FCC SAR TEST REPORT

Test File No : F690501-RF-SAR000527

Equipment Under Test	Telematics
Model Name	TFGMEIBBCD1
Variant Model	TFGMEIBBCD2, TFGMEIBBCD3
Applicant	LG Electronics USA, Inc.
Address of Applicant	111 Sylvan Avenue, North Building, Englewood Cliffs, New Jersey, United States, 07632
FCC ID	BEJTFGMEIBBCD1
Exposure Category	General Population/Uncontrolled Exposure
Standards	FCC 47 CFR Part 2 (2.1093) IEEE 1528, 2013
Receipt No.	GPRI2410001163SR
Date of Receipt	2024-10-30
Date of SAR Test(s)	2024-11-27 ~2024-12-18
Date of Issue	2024-12-24
Test Result	Refer to the Page 07

In the configuration tested, the EUT complied with the standards specified above.

This test report does not assure KOLAS accreditation.

Remarks:

1) The results of this test report are effective only to the items tested.
2) The SGS Korea is not responsible for the sampling, the results of this test report apply to the sample as received.

Report prepared by /
Jayden Jung
Test Engineer

Approved by /
Minhyuk Han
Technical Manager

Revision history

Revision	Date of issue	Revisions	Revised By
-	Dec 24, 2024	Initial issue	

Table of Contents

1 Testing Laboratory

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2 Details of Applicant

Applicant	LG Electronics USA, Inc.
Address	111 Sylvan Avenue, North Building, Englewood Cliffs, New Jersey, United States, 07632
Email	David6.kim@lge.com
Phone No.	+1 201 470 2696

3 Details of Manufacturer

Applicant	LG Electronics Inc.
Address	128, Yeoui-daero, Yeongdeungpo-gu, Seoul, Republic of Korea, 07336

4 Description of EUT(s)

EUT Type	Telematics
Model Name	TFGMEIBBCD1
Variant Model	TFGMEIBBCD2, TFGMEIBBCD3
TFGMEIBBCD1 & Variant Model Difference	Same to RF module with Basic model except following function. TFGMEIBBCD1: Dual/Single GNSS and Ultra-super cruise service supported. TFGMEIBBCD2: Single GNSS and Ultra-super cruise service doesn't supported. TFGMEIBBCD3: Single GNSS and Ultra-super cruise service doesn't supported. eUICC part is different with TFGMEIBBCD2.
Antenna Information (Type / Manufacturer)	1. Ant1 86784729 / Continental 2. Ant2 85647584 / Continental
Software Version	SW176
Hardware Version	Rev. F
Serial Number	004400152020000

Mode of Operation	WCDMA II / WCDMA IV / WCDMA V / LTE Band 2 / LTE Band 4 / LTE Band 5 / LTE Band 7 / LTE Band 12 / LTE Band 13 / LTE Band 14 / LTE Band 26 / LTE Band 66 / 5G NR n2 / 5G NR n5 / 5G NR n7 / 5G NR n12 / 5G NR n13 / 5G NR n14 / 5G NR n25 / 5G NR n26 / 5G NR n66 / 5G NR n71 / 5G NR n41 / 5G NR n77 / 5G NR n78
Tx Frequency Range	WCDMA II : 1850.0 ~ 1910 MHz WCDMA IV : 1710.0 ~ 1755.0 MHz WCDMA V : 824.0 ~ 849.0 MHz LTE Band 2 : 1850.0 ~ 1910.0 MHz LTE Band 4 : 1710.0 ~ 1755.0 MHz LTE Band 5 : 824.0 ~ 849.0 MHz LTE Band 7 : 2500.0 ~ 2570.0 MHz LTE Band 12 : 699.0 ~ 716.0 MHz LTE Band 13 : 777.0 ~ 787.0 MHz LTE Band 14 : 788.0 ~ 798.0 MHz LTE Band 26 : 814 ~ 849 MHz LTE Band 66 : 1710.0 ~ 1780.0 MHz 5G NR n2 : 1850 ~ 1910 MHz 5G NR n5 : 824.0 ~ 849.0 MHz 5G NR n7 : 2500.0 ~ 2570.0 MHz 5G NR n12 : 699 ~ 716 MHz 5G NR n13 : 777.0 ~ 787.0 MHz 5G NR n14 : 788.0 ~ 798.0 MHz 5G NR n25 : 1850 ~ 1915 MHz 5G NR n26 : 814 ~ 849 MHz 5G NR n66 : 1710 ~ 1780 MHz 5G NR n71 : 663 ~ 698 MHz 5G NR n41 : 2496 ~ 2690 MHz 5G NR n77 DoD : 3450 ~ 3550 MHz 5G NR n77 : 3700 ~ 3980 MHz 5G NR n78 DoD : 3450 ~ 3550 MHz 5G NR n78 : 3700 ~ 3800 MHz

5 The Highest Reported SAR Values

Band	Highest Reported SAR 1g (W/kg)
WCDMA II	0.364
WCDMA IV	0.430
WCDMA V	0.135
LTE Band 2	0.339
LTE Band 5	0.143
LTE Band 7	0.472
LTE Band 12	0.118
LTE Band 13	0.192
LTE Band 14	0.191
LTE Band 26	0.165
LTE Band 66	0.513
5G NR n7	0.461
5G NR n12	0.147
5G NR n13	0.151
5G NR n14	0.215
5G NR n25	0.434
5G NR n26	0.172
5G NR n41	0.322
5G NR n41 MIMO Ant1	0.191
5G NR n41 MIMO Ant2	0.171
5G NR n66	**0.515**
5G NR n71	0.101
5G NR n77	0.246
5G NR n77 DoD	0.345
5G NR n77 MIMO Ant1	0.105
5G NR n77 MIMO Ant2	0.108
5G NR n77 DoD MIMO Ant1	0.190
5G NR n77 DoD MIMO Ant2	0.150
Simultaneous SAR(TER) per KDB 690783 D01v01r03 :	0.759

6 Test Methodology

ANSI/IEEE C95.1–1999: IEEE Standard for Safety Levels with Respect to Human Exposure to Radio Frequency Electromagnetic Fields, 3 kHz to 300 GHz. It specifies the maximum exposure limit of 1.6 W/kg as averaged over any 1 gram of tissue for portable devices being used within 20 cm of the user in the uncontrolled environment.

Test tests documented in this report were performed in accordance with IEEE Standard 1528-2013 and the following published KDB procedures.

☒	**KDB 865664 D01v01r04**	**SAR Measurement Requirements for 100 MHz to 6 GHz**
☒	**KDB 865664 D02v01r02**	**RF Exposure Compliance Reporting and Documentation Considerations**
☐	KDB 447498 D01v06	Mobile and Portable Devices RF Exposure Procedures and Equipment Authorization Policies
☒	**KDB 447498 D04v01**	**Interim General RF Exposure Guidance**
☐	KDB 447498 D02v02r01	SAR Measurement Procedures for USB Dongle Transmitters
☐	KDB 248227 D01v02r02	SAR Guidance For IEEE 802.11 (Wi-Fi) Transmitters
☐	KDB 615223 D01v01r01	802.16e/WiMax SAR Measurement Guidance
☐	KDB 616217 D04v01r02	SAR Evaluation Considerations for Laptop, Notebook, Netbook and Tablet Computers
☐	KDB 643646 D01v01r03	SAR Test Considerations for Occupational PTT Radios
☐	KDB 648474 D03v01r04	Evaluation and Approval Considerations for Handsets with Specific Wireless Charging Battery Covers
☐	KDB 648474 D04v01r03	SAR Evaluation Considerations for Wireless Handsets
☐	KDB 680106 D01v03r01	RF Exposure Considerations for Low Power Consumer Wireless Power Transfer Applications
☒	**KDB 941225 D01v03r01**	**3G SAR Measurement Procedures**
☒	**KDB 941225 D05v02r05**	**SAR Evaluation Considerations for LTE Devices**
☐	KDB 941225 D06v02r01	SAR Evaluation Procedures for Portable Devices with Wireless Router Capabilities
☐	KDB 941225 D07v01r02	SAR Evaluation Procedures for UMPC Mini-Tablet Devices

7 Testing Environment

Ambient temperature	: 18°C ~ 25°C
Relative humidity	: 30% ~ 70%
Liquid temperature of during the test	: <± 2°C
Ambient noise & Reflection	: < 0.012 W/kg

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:

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

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

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

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

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

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

Where: σ is the conductivity of the tissue, ρ is the mass density of the tissue and E is the RMS electrical field strength. However for evaluating SAR of low power transmitter, electrical field measurement is typically applied.

8.3 Test Standards and Limits

According to FCC 47CFR §2.1093(d) The limits to be used for evaluation are based generally on criteria published by the American National Standards Institute (ANSI) for localized specific absorption rate ("SAR") in Section 4.2 of "IEEE Standard for Safety Levels with Respect to Human Exposure to Radio Frequency Electromagnetic Fields, 3 ㎑ to 300 ㎓," ANSI/IEEE C95.3–2003, Copyright 2003 by the Institute of Electrical and Electronics Engineers, Inc., New York, New York 10017. These criteria for SAR evaluation are similar to those recommended by the National Council on Radiation Protection and Measurements (NCRP) in "Biological Effects and Exposure Criteria for Radio frequency Electromagnetic Fields," NCRP Report No. 86, Section 17.4.5. Copyright NCRP, 1986, Bethesda, Maryland 20814. SAR is a measure of the rate of energy absorption due to exposure to an RF transmitting source. SAR values have been related to threshold levels for potential biological hazards. The criteria to be used are specified in paragraphs (d)(1) and (d)(2) of this section and shall apply for portable devices transmitting in the frequency range from 100 ㎑ to 6 ㎓. Portable devices that transmit at frequencies above 6 ㎓ are to be evaluated in terms of the MPE limits specified in § 1.1310 of this chapter. Measurements and calculations to demonstrate compliance with MPE field strength or power density limits for devices operating above 6 ㎓ should be made at a minimum distance of 5 cm from the radiating source.

(1) Limits for Occupational/Controlled exposure: 0.4 W/kg as averaged over the whole-body and spatial peak SAR not exceeding 8 W/kg as averaged over any 1 gram of tissue (defined as a tissue volume in the shape of a cube). Exceptions are the hands, wrists, feet and ankles where the spatial peak SAR shall not exceed 20 W/kg, as averaged over an 10 grams of tissue (defined as a tissue volume in the shape of a cube). Occupational/Controlled limits apply when persons are exposed as a consequence of their employment provided these persons are fully aware of and exercise control over their exposure. Awareness of exposure can be accomplished by use of warning labels or by specific training or education through appropriate means, such as an RF safety program in a work environment.

(2) Limits for General Population/Uncontrolled exposure: 0.08 W/kg as averaged over the whole-body and spatial peak SAR not exceeding 1.6 W/kg as averaged over any 1 gram of tissue (defined as a tissue volume in the shape of a cube). Exceptions are the hands, wrists, feet and ankles where the spatial peak SAR shall not exceed 4 W/kg, as averaged over any 10 grams of tissue (defined as a tissue volume in the shape of a cube). General Population/Uncontrolled limits apply when the general public may be exposed, or when persons that are exposed as a consequence of their employment may not be fully aware of the potential for exposure or do not exercise control over their exposure. Warning labels placed on consumer devices such as cellular telephones will not be sufficient reason to allow these devices to be evaluated subject to limits for occupational/controlled exposure in paragraph (d)(1) of this section.

Human Exposure	Uncontrolled Environment General Population	Controlled Environment Occupational
Partial Peak SAR (Partial)	1.60 mW/g	8.00 mW/g
Partial Average SAR (Whole Body)	0.08 mW/g	0.40 mW/g
Partial Peak SAR (Hands/Feet/Ankle/Wrist)	4.00 mW/g	20.00 mW/g

1. The spatial Peak value of the SAR averaged over any 1g gram of tissue (defined as a tissue volume in the shape of a cube) and over the appropriate averaging time.
2. The spatial Average value of the SAR averaged over the whole body.
3. The Spatial Peak value of the SAR averaged over any 10 grams of tissue (defined as a tissue volume in the shape of a cube) and over the appropriate averaging time.

9 The SAR Measurement System

A block diagram of the SAR measurement System is given in Fig. 1. This SAR Measurement System uses a Computer-controlled 3-D stepper motor system (SPEAG DASY system). The model EX3DV4 field probe is used to determine the internal electric fields. The SAR can be obtained from the equation SAR= σ ($|Ei|^2$)/ ρ where σ and ρ are the conductivity and mass density of the tissue-simulant.

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

- A standard high precision 6-axis robot (Staubli TX family) with controller, teach pendant and software. An arm extension is for accommodating the data acquisition electronics (DAE).
- A dosimeter probe, i.e., an isotropic E-field probe optimized and calibrated for usage in tissue simulating liquid. The probe is equipped with an optical surface detector system.
- 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.

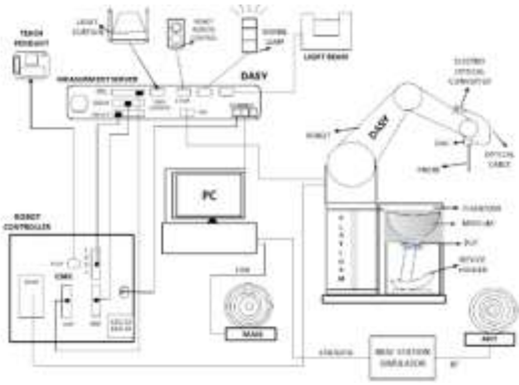


Fig a. The microwave circuit arrangement used for SAR system verification

- The Electro-optical converter (EOC) performs the conversion between optical and electrical of the signals for the digital communication to the DAE and for the analog signal from the optical surface detection. The EOC is connected 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.
- A probe alignment unit which improves the (absolute) accuracy of the probe positioning.
- A computer operating Windows.
- DASY software.
- Remote control with teach pendant and additional circuitry for robot safety such as warning lamps, etc.
- The SAM twin phantom enabling testing left-hand and right-hand usage.
- The device holder for handheld mobile phones.
- Tissue simulating liquid mixed according to the given recipes.
- Verification dipole kits allowing to validate the proper functioning of the system.

10 System Components

10.1 Probe

Construction : Symmetrical design with triangular core.
Built-in shielding against static charges.
PEEK enclosure material (resistant to organic solvents, e.g., DGBE)

Calibration : Basic Broad Band Calibration in air Conversion Factors (CF) for HSL 835 and HSL1900.
Additional CF-Calibration for other liquids and frequencies upon request.

Frequency : 10 ㎒ to 6 ㎓; Linearity: ± 0.2 ㏈ (30 ㎒ to 6 ㎓)

Directivity : ± 0.3 ㏈ in HSL (rotation around probe axis)
± 0.5 ㏈ in tissue material (rotation normal to probe axis)

Dynamic Range : 10µW/g to > 100 m W/g;
Linearity: ± 0.2 ㏈(noise: typically < 1 µW/g)

Dimensions : Overall length: 337 ㎜ (Tip length: 20 ㎜)
Tip diameter: 2.5 ㎜ (Body diameter: 12 ㎜)
Distance from probe tip to dipole centers: 1 ㎜

Application : High precision dosimetric measurements in any exposure scenario (e.g., very strong gradient fields). Only probe which enables compliance testing for frequencies up to 6 ㎓ with precision of better 30%

EX3DV4 E-Field Probe

NOTE:

1. The Probe parameters have been calibrated by the SPEAG. Please reference “APPENDIX C” for the Calibration Certification Report.

10.2 ELI Phantom

Construction : Phantom for compliance testing of handheld and bodymounted wireless devices in the frequency range of 30 ㎒ to 6 ㎓. 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.

ELI V5.0 has the same shell geometry and is manufactured from the same material as ELI4, but has reinforced top structure

ELI Phantom

Shell Thickness : 2.0 ㎜ ± 0.1 ㎜

Dimensions : Major axis : 600 ㎜
Minor axis : 400 ㎜

10.3 Device Holder

Construction: **:** In combination with the Twin SAM PhantomV4.0/V4.0C or Twin SAM, the Mounting Device (made from POM) enables the rotation of the mounted transmitter in spherical coordinates, whereby the rotation point is the ear opening. The devices can be easily and accurately positioned according to IEC, IEEE, CENELEC, FCC or other specifications. The device holder can be locked at different phantom locations (left head, right head, flat phantom).

Device Holder

11 SAR Measurement Procedures

11.1 Normal SAR Measurement Procedure

Step 1: Power Reference Measurement

The Power Reference Measurement and Power Drift Measurements are for monitoring the power drift of the device under test in the batch process. The Minimum distance of probe sensors to surface determines the closest measurement point to phantom surface. The minimum distance of probe sensors to surface is 1.4 ㎜. This distance cannot be smaller than the Distance of sensor calibration points to probe tip as defined in the probe properties.

Step 2 and 3: Area Scan & Zoom Scan Procedures

The entire evaluation of the spatial peak values is performed within the Post-processing engine (SEMCAD). The system always gives the maximum values for the 1 g and 10 g cubes. The algorithm to find the cube with highest averaged SAR is divided into the following stages:

1. The extraction of the measured data (grid and values) from the Zoom Scan.
2. The calculation of the SAR value at every measurement point based on all stored data (A/D values and measurement parameters)
3. The generation of a high-resolution mesh within the measured volume
4. The interpolation of all measured values from the measurement grid to the high-resolution grid
5. The extrapolation of the entire 3-D field distribution to the phantom surface over the distance from sensor to surface
6. The calculation of the averaged SAR within masses of 1 g and 10 g.

Step 4: Power drift measurement

The Power Drift Measurement measures the field at the same location as the most recent power reference measurement within the same procedure, and with the same settings. The Power Drift Measurement gives the field difference in dB from the reading conducted within the last Power Reference Measurement. This allows a user to monitor the power drift of the device under test within a batch process. The measurement procedure is the same as Step 1. SAR drift shall be kept within ± 5 % and if it without ± 5 %, SAR retest according to measurement procedure step 1~4.

< Area and Zoom Scan Resolutions per FCC KDB Publication 865664 D01v01r04 >

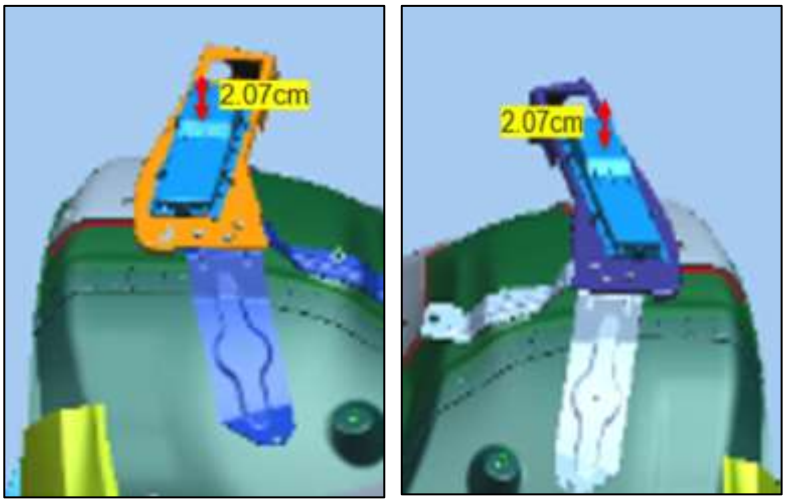
<table>
<tr><td colspan="3"></td><td>$\leq$ 3 GHz</td><td>> 3 GHz</td></tr>
<tr><td colspan="3">Maximum distance from closest measurement point (geometric center of probe sensors) to phantom surface</td><td>5 mm ± 1 mm</td><td>$\frac{1}{2} \cdot \delta \cdot \ln(2)$ mm ± 0.5 mm</td></tr>
<tr><td colspan="3">Maximum probe angle from probe axis to phantom surface normal at the measurement location</td><td>30° ± 1°</td><td>20° ± 1°</td></tr>
<tr><td colspan="3" rowspan="2">Maximum area scan spatial resolution: Δx_{Area}, Δy_{Area}</td><td>$\leq$ 2 GHz: $\leq$ 15 mm
2 – 3 GHz: $\leq$ 12 mm</td><td>3 – 4 GHz: $\leq$ 12 mm
4 – 6 GHz: $\leq$ 10 mm</td></tr>
<tr><td colspan="2">When the x or y dimension of the test device, in the measurement plane orientation, is smaller than the above, the measurement resolution must be $\leq$ the corresponding x or y dimension of the test device with at least one measurement point on the test device.</td></tr>
<tr><td colspan="3">Maximum zoom scan spatial resolution: Δx_{Zoom}, Δy_{Zoom}</td><td>$\leq$ 2 GHz: $\leq$ 8 mm
2 – 3 GHz: $\leq$ 5 mm*</td><td>3 – 4 GHz: $\leq$ 5 mm*
4 – 6 GHz: $\leq$ 4 mm*</td></tr>
<tr><td rowspan="3">Maximum zoom scan spatial resolution, normal to phantom surface</td><td colspan="2">uniform grid: $\Delta z_{Zoom}(n)$</td><td>$\leq$ 5 mm</td><td>3 – 4 GHz: $\leq$ 4 mm
4 – 5 GHz: $\leq$ 3 mm
5 – 6 GHz: $\leq$ 2 mm</td></tr>
<tr><td rowspan="2">graded grid</td><td>$\Delta z_{Zoom}(1)$: between 1st two points closest to phantom surface</td><td>$\leq$ 4 mm</td><td>3 – 4 GHz: $\leq$ 3 mm
4 – 5 GHz: $\leq$ 2.5 mm
5 – 6 GHz: $\leq$ 2 mm</td></tr>
<tr><td>$\Delta z_{Zoom}(n>1)$: between subsequent points</td><td colspan="2">$\leq 1.5 \cdot \Delta z_{Zoom}(n-1)$ mm</td></tr>
<tr><td>Minimum zoom scan volume</td><td colspan="2">x, y, z</td><td>$\geq$ 30 mm</td><td>3 – 4 GHz: $\geq$ 28 mm
4 – 5 GHz: $\geq$ 25 mm
5 – 6 GHz: $\geq$ 22 mm</td></tr>
<tr><td colspan="5">Note: δ is the penetration depth of a plane-wave at normal incidence to the tissue medium; see IEEE Std 1528-2013 for details.
* When zoom scan is required and the <u>reported</u> SAR from the area scan based 1-g SAR estimation procedures of KDB Publication 447498 is $\leq$ 1.4 W/kg, $\leq$ 8 mm, $\leq$ 7 mm and $\leq$ 5 mm zoom scan resolution may be applied, respectively, for 2 GHz to 3 GHz, 3 GHz to 4 GHz and 4 GHz to 6 GHz.</td></tr>
</table>

12 Definition of Reference※

12.1 Other consumer electronic devices

The exposure conditions of transmitters and modules incorporated in certain consumer electronic devices, such as printers, cameras, and camcorders may vary according to the installation and operating configurations required by the host products. Details of the transmitter and antenna configurations, antenna to user test separation distance, device operating configurations, etc., are required to determine SAR test exclusion or SAR measurement requirements for each host product. When SAR tests are required, a KDB inquiry is recommended to confirm the test setup. Unless the transmitter is used in a specific/dedicated host device, the standalone and simultaneous transmission SAR procedures for transmitters and modules should be applied. These must be fully explained in the permissive change documentation or equipment approval filing, whichever is applicable.

“Intended use distance” specified by the manufacturer: When there is no regulatory requirement, the intended use condition or distance specified by the manufacturer shall be used. This information shall be acquired from the user documentation accompanying the DUT. This device is mounted on the vehicle, and the physical distance from the device is 20mm. By manufacturer declaration, the test distance is 20mm. Testing of all six faces of the DUT might not be required; justification shall be provided when omitting testing of some faces. The SAR was tested only in one position, the Front.



Ant 1 / Ant 2

- The data marked ※ in this report was provided by the customer and may affect the validity of the test results.

We are responsible for all the information of this test report except for the data(※) provided by the customer.

13 SAR System Verification

The microwave circuit arrangement for system verification is sketched in Fig 1. The daily system accuracy verification occurs within the flat section of the SAM phantom. A SAR measurement was performed to see if the measured SAR was within +/- 10% from the target SAR values. These tests were done at 750 / 835 / 1750 / 1900 / 2600 / 3500 / 3900 ㎒. The tests were conducted on the same days as the measurement of the DUT. The obtained results from the system accuracy verification are displayed in the table 1. (SAR values are normalized to 1W forward power delivered to the dipole). During the tests, the ambient temperature of the laboratory was in the range (22 ± 2) ° C, the relative humidity was in the range (55 ± 5) % R.H and the liquid depth above the ear reference points was ≥ 15 cm ± 5 mm (frequency ≤ 3 GHz) or ≥ 10 cm ± 5 mm (frequency > 3 G Hz)in all the cases. It is seen that the system is operating within its specification, as the results are within acceptable tolerance of the reference values.

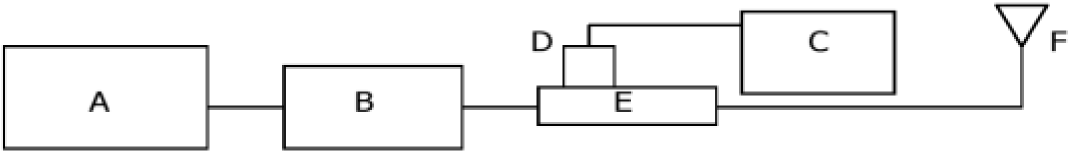


Fig 1. The microwave circuit arrangement used for SAR system verification

A. Signal Generator
B. RF Amplifier
C. Power Meter
D. Power Sensor
E. Dual Directional Coupler
F. Reference dipole Antenna

Photo of the dipole Antenna

SAR System Verification

Dipole Validation Kits		Probe S/N	Freq. (MHz)	Input Power (W)	Target SAR values (W/Kg)	1 W normalized Measured SAR (W/Kg)	SAR Deviation (%)	Date	Temperature (°C)	
Model	S/N				1g	1g	1g		Ambient	Liquid
D750V3	1085	3986	750	0.10	8.49	8.47	-0.24	2024-12-04	21.9	21.6
D750V3	1085	3986	750	0.10	8.49	8.48	-0.12	2024-12-05	21.9	21.7
D750V3	1085	3986	750	0.10	8.49	8.19	-3.53	2024-12-06	22.0	21.8
D835V2	490	3986	835	0.10	9.64	9.24	-4.15	2024-12-03	22.1	21.8
D835V2	490	3986	835	0.10	9.64	9.27	-3.84	2024-12-04	21.9	21.6
D835V2	490	3986	835	0.10	9.64	9.46	-1.87	2024-12-18	22.0	21.5
D1750V2	1070	3986	1750	0.10	36.90	38.80	5.15	2024-11-27	22.7	21.7
D1750V2	1070	3986	1750	0.10	36.90	38.90	5.42	2024-12-02	21.8	21.6
D1750V2	1070	3986	1750	0.10	36.90	35.80	-2.98	2024-12-18	22.0	21.5
D1900V2	5d033	3986	1900	0.10	40.60	43.20	6.40	2024-11-27	22.7	21.7
D1900V2	5d033	3986	1900	0.10	40.60	43.20	6.40	2024-12-02	21.8	21.6
D2600V2	1124	3986	2600	0.10	54.50	52.30	-4.04	2024-12-08	22.1	21.7
D2600V2	1124	3986	2600	0.10	54.50	52.20	-4.22	2024-12-09	21.9	21.6
D2600V2	1124	3986	2600	0.10	54.50	51.50	-5.50	2024-12-10	21.5	21.1
D2600V2	1124	3986	2600	0.10	54.50	51.50	-5.50	2024-12-18	22.0	21.5
D3500V2	1058	3986	3500	0.10	65.30	61.20	-6.28	2024-12-11	21.6	21.5
D3500V2	1058	3986	3500	0.10	65.30	62.70	-3.98	2024-12-12	21.8	21.5
D3900V2	1036	3986	3900	0.10	68.00	65.10	-4.26	2024-12-11	21.6	21.5
D3900V2	1036	3986	3900	0.10	68.00	64.90	-4.56	2024-12-12	21.8	21.5

Table 1 Results system verification

14 Tissue Simulant Fluid for the Frequency Band

The dielectric properties for this simulant fluid were measured by using the Speag Model DAK-3.5 in conjunction with Keysight E5063A Network Analyzer by using a procedure.

Freq. (MHz)	Target Value		Measure Value		Deviation (%)		Date	Liquid Temperature (°C)
	Permitivity	Conductivity (S/m)	Permitivity	Conductivity (S/m)	Permitivity	Conductivity (S/m)		
750*	41.90	0.89	41.705	0.917	-0.47	3.03	2024-12-04	21.6
782.00	41.90	0.89	41.704	0.931	-0.47	4.61		
793.00	41.90	0.89	41.700	0.934	-0.48	4.94		
750*	41.90	0.89	42.164	0.909	0.63	2.13	2024-12-05	21.7
704.00	41.90	0.89	42.220	0.884	0.76	-0.67		
707.50	41.90	0.89	42.186	0.887	0.68	-0.34		
793.00	41.90	0.89	41.875	0.934	-0.06	4.94		
750*	41.90	0.89	43.051	0.890	2.75	0.00	2024-12-06	21.8
680.50	41.90	0.89	43.431	0.868	3.65	-2.47		
782.00	41.90	0.89	42.998	0.907	2.62	1.91		
793.00	41.90	0.89	42.968	0.915	2.55	2.81		
835*	41.50	0.90	41.878	0.914	0.91	1.56	2024-12-03	21.8
829.00	41.50	0.90	41.983	0.906	1.16	0.67		
831.50	41.50	0.90	41.936	0.909	1.05	1.00		
836.60	41.50	0.90	41.848	0.916	0.84	1.78		
835*	41.50	0.90	41.939	0.914	1.06	1.56	2024-12-04	21.6
831.50	41.50	0.90	42.000	0.909	1.20	1.00		
835*	41.50	0.90	40.223	0.938	-3.08	4.22	2024-12-18	21.5
829.00	41.50	0.90	40.276	0.934	-2.95	3.78		
1750*	40.10	1.37	40.942	1.350	2.10	-1.46	2024-11-27	21.7
1745.00	40.10	1.37	40.941	1.345	2.10	-1.82		
1750*	40.10	1.37	41.660	1.376	3.89	0.44	2024-12-02	21.6
1732.60	40.10	1.37	41.721	1.352	4.04	-1.31		
1745.00	40.10	1.37	41.667	1.370	3.91	0.00		
1750*	40.07	1.37	41.823	1.379	4.37	0.66	2024-12-18	21.5
1750.10	40.07	1.37	41.823	1.380	4.37	0.73		
1752.50	40.07	1.37	41.833	1.381	4.40	0.80		
1900*	40.00	1.40	40.717	1.447	1.79	3.36	2024-11-27	21.7
1860.00	40.00	1.40	40.836	1.403	2.09	0.21		
1880.00	40.00	1.40	40.801	1.432	2.00	2.29		
1900*	40.00	1.40	40.458	1.454	1.15	3.86	2024-12-02	21.6
1882.50	40.00	1.40	40.538	1.441	1.34	2.93		
2600*	39.00	1.96	39.625	1.978	1.60	0.92	2024-12-08	21.7
2510.00	39.00	1.96	39.822	1.904	2.11	-2.86		
2535.00	39.00	1.96	39.822	1.929	2.11	-1.58		
2600*	39.00	1.96	40.232	1.972	3.16	0.61	2024-12-09	21.6
2510.00	39.00	1.96	40.942	1.915	4.98	-2.30		
2592.99	39.00	1.96	40.300	1.966	3.33	0.31		
2600*	39.00	1.96	40.373	1.922	3.52	-1.94	2024-12-10	21.1
2592.99	39.00	1.96	40.300	1.966	3.33	0.31		
2600*	39.00	1.96	39.156	1.925	0.40	-1.79	2024-12-18	21.5
2535.00	39.00	1.96	39.260	1.869	0.67	-4.64		

Freq. (MHz)	Target Value		Measure Value		Deviation (%)		Date	Liquid Temperature (°C)
	Permitivity	Conductivity (S/m)	Permittivity	Conductivity (S/m)	Permittivity	Conductivity (S/m)		
3500*	37.90	2.91	38.973	2.925	2.83	0.52	2024-12-11	21.5
3500.01	37.90	2.91	38.973	2.925	2.83	0.52		
3500*	37.90	2.91	38.211	2.868	0.82	-1.44	2024-12-12	21.5
3500.01	37.90	2.91	38.211	2.868	0.82	-1.44		
3900*	37.50	3.33	37.310	3.363	-0.51	0.99	2024-12-11	21.5
3840.00	37.50	3.33	37.946	3.336	1.19	0.18		
3900*	37.50	3.33	37.089	3.352	-1.10	0.66	2024-12-12	21.5
3840.00	37.50	3.33	37.124	3.266	-1.00	-1.92		

Note: The data marked (*) in this table was Permittivity/Conductivity results of Verification

The brain mixtures consist of a viscous gel using hydroxethlcellullose(HEC) gelling agent and saline solution. Preservation with a bacteriacide is added and visual inspection is made to make sure air bubbles are not trapped during the mixing process. The mixture is calibrated to obtain proper dielectric constant (permittivity) and conductivity of the desired tissue. The composition of ingredients may be modified accordingly to achieve the desired target tissue parameters required for routine SAR evaluation. The dielectric properties of the liquid material required to fill the phantom shell shall be target. For 3.4 to 10.0 GHz, the tests were done with using stimulating liquid made by SPEAG.

Frequency (㎒)	**450**	**835**	**900**	**1800-2000**	**2450**	**2600**
Tissue Type	**Body**					
Ingredient (% by weight)						
Water	38.91	40.29	40.29	55.24	45.0	45.0
Salt (NaCl)	3.79	1.38	1.38	0.31	0	0
Sugar	56.93	57.90	57.90	0	0	0
HEC	0.25	0.24	0.24	0	0	0
Bactericide	0.12	0.18	0.18	0	0	0
Triton X-100	0	0	0	0	0	0
DGBE	0	0	0	44.45	55.0	55.0
Tissue parameter target by IEEE 1528-2013						
Dielectric Constant	43.5	41.5	41.5	**40.0**	**39.2**	**39.0**
Conductivity (S/m)	0.87	0.90	0.97	**1.40**	**1.80**	**1.96**
Salt: 99^{+}% Pure Sodium Chloride Water: De-ionized, 16 M $^{+}$ resistivity				Sucrose: 98^{+}% Pure Sucrose **HEC: Hydroxyethyl Cellulose**		
DGBE: 99^{+}% Di(ethylene glycol) butyl ether, [2-(2-butoxyethoxy)ethanol]						

15 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 ㏈, within 20 % of prior calibration) and impedance (within 5 ohm from prior calibration) requirements per extended calibrations in KDB publication 865664 D01V01r04:

750V3_Head (SN : 1085)				
750 MHz				
Measurement Date	Return Loss (㏈)	Δ%	Impedance (Ω)	ΔΩ
2024-02-28	-28.120	1.08	51.77	1.63

3500V2_Head (SN : 1058)				
3500 MHz				
Measurement Date	Return Loss (㏈)	Δ%	Impedance (Ω)	ΔΩ
2024-08-08	-24.101	0.86	51.13	0.20

3900V2_Head (SN : 1036)				
3900 MHz				
Measurement Date	Return Loss (㏈)	Δ%	Impedance (Ω)	ΔΩ
2024-08-05	-24.925	15.58	49.25	1.80

16 Instruments List

Test Platform	SPEAG DASY System
Manufacture	SPEAG
Description	SAR Test System
Software Reference	DASY52: 52.10.4(1527) SEMCAD X: 14.6.14(7483)

Equipment	Type	Serial Number	Cal Date	Cal Interval	Cal Due
Phantom	ELI Phantom	TP-1244	N/A	N/A	N/A
Verification Dipole	D750V3	1085	2023-03-21	Biennial	2025-03-21
Verification Dipole	D835V2	490	2024-06-07	Biennial	2026-06-07
Verification Dipole	D1750V2	1070	2024-07-11	Biennial	2026-07-11
Verification Dipole	D1900V2	5d033	2024-06-13	Biennial	2026-06-13
Verification Dipole	D2600V2	1124	2024-07-22	Biennial	2026-07-22
Verification Dipole	D3500V2	1058	2023-09-28	Biennial	2025-09-28
Verification Dipole	D3900V2	1036	2023-09-27	Biennial	2025-09-27
Dielectric Assessment Kit	DAK-3.5	1107	2024-05-21	Annual	2025-05-21
DAE	DAE3	567	2024-02-16	Annual	2025-02-16
E-Field Probe	EX3DV4	3986	2024-01-24	Annual	2025-01-24
Network Analyzer	E5063A	MY54706220	2024-01-10	Annual	2025-01-10
Signal Generator	N5173B	MY62220611	2024-07-05	Annual	2025-07-05
Vector Signal Generator	SMBV100A	262093	2024-05-14	Annual	2025-05-14
Power Meter	N1914A	MY56120017	2024-06-03	Annual	2025-06-03
Power Meter	E4419B	GB43311715	2024-02-19	Annual	2025-02-19
Power Meter	E4416A	GB41292123	2024-06-10	Annual	2025-06-10
Power Sensor	E9300H	MY41495307	2024-04-17	Annual	2025-04-17
Power Sensor	E9300H	MY41495314	2024-04-17	Annual	2025-04-17
Power Sensor	N8481A	MY63190004	2024-07-05	Annual	2025-07-05
Power Sensor	N8481A	MY63190005	2024-07-05	Annual	2025-07-05
Power Sensor	N8481A	MY56120030	2024-02-19	Annual	2025-02-19
RF Amplifier	AMP2027	10008	2024-03-07	Annual	2025-03-07
RF Amplifier	AMP2027ADB	10006	2024-01-15	Annual	2025-01-15
Power Amplifier	BLMA1060-10	1711221	2024-03-14	Annual	2025-03-14
Dual Directional Coupler	772D	MY52180226	2024-03-05	Annual	2025-03-05
Dual Directional Coupler	778D	MY52180497	2024-03-07	Annual	2025-03-07
LP Filter	LA-15N	LF02	2024-03-05	Annual	2025-03-05
LP Filter	LA-30N	LF03	2024-03-05	Annual	2025-03-05
LP Filter	LA-60N	LF04	2024-03-05	Annual	2025-03-05
Attenuator	05AS102-K03	A1	2024-12-06	Annual	2025-12-06
Attenuator	05AS102-K20	A4	2024-12-06	Annual	2025-12-06
Attenuator	18N-20	21	2024-11-27	Annual	2025-11-27
Radio Communication Analyzer	MT8821C	6201502996	2024-08-21	Annual	2025-08-21
Radio Communication Analyzer	MT8821C	6261760829	2024-02-08	Annual	2025-02-08
Radio Communication Analyzer	MT8821C	6262094325	2024-03-05	Annual	2025-03-05
Radio Communication Test Station	MT8000A	6262036831	2024-02-08	Annual	2025-02-08
Digital Thermometer	SDT25	23111500095	2024-01-09	Annual	2025-01-09
Hygro-Thermometer	303C	210609816	2024-01-30	Annual	2025-01-30
Signal Analyzer	FSQ26	201057	2024-03-18	Annual	2025-03-18

17 FCC Power Measurement Procedures

The SAR measurement Software calculates a reference point at the start and end of the test to check for power drifts. If conducted power deviations of more than 5 % occurred, the tests were repeated.

18 Measured and Reported SAR

Per FCC KDB Publication 447498 D04v01, When SAR is not measured at the maximum power level allowed for production units, the results must be scaled to the maximum tune-up tolerance limit according to the power applied to the individual channels tested to determine compliance. For simultaneous transmission, the measured aggregate SAR must be scaled according to the sum of the differences between the maximum tune-up tolerance and actual power used to test each transmitter. When SAR is measured at or scaled to the maximum tune-up tolerance limit, the results are referred to as reported SAR. Test highest reported SAR results are identified on the grant of equipment authorization according to procedures in KDB 690783 D01v01r03.

19 5G NR FR1※

19.1 5G NR FR1 Test Application

This device supports 5G NR FR1 Band n2, n5, n7, n12, n13, n25, n66, n71, n41, n77 and n78 is declared by the manufacturer used to configuration for frequency, SCS, Bandwidth, Target power, and etc. The RB Configuration was evaluated all using reference to SCS / Bandwidth / Modulation supported by Section 6.1-1 of TS38.521-1.

MPR is permanently implemented for this device by the manufacturer. The specific manufacturer target MPR is indicated alongside the SAR results. MPR is enabled for this device, according to MPR is 3GPP TS38.101-1 Section 6.2.2.

NR test was evaluated under Maximum power in NR single mode. In NR standalone mode, NR power states in the highest power, and the SAR measurement is determined by measuring LTE and 5G NR respectively.

<table>
<tr><th>5G NR Band</th><th>Mode</th><th>SCS (kHz)</th><th>Bandwidth (MHz)</th><th>Waveform</th><th>UL Modulation</th><th>RB Configuration</th><th>EN-DC (LTE Band)</th></tr>
<tr><td>n2</td><td>NSA/SA</td><td>15</td><td>5, 10, 15, 20</td><td rowspan="11">DFT-s-OFDM

CP OFDM</td><td rowspan="11">PI/2 BPSK
QPSK
16QAM
64QAM
256QAM</td><td rowspan="14">Inner 1RB left
Inner 1RB Right
Inner Full
Outer Full
Edge 1RB Left
Edge Full Left
Edge 1RB Right
Edge Full Right</td><td>5, 12, 13, 14</td></tr>
<tr><td>n5</td><td>NSA/SA</td><td>15</td><td>5, 10, 15, 20</td><td>2, 7, 66</td></tr>
<tr><td>n7</td><td>NSA/SA</td><td>15</td><td>5, 10, 15, 20</td><td>5, 12</td></tr>
<tr><td>n12</td><td>NSA/SA</td><td>15</td><td>5, 10, 15</td><td>2, 66</td></tr>
<tr><td>n13</td><td>NSA/SA</td><td>15</td><td>5, 10</td><td>66</td></tr>
<tr><td>n25</td><td>NSA/SA</td><td>15</td><td>5, 10, 15, 20</td><td>12</td></tr>
<tr><td>n66</td><td>NSA/SA</td><td>15</td><td>5, 10, 15, 20, 40</td><td>5, 12, 13, 14</td></tr>
<tr><td>n71</td><td>NSA/SA</td><td>15</td><td>5, 10, 15, 20</td><td>2, 7, 66</td></tr>
<tr><td>n41</td><td>NSA/SA</td><td rowspan="3">30</td><td>20, 30, 40, 50, 60, 80, 90, 100</td><td>5, 26</td></tr>
<tr><td>n77</td><td>NSA/SA</td><td>20, 30, 40, 50, 60, 70, 80, 90, 100</td><td>2, 5, 7, 12, 13, 14, 66</td></tr>
<tr><td>n78</td><td>NSA/SA</td><td>20, 30, 40, 50, 60, 70, 80, 90, 100</td><td>2, 5, 7, 12, 26, 66</td></tr>
<tr><td>n41 MIMO</td><td>SA</td><td rowspan="3">30</td><td>20, 30, 40, 50, 60, 80, 90, 100</td><td rowspan="3">CP OFDM</td><td rowspan="3">QPSK
16QAM
64QAM
256QAM</td><td>-</td></tr>
<tr><td>n77 MIMO</td><td>SA</td><td>20, 30, 40, 50, 60, 70, 80, 90, 100</td><td>-</td></tr>
<tr><td>n78 MIMO</td><td>SA</td><td>20, 30, 40, 50, 60, 70, 80, 90, 100</td><td>-</td></tr>
</table>

- The data marked ※ in this report was provided by the customer and may affect the validity of the test results.

We are responsible for all the information of this test report except for the data(※) provided by the customer.

20 Maximum Output Power Specifications

This device operates using the following maximum output power specifications. SAR values were scaled to the maximum allowed power to determine compliance per KDB Publication 447498 D04v01

WCDMA Maximum Power

Mode	Maximum/Normal	Maximum Output Power (dBm)			
		3GPP WCDMA AMR / RMC	3GPP HSDPA	3GPP HSUPA	3GPP DC-HSDPA
WCDMA II	**Maximum**	**25.00**	**25.00**	**25.00**	**25.00**
	Normal	24.00	24.00	24.00	24.00
WCDMA IV	**Maximum**	**24.50**	**24.50**	**24.50**	**24.50**
	Normal	23.50	23.50	23.50	23.50
WCDMA V	**Maximum**	**25.00**	**25.00**	**25.00**	**25.00**
	Normal	24.00	24.00	24.00	24.00

LTE Maximum Power

Mode	Maximum / Normal	Maximum Output Power (dBm)
LTE Band 2	**Maximum**	**25.00**
	Nominal	24.00
LTE Band 4	**Maximum**	**24.50**
	Nominal	23.50
LTE Band 5	**Maximum**	**25.20**
	Nominal	24.20
LTE Band 7	**Maximum**	**25.00**
	Nominal	24.00
LTE Band 12	**Maximum**	**25.20**
	Nominal	24.20
LTE Band 13	**Maximum**	**25.00**
	Nominal	24.00
LTE Band 14	**Maximum**	**25.00**
	Nominal	24.00
LTE Band 26	**Maximum**	**25.00**
	Nominal	24.00
LTE Band 66	**Maximum**	**24.50**
	Nominal	23.50

5G NR Maximum Power

Mode	Maximum / Normal	Maximum Output Power (dBm)
5G NR n2	**Maximum**	**25.00**
	Normal	24.00
5G NR n5	**Maximum**	**25.00**
	Normal	24.00
5G NR n7	**Maximum**	**25.00**
	Normal	24.00
5G NR n12	**Maximum**	**25.00**
	Normal	24.00
5G NR n13	**Maximum**	**25.00**
	Normal	24.00
5G NR n14	**Maximum**	**25.00**
	Normal	24.00
5G NR n25	**Maximum**	**25.00**
	Normal	24.00
5G NR n26	**Maximum**	**25.00**
	Normal	24.00
5G NR n66	**Maximum**	**24.50**
	Normal	23.50
5G NR n71	**Maximum**	**25.00**
	Normal	24.00
5G NR n41	**Maximum**	**26.00**
	Normal	25.00
5G NR n77 DoD	**Maximum**	**26.00**
	Normal	25.00
5G NR n77	**Maximum**	**26.00**
	Normal	25.00
5G NR n78 DoD	**Maximum**	**26.00**
	Normal	25.00
5G NR n78	**Maximum**	**26.00**
	Normal	25.00
5G NR n41 MIMO	**Maximum**	**26.00**
	Normal	25.00
5G NR n77 DoD MIMO	**Maximum**	**26.00**
	Normal	25.00
5G NR n77 MIMO	**Maximum**	**26.00**
	Normal	25.00
5G NR n78 DoD MIMO	**Maximum**	**26.00**
	Normal	25.00
5G NR n78 MIMO	**Maximum**	**26.00**
	Normal	25.00

21 RF Conducted Power Measurement

21.1 WCDMA

21.1.1 Output Power Verification

Maximum output power is measured on the High, Middle and Low channels for each applicable transmission band according to the general descriptions in section 5.2 of 3GPP TS 34.121, using the appropriate RMC or AMR with TPC (transmit power control) set to all “1s”.

21.1.2 Output Body SAR Measurements

SAR for body exposure configurations is measured using the 12.2 kbps RMC with the TPC bits all “1s”.

21.1.3 Procedures Used to Establish RF Signal for SAR HSDPA Data Devices

Body SAR is not required for handsets with HSDPA capabilities when the maximum average output of each RF channel with HSDPA active is less than ¼ dB higher than that measured without HSDPA using 12.2 kbps RMC and the maximum SAR for 12.2 kbps RMC is ≤ 75 % of the SAR limit. Otherwise, SAR is Measured for HSDPA, using an FRC with H-Set 1 in Sub-test 1 and a 12.2 kbps RMC configured in Test Loop Mode 1, using the highest body SAR configuration in 12.2 kbps RMC without HSDPA, on the maximum output channel with the body exposure configuration that results in the highest SAR in 12.2 kbps RMC for that RF channel.

Sub-Test 1 Setup for Release 5 HSDPA

Sub-test	β_c	β_d	β_d (SF)	β_c/β_d	β_{hs} (1)	CM (dB)(2)
1	2/15	15/15	64	2/15	4/15	0.0
2	12/15(3)	15/15(3)	64	12/15(3)	24/15	1.0
3	15/15	8/15	64	15/8	30/15	1.5
4	15/15	4/15	64	15/4	30/15	1.5

Note 1: Δ_{ACK}, Δ_{NACK} and Δ_{CQI} = 8 ⇔ $A_{hs} = \beta_{hs}/\beta_c = 30/15$ ⇔ $\beta_{hs} = 30/15 * \beta_c$
Note 2: CM = 1 for β_c/β_d =12/15, β_{hs}/β_c=24/15.
Note 3: For subtest 2 the β_c/β_d ratio of 12/15 for the TFC during the measurement period (TF1, TF0) is achieved by setting the signaled gain factors for the reference TFC (TF1, TF1) to β_c = 11/15 and β_d = 15/15.

21.1.4 SAR Measurements for Conditions for HSUPA Data Devices

Body SAR is not required for handsets with HSPA capabilities when the maximum average output of each RF channel with HSUPA/HSDPA active is less than ¼ dB higher than that measured without HSUPA/HSDPA using 12.2 kbps RMC and the maximum SAR for 12.2 kbps RMC is ≤ 75 % of the SAR limit. Body SAR for HSPA is measured with E-DCH Sub-test 5, using H-Set 1 and QPSK for FRC and a 12.2 kbps RMC configured in Test Loop Mode 1 with power control algorithm 2, according to the highest body SAR configuration in 12.1 kbps RMC without HSPA. When VOIP is applicable for head exposure, SAR is not required when the maximum output of each RF channel with HSPA is less than ¼ dB higher than that measured using 12.2 kbps RMC; otherwise, the same HSPA configuration used for body measurement should be used to test for head exposure.

Sub-test	β_c	β_d	β_d (SF)	β_c/β_d	β_{hs} (1)	β_{ec}	β_{ed}	β_{ed} (SF)	β_{ed} (codes)	CM(2) (dB)	MPR (dB)	AG(4) Index	E-TFCI
1	11/15(3)	15/15(3)	64	11/15(3)	22/15	209/225	1039/225	4	1	1.0	0.0	20	75
2	6/15	15/15	64	6/15	12/15	12/15	94/75	4	1	3.0	2.0	12	67
3	15/15	9/15	64	15/9	30/15	30/15	β_{ed1}: 47/15 β_{ed2}: 47/15	4	2	2.0	1.0	15	92
4	2/15	15/15	64	2/15	4/15	2/15	56/75	4	1	3.0	2.0	17	71
5	15/15(4)	15/15(4)	64	15/15(4)	30/15	24/15	134/15	4	1	1.0	0.0	21	81

Note 1: Δ_{ACK}, Δ_{NACK} and Δ_{CQI} = 8 ⇔ $A_{hs} = \beta_{hs}/\beta_c = 30/15$ ⇔ $\beta_{hs} = 30/15 * \beta_c$.
Note 2: CM = 1 for β_c/β_d =12/15, β_{hs}/β_c=24/15. For all other combinations of DPDCH, DPCCH, HS- DPCCH, E-DPDCH and E-DPCCH the MPR is based on the relative CM difference.
Note 3: For subtest 1 the β_c/β_d ratio of 11/15 for the TFC during the measurement period (TF1, TF0) is achieved by setting the signaled gain factors for the reference TFC (TF1, TF1) to β_c = 10/15 and β_d = 15/15.
Note 4: For subtest 5 the β_c/β_d ratio of 15/15 for the TFC during the measurement period (TF1, TF0) is achieved by setting the signaled gain factors for the reference TFC (TF1, TF1) to β_c = 14/15 and β_d = 15/15.
Note 5: Testing UE using E-DPDCH Physical Layer category 1 Sub-test 3 is not required according to TS 25.306 Table 5.1g.
Note 6: β_{ed} can not be set directly; it is set by Absolute Grant Value.

21.2 LTE

21.2.1 SAR measurement Conditions for LTE

LTE modes were tested according to FCC KDB 941225 D05v02r05 publication. Please see notes after the tabulated SAR data for required test configurations. Establishing connections with base station simulators ensure a consistent means for testing SAR and are recommended for evaluation SAR. Anritsu MT8821C was used for LTE output power measurements and SAR testing. Closed loop power control was used so the UE transmits with maximum output power during SAR testing. SAR tests were performed with the same number of RB and RB offsets transmitting on all TTI frames (maximum TTI).

21.2.2 Spectrum Plots for RB Configurations

A properly configured base station simulator was used for SAR tests and power measurements. Therefore, spectrum plots for RB configurations were not required to be included in this report.

21.2.3 MPR

MPR is permanently implemented for this device by the manufacture. The specific manufacturer target MPR is indicated alongside the SAR results. MPR is enabled for this device, according to 3GPP TS36.101 Section 6.2.3 – 6.2.5 under Table 6.2.3.-1

21.2.4 A-MPR

A-MPR (Additional MPR) has been disabled for all SAR tests by setting NS=01 on the base station simulator.

21.2.5 Required RB Size and RB Offsets for SAR Testing

According to FCC KDB 941225 D05V02r05

a. Per Section 5.2.1, SAR is required for QPSK 1 RB Allocation for the largest bandwidth
    i. The required channel and offset combination with the highest maximum output power is required for SAR.
    ii. When the reported SAR is ≤ 0.8 W/kg, testing of the remaining RB offset configurations and required test channels is not required. Otherwise, SAR is required for the remaining required test channels using the RB offset configuration with highest output power for that channel
    iii. When the reported SAR for a required test channel is > 1.45 W/kg, SAR is required for all RB offset configurations for that channel.
b. Per Section 5.2.2, SAR is required for 50% RB allocation using the largest bandwidth following the same procedures outlined in Section 5.2.1.
c. Per Section 5.2.3, QPSK SAR is not required for the 100% allocation when the highest maximum output power for the 100% allocation is less than the highest maximum output power of the 1 RB and 50% RB allocations and the reported SAR for the 1 RB and 50% RB allocations is < 0.8 W/kg.
d. Per Section 5.2.4 and 5.3, SAR tests for higher order modulations and lower bandwidths configurations are not required when the conducted power of the required test configurations determined by Section 5.2.1, through 5.2.3 is less than or equal to 1/2 dB higher than the equivalent configuration using QPSK modulation and when the QPSK SAR for those configurations is < 1.45 W/kg.

21.2.6 TDD

LTE TDD testing is performed using the SAR test guidance provided in FCC KDB 941225 D05V02r04.

TDD is tested at the highest duty factor using UL-DL configuration 0 with special subframe configuration 6 and applying the FDD LTE procedures in KDB 941225 D05v02r04. SAR testing is performed using the extended cyclic prefix listed in 3GPP TS 36.211 Section 4.

21.2.7 5G NR

According to October 2020 TCB Workshop Guidance, NR FR1 SAR evaluations are being generally based on adapting the existing LTE SAR procedures (FCC KDB 941225 D05V02r05). Therefore, NR SAR for the lower bandwidths was not required for testing based on the measured output power and the reported NR SAR for the highest bandwidth.

The following tests were conducted according to the test requirements outlined in section 6.2 of the 3GPP TS38.521-1 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 TS38.521-1.

The allowed A-MPR values specified Table 6.2.3.3.1-1 of 3GPP TS38.521-1 are in addition to the allowed MPR requirements. All the measurements below were performed with A-MPR disabled, by using Network Signaling Value of "NS_01"

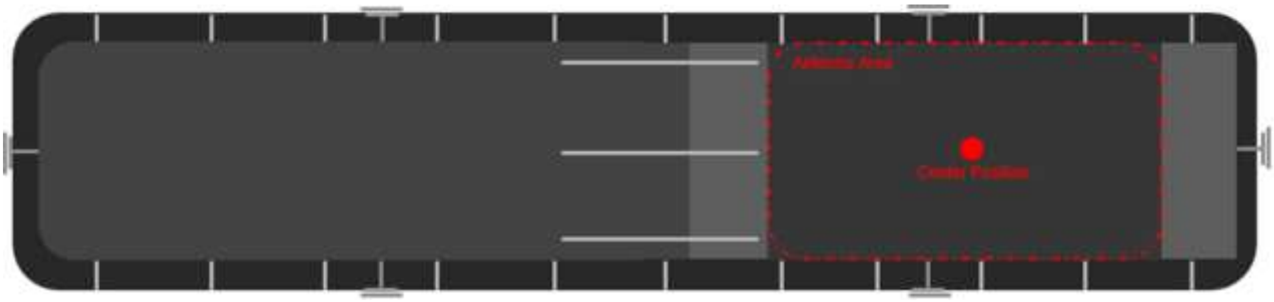
Uplink RB allocations were used to Table 6.1-1 of the 3GPP TS38.521-1.

22 RF Conducted Power

- Refer to Appendix E.

23 DUT Antenna Locations※

Front View



- The data marked ※ in this report was provided by the customer and may affect the validity of the test results.

We are responsible for all the information of this test report except for the data(※) provided by the customer.

24 SAR Data Summary

24.1 SAR data

WCDMA II Ant1 Body SAR				Ambient Temperature (°C)		22.7				
				Liquid Temperature (°C)		21.7				
				Date		2024-11-27				
Position	**Mode**	**Freq (MHz)**	**Ch.**	**Sensor State (Grip)**	**Space (㎜)**	**Measure Power (dBm)**	**Measure 1g SAR (W/kg)**	**Tune-Up Limit (dBm)**	**Power Scaling Factor**	**Scaling 1g SAR (W/kg)**
Front	RMC	1880.00	9400	N/A	20	24.25	0.306	25.00	1.189	**0.364**

WCDMA IV Ant1 Body SAR				Ambient Temperature (°C)		21.8				
				Liquid Temperature (°C)		21.8				
				Date		2024-12-02				
Position	**Mode**	**Freq (MHz)**	**Ch.**	**Sensor State (Grip)**	**Space (㎜)**	**Measure Power (dBm)**	**Measure 1g SAR (W/kg)**	**Tune-Up Limit (dBm)**	**Power Scaling Factor**	**Scaling 1g SAR (W/kg)**
Front	RMC	1732.60	1413	N/A	20	23.59	0.349	24.50	1.233	**0.430**

WCDMA V Ant1 Body SAR				Ambient Temperature (°C)		22.1				
				Liquid Temperature (°C)		21.8				
				Date		2024-12-03				
Position	**Mode**	**Freq (MHz)**	**Ch.**	**Sensor State (Grip)**	**Space (㎜)**	**Measure Power (dBm)**	**Measure 1g SAR (W/kg)**	**Tune-Up Limit (dBm)**	**Power Scaling Factor**	**Scaling 1g SAR (W/kg)**
Front	RMC	836.60	4183	N/A	20	24.53	0.121	25.00	1.114	**0.135**

LTE Band 2 Ant1 Body SAR							Ambient Temperature (°C)			22.7			
							Liquid Temperature (°C)			21.7			
							Date			2024-11-27			
Position	**Mod.**	**BW (MHz)**	**Freq (MHz)**	**Ch.**	**RB Size**	**RB Offset**	**Sensor State (Grip)**	**Space (㎜)**	**Measure Power (dBm)**	**Measure 1g SAR (W/kg)**	**Tune-Up Limit (dBm)**	**Power Scaling Factor**	**Scaling 1g SAR (W/kg)**
Front	QPSK	20	1860.00	18700	1	0	N/A	20	24.12	0.277	25.00	1.225	**0.339**
Front	QPSK	20	1860.00	18700	50	13	N/A	20	23.11	0.230	24.00	1.227	0.282

LTE Band 5 Ant1 Body SAR							Ambient Temperature (°C)			22.1			
							Liquid Temperature (°C)			21.8			
							Date			2024-12-03			
Position	**Mod.**	**BW (MHz)**	**Freq (MHz)**	**Ch.**	**RB Size**	**RB Offset**	**Sensor State (Grip)**	**Space (㎜)**	**Measure Power (dBm)**	**Measure 1g SAR (W/kg)**	**Tune-Up Limit (dBm)**	**Power Scaling Factor**	**Scaling 1g SAR (W/kg)**
Front	QPSK	10	829.00	20450	1	25	N/A	20	24.57	0.124	25.20	1.156	**0.143**
Front	QPSK	10	829.00	20450	25	25	N/A	20	23.54	0.100	24.20	1.164	0.116

LTE Band 7 Ant1 Body SAR							**Ambient Temperature (°C)**			22.1			
							Liquid Temperature (°C)			21.7			
							Date			2024-12-08			
Position	**Mod.**	**BW (MHz)**	**Freq (MHz)**	**Ch.**	**RB Size**	**RB Offset**	**Sensor State (Grip)**	**Space (㎜)**	**Measure Power (dBm)**	**Measure 1g SAR (W/kg)**	**Tune-Up Limit (dBm)**	**Power Scaling Factor**	**Scaling 1g SAR (W/kg)**
Front	QPSK	20	2535.00	21100	1	99	N/A	20	24.33	0.408	25.00	1.156	**0.472**
Front	QPSK	20	2535.00	21100	50	13	N/A	20	23.43	0.334	24.00	1.164	0.389

LTE Band 12 Ant1 Body SAR							**Ambient Temperature (°C)**			21.9			
							Liquid Temperature (°C)			21.7			
							Date			2024-12-05			
Position	**Mod.**	**BW (MHz)**	**Freq (MHz)**	**Ch.**	**RB Size**	**RB Offset**	**Sensor State (Grip)**	**Space (㎜)**	**Measure Power (dBm)**	**Measure 1g SAR (W/kg)**	**Tune-Up Limit (dBm)**	**Power Scaling Factor**	**Scaling 1g SAR (W/kg)**
Front	QPSK	10	704.00	23060	1	25	N/A	20	24.49	0.100	25.20	1.178	**0.118**
Front	QPSK	10	704.00	23060	25	0	N/A	20	23.48	0.080	24.20	1.180	0.094

LTE Band 13 Ant1 Body SAR							**Ambient Temperature (°C)**			21.9			
							Liquid Temperature (°C)			21.6			
							Date			2024-12-04			
Position	**Mod.**	**BW (MHz)**	**Freq (MHz)**	**Ch.**	**RB Size**	**RB Offset**	**Sensor State (Grip)**	**Space (㎜)**	**Measure Power (dBm)**	**Measure 1g SAR (W/kg)**	**Tune-Up Limit (dBm)**	**Power Scaling Factor**	**Scaling 1g SAR (W/kg)**
Front	QPSK	10	782.00	23230	1	25	N/A	20	24.05	0.154	25.00	1.245	**0.192**
Front	QPSK	10	782.00	23230	25	0	N/A	20	23.11	0.154	24.00	1.227	0.189

LTE Band 14 Ant1 Body SAR							**Ambient Temperature (°C)**			21.9, 21.9			
							Liquid Temperature (°C)			21.6, 21.7			
							Date			2024-12-04, 2024-12-05			
Position	**Mod.**	**BW (MHz)**	**Freq (MHz)**	**Ch.**	**RB Size**	**RB Offset**	**Sensor State (Grip)**	**Space (㎜)**	**Measure Power (dBm)**	**Measure 1g SAR (W/kg)**	**Tune-Up Limit (dBm)**	**Power Scaling Factor**	**Scaling 1g SAR (W/kg)**
Front	QPSK	10	793.00	23330	1	0	N/A	20	24.04	0.153	25.00	1.247	**0.191**
Front	QPSK	10	793.00	23330	25	0	N/A	20	23.01	0.114	24.00	1.256	0.143

LTE Band 26 Ant1 Body SAR							**Ambient Temperature (°C)**			22.1			
							Liquid Temperature (°C)			21.8			
							Date			2024-12-03			
Position	**Mod.**	**BW (MHz)**	**Freq (MHz)**	**Ch.**	**RB Size**	**RB Offset**	**Sensor State (Grip)**	**Space (㎜)**	**Measure Power (dBm)**	**Measure 1g SAR (W/kg)**	**Tune-Up Limit (dBm)**	**Power Scaling Factor**	**Scaling 1g SAR (W/kg)**
Front	QPSK	15	831.50	26865	1	0	N/A	20	23.58	0.119	25.00	1.387	**0.165**
Front	QPSK	15	831.50	26865	36	0	N/A	20	22.87	0.099	24.00	1.297	0.128

LTE Band 66 Ant1 Body SAR								Ambient Temperature (°C)		22.7		
								Liquid Temperature (°C)		21.7		
								Date		2024-11-27		
Position	**Mod.**	**BW (MHz)**	**Freq (MHz)**	**Ch.**	**RB Size**	**RB Offset**	**Sensor State (Grip)**	**Space (㎜)**	**Measure Power (dBm)**	**Measure 1g SAR (W/kg)**	**Tune-Up Limit (dBm)**	**Power Scaling Factor**	**Scaling 1g SAR (W/kg)**
Front	QPSK	20	1745.00	132322	1	0	N/A	20	23.17	0.378	24.50	1.358	**0.513**
Front	QPSK	20	1745.00	132322	50	25	N/A	20	22.58	0.288	23.50	1.236	0.356

5G NR n7 Ant1 Body SAR									Ambient Temperature (°C)		22.1, 21.9			
									Liquid Temperature (°C)		21.7, 21.6			
									Date		2024-12-08, 2024-12-09			
Position	**Waveform**	**Mod.**	**SCS (kHz)**	**BW (MHz)**	**Freq. (MHz)**	**Ch.**	**RB Size**	**RB Offset**	**Sensor State (Grip)**	**Space (㎜)**	**Measure Power (dBm)**	**Measure 1 g SAR (W/kg)**	**Tune-Up Limit (dBm)**	**Power Scaling Factor**	**Scaling 1 g SAR (W/kg)**
Front	DFT-s-OFDM	QPSK	15	20	2510.00	502000	1	1	N/A	20	24.42	0.382	25.00	1.143	0.437
Front	DFT-s-OFDM	QPSK	15	20	2510.00	502000	50	25	N/A	20	24.22	0.385	25.00	1.197	**0.461**

5G NR n12 Ant1 Body SAR									Ambient Temperature (°C)		21.9			
									Liquid Temperature (°C)		21.7			
									Date		2024-12-05			
Position	**Waveform**	**Mod.**	**SCS (kHz)**	**BW (MHz)**	**Freq. (MHz)**	**Ch.**	**RB Size**	**RB Offset**	**Sensor State (Grip)**	**Space (㎜)**	**Measure Power (dBm)**	**Measure 1 g SAR (W/kg)**	**Tune-Up Limit (dBm)**	**Power Scaling Factor**	**Scaling 1 g SAR (W/kg)**
Front	DFT-s-OFDM	BPSK	15	15	707.50	141500	1	1	N/A	20	23.56	0.100	25.00	1.393	0.139
Front	DFT-s-OFDM	BPSK	15	15	707.50	141500	36	18	N/A	20	23.55	0.105	25.00	1.396	**0.147**

5G NR n13 Ant1 Body SAR									Ambient Temperature (°C)		22.0			
									Liquid Temperature (°C)		21.8			
									Date		2024-12-06			
Position	**Waveform**	**Mod.**	**SCS (kHz)**	**BW (MHz)**	**Freq. (MHz)**	**Ch.**	**RB Size**	**RB Offset**	**Sensor State (Grip)**	**Space (㎜)**	**Measure Power (dBm)**	**Measure 1 g SAR (W/kg)**	**Tune-Up Limit (dBm)**	**Power Scaling Factor**	**Scaling 1 g SAR (W/kg)**
Front	DFT-s-OFDM	BPSK	15	10	782.00	156400	1	1	N/A	20	23.14	0.095	25.00	1.535	0.146
Front	DFT-s-OFDM	BPSK	15	10	782.00	156400	25	12	N/A	20	23.07	0.097	25.00	1.560	**0.151**

5G NR n14 Ant1 Body SAR									Ambient Temperature (°C)		22.0			
									Liquid Temperature (°C)		21.8			
									Date		2024-12-06			
Position	**Waveform**	**Mod.**	**SCS (kHz)**	**BW (MHz)**	**Freq. (MHz)**	**Ch.**	**RB Size**	**RB Offset**	**Sensor State (Grip)**	**Space (㎜)**	**Measure Power (dBm)**	**Measure 1 g SAR (W/kg)**	**Tune-Up Limit (dBm)**	**Power Scaling Factor**	**Scaling 1 g SAR (W/kg)**
Front	DFT-s-OFDM	BPSK	15	10	793.00	158600	1	1	N/A	20	23.50	0.152	25.00	1.413	**0.215**
Front	DFT-s-OFDM	BPSK	15	10	793.00	158600	25	12	N/A	20	23.12	0.137	25.00	1.542	0.211

5G NR n25 Ant1 Body SAR									Ambient Temperature (°C)			21.8			
									Liquid Temperature (°C)			21.6			
									Date			2024-12-02			
Position	**Waveform**	**Mod.**	**SCS (kHz)**	**BW (MHz)**	**Freq. (MHz)**	**Ch.**	**RB Size**	**RB Offset**	**Sensor State (Grip)**	**Space (㎜)**	**Measure Power (dBm)**	**Measure 1 g SAR (W/kg)**	**Tune-Up Limit (dBm)**	**Power Scaling Factor**	**Scaling 1 g SAR (W/kg)**
Front	DFT-s-OFDM	BPSK	15	20	1882.50	376500	1	1	N/A	20	23.64	0.317	25.00	1.368	**0.434**
Front	DFT-s-OFDM	BPSK	15	20	1882.50	376500	50	25	N/A	20	23.57	0.295	25.00	1.390	0.410

5G NR n26 Ant1 Body SAR									Ambient Temperature (°C)			21.9			
									Liquid Temperature (°C)			21.6			
									Date			2024-12-04			
Position	**Waveform**	**Mod.**	**SCS (kHz)**	**BW (MHz)**	**Freq. (MHz)**	**Ch.**	**RB Size**	**RB Offset**	**Sensor State (Grip)**	**Space (㎜)**	**Measure Power (dBm)**	**Measure 1g SAR (W/kg)**	**Tune-Up Limit (dBm)**	**Power Scaling Factor**	**Scaling 1 g SAR (W/kg)**
Front	DFT-s-OFDM	QPSK	15	20	831.50	166300	1	1	N/A	20	23.92	0.125	25.00	1.282	0.160
Front	DFT-s-OFDM	QPSK	15	20	831.50	166300	50	25	N/A	20	23.78	0.130	25.00	1.324	**0.172**

5G NR n41 Ant2 Body SAR									Ambient Temperature (°C)			21.9			
									Liquid Temperature (°C)			21.6			
									Date			2024-12-09			
Position	**Waveform**	**Mod.**	**SCS (kHz)**	**BW (MHz)**	**Freq. (MHz)**	**Ch.**	**RB Size**	**RB Offset**	**Sensor State (Grip)**	**Space (㎜)**	**Measure Power (dBm)**	**Measure 1 g SAR (W/kg)**	**Tune-Up Limit (dBm)**	**Power Scaling Factor**	**Scaling 1 g SAR (W/kg)**
Front	DFT-s-OFDM	BPSK	30	100	2592.99	518598	1	1	N/A	20	25.89	0.285	26.00	1.026	0.292
Front	DFT-s-OFDM	BPSK	30	100	2592.99	518598	135	67	N/A	20	25.83	0.310	26.00	1.040	**0.322**

5G NR n41 MIMO Ant1 Body SAR									Ambient Temperature (°C)			21.5			
									Liquid Temperature (°C)			21.1			
									Date			2024-12-10			
Position	**Waveform**	**Mod.**	**SCS (kHz)**	**BW (MHz)**	**Freq. (MHz)**	**Ch.**	**RB Size**	**RB Offset**	**Sensor State (Grip)**	**Space (㎜)**	**Measure Power (dBm)**	**Measure 1 g SAR (W/kg)**	**Tune-Up Limit (dBm)**	**Power Scaling Factor**	**Scaling 1 g SAR (W/kg)**
Front	CP-OFDM	QPSK	30	100	2592.99	518598	1	1	N/A	20	24.90	0.148	26.00	1.288	**0.191**
Front	CP-OFDM	QPSK	30	100	2592.99	518598	135	68	N/A	20	24.79	0.115	26.00	1.321	0.152

5G NR n41 MIMO Ant2 Body SAR									Ambient Temperature (°C)			21.5			
									Liquid Temperature (°C)			21.1			
									Date			2024-12-10			
Position	**Waveform**	**Mod.**	**SCS (kHz)**	**BW (MHz)**	**Freq. (MHz)**	**Ch.**	**RB Size**	**RB Offset**	**Sensor State (Grip)**	**Space (㎜)**	**Measure Power (dBm)**	**Measure 1 g SAR (W/kg)**	**Tune-Up Limit (dBm)**	**Power Scaling Factor**	**Scaling 1 g SAR (W/kg)**
Front	CP-OFDM	QPSK	30	100	2592.99	518598	1	1	N/A	20	24.90	0.133	26.00	1.288	**0.171**
Front	CP-OFDM	QPSK	30	100	2592.99	518598	135	68	N/A	20	24.79	0.128	26.00	1.321	0.169

5G NR n66 Ant1 Body SAR									**Ambient Temperature (°C)**			21.8			
									Liquid Temperature (°C)			21.6			
									Date			2024-12-02			
Position	**Waveform**	**Mod.**	**SCS (kHz)**	**BW (MHz)**	**Freq. (MHz)**	**Ch.**	**RB Size**	**RB Offset**	**Sensor State (Grip)**	**Space (㎜)**	**Measure Power (dBm)**	**Measure 1 g SAR (W/kg)**	**Tune-Up Limit (dBm)**	**Power Scaling Factor**	**Scaling 1 g SAR (W/kg)**
Front	DFT-s-OFDM	BPSK	15	40	1745.00	349000	1	1	N/A	20	23.50	0.409	24.50	1.259	**0.515**
Front	DFT-s-OFDM	BPSK	15	40	1745.00	349000	108	54	N/A	20	23.22	0.360	24.50	1.343	0.483

5G NR n71 Ant1 Body SAR									**Ambient Temperature (°C)**			22.0			
									Liquid Temperature (°C)			21.8			
									Date			2024-12-06			
Position	**Waveform**	**Mod.**	**SCS (kHz)**	**BW (MHz)**	**Freq. (MHz)**	**Ch.**	**RB Size**	**RB Offset**	**Sensor State (Grip)**	**Space (㎜)**	**Measure Power (dBm)**	**Measure 1 g SAR (W/kg)**	**Tune-Up Limit (dBm)**	**Power Scaling Factor**	**Scaling 1 g SAR (W/kg)**
Front	DFT-s-OFDM	BPSK	15	20	680.50	136100	1	1	N/A	20	23.97	0.079	25.00	1.268	0.100
Front	DFT-s-OFDM	BPSK	15	20	680.50	136100	50	25	N/A	20	23.81	0.077	25.00	1.315	**0.101**

5G NR n77 Ant2 Body SAR									**Ambient Temperature (°C)**			21.6			
									Liquid Temperature (°C)			21.5			
									Date			2024-12-11			
Position	**Waveform**	**Mod.**	**SCS (kHz)**	**BW (MHz)**	**Freq. (MHz)**	**Ch.**	**RB Size**	**RB Offset**	**Sensor State (Grip)**	**Space (㎜)**	**Measure Power (dBm)**	**Measure 1 g SAR (W/kg)**	**Tune-Up Limit (dBm)**	**Power Scaling Factor**	**Scaling 1 g SAR (W/kg)**
Front	DFT-s-OFDM	BPSK	30	100	3840.00	656000	1	1	N/A	20	25.78	0.184	26.00	1.052	0.194
Front	DFT-s-OFDM	BPSK	30	100	3840.00	656000	135	67	N/A	20	25.40	0.214	26.00	1.148	**0.246**

5G NR n77 DoD Ant2 Body SAR									**Ambient Temperature (°C)**			21.8			
									Liquid Temperature (°C)			21.5			
									Date			2024-12-12			
Position	**Waveform**	**Mod.**	**SCS (kHz)**	**BW (MHz)**	**Freq. (MHz)**	**Ch.**	**RB Size**	**RB Offset**	**Sensor State (Grip)**	**Space (㎜)**	**Measure Power (dBm)**	**Measure 1 g SAR (W/kg)**	**Tune-Up Limit (dBm)**	**Power Scaling Factor**	**Scaling 1 g SAR (W/kg)**
Front	DFT-s-OFDM	BPSK	30	100	3500.01	633334	1	1	N/A	20	25.55	0.255	26.00	1.109	0.283
Front	DFT-s-OFDM	BPSK	30	100	3500.01	633334	135	67	N/A	20	25.48	0.306	26.00	1.127	**0.345**

5G NR n77 MIMO Ant1 Body SAR									**Ambient Temperature (°C)**			21.8			
									Liquid Temperature (°C)			21.5			
									Date			2024-12-12			
Position	**Waveform**	**Mod.**	**SCS (kHz)**	**BW (MHz)**	**Freq. (MHz)**	**Ch.**	**RB Size**	**RB Offset**	**Sensor State (Grip)**	**Space (㎜)**	**Measure Power (dBm)**	**Measure 1 g SAR (W/kg)**	**Tune-Up Limit (dBm)**	**Power Scaling Factor**	**Scaling 1 g SAR (W/kg)**
Front	CP-OFDM	QPSK	30	100	3840.00	656000	1	1	N/A	20	24.82	0.071	26.00	1.312	0.093
Front	CP-OFDM	QPSK	30	100	3840.00	656000	135	68	N/A	20	24.80	0.080	26.00	1.318	**0.105**

5G NR n77 MIMO Ant2 Body SAR									Ambient Temperature (°C)		21.6			
									Liquid Temperature (°C)		21.5			
									Date		2024-12-11			
Position	**Waveform**	**Mod.**	**SCS (kHz)**	**BW (MHz)**	**Freq. (MHz)**	**Ch.**	**RB Size**	**RB Offset**	**Sensor State (Grip)**	**Space (㎜)**	**Measure Power (dBm)**	**Measure 1 g SAR (W/kg)**	**Tune-Up Limit (dBm)**	**Power Scaling Factor**	**Scaling 1 g SAR (W/kg)**
Front	CP-OFDM	QPSK	30	100	3840.00	656000	1	1	N/A	20	24.82	0.068	26.00	1.312	0.089
Front	CP-OFDM	QPSK	30	100	3840.00	656000	135	68	N/A	20	24.80	0.082	26.00	1.318	**0.108**

5G NR n77 DoD MIMO Ant1 Body SAR									Ambient Temperature (°C)		21.8				
									Liquid Temperature (°C)		21.5				
									Date		2024-12-12				
Position	**Waveform**	**Mod.**	**SCS (kHz)**	**BW (MHz)**	**Freq. (MHz)**	**Ch.**	**RB Size**	**RB Offset**	**Sensor State (Grip)**	**Space (㎜)**	**Measure Power (dBm)**	**Measure 1 g SAR (W/kg)**	**Tune-Up Limit (dBm)**	**Power Scaling Factor**	**Scaling 1 g SAR (W/kg)**
Front	CP-OFDM	QPSK	30	100	3500.01	633334	1	1	N/A	20	24.82	0.100	26.00	1.312	0.131
Front	CP-OFDM	QPSK	30	100	3500.01	633334	135	68	N/A	20	24.80	0.144	26.00	1.318	**0.190**

5G NR n77 DoD MIMO Ant2 Body SAR									Ambient Temperature (°C)		21.6				
									Liquid Temperature (°C)		21.5				
									Date		2024-12-11				
Position	**Waveform**	**Mod.**	**SCS (kHz)**	**BW (MHz)**	**Freq. (MHz)**	**Ch.**	**RB Size**	**RB Offset**	**Sensor State (Grip)**	**Space (㎜)**	**Measure Power (dBm)**	**Measure 1 g SAR (W/kg)**	**Tune-Up Limit (dBm)**	**Power Scaling Factor**	**Scaling 1 g SAR (W/kg)**
Front	CP-OFDM	QPSK	30	100	3500.01	633334	1	1	N/A	20	24.82	0.112	26.00	1.312	0.147
Front	CP-OFDM	QPSK	30	100	3500.01	633334	135	68	N/A	20	24.80	0.114	26.00	1.318	**0.150**

General Notes:

1. The test data reported are the worst-case SAR values according to test procedures specified in FCC KDB Publication 447498 D04v01.
2. Liquid tissue depth was at least 15 cm for all frequencies.
3. All modes of operation were investigated, and worst-case results are reported.
4. The EUT is tested 2^{nd} hot-spot peak, if it is less than 2 dB below the highest peak.
5. The manufacturer has confirmed that the device(s) tested have the same physical, mechanical and thermal characteristics and are within operational tolerances expected for production units.
6. SAR results were scaled to the maximum allowed power to demonstrate compliance per FCC KDB Publication 447498 D04v01.

WCDMA Notes:

1. WCDMA mode in Body SAR was tested under RMC 12.2 kbps with HSPA inactive per KDB Publication 941225 D01v03r01. HSPA SAR was not required since the average output power of the HSPA subtests was not more than 0.25 ㏈ higher than the RMC level and SAR was less than 1.2 W/kg.
2. Per FCC KDB Publication 447498 D04v01, if the reported (scaled) SAR measured at the middle channel or highest output power channel for each test configuration is ≤ 0.8 W/kg then testing at the other channels is not required for such test configuration(s). When the maximum output power variation across the required test channels is > $^1/_2$ ㏈, instead of the middle channel, the highest output power channel must be used.

LTE Notes:

1. LTE Considerations: LTE test configurations are determined according to SAR Evaluation Considerations for LTE Devices in FCC KDB Publication 941225 D05v02r05. The general test procedures used for testing can be found in Section 5.
2. MPR is permanently implemented for this device by the manufacturer. The specific manufacturer target MPR is indicated alongside the SAR results. MPR is enabled for this device, according to 3GPP TS36.101 Section 6.2.3-6.2.5 under Table 6.2.3-1.
3. A-MPR was disabled for all SAR tests by setting NS=01 on the base station simulator.
4. This device supports LTE capabilities with overlapping transmission frequency rages. When the supported frequency range of an LTE Band falls completely within an LTE band with a larger transmission frequency range, both LTE bands have the same target power (or the band with the larger transmission frequency range has a higher target power), and both LTE bands share the same transmission path and signal characteristics, SAR was only assessed for the band with larger transmission frequency range.

5G NR Notes:

1. According to FCC guidance, SAR test for NR bands and LTE anchor Bands were performed separately due to limitations in SAR probe calibration factors. And, Due to test setup limitations, SAR testing for NR was performed using test mode software to establish the connection.
2. NR configurations of SAR test were determined according to Section 5.2 of KDB 941225 D05.
3. A-MPR was disabled for all SAR tests by setting NS=01 on the base station simulator.
4. According to FCC guidance, NR modulations and RB sizes/offsets were selected for testing such that configurations with the highest output power were evaluated for SAR tests.
5. This device supports 5G FR1 capabilities with overlapping transmission frequency ranges. When the supported frequency range of an NR band falls completely within an NR band with a larger transmission frequency range, both NR bands have the same target power (or the band with the larger transmission frequency range has a higher target power), and both NR bands share the same transmission path and signal characteristics, SAR was only assessed for the band with the larger transmission frequency range.
6. 5G NR n41, n77 and n78 MIMO only support CP-OFDM.
7. 5G NR n41, n77 and n78 is synchronized using maximum duty cycle of 100 %. SAR testing was performed using FTM mode with a 100 % duty cycle applied to match final duty cycle.
8. Ant1 and Ant2 of this DUT are each separated and mounted on the front wheels of the vehicle. Since the separation distance between the two antennas is large, testing under MIMO conditions was performed by testing each antenna separately and summing the SAR values of Ant1 and Ant2 for simultaneous SAR evaluation.

25 Simultaneous SAR Results

25.1 5G NR EN-DC

Configuration		Body
		Front
LTE Band 2	5G NR n12	0.486
LTE Band 2	5G NR n71	0.440
LTE Band 2	5G NR n77	0.585
LTE Band 5	5G NR n7	0.604
LTE Band 5	5G NR n66	0.658
LTE Band 5	5G NR n41	0.465
LTE Band 5	5G NR n77	0.389
LTE Band 7	5G NR n71	0.573
LTE Band 7	5G NR n77	0.718
LTE Band 12	5G NR n7	0.579
LTE Band 12	5G NR n25	0.552
LTE Band 12	5G NR n66	0.633
LTE Band 12	5G NR n77	0.364
LTE Band 13	5G NR n66	0.707
LTE Band 13	5G NR n77	0.438
LTE Band 14	5G NR n66	0.706
LTE Band 14	5G NR n77	0.437
LTE Band 26	5G NR n41	0.487
LTE Band 66	5G NR n12	0.660
LTE Band 66	5G NR n13	0.664
LTE Band 66	5G NR n71	0.614
LTE Band 66	5G NR n77	**0.759**

25.2 LTE Inter band ULCA

Configuration		Body
		Front
LTE Band 2	LTE Band 5	0.482
LTE Band 2	LTE Band 12	0.457
LTE Band 2	LTE Band 13	0.531
LTE Band 5	LTE Band 66	0.656
LTE Band 12	LTE Band 66	0.631
LTE Band 13	LTE Band 66	0.705

25.3 5G NR MIMO

Configuration		Body
		Front
5G NR n41 MIMO Ant1	5G NR n41 MIMO Ant2	0.362
5G NR n77 MIMO Ant1	5G NR n77 MIMO Ant2	0.213
5G NR n77 DoD MIMO Ant1	5G NR n77 DoD MIMO Ant2	0.340

26 LTE Uplink Carrier Aggregation

This device supports LTE Carrier Aggregation in the uplink for LTE Band 5B, 7C, 66B, 66C. In the supported uplink Carrier Aggregation, additional uplink Carrier Aggregation band conducted power and SAR were evaluated for the worst-case SAR band in the Single Carrier. Since LTE Band 66B does not support BW 20 MHz, according to the 3GPP TS 36.521 document, it was tested at BW 10 MHz with using the next highest conducted power.

26.1 Intra band ULCA

The configuration of the worst-case SAR result Band:

LTE Band 5B / Front / Test Distance, 20 mm

PCC						SCC						CA Total (dBm)	Single Carrier (dBm)
BW (MHz)	Uplink		Modulation	RB Size	RB Offset	Band width (MHz)	Uplink		Modulation	RB Size	RB Offset		
	Channel	Frequency (MHz)					Channel	Frequency (MHz)					
10	20450	829.00	QPSK	1	49	10	20549	838.90	QPSK	1	0	Conducted Power	
												24.51	24.57
												Measure 1g SAR	
												0.121	0.124
												Scaling 1g SAR	
												0.142	0.143

LTE Band 7C / Front / Test Distance, 20 mm

PCC						SCC						CA Total (dBm)	Single Carrier (dBm)
BW (MHz)	Uplink		Modulation	RB Size	RB Offset	Band width (MHz)	Uplink		Modulation	RB Size	RB Offset		
	Channel	Frequency (MHz)					Channel	Frequency (MHz)					
20	21100	2535.00	QPSK	1	0	20	20902	2512.20	QPSK	1	99	Conducted Power	
												23.09	24.33
												Measure 1g SAR	
												0.200	0.408
												Scaling 1g SAR	
												0.231	0.472

LTE Band 66B / Front / Test Distance, 20 mm

PCC						SCC						CA Total (dBm)	Single Carrier (dBm)
BW (MHz)	Uplink		Modulation	RB Size	RB Offset	Band width (MHz)	Uplink		Modulation	RB Size	RB Offset		
	Channel	Frequency (MHz)					Channel	Frequency (MHz)					
10	132373	1750.10	QPSK	1	49	10	132472	1760.00	QPSK	1	0	Conducted Power	
												22.93	23.17
												Measure 1g SAR	
												0.289	0.378
												Scaling 1g SAR	
												0.415	0.513

LTE Band 66C / Front / Test Distance, 20 mm

PCC						SCC						CA Total (dBm)	Single Carrier (dBm)
BW (MHz)	Uplink		Modulation	RB Size	RB Offset	Band width (MHz)	Uplink		Modulation	RB Size	RB Offset		
	Channel	Frequency (MHz)					Channel	Frequency (MHz)					
20	132397	1752.50	QPSK	1	99	5	132514	1764.20	QPSK	1	0	Conducted Power	
												22.87	23.17
												Measure 1g SAR	
												0.273	0.378
												Scaling 1g SAR	
												0.397	0.513

27 SAR Measurement Variability

27.1 Measurement Variability

Per FCC KDB Publication 865664 D01v01r04, 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 power supply 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. When the original highest measured SAR is ≥ 0.80 W/kg, the measurement was repeated once.
2. A second repeated measurement was performed only if the ratio of largest to smallest SAR for the original and first repeated measurements was > 1.20 or when the original or repeated measurement was ≥ 1.45 W/kg (~ 10% from the 1-g SAR limit).
3. A third repeated measurement was performed only if the original, first or second repeated measurement was ≥ 1.5 W/kg and the ratio of largest to smallest SAR for the original, first and second repeated measurements is > 1.20.
4. Repeated measurements are not required when the original highest measured SAR is < 0.80 W/kg

27.2 Measurement Uncertainty

The measured SAR was < 1.5 W/kg for all frequency bands. Therefore, per KDB Publication 865664 D01v01r04, the extended measurement uncertainty analysis per IEEE 1528-2013 was not required.

28 Appendixes List

Appendix A	Appendix A Verification Plots
Appendix B	Appendix B Test Plots
Appendix C	Appendix C Photograph
Appendix D	Appendix D Probe, DAE and Dipole Calibration Certificates
Appendix E	Appendix E RF Conducted Power

-THE END-