



INTERNATIONAL TELECOMMUNICATION UNION

**ITU-T**

TELECOMMUNICATION  
STANDARDIZATION SECTOR  
OF ITU

**G.451**

**INTERNATIONAL ANALOGUE CARRIER SYSTEMS  
COORDINATION OF RADIOTELEPHONY AND LINE  
TELEPHONY**

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**USE OF RADIO LINKS IN INTERNATIONAL  
TELEPHONE CIRCUITS**

**ITU-T Recommendation G.451**

(Extract from the *Blue Book*)

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## NOTES

1 ITU-T Recommendation G.451 was published in Fascicle III.2 of the *Blue Book*. This file is an extract from the *Blue Book*. While the presentation and layout of the text might be slightly different from the *Blue Book* version, the contents of the file are identical to the *Blue Book* version and copyright conditions remain unchanged (see below).

2 In this Recommendation, the expression “Administration” is used for conciseness to indicate both a telecommunication administration and a recognized operating agency.

## Recommendation G.451

### USE OF RADIO LINKS IN INTERNATIONAL TELEPHONE CIRCUITS<sup>1)</sup>

The CCITT,

*considering*

(a) that, at the present time, radiotelephone systems connecting the various countries often employ carrier-frequencies below about 30 MHz<sup>2)</sup>;

(b) that the use of such a radio link, in a long-distance telephone circuit, implies certain special conditions, which introduce particular difficulties not encountered when purely metallic connections are used;

(c) that such a radiotelephone circuit differs from a metallic circuit in the following ways:

- 1) such a radiotelephone circuit is subject to attenuation variation with the special difficulty of fading;
- 2) such a radiotelephone circuit suffers from noise caused by atmospherics, the intensity of which may reach, or even exceed, a value comparable with that of the signal which it is desired to receive;
- 3) special precautions are necessary in the setting up and maintenance of such a radiotelephone circuit, to avoid disturbance of the radio receiver by any radio transmitter and especially by its own radio transmitter;
- 4) to maintain the radiotelephone link in the best condition from the point of view of transmission performance, it is necessary to take special measures to ensure that the radio transmitter always operates, as far as possible, under conditions of full loading, whatever may be the nature and the attenuation of the telephone system connected to the radiotelephone circuit;
- 5) it is necessary to take measures to avoid or correct conditions of abnormal oscillation or cross-talk;
- 6) although the recommended frequency band, to be effectively transmitted by international landline circuits, has been determined by a study of the requirements of the human ear, this band (for a radiotelephone circuit operating at a frequency below 30 MHz) may be limited by the necessity of obtaining the maximum number of telephone channels in this part of the radio-frequency spectrum and so that each telephone channel does not occupy a radio-frequency band larger than necessary;
- 7) in general, such a radiotelephone circuit is a long-distance international circuit giving telephone service between two extended networks, and this fact is of great importance from two points of view:
  - i) on the one hand, international conversations, in general, are of great importance to the subscribers and, on the other hand, they are made in languages which are not always their mother tongue, so that high quality reception is particularly important;
  - ii) the public should not be deprived of a very useful service under the pretext that it does not always satisfy the degree of excellence desirable for long-distance communication,

*unanimously recommends*

#### **1 Circuits above 30 MHz**

that between fixed points, telephone communications should be effected wherever possible by means of metallic conductors, or radio links using frequencies above 30 MHz to make the allocation of radio frequencies less

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<sup>1</sup> CCIR Recommendation 335 [1].

<sup>2</sup> Further reference to 30 MHz in this Recommendation means "about 30 MHz".

difficult; where this can be realized, the objective should be to attain the transmission performance recommended by the CCITT for international telephone circuits on metallic conductors;

## 2 Circuits below 30 MHz

2.1 that since it becomes necessary to economize in the use of the frequency spectrum, when considering international circuits which consist mainly of single long-distance radio links operating at frequencies less than 30 MHz, it is desirable to use single-sideband transmission to the maximum extent possible, to employ a speech band less than the 300 to 3400 Hz recommended by the CCITT for landline circuits and, preferably, to reduce the upper frequency of the speech band to 3000 Hz or less, but not below 2600 Hz, except in special circumstances;

2.2 that, although it will be necessary to tolerate large variations in noise level on such a radiotelephone circuit, every possible effort should be made to obtain minimum disturbance to the circuit from noise and fading by the use of such techniques as full transmitter modulation, directional antennas and single-sideband operation;

2.3 that, during the time that such a radiotelephone circuit is connected to an extension circuit equipped with echo suppressors (voice-operated switching device), the intensity of disturbing currents should not be sufficient to operate the echo suppressor frequently;

2.4 that such a radiotelephone circuit should be provided with an echo suppressor to avoid singing or echo disturbance on the complete circuit, or, preferably, with terminals using the principles of constant overall transmission loss, as set forth in CCIR Recommendation 455 [2];

2.5 that such a radiotelephone circuit should be equipped with automatic gain control to compensate automatically, as far as possible, for the phenomenon of fading;

2.6 that the terminal equipment of such a radiotelephone circuit should be such that it may be connected, in the same way as any other circuit, with any other type of circuit;

2.7 that, where privacy equipment is used, this equipment should not appreciably affect the quality of telephone transmission;

2.8 that, when suitable automatic devices are not provided, the circuit controls should be adjusted, as often as necessary, by an operator to ensure optimum adjustment of transmitter loading, received volume and the operating conditions of the echo suppressor.

*Note* - Although the requirements contained in § 2 are much less severe than those imposed on international landline circuits, the objective remains to attain the same standards of telephone transmission in all cases. In view of this, it is desirable that the telephone systems connected to a radiotelephone circuit should conform to CCITT Recommendations covering the general conditions to be met by international circuits used for landline telephony, especially in respect of equivalent, distortion, noise, echoes and transient phenomena.

Bearing in mind the recommendations contained in §§ 1 and 2, it is desirable that in each particular case, Administrations concerned should first reach agreement on how far the standards usually employed for international landline circuits may be attained in the case considered. If the technique of § 1 can be used, the objective should be to obtain, as far as possible, the characteristics recommended by the CCITT for international landline circuits. Otherwise the Administrations concerned should study the best solution from the point of view of both technique and economy.

### References

- [1] CCIR Recommendation *Use of radio links in international telephone circuits*, Vol. III, Rec. 335, Dubrovnik, 1986.
- [2] CCIR Recommendation *Improved transmission system for HF radiotelephone circuits*, Vol. III, Rec. 455, Dubrovnik, 1986.