ETSI Plugtests Report V1.0.0 (2021-06)

1st ETSI FRMCS Plugtests
Remote Event
14 June – 18 June 2021

ETSI

Keywords
Testing, Interoperability, Mission-Critical, LTE,
MCPTT. MCX, FRMCS

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Contents

Executive Summary

FRMCS specific features built using MCX (collectively for MCPTT, MCVideo and MCData services) framework were tested during the 1st FRMCS Plugtests from 14th June to 18th June 2021 remotely. More than 60 test sessions were executed between vendors, based on 3GPP Release-16.

The 1st ETSI FRMCS Plugtests have concluded with a success rate of 95% of the executed tests in the validation of 3GPP mission critical services vendor interoperability.

These tests are essential to ensure seamless access to mission critical services across different vendors' products and implementations.

The MCX ETSI Plugtests series is the first independent testing of public safety and other mission critical LTE. The MCX services are the basis for the Future Rail Mobile Communications System (FRMCS). For the first time, rail specific features were tested in the 1st FRMCS Plugtests. The preparations for the 1st FRMCS Plugtests started in February 2021 and were concluded by a remote testing week in June 2021.

The tests were based on 3GPP Release-16 and 347 tests were executed between the different vendors in more than 60 test sessions. The test cases have been amended with additional rail specific test scenarios and will be included in a future version of ETSI TS 103 564 (after the ETSI committee TCCE approval). Besides the MCPTT, MCData and MCVideo Application Servers and Clients, the testing also included IMS (IP Multimedia Subsystem) and eMBMS (Evolved Multimedia Broadcast Multicast Services) components and testing of MCData IP Connectivity, Multi Talker Operation, User Regrouping, etc.

Additionally, 11 observations were gathered during the Plugtests event preparation and testing. The observations from the Plugtests events provide essential feedback to 3GPP Working Groups as work continues on mission critical communication specifications.

This first FRMCS Plugtests was organized by ETSI with the support of the European Commission, EFTA, TCCA and UIC.

The Plugtests event was a pure interoperability testing event and no products were certified.

The next MCX#6 Plugtests event is planned for 08 - 19 November 2021.

The following equipment was tested by the companies participating in this FRMCS Plugtests:

MCX Application Servers:

- Alea
- Consort Digital
- Kontron
- Leonardo
- MCLabs
- Nemergent Solutions
- Nokia
- TASSTA
- Voxtronic

MCX Clients:

- Alea
- Bull (Atos)
- Consort Digital
- Frequentis
- Funkwerk
- Kontron
- Leonardo

- Nemergent Solutions
- Sepura
- Siemens
- Softil
- TASSTA

Evolved Packet Core:

- Athonet
- Enensys

Evolved NodeBs:

- Enensys

User Equipment:

- Funkwerk
- Leonardo
- Sepura
- Teltronic

Evolved Multimedia Broadcast Multicast Services (eMBMS) Components:

- Athonet
- Enensys

IP Multimedia Subsystem (IMS):

- Athonet

Test Tool Vendors:

- Expandium


FRMCS Plugtests Vendors
ALEA S.r.l.
TALKWAY
ATHONET
Atos
CONSORT
ENENSYS Technologies
expandium
a VIAVI Solutions company
FREQUENTIS
funkwerk
kontron
LEONARDO
mclabs
nemergent solutions
NOKIA
sepura
SIEMENS
SOFTIL
INNOVATIVE COMMUNICATIONS
TASSTA
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Voxtronic.
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FRMCS Plugtests Observers
astrid
BANE NOR
DB
dsb
Norwegian Directorate for Civil Protection
ERILLISVERKOT
ETRI
Grundy County ETSB
9 1 1
Emergency Telephone System Board
HANSUNG UNIVERSITY
Home Office
lineco
KRRI
KYONGGI UNIVERSITY
NetworkRail
Public Transport Authority
Rail Baltic Estonia
SNCF RÉSEAU
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1 Introduction

Mission Critical MCX Services (MCPTT, MCVideo and MCData) are standardized services which ensure that LTE and 5G systems support mission-critical communications.

The Global Mission-Critical Communication Market was valued at USD 13.63 Billion in 2018 and is estimated to reach USD 26.66 Billion by 2025 growing at a CAGR of 10.5% during the forecast period 2019–2025, according to the market research. The first nationwide rollouts in the United States, South Korea, the UK, the Middle East and Asian countries are expected to trigger significant large-scale investments in mission-critical LTE.

Mission Critical Push To Talk (MCPTT) was the first of a number of Mission Critical features which was introduced by 3GPP in Release-13. Mission Critical Video and Mission Critical Data were introduced in Release-14. With the standardization of MCX (Mission-Critical PTT, Video & Data), IOPS (Isolated Operation for Public Safety), and other critical communications features by 3GPP, LTE and 5G networks are increasingly gaining recognition as an all-inclusive communications platform for public safety, rail and other critical communications sectors.

Preparations for the 1st ETSI FRMCS Plugtests event started in February 2021 with the registrations of vendors and observers. During bi-weekly conference calls from February to June 2021 the setup of the tests, the test specification and organizational issues were agreed between the participants. Before the main event, the vendors have been done remote pre-testing of their implementations via VPN tunnels which connected their labs to a central exchange hub.

All the information required to organise and manage the 1st FRMCS Plugtests event was compiled and shared with participants in a dedicated private WIKI which was put in place by ETSI. All participants were provided with credentials that allowed them to access and update their details. All the information presented in this document has been extracted from the 1st FRMCS Plugtests event wiki: https://wiki.plugtests.net/FRMCS-Plugtests/index.php?title=Main_Page (login required). Clause 4 describes the management of the Plugtests event.

The following equipment was tested – please see also clause 5:

- MCX Application Servers (MCX AS)
- MCX Clients
- Evolved Packet Core (EPC)
- Evolved Node Bs (eNB)
- User Equipment (UE)
- IP Multimedia Subsystem (IMS)
- Broadcast Multicast Service Center (BMSC)
- Test Tools

This Plugtests specifically focused on railways-oriented features of the Application Servers and Clients.

A dedicated Test Tools test stream was available for test tool vendors and other vendors to check their tools and the conformance off the implementations with a test tool.

The remote test infrastructure is described in clause 6; the test procedures are described in clause 7.

The vendors and ETSI have set up VPN-Tunnels from the vendors' premises to the ETSI VPN hub. This allowed the vendors to start integration work and pre-testing of MCX services.

For the 1st FRMCS Plugtests additional 34 test cases were developed by ETSI. In total, the test specification has now 238 test cases which includes test cases from MCX Plugtests as well as FRMCS Plugtests. See clause 8. An updated version of the test specification, including the new FRMCS test cases, will be published as a new version of ETSI document ETSI TS 103 564 (after ETSI TC TCCE approval).

About 347 tests were conducted by the vendors. 95% of the tests were successful, the remaining 5% failed for various reasons. The detailed results of the tests are available for the involved vendors in these test sessions but are not disclosed to the other vendors or to the public. All participants had to sign a Non-Disclosure Agreement and Rules of Engagement before joining the Plugtests event. The statistics of the test results are listed in clause 9.

The failed tests give the vendors valuable information to improve their implementations. They also help to discover ambiguities in the standards and to clarify and improve the specifications.

ETSI plan to conduct more FRMCS Plugtests in the future. The next MCX Plugtests sessions are planned for November 2021. Vendors who have not participated in the previous MCX or FRMCS Plugtests events are welcomed and encouraged to join the next MCX Plugtests event planned for November 2021.

2 References

The following documents have been used as references in the Plugtests. The participants in the Plugtests agreed on a set of specific documents and **Release 16 versions (December 2020 3GPP Release)** for the first FRMCS Plugtests. Please see also the test specification document for the references.

[1] ETSI TS 103 564: Plugtests scenarios for Mission Critical Services.

[2] 3GPP TS 22.179: Mission Critical Push to Talk (MCPTT) over LTE.

[3] 3GPP TS 23.280: Common functional architecture to support mission critical services.

[4] 3GPP TS 23.379: Functional architecture and information flows to support Mission Critical Push To Talk (MCPTT).

[5] 3GPP TS 24.229: IP multimedia call control protocol based on Session Initiation Protocol (SIP) and Session Description Protocol (SDP).

[6] 3GPP TS 24.281: Mission Critical Video (MCVideo) signalling control; Protocol specification.

[7] 3GPP TS 24.282: Mission Critical Data (MCData) signalling control.

[8] 3GPP TS 24.379: Mission Critical Push To Talk (MCPTT) call control.

[9] 3GPP TS 24.380: Mission Critical Push To Talk (MCPTT) media plane control.

[10] 3GPP TS 24.481: Mission Critical Services (MCS) group management.

[11] 3GPP TS 24.482: Mission Critical Services (MCS) identity management.

[12] 3GPP TS 24.483: Mission Critical Services (MCS) Management Object (MO).

[13] 3GPP TS 24.484: Mission Critical Services (MCS) configuration management.

[14] 3GPP TS 24.581: Mission Critical Video (MCVideo) media plane control.

[15] 3GPP TS 24.582: Mission Critical Data (MCData) media plane control.

[16] 3GPP TS 26.179: Mission Critical Push To Talk (MCPTT); Codecs and media handling.

[17] 3GPP TS 26.346: Multimedia Broadcast/Multicast Service (MBMS); Protocols and codecs.

[18] 3GPP TS 29.212: Policy and Charging Control (PCC); Reference points.

[19] 3GPP TS 29.214: Policy and Charging Control over Rx reference point.

[20] 3GPP TS 29.468: Group Communication System Enablers for LTE(GCSE_LTE); MB2 reference point.

[21] 3GPP TS 33.180: Security of the mission critical service.

[22] IETF RFC 3515: The Session Initiation Protocol (SIP) Refer Method.

[23] IETF RFC 3856: A Presence Event Package for the Session Initiation Protocol (SIP).

[24] IETF RFC 3903: Session Initiation Protocol (SIP) Extension or Event State Publication.

[25] IETF RFC 4488: Suppression of Session Initiation Protocol (SIP) REFER Method Implicit Subscription.

[26] IETF RFC 4825: The Extensible Markup Language (XML) Configuration Access Protocol (XCAP).

[27] IETF RFC 5366: Conference Establishment Using Request-Contained Lists in the Session Initiation Protocol (SIP).

[28] IETF RFC 5373: Requesting Answering Modes for the Session Initiation Protocol (SIP).

[29] IETF RFC 5875: An Extensible Markup Language (XML) Configuration Access Protocol (XCAP) Diff Event Package.

[30] IETF RFC 6135: An Alternative Connection Model for the Message Session Relay Protocol (MSRP).

[31] IETF RFC 6665: SIP-Specific Event Notification.

[32] IETF RFC 7647: Clarifications for the use of REFER with RFC6665.

[33] OMA. OMA-TS-XDM_Core-V2_1-20120403-A: XML Document Management (XDM) Specification.

[34] OMA. OMA-TS-XDM_Group-V1_1_1-20170124-A: Group XDM Specification.

[35] IETF RFC 7230: Hypertext Transfer Protocol (HTTP/1.1): Message Syntax and Routing..

[36] IETF RFC 5246: The Transport Layer Security (TLS).

[37] IETF RFC 6101: The Secure Sockets Layer (SSL).

[38] IETF RFC 4975: The Message Session Relay Protocol (MSRP).

3 Abbreviations

For the purposes of the present document, the abbreviations given in 3GPP TR 21.905 [27] and the following apply. An abbreviation defined in the present document takes precedence over the definition of the same abbreviation, if any, in 3GPP TR 21.905 [27].

AMR	Adaptative Multi-Rate Audio Codec
AMR-WB	Adaptative Multi-Rate Audio Codec Wideband
APP	Application
AS	Application Server
CMS	Configuration Management Server
CSC	Common Services Core
CSCF	Call Session Control Function
CSK	Client-Server Key
DUT	Device Under Test
E-UTRAN	Evolved Universal Terrestrial Radio Access Network
EPC	Evolved Packet Core
EPS	Evolved Packet System
ETSI	European Telecommunications Standard Institute
EUT	Equipment Under Test
FD	File Distribution
FE	Functional Element
FRMCS	Future Railway Mobile Communication System
GCSE	Group Communication Service Enabler
GMK	Group Master Key
GMS	Group Management Server
iFC	Initial Filter Criteria
IFS	Interoperable Functions Statement
IMPI	IP Multimedia Private Identity
IMPU	IP Multimedia Public identity
IMS	IP Multimedia Subsystem
IP	Internet Protocol
IdMS	Identity Management Server
KMS	Key Management Server
MBMS	Multimedia Broadcast and Multicast Service
MCData	Mission Critical Data
MCPTT ID	MCPTT user identity
MCPTT	Mission Critical Push-To-Talk
MCVideo	Mission Critical Video
MCX	Mission Critical Services (X stands for PTT, Data and Video)
OAM	Operation and Maintenance
OTT	Over the Top
PCC	Policy and Charging Control
PCRF	Policy and Charging Rules Function
PES	Pre-established Sessions
PSI	Public Service Identity
PSTA	Public Safety Technology Association
PTT	Push-To-Talk
ProSe	Proximity-based Services
RAN	Radio Access Network
RTP	Real-time Transport Protocol
SDS	Short Data Service
SIP	Session Initiation Protocol
SPK	Signalling Protection Key
TCCA	The Critical Communications Association
TD	Test Description
TR	Technical Recommendation
TRT	Test Reporting Tool
TS	Technical Specification
UE	User Equipment
UIC	International union of railways (Union Internationale des Chemins de fer)

4 Technical and Project Management

4.1 Scope

The main goal of the 1st FRMCS Plugtests was testing the interoperability of the MCPTT, MCData and MCVideo ecosystem signalling and media plane at different levels. The railway related functionalities were the focus of the interoperability event.

The basic scenario in FRMCS Plugtests comprises MCX application server(s) - both controlling and participating - and MCX clients deployed over a generic SIP/IMS core and UEs. The following figure (Fig 1) illustrates the basic test infrastructure. In this 1st FRMCS Plugtests most of the tests were carried out Over-The-Top (OTT) using pure IP connectivity and FRMCS features on top of the MCX components were specially considered.

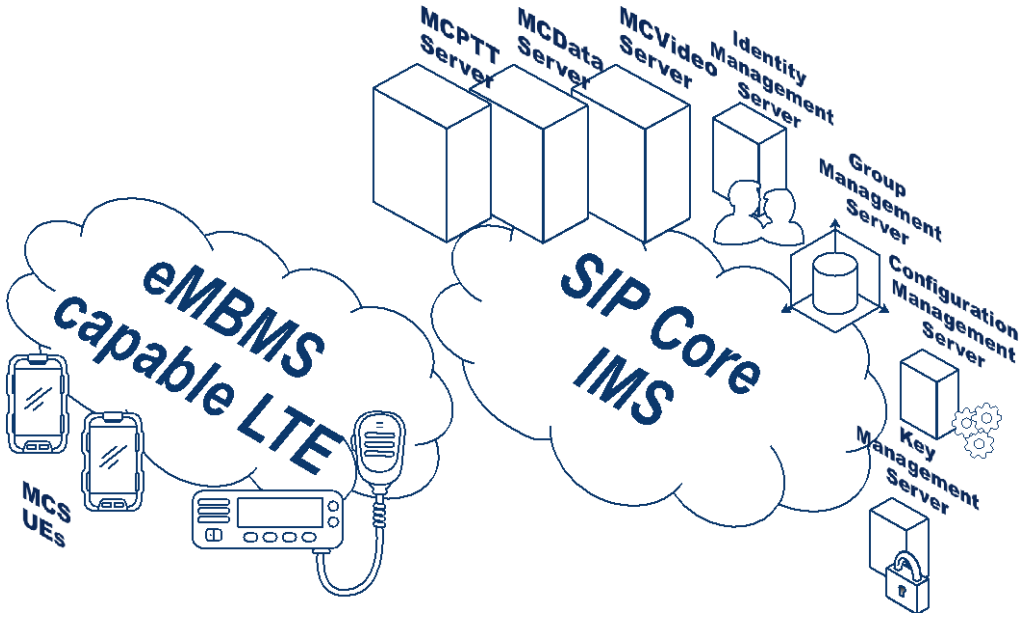

Figure 1. Typical MCPTT/MCData/MCVideo scenario to be considered in the Plugtests

In the scope of this Plugtests event, the following high-level test objectives were performed

- **Functional alias (FA):** Affiliation change, exchange of FA during call signalling and floor control were evaluated.
- **Connectivity:** A not-authorized MCPTT User initiates different operations.
- **Multi-talker:** Multi-talker functionality in Floor Control operations.
- **MCData IP Connectivity**: MCData client establishes an IP Connectivity session.
- **User Regrouping:** MCPTT user requests/remove the users regroup.
- **Observer Test Scenarios Railway Emergency Alert**: Observer test scenarios was developed after inputs from the UIC.

4.2 Timeline

The preparation was run through different phases as described in the figure below.

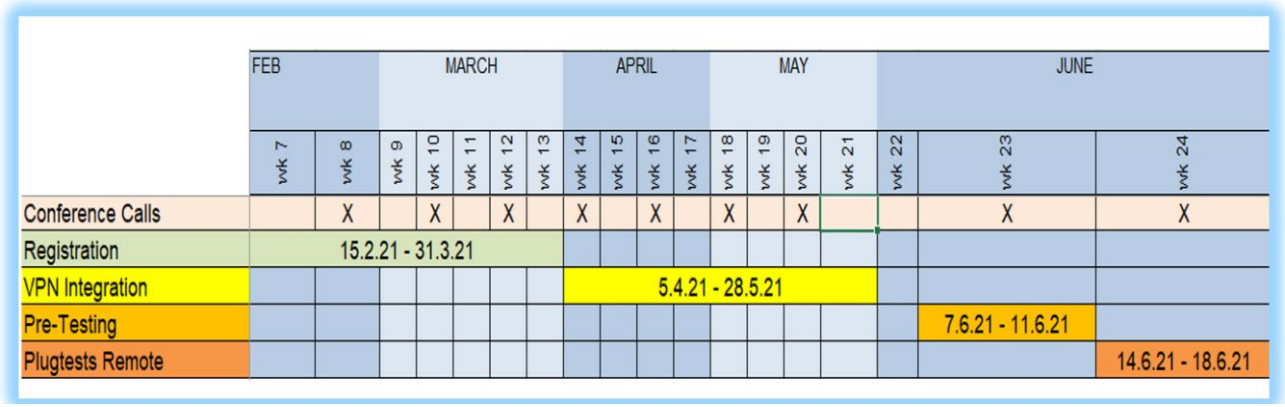

Figure 2. Plugtests event timeline

Registration to the FRMCS Plugtests event was open from 15th February 2021 to 31st March 2021 to any organisation willing to participate in testing the MCX Services Ecosystem. A total of 102 people was finally involved in the remote Plugtests event.

The following clauses describe the different phases of the Plugtests event preparation. It is worth noting that since the start of the documentation phase until the first week of the Plugtests event, bi-weekly conference calls were run among organisers and participants to discuss and track the progress, anticipate and solve technical issues, review the test plan, etc.

4.2.1 Documentation

Once the registration to the Plugtests event was closed, the following documentation activities were launched in parallel:

1) Equipment Under Test (EUT) Documentation

Participants documented their EUTs, by providing the information directly to the Plugtests event team. The Plugtests event team compiled the final EUT table for all the participating vendors and was appended to the Plugtests event Test Plan,

All the information described above was made available in the Plugtests event WIKI, so that it could be easily maintained and consumed by participants.

2) Test Plan Development

The Test Plan development was led by ETSI Centre for Testing and Interoperability following the methodology defined by 3GPP TSG SA6 and 3GPP TSG CT1. The Test Plan was scoped around 3GPP Test Specifications Release-16 capabilities and concentrated on the features supported by the implementations attending the Plugtests event.

The Test Plan was developed and consolidated in an iterative way, taking into account input and feedback received from Plugtests event participants. See details in clause 8.

4.2.2 Remote integration & pre-testing

Participants connected their implementations remotely to the Plugtests event infrastructure, known as HIVE: Hub for Interoperability and Validation at ETSI.

During this phase, up to 20 remote labs connected to HIVE for the FRMCS Plugtests and each of them was allocated a dedicated network. The interconnection of remote labs allowed running integration and pre-testing tasks remotely among any combination of participating EUTs, in order to ensure an efficient use of the f Plugtests event time and smoother Interoperability test sessions.

A VPN connection to HIVE was highly recommended for participants providing MCX Application Servers, MCX Clients and IMS for first connectivity tests, trouble shooting and infrastructure access purposes.

Additional details on the remote test infrastructure, remote integration and pre-testing procedures are provided in Clauses 6 and 7.

During this phase, the bi-weekly conference calls were continued among organisers and participants to synchronise, track progress and get ready for the on-site phase. Conference calls with observers were organised to develop observer scenario relevant for the railways.

4.2.3 Plugtests event

From 14th of June to the 18th of June 2021, participants connected their equipment with ETSI HIVE infrastructure to collaboratively run the Interoperability Test Sessions scheduled by ETSI CTI.

The 5 days were dedicated to remote interoperability test sessions involving all the participating EUTs organised in several parallel tracks, see details in Clause 4.3.2.

The scheduling of individual test combinations was done randomly using ETSI Test Reporting tool with the inputs and requests from the participants. The schedule was adapted during the test session slots on a per need basis.

4.3 Tools

4.3.1 Plugtests event WIKI

The Plugtests event WIKI was the main source of information for the FRMCS Plugtests event, from logistics aspects to testing procedures. Access to the WIKI was restricted to participating companies.

The main technical information provided in the wiki was organised as follows:

- **Event Information** – Logistics aspects of the Plugtests event.
- **Participants** – List of participants in the event.
- **Schedule**- Planning of different phases of the event.
- **Observer Program** – Information about the Observer program and interoperability demo during the Plugtests event.
- **Test Tools** – Information from the Test Tool vendors about what kind of tests they are offering for the Plugtests.
- **Testing Infrastructure (Network Information)** - HIVE connection request tool, and remote connections status overview.
- **Specification -** Test specification developed during the FRMCS Plugtests.
- **Equipment Under Test** - Participating EUTs overview with feature support, test case support, integration and contact information.
- **Provisioning Information -** Pre-configured parameters for EUTs recommended and IP addresses of EUTs.
- **Test Reporting Tool** - Documentation of the Test Reporting Tool.
- **Conference Calls** - Calendar, logistics, agendas and minutes of the bi-weekly conference calls run during the remote integration and pre-testing phase.
- **Observations** - Issues found during Plugtests event.

In addition, Slack was used among the participants to communicate with each other during the pre-testing phase and Test Sessions, include their remote colleagues (back-office support) in the discussions.

4.3.2 Test Reporting Tool (TRT)

The Test Reporting Tool guides participants through the Test Plan test cases during the pre-testing and main Test Sessions. It allows creating Test Session Reports compiling detailed results for the individual scheduled Test Sessions.

Only the companies providing the EUTs for each specific Test Session combination have access to their Test Session Reports contents and specific results. All companies involved in a specific session and who have entered the test results

were required to verify and approve the reported results at the end of each session. Only test report which has been approved by all involved parties are considered as valid.

Another interesting feature of this tool is the ability to generate real-time stats (aggregated data) of the reported results, per test case, test group, test session or overall results. These stats are available to all participants and organisers and allow tracking the progress of the testing with different levels of granularity, which is extremely useful to analyse the results.

2021-06-14 16:00	120	I	Config-MCX	Sepura - MCX Client Nemergent - MCX AS Athonet - IMS
2021-06-17 08:00	120	II	Config-MCX	Alea - MCX Client MClabs private limited - MCX AS
2021-06-14 08:00	120	IV	Config-MCX	Sepura - MCX Client Leonardo - MCX AS
2021-06-17 08:00	120	I	Config-MCX	Softil - MCX Client ConsortDigital - MCX AS
2021-06-14 16:00	120	III	Config-MCX	ATOS - MCX Client Nokia - MCX AS
2021-06-15 08:00	120	V	Config-MCX	ATOS - MCX Client Nemergent - MCX AS Athonet - IMS
2021-06-15 10:00	120	I	Config-MCX	ATOS - MCX Client Tassta - MCX AS
2021-06-15 14:00	120	III	Config-MCX	ATOS - MCX Client Voxtronic - MCX AS
2021-06-16 16:00	120	III	Config-MCX	ATOS - MCX Client Kontron - MCX AS

Figure 3. Test Reporting Tool – example screen shot

5 Equipment Under Test

The tables below summarise the different EUTs provided by the Plugtests event participants:

5.1 MCX Application Servers

Organisation	Support
Alea	MCPTT, MCDATA, MCVIDEO
Consort Digital	MCPTT, MCDATA
Kontron	MCPTT, MCDATA, MCVIDEO
Leonardo	MCPTT, MCDATA, MCVIDEO
MCLabs	MCPTT, MCDATA
Nemergent	MCPTT, MCDATA, MCVIDEO
Nokia	MCPTT, MCDATA, MCVIDEO
TASSTA	MCPTT, MCDATA
Voxtronic	MCPTT

Table 1. MCPTT Application Servers Under Test

5.2 MCX Clients

Organisation	Support
Alea	MCPTT, MCDATA, MCVIDEO
Bull(Atos)	MCPTT, MCDATA
Consort Digital	MCPTT, MCDATA
Frequentis	MCPTT, MCDATA
Funkwerk	MCPTT, MCDATA
Kontron	MCPTT, MCDATA, MCVIDEO
Leonardo	MCPTT, MCDATA, MCVIDEO
Nemergent	MCPTT, MCDATA, MCVIDEO
Sepura	MCPTT
Siemens	MCPTT, MCDATA
Softil	MCPTT, MCDATA, MCVIDEO
TASSTA	MCPTT, MCDATA

Table 2. MCX Clients Under Test

5.3 IP Multimedia Subsystem (IMS)

Organisation	Support
Athonet	

Table 3. IP Multimedia Subsystem (IMS) Under Test

5.4 Evolved Multimedia Broadcast Multicast Services (eMBMS) Components

Organisation	Support
Athonet	
Enensys	

Table 4. Evolved Multimedia Broadcast Multicast Services (eMBMS) Components Under Test

5.5 Evolved Packet Core (EPC)

Organisation	Support
Athonet	MC-QCI, MC-APN
Enensys	MC-QCI

Table 5. Evolved Multimedia Broadcast Multicast Services (eMBMS) Components Under Test

5.6 User Equipment (UE)

Organisation	Support
Funkwerk	MC-QCI, MC-APN
Leonardo	
Sepura	
Teltronic	MC-QCI, MC-APN, eMBMS

Table 6. Evolved Multimedia Broadcast Multicast Services (eMBMS) Components Under Test

5.7 Evolved Node B (eNB)

Organisation	Support
Enensys	MC-QCI

Table 7. Evolved Multimedia Broadcast Multicast Services (eMBMS) Components Under Test

5.8 Test Tools

Organisation	Support
Expandium	

Table 8. Testers Under Test

6 Test Infrastructure

6.1 Remote Test Infrastructure

The remote testing and pre-testing phase were enabled by the setup as shown in Figure 5:

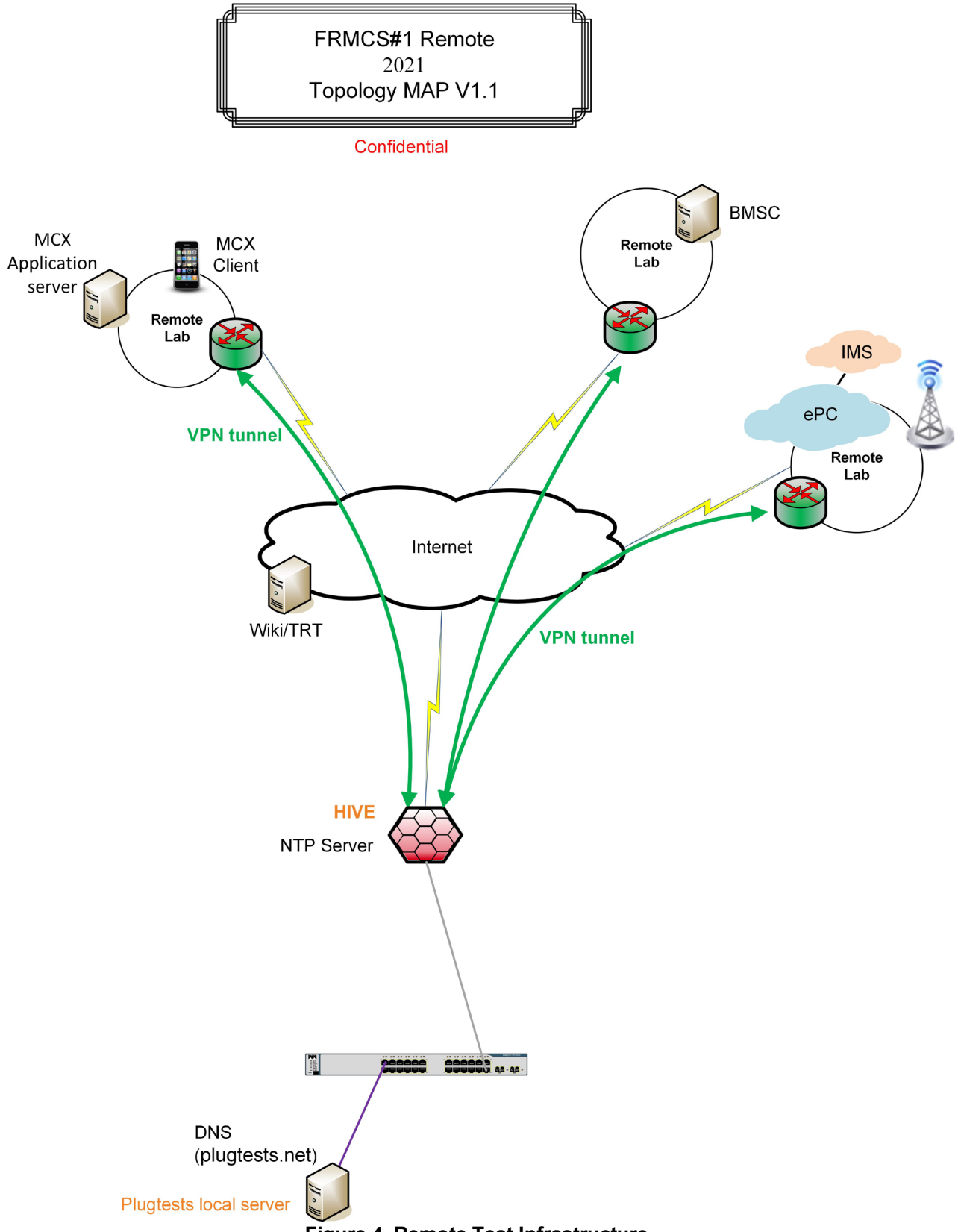

Figure 4. Remote Test Infrastructure

Once HIVE was deployed, a number of VPN tunnels were created to interconnect the equipment of the participants where the EUTs were running.

A total of 20 Remote Labs connected to the setup described above as a participant's lab.

7 Test Procedures

7.1 Remote Integration & Pre-testing Procedure

During the remote integration and pre-testing phase the following procedures were followed by the participating Equipment Under Test. Once the EUT documentation and HIVE connection had been successfully completed, the test cases from the test specifications were executed as part of the pre-testing

The progress of these procedures for the different combinations of EUTs was captured in the reporting function of TRT. The following Pre-Testing configurations were used in the pretesting phase

Config Name	Pre-testing Configuration
Config-MCX	MCX Client + MCX AS (SIP Core) + IMS

Table 9. Pre-testing Configuration

7.2 Interoperability Testing Procedure

During the Plugtests event, a daily Test Session Schedule was produced and shared via the TRT. Test Sessions were organised in several parallel tracks, ensuring that all participants had at least one Test Session scheduled any time. The different test configurations were used for the main event.

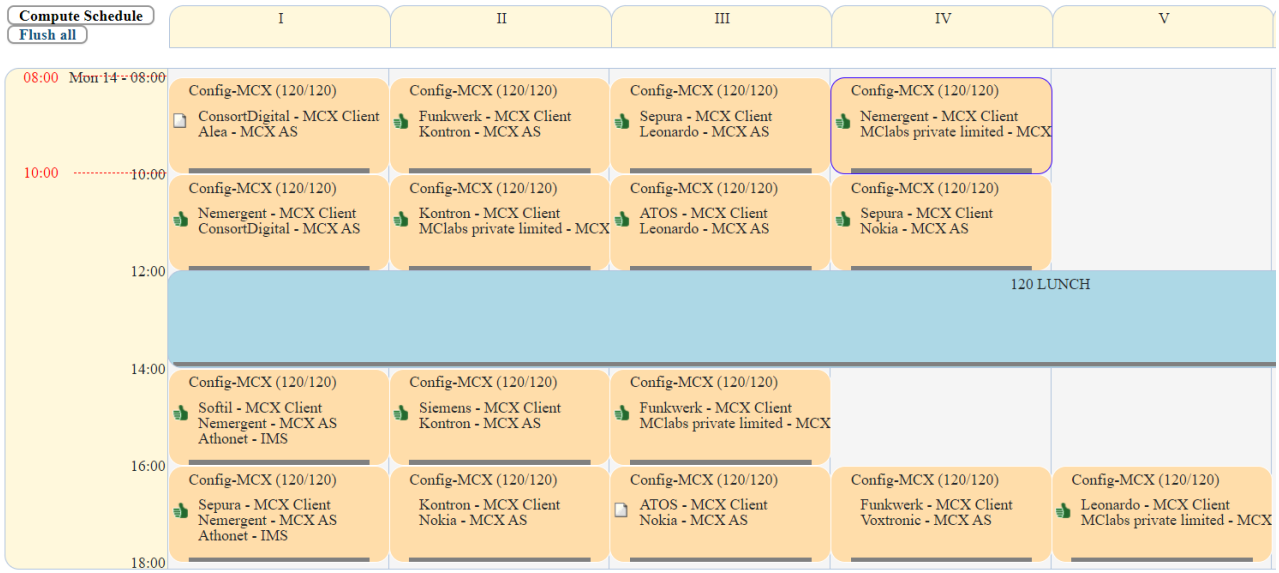

Figure 5. Daily Schedule & Test Sessions – example excerpt

Config Name	Main Test Configuration
Config-MCX	MCX Client + MCX AS (in-built SIP Core) + IMS
Config-MCX-UE	MCX Client + MCX AS (in-built SIP Core) + IMS + MCX UE
Config-MCX-LTE	MCX Client + MCX AS (in-built SIP Core) + IMS + MCX UE + eNB + EPC
Config-MCX-BMSC	BMSC + MCX AS (in-built SIP Core)
Config-MCX-Tester-AS	Tester + MCX AS
Config-MCX-Tester-Client	Tester + MCX Client

Table 10. Main Test Configurations

During each test session, for each tested combinations the Interoperability testing procedure was as follows:

1. The participating vendors opened the Test Session Report and the Test Plan.

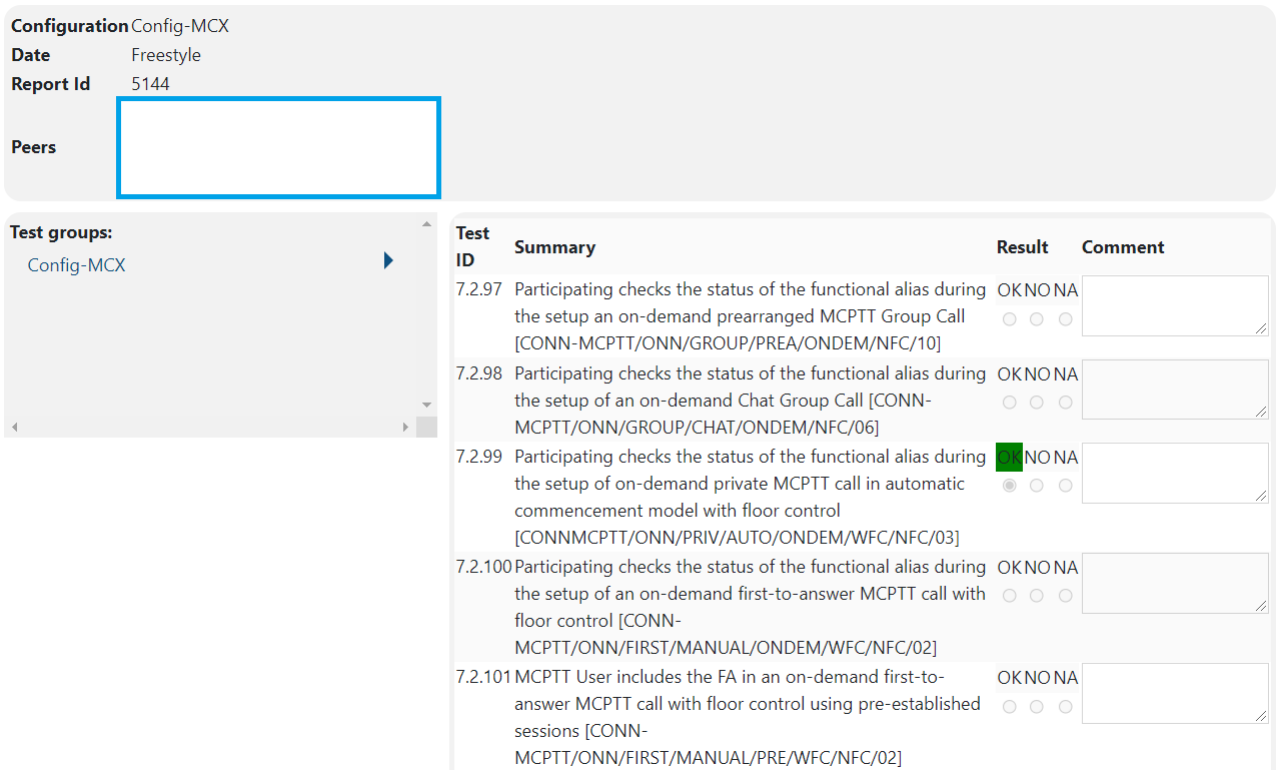

Figure 6. Test Session Report

2. For each Test in the Test Plan:

    a. The corresponding Test Description and EUT Configuration were followed.

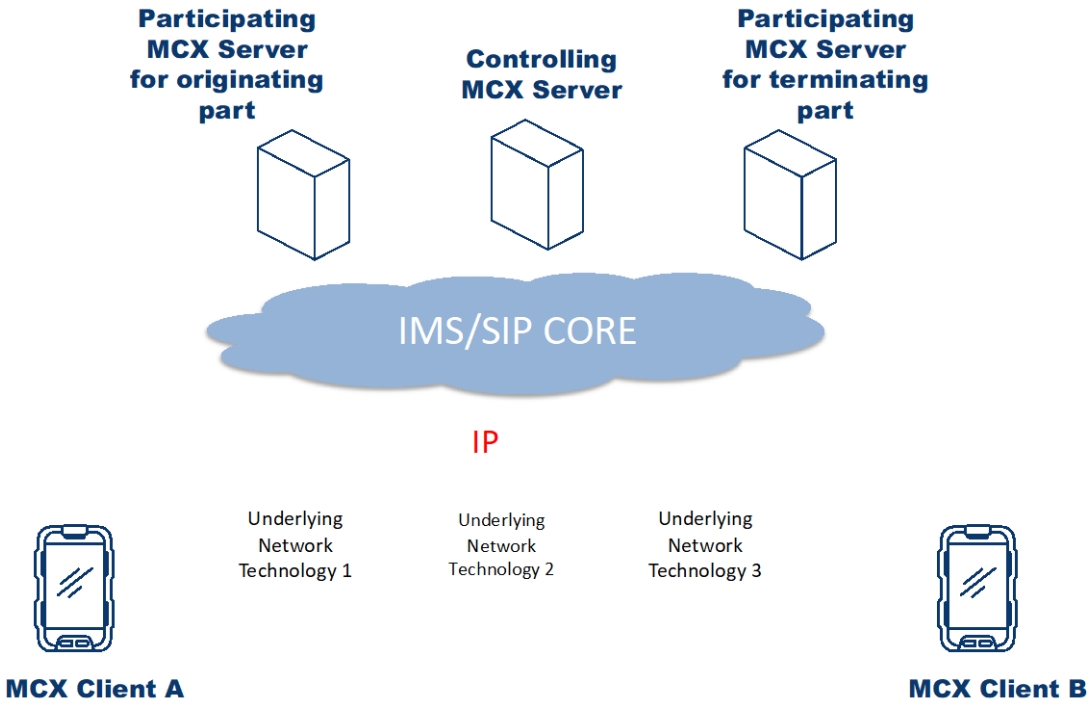

Figure 7. System Under Test (SUT) Configuration

Interoperability Test Description			
Identifier	REGRPREC/USERREG/01		
Test Objective	Verify IP connectivity, SIP core/IMS configuration and proper routing, SIP signalling for the user regroup request operation		
Configuration(s)	• CFG_ONN_OTT-1 (clause 5.2) • CFG_ONN_UNI-MC-LTE-1 (clause 5.3) • CFG_ONN_MULTI-MC-LTE-1 (clause 5.4)		
References	• SIP (see ETSI TS 124 229 [6] and other references in ETSI TS 124 379 [9]) • MCPT (see ETSI TS 124 380 [10] and other references in ETSI TS 124 379 [9]) • RTP (see ETSI TS 124 229 [6] and other references in ETSI TS 124 379 [9])		
Applicability	• MCPTT-Client_ONN-MCPTT-CALL, MCPTT-Client_AMR-WB • MCPTT-Client_AFFIL, MCPTT-Client_MCPTT-FC (clause 6.2) • MCPTT-Part_ONN-MCPTT-CALL, MCPTT-Part_AFFIL • MCPTT-Part_MCPTT-FC, MCPTT-Part_RX (CFG_ONN_UNI-MCLTE-1 only) • MCPTT-Part_GCSE (CFG_ONN_MULTI-MC-LTE-1 only) (clause 6.5) • MCPTT-Ctrl_ONN-MCPTT-CALL, MCPTT-Ctrl_AFFIL (clause 6.6)		
Pre-test conditions	• IP connectivity among all elements of the specific scenario • Proper configuration of the SIP core/IMS to forward the signalling to the specific controlling and participating servers • UEs properly registered to the SIP core/IMS and MCPTT system		
Test Sequence	**Step**	**Type**	**Description**
	1	stimulus	User 1 (mcptt_id_clientA@example.com) request the creation of a temporary group using the user regrouping with preconfigure group mechanism (4 users: A, B, C, D)
	2	check	SIP MESSAGE received at the MCPTT participating server of mcptt_id_clientA@example.com
	3	check	SIP MESSAGE received at the MCPTT controlling server
	4	check	The MCPTT controlling server creates separate lists grouped per terminating participating server and generates outgoing SIP MESSAGES to every participating
	5	check	Upon receiving the SIP MESSAGE very participating sends a SIP MESSAGE to the public identity of each of the users he is responsible for with no elements in the <users-for-regroup>
	6	check	Upon 200 OK the participatings the controlling considers the group is created with those users considered as affiliated
	7	verify	Temporary group built with user regrouping using a preconfigured group active

Figure 8. Test Description example

3. MCX equipment providers jointly executed the different steps specified in the test description and evaluated interoperability through the different IOP Checks prescribed in the Test Description

   b. The MCX equipment provider recorded the Test Result in the Test Session Report, as follows:

      i. OK: all IOP Checks were successful

      ii. NO: at least one IOP Check failed. A comment was requested.

      iii. NA: the feature was not supported by at least 1 of the involved EUTs. A comment was requested.

4. Once all the tests in the Test Session Report were executed and results recorded, the participants reviewed the Report and approved it.

8 Test Plan Overview

8.1 Introduction

This 1st FRMCS Plugtests Test Plan was developed following ETSI guidelines for interoperability. Additional test cases were included comprising functional aliases, Multi-talker, MCData IP Connectivity, User Regrouping in different configurations.

The Test Plan was reviewed and discussed with participants during the preparation and pre-testing phase. Considering the huge number of resulting test cases and difference expected maturity of the implementations and differences from participants in the previous Plugtests event and new companies, vendors selected the subset of test cases to evaluate in a per-testing slot basis.

The following sections summarise the methodology used for identifying the different configuration and test objectives leading to different test cases subgroups.

8.2 Test configurations

The overall MCX ecosystem comprises both controlling and participating MCPTT/MCData/MCVideo application server(s), MCPTT/MCData/MCVideo Clients deployed over a generic SIP Core/IMS. Furthermore, a series of support servers were integrated in the so-called Common Services Core provide configuration, identity, group and key management capabilities. Note, again 3GPP Release-16 compliant On-Network operations only were considered.

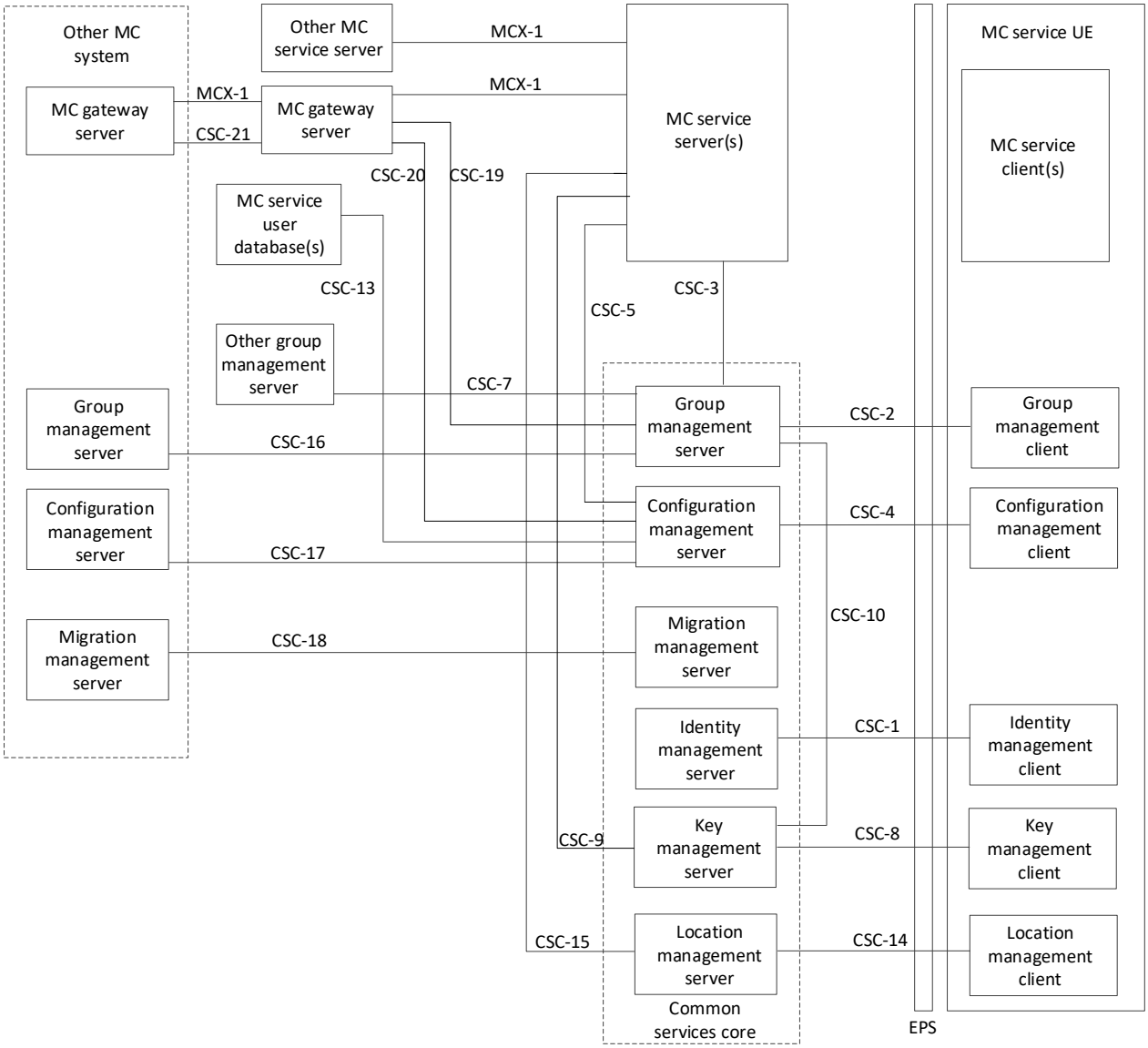

Figure 9. Functional model for application plane Figure 7.3.1-1 in 3GPP TS 23.280 [3].

Figure 7.3.1-1 in 3GPP TS 23.280 [3] describes the overall architecture and the reference points considered for the interoperability testing for any (MCPTT/MCData/MCVideo) Mission Critical Services (MCS). As can be seen, the resulting number of functional elements, interfaces and protocols involved is quite large. In order to focus on MCS signalling the following configuration were initially considered: MCPTT/MCData/MCVideo as an application service over IP networks (Over-the-Top).

8.2.1 Over-The-Top Configuration for On-Network calls (CFG_ONN_OTT-1)

This configuration considered On-Network Calls (ONN) with a pure Over-The-Top (OTT) approach. It emulated a scenario where any underlying network (i.e. commercial LTE, WiFi or any wired technology such as Ethernet) would provide a bit-pipe type only access. No QoS/prioritization enforcement neither access-layer multi/broadcasting capabilities would be provided (i.e. nor unicast PCC support or multicast mechanisms in LTE). Therefore, although not usable in a real world Mission Critical environment, it was used for connectivity tests since it did not require any binding between the IMS/SIP Core and the underlying LTE infrastructure and allowed both signalling and media plane parallel testing easily.

8.2.2 Unicast Mission Critical LTE for On-Network calls (CFG_ONN_UNI-MC-LTE-1)

In this configuration the LTE network (both EPC and eUTRAN) provided PCC capabilities and therefore enforced QoS policies in terms of prioritization and pre-emptiveness of Mission Critical unicast bearers. That included new Public Safety QCI 65/69 support in UEs and EPC/EUTRAN, and the availability of a PCRF with MCPTT compliant Rx/MCPTT-5 interface. Specific Rx/MCPTT-5 reference points and unicast bearer setup and update triggering mechanisms were tested using this configuration. Note that, although MCPTT only is mentioned and depicted in the following figure, MCVideo/MCData could follow the same approach.

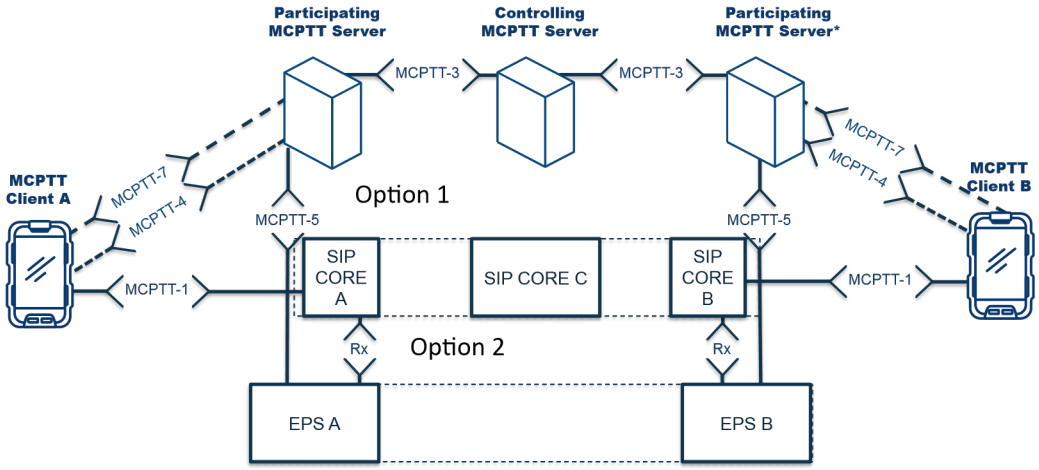

Figure 10. CFG_ONN_UNI-MC-LTE-1 configuration, MCPTT example

8.2.3 Multicast Mission Critical LTE for On-Network calls (CFG_ONN_MULTI-MC-LTE-1)

In this configuration LTE provided multicast capability including Rel. 14 (and beyond) LTE-A Pro eMBMS and needed interfaces both in the core side (MB2-C and MB2-U with the BM-SC) and in the eUTRAN/UE side. It was used to test eMBMS bearer setup and update related test cases.

NOTE: In this remote 1st FRMCS Plugtests the unicast and multicast scenarios were limited to internal deployment due to the remote nature, so that they were not considered as different in the TRT tool.

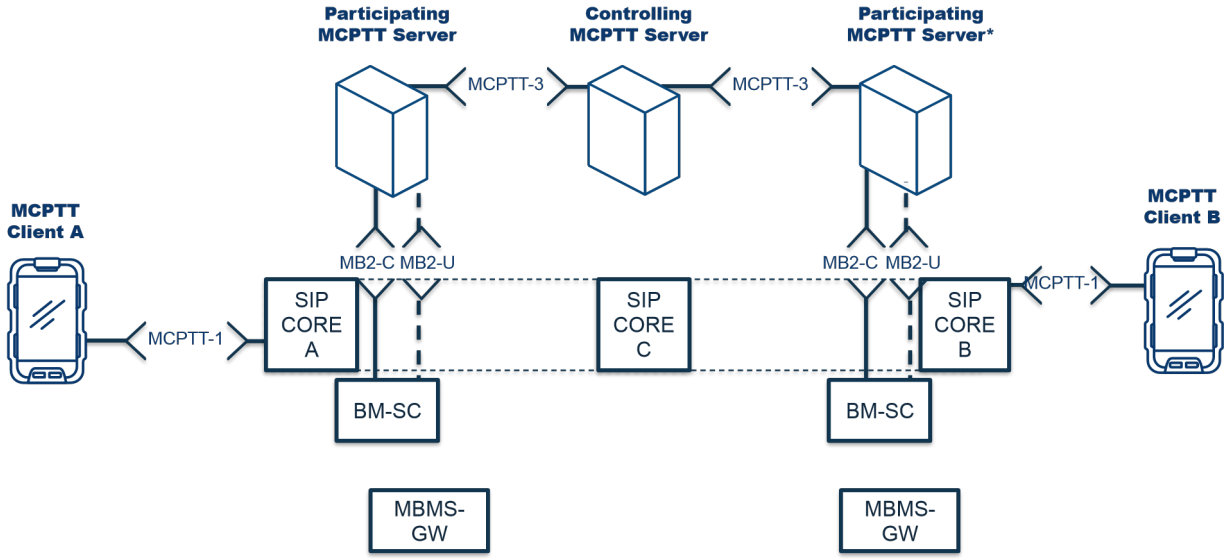

Figure 11. CFG_ONN_MULTI-MC-LTE-1 configuration, MCPTT example

Due to specific low level technical constraints (i.e. the availability of joint/split participating and controlling AS, usage of MCPTT-5 interface instead of Rx for the PCC or eMBMS support in the UE) the original configurations led to the ones described in Figure 11 according to the following mapping.

In order to deal with the different test setting according to the three aforementioned configurations and cover specific more complex test configuration involving different clients and Observer test cases, the following configuration modes were defined in the TRT tool.

Configuration	Resulting configuration mode in the Plugtests (TRT)
ONN-OTT	Config-MCX Config-MCX-BMSC Config-MCX-LTE Config-MCX-UE Config-MCX-Tester-AS Config-MCX-Tester-Client

Table 11. Mapping of scenario architecture configurations and Plugtests event practical configurations

8.2.5 Mapping of Test Cases to Test Case Numbers

The following tables collect the test cases from ETSI TS 103 564 [1] and the new developed test cases from the FRMCS Plugtests, grouped by test objective following the structure of the test specification document itself.

Please note that not all test cases from ETSI TS 103 564 [1] were in scope of the FRMCS Plugtests.

The results from the Observer Scenarios were not captures in the TRT.

Number	Name
Connectivity (CONN)	
7.2.97	Participating checks the status of the functional alias during the setup an on-demand prearranged MCPTT Group Call [CONN-MCPTT/ONN/GROUP/PREA/ONDEM/NFC/10]
7.2.98	Participating checks the status of the functional alias during the setup of an on-demand Chat Group Call [CONN-MCPTT/ONN/GROUP/CHAT/ONDEM/NFC/06]
7.2.99	Participating checks the status of the functional alias during the setup of on-demand private MCPTT call in automatic commencement model with floor control [CONNMCPTT/ONN/PRIV/AUTO/ONDEM/WFC/NFC/03]
7.2.100	Participating checks the status of the functional alias during the setup of an on-demand first-to-answer MCPTT call with floor control [CONN-MCPTT/ONN/FIRST/MANUAL/ONDEM/WFC/NFC/02]
7.2.101	MCPTT User includes the FA in an on-demand first-to-answer MCPTT call with floor control using pre-established sessions [CONN-MCPTT/ONN/FIRST/MANUAL/PRE/WFC/NFC/02]
7.2.102	MCPTT User includes the FA in an on-demand private MCPTT call in automatic commencement model with floor control [CONN-MCPTT/ONN/PRIV/AUTO/ONDEM/WFC/NFC/04]
7.2.103	MCPTT User calls a FA using an on-demand first-to-answer MCPTT call with floor control [CONN-MCPTT/ONN/FIRST/MANUAL/ONDEM/WFC/NFC/03]
7.2.104	MCPTT User calls a FA using an on-demand first-to-answer MCPTT call without floor control [CONN-MCPTT/ONN/FIRST/MANUAL/ONDEM/WOFC/02]
7.2.105	MCPTT User calls a FA using an on-demand first-to-answer MCPTT call with floor control using pre-established sessions [CONN-MCPTT/ONN/FIRST/MANUAL/PRE/WFC/NFC/03]
7.2.106	MCPTT User calls a FA using a pre-established first-to-answer MCPTT call in manual commencement mode without floor control [CONN-MCPTT/ONN/FIRST/MANUAL/PRE/WOFC/02]
7.2.107	A not-authorized MCPTT User initiates an on-demand private MCPTT call in automatic commencement model with floor control [CONN-MCPTT/ONN/PRIV/AUTO/ONDEM/WFC/NFC/05]
7.2.108	A not-authorized MCPTT User initiates an on-demand private MCPTT call in manual commencement mode with floor control [CONN-MCPTT/ONN/PRIV/MANUAL/ONDEM/WFC/NFC/02]
7.2.109	A not-authorized MCPTT User initiates a pre-established private MCPTT call in automatic commencement mode with floor control [CONN-MCPTT/ONN/PRIV/AUTO/PRE/WFC/NFC/02]
7.2.110	A not-authorized MCPTT User initiates a pre-established private MCPTT call in manual commencement mode with floor control [CONN-MCPTT/ONN/PRIV/MANUAL/PRE/WFC/NFC/02]
7.2.111	A not-authorized MCPTT User initiates an on-demand private MCPTT call in automatic commencement mode without floor control [CONN-MCPTT/ONN/PRIV/AUTO/ONDEM/WOFC/02]
7.2.112	A not-authorized MCPTT User initiates an on-demand private MCPTT call in manual commencement mode without floor control [CONN-MCPTT/ONN/PRIV/MANUAL/ONDEM/WOFC/02]
7.2.113	A not-authorized MCPTT User initiates a pre-established private MCPTT call in automatic commencement mode without floor control [CONN-MCPTT/ONN/PRIV/AUTO/PRE/WOFC/02]
7.2.114	A not-authorized MCPTT User initiates a pre-established private MCPTT call in manual commencement mode without floor control [CONN-MCPTT/ONN/PRIV/MANUAL/PRE/WOFC/02]
7.2.115	A not-authorized MCPTT User initiates an on-demand private MCPTT emergency call in automatic commencement model with floor control [CONN-MCPTT/ONN/PRIV/AUTO/ONDEM/WFC/NFC/06]
7.2.116	Handling of non-acknowledged user information during an on-demand prearranged MCPTT Group Call [CONN-MCPTT/ONN/GROUP/PREA/ONDEM/NFC/11]

Number	Name
7.2.117	Handling of TNG1 timer during the setup of an on-demand prearranged MCPTT Group Call [CONN-MCPTT/ONN/GROUP/PREA/ONDEM/NFC/12]
7.2.118	Handling of non-acknowledged user information during a prearranged MCPTT Group Call using preestablished session [CONN-MCPTT/ONN/GROUP/PREA/PRE/NFC/05]
7.2.119	Handling of TNG1 timer during the setup of a prearranged MCPTT Group Call using pre-established session [CONN-MCPTT/ONN/GROUP/PREA/PRE/NFC/06]
7.2.120	MCData client establishes a IP Connectivity session with another MCData client [CONNMCDATA/ONN/IPCONN/01]
7.2.121	MCData client establishes a IP Connectivity session with another MCData client by using the target IP Information [CONN-MCDATA/ONN/IPCONN/02]
Floor Controlling (FC)	
7.3.6	Sharing/Display of FA during basic FC operations [FC/FA/BASIC/01]
Multi-Talker (MT)	
7.3.7	Multi-talker basic operation [FC/MT/BASIC/01]
Registration and Authorization (RegAuth)	
7.4.4	MCPTT service server limits the number of simultaneous successful service authorisations while using third-party registration [REGAUTH/3PRTYREG/REGISTER/02]
7.4.5	MCPTT service server limits the number of simultaneous successful service authorisations while using PUBLISH mechanism [REGAUTH/PUBLISH/REGISTER/02]
Affiliation (AFFIL)	
7.7.6	Affiliation change triggered by a functional-alias activation criteria [AFFIL/CHANGE/04]
7.7.7	Affiliation change triggered by a functional-alias deactivation criteria [AFFIL/CHANGE/05]
Functional Aliases (FA)	
7.13.1	MCPTT user requests to activate one or more functional aliases [FA/CHANGE/01]
7.13.2	MCPTT user requests to deactivate one or more functional aliases [FA/CHANGE/02]
7.13.3	MCPTT user refreshes the interest on one or more functional aliases [FA/CHANGE/03]
7.13.4	MCPTT user takes over a functional alias [FA/CHANGE/04]
7.13.5	MCPTT user requests to activate one or more functional aliases upon entering a location area [FA/LOCCHANGE/01]
7.13.6	MCPTT user requests to deactivate one or more functional aliases upon entering a location area [FA/LOCCHANGE/02]
7.13.7	MCPTT user determines the functional aliases successfully activated [FA/DET/01]
7.13.8	MCPTT user determines the functional aliases successfully activated for another user [FA/DET/02]
7.13.9	MCPTT server requests a resolution of the Functional alias from the MCPTT server owning that FA [FA/RESOL/01]
7.13.10	Automatic deactivation of FA [FA/CHANGE/05]
Regroup using a preconfigured group (RegrPrec)	
7.15.1	MCPTT user requests a users regroup using a preconfigured group [REGRPREC/USERREG/01]
7.15.2	MCPTT user removes a users regroup using a preconfigured group [REGRPREC/USERREG/02]
Observers scenarios	
9.13	Parallel MCPTT and MCVIDEO [OS9]
9.14	Initiation of the Railway emergency alert [OS10]

Table 12. Mapping of Test Case Numbers to Test Case Names

9 Interoperability Results

9.1 Overall Results

During the Plugtests event, a total of 65 Test Sessions were run: that is, 66 different combinations based on different configurations in Test Scope: MCX Client, MCX Application Server (Participating and Controlling), and IMS/SIP Core were tested for interoperability. Overall, 347 test executions were conducted and reported interoperability results.

The table below provides the overall results (aggregated data) from all the Test Cases run during all the Test Sessions with all the different combinations of Equipment Under Test from all the participating companies.

Among the executed Test Cases, the possible results were “OK”, when interoperability was successfully achieved and “NO” (Not OK) when it was not.

Interoperability		Totals
OK	**NO**	**Run**
330 (95.1%)	17(4.9%)	347

Table 13. Overall Results

Figure 12. Overall results (%)

A overall interoperability success rate of 95.1% was achieved, which indicates a very high degree of compatibility among the participating implementations (EUTs) in the areas of the Test Plan where features were widely supported and the test cases could be executed in most of the Test Sessions. In the next clauses, we will see that this high rate is also a consequence of the good preparation and involvement of participants during the remote integration and pre-testing phase of the Plugtests.

9.2 Results per Test Configuration

The table below provides the results for each test configuration in the scope of the Plugtests event. The below configurations are defined in clause 7.2.

	Interoperability		
	OK	NO	Run
Config-MCX	311 (94.8%)	17 (5.2%)	328
Config-MCX-Tester-Client	2 (100.0%)	0 (0.0%)	2
Config-MCX-LTE	10 (100.0%)	0 (0.0%)	10
Config-MCX-UE	5 (100.0%)	0 (0.0%)	5
Config-MCX-Tester-AS	2 (100.0%)	0 (0.0%)	2

Table 14. Results per Test Configuration

The table shows that very high execution and interoperability rates for different Test Configurations were achieved.

9.3 Results per Test Case

The table below provides the results for each test case in the scope of the Plugtests event. Test Cases numbering is referred from ETSI TS 103 564.

	Interoperability		
	OK	NO	Run
7.2.97	14 (100.0%)	0 (0.0%)	14
7.2.98	4 (100.0%)	0 (0.0%)	4
7.2.99	9 (100.0%)	0 (0.0%)	9
7.2.100	2 (100.0%)	0 (0.0%)	2
7.2.101	0 (0.0%)	1 (100.0%)	1
7.2.102	24 (96.0%)	1 (4.0%)	25
7.2.103	16 (94.1%)	1 (5.9%)	17
7.2.104	11 (100.0%)	0 (0.0%)	11
7.2.105	0 (0.0%)	1 (100.0%)	1
7.2.106	0 (0.0%)	1 (100.0%)	1
7.2.107	7 (100.0%)	0 (0.0%)	7
7.2.108	6 (100.0%)	0 (0.0%)	6
7.2.109	0 (0.0%)	0 (0.0%)	0
7.2.110	0 (0.0%)	0 (0.0%)	0
7.2.111	4 (100.0%)	0 (0.0%)	4
7.2.112	5 (100.0%)	0 (0.0%)	5

7.2.113	0 (0.0%)	0 (0.0%)	0
7.2.114	0 (0.0%)	0 (0.0%)	0
7.2.115	3 (100.0%)	0 (0.0%)	3
7.2.116	0 (0.0%)	0 (0.0%)	0
7.2.117	1 (100.0%)	0 (0.0%)	1
7.2.118	0 (0.0%)	0 (0.0%)	0
7.2.119	0 (0.0%)	0 (0.0%)	0
7.2.120	2 (66.7%)	1 (33.3%)	3
7.2.121	1 (100.0%)	0 (0.0%)	1
7.3.6	13 (100.0%)	0 (0.0%)	13
7.3.7	4 (100.0%)	0 (0.0%)	4
7.4.4	1 (100.0%)	0 (0.0%)	1
7.4.5	0 (0.0%)	0 (0.0%)	0
7.7.6	2 (100.0%)	0 (0.0%)	2
7.7.7	2 (100.0%)	0 (0.0%)	2
7.13.1	54 (94.7%)	3 (5.4%)	57
7.13.2	38 (88.4%)	5 (11.9%)	43
7.13.3	19 (100.0%)	0 (0.0%)	19
7.13.4	11 (91.7%)	1 (8.3%)	12
7.13.5	3 (100.0%)	0 (0.0%)	3
7.13.6	3 (100.0%)	0 (0.0%)	3
7.13.7	47 (97.9%)	1 (2.1%)	48
7.13.8	17 (94.4%)	1 (5.6%)	18
7.13.9	0 (0.0%)	0 (0.0%)	0
7.13.10	5 (100.0%)	0 (0.0%)	5
7.15.1	1 (100.0%)	0 (0.0%)	1
7.15.2	1 (100.0%)	0 (0.0%)	1

Table 15. Results per Test Case

10 Plugtests Observations

As a result of the Plugtests event activities some issues in 3GPP Technical Specifications (TSs) and related standards were identified together with practical deployment problems that may demand some clarification or feedback from the related SDOs. We have classified those aspects into the following two categories:

- **Observations to MCX Standards**: Missing, erroneous or ambiguous definition of procedures in 3GPP's MCPTT TSs.
- **Technical constraints**: Related to implementation issues, not covered by the standards, but which need to be faced by vendors in most deployments.

The reader should note that 3GPP Release 16 TS approved by December 2020 were considered for the first FRMCS Plugtests event.

The 1st FRMCS Plugtests event team wants to thank all the participants in the Plugtests for kindly sharing the following lessons learned. Specific actions towards pushing this feedback to relevant TSGs in 3GPP have already been started at the time of the release of this report.

10.1 Standards issues

10.1.1 Mismatch between per-functional alias status information between 9A.3.1.2 and 9A.2.2.2.7

The content of the pidf in the NOTIFY a result of a per-functional alias status information subscription differs in which id attribute of the <tuple> element in the mentioned subclauses in the 3GPP TS 24.379.

10.1.2 PAS/CAS to be in the media path of the IPCONN GRE tunnels being optional/mandatory

In 3GPP TS 24.282 Subclause 20.1.3 (i.e. for the CAS), the CAS replacing the IP of the SDP with his own one seems to be not mandatory "shall replace the IP address for the offered media stream in the received SDP offer with the IP address of the controlling MC Data function, if required". This would allow e2e GRE tunnels without PAS/CAS becoming endpoints:

SIGNALLING => ORIGPAS CAS TERMPAS

MCDATA1 o==========o MCDATA2

vs.

MCDATA1 o===o ORIGPAS o===o CAS o===o TERMPAS o===o MCDATA2

However, later, in Subclause 20.4.1 (for the CAS) it states "1) shall interact with the media plane as specified in 3GPP TS 24.582" assuming it needs to be always in the media path.

Similarly, in 3GPP TS 24.582 itself (i.e. Subclauses 13.2 and 13.3) the need for both PAS and CAS to be end points is clear: "13.2 Participating MCData function procedures The participating MCData function shall provide an endpoint for an IP tunnel towards the MCData client, and a second endpoint for an IP tunnel towards the controlling MCData function. " "Additionally, the participating MCData function shall act as an IP relay for the IP traffic between these two IP tunnels."

"13.3 Controlling MCData function procedures the controlling MCData function shall provide an endpoint for an IP tunnel towards the MCData originating participating MCData function, and a second endpoint for an IP tunnel towards the terminating participating MCData function. Additionally, the controlling MCData function shall act as an IP relay for the IP traffic between these two IP tunnels."

10.1.3 Usage of <functional-alias-URI> in chat group call

The only mechanism to convey the functional-alias-URI to the other members of a chat group seems to be the SIP INVITE request, limited to very particular situations: subclause 10.1.2.2.1.6 in 3GPP TS 24.379, “MCPTT client receives a SIP INVITE request for an MCPTT group call”, which is only used for MCPTT emergency and MCPTT imminent peril calls when the MCPTT client is affiliated but not joined to the chat group. Therefore this would be the only case where the MCPTT client “may display to the MCPTT user the functional alias of the inviting MCPTT user”.

10.1.4 Forwarding the <call-to-functional-alias-ind> from the Controlling to the callees

From subclauses 11.1.1.[3-4] in 3GPP TS 24.379 it is not clear if the intermediate components include the mcptt-info with the <call-to-functional-ind> element

10.1.5 Not explicit inclusion of call-to-functional-alias-ind in first to answer over preestablished sessions

Subclause 11.1.1.2.2.1 in 3GPP TS 24.379 does not define the mechanism to be used for stating the uri in the RLS to be a functional alias.

10.1.6 Forwarding of SIP INFO with non acknowledged user information when using pre-stablished sessions

Subclause 6.3.3.3 defines the behaviour of the controlling server in terms of TNG1 timer handling and non acknowledged user information. When all the conditions are met the the controlling MCPTT function may generate a SIP INFO request including the Info-Package header field set to g.3gpp.mcptt-info in the SIP INFO request and n application/vnd.3gpp.mcptt-info+xml MIME body as specified in clause F.1 with a <non-acknowledged-user> element containing the MCPTT ID of each of the invited members that have not sent a SIP 200 (OK) response; and send the SIP INFO request towards the inviting MCPTT client in the dialog created by the SIP request from the inviting MCPTT client.

The controlling behaviour would also apply to prearranged group calls over pre-established sessions but how/whether the SIP INFO will be forwarded by the originating participating to the caller is not explicitely addressed.

The only not-that-similar reference is the behaviour of the participating when a SIP INFO is received from the controlling in emergency call resulting on a reINVITE in 6.3.2.1.8.5:

Upon receipt of a SIP INFO request from the controlling MCPTT function within the dialog of the SIP INVITE request for an MCPTT emergency call or MCPTT imminent peril call, the participating MCPTT function: 1) shall generate a SIP re-INVITE request according to 3GPP TS 24.229 [4] to be sent within the SIP dialog of the pre-established session; 2) shall include in the SIP re-INVITE request an SDP offer based upon the previously negotiated SDP for the pre-established session;

Of course, such behaviour would not apply here since the SIP INFO only conveys information to be shown at the caller and does not demand any change in the SDP.

Furthermore, the Warning header in the 200 does not arrive at the caller.

10.1.7 [Editorial] Behaviour upon reaching the maximum number of simultaneous successful service authorisations while using third-party registration and publish differ

Step 2a) in 7.3.2 in 3GPP 24.379 defines the behaviour does not specify the result: 2a) shall check if the number of maximum simultaneous authorizations supported for the MCPTT user as specified in the <max-simultaneous-authorizations> element of the <anyExt> element contained in the <OnNetwork> element of the MCPTT service configuration document (see the service configuration document in 3GPP TS 24.484 [50]) has been reached. If reached, the MCPTT server shall not continue with the rest of the steps in this subclause;

while Step 3a) in 7.3.3 (for PUBLISH does)

3a) shall check if the number of maximum simultaneous authorizations supported for the MCPTT user as specified in the <max-simultaneous-authorizations> element of the <anyExt> element contained in the <OnNetwork> element of the MCPTT service configuration document (see the service configuration document in 3GPP TS 24.484 [50]) has been reached. If reached, the MCPTT server shall send a SIP 486 (Busy Here) response towards the MCPTT client with the warning text set to: "164 maximum number of service authorizations reached" in a Warning header field as specified in subclause 4.4, and shall not continue with the rest of the steps in this subclause;

10.1.8 (Non)mandatory download and HTTP in MCData

Section 8.3.2.7 in 3GPP TS 24.484 states that the affiliation rules need to be evaluated upon a change in the activated/deactivated status of a specific FA to trigger the (de)affiliation but it's not clear in which combination the de-activation triggers the de-affiliation (as the feature would typically look like)

10.1.9 Format of the m= line in the SDP for IPCONN's INVITE

From 3GPP TS 24.282, Section 20.1.1: "depending on the service operator policy, the client shall add a zero port number value to the media descriptions of the SDP offer, in order to inform network entities that media resources are not requested for the session , or add a specific port number value to reserve the necessary media resources to be used in the data exchange" and "MCData client shall include an SDP offer/answer according to subclause 6.1.2 of 3GPP TS 24.229"

Unlike other sections in 3GPP TS 24.282 there is no explicit reference to the content of the m= line and the role of the port and network resources considering that later GRE tunnels will be used to convey Application data back/forward through MCData nodes and not any transport protocol.

10.1.10 Content of mcptt-regroup+xml and behaviour of the terminating clients when receiving a notification of creation of a regroup

From 3GPP TS 24.379, Section 16.2.1.3: in the application/vnd.3gpp.mcptt-regroup+xml MIME body is contained in the incoming SIP MESSAGE request: a) if a <users-for-regroup> element is included in that MIME body, shall store the value of the <mcptt-regroup-uri> element as the temporary group identity and associate that with the group identity received in the <mcptt-regroup-uri> element, along with the information that the created regroup is a user regroup and should store the contents of the <users-for-regroup> element as the list of users that are part of that user regroup: or

But in the terminating participating that information seems to be removed according to Section 16.3.2.4 Step 3e:

e) shall copy the contents of the application/vnd.3gpp.mcptt-regroup+xml MIME body received in the incoming SIP MESSAGE request into an application/vnd.3gpp.mcptt-regroup+xml MIME body included in the outgoing SIP MESSAGE request, with the exceptions that any <users-for-regroup> elements shall not be copied;

10.1.11 Clarification on pidf+xml body for FA deactivation [test 7.13.2]

Subclause 9A.2.1.2 in 3GPP TS 24.379 states:

```
4) if the MCPTT client requests to activate one or more functional aliases,
shall set the Expires header field
according to IETF RFC 3903 [37], to 4294967295
5) if the MCPTT client requests to deactivate one or more functional
aliases, shall set the Expires header field
according to IETF RFC 3903 [37], to zero
6) shall include an application/pidf+xml MIME body indicating per-user
functional alias information according to
subclause 9A.3.1. In the MIME body, the MCPTT client:
shall include all functional aliases where the MCPTT user requests
activation for the MCPTT ID
```

This is ambiguous because in a deactivation user do not request activations so it is not clear what have to be indicated in deactivation requests.

In Plugtests two interpretations have been implemented:

in deactivation FA to be deactivated have to be listed as in activation (as indicated in ETSI TS 103 564 7.13.2)

In activation FA to be activated have to be listed, while in deactivation the listed FA are maintained and the active FA not indicated are deactivated.

So, the same request

```
PUBLISH sip:mcptt-orig-part-server-psi@example.com
Expires: 0
multipart: MCPTT-INFO:...<mcptt-info>
<mcptt-Params>:...<mcptt-request-uri
Type="Normal"><mcpttURI>sip:mcptt_id_clientA@example.com</mcpttURI></mcptt-
request-uri>
...</mcptt-Params>
</mcptt-info>...| PIDF: ...<presence
entity="sip:mcptt_id_clientA@example.com"><mcpttPIFA10:p-id-
fa>UNIQUEFAID</mcpttPIFA10:p-id-fa><tuple id="urn:uuid:00000000-0000-1000-
8000-AABBCCDDEEFF">
<status>
  <mcpttPIFA10:functionalAlias functionalAliasID="FA_A1"/>
  <mcpttPIFA10:functionalAlias functionalAliasID="FA_A2"/>
</status>
</tuple></presence>
```

can lead both to

deactivate FA_A1 and FA_A2

deactivate all FA BUT FA_A1 and FA_A2

10.2 Technical Constraints

None identified during this Plugtests.

11 Observer Program

The Observers contributed to the FRMCS Plugtests in the definition of the scope and scenarios, in the Observer Program and for the Observer demo.

11.1 Preparation Phase

During the preparation of the Plugtests event, conference calls were organised to create **Observer Scenarios**. Observer scenarios are use cases which were created by the observers, which becomes part of the interop demo and test specifications ETSI TS 103 564. Use cases are more complex scenarios which were use different features to describe most common use cases in a railway sector. Observers contributed with the user regrouping test cases 7.15.1 and 7.15.2, and with the scenario 9.14 Railway Emergency Call.

11.2 Observer Program

Observer programme is a presentation program during FRMCS Plugtests event which focused on the deployment plans and challenges of FRMCS.
The observer program provided a platform to the various stake holders in the railway industry to discuss the progress of FRMCS technology. The speakers were from government organisations, operators, regulators, users, associations which provide updates on deployment plans in their respective countries, pilot projects and updates on standards.

The observer program was conducted during half a day on 15th June 2021. The speakers presented to program outlined in Table 16.
Presentations in the observer program and the Questions & Answers are available on the Plugtests WIKI.

Presentations included:

Topic	Presenter
Welcome Presentation	Saurav Arora, ETSI CTI, Guillaume Gach, UIC
FRMCS Introduction	Dan MANDOC, UIC
TCCA update – activities for common good in critical communications	Tero Pesonen, TCCA
Japan Railways FRMCS Deployment Plan	Kazuki NAKAMURA, Railway Technical Research Institute (RTRI)
Australian Railways FRMCS Deployment Plan	Shane RENNICK, Public Transport Authority of Western Australia (PTA WA)
Korean Railways FRMCS Deployment Plan	Dr. Yang, Young Min, Korea National Railway (KNR)
5G for future RAILway mobile communication system - 5GRAIL	Dan Mandoc, UIC
Swiss Railways FRMCS Deployment Plan	Massimiliano Rizzato, SBB
German Railways FRMCS Deployment Plan	Achim Vrielink, DBN
French Railways SNCF Réseau FRMCS Deployment Plan	Eric GIRAUD-DESJUZEUR, SNCF-Réseau
Finnish shared use of Rail with Public Safety and plans for the future	Peteveikko Lyly, Erillisverkot on behalf of Finnish Transport Infrastructure Agency (FTIA)

Table 16. Observer Program

11.3 Observer Demo

The Observer Demo was a possibility for vendors to present their solutions and rail features to the observers. Interested vendors could book 30 minutes slots during the half day on 16 June 2021. Table 17 shows the observer demo overview.

MCX AS	MCX Client	LTE Network
ALEA	ALEA	Athonet EPC (w/ 3rd party eNB)
Expandium Testing tool		
Nemergent	Frequentis	(Athonet's IMS)
Kontron	Funkwerk/Kontron	
ALEA	Leonardo	

Table 17. Observer Demo

History

Document history		
V0.0.0	18/06/2021	First Draft
V0.1.0	23/06/2021	Stable Draft
V0.1.0	02/07/2021	Final Draft