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Shenzhen Branch

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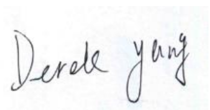
FCC SAR TEST REPORT

Application No:	HR/2018/90005
Applicant:	KYOCERA Corporation
Manufacturer:	KYOCERA Corporation
Factory:	KYOCERA Corporation
Product Name:	Smart Phone
Model No.(EUT):	JA32
Trade Mark:	Kyocera
FCC ID:	JOYJA32
Standards:	FCC 47CFR §2.1093
Date of Receipt:	2018-10-23
Date of Test:	2018-10-26 to 2018-11-08
Date of Issue:	2018-11-17
Test Result:	**PASS ***

* In the configuration tested, the EUT detailed in this report complied with the standards specified above.

Authorized Signature:



Derek Yang

Wireless Laboratory Manager

The manufacturer should ensure that all products in series production are in conformity with the product sample detailed in this report.
If the product in this report is used in any configuration other than that detailed in the report, the manufacturer must ensure the new system complies with all relevant standards. Any mention of SGS International Electrical Approvals or testing done by SGS International Electrical Approvals in connection with, distribution or use of the product described in this report must be approved by SGS International Electrical Approvals in writing.

REVISION HISTORY

Revision Record				
Version	Chapter	Date	Modifier	Remark
01		2018-11-17		Original

TEST SUMMARY

Frequency Band	Maximum Reported SAR(W/kg)			
	Head	Body-worn	Hotspot	product specific 10-g SAR
GSM850	0.72	0.36	0.44	/
GSM1900	0.26	0.12	**0.64**	/
WCDMA Band V	0.54	**0.47**	0.63	/
LTE Band 17	0.18	0.28	0.30	/
WI-FI (2.4GHz)	0.43	<0.1	0.10	/
WI-FI (5GHz)	**0.93**	<0.1	<0.1	0.43
Buletooth	0.15	/	/	/
SAR Limited(w/kg)	1.6			4.0
Maximum Simultaneous Transmission SAR (W/kg)				
Scenario	Head	Body-worn	Hotspot	product specific 10-g SAR
Sum SAR	1.54	0.61	0.85	0.43
SPLSR	N/A	N/A	N/A	N/A
SPLSR Limited	0.04			0.1

Approved & Released by

Simon Ling

SAR Manager

Tested by

Jackson Li

SAR Engineer

CONTENTS

1 General Information

1.1 Details of Client

Applicant:	KYOCERA Corporation.
Address:	Yokohama Office 2-1-1 Kagahara,Tsuzuki-ku Yokohama-shi,Kanagawa,Japan
Manufacturer:	KYOCERA Corporation.
Address:	Yokohama Office 2-1-1 Kagahara,Tsuzuki-ku Yokohama-shi,Kanagawa,Japan
Factory:	KYOCERA Corporation.
Address:	Yokohama Office 2-1-1 Kagahara,Tsuzuki-ku Yokohama-shi,Kanagawa,Japan

1.2 Test Location

Company: SGS-CSTC Standards Technical Services Co., Ltd. Shenzhen Branch E&E Lab

Address: No. 1 Workshop, M-10, Middle section, Science & Technology Park, Shenzhen, Guangdong, China

Post code: 518057

Telephone: +86 (0) 755 2601 2053

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E-mail: ee.shenzhen@sgs.com

1.3 Test Facility

The test facility is recognized, certified, or accredited by the following organizations:

• CNAS (No. CNAS L2929)

CNAS has accredited SGS-CSTC Standards Technical Services Co., Ltd. Shenzhen Branch EMC Lab to ISO/IEC 17025:2005 General Requirements for the Competence of Testing and Calibration Laboratories (CNAS-CL01 Accreditation Criteria for the Competence of Testing and Calibration Laboratories) for the competence in the field of testing.

• A2LA (Certificate No. 3816.01)

SGS-CSTC Standards Technical Services Co., Ltd., Shenzhen EMC Laboratory is accredited by the American Association for Laboratory Accreditation (A2LA). Certificate No. 3816.01.

• VCCI

The 10m Semi-anechoic chamber and Shielded Room of SGS-CSTC Standards Technical Services Co., Ltd. have been registered in accordance with the Regulations for Voluntary Control Measures with Registration No.: G-823, R-4188, T-1153 and C-2383 respectively.

• FCC –Designation Number: CN1178

SGS-CSTC Standards Technical Services Co., Ltd., Shenzhen EMC Laboratory has been recognized as an accredited testing laboratory.

Designation Number: CN1178. Test Firm Registration Number: 406779.

• Industry Canada (IC)

Two 3m Semi-anechoic chambers and the 10m Semi-anechoic chamber of SGS-CSTC Standards Technical Services Co., Ltd. Shenzhen Branch EMC Lab have been registered by Certification and Engineering Bureau of Industry Canada for radio equipment testing with Registration No.: 4620C-1, 4620C-2, 4620C-3.

1.4 General Description of EUT

Product Name:	Smart Phone		
Model No.(EUT):	JA32		
Trade Mark:	Kyocera		
Product Phase:	production unit		
Device Type :	portable device		
Exposure Category:	uncontrolled environment / general population		
SN:	9937d653/9937d616		
FCC ID:	JOYJA32		
Hardware Version:	JA32		
Software Version:	Sdm660_64-userdebug 9		
Antenna Type:	Inner Antenna		
Device Operating Configurations :			
Modulation Mode:	**GSM:** GMSK, 8PSK; **WCDMA**: QPSK; **LTE:** QPSK,16QAM, 64QAM; **WIFI:** DSSS; OFDM; **BT:** GFSK, π/4DQPSK,8DPSK		
Device Class:	B		
GPRS Multi-slots Class:	12	EGPRS Multi-Slots Class:	12
HSDPA UE Category:	14	HSUPA UE Category	6
DC-HSDPA UE Category:	24		
Power Class	4,tested with power level 5(GSM850)		
	1,tested with power level 0(GSM1900)		
	3, tested with power control "all 1"(WCDMA Band V)		
	3, tested with power control Max Power(LTE Band 17)		
Frequency Bands:	Band	Tx (MHz)	Rx (MHz)
	GSM850	824~849	869~894
	GSM1900	1850~1910	1930~1990
	WCDMA Band V	824~849	869~894
	LTE Band 17	704~716	734~746
	WIFI(2.4GHz)	2412~2462	2412~2462
	WIFI(U-NII-1)	5150~5250	5150~5250
	WIFI(U-NII-2A)	5250~5350	5250~5350
	WIFI(U-NII-2C)	5470~5725	5470~5725
	BT	2402~2480	2402~2480
Battery Information:	Model No.:	5AAXBT124JAA	
	Normal Voltage :	3.85V	
	Rated capacity :	2800mAh	
	Manufacturer:	Shanghai BYD Company Limited	

1.5 Test Specification

Identity	Document Title
FCC 47CFR §2.1093	Radiofrequency Radiation Exposure Evaluation: Portable Devices
ANSI/IEEE Std C95.1 – 1992	IEEE Standard for Safety Levels with Respect to Human Exposure to Radio Frequency Electromagnetic Fields, 3 kHz – 300 GHz.
IEEE 1528-2013	Recommended Practice for Determining the Peak Spatial-Average Specific Absorption Rate (SAR) in the Human Head from Wireless Communications Devices: Measurement Techniques
KDB 941225 D01 3G SAR Procedures v03r01	3G SAR Measurement Procedures
KDB 941225 D05 SAR for LTE Devices v02r05	SAR EVALUATION CONSIDERATIONS FOR LTE DEVICES
KDB 248227 D01 802.11 Wi-Fi SAR v02r02	SAR GUIDANCE FOR IEEE 802.11 (Wi-Fi) TRANSMITTERS
KDB 941225 D06 Hotspot Mode SAR v02r01	SAR Evaluation Procedures for Portable Devices with Wireless Router Capabilities
KDB 648474 D04 Handset SAR v01r03	SAR Evaluation Considerations for Wireless Handsets
KDB447498 D01 General RF Exposure Guidance v06	Mobile and Portable Devices RF Exposure Procedures and Equipment Authorization Policies
KDB447498 D03 Supplement C Cross-Reference v01	OET Bulletin 65, Supplement C Cross-Reference
KDB 865664 D01 SAR Measurement 100 MHz to 6 GHz v01r04	SAR Measurement Requirements for 100 MHz to 6 GHz
KDB 865664 D02 RF Exposure Reporting v01r02	RF Exposure Compliance Reporting and Documentation Considerations
KDB616217 D04 SAR for laptop and tablets v01r02	SAR for laptop and tablets

1.6 RF exposure limits

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

Notes:

* The Spatial Peak value of the SAR averaged over any 1 gram of tissue (defined as a tissue volume in the shape of a cube) and over the appropriate averaging time

** The Spatial Average value of the SAR averaged over the whole body.

*** The Spatial Peak value of the SAR averaged over any 10 grams of tissue (defined as a tissue volume in the shape of a cube) and over the appropriate averaging time.

Uncontrolled Environments are defined as locations where there is the exposure of individuals who have no knowledge or control of their exposure.

Controlled Environments are defined as locations where there is exposure that may be incurred by persons who are aware of the potential for exposure, (i.e. as a result of employment or occupation.)

2 SAR Measurements System Configuration

2.1 The SAR Measurement System

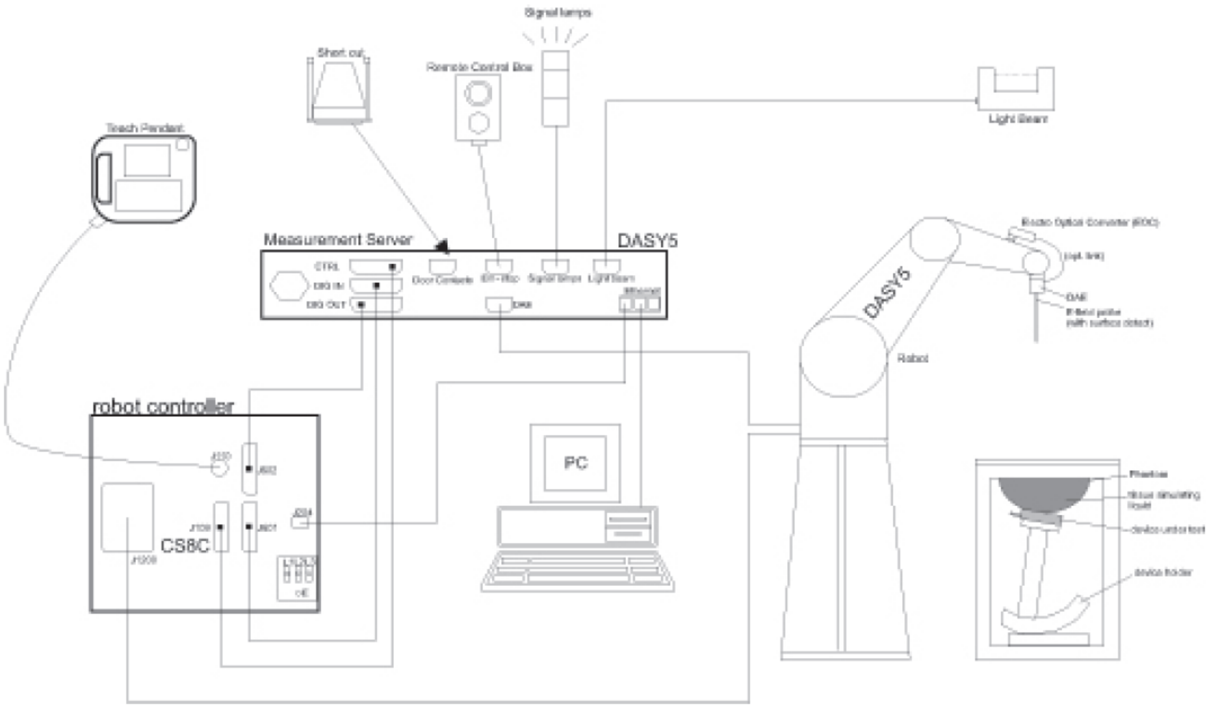
This SAR Measurement System uses a Computer-controlled 3-D stepper motor system (SPEAG DASY5 professional system). A E-field probe is used to determine the internal electric fields. The SAR can be obtained from the equation SAR= σ (|Ei|2)/ ρ where σ and ρ are the conductivity and mass density of the tissue-Simulate.

The DASY5 system for performing compliance tests consists of the following items:
A standard high precision 6-axis robot (Stabile RX family) with controller, teach pendant and software .An arm extension for accommodation the data acquisition electronics (DAE).

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.

A data acquisition electronics (DAE) which performs the signal amplification, signal multiplexing, AD-conversion, offset measurements, mechanical surface detection, collision detection, etc. The unit is battery powered with standard or rechargeable batteries. The signal is optically transmitted to the EOC.

The Electro-optical converter (EOC) performs the conversion between optical and electrical of the signals for the digital communication to DAE and for the analog signal from the optical surface detection. The EOC is connected to the measurement server.



F-1. SAR Measurement System Configuration

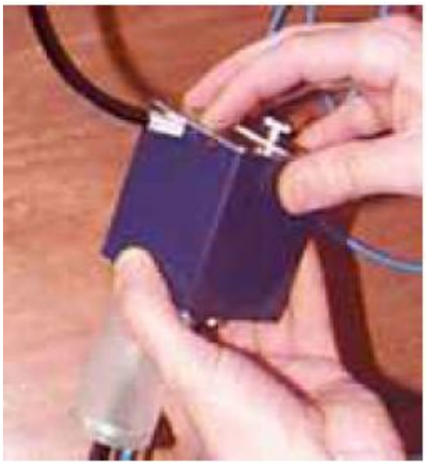
- The function of the measurement server is to perform the time critical tasks such as signal filtering, control of the robot operation and fast movement interrupts.
- A probe alignment unit which improves the (absolute) accuracy of the probe positioning.
- A computer operating Windows 7.
- DASY5 software.
- Remote control with teach pendant and additional circuitry for robot safety such as warning lamps, etc.
- The SAM twin phantom enabling testing left-hand, right-hand and Body Worn usage.
- The device holder for handheld mobile phones.
- Tissue simulating liquid mixed according to the given recipes.
- Validation dipole kits allowing to validating the proper functioning of the system.

2.2 Isotropic E-field Probe EX3DV4

	Symmetrical design with triangular core 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 TSL (rotation around probe axis) ± 0.5 dB in TSL (rotation normal to probe axis)
Dynamic Range	10 µW/g to > 100 mW/g Linearity: ± 0.2 dB (noise: typically < 1 µW/g)
Dimensions	Overall length: 337 mm (Tip: 20 mm) Tip diameter: 2.5 mm (Body: 12 mm) Typical distance from probe tip to dipole centers: 1 mm
Application	High precision dosimetric measurements in any exposure scenario (e.g., very strong gradient fields); the only probe that enables compliance testing for frequencies up to 6 GHz with precision of better 30%.
Compatibility	DASY3, DASY4, DASY52 SAR and higher, EASY4/MRI

2.3 Data Acquisition Electronics (DAE)

Model	DAE4
Construction	Signal amplifier, multiplexer, A/D converter and control logic. Serial optical link for communication with DASY4/5 embedded system (fully remote controlled). Two step probe touch detector for mechanical surface detection and emergency robot stop.
Measurement Range	-100 to +300 mV (16 bit resolution and two range settings: 4mV,400mV)
Input Offset Voltage	< 5μV (with auto zero)
Input Bias Current	< 50 f A
Dimensions	60 x 60 x 68 mm



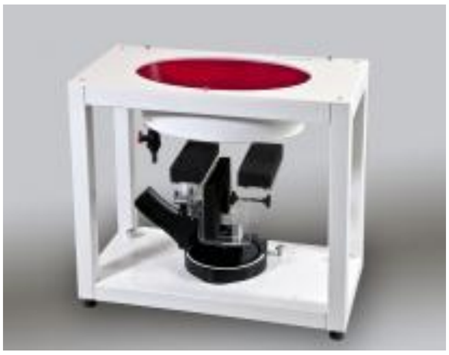
2.4 SAM Twin Phantom

Material	Vinylester, glass fiber reinforced (VE-GF)
Liquid Compatibility	Compatible with all SPEAG tissue simulating liquids (incl. DGBE type)
Shell Thickness	2 ± 0.2 mm (6 ± 0.2 mm at ear point)
Dimensions (incl. Wooden Support)	Length: 1000 mm Width: 500 mm Height: adjustable feet
Filling Volume	approx. 25 liters
Wooden Support	SPEAG standard phantom table

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.

Twin SAM V5.0 has the same shell geometry and is manufactured from the same material as Twin SAM V4.0, but has reinforced top structure.

2.5 ELI Phantom

Material	Vinylester, glass fiber reinforced (VE-GF)	
Liquid Compatibility	Compatible with all SPEAG tissue simulating liquids (incl. DGBE type)	
Shell Thickness	2.0 ± 0.2 mm (bottom plate)	
Dimensions	Major axis: 600 mm Minor axis: 400 mm	
Filling Volume	approx. 30 liters	
Wooden Support	SPEAG standard phantom table	

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.

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

2.6 Device Holder for Transmitters

F-2. **Device Holder for Transmitters**

- The DASY device holder is designed to cope with different positions given in the standard. It has two scales for the device rotation (with respect to the body axis) and the device inclination (with respect to the line between the ear reference points). The rotation centres for both scales are the ear reference point (ERP). Thus the device needs no repositioning when changing the angles.
- The DASY device holder has been made out of low-loss POM material having the following dielectric parameters: relative permittivity ε=3 and loss tangent δ=0.02. The amount of dielectric material has been reduced in the closest vicinity of the device, since measurements have suggested that the influence of the clamp on the test results could thus be lowered.

2.7 Measurement procedure

2.7.1 Scanning procedure

Step 1: Power reference measurement

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.

Step 2: *Area scan*

The SAR distribution at the exposed side of the head was measured at a distance of 4mm from the inner surface of the shell. The area covered the entire dimension of the head and the horizontal grid spacing was 15mm*15mm or 12mm*12mm or 10mm*10mm.Based on the area scan data, the area of the maximum absorption was determined by spline interpolation.

Step 3: *Zoom scan*

Around this point, a volume of 30mm*30mm*30mm (fine resolution volume scan, zoom scan) was assessed by measuring 5x5x7 points (≤2GHz) and 7x7x7 points (≥2GHz). On this basis of this data set, the spatial peak SAR value was evaluated with the following procedure:

The data at the surface was extrapolated, since the centre of the dipoles is 2.0mm away from the tip of the probe and the distance between the surface and the lowest measuring point is 1.2mm. (This can be variable. Refer to the probe specification).The extrapolation was based on a least square algorithm. A polynomial of the fourth order was calculated through the points in z-axes. This polynomial was then used to evaluate the points between the surface and the probe tip. The maximum interpolated value was searched with a straight-forward algorithm. Around this maximum the SAR values averaged over the spatial volumes (1g or 10g) were computed using the 3D-Spline interpolation algorithm. The volume was integrated with the trapezoidal algorithm. One thousand points were interpolated to calculate the average. All neighbouring volumes were evaluated until no neighboring volume with a higher average value was found.

The area and zoom scan resolutions specified in the table below must be applied to the SAR measurements Probe boundary effect error compensation is required for measurements with the probe tip closer than half a probe tip diameter to the phantom surface. Both the probe tip diameter and sensor offset distance must satisfy measurement protocols; to ensure probe boundary effect errors are minimized and the higher fields closest to the phantom surface can be correctly measured and extrapolated to the phantom surface for computing 1-g SAR. Tolerances of the post-processing algorithms must be verified by the test laboratory for the scan resolutions used in the SAR measurements, according to the reference distribution functions specified in IEEE Std. 1528-2013.

<table>
<tr><th colspan="3"></th><th>≤ 3 GHz</th><th>> 3 GHz</th></tr>
<tr><td colspan="3">Maximum distance from closest measurement point (geometric center of probe sensors) to phantom surface</td><td>5 ± 1 mm</td><td>½·δ·ln(2) ± 0.5 mm</td></tr>
<tr><td colspan="3">Maximum probe angle from probe axis to phantom surface normal at the measurement location</td><td>30° ± 1°</td><td>20° ± 1°</td></tr>
<tr><td colspan="3" rowspan="2">Maximum area scan spatial resolution: Δx_{Area}, Δy_{Area}</td><td>≤ 2 GHz: ≤ 15 mm
2 – 3 GHz: ≤ 12 mm</td><td>3 – 4 GHz: ≤ 12 mm
4 – 6 GHz: ≤ 10 mm</td></tr>
<tr><td colspan="2">When the x or y dimension of the test device, in the measurement plane orientation, is smaller than the above, the measurement resolution must be ≤ the corresponding x or y dimension of the test device with at least one measurement point on the test device.</td></tr>
<tr><td colspan="3">Maximum zoom scan spatial resolution: Δx_{Zoom}, Δy_{Zoom}</td><td>≤ 2 GHz: ≤ 8 mm
2 – 3 GHz: ≤ 5 mm*</td><td>3 – 4 GHz: ≤ 5 mm*
4 – 6 GHz: ≤ 4 mm*</td></tr>
<tr><td rowspan="3">Maximum zoom scan spatial resolution, normal to phantom surface</td><td colspan="2">uniform grid: $\Delta z_{Zoom}(n)$</td><td>≤ 5 mm</td><td>3 – 4 GHz: ≤ 4 mm
4 – 5 GHz: ≤ 3 mm
5 – 6 GHz: ≤ 2 mm</td></tr>
<tr><td rowspan="2">graded grid</td><td>$\Delta z_{Zoom}(1)$: between 1st two points closest to phantom surface</td><td>≤ 4 mm</td><td>3 – 4 GHz: ≤ 3 mm
4 – 5 GHz: ≤ 2.5 mm
5 – 6 GHz: ≤ 2 mm</td></tr>
<tr><td>$\Delta z_{Zoom}(n>1)$: between subsequent points</td><td colspan="2">≤ 1.5·$\Delta z_{Zoom}(n-1)$</td></tr>
<tr><td>Minimum zoom scan volume</td><td colspan="2">x, y, z</td><td>≥ 30 mm</td><td>3 – 4 GHz: ≥ 28 mm
4 – 5 GHz: ≥ 25 mm
5 – 6 GHz: ≥ 22 mm</td></tr>
<tr><td colspan="5">Note: δ is the penetration depth of a plane-wave at normal incidence to the tissue medium; see draft standard IEEE P1528-2011 for details.
* When zoom scan is required and the <u>reported</u> SAR from the area scan based 1-g SAR estimation procedures of KDB 447498 is ≤ 1.4 W/kg, ≤ 8 mm, ≤ 7 mm and ≤ 5 mm zoom scan resolution may be applied, respectively, for 2 GHz to 3 GHz, 3 GHz to 4 GHz and 4 GHz to 6 GHz.</td></tr>
</table>

Step 4: Power reference measurement (drift)

The Power Drift Measurement job measures the field at the same location as the most recent power reference measurement job within the same procedure, and with the same settings. The indicated drift is mainly the variation of the DUT's output power and should vary max. ± 5 %

2.7.2 Data Storage

The DASY 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], [m W/g], [m W/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.

2.7.3 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 Dcpi
Device parameters: - Frequency f
- Crest factor cf
Media parameters: - Conductivity ε
- Density ρ

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 DASY components. In the direct measuring mode of the multimeter option, the parameters of the actual system setup are used. In the scan visualization and export modes, the parameters stored in the corresponding document files are used.

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

If the exciting field is pulsed, the crest factor of the signal must be known to correctly compensate for peak power.

The formula for each channel can be given as:

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

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

Ui = 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 Vi = compensated signal of channel i (i = x, y, z)
Normi = 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]
Ei = electric field strength of channel i in V/m

Hi = 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.

$$SAR = (Etot^2 \cdot \sigma) / (\varepsilon \cdot 1000)$$

with SAR = local specific absorption rate in mW/g

Etot = total field strength in V/m

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

ε= 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.

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

with Ppwe = equivalent power density of a plane wave in mW/cm2
Etot = total electric field strength in V/m

Htot = total magnetic field strength in A/m

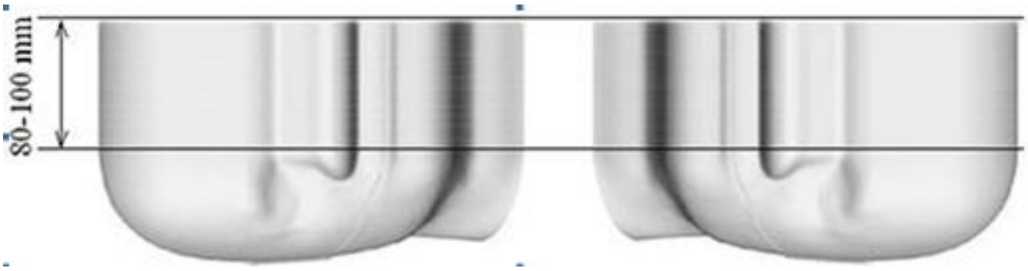
3 Description of Test Position

3.1 Head Exposure Condition

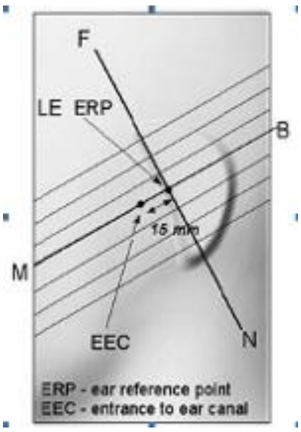
3.1.1 SAM Phantom Shape

F-3. Front, back, and side views of SAM (model for the phantom shell). Full-head model is for illustration purposes only-procedures in this recommended practice are intended primarily for the phantom setup.

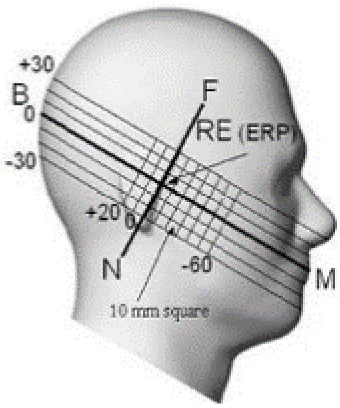
Note: The centre strip including the nose region has a different thickness tolerance.



F-4. Sagittally bisected phantom with extended perimeter (shown placed on its side as used for SAR measurements)

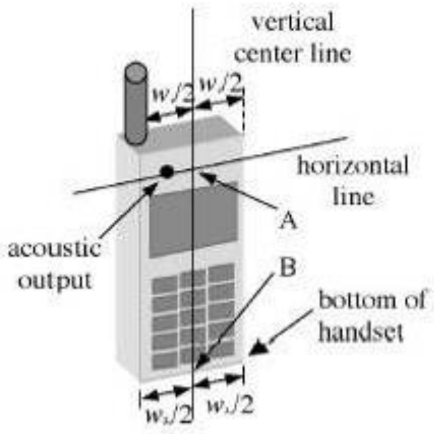


F-5. Close-up side view of phantom, showing the ear region, N-F and B-M lines, and seven cross-sectional plane locations

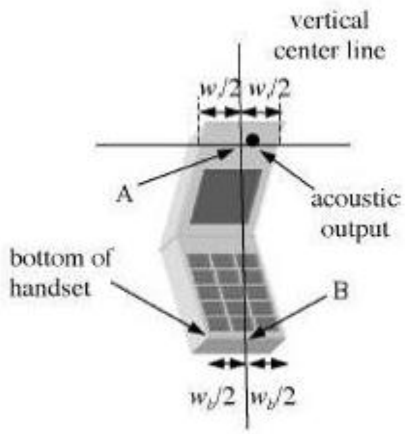


F-6. Side view of the phantom showing relevant markings and seven cross-sectional plane locations

3.1.2 EUT constructions



F-7. Handset vertical and horizontal reference lines-“fixed case”



F-8. Handset vertical and horizontal reference lines-“clam-shell case”

3.1.3 Definition of the “cheek” position

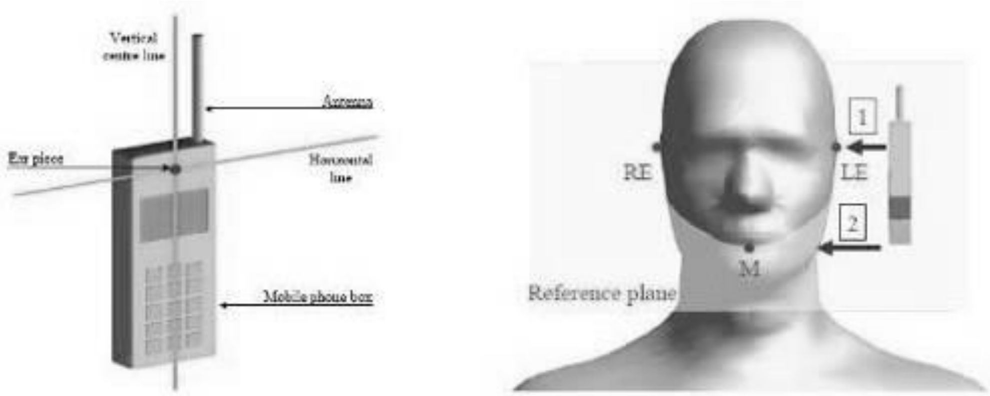
a) Position the device with the vertical centre line of the body of the device and the horizontal line crossing the centre of the ear piece in a plane parallel to the sagittal plane of the phantom ("initial position"). While maintaining the device in this plane, align the vertical centre line with the reference plane containing the three ear and mouth reference points (M, RE and LE) and align the centre of the ear piece with the line RE-LE.

b) Translate the mobile phone box towards the phantom with the ear piece aligned with the line LE-RE until telephone touches the ear. While maintaining the device in the reference plane and maintaining the phone contact with the ear, move the bottom of the box until any point on the front side is in contact with the cheek of the phantom or until contact with the ear is lost.

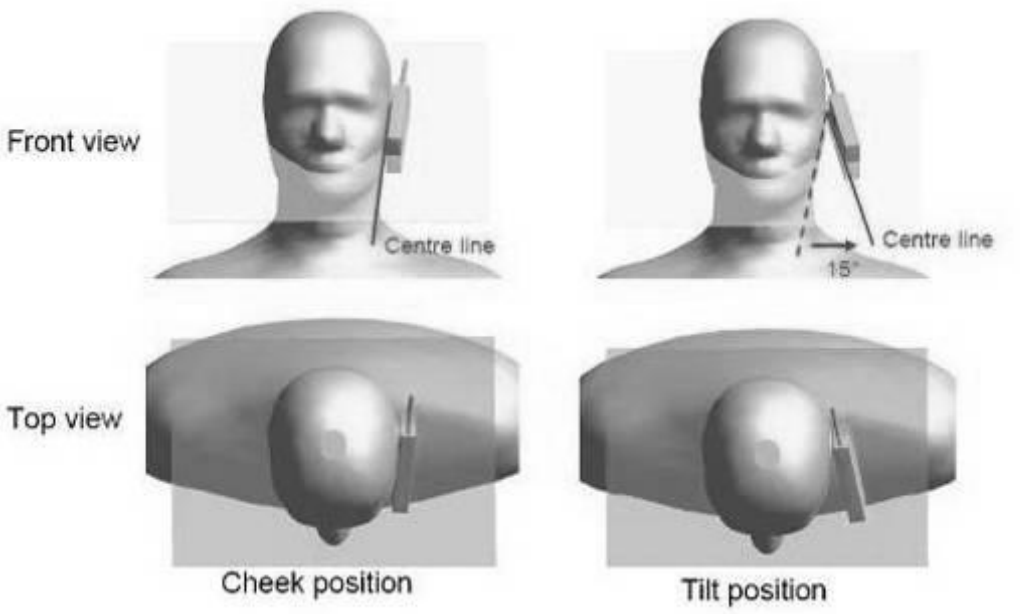
3.1.4 Definition of the "tilted" position

a) Position the device in the "cheek" position described above;

b) While maintaining the device in the reference plane described above and pivoting against the ear, move it outward away from the mouth by an angle of 15 degrees or until contact with the ear is lost.



F-9. **Definition of the reference lines and points, on the phone and on the phantom and initial position**



F-10. **"Cheek" and "tilt" positions of the mobile phone on the left side**

3.2 Body Exposure Condition

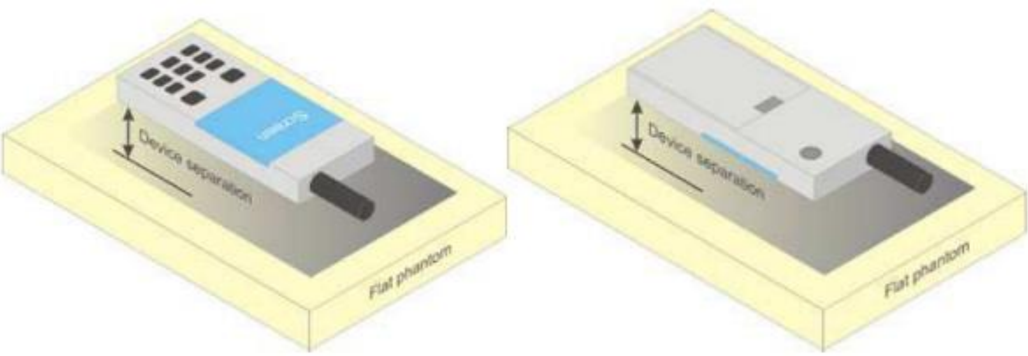
3.2.1 Body-worn accessory exposure conditions

Body-worn operating configurations should be tested with the belt-clips and holsters attached to the device and positioned against a flat phantom in normal use configurations.

Body-worn operating configurations are tested with the belt-clips and holsters attached to the device and positioned against a flat phantom in a normal use configuration. Per FCC KDB Publication 648474 D04, Body-worn accessory exposure is typically related to voice mode operations when handsets are carried in body-worn accessories. The body-worn accessory procedures in FCC KDB Publication 447498 D01 should be used to test for body-worn accessory SAR compliance, without a headset connected to it. This enables the test results for such configuration to be compatible with that required for hotspot mode when the body-worn accessory test separation distance is greater than or equal to that required for hotspot mode, when applicable. When the reported SAR for a body-worn accessory, measured without a headset connected to the handset, is > 1.2 W/kg, the highest reported SAR configuration for that wireless mode and frequency band should be repeated for that body-worn accessory with a headset attached to the handset.

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

Body-worn accessories may not always be supplied or available as options for some devices intended to be authorized for body-worn use. In this case, a test configuration with a separation distance between the back of the device and the flat phantom is used. Test position spacing was documented. Transmitters that are designed to operate in front of a person’s face, as in push-to-talk configurations, are tested for SAR compliance with the front of the device positioned to face the flat phantom in head fluid. For devices that are carried next to the body such as a shoulder, waist or chest-worn transmitters, SAR compliance is tested with the accessories, including headsets and microphones, attached to the device and positioned against a flat phantom in a normal use configuration.



F-11. **Test positions for body-worn devices**

3.2.2 Wireless Router exposure conditions

Some battery-operated handsets have the capability to transmit and receive user data through simultaneous transmission of WIFI simultaneously with a separate licensed transmitter. The FCC has provided guidance in FCC KDB Publication 941225 D06 where SAR test considerations for handsets (L x W ≥ 9 cm x 5 cm) are based on a composite test separation distance of 10 mm from the front, back and edges of the device containing transmitting antennas within 2.5 cm of their edges, determined from general mixed use conditions for this type of devices. For devices with form factors smaller than 9 cm x 5 cm, a test separation distance of 5 mm is required.

4 SAR System Verification Procedure

4.1 Tissue Simulate Liquid

4.1.1 Recipes for Tissue Simulate Liquid

The bellowing tables give the recipes for tissue simulating liquids to be used in different frequency bands：

Ingredients (% by weight)	Frequency (MHz)							
	450		700-950		1700-2000		2300-2700	
Tissue Type	**Head**	**Body**	**Head**	**Body**	**Head**	**Body**	**Head**	**Body**
Water	38.56	51.16	40.30	50.75	55.24	70.17	55.00	68.53
Salt (NaCl)	3.95	1.49	1.38	0.94	0.31	0.39	0.2	0.1
Sucrose	56.32	46.78	57.90	48.21	0	0	0	0
HEC	0.98	0.52	0.24	0	0	0	0	0
Bactericide	0.19	0.05	0.18	0.10	0	0	0	0
Tween	0	0	0	0	44.45	29.44	44.80	31.37
Salt: 99^+% Pure Sodium Chloride Water: De-ionized, 16 $M\Omega^+$ resistivity Tween: Polyoxyethylene (20) sorbitan monolaurate				Sucrose: 98^+% Pure Sucrose HEC: Hydroxyethyl Cellulose				
HSL5GHz is composed of the following ingredients: Water: 50-65% Mineral oil: 10-30% Emulsifiers: 8-25% Sodium salt: 0-1.5%								
MSL5GHz is composed of the following ingredients: Water: 64-78% Mineral oil: 11-18% Emulsifiers: 9-15% Sodium salt: 2-3%								

Table 1： Recipe of Tissue Simulate Liquid

4.1.2 Measurement for Tissue Simulate Liquid

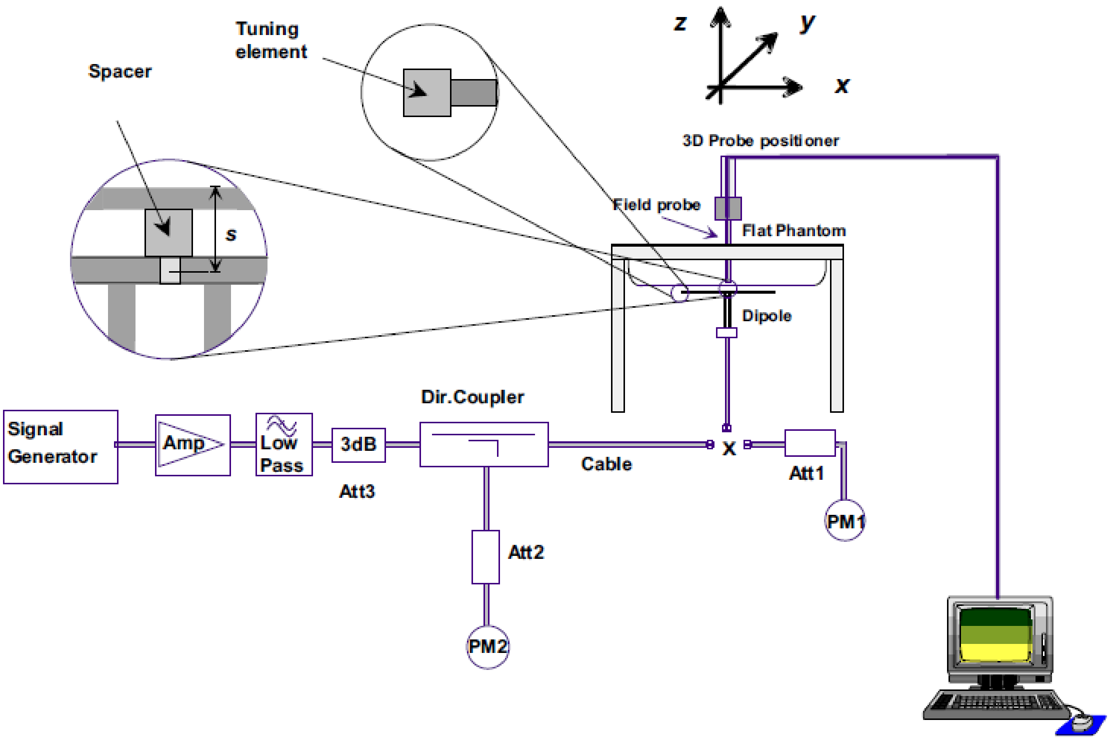
The dielectric properties for this Tissue Simulate Liquids were measured by using the Agilent Model 85070E Dielectric Probe in conjunction with Agilent E5071C Network Analyzer (300 KHz-8500 MHz). The Conductivity (σ) and Permittivity (ρ) are listed in Table 2. For the SAR measurement given in this report. The temperature variation of the Tissue Simulate Liquids was 22±2°C.

Tissue Type	Measured Frequency （MHz）	Target Tissue (±5%)		Measured Tissue		Liquid Temp.	Measured Date
		ε_r	σ(S/m)	ε_r	σ(S/m)	(℃)	
750 Head	750	41.9 (39.81~44)	0.89 (0.85~0.94)	43.759	0.860	22.1	2018/10/26
750 Body	750	55.5 (52.73~58.28)	0.96 (0.91~1.00)	57.694	0.951	22.1	2018/10/29
835 Head	835	41.5 (39.43~43.58)	0.90 (0.86~0.95)	43.207	0.916	22.1	2018/10/26
835 Body	835	55.2 (52.44~57.96)	0.97 (0.92~1.02)	57.435	1.012	22.1	2018/10/30
1900 Head	1900	40.0 (38.00~42.00)	1.40 (1.33~1.47)	40.640	1.394	22.3	2018/10/27
1900 Body	1900	53.3 (50.64~55.97)	1.52 (1.44~1.60)	52.651	1.499	22.3	2018/10/26
2450 Head	2450	39.20 (37.24~41.16)	1.80 (1.71~1.89)	40.177	1.803	22.0	2018/11/7
2450 Body	2450	52.70 (50.07~55.34)	1.95 (1.85~2.05)	50.387	1.986	22.0	2018/11/6
5250Head	5250	35.9 (34.11~37.70)	4.71 (4.47~4.95)	36.011	4.767	22.2	2018/11/6
5250 Body	5250	48.9 (46.46~51.35)	5.36 (5.09~5.63)	48.368	5.382	22.2	2018/11/8
5600 Head	5600	35.5 (33.73~37.28)	5.07 (4.82~5.32)	35.059	5.157	22.2	2018/11/6
5600 Body	5600	48.5 (46.08~50.93)	5.77 (5.48~6.06)	47.435	5.803	22.2	2018/11/8

Table 2： Measurement result of Tissue electric parameters

4.2 SAR System Check

The microwave circuit arrangement for system Check is sketched in F-12. The daily system accuracy verification occurs within the flat section of the SAM phantom. A SAR measurement was performed to see if the measured SAR was within +/- 10% from the target SAR values. The tests were conducted on the same days as the measurement of the EUT. The obtained results from the system accuracy verification are displayed in the following table 3(A power level of 250mw (below 3GHz) or 100mw (3-6GHz) was input to the dipole antenna). During the tests, the ambient temperature of the laboratory was in the range 22±2°C, the relative humidity was in the range 60% and the liquid depth above the ear reference points was above 15±0.5 cm in all the cases. It is seen that the system is operating within its specification, as the results are within acceptable tolerance of the reference values.



F-12. the microwave circuit arrangement used for SAR system check

4.2.1 Justification for Extended SAR Dipole Calibrations

1) Referring to KDB865664 D01 requirements for dipole calibration, instead of the typical annual calibration recommended by measurement standards, longer calibration intervals of up to three years may be considered when it is demonstrated that the SAR target, impedance and return loss of a dipole have remain stable according to the following requirements. 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) Return-loss is within 10% of calibrated measurement;
d) Impedance is within 5Ω from the previous measurement.

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

4.2.2 Summary System Check Result(s)

Validation Kit		Measured SAR 250mW	Measured SAR 250mW	Measured SAR (normalized to 1W)	Measured SAR (normalized to 1W)	Target SAR (normalized to 1W) (±10%)	Target SAR (normalized to 1W) (±10%)	Liquid Temp. (℃)	Measured Date
		1g (W/kg)	10g (W/kg)	1g (W/kg)	10g (W/kg)	1-g(W/kg)	10-g(W/kg)		
D750V2	Head	1.91	1.26	7.64	5.04	8.17 (7.35~8.99)	5.36 (4.82~5.9)	22.1	2018/10/26
	Body	2.10	1.40	8.40	5.60	8.57 (7.71~9.43)	5.66 (5.09~6.23)	22.1	2018/10/29
D835V2	Head	2.51	1.64	10.04	6.56	9.59 (8.63~10.55)	6.29 (5.66~6.92)	22.1	2018/10/26
	Body	2.54	1.68	10.16	6.72	9.65 (8.69~10.62)	6.46 (5.81~7.11)	22.1	2018/10/30
D1900V2	Head	10.30	5.35	41.20	21.40	40.7 (36.63~44.77)	21.1 (18.99~23.21)	22.3	2018/10/27
	Body	10.20	5.39	40.80	21.56	41.6 (37.44~45.76)	21.4 (19.26~23.54)	22.3	2018/10/26
D2450V2	Head	13.20	6.09	52.80	24.36	53.1 (47.79~58.41)	24.9 (22.41~27.39)	22.0	2018/11/7
	Body	12.90	5.91	51.60	23.64	51.0 (45.9~56.1)	23.5 (21.15~25.85)	22.0	2018/11/6
Validation Kit		Measured SAR 100mW	Measured SAR 100mW	Measured SAR (normalized to 1W)	Measured SAR (normalized to 1W)	Target SAR (normalized to 1W) (±10%)	Target SAR (normalized to 1W) (±10%)	Liquid Temp. (℃)	Measured Date
		1g (W/kg)	10g (W/kg)	1g (W/kg)	10g (W/kg)	1-g(W/kg)	10-g(W/kg)		
D5GHzV2	Head (5.25GHz)	7.10	2.02	71.00	20.20	76.6 (68.94~84.26)	21.9 (19.71~24.09)	22.2	2018/11/6
	Body (5.25GHz)	8.05	2.24	80.50	22.40	75.6 (68.04~83.16)	21.3 (19.17~23.43)	22.2	2018/11/8
	Head (5.6GHz)	7.92	2.23	79.20	22.30	80.4 (72.36~88.44)	22.8 (20.52~25.08)	22.2	2018/11/6
	Body (5.6GHz)	8.43	2.33	84.30	23.30	81.1 (72.99~89.21)	22.9 (20.61~25.19)	22.2	2018/11/8

Table 3： SAR System Check Result

4.2.3 Detailed System Check Results

Please see the Appendix A

5 Test results and Measurement Data

5.1 3G SAR Test Reduction Procedure

According to KDB 941225D01, in the following procedures, the mode tested for SAR is referred to as the primary mode. The equivalent modes considered for SAR test reduction are denoted as secondary modes. Both primary and secondary modes must be in the same frequency band. When the maximum output power and tune-up tolerance specified for production units in a secondary mode is ≤ ¼ dB higher than the primary mode or when the highest reported SAR of the primary mode is scaled by the ratio of specified maximum output power and tune-up tolerance of secondary to primary mode and the adjusted SAR is ≤ 1.2 W/kg, SAR measurement is not required for the secondary mode. 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.

5.2 Operation Configurations

5.2.1 GSM Test Configuration

SAR tests for GSM 850 and GSM 1900, a communication link is set up with a base station by air link. Using CMU200 the power lever is set to “5”and “0” in SAR of GSM 850 and GSM 1900. The tests in the band of GSM 850 and GSM 1900 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.

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.

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 8-PSK.

The 3G SAR test reduction procedure is applied to 8-PSK EDGE with GMSK GPRS/EDGE as the primary mode

5.2.2 WCDMA Test Configuration

1）. <u>Output Power Verification</u>

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

2）. <u>Head SAR</u>

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

3）. <u>Body SAR</u>

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

4）. <u>HSDPA / HSUPA / DC-HSDPA</u>

According to KDB 941225 D01v03, RMC 12.2kbps setting is used to evaluate SAR. If the maximum output power and tune-up tolerance specified for production units in HSDPA / HSUPA / DC-HSDPA is ≤ ¼ dB higher than RMC 12.2Kbps or when the highest reported SAR of the RMC12.2Kbps is scaled by the ratio of specified maximum output power and tune-up tolerance of HSDPA / HSUPA / DC-HSDPA to RMC12.2Kbps and the adjusted SAR is ≤ 1.2 W/kg, SAR measurement is not required for HSDPA / HSUPA / DC-HSDPA

a) <u>HSDPA</u>

HSDPA is configured according to the applicable UE category of a test device. The number of HS-DSCH/HS-PDSCHs, HARQ 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 conditions, QPSK is used in the H-set for SAR testing. HS-DPCCH should be configured with a CQI feedback cycle of 4 ms and a CQI repetition factor of 2 to maintain a constant rate of active CQI slots. DPCCH and DPDCH gain factors(βc, βd), and HS-DPCCH power offset parameters (ΔACK, $\Delta NACK$, ΔCQI) are set according to values indicated in the following table The CQI value is determined by the UE category, transport block size, number of HS-PDSCHs and modulation used in the H-set.

Sub-test	βc	Bd	βd(SF)	βc/βd	βhs	CM(dB)	MPR (dB)
1	2/15	15/15	64	2/15	4/15	0.0	0
2	12/15(3)	15/15(3)	64	12/15(3)	24/15	1.0	0
3	15/15	8/15	64	15/8	30/15	1.5	0.5
4	15/15	4/15	64	15/4	30/15	1.5	0.5

Note1: △ACK, △NACK and △CQI= 8 Ahs = βhs/βc=30/15 βhs=30/15*βc
Note2:For the HS-DPCCH power mask requirement test in clause 5.2C,5.7A,and the Error Vector Magnitude(EVM) with HS-DPCCH test in clause 5.13.1.A,and HSDPA EVM with phase discontinuity in clause 5.13.1AA, △ACK and △NACK= 8 (Ahs=30/15) with βhs=30/15*βc,and △CQI= 7 (Ahs=24/15) with βhs=24/15*βc.
Note3: CM=1 forβc/βd =12/15, βhs/βc=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.

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

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

Table 4： settings of required H-Set 1 QPSK acc. to 3GPP 34.121

HS-DSCH Category	Maximum HS-DSCH Codes Received	Minimum Inter-TTI Interval	MaximumH S-DSCH Transport BlockBits/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

Table 5： HSDPA UE category

b) HSUPA

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 HSUPA should be configured according to the values indicated below as well as other applicable procedures described in the „WCDMA Handset" and „Release 5 HSUPA Data Device" sections of 3G device.

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

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

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

Note 3 : For subtest 1 the β_c/β_d ratio of 11/15 for the TFC during the measurement period (TF1, TF0) is achieved by setting the signalled gain factors for the reference TFC (TF1, TF1) to $\beta_c = 10/15$ and $\beta_d = 15/15$

Note 4 : For subtest 5 the β_c/β_d ratio of 15/15 for the TFC during the measurement period (TF1, TF0) is achieved by setting the signalled gain factors for the reference TFC (TF1, TF1) to $\beta_c = 14/15$ and $\beta_d = 15/15$

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

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

Table 6： Subtests for UMTS Release 6 HSUPA

UE E-DCH Category	Maximum E-DCH Codes Transmitted	Number of HARQ Processes	E-DCH TTI(ms)	Minimum Speading 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).

Table 7： HSUPA UE category

c) 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

Table 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

Table 8： settings of required H-Set 12 QPSK acc. to 3GPP 34.121

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.

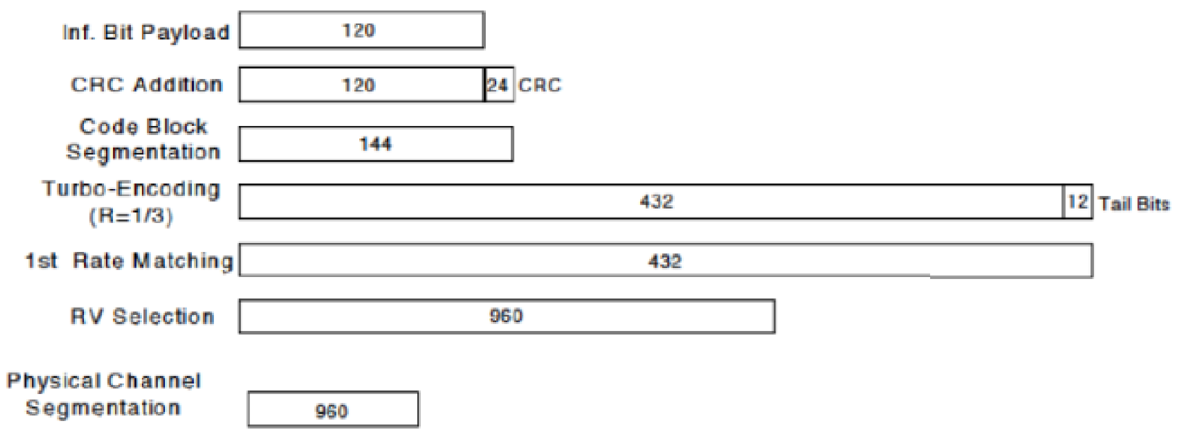


Figure C.8.19: Coding rate for Fixed reference Channel H-Set 12 (QPSK)

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

Sub-test	β_c	β_d	β_d (SF)	β_c/β_d	β_{hs} (1)	CM(dB)(2)	MPR (dB)
1	2/15	15/15	64	2/15	4/15	0.0	0
2	12/15(3)	15/15(3)	64	12/15(3)	24/15	1.0	0
3	15/15	8/15	64	15/8	30/15	1.5	0.5
4	15/15	4/15	64	15/4	30/15	1.5	0.5
Note 1: Δ ACK, Δ NACK and Δ CQI = 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.

Note:

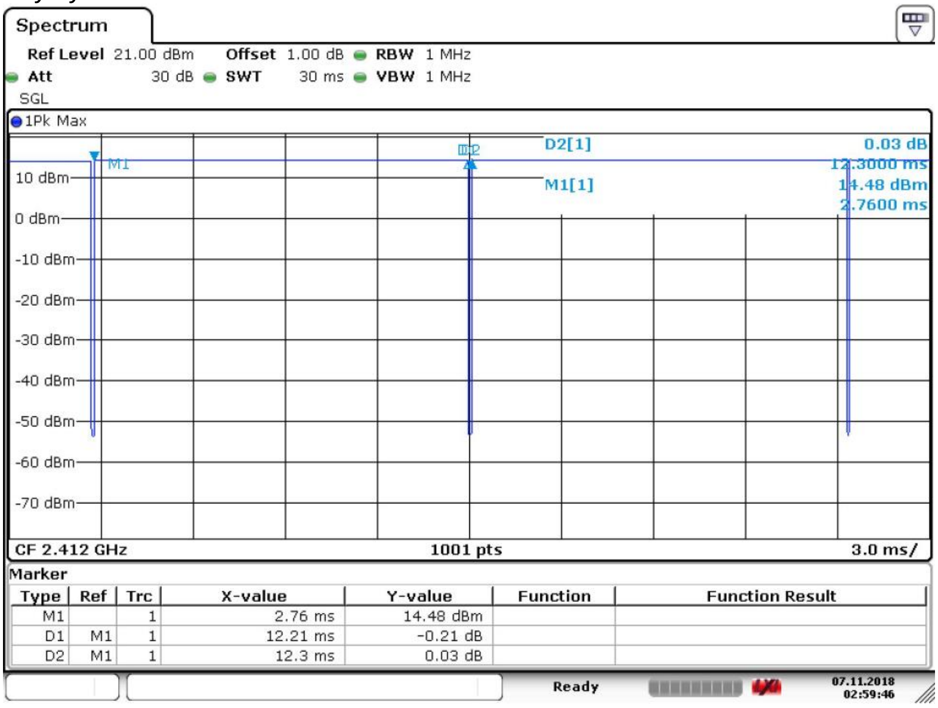
1. The Dual Carriers transmission only applies to HSDPA physical channels
2. The Dual Carriers belong to the same Node and are on adjacent carriers.
3. The Dual Carriers do not support MIMO to serve UEs configured for dual cell operation
4. The Dual Carriers operate in the same frequency band.
5. The 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.

5.2.3 WiFi Test Configuration

A Wi-Fi device must be configured to transmit continuously at the required data rate, channel bandwidth and signal modulation, using the highest transmission duty factor supported by the test mode tools for SAR measurement.

- 2.4G WIFI 802.11b

  Duty cycle= 12.21/12.3 = 99.27%



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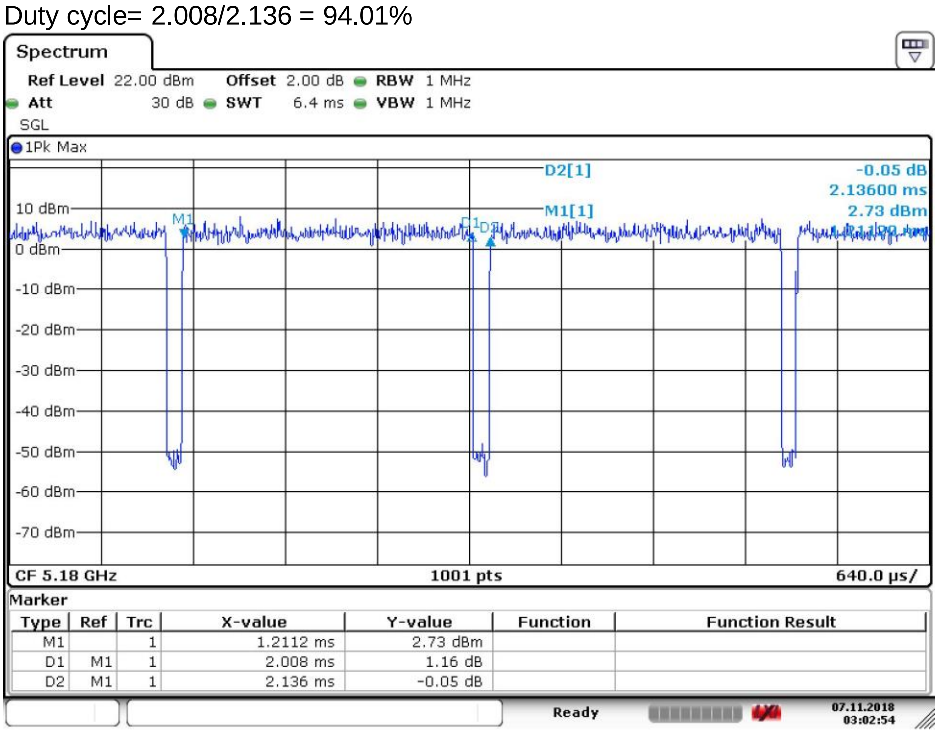
- 5G WIFI 802.11a

  Duty cycle= 2.008/2.136 = 94.01%



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5.2.3.1 Initial Test Position SAR Test Reduction Procedure

DSSS and OFDM configurations are considered separately according to the required SAR procedures. SAR is measured in the initial test position using the 802.11 transmission mode configuration required by the DSSS procedure or initial test configuration and subsequent test configuration(s) according to the OFDM procedures. The initial test position procedure is described in the following:

1）. When the reported SAR of the initial test position is ≤ 0.4 W/kg, further SAR measurement is not required for the other (remaining) test positions in that exposure configuration and 802.11 transmission mode combinations within the frequency band or aggregated band. SAR is also not required for that exposure configuration in the subsequent test configuration(s).

2）. When the reported SAR of the initial test position is > 0.4 W/kg, SAR is repeated for the 802.11 transmission mode configuration tested in the initial test position using subsequent highest extrapolated or estimated 1-g SAR conditions determined by area scans or next closest/smallest test separation distance and maximum RF coupling test positions based on manufacturer justification, on the highest maximum output power channel, until the reported SAR is ≤ 0.8 W/kg or all required test positions (left, right, touch, tilt or subsequent surfaces and edges) are tested.

3）. For all positions/configurations tested using the initial test position and subsequent test positions, when the reported SAR is > 0.8 W/kg, SAR is measured for these test positions/configurations on the subsequent next highest measured output power channel(s) until the reported SAR is ≤ 1.2 W/kg or all required channels are tested. a) Additional power measurements may be required for this step, which should be limited to those necessary for identifying the subsequent highest output power channels.

5.2.3.2 Initial Test Configuration Procedures

An initial test configuration is determined for OFDM transmission modes according to the channel bandwidth, modulation and data rate combination(s) with the highest maximum output power specified for production units in each standalone and aggregated frequency band. SAR is measured using the highest measured maximum output power channel. For configurations with the same specified or measured maximum output power, additional transmission mode and test channel selection procedures are required. SAR test reduction for subsequent highest output test channels is determined according to *reported* SAR of the initial test configuration.
For next to the ear, hotspot mode and UMC mini-tablet exposure configurations where multiple test positions are required, the initial test position procedure is applied to minimize the number of test positions required for SAR measurement using the initial test configuration transmission mode. For fixed exposure conditions that do not have multiple SAR test positions, SAR is measured in the transmission mode determined by the initial test configuration.
When the *reported* SAR of the initial test configuration is > 0.8 W/kg, SAR measurement is required for subsequent next highest measured output power channel(s) in the initial test configuration until *reported* SAR is ≤ 1.2 W/kg or all required channels are tested.

5.2.3.3 Subsequent Test Configuration Procedures

SAR measurement requirements for the remaining 802.11 transmission mode configurations that have not been tested in the initial test configuration are determined separately for each standalone and aggregated frequency band, in each exposure condition, according to the maximum output power specified for production units. The initial test position procedure is applied to next to the ear, UMPC mini-tablet and hotspot mode configurations. When the same maximum output power is specified for multiple transmission modes, additional power measurements may be required to determine if SAR measurements are required for subsequent highest output power channels in a subsequent test configuration. The subsequent test configuration and SAR measurement procedures are described in the following.

1）. When SAR test exclusion provisions of KDB Publication 447498 are applicable and SAR measurement is not required for the initial test configuration, SAR is also not required for the next highest maximum output power transmission mode subsequent test configuration(s) in that frequency band or aggregated band and exposure configuration.

2）. When the highest *reported* SAR for the initial test configuration (when applicable, include subsequent highest output channels), according to the initial test position or fixed exposure position requirements, is adjusted by the ratio of the subsequent test configuration to initial test configuration specified maximum output power and the adjusted SAR is ≤ 1.2 W/kg, SAR is not required for that subsequent test configuration.

3）. The number of channels in the initial test configuration and subsequent test configuration can be different due to differences in channel bandwidth. When SAR measurement is required for a subsequent test configuration and the channel bandwidth is smaller than that in the initial test configuration, all channels in the subsequent test configuration that overlap with the larger bandwidth channel tested in the initial test configuration should be used to determine the highest maximum output power channel. This step requires additional power measurement to identify the highest maximum output power channel in the subsequent test configuration to determine SAR test reduction.

a)SAR should first be measured for the channel with highest measured output power in the subsequent test configuration.

b) SAR for subsequent highest measured maximum output power channels in the subsequent test configuration is required only when the *reported* SAR of the preceding higher maximum output power channel(s) in the subsequent test configuration is > 1.2 W/kg or until all required channels are tested. i) For channels with the same measured maximum output power, SAR should be measured using the channel closest to the center frequency of the larger channel bandwidth channel in the initial test configuration.

4）. SAR measurements for the remaining highest specified maximum output power OFDM transmission mode configurations that have not been tested in the initial test configuration (highest maximum output) or subsequent test configuration(s) (subsequent next highest maximum output power) is determined by recursively applying the subsequent test configuration procedures in this section to the remaining configurations according to the following:

a)replace “subsequent test configuration” with “next subsequent test configuration” (i.e., subsequent next highest specified maximum output power configuration)

b) replace “initial test configuration” with “all tested higher output power configurations”

5.2.3.4 2.4 GHz SAR Procedures

Separate SAR procedures are applied to DSSS and OFDM configurations in the 2.4 GHz band to simplify DSSS test requirements. For 802.11b DSSS SAR measurements, DSSS SAR procedure applies to fixed exposure test position and initial test position procedure applies to multiple exposure test positions. When SAR measurement is required for an OFDM configuration, the initial test configuration, subsequent test configuration and initial test position procedures are applied. The SAR test exclusion requirements for 802.11g/n OFDM configurations are described in following.

- **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 (section 5.3, including sub-sections). 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 802.11 g/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.

5.2.3.5 5 GHz WiFi SAR Procedures

- **U-NII-1 and U-NII-2A Bands**

For devices that operate in only one of the U-NII-1 and U-NII-2A bands, the normally required SAR procedures for OFDM configurations are applied. For devices that operate in both U-NII bands using the same transmitter and antenna(s), SAR test reduction is determined according to the following：

1) When the same maximum output power is specified for both bands, begin SAR measurement in U-NII-2A band by applying the OFDM SAR requirements. If the highest reported SAR for a test configuration is ≤ 1.2 W/kg, SAR is not required for U-NII-1 band for that configuration (802.11 mode and exposure condition); otherwise, both bands are tested independently for SAR.
2) When different maximum output power is specified for the bands, begin SAR measurement in the band with higher specified maximum output power. The highest reported SAR for the tested configuration is adjusted by the ratio of lower to higher specified maximum output power for the two bands. When the adjusted SAR is ≤ 1.2 W/kg, SAR is not required for the band with lower maximum output power in that test configuration; otherwise, both bands are tested independently for SAR.
3) The two U-NII bands may be aggregated to support a 160 MHz channel on channel number 50. Without additional testing, the maximum output power for this is limited to the lower of the maximum output power certified for the two bands. When SAR measurement is required for at least one of the bands and the highest reported SAR adjusted by the ratio of specified maximum output power of aggregated to standalone band is > 1.2 W/kg, SAR is required for the 160 MHz channel. This procedure does not apply to an aggregated band with maximum output higher than the standalone band(s); the aggregated band must be tested independently for SAR. SAR is not required when the 160 MHz channel is operating at a reduced maximum power and also qualifies for SAR test exclusion.

- **U-NII-2C and U-NII-3 Bands**

The frequency range covered by these bands is 380 MHz (5.47 – 5.85 GHz), which requires a minimum of at least two SAR probe calibration frequency points to support SAR measurements. when Terminal Doppler Weather Radar (TDWR) restriction applies, all channels that operate at 5.60 – 5.65 GHz must be included to apply the SAR test reduction and measurement procedures.

When the same transmitter and antenna(s) are used for U-NII-2C band and U-NII-3 band or 5.8 GHz band of §15.247, the bands may be aggregated to enable additional channels with 20, 40 or 80 MHz bandwidth to span across the band gap, as illustrated in Appendix B. The maximum output power for the additional band gap channels is limited to the lower of those certified for the bands. Unless band gap channels are permanently disabled, they must be considered for SAR testing. The frequency range covered by these bands is 380 MHz (5.47 – 5.85 GHz), which requires a minimum of at least two SAR probe calibration frequency points to support SAR measurements. To maintain SAR measurement accuracy and to facilitate test reduction, the channels in U-NII-2C band above 5.65 GHz may be grouped with the 5.8 GHz channels in U-NII-3 or §15.247 band to enable two SAR probe calibration frequency points to cover the bands, including the band gap channels. When band gap channels are supported and the bands are not aggregated for SAR testing, band gap channels must be considered independently in each band according to the normally required OFDM SAR measurement and probe calibration frequency points requirements.

- **OFDM Transmission Mode SAR Test Configuration and Channel Selection Requirements**
  The initial test configuration for 5 GHz OFDM transmission modes is determined by the 802.11 configuration with the highest maximum output power specified for production units, including tune-up tolerance, in each standalone and aggregated frequency band. SAR for the initial test configuration is measured using the highest maximum output power channel determined by the default power measurement procedures. When multiple configurations in a frequency band have the same specified maximum output power, the initial test configuration is determined according to the following steps applied sequentially.
  1) The largest channel bandwidth configuration is selected among the multiple configurations with the same specified maximum output power.
  2) If multiple configurations have the same specified maximum output power and largest channel bandwidth, the lowest order modulation among the largest channel bandwidth configurations is selected.
  3) If multiple configurations have the same specified maximum output power, largest channel bandwidth and lowest order modulation, the lowest data rate configuration among these configurations is selected.
  4) When multiple transmission modes (802.11a/g/n/ac) have the same specified maximum output power, largest channel bandwidth, lowest order modulation and lowest data rate, the lowest order 802.11 mode is selected; i.e., 802.11a is chosen over 802.11n then 802.11ac or 802.11g is chosen over 802.11n.
     After an initial test configuration is determined, if multiple test channels have the same measured maximum output power, the channel chosen for SAR measurement is determined according to the following. These channel selection procedures apply to both the initial test configuration and subsequent test configuration(s), with respect to the default power measurement procedures or additional power measurements required for further SAR test reduction. The same procedures also apply to subsequent highest output power channel(s) selection.
     a) The channel closest to mid-band frequency is selected for SAR measurement.
     b) For channels with equal separation from mid-band frequency; for example, high and low channels or two mid-band channels, the higher frequency (number) channel is selected for SAR measurement.

- **SAR Test Requirements for OFDM configurations**

When SAR measurement is required for 802.11 a/n/ac OFDM configurations, each standalone and frequency aggregated band is considered separately for SAR test reduction. When the same transmitter and antenna(s) are used for U-NII-1 and U-NII-2A bands, additional SAR test reduction applies. When band gap channels between U-NII-2C band and 5.8 GHz U-NII-3 or §15.247 band are supported, the highest maximum output power transmission mode configuration and maximum output power channel across the bands must be used to determine SAR test reduction, according to the initial test configuration and subsequent test configuration requirements. 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.

5.2.4 LTE Test Configuration

LTE modes were tested according to FCC KDB 941225 D05 publication. Please see notes after the tabulated SAR data for required test configurations. Establishing connections with base station simulators ensure a consistent means for testing SAR and are recommended for evaluating SAR [4]. The Anritsu MT8821C was used for LTE output power measurements and SAR testing. Max power control was used so the UE transmits with maximum output power during SAR testing. SAR must be measured with the maximum TTI (transmit time interval) supported by the device in each LTE configuration.

A) Spectrum Plots for RB Configurations

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

B) MPR

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

Modulation	Channel bandwidth / Transmission bandwidth (N_{RB})						MPR (dB)
	1.4 MHz	3.0 MHz	5 MHz	10 MHz	15 MHz	20 MHz	
QPSK	> 5	> 4	> 8	> 12	> 16	> 18	≤ 1
16 QAM	≤ 5	≤ 4	≤ 8	≤ 12	≤ 16	≤ 18	≤ 1
16 QAM	> 5	> 4	> 8	> 12	> 16	> 18	≤ 2
64 QAM	≤ 5	≤ 4	≤ 8	≤ 12	≤ 16	≤ 18	≤ 2
64 QAM	> 5	> 4	> 8	> 12	> 16	> 18	≤ 3

C) A-MPR

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

D) Largest channel bandwidth standalone SAR test requirements

1) 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.

2) QPSK with 50% RB allocation

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

3) QPSK with 100% RB allocation

For QPSK with 100% RB allocation, SAR is not required when the highest maximum output power for 100 % RB allocation is less than the highest maximum output power in 50% and 1 RB allocations and the highest reported SAR for 1 RB and 50% RB allocation in 1) and 2) are ≤ 0.8 W/kg. Otherwise, SAR is measured for the highest output power channel and if the reported SAR is > 1.45 W/kg, the remaining required test channels must also be tested.

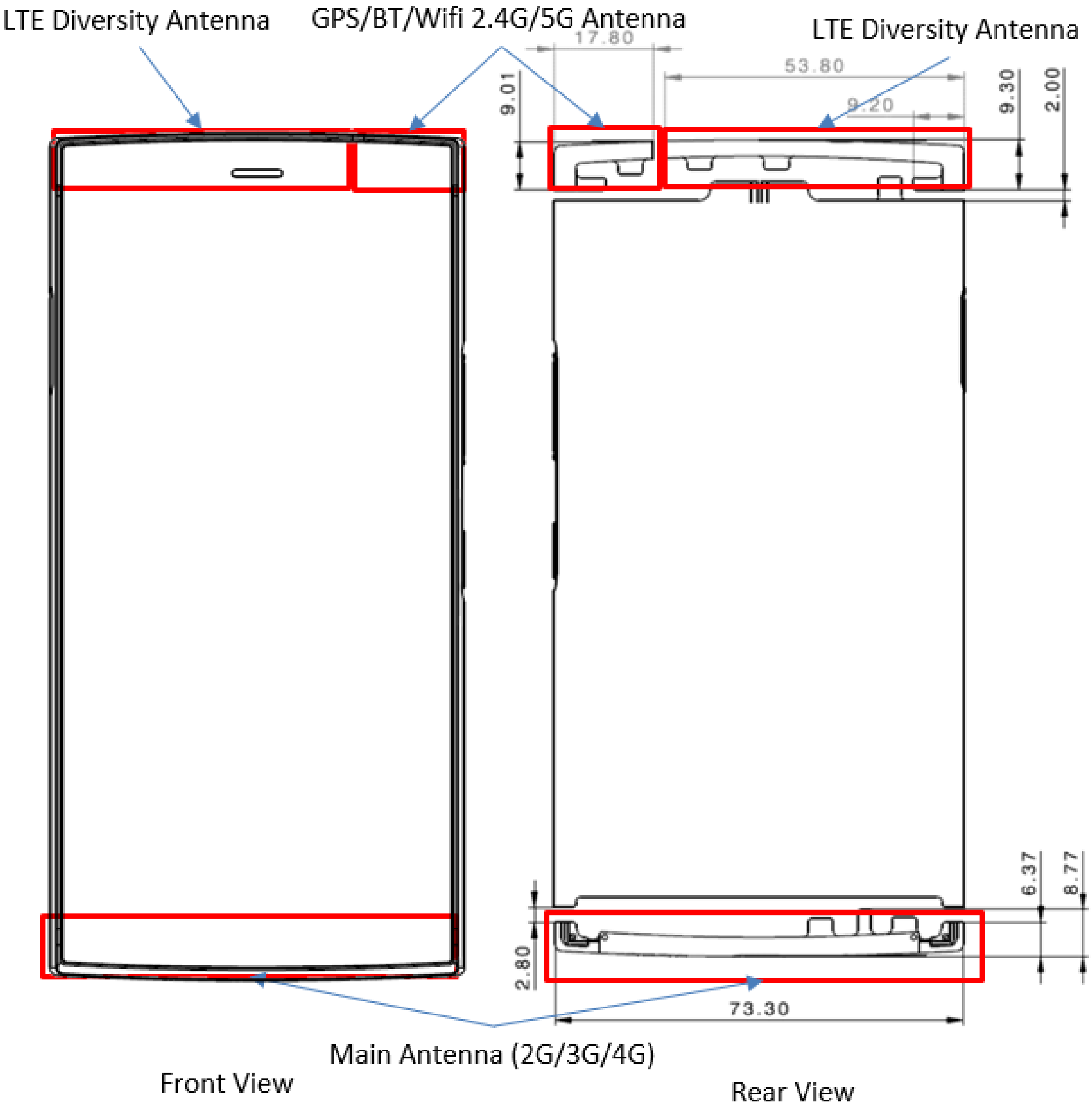
4) Higher order modulations

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.

E) 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.

5.2.5 DUT Antenna Locations



Note:
The test device is a mobile phone. The display diagonal dimension is 14.5 cm and the overall diagonal dimension of this device is 16.7 cm.

1) The diversity Antenna does not support transmitter function.

5.2.6 EUT side for SAR Testing

According to the distance between LTE/WCDAM/GSM&WIFI antennas and the sides of the EUT we can draw the conclusion that:

EUT Sides for SAR Testing						
Mode	Front	Back	Left	Right	Top	Bottom
GSM	Yes	Yes	Yes	Yes	No	Yes
WCDMA	Yes	Yes	Yes	Yes	No	Yes
LTE	Yes	Yes	Yes	Yes	No	Yes
Wi-F（2.4GHz）	Yes	Yes	No	Yes	Yes	No
Wi-Fi（5GHz）	Yes	Yes	No	Yes	Yes	No

Table 9： EUT Sides for SAR Testing

Note: When the antenna-to-edge distance is greater than 2.5cm, such position does not need to be tested.

5.2.7 Stand-alone SAR test evaluation

Unless specifically required by the published RF exposure KDB procedures, standalone 1-g head or body and 10-g extremity SAR evaluation for general population exposure conditions, by measurement or numerical simulation, is not required when the corresponding SAR Test Exclusion Threshold condition is satisfied. These test exclusion conditions are based on source-based time-averaged maximum conducted output power of the RF channel requiring evaluation, adjusted for tune-up tolerance, and the minimum test separation distance required for the exposure conditions.

Freq. Band	Frequency (GHz)	Position	Average Power		Test Separation (mm)	Calculate Value	Exclusion Threshold	Exclusion (Y/N)
			dBm	mW				
Wi-Fi	2.45	Head	16.00	39.81	0	12.5	3	N
		Body-worn	16.00	39.81	15	4.2	3	N
		hotspot	16.00	39.81	10	6.2	3	N
Wi-Fi	5.72	Head	15.00	31.62	0	15.1	3	N
		Body-worn	15.00	31.62	15	5.0	3	N
		hotspot	15.00	31.62	10	7.6	3	N
Bluetooth	2.48	Head	10.00	10.00	0	3.1	3	N
		Body-worn	10.00	10.00	15	1.0	3	Y
		hotspot	10.00	10.00	10	1.6	3	Y

The 1-g and 10-g SAR test exclusion thresholds for 100 MHz to 6 GHz at test separation distances ≤ 50 mm are determined by:
[(max. power of channel, including tune-up tolerance, mW)/(min. test separation distance, mm)] · [√f(GHz)] ≤ 3.0 for 1-g SAR and ≤ 7.5 for 10-g extremity 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

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

5.3 Measurement of RF conducted Power

5.3.1 Conducted Power Of GSM

GSM 850										
Burst Output Power(dBm)					Tune up	Division Factors	Frame-Average Output Power(dBm)			Tune up
Channel		128	190	251			128	190	251	
GSM(GMSK)	GSM	33.69	33.65	33.51	34.00	-9.19	24.5	24.46	24.32	24.81
GPRS/EGPRS (GMSK)	1 TX Slot	33.69	33.55	33.48	34.00	-9.19	24.5	24.36	24.29	24.81
	2 TX Slots	31.33	31.71	30.89	32.00	-6.18	25.15	**25.53**	24.71	**25.82**
	3 TX Slots	29.38	29.52	29.13	30.00	-4.42	24.96	25.1	24.71	25.58
	4 TX Slots	28.01	28.16	27.78	28.50	-3.17	24.84	24.99	24.61	25.33
EGPRS(8PSK)	1 TX Slot	28.33	28.25	27.81	28.50	-9.19	19.14	19.06	18.62	19.31
	2 TX Slots	26.25	25.49	25.25	26.50	-6.18	20.07	19.31	19.07	20.32
	3 TX Slots	23.66	23.65	23.31	24.00	-4.42	19.24	19.23	18.89	19.58
	4 TX Slots	22.13	22.22	21.85	22.50	-3.17	18.96	19.05	18.68	19.33
GSM 1900										
Burst Output Power(dBm)					Tune up	Division Factors	Frame-Average Output Power(dBm)			Tune up
Channel		512	661	810			512	661	810	
GSM(GMSK)	GSM	29.97	30.15	29.89	30.50	-9.19	20.78	20.96	20.7	21.31
GPRS/EGPRS (GMSK)	1 TX Slot	29.78	30.01	29.72	30.50	-9.19	20.59	20.82	20.53	21.31
	2 TX Slots	27.49	27.47	27.08	28.00	-6.18	**21.31**	21.29	20.9	**21.82**
	3 TX Slots	25.26	25.39	25.02	26.00	-4.42	20.84	20.97	20.6	21.58
	4 TX Slots	24.08	24.18	23.79	24.50	-3.17	20.91	21.01	20.62	21.33
EGPRS(8PSK)	1 TX Slot	26.23	26.15	25.96	27.00	-9.19	17.04	16.96	16.77	17.81
	2 TX Slots	23.59	23.89	23.72	24.00	-6.18	17.41	17.71	17.54	17.82
	3 TX Slots	21.95	22.18	21.94	22.50	-4.42	17.53	17.76	17.52	18.08
	4 TX Slots	20.67	20.48	20.61	21.00	-3.17	17.5	17.31	17.44	17.83

Table 10：Conducted Power Of GSM.

Note:

1）. CMU200 measures GSM peak and average output power for active timeslots. For SAR the time based average power is relevant. The difference in between depends on the duty cycle of the TDMA signal:

No. of timeslots	1	2	3	4
Duty Cycle	1:8.3	1:4.15	1:2.77	1:2.075
Time based avg. power compared to slotted avg. power	-9.19	-6.18	-4.42	-3.17

2）. The frame-averaged power is linearly proportion to the slot number configured and it is linearly scaled the maximum burst-averaged power based on time slots. The calculated method is shown as below:
Frame-averaged power = 10 x log (Burst-averaged power mW x Slot used / 8

3）. 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

5.3.2 Conducted Power Of WCDMA

WCDMA Band V					
Average Conducted Power(dBm)					
Channel		4132	4182	4233	Tune up
WCDMA	12.2kbps RMC	23.03	**23.20**	23.14	23.50
	12.2kbps AMR	23.02	23.18	23.11	23.50
HSDPA	Subtest 1	22.35	22.41	22.38	23.00
	Subtest 2	22.10	22.35	22.23	23.00
	Subtest 3	21.57	21.88	21.74	22.50
	Subtest 4	21.57	21.82	21.66	22.50
HSUPA	Subtest 1	22.11	22.25	22.15	22.50
	Subtest 2	20.09	20.25	20.16	21.00
	Subtest 3	21.10	21.29	21.19	21.50
	Subtest 4	20.07	20.31	20.16	21.00
	Subtest 5	22.13	22.33	22.21	22.50
DC-HSDPA	Subtest 1	22.46	22.41	22.44	23.00
	Subtest 2	22.13	22.16	22.10	23.00
	Subtest 3	21.54	21.71	21.70	22.50
	Subtest 4	21.51	21.73	21.66	22.50

Table 11：Conducted Power Of WCDMA.

Note:

1) 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.

5.3.3 Conducted Power Of LTE

LTE FDD Band 17				Conducted Power(dBm)			
Bandwidth	Modulation	RB size	RB offset	Channel 23755	Channel 23790	Channel 23825	Tune up
5MHz	QPSK	1	0	23.85	23.91	23.86	24.50
		1	13	24.03	23.95	24.01	24.50
		1	24	23.82	24.03	23.98	24.50
		12	0	22.96	22.94	23.04	23.50
		12	6	23.10	22.99	23.09	23.50
		12	13	22.90	22.88	23.09	23.50
		25	0	22.99	22.92	23.09	23.50
	16QAM	1	0	23.07	23.00	23.02	23.50
		1	13	23.32	23.18	23.44	23.50
		1	24	22.98	23.07	23.09	23.50
		12	0	22.03	21.93	22.03	22.50
		12	6	22.15	21.93	22.19	22.50
		12	13	21.97	21.97	22.10	22.50
		25	0	21.95	21.99	22.11	22.50
	64QAM	1	0	22.10	22.02	22.02	22.50
		1	13	21.99	21.93	21.95	22.50
		1	24	22.12	22.10	21.93	22.50
		12	0	20.66	21.10	20.85	22.50
		12	6	21.11	20.80	20.82	22.50
		12	13	20.93	20.72	20.71	22.50
		25	0	21.05	21.07	20.99	22.50
Bandwidth	Modulation	RB size	RB offset	Channel 23780	Channel 23790	Channel 23800	Tune up
10MHz	QPSK	1	0	23.88	23.74	23.86	24.50
		1	25	23.81	23.99	**23.88**	24.50
		1	49	**23.98**	**24.06**	23.80	24.50
		25	0	23.04	23.03	**23.05**	23.50
		25	13	23.02	23.00	22.96	23.50
		25	25	22.97	22.87	22.93	23.50
		50	0	**23.04**	22.99	23.02	23.50
	16QAM	1	0	23.05	23.27	22.94	23.50
		1	25	22.75	22.97	23.04	23.50
		1	49	23.15	23.17	23.14	23.50
		25	0	22.01	21.93	22.01	22.50
		25	13	21.98	22.06	22.01	22.50
		25	25	22.02	22.10	21.98	22.50
		50	0	22.01	22.01	21.99	22.50
	64QAM	1	0	22.13	22.06	22.04	22.50
		1	25	22.02	21.95	21.99	22.50
		1	49	22.17	22.13	21.96	22.50
		25	0	20.68	21.12	20.88	22.50
		25	13	21.14	20.85	20.84	22.50
		25	25	20.96	20.76	20.74	22.50
		50	0	21.10	21.08	21.02	22.50

Table 12：Conducted Power Of LTE.

5.3.4 Conducted Power Of WIFI and BT

Mode	Channel	Frequency(MHz)	Data Rate(Mbps)	Tune up	Average Power (dBm)	SAR Test
802.11b	1	2412	1	16.00	15.02	No
	6	2437		16.00	14.91	No
	11	2462		16.00	**15.09**	Yes
802.11g	1	2412	6	12.00	11.01	No
	6	2437		12.00	10.77	No
	11	2462		12.00	10.85	No
802.11n HT20	1	2412	6.5	12.00	10.83	No
	6	2437		12.00	10.65	No
	11	2462		12.00	10.88	No

5GHz	mode	Channel	Frequency(MHz)	Data Rate(Mbps)	Tune up	Average Power (dBm)	SAR Test
802.11a	U-NII-1	36	5180	6	15.00	13.96	No
		40	5200		15.00	13.95	No
		44	5220		15.00	13.94	No
		48	5240		15.00	13.89	No
	U-NII-2A	52	5260		15.00	**14.02**	Yes
		56	5280		15.00	**14.01**	Yes
		60	**5300**		15.00	13.99	No
		64	5320		15.00	14.00	No
	U-NII-2C	100	5500		15.00	**13.78**	Yes
		104	5520		15.00	13.72	No
		108	5540		15.00	13.68	No
		112	5560		15.00	13.72	No
		116	5580		15.00	13.65	No
		120	5600		15.00	13.58	No
		124	5620		15.00	13.59	No
		128	5640		15.00	13.61	No
		132	5660		15.00	13.50	No
		136	5680		15.00	13.52	No
		140	5700		15.00	13.61	No
		144	5720		15.00	13.61	No
5GHz	mode	Channel	Frequency(MHz)	Data Rate(Mbps)	Tune up	Average Power (dBm)	SAR Test
802.11n-HT20	U-NII-1	36	5180	MCS0	15.00	13.78	No
		40	5200		15.00	13.75	No
		44	5220		15.00	13.85	No
		48	5240		15.00	13.69	No
	U-NII-2A	52	5260		15.00	13.84	No
		56	5280		15.00	13.93	No
		60	5300		15.00	13.79	No
		64	5320		15.00	13.77	No
	U-NII-2C	100	5500		15.00	13.65	No
		104	5520		15.00	13.54	No
		108	5540		15.00	13.58	No
		112	5560		15.00	13.56	No
		116	5580		15.00	13.47	No

5GHz	mode	Channel	Frequency(MHz)	Data Rate(Mbps)	Tune up	Average Power (dBm)	SAR Test
		120	5600		15.00	13.43	No
		124	5620		15.00	13.41	No
		128	5640		15.00	13.44	No
		132	5660		15.00	13.33	No
		136	5680		15.00	13.37	No
		140	5700		15.00	13.41	No
		144	5720		15.00	13.51	No
5GHz	mode	Channel	Frequency(MHz)	Data Rate(Mbps)	Tune up	Average Power (dBm)	SAR Test
802.11n-HT40	U-NII-1	38	5190	MCS0	13.00	12.76	No
		46	5230		13.00	12.65	No
	U-NII-2A	54	5270		13.00	12.73	No
		62	5310		13.00	12.69	No
	U-NII-2C	102	5510		13.00	12.51	No
		110	5550		13.00	12.60	No
		118	5590		13.00	12.36	No
		126	5630		13.00	12.41	No
		134	5670		13.00	12.25	No
		142	5710		13.00	12.31	No
5GHz	mode	Channel	Frequency(MHz)	Data Rate(Mbps)	Tune up	Average Power (dBm)	SAR Test
802.11ac 20M	U-NII-1	36	5180	MCS0	15.00	13.68	No
		40	5200		15.00	13.71	No
		44	5220		15.00	13.82	No
		48	5240		15.00	13.72	No
	U-NII-2A	52	5260		15.00	13.71	No
		56	5280		15.00	13.87	No
		60	5300		15.00	13.78	No
		64	5320		15.00	13.83	No
	U-NII-2C	100	5500		15.00	13.48	No
		104	5520		15.00	13.51	No
		108	5540		15.00	13.52	No
		112	5560		15.00	13.55	No
		116	5580		15.00	13.46	No
		120	5600		15.00	13.39	No
		124	5620		15.00	13.44	No
		128	5640		15.00	13.41	No
		132	5660		15.00	13.39	No
		136	5680		15.00	13.38	No
		140	5700		15.00	13.29	No
		144	5720		15.00	13.49	No
5GHz	mode	Channel	Frequency(MHz)	Data Rate(Mbps)	Tune up	Average Power (dBm)	SAR Test
802.11ac 40M	U-NII-1	38	5190	MCS0	13.00	12.73	No
		46	5230		13.00	12.69	No
	U-NII-2A	54	5270		13.00	12.69	No
		62	5310		13.00	12.66	No
	U-NII-2C	102	5510		13.00	12.59	No
		110	5550		13.00	12.51	No
		118	5590		13.00	12.25	No
		126	5630		13.00	12.21	No
		134	5670		13.00	12.23	No
		142	5710		13.00	12.18	No

5GHz	mode	Channel	Frequency(MHz)	Data Rate(Mbps)	Tune up	Average Power (dBm)	SAR Test
802.11ac 80M	U-NII-1	42	5210	MCS0	13.00	12.37	No
	U-NII-2A	58	5290		13.00	12.58	No
	U-NII-2C	106	5530		13.00	12.28	No
		122	5610		13.00	12.01	No
		138	5690		13.00	12.22	No

Table 13：Conducted Power Of WIFI.

Note:

a) Power must be measured at each transmit antenna port according to the DSSS and OFDM transmission configurations in each standalone and aggregated frequency band.

b) Power measurement is required for the transmission mode configuration with the highest maximum output power specified for production units.

1) When the same highest maximum output power specification applies to multiple transmission modes, the largest channel bandwidth configuration with the lowest order modulation and lowest data rate is measured.

2) When the same highest maximum output power is specified for multiple largest channel bandwidth configurations with the same lowest order modulation or lowest order modulation and lowest data rate, power measurement is required for all equivalent 802.11 configurations with the same maximum output power.

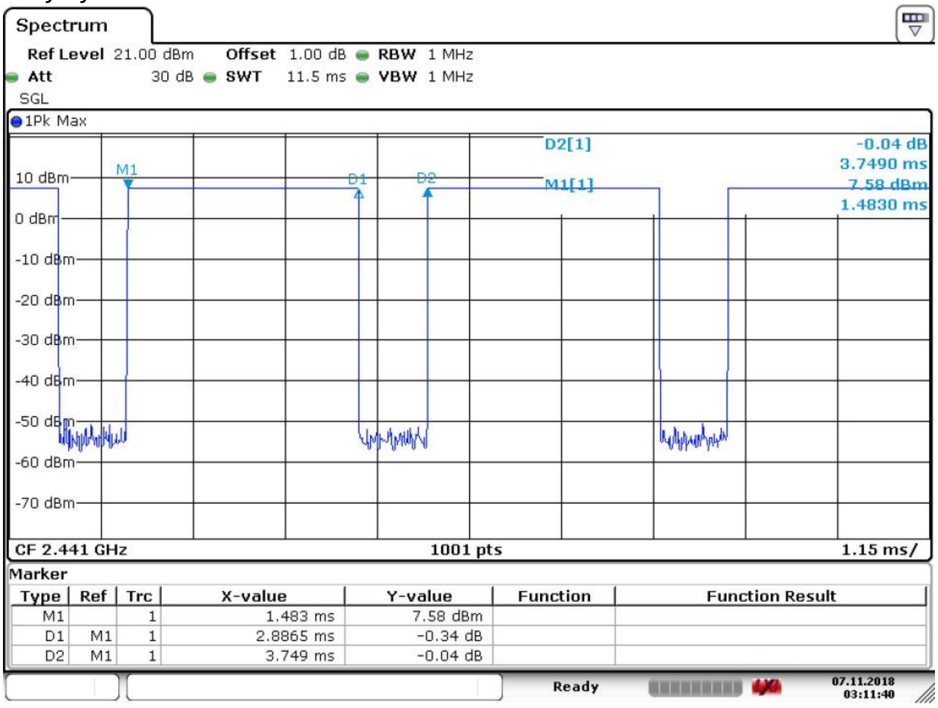
c) For each transmission mode configuration, power must be measured for the highest and lowest channels; and at the mid-band channel(s) when there are at least 3 channels. For configurations with multiple mid-band channels, due to an even number of channels, both channels should be measured.

BT			Tune up (dBm)	Average Conducted Power(dBm)
Modulation	Channel	Frequency(MHz)		
GFSK	0	2402	10.00	**9.51**
	39	2441	10.00	8.04
	78	2480	10.00	8.79
π/4DQPSK	0	2402	7.50	7.08
	39	2441	7.50	5.54
	78	2480	7.50	6.44
8DPSK	0	2402	7.50	7.07
	39	2441	7.50	5.65
	78	2480	7.50	6.41

BLE			Tune up (dBm)	Average Conducted Power(dBm)
Modulation	Channel	Frequency(MHz)		
GFSK	0	2402	0.00	-2.16
	19	2440	0.00	-3.10
	39	2480	0.00	-1.99

Table 14：Conducted Power Of BT.

Duty cycle= 2.8865/3.749 = 76.99%



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5.4 Measurement of SAR Data

5.4.1 SAR Result Of GSM850

Test position	Test mode	Test Ch./Freq.	Duty Cycle	SAR (W/kg) 1-g	Power Drift (dB)	Conducted Power (dBm)	Tune up Limit (dBm)	Scaled factor	Scaled SAR (W/kg)	Liquid Temp
Head Test data										
Left cheek	GSM	190/836.6	1:8.3	0.564	-0.09	33.65	34.00	1.084	0.611	22.1
Left tilted	GSM	190/836.6	1:8.3	0.463	-0.07	33.65	34.00	1.084	0.502	22.1
Right cheek	GSM	190/836.6	1:8.3	0.662	-0.13	33.65	34.00	1.084	**0.718**	22.1
Right tilted	GSM	190/836.6	1:8.3	0.437	-0.09	33.65	34.00	1.084	0.474	22.1
Body worn Test data (Separate 15mm)										
Front side	GSM	190/836.6	1:8.3	0.333	0.04	33.65	34.00	1.084	**0.361**	22.1
Back side	GSM	190/836.6	1:8.3	0.326	0.02	33.65	34.00	1.084	0.353	22.1
Hotspot Test data (Separate 10mm)										
Front side	GPRS 2TS	190/836.6	1:4.15	0.355	0.02	31.71	32.00	1.069	0.380	22.1
Back side	GPRS 2TS	190/836.6	1:4.15	0.412	-0.02	31.71	32.00	1.069	**0.440**	22.1
Left side	GPRS 2TS	190/836.6	1:4.15	0.218	-0.13	31.71	32.00	1.069	0.233	22.1
Right side	GPRS 2TS	190/836.6	1:4.15	0.408	-0.03	31.71	32.00	1.069	0.436	22.1
Bottom side	GPRS 2TS	190/836.6	1:4.15	0.134	-0.08	31.71	32.00	1.069	0.143	22.1

Table 15：SAR of GSM850 for Head and Body.

Note:

1) The maximum Scaled SAR value is marked in bold. Graph results refer to Appendix B.

2) Per FCC KDB Publication 447498 D01, if the reported (scaled) SAR measured at the middle channel or highest output power channel for each test configuration is ≤ 0.8 W/kg then testing at the other channels is not required for such test configuration(s).

3) When multiple slots can be used, SAR should be tested to account for the maximum source-based time-averaged output power.

4) Per KDB 648474 D04, Product Specific 10-g SAR test is not required for this frequency band since hotspot mode 1-g reported SAR < 1.2 W/kg.

5.4.2 SAR Result Of GSM1900

Test position	Test mode	Test Ch./Freq.	Duty Cycle	SAR (W/kg)1-g	Power Drift (dB)	Conducted Power (dBm)	Tune up Limit (dBm)	Scaled factor	Scaled SAR (W/kg)	Liquid Temp
Head Test data										
Left cheek	GSM	661/1880	1:8.3	0.235	0.02	30.15	30.50	1.084	**0.255**	22.3
Left tilted	GSM	661/1880	1:8.3	0.088	0.04	30.15	30.50	1.084	0.095	22.3
Right cheek	GSM	661/1880	1:8.3	0.123	-0.12	30.15	30.50	1.084	0.133	22.3
Right tilted	GSM	661/1880	1:8.3	0.073	0.09	30.15	30.50	1.084	0.079	22.3
Body worn Test data (Separate 15mm)										
Front side	GSM	661/1880	1:8.3	0.113	0.01	30.15	30.50	1.084	**0.122**	22.3
Back side	GSM	661/1880	1:8.3	0.087	0.02	30.15	30.50	1.084	0.094	22.3
Hotspot Test data (Separate 10mm)										
Front side	GPRS 2TS	661/1880	1:4.15	0.400	0.04	27.47	28.00	1.130	0.452	22.3
Back side	GPRS 2TS	661/1880	1:4.15	0.316	-0.05	27.47	28.00	1.130	0.357	22.3
Left side	GPRS 2TS	661/1880	1:4.15	0.332	0.08	27.47	28.00	1.130	0.375	22.3
Right side	GPRS 2TS	661/1880	1:4.15	0.035	0.02	27.47	28.00	1.130	0.039	22.3
Bottom side	GPRS 2TS	661/1880	1:4.15	0.570	0.01	27.47	28.00	1.130	**0.644**	22.3

Table 16：SAR of GSM1900 for Head and Body.

Note:

1) The maximum Scaled SAR value is marked in bold. Graph results refer to Appendix B.

2) Per FCC KDB Publication 447498 D01, if the reported (scaled) SAR measured at the middle channel or highest output power channel for each test configuration is ≤ 0.8 W/kg then testing at the other channels is not required for such test configuration(s).

3) When multiple slots can be used, SAR should be tested to account for the maximum source-based time-averaged output power.

4) Per KDB 648474 D04, Product Specific 10-g SAR test is not required for this frequency band since hotspot mode 1-g reported SAR < 1.2 W/kg.

5.4.3 SAR Result Of WCDMA Band V

Test position	Test mode	Test Ch./Freq.	Duty Cycle	SAR (W/kg) 1-g	Power Drift (dB)	Conducted Power (dBm)	Tune up Limit (dBm)	Scaled factor	Scaled SAR (W/kg)	Liquid Temp
Head Test data										
Left cheek	RMC	4182/836.4	1:1	0.363	0.040	23.20	23.50	1.072	0.389	22.1
Left tilted	RMC	4182/836.4	1:1	0.311	0.030	23.20	23.50	1.072	0.333	22.1
Right cheek	RMC	4182/836.4	1:1	0.506	0.16	23.20	23.50	1.072	**0.542**	22.1
Right tilted	RMC	4182/836.4	1:1	0.306	-0.06	23.20	23.50	1.072	0.328	22.1
Body worn Test data (Separate 15mm)										
Front side	RMC	4182/836.4	1:1	0.438	0.00	23.20	23.50	1.072	0.469	22.1
Back side	RMC	4182/836.4	1:1	0.442	-0.01	23.20	23.50	1.072	**0.474**	22.1
Hotspot Test data (Separate 10mm)										
Front side	RMC	4182/836.4	1:1	0.467	-0.03	23.20	23.50	1.072	0.500	22.1
Back side	RMC	4182/836.4	1:1	0.519	-0.02	23.20	23.50	1.072	0.556	22.1
Left side	RMC	4182/836.4	1:1	0.325	-0.13	23.20	23.50	1.072	0.348	22.1
Right side	RMC	4182/836.4	1:1	0.588	-0.09	23.20	23.50	1.072	**0.630**	22.1
Bottom side	RMC	4182/836.4	1:1	0.230	-0.04	23.20	23.50	1.072	0.246	22.1

Table 17：SAR of WCDMA Band V for Head and Body.

Note:

1) The maximum Scaled SAR value is marked in bold. Graph results refer to Appendix B.

2) Per FCC KDB Publication 447498 D01, if the reported (scaled) SAR measured at the middle channel or highest output power channel for each test configuration is ≤ 0.8 W/kg then testing at the other channels is not required for such test configuration(s).

3) Per KDB 648474 D04, Product Specific 10-g SAR test is not required for this frequency band since hotspot mode 1-g reported SAR < 1.2 W/kg.

5.4.4 SAR Result Of LTE Band 17

Test position	BW.	Test mode	Test Ch./Freq.	Duty Cycle	SAR (W/kg) 1-g	Power Drift (dB)	Conducted power (dBm)	Tune up Limit (dBm)	Scaled factor	Scaled SAR (W/kg)	Liquid Temp.
Head Test data(1RB)											
Left cheek	10	QPSK 1RB_49	23790/710	1:1	0.146	0.05	24.06	24.50	1.107	0.162	22.1
Left tilted	10	QPSK 1RB_49	23790/710	1:1	0.088	-0.04	24.06	24.50	1.107	0.097	22.1
Right cheek	10	QPSK 1RB_49	23790/710	1:1	0.163	0.06	24.06	24.50	1.107	**0.180**	22.1
Right tilted	10	QPSK 1RB_49	23790/710	1:1	0.099	-0.05	24.06	24.50	1.107	0.109	22.1
Head Test data(50%RB)											
Left cheek	10	QPSK 25RB_0	23800/711	1:1	0.115	0.01	23.05	23.50	1.109	0.128	22.1
Left tilted	10	QPSK 25RB_0	23800/711	1:1	0.069	-0.12	23.05	23.50	1.109	0.076	22.1
Right cheek	10	QPSK 25RB_0	23800/711	1:1	0.128	0.08	23.05	23.50	1.109	0.142	22.1
Right tilted	10	QPSK 25RB_0	23800/711	1:1	0.076	0.11	23.05	23.50	1.109	0.084	22.1
Body worn Test data (Separate 15mm 1RB)											
Front side	10	QPSK 1RB_49	23790/710	1:1	0.230	-0.01	24.06	24.50	1.107	0.255	22.1
Back side	10	QPSK 1RB_49	23790/710	1:1	0.251	-0.01	24.06	24.50	1.107	**0.278**	22.1
Body worn Test data (Separate 15mm 50%RB)											
Front side	10	QPSK 25RB_0	23800/711	1:1	0.177	-0.05	23.05	23.50	1.109	0.196	22.1
Back side	10	QPSK 25RB_0	23800/711	1:1	0.189	-0.06	23.05	23.50	1.109	0.210	22.1
Hotspot Test data (Separate 10mm 1RB)											
Front side	10	QPSK 1RB_49	23790/710	1:1	0.255	-0.02	24.06	24.50	1.107	0.282	22.1
Back side	10	QPSK 1RB_49	23790/710	1:1	0.271	0.00	24.06	24.50	1.107	**0.300**	22.1
Left side	10	QPSK 1RB_49	23790/710	1:1	0.215	0.00	24.00	24.50	1.122	0.241	22.1
Right side	10	QPSK 1RB_49	23790/710	1:1	0.248	0.00	24.00	24.50	1.122	0.278	22.1
Bottom side	10	QPSK 1RB_49	23790/710	1:1	0.024	-0.01	24.00	24.50	1.122	0.026	22.1
Hotspot Test data (Separate 10mm 50%RB)											
Front side	10	QPSK 25RB_0	23800/711	1:1	0.194	-0.09	23.05	23.50	1.109	0.215	22.1
Back side	10	QPSK 25RB_0	23800/711	1:1	0.208	-0.04	23.05	23.50	1.109	0.231	22.1
Left side	10	QPSK 25RB_0	23800/711	1:1	0.125	0.00	23.05	23.50	1.109	0.139	22.1
Right side	10	QPSK 25RB_0	23800/711	1:1	0.202	-0.03	23.05	23.50	1.109	0.224	22.1
Bottom side	10	QPSK 25RB_0	23800/711	1:1	0.024	0.01	23.05	23.50	1.109	0.027	22.1

Table 18：SAR of LTE Band 17 for Head and Body.

Note:

1) The maximum Scaled SAR value is marked in bold. Graph results refer to Appendix B.

2) Per FCC KDB Publication 447498 D01, if the reported (scaled) SAR measured at the middle channel or highest output power channel for each test configuration is ≤ 0.8 W/kg then testing at the other channels is not required for such test configuration(s).

3) Per KDB 648474 D04, Product Specific 10-g SAR test is not required for this frequency band since hotspot mode 1-g reported SAR < 1.2 W/kg.

5.4.5 SAR Result Of WIFI 2.4G

Test position	Test mode	Test Ch./Freq.	Duty Cycle	Duty Cycle Scaled factor	SAR (W/kg) 1-g	Power drift (dB)	Conducted power (dBm)	Tune up Limit (dBm)	Scaled factor	Scaled SAR (W/kg)	Liquid Temp.
Head Test data											
Left cheek	802.11b	11/2462	99.27%	1.007	0.341	0.06	15.09	16.00	1.233	0.423	22.0
Left tilted	802.11b	11/2462	99.27%	1.007	0.349	0.06	15.09	16.00	1.233	**0.433**	22.0
Right cheek	802.11b	11/2462	99.27%	1.007	0.147	0.01	15.09	16.00	1.233	0.183	22.0
Right tilted	802.11b	11/2462	99.27%	1.007	0.125	0.06	15.09	16.00	1.233	0.155	22.0
Body worn Test data(Separate 15mm)											
Front side	802.11b	11/2462	99.27%	1.007	0.033	0.18	15.09	16.00	1.233	**0.041**	22.0
Back side	802.11b	11/2462	99.27%	1.007	0.032	0.01	15.09	16.00	1.233	0.040	22.0
Hotspot Test data (Separate 10mm)											
Front side	802.11b	11/2462	99.27%	1.007	0.068	-0.06	15.09	16.00	1.233	0.084	22.0
Back side	802.11b	11/2462	99.27%	1.007	0.080	-0.06	15.09	16.00	1.233	0.099	22.0
Right side	802.11b	11/2462	99.27%	1.007	0.082	0.02	15.09	16.00	1.233	**0.101**	22.0
Top side	802.11b	11/2462	99.27%	1.007	0.022	0.05	15.09	16.00	1.233	0.027	22.0

Table 19：SAR of WIFI 2.4G for Head and Body.

Note:

1) The maximum Scaled SAR value is marked in bold. Graph Results refer to Appendix B

2) If the reported (scaled) SAR measured at the middle channel or highest output power channel for each test configuration is ≤ 0.8 W/kg then testing at the other channels is not required for such test configuration(s).

3) Per KDB 648474 D04, Product Specific 10-g SAR test is not required for this frequency band since hotspot mode 1-g reported SAR < 1.2 W/kg.

4) Per KDB248227D01, for Body SAR test of WiFi 2.4G, SAR is measured for 2.4 GHz 802.11b DSSS using the initial test position procedure.The highest reported SAR for DSSS is adjusted by the ratio of OFDM 802.11g/n to DSSS specified maximum output power and the adjusted SAR is < 1.2 W/kg, so SAR for 802.11g/n is not required.

Mode	Tune up (dBm)	Tune up (mW)	Max report SAR(W/kg)	Adjusted SAR(W/kg)	SAR Test (Yes/No)
802.11b	16	39.81	0.443	/	Yes
802.11g	12	15.85	/	0.176	No
802.11n-HT20	12	15.85	/	0.176	No

5.4.6 SAR Result Of WIFI 5GHz

Test position	Test mode	Test Ch./Freq.	Duty Cycle	Duty Cycle Scaled factor	SAR (W/kg) 1-g	Power drift (dB)	Conducted power (dBm)	Tune up Limit (dBm)	Scaled factor	Scaled SAR (W/kg)	Liquid Temp.
Head Test data of U-NII-2A											
Left cheek	802.11a	52/5260	94.01%	1.064	0.700	0.01	14.02	15.00	1.253	**0.933**	22.2
Left cheek	802.11a	56/5280	94.01%	1.064	0.636	0.17	14.01	15.00	1.256	0.850	22.2
Left tilted	802.11a	52/5260	94.01%	1.064	0.439	0.08	14.02	15.00	1.253	0.585	22.2
Right cheek	802.11a	52/5260	94.01%	1.064	0.432	-0.11	14.02	15.00	1.253	0.576	22.2
Right tilted	802.11a	52/5260	94.01%	1.064	0.355	0.07	14.02	15.00	1.253	0.473	22.2
Head Test data of U-NII-2C											
Left cheek	802.11a	100/5500	94.01%	1.064	0.483	0.08	13.78	15.00	1.324	0.681	22.2
Left tilted	802.11a	100/5500	94.01%	1.064	0.491	-0.07	13.78	15.00	1.324	**0.692**	22.2
Right cheek	802.11a	100/5500	94.01%	1.064	0.441	-0.07	13.78	15.00	1.324	0.621	22.2
Right tilted	802.11a	100/5500	94.01%	1.064	0.340	0.08	13.78	15.00	1.324	0.479	22.2
Body worn Test data of U-NII-2A (Separate 15mm)											
Front side	802.11a	52/5260	94.01%	1.064	0.010	0.00	14.02	15.00	1.253	0.013	22.2
Back side	802.11a	52/5260	94.01%	1.064	0.001	0.00	14.02	15.00	1.253	0.001	22.2
Body worn Test data of U-NII-2C(Separate 15mm)											
Front side	802.11a	100/5500	94.01%	1.064	0.017	0.00	13.78	15.00	1.324	**0.025**	22.2
Back side	802.11a	100/5500	94.01%	1.064	0.002	0.00	13.78	15.00	1.324	0.003	22.2
Hotspot Test data of U-NII-1(Separate 10mm)											
Front side	802.11a	36/5180	94.01%	1.064	0.024	0.09	13.96	15.00	1.271	0.032	22.2
Back side	802.11a	36/5180	94.01%	1.064	0.026	0.00	13.96	15.00	1.271	**0.035**	22.2
Right side	802.11a	36/5180	94.01%	1.064	0.001	0.00	13.96	15.00	1.271	0.001	22.2
Top side	802.11a	36/5180	94.01%	1.064	0.009	0.02	13.96	15.00	1.271	0.013	22.2
Test position	**Test mode**	**Test Ch./Freq.**	**Duty Cycle**	**Duty Cycle Scaled factor**	**SAR (W/kg) 10-g**	**Power drift(dB)**	**Conducted power(dBm)**	**Tune up Limit(dBm)**	**Scaled factor**	**Scaled SAR(W/kg)**	**Liquid Temp.**
Product Specific 10-g SAR Test data of U-NII-2A(Separate 0mm)											
Front side	802.11a	52/5260	94.01%	1.064	0.303	0.00	14.02	15.00	1.253	**0.404**	22.2
Back side	802.11a	52/5260	94.01%	1.064	0.162	0.00	14.02	15.00	1.253	0.216	22.2
Right side	802.11a	52/5260	94.01%	1.064	0.012	-0.09	14.02	15.00	1.253	0.016	22.2
Top side	802.11a	52/5260	94.01%	1.064	0.169	0.08	14.02	15.00	1.253	0.225	22.2
Product Specific 10-g SAR Test data of U-NII-2C(Separate 0mm)											
Front side	802.11a	100/5500	94.01%	1.064	0.303	0.00	13.78	15.00	1.324	**0.427**	22.2
Back side	802.11a	100/5500	94.01%	1.064	0.185	0.01	13.78	15.00	1.324	0.261	22.2
Right side	802.11a	100/5500	94.01%	1.064	0.001	0.00	13.78	15.00	1.324	0.001	22.2
Top side	802.11a	100/5500	94.01%	1.064	0.155	0.08	13.78	15.00	1.324	0.218	22.2

Table 20：SAR of WIFI 5GHz for Head and Body.

Note:

1) The maximum Scaled SAR value is marked in bold. Graph Results refer to Appendix B

2) If the reported (scaled) SAR measured at the middle channel or highest output power channel for each test configuration is ≤ 0.8 W/kg then testing at the other channels is not required for such test configuration(s).

3) When the same maximum output power is specified for both bands, begin SAR measurement in U-NII-2A band by applying the OFDM SAR requirements. As the highest reported SAR for a test configuration is ≤ 1.2 W/kg, SAR is not required for U-NII-1 band for that configuration;

Mode	Tune up (dBm)	Tune up (mW)	Max report SAR(W/kg)	Adjusted SAR(W/kg)	SAR Test (Yes/No)
802.11a 20M (U-NII-2A)	15	31.62	0.933	/	Yes
802.11a 20M (U-NII-1)	15	31.62	/	0.933	No

4) For Wi-Fi 5G, U-NII-2A (5250-5350 MHz) and U-NII-2C (5470-5725 MHz) bands does not support hotspot function.

Note: Per KDB248227D01,as the highest reported SAR for the initial test configuration is adjusted by the ratio of the subsequent test configuration to initial test configuration specified maximum output power and the adjusted SAR is ≤ 1.2 W/kg, SAR test for the other 802.11 modes are not required.

Mode	Tune up (dBm)	Tune up (mW)	Max report SAR(W/kg)	Adjusted SAR(W/kg)	SAR Test (Yes/No)
5.3G U-NII-2A Band					
802.11a 20M	15.00	31.62	0.933	/	Yes
802.11n-HT20	15.00	31.62	/	0.933	No
802.11n-HT40	13.00	19.95	/	0.589	No
802.11ac 20M	15.00	31.62	/	0.933	No
802.11ac 40M	13.00	19.95	/	0.589	No
5.5G U-NII-2C Band					
802.11a 20M	15.00	31.62	0.692	/	Yes
802.11n-HT20	15.00	31.62	/	0.692	No
802.11n-HT40	13.00	19.95	/	0.437	No
802.11ac 20M	15.00	31.62	/	0.692	No
802.11ac 40M	13.00	19.95	/	0.437	No

5.4.7 SAR Result Of BT

Test position	Test mode	Test Ch./Freq.	Duty Cycle	Duty Cycle Scaled factor	SAR (W/kg) 1-g	Power drift (dB)	Conducted power (dBm)	Tune up Limit (dBm)	Scaled factor	Scaled SAR (W/kg)	Liquid Temp.
Head Test data											
Left cheek	DH5	0/2402	76.99%	1.299	0.101	0.05	9.51	10.00	1.119	**0.147**	22.0
Left tilted	DH5	0/2402	76.99%	1.299	0.076	-0.09	9.51	10.00	1.119	0.110	22.0
Right cheek	DH5	0/2402	76.99%	1.299	0.035	0.04	9.51	10.00	1.119	0.051	22.0
Right tilted	DH5	0/2402	76.99%	1.299	0.031	0.01	9.51	10.00	1.119	0.044	22.0

Table 21：SAR of BT for Head.

Note:

1) The maximum Scaled SAR value is marked in bold. Graph Results refer to Appendix B

2) If the reported (scaled) SAR measured at the middle channel or highest output power channel for each test configuration is ≤ 0.8 W/kg then testing at the other channels is not required for such test configuration(s).

5.5 Multiple Transmitter Evaluation

5.5.1 Simultaneous SAR SAR test evaluation

1) Simultaneous Transmission

NO.	Simultaneous Transmission Configuration	Head	Body worn	Hotspot	Product Specific 10-g SAR
1	GSM(Voice) + WiFi	Yes	Yes	No	Yes
2	GSM(Voice) + BT	Yes	Yes	No	Yes
3	WCDMA(Voice) + WiFi	Yes	Yes	No	Yes
4	WCDMA(Voice) + BT	Yes	Yes	No	Yes
5	GPRS / EDGE(Data) + WiFi	No	No	Yes	No
6	GPRS / EDGE(Data) + BT	No	No	Yes	No
7	WCDMA(Data) + WiFi	No	No	Yes	No
8	WCDMA(Data) + BT	No	No	Yes	No
9	LTE(Data) + WiFi	Yes	Yes	Yes	Yes
10	LTE(Data) + BT	Yes	Yes	Yes	Yes
11	BT+WIFI (They share the same antenna and cannot transmit at the same time by design.)	No	No	No	No

Note:
1) Wi-Fi 2.4G can transmit simultaneously with Bluetooth.
2) For Wi-Fi 5G, U-NII-2A (5250-5350 MHz) and U-NII-2C (5470-5725 MHz) bands does not support hotspot function.
3) The device does not support DTM function.

5.5.2 Estimated SAR

When the standalone SAR test exclusion is applied to an antenna that transmits simultaneously with other antennas, the standalone SAR must be estimated according to the 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 distances is > 50 mm.

Estimated SAR Result

Freq. Band	Frequency (GHz)	Test Position	max. power(dBm)	Test Separation (mm)	Estimated SAR (W/kg)
Bluetooth	2.48	Body-worn	10.00	15	0.140
		hotspot	10.00	10	0.210
		Product Specific 10-g SAR	10.00	5	0.168

1) Simultaneous Transmission SAR Summation Scenario for head

WWAN Band	Exposure position	① MAX.WWAN SAR(W/kg)	② MAX.WLAN 2.4G SAR(W/kg)	③ MAX.BT SAR(W/kg)	④ MAX.WLAN 5G SAR(W/kg)	Summed SAR①+②	Summed SAR①+③	Summed SAR①+④	Case NO.
GSM850	Left Touch	0.611	0.423	0.147	0.933	1.034	0.758	**1.544**	No
	Left Tilt	0.502	0.433	0.110	0.692	0.935	0.612	1.194	No
	Right Touch	0.718	0.183	0.051	0.621	0.901	0.769	1.339	No
	Right Tilt	0.474	0.155	0.044	0.479	0.629	0.518	0.953	No
GSM1900	Left Touch	0.255	0.423	0.147	0.933	0.678	0.402	1.188	No
	Left Tilt	0.095	0.433	0.110	0.692	0.528	0.205	0.787	No
	Right Touch	0.133	0.183	0.051	0.621	0.316	0.184	0.754	No
	Right Tilt	0.079	0.155	0.044	0.479	0.234	0.123	0.558	No
WCDMA Band V	Left Touch	0.389	0.423	0.147	0.933	0.812	0.536	1.322	No
	Left Tilt	0.333	0.433	0.110	0.692	0.766	0.443	1.025	No
	Right Touch	0.542	0.183	0.051	0.621	0.725	0.593	1.163	No
	Right Tilt	0.328	0.155	0.044	0.479	0.483	0.372	0.807	No
LTE Band 17	Left Touch	0.162	0.423	0.147	0.933	0.585	0.309	1.095	No
	Left Tilt	0.097	0.433	0.110	0.692	0.530	0.207	0.789	No
	Right Touch	0.180	0.183	0.051	0.621	0.363	0.231	0.801	No
	Right Tilt	0.109	0.155	0.044	0.479	0.264	0.153	0.588	No

2) Simultaneous Transmission SAR Summation Scenario for body worn

WWAN Band	Exposure position	① MAX.WWAN SAR(W/kg)	② MAX.WLAN 2.4G SAR(W/kg)	③MAX.BT SAR(W/kg)	④ MAX.WLAN 5G SAR(W/kg)	Summed SAR①+②	Summed SAR①+③	Summed SAR①+④	Case NO.
GSM850	Front	0.361	0.041	0.140	0.025	0.402	0.501	0.386	No
	Back	0.353	0.040	0.140	0.003	0.393	0.493	0.356	No
GSM1900	Front	0.122	0.041	0.140	0.025	0.163	0.262	0.147	No
	Back	0.094	0.040	0.140	0.003	0.134	0.234	0.097	No
WCDMA Band V	Front	0.469	0.041	0.140	0.025	0.510	0.609	0.494	No
	Back	0.474	0.040	0.140	0.003	0.514	**0.614**	0.477	No
LTE Band 17	Front	0.255	0.041	0.140	0.025	0.296	0.395	0.280	No
	Back	0.278	0.040	0.140	0.003	0.318	0.418	0.281	No

3) Simultaneous Transmission SAR Summation Scenario for hotspot

WWAN Band	Exposure position	① MAX.WWAN SAR(W/kg)	② MAX.WLAN 2.4G SAR(W/kg)	③MAX.BT SAR(W/kg)	④ MAX.WLAN 5G SAR(W/kg)	Summed SAR①+②	Summed SAR①+③	Summed SAR①+④	Case NO.
GSM850	Front	0.380	0.084	0.210	0.032	0.464	0.590	0.412	No
	Back	0.440	0.099	0.210	0.035	0.539	0.650	0.475	No
	Left	0.233	0.000	0.210	0.000	0.233	0.443	0.233	No
	Right	0.436	0.101	0.210	0.001	0.537	0.646	0.437	No
	Top	0.000	0.027	0.210	0.013	0.027	0.210	0.013	No
	Bottom	0.143	0.000	0.210	0.032	0.143	0.353	0.175	No
GSM1900	Front	0.452	0.084	0.210	0.032	0.536	0.662	0.484	No
	Back	0.357	0.099	0.210	0.035	0.456	0.567	0.392	No
	Left	0.375	0.000	0.210	0.000	0.375	0.585	0.375	No
	Right	0.039	0.101	0.210	0.001	0.140	0.249	0.040	No
	Top	0.000	0.027	0.210	0.013	0.027	0.210	0.013	No
	Bottom	0.644	0.000	0.210	0.032	0.644	**0.854**	0.676	No
WCDMA Band V	Front	0.500	0.084	0.210	0.032	0.584	0.710	0.532	No
	Back	0.556	0.099	0.210	0.035	0.655	0.766	0.591	No
	Left	0.348	0.000	0.210	0.000	0.348	0.558	0.348	No
	Right	0.630	0.101	0.210	0.001	0.731	0.840	0.631	No
	Top	0.000	0.027	0.210	0.013	0.027	0.210	0.013	No
	Bottom	0.246	0.000	0.210	0.032	0.246	0.456	0.278	No
LTE Band 17	Front	0.282	0.084	0.210	0.032	0.366	0.492	0.314	No
	Back	0.300	0.099	0.210	0.035	0.399	0.510	0.335	No
	Left	0.241	0.000	0.210	0.000	0.241	0.451	0.241	No
	Right	0.278	0.101	0.210	0.001	0.379	0.488	0.279	No
	Top	0.000	0.027	0.210	0.013	0.027	0.210	0.013	No
	Bottom	0.027	0.000	0.210	0.032	0.027	0.237	0.059	No

4) Simultaneous Transmission SAR Summation Scenario for Product Specific 10-g SAR

WWAN Band	Exposure position	① MAX.WWAN SAR(W/kg)	② MAX.WLAN 2.4G SAR(W/kg)	③MAX.BT SAR(W/kg)	④ MAX.WLAN 5G SAR(W/kg)	Summed SAR①+②	Summed SAR①+③	Summed SAR①+④	Case NO.
GSM850	Front	/	/	0.168	0.427	/	0.168	0.427	No
	Back	/	/	0.168	0.261	/	0.168	0.261	No
	Left	/	/	0.168	/	/	0.168	/	No
	Right	/	/	0.168	0.016	/	0.168	0.016	No
	Top	/	/	0.168	0.225	/	0.168	0.225	No
	Bottom	/	/	0.168	/	/	0.168	/	No
GSM1900	Front	/	/	0.168	0.427	/	0.168	0.427	No
	Back	/	/	0.168	0.261	/	0.168	0.261	No
	Left	/	/	0.168	/	/	0.168	/	No
	Right	/	/	0.168	0.016	/	0.168	0.016	No
	Top	/	/	0.168	0.225	/	0.168	0.225	No
	Bottom	/	/	0.168	/	/	0.168	/	No
WCDMA Band V	Front	/	/	0.168	0.427	/	0.168	0.427	No
	Back	/	/	0.168	0.261	/	0.168	0.261	No
	Left	/	/	0.168	/	/	0.168	/	No
	Right	/	/	0.168	0.016	/	0.168	0.016	No
	Top	/	/	0.168	0.225	/	0.168	0.225	No
	Bottom	/	/	0.168	/	/	0.168	/	No
LTE Band 17	Front	/	/	0.168	0.427	/	0.168	0.427	No
	Back	/	/	0.168	0.261	/	0.168	0.261	No
	Left	/	/	0.168	/	/	0.168	/	No
	Right	/	/	0.168	0.016	/	0.168	0.016	No
	Top	/	/	0.168	0.225	/	0.168	0.225	No
	Bottom	/	/	0.168	/	/	0.168	/	No

6 Equipment list

Test Platform	SPEAG DASY5 Professional					
Location	SGS-CSTC Standards Technical Services Co., Ltd. Shenzhen Branch					
Description	SAR Test System (Frequency range 300MHz-6GHz)					
Software Reference	DASY52 52.8.8(1222); SEMCAD X 14.6.10(7331)					
Hardware Reference						
Equipment		Manufacturer	Model	Serial Number	Calibration Date	Due date of calibration
☒	Twin Phantom	SPEAG	SAM 1	1283	NCR	NCR
☒	Twin Phantom	SPEAG	SAM 2	1913	NCR	NCR
☒	Twin Phantom	SPEAG	SAM 1	1912	NCR	NCR
☒	Twin Phantom	SPEAG	SAM 2	1640	NCR	NCR
☒	ELI	SPEAG	ELI V5.0	1123	NCR	NCR
☒	DAE	SPEAG	DAE4	1267	2017-11-28	2018-11-27
☒	DAE	SPEAG	DAE4	1428	2018-01-17	2019-08-30
☒	E-Field Probe	SPEAG	EX3DV4	3962	2018-01-11	2019-01-10
☒	E-Field Probe	SPEAG	EX3DV4	3789	2018-02-08	2019-02-07
☒	Validation Kits	SPEAG	D750V3	1160	2016-06-22	2019-06-21
☒	Validation Kits	SPEAG	D835V2	4d105	2016-12-08	2019-12-07
☒	Validation Kits	SPEAG	D1900V2	5d028	2016-12-07	2019-12-06
☒	Validation Kits	SPEAG	D2450V2	733	2016-12-07	2019-12-06
☒	Validation Kits	SPEAG	D5GHzV2	1165	2016-12-13	2019-12-12
☒	Agilent Network Analyzer	Agilent	E5071C	MY46523590	2018-03-13	2019-03-12
☒	Dielectric Probe Kit	Agilent	85070E	US01440210	NCR	NCR
☒	Universal Radio Communication Tester	R&S	CMU200	123090	2018-06-21	2019-06-20
☒	Radio Communication Analyzer	Anritsu Corporation	MT8821C	6201502984	2018-05-02	2019-05-01
☒	RF Bi-Directional Coupler	Agilent	86205-60001	MY31400031	NCR	NCR
☒	Signal Generator	Agilent	N5171B	MY53050736	2018-03-13	2019-03-12
☒	Preamplifier	Mini-Circuits	ZHL-42W	15542	NCR	NCR
☒	Preamplifier	Compliance Directions Systems Inc.	AMP28-3W	073501433	NCR	NCR
☒	Power Meter	Agilent	E4416A	GB41292095	2018-03-13	2019-03-12
☒	Power Sensor	Agilent	8481H	MY41091234	2018-03-13	2019-03-12
☒	Power Sensor	R&S	NRP-Z92	100025	2018-03-13	2019-03-12
☒	Attenuator	SHX	TS2-3dB	30704	NCR	NCR
☒	Coaxial low pass filter	Mini-Circuits	VLF-2500(+)	NA	NCR	NCR
☒	Coaxial low pass filter	Microlab Fxr	LA-F13	NA	NCR	NCR

☒	50 Ω coaxial load	Mini-Circuits	KARN-50+	00850	NCR	NCR
☒	DC POWER SUPPLY	SAKO	SK1730SL5A	NA	NCR	NCR
☒	Speed reading thermometer	MingGao	T809	NA	2018-03-19	2019-03-18
☒	Humidity and Temperature Indicator	KIMTOKA	KIMTOKA	NA	2018-03-19	2019-03-18

Note: All the equipments are within the valid period when the tests are performed.

7 Measurement Uncertainty

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.

8 Calibration certificate

Please see the Appendix C

9 Photographs

Please see the Appendix D

Appendix A: Detailed System Check Results

Appendix B: Detailed Test Results

Appendix C: Calibration certificate

Appendix D: Photographs

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