RECOMMENDATION ITU-R BT.655-7

Radio-frequency protection ratios for AM vestigial sideband terrestrial television systems interfered with by unwanted analogue vision signals and their associated sound signals

(Question ITU-R 56/6)

(1986-1990-1992-1994-1995-1998-2000-2004)

The ITU Radiocommunication Assembly,

considering

a) that accurate protection ratio values are required in order to permit the planning of terrestrial television services in an effective manner,

recommends

1 that the protection ratios given in Annex 1 be used for planning terrestrial television services;

2 that studies should be undertaken to complete the information on protection ratios, in particular with reference to the items identified in § 4 of Annex 1.

NOTE – Systems for the emission of digital terrestrial television services are being developed and the associated protection ratios are given in Recommendation ITU-R BT.1368.

Annex 1

Radio-frequency protection ratios for terrestrial television systems

1 Introduction

This Annex contains general information related to protection ratios for terrestrial television systems. It also contains a series of Appendices, each containing protection ratios required for the protection of an individual category of system or signal.

Appendices 1 and 2 contain protection ratios for 525- and 625-line analogue television systems, respectively.

Appendix 3 contains protection ratios for the sound signals of analogue television systems.

2 General

The RF protection ratio is the minimum value of wanted-to-unwanted signal ratio, usually expressed in decibels at the receiver input, determined under specified conditions such that a specific reception quality is achieved at the receiver output.

Measurements of protection ratio for the vision signal of a wanted analogue television system should preferably be made with the subjective comparison method with a sine-wave reference interferer described in Recommendation ITU-R BT.1368, Annex 5.

2.1 The values of protection ratio quoted apply to interference produced by a single source. Except where otherwise stated, the ratios apply to tropospheric, *T*, interference and correspond closely to a slightly annoying impairment condition. They are considered to be acceptable only if the interference occurs for a small percentage of the time, not precisely defined but generally considered to be between 1% and 10%. For substantially non-fading unwanted signals, it is necessary to provide a higher degree of protection and ratios appropriate to continuous, *C*, interference should be used (see Annex 2). If the latter are not known, then the tropospheric, *T*, values increased by 10 dB can be applied.

Values applicable to limit of perceptibility, *LP*, are given for information only.

2.2 Significantly strong wanted input signals can require higher protection ratio values because of non-linear effects in the receiver.

2.3 For 625-line systems, the reference impairment levels are those which correspond to co-channel protection ratios of 30 dB and 40 dB with a frequency-offset between vision carriers close to two-thirds of the line frequency but adjusted for maximum impairment, the precise frequency difference being 10.416 kHz. These conditions approximate to impairment grades 3 (slightly annoying) and 4 (perceptible but not annoying) and apply to tropospheric, *T*, and continuous, *C*, interference, respectively.

2.4 It should be noted that the amplitude of a vision-modulated signal is defined as the r.m.s. value of the carrier at peaks of the modulation envelope (taking no account of the chrominance signal in positive-modulation systems), while that of a sound-modulated signal is the r.m.s. value of the unmodulated carrier, both for amplitude modulation and for frequency modulation.

For planning purposes, it may be assumed that the power in the chrominance channel does not exceed a value which is 16 dB lower than the power in the vision carrier during peaks of the modulation envelope.

2.5 The protection ratio values are not affected if digital data are included in the field-blanking interval of the unwanted television signal. However, certain values are affected in the case of a full-field data unwanted signal; in particular, it is not possible to achieve the full advantages of precision offset operation.

2.6 The relationship between the vision carrier frequencies of the wanted and unwanted signal is as follows (see Annex 3):

2.6.1 Non-controlled condition

No special control of the nominal frequency difference between the carriers of the wanted and unwanted signals.

2.6.2 Non-precision offset

The difference between the nominal frequencies of the wanted and unwanted carriers is suitably related to the line frequency, the tolerance of the carrier frequencies being ±500 Hz.

The line synchronization of television receivers must be sufficiently immune to periodic interference if full advantage of carrier offset operation is to be achieved.

2.6.3 Precision offset (see Annex 4 for the case of 625-line systems)

The difference between the nominal frequencies of the wanted and unwanted carriers is suitably related to the line and field frequencies, but with a tolerance of each of the nominal carrier frequencies of the order of ±1 Hz and stability of the line frequencies equal to or better than 1×10^{-6}. In order to take full advantage of precision offset when the interfering carrier falls in the upper video range (greater than 2 MHz) of the wanted signal, a line-frequency stability of at least 2×10^{-7} is necessary.

3 Synchronized carrier operation

Field and laboratory tests have demonstrated that synchronized carrier television systems allow a similar reduction in co-channel interference to that achieved by use of precision offset techniques, when the same television programme is transmitted. Ratios of wanted-to-unwanted signals of 28 dB and 38 dB were found to correspond to impairment grades of 3.5 and 4.5, respectively.

No degradation of picture quality was observed when the frequency difference between both vision carriers was less than 0.2 Hz and/or the phase fluctuations were less than 20°.

The use of synchronized carrier techniques simplifies the introduction of new television transmitters and transposers into existing networks.

Further studies in this field are required, especially for the case of different television programmes.

4 Further studies

In a number of cases, the available protection ratio values are incomplete. In particular, this applies to:

– data signals,

– out-of-channel response,

– 525-line systems,

– synchronized carrier operation,

– protection ratio values for digital television systems,

– protection ratio values for the protection of analogue television signals against interference from digital television signals.

In addition, it is necessary to establish the relationships between picture quality or impairment grade and protection ratio value. While the information is available for grades 3, 4 and 4.5, it is not yet available for lower grades.