



# STIN 522

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## Suppliers' Trial Information Note

*For The BT Network*

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### **Long Reach VDSL (LR-VDSL) Trial Service & Interface Description**

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## **1. Service Outline**

### **1.1 General**

The information contained in this STIN relates to the trial of a potential change to engineering policy and practice. The publication of this STIN does not commit Openreach to a commercial launch of any new/changed service, nor does it commit Openreach to the particular implementation described within this document. Should Openreach decide to commence a roll-out of the trialled engineering implementation, the matters pertaining to this STIN will be reflected in an update to the relevant Suppliers Information Notes (SINs) and the publication of the necessary Service Provider Information Notes (SPINs).

It should be noted that the information contained within this STIN might be subject to change due to either the results of BT testing, or due to feedback from trial participants. Please check with the <http://www.btplc.com/sinet/> site to ensure you have the latest version of this document.

Further information regarding the trial can be obtained by contacting Alison Walpole ([alison.walpole@openreach.co.uk](mailto:alison.walpole@openreach.co.uk)), Openreach Product Line.

This STIN is a pointer document to Openreach SIN498 (GEA-FTTC Service and Interface Specification) [1] and highlights any deltas to SIN498 relating to Long Reach VDSL.

### **1.2 Service Availability**

Openreach are planning to run a technical trial of Long Reach VDSL (LR-VDSL) across a number of exchange areas. This trial will run from August 2016 and will be available in the locations announced via the Copper and Fibre Products Commercial Group and a list of sites will be maintained and updated on the CFPCG collaboration area.

In the trial locations, as a result of the potential degradation to ADSL services from application of LR-VDSL:

- CPs will need to cancel their SMPF services before they can take advantage of any trial special offer.
- CPs will not be able order SMPF on any of the Trial Cabinets but may order MPF subject to an acknowledgment that any ADSL service they want to offer will be impacted by LR-VDSL and that, in the circumstances, we strongly recommend they use GEA FTTC for broadband services.

## **2. Long Reach VDSL (LR-VDSL)**

LR-VDSL exploits existing features currently defined in ITU-T Recommendations (ITU-T Recommendation G.993.2 and G.993.5) to enable FTTC VDSL2 lines with a D-side length in excess of 1.25km (0.5mm diameter copper) to be uplifted to give a higher downstream rate. This uplift involves the following steps:

- 1) Changing the CAL (cabinet assigned loss) value of the FTTC cabinet from EdB to 0dB (where E is the CAL assigned to that cabinet) for lines still operating under 17a. Removing the CAL shaping for LR-VDSL2 lines so that no PSD shaping is applied to the downstream VDSL2 signals, other than the G.993.2 limits.

Note: As this is contrary to Part B of the current Access Network Frequency Plan (ANFP) [6], special dispensation has been received from Ofcom to enable LR-VDSL trials to be

deployed at specific locations. In order to prevent exchange based ADSL or ADSL2plus customers served via a cabinet selected for LR-VDSL being adversely affected, these lines must be migrated to an FTTC GEA service (either VDSL or LR-VDSL, depending on D-side insertion loss measured at 300kHz). This means that LR-VDSL can be safely deployed without adversely impacting exchange based services.

- 2) Enabling vectoring (i.e. dynamic crosstalk cancellation) to all lines on the cabinet. Vectoring is applied in the downstream direction only and will cancel crosstalk from 138kHz (i.e. the lowest downstream frequency used). Rogue line control will be used to remove any non-vector compatible modems from the vector group.
- 3) Deactivating and reactivating the lines to apply the changes.
- 4) Lines identified as being suitable for LR-VDSL will then have the appropriate LR-VDSL profile applied to enable them to offer higher downstream speeds.

## 2.1 LR-VDSL profiles

Profiles are used by the Element Management System (EMS) to configure various parameters on each DSLAM port (e.g. speed, noise margin, transmission mode etc.). Although there are in excess of 10,000 profiles available for GEA-FTTC, the LR-VDSL trial will only use a single profile.

The profile comprises the following elements:

**Line Template** – Defines which channel configuration profile and line configuration profile are to be used.

Profile	LR_D400_001R18_05U100_001R18_05
Channel Configuration profile	LR_D400_001R18_05U100_001R18_05
Line Configuration profile	LRdefault

**Table 1: Line Template Settings**

**Channel Configuration Profile** – Defines various parameters including maximum and minimum upstream and downstream line and data rates, retransmission settings etc. A single channel configuration profile will be used for the LR-VDSL trial (LR\_D400\_001R18\_05U100\_001R18\_05). This defines the following parameters:

Parameter	LR_D400_001R18_05U100_001R18_05	
	D/S	U/S
Maximum Line Rate	40Mbps	10Mbps
Minimum Line Rate	128kbps	128kbps
Retransmission	Enabled	Enabled
RTX_MODE	1	1
MAXNDR_RTX	40Mbps	10Mbps
MAXETR_RTX	40Mbps	10Mbps
Dmax	16ms	8ms
INPmin	8 symbols	8 symbols

INPMIN_REIN_RTX	1 symbol	1 symbol
DELAYMAX_RTX	18ms	18ms
INPMIN_SHINE_RTX	32 symbols	32 symbols
SHINERATIO_RTX (0.001)	5	5

**Table 2: Channel Configuration Parameter Settings**

**Line Configuration Profile** – Defines various parameters including noise margin. Also defines the spectrum configuration profile that is to be applied.

Parameter	LR_default	
	D/S	U/S
Adaption Mode	Adapt at start-up	Adapt at start-up
Bit Swap	Enabled	Enabled
Target SNR Margin	6dB	6dB
Maximum SNR Margin	31dB	31dB
Minimum SNR Margin	0dB	0dB
Transmission Mode	G.993.2 Annex B POTS	
Upstream Power back-off (UPBO)	N/A	Enabled
Spectrum Config Profile	LR_default	

**Table 3: Line Configuration Parameter Settings**

LR-VDSL lines will be configured for a default downstream target margin of 6dB. As part of the trials, some lines may be migrated to operate with lower target margins to determine what impact this has on speed and stability. This STIN will be updated to reflect any profile changes.

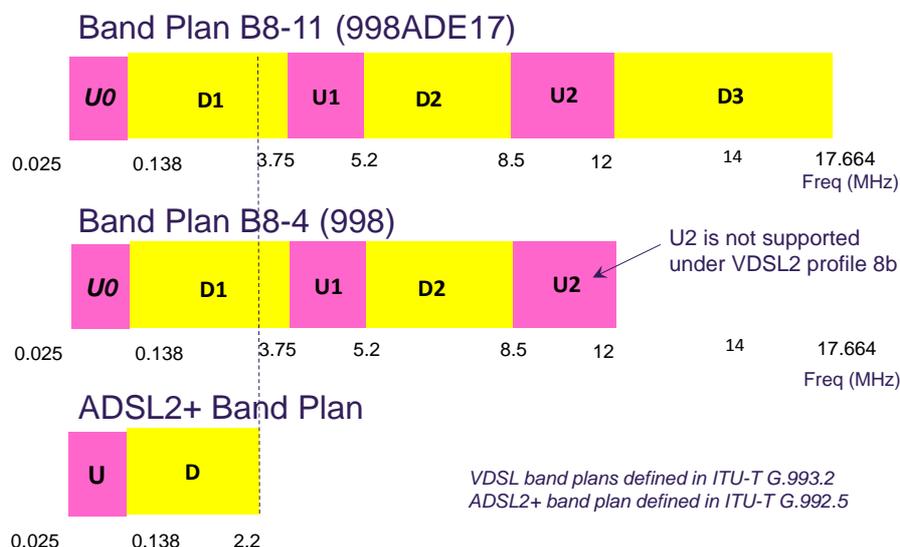
**Spectrum Configuration Profile** – Defines which band plan and which of the VDSL profiles defined in G.993.2 are to be applied. A single spectrum configuration profile will be used for the LR-VDSL trial (LR\_default).

Parameter	LR_default	
	D/S	U/S
G.993.2 Profile	G.993.2 Profile 8b	
Use of U0 band	Enabled	
PSD Class mask	Annex B 998 (B8-4)	
Selected Upstream PSD mask	ADLU-32/EU-32	
Maximum Nominal Aggregate Transmit Power	20.5dBm	14.5dBm

**Table 4: Spectrum Configuration Parameter Settings**

### 2.1.1 LR-VDSL Band Plan

Current GEA VDSL2 transmission systems use VDSL2 band plan 998ADE17 (B8-11) as defined in G.993.2 Annex B [2]. The band plan defines the various frequency bands that are used for upstream and downstream transmission and defines a maximum frequency of 17.664MHz. LR-VDSL shall use VDSL2 band plan 998 (B8-4) as defined in G.993.2 Annex B [2] which is spectrally compatible with the 998ADE17 band plan but defines a maximum frequency of 12MHz. These band plans are shown in Figure 1 along with the band plan for ADSL2+ as defined in ITU-T Recommendation G.992.5.



**Figure 1: Band Plans**

### 2.1.2 Aggregate Transmit Power

Current GEA VDSL2 transmission system have a maximum aggregate transmit power of 14.5dBm in both the upstream and downstream directions as defined in G.993.2 Profile 17a [2]. LR-VDSL shall have a maximum aggregate transmit power of 20.5dBm in the downstream direction and 14.5dBm in the upstream direction as defined in G.993.2 Profile 8b [2]. This also limits the maximum frequency that can be used for LR-VDSL to 8.5MHz (see Figure 1 and Table 5).

Parameter	Profile 8b	Profile 17a
Max Aggregate Transmit Power	D/S = 20.5dBm U/S = 14.5dBm	D/S = 14.5dBm U/S = 14.5dBm
Highest Supported Tone (Freq)	D/S = 1971 (8.5MHz) U/S = 1205 (5.2MHz)	D/S = 4095 (17.66MHz) U/S = 2782 (12MHz)
Support of US0 (25 to 138kHz)	Yes	Yes

**Table 5: VDSL2 Profiles (from G.993.2)**

The increased maximum aggregate transmit power and reduced frequency band enables the performance (i.e. downstream line rate) of longer lines to be improved – this is the basis for LR-VDSL.

## 2.2 LR-VDSL Line Selection

In order for a line to be selected for uplifting to LR-VDSL, the following criteria must be met:

- 1) The D-side insertion loss (measured at 300kHz) of the line shall be greater than 12.5dB and less than 40 dB (both measured at 300kHz). Lines with a loss lower than this will not benefit from LR-VDSL and will remain as a 17MHz vectored VDSL2 line.
- 2) The CP shall have confirmed to Openreach Product Line that they are prepared to participate in the trial activity.
- 3) The CP provided CPE shall support Profile 8b operation and vectoring as defined in G.993.2 [2] and G.993.5 [3].

## 2.3 LR-VDSL Rates

Customers uplifted to LR-VDSL shall receive a maximum service rate of 40Mbps downstream and 10Mbps upstream.

## 2.4 Retransmission

Physical layer retransmission (as defined in ITU-T Recommendation G.998.4 [4]) shall be applied in both the upstream and downstream directions.

## 2.5 Vectoring

Vectoring (i.e. “real time” crosstalk cancellation [3]) is required to ensure that the LR-VDSL signals do not adversely impact the existing VDSL2 signals. Vectoring shall be applied in the downstream direction starting from 138kHz . No vectoring is applied in the upstream direction. Modems which cannot support vectoring will be manually removed from the vectoring group.

## 2.6 Seamless Rate Adaptation

Seamless Rate Adaptation (SRA) may be applied to some of the LR-VDSL lines as part of the trial activity. If applied, this STIN will be updated to reflect any associated profile changes.

## 2.7 Dynamic Line Management

All LR-VDSL lines shall be specifically excluded from Dynamic Line Management (DLM) control. All lines will be monitored on a daily basis and any lines showing instability (ie high number of retrains or error counts) will be restored to their original 17MHz profile.

## 3. References

[1]	SIN498	Generic Ethernet Access Fibre to the Cabinet (GEA-FTTC) Service and Interface Description
[2]	G.993.2	“Very high speed digital subscriber line transceivers 2 (VDSL2)”, ITU-T Recommendation G.993.2
[3]	G.993.5	“Self-FEXT cancellation (vectoring) for use with VDSL2 transceivers”, ITU-T Recommendation G.993.5
[4]	G.998.4	“Improved impulse noise protection for digital subscriber line (DSL) transceivers”, ITU-T Recommendation G.998.4
[5]	G.992.5	“Asymmetric digital subscriber line 2 transceivers (ADSL2)- Extended bandwidth ADSL2 (ADSL2plus)”, ITU-T Recommendation G.992.5
[6]	ND1602	“Specification of the Access Network Frequency Plan (ANFP) applicable to transmission systems used on the BT Access Network”, NICC Document ND1602

For information on where to obtain these referenced documents, please see the document sources list at <http://www.btplc.com/sinet/>.

#### 4. **Abbreviations**

ADSL2plus	Asymmetric digital subscriber line 2 transceivers (ADSL2) - Extended bandwidth ADSL2 (ADSL2plus)
ANFP	Access Network Frequency Plan
CP	Communications Provider
D-side	Segment of access network extending from PCP to end-customers premise
dB	Decibel
DSLAM	Digital Subscriber Line Access Multiplexer
DLM	Dynamic Line Management
E-side	Segment of access network extending from exchange frame to PCP
FEXT	Far-end Crosstalk
FTTC	Fibre to the Cabinet
GEA	Generic Ethernet Access
ITU-T	International Telecommunication Union – Telecommunications Sector
LR-VDSL	Long Reach VDSL2
PCP	Primary Cross-connection Point (aka cabinet)
SIN	Suppliers’ Information Note (BT Publication)
SNR	Signal to Noise Ratio
STIN	Suppliers' Trial Information Note (BT Publication)

VDSL2	Very high speed Digital Subscriber Line (2 <sup>nd</sup> generation)
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## 5. History

<b>Issue</b>	<b>Date</b>	<b>Changes</b>
Issue 1.0	August 2016	First published.

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