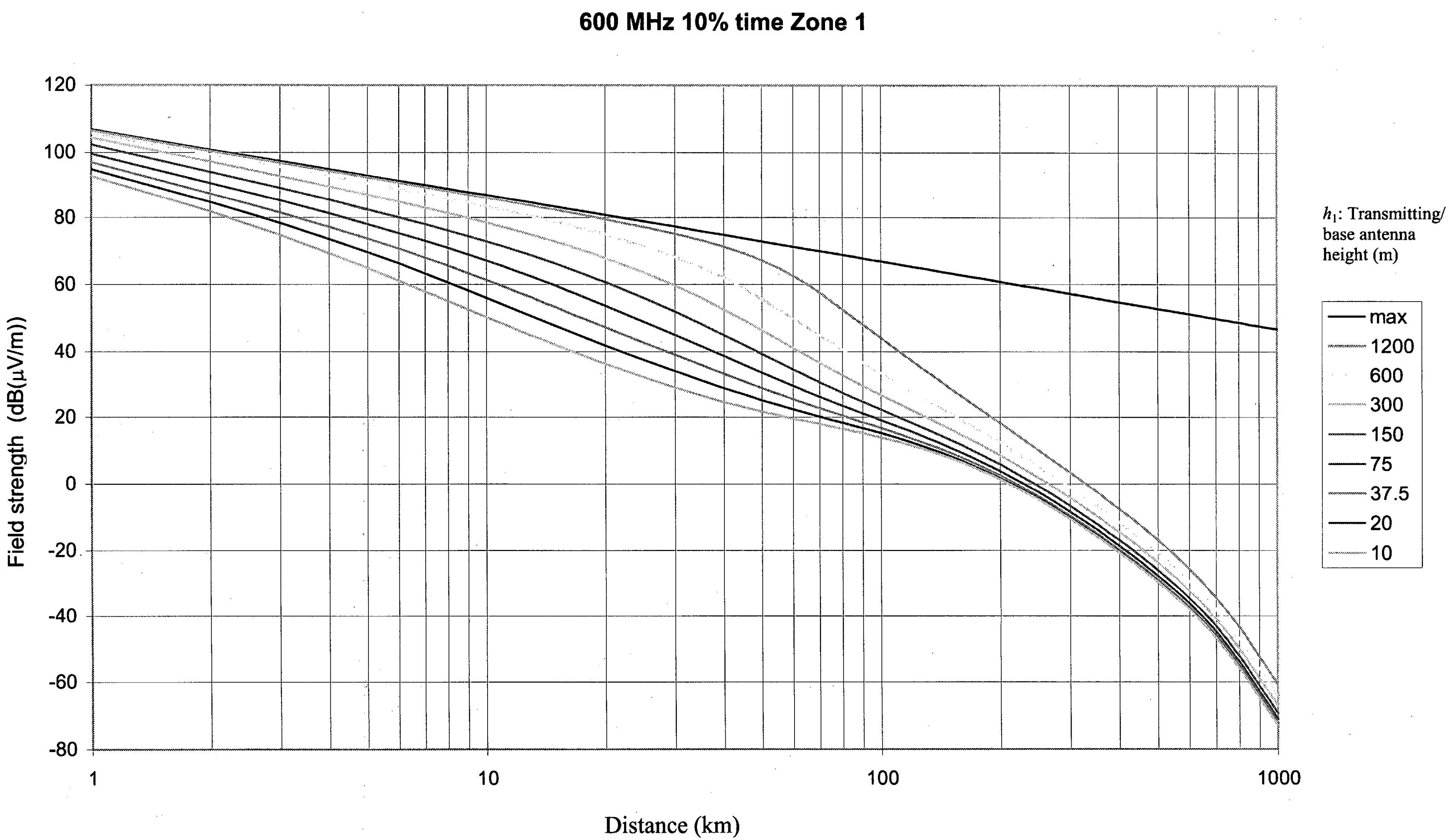

100 MHz 10% time Zone 1
Field strength (dB(μV/m))
120
100
80
60
40
20
0
−20
−40
−60
−80
1
10
100
1000
Distance (km)
h1: Transmitting/ base antenna height (m)
max
1200
600
300
150
75
37.5
20
10

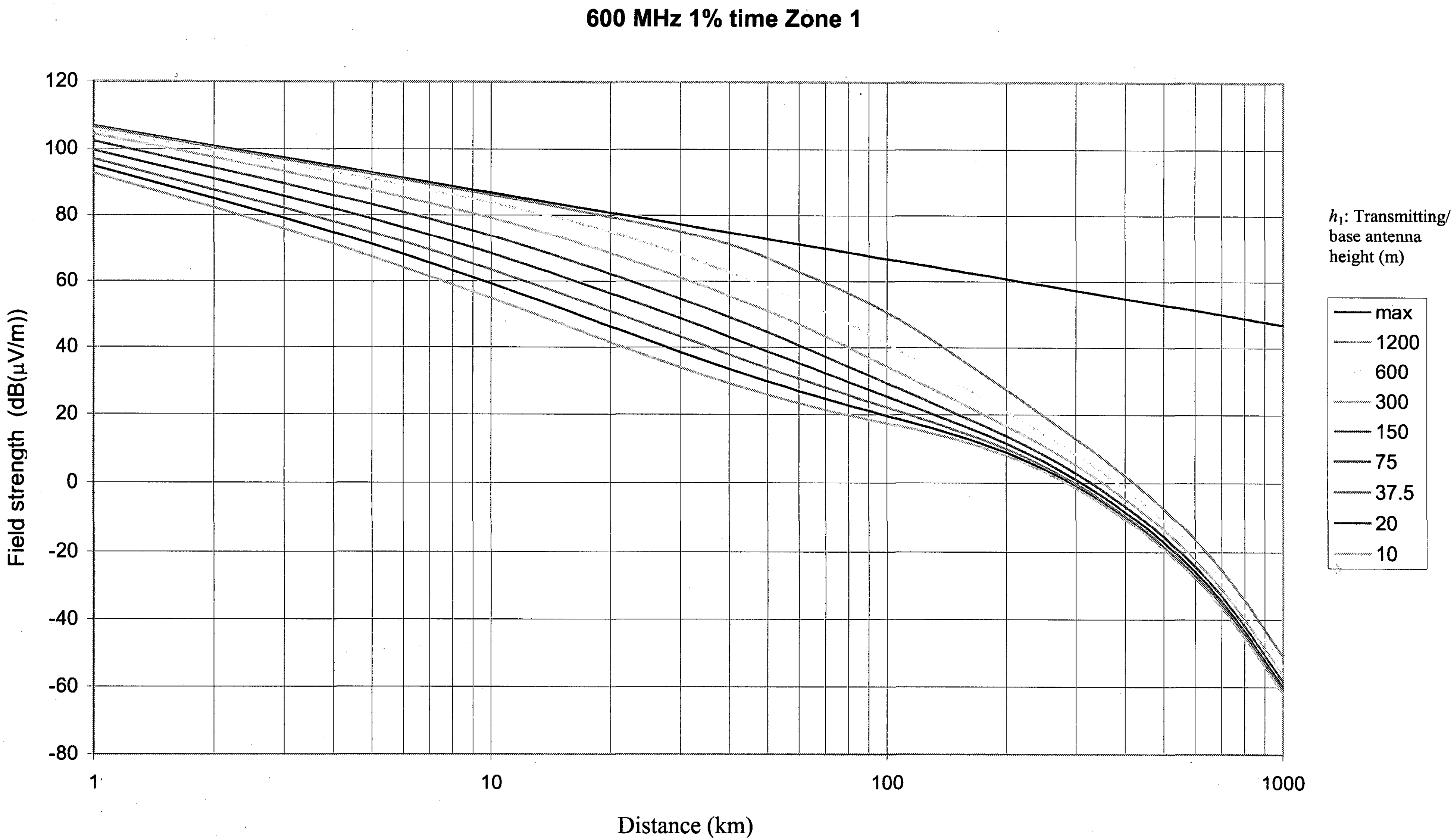
100 MHz 1% time Zone 1

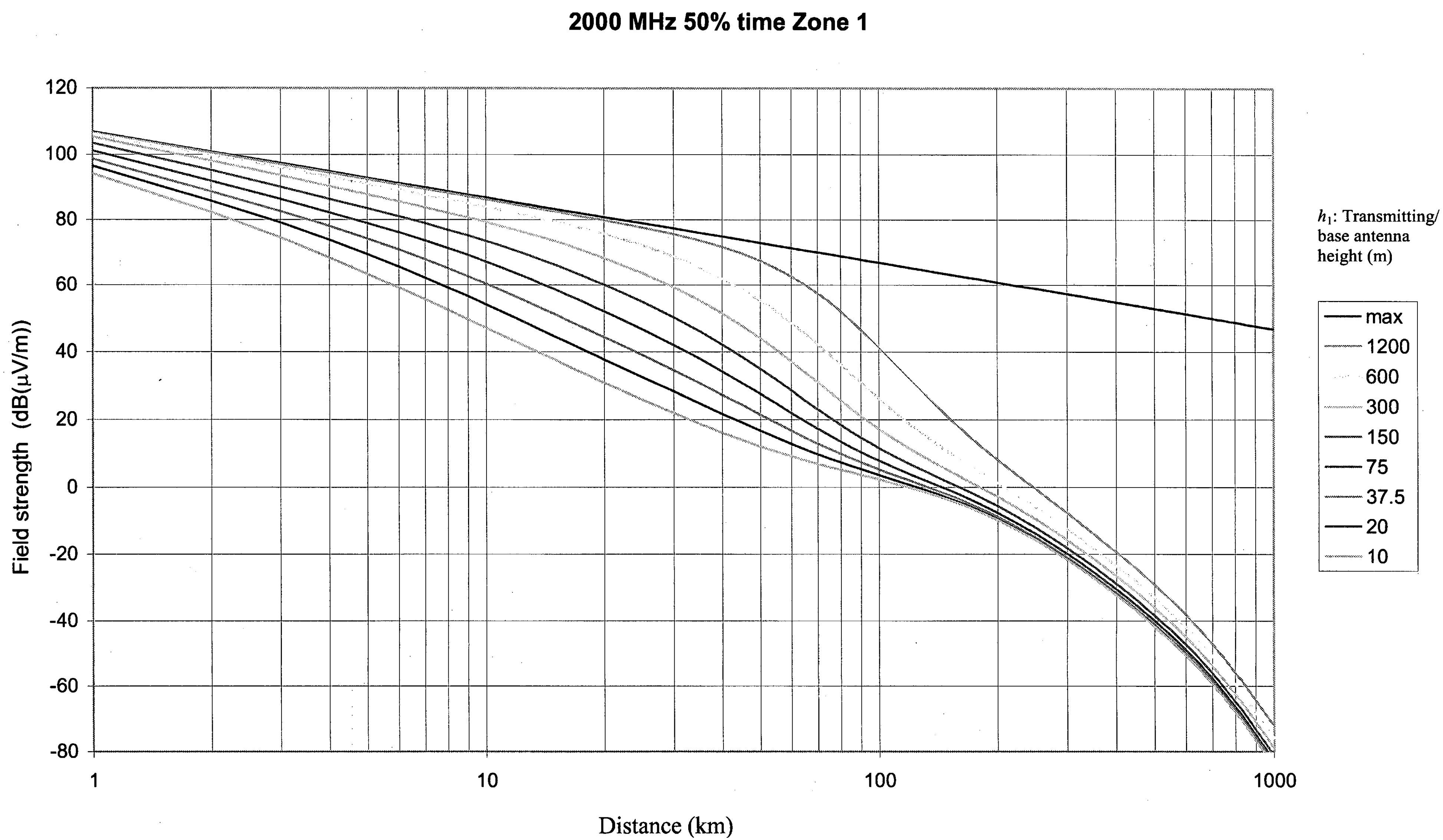



600 MHz 50% time Zone 1
120
100
80
60
40
20
0
-20
-40
-60
-80
Field strength (dB(μV/m))
1
10
100
Distance (km)
h_1: Transmitting/ base antenna height (m)
max
1200
600
300
150
75
37.5
20
10

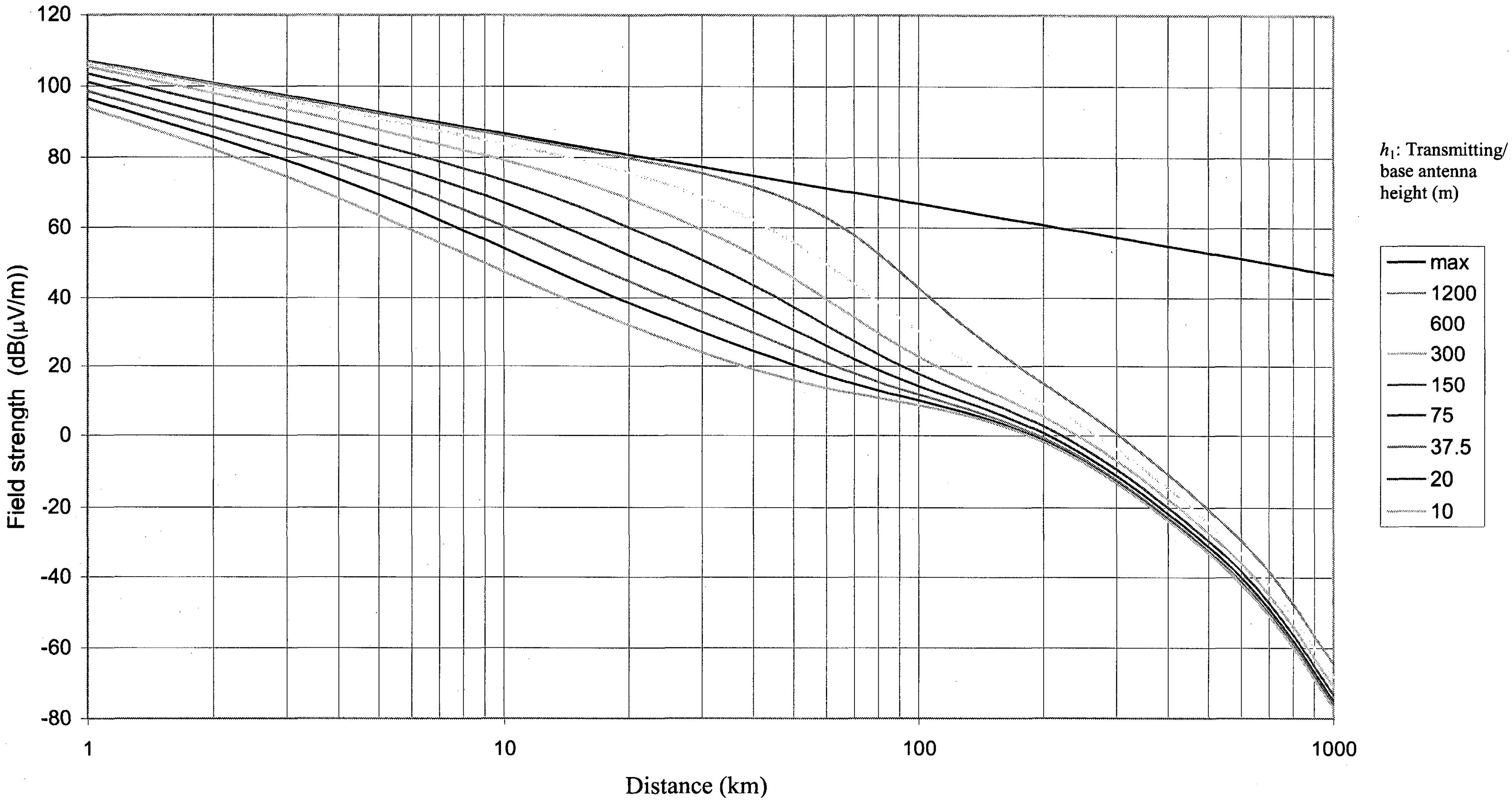
64


600 MHz 10% time Zone 1
120
100
80
60
40
20
0
-20
-40
-60
-80
Field strength (dB(μV/m))
1
10
100
1000
Distance (km)
h_1: Transmitting/ base antenna height (m)
max
1200
600
300
150
75
37.5
20
10

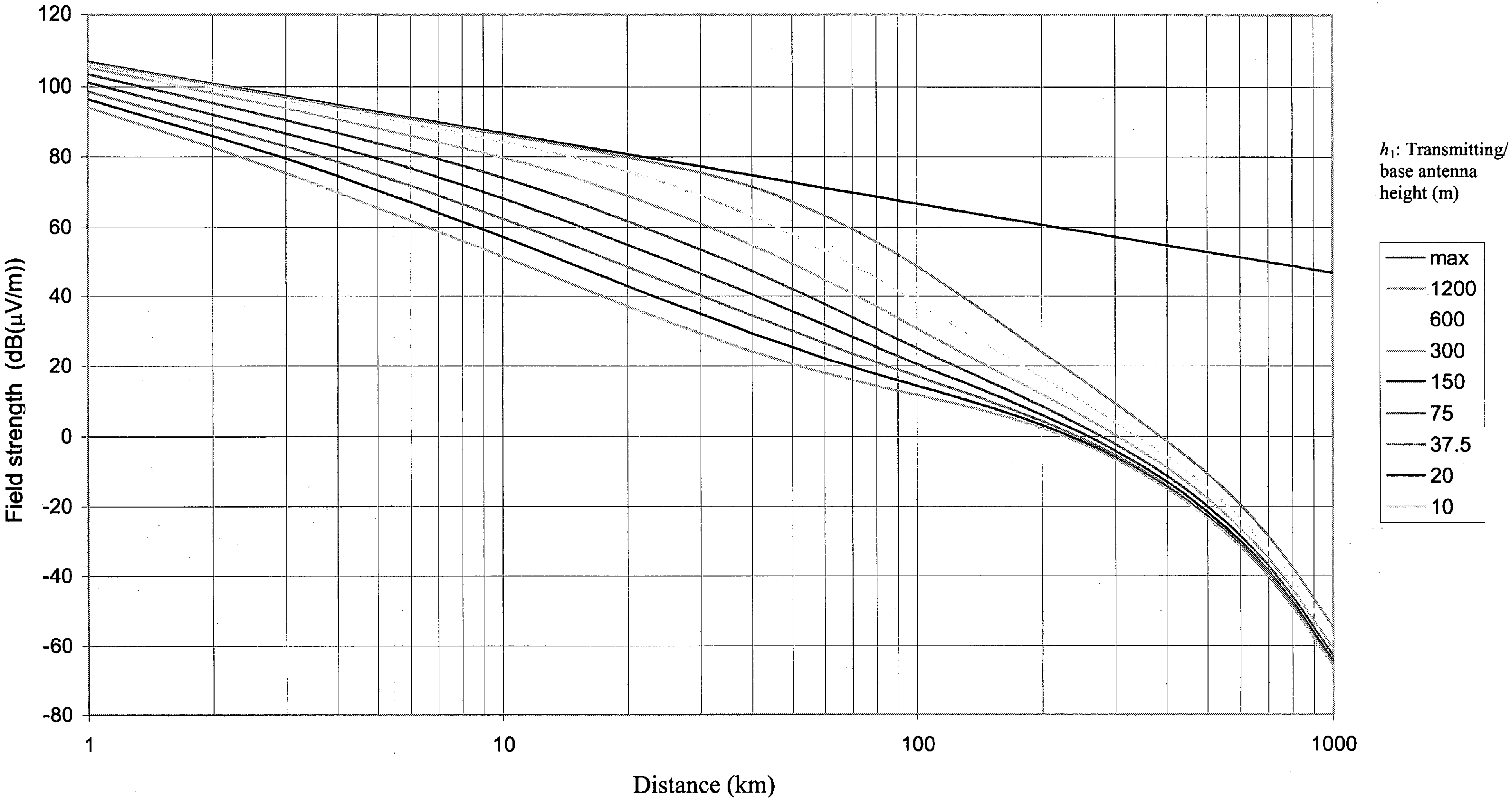

600 MHz 1% time Zone 1
Field strength (dB(µV/m))
120
100
80
60
40
20
0
-20
-40
-60
-80
1
10
100
1000
Distance (km)
h_1: Transmitting/ base antenna height (m)
max
1200
600
300
150
75
37.5
20
10

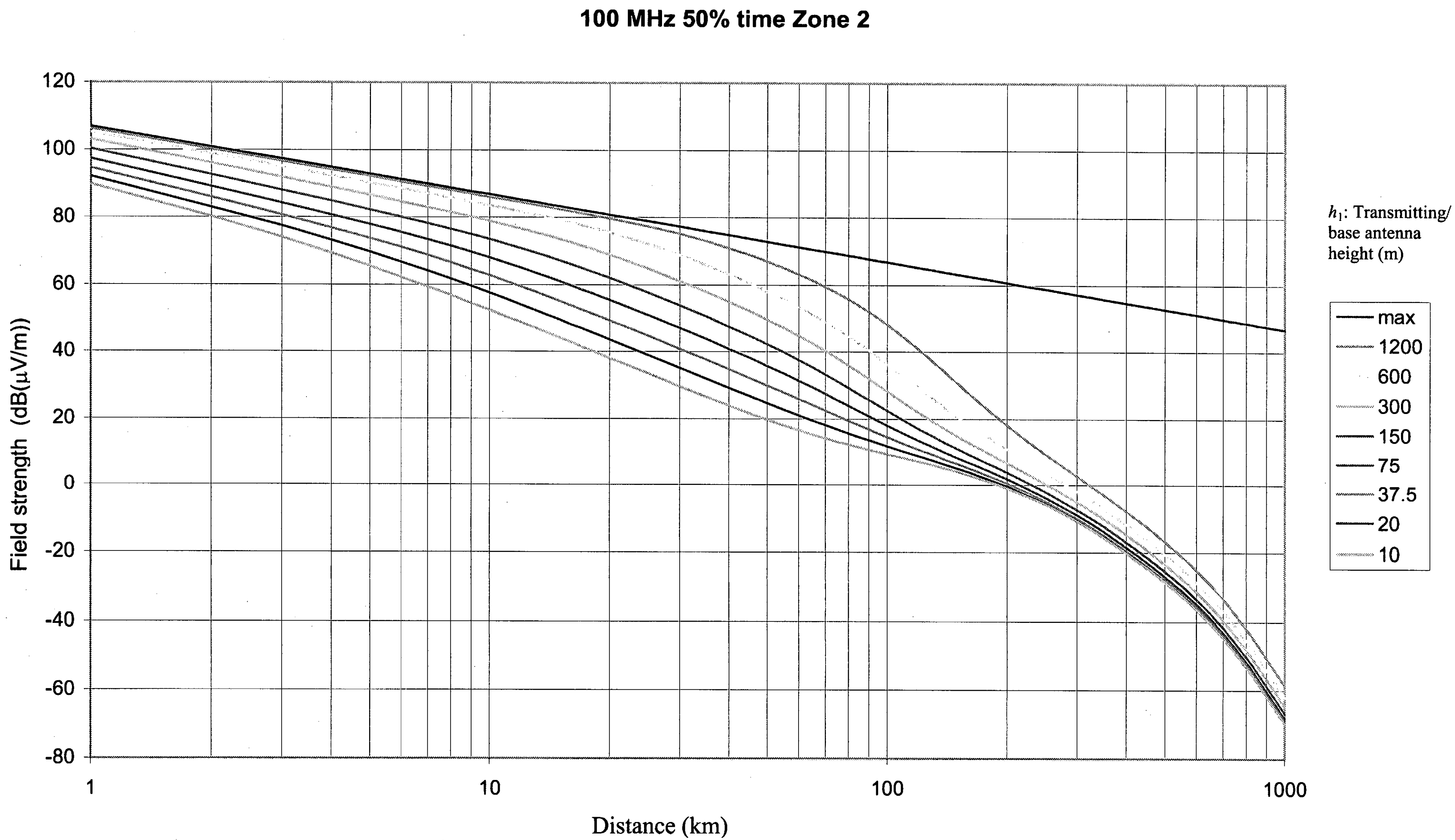

2000 MHz 50% time Zone 1
120
100
80
60
40
20
0
-20
-40
-60
-80
Field strength (dB(µV/m))
1
10
100
1000
Distance (km)
h_1: Transmitting/
base antenna
height (m)
max
1200
600
300
150
75
37.5
20
10

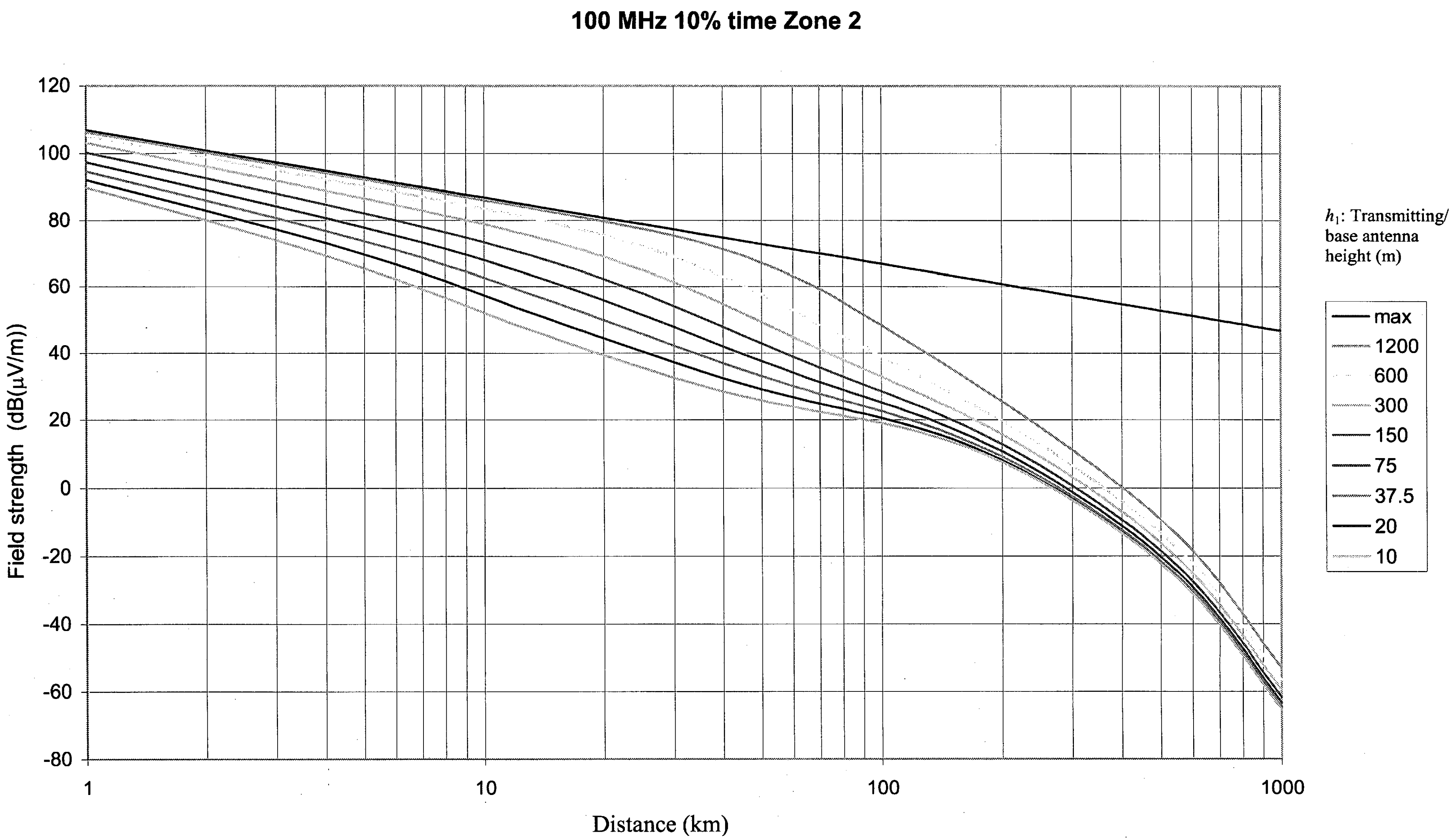
2 000 MHz 10% time Zone 1



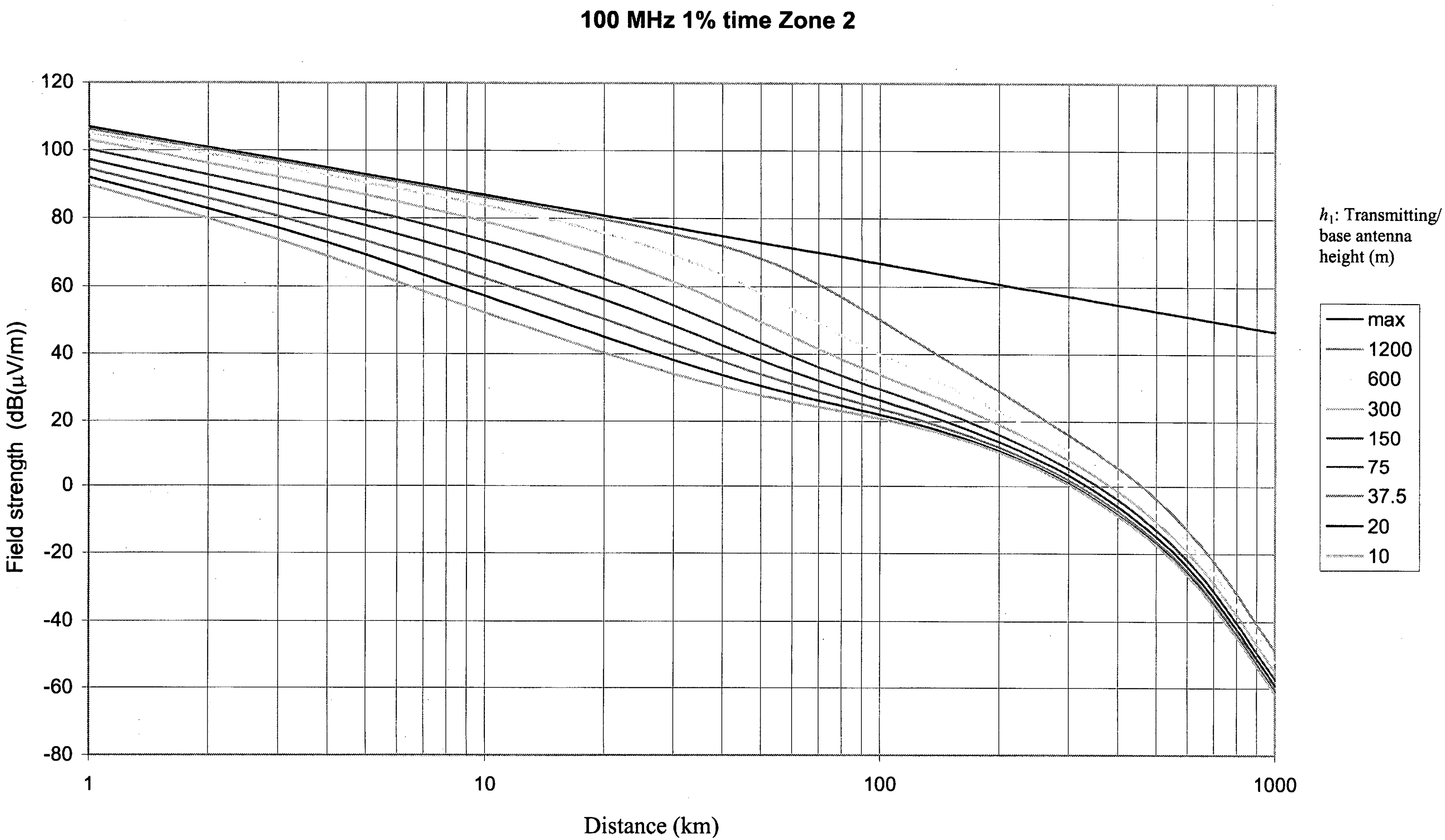
2 000 MHz 1% time Zone 1

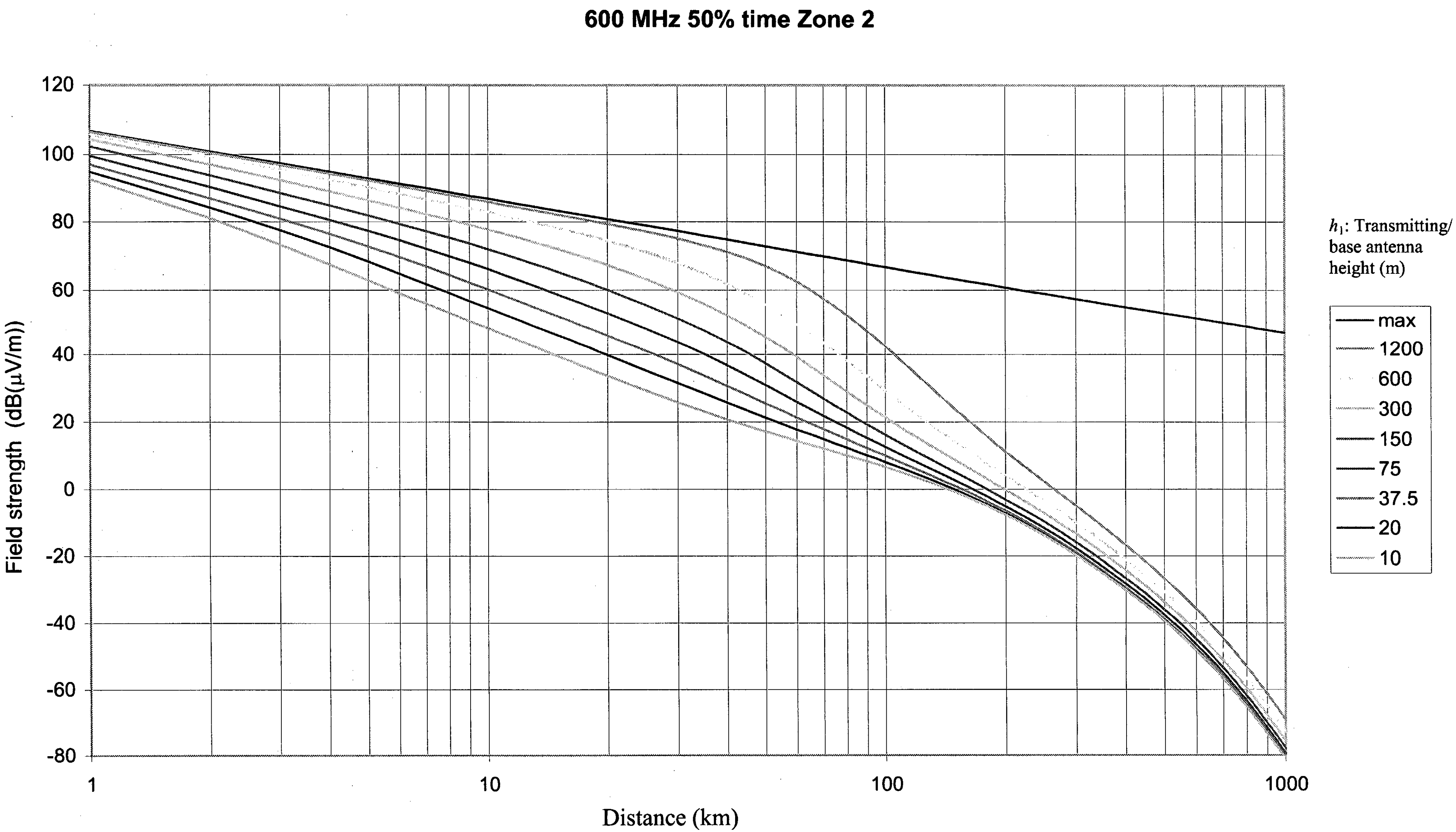


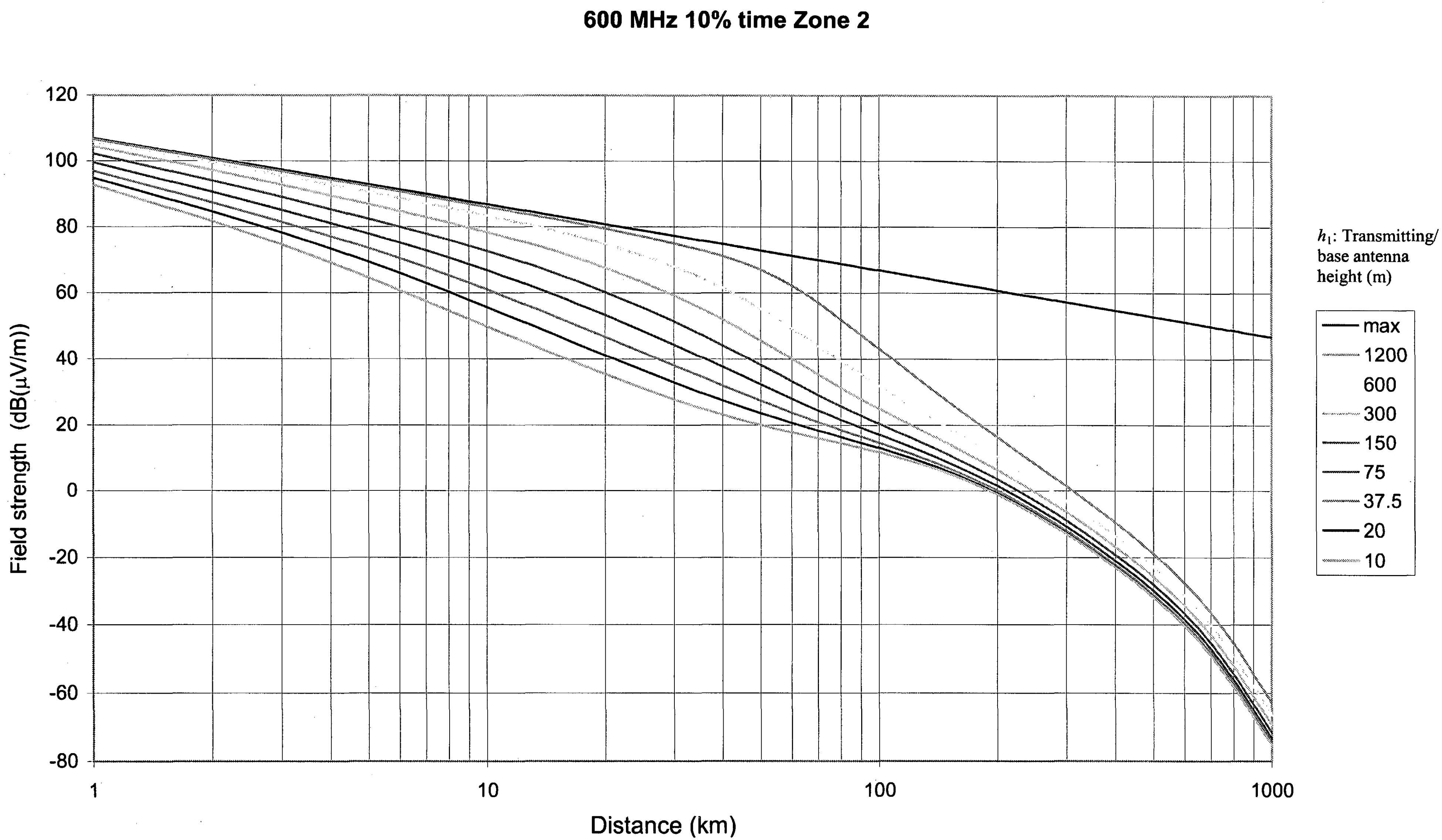

100 MHz 50% time Zone 2
Field strength (dB(μV/m))
120
100
80
60
40
20
0
-20
-40
-60
-80
1
10
100
1000
Distance (km)
h1: Transmitting/ base antenna height (m)
max
1200
600
300
150
75
37.5
20
10


100 MHz 10% time Zone 2
Field strength (dB(μV/m))
120
100
80
60
40
20
0
-20
-40
-60
-80
1
10
100
1000
Distance (km)
h1: Transmitting/ base antenna height (m)
max
1200
600
300
150
75
37.5
20
10

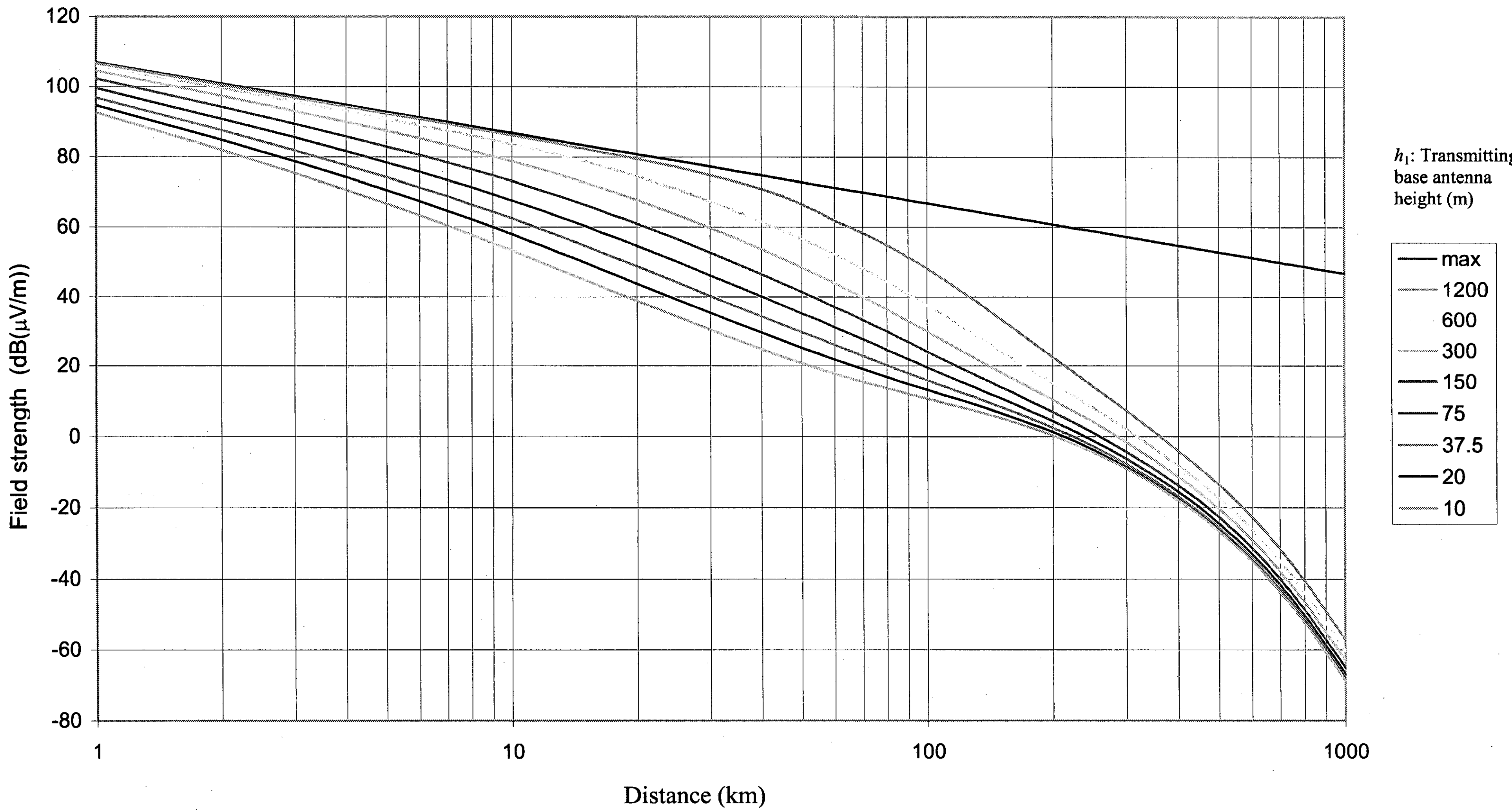
71


100 MHz 1% time Zone 2
Field strength (dB(μV/m))
120
100
80
60
40
20
0
-20
-40
-60
-80
1
10
100
1000
Distance (km)
h1: Transmitting/ base antenna height (m)
max
1200
600
300
150
75
37.5
20
10

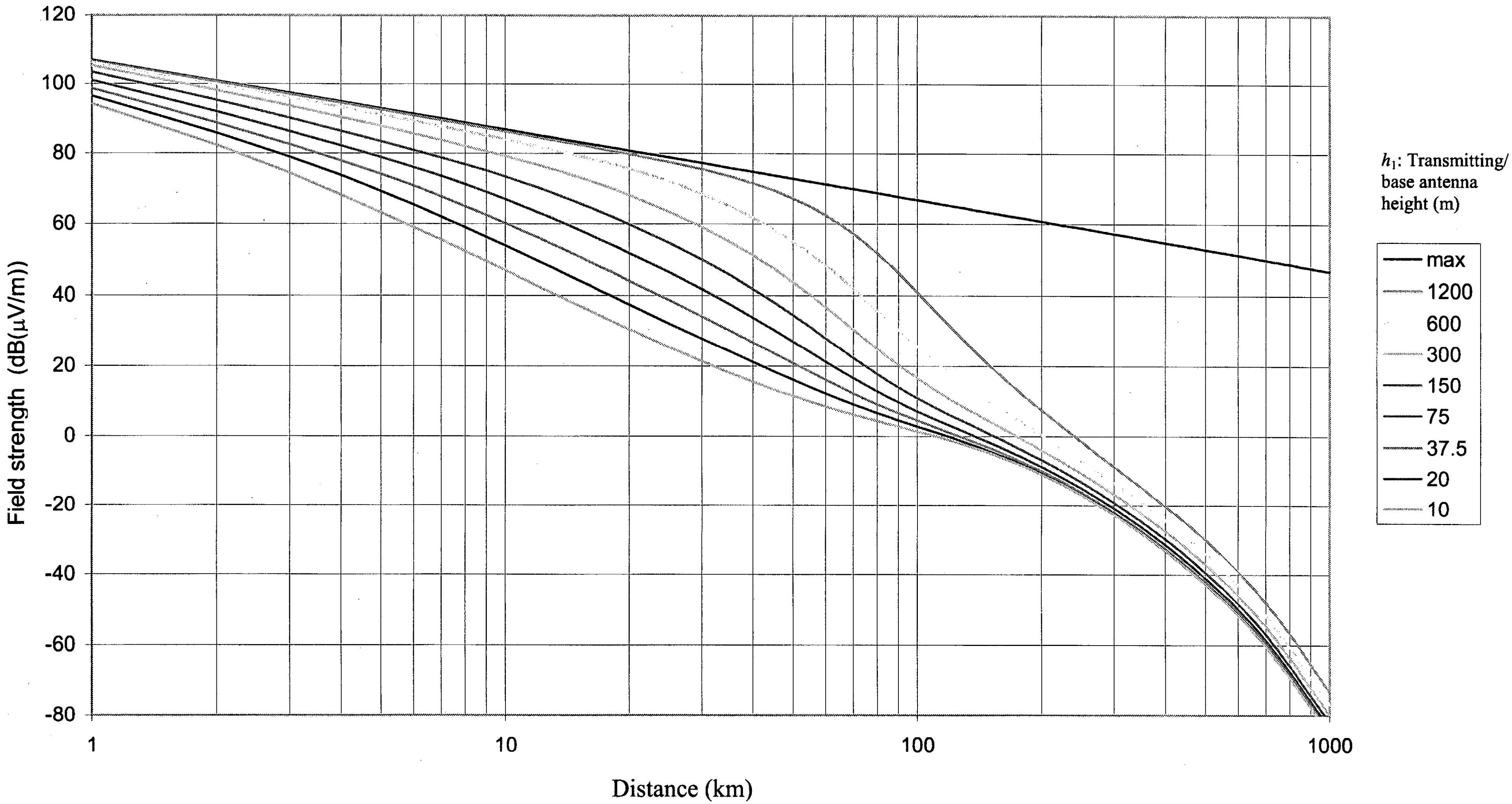

600 MHz 50% time Zone 2
120
100
80
60
40
20
0
-20
-40
-60
-80
Field strength (dB(µV/m))
1
10
100
1000
Distance (km)
h_1: Transmitting/ base antenna height (m)
max
1200
600
300
150
75
37.5
20
10

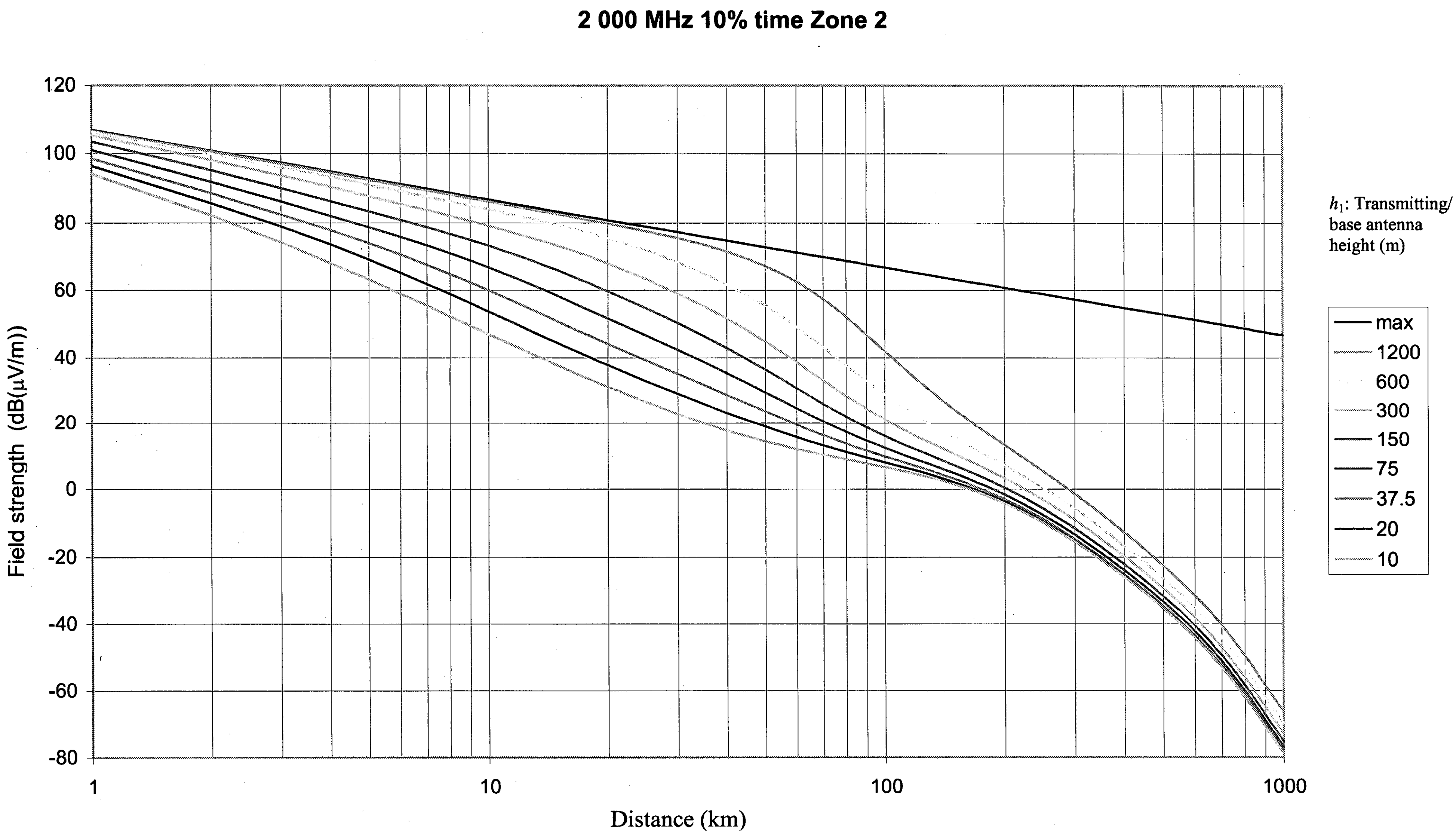

600 MHz 10% time Zone 2
Field strength (dB(µV/m))
120
100
80
60
40
20
0
-20
-40
-60
-80
1
10
100
1000
Distance (km)
h_1: Transmitting/ base antenna height (m)
max
1200
600
300
150
75
37.5
20
10

600 MHz 1% time Zone 2

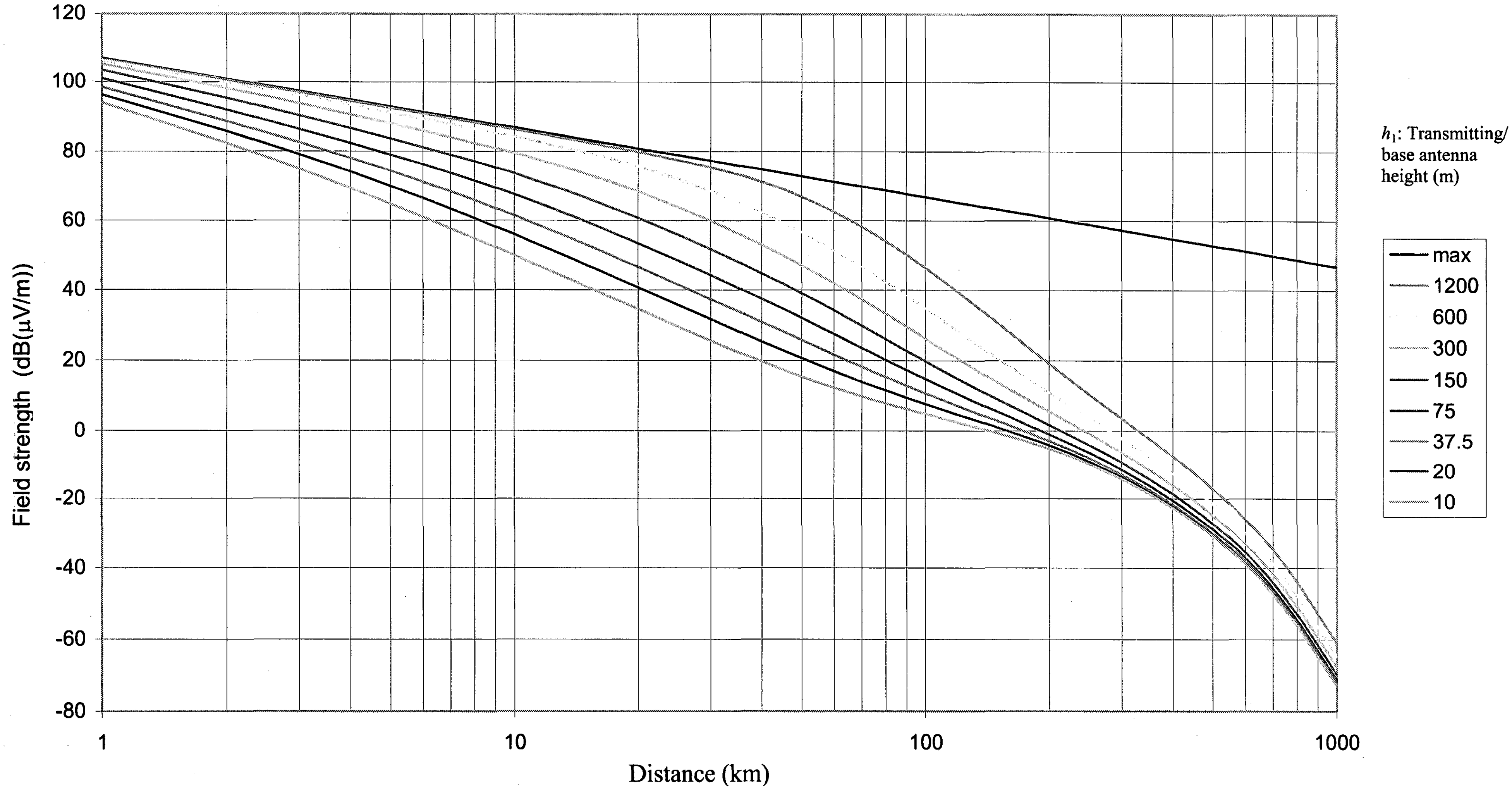


2 000 MHz 50% time Zone 2

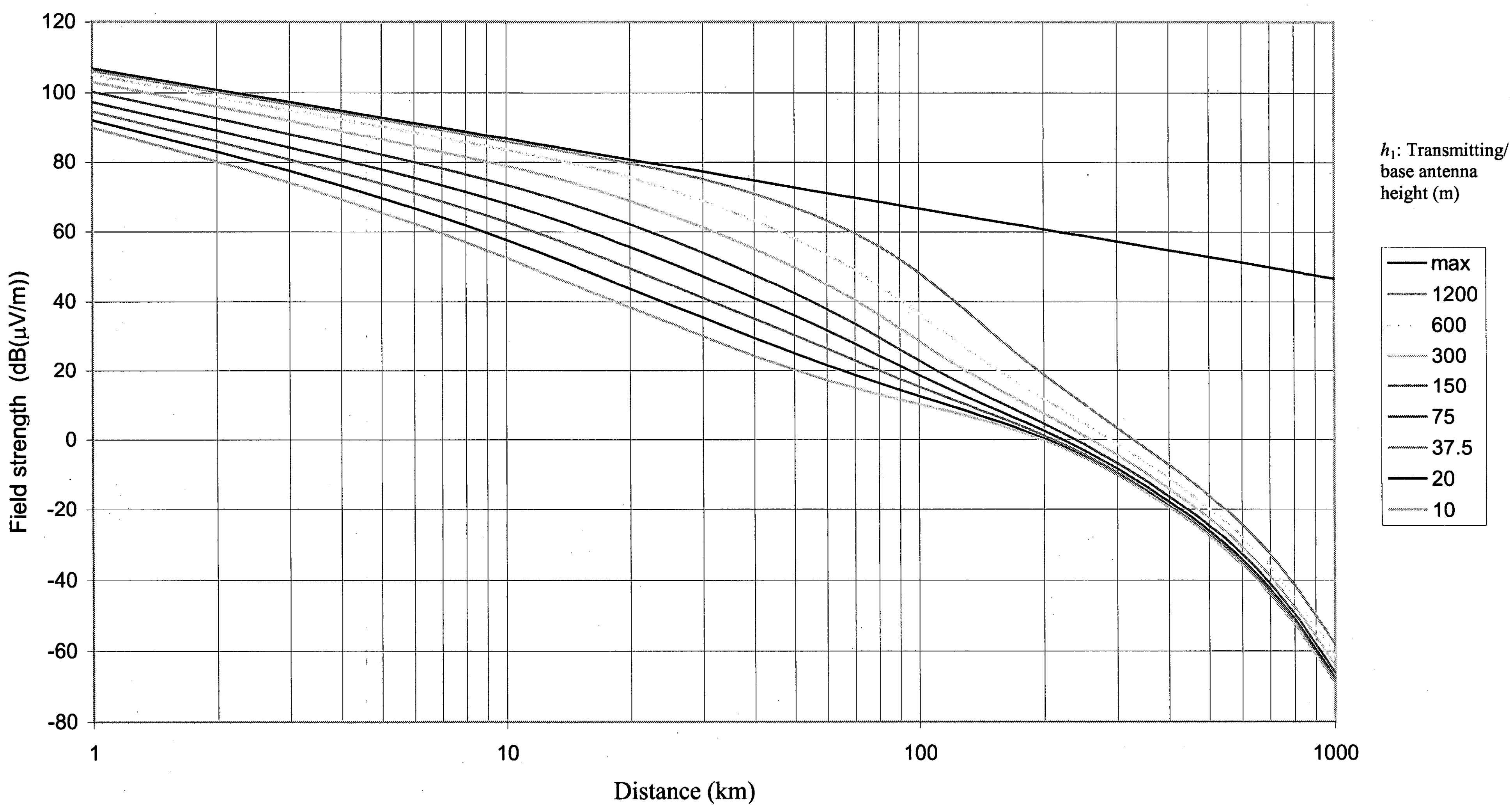


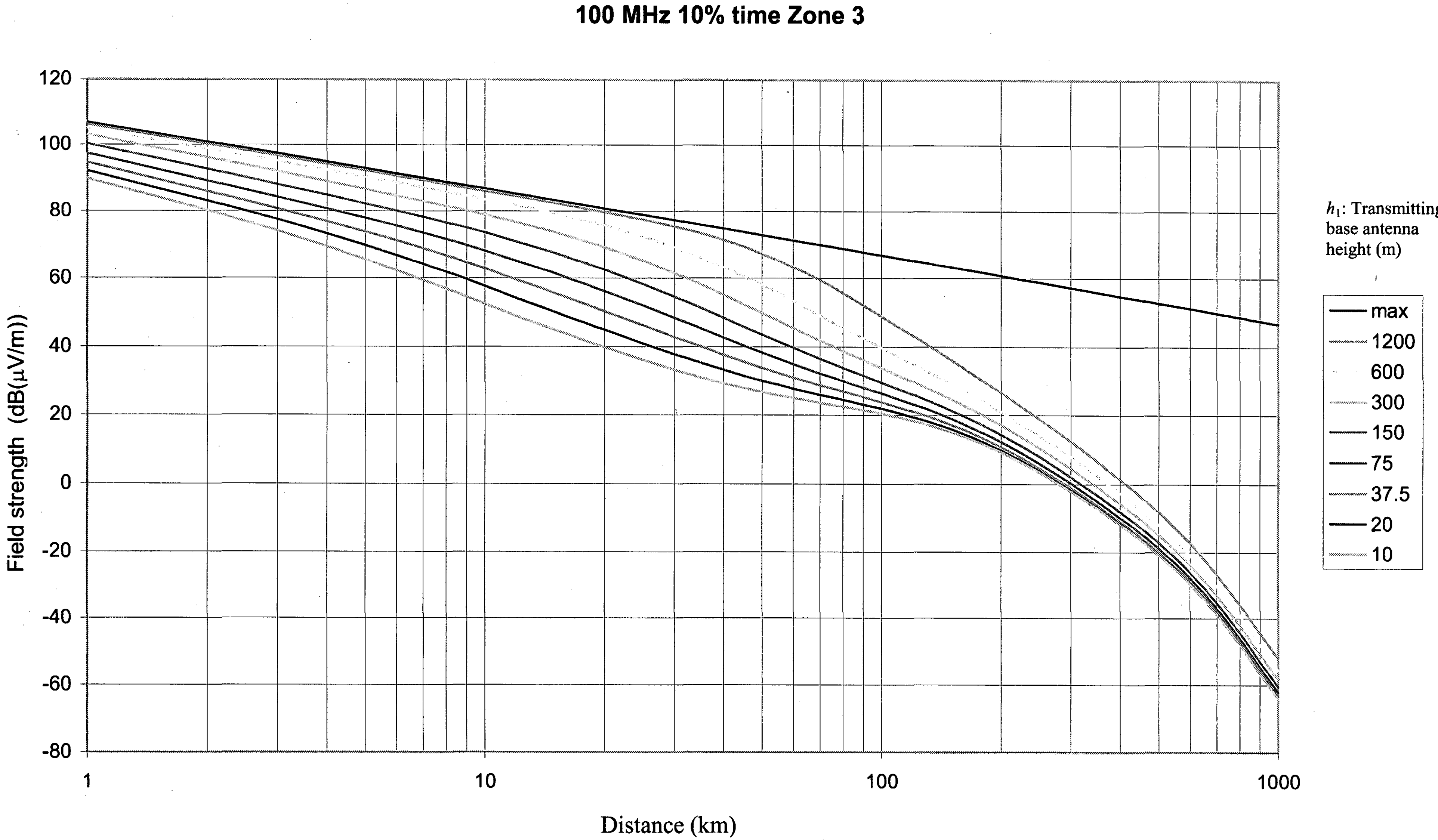

2 000 MHz 10% time Zone 2
120
100
80
60
40
20
0
-20
-40
-60
-80
Field strength (dB(μV/m))
1
10
100
1000
Distance (km)
h_1: Transmitting/ base antenna height (m)
max
1200
600
300
150
75
37.5
20
10

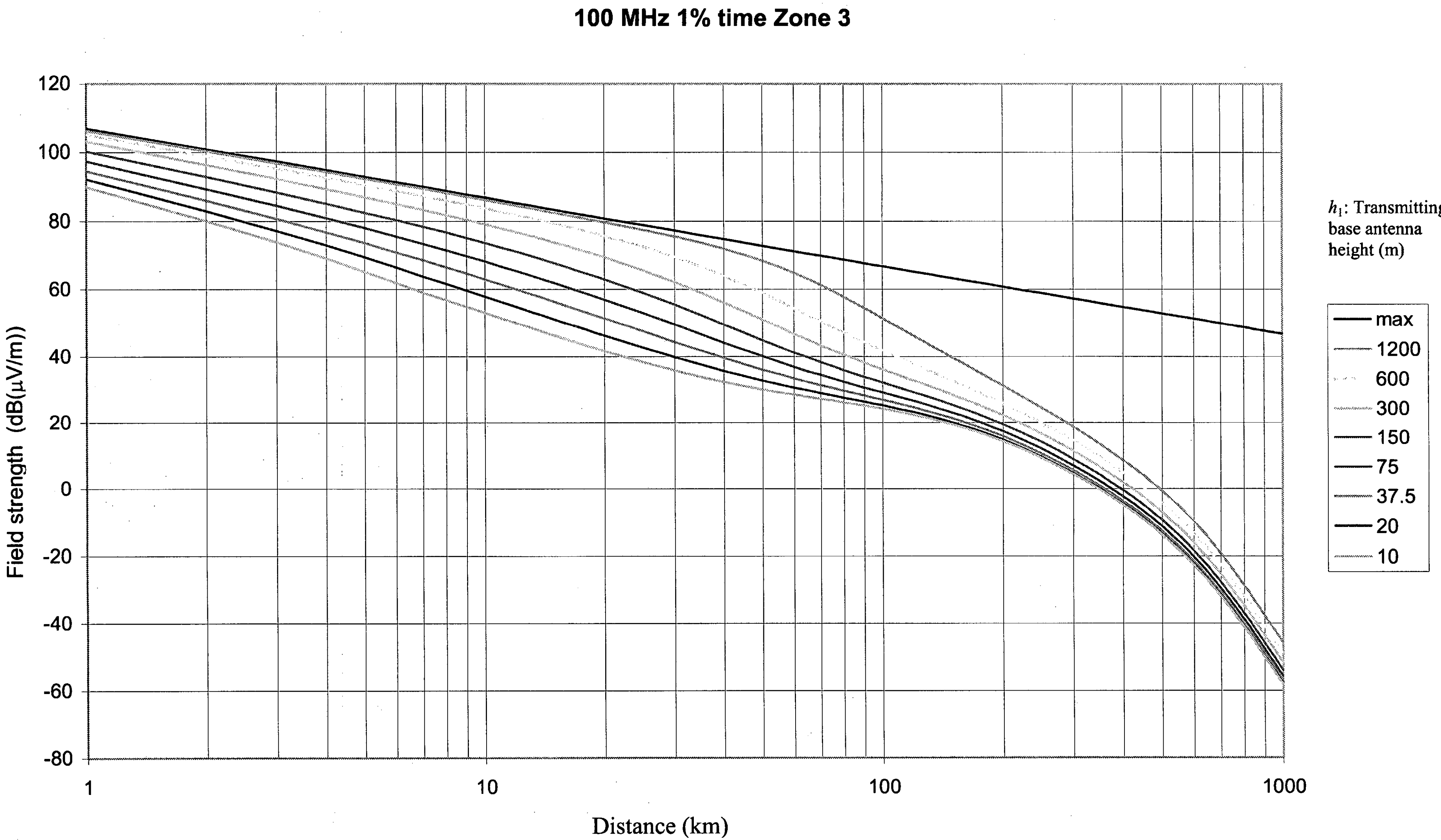
2 000 MHz 1% time Zone 2

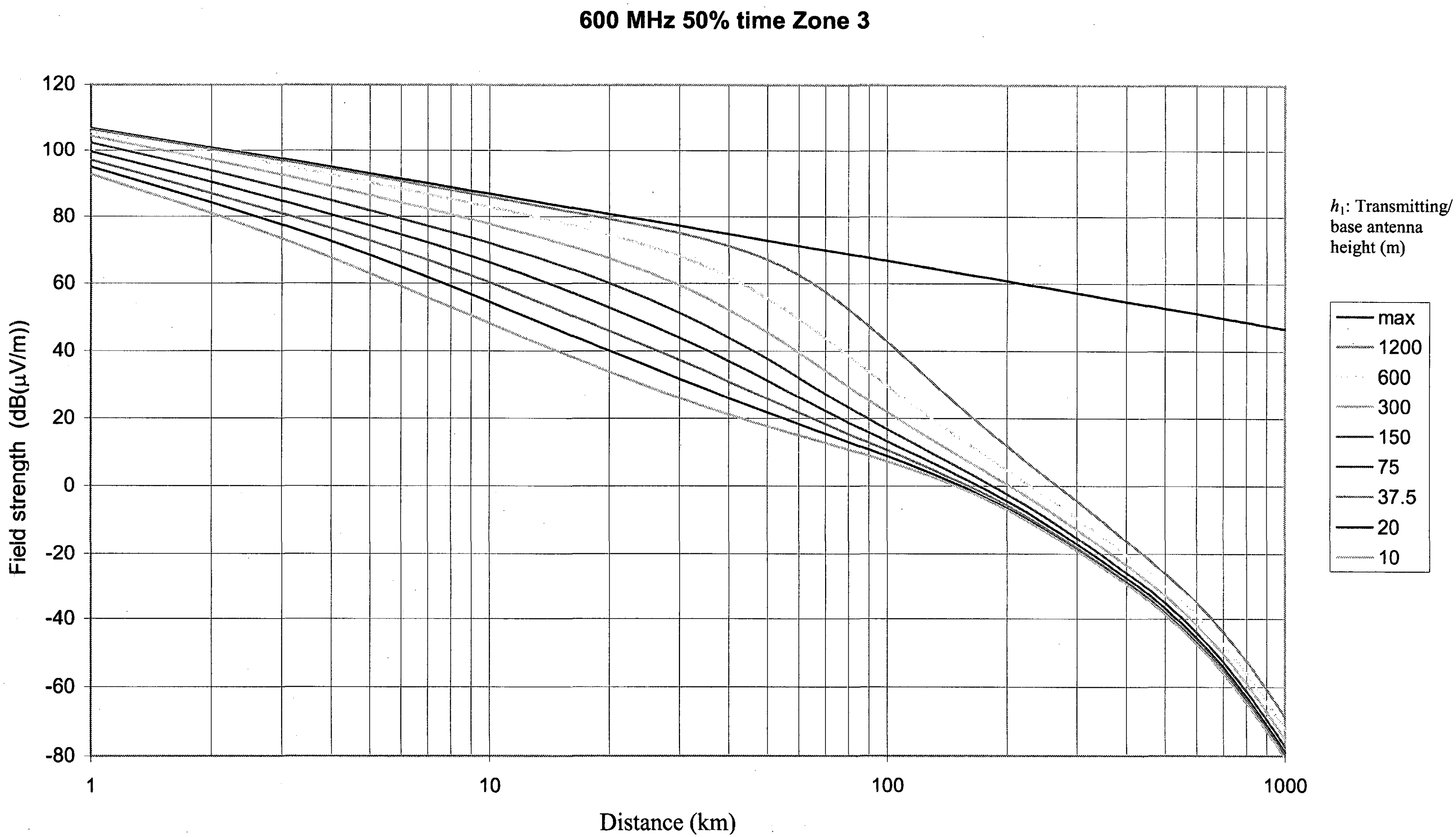


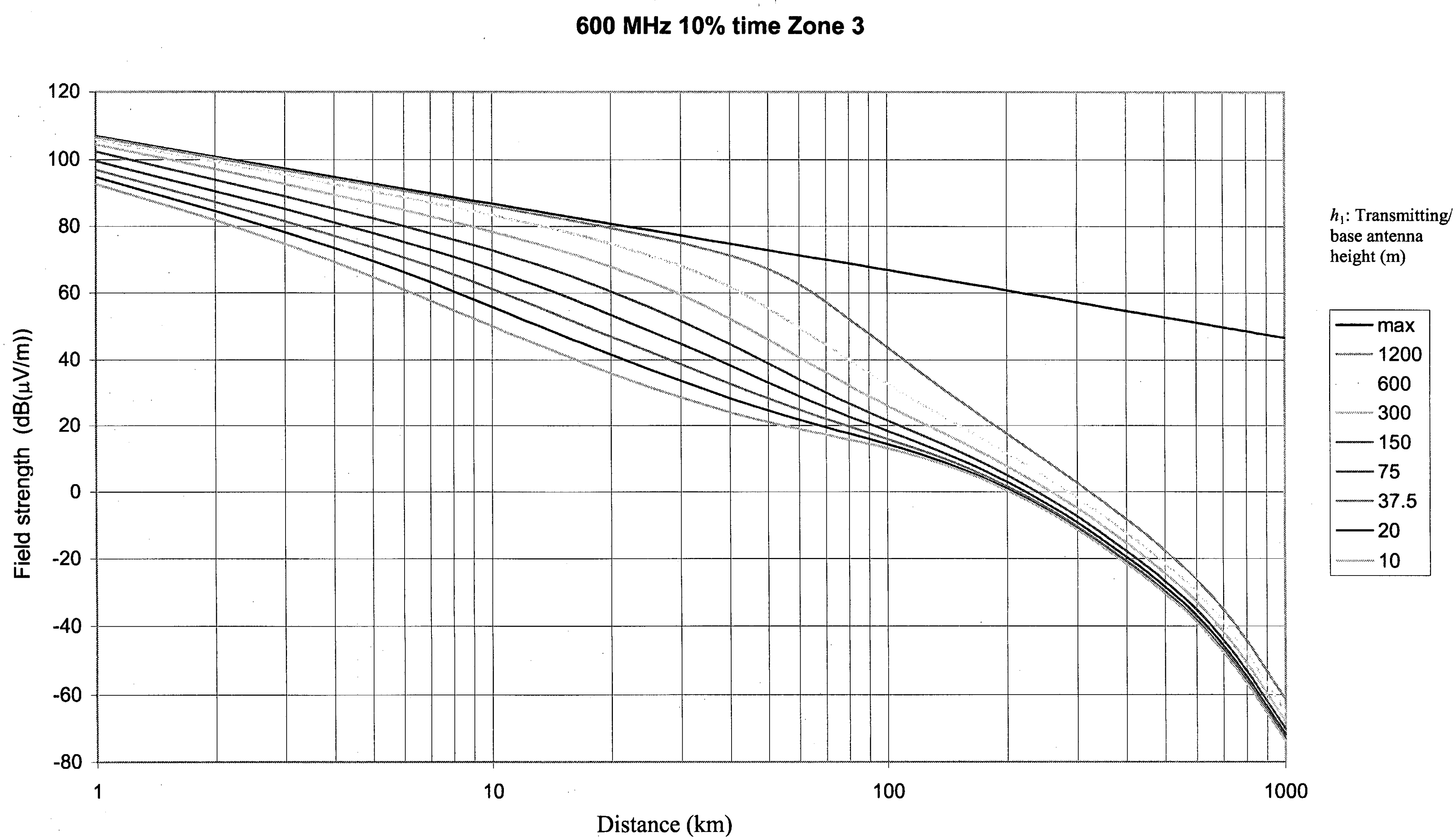
100 MHz 50% time Zone 3



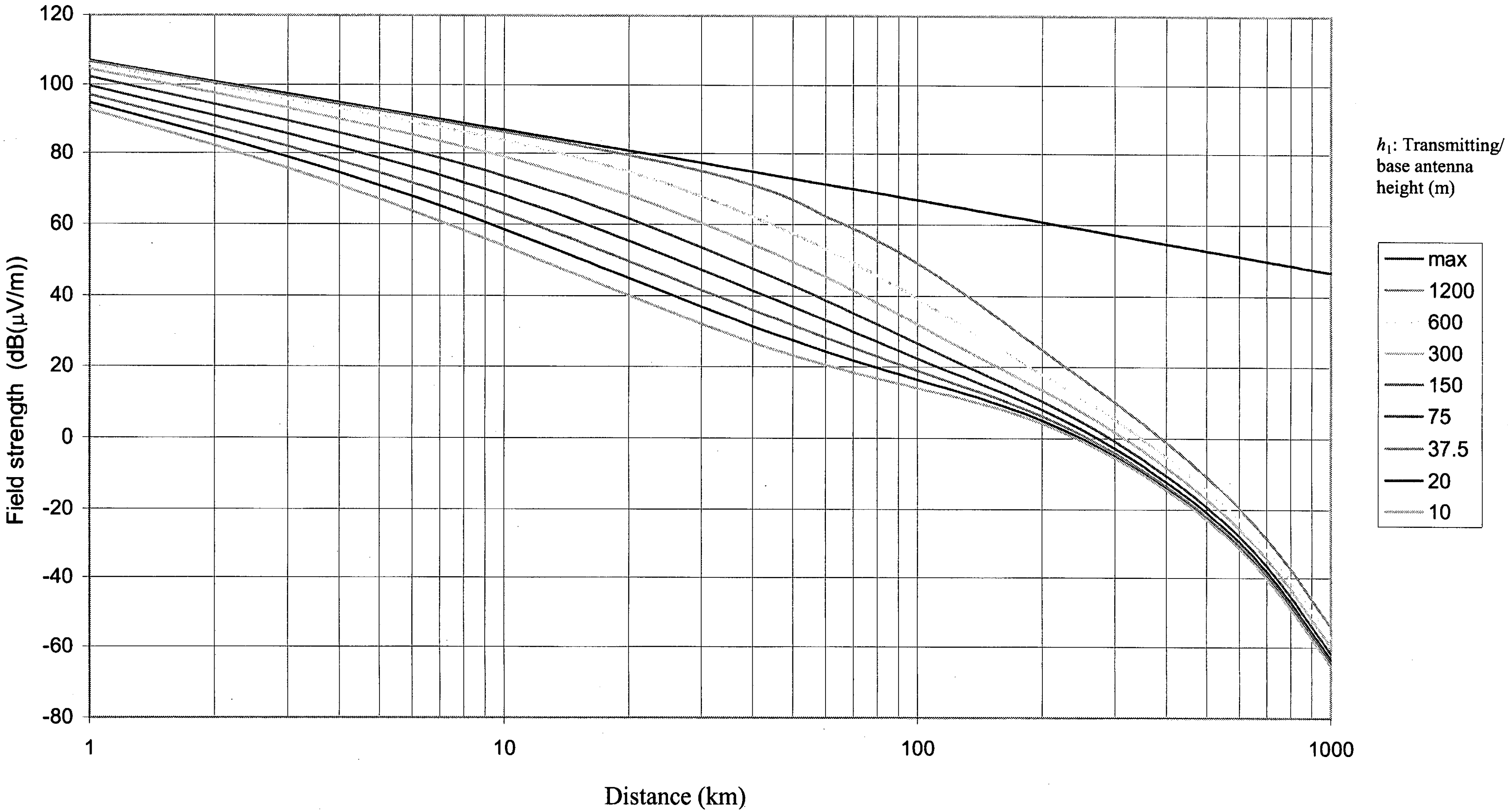

100 MHz 10% time Zone 3
Field strength (dB(μV/m))
120
100
80
60
40
20
0
-20
-40
-60
-80
1
10
100
1000
Distance (km)
h1: Transmitting/ base antenna height (m)
max
1200
600
300
150
75
37.5
20
10


100 MHz 1% time Zone 3
Field strength (dB(μV/m))
120
100
80
60
40
20
0
-20
-40
-60
-80
1
10
100
1000
Distance (km)
h_1: Transmitting/ base antenna height (m)
max
1200
600
300
150
75
37.5
20
10

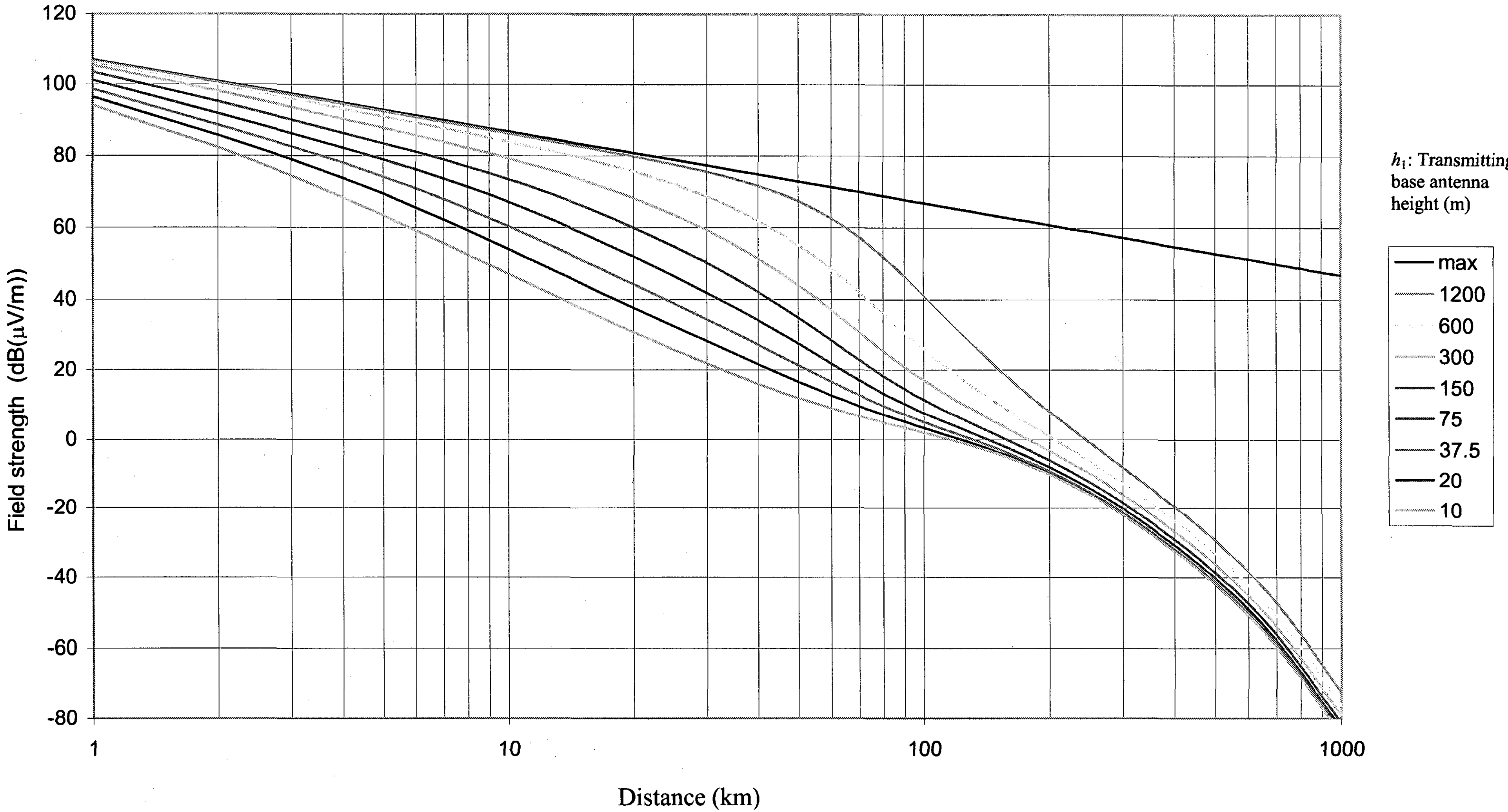

600 MHz 50% time Zone 3
Field strength (dB(μV/m))
120
100
80
60
40
20
0
-20
-40
-60
-80
1
10
100
1000
Distance (km)
h_1: Transmitting/ base antenna height (m)
max
1200
600
300
150
75
37.5
20
10

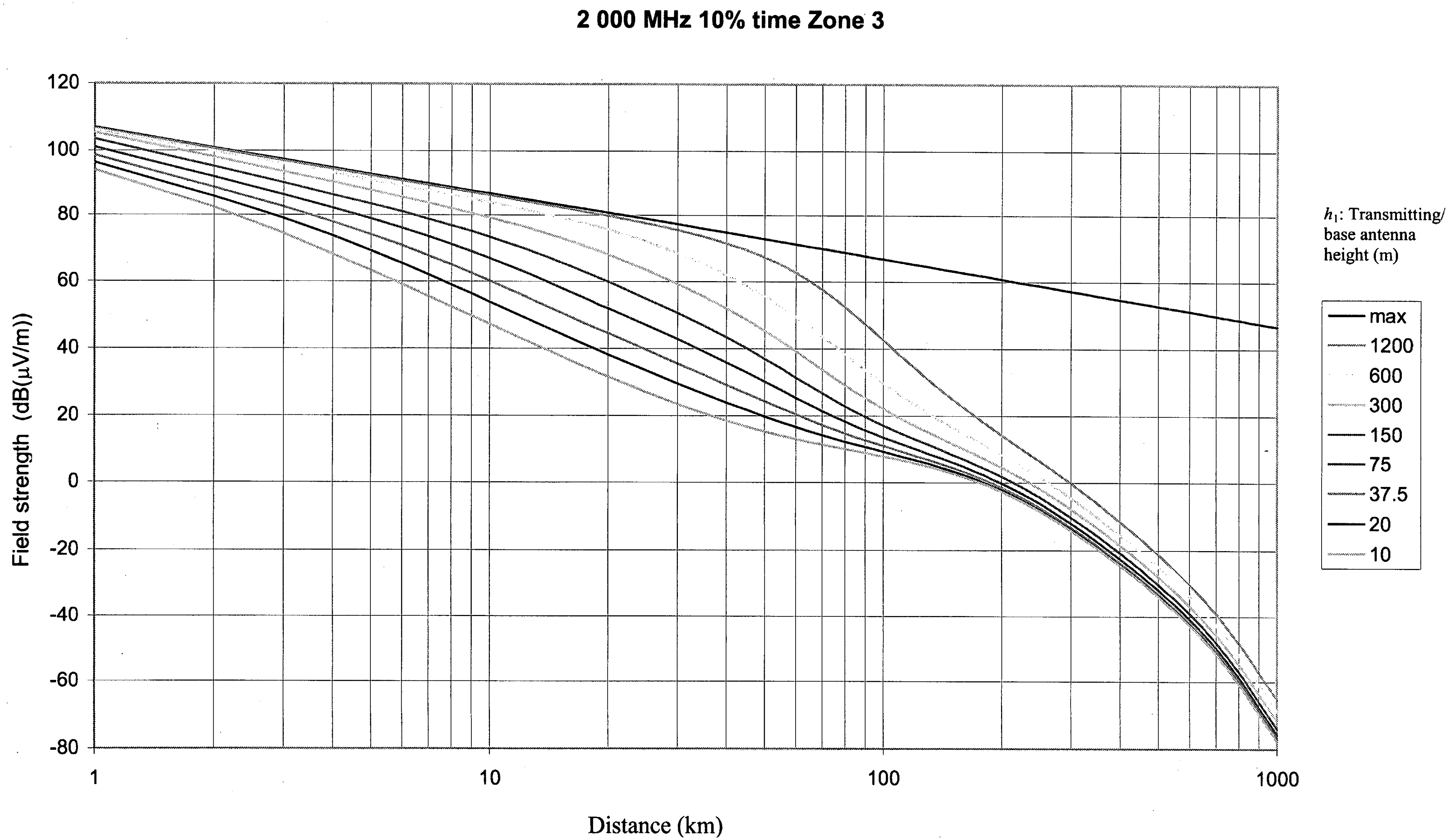

600 MHz 10% time Zone 3
Field strength (dB(μV/m))
Distance (km)
120
100
80
60
40
20
0
-20
-40
-60
-80
1
10
100
1000
h1: Transmitting/ base antenna height (m)
max
1200
600
300
150
75
37.5
20
10

600 MHz 1% time Zone 3

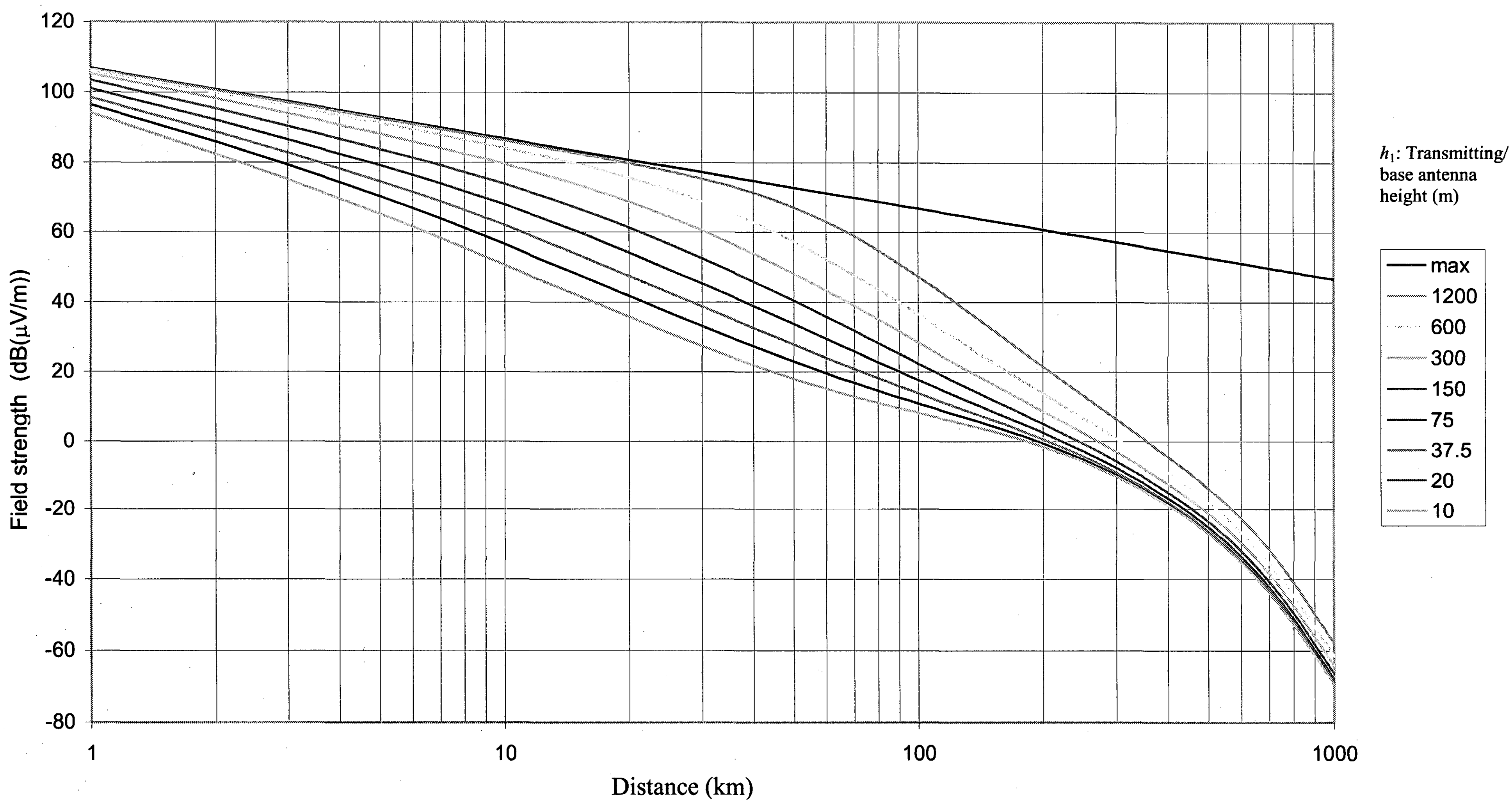


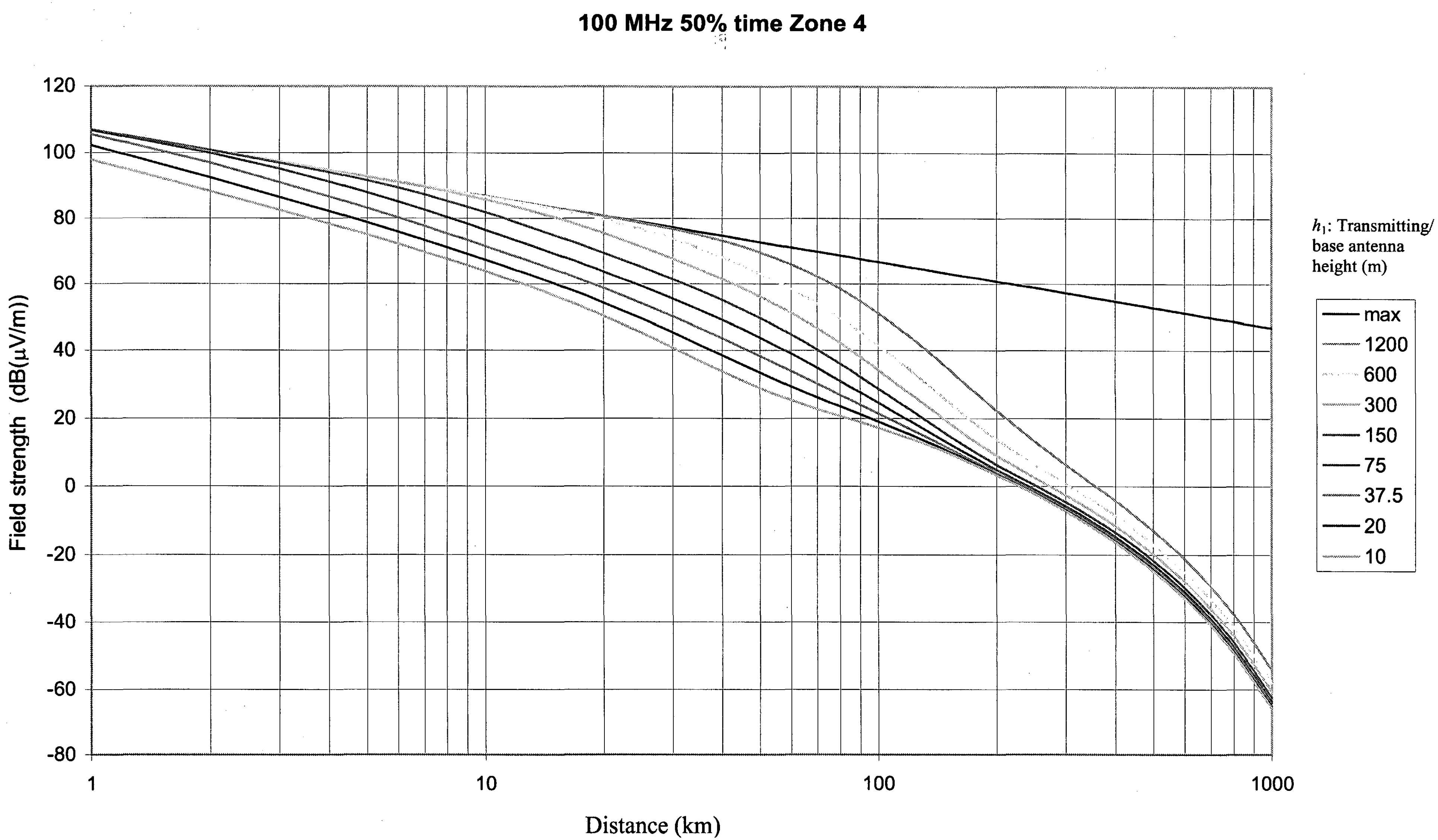
2 000 MHz 50% time Zone 3

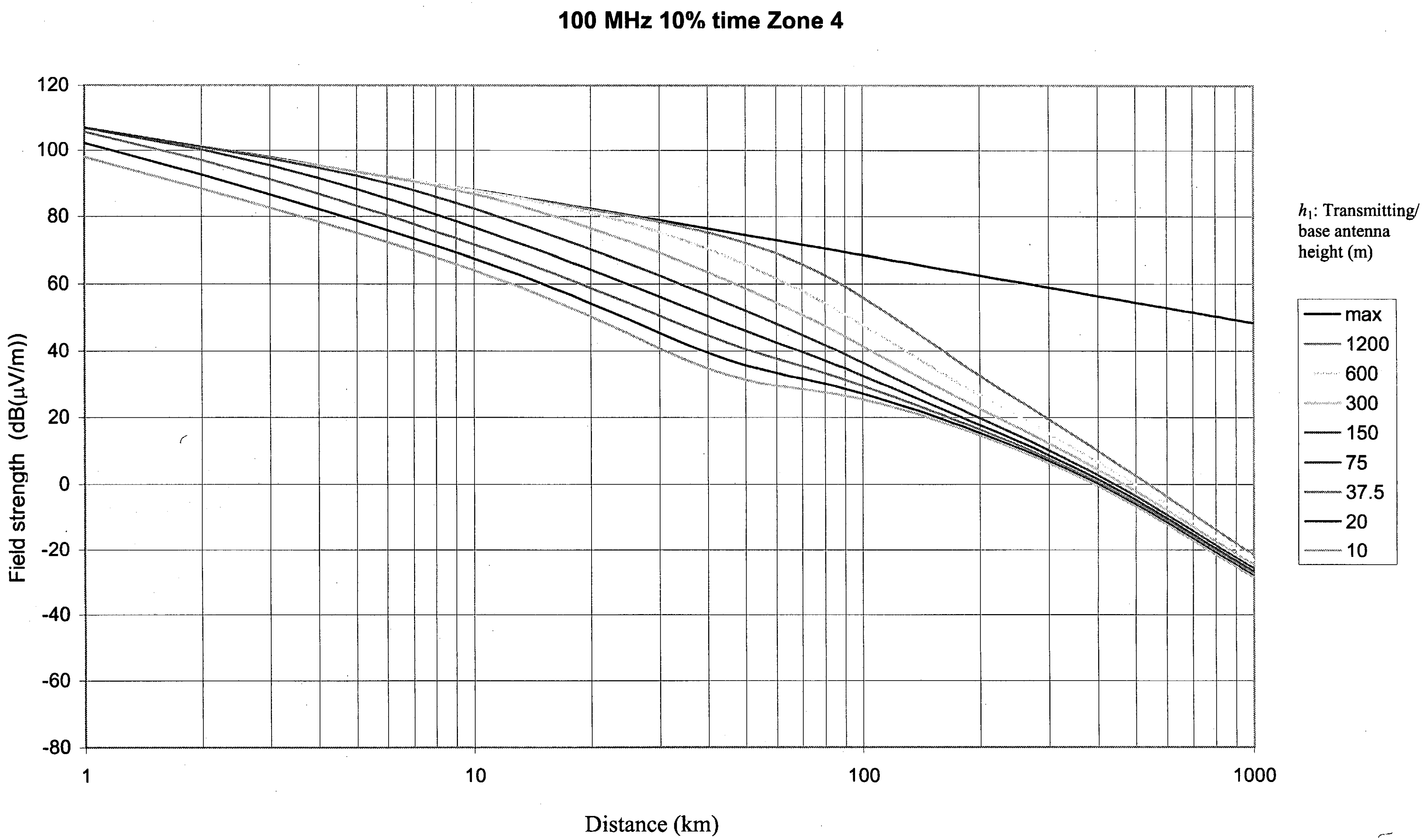


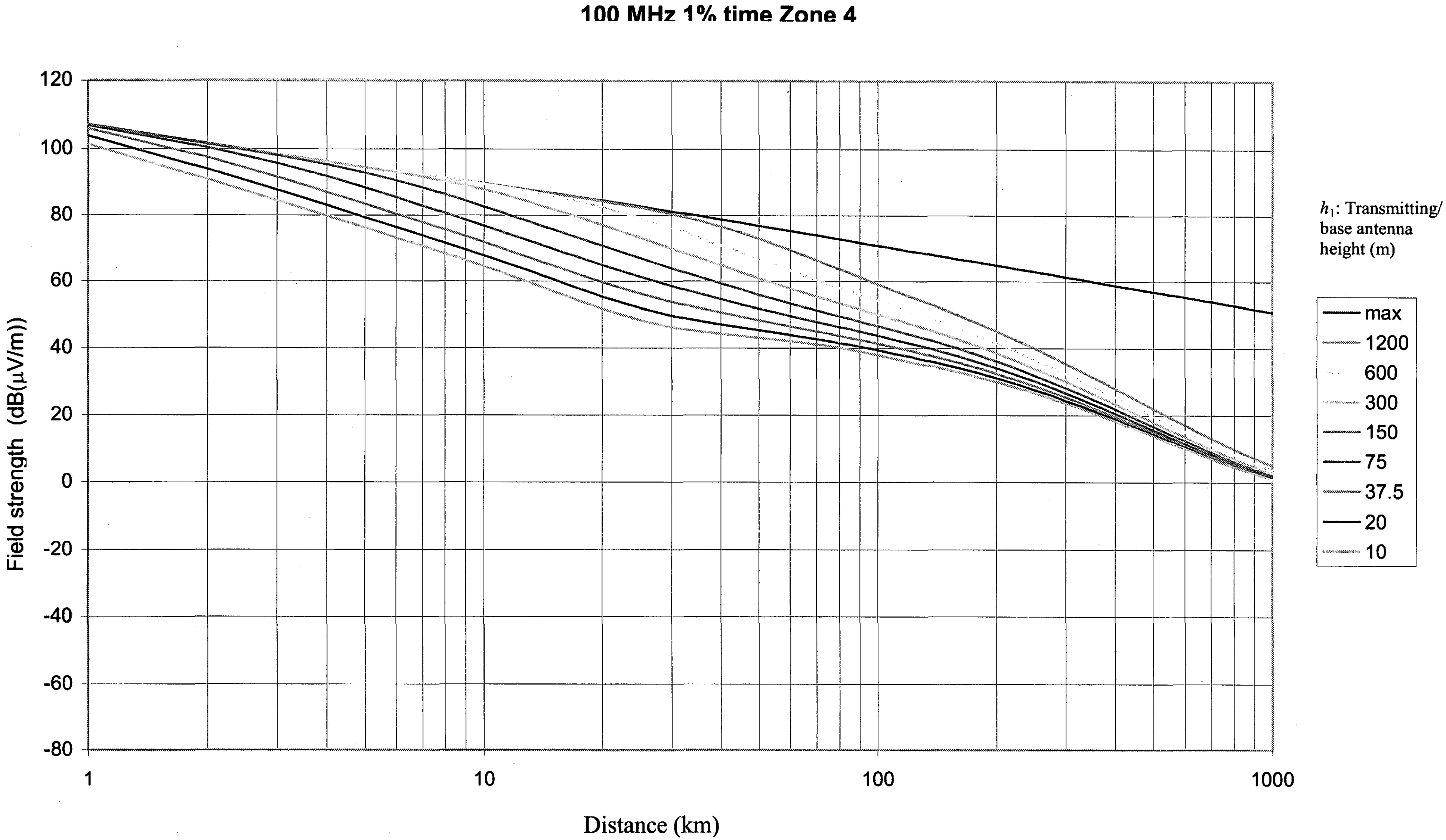

2 000 MHz 10% time Zone 3
Field strength (dB(μV/m))
Distance (km)
120
100
80
60
40
20
0
-20
-40
-60
-80
1
10
100
1000
h1: Transmitting/ base antenna height (m)
max
1200
600
300
150
75
37.5
20
10

2 000 MHz 1% time Zone 3

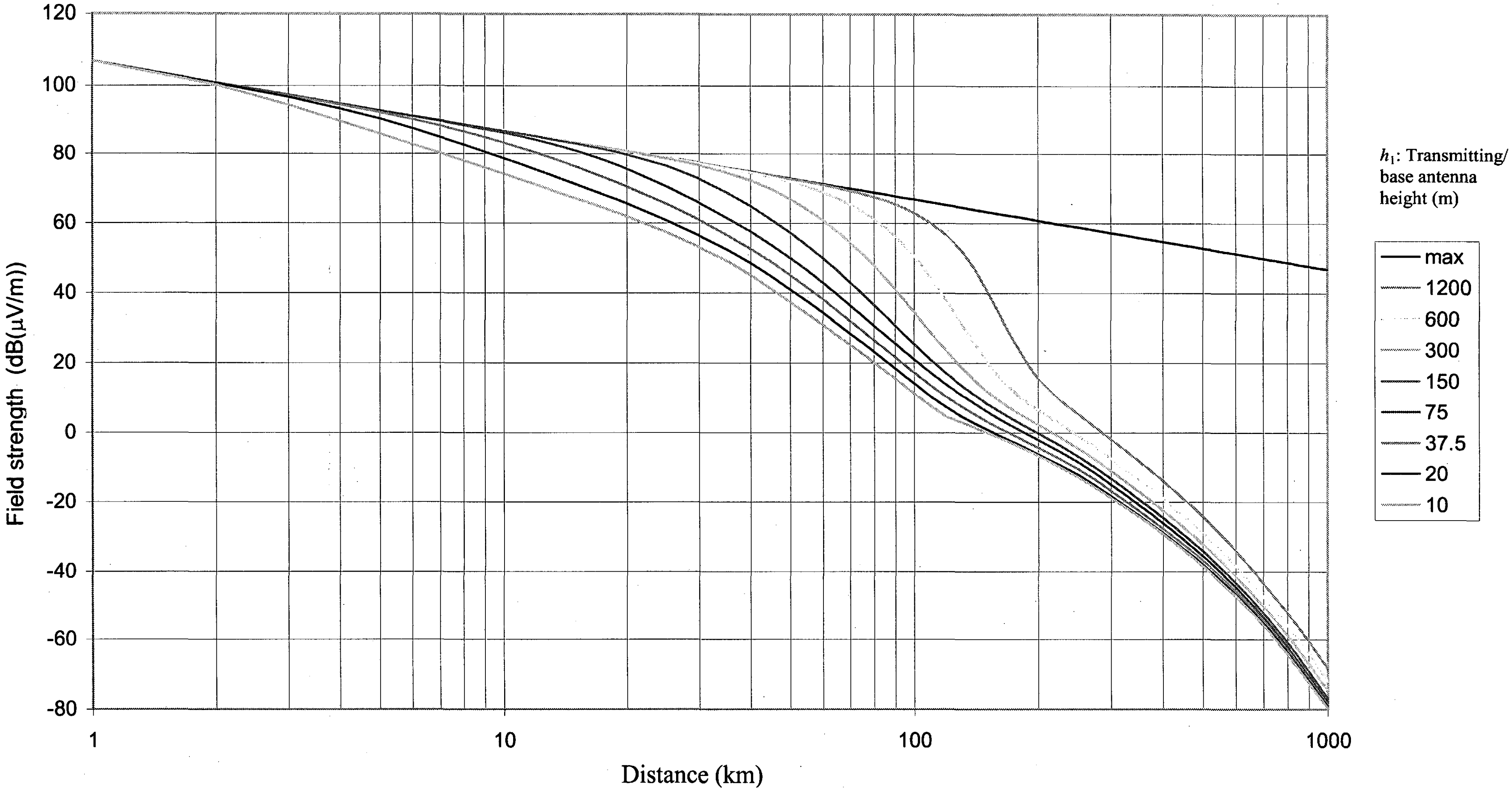



100 MHz 50% time Zone 4
Field strength (dB(µV/m))
120
100
80
60
40
20
0
-20
-40
-60
-80
1
10
100
1000
Distance (km)
h_1: Transmitting/ base antenna height (m)
max
1200
600
300
150
75
37.5
20
10

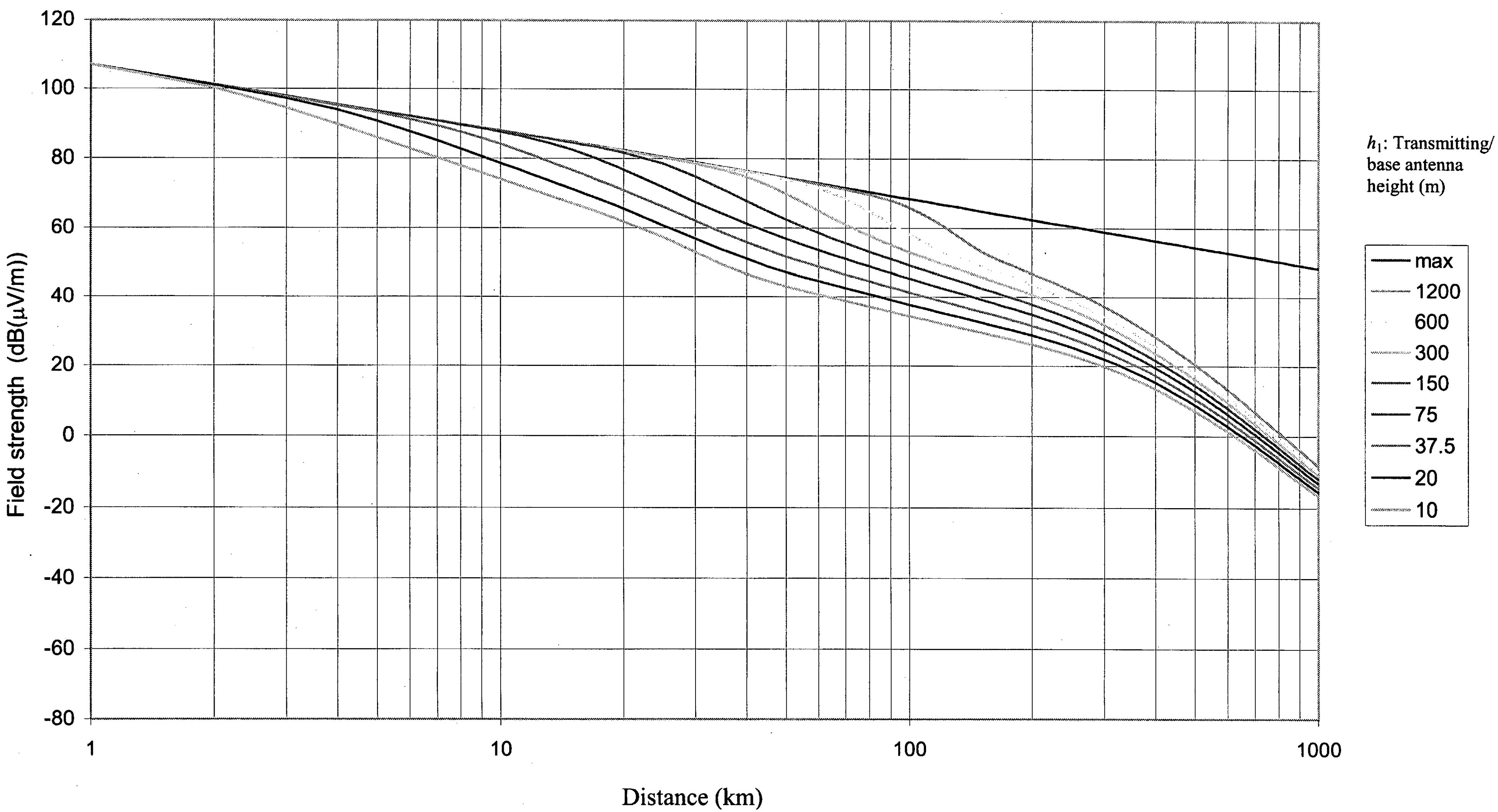

100 MHz 10% time Zone 4
120
100
80
60
40
20
0
-20
-40
-60
-80
Field strength (dB(μV/m))
1
10
100
1000
Distance (km)
h_1: Transmitting/ base antenna height (m)
max
1200
600
300
150
75
37.5
20
10

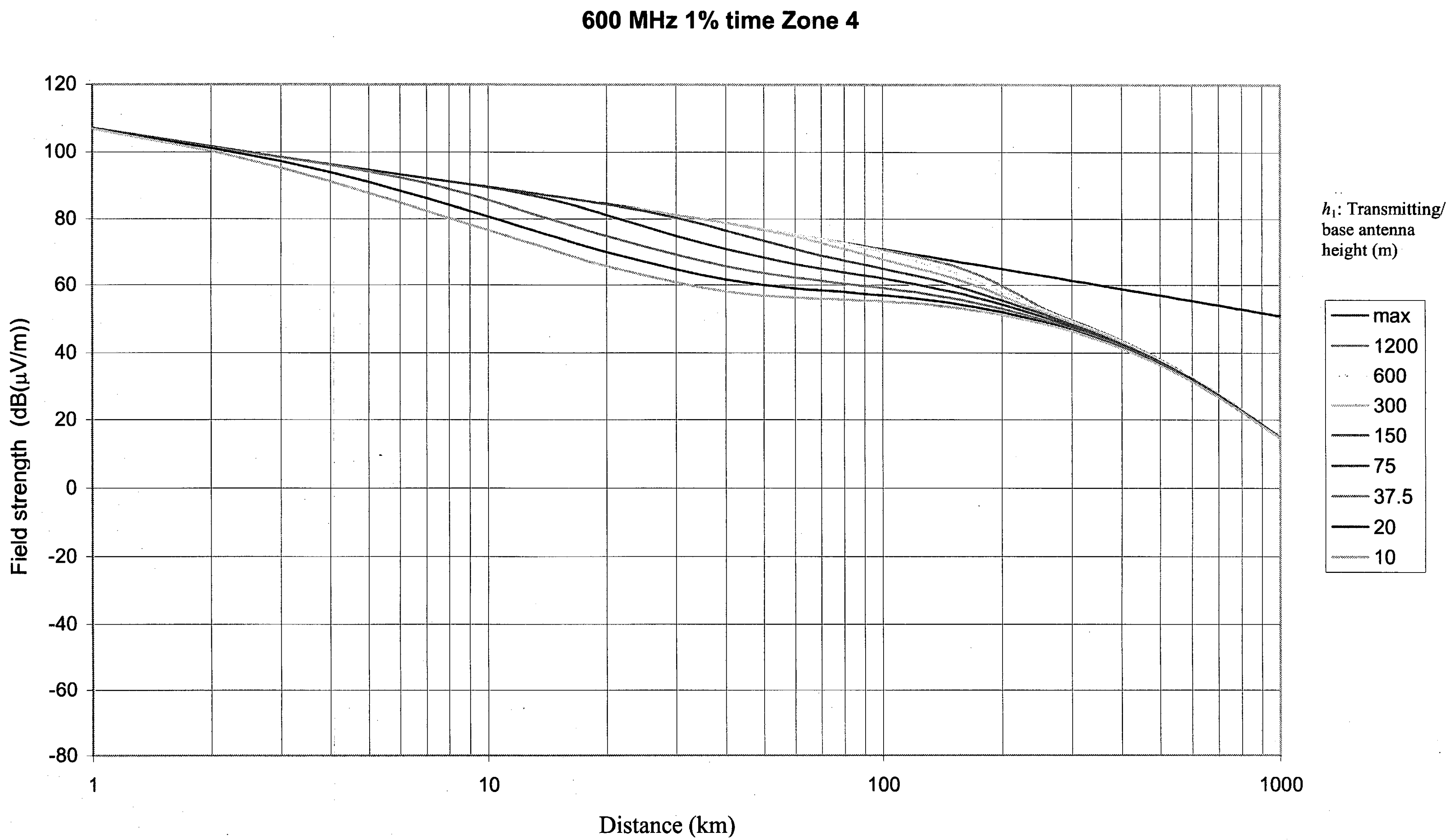

100 MHz 1% time Zone 4
120
100
80
60
40
20
0
-20
-40
-60
-80
Field strength (dB(μV/m))
1
10
100
1000
Distance (km)
h_1: Transmitting/ base antenna height (m)
max
1200
600
300
150
75
37.5
20
10

600 MHz 50% time Zone 4

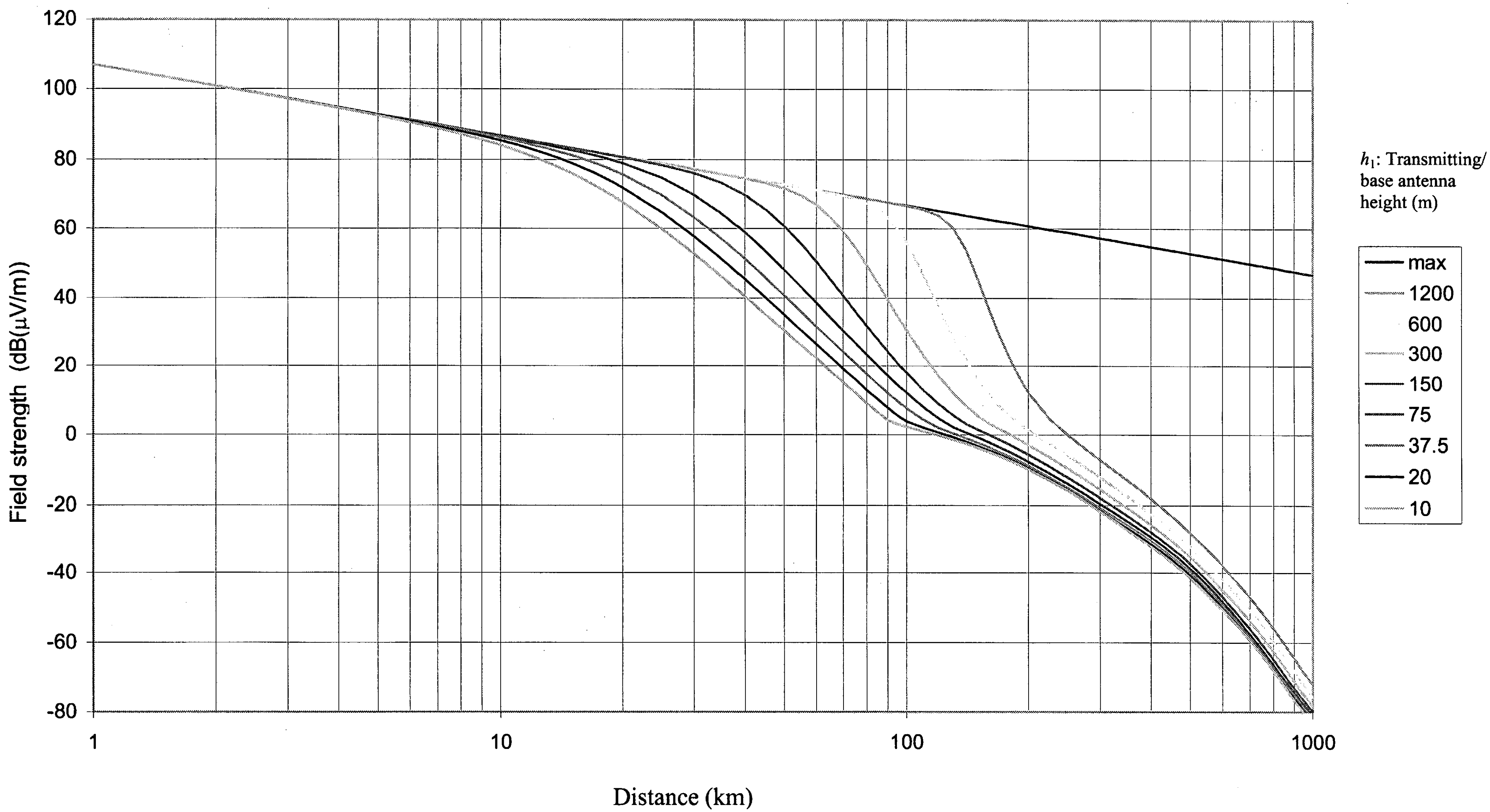


600 MHz 10% time Zone 4

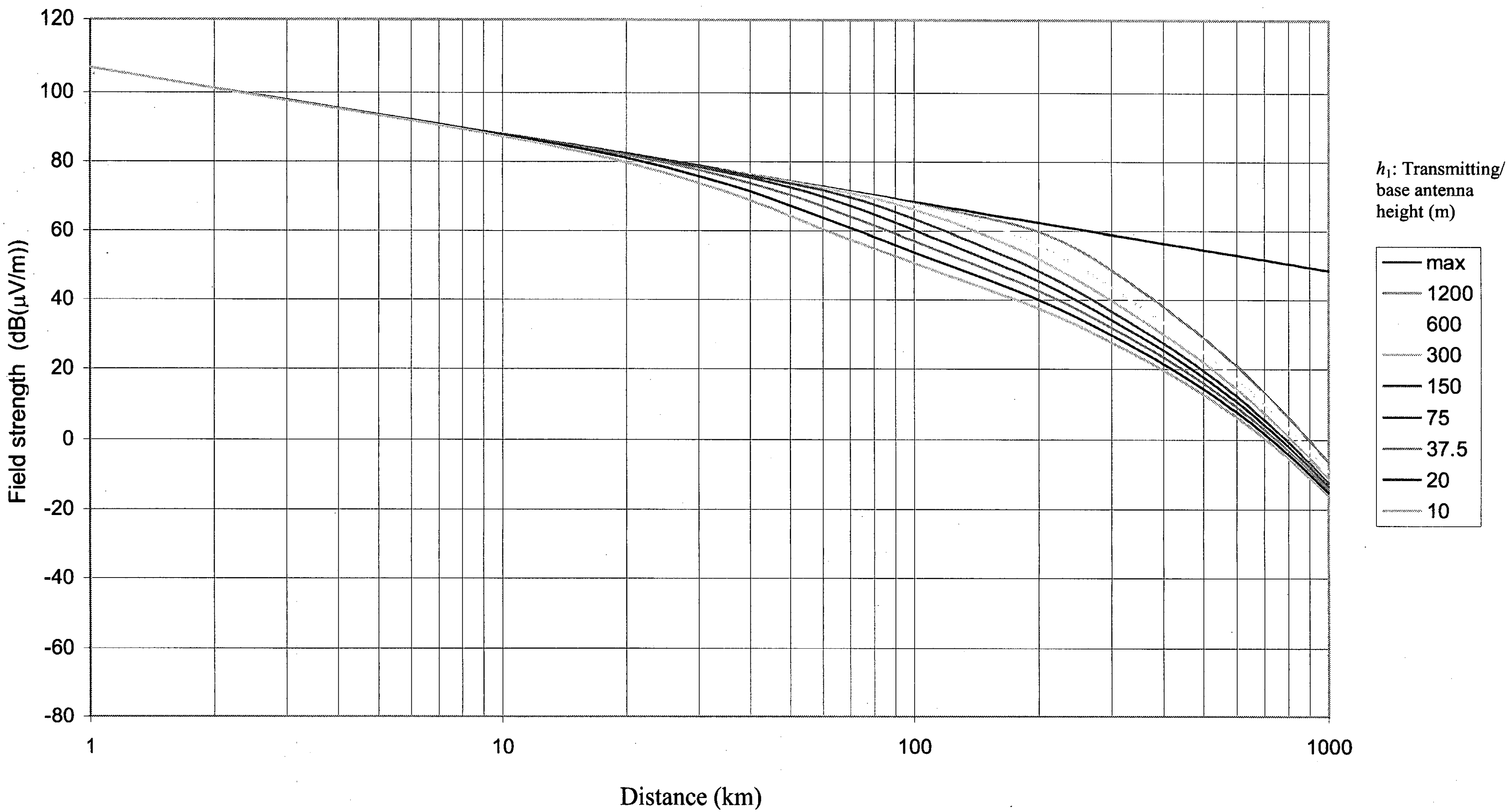


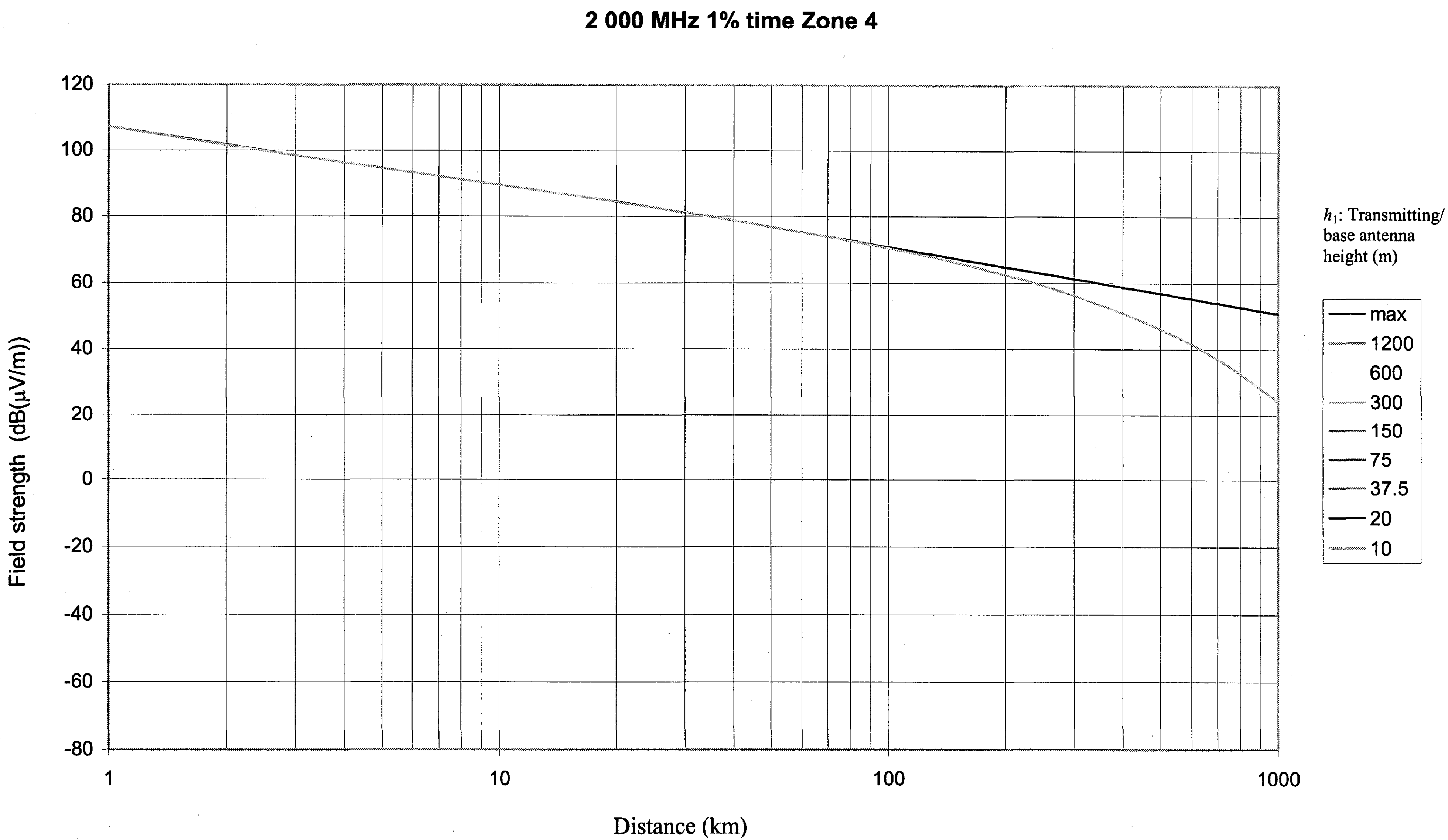

600 MHz 1% time Zone 4
Field strength (dB(μV/m))
120
100
80
60
40
20
0
-20
-40
-60
-80
1
10
100
1000
Distance (km)
h_1: Transmitting/ base antenna height (m)
max
1200
600
300
150
75
37.5
20
10

2 000 MHz 50% time Zone 4

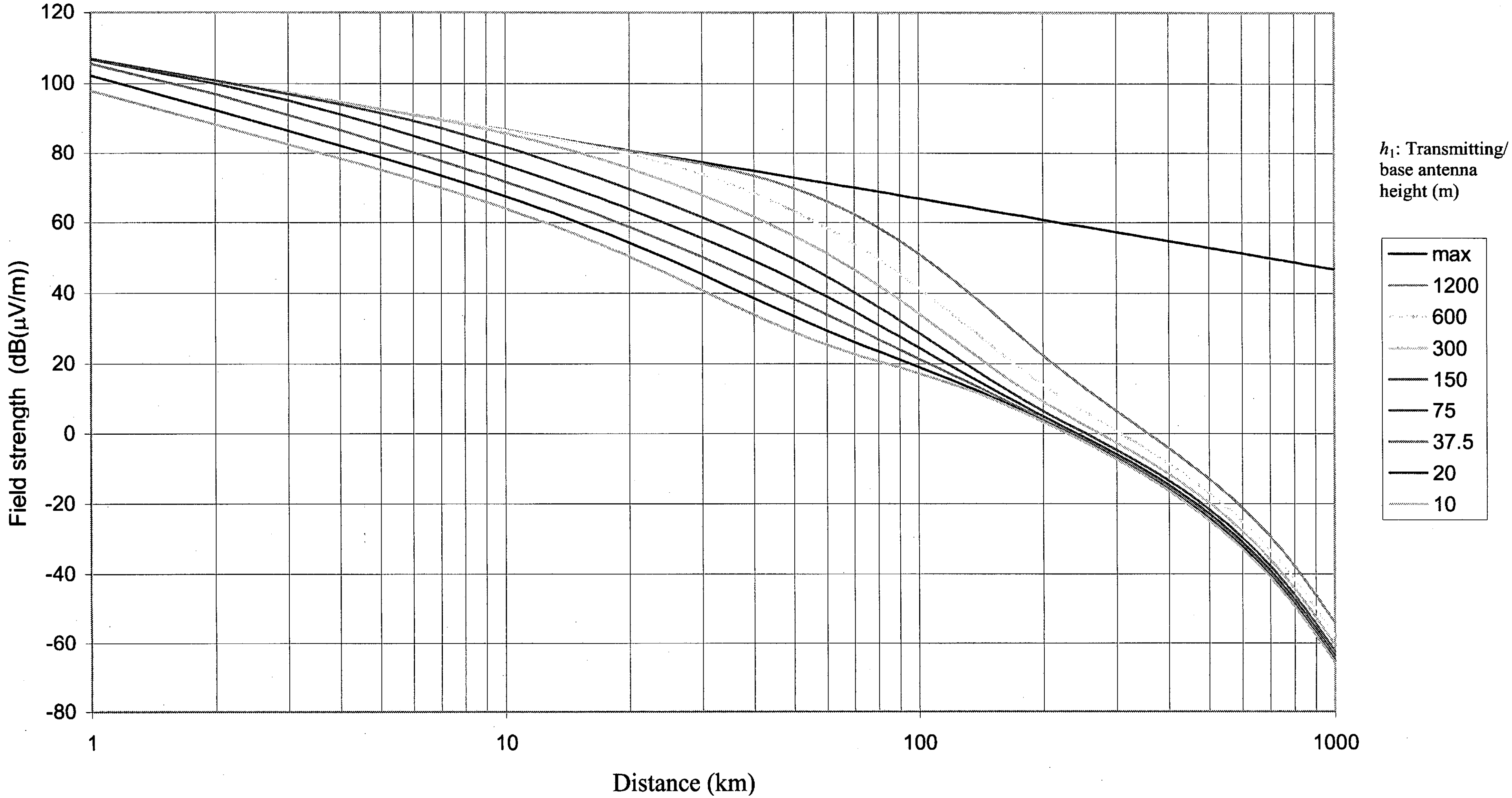


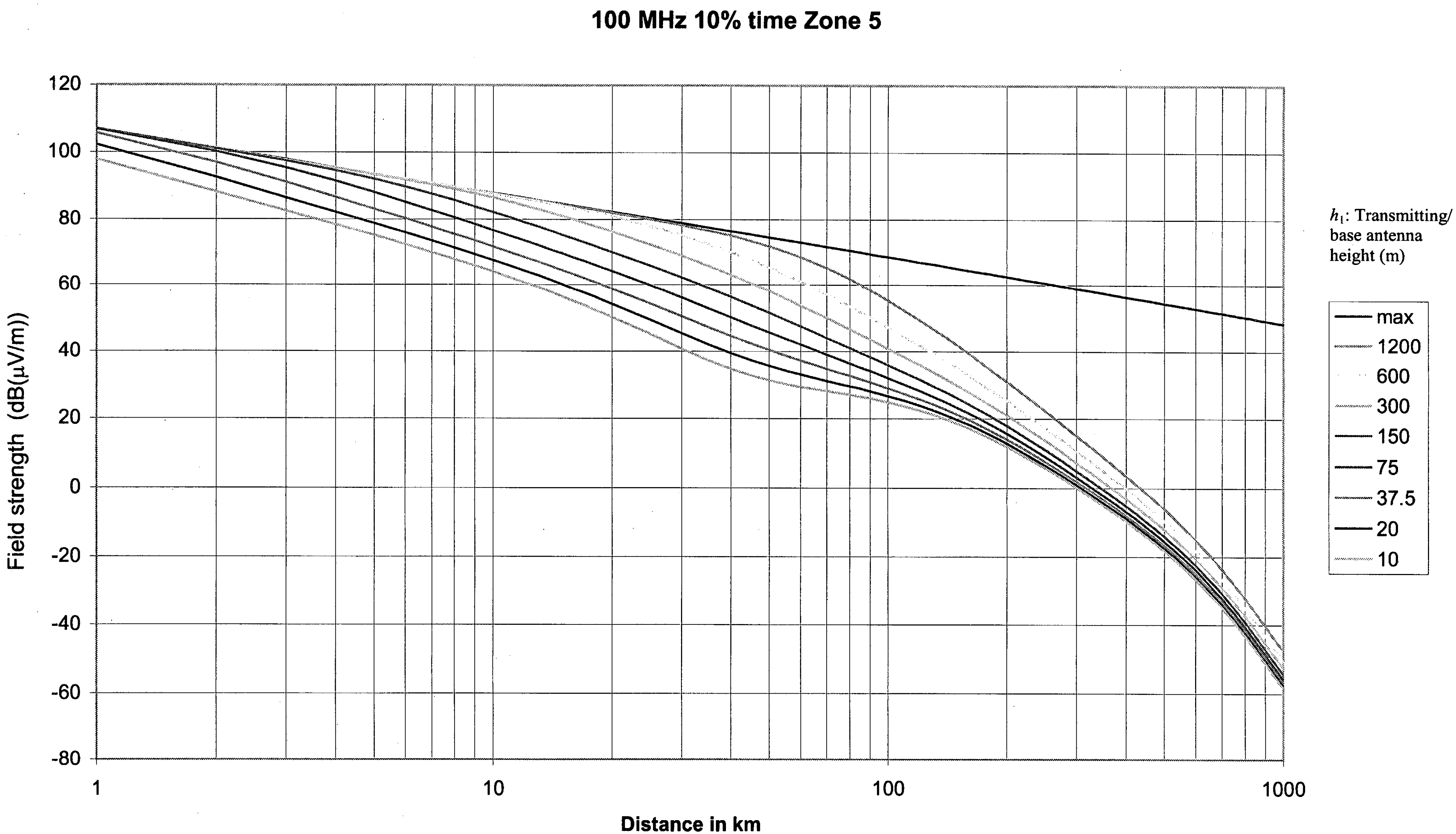
2 000 MHz 10% time Zone 4

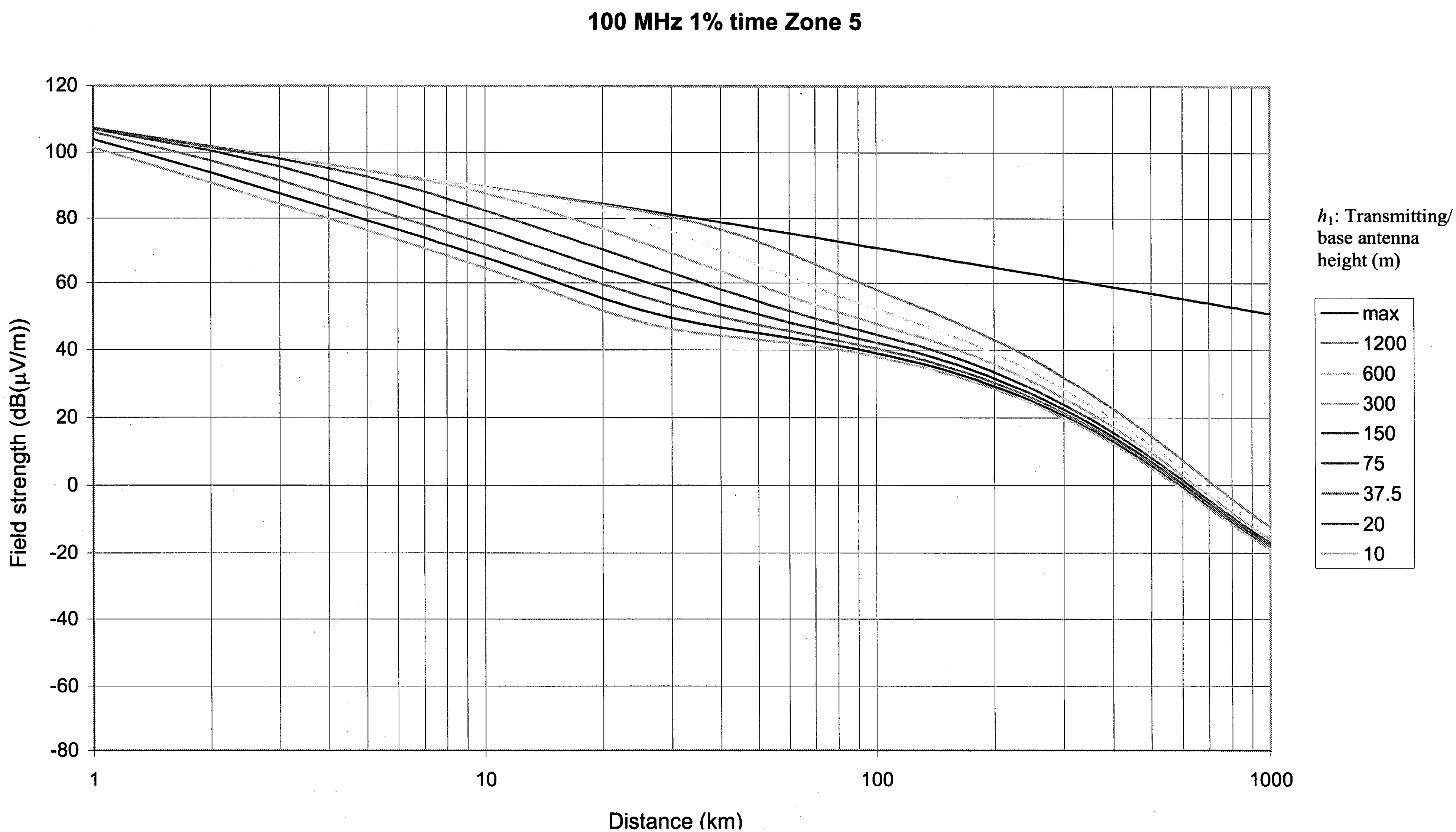



2 000 MHz 1% time Zone 4
120
100
80
60
40
20
0
-20
-40
-60
-80
Field strength (dB(μV/m))
1
10
100
1000
Distance (km)
h_1: Transmitting/ base antenna height (m)
max
1200
600
300
150
75
37.5
20
10

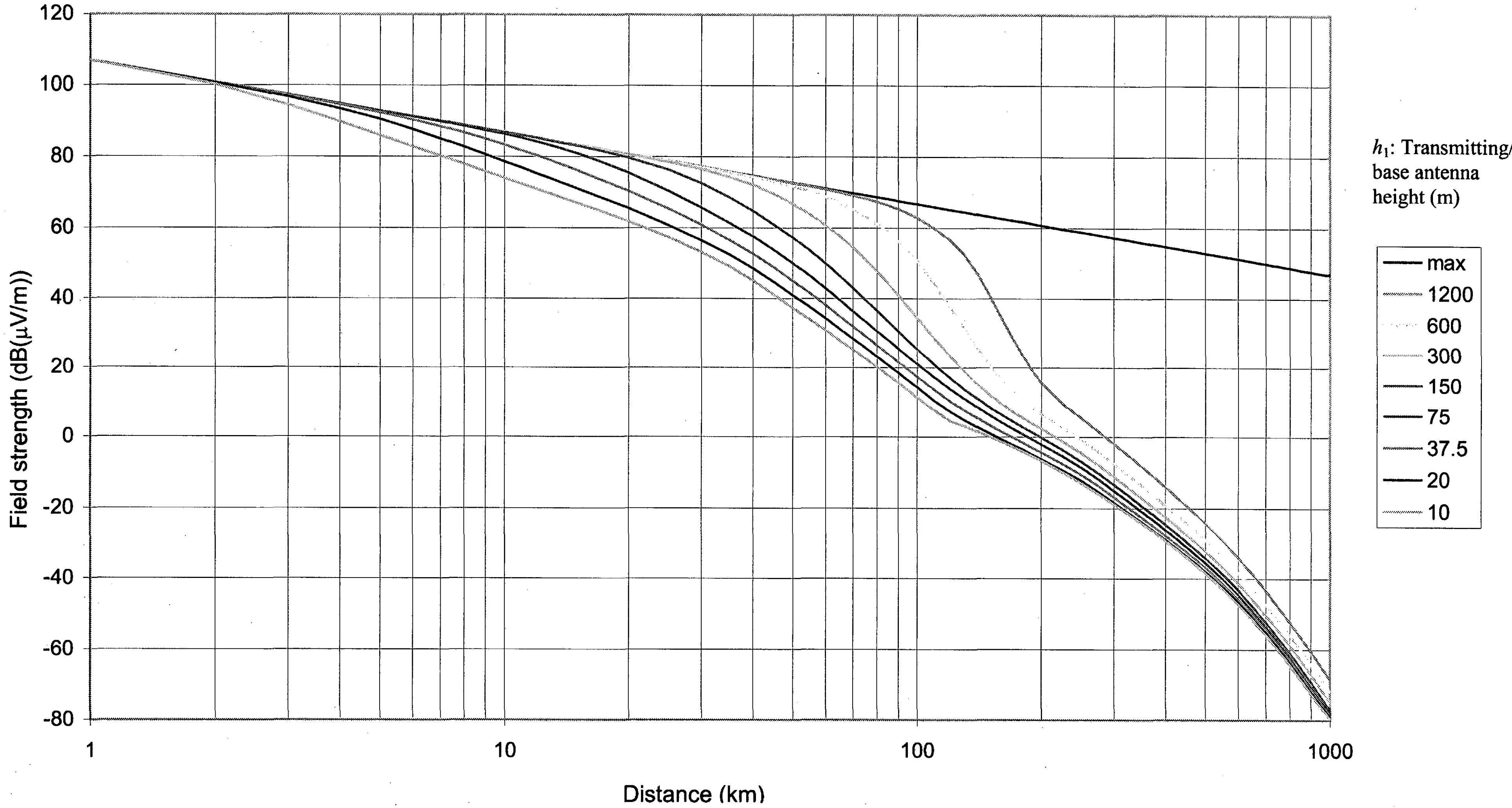
100 MHz 50% time Zone 5



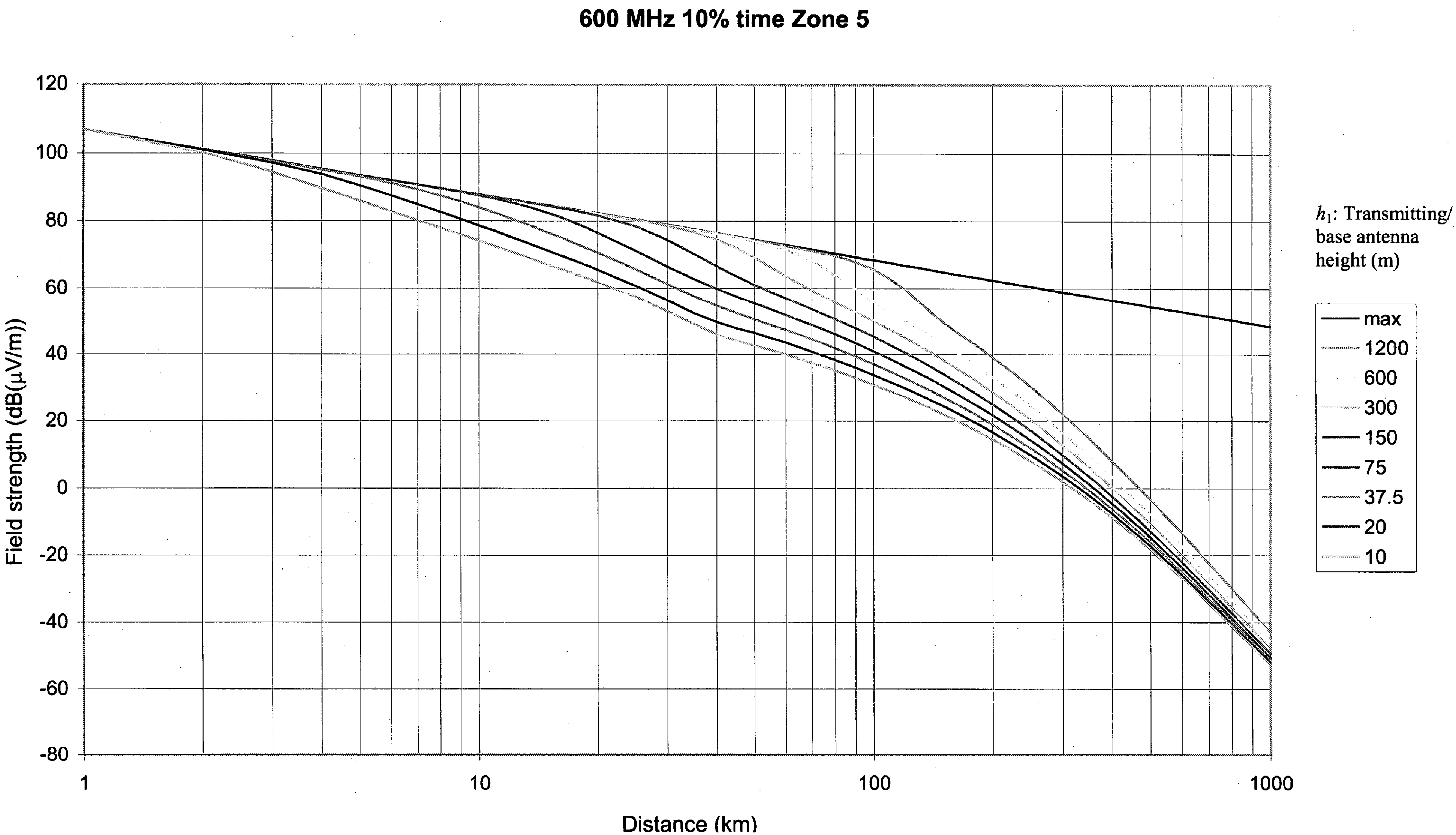

100 MHz 10% time Zone 5
Field strength (dB(μV/m))
120
100
80
60
40
20
0
-20
-40
-60
-80
1
10
100
1000
Distance in km
h_1: Transmitting/ base antenna height (m)
max
1200
600
300
150
75
37.5
20
10

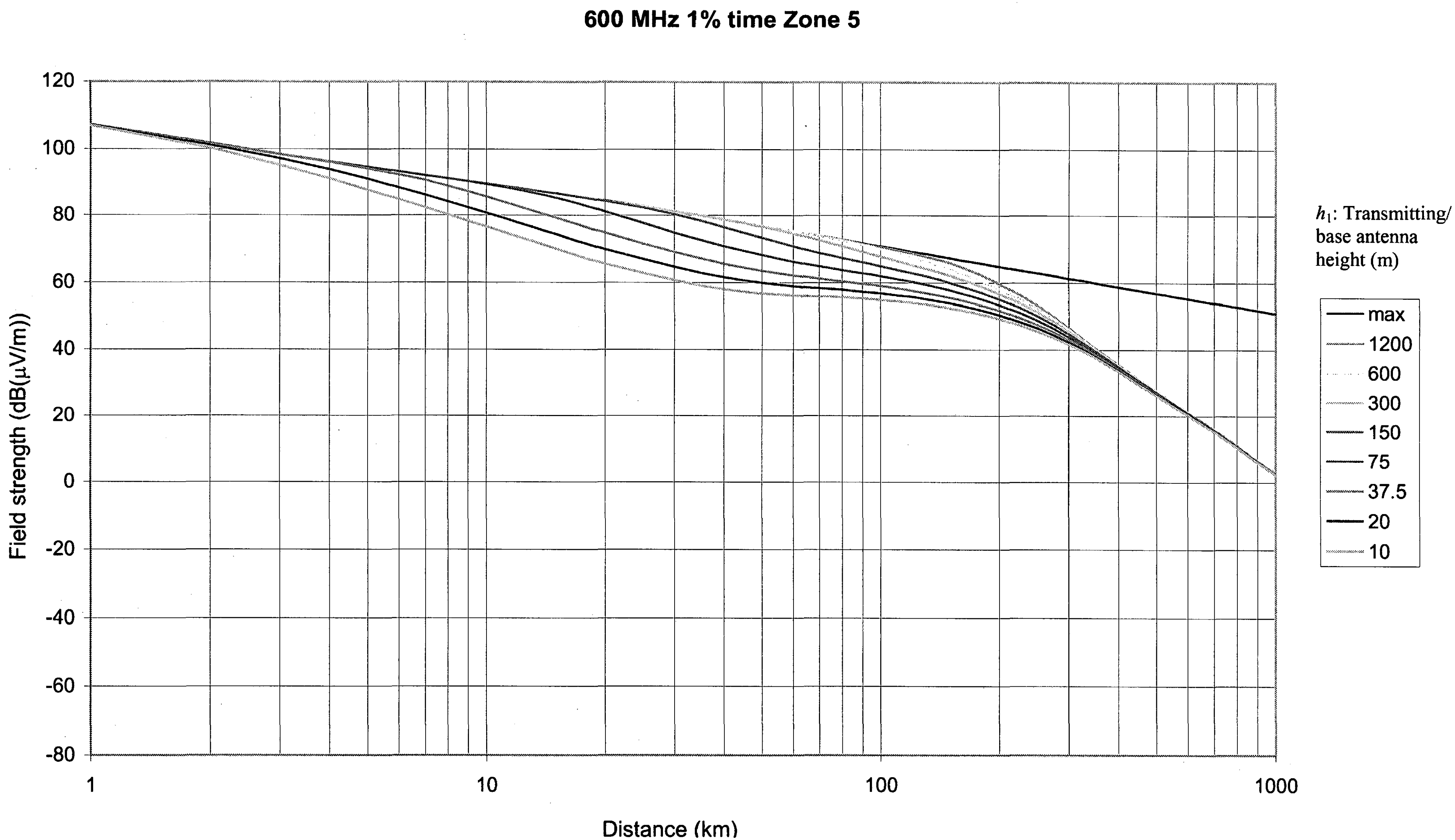

100 MHz 1% time Zone 5
Field strength (dB(μV/m))
Distance (km)
120
100
80
60
40
20
0
-20
-40
-60
-80
1
10
100
1000
h1: Transmitting/ base antenna height (m)
max
1200
600
300
150
75
37.5
20
10

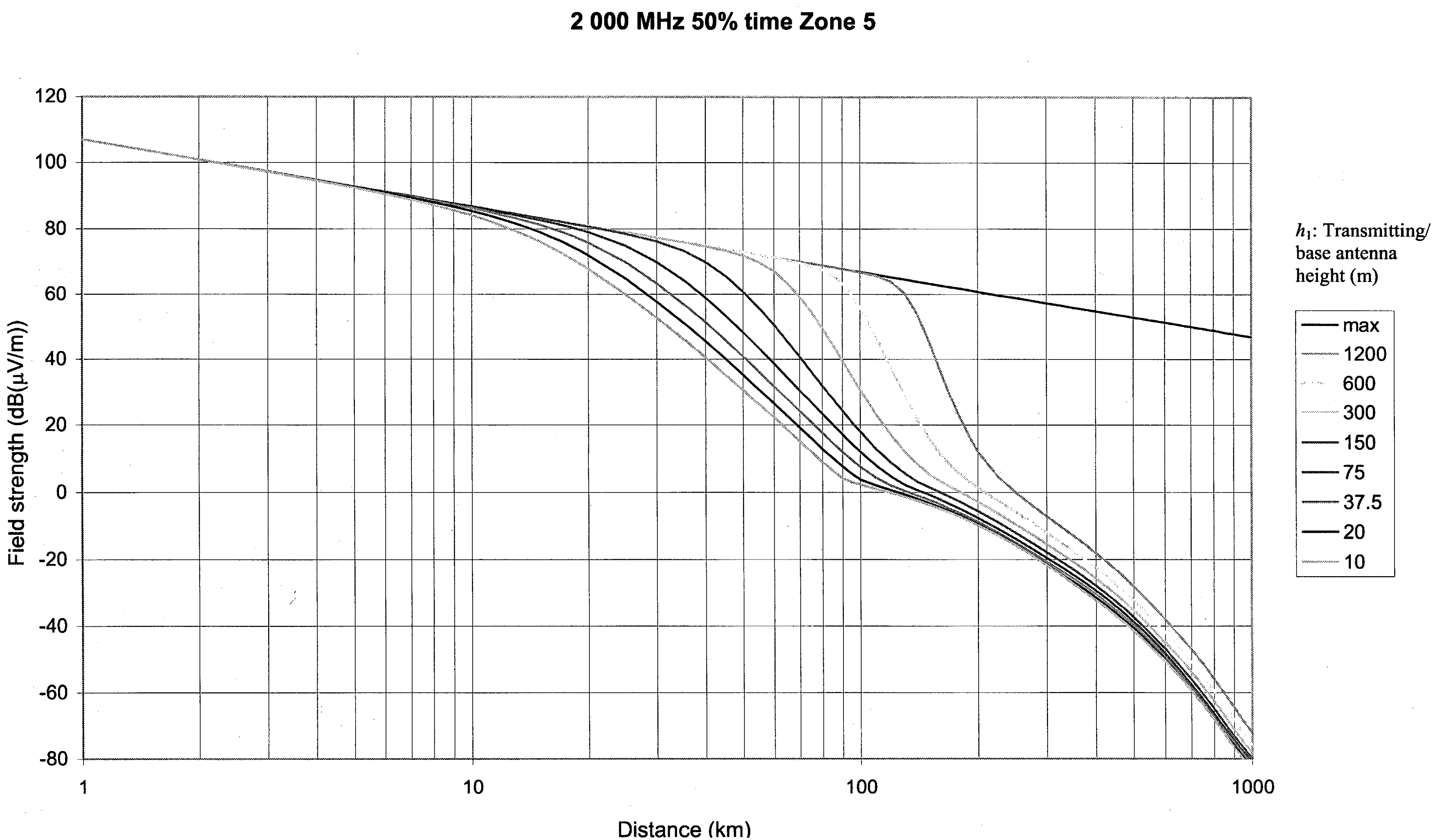
600 MHz 50% time Zone 5



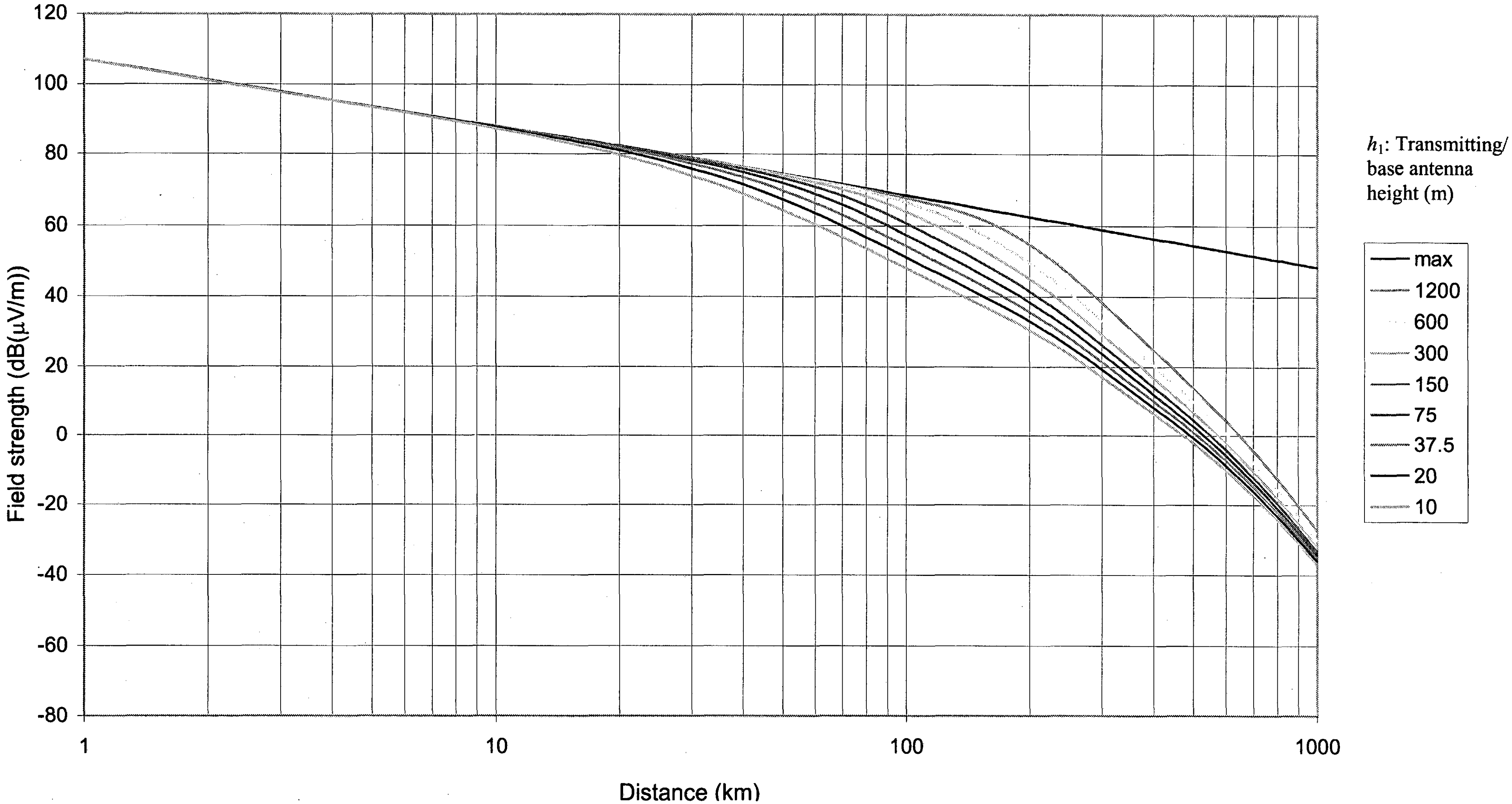
101

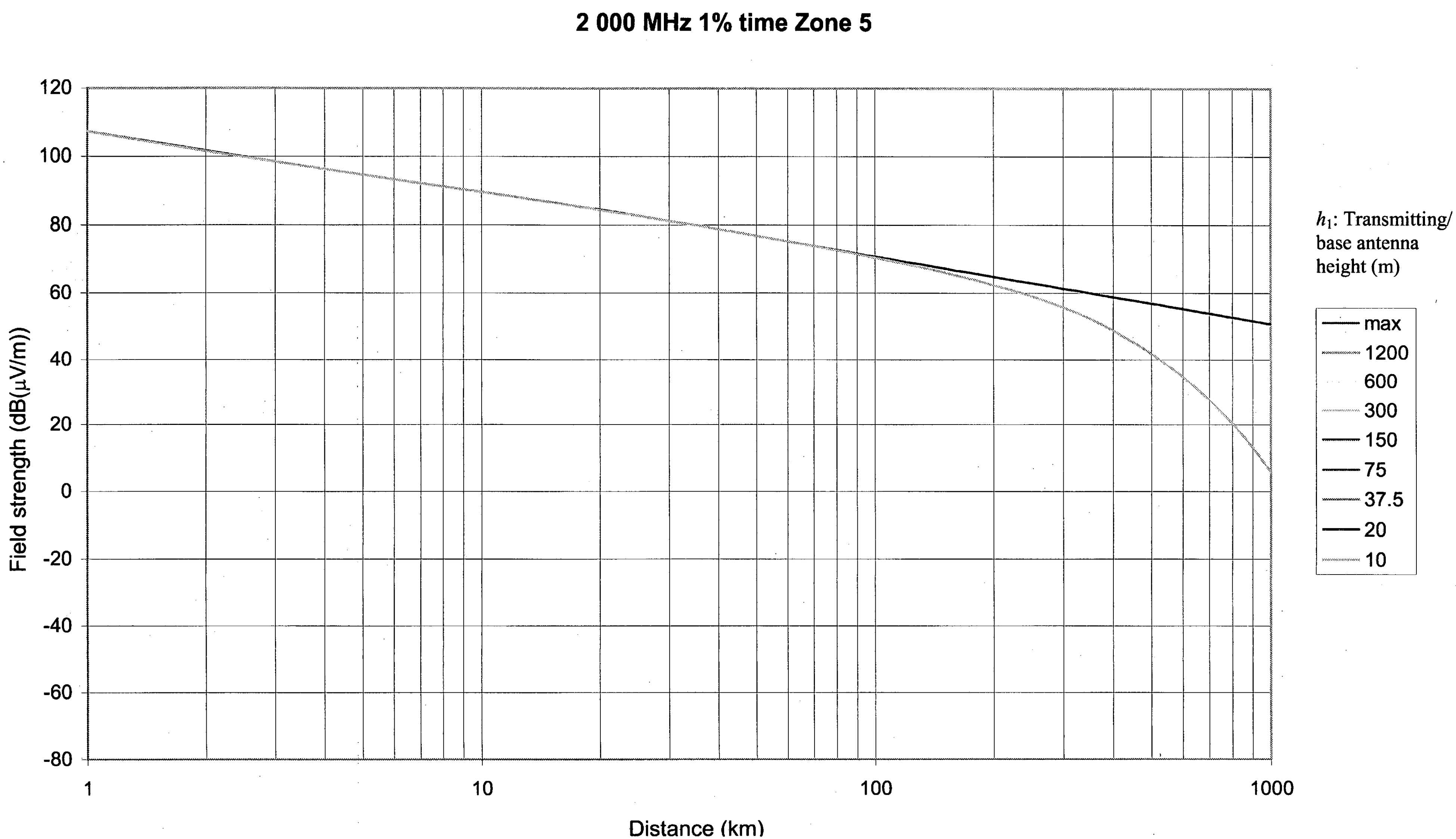

600 MHz 10% time Zone 5
Field strength (dB(μV/m))
Distance (km)
120
100
80
60
40
20
0
-20
-40
-60
-80
1
10
100
1000
h1: Transmitting/ base antenna height (m)
max
1200
600
300
150
75
37.5
20
10

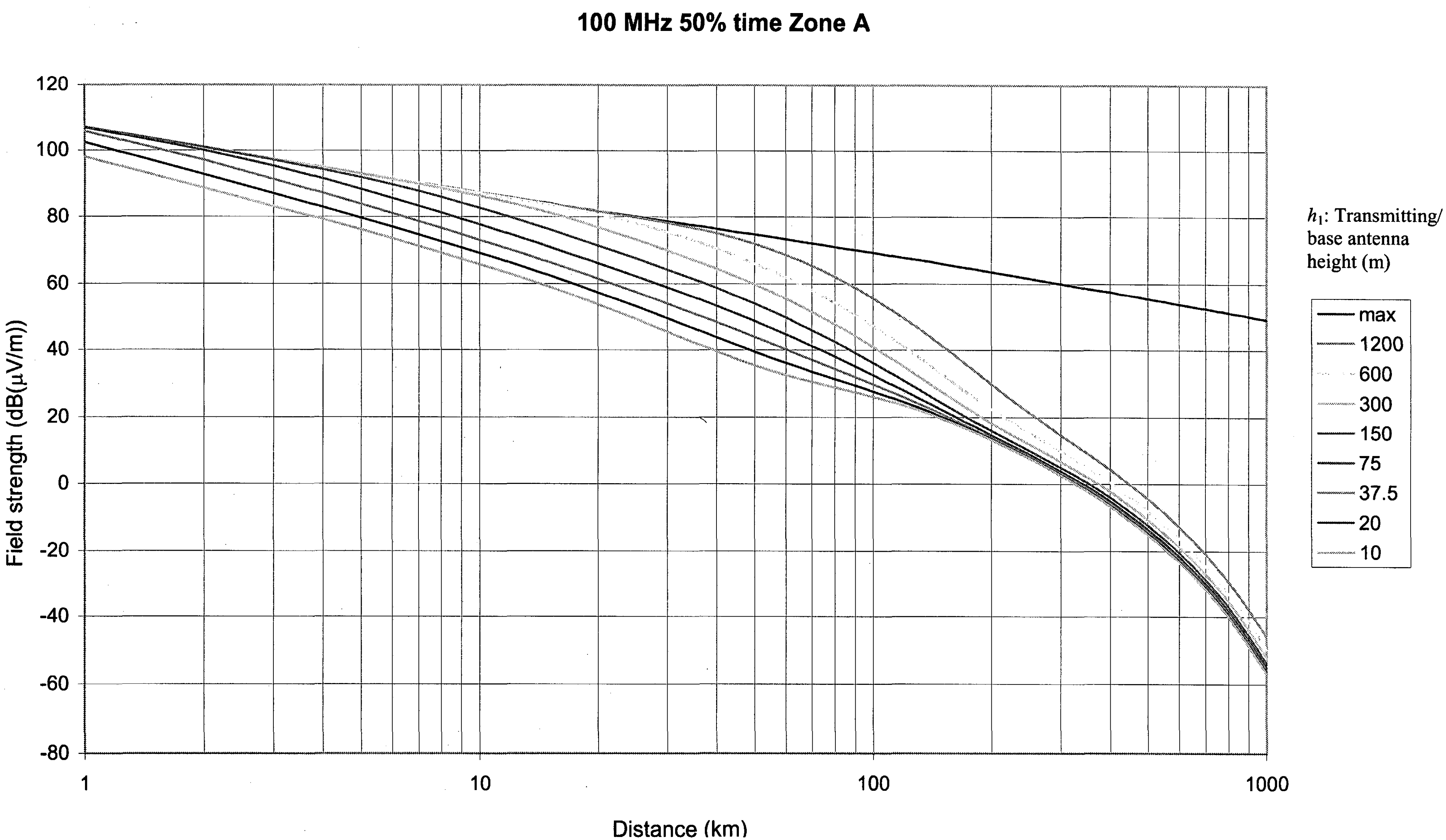

600 MHz 1% time Zone 5
Field strength (dB(μV/m))
120
100
80
60
40
20
0
-20
-40
-60
-80
1
10
100
1000
Distance (km)
h1: Transmitting/
base antenna
height (m)
max
1200
600
300
150
75
37.5
20
10


2 000 MHz 50% time Zone 5
120
100
80
60
40
20
0
-20
-40
-60
-80
Field strength (dB(μV/m))
1
10
100
1000
Distance (km)
h_1: Transmitting/ base antenna height (m)
max
1200
600
300
150
75
37.5
20
10

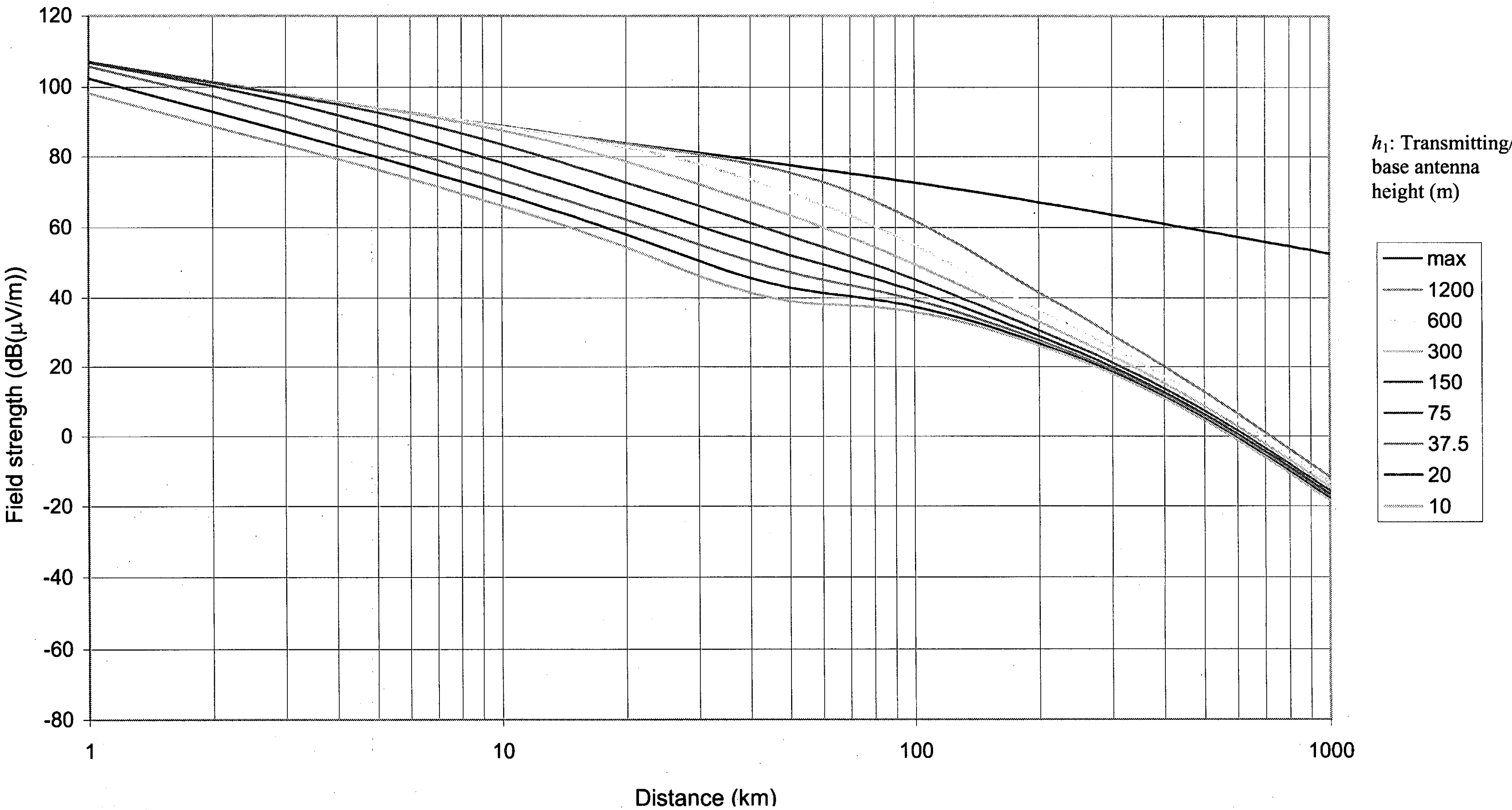
2 000 MHz 10% time Zone 5

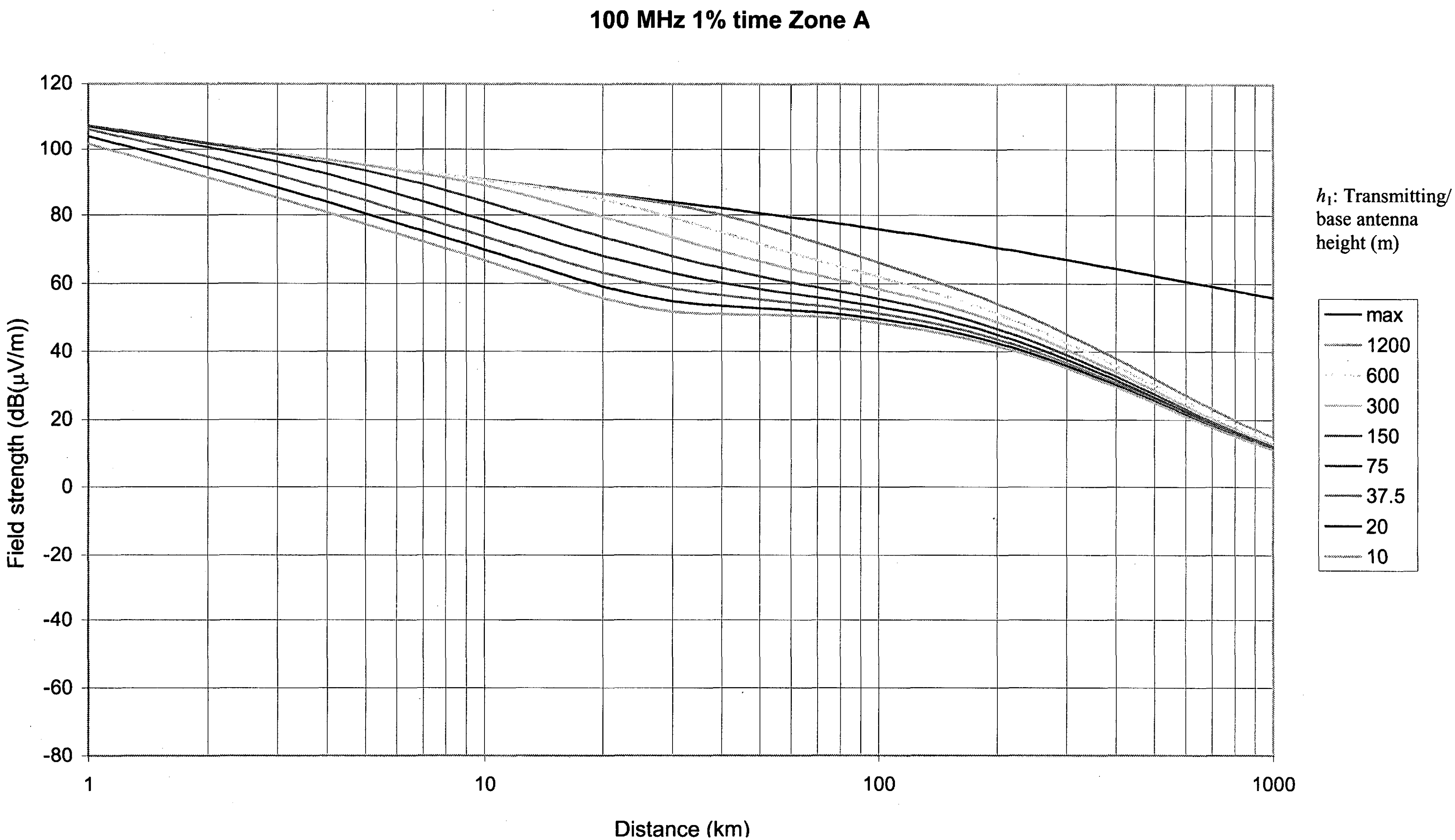


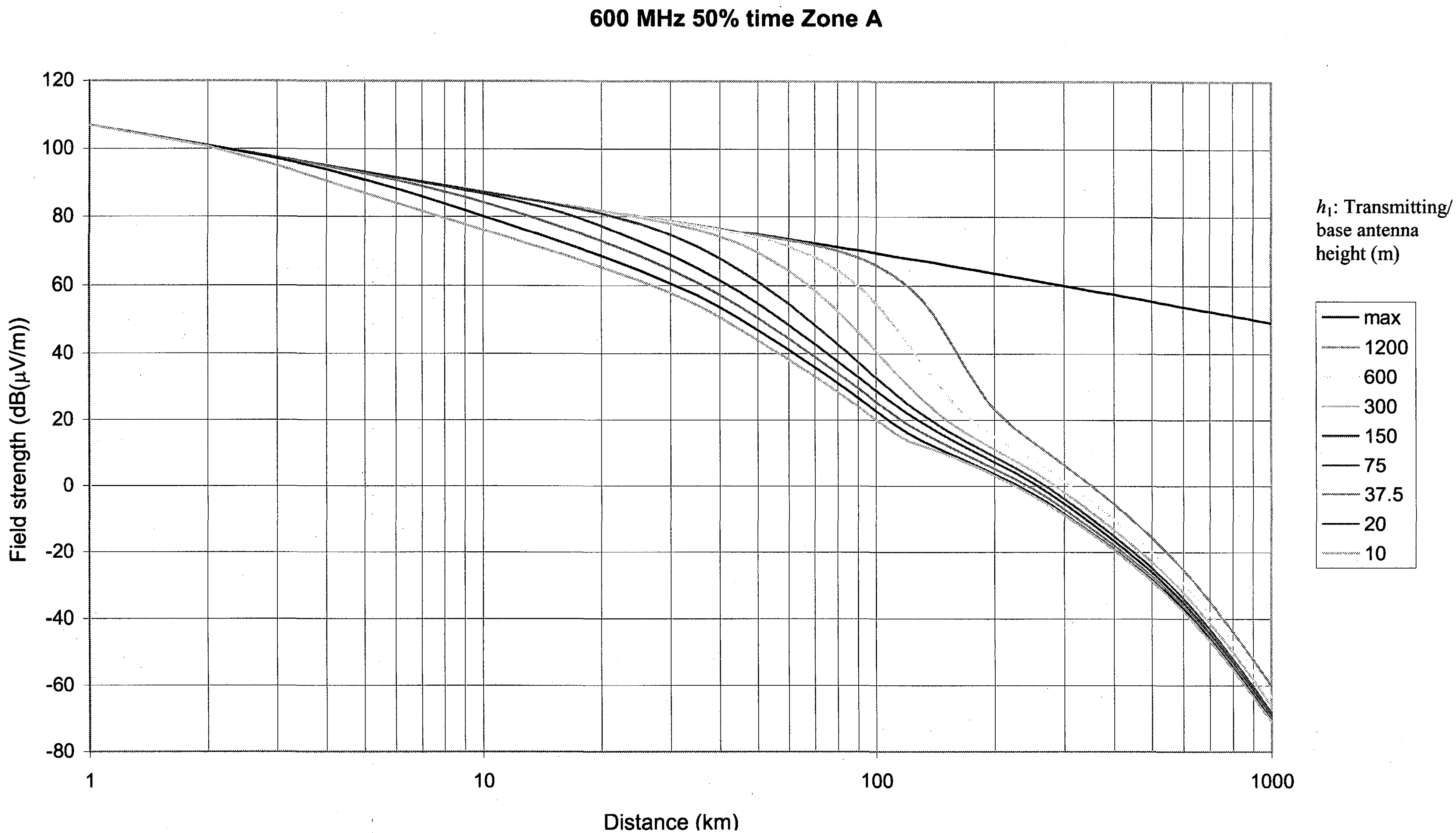

2 000 MHz 1% time Zone 5
Field strength (dB(μV/m))
120
100
80
60
40
20
0
-20
-40
-60
-80
1
10
100
1000
Distance (km)
h1: Transmitting/ base antenna height (m)
max
1200
600
300
150
75
37.5
20
10


100 MHz 50% time Zone A
Field strength (dB(μV/m))
Distance (km)
120
100
80
60
40
20
0
-20
-40
-60
-80
1
10
100
1000
h_1: Transmitting/ base antenna height (m)
max
1200
600
300
150
75
37.5
20
10

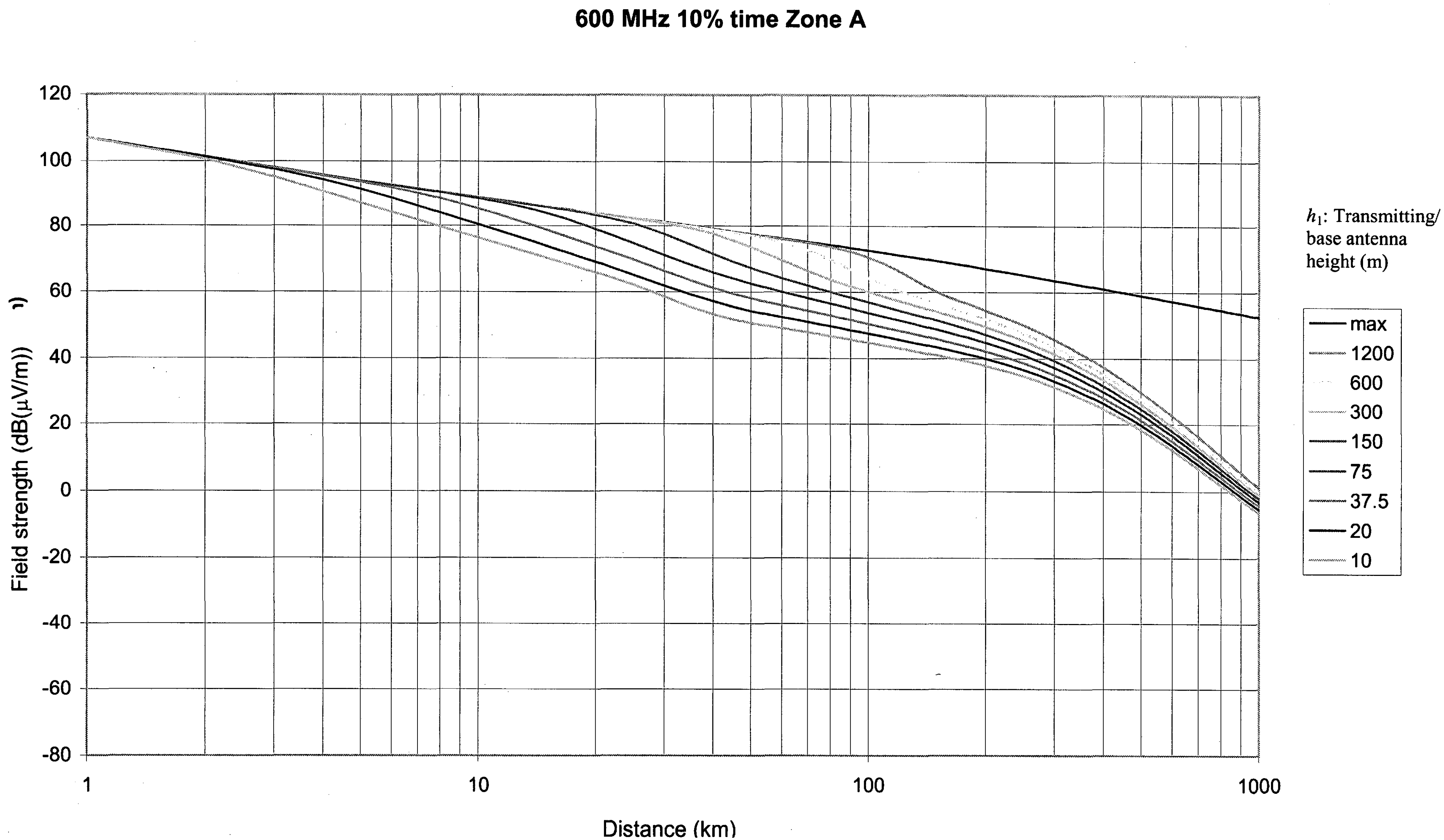
100 MHz 10% time Zone A



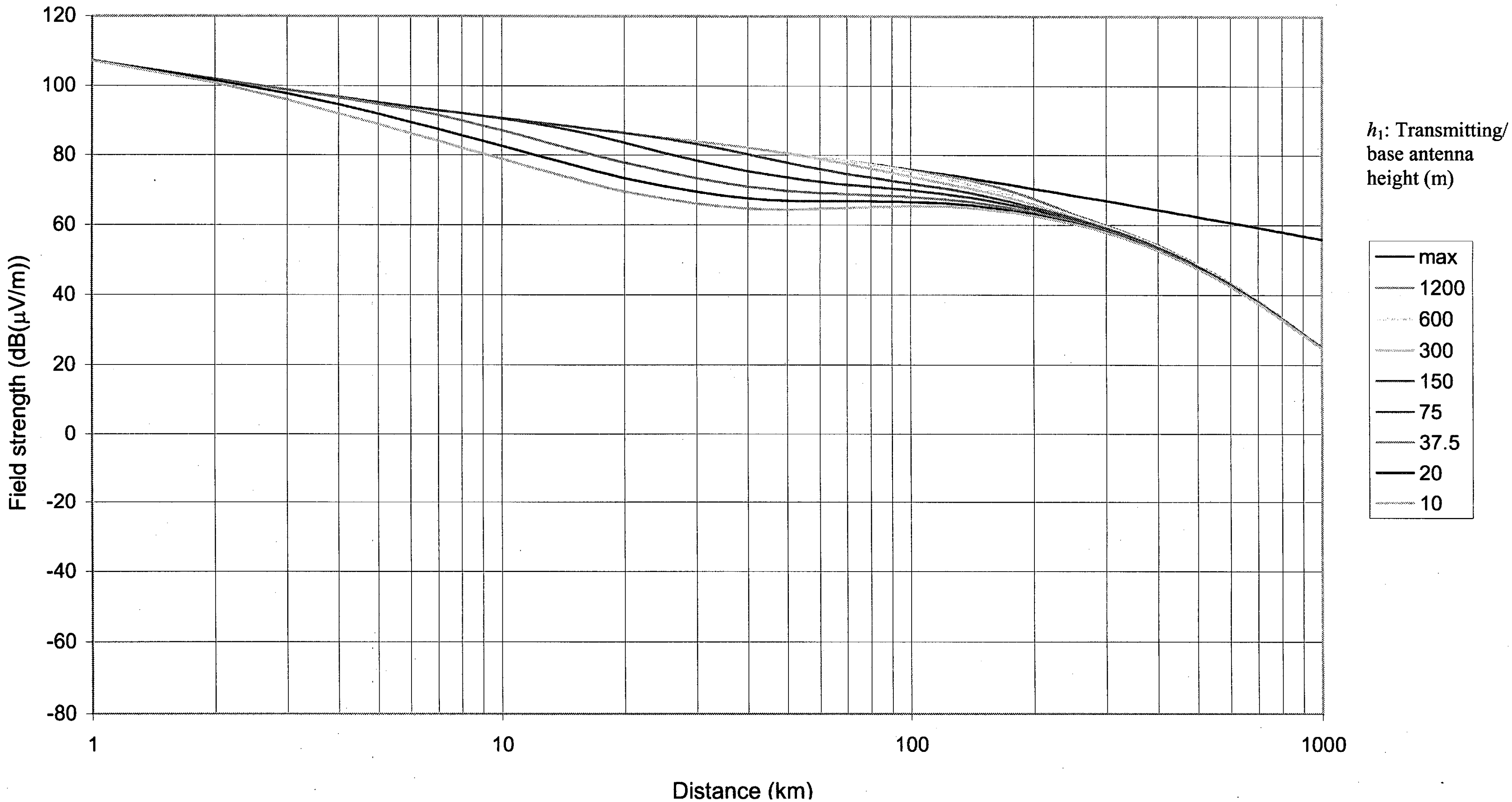

100 MHz 1% time Zone A
Field strength (dB(μV/m))
Distance (km)
120
100
80
60
40
20
0
-20
-40
-60
-80
1
10
100
1000
h_1: Transmitting/ base antenna height (m)
max
1200
600
300
150
75
37.5
20
10

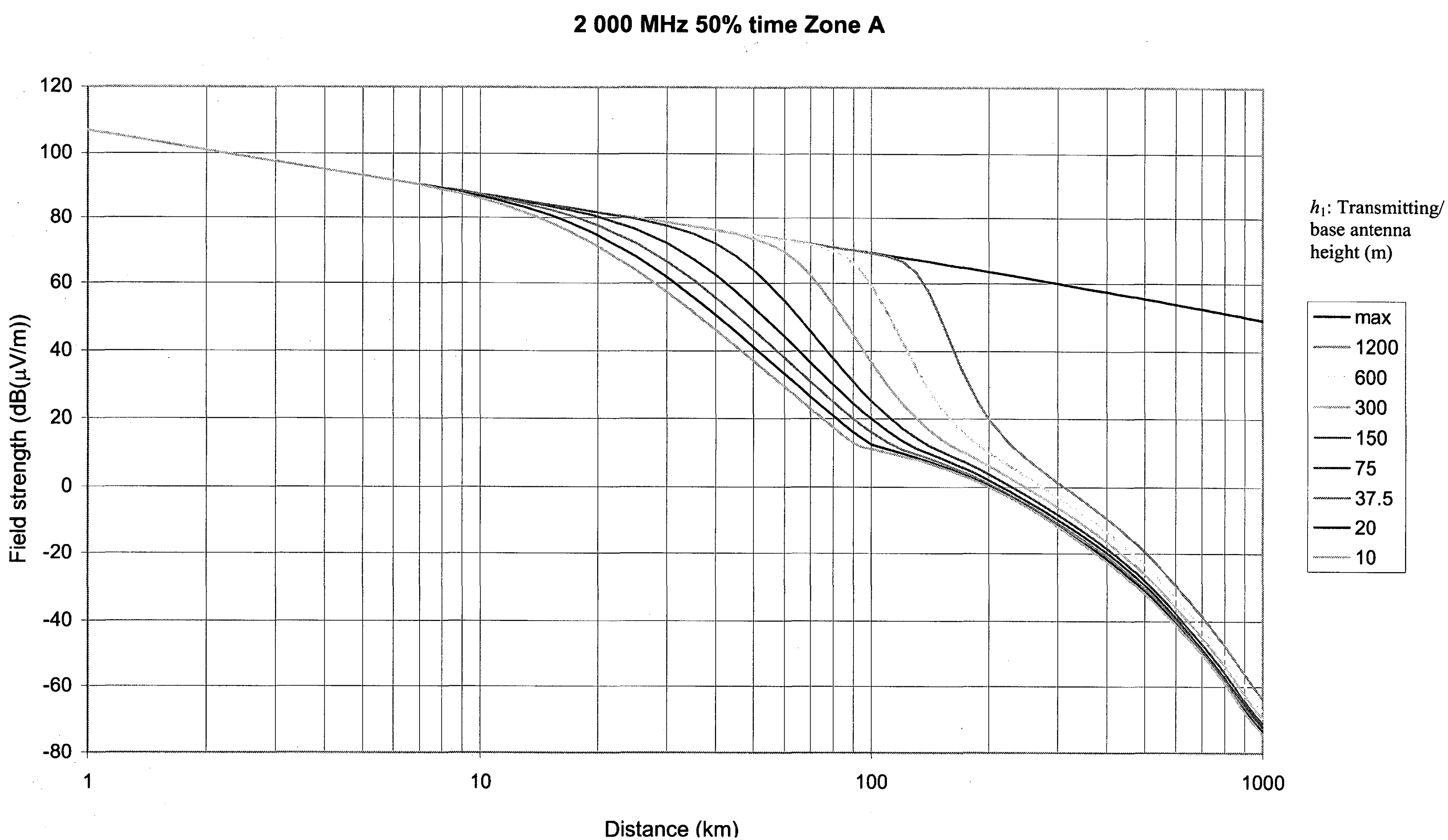

600 MHz 50% time Zone A
Field strength (dB(μV/m))
120
100
80
60
40
20
0
-20
-40
-60
-80
1
10
100
1000
Distance (km)
h_1: Transmitting/ base antenna height (m)
max
1200
600
300
150
75
37.5
20
10

110

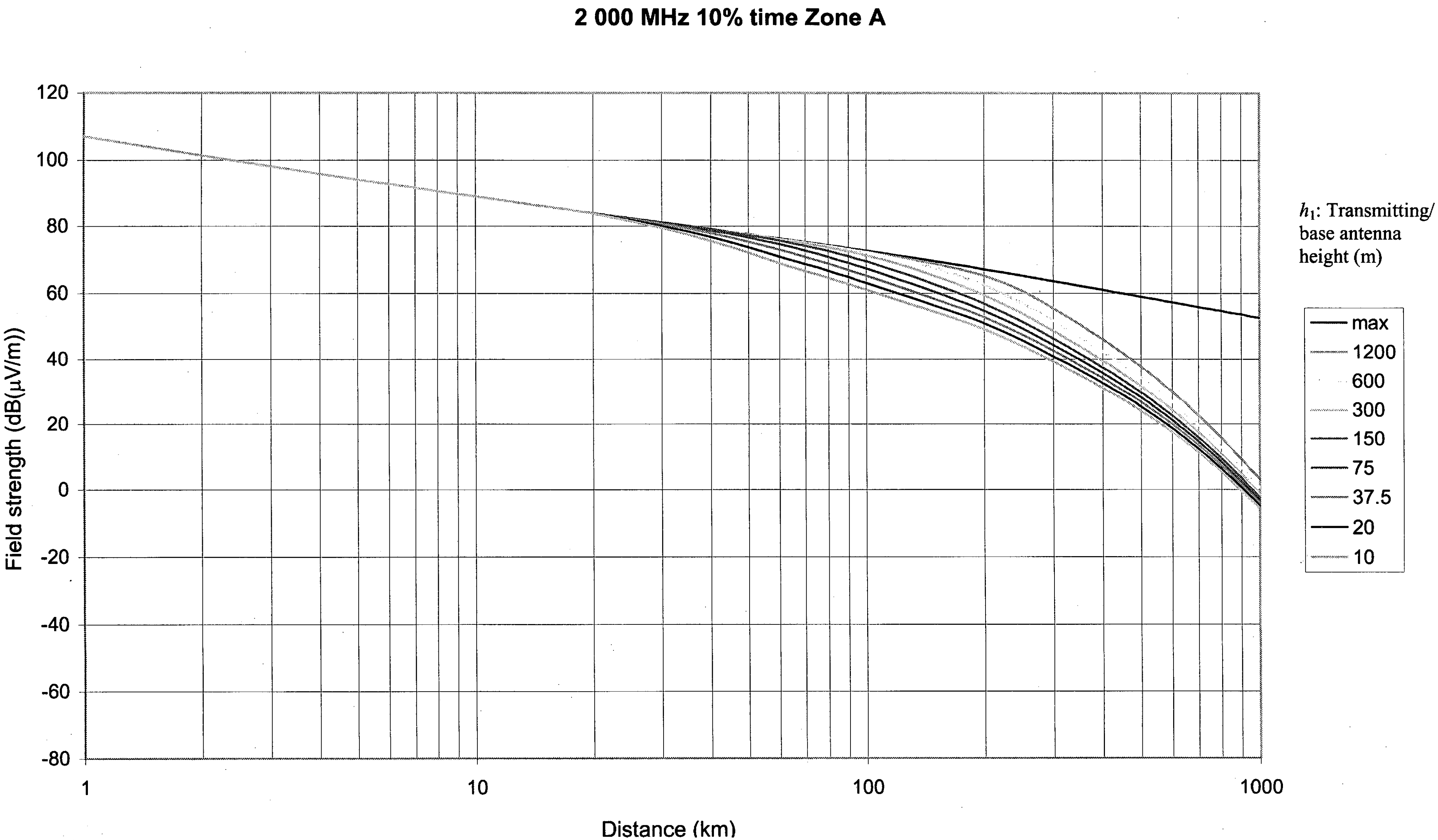

600 MHz 10% time Zone A
Field strength (dB(μV/m))
Distance (km)
120
100
80
60
40
20
0
-20
-40
-60
-80
1
10
100
1000
h1: Transmitting/ base antenna height (m)
max
1200
600
300
150
75
37.5
20
10

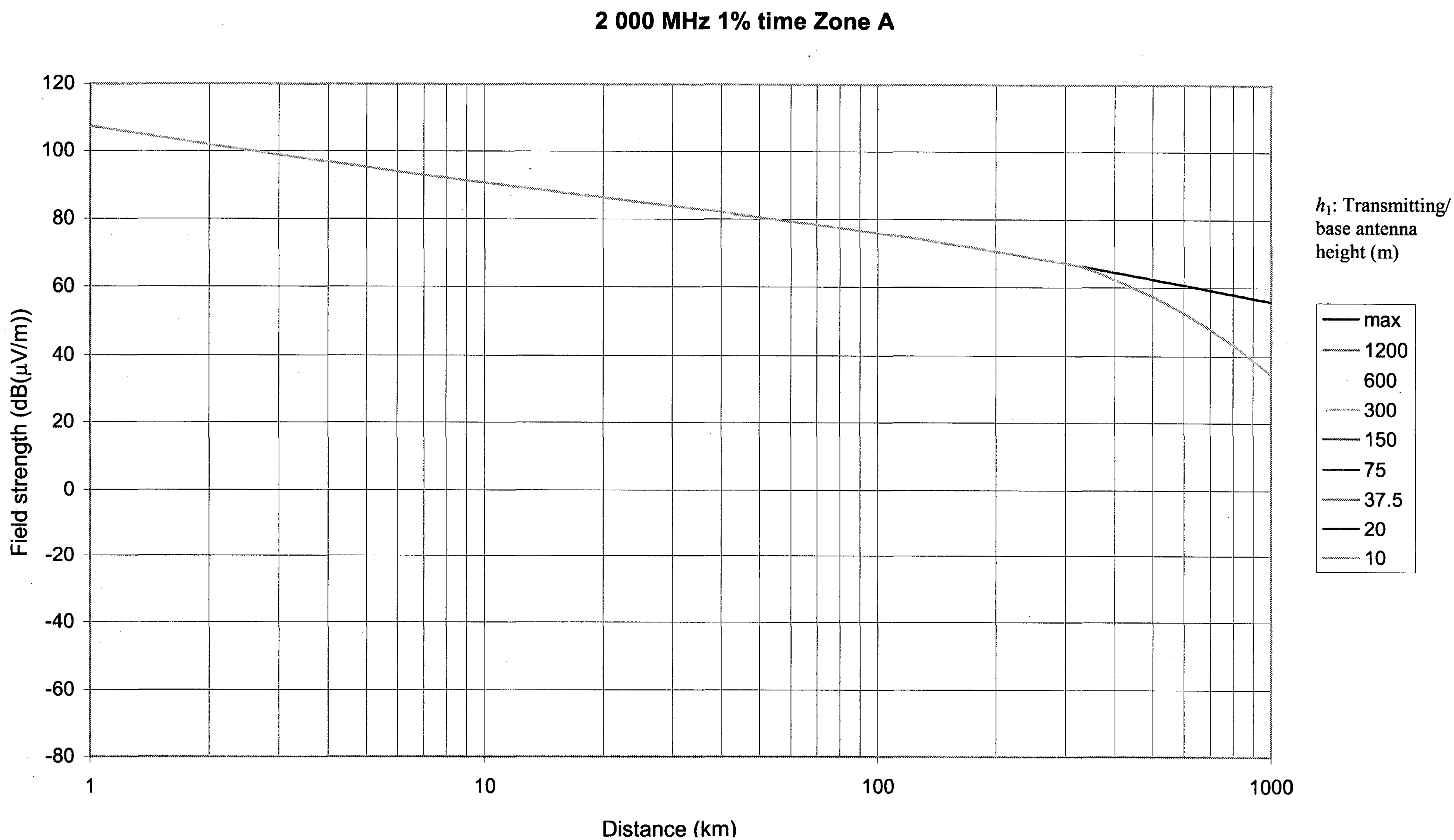
600 MHz 1% time Zone A



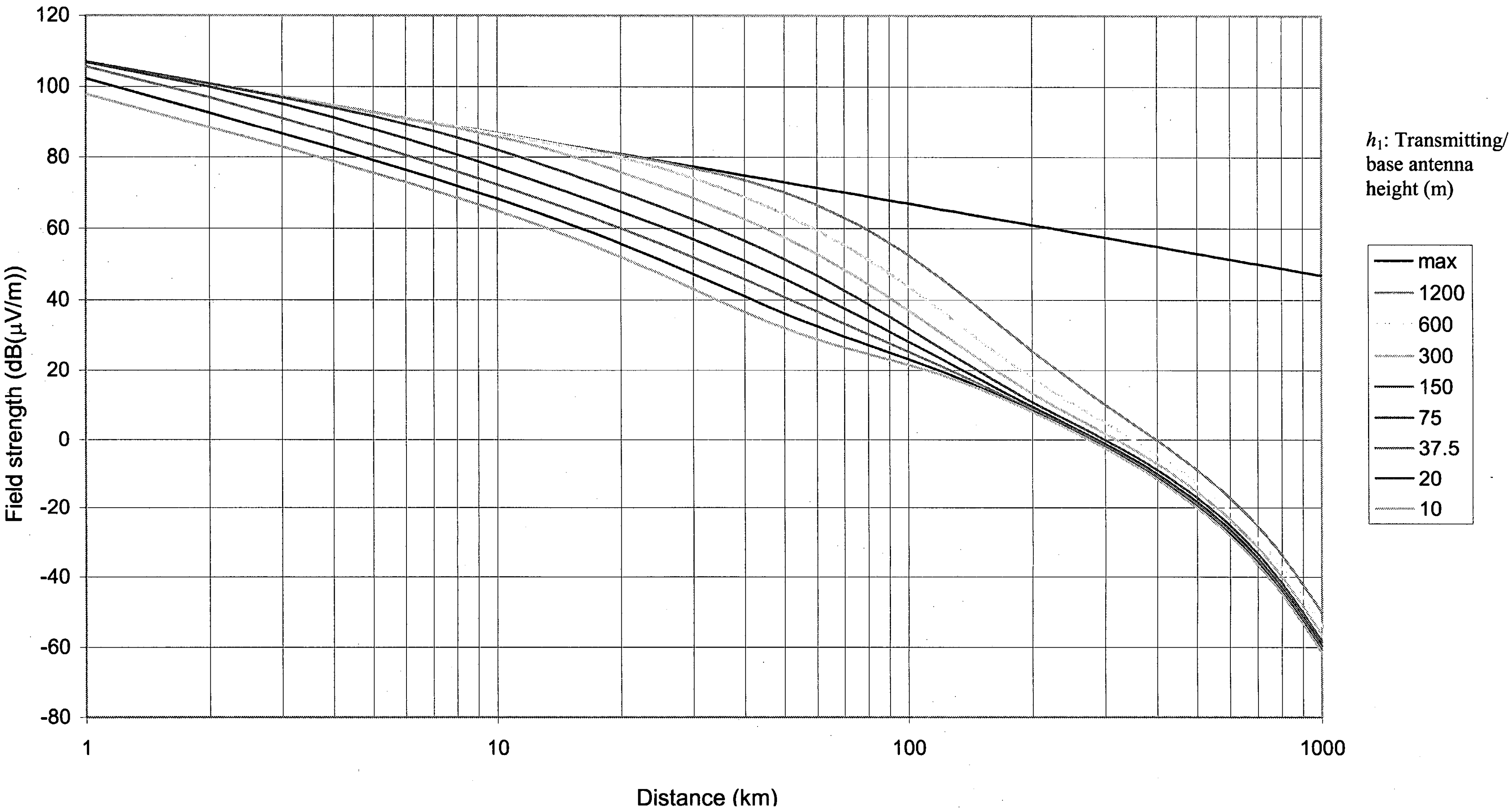

2 000 MHz 50% time Zone A
120
100
80
60
40
20
0
-20
-40
-60
-80
Field strength (dB(μV/m))
1
10
100
1000
Distance (km)
h_1: Transmitting/ base antenna height (m)
max
1200
600
300
150
75
37.5
20
10

113

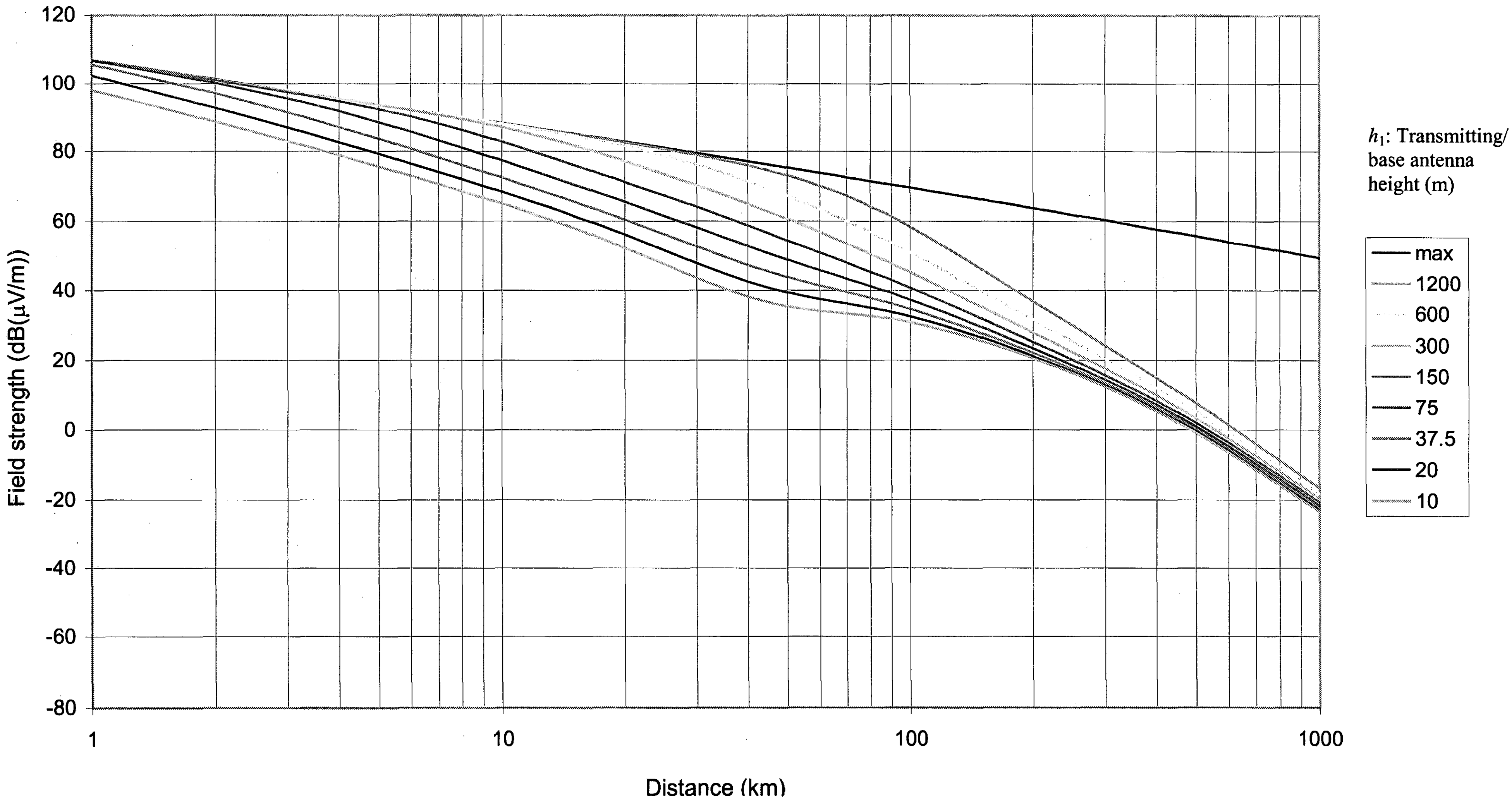

2 000 MHz 10% time Zone A
120
100
80
60
40
20
0
-20
-40
-60
-80
Field strength (dB(μV/m))
1
10
100
1000
Distance (km)
h1: Transmitting/
base antenna
height (m)
max
1200
600
300
150
75
37.5
20
10

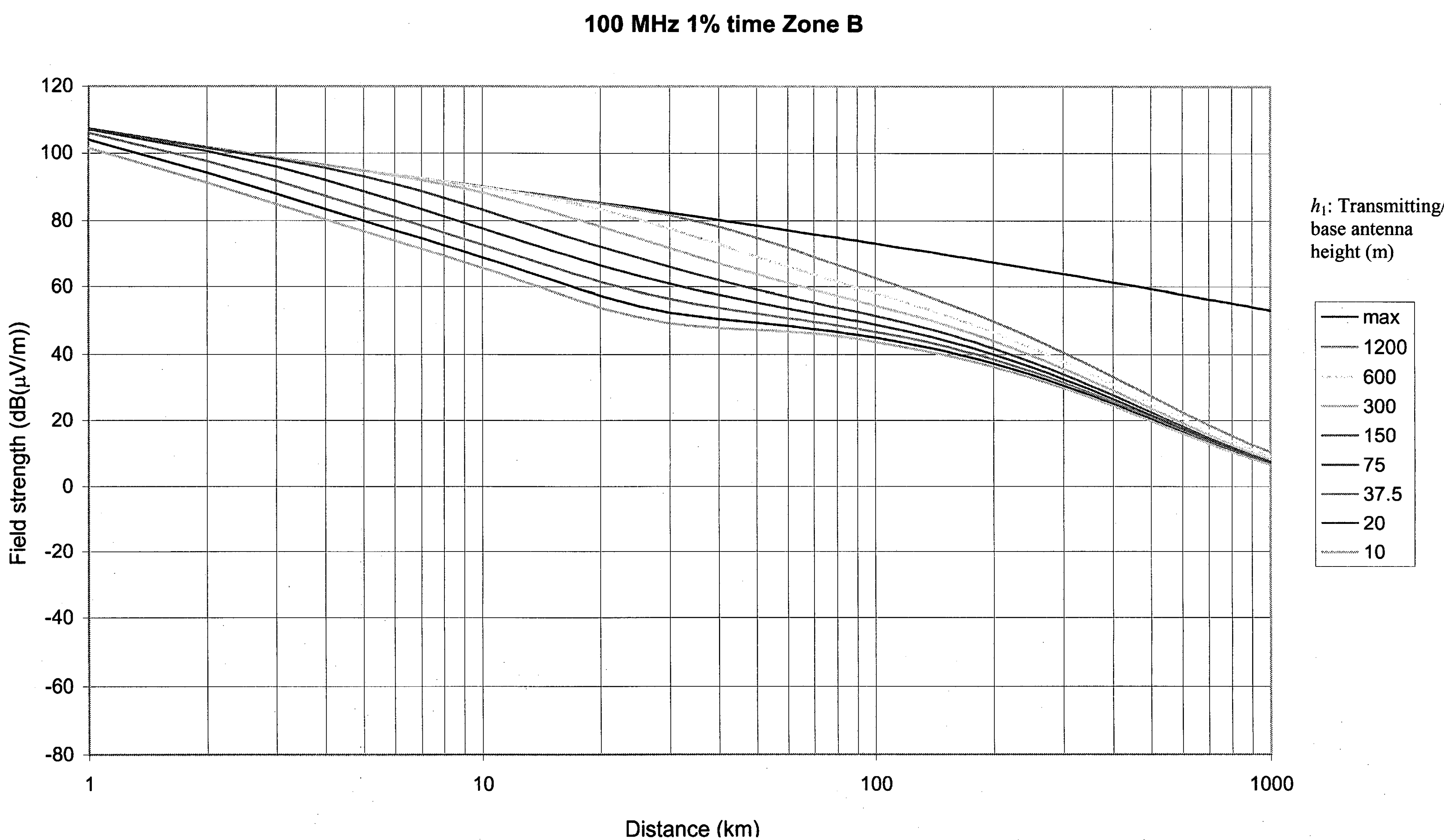

2 000 MHz 1% time Zone A
120
100
80
60
40
20
0
-20
-40
-60
-80
Field strength (dB(μV/m))
1
10
100
1000
Distance (km)
h_1: Transmitting/ base antenna height (m)
max
1200
600
300
150
75
37.5
20
10

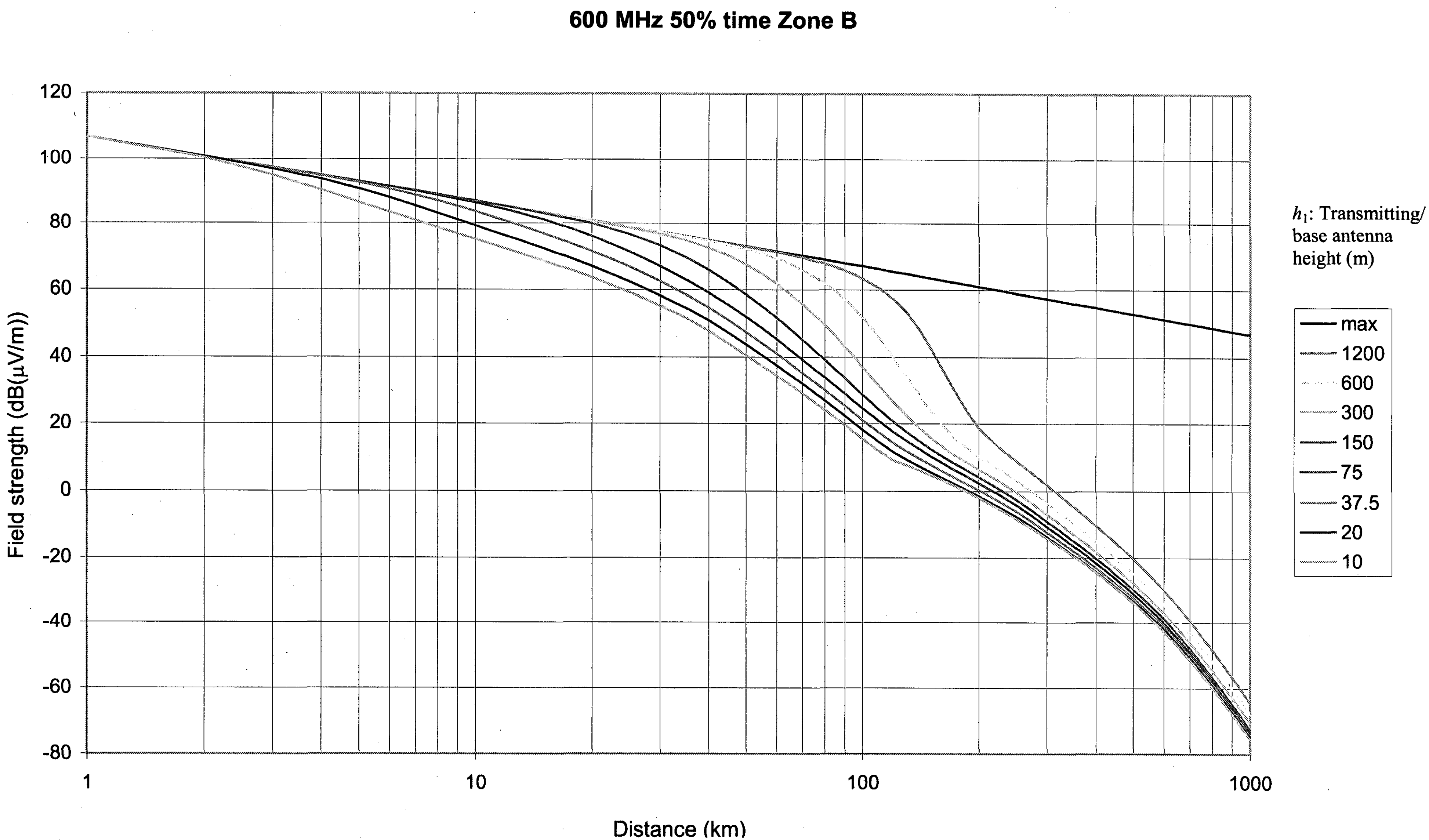
100 MHz 50% time Zone B



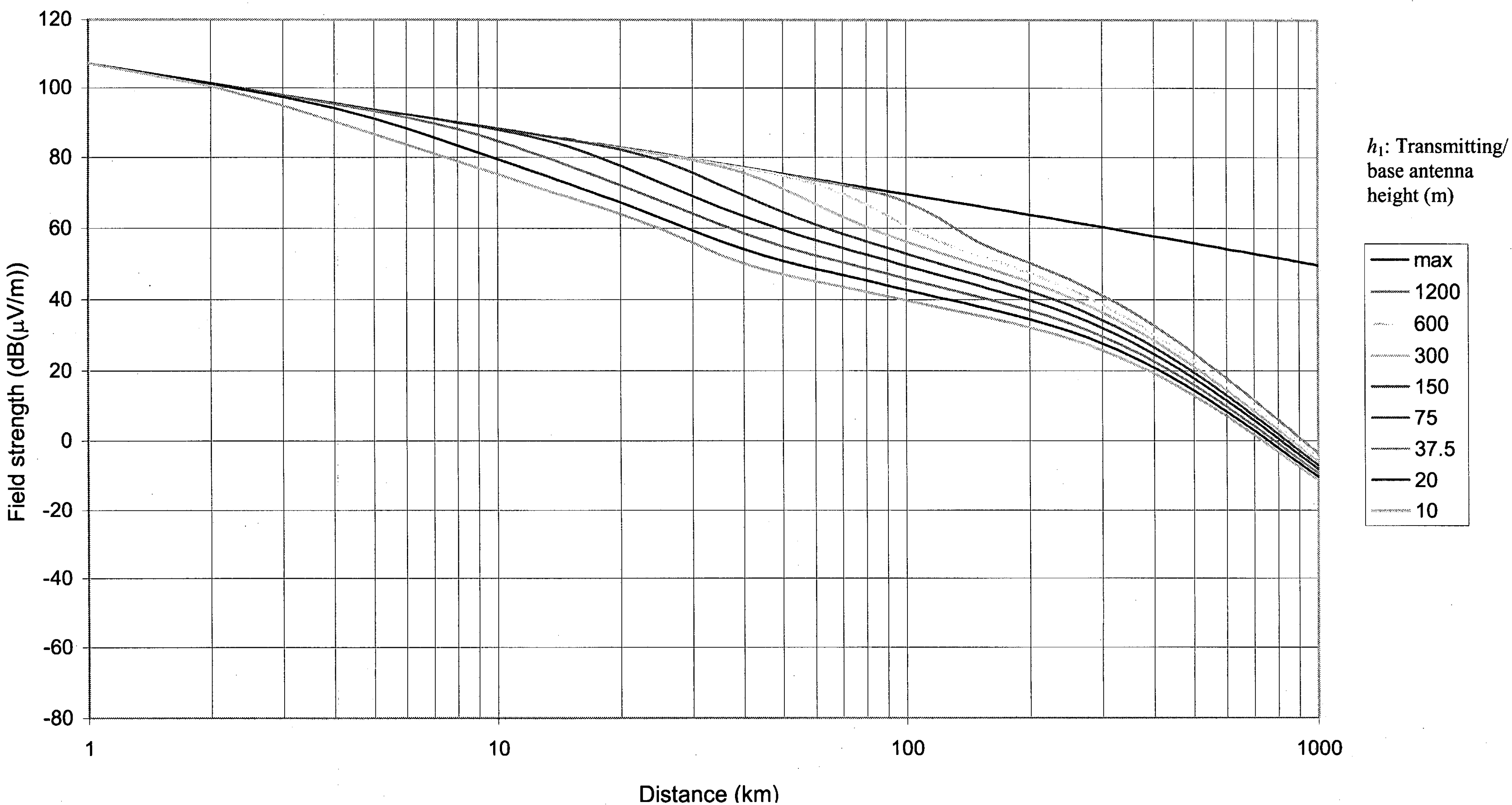
100 MHz 10% time Zone B

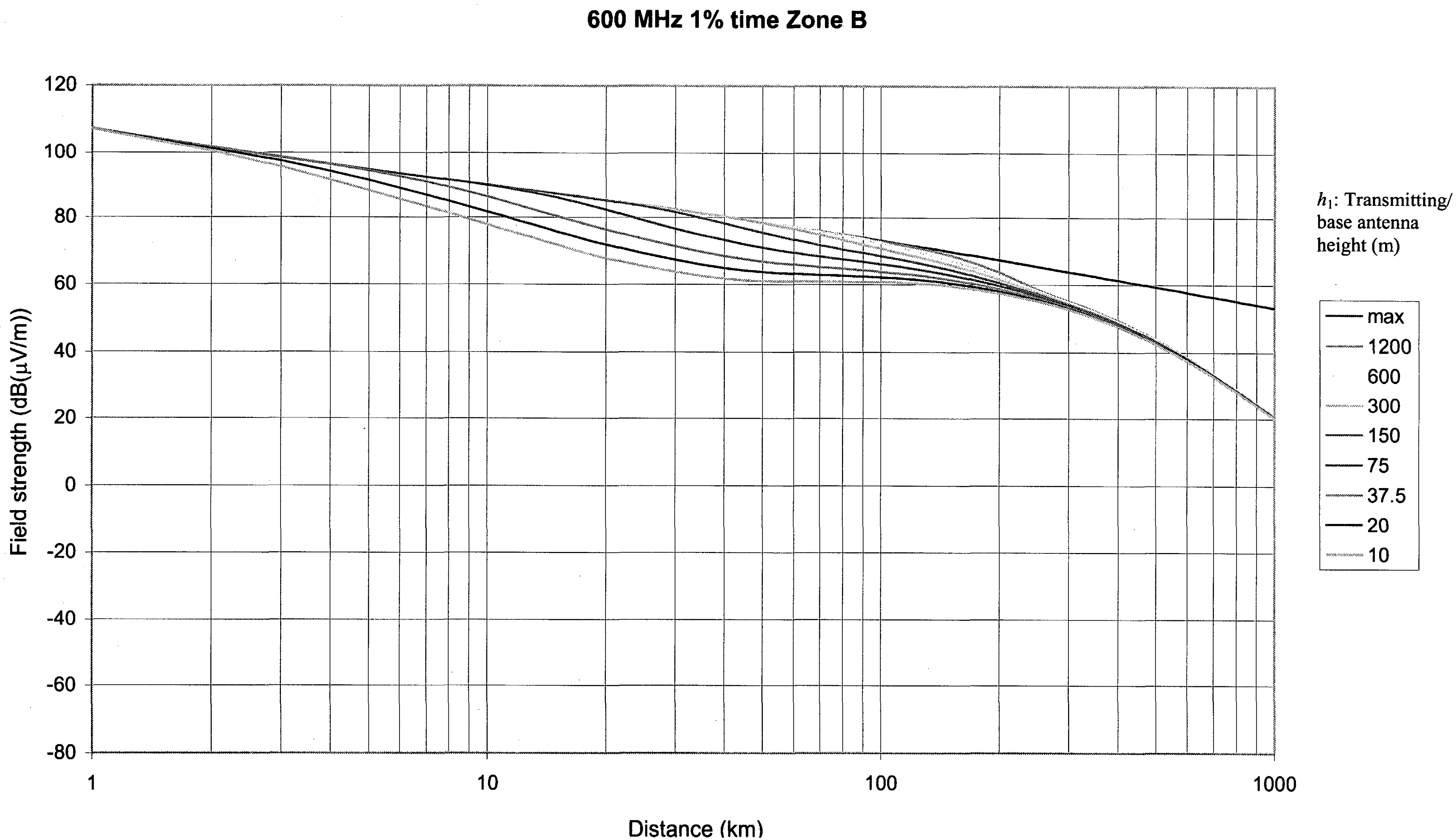


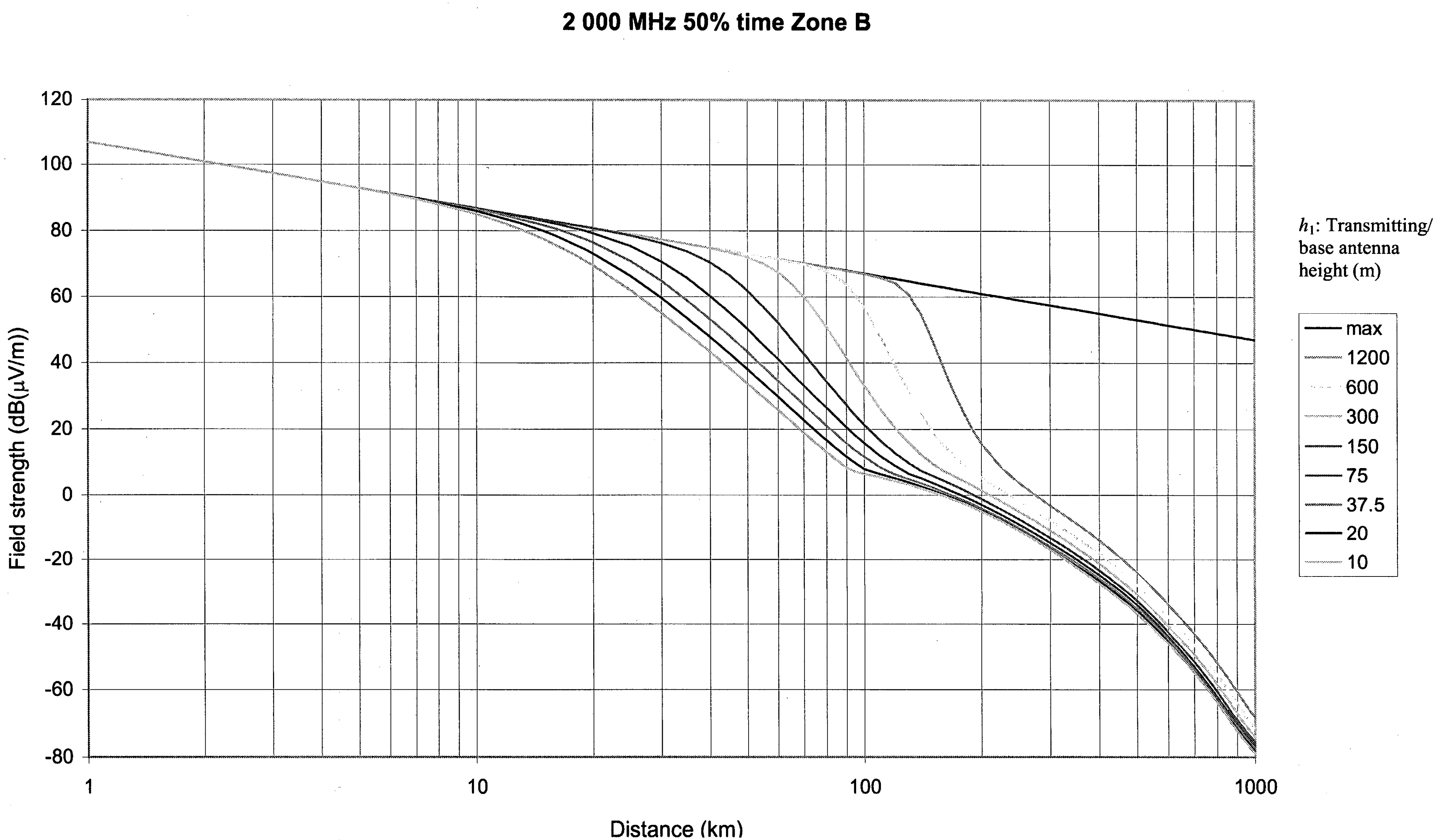

100 MHz 1% time Zone B
Field strength (dB(μV/m))
120
100
80
60
40
20
0
-20
-40
-60
-80
1
10
100
1000
Distance (km)
h_1: Transmitting/ base antenna height (m)
max
1200
600
300
150
75
37.5
20
10


600 MHz 50% time Zone B
120
100
80
60
40
20
0
-20
-40
-60
-80
Field strength (dB(µV/m))
1
10
100
1000
Distance (km)
h1: Transmitting/ base antenna height (m)
max
1200
600
300
150
75
37.5
20
10

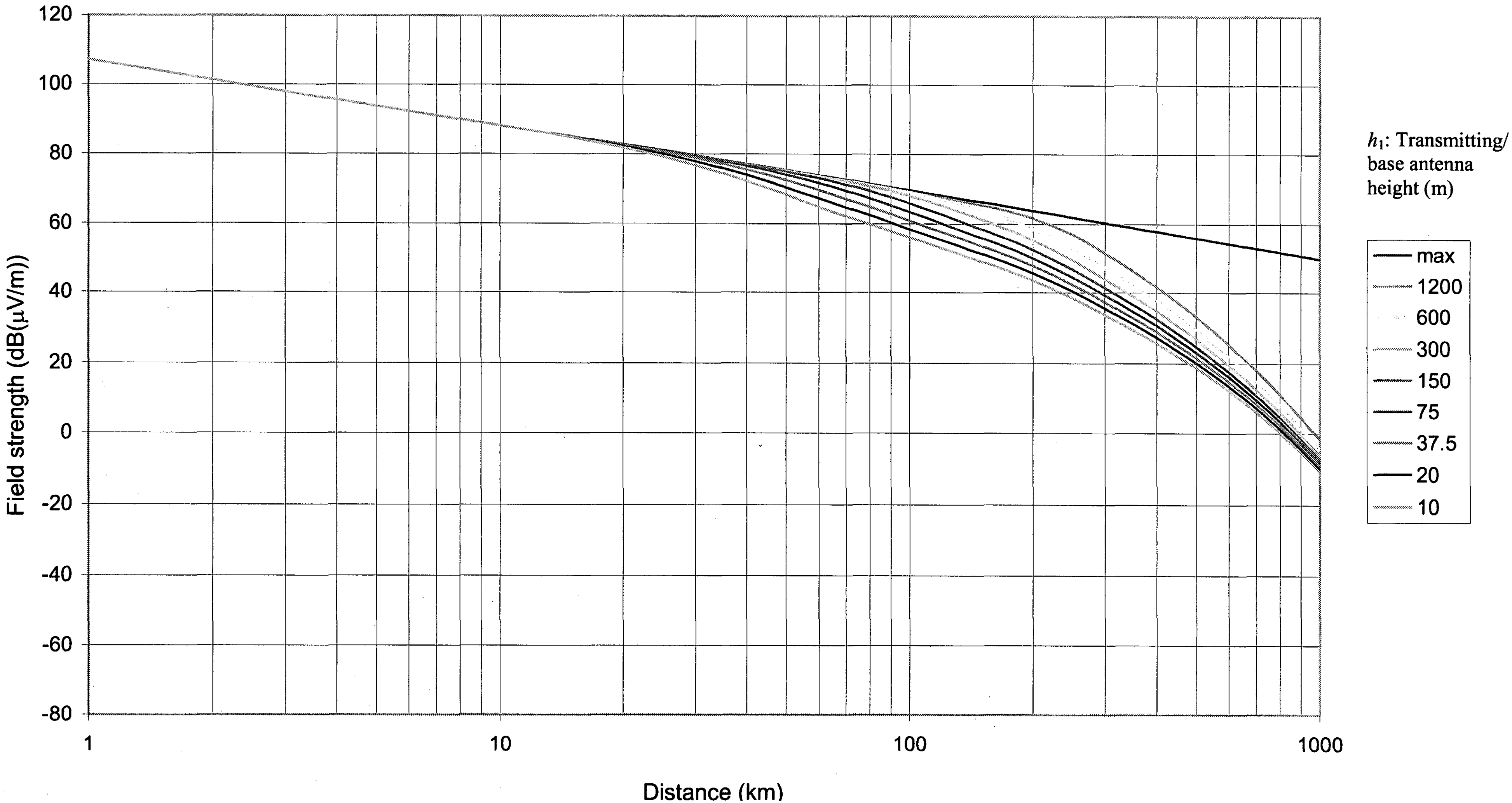
600 MHz 10% time Zone B

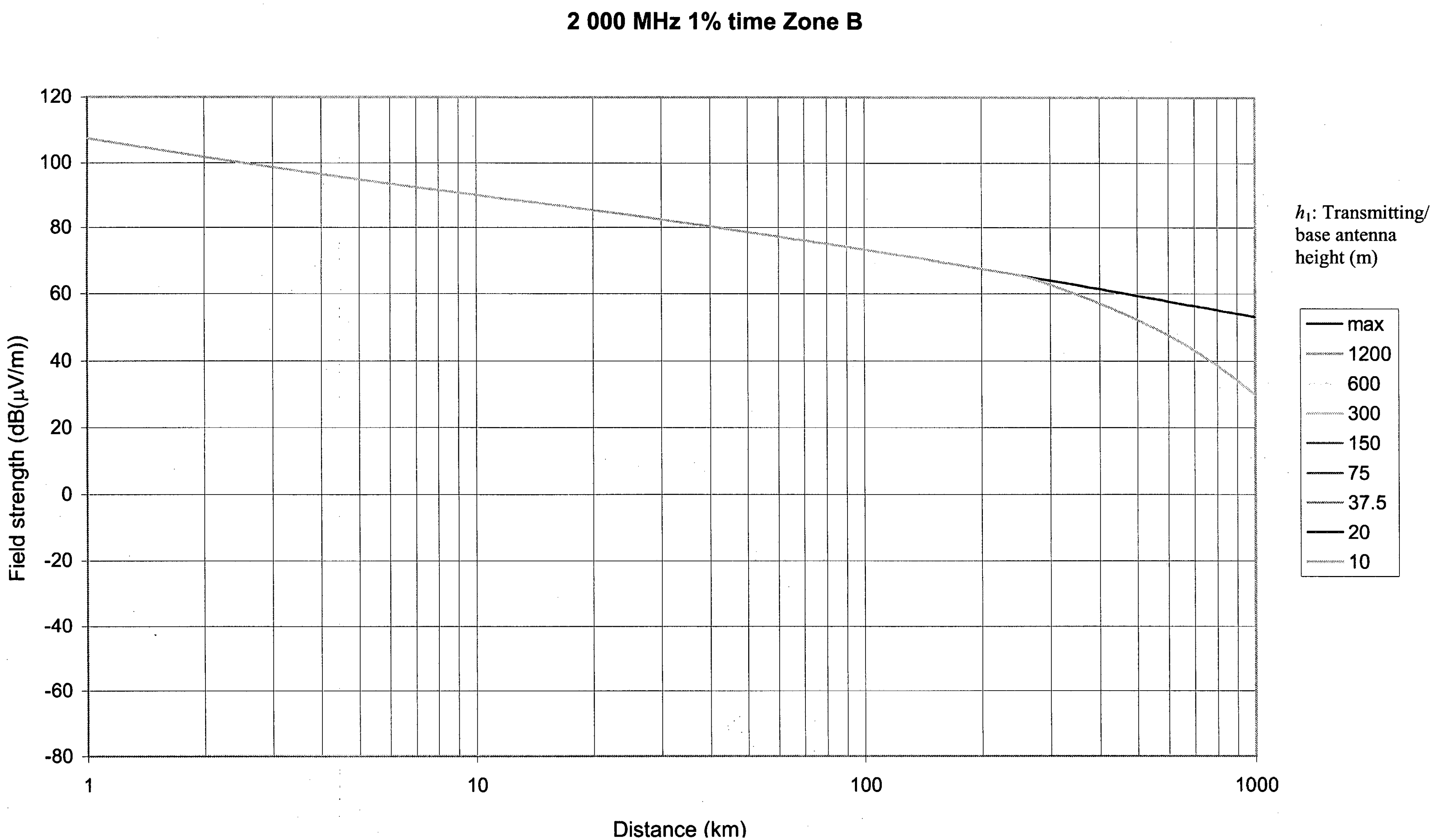


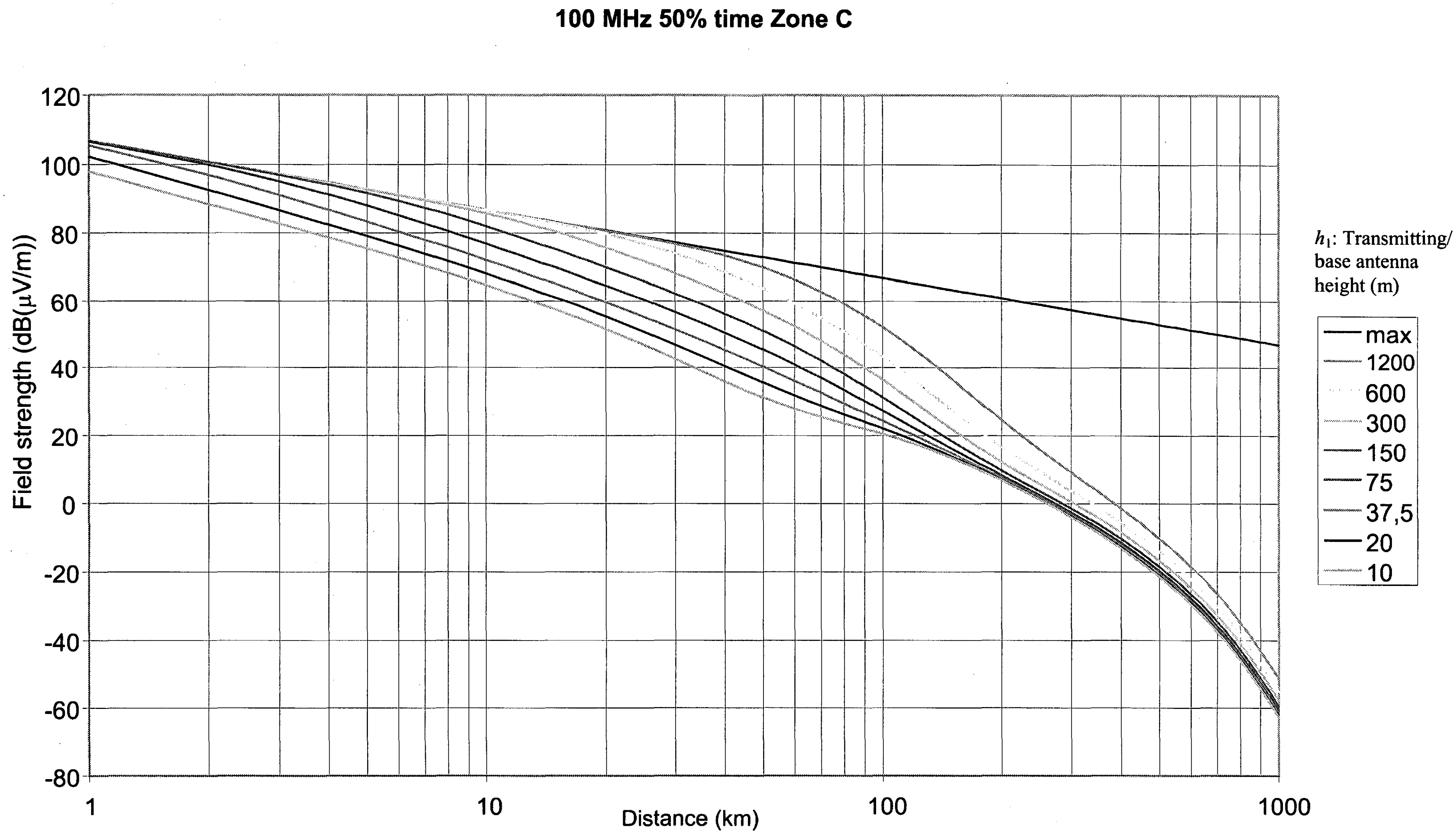

600 MHz 1% time Zone B
120
100
80
60
40
20
0
-20
-40
-60
-80
Field strength (dB(μV/m))
1
10
100
1000
Distance (km)
h1: Transmitting/ base antenna height (m)
max
1200
600
300
150
75
37.5
20
10


2 000 MHz 50% time Zone B
Field strength (dB(μV/m))
120
100
80
60
40
20
0
-20
-40
-60
-80
1
10
100
1000
Distance (km)
h1: Transmitting/ base antenna height (m)
max
1200
600
300
150
75
37.5
20
10

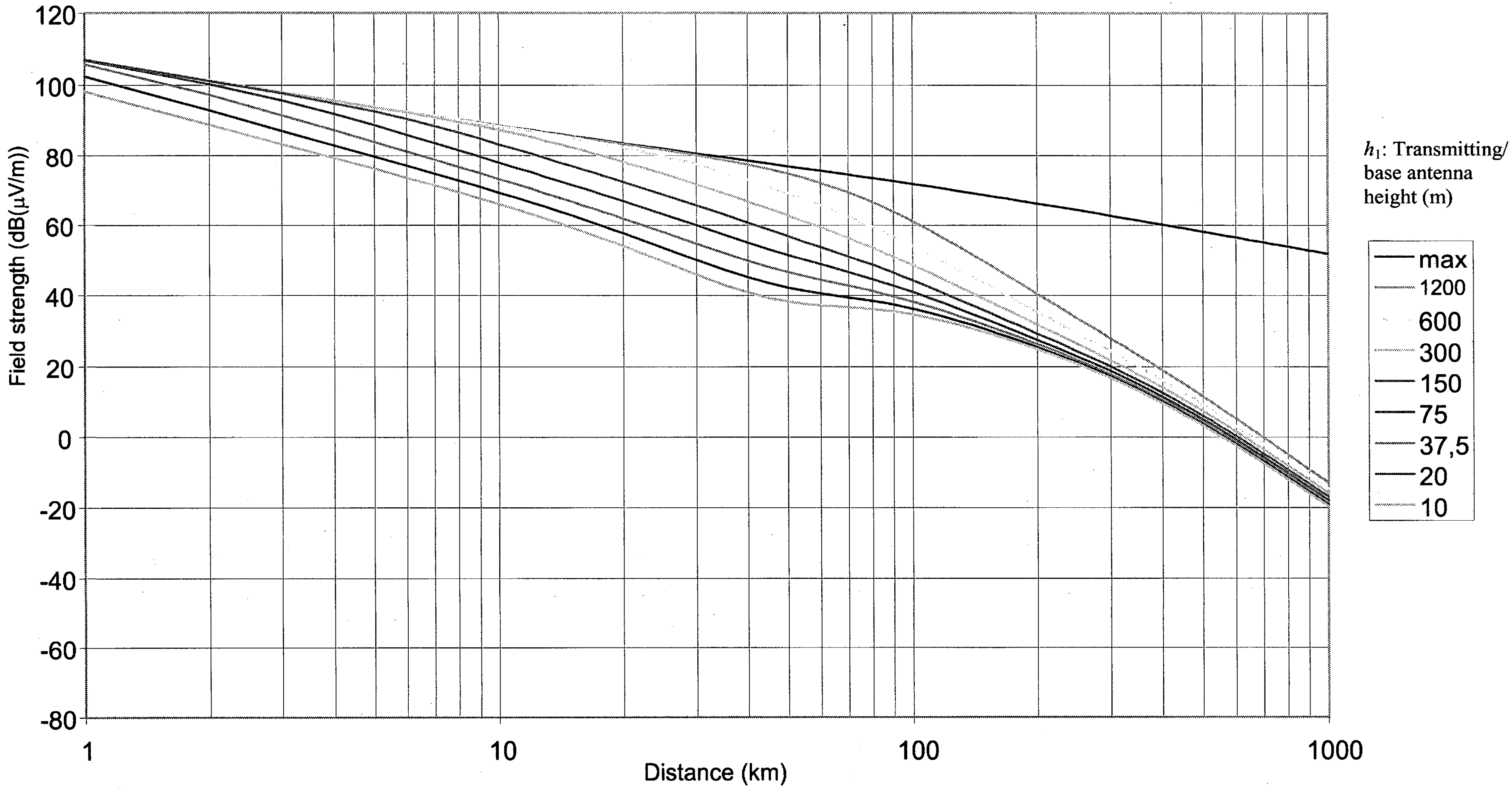
2 000 MHz 10% time Zone B



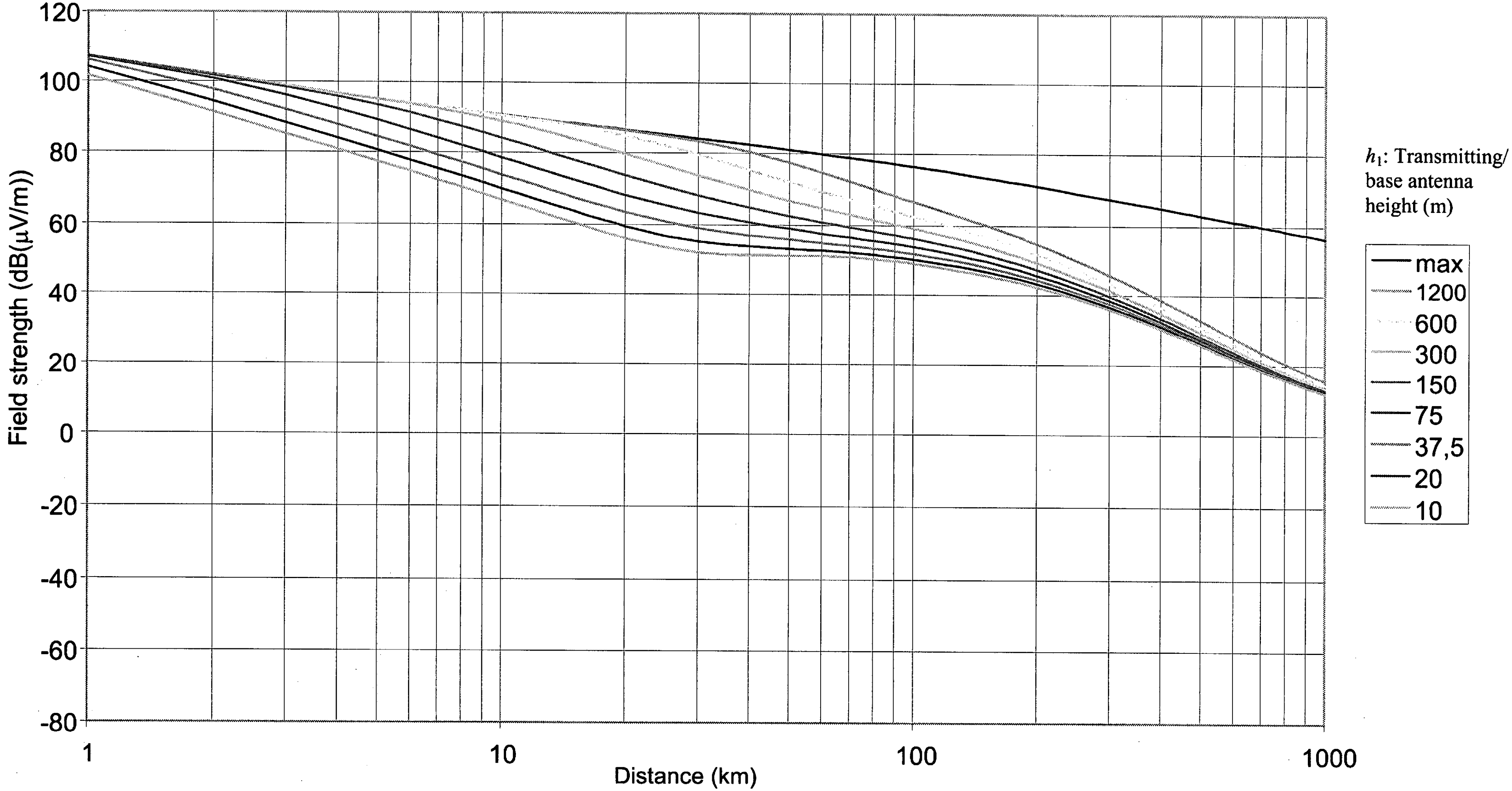

2 000 MHz 1% time Zone B
120
100
80
60
40
20
0
-20
-40
-60
-80
Field strength (dB(μV/m))
1
10
100
1000
Distance (km)
h_1: Transmitting/ base antenna height (m)
max
1200
600
300
150
75
37.5
20
10


100 MHz 50% time Zone C
Field strength (dB(μV/m))
120
100
80
60
40
20
0
-20
-40
-60
-80
1
10
100
1000
Distance (km)
h1: Transmitting/ base antenna height (m)
max
1200
600
300
150
75
37,5
20
10

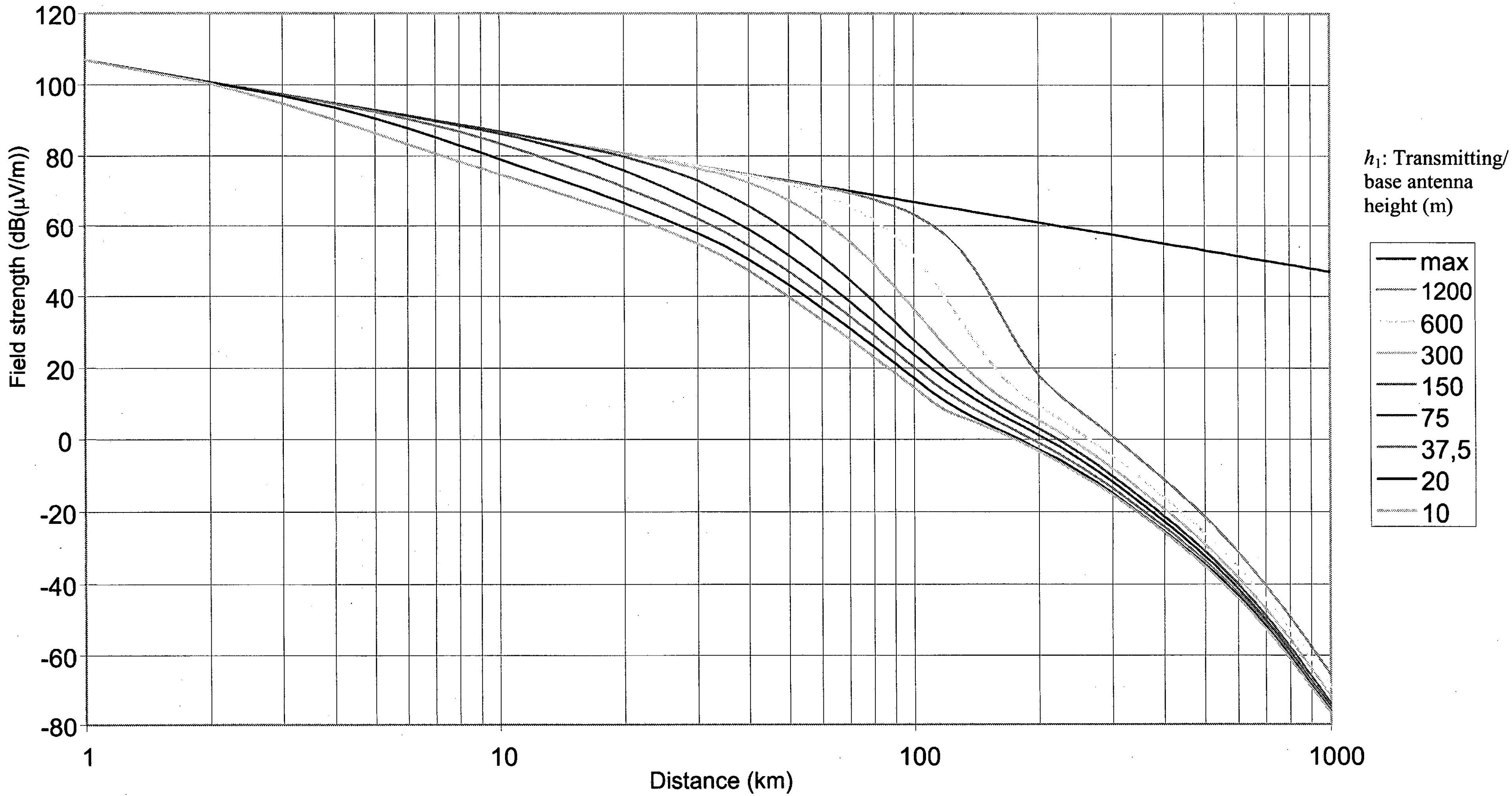
100 MHz 10% time Zone C

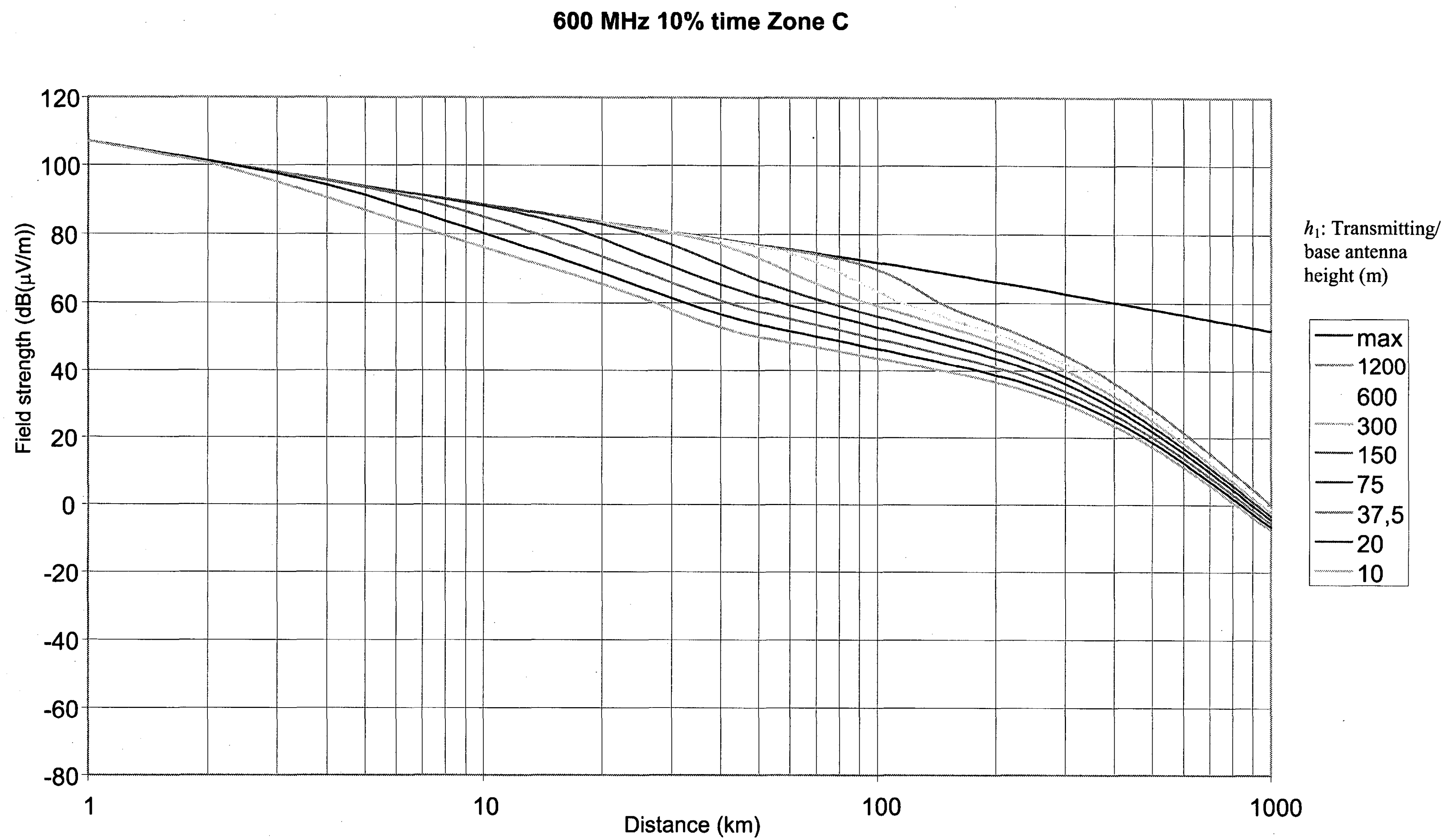


100 MHz 1% time Zone C

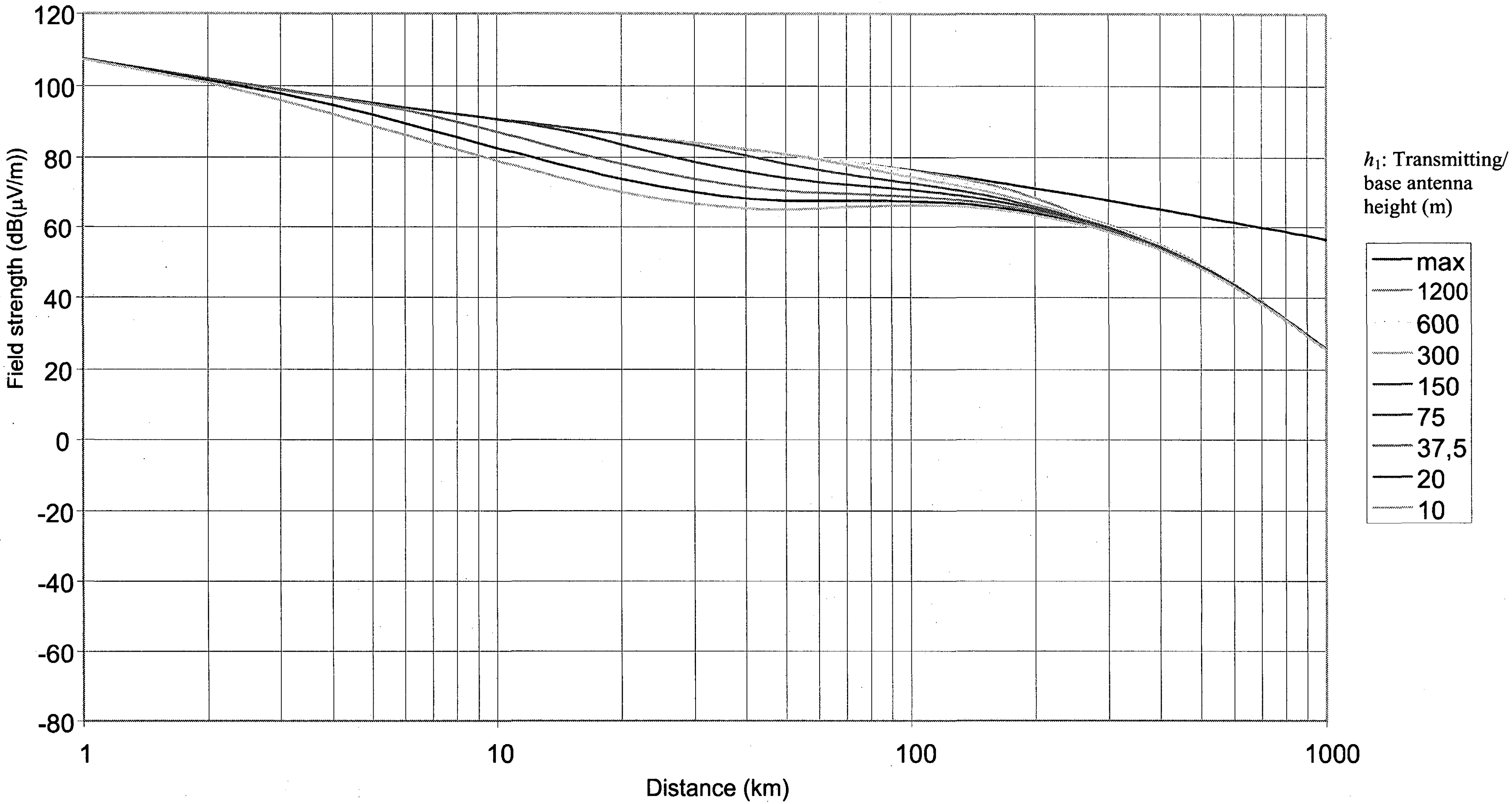


600 MHz 50% time Zone C

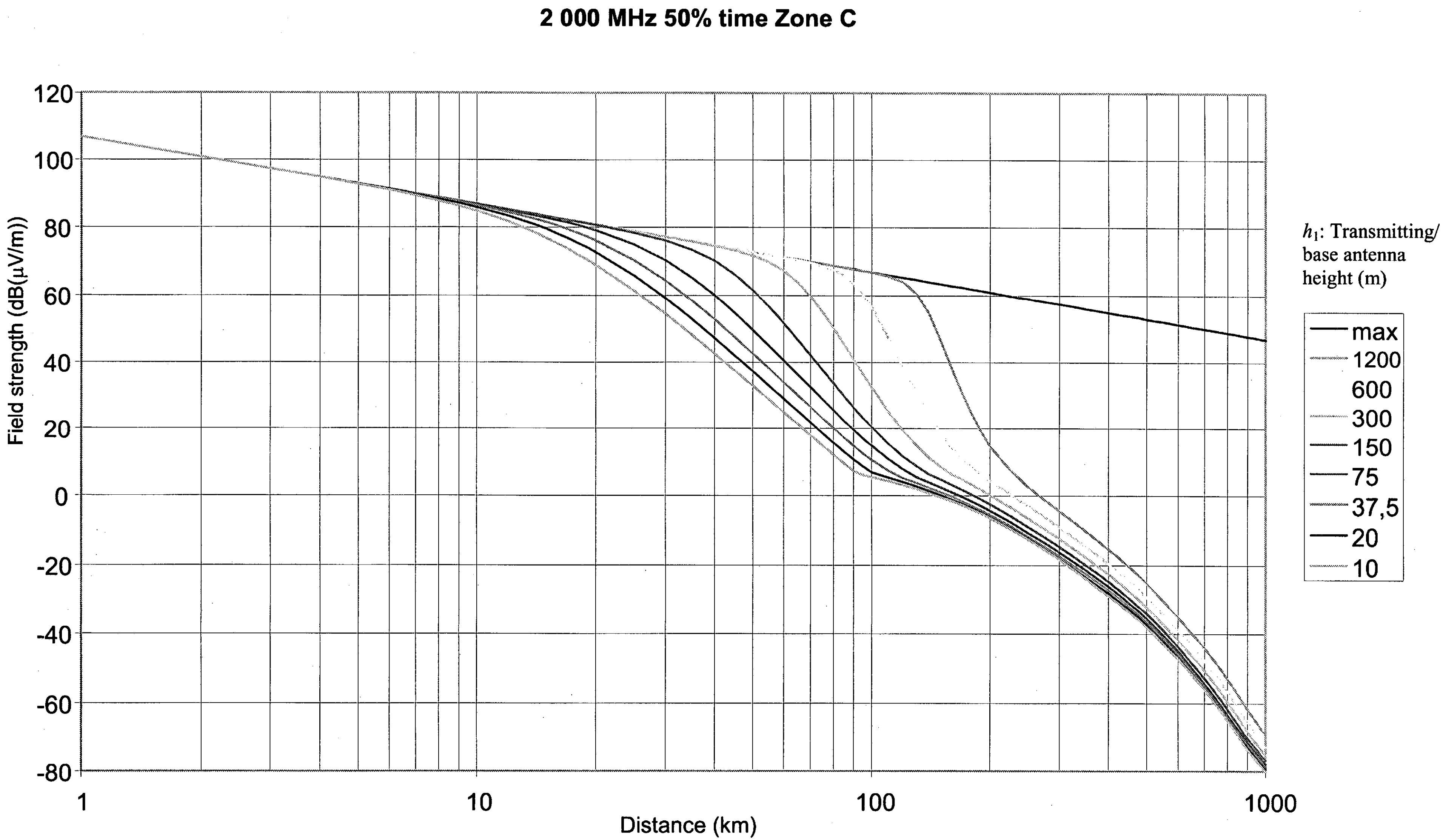



600 MHz 10% time Zone C
Field strength (dB(μV/m))
120
100
80
60
40
20
0
-20
-40
-60
-80
1
10
100
1000
Distance (km)
h1: Transmitting/
base antenna
height (m)
max
1200
600
300
150
75
37,5
20
10

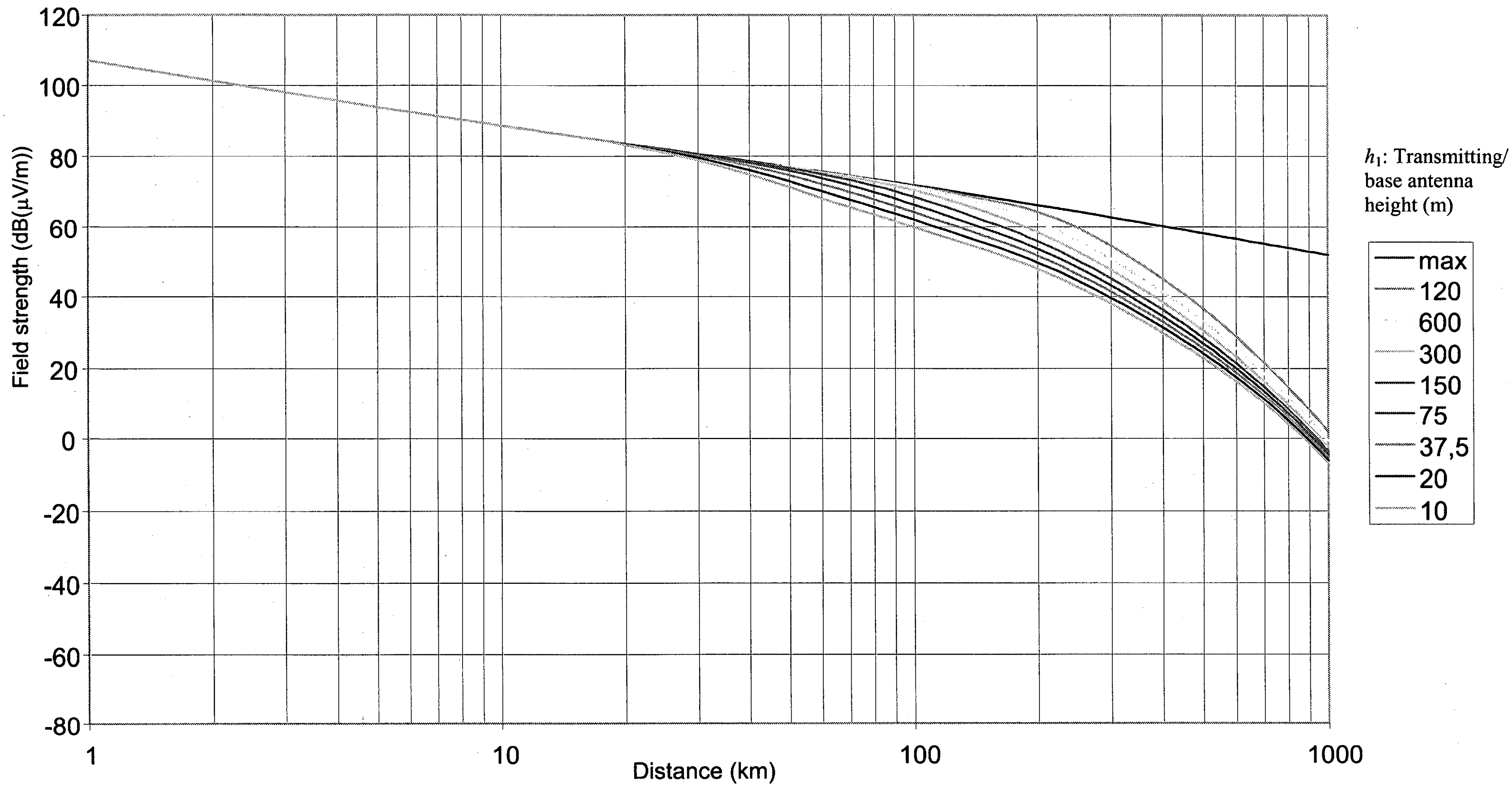
600 MHz 1% time Zone C



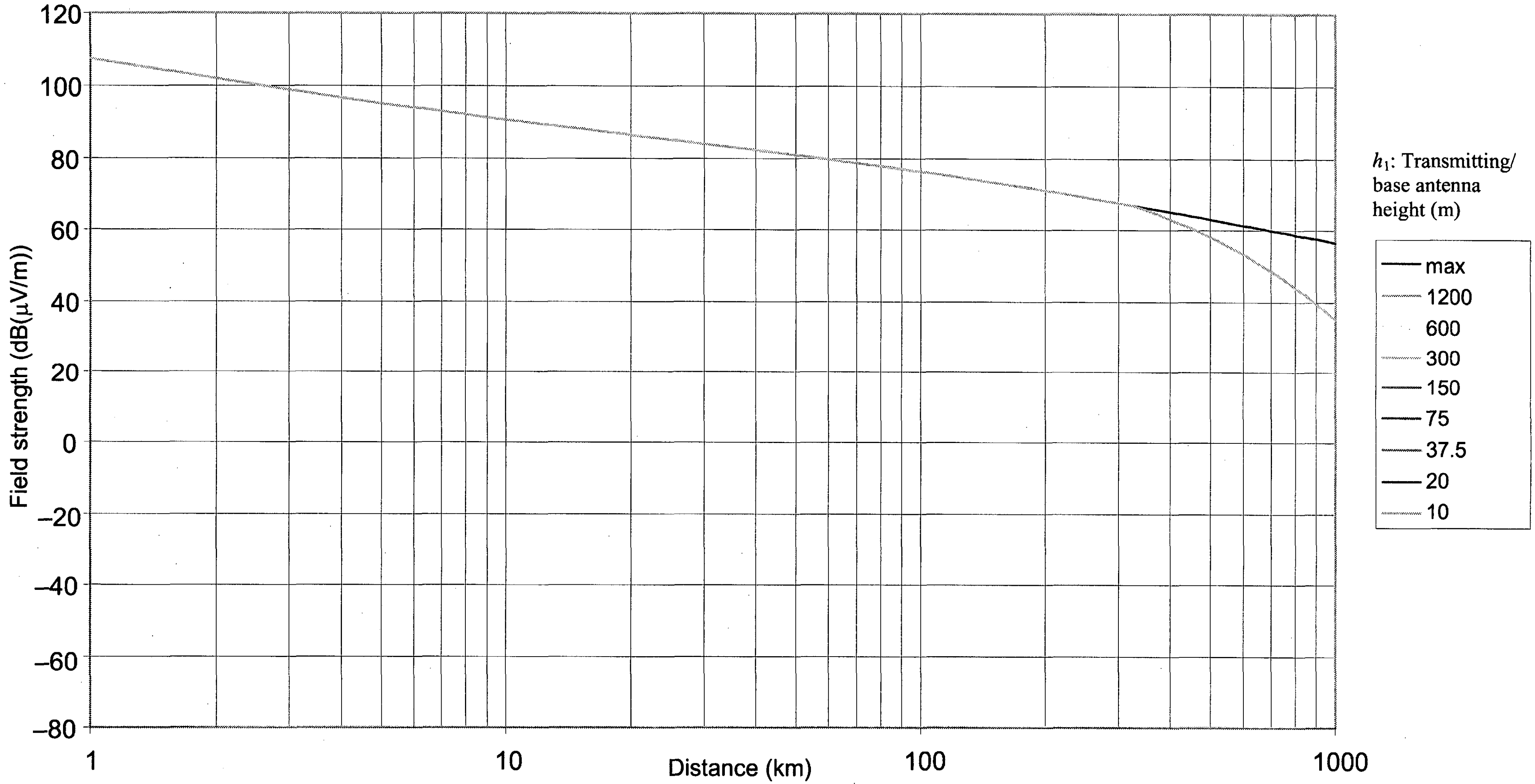
130

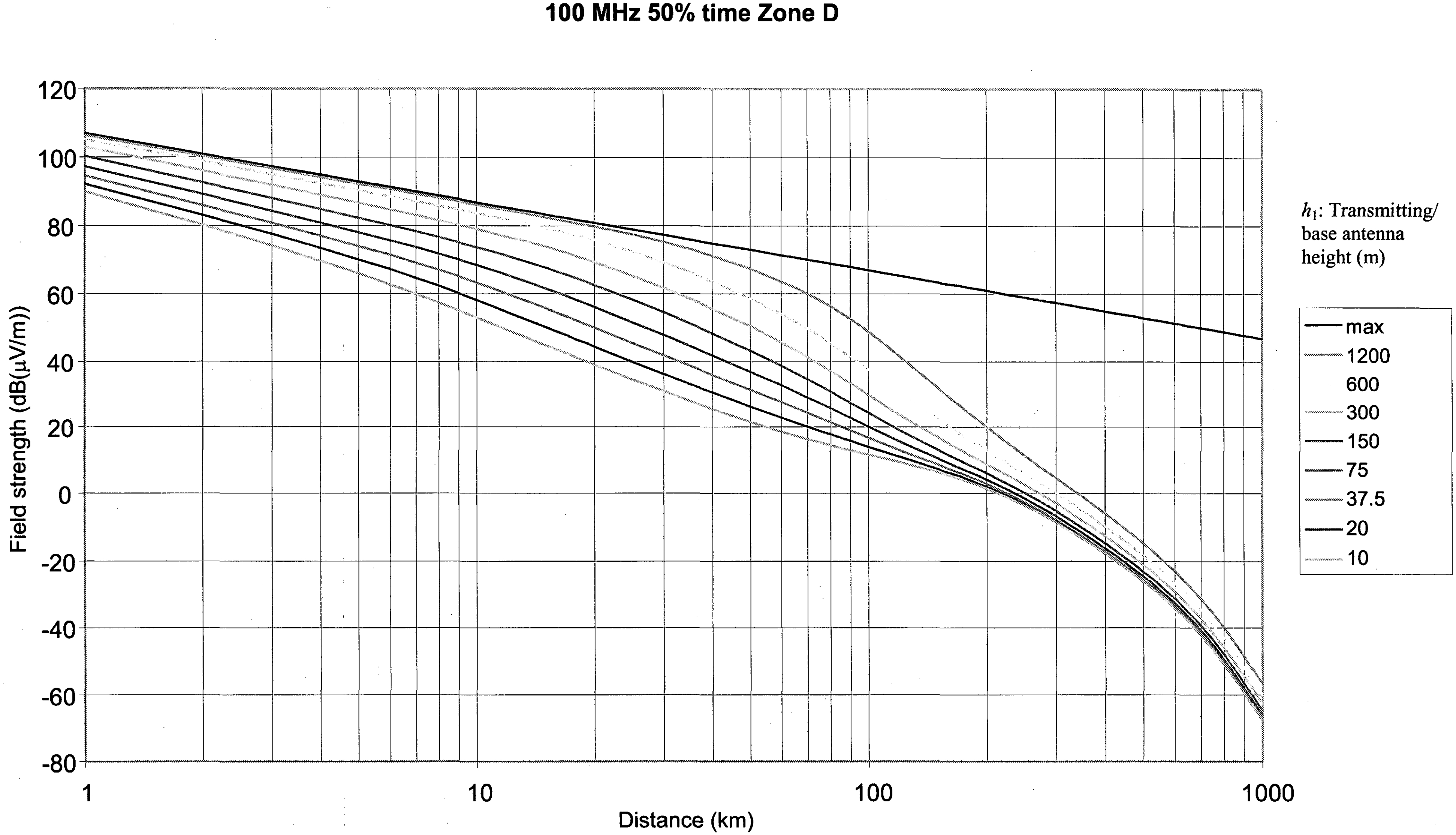

2 000 MHz 50% time Zone C
Field strength (dB(μV/m))
120
100
80
60
40
20
0
-20
-40
-60
-80
1
10
100
1000
Distance (km)
h1: Transmitting/ base antenna height (m)
max
1200
600
300
150
75
37,5
20
10

2 000 MHz 10% time Zone C

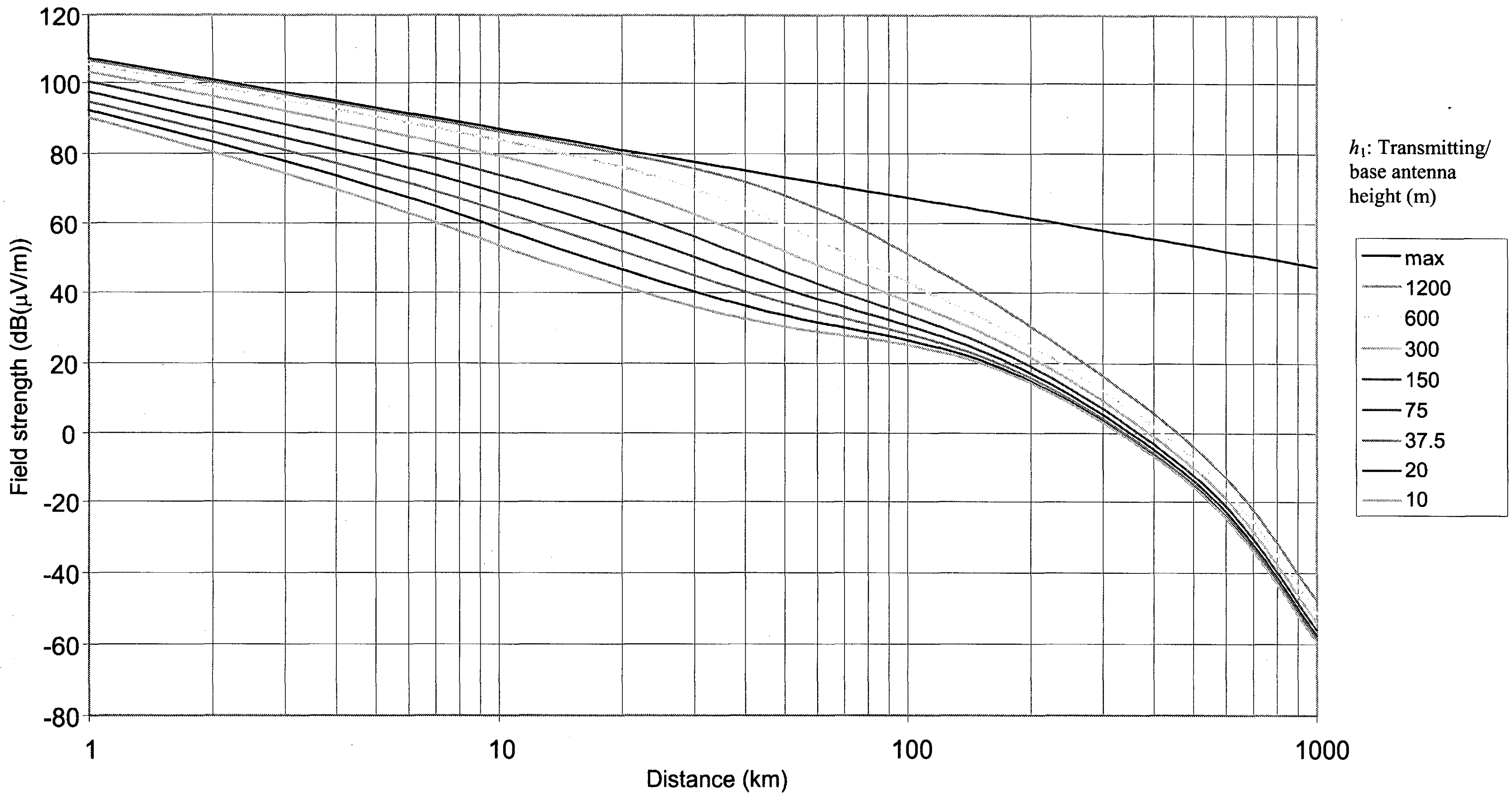


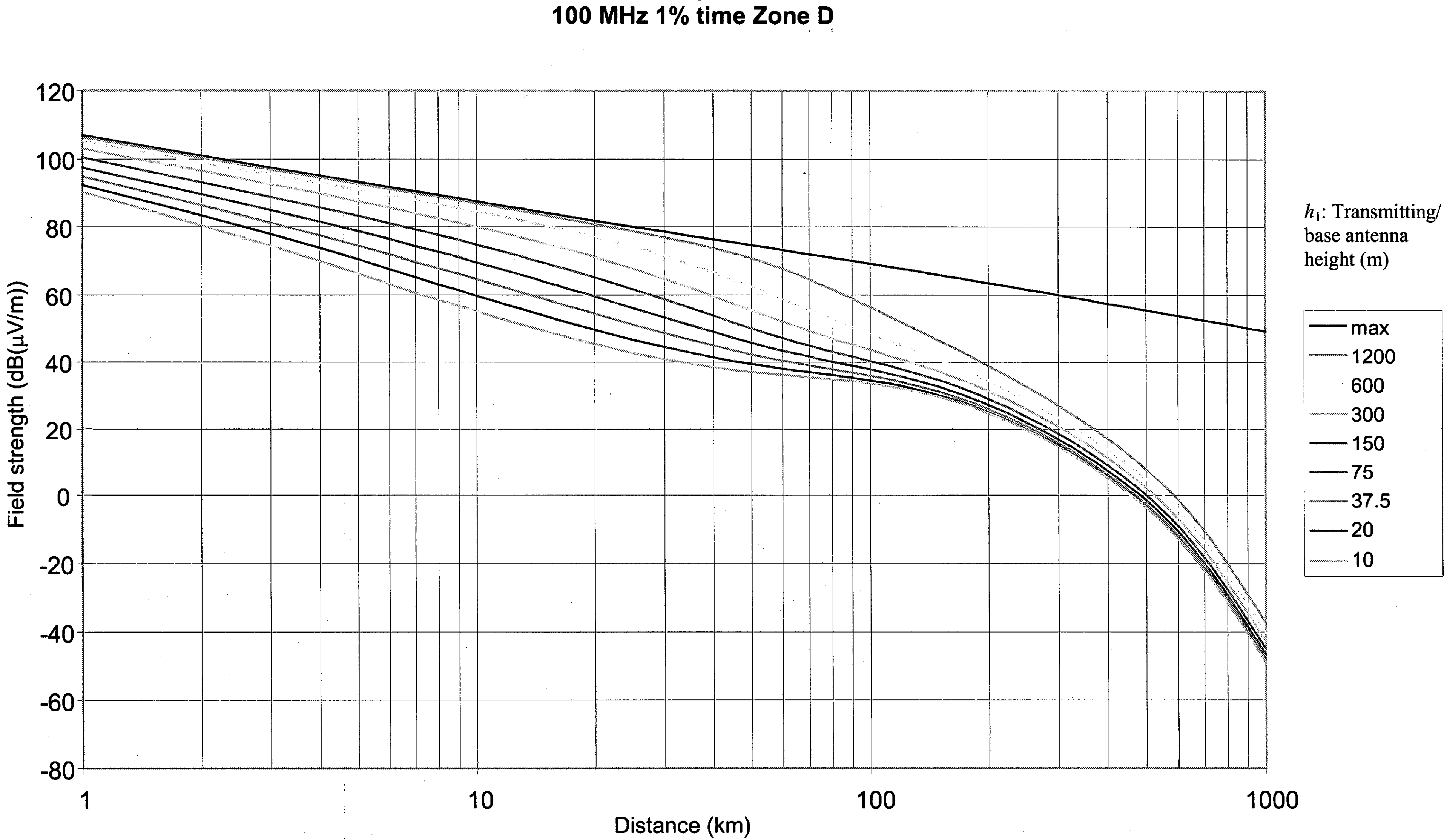
2 000 MHz 1% time Zone C



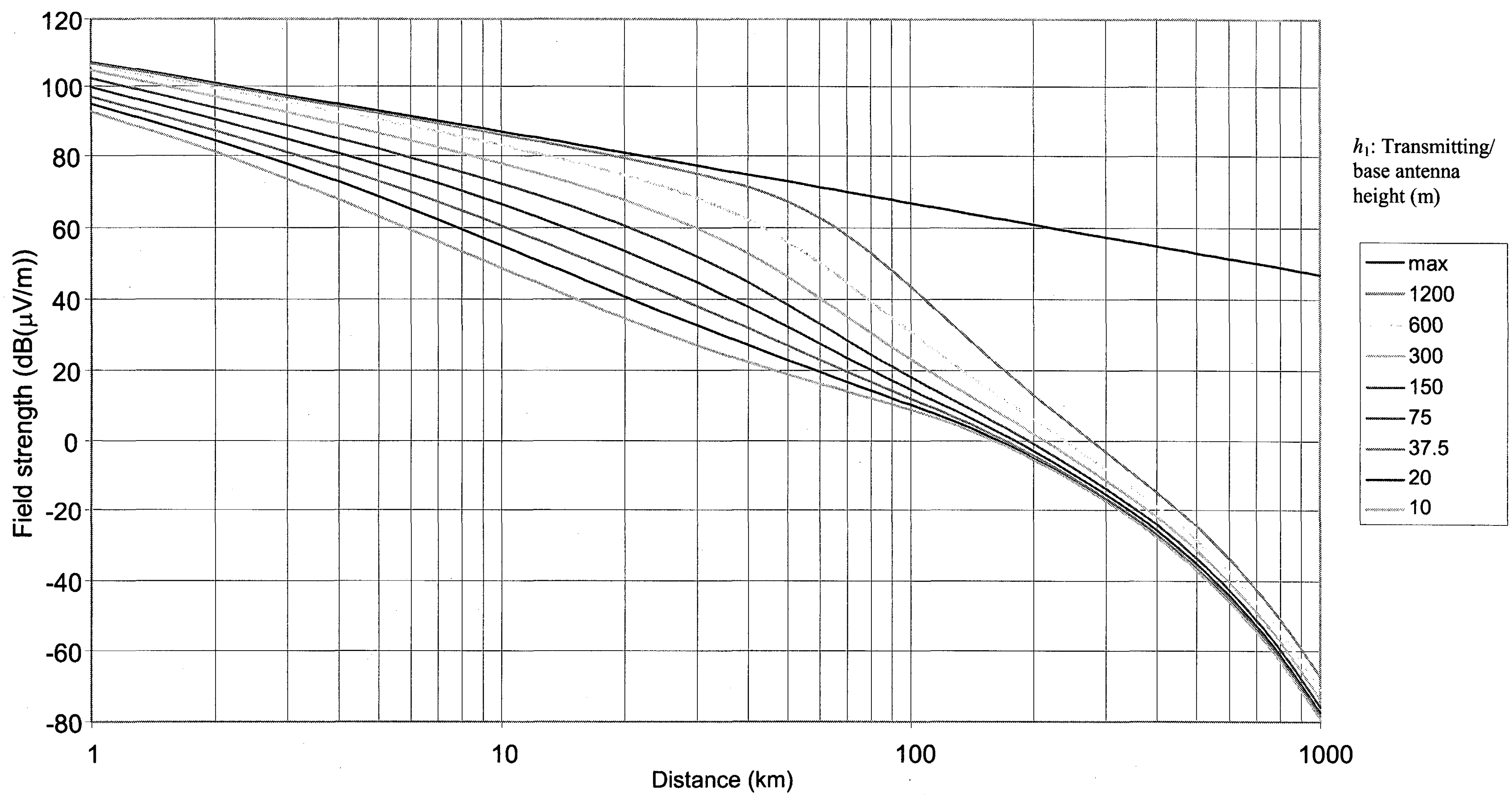

100 MHz 50% time Zone D
Field strength (dB(μV/m))
120
100
80
60
40
20
0
-20
-40
-60
-80
1
10
100
1000
Distance (km)
h_1: Transmitting/ base antenna height (m)
max
1200
600
300
150
75
37.5
20
10

100 MHz 10% time Zone D

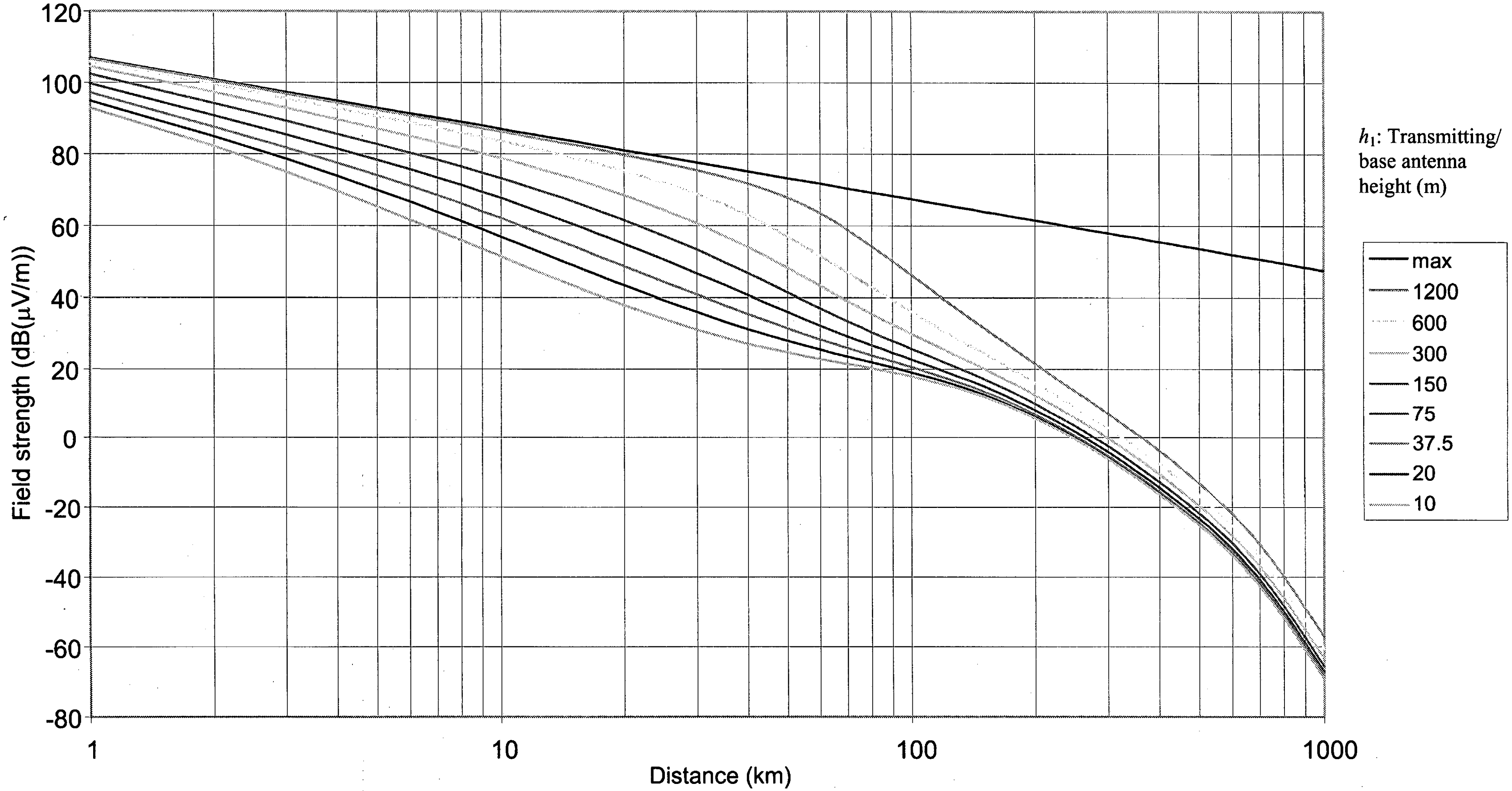



100 MHz 1% time Zone D
120
100
80
60
40
20
0
-20
-40
-60
-80
Field strength (dB(μV/m))
1
10
100
1000
Distance (km)
h1: Transmitting/ base antenna height (m)
max
1200
600
300
150
75
37.5
20
10

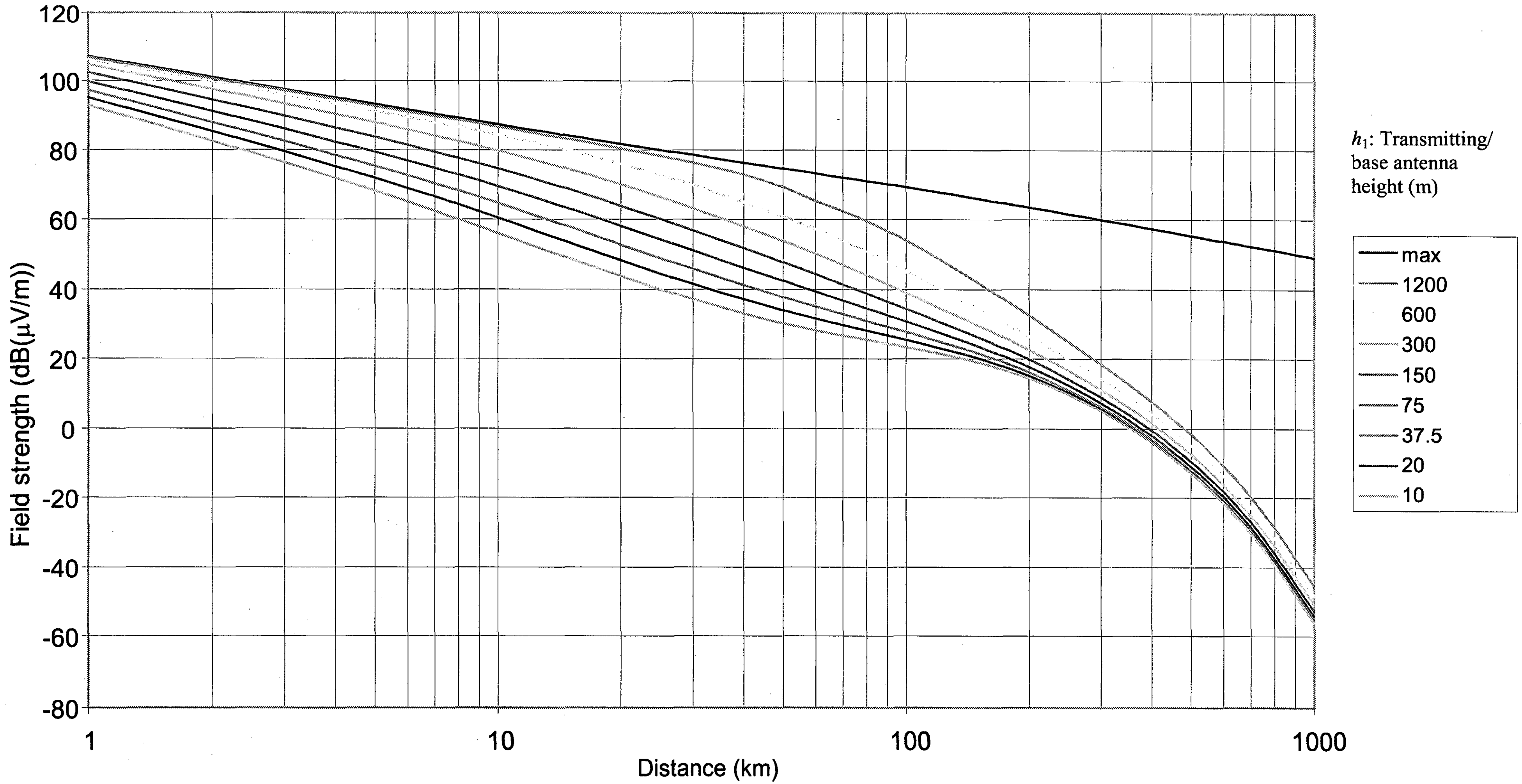
600 MHz 50% time Zone D

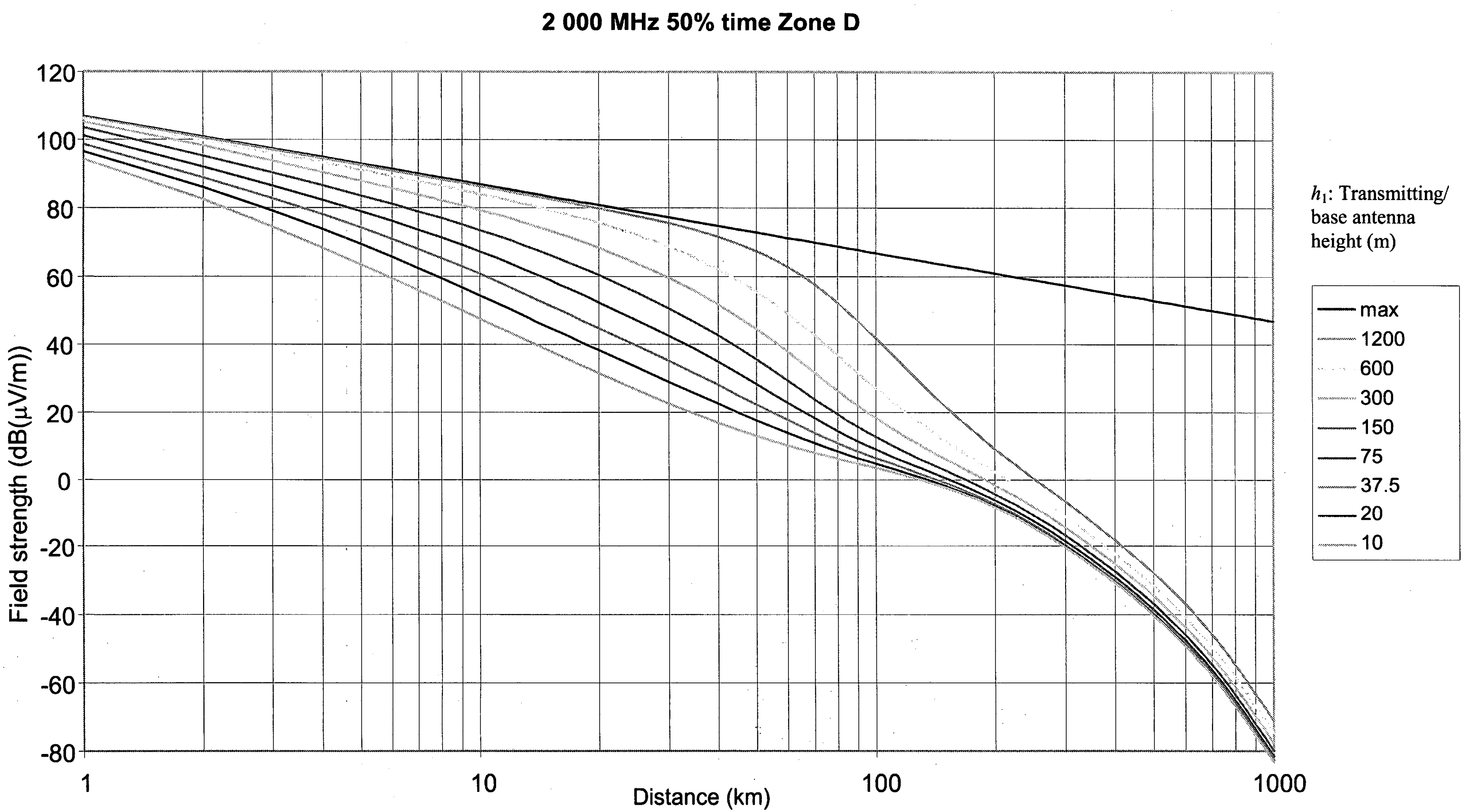


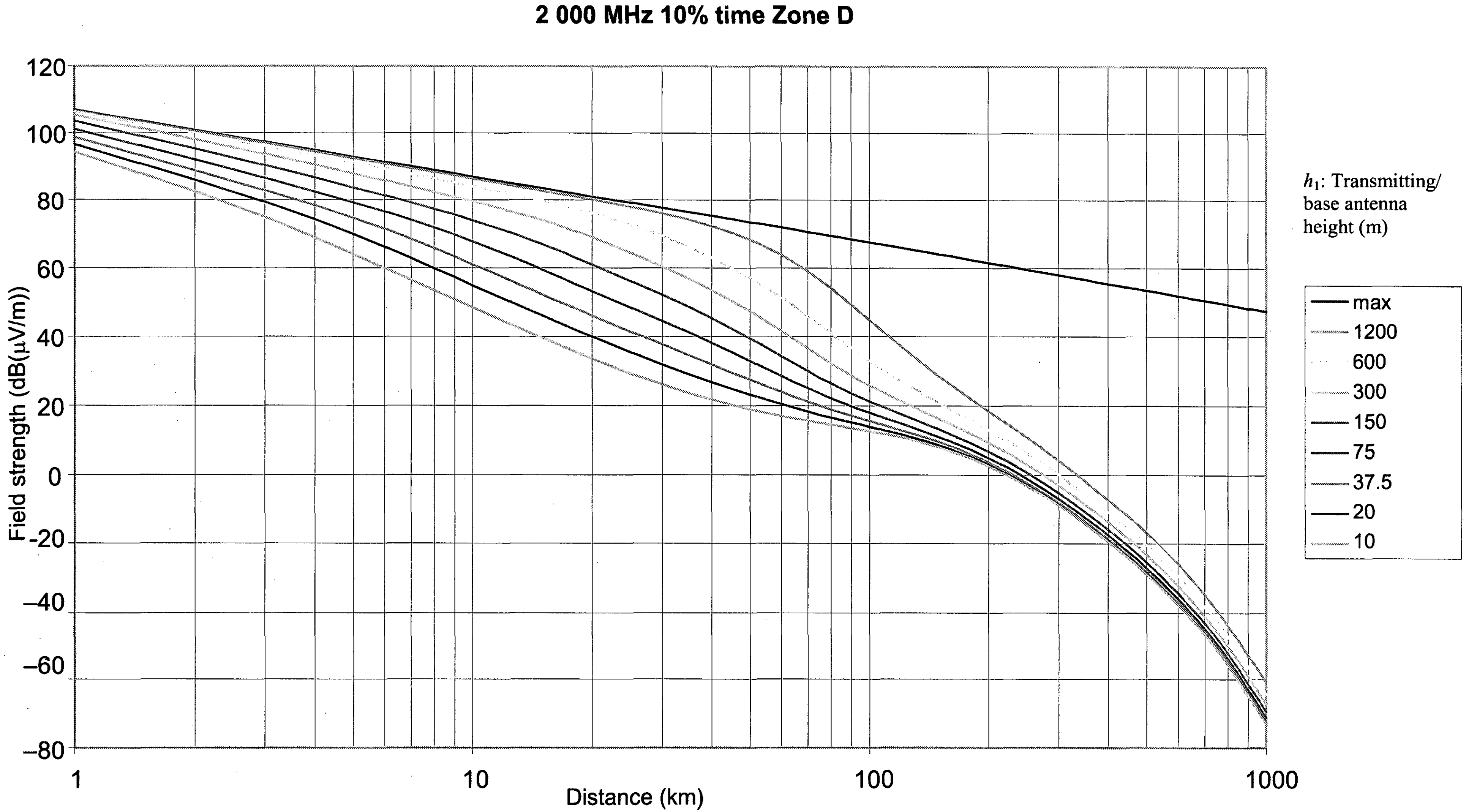
600 MHz 10% time Zone D



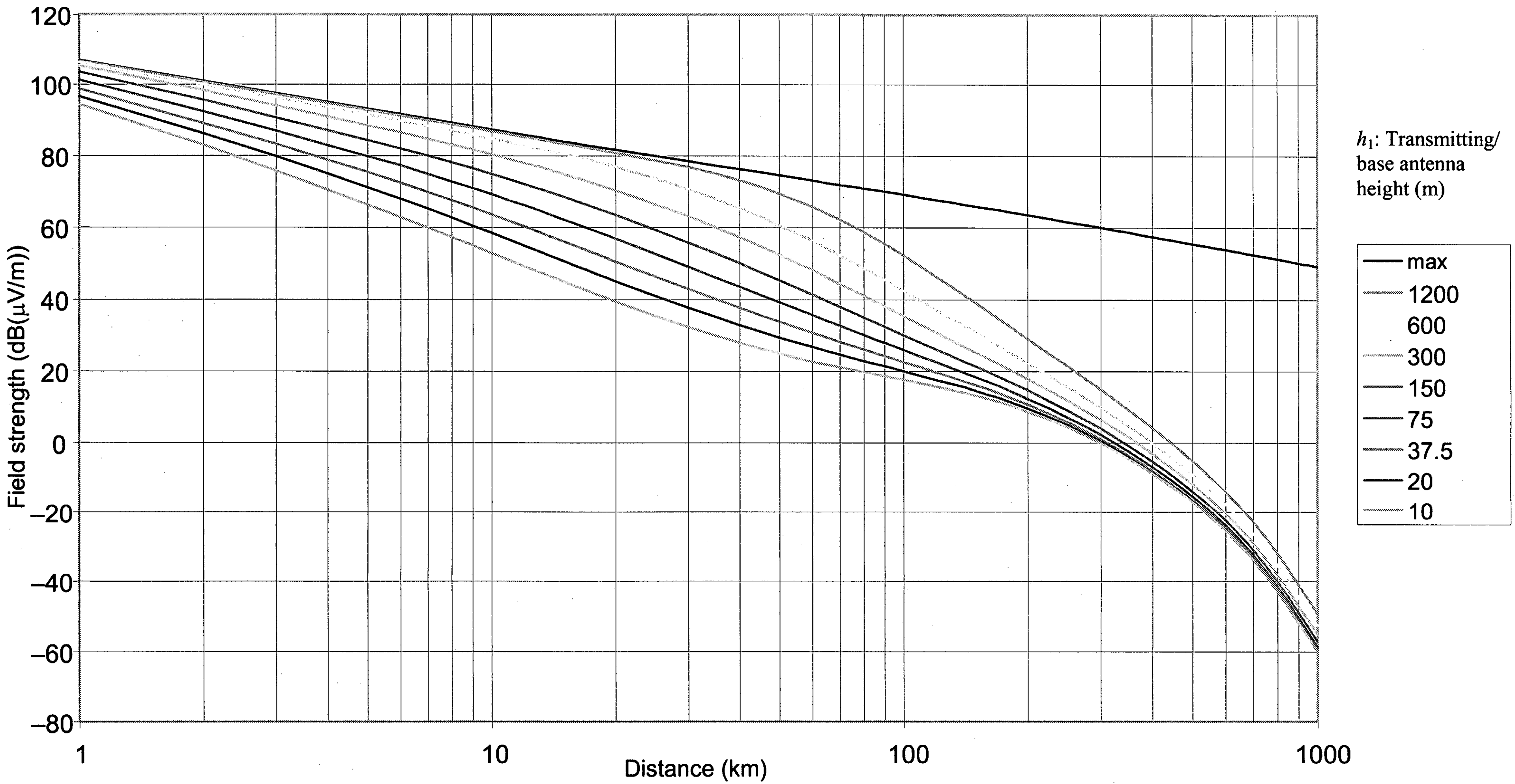
600 MHz 1% time Zone D




2 000 MHz 50% time Zone D
Field strength (dB(μV/m))
120
100
80
60
40
20
0
-20
-40
-60
-80
1
10
100
1000
Distance (km)
h1: Transmitting/ base antenna height (m)
max
1200
600
300
150
75
37.5
20
10


2 000 MHz 10% time Zone D
120
100
80
60
40
20
0
-20
–40
–60
–80
Field strength (dB(µV/m))
1
10
100
1000
Distance (km)
h1: Transmitting/ base antenna height (m)
max
1200
600
300
150
75
37.5
20
10

2 000 MHz 1% time Zone D



CHAPTER 3

Technical basis and characteristics

CONTENTS

3.1 Frequency bands, channel spacing, channel distribution

3.1.1 General

In Band III (174-230 MHz), the new digital plan should accommodate DVB-T and T-DAB.

Furthermore, the whole of Band III should be available for DVB-T and T-DAB planning.

Both DVB-T and T-DAB services should coexist in Band III. There should not be a rigid splitting of Band III between DVB-T and T-DAB, unless this is proposed on a national basis and only depending on national requirements. However, administrations should note that the efficient use of Band III may be facilitated by the separation of T-DAB and DVB-T services, as well as a harmonized 7 MHz bandwidth for all of Band III.

In Bands IV and V (470-862 MHz), the new digital plan should accommodate DVB-T. Also, in Bands IV and V, the new digital plan should be based upon an 8 MHz channel bandwidth associated with an identical 8 MHz channel spacing.

For T-DAB, the channelling plan in Band III as given in Recommendation ITU-R BS.1660 – Technical basis for planning of terrestrial digital sound broadcasting in the VHF band, should be inserted into the new digital plan.

Information concerning the frequencies for analogue and DVB-T television channels and for T-DAB frequency blocks in Bands III, IV and V is given in Annex 3.1, Tables A.3.1-1 to A.3.1-10. DVB-T channels have the same channel reference and channel boundaries as for the analogue channels given in the Annex 3.1, Tables A.3.1-1 to A.3.1-9. However, for DVB-T channels the assigned frequency is the centre frequency.

For channel bandwidths and channel spacing in Band III, each administration may retain its own arrangement (channel spacing and bandwidth defined previously for analogue TV).

3.1.2 Details of frequency bands

In Band III, different television channel spacings are used across the planning area. In Eastern Europe, France, Ireland and some African countries, channels are 8 MHz wide but they are aligned differently. In other countries the channel width is 7 MHz, also with different channel alignments. In some countries using a 7 MHz channel width (e.g. Italy and Morocco), there are also different channel spacings. This means that in the VHF bands there are many cases where channels overlap.

Within Bands IV and V, there is a single channel spacing of 8 MHz, with the upper and lower edges, and vision carrier, of each channel being the same for all countries in the planning area.

Annex 3.1 shows a list of television systems as notified by administrations with territories located in the planning area. The frequencies for these television channels in Bands III, IV and V are given in Annex 3.1, Tables A.3.1-1 to A.3.1-9, as provided by administrations.

It should be noted that while the frequency band 174-216 MHz is primarily used for terrestrial analogue television, there are also some T-DAB allotments in this band in Europe. The frequency band 216-230 MHz is mainly allocated to T-DAB in European countries; nevertheless there is still widespread use of part of this band for television.

3.1.3 Future Band III sharing options

Three ways in which Band III can be shared between T-DAB and DVB-T have been identified and these are considered in this chapter, namely:

– Option 1 single service usage of the band;

– Option 2 partitioning of the band;

– Option 3 mixed T-DAB/DVB-T.

Descriptions of these options are given in Annex 3.2.

3.2 Planning considerations

It must be recognized that digital broadcasting frequency planning is a multidimensional subject requiring many technical inputs: criteria such as minimum signal levels and protection ratios and parameters such as distance between transmitters, transmitting antenna heights and type of reception. There is no single and universal solution. In planning the initial introduction of digital television, it may be necessary to restrict the planning studies to a representative subset of criteria and parameters (see § 3.6).

For frequency planning, three field strengths are important:

– the first is the field strength of the wanted signals inside the coverage area, known as the wanted field strength;

– the second results from the power radiated by the wanted transmitters towards areas outside of the coverage area and is usually called outgoing interference or outgoing interfering field strength;

– the third is the field strength inside the wanted coverage area due to radiation from interfering transmitters outside the wanted coverage area, known as incoming interference or nuisance field strength.

The network configurations and reception modes can evolve from one configuration to another due to the flexibility of the digital systems. Frequency planning should provide flexibility in order to cope with future demands (e.g. a conversion from fixed reception to portable and mobile reception may require an evolution from a multifrequency network (MFN) to a single frequency network (SFN) configuration).

A digital frequency plan should also include the possibility of introducing a number of network configurations for different reception modes which result in different reference usable field strengths.

The usable field strength is calculated by combining the individual nuisance field strengths and the combined location correction factor.

3.3 Reception modes

DVB-T planning should be able to deal with different reception modes, namely, fixed reception, portable (outdoor and indoor) reception and mobile reception, using a limited number of appropriate system variants and location probabilities (see § 3.6).

T-DAB planning should be able to deal with mobile reception and with portable indoor reception.

3.3.1 Fixed reception

The reference antenna height considered to be representative in calculating the field strength for fixed reception is 10 m above ground level. The derivation of the minimum median wanted signal levels for Bands III, IV and V requires standard radiation patterns (as given in Recommendation ITU-R BT.419), reference antenna gains (relative to half-wave dipole) and feeder loss from the receiving antenna.

3.3.1.1 Radiation patterns for receiving fixed antennas at roof level

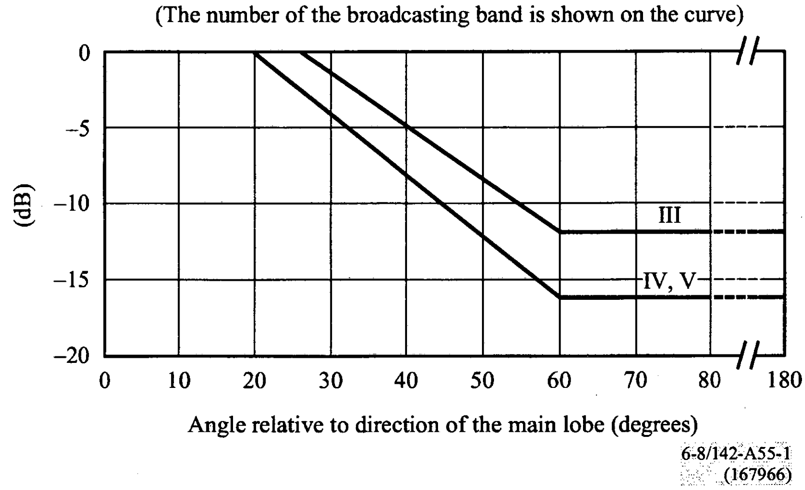
Standard radiation patterns for receiving antennas for Bands III, IV and V are given in Recommendation ITU-R BT.419 (see Fig. 3.3-1).

FIGURE 3.3-1

Directivity of receiving antennas for Bands III, IV and V

(Band I is not covered by this report)

(The number of the broadcasting band is shown on the curve)



3.3.1.2 Antenna gain

The antenna gain values (relative to a half-wave dipole) used in the derivation of the minimum median wanted signal levels are given in Table 3.3-1:

TABLE 3.3-1

Antenna gain (relative to a half-wave dipole) in Bands III, IV and V

Frequency (MHz)	200	500	800
Antenna gain (dB)	7	10	12

These values are considered as realistic minimum values.

Within any frequency band, the variation of antenna gain with frequency may be taken into account by the addition of a correction factor:

$$\text{Corr} = 10 \log (F_A/F_R)$$

where:

F_A: actual frequency being considered

F_R: relevant reference frequency quoted above.

3.3.1.3 Feeder loss

The feeder loss values used in the derivation of the minimum median wanted signal levels are given in Table 3.3-2.

TABLE 3.3-2

Feeder loss in Bands III, IV and V

Frequency (MHz)	200	500	800
Feeder loss (dB)	2	3	5

Measurements were carried out at the indicated frequencies.

The variation of feeder loss values with frequency in Bands IV and V is made by linear interpolation between the two extreme values.

3.3.1.4 Location probability for fixed reception

For fixed reception, a location probability of 95% should be used.

3.3.1.5 Polarization discrimination for fixed reception

It is possible to take advantage of polarization discrimination for fixed reception.

Referring to Note 3 in Recommendation ITU-R BT.419, in the case of orthogonal polarization the combined discrimination provided by directivity and orthogonality cannot be calculated by adding together the separate discrimination values. However, it has been found in practice that a combined discrimination value of 16 dB may be applied for all angles of azimuth in the terrestrial television Bands I to V.

3.3.2 Portable reception

Portable reception is defined in Chapter 1, § 1.6.11.

For planning purposes, it has been assumed that the antenna of a portable receiver is omnidirectional and that the gain (relative to a half-wave dipole) is 0 dB for a UHF antenna and −2.2 dB for a VHF antenna. A portable receiver can be assumed to have 0 dB feeder loss.

3.3.2.1 Considerations on height loss

For portable reception, the antenna height of 10 m above ground level generally used for planning purposes is not realistic and a correction factor needs to be introduced based on a receiving antenna near ground level. For this reason a receiving antenna height of 1.5 m above ground level (outdoor) or above floor level (indoor) has been assumed.

The field-strength values given by the land curves in Recommendation ITU-R P.1546-1 are for a reference receiving antenna at a height representative of the height of the ground cover surrounding the receiving antenna, subject to a minimum height value of 10 m. For planning purposes, the ground cover at the receiver location is generally not known and, hence, a receiving antenna at a height of 10 m in an open area is assumed. To correct the predicted values for a receiving height of 1.5 m above ground level, a factor called "height loss correction factor" has been introduced.

For planning purposes, the height loss values given in Table 3.3-3 should be used for portable and for mobile reception.

TABLE 3.3-3

Height loss in Bands III, IV and V

200 MHz	12 dB
500 MHz	16 dB
800 MHz	18 dB

These values are those obtained for suburban coverages and are used for the calculation of the portable and mobile reception cases. They are used in calculations of reference planning configurations (see § 3.6).

For other frequencies, linear interpolation should be used.

3.3.2.2 Considerations on building penetration loss

Portable reception can take place at outdoor and indoor locations. The field strength at indoor locations will be attenuated significantly by an amount depending on the materials and the construction of the building. A wide range of building penetration losses is to be expected.

The mean absolute building penetration loss is the difference (dB) between the mean field strength inside a building at a given height above ground level and the mean field strength outside the same building at the same height above ground level.

TABLE 3.3-4

Building penetration loss in Bands III, IV and V

	Building penetration loss	Standard deviation
VHF	9 dB	3 dB
UHF	8 dB	5.5 dB

However, existing evidence that the loss could be even higher suggests that these values should be seen as lower limits.

Reception improvement may be achieved by means of active devices and/or more sophisticated solutions such as the antenna diversity proposed for digital terrestrial television. For frequency planning purposes, antenna diversity is not taken into account.

3.3.2.3 Location probability for portable reception

The location probability for T-DAB for indoor reception should be taken as 95%.

For DVB-T, a lower percentage of location probability may be used (from 70% to 95%).

3.3.2.4 Polarization discrimination for portable reception

Polarization discrimination is not taken into account in frequency planning for portable reception.

3.3.3 Mobile reception

Mobile reception is defined in Chapter 1, § 1.6.12.

The reference situation is defined as being reception of a digital signal while in motion, using an antenna situated at no less than 1.5 m above ground level.

A mobile receiver can be assumed to have a low feeder loss in all bands. The values for antenna gains (relative to a half-wave dipole) are initially assumed to be –2.2 dB in Band III and 0 dB in Bands IV and V. However, improvements may be achieved by means of active devices and/or more sophisticated solutions. Antenna diversity is a key technique for future mobile DVB-T compliant broadband multimedia receivers. The potential advantages of using antenna diversity for mobile reception are considerable, since for low-speed mobile reception a 6 to 8 dB gain in *C/N* values is expected. This should lead to improved robustness against variations in reception conditions.

For planning purposes, antenna diversity is not taken into account.

3.3.3.1 Location probability for mobile reception

For mobile reception, a location probability of 99% should be used.

3.3.3.2 Polarization discrimination for mobile reception

Polarization discrimination is not taken into account in planning for mobile reception.

3.3.4 T-DAB and DVB-T receiver noise figure

It is assumed that the noise figure of the receiver is the same for all reception modes, namely 7 dB.

3.4 Planning criteria

This section concerns the different criteria for planning digital terrestrial television systems (DVB-T) in Bands III, IV and V, with the addition of a digital terrestrial sound system (T-DAB) in Band III only.

The planning criteria consist of the following:

– *C/N* values;

– protection ratios;

– location correction factors and the percentage of time.

For planning the introduction of digital terrestrial broadcasting, it is usually necessary to restrict the interim planning studies to a representative subset of variants corresponding to particular *C/N* values.

3.4.1 *C/N* values for planning

For DVB-T the *C/N* values for the non-hierarchical mode should be taken from Table 3.4-1 below. The *C/N* values given for the Ricean channel should be used for the fixed reception case, and those for the Rayleigh channel should be used for the portable and mobile reception cases. For hierarchical modes, the *C/N* values can be found in Annex 3.4.

However, for the planning process, the possible DVB-T variants will be limited in number (see § 3.6).

TABLE 3.4-1

Required C/N for non-hierarchical transmission to achieve a BER = 2×10^{-4} after Viterbi decoding and net bit rate values (Mbit/s)

			Required C/N for BER = 2×10^{-4} after Viterbi decoding (quasi error-free after Reed-Solomon decoding)[1]			Net bit rate (Mbit/s) For different guard intervals (GI)			
System variant[2]	Modulation	Code rate	Gaussian channel	Ricean channel	Rayleigh channel	GI = 1/4	GI = 1/8	GI = 1/16	GI = 1/32
8 MHz variants									
A1	QPSK	1/2	3.1	3.6	5.4	4.98	5.53	5.85	6.03
A2	QPSK	2/3	4.9	5.7	8.4	6.64	7.37	7.81	8.04
A3	QPSK	3/4	5.9	6.8	10.7	7.46	8.29	8.78	9.05
A5	QPSK	5/6	6.9	8.0	13.1	8.29	9.22	9.76	10.05
A7	QPSK	7/8	7.7	8.7	16.3	8.71	9.68	10.25	10.56
B1	16-QAM (M1[1])	1/2	8.8	9.6	11.2	9.95	11.06	11.71	12.06
B2	16-QAM	2/3	11.1	11.6	14.2	13.27	14.75	15.61	16.09
B3	16-QAM	3/4	12.5	13.0	16.7	14.93	16.59	17.56	18.10
B5	16-QAM	5/6	13.5	14.4	19.3	16.59	18.43	19.52	20.11
B7	16-QAM	7/8	13.9	15.0	22.8	17.42	19.35	20.49	21.11
C1	64-QAM (M2[1])	1/2	14.4	14.7	16.0	14.93	16.59	17.56	18.10
C2	64-QAM (M3[1])	2/3	16.5	17.1	19.3	19.91	22.12	23.42	24.13
C3	64-QAM	3/4	18.0	18.6	21.7	22.39	24.88	26.35	27.14
C5	64-QAM	5/6	19.3	20.0	25.3	24.88	27.65	29.27	30.16
C7	64-QAM	7/8	20.1	21.0	27.9	26.13	29.03	30.74	31.67
7 MHz variants									
D1	QPSK	1/2	3.1	3.6	5.4	4.35	4.84	5.12	5.28
D2	QPSK	2/3	4.9	5.7	8.4	5.81	6.45	6.83	7.04
D3	QPSK	3/4	5.9	6.8	10.7	6.53	7.26	7.68	7.92
D5	QPSK	5/6	6.9	8.0	13.1	7.26	8.06	8.54	8.80
D7	QPSK	7/8	7.7	8.7	16.3	7.62	8.47	8.97	9.24
E1	16-QAM	1/2	8.8	9.6	11.2	8.71	9.68	10.25	10.56
E2	16-QAM	2/3	11.1	11.6	14.2	11.61	12.90	13.66	14.08
E3	16-QAM	3/4	12.5	13.0	16.7	13.06	14.52	15.37	15.83
E5	16-QAM	5/6	13.5	14.4	19.3	14.52	16.13	17.08	17.59
E7	16-QAM	7/8	13.9	15.0	22.8	15.24	16.93	17.93	18.47
F1	64-QAM	1/2	14.4	14.7	16.0	13.06	14.51	15.37	15.83
F2	64-QAM	2/3	16.5	17.1	19.3	17.42	19.35	20.49	21.11
F3	64-QAM	3/4	18.0	18.6	21.7	19.60	21.77	23.05	23.75
F5	64-QAM	5/6	19.3	20.0	25.3	21.77	24.19	25.61	26.39
F7	64-QAM	7/8	20.1	21.0	27.9	22.86	25.40	26.90	27.71

(1) ITU-R reference system variants (Recommendation ITU-R BT.1368).

(2) Identifiers of DVB-T variant used for non-hierarchical transmission.

For T-DAB, a *C/N* value of 15 dB is implicitly given in Recommendation ITU-R BS.1660 – Technical basis for planning of terrestrial digital sound broadcasting in the VHF band.

In the case of T-DAB, only portable indoor and mobile reception modes are relevant for planning purposes, and consequently, only the Rayleigh channel should be used. As already observed, the *C/N* values given are based on theoretical considerations.

3.4.2 Protection ratios

For DVB-T (vis-à-vis DVB-T, T-DAB and analogue television, and conversely), the protection ratios given in Recommendation ITU-R BT.1368 – Planning criteria for digital terrestrial television services in the VHF/UHF bands should be used.

For T-DAB vis-à-vis T-DAB, a value of 15 dB should be used.

For wanted T-DAB vis-à-vis DVB-T or analogue television, the protection ratios given in Recommendation ITU-R BS.1660 – Technical basis for planning of terrestrial digital sound broadcasting in the VHF band, should be used.

For wanted analogue television vis-à-vis T-DAB, the protection ratios given in Recommendation ITU-R BT.655 – Radio-frequency protection ratios for AM vestigial sideband terrestrial television systems interfered with by unwanted analogue vision signals and their associated sound signals, should be used.

3.4.3 Location correction factors and percentage of time

Due to the sharp degradation of quality that occurs when the required *C/I* is not attained, calculations involving high percentages of time and locations are required for the wanted field (and low percentages for the interfering signals). Therefore, an extra correction to the value derived from Recommendation ITU-R P.1546-1 curves is required.

Field-strength variations can be divided into macro-scale and micro-scale variations. The macro-scale variations relate to areas with linear dimensions of 10 m to 100 m or more and are mainly caused by shadowing and by multipath reflections from distant objects. The micro-scale variations relate to areas with dimensions of the order of a wavelength and are mainly caused by multipath reflections from nearby objects. As it may be assumed that, for portable reception, the position of the antenna can be optimized within the order of a wavelength, micro-scale variations will not be too significant for planning purposes. Another way to overcome these variations is the possibility of using a receiver with antenna diversity.

Macro-scale variations of the field strength are very important for coverage assessment. In general, a high target percentage for coverage will be required to compensate for the rapid failure rate of digital television and sound signals.

The field strength prediction method relies on curves for 50% of locations, 50% of time for the wanted signal and 50% of locations, 1% of time for the unwanted signal.

3.4.3.1 Signal variations at outdoor locations

Recommendation ITU-R P.1546-1 gives a standard deviation of 5.5 dB for wideband signals. This value is used for determining the field-strength variation at outdoor locations, as represented by the "location correction factor".

This location correction factor for macro-scale variations is therefore:

TABLE 3.4-2

Coverage target (location probability) (%)	Location correction factor (VHF and UHF) (dB)
99	13
95	9
70	3

For mobile reception it may be necessary to plan for a location probability of 99%. There is no need to take into account building penetration losses, but the specification of the channel model is more stringent than for portable reception.

3.4.3.2 Signal variations at indoor locations

The field-strength variation at indoor locations is the combined result of the outdoor variation and the variation due to building attenuation. These variations are likely to be uncorrelated. The standard deviation of the indoor field strength distribution can therefore be calculated by taking the square root of the sum of the squares of the individual standard deviations. At VHF, where the signal standard deviations are 5.5 dB and 3 dB respectively, the combined value is 6.3 dB. At UHF, where the signal standard deviations are both 5.5 dB, the combined value is 7.8 dB.

The location correction factor for macro-scale variations at indoor locations is given in Table 3.4-3:

TABLE 3.4-3

Coverage target (location probability) (%)	Location correction factor (VHF) (dB)	Location correction factor (UHF) (dB)
95	10	13
70	3	4

The overall field-strength prediction process must take account of the location variation.

3.4.4 Considerations regarding the minimum signal levels for planning

This section presents general considerations regarding the minimum signal levels for planning. Nevertheless § 3.6 presents reference planning configurations to enable administrations to reduce the number of variants to be taken into consideration.

When trying to build new digital terrestrial networks, the main questions are the evaluation of the service area and of the population served. These evaluations are made by estimating the level of the useful signals and the level of the interfering signals.

The minimum signal levels needed to overcome noise, usually expressed as the minimum receiver input power or the corresponding minimum equivalent receiver input voltage, do not take any propagation effects into account. However, it is necessary to take account of these effects when considering television or sound reception in a real environment.

Due to the very rapid transition from near perfect reception to no reception at all, it is necessary that the minimum required signal level be achieved at a high percentage of locations. For fixed or portable reception of digital television, these percentages have been set at 70% for "acceptable" and 95% for "good" reception. The latter value applies also if portable indoor digital sound reception is considered. The value of 99% has to be used for mobile reception of digital broadcasting signals. Minimum median signal levels may be derived, taking account of propagation factors, in order to ensure that the minimum values are achieved at the specified percentage of locations.

An example is given in Annex 3.5 (see Tables A.3.5-1 to A.3.5-3). The minimum median signal levels are calculated for:

- four different digital television receiving modes (fixed, portable outdoor, portable indoor at ground floor and mobile reception);
- different frequency bands;
- different representative C/N ratios;
- digital sound broadcasting for mobile and portable indoor receiving modes.

Representative C/N values are used for these examples. Results for any given system variant may be obtained by interpolation between the relevant representative values.

When evaluating the coverage area of an analogue television service using typical prediction tools, the value of the field strength specified at the edge of the coverage area is a mean value. It represents the average value of all the actual values of the field strength that could be measured within a small area, usually taken to be 100 m × 100 m. This means that in this small area, about half of the actual values of the field strength are below this mean value and about half are above this value. For analogue television, if the value of, say, 67 dB(μV/m) is specified as the lower limit of the mean value, that implies that lower-than-average values of the field strength can be found inside the small area. However, if 67 dB(μV/m) corresponds to grade 4 for the picture quality according to the ITU scale, a lower value of field strength will give a somewhat lower quality because of the smooth degradation of analogue reception in the presence of noise or interference. A reduction of about 6 dB for the C/N or C/I will lead to a loss of one grade of picture quality. Thus, at the edge of the service area, even if the actual value of the wanted field strength is below the specified limit value, a picture will still be received but with a lower quality. We can say that the inherent assumption for analogue television is that the "average" quality is grade 4 at the edge of the service area.

For digital broadcasting, it is known that the behaviour of the receiver is completely different. When the signal level decreases and the C/N or C/I falls below a given "minimum" value, the television or sound programme disappears completely if there is a further signal level reduction of less than about 1 dB. This behaviour is generally referred to as the rapid failure characteristic of the digital system and the limit value of the field strength is designated as the minimum field strength. This is due to the fact that there is no smooth degradation for digital receivers; the picture quality changes rapidly from grade 5 to grade 0, without any intermediate levels of quality. If the same coverage definition as for analogue systems were used for digital systems, this would mean that 50% of the locations would not be served at or near the edge of the service area or in any other areas of reduced signal caused by local obstructions. This value of only 50% of locations receiving a programme is clearly unacceptable, and higher values of the percentage of locations have to be selected in order to allow reception in a larger number of households with a standard receiving installation, or in other receiving situations. The exact value chosen depends on the target level of service quality, and that is why values can be different from one country to another, or even from one service provider to another within a given country.

Nevertheless, values of 70%, 95% and 99% of locations have been chosen for digital television, depending on the reception conditions. For digital sound broadcasting, values of 95% and 99% of locations are recommended for planning.

3.4.5 Minimum median power flux-density and minimum median field strength values

The minimum median power flux-density values and the corresponding minimum median field strength values are calculated for different frequency bands and for different conditions of percentage of location and for representative C/N ratios.

Illustrations of calculations for minimum median power flux-density values and minimum median field strength values are given in Annex 3.5 for DVB-T and T-DAB.

3.4.6 Reference parameters for field strength representation

For the different reception modes, the field strengths required to provide the desired location probability for reception of the wanted signal can best be compared by using a reference receiving antenna height, location probability and percentage of time, as follows:

- Receiving antenna height: 10 m above ground level
- Location probability: 50%
- Percentage of time: 50%.

The field strengths corresponding to these conditions are termed the "minimum median field strengths".

3.5 Spectrum mask

The spectrum mask is inherent to digital broadcasting systems and must be taken into account for efficient frequency planning.

In order to avoid excessive out-of-band emissions and to allow implementations adjacent to broadcasting channels or to other services, a technical description of spectrum masks is given below.

3.5.1 Spectrum mask for digital sound broadcasting (T-DAB)

Recommendation ITU-R BS.1114-5 – Systems for terrestrial digital sound broadcasting to vehicular, portable and fixed receivers in the frequency range 30-3 000 MHz, gives the spectrum mask for T-DAB.

3.5.2 Spectrum mask for digital television (DVB-T)

3.5.2.1 Symmetrical spectrum mask for DVB-T in 8 MHz and 7 MHz channels

For digital television transmitters using the channels adjacent to other services (low power or receive only), the spectrum mask may not give enough attenuation on the side of the digital television channel falling in the frequency band where the other service operates (see Chapter 4 – Compatibility with other primary services).

In such cases, special spectrum masks have to be defined, based on the characteristics of the other service and the distance between the digital television transmitter and the service area (or receiving installation) of the other service. It must be borne in mind, however, that spectrum mask filters showing a higher attenuation close to the digital television channel will be very expensive and imply a higher insertion loss.

Two symmetrical spectrum masks are shown in Fig. 3.5-1 and the associated Table 3.5-1. The mask having a shoulder attenuation of 40 dB is intended for non-critical cases, and the mask with a shoulder attenuation of 50 dB is intended for sensitive cases.

The mask for non-critical cases should also be used for measurements of protection ratios for analogue television interfered with by DVB-T.

The shape of the masks has been established on the following basis:

- the natural spectrum of a 7.6 MHz OFDM signal (for 8 MHz channels) and a 6.7 MHz OFDM signal (for 7 MHz channels);
- the amplitude response of an IF SAW-filter;
- the power amplifier of the transmitter produces intermodulation outside the channel at a level limited by the amount of intermodulation acceptable inside the channel;
- the mask for sensitive cases also includes the amplitude response of a six-cavity band pass filter at the output of the transmitter.

FIGURE 3.5-1

Symmetrical spectrum masks for non-critical and sensitive cases

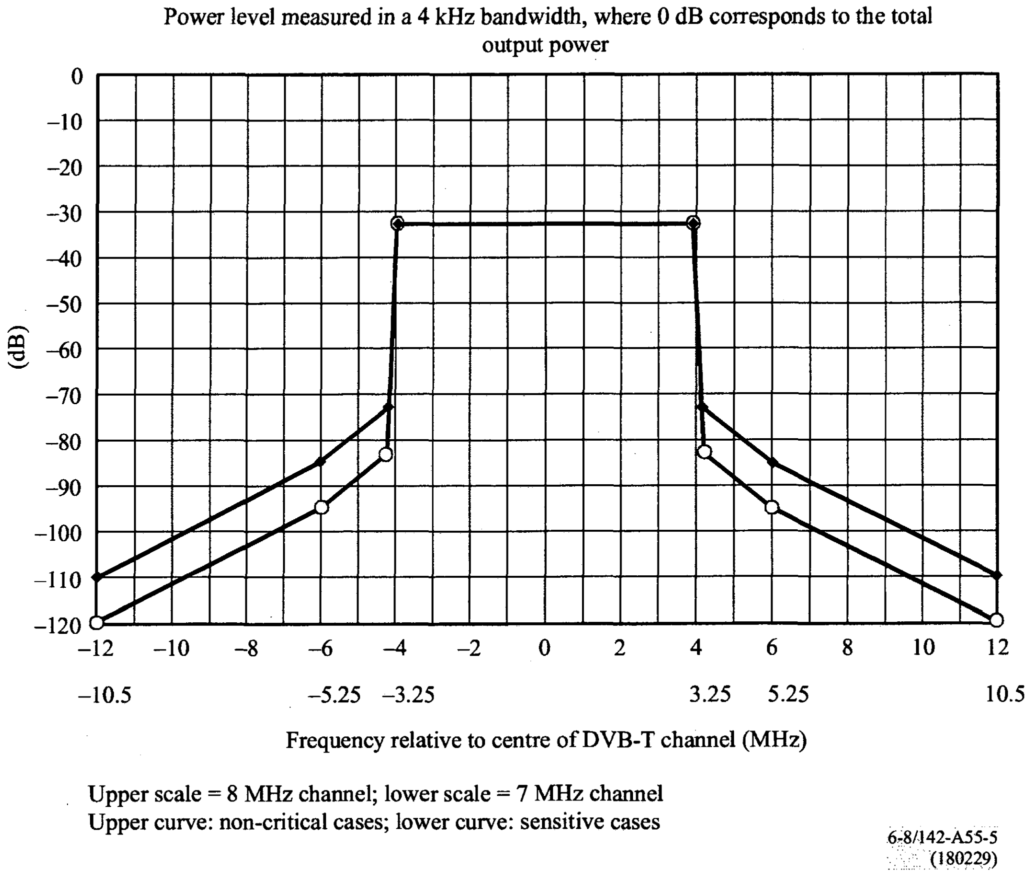


TABLE 3.5-1

Symmetrical spectrum masks for non-critical and sensitive cases

Breakpoints					
8 MHz channels			7 MHz channels		
	Non-critical cases	Sensitive cases		Non-critical cases	Sensitive cases
Relative frequency (MHz)	**Relative level (dB)**	**Relative level (dB)**	**Relative frequency (MHz)**	**Relative level (dB)**	**Relative level (dB)**
–12	–110	–120	–10.5	–110	–120
–6	–85	–95	–5.25	–85	–95
–4.2	–73	–83	–3.7	–73	–83
–3.9	–32.8	–32.8	–3.35	–32.8	–32.8
+3.9	–32.8	–32.8	+3.35	–32.8	–32.8
+4.2	–73	–83	+3.7	–73	–83
+6	–85	–95	+5.25	–85	–95
+12	–110	–120	+10.5	–110	–120

3.5.2.2 Asymmetrical spectrum mask for DVB-T in 8 MHz and 7 MHz channels

In the starting phase of terrestrial digital television, channels will have to be found mainly between those already in use for analogue television. In some cases, it will be necessary to use channels adjacent to existing analogue television channels. To avoid interference into the analogue television services, it is considered important to limit the out-of-channel emissions from digital television transmitters as much as possible. This leads to a need for defined spectrum masks for digital television transmitters.

Examples of asymmetrical DVB-T masks for 8 and 7 MHz systems appropriate for ensuring compatibility between broadcasting services are given in Annex 3.6. They allow for a digital transmitter to use an adjacent channel of an analogue TV transmitter with the assumption that they are co-sited and radiating the same power.

3.6 Network structure and configurations

3.6.1 General considerations

3.6.1.1 Typical digital terrestrial broadcasting configurations: MFN, SFN or mixed MFN-SFN

In digital terrestrial broadcasting planning there are many more criteria and parameters to be considered than in analogue planning. The planning criteria and parameters should be limited to a number of essential reference configurations in order to enable planning exercises to be conducted in a limited time-frame.

For digital terrestrial broadcasting systems such as DVB-T and T-DAB, there are many possible options for implementing networks. For example, there is a choice of criteria: digital terrestrial broadcasting variants in the case of television, or transmission modes in the case of sound. Also, there is a choice of parameters for the infrastructure: MFNs, SFNs or mixed MFN-SFN.

SFNs can be implemented by one of two types of structure. One is called an "open" and the other a "closed" network. It is assumed that both types of network are designed to provide the minimum wanted field strength at the boundary of the coverage area.

- In an open network, no measures are taken to minimize the level of radiation towards areas outside the coverage area. In the limiting case, an open network can consist of just a single transmitter.
- In a closed network, the level of radiation towards areas outside the coverage area is deliberately reduced without reduction of the coverage of the intended area. This can be achieved by using directional antennas at transmitting stations near the periphery of the coverage area.

In a real network covering a large area, there will be considerable distances between the transmitters. If such a network is designed as a closed network, it will cause less interference at a given distance outside its coverage area than if it had been designed as an open network. The reason for this is that the level of interference is mainly determined by the radiated power from the transmitters closest to the boundary of the coverage area in the direction considered.

However, in a closed network covering a small area, the radiated power from transmitters on the side of the coverage area opposite to the direction considered contributes relatively more to the outgoing interference level than in a closed network covering a large area. Thus, the use of directional transmitting antennas at transmitters near the boundary of the coverage area brings less advantage than in the case of networks covering larger areas.

It follows from the above that, for relatively large coverage areas, the separation distance between co-channel areas will generally be less for closed networks than for open ones. For smaller coverage areas, the separation distance for closed networks approaches that for open networks.

To date, SFN structures have been used in implementing T-DAB and some DVB-T networks.

3.6.1.2 Transmitting sites (distance between sites and effective radiated power)

Digital terrestrial broadcasting can use existing sites, new sites, or alternative network architectures. These parameters thus affect the choice of digital terrestrial broadcasting variant and the frequency requirements. In some countries, it is intended to use the same sites for digital as for analogue (with the possibility of establishing local high-density SFN).

The number of transmitter sites deployed and the separation distances will vary significantly from country to country and will depend the system variant, the reception mode (fixed, portable or mobile), the size of the country and boundary situations. For digital terrestrial broadcasting, the distance between transmitter sites may vary between 30 and 50 km in the most populated areas or in hilly areas, and between 75 and 125 km in less populated areas or less hilly areas.

In an SFN using appropriate digital terrestrial broadcasting standards, the separation distance between transmitters influences the choice of guard interval, which in turn limits the size of the network. The separation distance and the effective height influence the e.r.p.

In the case of SFNs, the use of "dense networks" can offer some advantages over networks based on high-power transmitters separated by large distances (sixty to several hundred kilometres).

Particularly in the case of regional SFNs, but also for national SFNs, it is possible to consider various forms of dense networks, with all of the transmitters using the same channel, but having significantly lower e.r.p. than that required by a single transmitter serving the same area. For digital terrestrial broadcasting, the concept of "distributed emission" can provide the needed field strength over the entire service area with a number of low-power, synchronized SFN transmitters located on a more-or-less regular lattice. It is also possible to use on-channel repeaters receiving their signal off-air from the main transmitter, to improve the coverage of the main transmitter. In the latter case, the repeaters need not be synchronized in time, and no parallel transmission infrastructure is needed to bring the signal to them.

Furthermore, local high-density SFNs could be used to supplement large SFNs in areas where the coverage would otherwise be inadequate, due to the orography. Finally, they offer a reduction of the impact of co-channel interference at the border of the service area, by introducing a sharper field strength roll-off. This can be further improved by suitable use of transmitting antenna directivity.

For example, it is possible to envisage transmitter topologies in which the central part of the service area is covered by a large SFN (with high-power transmitters separated by large distances), but near the border a dense transmitter network is installed (with low e.r.p. and with low-height and directive antennas). This allows the e.r.p. to be "tailored" according to the service area contour, reducing the interference to adjacent areas and maintaining a high level of service availability inside the service area. This technique can also be useful on the borders of national SFNs.

3.6.1.3 Transmitting antenna types and radiation patterns

Transmitting antennas will have an omnidirectional or directional pattern. For the stations located along or close to country borders or sea borders, directional antennas should preferably be used to reduce interference outside service areas. This will reduce the re-use distance for the frequencies in question, and protect coverage areas of existing television stations. This is especially true for high-power and medium-power stations and will in general result in a more efficient use of the frequency spectrum.

Beam-tilt, applied to antennas with an effective height of more than 100 m, is an efficient tool to target the radiated power of high-power stations to the inner part of the coverage area and, at the same time, reduces the interference potential at large distances and to the aeronautical service.

Recommendation ITU-R BS.1195 – Transmitting antenna characteristics at VHF and UHF, might be used as a source of comprehensive information on the characteristics of VHF and UHF transmitting antenna systems for frequency planning. The transmitting antenna radiation patterns are normalized to 0 dB.

3.6.1.4 Factors influencing the distance between transmitters

There are several factors that influence the distance between transmitters, for example radiated power, antenna height, reception mode, system variant and propagation path. It must be noted that these may be different for different reference networks. In SFNs, the distance between adjacent transmitters is limited by the length of the guard interval.

3.6.1.5 Factors influencing the separation distance between transmitters

The separation distance between transmitters has a significant influence on the number of frequency blocks or channels needed to establish coverage of a larger area encompassing several countries or regions, each having its own programmes transmitted in one frequency block or channel.

Coverage areas served by transmitters located along the periphery and using directive antennas pointing inwards (i.e., a closed network) will result in somewhat shorter separation distances compared to equivalent coverage achieved by the use of non-directional antennas (i.e., an open network). In the case of propagation paths with a significant amount of sea, separation distances will be larger than for land-only paths.

3.6.2 Reference planning configurations

3.6.2.1 General

T-DAB and DVB-T offer the freedom to implement a large variety of broadcast service options. For DVB-T in particular, several thousand planning configurations could be thought of by combining the various possible modulation schemes, code rates, fast Fourier transform (FFT) modes, guard intervals, reception modes, coverage quality classes, network approaches, etc. Thus, a planning configuration describes the sum of all relevant technical aspects of a broadcasting service implementation. The various aspects of a planning configuration, for the example of DVB-T, are summarized in Table 3.6-1.

TABLE 3.6-1

Aspects of DVB-T planning configurations

Aspect	Element
Reception mode	Fixed roof-level Portable outdoor Portable indoor Mobile
Coverage quality (in terms of percentage of locations)	70% 95% 99%
Network structure	MFN (single transmitter) SFN Dense SFN
DVB-T system variant	from QPSK-1/2 to 64-QAM-7/8
Frequency band	Band III (200 MHz) Band IV (500 MHz) Band V (800 MHz)

However, a large number of these theoretically possible combinations make little or no sense, from an economic, a technical or a frequency-management point of view.

Moreover, seen from the point of view of compatibility analysis, which is the major issue in producing a frequency plan, a large number of the realistic and meaningful planning configurations can be treated as equivalent, since they differ little or not at all in terms of compatibility aspects.

For frequency planning purposes, a reduction to a very small number of so-called reference planning configurations (RPCs) is possible, which then are abstract in the sense that they no longer correspond to specific real planning configurations. Thus, a reference planning configuration represents a T-DAB or a DVB-T implementation with the parameters of a typical planning configuration.

3.6.2.2 Reference planning configurations for DVB-T

For DVB-T, a grouping of planning configurations can be found which are governed by the reception mode aspect and the frequency band aspect:

- fixed reception;
- portable outdoor reception, mobile reception and lower coverage quality portable indoor reception;
- higher coverage quality portable indoor reception.

For reference frequencies:

- 200 MHz (VHF);
- 650 MHz (UHF).

The grouping assumes that, for fixed reception, less rugged DVB-T variants with a high data capacity are used. This is possible since the transmission channel is less difficult in this case than for portable or mobile reception. In the latter case, more rugged DVB-T variants are assumed, this being necessary in order to overcome the adverse effects of the portable or mobile transmission channel. However, this higher ruggedness has to be paid for with less data capacity.

In this way, for DVB-T, a reduction of the large number of possible planning configurations to three RPCs for each of the two reference frequencies is achieved, which facilitates the establishment of the frequency plan and the definition of coordination procedures.

The reference planning configurations are summarized in Table 3.6-2.

TABLE 3.6-2

RPCs for DVB-T

RPC	RPC 1	RPC 2	RPC 3
Reference location probability	95%	95%	95%
Reference C/N (dB)	21	19	17
Reference $(E_{med})_{ref}$ (dB(μV/m)) at 200 MHz	50	67	76
Reference $(E_{med})_{ref}$ (dB(μV/m)) at 650 MHz	56	78	88

$(E_{med})_{ref}$: minimum median equivalent field strength

RPC 1: RPC for fixed roof-level reception

RPC 2: RPC for portable outdoor reception or lower coverage quality portable indoor reception or mobile reception

RPC 3: RPC for higher coverage quality for portable indoor reception.

For other frequencies, interpolation of the previous proposed reference field-strength values should follow the following rules: For other frequencies, interpolation of the previous proposed reference field-strength values should follow the following rules:

– for fixed reception, Corr = 20 log (f/f_r), where f is the actual frequency and f_r the reference frequency of the relevant band quoted above;

– for portable reception and mobile reception, Corr = 30 log (f/f_r) where f is the actual frequency and f_r the reference frequency of the relevant band quoted above.

The reference parameters of the RPC that are given in Table 3.6-2 (location probability, *C/N*, minimum median field strength) are not associated with a particular DVB-T system variant or a real DVB-T network implementation; rather, they stand for a large number of different real implementations. For instance, a DVB-T service for mobile reception might use as real implementation parameters a location probability of 99% and a rugged DVB-T variant with a *C/N* of 14 dB. Nevertheless, this service will be represented by RPC 2 with a reference location probability of 95% and a reference *C/N* of 19 dB without restricting the possibilities for the implementation of the "real" service for mobile DVB-T reception.

Typically, a data capacity of about 20-27 Mbit/s is associated with RPC 1, about 8-24 Mbit/s with RPC 2, and about 13-16 Mbit/s with RPC 3. However, it is to be emphasized that there is a trade-off between coverage and data capacity. An increase of the coverage area can be achieved within an RPC when a more rugged DVB-T variant is chosen which is accompanied by a reduction of the data capacity, and vice versa.

For a compatibility analysis, protection ratios for the concerned services are needed. Since the RPCs represent artificial configurations, there do not exist measurements for the appropriate protection ratios. Instead, it is recommended to use the following values:

– for DVB-T against DVB-T analysis, the respective value of the reference *C/N* in Table 3.6-2 as the protection ratio;

– in other cases:
  – for RPC 1, protection ratio values for DVB-T variant 64-QAM 3/4, to be found in Recommendation ITU-R BT.1368;
  – for RPC 2, protection ratio values for DVB-T variant 16-QAM 3/4, to be found in Recommendation ITU-R BT.1368;
  – for RPC 3, protection ratio values for DVB-T variant 16-QAM 2/3, to be found in Recommendation ITU-R BT.1368.

3.6.2.3 Reference planning configurations for T-DAB

For T-DAB, the situation is simpler, since there is not a large variety of possible planning configurations. Frequency planning will be performed for mobile or portable indoor reception and an average channel code rate $R = 0.5$ (see Recommendation ITU-R BS.1114).

Two RPCs are available for T-DAB in Band III:

TABLE 3.6-3

RPCs for T-DAB

Reference planning configuration	RPC 4	RPC 5
Location probability	99%	95%
Reference C/N (dB)	15	15
Reference $(E_{med})_{ref}$ (dB(μV/m)) at 200 MHz	60	66

$(E_{med})_{ref}$: minimum median equivalent field strength

RPC 4: RPC for mobile reception

RPC 5: RPC for portable indoor reception

The relevant protection ratios for compatibility calculations are given in § 3.4.2.

3.6.3 Reference networks

3.6.3.1 General considerations

A basic task when establishing a frequency plan is to perform compatibility analyses between transmitters and/or networks. For such calculations, the characteristics of the transmitters have to be known. If a requirement is given in assignment form, these characteristics are available.

However, there will be cases where the exact transmitter characteristics of a network will not be known at the time when a frequency plan is to be established. This will in particular be true for the case of SFN implementations where the service area may already be known, but not yet the exact number, locations and powers of the SFN transmitters. Despite this lack of such information, it is necessary to perform the compatibility calculations in order to establish the plan. For this purpose, it is useful to define generic network structures which may represent the as yet unknown real networks in a compatibility analysis. Such generic networks are called reference networks.

Three RPCs have been selected for Bands III and IV/V for DVB-T and two for T-DAB in Band III. For each of them, reference networks have been developed, and the properties of these reference networks will be different according to the characteristics of the associated RPCs.

Reference networks are regarded as idealized approximations of real network implementations. They exhibit a high degree of geometrical symmetry and homogeneity with regard to transmitter characteristics. They can be characterized by the following parameters:

- Number of transmitters
- Distance between transmitters
- Transmitter network geometry
- Transmitter power
- Transmitter antenna height
- Transmitter antenna pattern
- Service area (area to be covered).

Reference networks facilitate the compatibility analysis and plan synthesis in frequency planning. Their main purpose is to determine interference potentials and interference susceptibilities of typical DVB-T or T-DAB, which are the basic input for a compatibility calculation between service areas and hence fundamental to the production of a frequency plan.

It has to be emphasized that real networks, as implemented, by no means need to have the same characteristics as the reference network– whether in terms of the number of transmitters, of transmitter locations, of transmitter powers, or of any other property of the reference network – as long as the real network implementation complies with the interference potential restriction that is associated with the relevant reference network.

3.6.3.2 Single reference transmitter

A single artificial reference transmitter, in the case of the MFN approach, would be the simplest representative of a reference "network". However, in the majority of cases of a single-transmitter requirement, the characteristics of the transmitter are already known – and if not, they can easily be calculated from the intended service area properties. Therefore, in the single-transmitter case, there is no need to define an artificial "reference transmitter"; rather, the "real" transmitter properties can be used in the compatibility analysis. Thus, if a requirement is given in assignment form, the compatibility analysis will be made on the basis of the required transmitter properties.

3.6.3.3 Reference SFN

SFNs are intended to cover larger service areas than those of single transmitters, and in general not all of the SFN transmitters and their characteristics will be known at the stage of the establishment of the frequency plan. Moreover, these transmitter characteristics are not necessarily needed in an allotment planning approach at the stage of the establishment of the frequency plan. Compatibility calculations may be performed by means of reference networks as described above. Where the real transmitter locations and other characteristics are known, these should be used in compatibility calculations in the SFN case. A detailed description of reference networks is given in Annex 3.7.

3.6.3.4 Interference potential

The interference potential of a transmitter or a transmitter network is the outgoing interference that is produced by the transmitter or the transmitter network. If, in the planning process, the real interference potential of a network is not known, the interference potential of a reference network may be taken as representative of the real interference potential.

The interference potential of a reference network may be represented by a field-strength curve which is calculated by summing the interfering field strengths of the transmitters of the reference network along a line directed outwards from the reference network and starting at the border of the service area of that reference network. The summation can be performed by means of the power sum method or a statistical summation method.

In a compatibility analysis, the interference potential curve may be used to calculate the hypothetical interference at a certain location, by assuming that the test points on the border of the service area of the network under consideration are – one by one – the source of interference. The highest interfering field-strength value is then taken as representative of the interference at that location. Of course, a direct evaluation of the interference produced by the reference network transmitters at that location is also possible in a compatibility analysis, after having defined the exact position of the reference network with regard to the boundary test point.

ANNEX 3.1

List of terrestrial broadcasting systems in the VHF and UHF bands

TABLE A.3.1-1

VHF System B

Used in the following geographical areas:

ALB, ALG, ARS, AUT, BEL, BHR, BIH, CME, CNR, CVA, CYP, D, DJI, DNK, E, EGY, ERI, ETH, FIN, FRO, GHA, GIB, GNB, GNE, GRC, HOL, HRV, IRN, IRQ, ISL, ISR, JOR, KEN, KWT, LBN, LBR, LBY, LIE, LUX, MAU, MDR, MKD, MLI, MLT, MTN, NIG, NOR, OMA, POR, QAT, RRW, S, SCG, SDN, SEY, SOM, SRL, STP, SUI, SVN, SYR, TCD, TUN, TUR, UAE, UGA, YEM, ZMB

Channel	Channel boundaries (MHz)		Assigned frequency (MHz)	Vision carrier (MHz)	Sound carrier (MHz)	Dual FM second sound carrier (MHz)	NICAM carrier (MHz)
5	174	181	177.50	175.25	180.75	180.99	181.1
6	181	188	184.50	182.25	187.75	187.99	188.1
7	188	195	191.50	189.25	194.75	194.99	195.1
8	195	202	198.50	196.25	201.75	201.99	202.1
9	202	209	205.50	203.25	208.75	208.99	209.1
10	209	216	212.50	210.25	215.75	215.99	216.1
11	216	223	219.50	217.25	222.75	222.99	223.1
12	223	230	226.50	224.25	229.75	229.99	230.1
13*	230	237	233.50	231.25	236.75	236.99	237.1
14*	246.18	253.18	249.68	247.43	252.63	252.87	252.98

* Used in ZMB only (outside the planned bands for RRC).

TABLE A.3.1-2

VHF System B

Used in the following geographical areas:

I, SMR

Channel	Channel boundaries (MHz)		Assigned frequency (MHz)	Vision carrier (MHz)	Sound carrier (MHz)	Dual FM second sound carrier (MHz)
D	174.00	181.00	177.50	175.25	180.75	180.99
E	182.50	189.50	186.00	183.75	189.25	188.49
F	191.00	198.00	194.50	192.25	197.75	197.99
G	200.00	207.00	203.50	201.25	206.75	206.99
H	209.00	216.00	212.50	210.25	215.75	215.99
H1	216.00	223.00	219.50	217.25	222.75	222.99
H2	223.00	230.00	226.50	224.25	229.75	229.99

TABLE A.3.1-3

VHF System B

Used in the following geographical area:

MRC

Channel	Channel boundaries (MHz)		Assigned frequency (MHz)	Vision carrier (MHz)	Sound carrier (MHz)
4*	162	169	165.50	163.25	168.75
5*	170	177	173.50	171.25	176.75
6	178	185	181.50	179.25	184.75
7	186	193	189.50	187.25	192.75
8	194	201	197.50	195.25	200.75
9	202	209	205.50	203.25	208.75
10	210	217	213.50	211.25	216.75
11	216	223	219.50	217.25	222.75
12	223	230	226.50	224.25	229.75

* Outside the planned bands (or partially outside) for RRC.

TABLE A.3.1-4

VHF System B1

Used in the following geographical areas:

EST, SVK

Channel	Channel boundaries (MHz)		Assigned frequency (MHz)	Vision carrier (MHz)	Sound carrier (MHz)	Dual FM second sound carrier (MHz)	NICAM carrier (MHz)
6	174	182	178.00	175.25	180.75	180.99	181.1
7	182	190	186.00	183.25	188.75	188.99	189.1
8	190	198	194.00	191.25	196.75	196.99	197.1
9	198	206	202.00	199.25	204.75	204.99	205.1
10	206	214	210.00	207.25	212.75	212.99	213.1
11	214	222	218.00	215.25	220.75	220.99	221.1
12	222	230	226.00	223.25	228.75	228.99	229.1

TABLE A.3.1-5

VHF System D

Used in the following geographical areas:

ARM, AZE, BLR, BUL, CZE, GEO, HNG, KAZ, KGZ, LTU, LVA, MDA, ROU, RUS, SVK, TJK, TKM, UKR, UZB

VHF System D1

Used in the following geographical areas:

LTU, LVA, POL

VHF System K1

Used in the following geographical areas:

BDI, BEN, BFA, CAF, COD, COG, COM, CPV, CTI, GAB, GUI, MDG, MYT, NGR, REU, SEN, TGO

Channel System K1	Channel Systems D and D1	Channel boundaries (MHz)		Assigned frequency (MHz)	Vision carrier (MHz)	Sound carrier (MHz)	NICAM carrier (MHz)
	6A*	173	181	177.00	174.25	180.75	180.10
5	6	174	182	178.00	175.25	181.75	181.10
6	7	182	190	186.00	183.25	189.75	189.10
7	8	190	198	194.00	191.25	197.75	197.10
8	9	198	206	202.00	199.25	205.75	205.10
9	10	206	214	210.00	207.25	213.75	213.10
10	11	214	222	218.00	215.25	221.75	221.10
11	12	222	230	226.00	223.25	229.75	229.10

* System D only.

TABLE A.3.1-6

VHF System I

Used in the following geographical areas:

AFS, AGL, ASC, BOT, G, GMB, IRL, LSO, MWI, NMB, SHN, TRC, TZA

Channel GE89	Channel ST61	Channel boundaries (MHz)		Assigned frequency (MHz)	Vision carrier (MHz)	Sound carrier (MHz)	NICAM carrier (MHz)
5	D	174	182	178.00	175.25	181.25	181.80
6	E	182	190	186.00	183.25	189.25	189.80
7	F	190	198	194.00	191.25	197.25	197.80
8	G	198	206	202.00	199.25	205.25	205.80
9	H	206	214	210.00	207.25	213.25	213.80
10	J	214	222	218.00	215.25	221.25	221.80
11	K	222	230	226.00	223.25	229.25	229.80
12*	-	230	238	234.00	231.25	237.25	237.80
13*	-	246.18	254.18	250.18	247.43	253.43	253.98

* Used in AFS, BOT, MWI, NMB only (outside the planned bands for RRC).

TABLE A.3.1-7

VHF System L

Used in the following geographical area:

F

Channel	Channel boundaries (MHz)		Assigned frequency (MHz)	Vision carrier (MHz)	Sound carrier (MHz)	NICAM carrier (MHz)
5	174.75	182.75	178.75	176.00	182.50	181.85
6	182.75	190.75	186.75	184.00	190.50	189.85
7	190.75	198.75	194.75	192.00	198.50	197.85
8	198.75	206.75	202.75	200.00	206.50	205.85
9	206.75	214.75	210.75	208.00	214.50	213.85
10	214.75	222.75	218.75	216.00	222.50	221.85

TABLE A.3.1-8

VHF System G

Used in the following geographical areas:

MOZ, SWZ, ZWE

Channel	Channel boundaries (MHz)		Assigned frequency (MHz)	Vision carrier (MHz)	Sound carrier (MHz)
5	174.00	182.00	178.00	175.25	180.75
6	182.00	190.00	186.00	183.25	188.75
7	190.00	198.00	194.00	191.25	196.75
8	198.00	206.00	202.00	199.25	204.75
9	206.00	214.00	210.00	207.25	212.75
10	214.00	222.00	218.00	215.25	220.75
11	222.00	230.00	226.00	223.25	228.75
12*	230.00	238.00	234.00	231.25	236.75
13*	246.18	254.18	250.18	247.43	252.93

* Used in MOZ and ZWE only (outside the planned bands for RRC).

TABLE A.3.1-9

UHF Systems D1, G, H, I, I1, K, K1 and L

Channel	Channel boundaries (MHz)		Vision carrier (MHz)	System G, H sound carrier (MHz)	System G dual FM second sound carrier (MHz)	System G System L System D1 NICAM carrier (MHz)	System I System I1 sound carrier (MHz)	System K System K1 System L System D1 sound carrier (MHz)	System I System I1 NICAM carrier (MHz)
21	470	478	471.25	476.75	476.99	477.1	477.25	477.75	477.8
22	478	486	479.25	484.75	484.99	485.1	485.25	485.75	485.8
23	486	494	487.25	492.75	492.99	493.1	493.25	493.75	493.8
24	494	502	495.25	500.75	500.99	501.1	501.25	501.75	501.8
25	502	510	503.25	508.75	508.99	509.1	509.25	509.75	509.8
26	510	518	511.25	516.75	516.99	517.1	517.25	517.75	517.8
27	518	526	519.25	524.75	524.99	525.1	525.25	525.75	525.8
28	526	534	527.25	532.75	532.99	533.1	533.25	533.75	533.8
29	534	542	535.25	540.75	540.99	541.1	541.25	541.75	541.8
30	542	550	543.25	548.75	548.99	549.1	549.25	549.75	549.8
31	550	558	551.25	556.75	556.99	557.1	557.25	557.75	557.8
32	558	566	559.25	564.75	564.99	565.1	565.25	565.75	565.8
33	566	574	567.25	572.75	572.99	573.1	573.25	573.75	573.8
34	574	582	575.25	580.75	580.99	581.1	581.25	581.75	581.8
35	582	590	583.25	588.75	588.99	589.1	589.25	589.75	589.8
36	590	598	591.25	596.75	596.99	597.1	597.25	597.75	597.8
37	598	606	599.25	604.75	604.99	605.1	605.25	605.75	605.8
38	606	614	607.25	612.75	612.99	613.1	613.25	613.75	613.8
39	614	622	615.25	620.75	620.99	621.1	621.25	621.75	621.8
40	622	630	623.25	628.75	628.99	629.1	629.25	629.75	629.8
41	630	638	631.25	636.75	636.99	637.1	637.25	637.75	637.8
42	638	646	639.25	644.75	644.99	645.1	645.25	645.75	645.8
43	646	654	647.25	652.75	652.99	653.1	653.25	653.75	653.8
44	654	662	655.25	660.75	660.99	661.1	661.25	661.75	661.8
45	662	670	663.25	668.75	668.99	669.1	669.25	669.75	669.8
46	670	678	671.25	676.75	676.99	677.1	677.25	677.75	677.8
47	678	686	679.25	684.75	684.99	685.1	685.25	685.75	685.8
48	686	694	687.25	692.75	692.99	693.1	693.25	693.75	693.8
49	694	702	695.25	700.75	700.99	701.1	701.25	701.75	701.8
50	702	710	703.25	708.75	708.99	709.1	709.25	709.75	709.8
51	710	718	711.25	716.75	716.99	717.1	717.25	717.75	717.8
52	718	726	719.25	724.75	724.99	725.1	725.25	725.75	725.8
53	726	734	727.25	732.75	732.99	733.1	733.25	733.75	733.8

TABLE A.3.1-9 (*end*)

Channel	Channel boundaries (MHz)		Vision carrier (MHz)	System G, H sound carrier (MHz)	System G dual FM second sound carrier (MHz)	System G System L System D1 NICAM carrier (MHz)	System I System I1 sound carrier (MHz)	System K System K1 System L System D1 sound carrier (MHz)	System I System I1 NICAM carrier (MHz)
54	734	742	735.25	740.75	740.99	741.1	741.25	741.75	741.8
55	742	750	743.25	748.75	748.99	749.1	749.25	749.75	749.8
56	750	758	751.25	756.75	756.99	757.1	757.25	757.75	757.8
57	758	766	759.25	764.75	764.99	765.1	765.25	765.75	765.8
58	766	774	767.25	772.75	772.99	773.1	773.25	773.75	773.8
59	774	782	775.25	780.75	780.99	781.1	781.25	781.75	781.8
60	782	790	783.25	788.75	788.99	789.1	789.25	789.75	789.8
61	790	798	791.25	796.75	796.99	797.1	797.25	797.75	797.8
62	798	806	799.25	804.75	804.99	805.1	805.25	805.75	805.8
63	806	814	807.25	812.75	812.99	813.1	813.25	813.75	813.8
64	814	822	815.25	820.75	820.99	821.1	821.25	821.75	821.8
65	822	830	823.25	828.75	828.99	829.1	829.25	829.75	829.8
66	830	838	831.25	836.75	836.99	837.1	837.25	837.75	837.8
67	838	846	839.25	844.75	844.99	845.1	845.25	845.75	845.8
68	846	854	847.25	852.75	852.99	853.1	853.25	853.75	853.8
69	854	862	855.25	860.75	860.99	861.1	861.25	861.75	861.8

TABLE A.3.1-10

T-DAB frequency blocks in Band III

T-DAB block number	Centre frequency (MHz)	Block bandwidth (MHz)	Lower guardband (kHz)	Upper guardband (kHz)	Frequency range* (MHz)
5A	174.928	174.160-175.696	–	176	174.0-181.0
5B	176.640	175.872-177.408	176	176	
5C	178.352	177.584-179.120	176	176	
5D	180.064	179.296-180.832	176	336	
6A	181.936	181.168-182.704	336	176	181.0-188.0
6B	183.648	182.880-184.416	176	176	
6C	185.360	184.592-186.128	176	176	
6D	187.072	186.304-187.840	176	320	
7A	188.928	188.160-189.696	320	176	188.0-195.0
7B	190.640	189.872-191.408	176	176	
7C	192.352	191.584-193.120	176	176	
7D	194.064	193.296-194.832	176	336	
8A	195.936	195.168-196.704	336	176	195.0-202.0
8B	197.648	196.880-198.416	176	176	
8C	199.360	198.592-200.128	176	176	
8D	201.072	200.304-201.840	176	320	
9A	202.928	202.160-203.696	320	176	202.0-209.0
9B	204.640	203.872-205.408	176	176	
9C	206.352	205.584-207.120	176	176	
9D	208.064	207.296-208.832	176	336	
10A	209.936	209.168-210.704	336	176	209.0-216.0
10B	211.648	210.880-212.416	176	176	
10C	213.360	212.592-214.128	176	176	
10D	215.072	214.304-215.840	176	320	
11A	216.928	216.160-217.696	320	176	216.0-223.0
11B	218.640	217.872-219.408	176	176	
11C	220.352	219.584-221.120	176	176	
11D	222.064	221.296-222.832	176	336	
12A	223.936	223.168-224.704	336	176	223.0-230.0
12B	225.648	224.880-226.416	176	176	
12C	227.360	226.592-228.128	176	176	
12D	229.072	228.304-229.840	176	–	

* The frequency ranges given are the channels for System B/PAL, which are 7 MHz wide. They have no other significance.

TABLE A.3.1-11

Overview of digital broadcast systems intended for or already in use in the Bands III, IV and V

(as of 16 September 2003)

Administration/geographical area symbol	Band III		Band IV/V
	Digital systems		
	Sound	Television	Digital television
AFS			
AGL			
ALB			
ALG	Not available	Not available*	DVB-T
AND			
AOE			
ARM			
ARS	Not available	Not available*	DVB-T
ASC			
AUT	T-DAB	DVB-T	DVB-T
AZE			
AZR			
BDI			
BEL	T-DAB	DVB-T	DVB-T
BEN			
BFA			
BHR	T-DAB	DVB-T	DVB-T
BIH			
BLR			
BOT	T-DAB	DVB-T	
BUL	T-DAB	DVB-T	DVB-T
CAF			
CME	T-DAB	DVB-T	DVB-T
CNR	T-DAB	DVB-T	DVB-T
COD			
COG			
COM			
CPV			
CTI			
CVA	T-DAB	DVB-T	DVB-T
CYP			
CZE	T-DAB	DVB-T	DVB-T
D	T-DAB	DVB-T	DVB-T
DJI	Not available	Not available*	DVB-T
DNK	T-DAB	DVB-T	DVB-T
E	T-DAB	DVB-T	DVB-T
EGY	Not available	Not available*	DVB-T
ERI			
EST	T-DAB	DVB-T	DVB-T
ETH			
F	T-DAB	DVB-T	DVB-T
FIN	T-DAB	DVB-T	DVB-T
FRO			
G	T-DAB	Not available	DVB-T
GAB			

TABLE A.3.1-11 (*continued*)

Administration/geographical area symbol	Band III Digital systems Sound	Band III Digital systems Television	Band IV/V Digital television
GEO			
GHA			
GIB			
GMB			
GNB			
GNE			
GRC	T-DAB	DVB-T	DVB-T
GUI			
HNG	T-DAB	DVB-T	DVB-T
HOL	T-DAB	DVB-T	DVB-T
HRV	T-DAB	DVB-T	DVB-T
I	T-DAB	DVB-T	DVB-T
IRL	T-DAB	DVB-T	DVB-T
IRN	Not available	Not available*	DVB-T
IRQ			
ISL			
ISR	T-DAB	DVB-T	DVB-T
JOR	Not available	Not available*	DVB-T
KAZ			
KEN			
KGZ			
KWT			
LBN			
LBR			
LBY			
LIE	T-DAB	DVB-T	DVB-T
LSO			
LTU	T-DAB	DVB-T	DVB-T
LUX			
LVA	T-DAB	DVB-T	DVB-T
MAU			
MCO			
MDA	T-DAB	DVB-T	DVB-T
MDG			
MDR			
MKD	T-DAB	DVB-T	DVB-T
MLI			
MLT			
MOZ			
MRC	Not available	DVB-T	DVB-T
MTN			
MWI			
MYT			
NGR			
NIG			
NMB			
NOR	T-DAB	DVB-T	DVB-T
OMA	T-DAB	DVB-T	DVB-T
POL	T-DAB	DVB-T	DVB-T
POR	T-DAB	DVB-T	DVB-T
PSE		DVB-T	DVB-T
QAT	Not available	Not available*	DVB-T
REU			

TABLE A.3.1-11 (*end*)

Administration/geographical area symbol	Band III		Band IV/V
	Digital systems		Digital television
	Sound	Television	
ROU	T-DAB	DVB-T	DVB-T
RRW			
RUS	T-DAB	DVB-T	DVB-T
S	T-DAB	DVB-T	DVB-T
SCG	T-DAB	DVB-T	DVB-T
SDN	Not available	Not available*	DVB-T
SEN	T-DAB	DVB-T	DVB-T
SEY			
SHN			
SMR	T-DAB	DVB-T	DVB-T
SOM			
SRL			
STP			
SUI	T-DAB	DVB-T	DVB-T
SVK	T-DAB	DVB-T	DVB-T
SVN	T-DAB	DVB-T	DVB-T
SWZ			
SYR	Not available	*	DVB-T
TCD			
TGO			
TJK			
TKM			
TRC			
TUN	–	*	DVB-T
TUR	T-DAB	DVB-T	DVB-T
TZA			
UAE	–	*	DVB-T
UGA			
UKR	T-DAB	DVB-T	DVB-T
UZB			
YEM	–	*	DVB-T
ZMB			
ZWE			

* DVB-T system will be introduced in VHF Band III in the very long-term future, after its successful implementation in the UHF Bands IV and V.

Information on television systems as notified by administrations with territories located in the planning area of RRC

A.3.1.1 Television systems

Recommendation ITU-R BT.470 contains detailed technical information on conventional television systems. Table A.3.1-12 contains the information on television systems as recorded in the master copies of the ST61 and GE89 Plans, which the Bureau maintains in accordance with the relevant provisions of the ST61 and GE89 Regional Agreements. Systems are grouped by geographical areas, which are located within or partly within the planning area of RRC.

The Table also lists the band of operation, the vision and colour systems, the nominal RF channel bandwidth, the class of emission of the vision component, the separation of the vision carrier frequency relative to the assigned frequency, the separation of the first sound carrier frequency relative to the vision carrier, and the line frequency.

Note that the power ratio of the vision carrier to the first sound carrier is not listed, although it is notified and recorded in the database, because such an inclusion would generate an unpractical, long list for all the different combinations of power ratios notified.

Administrations are encouraged to review and update, where necessary, the information as notified and recorded[1].

[1] It should also be noted that some administrations indicated their intention to change the television system in their countries, but did not formalize this intention by notifying modifications to the ST61 Plan or to the Master Register.

TABLE A.3.1-12[(1)]

Television systems recorded in the GE89 and ST61 Plans and in the Master Register

(as at September 2003)

Symbol	Designation	Band	Vision system	Colour system	TV channel bandwidth (kHz)	Class of emission	Assigned frequency relative to vision carrier frequency (MHz)	Sound carrier frequency relative to vision carrier frequency (MHz)	Line frequency (kHz)
AFS	South Africa (Republic of)	UHF	I		8 000	C3F--	2.75	5.9996	15.625
		UHF	I	PAL	8 000	C3F--	2.75	5.9996	15.625
		VHF	I		8 000	C3F--	2.75	5.9996	15.625
		VHF	I	PAL	8 000	C3F--	2.75	5.9996	15.625
AGL	Angola (Republic of)	UHF	I	PAL	8 000	C3F--	2.75	5.9996	15.625
		UHF	K1	PAL	8 000	C3F--	2.75	6.5	15.625
		VHF	I	PAL	8 000	C3F--	2.75	5.9996	15.625
ALB	Albania (Republic of)	UHF	G		8 000	C3F--	2.75	5.5	15.625
		VHF	B		7 000	C3F--	2.25	5.5	15.625
ALG	Algeria (People's Democratic Republic of)	UHF	G		8 000	C3F--	2.75	5.5	15.625
		UHF	G	PAL	8 000	C3F--	2.75	5.5	15.625
		VHF	B	PAL	7 000	C3F--	2.25	5.5	15.625
AND	Andorra (Principality of)	UHF	G		8 000	C3F--	2.75	5.5	15.625
		UHF	L		8 000	C3F--	2.75	6.5	15.625
		VHF	B		7 000	C3F--	2.25	5.5	15.625
AOE	Western Sahara	VHF	B	SECAM	7 000	C3F--	2.25	5.5	15.625
ARM	Armenia (Republic of)	UHF	K	SECAM	8 000	C3F--	2.75	6.5	15.625
		VHF	D		8 000	C3F--	2.75	6.5	15.625
		VHF	D	SECAM	8 000	C3F--	2.75	6.5	15.625
ARS	Saudi Arabia (Kingdom of) ***	UHF	G		8 000	C3F--	2.75	5.5	15.625
		UHF	G	SECAM	8 000	C3F--	2.75	5.5	15.625
		UHF	H		8 000	C3F--	2.75	5.5	15.625
		VHF	B		7 000	C3F--	2.25	5.5	15.625
		VHF	B	PAL	7 000	C3F--	2.25	5.5	15.625
		VHF	B	SECAM	7 000	C3F--	2.25	5.5	15.625
ASC	Ascension	UHF	I	PAL	8 000	C3F--	2.75	5.9996	15.625
		VHF	I	PAL	8 000	C3F--	2.75	5.9996	15.625
AUT	Austria	UHF	G		8 000	C3F--	2.75	5.5	15.625
		UHF	G	PAL	8 000	C3F--	2.75	5.5	15.625
		VHF	B		7 000	C3F--	2.25	5.5	15.625
		VHF	B	PAL	7 000	C3F--	2.25	5.5	15.625
AZE	Azerbaijani Republic	UHF	D	SECAM	8 000	C3F--	2.75	6.5	15.625
		UHF	K	SECAM	8 000	C3F--	2.75	6.5	15.625
		VHF	D		8 000	C3F--	2.75	6.5	15.625
		VHF	D	SECAM	8 000	C3F--	2.75	6.5	15.625
AZR	Azores	VHF	B	PAL	7 000	C3F--	2.25	5.5	15.625
		UHF	G	PAL	8 000	C3F	2.75	5.5	15.625
BDI	Burundi (Republic of)	UHF	K1	SECAM	8 000	C3F--	2.75	6.5	15.625
		VHF	K1	SECAM	8 000	C3F--	2.75	6.5	15.625
BEL	Belgium	UHF	G	PAL	8 000	C3F--	2.75	5.5	15.625
		UHF	H		8 000	C3F--	2.75	5.5	15.625
		VHF	B		7 000	C3F--	2.25	5.5	15.625
		VHF	B	PAL	7 000	C3F--	2.25	5.5	15.625

[(1)] This Table is for information only.

TABLE A.3.1-12 (*continued*)

Symbol	Designation	Band	Vision system	Colour system	TV channel bandwidth (kHz)	Class of emission	Assigned frequency relative to vision carrier frequency (MHz)	Sound carrier frequency relative to vision carrier frequency (MHz)	Line frequency (kHz)
BEN	Benin (Republic of)	UHF	K1	SECAM	8 000	C3F--	2.75	6.5	15.625
		VHF	K1	SECAM	8 000	C3F--	2.75	6.5	15.625
BFA	Burkina Faso	UHF	K1	SECAM	8 000	C3F--	2.75	6.5	15.625
		VHF	K1	SECAM	8 000	C3F--	2.75	6.5	15.625
BHR	Bahrain (State of)	UHF	G		8 000	C3F--	2.75	5.5	15.625
		UHF	G	PAL	8 000	C3F--	2.75	5.5	15.625
BIH	Bosnia and Herzegovina (Republic of)	UHF	G		8 000	C3F--	2.75	5.5	15.625
		UHF	G	PAL	8 000	C3F--	2.75	5.5	15.625
		VHF	B		7 000	C3F--	2.25	5.5	15.625
		VHF	B	PAL	7 000	C3F--	2.25	5.5	15.625
BLR	Belarus (Republic of)	UHF	K		8 000	C3F--	2.75	6.5	15.625
		UHF	K	SECAM	8 000	C3F--	2.75	6.5	15.625
		VHF	D	SECAM	8 000	C3F--	2.75	6.5	15.625
BOT	Botswana (Republic of)	UHF	I	PAL	8 000	C3F--	2.75	5.9996	15.625
		VHF	I	PAL	8 000	C3F--	2.75	5.9996	15.625
BUL	Bulgaria (Republic of)	UHF	K		8 000	C3F--	2.75	6.5	15.625
		UHF	K	PAL	8 000	C3F--	2.75	6.5	15.625
		UHF	K	SECAM	8 000	C3F--	2.75	6.5	15.625
		VHF	D		8 000	C3F--	2.75	6.5	15.625
		VHF	D	SECAM	8 000	C3F--	2.75	6.5	15.625
CAF	Central African Republic	UHF	K1	SECAM	8 000	C3F--	2.75	6.5	15.625
		VHF	K1	SECAM	8 000	C3F--	2.75	6.5	15.625
CME	Cameroon (Republic of)	UHF	G	PAL	8 000	C3F--	2.75	5.5	15.625
		VHF	B	PAL	7 000	C3F--	2.25	5.5	15.625
CNR	Canary Islands	UHF	G	PAL	8 000	C3F--	2.75	5.5	15.625
		UHF	T1**		8 000	X7FXF			
		VHF	B	PAL	7 000	C3F--	2.25	5.5	15.625
COD	Democratic Republic of the Congo	UHF	K1	SECAM	8 000	C3F--	2.75	6.5	15.625
		VHF	K1	SECAM	8 000	C3F--	2.75	6.5	15.625
COG	Congo (Republic of the)	UHF	K1	SECAM	8 000	C3F--	2.75	6.5	15.625
		VHF	K1		8 000	C3F--	2.75	6.5	15.625
		VHF	K1	SECAM	8 000	C3F--	2.75	6.5	15.625
COM	Comoros (Union of the)	UHF	K1	SECAM	8 000	C3F--	2.75	6.5	15.625
		VHF	K1	SECAM	8 000	C3F--	2.75	6.5	15.625
CPV	Cape Verde (Republic of)	UHF	K1	SECAM	8 000	C3F--	2.75	6.5	15.625
		VHF	K1	SECAM	8 000	C3F--	2.75	6.5	15.625
CTI	Côte d'Ivoire (Republic of)	UHF	K1	SECAM	8 000	C3F--	2.75	6.5	15.625
		VHF	K1		8 000	C3F--	2.75	6.5	15.625
		VHF	K1	SECAM	8 000	C3F--	2.75	6.5	15.625
CVA	Vatican City State	UHF	H		8 000	C3F--	2.75	5.5	15.625
		VHF	B		7 000	C3F--	2.25	5.5	15.625
CYP	Cyprus (Republic of)	UHF	G		8 000	C3F--	2.75	5.5	15.625
		UHF	G	PAL	8 000	C3F--	2.75	5.5	15.625
		UHF	H		8 000	C3F--	2.75	5.5	15.625
		VHF	B		7 000	C3F--	2.25	5.5	15.625
CZE	Czech Republic ***	UHF	K		8 000	C3F--	2.75	6.5	15.625
		VHF	D		8 000	C3F--	2.75	6.5	15.625

TABLE A.3.1-12 (*continued*)

Symbol	Designation	Band	Vision system	Colour system	TV channel bandwidth (kHz)	Class of emission	Assigned frequency relative to vision carrier frequency (MHz)	Sound carrier frequency relative to vision carrier frequency (MHz)	Line frequency (kHz)
D	Germany (Federal Republic of)	UHF	G		8 000	C3F--	2.75	5.5	15.625
		UHF	G	PAL	8 000	C3F--	2.75	5.5	15.625
		UHF	G	SECAM	8 000	C3F--	2.75	5.5	15.625
		UHF	I		8 000	C3F--	2.75	5.9996	15.625
		UHF	I	PAL	8 000	C3F--	2.75	5.9996	15.625
		UHF	M		6 000	C3F--	1.75	4.5	15.750
		VHF	B		7 000	C3F--	2.25	5.5	15.625
		VHF	B	PAL	7 000	C3F--	2.25	5.5	15.625
DJI	Djibouti (Republic of)	UHF	G	SECAM	8 000	C3F--	2.75	5.5	15.625
		VHF	B	SECAM	7 000	C3F--	2.25	5.5	15.625
DNK	Denmark	UHF	G		8 000	C3F--	2.75	5.5	15.625
		UHF	G	PAL	8 000	C3F--	2.75	5.5	15.625
		VHF	B		7 000	C3F--	2.25	5.5	15.625
		VHF	B	PAL	7 000	C3F--	2.25	5.5	15.625
E	Spain	UHF	G		8 000	C3F--	2.75	5.5	15.625
		UHF	G	PAL	8 000	C3F--	2.75	5.5	15.625
		UHF	T1**		8 000	X7FXF			
		VHF	B		7 000	C3F--	2.25	5.5	15.625
		VHF	B	PAL	7 000	C3F--	2.25	5.5	15.625
EGY	Egypt (Arab Republic of)	UHF	G	PAL	8 000	C3F--	2.75	5.5	15.625
		UHF	G	SECAM	8 000	C3F--	2.75	5.5	15.625
		VHF	B		7 000	C3F--	2.25	5.5	15.625
		VHF	B	PAL	7 000	C3F--	2.25	5.5	15.625
		VHF	B	SECAM	7 000	C3F--	2.25	5.5	15.625
ERI	Eritrea	UHF	G	PAL	8 000	C3F--	2.75	5.5	15.625
		VHF	B	PAL	7 000	C3F--	2.25	5.5	15.625
EST	Estonia (Republic of) ***	UHF	G	PAL	8 000	C3F--	2.75	5.5	15.625
		UHF	K		8 000	C3F--	2.75	6.5	15.625
		UHF	K	SECAM	8 000	C3F--	2.75	6.5	15.625
		VHF	B1	PAL	8 000	C3F--	2.75	5.5	15.625
		VHF	D		8 000	C3F--	2.75	6.5	15.625
ETH	Ethiopia (Federal Democratic Republic of)	UHF	G	PAL	8 000	C3F--	2.75	5.5	15.625
		VHF	B		7 000	C3F--	2.25	5.5	15.625
		VHF	B	PAL	7 000	C3F--	2.25	5.5	15.625
F	France	UHF	G		8 000	C3F--	2.75	5.5	15.625
		UHF	G	PAL	8 000	C3F--	2.75	5.5	15.625
		UHF	L		8 000	C3F--	2.75	6.5	15.625
		UHF	L	SECAM	8 000	C3F--	2.75	6.5	15.625
		VHF	L		8 000	C3F--	2.75	6.5	15.625
		VHF	L	SECAM	8 000	C3F--	2.75	6.5	15.625
FIN	Finland	UHF	G		8 000	C3F--	2.75	5.5	15.625
		UHF	G	PAL	8 000	C3F--	2.75	5.5	15.625
		VHF	B		7 000	C3F--	2.25	5.5	15.625
		VHF	B	PAL	7 000	C3F--	2.25	5.5	15.625
FRO	Faroe Islands	UHF	G	PAL	8 000	C3F--	2.75	5.5	15.625
G	United Kingdom of Great Britain and Northern Ireland	UHF	I		8 000	C3F--	2.75	5.9996	15.625
		UHF	I	PAL	8 000	C3F--	2.75	5.9996	15.625
		UHF	T1**		8 000	X7FXF			

TABLE A.3.1-12 (*continued*)

Symbol	Designation	Band	Vision system	Colour system	TV channel bandwidth (kHz)	Class of emission	Assigned frequency relative to vision carrier frequency (MHz)	Sound carrier frequency relative to vision carrier frequency (MHz)	Line frequency (kHz)
GAB	Gabonese Republic	UHF	G	PAL	8 000	C3F--	2.75	5.5	15.625
		UHF	K1	SECAM	8 000	C3F--	2.75	6.5	15.625
		VHF	K1		8 000	C3F--	2.75	6.5	15.625
		VHF	K1	SECAM	8 000	C3F--	2.75	6.5	15.625
GEO	Georgia	UHF	K	SECAM	8 000	C3F--	2.75	6.5	15.625
		VHF	D		8 000	C3F--	2.75	6.5	15.625
		VHF	D	SECAM	8 000	C3F--	2.75	6.5	15.625
GHA	Ghana	UHF	G	PAL	8 000	C3F--	2.75	5.5	15.625
		VHF	B	PAL	7 000	C3F--	2.25	5.5	15.625
GIB	Gibraltar	UHF	G		8 000	C3F--	2.75	5.5	15.625
		VHF	B		7 000	C3F--	2.25	5.5	15.625
GMB	Gambia (Republic of the)	UHF	I	PAL	8 000	C3F--	2.75	5.9996	15.625
		VHF	I	PAL	8 000	C3F--	2.75	5.9996	15.625
GNB	Guinea-Bissau (Republic of)	UHF	G	PAL	8 000	C3F--	2.75	5.5	15.625
		VHF	B	PAL	7 000	C3F--	2.25	5.5	15.625
GNE	Equatorial Guinea (Republic of)	UHF	G	PAL	8 000	C3F--	2.75	5.5	15.625
		VHF	B	PAL	7 000	C3F--	2.25	5.5	15.625
GRC	Greece ***	UHF	G		8 000	C3F--	2.75	5.5	15.625
		UHF	G	SECAM	8 000	C3F--	2.75	5.5	15.625
		UHF	H		8 000	C3F--	2.75	5.5	15.625
		VHF	B		7 000	C3F--	2.25	5.5	15.625
GUI	Guinea (Republic of)	UHF	K1	PAL	8 000	C3F--	2.75	6.5	15.625
		VHF	K1	PAL	8 000	C3F--	2.75	6.5	15.625
HNG	Hungary (Republic of)	UHF	G	PAL	8 000	C3F--	2.75	5.5	15.625
		UHF	K		8 000	C3F--	2.75	6.5	15.625
		UHF	K	PAL	8 000	C3F--	2.75	6.5	15.625
		VHF	D		8 000	C3F--	2.75	6.5	15.625
		VHF	D	PAL	8 000	C3F--	2.75	6.5	15.625
HOL	Netherlands (Kingdom of the) ***	UHF	G		8 000	C3F--	2.75	5.5	15.625
		UHF	G	PAL	8 000	C3F--	2.75	5.5	15.625
		UHF	M		6 000	C3F--	1.75	4.5	15.750
		VHF	B		7 000	C3F--	2.25	5.5	15.625
		VHF	B	PAL	7 000	C3F--	2.25	5.5	15.625
HRV	Croatia (Republic of)	UHF	G		8 000	C3F--	2.75	5.5	15.625
		UHF	G	PAL	8 000	C3F--	2.75	5.5	15.625
		VHF	B		7 000	C3F--	2.25	5.5	15.625
		VHF	B	PAL	7 000	C3F--	2.25	5.5	15.625
I	Italy ***	UHF	G		8 000	C3F--	2.75	5.5	15.625
		UHF	H		8 000	C3F--	2.75	5.5	15.625
		VHF	B		7 000	C3F--	2.25	5.5	15.625
IRL	Ireland	UHF	I		8 000	C3F--	2.75	5.9996	15.625
		UHF	I	PAL	8 000	C3F--	2.75	5.9996	15.625
		VHF	I		8 000	C3F--	2.75	5.9996	15.625
IRN	Iran (Islamic Republic of) ***	UHF	G	SECAM	8 000	C3F--	2.75	5.5	15.625
		VHF	B		7 000	C3F--	2.25	5.5	15.625
		VHF	B	SECAM	7 000	C3F--	2.25	5.5	15.625
IRQ	Iraq (Republic of)	UHF	G	SECAM	8 000	C3F--	2.75	5.5	15.625
		VHF	B		7 000	C3F--	2.25	5.5	15.625
		VHF	B	PAL	7 000	C3F--	2.25	5.5	15.625
		VHF	B	SECAM	7 000	C3F--	2.25	5.5	15.625

TABLE A.3.1-12 (*continued*)

Symbol	Designation	Band	Vision system	Colour system	TV channel bandwidth (kHz)	Class of emission	Assigned frequency relative to vision carrier frequency (MHz)	Sound carrier frequency relative to vision carrier frequency (MHz)	Line frequency (kHz)
ISL	Iceland	VHF	B		7 000	C3F--	2.25	5.5	15.625
ISR	Israel (State of)	UHF	G		8 000	C3F--	2.75	5.5	15.625
		UHF	G	PAL	8 000	C3F--	2.75	5.5	15.625
		VHF	B		7 000	C3F--	2.25	5.5	15.625
		VHF	B	PAL	7 000	C3F--	2.25	5.5	15.625
JOR	Jordan (Hashemite Kingdom of)	UHF	G		8 000	C3F--	2.75	5.5	15.625
		UHF	G	PAL	8 000	C3F--	2.75	5.5	15.625
		VHF	B		7 000	C3F--	2.25	5.5	15.625
		VHF	B	PAL	7 000	C3F--	2.25	5.5	15.625
KAZ	Kazakhstan (Republic of)	UHF	K	SECAM	8 000	C3F--	2.75	6.5	15.625
		VHF	D		8 000	C3F--	2.75	6.5	15.625
		VHF	D	SECAM	8 000	C3F--	2.75	6.5	15.625
KEN	Kenya (Republic of)	UHF	G	PAL	8 000	C3F--	2.75	5.5	15.625
		VHF	B	PAL	7 000	C3F--	2.25	5.5	15.625
KGZ	Kyrgyz Republic	UHF	K	SECAM	8 000	C3F--	2.75	6.5	15.625
		VHF	D		8 000	C3F--	2.75	6.5	15.625
		VHF	D	SECAM	8 000	C3F--	2.75	6.5	15.625
KWT	Kuwait (State of)	UHF	G	PAL	8 000	C3F--	2.75	5.5	15.625
		VHF	B	PAL	7 000	C3F--	2.25	5.5	15.625
LBN	Lebanon	UHF	G		8 000	C3F--	2.75	5.5	15.625
		VHF	B		7 000	C3F--	2.25	5.5	15.625
LBR	Liberia (Republic of)	UHF	G	PAL	8 000	C3F--	2.75	5.5	15.625
		VHF	B	PAL	7 000	C3F--	2.25	5.5	15.625
LBY	Libya (Socialist People's Libyan Arab Jamahiriya)	UHF	G		8 000	C3F--	2.75	5.5	15.625
		UHF	G	PAL	8 000	C3F--	2.75	5.5	15.625
		VHF	B		7 000	C3F--	2.25	5.5	15.625
		VHF	B	PAL	7 000	C3F--	2.25	5.5	15.625
LIE	Liechtenstein (Principality of)	UHF	G	PAL	8 000	C3F--	2.75	5.5	15.625
LSO	Lesotho (Kingdom of)	UHF	I	PAL	8 000	C3F--	2.75	5.9996	15.625
		VHF	I	PAL	8 000	C3F--	2.75	5.9996	15.625
LTU	Lithuania (Republic of) ***	UHF	K		8 000	C3F--	2.75	6.5	15.625
		UHF	K	PAL	8 000	C3F--	2.75	6.5	15.625
		UHF	K	SECAM	8 000	C3F--	2.75	6.5	15.625
		VHF	D		8 000	C3F--	2.75	6.5	15.625
		VHF	D	PAL	8 000	C3F--	2.75	6.5	15.625
		VHF	D	SECAM	8 000	C3F--	2.75	6.5	15.625
LUX	Luxembourg	UHF	G		8 000	C3F--	2.75	5.5	15.625
		UHF	G	PAL	8 000	C3F--	2.75	5.5	15.625
		VHF	B		7 000	C3F--	2.25	5.5	15.625
LVA	Latvia (Republic of)	UHF	K	PAL	8 000	C3F--	2.75	6.5	15.625
		VHF	D	PAL	8 000	C3F--	2.75	6.5	15.625
MAU	Mauritius (Republic of)	UHF	G	SECAM	8 000	C3F--	2.75	5.5	15.625
		VHF	B	SECAM	7 000	C3F--	2.25	5.5	15.625
MCO	Monaco (Principality of)	UHF	G		8 000	C3F--	2.75	5.5	15.625
		UHF	L		8 000	C3F--	2.75	6.5	15.625
MDA	Moldova (Republic of)	UHF	K		8 000	C3F--	2.75	6.5	15.625
		UHF	K	SECAM	8 000	C3F--	2.75	6.5	15.625
		VHF	D		8 000	C3F--	2.75	6.5	15.625
		VHF	D	SECAM	8 000	C3F--	2.75	6.5	15.625

TABLE A.3.1-12 (*continued*)

Symbol	Designation	Band	Vision system	Colour system	TV channel bandwidth (kHz)	Class of emission	Assigned frequency relative to vision carrier frequency (MHz)	Sound carrier frequency relative to vision carrier frequency (MHz)	Line frequency (kHz)
MDG	Madagascar (Republic of)	UHF	K1	SECAM	8 000	C3F--	2.75	6.5	15.625
		VHF	K1	SECAM	8 000	C3F--	2.75	6.5	15.625
MDR	Madeira	VHF	B	PAL	7 000	C3F--	2.25	5.5	15.625
		UHF	G	PAL	8 000	C3F--	2.75	5.5	15.625
MKD	The Former Yugoslav Republic of Macedonia	UHF	G		8 000	C3F--	2.75	5.5	15.625
		UHF	G	PAL	8 000	C3F--	2.75	5.5	15.625
		VHF	B		7 000	C3F--	2.25	5.5	15.625
		VHF	B	PAL	7 000	C3F--	2.25	5.5	15.625
MLI	Mali (Republic of)	UHF	G	SECAM	8 000	C3F--	2.75	5.5	15.625
		VHF	B	SECAM	7 000	C3F--	2.25	5.5	15.625
MLT	Malta	UHF	G		8 000	C3F--	2.75	5.5	15.625
		UHF	G	PAL	8 000	C3F--	2.75	5.5	15.625
		VHF	B		7 000	C3F--	2.25	5.5	15.625
MOZ	Mozambique (Republic of)	UHF	G	PAL	8 000	C3F--	2.75	5.5	15.625
		VHF	G	PAL	8 000	C3F--	2.75	5.5	15.625
MRC	Morocco (Kingdom of)	UHF	G	SECAM	8 000	C3F--	2.75	5.5	15.625
		UHF	K		8 000	C3F--	2.75	6.5	15.625
		VHF	B		7 000	C3F--	2.25	5.5	15.625
		VHF	B	SECAM	7 000	C3F--	2.25	5.5	15.625
		VHF	D		8 000	C3F--	2.75	6.5	15.625
MTN	Mauritania (Islamic Republic of)	UHF	G	SECAM	8 000	C3F--	2.75	5.5	15.625
		VHF	B	SECAM	7 000	C3F--	2.25	5.5	15.625
MWI	Malawi	UHF	I	PAL	8 000	C3F--	2.75	5.9996	15.625
		VHF	I	PAL	8 000	C3F--	2.75	5.9996	15.625
MYT	Mayotte (Territorial Collectivity of)	UHF	K1	SECAM	8 000	C3F--	2.75	6.5	15.625
		VHF	K1	SECAM	8 000	C3F--	2.75	6.5	15.625
NGR	Niger (Republic of the)	UHF	K1	SECAM	8 000	C3F--	2.75	6.5	15.625
		VHF	K1	SECAM	8 000	C3F--	2.75	6.5	15.625
NIG	Nigeria (Federal Republic of)	UHF	G	PAL	8 000	C3F--	2.75	5.5	15.625
		VHF	B	PAL	7 000	C3F--	2.25	5.5	15.625
NMB	Namibia (Republic of)	UHF	I	PAL	8 000	C3F--	2.75	5.9996	15.625
		VHF	I		8 000	C3F--	2.75	5.9996	15.625
		VHF	I	PAL	8 000	C3F--	2.75	5.9996	15.625
NOR	Norway	UHF	G		8 000	C3F--	2.75	5.5	15.625
		UHF	G	PAL	8 000	C3F--	2.75	5.5	15.625
		VHF	B		7 000	C3F--	2.25	5.5	15.625
		VHF	B	PAL	7 000	C3F--	2.25	5.5	15.625
OMA	Oman (Sultanate of)	UHF	G		8 000	C3F--	2.75	5.5	15.625
		UHF	G	PAL	8 000	C3F--	2.75	5.5	15.625
		VHF	B		7 000	C3F--	2.25	5.5	15.625
		VHF	B	PAL	7 000	C3F--	2.25	5.5	15.625
POL	Poland (Republic of)	UHF	K		8 000	C3F--	2.75	6.5	15.625
		UHF	K	PAL	8 000	C3F--	2.75	6.5	15.625
		UHF	K	SECAM	8 000	C3F--	2.75	6.5	15.625
		VHF	D*		8 000	C3F--	2.75	6.5	15.625
		VHF	D*	PAL	8 000	C3F--	2.75	6.5	15.625
		VHF	D*	SECAM	8 000	C3F--	2.75	6.5	15.625

TABLE A.3.1-12 (*continued*)

Symbol	Designation	Band	Vision system	Colour system	TV channel bandwidth (kHz)	Class of emission	Assigned frequency relative to vision carrier frequency (MHz)	Sound carrier frequency relative to vision carrier frequency (MHz)	Line frequency (kHz)
POR	Portugal	UHF	G		8 000	C3F--	2.75	5.5	15.625
		UHF	G	PAL	8 000	C3F--	2.75	5.5	15.625
		VHF	B		7 000	C3F--	2.25	5.5	15.625
QAT	Qatar (State of)	UHF	G		8 000	C3F--	2.75	5.5	15.625
		UHF	G	PAL	8 000	C3F--	2.75	5.5	15.625
		VHF	B	PAL	7 000	C3F--	2.25	5.5	15.625
REU	Reunion (French Department of)	UHF	K1	SECAM	8 000	C3F--	2.75	6.5	15.625
		VHF	K1	SECAM	8 000	C3F--	2.75	6.5	15.625
ROU	Romania	UHF	G	PAL	8 000	C3F--	2.75	5.5	15.625
		UHF	K		8 000	C3F--	2.75	6.5	15.625
		UHF	K	PAL	8 000	C3F--	2.75	6.5	15.625
		VHF	D		8 000	C3F--	2.75	6.5	15.625
		VHF	D	PAL	8 000	C3F--	2.75	6.5	15.625
RRW	Rwandese Republic	UHF	G	PAL	8 000	C3F--	2.75	5.5	15.625
		VHF	B	PAL	7 000	C3F--	2.25	5.5	15.625
RUS	Russian Federation	UHF	D	SECAM	8 000	C3F--	2.75	6.5	15.625
		UHF	K		8 000	C3F--	2.75	6.5	15.625
		UHF	K	SECAM	8 000	C3F--	2.75	6.5	15.625
		UHF	T1**		8 000	X7FXF			
		VHF	D		8 000	C3F--	2.75	6.5	15.625
		VHF	D	SECAM	8 000	C3F--	2.75	6.5	15.625
S	Sweden	UHF	G		8 000	C3F--	2.75	5.5	15.625
		UHF	G	PAL	8 000	C3F--	2.75	5.5	15.625
		VHF	B		7 000	C3F--	2.25	5.5	15.625
		VHF	B	PAL	7 000	C3F--	2.25	5.5	15.625
SCG	Serbia and Montenegro	UHF	G		8 000	C3F--	2.75	5.5	15.625
		UHF	G	PAL	8 000	C3F--	2.75	5.5	15.625
		VHF	B		7 000	C3F--	2.25	5.5	15.625
		VHF	B	PAL	7 000	C3F--	2.25	5.5	15.625
SDN	Sudan (Republic of the)	UHF	G	PAL	8 000	C3F--	2.75	5.5	15.625
		VHF	B		7 000	C3F--	2.25	5.5	15.625
		VHF	B	PAL	7 000	C3F--	2.25	5.5	15.625
SEN	Senegal (Republic of)	UHF	K1	SECAM	8 000	C3F--	2.75	6.5	15.625
		VHF	K1	SECAM	8 000	C3F--	2.75	6.5	15.625
SEY	Seychelles (Republic of)	VHF	B	PAL	7 000	C3F--	2.25	5.5	15.625
SHN	Saint Helena	UHF	I	PAL	8 000	C3F--	2.75	5.9996	15.625
		VHF	I	PAL	8 000	C3F--	2.75	5.9996	15.625
SMR	San Marino (Republic of)	UHF	G	PAL	8 000	C3F--	2.75	5.5	15.625
SOM	Somali Democratic Republic	UHF	G	PAL	8 000	C3F--	2.75	5.5	15.625
		VHF	B	PAL	7 000	C3F--	2.25	5.5	15.625
SRL	Sierra Leone	UHF	G	PAL	8 000	C3F--	2.75	5.5	15.625
		VHF	B	PAL	7 000	C3F--	2.25	5.5	15.625
STP	Sao Tome and Principe (Democratic Republic of)	UHF	G	PAL	8 000	C3F--	2.75	5.5	15.625
		VHF	B	PAL	7 000	C3F--	2.25	5.5	15.625

TABLE A.3.1-12 (*continued*)

Symbol	Designation	Band	Vision system	Colour system	TV channel bandwidth (kHz)	Class of emission	Assigned frequency relative to vision carrier frequency (MHz)	Sound carrier frequency relative to vision carrier frequency (MHz)	Line frequency (kHz)
SUI	Switzerland (Confederation of) ***	UHF	G		8 000	C3F--	2.75	5.5	15.625
		UHF	G		8 000	C3F--	2.75	5.5	15.625
		VHF	B		7 000	C3F--	2.25	5.5	15.625
		VHF	B	PAL	7 000	C3F--	2.25	5.5	15.625
SVK	Slovak Republic ***	UHF	G	PAL	8 000	C3F--	2.75	5.5	15.625
		UHF	K		8 000	C3F--	2.75	6.5	15.625
		UHF	K	PAL	8 000	C3F--	2.75	6.5	15.625
		VHF	D		8 000	C3F--	2.75	6.5	15.625
SVN	Slovenia (Republic of)	UHF	G		8 000	C3F--	2.75	5.5	15.625
		UHF	G	PAL	8 000	C3F--	2.75	5.5	15.625
		VHF	B		7 000	C3F--	2.25	5.5	15.625
		VHF	B	PAL	7 000	C3F--	2.25	5.5	15.625
SWZ	Swaziland (Kingdom of)	UHF	G		8 000	C3F--	2.75	5.5	15.625
		UHF	G	PAL	8 000	C3F--	2.75	5.5	15.625
		VHF	B		7 000	C3F--	2.25	5.5	15.625
		VHF	B	PAL	7 000	C3F--	2.25	5.5	15.625
		VHF	G	PAL	8 000	C3F--	2.75	5.5	15.625
		VHF	I	PAL	8 000	C3F--	2.75	5.9996	15.625
SYR	Syrian Arab Republic	UHF	G	PAL	8 000	C3F--	2.75	5.5	15.625
		UHF	H		8 000	C3F--	2.75	5.5	15.625
		VHF	B		7 000	C3F--	2.25	5.5	15.625
TCD	Chad (Republic of) ***	UHF	K1	SECAM	8 000	C3F--	2.75	6.5	15.625
		VHF	K1	SECAM	8 000	C3F--	2.75	6.5	15.625
TGO	Togolese Republic	UHF	K1	SECAM	8 000	C3F--	2.75	6.5	15.625
		VHF	K1	SECAM	8 000	C3F--	2.75	6.5	15.625
TJK	Tajikistan (Republic of)	UHF	K	SECAM	8 000	C3F--	2.75	6.5	15.625
		VHF	D		8 000	C3F--	2.75	6.5	15.625
		VHF	D	SECAM	8 000	C3F--	2.75	6.5	15.625
TKM	Turkmenistan	UHF	K	SECAM	8 000	C3F--	2.75	6.5	15.625
		VHF	D		8 000	C3F--	2.75	6.5	15.625
		VHF	D	SECAM	8 000	C3F--	2.75	6.5	15.625
TRC	Tristan da Cunha	UHF	I	PAL	8 000	C3F--	2.75	5.9996	15.625
		VHF	I	PAL	8 000	C3F--	2.75	5.9996	15.625
TUN	Tunisia ***	UHF	G		8 000	C3F--	2.75	5.5	15.625
		VHF	B		7 000	C3F--	2.25	5.5	15.625
TUR	Turkey	UHF	G		8 000	C3F--	2.75	5.5	15.625
		UHF	G	PAL	8 000	C3F--	2.75	5.5	15.625
		UHF	H		8 000	C3F--	2.75	5.5	15.625
		UHF	H	PAL	8 000	C3F--	2.75	5.5	15.625
		VHF	B		7 000	C3F--	2.25	5.5	15.625
		VHF	B	PAL	7 000	C3F--	2.25	5.5	15.625
TZA	Tanzania (United Republic of)	UHF	I	PAL	8 000	C3F--	2.75	5.9996	15.625
		UHF	K1	PAL	8 000	C3F--	2.75	6.5	15.625
		VHF	I	PAL	8 000	C3F--	2.75	5.9996	15.625
UAE	United Arab Emirates	UHF	G		8 000	C3F--	2.75	5.5	15.625
		UHF	G	PAL	8 000	C3F--	2.75	5.5	15.625
		VHF	B		7 000	C3F--	2.25	5.5	15.625
		VHF	B	PAL	7 000	C3F--	2.25	5.5	15.625

TABLE A.3.1-12 (*end*)

Symbol	Designation	Band	Vision system	Colour system	TV channel bandwidth (kHz)	Class of emission	Assigned frequency relative to vision carrier frequency (MHz)	Sound carrier frequency relative to vision carrier frequency (MHz)	Line frequency (kHz)
UGA	Uganda (Republic of)	UHF	G	PAL	8 000	C3F--	2.75	5.5	15.625
		UHF	K1	PAL	8 000	C3F--	2.75	6.5	15.625
		VHF	B	PAL	7 000	C3F--	2.25	5.5	15.625
UKR	Ukraine	UHF	K		8 000	C3F--	2.75	6.5	15.625
		UHF	K	SECAM	8 000	C3F--	2.75	6.5	15.625
		VHF	D		8 000	C3F--	2.75	6.5	15.625
		VHF	D	SECAM	8 000	C3F--	2.75	6.5	15.625
UZB	Uzbekistan (Republic of)	UHF	K	SECAM	8 000	C3F--	2.75	6.5	15.625
		VHF	D		8 000	C3F--	2.75	6.5	15.625
		VHF	D	SECAM	8 000	C3F--	2.75	6.5	15.625
YEM	Yemen (Republic of)	UHF	G	PAL	8 000	C3F--	2.75	5.5	15.625
		VHF	B	PAL	7 000	C3F--	2.25	5.5	15.625
ZMB	Zambia (Republic of)	UHF	G	PAL	8 000	C3F--	2.75	5.5	15.625
		VHF	B		7 000	C3F--	2.25	5.5	15.625
		VHF	B	PAL	7 000	C3F--	2.25	5.5	15.625
ZWE	Zimbabwe (Republic of)	UHF	G	PAL	8 000	C3F--	2.75	5.5	15.625
		VHF	B		7 000	C3F--	2.25	5.5	15.625
		VHF	G	PAL	8 000	C3F--	2.75	5.5	15.625

* The Administration of Poland has informed the Bureau that it intends to replace system D/K with system D1.

** T1 is used for an 8 MHz digital television system.

*** These administrations have indicated modifications to their information, as summarized below:

- Saudi Arabia (Kingdom of): replace SECAM by PAL
- Estonia (Republic of): delete UHF System K, UHF System K SECAM and VHF D
- Italy: add PAL
- Iran (Islamic Republic of): replace SECAM by PAL
- Lithuania (Republic of): replace SECAM by PAL
- Slovak Republic: delete UHF System K; add VHF System B1 PAL with sound carrier at 5.5 MHz
- Chad (Republic of): delete UHF System K1; replace VHF K1 by VHF System B with sound carrier at 5.5 MHz
- Tunisia: add PAL in UHF and VHF
- Czech Republic: add PAL in UHF and VHF
- Greece: delete UHF System G SECAM and UHF System H; add PAL in UHF and VHF
- Netherlands (Kingdom of the): delete UHF System G without colour system, UHF System M and VHF System B without colour system
- Switzerland (Confederation of): delete UHF System G and VHF System B, add T1, colour PAL to UHF System G
- Russian Federation: delete UHF D SECAM
- Senegal: add System B for VHF and UHF.

ANNEX 3.2

Future Band III sharing options

A.3.2.1 Option 1 – Single service usage of Band III

Single service usage of T-DAB or DVB-T throughout Band III leaves only sharing with analogue television to be considered during the transition period from analogue to digital transmission.

A.3.2.1.1 All T-DAB

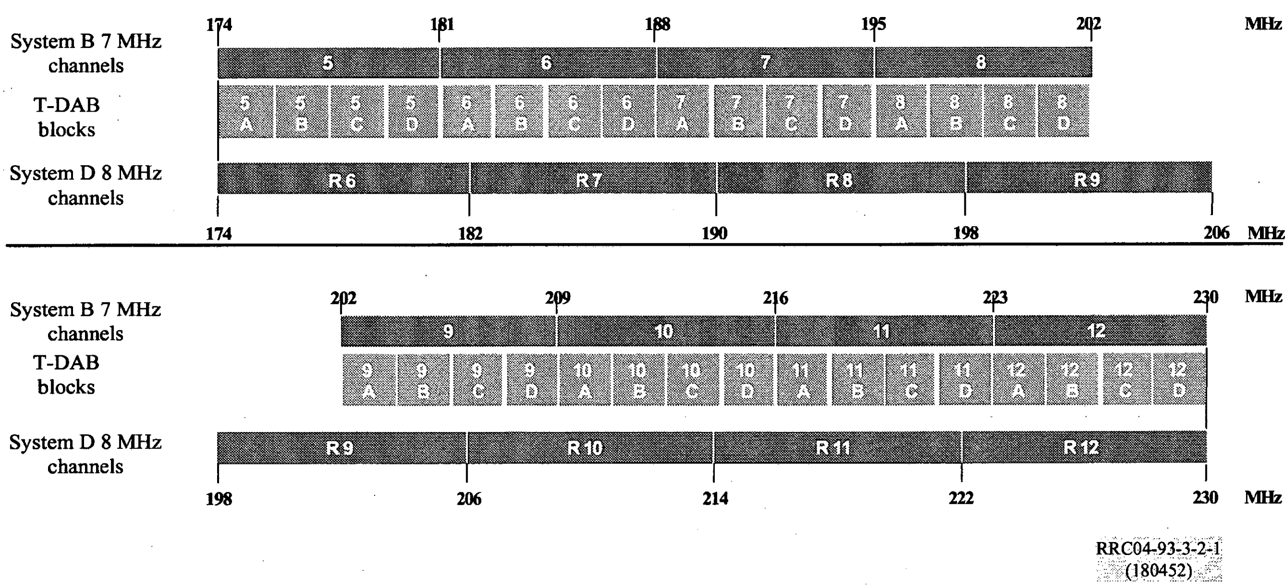
In this scenario, the maximum available spectrum (of 56 MHz) in Band III is divided into 32 T-DAB blocks, 5A, 5B, etc., through to 12D, identified by the System B channel number (5 to 12) and a T-DAB block letter (A to D), as shown in Fig. A.3.2-1.

A.3.2.1.2 All DVB-T

The 56 MHz of spectrum in Band III could be divided into seven 8 MHz or eight 7 MHz DVB-T channels (see Fig. A.3.2-1). This scenario excludes the use of Band III by T-DAB, and is not likely to be of interest in most European countries, as T-DAB is either planned or has been already implemented in this band. However, the all-DVB-T scenario may be of interest in other parts of the planning area.

FIGURE A.3.2-1

Relative positions of 7 MHz System B and 8 MHz System D television channel spacings with respect to T-DAB blocks



A.3.2.2 Option 2 – Partitioning of Band III

A.3.2.2.1 Partitioning of the band

Partitioning of the band means that Band III is split into two or more parts, each of which is designated for exclusive use by either T-DAB or DVB-T. The partitioning of Band III may differ from country to country according to the needs of each. It is likely that better spectral utilization would be achieved if groups of neighbouring countries used common band partitioning.

If a different channel raster is used in neighbouring countries, the partitioning scenarios will be complicated. This aspect is not considered in this chapter, as it will have to be dealt with through bilateral or multilateral agreements. Thus, only a limited set of television channel spacings is considered – System D (8 MHz) and System B (7 MHz) (see Fig. A.3.2-1).

In band partitioning, it is assumed that the T-DAB blocks are grouped in one or more television channels and not scattered throughout the band. The channel spacing of the television service influences how effectively multiple partitions can be implemented in Band III. Tables A.3.2-1 and A.3.2-2 give the most effective sharing possibilities for T-DAB, 8 MHz System D and 7 MHz System B.

A.3.2.2.1.1 Partitioning between T-DAB and the 8 MHz System D television channel spacing

For the 8 MHz System D television channels, examination of Fig. A.3.2-1 shows that the sharing possibilities in Table A.3.2-1 (assuming contiguous 8 MHz television channels and a contiguous allocation of channels to T-DAB) give good spectrum usage. As the T-DAB blocks are based on the System B 7 MHz channel spacing, they cannot always be in perfect alignment with any 8 MHz channel spacing. Therefore, only a limited range of options leads to effective spectrum usage, although in principle any number of television channels (between 0 and 7) could be used for T-DAB, and the remaining spectrum allocated to television.

TABLE A.3.2-1

Effective usage of Band III between T-DAB and 8 MHz System D television channels

Number of contiguous 8 MHz television channels allocated to T-DAB	Number of T-DAB blocks	Number of television channels
0	0	7
2	9	5
4	18	3
7	32	0

The allocation of two contiguous 8 MHz System D television channels to T-DAB leaves only five Band III television channels for DVB-T.

A.3.2.2.1.2 Partitioning between T-DAB and the 7 MHz System B television channel spacing

Table A.3.2-2 gives the sharing possibilities between T-DAB and television for the System B 7 MHz channel spacing. There is perfect alignment between the T-DAB blocks and the System B channel spacing throughout Band III. Therefore, a country using this channel spacing can designate any number of television channels (between 0 and 8) for T-DAB and use the remaining spectrum for television. Neither the channels containing the T-DAB blocks nor the channels used for television have to be contiguous, and Band III can be partitioned into two or more segments, each being used exclusively for either T-DAB or DVB-T.

TABLE A.3.2-2

Effective usage of Band III between T-DAB and 7 MHz System B television channels

Number of 7 MHz television channels allocated to T-DAB	Number of T-DAB blocks	Number of television channels
0	0	8
1	4	7
2	8	6
3	12	5
4	16	4
5	20	3
6	24	2
7	28	1
8	32	0

The situation for the 7 MHz System B television channels is somewhat better than in the 8 MHz case, as the allocation of two 7 MHz television channels to T-DAB leaves an additional channel for DVB-T.

A.3.2.3 Option 3 – Mixed T-DAB/DVB-T

In parts of Europe, it is likely that there will be extended areas in which several coverage layers of T-DAB and one DVB-T coverage will be in operation at the same time in Band III. It is likely that additional demand for T-DAB coverage will arise in the future. The individual requirements might differ dramatically, as might the constraints to be taken into account for each of them.

Partitioning the VHF spectrum to accommodate both services may no longer be a successful strategy in such circumstances. It may turn out that T-DAB blocks have to be accommodated in any VHF channel in order to minimize mutual interaction between services. The price to pay is a more complex sharing scenario than in the straightforward partitioning schemes described in § A.3.2.2.

In general, there will be overlapping areas in which co-spectrum usage is forbidden, and adjacent channel or block restrictions may also apply. Furthermore, the interference potential between two service areas depends on the services in operation.

The formation of coverage areas that combine to build several nationwide layers of coverage gives rise to two principle types of interference which can be labelled by the term "overlap". These two types of overlap are spectral overlap and geographical overlap.

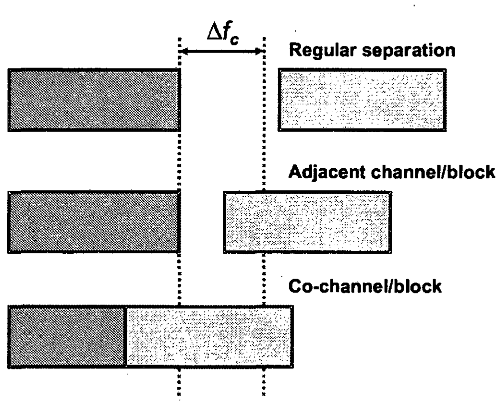
Spectral overlap is due to the different channel spacings currently used in the VHF range across Europe (see § 3.1). Contiguous coverage areas belonging to regions in which different channel spacings are used must fully take into account partially overlapping channels. This can occur, for example, in border areas.

The second type of overlap is overlap of geographical areas. This is inevitably linked to the existence of more than one nationwide coverage layer. In general, there will be different network providers both for T-DAB and for DVB-T. In addition, different layers of T-DAB coverage could be established by different network providers. Co-sited transmission of the signals cannot always be guaranteed in view of the probable involvement of different network providers. Therefore, it may be necessary to impose constraints on the frequency plan in order to avoid adjacent channel/block usage in overlapping areas.

The term "adjacent" needs some clarification in the context of two digital transmission systems employing different bandwidths. In a DVB-T/DVB-T sharing situation, adjacent means consecutive channels, for example channel 5 and channel 6. The term is applicable in a T-DAB-only context where the word "channels" is substituted by "blocks". However, when considering a T-DAB/DVB-T case, more care has to be taken. A reasonable approach that includes all possible cases is given by introducing a critical spectral distance by which two frequencies need to be separated if the corresponding coverage areas overlap. Figure A.3.2-2 sketches the definition of the critical spectral distance, Δf_C. It has to be noted that this definition of spectral overlap clearly can be applied to problems arising from different channel spacings as well.

FIGURE A.3.2-2

Definition of the critical spectral distance between two spectral blocks to be obeyed for overlapping coverage areas



Usually, the concept of a geographical separation distance for co-channel/block usage is employed as a first indicator to determine if interference beyond the acceptable limits is to be expected. Since the Wiesbaden 1995 Plan, the separation distance between two T-DAB allotment areas is fixed at 81 km for Band III for an all-land path. For the DVB-T/DVB-T interaction, no separation distance has been finally agreed. The same holds for the T-DAB/DVB-T case. If propagation paths above cold or warm sea have also to be taken into account, the geographic distance between two areas must be replaced by an effective distance appropriately defined to represent the impact of mixed paths.

However, previous experience shows that the simple approach of determining the mutual interference of two allotment areas based only on their separation distance does not lead to satisfying results in cases where particular topographic profiles have to be taken into account. The calculation of field strengths to be expected at properly chosen test points based on wave propagation models like Recommendation ITU-R P.1546-1 or terrain models might lead to a more refined image of the interference potential.

Sharing spectrum of Band III between T-DAB and DVB-T means the assignment of TV channels or T-DAB blocks to any area requiring them. This requires that many different types of constraint on the accessibility to spectrum be taken into account in practice.

Basically, there are three system-based interaction cases, namely T-DAB to T-DAB, DVB-T to DVB-T or the mixed interaction T-DAB to DVB-T. Due to the large number of system variants of DVB-T, these cases may require completely different mutual protection demands. In some cases, particularly in the transition period, the interactions between analogue television and T-DAB and DVB-T may also have to be considered.

The experience of previous frequency planning conferences demonstrates that last-minute changes could occur, and that flexible planning methods are needed. This rules out the application of highly sophisticated mathematical algorithms that are perfectly adapted to special sets of constraints.

A.3.2.4 Tabulated comparison of sharing options

Table A.3.2-3 shows a comparison of the three options described above.

TABLE A.3.2-3

Comparison of options for sharing of Band III

Sharing options in Band III	Option 1	Option 2	Option 3
Method	Single-service usage of T-DAB or DVB-T throughout a whole region	Partitioning of Band III for use by both T-DAB and DVB-T services	Mixed T-DAB/DVB-T
T-DAB blocks grouping	Required	Required	Not required
Efficient spectrum use	Not very satisfactory overall	– Frequency efficiency can be achieved if groups of neighbouring countries use common band partitioning – In some cases, only a limited number of television channel spacings can be considered – The channel spacing used by the television service influences how effectively multiple partitions can be implemented	The most efficient
Ease of sharing	Very easy	Not easy – complicated if different channel spacings are used by neighbouring countries	Complicated – requires the use of sophisticated planning methods
Coordination with neighbouring countries after the conference (Article 4)	Business as usual	Will be laborious in many cases, where different services and channel spacings are used by neighbouring countries	Will be laborious and complicated
Flexibility	None	Very restricted	Most flexible
Comments	The exclusive use of DVB-T in Band III is not of interest for Europe since T-DAB is already planned or has been already implemented in this band in most European countries		There will be overlapping areas in which co-spectrum usage is forbidden and where adjacent channel or block channel restrictions may also apply

ANNEX 3.3

Mobile reception

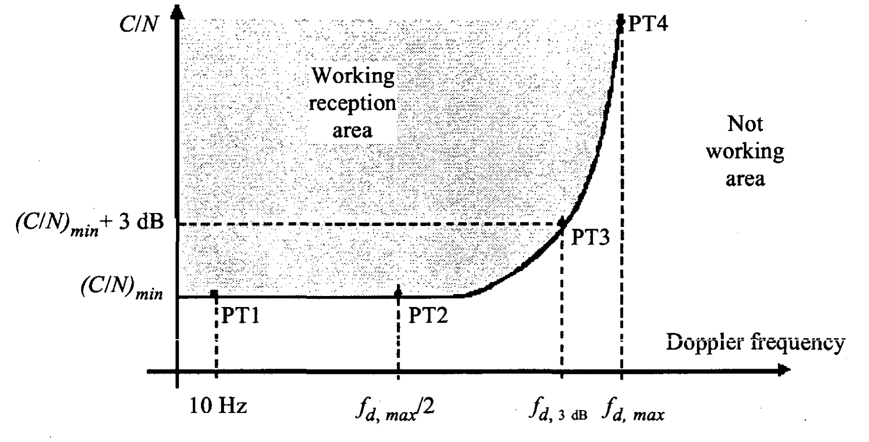
In general, the required C/N over a mobile channel is defined as the average C/N over a sufficiently long time to obtain a stable value, and a sufficiently short time to avoid any influence of shadow fading. This means that fast fading signal variations are included in the C/N values given but not the shadow (log-normal) fading.

For OFDM systems (T-DAB and DVB-T), and for a given mode and a given channel profile, the required C/N for a certain quality level is a function of Doppler frequency only, and a curve like the one presented in Fig. A.3.3-1 can be drawn. Similar receiver behaviour can also be observed for T-DAB.

The curve is characterized by a C/N floor, C/N_{min}, which gives information about the minimum signal requirement for good reception when in motion. For low speeds, the required C/N value is relatively independent of the specific Doppler frequency. However, the slope of the C/N curve at low Doppler (between points PT1 and PT2 in Fig. A.3.3-1) varies, in the case of DVB-T with the DVB-T variants used and the quality of service requirements. For higher speeds (or Doppler frequencies) the required C/N value increases gradually until a maximum acceptable Doppler frequency is reached.

FIGURE A.3.3-1

DVB-T receiver behaviour in a mobile propagation channel



$f_{d,\,max}/2$, $f_{d,\,3\,dB}$, $f_{d,\,max}$ represent the values of Doppler frequency for 10 Hz, half of the maximum Doppler frequency, the Doppler frequency for C/N_{min} + 3 dB and the maximum Doppler frequency. PT1, PT2, PT3 and PT4 are the corresponding points of C/N for different Doppler frequency values

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To characterize the C/N versus Doppler curve in a given DVB-T variant, using a given channel profile, four measurement points are used:

– PT1: C/N at very low Doppler frequency (for example 10 Hz);
– PT2: C/N_{min} which characterizes the noise floor acceptable by the mobile receiver;
– PT3: C/N_{min} + 3 dB which gives an indication of the speed limit;
– PT4: maximum Doppler limit which characterizes the maximum speed when no noise is added. This corresponds to an infinite C/N loss.

As the impairments occurring in the mobile environment are related to the Doppler characteristics of the propagation channel, and because the "Doppler distortion" evolves proportionally both with the speed of the vehicle and the signal centre-frequency, the RF channel used to deliver a digital service to mobiles is of major importance for the service reception performance. Better performance is obtained when lower frequencies are used, whilst worse performance will occur when higher frequencies are used.

Values for DVB-T mobile reception are given in Tables A.3.3-1 and A.3.3-2 for the typical channel profile – Typical urban. Table A.3.3-1 shows values for the minimum C/N ratio and the speed limits (corresponding to a Doppler frequency for a C/N equal to C/N_{min} + 3 dB) in the non-diversity case. Table A.3.3-2 contains the corresponding values for the antenna diversity case. The speed limits are given for three frequencies (200 MHz, 500 MHz and 800 MHz).

The figures apply to the case of single transmitter coverage. Simulations show that in the SFN case, where large echo delays reduce the probability of flat fading, smaller values for C/N are needed. Improvements may be achieved with receivers particularly designed for mobile reception.

The figures for C/N as well as for the Doppler frequencies are to be considered as preliminary.

In the absence of these values for DVB-T, Tables A.3.3-1 and A.3.3-2 provide the values in use in the CEPT countries.

Higher code rates than 1/2 and 2/3 are less suitable for mobile reception. The usage of 64-QAM modulation will be power limited due to the very high C/N requirement in the non-diversity case.

The values for the bit rate correspond to the shortest guard interval of 1/32, which is the least critical case in terms of Doppler; with a 1/4 guard interval, about 85% of this performance is to be expected. In SFN networks, a shorter guard interval may increase the risk of self-interference.

It can be seen from Tables A.3.3-1 and A.3.3-2 that lower frequencies allow for a higher speed of the vehicle and also that 2k variants allow for higher speed than 8k variants. For UHF, the lower part of the band is better suited for mobile reception.

TABLE A.3.3-1

***C/N*, speed limits for mobile reception with the "Typical urban" profile for the antenna non-diversity case**

Guard interval = 1/32			**2k**			**Speed at f_d, 3 dB (km/h)**			**8k**			**Speed at f_d, 3 dB (km/h)**		
Modulation	**Bit rate (Mbit/s)**	**Code rate**	**C/N_{min} (dB)**	**$f_{d,\,max}$ (Hz)**	**f_d @ C/N_{min} + 3 dB**	**200 MHz**	**500 MHz**	**800 MHz**	**C/N_{min} (dB)**	**$f_{d,\,max}$ (Hz)**	**f_d @ C/N_{min} + 3 dB**	**200 MHz**	**500 MHz**	**800 MHz**
QPSK	6.03	1/2	13.0	318	259	1398	559	349	13.0	76	65	349	140	87
QPSK	8.04	2/3	16.0	247	224	1207	483	302	16.0	65	53	286	114	71
16-QAM	12.06	1/2	18.5	224	182	985	394	246	18.5	59	47	254	102	64
16-QAM	16.09	2/3	21.5	176	147	794	318	199	21.5	41	35	191	76	48
64-QAM	18.10	1/2	23.5	141	118	635	254	159	23.5	35	29	159	64	40
64-QAM	24.13	2/3	27.0	82	65	349	140	87	27.0	24	18	95	38	24

TABLE A.3.3-2

***C/N*, speed limits for mobile reception with the "Typical urban" profile for the antenna diversity case**

Guard interval = 1/32			**2k**			**Speed at f_d, 3 dB (km/h)**			**8k**			**Speed at f_d, 3 dB (km/h)**		
Modulation	**Bit rate (Mbit/s)**	**Code rate**	**C/N_{min} (dB)**	**$f_{d,\,max}$ (Hz)**	**f_d @ C/N_{min} + 3 dB**	**200 MHz**	**500 MHz**	**800 MHz**	**C/N_{min} (dB)**	**$f_{d,\,max}$ (Hz)**	**f_d @ C/N_{min} + 3 dB**	**200 MHz**	**500 MHz**	**800 MHz**
QPSK	6.03	1/2	7.0	560	518	2795	1118	699	7.0	140	129	699	280	175
QPSK	8.04	2/3	10.0	494	447	2414	966	604	10.0	129	106	572	229	143
16-QAM	12.06	1/2	12.5	447	365	1969	788	492	12.5	118	94	508	203	127
16-QAM	16.09	2/3	15.5	353	294	1588	635	397	15.5	82	71	381	152	95
64-QAM	18.10	1/2	17.5	282	235	1271	508	318	17.5	71	59	318	127	79
64-QAM	24.13	2/3	21.0	165	129	699	280	175	21.0	47	35	191	76	48

ANNEX 3.4
C/N values for hierarchical transmissions

TABLE A.3.4-1

Required C/N for hierarchical transmission to achieve a BER = 2×10^{-4} after Viterbi decoding and net bit rate (Mbit/s)

			Required C/N for BER = 2×10^{-4} after Viterbi (quasi error-free after Reed-Solomon)			**Net bit rate (Mbit/s) For different guard intervals (GI)**			
Modulation	**Code rate**	**α[(1)]**	**Gaussian channel**	**Ricean channel (F_1)**	**Rayleigh channel (P_1)**	**GI = 1/4**	**GI = 1/8**	**GI = 1/16**	**GI = 1/32**
8 MHz variants									
QPSK in non-uniform 16-QAM	1/2		4.8	5.4	6.9	4.98	5.53	5.85	6.03
	2/3		7.1	7.7	9.8	6.64	7.37	7.81	8.04
	3/4		8.4	9.0	11.8	7.46	8.29	8.78	9.05
		2				+			
	1/2		13.0	13.3	14.9	4.98	5.53	5.85	6.03
	2/3		15.1	15.3	17.9	6.64	7.37	7.81	8.04
	3/4		16.3	16.9	20.0	7.46	8.29	8.78	9.05
	5/6		16.9	17.8	22.4	8.29	9.22	9.76	10.05
	7/8		17.9	18.7	24.1	8.71	9.68	10.25	10.56
QPSK in non-uniform 16-QAM	1/2		3.8	4.4	6.0	4.98	5.53	5.85	6.03
	2/3		5.9	6.6	8.6	6.64	7.37	7.81	8.04
	3/4		7.1	7.9	10.7	7.46	8.29	8.78	9.05
		4				+			
	1/2		17.3	17.8	19.6	4.98	5.53	5.85	6.03
	2/3		19.1	19.6	22.3	6.64	7.37	7.81	8.04
	3/4		20.1	20.8	24.2	7.46	8.29	8.78	9.05
	5/6		21.1	22.0	26.0	8.29	9.22	9.76	10.05
	7/8		21.9	22.8	28.5	8.71	9.68	10.25	10.56
7 MHz variants									
QPSK in non-uniform 16-QAM	1/2		4.8	5.4	6.9	4.35	4.84	5.12	5.28
	2/3		7.1	7.7	9.8	5.81	6.45	6.83	7.04
	3/4		8.4	9.0	11.8	6.53	7.26	7.68	7.92
		2				+			
	1/2		13.0	13.3	14.9	4.35	4.84	5.12	5.28
	2/3		15.1	15.3	17.9	5.81	6.45	6.83	7.04
	3/4		16.3	16.9	20.0	6.53	7.26	7.68	7.92
	5/6		16.9	17.8	22.4	7.26	8.06	8.54	8.80
	7/8		17.9	18.7	24.1	7.62	8.47	8.97	9.24
QPSK in non-uniform 16-QAM	1/2		3.8	4.4	6.0	4.35	4.84	5.12	5.28
	2/3		5.9	6.6	8.6	5.81	6.45	6.83	7.04
	3/4		7.1	7.9	10.7	6.53	7.26	7.68	7.92
		4				+			
	1/2		17.3	17.8	19.6	4.35	4.84	5.12	5.28
	2/3		19.1	19.6	22.3	5.81	6.45	6.83	7.04
	3/4		20.1	20.8	24.2	6.53	7.26	7.68	7.92
	5/6		21.1	22.0	26.0	7.26	8.06	8.54	8.80
	7/8		21.9	22.8	28.5	7.62	8.47	8.97	9.24

(1) α: Value corresponding to constellation diagrams used in hierarchical transmission.

TABLE A.3.4-2

Required C/N for hierarchical transmission to achieve a BER = 2×10^{-4} after Viterbi decoding. Results for QPSK in non-uniform 64-QAM with $\alpha = 4$ is not included due to the poor performance of the 64-QAM signal

			Required C/N for BER = 2×10^{-4} after Viterbi (quasi error-free after Reed-Solomon)			Net bit rate (Mbit/s) For different guard intervals (GI)			
Modulation	**Code rate**	α[1]	**Gaussian channel**	**Ricean channel (F_1)**	**Rayleigh channel (P_1)**	**GI = 1/4**	**GI = 1/8**	**GI = 1/16**	**GI = 1/32**
8 MHz variants									
QPSK in uniform 64-QAM	1/2	1	8.9	9.5	11.4	4.98	5.53	5.85	6.03
	2/3		12.1	12.7	14.8	6.64	7.37	7.81	8.04
	3/4		13.7	14.3	17.5	7.46	8.29	8.78	9.05
	1/2		14.6	14.9	16.4	9.95	11.06	11.71	12.06
	2/3		16.9	17.6	19.4	13.27	14.75	15.61	16.09
	3/4		18.6	19.1	22.2	14.93	16.59	17.56	18.10
	5/6		20.1	20.8	25.8	16.59	18.43	19.52	20.11
	7/8		21.1	22.2	27.6	17.42	19.35	20.49	21.11
QPSK in non-uniform 64-QAM	1/2	2	6.5	7.1	8.7	4.98	5.53	5.85	6.03
	2/3		9.0	9.9	11.7	6.64	7.37	7.81	8.04
	3/4		10.8	11.5	14.5	7.46	8.29	8.78	9.05
	1/2		16.3	16.7	18.2	9.95	11.06	11.71	12.06
	2/3		18.9	19.5	21.7	13.27	14.75	15.61	16.09
	3/4		21.0	21.6	24.5	14.93	16.59	17.56	18.10
	5/6		21.9	22.7	27.3	16.59	18.43	19.52	20.11
	7/8		22.9	23.8	29.6	17.42	19.35	20.49	21.11
7 MHz variants									
QPSK in uniform 64-QAM	1/2	1	8.9	9.5	11.4	4.35	4.84	5.12	5.28
	2/3		12.1	12.7	14.8	5.81	6.45	6.83	7.04
	3/4		13.7	14.3	17.5	6.53	7.26	7.68	7.92
	1/2		14.6	14.9	16.4	8.71	9.68	10.25	10.56
	2/3		16.9	17.6	19.4	11.61	12.90	13.66	14.08
	3/4		18.6	19.1	22.2	13.06	14.52	15.37	15.83
	5/6		20.1	20.8	25.8	14.52	16.13	17.08	17.59
	7/8		21.1	22.2	27.6	15.24	16.93	17.93	18.47
QPSK in non-uniform 64-QAM	1/2	2	6.5	7.1	8.7	4.35	4.84	5.12	5.28
	2/3		9.0	9.9	11.7	5.81	6.45	6.83	7.04
	3/4		10.8	11.5	14.5	6.53	7.26	7.68	7.92
	1/2		16.3	16.7	18.2	8.71	9.68	10.25	10.56
	2/3		18.9	19.5	21.7	11.61	12.90	13.66	14.08
	3/4		21.0	21.6	24.5	13.06	14.52	15.37	15.83
	5/6		21.9	22.7	27.3	14.52	16.13	17.08	17.59
	7/8		22.9	23.8	29.6	15.24	16.93	17.93	18.47

[1] α: Value corresponding to constellation diagrams used in hierarchical transmission.

ANNEX 3.5

Illustration of minimum median power flux-density and minimum median field strength for digital terrestrial television broadcasting (DVB-T) and digital terrestrial sound broadcasting (T-DAB)

A.3.5.1 Calculation of minimum signal levels for digital terrestrial broadcasting

The minimum signal levels to overcome receiver noise are given by the minimum receiver input power and the corresponding minimum equivalent receiver input voltage, assuming a receiver noise figure of 7 dB. No account is taken of any location variation effects. However, it is necessary to take account of these effects when considering television reception in a practical environment.

In defining coverage it is indicated that due to the very rapid transition from near perfect to no reception at all, it is necessary that the minimum required signal level is achieved at a high percentage of locations. This defines the "quality" of the coverage.

The minimum median power-flux densities for DVB-T are calculated for:

- 8 MHz channels. For 7 MHz channels, 0.6 dB should be subtracted from the relevant results given in Tables A.3.5-1 to A.3.5-12;
- three different receiving conditions:
  - fixed reception;
  - portable reception:
    - portable outdoor reception;
    - portable indoor reception at ground floor;
  - mobile;
- three frequencies representing Band III, Band IV and Band V:
  - 200 MHz;
  - 500 MHz;
  - 800 MHz;
- representative C/N ratios.

The minimum median power-flux densities for T-DAB (Table A.3.5-13) are calculated for:

- bandwidth of 1.536 MHz;
- two different receiving conditions:
  - portable indoor reception;
  - mobile;
- frequency of 200 MHz representing Band III;
- representative C/N ratio of 15 dB.

Representative C/N values are used for these examples. Results for any chosen system and system variant may be obtained by interpolation between relevant representative values.

All minimum median field-strength values presented in this Chapter are for coverage by a single transmitter only, not for single frequency networks.

To calculate the minimum median power flux-density and the minimum median field strength needed to ensure that the minimum values of signal level can be achieved at the required percentage of locations, the following formulas are used:

$$P_n = F + 10 \log_{10} (k\, T_0\, B)$$

$$P_{s\,min} = C/N + P_n$$

$$A_a = G_D + 10 \log_{10} (1.64 \cdot \lambda^2/4\pi)$$

$$\varphi_{min} = P_{s\,min} - A_a + L_f \quad \text{for fixed reception}$$

$$\varphi_{min} = P_{s\,min} - A_a \quad \text{for portable/mobile reception}$$

$$E_{min} = \varphi_{min} + 120 + 10 \log_{10} (120\pi) = \varphi_{min} + 145.8$$

$$\varphi_{med} = \varphi_{min} + P_{mmn} + C_l \quad \text{for fixed reception}$$

$$\varphi_{med} = \varphi_{min} + P_{mmn} + C_l + L_h \quad \text{for outdoor portable/mobile reception}$$

$$\varphi_{med} = \varphi_{min} + P_{mmn} + C_l + L_h + L_b \quad \text{for indoor reception}$$

$$E_{med} = \varphi_{med} + 120 + 10 \log_{10} (120\pi) = \varphi_{med} + 145.8$$

where:

A_a: effective antenna aperture (dBm^2)
C/N: RF signal-to-noise ratio required by the system (dB)
C_l: location correction factor (dB)
E_{med}: minimum median field strength, planning value (dB(μV/m))
E_{min}: minimum field strength at receiving place (dB(μV/m))
G_D: antenna gain relative to half-wave dipole (dB)
L_b: building penetration loss (dB)
L_f: feeder loss (dB)
L_h: height loss (between 10 m and 1.5 m above ground level) (dB)
P_{mmn}: allowance for man-made noise (dB)
φ_{min}: minimum power flux-density at receiving location ($dB(W/m^2)$)
φ_{med}: minimum median power flux-density, planning value ($dB(W/m^2)$)
λ: wavelength (m)
P_n: receiver noise input power (dBW)

F: receiver noise figure (dB)

k: Boltzmann's constant ($k = 1.38 \times 10^{-23}$) J/K

T_0: absolute temperature ($T_0 = 290$ K)

B: receiver noise bandwidth (6.66×10^6 Hz for a 7 MHz channel, 7.61×10^6 Hz for a 8 MHz channel and 1.54×10^6 Hz for T-DAB)

$P_{s\,min}$: minimum receiver signal input power (dBW).

Additionally, the following formula is presented, for information only:

$$U_{s\,min} = P_{s\,min} + 120 + 10 \log_{10} R$$

$U_{s\,min}$: minimum equivalent receiver input voltage, for 75 Ω (dBμV)

R: input impedance of receiver ($R = 75$ Ω).

For calculating the location correction factor C_l (see definition in Chapter 1), a log-normal distribution of the received signal is assumed. It should be noted that this standard deviation only relates to location statistics and the inherent inaccuracies of the propagation prediction method are not taken into account. The location correction factor will need to be re-assessed as more information becomes available.

The location correction factor can be calculated by the formula:

$$C_l = \mu \cdot \sigma$$

where:

μ: distribution factor, being 0.52 for 70%, 1.64 for 95% and 2.32 for 99%

σ: standard deviation, taken as 5.5 dB for outdoor reception.

Other appropriate values of σ are used in the case of indoor reception.

The tables below give the minimum median power flux-density and the minimum median field strength for 70% and 95% of location probability in Bands III, IV and V, as well as for 99% of location probability in the case of mobile reception in Bands III, IV and V only. These values are related to the minimum power flux-density and minimum field strength at the receiving location. For Band III, an allowance for man-made noise has been included.

A.3.5.2 Digital terrestrial television broadcasting (DVB-T)

The results for the different DVB-T antenna reception modes are given in Tables A.3.5-1 to A.3.5-12.

TABLE A.3.5-1

Minimum median power flux-density and minimum median field strength in Band III for 70% and 95% location probability, fixed reception

Receiving condition: fixed, Band III

Frequency	f (MHz)	200				
Minimum C/N required by system	**(dB)**	**2**	**8**	**14**	**20**	**26**
Minimum receiver signal input power	$P_{s\,min}$ (dBW)	−126.2	−120.2	−114.2	−108.2	−102.2
Minimum equivalent receiver input voltage, 75 Ω	$U_{s\,min}$ (dBμV)	12.6	18.6	24.6	30.4	36.6
Feeder loss	L_f (dB)	2				
Antenna gain relative to half wave dipole	G_D (dB)	7				
Effective antenna aperture	A_a (dBm^2)	1.7				
Minimum power flux-density at receiving location	φ_{min} (dB(W/m^2))	−125.9	−119.9	−113.9	−107.9	−101.9
Minimum field strength at receiving location	E_{min} (dB(μV/m))	20	26	32	38	44
Allowance for man-made noise	P_{mmn} (dB)	2				

Location probability: 70%

Location correction factor	C_l (dB)	3				
Minimum median power flux-density at 10 m a.g.l. 50% of time and 50% of locations	φ_{med} (dB(W/m^2))	−121	−115	−109	−103	−97
Minimum median field strength at 10 m a.g.l. 50% of time and 50% of locations	E_{med} (dB(μV/m))	25	31	37	43	49

Location probability: 95%

Location correction factor	C_l (dB)	9				
Minimum median power flux-density at 10 m a.g.l. 50% of time and 50% of locations	φ_{med} (dB(W/m^2))	−115	−109	−103	−97	−91
Minimum median field strength at 10 m a.g.l. 50% of time and 50% of locations	E_{med} (dB(μV/m))	31	37	43	49	55

a.g.l.: above ground level.

TABLE A.3.5-2

Minimum median power flux-density and minimum median field strength in Band IV for 70% and 95% location probability, fixed reception

Receiving condition: fixed, Band IV

Frequency	f (MHz)	500				
Minimum C/N required by system	**(dB)**	**2**	**8**	**14**	**20**	**26**
Minimum receiver signal input power	$P_{s\,min}$ (dBW)	–126.2	–120.2	–114.2	–108.2	–102.2
Minimum equivalent receiver input voltage, 75 Ω	$U_{s\,min}$ (dBμV)	12.6	18.6	24.6	30.4	36.6
Feeder loss	L_f (dB)	3				
Antenna gain relative to half wave dipole	G_D (dB)	10				
Effective antenna aperture	A_a (dBm^2)	–3.3				
Minimum power flux-density at receiving location	φ_{min} (dB(W/m^2))	–119.9	–113.9	–107.9	–101.9	–95.9
Minimum field strength at receiving location	E_{min} (dB(μV/m))	26	32	38	44	50
Allowance for man-made noise	P_{mmn} (dB)	0				

Location probability: 70%

Location correction factor	C_l (dB)	3				
Minimum median power flux-density at 10 m a.g.l. 50% of time and 50% of locations	φ_{med} (dB(W/m^2))	–117	–111	–105	–99	–93
Minimum median field strength at 10 m a.g.l. 50% of time and 50% of locations	E_{med} (dB(μV/m))	29	35	41	47	53

Location probability: 95%

Location correction factor	C_l (dB)	9				
Minimum median power flux-density at 10 m a.g.l. 50% of time and 50% of locations	φ_{med} (dB(W/m^2))	–111	–105	–99	–93	–87
Minimum median field strength at 10 m a.g.l. 50% of time and 50% of locations	E_{med} (dB(μV/m))	35	41	47	53	59

TABLE A.3.5-3

Minimum median power flux-density and minimum median field strength in Band V for 70% and 95% location probability, fixed reception

Receiving condition: fixed, Band V

Frequency	f (MHz)	800				
Minimum *C/N* required by system	**(dB)**	**2**	**8**	**14**	**20**	**26**
Minimum receiver signal input power	$P_{s\,min}$ (dBW)	−126.2	−120.2	−114.2	−108.2	−102.2
Minimum equivalent receiver input voltage, 75 Ω	$U_{s\,min}$ (dBμV)	12.6	18.6	24.6	30.4	36.6
Feeder loss	L_f (dB)	5				
Antenna gain relative to half wave dipole	G_D (dB)	12				
Effective antenna aperture	A_a (dBm^2)	−5.4				
Minimum power flux-density at receiving location	φ_{min} (dB(W/m^2))	−115.8	−109.8	−103.8	−97.8	−91.8
Minimum field strength at receiving location	E_{min} (dB(μV/m))	30	36	42	48	54
Allowance for man-made noise	P_{mmn} (dB)	0				

Location probability: 70%

Location correction factor	C_l (dB)	3				
Minimum median power flux-density at 10 m a.g.l. 50% of time and 50% of locations	φ_{med} (dB(W/m^2))	−113	−107	−101	−95	−89
Minimum median field strength at 10 m a.g.l. 50% of time and 50% of locations	E_{med} (dB(μV/m))	33	39	45	51	57

Location probability: 95%

Location correction factor	C_l (dB)	9				
Minimum median power flux-density at 10 m a.g.l. 50% of time and 50% of locations	φ_{med} (dB(W/m^2))	−107	−101	−95	−89	−83
Minimum median field strength at 10 m a.g.l. 50% of time and 50% of locations	E_{med} (dB(μV/m))	39	45	51	57	63

TABLE A.3.5-4

Minimum median power flux-density and minimum median field strength in Band III for 70% and 95% location probability, portable outdoor reception

Receiving condition: portable outdoor (Class A), Band III

Frequency	f (MHz)	200				
Minimum C/N required by system	**(dB)**	**2**	**8**	**14**	**20**	**26**
Minimum receiver signal input power	$P_{s\,min}$ (dBW)	–126.2	–120.2	–114.2	–108.2	–102.2
Minimum equivalent receiver input voltage, 75 Ω	$U_{s\,min}$ (dBμV)	12.6	18.6	24.6	30.4	36.6
Antenna gain relative to half wave dipole	G_D (dB)	–2.2				
Effective antenna aperture	A_a (dBm^2)	–7.5				
Minimum power flux-density at receiving location	φ_{min} (dB(W/m^2))	–118.7	–112.7	–106.7	–100.7	–94.7
Minimum field strength at receiving location	E_{min} (dB(μV/m))	27	33	39	45	51
Allowance for man-made noise	P_{mmn} (dB)	2				
Height loss	L_h (dB)	12				

Location probability: 70%

Location correction factor	C_l (dB)	3				
Minimum median power flux-density at 10 m a.g.l. 50% of time and 50% of locations	φ_{med} (dB(W/m^2)	–102	–96	–90	–84	–78
Minimum median field strength at 10 m a.g.l. 50% of time and 50% of locations	E_{med} (dB(μV/m)	44	50	56	62	68

Location probability: 95%

Location correction factor	C_l (dB)	9				
Minimum median power flux-density at 10 m a.g.l. 50% of time and 50% of locations	φ_{med} (dB(W/m^2))	–96	–90	–84	–78	–72
Minimum median field strength at 10 m a.g.l. 50% of time and 50% of locations	E_{med} (dB(μV/m))	50	56	62	68	74

TABLE A.3.5-5

Minimum median power flux-density and minimum median field strength in Band IV for 70% and 95% location probability, portable outdoor reception

Receiving condition: portable outdoor (Class A), Band IV

Frequency	f (MHz)	500				
Minimum C/N required by system	**(dB)**	**2**	**8**	**14**	**20**	**26**
Minimum receiver signal input power	$P_{s\,min}$ (dBW)	–126.2	–120.2	–114.2	–108.2	–102.2
Minimum equivalent receiver input voltage, 75 Ω	$U_{s\,min}$ (dBμV)	12.6	18.6	24.6	30.4	36.6
Antenna gain relative to half wave dipole	G_D (dB)	0				
Effective antenna aperture	A_a (dBm^2)	–13,3				
Minimum power flux-density at receiving location	φ_{min} (dB(W/m^2))	–112.9	–106.9	–100.9	–94.9	–88.9
Minimum field strength at receiving location	E_{min} (dB(μV/m))	33	39	45	51	57
Allowance for man-made noise	P_{mmn} (dB)	0				
Height loss	L_h (dB)	16				

Location probability: 70%

Location correction factor	C_l (dB)	3				
Minimum median power flux-density at 10 m a.g.l. 50% of time and 50% of locations	φ_{med} (dB(W/m^2))	–94	–88	–82	–76	–70
Minimum median field strength at 10 m a.g.l. 50% of time and 50% of locations	E_{med} (dB(μV/m))	52	58	64	70	76

Location probability: 95%

Location correction factor	C_l (dB)	9				
Minimum median power flux-density at 10 m a.g.l. 50% of time and 50% of locations	φ_{med} (dB(W/m^2))	–88	–82	–76	–70	–64
Minimum median field strength at 10 m a.g.l. 50% of time and 50% of locations	E_{med} (dB(μV/m))	58	64	70	76	82

TABLE A.3.5-6

Minimum median power flux-density and minimum median field strength in Band V for 70% and 95% location probability, portable outdoor reception

Receiving condition: portable outdoor (Class A), Band V

Frequency	f (MHz)	800				
Minimum C/N required by system	**(dB)**	**2**	**8**	**14**	**20**	**26**
Minimum receiver signal input power	$P_{s\,min}$ (dBW)	−126.2	−120.2	−114.2	−108.2	−102.2
Minimum equivalent receiver input voltage, 75 Ω	$U_{s\,min}$ (dBμV)	12.6	18.6	24.6	30.4	36.6
Antenna gain relative to half wave dipole	G_D (dB)	0				
Effective antenna aperture	A_a (dBm²)	−17.4				
Minimum power flux-density at receiving location	φ_{min} (dB(W/m²))	−108.8	−102.8	−96.8	−90.8	−84.8
Minimum field strength at receiving location	E_{min} (dB(μV/m))	37	43	49	55	61
Allowance for man-made noise	P_{mmn} (dB)	0				
Height loss	L_h (dB)	18				

Location probability: 70%

Location correction factor	C_l (dB)	3				
Minimum median power flux-density at 10 m a.g.l. 50% of time and 50% of locations	φ_{med} (dB(W/m²))	−88	−82	−76	−70	−64
Minimum median field strength at 10 m a.g.l. 50% of time and 50% of locations	E_{med} (dB(μV/m))	58	64	70	76	82

Location probability: 95%

Location correction factor	C_l (dB)	9				
Minimum median power flux-density at 10 m a.g.l. 50% of time and 50% of locations	φ_{med} (dB(W/m²))	−82	−76	−70	−64	−58
Minimum median field strength at 10 m a.g.l. 50% of time and 50% of locations	E_{med} (dB(μV/m))	64	70	76	82	88

TABLE A.3.5-7

Minimum median power flux-density and minimum median field strength in Band III for 70% and 95% location probability, portable indoor reception at ground floor

Receiving condition: portable indoor ground floor (Class B), Band III

Frequency	f (MHz)	200				
Minimum *C/N* required by system	**(dB)**	**2**	**8**	**14**	**20**	**26**
Minimum receiver signal input power	$P_{s\,min}$ (dBW)	–126.2	–120.2	–114.2	–108.2	–102.2
Minimum equivalent receiver input voltage, 75 Ω	$U_{s\,min}$ (dBμV)	12.6	18.6	24.6	30.4	36.6
Antenna gain relative to half wave dipole	G_D (dB)	–2.2				
Effective antenna aperture	A_a (dBm^2)	–7.5				
Minimum power flux-density at receiving location	φ_{min} (dB(W/m^2))	–118.7	–112.7	–106.7	–100.7	–94.7
Minimum field strength at receiving location	E_{min} (dB(μV/m))	27	33	39	45	51
Allowance for man-made noise	P_{mmn} (dB)	2				
Height loss	L_h (dB)	12				
Building penetration loss	L_b (dB)	9				

Location probability: 70%

Indoor location correction factor	C_l (dB)	3				
Minimum median power flux-density at 10 m a.g.l. 50% of time and 50% of locations	φ_{med} (dB(W/m^2))	–93	–87	–81	–75	–69
Minimum median field strength at 10 m a.g.l. 50% of time and 50% of locations	E_{med} (dB(μV/m))	53	59	65	71	77

Location probability: 95%

Indoor location correction factor	C_l (dB)	10				
Minimum median power flux-density at 10 m a.g.l. 50% of time and 50% of locations	φ_{med} (dB(W/m^2))	–86	–80	–74	–68	–62
Minimum median field strength at 10 m a.g.l. 50% of time and 50% of locations	E_{med} (dB(μV/m))	60	66	72	78	84

NOTE 1 – Minimum median field-strength values at 10 m a.g.l. for 50% of the time and 50% of the locations are expected to be:

– 5 dB lower than the values shown if reception is required in rooms at the first floor;

– 10 dB lower than the values shown if reception is required in rooms higher than the first floor.

TABLE A.3.5-8

Minimum median power flux-density and minimum median field strength in Band IV for 70% and 95% location probability, portable indoor reception at ground floor

Receiving condition: portable indoor ground floor (Class B), Band IV

Frequency	f (MHz)	500				
Minimum *C/N* required by system	**(dB)**	**2**	**8**	**14**	**20**	**26**
Minimum receiver signal input power	$P_{s\,min}$ (dBW)	−126.2	−120.2	−114.2	−108.2	−102.2
Minimum equivalent receiver input voltage, 75 Ω	$U_{s\,min}$ (dBμV)	12.6	18.6	24.6	30.4	36.6
Antenna gain relative to half wave dipole	G_D (dB)	0				
Effective antenna aperture	A_a (dBm^2)	−13.3				
Minimum power flux-density at receiving location	φ_{min} (dB(W/m^2))	−112.9	−106.9	−100.9	−94.9	−88.9
Minimum field strength at receiving location	E_{min} (dB(μV/m))	33	39	45	51	57
Allowance for man-made noise	P_{mmn} (dB)	0				
Height loss	L_h (dB)	16				
Building penetration loss	L_b (dB)	8				

Location probability: 70%

Indoor location correction factor	C_l (dB)	4				
Minimum median power flux-density at 10 m a.g.l. 50% of time and 50% of locations	φ_{med} (dB(W/m^2))	−85	−78	−73	−67	−61
Minimum median field strength at 10 m a.g.l. 50% of time and 50% of locations	E_{med} (dB(μV/m))	61	67	73	79	85

Location probability: 95%

Indoor location correction factor	C_l (dB)	13				
Minimum median power flux-density at 10 m a.g.l. 50% of time and 50% of locations	φ_{med} (dB(W/m^2))	−76	−70	−64	−58	−52
Minimum median field strength at 10 m a.g.l. 50% of time and 50% of locations	E_{med} (dB(μV/m))	70	76	82	88	94

NOTE 1 – Minimum median field-strength values at 10 m a.g.l. for 50% of the time and 50% of the locations are expected to be:

– 6 dB lower than the values shown if reception is required in rooms at the first floor;

– 12 dB lower than the values shown if reception is required in rooms higher than the first floor.

TABLE A.3.5-9

Minimum median power flux-density and minimum median field strength in Band V for 70% and 95% location probability, portable indoor reception at ground floor

Receiving condition: portable indoor ground floor (Class B), Band V

Frequency	f (MHz)	800				
Minimum C/N required by system	**(dB)**	**2**	**8**	**14**	**20**	**26**
Minimum receiver signal input power	$P_{s\,min}$ (dBW)	−126.2	−120.2	−114.2	−108.2	−102.2
Minimum equivalent receiver input voltage, 75 Ω	$U_{s\,min}$ (dBμV)	12.6	18.6	24.6	30.4	36.6
Antenna gain relative to half wave dipole	G_D (dB)	0				
Effective antenna aperture	A_a (dBm^2)	−17.4				
Minimum power flux-density at receiving location	φ_{min} (dB(W/m^2))	−108.8	−102.8	−96.8	−90.8	−84.8
Minimum field strength at receiving location	E_{min} (dB(μV/m))	37	43	49	55	61
Allowance for man-made noise	P_{mmn} (dB)	0				
Height loss	L_h (dB)	18				
Building penetration loss	L_b (dB)	8				

Location probability: 70%

Indoor location correction factor	C_l (dB)	4				
Minimum median power flux-density at 10 m a.g.l. 50% of time and 50% of locations	φ_{med} (dB(W/m^2))	−79	−73	−67	−61	−55
Minimum median field strength at 10 m a.g.l. 50% of time and 50% of locations	E_{med} (dB(μV/m))	67	73	79	85	91

Location probability: 95%

Indoor location correction factor	C_l (dB)	13				
Minimum median power flux-density at 10 m a.g.l. 50% of time and 50% of locations	φ_{med} (dB(W/m^2))	−70	−64	−58	−52	−46
Minimum median field strength at 10 m a.g.l. 50% of time and 50% of locations	E_{med} (dB(μV/m))	76	82	88	94	100

NOTE 1 – Minimum median field-strength values at 10 m a.g.l. for 50% of the time and 50% of the locations are expected to be:

– 6 dB lower than the values shown if reception is required in rooms at the first floor;

– 12 dB lower than the values shown if reception is required in rooms higher than the first floor.

TABLE A.3.5-10

Minimum median power flux-density and minimum median field strength for 70%, 95% and 99% location probability

Receiving condition: mobile reception, Band III

Frequency	f (MHz)	200					
Representative minimum C/N ratio	**(dB)**	**2**	**8**	**14**	**20**	**26**	**32**
Minimum receiver signal input power	$P_{s\,min}$ (dBW)	–126.2	–120.2	–114.2	–108.2	–102.2	–96.2
Minimum equivalent receiver input voltage, 75 Ω	$U_{s\,min}$ (dBμV)	12.6	18.6	24.6	30.4	36.6	42.6
Antenna gain relative to half wave dipole	G_D (dB)	–2.2					
Effective antenna aperture	A_a (dBm^2)	–7.5					
Minimum power flux-density at receiving location	φ_{min} (dB(W/m^2))	–118.7	–112.7	–106.7	–100.7	–94.7	–88.7
Minimum field strength at receiving location	E_{min} (dB(μV/m))	27	33	39	45	51	57
Allowance for man-made noise	P_{mmn} (dB)	2					
Height loss	L_h (dB)	12					

Location probability: 70%

Location correction factor	C_l (dB)	3					
Minimum median power flux-density at 10 m a.g.l. 50% of time and 50% of locations	φ_{med} (dB(W/m^2))	–102	–96	–90	–84	–78	–72
Minimum median field strength at 10 m a.g.l. 50% of time and 50% of locations	E_{med} (dB(μV/m))	44	50	56	62	68	74

Location probability: 95%

Location correction factor	C_l (dB)	9					
Minimum median power flux-density at 10 m a.g.l. 50% of time and 50% of locations	φ_{med} (dB(W/m^2))	–96	–90	–84	–78	–72	–66
Minimum median field strength at 10 m a.g.l. 50% of time and 50% of locations	E_{med} (dB(μV/m))	50	56	62	68	74	80

Location probability: 99%

Location correction factor	C_l (dB)	13					
Minimum median power flux-density at 10 m a.g.l. 50% of time and 50% of locations	φ_{med} (dB(W/m^2))	–92	–86	–80	–74	–68	–62
Minimum median field strength at 10 m a.g.l. 50% of time and 50% of locations	E_{med} (dB(μV/m))	54	60	66	72	78	84

TABLE A.3.5-11

Minimum median power flux-density and minimum median field strength for 70%, 95% and 99% location probability

Receiving condition: mobile reception, Band IV

Frequency	f (MHz)	500					
Representative minimum C/N ratio	**(dB)**	**2**	**8**	**14**	**20**	**26**	**32**
Minimum receiver signal input power	$P_{s\,min}$ (dBW)	–126.2	–120.2	–114.2	–108.2	–102.2	–96.2
Minimum equivalent receiver input voltage, 75 Ω	$U_{s\,min}$ (dBμV)	12.6	18.6	24.6	30.4	36.6	42.6
Antenna gain relative to half wave dipole	G_D (dB)	0					
Effective antenna aperture	A_a (dBm^2)	–13.3					
Minimum power flux-density at receiving location	φ_{min} (dB(W/m^2))	–112.9	–106.9	–100.9	–94.9	–88.9	–82.9
Minimum field strength at receiving location	E_{min} (dB(μV/m))	33	39	45	51	57	63
Allowance for man-made noise	P_{mmn} (dB)	0					
Height loss	L_h (dB)	16					

Location probability: 70%

Location correction factor	C_l (dB)	3					
Minimum median power flux-density at 10 m a.g.l. 50% of time and 50% of locations	φ_{med} (dB(W/m^2))	–94	–88	–82	–76	–70	–64
Minimum median field strength at 10 m a.g.l. 50% of time and 50% of locations	E_{med} (dB(μV/m))	52	58	64	70	76	82

Location probability: 95%

Location correction factor	C_l (dB)	9					
Minimum median power flux-density at 10 m a.g.l. 50% of time and 50% of locations	φ_{med} (dB(W/m^2))	–88	–82	–76	–70	–64	–58
Minimum median field strength at 10 m a.g.l. 50% of time and 50% of locations	E_{med} (dB(μV/m))	58	64	70	76	82	88

Location probability: 99%

Location correction factor	C_l (dB)	13					
Minimum median power flux-density at 10 m a.g.l. 50% of time and 50% of locations	φ_{med} (dB(W/m^2))	–84	–78	–72	–66	–60	–54
Minimum median field strength at 10 m a.g.l. 50% of time and 50% of locations	E_{med} (dB(μV/m))	62	68	74	80	86	92

TABLE A.3.5-12

Minimum median power flux-density and minimum median field strength for 70%, 95% and 99% location probability

Receiving condition: mobile reception, Band V

Frequency	f (MHz)	800					
Representative minimum C/N ratio	**(dB)**		**8**	**14**	**20**	**26**	**32**
Minimum receiver signal input power	$P_{s\,min}$ (dBW)		–120.2	–114.2	–108.2	–102.2	–96.2
Minimum equivalent receiver input voltage, 75 Ω	$U_{s\,min}$ (dBμV)		18.6	24.6	30.4	36.6	42.6
Antenna gain relative to half wave dipole	G_D (dB)	0					
Effective antenna aperture	A_a (dBm^2)	–17.4					
Minimum power flux-density at receiving location	φ_{min} (dB(W/m^2))		–102.8	–96.8	–90.8	–84.8	–78.8
Minimum field strength at receiving location	E_{min} (dB(μV/m))		43	49	55	61	67
Allowance for man-made noise	P_{mmn} (dB)	0					
Height loss	L_h (dB)	18					

Location probability: 70%

Location correction factor	C_l (dB)	3					
Minimum median power flux-density at 10 m a.g.l. 50% of time and 50% of locations	φ_{med} (dB(W/m^2))		–82	–76	–70	–64	–58
Minimum median field strength at 10 m a.g.l. 50% of time and 50% of locations	E_{med} (dB(μV/m))		64	70	76	82	88

Location probability: 95%

Location correction factor	C_l (dB)	9					
Minimum median power flux-density at 10 m a.g.l. 50% of time and 50% of locations	φ_{med} (dB(W/m^2))		–76	–70	–64	–58	–52
Minimum median field strength at 10 m a.g.l. 50% of time and 50% of locations	E_{med} (dB(μV/m))		70	76	82	88	94

Location probability: 99%

Location correction factor	C_l (dB)	13					
Minimum median power flux-density at 10 m a.g.l. 50% of time and 50% of locations	φ_{med} (dB(W/m^2))		–72	–66	–60	–54	–48
Minimum median field strength at 10 m a.g.l. 50% of time and 50% of locations	E_{med} (dB(μV/m))		74	80	86	92	98

A.3.5.3 Digital terrestrial sound broadcasting (T-DAB)

As for DVB-T, Table A.3.5-13 gives an example for T-DAB outdoor and indoor reception modes.

TABLE A.3.5-13

Minimum median power flux-density and minimum median field strength for 95% and 99% location probability

Receiving condition: T-DAB mobile and portable indoor reception, Band III

Frequency	f (MHz)	200	
Reception mode		**Mobile**	**Portable indoor**
Representative minimum C/N ratio	**(dB)**	**15**	
Minimum receiver signal input power	$P_{s\,min}$ (dBW)	−120.1	
Minimum equivalent receiver input voltage, 75 Ω	$U_{s\,min}$ (dBμV)	18.6	
Antenna gain relative to half wave dipole	G_D (dB)	−2.2	
Effective antenna aperture	A_a (dBm^2)	−7.5	
Minimum power flux-density at receiving location	φ_{min} (dB(W/m^2))	−112.6	
Minimum field strength at receiving location	E_{min} (dB(μV/m))	33.2	
Allowance for man-made noise	P_{mmn} (dB)	2	
Height loss	L_h (dB)	12	
Building penetration loss	L_b (dB)	0	9

Location probability: 95%

Location correction factor	C_l (dB)	Not applicable	10
Minimum median power flux-density at 10 m a.g.l. 50% of time and 50% of locations	φ_{med} (dB(W/m^2))	Not applicable	−80
Minimum median field strength at 10 m a.g.l. 50% of time and 50% of locations	E_{med} (dB(μV/m))	Not applicable	66

Location probability: 99%

Location correction factor	C_l (dB)	13	Not applicable
Minimum median power flux-density at 10 m a.g.l. 50% of time and 50% of locations	φ_{med} (dB(W/m^2))	−86	Not applicable
Minimum median field strength at 10 m a.g.l. 50% of time and 50% of locations	E_{med} (dB(μV/m))	60	Not applicable

ANNEX 3.6

Asymmetrical spectrum mask for DVB-T in 8 MHz and 7 MHz channels

Examples of asymmetrical DVB-T masks for 8 and 7 MHz systems appropriate for ensuring compatibility between broadcasting services are given below in Figs. A.3.6-1 and A.3.6-2 and the associated Tables A.3.6-1 and A.3.6-2. They allow for a digital transmitter to use an adjacent channel of an analogue TV transmitter with the assumption that they are co-sited and radiating the same power. If the radiated powers are not identical, proportional correction could be applied.

FIGURE A.3.6-1

Asymmetrical spectrum masks for a digital terrestrial television transmitter operating in a channel adjacent to a co-sited analogue television transmitter, 8 MHz

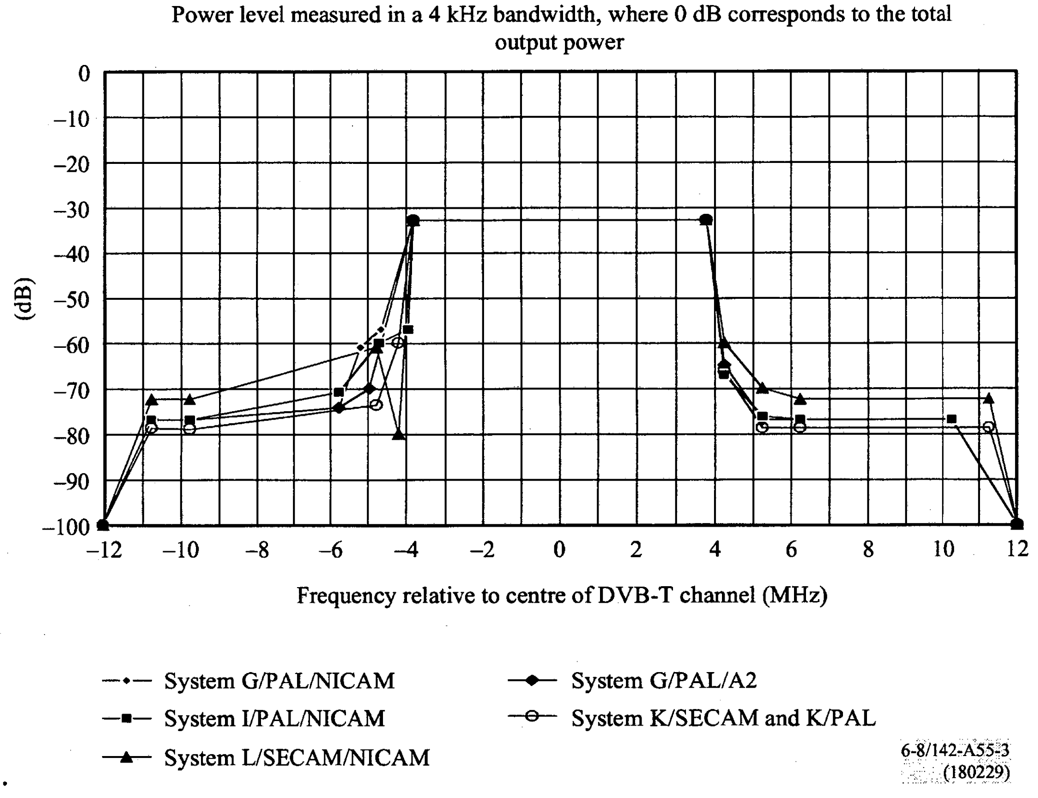


TABLE A.3.6-1

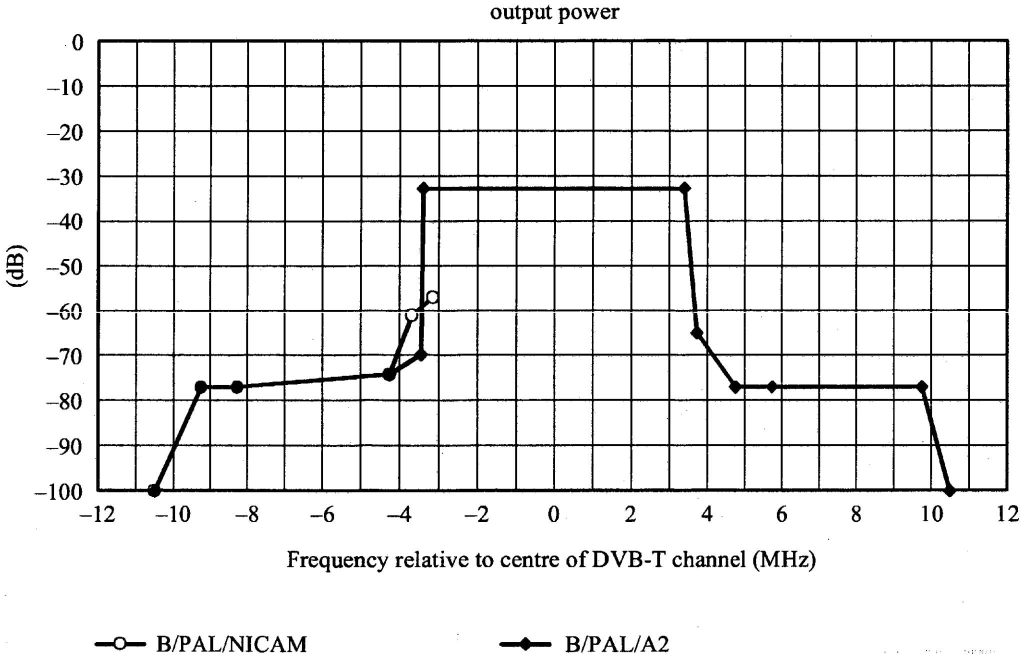
Asymmetrical spectrum masks for a digital terrestrial television transmitter operating in a channel adjacent to a co-sited analogue television transmitter, 8 MHz

Breakpoints										
	G/PAL/NICAM		G/PAL/A2		I/PAL/NICAM		K/SECAM, K/PAL		L/SECAM/NICAM	
	Relative frequency (MHz)	**Relative level (dB)**	**Relative frequency (MHz)**	**Relative level (dB)**	**Relative frequency (MHz)**	**Relative level (dB)**	**Relative frequency (MHz)**	**Relative level (dB**	**Relative frequency (MHz)**	**Relative level (dB)**
1	–12	–100	–12	–100	–12	–100	–12	–100	–12	–100
4	–5.75	–74.2	–5.75	–74.2	–5.75	–70.9	–4.75	–73.6	–4.75	–60.9
5	–5.185	–60.9	–5.185	Not available	–4.685	–59.9	–4.185	–59.9	–4.185	–79.9
6	Not available	Not available	–4.94	–69.9	Not available	Not available	Not available	Not available	Not available	Not available
7	–4.65	–56.9	Not available	Not available	–3.925	–56.9	Not available	Not available	Not available	Not available
8	–3.8	–32.8	–3.8	–32.8	–3.8	–32.8	–3.8	–32.8	–3.8	–32.8
9	+3.8	–32.8	+3.8	–32.8	+3.8	–32.8	+3.8	–32.8	+3.8	–32.8
10	+4.25	–64.9	+4.25	–64.9	+4.25	–66.9	+4.25	–66.1	+4.25	–59.9
11	+5.25	–76.9	+5.25	–76.9	+5.25	–76.2	+5.25	–78.7	+5.25	–69.9
12	+6.25	–76.9	+6.25	–76.9	+6.25	–76.9	+6.25	–78.7	+6.25	–72.4
14	+12	–100	+12	–100	+12	–100	+12	–100	+12	–100

FIGURE A.3.6-2

Asymmetrical spectrum masks for a digital terrestrial television transmitter operating in a channel adjacent to a co-sited analogue System B television transmitter, 7 MHz

Power level measured in a 4 kHz bandwidth, where 0 dB corresponds to the total output power



6-8/142-A55-4
(180229)

TABLE A.3.6-2

Asymmetrical spectrum masks for a digital terrestrial television transmitter operating in a channel adjacent to a co-sited analogue System B television transmitter, 7 MHz

Breakpoints				
	B/PAL/NICAM		B/PAL/A2	
	Relative frequency (MHz)	Relative level (dB)	Relative frequency (MHz)	Relative level (dB)
1	–10.5	–100	–10.5	–100
2	–9.25	–76.9	–9.25	–76.9
3	–8.25	–76.9	–8.25	–76.9
4	–4.25	–74.2	–4.25	–74.2
5	–3.685	–60.9	–3.685	Not available
6	Not available	Not available	–3.44	–69.9
7	–3.15[(1)]	–56.9	Not available	Not available
8	–3.35	–32.8	–3.4	–32.8
9	+3.35	–32.8	+3.4	–32.8
10	+3.75	–64.9	+3.75	–64.9
11	+4.75	–76.9	+4.75	–76.9
12	+5.75	–76.9	+5.75	–76.9
13	+9.75	–76.9	+9.75	–76.9
14	+10.5	–100	+10.5	–100

(1) The NICAM signal overlaps with the DVB-T signal if relative offset is less than 200 kHz.

ANNEX 3.7

Reference networks

A.3.7.1 Reference networks for DVB-T

A.3.7.1.1 General considerations

Four reference networks have been designed in order to cover the different implementation requirements for DVB-T networks.

For the determination of the power budget of the reference networks, antenna heights and powers are adjusted in such a way that the desired coverage probability is achieved at each location of the service area. Full account is taken of network gain and self-interference aspects in the calculation of the coverage probability within the service area. Recommendation ITU-R P.1546-1 is used as the field-strength prediction model. Statistical field-strength summation is performed by means of the *k*-LNM method.

The approach of adjusting the power budget of the network described above uses a noise-limited basis, which is known to be not very frequency efficient. To overcome this drawback, the powers of the transmitters in the reference networks have to be increased by a value of 3 dB. This additional power is indicated in the relevant tables by the symbol Δ to ensure that there is no confusion regarding the various elements which enter into the power budget.

For the effective antenna heights of the transmitter in the reference networks, 150 m has been used as a reasonable average value. It is clear that in real network implementations, effective antenna heights may differ considerably from this average value. However, it should be kept in mind that there is a trade-off between effective antenna heights and transmitter powers. If, in an SFN, a transmitter has a significantly larger effective antenna height than the other transmitters, its power will normally be reduced, since in an SFN it is not desirable to have strong inhomogeneities with regard to transmitter characteristics, because self-interference would then become dominant.

An open network structure has been chosen for the reference networks, since it is assumed that real network implementations will more often resemble this network type. The service area is defined as a hexagon about 15% larger than the hexagon formed by the peripheral transmitters. However, in order to allow for network implementations with very low interference potentials, a reference network with a semi-closed network structure is also introduced.

A.3.7.1.2 Reference network 1 (large service area SFN)

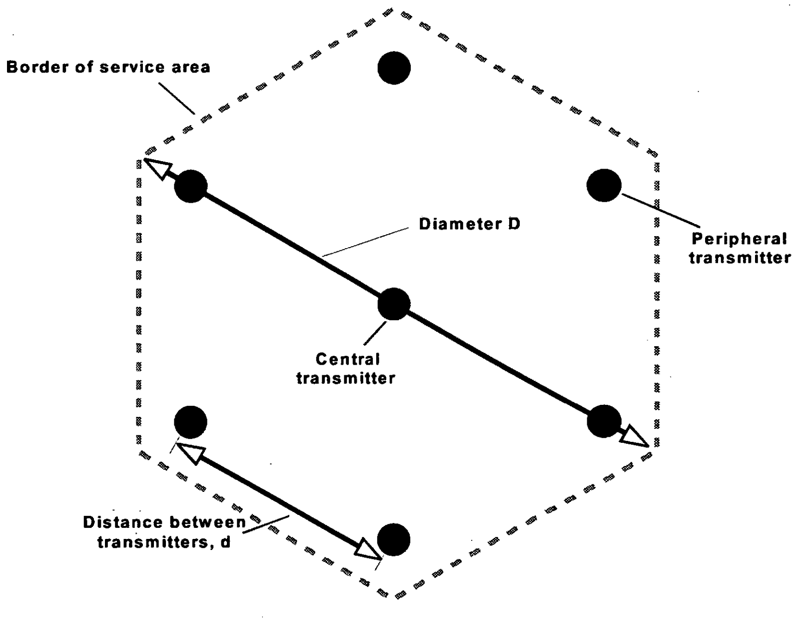
The network consists of seven transmitters situated at the centre and at the vertices of a hexagonal lattice. An open network type has been chosen, i.e. the transmitters have non-directional antenna patterns and the service area is assumed to exceed the transmitter hexagon by about 15%. The geometry of the network is given in Fig. A.3.7-1.

This reference network (RN 1) is applied to different cases: fixed (RPC 1), outdoor/mobile (RPC 2) and indoor (RPC 3) reception, for both Band III and Band IV/V.

RN 1 is intended for large service area SFN coverage. It is assumed that main transmitter sites with a reasonable effective antenna height are used as a backbone for this type of network. For portable and mobile reception, the size of the real service areas for this type of SFN coverage will be restricted to 150 to 200 km in diameter because of self-interference degradation, unless very rugged DVB-T system variants are used or the concept of dense networks is employed.

FIGURE A.3.7-1

RN 1 (large service area SFN)



For the guard interval length, the maximum value 1/4 T_u of the 8k FFT mode has been chosen. The distance between transmitters in an SFN should not overly exceed the distance equivalent to the guard interval duration. In this case, the guard interval duration is 224 μs, which corresponds to a distance of 67 km. The distance between transmitters for RPC 1 is taken as 70 km. For the RPC 2 and 3, 70 km is too large a distance from a power budget point of view. Therefore, smaller values for the distance between transmitters have been selected, 50 km for RPC 2 and 40 km for RPC 3.

Table A.3.7-1 gives the parameters and the power budgets of RN 1.

TABLE A.3.7-1

Parameters of RN 1 (large service area SFN)

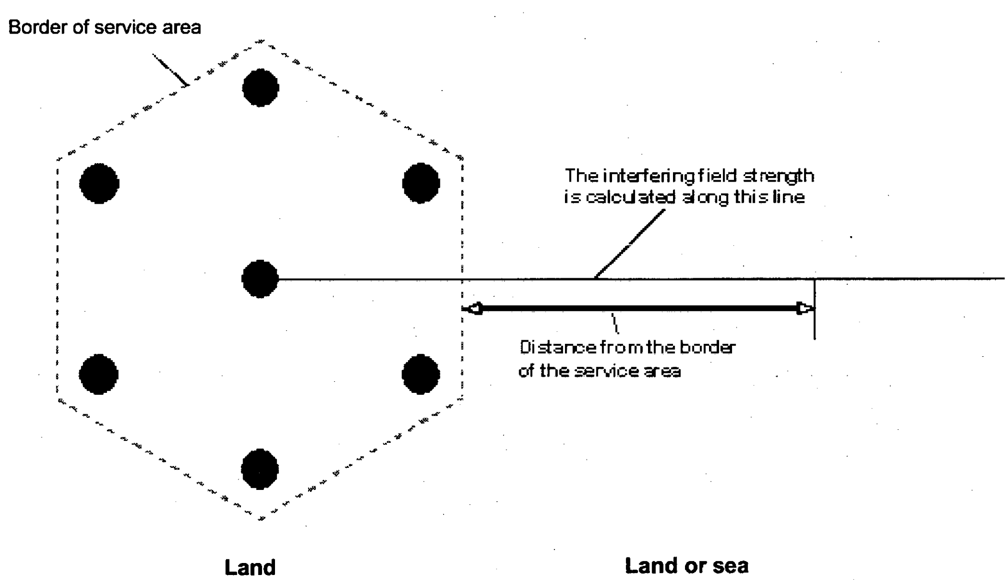
RPC and reception type		RPC 1 Fixed antenna	RPC 2 Portable outdoor and mobile	RPC 3 Portable indoor
Type of network		Open	Open	Open
Geometry of service area		Hexagon	Hexagon	Hexagon
Number of transmitters		7	7	7
Geometry of transmitter lattice		Hexagon	Hexagon	Hexagon
Distance between transmitters d (km)		70	50	40
Service area diameter D (km)		161	115	92
Tx antenna height (m)		150	150	150
Tx antenna pattern		Non-directional	Non-directional	Non-directional
e.r.p. (dBW)	Band III	31.1 + Δ	33.2 + Δ	37.0 + Δ
	Band IV/V	39.8 + Δ	46.7 + Δ	49.4 + Δ

The power margin Δ is 3 dB.

Figure A.3.7-2 shows the geometry for the interference potential calculation.

FIGURE A.3.7-2

Geometry used in the calculation of interference potential, RN 1



A.3.7.1.3 Reference network 2 (small service area SFNs, dense SFNs)

The network consists of three transmitters situated at the vertices of an equilateral triangle. An open network type has been chosen, i.e. the transmitters have non-directional antenna patterns. The service area is assumed to be hexagonal, as indicated in Fig. A.3.7-3.

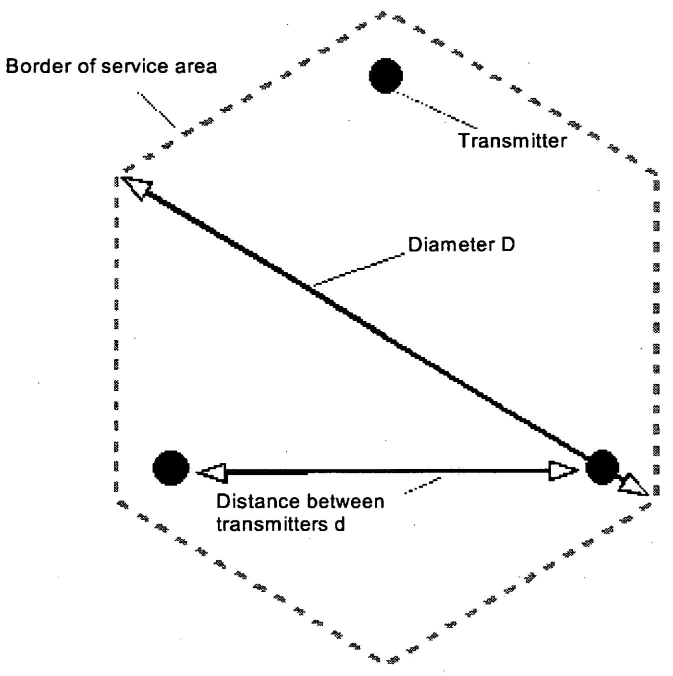
This reference network (RN 2) is applied to different cases: fixed (RPC 1), outdoor/mobile (RPC 2) and indoor (RPC 3) reception, for both Band III and Band IV/V.

RN 2 is intended for small service area SFN coverage. Transmitter sites with reasonable effective antenna heights are assumed to be available for this type of network and self-interference restrictions are expected to be small. Typical service area diameters may be from 30 to 50 km.

It is also possible to cover large service areas with this kind of dense SFN. However, a very large number of transmitters is then necessary. It therefore seems reasonable to choose RN 1 for large service areas, even if a dense network structure is envisaged.

FIGURE A.3.7-3

RN 2 (small service area SFN)



In RN 2 the inter-transmitter distance is 25 km in the case of RPCs 2 and 3. It is therefore possible to use a value of 1/8 T_u (8k FFT) for the guard interval, which would increase the available data capacity as compared to RN 1. The same guard interval value might also be feasible for the RPC 1, with its greater distance between transmitters of 40 km, since fixed roof-level reception is less sensitive to self-interference because of the directional properties of the receiving antenna.

Table A.3.7-2 gives the parameters and the power budgets of the RN 2.

TABLE A.3.7-2

Parameters of RN 2 (small service area SFN)

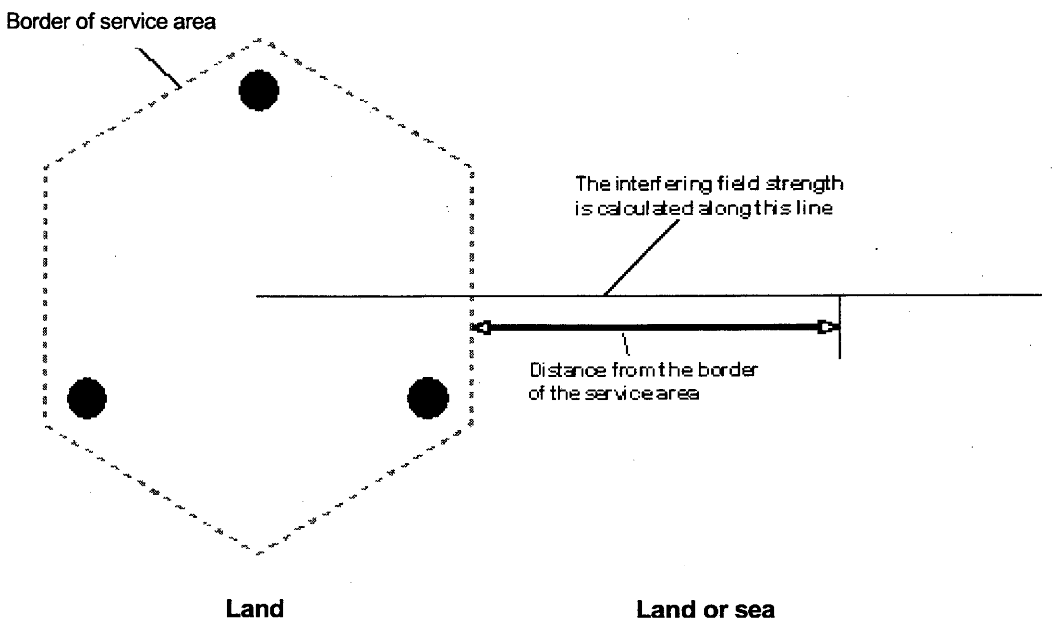
Reference planning configuration and reception type		**RPC 1 Fixed antenna**	**RPC 2 Portable outdoor and mobile**	**RPC 3 Portable indoor**
Type of network		Open	Open	Open
Geometry of service area		Hexagon	Hexagon	Hexagon
Number of transmitters		3	3	3
Geometry of transmitter lattice		Triangle	Triangle	Triangle
Distance between transmitters *d* (km)		40	25	25
Service area diameter *D* (km)		53	33	33
Tx antenna height (m)		150	150	150
Tx antenna pattern		Non-directional	Non-directional	Non-directional
e.r.p. (dBW)	Band III	$21.1 + \Delta$	$23.6 + \Delta$	$31.1 + \Delta$
	Band IV/V	$28.8 + \Delta$	$36.0 + \Delta$	$43.3 + \Delta$

The power margin Δ is 3 dB.

Figure A.3.7-4 shows the geometry for the interference potential calculation.

FIGURE A.3.7-4

Geometry for the calculation of interference potential, RN 2



A.3.7.1.4 Reference network 3 (RN 3) (small service area SFNs for urban environment)

The geometry of the transmitter lattice of RN 3 and the service area is identical with that of RN 2; it is therefore not necessary to repeat the figures.

RN 3 is applied to different cases: fixed (RPC 1), outdoor/mobile (RPC 2) and indoor (RPC 3) reception, for both Band III and Band IV/V.

RN 3 is intended for small service area SFN coverage in an urban environment. It is identical to RN 2, apart from the fact that urban type height loss figures are used (see Table A.3.7-3). This increases the required power of the SFN transmitters by about 5 dB.

TABLE A.3.7-3

Parameters of RN 3 (small service area SFN for urban environment)

Reference planning configuration and reception type		RPC 1 Fixed antenna	RPC 2 Portable outdoor and mobile	RPC 3 Portable indoor
Type of network		Open	Open	Open
Geometry of service area		Hexagon	Hexagon	hexagon
Number of transmitters		3	3	3
Geometry of transmitter lattice		Triangle	Triangle	Triangle
Distance *d* (km)		40	25	25
Service area diameter *D* (km)		53	33	33
Tx antenna height (m)		150	150	150
Tx antenna pattern		Non-directional	Non-directional	Non-directional
e.r.p. (dBW)	Band III	21.1 + Δ	29.5 + Δ	37.1 + Δ
	Band IV/V	28.8 + Δ	41.9 + Δ	49.2 + Δ

The power margin Δ is 3 dB.

A.3.7.1.5 Reference network 4 (RN 4) (semi-closed small service area SFN)

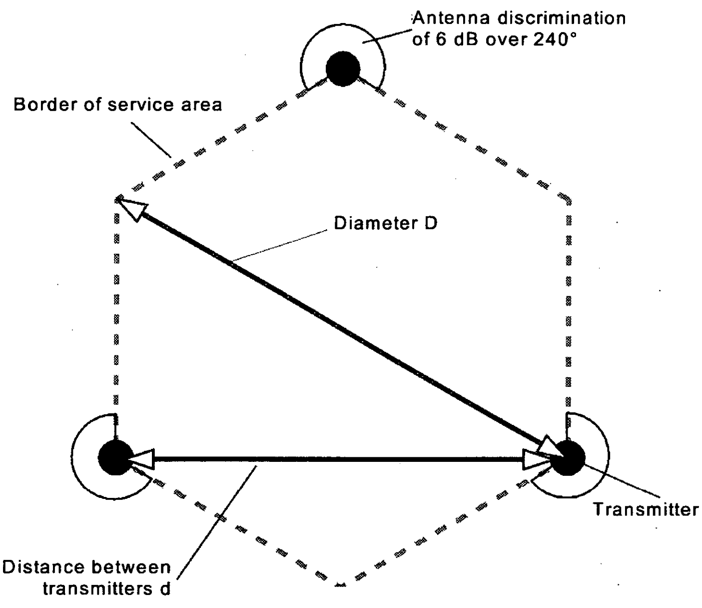
This reference network is intended for cases in which increased implementation efforts regarding transmitter locations and antenna patterns are undertaken in order to reduce the outgoing interference of the network.

The geometry for RN 4 is identical to that for RN 2, except for the antenna patterns of the transmitters, which have a reduction of the outgoing field strength of 6 dB over 240° (i.e. it is a semi-closed RN). The service area of this RN is shown in Fig. A.3.7-5.

RN 4 is applied to different cases: fixed (RPC 1), outdoor/mobile (RPC 2) and indoor (RPC 3) reception, for both Band III and Band IV/V.

FIGURE A.3.7-5

RN 4 (semi-closed small service area SFN)



The difference between RN 4 and RN 2 is the outgoing interference (interference potential). RN 4 has a lower interference potential compared to the other RNs. Because of this, the distance at which the same frequency can be re-used is smaller when two allotments are both planned with RN 4.

There is a trade-off between this lower interference potential and the increased implementation costs to achieve the directional antennas. This should be kept in mind when choosing this RN for planning. There is also a reduction in the diameters of the service areas compared with those for RN 2.

Table A.3.7-4 gives the parameters and the power budgets of the reference networks RN 4.

TABLE A.3.7-4

Parameters of RN 4 (semi-closed small service area SFN)

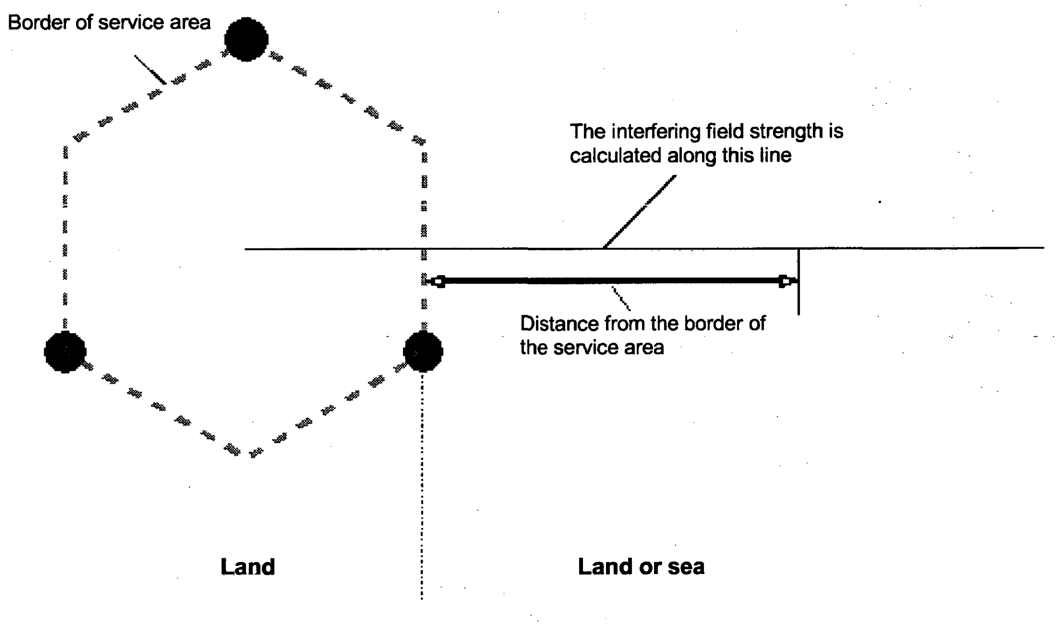
RPC		RPC 1	RPC 2	RPC 3
Type of network and reception type		Semi-closed Fixed antenna	Semi-closed Portable outdoor and mobile	Semi-closed Portable indoor
Geometry of service area		Hexagon	Hexagon	Hexagon
Number of transmitters		3	3	3
Geometry of transmitter lattice		Triangle	Triangle	Triangle
Distance between transmitters d (km)		40	25	25
Service area diameter D (km)		46	29	29
Tx antenna height (m)		150	150	150
Tx antenna pattern		Directional 6 dB reduction over 240°	Directional 6 dB reduction over 240°	Directional 6 dB reduction over 240°
e.r.p. (dBW)	Band III	$19.0 + \Delta$	$21.0 + \Delta$	$29.5 + \Delta$
	Band IV/V	$26.4 + \Delta$	$34.2 + \Delta$	$41.8 + \Delta$

The power margin Δ is 3 dB.

Figure A.3.7-6 shows the geometry for the interference potential calculation.

FIGURE A.3.7-6

Geometry for the calculation of interference potential, RN 4



A.3.7.2 Reference networks for T-DAB

Two reference networks for T-DAB have been designed, respectively, for RPC 4 and RPC 5.

For RPC 4, the mobile reception case, the reference network consists of seven transmitters located at the centre and the vertices of a hexagon and is of the closed network type. The power of the central transmitter is reduced by 10 dB with respect to the peripheral transmitters, which have a power of 1 kW.

For RPC 5, the portable indoor reception case, the same reference network geometry is used as for RPC 4, and the transmitter powers are increased by 9 dB, corresponding to the higher minimum field strength needed for this reception mode.

Table A.3.7-5 gives the parameters and the power budgets of the RN for RPC 4 and RPC 5; Fig. A.3.7-7 shows the geometry of the RN, and Fig. A.3.7-8 provides information relating to the geometry used in the calculation of the interference potential.

TABLE A.3.7-5

Parameters of the RN for RPC 4 and RPC 5

RPC	RPC 4	RPC 5
Reception type	Mobile	Portable indoor
Type of network	Closed	closed
Geometry of service area	Hexagon	Hexagon
Number of transmitters	7	7
Geometry of transmitter lattice	Hexagon	Hexagon
Distance between transmitters *d* (km)	60	60
Service area diameter *D* (km)	120	120
Tx antenna height (m)	150	150
Peripheral Tx antenna pattern	Directional 12 dB reduction over 240°	Directional 12 dB reduction over 240°
Central Tx antenna pattern	Non-directional	Non-directional
Peripheral Tx e.r.p. (dBW)	30.0	39.0
Central Tx e.r.p. (dBW)	20.0	29.0

FIGURE A.3.7-7

Geometry of the RN

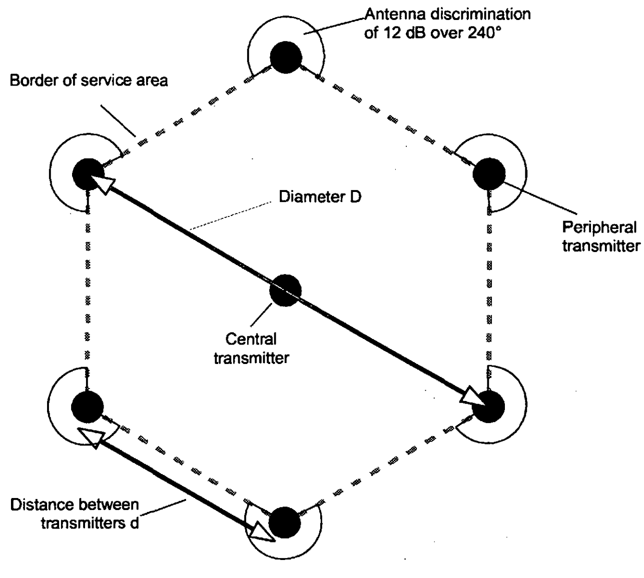
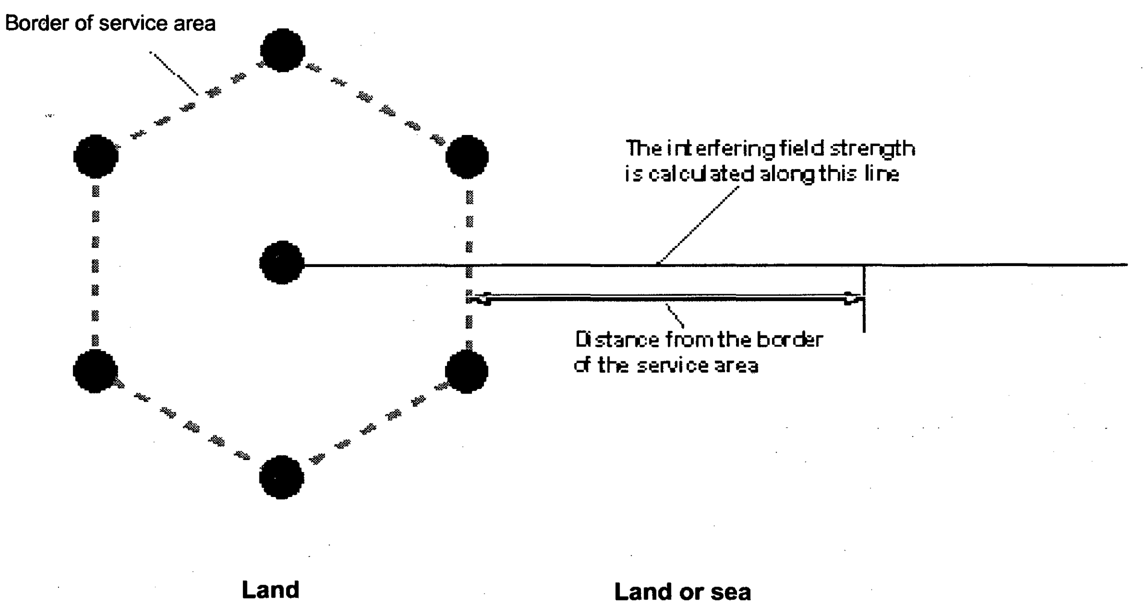


FIGURE A.3.7-8

Geometry used in the calculation of interference potential



CHAPTER 4

Compatibility with other primary services

CONTENTS

4 Introduction

This Chapter considers compatibility of digital terrestrial sound and television broadcasting with primary services other than terrestrial broadcasting.

4.1 Compatibility with other primary services in the planned bands

4.1.1 Other primary services and sharing situations in the bands 174-230 MHz and 470-862 MHz

Most countries of the planning area use the broadcasting service in the bands 174-230 MHz and 470-862 MHz; however, the broadcasting service does not have exclusive access to these bands. The following sharing situations with other primary services need to be taken into account:

In the VHF band between the broadcasting and the following primary services:

– the fixed service;
– the mobile service;
– the aeronautical radionavigation service.

In the UHF band between the broadcasting and the following primary services:

– the fixed service;
– the mobile service;
– the radionavigation service (including the aeronautical radionavigation service);
– the radio astronomy service;
– the broadcasting-satellite service;
– the mobile-satellite (except aeronautical mobile-satellite) service.

For terrestrial services and radio astronomy, compatibility with digital terrestrial broadcasting can be achieved by translating technical requirements into spatial separations. Further details concerning the sharing situation with other primary services are given in § 4.1.1.1.

For space services, other information such as pfd limits are needed. Some information on the sharing situations between digital terrestrial television and space services is included in § 4.1.1.2.

4.1.1.1 Sharing situations with other primary services

In the VHF band, the following primary allocations exist for other services in the planning area in the band 174-230 MHz:

– the **fixed service** in the Islamic Republic of Iran, in the band 174-230 MHz;
– the **mobile service** in the Islamic Republic of Iran, in the band 174-230 MHz;
– the **aeronautical radionavigation service** in the Islamic Republic of Iran and in the countries of Region 1 listed in RR No. 5.247, in the band 223-230 MHz;
– the **land mobile service** in the band 174-223 MHz, to countries listed in RR No. 5.235. Protection is required only between the countries mentioned in that provision.

In the UHF band, the following primary allocations exist in the planning area in the band 470-862 MHz:

- the **fixed service** in Region 1 and in the Islamic Republic of Iran in the band 790-862 MHz, and in the Islamic Republic of Iran in the band 470-790 MHz;
- the **mobile service** in the Islamic Republic of Iran, in the band 470-862 MHz;
- the **mobile, except aeronautical mobile, service** in the band 790-862 MHz, to the countries of Region 1 listed in RR No. 5.316. Protection is required only between countries mentioned in that provision;
- the **radionavigation service** in the Islamic Republic of Iran, in the band 585-610 MHz;
- the **aeronautical radionavigation service** in the United Kingdom in the band 590-598 MHz according to RR No. 5.302, in the countries of Region 1 listed in RR No. 5.312 in the band 645-862 MHz;
- the **radio astronomy service** in the whole of the African Broadcasting Area, in the band 606-614 MHz, according to RR No. 5.304;
- the **broadcasting-satellite service** in the band 620-790 MHz. Protection is required only for those systems which are in operation;
- the **mobile-satellite, except aeronautical mobile-satellite (R), service** in the bands 806-840 MHz (Earth-to-space) and 856-862 MHz (space-to-Earth) to the countries listed in RR No. 5.319 and used only by countries mentioned in that provision.

4.1.1.2 Sharing situations with primary space services

In the UHF band there are primary allocations to the mobile-satellite service (MSS) and the broadcasting-satellite service (BSS).

4.1.1.2.1 Compatibility with the mobile-satellite service

RR No. 5.319 states:

"**5.319** *Additional allocation*: in Belarus, Russian Federation and Ukraine, the bands 806-840 MHz (Earth-to-space) and 856-890 MHz (space-to-Earth) are also allocated to the mobile-satellite, except aeronautical mobile-satellite (R), service. The use of these bands by this service shall not cause harmful interference to, or claim protection from, services in other countries operating in accordance with the Table of Frequency Allocations and is subject to special agreements between the administrations concerned."

Therefore, the issue of sharing between the MSS (except aeronautical mobile-satellite (R) service) and the broadcasting service needs to be considered only between the countries mentioned in RR No. 5.319.

4.1.1.2.2 Compatibility with the broadcasting-satellite service

The band 620-790 MHz is allocated to the BSS with the conditions stipulated in RR No. 5.311 (as modified by WRC-03).

4.1.1.2.2.1 WRC-03, under agenda item 1.37, reviewed the sharing situation as prescribed in RR No. 5.311 and took the following decisions:

a) Modified RR No. 5.311 with immediate effect (as of 4 July 2003) as follows:

"**5.311** Within the frequency band 620-790 MHz, assignments may be made to television stations using frequency modulation in the broadcasting-satellite service subject to agreement between the administrations concerned and those having services, operating in accordance with the Table, which may be affected (see Resolutions **33 (Rev.WRC-03)** and **507 (Rev.WRC-03)**). Such stations shall not produce a power flux-density in excess of the value -129 dB(W/m^2) for angles of arrival less than 20° (see Recommendation **705**) within the territories of other countries without the consent of the administrations of those countries. Resolution **545 (WRC-03)** applies."

b) Adopted a new Resolution (Resolution 545 (WRC-03)), *resolves* 1-3 and 5 of which stipulated that:

"1 that the processing of submissions of GSO BSS networks and non-GSO BSS satellite networks or systems in the frequency band 620-790 MHz received by the Bureau and not brought into use prior to 5 July 2003, irrespective of their date of receipt, shall be suspended pending WRC-07 decisions on the sharing criteria, including the pfd required to protect the terrestrial services in this frequency band;

2 to suspend the application of No. **5.311** and Recommendation **705** until the end of WRC-07 with respect to the GSO BSS networks and non-GSO BSS satellite networks or systems in the frequency band 620-790 MHz and for which notification is received between 5 July 2003 and the end of WRC-07;

3 that GSO BSS networks and non-GSO BSS satellite networks or systems in the frequency band 620-790 MHz other than those notified, brought into use and the date of bringing into use confirmed before the end of WRC-03, shall not be brought into use before the end of WRC-07;"

4 NOTE – Not applicable to this Report;

"5 that the BSS systems referred to in *resolves* 1 above shall not be taken into account in the application of *resolves* 3.1C and 3.4 of Council Resolution 1185;"

Under the *invites* part of the Resolution mentioned above the Conference decided to invite ITU-R:

"to conduct studies as a matter of urgency, and develop sharing criteria and regulatory provisions, prior to WRC-07, for the protection of terrestrial services, in particular terrestrial television broadcasting services, in the 620-790 MHz band from GSO BSS networks and non-GSO BSS satellite networks or systems which it is planned to operate in this band,"

Under the *instructs* parts of the above-mentioned Resolution, the conference decided to

"*instructs the Director of the Radiocommunication Bureau*

subject to the decisions taken by WRC-07, to resume, as appropriate, the application of Nos. **5.311**, **9.34** and **11.30** and other relevant associated provisions of the Radio Regulations,

instructs the Secretary-General

to bring this Resolution to the attention of the Regional Radiocommunication Conference (RRC-04/05)."

4.1.1.2.2.2 In addition, the first session of the Regional Radiocommunication Conference (RRC) has approved Resolution [COM4/1], which recommends to the second session to adopt necessary regulatory procedures for protection of DVB-T systems from the BSS service in the band 620-790 MHz.

4.1.2 Protection of terrestrial services including aeronautical stations of other primary services against transmissions of digital terrestrial broadcasting

4.1.2.1 Input information needed to calculate the interference into other primary services

The input information format of other primary services are available in Chapter 6.

4.1.2.1.1 Information concerning protection needs of other primary services

Basic parameters which are needed for the protection of other primary services are:

- centre frequency;
- detailed type of service;
- field strength to be protected;
- protection ratio as a function of frequency separation between the digital terrestrial broadcasting and the other primary services' centre frequencies;
- percentage of the time for which protection is required.

Additional parameters which are needed have to do with the location of the stations to be protected, directional discrimination and the polarization of the electromagnetic wave.

The location of the stations of the other primary service is usually described by a set of test points (latitude, longitude, and height above ground or sea), which represent the boundary of the area for which protection is required, or by the locations where receiving stations of the service to be protected are installed or may be installed.

For receiving stations installed at fixed locations which use directional antennas pointing at a fixed direction, the antenna pattern, the polarization and the main beam direction are needed.

For mobile stations, polarization and direction discrimination cannot be taken into account.

Intermodulation interference and near field effects will not be addressed, but they may need to be addressed at the national level.

4.1.2.1.2 Information concerning interference potential of digital terrestrial broadcasting

The input information which can be used depends on whether assignment or allotment planning has been chosen.

In the case of assignments, the specific transmitting locations are known and appropriate parameters may be identified:

- centre frequency (of broadcast channel);
- type of the broadcasting system;
- radiated power as a function of azimuth angle and polarization;

– transmitting antenna location (longitude, latitude and height above sea level as well as height above ground, and effective height).

In the case of allotments, as specific transmitting locations are not known, a method situating reference sources at each of the test points around the boundary of the allotments may be used. Further details can be found in Chapter 5.

4.1.2.2 Supply of the information needed to calculate interference into other primary services

The information needed is to be supplied by the administrations involved in accordance with what is specified in Chapter 6 on input parameters, except where the information is already available in the Master International Frequency Register (MIFR).

Protection criteria for other primary services are given in Annexes 4.1 and 4.2. This includes some generic information as well as default values for field strength to be protected, protection ratios as a function of frequency separation, and receiving antenna heights for some typical systems.

Annex 4.1 supplies protection criteria for other primary services interfered with by digital sound broadcasting (T-DAB), and Annex 4.2 supplies protection criteria for other primary services interfered with by digital terrestrial television broadcasting (DVB-T).

4.1.2.3 Calculations required to protect other primary services

A calculation needs to be made for all fixed locations and all test points defining the boundary of the service area of the other primary service.

Calculate the interfering field strength (50% of the locations value and the appropriate time percentage value) caused by the digital terrestrial broadcasting assignment or allotment, taking into account the directivity of the transmitting antenna if relevant.

Calculate from this the nuisance field strength caused by the digital terrestrial broadcasting assignment or allotment, taking into account the protection ratio and, if relevant, receiving antenna discrimination (directivity, polarization).

Subtracting the nuisance field strength (caused by the broadcasting assignment or allotment) and the combined location correction factor from the minimum field strength (50% of the locations value), gives the protection margin which can be used for the coordination process.

Calculation methods are described in Chapter 5.

Information on the propagation models to be used for the calculations can be found in Chapter 2.

4.1.3 Protection of receiving space stations of other primary services against transmissions of digital terrestrial broadcasting

It does not seem feasible to have receiving satellites in the same band and area as broadcasting, as there seems to be no possibility to protect the satellite. (Using highly directive antennas is a problem in the frequency ranges concerned; moreover, it is not appropriate for broadcasting. Severe restrictions of the number and the effective radiated power (e.r.p.) of broadcasting stations would not be acceptable to terrestrial broadcasting as a primary allocation.)

At present, no entries exist in the ITU database for receiving space stations in the broadcasting bands.

4.1.4 Protection of digital terrestrial broadcasting against transmissions of stations of other primary terrestrial services

This paragraph describes the protection of digital terrestrial broadcasting. It is applicable for protection against transmissions of stations of other primary terrestrial services including aeronautical services.

4.1.4.1 Input information needed to calculate interference into digital terrestrial broadcasting

This paragraph lists basic parameters required for calculations to protect digital terrestrial broadcasting; further discussion is provided in Chapter 6.

4.1.4.1.1 Information concerning protection needs of digital terrestrial broadcasting

a) Basic elements which are needed for the protection of digital terrestrial broadcasting assignments are:

- centre frequency;
- type of service;
- field strength to be protected;
- protection ratio as a function of frequency separation between other service and digital terrestrial broadcasting centre frequencies;
- percentage of time for which protection is required.

The coverage area of digital terrestrial broadcasting assignments is usually described by a set of test points (latitude, longitude and height above ground) or by transmitting antennas location and radiated power.

For fixed reception, the antenna pattern, polarization, and the main beam direction are needed.

b) Basic elements which are needed for the protection of digital terrestrial broadcasting allotments are:

- centre frequency;
- type of service;
- field strength to be protected;
- protection ratio as a function of frequency separation between other service and digital terrestrial broadcasting centre frequencies;
- percentage of time for which protection is required.

The coverage area of digital terrestrial broadcasting allotments is usually described by a set of test points (latitude, longitude and height above ground).

Because the geographical relationship between transmitting and receiving locations is not known, directivity discrimination cannot be taken into account.

Intermodulation interference and near field effects will not be addressed, but they may need to be addressed at the national level.

4.1.4.1.2 Information concerning the interference potential of terrestrial stations of other primary services

The following basic elements are needed:

- centre frequency;
- the type of service;
- radiated power as a function of azimuth angle and polarization;
- transmitting antenna location (longitude, latitude and height).

In addition, the channel bandwidth of the system needs to be known.

Information on unwanted emissions is available in Recommendations ITU-R SM.328, ITU-R SM.329, ITU-R SM.1540 and ITU-R SM.1541.

4.1.4.2 Supply of the information needed to calculate the interference into digital terrestrial broadcasting

The information needed is to be supplied by the administrations involved in accordance with what is specified in Chapter 6 on input parameters, except where the information is already available in the MIFR.

In Annexes 4.3 and 4.4, protection criteria for digital terrestrial broadcasting are given, such as minimum field strength to be protected and protection ratios as a function of frequency separation.

Annex 4.3 supplies protection criteria for T-DAB interfered with by other primary services, and Annex 4.4 supplies protection criteria for DVB-T interfered with by other primary services.

4.1.4.3 Calculations required to protect digital terrestrial broadcasting

A calculation needs to be made for each of the test points defining the coverage area of a digital terrestrial broadcasting requirement.

Calculate the interfering field strength (50% of the locations value and the appropriate time percentage value) caused by the other primary service, taking into account the directivity of the transmitting antennas if relevant.

Calculate from this the nuisance field strength caused by the other primary service, taking into account the protection ratio and, if relevant, receiving antenna discrimination (directivity, polarization).

Subtracting the nuisance field strength (caused by the other primary service) and the combined location correction factor from the minimum field strength to be protected (50% of the locations value) gives the protection margin which can be used for the coordination process.

Calculation methods are described in Chapter 5.

Information on the propagation models to be used for the calculations can be found in Chapter 2.

4.2 Compatibility with primary non-broadcasting services in adjacent bands

Interference between digital terrestrial broadcasting and primary non-broadcasting services may occur not only within the bands 174-230 MHz and 470-862 MHz, but also in adjacent bands. In order to minimize interference problems involving adjacent bands, careful design of all the equipment involved is necessary, especially appropriate filtering. This could include improved masks for the services concerned.

However, for adjacent bands, the probability of interference is relatively low as the systems are usually decoupled by frequency separation (the systems are outside the bands discussed). It is therefore suggested not to include systems outside the bands 174-230 MHz and 470-862 MHz in the coordination process.

4.3 Regulatory procedures

Relevant regulatory procedures are dealt with in Chapter 7.

ANNEX 4.1

Protection criteria for other primary services interfered with by digital terrestrial sound broadcasting

The following tables contain the protection ratio values to be used and the field strengths to be protected.

The required separation distance is given where known.

Aeronautical safety service: 0

Service type code: AA

Field strength to be protected (dB(μV/m)): 26.0

Receiver height (m): 10 000.0

Separation distance (m): 1 000.0

Δf (MHz)	–2.500	–2.000	–1.500	–1.000	0.000	1.000	2.000	3.000	4.000	5.000	5.630
PR 1% (dB)	–0.1	3.8	21.0	32.0	39.8	43.0	39.5	37.3	39.3	38.0	24.5
PR 50% (dB)	5.9	10.3	25.5	38.0	46.8	48.3	44.3	41.8	45.5	42.5	30.0

The rows in the Table have the following meaning:

Δf: frequency difference (MHz), i.e. interfering T-DAB block centre frequency minus centre frequency of interfered-with other primary service

PR 1%: protection ratio (dB) required for tropospheric interference

PR 50%: protection ratio (dB) required for continuous interference (if known).

Aeronautical safety service: 1

Service type code: AL

Field strength to be protected (dB(μV/m)): 26.0

Receiver height (m): 10 000.0

Separation distance (m): 1 000.0

Δf (MHz)	–10.000	–9.000	–0.800	–0.600	–0.400	–0.200	0.000	0.200	0.400	0.600	0.800
PR 1% (dB)	–66.0	–6.6	–6.6	2.7	3.2	4.1	6.5	4.1	3.2	2.7	–6.6
Δf (MHz)	9.000	10.000									
PR 1% (dB)	–6.6	–66.0									

Fixed service, values used as for PMR (5 kHz channel spacing).

Service type code: CA

Field strength to be protected (dB(μV/m)): 15.0

Receiver height (m): 10.0

Separation distance (m)

Δf (MHz)	–0.920	–0.870	–0.820	–0.795	–0.782	–0.770	0.000	0.770	0.782	0.795	0.820
PR 1% (dB)	–58.0	–49.0	–41.0	–37.0	–34.0	–14.0	–12.0	–14.0	–34.0	–37.0	–41.0
Δf (MHz)	0.870	0.920									
PR 1% (dB)	–49.0	–58.0									

Aeronautical safety service 2; type A receiver. First channel 230.05 MHz.

Service type code: DA

Field strength to be protected (dB(μV/m)): 26.0

Receiver height (m): 10 000.0

Separation distance (m): 1 000.0

Δf (MHz)	–10.20	–6.550	–6.350	–6.150	–5.930	–5.770	0.000	10.000			
PR 1% (dB)	–56.0	–56.0	–54.0	–49.0	–33.0	6.0	6.0	6.0			

Aeronautical safety service DB. The centre frequency is 235.0 MHz and the first channel is at 231.0 MHz.

Service type code: DB

Field strength to be protected (dB(μV/m)): 26.0

Receiver height (m): 10 000.0

Separation distance (m): 1 000.0

Δf (MHz)	–5.250	–4.470	–4.270	0.000	9.770	9.970	10.750				
PR 1% (dB)	–81.0	–46.0	–1.0	–1.0	–1.0	–46.0	–81.0				

Fixed service (224.25 MHz). S1 (WB FM mono) data used.

Service type code: IA

Field strength to be protected (dB(μV/m)): 48.0

Receiver height (m): 10.0

Separation distance (m)

Δf (MHz)	–1.00	–0.900	–0.800	0.000	0.800	0.900	1.000				
PR 1% (dB)	–22.0	–16.0	18.0	18.0	18.0	–16.0	–22.0				

Land mobile service (173-174 MHz). Not applicable in general. Centre frequency 173.95 MHz.

Service type code: MA

Field strength to be protected (dB(μV/m)): 4.0

Receiver height (m): 10.0

Separation distance (m)

Δf (MHz)	–1.000	–0.900	0.000	0.900	1.000						
PR 1% (dB)	–60.0	–40.0	12.0	–40.0	–60.0						

National defence air-ground-air system, analogue (type B and C receivers). Minimum separation distance is 1 km. Frequency range is 230 MHz to just above 240 MHz, but channel frequencies are not identical in all countries.

Service type code: ME

Field strength to be protected (dB(μV/m)): 26.0

Receiver height (m): 10 000.0

Separation distance (m): 1 000.0

Δf (MHz)	–1.750	–0.970	–0.770	0.000	0.770	0.970	1.750				
PR 1% (dB)	–81.0	–46.0	–1.0	–1.0	–1.0	–46.0	–81.0				

National defence air-ground-air system, digital (230-243 MHz). ME data used.

Service type code: MF

Field strength to be protected (dB(μV/m)): 26.0

Receiver height (m): 10 000.0

Separation distance (m): 1 000.0

Δf(MHz)	−1.750	−0.970	−0.770	0.000	0.770	0.970	1.750				
PR 1% (dB)	−81.0	−46.0	−1.0	−1.0	−1.0	−46.0	−81.0				

National defence air-ground-air system, frequency hopping (230-243 MHz). ME data used.

Service type code: MG

Field strength to be protected (dB(μV/m)): 26.0

Receiver height (m): 10 000.0

Separation distance (m): 1 000.0

Δf(MHz)	−1.750	−0.970	−0.770	0.000	0.770	0.970	1.750				
PR 1% (dB)	−81.0	−46.0	−1.0	−1.0	−1.0	−46.0	−81.0				

Mobile navy service, analogue (230-243 MHz). ME data used.

Service type code: MI

Field strength to be protected (dB(μV/m)): 26.0

Receiver height (m): 10 000.0

Separation distance (m): 1 000.0

Δf(MHz)	−1.750	−0.970	−0.770	0.000	0.770	0.970	1.750				
PR 1% (dB)	−81.0	−46.0	−1.0	−1.0	−1.0	−46.0	−81.0				

Mobile navy service, digital (230-243 MHz). ME data used.

Service type code: MJ

Field strength to be protected (dB(μV/m)): 26.0

Receiver height (m): 10 000.0

Separation distance (m): 1 000.0

Δf(MHz)	−1.750	−0.970	−0.770	0.000	0.770	0.970	1.750				
PR 1% (dB)	−81.0	−46.0	−1.0	−1.0	−1.0	−46.0	−81.0				

Mobile navy service, frequency hopping (230-243 MHz). ME data used.

Service type code: MK

Field strength to be protected (dB(μV/m)): 26.0

Receiver height (m): 10 000.0

Separation distance (m): 1 000.0

Δf (MHz)	–1.750	–0.970	–0.770	0.000	0.770	0.970	1.750				
PR 1% (dB)	–81.0	–46.0	–1.0	–1.0	–1.0	–46.0	–81.0				

National defence fixed services (230-243 MHz). MT values used.

Service type code: ML

Field strength to be protected (dB(μV/m)): 20.0

Receiver height (m): 10.0

Separation distance: (m)

Δf (MHz)	–2.000	–1.000	0.000	1.000	2.000						
PR 1% (dB)	–5.0	15.0	25.0	15.0	–5.0						

National defence mobile service. Centre frequency 232.625 MHz.

Service type code: MQ

Field strength to be protected (dB(μV/m)): 26.0

Receiver height (m): 10 000.0

Separation distance (m): 1 000.0

Δf (MHz)	–2.63	–2.625	0.000	2.625	2.630						
PR 1% (dB)	–60.0	–1.0	–1.0	–1.0	–60.0						

National defence mobile and fixed (tactical) services.

Service type code: MT

Field strength to be protected (dB(μV/m)): 20.0

Receiver height (m): 10.0

Separation distance: (m)

Δf (MHz)	–2.000	–1.000	0.000	1.000	2.000						
PR 1% (dB)	–5.0	15.0	25.0	15.0	–5.0						

Mobile radio – low-power devices. Wideband FM (stereo) data used.

Service type code: MU

Field strength to be protected (dB(μV/m)): 54.0

Receiver height (m): 10.0

Separation distance (m)

Δf (MHz)	–1.000	–0.900	–0.800	0.000	0.800	0.900	1.000				
PR 1% (dB)	–12.0	5.0	38.0	38.0	38.0	5.0	–12.0				

Mobile services – narrow-band FM system (12.5 kHz) interfered with by a single T-DAB block. T-DAB assumed to be always higher in frequency than PMR: M2 values used.

Service type code: M1

Field strength to be protected in (dB(μV/m)): 15.0

Receiver height (m): 10.0

Separation distance: (m)

Δf (MHz)	–.92	–0.870	–0.820	–0.795	–0.782	–0.770	0.000	0.770	0.782	0.795	0.820
PR 1% (dB)	–58.	–49.0	–41.0	–37.0	–34.0	–14.0	–12.0	–14.0	–34.0	–37.0	–41.0
Δf (MHz)	0.870	0.920									
PR 1% (dB)	–49.0	–58.0									

Narrow-band FM system interfered with by two or more T-DAB blocks.

Service type code: M2

Field strength to be protected (dB(μV/m)): 36.0

Receiver height (m): 10.0

Separation distance (m)

Δf (MHz)	–0.920	–0.870	–0.820	–0.795	–0.782	–0.770	0.000	0.770	0.782	0.795	0.820
PR 1% (dB)	–58.0	–49.0	–41.0	–37.0	–34.0	–14.0	–12.0	–14.0	–34.0	–37.0	–41.0
Δf (MHz)	0.870	0.920									
PR 1% (dB)	–49.0	–58.0									

Mobile services – narrow-band FM system (12.5 kHz) interfered with by a single T-DAB block. T-DAB assumed to be always higher in frequency than PMR: M2 values used.

Service type code: RA

Field strength to be protected (dB(μV/m)): 15.0

Receiver height (m): 10.0

Separation distance (m)

Δf (MHz)	–0.920	–0.870	–0.820	–0.795	–0.782	–0.770	0.000	0.770	0.782	0.795	0.820
PR 1% (dB)	–58.0	–49.0	–41.0	–37.0	–34.0	–14.0	–12.0	–14.0	–34.0	–37.0	–41.0
Δf (MHz)	0.870	0.920									
PR 1% (dB)	–49.0	–58.0									

Medical telemetry service. Centre frequency 224.1 MHz.

Service type code: R1

Field strength to be protected in (dB(μV/m)): 32.0

Receiver height (m): 10.0

Separation distance (m)

Δf (MHz)	–1.800	–1.600	0.000	1.600	1.800						
PR 1% (dB)	–60.0	–6.0	–6.0	–6.0	–60.0						

Mobile service – remote control. Centre frequency is 224 MHz. S2 (wideband FM stereo) data used.

Service type code: R3

Field strength to be protected (dB(μV/m)): 30.0

Receiver height (m): 10.0

Separation distance (m)

Δf (MHz)	–1.000	–0.900	–0.800	0.000	0.800	0.900	1.000				
PR 1% (dB)	–12.0	5.0	38.0	38.0	38.0	5.0	–12.0				

Mobile service – remote control. Centre frequency is 224 MHz. S2 (wideband FM stereo) data used.

Service type code: R4

Field strength to be protected (dB(μV/m)): 30.0

Receiver height (m): 10.0

Separation distance (m)

Δf (MHz)	–1.000	–0.900	–0.800	0.000	0.800	0.900	1.000			
PR 1% (dB)	–12.0	5.0	38.0	38.0	38.0	5.0	–12.0			

PMR (5 kHz channel spacing).

Service type code: XA

Field strength to be protected (dB(μV/m)): 15.0

Receiver height (m): 10.0

Separation distance (m)

Δf (MHz)	–0.920	–0.870	–0.820	–0.795	–0.782	–0.770	0.000	0.770	0.782	0.795	0.820
PR 1% (dB)	–58.0	–49.0	–41.0	–37.0	–34.0	–14.0	–12.0	–14.0	–34.0	–37.0	–41.0
Δf (MHz)	0.870	0.920									
PR 1% (dB)	–49.0	–58.0									

Alarm system. Frequency range 230 to 231 MHz.

Service type code: XB

Field strength to be protected (dB(μV/m)): 37.0

Receiver height (m): 10.0

Separation distance (m)

Δf (MHz)	–0.600	–0.500	0.000	0.500	0.600						
PR 1% (dB)	–60.0	10.0	10.0	10.0	–60.0						

National defence air-ground-air system based on aeronautical blocks. No information (–60 dB).

Service type code: XE

Field strength to be protected (dB(μV/m)): 0.0

Receiver height (m): 0.0

Separation distance (m)

Δf (MHz)	–0.100	0.000	0.100								
PR 1% (dB)	–60.0	–60.0	–60.0								

Radio microphones (VHF). S1 (wideband FM mono) data used.

Service type code: XM

Field strength to be protected (dB(μV/m)): 48.0

Receiver height (m): 10.0

Separation distance (m)

Δf (MHz)	−1.000	−0.900	−0.800	0.000	0.800	0.900	1.000				
PR 1% (dB)	−22.0	−16.0	18.0	18.0	18.0	−16.0	−22.0				

Audio link (F).

Service type code: YA

Field strength to be protected (dB(μV/m)): 29.0

Receiver height (m): 10.0

Separation distance (m)

Δf (MHz)	−0.900	−0.800	−0.700	0.000	0.700	0.800	0.900				
PR 1% (dB)	−60.0	−6.0	30.0	30.0	30.0	−6.0	−60.0				

Video link (F).

Service type code: YB

Field strength to be protected (dB(μV/m)): 29.0

Receiver height (m): 500.0

Separation distance (m)

Δf (MHz)	−13.000	−12.000	0.000	12.000	13.000						
PR 1% (dB)	−46.0	20.0	20.0	20.0	−46.0						

Air-ground-air system 1 (F).

Service type code: YC

Field strength to be protected (dB(μV/m)): 10.0

Receiver height (m): 10 000.0

Separation distance (m): 1 000.0

Δf (MHz)	−1.750	−0.970	−0.930	−0.770	0.770	0.930	0.970	1.750			
PR 1% (dB)	−84.0	−49.0	−40.0	−4.0	−4.0	−40.0	−49.0	−84.0			

Air-ground-air system 2 (F).

Service type code: YD

Field strength to be protected (dB(μV/m)): 10.0

Receiver height (m): 10 000.0

Separation distance (m): 1 000.0

Δf (MHz)	−1.75	−0.970	−0.930	−0.770	0.770	0.930	0.970	1.750			
PR 1% (dB)	−84.0	−49.0	−40.0	−4.0	−4.0	−40.0	−49.0	−84.0			

Navy channels (F).

Service type code: YE

Field strength to be protected (dB(μV/m)): 10.0

Receiver height (m): 10 000.0

Separation distance (m): 1 000.0

Δf (MHz)	−1.75	−0.970	−0.930	−0.770	0.770	0.930	0.970	1.750			
PR 1% (dB)	−84.0	−49.0	−40.0	−4.0	−4.0	−40.0	−49.0	−84.0			

National defence mobile and fixed (tactical) services. Tactical link (F).

Service type code: YF

Field strength to be protected (dB(μV/m)): 20.0

Receiver height (m): 10.0

Separation distance (m)

Δf (MHz)	−2.000	−1.000	0.000	1.000	2.000						
PR 1% (dB)	−5.0	15.0	25.0	15.0	−5.0						

Safety and distress (F).

Service type code: YG

Field strength to be protected (dB(μV/m)): 16.0

Receiver height (m): 10 000.0

Separation distance (m): 1 000.0

Δf (MHz)	−0.800	−0.600	−0.400	−0.200	0.000	0.200	0.400	0.600	0.800		
PR 1% (dB)	−6.6	2.7	3.2	4.1	6.5	4.1	3.2	2.7	−6.6		

Audio link (F).

Service type code: YH

Field strength to be protected (dB(μV/m)): 29.0

Receiver height (m): 5 000.0

Separation distance (m)

Δf (MHz)	–0.900	–0.800	–0.700	0.700	0.800	0.900					
PR 1% (dB)	–60.0	–6.0	30.0	30.0	–6.0	–60.0					

Telemetry as air-ground-air system 1 (F) YC.

Service type code: YT

Field strength to be protected dB(μV/m): 10.0

Receiver height (m): 10 000.0

Separation distance (m): 1 000.0

Δf (MHz)	–1.10	–0.970	–0.930	–0.770	0.770	0.930	0.970	1.100			
PR 1% (dB)	–60.0	–49.0	–40.0	–4.0	–4.0	–40.0	–49.0	–60.0			

Telemetry as air-ground-air system 1 (F) YC.

Service type code: YW

Field strength to be protected (dB(μV/m)): 10.0

Receiver height (m): 10 000.0

Separation distance (m): 1 000.0

Δf (MHz)	–1.100	–0.970	–0.930	–0.770	0.770	0.930	0.970	1.100			
PR 1% (dB)	–60.0	–49.0	–40.0	–4.0	–4.0	–40.0	–49.0	–60.0			

Short-range system DGPT (F).

Service type code: YY

Field strength to be protected (dB(μV/m)): 40.0

Receiver height (m): 10.0

Separation distance (m)

Δf (MHz)	–1.000	–0.900	–0.800	0.000	0.800	0.900	1.000				
PR 1% (dB)	–22.0	–5.0	28.0	28.0	28.0	–5.0	–22.0				

DGPT, not used as TV.

Service type code: YZ

Field strength to be protected in (dB(μV/m)): 55.0

Receiver height (m): 10.0

Separation distance (m)

Δf (MHz)	−1.900	−1.000	0.000	1.000	2.000	3.000	4.000	5.000	5.200	5.740	6.440
PR 1% (dB)	−1.5	30.0	42.0	42.0	37.0	32.0	39.0	39.0	30.5	32.0	30.0
PR 50% (dB)	1.8	36.0	48.0	48.0	42.0	36.0	45.3	45.3	38.3	40.0	38.0
Δf (MHz)	6.490	6.740	7.240								
PR 1% (dB)	27.0	1.0	0.2								
PR 50% (dB)	35.0	9.0	7.7								

Where no information concerning protection ratios for other primary services interfered with by T-DAB has been supplied to the planning meeting, the administrations concerned should develop appropriate sharing criteria by mutual agreement or use the relevant ITU-R Recommendations, if available.

Symbols of service type codes used in this Annex are listed in the Table below.

Table of service type codes

(protection of other primary services from T-DAB)

Service type code	Radio Regulations provision (RR No.)	Service
AA	1.34	aeronautical mobile (OR)
AL	1.34	aeronautical mobile (OR)
CA	1.20	fixed
DA	1.34	aeronautical mobile (OR)
DB	1.34	aeronautical mobile (OR)
IA	1.20	fixed
MA	1.26	land mobile
ME	1.34	aeronautical mobile (OR)
MF	1.34	aeronautical mobile (OR)
MG	1.34	aeronautical mobile (OR)
MI	1.28	maritime mobile
MJ	1.28	maritime mobile
MK	1.28	maritime mobile
ML	1.20	fixed
MQ	1.24	mobile
MT	1.20	fixed
MU	1.24	mobile
M1	1.24	mobile
M2	1.24	mobile
RA	1.24	mobile
R1	1.26	land mobile
R3	1.24	mobile
R4	1.24	mobile
XA	1.26	land mobile
XB	1.20	fixed
XE	1.34	aeronautical mobile (OR)
XM	1.26	land mobile
YA	1.26	land mobile
YB	1.26	land mobile
YC	1.34	aeronautical mobile (OR)
YD	1.34	aeronautical mobile (OR)
YE	1.28	maritime mobile
YF	1.20	fixed
YG	1.34	aeronautical mobile (OR)
YH	1.26	land mobile
YT	1.34	aeronautical mobile (OR)
YW	1.34	aeronautical mobile (OR)
YY	1.26	land mobile
YZ	1.26	land mobile

ANNEX 4.2

Protection criteria for other primary services interfered with by DVB-T

A.4.2.1 Protection criteria for VHF and UHF fixed services

Recommendation ITU-R F.1670 – Protection of fixed wireless systems from terrestrial digital video broadcasting systems in the VHF and UHF shared bands, provides the protection criteria for VHF and UHF fixed systems.

The following sharing situations need to be addressed between the broadcasting service and the primary fixed service, bearing in mind the allocations to the fixed service in the Table of Frequency Allocations:

– in the VHF band: for the Islamic Republic of Iran, in the band 174-230 MHz;

– in the UHF band: for Region 1 in the band 790-862 MHz, for the Islamic Republic of Iran in the band 470-862 MHz.

A.4.2.1.1 Protection criteria for two examples of the fixed service

Example 1 contains information for the protection of a relocatable system (service type code FF) used in the Netherlands. For this system, the following technical characteristics[2] are supplied:

Minimum receiver input power: –95 dBm

Frequency: 862 MHz

Antenna gain: 15 dBi

Cable loss: 8 dB

As a result, a minimum field strength of 35 dB(μV/m) is given.

For the interference in the co-channel case a protection ratio (PR) of 11 dB is supplied. The full set of protection ratios as a function of frequency separation is as follows:

PRs of relocatable system (1 024 kbit/s) vs. DVB-T/8 MHz

Δf (MHz)	–6.0	–5.0	–4.0	0.0	4.0	5.0	6.0
PR (dB)	–46	–39	7	11	7	–39	–46

[2] The technical information is from ERC Report 106 (CEPT), February 2001.

Example 2 contains information for the protection of a point-to-multipoint (P-MP) system (service type code FH) used in Ukraine. For this system, the following technical characteristics[1] are supplied:

Minimum receiver input power: –130 dBW

Wave length: 0.36 m

Antenna gain: 17 dBi

Cable loss: 3 dB

As a result of this, a minimum field strength of 18 dB(μV/m) has been calculated.

For the interference in the co-channel case a protection ratio of –1 dB is supplied. The full set of PRs as a function of frequency separation is as follows:

Protection ratios of P-MP interfered with by DVB-T/8 MHz

Δf (MHz)	–6.0	–4.2	–3.9	–3.4	0	3.4	3.9	4.2	6.0
PR (dB)	–65	–54	–4	–1	–1	–1	–4	–54	–65

A.4.2.1.2 Protection criteria for any cases where no system information is available

The wanted level to be protected is $-114 + 10 \log B$ (dBm).

The field strength to be protected is $-44 + 20 \log f + 10 \log B$ (dB(μV/m)).

B is the necessary bandwidth in MHz of the system of the fixed service and f is the centre frequency in MHz.

"Generic" PRs table for the fixed service interfered with by DVB-T (7 MHz) (service type code FK7)

Δf (MHz)	±10	±9	±8	±7	±6
PR (dB) using the non-critical DVB-T mask	–75	–70	–65	–61	–56
PR (dB) using the sensitive DVB-T mask	–85	–80	–75	–71	–66

Δf (MHz)	±5	±4	±3	±2	±1
PR (dB) using the non-critical DVB-T mask	–50	–43	0	0	0
PR (dB) using the sensitive DVB-T mask	–60	–53	0	0	0

**"Generic" PRs table for the fixed service interfered with by DVB-T (8 MHz)
(service type code FK8)**

Δf (MHz)	±12	±10	±9	±8	±7	±6
PR (dB) using the non-critical DVB-T mask	–77	–69	–65	–61	–56	–52
PR (dB) using the sensitive DVB-T mask	–87	–79	–75	–71	–66	–62

Δf (MHz)	±5	±4	±3	±2	±1
PR (dB) using the non-critical DVB-T mask	–45	–13	0	0	0
PR (dB) using the sensitive DVB-T mask	–55	–17	0	0	0

The generic PR tables given above may only be used for systems having a bandwidth which is small compared to the bandwidth of DVB-T.

A.4.2.1.3 Antenna discrimination

Antennas can be found deployed in vertical or horizontal polarizations; therefore, it may be appropriate to assume cross-polarization advantage. Any cross polarization between the horizontal (mainly used) DVB-T and the fixed system antenna (both polarizations are used) will result in higher DVB-T interfering power. For any interfering DVB-T signal arriving in the side-lobe of the fixed system antenna, the side-lobe gain is to be compared to the main-lobe antenna gain.

For fixed systems, the adjustment factor, resulting from the antenna polarization discrimination for horizontally polarized broadcasting emissions, may rise to –18 dB (refer to Recommendation ITU-R SM.851). Where vertically or mixed polarized broadcasting emissions are used, no antenna polarization discrimination is to be taken into account.

Most DVB-T operate in horizontal polarization, therefore, it could be appropriate to assume a 10-18 dB cross-polarization advantage, at least for the vertical fixed system station. Assuming different cross polarization between the horizontal (most common) DVB-T and the fixed system antenna would yield different DVB-T interference levels.

There might also be attenuation in the antenna elevation pattern, due to elevation angle of fixed system or DVB-T antennas in high mountains.

For any interfering DVB-T signal arriving through a side-lobe of the fixed system antenna, the side-lobe gain is to be compared to the assumed 15 dBi gain. Actual antenna radiation patterns should be used. If they are not available, to assess the antenna gain in the side-lobe for frequencies in the range 100 MHz to 1 GHz, in cases where the ratio of the antenna diameter to the wavelength is greater than 0.63 (G_{max} is greater than 3.7 dBi), the following equations given in Recommendation ITU-R F.699 are to be used:

$$G(\varphi) = G_{max} - 2.5 \times 10^{-3} \left(\frac{D}{\lambda}\varphi\right)^2 \qquad \text{for } 0^\circ < \varphi < \varphi_m$$

$$G(\varphi) = G_1 \qquad \text{for } \varphi_m \leq \varphi < 100\frac{\lambda}{D}$$

$$G(\varphi) = 52 - 10\log\frac{D}{\lambda} - 25\log\varphi \qquad \text{for } 100\frac{\lambda}{D} \leq \varphi < \varphi_s$$

$$G(\varphi) = -2 - 5\log\frac{D}{\lambda} \qquad \text{for } \varphi_s \leq \varphi \leq 180^\circ$$

where:

$G(\varphi)$: gain relative to isotropic antenna

φ: off-axis angle

D: antenna diameter
λ: wavelength
} expressed in the same units

G_1: gain of the first side-lobe $= 2 + 15\log\frac{D}{\lambda}$

φ_m and φ_s are defined as follows:

$$\varphi_m = \frac{20\lambda}{D}\sqrt{G_{max} - G_1} \qquad \text{degrees}$$

$$\varphi_s = 144.5\left(\frac{D}{\lambda}\right)^{-0.2} \qquad \text{degrees}$$

In cases where only the maximum antenna gain is known, D/λ may be estimated from the following expression:

$$20\log\frac{D}{\lambda} \approx G_{max} - 7.7$$

where G_{max} is the main-lobe antenna gain (dBi).

For antennas with asymmetrical apertures, the D/λ value computed from G_{max} is an equivalent D/λ and not the actual D/λ.

A.4.2.2 Protection criteria for radio astronomy

The frequency band 608-614 MHz is also allocated to the radio astronomy service. In Africa this allocation is on a primary basis (RR No. 5.304); however, currently there is no indication that a station exists. In Europe it is on a secondary basis (RR No. 5.305). European administrations have agreed, in the Chester, 1997 Agreement*, to coordinate TV transmitters in Channel 38 (606-614 MHz) with their radio astronomy stations. This can be continued through bilateral or multilateral agreements.

The protection criteria for single telescope observations and very long baseline interferometry (VLBI) observations are given in Recommendation ITU-R RA.769**. Whilst this Recommendation provides for a protection level of –253 dB(W/(m^2 · Hz)) for single-dish observations, the limit for VLBI is –212 dB(W/(m^2 · Hz)). Taking into account a bandwidth of 6 MHz (68 dBHz), the levels of maximum power flux-density (pfd) to be protected are –185 dB(W/m^2) for single-dish telescopes and –143 dB(W/m^2) for VLBI.

These pfd limits correspond to a field strength to be protected of –39 dB(μV/m) for single-dish telescopes, and of 3 dB(μV/m) for VLBI.

Protection from adjacent channels also needs to be taken into account. Taking into account the DVB-T spectrum mask for the sensitive case (see § 3.5) and the fact that only three quarters of the total DVB-T transmitted power falls into the 6 MHz radio astronomy band, the following Tables result:

Wanted: radio astronomy single-dish telescope (service type code XA8) in the band 608-614 MHz

Default field strength to be protected (dB(μV/m)): –39

Default receiving antenna height (m): 50

Unwanted: DVB-T/8 MHz

Δ*f* (MHz)	–9.0	–7.0	–6.8	0.0	6.8	7.0	9.0		
PR (dB)	–66.2	–45.8	–1.2	–1.2	–1.2	–45.8	–66.2		

* The Chester 1997 Multilateral Coordination Agreement relating to Technical Criteria, Coordination Principles and Procedures for the introduction of DVB-T.

** The Arab Administrations, during RA-03, objected to those values of protection of the radio astronomy service which are contained in Recommendation ITU-R RA.769.

Wanted: radio astronomy VLBI (service type code XB8) in the band 608-614 MHz

Default field strength to be protected (dB(μV/m)): 3

Default receiving antenna height (m): 50

Unwanted: DVB-T/8 MHz

Δf (MHz)	−9.0	−7.0	−6.8	0.0	6.8	7.0	9.0		
PR (dB)	−66.2	−45.8	−1.2	−1.2	−1.2	−45.8	−66.2		

A.4.2.3 Protection criteria for the land mobile service

A.4.2.3.1 Protection criteria for analogue systems of the land mobile service

1) Protection criteria for 12.5 kHz systems subjected to emissions from DVB-T (8 MHz)

The tables below give the protection ratios required for different frequency offsets between DVB-T and analogue PMR. The land mobile service has various applications, and the required quality of service will be dependent on the specific application.

Below are two tables giving examples for different values of wanted signal level.

PMR protection ratios in the presence of an offset DVB-T for a wanted level of −107.0 dBm (service type code NV)

Unwanted signal: DVB-T 8 MHz

Wanted signal: FM, 1 kHz tone, 1.5 kHz deviation, at −107.0 dBm

For a receiving base station to be protected: default field strength to be protected (at 174 MHz): 7 dB(μV/m), default receiving antenna height: 20 m

For a receiving mobile station to be protected: default field strength to be protected (at 174 MHz): 15 dB(μV/m), default receiving antenna height: 1.5 m

Failure criteria: reduction of SINAD to 14.0 dB

Δf (MHz)	−10.0	−9.0	−8.0	−7.0	−6.0	−5.0	−4.0	−3.9	−3.8	−3.7	−3.0	−1.0	0.0
PR (dB)	−81.8	−79.7	−77.8	−76.0	−74.0	−71.8	−71.5	−52.6	−24.1	−23.0	−23.0	−23.0	−23.0
Δf (MHz)	+1.0	+3.0	+3.7	+3.8	+3.9	+4.0	+5.0	+6.0	+7.0	+8.0	+9.0	+10.0	
PR (dB)	−23.0	−23.0	−23.0	−24.1	−52.6	−71.5	−71.8	−74.0	−76.0	−77.8	−79.7	−81.8	

PMR protection ratios in the presence of an offset DVB-T for a wanted level of –87.0 dBm (service type code NX)

Unwanted signal: DVB-T 8 MHz

Wanted signal: FM, 1 kHz tone, 1.5 kHz deviation, at –87.0 dBm

For a receiving base station to be protected: default field strength to be protected (at 174 MHz): 27 dB(μV/m), default receiving antenna height: 20 m

For a receiving mobile station to be protected: default field strength to be protected (at 174 MHz): 35 dB(μV/m), default receiving antenna height: 1.5 m

Failure criteria: reduction of SINAD to 14.0 dB

Δf (MHz)	–10.0	–9.0	–8.0	–7.0	–6.0	–5.0	–4.0	–3.9	–3.8	–3.7	–3.0	–1.0	0.0
PR (dB)	–70.5	–67.9	–65.8	–64.3	–63.0	–61.8	–61.2	–52.3	–24.0	–23.2	–23.2	–23.2	–23.2
Δf (MHz)	+1.0	+3.0	+3.7	+3.8	+3.9	+4.0	+5.0	+6.0	+7.0	+8.0	+9.0	+10.0	
PR (dB)	–23.2	–23.2	–23.2	–24.0	–52.3	–61.2	–61.8	–63.0	–64.3	–65.8	–67.9	–70.5	

2) Protection criteria for 20/25 kHz land mobile systems subjected to emissions from DVB-T (8 MHz)

Protection ratios have been measured for a few narrow-band FM UHF handhelds operating in the frequency range 470-500 MHz and having channel bandwidths of 20 or 25 kHz.

The failure criteria was degradation of SINAD from 20 dB to 19 dB.

The resulting protection ratios for the most susceptible piece of equipment (service type code NY) are as follows:

Δf = 0 MHz –10 dB

Δf = 3.8 MHz –17 dB

Δf = 4.2 MHz –55 dB.

The resulting protection ratios for the least susceptible piece of equipment (service type code NZ) are as follows:

Δf = 0 MHz –17 dB

Δf = 3.8 MHz –20 dB

Δf = 4.2 MHz –71 dB.

The fact that the co-channel protection ratios are negative can be explained by the small bandwidth of the systems. This implies that only a very small percentage of the DVB-T energy falls in the bandwidth of the mobile system.

Typical values for field strength to be protected are 31 dB(μV/m).

3) Protection criteria for service ancillary to broadcasting/service ancillary to programme-making (SAB/SAP)

Default values for field strength to be protected as well as protection ratios as a function of frequency separation for radiomicrophones, OB links (audio), and talkback links are given in the following tables.

All these values have been derived from measurements, involving a large number of pieces of equipment.

The failure criteria was degradation of SINAD from 20 dB to 19 dB for the FM talkback equipment. For the OB links and radiomicrophones, the failure criteria was degradation of the *S/N* by 3 dB.

Wanted: radio microphone (companded) (service type code NR7)

Default field strength to be protected: 68 dB(μV/m)

Frequency: 650 MHz

Default receiving antenna height: 1.5 m

Unwanted: DVB-T/7 MHz

Δf (MHz)	–10.5	–8.75	–7.0	–5.25	–3.68	–3.32	–3.15	0.0	3.15	3.32
PR (dB)	–49.0	–49.0	–44.0	–39.0	–34.0	8.0	13.0	13.0	13.0	8.0
Δf (MHz)	3.68	5.25	7.0	8.75	10.5					
PR (dB)	–34.0	–39.0	–44.0	–49.0	–49.0					

Wanted: radio-microphone (companded) (service type code NR8)

Default field strength to be protected: 68 dB(μV/m)

Frequency: 650 MHz

Default receiving antenna height: 1.5 m

Unwanted: DVB-T/8 MHz

Δf (MHz)	–12.0	–10.0	–8.0	–6.0	–4.2	–3.8	–3.6	0.0	3.6	3.8
PR (dB)	–50.0	–50.0	–45.0	–40.0	–35.0	7.0	12.0	12.0	12.0	7.0
Δf (MHz)	4.2	6.0	8.0	10.0	12.0					
PR (dB)	–35.0	–40.0	–45.0	–50.0	–50.0					

Wanted: OB link (stereo, non-companded) (service type code NS7)

Default field strength to be protected: 86 dB(μV/m)

Frequency: 650 MHz

Default receiving antenna height: 10 m

Unwanted: DVB-T/7 MHz

Δ*f* (MHz)	–10.5	–8.75	–7.0	–5.25	–3.68	–3.32	–3.15	0.0	3.15	3.32
PR (dB)	–17.0	–16.0	–11.0	–8.0	–4.0	37.0	44.0	44.0	44.0	37.0
Δ*f* (MHz)	3.68	5.25	7.0	8.75	10.5					
PR (dB)	–4.0	–8.0	–11.0	–16.0	–17.0					

Wanted: OB link (stereo, non-companded) (service type code NS8)

Default field strength to be protected 86 dB(μV/m)

Frequency: 650 MHz

Default receiving antenna height: 10 m

Unwanted: DVB-T/8 MHz

Δ*f* (MHz)	–12.0	–10.0	–8.0	–6.0	–4.2	–3.8	–3.6	0.0	3.6	3.8
PR (dB)	–18.0	–17.0	–12.0	–9.0	–5.0	36.0	43.0	43.0	43.0	36.0
Δ*f* (MHz)	4.2	6.0	8.0	10.0	12.0					
PR (dB)	–5.0	–9.0	–12.0	–17.0	–18.0					

Wanted: Talkback (non-companded) (service type code NT7)

Default field strength to be protected: 31 dB(μV/m)

Frequency: 650 MHz

Default receiving antenna height: 1.5 m

Unwanted: DVB-T/7 MHz

Δ*f* (MHz)	–10.5	–8.75	–7.0	–5.25	–3.68	–3.32	–3.15	0.0	3.15	3.32
PR (dB)	–96.0	–91.0	–84.0	–79.0	–69.0	–19.0	–13.0	–13.0	–13.0	–19.0
Δ*f* (MHz)	3.68	5.25	7.0	8.75	10.5					
PR (dB)	–69.0	–79.0	–84.0	–91.0	–96.0					

Wanted: Talkback (non-companded) (service type code NT8)

Default field strength to be protected: 31 dB(μV/m)

Frequency: 650 MHz

Default receiving antenna height: 1.5 m

Unwanted: DVB-T/8 MHz

Δf (MHz)	–12.0	–10.0	–8.0	–6.0	–4.2	–3.8	–3.6	0.0	3.6	3.8
PR (dB)	–97.0	–92.0	–85.0	–80.0	–70.0	–20.0	–14.0	–14.0	–14.0	–20.0
Δf (MHz)	4.2	6.0	8.0	10.0	12.0					
PR (dB)	–70.0	–80.0	–85.0	–92.0	–97.0					

A.4.2.3.2 Protection criteria for digital equipment in the land mobile service in the band 790-862 MHz operating in countries listed in RR No. 5.316 and in the band 470-862 MHz in the Islamic Republic of Iran

The field strength to be protected is 13 dB(μV/m) (8 MHz) for a base station.

The protection ratios (PR) for the digital land mobile service (for example CDMA) interfered with by emissions from DVB-T (8 MHz) service type code NA are as follows:

Δf (MHz)	**±7.5**	**±6.25**	**±5**	**±3.75**	**±2.5**	**±1.25**	**0**
PR (dB) using DVB-T mask, non-critical cases	–63	–57	–50	–7	–5	–5	–5
PR (dB) using DVB-T mask, sensitive cases	–73	–67	–60	–7	–5	–5	–5

The protection ratios in the Table above are based on the DVB-T transmitter masks as quoted in Chapter 3 (§ 3.5.2.1 "Symmetrical spectrum mask for DVB-T in 8 and 7 MHz channels").

A.4.2.3.3 Protection criteria for any VHF/UHF land mobile service systems not covered previously and for which no system information is available

In cases where no system information is available, the following protection criteria may be used during negotiations by concerned administrations:

The maximum allowable field strength to be protected depends on the bandwidth and equals:

– for base stations (14 dBi equivalent antenna gain):

Frequency (MHz)	174	230	470	790	862
Field strength (dB(μV/m))	1 + 10 log *B*	4 + 10 log *B*	10 + 10 log *B*	14 + 10 log *B*	15 + 10 log *B*

B is the necessary bandwidth (MHz).

For other frequencies, it is proposed to use the higher frequency limit, or to interpolate:

– for mobile stations (no directive antenna):

Frequency (MHz)	174	230	470	790	862
Field strength (dB(μV/m))	15 + 10 log *B*	18 + 10 log *B*	24 + 10 log *B*	28 + 10 log *B*	29 + 10 log *B*

For other frequencies, it is proposed to use the higher frequency field strength and signal levels, or to interpolate.

The following protection ratios may be used during negotiations by concerned administrations:

"Generic" protection ratios for the mobile service interfered with by DVB-T (7 MHz) (service type code NB7)

Δ*f* (MHz)	**±10**	**±9**	**±8**	**±7**	**±6**
PR (dB) using the DVB-T mask, non-critical cases	–75	–70	–65	–61	–56
PR (dB) using the DVB-T mask, sensitive cases	–85	–80	–75	–71	–66

Δ*f* (MHz)	**±5**	**±4**	**±3**	**±2**	**±1**
PR (dB) using the DVB-T mask, non-critical cases	–50	–43	0	0	0
PR (dB) using the DVB-T mask, sensitive cases	–60	–53	0	0	0

"Generic" protection ratios for the mobile service interfered with by DVB-T (8 MHz) (service type code NB8)

Δf (MHz)	±12	±10	±9	±8	±7	±6
PR (dB) using the DVB-T mask, non-critical cases	–77	–69	–65	–61	–56	–52
PR (dB) using the DVB-T mask, sensitive cases	–87	–79	–75	–71	–66	–62

Δf (MHz)	±5	±4	±3	±2	±1
PR (dB) using the DVB-T mask, non-critical cases	–45	–13	0	0	0
PR (dB) using the DVB-T mask, sensitive cases	–55	–17	0	0	0

The generic protection ratio tables given above may only be used for systems having a bandwidth which is small compared to the DVB-T bandwidth.

A.4.2.4 Protection criteria for aeronautical radionavigation service

A.4.2.4.1 Protection criteria for aeronautical radionavigation systems used in the band 645-862 MHz in several countries of Region 1 according to RR No. 5.312 and in the bands 223-230 MHz and 585-610 MHz in the Islamic Republic of Iran

In accordance with provision RR No. 5.312, the band 645-862 MHz is allocated in several countries to the aeronautical radionavigation service on a primary basis.

In accordance with the Table of Frequency Allocations, the band 223-230 MHz is allocated to the aeronautical radionavigation service and the band 585-610 MHz is allocated to the radionavigation service[2] in Region 3 (the Islamic Republic of Iran) on a primary basis.

Several types of radionavigation systems are used in the aeronautical radionavigation service including:

– short range radionavigation system (RSBN);
– air traffic control secondary radars, which include ground radar and aircraft responders;
– air traffic control aerodrome primary radars and route primary radars.

All indicated systems are used for navigation and air traffic control.

[2] The information contained in this section is limited to the aeronautical radionavigation service only.

A.4.2.4.1.1 Protection criteria for the air-to-ground component of the RSBN system

Background information

The RSBN aeronautical radionavigation system is used in several countries of Region 1 and in the Islamic Republic of Iran in Region 3.

Field strength to be protected and protection ratios for the air-to-ground component of the RSBN system operating in the UHF band

Many measurements have been made and some theoretical work has been done to study the protection of the system against transmissions of digital terrestrial television. However, the results of the measurements differ, i.e. the measured values for the level to be protected differ significantly by around 20 dB and the measured values for the PR values show some differences.

Considering the theoretical and measured values, the use of a field strength to be protected of 42 dB(μV/m), corresponding to a *C/I* value of 3 dB, has been accepted. This leads to an operational range of 400 km and sometimes even more for the RSBN system.

The PRs given below are close to the measured PRs for RSBN receivers with field-strength values to be protected between 42 dB(μV/m) and 49 dB(μV/m).

Wanted: Aeronautical radionavigation RSBN

Default field strength to be protected: 42 dB(μV/m)

Default receiving antenna height: 10 m

Service type code: AA8

Unwanted: DVB-T/8 MHz

Δf (MHz)	–12.0	–10.0	–8.0	–6.0	–4.0	–2.0	–0.0	+2.0	+4.0
PR (dB)	**–65.0**	**–50.0**	**–27.0**	**–16.0**	**–5.0**	**0.0**	**0.0**	**0.0**	**–5.0**
Δf (MHz)	+6.0	+8.0	+10.0	+12.0					
PR (dB)	**–16.0**	**–40.0**	**–52.0**	**–65.0**					

Guidance for application

Protection is sought for the RSBN ground receivers at airports or zones around airports, but not for the entire territory of countries. It is recommended to take into account additional decoupling of both stations caused by, for example, terrain irregularity transmitting and receiving antenna pattern. Moreover, realistic assumptions for the operational range of the RSBN station should be made.

The field strength to be protected given in the table corresponds to the lowest possible field strength received by a RSBN receiver. During the coordination of DVB-T assignments it is advisable to use values for the field strength to be protected that are close to the realistic useful signal strengths, which could be received by a RSBN receiver, derived by taking into account the location of the RSBN ground receivers.

To calculate the interfering field strength of the DVB-T station, propagation curves from Recommendation ITU-R P.1546-1 have to be used (see Chapter 2). Protection of the RSBN systems should be provided for 90% of the time.

A.4.2.4.1.2 Protection criteria for air traffic control radars operating in the band 645-862 MHz in several countries of Region 1 and in the bands 223-230 MHz and 585-610 MHz in the Islamic Republic of Iran which are interfered with by DVB-T

The band 645-862 MHz is used by air traffic control radars in the aeronautical radionavigation service, which, according to RR No. 5.312, has a primary allocation in several countries of Region 1. The bands 223-230 MHz and 585-610 MHz are used for the same purposes in the Islamic Republic of Iran according to the Table of Frequency Allocations. Recommendation ITU-R M.1461 provides guidance on the protection criteria for radars operating in the radiodetermination service. However, no studies have been conducted within ITU-R on the protection criteria for these air traffic control radars interfered with by DVB-T. ITU-R studies on these issues have been requested, on an urgent basis, by Resolution [COM4/3] of RRC-04 in order to provide adequate protection for these systems.

A.4.2.4.2 Protection criteria for the aeronautical radionavigation system used in the United Kingdom in the band 590-598 MHz

The band 590-598 MHz is allocated on a primary basis to the aeronautical radionavigation service in the United Kingdom as per RR No. 5.302. The following protection criteria need to be applied to protect the system (service type code XG).

Wanted: CH36 airport radars (UK)

Default field strength to be protected: –12 dB(μV/m)

Default receiving antenna height: 7 m

Unwanted: DVB-T/8 MHz

Δf (MHz)	–5.0	–4.0	–3.0	0.0	3.0	4.0	5.0		
PR (dB)	–79.0	–40.0	0.0	0.0	0.0	–40.0	–79.0		

Symbols of service type codes used in this Annex are listed in the table below.

Table of service type codes

(protection of other primary services from DVB-T)

Service type code	RR No.	Service
AA8	1.46	aeronautical radionavigation
FF	1.20	fixed
FH	1.20	fixed
FK7	1.20	fixed
FK8	1.20	fixed
NA	1.26	land mobile
NB7	1.26	land mobile
NB8	1.26	land mobile
NR7	1.26	land mobile
NR8	1.26	land mobile
NS7	1.26	land mobile
NS8	1.26	land mobile
NT7	1.26	land mobile
NT8	1.26	land mobile
NV	1.26	land mobile
NX	1.26	land mobile
NY	1.26	land mobile
NZ	1.26	land mobile
XA8	1.58	radio astronomy
XB8	1.58	radio astronomy
XG	1.46	aeronautical radionavigation

ANNEX 4.3

Protection criteria for digital terrestrial sound broadcasting (T-DAB) interfered with by other primary services

Protection criteria for T-DAB interfered with by other primary services can be found in Recommendation ITU-R BS.1660 – Technical basis for planning of terrestrial digital sound broadcasting in the VHF band.

ANNEX 4.4

Protection criteria for digital terrestrial television broadcasting (DVB-T) interfered with by other primary services

Protection ratios for DVB-T are provided in this Annex. Information on minimum field strengths for DVB-T can be found in Chapter 3.

Resolution COM4/2 has been adopted by the first session of the RRC to carry out additional studies, as a matter of urgency, in order to develop protection criteria for DVB-T systems interfered with by those primary service systems operating in the bands 174-230 MHz and 470-862 MHz for which no information is contained in Recommendation ITU-R BT.1368-4.

Protection ratios for DVB-T subjected to continuous wave (CW) or narrow-band FM signals

The following protection ratio table can be used for interfering signals with narrow bandwidth, e.g. analogue sound carriers or non-broadcasting services.

Co-channel protection ratios (dB) for a DVB-T 8 MHz 64-QAM code rate 2/3 signal interfered with by a CW or an FM carrier (non-controlled frequency offset)

Δf (MHz)	–12	–4.5	–3.9	0	3.9	4.5	12
PR (dB)	–38	–33	–3	–3	–3	–33	–38

where:

Δf: frequency difference between centre frequencies

PR: required protection ratio.

The following protection ratio table can be used for interfering signals with narrow bandwidth, e.g. analogue sound carriers or non-broadcasting services. It should be noted that the fine structure of the protection ratio versus frequency offset between the OFDM signal and the interfering CW signal exhibits a cyclic variation. The values shown in the table below are for the optimum offset.

Co-channel protection ratios (dB) for a DVB-T 7 MHz 64-QAM code rate 2/3 signal interfered with by a CW carrier (controlled frequency offset)

Δf (MHz)	–8	–4	–3	0	3	4	8
PR (dB)	–48	–41	–8	–9	–6	–39	–48

Protection ratios for DVB-T interfered with by the fixed service with the following characteristics:

Technical characteristics of the application of the fixed service (relocatable system)

– typical output power: less than or equal to 1 W
– typical antenna gain: around 15 dBi
– modulation: 2-FSK
– bandwidth at –60 dB: 2 MHz.

More information on fixed service systems may be found in Recommendation ITU-R F.758-3 – Considerations in the development of criteria for sharing between terrestrial fixed service and other services.

Basic conditions for the measurements

The protection ratios given below are based on the following characteristics of DVB-T:

– modulation: 64-QAM
– code rate: 2/3
– channel bandwidth: 8 MHz.

The measured receiver sensitivity is –78 dBm.

For all the measurements of the protection ratios a wanted DVB-T signal level of –70 dBm or greater is assumed. (This is the wanted signal level at which the protection ratios are stable, for lower levels of the wanted signal, larger protection ratios are needed.)

Protection ratios for DVB-T subjected to transmissions of system described above

The following protection ratios are derived from the measurements:

Δf (MHz)	–12	–4.5	–3.75	0	3.75	4.5	12
PR(dB)	–45	–27	1	4	1	–27	–45

CHAPTER 5

Planning principles and methods in the frequency bands 174-230 MHz and 470-862 MHz

CONTENTS

5.1 Planning principles

5.1.1 Scope of the agreement

5.1.1.1 Planning area

The definition of the planning area is provided in Chapter 1, § 1.1.3.

5.1.2 Equitable access

The planning process shall be based on the principle of "equitable access" to frequency resources in accordance with No. 196 of Article 44 of the ITU Constitution. In this connection, during the establishment of the plan, the analogue and digital requirements, as well as assignments of other primary services, need to be taken into account according to their respective definitions as contained in § 1.7.

Planning exercises should be carried out to indicate the possibilities in different parts of the planning area, taking account of the requirements for digital terrestrial broadcasting and the data for other primary services submitted by administrations.

Planning exercises also need to be based on equitable access with respect to, but not limited to, the following criteria:

– coverage, in terms of area to be covered;
– quality of reception (*C/I*, *C/N*, protection ratio, power flux-density/minimum field strength to be protected);
– percentage of locations and percentage of the time for which a given quality of reception is to be achieved and for which the interference analysis is to be performed;
– type of reception: fixed, portable (indoor/outdoor), mobile;
– bandwidth available for planning;
– other criteria, which will be used for the establishment of the plan(s).

The new Agreement will need to provide a framework in which individual countries can continue to develop their individual and different requirements on an equitable access basis.

In cases where an administration requires assignments of primary services other than broadcasting to be taken into account in the establishment of the plan, its access to the frequency band used by these assignments in the geographical area concerned, might be reduced for digital broadcasting services, based on the results of the planning exercise.

However, the methods and criteria for the implementation of the principle of equitable access mentioned above need to be further studied and reported to the second session of RRC for its consideration.

5.1.3 Flexibility regarding possible future developments

5.1.3.1 T-DAB and DVB-T in Band III

The whole of Band III (174 to 230 MHz) should be available for both DVB-T and T-DAB planning. Taking into account equitable access, due care should be taken in the planning of digital broadcasting, DVB-T and T-DAB, to ensure cross-border compatibility. This can be ensured by bilateral and multilateral agreements between the administrations concerned. There should not be a rigid splitting of Band III between DVB-T and T-DAB unless it is proposed on a national basis and only depending on national requirements.

5.1.3.2 Transmitter networks and reception modes

Subject to the conditions described in § 5.1.2, the planning should be able to deal with:

a) different network structures, namely, multifrequency networks (MFN), single frequency networks (SFN) and a mixture of both configurations, using the appropriate system variants and location probabilities;

b) different reception modes, namely, fixed reception, portable (outdoor and indoor) reception and mobile reception, using a limited number of appropriate system variants and location probabilities.

5.1.3.3 Possible future developments

The new plans, to be adopted at the second session, will need to provide a framework in which each country can continue to satisfy its own individual requirements on an equitable access basis.

The new plans must be sufficiently forward-looking and sufficiently flexible to cover developments in digital technology in future years.

In addition to video and audio signal distribution, digital terrestrial broadcasting may serve as a data platform for innovative telecommunication applications (e.g. e-health, e-government, e-learning) to effectively help to bridge the digital divide, in particular in the developing world.

5.1.4 Efficient use of frequency bands

A minimum number of channels should be used to satisfy the requirements.

5.1.5 Approach to the production of a plan, including protection of existing and planned stations

5.1.5.1 Attributes of the planning process

- The planning process shall deal with the two bands (VHF Band III and UHF Band IV/V) separately.
- In order to expedite the planning exercises, requirements for assignments to low power digital stations[1] or small allotment areas[2] in the planning process shall be ignored. Once the plan is adopted, low power digital stations and small allotments may be entered in the plan in accordance with the plan modification procedures established by the second session of the conference.
- Input requirements for digital broadcasting assignments of more than 200 kW e.r.p. should not be considered in the planning process.
- In order to facilitate the planning process, administrations are encouraged to state which of their existing and planned assignments defined in § 1.7 they would like to be protected in the establishment of the plans and/or during the implementation of the plans in the transition period.

[1] See definition of low power station in § 1.6.4.3.

[2] See definition of small allotment in § 1.6.1.6.

- Bilateral and multilateral discussions will aid the planning process. Administrations are encouraged, as part of the planning process, to agree, on a bilateral and multilateral basis, the mutual compatibility between the input requirements of digital terrestrial broadcasting services and the compatibility between those input requirements and other assignments and services. Such agreements need to be notified to the ITU Radiocommunication Bureau in order to assist the planning process.
- The planning process will use the inventory of requirements communicated by administrations to the ITU Radiocommunication Bureau in accordance with the process and data format described in Chapter 6.

5.1.5.2 Compatibility in the planning process – Protection of existing and planned stations

Compatibility between the digital assignments/allotments contained in the new digital plan and existing and planned[1] analogue assignments should, as far as possible, be ensured in the design of the plan, without the need for the application of supplementary procedures.

Compatibility between the digital assignments/allotments contained in the new digital plan should, as far as possible, be ensured in the design of the plan, without the need for the application of supplementary procedures.

5.1.5.3 Approaches to the production of the plan

RRC is to establish a new plan for digital terrestrial broadcasting, while protecting, during the transition period, existing and planned assignments/allotments as defined in § 1.7 of this report. The transition period is defined in Chapter 7, § 7.4.

In this process, spectrum efficiency needs to be taken into account.

One approach is to ensure compatibility between the new digital plan and existing and planned assignments/allotments in the design of the new plan, without the need for any procedures at the stage of implementation of the new plan. This approach, however, results in non-optimum use of spectrum, hence less capacity available per country for satisfying its future digital requirements.

Another approach, by which spectrum efficiency may be maximized, is not to take into account existing and planned assignments/allotments in the design of the plan, but to ensure compatibility between them and the new plan at the stage of implementation of the new plan by the application of appropriate procedures (see Chapter 7). In this approach, it is likely that many assignments in the new plan could not be brought into service without restrictions before the end of the transition period.

[1] See definition of existing and planned analogue assignments in § 1.7.

It is likely that most administrations will tend to include, as part of their digital requirements, some degree of compatibility with existing and planned assignments/allotments, for example by converting analogue assignments into digital. In practice, the two above approaches will therefore tend to converge, i.e. a large proportion of the existing and planned assignments/allotments will be taken into account in the planning process, and only a small proportion of the assignments in the new digital plan could not be brought into service without restrictions before the end of the transition period.

It is expected that the iterations of the draft plan(s) considered could establish the proper balance between the above contradictory objectives in order to satisfy all administrations.

Where an administration chooses to base its digital input requirements on existing and planned analogue assignments, the expression "digital conversion" is sometimes used. Such digital conversions may be submitted to the ITU Radiocommunication Bureau as input requirements and be subject to the same compatibility analysis and synthesis as other input requirements. The concept of a digital conversion may be understood as one or more digital assignments or a digital allotment that replace an analogue assignment on the same frequency as the existing analogue assignment.

A requirement which is a digital conversion could be identified as such in the output of the planning process. This would facilitate the implementation of the digital plan.

During the transition period, some digital assignments in the plan may need to be operated with some restrictions, for example a reduction of radiated power, in order to protect analogue assignments. In such cases, the administrations concerned may agree on a date before the end of the transition period at which such restrictions may be removed. This date will be recorded in the plan.

5.1.6 Treatment of digital broadcasting requirements

5.1.6.1 Scope of digital broadcasting requirements

The following types of digital broadcasting notices are accepted:

- allotments;
- assignments.

Notices for individual assignments can be linked together to form a single frequency network. See § 6.2 for the definition of the data elements of digital broadcasting requirements.

Receiving antenna polarization discrimination should not be taken into account in the planning process except in the case of fixed reception where this is requested by an administration in its input digital requirement. Thus, in the planning process, receiving antenna polarization discrimination will only be applied in considering interference to and from assignments or allotments for which both requirements have indicated a specific polarization.

T-DAB planning should be able to deal with mobile reception and with portable indoor reception. Planning of digital television broadcasting should make provision for all three reception modes, i.e. fixed, portable and mobile.

5.1.6.2 Bilateral and multilateral agreements

On the basis of planning exercises between the sessions, every effort is to be made to reduce incompatibilities and, where they occur, to resolve them by bilateral or multilateral discussions, preferably before the second session of the conference. During the planning process, all proposed digital broadcasting allotments and assignments are open to discussion through bilateral or multilateral negotiation among the administrations concerned, which may be conducted either directly or with the assistance of the ITU Radiocommunication Bureau within their available resources, on the understanding that those administrations may be requested to modify the characteristics of their allotments or assignments. These bilateral or multilateral agreements need to be taken into account in the planning process when administrations declare incompatible digital broadcasting requirements as compatible, providing this does not affect other administrations concerned. See § 6.2 for the format in which such agreements are recorded.

5.1.7 Treatment of other primary services

5.1.7.1 General

The definition of existing and planned assignments of other primary services to be protected by digital broadcasting assignments and allotments in the new plan is found in § 1.7. Before the start of the second session of RRC, the ITU Radiocommunication Bureau will draw up and post on the RRC section of the ITU website (www.itu.int) a list of such assignments of other primary services that need to be taken into account. Existing and planned assignments to other primary services should only be taken into account during the planning process at the request of administrations concerned and as defined in § 1.7 of this report. Potential incompatibilities between digital broadcasting requirements and assignments of other primary services could be resolved by bilateral or multilateral negotiations.

5.1.7.2 Protection of assignments of other primary services during the establishment of the new plan

Compatibility between the digital broadcasting assignments/allotments contained in this new digital plan and the existing and planned assignments of other primary services that are to be protected in the new plan should be ensured in the design of the plan.

See also § 1.7 including footnotes 5, 6 and 7.

5.1.8 Preparation of requirements

The preparation of requirements is the responsibility of administrations.

5.1.8.1 Generating digital broadcasting requirements when none are submitted

In order to preserve the rights of all administrations and facilitate subsequent coordination, those countries covered by the planning area, but not present at the second session of the conference, and which have not submitted their digital broadcasting requirements, should be provided with a reasonable number of allotments and/or assignments.

5.2 Planning methods

5.2.1 General aspects of the planning structure

The following aspects need to be considered in relation to the broadcasting planning structure:

5.2.1.1 Planning approach and methods

– The planning methods should be able to deal with different planning approaches being adopted for different geographical areas. Since different planning methods and approaches may be used, special measures and procedures should be elaborated to ensure the compatibility of plans;

– different planning methods may be used for different portions of the bands being considered;

– both lattice-based and non-lattice-based planning methods should be accommodated during the planning process.

5.2.1.2 Allotments and assignments

– T-DAB planning should be based on allotment planning, if appropriate;

– DVB-T planning should be based either on allotment or assignment planning or a combination of both;

– the planning process should be able to deal with both allotments and assignments;

– planning should be based on the protection of the service area for assignments and allotments. Administrations should be free to specify their input requirements as either assignments and/or allotments. (See also § 5.1.7 "Treatment of other primary services".)

5.2.1.3 Network configuration, receiving modes and system variants

– T-DAB planning should as far as practicable be based on SFNs;

– for DVB-T, the planning process should be able to deal with MFN, SFN or a combination of both;

– for both T-DAB and DVB-T, the planning methods shall enable plans to be developed for RPCs and different reference networks as given in § 3.6.2 and 3.6.3, respectively;

– the number of system variants to be considered in the planning process should be limited as far as possible, as described in Annex A.3.4.

5.2.2 Allotments and assignments

5.2.2.1 Introduction

The planning process can be considered as a multiple-step process which includes a "compatibility analysis" and a "synthesis". The analysis step is intended to identify incompatibilities among the input requirements to determine which requirements may not share any given channel, while the synthesis step is intended to identify different possible frequency distributions.

5.2.2.2 Assignment planning

The term "assignment planning" is defined in Chapter 1, § 1.6.2.

In the past, terrestrial television planning has been implemented by way of assignment conferences. In assignment planning, a significant amount of individual station planning is needed to prepare for a planning conference.

Assignment planning, based on a lattice structure, for terrestrial digital television is appropriate where all the transmitter sites can be assumed to have the same characteristics. This is not to say that station characteristics are fixed for all time.

An assignment plan provides a frequency for each station and at the completion of the assignment planning process the locations and characteristics of the transmitters in the planning area are known. The transmitters can be brought into service without further coordination.

For practical reasons, a lower limit for the radiated power is normally defined for stations to be dealt with in the planning process. Stations with a radiated power below the limit are then included in the plan subsequently.

5.2.2.3 Allotment planning

The term "allotment planning" is defined in Chapter 1, § 1.6.1.

The possibility of obtaining allotments at a terrestrial broadcasting conference has received attention in recent years, particularly because of the opportunities offered by SFNs. Allotments may also be applicable for MFN planning where a country has no plans to use specific transmitter sites and wishes to retain some flexibility for the future.

Thus, in order to carry out the planning it is necessary to define some reasonably realistic reference transmission conditions which represent the potential interference which could be caused, so that any necessary compatibility calculations can be made.

The resulting allotment plan provides the frequencies to be used in particular areas without specifying the stations to which the frequencies are assigned.

5.2.2.4 Mixed planning

It is not necessary to use exclusively allotment planning or exclusively assignment planning to produce a plan. A mixed plan can be produced, provided that at least the following are specified:

a) the intended service area;

b) the interference potential of the assignment or allotment.

Such a mixed plan, containing both assignments and allotments, gives equal priority to both.

5.2.2.5 Specification of service area

Service areas are specified by boundary test points. The service area of an allotment is explicitly given in the allotment area requirement (see Chapter 6). In the case of an assignment, the service area is calculated from the characteristics of the assignment as part of the planning procedure (a method for this is given in § A.5.2.2.1).

5.2.2.6 Characterization of interference potential

For an assignment the interference potential can be calculated from the characteristics of the assignment supplied by the requesting administration.

For an allotment, the interference potential may either be calculated as:

a) the aggregate interference from the known assignments, i.e. one transmitter or a group of transmitters (forming an SFN) whose precise site location(s) and other technical characteristics are known at the time when the plan is made; or as

b) the interference potential from the relevant reference network specified by the administration in its input requirements. (See § 3.6.3 on reference networks.)

5.2.2.7 Methods for the conversion of analogue assignments into digital allotment or assignment requirements

Administrations may wish to establish a frequency plan for digital broadcasting which is based on existing analogue frequency plans. It can be advantageous to convert entries of existing analogue frequency plans (which are lattice based) to digital assignment or allotment requirements. Two such methods are described in § A.5.2.2.2.

5.2.3 Procedure for the production of a plan

5.2.3.1 Lattice and non-lattice-based planning

Traditionally, two methods have been employed for the preparation of a frequency plan. These are:

– lattice-based – a systematic and geographically regular distribution of frequency resources over an area;

– non-lattice-based – an irregular, but spectrum-utilization-efficient distribution of frequency resources over a geographical area.

Either of the two methods is suitable for assignment/allotment planning, and either is capable of use in the presence of pre-existing constraints.

With regard to the choice of a planning method or methods, lattice-based methods have successfully provided the basis for most of the past frequency plans and would be appropriate for use in digital broadcasting planning in areas of relative uniformity of requirement characteristics. This method essentially applies in areas where existing or planned assignments are converted to digital assignments and will form part of the digital plan.

However, in areas where there are non-uniform requirements for digital broadcasting (e.g. very different sizes of service area and various reception conditions), or in areas where there is a requirement for digital broadcasting stations and there are already networks of analogue stations, non-lattice-based planning will provide an optimum means to achieve both the desired coverage and the most efficient use of the available spectrum. This method permits the addition of assignments which are not distributed across the total area in any regular way and which may not have equal-sized service areas.

5.2.3.2 "Compatibility analysis" and "synthesis" process

The planning process can be split into "compatibility analysis" and "synthesis" stages. The analysis stage would enable incompatibilities to be identified and appropriate responses to these incompatibilities to be considered by the second session of the conference.

The planning process may be summarized by the following steps:

Step 1: submission of the input requirements for digital broadcasting;

Step 2: identification of the analogue broadcasting stations and of other services that need to be taken into account;

Step 3: performance of compatibility analyses;

Step 4: assessment of the results from Step 3;

Step 5: allowance for administrative input concerning compatibility between requirements, with a return to Step 3 if necessary;

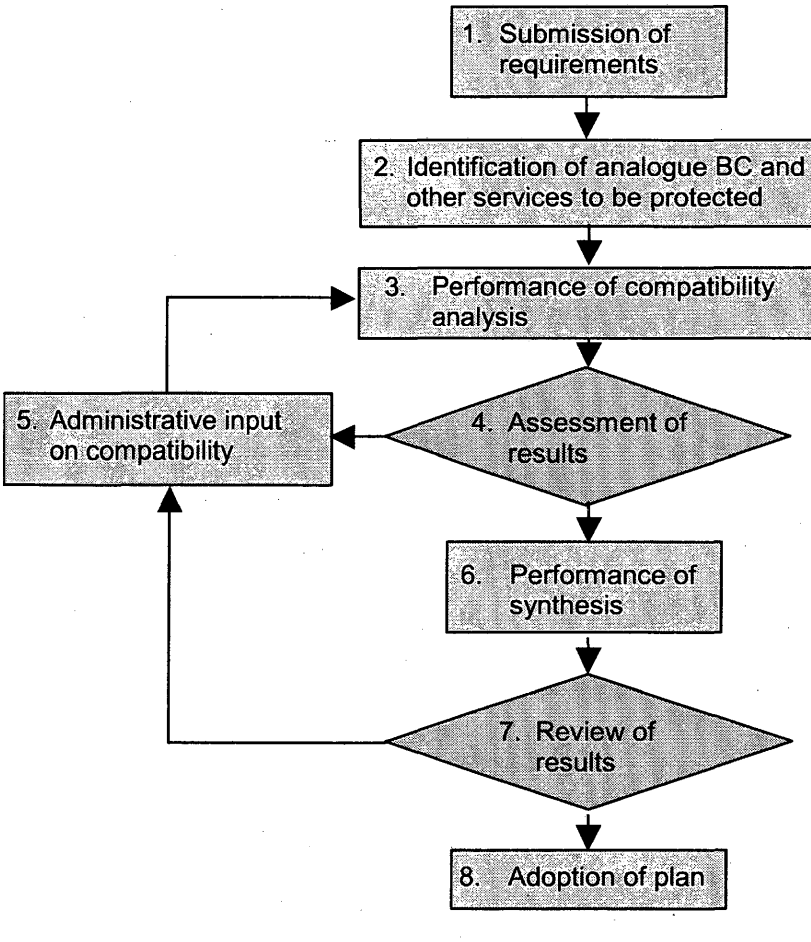
Step 6: performance of synthesis, the output of which is a plan;

Step 7: review of the results, with a loop back to Step 5 and then to Step 3 if the desired result is not achieved;

Step 8: adoption of the final plan.

FIGURE 5.2.3-1

Steps in the "compatibility analysis" and "synthesis" process



A detailed description of the compatibility analysis is given in § 5.3.1.

A detailed description of the synthesis process is given in § 5.3.2.

5.3 Planning tools

5.3.1 Compatibility analysis

5.3.1.1 Planning methods

5.3.1.1.1 Identification of incompatibilities between requirements

5.3.1.1.1.1 General

In order to produce a frequency plan it is necessary to know which requirements may not share any given channel. This is done by identifying all of the requirements which are incompatible with a given requirement. It is only necessary to consider two requirements at a time in order to establish a complete set of incompatibilities. For this purpose it is not necessary to know which channels any given requirement may use.

From the protection ratio values for digital broadcasting systems it is apparent that only co-channel or overlapping channel interference need be taken into account and that adjacent channel and image channel interference may be neglected.

The more general case of requirements using channels in Bands IV or V is dealt with first. The additional information needed for the case of requirements using channels in Band III is dealt with at the end of this section.

In order to be able to deal with a set of requirements which may be specified as assignments or allotments or as a mixture of these two, it is necessary to assume that the area to be covered by any given requirement is specified in some way. The following text assumes that this is done by means of a series of geographic locations, referred to as test points, situated around the boundary of that area. These test points are specified by their geographic coordinates.

The service within the area of the requirement may be provided either by a single assignment or by a set of assignments operating as a single frequency network (SFN). The following text assumes that the outgoing interference from any point on the boundary of an SFN is represented as a "reference source" situated on a specified location on a reference network. The implication of this is that it is not necessary to specify the site locations of the individual assignments within the SFN.

The interference potential of an individual requirement using an SFN may be determined by considering that the reference source, relevant to the reference network specified by the concerned administration for the requirement, is situated at each of the test points in turn. It is to be noted that this does not imply that the reference network needs to be implemented physically in order to provide coverage within the area of the requirement, nor does it imply that an interference source will exist physically at any test point when the requirement is implemented.

5.3.1.1.1.2 Calculation methods

In order to identify requirements which are incompatible, two sets of calculations are needed. The first set identifies requirements which have a service overlap, and the second set identifies requirements which would produce excessive interference if operating on the same channel.

To identify requirements which overlap, it is necessary to examine each of the test points for one requirement to determine if it lies inside the area of a second requirement. Because there can be anomalies in the case where there are large separation distances between adjacent test points, it is also necessary to repeat the examination to determine if any of the test points of the second requirement lies inside the area of the first requirement.

To identify requirements which are incompatible because of potential interference, it is necessary to consider three cases:

– where both of the requirements are specified as assignments;
– where one of the requirements is specified as an assignment and the other is specified as an allotment;
– where both requirements are specified as allotments.

In all three of the above cases, the assessment of the protection margin is made separately using the method of § 5.3.1.2.1 for each of the test points which define the area to be served.

When applying the method of § 5.3.1.2.1, the wanted field strength is:

– in the case of an assignment, the reference field strength for 50% of the time and 50% of locations or the wanted field strength for 50% of the time and 50% of locations provided by the assignment calculated using the method of § 5.3.1.2.2;
– in the case of an allotment, the reference field strength for 50% of the time and 50% of locations specified for use with the specified reference network.

The nuisance field strength is calculated for 50% of locations and for 1% of the time (thus providing protection against interference for 99% of the time) except where a value greater than 1% is agreed between the concerned administrations.

The wanted field strength and the reference field strength are dependent on the service conditions. These service conditions include:

– reception mode: (fixed, portable, mobile);
– type of service: (television or sound radio);
– system variant: (64-QAM, 16-QAM or QPSK) together with the code rate to be used;
– reference planning configuration;
– target percentage of locations to be achieved.

The calculations described above are needed for the case of the first requirement considered as the source of potential interference to the second requirement, and for the case of the second requirement considered as the source of potential interference to the first requirement.

If the protection margin is negative at any test point of either requirement, the two requirements are theoretically incompatible.

5.3.1.1.1.3 Special consideration for requirements in Band III

In the case of Band III, it is also necessary to consider the impact of the possible overlapping channel situations which might occur. This involves an extension to the process described in § 5.3.1.1.1.1 and § 5.3.1.1.1.2. In addition to the calculations described there, it is also necessary to calculate the amount of any permitted frequency overlap between two requirements and also to obtain information about the particular set of channels which each requirement might occupy. The latter information is available from knowledge of the channel alignment in use by any given administration.

5.3.1.1.1.4 Sets of incompatible requirements

For each requirement, the process described in § 5.3.1.1.1.2, when applied to all other requirements in turn, permits the establishment of the set of incompatible requirements. If applicable, this information may need to be supplemented as described in § 5.3.1.1.1.3. This set of incompatible requirements forms one element of the planning process.

5.3.1.1.1.5 Administrative declarations

If it so wishes, an administration may declare that two of its requirements are compatible, without adversely affecting other administrations, even though the calculations using the methods of § 5.3.1.1.1.2 indicate that the requirements are incompatible. This is equivalent to declaring that the requirements may share a channel if that makes the planning process easier.

It is possible for two administrations to declare that two requirements, one for each administration, are compatible, without adversely affecting other administrations, even though the calculations using the methods of § 5.3.1.1.1.2 indicate that the requirements are incompatible. This is equivalent to declaring that the requirements may share a channel if that makes the planning process easier.

It is possible for one administrations to declare that two of its requirements are incompatible even though the calculations using the methods of § 5.3.1.1.1.2 indicate that the requirements are compatible. This is equivalent to declaring that the requirements may not share a channel.

It is also possible for two administrations to declare that two requirements, one for each administration, are incompatible even though the calculations using the methods of § 5.3.1.1.1.2 indicate that the requirements are compatible. This is equivalent to declaring that the requirements may not share a channel.

5.3.1.1.2 Identification of channels available for use by a requirement

5.3.1.1.2.1 General

In order to identify which channels might be available for use by a given requirement, it is necessary to take into account any indications provided by the concerned administration and to calculate any potential interference from or to all existing or planned broadcasting stations and all other primary service stations, as appropriate. However, in the case where an administration allows for a choice to be made between multiple channels, it is not necessary to know which requirements are compatible with any other requirements, all that is established here is which channels a given requirement might be able to use.

5.3.1.1.2.2 Calculation methods

As was already noted in § 5.3.1.1.1.1, digital broadcasting requirements have their service area defined by a set of test points. Analogue broadcasting service stations, mobile service stations and stations of the aeronautical radionavigation service are considered in the same way, although it is necessary to calculate the locations of the test points by the method of § 5.3.1.1.3 if the service area is not specified by the concerned administration. Reception locations for fixed service stations will need to be specified by the concerned administration. Radio astronomy service station sites will need to be specified by the concerned administration.

All calculations for a given requirement take account of any potential interference which it might cause and what potential interference it might suffer (except in the case of possible interaction with a station of the radio astronomy service) if it were to use any individual channel.

In the case of potential interference to the requirement, the protection margin is calculated as in § 5.3.1.2.1:

- for each channel;
- for each broadcasting or other primary service station which might cause interference to the requirement;
- for each of the test points defining the boundary of the area of the requirement.

In the assessment of the protection margin:

- 50% of the time and 50% of location values will be used for the wanted signal;
- 1% of the time (except in the case of a specific request by individual administrations to use a higher value) and 50% of location values will be used for the nuisance signal, calculated as in § 5.3.1.2.3.

The reference reception values for the wanted signal depend on the service conditions.

In the case of potential interference from the requirement, the protection margin is calculated as in § 5.3.1.2.1:

- for each channel;
- for each broadcasting or other primary service station which might suffer interference from the requirement;
- for each of the fixed test points or the test points defining the boundary of the service area of the other service.

In the assessment of the protection margin:

- 50% of the time and 50% of location values will be used for the other primary service wanted signal;
- the percentage time and location values used for the nuisance signal, calculated as in § 5.3.1.2.3, are given in Chapter 4.

The reference emission values for the signal from the requirement depend on the service conditions.

If the lowest protection margin for any test point and for any channel is less than –0.5 dB, that channel is not available for the requirement.

5.3.1.1.2.3 Channel availability lists

At the end of the calculations described in § 5.3.1.1.2.2, the set of available channels is known for a given requirement.

5.3.1.1.2.4 Administrative declarations

If it so wishes, an administration may declare that a requirement may use a given channel even though the calculations using the methods of § 5.3.1.1.2.2 indicate that the use of that channel is not possible. This is equivalent to declaring that the requirement may use a particular channel if that makes the planning process easier. However, this declaration is only possible if there are no potential incompatibilities with services of some other administration. If there are incompatibilities which involve more than one administration, then it will be necessary for both administrations to declare that a given channel may be used by a given requirement.

It is also possible for an administration to declare that a requirement may not use a given channel even though the calculations using the methods of § 5.3.1.1.2.2 indicate that the channel may be used.

The declarations identified in the previous paragraphs may only be made if they do not adversely impact the planning process.

5.3.1.1.3 Calculation of the position of the test points delineating the service area

The method of § 5.3.1.2.4 is used to calculate the position of the test points delineating a service area in the case that the service is provided by an assignment and not by an allotment. While the emission and reception conditions are service-dependent, the same process is used for all services. In order to use the method of § 5.3.1.2.4, it is necessary to specify the bearings for which the service radius is to be determined.

In the form given in § 5.3.1.2.4, the method calculates the coverage area in the absence of interference. However, by calculating the protection margin instead of the wanted field strength, the effect of interference is taken into account and the service area is then defined.

5.3.1.1.4 Method for producing a plan

The method given in § 5.3.2 is to be used to produce a plan.

5.3.1.1.5 Analysis of final plan(s)

The approach given in § 5.3.1.2.4 will be used to calculate the position of the test points delineating the service area of all assignments in the final plan(s), noting that it is necessary to calculate protection margins instead of wanted field strength in order to take interference into account. For allotments, the analysis will consist of calculating the protection margins for the test point locations specified by the administration concerned.

5.3.1.2 Elements of planning methods

The elements given below apply to calculations involving digital and analogue transmitting and receiving stations in the broadcasting service and in other primary services. It is to be noted that the terms "base" and "mobile" are used in the mobile service. In this section, the terms "transmitting station" and "receiving station" are used to describe the functionality of stations in general and are thus not confined to stations of the broadcasting service.

5.3.1.2.1 Protection margin

The protection margin is calculated as:

wanted field strength – nuisance field strength – combined location correction factor

In this expression, the wanted and nuisance field strengths refer to 50% of location values of those field strengths. The purpose of the combined location correction factor is to convert the protection margin to the percentage location value needed for the wanted service.

Calculate the wanted field strength as in § 5.3.1.2.2.

Calculate the nuisance field strength as in § 5.3.1.2.3.

Calculate the combined location correction margin as in § 5.3.1.3.4.

The test point location at which the wanted field strength is to be determined will be determined as part of the planning process. These test point locations may be calculated or may be defined by the concerned administration.

Test point locations:

– in the case of an assignment or allotment with a single defined service area, the test point location may be at any point on the periphery of that service area in order to ensure that worst-case conditions are taken into account;

– in the case of an allotment whose service area is made up of a number of discrete areas taken together, the test point location may be at any point on the composite boundary of these areas taken together;

– in the case of an assignment or allotment whose service area is an entire country, the test point location may be at any point on the boundary of the country.

In any of these cases, the test point locations may be defined by the concerned administration, although it will be necessary to verify by means of calculations that such test points are technically valid.

In any case where the test point is intended to represent the edge of the service area, the wanted field strength indicated in the expression in the first two lines of the this section will be the minimum median field strength. This value is derived from the minimum field strength as in § 5.3.1.3.5.

In the case that there are several nuisance signals, it is necessary to combine them, using the information in § 5.3.1.2.6, and substitute the results for 50% of location value of nuisance field strength and σ_n in the expressions given above and in § 5.3.1.3.4. An additional signal will be included in the summation; this is the minimum median field strength and it is added to represent the noise level.

Similarly, if the wanted signals come from multiple sources, it will be necessary to combine them, using for example the information in § 5.3.1.2.5, and substitute the results for 50% of location value of wanted field strength and σ_w in the expressions given above and in § 5.3.1.3.4.

5.3.1.2.2 Wanted field strength at a receiving location

Identify the receiving location in terms of its geographic coordinates.

Identify the frequency, percentage of time and percentage of locations for which the result is needed. All of these elements enter into the detailed calculations carried out in subsequent steps.

Identify the source of the wanted signal and its geographic coordinates.

Calculate two field strengths (one for each polarization) at the destination given by the receiving location coordinates as in § 5.3.1.3.1.

If the reception mode is fixed:

– Calculate 50% of location field strength as the value obtained from § 5.3.1.3.1 for the polarization of the receiving antenna. In the case of a transmitted signal which has mixed polarization, the polarization of the receiving antenna is that of the larger received component, otherwise, the polarization of the receiving antenna is that of the wanted transmission.

If the reception mode is portable or mobile:

– Calculate 50% of location field strength as the larger of the values for the two planes of polarization obtained from § 5.3.1.3.1.

In the case where the polarization of the wanted signal is not specified, the receiving antenna is also assumed to have no polarization discrimination.

5.3.1.2.3 Nuisance field strength at a receiving location

Identify the receiving location in terms of its geographic coordinates.

Identify the frequency, percentage of time and percentage of locations for which the result is needed. All of these elements enter into the detailed calculations carried out in subsequent steps.

Identify the source of the interfering signal and its geographic coordinates.

Calculate two field strengths (one for each polarization) at the destination given by the receiving location coordinates as in § 5.3.1.3.1.

If the receiving antenna has directional or polarization characteristics:

– Calculate the bearing from the receiving location to the source location.

– Calculate the receiving antenna discriminations against vertically and horizontally polarized signals as in § 5.3.1.3.2.

– Calculate 50% of location field strength at the receiving location as the power sum of the relevant field strengths and receiving antenna discriminations for the two planes of polarization.

If the receiving antenna has no directional or polarization characteristics:

– Calculate 50% of location interfering field strength at the receiving location as the power sum of the two field strengths.

Calculate the relevant protection ratio value as in § 5.3.1.3.3.

Calculate the sum of the protection ratio and the interfering field strength at the receiving location.

5.3.1.2.4 Receiving location at which a target field strength is reached

Identify the frequency, percentage of time and percentage of locations for which the result is needed. All of these elements enter into the detailed calculations carried out in subsequent steps.

Obtain the bearing for which the receiving location is needed.

Set the "current distance" to an initial value of, say, 1 km.

5.3.1.2.4.1 Calculate a "current receiving location" on the given bearing at the "current distance".

5.3.1.2.4.2 Calculate the "current field strength" for the destination given by the "current receiving location" as in § 5.3.1.3.1.

5.3.1.2.4.3 If the absolute difference between the "current field strength" and the target field strength is smaller than a defined margin, the required receiving location has been found.

5.3.1.2.4.4 If the field strength from § 5.3.1.2.4.1 is larger than the target field strength, increase the current distance.

5.3.1.2.4.5 If the field strength from § 5.3.1.2.4.1 is smaller than the target field strength, reduce the current distance.

5.3.1.2.4.6 Return to § 5.3.1.2.4.1.

5.3.1.2.5 Wanted signal summation

In the case of digital broadcasting, it is possible to operate a set of transmitting stations as an SFN, and it is then necessary to use a statistical method for signal summation. The *k*-LNM (see § 5.3.1.3.7) will be used to calculate the mean and standard deviation of the field strength distribution test points.

5.3.1.2.6 Unwanted signal summation

If the wanted signal is analogue or digital:

– the power sum method as given in § 5.3.1.3.6 is used.

5.3.1.3 Details of calculation methods

5.3.1.3.1 Field strengths at a destination

Calculate the length of the path from source to destination using great circle geometry.

Calculate the relative proportions of land and sea for the path.

If the source is a transmitter:

– calculate the bearing from the source to the destination using great circle geometry;

– calculate the effective height of the transmitting antenna as a function of the bearing;

- calculate the field strength value at the destination for an effective radiated power (e.r.p.) of 1 kW using the propagation prediction method given in Chapter 2.

In the case where the transmitted signal has mixed polarization:

- obtain the maximum e.r.p. for the horizontally and vertically polarized components of the radiated signal;
- calculate the reduction in e.r.p. for each plane of polarization as a function of the bearing;
- calculate the field strengths at the destination taking account of the maximum e.r.p. and the reductions in each plane of polarization.

In the case where the transmitted signal has either vertical or horizontal polarization:

- obtain the maximum e.r.p. for the relevant polarized component of the radiated signal;
- calculate the reduction in e.r.p. for the relevant plane of polarization as a function of the bearing;
- calculate the field strength at the destination taking account of the maximum e.r.p. and the reduction in the relevant plane of polarization;
- set the field strength in the other plane of polarization to a low value, say −99.9 dB(μV/m).

In the case where the polarization of the transmitted signal is not specified, the polarization must be regarded as being the same as that of the receiving antenna in order to ensure that worst-case conditions are taken into account.

If the source is a reference source:

- calculate the field strength at the destination from the characteristics of the reference source taking account of the distance and the propagation path and also taking account of the polarization of the reference source (as specified above for the case of a transmitter). In the case where the reception location is specified to be significantly above the surface of the earth and where a line of sight condition applies, the field strength is obtained using a free space calculation and taking account of the total power of the transmitters in the reference network.

5.3.1.3.2 Receiving antenna discrimination values

If the receiving antenna has neither directivity discrimination nor polarization discrimination:

- set the discrimination against horizontally polarized signals to zero;
- set the discrimination against vertically polarized signals to zero.

If the receiving antenna has directivity or polarization discrimination:

- Calculate the directivity discrimination of the receiving antenna as a function of the frequency and the absolute difference between the bearing of the interfering signal and the bearing of the wanted signal.

– Calculate the polarization discrimination, this may be a function of the frequency in the case of some other primary services.
– Determine the polarization of the receiving antenna:
  – If the antenna is vertically polarized, set the discrimination against vertically polarized signals to the value of the directivity discrimination and set the discrimination against horizontally polarized signals to the value of the polarization discrimination.
  – If the antenna is horizontally polarized, set the discrimination against horizontally polarized signals to the value of the directivity discrimination and set the discrimination against vertically polarized signals to the value of the polarization discrimination.

5.3.1.3.3 Protection ratio value

Calculate the protection ratio from the information in Chapters 3 and 4.

The planning exercise team will need to select the relevant protection ratios where no information has been provided by administrations, and seek the approval of the administrations concerned. The IPG need to be informed in this regard.

5.3.1.3.4 Combined location correction factor

Calculate the combined location correction factor as:

$$\mu\sqrt{(\sigma_w^2 + \sigma_n^2)}$$

where:

$\mu = Q_i(1 - x/100)$

Q_i: multiplying factor given in section 12 of Annex 2.1 to Chapter 2

x: percentage of location for which protection is required

σ_w: standard deviation of location variation for the wanted signal

σ_n: standard deviation of location variation for the nuisance signal.

5.3.1.3.5 Minimum median field strength

The minimum median field strength is the field strength required at 50% of locations in order to ensure that the minimum field strength can be achieved for the wanted service at the required percentage of locations. This is expressed as:

$$\text{minimum median field strength} = \text{minimum field strength} + \mu\,\sigma_w$$

where the symbols have the same meaning as in § 5.3.1.3.4.

5.3.1.3.6 Power sum method

The power sum is the logarithmic value of the sum of the individual field strengths expressed as arithmetic powers:

$$\text{sum} = 10 \log\left(\sum 10^{\frac{E_i}{10}}\right)$$

where E_i represents the individual field strengths (dB(μV/m)).

5.3.1.3.7 Statistical summation method

The *k*-LNM method is described in detail in Annex A.5.3.1

5.3.1.3.8 Derivation of intermediate radiation pattern values

Where an antenna is directional, horizontal radiation patterns may have been given as part of the input data for bearings at intervals of 10°, linear interpolation being used to obtain radiation reduction values for intermediate bearings. Alternatively, the transmitting antenna pattern may be calculated, where the relevant information has been provided as part of the input data, using Recommendation ITU-R BS.1195 for broadcasting services and Recommendation ITU-R F.699 for fixed service.

5.3.1.3.9 Derivation of intermediate values of effective height

Where the terrain around a transmitter site is not uniform, an array of effective height values may have been given as part of the input data for bearings at intervals of 10°, linear interpolation being used to obtain effective height values for intermediate bearings.

5.3.2 Plan synthesis

5.3.2.1 General

The synthesis of a frequency plan is the process of determining a suitable channel (frequency) for each requirement (assignment or allotment) so that no harmful interference is caused to the existing and planned stations by the requirements, and that no harmful interference is caused to the requirements, either due to the existing and planned stations or due to the requirements amongst themselves, in their respective channels. The situation concerning requirement compatibility/incompatibility and channel availability is calculated during the compatibility analysis (see § 5.3.1) and is thus a predetermined input to a synthesis process.

5.3.2.2 Synthesis: algorithms

A synthesis procedure involves the attribution of channels (frequencies) to requirements, taking into account the results of the compatibility analysis as regards:

– the channels which are available to meet the requirements;
– the incompatibilities between requirements.

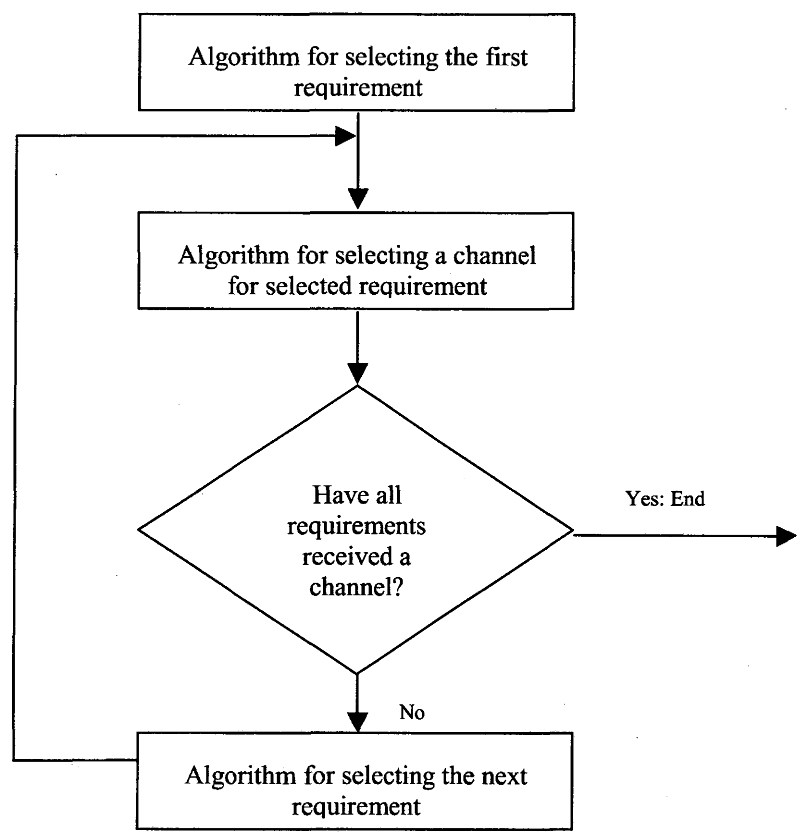
At any point during the synthesis process there are generally many possible channels available for each particular requirement. The selection of a channel for a requirement at any juncture will influence the development of the synthesis thereafter. Each individual choice is determined by the rules of the particular algorithm. The number of channel choices available for requirements treated towards the end of the process will generally decrease as the synthesis continues. In the worst case, no channels will be available for one or more requirements towards the end of the synthesis procedure. Thus, it is important to make assignment choices at the beginning of a synthesis process that do not too significantly reduce the possibilities in the synthesis process at a later point.

Variations in the planning situation between Band III and Band IV/V will necessitate different synthesis approaches, and therefore different computer synthesis implementations, to reflect the distinctions. For example, in Band III, the plan will be synthesized with respect to T-DAB with a 1.75 MHz bandwidth (32 frequency blocks) and DVB-T with a 7 or 8 MHz bandwidth (7 or 8 channels) and multiple channel spacings and alignments; in Band IV/V, the plan will be synthesized with respect to DVB-T with a 8 MHz bandwidth (49 channels) and a single channel spacing and alignment.

Specific synthesis methods to be used include sequential assignment procedures whereby frequencies are assigned to requirements one by one (see Fig. 5.3.2-1 for a general approach). These methods are rapid when carried out with a computer, and many algorithms are known. A large number of such algorithms form the basis of a single synthesis approach, with the results of the best algorithm being retained as the overall result.

FIGURE 5.3.2-1

General flowchart of sequential frequency-synthesis planning



5.3.2.3 Synthesis planning

Synthesis is generally not an "all at once" event, but starts with no requirements having been assigned a channel, and proceeds to the finish, where all requirements have been assigned a channel.

During the synthesis stage of planning, a satisfactory solution (i.e. all requirements assigned a frequency) is not expected to be achieved on the first synthesis attempt. It is thus necessary to adopt an iterative procedure, as shown in § 5.2.3.2.

ANNEX 5.2.2

A.5.2.2.1 Proposed method for establishing the service area of assignments

A.5.2.2.1.1 Existing or planned assignments

To calculate the service area of an existing or planned assignment, two elements are necessary:

– the parameters specific to an individual transmitting station (coordinates, effective height of the antenna, radiated power, etc.) which are used to calculate the wanted signal. These parameters are needed for the individual station under consideration and for all potentially interfering stations;

– the system parameters such as the minimum median field strength and the protection ratios which are used to calculate the individual nuisance field strengths and the usable field strength.

Because a certain amount of iteration is involved, the service areas are determined in three stages, and reference should be made to Fig. A.5.2.2.1-1 for clarification of the following texts:

Stage 1 – Calculation of noise-limited coverage area

Using the agreed propagation prediction model, the locations of the noise-limited test points are found, which represent the area that could be served if there were no interference. This area may be approximated on the basis of up to 36 radials, using the e.r.p. and the effective antenna height. For each radial, that location is determined where the field strength of the wanted transmitter equals the minimum median field strength.

Stage 2 – Identification of interferers

The impact of co-channel (and, in Band III, overlapping channel) interference from other transmitters and allotments is calculated for each wanted station and each noise-limited test point from Stage 1. First, the subset of possible interferers is established. This consists of the stations and allotments which can produce a nuisance field which is no more than 12 dB below the minimum median field strength at any of the noise-limited test points from Stage 1.

Stage 3 – Calculation of the test points for the interference-limited coverage

The individual nuisance field strength caused by each of the interfering stations or allotments in this subset of interferers is calculated at each of the noise-limited test points from Stage 1 (see Fig. A.5.2.2.1-1). The usable field strength is calculated for each of these test points.

In the case of no interferers, the usable field strength at a test point is equal to the minimum median field strength, no further calculation is required, and the coverage radius is that of Stage 1 above (see also Fig. A.5.2.2.1-1).

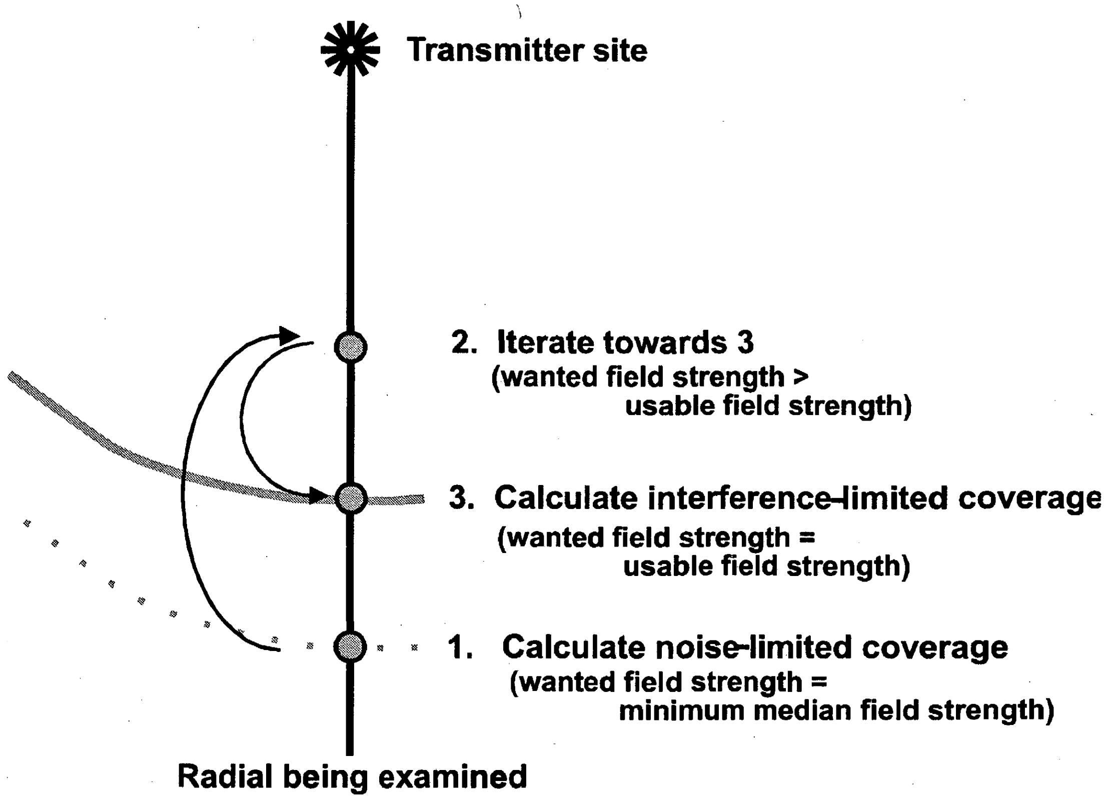
If the usable field strength at a test point is greater than the minimum median field strength, it is then necessary to find the new coverage radius on this bearing at which the field strength from the wanted station equals the usable field strength.

In general, the coverage radius thus calculated will not equal the radius previously calculated for the same bearing and thus the nuisance field strengths will change; hence, the process of the previous paragraph is repeated to obtain a close approximation to the required coverage radius on each of the bearings.

If the coverage radius crosses a country boundary, the test points in this area are located at the crossing points between a radial and the boundary unless otherwise agreed by the concerned administrations.

FIGURE A.5.2.2.1-1

Illustration of the calculation of location of test points for the interference-limited coverage



A.5.2.2.1.2 New digital assignment requirements

The method to calculate the service area of a digital assignment also refers to the calculation of a noise-limited coverage area, but, taking into account a required minimum median field strength which is augmented by a margin of 3 dB. This margin is added in order to allow a limited amount of interference to be introduced during the planning stage. Apart from this modification, the calculation of the service area is based on the same two elements as in § A.5.2.2.1.1. Furthermore, it follows the same procedure as given in § A.5.2.2.1.1, except that only the first stage of the calculation is needed. In this case also, the test points must not be outside the territory of the administration responsible for the assignment.

A.5.2.2.2 Two possible methods for the conversion of analogue assignments into digital allotment or assignment requirements

A.5.2.2.2.1 MFN conversion

A possible method to prepare assignment requirements for an all-digital plan is the conversion of analogue assignments into digital, while retaining the original MFN configuration. In this context, a conversion is one digital assignment that replaces one analogue assignment on the same frequency channel without increasing the usable field strength of other administrations' assignments and allotments. This is achieved by a suitable reduction of the e.r.p. of the digital assignment relative to that of the analogue assignment being converted, while maintaining the other transmission parameters (such as transmitting antenna height and radiation pattern) unchanged. The coverage of the converted digital assignments can closely match the service area of the original analogue stations. Low-power stations could form a part of such a plan and may be included in the conversion process.

This method might be suitable for countries that rely on fixed terrestrial antennas for a large proportion of their television reception.

With the correct e.r.p. reduction relative to the original analogue assignment, it retains compatibility with the current analogue entries in the ST61 or GE89 Plans, or with fully coordinated assignments in other countries outside the areas of these plans.

A.5.2.2.2.2 The channel potential method

The channel potential method provides information on how analogue assignments could be converted into digital allotment requirements, while facilitating compatibility with existing analogue or digital services.

The conversion of analogue assignments into digital allotments is a twofold process, in the sense that it involves two independent stages. The first stage consists in the construction of so-called channel potential areas for each channel under consideration.

The step-wise procedure to calculate the channel potential area is given below and illustrated in Fig. A.5.2.2.2-1:

Step 1: Define the minimum power limit of analogue assignments to be taken into account.

Step 2: Select all analogue assignments using a particular channel, according to the power limit.

Step 3: Calculate interference-limited contour for each selected assignment.

Step 4: Choose an assignment for which the channel potential area is to be calculated.

Step 5: Draw a line between the chosen assignment and any other adjacent assignment.

Step 6: Draw a normal at the midpoint between the intersections of the line with the interference contours.

Step 7: Define the value of the channel re-use distance *R*. This depends on the required transmitting parameters, the reception conditions and the propagation conditions between the two areas under consideration.

Step 8: On either side of the normal, at a distance of *R*/2, draw a line parallel to the normal.

Step 9: Repeat Steps 5 to 8 for each assignment adjacent to the chosen one.

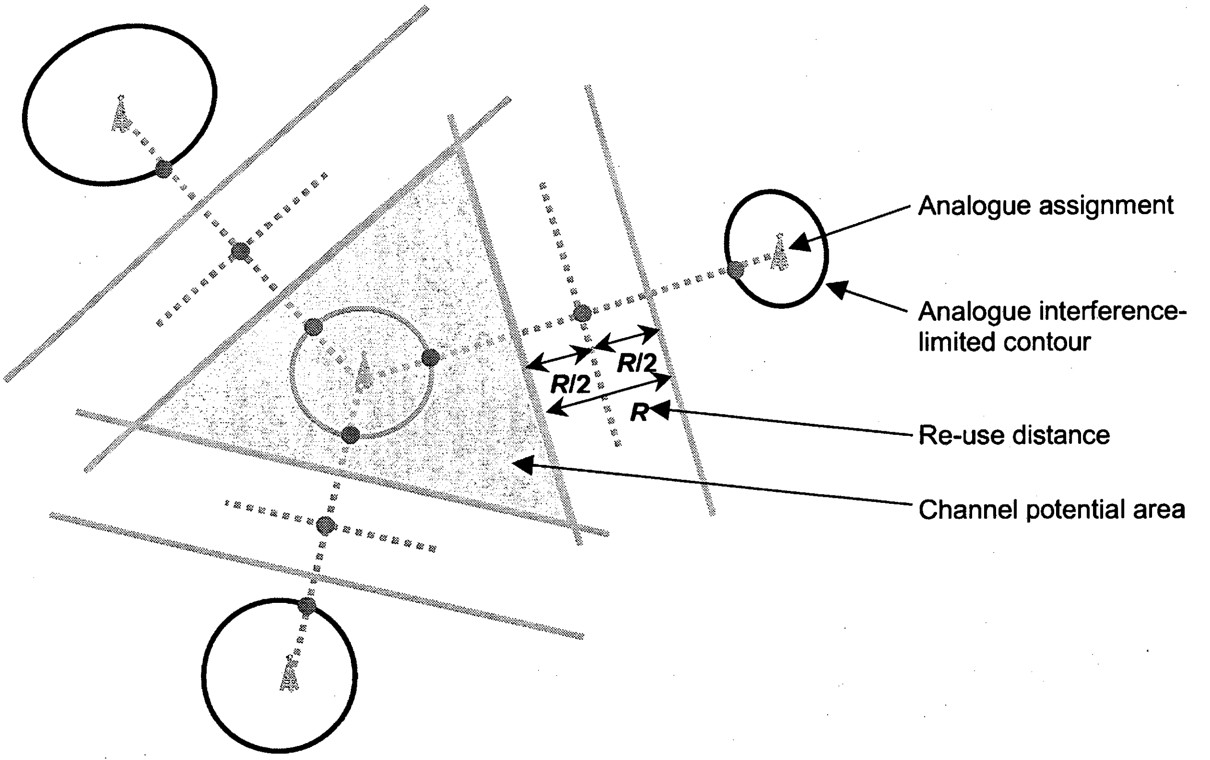
Step 10: Construct the channel potential area by connecting the intersection points of the individual borderlines.

In the second stage, the channel potential areas constructed in the manner described above are mapped onto the required service areas so that the allotment requirements are created. It should be also noted that channel potential areas constructed from the assignments belonging to one administration could be combined in order to provide more flexibility in defining allotment areas.

This method might be suitable for countries that wish to cooperate in the production of mutually compatible allotment plans.

FIGURE A.5.2.2.2-1

Construction of the channel potential area from analogue assignments



ANNEX 5.3.1

Mathematical treatment for combining multiple field strengths

A.5.3.1.1 *k*-LNM method

A value of 0.6 is used for k, and this can be expected to provide an accuracy within a few dB over 70% to 99% of location range.

Suppose there are given n logarithmic fields, F_i, with Gaussian distribution (parameters $\overline{F_i}, \sigma_i, i=1...n$), i.e. the corresponding powers are log-normally distributed.

The task is to determine the approximate log-normal distribution of the power sum, or, equivalently, to find the parameters of the Gaussian distribution of the corresponding logarithmic sum field:

Step 1: Transform $\overline{F_i}, \sigma_i, i=1...n$, from dB scale to Neper scale:

$$X_{Neper} = \frac{1}{10\log_{10}(e)} \cdot X_{dB}$$

Step 2: Evaluate the mean values, M_i, and the variances, S_i^2, of the n power distributions:

$$M_i = e^{\overline{F_i}+\frac{\sigma_i^2}{2}}, \quad S_i^2 = e^{2\overline{F_i}+\sigma_i^2} \cdot \left(e^{\sigma_i^2} - 1\right), \quad i=1...n \qquad \text{(Neper scale)}$$

Step 3: Determine mean value, M, and variance, S^2, of the sum power distribution:

$$M = \sum_{i=1}^{n} M_i, \quad S^2 = \sum_{i=1}^{n} S_i^2 \qquad \text{(Neper scale)}$$

Step 4: Determine the distribution parameters $\overline{F_\Sigma}$ and σ_Σ of the approximate log-normal sum distribution:

$$\sigma_\Sigma^2 = \log_e\left(k\frac{S^2}{M^2} + 1\right), \quad \overline{F_\Sigma} = \log_e(M) - \frac{\sigma_\Sigma^2}{2} \qquad \text{(Neper scale)}$$

Step 5: Transform $\overline{F_\Sigma}$ and σ_Σ from Neper scale to dB scale:

$$X_{dB} = 10\log_{10}(e) \cdot X_{Neper}$$

$\overline{F_\Sigma}$ and σ_Σ are the mean value and the standard deviation, respectively, of the approximate log-normal distribution of the true sum field.

CHAPTER 6

Requirements for digital broadcasting and data for analogue television and other primary services submitted by administrations

CONTENTS

6.1 Introduction

Administrations shall collate data for requirements for digital broadcasting services for the planning exercises during the intersessional period and for the second session of the conference.

§ 6.2 specifies the necessary data for the digital broadcasting requirements.

As a general principle, data for existing and planned broadcasting stations and existing and planned assignments of other primary services are to be taken into account in the planning process and shall be retrieved from the relevant files as indicated in Chapter 1, § 1.7.

It is essential that the records contained in the relevant plans or the MIFR be up to date. If this is not the case, administrations should update these records via the appropriate procedures prior to the reference date.

In addition, for bilateral or multilateral negotiations between administrations, more detailed information on the existing stations may be needed. Paragraphs 6.3 and 6.4 define the data elements that administrations might use for these negotiations.

All data regarding the digital broadcasting requirements shall be submitted in electronic form.

The term "data element" is used to describe the set of individual data items which, taken together, constitute one requirement from an administration.

Geographical longitude and latitude coordinates in the requirements should preferably be based on the World Geodetic System 1984 (WGS84). If this is the case, the administration concerned has to confirm this in the "Remarks" item.

On the basis of the tables in § 6.2 and 6.4, BR will produce a circular letter to administrations with explanatory notes and examples.

6.2 Requirements for digital broadcasting

This section specifies the data elements for four types of requirements:

- a digital television broadcasting assignment requirement;
- a digital television broadcasting allotment requirement;
- a digital sound broadcasting assignment requirement;
- a digital sound broadcasting allotment requirement.

For the first planning exercise, administrations have to submit their requirements. For the subsequent planning exercises, the administrations have the option of submitting a new set or only the modifications to the list by using item No. 1 in each table. The Intersessional Planning Group (IPG) will always use the latest set of requirements. All requirements have the same status in the planning process, irrespective of the date they were submitted.

Each requirement may have a channel or a range of acceptable channels (DVB-T) or acceptable frequency blocks (T-DAB) in the appropriate field. If such information is not supplied, it is assumed that all channels or frequency blocks are acceptable.

Existing and planned digital broadcasting assignments/allotments should be submitted as digital requirements using the following tables, as appropriate.

The planning exercise team will take the necessary information for the protection of these assignments/allotments, as indicated in Chapter 1, § 1.7.

The requirements related to existing and planned digital television assignments which already appear in the ST61 or GE89 Plans, or for which the relevant plan modification procedure has been successfully applied, need to be identified accordingly, and their conformity with the corresponding T02 forms verified.

Legend:

TerRaBase ref: field exists in TerRaBase and (in principle) contains necessary data

M: mandatory

(M): conditionally mandatory – depends on the data in one or more other related field(s)

O: optional

The same legend applies to all tables in this Chapter.

TABLE 6.2-1

Data for a digital television broadcasting assignment requirement

No	Item	Mand. /Opt.	App. 4 ref.	TerRaBase ref.
1	Add, modify, suppress	M		t_action
2	ITU symbol for administration responsible	M	B	t_adm
3	Unique identifier given by the administration for the assignment (AdminRefId)	M		t_adm_ref_id
3a	Unique identifier given by the administration for the target assignment, only for MOD or SUP	(M)		t_trg_adm_ref_id
4	ITU symbol for country in which transmitter is sited	M	4B	t_ctry
5	Name of the location of the transmitting station	M	4A	t_site_name
6	Geographical coordinate, latitude	M	4C	t_lat
7	Geographical coordinate, longitude	M	4C	t_long
8	Altitude of site (metres above sea level, as a sign followed by a number)	M	9EA	t_site_alt
	Enter either 9a + 9b or 10			
9a	Digital television system (including DVB-T variant)[1]	(M)		
9b	Reception mode (e.g. fixed, portable)	(M)		
10	Reference planning configuration (RPC 1, RPC 2 or RPC 3)	(M)		
11	List of acceptable channels	O		
	Complete 12 and/or 13, based on the value given in field 17			
12	Maximum e.r.p. of horizontally polarized component (dBW), as a sign followed by a number including a decimal point	(M)	8BH	t_erp_h_dbw
13	Maximum e.r.p. of vertically polarized component (dBW), as a sign followed by a number including a decimal point	(M)	8BV	t_erp_v_dbw

14	Identifier for SFN	(M)		
15	Relative timing of transmitter within an SFN (μs)	(M)		
16	Unique DVB-T allotment identifier given by the administration for the allotment to which this assignment is related	O		
17	Polarization (H-horizontal/V-vertical/M-mixed/U-unspecified)	M	9D	t_polar
18	Height of antenna (metres above ground level)	M	9E	t_hgt_agl
19	Directivity (directional/non-directional)	M	9	
20	36 values of e.r.p. reduction (dB) of the horizontally-polarized component in the horizontal plane relative to the maximum e.r.p. of the horizontally-polarized component as given above (at 10° intervals, starting at North), mandatory if field 19 = D	(M)	9NH	t_attn@azmxx0 in ANT_DIAGR_H subsection
21	36 values of e.r.p. reduction (dB) of the vertically-polarized component in the horizontal plane relative to the maximum e.r.p. of the vertically-polarized component as given above (at 10° intervals, starting at North), mandatory if field 19 = D	(M)	9NV	t_attn@azmxx0 in ANT_DIAGR_V sub-section
22	Maximum effective antenna height (m)	M	9EB	t_eff_hgtmax
23	36 values of effective antenna height (metres, at 10° intervals, starting at North); if not provided, the value of the maximum effective antenna height should be used for all 36 values	M	9EC	t_eff_hgt@azmxx0 in ANT_HGT sub-section
24	Spectrum mask	O		
25	Date of notification by administrations	O		t_d_adm_ntc
26	Origin: conversion of an analogue assignment[2]	O		
27	Successfully pre-coordinated with ...	O	11	t_adm in COORD sub-section
28	Remarks	O		t_remarks

[1] The DVB-T variant should fully identify the system used (e.g. modulation mode, number of carriers, FEC, guard interval).

[2] BR will determine a suitable way to identify the corresponding analogue assignment (if any) and inform the IPG if there is a need for advice.

TABLE 6.2-2

Data for a digital television broadcasting allotment requirement

No	Item	Mand. /Opt.	App. 4 ref.	TerRaBase ref.
1	Add, modify, suppress	M		t_action
2	ITU symbol for administration responsible	M	B	t_adm
3	Unique DVB-T identifier for the allotment given by the administration (AdminRefId)	M		t_admin_ref_id
3a	Unique identifier given by the administration for the target allotment, only for MOD or SUP	(M)		t_trg_dm_ref_id
4	ITU symbol for country in which allotment is sited	M	4B	t_ctry
5	Digital broadcasting allotment name	M		
	Enter either 6a + 6b or 7			
6a	Digital television system (including DVB-T variant)[3]	(M)		
6b	Reception mode (e.g. portable, mobile...)	(M)		
7	Reference planning configuration (RPC 1, RPC 2 or RPC 3)	(M)		
8	Type of the reference network (RN 1, RN 2, RN 3 or RN 4)	M		
9	Identifier for SFN	(M)		
10	Polarization (H-horizontal/V-vertical/M-mixed/U-unspecified)	M	9D	t_polar
11	List of acceptable channels	O		
12	If all the test points are on the country boundary for this allotment, enter the identifier for national boundary	(M)		
13	If previous field is blank, enter number (up to 9) of sub-areas within this allotment (if there is no subdivision, enter 1)	(M)		
14	Enter for each sub-area (up to 9) a unique contour number, its number of boundary test points (up to 99) and the coordinates of its associated allotment test points	(M)		
15	Date of notification by administrations	O		t_d_adm_ntc
16	Origin: conversion of an analogue assignment[4]	O		
17	Successfully pre-coordinated with ...	O	11	t_adm in COORD sub-section
18	Remarks	O		t_remarks

[3] The DVB-T variant should fully identify the system used (e.g. modulation mode, number of carriers, FEC, guard interval).

[4] BR will determine a suitable way to identify the corresponding analogue assignment (if any) and inform the IPG if there is a need for advice.

TABLE 6.2-3

Data for a digital sound broadcasting assignment requirement

No	Item	Mand. /Opt.	App. 4 ref.	TerRaBase ref.
1	Add, modify, suppress	M		t_action
2	ITU symbol for administration responsible	M	B	t_adm
3	Unique identifier given by the administration for the assignment (AdminRefId)	M		t_adm_ref_id
3a	Unique identifier of the target given by the administration for the target assignment, only for MOD or SUP	(M)		t_trg_dm_ref_id
4	ITU symbol for country in which transmitter is sited	M	4B	t_ctry
5	Name of the location of the transmitting station	M	4A	t_site_name
6	Geographical coordinate, latitude	M	4C	t_lat
7	Geographical coordinate, longitude	M	4C	t_long
8	Altitude of site (metres above sea level, as a sign followed by a number)	M	9EA	t_site_alt
9	Reference planning configuration (RPC 4 or RPC 5)	M		
10	List of acceptable frequency blocks	O		
	Complete 11 and/or 12, based on the value given in field 16			
11	Maximum e.r.p. of horizontally polarized component (dBW), as a sign followed by a number including a decimal point	(M)	8BH	t_erp_h_dbw
12	Maximum e.r.p. of vertically polarized component (dBW), as a sign followed by a number including a decimal point	(M)	8BV	t_erp_v_dbw
13	Identifier for SFN	(M)		
14	Unique T-DAB allotment identifier given by the administration for the allotment to which this assignment is related	O		
15	Relative timing of transmitter within an SFN (μs)	(M)		
16	Polarization (H-horizontal/V-vertical/M-mixed/U-unspecified)	M	9D	t_polar
17	Height of transmitting antenna (metres above ground level)	M	9E	t_hgt_agl
18	Directivity (directional/non-directional)	M	9	
19	Antenna attenuation – horizontal. 36 values of e.r.p. reduction (dB) of the horizontally-polarized component in the horizontal plane relative to the maximum e.r.p. component as given above (at 10° intervals, starting at North, clockwise), mandatory if field 18 = D	(M)	9NH	t_attn@azmxx0 in ANT_DIAGR_H subsection
20	Antenna attenuation – vertical. 36 values of e.r.p. reduction (dB) of the vertically-polarized component in the horizontal plane relative to the maximum e.r.p. as given above (at 10° intervals, starting at North, clockwise), mandatory if field 18 = D	(M)	9NV	t_attn@azmxx0 in ANT_DIAGR_V sub-section
21	Maximum effective antenna height (m)	M	9EB	t_eff_hgtmax
22	36 values of effective antenna height (metres, at 10° intervals, starting at North); if not provided, the value of the maximum effective antenna height should be used for all 36 values	M	9EC	t_eff_hgt@azmxx0 in ANT_HGT sub-section
23	Spectrum mask	O		
24	Date of notification by administration	O		t_d_adm_ntc
25	Successfully pre-coordinated with …	O	11	t_adm in COORD sub-section
26	Remarks	O		t_remarks

TABLE 6.2-4

Data for a digital sound broadcasting allotment requirement

No	Item	Mand. /Opt.	App. 4 ref.	TerRaBase ref.
1	Add, modify, suppress	M		t_action
2	ITU symbol for administration responsible	M		t_adm
3	Unique T-DAB allotment identifier given by the administration (AdminRefId)	M		t_adm_ref_id
3a	Unique identifier given by the administration for the target allotment, only for MOD or SUP	(M)		t_trg_dm_ref_id
4	ITU symbol for country in which allotment is sited	M	4B	t_ctry
5	Digital broadcasting allotment name	M		
6	Type of the reference network	M		
7	Reference planning configuration (RPC 4 or RPC 5)	M		
8	List of acceptable frequency blocks	O		
9	Identifier for SFN	(M)		
10	Polarization (H-horizontal/V-vertical/M-mixed/U-unspecified)	M	9D	t_polar
11	If the test points on country boundary for the allotment are to be used, enter the identifier for national boundary or sub-boundary	(M)		
12	If previous field is blank, enter number (up to 9) of sub-areas within this allotment (if there is no subdivision, enter 1)	(M)		
13	Enter for each sub-area (up to 9) a unique contour number, its number of boundary test points (up to 99) and the coordinates of its associated allotment test points	(M)		
14	Date of notification by administration	O		t_d_adm_ntc
15	Successfully pre-coordinated with ...	O	11	t_adm in COORD sub-section
16	Remarks	O		t_remarks

6.3 Data for existing and planned [analogue] television

The planning exercise team will take the necessary data for the protection of the existing and planned analogue television assignments from the relevant files as indicated in Chapter 1, § 1.7. Administrations wishing to update these records should use BR form T02 and apply the existing rules prior to the reference date.

6.4 Data for existing and planned assignments of other primary services

The planning exercise team will take the data necessary for the protection of the existing and planned assignments of other primary services as defined in Chapter 1, § 1.7. It is essential that the administrations wishing to complete or update these records use BR form T11, T12, T13 or T14 and apply the existing rules.

In addition, for bilateral or multilateral negotiations between administrations, more detailed information on the existing and planned assignments of other primary services may be needed as provided in Table 6.4-1 below.

TABLE 6.4-1

Data for assignments in other primary services

No.	Item	Mand-atory/ Opt-ional	App.4 ref.	TerRaBase ref.
1	ITU symbol for the notifying administration	M	B	t_adm in HEAD sub-section
2	Other service type code	O		
3	Record for Transmit/Receive/Both operations. The same identification code for a given station if described in two records	O		
4	Intent (ADD/MOD/SUP)	M		t_action
5	Unique identifier given by the administration for the assignment (AdminRefId)	O		t_adm_ref_id
5a	Unique identifier given by the administration for the target assignment, only for MOD or SUP and only if previously notified	(M)		t_trg_adm_ref_id
6	ITU symbol for the geographical area where the transmitter is situated	M	4B	t_ctry
7	Field strength to be protected (dB(μV/m)). Use value 999 for transmitting-only service where reception parameters are specified in a separate record	O		
8	Percentage of the time for which protection is sought	O		
9	Transmitting antenna site name	M	4A	t_site_name
10	Assigned frequency	M	1A	t_freq_assgn
10a	Assigned frequency of the target assignment, only for MOD or SUP and only if AdminRefId of the target assignment not notified	M	O-1A	t_trg_freq_assgn
11	Geographical coordinate, latitude	M	4C	t_lat
11a	Geographical coordinate, latitude of the target assignment, only for MOD or SUP and only if AdminRefId of the target assignment not notified	(M)	O-4C	t_trg_lat
12	Geographical coordinate, longitude	M	4C	t_long
12a	Geographical coordinate of the target assignment, longitude, only for MOD or SUP and only if AdminRefId of the target assignment not notified	(M)	O-4C	t_trg_long
13	Class of station	M	6A	t_stn_cls
13a	Class of station of the target assignment, only for MOD or SUP and only if AdminRefId of the target assignment not notified	(M)	O-6A	t_trg_stn_cls
14	Necessary bandwidth code	M	7A	t_bdwdth_cde
14a	Necessary bandwidth code of the target assignment, only for MOD or SUP and only if AdminRefId of the target assignment not notified	(M)	O-7A	t_trg_bdwdth_cde
15	Class of emission	M	7A	t_emi_cls
15a	Class of emission of the target assignment, only for MOD or SUP and only if AdminRefId of the target assignment not notified	M	O-7A	t_trg_emi_cls
16	Maximum effective radiated power (e.r.p.) in dBW. Use value –99 for receive-only service where transmission parameters are specified in a separate record	M	8B	t_pwr_dbw

TABLE 6.4-1 (*Continued*)

17	Altitude of the site above sea level (m)	O	9EA	t_site_alt
18	Height of the antenna above ground level (m)	O	9E	t_hgt_agl
19	Maximum effective antenna height (m)	O	9EB	t_eff_hgtmax
20	36 values of effective height (in m), at 10° intervals starting at North; if not provided, the value of the maximum effective height (9EB) should be used for all 36 values	O	9EC	t_eff_hgt@azmxx 0 in ANT_HGT sub-section
21	Polarization (H/V/M)	M	9D	t_polar
22	Antenna pattern 1: (D/ND) Put ND if the transmitting antenna is non-directional or the width of the main lobe is greater than 99°. Otherwise put D	M	9	-
23	Antenna pattern 2: 36 values of e.r.p. reduction (dB) of the e.r.p. relative to the maximum value, at 10° intervals starting from North, if previous field = D	O	9NH	t_attn@azmxx0 in ANT_DIAGR_H subsection
24	Test points 1: Enter B if test points for whole country are to be used	O		
25	Test points 2: If previous field is blank, enter number of test points (up to 99)	O		
26	Test points 3: Up to 99 coordinates	O		
27	Date of notification of this record	O		t_d_adm_ntc
28	Successfully pre-coordinated with ...	O	11	t_adm in COORD sub-section
29	Remarks	O		t_remarks

6.5 Output format for the planning exercises

The output format for the planning exercises will be determined by the planning exercise team and proposed to the IPG.

CHAPTER 7

Regulatory/procedural aspects

CONTENTS

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Introduction

Regulatory and procedural content must take account of the terms of the new agreement, in particular the planning area, the plans associated with the agreement, the entry into force of the agreement and the length of the transition period. These will form the basis for determining the regulatory procedures for modifying the plans, the coordination procedures for the transition from analogue to digital and the regulatory procedures to be used for sharing of the frequency bands 174-230 MHz and 470-862 MHz between the broadcasting service and other services to which they are allocated on an equal primary basis.

7.1 Planning area

Region 1 (parts of Region 1 situated to the west of meridian 170° E and to the north of parallel 40° S) and the Islamic Republic of Iran, except the territories of Mongolia.

7.2 Plans associated with the new agreement

The new Agreement should contain the following frequency plans:

i) A digital plan comprising two parts:

– Part 1, for digital broadcasting in Band III (174-230 MHz), with provisions for T-DAB and DVB-T;

– Part 2, for digital broadcasting in Bands IV and V (470-862 MHz), with provisions for DVB-T.

The digital plan would contain existing and planned assignments and allotments, as defined in § 1.7 of this report, in addition to the assignments and allotments proposed by administrations and approved by the conference at its second session.

ii) An analogue plan comprising two parts:

– Part 1, for analogue broadcasting in Band III (174-230 MHz);

– Part 2, for analogue broadcasting in Bands IV and V (470-862 MHz).

The analogue plan would contain existing and planned analogue assignments as defined in § 1.7 of this report.

7.3 Date of entry into force of the agreement

The date of entry into force of the new agreement, to be decided by the second session, should not be earlier than 12 months after the end of the second session.

The final acts of the second session may need to provide for provisional application of the new agreement (or parts of it) as from the date of the end of the second session, provided that such provisional application does not constrain the resolution of any incompatibility not resolved during the second session.

This provisional application may require the provisional application of the revision of the relevant parts of the current agreements at the same time.

NOTE – If the new agreement cannot be applied immediately after the end of the second session, there will be a period during which countries may need to apply the current procedures of the existing relevant agreements to modify existing assignments or to add new assignments to the existing plans. As these new or modified assignments may not have been known to, and taken into consideration by, the conference, this may lead to incompatibilities with the new agreement. On the other hand, if the conference decides to freeze the existing plans and associated provisions between the end of the second session and the date of entry into force, this may affect the right of administrations to develop their analogue broadcasting service.

7.4 Transition period

During the transition period, the existing and planned analogue assignments will continue to be used and protected by the new digital plan. After this period, analogue assignments may continue to be used[1], provided that:

– protection is afforded to the new digital plan and its modifications; and

– no protection is claimed from the new digital plan and its modifications.

This period starts at the date of entry into force of the new agreement and ends on a date to be agreed by the second session of the conference.

Two options have been identified so far with respect to this second date:

– Option 1

  As early as possible and preferably not later than 2015; however, longer or shorter transition periods may be agreed multilaterally provided they do not affect other administrations concerned.

– Option 2

  No earlier than 2028 and no later than 2038; however, shorter transition periods may be agreed multilaterally.

It is up to each administration to decide on the date as of which its analogue transmissions will cease.

7.5 Procedures

7.5.1 General

The procedures necessary for the implementation of the new agreement are applicable between any Member State of the Union in the planning area which has approved or acceded to the agreement.

Relations between two administrations, one of which is not party to the new agreement, will be based on the Radio Regulations, together with any bilateral or multilateral agreement.

The criteria/thresholds to be used in these procedures in order to determine the need for coordination should be part of the new agreement. These should be as simple as possible (i.e. field strength or pfd at the edge of the service area or at the location of the broadcasting station, the base station of the mobile service or the fixed station).

[1] The procedures and criteria for this purpose need to be established by the second session of RRC.

7.5.2 Current situation

The plan modification procedures in the ST61 and GE89 Agreements, although not identical, ensure that additional broadcasting requirements of the administrations can be accommodated and included in the relevant plans, as long as all the agreements required from administrations having assignments that may be affected in the broadcasting or other primary services have been obtained. These procedures include the following steps:

a) submission of the basic characteristics of the assignment proposed to be included in the relevant plan;

b) examination and publication by the Bureau, according to the case[1];

c) process of seeking agreement from the affected administrations;

d) deadline for comments and response[2];

e) in case of disagreement, possibility of technical examination by the Bureau to assist both administrations in resolving the problem;

f) when all agreements required have been obtained, the assignment is included in the relevant plan;

g) notification under Article 11 of the Radio Regulations or the appropriate provisions of the agreement. If the assignment is not in conformity with the relevant plan, the notice is returned to the administration.

Both ST61 and GE89 Agreements also include procedures for seeking agreement for new or modified assignments of other primary services with respect to the relevant assignments in the broadcasting service.

7.5.3 Scope and objectives of the procedures

In order to facilitate the transition from analogue to digital, administrations may modify the analogue and digital assignments/allotments in the transition period by the application of the plan modification procedures.

The procedures for the transition period set forth in the new agreement should allow for a gradual transition from analogue to digital broadcasting and should permit administrations to implement digital broadcasting in accordance with their own implementation strategy and their technical and financial resources.

During the transition period, there will be plans in the same bands for both analogue and digital broadcasting, which may give rise to incompatibilities in the transition period. Any transition period incompatibilities would need to be addressed through coordination procedures.

The new agreement should have modification procedures in order to enable administrations, in meeting their requirements, to modify the plans. For this purpose, the necessary coordination procedures need to be included in the agreement to cover inter-service and intraservice protection requirements for:

[1] In the ST61 Agreement, the normal procedure is bilateral coordination between administrations concerned before publication by BR.

[2] In the ST61 and GE89 Agreements, no response within the deadline means agreement.

- analogue television broadcasting (during the transition period);
- digital broadcasting;
- other primary services sharing the frequency bands in question.

The new agreement should also include procedures for the coordination of assignments of other primary services with stations in the broadcasting service.

In order to retain the rights of countries with respect to the protection of the analogue television broadcasting stations, the relevant procedures of the ST61 Agreement and the GE89 Agreement may be transferred to the new agreement.

7.5.4 Outline of the procedures

For the implementation of the agreement to be concluded by the second session of RRC, the first session of RRC has identified the following, non-exhaustive list of procedures, for study by RPG and possible adoption by the second session of RRC.

7.5.4.1 Specific procedures for coordination of unresolved incompatibilities affecting the new plans

7.5.4.1.1 Specific procedures for coordinating an assignment/allotment in one of the plans with existing and planned broadcasting assignments during the transition period

Compatibility of some assignments/allotments in one of the plans with existing and planned broadcasting assignments during the transition period may need to be ensured after the second session of the conference by the application of a specific procedure[3]. This could be implemented by specifying, under a specific section of the new agreement, that before an assignment in one of the plans, or an assignment obtained by conversion of an allotment in the digital plan, is brought into service, coordination is to be effected with the existing and planned digital or analogue assignments in the relevant plans which may be affected. In the application of this specific procedure, equitable access to frequency resources should be preserved.

7.5.4.1.2 Specific procedures for coordinating assignments/allotments in one of the plans with existing and planned assignments of other primary services

For cases where compatibility of some assignments/allotments in one of the plans with existing and planned assignments of other primary services (i.e. primary services other than the broadcasting service) as defined by the first session of RRC, could not be ensured by design of the new plan, such compatibility should be ensured after the second session of the conference by the application of a specific procedure. This could be implemented, for example, by specifying, under a specific section of the new agreement, that before an assignment in one of the plans is brought into service, coordination is to be effected with the existing and planned assignments of other primary services, as defined by the first session of RRC, which may be affected.

[3] This may be the case, in particular, between countries wishing to implement different planning approaches.

The above procedure does not apply to the specific cases of unresolved incompatibilities between existing and planned assignments/allotments in the broadcasting service and existing and planned assignments of other primary services to which footnotes 5, 6 or 7 in § 1.7 apply.

7.5.4.1.3 Procedures for coordination of other unresolved incompatibilities within the broadcasting requirements

Experience from previous planning conferences indicates that there might be some or even many cases for which time constraints at the conference would not permit complete resolution of all incompatibilities between proposed broadcasting requirements. For these cases, the new agreement should include the necessary provisions and/or procedures for their resolution.

Unresolved cases need to be included in an attachment to the agreement, together with relevant procedures for their resolution. The status of that attachment needs to be addressed.

7.5.4.2 Procedures for modifying one of the plans

Starting from the date of applicability of the new agreement, in any given band covered by the mandate of RRC, there will be two plans:

– a digital plan as adopted by the second session of the conference, with any additional/modified assignment/allotment which has been successfully coordinated following the application of the plan modification procedure. In Band III, this digital plan includes T-DAB, as well as DVB-T;

– an analogue plan as adopted by the second session of the conference, with any additional/modified analogue assignment which has been successfully coordinated following the application of the plan modification procedure.

The plan modification procedure should include the need to coordinate new or modified assignments/allotments proposed to be included in the relevant broadcasting plan with:

7.5.4.2.1 assignments/allotments in the digital plan;

7.5.4.2.2 assignments/allotments for which the procedure for modification of the digital plan has been previously initiated;

7.5.4.2.3 assignments in the analogue plan (during the transition period only);

7.5.4.2.4 assignments for which the procedure for modification of the analogue plan has been previously initiated (during the transition period only);

7.5.4.2.5 assignments of other primary services recorded in the MIFR with a favourable finding;

7.5.4.2.6 assignments of other primary services for which the procedure under § 7.5.4.4 below has been initiated.

There may also be merit in studying the advantages/disadvantages of provisions to limit the time granted to an administration to complete the modification procedure, as currently specified in the GE89 Agreement (§ 4.6.1), and to limit the time granted to notify a new or modified assignment/allotment in the plan.

7.5.4.3 Cancellation of an assignment or an allotment

7.5.4.4 Procedures for coordination of future assignments of other primary services with the broadcasting service

These procedures should include the need to coordinate future assignments of other primary services with:

7.5.4.4.1 assignments/allotments in the digital plan;

7.5.4.4.2 assignments/allotments for which the procedure for modification of the digital plan has been previously initiated;

7.5.4.4.3 assignments in the analogue plan;

7.5.4.4.4 assignments for which the procedure for modification of the analogue plan has been previously initiated.

7.5.4.5 Procedure for converting an analogue assignment in the plan into a digital assignment/allotment during the transition period

The agreement should also include a procedure for converting an analogue assignment in the plan into a digital assignment/allotment during the transition period (see Annex 5.2.2).

7.5.4.6 Procedure for converting a digital allotment into one or more digital assignments

The agreement should also include a procedure for converting a digital allotment in the plan into one or more digital assignments.

7.5.4.7 Notification

7.5.4.8 Use of a digital assignment/allotment in the plan for analogue broadcasting during the transition period, under certain conditions

The new agreement should include a procedure allowing an administration, during the transition period, to use a digital assignment in the plan for analogue transmissions, provided that it does not cause more interference in any direction than would be caused by the broadcasting assignment/allotment it replaces, or require greater protection than would be given to the broadcasting assignment/allotment it replaces. However, the implications of this approach for the plan adopted by the second session should be studied.

An in-depth examination would be required by BR to clearly indicate that the above-mentioned conditions are fully met. The methodology to perform such an examination needs to be studied during the intersessional period and submitted to the second session for consideration and possible adoption. Once this methodology is adopted, this may also call for the development and use of software to implement it.

7.5.4.9 Use of an assignment in the plan for purposes other than broadcasting under certain conditions

The agreement could also contain provisions to enable administrations to use an assignment/allotment in one of the plans for a different terrestrial service or broadcasting system, provided that such use does not cause more interference in any direction than would be caused by the broadcasting assignment/allotment it replaces, or require greater protection than would be given to the broadcasting assignment/allotment it replaces.

Such use would need to be considered as within the broadcasting service in the application of the procedures of this agreement, and would need to be part of the notification.

An in-depth examination would be required by BR to clearly indicate that the above-mentioned conditions are fully met. The methodology to perform such an examination needs to be studied during the intersessional period and submitted to the second session for consideration and possible adoption. Once this methodology is adopted, this may also call for the development and use of software to implement it.

7.5.4.10 Continued use of an analogue broadcasting assignment after the transition period, under certain conditions

After the transition period, analogue assignments may continue to be used, provided that protection is afforded to, and no protection is claimed from, the new digital plan and its modifications. The procedures and criteria to achieve these objectives need to be considered by the second session of RRC.

7.5.4.11 Elimination of harmful interference

7.5.4.12 Settlement of disputes

7.5.4.13 Accession to the agreement

7.5.4.14 Denunciation of the agreement

7.5.4.15 Revision of the agreement

7.5.4.16 Entry into force and duration of the agreement

RESOLUTION [COM4/1]

Protection of digital terrestrial broadcasting from broadcasting-satellite service networks operating in the 620-790 MHz band

The first session of the Regional Radiocommunication Conference (Geneva, 2004),

considering

a) that it is necessary to adequately protect, *inter alia*, the terrestrial television broadcasting systems in this band;

b) that geostationary (GSO) broadcasting-satellite service (BSS) networks and non-geostationary (non-GSO) BSS satellite networks or systems are at the stage of advance publication or coordination, or have been notified in the 620-790 MHz frequency band;

c) that the impact of these GSO BSS networks and non-GSO BSS networks or systems on digital and analogue television broadcasting systems has yet to be examined and that the sharing criteria, including the pfd limits required to protect the terrestrial services in this frequency band, are not known and depend on a possible decision of WRC-07;

d) that many administrations have extensive infrastructure for the transmission and reception of analogue and digital television signals between 620 MHz and 790 MHz;

e) that the second session of the conference will adopt an agreement together with associated plans for digital terrestrial broadcasting, *inter alia*, in the band 620-790 MHz,

noting

that the existing provisions relating to the band 620-790 MHz are ambiguous and have been difficult to apply by administrations and the Radiocommunication Bureau,

recognizing

a) that No. 5.311 of the Radio Regulations specifies the conditions under which the band 620-790 MHz may be used for assignments to television stations using frequency modulation in the BSS;

b) that use of the band 620-790 MHz by GSO and non-GSO BSS networks has been suspended by Resolution 545 (WRC-03) pending a decision by WRC-07,

further recognizing

a) that pursuant to *resolves* 3 of Resolution 545 (WRC-03), GSO BSS networks and non-GSO BSS networks or systems in the band 620-790 MHz other than those notified, brought into use and with a date of bringing into use confirmed before the end of WRC-03, shall not be brought into use before the end of WRC-07;

b) that pursuant to *resolves* 5 of Resolution 545 (WRC-03), the BSS systems referred to in *resolves* 1 of that Resolution shall not be taken into account in the application of *resolves* 3.4 of Council Resolution 1185 (modified, 2003),

resolves

to recommend the second session of the conference to adopt the regulatory procedures necessary to ensure that:

1 the GSO-BSS and/or non-GSO BSS satellite networks/systems which were not brought into use prior to 5 July 2003 shall protect the plan(s) to be established at that session and its/their subsequent evolution;

2 the ground terminals of GSO BSS and/or non-GSO BSS satellite networks/systems which were not brought into use prior to 5 July 2003 shall not claim protection from the plan(s) as evolved nor put any constraint on the operation of the assignments/allotments of the plan(s) and its/their subsequent development and evolution,

instructs the Secretary-General

to bring the results of the studies called for in this resolution to the attention of the second session of the Regional Radiocommunication Conference.

RESOLUTION [COM4/2]

Development of protection criteria for terrestrial digital television systems interfered with by terrestrial services other than broadcasting

The first session of the Regional Radiocommunication Conference (Geneva, 2004),

considering

a) that the bands 174-230 MHz and 470-862 MHz are allocated on a co-primary basis to the broadcasting service as well as to some other terrestrial and space services in the planning area of the Regional Radiocommunication Conference (RRC);

b) that relevant protection criteria are required for the analysis of compatibility between these services during the development of the new plan and at the stage of its implementation;

c) that protection criteria for terrestrial digital television (DVB-T) systems interfered with by terrestrial systems of other primary services, referred to in Annex 4 to Chapter 4 of the report from the first session to the second session, cover only specific sharing scenarios;

d) that Recommendation ITU-R BT.1368-4 contains only protection ratios for DVB-T systems interfered with by narrow-band FM applications and by certain types of fixed-service systems,

recognizing

that criteria for protection of DVB-T against other types of potentially interfering systems, including digital wideband systems, need to be developed,

resolves to invite ITU-R

to carry out additional studies, as a matter of urgency, in order to develop protection criteria for terrestrial digital television systems interfered with by those primary-service systems operating in the bands 174-230 MHz and 470-862 MHz for which no information is contained in Recommendation ITU-R BT.1368-4,

urges administrations

to actively participate in these studies and to provide, whenever available, measured protection ratios for sharing scenarios mentioned in *resolves to invite ITU-R*,

instructs the Secretary-General

to bring the results of the studies called for in this resolution to the attention of the second session of the Regional Radiocommunication Conference.

RESOLUTION [COM4/3]

Development of protection criteria for aeronautical radionavigation service systems operating in the bands 223-230 MHz, 585-610 MHz and 645-862 MHz interfered with by terrestrial digital television systems

The first session of the Regional Radiocommunication Conference (Geneva, 2004),

considering

a) that the bands 174-230 MHz and 470-862 MHz are allocated on a primary basis to the broadcasting service in the Regional Radiocommunication Conference (RRC) planning area;

b) that the band 645-862 MHz is also allocated on a primary basis to the aeronautical radionavigation service in some countries of Region 1 according to RR No. 5.312;

c) that the band 223-230 MHz is allocated on a primary basis to the aeronautical radionavigation service in Region 3 (the Islamic Republic of Iran);

d) that the band 585-610 MHz is allocated on a primary basis to the radionavigation service in Region 3 (the Islamic Republic of Iran);

e) that relevant protection criteria are required for the analysis of interference from terrestrial digital television (DVB-T) systems to aeronautical radionavigation systems during the development of the new plan and at the implementation stage;

f) that protection criteria for the air-to-ground component of one type of aeronautical radionavigation system interfered with by DVB-T are contained in Annex 2 to Chapter 4 of the report from the first session of the RRC to the second session;

g) that Recommendation ITU-R M.1461 provides guidance on the protection criteria for radars operating in the radiodetermination service,

recognizing

that criteria for the protection of other types of aeronautical radionavigation systems, including radars, against DVB-T need to be developed,

resolves to invite ITU-R

to carry out additional studies, as a matter of urgency, in order to develop protection criteria for other types of aeronautical radionavigation systems, including radars, operating in the bands 223-230 MHz, 585-610 MHz and 645-862 MHz, which are interfered with by DVB-T systems and for which no information is contained in Annex 2 to Chapter 4 of the report from the first session of the RRC to the second session,

urges administrations

to actively participate in these studies and to provide, whenever available, measured values for possible sharing scenarios mentioned in *resolves to invite ITU-R*,

instructs the Secretary-General

to bring this the results called for in this Resolution to the attention of the second session of the RRC.

RESOLUTION [COM4/4]

Studies of radiowave propagation in the planning area

The first session of the Regional Radiocommunication Conference (Geneva, 2004),

considering

a) that the first session of the conference adopted a propagation prediction method for use in the planning of the bands 174-230 MHz and 470-862 MHz and for associated compatibility analyses;

b) that the prediction method takes account of the geographic variation in propagation behaviour in the planning area due to differences in atmospheric refractivity and that this variation is depicted in a map of propagation zones adopted by the conference;

c) that the accuracy of propagation predictions in the planning area is dependent on the representative values of vertical refractivity gradient selected for the propagation zones;

d) that Recommendation ITU-R P.453 provides global numerical maps of the vertical refractivity gradient derived from measurements made throughout the world,

recognizing

that further information on refractivity and ducting in the planning area will depend on new measurements of vertical refractivity gradient becoming available,

resolves to invite ITU-R

taking into account the measurement results provided by administrations, to undertake studies on refractivity and ducting in the planning area with a view to reviewing and, if necessary, revising the corresponding map of propagation zones adopted by the first session of the conference,

urges administrations

to provide ITU-R with results of measurements of vertical refractivity gradient for their territories,

instructs the Secretary-General

to bring the results of the studies called for in this resolution to the attention of the second session of the Regional Radiocommunication Conference.

RESOLUTION [COM4/5]

Development of additional protection criteria for broadcasting services for frequency planning exercises during the intersessional period and for the development of a digital frequency plan during the second session

The first session of the Regional Radiocommunication Conference (Geneva, 2004),

considering

a) that ITU Council Resolution 1185 (modified, 2003) states that the development of a digital frequency plan needs to take into account, among others, the protection of analogue broadcasting stations;

b) that relevant protection criteria are required for the analysis of compatibility between the digital and analogue broadcasting services during the development of the new plan and during its implementation;

c) that protection criteria for terrestrial digital video broadcasting (DVB-T), terrestrial digital audio broadcasting (T-DAB) and analogue broadcasting services provided in Recommendations ITU-R BS.1660 and ITU-R BT.1368-4 may not cover all cases necessary for carrying out the required compatibility analysis,

recognizing

that additional protection criteria for broadcasting services for frequency planning exercises during the intersessional period and for the development of a digital frequency plan during the second session need to be developed,

resolves to invite ITU-R

to carry out studies, as a matter of urgency, in order to develop additional protection criteria for broadcasting services, not given in Recommendations ITU-R BS.1660 and ITU-R BT.1368-4 (listed in the Annex), for frequency planning exercises during the intersessional period and for the development of a digital frequency plan during the second session,

urges administrations

to actively participate in these studies and to provide, whenever available, measured protection ratios for sharing scenarios particularly mentioned in *resolves* and if possible for other options that may be required,

instructs the Secretary-General

to bring the results of the studies called for in this resolution to the attention of the second session of the Regional Radiocommunication Conference.

ANNEX

Development of additional protection criteria for broadcasting services for frequency planning exercises during the intersessional period and for the development of a digital frequency plan during the second session

The protection criteria required are listed below.

1) Protection of DVB-T interfered with by analogue terrestrial television.

– Wanted DVB-T systems defined as Reference Planning Configuration (RPC 1, RPC 2 and RPC 3) are described in § 3.6.2.2 of the report to the second session:
  - DVB-T 64-QAM-3/4 Ricean channel
  - DVB-T 16-QAM-2/3 Rayleigh channel
  - DVB-T 16-QAM-3/4 Rayleigh channel.

– Unwanted analogue television systems include:
  - B/PAL, B1/PAL, D/PAL, D1/PAL, K1/PAL, I/PAL, B/SECAM, D/SECAM, D1/SECAM, K1/SECAM, L/SECAM in VHF
  - G/PAL, H/PAL, I/PAL, K/PAL, K1/PAL, G/SECAM, K/SECAM, K1/SECAM, L/SECAM in UHF.

2) Protection of T-DAB interfered with by analogue terrestrial television.

– Wanted T-DAB.

– Unwanted analogue television systems include B/PAL, B1/PAL, D/PAL, D1/PAL, K1/PAL, I/PAL, B/SECAM, D/SECAM, D1/SECAM, K1/SECAM, L/SECAM in VHF.

3) Protection of analogue terrestrial television interfered with by DVB-T broadcasting.

– Wanted analogue television systems include:
  - B/PAL, B1/PAL, D/PAL, D1/PAL, K1/PAL, I/PAL, B/SECAM, D/SECAM, D1/SECAM, K1/SECAM, L/SECAM in VHF
  - G/PAL, H/PAL, I/PAL, K/PAL, K1/PAL, G/SECAM, K/SECAM, K1/SECAM, L/SECAM in UHF.

– Unwanted DVB-T.

RESOLUTION [COM4/6]

Development of protection criteria for land mobile services using narrow-band frequency modulation interfered with by terrestrial audio broadcasting systems

The first session of the Regional Radiocommunication Conference (Geneva, 2004),

considering

a) that the bands 174-230 MHz and 470-862 MHz are allocated on a primary basis to the broadcasting service in the Regional Radiocommunication Conference (RRC) planning area;

b) that the band 174-223 MHz is also allocated on a primary basis to the land mobile service to countries listed in RR No. 5.235. Protection is required only between the countries mentioned in that provision;

c) that the band 174-230 MHz is allocated on a primary basis to the mobile service in the Islamic Republic of Iran, in Region 3;

d) that relevant protection criteria are required for the analysis of interference from terrestrial digital audio broadcasting (T-DAB) systems to land mobile radio services using narrow-band frequency modulated equipment during the development of the new plan and its implementation;

e) that land mobile radio services using narrow-band frequency modulated equipment typically use different antenna systems and different antenna heights for base station reception and mobile station reception and it is likely that different values of field strength may need to be protected in each case,

noting

that ITU-R has developed protection criteria for the land mobile service (with the same operational characteristics as those in *considering e)* above) from terrestrial digital video broadcasting (DVB-T) emissions,

noting further

that ITU-R has also developed protection criteria to protect the land mobile service from T-DAB emissions that do not take into account the use of different antenna systems,

resolves to invite ITU-R

to carry out additional studies, as a matter of urgency, in order to develop protection criteria for land mobile radio services using narrow-band frequency modulated equipment, with different antenna systems and heights for the base station, which are interfered with by T-DAB systems; and to update, if necessary, the existing information in Annex 1 to Chapter 4 of the report from the first session of the conference to the second session, *urges administrations*

to actively participate in these studies and to provide, whenever available, measured protection criteria for the sharing scenarios mentioned in *resolves to invite ITU-R*,

instructs the Secretary-General

to bring the results of the studies called for in this resolution to the attention of the second session of the Regional Radiocommunication Conference.

RESOLUTION [COM4/7]

Development of methods for the identification of administrations whose existing and planned digital and analogue assignments/allotments in the broadcasting service and assignments to other primary services may be affected by the application of the interim coordination procedures adopted by the first session of the Regional Radiocommunication Conference (Geneva, 2004)

The first session of the Regional Radiocommunication Conference (Geneva, 2004),

considering

a) that it has adopted definitions for existing and planned assignments/allotments of the broadcasting service and for existing and planned assignments of primary services other than broadcasting that are to be taken into account in the design of the new plan (see § 1.7 of the report to the second session);

b) that it has adopted a list of the primary services other than broadcasting that are to be taken into account in the design of the new plan (see Chapter 4 of the report to the second session);

c) that the current procedures included in the Stockholm, 1961 and Geneva, 1989 Agreements are applicable only between the parties to those agreements;

d) that it has adopted interim procedures for the coordination of assignments of primary services other than broadcasting with existing and planned assignments/allotments of the broadcasting service,

considering further

that the coordination between administrations concerned may be undertaken on the basis of bilateral or multilateral agreements,

resolves to invite ITU-R

to study, as a matter of urgency, the development of methods for the identification of administrations whose existing and planned digital and analogue assignments/allotments in the broadcasting service, and assignments to other primary services may be affected by the application of the interim coordination procedures adopted by this session of the conference, taking into consideration the need to verify the contents of the Annex to this resolution,

urges administrations

to actively participate in the studies referred to in *resolves to invite ITU-R* and to provide, whenever available, appropriate information to facilitate those studies,

instructs the Secretary-General

to bring the results of the studies requested in this resolution to the attention of the second session of the Regional Radiocommunication Conference.

ANNEX

Methods to identify administrations potentially affected by assignments or allotments in the broadcasting service and other primary services

1 Identification of the administrations whose analogue or digital assignments in the broadcasting service or assignments in other primary services may be affected by digital assignments recorded in the ST61 and GE89 Plans

Initial provisional studies of the Rules of Procedure of the Stockholm, 1961 Agreement (Part A2) and of the Geneva, 1989 Agreement (Part A6) indicate that the following approach may be used to protect the analogue broadcasting services and some other primary services from digital terrestrial broadcasting services, by applying the coordination distances as described below.

1.1 Coordination distances to assess the potential impact of DVB-T assignments on analogue television and comparison with the ST61/GE89 limiting distances

For the impact of DVB-T on analogue television, the minimum median field-strength values given in Recommendation ITU-R BT.417 have been used to calculate the values of maximum interfering field strength, and a protection ratio of 41 dB has been used (Recommendation ITU-R BT.1368), which leads to the maximum interfering field-strength values as tabulated below.

TABLE 1

Values of maximum interfering field strength (dB(μV/m)) for analogue television interfered with by DVB-T used to evaluate coordination distances

	Minimum median field-strength value (dB(μV/m))	Maximum interfering field strength (dB(μV/m)) $E_{max\ int}$
Band III	55	14
Band IV	65	24
Band V	70	29

The field-strength values are converted into coordination distances by applying Recommendation ITU-R P.1546 as described in Chapter 2 of the report to the second session, using 1 kW e.r.p. transmitters with 300 m effective antenna heights, but without taking into account terrain clearance angle.

Considering the information presented by the Radiocommunication Bureau, the only new digital assignments in the ST61/GE89 Plans or in the Master International Frequency Register are in Band IV/V. Consequently, the analysis has been conducted for 600 MHz only.

TABLE 2

Comparison of coordination distances (1 kW e.r.p., 300 m effective antenna height)

	Calculated coordination distances with Recommendation ITU-R P.1546 (1% of the time) (km)	ST61 limiting distances (km)	GE89 limiting distances (km)[(1)]
Case 1 (600 MHz, land)	130	220	150 to 180
Case 2[(2)] (600 MHz, warm sea)	670	Not given (>1 000 km)	650 to 750
Case 3[(3)] (600 MHz, cold sea)	500	980	

(1) For the GE89 distances, the distances related to Zone 1 (for land) and Zone 4 (for warm sea) are considered in this document for comparison. No comparison has been drawn for cold sea.

(2) For this case, the ST61 distances for comparison are taken from the "Mediterranean Sea" case.

(3) For this case, the ST61 distances for comparison are taken from the "sea in general" case.

Based on these results, it can be seen that, for the chosen cases, the calculated coordination distances are lower than the limiting distances provided by ST61 and GE89. It is envisaged that this will be generally valid (e.g. for other values of transmit powers and antenna heights).

It is therefore concluded that the distances provided by ST61 and GE89 can be used to identify administrations whose analogue assignments in the broadcasting service may be affected by digital assignments recorded in the ST61 and GE89 Plans.

1.2 Coordination distances to assess the potential impact of DVB-T assignments on other primary services

1.2.1 Reception of other primary services at ground level

It has been agreed that, in this case, limiting distances from ST61/GE89 can be used to identify administrations whose assignments to other primary services can potentially be affected by a digital assignment recorded in the ST61 and GE89 Plans.

1.2.2 Reception of other primary services on board aircraft

It has been concluded that, in this case, the coordination distances should be determined by line of sight using free-space propagation.

For the application of this method, it seems necessary to have a means to specify the reference points of the aircraft receiver area, which should be limited to the service area of the aeronautical land station, and shall be limited to the territory of the notifying administration responsible for the aeronautical radionavigation system.

As an example, the case of an aircraft at 10 000 m altitude will lead to line-of-sight distances around 450 km, which will depend upon the DVB-T antenna height.

2 Identification of the administrations whose analogue or digital assignments in the broadcasting service or assignments in other primary services may be affected by T-DAB allotments/assignments

2.1 Impact of T-DAB allotments/assignments on analogue or digital assignments in the broadcasting service

In order to identify the administrations whose analogue or digital assignments in the broadcasting service may be affected by T-DAB allotments/assignments, Recommendations ITU-R BS.1660, ITU-R BT.655 and ITU-R BT.1368 should be applied.

2.2 Impact of T-DAB allotments/assignments on assignments in other primary services

For assignments related to ground-based receiving stations from another primary service, distances from ST61/GE89 can apply to identify administrations potentially affected by T-DAB allotments/assignments.

For an airborne receiving station from another primary service, these distances will be determined with line of sight (see § 1.2.2).

3 Identification of the administrations whose analogue or digital assignments in the broadcasting service may be affected by assignments in other primary services

It is proposed to use the same method as described in § 1.2.

When the transmitting station of the other primary service is ground-based, distances from ST61/GE89 may be applied (see § 1.2.1).

When the transmitting station of the other primary service is on board an aircraft, the distances will be determined with line of sight (see § 1.2.2).

4 Identification of the administrations in the RRC planning area whose broadcasting and other primary services may be affected by the broadcasting analogue assignments contained in the "RCC List"

This case has not been studied in detail, but it is expected that the methods proposed in section 1 will be applicable as well.

5 Applicability to DVB-T allotments

In the case of DVB-T allotments, the combined effect of individual transmitters in the corresponding reference network should be considered (see § 5.3.1.2.6 of the report from the first to the second session of RRC).

RESOLUTION [COM5/1]

Intersessional activities relating to the accomplishment of the required planning exercises as requested by the first session of the Regional Radiocommunication Conference (Geneva, 2004)

The first session of the Regional Radiocommunication Conference (Geneva, 2004),

considering

a) that it has adopted planning principles, planning methods, planning parameters and criteria and network configurations, to be used for the establishment of the digital terrestrial broadcasting service in the planning area referred to in Council Resolution 1185 (modified, 2003);

b) that it has also established inter-service and intraservice sharing in the frequency bands 174-230 MHz and 470-862 MHz;

c) that administrations need to provide their digital broadcasting requirements before the established deadlines (see Annex 2) using the format developed in accordance with the decisions of this session;

d) that administrations need to provide requirements related to their existing and planned broadcasting service and data related to other primary services before the established deadlines (see Annex 2),

noting

that there is a need to carry out necessary planning activities between the two sessions of the conference based on the information referred to in *considering a), b), c)* and *d)* above, in accordance with the time schedule in Annex 2,

further noting

a) that the planning software will be developed by administrations and regional organizations and provided to the Radiocommunication Bureau (BR) prior to 1 September 2004;

b) that BR needs to examine and test this software before integrating into its software package,

recognizing

a) that *resolves* 5 of Council Resolution 1185 (modified, 2003) provides for the establishment of a planning project team (PPT) to carry out the planning activities;

b) that, pursuant to No. 159E of Article 28 of the ITU Constitution, expenses incurred by regional conferences referred to in No. 43 of the Constitution shall be borne by all Member States of the region concerned in accordance with their class of contribution, *resolves*

1 to establish an intersessional planning group (IPG)[1], open to participation on the same basis as the Regional Radiocommunication Conference (RRC) with the following terms of reference:

a) to monitor the intersessional activities in respect of the development of the draft plan and supervise the activities of the planning exercise team (composed of BR assisted by experts nominated by the respective groups);

b) to take into account the results of bilateral and multilateral negotiations carried out by administrations, when submitted to IPG;

c) to review the result of the planning exercise and the draft plan and, where appropriate, give instructions to the planning exercise team to make the necessary adjustments[2] for carrying out subsequent activities;

d) to take into account the results of ITU-R studies as requested by the first session of RRC (see Resolutions [COM4/2], [COM4/3], [COM4/4], [COM4/5], [COM4/6] and [COM4/7]), if available, with a view to their implementation for the improvement of the planning exercise process;

e) to prepare a report after each IPG meeting, including the results of the planning exercise and the draft plan, to be dispatched to administrations for comment and feedback as soon as it becomes available; the report should also contain suggestions to administrations on any appropriate action that may be necessary to achieve the objectives of the planning exercise;

f) to review and revise, if appropriate the time schedule and scope of intersessional activities set out in Annex 2, taking into account the work carried out by IPG and the planning exercise team, provided that these changes in no way affect the overall schedule of the intersessional activities and the right of administrations in terms of the date of submission of information (requirements and data) to be taken into account;

2 that IPG will be chaired by an expert representing a Member State of the Union from the planning area assisted by four vice-chairmen each representing a regional group;

3 that IPG will work in accordance with the working methods contained in Annex 1;

4 that IPG will work in close cooperation with the Regulatory/Procedural Group (RPG);

5 that the estimated costs of CHF 738 100 incurred by IPG will be included in the intersessional activities budget,

instructs the Secretary-General

1 to bring this resolution to the attention of the Member States of the Union and ITU-R Sector Members indicating that for outside the planning area it is for information only;

2 to submit the final output of IPG including the draft plans to the second session of RRC,

further instructs the Secretary-General

1 to bring this resolution to the attention of the Council at its 2004 session for necessary action, as appropriate;

[1] This constitutes the PPT mentioned in Council Resolution 1185 (modified, 2003).

[2] This adjustment excludes any change to the requirements of administrations without their prior agreement.

2 to provide the administrations and IPG with information every three months on ITU expenses incurred in the intersessional work;

3 to ensure that the information, if available, is based on a transparent and open time recording process

instructs the Director of the Radiocommunication Bureau

1 to make the necessary arrangements for convening the meetings of IPG and to provide it with the necessary facilities and information;

2 to establish a Planning exercise team[3] (see Annex 3) composed of BR officials assisted by experts nominated by the respective groups[4];

3 to provide, if possible, one fellowship per least-developed country administration, for their participation at the IPG meetings, within the available resources in the budget envisaged for the intersessional work;

4 to provide to administrations, in particular those of developing countries and countries with economies in transition, assistance necessary for their preparation for the second session, within the available resources in the budget envisaged for the intersessional work;

5 to dispatch to the Member States of the Union within the planning area, the reports referred to in *resolves* 1*e)* above as soon as they become available, including the final report, at least two months before the commencement of the second session of RRC, for their consideration and required action, as appropriate;

6 to make the necessary arrangements for organizing regional information meetings/workshops to provide assistance to the administrations in their preparations during the intersessional period and for the second session of RRC,

invites the Director of the Telecommunication Development Bureau

to make the necessary arrangements for organizing regional information meetings/workshops to provide assistance to the administrations in their preparations during the intersessional period and for the second session of RRC,

invites

1 the administrations of the Member States and ITU-R Sector Members belonging to the planning area of RRC to actively participate in the meeting of IPG;

2 the administrations of Member States to nominate one point of contact for the work of IPG (see Annex 2).

[3] The cost of participation of the nominated experts will be borne by their respective administrations or regional organizations as appropriate.

[4] The leader of the planning exercise team will be nominated by the Director of the Radiocommunication Bureau.

ANNEX 1

Working methods for the Intersessional Planning Group (IPG)

Steering group

An IPG "steering group" composed of a chairman and four vice-chairman will be established.

The leader of the planning exercise team will participate in the meetings of the steering group.

The steering group will meet as necessary.

The steering group will work in one language only.

The first meeting of the steering group will take place in the fourth quarter of 2004.

IPG meetings

IPG will hold two meetings[5] as indicated in Annex 2.

The meetings of IPG will take place in the following periods:

July 2005

February 2006

The meetings of IPG will be with interpretation in the five relevant working languages of the Union. The documentation will be in the five relevant working languages of the Union.

IPG will meet for a maximum of 10 working days. This period will be appropriately distributed between the two meetings, depending on the scope and volume of the work to be carried out at each meeting.

The participants are encouraged to work electronically.

Contributions

The deadline for submission of contributions to IPG shall be in accordance with the time-limits in Resolution ITU-R 1.

[5] Due to limited capacity of the meeting rooms it may be necessary to limit the number of participants from each administration and Sector Member.

ANNEX 2

The following schedule is based on the assumption that the second session of RRC will begin in May 2006:

<table>
<tr><th>Activity/event</th><th>Duration</th><th>Deadline</th><th colspan="2">Action by</th></tr>
<tr><td>End of the first session of RRC</td><td></td><td>28.05.2004</td><td colspan="2"></td></tr>
<tr><td>Preparatory phase</td><td></td><td></td><td colspan="2"></td></tr>
<tr><td>Development and distribution of:
– electronic form for input data(1)
– data capture software(2)</td><td>
1 month
3 months</td><td>
30.06.2004
01.09.2004</td><td colspan="2">
BR</td></tr>
<tr><td>Planning software to be provided to BR</td><td>–</td><td>01.09.2004</td><td colspan="2">Administrations and regional organizations</td></tr>
<tr><td>Planning software implementation and verification using test data(3)</td><td rowspan="5">6 months</td><td></td><td colspan="2">BR assisted by the experts</td></tr>
<tr><td>Information/workshop regional meetings</td><td></td><td colspan="2">BR and BDT</td></tr>
<tr><td>Meeting of the IPG Steering Group for review of implementation and test runs of the planning software before launch of the next phase</td><td>Mid January 2005</td><td colspan="2">IPG Steering Group</td></tr>
<tr><td>First planning exercise</td><td></td><td colspan="2"></td></tr>
<tr><td>Preparation and submission of initial input data(1)</td><td>28.02.2005</td><td colspan="2">Administrations</td></tr>
<tr><td>Validation, correction and publication of input data</td><td>3 months</td><td>31.05.2005</td><td colspan="2">BR and administrations</td></tr>
<tr><td>First planning exercise</td><td rowspan="3">1.5 month</td><td></td><td>BR assisted by the experts</td><td rowspan="2">See resolves 1</td></tr>
<tr><td>Meeting of IPG</td><td>Mid July 2005</td><td>IPG</td></tr>
<tr><td>Publication of the results of the second planning exercise</td><td>15.07.2005</td><td colspan="2">BR</td></tr>
<tr><td>Analysis of the results by administrations and preparation of input data for production of the draft plan</td><td>3.5 months</td><td></td><td colspan="2">Administrations</td></tr>
</table>

<table>
<tr><th>Activity/event</th><th>Duration</th><th>Deadline</th><th colspan="2">Action by</th></tr>
<tr><td>Production of the draft Plan</td><td></td><td></td><td colspan="2"></td></tr>
<tr><td>Reference situation date(4)</td><td></td><td>31.10.2005</td><td colspan="2">Administrations</td></tr>
<tr><td>Last submission of input data(1) prior to the second session of RRC</td><td></td><td>31.10.2005</td><td colspan="2">Administrations</td></tr>
<tr><td>Validation, correction and publication of input data</td><td>3 months</td><td>31.01.2006</td><td colspan="2">BR and administrations</td></tr>
<tr><td>Production of the draft plan</td><td rowspan="3">1 month</td><td></td><td>BR assisted by the experts</td><td rowspan="2">See resolves 1a)</td></tr>
<tr><td>Meeting of the IPG; submission of the draft plan to the second session of RRC</td><td>February 2006</td><td>IPG</td></tr>
<tr><td>Publication of the draft plan</td><td>28.02.2006</td><td colspan="2">BR</td></tr>
<tr><td>Analysis of the draft plan by administrations</td><td>2 months[6]</td><td></td><td colspan="2">Administrations</td></tr>
<tr><td>Beginning of the second session of RRC</td><td></td><td>May 2006[7]</td><td colspan="2"></td></tr>
</table>

(1) Input data to the planning exercises and production of the draft plan consist of:

- Requirements for digital broadcasting assignments and/or allotments (data shall be provided by the administrations and not generated by BR), including existing or planned digital assignments/allotments.
- Data for:
  - existing and planned analogue broadcasting assignments; and
  - existing and planned assignments of other primary services

  shall be retrieved from the relevant files as indicated in § 1.7. Attention is drawn to the fact that administrations which intend to update their data should complete relevant procedures prior to the reference situation date.

Administrations shall indicate:

- those existing and planned broadcasting assignments/allotments that are not to be taken into account in the planning process; and
- those existing and planned assignments of other primary services that are to be taken into account in the planning process.

Information on existing digital assignments in ST61 or GE89 Plans shall be submitted in the new form for requirements.

Requirements for digital broadcasting shall be submitted to BR in an electronic form.

Submission of input data for the draft plan may include a complete set of input data or modification to the previously submitted input data. There is no priority attached to input data with regard to date of submission, provided that input data are received by BR by the deadline as indicated in the time schedule, in a complete form.

For administrations that have not submitted data, it is assumed that all the existing and planned broadcasting or other services assignments, according to the definition provided in § 1.7, shall be protected in the planning process.

(2) Development and distribution of form for input data and data capture software.

- form of input data, including electronic data format, should be made available to the administrations as soon as it is developed, but not later than one month after the end of the first session of RRC. It will allow preparation of initial input data to begin immediately after publication of the form of requirements;
- data capture software should be developed and distributed to administrations not later than three months after the end of the first session of RRC.

6 Irrespective of the date of the second session, which will be decided by the Council, the two months foreseen for the analysis of the draft plan shall not be reduced to less than two months.

7 To be decided by the Council.

(3) Test data will be generated by BR and the experts and will consist of:

- digital broadcasting assignments and/or allotments
- existing and planned broadcasting assignments
- existing and planned assignments of other primary services,

these data shall be retrieved from the relevant existing BR files.

(4) The reference situation contains the existing and planned assignments and allotments of the broadcasting service and the existing and planned assignments of the other primary service to be taken into account for the development of the Plan(s).

NOTE – In order to facilitate the exchange of information between administrations and BR, each administration shall nominate a contact person. Full contact details (name, title, postal address, telephone and telefax numbers, e-mail …) shall be supplied to BR.

ANNEX 3

Planning exercise team

- The planning exercise team will be composed of BR officials assisted by experts nominated by the respective groups. There will be up to two experts each from EBU, CEPT, ATU, RCC and the League of Arab States, and one from the Islamic Republic of Iran.
- The cost of participation of the nominated experts will be borne by their respective administrations or regional organizations, as appropriate.
- The leader of the planning exercise team will be nominated by the Director of the Radiocommunication Bureau.
- The planning exercise team will meet as appropriate.
- The planning exercise team will work electronically as far as possible.
- The overall responsibility for the planning exercise activities lies with the Director of the Radiocommunication Bureau.

Any clarification regarding the working methods of this team can be coordinated with the IPG steering group as required.

RESOLUTION [COM5/2]

Date, duration, venue and agenda of the second session of the Regional Radiocommunication Conference for the planning of the digital terrestrial broadcasting service in Region 1 (parts of Region 1 situated to the west of meridian 170° E and to the north of parallel 40° S, except the territories of Mongolia) and in the Islamic Republic of Iran, in the frequency bands 174-230 MHz and 470-862 MHz

The first session of the Regional Radiocommunication Conference (Geneva, 2004),

considering

a) that Council Resolution 1185 (modified, 2003) resolves to convene a regional radiocommunication conference (RRC) for the planning of the digital terrestrial broadcasting service in Region 1 (parts of Region 1 situated to the west of meridian 170° E and to the north of parallel 40° S, except the territory of Mongolia) and in the Islamic Republic of Iran, in the frequency bands 174-230 MHz and 470-862 MHz;

b) that *resolves* 3 of Council Resolution 1185 (modified, 2003) deals with the date, duration and the agenda of the second session of RRC, responsible for preparing an agreement and an associated frequency plan for terrestrial digital broadcasting in the frequency bands 174-230 MHz and 470-862 MHz,

noting

that there is a need to amend *resolves* 3 to reflect the results and decisions of the first session,

resolves to recommend to the Council

to modify *resolves* 3 of Resolution 1185 (modified, 2003) to read as follows:

"3 that the second session of RRC will be held in the second quarter of 2006[1] in [...][2] for a duration of five weeks[3] to establish, on the basis of proposals from administrations and of the report of the first session of the conference, and taking into consideration the report from the Director of the Radiocommunication Bureau on the intersessional work, a new regional agreement for the planning area referred to in "*resolves* 1" above and for the concerned frequency bands, including:

3.1 associated frequency plans, as described in § 5.1.1.2 of the report of the first session, for terrestrial digital broadcasting in the frequency bands 174-230 MHz and 470-862 MHz, taking account of the following items:

a) planning principles;

[1] The exact date to be decided by the Council.

[2] The venue to be decided by the Council.

[3] The duration of five weeks shall include the two short conferences to revise, as appropriate, the relevant parts of the Stockholm, 1961 and Geneva, 1989 Agreements, in accordance with Resolutions [GT-PLEN/1] and [GT-PLEN/2] of the first session of the conference.

b) protection of existing and planned broadcasting assignments;

c) mechanisms, including time periods, for the migration from analogue to digital broadcasting;

d) protection of existing and planned assignments to other primary services in the bands 174-230 MHz and 470-862 MHz;

e) definition of terms to be used in the agreement;

f) propagation characteristics and methods of predicting field-strength values in the VHF and UHF bands;

g) planning criteria (including protection ratios), planning methods and network configurations (e.g. single-frequency networks, multi-frequency networks);

h) inter-service and intra-service sharing and compatibility criteria, including for frequency bands adjacent to the frequency bands 174-230 MHz and 470-862 MHz;

3.2 regulatory and procedural aspects relating to the use of the bands 174-230 MHz and 470-862 MHz by the broadcasting service and to the sharing of these bands between the broadcasting service and the other primary services;

3.3 the relationship between the agreement to be established by the second session and the Stockholm 1961 and Geneva 1989 Agreements with a view to harmonizing the scope of application of each of these three agreements;",

instructs the Secretary-General

to bring this resolution to the attention of the 2004 session of the Council.

RESOLUTION GT-PLEN/1

Recommended course of action with respect to those parts of the Stockholm 1961 Agreement to be dealt with in the new regional agreement for the frequency bands 174-230 MHz and 470-862 MHz

The first session of the Regional Radiocommunication Conference (Geneva, 2004),

considering

a) that the Regional Administrative Radiocommunication Conference (Stockholm, 1961) (ST61) adopted provisions relating to the use of the broadcasting service (sound and television) in the European Broadcasting Area for the bands between 41 MHz and 960 MHz allocated on a primary basis to the broadcasting service under Article 5 of the Radio Regulations (Geneva, 1959), with the exception of the bands 68-73 MHz and 76-87.5 MHz;

b) that Council Resolution 1185 (modified, 2003) resolves that the agenda of this session of the Regional Radiocommunication Conference (RRC) is to include making a proposal on the recommended course of action with respect to those parts of the agreement referred to in *considering a)* to be dealt with in the new regional agreement for the frequency bands 174-230 MHz and 470-862 MHz;

c) that Council Resolution 1185 (modified, 2003) resolves to convene a conference of short duration immediately after the second session of RRC, to revise the relevant parts of the agreement referred to in *considering a)*;

d) that some Member States are included in the planning areas of both the ST61 and Geneva, 1989 (GE89) Agreements;

e) that the costs associated with the conference mentioned in *considering c)* above need to be identified separately from those associated with the second session of RRC and could be minimized by associating this conference in time and place with the second session of RRC,

further considering

a) that the report to the second session of RRC recommends that RRC, at its second session, adopt a new agreement to govern the frequency bands 174-230 MHz and 470-862 MHz, which would include plans for the analogue and digital broadcasting services, as well as regulatory procedures to address sharing situations within the broadcasting service and between the broadcasting service and other primary services;

b) that preparation for the conference referred to in *considering c)* above should start as early as possible, making maximum use of informal consultations, *noting*

that unnecessary complexity may be avoided by having all the provisions and procedures relating to the frequency bands concerned by RRC gathered in a single agreement adopted by the second session of RRC, rather than in two agreements, one to be adopted by the second session of RRC and one revising the current ST61 Agreement,

resolves to recommend

1 that the Council, at its 2004 session, amend *resolves* 4 of Council Resolution 1185 (modified, 2003) in order to convene a short conference associated in time and place with the second session of RRC, and to be concluded immediately after it, to revise the ST61 Agreement, with a view to harmonizing the parts of that agreement that relate to the use of the frequency bands 174-230 MHz and 470-862 MHz by the broadcasting service with the agreement adopted by the second session of RRC;

2 to ensure that the meetings of this short conference are not held in parallel with those of the second session of RRC or with meetings of the other short conference which may be associated with RRC in time and place (see Resolution GT-PLEN/2);

3 that the date of entry into force of the revisions decided by this short conference should be the date of entry into force of the new agreement adopted by the second session of RRC;

4 that the revision should be provisionally applicable as from the end of the short conference,

instructs the Secretary-General

to bring this resolution to the attention of the Council at its 2004 session.

RESOLUTION GT-PLEN/2

Recommended course of action with respect to those parts of the Geneva 1989 Agreement to be dealt with in the new regional agreement for the frequency bands 174-230 MHz and 470-862 MHz

The first session of the Regional Radiocommunication Conference (Geneva, 2004),

considering

a) that the Regional Administrative Radiocommunication Conference (Geneva, 1989) (GE89) adopted provisions and a related plan concerning the television broadcasting service in the bands 47-68 MHz, 174-230 MHz, 230-238 MHz, 246-254 MHz and 470-862 MHz, together with provisions for other primary and permitted services in the African Broadcasting Area and neighbouring countries;

b) that Council Resolution 1185 (modified, 2003) resolves that the agenda of this session is to include making a proposal on the recommended course of action with respect to those parts of the agreements referred to in *considering a)* to be dealt with in the new regional agreement for the frequency bands 174-230 MHz and 470-862 MHz;

c) that Council Resolution 1185 (modified, 2003) resolves to convene a conference of short duration immediately after the second session of the Regional Radiocommunication Conference (RRC), to revise the relevant parts of the agreement referred to in *considering a)*;

d) that some Member States are included in the planning areas of both the Stockholm, 1961 (ST61) and GE89 Agreements;

e) that the costs associated with the conference mentioned in *considering c)* above need to be identified separately from those associated with the second session of RRC and could be minimized by associating this conference in time and place with the second session of RRC,

further considering

a) that the report to the second session of RRC recommends that RRC, at its second session, adopt a new agreement to govern the frequency bands 174-230 MHz and 470-862 MHz, which would include plans for the analogue and digital broadcasting services, as well as regulatory procedures to address sharing situations within the broadcasting service and between the broadcasting service and other primary services;

b) that preparation for the conference referred to in *considering c)* above should start as early as possible, making maximum use of informal consultations, *noting*

that unnecessary complexity may be avoided by having all the provisions and procedures relating to the frequency bands concerned by RRC gathered in a single agreement adopted by the second session of RRC, rather than in two agreements, one to be adopted by the second session of RRC and one revising the current GE89 Agreement,

resolves to recommend

1 that the Council, at its 2004 session, amend *resolves* 4 of Council Resolution 1185 (modified, 2003) in order to convene a short conference associated in time and place with the second session of RRC, and to be concluded immediately after it, to revise the GE89 Agreement, with a view to harmonizing the parts of that agreement that relate to the use of the frequency bands 174-230 MHz and 470-862 MHz by the broadcasting service with the agreement adopted by the second session of RRC;

2 to ensure that the meetings of this short conference are not held in parallel with those of the second session of RRC or with meetings of the other short conference which may be associated with RRC in time and place (see Resolution GT-PLEN/1);

3 that the date of entry into force of the revisions decided by this short conference should be the date of entry into force of the new agreement adopted by the second session of RRC;

4 that the revision should be provisionally applicable as from the end of the short conference,

instructs the Secretary-General

to bring this resolution to the attention of the Council at its 2004 session.

RESOLUTION [GT-PLEN/3]

Interim procedure for the coordination of assignments of primary services other than broadcasting with existing and planned assignments/allotments of the broadcasting service

The first session of the Regional Radiocommunication Conference (Geneva, 2004),

considering

a) that this session of the conference adopted definitions for existing and planned assignments/allotments of the broadcasting service and for existing and planned assignments of primary services other than broadcasting that are to be taken into account in the design of the new plan (see § 1.7 of the report to the second session);

b) that this session of the conference adopted a list of the primary services other than broadcasting that are to be taken into account in the design of the new plan (see § 1.7 of the report to the second session);

c) that the current procedures included in the Stockholm, 1961 (ST61) and Geneva, 1989 (GE89) Agreements to coordinate primary services other than broadcasting with the broadcasting service are applicable only between the parties to those agreements;

d) that, in order to identify and resolve any incompatibilities between assignments/allotments referred to in *considering a)* above, assignments of primary services other than broadcasting notified to the Radiocommunication Bureau after 10 May 2004 for which the procedures referred to in *considering c)* above are not applicable need to be coordinated with affected administrations,

considering further

that the coordination between administrations concerned may be undertaken on the basis of bilateral or multilateral agreements,

resolves

that, in order for an assignment to a primary service other than broadcasting notified to the Bureau after 10 May 2004 to be considered as "existing and planned", this assignment shall be coordinated with assignments of all administrations concerned in the broadcasting service using the coordination procedure specified in the annex to this resolution, unless bilaterally or multilaterally agreed between the administrations concerned.

ANNEX

Interim procedure for the coordination of assignments of primary services other than broadcasting with existing and planned assignments/allotments of the broadcasting service

1 When an administration proposes to consider as "existing and planned" an assignment of a primary service other than broadcasting which is notified to the Radiocommunication Bureau after 10 May 2004, the following actions shall be taken:

1.1 If the distances from the station using the assignment under consideration to the nearest points of the boundaries of other countries within the RRC planning area are less than the limits specified in § 3 of the report, agreement shall be sought from the administrations of those countries.

1.2 In seeking agreement, the administration proposing the assignment of a primary service other than broadcasting should furnish to the administrations that are being consulted all the information specified in § 6.4 of the report of the first session of RRC.

1.3 The assignments to be taken into account in the broadcasting service are those included in the relevant plan (ST61 or GE89), those for which the procedure for modification of the relevant plan (ST61 or GE89) has been initiated before 31 October 2005, or those which have been recorded in the Master International Frequency Register with a favourable finding and are included in the "RCC List" in Circular Letter CR/209.

1.4 The administrations concerned shall make every effort to reach agreement taking into account relevant methods and criteria contained in the ST61 and GE89 Agreements and the report of the first session of RRC.

1.5 Administrations from which agreement was requested which have not replied to the request within ten weeks shall be sent an urgent reminder. If there is no reply to the urgent reminder within two weeks following its dispatch, the consulting administration may seek the assistance of the Bureau. In this event, the Bureau shall forthwith send a telegram to the administration which has failed to reply requesting an immediate acknowledgement. If there is no acknowledgement of receipt within 30 days after the Bureau's action, it shall be deemed that the administration which has failed to acknowledge receipt is not affected by the proposed assignment.

RESOLUTION [PLEN-1]

Study of regulatory/procedural issues

The first session of the Regional Radiocommunication Conference (Geneva, 2004),

considering

a) that a significant body of work of a regulatory/procedural nature might be identified in preparation for the second session of the Regional Radiocommunication Conference (RRC-06);

b) that a mechanism should be put in place to facilitate such preparations,

recognizing

that, pursuant to No. 159E of Article 28 of the ITU Constitution, expenses incurred by regional conferences referred to in No. 43 of this Constitution shall be borne by all Member States of the Region concerned, in accordance with their class of contribution,

resolves

1 to establish a Regulatory/Procedural Group (RPG) with a working party to study regulatory/procedural matters relating to the relevant parts of the [RRC-06] agenda, and the agendas of the short conferences, associated with RRC-06, to revise the Regional Agreements Stockholm, 1961 and Geneva, 1989;

2 that RPG shall identify suitable options and, where appropriate, draft example regulatory text in accordance with those options;

3 that the results of the studies by RPG shall be contained in a report to RRC-06 and to the short conferences referred to in *resolves* 1;

4 that the report of the RPG shall be available at least six months before the start of RRC-06;

5 that the RPG working party shall hold its meeting, of approximately four days, in October/November 2004;

6 that RPG itself shall meet for four days during the last quarter of 2005, with simultaneous interpretation and with document translation facilities;

7 that RPG or its working group shall meet, as far as practicable, immediately before or after either a meeting of the Special Committee or a meeting of the Intersessional Planning Group (IPG) in order to minimize expenses to the participants;

8 that RPG shall work in close cooperation with IPG,

further resolves

1 that participation in and attendance at RPG and its working party will be on the same basis as that of RRC;

2 that the working methods of RPG will be similar to those of Resolution ITU-R 1;

3 that the estimated costs of the work of RPG, estimated at CHF 323 500, will be included in the intersessional activities budget,

instructs the Secretary-General

1 to bring this Resolution to the attention of the Member States and ITU-R Sector Members,

instructs the Director of the Radiocommunication Bureau

to make the necessary arrangements for convening the meeting of RPG and its working party, and to provide the necessary assistance and information where required,

invites

administrations of the Member States and ITU-R Sector Members belonging to the planning area of the RRC to actively participate at the meeting of RPG and its working party.

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