**3GPP TSG-RAN Meeting #94-e *RP-213474***

**Electronic Meeting, 6th – 17th December 2021**

**MCC Task Force 160 (TF160)**

**Description** **and** **Terms of Reference for 2022**

# 0. Background

The MCC TF160 was setup in June 2000 and is under the responsibility of 3GPP TSG RAN WG 5 (RAN5) for the development, maintenance and deliveries of TTCN Test Suites. MCC TF160 is the 3GPP TTCN expertise pool for TSG RAN, as well as for TSG CT and TSG SA for some features (e.g. NAS, IMS, MCX). The task force (TF) consists of skilled protocol / TTCN experts coming from various companies of the 3GPP partners.

To date, the following conformance test cases have been developed in TTCN and are being maintained:

1700 UTRA FDD & LCR TDD tests (Radio Access & NAS),

2200 LTE FDD & TDD tests (E-UTRA & EPC),

820 5G FR1 & FR2 tests (EN-DC & NR/5GC).

190 Positioning tests,

280 IMS tests,

60 Mission Critical tests,

The majority of those tests have been verified/approved and made available to the industry for User Equipment (UE) conformance testing and certification purposes.

# 1. Rationale & Objective

**1.1** The funding of an expert team as a Task Force (TF) at the Mobile Competence Centre (MCC) has proved to be the most efficient and cost-effective way to develop the test specifications found in 3GPP TS 34.123-3, 34.229-3, 36.523-3, 36.579-5, 37.571-4, 38.523-3 and 51.010-5. In order to stabilise and to maintain all the currently available TTCN Test Suites and to continue developing new TTCN test cases for the different 3GPP Releases, MCC TF160 has been resourced, in part, by the 3GPP PCG/OP. 58 man months (mm) were allocated at OP#46 in October 2021, to cover the RAN/RAN5 2022 TTCN tasks requirement list. Voluntary funding of 43 mm will also be sought from various external organisations as well as individual companies, in the form of both manpower and cash. Responsibility for ensuring that the TF is resourced to meet the test development requirements rests with TSG RAN.

**1.2** MCC TF160 works in accordance with the priorities identified by the Global Certification Forum (GCF), the TD Industry Alliance (TDIA), the PCS Testing Certification Review Board (PTCRB) and the GSM Association (GSMA).

**1.3** **UTRA/NAS:** Maintenance of the existing set of 3GPP approved TTCN test cases for UTRA FDD R99 to Rel-14 and LCR TDD Rel-4 to Rel-9 needs to continue.

To meet the LTE-UMTS (without GSM) market demands, the UE CS Supplementary Services test will also be maintained in TTCN.

**1.4** **E-UTRA/EPS:** LTE-Advanced-Pro technology is continuing its evolution with many new features added in Rel-14 to Rel-16 to provide new functionalities and services. MCC TF160 shall implement & deliver the TTCN test cases for all the prioritised E-UTRA/EPC features in those Releases, in particular (but not only) enhancements to Machine Type Communications (feMTC, efeMTC), enhancements to Narrowband IoT (feNB-IoT), new Carrier Aggregation (CA) enhancements (new CA band combinations), further enhancements for mobility, optimisations on UE E-UTRA radio capability signalling.

Maintenance of the existing set of 3GPP approved TTCN test cases for LTE Rel-8 to Rel-14 (FDD & TDD) also needs to continue.

**1.5** **5G:** Many 5G networks are now in commercial operation based on the Rel-15 version of 5G standard. Many more 5G deployment are foreseen. To ensure the worldwide inter-operability of the 5G System, there is a strong demand for a consolidated set of conformance test cases. MCC TF160 shall continue to develop & deliver the corresponding 5G test cases reference implementation in TTCN-3, with priority for EN-DC, NR/5GC and NE-DC.

The deployed 5G networks are expected to soon start supporting Rel-16, so conformance test cases for Rel-16 are being developed for the following set of features: new NR bands & extension of existing NR bands, NR CA/DC band combinations & enhancements, NR Industrial IoT, V2X with NR sidelink, private network support, UE power saving in NR, NR mobility & MIMO enhancements, NR SON & MDT support, enhancements for NR Ultra-Reliable and Low Latency Communication (URLLC), optimisations on UE NR radio capability signalling, network slicing enhancements, NR 2-step RACH, NR in unlicensed spectrum.

Furthermore, there is a need to prepare for the upcoming 5G Rel-17, which will be frozen by 3GPP during 2022, and for which conformance test cases are already being planned, with initial focus on the following set of features: NR / EN-DC SON & MDT enhancements, NR sidelink enhancements & relay, NR UE power saving enhancements, NR RAN slicing enhancements, multi-SIM UEs, reduced capability NR UEs, NR multi/broadcast services, NR operation up to 71GHz.

**1.6** **Inter-RAT/Inter-System:** Many of the 5G network deployments rely on LTE & UMTS to provide a seamless fallback solution in areas where 5G coverage is not yet ubiquitous. New features have been added in Rel-16 for NR SON & MDT support with E-UTRA/WLAN/Bluetooth. The related conformance test cases are being specified. MCC TF160 shall develop & deliver the corresponding TTCN test cases.

Maintenance of the existing set of 3GPP approved Inter-RAT TTCN test cases for inter-working between NR, E-UTRA & legacy RATs (UTRA FDD, LCR TDD, GERAN, CDMA2000, WLAN) also needs to continue. As part of this task MCC TF160 will continue to maintain the GERAN (Inter-RAT) test suite.

**1.7** **IMS:** 5G network deployments rely on IMS for multimedia (especially voice & video) services so there is a strong need for conformance testing of the IMS layer and associated 5G features by the industry. MCC TF160 shall implement & deliver the TTCN test cases for the RAN5 prioritised Rel-15 IMS features, in particular IMS over NR and Rel-16 IMS-based eCall over NR.

Maintenance of the existing set of 3GPP approved TTCN test cases for IMS Rel-8 to Rel-15 also needs to continue.

**1.8** **Positioning:** More and more applications and services rely on the capability for the device to acquire its accurate location. Positioning functionalities are specified in 3GPP standards and require conformance testing. New Positioning features have been added in Rel-16, and the related conformance test cases are being specified. MCC TF160 shall develop & deliver the corresponding TTCN test cases, in particular positioning over NR and its Rel-17 enhancements.

Maintenance of the existing set of 3GPP approved TTCN test cases for Positioning Rel-8 to Rel-15 also needs to continue.

**1.9** **Mission Critical (MCX):** The mission critical industry is pursuing the evolution & migration of its wireless solutions to enable new services & use cases such as video and broadband data. 3GPP has specified in Rel-13 an LTE-based solution to support those new services, and this solution has been enhanced in Rel-14 & Rel-15. There is a strong demand for UE conformance test cases that would enable a MCX UE certification scheme to be put in place to guarantee inter-operability. In that context MCC TF160 shall continue implementing & delivering the TTCN test cases for Rel-14 Mission Critical Push To Talk (MCPTT), MCVideo & MCData, as well as the Rel-15 enhancements.

Maintenance of the existing set of 3GPP approved TTCN test cases for MCX Rel-14 to Rel-15 also needs to continue.

# 2. Consequences if not resourced

All test cases produced by MCC TF160 are used to prepare UEs for worldwide roaming and interoperability within commercial 3GPP networks. Without such tests, the UE interoperability cannot be guaranteed. Should MCC TF160 be discontinued, then the cohesive and unified approach to develop common TTCN modules will be lost. The system simulator manufacturers will inevitably deliver test platforms with different interpretations of the core specifications which will, in turn, lead to variable results and general confusion as to what constitutes a conformant UE. Furthermore, the broader implementation of 3GPP networks could be delayed as potential issues, such as interoperability of UEs, may not be resolved.

# 3. Detailed description

**3.1 Subject title:** 3GPP TTCN specifications for UE of different 3GPP Releases

**3.2 Reference Technical Body:** 3GPP TSG RAN WG 5

**3.3 Other interested Technical Bodies:**

3GPP TSG RAN WG 2, TSG CT WG 1, TSG SA WG 6

**3.4 Target dates for the start of work:** January 2022

**3.5 Target dates for the conclusion of the work:** December 2022

**3.6 Resource requirement**

**3.6.1 Estimated man month requirement in 2022**

It was estimated that the resource requirement, in terms of TTCN experts for 2022 will be 101 man months. A review of the funding requirement for 2022 was undertaken by RAN5 in August 2021 and later endorsed by TSG RAN in September 2021.

**3.6.2 Additional tasks requiring resources**

In addition to the TTCN development ETSI needs to host MCC TF160, as well as provide the Task Force’s overall leadership, management, logistical and IT support.

**3.6.3 Qualifications required, mix of skills**

The experts shall have deep 3GPP protocol knowledge at the Uu, LTE-Uu, Um or Gm reference points and good coding skills for writing TTCN test cases & maintaining high quality TTCN Test Suites.

3.7 Release and Configuration Management (RCM)

In January 2004, an RCM expert was appointed with specific duties to control the release of all TTCN test suites, maintain the database of the test case verification status, regularly provide the 3GPP test case status reports, as well as coordinate the verification activity between the test industry (verification teams) and MCC TF160. The continuation of the RCM in 2022 is to provide great benefits to the test industry and the RCM is an integral part of MCC TF160.

3.8 Scope of Terms of Reference

**3.8.1** The technical areas of MCC TF160 cover the conformance test specifications for UE signalling, radio protocols and radio access bearer interoperability in FDD and TDD radio technologies in UTRA, E-UTRA & NR, as well as the NAS (3G CN, EPC & 5G CN), IMS & MCX protocols. The UE handover and interoperability between NR, E-UTRA, IMS and the other legacy technologies also belong to the area.

**3.8.2** The Task Force is responsible for the development, maintenance and deliveries of UTRA, E-UTRA, NR, IMS and inter-RAT TTCN Test Suites, as well as UE positioning & MCX TTCN Test Suites in the different 3GPP Releases according to the relevant 3GPP prose test specifications. For the purposes of enabling GCF/PTCRB certification of UEs, priority is given to the completion and maintenance of the test cases selected by the certification fora.

**3.8.3** The Task Force is also responsible to implement the RAN5 prose and TTCN Change Requests (CRs) in TTCN, to integrate the verified TTCN test cases into the existing Test Suites and to deliver the 3GPP formally approved and RAN5 interim working test suite releases.

**3.8.4** MCC TF160 consists of several teams: a UTRA FDD team, an LCR TDD team, an LTE/EPC team, a 5G team, an IMS team, a positioning team and an MCX team. The UTRA FDD team concentrates on the FDD Test Suites (R99 to Rel-9) in TTCN-2 & the Test Suites (Rel-10 onwards) in TTCN-3. The LCR TDD team concentrates on the LCR TDD Test Suites for Rel-4 and the later releases in TTCN-2. The LTE/EPC team contributes to the LTE/EPC Test Suites in Rel-8 and the later Releases in TTCN-3. The 5G team contributes to the 5G Test Suites in Rel-15 and the later Releases in TTCN-3. The IMS team progresses all IMS related test cases in TTCN-3. The positioning team focuses on the positioning Test Suite in TTCN-3. The MCX team focuses on the MCX Test Suite in TTCN-3. The test split according to the access technologies of FDD and TDD has been maintained for UTRA HSPA test. The LTE/EPC & 5G test suites are shared by the technologies of FDD and TDD.

3.9 Context of the tasks in relation to TS 34.123, TS 34.229, TS 36.523, TS 37.571, TS 51.010, TS 36.579 and TS 38.523

3.9.1 Part One. The first part of TS 34.123, TS 34.229, TS 36.523, TS 51.010 and TS 38.523, as well as TS 37.571-2 and TS 36.579-2 specifies the test structure, test purposes and give each test case a prose description.

**3.9.2** Part Two. The second part specifies necessary ICS questions for UE manufacturers on the UE capabilities and the test case applicability.

**3.9.3** TTCN Parts (34.123-3, 34.229-3, 36.523-3, 37.571-4, 51.010-5, 36.579-5 and 38.523-3). These parts contain the TTCN Test Suites themselves and are considered as 3GPP formal test specifications; they are among the formal deliveries of MCC TF160.

3.10 Related activity in other bodies and necessary co-ordination of schedules

Changes on inter-RAT tests in TS 34.123, TS 36.523, TS 38.523 or TS 51.010 of RAN5 can have interactive impact. The stability of the relevant core specifications of CT1, RAN2 and SA6, as well as backwards compatibility between the 3GPP Releases, will have an impact on the progress of the Task.

**3.11 Base documents used**

TS 24.008: Mobile radio interface layer 3 specification, Core Network Protocols - Stage 3

TS 24.229: IMS CC protocol based on SIP and SDP - Stage 3

TS 24.301: NAS protocol for EPS - Stage 3

TS 25.321: MAC protocol specification

TS 25.322: RLC protocol specification

TS 25.331: RRC protocol specification

TS 36.321: E-UTRA MAC protocol specification

TS 36.322: E-UTRA RLC protocol specification

TS 36.323: E-UTRA PDCP specification

TS 36.331: E-UTRA RRC protocol specification

TS 24.501: NAS protocol for 5G System - Stage 3

TS 37.324: E-UTRA and NR SDAP specification

TS 38.321: NR MAC protocol specification

TS 38.322: NR RLC protocol specification

TS 38.323: NR PDCP specification

TS 38.331: E-UTRA RRC protocol specification

TS 34.108: Common test environment for UE conformance testing

TS 34.109: Terminal logical test interface; Special conformance testing functions

TS 34.123-1: UE conformance specification, part 1: protocol conformance specification

TS 34.123-2: UE conformance specification, part 2: ICS Proforma specification

TS 51.010-1: Mobile station conformance specification, part 1: protocol conformance specification

TS 51.010-2: Mobile station conformance specification, part 2: ICS Proforma specification

TS 34.229-1: IMS CC UE conformance specification part 1: protocol conformance specification

TS 34.229-2: IMS CC UE conformance specification, part 2: ICS Proforma specification

TS 34.229-5: IMS CC UE conformance specification part 5: protocol conformance specification using 5GS

TS 36.508: Common test environment for evolved UE conformance testing

TS 36.509: E-UTRA and EPC; Special conformance testing functions for User Equipment (UE)

TS 36.523-1: UE conformance specification, part 1: protocol conformance specification

TS 36.523-2: UE conformance specification, part 2: ICS Proforma specification

TS 37.571-2: E-UTRA and EPC UE conformance specification for UE positioning; Part 2: Protocol conformance

TS 37.571-3: E-UTRA and EPC UE conformance specification for UE positioning; Part 3: ICS

TS 37.571-5: UTRA and E-UTRA and EPC; UE conformance specification for UE positioning; Part 5: Test scenarios and assistance data

TS 36.579-1: Mission Critical (MC) services over LTE; Part 1: Common test environment

TS 36.579-2: Mission Critical (MC) services over LTE; Part 2: MCPTT UE Protocol conformance specification

TS 36.579-4: Mission Critical (MC) services over LTE; Part 4: Test Applicability and ICS proforma specification

TS 36.579-6: Mission Critical (MC) services over LTE; Part 6: MCVideo UE Protocol conformance specification

TS 36.579-7: Mission Critical (MC) services over LTE; Part 7: MCData UE Protocol conformance specification

TS 38.508-1: 5GS; UE conformance specification; Part 1: Common test environment

TS 38.508-2: 5GS; UE conformance specification; Part 2: Common ICS proforma

TS 38.509: 5GS; Special conformance testing functions for UE

TS 38.523-1: 5GS; UE conformance specification; Part 1: Protocol

TS 38.523-2: 5GS; UE conformance specification; Part 2: Applicability of protocol test cases

**3.12 Relevant RAN/RAN5 Work items**

All TEIx\_Test,

MCPTT-ConTest,

LTE\_feMTC-UEConTest,

LTE\_CA\_R15-UEConTest,

NB\_IOTenh2-UEConTest,

5GS\_NR\_LTE-UEConTest,

LTE\_CA\_R16-UEConTest,

MCImp-UEConTest,

NR\_CADC\_NR\_LTE\_DC\_R16-UEConTest,

NR\_bands\_BW\_R16-UEConTest,

LTE\_eMTC4-UEConTest,

LTE\_feMob-UEConTest,

NR\_IIOT-UEConTest,

5G\_V2X\_NRSL\_eV2XARC-UEConTest,

NG\_RAN\_PRN\_Vertical\_LAN-UEConTest,

NR\_UE\_pow\_sav-UEConTest,

NR\_Mob\_enh-UEConTest,

NR\_eMIMO-UEConTest,

NR\_SON\_MDT-UEConTest,

RACS-UEConTest,

NR\_RF\_FR1-UEConTest,

MCenh-UEConTest,

NR\_L1enh\_URLLC-UEConTest,

NR\_pos-UEConTest,

NR\_lic\_bands\_BW\_R17-UEConTest,

NR\_CADC\_NR\_LTE\_DC\_R17-UEConTest,

NR\_EIEI-UEConTest,

eNS-UEConTest,

NR\_2step\_RACH-UEConTest,

LTE\_NR\_DC\_CA\_enh-UEConTest,

NR\_unlic-UEConTest,

LTE\_NR\_MUSIM-UEConTest,

NR\_ENDC\_SON\_MDT\_enh,

NR\_SL\_enh,

NR\_UE\_pow\_sav\_enh,

NR\_slice,

NR\_pos\_enh,

NR\_redcap,

NR\_MBS,

NR\_SL\_relay,

NR\_ext\_to\_71GHz.

**3.13 Expected Output**

TS 34.123-3: UTRA UE conformance specification, part 3: Abstract Test Suite (ATS)

TS 51.010-5: GERAN Mobile station conformance specification, part 5: Abstract Test Suite (ATS)

TS 34.229-3: IMS CC UE conformance specification, part 3: Abstract Test Suite (ATS)

TS 36.523-3: E-UTRA UE conformance specification, part 3: Test Suites

TS 37.571-4: E-UTRA and EPC UE conformance specification for UE positioning; Part 4: Test Suites

TS 36.579-5: Mission Critical (MC) services over LTE; Part 5: Abstract test suite (ATS)

TS 38.523-3: 5GS; UE conformance specification; Part 3: Protocol Test Suites

In addition, the outputs will be in the form of TTCN Test Suites and will be delivered in accordance with the RAN/RAN5 approved test specifications and the delivery schedule. In essence, MCC TF160 will deliver 4 formal releases (at quarterly intervals) containing those test cases which have been verified according to RAN5 PRD-12 and approved by TSG RAN Plenary. In between these releases, MCC TF160 will deliver a series of RAN5 interim working documents that contain the entire suite of test cases i.e. including those that have yet to be verified. This enables the test industry to verify the outstanding test cases within the framework of the extant working Test Suites.