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Author: M. Harbi

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The Rio de Janeiro Plan

an MF broadcasting Plan for Region 2

by
M. HARBI
IFRB

1. Introduction

THE second session of the Regional Administrative MF Broadcasting Conference (Region 2) was held in Rio de Janeiro from 9 November to 19 December 1981. Under Resolution No. 848 adopted by the International Telecommunication Union (ITU) Administrative Council at its 35th session, the Conference was responsible for drawing up an Agreement and an associated Plan based on the technical standards and criteria adopted by the first session in Buenos Aires (March 1980).

2. Preparation of the Conference

The first session of the Conference requested the International Frequency Registration Board (IFRB) to carry out a certain amount of preparatory work with the help of a Panel of Experts appointed by the following administrations: Argentina, Brazil, Canada, Cuba, Mexico, Peru, United States and Uruguay.

To carry out the work which it had been assigned, the IFRB established a small group to prepare the computer programs based on the use, wherever possible, of the programs prepared by administrations.

The preparatory work assigned to the IFRB and the Panel of Experts may be summarized as follows:

— development of software to manage the Basic Inventory,

— development of calculation programs,

— study of the Basic Inventory for a channel spacing of 9 kHz and 10 kHz,

— comparative study for the two channel spacings.

This work was completed on schedule and the results were published in a Report annexed to IFRB Circular letter No. 484 of 16 July 1981. In view of the bulk of some of the annexes, some files and calculation results were published on microfiche. Microfiche readers were despatched to the administrations of Region 2. Although very practical, this system was not used at the Conference since delegations preferred to have the information in printed form.

The material developed in the interval between the two sessions as part of preparations for the second session was made available to the Conference.

3. Basic data

3.1 Basic Inventory

In accordance with Administrative Council Resolution No. 836 and following IFRB Circular letter No. 441 of 24 August 1979, the "Basic Inventory" was established on the basis of the requirements communicated by the administrations of the countries in Region 2. It contains the characteristics of stations in service and stations authorized until 31 December 1982. The first session decided that the Plan to be established by the second session must use the Basic Inventory as modified by administrations between the two sessions. In addition, as the technical criteria contain power limits, it had authorized those limits to be exceeded only in the case of the countries not represented at the first session and only until 31 May 1980. Administrations were also requested by the first session to communicate their requirements for 1983-1987 to the IFRB in simplified form (*inter alia*, without indicating the frequency). This second category of requirements was intended to develop a second plan, but the second session did not take them into account.

Requests were presented in the form adopted by the first session and classified as follows:

— Class A:
stations for which protection of the groundwave and skywave service area was requested,

— Classes B and C:
stations for which protection of the groundwave service area only was requested.

At the opening of the Conference, the number of requests stood at about 13 500.

3.2 Validation of the Basic Inventory

To make the calculations between the two sessions, the data submitted on the notice form first had to be checked by applying a variety of criteria and the administrations concerned had to be contacted to correct the inaccurate information and obtain the information which was missing.

Where it had received no reply from the administrations concerned, the IFRB entered data in the boxes which had not been completed or made the necessary corrections to the data supplied. The modifications to the Basic Inventory made on the IFRB's own initiative were published in a document submitted first to

the second session, which was invited to adopt the validated Basic Inventory. It did so during the first week.

4. Technical standards and criteria

The Conference adopted the technical standards and criteria set forth in the Report of the first session. The following matters however were settled by decisions taken at the second session.

4.1 Channel spacing

From the outset the Conference had been assigned the task of solving the problem of the choice of a channel spacing for Region 2. It had not been possible to settle this important question at the first session, which recommended that a study should be undertaken and that a comparative report on 9 and 10 kHz spacing should be submitted at the second session. This study was carried out by the IFRB with the assistance of the Panel of Experts according to the following plan:

4.1.1 Study of 10 kHz spacing

This study entailed the following calculations:

- evaluation of incompatibilities;
- evaluation of interference between regions;
- determination of usable field strength, E_u;
- solutions recommended for interference problems in cases where serious degradations in the service areas were observed;
- determination, wherever possible, of the number of new frequency assignments which would be available in all countries of Region 2 in relation to the future requirements identified and evaluation of degradations caused in the service areas of stations.

4.1.2 Study of 9 kHz spacing

The study of 9 kHz spacing, after determining the choice of the frequency transfer procedure (block transfer) for all stations in the validated list so as to arrive at an appropriate arrangement of stations with a 9 kHz spacing, involved the same calculations as those referred to in 4.1.1.

4.1.3 Comparative study

In conformity with Chapter 8 of the Report to the second session and with Resolution A, the following data were submitted to administrations for comparing the Plans with the two channel spacings:

- comparison of results concerning adjacent channel interference;
- comparison of results concerning interference between regions;
- how far the service area of stations might be extended;
- number of new frequency assignments which would be available in all countries of Region 2 where new requirements are recognized;
- wherever possible, any other relevant data, such as the economic and operational implications, provided by administrations.

4.1.4 Choice of spacing

After examining the comparative study and taking into account the specific problems of Region 2, the Conference decided to adopt a 10 kHz spacing. The first channel in the Plan having been fixed at 540 kHz, the carrier frequencies are whole multiples of 10 kHz.

4.2 Excess polarization coupling loss

To take account of the difficulties encountered in South America where the value of 0° for magnetic dip may be observed, the Conference did not take excess polarization coupling loss into account.

4.3 Noise zones

In drawing up the Plan, the Conference retained the three noise zones defined by the first session. However, as from the date of entry into force of the Agreement, only two noise zones will be considered.

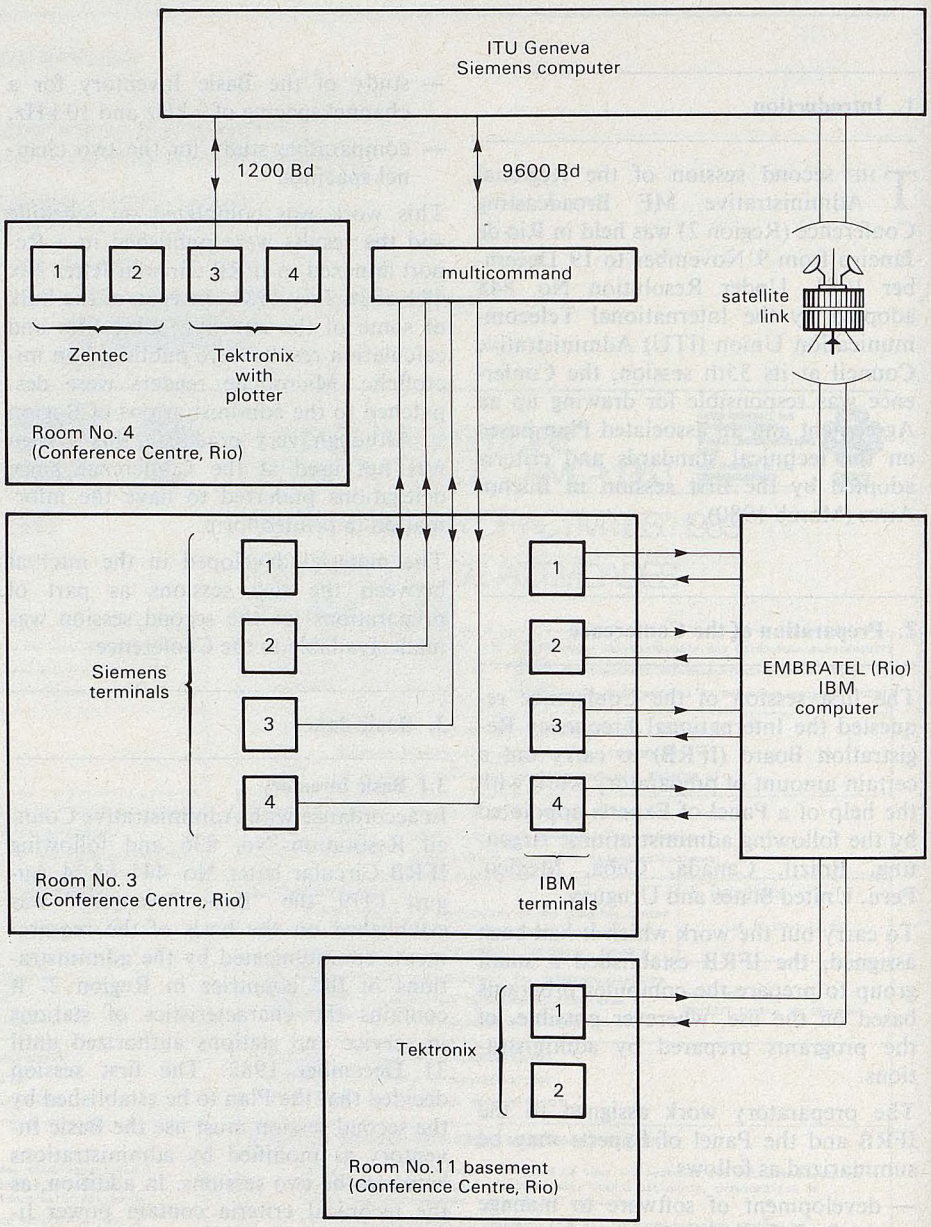

Figure 1—Block diagram of structure of computer facilities

5. Organization of the work of the Conference

The Conference adopted the usual structure for ITU administrative conferences. The work was mostly carried out by two main Committees, i.e.:

— Committee 4 (Planning),
— Committee 5 (Agreement),

and a Technical Group.

Towards the end of the Conference, a number of Working Groups were created either by the Plenary or by Committees 4 and 5 to deal with specific questions.

Committee 4 was divided into four Planning Groups in accordance with the recommendation made in the Report of the IFRB and the Panel of Experts. The geographical division was substantially the same as that adopted for carrying out the comparative studies.

6. Computer facilities available to the Conference

The following computer facilities were made available to the Conference (see figure 1).

6.1 ITU computer (Geneva)

Four terminals were connected to the two ITU computers in Geneva. The *Siemens 7541* computer (4 MB, 750 kops) was used for data entry and for the test programs and the *7760* computer (4 MB, 1070 kops) for the complete calculation of incompatibilities. The test programs were these:

• *SKYONE*: calculation of usable field strength (E_u) at a given point (the site of a transmitter or its protected contour); the program also gave the breakdown of the calculations made (skywave only).

• *SKYMANY*: calculation of the impact of a new station or a modification to an existing station on all the stations already operating at a given frequency (skywave only).

• *GRDWONE*: calculation of groundwave incompatibilities caused by a given station in relation to other pre-selected stations.

For these three test programs, the requests submitted by delegations were processed by the Technical Secretariat and the results were communicated to them through the Planning Groups.

6.2 EMBRATEL computer

Four terminals were connected to the *Empresa Brasileira de Telecomunicações SA IBM 370* computer in Rio, which was used for the following calculations:

— incompatibility matrix: this matrix supplies the data for the interfering signals transmitted and received, together with the RSS value;
— "B form": for each station, a "B form" was printed indicating the level of the usable field strength of that station and listing the stations of other countries interferred with by that station;
— printing of the Interim Plan.

6.3 Microcomputer

Four microcomputers (64 kB), two with magnetic cassettes and two with floppy discs, were used to run the following programs:

— calculation of distance and azimuth,
— calculation and drawing of directional antenna patterns,
— design of simple systems with directional antennas having two or three masts,
— calculation of synchronized networks.

Two graphic plotters were also available. Delegations were able to obtain the outline of the service and/or interference contours of the stations studied on request (see photograph).

6.4 Use of computing facilities

The computing facilities referred to in 6.1 and 6.2 above were reserved for the Technical Secretariat and requests for calculations were submitted by delegates on special forms. However, delegates had direct access to the microcomputers.

During the Conference 692 test requests (SKYONE, SKYMANY, GRDWONE and matrix) submitted by delegations were fulfilled. These calculations were made in addition to the complete incompatibility calculations, which were supplied on a regular basis.

7. Procedures and working documents used for planning

7.1 Reference documentation

The four main documents were:

— an up-to-date extract from the Basic Inventory for the stations of each country, termed Document No. 1. A global copy of the Inventory was available to delegations for consultation (the extracts and global Inventory were printed in Geneva);
— an "RSS" list, termed Document No. 2, showing for the stations of each country the usable field strength E_u and the stations contributing to interference (see e.g. figure 2) (calculations and print-outs from Geneva);
— a number of "B forms", termed Document No. 3 (see specimen figure 3), indicating for each station the list of stations receiving interference from

820076

View of the ITU's electronic equipment room

				frequency 540 kHz interfering stations first contributer			second contributer			third contributer			fourth contributer		
name of country	IFRB serial number	nominal usable field strength (E_{nom}) (mV/m)	usable field strength (E_U) (mV/m)	name of country	IFRB serial number	contribution to interference (mV/m)	name of country	IFRB serial number	contribution to interference (mV/m)	name of country	IFRB serial number	contribution to interference (mV/m)	name of country	IFRB serial number	contribution to interference (mV/m)
GTM	816A	0.5	18	SLV	1334	12.3	MEX	2142	9.9	NCG	978	8.7	CTR	1965	5.8

Figure 2—Extracts of an "RSS" list for Guatemala

SPECIMEN OF "B FORM"

Frequency 540 kHz - Station of Guatemala

STATION ACCEPTEE - STATION ACCEPTED - ESTACIÓN ACEPTADA

ADM - GIM

SIGNATURE/
FIRMA .....

DATE/FECHA 25/11/81

NUMERO DE SERIE/
SERIAL NUMBER/
NÚMERO SERIE 816

EU (mV/m): 18.00

STATIONS AFFECTEES / AFFECTED STATIONS / ESTACIONES AFECTADAS

FREQ. (kHz)	SER. NUM.	ADM.	INTERFERENCE (mV/m)	Enom (mV/m)	DELEG.	SIGN. FIRMA
540	623	CUB	4.09	4.00	.....	.....
540	978	NGG	19.24	4.00	.....	.....
540	1085	PNR	9.23	4.00	.....	.....
540	1334	SLV	27.50	0.50	.....	.....
540	1965	CTR	13.07	2.50	.....	.....
540	2142	MEX	5.75	0.50	.....	.....
540	13002	USA	2.72	2.50	.....	.....

PRES. GROUPE / PRES. GROUP / PRES. GRUPO

SIGNATURE/
FIRMA .....

DATE/FECHA ../../..

Figure 3—Specimen of "B form". Frequency 540 kHz—Station of Guatemala

that station (the software was developed in Rio and the forms were printed on the EMBRATEL IBM computer);

— a list, termed Document No. 4, showing for each country the stations not causing any interference (list printed in Geneva).

These four working documents, which are shown schematically in figure 4, constituted the main working documents for the delegations and Planning Groups.

Very close co-ordination had been established between the Conference Secretariat in Rio and ITU headquarters in Geneva so that Documents Nos. 1, 2 and 4 and the magnetic tapes required for printing Document No. 3 in Rio, would arrive regularly by air in the diplomatic pouch. This arrangement functioned well during the Conference and delegations received the calculation results fairly regularly with the exception of one period when the system was disrupted through a conjunction of unforeseen circumstances (cable failure between Conference headquarters and EMBRATEL, late arrival of a plane).

7.2 Entry of assignments into the Plan

In the early stages of its work, the Planning Commitee defined a transitional planning stage based on an "Interim Plan". This Plan was to comprise all stations:

— not causing any interference and whose usable field strength was lower than or close to the nominal usable field strength;

— not causing any interference and whose usable field strength was higher

than the nominal usable field strength and was not accepted by the countries concerned; these stations bore a special symbol;

— whose received and caused interference was accepted by all the parties concerned.

Using the above framework the delegates then proceded by successive stages.

In the first stage, delegations identified, on the basis of Document No. 4, the stations in their respective countries which did not cause any interference and whose usable field strength was lower than or close to the nominal usable field strength. The stations thus inventoried were the first to be entered in the "Interim Plan". Those stations which did not cause any interference but whose usable field strength was deemed to be too high and subject to subsequent negotiation were also entered in the "Interim Plan" with a special symbol for ready identification.

The second stage involved the actual negotiations and consisted in seeking technical solutions to reduce interference. Although the solutions adopted varied from one Planning Group to another, they can be broadly summarized as follows:

— adoption of a usable field strength level 6 dB higher than the nominal usable field strength,

— power reduction,

— use of directional antennas,

— change of frequency.

When agreement had been reached, Documents Nos. 3 and 4, signed by the delegations concerned and countersigned by the Chairmen of the Planning Groups, were submitted to the Technical Secretariat as and when they became available. The Technical Secretariat then entered the data in a special file which was used to draw up the "Interim Plan".

The format of the "Interim Plan", which was retained for the printing of the Plan in Rio, included the following data for each station:

— technical characteristics of the station,

— usable field strength of the station together with the stations contributing to the interference and the level of their contribution,

— stations receiving interference from the station and the level of the interference for each one of them.

In fact, the "Interim Plan" assembled the information contained in the Basic Inventory, in the "RSS" list and in the "B forms".

For its submission and adoption by the Conference, the Plan was divided into two lists:

• *List A:* includes the assignments of all countries (whether or not they were signatories to the Final Acts), whose *caused and received* interference is accepted by all the parties concerned.

• *List B:* includes all the assignments which do not appear in List A.

Lists A and B were established using the Basic Inventory. As to the requirements submitted by several administrations for the period from 1 January 1983 to 31 December 1987, it was decided that those administrations may apply the provisions of Article 4 of the Agreement.

The flowchart in figure 5 illustrates the various processes followed before a station was entered either in List A or in List B.

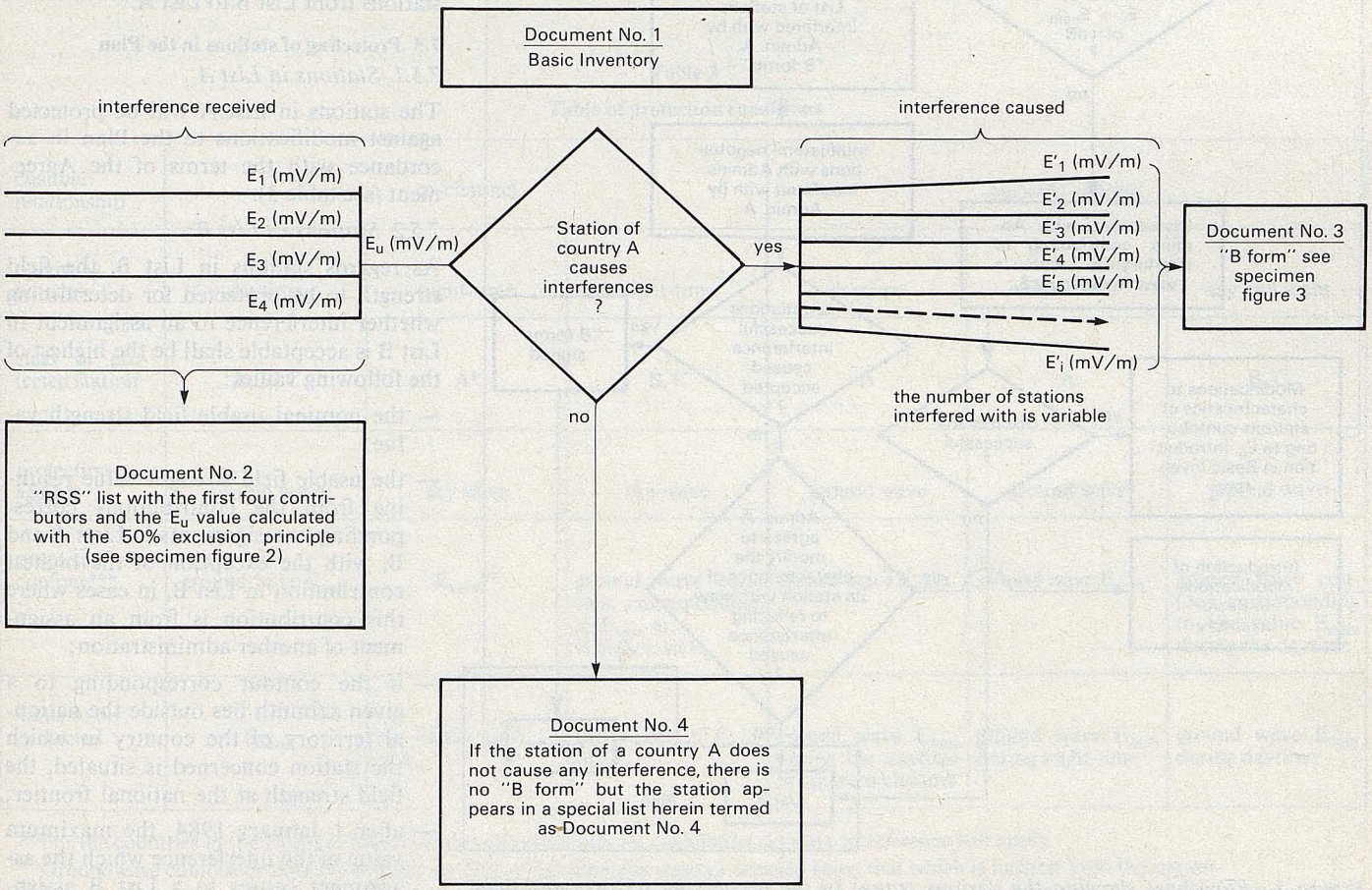

Figure 4—Diagram showing the various documents used in drawing up the Plan

7.3 Processing of unresolved cases

For the processing of cases of interference not resolved at the Conference and therefore for the transfer of assignments from List B to List A, special provisions were adopted in Annex 2 to Resolution No. COM 4/1. The application of this annex relies on the goodwill of administrations in pursuing negotiations with working documents similar to those supplied during the conference by the IFRB. The Board will supply on request a number of forms ("RSS" list and "B forms") giving information on the interference received and caused. The negotiations will be conducted by correspondence or at bilateral or multilateral meetings. The outcome of these negotiations will be communicated to the IFRB, which will then check the "B forms" and, where negotiations have been successfully completed, transfer the assignments from List B to List A.

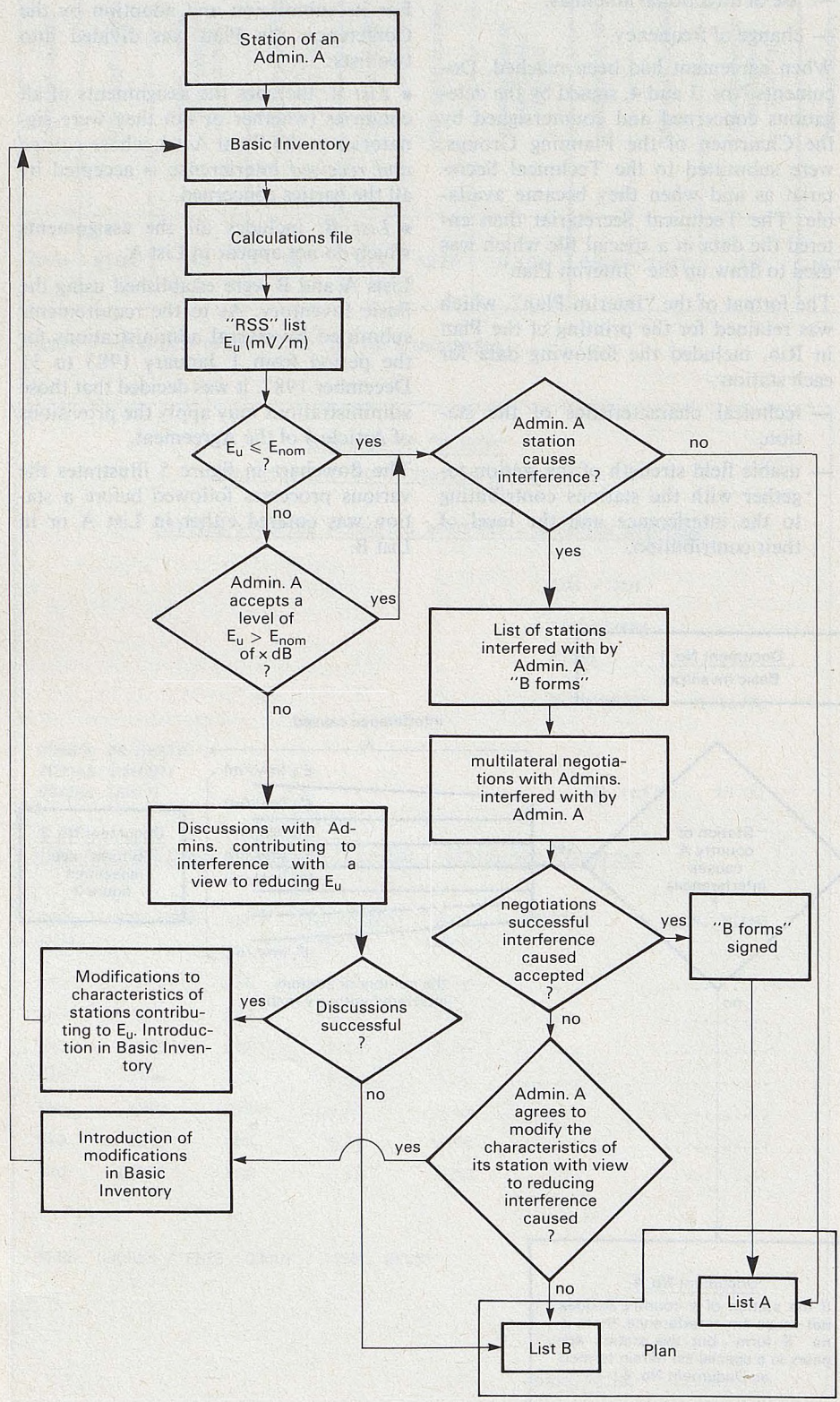

Figure 5—Flowchart showing the various stages in the processing of an assignment between notification by an administration and entry in the Plan

7.4 Statistics

Total number of stations:	11 808
Number of stations in daytime and night-time operation:	8 720
Number of stations in daytime operation only:	2 904
Number of stations in night-time operation only:	184
Number of Class A stations	587
Number of Class B stations	7 313
Number of Class C stations	3 908

Table 1 shows the distribution of the stations between Lists A and B in number and in percentage.

Table 2 shows that the difference between the average usable field strength for Region 2 stations in Lists A and B is relatively small (less than 6 dB). This augurs well for the continuation of the negotiations to be conducted between administrations with a view to transferring stations from List B to List A.

7.5 Protecting of stations in the Plan

7.5.1 Stations in List A

The stations in List A will be protected against modifications to the Plan in accordance with the terms of the Agreement (see table 3).

7.5.2 Stations in List B

As regards stations in List B, the field strength to be protected for determining whether interference to an assignment in List B is acceptable shall be the highest of the following values:

- the nominal usable field strength value;
- the usable field strength value resulting from the contributions corresponding to assignments in Lists A and B, with the exception of the highest contribution in List B, in cases where this contribution is from an assignment of another administration;
- if the contour corresponding to a given azimuth lies outside the national territory of the country in which the station concerned is situated, the field strength at the national frontier;
- after 1 January 1984, the maximum value of the interference which the assignment causes to a List B assignment of another administration.

Table 1

	List A		List B	
	daytime	night-time	daytime	night-time
number of stations	10 151	6 593	1 474	2 312
%	87.3	74	12.7	26

Table 2

Average usable field strength $\overline{E}_u$ for stations in Lists A and B by noise zone—Night-time

	$\overline{E}_u$ Zone 1		$\overline{E}_u$ Zone 2		$\overline{E}_u$ Zone 3		$\overline{E}_u$ Region 2	
	mV/m	dB μ	mV/m	dB μ	mV/m	dB μ	mV/m	dB μ
List A	5	74	6.2	75.8	10.3	80.3	7.2	77.1
List B	9.2	79.3	13.8	82.8	16	84.1	13	82.3
total Lists A and B	7.1	77	10	80	13.4	82.5	10.1	80.1

8. Non-participating countries

8.1 Processing of assignments during the Conference

In accordance with a decision taken in plenary, the IFRB represented the interests of non-participating countries. These countries were the following: Barbados, Bolivia, Dominican Republic, El Salvador, Guatemala, Haiti, Honduras and Suriname.

On behalf of these countries, the IFRB carried out all the necessary work for checking the weekly lists supplied by the Technical Secretariat and negotiated with the delegations of the countries in Region 2 on the basis of the technical standards adopted by the Conference and on the basis of a higher usable field strength with those countries having accepted the principle of reciprocity. A telex was sent to the non-participating countries informing them of the decision taken by the Conference regarding the safeguarding of their interests by the IFRB. In that telex, the IFRB attempted to establish direct contact for continued negotiations. Difficulties of communication prevented the countries concerned from following-up the telex. Table 4 shows the results obtained for these countries.

Table 3

Table of protection conditions

channel relationship	co-channel			adjacent channel		
operating schedule	daytime	night-time	night-time	daytime	night-time	day and night
class of protected station	A, B, C	A*	B, C	A	A	B, C
protection against	ground wave	sky wave	sky wave	ground wave	ground wave	ground wave
protected contour***	ground wave E_{nom}	E_{nom}**	ground wave contour corresponding to E_{nom} or, if higher, to E_u	ground wave E_{nom}	ground wave E_{nom}	ground wave contour corresponding to the value E_{nom} during the daytime
value to be protected	E_{nom}	the higher of E_{nom} or E_u	the higher of E_{nom} or E_u	ground wave E_{nom} during the daytime in adjacent channel	ground wave E_{nom} during night-time	ground wave E_{nom} during daytime

* For the countries in the North of Region 2, special procedures for calculating skywave interference will apply.

** Groundwave contour or skywave contour for 50% of the time, the contour selected being that which is furthest from the station.

*** Special protection provisions are applicable when the protected contour extends beyond the frontier of the country in which the station is situated.

Table 4

Stations of non-participating countries

country	number of stations in Basic Inventory	number of stations in List A		number of stations in List B *	
		day	night	day	night
Barbados	2	1	—	1	2
Bolivia	97	96	94	1	3
Dominican Republic	131	128	122	3	9
El Salvador	72	32	4	40	68
Guatemala	92	42	10	50	82
Haiti	41	29	25	12	16
Honduras	152	103	6	49	146
Suriname	6	5	5	1	1

* The high number of stations in List B for countries such as Guatemala, Honduras and El Salvador is accounted for by their central geographical position leading to a high usable field strength which could not be accepted. The stations of these countries also cause a considerable amount of interference to the other countries of Region 2.

8.2 Processing of the assignments of non-signatory countries after the Conference

The assignments in List B for countries which did not sign the Final Acts are governed by Resolution No. COM 4/2. This Resolution draws a distinction between the non-signatory participating countries (i.e. Cuba which withdrew from the Conference a week before the end) and non-signatory non-participating countries (i.e. Barbados, Bolivia, Dominican Republic, El Salvador, Guatemala, Haiti, Honduras and Suriname). The Conference decided that the assignments of these countries entered in List B would bear a symbol indicating that a signatory country is not bound to take these assignments into consideration in transferring one of its stations from List B to List A or in making a modification to the Plan. For stations in service on 10 November 1981, the consequences of the entry of this symbol will take effect only as from 1 August 1982, except for Cuba where they will take effect as from 1 January 1982. This symbol will be deleted when the IFRB receives from these countries a letter in which they undertake to comply with the provisions of Resolutions Nos. COM 4/1, COM 4/2 and PL/2.

9. Inter-regional interference

The Conference adopted Recommendation Gr. Tech/1 on the technical criteria to be applied by the IFRB for the examination of frequency assignment notices from the point of view of interference between regions. The IFRB is to take this Recommendation into account when it develops and adopts the technical standards for the examination of frequency assignment notices relating to broadcasting stations in Region 2 operating in the band 545-1605 kHz, from the standpoint of the probability of harmful interference to stations in Regions 1 and 3 and vice versa.

10. Structure and date of entry into force of the Final Acts

The Final Acts consist of:

- the Agreement with two annexes:
  - Annex 1 (Plan),
  - Annex 2 (Technical data to be used in the application of the Agreement);
- six Resolutions;
- three Recommendations.

The date for the entry in force of the Final Acts was fixed at 1 January 1982. The Agreement and the Plan will enter *into force on 1 July 1983* at 08h00 UTC.

11. Work to be carried out in 1982

A considerable number of tasks of varying complexity were assigned to the IFRB and must be carried out beginning on 1 January 1982. These tasks have been identified and some of them call for close collaboration with the administrations of Region 2, for example:

- in reducing the radiation values where the difference between the notified and calculated values exceeds 20%,
- in checking the Plan.

As regards the rest of the work, the Board will submit a report to the ITU Administrative Council on the impact of the specific requirements expressed by the administrations in Region 2.

12. Conclusions

The night of Friday 18 December 1981, when the Conference adopted the Plan, officially termed the "Rio de Janeiro Plan" in Resolution No. PL/3, was a historic moment for the administrations of Region 2, since it was the first time that an ITU regional administrative radio conference had adopted a Plan for Region 2.

If any confirmation were needed of the solemn reserve of the administrations of Region 2 to provide the region with the regulatory and technical instruments required for the harmonious development of the MF broadcasting service, it came with the signing of the Final Acts on the morning of Saturday 19 December by all the countries present. The spirit of co-operation shown by the countries of the region and their determination to achieve concrete results prevailed over the main difficulties encountered by the Conference. The dedication of the ITU staff and the assistance of the Brazilian Administration made it possible to overcome the difficulties involved in operating two different computers in two different places, Rio and Geneva. The results obtained may be regarded as satisfactory by the administrations of Region 2 although a substantial amount of work still remains to be done to process the cases of interference not resolved at the Conference and concerning List B of the Plan. It is to be hoped that the problems which arose between Cuba and other countries will be solved through the same spirit of co-operation as that which prevailed at the Conference. Once the non-participating countries have acceded to the Agreement, Region 2 will be in a position to derive full benefit from an Agreement which covers all the countries in the region.

(Original language: French)