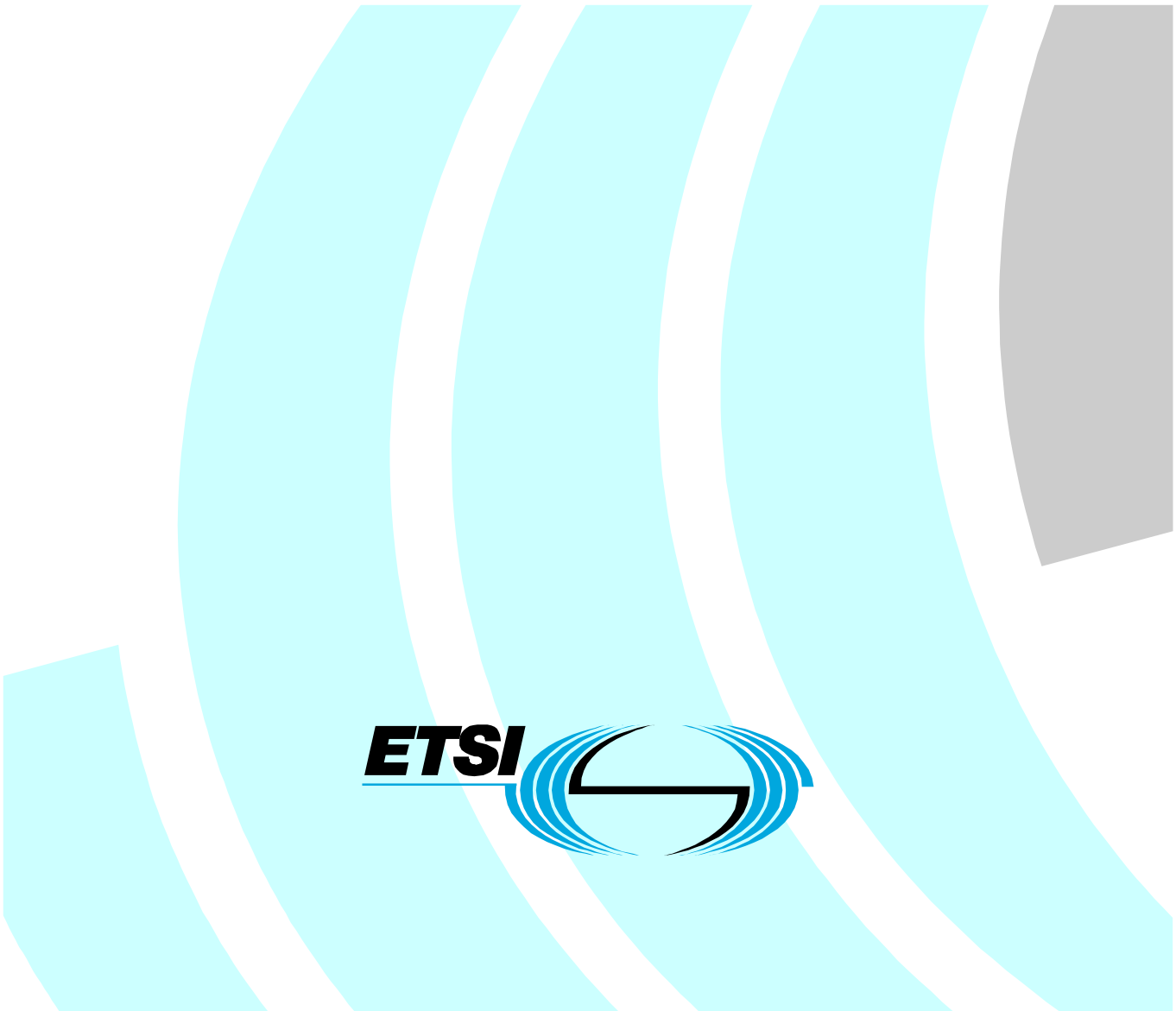
ETSI TR 101 960 V1.1.1 (2002-05)

Technical Report

Access and Terminals (AT);
Study on outband spectrum requirements for PSTN access



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Foreword

This Technical Report (TR) has been produced by ETSI Technical Committee Access and Terminals (AT).

1 Scope

The present document describes and enumerates various requirements on metallic (horizontal) outband spectrum for analogue terminals connected to the PSTN.

2 References

For the purposes of this Technical Report (TR), the following references apply:

[1] ETSI TBR 021 (1998): "Attachment requirements for pan-European approval for connection to the analogue Public Switched Telephone Networks (PSTNs) of TE (excluding TE supporting the voice telephony service) in which network addressing, if provided, is by means of Dual Tone Multi Frequency (DTMF) signalling".

[2] ETSI TR 103 000-2-1 (V1.1.1): "Access and Terminals (AT); Analogue Access to Public Telephone Network; Advisory Notes to Standards Harmonizing Terminal Interface; Part 2: Generally applicable Advisory Notes; Sub-part 1: Modification to sending spectral density requirements".

[3] FCC Part68 / EIA/TIA/IS-968 (July 2001) (Federal Communications Commission). http://www.fcc.gov/wcb/iatd/part_68.html

[4] ACA TS 002 - 1997: "Analogue Interworking and Non interference Requirements for Customer Equipment Connected to the Public Switch Telephone Network".

[5] CNC-st2-44-01 - 1998: "Reglamento Técnico Equipos Terminales Telefónicos (Argentina)".

[6] NET 001/92: Requisitos Mínimos Para Certificação de Equipamentos Terminais com Interfaceamento Analógico à Rede Telefônica Pública (Brasil) ".

[7] HKTA 2011 Issue2 (September 1999): "Network Connection Specification for Connection of Customer Premises Equipment (CPE) to Direct Exchange Lines (DEL) of the Public Switched Telephone Network (PSTN) in Hong-Kong".

[8] NO. S/INT-02W/01. May 94: "Requirements of Subscribers End Equipment (SEE) Connected to 2-Wire Cable Plant (India) (Department of Telecommunications, Telecommunications Engineering Centre".

[9] STEL D-001-1996: "Telecommunication Specification Modem Data Equipment (Indonesia)".

[10] JATE 04/2001: "Japan Approvals Institute for Telecommunications Equipment".

[11] Art20 1998: "Technical Criteria of Terminal Equipment (Korea) (Ministry of Information and Communication Proclamation N° 1998-18 of February 21 1998 and N° 1968-62 of March 9 1998)".

[12] PTC200-1997: "Requirements for Connection of Customer Equipment to Analogue Lines (New-Zealand)".

[13] GOST 26557-85: "Data transmission signals entering in the communication channels. Energetic parameters (Russia)".

[14] IDA TS PSTN1 issue4 2000: "Type Approval Specification for Terminal Equipment for Connection to the Public Switched Telephone Network (Singapore)".

[15] TE-001 1999: "Standard Specification For Telecommunication-Line Terminal Equipment for Connection to the Public Switched Telephone Network (South Africa)".

[16] PSTN 01 2001: "Technical Specification for Terminal Equipment for Connection to Public Switched Telephone Network (Taiwan)".

3 Definitions and abbreviations

3.1 Definitions

For the purposes of the present document, the following terms and definitions apply:

dBm: Power (dBm) = 10 log (Power1 /1 mW_{rms}) where Power1 is measured in mW_{rms}

dBV: Voltage (dBV) = 20 log (Voltage1 / 1 V_{rms}) where Voltage1 is measured in V_{rms}

Public Switched Telephone Network (PSTN): used to describe the ordinary telephone system including subscriber lines, local exchanges and the complete system of trunks and the exchange hierarchy which makes up the network

reference impedance 135 Ω: pure resistor of 135 Ω

reference impedance 300 Ω: pure resistor of 300 Ω

reference impedance 600 Ω: pure resistor of 600 Ω

reference impedance Z_1: complex impedance made up of 220 Ω in series with a parallel combination of 820 Ω and 115 nF

reference impedance Z_R: complex impedance made up of 270 Ω in series with a parallel combination of 750 Ω and 150 nF

3.2 Abbreviations

For the purposes of the present document, the following abbreviations apply:

PSTN	Public Switched Telephone Network
TE	Terminal Equipment

4 Various standards requirements

The disclosed information is simplified for comparison purpose. For more detail please refer to original document.

4.1 TBR 021

Requirement: As described in [1], clause 4.7.3.4 the total voltage level in a bandwidth, defined in table 4.1, wholly contained within the frequency range 4,3 kHz to 200 kHz, arising from normal operation of the TE when in an on-line, non-dialling state, and when terminated with Z_R, shall not exceed the limits shown in table 4.1 and figure 4.1.

Table 4.1: Maximum sending level above 4,3 kHz

Points	Frequency range kHz	Maximum sending level in a specified bandwidth dBV	Measurement bandwidth	Reference Impedance
G to H	4,3 to 5,1	-40 decreasing to 44	300 Hz	Z_R
H to I	5,1 to 8,9	-44	300 Hz	Z_R
I to J	8,9 to 11	-44 decreasing to 58,5	300 Hz	Z_R
J to K	11 to 200	-58,5	1 kHz	Z_R
NOTE: Limits for intermediate frequencies can be found by drawing a straight line between the break points on a logarithmic (Hz) - linear (dB) scale.				

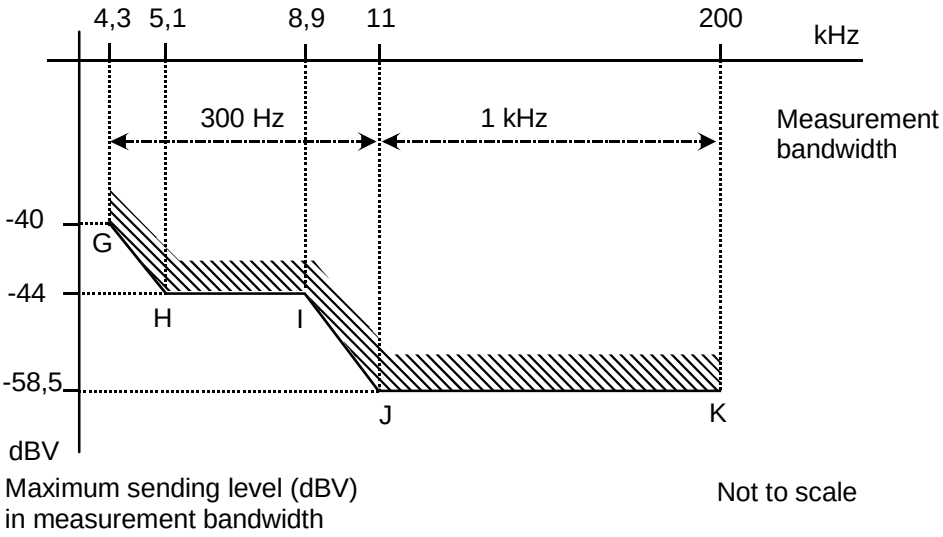

Figure 4.1: Maximum sending level above 4,3 kHz

4.2 TR 103 000-2-01

Requirement: As described in [2], clause 4.3.2 the total voltage level in a bandwidth, defined in table 4.2, wholly contained within the frequency range 4,3 kHz to 200 kHz, arising from normal operation of the TE when in an on-line, non-dialling state, and when terminated with Z_R, shall not exceed the limits shown in table 4.2 and figure 4.2.

Table 4.2: Maximum sending level above 4,3 kHz

Points	Frequency range kHz	Maximum sending level in a specified bandwidth dBV	Measurement bandwidth	Reference Impedance
G to H	4,3 to 6,0	-15	300 Hz	Z_R
H to I	6,0 to 8,9	-15 decreasing to -44	300 Hz	Z_R
I to J	8,9 to 12	-44 decreasing to -58,5	300 Hz	Z_R
J to K	12 to 200	-58,5	1 kHz	Z_R
NOTE: Limits for intermediate frequencies can be found by drawing a straight line between the break points on a logarithmic (Hz) - linear (dB) scale.				

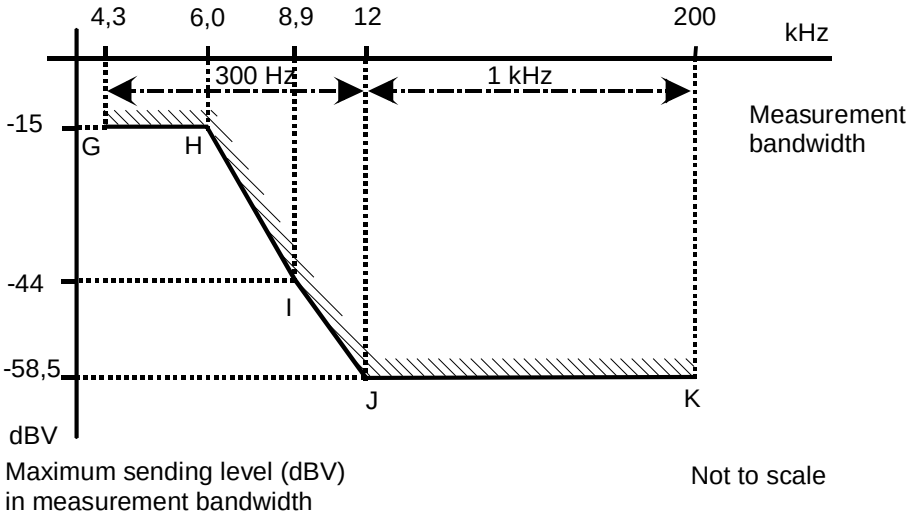

Figure 4.2: Maximum sending level above 4,3 kHz

4.3 FCC Part68 / EIA/TIA/IS-968

Requirement: As described in [3] 68.308c the total voltage level in a bandwidth shall not exceed the limits shown in table 4.3 and figure 4.3.

Table 4.3: Maximum sending level above 4 kHz

Points	Frequency range kHz	Maximum sending level in a specified bandwidth in dBV	Measurement bandwidth	Reference Impedance
A to B	4 to 12	-14 decreasing to -20	4 kHz	300 Ω
C to D	12 to 90	-20,2 decreasing to -55,2	4 kHz	135 Ω
D to E	90 to 266	-55	4 kHz	135 Ω
F to G	270 to 6 000	-15	4 kHz	135 Ω
NOTE: Limits for intermediate frequencies can be found by drawing a straight line between the break points on a logarithmic (Hz) - linear (dB) scale. Reference impedances are pure resistors.				

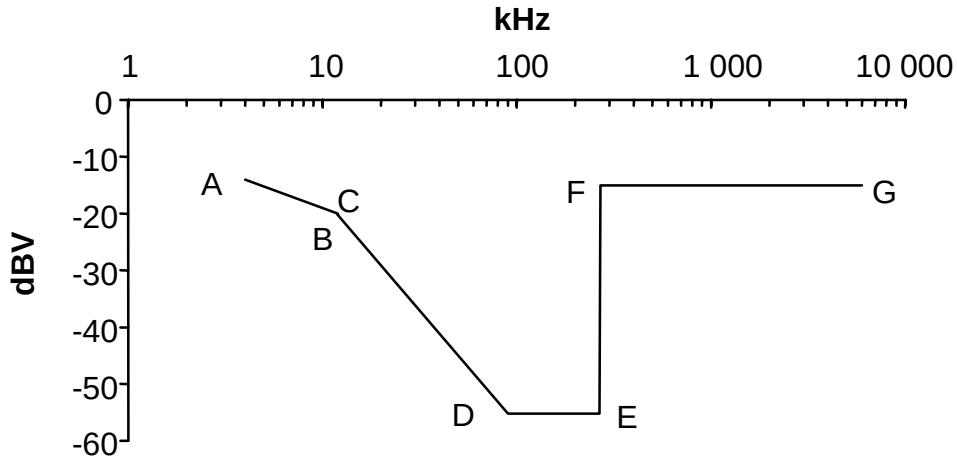

Figure 4.3: Maximum sending level above 4 kHz

4.4 ACA TS 002

Requirement: As described in [4], clause 5.4.2 the total voltage level in a bandwidth shall not exceed the limits shown in table 4.4 and figure 4.4.

Table 4.4: Maximum sending level above 3,4 kHz

Points	Frequency range in kHz	Maximum sending level in a specified bandwidth dBm	Measurement bandwidth	Reference Impedance
A to B	3,4 to 100	+3 decreasing to -54,8	Not specified	600 Ω
NOTE: Limits for intermediate frequencies can be found by drawing a straight line between the break points on a logarithmic (Hz) - linear (dB) scale. Reference impedance is pure resistor.				

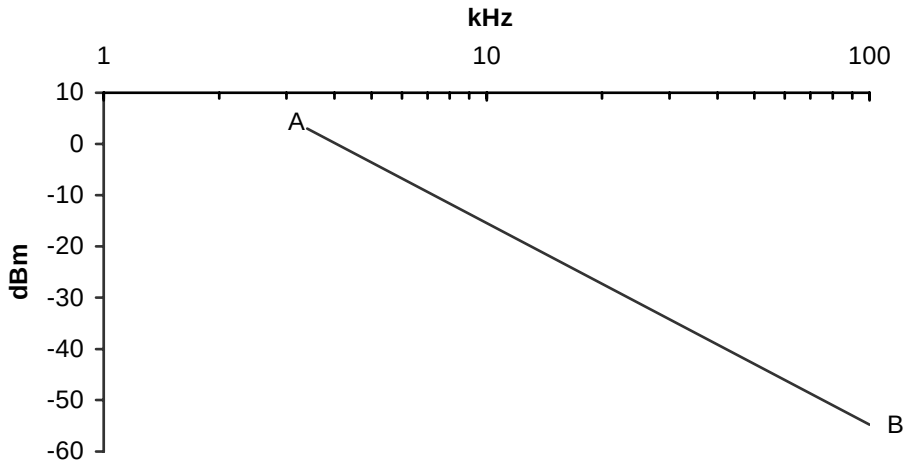

Figure 4.4: Maximum sending level above 3,4 kHz

4.5 CNC-ST2-44-01

Requirement: As described in [5], clause 4.2.3 the total voltage level in a bandwidth shall decrease as -6 dB per Octave.

4.6 NET 001/92

Requirement: As described in [6], clause 5.6.3 the total voltage level in a bandwidth shall not exceed the limits shown in table 4.6 and figure 4.6.

Table 4.6: Maximum sending level above 4 kHz

Points	Frequency range kHz	Maximum sending level in a specified bandwidth dBm	Measurement bandwidth	Reference Impedance
A to B	4 to 8	-30	Not specified	600 Ω
C to D	8 to 12	-50	Not specified	600 Ω
E to F	12 to 1 000	-70	Not specified	600 Ω

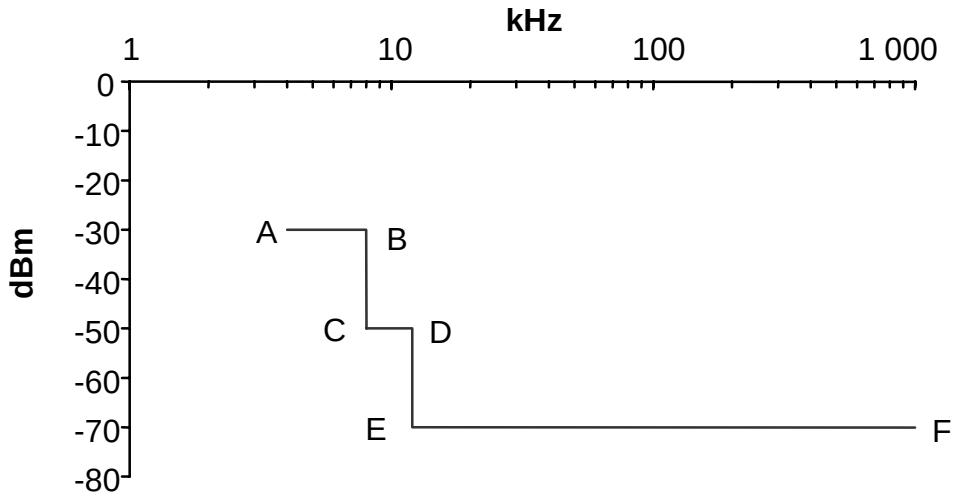

Figure 4.6: Maximum sending level above 4 kHz

4.7 HKTA 2011 Issue2

Requirement: As described in [7], clause 3.4 the total voltage level in a bandwidth shall not exceed the limits shown in table 4.7 and figure 4.7.

Table 4.7: Maximum sending level above 4 kHz

Points	Center Frequency in kHz	Maximum sending level in a specified bandwidth dBV	Measurement bandwidth	Reference Impedance
A to B	8 to 12	-17,8 decreasing to -20	8 kHz	300 Ω
B to C	12 to 90	-20 decreasing to -55,1	8 kHz	135 Ω
D to E	90 to 266	-55	8 kHz	135 Ω
NOTE: Limits for intermediate frequencies can be found by drawing a straight line between the break points on a logarithmic (Hz) - linear (dB) scale. Reference impedances are pure resistors.				

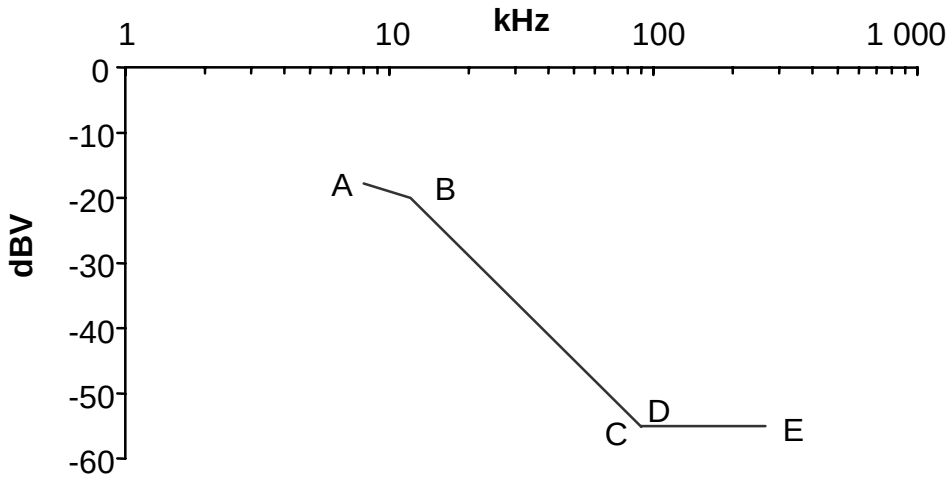

Figure 4.7: Maximum sending level above 4 kHz

4.8 NO. S/INT-02W/01

Requirement: As described in [8], clause 2.1.3.4.3.7.3 the total voltage level in a bandwidth shall not exceed the limits shown in table 4.8 and figure 4.8.

Table 4.8: Maximum sending level above 3,4 kHz

Points	Frequency range kHz	Maximum sending level in a specified bandwidth dBm	Measurement bandwidth	Reference Impedance
A to B	3,4 to 5,1	-33 decreasing to -40	Not specified	600 Ω
B to C	5,1 to 8,9	-40	Not specified	600 Ω
C to D	8,9 to 50	-40 decreasing to -70	Not specified	600 Ω
D to E	50 to 10 000	-70	Not specified	600 Ω
NOTE: Limits for intermediate frequencies can be found by drawing a straight line between the break points on a logarithmic (Hz) - linear (dB) scale. Reference impedance is pure resistor.				

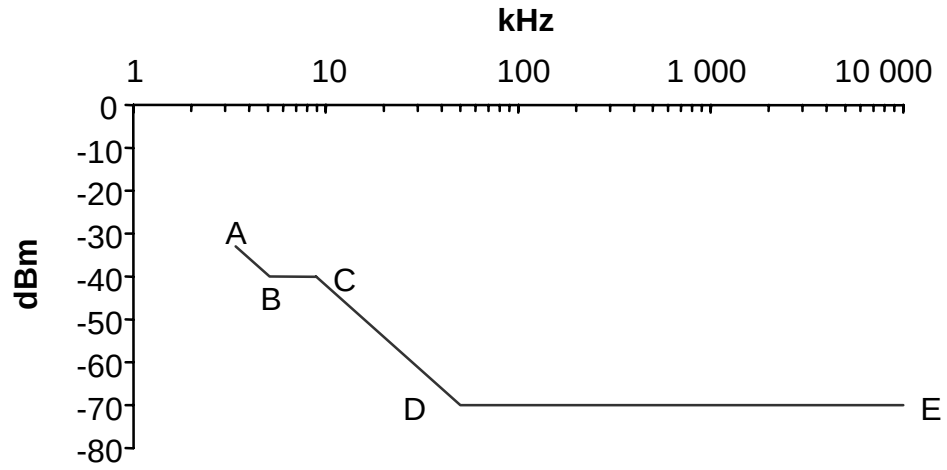

Figure 4.8: Maximum sending level above 3,4 kHz

4.9 STEL D-001-1996

Requirement: Not specified in [9].

4.10 JATE 04/2001

Requirement: As described in [10] article 14 the total voltage level in a bandwidth shall not exceed the limits shown in table 4.8 and figure 4.8.

Table 4.10: Maximum sending level above 4 kHz

Points	Frequency range kHz	Maximum sending level in a specified bandwidth dBm	Measurement bandwidth	Reference Impedance
A to B	4 to 8	-20	4 kHz	600 Ω
C to D	8 to 12	-40	4 kHz	600 Ω
E to F	12 and more	-60	4 kHz	600 Ω

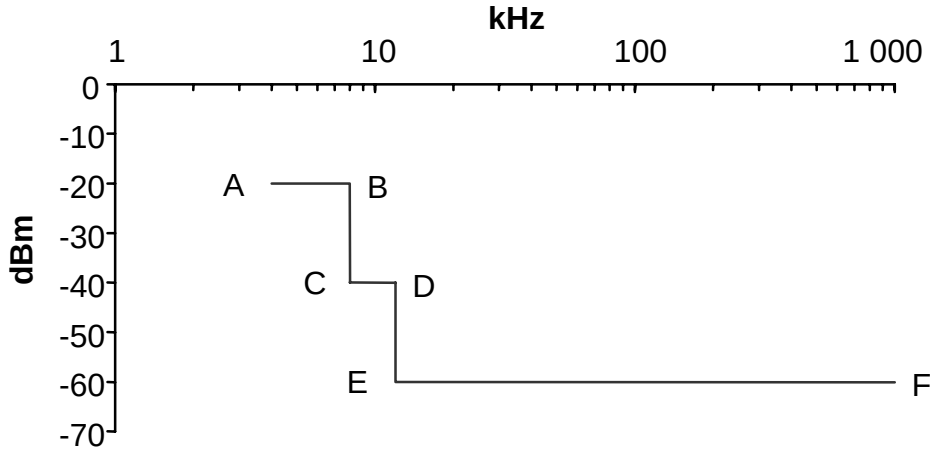

Figure 4.10: Maximum sending level above 4 kHz

4.11 Art20 1998

Requirement: As described in [11], clause 3 the total voltage level in a bandwidth shall not exceed the limits shown in table 4.11 and figure 4.11.

Table 4.11: Maximum sending level above 4 kHz

Points	Center Frequency in kHz	Maximum sending level in a specified bandwidth dBV	Measurement bandwidth	Reference Impedance
A to B	8 to 12	-17,8 decreasing to -20	8 kHz	300 Ω
B to C	12 to 90	-20 decreasing to -55,1	8 kHz	135 Ω
D to E	90 to 266	-55	8 kHz	135 Ω
NOTE: Limits for intermediate frequencies can be found by drawing a straight line between the break points on a logarithmic (Hz) - linear (dB) scale. Reference impedances are pure resistors.				

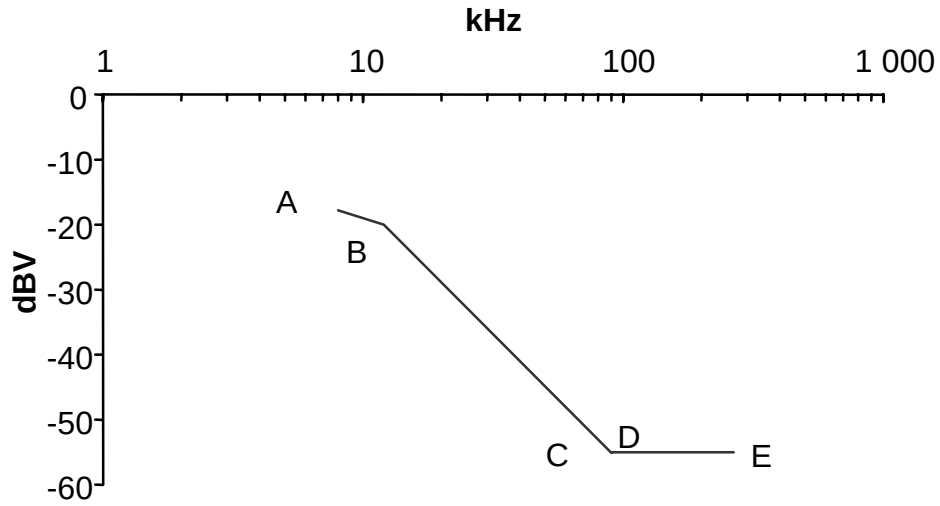

Figure 4.11: Maximum sending level above 4 kHz

4.12 PTC200-1997

Requirement: As described in [12], clause 4.3 the total voltage level in a bandwidth shall not exceed the limits shown in table 4.12 and figure 4.12.

Table 4.12: Maximum sending level above 4 kHz

Points	Frequency range kHz	Maximum sending level in a specified bandwidth dBm	Measurement bandwidth	Reference Impedance
A to B	4 to 10	-40	3 kHz	600 Ω
B to C	10 to 20	-40 decreasing to -50	3 kHz	600 Ω
C to D	20 to 50	-50 decreasing to -70	3 kHz	600 Ω
D to E	50 to 100	-70	3 kHz	600 Ω
F to G	100 to 10 000	-50	3 kHz	600 Ω
NOTE: Limits for intermediate frequencies can be found by drawing a straight line between the break points on a logarithmic (Hz) - linear (dB) scale. Reference impedance is pure resistor.				

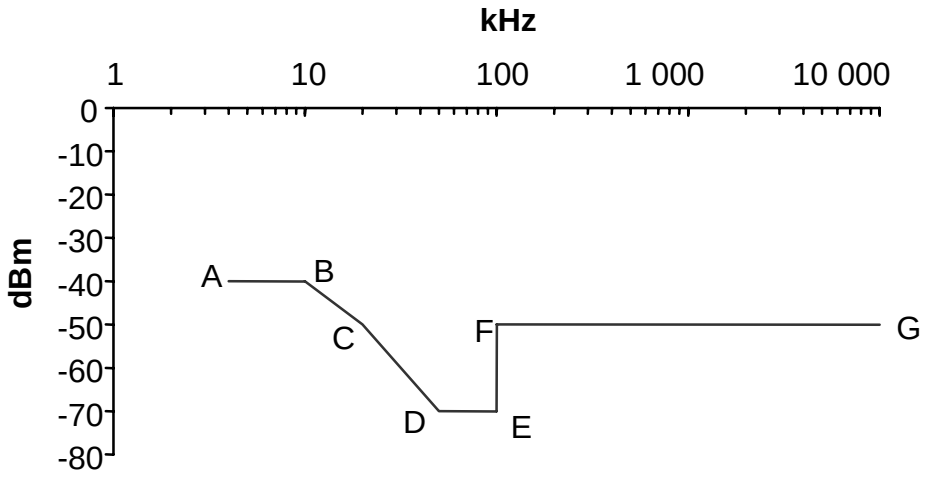

Figure 4.12: Maximum sending level above 4 kHz

4.13 GOST 26557-85

Requirement: As described in [13], clause 6.4.1.3 the total voltage level in a bandwidth shall not exceed the limits shown in table 4.13 and figure 4.13.

Table 4.13: Maximum sending level above 3,4 kHz

Points	Frequency range kHz	Maximum sending level in a specified bandwidth dBm	Measurement bandwidth	Reference Impedance
A to B	3,4 to 10	-30	Not specified	600 Ω
B to C	10 to 100	-60	Not specified	600 Ω
NOTE: Limits for intermediate frequencies can be found by drawing a straight line between the break points on a logarithmic (Hz) - linear (dB) scale. Reference impedance is pure resistor.				

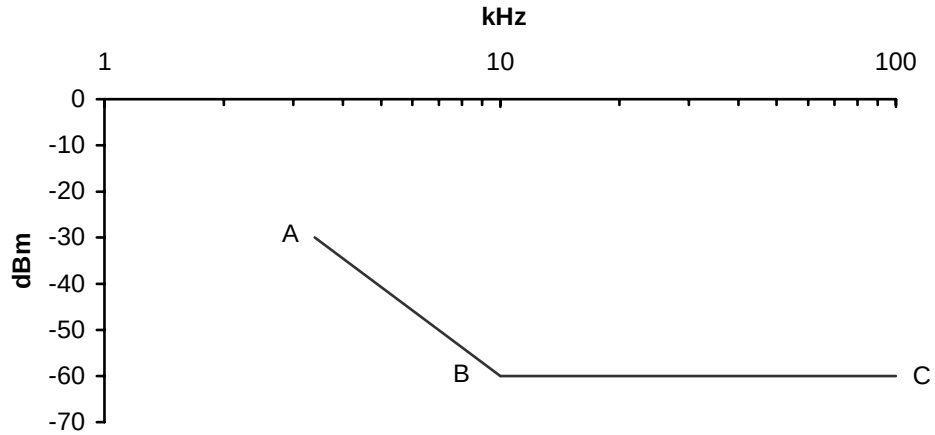

Figure 4.13: Maximum sending level above 3,4 kHz

4.14 IDA TS PSTN1 issue4 2000

Requirement: As described in [14], clause 6.4.1.3 the total voltage level in a bandwidth shall not exceed the limits shown in table 4.14 and figure 4.14.

Table 4.14: Maximum sending level above 3,4 kHz

Points	Frequency range kHz	Maximum sending level in a specified bandwidth dBm	Measurement bandwidth	Reference Impedance
A to B	3,4 to 50	-33	Not specified	600 Ω
C to D	50 to 200	-70	Not specified	600 Ω
NOTE: Limits for intermediate frequencies can be found by drawing a straight line between the break points on a logarithmic (Hz) - linear (dB) scale. Reference impedance is pure resistor.				

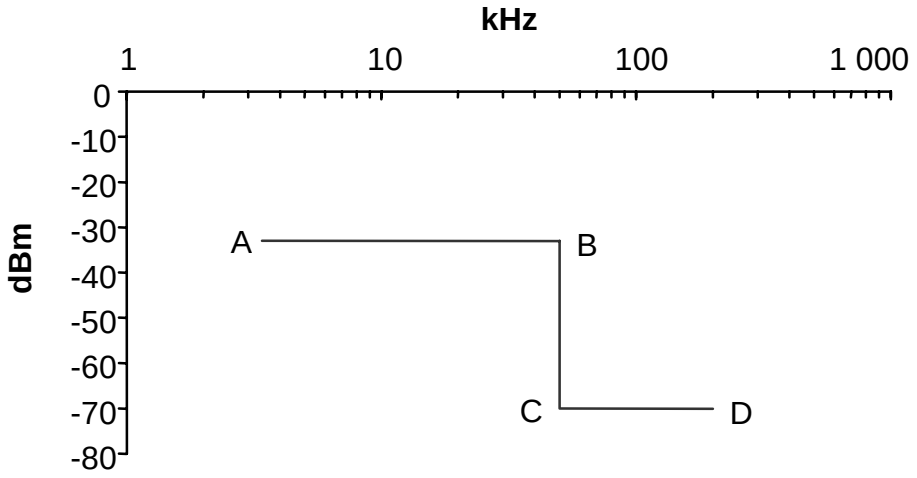

Figure 4.14: Maximum sending level above 3,4 kHz

4.15 TE-001

Requirement: As described in [15], clause 14.4 the total voltage level in a bandwidth shall not exceed the limits shown in table 4.15 and figure 4.15.

Table 4.15: Maximum sending level above 3,4 kHz

Points	Frequency range kHz	Maximum sending level in a specified bandwidth dBm	Measurement bandwidth	Reference Impedance
A to B	3,4 to 5	-35	1 kHz	Z_1
B to C	5 to 9	-40	1 kHz	Z_1
C to D	9 to 50	-40 decreasing to -70	1 kHz	Z_1
D to E	50 to 1 000	-70	1 kHz	Z_1
NOTE: Limits for intermediate frequencies can be found by drawing a straight line between the break points on a logarithmic (Hz) - linear (dB) scale.				

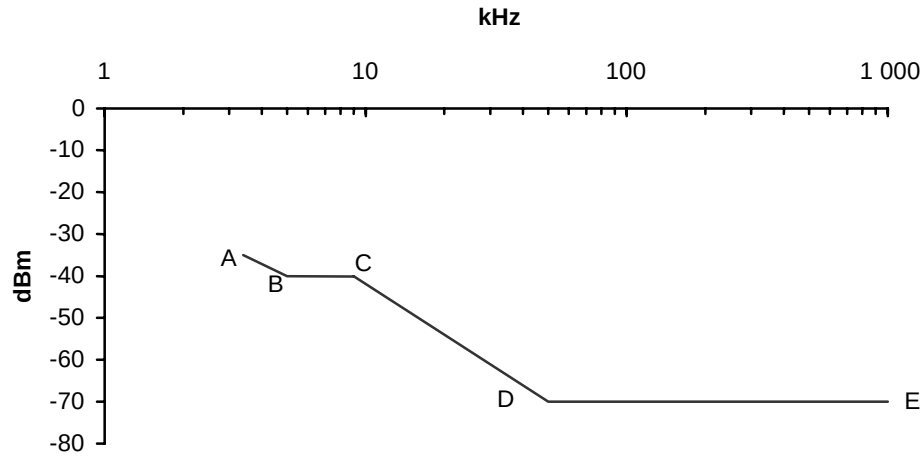

Figure 4.15: Maximum sending level above 3,4 kHz

4.16 PSTN 01

Requirement: As described in [16], clause 5.1.8 the total voltage level in a bandwidth shall not exceed the limits shown in table 4.16 and figure 4.16.

Table 4.16: Maximum sending level above 4 kHz

Points	Frequency range kHz	Maximum sending level in a specified bandwidth dBm	Measurement bandwidth	Reference Impedance
A to B	4 to 8	-20	4 kHz	600 Ω
C to D	8 to 12	-40	4 kHz	600 Ω
E to F	12 to 48	-60	4 kHz	600 Ω

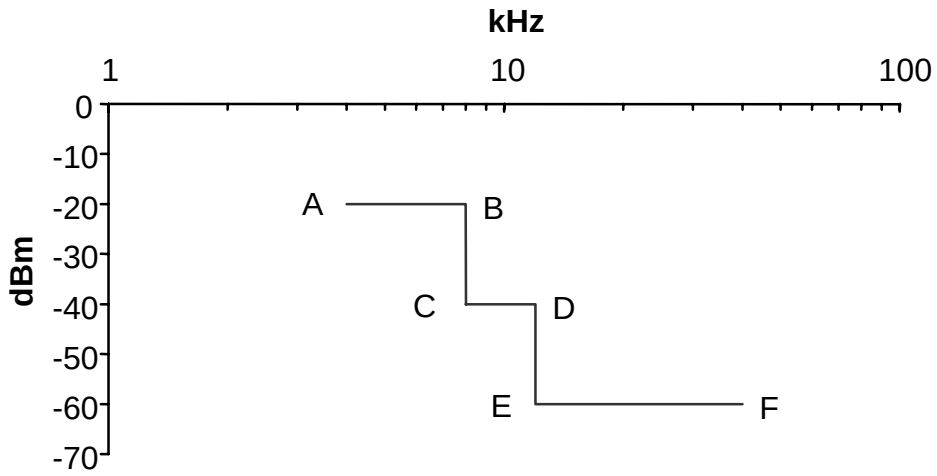

Figure 4.16: Maximum sending level above 4 kHz

5 Conclusion

Though this study is not exhaustive, it is believed to be representative of what a TE manufacturer has to follow to design a world-wide compliant product.

It is also believed to be representative of the characteristics of products already in use and on the market today.

It is suggested to enhance the present document with an extended scope in a next edition.

This would allow to take advantage of:

- ongoing studies on frequency management on local loop;
- ongoing studies on measurement method;
- uploaded information from referenced and other authorities;

and facilitates a comparison among the requirements identified. For this purpose parameters like measurement bandwidth, have to be identified more precisely. There should be identified the possibility of a common measurement method and a higher limit value (or some alternative) for the frequency domain of the requirements.

The information in the present document and in the future revision can be of assistance for spectrum management studies.

Annex A:
Reference Impedances

A.1 Reference Impedance Z_R

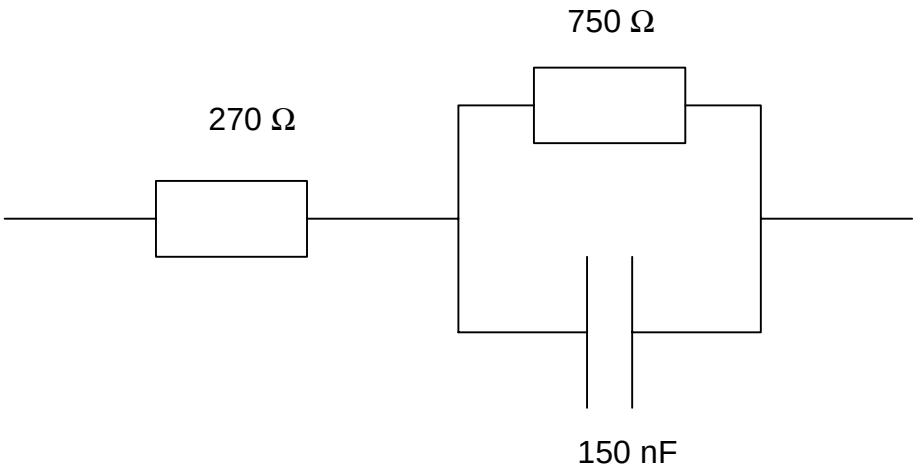

Figure A.1: Reference impedance Z_R

A.2 Reference Impedance Z_1

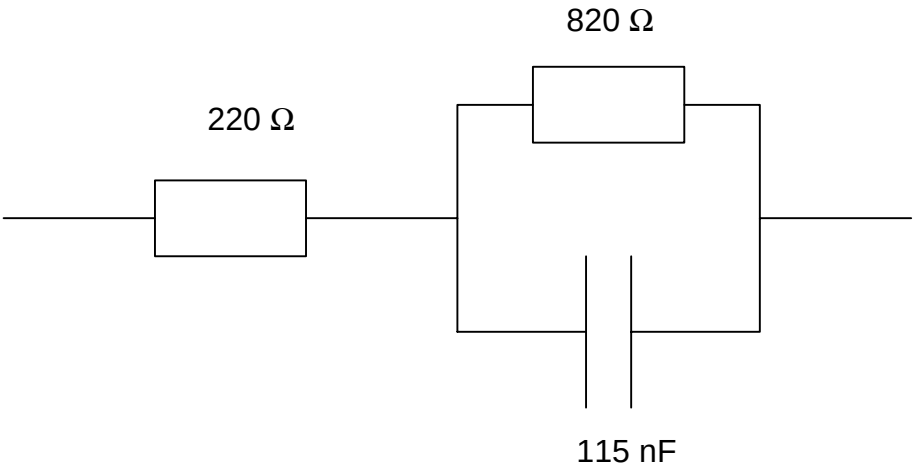

Figure A.2: Reference impedance Z_1

History

Document history		
V1.1.1	May 2002	Publication