FCC SAR Test Report

APPLICANT	:	HMD Global Oy
EQUIPMENT	:	GSM/WCDMA/LTE Mobile Phone
BRAND NAME	:	NOKIA
MODEL NAME	:	TA-1496
FCC ID	:	2AJOTTA-1496
STANDARD	:	FCC 47 CFR Part 2 (2.1093)

We, Sporton International Inc. (Kunshan), would like to declare that the tested sample has been evaluated in accordance with the test procedures given in 47 CFR Part 2.1093 and FCC KDB and has been in compliance with the applicable technical standards.

The test results in this report apply exclusively to the tested model / sample. Without written approval of Sporton International Inc. (Kunshan), the test report shall not be reproduced except in full.

Si Zhang

Approved by: Si Zhang

ilac-MRA

ACCREDITED
Cert #5145.02

Sporton International Inc. (Kunshan)
No. 1098, Pengxi North Road, Kunshan Economic Development Zone Jiangsu Province 215300 People's Republic of China

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Revision History

REPORT NO.	VERSION	DESCRIPTION	ISSUED DATE
FA241205	Rev. 01	Initial issue of report.	Jul. 05, 2022

1. Statement of Compliance

The maximum results of Specific Absorption Rate (SAR) found during testing for **HMD Global Oy, GSM/WCDMA/LTE Mobile Phone, TA-1496,** are as follows.

Equipment Class	Frequency Band		Highest SAR Summary		
			Head (Separation 0mm)	Body-worn (Separation 15mm)	Highest Simultaneous Transmission
			1g SAR (W/kg)		1g SAR (W/kg)
Licensed	GSM	GSM 850	**0.88**	**0.64**	0.92
		GSM1900	0.32	0.38	
	WCDMA	WCDMA II	0.35	0.45	
		WCDMA IV	0.71	0.42	
		WCDMA V	0.76	0.55	
	LTE	LTE Band 2	0.59	0.48	
		LTE Band 4	0.59	0.34	
		LTE Band 5	0.68	0.41	
		LTE Band 7	0.64	0.19	
DSS	Bluetooth	2.4GHz Bluetooth	<0.10	<0.10	0.92
Date of Testing:			2022/5/30 ~ 2022/6/13		

Declaration of Conformity:
The test results with all measurement uncertainty excluded are presented in accordance with the regulation limits or requirements declared by manufacturers.
Comments and Explanations:
The declared of product specification for EUT presented in the report are provided by the manufacturer, and the manufacturer takes all the responsibilities for the accuracy of product specification.

This device is in compliance with Specific Absorption Rate (SAR) for general population/uncontrolled exposure limits (1.6 W/kg for Partial-Body 1g SAR) specified in FCC 47 CFR part 2 (2.1093) and ANSI/IEEE C95.1-1992, and had been tested in accordance with the measurement methods and procedures specified in IEEE 1528-2013 and FCC KDB publications.

2. Administration Data

Sporton International Inc. (Kunshan) is accredited to ISO/IEC 17025:2017 by American Association for Laboratory Accreditation with Certificate Number 5145.02.

Testing Laboratory			
Test Firm	Sporton International Inc. (Kunshan)		
Test Site Location	No. 1098, Pengxi North Road, Kunshan Economic Development Zone Jiangsu Province 215300 People's Republic of China TEL : +86-512-57900158 FAX : +86-512-57900958		
Test Site No.	Sporton Site No.	FCC Designation No.	FCC Test Firm Registration No.
	SAR05-KS	CN1257	314309

Applicant	
Company Name	HMD Global Oy
Address	Bertel Jungin aukio 9, 02600 Espoo, Finland

Manufacturer	
Company Name	HMD Global Oy
Address	Bertel Jungin aukio 9, 02600 Espoo, Finland

3. Guidance Applied

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

- FCC 47 CFR Part 2 (2.1093)
- ANSI/IEEE C95.1-1992
- IEEE 1528-2013
- FCC KDB 865664 D01 SAR Measurement 100 MHz to 6 GHz v01r04
- FCC KDB 865664 D02 SAR Reporting v01r02
- FCC KDB 447498 D01 General RF Exposure Guidance v06
- FCC KDB 648474 D04 SAR Evaluation Considerations for Wireless Handsets v01r03
- FCC KDB 941225 D01 3G SAR Procedures v03r01
- FCC KDB 941225 D05 SAR for LTE Devices v02r05

4. Equipment Under Test (EUT) Information

4.1 General Information

Product Feature & Specification	
Equipment Name	GSM/WCDMA/LTE Mobile Phone
Brand Name	NOKIA
Model Name	TA-1496
FCC ID	2AJOTTA-1496
IMEI Code	IMEI 1: 359012910000738 IMEI 2: 359012910001736
Wireless Technology and Frequency Range	GSM850: 824 MHz ~ 849 MHz GSM1900: 1850 MHz ~ 1910 MHz WCDMA Band II: 1850 MHz ~ 1910 MHz WCDMA Band IV: 1710 MHz ~ 1755 MHz WCDMA Band V: 824 MHz ~ 849 MHz LTE Band 2: 1850 MHz ~ 1910 MHz LTE Band 4: 1710 MHz ~ 1755 MHz LTE Band 5: 824 MHz ~ 849 MHz LTE Band 7: 2500 MHz ~ 2570 MHz Bluetooth: 2402 MHz ~ 2480 MHz
Mode	GSM/GPRS RMC/AMR 12.2Kbps HSDPA/HSUPA LTE: QPSK, 16QAM Bluetooth BR/EDR
HW Version	0207
SW Version	0.2221.15.10
GSM /GPRS Transfer mode	Class B – EUT cannot support Packet Switched and Circuit Switched Network simultaneously but can automatically switch between Packet and Circuit Switched Network.
EUT Stage	Identical Prototype

Remark:

1. This device supports VoIP in GPRS, WCDMA and LTE (e.g. for 3rd-party VoIP), LTE supports VoLTE operation.
2. This device does not support DTM operation and supports GPRS mode up to multi-slot class 12.
3. For dual SIM card mobile has two SIM slots and supports dual SIM dual standby. The WWAN radio transmission will be enabled by either one SIM at a time (single active). After pre-scan two SIM cards power, we found test result of the SIM1 was the worse, so we chose SIM1 slot to perform all tests.
4. This device has two Bluetooth earphones，and used as an accessory. One is used for left ear, and another one for right ear. Due to Bluetooth earphone can be charged in the phone, for using with Bluetooth earphone condition, we tested the worst case from normal condition which is without earphone with each of earphones and couple of earphones for conservative evaluation.

4.2 General LTE SAR Test and Reporting Considerations

Summarized necessary items addressed in KDB 941225 D05 v02r05	
FCC ID	2AJOTTA-1496
Equipment Name	GSM/WCDMA/LTE Mobile Phone
Operating Frequency Range of each LTE transmission band	LTE Band 2: 1850 MHz ~ 1910 MHz LTE Band 4: 1710 MHz ~ 1755 MHz LTE Band 5: 824 MHz ~ 849 MHz LTE Band 7: 2500 MHz ~ 2570 MHz
Channel Bandwidth	LTE Band 2:1.4MHz, 3MHz, 5MHz, 10MHz, 15MHz, 20MHz LTE Band 4:1.4MHz, 3MHz, 5MHz, 10MHz, 15MHz, 20MHz LTE Band 5:1.4MHz, 3MHz, 5MHz, 10MHz LTE Band 7: 5MHz, 10MHz, 15MHz, 20MHz
uplink modulations used	QPSK / 16QAM
LTE Voice / Data requirements	Voice and Data
LTE Release Version	R12, Cat1
CA Support	Not Supported
LTE MPR permanently built-in by design	Table 6.2.3-1: Maximum Power Reduction (MPR) for Power Class 1, 2 and 3

Table 6.2.3-1: Maximum Power Reduction (MPR) for Power Class 1, 2 and 3

Modulation	Channel bandwidth / Transmission bandwidth (N_{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
64 QAM	≤ 5	≤ 4	≤ 8	≤ 12	≤ 16	≤ 18	≤ 2
64 QAM	> 5	> 4	> 8	> 12	> 16	> 18	≤ 3
256 QAM	≥ 1						≤ 5

LTE A-MPR	In the base station simulator configuration, Network Setting value is set to NS_01 to disable A-MPR during SAR testing and the LTE SAR tests was transmitting on all TTI frames (Maximum TTI)
Spectrum plots for RB configuration	A properly configured base station simulator was used for the SAR and power measurement; therefore, spectrum plots for each RB allocation and offset configuration are not included in the SAR report.

Transmission (H, M, L) channel numbers and frequencies in each LTE band

LTE Band 2

	Bandwidth 1.4 MHz		Bandwidth 3 MHz		Bandwidth 5 MHz		Bandwidth 10 MHz		Bandwidth 15 MHz		Bandwidth 20 MHz	
	Ch. #	Freq. (MHz)	Ch. #	Freq. (MHz)	Ch. #	Freq. (MHz)	Ch. #	Freq. (MHz)	Ch. #	Freq. (MHz)	Ch. #	Freq. (MHz)
L	18607	1850.7	18615	1851.5	18625	1852.5	18650	1855	18675	1857.5	18700	1860
M	18900	1880	18900	1880	18900	1880	18900	1880	18900	1880	18900	1880
H	19193	1909.3	19185	1908.5	19175	1907.5	19150	1905	19125	1902.5	19100	1900

LTE Band 4

	Bandwidth 1.4 MHz		Bandwidth 3 MHz		Bandwidth 5 MHz		Bandwidth 10 MHz		Bandwidth 15 MHz		Bandwidth 20 MHz	
	Ch. #	Freq. (MHz)	Ch. #	Freq. (MHz)	Ch. #	Freq. (MHz)	Ch. #	Freq. (MHz)	Ch. #	Freq. (MHz)	Ch. #	Freq. (MHz)
L	19957	1710.7	19965	1711.5	19975	1712.5	20000	1715	20025	1717.5	20050	1720
M	20175	1732.5	20175	1732.5	20175	1732.5	20175	1732.5	20175	1732.5	20175	1732.5
H	20393	1754.3	20385	1753.5	20375	1752.5	20350	1750	20325	1747.5	20300	1745

LTE Band 5

	Bandwidth 1.4 MHz		Bandwidth 3 MHz		Bandwidth 5 MHz		Bandwidth 10 MHz	
	Ch. #	Freq. (MHz)	Ch. #	Freq. (MHz)	Ch. #	Freq. (MHz)	Ch. #	Freq. (MHz)
L	20407	824.7	20415	825.5	20425	826.5	20450	829
M	20525	836.5	20525	836.5	20525	836.5	20525	836.5
H	20643	848.3	20635	847.5	20625	846.5	20600	844

LTE Band 7

	Bandwidth 5 MHz		Bandwidth 10 MHz		Bandwidth 15 MHz		Bandwidth 20 MHz	
	Ch. #	Freq. (MHz)	Ch. #	Freq. (MHz)	Ch. #	Freq. (MHz)	Ch. #	Freq. (MHz)
L	20775	2502.5	20800	2505	20825	2507.5	20850	2510
M	21100	2535	21100	2535	21100	2535	21100	2535
H	21425	2567.5	21400	2565	21375	2562.5	21350	2560

5. RF Exposure Limits

5.1 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.

5.2 Controlled Environment

Controlled Environments are defined as locations where there is exposure that may be incurred by persons who are aware of the potential for exposure, (i.e. as a result of employment or occupation). In general, occupational/controlled exposure limits are applicable to situations in which persons are exposed as a consequence of their employment, who have been made fully aware of the potential for exposure and can exercise control over their exposure. The exposure category is also applicable when the exposure is of a transient nature due to incidental passage through a location where the exposure levels may be higher than the general population/uncontrolled limits, but the exposed person is fully aware of the potential for exposure and can exercise control over his or her exposure by leaving the area or by some other appropriate means.

Limits for Occupational/Controlled Exposure (W/kg)

Whole-Body	Partial-Body	Hands, Wrists, Feet and Ankles
0.4	8.0	20.0

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.

6. Specific Absorption Rate (SAR)

6.1 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.

6.2 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:

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

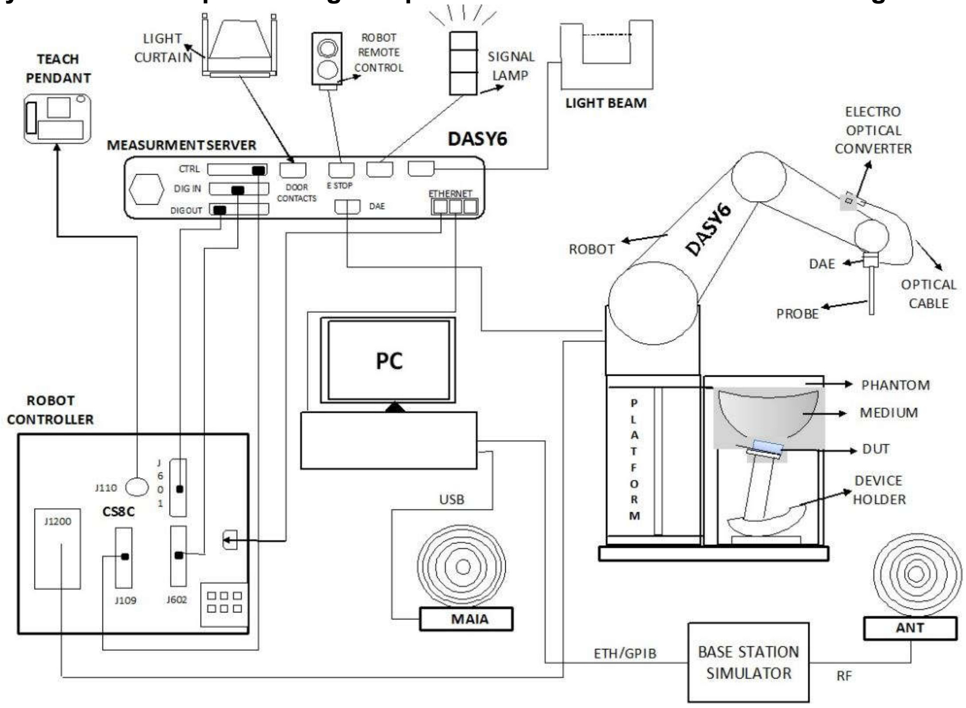
SAR is expressed in units of Watts per kilogram (W/kg)

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

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

7. System Description and Setup

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



- A standard high precision 6-axis robot 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 Win7 or Win10 and the DASY5 or DASY6 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.

7.1 E-Field Probe

The SAR measurement is conducted with the dosimetric probe (manufactured by SPEAG).The probe is specially designed and calibrated for use in liquid with high permittivity. The dosimetric probe has special calibration in liquid at different frequency. This probe has a built in optical surface detection system to prevent from collision with phantom.

<EX3DV4 Probe>

Construction	Symmetric design with triangular core Built-in shielding against static charges PEEK enclosure material (resistant to organic solvents, e.g., DGBE)	
Frequency	10 MHz – >6 GHz Linearity: ±0.2 dB (30 MHz – 6 GHz)	
Directivity	±0.3 dB in TSL (rotation around probe axis) ±0.5 dB in TSL (rotation normal to probe axis)	
Dynamic Range	10 µW/g – >100 mW/g Linearity: ±0.2 dB (noise: typically <1 µW/g)	
Dimensions	Overall length: 337 mm (tip: 20 mm) Tip diameter: 2.5 mm (body: 12 mm) Typical distance from probe tip to dipole centers: 1 mm	

7.2 Data Acquisition Electronics (DAE)

The data acquisition electronics (DAE) consists 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 and 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 input impedance of the DAE is 200 MOhm; the inputs are symmetrical and floating. Common mode rejection is above 80 dB.

Photo of DAE

7.3 Phantom

<SAM Twin Phantom>

Shell Thickness	2 ± 0.2 mm; Center ear point: 6 ± 0.2 mm
Filling Volume	Approx. 25 liters
Dimensions	Length: 1000 mm; Width: 500 mm; Height: adjustable feet
Measurement Areas	Left Hand, Right Hand, Flat Phantom

The bottom plate contains three pair of bolts for locking the device holder. The device holder positions are adjusted to the standard measurement positions in the three sections. A white cover is provided to tap the phantom during off-periods to prevent water evaporation and changes in the liquid parameters. On the phantom top, three reference markers are provided to identify the phantom position with respect to the robot.

<ELI Phantom>

Shell Thickness	2 ± 0.2 mm (sagging: <1%)
Filling Volume	Approx. 30 liters
Dimensions	Major ellipse axis: 600 mm Minor axis: 400 mm

The ELI phantom is intended for compliance testing of handheld and body-mounted wireless devices in the frequency range of 30 MHz to 6 GHz. ELI4 is fully compatible with standard and all known tissue simulating liquids.

7.4 Device Holder

<Mounting Device for Hand-Held Transmitter>

In combination with the Twin SAM V5.0/V5.0c or ELI phantoms, the Mounting Device for Hand-Held Transmitters enables rotation of the mounted transmitter device to specified spherical coordinates. At the heads, the rotation axis is at the ear opening. Transmitter devices can be easily and accurately positioned according to IEC 62209-1, IEEE 1528, FCC, or other specifications. The device holder can be locked for positioning at different phantom sections (left head, right head, flat). And upgrade kit to Mounting Device to enable easy mounting of wider devices like big smart-phones, e-books, small tablets, etc. It holds devices with width up to 140 mm.

Mounting Device for Hand-Held Transmitters

Mounting Device Adaptor for Wide-Phones

<Mounting Device for Laptops and other Body-Worn Transmitters>

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 positioned. The extension is fully compatible with the SAM Twin and ELI phantoms.

Mounting Device for Laptops

8. Measurement Procedures

The measurement procedures are as follows:

<Conducted power measurement>

(a) For WWAN power measurement, use base station simulator to configure EUT WWAN transmission in conducted connection with RF cable, at maximum power in each supported wireless interface and frequency band.
(b) Read the WWAN RF power level from the base station simulator.
(c) For WLAN/BT power measurement, use engineering software to configure EUT WLAN/BT continuously transmission, at maximum RF power in each supported wireless interface and frequency band
(d) Connect EUT RF port through RF cable to the power meter, and measure WLAN/BT output power

<SAR measurement>

(a) Use base station simulator to configure EUT WWAN transmission in radiated connection, and engineering software to configure EUT WLAN/BT continuously transmission, at maximum RF power, in the highest power channel.
(b) Place the EUT in the positions as Appendix D demonstrates.
(c) Set scan area, grid size and other setting on the DASY software.
(d) Measure SAR results for the highest power channel on each testing position.
(e) Find out the largest SAR result on these testing positions of each band
(f) Measure SAR results for other channels in worst SAR testing position if the reported SAR of highest power channel is larger than 0.8 W/kg

According to the test standard, the recommended procedure for assessing the peak spatial-average SAR value consists of the following steps:

(a) Power reference measurement
(b) Area scan
(c) Zoom scan
(d) Power drift measurement

8.1 Spatial Peak SAR Evaluation

The procedure for spatial peak SAR evaluation has been implemented according to the test standard. It can be conducted for 1g and 10g, as well as for user-specific masses. The DASY software includes all numerical procedures necessary to evaluate the spatial peak SAR value.

The base for the evaluation is a "cube" measurement. The measured volume must include the 1g and 10g cubes with the highest averaged SAR values. For that purpose, the center of the measured volume is aligned to the interpolated peak SAR value of a previously performed area scan.

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 1g and 10g cubes. The algorithm to find the cube with highest averaged SAR is divided into the following stages:

(a) Extraction of the measured data (grid and values) from the Zoom Scan
(b) Calculation of the SAR value at every measurement point based on all stored data (A/D values and measurement parameters)
(c) Generation of a high-resolution mesh within the measured volume
(d) Interpolation of all measured values form the measurement grid to the high-resolution grid
(e) Extrapolation of the entire 3-D field distribution to the phantom surface over the distance from sensor to surface
(f) Calculation of the averaged SAR within masses of 1g and 10g

8.2 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. This distance cannot be smaller than the distance of sensor calibration points to probe tip as defined in the probe properties.

8.3 Area Scan

The area scan is used as a fast scan in two dimensions to find the area of high field values, before doing a fine measurement around the hot spot. The sophisticated interpolation routines implemented in DASY software can find the maximum found in the scanned area, within a range of the global maximum. The range (in dB0 is specified in the standards for compliance testing. For example, a 2 dB range is required in IEEE standard 1528 and IEC 62209 standards, whereby 3 dB is a requirement when compliance is assessed in accordance with the ARIB standard (Japan), if only one zoom scan follows the area scan, then only the absolute maximum will be taken as reference. For cases where multiple maximums are detected, the number of zoom scans has to be increased accordingly.

Area scan parameters extracted from FCC KDB 865664 D01v01r04 SAR measurement 100 MHz to 6 GHz.

	≤ 3 GHz	> 3 GHz
Maximum distance from closest measurement point (geometric center of probe sensors) to phantom surface	5 ± 1 mm	½·δ·ln(2) ± 0.5 mm
Maximum probe angle from probe axis to phantom surface normal at the measurement location	30° ± 1°	20° ± 1°
Maximum area scan spatial resolution: Δx_{Area}, Δy_{Area}	≤ 2 GHz: ≤ 15 mm 2 – 3 GHz: ≤ 12 mm	3 – 4 GHz: ≤ 12 mm 4 – 6 GHz: ≤ 10 mm
	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 ≤ the corresponding x or y dimension of the test device with at least one measurement point on the test device.	

8.4 Zoom Scan

Zoom scans are used assess the peak spatial SAR values within a cubic averaging volume containing 1 gram and 10 gram of simulated tissue. The zoom scan measures points (refer to table below) within a cube shoes base faces are centered on the maxima found in a preceding area scan job within the same procedure. When the measurement is done, the zoom scan evaluates the averaged SAR for 1 gram and 10 gram and displays these values next to the job's label.

Zoom scan parameters extracted from FCC KDB 865664 D01v01r04 SAR measurement 100 MHz to 6 GHz.

<table>
<tr><td colspan="3"></td><td>$\leq$ 3 GHz</td><td>> 3 GHz</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">$\leq 1.5 \cdot \Delta z_{Zoom}(n-1)$</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 draft standard IEEE P1528-2011 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 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>

8.5 Volume Scan Procedures

The volume scan is used for assess overlapping SAR distributions for antennas transmitting in different frequency bands. It is equivalent to an oversized zoom scan used in standalone measurements. The measurement volume will be used to enclose all the simultaneous transmitting antennas. For antennas transmitting simultaneously in different frequency bands, the volume scan is measured separately in each frequency band. In order to sum correctly to compute the 1g aggregate SAR, the EUT remain in the same test position for all measurements and all volume scan use the same spatial resolution and grid spacing. When all volume scan were completed, the software, SEMCAD postprocessor can combine and subsequently superpose these measurement data to calculating the multiband SAR.

8.6 Power Drift Monitoring

All SAR testing is under the EUT install full charged battery and transmit maximum output power. In DASY measurement software, the power reference measurement and power drift measurement procedures are used for monitoring the power drift of EUT during SAR test. Both these procedures measure the field at a specified reference position before and after the SAR testing. The software will calculate the field difference in dB. If the power drifts more than 5%, the SAR will be retested.

9. Test Equipment List

Manufacturer	Name of Equipment	Type/Model	Serial Number	Calibration	
				Last Cal.	Due Date
SPEAG	835MHz System Validation Kit	D835V2	4d162	2021/12/17	2022/12/16
SPEAG	1750MHz System Validation Kit	D1750V2	1090	2022/2/24	2023/2/23
SPEAG	1900MHz System Validation Kit	D1900V2	5d182	2021/12/20	2022/12/19
SPEAG	2450MHz System Validation Kit	D2450V2	924	2020/9/2	2023/9/1
SPEAG	2600MHz System Validation Kit	D2600V2	1061	2020/11/26	2023/11/25
SPEAG	Data Acquisition Electronics	DAE4	1649	2022/3/30	2023/3/29
SPEAG	Dosimetric E-Field Probe	EX3DV4	3887	2021/10/22	2022/10/21
SPEAG	SAM Twin Phantom	SAM Twin	TP-2074	NCR	NCR
Testo	Thermo-Hygrometer	608-H1	1241332126	2022/1/6	2023/1/5
SPEAG	Phone Positioner	N/A	N/A	NCR	NCR
Anritsu	Radio Communication Analyzer	MT8821C	6262306173	2021/7/15	2022/7/14
Agilent	ENA Series Network Analyzer	E5071C	MY46106933	2021/7/31	2022/7/30
SPEAG	Dielectric Probe Kit	DAK-3.5	1071	2022/1/24	2023/1/23
Anritsu	Vector Signal Generator	MG3710A	6201682672	2022/1/6	2023/1/5
Anritsu	Power Meter	NRVD	102081	2021/8/12	2022/8/11
Rohde & Schwarz	Power Sensor	NRV-Z5	100538	2021/8/12	2022/8/11
Rohde & Schwarz	Power Sensor	NRV-Z5	100539	2021/8/12	2022/8/11
R&S	CBT BLUETOOTH TESTER	CBT	100641	2022/1/5	2023/1/4
EXA	Spectrum Analyzer	FSV7	101631	2021/10/14	2022/10/13
FLUKE	DIGITAC THERMOMETER	51II	97240029	2021/10/23	2022/10/22
BONN	POWER AMPLIFIER	BLMA 0830-3	087193A	Note 1	
BONN	POWER AMPLIFIER	BLMA 2060-2	087193B	Note 1	
Agilent	Dual Directional Coupler	778D	20500	Note 1	
Agilent	Dual Directional Coupler	11691D	MY48151020	Note 1	
ARRA	Power Divider	A3200-2	N/A	Note 1	
MCL	Attenuation1	BW-S10W5+	N/A	Note 1	
MCL	Attenuation2	BW-S10W5+	N/A	Note 1	
MCL	Attenuation3	BW-S10W5+	N/A	Note 1	

Note:

1. Prior to system verification and validation, the path loss from the signal generator to the system check source and the power meter, which includes the amplifier, cable, attenuator and directional coupler, was measured by the network analyzer. The reading of the power meter was offset by the path loss difference between the path to the power meter and the path to the system check source to monitor the actual power level fed to the system check
2. Referring to KDB 865664 D01v01r04, the dipole calibration interval can be extended to 3 years with justification. The dipoles are also not physically damaged, or repaired during the interval.
3. The justification data of dipole can be found in appendix C. The return loss is < -20dB, within 20% of prior calibration, the impedance is within 5 ohm of prior calibration.

10. System Verification

10.1 Tissue Simulating Liquids

For the measurement of the field distribution inside the SAM phantom with DASY, the phantom must be filled with around 25 liters of homogeneous body tissue simulating liquid. For head SAR testing, the liquid height from the ear reference point (ERP) of the phantom to the liquid top surface is larger than 15 cm, which is shown in Fig. 11.1. For body SAR testing, the liquid height from the center of the flat phantom to the liquid top surface is larger than 15 cm, which is shown in Fig. 11.2.

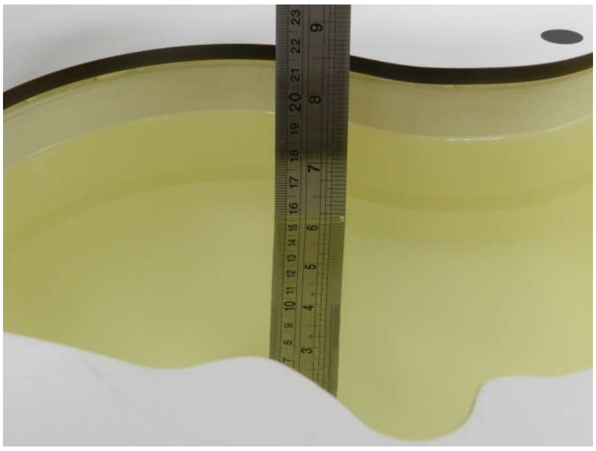


Fig 10.1 Photo of Liquid Height for Head SAR

Fig 10.2 Photo of Liquid Height for Body SAR

10.2 Tissue Verification

The following tissue formulations are provided for reference only as some of the parameters have not been thoroughly verified. The composition of ingredients may be modified accordingly to achieve the desired target tissue parameters required for routine SAR evaluation.

Frequency (MHz)	Water (%)	Sugar (%)	Cellulose (%)	Salt (%)	Preventol (%)	DGBE (%)	Conductivity (σ)	Permittivity (εr)
For Head								
835	40.3	57.9	0.2	1.4	0.2	0	0.90	41.5
1800, 1900	55.2	0	0	0.3	0	44.5	1.40	40.0
2450	55.0	0	0	0	0	45.0	1.80	39.2
2600	54.8	0	0	0.1	0	45.1	1.96	39.0

<Tissue Dielectric Parameter Check Results>

Frequency (MHz)	Head	Liquid Temp. (℃)	Conductivity (σ)	Permittivity (ε_r)	Conductivity Target (σ)	Permittivity Target (ε_r)	Delta (σ) (%)	Delta (ε_r) (%)	Limit (%)	Date
835	Head	22.8	0.926	41.100	0.90	41.50	2.89	-0.96	±5	2022/5/30
1750	Head	22.5	1.360	40.900	1.37	40.10	-0.73	2.00	±5	2022/6/1
1900	Head	22.9	1.450	40.700	1.40	40.00	3.57	1.75	±5	2022/6/5
2450	Head	22.8	1.800	38.600	1.80	39.20	0.00	-1.53	±5	2022/6/11
2600	Head	22.6	1.930	39.000	1.96	39.00	-1.53	0.00	±5	2022/6/13

10.3 System Performance Check Results

Comparing to the original SAR value provided by SPEAG, the verification data should be within its specification of 10 %. Below table shows the target SAR and measured SAR after normalized to 1W input power. The table below indicates the system performance check can meet the variation criterion and the plots can be referred to Appendix A of this report.

Date	Frequency (MHz)	Head	Input Power (mW)	Dipole S/N	Probe S/N	DAE S/N	Measured 1g SAR (W/kg)	Targeted 1g SAR (W/kg)	Normalized 1g SAR (W/kg)	Deviation (%)
2022/5/30	835	Head	50	4d162	3887	1649	0.448	9.64	8.96	-7.05
2022/6/1	1750	Head	50	1090	3887	1649	1.720	37.00	34.4	-7.03
2022/6/5	1900	Head	50	5d182	3887	1649	1.900	39.60	38	-4.04
2022/6/11	2450	Head	50	924	3887	1649	2.420	51.40	48.4	-5.84
2022/6/13	2600	Head	50	1061	3887	1649	2.630	56.60	52.6	-7.07

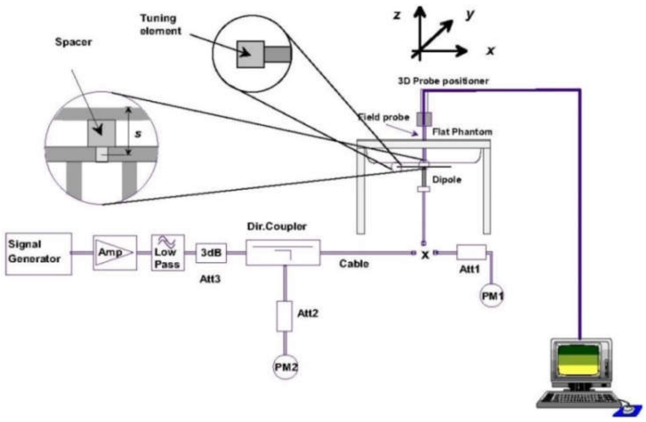


Fig 11.3.1 System Performance Check Setup

Fig 11.3.2 Setup Photo

11. RF Exposure Positions

11.1 Ear and handset reference point

Figure 12.1.1 shows the front, back, and side views of the SAM phantom. The center-of-mouth reference point is labeled “M,” the left ear reference point (ERP) is marked “LE,” and the right ERP is marked “RE.” Each ERP is 15 mm along the B-M (back-mouth) line behind the entrance-to-ear-canal (EEC) point, as shown in Figure 12.1.2 The Reference Plane is defined as passing through the two ear reference points and point M. The line N-F (neck-front), also called the reference pivoting line, is normal to the Reference Plane and perpendicular to both a line passing through RE and LE and the B-M line (see Figure 12.1.3). Both N-F and B-M lines should be marked on the exterior of the phantom shell to facilitate handset positioning. Posterior to the N-F line the ear shape is a flat surface with 6 mm thickness at each ERP, and forward of the N-F line the ear is truncated, as illustrated in Figure 12.1.2. The ear truncation is introduced to preclude the ear lobe from interfering with handset tilt, which could lead to unstable positioning at the cheek.

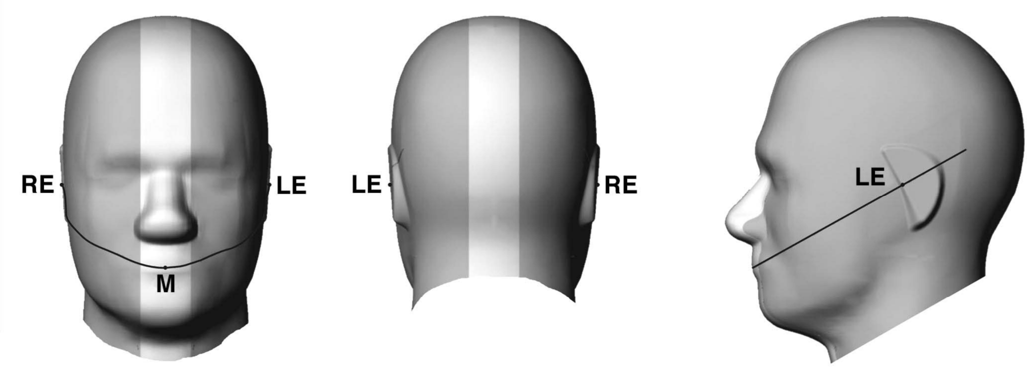


Fig 12.1.1 Front, back, and side views of SAM twin phantom

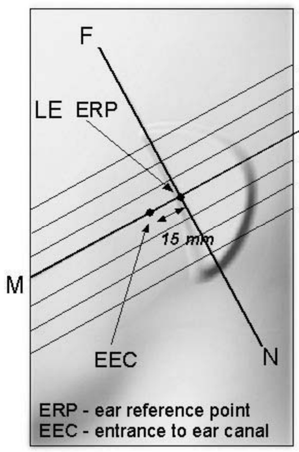


Fig 12.1.2 Close-up side view of phantom showing the ear region.

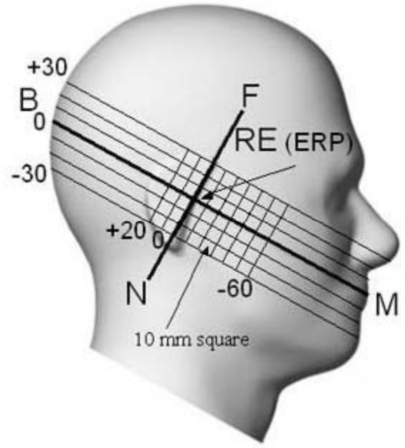


Fig 12.1.3 Side view of the phantom showing relevant markings and seven cross-sectional plane locations

11.2 Definition of the cheek position

1. Ready the handset for talk operation, if necessary. For example, for handsets with a cover piece (flip cover), open the cover. If the handset can transmit with the cover closed, both configurations must be tested.
2. Define two imaginary lines on the handset—the vertical centerline and the horizontal line. The vertical centerline passes through two points on the front side of the handset—the midpoint of the width wt of the handset at the level of the acoustic output (point A in Figure 12.2.1 and Figure 12.2.2), and the midpoint of the width wb of the bottom of the handset (point B). The horizontal line is perpendicular to the vertical centerline and passes through the center of the acoustic output (see Figure 12.2.1). The two lines intersect at point A. Note that for many handsets, point A coincides with the center of the acoustic output; however, the acoustic output may be located elsewhere on the horizontal line. Also note that the vertical centerline is not necessarily parallel to the front face of the handset (see Figure 12.2.2), especially for clamshell handsets, handsets with flip covers, and other irregularly-shaped handsets.
3. Position the handset close to the surface of the phantom such that point A is on the (virtual) extension of the line passing through points RE and LE on the phantom (see Figure 12.2.3), such that the plane defined by the vertical centerline and the horizontal line of the handset is approximately parallel to the sagittal plane of the phantom.
4. Translate the handset towards the phantom along the line passing through RE and LE until handset point A touches the pinna at the ERP.
5. While maintaining the handset in this plane, rotate it around the LE-RE line until the vertical centerline is in the plane normal to the plane containing B-M and N-F lines, i.e., the Reference Plane.
6. Rotate the handset around the vertical centerline until the handset (horizontal line) is parallel to the N-F line.
7. While maintaining the vertical centerline in the Reference Plane, keeping point A on the line passing through RE and LE, and maintaining the handset contact with the pinna, rotate the handset about the N-F line until any point on the handset is in contact with a phantom point below the pinna on the cheek. See Figure 12.2.3. The actual rotation angles should be documented in the test report.

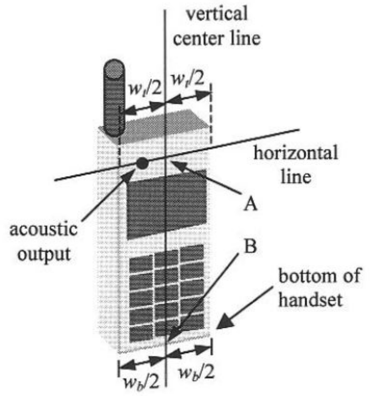


Fig 12.2.1 Handset vertical and horizontal reference lines—"fixed case

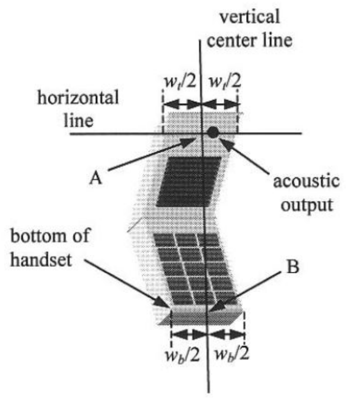


Fig 12.2.2 Handset vertical and horizontal reference lines—"clam-shell case"

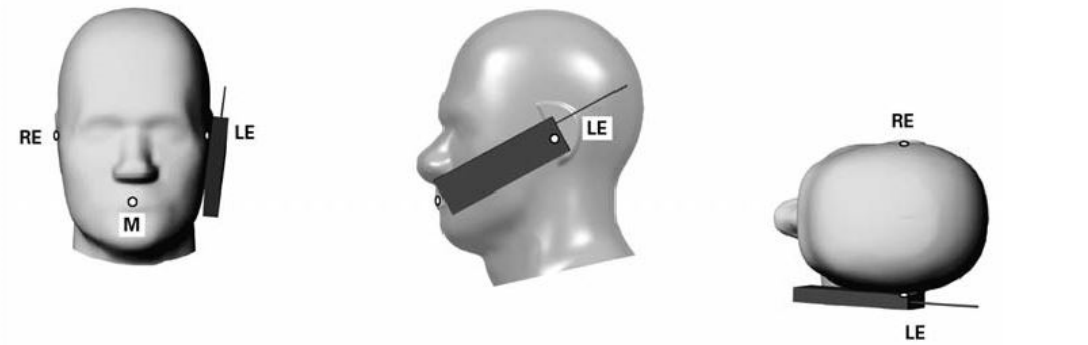


Fig 12.2.3 cheek or touch position. The reference points for the right ear (RE), left ear (LE), and mouth (M), which establish the Reference Plane for handset positioning, are indicated.

11.3 Definition of the tilt position

1. Ready the handset for talk operation, if necessary. For example, for handsets with a cover piece (flip cover), open the cover. If the handset can transmit with the cover closed, both configurations must be tested.
2. While maintaining the orientation of the handset, move the handset away from the pinna along the line passing through RE and LE far enough to allow a rotation of the handset away from the cheek by 15°.
3. Rotate the handset around the horizontal line by 15°.
4. While maintaining the orientation of the handset, move the handset towards the phantom on the line passing through RE and LE until any part of the handset touches the ear. The tilt position is obtained when the contact point is on the pinna. See Figure 12.3.1. If contact occurs at any location other than the pinna, e.g., the antenna at the back of the phantom head, the angle of the handset should be reduced. In this case, the tilt position is obtained if any point on the handset is in contact with the pinna and a second point

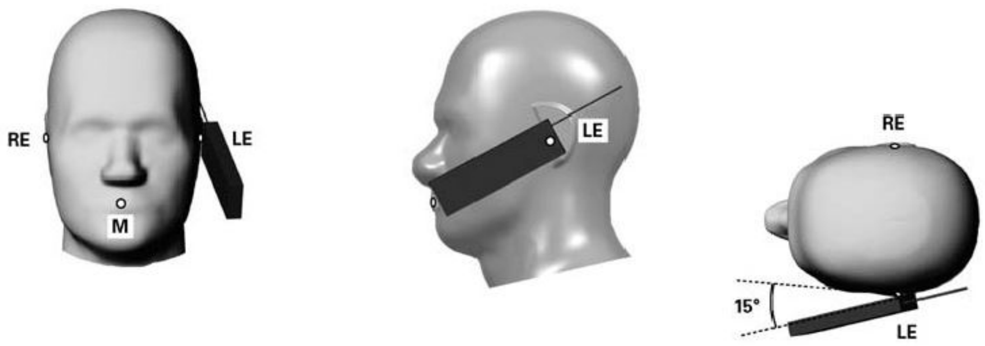


Fig 12.3.1 Tilt position. The reference points for the right ear (RE), left ear (LE), and mouth (M), which define the Reference Plane for handset positioning, are indicated.

11.4 Body Worn Accessory

Body-worn operating configurations are tested with the belt-clips and holsters attached to the device and positioned against a flat phantom in a normal use configuration (see Figure 12.4). Per KDB648474 D04v01r03, body-worn accessory exposure is typically related to voice mode operations when handsets are carried in body-worn accessories. The body-worn accessory procedures in FCC KDB 447498 D01v06 should be used to test for body-worn accessory SAR compliance, without a headset connected to it. This enables the test results for such configuration to be compatible with that required for hotspot mode when the body-worn accessory test separation distance is greater than or equal to that required for hotspot mode, when applicable. When the reported SAR for body-worn accessory, measured without a headset connected to the handset is > 1.2 W/kg, the highest reported SAR configuration for that wireless mode and frequency band should be repeated for that body-worn accessory with a handset attached to the handset.

Accessories for body-worn operation configurations are divided into two categories: those that do not contain metallic components and those that do contain metallic components and those that do contain metallic components. When multiple accessories that do not contain metallic components are supplied with the device, the device is tested with only the accessory that dictates the closest spacing to the body. Then multiple accessories that contain metallic components are test with the device with each accessory. If multiple accessories share an identical metallic component (i.e. the same metallic belt-chip used with different holsters with no other metallic components) only the accessory that dictates the closest spacing to the body is tested.

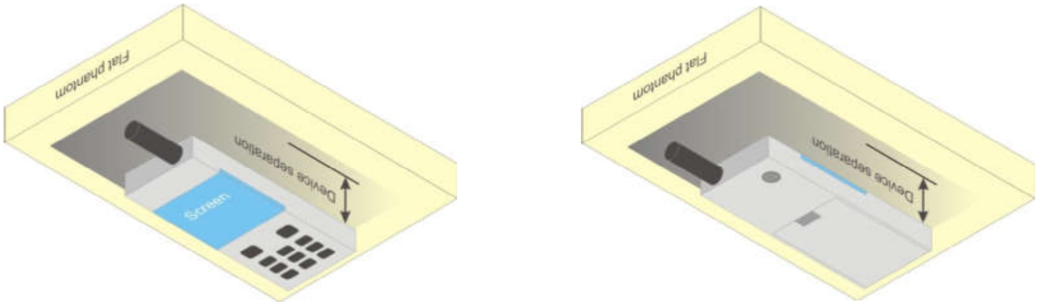


Fig 12.4 Body Worn Position

12. Conducted RF Output Power (Unit: dBm)

The detailed conducted power table can refer to Appendix E.

<GSM Conducted Power>

1. Per KDB 447498 D01v06, the maximum output power channel is used for SAR testing and for further SAR test reduction.
2. Per KDB 941225 D01v03r01, for SAR test reduction for GSM / GPRS modes is determined by the source-based time-averaged output power including tune-up tolerance. The mode with highest specified time-averaged output power should be tested for SAR compliance in the applicable exposure conditions. For modes with the same specified maximum output power and tolerance, the higher number time-slot configuration should be tested.
3. Other configurations of GSM / GPRS are considered as secondary modes. The 3G SAR test reduction procedure is applied, 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, SAR measurement is not required for the secondary mode.

<WCDMA Conducted Power>

1. The following tests were conducted according to the test requirements outlines in 3GPP TS 34.121 specification.
2. The procedures in KDB 941225 D01v03r01 are applied for 3GPP Rel. 6 HSPA to configure the device in the required sub-test mode(s) to determine SAR test exclusion.

A summary of these settings are illustrated below:

HSDPA Setup Configuration:

a. The EUT was connected to Base Station Agilent E5515C referred to the Setup Configuration.
b. The RF path losses were compensated into the measurements.
c. A call was established between EUT and Base Station with following setting:
   i. Set Gain Factors (β_c and β_d) and parameters were set according to each
   ii. Specific sub-test in the following table, C10.1.4, quoted from the TS 34.121
   iii. Set RMC 12.2Kbps + HSDPA mode.
   iv. Set Cell Power = -86 dBm
   v. Set HS-DSCH Configuration Type to FRC (H-set 1, QPSK)
   vi. Select HSDPA Uplink Parameters
   vii. Set Delta ACK, Delta NACK and Delta CQI = 8
   viii. Set Ack-Nack Repetition Factor to 3
   ix. Set CQI Feedback Cycle (k) to 4 ms
   x. Set CQI Repetition Factor to 2
   xi. Power Ctrl Mode = All Up bits
d. The transmitted maximum output power was recorded.

Table C.10.1.4: β values for transmitter characteristics tests with HS-DPCCH

Sub-test	β_c	β_d	β_d (SF)	β_c/β_d	β_{HS} (Note1, Note 2)	CM (dB) (Note 3)	MPR (dB) (Note 3)
1	2/15	15/15	64	2/15	4/15	0.0	0.0
2	12/15 (Note 4)	15/15 (Note 4)	64	12/15 (Note 4)	24/15	1.0	0.0
3	15/15	8/15	64	15/8	30/15	1.5	0.5
4	15/15	4/15	64	15/4	30/15	1.5	0.5

Note 1: Δ_{ACK}, Δ_{NACK} and Δ_{CQI} = 30/15 with β_{hs} = 30/15 * β_c.

Note 2: For the HS-DPCCH power mask requirement test in clause 5.2C, 5.7A, and the Error Vector Magnitude (EVM) with HS-DPCCH test in clause 5.13.1A, and HSDPA EVM with phase discontinuity in clause 5.13.1AA, Δ_{ACK} and Δ_{NACK} = 30/15 with β_{hs} = 30/15 * β_c, and Δ_{CQI} = 24/15 with β_{hs} = 24/15 * β_c.

Note 3: CM = 1 for β_c/β_d =12/15, β_{hs}/β_c=24/15. For all other combinations of DPDCH, DPCCH and HS-DPCCH the MPR is based on the relative CM difference. This is applicable for only UEs that support HSDPA in release 6 and later releases.

Note 4: 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 signalled gain factors for the reference TFC (TF1, TF1) to β_c = 11/15 and β_d = 15/15.

Setup Configuration

HSUPA Setup Configuration:

a. The EUT was connected to Base Station Agilent E5515C referred to the Setup Configuration.
b. The RF path losses were compensated into the measurements.
c. A call was established between EUT and Base Station with following setting * :
   i. Call Configs = 5.2B, 5.9B, 5.10B, and 5.13.2B with QPSK
   ii. Set the Gain Factors (β_c and β_d) and parameters (AG Index) were set according to each specific sub-test in the following table, C11.1.3, quoted from the TS 34.121
   iii. Set Cell Power = -86 dBm
   iv. Set Channel Type = 12.2k + HSPA
   v. Set UE Target Power
   vi. Power Ctrl Mode= Alternating bits
   vii. Set and observe the E-TFCI
   viii. Confirm that E-TFCI is equal to the target E-TFCI of 75 for sub-test 1, and other subtest's E-TFCI
d. The transmitted maximum output power was recorded.

Table C.11.1.3: β values for transmitter characteristics tests with HS-DPCCH and E-DCH

Sub-test	β_c	β_d	β_d (SF)	β_c/β_d	β_{HS} (Note1)	β_{ec}	β_{ed} (Note 4) (Note 5)	β_{ed} (SF)	β_{ed} (Codes)	CM (dB) (Note 2)	MPR (dB) (Note 2) (Note 6)	AG Index (Note 5)	E-TFCI
1	11/15 (Note 3)	15/15 (Note 3)	64	11/15 (Note 3)	22/15	209/225	1309/225	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_{ed}1: 47/15 β_{ed}2: 47/15	4 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	0	-	-	5/15	5/15	47/15	4	1	1.0	0.0	12	67

Note 1: For sub-test 1 to 4, Δ_{ACK}, Δ_{NACK} and Δ_{CQI} = 30/15 with β_{hs} = 30/15 * β_c. For sub-test 5, Δ_{ACK}, Δ_{NACK} and Δ_{CQI} = 5/15 with β_{hs} = 5/15 * β_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 signalled gain factors for the reference TFC (TF1, TF1) to β_c = 10/15 and β_d = 15/15.
Note 4: In case of testing by UE using E-DPDCH Physical Layer category 1, Sub-test 3 is omitted according to TS25.306 Table 5.1g.
Note 5: β_{ed} can not be set directly; it is set by Absolute Grant Value.
Note 6: For subtests 2, 3 and 4, UE may perform E-DPDCH power scaling at max power which could results in slightly smaller MPR values.

Setup Configuration

<WCDMA Conducted Power>

General Note:

1. Per KDB 941225 D01v03r01, for SAR testing is measured using a 12.2 kbps RMC with TPC bits configured to all "1's".
2. Per KDB 941225 D01v03r01, RMC 12.2kbps setting is used to evaluate SAR. The maximum output power and tune-up tolerance specified for production units in HSDPA / HSUPA is ≤ ¼ dB higher than RMC 12.2Kbps or when the highest reported SAR of the RMC12.2Kbps is scaled by the ratio of specified maximum output power and tune-up tolerance of HSDPA / HSUPA to RMC12.2Kbps and the adjusted SAR is ≤ 1.2 W/kg, SAR measurement is not required for HSDPA / HSUPA , and according to the following RF output power, the output power results of the secondary modes (HSDPA / HSUPA) are less than ¼ dB higher than the primary modes; therefore, SAR measurement is not required for HSDPA / HSUPA.

<LTE Conducted Power>

General Note:

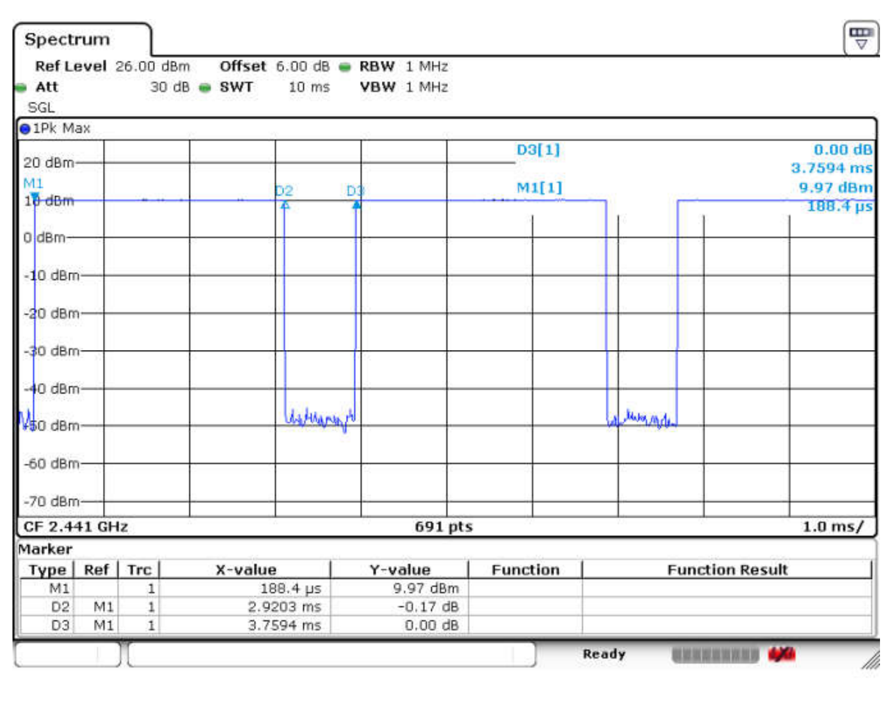
1. Anritsu MT8820C base station simulator was used to setup the connection with EUT; the frequency band, channel bandwidth, RB allocation configuration, modulation type are set in the base station simulator to configure EUT transmitting at maximum power and at different configurations which are requested to be reported to FCC, for conducted power measurement and SAR testing.
2. Per KDB 941225 D05v02r05, when a properly configured base station simulator is used for the SAR and power measurements, spectrum plots for each RB allocation and offset configuration is not required.
3. Per KDB 941225 D05v02r05, start with the largest channel bandwidth and measure SAR for QPSK with 1 RB allocation, using the RB offset and required test channel combination with the highest maximum output power for RB offsets at the upper edge, middle and lower edge of each required test channel.
4. Per KDB 941225 D05v02r05, 50% RB allocation for QPSK SAR testing follows 1RB QPSK allocation procedure.
5. Per KDB 941225 D05v02r05, 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 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.
6. Per KDB 941225 D05v02r05, 16QAM output power for each RB allocation configuration is > not ½ dB higher than the same configuration in QPSK and the reported SAR for the QPSK configuration is ≤ 1.45 W/kg; Per KDB 941225 D05v02r05, 16QAM SAR testing is not required.
7. Per KDB 941225 D05v02r05, smaller bandwidth output power for each RB allocation configuration is > not ½ dB higher than the same configuration in the largest supported bandwidth, and the reported SAR for the largest supported bandwidth is ≤ 1.45 W/kg; Per KDB 941225 D05v02r05, smaller bandwidth SAR testing is not required.
8. For LTE B4/B5 the maximum bandwidth does not support three non-overlapping channels, per KDB 941225 D05v02r05, when a device supports overlapping channel assignment in a channel bandwidth configuration, the middle channel of the group of overlapping channels should be selected for testing.

<2.4GHz Bluetooth>

General Note:

1. For 2.4GHz Bluetooth SAR testing was selected 1Mbps, due to its highest average power.
2. The Bluetooth duty cycle is 77.68% as following figure, according to 2016 Oct. TCB workshop for Bluetooth SAR scaling need further consideration and the maximum duty cycle is 100%, therefore the actual duty cycle will be scaled up to 100% for Bluetooth reported SAR calculation

Bluetooth time-domain plot



13. Antenna Location

The detailed antenna location information can refer to SAR Test Setup Photos.

14. SAR Test Results

General Note:

1. Per KDB 447498 D01v06, the reported SAR is the measured SAR value adjusted for maximum tune-up tolerance.
    a. Tune-up scaling Factor = tune-up limit power (mW) / EUT RF power (mW), where tune-up limit is the maximum rated power among all production units.
    b. For SAR testing of BT signal with non-100% duty cycle, the measured SAR is scaled-up by the duty cycle scaling factor which is equal to "1/(duty cycle)"
    c. For WWAN: Reported SAR(W/kg)= Measured SAR(W/kg)*Tune-up Scaling Factor
    d. For BT: Reported SAR(W/kg)= Measured SAR(W/kg)* Duty Cycle scaling factor * Tune-up scaling factor
2. Per KDB 447498 D01v06, for each exposure position, 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:
    - ≤ 0.8 W/kg or 2.0 W/kg, for 1-g or 10-g respectively, when the transmission band is ≤ 100 MHz
    - ≤ 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
    - ≤ 0.4 W/kg or 1.0 W/kg, for 1-g or 10-g respectively, when the transmission band is ≥ 200 MHz
3. Per KDB 865664 D01v01r04, for each frequency band, repeated SAR measurement is required when the measured SAR is ≥ 0.8W/kg.
4. For dual SIM card mobile has two SIM slots and supports dual SIM dual standby. The WWAN radio transmission will be enabled by either one SIM at a time (single active). After pre-scan two SIM cards power, we found test result of the SIM1 was the worse, so we chose SIM1 slot to perform all tests.
5. Pre KDB648474 D04v01r03, when the reported SAR for a body-worn accessory, measured without a headset connected to the handset, is > 1.2 W/kg, the highest reported SAR configuration for that wireless mode and frequency band should be repeated for that body-worn accessory with a headset attached to the handset. When headset SAR is less than or equal than without headset SAR, no need to verify the remaining channels for headset SAR.
6. This device has two Bluetooth earphones，and used as an accessory. One is used for left ear, and another one for right ear. Due to Bluetooth earphone can be charged in the phone, for using with Bluetooth earphone condition, we tested the worst case from normal condition which is without earphone with each of earphones and couple of earphones for conservative evaluation.

GSM Note:

1. Per KDB 941225 D01v03r01, for SAR test reduction for GSM / GPRS modes is determined by the source-based time-averaged output power including tune-up tolerance. The mode with highest specified time-averaged output power should be tested for SAR compliance in the applicable exposure conditions. For modes with the same specified maximum output power and tolerance, the higher number time-slot configuration should be tested.
2. Other configurations of GSM / GPRS are considered as secondary modes. The 3G SAR test reduction procedure is applied, 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, SAR measurement is not required for the secondary mode.

WCDMA Note:

1. Per KDB 941225 D01v03r01, for SAR testing is measured using a 12.2 kbps RMC with TPC bits configured to all “1’s”.
2. Per KDB 941225 D01v03r01, RMC 12.2kbps setting is used to evaluate SAR. The maximum output power and tune-up tolerance specified for production units in HSDPA / HSUPA is ≤ ¼ dB higher than RMC 12.2Kbps or when the highest reported SAR of the RMC12.2Kbps is scaled by the ratio of specified maximum output power and tune-up tolerance of HSDPA / HSUPA to RMC12.2Kbps and the adjusted SAR is ≤ 1.2 W/kg, SAR measurement is not required for HSDPA / HSUPA, and according to the following RF output power, the output power results of the secondary modes (HSDPA / HSUPA) are less than ¼ dB higher than the primary modes; therefore, SAR measurement is not required for HSDPA / HSUPA.

LTE Note:

1. Per KDB 941225 D05v02r05, start with the largest channel bandwidth and measure SAR for QPSK with 1 RB allocation, using the RB offset and required test channel combination with the highest maximum output power for RB offsets at the upper edge, middle and lower edge of each required test channel.
2. Per KDB 941225 D05v02r05, 50% RB allocation for QPSK SAR testing follows 1RB QPSK allocation procedure.
3. Per KDB 941225 D05v02r05, 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 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.
4. Per KDB 941225 D05v02r05, 16QAM output power for each RB allocation configuration is > not ½ dB higher than the same configuration in QPSK and the reported SAR for the QPSK configuration is ≤ 1.45 W/kg; Per KDB 941225 D05v02r05, 16QAM SAR testing is not required.
5. Per KDB 941225 D05v02r05, smaller bandwidth output power for each RB allocation configuration is > not ½ dB higher than the same configuration in the largest supported bandwidth, and the reported SAR for the largest supported bandwidth is ≤ 1.45 W/kg; Per KDB 941225 D05v02r05, smaller bandwidth SAR testing is not required.
6. For LTE B4/B5 the maximum bandwidth does not support three non-overlapping channels, per KDB 941225 D05v02r05, when a device supports overlapping channel assignment in a channel bandwidth configuration, the middle channel of the group of overlapping channels should be selected for testing.

14.1 Head SAR

Plot No.	Band	BW (MHz)	Modulation	RB Size	RB offset	Mode	Test Position	Gap (mm)	Headset	Ch.	Freq. (MHz)	Average Power (dBm)	Tune-Up Limit (dBm)	Tune-up Scaling Factor	Power Drift (dB)	Measured 1g SAR (W/kg)	Reported 1g SAR (W/kg)
835MHz																	
01	GSM850	-	-	-	-	GPRS (3 Tx slots)	Right Cheek	0mm	-	189	836.4	29.21	30.00	1.199	-0.01	0.734	0.880
	GSM850	-	-	-	-	GPRS (3 Tx slots)	Right Cheek	0mm	-	128	824.2	29.10	30.00	1.230	0.11	0.691	0.850
	GSM850	-	-	-	-	GPRS (3 Tx slots)	Right Cheek	0mm	-	251	848.8	29.18	30.00	1.208	0.09	0.711	0.859
	GSM850	-	-	-	-	GPRS (3 Tx slots)	Right Cheek	0mm	Left earphone	189	836.4	29.21	30.00	1.199	0.15	0.712	0.854
	GSM850	-	-	-	-	GPRS (3 Tx slots)	Right Cheek	0mm	Right earphone	189	836.4	29.21	30.00	1.199	-0.07	0.708	0.849
	GSM850	-	-	-	-	GPRS (3 Tx slots)	Right Cheek	0mm	couple of earphone	189	836.4	29.21	30.00	1.199	0.14	0.720	0.864
	GSM850	-	-	-	-	GPRS (3 Tx slots)	Right Tilted	0mm	-	189	836.4	29.21	30.00	1.199	-0.19	0.428	0.513
	GSM850	-	-	-	-	GPRS (3 Tx slots)	Left Cheek	0mm	-	189	836.4	29.21	30.00	1.199	-0.02	0.684	0.820
	GSM850	-	-	-	-	GPRS (3 Tx slots)	Left Tilted	0mm	-	189	836.4	29.21	30.00	1.199	-0.04	0.386	0.463
	WCDMA V	-	-	-	-	RMC 12.2Kbps	Right Cheek	0mm	-	4182	836.4	24.33	25.00	1.167	-0.05	0.641	0.748
	WCDMA V	-	-	-	-	RMC 12.2Kbps	Right Tilted	0mm	-	4182	836.4	24.33	25.00	1.167	0.05	0.366	0.427
02	WCDMA V	-	-	-	-	RMC 12.2Kbps	Left Cheek	0mm	-	4182	836.4	24.33	25.00	1.167	0.05	0.650	0.758
	WCDMA V	-	-	-	-	RMC 12.2Kbps	Left Cheek	0mm	Left earphone	4182	836.4	24.33	25.00	1.167	0.01	0.565	0.659
	WCDMA V	-	-	-	-	RMC 12.2Kbps	Left Cheek	0mm	Right earphone	4182	836.4	24.33	25.00	1.167	0.06	0.583	0.680
	WCDMA V	-	-	-	-	RMC 12.2Kbps	Left Cheek	0mm	couple of earphone	4182	836.4	24.33	25.00	1.167	0.16	0.595	0.694
	WCDMA V	-	-	-	-	RMC 12.2Kbps	Left Tilted	0mm	-	4182	836.4	24.33	25.00	1.167	0.04	0.393	0.459
	LTE Band 5	10M	QPSK	1	0	-	Right Cheek	0mm	-	20525	836.5	23.59	24.00	1.099	0.08	0.403	0.443
	LTE Band 5	10M	QPSK	25	0	-	Right Cheek	0mm	-	20525	836.5	22.65	23.00	1.084	-0.13	0.343	0.372
	LTE Band 5	10M	QPSK	1	0	-	Right Tilted	0mm	-	20525	836.5	23.59	24.00	1.099	-0.19	0.237	0.260
	LTE Band 5	10M	QPSK	25	0	-	Right Tilted	0mm	-	20525	836.5	22.65	23.00	1.084	-0.17	0.201	0.218
03	LTE Band 5	10M	QPSK	1	0	-	Left Cheek	0mm	-	20525	836.5	23.59	24.00	1.099	0.05	0.616	0.677
	LTE Band 5	10M	QPSK	1	0	-	Left Cheek	0mm	Left earphone	20525	836.5	23.59	24.00	1.099	-0.15	0.529	0.581
	LTE Band 5	10M	QPSK	1	0	-	Left Cheek	0mm	Right earphone	20525	836.5	23.59	24.00	1.099	0.03	0.589	0.647
	LTE Band 5	10M	QPSK	1	0	-	Left Cheek	0mm	couple of earphone	20525	836.5	23.59	24.00	1.099	-0.15	0.599	0.658
	LTE Band 5	10M	QPSK	25	0	-	Left Cheek	0mm	-	20525	836.5	22.65	23.00	1.084	-0.05	0.354	0.384
	LTE Band 5	10M	QPSK	1	0	-	Left Tilted	0mm	-	20525	836.5	23.59	24.00	1.099	0.08	0.248	0.273
	LTE Band 5	10M	QPSK	25	0	-	Left Tilted	0mm	-	20525	836.5	22.65	23.00	1.084	0.06	0.215	0.233
1750MHz																	
04	WCDMA IV	-	-	-	-	RMC 12.2Kbps	Right Cheek	0mm	-	1413	1732.6	24.77	25.00	1.054	0.16	0.669	0.705
	WCDMA IV	-	-	-	-	RMC 12.2Kbps	Right Cheek	0mm	Left earphone	1413	1732.6	24.77	25.00	1.054	0.04	0.541	0.570
	WCDMA IV	-	-	-	-	RMC 12.2Kbps	Right Cheek	0mm	Right earphone	1413	1732.6	24.77	25.00	1.054	0.05	0.594	0.626

	WCDMA IV	-	-	-	-	RMC 12.2Kbps	Right Cheek	0mm	couple of earphone	1413	1732.6	24.77	25.00	1.054	0.01	0.613	0.646
	WCDMA IV	-	-	-	-	RMC 12.2Kbps	Right Tilted	0mm	-	1413	1732.6	24.77	25.00	1.054	-0.09	0.594	0.626
	WCDMA IV	-	-	-	-	RMC 12.2Kbps	Left Cheek	0mm	-	1413	1732.6	24.77	25.00	1.054	-0.14	0.503	0.530
	WCDMA IV	-	-	-	-	RMC 12.2Kbps	Left Tilted	0mm	-	1413	1732.6	24.77	25.00	1.054	-0.13	0.653	0.689
05	LTE Band 4	20M	QPSK	1	0	-	Right Cheek	0mm	-	20175	1732.5	23.96	25.00	1.271	-0.07	0.466	**0.592**
	LTE Band 4	20M	QPSK	1	0	-	Right Cheek	0mm	Left earphone	20175	1732.5	23.96	25.00	1.271	0.01	0.443	0.563
	LTE Band 4	20M	QPSK	1	0	-	Right Cheek	0mm	Right earphone	20175	1732.5	23.96	25.00	1.271	0.03	0.423	0.537
	LTE Band 4	20M	QPSK	1	0	-	Right Cheek	0mm	couple of earphone	20175	1732.5	23.96	25.00	1.271	0.19	0.418	0.531
	LTE Band 4	20M	QPSK	50	0	-	Right Cheek	0mm	-	20175	1732.5	22.89	24.00	1.291	-0.09	0.392	0.506
	LTE Band 4	20M	QPSK	1	0	-	Right Tilted	0mm	-	20175	1732.5	23.96	25.00	1.271	0.03	0.167	0.212
	LTE Band 4	20M	QPSK	50	0	-	Right Tilted	0mm	-	20175	1732.5	22.89	24.00	1.291	0.03	0.144	0.186
	LTE Band 4	20M	QPSK	1	0	-	Left Cheek	0mm	-	20175	1732.5	23.96	25.00	1.271	0.03	0.342	0.435
	LTE Band 4	20M	QPSK	50	0	-	Left Cheek	0mm	-	20175	1732.5	22.89	24.00	1.291	-0.13	0.275	0.355
	LTE Band 4	20M	QPSK	1	0	-	Left Tilted	0mm	-	20175	1732.5	23.96	25.00	1.271	0.06	0.196	0.249
	LTE Band 4	20M	QPSK	50	0	-	Left Tilted	0mm	-	20175	1732.5	22.89	24.00	1.291	0.07	0.163	0.210
1900MHz																	
06	GSM1900	-	-	-	-	GPRS (3 Tx slots)	Right Cheek	0mm		661	1880	26.66	27.50	1.213	0.07	0.265	**0.322**
	GSM1900	-	-	-	-	GPRS (3 Tx slots)	Right Cheek	0mm	Left earphone	661	1880	26.66	27.50	1.213	-0.06	0.256	0.311
	GSM1900	-	-	-	-	GPRS (3 Tx slots)	Right Cheek	0mm	Right earphone	661	1880	26.66	27.50	1.213	0.04	0.263	0.319
	GSM1900	-	-	-	-	GPRS (3 Tx slots)	Right Cheek	0mm	couple of earphone	661	1880	26.66	27.50	1.213	0.05	0.256	0.311
	GSM1900	-	-	-	-	GPRS (3 Tx slots)	Right Tilted	0mm	-	661	1880	26.66	27.50	1.213	-0.07	0.118	0.143
	GSM1900	-	-	-	-	GPRS (3 Tx slots)	Left Cheek	0mm	-	661	1880	26.66	27.50	1.213	-0.13	0.192	0.233
	GSM1900	-	-	-	-	GPRS (3 Tx slots)	Left Tilted	0mm	-	661	1880	26.66	27.50	1.213	0.07	0.137	0.166
07	WCDMA II	-	-	-	-	RMC 12.2Kbps	Right Cheek	0mm	-	9400	1880	24.74	25.00	1.062	0.05	0.333	**0.354**
	WCDMA II	-	-	-	-	RMC 12.2Kbps	Right Cheek	0mm	Left earphone	9400	1880	24.74	25.00	1.062	0.02	0.330	0.350
	WCDMA II	-	-	-	-	RMC 12.2Kbps	Right Cheek	0mm	Right earphone	9400	1880	24.74	25.00	1.062	0.12	0.323	0.343
	WCDMA II	-	-	-	-	RMC 12.2Kbps	Right Cheek	0mm	couple of earphone	9400	1880	24.74	25.00	1.062	0.01	0.324	0.344
	WCDMA II	-	-	-	-	RMC 12.2Kbps	Right Tilted	0mm	-	9400	1880	24.74	25.00	1.062	0.15	0.134	0.142
	WCDMA II	-	-	-	-	RMC 12.2Kbps	Left Cheek	0mm	-	9400	1880	24.74	25.00	1.062	-0.01	0.203	0.216
	WCDMA II	-	-	-	-	RMC 12.2Kbps	Left Tilted	0mm	-	9400	1880	24.74	25.00	1.062	0.08	0.158	0.168
08	LTE Band 2	20M	QPSK	1	0	-	Right Cheek	0mm	-	18900	1880	23.91	25.00	1.285	0.01	0.458	**0.589**
	LTE Band 2	20M	QPSK	1	0	-	Right Cheek	0mm	Left earphone	18900	1880	23.91	25.00	1.285	-0.15	0.310	0.398
	LTE Band 2	20M	QPSK	1	0	-	Right Cheek	0mm	Right earphone	18900	1880	23.91	25.00	1.285	0.13	0.315	0.405
	LTE Band 2	20M	QPSK	1	0	-	Right Cheek	0mm	couple of earphone	18900	1880	23.91	25.00	1.285	0.07	0.309	0.397
	LTE Band 2	20M	QPSK	50	0	-	Right Cheek	0mm	-	18900	1880	22.79	24.00	1.321	-0.06	0.339	0.448
	LTE Band 2	20M	QPSK	1	0	-	Right Tilted	0mm	-	18900	1880	23.91	25.00	1.285	-0.15	0.178	0.229
	LTE Band 2	20M	QPSK	50	0	-	Right Tilted	0mm	-	18900	1880	22.79	24.00	1.321	-0.18	0.138	0.182
	LTE Band 2	20M	QPSK	1	0	-	Left Cheek	0mm	-	18900	1880	23.91	25.00	1.285	0.18	0.307	0.395
	LTE Band 2	20M	QPSK	50	0	-	Left Cheek	0mm	-	18900	1880	22.79	24.00	1.321	0.14	0.226	0.299
	LTE Band 2	20M	QPSK	1	0	-	Left Tilted	0mm	-	18900	1880	23.91	25.00	1.285	0.04	0.199	0.256
	LTE Band 2	20M	QPSK	50	0	-	Left Tilted	0mm	-	18900	1880	22.79	24.00	1.321	0.02	0.167	0.221
2600MHz																	
09	LTE Band 7	20M	QPSK	1	0	-	Right Cheek	0mm	-	21100	2535	23.89	25.00	1.291	0.02	0.494	**0.638**
	LTE Band 7	20M	QPSK	1	0	-	Right Cheek	0mm	Left earphone	21100	2535	23.89	25.00	1.291	0.03	0.386	0.498
	LTE Band 7	20M	QPSK	1	0	-	Right Cheek	0mm	Right earphone	21100	2535	23.89	25.00	1.291	0.08	0.370	0.478
	LTE Band 7	20M	QPSK	1	0	-	Right Cheek	0mm	couple of earphone	21100	2535	23.89	25.00	1.291	0.07	0.339	0.438
	LTE Band 7	20M	QPSK	50	0	-	Right Cheek	0mm	-	21100	2535	22.77	24.00	1.327	0.04	0.417	0.554
	LTE Band 7	20M	QPSK	1	0	-	Right Tilted	0mm	-	21100	2535	23.89	25.00	1.291	0.04	0.247	0.319
	LTE Band 7	20M	QPSK	50	0	-	Right Tilted	0mm	-	21100	2535	22.77	24.00	1.327	0.04	0.205	0.272
	LTE Band 7	20M	QPSK	1	0	-	Left Cheek	0mm	-	21100	2535	23.89	25.00	1.291	-0.07	0.492	0.635
	LTE Band 7	20M	QPSK	50	0	-	Left Cheek	0mm	-	21100	2535	22.77	24.00	1.327	0.15	0.373	0.495
	LTE Band 7	20M	QPSK	1	0	-	Left Tilted	0mm	-	21100	2535	23.89	25.00	1.291	-0.11	0.180	0.232
	LTE Band 7	20M	QPSK	50	0	-	Left Tilted	0mm	-	21100	2535	22.77	24.00	1.327	-0.09	0.143	0.190

Plot No.	Band	Mode	Test Position	Gap (mm)	Headset	Ch.	Freq. (MHz)	Average Power (dBm)	Tune-Up Limit (dBm)	Tune-up Scaling Factor	Duty Cycle %	Duty Cycle Scaling Factor	Power Drift (dB)	Measured 1g SAR (W/kg)	Reported 1g SAR (W/kg)
2450MHz															
10	Bluetooth	1Mbps	Right Cheek	0mm	-	39	2441	10.12	12.00	1.542	77.68	1.287	0.03	0.018	**0.036**
	Bluetooth	1Mbps	Right Cheek	0mm	Left earphone	39	2441	10.12	12.00	1.542	77.68	1.287	-0.17	0.013	0.026
	Bluetooth	1Mbps	Right Cheek	0mm	Right earphone	39	2441	10.12	12.00	1.542	77.68	1.287	0.09	0.009	0.018
	Bluetooth	1Mbps	Right Cheek	0mm	couple of earphone	39	2441	10.12	12.00	1.542	77.68	1.287	-0.08	0.006	0.012
	Bluetooth	1Mbps	Right Tilted	0mm	-	39	2441	10.12	12.00	1.542	77.68	1.287	-0.07	0.006	0.012
	Bluetooth	1Mbps	Left Cheek	0mm	-	39	2441	10.12	12.00	1.542	77.68	1.287	0.03	0.005	0.010
	Bluetooth	1Mbps	Left Tilted	0mm	-	39	2441	10.12	12.00	1.542	77.68	1.287	0.02	0.004	0.008

14.2 Body Worn Accessory SAR

Plot No.	Band	BW (MHz)	Modulation	RB Size	RB offset	Mode	Test Position	Gap (mm)	Headset	Ch.	Freq. (MHz)	Average Power (dBm)	Tune-Up Limit (dBm)	Tune-up Scaling Factor	Power Drift (dB)	Measured 1g SAR (W/kg)	Reported 1g SAR (W/kg)
835MHz																	
11	GSM850	-	-	-	-	GPRS (3 Tx slots)	Front	15mm	-	189	836.4	29.21	30.00	1.199	0.06	0.533	**0.639**
	GSM850	-	-	-	-	GPRS (3 Tx slots)	Front	15mm	Left earphone	189	836.4	29.21	30.00	1.199	0.04	0.518	0.621
	GSM850	-	-	-	-	GPRS (3 Tx slots)	Front	15mm	Right earphone	189	836.4	29.21	30.00	1.199	-0.02	0.466	0.559
	GSM850	-	-	-	-	GPRS (3 Tx slots)	Front	15mm	couple of earphone	189	836.4	29.21	30.00	1.199	0.01	0.520	0.624
	GSM850	-	-	-	-	GPRS (3 Tx slots)	Back	15mm	-	189	836.4	29.21	30.00	1.199	0.07	0.518	0.621
	WCDMA V	-	-	-	-	RMC 12.2Kbps	Front	15mm	-	4182	836.4	24.33	25.00	1.167	-0.08	0.413	0.482
12	WCDMA V	-	-	-	-	RMC 12.2Kbps	Back	15mm	-	4182	836.4	24.33	25.00	1.167	0.03	0.473	**0.552**
	WCDMA V	-	-	-	-	RMC 12.2Kbps	Back	15mm	Left earphone	4182	836.4	24.33	25.00	1.167	-0.14	0.443	0.517
	WCDMA V	-	-	-	-	RMC 12.2Kbps	Back	15mm	Right earphone	4182	836.4	24.33	25.00	1.167	-0.02	0.434	0.506
	WCDMA V	-	-	-	-	RMC 12.2Kbps	Back	15mm	couple of earphone	4182	836.4	24.33	25.00	1.167	-0.02	0.451	0.526
	LTE Band 5	10M	QPSK	1	0	-	Front	15mm	-	20525	836.5	23.59	24.00	1.099	-0.07	0.313	0.344
	LTE Band 5	10M	QPSK	25	0	-	Front	15mm	-	20525	836.5	22.65	23.00	1.084	0.07	0.301	0.326
13	LTE Band 5	10M	QPSK	1	0	-	Back	15mm	-	20525	836.5	23.59	24.00	1.099	0.05	0.374	**0.411**
	LTE Band 5	10M	QPSK	25	0	-	Back	15mm	-	20525	836.5	22.65	23.00	1.084	-0.16	0.309	0.335
	LTE Band 5	10M	QPSK	1	0	-	Back	15mm	Left earphone	20525	836.5	23.59	24.00	1.099	-0.15	0.337	0.370
	LTE Band 5	10M	QPSK	1	0	-	Back	15mm	Right earphone	20525	836.5	23.59	24.00	1.099	0.07	0.336	0.369
	LTE Band 5	10M	QPSK	1	0	-	Back	15mm	couple of earphone	20525	836.5	23.59	24.00	1.099	0.06	0.318	0.349
1750MHz																	
	WCDMA IV	-	-	-	-	RMC 12.2Kbps	Front	15mm	-	1413	1732.6	24.77	25.00	1.054	-0.18	0.393	0.414
14	WCDMA IV	-	-	-	-	RMC 12.2Kbps	Back	15mm	-	1413	1732.6	24.77	25.00	1.054	-0.01	0.399	**0.421**
	WCDMA IV	-	-	-	-	RMC 12.2Kbps	Back	15mm	Left earphone	1413	1732.6	24.77	25.00	1.054	0.19	0.355	0.374
	WCDMA IV	-	-	-	-	RMC 12.2Kbps	Back	15mm	Right earphone	1413	1732.6	24.77	25.00	1.054	-0.02	0.327	0.345
	WCDMA IV	-	-	-	-	RMC 12.2Kbps	Back	15mm	couple of earphone	1413	1732.6	24.77	25.00	1.054	0.13	0.309	0.326
	LTE Band 4	20M	QPSK	1	0	-	Front	15mm	-	20175	1732.5	23.96	25.00	1.271	-0.15	0.266	0.338
	LTE Band 4	20M	QPSK	50	0	-	Front	15mm	-	20175	1732.5	22.89	24.00	1.291	0.02	0.214	0.276
15	LTE Band 4	20M	QPSK	1	0	-	Back	15mm	-	20175	1732.5	23.96	25.00	1.271	0.05	0.267	**0.339**
	LTE Band 4	20M	QPSK	50	0	-	Back	15mm	-	20175	1732.5	22.89	24.00	1.291	0.05	0.213	0.275
	LTE Band 4	20M	QPSK	1	0	-	Back	15mm	Left earphone	20175	1732.5	23.96	25.00	1.271	0.05	0.262	0.333
	LTE Band 4	20M	QPSK	1	0	-	Back	15mm	Right earphone	20175	1732.5	23.96	25.00	1.271	0.01	0.239	0.304
	LTE Band 4	20M	QPSK	1	0	-	Back	15mm	couple of earphone	20175	1732.5	23.96	25.00	1.271	0.15	0.225	0.286
1900MHz																	
	GSM1900	-	-	-	-	GPRS (3 Tx slots)	Front	15mm	-	661	1880	26.66	27.50	1.213	0.02	0.204	0.248
16	GSM1900	-	-	-	-	GPRS (3 Tx slots)	Back	15mm	-	661	1880	26.66	27.50	1.213	-0.03	0.313	**0.380**
	GSM1900	-	-	-	-	GPRS (3 Tx slots)	Back	15mm	Left earphone	661	1880	26.66	27.50	1.213	0.05	0.240	0.291
	GSM1900	-	-	-	-	GPRS (3 Tx slots)	Back	15mm	Right earphone	661	1880	26.66	27.50	1.213	0.15	0.248	0.301
	GSM1900	-	-	-	-	GPRS (3 Tx slots)	Back	15mm	couple of earphone	661	1880	26.66	27.50	1.213	0.14	0.243	0.295
	WCDMA II	-	-	-	-	RMC 12.2Kbps	Front	15mm	-	9400	1880	24.74	25.00	1.062	-0.12	0.262	0.278
17	WCDMA II	-	-	-	-	RMC 12.2Kbps	Back	15mm	-	9400	1880	24.74	25.00	1.062	0.01	0.421	**0.447**
	WCDMA II	-	-	-	-	RMC 12.2Kbps	Back	15mm	Left earphone	9400	1880	24.74	25.00	1.062	-0.13	0.376	0.399
	WCDMA II	-	-	-	-	RMC 12.2Kbps	Back	15mm	Right earphone	9400	1880	24.74	25.00	1.062	0.05	0.377	0.400
	WCDMA II	-	-	-	-	RMC 12.2Kbps	Back	15mm	couple of earphone	9400	1880	24.74	25.00	1.062	0.04	0.379	0.402
	LTE Band 2	20M	QPSK	1	0	-	Front	15mm	-	18900	1880	23.91	25.00	1.285	0.1	0.187	0.240
	LTE Band 2	20M	QPSK	50	0	-	Front	15mm	-	18900	1880	22.79	24.00	1.321	-0.07	0.136	0.180
18	LTE Band 2	20M	QPSK	1	0	-	Back	15mm	-	18900	1880	23.91	25.00	1.285	-0.05	0.370	**0.476**
	LTE Band 2	20M	QPSK	50	0	-	Back	15mm	-	18900	1880	22.79	24.00	1.321	0.01	0.298	0.394
	LTE Band 2	20M	QPSK	1	0	-	Back	15mm	Left earphone	18900	1880	23.91	25.00	1.285	0.01	0.307	0.395
	LTE Band 2	20M	QPSK	1	0	-	Back	15mm	Right earphone	18900	1880	23.91	25.00	1.285	0.06	0.305	0.392
	LTE Band 2	20M	QPSK	1	0	-	Back	15mm	couple of earphone	18900	1880	23.91	25.00	1.285	0.04	0.315	0.405
2600MHz																	
	LTE Band 7	20M	QPSK	1	0	-	Front	15mm	-	21100	2535	23.89	25.00	1.291	-0.05	0.105	0.136

	LTE Band 7	20M	QPSK	50	0	-	Front	15mm	-	21100	2535	22.77	24.00	1.327	-0.04	0.087	0.115
19	LTE Band 7	20M	QPSK	1	0	-	Back	15mm	-	21100	2535	23.89	25.00	1.291	0.06	0.143	**0.185**
	LTE Band 7	20M	QPSK	50	0	-	Back	15mm	-	21100	2535	22.77	24.00	1.327	0.05	0.105	0.139
	LTE Band 7	20M	QPSK	1	0	-	Back	15mm	Left earphone	21100	2535	23.89	25.00	1.291	-0.13	0.131	0.169
	LTE Band 7	20M	QPSK	1	0	-	Back	15mm	Right earphone	21100	2535	23.89	25.00	1.291	0.03	0.142	0.183
	LTE Band 7	20M	QPSK	1	0	-	Back	15mm	couple of earphone	21100	2535	23.89	25.00	1.291	0.07	0.141	0.182

Plot No.	Band	Mode	Test Position	Gap (mm)	Headset	Ch.	Freq. (MHz)	Average Power (dBm)	Tune-Up Limit (dBm)	Tune-up Scaling Factor	Duty Cycle %	Duty Cycle Scaling Factor	Power Drift (dB)	Measured 1g SAR (W/kg)	Reported 1g SAR (W/kg)
2450MHz															
	Bluetooth	1Mbps	Front	15mm	-	39	2441	10.12	12.00	1.542	77.68	1.287	0.05	0.002	0.004
20	Bluetooth	1Mbps	Back	15mm	-	39	2441	10.12	12.00	1.542	77.68	1.287	0.05	0.004	**0.008**
	Bluetooth	1Mbps	Back	15mm	Left earphone	39	2441	10.12	12.00	1.542	77.68	1.287	0.02	0.002	0.004
	Bluetooth	1Mbps	Back	15mm	Right earphone	39	2441	10.12	12.00	1.542	77.68	1.287	0.06	0.002	0.004
	Bluetooth	1Mbps	Back	15mm	couple of earphone	39	2441	10.12	12.00	1.542	77.68	1.287	-0.03	0.003	0.006

15. Simultaneous Transmission Analysis

No.	Simultaneous Transmission Configurations	Portable Handset	
		Head	Body-worn
1.	WWAN + Bluetooth	Yes	Yes

General Note:
1. This device supports VoIP in GPRS, WCDMA and LTE (e.g. for 3rd-party VoIP), LTE supports VoLTE operation.
2. EUT will choose each GSM, WCDMA and LTE according to the network signal condition; therefore, they will not operate simultaneously at any moment.
3. The Bluetooth don't support tethering applications.
4. According to the EUT characteristic, WWAN and Bluetooth can transmit simultaneously.
5. The maximum SAR summation is calculated based on the same configuration and test position.
6. Per KDB 447498 D01v06, simultaneous transmission SAR is compliant if,
   i) 1g Scalar SAR summation < 1.6W/kg.
   ii) SPLSR = (SAR1 + SAR2)^1.5 / (min. separation distance, mm), and the peak separation distance is determined from the square root of [(x1-x2)2 + (y1-y2)2 + (z1-z2)2], where (x1, y1, z1) and (x2, y2, z2) are the coordinates of the extrapolated peak SAR locations in the zoom scan.
   iii) If SPLSR ≤ 0.04 for 1g SAR, simultaneously transmission SAR measurement is not necessary.
   iv) Simultaneously transmission SAR measurement, and the reported multi-band 1g SAR < 1.6W/kg.

15.1 Head Exposure Conditions

WWAN Band		Exposure Position	1 WWAN 1g SAR (W/kg)	2 Bluetooth 1g SAR (W/kg)	1+2 Summed 1g SAR (W/kg)
GSM	GSM850	Right Cheek	0.880	0.036	0.92
		Right Tilted	0.513	0.012	0.53
		Left Cheek	0.820	0.010	0.83
		Left Tilted	0.463	0.008	0.47
	GSM1900	Right Cheek	0.322	0.036	0.36
		Right Tilted	0.143	0.012	0.16
		Left Cheek	0.233	0.010	0.24
		Left Tilted	0.166	0.008	0.17
WCDMA	WCDMA II	Right Cheek	0.354	0.036	0.39
		Right Tilted	0.142	0.012	0.15
		Left Cheek	0.216	0.010	0.23
		Left Tilted	0.168	0.008	0.18
	WCDMA IV	Right Cheek	0.705	0.036	0.74
		Right Tilted	0.626	0.012	0.64
		Left Cheek	0.530	0.010	0.54
		Left Tilted	0.689	0.008	0.70
	WCDMA V	Right Cheek	0.748	0.036	0.78
		Right Tilted	0.427	0.012	0.44
		Left Cheek	0.758	0.010	0.77
		Left Tilted	0.459	0.008	0.47
LTE	LTE Band 2	Right Cheek	0.589	0.036	0.63
		Right Tilted	0.229	0.012	0.24
		Left Cheek	0.395	0.010	0.41
		Left Tilted	0.256	0.008	0.26
	LTE Band 4	Right Cheek	0.592	0.036	0.63
		Right Tilted	0.212	0.012	0.22
		Left Cheek	0.435	0.010	0.45
		Left Tilted	0.249	0.008	0.26
	LTE Band 5	Right Cheek	0.443	0.036	0.48
		Right Tilted	0.260	0.012	0.27
		Left Cheek	0.677	0.010	0.69
		Left Tilted	0.273	0.008	0.28
	LTE Band 7	Right Cheek	0.638	0.036	0.67
		Right Tilted	0.319	0.012	0.33
		Left Cheek	0.635	0.010	0.65
		Left Tilted	0.232	0.008	0.24

15.2 Body-Worn Accessory Exposure Conditions

WWAN Band	Exposure Position	1 WWAN 1g SAR (W/kg)	2 Bluetooth 1g SAR (W/kg)	1+2 Summed 1g SAR (W/kg)
GSM850	Front	0.639	0.004	0.64
	Back	0.621	0.008	0.63
GSM1900	Front	0.248	0.004	0.25
	Back	0.380	0.008	0.39
WCDMA II	Front	0.278	0.004	0.28
	Back	0.447	0.008	0.46
WCDMA IV	Front	0.414	0.004	0.42
	Back	0.421	0.008	0.43
WCDMA V	Front	0.482	0.004	0.49
	Back	0.552	0.008	0.56
LTE Band 2	Front	0.240	0.004	0.24
	Back	0.476	0.008	0.48
LTE Band 4	Front	0.338	0.004	0.34
	Back	0.339	0.008	0.35
LTE Band 5	Front	0.344	0.004	0.35
	Back	0.411	0.008	0.42
LTE Band 7	Front	0.136	0.004	0.14
	Back	0.185	0.008	0.19

Test Engineer : Martin Li, Varus Wang, Light Wang, Ricky Gu, Damon Zhu

16. Uncertainty Assessment

Per KDB 865664 D01 SAR measurement 100MHz to 6GHz, when the highest measured 1-g SAR within a frequency band is < 1.5 W/kg and the measured 10-g SAR within a frequency band is < 3.75 W/kg. The expanded SAR measurement uncertainty must be ≤ 30%, for a confidence interval of k = 2. If these conditions are met, extensive SAR measurement uncertainty analysis described in IEEE Std 1528-2013 is not required in SAR reports submitted for equipment approval. For this device, the highest measured 1-g SAR is less 1.5W/kg and highest measured 10-g SAR is less 3.75W/kg. Therefore, the measurement uncertainty table is not required in this report.

17. References

[1] FCC 47 CFR Part 2 “Frequency Allocations and Radio Treaty Matters; General Rules and Regulations”

[2] ANSI/IEEE Std. C95.1-1992, “IEEE Standard for Safety Levels with Respect to Human Exposure to Radio Frequency Electromagnetic Fields, 3 kHz to 300 GHz”, September 1992

[3] 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”, Sep 2013

[4] SPEAG DASY System Handbook

[5] FCC KDB 865664 D01 v01r04, "SAR Measurement Requirements for 100 MHz to 6 GHz", Aug 2015.

[6] FCC KDB 865664 D02 v01r02, “RF Exposure Compliance Reporting and Documentation Considerations” Oct 2015.

[7] FCC KDB 447498 D01 v06, “Mobile and Portable Device RF Exposure Procedures and Equipment Authorization Policies”, Oct 2015

[8] FCC KDB 648474 D04 v01r03, “SAR Evaluation Considerations for Wireless Handsets”, Oct 2015.

[9] FCC KDB 941225 D01 v03r01, “3G SAR MEAUREMENT PROCEDURES”, Oct 2015

[10] FCC KDB 941225 D05 v02r05, “SAR Evaluation Considerations for LTE Devices”, Dec 2015

------THE END------

Appendix A. Plots of System Performance Check

The plots are shown as follows.

Date: 2022-05-30

System Check_Head_835MHz

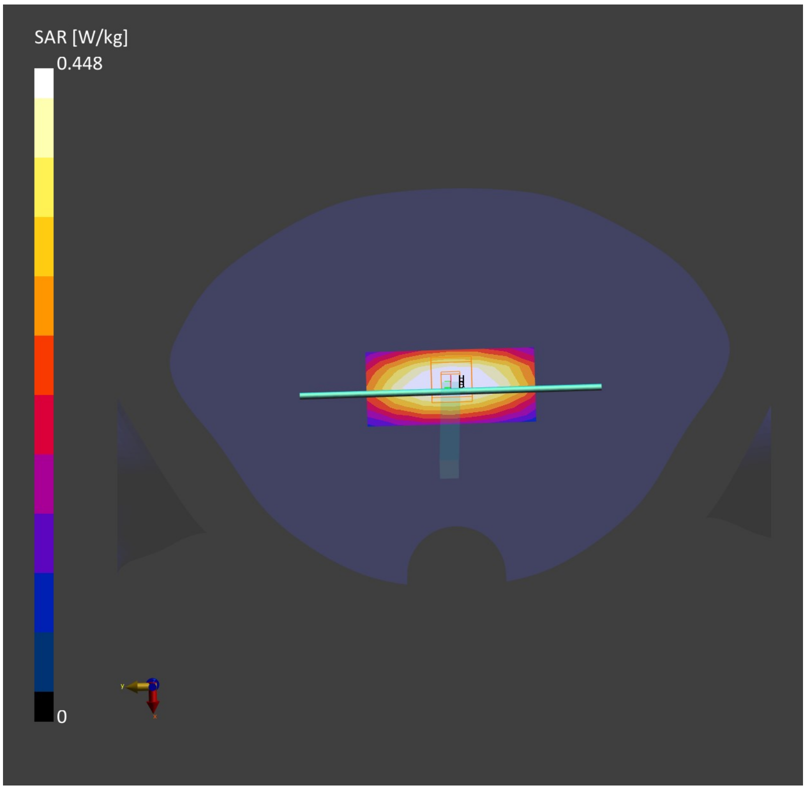
DUT: D835V2-SN:4d162

Communication System: ; Frequency: 835.0
Medium: HSL. Medium parameters used: f= 835.0 MHz; σ= 0.926 S/m; ε_r = 41.1
Ambient Temperature: 23.2°C; Liquid Temperature: 22.8°C

DASY6 Configuration:
- Probe: EX3DV4 - SN3887; ConvF(9.38, 9.38, 9.38); Calibrated: 2021-10-22
- Sensor-Surface: 1.4 mm
- Electronics: DAE4 Sn1649; Calibrated: 2022-03-30
- Phantom: Twin-SAM V8.0 (30deg probe tilt); Serial: 2074; Section: Flat
- Measurement Software: cDASY6 V6.6.0.13926

Area Scan (40.0 mm x 90.0 mm): Measurement Grid: 15.0 mm x 15.0 mm
SAR (1g) = 0.437 W/kg; SAR (10g) = 0.290 W/kg;

Zoom Scan (32.0 mm x 32.0 mm x 30.0 mm): Measurement Grid: 8.0 mm x 8.0 mm x 5.0 mm
Power Drift = 0.01 dB
SAR (1g) = 0.448 W/kg; SAR (10g) = 0.291 W/kg;



Date: 2022-06-01

System Check_Head_1750MHz

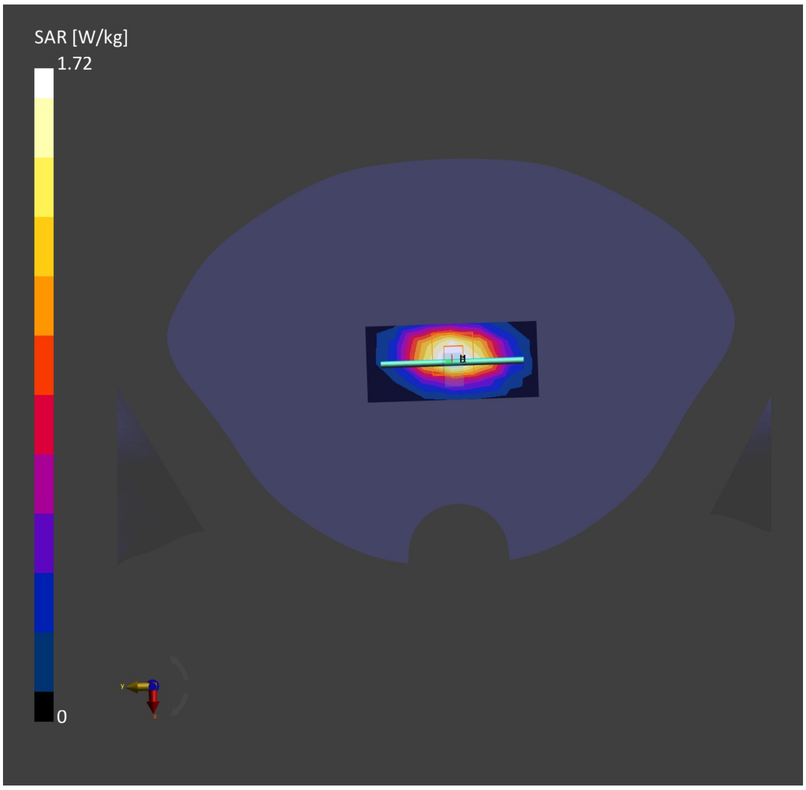
DUT: D1750V2-SN:1090

Communication System: ; Frequency: 1750.0
Medium: HSL. Medium parameters used: f= 1750.0 MHz; σ= 1.36 S/m; ε_r = 40.9
Ambient Temperature: 23.2°C; Liquid Temperature: 22.5°C

DASY6 Configuration:
- Probe: EX3DV4 - SN3887; ConvF(8.42, 8.42, 8.42); Calibrated: 2021-10-22
- Sensor-Surface: 1.4 mm
- Electronics: DAE4 Sn1649; Calibrated: 2022-03-30
- Phantom: Twin-SAM V8.0 (30deg probe tilt); Serial: 2074; Section: Flat
- Measurement Software: cDASY6 V6.6.0.13926

Area Scan (40.0 mm x 90.0 mm): Measurement Grid: 15.0 mm x 15.0 mm
SAR (1g) = 1.63 W/kg; SAR (10g) = 0.896 W/kg;

Zoom Scan (32.0 mm x 32.0 mm x 30.0 mm): Measurement Grid: 8.0 mm x 8.0 mm x 5.0 mm
Power Drift = -0.01 dB
SAR (1g) = 1.72 W/kg; SAR (10g) = 0.901 W/kg;



Date: 2022-06-05

System Check_Head_1900MHz

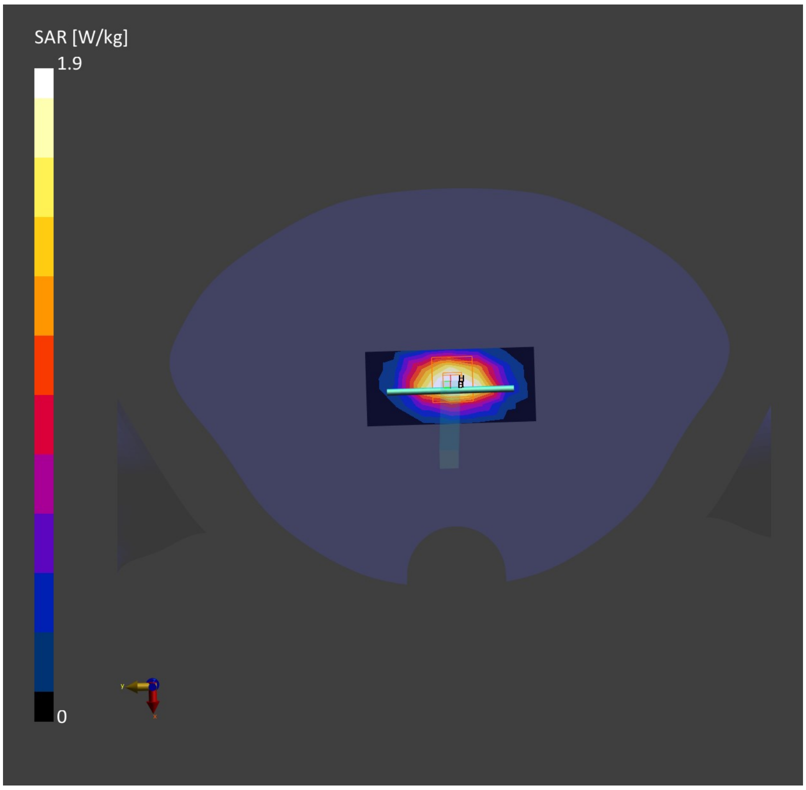
DUT: D1900V2-SN:5d182

Communication System: ; Frequency: 1900.0
Medium: HSL. Medium parameters used: f= 1900.0 MHz; σ= 1.45 S/m; ε_r = 40.7
Ambient Temperature: 23.2°C; Liquid Temperature: 22.9°C

DASY6 Configuration:
- Probe: EX3DV4 - SN3887; ConvF(8.2, 8.2, 8.2); Calibrated: 2021-10-22
- Sensor-Surface: 1.4 mm
- Electronics: DAE4 Sn1649; Calibrated: 2022-03-30
- Phantom: Twin-SAM V8.0 (30deg probe tilt); Serial: 2074; Section: Flat
- Measurement Software: cDASY6 V6.6.0.13926

Area Scan (40.0 mm x 90.0 mm): Measurement Grid: 15.0 mm x 15.0 mm
SAR (1g) = 1.85 W/kg; SAR (10g) = 0.977 W/kg;

Zoom Scan (32.0 mm x 32.0 mm x 30.0 mm): Measurement Grid: 8.0 mm x 8.0 mm x 5.0 mm
Power Drift = 0.06 dB
SAR (1g) = 1.90 W/kg; SAR (10g) = 0.994 W/kg;



Date: 2022-06-11

System Check_Head_2450MHz

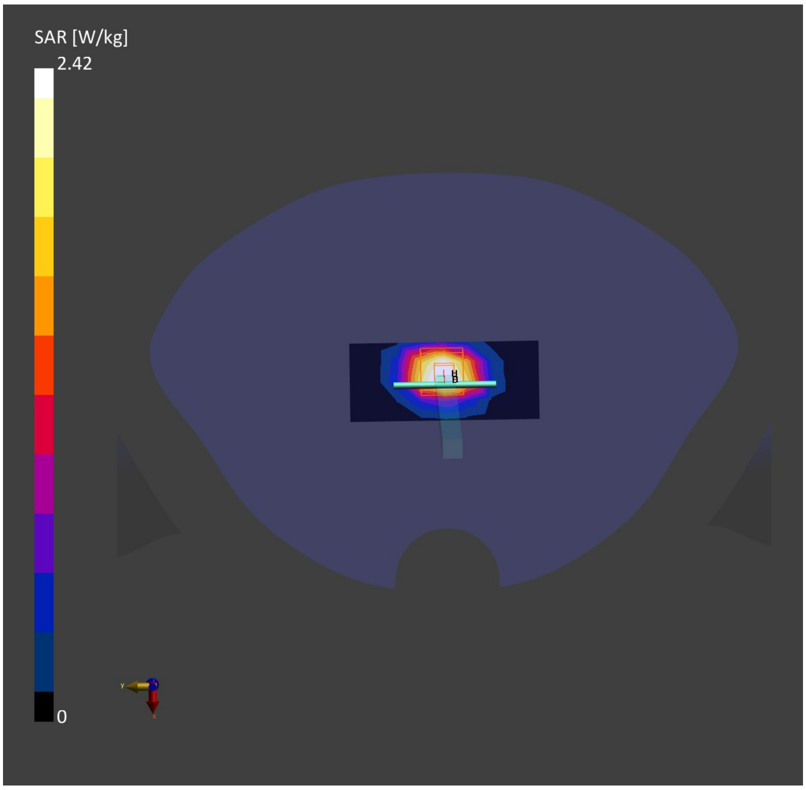
DUT: D2450V2-SN:924

Communication System: ; Frequency: 2450.0
Medium: HSL. Medium parameters used: f= 2450.0 MHz; σ= 1.80 S/m; ε_r = 38.6
Ambient Temperature: 23.3°C; Liquid Temperature: 22.8°C

DASY6 Configuration:
- Probe: EX3DV4 - SN3887; ConvF(7.48, 7.48, 7.48); Calibrated: 2021-10-22
- Sensor-Surface: 1.4 mm
- Electronics: DAE4 Sn1649; Calibrated: 2022-03-30
- Phantom: Twin-SAM V8.0 (30deg probe tilt); Serial: 2074; Section: Flat
- Measurement Software: cDASY6 V6.6.0.13926

Area Scan (40.0 mm x 96.0 mm): Measurement Grid: 12.0 mm x 12.0 mm
SAR (1g) = 2.30 W/kg; SAR (10g) = 1.12 W/kg;

Zoom Scan (30.0 mm x 30.0 mm x 30.0 mm): Measurement Grid: 5.0 mm x 5.0 mm x 5.0 mm
Power Drift = 0.02 dB
SAR (1g) = 2.42 W/kg; SAR (10g) = 1.13 W/kg;



Date: 2022-06-13

System Check_Head_2600MHz

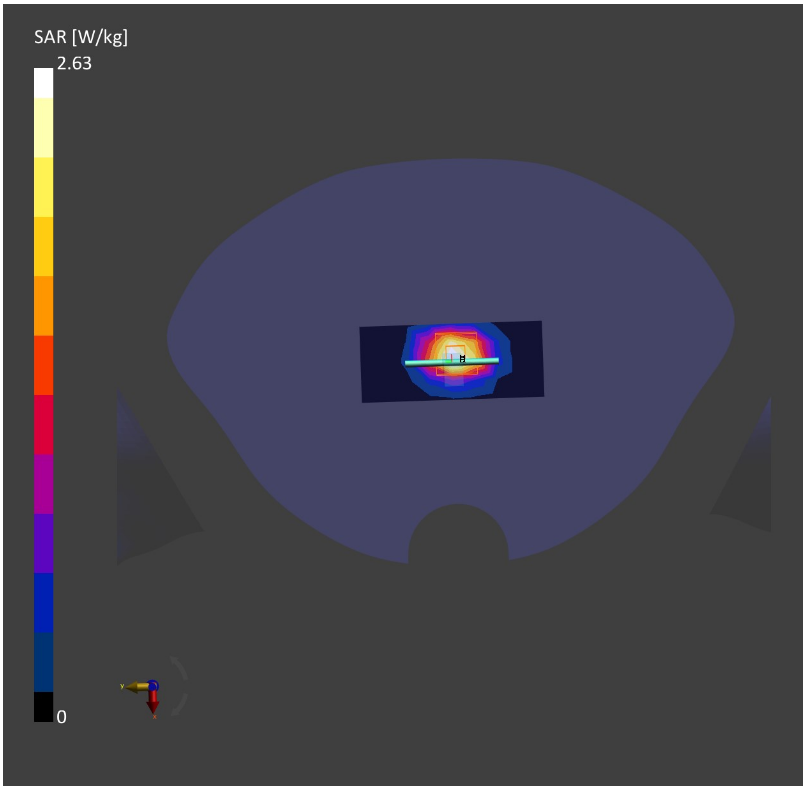
DUT: D2600V2-SN:1061

Communication System: ; Frequency: 2600.0
Medium: HSL. Medium parameters used: f= 2600.0 MHz; σ= 1.93 S/m; ε_r = 39.0
Ambient Temperature: 23.4°C; Liquid Temperature: 22.6°C

DASY6 Configuration:
- Probe: EX3DV4 - SN3887; ConvF(7.24, 7.24, 7.24); Calibrated: 2021-10-22
- Sensor-Surface: 1.4 mm
- Electronics: DAE4 Sn1649; Calibrated: 2022-03-30
- Phantom: Twin-SAM V8.0 (30deg probe tilt); Serial: 2074; Section: Flat
- Measurement Software: cDASY6 V6.6.0.13926

Area Scan (40.0 mm x 96.0 mm): Measurement Grid: 12.0 mm x 12.0 mm
SAR (1g) = 2.40 W/kg; SAR (10g) = 1.13 W/kg;

Zoom Scan (30.0 mm x 30.0 mm x 30.0 mm): Measurement Grid: 5.0 mm x 5.0 mm x 5.0 mm
Power Drift = 0.01 dB
SAR (1g) = 2.63 W/kg; SAR (10g) = 1.19 W/kg;



Appendix B. Plots of High SAR Measurement

The plots are shown as follows.

Date: 2022-05-30

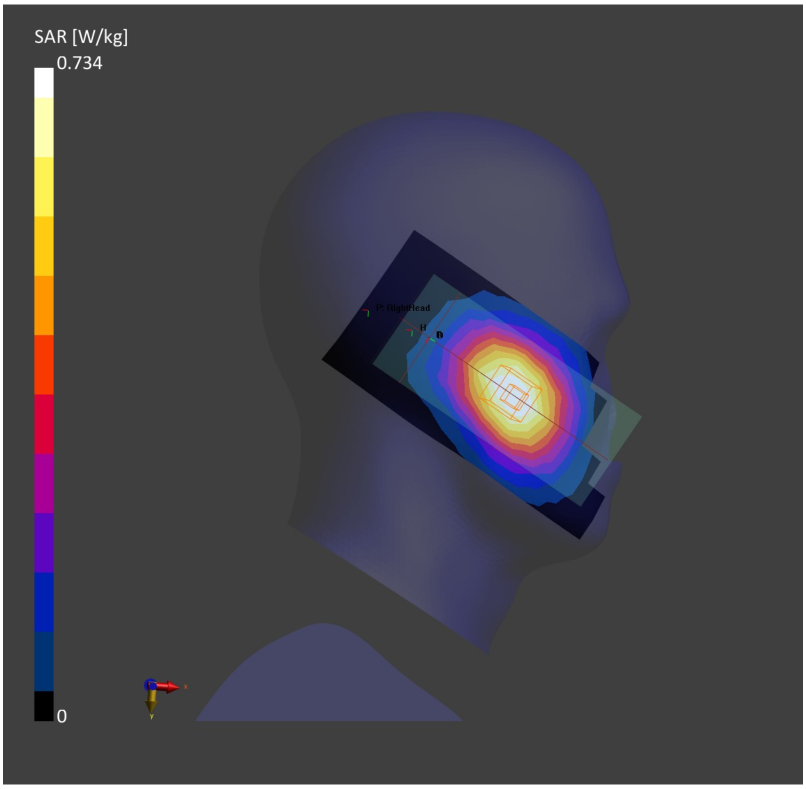
01_GSM850_GPRS (3 Tx slots)_Right Cheek_0mm_Ch189

Communication System: GSM 850; Frequency: 836.4
Medium: HSL. Medium parameters used: f= 836.4 MHz; σ= 0.926 S/m; ε_r = 41.0
Ambient Temperature: 23.2°C; Liquid Temperature: 22.8°C

DASY6 Configuration:
- Probe: EX3DV4 - SN3887; ConvF(9.38, 9.38, 9.38); Calibrated: 2021-10-22
- Sensor-Surface: 1.4 mm
- Electronics: DAE4 Sn1649; Calibrated: 2022-03-30
- Phantom: Twin-SAM V8.0 (30deg probe tilt); Serial: 2074; Section: RightHead
- Measurement Software: cDASY6 V6.6.0.13926

Area Scan (90.0 mm x 180.0 mm): Measurement Grid: 15.0 mm x 15.0 mm
SAR (1g) = 0.696 W/kg; SAR (10g) = 0.472 W/kg;

Zoom Scan (32.0 mm x 32.0 mm x 30.0 mm): Measurement Grid: 8.0 mm x 8.0 mm x 5.0 mm
Power Drift = -0.01 dB
SAR (1g) = 0.734 W/kg; SAR (10g) = 0.532 W/kg;



Date: 2022-05-30

02_WCDMA V_RMC 12.2Kbps_Left Cheek_0mm_Ch4182

Communication System: Band 5, UTRA/FDD; Frequency: 836.4
Medium: HSL. Medium parameters used: f= 836.4 MHz; σ= 0.926 S/m; ε_r = 41.0
Ambient Temperature: 23.2°C; Liquid Temperature: 22.8°C

DASY6 Configuration:
- Probe: EX3DV4 - SN3887; ConvF(9.38, 9.38, 9.38); Calibrated: 2021-10-22
- Sensor-Surface: 1.4 mm
- Electronics: DAE4 Sn1649; Calibrated: 2022-03-30
- Phantom: Twin-SAM V8.0 (30deg probe tilt); Serial: 2074; Section: LeftHead
- Measurement Software: cDASY6 V6.6.0.13926

Area Scan (90.0 mm x 180.0 mm): Measurement Grid: 15.0 mm x 15.0 mm
SAR (1g) = 0.611 W/kg; SAR (10g) = 0.417 W/kg;

Zoom Scan (32.0 mm x 32.0 mm x 30.0 mm): Measurement Grid: 8.0 mm x 8.0 mm x 5.0 mm
Power Drift = 0.05 dB
SAR (1g) = 0.650 W/kg; SAR (10g) = 0.474 W/kg;