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HD Group Enterprises LLC

TEST REPORT

SCOPE OF WORK
FCC TESTING– 911 DIRECT

REPORT NUMBER
230912030SZN-002

ISSUE DATE	**[REVISED DATE]**
13 June 2025	[--------------------]

PAGES
103

DOCUMENT CONTROL NUMBER
FCC SAR_b

SAR TEST REPORT

For

HD Group Enterprises LLC

Two Way Portable Emergency Communicator Device

Model No.: 911 DIRECT

FCC ID: 2BCVN-HDG01

Report No.: 230912030SZN-002

Issue Date: 13 June 2025

Prepared by

Intertek Testing Services Shenzhen Ltd. Longhua Branch

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Table of Contents

1 GENERAL INFORMATION

Applicant:	HD Group Enterprises LLC 1300 47th Avenue NE St. Petersburg, Florida 33703
Manufacturer:	HD Group Enterprises LLC 1300 47th Avenue NE St. Petersburg, Florida 33703
Product Description:	Two Way Portable Emergency Communicator Device
Model Number:	911 DIRECT
File Number:	230912030SZN-002
Date of Test:	23 November 2024 25 November 2024

The above equipment was tested by Intertek Testing Services Shenzhen Ltd. Longhua Branch. The test data, data evaluation, test procedures, and equipment configurations shown in this report were made in accordance with the procedures given in IEEE 1528-2013 and KDB 865664. This device is in compliance with Specific Absorption Rate (SAR) for general population/uncontrolled exposure limits (1.6 W/kg) specified in ANSI/IEEE C95.1-1992.

The test results of this report relate only to the tested sample identified in this report

Prepared and Checked by:

Allen Qin
Engineer

Approved by:

Johnny Wang
Project Engineer
13 June 2025

STATEMENT OF COMPLIANCE

The Maximum reported SAR1g

Body Configuration Separation of Distance: 0mm

Equipment Class	Frequency Band		Product Specific 1g SAR (W/kg) (0 mm)
License	LTE	Band 2	1.54
		Band 4	1.30
		Band 12	1.32

The SAR values found for the Two Way Portable Emergency Communicator Device are below the maximum recommended levels of 1.6W/kg as averaged over any 1g tissue according to the ANSI C95.1-1992

The maximum reported SAR value is: 1.54 W/kg (1g).

2 EQUIPMENT UNDER TEST (EUT) TECHNICAL DESCRIPTION

<table>
<tr><th>Characteristics</th><th colspan="3">Description</th></tr>
<tr><td>Product Name:</td><td colspan="3">Two Way Portable Emergency Communicator Device</td></tr>
<tr><td>Device type:</td><td colspan="3">Portable device</td></tr>
<tr><td>Exposure Category:</td><td colspan="3">Uncontrolled Environment/General Population</td></tr>
<tr><td rowspan="2"></td><td colspan="3">LTE/TM1 (LTE system, QPSK modulation)</td></tr>
<tr><td colspan="3">LTE/TM2 (LTE system, 16QAM modulation)</td></tr>
<tr><td>Device Class:</td><td colspan="3">B</td></tr>
<tr><td>Antenna Type:</td><td colspan="3">LTE: Internal permanent antenna</td></tr>
<tr><td>Antenna Gain:</td><td colspan="3">LTE BAND2: -5.67dBi
LTE BAND4: -6.63dBi
LTE BAND12: -8.76dBi</td></tr>
<tr><td rowspan="4">Operating Frequency Range(s)</td><td>Band</td><td>Tx (MHz)</td><td>Rx (MHz)</td></tr>
<tr><td>LTE Band 2</td><td>1850-1910</td><td>1930-1990</td></tr>
<tr><td>LTE Band 4</td><td>1710-1755</td><td>2110-2155</td></tr>
<tr><td>LTE Band 12</td><td>699 - 716</td><td>729-746</td></tr>
<tr><td>Power Class:</td><td colspan="3">LTE Band 2: 3
LTE Band 4: 3
LTE Band 12: 3</td></tr>
<tr><td rowspan="15">Test Channels (low-mid-high):</td><td colspan="3">18607-18900-19193(LTE Band II BW=1.4MHz)</td></tr>
<tr><td colspan="3">18615-18900-19185(LTE Band II BW=3MHz)</td></tr>
<tr><td colspan="3">18625-18900-19175(LTE Band II BW=5MHz)</td></tr>
<tr><td colspan="3">18650-18900-19150(LTE Band II BW=10MHz)</td></tr>
<tr><td colspan="3">18675-18900-19125(LTE Band II BW=15MHz)</td></tr>
<tr><td colspan="3">18700-18900-19100(LTE Band II BW=20MHz)</td></tr>
<tr><td colspan="3">19957-20175-20393(LTE Band IV BW=1.4MHz)</td></tr>
<tr><td colspan="3">19965-20175-20385(LTE Band IV BW=3MHz)</td></tr>
<tr><td colspan="3">19975-20175-20375(LTE Band IV BW=5MHz)</td></tr>
<tr><td colspan="3">20000-20175-20350(LTE Band IV BW=10MHz)</td></tr>
<tr><td colspan="3">20025-20175-20325(LTE Band IV BW=15MHz)</td></tr>
<tr><td colspan="3">20050-20175-20300(LTE Band IV BW=20MHz)</td></tr>
<tr><td colspan="3">23017-23095-23173(LTE Band XII BW=1.4MHz)</td></tr>
<tr><td colspan="3">23025-23095-23165(LTE Band XII BW=3MHz)</td></tr>
<tr><td colspan="3">23035-23095-23155(LTE Band XII BW=5MHz)</td></tr>
</table>

	23060-23095-23130(LTE Band XII BW=10MHz)
Power supply:	D.C. 3.7V with battery
	D.C. 5V/1A with adaptor
Product Software Version:	N/A
Product Hardware Version:	N/A

Note:

1. *For more details, please refer to the User's manual of the EUT.*
2. *The sample under test was selected by the Client.*

3 AUXILIARY EQUIPMENT DETAILS

Description	Manufacturer	Description
Power Adapter	Provide by Intertek	Model: GS-511 Input: 100-240V~, 50/60Hz, 0.5A Output: 5V⎓3A, 9V⎓2A, 12V⎓1.5A
USB cable	Provided by Intertek	unshielded, Length: 100cm

4 TEST FACILITY

Site Description	
EMC Lab.	The Laboratory has been assessed and proved to be in compliance with CNAS/CL01: 2006(identical to ISO/IEC17025: 2005) The Certificate Registration Number is L0327
	Accredited by FCC The Certificate Registration Number is CN1188
Name of Firm	Intertek Testing Services Shenzhen Ltd. Longhua Branch
Site Location	101, 201, Building B, No. 308 Wuhe Avenue, Zhangkengjing Community, GuanHu Subdistrict, LongHua District, ShenZhen, P.R. China

5 GUIDANCE STANDARD

The Specific Absorption Rate (SAR) testing specification, method, and procedure for this device is in accordance with the following standards:

☒FCC 47CFR §2.1093 Radiofrequency Radiation Exposure Evaluation: Portable Devices

☒ANSI C95.1, 1992: Safety Levels with Respect to Human Exposure to Radio Frequency Electromagnetic Fields, 3 kHz to 300 GHz.(IEEE Std C95.1-1991)

☒IEEE Std 1528™-2013: IEEE Recommended Practice for Determining the Peak Spatial-Average Specific Absorption Rate (SAR) in the Human Head from Wireless Communications Devices: Measurement Techniques.

☒KDB 865664 D01 SAR measurement 100 MHz to 6 GHz v01r04: SAR Measurement Requirements for 100 MHz to 6 GHz

☒KDB 865664 D02 SAR Reporting v01r02

☒ KDB690783 D01 SAR Listings on Grants v01r03

☒KDB 447498 D01 Mobile Portable RF Exposure v06: Mobile and Portable Device RF Exposure Procedures and Equipment Authorization Policies

☐KDB 941225 D01 SAR test for 3G Devices v03r01: SAR Measurement Procesures CDMA2000 1×RTT,1×Ev-Do, WCDMA,HSDPA/HSPA

☒KDB 941225 D05 SAR for LTE Devices v02r05: SAR Evaluation Considerations for LTE Devices

☐KDB 941225 D06 Hotspot Mode v02r01: SAR Evaluation Procedures for Portable Devices with Wireless Router Capabilities

☐KDB 248227 D01 SAR measurement for 802.11 a b g v02r02:SAR Measurement Procedures for 802.11 a/b/g Transtitters

Remark:
This portable wireless equipment has been measured in all cases requested by the relevant standards. Test results in Chapter 11 of this test report are below limits specified in the relevant standards for the tested bands only.

6 EUT ANTENNA LOCATIONS

Test position consideration:

Distance of EUT antenna-to-edge/surface(mm), Test distance:0mm						
Antennas	Front side	rear side	Left side	Right side	Top side	Bottom side
4G	1	3	6	3	51	2

Distance of EUT antenna-to-edge/surface(mm), Test distance:0mm						
Antennas	Front side	rear side	Left side	Right side	Top side	Bottom side
4G	Yes	Yes	Yes	Yes	N/A	Yes

Note:

1. Limb SAR assessments are required.

2. Per KDB 447498 D01v06, for EUT the test separation distance is determined by the smallest distance between the outer surface of the device and the user, which is 0 mm for Body SAR.

7 RF EXPOSURE

7.1 LIMITS

Uncontrolled Environment

Uncontrolled Environments are defined as locations where there is the exposure of individuals who have no knowledge or control of their exposure. The general population/uncontrolled exposure limits are applicable to situations in which the general public may be exposed or in which persons who are exposed as a consequence of their employment may not be made fully aware of the potential for exposure or cannot exercise control over their exposure. Members of the general public would come under this category when exposure is not employment-related; for example, in the case of a wireless transmitter that exposes persons in its vicinity.

Limits for General Population/Uncontrolled Exposure (W/kg)

Whole-Body	Partial-Body	Hands, Wrists, Feet and ankles
0.08	1.6	4.0

Whole-Body SAR is averaged over the entire body, partial-body SAR is averaged over any 1gram of tissue defined as a tissue volume in the shape of a cube. SAR for hands, wrists, feet and ankles is averaged over any 10 grams of tissue defined as a tissue volume in the shape of a cube.

7.2 EVALUATION

☒According to FCC KDB447498 D01 and §1.1310, systems operating under the provisions of this section shall be operated in a manner that ensures that the public is not exposed to radio frequency energy level in excess of the Commission's guidelines.

1) The 1-g and 10-g SAR test exclusion thresholds for 100 MHz to 6 GHz at *test separation distances* ≤ 50 mm are determined by:

   [(*max. power of channel, including tune-up tolerance, mW*)/(*min. test separation distance, mm*)] · [$\sqrt{f_{(GHz)}}$] ≤ 3.0 for 1-g SAR and ≤ 7.5 for 10-g extremity SAR,[16] where

   - $f_{(GHz)}$ is the RF channel transmit frequency in GHz
   - Power and distance are rounded to the nearest mW and mm before calculation[17]
   - The result is rounded to one decimal place for comparison

   The test exclusions are applicable only when the minimum *test separation distance* is ≤ 50 mm and for transmission frequencies between 100 MHz and 6 GHz. When the minimum *test separation distance* is < 5 mm, a distance of 5 mm is applied to determine SAR test exclusion.

Routine SAR evaluation refers to that specifically required by § 2.1093, using measurements or computer simulation. Portable transmitters with output power greater than the applicable low threshold require SAR testing to qualify for TCB approval.

Exclusion Thresholds = $P\sqrt{F}\,/\,D$

P= Maximum turn-up power in mW

F= Channel frequency in GHz

D= Minimum test separation distance in mm

8 SPECIFIC ABSORPTION RATE (SAR)

8.1 INTRODUCTION

SAR is related to the rate at which energy is absorbed per unit mass in an object exposed to a radio field. The SAR distribution in a biological body is complicated and is usually carried out by experimental techniques or numerical modeling. The standard recommends limits for two tiers of groups, occupational/controlled and general population/uncontrolled, based on a person's awareness and ability to exercise control over his or her exposure. In general, occupational/controlled exposure limits are higher than the limits for general population/uncontrolled.

8.2 SAR DEFINITION

The SAR definition is the time derivative (rate) of the incremental energy (dW) absorbed by (dissipated in) an incremental mass (dm) contained in a volume element (dv) of a given density (ρ). The equation description is as below:

$$SAR = \frac{d}{dt}\left(\frac{dW}{dm}\right) = \frac{d}{dt}\left(\frac{dW}{\rho dv}\right)$$

SAR is expressed in units of Watts per kilogram (W/kg)

SAR measurement can be either related to the temperature elevation in tissue by

$$SAR = c\left(\frac{\delta T}{\delta t}\right)$$

Where: C is the specific head capacity, δT is the temperature rise and δt is the exposure duration, or related to the electrical field in the tissue by

$$SAR = \frac{\sigma |E|^2}{\rho}$$

Where: σ is the conductivity of the tissue ρ is the mass density of tissue and E is the RMS electrical field strength.

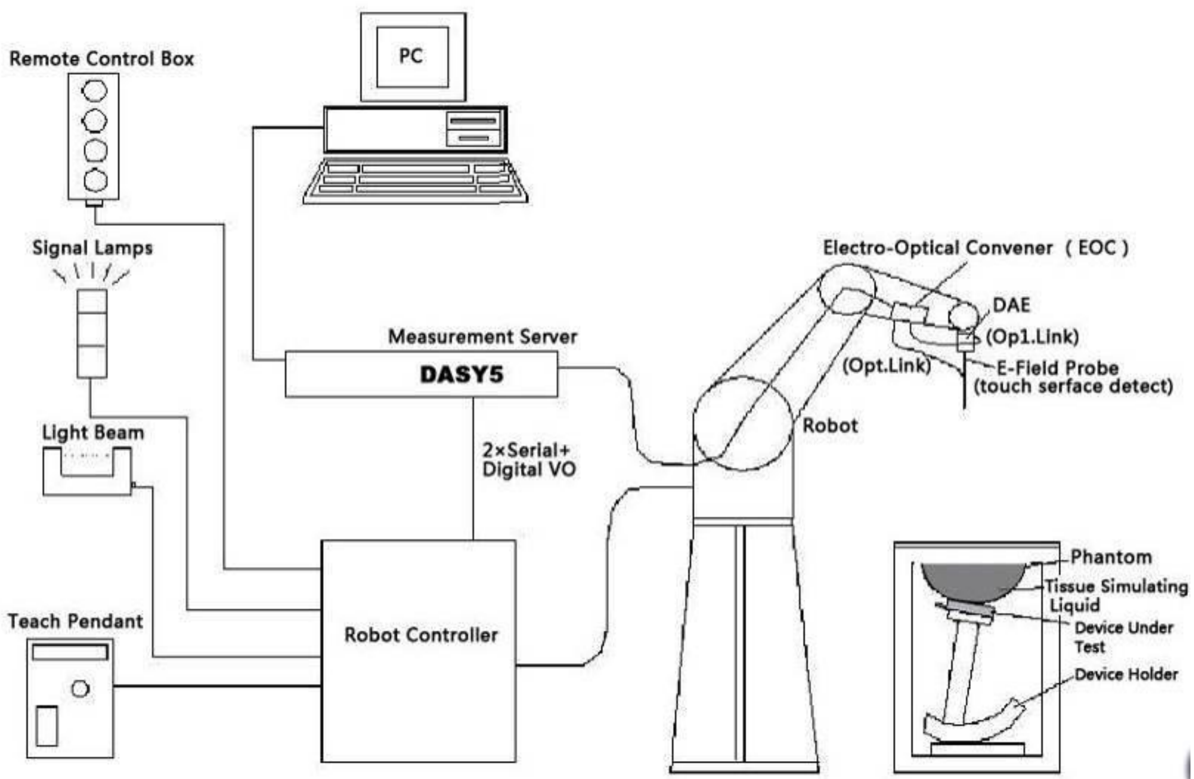
However for evaluating SAR of low power transmitter, electrical field measurement is typically applied.

9 SAR MEASUREMENTS SYSTEM CONFIGURATION

9.1 SAR MEASUREMENT SET-UP

The DASY5 system for performing compliance tests consists of the following items:

- A standard high precision 6-axis robot (Stäubli TX=RX family) with controller, teach pendant and software. An arm extension for accommodating the data acquisition electronics (DAE).
- An isotropic field probe optimized and calibrated for the targeted measurement.
- A data acquisition electronics (DAE) which performs the signal amplification, signal multiplexing, AD-conversion, offset measurements, mechanical surface detection, collision detection, etc. The unit is battery powered with standard or rechargeable batteries. The signal is optically transmitted to the EOC.
- The Electro-optical converter (EOC) performs the conversion from optical to electrical signals for the digital communication to the DAE. To use optical surface detection, a special version of the EOC is required. The EOC signal is transmitted to the measurement server.
- The function of the measurement server is to perform the time critical tasks such as signal filtering, control of the robot operation and fast movement interrupts.
- The Light Beam used is for probe alignment. This improves the (absolute) accuracy of the probe positioning.
- A computer running Win 7 profesional operating system and the DASY5 software.
- Remote control and teach pendant as well as additional circuitry for robot safety such as warning lamps, etc.
- The phantom, the device holder and other accessories according to the targeted measurement.



Picture 1. SAR Lab Test Measurement Set-up

9.2 DASY5 E-FIELD PROBE SYSTEM

The SAR measurements were conducted with the dosimetric probe designed in the classical triangular configuration and optimized for dosimetric evaluation. The probe is constructed using the thick film technique; with printed resistive lines on ceramic substrates. The probe is equipped with an optical multifiber line ending at the front of the probe tip. It is connected to the EOC box on the robot arm and provides an automatic detection of the phantom surface. Half of the fibers are connected to a pulsed infrared transmitter, the other half to a synchronized receiver. As the probe approaches the surface, the reflection from the surface produces a coupling from the transmitting to the receiving fibers. This reflection increases first during the approach, reaches maximum and then decreases. If the probe is flatly touching the surface, the coupling is zero. The distance of the coupling maximum to the surface is independent of the surface reflectivity and largely independent of the surface to probe angle. The DASY5 software reads the reflection turning a software approach and looks for the maximum using 2^{nd} ord curve fitting. The approach is stopped at reaching the maximum.

Probe Specifications:

Model: EX3DV4

Calibration: ISO/IEC 17025 calibration service available

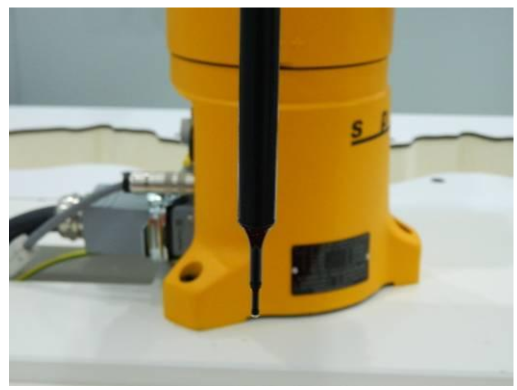
Probe Length: 337 mm

Probe Tip Length: 9 mm

Body Diameter: 10 mm

Tip Diameter: 2.5 mm

Application: High Precision dosimetric measurements in any exposure scenario(e.g., very strong gradient fields).



9.3 E-FIELD PROBE CALIBRATION

Each E-Probe/Probe Amplifier combination has unique calibration parameters. A TEM cell calibration procedure is conducted to determine the proper amplifier settings to enter in the probe parameters. The amplifier settings are determined for a given frequency by subjecting the probe to a known E-field density (1 mW/cm^2) using an RF Signal generator, TEM cell, and RF Power Meter.
The free space E-field from amplified probe outputs is determined in a test chamber. This calibration can be performed in a TEM cell if the frequency is below 1 GHz and inn a waveguide or other methodologies above 1 GHz for free space. For the free space calibration, the probe is placed in the volumetric center of the cavity and at the proper orientation with the field. The probe is then rotated 360 degrees until the three channels show the maximum reading. The power density readings equate to 1 mw/ cm^2.
E-field temperature correlation calibration is performed in a flat phantom filled with the appropriate simulated brain tissue. The E-field in the medium correlates with the temperature rise in the dielectric medium. For temperature correlation calibration a RF transparent thermistor-based temperature probe is used in conjunction with the E-field probe.

$$SAR = C\frac{\Delta T}{\Delta t}$$

Where:
Δt = Exposure time (30 seconds),
C = Heat capacity of tissue (brain or muscle),
ΔT = Temperature increase due to RF exposure.

$$SAR = \frac{|E|^2 \cdot \sigma}{\rho}$$

Where:
σ = Simulated tissue conductivity,
ρ = Tissue density (kg/m^3).

9.4 OTHER TEST EQUIPMENT

9.4.1 Data Acquisition Electronics (DAE)

The data acquisition electronics consist of a highly sensitive electrometer-grade preamplifier with auto-zeroing, a channel and gain-switching multiplexer, a fast 16 bit AD-converter and a command decoder with a control logic unit. Transmission to the measurement server is accomplished through an optical downlink for data and status information, as well as an optical uplink for commands and the clock.
The mechanical probe mounting device includes two different sensor systems for frontal and sideways probe contacts. They are used for mechanical surface detection and probe collision detection.
The input impedance of the DAE is 200 MOhm; the inputs are symmetrical and floating. Common mode rejection is above 80 dB.

Picture 3: DAE

9.4.2 Robot

The SPEAG DASY system uses the high precision robots (DASY5: TX90XL) type from Stäubli SA (France). For the 6-axis controller system, the robot controller version from Stäubli is used. The Stäubli robot series have many features that are important for our application:

- High precision (repeatability 0.02mm)
- High reliability (industrial design)
- Low maintenance costs (virtually maintenance free due to direct drive gears; no belt drives)
- Jerk-free straight movements (brushless synchron motors; no stepper motors)
- Low ELF interference (motor control fields shielded via the closed metallic construction shields)

Picture 4 DASY 5

9.4.3 Measurement Server

The Measurement server is based on a PC/104 CPU broad with CPU (DASY5: 400 MHz, Intel Celeron), chip disk (DASY5: 128MB), RAM (DASY5: 128MB). The necessary circuits for communication with the DAE electronic box, as well as the 16 bit AD converter system for optical detection and digital I/O interface are contained on the DASY I/O broad, which is directly connected to the PC/104 bus of the CPU broad.

Picture 5 Server for DASY 5

The measurement server performs all real-time data evaluation of field measurements and surface detection, controls robot movements and handles safety operation. The PC operating system cannot interfere with these time critical processes. All connections are supervised by a watchdog, and disconnection of any of the cables to the measurement server will automatically disarm the robot and disable all program-controlled robot movements. Furthermore, the measurement server is equipped with an expansion port which is reserved for future applications. Please note that this expansion port does not have a standardized pinout, and therefore only devices provided by SPEAG can be connected. Devices from any other supplier could seriously damage the measurement server.

9.4.4 Device Holder for Phantom

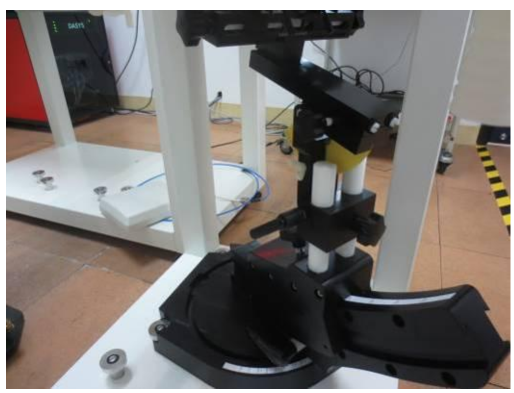
The SAR in the phantom is approximately inversely proportional to the square of the distance between the source and the liquid surface. For a source at 5mm distance, a positioning uncertainty of ±0.5mm would produce a SAR uncertainty of ±20%. Accurate device positioning is therefore crucial for accurate and repeatable measurements. The positions in which the devices must be measured are defined by the standards.

The DASY device holder is designed to cope with the different positions given in the standard. It has two scales for device rotation (with respect to the body axis) and device inclination (with respect to the line between the ear reference points). The rotation centers for both scales are the ear reference point (ERP). Thus the device needs no repositioning when changing the angles.

The DASY device holder is constructed of low-loss POM material having the following dielectric parameters: relative permittivity ε =3 and loss tangent δ =0.02. The amount of dielectric material has been reduced in the closest vicinity of the device, since measurements have suggested that the influence of the clamp on the test results could thus be lowered.

<Laptop Extension Kit>

The extension is lightweight and made of POM, acrylic glass and foam. It fits easily on the upper part of the Mounting Device in place of the phone positioner. The extension is fully compatible with the Twin-SAM and ELI phantoms.



Picture 6: Device Holder

9.4.5 Phantom

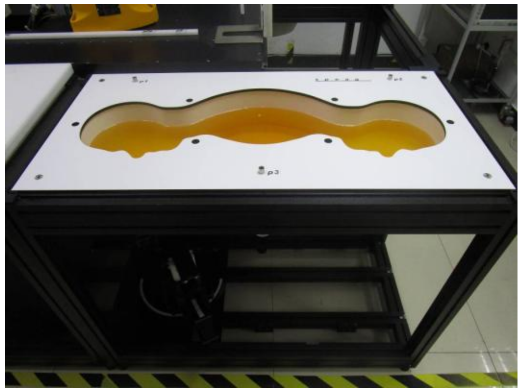
The SAM Twin Phantom V4.0 is constructed of a fiberglass shell integrated in a table. The shape of the shell is based on data from an anatomical study designed to Represent the 90th percentile of the population. The phantom enables the dissymmetric evaluation of SAR for both left and right handed handset usage, as well as body-worn usage using the flat phantom region. Reference markings on the Phantom allow the complete setup of all predefined phantom positions and measurement grids by manually teaching three points in the robot. The shell phantom has a 2mm shell thickness (except the ear region where shell thickness increases to 6 mm).

Shell Thickness: 2 ± 0. 2 mm

Filling Volume: Approx. 25 liters

Dimensions: 810 x l000 x 500 mm (H x L x W)

Available: Special



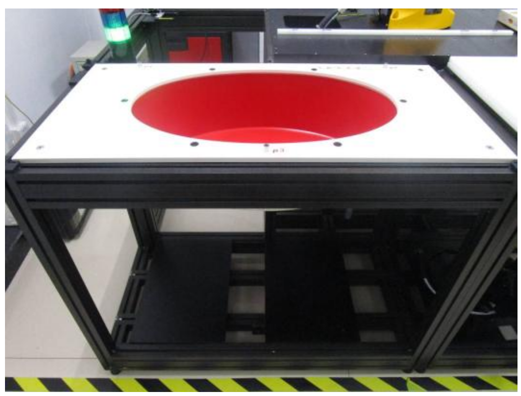
Picture 7: SAM Twin Phantom

Phantom for compliance testing of handheld and body-mounted wireless devices in the frequency range of 30 MHz to 6 GHz. ELI is fully compatible with the IEC 62209-2 standard and all known tissue simulating liquids. ELI has been optimized regarding its performance and can be integrated into our standard phantom tables. A cover prevents evaporation of the liquid. Reference markings on the phantom allow installation of the complete setup, including all predefined phantom positions and measurement grids, by teaching three points. The phantom is compatible with all SPEAG dosimetric probes and dipoles.

Shell Thickness 2±0.2 mm

Filling Volume Approx. 30 liters

Dimensions 190×600×0 mm (H x L x W)



Picture 8.ELI Phantom

9.5 SCANNING PROCEDURE

The DASY5 installation includes predefined files with recommended procedures for measurements and validation. They are read-only document files and destined as fully defined but unmeasured masks. All test positions (head or body-worn or Limb) are tested with the same configuration of test steps differing only in the grid definition for the different test positions.

The “reference” and “drift” measurements are located at the beginning and end of the batch process. They measure the field drift at one single point in the liquid over the complete procedure. The indicated drift is mainly the variation of the DUT’s output power and should vary max. ± 5 %.

The “surface check” measurement tests the optical surface detection system of the DASY5 system by repeatedly detecting the surface with the optical and mechanical surface detector and comparing the results. The output gives the detecting heights of both systems, the difference between the two systems and the standard deviation of the detection repeatability. Air bubbles or refraction in the liquid due to separation of the sugar-water mixture gives poor repeatability (above ± 0.1mm). To prevent wrong results tests are only executed when the liquid is free of air bubbles.

The difference between the optical surface detection and the actual surface depends on the probe and is specified with each probe. (It does not depend on the surface reflectivity or the probe angle to the surface within ± 30°.)

Area Scan

The Area Scan is used as a fast scan in two dimensions to find the area of high field values before running a detailed measurement around the hot spot. Before starting the area scan a grid spacing is set according to FCC KDB Publication 865664. During scan the distance of the probe to the phantom remains unchanged. After finishing area scan, the field maxima within a range of 2 dB will be ascertained.

Zoom Scan

After the maximum interpolated values were calculated between the points in the cube, the SAR was averaged over the spatial volume (1g or 10g) using a 3D-Spline interpolation algorithm. The 3D-spline is composed of three one-dimensional splines with the "Not a knot" condition (in x, y, and z directions). The volume was then integrated with the trapezoidal algorithm.

Spatial Peak Detection

The procedure for spatial peak SAR evaluation has been implemented and can determine values of masses of 1g and 10g, as well as for user-specific masses. The DASY5 system allows evaluations that combine measured data and robot positions, such as:

• maximum search

• extrapolation

• boundary correction

• peak search for averaged SAR

During a maximum search, global and local maxima searches are automatically performed in 2-D after each Area Scan measurement with at least 6 measurement points. It is based on the evaluation of the local SAR gradient calculated by the Quadratic Shepard's method. The algorithm will find the global maximum and all local maxima within -2 dB of the global maxima for all SAR distributions.

Extrapolation routines are used to obtain SAR values between the lowest measurement points and the inner phantom surface. The extrapolation distance is determined by the surface detection distance and the probe sensor offset. Several measurements at different distances are necessary for the extrapolation. Extrapolation routines require at least 10 measurement points in 3-D space.

They are used in the Zoom Scan to obtain SAR values between the lowest measurement points and the inner phantom surface. The routine uses the modified Quadratic Shepard's method for extrapolation.

A Z-axis scan measures the total SAR value at the x-and y-position of the maximum SAR value found during the cube scan. The probe is moved away in z-direction from the bottom of the SAM phantom in 5mm steps.

Table 1: Area and Zoom Scan Resolutions per FCC KDB Publication 865664 D01

Frequency	Maximum Area Scan Resolution (mm) (Δxarea, Δyarea)	Maximum Zoom Scan Resolution (mm) (Δxzoom, Δyzoom)	Maximum Zoom Scan Spatial Resolution (mm) Δzzoom(n)	Minimum Zoom Scan Volume (mm) (x,y,z)
≤2 GHz	≤15	≤8	≤5	≥ 30
2-3 GHz	≤12	≤5	≤5	≥30
3-4 GHz	≤12	≤5	≤4	≥28
4-5 GHz	≤10	≤4	≤3	≥25
5-6 GHz	≤10	≤4	≤2	≥22

9.6 DATA STORAGE AND EVALUATION

9.6.1 Data Storage

The DASY5 software stores the acquired data from the data acquisition electronics as raw data (in microvolt readings from the probe sensors), together with all necessary software parameters for the data evaluation (probe calibration data, liquid parameters and device frequency and modulation data) in measurement files with the extension ".DAE4". The software evaluates the desired unit and format for output each time the data is visualized or exported. This allows verification of the complete software setup even after the measurement and allows correction of incorrect parameter settings. For example, if a measurement has been performed with a wrong crest factor parameter in the device set up, the parameter can be corrected afterwards and the data can be re-evaluated.
The measured data can be visualized or exported in different units or formats, depending on the selected probe type ([V/m], [A/m], [°C], [mW/g], [mW/cm²], [dBrel], etc.). Some of these units are not available in certain situations or show meaningless results, e.g., a SAR output in a loss less media will always be zero. Raw data can also be exported to perform the evaluation with other software packages.

9.6.2 Data Evaluation by SEMCAD

The SEMCAD software automatically executes the following procedures to calculate the field units from the microvolt readings at the probe connector. The parameters used in the evaluation are stored in the configuration modules of the software:

Probe parameters:

- Sensitivity $Norm_i$, a_{i0}, a_{i1}, a_{i2}
- Conversion factor $ConvF_i$
- Diode compression point Dcp_i

Device parameters:

- Frequency f
- Crest factor cf

Media parameters:
- Conductivity
- Density

These parameters must be set correctly in the software. They can be found in the component documents or they can be imported into the software from the configuration files issued for the DASY5 components. In the direct measuring mode of the multimeter option, the parameters of the actual system setup are used. In the scan visualization and export modes, the parameters stored in the corresponding document files are used.

The first step of the evaluation is a linearization of the filtered input signal to account for the compression characteristics of the detector diode. The compensation depends on the input signal, the diode type and the DC-transmission factor from the diode to the evaluation electronics.

If the exciting field is pulsed, the crest factor of the signal must be known to correctly compensate for peak power. The formula for each channel can be given as:

$$\mathbf{V_i = U_i + U_i^2 \cdot c f / dcp_i}$$

With $\mathbf{V_i}$ = compensated signal of channel i (i = x, y, z)

$\mathbf{U_i}$ = input signal of channel i (i = x, y, z)

cf = crest factor of exciting field (DASY parameter)

$\mathbf{dcp_i}$ = diode compression point (DASY parameter)

From the compensated input signals the primary field data for each channel can be

evaluated:

E-field probes: $\mathbf{E_i = (V_i / Norm_i \cdot ConvF)^{1/2}}$

H-field probes: $\mathbf{H_i = (V_i)^{1/2} \cdot (a_{i0} + a_{i1} f + a_{i2} f^2) / f}$

With $\mathbf{V_i}$ = compensated signal of channel i (i = x, y, z)

$\mathbf{Norm_i}$ = sensor sensitivity of channel i (i = x, y, z)

[mV/(V/m)2] for E-field Probes

ConvF = sensitivity enhancement in solution

$\mathbf{a_{ij}}$ **=** sensor sensitivity factors for H-field probes

f = carrier frequency [GHz]

$\mathbf{E_i}$ = electric field strength of channel i in V/m

$\mathbf{H_i}$ = magnetic field strength of channel i in A/m

The RSS value of the field components gives the total field strength (Hermitian magnitude):

$\mathbf{E_{tot} = (E_x^2 + E_Y^2 + E_z^2)^{1/2}}$

The primary field data are used to calculate the derived field units.

$\mathbf{SAR = (E_{tot})\ 2 \cdot \sigma / (\rho \cdot 1000)}$

with **SAR** = local specific absorption rate in mW/g

$\mathbf{E_{tot}}$ = total field strength in V/m

σ = conductivity in [mho/m] or [Siemens/m]

ρ = equivalent tissue density in g/cm^3

Note that the density is normally set to 1 (or 1.06), to account for actual brain density rather than the density of the simulation liquid. The power flow density is calculated assuming the excitation field to be a free space field.

$\mathbf{P_{pwe} = E_{tot}^2 / 3770}$ **or** $\mathbf{P_{pwe} = H_{tot}^2 \cdot 37.7}$

with $\mathbf{P_{pwe}}$ = equivalent power density of a plane wave in mW/cm^2

$\mathbf{E_{tot}}$ = total electric field strength in V/m ; $\mathbf{H_{tot}}$ = total magnetic field strength in A/m

9.7 TISSUE-EQUIVALENT LIQUID

9.7.1 Tissue-equivalent Liquid Ingredients

The liquid is consisted of water, salt and Glycol. The liquid has previously been proven to be suited for worst-case. The Table 2 & 3 shows the detail solution. It's satisfying the latest tissue dielectric parameters requirements proposed by the KDB 865664 D01.

Table 2: Recommended Dielectric Performance of Tissue

Recommended Dielectric Performance of Tissue												
Ingredients (% by weight)	Frequency (MHz)											
	750		835		1800		1900		2450		2600	
Tissue Type	Head	Body	Head	Body	Head	Body	Head	Body	Head	Body	Head	Body
Water	40.52	51.83	41.46	52.4	55.2	70.2	54.9	40.4	62.7	73.2	54.8	68.1
Salt (Nacl)	1.61	1.52	1.45	1.4	0.3	0.4	0.18	0.5	0.5	0.04	0.1	0.01
Sugar	57.67	46.45	56.0	45.0	0.0	0.0	0.0	58.0	0.0	0.0	0.0	0.0
HEC	0.1	0.1	1.0	1.0	0.0	0.0	0.0	1.0	0.0	0.0	0.0	0.0
Bactericide	0.1	0.1	0.1	0.1	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.0
Triton x-100	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	36.8	0.0	0.0	0.0
DGBE	0.0	0.0	0.0	0.0	44.5	29.4	44.92	0.0	0.0	26.4	45.1	31.8
Dielectric Constant	40.93	54.32	42.54	56.1	40.0	53.3	39.9	54.0	39.8	52.5	39.0	52.5
Conductivity (s/m)	0.87	0.95	0.91	0.95	1.40	1.52	1.42	1.45	1.88	1.78	1.96	2.15

9.7.2 Tissue-equivalent Liquid Properties

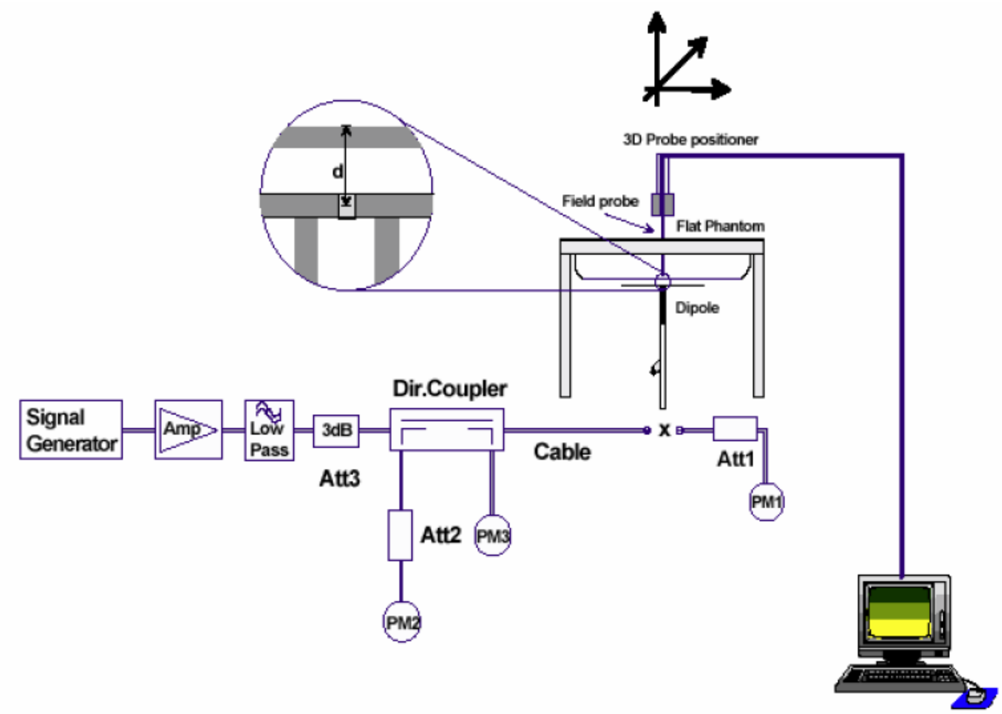
Table 3: Dielectric Performance of Head Tissue Simulating Liquid

Temperature: 21°C Relative humidity: 57%				
Frequency (MHz)	Measured Date	Description	Dielectric Parameters	
			εr	σ(s/m)
750	2024-11-23	Target Value ±5% window	41.50 39.43 — 43.58	0.90 0.855 — 0.945
		Measurement Value	42.37	0.894
1750	2024-11-24	Target Value ±5% window	40.10 38.095 — 42.105	1.37 1.302 — 1.439
		Measurement Value	40.569	1.404
1900	2024-11-25	Target Value ±5% window	40.00 38.00 — 42.00	1.40 1.33 — 1.47
		Measurement Value	40.383	1.382

9.8 SYSTEM CHECK

9.8.1 Description of System Check

The manufacturer calibrates the probes annually. Dielectric parameters of the tissue simulants were measured every day using the dielectric probe kit and the network analyzer. A system check measurement was made following the determination of the dielectric parameters of the simulant, using the dipole validation kit. A power level of 250 mW was supplied to the dipole antenna, which was placed under the flat section of the twin SAM phantom. The system check results (dielectric parameters and SAR values) are given in the table 5. System check results have to be equal or near the values determined during dipole calibration with the relevant liquids and test system (±10 %). System check is performed regularly on all frequency bands where tests are performed with the DASY5 system.



Picture 10. System Check Set-up

Justification for Extended SAR Dipole Calibrations
Usage of SAR dipoles calibrated less than 3 years ago but more than 1 year ago were confirmed in maintaining return loss (< - 20 dB, within 20% of prior calibration) and impedance (within 5 ohm from prior calibration) requirements per extended calibrations in KDB 865664 D01:

9.8.2 System Check Results

Table 4: System Check for Simulating Liquid

Measurement Date	Frequency (MHz)	Liquid Type (head/body)	1W Target SAR1g (W/kg)	Measured SAR1g (W/kg)	1W Normalized SAR1g (W/kg)	Limit (±10% Deviation)
2024-11-23	750	head	8.32	2.08	8.32	0.00
2024-11-24	1750	head	36.2	9.23	36.92	-1.99
2024-11-25	1900	head	39.5	9.86	39.44	0.15

Note: system check input power: 250mW.

10 MEASUREMENT PROCEDURES

10.1 GENERAL DESCRIPTION OF TEST PROCEDURES

A communication link is set up with a System Simulator (SS) by air link, and a call is established. Then EUT is commanded to operate at maximum transmitting power.
Connection to the EUT is established via air interface with CMU 200, and the EUT is set to maximum output power. The EUT battery must be fully charged and checked periodically during the test to ascertain uniform power output. The antenna connected to the output of the base station simulator shall be placed at least 50 cm away from the EUT. The signal transmitted by the simulator to the antenna feeding point shall be lower than the output power level of the EUT by at least 30 dB.

10.2 MEASUREMENT VARIABILITY

Per FCC KDB Publication 865664 D01, SAR measurement variability was assessed for each frequency band, which was determined by the SAR probe calibration point and tissue-equivalent medium used for the device measurements. When both head and body tissue-equivalent media were required for SAR measurements in a frequency band, the variability measurement procedures were applied to the tissue medium with the highest measured SAR, using the highest measured SAR configuration for that tissue-equivalent medium. These additional measurements were repeated after the completion of all measurements requiring the same head or body tissue-equivalent medium in a frequency band. The test device was returned to ambient conditions (normal room temperature) with the battery fully charged before it was re-mounted on the device holder for the repeated measurement(s) to minimize any unexpected variations in the repeated results.
SAR Measurement Variability was assessed using the following procedures for each frequency band:

1) Repeated measurement is not required when the original highest measured SAR is < 2.0 W/kg; steps 2) through 4) do not apply.

2) When the original highest measured SAR is ≥ 2.0 W/kg, repeat that measurement once.

3) Perform a second repeated measurement only if the ratio of largest to smallest SAR for the original and first repeated measurements is > 3.00 or when the original or repeated measurement is ≥ 3.625 W/kg (~ 10% from the 10-g SAR limit).

4) Perform a third repeated measurement only if the original, first or second repeated measurement is ≥ 3.75 W/kg and the ratio of largest to smallest SAR for the original, first and second repeated measurements is > 3.0.

10.3 TEST COFIGURATION

10.3.1 GSM Test Configuration

SAR tests for GSM 850 and GSM 1900, a communication link is set up with a System Simulator (SS) by air link. Using CMU200 the power level is set to "5" for GSM 850, set to "0" for GSM 1900. Since the GPRS class is 12 for this EUT, it has at most 4 timeslots in uplink and at most 4 timeslots in downlink, the maximum total timeslots is 5.

10.3.2 UMTS Test Configuration

10.3.2.1 3G SAR Test Reduction Procedure

In the following procedures, the mode tested for SAR is referred to as the primary mode. The equivalent modes considered for SAR test reduction are denoted as secondary modes. Both primary and secondary modes must be in the same frequency band. When the maximum output power and tune-up tolerance specified for production units in a secondary mode is ≤ ¼ dB higher than the primary mode or when the highest reported SAR of the primary mode is scaled by the ratio of specified maximum output power and tune-up tolerance of secondary to primary mode and the adjusted SAR is ≤ 1.2 W/kg, SAR measurement is not required for the secondary mode.3 This is referred to as the 3G SAR test reduction procedure in the following SAR test guidance, where the primary mode is identified in the applicable wireless mode test procedures and the secondary mode is wireless mode being considered for SAR test reduction by that procedure. When the 3G SAR test reduction procedure is not satisfied, it is identified as "otherwise" in the applicable procedures; SAR measurement is required for the secondary mode.

10.3.2.2 Output power Verification

Maximum output power is verified on the high, middle and low channels according to procedures described in section 5.2 of 3GPP TS 34.121, using the appropriate RMC or AMR with TPC (transmit power control) set to all "1's" for WCDMA/HSDPA or by applying the required inner loop power control procedures to maintain maximum output power while HSUPA is active. Results for all applicable physical channel configurations (DPCCH, DPDCHn and spreading codes, HSDPA, HSPA) are required in the SAR report. All configurations that are not supported by the handset or cannot be measured due to technical or equipment limitations must be clearly identified.

10.3.2.3 Limb Accessory SAR

SAR for Limb accessory configurations is measured using a 12.2 kbps RMC with TPC bits configured to all "1's". The 3G SAR test reduction procedure is applied to other spreading codes and multiple DPDCHn configurations supported by the handset with 12.2 kbps RMC as the primary mode. Otherwise, SAR is measured using an applicable RMC configuration with the corresponding spreading code or DPDCHn, for the highest reported Limb accessory exposure SAR configuration in 12.2 kbps RMC. When more than 2 DPDCHn are supported by the handset, it may be necessary to configure additional DPDCHn using FTM (Factory Test Mode) or other chipset based test approaches with parameters similar to those used in 384 kbps and 768 kbps RMC.

10.3.3 LTE Test Configuration

This device contains LTE transmitter which follows 3GPP standards, is category 3, supports both QPSK and 16QAM modulations. The output power was tested per 3GPP TS 36.521-1 maximum transmit procedures for both QPSK and 16QAM modulation.

During LTE SAR testing, the related parameters of operating band, channel bandwidth, uplink channel number, modulation type, and RB was set in base station simulator. When the EUT has registered and communicated to base station simulator, the simulator set to make EUT transmitting the maximum radiated power.

10.3.3.1 General

The general test requirements of VoIP support for handsets are described in KDB Publication 648474 D04. The head, body, body-worn accessories and other required test considerations in KDB Publication 447498 D01 and other published RF exposure KDB procedures should be applied to configure LTE devices for standalone and simultaneous transmission in voice and data modes for the required exposure conditions.

Based on the design specifications and other information available from the device manufacturer, typically through measurement and analysis during product development, when the maximum output power specifications for the different RB allocations and RB offset conditions within a channel bandwidth, modulation, or across the channels in a frequency band varies by more than 1 dB, a KDB inquiry is required to determine whether the required test channels are acceptable for SAR testing or if a different set of required test channels should be used. The maximum average conducted output power measured according to the following configurations, for the required test channels, channel bandwidths and uplink modulations, in each frequency band, are used to support the SAR test reduction and exclusion.

a) 100% RB allocation

b) 1 RB, and also 50% RB allocation, offset to the upper edge, middle, and lower edge of the channel bandwidth of each required test channel

Based on the power measurements, the SAR test reduction and exclusion provisions in KDB Publication 447498 D01 should be applied to determine SAR measurement requirements. SAR is evaluated separately according to the following procedures for the different test positions in each exposure condition – head, body, body-worn accessories, and other use conditions. The configurations and conditions that qualify for SAR test exclusion or require testing must be clearly explained in the SAR report. The procedures in the following subsections are applied separately to test each LTE frequency band. SAR must be measured with the maximum TTI (transmit time interval) supported by the device in each LTE configuration. The TTI configurations supported and tested must be described in the SAR report.

10.3.3.2 Largest channel bandwidth standalone SAR test requirements

1. QPSK with 1 RB allocation

Start with the largest channel bandwidth then measure SAR for QPSK with 1 RB allocation, using the RB offset and required test channel combination with the highest maximum output power among RB offsets at the upper edge, middle, and lower edge of each required test channel. When the reported SAR is ⩽ 2.0 W/kg, testing of the remaining RB offset configurations and required test channels is not required for 1 RB allocation; otherwise, SAR is required for the remaining required test channels and only for the RB offset configuration with the highest output power for that channel. When the reported SAR of a required test channel is > 3.625 W/kg, SAR is required for all three RB offset configurations for that required test channel.

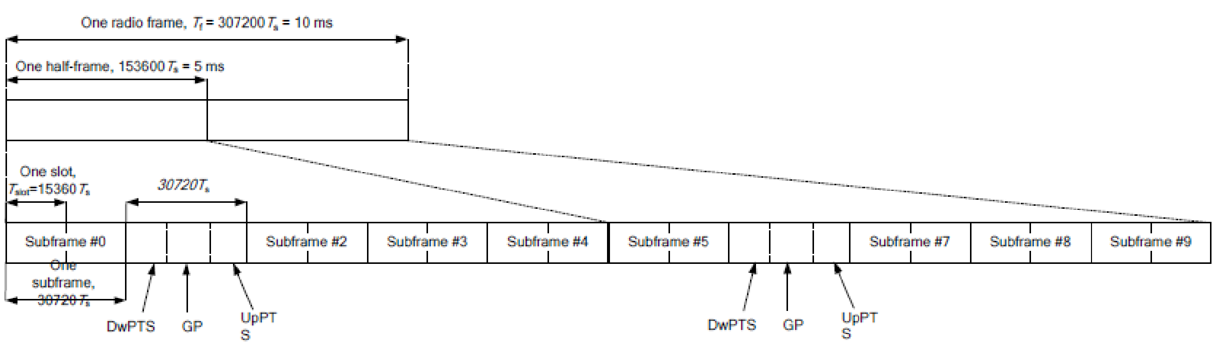
2. QPSK with 50% RB allocation
The procedures required for 1 RB allocation in 5.2.1 are applied to measure the SAR for QPSK with 50% RB allocation.

3. QPSK with 100% RB allocation
For QPSK with 100% RB allocation, SAR is not required when the highest maximum output power for 100 % RB allocation is less than the highest maximum output power in 50% and 1 RB allocations, and the highest reported SAR for 1 RB and 50% RB allocation in 5.2.1 and 5.2.2 are ≤ 2.0 W/kg. Otherwise, SAR is measured for the highest output power channel; and if the reported SAR is > 3.625 W/kg, the remaining required test channels must also be tested.

4. Higher order modulations
For each modulation besides QPSK; e.g., 16-QAM, 64-QAM, apply the QPSK procedures in 5.2.1, 5.2.2, and 5.2.3 to determine the QAM configurations that may need SAR measurement. For each configuration identified as required for testing, SAR is required only when the highest maximum output power for the configuration in the higher order modulation is > ½ dB higher than the same configuration in QPSK or when the reported SAR for the QPSK configuration is > 3.625 W/kg.

10.3.3.3 TDD-LTE test configurations

According to KDB 941225 D05, SAR testing for TDD-LTE device must be tested using a fixed periodic duty factor according to the highest transmission duty factor implemented for the device and supported by the defined 3GPP TDD-LTE configurations. The TDD-LTE of this device supports frame structure type 2 defined in 3GPP TS 36.211 section 4.2, and the frame structure configuration can be referred to below.



3GPP TS 36.211 Figure 4.2-1: Frame Structure Type 2

Special Subframe Configuration	Normal Cyclic Prefix in Downlink			Extended Cyclic Prefix in Downlink		
	DwPTS	UpPTS		DwPTS	UpPTS	
		Normal Cyclic Prefix in Uplink	Extended Cyclic Prefix in Uplink		Normal Cyclic Prefix in Uplink	Extended Cyclic Prefix in Uplink
0	6592 · Ts	2192 · Ts	2560 · Ts	7680 · Ts	2192 · Ts	2560 · Ts
1	19760 · Ts			20480 · Ts		
2	21952 · Ts			23040 · Ts		
3	24144 · Ts			25600 · Ts		
4	26336 · Ts			7680 · Ts	4384 · Ts	5120 · Ts
5	6592 · Ts	4384 · Ts	5120 · Ts	20480 · Ts		
6	19760 · Ts			23040 · Ts		
7	21952 · Ts			12800 · Ts		
8	24144 · Ts			-	-	-
9	13168 · Ts			-	-	-

3GPP TS 36.211 Table 4.2-1: Configuration of Special Subframe

Uplink-Downlink Configuration	Downlink-to-Uplink Switch-Point Periodicity	Subframe Number									
		0	1	2	3	4	5	6	7	8	9
0	5 ms	D	S	U	U	U	D	S	U	U	U
1	5 ms	D	S	U	U	D	D	S	U	U	D
2	5 ms	D	S	U	D	D	D	S	U	D	D
3	10 ms	D	S	U	U	U	D	D	D	D	D
4	10 ms	D	S	U	U	D	D	D	D	D	D
5	10 ms	D	S	U	D	D	D	D	D	D	D
6	5 ms	D	S	U	U	U	D	S	U	U	D

3GPP TS 36.211 Table 4.2-2: Uplink-Downlink Configurations

The variety of different TD-LTE uplink-downlink configurations allows a network operator to allocate the network's capacity between uplink and downlink traffic to meet the needs of the network. The uplink duty cycle of these seven configurations can readily be computed and shown in below.

UL-DL Configuration	0	1	2	3	4	5	6
Highest Duty-Cycle	63.33%	43.33%	23.33%	31.67%	21.67%	11.67%	53.33%

Considering the highest transmission duty cycle, TDD-LTE was tested using Uplink-Downlink Configuration 0 with 6 uplink subframe and 2 special subframe. The special subframe was set to special subframe configuration 7 using extended cyclic prefix uplink. Therefore, SAR testing for TDD-LTE was performed at the maximum output power with highest transmission duty cycle of 63.33%.

11 TEST RESULTS

11.1.1.1 Conducted Power Results

Test Condition:

1. Conducted Measurement
   EUT was set for low, mid, high channel with modulated mode and highest RF output power.
   The base station simulator was connected to the antenna terminal.
2. Conducted Emissions Measurement Uncertainty
   All test measurements carried out are traceable to national standards. The uncertainty of the measurement at a confidence level of approximately 95% (in the case where distributions are normal), with a coverage factor of 2, in the range 30MHz – 40GHz is ±1.5dB.
3. Environmental Conditions

Environmental Conditions	Temperature	22°C
	Relative Humidity	55%
	Atmospheric Pressure	1009mbar

4. Test Date: 20 April 2023
   Tested By: Allen Qin

Test Procedures:

Output power measurement

1. The transmitter output port was connected to base station emulator.
2. Establish communication link between emulator and EUT and set EUT to operate at maximum output power all the time.
3. Select lowest, middle, and highest channels for each band and different possible test mode.
4. Measure the conducted peak burst power and conducted average burst power from EUT antenna port.

Other radio output power measurement:

The output power was measured using power meter at low, mid, and hi channels.

LTE Power Reduction

The following tests were conducted according to the test requirements outlined in section 6.2 of the 3GPP TS36.101 specification.

The allowed Maximum Power Reduction (MPR) for the maximum output power due to higher order modulation and transmit bandwidth configuration (resource blocks) is specified in Table 6.2.3-1 of the 3GPP TS36.101.

Table 6.2.3-1: Maximum Power Reduction (MPR) for Power Class 3

Modulation	Channel bandwidth / Transmission bandwidth (RB)						MPR (dB)
	1.4 MHz	3.0 MHz	5 MHz	10 MHz	15 MHz	20 MHz	
QPSK	> 5	> 4	> 8	> 12	> 16	> 18	≤ 1
16 QAM	≤ 5	≤ 4	≤ 8	≤ 12	≤ 16	≤ 18	≤ 1
16 QAM	> 5	> 4	> 8	> 12	> 16	> 18	≤ 2

The allowed A-MPR values specified below in Table 6.2.4.-1 of 3GPP TS36.101 are in addition to the allowed MPR requirements. All the measurements below were performed with A-MPR disabled, by using Network Signalling Value of "NS_01".

Table 6.2.4-1: Additional Maximum Power Reduction (A-MPR)

Network Signalling value	Requirements (sub-clause)	E-UTRA Band	Channel bandwidth (MHz)	Resources Blocks (N_{RB})	A-MPR (dB)
NS_01	6.6.2.1.1	Table 5.5-1	1.4, 3, 5, 10, 15, 20	Table 5.6-1	NA
NS_03	6.6.2.2.1	2, 4,10, 23, 25, 35, 36	3	>5	≤ 1
			5	>6	≤ 1
			10	>6	≤ 1
			15	>8	≤ 1
			20	>10	≤ 1
NS_04	6.6.2.2.2	41	5	>6	≤ 1
			10, 15, 20	See Table 6.2.4-4	
NS_05	6.6.3.3.1	1	10,15,20	≥ 50	≤ 1
NS_06	6.6.2.2.3	12, 13, 14, 17	1.4, 3, 5, 10	Table 5.6-1	n/a
NS_07	6.6.2.2.3 6.6.3.3.2	13	10	Table 6.2.4-2	Table 6.2.4-2
NS_08	6.6.3.3.3	19	10, 15	> 44	≤ 3
NS_09	6.6.3.3.4	21	10, 15	> 40	≤ 1
				> 55	≤ 2
NS_10		20	15, 20	Table 6.2.4-3	Table 6.2.4-3
NS_11	6.6.2.2.1	23[1]	1.4, 3, 5, 10	Table 6.2.4-5	Table 6.2.4-5
..					
NS_32	-	-	-	-	-
Note 1: Applies to the lower block of Band 23, i.e. a carrier placed in the 2000-2010 MHz region.					

Band	Bandwidth	Modulation	Channel	RB Configuration	Result(dBm)	Tune up Power tolerant	MPR
Band2	20MHz	QPSK	18700	1RB#0	17	16±1	/
Band2	20MHz	QPSK	18700	1RB#49	16.91	16±1	/
Band2	20MHz	QPSK	18700	1RB#99	16.68	16±1	/
Band2	20MHz	QPSK	18700	50RB#0	15.85	16±1	/
Band2	20MHz	QPSK	18700	50RB#25	15.84	16±1	/
Band2	20MHz	QPSK	18700	50RB#50	15.6	16±1	/
Band2	20MHz	QPSK	18700	100RB#0	15.85	16±1	/
Band2	20MHz	QPSK	18900	1RB#0	16.88	16±1	/
Band2	20MHz	QPSK	18900	1RB#49	16.93	16±1	/
Band2	20MHz	QPSK	18900	1RB#99	16.85	16±1	/
Band2	20MHz	QPSK	18900	50RB#0	15.43	16±1	/
Band2	20MHz	QPSK	18900	50RB#25	15.42	16±1	/
Band2	20MHz	QPSK	18900	50RB#50	15.44	16±1	/
Band2	20MHz	QPSK	18900	100RB#0	15.47	16±1	/
Band2	20MHz	QPSK	19100	1RB#0	16.73	16±1	/
Band2	20MHz	QPSK	19100	1RB#49	16.78	16±1	/
Band2	20MHz	QPSK	19100	1RB#99	16.68	16±1	/
Band2	20MHz	QPSK	19100	50RB#0	15.45	16±1	/
Band2	20MHz	QPSK	19100	50RB#25	15.46	16±1	/
Band2	20MHz	QPSK	19100	50RB#50	15.04	16±1	/
Band2	20MHz	QPSK	19100	100RB#0	15.21	16±1	/
Band2	20MHz	16QAM	18700	1RB#0	15.6	15±1	/
Band2	20MHz	16QAM	18700	1RB#49	15.27	15±1	/
Band2	20MHz	16QAM	18700	1RB#99	14.43	15±1	/
Band2	20MHz	16QAM	18900	1RB#0	15.43	15±1	/
Band2	20MHz	16QAM	18900	1RB#49	15.93	15±1	/
Band2	20MHz	16QAM	18900	1RB#99	15.89	15±1	/
Band2	20MHz	16QAM	19100	1RB#0	15.1	15±1	/
Band2	20MHz	16QAM	19100	1RB#49	14.86	15±1	/
Band2	20MHz	16QAM	19100	1RB#99	14.18	15±1	/
Band4	20MHz	QPSK	20050	1RB#0	16.5	16±1	/
Band4	20MHz	QPSK	20050	1RB#49	16.68	16±1	/
Band4	20MHz	QPSK	20050	1RB#99	16.47	16±1	/
Band4	20MHz	QPSK	20050	50RB#0	15.7	16±1	/
Band4	20MHz	QPSK	20050	50RB#25	15.7	16±1	/
Band4	20MHz	QPSK	20050	50RB#50	15.77	16±1	/
Band4	20MHz	QPSK	20050	100RB#0	15.57	16±1	/
Band4	20MHz	QPSK	20175	1RB#0	16.67	16±1	/
Band4	20MHz	QPSK	20175	1RB#49	16.91	16±1	/
Band4	20MHz	QPSK	20175	1RB#99	16.95	16±1	/

Band4	20MHz	QPSK	20175	50RB#0	15.62	16±1	/
Band4	20MHz	QPSK	20175	50RB#25	15.62	16±1	/
Band4	20MHz	QPSK	20175	50RB#50	15.9	16±1	/
Band4	20MHz	QPSK	20175	100RB#0	15.61	16±1	/
Band4	20MHz	QPSK	20300	1RB#0	16.91	16±1	/
Band4	20MHz	QPSK	20300	1RB#49	16.88	16±1	/
Band4	20MHz	QPSK	20300	1RB#99	16.73	16±1	/
Band4	20MHz	QPSK	20300	50RB#0	15.88	16±1	/
Band4	20MHz	QPSK	20300	50RB#25	15.88	16±1	/
Band4	20MHz	QPSK	20300	50RB#50	15.76	16±1	/
Band4	20MHz	QPSK	20300	100RB#0	15.74	16±1	/
Band4	20MHz	16QAM	20050	1RB#0	15.65	15±1	/
Band4	20MHz	16QAM	20050	1RB#49	15.54	15±1	/
Band4	20MHz	16QAM	20050	1RB#99	15.55	15±1	/
Band4	20MHz	16QAM	20175	1RB#0	15.73	15±1	/
Band4	20MHz	16QAM	20175	1RB#49	15.83	15±1	/
Band4	20MHz	16QAM	20175	1RB#99	16.08	15±1	/
Band4	20MHz	16QAM	20300	1RB#0	15.46	15±1	/
Band4	20MHz	16QAM	20300	1RB#49	15.57	15±1	/
Band4	20MHz	16QAM	20300	1RB#99	15.41	16±1	/
Band12	10MHz	QPSK	23060	1RB#0	17.79	17.5±1	/
Band12	10MHz	QPSK	23060	1RB#24	18.14	17.5±1	/
Band12	10MHz	QPSK	23060	1RB#49	17.4	17.5±1	/
Band12	10MHz	QPSK	23060	25RB#0	16.77	16.5±1	1
Band12	10MHz	QPSK	23060	25RB#12	16.78	16.5±1	1
Band12	10MHz	QPSK	23060	25RB#25	16.61	16.5±1	1
Band12	10MHz	QPSK	23060	50RB#0	16.63	16.5±1	1
Band12	10MHz	QPSK	23095	1RB#0	17.75	17.5±1	/
Band12	10MHz	QPSK	23095	1RB#24	18.06	17.5±1	/
Band12	10MHz	QPSK	23095	1RB#49	17.82	17.5±1	/
Band12	10MHz	QPSK	23095	25RB#0	16.64	16.5±1	1
Band12	10MHz	QPSK	23095	25RB#12	16.64	16.5±1	1
Band12	10MHz	QPSK	23095	25RB#25	16.62	16.5±1	1
Band12	10MHz	QPSK	23095	50RB#0	16.54	16.5±1	1
Band12	10MHz	QPSK	23130	1RB#0	17.64	17.5±1	/
Band12	10MHz	QPSK	23130	1RB#24	17.9	17.5±1	/
Band12	10MHz	QPSK	23130	1RB#49	17.56	17.5±1	/
Band12	10MHz	QPSK	23130	25RB#0	16.68	16.5±1	1
Band12	10MHz	QPSK	23130	25RB#12	16.69	16.5±1	1
Band12	10MHz	QPSK	23130	25RB#25	16.69	16.5±1	1
Band12	10MHz	QPSK	23130	50RB#0	16.65	16.5±1	1
Band12	10MHz	16QAM	23060	1RB#0	16.35	16.5±1	/
Band12	10MHz	16QAM	23060	1RB#24	17.04	16.5±1	/

Band12	10MHz	16QAM	23060	1RB#49	16.67	16.5±1	/
Band12	10MHz	16QAM	23060	25RB#0	15.88	16.5±1	/
Band12	10MHz	16QAM	23060	25RB#12	15.88	16.5±1	/
Band12	10MHz	16QAM	23060	25RB#25	15.63	16.5±1	/
Band12	10MHz	16QAM	23095	1RB#0	16.47	16.5±1	/
Band12	10MHz	16QAM	23095	1RB#24	16.96	16.5±1	/
Band12	10MHz	16QAM	23095	1RB#49	16.8	16.5±1	/
Band12	10MHz	16QAM	23095	25RB#0	15.81	16.5±1	/
Band12	10MHz	16QAM	23095	25RB#12	15.81	16.5±1	/
Band12	10MHz	16QAM	23095	25RB#25	15.76	16.5±1	/
Band12	10MHz	16QAM	23130	1RB#0	16.58	16.5±1	/
Band12	10MHz	16QAM	23130	1RB#24	17.47	16.5±1	/
Band12	10MHz	16QAM	23130	1RB#49	16.99	16.5±1	/
Band12	10MHz	16QAM	23130	25RB#0	15.42	16±1	0.5
Band12	10MHz	16QAM	23130	25RB#12	15.72	16.5±1	/
Band12	10MHz	16QAM	23130	25RB#25	15.89	16.5±1	/

11.2 SAR TEST RESULTS

Table 5: SAR Values

Band	Mode	RB	Test Position	Channel	Maximum Tune-up (dBm)	Conducted Power (dBm)	Power Drift	SAR 1g	Scaling Factor	Scaled 1g SAR
LTE 2	QPSK20M	1RB#0	Front Face	18700	17.00	17.00	0.04	1.540	1.00	**1.54**
	QPSK20M	1RB#0	Rear Face	18700	17.00	17.00	-0.04	0.301	1.00	0.30
	QPSK20M	1RB#0	Left Side	18700	17.00	17.00	0.09	0.408	1.00	0.41
	QPSK20M	1RB#0	Right Side	18700	17.00	17.00	0.05	0.390	1.00	0.39
	QPSK20M	1RB#0	Bottom Side	18700	17.00	17.00	0.04	0.070	1.00	0.07
	QPSK20M	1RB#49	Front Face	18700	17.00	16.91	-0.06	1.340	1.02	1.37
	QPSK20M	1RB#99	Front Face	18700	17.00	16.68	0.01	1.320	1.08	1.42
	QPSK20M	1RB#49	Front Face	18900	17.00	16.93	0.01	1.510	1.02	1.53
	QPSK20M	1RB#0	Front Face	18900	17.00	16.88	0.02	1.460	1.03	1.50
	QPSK20M	1RB#99	Front Face	18900	17.00	16.85	-0.05	1.480	1.04	1.53
	QPSK20M	1RB#49	Front Face	19100	17.00	16.78	-0.07	1.410	1.05	1.48
	QPSK20M	1RB#0	Front Face	19100	17.00	16.73	0.03	1.380	1.06	1.47
	QPSK20M	1RB#99	Front Face	19100	17.00	16.68	0.08	1.350	1.08	1.45
	QPSK20M	50RB#0	Front Face	18700	17.00	15.85	-0.04	0.950	1.30	1.24
	QPSK20M	50RB#0	Rear Face	18700	17.00	15.85	-0.06	0.393	1.30	0.51
	QPSK20M	50RB#0	Left Side	18700	17.00	15.85	-0.06	0.404	1.30	0.53
	QPSK20M	50RB#0	Right Side	18700	17.00	15.85	-0.07	0.506	1.30	0.66

Band	Mode	RB	Test Position	Channel	Maximum Tune-up (dBm)	Conducted Power (dBm)	Power Drift	SAR 1g	Scaling Factor	Scaled 1g SAR
	QPSK20M	50RB#0	Bottom Side	18700	17.00	15.85	0.07	0.077	1.30	0.10
	QPSK20M	50RB#50	Front Face	18900	17.00	15.44	-0.03	0.902	1.43	1.29
	QPSK20M	50RB#25	Front Face	19100	17.00	15.46	-0.14	0.931	1.43	**1.33**
	QPSK20M	100RB#0	Front Face	18700	17.00	15.85	-0.01	0.908	1.30	1.18
LTE 4	QPSK20M	1RB#99	Front Face	20175	17.00	16.95	0.06	1.090	1.01	1.10
	QPSK20M	1RB#99	Rear Face	20175	17.00	16.95	-0.01	0.103	1.01	0.10
	QPSK20M	1RB#99	Left Side	20175	17.00	16.95	0.01	0.235	1.01	0.24
	QPSK20M	1RB#99	Right Side	20175	17.00	16.95	0.03	0.608	1.01	0.62
	QPSK20M	1RB#99	Bottom Side	20175	17.00	16.95	0.03	0.140	1.01	0.14
	QPSK20M	1RB#99	Front Face	20300	17.00	16.91	-0.10	1.250	1.02	**1.28**
	QPSK20M	1RB#99	Front Face	20050	17.00	16.68	0.09	0.979	1.08	1.05
	QPSK20M	50RB#50	Front Face	20175	17.00	15.90	0.18	0.822	1.29	1.06
	QPSK20M	50RB#50	Rear Face	20175	17.00	15.90	0.11	0.192	1.29	0.25
	QPSK20M	50RB#50	Left Side	20175	17.00	15.90	0.12	0.621	1.29	0.80
	QPSK20M	50RB#50	Right Side	20175	17.00	15.90	-0.03	0.380	1.29	0.49
	QPSK20M	50RB#50	Bottom Side	20175	17.00	15.90	-0.03	0.210	1.29	0.27
	QPSK20M	50RB#0	Front Face	20300	17.00	15.88	-0.07	0.990	1.29	**1.28**
	QPSK20M	50RB#50	Front Face	20050	17.00	15.77	-0.01	0.835	1.33	1.11
	QPSK20M	100RB#0	Front Face	20030	17.00	15.74	-0.03	0.975	1.34	**1.30**
LTE 1	QPSK10M	1RB#24	Front Face	23060	18.50	18.14	-0.07	1.180	1.09	1.28
	QPSK10M	1RB#24	Rear Face	23060	18.50	18.14	-0.09	0.133	1.09	0.14
	QPSK10M	1RB#24	Left Side	23060	18.50	18.14	-0.09	0.207	1.09	0.22
	QPSK10M	1RB#24	Right Side	23060	18.50	18.14	0.07	0.238	1.09	0.26
	QPSK10M	1RB#24	Bottom Side	23060	18.50	18.14	0.08	0.172	1.09	0.19
	QPSK10M	1RB#24	Front Face	23095	18.50	18.06	0.08	1.190	1.11	**1.32**
	QPSK10M	1RB#24	Front Face	23130	18.50	17.90	0.04	1.030	1.15	1.18
	QPSK10M	25RB#12	Front Face	20360	17.50	16.78	-0.08	0.911	1.18	1.08
	QPSK10M	25RB#12	Rear Face	20360	17.50	16.78	-0.05	0.114	1.18	0.13
	QPSK10M	25RB#12	Left Side	20360	17.50	16.78	-0.07	0.042	1.18	0.05
	QPSK10M	25RB#12	Right Side	20360	17.50	16.78	-0.06	0.018	1.18	0.02
	QPSK10M	25RB#12	Bottom Side	20360	17.50	16.78	-0.18	0.734	1.18	0.20
	QPSK10M	25RB#0	Front Face	23095	17.50	16.64	0.02	1.070	1.22	**1.30**
	QPSK10M	25RB#12	Front Face	23130	17.50	16.69	0.03	0.891	1.21	1.07
	QPSK10M	50RB#0	Front Face	23130	17.50	16.65	0.01	0.973	1.22	**1.18**

Note:

1. For QPSK with 100% RB allocation, SAR is not required when the highest maximum output power for 100 % RB allocation is less than the highest maximum output power in 50% and 1 RB allocations, and the highest reported SAR for 1 RB and 50% RB allocation in 5.2.1 and 5.2.2 are ≤ 0.8 W/kg. Otherwise, SAR is measured for the highest output power channel; and if the reported SAR is > 1.45 W/kg, the remaining required test channels must also be tested.

2. The maximum output power for 16QAM > the same configuration in QPSK or the reported SAR for QPSK is <1.45W/kg. According to FCC KDB 941225 D02 v02r05, the SAR measurement is not required for 16QAM.

3. According to KDB 447498 D01, testing of other required channels within the operating mode of a frequency band is not required when the reported 1-g or 10-g SAR for the mid-band or highest output power channel is:

a) ≤ 0.8 W/kg or 2.0 W/kg, for 1-g or 10-g respectively, when the transmission band is ≤ 100 MHz
b) ≤ 0.6 W/kg or 1.5 W/kg, for 1-g or 10-g respectively, when the transmission band is between 100 MHz and 200 MHz
c) ≤ 0.4 W/kg or 1.0 W/kg, for 1-g or 10-g respectively, when the transmission band is ≥ 200 MHz

Measurement variability consideration

According to KDB 865664 D01v01r04 section 2.8.1, repeated measurements are required following the procedures as below:

1. Repeated measurement is not required when the original highest measured SAR is < 0.8W/kg; steps 2) through 4) do not apply.
2. When the original highest measured SAR is ≥ 0.8 W/kg, repeat that measurement once.
3. Perform a second repeated measurement only if the ratio of largest to smallest SAR for the original and first repeated measurements is > 1.2 or when the original or repeated measurement is ≥ 1.45W/kg (~ 10% from the 1-g SAR limit).
4. Perform a third repeated measurement only if the original, first or second repeated measurement is ≥ 1.5 W/kg and the ratio of largest to smallest SAR for the original, first and second repeated measurements is > 3.0.

Repeated SAR

Band	Channel	Mode	RF Exposure	Test Position	Repeated SAR (Yes/No)	Highest Measured SAR (W/kg)	First Repeated		Second Repeated	
							Measurement SAR (W/kg)	largest to smallest SAR Ratio	Measurement SAR (W/kg)	largest to smallest SAR Ratio
LTE Band2	18700	QPSK20M	Body	Front Face	Yes	1.54	1.52	1.01	1.53	1.01
LTE Band4	20175	QPSK20M	Body	Front Face	Yes	1.09	0.98	1.01	N/A	N/A
LTE Band12	23060	QPSK10M	Body	Front Face	Yes	1.18	1.11	1.01	N/A	N/A

11.3 MAXIMUM GRAPH RESULTS

The graph results see ANNEX C.

12 MEASUREMENT UNCERTAINTY

When the highest measured 1-g SAR within a frequency band is < 1.5 W/kg, the extensive SAR measurement uncertainty analysis described in IEEE Std 1528-2013 is not required in SAR reports submitted for equipment approval.

13 MAIN TEST INSTRUMENT

Equipment No.	Equipment	Manufacturer	Model No.	Serial No.	Last Cal.	Cal. Interval
SZ060-01	SAR Test System	SPEAG	DASY52 SAR TX90XL	F14/5YJ0B1 /A/01	2024-03-18	1 year
SZ060-01-01	E-Field Probe	SPEAG	EX3DV4	7322	2024-03-26	1 year
SZ060-01-03	System Validation Dipole	SPEAG	D750V3	1141	2024-03-14	3 year
SZ060-01-06	System Validation Dipole	SPEAG	D1750V2	1138	2024-11-06	3 year
SZ060-01-07	System Validation Dipole	SPEAG	D1900V2	5d203	2024-11-04	3 year
SZ060-01-13	Data Acquisition Unit	SPEAG	DAE4	1473	2024-03-18	1 year
SZ060-01-14	Dielectric Assessment Kit	SPEAG	DAKS 3.5	1056	2024-11-01	1 year
SZ060-01-15	Vector Reflectometer	Copper Mountain Technologies	Planar R140	0090614	2024-11-01	1 year
SZ060-01-16	Thermometer	LKM electronics GmbH	DTM3000	3477	2024-12-26	1 year
SZ060-01-17	Power Amplifier	Mini Circuits	ZHL-42W+	QA1449003	2024-11-01	1 year
SZ060-01-18	Power Amplifier	Mini Circuits	ZVE-8G+	111701437	2024-11-01	1 year
SZ060-01-19	SAM Twin Phantom	SPEAG	SAM Twin Phantom V5.0	1888	N/A	N/A
SZ060-01-20	SAM Twin Phantom	SPEAG	SAM Twin Phantom V5.0	1891	N/A	N/A
SZ060-01-21	ELI Phantom	SPEAG	ELI Phantom V6.0	2033	N/A	N/A
SZ180-13	MXG Vector Signal Generator	Keysight	N5182B	MY53051328	2024-09-29	1 year
SZ070-04	Directional Bridge	Agilent	86205A	MY31402141	2024-12-05	1 year
SZ182-02	RF Power Meter	Anritsu	ML2496A	1302005	2024-04-22	1 year
SZ182-02-01	Pulse Power Sensor	Anritsu	MA2411B	1207429	2024-04-22	1 year
SZ182-03	Average power sensor	R&S	NRP-Z22	101689	2024-04-22	1 year
SZ065-06	Wideband Radio Communication Tester	R&S	CMW500	154161	2024-09-29	1 year
N/A	Device Holder	SPEAG	N/A	N/A	N/A	N/A

ANNEX A Test Position Photos

The graph results see 230912030SZN-002_SAR Appendix 1.

ANNEX B System Check Results

The graph results see 230912030SZN-002_SAR Appendix 1.

ANNEX C: MAXIMUM GRAPH RESULTS

The graph results see 230912030SZN-002_SAR Appendix 1.

ANNEX D: SYSTEM VALIDATION

The graph results see 230912030SZN-002_SAR Appendix 1.

ANNEX E RELEVANT PAGES FROM PROBE, DAE and DIPOLE CALIBRATION REPORT(S)

The graph results see 230912030SZN-002_SAR Appendix 2.

**********End The Report**********