INTERNATIONAL TELECOMMUNICATION UNION

ITU-T Q.414

TELECOMMUNICATION
STANDARDIZATION SECTOR
OF ITU

SPECIFICATIONS OF SIGNALLING SYSTEM R2

LINE SIGNALLING, ANALOGUE VERSION

SIGNAL SENDER

ITU-T Recommendation Q.414

(Extract from the *Blue Book*)

NOTES

1 ITU-T Recommendation Q.414 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.414

2.3.1 SIGNAL SENDER

2.3.1.1 *Signalling frequency*

The nominal value of the signalling frequency is 3825 Hz. Measured at the sending point, the frequency variation from the nominal value must not exceed ± 4 Hz.

2.3.1.2 *Send level*

The send level of the signalling frequency, measured at the group distribution frame or an equivalent point, must be -20 ± 1 dBm0.

2.3.1.3 *Leaks*

The level of the signal frequency which may be transmitted to line as a leak current (e.g. when static modulators are used), must be at least 25 dB below the level of the signalling tone.

2.3.1.4 *Phase distribution of the signalling frequencies*

As the signalling frequency is sent on any circuit in idle state, the addition of these tones in moments of low traffic may give rise to the following phenomena on certain transmission systems:

- high peak voltage on the line caused by the signalling tones and involving the possibility of overloading the system;
- intelligible crosstalk due to third-order intermodulation;
- unwanted tones coming from second-order intermodulation products and occurring within sound-programme circuits.

The following special measures must be taken to avoid these effects:

One method recommended is to inject the signalling frequencies with random 0 and π radian phases in the channels. An equivalent method is to use carrier frequencies of which the phases are randomly distributed 0 and π radians. With these methods the probability of occurrence of 0 and π radian phases should be 0.5[1)] .

Other methods may be used provided they give comparable results.

2.3.1.5 *Protection of the signalling channel at the sending end*

This signalling channel must be protected at the sending end against disturbance from the associated and the adjacent speech channel.

When a sinewave at 0 dBm0 level is applied to the audio-frequency input of the associated channel, the level measured at the group distribution frame or at an equivalent point must not exceed the levels shown in Figure 6/Q.414.

When a sinewave of frequency *f* is applied to the audio-frequency input of the adjacent channel it produces two signals that appear on the frequency scale of Figure 6/Q.414 as having the frequencies (4000 + *f*) and (4000 - *f*). The level of the (4000 + *f*) signal, measured at the group distribution frame or at an equivalent point, shall not be higher than -33 dBm0 when the sinewave with frequency *f* is applied to the audio-frequency input of the adjacent channel at a level shown in Figure 6/Q.414 for the frequency of (4000 + *f*). The level of the (4000 - *f*) signal, measured

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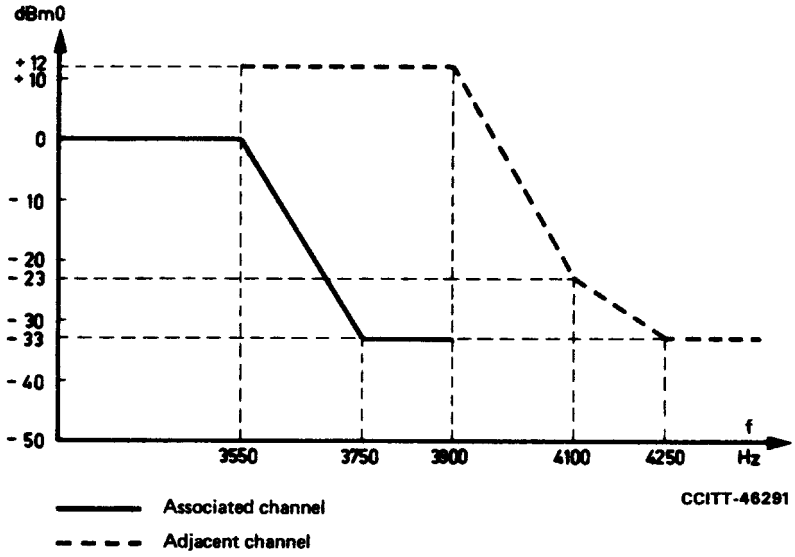
1) For further details on the method of random distribution of the phases of frequency 3825 Hz, see: Ekholm, O. and Johannesson, N.O.: "Loading Effects with Continuous Tone Signalling", English edition of *TELE*, No. 2, 1969. For further details on a systematic method of phase distribution, see: Rasch, J. and Kagelmann, H.: "On Measures for Reducing Voltage Peaks and Distortion Noise on Carrier Transmission Paths with Single Channel Supervision", *Nachrichtentechnische Zeitschrift (NTZ)*, 22 (1969), No. 1, pp. 24-31.

at the group distribution frame or at an equivalent point, shall not be higher than -33 dBm0 when the sinewave with frequency *f* is applied to the audio-frequency input of the adjacent channel at any level below the value shown in Figure 6/Q.414 for the frequency (4000 - *f*).



Note – The frequency of the virtual carrier of the associated speech channel is the origin of the frequency scale (zero frequency).

FIGURE 6/Q.414

Protection of the signalling channel at the sending end

When the Go path is looped to the Return path at the group distribution frame or an equivalent point, the signal receiver must not change condition when:

- the click generator shown in Figure 7/Q.414 is connected to the associated speech channel or to the adjacent speech channel at the very point where this channel is connected to the switching equipment;
- to take the most difficult circumstances possible, the channel level adjusting devices are set to such values encountered in practice which give rise to the worst disturbance;
- gain is introduced in the loop at the group distribution frame or at the equivalent point, so that the receive level at the point in question is +3 dBm0.

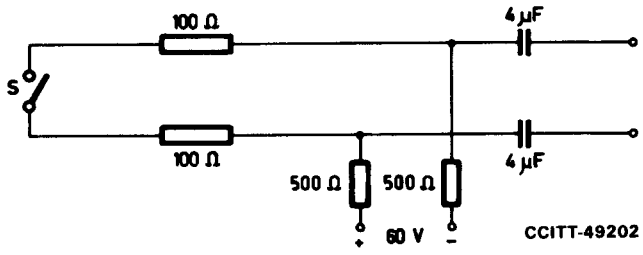


FIGURE 7/Q.414

Click generator

2.3.1.6 *Response time*

The response time of the signal sender is defined as the interval between the instant when the change signalling condition command is applied to the sender and the instant at which the envelope of the signalling frequency, measured at the group distribution frame or at an equivalent point, reaches half of its value in the steady state. For each of the two possible changes of signalling condition the response time must be less than 7 ms.