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INTERNATIONAL ANALOGUE CARRIER SYSTEMS

GENERAL CHARACTERISTICS COMMON TO ALL ANALOGUE CARRIER - TRANSMISSION SYSTEMS

MEASURING METHODS FOR NOISE PRODUCED BY MODULATING EQUIPMENT AND THROUGH-CONNECTION FILTERS

ITU-T Recommendation G.230

(Extract from the *Blue Book*)

NOTES

1 ITU-T Recommendation G.230 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.

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Recommendation G.230

MEASURING METHODS FOR NOISE PRODUCED BY MODULATING EQUIPMENT AND THROUGH-CONNECTION FILTERS

(Geneva, 1976 and 1980)

Considering the provisions of Recommendation G.222, § 4 and the assumptions for the calculation of noise of Recommendation G.223, the following methods for measuring the noise produced by modulating equipments are recommended:

1 12-channel translating equipments

For the measurement of noise produced by 12-channel translating equipments, eleven incoherent noise random signals with a normal (Gaussian) level distribution and with a power distribution according to Recommendation G.227 should be used. As a provisional value, the peak/r.m.s. ratio of each of the noise signals should be about 12 dB. The allocation on the 12-channel inputs of the conventional load of 2140 µW0 (+3.3 dBm0) should be as follows:

1 channel being measured	0 µW0
2 adjacent channels at 32 µW0 (-15 dBm0) each	64 µW0
9 channels at 230 µW0 (-6.4 dBm0) each	2070 µW0
	2134 µW0

2 Higher order translating equipments

2.1 *Allocation of loading*

For the measurement of noise produced by higher order translating equipments (groups, supergroups, etc. translating equipment), the values for the allocation of the conventional load to the different translating equipments are given in Table 1/G.222.

The number of incoherent band-limited white noise signals is assumed to be equal to the number of the input ports of the groups, supergroups, etc. translating equipment under measurement. In certain circumstances, however, the number of noise signals may be smaller than the number of group input ports.

2.2 *Measuring frequencies*

The measuring frequencies in Table 1/G.230 are recommended.

TABLE 1/G.230

Basic group to be measured	Frequency range (kHz)	Measuring frequencies (kHz)		
Group	60- 108	70		98
Supergroup	312- 552	331		534
Mastergroup	812- 2 044	1 002	1 248	1 730
15 supergroup assembly	312- 4 028	534	1 248	3 886
Supermastergroup	8 516- 12 388	9 073		11 700

2.3 *Filter characteristics*

The following filter characteristics are recommended:

2.3.1 bandpass filters (see Table 2/G.230);

2.3.2 bandstop filters (see Table 3/G.230).

Note - Measuring frequencies of Table 1/G.230 and filter characteristics of Tables 2/G.230 and 3/G.230 (with the exception of the 70-kHz filter) are the same as in CCIR Recommendations 399 [1] and 482 [2] and CCITT Recommendation G.228 used for line system arrangements. Annex B to Recommendation G.228 deals with the subject of corrections, if any, to be applied to measurements to allow for filter effects.

TABLE 2/G.230

Bandpass filters

<table>
<tr><td rowspan="2"></td><td rowspan="2">Capacity
(channels)</td><td rowspan="2">Limit of band occupied
by telephone channels (kHz)</td><td colspan="2">Effective cut-off frequencies of bandpass filters (kHz)</td><td colspan="2">Frequency bands (kHz) inside of which the discrimination should exceed 75 dB</td></tr>
<tr><td>Highpass</td><td>Lowpass</td><td>Below the passband</td><td>Above the passband</td></tr>
<tr><td>Basic Group B</td><td>12</td><td>60- 108</td><td>61 ± 2</td><td>107 ± 2</td><td>6- 52</td><td>116- 1 200</td></tr>
<tr><td>Basic supergroup</td><td>60</td><td>312- 552</td><td>320 ± 8</td><td>546 ± 10</td><td>6- 288</td><td>577- 8 500</td></tr>
<tr><td>Basic mastergroup</td><td>300</td><td>812- 2 044</td><td>840 ± 16</td><td>2 004 ± 30</td><td>6- 412</td><td>2 318- 26 000</td></tr>
<tr><td>Basic 15 supergroup assembly</td><td>900</td><td>312- 4 028</td><td>320 ± 8</td><td>4 070 ± 60</td><td>6- 288</td><td>4 544- 30 000</td></tr>
<tr><td>Basic supermastergroup</td><td>900</td><td>8 516- 12 388</td><td rowspan="2">8 560 ± 200</td><td rowspan="2">12 250 ± 180</td><td rowspan="2">6- 7 686</td><td rowspan="2">13 085-135 000</td></tr>
<tr><td>(15 supergroups assembly No. 3)</td><td>900</td><td>8 620- 12 336</td></tr>
<tr><td colspan="5"></td><td colspan="2">Above and below these bands, the discrimination may decrease with a slope of 6 dB/octave.</td></tr>
</table>

TABLE 3/G.230

Bandstop filters

Centre frequence f_c (kHz)	Bandwith (kHz) in relation to f_c over which the discrimination should be at least			Bandwith (kHz), in relation to f_c outside of which the discrimination should not exceed		Notes
	70 dB	55 dB	30dB	3dB	0.5dB	
70	± 1.5	± 1.7	± 2.0	± 5	± 10	
98	± 1.5	± 1.8	± 2.1	± 4	± 9	a)
331	± 1.5	± 2.7	± 4.0	± 17	± 30	
534	± 1.5	± 3.5	± 7.0	± 15	± 48	b)
1 002	± 1.5	± 4.0	± 9.0	± 27	± 90	a)
1 248	± 1.5	± 4.0	± 11.0	± 35	± 110	b)
1 730	± 1.5	± 4.2	± 14.0	± 48	± 155	a)
3 886	± 1.5	± 1.8	± 3.5	± 12	± 100	b)
3 886	—	± 15.0	± 30.0	± 110	± 350	
9 073	± 1.5	± 2.7	± 5.8	± 18	± 250	b)
11 700	± 1.5	± 3.0	± 7.0	± 20	± 300	

a) CCIR Recommendation 482 [2].

b) CCIR Recommendation 399 [1].

2.4 *Measuring procedures*

The measuring procedures should comply with Recommendation G.228. Measurements must be carried out with the regulators, if any, not included and with the levels at the nominal value.

Note - Some Administrations have chosen for groups and supergroups not being tested in conformance with Table 1/G.230 higher values of the load, but only for testing equipments with some margin to take account of the application where higher than nominal activity is to be expected.

As a consequence, in such cases, higher noise limits have to be admitted than those indicated in Recommendation G.222, § 4).

3 Through-connection filters

3.1 *Allocation of loading*

For the measurement of noise produced by through-connection filters the values for the allocation of the conventional load according to Table 2/G.223 to the different filters are given in Table 4/G.230.

TABLE 4/G.230

Filter for the basic	Band of the noise spectrum (kHz)		level of the noise power (dBm0)
Group	12 to	252	+ 6.1 ($\hat{=}$ 60 channels)
	60 to	108	+ 3.3 ($\hat{=}$ 12 channels)
Supergroup	60 to	1 296	+ 9.8 ($\hat{=}$ 300 channels)
	316 to	552	+ 6.1 ($\hat{=}$ 60 channels)
Mastergroup	316 to	2 600	+ 12.3 ($\hat{=}$ 530 channels)
Supermastergroup	4 370 to	17 300	+ 17.6 ($\hat{=}$ 1800 channels)
15 supergroup assembly	316 to	8 160	+ 17.6 ($\hat{=}$ 1800 channels)

Note 1 - Group and supergroup through-connection filters require two measurements. One with "broadband loading" with components outside the pass-band, and an additional one with loading in the passband only. Since in these cases the number of transmitted channels is smaller than 240 (the range where the power level of the conventional load is not proportional to 10 $\log_{10} n$, see § 2.1 of Recommendation G.223) the proportional part of the broadband loading transmitted in the passband gives a loading which is lower than the conventional load for 12 or 60 channels respectively.

Note 2 - The choice of the correct load figure for the measurement of the noise produced by the through-supermastergroup filter requires careful consideration bearing in mind that band limiting filters for a bandwidth complying with actual load conditions are not available.

3.2 *Measuring frequencies*

See § 2.2.

3.3 *Filter characteristics*

Highpass and lowpass filters complying with Table 2/G.228 and [3] can be used to limit the frequency of the noise spectrum. For bandstop filters, see Table 3/G.230.

3.4 *Measuring procedures*

The measuring procedure should comply with Recommendation G.228. For through-group and through-supergroup filters, two measurements have to be carried out in the appropriate measuring slots in the passband.

References

[1] CCIR Recommendation *Measurement of noise using a continuous uniform spectrum signal on frequency-division multiplex telephony radio-relay systems*, Vol. IX, Rec. 399, Dubrovnik, 1986.

[2] CCIR Recommendation *Measurement of performance by means of a signal of a uniform spectrum for systems using frequency-division multiplex telephony in the fixed satellite service*, Vol. IV, Rec. 482, Dubrovnik, 1986.

[3] CCIR Recommendation *Measurement of performance by means of a signal of a uniform spectrum for systems using frequency-division multiplex telephony in the fixed satellite service*, Vol. IV, Rec. 482, Table I, Dubrovnik, 1986.