

RECOMMENDATION 559-2*

OBJECTIVE MEASUREMENT OF RADIO-FREQUENCY PROTECTION RATIOS IN LF, MF AND HF BROADCASTING

(Question 44/10, Study Programme 44A/10)

(1978-1982-1990)

The CCIR,

CONSIDERING

- (a) that the radio-frequency protection ratio is directly related to the audio-frequency protection ratio (see Recommendation 638);
- (b) that this relationship depends on a number of technical parameters, such as:
- the frequency separation between the wanted and unwanted carriers;
 - the bandwidths of the transmitter and the receiver;
 - the rate-of-cut of the band-limiting filters at the transmitting and receiving end;
 - the type and depth of modulation;
 - the spectral energy distribution of the modulation signal;
 - the dynamic compression;
 - the pre-emphasis and de-emphasis characteristics, if any;
 - the out-of-band radiation of the transmitter;
 - the amplitude/frequency response of the human ear, which can be simulated by the weighting network of the measuring instrument, (see Recommendation 468);
 - the amplitude of the receiver input voltage,

UNANIMOUSLY RECOMMENDS

that, once an audio-frequency protection ratio has been agreed upon, one of the following objective two-signal methods should be used for the determination of radio-frequency protection ratios in amplitude-modulation sound broadcasting.

1. Objective measuring method

1.1 Principle

The objective method is essentially a two-signal method which consists in modulating successively, with a given modulation depth, the wanted and the interfering transmitter by a standard colour noise signal, the spectral amplitude distribution of which corresponds to modern dance music programmes.

The interference effect is measured at the audio-frequency output of the receiver by means of a single channel measurement circuit using a standardized instrument or an instrument based on a two-channel measurement circuit (see § 1.2).

1.2 Output measurement

For measuring the wanted and interfering signals at the output of the receiver, use should be made of:

- a standardized instrument which should include a network for weighting the subjective interference effect of different interfering frequencies in accordance with Recommendation 468 and a voltmeter suitable for r.m.s. measurements**;
- or a special instrument based on the circuit shown in Fig. 1 and having weighting filters with an amplitude-frequency characteristic as shown in Fig. 2. This instrument has circuits for the separation of narrow-band and wideband interference by means of retunable band and rejection filters respectively, circuits for weighting each of these types of interference with maxima in the region of 4 kHz, and 0.5 kHz and 3.0 kHz respectively, an adder and an r.m.s. voltmeter.

* Further information is given in Recommendation 560.

** The use of an r.m.s. rather than a quasi-peak meter as given in Recommendation 468 permits more accurate account to be taken of the beat-note predominant with closer frequency spacings and all other effects. This conclusion was drawn from the excellent agreement between the values of radio-frequency protection ratio obtained either using the objective two-signal method, or from subjective listening tests for all values of frequency spacing.

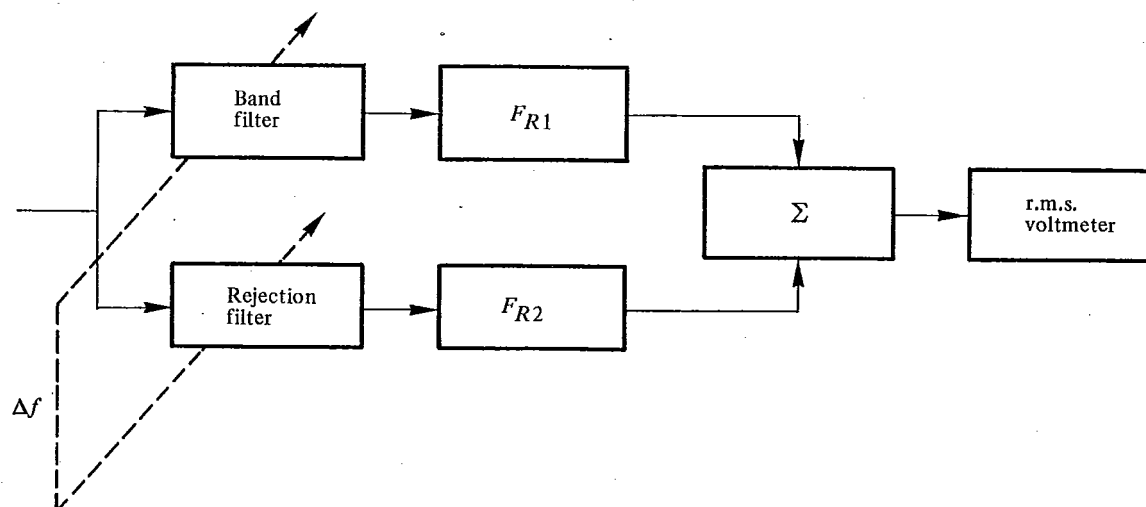


FIGURE 1 — Schematic of the measuring apparatus

F_{R1} , F_{R2} : weighting networks

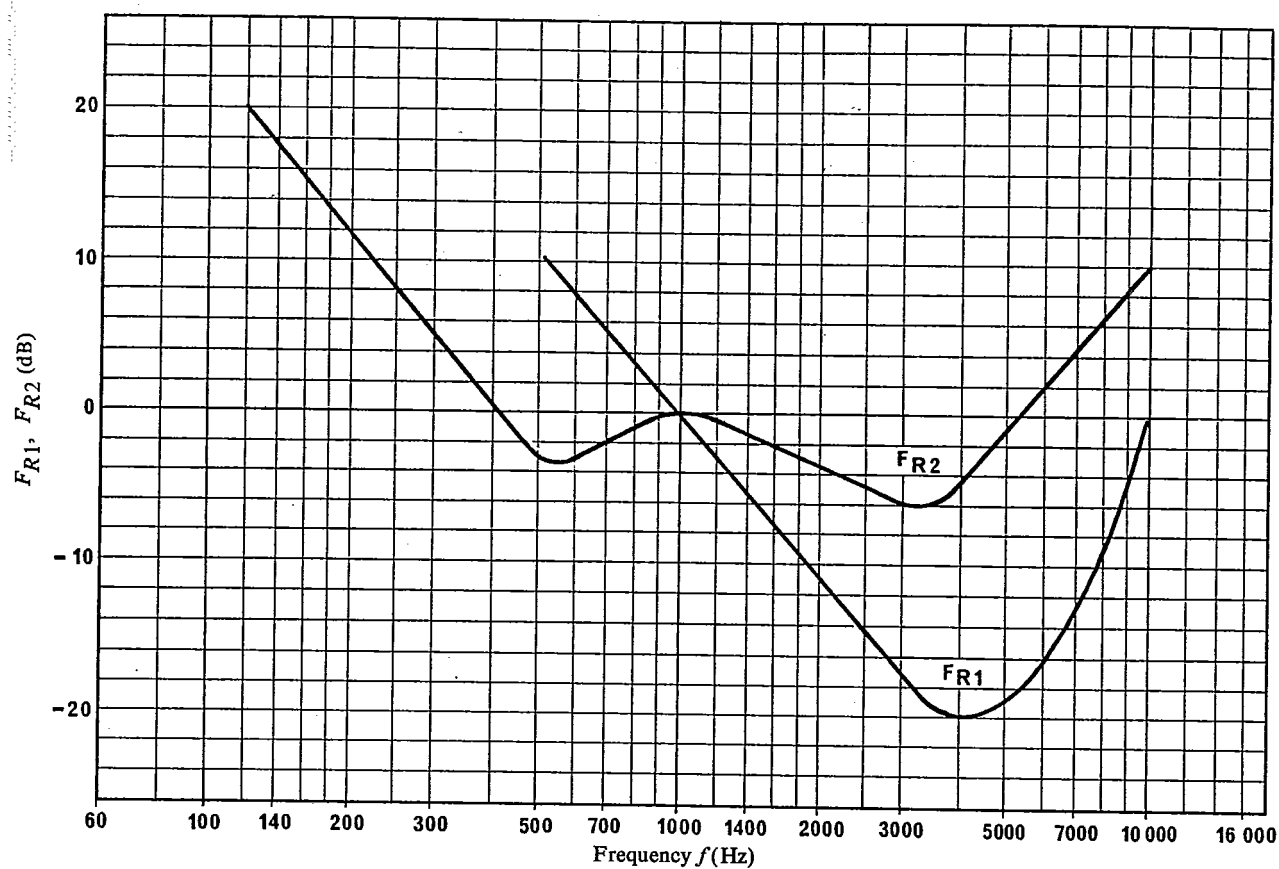


FIGURE 2 — Frequency responses of the weighting networks

1.3 Noise signal for modulating the signal generators

Two conditions must be fulfilled by the standardized signal to simulate programme modulation:

- its spectral constitution must correspond to that of a representative broadcast programme;
- its dynamic range must be so small as to result in a constant unequivocal reading on the instrument.

The amplitude distribution of modern dance music was taken as a basis, as it is a type of programme with a considerable proportion of high audio-frequencies, which occur most frequently. However, the dynamic range of this type of programme is too wide and does not fulfil, therefore, the second requirement mentioned above. A signal which is appropriate for this purpose is a standardized coloured noise signal, the spectral amplitude distribution of which is fairly close to that of modern dance music (see curve A of Fig. 3, which is measured using one-third octave filters).*

This standardized coloured noise signal may be obtained from a "white-noise" generator by means of a passive filter circuit as shown in Fig. 4. The frequency-response characteristic of this filter is reproduced as curve B of Fig. 3. (It should be noted that the difference between curves A and B of Fig. 3 is due to the fact that curve A is based on measurements with "one-third octave" filters which pass greater amounts of energy as the bandwidth of the filter increases with frequency.

The spectrum beyond the required bandwidth of the standardized coloured noise should be restricted by a low-pass filter having a cut-off frequency and a slope such that the bandwidth of the modulating signal is approximately equal to half the standardized bandwidth of emission. The audio-frequency amplitude/frequency characteristic of the modulating stage of the signal generator shall not vary by more than 2 dB up to the cut-off frequency of the low-pass filter.

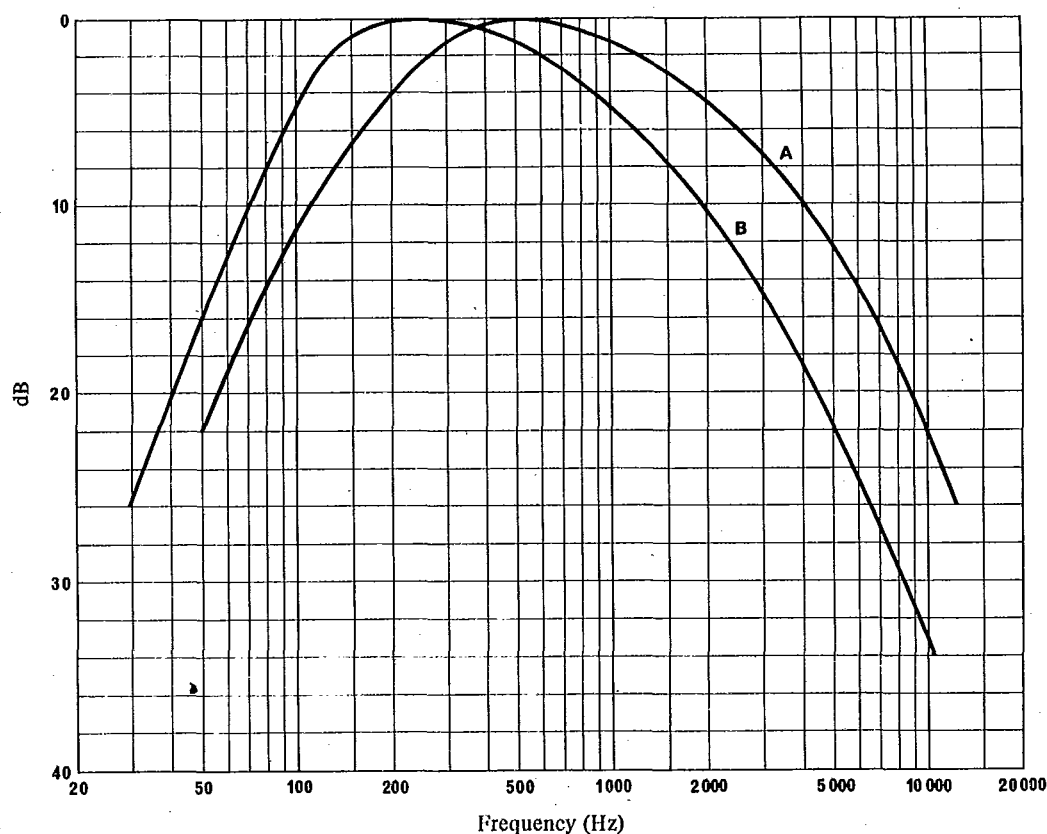


FIGURE 3

Curve A: Frequency spectrum of standardized noise (measured with one-third octave filters)

Curve B: Frequency response characteristic of filter-circuit

* Recommendation 571 proposes a different coloured noise signal. The use of that signal instead of the one proposed in this Recommendation would lead to different relative values of the radio-frequency protection ratio which would only be justified if the characteristics of a typical programme signal would better be simulated by the coloured noise of Recommendation 571. (See Report 798.)