INTERNATIONAL TELECOMMUNICATION UNION

ITU-T Q.24

TELECOMMUNICATION
STANDARDIZATION SECTOR
OF ITU

GENERAL RECOMMENDATIONS ON TELEPHONE SWITCHING AND SIGNALLING

INTERNATIONAL AUTOMATIC AND SEMI-AUTOMATIC WORKING

MULTIFREQUENCY PUSH-BUTTON SIGNAL RECEPTION

ITU-T Recommendation Q.24

(Extract from the *Blue Book*)

NOTES

1 ITU-T Recommendation Q.24 was published in Fascicle VI.1 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.24

MULTIFREQUENCY PUSH-BUTTON SIGNAL RECEPTION

1 Introduction

Characteristics of multifrequency push-button (MFPB) telephone sets using voice frequency signals are included in Recommendation Q.23. This Recommendation Q.24 is intended primarily for application in local exchanges for the reception of MFPB signals. Other MFPB signal receiving applications, such as transit exchanges, would need to take into account the effects of transmission impairments, such as signal clipping, that could be introduced in long distance telephone networks. Since technical factors, such as transmission loss, vary among national networks, varying national standards exist. Varying standards may also exist, for example, to incorporate differences between local and transit exchange applications. This Recommendation is not intended to supersede existing national standards nor is it intended to imply that Administrations should modify those standards.

2 Technical parameters

2.1 *General*

The technical parameters identified herein are fundamental to the MFPB receiving function and reasons are given for the importance of each parameter. The parameters require operational values to be specified for compatibility with the MFPB sending equipment (Recommendation Q.23) and the network environment in which the receiving equipment must function. Annex A contains a Table showing values for some of these parameters that have been adopted by various Administrations and RPOAs. In addition to the fundamental parameters covered by this Recommendation, Administrations should consider whether other parameters need specification to account for operating conditions found in their networks.

2.2 *Signal frequencies*

Each signal consists of two frequencies taken from two mutually exclusive frequency groups (a high group and a low group) of four frequencies each, as specified in Recommendation Q.23. These frequencies and their allocation to form the various digits and symbols of the push-button signalling code are defined in Recommendation Q.23. The exchange shall provide a check for the simultaneous presence of one and only one frequency from the high group and one and only one from the low group.

2.3 *Frequency tolerances*

The exchange should respond to signals whose frequencies are within the tolerances for MFPB sending. Somewhat wider tolerances may be appropriate, for example to cater for transmission impairments encountered in subscriber cables or FDM transmission facilities. However, wider limits may increase susceptibility to noise and digit simulation by speech.

2.4 *Power levels*

The exchange should provide proper reception of signals whose power levels are determined by the amplitude of the sending equipment and loss that may be introduced by the subscriber cables or other network elements. The sending amplitude and transmission attenuation may be different for different frequencies. The reception characteristics may take advantage of a limitation, if specified, on the maximum difference in power level between the two received frequencies forming a valid signal to facilitate improved overall performance.

2.5 *Signal reception timing*

The exchange should recognize signals whose duration exceeds the minimum expected value from subscribers. To guard against false signal indications the exchange should not respond to signals whose duration is less than a specified maximum value. Similarly, pause intervals greater than a specified minimum value should be recognized by the exchange. To minimize erroneous double-registration of a signal if reception is interrupted by a short break in transmission or by a noise pulse, interruptions shorter than a specified maximum value must not be recognized. The

maximum rate at which signals can be received (signalling velocity) may be related to the above minimum values. All of these values may also be determined by subscriber feature requirements.

2.6 *Signal simulation by speech*

Because telephone set speech transmitters are normally connected in the circuit during the push-button dialling interval, it is necessary for the exchange to properly receive valid MFPB signals in the presence of voice or other disturbances. The nature of such disturbances may vary from one geographical area to another. The number of calls affected by signal simulation should not significantly degrade the overall telephone network performance experienced by subscribers.

Since actual immunity to digit simulation may be difficult to measure, a test environment using recorded speech, music, and other voice frequency sounds may be utilized to verify design performance.

2.7 *Interference by dial tone*

MFPB reception should not be adversely affected while dial tone is being applied. Characteristics of dial tone such as frequencies, power levels and spurious components are covered in Recommendation Q.35. These characteristics are specified to minimize the interference between the dial tone sending and the MFPB receiving functions. These functions are normally provided by closely related exchange equipment which must be designed to function properly over the entire range of signal characteristics and transmission impairments to be encountered.

2.8 *Interference by echos*

MFPB signal reception from extended subscriber lines having long 4-wire transmission sections must discriminate between a true signal condition and an echo condition which may persist for a number of milliseconds. Failure to provide such discrimination could result in signal reception errors, for example due to a reduction of the detected pause duration. Administrations having such extended subscriber lines with MFPB signalling should therefore specify the echo conditions under which the MFPB signalling function must operate.

2.9 *Noise immunity*

Noise sources such as power lines, electric railways and telecommunication circuits may induce electrical disturbances with various characteristics into MFPB signalling paths. These disturbances may cause MFPB signals to be missed, split (double signal registration) or cause signal simulation. The distortion products produced by the MFPB signalling source should also be included in the noise environment. A realistic noise environment specification and facilities for testing MFPB reception under the specified conditions, e.g., using recorded test tapes, are important to ensure that performance standards will be met under actual service conditions.

ANNEX A

(to Recommendation Q.24)

TABLE A-1/Q.24

Values of multi-frequency push-button receiving parameters adopted by various Administrations/RPOAs

Parameters			Values				
			NTT	AT&T	Danish Administration [a]	Australian Administration	Brazilian Administration
Signal frequencies	Low group		697, 770, 852, 941 Hz	same as left column	same as left column	same as left column	same as left column
	High group		1209, 1336, 1477, 1633 Hz				
Frequency tolerance $\lvert \Delta f \rvert$	Operation		≤ 1.8%	≤ 1.5%	≤ (1.5% + 2 Hz)	≤ (1.5% + 4 Hz)	≤ 1.8%
	Non-operation		≥ 3.0%	≥ 3.5%		≥ 7%	≥ 3%
Power levels per frequency	Operation		-3 to -24 dBm	0 to -25 dBm	(A + 25) to A dBm	-5 to -27 dBm	-3 to -25 dBm
	Non-operation		Max. -29 dBm	Max. -55 dBm	Max. (A - 9) dBm (A = -27)	Max. -30 dBm	Max. -50 dBm
Power level difference between frequencies			Max. 5 dB	+4 dB to -8 dB [b]	Max. 6 dB	Max. 10 dB	Max. 9 dB
Signal reception timing	Signal duration	Operation	Min. 40 ms	Min. 40 ms	Min. 40 ms	Min. 40 ms	Min. 40 ms
		Non-Operation	Max. 24 ms	Max. 23 ms	Max. 20 ms	Max. 25 ms	Max. 20 ms
	Pause duration		Min. 30 ms	Min. 40 ms	Min. 40 ms	Min. 70 ms	Min. 30 ms
	Signal interruption		Max. 10 ms [c]	Max. 10 ms	Max. 20 ms	Max. 12 ms	Max. 10 ms
	Signalling velocity		Min. 120 ms/digits	Min. 93 ms/digit	Min 100 ms/digit	Min. 125 ms/digit	Min. 120 ms/digits
Signal simulation by speech			6 false/46 hours for speech with a mean level of -15 dBm	For the codes 0-9, 1 false/3000 calls For the codes 0-9, *, #, 1 false/2000 calls For the codes 0-9, *, # A-D, 1 false/1500 calls	46 false/100 hours for speech with a mean level of -12 dBm		5 false/50 hours for speech with a mean level of -13 dBm
Interference by echos				Should tolerate echos delayed up to 20 ms and at least 10 dB down			

a) Same characteristics are used by several European Administrations; Values of A range from -22 to -30 to suit national conditions.

b) The high group frequency power level may be up to 4 dB more or 8 dB less than the low group frequency power level.

c) For analogue multifrequency push-button receivers only.