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SERIES H: TRANSMISSION OF NON-TELEPHONE SIGNALS

Telephone circuits or cables used for various types of
telegraph transmission or simultaneous transmission

**Subdivision of the frequency band of a
telephone-type circuit between telegraphy and
other services**

ITU-T Recommendation H.34

Extract of **Red Book Fascicle III.4 (1984)**

NOTES

- 1 ITU-T Recommendation H.34 was published in Fascicle III.4 of the *Red Book*. This file is an extract from the *Red Book*. While the presentation and layout of the text might be slightly different from the *Red Book* version, the contents of the file are identical to the *Red 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.

**SUBDIVISION OF THE FREQUENCY BAND OF A TELEPHONE-TYPE CIRCUIT
BETWEEN TELEGRAPHY AND OTHER SERVICES**

(Geneva, 1972, amended at Geneva, 1984)

1 General

The specific case considered here is that of frequency subdivision at nominally 2700 Hz, 2800 Hz and 2950 Hz of a 4-wire circuit into a main band (which can be used for telephony, data, phototelegraphy or facsimile transmission) and a secondary band, above the main band, reserved for frequency-modulation (FM) telegraphy.

The solution described in this Recommendation is recommended when the equipments are supplied by the Administration for use on leased circuits and when the derived voice channel is used on the public switched telephone network. It should be pointed out that, in accordance with the Recommendation cited in [1], Administrations are not obliged to accept any responsibility for the end-to-end quality of transmissions over connected circuits which comprise a private leased circuit network.

It is understood that any other system may be used on a leased circuit, provided the conditions concerning levels given in § 5 are observed; in this case, Administrations can give no guarantee concerning the quality of circuits, to the users of a leased circuit.

2 Main channel

With the upper part limited in this way, the main channel can be used for:

- a) telephone calls of a reduced quality plus appropriate signalling system;
- b) data transmission in accordance with Recommendations V.15 [2], V.16 [3], V.19 [4], V.20 [5], V.21 [6], V.22 [7], V.23 [8] V.26 [9] and V.26 *bis* [10];
- c) data transmission in accordance with Recommendations V.27 [11], V.27 *bis* [12], V.27 *ter* [13];
- d) data transmission in accordance with Recommendation V.29 [14];
- e) facsimile transmission in accordance with Recommendation T.1 [15];
- f) facsimile transmission in accordance with Recommendations T.2 [16] and T.3 [17] (Groups 1 and 2);
- g) facsimile transmission in accordance with Recommendation T.4 [18] (Group 3).

For services b), c), f) and g) above, the combination of circuit and filters should be designed to keep the relative group-delay distortion and amplitude frequency response within the characteristics of the Recommendation M.1020 [21] circuit specification used, up to 100 Hz below the 3 dB filter cut-off for these services.

For service d) (the 2950 Hz filter), the group-delay distortion design limit should be under plus or minus 100 microseconds over the frequency band 550 Hz to 2850 Hz.

The characteristics of the main channel in a) are given in the case of a simple telephone circuit by Recommendation M.1040 [19] and for a private switched network by Recommendation G.171 [20].

The characteristics of the main channel in b) to g) are given in Recommendation M.1020 [21].

The characteristics of the telegraph channels are given in the R-Series Recommendations.

The level condition stated in § 5 must be complied with at all times.

With regard to service a), where applicable, account should be taken of the telephony impairment (about 2 dB) due to the limitation of the frequency band (see Recommendation G.113) [22].

With regard to services b) to g) inclusive, the subdivisions permit reliable data transmission in accordance with the following table:

| Filter Stop ^{a)} Band Attenuation | Filter 3 dB Cutoff | Maximum Rate | Paragraph 2 Category |
|---|-----------------------|--------------|-------------------------|
| 56 dB | 2700 Hz | 2400 bps | a, b and e |
| 56 dB | 2800 Hz | 4800 bps | c, f and g |
| 30 dB | 2950 Hz | 9600 bps | d |

^{a)} Stop Band operates from 100 Hz above the filter 3 dB point. For 9600 bps Alternative Voice and Data, the voice may require a 2.7 or 2.8 kHz-type filter.

3 Telegraph channels

The following are the preferred arrangements of telegraph channels in the secondary band in the case of a normal 300-3400 Hz telephone-type circuit for the three cases of subdivision:

| Filter Type | 2700 Hz | 2800 Hz | 2950 Hz |
|-------------|--------------------|---------------|----------|
| Option 1) | 121, 122, 123, 124 | 122, 123, 124 | 123, 124 |
| Option 2) | 211, 123, 124 | 122, 212 | 212 |
| Option 3) | 211, 212 | | |
| Option 4) | 406 | | |

The numbering, modulation and other characteristics of the telegraph channel should comply with Recommendations R.35 [23], R.37 [24], R.38A [25] and R.70 *bis* [26], as far as possible, considering the reduced transmission level which may result in sub-standard performance.

Where the upper limit is reduced to 3050 Hz (as in telephone channels complying with Recommendation G.235 [27]), it will only be possible to use two 120 Hz channels (Nos. 121 and 122) or one 240 Hz channel (No. 211) with the 2700 Hz subdivision.

With the same subdivision, the main channel may be used for:

- telephone calls,
- facsimile (including phototelegraphy),
- data,

and the secondary channel for:

- data transmission by telegraph channel.

However, private systems may be used depending on the characteristics of the portion of the band available, provided the conditions concerning levels given in § 5 are observed.

4 Filters

For the protection of telegraph channels for interference by speech or data transmission components in the upper frequency range, a filter must be used at the sending end with the nominal cut-off frequencies specified in § 2. These filters should be designed to minimize the impairment introduced to data transmission by the characteristic amplitude variations and delay distortion.

Note – This filter protects the telegraph channels from the signals transmitted on the main channel. The filters mentioned in Recommendation R.35 [23] to R.38A [25] for the protection in the opposite direction can be relied on; when the secondary channel is used for other purposes, special precautions should be taken to protect the main channel.

Sufficient protection of the main band from interference by the telegraph signals in the secondary band is assured by a similar filter at the receiving end. It is assumed that the telegraph channels are provided with filters so as to meet the provisions of Recommendations R.35 [23], R.37 [24] or R.38A [25].

5 Levels

The general principle concerning levels for each type of service is that the allowable mean signal power is proportional to the bandwidth assigned.

Of the maximum permissible 1-minute mean loading of 50 μW_0 (–13 dBm₀), 10 μW_0 are allocated to the secondary band and the remaining 40 μW_0 to the main band. In the case of telephony this implies that normal levels for speech and signalling can be retained (given in Recommendations G.223 [28] as 32 μW), and for the telegraph band one telegraph channel at –20 dBm₀ or four channels at –26 dBm₀.

6 Limitation of amplitude

It may be desirable to impose a limit on amplitude in the main band path so that the onset of nonlinearity in the common transmission path will not cause intermodulation and possible interference with the telegraph channels.

7 Network control

In many instances, Administrations may find it desirable to control the remote-end equipment for various purposes, such as choosing different filter cut-offs, reconfiguring the number and bandwidth of telegraph channels (as per § 3 above), switching from voice to data transmission remotely, etc. Furthermore, remote testing via loopbacks specified in Recommendation V.54 [29] may be desirable on such leased networks. For such purposes, a low-speed, narrow band control channel may be added. Such a channel shall operate in the controlled carrier mode, i.e. shall transmit a burst of tone only during a request for such a remote function. Such a channel shall not occupy any additional allocated bandwidth (i.e. under the modem reverse channel band) and its presence shall not cause interference to speech, telephone signalling, facsimile or data transmission, nor shall it disrupt any of the telephone channels. Furthermore, such a channel shall be equipped with sufficient protection by means of redundant coding to be able to distinguish between actual commands for remote control and random signals due to the overlapping spectra of speech, or data transmission originating from modems specified in §§ 2 b) to 2 g).

References

- [1] CCITT Recommendation *General principles for the lease of international (continental and intercontinental) private leased telecommunication circuits*, Vol. II, Rec. D.1, § 5.8.
- [2] CCITT Recommendation *Use of acousting coupling for data transmission*, Vol. VIII, Rec. V.15.
- [3] CCITT Recommendation *Medical analogue data transmission modems*, Vol. VIII, Rec. V.16.
- [4] CCITT Recommendation *Modems for parallel data transmission using telephone signalling frequencies*, Vol. VIII, Rec. V.19.
- [5] CCITT Recommendation *Parallel data transmission modems standardized for universal use in the general switched telephone network*, Vol. VIII, Rec. V.20.
- [6] CCITT Recommendation *300 bits per second duplex modem standardized for use in the general switched telephone network*, Vol. VIII, Rec. V.21.

- [7] CCITT Recommendation *1200 bits per second duplex modem standardized for use on the general switched telephone network and on the leased circuits*, Vol. VIII, Rec. V.22.
- [8] CCITT Recommendation *600/1200-baud modem standardized for use in the general switched telephone network*, Vol. VIII, Rec. V.23.
- [9] CCITT Recommendation *2400 bits per second modem standardized for use on 4-wire leased telephone-type circuits*, Vol. VIII, Rec. V.26.
- [10] CCITT Recommendation *2400/1200 bits per second modem standardized for use in the general switched telephone network*, Vol. VIII, Rec. V.26 bis.
- [11] CCITT Recommendation *4800 bits per second modem with manual equalizer standardized for use on leased telephone-type circuits*, Vol. VIII, Rec. V.27.
- [12] CCITT Recommendation *4800/2400 bits per second modem with automatic equalizer standardized for use on leased telephone-type circuits*, Vol. VIII, Rec. V.27 bis.
- [13] CCITT Recommendation *4800/2400 bits per second modem standardized for use in the general switched telephone network*, Vol. VIII, Rec. V.27 ter.
- [14] CCITT Recommendation *9600 bits per second modem standardized for use on point-to-point 4-wire leased circuits*, Vol. VIII, Rec. V.29.
- [15] CCITT Recommendation *Standardization of phototelegraph apparatus*, Vol. VII, Rec. T.1.
- [16] CCITT Recommendation *Standardization of Group 1 facsimile apparatus for document transmission*, Vol. VII, Rec. T.2.
- [17] CCITT Recommendation *Standardization of Group 2 facsimile apparatus for document transmission*, Vol. VII, Rec. T.3.
- [18] CCITT Recommendation *Standardization of Group 3 facsimile apparatus for document transmission*, Vol. VII, Rec. T.4.
- [19] CCITT Recommendation *Characteristics of ordinary quality international leased circuits*, Vol. IV, Rec. M.1040.
- [20] CCITT Recommendation *Transmission characteristics of leased circuits forming part of a private telephone network*, Vol. III, Rec. G.171.
- [21] CCITT Recommendation *Characteristics of special quality international leased circuits with special bandwidth conditioning*, Vol. IV, Rec. M.1020.
- [22] CCITT Recommendation *Transmission impairments*, Vol. III, Rec. G.113.
- [23] CCITT Recommendation *Standardization of FMVFT systems for a modulation rate of 50 bauds*, Vol. VII, Rec. R.35.
- [24] CCITT Recommendation *Standardization of FMFVT systems for a modulation rate of 100 bauds*, Vol. VII, Rec. R.37.
- [25] CCITT Recommendation *Standardization of FMFVT systems for a modulation rate of 200 bauds, with channels spaced at 480 Hz*, Vol. VII, Rec. 38A.
- [26] CCITT Recommendation *Numbering of international VFT channels*, Vol. VII, Rec. R.70 bis.
- [27] CCITT Recommendation *16-channel terminal equipments*, Vol. III, Rec. G.235.
- [28] CCITT Recommendation *Assumptions for the calculation of noise on hypothetical reference circuits for telephony*, Vol. III, Rec. 223.
- [29] CCITT Recommendation *Loop test devices for modems*, Vol. VIII, Rec. V.54.