RECOMMENDATION ITU-R F.403-3*,**

Intermediate-frequency characteristics for the interconnection of analogue radio-relay systems

(1956-1959-1963-1966-1970-1978)

The ITU Radiocommunication Assembly,

considering

a) that radio-relay systems for television and frequency-division multiplex telephony may form part of an international circuit;

b) that it may at times be desirable to make international connections between such systems at intermediate frequencies;

c) that, to facilitate international connections at intermediate frequencies, systems of the same channel capacity (independent of their radio frequencies), should preferably have the same intermediate frequency;

d) that, to facilitate the best choice for a radio-frequency channelling arrangement, it is desirable to adopt a preferred value for the intermediate frequency;

e) that incorrect interconnection may have harmful consequences (noise in radio-relay systems for telephony, and linear or non-linear distortion in radio-relay systems for television),

recommends

that, as far as practicable, frequency-division multiplex radio-relay systems, forming part of an international circuit, should have intermediate-frequency circuits which, at a point of international connection, conform to the preferred values listed below:

1 Centre value of the intermediate frequency

Nominal centre value of intermediate frequency (MHz)	Maximum channel capacity
35 (for radio frequencies up to about 1.7 GHz)(1) 70 (for radio frequencies about 1 GHz)	12, 24, 60, 120
70	300, 600, 960, 1 260, 1 800
140	2 700

(1) The intermediate frequency of 70 MHz may also be used in some radio-relay system.

* This Recommendation applies to line-of-sight and near line-of-sight radio-relay systems and, where appropriate, to trans-horizon radio-relay systems.

** Radiocommunication Study Group 9 made editorial amendments to this Recommendation in 2001 in accordance with Resolution ITU-R 44.

The tolerance relative to the nominal centre value of the intermediate frequency may well prove to be a function of a specific system, and is the subject of further studies. Until a final Recommendation can be set up, the tolerance should be agreed between the administrations concerned.

2 Output and input voltages of the intermediate-frequency signal

Nominal values	*Tolerances*
Output: 0.5 V r.m.s. (+5.2 dBm)	+1.0 dB −1.5 dB

The voltage at the output of a receiver corresponds to that of nominal radio-frequency level at the receiver input.

Input: 0.3 V r.m.s. (+0.8 dBm)	+1.0 dB −1.5 dB

Variations in levels which exceed the above range and which are either due to variations of the receive signal or to phenomena which are independent of propagation, should be the subject of agreement between the administrations concerned.

Connection between an output and an input may be made at an input voltage range of between 0.5 V r.m.s. to 0.3 V r.m.s. by agreement between the administrations concerned. Any necessary level adaptation should be made at the input point by the administration concerned.

3 Impedance of the intermediate-frequency circuit

Nominal impedance: 75 Ω (unbalanced).

Return loss: ≥ 26 dB within a frequency band including the baseband and the continuity pilot frequency on both sides of the centre frequency, for systems with a capacity of more than 600 telephone channels, or the equivalent.

Values greater than 26 dB may be necessary depending upon the characteristics of the junction cables used, especially their length, and the bandwidth transmitted (a large number of telephone channels or television and sound broadcasting signals).

The matching conditions for systems with a capacity of 600 channels or less, remain under study.

4 Intermediate-frequency characteristics at harmonic frequencies

The generation of harmonics (particularly the second harmonic) should be controlled as these may recombine with the fundamental frequency and cause distortions which could impair the transmission quality. As an example equipment-generated harmonics propagated through a junction cable may be reflected from the cable terminations to produce intermediate-frequency signals which are delayed with respect to the main signal and so result in intermodulation distortion noise.

Administrations should consider the level of harmonics and the impedance at harmonic frequencies of the cable termination, with a view to applying appropriate remedies, pending agreement upon a Recommendation.

NOTE 1 – When diversity reception is used, the preferred values quoted above for impedance and output level apply to the combined output of the receivers used.

NOTE 2 – It is recognized that in certain cases and in certain regions, it may be desirable to use, by agreement between the administrations concerned, intermediate-frequency characteristics other than those given above.

NOTE 3 – The precise definition of the point of international connection is the responsibility of the administrations concerned.