



INTERNATIONAL TELECOMMUNICATION UNION

**ITU-T**

TELECOMMUNICATION  
STANDARDIZATION SECTOR  
OF ITU

**Q.455**

**SPECIFICATIONS OF SIGNALLING SYSTEM R2  
INTERREGISTER SIGNALLING  
MULTIFREQUENCY SIGNALLING EQUIPMENT**

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**THE RECEIVING PART OF THE  
MULTIFREQUENCY EQUIPMENT**

**ITU-T Recommendation Q.455**

(Extract from the *Blue Book*)

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## NOTES

1 ITU-T Recommendation Q.455 was published in Fascicle VI.4 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 Q.455

### 4.4.5 THE RECEIVING PART OF THE MULTIFREQUENCY EQUIPMENT

#### 4.4.5.1 Sensitivity range

The power levels given below relate to the nominal impedance of the receiving part of the multifrequency signalling equipment.

The receiving part of the multifrequency signalling equipment shall have a sensitivity range of -31.5 dBm0 to -5 dBm0<sup>1)</sup>.

#### 4.4.5.2 Operate and release time requirements

The operating and release times of the receiving part of the multifrequency signalling equipment depend on the design and, for a given design, on:

- the time difference between the instants of reception of each of the two frequencies making up a multifrequency combination;
- the level of each of the two frequencies;
- the difference in level between the two frequencies;
- the level, spectrum and instant of onset of the noise.

The factors vary with transmission conditions. With certain types of switching equipment it may prove advisable to embody devices to counteract low-frequency disturbances in the multifrequency signalling equipment.

Time requirements have been specified for two types of *multifrequency test combinations*, A and B, applied to the input of the receiving part of the multifrequency signalling equipment in the presence of disturbing signals as specified below.

When test combinations and disturbing frequencies as specified under a) to c) below are applied to the terminals A (see Figure 17/Q.451) of 2-wire multifrequency signalling equipment or to the terminals C (see Figure 16/Q.451) of 4-wire multifrequency signalling equipment, the following time requirements must be met:

- for type A test combinations:

$$T_0 + T_R \leq 70 \text{ ms}$$

- for type B test combinations:

$$T_0 + T_R \leq 80 \text{ ms}$$

- for test combinations of types A and B:

$$(T'_0 + T'_R) \leq (T_0 + T_R) + 5 \text{ ms}$$

For definitions of  $T_0$ ,  $T'_0$ ,  $T_R$  and  $T'_R$  see Recommendation Q.451.

For the third requirement, the only cases to be considered are those in which the frequency first appearing is also the first to disappear (transmission delay effect). The  $T'_0$  and  $T'_R$  time requirements are specified to ensure proper functioning of the multifrequency signalling equipment when the received multifrequency combination is affected by group delay distortion, for example. The appropriate procedure for this test depends on the design of the equipment to be

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<sup>1)</sup> For equipments already in service the sensitivity range is -35 dBm to -5 dBm.

tested; in many cases it will be convenient to assume that a delay of one second or more for the second frequency constitutes the most unfavourable case.

When a multifrequency combination has caused the receiving part of the multifrequency signalling equipment to operate, the latter cannot release if the signal frequencies are interrupted for not more than 7 ms. A method of improving the system reliability in case of interrupted signals is described in Annex B of Section 4.

a) *Multifrequency test combinations type A*

- The multifrequency test combination consists of any 2-out-of- $n$  combination of the  $n$  signalling frequencies;
- each frequency differs from the nominal frequency by not more than  $\pm 5$  Hz;
- the absolute power level of each of the two frequencies of the multifrequency combination lies between -5 dBm and -20 dBm;
- the difference in level between the two frequencies is not greater than 3 dB.

b) *Multifrequency test combinations type B*

- The multifrequency test combination consists of any 2-out-of- $n$  combination of the  $n$  signalling frequencies;
- each frequency differs from the nominal frequency by not more than  $\pm 10$  Hz;
- the absolute power level of each of the two frequencies of the multifrequency combination lies between -5 dBm and -35 dBm;
- the difference in level between the two frequencies is not greater than 5 dB for adjacent frequencies and 7 dB for non-adjacent frequencies.

c) *Disturbing frequencies*

The disturbing frequencies to be applied are:

- in all cases one or more of the  $n$  frequencies for which the receiving part under test is designed, with a total power level of -55 dBm or less, when no multifrequency test combination is being applied;
- when a multifrequency test combination is applied, one or more of the  $(n - 2)$  remaining frequencies with a total power level 20 dB below the highest test combination frequency level during application of the test combination;
- for testing the receiving part of 4-wire multifrequency signalling equipment in an outgoing international R2 register:

any multifrequency combination consisting of two frequencies out of the forward group of frequencies, each of these two frequencies having a level of 13.5 dB above the lowest test-combination frequency level in the backward direction; an upper limit of - 12.5 dBm is nevertheless specified for the level of the disturbing signal.

System R2 interregister signalling may be used in the country of origin on the national links preceding the out-going international R2 register. In that case, the receiving part of 4-wire multifrequency signalling equipment connected to the forward speech path of the national 4-wire links may have to function in the presence of frequencies used in the backward direction. No general specification can be given for the level of these disturbing frequencies; it is recommended that Administrations formulate their own specifications.

- for testing the receiving part of 2-wire multifrequency signalling equipment:

any multifrequency combination at the highest level used in operational signalling (measured at point A, Figure 17/Q.451) by the sending part of the 2-wire multifrequency signalling equipment concerned.

#### 4.4.5.3 *Non-operate and non-recognition requirements*

The receiving part of the multifrequency signalling equipment must remain in the *non-operate* state when the following disturbances, singly or together, are the only signals that are applied to the terminals A or C (see Figures 17/Q.451 and 16/Q.451):

- any single pure sine wave or any combination of two pure sine waves, each with a power level of -38.5 dBm<sub>0</sub> within the 300-3400 Hz band;<sup>2)</sup>
- any single pure sine wave or any combination of two pure sine waves, each with a power level of -42 dBm within the 300-3400 Hz band;
- any combination of two pure sine waves, each with a power level of -5 dBm within the 1300-3400 Hz band for the set of frequency receivers used in the backward direction; and within the 330-1150 Hz and 2130-3400 Hz bands for the set of frequency receivers used in the forward direction.

Furthermore, when signalling tones have activated the receiving part of the multifrequency signalling equipment, this must assume the *non-operate* state when the signalling tones are removed in the presence of these same disturbances, singly or together, at the above-mentioned terminals.

The receiving part of the multifrequency signalling equipment must not recognize a combination consisting of two signalling frequencies out of the set of frequencies normally used in the transmission direction considered, each having a level not exceeding -5 dBm and a duration of less than 7 ms.

The receiving part of the multifrequency signalling equipment must not recognize a combination consisting of two signalling frequencies used in the transmission direction considered, having a difference in level of 20 dB or more.

#### 4.4.5.4 *Influence of transient disturbances* (see also Recommendation Q.458)

The recognition of faulty signals due to short-lived transient conditions can largely be avoided if a multifrequency combination is recognized only after a specified minimum time, during which two, and only two, of the individual receivers are active and if the absence of multifrequency combinations is recognized only after a minimum time, during which all individual receivers are at rest. These times are included in the operating and release times  $T_0$  and  $T_R$ .

Typical transient disturbances, such as clicks, change of polarity, etc., generated by the switching equipment, must not change signals transferred from the receiving part of the signalling equipment to the register.

It is recommended that Administrations formulate their own specification for a test method according to the type of disturbances encountered in their switching equipment.

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<sup>2)</sup> For equipments already in service, the non-operation level is -42 dBm.