Video Surveillance Plugtests; Sophia-Antipolis, France; 7-9 April 2025

Keywords
Testing

ETSI

650 Route des Lucioles
F-06921 Sophia Antipolis Cedex - FRANCE

Tel.: +33 4 92 94 42 00 Fax: +33 4 93 65 47 16

Siret N° 348 623 562 00017 - NAF 742 C
Association à but non lucratif enregistrée à la
Sous-Préfecture de Grasse (06) N° 7803/88

Important notice

Individual copies of the present document can be downloaded from:
http://www.etsi.org

The present document may be made available in more than one electronic version or in print. In any case of existing or perceived difference in contents between such versions, the reference version is the Portable Document Format (PDF). In case of dispute, the reference shall be the printing on ETSI printers of the PDF version kept on a specific network drive within ETSI Secretariat.

Users of the present document should be aware that the document may be subject to revision or change of status. Information on the current status of this and other ETSI documents is available at

http://portal.etsi.org/tb/status/status.asp

If you find errors in the present document, please send your comment to one of the following services:
http://portal.etsi.org/chaircor/ETSI_support.asp

Copyright Notification

No part may be reproduced except as authorized by written permission.
The copyright and the foregoing restriction extend to reproduction in all media.

© European Telecommunications Standards Institute 2024.
All rights reserved.

DECT™, **PLUGTESTS**™, **UMTS**™ and the ETSI logo are Trade Marks of ETSI registered for the benefit of its Members.
3GPP™ and **LTE**™ are Trade Marks of ETSI registered for the benefit of its Members and of the 3GPP Organizational Partners.
GSM® and the GSM logo are Trade Marks registered and owned by the GSM Association.

Contents

Intellectual Property Rights

IPRs essential or potentially essential to the present document may have been declared to ETSI. The information pertaining to these essential IPRs, if any, is publicly available for **ETSI members and non-members**, and can be found in ETSI SR 000 314: *"Intellectual Property Rights (IPRs); Essential, or potentially Essential, IPRs notified to ETSI in respect of ETSI standards"*, which is available from the ETSI Secretariat. Latest updates are available on the ETSI Web server (http://ipr.etsi.org).

Pursuant to the ETSI IPR Policy, no investigation, including IPR searches, has been carried out by ETSI. No guarantee can be given as to the existence of other IPRs not referenced in ETSI SR 000 314 (or the updates on the ETSI Web server) which are, or may be, or may become, essential to the present document.

1 Executive Summary

ETSI, with the support of the PowerEOC Alliance and the ETSI TC ATTM, has organized the first Video Surveillance Plugtests™. This event was held at ETSI in Sophia Antipolis, France, from 07 to 09 April 2025.

The objective of this Plugtests on "IP Video Surveillance systems by enabling the transmission of IP data over coaxial cable infrastructures" was to confirm the full interoperability of these systems.

The testing plan provided, was adapted from a selection of tests from PowerEOC Alliance, and will be contributed to the upcoming position paper ETSI GR OEU 042. It covers testing of the following ETSI specifications:

- ETSI TS 105 176-2 on "Ethernet and power over coaxial cables for IP video surveillance"
- ETSI TR 105 177 on "Benefit Analysis of Ethernet and power over coaxial cables - IP Video Surveillance Case Studies

Test Equipment vendors were offered to participate and to provide tools and additional testing.

9 organizations from Europe, North America and Asia, had the opportunity to connect their equipment to the test infrastructure and validate the interoperability and conformity of their market solutions using different scenarios. In addition, 4 organizations participated as observers. In total, 18 organizations were involved in the Plugtests.

2 References

The following base specifications were partly validated in the Plugtests event.

[i.1] ETSI TS 105 176-2 on "Ethernet and power over coaxial cables for IP video surveillance"

[i.2] ETSI TR 105 177 on "Benefit Analysis of Ethernet and power over coaxial cables - IP Video Surveillance Case Studies

3 Abbreviations

1901 STA	IEEE 1901 Station
BM	BSS Manager
BSS	Basic Service Set
CCo	Central Coordinator
CRC	Cyclic Redundancy Check
DHCP	Dynamic Host Configuration Protocol
DUT	Device Under Test
DUT_NET_UI	Device Under Test Network User Interface

E&POC	Ethernet and Power over Coax as defined in [i.3]
E&POC BSS	E&POC Basic Service Set
E&POC STA	E&POC Station
eDEV	E&POC Edge Device
eSTA	E&POC Edge Station
eSYS	Edge System
FUNC	Functional test
HD	High Definition
HPAV	HomePlugAV
IP	Internet Protocol
IPoC	IP over Coax
LAN	Local Area Network
NN	Neighbor Network
NNI	Neighbor Network Interference
PERF	Performance Test
PoC	Power over Coax
PS	Power Segment
rDEV	E&POC Receiver Device
REF_CABLE	Reference Cable
REF_CAM	Reference Camera
REF_DEV	Reference Device
REF_eDEV	Reference Edge Device
REF_eSYS	Reference Edge System
REF_NET_UI	Reference Network User Interface
REF_rDEV	Reference Receiver Device
REF_VMS	Reference Video Management Software
rSTA	E&POC Receiver Station
RTP	Real-time Transport Protocol
SD	Standard Definition
STA	Station
STD_REF_DEV	Standard Reference Device
STD_REF_NET_UI	Standard Reference Network User Interface
TBD	To Be Defined
TCP	Transmission Control Protocol
U_BM	Unassociated BSS Manager
U_CCo	Unassociated Central Coordinator
UDP	User Datagram Protocol
UI	User Interface
UIS	User Interface Station
VMS	Video Management Software

4 Participants

25 people participated in the first Video Surveillance Plugtests™ event

6 Countries represented – geographical split:

- 80% EU: France (76%) and Germany
- 20% Outside EC: Republic of Korea, Singapore, Taiwan, Province of China and United States of America.

Types of organizations:

- Larger Enterprises: 40%
- SMEs: 30%
- Others 30%

Participating organizations in the Plugtests who signed the Rules of Engagement (RoE) and Non-Disclosure Agreement (NDA) are listed below:

Role	Organisation Name
Experts	LANPARK
Observer	CODAGE
Observer	EVDI
Observer	RATP
Observer	SEVISY
Partner	EG4U
Support	CAE GROUPE
Support	WAVETEL
Vendor	AEM - Precision Cable Test

Role	Organisation Name
Vendor	AETEK Inc.
Vendor	HIKVISION
Vendor	Intercoax
Vendor	KBC Networks
Vendor	KYOLIS
Vendor	LEA Networks
Vendor	M2M Factory
Vendor	ROBERT BOSCH GmbH
Vendor	Videoconseil

Table 1: List of organizations

5 Scope of the event

5.1 Objectives

The objective of this Plugtests on "IP Video Surveillance systems by enabling the transmission of IP data over coaxial cable infrastructures" was to confirm the full interoperability of these systems.
The testing provided was based on the ETSI GR OEU 042 and addressed the following ETSI specifications:

ETSI TS 105 176-2 on "Ethernet and power over coaxial cables for IP video surveillance"

ETSI TR 105 177 on "Benefit Analysis of Ethernet and power over coaxial cables - IP Video Surveillance Case Studies

ETSI published the specification for an Ethernet & Power over Coax technology promoting the development of interoperable Ethernet & Power over Coax solutions for Video Surveillance in June 2019 under the reference TS 105 176-2 V1.1.1 (2019-06).

Based on this specification, the PowerEOC Alliance (see power-eoc.org) has been formed to promote this technology and manage a certification program allowing manufacturer to certify their solutions. This certification program allows end users to choose compliant and interoperable products regardless of the selected supplier. The list of certified products can be found here: https://power-eoc.org/certified-products.

Evolutions of this standard, based on the Returns of Experience from real deployments, are currently under study by the technical working group of the PowerEOC Alliance.

One of them concerns the improvement of the security of the deployed systems while maintaining the interoperability of the solutions. Another one concerns the power management of the terminals, which needs to be standardized between manufacturers.

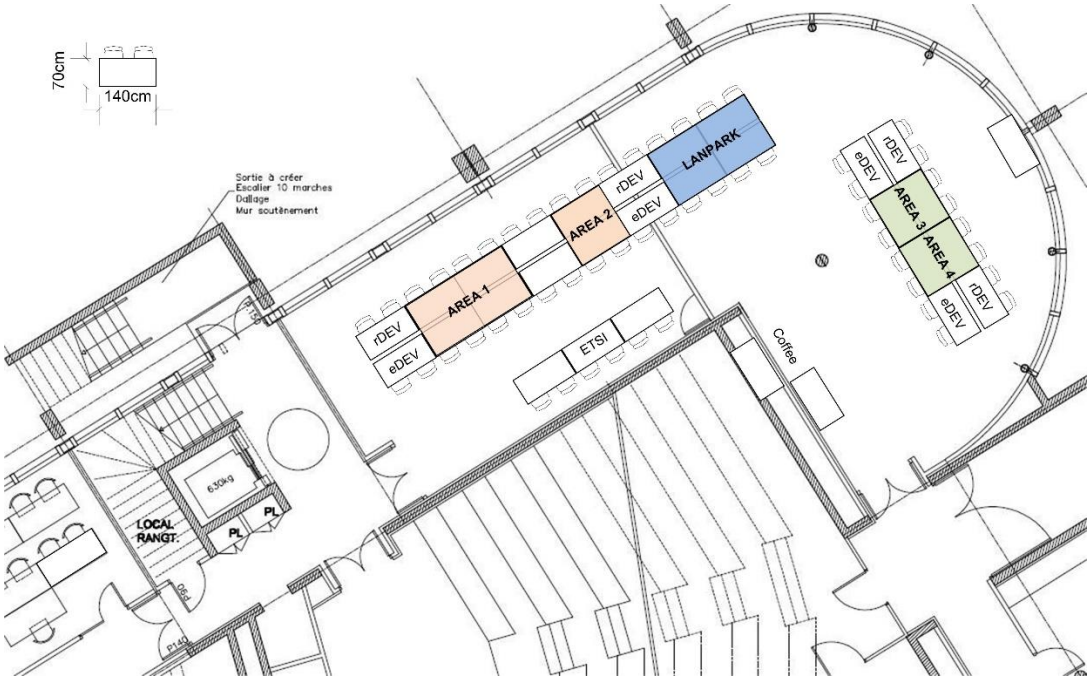
The objectives of this ETSI Plugtests™ were therefore to evaluate the interoperability of the implemented new functionalities from the different manufacturers and the levels of performance of the new mechanisms.

5.2 Description

5.2.1 General

The Plugtests room was located in the ETSI premises.

4 areas were prepared for running different set-ups, including traffic generators and different lengths and types of cables.



5.2.2 Plugtests Schedule

Monday 07 April	Tuesday 08 April	Wednesday 09 April
Set-up B2-B3 **9:00 - 13:00** **Welcome Presentation 11:00**	**Plugtests Room B2-B3** **Tests Session 1** **9:00 - 13:00**	**Plugtests Room B2-B3** **Tests Session 3** **9:00 - 13:00**
Plugtests Room B2-B3 Pretesting **14:00-17:30**	**Plugtests Room B2-B3** **Tests Session 2** **14:00-18:00**	**Plugtests Room B2-B3** **Demos Preparation** **16:00-18:00**

5.3 Testing

5.3.1 Test Plan

The Plugtests Test plan is based on the internal PowerEOC certification test plan.

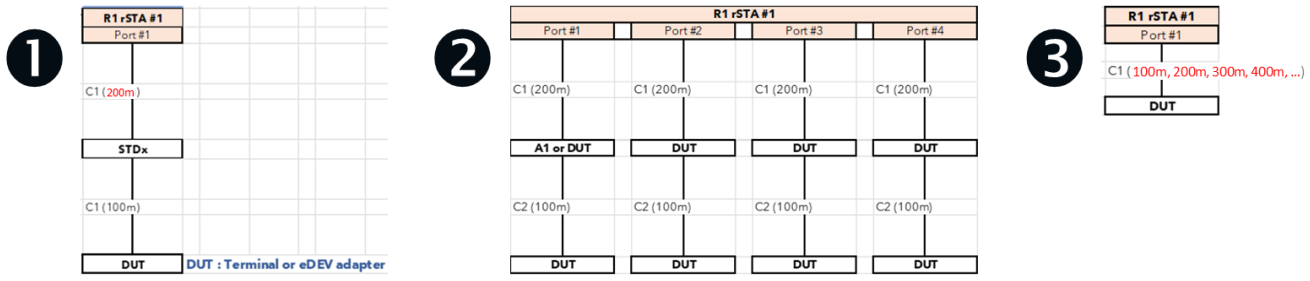
Due to logistics and time constraints, the tests are restricted to a subset of interoperability and data transmission tests cases:

- [INT_1] Communication Mode Compliancy & Network Password
- [INT_2] E&POC System and BSS establishment
- [INT_3] E&POC System Communication
- [INT_14] Adapter eDEV throughput capability - Minimum TX rate in presence of multiple reference eDEVs
- [INT_15] Terminal eDEV throughput capability - Minimum TX rate in presence of multiple reference eDEVs
- [INT_16] Hot-Plug Support – Adding an Adapter eDEV (as a DUT)
- [INT_17] Hot-Plug Support – Adding a Terminal eDEV (as a DUT)
- [DATA_5] Throughput capability with an Adapter eDEV - Minimum unitary TX rate
- [DATA_6] Throughput capability with Adapters eDEV - Minimum TX rate in presence of Multiple DUTs
- [DATA_7] Throughput capability with an Adapter eDEV – Multi-stream capability
- [DATA_8] Throughput capability with Terminals eDEV - Minimum TX rate in presence of Multiple DUTs
- [DATA_9] Throughput capability with a Terminal eDEV – Multi-stream capability

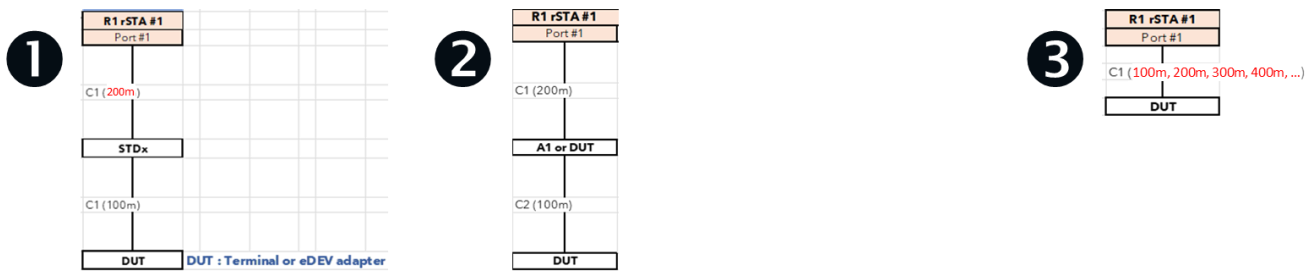
5.3.2 Test Set-ups

Test ID		Test Set-up
[INT_1]	Communication Mode Compliancy & Network Password	#1
[INT_2]	E&POC System and BSS establishment	#2
[INT_3]	E&POC System Communication	#2
[INT_14]	Adapter eDEV throughput capability - Minimum TX rate in presence of multiple reference eDEVs	#2
[INT_15]	Terminal eDEV throughput capability - Minimum TX rate in presence of multiple reference eDEVs	#2
[INT_16]	Hot-Plug Support – Adding an Adapter eDEV (as a DUT)	#2
[INT_17]	Hot-Plug Support – Adding a Terminal eDEV (as a DUT)	#2
[DATA_5]	Throughput capability with an Adapter eDEV - Minimum unitary TX rate	#3
[DATA_6]	Throughput capability with Adapters eDEV - Minimum TX rate in presence of Multiple DUTs	#2
[DATA_7]	Throughput capability with an Adapter eDEV – Multi-stream capability	#3
[DATA_8]	Throughput capability with Terminals eDEV - Minimum TX rate in presence of Multiple DUTs	#2
[DATA_9]	Throughput capability with a Terminal eDEV – Multi-stream capability	#3

- **Test set-ups for multiport receivers**



- **Test set-ups for single-port receivers**



5.3.4 Test Areas

Four test areas (room positions) in total are proposed to the participants, enabling parallel testing for more efficiency in the scheduling of the test event:

	Area 1	Area 2	Area 3	Area 4
Multi-port receiver	Set-up 1+2			
		Set-up 3		
Single-port receiver			Set-up 1+2	
				Set-up 3

Each area implements different types of cables, allowing the study of the performance as a function of the cable lengths throughout the test event.

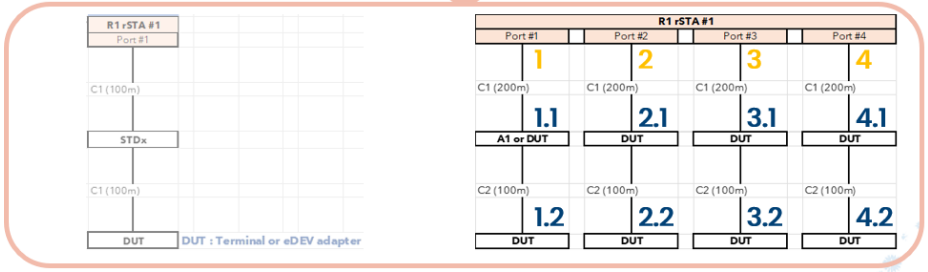
Multi-port receiver areas	**Area 1**	4 x **C2**	4 x **C1**
	Area 2	2 x **C1** 1 x **C4** 2 x **C5** 1 x **C6**	
Single-port receiver areas	**Area 3**	2 x **C1**	1 x **C1**
	Area 4	2 x **C1** 1 x **C4** 2 x **C5** 1 x **C6**	

Technical Details of the coax cables are given in the table below:

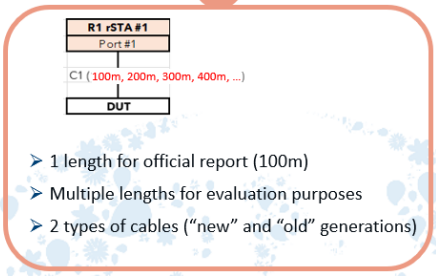
Cables / New Generation			
C1	100m	12	Cable Noir UHD08370ULTRA (idem Violet mais plus souple ce sera aussi plus facile pour les tests)
C2	200m	4	Cable Noir UHD08370ULTRA (idem Violet mais plus souple ce sera aussi plus facile pour les tests)
C3	200m	4	4* 200m (Gros câbles Violet UHD16720LSZH)
C4	200m	2	2*200 (Petit cable violet UHD10460LSZH)
Cables / Old Generation			
C5	100m	4	KX6
C6	200m	2	KX8

Test areas were split to offer testing capabilities for either multiport receivers or single-port receivers as defined below:

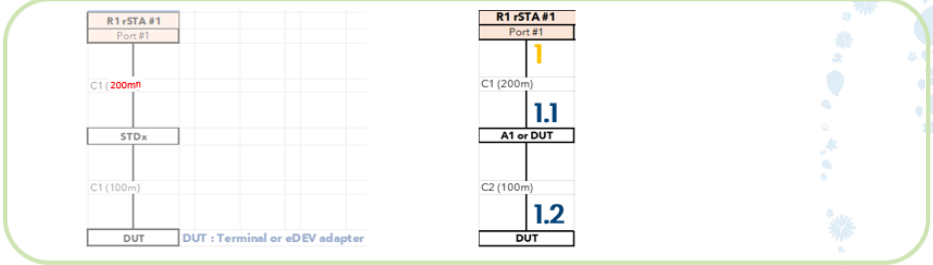
➢ **Test areas for multiport receivers** 1



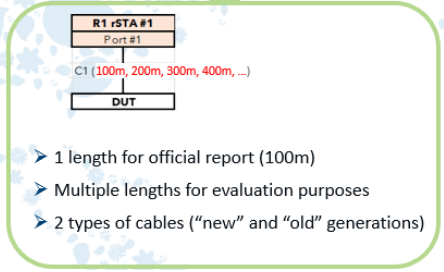
2



➢ **Test areas for single-port receivers** 3



4



Each test area is connected to a traffic generator/analyser to generate traffic and for each throughput class (C1, C2, or C3), and check the packet loss during a 1mn period.

The figures below detail the traffic configurations used for each test area.

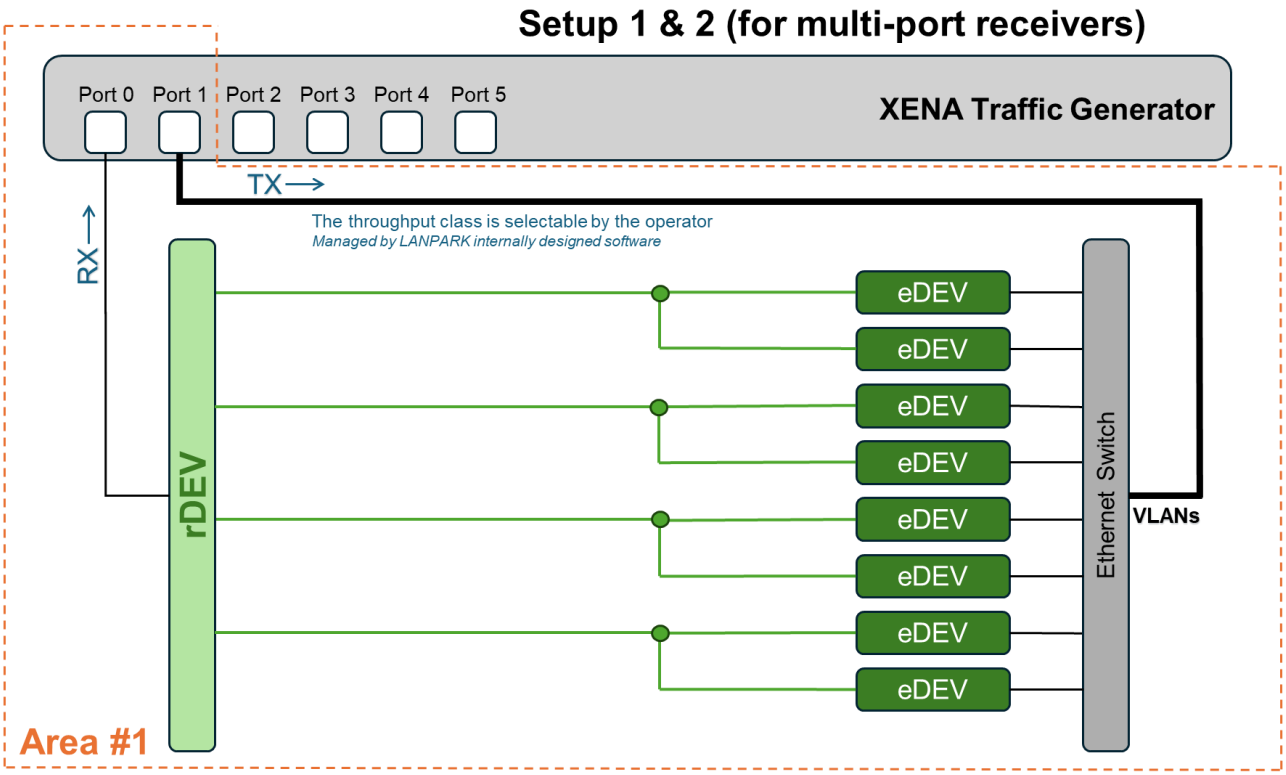


Figure 1: Traffic setup for Area 1 (setup 1+2)

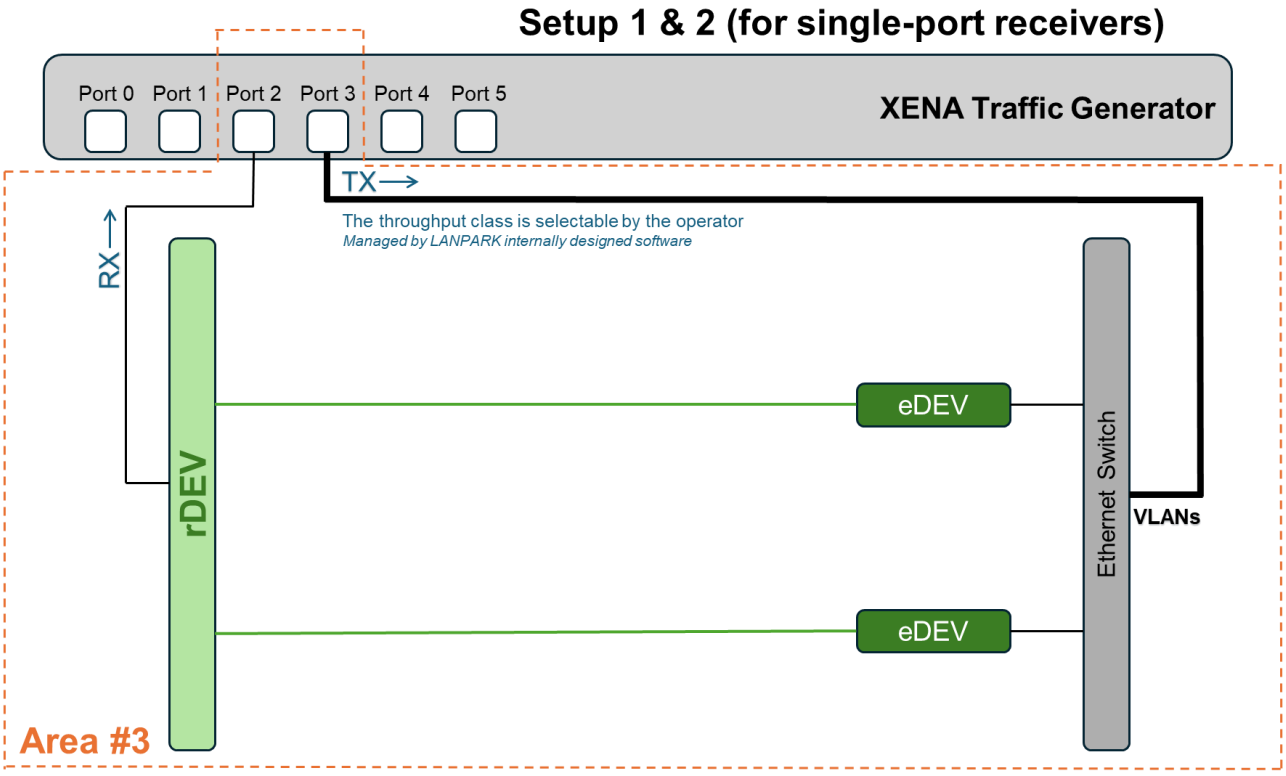


Figure 2: Traffic setup for Area 3 (setup 1+2)

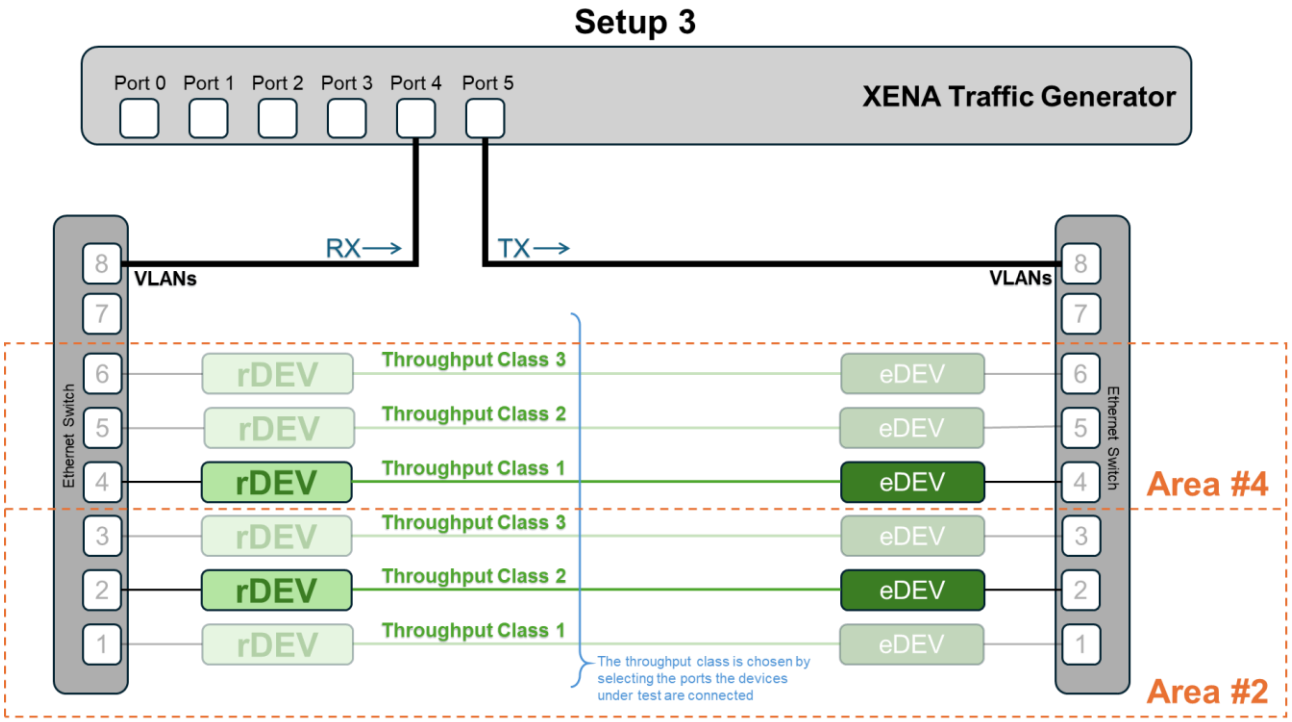


Figure 3: Traffic setup for Area 2 & 4 (set-up 3)

6 Achieved Results

6.1 Statistics

6.1.1 Overall test results

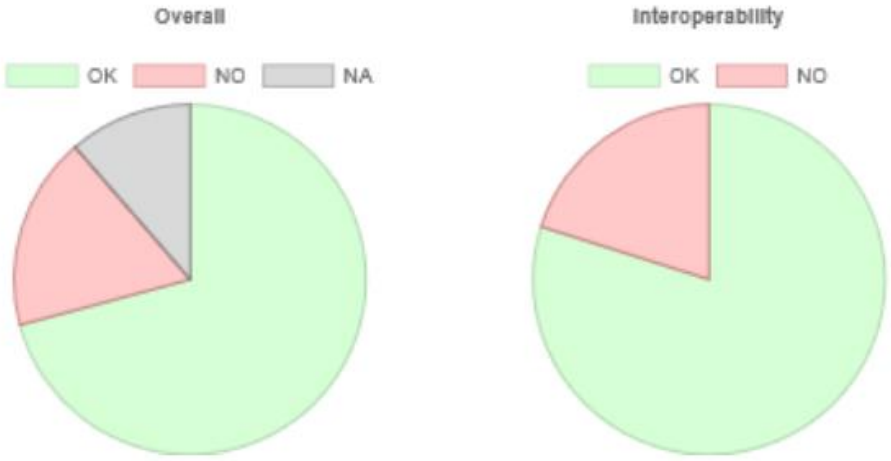


Figure 4: Overview of test results

The overall statistics from the whole test event are summarised below:

- Number of Sessions: 49 of 1 hour each

- Total count of test cases: **538**
- Run test cases: **477**
- PASS test cases: **381 (79.9%)**
- FAIL test cases: **96 (20.1%)**

6.1.2 Results per testcases

The table below shows the interoperability results & statistics obtained during the test event from the perspective of each unitary test case.

Testcase		Interoperability		Totals	
		OK (PASS)	NO (FAIL)	Runs	Results
INT_1	Communication Mode Compliancy & Network Password	19 (86.4%)	3 (13.6%)	22 (88.0%)	25
INT_2	E&POC System and BSS establishment	19 (86.4%)	3 (13.6%)	22 (88.0%)	25
INT_3	E&POC System Communication	17 (89.5%)	2 (10.5%)	19 (86.4%)	22
INT_14	Adapter eDEV throughput capability - Minimum TX rate in presence of multiple reference eDEVs	17 (85.0%)	3 (15.0%)	20 (83.3%)	24
INT_15	Terminal eDEV throughput capability - Minimum TX rate in presence of multiple reference eDEVs	13 (81.3%)	3 (18.8%)	16 (80.0%)	20
INT_16	Hot-Plug Support – Adding an Adapter eDEV (as a DUT)	18 (85.7%)	3 (14.3%)	21 (87.5%)	24
INT_17	Hot-Plug Support – Adding a Terminal eDEV (as a DUT)	12 (80.0%)	3 (20.0%)	15 (78.9%)	19
DATA_5	Throughput capability with an Adapter eDEV - Minimum unitary TX rate	15 (83.3%)	3 (16.7%)	18 (94.7%)	19
DATA_6	Throughput capability with Adapters eDEV - Minimum TX rate in presence of Multiple DUTs	17 (85.0%)	3 (15.0%)	20 (83.3%)	24
DATA_7	Throughput capability with an Adapter eDEV – Multi-stream capability	16 (84.2%)	3 (15.8%)	19 (95.0%)	20
DATA_8	Throughput capability with Terminals eDEV - Minimum TX rate in presence of Multiple DUTs	4 (50.0%)	4 (50.0%)	8 (42.1%)	19
DATA_9	Throughput capability with a Terminal eDEV – Multi-stream capability	4 (80.0%)	1 (20.0%)	5 (100.0%)	5

6.2 Additional tests

On test bench #3, a set of cables was available to complete DATA 5, DATA 7, and DAT 9 tests cases by extending the coaxial cable lengths from 100m up to 1000m by steps of 100m.

So, when time permitted, each [rDEV, eDEV] pair was able to perform throughput tests for different lengths.

The table below shows the statistics obtained for each cable length.

Testcase	Interoperability		Totals	
	OK	NO	Run	Results
DATA_5 - Throughput capability with an Adapter eDEV - Minimum unitary TX rate	15 (83.3%)	3 (16.7%)	18 (94.7%)	19
DATA_5 (200m)	13 (81.3%)	3 (18.8%)	16 (94.1%)	17
DATA_5 (300m)	13 (81.3%)	3 (18.8%)	16 (94.1%)	17
DATA_5 (400m)	13 (81.3%)	3 (18.8%)	16 (94.1%)	17
DATA_5 (500m)	12 (80.0%)	3 (20.0%)	15 (93.8%)	16
DATA_5 (600m)	14 (77.8%)	4 (22.2%)	18 (94.7%)	19
DATA_5 (700m)	10 (76.9%)	3 (23.1%)	13 (92.9%)	14
DATA_5 (800m)	7 (53.8%)	6 (46.2%)	13 (92.9%)	14
DATA_5 (900m)	5 (83.3%)	1 (16.7%)	6 (85.7%)	7
DATA_5 (1000m)	7 (87.5%)	1 (12.5%)	8 (88.9%)	9
DATA_7 - Throughput capability with an Adapter eDEV – Multi-stream capability	16 (84.2%)	3 (15.8%)	19 (95.0%)	20
DATA_7 (200m)	12 (80.0%)	3 (20.0%)	15 (93.8%)	16
DATA_7 (300m)	12 (80.0%)	3 (20.0%)	15 (93.8%)	16
DATA_7 (400m)	12 (80.0%)	3 (20.0%)	15 (93.8%)	16
DATA_7 (500m)	11 (78.6%)	3 (21.4%)	14 (87.5%)	16
DATA_7 (600m)	14 (82.4%)	3 (17.6%)	17 (94.4%)	18
DATA_7 (700m)	10 (76.9%)	3 (23.1%)	13 (92.9%)	14
DATA_7 (800m)	8 (57.1%)	6 (42.9%)	14 (87.5%)	16
DATA_7 (900m)	6 (85.7%)	1 (14.3%)	7 (87.5%)	8
DATA_7 (1000m)	8 (88.9%)	1 (11.1%)	9 (90.0%)	10
DATA_9 - Throughput capability with a Terminal eDEV – Multi-stream capability	4 (80.0%)	1 (20.0%)	5 (100.0%)	5
DATA_9 (200m)	3 (75.0%)	1 (25.0%)	4 (100.0%)	4
DATA_9 (300m)	3 (75.0%)	1 (25.0%)	4 (100.0%)	4
DATA_9 (400m)	3 (75.0%)	1 (25.0%)	4 (100.0%)	4
DATA_9 (500m)	3 (75.0%)	1 (25.0%)	4 (100.0%)	4
DATA_9 (600m)	4 (80.0%)	1 (20.0%)	5 (100.0%)	5
DATA_9 (700m)	2 (66.7%)	1 (33.3%)	3 (100.0%)	3
DATA_9 (800m)	2 (66.7%)	1 (33.3%)	3 (100.0%)	3
DATA_9 (900m)	1 (50.0%)	1 (50.0%)	2 (100.0%)	2
DATA_9 (1000m)	2 (66.7%)	1 (33.3%)	3 (100.0%)	3

7 Observations & Issues

7.1 Overall test results

Tested products were embedding various Homeplug chipset generations from 3 different chipset manufacturers from the market.

Some specific test cases could not be carried out due to a lack of time or a lack of samples (particularly for throughput tests of Terminal eDEV DAT_8 and DATA_9, which require the use of up to 8 DUT samples).

The tests went very well and run successfully for most of it with an overall success rate of 80%.

A few connectivity issues were observed when different generations of Homeplug chipsets were used within the test cases, acknowledging the need for chipset vendors to improve their interoperability level amongst their families of chipsets. Adjustments will need to be made by the relevant manufacturers to address such interoperability issues.

Only one case of crosstalk issue was identified and observed during the event on a product whose design needed to be improved.

No issues with the interpretation of the ETSI TS 105 176-2 standard were observed.

7.2 Additional tests

The figure below shows the percentages of [rDEV, eDEV] pairs that were able to connect with a throughput class 1, 2, or 3 these different lengths.

One can observe that more than 50% of the pairs were able to connect for a cable length of 800m.

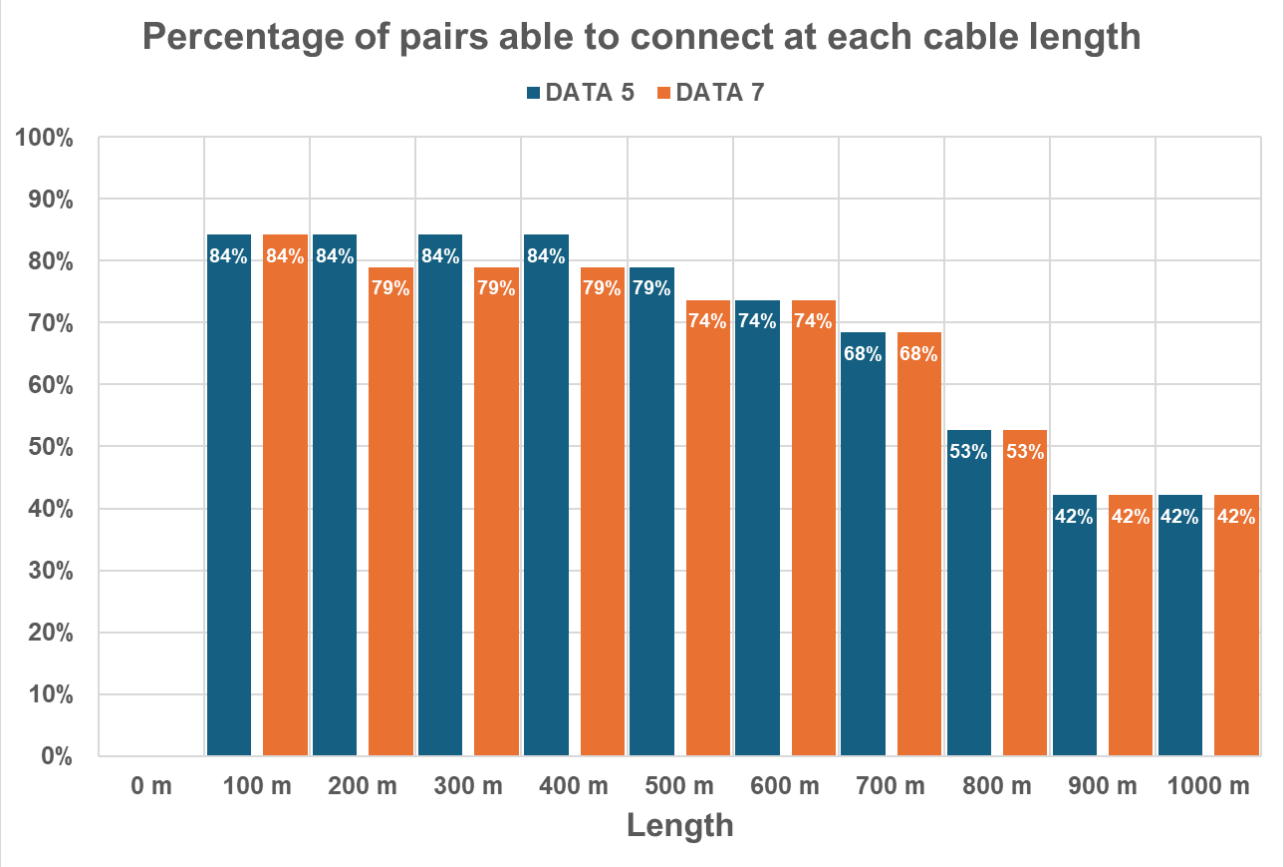


Figure 5: Overview of test results

History

V1.0	20.05.2025	ETSI CTI	First revision