International Telecommunication Union

ITU-T

TELECOMMUNICATION
STANDARDIZATION SECTOR
OF ITU

G.993.5

Amendment 5

(04/2014)

SERIES G: TRANSMISSION SYSTEMS AND MEDIA, DIGITAL SYSTEMS AND NETWORKS

Digital sections and digital line system – Metallic access networks

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Self-FEXT cancellation (vectoring) for use with VDSL2 transceivers

Amendment 5: Exchange of transceiver IDs during initialization

Recommendation ITU-T G.993.5 (2010) – Amendment 5

International Telecommunication Union

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Recommendation ITU-T G.993.5

Self-FEXT cancellation (vectoring) for use with VDSL2 transceivers

Amendment 5

Exchange of transceiver IDs during initialization

Summary

Amendment 5 to Recommendation ITU-T G.993.5 (2010) covers the following functionality:

- Exchange of transceiver IDs during initialization to avoid two VTU-Rs operating with the same upstream pilot sequence (new functionality).

History

Edition	Recommendation	Approval	Study Group	Unique ID*
1.0	ITU-T G.993.5	2010-04-22	15	11.1002/1000/10414
1.1	ITU-T G.993.5 (2010) Cor. 1	2011-06-22	15	11.1002/1000/11128
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1.3	ITU-T G.993.5 (2010) Cor. 2	2012-06-13	15	11.1002/1000/11643
1.4	ITU-T G.993.5 (2010) Amd. 2	2012-10-29	15	11.1002/1000/11796
1.5	ITU-T G.993.5 (2010) Amd. 3	2013-04-22	15	11.1002/1000/11889
1.6	ITU-T G.993.5 (2010) Amd. 4	2013-08-29	15	11.1002/1000/11993
1.7	ITU-T G.993.5 (2010) Amd. 5	2014-04-04	15	11.1002/1000/12095

* To access the Recommendation, type the URL http://handle.itu.int/ in the address field of your web browser, followed by the Recommendation's unique ID. For example, http://handle.itu.int/11.1002/1000/11830-en.

FOREWORD

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The World Telecommunication Standardization Assembly (WTSA), which meets every four years, establishes the topics for study by the ITU-T study groups which, in turn, produce Recommendations on these topics.

The approval of ITU-T Recommendations is covered by the procedure laid down in WTSA Resolution 1.

In some areas of information technology which fall within ITU-T's purview, the necessary standards are prepared on a collaborative basis with ISO and IEC.

NOTE

In this Recommendation, the expression "Administration" is used for conciseness to indicate both a telecommunication administration and a recognized operating agency.

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As of the date of approval of this Recommendation, ITU had not received notice of intellectual property, protected by patents, which may be required to implement this Recommendation. However, implementers are cautioned that this may not represent the latest information and are therefore strongly urged to consult the TSB patent database at http://www.itu.int/ITU-T/ipr/.

Recommendation ITU-T G.993.5

Self-FEXT cancellation (vectoring) for use with VDSL2 transceivers

Amendment 5

Exchange of transceiver IDs during initialization

1 Exchange of transceiver IDs during initialization (new functionality)

Add new clause 10.2.1 as follows:

10.2 ITU-T G.994.1 handshake phase

...

10.2.1 Avoidance of false initialization in a crosstalk environment

The functionality defined in this clause prevents one VTU-O from establishing communication with two VTU-Rs. Such communication would lead to two VTU-Rs sending the same upstream pilot sequence, with potential negative impact on the VCE learning the upstream channel matrix.

Support of this functionality is optional for the VTU-O and is optional for the VTU-R. If supported, the functionality shall be implemented as defined in this clause.

In the ITU-T G.994.1 identification field, two parameters are defined for the exchange of transceiver IDs (see [ITU-T G.994.1] Table 9.14, Tables 9.14.1.x, and Tables 9.14.2.x):

– Network side transceiver ID Spar(2) with associated 30-bit NPar(3) parameter;

– Remote side transceiver ID Spar(2) with associated 30-bit NPar(3) parameter;

The network side transceiver ID is the VTU-O ID. The VTU-O ID shall be generated by the VTU-O.

The remote side transceiver ID is the VTU-R ID. The VTU-R ID shall be generated by the VTU-R.

The 30-bit VTU ID shall consist of 2 parts:

– A first part (the MSBs) derived from the serial number and vendor ID.

– A second part (the LSBs) using a random number generator.

The first part has a length of 16 bits and shall be calculated as the 16-bit HDLC frame check sequence (FCS), as specified in clause 6.3.4 of [ITU-T G.997.1], of the VTU vendor ID and the VTU serial number.

The FCS shall be calculated over all bits of the VTU vendor ID followed by the VTU serial number.

The FCS shall be calculated starting with bit 1 (LSB) of octet 1. The octets shall follow each other in ascending numerical order. Within an octet, the bits shall follow each other in ascending numerical order.

The register used to calculate the CRC shall be initialized to the value $FFFF_{16}$.

The VTU vendor ID shall consist of the T.35 country code (2 octets) followed by the provider code (4 octets), as indicated in the Vendor ID information block during the ITU-T G.994.1 handshake phase of initialization (see Table 7 of [ITU-T G.994.1]).

NOTE 1 – This is excluding the "Vendor-specific information" of the Vendor ID information block.

The VTU-O serial number shall be the ITU-T G.997.1 XTU-C serial number (see clause 7.4.7 of [ITU-T G.997.1]).

The VTU-R serial number shall be the equipment serial number that is part of the ITU-T G.997.1 XTU-R serial number (see clause 7.4.8 of [ITU-T G.997.1]).

NOTE 2 – This is excluding the equipment model and the equipment firmware version that are also part of the ITU-T G.997.1 XTU-R serial number.

The second part has a length of 14 bits and shall be generated by the VTU by means of a vendor discretionary random number generator. The randomly generated number shall change from one ITU-T G.994.1 session to the next.

If a transceiver sends any of the messages listed in Table 10-a, that message shall include the transceiver IDs as listed in Table 10-a. The "M" denotes "mandatory", the "CO" denotes "conditionally optional" and the "CM" denotes "conditionally mandatory", with the condition being that the far-end transceiver ID is included if and only if it has been received in a previous message during the same ITU-T G.994.1 session.

Table 10-a – Transceiver IDs included in ITU-T G.994.1 and initialization messages

	VTU-O ID	**VTU-R ID**
CLR	-	M
CL	M	CO
MP	CM	M
MS from VTU-O	M	CM
MS from VTU-R	CM	M
O-SIGNATURE	-	CM

If the VTU-R receives a CL or MS message that contains a VTU-R ID different from the VTU-R ID sent in the CLR message, then the VTU-R shall respond with a NAK-CD message followed by the ITU-T G.994.1 session cleardown procedure specified in clause 11.3 of [ITU-T G.994.1].

If the VTU-O receives an MP or MS message that contains a VTU-O ID different from the VTU-O ID sent in the CL message, then the VTU-O shall respond with a NAK-CD message followed by the ITU-T G.994.1 session cleardown procedure specified in clause 11.3 of [ITU-T G.994.1].

If the VTU-R receives an O-SIGNATURE message that contains a VTU-R ID different from the VTU-R ID sent in the CLR message, then the VTU-R shall return to the R-SILENT state.

If the VTU-R receives an O-SIGNATURE message that contains a VTU-R ID equal to the VTU-R ID sent in the CLR message, then communication has been established only among transceivers with acknowledged transceiver IDs and initialization shall proceed as defined in clause 10.3.

NOTE 3 – The VTU-R transceiver ID is included in O-SIGNATURE to avoid false detection in the case of a VTU-O that decides to interrupt the communication during O-P-VECTOR-1.

NOTE 4 – Even if communication has been established only among transceivers with acknowledged Transceiver IDs, the resulting communication may be over a crosstalk path (i.e., not the direct path). If this should occur, the integrity of the upstream channel matrix is not compromised during the R-P-VECTOR 1 phase of channel discovery, since the VCE will see unique upstream pilot sequences on each initializing line.

The VTU-O shall ensure that the ITU-T G.994.1 message sequence allows both the VTU-O and the VTU-R to get acknowledgement of their transceiver ID during the ITU-T G.994.1 session. Table 10-b lists examples of such ITU-T G.994.1 message sequences.

Table 10-b – Examples of ITU-T G.994.1 transaction sequences

Example nr	ITU-T G.994.1 message sequence
1	Transaction C: CLR → CL → ACK(1) Transaction D: MP → MS → ACK(1)
2	Transaction C: CLR → CL → ACK(1) Extended Transaction A:B: MS → REQ-MR → MR → MS → ACK(1)
3	Transaction C: CLR → CL (including the VTU-R ID) → ACK(1) Transaction A: MS → ACK(1)
4	Transaction C: CLR → CL (including the VTU-R ID) → ACK(1) Transaction B: MR → MS → ACK(1)

Add a row in Table 10-1 and add paragraph at end of clause 10.3.2.1 as follows:

10.3.2.1 O-SIGNATURE

…

Table 10-1 – ITU-T G.993.5 parameter field A in message O-SIGNATURE

Field	Content of field	Format
1	ITU-T G.993.5 parameter field length	1 byte
2	Vectored downstream bands	Bands descriptor
3	Upstream pilot sequence length	2 bytes
4	Upstream pilot sequence	(1-64) bytes
5	Upstream sync symbol offset	1 bytes
6	Upstream R-P-VECTOR 1 PSD cutback	1 bytes
7	Downstream sync symbol counter modulo value (*N_SSC*)	2 bytes
8	VCE vendor ID and version number	10 bytes
9	VTU-R ID	4 bytes

…

Field #9 "VTU-R ID", contains the 30-bit transceiver ID of the VTU-R (with the 2 MSBs of this field set to 00_2). If the VTU-O has received the VTU-R ID during the last previous ITU-T G.994.1 session, then this field shall contain that VTU-R ID, otherwise this field shall be set to 00000000_{16}.

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