वर्गीय आवश्यकताओं के लिए मानक

सं. टी.ई.सी २३०४०:२०२५

(सं. २३०४०:२००९ को अधिक्रमित करता है)

STANDARD FOR GENERIC REQUIREMENTS

No. TEC 23040:2025

(Supersedes No.: TEC 23040:2009)

सेलुलर नेटवर्क के लिए ड्राइव टेस्ट उपकरण

Drive Test Tool for Cellular Networks

ISO 9001:2015

दूरसंचार अभियांत्रिकी केंद्र

खुर्शीदलाल भवन, जनपथ, नई दिल्ली-११०००१, भारत

TELECOMMUNICATION ENGINEERING CENTRE

KHURSHIDLAL BHAWAN, JANPATH, NEW DELHI–110001, INDIA

www.tec.gov.in

Release 2: September, 2025

FOREWORD

Telecommunication Engineering Centre (TEC) functions under Department of Telecommunications (DOT), Government of India. Its activities include:

- Issue of Standards for Generic Requirements (GR), Interface Requirements (IR) and Service Requirements (SR) as well as Test guides for Telecom Products and Services;
- Issue of Technical regulations in the form of essential Requirements (ER);
- Field evaluation of products and Systems;
- National Fundamental Plans;
- Support to DOT on technology issues;
- Testing & Certification of Telecom products; and
- Designation of Conformance Assessment Bodies (CABs) for testing.

For the purpose of testing, four Regional Telecom Engineering Centers (RTECs) have been established which are located at New Delhi, Bangalore, Mumbai, and Kolkata.

ABSTRACT

This document is the Standard for Generic Requirements (GR) of the Drive Test Tool for Cellular Networks in the Indian mobile communication network. This document covers briefly an overview of drive testing, applications, supported technologies, technical requirements, accessory requirements, as well as the display parameters and measurement capabilities to be supported.

CONVENTIONS

In this document, requirements are classified as follows:

- The keywords "shall" or “is/are required to” indicate a requirement or requirements, which must be mandatorily complied and from which no deviation is permitted, if conformance to this document is to be claimed; and
- The keyword "should" indicate a recommended requirement, which is not mandatory for claiming conformance to this document. However, its implementation is strongly advised as it represents best practices or preferred functionality; and
- The keywords “Optional” or “may” indicate an optional requirement, which is permissible for exclusion from mandatory compliance, unless the said requirement is claimed to be complied by the vendor. These terms are not intended to imply that the vendor's implementation must provide the option; it means the vendor may optionally provide the feature and still claim conformance with this document.

CONTENTS

HISTORY SHEET

S. No.	Standard No.	Title	Remarks
1.	GR/WS/DTG001/01. MAR.2009	Drive Test Tool for GSM, GPRS, EDGE and WCDMA Networks	First Issue: March 2009
2.	TEC 23040:2009	Standard for Generic Requirements for a Drive Test Tool for GSM, GPRS, EDGE and WCDMA Networks	Includes revised Numbering Scheme
3.	TEC 23040:2025	Standard for Generic Requirements for Drive Test Tool for Cellular networks	Revised to incorporate requirements for 4G and 5G technologies. This issue also introduces post-processing tool features into the existing GR.

REFERENCES

S.N.	Document No.	Title / Document Name
1.	3GPP TS 38.410	5G; NG-RAN; NG general aspects and principles
2.	3GPP TS 29.281	Universal Mobile Telecommunications System (UMTS); LTE; 5G; General Packet Radio System (GPRS) Tunnelling Protocol User Plane (GTPv1-U)
3.	3GPP TS 36.410	LTE; Evolved Universal Terrestrial Radio Access Network (E-UTRAN); S1 general aspects and principles
4.	3GPP TS 29.274	Universal Mobile Telecommunications System (UMTS); LTE; 5G; 3GPP Evolved Packet System (EPS); Evolved General Packet Radio Service (GPRS) Tunnelling Protocol for Control plane (GTPv2-C); Stage 3
5.	3GPP TS 25.201	UMTS, Physical layer - general description
6.	3GPP TS 25.215	Physical layer; Measurements (FDD)
7.	3GPP TS 25.225	Physical layer; Measurements (TDD)
8.	3GPP TS 44.004	Layer 1; General Requirements
9.	3GPP TS 38.213	"Physical Layer Procedures for Control"
10.	3GPP TS 38.214	"Physical Layer Procedures for Data", Power Allocation for downlink
11.	3GPP TS 38.133	"NR; Requirements for support of radio resource management" chap. 10.1.2. – 10.1.5.
12.	3GPP TS 28.554	"5G end to end Key Performance Indicators (KPI)"
13.	3GPP TS 32.450	"Key Performance Indicator (KPI) for Evolved Universal Terrestrial Radio Access Networks (E-UTRAN): Definitions"
14.	3GPP TS 37.320	"Radio measurement collection for Minimization of Drive Tests (MDT)"

15.	3GPP TS 38.211	"Physical channels and modulation"
16.	ITU-T P.863	“Perceptual Objective Listening Quality Analysis”
17.	ITU-T E.806	“Measurement campaigns, monitoring systems and sampling methodologies to monitor the quality of service in mobile networks”
18.	ITU-T J.343	“Hybrid perceptual bitstream models for objective video quality measurements”
19.	ITU-T P.1203	“Parametric bitstream-based quality assessment of progressive download and adaptive audiovisual streaming services over reliable transport”
20.	ETSI TR 103 559	“Speech and multimedia Transmission Quality (STQ); Best practices for robust network QoS benchmark testing and scoring”
21.	ETSI TS 102 250-2	Speech and multimedia Transmission Quality (STQ); QoS aspects for popular services in mobile networks; Part 2: Definition of Quality-of-Service parameters and their computation

CHAPTER 1

1. Introduction & Description

1.1. Scope:

This document is the Standard for Generic Requirements (GR) of the Drive Test Tool for cellular networks in the Indian mobile communication network. This document provides an overview of Drive Testing, applications, supported technologies, technical requirements, accessory requirements, display parameters and measurement capabilities to be supported.

1.2. General:

1.2.1. A Drive Test Tool for cellular networks is essential for assessing network performance, quality, and coverage. The key features of such a tool include network coverage analysis, which evaluates signal strength and quality to identify coverage gaps and weak-signal areas. Drive testing analysis provides clear insights into mobile network coverage and performance by measuring key performance indicators (KPIs) such as accessibility, retainability, mobility, integrity, and availability across the supported mobile technologies. By analyzing drive test results, Telecom Service Providers (TSPs) will be able to address the following aspects:

1. Identification of cell overshooting caused by improper network design during planning, leading to interference.
2. Detection of black spots i.e. non-coverage spots
3. Recognition of interference-prone areas, such as densely populated regions or zones with poor frequency planning and overlapping cells
4. Identification of sectors receiving poor signal quality (e.g., slow data speed, dropped calls, etc.)
5. Handover failures between cell sites
6. Gaining a competitive edge in the market
7. Reduction in customer complaints and churn
8. Improvement of overall customer experience and satisfaction

1.2.2. A typical Drive Test Tool comprises of a digital RF receiver (scanner), satellite navigation system, test mobile, engineering handset and necessary software and hardware for their functioning. In addition, a Post Processing Tool may also be provided.

a) **Receiver (Scanner) -** The receiver is used for performing network independent measurements like spectrum analysis, Continuous Wave (CW) and channel power analysis, broadcast/synchronization channel decoding, as well as interference analysis.

b) **Satellite Navigation System** – The Satellite Navigation System (e.g. GNSS, regional navigation system like NavIC) provides geodetic data—such as latitude, longitude, and altitude—for location referencing, along with precise timing information for synchronization purposes.

c) **Test Mobile: -** A Test Mobile is used for capturing air interface parameters and signaling information for voice and data of GSM, GPRS, EDGE, WCDMA, HSDPA/HSUPA, LTE/LTE-A, and 5G NR wireless networks.

   i. Test Mobile communicates the air interface data online to connected laptop through data port so that one can see these parameters on the laptop screen.

   ii. The parameters are not displayed on Test Mobile screen.

   iii. The parameters or data are not stored in memory of Test Mobile or on any mini data cards.

d) **Engineering Handset (Hand Held Test Mobile)** – An Engineering handset capture, store, and display air interface RF parameters. The Engineering Handset has following features/functionalities:

   i. Measures and stores network dependent parameters

   ii. Communicates and interacts with Drive Test Tool software. It shall be possible to use Engineering handset as a stand-alone tool for indoor and outdoor data collection

   iii. Display Key parameters

e) **Post Processing Tool:** It is a laptop/desktop/server/cloud-based software system used for processing and generating reports for measurement data collected over the cellular network air interface. The data processing is required for installation, maintenance, optimization of the network and to take corrective actions to ensure the desired radio network availability and quality. The tool is also used for generating benchmarking report of different technologies of same operator or different operators.

1.3. Types of Drive Test

1.3.1. Single Site Verification (SSV)/Single Cell Functionality Test (SCFT) Drive Test:

SSV drive test or SCFT drive test is all about performing drive test analysis on a particular site (for e.g., newly installed cell tower) and this is usually performed by drive testing or by walk testing around the site.

In site level testing, the site is ready for performing SSV testing after completion of engineering, installation and integration and no active alarms are observed. The main aim of SSV testing is to validate functional performance of the site and identify/flag workmanship issues, product issues & provisioning issues before turning the site on for commercial users. Such kind of SSV testing for site entails stationary and mobility drive tests conducted using smartphone app-based solutions. SSV tests for a site and includes Voice calls, Ping Test, FTP file uploads and downloads etc.

Single cell functionality test or single site verification is a static test which collects each sector information of the cell site in terms of coverage and quality parameters depending upon the technology like 4G LTE, 5G in the cellular mobile network.

1.3.2. Multiple site verification (MSV) or Cluster drive test:

As the name suggests, drive test when performed on a group of cells is termed as a 'Cluster drive test' or 'MSV'.

Initially, in traditional drive tests, network testers used to drive along target routes to collect information regarding coverage data through various iterations and field tests with cellular RF drive test equipment. But, as telecom businesses are expanding, it is cumbersome to refine expanded networks in terms of size, capacity, and number of users. With cluster drive tests, operators can perform network tests by taking a group of cells and deploying it in a particular location and investigating the network accordingly.

Cluster drive test is executed when the network is in active mode (i.e. providing service to customers) and helps to inspect the interference amid two cells and verify handover between cells. Network parameter details like RSRP, RSRQ, SINR, Coverage plot, Download and Upload throughput, etc. is accumulated. Operators use this data to get output which is further utilized to optimize the mobile network and deliver efficient service to users. Drive Test Tools can be used to measure cellular network parameters using compatible smartphones and deployed on a variety of available smartphones for cluster (mass) drive testing.

Multiple site verification drive test shall have measurements of radio parameters

for cellular networks and at least basic level to identify primary network issues. Implementation of cell lock / band lock feature allows RF engineers to measure all these parameters on selected bands as per their requirements.

The Drive Test Tool should have parameters for voice and data services. The Drive Test Tool users can conduct drive tests for various tests like Ping test, Call test, Speed test, HTTP test, SMS test and Video Stream test and analyze the drive data for QoE and RAN monitoring. The tool enables users to generate cluster drive-based reports on a daily basis or hourly basis as per requirement for QoE RAN monitoring. Conducting a drive test can resolve ARPU customer complaints based on network usage and cost optimization techniques.

Cluster drive test is also used to collect MOS (Mean opinion Score) which gives the customer perceived voice quality of the network.

1.3.3. Operator benchmarking drive test (Market level drive test):

In this test, comparison is done in terms of number of call drops, data throughputs, and other key KPIs on cellular networks between various network operators and analyze who is providing better user experience. Usually, market level drive testing is performed by operators themselves/ independent bodies/ telecom regulators. For example, telecom regulators from various countries constantly perform market level drive tests to identify underperforming operators whose user experience KPIs are not meeting regulatory requirements.

'Market level drive test' analysis is carried out based on a particular market or an entire geographical area with the use of appropriate Drive Test Tools. Operators conduct drive testing on an area to analyze user experience with respect to other cellular service providers. Market level drive testing can identify their strengths.

Drive test engineers / RAN testing engineers can perform a drive test by locking on to a specific cell, for instance, 4G LTE cell in their test location and select the desired bandwidth such as LTE 40, LTE 25, and so on.

The operators or regulators have a network comparison feature wherein users can compare multiple different network operators and generate reports automatically. Telecom operators or regulators can use these reports to quickly determine high performing and underperforming networks.

1.3.4. UE based Drive test :

UE-based drive tests and walk tests consist of an active and planned measurement of a particular area of the network with a particular User Equipment. Procedure for carrying out these tests usually include:

- Uplink (UL) and Downlink (DL) data transfers of different durations and/or file sizes;
- Voice calls;
- Streaming;
- Web browsing.

CHAPTER 2

2. Functional Requirements

2.1. General: - This chapter provides the functional requirements of a radio network Drive Test Tool. The Drive Test Tool serves as an air-interface test tool for real time diagnostics enabling the monitoring of voice and data channels. It is equipped with basic testing and inspection functions, designed to assist experienced RF personnel in verifying, troubleshooting and optimizing the performance of the radio network.

2.2. Support of technologies: The Drive Test Tool shall support one or more of the following technologies, depending on the requirements specified by the procurer:

GSM
GPRS
EDGE
WCDMA
HSDPA/HSUPA
HSPA+
LTE/LTE-A
5G NR

2.3. Drive Test Tool Components: - The Drive Test Tool solutions shall, at a minimum, comprise the following elements, which may include both hardware and software components for data collection in outdoor and in-building environments:

i. Engineering handset, Test mobile (e.g phone, data card etc.) with driver software, data cable, charger and necessary accessories.
ii. Receiver (Scanner) with cables, antenna and necessary accessories.
iii. GNSS-based satellite navigation system (optionally supporting NavIC) with 1 PPS (Pulse Per Second) output, including antenna, necessary cables and accessories, with USB/Bluetooth connectivity.
iv. Post processing tool (Optional)
v. Hub/Hardware Unit for connecting the above units (the hub may or may not be required depending on the implementation).
vi. Additional accessories like charging attachment (to be used for charging etc.) and the phone holders. All items (phones, scanner etc.) shall be connected to one carrying case.

2.4. Drive test Solution shall be identified as one of the below:

2.4.1. Laptop based Drive Test Tools – The data collection software is installed on the laptop. The test devices/handset are connected to the laptop through appropriate accessories. The software on the laptop controls the tests executed on these test devices/handsets. The laptop-based solution can support single test device/handset and can go upto 50 or more test devices/handsets using relevant accessories like backpack or any other relevant equipment. All the test logs are collected on the laptop.

2.4.2. Handheld Based Drive Test Tool – The data collection software is installed on the test device/handset itself. The tests are executed directly on the test device/handset and corresponding logs are generated and stored on the same.

2.4.3. Receiver Based Drive Test Tool - The receiver-based drive-test tool configuration consists of a receiver and navigation unit (like GNSS and regional navigation system) connected to a laptop. In this setup, network-independent parameters are measured to assess the performance and quality of the wireless network

2.4.4. Phone Plus Receiver Based Drive Test Tool - The phone and receiver-based configuration consists of engineering handset, test mobile, receiver and navigation unit connected to Laptop. In this configuration, network dependent and network independent measurements/observations are carried out simultaneously.

2.5. The Drive Test Tool shall perform voice and data testing, verification, troubleshooting, optimization, and benchmarking for all supported cellular technologies on the same laptop without software platform changes.

2.6. The Drive Test Tool software shall support 3GPP specifications from Rel 99 to Rel 19 and shall be upgradable to higher applicable releases.

2.7. The tool shall simultaneously display radio parameters (e.g. RxLev, RxQual, RSRP/ss-RSRP, RSRQ/ss-RSRQ, POLQA-MOS etc.) using the same software platform for supported cellular technologies of same or different operators on the map using parallel information streams.

2.8. The Drive Test Tool shall show/draw line to serving cells in map view and show neighbor cells. It shall show parameters such as Cell ID, BCCH, SC, PBCH, ECI,

NCI, SIB, and PCI on map.

2.9. The Drive Test Tool shall be able to perform drive-test with a minimum of 4 mobiles for voice and data testing. For benchmarking purposes, simultaneous voice and data testing shall also be possible. Along with the test mobiles, external receiver with GNSS/NavIC and USB hub shall also be supported. It shall also be possible to use all the phones to perform data measurement on the same or different networks. It shall be possible to do multiple data testing simultaneously on each phone. There shall be provision of making short calls and long calls simultaneously on different handsets and the duration of calls shall be user configurable.

2.10. Apart from Outdoor measurement, the Drive Test Tool shall be capable of performing in-door measurements using multiple test mobiles as used for outdoor measurements with a laptop. For indoor benchmarking, the tool shall be capable of measurement of multiple cellular technologies (as supported) of same or different operator networks.

2.11. The Drive Test Tool shall also have functionality to plan drive-testing route on the map beforehand. Route based on certain parameters shall be visible for all connected test mobiles simultaneously.

2.12. The tool shall have the ability to view outdoor measurements on a digital map and in-building measurements on a floor plan map of the building. It shall have ability to import standard formats such as jpg, tif, bmp, png, pdf, svg or any other global standard format for indoor maps. The indoor measurement shall be possible using multiple test mobiles connected to the laptop or using one of the test mobiles with Engineering Handset features.

2.13. It shall be possible to insert markers during indoor measurement and load such file into the combined data of Drive Test Tool.

2.14. For indoor measurement scenarios, 5G-supported positioning capabilities (e.g., UE-based or network-assisted positioning) may be utilized for accurate trace plotting and location mapping by the Drive Test Tool.

2.15. Digital Receiver (Scanner) shall support downlink measurements. The Digital Receiver shall be an external high speed scanning tool with GNSS/NavIC.

2.16. The measurement tool shall support full RF measurement parameters (e.g

RXQUAL Sub, RXLEV Sub, FER, RSRP, RSRQ, SINR, BLER, PER, Timing Advance, etc.) along with voice quality measurement parameters and statistics for the supporter technologies.

2.17. The measurement tool shall support the export of measurement data in commonly used open formats, such as ASCII, CSV, any other global standard format.

2.18. The Drive Test Tool shall support insertion of log file markers as initiated by user.

2.19. The Drive Test Tool shall provide the ability to monitor and log multiple devices and multiple technologies simultaneously.

2.20. Auto and Manual Mode of Operation: The Drive Test Tool shall have provision to configure test mode as auto and manual mode. In auto mode, it shall run the program automatically as configured and give results. In manual mode, it shall be possible to perform any specific measurement as required by user. The tool shall automatically select default signaling/timeslot protocols etc. applicable for the interface/link being monitored.

2.21. The measurement tool shall support the seamless transition from different technologies without losing any loggable attributes.

2.22. The measurement software shall support multiple workspaces and simultaneous display of multiple views to allow network comparisons.

2.23. The measurement software shall support simultaneous data synchronization during data collection or playback.

2.24. The measurement software shall support automatic dialing to repeatedly place calls during a test, with user-defined parameters.

2.25. The measurement software shall show call statistics, categorized by call termination result.

2.26. The measurement software shall support alarms, triggered by user-defined parameters and limits.

2.27. The measurement software shall support Layer 2 and Layer 3 message decoding. It shall be possible to read the Layer messages while logging the data.

2.28. The measurement software shall have auto-save option to recover from

software crash.

2.29. The measurement software shall support user customizable graph, message, map, colour and statistical displays that may be saved or loaded in a single workspace display. Live customization of windows shall be possible while collecting data.

2.30. The measurement software shall have views to plot two values against each other to see their distribution in real time.

2.31. The Drive Test Tool shall support export of data in commonly used open and map-compatible formats such as CSV, Tab-Delimited, MapInfo format or any other global standard format.

2.32. The measurement software shall provide the capability to import and merge cell site databases from multiple operators in commonly used formats (e.g., Excel, TXT, or equivalent) and display the consolidated information on a single map.

2.33. The measurement software shall have the option to link the parameters of test mobile and receiver so that both monitors the same carrier and network.

2.34. The test tool shall support important radio data channel measurements, as applicable to the supported cellular technologies, including but not limited to C/I burst ration and BER for uplink and downlink, packet attach and detach KPIs, packet session KPIs, DL/UL throughput at various layers (application, RLC, MAC, PDSCH, PUSCH, PPP etc.), BLER, RSRP, RSRQ, SINR, CQI.

2.35. Log file generated from Drive Test Tool must be highly compressed without any message filters so that Engineer can easily (by phone or email) send these log files from far field to central office for post processing.

2.36. The Drive Test Tool shall support capturing of parameters (including but not limited to the following like Co-channel Interference, Adjacent channel interference, S-SCH Ec/N0, CPICH Ec/N0, RS CINR, SS-SINR, SSB-SINR, PBCH DM-SINR) from scanner for checking interference for all the supported cellular technologies.

2.37. The Drive Test Tool shall support the following:

2.37.1. Measurements as per supported cellular technologies.

2.37.2. Data testing, including HTTP/HTTPS, latency, and FTP/FTPS speed tests.

2.37.3. Voice testing for the supported cellular technologies, including LTE voice features such as CSFB and SRVCC (as applicable).

2.37.4. Cell Lock / Band Lock feature.

2.37.5. Video streaming test support on supported cellular technologies.

2.37.6. Frequency scanning for all supported RAN technologies and frequencies allotted to telecom operators in India.

2.37.7. Layer 3 and Layer 2 messaging capture.

2.37.8. Manual and automated test scenarios for call and data sessions.

2.37.9. Capture of GNSS information along the drive route.

2.37.10. RF tools shall be portable, with measurement software ideally available on smartphones. (Applicable for engineering handset-based drive test tool only).

2.37.11. Scanners with at least 4 Rx paths for measuring coverage in LTE and NR technologies (applicable as per supported cellular technologies).

2.37.12. Latency measurement support.

2.37.13. SMS, MMS, app-based messaging, and video conferencing testing.

2.37.14. GIS mapping support.

2.37.15. Support for quality of measurement test cases, including:

2.37.15.1. Automatic and fast device detection regardless of number of test devices (for laptop-based Drive Test Tool).

2.37.15.2. Voice quality measurement as per ITU-T P.863 specifications for supported technologies including CSFB and SRVCC as applicable

2.37.15.3. Automated Voice Quality MOS (POLQA) measurements for Over- The-Top (OTT) applications such as VoIP services, with support for POLQA algorithm.

2.37.15.4. SIP/RTP logging for VoLTE and VoNR calls (applicable, if LTE/LTE-A and 5G NR are supported)

2.37.15.5. Support for all the latest chipsets from chipset manufacturers.

2.37.15.6. **Support of ITU E.806:** Measurement campaigns, monitoring systems and sampling methodologies to monitor the quality of service in mobile networks.

2.37.15.7. **Support of ITU J.343:** Hybrid perceptual bit stream models for objective video quality measurements. ITU J.343 provide

methods which measures Quality-of-Experience evaluation, benchmarking and optimization of any adaptive video streaming services in fixed and mobile networks.

2.37.15.8. **Support of ITU-T P.1203 (Optional):** Parametric bitstream-based quality assessment of progressive download and adaptive audiovisual streaming services over reliable transport. This recommendation may be used for in-service quality monitoring for specific IP-based audiovisual services.

2.37.16. The tool shall not implement any log mask that filters or restricts data collection. All samples must be recorded in the measurement log without omission under any circumstances.

2.37.17. The tool shall create separate logfile for each device

2.37.18. The tool shall support Iperf 2.0 and Iperf 3.0.

2.37.19. The tool shall support the capture and export of logs in formats compatible with commonly used network packet analyzer tools, such as Wireshark.

2.37.20. The tool shall have capability to be controlled remotely and should have a cloud based separate monitoring tool.

2.37.21. The tool shall support Technology Lock, Band Lock, and frequency/channel lock applicable to each supported RAT.

2.37.22. The tool shall support the testing of following protocols and services-

a. ICMP (Internet Control Message Protocol)
b. FTP (File Transfer Protocol)
c. HTTP (Hypertext Transfer Protocol)
d. TCP (Transmission Control Protocol) and UDP (User Datagram Protocol)
e. SMTP (Simple Mail Transfer Protocol) and POP3 (Post Office Protocol 3) protocols (for email testing)
f. SMS (Short Message Service)
g. MMS (Multimedia Messaging Service)
h. Video streaming (OTT and streaming services)
i. Video connectivity

2.38. Test Mobile Requirements:

2.38.1. The test mobile shall be capable of testing all the parameters of the

supported technologies.

2.38.2. The Drive Test Tool shall be able to inter-work with mobiles of at least 4 makes and 10 models of major vendors available in the market.

2.39. Engineering Handset (Handheld Test Mobile) Requirements:

2.39.1. The Drive Test Tool shall be supplied with at least one of the test mobiles having features of an Engineering Handset.

2.39.2. The Engineering Handset shall be a mobile phone-based tool having an application running on commonly used mobile phone operating system for measurement of air-interface parameters of all the supported cellular technologies.

2.39.3. It shall be possible to use this phone for laptop-based data collection as a normal Test Mobile or a standalone tool for indoor and outdoor data collection.

2.39.4. It shall support the following key features:

2.39.4.1. Log files storage for minimum 100 hours.

2.39.4.2. Graphical, fully customizable and user-friendly user interface

2.39.4.3. Video streaming and voice quality measurements based on Mean Opinion Score (MOS)

2.39.4.4. Automated service testing with Test Scenarios for: voice quality, voice call, video call, FTP, HTTP, HTML browsing, send/receive email, MMS, SMS

2.39.4.5. It shall be possible to create and modify Test Scenarios and with a built-in editor

2.39.4.6. Real-time statistics

2.39.4.7. Site database File support

2.39.4.8. Display freeze

2.39.4.9. User-definable notifications/alerts

2.39.4.10. Measurement results shall be displayed in different types of windows including text, bar and line graphs and neighbor graph (bar, line, and inter-system bar). It shall also be possible to stack bar and line graphs. Bar graph scales shall be shown for each bar simultaneously. Integer parameters shall be shown in decimal and in octal format. It shall be possible to shows the current logging status.

2.39.4.11. It shall be possible to use the engineering handset as a regular phone while it is logging in the background.

2.39.4.12. It shall provide real-time statistics on voice and video calls, PDP context, FTP/HTTP connections, SMS/MMS messaging, HTML browsing, email sending/receiving, ping, and inter-system cell reselections and handovers. The real-time results of both manual and Test Scenario-aided testing can be monitored throughout the duration of the connection.

2.39.4.13. It shall support several built-in application testing options like:

i). Voice quality

ii). Voice and video calls

iii). FTP/HTTP (File Transfer Protocol / Hypertext Transfer Protocol) data transfers

iv). HTML (Hypertext Markup Language) browsing

v). SMS/MMS (Short Message Service / Multimedia Messaging Service) messaging

vi). Email (sending and receiving) andping

vii). The QoS / QoE KPIs logged including connection setup delay

viii). Download time

ix). Time-to-content delay

x). Throughput etc.

2.39.4.14. The handset shall support video streaming quality measurements, which should automatically activate when a video stream is initiated on the handset. It shall allow testing with any video format from any accessible platform or server.

2.39.4.15. It shall offer a set of configurable audio notifications that can be used to notify the user of important measurement events. Other notification features shall include individual notification activation/deactivation through the handset UI and a user-definable hysteresis timer for controlling and silencing repeating notifications.

2.40. Physical Interfaces & Connectors

Data Interface Type: RS232 or USB 3.0 or RJ-45

GNSS/NavIC antenna connector: SMA type/BNC type / USB type

Number of USB Ports for Test Mobiles: 4

2.41. Laptop: Laptop with following minimum configuration shall be provided:

a) **Processor:** Intel® Core™ i5 or higher (2.6 GHz or higher) or equivalent AMD Ryzen™ 5 processor

b) **RAM:** Minimum 8GB DDR4 RAM

c) **Ports:** USB 3.0 or USB-C (for software key support and external hardware)

d) **Expansion Slots**: USB-C/Thunderbolt 3/4 or USB-A connection for multiple hardware support

e) **Storage**: Minimum 512GB SSD

f) **Optical Drive**: DVD or Blu-ray Writer (optional, as most modern laptops may not include optical drives)

g) **Display:** Minimum 1920 x 1080 Full HD display resolution

h) **Display Size:** 13” to 15.6” screen size

i) **Graphics**: Integrated Intel® UHD Graphics or AMD Radeon Vega graphics

j) **Ethernet:** Integrated Gigabit Ethernet (optional on ultra-portable models; USB Ethernet adapter can be used)

k) **Modem:** Optional (Most modern laptops rely on high-speed internet connections and have built-in Wi-Fi 5/6)

l) **Security Subsystem**: TPM 2.0 (Trusted Platform Module 2.0) or equivalent hardware-based security for data protection

2.42. Memory/Storage: -

2.42.1. The Drive Test Tool controller PC (Laptop) shall be equipped with adequate hard-disk capacity to enable storage of monitored data and other software programs.

2.42.2. A minimum capacity of 512 GB SSD hard disk shall be provided for storage.

2.42.3. The memory requirement for the software for Drive Test Tool and associated accessories shall be specified by the supplier.

2.43. External Accessories/Devices

2.43.1. The Drive Test Tool shall have provision for connecting printer, external monitor (which has same or extended display as on the screen of the Drive Test Tool). Any additional software or

hardware required for this provision shall be provided by the supplier.

2.43.2. It shall be possible to print the stored information (e.g., captured data) on an externally connected printer.

2.43.3. The following accessories may be supplied, if required by the Tendering Authority.

- Transit Case
- Walk Test Kit and Carry Case (indoor & sub-lane drive test)
- Inverter
- Printer/Plotter

2.44. Satellite Navigation System Requirements

The Drive Test Tool shall support GNSS, with optional support for the Indian Regional Navigation Satellite System (NavIC).

2.44.1. USB GNSS Requirement:

a) Sensitivity: minimum -165 dBW

b) Connector: USB Type-A/Type-C

2.44.2. BLUETOOTH GNSS Requirement:

a) Frequency: L1 (1,575.42 MHz)

b) Channels: 20 Channels all-in-view tracking

c) System Back Up: Replaceable/built-in Li-Ion battery

d) Battery: Rechargeable

e) Operation time: at least 15 hrs at full charge continuous

2.45. Scanner Requirements:

2.45.1. The scanner shall accurately and efficiently capture signals from all the supported cellular technologies. It shall support measurements such as BCCH C/I and BSIC detection for GSM, RSRP and SINR for LTE, and SS-RSRP and SS-SINR for 5G NR across the applicable bandwidths.

2.45.2. The scanner bandwidths shall comply with the requirements of applicable cellular technologies and shall cover the frequency bands as notified in the latest National Frequency Allocation Plan (NFAP). The specific bandwidths to be supported may be defined by the procurer.

2.45.3. It shall support channel power measurements, frequency scanning parameters and pilot scanning parameters for user-defined set of frequencies.

2.45.4. In cases where the UE operates with multiple MIMO layers, the tool shall approximate the throughput of multi-layer transmissions, since individual MIMO layer throughputs may differ.

2.46. The Drive Test Tool shall support the following technology-specific requirements (Note: Support for technologies as per clause 2.2):

2.46.1. 2G (GSM/GPRS/EDGE) Requirements

2.46.1.1. The Drive Test Tool shall support the measurement and logging of the following parameters for 2G networks:

i). Logging of Layer-3 messages (RR, MM, CC) to analyze the cell-related system information, broadcast messages and troubleshoot timing-related events.

ii). BCCH ARFCN, BSIC.

iii). Carrier-to-Interference ratio (C/I)

iv). Received Signal Strength Indicator (RSSI)

v). Bit Error Rate (BER), Frame Erasure Rate (FER), and Block Error Rate (BLER)

vi). RxQual

vii). Supported modulation schemes such as GMSK and 8-PSK (for EDGE) based on network conditions.

viii). UE transmit power.

ix). Application-layer throughput.

2.46.2. 3G (UMTS/HSPA/HSPA+) Requirements:

2.46.2.1. The Drive Test Tool shall support the measurement and logging of the following parameters for 3G networks:

i). Logging of Layer-3 signaling (RRC, NAS, MM/CC) to analyze the cell-related system information, broadcast messages and troubleshoot timing-related events.

ii). UARFCN to determine active and powered-on cells (i.e., NodeBs).

iii). RSCP, Ec/No

iv). CQI and RSSI

v). Throughput on HS-DSCH, E-DCH channels

vi). FER and BER.

vii). Supported modulation schemes: QPSK, 16 QAM, or 64 QAM b

viii). Tx Power Control (TPC) values and UE transmit power class.

ix). BCCH/CCCH messages (SI1–SI6 messages)

x). RRC messages for call setup, reconfiguration, etc.

xi). MIB, SIB1–SIBx decoding.

xii). HSPA Parameters: shall be as per 3GPP TS 25.201, TS 25.215 & TS 25.225 and shall have graphical representation and grouping of HSPA parameters for powerful troubleshooting and analysis

2.46.3. 4G (LTE/LTE-A) Requirements:

2.46.3.1. The Drive Test Tool shall support measurement and logging of the following parameters for 4G networks:

i). Logging of layer-3 signaling (like RRC log, NAS log) to analyze the cell related system information's and broadcast messages and troubleshoot timing related events

ii). E-ARFCN/Physical Cell-ID (PCI) to determine active and powered on cells (eNB)

iii). RSRP, RSRQ and SINR.

iv). CQI and RSSI.

v). Downlink and uplink throughput (DL-SCH, UL-SCH)

vi). BLER for DL-SCH and UL-SCH

vii). DL/UL resource blocks allocation

viii). Supported modulation schemes: BPSK, QPSK, 16 QAM or 64 QAM based on network conditions

ix). Channel Quality Information (wideband and narrowband)

x). UE transmit power

xi). User application throughput

xii). RRC messages

xiii). MIMO configuration

xiv). PBCH and SIB

xv). Beamforming matrix (Optional).

2.46.3.2. The Drive Test Tool shall support Carrier Aggregation testing and DSS measurements.

2.46.4. 5G (NR Requirements)-

The Drive Test Tool shall support the following measurements and testing for 5G NR networks:

2.46.4.1. Carrier aggregation testing

2.46.4.2. NSA/SA mode forcing.

2.46.4.3. Channel/PCI forcing.

2.46.4.4. Collection of beam specific KPIs

2.46.4.5. Massive MIMO (mMIMO) drive tests and field measurements.

2.46.4.6. Dynamic Spectrum Sharing (DSS) measurements

2.46.4.7. MIMO measurements

2.46.4.8. PCI (Physical Cell ID),

2.46.4.9. SS-RSRP, SS-RSRQ, SS-SINR (from SSBs including PSS, SSS, PBCH-DMRS)

2.46.4.10. PBCH Decoding,

2.46.4.11. Coverage in IDLE states (i.e. RRC_IDLE or RRC_INACTIVE),

2.46.4.12. Coverage and performance in CONNECTED states (RRC_CONNECTED).

2.46.4.13. Bandwidth,

2.46.4.14. MIMO layers,

2.46.4.15. Load and data channel (SINR),

2.46.4.16. Path loss and

2.46.4.17. PDSCH SINR.

2.47. Post Processing Tool requirements

2.47.1. Post Processing Tool shall support standalone as well as enterprise (server-client) architecture. Procurer may choose any architecture as per their requirement.

2.47.2. The tool may be a desktop/laptop/server/cloud-based solution.

2.47.3. The tool shall support analysis of all the supported cellular technologies.

2.47.4. The tool shall have the capability of report generation by analyzing the collected data.

2.47.5. The post processing tool will be used to process the logs collected from the Drive Test Tool. The post processing will be laptop-based solution or can be installed on the server if it has to process and generate reports for the logs collected on 10 devices or more.

2.47.6. It shall support near real-time upload of test data to post

processing tool.

2.47.7. The tool shall support analysis of data on map-based view.

2.47.8. The tool shall provide graphical and tabular reports for cellular technology-specific performance parameters with various file formats supported

2.47.9. The post processing tool shall have support of GIS mapping

2.47.10. The tool shall support generation of KPIs such as handover success rate, call drop rate, call setup time, call setup success rate, latency, throughput, and voice quality metrics, among others

2.47.11. The post processing tool may support ETSI TR 103 559 Network Performance Scoring mechanism which describes the best practices for robust network QoS benchmark testing and scoring.

2.47.12. The tool shall provide best-in-class visualization including following:

i). Synchronized workbooks, workbook pages, and data views

ii). A comprehensive range of data views, including maps, grids, line graphs, bar graphs, pie charts, surface grids, color grids, and spreadsheets

iii). Cutting-edge field test data visualization: area binning, distance binning, advanced base station overlay with the service areas, signal power, etc. of selected antennas visualized as area bins, and line drawing from terminal to active and monitored cells based on any parameter (e.g. indicating pilot pollution). Base station map overlay can be synchronized with base station data to enable automatic zoom to the map representation of the cell selected on the grid.

iv). Easy-to-use graphical interface for designing and creating custom KPIs without any knowledge of SQL.

v). A 3D visualizer option to display 5G NR beams on a 3D map, enabling detection of building and tree attenuation effects on signal levels, as well as evaluation of beam width and coverage in real-world conditions. (if 5G support is mentioned by the procurer)

vi). Playback of individual log files

vii). Dashboards

2.47.13. The tool shall automate reporting and provides flexible customization including following:

i). Full cloud integration to enable automation of the end-to-end process for analysis and reporting.

ii). Automated data loading and execution of reports/workbooks

iii). Automation of scheduled workbooks, reports, and measurement data uploads from predefined folders. A notification email can be configured to be sent when a new workbook/report is generated, .

iv). Pre-defined and customizable benchmarking reports, including CDR end-to-end voice and data reports, where data is aggregated per transaction (combining both A and B parties for voice calls) and further analyzed to get the results.

v). Statistical reporting with Spreadsheet Reports compatible with Microsoft Excel.

vi). Support for report templates in MS Word and MS PowerPoint with a limited set of features.

vii). Flexible customization of user interface elements and functionalities (workbooks, data view layouts, queries, color sets, KPIs, etc.) with the ability to export and import custom settings.

viii). Automated filtering of processed data based on configurable parameter threshold conditions (e.g., filtering out data from outside the coverage area).

ix). Support for execution of custom SQL queries

2.47.14. The tool shall support the generation of KPIs for all the supported cellular technologies as per clause 2.2.

2.47.15. The Post Processing Tool shall be capable of generating KPI on following services (applicable as per supported cellular technology)-

i). Voice call/ Video call

ii). CSFB Call

iii). MMS

iv). SMS

v). FTP

vi). HTTP

vii). WAP

viii). IMAP/POP3

ix). SMTP

x). Ping Test

xi). Social Media Applications

xii). File Sharing Applications

xi). Video Streaming

xii). IMS Voice Call

xiii). IMS VideoCall

xiv). Streaming Application

2.47.16. The Post-Processing Tool shall support the following KPIs for various application tests (applicable as per supported cellular technologies)-

2.47.16.1. **Voice/Video Call KPIs**

i). Call attempts

ii). Call attempt failures

iii). Successful call setups

iv). Incoming call attempts

v). Incoming call attempt failures

vi). Successful incoming call setups

vii). Normal call disconnects

viii). Dropped call

ix). Average call duration

x). Service accessibility

xi). Call completion rate

xii). Call setup time

xiii). DL speech quality on sample basis

xiv). UL speech quality on sample basis

xv). DL speech quality on call basis

xvi). UL speech quality on call basis

2.47.16.2. **CSFB Voice KPIs**

i). CSFB call attempt

ii). CSFB call connected

iii). CSFB call disconnected

iv). CSFB call dropped

v). CSFB call attempt failure

vi). Call setup time to ALERTING CSFB

vii). System fallback time to 3G for a CSFB call

viii). System fallback time to 2G for a CSFB call

ix). Call setup time to CONNECTED CSFB

2.47.16.3. **MMS Test KPIs**

i). MMS send attempts

ii). MMS send failures

iii). Successfully send MMS's

iv). Received MMS delivery reports

v). MMS receive attempts

vi). MMS receive falures

vii). Successfully received MMS's

viii). Received MMS notifications

ix). MMS send time

x). MMS retrieval time

xi). MMS notification time

xii). MMS end-to-end delivery time

2.47.16.4. **SMS Test KPIs**

i). SMS send attempts

ii). SMS send failures

iii). Successfully send SMSs

iv). Successfully received SMSs

v). SMS status reports received

vi). SMS service accessibility

vii). SMS send time

viii). SMS end to end delivery time

2.47.16.5. **FTP Test KPIs**

i). FTP connection attempt

ii). FTP server disconnect

iii). FTP server connect

iv). FTP connect failures

v). FTP connection drops

vi). FTP file transfer attempt

vii). FTP file transfer success

viii). FTP file transfer drops

ix). FTP IP service setup time (ETSI TS 102 250-2 method A)

x). FTP application throughput DL 1s

xi). FTP initial duration

xii). FTP initial bytes

xiii). FTP Mean data rate DL (ETSI TS 102 250-2 method A)

xiv). FTP Mean data rate UL (ETSI TS 102 250-2 method A)

xv). FTP file transfer upload time

xvi). FTP file transfer download time

2.47.16.6. **HTTP Transfer Test KPIs**

i). HTTP attempts

ii). HTTP successes

iii). HTTP failures

iv). HTTP initial duration

v). HTTP initial bytes

vi). HTTP IP service setup time (ETSI TS 102 250-2 method A)

vii). HTTP Mean data rate DL (ETSI TS 102 250-2 method A)

viii). HTTP Mean data rate UL (ETSI TS 102 250-2 method A)

ix). HTTP file transfer upload time

x). HTTP file transfer download time

2.47.16.7. **HTTP Browsing Test KPIs**

i). HTTP browsing IP service setup time (ETSI TS 102 250-2 method A)

ii). HTTP browsing Mean data rate DL (ETSI TS 102 250-2 method A)

iii). HTTP browsing Mean data rate UL (ETSI TS 102 250-2 method A)

iv). HTTP browsing attempts

v). HTTP browsing redirected address

vi). HTTP browsing info

vii). HTTP browsing transfer status

viii). HTTP browsing application data throughput

ix). HTTP browsing successes

x). HTTP browsing application throughput DL 1s

xi). HTTP browsing initial duration

xii). HTTP browsing initial bytes

xiii). HTTP browsing failure

xiv). HTTP browsing file transfer download time

2.47.16.8. **WAP Test KPIs**

i). WAP attempt

ii). WAP success

iii). WAP failure

iv). WAP content

2.47.16.9. **IMAP/POP3 Test KPIs**

i). POP3 server connection attempt

ii). POP3 server disconnect

iii). POP3 server connect

iv). POP3 server connect failure

v). POP3 server connection dropped

vi). POP3 mail transfer attempt

vii). POP3 mail transfer success

viii). POP3 mail transfer dropped

ix). IMAP server connection attempt

x). IMAP server disconnect

xi). IMAP server connect

xii). IMAP server connect failure

xiii). IMAP server connection dropped

xiv). IMAP file transfer attempt

xv). IMAP file transfer success

xvi). IMAP file transfer dropped

2.47.16.10. **SMTP Test KPIs**

i). SMTP server connection attempt

ii). SMTP server disconnect

iii). SMTP server connect

iv). SMTP server connect failure

v). SMTP server connection dropped

vi). SMTP mail transfer attempt

vii). SMTP mail transfer success

viii). SMTP mail transfer dropped

2.47.16.11. **PING Test KPIs**

i). Ping round trip time (RTT)

ii). Ping timeout

iii). Ping packet size

iv). Ping rate

v). Ping lost packet

vi). Ping requests

vii). Ping responses

viii). Ping timeouts

ix). Ping success rate

x). Ping session status

2.47.16.12. **Social Media Application Testing KPIs**

i). Access attempts

ii). Access successes

iii). Access failures

iv). Transaction attempts

v). Transaction successes

vi). Transaction failures

vii). Connection Time

viii). Transaction time

ix). Transfer time

x). Session Time

xi). Download time

2.47.16.13. **File Sharing Applications Testing KPIs**

i). Transaction attempts

ii). Transaction successes

iii). Transaction failures

iv). Transaction time

v). Session transfer status

2.47.16.14. **IMS Video Call Testing KPIs**

i). IMS video call attempt

ii). IMS video call attempt failure

iii). IMS video call connected

iv). IMS video call disconnected

v). IMS video call dropped

vi). IMS video codec

vii). Call setup time to ALERTING IMS video (for LTE/NR, RRC CONNECTED/IDLE cases)

viii). RTP video interarrival time downlink

ix). RTP video packet error rate

x). RTP video jitter downlink

xi). IMS video RTP HO interruption time

xii). IMS video SIP handshake time

xiii).IMS VQ MOS DL absolute

xiv).IMS VQ MOS DL audio quality absolute

xv). IMS VQ MOS DL relative

xvi).IMS VQ MOS DL audio quality relative

xvii). IMS VQ MOS UL absolute

xviii). IMS VQ MOS UL audio quality absolute

xix).IMS VQ MOS UL relative

xx). IMS VQ MOS UL audio quality relative

2.47.16.15. **IMS Voice Call Testing KPIs**

i). SIP server registration attempt

ii). SIP server registration failed

iii). SIP server registration completed

iv). SIP server deregistered

v). SIP server deregistered abnormally

vi). RTP jitter downlink

vii). RTP packet error rate downlink

viii).RTP interarrival time downlink

ix). RTP bytes downlink

x). IMS voice RTP HO interruption time (LTE)

xi). IMS voice RTP HO interruption time (NR)

xii). RTP bytes in uplink

xiii).RTP packets in downlink

xiv).RTP packets in uplink

xv). IMS voice speech path delay

xvi).IMS voice – all speech path delays during call

xvii). IMS voice – maximum number of consecutive lost RTP packets

xviii). IMS voice – number of consecutive lost RTP packets

xix).IMS voice – burst error length

xx). IMS voice – total number of lost RTP packets

xxi).Call setup time to ALERTING (IMS voice)

xxii).Call setup time to ALERTING (IMS voice, for LTE/NR in RRC CONNECTED/IDLE cases)

xxiii). IMS voice codec

xxiv). IMS voice SIP handshake time

xxv). IMS voice call attempt

xxvi). IMS voice call connected

xxvii). IMS voice call disconnected

xxviii). IMS voice call dropped

xxix). IMS voice call attempt failure

xxx). VoLTE POLQA downlink average before SRVCC (LTE)

xxxi). VoNR POLQA downlink average before SRVCC (NR)

xxxii). IMS call duration (ETSI defined)

xxxiii). SRVCC handover (LTE)

xxxiv). SRVCC handover (NR)

xxxv). VoLTE intra-LTE handover failures (LTE)

xxxvi). VoNR intra-NR handover failures (NR)

xxxvii). VoLTE intra-LTE handover failure rate (%) (LTE)

xxxviii). VoNR intra-NR handover failure rate (%) (NR)

xxxix). ROHC compression rate in downlink

xl). ROHC compression rate in uplink

xli). SIP server registration excluded

xlii). SIP server deregistration excluded

xliii). SIP server re-registration success

xliv). SIP server re-registration rejected

xlv). SIP server re-registration failed

xlvi). SIP server re-registration timeout

xlvii). SIP server re-registration attempts

xlviii). RTP jitter uplink

xlix). RTP packet error rate uplink

l). SIP Signaling Messages

2.47.16.16. **Streaming Application KPIs**

i). Data transfer stream bandwidth

ii). Data transfer stream content type

iii). Data transfer stream video codec

iv). Video quality MOS

v). Video quality BVQA MOS (PEVQ-S)

vi). Session time

vii). Initial buffering time

viii). Video request all events

ix). Video request events.

x). Video successfully started (buffering started)

xi). Video successfully started (streaming started)

xii). Video successfully started (streaming not started)

xiii). Video player and video access time

xiv). Video player and video buffering time

xv). Video download time

xvi). Video request

xvii). Video resolution

xviii). Video successfully completed

xix). Video total duration

xx). Video request failed (Video reproduction not started)

xxi). Video request failed (Initial buffering not started)

xxii). Video request failed (Connection attempt failed)

xxiii). Video failed

xxiv). Video dropped

xxv). Video request failed

xxvi). Video access time

xxvii). Video player initialization time

xxviii). Data transfer stream file size

xxix). Video rebuffering

xxx). Video rebuffering rate

xxxi). Video rebuffering time

xxxii). Packet error rate downlink

xxxiii). Transferred packets downlink

xxxiv). Transferred packets uplink

xxxv). Erroneous packets uplink

xxxvi). Erroneous packets downlink

2.47.17. The Post Processing Tool shall be able to display all the KPIs as mentioned in the previous clauses for all the supported cellular technologies.

CHAPTER 3

3. Quality Requirements, EMI/EMC Requirements, Safety Requirements and Security Requirements

3.1. Engineering Requirements

3.1.1. Hardware

3.1.1.1. **General**

3.1.1.1.1. The solution should support maximum number for device for benchmarking activities. It should range from two device support and should have possibility to support 50 devices.

3.1.1.1.2. Compact and high-performance state-of-the-art hardware shall be used.

3.1.1.1.3. All components of the Drive Test Tool shall be of ruggedized construction suitable for field use, and shall be clearly and permanently labeled for identification.

3.1.1.1.4. Design precautions shall be taken to minimize the possibility of damage to tool arising from the insertion of an electronic package into the wrong connector or the removal of any package from any connector.

3.1.1.1.5. All components shall be rated for continuous operation of the tool under the normal operating conditions.

3.1.1.1.6. All RF IN / OUT connectors shall be reliable and of standard type to ensure failure free operation under environmental conditions specified in this GR.

3.1.1.1.7. All connectors and the cables supplied shall be of low loss type and suitably shielded. The supplier shall indicate the various types of cables and wires used. Detailed particulars of special wires and cables shall be furnished with their actual usage.

3.1.1.1.8. The mechanical design & construction of unit shall be inherently robust & rigid under all conditions of operation, adjustment, replacement, storage and transport.

3.1.1.1.9. The tool should support power supply from in vehicle accessories as well as regular power supply of AC 240 volts.

3.1.1.2. **Equipment practices**

3.1.1.2.1. All metal parts of frames, supports etc. shall be mechanically rugged and constructed of corrosion resistant material or treated with anti-corrosive finish.

3.1.1.2.2. The tool shall be adequately covered to safeguard against entry of even dust, insects etc.

3.1.2. Ease of upgradation

Up gradation, both software & hardware, for new release of LTE and 5G NR standards, shall be easy and economical. The upgrades shall be possible at site not requiring tool to be sent to factory or vendor's premises. The upgrade of the hardware and software should follow same standards of measurements.

3.1.3. Software

3.1.3.1. **General**

3.1.3.1.1. The software shall be modular in design, such that changes or enhancements can be introduced with minimal impact on other modules.

3.1.3.1.2. All supporting software documentation shall be provided in English. Any future software updates required to overcome equipment deficiencies (e.g., bugs, compatibility issues) shall be supplied free of cost by the equipment supplier.

3.1.3.1.3. The equipment supplier shall provide software updates on a continuing basis. Such updates may include new features, services, and maintenance enhancements.

3.1.3.1.4. The equipment supplier shall provide any software modifications necessitated by changes in applicable standards.

3.1.3.1.5. The tool shall provide online help for all key measurements.

3.1.3.1.6. The operating system shall be stable and efficient. Software or firmware upgrades capability shall be supported in the field.

3.1.3.1.7. The supplier shall clearly indicate the software version, and the version information shall be accessible on the LCD/screen or user interface when requested through software commands.

3.1.3.1.8. The software tools, drivers and cables (if required) for programming, configuration, software download, parameter changes and remote maintenance purposes shall be provided considering the following items:

a) Software tools and procedures for configuration and programming via keypad.

b) Software tools and procedures for software version upgrade through cables, PCMCIA memory card etc.

3.1.3.2. **Right to use**

There shall be no imposition of any sort of precondition on the 'Right to Use' of software.

3.1.4. Man-Machine Communication

3.1.4.1. All user instructions and information shall be provided in English. User inputs or commands shall be in English, and the system responses shall also be in English.

3.1.5. Markings

3.1.5.1. The marking on the tool and the cables shall be the same as that used on the schematic drawings, cabling lines etc., in the documentation supplied with the tool.

3.1.5.2. All instructions, labels, or any other marking on the tool shall be perfectly legible and in the English language.

3.1.5.3. Fuses shall have a suitable marking for the ratings to enable easy identification and replacement.

3.1.5.4. Marking shall ensure easy traceability.

3.1.5.5. The plug-in units whose removal or insertion (while the tool is in operation) might endanger the reliability or performance of the tool shall have suitable protection and caution marking.

3.1.5.6. The components shall be marked with their schematic references so that they are identifiable from the component layout diagram in the handbook.

3.1.6. Dimensions and Weight

The tool shall be portable and single integrated compact equipment for all measurements. Actual dimension and weight of tool shall be indicated by the equipment supplier.

3.1.7. Cooling Arrangement

The tool shall have necessary self-cooling arrangement with or without in-built fan. The fan, if used, shall be used in redundant configuration. The MTBF of the fan shall be at least 80,000 hours.

3.1.8. MTBF/MTTR

The MTBF and MTTR (predicted and observed values) figures shall be worked out by the equipment supplier and based on these figures, the maintenance spares for three years shall have to be specified by equipment supplier.

3.1.9. Diagnostics/Testing

The tool shall support diagnostic capabilities to verify its proper operation. Built-in test capabilities shall be provided which will run at specific events or on demand.

3.1.10. Field Proneness

The tool shall be fully solid state, field proven and shall adopt latest state-of-the-art technology.

3.1.11. Display Screen

a. It shall be such that the information displayed is clearly visible and shall not fade under direct sun light.
b. The screen shall provide color display.
c. It shall have spectrogram display to identify intermittent burst signals over time.
d. The Display Screen size shall be at least 15 inch diagonally for Laptop based Drive Test Tools.

3.2. Operational Requirements

3.2.1. The tool shall be easy to use by field engineers with minimum training. Important Do's and Don'ts about the operation of the tool shall be clearly indicated.

3.2.2. Provision shall be there for self-check of the tool whenever powered on.

3.2.3. The calibration of the tool shall be valid for at least one year.

3.2.4. Alarm Indications: Suitable indications shall be provided for alarms

3.3. Quality Requirements

3.3.1. Components

3.3.1.1. The source of procurement of components shall have to be submitted by the manufacturers. Alternatively, the bidders may indicate whether the components are approved by any international authority.

3.3.1.2. List of all the components for which second source is not available, shall be provided.

3.3.2. Quality Standards

3.3.2.1. The tool shall be manufactured in accordance with the International Quality Standard ISO-9001:2015 for which the manufacturer shall be duly accredited. The quality plan describing the quality assurance system followed by the manufacturer shall be submitted.

3.3.2.2. The equipment casing should support various EMC standards:

- EN 61000-4-2 Electrostatic Discharge (ESD) Surge Immunity Test
- EN 61000-4-3 Radiated RF Electromagnetic Field Immunity Test
- EN 61000-4-4 Electrical Fast Transient/ Burst Immunity Test
- EN 61000-4-5 Surge Immunity Test
- EN 61000-4-6 RF Conducted Immunity Test
- 61000-4-8:2010 Power Magnetic Fields Immunity
- EN 61000-4-11 Voltage DIPs and Interruptions, EN55011 Conducted Emissions Class A

Vibration and Environment standards

- IEC/EN 60068-2-64 Random vibration
- IEC/EN 60068-2-27 shock
- IEC/EN 60068-2-29 bump
- IEC/EN 60068-2-2 Hot environment
- IEC/EN 60068-2-1 Cold environment
- IEC/EN 60068-2-14 Change of temperature (shock)
- IEC/EN 60068-2-30 Damp heat cyclic Redundancy

The supplier shall indicate the redundancy provided.

3.3.3. Environmental Specifications

Test reports or testing as per international standards for environmental test including bump, vibration, salinity & dust tests.

3.4. Maintenance Requirement

3.4.1. Maintenance philosophy is to replace faulty units after quick analysis of monitoring and alarm indications. Actual repair will be undertaken at a repair centre. The supplier shall ensure the repair of faulty tool during and after warranty period.

3.4.2. Extensive facilities for testing, supervision and monitoring functions shall be provided for quick isolation and rectification of faults.

3.5. Power Supply

3.5.1. Power Supply unit

The power supply unit shall form an integral part of the tool and shall have protection as specified below and shall have visual indication to show power ON, OFF, battery low and standby status.

3.5.2. Input Supply

The tool shall operate on the following power supplies:

3.5.2.1. DC voltage (12 V), DC supply of vehicle car battery.

3.5.2.2. Nominal input supply of 230 V AC over voltage ranges of 90-300 V and frequency range of 50 Hz + 2 Hz. is also acceptable. In this case, the power system for conversion of DC to AC shall be provided by the supplier

3.5.3. Power consumption

The tool shall have low power consumption. Equipment supplier shall specify the power requirement.

3.5.4. Battery backup & charger

3.5.4.1. It shall have internal rechargeable battery (Lithium ion, NiMH or better) that shall be sufficient to allow the tool to be operative for at least three hours continuously.

3.5.4.2. It shall have charging facility.

3.5.4.3. The battery shall charge from the input power supply (as specified in clause 3.5.2) used for operation.

3.5.4.4. It shall have protection for overcharging and over discharging. There

shall be provision of alarms for these conditions.

3.5.5. Power Protection

It shall have protection for Over voltage and Spikes

3.6. Documentation

3.6.1. Hard copy of all documents in English and soft copy of all documents in bilingual format shall be provided by the tool supplier.. The documents shall comprise of:

3.6.1.1. Tool Description Documents

The following tool description documents shall be supplied along with the tool:

a) Overall tool specification and description of hardware and software.
b) Installation manuals and testing procedures. Installation manuals provided shall contain step-by-step process of installation of tool.
c) Tool layout drawings
d) Cabling and wiring diagrams
e) Detailed specification and description of all I/O devices.
f) Adjustment procedures, if there are any field adjustable units.
g) Spare parts catalog including information on individual component values, tolerances etc. enabling procurement from alternate sources.

3.6.1.2. Installation, operation & maintenance document

The following documents shall be provided by the tool supplier:

a) Operating manual of the tool
b) Maintenance manual.
c) Operation and maintenance manual for all I/O devices / auxiliary equipment.
d) Faulty location and troubleshooting instructions including fault dictionary.
e) Test procedures with auxiliary test equipment.
f) Emergency action procedures and alarm dictionary.
g) Safety measures to be observed in handling the tool.
h) Precautions for setting up, measurements and maintenance.

3.6.1.3. **Training documents**

Training manuals and documents necessary for organizing training in installation, operation & maintenance and repair of the tool shall be made available.

3.6.2. In addition to the printed documentation, all documents shall be provided in CD-ROM.

3.6.3. Any provisional document, if supplied, shall be clearly indicated. The updates of all provisional documents shall be supplied immediately following the issue of such updates.

3.6.4. The structure and scope of each document shall be clearly described.

3.7. Protection

3.7.1. The tool shall have provision for grounding.

3.7.2. Protection against short circuit and open circuit in the accessible points for measurements shall be provided.

3.7.3. All switches and controls on the tool shall have suitable safeguards against accidental operation.

3.7.4. The protection for input over voltage, under voltage, input reverse polarity and short circuit protection shall be provided. It shall have protection against battery reversals.

3.8. Accessories

All the necessary interfaces, connectors, connecting cables, special tools and accessories essential for installation, operation and maintenance of the tool shall be clearly indicated and supplied along with the tool.

3.9. Safety Requirements

The equipment shall conform to relevant safety requirements as per (IS/IEC 62368-1:2018 or Latest & IS 10437: 2019/IEC 60215: 2016) as prescribed under Table no. 1 of the TEC document 'SAFETY REQUIREMENTS OF TELECOMMUNICATION EQUIPMENT": TEC10009: 2024. These requirements are applicable for purposely built hardware or a physical entity only.

3.10. Electromagnetic Compatibility (EMC)

These requirements are applicable for purposely built hardware or a physical entity only. (These requirements shall be as per TEC Standard No. TEC11016:2016 as modified/ amended from time to time)

Clause	Parameter	Standard
1.	Conducted and Radiated Emission	CISPR 32 Class-A
2.	Immunity to Electrostatic discharge: Contact discharge level 2 {± 4 kV}	IEC-61000-4-2 Performance Criteria-B, Clause 9
3.	Immunity to Electrostatic discharge: Air discharge level 3 {± 8 kV}	IEC-61000-4-2 Performance Criteria-B, Clause 9
4.	Immunity to radiated RF: a) Radio Frequency: 80 MHz to 1 GHz, Electromagnetic field: 3V/m b) Radio Frequency: 800 MHz to 960 MHz, Electromagnetic field: 10V/m c) Radio Frequency: 1.4 GHz to 6 GHz, Electromagnetic field: 10V/m	IEC 61000-4-3 (2010);
5.	Immunity to fast transients (burst): Test Level 2: a) 1 kV for AC/DC power port b) 0. 5 kV for signal / control / data / telecom lines.	IEC 61000- 4- 4 {2012); Performance Criteria-B, Clause 9
6.	Immunity to surges: AC/DC ports a) 2 kV peak open circuit voltage for line to ground	IEC 61000-4-5 (2014) Performance Criteria-B, Clause 9
	b) 1kV peak open circuit voltage for line to line	

7.	Immunity to surges: Telecom ports a) 2 kV peak open circuit voltage for line to ground coupling. b) 2 kV peak open circuit voltage for line-to-line coupling.	IEC 61000-4-5 (2014) Performance Criteria-C, Clause 9
8.	Immunity to conducted disturbance induced by Radio frequency fields: Under the test level 2 {3 V r.m.s.} in the frequency range 150 kHz-80 MHz for AC / DC lines and Signal /Control/telecom lines.	IEC 61000-4-6 (2013) Performance Criteria-A, Clause 9
9.	Immunity to voltage dips & short interruptions (applicable to only ac mains power input ports, if any): Limits: - a) a voltage dip corresponding to a reduction of the supply voltage of 30% for 500ms (i.e., 70% supply voltage for 500ms) b) a voltage dip corresponding to a reduction of the supply voltage of 60% for 200ms; (i.e.,40% supply voltage for 200ms)	IEC 61000-4-11 (2004): a) Performance Criteria B for Reduction of Supply 30% for 500ms or Dip to reduction of 60% for 100ms b) Performance Criteria C for Reduction of 60% for 200ms c) Performance criteria C for Voltage Interruption>95% for 5 s (Note: In case of Battery back-up performance criteria A is applicable). d) Performance Criteria B for Voltage Interruption >95%

	c) a voltage interruption corresponding to a reduction of supply voltage of > 95% for 5s. d) a voltage interruption corresponding to a reduction of supply voltage of >95% for 10ms.	duration :10ms (Note: In case of Battery back-up Performance Criteria A is applicable for above conditions.)
10	Immunity to voltage dips & short interruptions (applicable to only DC power input ports, if any): a) Voltage Interruption with 0% of supply for 10ms. b) Voltage Interruption with 0% of supply for 30ms, 100ms, 300ms and 1000ms. c) Voltage dip corresponding to 40% & 70% of supply for 10ms, 30 ms. d) Voltage dip corresponding to 40% & 70% of supply for 100ms, 300 ms and 1000 ms. e) Voltage variation corresponding to 80% and 120%of supply for 100 ms to 10s as per Table 1c of IEC 61000-4-29.	IEC 61000-4-29(2000) a) Applicable Performance Criteria shall be B. b) Applicable Performance Criteria shall be C. c) Applicable Performance Criteria shall be B. d) Applicable Performance Criteria shall be C. Applicable Performance Criteria shall be B.

3.11. Security Requirements

No Requirements specified. However, the different Drive Test Tool components shall comply to the security requirements mentioned in the applicable Indian Telecommunication Security Assurance Requirements (ITSAR) as and when notified by National Centre for communication Security (NCCS).

CHAPTER 4

4. Information for the Procurer/Vendor of Product

Interfaces and features which are optional needs to be examined by the procurer and suitably specified in the tender conditions as per their requirement based on the deployment scenario specific to the procurer from below requirements-

S. No.	Tendering parameter	Clause
1.	Support of technologies: The tendering authority may review the requirement and specify the technologies to be supported, at the time of tendering	2.2
2.	The tendering authority may specify the requirement and quantity of each component, at the time of tendering.	2.3
3.	Tendering authority may specify the configuration of the scanner in terms of MIMO at the time of tendering	2.37.11
4.	The tendering authority may decide at the time of purchase for requirements and quantity as a percentage of equipment for measurements of Voice Quality– MOS scores as per ITU standard P.863	2.37.15.2
5.	The tendering authority may decide at the time of purchase for requirements and quantity as a percentage of equipment for measurements of QoS as per ITU standard E.806	2.37.15.6
6.	The tendering authority may decide at the time of purchase for requirements for support of MOS scores as per ITU standard J.343	2.37.15.7

7.	The tendering authority may decide at the time of purchase for requirements for support of MOS scores as per ITU standard P.1203	2.37.15.8
8.	Tendering authority may specify the model, make and quantity of the supported mobile handsets at the time of purchase	2.38.2
9.	The tendering authority may review the requirements of number of ports for connecting the test phones and the number of phones to be procured at the time of tendering.	2.40
10.	The tendering authority may specify the Bandwidth support at the time of procurement.	2.45.2

ABBREVIATIONS

2G	Second Generation
3G	Third Generation
3GPP	3rd Generation Partnership Project
4G	Fourth Generation
5G	Fifth Generation
5G NR	5G New Radio
AC	Alternating Current
AMR	Adaptive Multi-Rate
APN	Access Point Name
ARFCN	Absolute Radio Frequency Channel Number
BER	Bit Error Rate
BCH	Broadcast Channel
BCCH	Broadcast Control Channel
BLER	Block Error Rate
BVQA	Bitstream Video Quality Assessment
CAB	Conformance Assessment Body
CC	Call Control
CCCH	Common Control Channel
CDR	Call Detail Record
C/I	Carrier-to-Interference
CISPR	International Special Committee on Radio Interference
CPRI	Common Public Radio Interface
CQI	Channel Quality Indicator
CSFB	Circuit-Switched Fallback
CW	Continuous Wave
DL	Downlink
DMRS	Demodulation Reference Signal
DRX	Discontinuous Reception

DSS	Dynamic Spectrum Sharing
EDGE	Enhanced Data rates for GSM Evolution
EMC	Electromagnetic Compatibility
EMI	Electromagnetic Interference
EPS	Evolved Packet System
ER	Essential Requirements
ESD	Electrostatic Discharge
FER	Frame Erasure Rate
FTP/FTPS	File Transfer Protocol / File Transfer Protocol Secure
FDD	Frequency Division Duplex
FR1/FR2	Frequency Range 1 / Frequency Range 2
GMSK	Gaussian Minimum Shift Keying
GNSS	Global Navigation Satellite System
GPS	Global Positioning System
GR	Generic Requirements
GPRS	General Packet Radio Service
GTP	GPRS Tunneling Protocol
GTPv1-U	GPRS Tunneling Protocol, User Plane version 1
GTPv2-C	GPRS Tunneling Protocol, Control Plane version 2
GUI	Graphical User Interface
HSPA	High Speed Packet Access
HSPA+	Evolved High-Speed Packet Access
HSDPA	High-Speed Downlink Packet Access
HSUPA	High-Speed Uplink Packet Access
HTTP/HTTPS	Hypertext Transfer Protocol / Hypertext Transfer Protocol Secure
IEC	International Electrotechnical Commission
IMAP	Internet Message Access Protocol
IMS	IP Multimedia Subsystem
IoT	Internet of Things
IP	Internet Protocol

ISO	International Organization for Standardization
ITU	International Telecommunication Union
KPI	Key Performance Indicator
LTE	Long Term Evolution
LTE-A	Long Term Evolution – Advanced
MAC	Medium Access Control
MIB	Master Information Block
MDT	Minimization of Drive Test
MIMO	Multiple Input Multiple Output
MM	Mobility Management
MOS	Mean Opinion Score
MSC	Mobile Switching Centre
MSV	Multiple Site Verification
MTBF	Mean Time Between Failures
MTTR	Mean Time To Repair
NAS	Non-Access Stratum
NavIC	Navigation with Indian Constellation
NCI	NR Cell Identity
NFAP	National Frequency Allocation Plan
NR	New Radio (5G)
NSA	Non-Standalone
OTT	Over-The-Top
PBCH	Physical Broadcast Channel
PCI	Physical Cell Identity
PDP	Packet Data Protocol
PDSCH	Physical Downlink Shared Channel
PER	Packet Error Rate
PESQ	Perceptual Evaluation of Speech Quality
POLQA	Perceptual Objective Listening Quality Analysis
PPP	Point-to-Point Protocol

PPS	Pulse Per Second
PRB	Physical Resource Block
PSK	Phase Shift Keying
QAM	Quadrature Amplitude Modulation
QoE	Quality of Experience
QoS	Quality of Service
RAN	Radio Access Network
RF	Radio Frequency
RLC	Radio Link Control
RRC	Radio Resource Control
RSRP	Reference Signal Received Power
RSRQ	Reference Signal Received Quality
RSSI	Received Signal Strength Indicator
RSSNR	Reference Signal Signal-to-Noise Ratio
RxLev	Received Signal Level
RxQual	Received Signal Quality
SA	Standalone
SC	Scrambling Code
SCFT	Single Cell Functionality Test
SDR	Software Defined Radio
SIB	System Information Block
SINR	Signal-to-Interference-plus-Noise Ratio
SIP	Session Initiation Protocol
SMS	Short Message Service
SRVCC	Single Radio Voice Call Continuity
SSD	Solid State Drive
SS-RSRP	Synchronization Signal Reference Signal Received Power
SS-RSRQ	Synchronization Signal Reference Signal Received Quality
TCP	Transmission Control Protocol
TSP	Telecom Service Provider

TDD	Time Division Duplex
UDP	User Datagram Protocol
UE	User Equipment
UMTS	Universal Mobile Telecommunications System
USB	Universal Serial Bus
VoIP	Voice over Internet Protocol
VoLTE	Voice over LTE
VoNR	Voice over New Radio (5G)
VoWiFi	Voice over Wi-Fi
WCDMA	Wideband Code Division Multiple Access
Wi-Fi	Wireless Fidelity