

Technical aspects of shortwave broadcasting

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Technical Aspects Of Shortwave Broadcasting

By

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TECHNICAL ASPECTS OF SHORTWAVE BROADCASTING

BACKGROUND ON THE ASIA-PACIFIC BROADCASTING UNION

The Asia-Pacific Broadcasting Union (ABU) is a professional association of broadcasting organizations which has no political or commercial aims. It was established to assist in the development of radio and television in Asia and the Pacific, in the interests of the countries and territories served by its members.

The ABU maintains offices in Kuala Lumpur, Malaysia and Tokyo, Japan, through which the programs and projects of the organization are coordinated. The activities and functions of the ABU are briefly summarized below.

SATELLITE COORDINATION: The ABU is responsible for the maintenance and operation of the Satellite Coordination Centre whose objective is to promote the use of communication satellites among its members.

TV NEWS EXCHANGE (Asiavision): The ABU assists Radio Television Malaysia and Nippon Hoso Kyokai in Japan, two news exchange centers which collect news items from participating member countries, from each other, and from other regions of the world, including Eurovision.

SPORTS: The collective acquisition of television rights for international sport events is an important activity of the ABU in protecting and promoting the interests of members which operate a television service, including the Summer Olympic Games, the World Football Cup and the Asian Games.

PROGRAM EXCHANGES: One of the basic objectives of the ABU has been to promote the exchange of radio and television programs among its members and to serve as liason among members in the area of programming and related information.

ABU PRIZE COMPETITIONS: Competitions for seven prizes in radio and television are held annually, and program entries are available to any member of the ABU for broadcast.

ABU TECHNICAL CENTER: The Technical Center of the ABU coordinates the activities relating to technical and engineering studies carried out by the ABU member-organizations concerning broadcasting both in sound and television. Work in the technical area includes the arrangement of seminars, the publication of technical monographs and reports, the compilation of a registry of technical information pertaining to member countries, interaction with the ITU, the exchange of reception reports, and training of broadcast staff.

The Tokyo office of the ABU is responsible for all matters concerned with the needs of ABU members who operate in radio.

WORLD ADMINISTRATIVE RADIO CONFERENCE

In connection with the technical function of the ABU, Mr. Bhargava, the Senior Engineer, addressed the conference participants on the issues and problems facing the forthcoming World Administrative Radio Conference on shortwave broadcasting (WARC-HFBC) to be held in 1987. The ABU held a seminar in Bangkok in July 1986 to prepare member organizations for the WARC meetings, from which Mr. Bhargava abstracted some of the critical concerns as well as some of the relevant statistics and proposals for addressing the problems. The following is a summary of some of Mr. Bhargava's points, questions raised in the subsequent discussion, and on the next few pages some of the supporting data.

SESSION SUMMARY

Reception of shortwave broadcasting is in a very chaotic state, and in many cases reception is so poor that listeners prefer to switch off their receivers rather than to try to tune in the programs. There are many reasons for this including the growth and development in the area of transmitters, with the more affluent countries investing in ever larger and higher-powered transmitters resulting in the overshadowing of transmissions from countries with less-powerful transmitters. There is an increasing demand for frequencies, in fact, a much greater demand than can be accommodated (see Appendix 1). At present frequencies are assigned by the ITU, and there is concern that this is done without appropriate planning or attempts to equate the needs and awards of small and large broadcasters.

One of the outcomes of the ABU Preparatory Seminar was a proposed set of Planning Principles to guide the allocation of frequencies, based on a variety of technical criteria (see Appendix 2 and 3). Discussion of this area focussed on the difficulty of implementing such planning principles, since those broadcasters who have held frequency assignments for many, many years are reluctant to relinquish them to broadcasters more recently entering the shortwave broadcast arena. However, it was generally acknowledged that virtually all of the current broadcasters are concerned about the reception of their signals and recognize that there are problems with frequency assignment. In fact, about 20% of all short-wave broadcasting is outside assigned bands which further exacerbates the problem of signal clarity and the proprietary use of specific frequencies and band widths.

The need for protection ratios also relates to the current crisis in reception quality. The ABU conference participants agreed that this issue needs to be addressed by the International Frequency Regulation Board (IFRB) at its next session. Basically, it is necessary to determine the optimum intensity (DB) for reception of broadcast signals and for the reduction of the spread of those signals to adjacent frequencies (see Appendix 4).

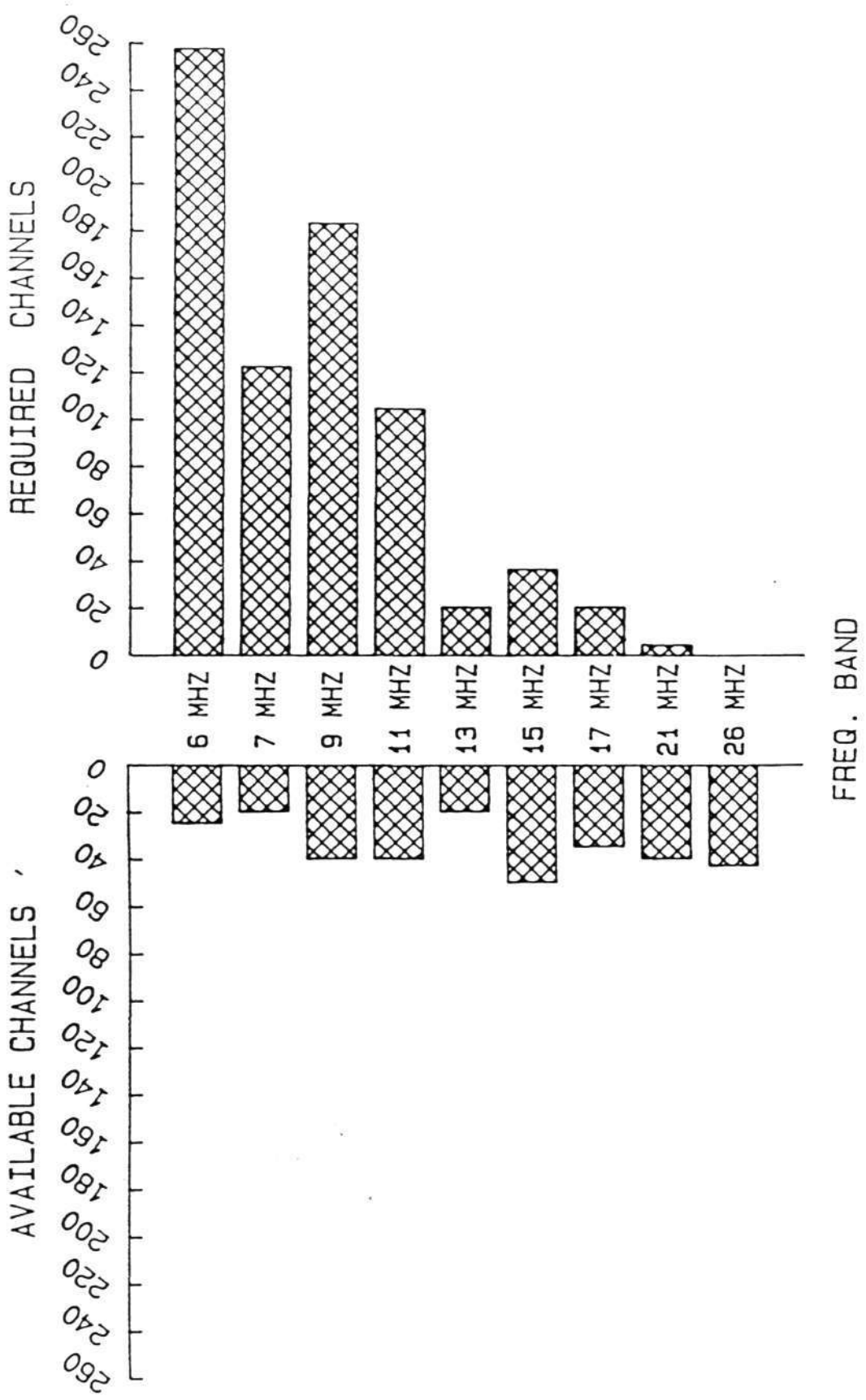
DISCUSSION

Some of the discussion areas included:

- the difficulty of the task of regulation when not all broadcasters are members of the ITU;
- the determination of the intended use of the broadcast frequency being requested;
- the compliance of countries with the regulations of the IFRB;
- the use of sanctions for noncompliance;
- service area definition (first hop, second hop, backfeed);
- the determination of priority (commercial, noncommercial, government, religious, etc.);

Generally, participants agreed that the technical issues pertaining to shortwave broadcasting are becoming more complex with the constant technological developments and the increased worldwide use of shortwave broadcasting. There was only brief mention of the potential for DSB (Direct Satellite Broadcasting) to ameliorate some of these problems, although the point was made that DSB introduces some new issues and concerns.

AVAILABLE NUMBER OF CHANNELS VERSUS
REQUIRED NUMBER OF CHANNELS
SEASON D-85 SSN 5 HOUR BLOCK 1



APPENDIX 2

TECHNICAL CRITERIA

The technical criteria adopted by the Conference to establish the planning principles and planning method related to the following:

- Double side-band (DSB) systems specifications
- Audio-frequency bandwidth
- Necessary bandwidth
- Characteristics of modulation processing
- Channel spacing
- Overall selectivity of the receiver
- Noise limited sensitivity of the receiver
- Method of prediction of sky-wave field strength for HF broadcast planning purposes
- Atmospheric radio noise data
- Man made radio noise data
- Method of calculation of basic circuit reliability
- Method of calculation of overall circuit reliability
- Method for computing basic reception reliability
- Method for computing overall reception reliability
- Method for computing overall broadcast reliability
- Values of the appropriate solar index and the seasonal periods on which planning shall be based
- Solar index values
- Radio-frequency protection ratios
- Frequency tolerances
- Relative values of protection ratio as a function of carrier frequency separation
- Values of minimum usable and reference usable field strength

- Value of audio frequency signal/noise ratio for planning purposes
- Value of radio frequency signal/noise ratio for planning purposes
- Antenna characteristics
- Choice of optimum antennas for various type of service
- Simplified antenna patterns for planning purposes
- Transmitter power and equivalent isotropically radiated power appropriate for satisfactory service
- Use of synchronized transmitters
- Reception zones and test points
- Maximum number of frequencies required for broadcasting the same programme to the same area
- Specifications and progressive introduction of an SSB system

APPENDIX 3

PLANNING PRINCIPLES

The planning of the high frequency bands allocated to the broadcasting service shall be based on the principle of equal rights of all countries, large or small, to equitable access to these bands and to utilize them in accordance with the decisions taken by this Conference. In planning, an attempt shall also be made to achieve an efficient utilization of these frequency bands, account being taken of the technical and economical constraints that may exist in certain cases.

On the basis of the foregoing, the following planning principles shall be applied:

All the broadcasting requirements, current or future, formulated by the administrations, shall be taken into account and be treated on an equitable basis, so as to guarantee the quality of rights referred to in paragraph above and to enable each administration to provide a satisfactory service.

All the broadcasting requirements, national and international shall be treated on an equal basis, with due consideration of the differences between these two kinds of broadcasting requirements.

In the planning procedure, an attempt shall be made to ensure, as far as practicable, the continuity of the utilization of a frequency or of a frequency band. However, such continuity should not prevent equal and technically optimum treatment of all broadcasting requirements.

The periodically planning process shall be based solely on the broadcasting requirements to become operational during the planning period. It shall furthermore be flexible to take into account new broadcasting requirements and modifications to the existing broadcasting requirements, in accordance with the modification procedures to be adopted by the Conference.

The planning procedure shall be based on DSB transmissions. SSB transmissions which administrations might wish to make may, however, be permitted in lieu of planned DSB transmissions, provided that the level of interference caused to DSB transmissions appearing in the Plan is not increased.

For efficient spectrum utilization, whenever possible, only one frequency should be used to meet a given broadcasting requirement in a given required service area and in any case the number of frequencies used should be the minimum necessary to provide satisfactory reception.

Those broadcasting requirements for which, through lack of the requisite technical facilities, the agreed minimum usable field strength is not ensured at any point of the required service area, could obtain proportionally reduced protection against interference.

In a first stage of the equitable application of the planning procedure, an attempt will be made to include the highest possible number of the submitted requirements so as to achieve the desired quality level. The remaining requirements would be processed on the understanding that lower quality levels would be acceptable.

The planning method shall satisfy on an equal basis a minimum of the broadcasting requirements submitted by administrations with the level of overall broadcasting reliability adopted by the Conference. Special consideration shall be given to administrations which, in the first instance, are unable to achieve the overall broadcasting reliability.

APPENDIX 4

PROTECTION RATIOS

The protection ratio is the minimum amount by which the wanted signal must exceed an interfering signal to ensure co-channel compatibility.

The first session of the HFBC conference decided that for good reception the value of protection ratio under stable condition should be 27 dB. In case of multiple interferences a margin of 6 dB should be added to 27 dB. To ensure a protection ratio of 27 dB for 90% of the time there is a need to add 10 dB to 27 dB to take fading allowance into consideration. Thus a total figure of protection ratio to ensure good reception for 90% of the time works out to be

$$27 + 6 + 10 = 43 \text{ dB}$$

Taking account of large number of requirements compared to the capacity of the bands the IFRB has decided a margin of 3 dB instead of 5 dB for multiple interferences and an allowance of 6 dB instead of 10 dB for fading. Thus for IFRB planning exercises the overall protection ratio would be $27 + 3 + 6 = 36 \text{ dB}$ for 90% of the time. For 80% of the time this figure can be reduced to 33 dB.