

FCC SAR Test Report

FCC ID: YR8ES820

Project No. : 2108H047
Equipment : 4G waterproof GPS Tracker
Brand Name : esky
Test Model : ES820
Series Model : N/A
Date of Receipt : Aug. 26, 2021
Date of Test : Sep. 02, 2021 ~ Sep. 26, 2021
Issued Date : Nov. 08, 2021
Report Version : R01
Test Sample : Engineering Sample No.: SH2021082426.
Standard(s) : Please refer to page 2.
Applicant : eSky wireless Inc.
Address : A311#,258,Road Ren'ai suzhou china
Manufacturer : eSky wireless Inc.
Address : A311#,258,Road Ren'ai suzhou china

The above equipment has been tested and found compliance with the requirement of the relative standards by BTL Inc.



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TESTING CERT #5123.02

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

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

KDB941225 D01 3G SAR Procedures v03r01
KDB941225 D05 SAR for LTE Devices v02r05
KDB447498 D01 General RF Exposure Guidance v06
KDB865664 D01 SAR measurement 100 MHz to 6 GHz v01r04
KDB865664 D02 SAR Reporting v01r02
KDB690783 D01 SAR Listings on Grants v01r03

Declaration

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Limitation

For the use of the authority's logo is limited unless the Test Standard(s)/Scope(s)/Item(s) mentioned in this test report is (are) included in the conformity assessment authorities acceptance respective.

Please note that the measurement uncertainty is provided for informational purpose only and are not use in determining the Pass/Fail results.

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REPORT ISSUED HISTORY

Report Version	Description	Issued Date
R00	Original Issue.	Nov. 05, 2021
R01	Modified the comments of TCB.	Nov. 08, 2021

1. GENERAL INFORMATION

1.1 STATEMENT OF COMPLIANCE

Mode	Highest Reported PTT (10mm) SAR-1g (W/kg)	Highest Reported Extremity (0mm) SAR-10g (W/kg)
UMTS B2	0.926	3.598
UMTS B4	0.838	3.699
UMTS B5	0.066	1.787
LTE B2	0.773	3.264
LTE B4	0.859	3.004
LTE B5	0.493	2.401
LTE B12	0.080	3.930
LTE B13	0.294	2.908
LTE B14	0.309	2.794
LTE B66	0.961	3.521
LTE B71	0.060	3.796

Note:

1) The device is in compliance with Specific Absorption Rate (SAR) for general population uncontrolled exposure limits according to the FCC rule §2.1093, the ANSI C95.1:1992/IEEE C95.1:1991, the NCRP Report Number 86 for uncontrolled environment and had been tested in accordance with the measurement methods and procedures specified in IEEE Std 1528-2013.

1.2 LABORATORY ENVIRONMENT

Temperature	Min. = 18°C, Max. = 25°C
Relative humidity	Min. = 30%, Max. = 70%
Ground system resistance	< 0.5Ω
Ambient noise is checked and found very low and in compliance with requirement of standards.	
Reflection of surrounding objects is minimized and in compliance with requirement of standards.	

1.3 GENERAL DESCRIPTION OF EUT

Equipment	4G waterproof GPS Tracker		
Brand Name	esky		
Test Model	ES820		
Series Model	N/A		
Model Difference(s)	N/A		
Hardware Version	ES820-MB-H102		
Modulation	UMTS(QPSK/16QAM), LTE(QPSK/16QAM/64QAM)		
Operation Frequency Range(s)	Band	TX (MHz)	RX (MHz)
	UMTS B2	1850~1910	1930~1990
	UMTS B4	1710~1755	2110~2155
	UMTS B5	824~849	869~894
	LTE B2	1850~1910	1930~1990
	LTE B4	1710~1755	2110~2155
	LTE B5	824~849	869~894
	LTE B12	699~716	729~746
	LTE B13	777~787	746~756
	LTE B14	788~798	758~768
	LTE B66	1710~1780	2110~2180
	LTE B71	663~698	617~652
HSDPA UE Category	24		
HSUPA UE Category	6		
DC-HSDPA Category	24		
HSPA+ Category	6		
Power Class	3, tested with power control "all up bits" (UMTS B2/4/5)		
	3, tested with power control "all Max" (LTE B2/4/5/12/13/14/66/71)		
Test Channels (low-mid-high)	9262-9400-9538 (UMTS B2)		
	1312-1413-1513 (UMTS B4)		
	4132-4182-4233 (UMTS B5)		
	18700-18900-19100 (LTE B2 BW=20MHz)		
	20050-20175-20300 (LTE B4 BW=20MHz)		
	20450-20525-20600 (LTE B5 BW=10MHz)		
	20850-21100-21350 (LTE B7 BW=20MHz)		
	23060-23095-23130 (LTE B12 BW=10MHz)		
	23230 (LTE B13 BW=10MHz)		
	23330 (LTE B14 BW=10MHz)		
	132072-132322-132572 (LTE B66 BW=20MHz)		
	133222-133322-133372 (LTE B71 BW=20MHz)		

Antenna Gain (dBi)	Band	Gain
	UMTS B2	1.997112536
	UMTS B4	2.983971461
	UMTS B5	-4.448946567
	LTE B2	1.997112536
	LTE B4	2.983971461
	LTE B5	-4.448946567
	LTE B12	-1.293400945
	LTE B13	-1.293400945
	LTE B14	-1.293400945
	LTE B66	2.983971461
	LTE B71	-0.861487628
Other Information		
Battery	Model Name	YL 753943
	Power Rating	DC 3.7V, 1500mAh, 5.55Wh

1.4 MAIN TEST INSTRUMENTS

Item	Equipment	Manufacturer	Model	Serial No.	Cal. Date	Cal. Interval
1	Data Acquisition Electronics	Speag	DAE4	1390	Nov. 06, 2020	1 Year
2	Data Acquisition Electronics	Speag	DAE4	420	Dec. 09, 2020	1 Year
3	Data Acquisition Electronics	Speag	DAE4	1423	Dec. 11, 2020	1 Year
4	E-field Probe	Speag	ES3DV3	3162	Jun. 15, 2021	1 Year
5	E-field Probe	Speag	EX3DV4	3974	Dec. 18, 2020	1 Year
6	E-field Probe	Speag	EX3DV4	7544	Oct. 29, 2020	1 Year
7	System Validation Dipole	Speag	D750V3	1095	Jun. 01, 2021	3 Years
8	System Validation Dipole	Speag	D835V2	4d160	Jun. 01, 2021	3 Years
9	System Validation Dipole	Speag	D1750V2	1101	Jun. 01, 2021	3 Years
10	System Validation Dipole	Speag	D1900V2	5d179	May 31, 2021	3 Years
11	Twin Sam Phantom	Speag	Twin Sam Phantom V5.0	1784	N/A	N/A
12	Twin Sam Phantom	Speag	Twin Sam Phantom V5.0	1896	N/A	N/A
13	Radio Communication Analver	Anritsu	MT8821C	6261915479	Jul. 24, 2021	1 Year
14	Wideband Radio Communication Tester	R&S	CMW500	104462	Jul. 27, 2021	1 Year
15	Power Amplifier	Mini-Circuits	ZHL-42W+	QA1333003	Dec. 29, 2020	1 Year
16	DC Source meter	Iteck	IT6154	006104126768201001	Jul. 24, 2021	1 Year
17	Signal Analyzer	R&S	FSV7	103120	Jul. 10, 2021	1 Year
18	Vector Network Analyzer	Agilent	E5071C	MY46102965	Feb. 28, 2021	1 Year
19	Signal Generator	Agilent	N5172B	MY53050758	Feb. 27, 2021	1 Year
20	Smart Power Sensor	R&S	NRP-Z21	102209	Feb. 28, 2021	1 Year
21	3.5mm Economy Calibration Kit	Agilent	85052D	MY43252246	Dec. 10, 2020	1 Year
22	Dielectric Assessment Kit	Speag	DAK-3.5	1226	N/A	N/A
23	Directional Coupler	Woken	TS-PCC0M-05	0107090019	Feb. 27, 2021	1 Year
24	Coupler	Woken	0110A05601O-10	COM5BNW1A2	Feb. 27, 2021	1 Year
25	Digital Thermometer	LKM	DTM3000	3519	Jun. 24, 2021	1 Year

Remark:

1. "N/A" denotes no model name, serial No. or calibration specified.

2.

1) Per KDB865664 D01 requirements for dipole calibration, the test laboratory has adopted three-year extended calibration interval. Each measured dipole is expected to evaluate with the following criteria at least on annual interval in Appendix C.

a) There is no physical damage on the dipole;

b) System check with specific dipole is within 10% of calibrated value;

c) The most recent return-loss result, measured at least annually, deviates by no more than 20% from the previous measurement;

d) The most recent measurement of the real or imaginary parts of the impedance, measured at least annually is within 5Ω from the previous measurement.

2) Network analyzer probe calibration against air, distilled water and a short block performed before measuring liquid parameters.

2. RF EMISSIONS MEASUREMENT

2.1 TEST FACILITY

The test facilities used to collect the test data in this report is SAR room at the location of Room 108, Building 2, No.1, Yile Road, Songshan Lake Zone, Dongguan City, Guangdong, People's Republic of China.

2.2 MEASUREMENT UNCERTAINTY

Note: Per KDB865664 D01 SAR Measurement 100 MHz to 6 GHz, when the highest measured 1-g SAR within a frequency band is < 1.5 W/kg, the extensive SAR measurement uncertainty analysis described in IEEE Std 1528-2013 is not required in SAR reports submitted for equipment approval. The equivalent ratio (1.5/1.6) is applied to extremity and occupational exposure conditions.

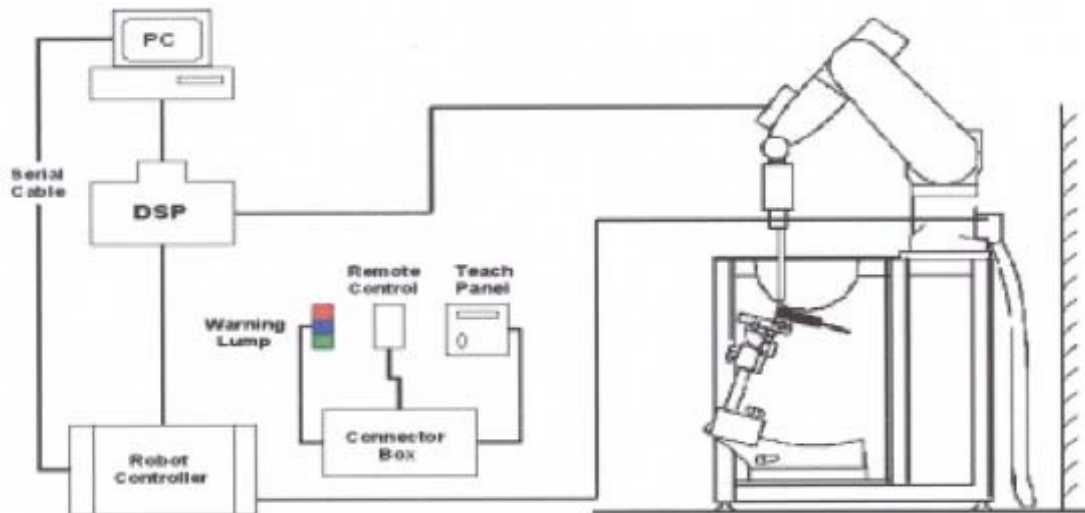
3. SAR MEASUREMENTS SYSTEM CONFIGURATION

3.1 SAR MEASUREMENT SET-UP

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

1. A standard high precision 6-axis robot (Stäubli RX family) with controller and software. An arm extension for accommodating the data acquisition electronics (DAE).
2. A dosimetric 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.
3. A data acquisition electronic (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.
4. A unit to operate the optical surface detector which is connected to the EOC.
5. The Electro-Optical Coupler (EOC) performs the conversion from the optical into a digital electric signal of the DAE. The EOC is connected to the DASY5 measurement server.
6. The DASY5 measurement server, which performs all real-time data evaluation for field measurements and surface detection, controls robot movements and handles safety operation. A computer operating Windows 7
7. DASY5 software and SEMCAD data evaluation software.
8. Remote control with teach panel and additional circuitry for robot safety such as warning lamps, etc.
9. The generic twin phantom enabling the testing of left-hand and right-hand usage.
10. The device holder for handheld mobile phones.
11. Tissue simulating liquid mixed according to the given recipes.
12. System validation dipoles allowing to validate the proper functioning of the system.

3.1.1 TEST SETUP LAYOUT



3.2 DASY5 E-FIELD PROBE SYSTEM

The SAR measurements were conducted with the dosimetric probe EX3DV4 (manufactured by SPEAG), designed in the classical triangular configuration and optimized for dosimetric evaluation.

3.2.1 PROBE SPECIFICATION

Construction	Symmetrical design with triangular core Interleaved sensors Built-in shielding against static charges PEEK enclosure material (resistant to organic solvents, e.g., DGBE)
Calibration	ISO/IEC 17025 calibration service available
Frequency	10 MHz to 6 GHz Linearity: ± 0.2 dB (30 MHz to 6 GHz)
Directivity	± 0.3 dB in HSL (rotation around probe axis) ± 0.5 dB in tissue material (rotation normal to probe axis)
Dynamic Range	10 μ W/g to > 100 mW/g Linearity: ± 0.2 dB
Dimensions	Overall length: 330 mm (Tip: 20 mm) Tip diameter: 2.5 mm (Body: 12 mm) Distance from probe tip to dipole centers: 1.0 mm



E-field Probe

3.2.2 E-FIELD PROBE CALIBRATION

Each probe is calibrated according to a dosimetric assessment procedure with accuracy better than $\pm 10\%$. The spherical isotropy was evaluated and found to be better than $\pm 0.25\text{dB}$. The sensitivity parameters (NormX, NormY, NormZ), the diode compression parameter (DCP) and the conversion factor (ConvF) of the probe are tested.

The free space E-field from amplified probe outputs is determined in a test chamber. This is performed in a TEM cell for frequencies below 1 GHz, and in a wave guide above 1 GHz for free space. For the free space calibration, the probe is placed in the volumetric center of the cavity and at the proper orientation with the field. The probe is then rotated 360 degrees.

E-field temperature correlation calibration is performed in a flat phantom filled with the appropriate simulated brain tissue. The measured free space E-field in the medium correlates to temperature rise in a dielectric medium. For temperature correlation calibration a RF transparent thermistor-based temperature probe is used in conjunction with the E-field probe.

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

Where: Δt = Exposure time (30 seconds),

C = Heat capacity of tissue (brain or muscle),

ΔT = Temperature increase due to RF exposure.

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

Where: σ = Simulated tissue conductivity,

ρ = Tissue density (kg/m^3).

3.2.3 OTHER TEST EQUIPMENT

3.2.3.1. Device Holder for Transmitters

Construction: Simple but effective and easy-to-use extension for Mounting Device that facilitates the testing of larger devices (e.g., laptops, cameras, etc.) It is light weight and fits easily on the upper part of the Mounting Device in place of the phone positioner. The extension is fully compatible with the Twin SAM, ELI and SAM v6.0 Phantoms.

Material: POM, Acrylic glass, Foam

3.2.3.2 Phantom

Model	Twin SAM	
Construction	The shell corresponds to the specifications of the Specific Anthropomorphic Mannequin (SAM) phantom defined in IEEE 1528 and IEC 62209-1. It enables the dosimetric evaluation of left and right hand phone usage as well as body mounted usage at the flat phantom region. A cover prevents evaporation of the liquid. Reference markings on the phantom allow the complete setup of all predefined phantom positions and measurement grids by teaching three points with the robot.	
Shell Thickness	2 ± 0.2 mm	
Filling Volume	Approx. 25 liters	
Dimensions	Length:1000mm; Width: 500mm Height: adjustable feet	
Available	Special	

3.2.4 SCANNING PROCEDURE

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

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

The “surface check” measurement tests the optical surface detection system of the DASY5 system by repeatedly detecting the surface with the optical and mechanical surface detector and comparing the results. The output gives the detecting heights of both systems, the difference between the two systems and the standard deviation of the detection repeatability. Air bubbles or refraction in the liquid due to separation of the sugar-water mixture gives poor repeatability (above $\pm 0.1\text{mm}$). To prevent wrong results tests are only executed when the liquid is free of air bubbles. The difference between the optical surface detection and the actual surface depends on the probe and is specified with each probe. (It does not depend on the surface reflectivity or the probe angle to the surface within $\pm 30^\circ$.)

- Area Scan

The “area scan” measures the SAR above the DUT or verification dipole on a parallel plane to the surface. It is used to locate the approximate location of the peak SAR with 2D spline interpolation. The robot performs a stepped movement along one grid axis while the local electrical field strength is measured by the probe. The probe is touching the surface of the SAM during acquisition of measurement values. The standard scan uses large grid spacing for faster measurement. Standard grid spacing for head measurements is 15 mm in x- and y- dimension ($\leq 2\text{GHz}$), 12 mm in x- and y- dimension (2-4 GHz) and 10mm in x- and y- dimension (4-6GHz). If a finer resolution is needed, the grid spacing can be reduced. Grid spacing and orientation have no influence on the SAR result. For special applications where the standard scan method does not find the peak SAR within the grid, e.g. mobile phones with flip cover, the grid can be adapted in orientation.

- Zoom Scan

A “zoom scan” measures the field in a volume around the 2D peak SAR value acquired in the previous “coarse” scan. This is a fine grid with maximum scan spatial resolution: $\Delta x_{\text{zoom}}, \Delta y_{\text{zoom}} \leq 2\text{GHz} \rightarrow \leq 8\text{mm}$, 2-4GHz $\rightarrow \leq 5\text{mm}$ and 4-6 GHz $\rightarrow \leq 4\text{mm}$; $\Delta z_{\text{zoom}} \leq 3\text{GHz} \rightarrow \leq 5\text{mm}$, 3-4 GHz $\rightarrow \leq 4\text{mm}$ and 4-6GHz $\rightarrow \leq 2\text{mm}$ where the robot additionally moves the probe along the z-axis away from the bottom of the Phantom. DASY is also able to perform repeated zoom scans if more than 1 peak is found during area scan. In this document, the evaluated peak 1g and 10g averaged SAR values are shown in the 2D-graphics in Appendix B. Test results relevant for the specified standard (see chapter 1.4.) are shown in table form in chapter 7.2.

A Z-axis scan measures the total SAR value at the x-and y-position of the maximum SAR value found during the cube scan. The probe is moved away in z-direction from the bottom of the SAM phantom in 2 mm steps. This measurement shows the continuity of the liquid and can - depending in the field strength – also show the liquid depth.

The following table summarizes the area scan and zoom scan resolutions per FCC KDB 865664D01:

Frequency	Maximun Area Scan resolution ($\Delta x_{\text{area}}, \Delta y_{\text{area}}$)	Maximun Zoom Scan spatial resolution ($\Delta x_{\text{Zoom}}, \Delta y_{\text{Zoom}}$)	Maximun Zoom Scan spatial resolution			Minimum zoom scan volume (x,y,z)
			Uniform Grid	Graded Grad		
			$\Delta z_{\text{Zoom}}(n)$	$\Delta z_{\text{Zoom}}(1)^*$	$\Delta z_{\text{Zoom}}(n>1)^*$	
$\leq 2\text{GHz}$	$\leq 15\text{mm}$	$\leq 8\text{mm}$	$\leq 5\text{mm}$	$\leq 4\text{mm}$	$\leq 1.5^* \Delta z_{\text{Zoom}}(n-1)$	$\geq 30\text{mm}$
2-3GHz	$\leq 12\text{mm}$	$\leq 5\text{mm}$	$\leq 5\text{mm}$	$\leq 4\text{mm}$	$\leq 1.5^* \Delta z_{\text{Zoom}}(n-1)$	$\geq 30\text{mm}$
3-4GHz	$\leq 12\text{mm}$	$\leq 5\text{mm}$	$\leq 4\text{mm}$	$\leq 3\text{mm}$	$\leq 1.5^* \Delta z_{\text{Zoom}}(n-1)$	$\geq 28\text{mm}$
4-5GHz	$\leq 10\text{mm}$	$\leq 4\text{mm}$	$\leq 3\text{mm}$	$\leq 2.5\text{mm}$	$\leq 1.5^* \Delta z_{\text{Zoom}}(n-1)$	$\geq 25\text{mm}$
5-6GHz	$\leq 10\text{mm}$	$\leq 4\text{mm}$	$\leq 2\text{mm}$	$\leq 2\text{mm}$	$\leq 1.5^* \Delta z_{\text{Zoom}}(n-1)$	$\geq 22\text{mm}$

3.2.5 SPATIAL PEAK SAR EVALUATION

The spatial peak SAR - value for 1 and 10 g is evaluated after the Cube measurements have been done. The basis of the evaluation are the SAR values measured at the points of the fine cube grid consisting of 5 x 5 x 7 points (with 8mm horizontal resolution) or 7 x 7 x 7 points (with 5mm horizontal resolution) or 8 x 8 x 7 points (with 4mm horizontal resolution). The algorithm that finds the maximal averaged volume is separated into three different stages.

- The data between the dipole center of the probe and the surface of the phantom are extrapolated. This data cannot be measured since the center of the dipole is 2.7 mm away from the tip of the probe and the distance between the surface and the lowest measuring point is about 1 mm (see probe calibration sheet). The extrapolated data from a cube measurement can be visualized by selecting "Graph Evaluated".
- The maximum interpolated value is searched with a straight-forward algorithm. Around this maximum the SAR - values averaged over the spatial volumes (1g or 10 g) are computed using the 3d-spline interpolation algorithm. If the volume cannot be evaluated (i.e., if a part of the grid was cut off by the boundary of the measurement area) the evaluation will be started on the corners of the bottom plane of the cube.
- All neighboring volumes are evaluated until no neighboring volume with a higher average value is found.

Extrapolation

The extrapolation is based on a least square algorithm [W. Gander, Computer mathematic, p.168-180]. Through the points in the first 3 cm along the z-axis, polynomials of order four are calculated. These polynomials are then used to evaluate the points between the surface and the probe tip. The points, calculated from the surface, have a distance of 1 mm from each other.

Interpolation

The interpolation of the points is done with a 3d-Spline. The 3d-Spline is composed of three one-dimensional splines with the "Not a knot"-condition [W. Gander, Computer mathematic, p.141-150] (x, y and z -direction) [Numerical Recipes in C, Second Edition, p.123ff].

Volume Averaging

At First the size of the cube is calculated. Then the volume is integrated with the trapezoidal algorithm. 8000 points (20x20x20) are interpolated to calculate the average.

Advanced Extrapolation

DASY5 uses the advanced extrapolation option which is able to compensate boundary effects on E-field probes.

3.2.6 DATA STORAGE AND EVALUATION

3.2.6.1 Data Storage

The DASY5 software stores the acquired data from the data acquisition electronics as raw data (in microvolt readings from the probe sensors), together with all necessary software parameters for the data evaluation (probe calibration data, liquid parameters and device frequency and modulation data) in measurement files with the extension "DAE". The software evaluates the desired unit and format for output each time the data is visualized or exported. This allows verification of the complete software setup even after the measurement and allows correction of incorrect parameter settings. For example, if a measurement has been performed with a wrong crest factor parameter in the device setup, the parameter can be corrected afterwards and the data can be re-evaluated.

The measured data can be visualized or exported in different units or formats, depending on the selected probe type ([V/m], [A/m], [°C], [mW/g], [mW/cm²], [dBrel], etc.). Some of these units are not available in certain situations or show meaningless results, e.g., a SAR output in a lossless media will always be zero. Raw data can also be exported to perform the evaluation with other software packages.

3.2.7 DATA EVALUATION BY SEMCAD

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

Probe parameters:	Sensitivity	Normi, ai0, ai1, ai2
	Conversion factor	ConvFi
	Diode compression point	Dcpj
Device parameters:	Frequency	f
	Crest factor	cf
Media parameters:	Conductivity	
	Density	

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

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

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

$$V_i = U_i + U_i^2 \cdot cf / dcp_i$$

With	V_i = compensated signal of channel i	(i = x, y, z)
	U_i = input signal of channel i	(i = x, y, z)
	cf = crest factor of exciting field	(DASY parameter)
	dcpj = diode compression point	(DASY parameter)

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

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

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

With V_i = compensated signal of channel i ($i = x, y, z$)

Norm_i = sensor sensitivity of channel i ($i = x, y, z$)
[mV/(V/m)²] for E-field Probes

ConvF = sensitivity enhancement in solution

a_{ij} = sensor sensitivity factors for H-field probes

f = carrier frequency [GHz]

E_i = electric field strength of channel i in V/m

H_i = magnetic field strength of channel i in A/m

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

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

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

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

With SAR = local specific absorption rate in mW/g

E_{tot} = total field strength in V/m
= conductivity in [mho/m] or [Siemens/m]
= equivalent tissue density in g/cm³

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

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

With P_{pwe} = equivalent power density of a plane wave in mW/cm²

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

H_{tot} = total magnetic field strength in A/m

4. SYSTEM VERIFICATION PROCEDURE

4.1 TISSUE VERIFICATION

The simulating liquids should be checked at the beginning of a series of SAR measurements to determine if the dielectric parameters are within the tolerances of the specified target values. The measured conductivity and relative permittivity should be within $\pm 5\%$ of the target values.

The following materials are used for producing the tissue-equivalent materials.

Tissue Type	Bactericide	DGBE	HEC	NaCl	Sucrose	Triton X-100	Water	Diethylene Glycol Mono-hexylether
Head 750	0.2	-	0.2	1.5	56.0	-	42.1	-
Head 835	0.2	-	0.2	1.5	57.0	-	41.1	-
Head 1750	-	47.0	-	0.4	-	-	52.6	-
Head 1900	-	44.5	-	0.2	-	-	55.3	-

Salt: 99+% Pure Sodium Chloride; Sugar: 98+% Pure Sucrose; Water: De-ionized, 16M + resistivity
HEC: Hydroxyethyl Cellulose; DGBE: 99+% Di(ethylene glycol) butyl ether, [2-(2-butoxyethoxy)ethanol]
Triton X-100 (ultra pure): Polyethylene glycol mono [4-(1,1,3,3-tetramethylbutyl)phenyl]ether

Tissue Verification									
Tissue Type	Frequency (MHz)	Liquid Temp. (°C)	Conductivity (σ)	Permittivity (ϵ_r)	Targeted Conductivity (σ)	Targeted Permittivity (ϵ_r)	Deviation Conductivity (σ) (%)	Deviation Permittivity (ϵ_r) (%)	Date
Head	750	22.2	0.887	42.826	0.89	41.9	-0.34	2.21	Sep. 02, 2021
Head	750	22.0	0.882	42.860	0.89	41.9	-0.90	2.29	Sep. 26, 2021
Head	835	22.2	0.914	42.151	0.90	41.5	1.56	1.57	Sep. 02, 2021
Head	835	22.4	0.908	42.186	0.90	41.5	0.89	1.65	Sep. 25, 2021
Head	1750	22.5	1.391	39.715	1.37	40.1	1.53	-0.96	Sep. 03, 2021
Head	1750	22.5	1.390	39.947	1.37	40.1	1.46	-0.38	Sep. 24, 2021
Head	1900	22.3	1.335	40.760	1.40	40.0	-4.64	1.90	Sep. 04, 2021
Head	1900	22.3	1.335	40.897	1.40	40.0	-4.64	2.24	Sep. 24, 2021

Note:

- 1) The dielectric parameters of the tissue-equivalent liquid should be measured under similar ambient conditions and within 2 °C of the conditions expected during the SAR evaluation to satisfy protocol requirements.
- 2) KDB 865664 was ensured to be applied for probe calibration frequencies greater than or equal to 50MHz of the EUT frequencies.
- 3) The above measured tissue parameters were used in the DASY software to perform interpolation via the DASY software to determine actual dielectric parameters at the test frequencies. The SAR test plots may slightly differ from the table above since the DASY rounds to three significant digits.

4.2 SYSTEM CHECK

The system check is performed for verifying the accuracy of the complete measurement system and performance of the software. The system check is performed with tissue equivalent material according to IEEE Std 1528 (described above). The following table shows system check results for all frequency bands and tissue liquids used during the tests.

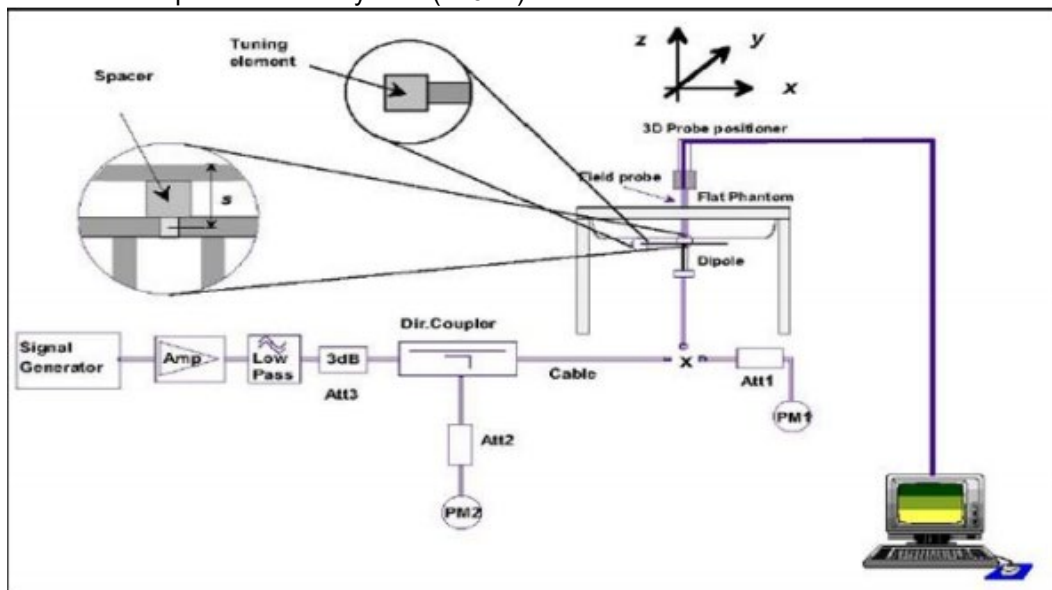
System Check	Date	Frequency (MHz)	Targeted SAR-1g (W/kg)	Measured SAR-1g (W/kg)	normalized SAR-1g (W/kg)	Deviation (%)	Dipole S/N
Head	Sep. 02, 2021	750	8.59	2.02	8.08	-5.94	1095
Head	Sep. 26, 2021	750	8.59	2.10	8.40	-2.21	1095
Head	Sep. 02, 2021	835	9.52	2.46	9.84	3.36	4d160
Head	Sep. 25, 2021	835	9.52	2.28	9.12	-4.20	4d160
Head	Sep. 03, 2021	1750	36.40	9.05	36.20	-0.55	1101
Head	Sep. 24, 2021	1750	36.40	8.72	34.88	-4.18	1101
Head	Sep. 04, 2021	1900	39.60	9.88	39.52	-0.20	5d179
Head	Sep. 24, 2021	1900	39.60	9.58	38.32	-3.23	5d179

4.3 SYSTEM CHECK PROCEDURE

The system check is performed by using a system check dipole which is positioned parallel to the planar part of the SAM phantom at the reference point. The distance of the dipole to the SAM phantom is determined by a plexiglass spacer. The dipole is connected to the signal source consisting of signal generator and amplifier via a directional coupler, N-connector cable and adaption to SMA. It is fed with a power of 250mW (below 3GHz) or 100mW (3-6GHz). To adjust this power a power meter is used.

The power sensor is connected to the cable before the system check to measure the power at this point and do adjustments at the signal generator. At the outputs of the directional coupler both return loss as well as forward power are controlled during the system check to make sure that emitted power at the dipole is kept constant. This can also be checked by the power drift measurement after the test.

System check results have to be equal or near the values determined during dipole calibration (target SAR in table above) with the relevant liquids and test system ($\pm 10\%$).



5. SAR MEASUREMENT VARIABILITY AND UNCERTAINTY

5.1 SAR MEASUREMENT VARIABILITY

Per KDB865664 D01 SAR measurement 100 MHz to 6 GHz, SAR measurement variability must be assessed for each frequency band, which is determined by the SAR probe calibration point and tissue-equivalent medium used for the device measurements. The additional measurements are repeated after the completion of all measurements requiring the same head or body tissue-equivalent medium in a frequency band. The test device should be returned to ambient conditions (normal room temperature) with the battery fully charged before it is re-mounted on the device holder for the repeated measurement(s) to minimize any unexpected variations in the repeated results.

- 1) Repeated measurement is not required when the original highest measured SAR is < 0.80 W/kg; steps 2) through 4) do not apply.
- 2) When the original highest measured SAR is ≥ 0.80 W/kg, repeat that measurement once.
- 3) Perform a second repeated measurement only if the ratio of largest to smallest SAR for the original and first repeated measurements is > 1.20 or when the original or repeated measurement is ≥ 1.45 W/kg ($\sim 10\%$ from the 1-g SAR limit).
- 4) Perform a third repeated measurement only if the original, first or second repeated measurement is ≥ 1.5 W/kg and the ratio of largest to smallest SAR for the original, first and second repeated measurements is > 1.20 .

The same procedures should be adapted for measurements according to extremity and occupational exposure limits by applying a factor of 2.5 for extremity exposure and a factor of 5 for occupational exposure to the corresponding SAR thresholds.

The detailed repeated measurement results are shown in Section 7.2.

6. OPERATIONAL CONDITIONS DURING TEST

6.1 SAR TEST CONFIGURATION

6.1.1 UMTS TEST CONFIGURATION

1. Output Power Verification

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

2. WCDMA

(1) Head SAR Measurements

SAR for next to ear head exposure is measured using a 12.2 kbps RMC with TPC bits configured to all "1s". The 3G SAR test reduction procedure is applied to AMR configurations with 12.2 kbps RMC as the primary mode. Otherwise, SAR is measured for 12.2 kbps AMR with 3.4kbps SRB (signaling radio bearer) using the highest reported SAR configuration in 12.2 kbps RMC for head exposure.

(2) Body SAR Measurements

SAR for body-worn accessory is measured using the 12.2 kbps RMC with the TPC bits configured to all "1s". The 3G SAR test reduction procedure is applied to other spreading codes and multiple DPDCHn configurations supported by handset with 12.2 kbps RMC as the primary mode.

3. HSDPA

SAR for body exposure configurations is measured according to the "Body SAR Measurements" procedures of 3G device. When the maximum output power and tune-up tolerance specified for production units in a secondary mode is $\leq \frac{1}{4}$ dB higher than the primary mode or when the highest reported SAR of the primary mode is scaled by the ratio of specified maximum output power and tune-up tolerance of secondary to primary mode and the adjusted SAR is ≤ 1.2 W/kg, SAR measurement is not required for the secondary mode. This is referred to as the 3G SAR test reduction procedure in the following SAR test guidance, where the primary mode is identified in the applicable wireless mode test procedures and the secondary mode is wireless mode being considered for SAR test reduction by that procedure. When the 3G SAR test reduction procedure is not satisfied, it is identified as "otherwise" in the applicable procedures; SAR measurement is required for the secondary mode.

Per KDB941225 D01, the 3G SAR test reduction procedure is applied to HSDPA body configurations with 12.2 kbps RMC as the primary mode. Otherwise, SAR is measured for HSDPA using the HSDPA body SAR procedures for the highest reported SAR body exposure configuration in 12.2 kbps RMC.

HSDPA should be configured according to UE category of a test device. The number of HS-DSCH/HS-PDSCHs, HAPRQ processes, minimum inter-TTI interval, transport block sizes and RV coding sequence are defined by the H-set. To maintain a consistent test configuration and stable transmission condition, QPSK is used in the H-set for SAR testing. HS-DPCCH should be configured with a CQI feedback cycle of 4ms with a CQI repetition factor of 2 to maintain a constant rate of active CQI slots. The β_c and β_d gain factors for DPCCH and DPDCH were set according to the values in the below table, β_{hs} for HS-DPCCH is set automatically to the correct value when ΔACK , $\Delta NACK$, $\Delta CQI = 8$. The variation of the β_c / β_d ratio causes a power reduction at sub-tests 2 - 4.

Sub-test ^o	β_c ^o	β_d ^o	β_d (SF) ^o	β_c / β_d ^o	β_{hs} (1) ^o	CM(dB)(2) ^o	MPR (dB) ^o
1 ^o	2/15 ^o	15/15 ^o	64 ^o	2/15 ^o	4/15 ^o	0.0 ^o	0 ^o
2 ^o	12/15(3) ^o	15/15(3) ^o	64 ^o	12/15(3) ^o	24/15 ^o	1.0 ^o	0 ^o
3 ^o	15/15 ^o	8/15 ^o	64 ^o	15/8 ^o	30/15 ^o	1.5 ^o	0.5 ^o
4 ^o	15/15 ^o	4/15 ^o	64 ^o	15/4 ^o	30/15 ^o	1.5 ^o	0.5 ^o

Note 1: ΔACK , $\Delta NACK$ and $\Delta CQI = 8$ $A_{hs} = \beta_{hs} / \beta_c = 30/15$ $\beta_{hs} = 30/15 * \beta_c$

Note 2: CM=1 for $\beta_c / \beta_d = 12/15$, $\beta_{hs} / \beta_c = 24/15$. 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 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 signalled gain factors for the reference TFC (TF1, TF1) to $\beta_c = 11/15$ and $\beta_d = 15/15$

The measurements were performed with a Fixed Reference Channel (FRC) and H-Set 1 QPSK.

Settings of required H-Set 1 QPSK acc. to 3GPP 34.121

Parameter	Value
Nominal average inf. bit rate	534 kbit/s
Inter-TTI Distance	3 TTI"s
Number of HARQ Processes	2 Processes
Information Bit Payload	3202 Bits
MAC-d PDU size	336 Bits
Number Code Blocks	1 Block
Binary Channel Bits Per TTI	4800 Bits
Total Available SMLs in UE	19200 SMLs
Number of SMLs per HARQ Process	9600 SMLs
Coding Rate	0.67
Number of Physical Channel Codes	5

HSDPA UE category

HS-DSCH Category	Maximum HS-DSCH Codes Received	Minimum Inter-TTI Interval	Maximum HS-DSCH Transport Block Bits/HS-DSCH TTI	Total Soft Channel Bits
1	5	3	7298	19200
2	5	3	7298	28800
3	5	2	7298	28800
4	5	2	7298	38400
5	5	1	7298	57600
6	5	1	7298	67200
7	10	1	14411	115200
8	10	1	14411	134400
9	15	1	25251	172800
10	15	1	27952	172800
11	5	2	3630	14400
12	5	1	3630	28800
13	15	1	34800	259200
14	15	1	42196	259200
15	15	1	23370	345600
16	15	1	27952	345600

4. HSUPA

SAR for Body exposure configurations is measured according to the “Body SAR Measurements” procedures of 3G device. When the maximum output power and tune-up tolerance specified for production units in a secondary mode is $\leq \frac{1}{4}$ dB higher than the primary mode or when the highest reported SAR of the primary mode is scaled by the ratio of specified maximum output power and tune-up tolerance of secondary to primary mode and the adjusted SAR is ≤ 1.2 W/kg, SAR measurement is not required for the secondary mode.

Per KDB941225 D01, the 3G SAR test reduction procedures is applied to HSPA (HSUPA/HSDPA with RMC) body configurations with 12.2 kbps RMC as the primary mode. Otherwise, SAR is measured for HSPA using the HSPA body SAR procedures for the highest reported body exposure SAR configuration in 12.2 kbps RMC.

Due to inner loop power control requirements in HSUPA, a commercial communication test set should be used for the output power and SAR tests. The 12.2 kbps RMC, FRC H-set 1 and E-DCH configurations for HSDPA should be configured according to the values indicated below as well as other applicable procedures described in the “WCDMA Handset” and “Release 5 HSDPA Data Device” sections of 3G device.

Subtests for WCDMA Release 6 HSUPA

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

Note 1: ΔACK , $\Delta NACK$ and $\Delta CQI = 8$ $A_{hs} = \beta_{hs}/\beta_c = 30/15$ $\beta_{hs} = 30/15 * \beta_c$

Note 2: CM = 1 for $\beta_c/\beta_d = 12/15$, $\beta_{hs}/\beta_c = 24/15$. For all other combinations of DPDCH, DPCCH, HS-DPCCH, E-DPDCH and E-DPCCH the MPR is based on the relative CM difference²

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 $\beta_c = 10/15$ and $\beta_d = 15/15$ ²

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 signalled gain factors for the reference TFC (TF1, TF1) to $\beta_c = 14/15$ and $\beta_d = 15/15$ ²

Note 5 : Testing UE using E-DPDCH Physical Layer category 1 Sub-test 3 is not required according to TS 25.306 Table 5.1g²

Note 6: β_{ed} can not be set directly; it is set by Absolute Grant Value.²

HSUPA UE category

UE E-DCH Category	Maximum E-DCH Codes Transmitted	Number of HARQ Processes	E-DCH TTI(ms)	Minimum Spreading Factor	Maximum E-DCH Transport Block Bits	Max Rate (Mbps)
1	1	4	10	4	7110	0.7296
2	2	8	2	4	2798	1.4592
	2	4	10	4	14484	
3	2	4	10	4	14484	1.4592
4	2	8	2	2	5772	2.9185
	2	4	10	2	20000	2.00
5	2	4	10	2	20000	2.00
6 (No DPDCH)	4	8	10	2SF2&2SF4	11484	5.76
	4	4	2		20000	2.00
7 (No DPDCH)	4	8	2	2SF2&2SF4	22996	?
	4	4	10		20000	?

NOTE: When 4 codes are transmitted in parallel, two codes shall be transmitted with SF2 and two with SF4. UE categories 1 to 6 support QPSK only. UE category 7 supports QPSK and 16QAM. (TS25.306-7.3.0).

5. DC-HSDPA

SAR is required for Rel. 8 DC-HSDPA when SAR is required for Rel.5 HSDPA; otherwise, the 3G SAR test reduction procedure is applied to DC-HSDPA with 12.2 kbps RMC as the primary mode.

Power is measured for DC-HSDPA according to the H-Set 12, FRC configuration in Table C.8.1.12 of 3GPP TS 34.121-1 to determine SAR test reduction. A primary and a Second serving HS-DSCH cell are required to perform the power measurement and for the results to be acceptable.

The following tests were completed according to procedures in section 7.3.13 of 3GPP TS 34.108 v9.5.0. A summary of these settings are illustrated below:

Downlink Physical Channels are set as per 3GPP TS34.121-1 v9.0.0 E.5.0
Levels for HSDPA connection setup

Parameter During Connection setup	Unit	Value
P-CPICH_Ec/Ior	dB	-10
P-CCPCH and SCH_Ec/Ior	dB	-12
PICH_Ec/Ior	dB	-15
HS-PDSCH	dB	off
HS-SCCH_1	dB	off
DPCH_Ec/Ior	dB	-5
OCNS_Ec/Ior	dB	-3.1

Call is set up as per 3GPP TS34.108 v9.5.0 sub clause 7.3.13

The configurations of the fixed reference channels for HSDPA RF tests are described in 3GPP TS 34.121, annex C for FDD and 3GPP TS 34.122.

The measurements were performed with a Fixed Reference Channel (FRC) H-Set 12 with QPSK

Parameter	Value
Nominal average inf. bit rate	60 kbit/s
Inter-TTI Distance	1 TTI's
Number of HARQ Processes	6 Processes
Information Bit Payload	120 Bits
Number Code Blocks	1 Block
Binary Channel Bits Per TTI	960 Bits
Total Available SMLs in UE	19200 SMLs
Number of SMLs per HARQ Process	3200 SMLs
Coding Rate	0.15
Number of Physical Channel Codes	1

Note:

1.The RMC is intended to be used for DC-HSDPA mode and both cells shall transmit with identical parameters as listed in the table above.

2.Maximum number of transmission is limited to 1,i.e.,retransmission is not allowed. The redundancy and constellation version 0 shall be used.

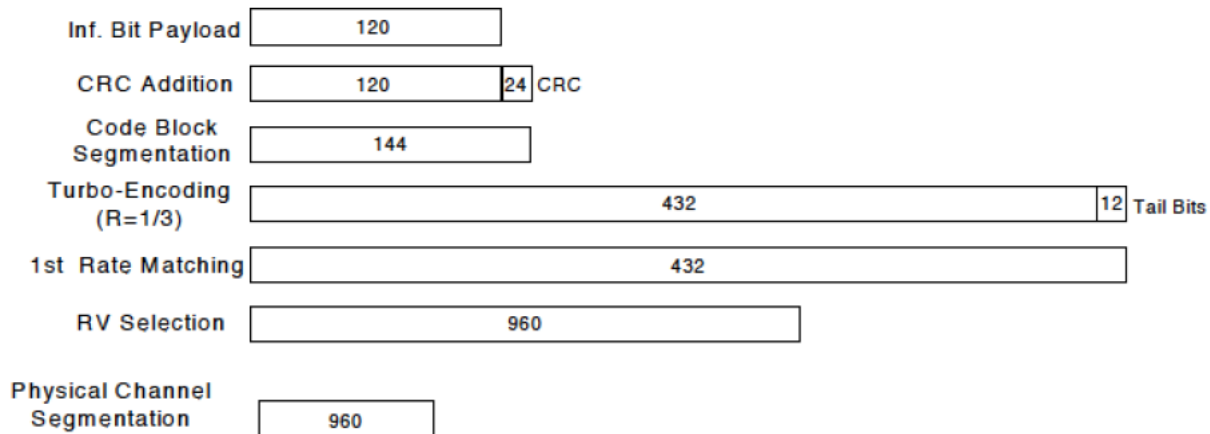


Figure C.8.19: Coding rate for Fixed reference Channel H-Set 12 (QPSK)

The following 4 Sub-tests for HSDPA were completed according to Release 5 procedures. A summary of subtest settings are illustrated below:

Sub-test ^o	β_c ^o	β_d ^o	β_d (SF) ^o	β_c/β_d ^o	$\beta_{hs}(1)$ ^o	CM(dB)(2) ^o	MPR (dB) ^o
1 ^o	2/15 ^o	15/15 ^o	64 ^o	2/15 ^o	4/15 ^o	0.0 ^o	0 ^o
2 ^o	12/15(3) ^o	15/15(3) ^o	64 ^o	12/15(3) ^o	24/15 ^o	1.0 ^o	0 ^o
3 ^o	15/15 ^o	8/15 ^o	64 ^o	15/8 ^o	30/15 ^o	1.5 ^o	0.5 ^o
4 ^o	15/15 ^o	4/15 ^o	64 ^o	15/4 ^o	30/15 ^o	1.5 ^o	0.5 ^o

Note 1: ΔACK , $\Delta NACK$ and $\Delta CQI = 8$ $A_{hs} = \beta_{hs}/\beta_c = 30/15$ $\beta_{hs} = 30/15 * \beta_c$

Note 2: CM=1 for $\beta_c/\beta_d = 12/15$, $\beta_{hs}/\beta_c = 24/15$. 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 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 signalled gain factors for the reference TFC (TF1, TF1) to $\beta_c = 11/15$ and $\beta_d = 15/15$.

Up commands are set continuously to set the UE to Max power.

6. HSPA+

An E-DCH call is set up according to TS 34.108 [3] 7.3.9 with the following exceptions in the RADIO BEARER SETUP messages. These exceptions allow the beta values to be set according to table C.11.1.4 and each UL physical channel to be at constant power at the start of the measurement. RF parameters are set up according to table E.5.A.1. Settings for the serving cell are defined in table 5.2E.4. Uplink SRB for DCCH mapped on E-DCH and downlink SRB for DCCH on DCH. E-DCH is configured with 2ms TTI.

Table C.11.1.4: β values for transmitter characteristics tests with HS-DPCCH and E-DCH with 16QAM

Sub-test	β_c (Note 3)	β_d	β_{HS} (Note 1)	β_{ec}	β_{ed} (2xSF2) (Note 4)	β_{ed} (2xSF4) (Note 4)	CM (dB) (Note 2)	MPR (dB) (Note 2)	AG Index (Note 4)	E-TFCI (Note 5)	E-TFCI (boost)
1	1	0	30/15	30/15	β_{ed1} : 30/15 β_{ed2} : 30/15	β_{ed3} : 24/15 β_{ed4} : 24/15	3.5	2.5	14	105	105
Note 1: Δ_{ACK}, Δ_{NACK} and $\Delta_{CQI} = 30/15$ with $\beta_{hs} = 30/15 * \beta_c$. Note 2: CM = 3.5 and the MPR is based on the relative CM difference, MPR = MAX(CM-1,0). Note 3: DPDCH is not configured, therefore the β_c is set to 1 and $\beta_d = 0$ by default. Note 4: β_{ed} can not be set directly; it is set by Absolute Grant Value. Note 5: All the sub-tests require the UE to transmit 2SF2+2SF4 16QAM EDCH and they apply for UE using E-DPDCH category 7. E-DCH TTI is set to 2ms TTI and E-DCH table index = 2. To support these E-DCH configurations DPDCH is not allocated. The UE is signaled to use the extrapolation algorithm.											

Note:

1. The Dual Carriers transmission support HSDPA and HSUPA physical channels.
2. The Dual Carriers belong to the same Node and are on adjacent carriers.
3. The Dual Carriers do not support MIMO to serve UEs configured for dual cell operation.
4. The Dual Carriers operate in the same frequency band.
5. The device doesn't support the modulation of 16QAM in uplink but 64QAM in downlink for DC-HSDPA mode.
6. The device doesn't support carrier aggregation for it just can operate in Release 8.

6.1.2 LTE TEST CONFIGURATION

SAR for LTE band exposure configurations is measured according to the procedures of KDB 941225 D05 SAR for LTE Devices. The CMW500 Wide Band Radio Communication Tester 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 test were performed with the same number of RB and RB offsets transmitting on all TTI frames (Maximum TTI).

1. Spectrum Plots for RB configurations

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

2. MPR

When MPR is implemented permanently within the UE, regardless of network requirements, only those RB configurations allowed by 3GPP for the channel bandwidth and modulation. Combinations may be tested with MPR active. Configurations with RB allocations less than the RB thresholds required by 3GPP must be tested without MPR.

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

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

Modulation	Channel bandwidth / Transmission bandwidth (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

3. A-MPR

A-MPR (Additional MPR) has been disabled for all SAR tests by using Network Signalling Value of "NS_01" on the base station simulator.

4. LTE procedures for SAR testing

A) Largest channel bandwidth standalone SAR test requirements

i) QPSK with 1 RB allocation

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. When the reported SAR is ≤ 0.8 W/kg, testing of the remaining RB offset configurations and required test channels is not required for 1 RB allocation; otherwise, SAR is required for the remaining required test channels and only for the RB offset configuration with the highest output power for that channel. When the reported SAR of a required test channel is > 1.45 W/kg, SAR is required for all three RB offset configurations for that required test channel.

ii) QPSK with 50% RB allocation

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

iii) QPSK with 100% RB allocation

For QPSK with 100% RB allocation, SAR is not required when the highest maximum output power for 100 % RB allocation is less than the highest maximum output power in 50% and 1 RB allocations and the highest reported SAR for 1 RB and 50% RB allocation in i) and ii) 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.

iv) Higher order modulations

For each modulation besides QPSK; e.g., 16-QAM, 64-QAM, apply the QPSK procedures in above sections to determine the QAM configurations that may need SAR measurement. For each configuration identified as required for testing, SAR is required only when the highest maximum output power for the configuration in the higher order modulation is $> \frac{1}{2}$ dB higher than the same configuration in QPSK or when the reported SAR for the QPSK configuration is > 1.45 W/kg.

B) Other channel bandwidth standalone SAR test requirements

For the other channel bandwidths used by the device in a frequency band, apply all the procedures required for the largest channel bandwidth in section A) to determine the channels and RB configurations that need SAR testing and only measure SAR when the highest maximum output power of a configuration requiring testing in the smaller channel bandwidth is $> \frac{1}{2}$ dB higher than the equivalent channel configurations in the largest channel bandwidth configuration or the reported SAR of a configuration for the largest channel bandwidth is > 1.45 W/kg.

6.2 TEST POSITION

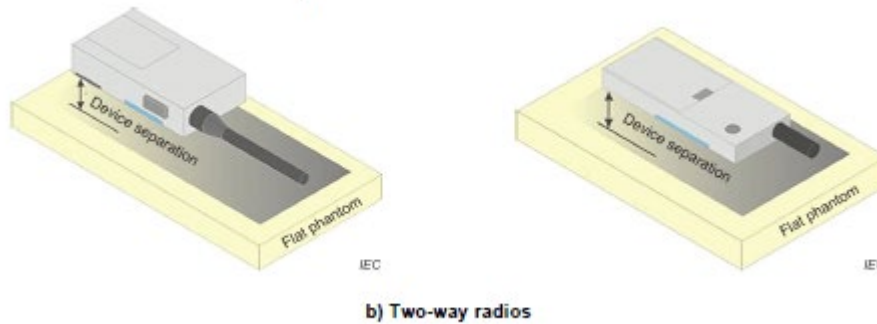
6.2.1 TEST MODE

The device does not have telephone receiver. Next to the ear operation is not supported. So the additional Head SAR testing for this device is not required.

The device connects to UMTS/LTE network once every 5 mins to send data for report location, each data transmission takes about 2 secs, for this mode is belong the body-worn mode, but it's below the low duty cycle device, so the body-worn SAR is not required.

The SAR Test Exclusion Power Thresholds please refer the MPE report refer the "BTL-FCCP-3-2108H047".

The device is support the push-to-talk function, when the user push button, device will be start the emergency call. User can talk on front face, so we test front face at 10m.



When user is on calling, the device will be hold on the hand, so we test the hand-held for front face, rear face, right side, left side, top side and bottom side at 0mm.

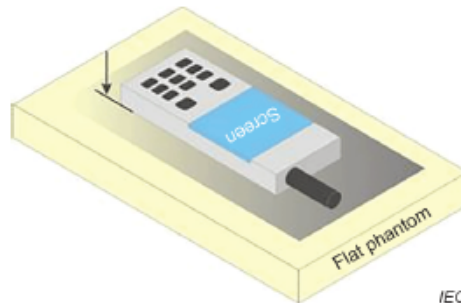
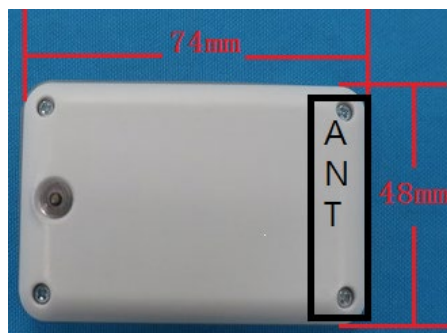


Figure 11 – Test position for hand-held devices, not used at the head or torso

6.2.2 ANTENNAS DETAILS

The location of the antennas inside EUT is shown as below picture:



6.2.3 HANDHELD PUSH-TO-TALK TEST CONFIGURATION

Per FCC KDB 447498 D01, when a body-worn accessory is not supplied with the PTT radio, a test separation distance ≤ 10 mm, applicable to the device form factor, must be applied to determine body-worn accessory SAR test exclusion. A test separation distance of 25 mm must be applied for in-front-of the face SAR test exclusion and SAR measurements.

6.2.4 EXTREMITY EXPOSURE TEST CONFIGURATION

Per KDB 447498 D01, devices that are designed or intended for use on extremities, or mainly operated in extremity only exposure conditions, i.e., hands, wrists, feet and ankles, may require extremity SAR evaluation. When the device also operates in close proximity to the user's body, SAR compliance for the body is also required. The 1-g body and 10-g extremity SAR Test Exclusion Thresholds in 4.3 should be applied to determine SAR test requirements. When extremity SAR testing is required, a flat phantom must be used if the exposure condition is more conservative than the actual use conditions; otherwise, a KDB inquiry is required to determine the phantom and test requirements. Body SAR compliance is also tested with a flat phantom. For devices with irregular shapes or form factors that do not conform to a flat phantom, and/or unusual operating configurations and exposure conditions, a KDB inquiry is also required to determine the appropriate SAR measurement procedures.

7. TEST RESULT

7.1 CONDUCTED POWER RESULTS

The conducted power measurement result please refer to Appendix E.

7.2 SAR TEST RESULTS

General Notes:

- 1) Per KDB447498 D01, all measurement SAR results are scaled to the maximum tune-up tolerance limit to demonstrate compliant.
- 2) Per KDB447498 D01, testing of other required channels within the operating mode of a frequency band is not required when the reported 1-g or 10-g SAR for the mid-band or highest output power channel is: ≤ 0.8 W/kg or 2.0 W/kg, for 1-g or 10-g respectively, when the transmission band is ≤ 100 MHz. When the maximum output power variation across the required test channels is $> \frac{1}{2}$ dB, instead of the middle channel, the highest output power channel must be used.
- 3) Per KDB865664 D01, for each frequency band, repeated SAR measurement is required only when the measured SAR is ≥ 0.8 W/kg; if the deviation among the repeated measurement is $\leq 20\%$, and the measured SAR < 1.45 W/kg, only one repeated measurement is required.
- 4) Per KDB941225 D06, the DUT Dimension is bigger than 9 cm x 5 cm, so 10mm is chosen as the test separation distance for Hotspot mode. When the antenna-to-edge distance is greater than 2.5cm, such position does not need to be tested.
- 5) Per KDB648474 D04, SAR is evaluated without a headset connected to the device. When the standalone reported body-worn SAR is ≤ 1.2 W/kg, no additional SAR evaluations using a headset are required.
- 6) Per KDB865664 D02, SAR plot is only required for the highest measured SAR in each exposure configuration, wireless mode and frequency band combination; Plots are also required when the measured SAR is > 1.5 W/kg, or > 7.0 W/kg for occupational exposure. The published RF exposure KDB procedures may require additional plots; for example, to support SAR to peak location separation ratio test exclusion and/or volume scan post-processing.

UMTS Notes:

Per KDB941225 D01, When the maximum output power and tune-up tolerance specified for production units in a secondary mode is $\leq \frac{1}{4}$ dB higher than the primary mode or when the highest reported SAR of the primary mode is scaled by the ratio of specified maximum output power and tune-up tolerance of secondary to primary mode and the adjusted SAR is ≤ 1.2 W/kg, SAR measurement is not required for the secondary mode.

LTE notes:

- 1) The LTE test configurations are determined according to KDB941225 D05 SAR for LTE Devices. The general test procedures used for SAR testing can be found in Section 7.1.3.
- 2) A-MPR was disabled for all SAR test by setting NS_01 on the base station simulator. SAR tests were performed with the same number of RB and RB offsets transmitting on all TTI frames (maximum TTI).

7.2.1 SAR MEASUREMENT RESULT OF PTT

1. PTT SAR test results of UMTS

Test No.	Band	Mode	Channel	Test Position	Separation Distance (cm)	Maximum Tune-up (dBm)	Conducted Power (dBm)	Power Drift (dB)	SAR 1g (W/kg)	SAR 10g (W/kg)	Reported 1g SAR
U29	UMTS B2	RMC12.2K	9400	Front Face	1.0	25	23.15	-0.07	0.605	0.372	0.926
U30	UMTS B2	RMC12.2K	9262	Front Face	1.0	25	23.13	0.05	0.600	0.334	0.923
U31	UMTS B2	RMC12.2K	9538	Front Face	1.0	25	23.16	0.18	0.545	0.305	0.833
U33	UMTS B4	RMC12.2K	1413	Front Face	1.0	25	23.35	-0.14	0.573	0.359	0.838
U34	UMTS B4	RMC12.2K	1312	Front Face	1.0	25	23.23	0.01	0.502	0.320	0.755
U35	UMTS B4	RMC12.2K	1513	Front Face	1.0	25	23.36	-0.16	0.490	0.297	0.715
U37	UMTS B5	RMC12.2K	4182	Front Face	1.0	25	23.01	0.17	0.042	0.030	0.066

Note: The value with boldface is the maximum SAR Value of each test band.

2. PTT SAR test results of LTE

Test No.	Band	Mode	Channel	RB	offset	Test Position	Separation Distance (cm)	Maximum Tune-up (dBm)	Conducted Power (dBm)	Power Drift (dB)	SAR 1g (W/kg)	SAR 10g (W/kg)	Reported 1g SAR
L161	LTE B2	QPSK20M	18900	1	99	Front Face	1.0	23.5	23.32	0.04	0.741	0.455	0.773
L162	LTE B2	QPSK20M	18900	50	25	Front Face	1.0	22.5	22.30	0.01	0.682	0.386	0.715
L164	LTE B4	QPSK20M	20300	1	50	Front Face	1.0	23.5	23.21	0.16	0.804	0.509	0.859
L165	LTE B4	QPSK20M	20050	50	25	Front Face	1.0	22.5	21.98	-0.01	0.756	0.443	0.852
L166	LTE B4	QPSK20M	20050	1	50	Front Face	1.0	23.5	22.94	-0.12	0.698	0.392	0.795
L167	LTE B4	QPSK20M	20175	1	0	Front Face	1.0	23.5	22.86	-0.14	0.710	0.362	0.823
L168	LTE B4	QPSK20M	20175	50	25	Front Face	1.0	22.5	21.82	0.13	0.719	0.395	0.840
L169	LTE B4	QPSK20M	20300	50	0	Front Face	1.0	22.5	21.92	0.11	0.746	0.476	0.852
L170	LTE B4	QPSK20M	20050	100	0	Front Face	1.0	22.5	21.94	0.02	0.677	0.430	0.770
L171	LTE B4	QPSK20M	20300	1	50	Front Face (Repeated)	1.0	23.5	23.21	-0.10	0.800	0.496	0.855
L173	LTE B5	QPSK10M	20450	1	24	Front Face	1.0	25	23.58	0.05	0.355	0.241	0.493
L174	LTE B5	QPSK10M	20525	25	12	Front Face	1.0	24	22.56	0.13	0.229	0.141	0.319
L176	LTE B12	QPSK10M	23060	1	49	Front Face	1.0	25	23.72	0.01	0.059	0.041	0.080
L177	LTE B12	QPSK10M	23130	25	0	Front Face	1.0	24	22.68	0.09	0.051	0.031	0.069
L179	LTE B13	QPSK10M	23230	1	49	Front Face	1.0	25	23.75	0.06	0.220	0.151	0.294
L180	LTE B13	QPSK10M	23230	25	12	Front Face	1.0	24	22.63	0.03	0.129	0.078	0.177
L182	LTE B14	QPSK10M	23330	1	24	Front Face	1.0	25	23.88	0.06	0.239	0.162	0.309
L183	LTE B14	QPSK10M	23330	25	12	Front Face	1.0	24	22.66	-0.13	0.147	0.089	0.200
L185	LTE B66	QPSK20M	132572	1	50	Front Face	1.0	23.5	23.27	-0.06	0.911	0.585	0.961
L186	LTE B66	QPSK20M	132572	50	50	Front Face	1.0	22.5	22.00	0.01	0.628	0.389	0.704
L187	LTE B66	QPSK20M	132072	1	50	Front Face	1.0	23.5	22.61	-0.02	0.782	0.497	0.960
L188	LTE B66	QPSK20M	132322	1	0	Front Face	1.0	23.5	22.99	0.09	0.804	0.526	0.904
L189	LTE B66	QPSK20M	132072	100	0	Front Face	1.0	22.5	21.78	-0.14	0.603	0.374	0.712
L190	LTE B66	QPSK20M	132572	1	50	Front Face (Repeated)	1.0	23.5	23.27	0.05	0.784	0.478	0.827
L192	LTE B71	QPSK20M	133322	1	50	Front Face	1.0	25	23.46	0.07	0.042	0.029	0.060
L193	LTE B71	QPSK20M	133372	50	0	Front Face	1.0	24	22.58	0.02	0.031	0.016	0.043

Note: The value with boldface is the maximum SAR Value of each test band.

7.2.2 SAR MEASUREMENT RESULT OF EXTREMITY

1. Extremity SAR test results of UMTS

Test No.	Band	Mode	Channel	Test Position	Separation Distance (cm)	Maximum Tune-up (dBm)	Conducted Power (dBm)	Power Drift (dB)	SAR 1g (W/kg)	SAR 10g (W/kg)	Reported 10g SAR
U01	UMTS B2	RMC12.2K	9400	Front Face	0	25	23.15	-0.04	1.520	0.774	1.185
U02	UMTS B2	RMC12.2K	9400	Rear Face	0	25	23.15	0.13	5.460	2.350	3.598
U03	UMTS B2	RMC12.2K	9400	Left Side	0	25	23.15	0.10	1.400	0.729	1.116
U04	UMTS B2	RMC12.2K	9400	Right Side	0	25	23.15	-0.13	1.810	0.946	1.448
U05	UMTS B2	RMC12.2K	9400	Top Side	0	25	23.15	-0.04	3.450	1.210	1.853
U06	UMTS B2	RMC12.2K	9400	Bottom Side	0	25	23.15	-0.02	0.141	0.077	0.117
U21	UMTS B2	RMC12.2K	9262	Rear Face	0	25	23.13	-0.05	3.970	1.690	2.599
U22	UMTS B2	RMC12.2K	9538	Rear Face	0	25	23.16	0.16	2.900	1.430	2.184
U23	UMTS B2	RMC12.2K	9400	Rear Face (Repeated)	0	25	23.15	0.01	5.240	2.250	3.445
U08	UMTS B4	RMC12.2K	1413	Front Face	0	25	23.35	-0.04	2.410	1.310	1.915
U09	UMTS B4	RMC12.2K	1413	Rear Face	0	25	23.35	0.00	5.100	2.380	3.480
U10	UMTS B4	RMC12.2K	1413	Left Side	0	25	23.35	0.03	1.540	0.710	1.038
U11	UMTS B4	RMC12.2K	1413	Right Side	0	25	23.35	0.06	1.740	0.800	1.170
U12	UMTS B4	RMC12.2K	1413	Top Side	0	25	23.35	-0.19	5.870	2.530	3.699
U13	UMTS B4	RMC12.2K	1413	Bottom Side	0	25	23.35	0.14	0.210	0.101	0.148
U27	UMTS B4	RMC12.2K	1312	Rear Face	0	25	23.23	0.02	4.450	2.120	3.187
U28	UMTS B4	RMC12.2K	1513	Rear Face	0	25	23.36	0.07	4.790	2.210	3.224
U24	UMTS B4	RMC12.2K	1312	Top Side	0	25	23.23	0.02	5.270	2.030	3.051
U25	UMTS B4	RMC12.2K	1513	Top Side	0	25	23.36	-0.15	5.810	2.430	3.545
U26	UMTS B4	RMC12.2K	1413	Top Side (Repeated)	0	25	23.35	0.13	5.670	2.350	3.436
U15	UMTS B5	RMC12.2K	4182	Front Face	0	25	23.01	-0.14	0.838	0.524	0.829
U16	UMTS B5	RMC12.2K	4182	Rear Face	0	25	23.01	0.10	2.460	1.130	1.787
U17	UMTS B5	RMC12.2K	4182	Left Side	0	25	23.01	-0.10	0.633	0.409	0.647
U18	UMTS B5	RMC12.2K	4182	Right Side	0	25	23.01	0.12	0.183	0.159	0.251
U19	UMTS B5	RMC12.2K	4182	Top Side	0	25	23.01	0.06	0.430	0.224	0.354
U20	UMTS B5	RMC12.2K	4182	Bottom Side	0	25	23.01	-0.16	0.074	0.043	0.068

Note: The value with boldface is the maximum SAR Value of each test band.

2. Extremity SAR test results of LTE

Test No.	Band	Mode	Channel	RB	offset	Test Position	Separation Distance (cm)	Maximum Tune-up (dBm)	Conducted Power (dBm)	Power Drift (dB)	SAR 1g (W/kg)	SAR 10g (W/kg)	Reported 10g SAR
L01	LTE B2	QPSK20M	18900	1	99	Front Face	0	23.5	23.32	0.04	2.080	1.060	1.105
L02	LTE B2	QPSK20M	18900	1	99	Rear Face	0	23.5	23.32	0	7.580	3.130	3.264
L03	LTE B2	QPSK20M	18900	1	99	Left Side	0	23.5	23.32	0.09	1.880	0.898	0.936
L04	LTE B2	QPSK20M	18900	1	99	Right Side	0	23.5	23.32	-0.04	1.450	0.755	0.787
L05	LTE B2	QPSK20M	18900	1	99	Top Side	0	23.5	23.32	0.12	5.020	2.160	2.252
L06	LTE B2	QPSK20M	18900	1	99	Bottom Side	0	23.5	23.32	-0.11	0.199	0.112	0.117
L56	LTE B2	QPSK20M	18900	50	25	Front Face	0	22.5	22.30	0.02	1.820	0.910	0.954
L57	LTE B2	QPSK20M	18900	50	25	Rear Face	0	22.5	22.30	-0.06	4.810	2.490	2.610
L58	LTE B2	QPSK20M	18900	50	25	Left Side	0	22.5	22.30	0.05	1.590	0.772	0.809
L59	LTE B2	QPSK20M	18900	50	25	Right Side	0	22.5	22.30	0.13	2.160	1.040	1.090
L60	LTE B2	QPSK20M	18900	50	25	Top Side	0	22.5	22.30	0.07	4.600	1.820	1.907
L61	LTE B2	QPSK20M	18900	50	25	Bottom Side	0	22.5	22.30	-0.09	0.083	0.044	0.046
L103	LTE B2	QPSK20M	18700	1	50	Rear Face	0	23.5	23.16	0.16	6.380	2.990	3.231
L104	LTE B2	QPSK20M	19100	1	0	Rear Face	0	23.5	23.17	-0.09	6.830	2.970	3.204
L105	LTE B2	QPSK20M	18700	1	50	Top Side	0	23.5	23.16	-0.02	6.830	2.640	2.853
L106	LTE B2	QPSK20M	19100	1	0	Top Side	0	23.5	23.17	-0.08	7.010	3.010	3.247
L107	LTE B2	QPSK20M	18700	50	25	Rear Face	0	22.5	22.26	0.04	5.780	2.670	2.823
L108	LTE B2	QPSK20M	19100	50	25	Rear Face	0	22.5	22.11	-0.07	5.600	2.520	2.758
L109	LTE B2	QPSK20M	18700	100	0	Rear Face	0	22.5	22.14	-0.1	5.690	2.630	2.859
L110	LTE B2	QPSK20M	18900	1	99	Rear Face (Repeated)	0	23.5	23.32	0.11	6.190	3.090	3.222
L08	LTE B4	QPSK20M	20300	1	50	Front Face	0	23.5	23.21	-0.06	2.840	1.520	1.625
L09	LTE B4	QPSK20M	20300	1	50	Rear Face	0	23.5	23.21	0.11	5.500	2.610	2.790
L10	LTE B4	QPSK20M	20300	1	50	Left Side	0	23.5	23.21	-0.02	2.030	1.070	1.144
L11	LTE B4	QPSK20M	20300	1	50	Right Side	0	23.5	23.21	-0.1	1.900	1.070	1.144
L12	LTE B4	QPSK20M	20300	1	50	Top Side	0	23.5	23.21	0.08	6.480	2.810	3.004
L13	LTE B4	QPSK20M	20300	1	50	Bottom Side	0	23.5	23.21	0.16	0.468	0.241	0.258
L62	LTE B4	QPSK20M	20050	50	25	Front Face	0	22.5	21.98	0.02	2.350	1.420	1.601
L63	LTE B4	QPSK20M	20050	50	25	Rear Face	0	22.5	21.98	-0.04	3.660	1.860	2.097
L64	LTE B4	QPSK20M	20050	50	25	Left Side	0	22.5	21.98	0.13	1.550	0.822	0.927
L65	LTE B4	QPSK20M	20050	50	25	Right Side	0	22.5	21.98	0.09	1.470	0.792	0.893
L66	LTE B4	QPSK20M	20050	50	25	Top Side	0	22.5	21.98	0.06	4.770	1.930	2.175
L67	LTE B4	QPSK20M	20050	50	25	Bottom Side	0	22.5	21.98	0.01	0.209	0.122	0.138
L111	LTE B4	QPSK20M	20050	1	50	Rear Face	0	23.5	22.94	0.15	4.860	2.370	2.698
L112	LTE B4	QPSK20M	20175	1	0	Rear Face	0	23.5	22.86	0.18	4.610	2.300	2.665
L113	LTE B4	QPSK20M	20050	1	50	Top Side	0	23.5	22.94	-0.07	6.170	2.470	2.812
L114	LTE B4	QPSK20M	20175	1	0	Top Side	0	23.5	22.86	0.12	6.190	2.505	2.903
L115	LTE B4	QPSK20M	20175	50	25	Rear Face	0	22.5	21.82	0.01	3.810	1.910	2.232
L116	LTE B4	QPSK20M	20300	50	0	Rear Face	0	22.5	21.92	0.05	3.600	1.880	2.147
L117	LTE B4	QPSK20M	20175	50	25	Top Side	0	22.5	21.82	0.05	4.460	1.890	2.209
L118	LTE B4	QPSK20M	20300	50	0	Top Side	0	22.5	21.92	0.17	4.280	1.830	2.090
L119	LTE B4	QPSK20M	20050	100	0	Top Side	0	22.5	21.94	-0.06	4.940	1.970	2.241
L120	LTE B4	QPSK20M	20300	1	50	Top Side (Repeated)	0	23.5	23.21	0.04	4.870	2.140	2.288

Test No.	Band	Mode	Channel	RB	offset	Test Position	Separation Distance (cm)	Maximum Tune-up (dBm)	Conducted Power (dBm)	Power Drift (dB)	SAR 1g (W/kg)	SAR 10g (W/kg)	Reported 10g SAR
L15	LTE B5	QPSK10M	20450	1	24	Front Face	0	25	23.58	0.15	1.050	0.671	0.931
L16	LTE B5	QPSK10M	20450	1	24	Rear Face	0	25	23.58	-0.04	3.790	1.730	2.401
L17	LTE B5	QPSK10M	20450	1	24	Left Side	0	25	23.58	0.02	1.110	0.705	0.978
L18	LTE B5	QPSK10M	20450	1	24	Right Side	0	25	23.58	0.17	0.406	0.267	0.371
L19	LTE B5	QPSK10M	20450	1	24	Top Side	0	25	23.58	-0.03	1.440	0.577	0.801
L20	LTE B5	QPSK10M	20450	1	24	Bottom Side	0	25	23.58	0	0.204	0.098	0.137
L68	LTE B5	QPSK10M	20525	25	12	Front Face	0	24	22.56	0.02	1.180	0.773	1.077
L69	LTE B5	QPSK10M	20525	25	12	Rear Face	0	24	22.56	0.07	3.200	1.550	2.160
L70	LTE B5	QPSK10M	20525	25	12	Left Side	0	24	22.56	-0.02	0.944	0.588	0.819
L71	LTE B5	QPSK10M	20525	25	12	Right Side	0	24	22.56	0.09	0.364	0.236	0.329
L72	LTE B5	QPSK10M	20525	25	12	Top Side	0	24	22.56	0.01	2.030	0.795	1.108
L73	LTE B5	QPSK10M	20525	25	12	Bottom Side	0	24	22.56	0.13	0.116	0.064	0.088
L121	LTE B5	QPSK10M	20525	1	24	Rear Face	0	25	23.55	0.13	3.740	1.680	2.347
L122	LTE B5	QPSK10M	20600	1	24	Rear Face	0	25	23.53	-0.19	3.240	1.460	2.046
L123	LTE B5	QPSK10M	20450	25	0	Rear Face	0	24	22.54	-0.03	2.910	1.280	1.791
L124	LTE B5	QPSK10M	20600	25	12	Rear Face	0	24	22.41	-0.09	2.620	1.180	1.701
L125	LTE B5	QPSK10M	20450	50	0	Rear Face	0	24	22.54	-0.03	2.940	1.300	1.821
L126	LTE B5	QPSK10M	20450	1	24	Rear Face (Repeated)	0	25	23.58	0.19	3.620	1.610	2.234
L22	LTE B12	QPSK10M	23060	1	49	Front Face	0	25	23.72	0.05	0.251	0.151	0.203
L23	LTE B12	QPSK10M	23060	1	49	Rear Face	0	25	23.72	0	7.140	2.930	3.930
L24	LTE B12	QPSK10M	23060	1	49	Left Side	0	25	23.72	-0.11	0.147	0.101	0.135
L25	LTE B12	QPSK10M	23060	1	49	Right Side	0	25	23.72	0.02	0.057	0.040	0.054
L26	LTE B12	QPSK10M	23060	1	49	Top Side	0	25	23.72	0.08	0.997	0.398	0.534
L27	LTE B12	QPSK10M	23060	1	49	Bottom Side	0	25	23.72	-0.14	0.117	0.055	0.073
L74	LTE B12	QPSK10M	23130	25	0	Front Face	0	24	22.68	0.01	0.204	0.131	0.178
L75	LTE B12	QPSK10M	23130	25	0	Rear Face	0	24	22.68	0.09	6.504	2.740	3.715
L76	LTE B12	QPSK10M	23130	25	0	Left Side	0	24	22.68	0.13	0.129	0.082	0.111
L77	LTE B12	QPSK10M	23130	25	0	Right Side	0	24	22.68	0.07	0.044	0.031	0.041
L78	LTE B12	QPSK10M	23130	25	0	Top Side	0	24	22.68	-0.08	0.948	0.391	0.530
L79	LTE B12	QPSK10M	23130	25	0	Bottom Side	0	24	22.68	0.04	0.059	0.033	0.044
L127	LTE B12	QPSK10M	23095	1	24	Rear Face	0	25	23.63	0.18	7.120	2.590	3.547
L128	LTE B12	QPSK10M	23130	1	24	Rear Face	0	25	23.66	0.1	6.980	2.730	3.718
L129	LTE B12	QPSK10M	23060	25	25	Rear Face	0	24	22.67	0.12	5.460	2.210	3.002
L130	LTE B12	QPSK10M	23095	25	25	Rear Face	0	24	22.66	-0.13	5.400	2.190	2.982
L131	LTE B12	QPSK10M	23130	50	0	Rear Face	0	24	22.60	0.17	5.320	2.150	2.968
L132	LTE B12	QPSK10M	23060	1	49	Rear Face (Repeated)	0	25	23.72	0.06	6.827	2.790	3.742

Test No.	Band	Mode	Channel	RB	offset	Test Position	Separation Distance (cm)	Maximum Tune-up (dBm)	Conducted Power (dBm)	Power Drift (dB)	SAR 1g (W/kg)	SAR 10g (W/kg)	Reported 10g SAR
L29	LTE B13	QPSK10M	23230	1	49	Front Face	0	25	23.75	0.04	0.766	0.438	0.584
L30	LTE B13	QPSK10M	23230	1	49	Rear Face	0	25	23.75	-0.13	5.410	2.180	2.908
L31	LTE B13	QPSK10M	23230	1	49	Left Side	0	25	23.75	0.05	0.605	0.379	0.506
L32	LTE B13	QPSK10M	23230	1	49	Right Side	0	25	23.75	0.03	0.223	0.139	0.185
L33	LTE B13	QPSK10M	23230	1	49	Top Side	0	25	23.75	-0.12	1.860	0.746	0.995
L34	LTE B13	QPSK10M	23230	1	49	Bottom Side	0	25	23.75	0.11	0.179	0.096	0.128
L80	LTE B13	QPSK10M	23230	25	12	Front Face	0	24	22.63	0.02	0.617	0.375	0.514
L81	LTE B13	QPSK10M	23230	25	12	Rear Face	0	24	22.63	-0.07	4.490	1.860	2.550
L82	LTE B13	QPSK10M	23230	25	12	Left Side	0	24	22.63	0.13	0.421	0.255	0.350
L83	LTE B13	QPSK10M	23230	25	12	Right Side	0	24	22.63	0.08	0.155	0.097	0.134
L84	LTE B13	QPSK10M	23230	25	12	Top Side	0	24	22.63	0.07	1.710	0.673	0.923
L85	LTE B13	QPSK10M	23230	25	12	Bottom Side	0	24	22.63	0.12	0.131	0.065	0.089
L133	LTE B13	QPSK10M	23230	1	0	Rear Face	0	25	23.43	-0.01	5.450	1.890	2.713
L134	LTE B13	QPSK10M	23230	1	24	Rear Face	0	25	23.61	0.1	4.920	1.850	2.549
L135	LTE B13	QPSK10M	23230	25	0	Rear Face	0	24	22.57	0.03	3.850	1.410	1.960
L136	LTE B13	QPSK10M	23230	25	25	Rear Face	0	24	22.48	-0.08	3.630	1.330	1.887
L137	LTE B13	QPSK10M	23230	50	0	Rear Face	0	24	22.53	0.08	3.800	1.390	1.950
L138	LTE B13	QPSK10M	23230	1	49	Rear Face (Repeated)	0	25	23.75	-0.01	5.070	1.974	2.633
L36	LTE B14	QPSK10M	23330	1	24	Front Face	0	25	23.88	0.05	0.949	0.586	0.758
L37	LTE B14	QPSK10M	23330	1	24	Rear Face	0	25	23.88	-0.01	4.900	2.160	2.794
L38	LTE B14	QPSK10M	23330	1	24	Left Side	0	25	23.88	0.11	0.566	0.391	0.506
L39	LTE B14	QPSK10M	23330	1	24	Right Side	0	25	23.88	0.14	0.215	0.151	0.195
L40	LTE B14	QPSK10M	23330	1	24	Top Side	0	25	23.88	0.09	1.850	0.758	0.981
L41	LTE B14	QPSK10M	23330	1	24	Bottom Side	0	25	23.88	-0.05	0.183	0.088	0.114
L86	LTE B14	QPSK10M	23330	25	12	Front Face	0	24	22.66	-0.02	0.572	0.402	0.547
L87	LTE B14	QPSK10M	23330	25	12	Rear Face	0	24	22.66	0.05	3.930	1.800	2.451
L88	LTE B14	QPSK10M	23330	25	12	Left Side	0	24	22.66	0.09	0.423	0.289	0.393
L89	LTE B14	QPSK10M	23330	25	12	Right Side	0	24	22.66	-0.13	0.154	0.109	0.148
L90	LTE B14	QPSK10M	23330	25	12	Top Side	0	24	22.66	0.08	1.460	0.670	0.912
L91	LTE B14	QPSK10M	23330	25	12	Bottom Side	0	24	22.66	0.07	0.072	0.047	0.064
L139	LTE B14	QPSK10M	23330	1	0	Rear Face	0	25	23.50	-0.06	4.270	1.950	2.754
L140	LTE B14	QPSK10M	23330	1	49	Rear Face	0	25	23.75	-0.06	4.190	2.000	2.667
L141	LTE B14	QPSK10M	23330	25	0	Rear Face	0	24	22.61	0.12	3.550	1.680	2.314
L142	LTE B14	QPSK10M	23330	25	25	Rear Face	0	24	22.59	0.1	3.270	1.550	2.145
L143	LTE B14	QPSK10M	23330	50	0	Rear Face	0	24	22.60	-0.14	3.330	1.570	2.167
L144	LTE B14	QPSK10M	23330	1	24	Rear Face (Repeated)	0	25	23.88	0.13	4.340	2.050	2.652

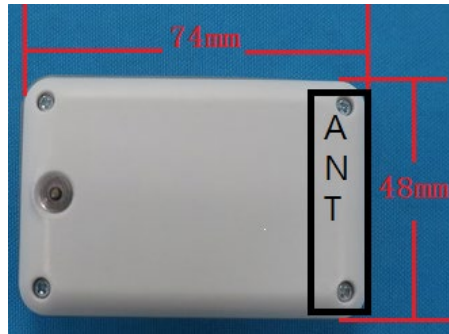
Test No.	Band	Mode	Channel	RB	offset	Test Position	Separation Distance (cm)	Maximum Tune-up (dBm)	Conducted Power (dBm)	Power Drift (dB)	SAR 1g (W/kg)	SAR 10g (W/kg)	Reported 10g SAR
L43	LTE B66	QPSK20M	132572	1	50	Front Face	0	23.5	23.27	-0.04	2.550	1.420	1.497
L44	LTE B66	QPSK20M	132572	1	50	Rear Face	0	23.5	23.27	-0.07	4.820	2.370	2.499
L45	LTE B66	QPSK20M	132572	1	50	Left Side	0	23.5	23.27	0.12	1.480	0.747	0.788
L46	LTE B66	QPSK20M	132572	1	50	Right Side	0	23.5	23.27	0.03	1.780	0.925	0.975
L47	LTE B66	QPSK20M	132572	1	50	Top Side	0	23.5	23.27	0.17	7.610	3.340	3.521
L48	LTE B66	QPSK20M	132572	1	50	Bottom Side	0	23.5	23.27	0	0.338	0.156	0.164
L92	LTE B66	QPSK20M	132572	50	50	Front Face	0	22.5	22.00	0.03	2.240	1.200	1.346
L93	LTE B66	QPSK20M	132572	50	50	Rear Face	0	22.5	22.00	0.08	4.070	2.150	2.411
L94	LTE B66	QPSK20M	132572	50	50	Left Side	0	22.5	22.00	0.09	1.070	0.549	0.616
L95	LTE B66	QPSK20M	132572	50	50	Right Side	0	22.5	22.00	0.13	1.410	0.725	0.813
L96	LTE B66	QPSK20M	132572	50	50	Top Side	0	22.5	22.00	-0.07	4.600	1.800	2.018
L97	LTE B66	QPSK20M	132572	50	50	Bottom Side	0	22.5	22.00	0.04	0.079	0.041	0.046
L145	LTE B66	QPSK20M	132072	1	50	Rear Face	0	23.5	22.61	0.02	4.680	2.220	2.723
L146	LTE B66	QPSK20M	132322	1	0	Rear Face	0	23.5	22.99	-0.1	4.270	2.020	2.270
L147	LTE B66	QPSK20M	132072	1	50	Top Side	0	23.5	22.61	0.04	5.678	2.280	2.797
L148	LTE B66	QPSK20M	132322	1	0	Top Side	0	23.5	22.99	0.13	5.529	2.203	2.475
L149	LTE B66	QPSK20M	132072	50	0	Rear Face	0	22.5	21.81	0.05	3.880	1.740	2.041
L150	LTE B66	QPSK20M	132322	50	25	Rear Face	0	22.5	21.88	-0.15	3.319	1.665	1.921
L151	LTE B66	QPSK20M	132072	50	0	Top Side	0	22.5	21.81	0.06	4.940	1.810	2.123
L152	LTE B66	QPSK20M	132322	50	25	Top Side	0	22.5	21.88	0.02	4.670	1.882	2.172
L153	LTE B66	QPSK20M	132072	100	0	Top Side	0	22.5	21.78	0.16	5.006	1.841	2.173
L154	LTE B66	QPSK20M	132572	1	50	Top Side (Repeated)	0	23.5	23.27	-0.09	5.678	2.330	2.457
L50	LTE B71	QPSK20M	133322	1	50	Front Face	0	25	23.46	-0.05	0.150	0.071	0.101
L51	LTE B71	QPSK20M	133322	1	50	Rear Face	0	25	23.46	-0.01	8.140	2.660	3.796
L52	LTE B71	QPSK20M	133322	1	50	Left Side	0	25	23.46	0.02	0.070	0.018	0.025
L53	LTE B71	QPSK20M	133322	1	50	Right Side	0	25	23.46	0.09	0.009	0.007	0.010
L54	LTE B71	QPSK20M	133322	1	50	Top Side	0	25	23.46	0.01	0.769	0.277	0.395
L55	LTE B71	QPSK20M	133322	1	50	Bottom Side	0	25	23.46	0.06	0.085	0.014	0.020
L98	LTE B71	QPSK20M	133372	50	0	Front Face	0	24	22.58	-0.12	0.081	0.033	0.045
L99	LTE B71	QPSK20M	133372	50	0	Rear Face	0	24	22.58	0.06	6.130	1.980	2.746
L100	LTE B71	QPSK20M	133372	50	0	Left Side	0	24	22.58	-0.01	0.050	0.015	0.021
L101	LTE B71	QPSK20M	133372	50	0	Right Side	0	24	22.58	-0.12	0.024	0.007	0.010
L102	LTE B71	QPSK20M	133372	50	0	Top Side	0	24	22.58	0.13	0.724	0.220	0.305
L155	LTE B71	QPSK20M	133222	1	50	Rear Face	0	25	23.09	0.08	6.660	2.320	3.601
L156	LTE B71	QPSK20M	133372	1	50	Rear Face	0	25	23.44	0.09	6.620	2.330	3.336
L157	LTE B71	QPSK20M	133222	50	25	Rear Face	0	24	22.55	0.07	5.098	1.734	2.421
L158	LTE B71	QPSK20M	133322	50	50	Rear Face	0	24	22.57	-0.08	5.270	1.810	2.514
L159	LTE B71	QPSK20M	133222	100	0	Rear Face	0	24	22.49	-0.06	5.213	1.780	2.521
L160	LTE B71	QPSK20M	133322	1	50	Rear Face (Repeated)	0	25	23.46	0.01	8.500	2.410	3.438

Note: The value with boldface is the maximum SAR Value of each test band.

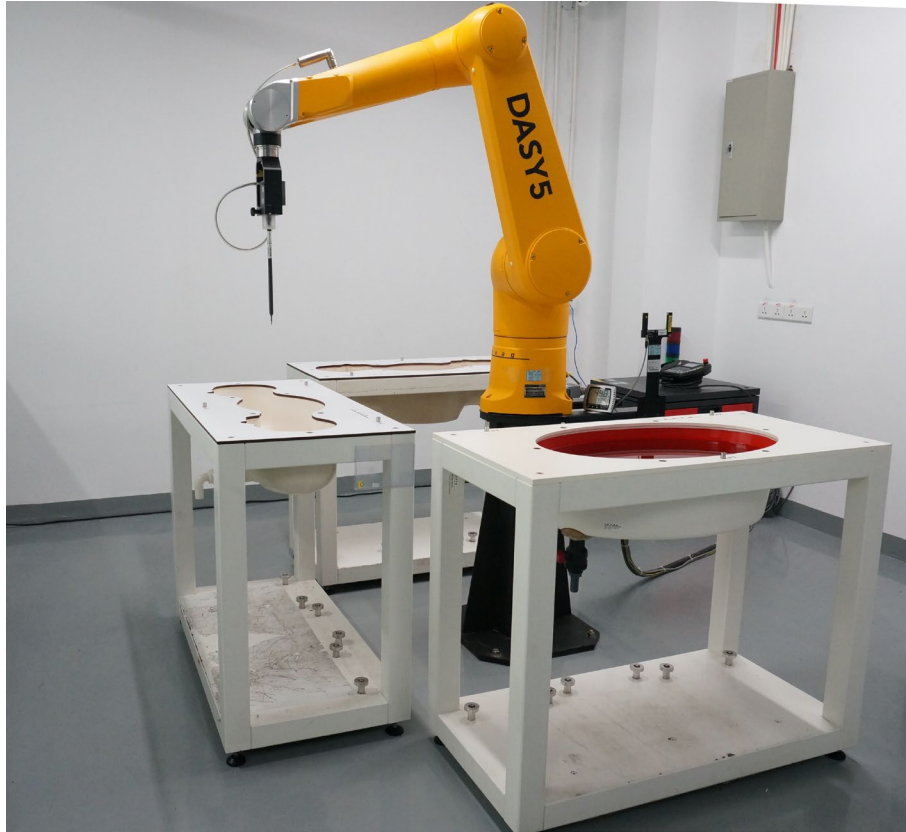
7.3 MULTIPLE TRANSMITTER EVALUATION

The following tables list information which is relevant for the decision if a simultaneous transmit evaluation is necessary according to FCC KDB 447498D01 General RF Exposure Guidance v06.

The location of the antennas inside EUT is shown as below picture:

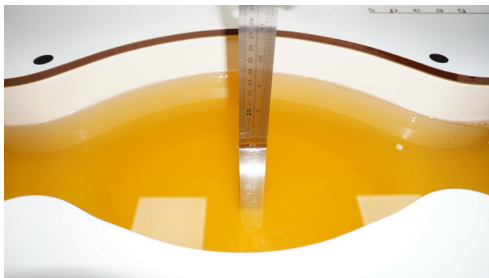
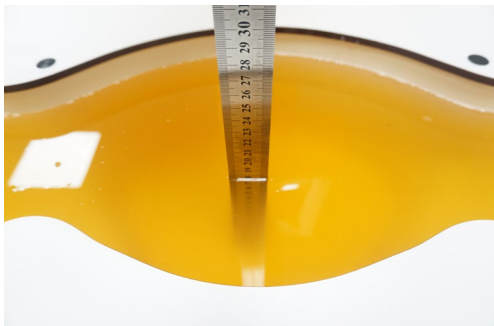


Note: The EUT only has one antenna and does not have synchronous transmission function.

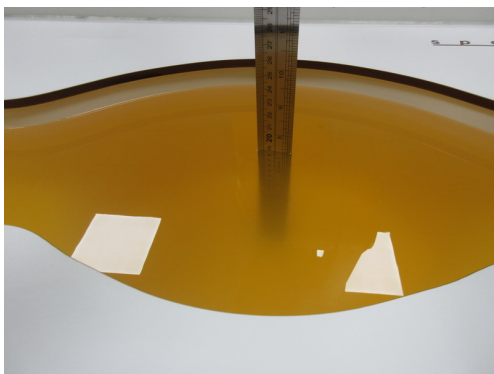
APPENDIX**1. TEST LAYOUT****Specific Absorption Rate Test Layout**

Liquid depth in the flat Phantom (≥ 15 cm depth)

HSL_690MHz-925MHz_Body_18.5cm HSL_1700MHz-1900MHz_Body_16.2cm



HSL_1900MHz-2300MHz_Body_18.8cm



Appendix A. SAR Plots of System Verification

(Pls See BTL-FCC SAR-1-2108H047_Appendix A.)

Appendix B. SAR Plots of SAR Measurement

(Pls See BTL-FCC SAR-1-2108H047_Appendix B.)

Appendix C. Calibration Certificate

(Pls See BTL-FCC SAR-1-2108H047_Appendix C.)

Appendix D. Photographs of the Test Set-Up

(Pls See BTL-FCC SAR-1-2108H047_Appendix D.)

Appendix E. Conducted Power Measurement Result

(Pls See BTL-FCC SAR-1-2108H047_Appendix E.)

End of Test Report