Addendum to WBA VDSL2

Introduction of 552kHz Vectoring on vectored lines

Approved by BIPT on 10/11/2017 – Updated on 11/01/2018 with the final overview of selectable line profiles

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1. Purpose

The present addendum further improves VDSL2 performance. It introduces 552 kHz vectoring on vectored VDSL2 lines for all homogenized ROPs . It is the 5th and last addendum of the project "Vectoring in ADSL(2+) frequencies".

For more details on the rationale and the definitions used for the project "Vectoring in ADSL(2+) frequencies", reference is made to the addendum to the BROBA reference offer: "*Vectoring in ADSL(2+) frequencies – phase 1*" which has been approved by the BIPT on 21/10/2016.

The purpose of the present addendum is to address the impacts on the WBA VDSL2 reference offer of the introduction of 552 kHz downstream vectoring for homogenized ROPs (including DLM).

The deployment rules for downstream vectoring on homogenized ROPs will be broadened thanks to 552 kHz vectoring. See further in this addendum for more details.

As these improvements would have implied a large number of new line profiles to be added to the WBA VDSL2 reference offer, Proximus reviewed the current definition of the line profiles by having removed some secondary parameters. This also enabled the removal of many similar line profiles. The details of this have been approved by the BIPT on 03/08/2017 with the addendum "Line Profile numbering rationalization".
The present addendum already uses these newly defined line profiles.

2. Dependencies with other addenda

Some addenda related to this addendum have already been submitted to the BIPT:

- Addendum to WBA, "Vectoring in the frequency band 1,1MHz -2,2Mhz" for the 1,1 MHz vectoring zones 1, 2 & 3" (approved by the BIPT on 22/02/2017),
- Addendum to WBA, "Upstream vectoring phase 2 and introduction of the vectoring zones 4&5" (approved by the BIPT on 09/08/2017),
- See also the list of other relevant addenda on vectoring referenced in section 2 of the above mentioned addenda.

As explained above, the present addendum already uses the newly defined line profiles as described in the addendum "Line Profile numbering rationalization" which has been approved by the BIPT on 03/08/17.

3. Scope and planning

This addendum is applicable to the WBA VDSL2 services with shared and with dedicated VLANs, as described in the WBA VDSL2 reference offer.
The present addendum has been submitted for approval to the BIPT in order to become effective as from **20 February 2018** [1].

[1] Proximus might postpone this date in order to guarantee the quality of the deliverables

4. Vectoring general principle and new deployment rules

Reminder: the principle of vectoring is to cancel the cross-talk (FEXT) between different VDSL2 lines present in the same copper binder by injecting an anti-signal on each crosstalk-impaired VDSL2 line of the bundle. With no interference, each vectored VDSL2 line can operate at higher-speeds, downstream and upstream, as if it was the only line in the binder.

As from 20/02/2018, Proximus also targets to **improve VDSL2 provisioning *downstream* speeds on vectored lines** on homogenuous ROPs to reach a:

- Downstream Maximum Net Data Rate of **25 Mbps in 552 kHz vectoring zone 4**
- Downstream Maximum Net Data Rate of **20 Mbps in 552 kHz vectoring zone 5**

The downstream speeds in the 552 kHz vectoring zones 1 to 3 remain unchanged but the provisioning rules will be broadened.

All existing vectored lines of homogenized ROPs will be re-evaluated in order to get new downstream speeds based on these new 552 kHz provisioning rules and line capabilities. Note that the provisioning zone will be re-evaluated also for every line when the vectoring level of the ROP changes from 2,2 MHz vectoring to 552 kHz vectoring, or from 1,1 MHz vectoring to 552 kHz vectoring, based on these new 552 kHz provisioning rules.

The ***new* provisioning rules, applicable for all new VDSL2 lines** on homogenized ROPs provisioned as from 20/02/2018 onwards, are summarized in the table below which distinguishes four cases:

1. Non-vectored ROP/LEX (no changes, for reference only (see columns "Legacy")
2. Vectored ROP, with vectoring as from 2,2MHz (see columns "2,2 MHz vectoring"),
3. Vectored homogenized ROP, with vectoring as from 1,1MHz (see columns "1,1 MHz vectoring")
4. Vectored homogenized ROP, with vectoring as from 552kHz (see columns "552 kHz vectoring")

	Legacy		2,2MHz Vectoring		1,1MHz Vectoring		552kHz Vectoring	
Zone	Length	Att	Length	Att	Length	Att	Length	Att
1	400	0,4	900	0,4	900	0,5	900	0,5
2	700	0,7	1200	0,7	1200	0,7	1200	0.8
3	1000	1	1700	1	1800	1,1	1900	1,15
4	1400	1,4	2300	1,4	2300	1,4	2300	1,4
5	1600	1,6	2700	1,6	2700	1,6	2700	1,6

TODAY

OCT 2017

FEB 2018

Remarks:

- The novelties of the October 2017 release are explained in the confidential addendum "Upstream vectoring phase 2 and introduction of vectoring zones 4&5" which has been approved by the BIPT on 09/08/2017.

- The existing 2,2 MHz and 1,1 MHz vectoring profiles on homogenized ROPs will gradually disappear as they will be replaced with the new 552 kHz vectoring profiles created in the framework of this addendum.
- The present addendum has no impact on the lines connected on non vectored ROPs/LEXs nor on 2,2 MHz vectored non-homogenized ROPs.
- Both criteria, length and attenuation must be fulfilled to assign a specific Line Profile but for 552 kHz vectoring, similarly to 2,2 MHz vectoring and 1,1 MHz vectoring, the "length" values have been set very high as attenuation and not distance is the main provisioning criterion for vectored lines.

5. New vectoring provisioning & repair profiles

New WBA VDSL2 lines eligible for 552 kHz vectoring and fulfilling the vectoring deployment rules as described in this addendum will get the new **vectoring line profile**, communicated through the standard line profile communication process (XML BGCOUT12).

In case of perturbation on the vectored line itself or on neighbouring lines, the vectoring provisioning line profile can be downgraded to one of the associated vectoring repair profiles defined for each vectoring zone.
The table below shows which are the main profiles applicable for each zone.

Table explanation:

Each cell contains 3 values:
- Left value: indicator for 2,2MHz vectoring
- Center value: indicator for 1,1MHz vectoring
- Right value: indicator for 552 kHz vectoring

Possible indicator values:
- "P": Provisioning profile
- "R": Repair profile
- "-": Not usable in the concerned zone

Downstream Maximum Net Data Rate	Upstream Maximum Net Data Rate	Zone 1	Zone 2	Zone 3	Zone 4	Zone 5
70 Mbps	30 Mbps	P/P/P	-/-/-	-/-/-	-/-/-	-/-/-
70 Mbps	20 Mbps	R/R/R	-/-/-	-/-/-	-/-/-	-/-/-
70 Mbps	15 Mbps	R/R/R	-/-/-	-/-/-	-/-/-	-/-/-
50 Mbps	15 Mbps	R/R/R	P/P/P	-/-/-	-/-/-	-/-/-
50 Mbps	10 Mbps	R/R/R	R/R/R	-/-/-	-/-/-	-/-/-
50 Mbps	6 Mbps	R/R/R	R/R/R	-/-/-	-/-/-	-/-/-
50 Mbps	5 Mbps	R/R/R	R/R/R	-/-/-	-/-/-	-/-/-
30 Mbps	10 Mbps	R/R/R	R/R/R	P/P/P	-/-/-	-/-/-
30 Mbps	5 Mbps	R/R/R	R/R/R	R/R/R	-/-/-	-/-/-
30 Mbps	3 Mbps	R/R/R	R/R/R	R/R/R	-/-/-	-/-/-
25 Mbps	2 Mbps	-/-/R	-/-/R	-/-/R	-/-/P	-/-/-
22 Mbps	2 Mbps	-/R/R	-/R/R	-/R/R	-/P/R	-/-/-
20 Mbps	3 Mbps	R/R/R	R/R/R	R/R/R	-/-/-	-/-/-
20 Mbps	1,5 Mbps	-/-/R	-/-/R	-/-/R	-/-/R	-/-/P
18 Mbps	2Mbps	R/R/R	R/R/R	R/R/R	P/R/R	-/-/-
18 Mbps	1,5 Mbps	-/R/R	-/R/R	-/R/R	-/R/R	-/P/R
16,5 Mbps	2Mbps	R/R/R	R/R/R	R/R/R	R/R/R	-/-/-
14,5 Mbps	2 Mbps	R/R/R	R/R/R	R/R/R	R/R/R	-/-/-
12 Mbps	1,5 Mbps	R/R/R	R/R/R	R/R/R	R/R/R	P/R/R

6. DLM process

The purpose of the present addendum is also to apply the DLM process on the 552 kHz vectoring profiles in the newly defined "552 kHz vectoring zones".

The DLM (Dynamic Line Management) process for the new 552kHz vectoring zones is identical to the DLM process applicable for the existing vectoring zones as already explained in previously approved addenda.

Whilst the maximum "up to" speeds will not increase in the new 552kHz vectoring zones, the VDSL2 lines equipped with a whitelisted vector-compliant modem have a much higher probability to reach a higher bitrate, especially for the lines on homogenized ROPs with endpoints located in the new 552kHz vectoring zones 4 & 5.

7. List of line profiles

No new line profiles had to be created in the framework of the present addendum.
The new deployment rules applicable to 552 kHz vectoring will re-use speeds and line profiles which have been introduced with the addenda "Line Profile numbering rationalization" and "Upstream vectoring phase 2 and introduction of the vectoring zones 4&5".

Although engineering design is not entirely finished yet, Proximus can already today reasonably assume that the 342 line profiles as defined in these addenda will be available as from 20/02/2018[2] for VDSL2-lines on homogenized ROPs equipped with a whitelisted vector-compliant modem.

In case of any change, the definitive number and parameters of the applicable line profiles will be communicated by Proximus **at the latest 6 weeks before the launch date of the service**.

8. Ordering and provisioning process

The new provisioning line profiles do not have any impact on the ordering process, nor on the communication flows during ordering and provisioning of new WBA VDSL2 lines: no new XML, no new action type, and no new fields in the XML messages.

More specifically the communication of the new Vectoring Provisioning Line Profiles will be performed through the XML BGCOUT9, BGCOUT10 & BGCOUT12 messages and remains unchanged.

[2] Proximus might postpone this date in order to guarantee the quality of the deliverables

9. Borderline cases

The new 552 kHz vectoring deployment rules mainly use the documented attenuation of lines connected to vectored homogenized ROPs in order to determine the 552 kHz vectored zone to which the line belongs. Because the attenuation thresholds for the 552 kHz vectored zones are defined to higher values, this operation will increase the number of VDSL2 lines on homogenized ROPs eligible for better provisioning profiles.

As the new vectoring deployment rules are only used for newly provisioned VDSL2 lines on vectored homogenized ROPs after 20/02/2018, an opportunity exists to reassess with the new "vectoring deployment rules table" all existing VDSL2 lines on homogenized ROPs equipped with a whitelisted vector-compliant modem that are:

1. provisioned on a 1,1MHz or 2,2MHz vectored homogenized ROP before 20/02/2018;
2. or provisioned on a ROP before the activation of 552 kHz vectoring on that ROP.

Therefore, as from 20/02/2018, a reassessment will be performed of the WBA VDSL2 lines connected on 1,1MHz and 2,2MHz vectored homogenized ROPs which are equipped with a whitelisted vector-compliant modem.

Information will be provided through the standard "planned works" process, in e-TS (Netevent), listing all ROP-related border lines per OLO, at least 48 hours in advance.

Targeted service interruption per customer is estimated to 3 minutes.

- Intervention window:
  - Monday 00h00 – 06h00 AM.
  - Tuesday – Friday: 6h – 7h15 AM.

More specifically, the communication of the new Vectoring Provisioning Line Profiles will be performed with BGCOUT12 XML messages and remains unchanged.

10. Other operational impacts

10.1 E-tools

10.1.1 XDSL availability tool (web interface)

The XDSL availability tool will provide the maximum downstream/upstream Maximum Net Data rate associated with the new vectoring provisioning line profile on a specific address or existing line by returning the new maximum downstream/upstream Maximum Net Data rate (see above the summary table with the new deployment rules).

10.1.2 XDSL availability tool (XML interface)

The (new) maximum upstream and downstream Maximum Net Data rate (where applicable) will be returned in the same way as today in the XML-pre-qualification response.
The new DLM line profiles **do not have any impact on the XDSL availability tool (web interface and XML interface).**

10.2 Delivery, repair & e-troubleshooting

The new line profiles will be delivered under the same conditions as the WBA VDSL2 product.
The repair & e-troubleshooting procedures remain unchanged .

10.3 TBF

The communication of the new line profiles through the TBF XML remains unchanged.
Launching a TBF on a line configured with a DLM profile does not change the applied DLM profile unless there are transmission quality errors and/or stability problems after the resynchronisation in which case the corresponding provisioning profile will be reconfigured as first step.

10.4 DLM

Proximus will as from 20/02/2018 continue to combine the effect of DLM and vectoring on VDSL2 lines located in Vectoring zones (as described above).

10.5 Pricing

No impact on WBA-VDSL2 pricing.

11. Adaptation on WBA documents

The sections of the WBA offer documents which are impacted by this Addendum are indicated in the subsequent paragraphs (changes are highlighted in green). Those adaptations refer to the consolidated version of the WBA VDSL2 reference offer (version 14), published on the Proximus website, at http://www.proximuswholesale.be/en/id_wba_vdsl2/public/access/regulated-services/wba-vdsl-2.html. Those adaptations already include the changes documented in the previous addenda which have not been integrated yet in this version 14:

- Addendum "Vectoring in the frequency band 1,1MHz -2,2Mhz" for the 1,1 MHz vectoring zones 1, 2 & 3": changes are highlighted in grey,
- Addendum "Line Profile numbering rationalization": changes are highlighted in yellow,
- Addendum "Upstream vectoring phase 2 and introduction of the vectoring zones 4&5": changes are highlighted in turquoise.

WBA Main Body

In section 4.12. "VDSL2 deployment rules" the tables applicable to End-User lines connected to a LEX or LDC or connected to a non-vectored ROP, or connected to a vectored ROP must be updated as follows :

For VDSL2 End-User lines connected to a LEX or LDC or connected to a non-vectored ROP:

No change compared with the values proposed in the chapter 7 of the addendum "Line Profile numbering rationalization" approved by the BIPT on 03/08/2017.

For VDSL2 End-User lines connected to a vectored ROP with 2,2 Mbps Vectoring activated:

$Att_{Loop\ [dB]}$	$Length_{Loop\ [m]}$	Line Profile name
<0,4	<900	~~LP042~~ LP040[3]
<0,7	~~<1000~~ <1.200	~~LP087~~ LP085[4]
<1	~~<1.400~~ <1.700	~~LP138~~ LP135[5]
<1,4	~~<1.400~~ <2.300	~~LP304~~ LP196
<1,6	~~<1.600~~ <2.700	~~LP323~~ LP225
<0,6	<600	LP275[6]
<0,6	<600	LP288[7]
<1	<1.000	LP329

[3] Vectoring Provisioning profiles or subsequent repair profiles will be configured on End-User lines equipped with a (whitelisted) vector-compliant CPE. Lines equipped with a vector-friendly CPE will be configured with a legacy provisioning profile or a subsequent repair profile.

[4] Vectoring Provisioning profiles or subsequent repair profiles will be configured on End-User line equipped with a (whitelisted) vector-compliant CPE. Lines equipped with a vector-friendly CPE will be configured with a legacy provisioning profile or a subsequent repair profile.

[5] Vectoring Provisioning profiles or subsequent repair profiles will be configured on End-User line equipped with a (whitelisted) vector-compliant CPE. Lines equipped with a vector-friendly CPE will be configured with a legacy provisioning profile or a subsequent repair profile.

[6] The profile ~~LP715~~ LP275 (and the related profiles ~~LP716~~ LP276, ~~LP717~~ LP288, ~~LP718~~ LP300) enable OLOs to offer a WBA service with higher upstream. These profiles will only be provisioned if the OLO made a specific request to order the "WBA VDSL2 high Upstream" product. The details on ordering are available in the "WBA VDSL2 XML content description" document, on the OLO personal page.

[7] The profile ~~LP717~~ LP288 (and the related profiles ~~LP718~~ LP300 & ~~LP740~~ LP329) enables OLOs to offer a WBA service with symmetric profiles. These profiles will only be provisioned if the OLO made a specific request to order the "WBA VDSL2 symmetric" product. The details on ordering are available in the "WBA VDSL2 XML content description" document, on the OLO personal page.

For VDSL2 End-User lines connected to a vectored homogenized ROP with 1,1 Mbps Vectoring activated (*)

$Att_{Loop\ [dB]}$	$Length_{Loop\ [m]}$	Line Profile name
<0,5	<900	~~LP042~~ LP040[3]
<0,7	~~<1000~~ <1.200	~~LP087~~ LP085[4]
<1,1	~~<1.400~~ <1.800	~~LP138~~ LP135[5]
<1,4	~~<1.400~~ <2.300	~~LP304~~ LP172
<1,6	~~<1.600~~ <2.700	~~LP323~~ LP197
<0,6	<600	LP275[6]
<0,6	<600	LP288[7]
<1	<1.000	LP329

(*) "These deployment rules are only applicable for new lines provisioned as from 01/07/2017 onwards on ROPs that became activated for 1,1 MHz Vectoring."

For VDSL2 End-User lines connected to a vectored homogenized ROP with 552 kHz Vectoring activated (*)

$Att_{Loop\ [dB]}$	$Length_{Loop\ [m]}$	Line Profile name
<0,5	<900	LP040[3]
<0,8	<1.200	LP085[4]
<1,15	<1.900	LP135[5]
<1,4	<2.300	LP160
<1,6	<2.700	LP185
<0,6	<600	LP275[6]
<0,6	<600	LP288[7]
<1	<1.000	LP329

(*) "These deployment rules are only applicable for new lines provisioned as from 20/02/2018 onwards on homogenized ROPs that might already be activated for 1,1 MHz Vectoring."

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