FCC SAR Test Report

FCC ID: 2AENAYPZNLT

Project No.	:	1903T095
Equipment	:	Smart Tracker By Yepzon
Model Name	:	YPZNLT
Applicant	:	Yepzon Oy
Address	:	Finlaysoninkuja 9, 33210 Tampere Finland

Date of Receipt	:	Mar. 25, 2019
Date of Test	:	Mar. 26, 2019 ~ Apr. 09, 2019
Issued Date	:	May. 09, 2019
Tested by	:	BTL Inc.

PREPARED BY : (Morrison Huang)

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Testing Laboratory
0659

Declaration

BTL represents to the client that testing is done in accordance with standard procedures as applicable and that test instruments used has been calibrated with standards traceable to international standard(s) and/or national standard(s).

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BTL's laboratory quality assurance procedures are in compliance with the **ISO/IEC 17025** requirements, and accredited by the conformity assessment authorities listed in this test report.

BTL is not responsible for the sampling stage, so the results only apply to the sample as received.

The information, data and test plan are provided by manufacturer which may affect the validity of results, so it is manufacturer's responsibility to ensure that the apparatus meets the essential requirements of applied standards and in all the possible configurations as representative of its intended use.

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	May. 09, 2019

1. GENERAL SUMMARY

Equipment	Smart Tracker By Yepzon
Brand Name	YEPZ0N
Model Name	YPZNLT
Manufacturer	VVDN Technologies Pvt. Ltd
Address	B-22,Infocity Sector-34, Gurgaon-122001, Haryana,India
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 **KDB447498 D01** General RF Exposure Guidance v06 **KDB248227 D01** 802. 11 Wi-Fi SAR v02r02 **KDB865664 D01** SAR measurement 100 MHz to 6 GHz v01r04 **KDB865664 D02** SAR Reporting v01r02 **KDB690783 D01** SAR Listings on Grants v01r03 **KDB941225 D01** 3G SAR Procedures v03r01 **KDB941225 D05** SAR for LTE Devices v02r05 **KDB941225 D06** Hot Spot SAR v02r01

The above equipment has been tested and found compliance with the requirement of the relative standards by BTL Inc.
The test data, data evaluation, and equipment configuration contained in our test report (Ref No. BTL-FCC SAR-1-1903T095) were obtained utilizing the test procedures, test instruments, test sites that has been accredited by the Authority of TAF according to the ISO/IEC 17025 quality assessment standard and technical standard(s).

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 No. 68-1, Ln. 169, Sec.2, Datong Rd., Xizhi Dist., New Taipei City 221, Taiwan.

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. GENERAL INFORMATION

3.1. STATEMENT OF COMPLIANCE

Equipment Class	Band	Highest Body SAR-1g (W/kg)	NB-IOT Highest Body SAR-1g (W/kg)	LTE Cat.M1 Highest Body SAR-1g (W/kg)
PCE	GSM850	0.699		
	GSM1900	0.728		
	LTE 2		0.75	1.273
	LTE 4		0.181	0.64
	LTE 12		0.037	0.264

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.

3.2. GENERAL DESCRIPTION OF EUT

Equipment	Smart Tracker By Yepzon		
Model Name	YPZNLT		
IMEI Code	911658550000300		
IMSI(DEC)	001010123456789		
Modulation	GSM(GMSK/8PSK) , LTE_Cat.M1(QPSK/16QAM) , LTE NB-Iot(BPSK_3.75KHz/ QPSK_15KHz) , BT(GFSK/ π /4-DQPSK/8-DPSK) , WiFi(DSSS/OFDM),		
Operation Frequency Range(s)	Band	TX (MHz)	RX (MHz)
	GSM850	824-849	869-894
	GSM1900	1850-1910	1930-1990
	LTE Band 2	1850-1910	1930-1990
	LTE Band 4	1710-1755	2110-2155
	LTE Band 12	699-716	729-746
	Bluetooth	2402-2483.5	
	WIFI 2.4G	2412-2462	
Test Channels (low-mid-high):	Band	Channel	
	GSM850	128-188-251	
	GSM1900	512-661-810	
	LTE Cat.M1_Band 2 BW=20MHz	18700-18900-19100	
	LTE Cat.M1_Band 4 BW=20MHz	20050-20175-20300	
	LTE Cat.M1_Band 12 BW=10MHz	23060-23095-23130	
	LTE NB-Iot_Band2 BW=15KHz	18601-18900-19199	
	LTE NB-Iot_Band4 BW=15KHz	19951-20175-20399	
	LTE NB-Iot_Band12 BW=15KHz	23011-23095-23179	
	WIFI 2.4G	1-6-11	
	BLE	0-19-39	
Other Information			
Battery	Model	BZ502435	
	Capacitance	450mAh	
	Rated Voltage	3.7V	
	Manufacturer	Shenzhen Benzo Energy Technology Co.,Ltd.	

Antenna Information				
Brand	Model	Type	Band	Gain(dBi)
Pulse	NBLT	PCB	GSM850	-7.27
			GSM1900	-4.45
			LTE Band 2	-4.45
			LTE Band 4	-0.24
			LTE Band 12	-6.70
			Bluetooth	-0.16
			WIFI 2.4G	-0.24

3.3. LABORATORY ENVIRONMENT

Temperature	Min. = 18ºC, Max. = 25ºC
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.	

3.4. MAIN TEST INSTRUMENTS

Item	Equipment	Manufacturer	Model	Serial No.	Cal. Date	Cal. Interval
1	Data Acquisition Electronics	Speag	DAE4	1486	Sep. 18, 2018	1 Year
2	Data Acquisition Electronics	Speag	DAE4	1561	Nov. 07, 2018	1 Year
3	E-field Probe	Speag	EX3DV4	7520	Nov. 05, 2018	1 Year
4	E-field Probe	Speag	EX3DV4	3901	Sep. 27, 2018	1 Year
5	System Validation Dipole	Speag	D750V3	1095	Jun. 05, 2018	3 Year
6	System Validation Dipole	Speag	D835V2	4d160	Jun. 05, 2018	3 Year
7	System Validation Dipole	Speag	D1750V2	1101	Jun. 07, 2018	3 Year
8	System Validation Dipole	Speag	D1900V2	5d179	Jun. 07, 2018	3 Year
9	Twin Sam Phantom	Speag	Twin Sam Phantom V5.0	1897	N/A	N/A
10	Radio Communication Analyer	Anritsu	MT8821C	6261935354	Feb. 28, 2019	1 Year
11	Power Meter	Anritsu	ML2495A	1128008	Dec. 06, 2018	1 Year
12	Power Sensor	Anritsu	MA2411B	1126001	Dec. 06, 2018	1 Year
13	Power Meter	Keysight	8990B	MY5100051	Aug. 17, 2018	1 Year
14	Power Sensor	Keysight	N1923A	MY58310005	Aug. 09, 2018	1 Year
15	ENA Network Analyzer	Agilent	E5071C	MY46524658	Mar. 16, 2019	1 Year
16	Signal Generator	R&S	SMR40	100502	Jun. 03, 2019	1 Year
17	Dielectric Probe Kit	Agilent	85070E	2593	N/A	N/A
18	Low pass filter	Mini-Circuits	SLP-2950+	M108294	N/A	N/A
19	Power Amplifier	Mini-Circuits	ZVE-2W-272+	N650001538	N/A	N/A
20	Power Amplifier	Mini-Circuits	ZVE-8G+	N628801631	N/A	N/A
21	Dielectric Probe Kit	Agilent	85070E	2593	N/A	N/A
22	Dielectric Probe Kit	Agilent	85070E	2593	N/A	N/A

Note:
1. "N/A" denotes no model name, serial No. or calibration specified.
2. * These test equipments have been recalibrated between the test periods. All these test equipments were within the valid period when the tests were performed.
3. 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.

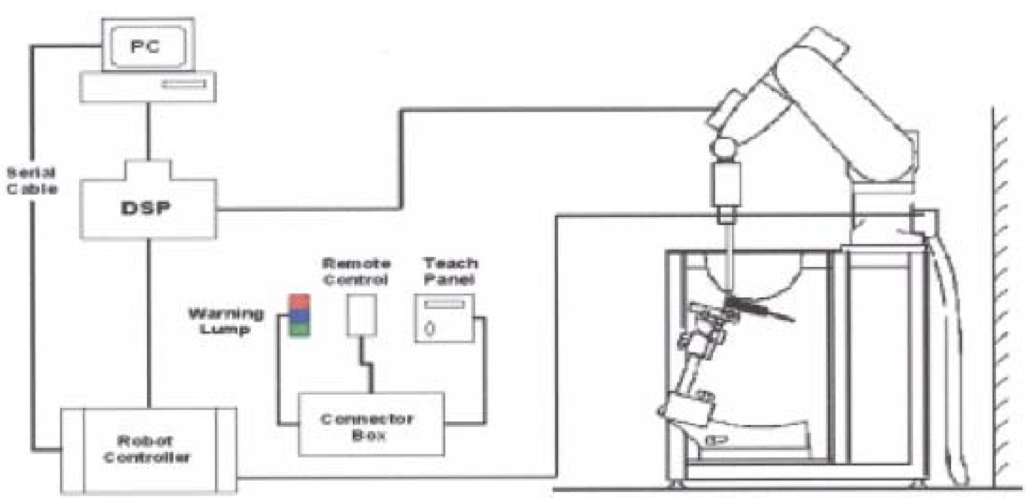
4. SAR MEASUREMENTS SYSTEM CONFIGURATION

4.1. 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. TheDASY5 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. 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.

4.1.1. TEST SETUP LAYOUT

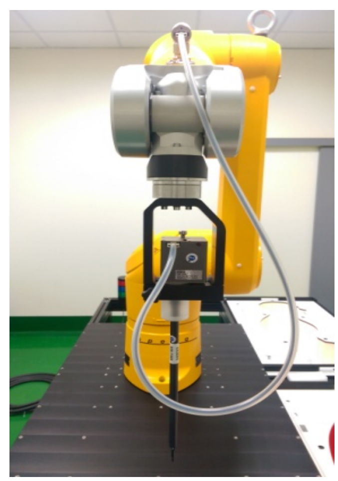


4.2. DASY5 E-FIELD PROBE SYSTEM

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

4.2.1. EX3DV4 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 μW/g to > 100 mW/g Linearity:± 0.2dB
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

EX3DV4 E-field Probe

4.2.2. E-FIELD PROBE CALIBRATION

Each probe is calibrated according to a dosimetric assessment procedure with accuracy better than ±10%. The spherical isotropy was evaluated and found to be better than ± 0.25dB. 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 bellow 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.

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

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

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

Where: σ = Simulated tissue conductivity,
ρ = Tissue density (kg/m3).

4.2.3. OTHER TEST EQUIPMENT

4.2.3.1. 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, ELI4and SAM v6.0Phantoms.
Material: POM, Acrylic glass, Foam

4.2.3.2 Phantom

Model	ELI4 Phantom	
Construction	Phantom for compliance testing of handheld and body-mounted wireless devices in the frequency range of 30 MHz to 6 GHz. ELI is fully compatible with the IEC 62209-2 standard and all known tissue simulating liquids. ELI has been optimized regarding its performance and can be integrated into our standard phantom tables. A cover prevents evaporation of the liquid. Reference markings on the phantom allow installation of the complete setup, including all predefined phantom positions and measurement grids, by teaching three points. The phantom is compatible with all SPEAG dosimetric probes and dipoles.	
Shell Thickness	2±0.1 mm	
Filling Volume	Approx. 30 liters	
Dimensions	Length: 600 mm ; Width: 190mm Height: adjustable feet	
Aailable	Special	

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	
Aailable	Special	

4.2.4. 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. ± 5 %.

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

- Area Scan

The “area scan” 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(≤2GHz)，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: Δx_{zoom}, $\Delta y_{zoom} \leq$ 2GHz -≤8mm, 2-4GHz -≤5 mm and 4-6 GHz-≤4mm; $\Delta z_{zoom} \leq$3GHz -≤5 mm, 3-4 GHz-≤4mm and 4-6GHz-≤2mm 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 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 (Δx_{area}, Δy_{area})	Maximun Zoom Scan spatial resolution (Δx_{Zoom}, Δy_{Zoom})	Maximun Zoom Scan spatial resolution			Minimum zoom scan volume (x,y,z)
			Uniform Grid	Graded Grad		
			$\Delta z_{Zoom}(n)$	$\Delta z_{Zoom}(1)^*$	$\Delta z_{Zoom}(n>1)^*$	
≤2GHz	≤15mm	≤8mm	≤5mm	≤4mm	≤1.5*Δz_{Zoom}(n-1)	≥30mm
2-3GHz	≤12mm	≤5mm	≤5mm	≤4mm	≤1.5*Δz_{Zoom}(n-1)	≥30mm
3-4GHz	≤12mm	≤5mm	≤4mm	≤3mm	≤1.5*Δz_{Zoom}(n-1)	≥28mm
4-5GHz	≤10mm	≤4mm	≤3mm	≤2.5mm	≤1.5*Δz_{Zoom}(n-1)	≥25mm
5-6GHz	≤10mm	≤4mm	≤2mm	≤2mm	≤1.5*Δz_{Zoom}(n-1)	≥22mm

4.2.5. 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.

4.2.6. DATA STORAGE AND EVALUATION

4.2.6.1 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 “DAE4”. The software evaluates the desired unit and format for output each time the data is visualized or exported. This allows verification of the complete software setup even after the measurement and allows correction of incorrect parameter settings. For example, if a measurement has been performed with a wrong crest factor parameter in the device 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.

4.2.7. 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, a_{i0}, a_{i1}, a_{i2}
	Conversion factor	$ConvF_i$
	Diode compression point	Dcp_i
Device parameters:	Frequency	f
	Crest factor	cf
Media parameters:	Conductivity	·
	Density	·

These parameters must be set correctly in the software. They can be found in the component documents or they can be imported into the software from the configuration files issued for the DASY5 components. In the direct measuring mode of the 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)
	dcp_i = diode compression point	(DASY parameter)

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

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

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

aij = 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):

$$E_{tot} = (E_X^2 + E_Y^2 + E_Z^2)^{1/2}$$

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

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

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/cm^3

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

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

With P_{pwe} = equivalent power density of a plane wave in mW/cm^2

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

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

5. SYSTEM VERIFICATION PROCEDURE

5.1. TISSUE VERIFICATION

The simulating liquids should be checked at the beginning of a series of SAR measurements to determine of the dielectic parameter are within the tolerances of the specified target values. The measured conductivity and relative permittivity should be within ± 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
Body 750	0.2	-	0.2	0.8	48.8	-	50.0	-
Body 835	0.2	-	0.2	0.9	48.5	-	50.2	-
Body 1750	-	31.0	-	0.2	-	-	68.8	-
Body 1900	-	29.5	-	0.3	-	-	70.2	-
Body 2000	-	30.0	-	0.2	-	-	69.8	-
Body 2450	-	31.4	-	0.1	-	-	68.5	-
Body 2600	-	31.8	-	0.1	-	-	68.1	-
Body 5G	-	-	-	-	-	10.7	78.6	10.7

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. (℃)	Conductivity (σ)	Permittivity (εr)	Targeted Conductivity (σ)	Targeted Permittivity (εr)	Deviation Conductivity (σ) (%)	Deviation Permittivity (εr) (%)	Date
Body	750	22.1	0.960	56.483	0.96	55.5	0.00	1.77	Apr. 08, 2019
Body	835	22.0	0.981	53.997	0.97	55.2	1.13	-2.18	Mar. 26, 2019
Body	1750	22.2	1.487	54.389	1.49	53.4	-0.20	1.85	Apr. 03, 2019
Body	1750	22.1	1.481	54.739	1.49	53.4	-0.60	2.51	Apr. 09, 2019
Body	1900	22.2	1.558	53.307	1.52	53.3	2.50	0.01	Mar. 26, 2019
Body	1900	22.5	1.555	53.605	1.52	53.3	2.30	0.57	Apr. 03, 2019

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.

5.2. SYSTEM CHECK

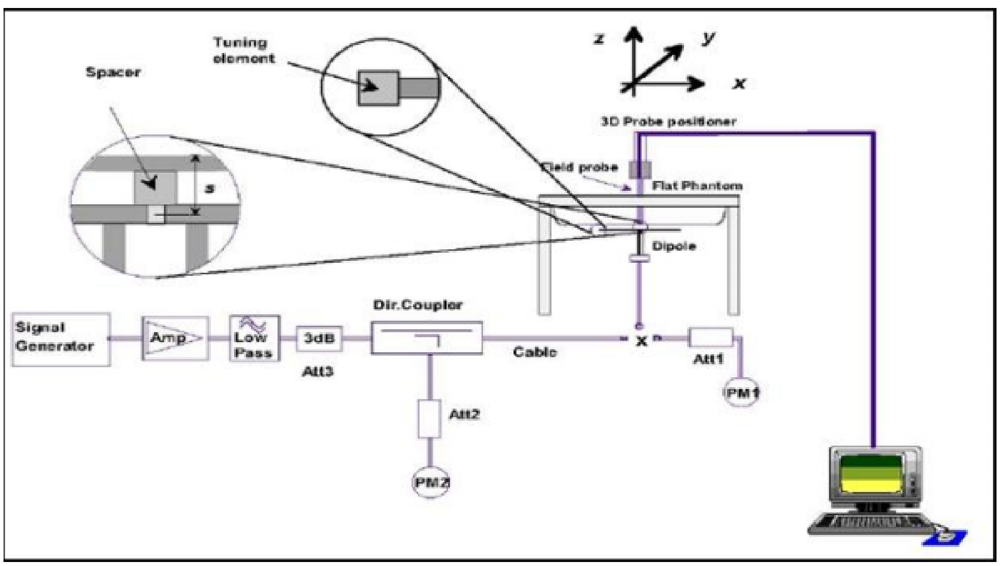
The system check is performed for verifying the accuracy of the complete measurement system and performance of the software. The system check is performed with tissue equivalent material according to IEEE P1528 (described above). The following table shows system check results for all frequency bands 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
Body	Apr. 08, 2019	750	8.51	2.20	8.80	3.41	1095
Body	Mar. 26, 2019	835	9.53	2.50	10.00	4.93	4d160
Body	Apr. 03, 2019	1750	37.40	9.76	39.04	4.39	1101
Body	Apr. 09, 2019	1750	37.40	9.74	38.96	4.17	1101
Body	Mar. 26, 2019	1900	39.80	9.75	39.00	-2.01	5d179
Body	Apr. 03, 2019	1900	39.80	10.40	41.60	4.52	5d179

5.3. 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 250 mW(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 (±10 %).



6. SAR MEASUREMENT VARIABILITY AND UNCERTAINTY

6.1. 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 (~ 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 8.2.

7. OPERATIONAL CONDITIONS DURING TEST

7.1. SAR TEST CONFIGURATION

7.1.1. GSM TEST CONFIGURATION

SAR tests for GSM850 and GSM1900, a communication link is set up with a base station by air link. Using 8960 Series the power lever is set to “5”and “0” in SAR of GSM850 and GSM1900. The tests in the band of GSM850 and GSM1900 are performed in the mode of GPRS/EGPRS function. Since the GPRS class is 12 for this EUT, it has at most 4 timeslots in uplink and at most 4 timeslots in downlink, the maximum total timeslot is 5. The EGPRS class is 12 for this EUT, it has at most 4 timeslots in uplink, and at most 4 timeslots in downlink, the maximum total timeslot is 5.

When SAR tests for EGPRS mode is necessary, GMSK modulation should be used to minimize SAR measurement error due to higher peak-to-average power (PAR) ratios inherent in 8PSK.

According to specification 3GPP TS 51.010, the maximum power of the GSM can do the power reduction for the multi-slot.

The allowed power reduction in the multi-slot configuration is as following:

Number of timeslots in uplink assignment		Reduction of maximum output power (dB)		
Band	Time Slots	GPRS (GMSK)	EGPRS (GMSK)	EGPRS (8PSK)
GSM850	1 TX slot	0.0	0.0	6.4
	2 TX slots	3.0	3.0	9.4
	3 TX slots	4.8	4.8	11.2
	4 TX slots	6.0	6.0	12.4
GSM1900	1 TX slot	0.0	0.0	4.3
	2 TX slots	3.0	3.0	7.3
	3 TX slots	4.8	4.8	9.1
	4 TX slots	6.0	6.0	10.3

7.1.2. LTE CAT.M1 TEST CONFIGURATION

SAR for LTE band exposure configurations is measured according to the procedures of KDB 941225 D05 SAR for LTE Devices. The MT8821C WideBand 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 6.2.3EA-1 of the 3GPP TS36.521:

Table 6.2.3EA-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	>2	>2	>1	>4	-	-	≤ 1
QPSK	>5	>5	-	-	-	-	≤ 2
16 QAM	≤ 2	≤ 2	>1	>3	-	-	≤ 1
16QAM	>2	>2	>3	>5	-	-	≤ 2

3. A-MPR

The allowed A-MPR(Additional MPR) values specified below in Table 6.2.4EA-1 of 3GPP TS36.521 are in addition to the allowed MPR requirements. All the measurements below were performed with A-MPR disabled, by using Network Signaling Value of"NS_01".

Table 6.2.4EA-1: Additional Maximum Power Reduction (A-MPR) for category M1 UE

Network Signalling value	Requirements (subclause)	E-UTRA Band	Resources Blocks (N_{RB})	A-MPR (dB)
NS_01	6.6.2.1.1	Table 5.2-1	Table 5.4.2-1	N/A
NS_03	6.6.2.2.1	2, 4	Table 5.4.2-1	N/A
NS_04	6.6.2.2.2	41	[TBD]	[TBD]
NS_05	6.6.3.3.3.2	1	Table 5.4.2-1	N/A
NS_06	6.6.2.2.3	12, 13, 14	Table 5.4.2-1	N/A
NS_07	6.6.2.2.3 6.6.3.3.3.3	13	Table 6.2.4-2E	
NS_08	6.6.3.3.3.4	19	Table 5.4.2-1	N/A
NS_09	6.6.3.3.3.5	21	Table 5.4.2-1	N/A
NS_10		20	Table 5.4.2-1	N/A
NS_12	6.6.3.3.3.7	26	[TBD]	
NS_13	6.6.3.3.3.8	26	Table 5.4.2-1	N/A
NS_14	6.6.3.3.3.9	26	Table 5.4.2-1	N/A
NS_15	6.6.3.3.3.10	26	Table 6.2.4-9	
NS_16	6.6.3.3.3.11	27	Table 5.4.2-1	N/A
NS_17	6.6.3.3.3.12	28	Table 5.4.2-1	N/A
NS_18	6.6.3.3.3.13	28	Table 5.4.2-1	N/A
NS_32	-	-	-	-
NS_35	[TBD]	71	[TBD]	[TBD]
NS_38	6.6.3.3.3.27	74	Table 5.4.2-1	N/A
NS_39	6.6.3.3.3.28	74	Table 5.4.2-1	N/A

7.1.3. NB-IOT NB1 TEST CONFIGURATION

The Category NB1 for a 3.75 kHz subcarrier spacing, the maximum output power is defined as the average measured power. When the UE does not transmit, the period is at least one time slot (2 ms), excluding the 2304 Ts gap. For a 15 kHz subcarrier spacing, the maximum output power is defined as the average measured power, which is at least one subframe (1 ms).

The initial test configurations of the environmental conditions and test frequencies based on the subset of E-UTRA operating defined. NB-IoT in clause 5.2F. All of these configurations shall be tested with applicable test parameters, and are shown in table 6.2. 2F.4.1-1 of 3GPP TS36.521.

Table 6.2.2F.4.1-1: Test Configuration Initial Conditions

Test Environment as specified in TS 36.508 [7] subclause 8.1.1		Normal, TL/VL, TL/VH, TH/VL, TH/VH		
Test Frequencies as specified in TS 36.508 [7] subclause 8.1.3.1		Frequency ranges defined in Annex K.1.2		
Test Parameters				
Configuration ID	**Downlink Configuration**	**Uplink Configuration**		
	N/A	Modulation	N_{tones}	Sub-carrier spacing (kHz)
1 (Note 2)		BPSK	1@0	3.75
2 (Note 3)		BPSK	1@47	3.75
3 (Note 2)		QPSK	1@0	15
4 (Note 3)		QPSK	1@11	15
5 (Note 1)		QPSK	3@3	15
Note 1: Applicable to UE supporting UL multi-tone transmissions Note 2: only applicable for low range Note 3: only applicable for high range				

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 > ½ 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 > ½ 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.

7.1.4. WIFI TEST CONFIGURATION

For WLAN SAR testing, WLAN engineering testing software installed on the DUT can provide continuous transmitting RF signal.

2.4G

Mode	802.11b	802.11g	802.11n HT20	802.11n HT40
Duty cycle	100%			
Crest factor	1			

For WiFi SAR testing, a communication link is set up with the test mode software for WiFi mode test. During the test, at the each test frequency channel, the EUT is operated at the RF continuous emission mode. The RF signal utilized in SAR measurement has 100% duty cycle and its crest factor is 1. The test procedures in KDB 248227 D01 are applied.

7.1.1.1 2.4G SAR Test Requirements

802.11b DSSS SAR Test Requirements

SAR is measured for 2.4 GHz 802.11b DSSS using either a fixed test position or, when applicable, the initial test position procedure. SAR test reduction is determined according to the following:

1) When the reported SAR of the highest measured maximum output power channel for the exposure configuration is ≤ 0.8 W/kg, no further SAR testing is required for 802.11b DSSS in that exposure configuration.
2) When the reported SAR is > 0.8 W/kg, SAR is required for that exposure configuration using the next highest measured output power channel. When any reported SAR is > 1.2 W/kg, SAR is required for the third channel; i.e., all channels require testing.

2.4 GHz 802.11g/n OFDM SAR Test Exclusion Requirements

When SAR measurement is required for 2.4 GHz 802.11g/n OFDM configurations, the measurement and test reduction procedures for OFDM are applied. SAR is not required for the following 2.4 GHz OFDM conditions.

1) When KDB Publication 447498 SAR test exclusion applies to the OFDM configuration.
2) When the highest reported SAR for DSSS is adjusted by the ratio of OFDM to DSSS specified maximum output power and the adjusted SAR is ≤ 1.2 W/kg.

SAR Test Requirements for OFDM configurations

When SAR measurement is required for 2.4 GHz 802.11g/n OFDM configurations, each standalone And frequency aggregated band is considered separately for SAR test reduction. In applying the initial test configuration and subsequent test configuration procedures, the 802.11 transmission configuration with the highest specified maximum output power and the channel within a test configuration with the highest measured maximum output power should be clearly distinguished to apply the procedures.

7.1.1.3 OFDM transmission mode and SAR test channel selection

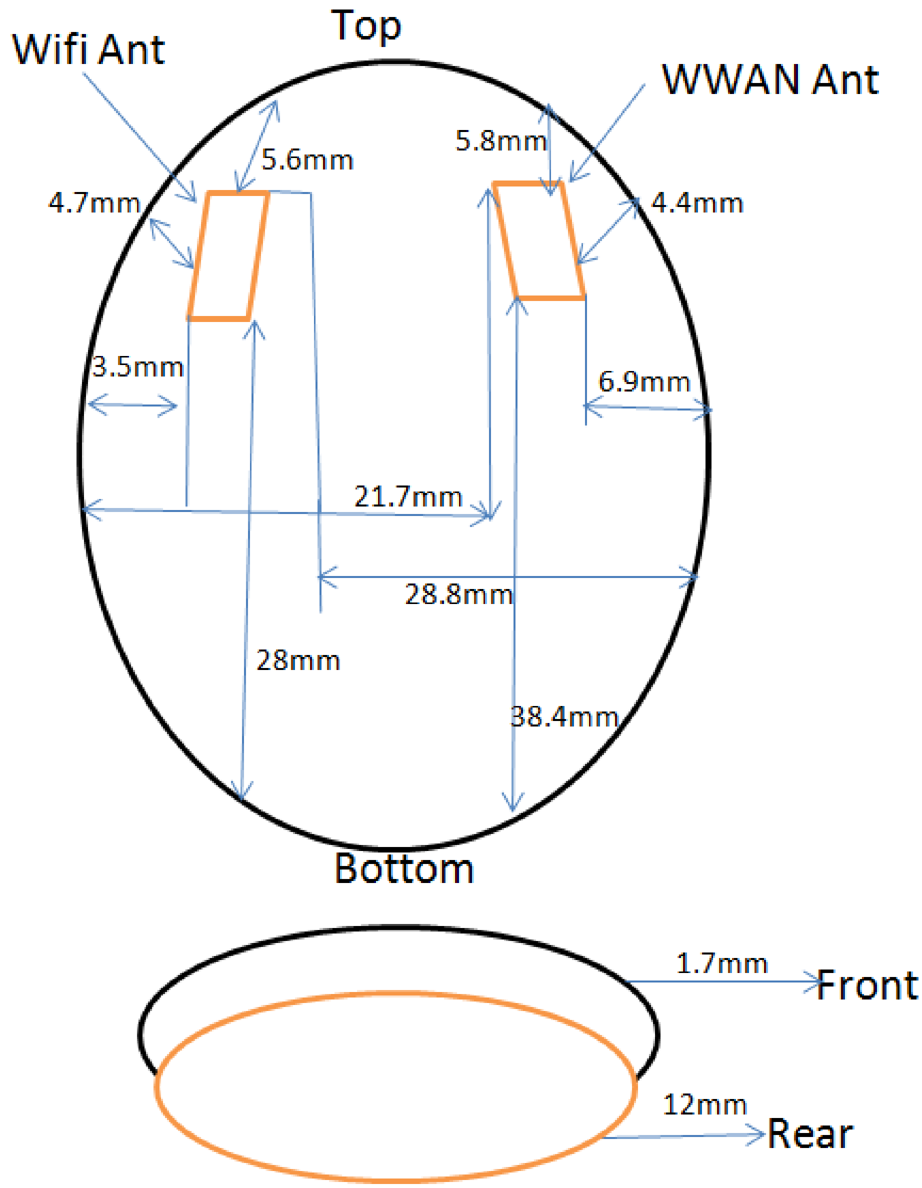
For the 2.4GHz, when the same maximum output power was specified for multiple OFDM transmission mode configurations in a frequency band or aggregated band, SAR is measured using the configuration with the largest channel bandwidth, lowest order modulation and lowest data rate. When the maximum output power of a channel is the same for equivalent OFDM configurations(for example 802.11g and 802.11n,with the same channel bandwidth, modulation, and data rate, etc.). When the maximum output power are the same for multiple test channels, either according to the default or additional power measurement requirements, SAR is measured using the channel closest to the middle of the frequency band or aggregated band. When there are multiple channels with the same maximum output power, SAR is measured using the higher number channel.

7.1.1.4 Initial test configuration procedure

For OFDM, in both 2.4G bands, an initial test configuration is determined for each frequency band and aggregated band, according to the transmission mode with the highest maximum output power specified for SAR measurements. When the same maximum output power is specified for multiple OFDM transmission mode configurations in a frequency band or aggregated band, SAR is measured using the configuration(s) with the largest channel bandwidth, lowest order modulation, and lowest data rate. If the average RF output powers of the highest identical transmission modes are within 0.25 dB of each other, mid channel of the transmission mode with highest average RF output powers is the initial test channel. Otherwise, the channel of the transmission mode with the highest average RF output power will be the initial test configuration.

When the reported SAR is ≤ 0.8 W/kg, no additional measurements on other test channels are required. Otherwise, SAR is evaluated using the subsequent highest average RF output channel until the reported SAR result is ≤1.2 W/kg or all channels are measured. When there are multiple untested channels having the same subsequent highest average RF output power, the channel with higher frequency from the lowest 802.11 mode is considered for SAR measurement.

7.2. TEST POSITION ANTENNA LOCATION



Antenna	Front Face	Rear Face	Right Side	Left Side	Top Side	Bottom Side
WWAN	1.7mm	12mm	4.4mm	21.7 mm	5.8mm	38.4 mm
WLAN	1.7mm	12mm	28.8mm	3.5 mm	5.6 mm	28 mm

8. TEST RESULT

8.1. CONDUCTED POWER RESULTS

8.1.1. CONDUCTED POWER MEASUREMENTS OF GSM BAND

GSM850		Max Burst Average Power (dBm)				Max Frame Average Power (dBm)			
		Max. Tune-up	Channel/Frequency(MHz)			Max. Tune-up	Channel/Frequency(MHz)		
			128/824.2	188/836.2	251/848.8		128/824.2	188/836.2	251/848.8
GPRS/EDGE (GMSK)	1 Tx Slot	27.00	26.88	26.93	26.92	17.81	17.69	17.74	17.73
	2 Tx Slot	27.50	27.07	26.74	26.76	21.37	20.94	20.61	20.63
	3 Tx Slot	27.50	27.04	26.93	26.68	23.08	22.62	22.51	22.26
	4 Tx Slot	27.00	26.94	26.84	26.53	23.82	23.76	23.66	23.35
EDGE (8PSK)	1 Tx Slot	25.00	24.84	24.73	24.69	15.81	15.65	15.54	15.50
	2 Tx Slot	25.00	24.68	24.62	24.58	18.87	18.55	18.49	18.45
	3 Tx Slot	25.00	24.66	24.52	24.43	20.58	20.24	20.10	20.01
	4 Tx Slot	25.00	24.51	24.42	24.39	21.82	21.33	21.24	21.21
GSM1900		Max Burst Average Power (dBm)				Max Frame Average Power (dBm)			
		Max. Tune-up	Channel/Frequency(MHz)			Max. Tune-up	Channel/Frequency(MHz)		
			512/1850.2	661/1880	810/1909.8		512/1850.2	661/1880	810/1909.8
GPRS/EDGE (GMSK)	1 Tx Slot	21.50	21.15	21.11	20.09	12.31	11.96	11.92	10.90
	2 Tx Slot	21.50	21.11	21.04	20.02	15.37	14.98	14.91	13.89
	3 Tx Slot	21.50	21.02	20.98	19.94	17.08	16.60	16.56	15.52
	4 Tx Slot	22.00	21.94	20.86	20.07	18.82	18.76	17.68	16.89
EDGE (8PSK)	1 Tx Slot	19.50	19.34	18.78	17.66	10.31	10.15	9.59	8.47
	2 Tx Slot	19.50	19.03	18.53	17.62	13.37	12.90	12.40	11.49
	3 Tx Slot	19.00	18.79	18.32	17.13	14.58	14.37	13.90	12.71
	4 Tx Slot	18.50	18.46	17.94	16.83	15.32	15.28	14.76	13.65

Note:

The conducted power of GSM Band is measured with RMS detector.

8.1.2. CONDUCTED POWER MEASUREMENTS OF LTE CAT.M1

LTE B2/BW=1.4M		Average Conducted Power(dBm)			
Modula-tion	RB Size/ Offset / NB Index	Max. Tune-up	Channel/Frequency(MHz)		
			18607/ 1850.7	18900/ 1880	19193/ 1909.3
QPSK	1/0/0	24.00	23.37	23.67	23.15
	1/5/0	24.00	23.53	23.57	22.71
	3/0/0	24.00	23.47	23.52	22.68
	3/3/0	24.00	23.41	23.47	22.57
	6/0/0	24.00	23.39	23.66	23.02
16QAM	1/0/0	22.50	22.08	22.14	21.31
	1/4/0	22.50	22.05	22.09	21.23
	3/0/0	22.50	21.99	22.04	21.20
	3/2/0	22.50	21.93	21.99	21.09
	5/0/0	22.00	21.88	21.95	21.33

LTE B2/BW=3M		Average Conducted Power(dBm)			
Modula-tion	RB Size/ Offset / NB Index	Max. Tune-up	Channel/Frequency(MHz)		
			18615/ 1851.5	18900/ 1880	19185/ 1908.5
QPSK	1/0/0	24.00	23.46	23.79	23.28
	1/5/1	24.00	23.62	23.66	22.80
	3/0/0	24.00	23.56	23.61	22.77
	3/3/1	24.00	23.50	23.56	22.66
	6/0/0	24.00	23.78	23.69	22.96
	6/0/1	24.00	23.45	23.52	22.90
16QAM	1/0/0	22.50	22.15	22.21	21.38
	1/4/1	22.50	22.12	22.16	21.30
	3/0/0	22.50	22.06	22.11	21.27
	3/2/1	22.50	22.00	22.06	21.16
	5/0/0	22.50	21.99	22.08	21.46
	5/0/1	22.50	21.95	22.02	21.40

LTE B2/BW=5M		Average Conducted Power(dBm)			
Modula-tion	RB Size/ Offset / NB Index	Max. Tune-up	Channel/Frequency(MHz)		
			18625/ 1852.5	18900/ 1880	19175/ 1907.5
QPSK	1/0/0	24.00	23.80	23.86	23.03
	1/0/3	24.00	23.77	23.81	22.95
	1/5/0	24.00	23.71	23.76	22.92
	1/5/3	24.00	23.65	23.71	22.81
	3/0/0	24.00	23.64	23.73	23.11
	3/3/3	24.00	23.60	23.67	23.05
	6/0/0	24.00	23.48	23.66	23.08
	6/0/3	24.00	23.36	23.58	22.94
16QAM	1/0/0	22.50	22.30	22.36	21.53
	1/0/3	22.50	22.27	22.31	21.45
	1/4/0	22.50	22.21	22.26	21.42
	1/4/3	22.50	22.15	22.21	21.31
	3/0/0	22.50	22.14	22.23	21.61
	3/2/3	22.50	22.10	22.17	21.55
	5/0/0	22.50	21.98	22.16	21.58
	5/0/3	22.50	21.86	22.08	21.44

LTE B2/BW=10M		Average Conducted Power(dBm)			
Modula-tion	RB Size/ Offset / NB Index	Max. Tune-up	Channel/Frequency(MHz)		
			18650/ 1855	18900/ 1880	19150/ 1905
QPSK	1/0/0	24.00	23.87	23.93	23.10
	1/0/3	24.00	23.84	23.88	23.02
	1/5/4	24.00	23.78	23.83	22.99
	1/5/7	24.00	23.72	23.78	22.88
	3/0/0	24.00	23.71	23.80	23.18
	3/3/7	24.00	23.67	23.74	23.12
	6/0/0	24.00	23.55	23.73	23.15
	6/0/7	24.00	23.43	23.65	23.01
16QAM	1/0/0	22.50	22.37	22.43	21.60
	1/0/3	22.50	22.34	22.38	21.52
	1/4/4	22.50	22.28	22.33	21.49
	1/4/7	22.50	22.22	22.28	21.38
	3/0/0	22.50	22.21	22.30	21.68
	3/2/7	22.50	22.17	22.24	21.62
	5/0/0	22.50	22.05	22.23	21.65
	5/0/7	22.50	21.93	22.15	21.51

LTE B2/BW=15M		Average Conducted Power(dBm)				LTE B2/BW=20M		Average Conducted Power(dBm)			
Modula-tion	RB Size/ Offset / NB Index	Max. Tune-up	Channel/Frequency(MHz)			Modula-tion	RB Size/ Offset / NB Index	Max. Tune-up	Channel/Frequency(MHz)		
			18675/ 1857.5	18900/ 1880	19125/ 1902.5				18700/ 1860	18900/ 1880	19100/ 1900
QPSK	1/0/0	24.50	23.99	24.05	23.22	QPSK	1/0/0	24.50	24.06	24.12	23.29
	1/0/3	24.50	23.96	24.00	23.14		1/0/3	24.50	24.03	24.07	23.21
	1/5/8	24.50	23.90	23.95	23.11		1/5/12	24.50	23.97	24.02	23.18
	1/5/11	24.00	23.84	23.90	23.00		1/5/15	24.00	23.91	23.97	23.07
	3/0/0	24.00	23.83	23.92	23.30		3/0/0	24.00	23.99	23.90	23.37
	3/3/11	24.00	23.79	23.86	23.24		3/3/15	24.00	23.86	23.93	23.31
	6/0/0	24.00	23.67	23.85	23.27		6/0/0	24.00	23.74	23.92	23.34
	6/0/11	24.00	23.55	23.77	23.13		6/0/15	24.00	23.62	23.84	23.20
16QAM	1/0/0	23.00	22.49	22.55	21.72	16QAM	1/0/0	23.00	22.56	22.62	21.79
	1/0/3	23.00	22.46	22.50	21.64		1/0/3	23.00	22.53	22.57	21.71
	1/4/8	23.00	22.40	22.45	21.61		1/4/12	23.00	22.47	22.52	21.68
	1/4/11	23.00	22.34	22.40	21.50		1/4/15	23.00	22.41	22.47	21.57
	3/0/0	22.50	22.33	22.42	21.80		3/0/0	22.50	22.40	22.49	21.87
	3/2/11	22.50	22.29	22.36	21.74		3/2/15	22.50	22.36	22.43	21.81
	5/0/0	22.50	22.17	22.35	21.77		5/0/0	22.50	22.24	22.42	21.84
	5/0/11	22.50	22.05	22.27	21.63		5/0/15	22.50	22.12	22.34	21.70

LTE B4/BW=1.4M		Average Conducted Power(dBm)				LTE B4/BW=3M		Average Conducted Power(dBm)			
Modula-tion	RB Size/ Offset / NB Index	Max. Tune-up	Channel/Frequency(MHz)			Modula-tion	RB Size/ Offset / NB Index	Max. Tune-up	Channel/Frequency(MHz)		
			19957/ 1710.7	20175/ 1732.5	20393/ 1754.3				19965/ 1711.5	20175/ 1732.5	20385/ 1753.5
QPSK	1/0/0	24.00	23.72	23.11	22.71	QPSK	1/0/0	24.00	23.79	23.22	22.77
	1/5/0	24.00	23.76	23.29	22.83		1/5/1	24.00	23.81	23.20	22.80
	3/0/0	24.00	23.70	23.19	22.72		3/0/0	24.00	23.85	23.38	22.92
	3/3/0	24.00	23.69	23.26	22.89		3/3/1	24.00	23.79	23.28	22.81
	6/0/0	24.00	23.57	23.16	22.81		6/0/0	24.00	23.78	23.35	22.98
							6/0/1	24.00	23.66	23.25	22.90
16QAM	1/0/0	22.50	22.49	21.88	21.48	16QAM	1/0/0	23.00	22.57	22.00	21.55
	1/4/0	22.50	22.46	22.06	21.60		1/4/1	23.00	22.59	21.98	21.58
	3/0/0	22.50	22.47	21.96	21.49		3/0/0	23.00	22.63	22.16	21.70
	3/2/0	22.00	21.53	21.44	21.55		3/2/1	23.00	22.57	22.06	21.59
	5/0/0	21.50	21.22	21.18	21.21		5/0/0	22.00	21.63	21.54	21.65
							5/0/1	22.00	21.35	21.23	21.29

LTE B4/BW=5M		Average Conducted Power(dBm)				LTE B4/BW=10M		Average Conducted Power(dBm)			
Modula-tion	RB Size/ Offset / NB Index	Max. Tune-up	Channel/Frequency(MHz)			Modula-tion	RB Size/ Offset / NB Index	Max. Tune-up	Channel/Frequency(MHz)		
			19975/ 1712.5	20175/ 1732.5	20375/ 1752.5				20000/ 1715	20175/ 1732.5	20350/ 1750
QPSK	1/0/0	24.00	23.99	23.52	22.94	QPSK	1/0/0	24.50	24.06	23.59	23.01
	1/0/3	24.00	23.94	23.41	22.86		1/0/3	24.50	24.01	23.48	22.93
	1/5/0	24.00	23.90	23.33	22.88		1/5/4	24.50	23.97	23.40	22.95
	1/5/3	24.00	23.92	23.31	22.91		1/5/7	24.50	23.99	23.38	22.98
	3/0/0	24.00	23.96	23.49	23.03		3/0/0	24.50	24.03	23.56	23.10
	3/3/3	24.00	23.90	23.39	22.92		3/3/7	24.50	23.97	23.46	22.99
	6/0/0	24.00	23.89	23.46	23.09		6/0/0	24.50	23.96	23.53	23.16
	6/0/3	24.00	23.77	23.36	23.01		6/0/7	24.00	23.84	23.43	23.08
16QAM	1/0/0	23.00	22.77	22.30	21.72	16QAM	1/0/0	23.00	22.84	22.37	21.79
	1/0/3	23.00	22.72	22.19	21.64		1/0/3	23.00	22.79	22.26	21.71
	1/4/0	23.00	22.68	22.11	21.66		1/4/4	23.00	22.75	22.18	21.73
	1/4/3	23.00	22.70	22.09	21.69		1/4/7	23.00	22.77	22.16	21.76
	3/0/0	23.00	22.74	22.27	21.81		3/0/0	23.00	22.81	22.34	21.88
	3/2/3	23.00	22.68	22.17	21.70		3/2/7	23.00	22.75	22.24	21.77
	5/0/0	22.00	21.74	21.65	21.76		5/0/0	22.00	21.81	21.72	21.83
	5/0/3	22.00	21.46	21.34	21.40		5/0/7	22.00	21.53	21.41	21.47
LTE B4/BW=15M		Average Conducted Power(dBm)				LTE B4/BW=20M		Average Conducted Power(dBm)			
Modula-tion	RB Size/ Offset / NB Index	Max. Tune-up	Channel/Frequency(MHz)			Modula-tion	RB Size/ Offset / NB Index	Max. Tune-up	Channel/Frequency(MHz)		
			20025/ 1717.5	20175/ 1732.5	20325/ 1747.5				20050/ 1720	20175/ 1732.5	20300/ 1745
QPSK	1/0/0	24.50	24.12	23.65	23.07	QPSK	1/0/0	24.50	24.20	23.73	23.15
	1/0/3	24.50	24.07	23.54	22.99		1/0/3	24.50	24.15	23.62	23.07
	1/5/8	24.50	24.03	23.46	23.01		1/5/12	24.50	24.11	23.54	23.09
	1/5/11	24.50	24.05	23.44	23.04		1/5/15	24.50	24.13	23.52	23.12
	3/0/0	24.50	24.09	23.62	23.16		3/0/0	24.50	24.17	23.70	23.24
	3/3/11	24.50	24.03	23.52	23.05		3/3/15	24.50	24.11	23.60	23.13
	6/0/0	24.50	24.02	23.59	23.22		6/0/0	24.50	24.10	23.67	23.30
	6/0/11	24.00	23.90	23.49	23.14		6/0/15	24.00	23.98	23.57	23.22
16QAM	1/0/0	23.00	22.90	22.43	21.85	16QAM	1/0/0	23.00	22.98	22.51	21.93
	1/0/3	23.00	22.85	22.32	21.77		1/0/3	23.00	22.93	22.40	21.85
	1/4/8	23.00	22.81	22.24	21.79		1/4/12	23.00	22.89	22.32	21.87
	1/4/11	23.00	22.83	22.22	21.82		1/4/15	23.00	22.91	22.30	21.90
	3/0/0	23.00	22.87	22.40	21.94		3/0/0	23.00	22.95	22.48	22.02
	3/2/11	23.00	22.81	22.30	21.83		3/2/15	23.00	22.89	22.38	21.91
	5/0/0	22.00	21.87	21.78	21.89		5/0/0	22.00	21.95	21.86	21.97
	5/0/11	22.00	21.59	21.47	21.53		5/0/15	22.00	21.67	21.55	21.61

LTE B12/BW=1.4M		Average Conducted Power(dBm)			
			Channel/Frequency(MHz)		
Modula-tion	RB Size/ Offset / NB Index	Max. Tune-up	23017/ 699.7	23095/ 707.5	23173/ 715.3
QPSK	1/0/0	23.50	23.03	23.31	22.96
	1/5/0	23.50	22.92	23.20	22.85
	3/0/0	23.50	23.07	23.35	23.00
	3/3/0	23.50	23.11	23.39	23.04
	6/0/0	23.50	23.05	23.33	22.98
16QAM	1/0/0	22.50	22.00	22.29	21.95
	1/4/0	22.50	22.05	22.26	22.00
	3/0/0	22.50	22.01	22.29	22.06
	3/2/0	21.50	21.03	21.30	20.94
	5/0/0	21.50	20.98	21.15	20.87

LTE B12/BW=3M		Average Conducted Power(dBm)			
			Channel/Frequency(MHz)		
Modula-tion	RB Size/ Offset / NB Index	Max. Tune-up	23025/ 700.5	23095/ 707.5	23165/ 714.5
QPSK	1/0/0	24.00	23.27	23.55	23.20
	1/5/1	24.00	23.14	23.42	23.07
	3/0/0	23.50	23.03	23.31	22.96
	3/3/1	23.50	23.18	23.46	23.11
	6/0/0	23.50	23.22	23.50	23.15
	6/0/1	23.50	23.16	23.44	23.09
16QAM	1/0/0	22.50	22.11	22.42	22.05
	1/4/1	22.50	22.07	22.36	22.02
	3/0/0	22.50	22.12	22.33	22.07
	3/2/1	22.50	22.08	22.36	22.13
	5/0/0	21.50	21.10	21.37	21.01
	5/0/1	21.50	21.05	21.22	20.94

LTE B12/BW=5M		Average Conducted Power(dBm)			
			Channel/Frequency(MHz)		
Modula-tion	RB Size/ Offset / NB Index	Max. Tune-up	23035/ 701.5	23095/ 707.5	23155/ 713.5
QPSK	1/0/0	24.00	23.35	23.63	23.28
	1/0/3	24.00	23.22	23.50	23.15
	1/5/0	24.00	23.11	23.39	23.04
	1/5/3	24.00	23.26	23.54	23.19
	3/0/0	24.00	23.30	23.58	23.23
	3/3/3	24.00	23.24	23.52	23.17
	6/0/0	24.00	23.19	23.53	23.34
	6/0/3	24.00	23.09	23.41	23.22
16QAM	1/0/0	23.00	22.19	22.50	22.13
	1/0/3	23.00	22.15	22.44	22.10
	1/4/0	23.00	22.20	22.41	22.15
	1/4/3	23.00	22.16	22.44	22.21
	3/0/0	22.00	21.18	21.45	21.09
	3/2/3	22.00	21.13	21.30	21.02
	5/0/0	22.00	21.10	21.26	21.05
	5/0/3	22.00	20.88	21.22	20.92

LTE B12/BW=10M		Average Conducted Power(dBm)			
			Channel/Frequency(MHz)		
Modula-tion	RB Size/ Offset / NB Index	Max. Tune-up	23060/ 704	23095/ 707.5	23130/ 711
QPSK	1/0/0	24.00	23.47	23.75	23.40
	1/0/3	24.00	23.34	23.62	23.27
	1/5/4	24.00	23.23	23.51	23.16
	1/5/7	24.00	23.38	23.66	23.31
	3/0/0	24.00	23.42	23.70	23.35
	3/3/7	24.00	23.36	23.64	23.29
	6/0/0	24.00	23.31	23.65	23.46
	6/0/7	24.00	23.21	23.53	23.34
16QAM	1/0/0	23.00	22.31	22.62	22.25
	1/0/3	23.00	22.27	22.56	22.22
	1/4/4	23.00	22.32	22.53	22.27
	1/4/7	23.00	22.28	22.56	22.33
	3/0/0	22.00	21.30	21.57	21.21
	3/2/7	22.00	21.25	21.42	21.14
	5/0/0	22.00	21.22	21.38	21.17
	5/0/7	22.00	21.00	21.34	21.04

8.1.3. CONDUCTED POWER MEASUREMENTS OF LTE NB-IOT

LTE B2/BW=3.75KHz		Average Conducted Power(dBm)				LTE B2/BW=15KHz		Average Conducted Power(dBm)			
Modula -tion	Ntones	Max. Tune-up	Channel/Frequency(MHz)			Modula -tion	Ntones	Max. Tune-up	Channel/Frequency(MHz)		
			18601/ 1850.1	18900/ 1880	19199/ 1909.9				18601/ 1850.1	18900/ 1880	19199/ 1909.9
BPSK	1@0	23.00	22.29	23.00	22.67	QPSK	1@0	23.00	22.48	22.74	22.95
							1@11	23.50	22.85	22.99	23.06
	1@47	23.00	22.42	22.96	22.71		3@3	24.50	23.70	23.97	24.06

LTE B4/BW=3.75KHz		Average Conducted Power(dBm)				LTE B4/BW=15KHz		Average Conducted Power(dBm)			
Modula -tion	Ntones	Max. Tune-up	Channel/Frequency(MHz)			Modula -tion	Ntones	Max. Tune-up	Channel/Frequency(MHz)		
			19951/ 1710.1	20175/ 1732.5	20399/ 1754.9				19951/ 1710.1	20175/ 1732.5	20399/ 1754.9
BPSK	1@0	22.50	22.41	22.23	22.36	QPSK	1@0	22.50	22.14	22.03	22.32
							1@11	23.00	21.98	22.04	22.52
	1@47	23.00	22.51	22.18	22.14		3@3	23.50	23.41	22.92	23.02

LTE B12/BW=3.75KHz		Average Conducted Power(dBm)				LTE B12/BW=15KHz		Average Conducted Power(dBm)			
Modula -tion	Ntones	Max. Tune-up	Channel/Frequency(MHz)			Modula -tion	Ntones	Max. Tune-up	Channel/Frequency(MHz)		
			23011/ 699.1	23095/ 707.5	23179/ 715.9				23011/ 699.1	23095/ 707.5	23179/ 715.9
BPSK	1@0	22.00	21.74	21.60	21.62	QPSK	1@11	22.00	21.74	21.70	21.60
							1@11	22.00	21.82	21.53	21.58
	1@47	22.00	21.71	21.49	21.58		3@3	22.50	22.22	22.18	21.92

8.1.4. CONDUCTED POWER MEASUREMENTS OF BT BAND

BT	Tune Up	Average Conducted Power (dBm)			SAR Test (Yes/No)
		CH0	CH19	CH39	
BLE	1.0	-0.51	0.75	0.31	NO

Note:

1) The conducted power of BT is measured with RMS detector.
2) The BT standalone SAR test exclusion, reference to section 9 for explanation of rationale for exemption of testing.

8.1.5. CONDUCTED POWER MEASUREMENTS OF WIFI 2.4G

Conducted power measurement results of WiFi 2.4G

Mode	Channel	Frequency (MHz)	Data Rate (Mbps)	Tune-up	Average Power (dBm)	SAR Test (Yes/No)
802.11b	1	2412	1	9.0	8.92	NO
	6	2437		9.0	8.50	NO
	11	2462		9.0	7.86	NO
802.11g	1	2412	6	8.5	8.23	NO
	6	2437		8.5	8.20	NO
	11	2462		8.5	8.12	NO
802.11n HT20	1	2412	6.5	9.0	7.49	NO
	6	2437		9.0	8.64	NO
	11	2462		9.0	8.29	NO
802.11n HT40	3	2422	13.5	8.5	6.49	NO
	6	2437		8.5	7.30	NO
	9	2452		8.5	8.34	NO

Note: 1) The Average conducted power of WiFi is measured with RMS detector.
2) The WIFI standalone SAR test exclusion, reference to section 9 for explanation of rationale for exemption of testing.

8.2. 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 > ½ 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 ≥0.8W/kg; if the deviation among the repeated measurement is ≤ 20%,and the measured SAR <1.45W/kg, only one repeated measurement is required.
4) 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.

GSM Notes:

1) Per KDB648474 D04, body-worn accessory testing is typically associated with voice operations. Therefore, GSM voice was evaluated for body-worn SAR.
2) Per KDB941225 D01, SAR test reduction for GPRS and EDGE modes is determined by the source-based time-averaged output power specified for production units, including tune-up tolerance. The data 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

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)

8.2.1. SAR MEASUREMENT RESULT

1) SAR test results of GSM _separation distance=0.5cm

Test No.	Band	Mode	Channel	Test Position	Maximum Tune-up (dBm)	Conducted Power (dBm)	Power Drift	SAR 1g (W/kg)	Reported 1g SAR (W/kg)
T01	GSM 850	GPRS12	251	Front Face	25	24.39	0.13	**0.607**	**0.699**
T02	GSM 850	GPRS12	251	Rear Face	25	24.39	-0.04	0.087	0.100
T03	GSM 850	GPRS12	251	Left Side	25	24.39	0.06	0.113	0.130
T04	GSM 850	GPRS12	251	Right Side	25	24.39	-0.01	0.032	0.037
T05	GSM 850	GPRS12	251	Top Side	25	24.39	0.09	0.369	0.425
T06	GSM 850	GPRS12	251	Bottom Side	25	24.39	-0.14	0.00824	0.009
T10	GSM 1900	GPRS12	512	Front Face	22	21.94	-0.09	**0.718**	**0.728**
T11	GSM 1900	GPRS12	512	Rear Face	22	21.94	-0.11	0.000584	0.001
T12	GSM 1900	GPRS12	512	Left Side	22	21.94	0.06	0.139	0.141
T13	GSM 1900	GPRS12	512	Right Side	22	21.94	-0.07	0.0121	0.012
T14	GSM 1900	GPRS12	512	Top Side	22	21.94	0.04	0.375	0.380
T15	GSM 1900	GPRS12	512	Bottom Side	22	21.94	0.07	0.224	0.227

2) SAR test results of LTE Cat.M1 _separation distance=0.5cm

Test No.	Band	Mode	Channel	RB	offset	NB Index	Test Position	Maximum Tune-up (dBm)	Conducted Power (dBm)	Power Drift	SAR 1g (W/kg)	Reported 1g SAR (W/kg)
T50	LTE B2_CatM1	QPSK20M	18900	1	0	0	Front Face	24.5	24.12	0.01	1.11	1.211
T51	LTE B2_CatM1	QPSK20M	18900	1	0	0	Rear Face	24.5	24.12	0.15	0.43	0.469
T52	LTE B2_CatM1	QPSK20M	18900	1	0	0	Left Side	24.5	24.12	0.07	0.367	0.401
T53	LTE B2_CatM1	QPSK20M	18900	1	0	0	Right Side	24.5	24.12	-0.11	0.04	0.044
T54	LTE B2_CatM1	QPSK20M	18900	1	0	0	Top Side	24.5	24.12	-0.05	0.0072	0.008
T55	LTE B2_CatM1	QPSK20M	18900	1	0	0	Bottom Side	24.5	24.12	-0.12	0.207	0.226
T56	LTE B2_CatM1	QPSK20M	18700	1	0	0	Front Face	24.5	24.06	0.08	**1.15**	**1.273**
T57	LTE B2_CatM1	QPSK20M	19100	1	0	0	Front Face	24.5	23.29	0.05	0.911	1.204
T58	LTE B2_CatM1	QPSK20M	18700	1	0	0	Front Face	24.5	24.06	0.07	1.14	1.262
T59	LTE B2_CatM1	QPSK20M	18700	3	0	0	Front Face	24	23.99	0.09	1.03	1.032
T60	LTE B2_CatM1	QPSK20M	18700	3	0	0	Rear Face	24	23.99	0.12	0.38	0.381
T61	LTE B2_CatM1	QPSK20M	18700	3	0	0	Left Side	24	23.99	0.04	0.328	0.329
T62	LTE B2_CatM1	QPSK20M	18700	3	0	0	Right Side	24	23.99	-0.08	0.046	0.046
T63	LTE B2_CatM1	QPSK20M	18700	3	0	0	Top Side	24	23.99	-0.09	0.00556	0.006
T64	LTE B2_CatM1	QPSK20M	18700	3	0	0	Bottom Side	24	23.99	0.04	0.202	0.202
T65	LTE B2_CatM1	QPSK20M	18900	3	0	0	Front Face	24	23.90	0.07	**1.05**	**1.074**
T66	LTE B2_CatM1	QPSK20M	19100	3	0	0	Front Face	24	23.37	0.01	0.848	0.980
T67	LTE B2_CatM1	QPSK20M	18900	3	0	0	Front Face	24	23.90	0.11	1.04	1.064
T101	LTE B2_CatM1	QPSK20M	18900	6	0	0	Front Face	24	23.95	0.06	1.03	1.042
T102	LTE B2_CatM1	QPSK20M	18700	6	0	0	Front Face	24	23.74	0.07	**1.12**	**1.189**
T103	LTE B2_CatM1	QPSK20M	19100	6	0	0	Front Face	24	23.34	0.02	0.889	1.035
T104	LTE B2_CatM1	QPSK20M	18700	6	0	0	Front Face	24	23.74	0.11	1.11	1.178

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

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Test No.	Band	Mode	Channel	RB	offset	NB Index	Test Position	Maximum Tune-up (dBm)	Conducted Power (dBm)	Power Drift	SAR 1g (W/kg)	Reported 1g SAR (W/kg)
T68	LTE B4_CatM1	QPSK20M	20050	1	0	0	Front Face	24.5	24.2	0.1	**0.594**	**0.636**
T69	LTE B4_CatM1	QPSK20M	20050	1	0	0	Rear Face	24.5	24.2	0.02	0.107	0.115
T70	LTE B4_CatM1	QPSK20M	20050	1	0	0	Left Side	24.5	24.2	-0.14	0.000601	0.001
T71	LTE B4_CatM1	QPSK20M	20050	1	0	0	Right Side	24.5	24.2	0.06	0.041	0.044
T72	LTE B4_CatM1	QPSK20M	20050	1	0	0	Top Side	24.5	24.2	-0.04	0.000707	0.001
T73	LTE B4_CatM1	QPSK20M	20050	1	0	0	Bottom Side	24.5	24.2	0.07	0.124	0.133
T77	LTE B4_CatM1	QPSK20M	20050	3	0	0	Front Face	24.5	24.17	-0.05	**0.593**	**0.640**
T78	LTE B4_CatM1	QPSK20M	20050	3	0	0	Rear Face	24.5	24.17	-0.14	0.103	0.111
T79	LTE B4_CatM1	QPSK20M	20050	3	0	0	Left Side	24.5	24.17	-0.02	0.037	0.040
T80	LTE B4_CatM1	QPSK20M	20050	3	0	0	Right Side	24.5	24.17	0.02	0.039	0.042
T81	LTE B4_CatM1	QPSK20M	20050	3	0	0	Top Side	24.5	24.17	-0.11	0.000411	0.000
T82	LTE B4_CatM1	QPSK20M	20050	3	0	0	Bottom Side	24.5	24.17	0.07	0.122	0.132
T86	LTE B12_CatM1	QPSK10M	23095	1	0	0	Front Face	24	23.75	-0.02	**0.244**	**0.258**
T87	LTE B12_CatM1	QPSK10M	23095	1	0	0	Rear Face	24	23.75	-0.06	0.031	0.033
T88	LTE B12_CatM1	QPSK10M	23095	1	0	0	Left Side	24	23.75	0.14	0.013	0.014
T89	LTE B12_CatM1	QPSK10M	23095	1	0	0	Right Side	24	23.75	0.05	0.059	0.062
T90	LTE B12_CatM1	QPSK10M	23095	1	0	0	Top Side	24	23.75	NA	<0.001	<0.001
T91	LTE B12_CatM1	QPSK10M	23095	1	0	0	Bottom Side	24	23.75	-0.03	0.00526	0.006
T95	LTE B12_CatM1	QPSK10M	23095	3	0	0	Front Face	24	23.70	-0.02	**0.246**	**0.264**
T96	LTE B12_CatM1	QPSK10M	23095	3	0	0	Rear Face	24	23.70	0.04	0.034	0.036
T97	LTE B12_CatM1	QPSK10M	23095	3	0	0	Left Side	24	23.70	0.12	0.13	0.139
T98	LTE B12_CatM1	QPSK10M	23095	3	0	0	Right Side	24	23.70	-0.04	0.06	0.064
T99	LTE B12_CatM1	QPSK10M	23095	3	0	0	Top Side	24	23.70	NA	<0.001	<0.001
T100	LTE B12_CatM1	QPSK10M	23095	3	0	0	Bottom Side	24	23.70	-0.09	0.00536	0.006

Note:1.The value with boldface is the maximum SAR Value of each test band.
2.The area scan SAR result <0.001,can not find zoom scan cube.

3) SAR test results of LTE_NB-Iot _separation distance=0.5cm

Test No.	Band	Mode	Channel	Ntones	Test Position	Maximum Tune-up (dBm)	Conducted Power (dBm)	Power Drift	SAR 1g (W/kg)	Reported 1g SAR (W/kg)
T209	LTE B2_NB1	QPSK_15KHz	19199	3@3	Front Face	24.5	24.06	0.04	**0.678**	**0.750**
T210	LTE B2_NB1	QPSK_15KHz	19199	3@3	Rear Face	24.5	24.06	0.01	0.164	0.181
T211	LTE B2_NB1	QPSK_15KHz	19199	3@3	Left Side	24.5	24.06	-0.06	0.133	0.147
T212	LTE B2_NB1	QPSK_15KHz	19199	3@3	Right Side	24.5	24.06	-0.14	0.00616	0.007
T213	LTE B2_NB1	QPSK_15KHz	19199	3@3	Top Side	24.5	24.06	0.05	0.103	0.114
T214	LTE B2_NB1	QPSK_15KHz	19199	3@3	Bottom Side	24.5	24.06	0.09	0.08	0.089
T227	LTE B4_NB1	QPSK_15KHz	19951	3@3	Front Face	23.5	23.41	0.1	**0.177**	**0.181**
T228	LTE B4_NB1	QPSK_15KHz	19951	3@3	Rear Face	23.5	23.41	-0.08	0.000824	0.001
T229	LTE B4_NB1	QPSK_15KHz	19951	3@3	Left Side	23.5	23.41	-0.14	0.041	0.042
T230	LTE B4_NB1	QPSK_15KHz	19951	3@3	Right Side	23.5	23.41	-0.16	0.011	0.011
T231	LTE B4_NB1	QPSK_15KHz	19951	3@3	Top Side	23.5	23.41	0.06	0.055	0.056
T232	LTE B4_NB1	QPSK_15KHz	19951	3@3	Bottom Side	23.5	23.41	0.04	0.032	0.033
T245	LTE B12_NB1	QPSK_15KHz	23011	3@3	Front Face	22.5	22.22	0	**0.035**	**0.037**
T246	LTE B12_NB1	QPSK_15KHz	23011	3@3	Rear Face	22.5	22.22	NA	<0.001	<0.001
T247	LTE B12_NB1	QPSK_15KHz	23011	3@3	Left Side	22.5	22.22	NA	<0.001	<0.001
T248	LTE B12_NB1	QPSK_15KHz	23011	3@3	Right Side	22.5	22.22	0.06	0.011	0.012
T249	LTE B12_NB1	QPSK_15KHz	23011	3@3	Top Side	22.5	22.22	0.15	0.016	0.017
T250	LTE B12_NB1	QPSK_15KHz	23011	3@3	Bottom Side	22.5	22.22	NA	<0.001	<0.001

Note:1.The value with boldface is the maximum SAR Value of each test band.
2.The area scan SAR result <0.001,can not find zoom scan cube.

9. STANDALONE SAR TEST EXCLUSION CONSIDERATIONS & ESTIMATED SAR

Per FCC KDB 447498 D01, the 1-g SAR and 10-g SAR test exclusion thresholds for 100 MHz to 6 GHz at test separation distances ≤ 50 mm are determined by:
[(max. power of channel, including tune-up tolerance, mW)/(min. test separation distance,mm)][√f(GHz)] ≤ 3.0 for 1-g SAR and ≤ 7.5 for product specific 10-g SAR, where:

- f(GHz) is the RF channel transmit frequency in GHz
- Power and distance are rounded to the nearest mW and mm before calculation
- The result is rounded to one decimal place for comparison

When the minimum test separation distance is < 5 mm, a distance of 5 mm is applied to determine SAR test exclusion.

Standalone SAR test exclusion for WIFI and BT

Mode	Position	P_{max} (dBm)*	P_{max} (mW)	Distance (mm)	f (GHz)	Calculation Result	SAR Exclusion threshold	Test Requirement (Yes/No)
802.11b	Body	9	7.94	5	2.412	2.467	3	No
BT	Body	1	1.26	5	2.48	0.395	3	No

Note: Therefore, WIFI and BT standalone SAR are not required.

When standalone SAR test exclusion applies to an antenna that transmits simultaneously with other antennas, the standalone SAR must be estimated according to following to determine simultaneous transmission SAR test exclusion:

- (max. power of channel, including tune-up tolerance, mW)/(min. test separation distance, mm)] •
  [√ f(GHz)/x] W/kg for test separation distances≤50 mm, where x = 7.5 for 1-g SAR and x = 18.75 for 10-g SAR.

- 0.4 W/kg for 1-g SAR and 1.0 W/kg for 10-g SAR, when the test separation distance is > 50 mm.

According to KDB 447498 D01,when standalone SAR test exclusion applies to an antenna that transmits simultaneously with other antennas, the standslone SAR was estimated according to following formula to result in substantially conservative SAR values of≤0.4W/kg to determine simultaneous transmission SAR test exclusion.

$$\text{Estimated SAR} = \frac{\text{Max. Tune up Power}_{(mW)}}{\text{Min. Test Separation Distance}_{(mm)}} \times \frac{\sqrt{f_{(GHz)}}}{7.5}$$

Mode	Position	P_{max} (dBm)*	P_{max} (mW)	Distance (mm)	f (GHz)	X	Estimated 1-g SAR (W/kg)
802.11b	Body	9	7.94	5	2.412	7.5	0.33
BT	Body	1	1.26	5	2.48	7.5	0.053

10. MULTIPLE TRANSMITTER EVALUATION

The EUT not support simultaneous transmission.

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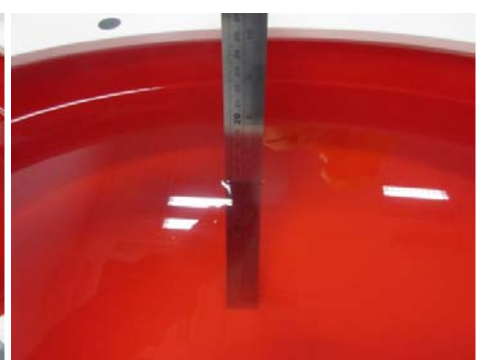
APPENDIX

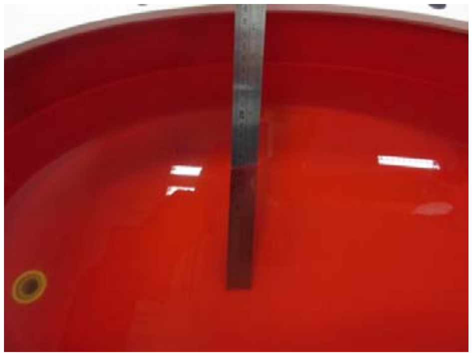
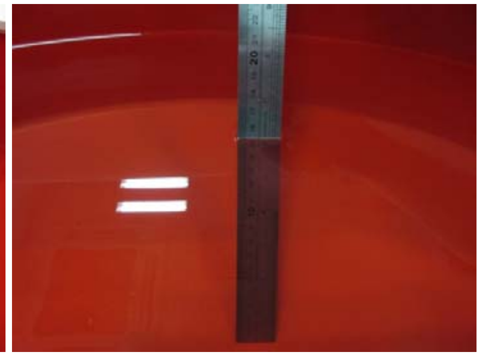
1. Test Layout

Specific Absorption Rate Test Layout

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

MSL(750MHz) MSL(835MHz)



Body(1750MHz)_15.6cm	Body(1900~3800MHz)_15.6cm
	

Appendix A. SAR Plots of System Verification

(Pls See BTL-FCC SAR-1-1903T095_Appendix A.)

Appendix B. SAR Plots of SAR Measurement

(Pls See BTL-FCC SAR-1-1903T095_Appendix B.)

Appendix C. Calibration Certificate

(Pls See BTL-FCC SAR-1-1903T095_Appendix C.)

Appendix D. Photographs of the Test Set-Up

(Pls See BTL-FCC SAR-1-1903T095_Appendix D.)

End of Test Report