
Copper Loop Frequency Management Plan

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Version Control

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- **If there are changes to the document between ‘Proposed’ and ‘Final’, change control operates.**

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1 Introduction

Operators, who wish to offer services across the local loop access network, need to have a high level of confidence that their services will operate as expected, both at the time of the deployment and in the future. Therefore, there is a need to minimise the level of interference, which may affect the access network. In order to control interference within an access network and so produce a predictable environment so that operators can make deployment decisions, it is necessary to have some form of frequency plan to which all deployed services conform.

This is referred to as the Copper Loop Frequency Management Plan (CLFMP). At its simplest, it is a list of rules governing the use of the copper loop access network. It also should not be overly restrictive, as it needs to aid the deployment of innovative services.

This CLFMP has been drafted by representatives of the industry, including open eir, other authorised operators (OAOs) and ComReg

It is recognised by all parties that this is a living document, which will need to be reviewed to deal with further developments in the area of deployment of future technology. Given the fundamental impact of this plan on the quality and breadth of services which operators can deploy on the network, as with the development of this plan, any modifications to it will be considered at an industry level under the chairmanship of ComReg. Any changes to the plan will require the explicit approval of ComReg.

The principle objective of the plan is to limit the signal levels transmitted by a system in order to protect the operation of other systems in neighbouring cable pairs. The approach taken to achieve this is by specifying a number of Power Spectral Density (PSD) masks with which equipment must comply.

Using this approach, the aim is therefore that a system permitted within the CLFMP can be deployed within a predictable noise environment.

2 Scope

- This CLFMP applies to the open eir copper loop network.
- The terms “copper loop”, “copper access network,” “local loop”, etc. are deemed to equate to the cable network between the local exchange main distribution frame (MDF) point and the customer’s premises Network Termination Point (NTP). Exchange Tie circuits are out of scope.
- Similar frequency plans will be required should other networks (e.g., other copper loop or cable TV networks) be unbundled
- It is designed to enable, rather than guarantee, the co-existence of services.
- It covers the issues of cross talk between pairs, not technologies which could coexist on a single pair.
- It does not cover the issue of external RF ingress into access cables; this will be handled by ComReg where appropriate.
- This version addresses inputs at the exchange MDF, the cabinet and the customer's premises.
- This Plan permits the use of frequencies up to 17.664 MHz for use in the access network. Frequencies above 17.664 MHz are reserved for further study and not allowed with this version of the Plan.

3 Construction of the Plan

In general, this document is based on similar documents published by other administrations, in particular the UK ANFP [5].

The Plan uses eight composite masks: two for exchange launched systems; one for cabinet launched systems; and five for CPE. The masks for cabinet-launched systems are modified by the distance from exchange to the cabinet. The masks for CPE are modified by the distance from exchange to the customer's premises and from the cabinet to the customer's premises.

POTS/PSTN is not covered by any of the masks below. It operates in the frequency range below 4 kHz with the exception of pulse metering at 12 kHz and is not considered to be a factor in generating crosstalk in other cable pairs, which will interfere with xDSL transmission. The signal levels present in the POTS band are specified by the relevant ETSI Standards:

- ES 201 970 [2] and ES 202 971 [3] for network side
- ES 203 021 [1] for the CPE side.

PSTN equipment complying with these specifications is considered to comply with the CLFMP

To be permissible under this plan, a proposed system has to conform to the relevant masks for both the exchange side and remote equipment, i.e., to be at or under the mask at all frequencies.

In all cases, line length is expressed as an insertion loss in dB measured or estimated at 300 kHz.

The length of the line for CLFMP purposes will be notified by the method documented by the ULMP/LS IPM.

The CLFMP is constructed to allow optimal use of the copper access network, with regard to crosstalk and interference between pairs on a cable.

4 Backward Compatibility with Previous Versions of CLFMP

The changes in this version of the CLFMP do not adversely affect technologies permitted in previous versions of the document

Technology	Affected	Remarks
ADSL / ADSL2+	No	Frequency masks defined in issue 7 are identical up to 2208 kHz as they were in issue 6
ISDN	No	Frequency masks defined in issue 7 are identical up to 2208 kHz as they were in issue 6
HDSL	No	Frequency masks defined in issue 7 are identical up to 2208 kHz as they were in issue 6
SHDSL	No	Frequency masks defined in issue 7 are identical up to 2208 kHz as they were in issue 6
VDSL2	Negligible	Exchange launched VDSL2 (EVDSL) is permitted on lines served directly from the exchange but not lines that are passing through a cabinet. Following lab tests, field trial, and simulation it was concluded that the impact of permitting this type of deployment is negligible on existing services and it allows VDSL service to be offered to a significant number of customers in this category.

4.1 Inclusion of EVDSL in the CLFMP

The inclusion of EVDSL in the CLFMP was studied by lab testing and field trials which were evaluated externally by TNO. Further analysis was carried out by TNO using their SPOCS simulation software. [8]

In their evaluation of the open eir access network [7] TNO divided it into three topologies:

Deployment of EVDSL on Direct Fed Lines (Figure 1)

Deployment of EVDSL on lines passing through a cabinet (Figure 2)

Deployment of EVDSL on cables that are used to serve cabinets and Direct Fed lines, but not lines passing through a cabinet. The CPE served by EVDSL shall be electrically connected on the exchange side of the cabinet (Figure 3)

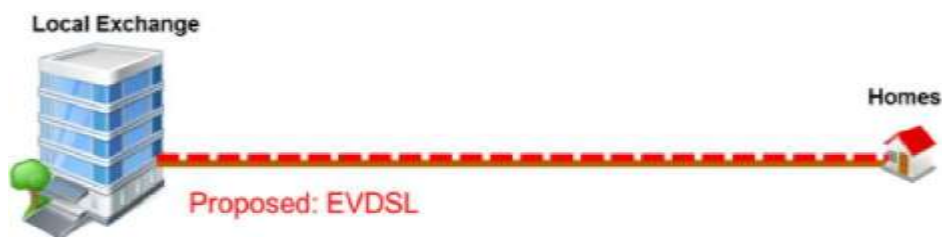


Figure 1 Topology 1 Direct fed lines that do not pass through a cabinet

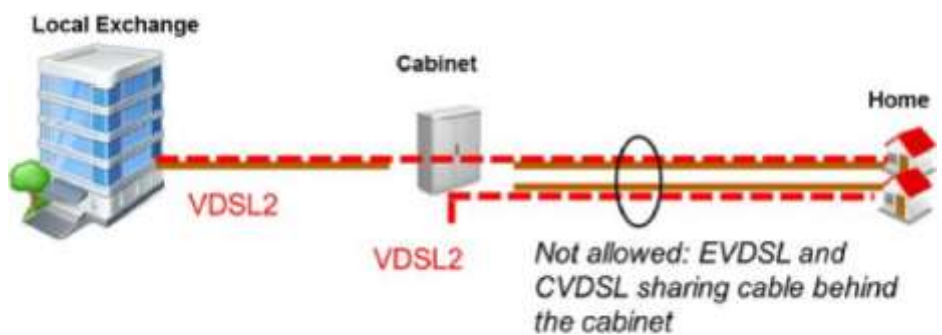


Figure 2 Topology 2 EVDSL and CVDSL sharing a cable behind the cabinet.

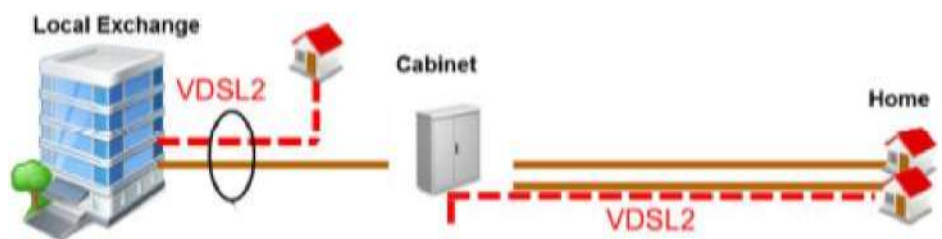


Figure 3 Topology 3 EVDSL on direct fed and CVDSL on Cabinet fed, shared cable between exchange and cabinet.

EVDSL is permitted to be deployed in Topology 1 and Topology 3 providing it meets the requirements in the present document.

5 Spectral Masks

The following masks define the maximum PSDs of systems that are permitted to be deployed in the copper loop Access Network. For each mask, the tables are normative and the figures are informative.

Where applicable, terminating equipment shall have the ability to reduce the PSD transmitted in the amateur radio bands as specified in Table 1 in order to reduce the risk of interference in these bands.

Band start (kHz)	Band stop(kHz)
1 800	2 000
3 500	4 000
7 000	7 300
10 100	10 150

Table 1 Amateur Radio Bands

5.1 Downstream mask from Exchange

There are two categories of masks applicable for downstream transmission from the exchange.

1. **Lines described by Topology 2** (Figure 2): It is not permitted to deploy Exchange Launched VDSL2 (EVDSL) on these lines under this version of the CLFMP
2. **Lines described by Topology 1 and Topology 3** (Figure 1 and Figure 3): These lines are considered suitable for EVDSL deployment.

Lines described by Topology 2

This mask permits technologies such as ISDN BRA, HDSL up to 1 Mbit/s, eSHDSL up to 5.696Mbit/s, ADSL and ADSL2+. Topology 2 is defined in section 4.1 and Figure 2.

Frequency (kHz)	Impedance	Measurement Bandwidth	Signal Level (dBm/Hz)
0.1	100 Ω or 135 Ω	10 Hz	-28.5
5	100 Ω or 135 Ω	10 Hz	-28.5
5	100 Ω or 135 Ω	1kHz	-28.5
50	100 Ω or 135 Ω	1kHz	-28.5
50	100 Ω or 135 Ω	10 kHz	-28.5
67	100 Ω or 135 Ω	10 kHz	-36.5
190	100 Ω or 135 Ω	10 kHz	-36.5
1104	100 Ω or 135 Ω	10 kHz	-36.5

1622	100 Ω or 135 Ω	10 kHz	-46.5
2208	100 Ω or 135 Ω	10 kHz	-47.8
2500	100 Ω or 135 Ω	10 kHz	-59.4
3001.5	100 Ω or 135 Ω	10 kHz	-80
4545	100 Ω or 135 Ω	10 kHz	-110
30000	100 Ω or 135 Ω	10 kHz	-110

Table 2: Downstream mask from the exchange, described by Topology 2

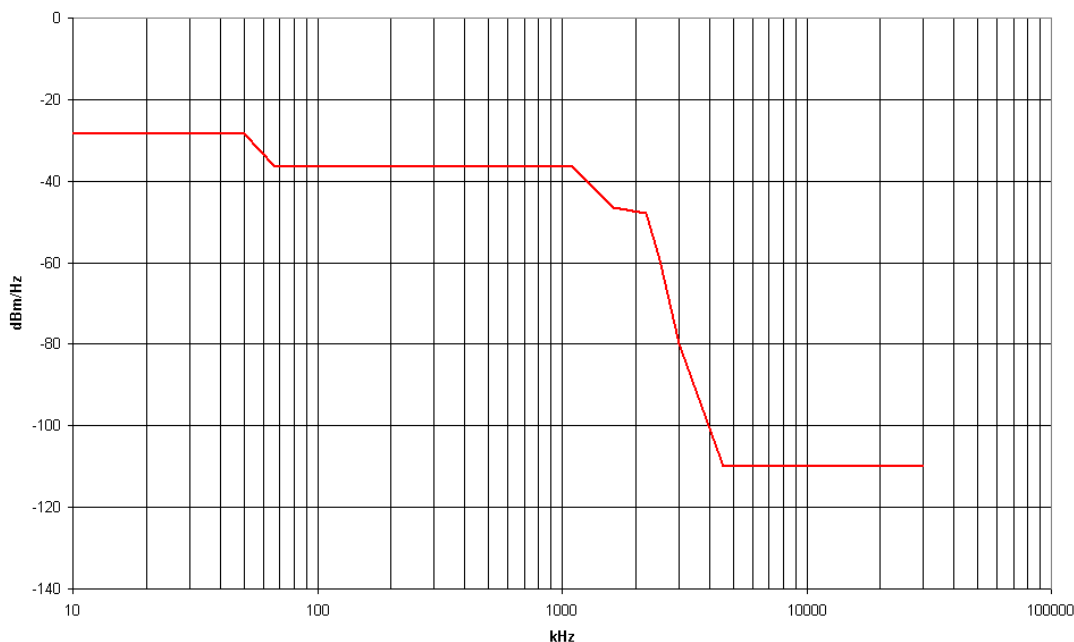


Figure 4 Downstream mask from the exchange, lines described by Topology 2

Lines described by Topology 1 and Topology 3

This mask permits technologies such as VDSL2, ISDN BRA, HDSL up to 1 Mbit/s, e,SHDSL up to 5.696Mbit/s, ADSL and ADSL2+. Topology 1 and Topology 3 are defined in Section 4.1 and Figure 1 and Figure 3).

Frequency (kHz)	Impedance	Measurement Bandwidth	Signal Level (dBm/Hz)
0.1	100 Ω or 135 Ω	10 Hz	-28.5
5	100 Ω or 135 Ω	10 Hz	-28.5
5	100 Ω or 135 Ω	1kHz	-28.5
50	100 Ω or 135 Ω	1kHz	-28.5
50	100 Ω or 135 Ω	10 kHz	-28.5
67	100 Ω or 135 Ω	10 kHz	-36.5
190	100 Ω or 135 Ω	10 kHz	-36.5
1104	100 Ω or 135 Ω	10 kHz	-36.5

1622	100 Ω or 135 Ω	10 kHz	-46.5
2208	100 Ω or 135 Ω	10 kHz	-47.8
3750	100 Ω or 135 Ω	10 kHz	-51.
3750	100 Ω or 135 Ω	10 kHz	-80
3925	100 Ω or 135 Ω	10 kHz	-100
5025	100 Ω or 135 Ω	10 kHz	-100
5200	100 Ω or 135 Ω	10 kHz	-80
5200	100 Ω or 135 Ω	10 kHz	-52.7
8500	100 Ω or 135 Ω	10 kHz	-54.8
8500	100 Ω or 135 Ω	10 kHz	-80
8675	100 Ω or 135 Ω	10 kHz	-100
11825	100 Ω or 135 Ω	10 kHz	-100
12000	100 Ω or 135 Ω	10 kHz	-56.5
17664	100 Ω or 135 Ω	10 kHz	-56.5
21000	100 Ω or 135 Ω	10 kHz	-80
21450	100 Ω or 135 Ω	10 kHz	-100
30000	100 Ω or 135 Ω	10 kHz	-100

Table 3: Downstream mask from the exchange lines described by Topology 1 and Topology 3

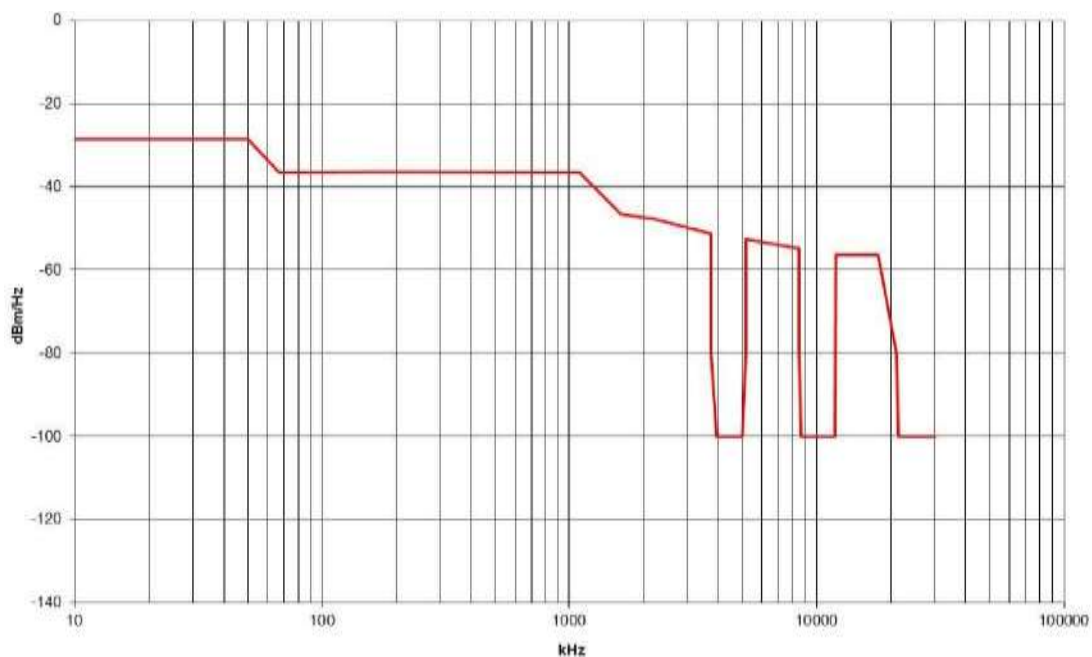


Figure 5 Downstream mask from the exchange, described by Topology 1 and Topology 3

5.2 Downstream mask from Cabinet

This section is applicable to transmission equipment to be connected at the cabinet transmitting to the CPE on the distribution side (D-Side) of the cabinet. It allows for the reuse of ADSL and ADSL2+ frequencies that are not usable by exchange launched equipment at the cabinet due to the distance between the exchange and the cabinet. This is achieved by shaping the PSD of the cabinet launched systems such that the Near End Cross Talk (NEXT) they generate will not interfere with exchange launched systems. The PSD shaping is a function of the electrical length between the exchange and the cabinet, known as E side electrical length (ESEL) this is expressed as a loss in dB at 300 kHz. Tables 4 – 6 give downstream masks for limits for cabinet launch services for ESEL in the range 0 – 60 dB at 5 dB intervals. Six of these masks (at 10 dB Intervals) are shown in Figure 6.

If the measured value of ESEL is more than 1 dB lower than the nearest value in the tables below then the mask for the next lower value of ESEL should be chosen.

Where a cabinet is served by two different E side cables the ESEL should be measured for both cables the lowest value of ESEL should be chosen. These masks are also applicable to the signals output by repeaters that may be fitted on some exchange launched systems.



ESEL = 0		ESEL = 5		ESEL = 10		ESEL = 15		ESEL = 20	
kHz	dBm/Hz	kHz	dBm/Hz	kHz	dBm/Hz	kHz	dBm/Hz	kHz	dBm/Hz
0.1	-28.5	0.1	-28.5	0.1	-28.5	0.1	-28.5	0.1	-28.5
11	-28.5	11	-28.5	11	-28.5	11	-28.5	11	-28.5
30	-29.5	30	-29.5	30	-29.5	30	-29.5	30	-29.5
30.3	-30	30.3	-30	30.3	-30	30.3	-30	30.3	-30
113	-38.8	113	-38.8	113	-38.8	113	-38.8	113	-38.8
125	-39.4	125	-39.4	125	-39.4	125	-39.4	125	-39.4
145	-41.4	145	-41.4	145	-41.4	145	-41.4	145	-41.4
155	-45.5	155	-45.5	155	-45.5	155	-45.5	155	-45.5
166	-48.9	166	-48.9	166	-48.9	166	-48.9	166	-48.9
168	-49.5	168	-49.5	168	-49.5	168	-49.5	168	-49.5
226	-49.5	1281	-49.5	226	-49.5	195	-49.5	226	-54.2
2208	-49.5	1623	-57.5	582	-49.5	226	-50.1	431	-59.5
2249	-48	2208	-60.6	1131	-54.5	500	-54.7	1011	-70.3
3750	-51.2	2208	-49.5	1623	-68.5	1131	-63.5	1115	-72.3
3750	-80	2249	-48	2207	-73.5	1579	-78.4	1707	-91.5
3925	-100	3750	-51.2	2208	-49.5	2207	-86.7	2072	-91.5
5025	-100	3750	-80	2249	-48	2208	-49.5	2208	-49.5
5200	-80	3925	-100	3750	-51.2	2249	-48	2249	-48
5200	-52.7	5025	-100	3750	-80	3750	-51.2	3750	-51.2
8500	-54.8	5200	-80	3925	-100	3750	-80	3750	-80
8500	-80	5200	-52.7	5025	-100	3925	-100	3925	-100
8675	-100	8500	-54.8	5200	-80	5025	-100	5025	-100
11825	-100	8500	-80	5200	-52.7	5200	-80	5200	-80
12000	-56.5	8675	-100	8500	-54.8	5200	-52.7	5200	-52.7
17664	-56.5	11825	-100	8500	-80	8500	-54.8	8500	-54.8
21000	-80	12000	-56.5	8675	-100	8500	-80	8500	-80
21450	-100	17664	-56.5	11825	-100	8675	-100	8675	-100
30000	-100	21000	-80	12000	-56.5	11825	-100	11825	-100
		21450	-100	17664	-56.5	12000	-56.5	12000	-56.5
		30000	-100	21000	-80	17664	-56.5	17664	-56.5
				21450	-100	21000	-80	21000	-80
				30000	-100	21450	-100	21450	-100
						30000	-100	30000	-100

Table 4: Downstream masks: Cabinet launch for ESEL = 0 to 20



Note: Load impedance and measurement bandwidth as described in Table 2 are used.

ESEL = 25		ESEL = 30		ESEL = 35		ESEL = 40		ESEL = 45	
kHz	dBm/Hz	kHz	dBm/Hz	kHz	dBm/Hz	kHz	dBm/Hz	KHz	dBm/Hz
0.1	-28.5	0.1	-28.5	0.1	-28.5	0.1	-28.5	0.1	-28.5
11	-28.5	11	-28.5	11	-28.5	11	-28.5	11	-28.5
30	-29.5	30	-29.5	30	-29.5	30	-29.5	30	-29.5
30.3	-30	30.3	-30	30.3	-30	30.3	-30	30.3	-30
113	-38.8	113	-38.8	113	-38.8	113	-38.8	113	-38.8
125	-39.4	125	-39.4	125	-39.4	125	-39.4	125	-39.4
145	-41.4	145	-41.4	145	-41.4	145	-41.4	145	-41.4
155	-45.5	155	-45.5	155	-45.5	155	-45.5	155	-45.5
166	-48.9	166	-48.9	166	-48.9	166	-48.9	166	-48.9
168	-49.5	168	-49.5	168	-49.5	168	-49.5	168	-49.5
226	-59.2	200	-60.2	200	-60.2	200	-60.2	200	-60.2
500	-67	226	-62.4	226	-62.4	226	-62.4	226	-62.4
1104	-80.6	301	-66.5	300	-69	300	-69	300	-69
1282	-88.7	392	-69.6	301	-71.4	301	-76.5	301	-79
1469	-91.2	621	-76.6	500	-79.1	500	-85.2	500	-90
1622	-80	818	-82	818	-90	621	-90	582	-90
1622	-49.5	1115	-90	1115	-90	818	-90	728	-80
2249	-48	1251	-90	1039	-90	938	-80	781	-49.5
3750	-51.2	1369	-80	1132	-80	939	-49.5	2249	-48
3750	-80	1400	-49.5	1163	-49.5	2249	-48	3750	-51.2
3925	-100	2249	-48	2249	-48	3750	-51.2	3750	-80
5025	-100	3750	-51.2	3750	-51.2	3750	-80	3925	-100
5200	-80	3750	-80	3750	-80	3925	-100	5025	-100
5200	-52.7	3925	-100	3925	-100	5025	-100	5200	-80
8500	-54.8	5025	-100	5025	-100	5200	-80	5200	-52.7
8500	-80	5200	-80	5200	-80	5200	-52.7	8500	-54.8
8675	-100	5200	-52.7	5200	-52.7	8500	-54.8	8500	-80
11825	-100	8500	-54.8	8500	-54.8	8500	-80	8675	-100
12000	-56.5	8500	-80	8500	-80	8675	-100	11825	-100
17664	-56.5	8675	-100	8675	-100	11825	-100	12000	-56.5
21000	-80	11825	-100	11825	-100	12000	-56.5	17664	-56.5
21450	-100	12000	-56.5	12000	-56.5	17664	-56.5	21000	-80
30000	-100	17664	-56.5	17664	-56.5	21000	-80	21450	-100
		21000	-80	21000	-80	21450	-100	30000	-100
		21450	-100	21450	-100	30000	-100		
		30000	-100	30000	-100				

Table 5: Downstream masks: Cabinet launch for ESEL = 25 to 45

Note: Load impedance and measurement bandwidth as described in Table 2 are used.

ESEL = 50		ESEL =55		ESEL = 60	
KHz	dBm/Hz	kHz	dBm/Hz	kHz	dBm/Hz
0.1	-28.5	0.1	-28.5	0.1	-28.5
11	-28.5	11	-28.5	11	-28.5
30	-29.5	30	-29.5	30	-29.5
30.3	-30	30.3	-30	30.3	-30
113	-38.8	113	-38.8	113	-38.8
125	-39.4	125	-39.4	125	-39.4
145	-41.4	145	-41.4	145	-41.4
155	-45.5	155	-45.5	155	-45.5
166	-48.9	166	-48.9	166	-48.9
168	-49.5	168	-49.5	168	-49.5
200	-60.2	200	-60.2	200	-60.2
226	-62.4	226	-62.4	226	-62.4
300	-69	300	-69	300	-69
301	-79	301	-79	301	-79
392	-84.3	392	-84.3	318	-80
472	-88.5	411	-81.3	336	-80
581	-80	452	-80	354	-49.5
582	-49.5	472	-49.5	2249	-48
2249	-48	2249	-48	3750	-51.2
3750	-51.2	3750	-51.2	3750	-80
3750	-80	3750	-80	3925	-100
3925	-100	3925	-100	5025	-100
5025	-100	5025	-100	5200	-80
5200	-80	5200	-80	5200	-52.7
5200	-52.7	5200	-52.7	8500	-54.8
8500	-54.8	8500	-54.8	8500	-80
8500	-80	8500	-80	8675	-100
8675	-100	8675	-100	11825	-100
11825	-100	11825	-100	12000	-56.5
12000	-56.5	12000	-56.5	17664	-56.5
17664	-56.5	17664	-56.5	21000	-80
21000	-80	21000	-80	21450	-100
21450	-100	21450	-100	30000	-100
30000	-100	30000	-100		

Table 6 : Downstream masks: Cabinet launch for ESEL = 50 to 60

Note: Load impedance and measurement bandwidth as described in Table 2 are used.

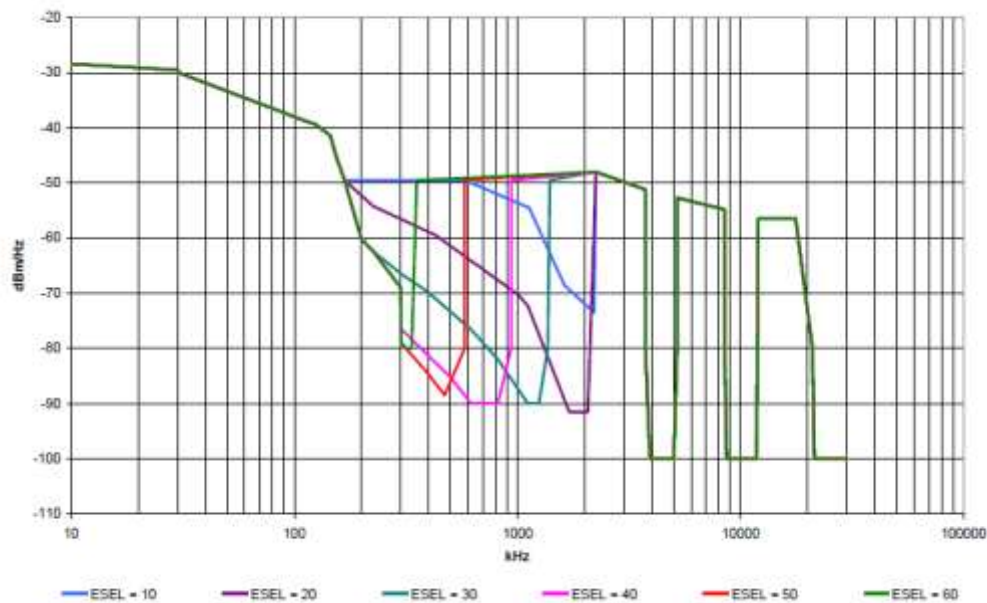


Figure 6 Downstream masks: Cabinet launched

5.3 Upstream mask from CPE

This section is applicable to the CPE that is connected to the NTP at the customer's premises. The mask limit is dependent on the electrical distance between the NTP and the MDF for technologies using frequencies up to 2208 kHz

For the higher frequency bands used by VDSL2 upstream the mask limit is dependent on the electrical distance between the NTP and the cabinet sub distribution frame or between the NTP and the Exchange MDF for EVDSL where permitted (See section 5.1). This shall be achieved by compliance with the protocol for Upstream Power Back Off (UPBO) as specified section 7.2.1.3 of ITU-T G.993.2, [4] adjusting the upstream transmitted power output level based on the parameter k10. Additionally, where the distance between the exchange MDF and the customer's premises (L1) is greater than 10.8 dB at 300 kHz, the US2 frequency band from 8.5 MHz to 12MHz shall not be used.

Deployment Limits

There are five deployment limits over which it is permitted to deploy various technologies

Line Category	Attenuation at 300 kHz
Ultra Short	<11.5 dB
Extra Short	< 21 dB
Short	≥ 21, < 38 dB
Medium	≥ 38 ,< 42 dB
Long	≥ 42 dB

Table 7: Deployment Limits

These are examples of the possible technologies permitted within these deployment limits.

Ultra Short	Extra Short	Short	Medium	Long
ISDN BRA	ISDN BRA	ISDN BRA	ISDN BRA	ISDN BRA
ADSL / ADSL2+ Annex A	ADSL / ADSL2+ Annex A	ADSL / ADSL2+ Annex A	ADSL / ADSL2+ Annex A	ADSL / ADSL2+ Annex A
ADSL2+ Annex M	ADSL2+ Annex M	HDSL 160 Kbit/s 2B1Q	HDSL 160 Kbit/s 2B1Q	HDSL 160 Kbit/s 2B1Q
HDSL 160 Kbit/s 2B1Q	HDSL 160 Kbit/s 2B1Q	SHDSL 576 Kbit/s	SHDSL 576 Kbit/s	SHDSL 576 Kbit/s
SHDSL 576 Kbit/s	SHDSL 576 Kbit/s	SHDSL 1152 Kbit/s	SHDSL 1152 Kbit/s	
SHDSL 1152 Kbit/s	SHDSL 1152 Kbit/s	HDSL 784 Kbit/s 2B1Q	HDSL 784 Kbit/s 2B1Q	
HDSL 784 Kbit/s 2B1Q	HDSL 784 Kbit/s 2B1Q	SHDSL 2304 Kbit/s		
SHDSL 2304 Kbit/s	SHDSL 2304 Kbit/s	HDSL 1168 Kbit/s 2B1Q		
SHDSL 5696 Kbit/s	HDSL 1168 Kbit/s 2B1Q			
HDSL 1168 Kbit/s 2B1Q				

Table 8: Examples of technologies permitted within deployment limits

Note 1: Cabinet Launched VDSL2 is permitted to be deployed under this plan, It may be deployed on any of the above line categories in compliance with section 5.2

Note 2 Exchange launched VDSL2 is permitted to be deployed on lines are described by Topology 1 and Topology 3 (See Section 4.1). The reach of EVDSL will not extend beyond the short line category.

Upstream - Ultra Short Line

The line category Ultra Short applied where the electrical distance of the line between the exchange MDF and the customer's premises is not greater than 11.5 dB at 300 kHz.

For EVDSL, where the distance between the exchange MDF and the customer's premises (L1) is greater than 10.8 dB at 300 KHz, the US2 frequency band from 8.5 MHz to 12MHz shall not be used.

Low Frequency Part		High Frequency Part - CVDSL			High Frequency Part - EVDSL L1 ≥10.8 dB		
KHz	dBm/Hz	kHz	dBm/Hz kI0=0	dBm/Hz kI0=17	kHz	dBm/Hz kI0=0	dBm/Hz kI0=17
0.1	-28	2825	-100	-100	2825	-100	-100
30	-28	3575	-100	-100	3575	-100	-100
35	-29	3750	-86	-51.2	3750	-86	-51.2
47.135	-34.5	5200	-94	-52.7	5200	-94	-52.7
138	-34.5	5200	-110	-110	5200	-110	-110
145.222	-37.5	8500	-110	-110	8500	-110	-110
276	-37.5	8500	-99	-54.8	8500	-110	-110
300.129	-41.61	10000	-103	-55.5	10000	-110	-110
332.369	-42.65	12000	--108	--55.5	12000	-110	-110
392.15	-42.8	12000	-110	-110	12000	-110	-110
570.4	-44.5	30000	-110	-110	30000	-110	-110
677.35	-47.2						
855.6	-57.7						
1283.4	-90						
1400	-90						
1924	-100						
2208	-100						

Table 9: Upstream PSD mask for Ultra Short line Category

Note: Load impedance and measurement bandwidth as described in Table 2 are used.

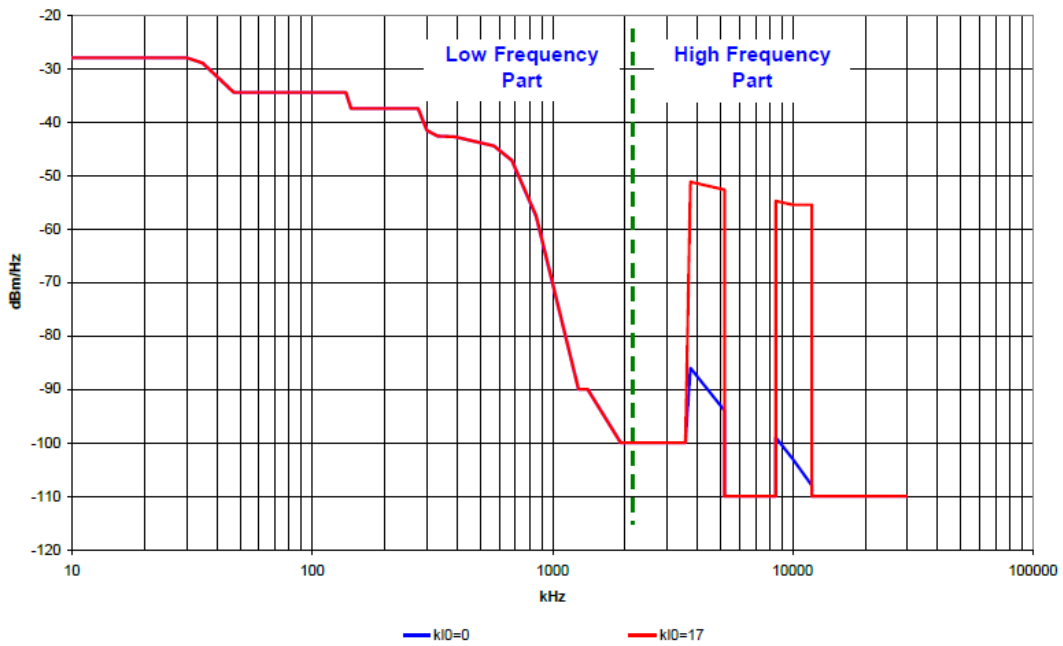


Figure 7 Upstream PSD mask for Ultra Short line Category

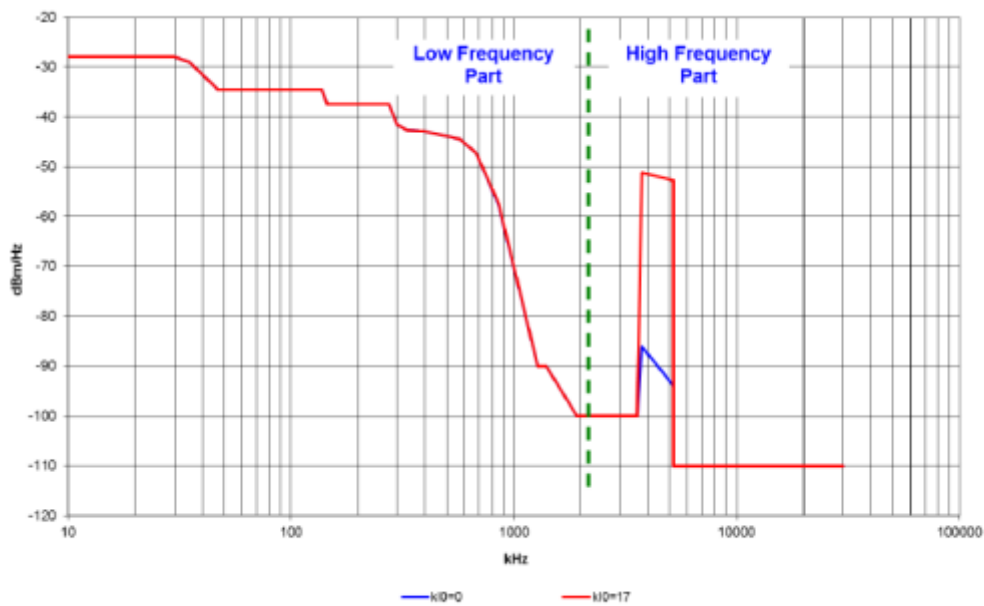


Figure 8 : Upstream PSD mask for Ultra Short line Category and EVDSL L1 ≥ 10.8 dB

Upstream - Extra Short Line

The line category Extra Short applies where the electrical distance of the line between the MDF and the customer's premises is not greater than 20 dB at 300 kHz.

For EVDSL, where the distance between the exchange MDF and the customer's premises (L1) is greater than 10.8 dB at 300 kHz, the US2 frequency band from 8.5 MHz to 12MHz shall not be used.

Low Frequency Part		High Frequency Part - CVDSL			High Frequency Part - EVDSL L1 ≥ 10.8 dB		
kHz	dBm/Hz	kHz	dBm/Hz kl0=0	dBm/Hz kl0=17	kHz	dBm/Hz kl0=0	dBm/Hz kl0=17
0.1	-28	2825	-100	-100	2825	-100	-100
30	-28	3575	-100	-100	3575	-100	-100
35	-29	3750	-86	-51.2	3750	-86	-51.2
47.135	-34.5	5200	-94	-52.7	5200	-94	-52.7
138	-34.5	5200	-110	-110	5200	-110	-110
145.222	-37.5	8500	-110	-110	8500	-110	-110
276	-37.5	8500	-99	-54.8	8500	-110	-110
300.129	-41.61	10000	-103	-55.5	10000	-110	-110
332.369	-42.65	12000	-108	-55.5	12000	-110	-110
359.87	-44.08	12000	-110	-110	12000	-110	-110
385.485	-46.06	30000	-110	-110	30000	-110	-110
412.2	-48.74						
440.882	-52.16						
475.149	-56.61						
513.55	-61.76						
553.011	-67.12						
590.281	-72.29						
613.196	-75.62						
624.021	-75.08						
650	-71						
735	-71						
1268.95	-90						
1400	-90						
1924	-100						
2208	-100						

Table 10: Upstream PSD Mask for Extra Short Line Category

Note: Load impedance and measurement bandwidth as described in Table 2 are used.

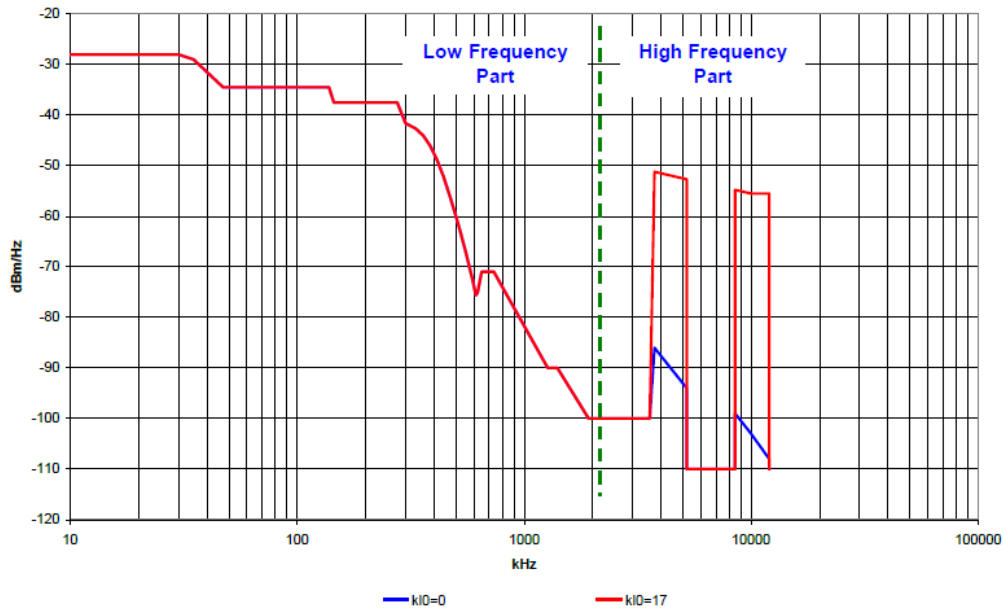


Figure 9 Upstream PSD Mask for Extra Short Line Category

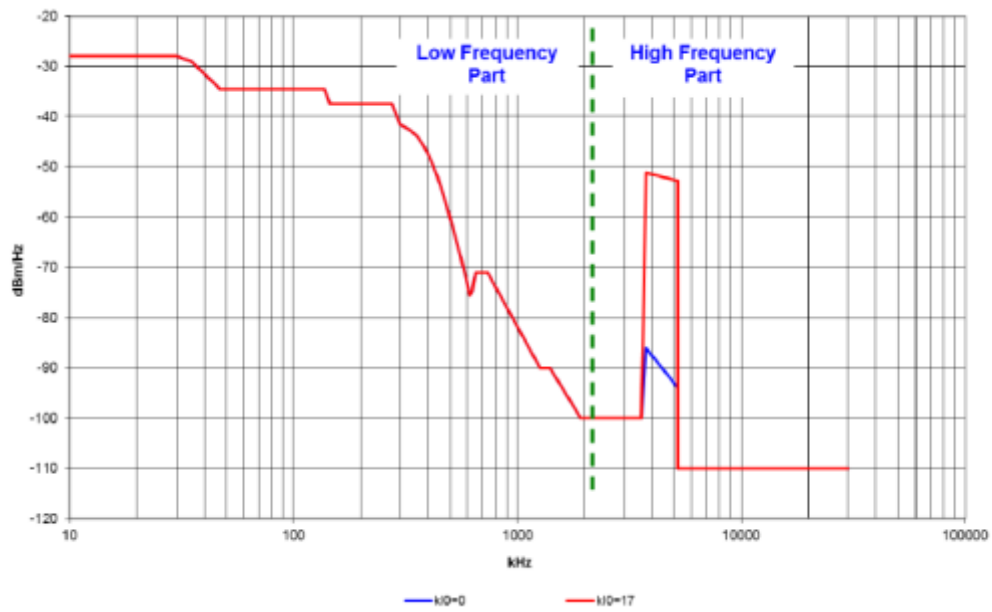


Figure 10 Upstream PSD mask for Extra Short line Category and EVDSL L1 ≥ 10.8 dB

Upstream - Short Line

The line category Short applies where the electrical distance of the line between the MDF and the customer's premises is greater than 21 dB and less than 38 dB at 300 kHz. For EVDSL, where the distance between the exchange MDF and the customer's premises (L1) is greater than 10.8 dB at 300 kHz, the US2 frequency band from 8.5 MHz to 12MHz shall not be used.

Low Frequency Part		High Frequency Part - CVDSL			High Frequency Part - EVDSL L1 ≥10.8 dB		
kHz	dBm/Hz	kHz	dBm/Hz k10=0	dBm/Hz k10=17	kHz	dBm/Hz k10=0	dBm/Hz k10=17
0.1	-28	2825	-100	-100	2825	-100	-100
30	-28	3575	-100	-100	3575	-100	-100
35	-29	3750	-86	-51.2	3750	-86	-51.2
47.135	-34.5	5200	-94	-52.7	5200	-94	-52.7
138	-34.5	5200	-110	-110	5200	-110	-110
145.222	-38.04	8500	-110	-110	8500	-110	-110
147.654	-39.16	8500	-99	-54.8	8500	-110	-110
155.286	-39.19	10000	-103	-55.5	10000	-110	-110
235.084	-39.2	12000	-108	-55.5	12000	-110	-110
241.968	-39.52	12000	-110	-110	12000	-110	-110
246.148	-39.96	30000	-110	-110	30000	-110	-110
250.067	-40.75						
265.315	-41.08						
267.397	-41.14						
292.485	-42.05						
295.483	-42.18						
318.586	-43.54						
336.7	-45.12						
342.917	-45.68						
344.352	-45.84						
400	-48.7						
500	-60.5						
534.365	-69.89						
545.577	-72.81						
613.095	-76.84						
650	-71						
735	-71						
1268.95	-90						
1400	-90						
1924	-100						
2208	-100						

Low Frequency Part		High Frequency Part - CVDSL			High Frequency Part - EVDSL L1 ≥10.8 dB		
kHz	dBm/Hz	kHz	dBm/Hz kI0=0	dBm/Hz kI0=17	kHz	dBm/Hz kI0=0	dBm/Hz kI0=17
0.1	-28	2825	-100	-100	2825	-100	-100
30	-28	3575	-100	-100	3575	-100	-100
35	-29	3750	-86	-51.2	3750	-86	-51.2
47.135	-34.5	5200	-94	-52.7	5200	-94	-52.7
138	-34.5	5200	-110	-110	5200	-110	-110
145.222	-38.04	8500	-110	-110	8500	-110	-110
147.654	-39.16	8500	-99	-54.8	8500	-110	-110
155.286	-39.19	10000	-103	-55.5	10000	-110	-110
235.084	-39.2	12000	-108	-55.5	12000	-110	-110
241.968	-39.52	12000	-110	-110	12000	-110	-110
246.148	-39.96	30000	-110	-110	30000	-110	-110
250.067	-40.75						
265.315	-41.08						
267.397	-41.14						
292.485	-42.05						
295.483	-42.18						
318.586	-43.54						
336.7	-45.12						
342.917	-45.68						
344.352	-45.84						
400	-48.7						
500	-60.5						
534.365	-69.89						
545.577	-72.81						
613.095	-76.84						
650	-71						
735	-71						
1268.95	-90						
1400	-90						
1924	-100						
2208	-100						

Table 11: Upstream PSD Mask for Short Line Category

Note: Load impedance and measurement bandwidth as described in Table 2 are used.

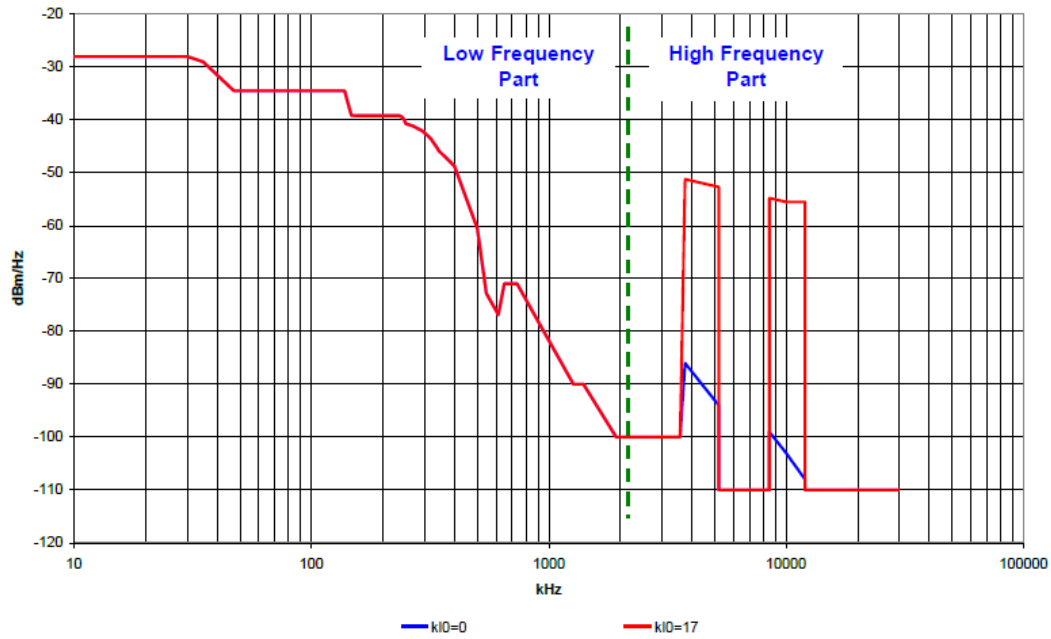


Figure 11 Upstream PSD Mask for Short Line Category

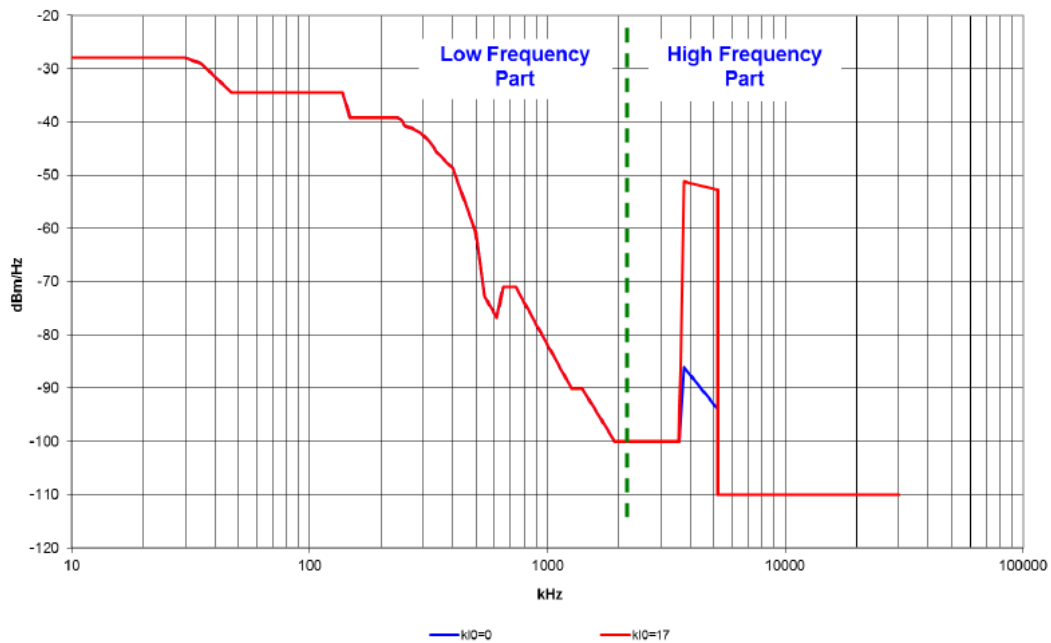


Figure 12 Upstream PSD mask for Extra Short line Category and EVDSL L1 ≥ 10.8 dB

Upstream - Medium Line

The line category Medium applies where the electrical distance of the line between the MDF and the customer's premises is greater than or equal to 38 dB and less than 42 dB at 300 kHz.

Low Frequency Part		High Frequency Part		
kHz	dBm/Hz	kHz	dBm/Hz kI0=0	dBm/Hz kI0=17
0.1	-28	2825	-100	-100
30	-28	3575	-100	-100
35	-29	3750	-86	-51.2
47.135	-34.5	5200	-94	-52.7
138	-34.5	5200	-110	-110
147.65	-39.19	8500	-110	-110
235.084	-39.2	8500	-99	-54.8
246.148	-39.96	10000	-103	-55.5
250.067	-40.77	12000	-108	-55.5
256.27	-42.68	12000	-110	-110
262.99	-46.67	30000	-110	-110
266.667	-46.94			
333.333	-58.74			
344.1	-63.23			
358.742	-66.25			
382.919	-71.41			
404.317	-76.17			
433.333	-69.24			
492	-69.24			
897.244	-90			
1400	-90			
1924	-100			
2208	-100			

Table 12: Upstream PSD Mask for Medium Line Category

Note: Load impedance and measurement bandwidth as described in Table 2 are used

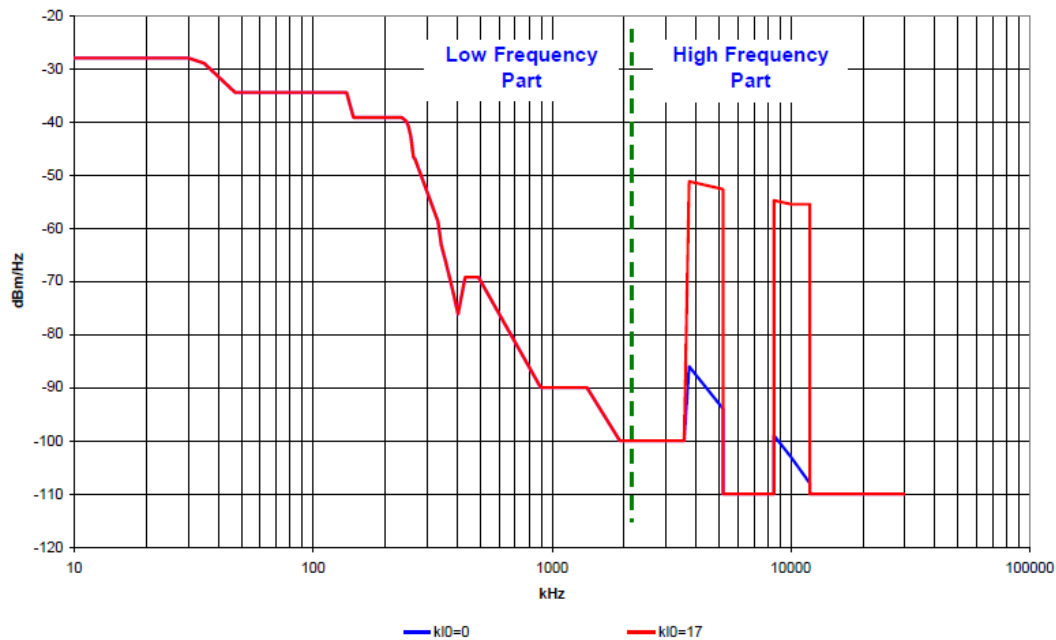


Figure 13 Upstream PSD Mask for Medium Line Category

Upstream - Long Line

The line category Medium applies where the electrical distance of the line between the MDF and the customer’s premises is greater than or equal to 42 dB at 300 kHz

Low Frequency Part		High Frequency Part		
kHz	dBm/Hz	kHz	dBm/Hz k10=0	dBm/Hz k10=17
0.1	-28	2825	-100	-100
30	-28	3575	-100	-100
35	-29	3750	-86	-51.2
46.922	-34.5	5200	-94	-52.7
138	-34.5	5200	-110	-110
199.724	-60.16	8500	-110	-110
300	-69	8500	-99	-54.8
301	-79	10000	-103	-55.5
500	-90	12000	--108	--55.5
1400	-90	12000	-110	-110
1924	-100	30000	-110	-110
2208	-100			

Table 13: Upstream PSD Mask for Long Line Category

Note: Load impedance and measurement bandwidth as described in Table 2 are used

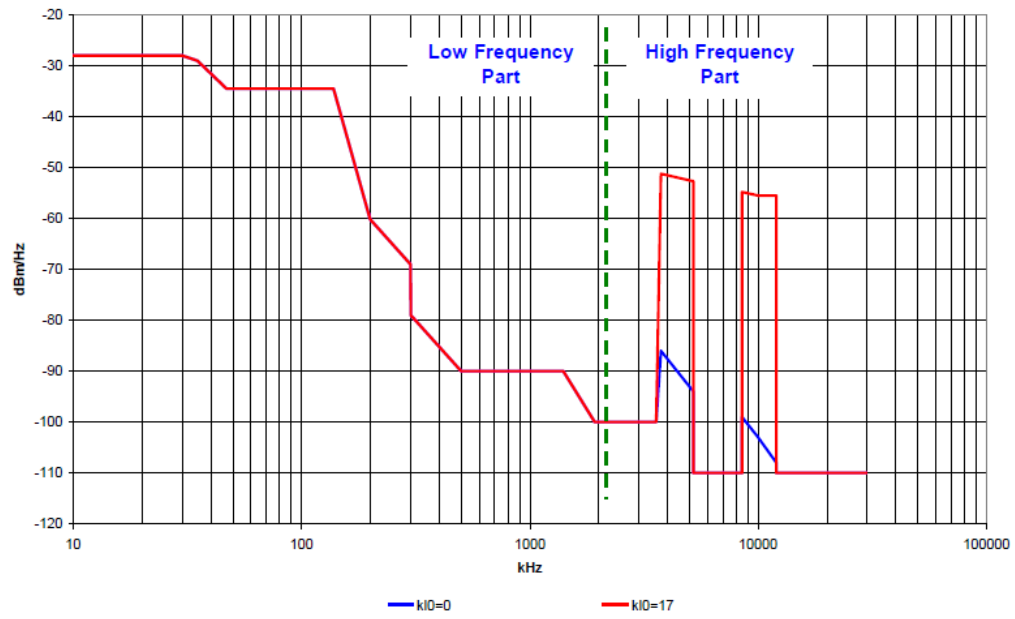


Figure 14 Upstream PSD Mask for Long Line Category

6. Exceptions

There are certain legacy systems that were deployed in the open eir network prior to the introduction of LLU and this revision of the CLFMP. In the construction of this plan it was recognised that some of these systems may not be capable of compliance with the CLFMP and others may be deployed on line lengths that do not comply with the plan or are launched into the network in ways which do not conform to the plan.

To leverage the benefits of the CLFMP it is necessary to restrict the amount of non-compliant equipment in the network. open eir will make reasonable endeavours not to make any further deployments that do not comply with the CLFMP.

Systems in service that do not comply will be tolerated provided that they do not cause interference to compliant systems. In the case where interference does occur open eir may need, in certain circumstances, to retain non-compliant systems in place to meet its regulatory obligations; however open eir will take all reasonable measures to alleviate the interference

7. General Principles

The following principles are the basis for the management of DSL system deployment within a cable. The numbering does not represent any form of priority or hierarchy.

I. Any transmission system on any pair

The CLFMP allows any transmission system that conforms to the plan to be used on any pair in the copper loop access cable. This means that the CLFMP allows:

- Any pair in a copper loop access cable to support any of the transmission systems allowed by the CLFMP.
- All pairs in the cable to support the same transmission system (i.e. 100% fill).

II. CLFMP applies equally to all users

The requirements of the CLFMP will apply equally to all users of the copper loop access network including all access seekers and open eir.

III. Laboratory Measurement is definitive

The definitive measurement to determine compliance with the CLFMP should be made in the laboratory in accordance with an agreed measurement scheme. The initial scheme will be that documented in the UK ANFP measurement annex included as Annex 1 to this CLFMP.

IV. Self-Declaration of Compliance

The users of the copper loop access network (i.e. Operators or Access Seekers) shall be responsible for declaring compliance to the CLFMP.

V. Safety

Human safety and the physical integrity of the wires must be ensured. The CLFMP must not prejudice this.

8. Review

Any changes to a CLFMP can adversely affect (e.g. in terms of reduced reach and reduced performance) the transmission systems permitted in the original CLFMP. Hence the mechanism for the control of changes to the CLFMP needs to be pre-defined so that users of the CLFMP can assess the risks associated with possible changes. For this reason the CLFMP will be under change control.

A CLFMP Working Group shall meet as required to review the implementation of the plan and make recommendations on adjustments in light of experience and technical developments. Any such meeting will be convened by ComReg if required at the request of open eir or any access seeker. Timely notice of this meeting should be given to all access seekers.

No change can be made this document without agreement of ComReg after consultation with open eir and all access seekers.

9. Dispute

Disputes arising from the implementation of this plan shall be raised with ComReg. The CLFMP Working Group (as mentioned in Section 8) may, if required by ComReg, be asked to form the initial basis of a review should licensed operators be in dispute over technologies or masks in the CLFMP.

10. Interference Code of Practice

In the event of an interference problem arising where reasonable suspicion falls on the Access Seekers equipment, the access seeker is required to co-operate with open eir's reasonable requests. Similarly, in the event that reasonable suspicion falls on open eir equipment, open eir is required to co-operate with an Access Seeker's reasonable request.

In extreme circumstances open eir reserves the right to initiate any appropriate remedial action, in accordance with general licence conditions.

11. References

- [1] ETSI ES 203 021 Harmonised Basic Attachment Requirements for Terminals for connection to Analogue Interfaces of Telephone Networks
- [2] ETSI ES 201 970 Public Switched Telephone Network (PSTN); Harmonised specification of physical and electrical characteristics at a 2-wire analogue presented Network Termination Point (NTP)
- [3] ETSI ES 202 971 Public Switched Telephone Network (PSTN); Harmonised specification of physical and electrical characteristics of a 2-wire analogue interface for short line interface
- [4] ITU-T G.993.2 (12/2011) Transmission systems and media, Digital systems and networks. Very high digital subscriber line transceivers 2 (VDSL2)
- [5] UK ANFP United Kingdom Access Network Frequency Plan
- [6] ITU-T G.993.5 (04/2010) TRANSMISSION SYSTEMS AND MEDIA, DIGITAL SYSTEMS AND NETWORKS Self-FEXT cancellation (vectoring) for use with VDSL2 transceivers.
- [7] TNO report 2014 R11646 Evaluation of the proposal to allow VDSL2 from the local exchange (EVDSL) in Ireland
- [8] TNO report 2015 R10267 Impact Analysis of VDSL2 from the local exchange (EVSDL) on VDSL2 from the cabinet (CVDSL) For the Irish access network

Annex A Test Specification

A 1 Scope

This test specification defines tests to be used in a laboratory environment to determine conformance of telecommunications equipment to the requirements specified in the main body of the CLFMP.

The tests here only relate to the requirements of the CLFMP. Other limits, for example those related to safety, line balance, and interactions between systems on the same pair are out of scope.

Note 1: This test specification is for use in a laboratory environment only.

Note 2: Strictly the CLFMP specifies limits at the ports of the access network, not for individual equipment per se. This specification is to verify that when deployed equipment would not violate the CLFMP.

Note 3: Section A6 of this document is based on the equivalent specification contained in the ANSI Spectrum Management For Loop Transmission Systems standard. The use and reproduction of extracts from that standard is provided with kind permission of ANSI (American National Standards Institute).

A2 Reference Model

The CLFMP limits the power that may be injected into a metallic pair in the copper loop access network at three interfaces, the NTP at the customer premises, the cabinet and the MDF at the exchange.

In the case of Local Loop Unbundling, there is another interface, the OLO BLOCK11. Managing crosstalk interference in the cabling between the OLO BLOCK and the MDF is the responsibility of the network operator(s) using that cabling. The CLFMP is applied at the MDF.

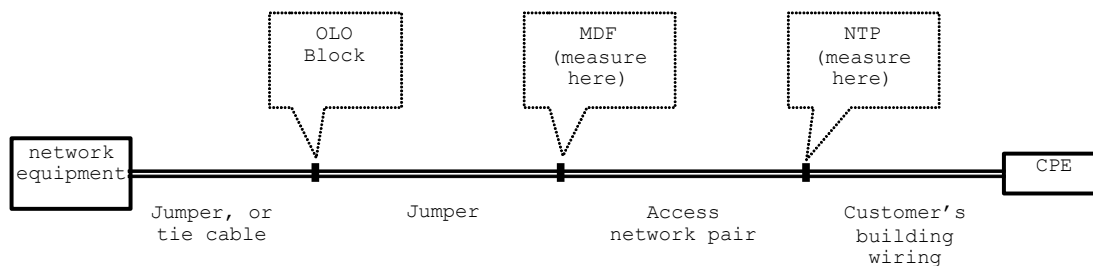


Figure 15 Network Interfaces to which the CLFMP applies

¹“OLO Block”, is the equipment which terminates the tie cables

A3 Test Configuration

The equipment under test (“EUT”) will comprise the end equipment, any ancillaries which are always present², and a load to represent the access network.

The equipment at each end is tested independently.

Equipment will be tested in all modes which the operator proposes to use. Other modes, perhaps provided for use in other countries, need not be tested.

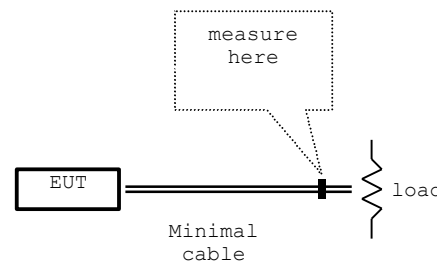


Figure 16 Test configuration

A4 Measurement Conditions

The prospective operator shall declare his deployment intentions for the equipment under test. This determines which modes the equipment is tested in, and which CLFMP mask(s) it is tested against.

A4.1 Estimation of uncertainty of measurement

A laboratory or facility performing testing shall have and shall apply procedures for estimating uncertainty of measurement.

When estimating the uncertainty of measurement, all uncertainty components which are of importance in a given situation shall be taken into account using appropriate methods of analysis.

The test report or compliance statement shall include the uncertainty of measurement.

Note: 1 Sources contributing to uncertainty include, but are not necessarily limited to, the reference standards and reference materials used, methods and equipment used, properties and condition of the item being tested.

A4.2 Compliance

Compliance to the requirements of this standard shall be determined either by use of the test methods defined within this standard or by use of test methods and results obtained from other standards accompanied with a technical justification detailing how such results demonstrate compliance to this standard.

Note: Since the requirements of this standard are derived from a number of technology specific standards in many cases it will be sufficient to test equipment to the specific design standard for their technology, and make a compliance statement to this standard following technical review of the results. The technical review should not be omitted as some options of specific technologies are excluded from these requirements and would present non-compliant results to this standard.

² For example splitter filters, and connecting leads which are part of the kit supplied with the end equipment

A4.3 Calibration of test equipment

Equipment and its software used for testing shall be capable of achieving the accuracy required. Calibration programs shall be established for values of the instruments where these properties have a significant effect on the result

The equipment shall be calibrated to provide a 95% confidence level in the accuracy of the results.

A4.4 General Conditions for Test

If the supplier has specified a temperature range within which the TE will be operational, the testing shall be performed within this range. The testing shall be performed within the temperature range 15 °C to 25 °C, if consistent with the temperature range declared by the supplier.

If the supplier has specified a humidity range within which the TE will be operational, the testing shall be performed within this range. The testing shall be performed within the humidity range 45% to 75%, if consistent with the humidity range declared by the supplier.

For equipment that is directly powered from the mains supply all tests shall be carried out within $\pm 5\%$ of the normal operating voltage.

If the equipment is powered by other means and those means are not supplied as part of the equipment, (e.g. batteries, stabilized AC supplies, DC) all tests shall be carried out within the power supply limit declared by the supplier.

If the power supply is AC the tests shall be conducted within $\pm 4\%$ of the stated frequency as declared by the supplier.

A4.5 Independence of polarity

The equipment shall conform independent of the polarity of the pair it uses. For a line powered EUT the tests shall be carried out twice, once with each polarity of connection of the power supply.

A5 Conformance testing methodology below 5 kHz

No formal tests are currently specified here.

Note: The absence of tests here should not be interpreted as license: the CLFMP does set limits below 5 kHz. Conformance testing methodology is for further study.

A6 Conformance testing methodology above 5 kHz

The conformance testing methodology shall be used to determine compliance with the signal power limitations requirements in the CLFMP.

Note: Where the CLFMP, makes no requirements (e.g. longitudinal output, non-stationary signals), this annex specifies no tests.

A6.1 PSD measurement procedure

The limits applicable to a particular end equipment are discussed above, in Section 4.

A6.1.1 Test circuit for PSD measurement

A test set-up as pictorially shown in Figure 9 Figure 8 shall be used for measuring PSD. Examples of specific embodiments of this test set-up are shown in Figure 10 and Figure 11. The difference between Figure 10 and Figure 11 is the input impedance of the instrument to be connected to V_{out} : in Figure 10 assumes a high-impedance port, Figure 11 assumes a 50Ω port (typical for a spectrum analyser). The PSD may be tested while line powered or locally powered as required by the intended application of the EUT.

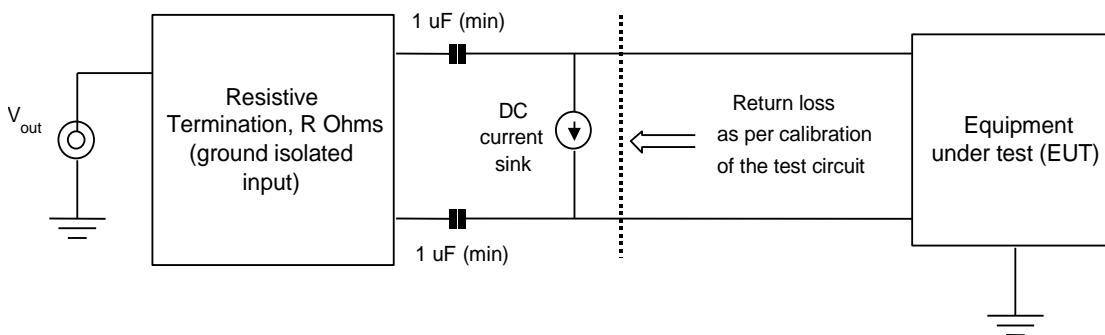


Figure 17 - PSD measurement set-up

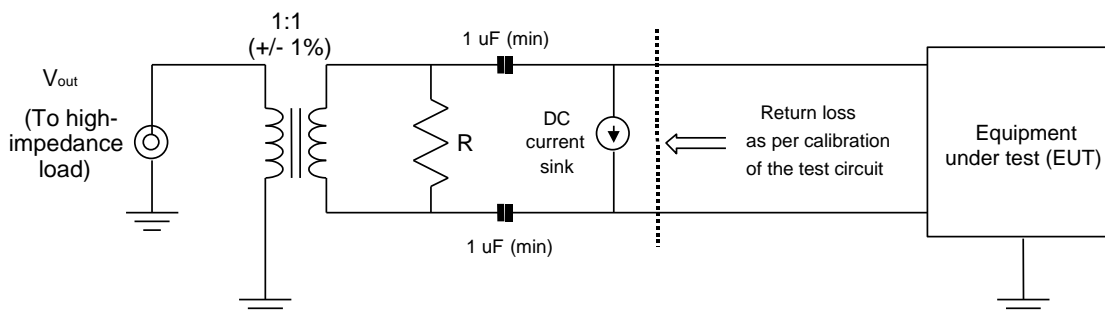


Figure 18 - Example PSD measurement set-up for high impedance instrument

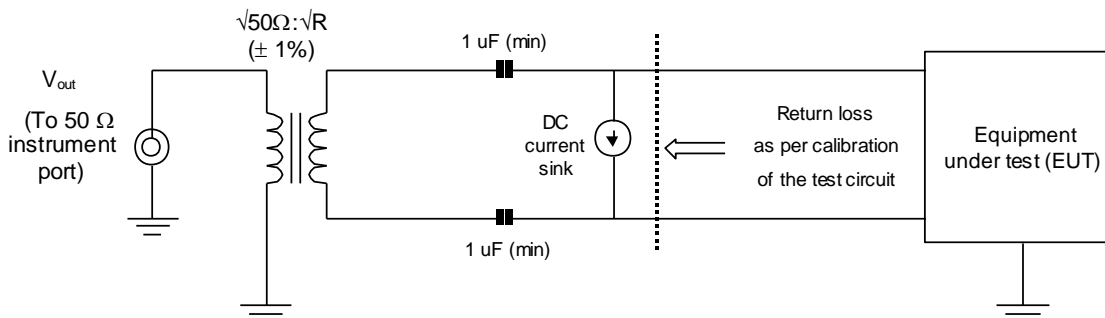


Figure 19 - Example PSD measurement set-up for 50 ohm instrument

If the EUT neither sources nor sinks power the blocking capacitors may be omitted, as may the current sink. If present the capacitors shall be matched in value to within 1%.

If the EUT is line powered then the test circuit shall contain provisions for DC power feed, instead of the current sink.

For line powered applications, if the EUT is a TU-C the test shall be performed with the line power supply activated and an appropriate DC current sink (with high AC impedance) attached to the test circuit. If the EUT is a TU-R the test shall be performed with power (DC voltage) applied at the line interface by an external voltage source feeding through an AC blocking impedance. Note that the DC current source/sink must present high impedance (at signal frequencies) to common ground. The test circuit contains provisions for transformer isolation for the measurement instrumentation. Transformer isolation of the instrumentation input prevents measurement errors from unintentional circuit paths through the common ground of the instrumentation and the EUT power feed circuitry. When the termination impedance of the test circuit seen by the EUT output meets the calibration requirements defined in A.4.3 the test circuit will not introduce more than 0.25 dB error with respect to a perfect test load of exactly the specified resistance.

If the EUT is supplied with a voice band splitter filter³ then the tests shall be carried out with the splitter in circuit but with no voice band signal applied. Where the splitter has a connector for the voice band connection, this shall be open circuit during tests. Where voice band equipment is integrated with the splitter this equipment shall be quiescent during tests.

The EUT shall be measured by equipment that is not synchronous with the transmitted symbols of the EUT, and there shall be no synchronisation between the measurement equipment and the EUT. This is to avoid any cyclo-stationarity effects causing a misleading measurement.

A6.1.2 Calibration of the test circuit and termination impedance

The nominal termination impedance of the test circuit as seen by the EUT output shall be resistive with a resistance of R between 100 Ω and 135 Ω . If the EUT has been designed to a published standard then the resistive impedance specified in that standard shall be used (providing it is between 100 Ω and 135 Ω). The minimum return loss with respect to the termination impedance R shall be 35 dB from 10 kHz to 2 MHz with a reduction of 20dB/decade below and above these corner frequencies.

³ e.g. to allow DSL and ordinary telephony to share the line

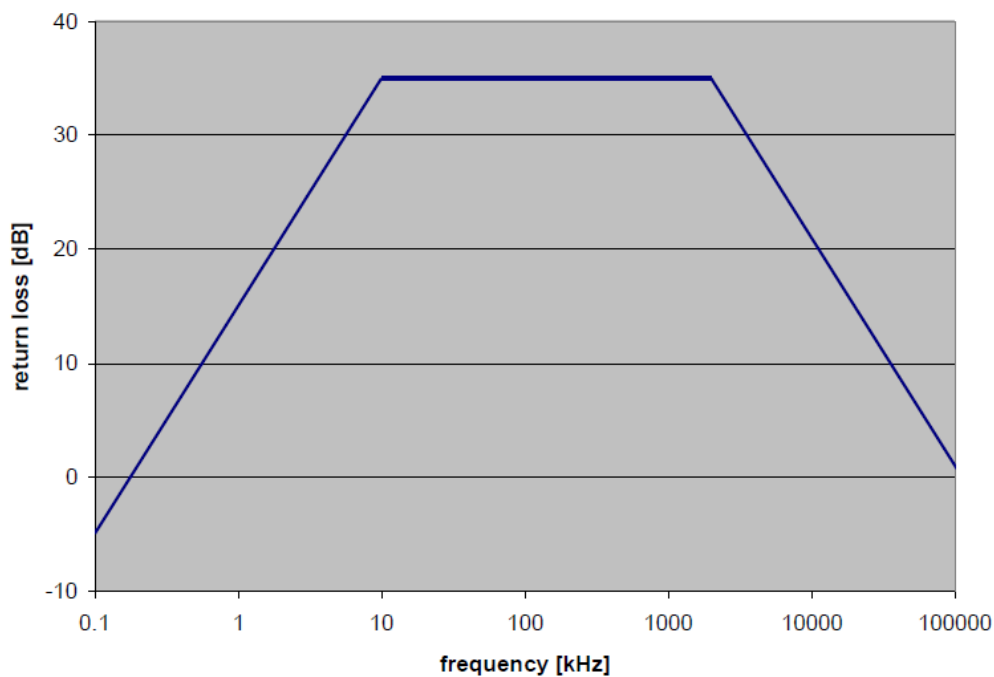


Figure 20: Return Loss Mask

Figure 20 shows the return loss mask. The test circuit must exhibit this loss or higher at all frequencies.

Note 1: No passive circuit can exhibit a negative return loss, so calibration has implied limits on the frequency band to be measured over.

Note 2: 35 dB return loss will allow ± 0.20 dB measurement error with respect to the nominal termination impedance value, R.

A6.1.3 Operation of the EUT

The EUT shall be tested while it transmits maximum power and maximum PSD levels at all measured frequencies, which it can transmit data when deployed. The EUT shall have power cutback or boost configured to match the proposed deployment. The EUT shall be tested under steady state conditions, after all start-up and initialisation procedures have been completed and while the EUT is transmitting data. To ensure that the EUT is in a steady-state condition, while undergoing test the EUT shall not have measured total average powers in distinct 1.25 millisecond time intervals that differ by more than 8 dB. The EUT input shall consist of a pseudo-random uniformly distributed data sequence, and the EUT output shall be a fully modulated transmit signal with all overhead, framing, coding, scrambling, modulation, filtering and all other operations performed on the data stream that the modem would normally perform while transmitting data.

Note: Although specific measurements of average power and PSD during start-up and other non-data transmission phases are not provided, a EUT that transmits inordinately high power or PSD levels during these phases may be considered to be in non-compliance with this standard.

A6.1.4 Power spectral density (PSD) measurement procedure

A6.1.4.1 PSD resolution bandwidth

The nominal frequency of a measurement will be the centre frequency of its resolution bandwidth. Instrument RBW shall be 10 kHz. Measurements will be at integer multiples of 10 kHz, starting at 10 kHz, so the lowest frequency measurement will be nominally 10 kHz and actually a window from 5 kHz to 15 kHz.

Inside the signal bands the measured values for each 10 kHz band shall be compared against the masks individually. Outside the signal bands the measured values will be averaged in overlapping groups of 100 10kHz bands, to produce the effect of a 1 MHz RBW sliding window; the averaged values will be compared against the masks.

The mask value to be compared against shall be the maximum value the mask takes within the effective window. (Typically the first few steps of the 1 MHz sliding window will be compared against substantially higher values than the mask at the nominal centre frequency would suggest).

For the CLFMP, masks this means:

Frequency Band	Resolution Bandwidth
5 kHz to 3095 kHz	10 kHz
3095 kHz to 30005 kHz	1 MHz

Table 14 - Resolution bandwidth for measuring against the down exchange mask

Frequency Band	Resolution Bandwidth
5 kHz to 1265 kHz	10 kHz
1265 kHz to 30005 kHz	1 MHz

Table 15 - Resolution bandwidth for measuring against the up short mask

Frequency Band	Resolution Bandwidth
5 kHz to 895 kHz	10 kHz
895 kHz to 30005 kHz	1 MHz

Table 16 - Resolution bandwidth for measuring against the up medium mask

Frequency Band	Resolution Bandwidth
5 kHz to 505 kHz	10 kHz
505 kHz to 30005 kHz	1 MHz

Table 17 - Resolution bandwidth for measuring against the up long mask

In each band the PSD of an EUT shall be recorded with frequency spacing equal to 10 kHz

A6.1.4.2 PSD Integration Time

Measurements shall be averaged over a sufficiently long time that the contribution to measurement uncertainty shall be no worse than 0.1 dB with 95% confidence. (For some spectrum analysers this will imply limits on video bandwidth and sweep time).

A7 Acknowledgements

The CLFMP working Group would like to thank Ofcom and BT for allowing them to reproduce and modify Laboratory Test Specification from the UK ANFP.

13. Annex B Informative: Non-Stationary Signals

This appendix concerns equipment which only transmits power intermittently – typically when there is data to send. The significant impact of such signals is due to their power when transmitting, not an average over all time.

It is technically difficult to specify how to measure intermittent signals, unless the equipment has a continuous signal test mode (in which case it may be sufficient to conduct tests in that mode, as for normal equipment). Furthermore, at time of writing there is little practical interest in deploying such equipment under the CLFMP. Therefore a normative laboratory test specification is not provided.

Note: The ANSI Spectrum Management specification does specify some tests for such signals, in its section 6.4 “Short-term stationary conformance criteria”

14. Glossary

Ω	OHM
2B1Q	2 Binary 1 Quaternary
ADSL	Asymmetric Digital Subscriber Line
BRA	Basic Rate Access
CLFMP	Copper Loop Frequency Management Plan
ComReg	Commission for Communications Regulation
CPE	Customer's Premises Equipment
dB	Decibel
dBm	Decibel relative to 1 milli watt
DC	Direct Current
DSL	Digital Subscriber Line
DP	Distribution Point
ESEL	Exchange Side Electrical Length
ETSI	European Telecommunications Standards Institute
EUT	Equipment Under Test
EVDSL	Exchange Launched VDSL2
G.sHDSL	An international standard for symmetric DSL developed by the ITU (G.991.2)
HDSL	High Bit Rate Digital Subscriber Line
Hz	Hertz
IPM	Industry Project Meeting
ISDN	Integrated Services Digital Network
ITU	International Telecommunications Union
kHz	Kilo Hertz
LLU	Local Loop Unbundling
LS	Line Share
MDF	Main Distribution Frame
MHz	Mega Hertz
NTP	Network Termination Point
OAO	Other Authorised Operator
ONP	Open Network Provision
POTS	Plain old Telephony Service

PSD	Power Spectral Density
PSTN	Public Switched Telephony Network
R+TTE	Radio + Telecommunications Terminal Equipment
RF	Radio Frequency
SHDSL	Symmetric High Bit Rate Digital Subscriber Line
TE	Terminal Equipment
TU-C	Test Unit – Central
TU-R	Test Unit – Remote
TV	Television
UK ANFP	United Kingdom Access Network Frequency Management Plan
ULMP	Unbundled Local Metallic Path
UPBO	Upstream Power Back Off
VDSL	Very High Speed Digital Subscriber Line

Version Control History

Version	Status	Update	Effective Date
1.0		Industry Agreed Document	8th April '02
2.0		Amended to include Sub Loop Insertion issue	December'02
3.0		Amend issue to allow ADSL2+	January 2005
4.0		Amend to remove masking of ADSL tones 38-48 in the downstream direction	September 2006
5.0		Amend to include e.SHDSL 5696 Kbit/s , VDSL2 and Cabinet Deployment	December 2007
6.0		Amend to include VDSL2 frequencies up to 17.66 MHz	January 012
6.1		Corrigendum to Issue 6 Rev 0	Sept 2012
7.1		Exchange Launched VDSL2 initial proposal	July 2014
7.1 (Draft 2)		Corrections to Issue 7 Draft 1 (Table 2 Tech + Editorials) Amended to align with Industry Agreement of Nov 26th 2014.	December 2014
8.1		Expansion of Exchange Launched VDSL2 footprint.	June 2015
8.1		Open eir Re-branded documentation	October 2015
8.1.1		Correct version of Figure 4 from June 2015 included. Re-branding edits	September 2016
V9.0	Final	This document is based on V8 1.1 Implementation of Standardised Change Control.	07/06/2017