

## SECTION 10A-2: SOUND BROADCASTING IN THE TROPICAL ZONE

## REPORT 303-3\*

DETERMINATION OF THE EFFECTS OF ATMOSPHERIC NOISE  
ON THE GRADE OF RECEPTION IN THE TROPICAL ZONE

(Question 45/10, Study Programme 45D/10)

(1978-1986)

**1. Introduction**

One of the primary requisites for establishing the limits of power for sound broadcasting is the determination of the value of the signal-to-noise ratio required for satisfactory listening in the absence of any other interference. Availability of reliable noise data is, therefore, necessary. In most of the countries in the Tropical Zone, which are either underdeveloped or developing and where man-made noise is comparatively low, atmospheric radio-noise is the principal source of interference in band 7 (HF).

**2. Results of studies**

2.1 The characteristics of atmospheric radio noise such as amplitude, duration and repetition rate of individual impulses are important in determining the noise response of the receiver. Atmospheric radio noise can be classified as either "fluctuation noise" or "impulsive noise". A theoretical analysis of the problem, i.e. dependence of the response of the receiver on fluctuation and impulsive noise has been made by [Thomas and Burgess, 1947]. It has been concluded there that:

2.1.1 the r.m.s. and peak values of the output response produced in a receiver by fluctuation noise are both proportional to the square root of the receiver bandwidth;

2.1.2 the r.m.s. and peak values of the output response produced in a receiver by a unit impulse are respectively proportional to the bandwidth and the square root of the bandwidth;

2.1.3 the output waveform is independent of the waveshape of the impulse if its duration is less than the order of the reciprocal of the receiver bandwidth, and is dependent only on its time integral;

2.1.4 the minimum value of tolerable signal-to-noise ratio for a high quality sound-broadcasting service is 40 dB.

[Landon, 1936; Jansky, 1939] have also found, on the basis of some experiments, the same bandwidth relationship.

2.2 Studies in India [CCIR, 1956a and CCIR, 1959] and South Africa [CCIR, 1956b] have led to the conclusion that a signal-to-noise ratio of approximately 40 dB is necessary to establish a satisfactory broadcasting service.

\* In view of the opinion expressed by Study Group 6, Study Group 10 will consider the possibility of transferring this text to Study Group 6 at the appropriate time.



### 3. Conclusion

Results of the studies, relating bandwidth and noise response, are mainly based on theoretical considerations and laboratory experimentation. It is, therefore, necessary that a detailed study under actual conditions, correlating the receiver response and noise encountered in the Tropical Zone, be made to find an answer to § 1 of Question 45/10.

On the basis of the studies described in this Report, it is also reasonable to recommend provisionally a signal-to-noise ratio of 40 dB to ensure a satisfactory reception for at least 90% of the time. Further investigation by different administrations in the Tropical Zone is required to confirm this.

### REFERENCES

- JANSKY, K. G. [1939] An experimental investigation of the characteristics of certain types of noise. *Proc. IRE*, Vol. 27, 763-768.  
 LANDON, V. D. [1936] A study of the characteristics of noise. *Proc. IRE*, Vol. 24, 1514-1521.  
 THOMAS, H. A. and BURGESS, R. E. [1947] Survey of existing information and data on radio noise over the frequency range 1-30 MHz. DSIR Radio Research Report No. 15.

#### *CCIR Documents*

- [1956] (Warsaw): a. 358 (India); b. 423 (Republic of South Africa).  
 [1959] (Los Angeles): 92 (India).

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### REPORT 302-1

## INTERFERENCE TO SOUND BROADCASTING IN THE SHARED BANDS IN THE TROPICAL ZONE

(Question 45/10 and Study Programme 45E/10)

(1956-1959-1963-1978)

### 1. Introduction

This Report is a summary of the information available on the question of interference in the bands shared with sound broadcasting in the Tropical Zone for the determination of the radio-frequency protection required for a broadcast signal in the presence of interference. The radio-frequency (RF) protection ratio is the value of the radio-frequency wanted to-interfering signal ratio that enables, under specified conditions, the necessary audio-frequency protection ratio to be obtained at the output of a receiver (Recommendation 638). These specified conditions include such diverse parameters as spacing  $\Delta f$  of the wanted and interfering carrier, emission characteristics (type of modulation, modulation depth, frequency deviation, etc.), receiver input and output levels as well as the receiver characteristics (selectivity and susceptibility to cross-modulation, etc.). The audio-frequency (AF) protection ratio is the agreed minimum value of the audio-frequency signal-to-interference ratio considered necessary to achieve a subjectively defined reception quality. This ratio may have different values according to the type of service desired (Recommendation 638). The wanted signal is from a broadcasting station operating in the shared bands in the Tropical Zone and the interfering signal may be either:

- from A1A/A1B and A2A/A2B telegraphy,
- A3E telephony and broadcasting or combinations of more than one type of emission.

Agreed values of protection ratios are necessary for the solution of frequency assignment problems in amplitude modulation sound-broadcasting systems and may also serve as basic reference data for the evaluation of the relative effectiveness to be expected of various amplitude modulation transmission systems.

The minimum wanted field to which this protection ratio is to be maintained is also to be determined taking into account the noise levels prevalent in different parts of the Tropical Zone.

In this Report, Part I deals with the considerations for the determination of protection ratios and Part II is concerned with the determination of the minimum value of the wanted field to which the recommended protection ratio is to be maintained.