Microtest
微测检测

Test Report

FCC ID : ZXW-WF68

Date of issue: Jul. 9, 2017

Report Number:	MTi170817E133
Sample Description:	Mobile Computer
Model(s):	WF68, WF68S, WF88
Applicant:	Widefly Ltd.
Address:	Unit 205, 2/F, Lakeside 2, No.10 Science Park West Avenue, Hong Kong Science Park, Shatin, N.T., HONG KONG.
Date of Test:	May. 26, 2017 to Jul. 9, 2017

Shenzhen Microtest Co., Ltd.
http://www.mtitest.com

TEST RESULT CERTIFICATION	
Applicant's name.......................:	**Widefly Ltd.**
Address..:	Unit 205, 2/F, Lakeside 2, No.10 Science Park West Avenue, Hong Kong Science Park, Shatin, N.T., HONG KONG.
Manufacture's Name..................:	**Widefly Ltd.**
Address..:	Unit 205, 2/F, Lakeside 2, No.10 Science Park West Avenue, Hong Kong Science Park, Shatin, N.T., HONG KONG.
Product description	
Product name ....:	Mobile Computer
Trade Name:	Widefly
Model and/or type reference ....:	WF68
Serial Model.................................:	WF68S, WF88
Standards ....:	**FCC 47 CFR Part2.1093** **ANSI/IEEE C95.1: 1999** **IEEE 1528: 2013**

Tested by: Ace Chai July. 09, 2017

Reviewed by: Smith Chen July. 10, 2017

Approved by: Tom Xue July. 10, 2017

Contents

1. TEST STANDARDS

The tests were performed according to following standards:

IEEE Std C95.1, 1999: IEEE Standard for Safety Levels with Respect to Human Exposure to Radio Frequency Electromagnetic Fields, 3 KHz to 300 GHz. It specifies the maximum exposure limit of 1.6 W/kg as averaged over any 1 gram of tissue for portable devices being used within 20 cm of the user in the uncontrolled environment.
IEEE Std 1528™-2013: IEEE Recommended Practice for Determining the Peak Spatial-Average Specific Absorption Rate (SAR) in the Human Head from Wireless Communications Devices: Measurement Techniques.
FCC Part 2.1093 Radiofrequency Radiation Exposure Evaluation:Portable Devices
KDB447498 D01 General RF Exposure Guidance v06 : Mobile and Portable Device RF Exposure Procedures and Equipment Authorization Policies
KDB648474 D04, Handset SAR v01r03: SAR Evaluation Considerations for Wireless Handsets
KDB865664 D01 SAR Measurement 100 MHz to 6 GHz v01r04 : SAR Measurement Requirements for 100 MHz to 6 GHz
KDB865664 D02 RF Exposure Reporting v01r02: RF Exposure Compliance Reporting and Documentation Considerations
KDB248227 D01 802.11 Wi-Fi SAR v02r02: SAR GUIDANCE FOR IEEE 802.11 (Wi-Fi) TRANSMITTERS
KDB941225 D01 3G SAR Procedures v03r01: 3G SAR MEAUREMENT PROCEDURES
KDB 941225 D06 Hotspot Mode v02r01: SAR EVALUATION PROCEDURES FOR PORTABLE DEVICES WITH WIRELESS ROUTER CAPABILITIES

2. SUMMARY

2.1. General Remarks

Date of receipt of test sample	:	May 25, 2017
Testing commenced on	:	May 26, 2017
Testing concluded on	:	Jul. 10, 2017

2.2. Product Description

The **ALPHA EXPORT AND IMPORT CO.,LIMITED**'s Model: DK66 or the "EUT" as referred to in this report; more general information as follows, for more details, refer to the user's manual of the EUT.

General Description	
Name of EUT	Mobile Computer
Model Number	WF68
Antenna Type	Internal
Device category	Portable Device
Exposure category	General population/uncontrolled environment
EUT Type	Production Unit
Rated Vlotage	DC 3.80 Battery
Hotsopt	Supported, power not reduced when Hotspot open
The EUT is a mobile phone. the mobile phone is intended for speech and Multimedia Message Service (MMS) transmission. It is equipped with GPRS/EDGE class 12 for GSM850, PCS1900, WCDMA Band V, LTEBand 2,LTEBand 4,LTEBand 7,LTEBand 17,and Bluetooth, WiFi, and camera functions. For more information see the following datasheet	

Technical Characteristics	
2G	
Support Networks	GSM, GPRS, EDGE
Support Band	GSM850/PCS1900
Frequency	GSM850: 824.2~848.8MHz GSM1900: 1850.2~1909.8MHz
Type of Modulation	GMSK, 8PSK (only downlink)
Antenna Type	Internal Antenna
GPRS Class	Class 12
GSM Release Version	R99
GPRS operation mode	Class B
DTM Mode	Not Supported
3G	
Support Networks	WCDMA RMC12.2K,HSDPA,HSUPA
Support Band	WCDMA Band V
Frequency Range	WCDMA Band V: 826.4~846.6MHz
Type of Modulation	QPSK
HSDPA UE Category	10
HSUPA UE Category	6
DC-HSDPA	Not Supported
Antenna Type	Internal Antenna
4G	
Operation Band:	FDD Band 2,FDD Band 4, FDD Band 7, FDD Band 17
Modilation Type:	QPSK， 16QAM
2.4G WiFi	
Support Standards	IEEE 802.11b, IEEE 802.11g, IEEE 802.11n
Frequency Range	2412-2462MHz for 11b/g/n(HT20), 2422-2452MHz for 11n(HT40)
Type of Modulation	CCK, OFDM, QPSK, BPSK, 16QAM,

Quantity of Channels	11 for 11b/g/n(HT20),7 for 11n(HT40)
Channel Separation	5MHz
Antenna Type	Internal Antenna
5G WiFi	
Supported type:	802.11a/802.11n
Modulation:	BPSK /QPSK /16QAM /64QAM
Operation frequency:	Band I:5150MHz-5250MHz
Channel Bandwidth	802.11a/n(H20):20MHz
Channel separation:	5MHz
Bluetooth+EDR	
Bluetooth Version	Supported BT4.0+EDR
Frequency Range	2402-2480MHz
Modulation	GFSK, π/4 QDPSK, 8DPSK
Quantity of Channels	79
Channel Separation	1MHz
Antenna Type	Internal Antenna
Bluetooth+BLE	
Version:	Supported BT4.0+BLE
Modulation:	GFSK
Operation frequency:	2402MHz~2480MHz
Channel number:	40
Channel separation:	2MHz
Antenna type:	Integral Antenna

2.3. Statement of Compliance

The maximum of results of SAR found during testing are follows:

<Highest Reported standalone SAR Summary>

Classment Class	Frequency Band	Head (Report 1g SAR(W/Kg)	Hotspot (Report 1g SAR(W/Kg)	Body-worn (Report 1g SAR(W/Kg)
PCE	GSM850	0.13	0.35	0.35
	GSM1900	0.18	0.46	0.46
	WCDMA Band V	0.13	0.38	0.38
	LTE Band 2	0.14	0.44	0.44
	LTE Band 4	0.15	0.30	0.30
	LTE Band 7	0.27	**0.77**	**0.77**
	LTE Band 17	0.04	0.23	0.23
DTS	WIFI2.4G	0.11	0.10	0.10
UNII	WIFI5G	0.19	0.13	0.13

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

<Highest Reported simultaneous SAR Summary>

Exposure Position	Frequency Band	Reported 1-g SAR (W/kg)	Classment Class	Highest Reported Simultaneous Transmission 1-g SAR (W/kg)
Back	LTE Band 7	0.77	PCE	**0.90**
	WIFI5G	0.13	UNII	

2.4. EUT configuration

The following peripheral devices and interface cables were connected during the measurement:

● - supplied by the manufacturer

○ - supplied by the lab

○	/	M/N:	/
		Manufacturer:	/

2.5. Modifications

No modifications were implemented to meet testing criteria.

3. TEST ENVIRONMENT

3.1. Address of the test laboratory

The Testing and Technology Center for Industrial Products of Shenzhen Entry-Exit Inspection and Quarantine Bureau
No.149,Gongye 7th Rd. Nanshan District, Shenzhen, China

3.2. Test Facility

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

CNAS-Lab Code: L2872

3.3. Environmental conditions

During the measurement the environmental conditions were within the listed ranges:

Temperature:	18-25 ° C
Humidity:	40-65 %
Atmospheric pressure:	950-1050mbar

3.4. SAR Limits

FCC Limit (1g Tissue)

EXPOSURE LIMITS	SAR (W/kg)	
	(General Population /Uncontrolled Exposure Environment)	(Occupational /Controlled Exposure Environment)
Spatial Average (averaged over the whole body)	0.08	0.4
Spatial Peak (averaged over any 1 g of tissue)	1.60	8.0
Spatial Peak (hands/wrists/feet/ankles averaged over 10 g)	4.0	20.0

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

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

3.5. Equipments Used during the Test

Test Equipment	Manufacturer	Type/Model	Serial Number	Calibration	
				Last Calibration	Calibration Interval
Data Acquisition Electronics DAEx	SPEAG	DAE4	1315	2016/07/26	1
E-field Probe	SPEAG	ES3DV3	3292	2016/09/02	1
E-field Probe	SPEAG	EX3DV4	3836	2016/07/07	1
System Validation Dipole D750V3	SPEAG	D750V3	1156	2016/02/02	3
System Validation Dipole D835V2	SPEAG	D835V2	4d069	2016/07/20	3
System Validation Dipole D1750V2	SPEAG	D1750V2	1062	2015/07/25	3
System Validation Dipole 1900V2	SPEAG	D1900V2	5d194	2015/01/07	3
System Validation Dipole D2450V2	SPEAG	D2450V2	955	2015/01/08	3
System Validation Dipole D2600V2	SPEAG	D2600V2	1120	2016/02/03	3
System Validation Dipole D5GHzV2	SPEAG	D5GHzV2	1185	2014/08/22	3
Network analyzer	Agilent	8753E	US37390562	2017/03/10	1
Wideband Communication Tester	R&S	CMW500	116581	2016/12/14	1
Dielectric Probe Kit	Agilent	85070E	US44020288	2016/12/14	/
Dual Directional Coupler	Agilent	778D	50127	2016/12/14	1
Dual Directional Coupler	Agilent	772D	50348	2016/12/14	1
Attenuator	PE	PE7005-10	E048	2016/12/14	1
Attenuator	PE	PE7005-3	E049	2016/12/14	1
Attenuator	Woken	WK0602-XX	E050	2016/12/14	1
Power meter	Agilent	E4417A	GB41292254	2016/12/14	1
Power Meter	Agilent	E7356A	GB54762536	2016/12/14	1
Power sensor	Agilent	8481H	MY41095360	2016/12/14	1
Power Sensor	Agilent	E9327A	Us40441788	2016/12/14	1
Signal generator	IFR	2032	203002/100	2016/12/14	1
Amplifier	AR	75A250	302205	2016/12/14	1

Note:

1) Per KDB865664D01 requirements for dipole calibration, the test laboratory has adopted three year extended calibration interval. Each measured dipole is expected to evalute with following criteria at least on annual interval.
   a) There is no physical damage on the dipole;
   b) System check with specific dipole is within 10% of calibrated values;
   c) The most recent return-loss results,measued at least annually,deviates by no more than 20% from the previous measurement;
   d) The most recent measurement of the real or imaginary parts of the impedance, measured at least annually is within 5Ω from the provious measurement.
2) Network analyzer probe calibration against air, distilled water and a shorting block performed before measuring liquid parameters.

4. SAR Measurements System configuration

4.1. SAR Measurement Set-up

The DASY4 system for performing compliance tests consists of the following items:

A standard high precision 6-axis robot (Stäubli RX family) with controller and software. An arm extension for accommodating 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 electronic (DAE) which performs the signal amplification, signal multiplexing, AD-conversion, offset measurements, mechanical surface detection, collision detection, etc. The unit is battery powered with standard or rechargeable batteries. The signal is optically transmitted to the EOC.

A unit to operate the optical surface detector which is connected to the EOC.

The Electro-Optical Coupler (EOC) performs the conversion from the optical into a digital electric signal of the DAE. The EOC is connected to the DASY4 measurement server.

The DASY4 measurement server, which performs all real-time data evaluation for field measurements and surface detection, controls robot movements and handles safety operation. A computer operating Windows 2003.

DASY4 software and SEMCAD data evaluation software.

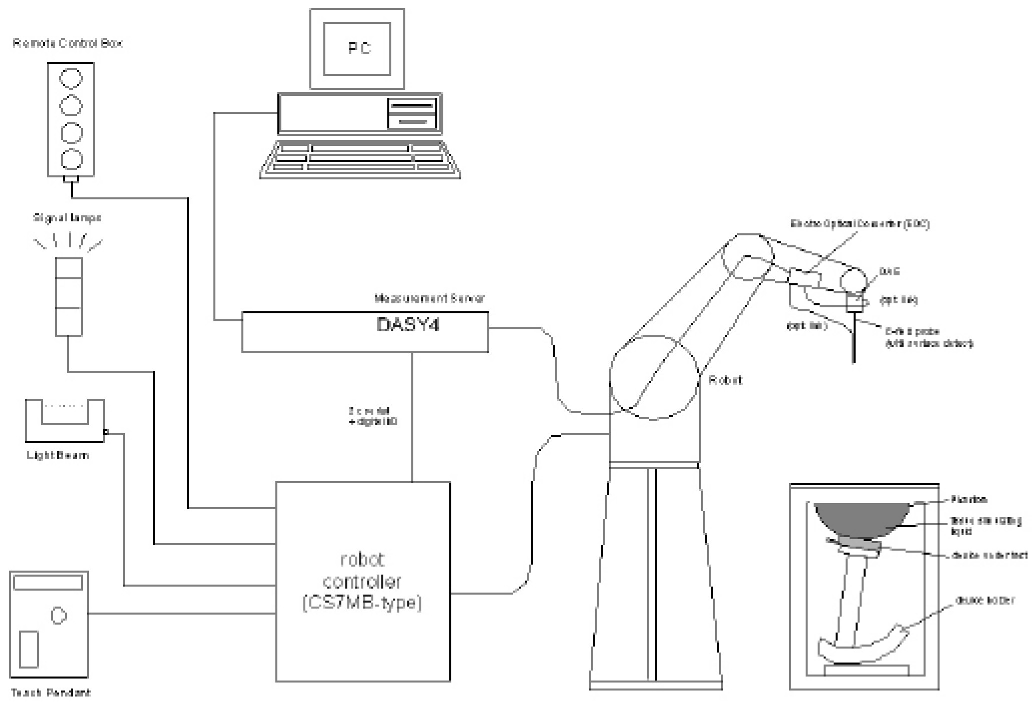
Remote control with teach panel and additional circuitry for robot safety such as warning lamps, etc.

The generic twin phantom enabling the testing of left-hand and right-hand usage.

The device holder for handheld mobile phones.

Tissue simulating liquid mixed according to the given recipes.

System validation dipoles allowing to validate the proper functioning of the system.



4.2. DASY4 E-field Probe System

The SAR measurements were conducted with the dosimetric probe ES3DV3 (manufactured by SPEAG), designed in the classical triangular configuration and optimized for dosimetric evaluation.

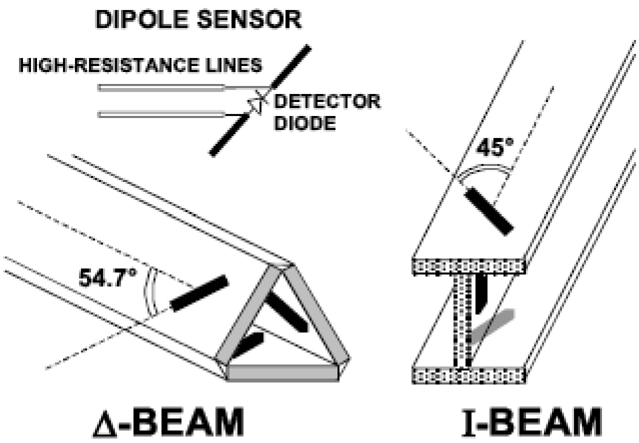
Probe Specification

Construction	Symmetrical design with triangular core Interleaved sensors Built-in shielding against static charges PEEK enclosure material (resistant to organic solvents, e.g., DGBE)
Calibration	ISO/IEC 17025 calibration service available.
Frequency	10 MHz to 4 GHz; Linearity: ± 0.2 dB (30 MHz to 4 GHz)
Directivity	± 0.2 dB in HSL (rotation around probe axis) ± 0.3 dB in tissue material (rotation normal to probe axis)
Dynamic Range	5 µW/g to > 100 mW/g; Linearity: ± 0.2 dB
Dimensions	Overall length: 337 mm (Tip: 20 mm) Tip diameter: 3.9 mm (Body: 12 mm) Distance from probe tip to dipole centers: 2.0 mm
Application	General dosimetry up to 4 GHz Dosimetry in strong gradient fields Compliance tests of mobile phones
Compatibility	DASY3, DASY4, DASY52 SAR and higher, EASY4/MRI

Isotropic E-Field Probe

The isotropic E-Field probe has been fully calibrated and assessed for isotropicity, and boundary effect within a controlled environment. Depending on the frequency for which the probe is calibrated the method utilized for calibration will change.

The E-Field probe utilizes a triangular sensor arrangement as detailed in the diagram below:



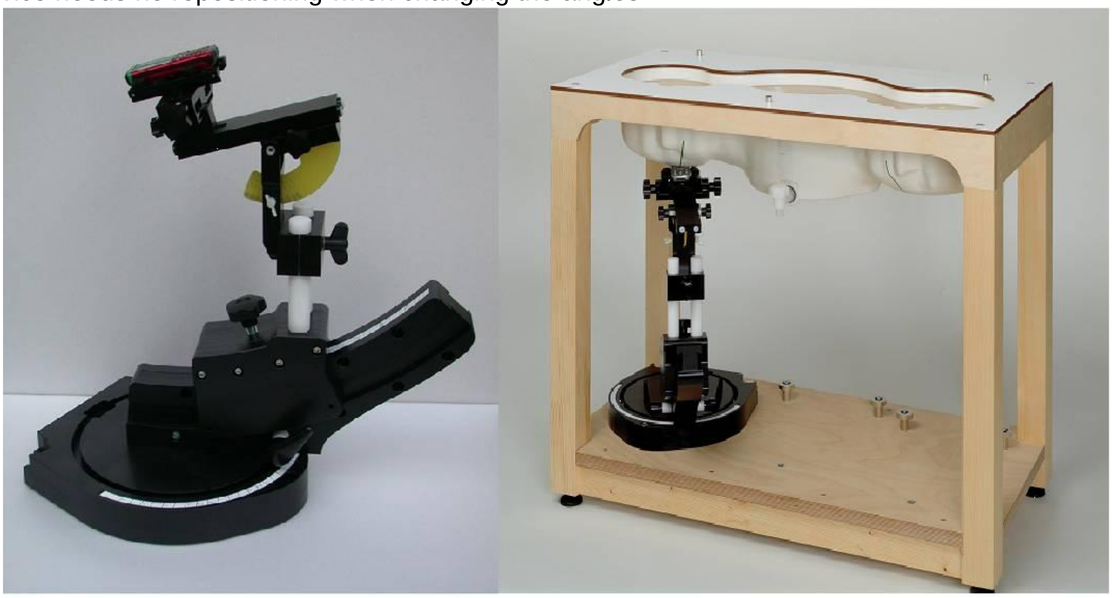
4.3. Phantoms

The phantom used for all tests i.e. for both system checks and device testing, was the twin-headed "SAM Phantom", manufactured by SPEAG. The SAM twin phantom is a fiberglass shell phantom with 2mm shell thickness (except the ear region, where shell thickness increases to 6mm).
System checking was performed using the flat section, whilst Head SAR tests used the left and right head profile sections. Body SAR testing also used the flat section between the head profiles.

SAM Twin Phantom

4.4. Device Holder

The device was placed in the device holder (illustrated below) that is supplied by SPEAG as an integral part of the DASY system.
The DASY device holder is designed to cope with the different positions given in the standard. It has two scales for device rotation (with respect to the body axis) and device inclination (with respect to the line between the ear reference points). The rotation centers for both scales is the ear reference point (ERP). Thus the device needs no repositioning when changing the angles.



Device holder supplied by SPEAG

4.5. Scanning Procedure

The DASY4 installation includes predefined files with recommended procedures for measurements and validation. They are read-only document files and destined as fully defined but unmeasured masks. All test positions (head or body-worn) are tested with the same configuration of test steps differing only in the grid definition for the different test positions.

The “reference” and “drift” measurements are located at the beginning and end of the batch process. They measure the field drift at one single point in the liquid over the complete procedure. The indicated drift is mainly the variation of the DUT’s output power and should vary max. ± 5 %.
The “surface check” measurement tests the optical surface detection system of the DASY4 system by repeatedly detecting the surface with the optical and mechanical surface detector and comparing the results. The output gives the detecting heights of both systems, the difference between the two systems and the standard deviation of the detection repeatability. Air bubbles or refraction in the liquid due to separation of the sugar-water mixture gives poor repeatability (above ± 0.1mm). To prevent wrong results tests are only executed when the liquid is free of air bubbles. The difference between the optical surface detection and the actual surface depends on the probe and is specified with each probe (It does not depend on the surface reflectivity or the probe angle to the surface within ± 30°.)

Area Scan
The Area Scan is used as a fast scan in two dimensions to find the area of high field values before running a detailed measurement around the hot spot.Before starting the area scan a grid spacing of 15 mm x 15 mm is set. During the scan the distance of the probe to the phantom remains unchanged. After finishing area scan, the field maxima within a range of 2 dB will be ascertained.

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

Zoom Scan
Zoom Scans are used to estimate the peak spatial SAR values within a cubic averaging volume containing 1 g and 10 g of simulated tissue. The default Zoom Scan is done by 7x7x7 points within a cube whose base is centered around the maxima found in the preceding area scan.

<table>
<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">$\leq 1.5 \cdot \Delta z_{Zoom}(n-1)$ mm</td></tr>
<tr><td>Minimum zoom scan volume</td><td colspan="2">x, y, z</td><td>≥ 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 IEEE Std 1528-2013 for details.
* When zoom scan is required and the <u>reported</u> SAR from the area scan based 1-g SAR estimation procedures of KDB Publication 447498 is ≤ 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>

Spatial Peak Detection
The procedure for spatial peak SAR evaluation has been implemented and can determine values of masses of 1g and 10g, as well as for user-specific masses.The DASY4 system allows evaluations that combine measured data and robot positions, such as: • maximum search • extrapolation • boundary correction • peak search for averaged SAR During a maximum search, global and local maxima searches are automatically performed in 2-D after each Area Scan measurement with at least 6 measurement points. It is based on the evaluation of the local SAR gradient calculated by the Quadratic Shepard's method. The algorithm will find the global maximum and all local maxima within -2 dB of the global maxima for all SAR distributions.

Extrapolation routines are used to obtain SAR values between the lowest measurement points and the inner phantom surface. The extrapolation distance is determined by the surface detection distance and the probe sensor offset. Several measurements at different distances are necessary for the extrapolation. Extrapolation routines require at least 10 measurement points in 3-D space. They are used in the Zoom Scan to obtain SAR values between the lowest measurement points and the inner phantom surface. The routine uses the modified Quadratic Shepard's method for extrapolation. For a grid using 7x7x7 measurement points with 5mm resolution amounting to 343 measurement points, the uncertainty of the extrapolation routines is less than 1% for 1g and 10g cubes.

A Z-axis scan measures the total SAR value at the x-and y-position of the maximum SAR value found during the cube 7x7x7 scan. The probe is moved away in z-direction from the bottom of the SAM phantom in 5mm steps.

4.6. Data Storage and Evaluation

Data Storage
The DASY4 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 ".DA4". The software evaluates the desired unit and format for output each time the data is visualized or exported. This allows verification of the complete software setup even after the measurement and allows correction of incorrect parameter settings. For example, if a measurement has been performed with a wrong crest factor parameter in the device setup, the parameter can be corrected afterwards and the data can be re-evaluated.

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

Data Evaluation

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	σ
	- 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 DASY4 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:

$$V_i = U_i + U_i^2 \cdot \frac{cf}{dcp_i}$$

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)
	dcpi = diode compression point	(DASY parameter)

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

$$\text{E} - \text{fieldprobes}: \qquad E_i = \sqrt{\frac{V_i}{Norm_i \cdot ConvF}}$$

$$\text{H} - \text{fieldprobes}: \qquad H_i = \sqrt{V_i} \cdot \frac{a_{i0} + a_{i1}f + a_{i2}f^2}{f}$$

With	Vi	= compensated signal of channel i	(i = x, y, z)
	Normi	= sensor sensitivity of channel i [mV/(V/m)2] for E-field Probes	(i = x, y, z)
	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):

$$E_{tot} = \sqrt{E_x^2 + E_y^2 + E_z^2}$$

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

$$SAR = E_{tot}^2 \cdot \frac{\sigma}{\rho \cdot 1'000}$$

with	SAR	= local specific absorption rate in mW/g
	Etot	= total field strength in V/m
	σ	= conductivity in [mho/m] or [Siemens/m]
	ρ	= 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.

4.7. Tissue Dielectric Parameters for Head and Body Phantoms

The liquid is consisted of water,salt,Glycol,Sugar,Preventol and Cellulose.The liquid has previously been proven to be suited for worst-case.It's satisfying the latest tissue dielectric parameters requirements proposed by the KDB865664.

The composition of the tissue simulating liquid

Ingredient	835MHz		1900MHz		1750 MHz		2450MHz		2600MHz	
(% Weight)	Head	Body	Head	Body	Head	Body	Head	Body	Head	Body
Water	41.45	52.5	55.242	69.91	55.782	69.82	62.7	73.2	62.3	72.6
Salt	1.45	1.40	0.306	0.13	0.401	0.12	0.50	0.10	0.20	0.10
Sugar	56	45.0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Preventol	0.10	0.10	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
HEC	1.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
DGBE	0.00	0.00	44.452	29.96	43.817	30.06	36.8	26.7	37.5	27.3

Target Frequency (MHz)	Head		Body	
	ε_r	$\sigma(S/m)$	ε_r	$\sigma(S/m)$
150	52.3	0.76	61.9	0.80
300	45.3	0.87	58.2	0.92
450	43.5	0.87	56.7	0.94
835	41.5	0.90	55.2	0.97
900	41.5	0.97	55.0	1.05
915	41.5	0.98	55.0	1.06
1450	40.5	1.20	54.0	1.30
1610	40.3	1.29	53.8	1.40
1800-2000	40.0	1.40	53.3	1.52
2450	39.2	1.80	52.7	1.95
2600	39.0	1.96	52.5	2.16
3000	38.5	2.40	52.0	2.73
5800	35.3	5.27	48.2	6.00

4.8. Tissue equivalent liquid properties

Dielectric performance of Head and Body tissue simulating liquid

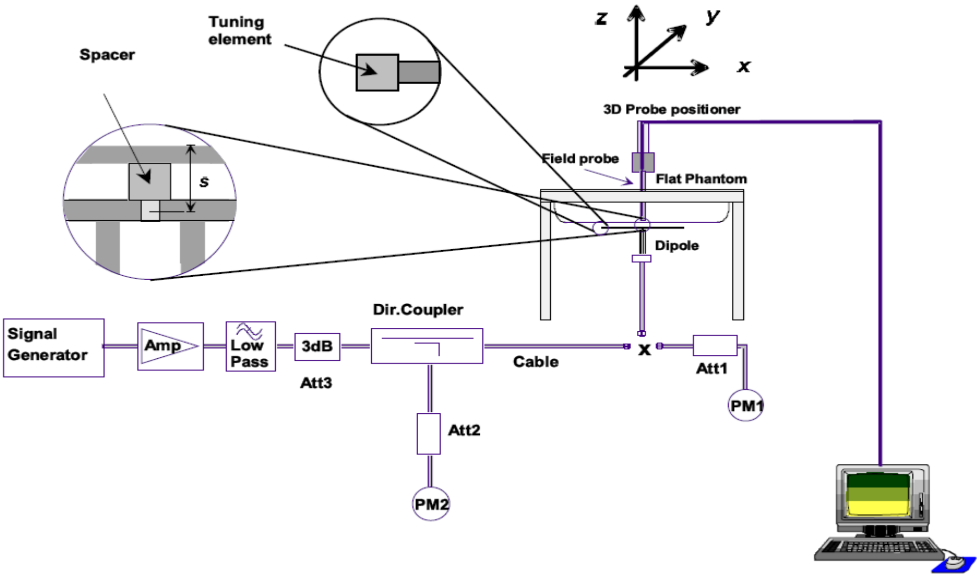
Tissue Type	Measured Frequency (MHz)	Target Tissue		Measured Tissue				Liquid Temp.	Test Data
		ε_r	σ	ε_r	Dev.	σ	Dev.		
750H	750	0.89	41.90	0.89	0.00%	41.01	-2.12%	22.3	07/03/2017
835H	835	0.97	41.5	0.95	-2.06%	42.80	3.13%	22.3	06/06/2017
1750H	1750	1.37	40.10	1.41	2.92%	40.73	1.57%	22.1	06/09/2017
1900H	1900	1.40	40.0	1.44	2.86%	41.30	3.25%	22.2	06/12/2017
2450H	2450	1.80	39.2	1.83	1.67%	38.19	-2.58%	22.3	06/16/2017
2600H	2600	1.96	39.0	1.93	-1.53%	38.83	-0.44%	22.5	06/21/2017
5200H	5200	4.66	36.0	4.6	-1.3%	36.7	1.9%	22.3	06/28/2017
750B	750	0.96	55.50	0.97	1.04%	57.87	4.27%	22.3	07/03/2017
835B	835	1.05	55.0	1.02	-2.86%	57.01	3.65%	22.3	06/06/2017
1750B	1750	1.44	53.52	1.49	3.47%	53.4	-0.22%	22.1	06/09/2017
1900B	1900	1.52	53.3	1.58	3.95%	55.20	3.56%	22.2	06/12/2017
2450B	2450	1.95	52.7	1.90	-2.56%	50.59	-4.00%	22.3	06/16/2017
2600B	2600	2.16	52.5	2.14	-0.93%	51.12	-2.63%	22.5	06/21/2017
5200B	5200	5.30	49.0	5.11	-3.58%	50.47	3.00%	22.3	06/28/2017

4.9. System Check

The purpose of the system check is to verify that the system operates within its specifications at the decice test frequency.The system check is simple check of repeatability to make sure that the system works correctly at the time of the compliance test;

System check results have to be equal or near the values determined during dipole calibration with the relevant liquids and test system (±10 %).

System check is performed regularly on all frequency bands where tests are performed with the DASY4 system.



The output power on dipole port must be calibrated to 24 dBm (250mW) before dipole is connected.

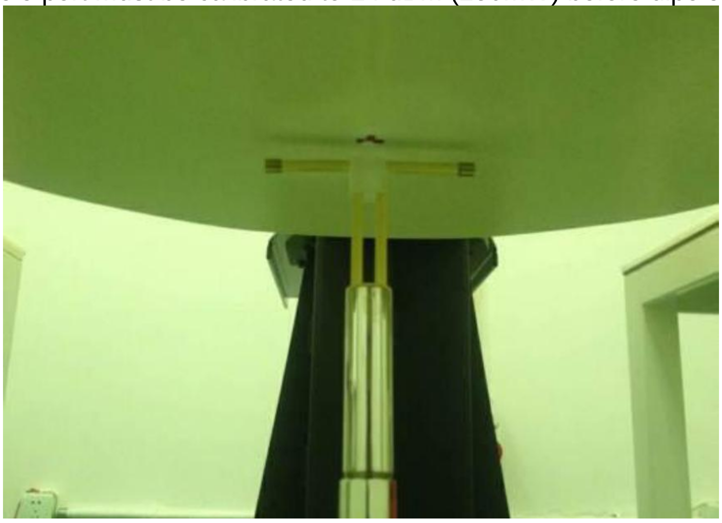


Photo of Dipole Setup

System Check in Head Tissue Simulating Liquid

Frequency	Test Date	Dielectric Parameters ε_r	Dielectric Parameters σ(s/m)	Temp (℃)	250mW Measured SAR_{1g} (W/Kg)	1W Normalized SAR_{1g} (W/Kg)	1W Target SAR_{1g} (W/Kg)	Limit (±10% Deviation)
750 MHz	07/03/2017	0.89	41.01	22.3	2.08	8.32	7.99	4.13%
835 MHz	06/06/2017	0.95	42.80	22.3	2.26	9.04	9.44	-4.24%
1750MHz	06/09/2017	1.41	40.73	22.1	9.62	38.48	37.10	3.72%
1900 MHz	06/12/2017	1.44	41.30	22.2	10.35	41.40	40.60	1.97%
2450 MHz	06/16/2017	1.83	38.19	22.3	13.30	53.20	52.40	1.53%
2600MHz	06/21/2017	1.93	38.83	22.5	14.2	56.80	53.9	5.38%
Frequency	**Test Date**	**Dielectric Parameters ε_r**	**Dielectric Parameters σ(s/m)**	**Temp (℃)**	**100mW Measured SAR_{1g} (W/Kg)**	**1W Normalized SAR_{1g} (W/Kg)**	**1W Target SAR_{1g} (W/Kg)**	**Limit (±10% Deviation)**
5200MHz	06/28/2017	4.66	36.0	22.3	8.18	81.8	78.2	4.60%

System Check in Body Tissue Simulating Liquid

Frequency	Test Date	Dielectric Parameters ε_r	Dielectric Parameters σ(s/m)	Temp (℃)	250mW Measured SAR_{1g} (W/Kg)	1W Normalized SAR_{1g} (W/Kg)	1W Target SAR_{1g} (W/Kg)	Limit (±10% Deviation)
750MHz	07/03/2017	0.97	57.87	22.3	2.26	9.04	8.70	3.91%
835MHz	06/06/2017	1.02	57.01	22.3	2.53	10.12	9.69	4.44%
1750MHz	06/09/2017	1.49	53.40	22.1	9.30	37.2	37.3	-0.27%
1900MHz	06/12/2017	1.58	55.20	22.2	9.95	39.80	40.10	-0.75%
2450MHz	06/16/2017	1.90	50.59	22.3	13.50	54.00	53.70	0.56%
2600MHz	06/21/2017	2.14	51.12	22.5	13.80	55.20	52.0	6.15%
Frequency	**Test Date**	**Dielectric Parameters ε_r**	**Dielectric Parameters σ(s/m)**	**Temp (℃)**	**100mW Measured SAR_{1g} (W/Kg)**	**1W Normalized SAR_{1g} (W/Kg)**	**1W Target SAR_{1g} (W/Kg)**	**Limit (±10% Deviation)**
5200MHz	06/28/2017	5.30	49.0	22.3	7.48	74.8	75.7	-1.19%

Note:
1. The graph results see system check.
2. Target Values used derive from the calibration certificate

Justification for Extended SAR Dipole Calibrations

Referring to KDB 865664D01V01r04, if dipoles are verified in return loss (<-20dB, within 20% of prior calibration), and in impedance (within 5 ohm of prior calibration), the annual calibration is not necessary and the calibration interval can be extended. While calibration intervals not exceed 3 years.

D750V2, Serial No.: 1156 Extend Dipole Calibrations

750 MHz Head						
Date of Measurement	Return-Loss (dB)	Delta (%)	Real Impedance (ohm)	Delta (ohm)	Imaginary Impedance (ohm)	Delta (ohm)
2016-02-02	-28.9		53.6		-0.9	
2017-01-30	-29.2	-1.0	54.8	1.2	-0.7	0.2

D750V2, Serial No.: 1156 Extend Dipole Calibrations

750 MHz Body						
Date of Measurement	Return-Loss (dB)	Delta (%)	Real Impedance (ohm)	Delta (ohm)	Imaginary Impedance (ohm)	Delta (ohm)
2016-02-02	-33.2		50.2		-2.2	
2017-01-30	-34.3	-3.3	51.5	1.3	-2.1	0.1

D1750V2, Serial No.: 1062 Extend Dipole Calibrations

1750 MHz Head						
Date of Measurement	Return-Loss (dB)	Delta (%)	Real Impedance (ohm)	Delta (ohm)	Imaginary Impedance (ohm)	Delta (ohm)
2015-07-25	-34.20		51.10		1.62	
2016-07-23	-33.70	0.50	52.42	1.32	2.28	-0.66

D1750V2, Serial No.: 1062 Extend Dipole Calibrations

1750 MHz Body						
Date of Measurement	Return-Loss (dB)	Delta (%)	Real Impedance (ohm)	Delta (ohm)	Imaginary Impedance (ohm)	Delta (ohm)
2015-07-25	-27.20		49.20		4.25	
2016-07-23	-25.40	1.80	50.58	1.38	3.80	-0.45

D1900V2, Serial No.: 5d194 Extend Dipole Calibrations

1900 MHz Head						
Date of Measurement	Return-Loss (dB)	Delta (%)	Real Impedance (ohm)	Delta (ohm)	Imaginary Impedance (ohm)	Delta (ohm)
2015-01-07	-24.5		53.700		4.900	
2016-01-02	-24.5	0.00%	53.779	0.079	4.041	-0.859
2017-01-01	-24.7	0.82%	53.81	0.11	4.136	-0.764

D1900V2, Serial No.: 5d194 Extend Dipole Calibrations

1900 MHz Body						
Date of Measurement	Return-Loss (dB)	Delta (%)	Real Impedance (ohm)	Delta (ohm)	Imaginary Impedance (ohm)	Delta (ohm)
2015-01-07	-25.6		48.9		5.1	
2016-01-02	-25.9	1.17%	49.1	0.2	4.93	-0.17
2017-01-01	-26.0	1.56%	49.12	0.22	4.86	-0.24

D2450V2, Serial No.: 955 Extend Dipole Calibrations

2450 MHz Head						
Date of Measurement	Return-Loss (dB)	Delta (%)	Real Impedance (ohm)	Delta (ohm)	Imaginary Impedance (ohm)	Delta (ohm)
2015-01-08	-24.9		54.800		3.500	
2016-01-02	-25.559	-2.65%	54.985	0.185	2.411	-1.089
2017-01-01	-25.61	2.85%	54.99	0.19	2.73	-0.77

D2450V2, Serial No.: 955 Extend Dipole Calibrations

2450 MHz Body						
Date of Measurement	Return-Loss (dB)	Delta (%)	Real Impedance (ohm)	Delta (ohm)	Imaginary Impedance (ohm)	Delta (ohm)
2015-01-08	-26.0		51.2		4.9	
2016-01-02	-26.22	0.85%	52.35	1.15	4.66	-0.24
2017-01-01	-26.37	1.42%	52.41	1.21	4.78	-0.12

D2600V2, Serial No.: 1120 Extend Dipole Calibrations

2600 MHz Head						
Date of Measurement	Return-Loss (dB)	Delta (%)	Real Impedance (ohm)	Delta (ohm)	Imaginary Impedance (ohm)	Delta (ohm)
2016-02-03	-25.0		50.7		-5.6	
2017-02-01	-23.9	4.40	51.5	0.8	-5.2	0.4

Note:The D5GHzV2, Serial No.: 1185 Extend Dipole Calibrations is in the next page of D5GHzV2 Dipole Calibration Certificate

D2600V2, Serial No.: 1120 Extend Dipole Calibrations

2600 MHz Body						
Date of Measurement	Return-Loss (dB)	Delta (%)	Real Impedance (ohm)	Delta (ohm)	Imaginary Impedance (ohm)	Delta (ohm)
2016-02-03	-25.0		47.0		-4.5	
2017-02-01	-23.6	5.60	48.3	1.3	-4.0	0.5

4.10. SAR measurement procedure

The procedure for assessing the average SAR value consists of the following steps:

- Power Reference Measurement

  The Power Reference Measurement and Power Drift Measurement jobs are useful jobs for monitoring the power drift of the device under test in the batch process. Both jobs measure the field at a specified reference position, at a selectable distance from the phantom surface. The reference position can be either the selected section's grid reference point or a user point in this section. The reference job projects the selected point onto the phantom surface, orients the probe perpendicularly to the surface, and approaches the surface using the selected detection method.

- Area Scan

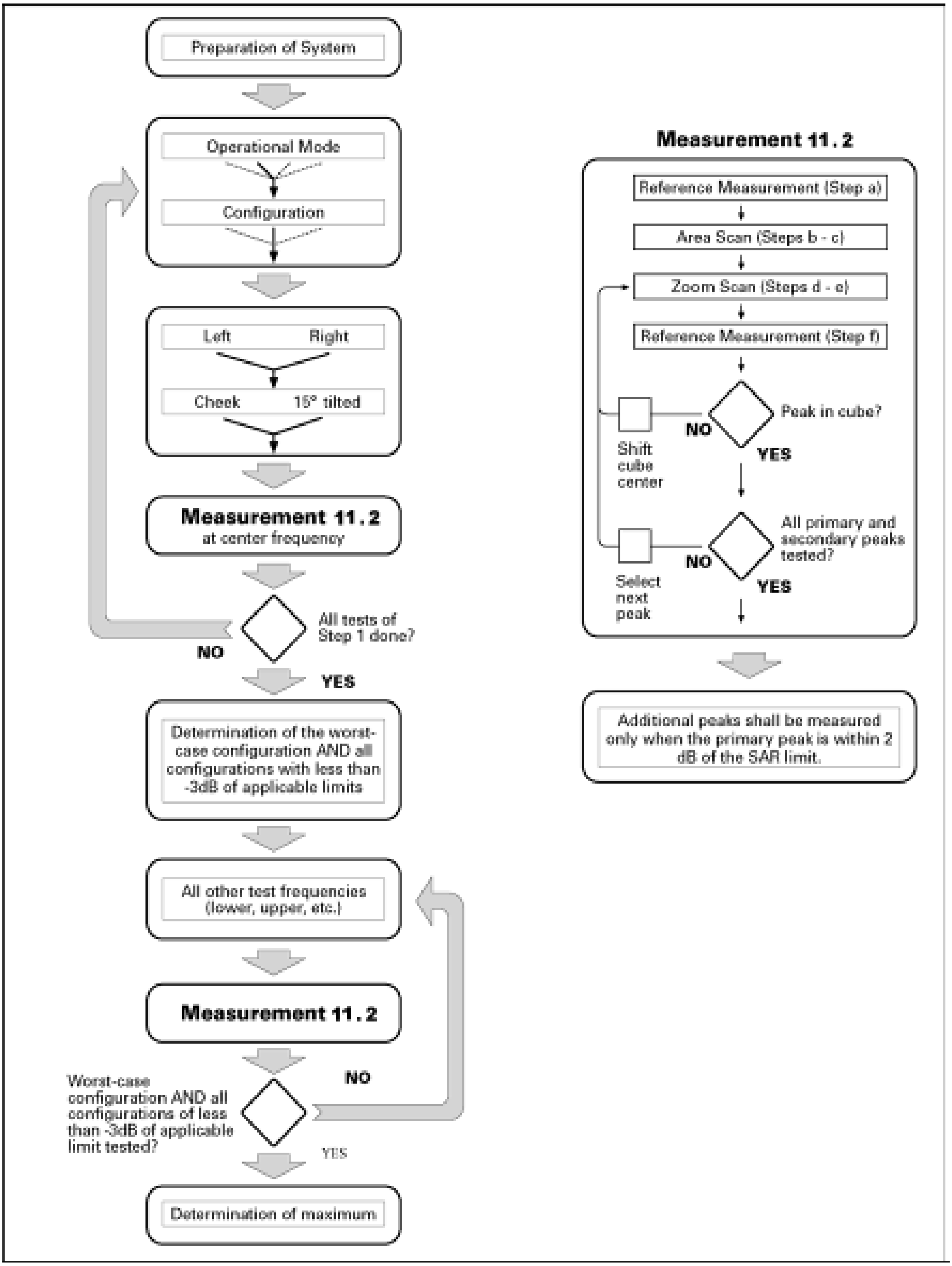
  The Area Scan is used as a fast scan in two dimensions to find the area of high field values, before doing a finer measurement around the hot spot. The sophisticated interpolation routines implemented in DASY4 software can find the maximum locations even in relatively coarse grids. The scanning area is defined by an editable grid. This grid is anchored at the grid reference point of the selected section in the phantom. When the Area Scan's property sheet is brought-up, grid settings can be edited by a user.

- Zoom Scan

  Zoom Scans are used to assess the peak spatial SAR values within a cubic averaging volume containing 1 g and 10 g of simulated tissue. The default Zoom Scan measures 7 x 7 x 7 points (5mmE545mmE545mm) within a cube whose base faces are centered on the maxima found in a preceding area scan job within the same procedure.

- Power Drift Measurement

  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 Power Drift Measurement gives the field difference in dB from the reading conducted within the last Power Reference Measurement.



Block diagram of the tests to be performed

4.11. Operational Conditions during Test

4.11.1. General Description of Test Procedures

A communication link is set up with a System Simulator (SS) by air link, and a call is established. The EUT is commanded to operate at maximum transmitting power.

Connection to the EUT is established via air interface with CMU 200, and the EUT is set to maximum output power by CMU 200. The EUT battery must be fully charged and checked periodically during the test to ascertain uniform power output. The antenna connected to the output of the base station simulator shall be placed at least 50 cm away from the EUT. The signal transmitted by the simulator to the antenna feeding point shall be lower than the output power level of the EUT by at least 30 dB.

4.11.2. Test Positions

4.11.2.1 Against Phantom Head

Measurements were made in "cheek" and "tilt" positions on both the left hand and right hand sides of the phantom.
The positions used in the measurements were according to IEEE 1528 - 2013 "IEEE Recommended Practice for Determining the Peak Spatial-Average Specific Absorption Rate(SAR) in the Human Head from Wireless Communications Devices: Measurement Techniques".

4.11.2.2. Body Worn Configuration

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.

4.12. Test Configuration

4.12.1. GSM Test Configuration

SAR tests for GSM 850 and GSM 1900, a communication link is set up with a System Simulator (SS) by air link. Using E5515C the power level is set to "5" for GSM 850, set to "0" for GSM 1900. 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 timeslots is 5. Since 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 timeslots is 5.
When SAR tests for EGPRS mode is necessary, GMSK modulation should be used to minimize SAR measurement error due to higher peak-to-average power (PAR) ratios inherent in 8-PSK.
According to specification 3GPP TS 51.010, the maximum power of the GSM can do the power reduction for the multi-slot. The allowed power reduction in the multi-slot configuration is as following: Output power of reductions:

The allowed power reduction in the multi-slot configuration

Number of timeslots in uplink assignment	Permissible nominal reduction of maximum output power,(dB)
1	0
2	0 to 3.0
3	1.8 to 4.8
4	3.0 to 6.0

4.12.2. UMTS Test Configuration

4.12.2.1. Output power Verification

Maximum output power is verified on the High, Middle and Low channel according to the 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 up bits for WCDMA/HSDPA or applying the required inner loop power control procedures to the maximum output power while HSUPA is active. Results for all applicable physical channel configuration (DPCCH, $DPDCH_n$ and spreading codes, HSDPA, HSPA) should be tabulated in the SAR report. All configuration that are not supported by the DUT or can not be measured due to technical or equipment limitations should be clearly identified.

4.12.2.2. Head SAR Measurements

SAR for head exposure configurations in voice mode is measured using a 12.2kbps RMC with TPC bits configured to all up bits. SAR in AMR configurations is not required when the maximum average output of each RF channel for 12.2kbps AMR is less than 1/4 dB higher than that measured in 12.2 kbps RMC. Otherwise, SAR is measured on the maximum output channel in 12.2kbps AMR with a 3.4 kbps SRB(Signaling radio bearer) using the exposure configuration that results in the highest SAR in 12.2kbps RMC for that RF channel.

4.12.2.3. Body SAR Measurements

SAR for body exposure configurations in voice and data modes is measured using 12.2kbps RMC with TPC bits configured to all up bits. SAR for other spreading codes and multiple $DPDCH_n$, when supported by the DUT, are not required when the maximum average output of each RF channel, for each spreading code and $DPDCH_n$ configuration, are less than 1/4 dB higher than those measured in 12.2kbps RMC. Otherwise, SAR is measured on the maximum output channel with an applicable RMC configuration for the corresponding spreading code or $DPDCH_n$ using the exposure configuration that results in the highest SAR with 12.2 kbps RMC. When more than 2 $DPDCH_n$ are supported by the DUT, it may be necessary to configure additional $DPDCH_n$ for a DUT using FTM (Factory Test Mode) or other chipset based test approaches with parameters similar to those used in 384 kbps and 768 kbps RMC.

4.12.2.4 Handsets with Release 5 HSDPA

The 3G SAR test reduction procedure is applied to HSDPA body-worn accessory configurations with 12.2 kbps RMC as the primary mode. Otherwise, SAR is measured for HSDPA using the HSDPA body SAR procedures in the “Release 5 HSDPA Data Devices” section of this document, for the highest reported SAR body-worn accessory exposure configuration in 12.2 kbps RMC. Handsets with both HSDPA and HSUPA are tested according to Release 6 HSPA test procedures.

HSDPA should be configured according to the UE category of a test device.The number of HSDSCH/ 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 with 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, ΔNACK, ΔCQI) should be set according to values indicated in the Table below. The CQI value is determined by the UE category, transport block size, number of HS-PDSCHs and modulation used in the H-set.

Table 2: Subtests for UMTS Release 5 HSDPA

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

Note1: $\triangle_{ACK}$, $\triangle_{NACK}$ and $\triangle_{CQI}$= 8⇔ $A_{hs} = \beta_{hs}/\beta_c$=30/15⇔ β_{hs}=30/15*β_c

Note2: CM=1 for β_c/β_d =12/15, β_{hs}/β_c=24/15.

Note3: For subtest 2 the $\beta_c\beta_d$ ratio of 12/15 for the TFC during the measurement period(TF1,TF0) is achieved by setting the signaled gain factors for the reference TFC (TFC1,TF1) to β_c=11/15 and β_d=15/15.

4.12.2.5 HSUPA Test Configuration

The 3G SAR test reduction procedure is applied to HSPA (HSUPA/HSDPA with RMC) body-worn accessory configurations with 12.2 kbps RMC as the primary mode. Otherwise, SAR is measured for HSPA using the HSPA body SAR procedures in the “Release 6 HSPA Data Devices” section of this document, for the highest reported body-worn accessory exposure SAR configuration in 12.2 kbps RMC. When VOIP is applicable for next to the ear head exposure in HSPA, the 3G SAR test reduction procedure is applied to HSPA with 12.2 kbps RMC as the primary mode; otherwise, the same HSPA configuration used for body-worn accessory measurements is tested for next to the ear head exposure.

Due to inner loop power control requirements in HSPA, a communication test set is required for output power and SAR tests. The 12.2 kbps RMC, FRC H-set 1 and E-DCH configurations for HSPA are configured according to the β values indicated in Table 2 and other applicable procedures described in the ‘WCDMA Handset’ and ‘Release 5 HSDPA Data Devices’ sections of this document

Table 3: Sub-Test 5 Setup for Release 6 HSUPA

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

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

Table 4: HSUPA UE category

UE E-DCH Category	Maximum E-DCH Codes Transmitted	Number of HARQ Processes	E-DCH TTI (ms)	Minimum Spreading Factor	Maximum E-DCH Transport Block Bits	Max Rate (Mbps)
1	1	4	10	4	7110	0.7296
2	2	8	2	4	2798	1.4592
	2	4	10	4	14484	
3	2	4	10	4	14484	1.4592
4	2	8	2	2	5772	2.9185
	2	4	10	2	20000	2.00
5	2	4	10	2	20000	2.00
6 (No DPDCH)	4	8	2	2 SF2 & 2 SF4	11484	5.76
	4	4	10		20000	2.00
7 (No DPDCH)	4	8	2	2 SF2 & 2 SF4	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 supports QPSK only. UE Category 7 supports QPSK and 16QAM. (TS25.306-7.3.0)

4.12.2.6 HSPA, HSPA+ and DC-HSDPA Test Configuration

measurement is required for HSPA, HSPA+ or DC-HSDPA, a KDB inquiry is required to confirm that the wireless mode configurations in the test setup have remained stable throughout the SAR measurements.35 Without prior KDB confirmation to determine the SAR results are acceptable, a PBA is required for TCB approval.

SAR test exclusion for HSPA, HSPA+ and DC-HSDPA is determined according to the following:
1) The HSPA procedures are applied to configure 3GPP Rel. 6 HSPA devices in the required sub-test mode(s) to determine SAR test exclusion.
2) SAR is required for Rel. 7 HSPA+ when SAR is required for Rel. 6 HSPA; otherwise, the 3G SAR test reduction procedure is applied to (uplink) HSPA+ with 12.2 kbps RMC as the primary mode.36 Power is measured for HSPA+ that supports uplink 16 QAM according to configurations in Table C.11.1.4 of 3GPP TS 34.121-1 to determine SAR test reduction.
3) 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 secondary serving HS-DSCH Cell are required to perform the power measurement and for the results to be acceptable.
4) Regardless of whether a PBA is required, the following information must be verified and included in the SAR report for devices supporting HSPA, HSPA+ or DC-HSDPA: a) The output power measurement results and applicable release version(s) of 3GPP TS 34.121.

i) Power measurement difficulties due to test equipment setup or availability must be resolved between the grantee and its test lab.

b) The power measurement results are in agreement with the individual device implementation and specifications. When Enhanced MPR (E-MPR) applies, the normal MPR targets may be modified according to the Cubic Metric (CM) measured by the device, which must be taken into consideration.
c) The UE category, operating parameters, such as the β and Δ values used to configure the device for testing, power setback procedures described in 3GGPP TS 34.121 for the power measurements, and HSPA/HSPA+ channel conditions (active and stable) for the entire duration of the measurement according to the required E-TFCI and AG index values.

5) When SAR measurement is required, the test configurations, procedures and power measurement results must be clearly described to confirm that the required test parameters are used, including E-TFCI and AG index stability and output power conditions.

Table 5: HS-DSCH UE category

Table 5.1a: FDD HS-DSCH physical layer categories

HS-DSCH category	Maximum number of HS-DSCH codes received	Minimum inter-TTI interval	Maximum number of bits of an HS-DSCH transport block received within an HS-DSCH TTI NOTE 1	Total number of soft channel bits	Supported modulations without MIMO operation or dual cell operation	Supported modulations with MIMO operation and without dual cell operation	Supported modulations with dual cell operation
Category 1	5	3	7298	19200	QPSK, 16QAM	Not applicable (MIMO not supported)	Not applicable (dual cell operation not supported)
Category 2	5	3	7298	28800			
Category 3	5	2	7298	28800			
Category 4	5	2	7298	38400			
Category 5	5	1	7298	57600			
Category 6	5	1	7298	67200			
Category 7	10	1	14411	115200			
Category 8	10	1	14411	134400			
Category 9	15	1	20251	172800			
Category 10	15	1	27952	172800			
Category 11	5	2	3630	14400	QPSK		
Category 12	5	1	3630	28800			
Category 13	15	1	35280	259200	QPSK, 16QAM, 64QAM		
Category 14	15	1	42192	259200			
Category 15	15	1	23370	345600	QPSK, 16QAM		
Category 16	15	1	27952	345600			
Category 17 NOTE 2	15	1	35280	259200	QPSK, 16QAM, 64QAM	–	
			23370	345600	–	QPSK, 16QAM	
Category 18 NOTE 3	15	1	42192	259200	QPSK, 16QAM, 64QAM	–	
			27952	345600	–	QPSK, 16QAM	
Category 19	15	1	35280	518400	QPSK, 16QAM, 64QAM		
Category 20	15	1	42192	518400			
Category 21	15	1	23370	345600	-	-	QPSK, 16QAM
Category 22	15	1	27952	345600			
Category 23	15	1	35280	518400			QPSK, 16QAM, 64QAM
Category 24	15	1	42192	518400			

4.12.3 WIFI Test Configuration

For WiFi SAR testing, WiFi engineering testing software installed on the DUT can provide continuous transmitting RF signal. This RF signal utilized in SAR measurement has almost 100% duty cycle and its crest factor is 1.
The SAR measurement and test reduction procedures are structured according to either the DSSS or OFDM transmission mode configurations used in each standalone frequency band and aggregated band. For devices that operate in exposure configurations that require multiple test positions, additional SAR test reduction may be applied. The maximum output power specified for production units, including tune-up tolerance, are used to determine initial SAR test requirements for the 802.11 transmission modes in a frequency band. SAR is measured using the highest measured maximum output power channel for the initial test configuration (section 5.1). SAR measurement and test reduction for the remaining 802.11 modes and test channels are determined according to measured or specified maximum output power and reported SAR of the initial measurements. The general test reduction and SAR measurement approaches are summarized in the following:
1. The maximum output power specified for production units are determined for all applicable 802.11 transmission modes in each standalone and aggregated frequency band. Maximum output power is measured for the highest maximum output power configuration(s) in each frequency band according to the default power measurement procedures.
2. For OFDM transmission configurations in the 2.4 GHz and 5 GHz bands, an “initial test configuration” (section 5.3.2) is first determined for each standalone and aggregated frequency band according to the maximum output power and tune-up tolerance specified for production units.
a. When the same maximum power is specified for multiple transmission modes in a frequency band, the largest channel bandwidth, lowest order modulation, lowest data rate and lowest order 802.11a/g/n/ac mode is used for SAR measurement, on the highest measured output power channel in the initial test configuration, for each frequency band (section 5.3.2)
b. SAR is measured for OFDM configurations using the initial test configuration procedures (section 5.3.3). Additional frequency band specific SAR test reduction may be considered for individual frequency bands (sections 5.2 and 5.3).
c. Depending on the reported SAR of the highest maximum output power channel tested in the initial test configuration, SAR test reduction may apply to subsequent highest output channels in the initial test configuration to reduce the number of SAR measurements.
3. The Initial test configuration does not apply to DSSS. The 2.4 GHz band SAR test requirements (section 3.1) and 802.11b DSSS procedures (section 5.2.1) are used to establish the transmission configurations required for SAR measurement.
4. An “initial test position” (section 5.1) is applied to further reduce the number of SAR tests for devices operating in next to the ear, UMPC mini-tablet or hotspot mode exposure configurations that require multiple test positions .
a. SAR is measured for 802.11b according to the 2.4 GHz DSSS procedure (section 5.2.1) using the exposure condition established by the initial test position.
b. SAR is measured for 2.4 GHz and 5 GHz OFDM configurations using the initial test configuration. 802.11b/g/n operating modes are tested independently according to the service requirements in each frequency band. 802.11b/g/n modes are tested on the maximum average output channel.
5. The Initial test position does not apply to devices that require a fixed exposure test position. SAR is measured in a fixed exposure test position for these devices in 802.11b according to the 2.4 GHz DSSS procedure (section 5.2.1) or in 2.4 GHz and 5 GHz OFDM configurations using the initial test configuration procedures (section 5.3.3).
6. The “subsequent test configuration” (section 5.3.4) procedures are applied to determine if additional SAR measurements are required for the remaining OFDM transmission modes that have not been tested in the initial test configuration. SAR test exclusion is determined according to reported SAR in the initial test configuration and maximum output power specified or measured for these other OFDM configurations.

2.4 GHz Band (§15.247)
The maximum output power permitted for devices authorized under §15.247 is 1 W conducted and 36 dBm EIRP.6 Within the frequency range of 2400 – 2483.5 MHz, currently a total of 13 channels may be used in the U.S. However, non-overlapping frequency channels are necessary to minimize interference degradation; therefore, channels 1, 6 and 11 are used most often. Channels 12 and 13, in general, require reduced output power to satisfy bandedge radiated field strength requirements at 2483.5 MHz. Provided higher maximum output power is not specified for the other channels, channels 1, 6 and 11 are used to configure 22 MHz DSSS and 20 MHz OFDM channels for SAR measurements; otherwise, the closest adjacent channel with the highest maximum output power specified for production units should be tested instead of channels 1, 6 or 11.7 When 40 MHz channels are supported, and provided higher maximum output power is not specified for other applicable 40 MHz channels, channel 6 is used to measure SAR; otherwise, the channel with highest specified maximum output power should be tested instead. In addition, SAR test reduction with respect to

reported SAR and transmission band width according to section 4.3.3 of KDB Publication 447498 may also be applied.

U-NII-1 and U-NII-2A Bands (§15.407)
The maximum output power permitted for devices authorized under §15.407 U-NII-1 band (5.15 – 5.25 GHz), is 250 - 1000 mW conducted and 21 – 36 dBm EIRP, depending on transmitter configurations and antenna operating requirements.8 For U-NII-2A band (5.25 – 5.35 GHz), the maximum output power is 250 mW conducted and 30 dBm EIRP. When applicable, a lower maximum output power may be required to satisfy emission bandwidth restrictions for these bands. When both bands apply to a device, SAR test reduction may be considered for each exposure configuration according to procedures in section 5.3.1.

U-NII-2C, U-NII-3 Bands (§15.407) and 5.8 GHz Band (§15.247)
The maximum output power permitted for devices authorized under §15.407 U-NII-2C band (5.470 – 5.725) is 250 mW conducted and 30 dBm EIRP. For U-NII-3 band (5.725 – 5.850 GHz) the maximum output power permitted is 1 W conducted and 36 dBm EIRP.9 When applicable, a lower maximum output power may be required due to emission bandwidth restrictions for these bands. In addition, when Terminal Doppler Weather Radar (TDWR) restriction applies, the channels at 5.60 – 5.65 GHz in U-NII-2C band must be disabled with acceptable mechanisms and documented in the equipment certification to avoid SAR requirements.10 TDWR restriction does not apply under the new rules; all channels that operate at 5.60 – 5.65 GHz must be included to apply the SAR test reduction and measurement procedures.
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 section 5.2.2.
1. SAR TEST PROCEDURES

SAR test reduction is determined according to 802.11 transmission mode configurations and certain exposure conditions with multiple test positions. In the 2.4 GHz band, separate SAR procedures are applied to DSSS and OFDM configurations to simplify DSSS test requirements. For OFDM, in both 2.4 and 5 GHz bands, an initial test configuration must be determined for each standalone and aggregated frequency band, according to the transmission mode configuration with the highest maximum output power specified for production units to perform SAR measurements. If the same highest maximum output power applies to different combinations of channel bandwidths, modulations and data rates, additional procedures (see section 5.3.2) are applied to determine which test configurations require SAR measurement. When applicable, an initial test position may be applied to reduce the number of SAR measurements required for next to the ear, UMPC mini-tablet or hotspot mode configurations with multiple test positions. For 2.4 GHz 802.11b DSSS, either the initial test position procedure for multiple exposure test positions or the DSSS procedure for fixed exposure position is applied; these are mutually exclusive. For 2.4 GHz and 5 GHz OFDM configurations, the initial test configuration is applied to measure SAR using either the initial test position procedure for multiple exposure test position configurations or the initial test configuration procedures for fixed exposure test conditions. Based on the reported SAR of the measured configurations and maximum output power of the transmission mode configurations that are not included in the initial test configuration, the subsequent test configuration and initial test position procedures are applied to determine if SAR measurements are required for the remaining OFDM transmission configurations. In general, the number of test channels that require SAR measurement is minimized based on maximum output power measured for the test sample(s)

1. Multiple Exposure Test Position SAR Test Reduction

The following procedures are applied to select an initial test position for handsets operating next to the ear, hotspot mode or UMPC mini-tablet configurations to minimize the number of SAR measurements normally required for the multiple test positions.14 SAR is measured for the highest measured maximum output power channel using the initial test position. The reported SAR and power measurement results are used to determine if SAR measurements are required for the other exposure positions and test channels.
The relative SAR levels of multiple exposure test positions can be established by area scan measurements on the highest measured output power channel to determine the initial test position.15
The area scans must be measured using the same SAR measurement configurations, including test channel, maximum output power, probe sensor to phantom shell distance, scan resolution etc. for the results to be comparable. The highest SAR at each peak SAR location is extrapolated to the phantom surface. The exposure test position with the highest extrapolated SAR is used for the initial test position.
Instead of extrapolated SAR, the 1-g estimated SAR procedures (fast SAR) in KDB Publication 447498 may be used instead. The extrapolated or 1-g estimated SAR must be scaled according to reported SAR requirements to determine the most conservative exposure test position.

a. Head Exposure Configuration: The left, right, touch and tilt test positions for next to ear exposure testing using the SAM phantom may be considered collectively as one head exposure configuration to facilitate initial test position SAR test reduction. The initial test position is determined according to area scans or by the side (left or right) of the SAM phantom and test position (touch or tilt) with the smallest test separation distance from the device outer surface, at the Wi-Fi antenna location, to the SAM phantom and maximum antenna to phantom RF coupling conditions.

   b. Hotspot mode and UMPC mini-tablets: The surfaces and edges that require SAR measurement in hotspot mode or UMPC mini-tablet configuration may be considered collectively as one exposure configuration to facilitate SAR test reduction. The initial test position is determined according to area scans or by the test position with the smallest test separation distance from the device outer surface, at the Wi-Fi antenna location, to the flat phantom and maximum antenna to phantom RF coupling conditions.

2. 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:
   a. 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).
   b. 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.
   c. 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.

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:

a. When the reported SAR of the highest measured maximum output power channel (section 3.1) for the exposure configuration is ≤ 0.8 W/kg, no further SAR testing is required for 802.11b DSSS in that exposure configuration.
b. 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.

3. 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). SAR is not required for the following 2.4 GHz OFDM conditions.

a. When KDB Publication 447498 SAR test exclusion applies to the OFDM configuration
b. 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.

4. SAR Test Requirements for OFDM Configurations

When SAR measurement is required for 802.11 a/g/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.20 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. 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, with respect to the highest reported SAR and maximum output power specified for production units. The procedures are applied independently to each exposure configuration; for example, head, body, hotspot mode etc.

a. 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.21 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.
b. 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.
c. 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.

6. OFDM Transmission Mode SAR Test Configuration and Channel Selection Requirements

The initial test configuration for 2.4 GHz and 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 (section 4). 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.
a. The largest channel bandwidth configuration is selected among the multiple configurations with the same specified maximum output power.
b. 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.
c. 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.
d. 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. When there are multiple test channels with the same measured maximum output power, the channel closest to mid-band frequency is selected for SAR measurement.
b. When there are multiple test channels with the same measured maximum output power and 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.

7. 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 (see section 5.3.2). SAR test reduction of subsequent highest output test channels is based on the 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.23 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 the subsequent next highest measured output power channel(s) in the initial test configuration until the reported SAR is ≤ 1.2 W/kg or all required channels are tested.

8. 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, the procedures in section 5.3.2 are applied to determine the test configuration. 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.

a. 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.
b. 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.
c. 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.
   1). SAR should first be measured for the channel with highest measured output power in the subsequent test configuration.
   2). 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.
   a) 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.
d. 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 applying the subsequent test configuration procedures in this section to the remaining configurations according to the following:
   1) replace “subsequent test configuration” with “next subsequent test configuration” (i.e., subsequent next highest specified maximum output power configuration)
   2) replace “initial test configuration” with “all tested higher output power configurations”

4.13. Power Drift

To control the output power stability during the SAR test, DASY5 system calculates the power drift by measuring the E-field at the same location at the beginning and at the end of the measurement for each test position. These drift values can be found in Table 14.1 to Table 14.11 labeled as: (Power Drift [dB]). This ensures that the power drift during one measurement is within 5%.

4.14. Power Reduction

The product without any power reduction.

5. TEST CONDITIONS AND RESULTS

5.1. Conducted Power Results

<GSM Conducted Power>

General Note:

1. Per KDB 447498 D01v06, the maximum output power channel is used for SAR testing and for further SAR test reduction.
2. According to October 2013TCB Workshop, for GSM / GPRS / EGPRS, the number of time slots to test for SAR should correspond to the highest frame-average maximum output power configuration, considering the possibility of e.g. 3rd party VoIP operation for head and body-worn SAR testing, the EUT was set in GPRS (4Tx slot) for GSM850/GSM1900 band due to their highest frame-average power.
3. For hotspot mode SAR testing, GPRS / EDGE should be evaluated, therefore the EUT was set in GPRS (4 Tx slots) for GSM850/GSM1900 band due to its highest frame-average power.
4. Measured power at SIM 1 and SIM 2, recorded highest power (worst case) at SIM 1.

Conducted Power Measurement Results(GSM 850/1900)

GSM 850		Burst Conducted power (dBm)			/	Average power (dBm)		
		Channel/Frequency(MHz)				Channel/Frequency(MHz)		
		128/824.2	190/836.6	251/848.8		128/824.2	190/836.6	251/848.8
GSM		32.73	32.65	32.53	-9.03dB	23.70	23.62	23.50
GPRS (GMSK)	1TX slot	32.70	32.62	32.51	-9.03dB	23.67	23.59	23.48
	2TX slot	30.14	30.15	30.03	-6.02dB	24.12	24.13	24.01
	3TX slot	28.43	28.40	28.27	-4.26dB	24.17	24.14	24.01
	4TX slot	27.20	27.14	27.03	-3.01dB	24.19	24.13	24.02
GSM 1900		Burst Conducted power (dBm)			/	Average power (dBm)		
		Channel/Frequency(MHz)				Channel/Frequency(MHz)		
		512/ 1850.2	661/ 1880	810/ 1909.8		512/ 1850.2	661/ 1880	810/ 1909.8
GSM		29.50	29.66	29.63	-9.03dB	20.47	20.63	20.60
GPRS (GMSK)	1TX slot	29.47	29.63	29.62	-9.03dB	20.44	20.60	20.59
	2TX slot	27.17	27.39	27.35	-6.02dB	21.15	21.37	21.33
	3TX slot	25.63	25.80	25.75	-4.26dB	21.37	21.54	21.49
	4TX slot	24.51	24.66	24.62	-3.01dB	21.50	21.65	21.61

Notes:

1) Division Factors

To average the power, the division factor is as follows:

1TX-slot = 1 transmit time slot out of 8 time slots=> conducted power divided by (8/1) => -9.03dB

2TX-slots = 2 transmit time slots out of 8 time slots=> conducted power divided by (8/2) => -6.02dB

3TX-slots = 3 transmit time slots out of 8 time slots=> conducted power divided by (8/3) => -4.26dB

4TX-slots = 4 transmit time slots out of 8 time slots=> conducted power divided by (8/4) => -3.01dB

2) According to the conducted power as above, the GPRS measurements are performed with 4Txslots for GPRS850 and GPRS1900.

<UMTS Conducted Power>

The following tests were conducted according to the test requirements outlines in 3GPP TS 34.121 specification. A summary of these settings are illustrated below:

HSDPA Setup Configuration:

a. The EUT was connected to Base Station E5515C referred to the Setup Configuration.
b. The RF path losses were compensated into the measurements.
c. A call was established between EUT and Base Station with following setting:
    i. Set Gain Factors (β_c and β_d) and parameters were set according to each
    ii. Specific sub-test in the following table, C10.1.4, quoted from the TS 34.121
    iii. Set RMC 12.2Kbps + HSDPA mode.
    iv. Set Cell Power = -86 dBm
    v. Set HS-DSCH Configuration Type to FRC (H-set 1, QPSK)
    vi. Select HSDPA Uplink Parameters
    vii. Set Delta ACK, Delta NACK and Delta CQI = 8

viii. Set Ack-Nack Repetition Factor to 3
ix. Set CQI Feedback Cycle (k) to 4 ms
x. Set CQI Repetition Factor to 2
xi. Power Ctrl Mode = All Up bits

d. The transmitted maximum output power was recorded.

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

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

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

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

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

Note 4: For subtest 2 the β_c/β_d ratio of 12/15 for the TFC during the measurement period (TF1, TF0) is achieved by setting the signalled gain factors for the reference TFC (TF1, TF1) to β_c = 11/15 and β_d = 15/15.

Setup Configuration

HSUPA Setup Configuration:

a. The EUT was connected to Base Station R&S CMU200 referred to the Setup Configuration.
b. The RF path losses were compensated into the measurements.
c. A call was established between EUT and Base Station with following setting * :
   i. Call Configs = 5.2B, 5.9B, 5.10B, and 5.13.2B with QPSK
   ii. Set the Gain Factors (β_c and β_d) and parameters (AG Index) were set according to each specific sub-test in the following table, C11.1.3, quoted from the TS 34.121
   iii. Set Cell Power = -86 dBm
   iv. Set Channel Type = 12.2k + HSPA
   v. Set UE Target Power
   vi. Power Ctrl Mode= Alternating bits
   vii. Set and observe the E-TFCI
   viii. Confirm that E-TFCI is equal to the target E-TFCI of 75 for sub-test 1, and other subtest's E-TFCI
d. The transmitted maximum output power was recorded.

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

Sub-test	β_c	β_d	β_d (SF)	β_c/β_d	β_{HS} (Note1)	β_{ec}	β_{ed} (Note 5) (Note 6)	β_{ed} (SF)	β_{ed} (Codes)	CM (dB) (Note 2)	MPR (dB) (Note 2)	AG Index (Note 6)	E-TFCI
1	11/15 (Note 3)	15/15 (Note 3)	64	11/15 (Note 3)	22/15	209/225	1309/225	4	1	1.0	0.0	20	75
2	6/15	15/15	64	6/15	12/15	12/15	94/75	4	1	3.0	2.0	12	67
3	15/15	9/15	64	15/9	30/15	30/15	β_{ed}1: 47/15 β_{ed}2: 47/15	4 4	2	2.0	1.0	15	92
4	2/15	15/15	64	2/15	4/15	2/15	56/75	4	1	3.0	2.0	17	71
5	15/15 (Note 4)	15/15 (Note 4)	64	15/15 (Note 4)	30/15	24/15	134/15	4	1	1.0	0.0	21	81

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

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

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

Note 4: 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 β_c = 14/15 and β_d = 15/15.

Note 5: In case of testing by UE using E-DPDCH Physical Layer category 1, Sub-test 3 is omitted according to TS25.306 Table 5.1g.

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

Setup Configuration

General Note

1. Per KDB 941225 D01, RMC 12.2kbps setting is used to evaluate SAR. If AMR 12.2kbps power is < 0.25dB higher than RMC 12.2kbps, SAR tests with AMR 12.2kbps can be excluded.
2. By design, AMR and HSDPA/HSUPA RF power will not be larger than RMC 12.2kbps, detailed information is included in Tune-up Procure exhibit.
3. It is expected by the manufacturer that MPR for some HSDPA/HSUPA subtests may differ from the specification of 3GPP, according to the chipset implementation in this model. The implementation and expected deviation are detailed in tune-up procedure exhibit.
4. Measured power at SIM 1 and SIM 2, recorded highest power (worst case) at SIM 1.

Conducted Power Measurement Results(WCDMA Band V/II)

Item	band	WCDMA Band V result (dBm)		
		Channel/Frequency(MHz)		
	ARFCN	4132/826.4	4183/836.6	4233/846.6
RMC	12.2kbps	22.13	22.02	22.16
HSDPA	Sub - Test 1	20.35	20.25	20.38
	Sub - Test 2	20.18	20.08	20.21
	Sub - Test 3	20.18	20.10	20.20
	Sub - Test 4	19.92	19.82	19.94
HSUPA	Sub - Test 1	19.81	19.71	19.83
	Sub - Test 2	19.65	19.55	19.68
	Sub - Test 3	19.56	19.47	19.59
	Sub - Test 4	19.51	19.41	19.53
	Sub - Test 5	19.45	19.36	19.48

Note : When the maximum output power and tune-up tolerance specified for production units in a secondary mode is ≤1/2dB higher than the primary mode (RMC12.2kbps) or when the highest reported SAR of the primary mode is scaled by the ratio of specified maximum output power and tune-up tolerance of secondary to primary mode and the adjusted SAR is ≤ 1.2 W/kg, SAR measurement is not required for the secondary mode.

< LTE Conducted Power >

General Note:

1. CMW500 base station simulator was used to setup the connection with EUT; the frequency band, channel,bandwidth, RB allocation configuration, modulation type are set in the base station simulator to configure EUTtransmitting at maximum power and at different configurations which are requested to be reported to FCC, forconducted power measurement and SAR testing.
2. Per KDB 941225 D05v02r03, when a properly configured base station simulator is used for the SAR and powermeasurements, spectrum plots for each RB allocation and offset configuration is not required.
3. Per KDB 941225 D05v02r03, start with the largest channel bandwidth and measure SAR for QPSK with 1 RBallocation, using the RB offset and required test channel combination with the highest maximum output power for RBoffsets at the upper edge, middle and lower edge of each required test channel.
4. Per KDB 941225 D05v02r03, 50% RB allocation for QPSK SAR testing follows 1RB QPSK allocation procedure.
5. Per KDB 941225 D05v02r03, for QPSK with 100% RB allocation, SAR is not required when the highest maximumoutput power for 100 % RB allocation is less than the highest maximum output power in 50% and 1 RB allocations andthe highest reported SAR for 1 RB and 50% RB allocation are ≤ 0.8 W/kg. Otherwise, SAR is measured for the highestoutput power channel; and if the reported SAR is > 1.45 W/kg, the remaining required test channels must also betested.
6. Per KDB 941225 D05v02r03, 16QAM output power for each RB allocation configuration is > not ½ dB higher than thesame configuration in QPSK and the reported SAR for the QPSK configuration is ≤ 1.45 W/kg; Per KDB 941225D05v02r03, 16QAM SAR testing is not required.
7. Per KDB 941225 D05v02r03, smaller bandwidth output power for each RB allocation configuration is > not ½ dBhigher than the same configuration in the largest supported bandwidth, and the reported SAR for the largest supportedbandwidth is ≤ 1.45 W/kg; Per KDB 941225 D05v02r03, smaller bandwidth SAR testing is not required.

LTE-FDD Band 2				Actual output Power (dBm)		
Band-width	**RBallocation**	**RBoffset**	**Modulation**	**Low**	**Middle**	**High**
1.4 MHz				**1850.7MHz**	**1880MHz**	**1909.3MHz**
	1RB	High	QPSK	22.57	22.67	22.55
			16QAM	21.70	21.79	21.68
		Middle	QPSK	22.56	22.66	22.52
			16QAM	21.71	21.81	21.69
		Low	QPSK	22.58	22.63	22.52
			16QAM	21.73	21.81	21.70
	3RB	High	QPSK	22.45	22.56	22.42
			16QAM	21.47	21.55	21.43
		Middle	QPSK	22.46	22.54	22.43
			16QAM	21.49	21.58	21.44
		Low	QPSK	22.45	22.57	22.45
			16QAM	21.47	21.57	21.45
	6RB	/	QPSK	21.62	21.73	21.58
			16QAM	20.56	20.66	20.54
3 MHz				**1851.5MHz**	**1880MHz**	**1908.5MHz**
	1RB	High	QPSK	22.55	22.64	22.53
			16QAM	21.74	21.82	21.71
		Middle	QPSK	22.53	22.64	22.51
			16QAM	21.75	21.85	21.72
		Low	QPSK	22.55	22.65	22.53
			16QAM	21.73	21.82	21.70
	8RB	High	QPSK	21.62	21.71	21.57
			16QAM	20.57	20.66	20.54
		Middle	QPSK	21.57	21.64	21.54
			16QAM	20.56	20.66	20.52
		Low	QPSK	21.58	21.67	21.55
			16QAM	20.58	20.66	20.56
	15RB	/	QPSK	21.54	21.65	21.52
			16QAM	20.55	20.67	20.50

5 MHz				1852.5MHz	1880MHz	1907.5MHz
	1RB	High	QPSK	22.53	22.62	22.51
			16QAM	21.73	21.82	21.71
		Middle	QPSK	22.55	22.65	22.53
			16QAM	21.75	21.85	21.71
		Low	QPSK	22.54	22.62	22.50
			16QAM	21.73	21.82	21.71
	12RB	High	QPSK	21.63	21.74	21.57
			16QAM	20.62	20.75	20.59
		Middle	QPSK	21.63	21.73	21.60
			16QAM	20.63	20.73	20.58
		Low	QPSK	21.62	21.71	21.59
			16QAM	20.65	20.74	20.62
	25RB		QPSK	21.60	21.70	21.57
			16QAM	20.59	20.68	20.55
10 MHz				1855MHz	1880MHz	1905MHz
	1RB	High	QPSK	22.54	22.63	22.51
			16QAM	21.72	21.81	21.70
		Middle	QPSK	22.55	22.65	22.52
			16QAM	21.74	21.84	21.70
		Low	QPSK	22.55	22.65	22.52
			16QAM	21.74	21.82	21.71
	25RB	High	QPSK	21.59	21.70	21.57
			16QAM	20.62	20.72	20.59
		Middle	QPSK	21.59	21.70	21.57
			16QAM	20.66	20.74	20.61
		Low	QPSK	21.58	21.68	21.55
			16QAM	20.64	20.73	20.61
	50RB	/	QPSK	21.61	21.70	21.56
			16QAM	20.60	20.69	20.55
15 MHz				1857.5MHz	1880MHz	1902.5MHz
	1RB	High	QPSK	22.57	22.66	22.55
			16QAM	21.73	21.82	21.71
		Middle	QPSK	22.54	22.66	22.51
			16QAM	21.74	21.85	21.71
		Low	QPSK	22.56	22.65	22.54
			16QAM	21.75	21.84	21.73
	36RB	High	QPSK	21.61	21.71	21.58
			16QAM	20.62	20.70	20.58
		Middle	QPSK	21.59	21.70	21.54
			16QAM	20.64	20.73	20.59
		Low	QPSK	21.62	21.73	21.60
			16QAM	20.60	20.70	20.57
	75RB	/	QPSK	21.52	21.62	21.49
			16QAM	20.55	20.66	20.52

				1860MHz	1880MHz	1900MHz
20 MHz	1RB	High	QPSK	22.53	22.65	22.61
			16QAM	21.73	21.84	21.82
		Middle	QPSK	22.56	22.66	22.64
			16QAM	21.76	21.84	21.81
		Low	QPSK	22.58	22.67	22.66
			16QAM	21.76	21.85	21.84
	50RB	High	QPSK	21.62	21.74	21.60
			16QAM	20.60	20.72	20.67
		Middle	QPSK	21.61	21.71	21.68
			16QAM	20.66	20.76	20.73
		Low	QPSK	21.62	21.71	21.69
			16QAM	20.67	20.76	20.74
	100RB	/	QPSK	21.55	21.67	21.60
			16QAM	20.54	20.66	20.59

LTE-FDD Band 4				Actual output Power (dBm)		
Band-width	RBallocation	RBoffset	Modulation	Low	Middle	High
1.4 MHz				1710.7MHz	1732.5MHz	1754.3MHz
	1RB	High	QPSK	22.50	22.58	22.49
			16QAM	21.63	21.70	21.62
		Middle	QPSK	22.49	22.57	22.46
			16QAM	21.64	21.72	21.63
		Low	QPSK	22.51	22.54	22.46
			16QAM	21.66	21.72	21.64
	3RB	High	QPSK	22.38	22.47	22.36
			16QAM	21.40	21.46	21.37
		Middle	QPSK	22.39	22.45	22.37
			16QAM	21.42	21.49	21.38
		Low	QPSK	22.38	22.48	22.39
			16QAM	21.40	21.48	21.39
	6RB	/	QPSK	21.55	21.64	21.52
			16QAM	20.49	20.57	20.48
3 MHz				1711.5MHz	1732.5MHz	1753.5MHz
	1RB	High	QPSK	22.48	22.55	22.47
			16QAM	21.67	21.73	21.65
		Middle	QPSK	22.46	22.55	22.45
			16QAM	21.68	21.76	21.66
		Low	QPSK	22.48	22.56	22.47
			16QAM	21.66	21.73	21.64
	8RB	High	QPSK	21.53	21.62	21.50
			16QAM	20.48	20.57	20.47
		Middle	QPSK	21.48	21.55	21.47
			16QAM	20.47	20.57	20.45
		Low	QPSK	21.49	21.58	21.48
			16QAM	20.49	20.57	20.49
	15RB	/	QPSK	21.45	21.56	21.45
			16QAM	20.46	20.58	20.43
5 MHz				1712.5MHz	1732.5MHz	1752.5MHz
	1RB	High	QPSK	22.46	22.53	22.45
			16QAM	21.66	21.73	21.65
		Middle	QPSK	22.48	22.56	22.47
			16QAM	21.68	21.76	21.65
		Low	QPSK	22.47	22.53	22.44
			16QAM	21.66	21.73	21.65
	12RB	High	QPSK	21.54	21.65	21.50
			16QAM	20.53	20.66	20.52
		Middle	QPSK	21.54	21.64	21.53
			16QAM	20.54	20.64	20.51
		Low	QPSK	21.53	21.62	21.52
			16QAM	20.56	20.65	20.55
	25RB	/	QPSK	21.51	21.61	21.50
			16QAM	20.50	20.59	20.48

10 MHz				1715MHz	1732.5MHz	1750MHz
	1RB	High	QPSK	22.47	22.54	22.45
			16QAM	21.65	21.72	21.64
		Middle	QPSK	22.48	22.56	22.46
			16QAM	21.67	21.75	21.64
		Low	QPSK	22.48	22.56	22.46
			16QAM	21.67	21.73	21.65
	25RB	High	QPSK	21.50	21.61	21.50
			16QAM	20.53	20.63	20.52
		Middle	QPSK	21.50	21.61	21.50
			16QAM	20.57	20.65	20.54
		Low	QPSK	21.49	21.59	21.48
			16QAM	20.55	20.64	20.54
	50RB	/	QPSK	21.52	21.61	21.49
			16QAM	20.51	20.60	20.48
15 MHz				1717.5MHz	1732.5MHz	1747.5MHz
	1RB	High	QPSK	22.50	22.57	22.49
			16QAM	21.66	21.73	21.65
		Middle	QPSK	22.47	22.57	22.45
			16QAM	21.67	21.76	21.65
		Low	QPSK	22.49	22.56	22.48
			16QAM	21.68	21.75	21.67
	36RB	High	QPSK	21.52	21.62	21.51
			16QAM	20.53	20.61	20.51
		Middle	QPSK	21.50	21.61	21.47
			16QAM	20.55	20.64	20.52
		Low	QPSK	21.53	21.64	21.53
			16QAM	20.51	20.61	20.50
	75RB	/	QPSK	21.43	21.53	21.42
			16QAM	20.46	20.57	20.45
20 MHz				1720MHz	1732.5MHz	1745MHz
	1RB	High	QPSK	22.46	22.56	22.45
			16QAM	21.66	21.75	21.66
		Middle	QPSK	22.49	22.57	22.48
			16QAM	21.69	21.75	21.65
		Low	QPSK	22.51	22.58	22.50
			16QAM	21.69	21.76	21.68
	50RB	High	QPSK	21.53	21.63	21.43
			16QAM	20.51	20.61	20.50
		Middle	QPSK	21.52	21.60	21.51
			16QAM	20.57	20.65	20.56
		Low	QPSK	21.53	21.60	21.52
			16QAM	20.58	20.65	20.57
	100RB	/	QPSK	21.46	21.56	21.43
			16QAM	20.45	20.55	20.42

LTE-FDD Band 7				Actual output Power (dBm)		
Band-width	RBallocation	RBoffset	Modulation	Low	Middle	High
5 MHz				2502.5MHz	2535MHz	2567.5MHz
	1RB	High	QPSK	22.03	22.12	22.06
			16QAM	21.22	21.28	21.22
		Middle	QPSK	22.05	22.12	22.05
			16QAM	21.27	21.34	21.29
		Low	QPSK	22.05	22.07	22.07
			16QAM	21.26	21.30	21.29
	12RB	High	QPSK	21.01	21.05	20.98
			16QAM	20.02	20.09	20.02
		Middle	QPSK	21.04	21.10	21.05
			16QAM	20.03	20.11	20.02
		Low	QPSK	21.04	21.07	20.98
			16QAM	20.11	20.14	20.00
	25RB		QPSK	21.03	21.13	21.00
			16QAM	20.08	20.14	20.05
10 MHz				2505MHz	2535MHz	2565MHz
	1RB	High	QPSK	22.09	22.13	22.04
			16QAM	21.26	21.32	21.26
		Middle	QPSK	22.09	22.09	22.01
			16QAM	21.30	21.33	21.26
		Low	QPSK	22.04	22.06	22.02
			16QAM	21.27	21.31	21.27
	25RB	High	QPSK	20.99	21.05	21.01
			16QAM	20.01	20.04	19.99
		Middle	QPSK	21.06	21.08	21.01
			16QAM	20.07	20.10	20.06
		Low	QPSK	21.05	21.11	20.97
			16QAM	20.01	20.06	20.03
	50RB		QPSK	21.05	21.07	21.00
			16QAM	20.03	20.08	20.02
15 MHz				2507.5MHz	2535MHz	2562.5MHz
	1RB	High	QPSK	22.04	22.11	22.04
			16QAM	21.26	21.31	21.27
		Middle	QPSK	22.02	22.14	22.06
			16QAM	21.28	21.34	21.29
		Low	QPSK	22.07	22.11	22.04
			16QAM	21.25	21.31	21.29
	36RB	High	QPSK	20.97	21.08	21.00
			16QAM	20.02	20.08	20.00
		Middle	QPSK	21.01	21.09	21.02
			16QAM	20.03	20.10	20.01
		Low	QPSK	21.02	21.04	21.00
			16QAM	20.09	20.13	19.99
	75RB		QPSK	21.03	21.11	21.04
			16QAM	20.06	20.10	20.01

20 MHz				2510MHz	2535MHz	2560MHz
	1RB	High	QPSK	22.05	22.15	22.07
			16QAM	21.29	21.33	21.27
		Middle	QPSK	22.07	22.17	22.12
			16QAM	21.28	21.36	21.30
		Low	QPSK	22.08	22.15	22.09
			16QAM	21.26	21.31	21.26
	50RB	High	QPSK	21.21	21.26	21.20
			16QAM	20.03	20.11	20.01
		Middle	QPSK	21.03	21.10	21.04
			16QAM	20.05	20.11	20.03
		Low	QPSK	21.01	21.06	21.06
			16QAM	20.02	20.11	20.03
	100RB		QPSK	21.06	21.14	21.06
			16QAM	20.05	20.13	20.15

LTE-FDD Band 17				Actual output Power (dBm)		
Band-width	**RBallocation**	**RBoffset**	**Modulation**	**High**	**Middle**	**Low**
5 MHz				**706.5MHz**	**710MHz**	**713.5MHz**
	1RB	High	QPSK	22.31	22.35	22.30
			16QAM	21.39	21.45	21.40
		Middle	QPSK	22.27	22.33	22.31
			16QAM	21.36	21.43	21.40
		Low	QPSK	22.27	22.34	22.31
			16QAM	21.37	21.43	21.38
	12RB	High	QPSK	21.31	21.33	21.31
			16QAM	20.32	20.37	20.33
		Middle	QPSK	21.29	21.35	21.30
			16QAM	20.30	20.35	20.30
		Low	QPSK	21.29	21.36	21.30
			16QAM	20.28	20.36	20.32
	25RB	/	QPSK	21.26	21.31	21.27
			16QAM	20.27	20.32	20.28
10 MHz				**709MHz**	**710MHz**	**711MHz**
	1RB	High	QPSK	22.32	22.40	22.30
			16QAM	21.42	21.47	21.43
		Middle	QPSK	22.28	22.34	22.30
			16QAM	21.40	21.45	21.41
		Low	QPSK	22.30	22.36	22.32
			16QAM	21.39	21.45	21.40
	25RB	High	QPSK	21.35	21.45	21.37
			16QAM	20.33	20.38	20.34
		Middle	QPSK	21.30	21.36	21.32
			16QAM	20.29	20.37	20.35
		Low	QPSK	21.30	21.35	21.32
			16QAM	20.29	20.32	20.33
	50RB	/	QPSK	21.26	21.34	21.31
			16QAM	20.27	20.35	20.33

<WLAN 2.4GHz Conducted Power>

Mode	Channel	Frequency (MHz)	Conducted Peak Power (dBm)	Conducted Average Power (dBm)	Data rate
802.11b	01	2412	19.61	16.73	1 Mbps
	06	2437	19.75	16.85	1 Mbps
	11	2462	19.59	16.70	1 Mbps
802.11g	01	2412	18.61	14.58	6 Mbps
	06	2437	18.68	14.60	6 Mbps
	11	2462	18.59	14.54	6 Mbps
802.11n(H20)	01	2412	17.59	13.41	6.5 Mbps
	06	2437	17.38	13.23	6.5 Mbps
	11	2462	17.52	13.34	6.5 Mbps
802.11n(H40)	3	2422	17.67	13.47	13.5 Mbps
	6	2437	17.21	13.10	13.5 Mbps
	9	2452	17.15	13.06	13.5 Mbps

*Note:*The output power was test all data rate and recorded worst case at recorded data rate.

<WLAN 5 GHz Conducted Power>

Mode	Channel	Frequency (MHz)	Conducted Peak Power (dBm)	Conducted Average Power (dBm)	Data rate
802.11a	36	5180	19.26	16.43	6Mbps
	40	5200	19.18	16.37	6Mbps
	44	5220	19.28	16.43	6Mbps
	48	5240	19.31	**16.47**	6Mbps
802.11n(HT20)	36	5180	18.76	16.01	MSC0
	40	5200	18.69	15.93	MSC0
	44	5220	18.69	15.94	MSC0
	48	5240	18.68	15.94	MSC0

<Bluetooth Conducted Power>

Mode	**Channel**	**Frequency (MHz)**	**Conducted PK Power (dBm)**	**Conducted Average Power (dBm)**
GFSK	0	2402	5.52	4.47
	39	2441	5.17	4.16
	78	2480	5.33	4.32
π/4DQPSK	0	2402	4.73	3.75
	39	2441	4.38	3.34
	78	2480	4.55	3.51
8DPSK	0	2402	4.77	3.72
	39	2441	4.39	3.33
	78	2480	4.66	3.61
BLE(GFSK)	0	2402	-1.56	-2.61
	19	2440	-1.47	-2.48
	39	2480	-1.76	-2.76

Manufacturing tolerance

GSM Speech

GSM 850 (GMSK) (Burst Average Power)			
Channel	Channel 128	Channel 190	Channel 251
Target (dBm)	32.0	32.0	32.0
Tolerance ±(dB)	1.0	1.0	1.0
GSM 1900 (GMSK) (Burst Average Power)			
Channel	Channel 512	Channel 661	Channel 810
Target (dBm)	29.0	29.0	29.0
Tolerance ±(dB)	1.0	1.0	1.0

GSM 850 GPRS (GMSK) (Burst Average Power)				
Channel		128	190	251
1 Txslot	Target (dBm)	32.0	32.0	32.0
	Tolerance ±(dB)	1.0	1.0	1.0
2 Txslot	Target (dBm)	29.5	29.5	29.5
	Tolerance ±(dB)	1.0	1.0	1.0
3 Txslot	Target (dBm)	27.5	27.5	27.5
	Tolerance ±(dB)	1.0	1.0	1.0
4 Txslot	Target (dBm)	26.5	26.5	26.5
	Tolerance ±(dB)	1.0	1.0	1.0
GSM 1900 GPRS (GMSK) (Burst Average Power)				
Channel		512	661	810
1 Txslot	Target (dBm)	29.0	29.0	29.0
	Tolerance ±(dB)	1.0	1.0	1.0
2 Txslot	Target (dBm)	27.0	27.0	27.0
	Tolerance ±(dB)	1.0	1.0	1.0
3 Txslot	Target (dBm)	25.0	25.0	25.0
	Tolerance ±(dB)	1.0	1.0	1.0
4 Txslot	Target (dBm)	24.0	24.0	24.0
	Tolerance ±(dB)	1.0	1.0	1.0

UMTS

UMTS Band V			
Channel	Channel 4132	Channel 4182	Channel 4233
Target (dBm)	21.5	21.5	21.5
Tolerance ±(dB)	1.0	1.0	1.0
UMTS Band V HSDPA(sub-test 1)			
Channel	Channel 4132	Channel 4182	Channel 4233
Target (dBm)	19.5	19.5	19.5
Tolerance ±(dB)	1.0	1.0	1.0
UMTS Band V HSDPA(sub-test 2)			
Channel	Channel 4132	Channel 4182	Channel 4233
Target (dBm)	19.5	19.5	19.5
Tolerance ±(dB)	1.0	1.0	1.0
UMTS Band V HSDPA(sub-test 3)			
Channel	Channel 4132	Channel 4182	Channel 4233
Target (dBm)	19.5	19.5	19.5
Tolerance ±(dB)	1.0	1.0	1.0
UMTS Band V HSDPA(sub-test 4)			
Channel	Channel 4132	Channel 4182	Channel 4233
Target (dBm)	19.5	19.5	19.5
Tolerance ±(dB)	1.0	1.0	1.0
UMTS Band V HSUPA(sub-test 1)			
Channel	Channel 4132	Channel 4182	Channel 4233
Target (dBm)	19.0	19.0	19.0
Tolerance ±(dB)	1.0	1.0	1.0
UMTS Band V HSUPA(sub-test 2)			
Channel	Channel 4132	Channel 4182	Channel 4233
Target (dBm)	19.0	19.0	19.0
Tolerance ±(dB)	1.0	1.0	1.0
UMTS Band V HSUPA(sub-test 3)			

Channel	Channel 4132	Channel 4182	Channel 4233
Target (dBm)	19.0	19.0	19.0
Tolerance ±(dB)	1.0	1.0	1.0
UMTS Band V HSUPA(sub-test 4)			
Channel	Channel 4132	Channel 4182	Channel 4233
Target (dBm)	19.0	19.0	19.0
Tolerance ±(dB)	1.0	1.0	1.0
UMTS Band V HSUPA(sub-test 5)			
Channel	Channel 4132	Channel 4182	Channel 4233
Target (dBm)	19.0	19.0	19.0
Tolerance ±(dB)	1.0	1.0	1.0

LTE

LTE Band 2			
Channel	Channel 19100	Channel 18900	Channel 18700
Target (dBm)	22	22	22
Tolerance ±(dB)	1.0	1.0	1.0
LTE Band 4			
Channel	Channel 20300	Channel 20175	Channel 20050
Tune-up(dB)	22	22	22
Tolerance ±(dB)	1.0	1.0	1.0
LTE Band 7			
Channel	Channel 20600	Channel 20525	Channel 20450
Tune-up(dB)	21.5	21.5	21.5
Tolerance ±(dB)	1.0	1.0	1.0
LTE Band 17			
Channel	Channel 21350	Channel 21100	Channel 20850
Tune-up(dB)	22	22	22
Tolerance ±(dB)	1.0	1.0	1.0

LTEMPRwillfollowup3GPPsettingasbelow:

Modulation	Channel bandwidth / Transmission bandwidth (NRB)						MPR (dB)
	1.4MHz	3.0MHz	5MHz	10MHz	15MHz	20MHz	
QPSK	≤ 5	≤ 4	≤ 8	≤ 12	≤ 16	≤ 18	0
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

2.4G WiFi

IEEE 802.11b (Average)			
Channel	Channel 1	Channel 6	Channel 11
Target (dBm)	16.0	16.0	16.0
Tolerance ±(dB)	1.0	1.0	1.0
IEEE 802.11g (Average)			
Channel	Channel 1	Channel 6	Channel 11
Target (dBm)	14.0	14.0	14.0
Tolerance ±(dB)	1.0	1.0	1.0
IEEE 802.11n HT20 (Average)			
Channel	Channel 1	Channel 6	Channel 11
Target (dBm)	13.0	13.0	13.0
Tolerance ±(dB)	1.0	1.0	1.0
IEEE 802.11n HT40 (Average)			
Channel	Channel 1	Channel 6	Channel 11
Target (dBm)	13.0	13.0	13.0
Tolerance ±(dB)	1.0	1.0	1.0

5G WiFi

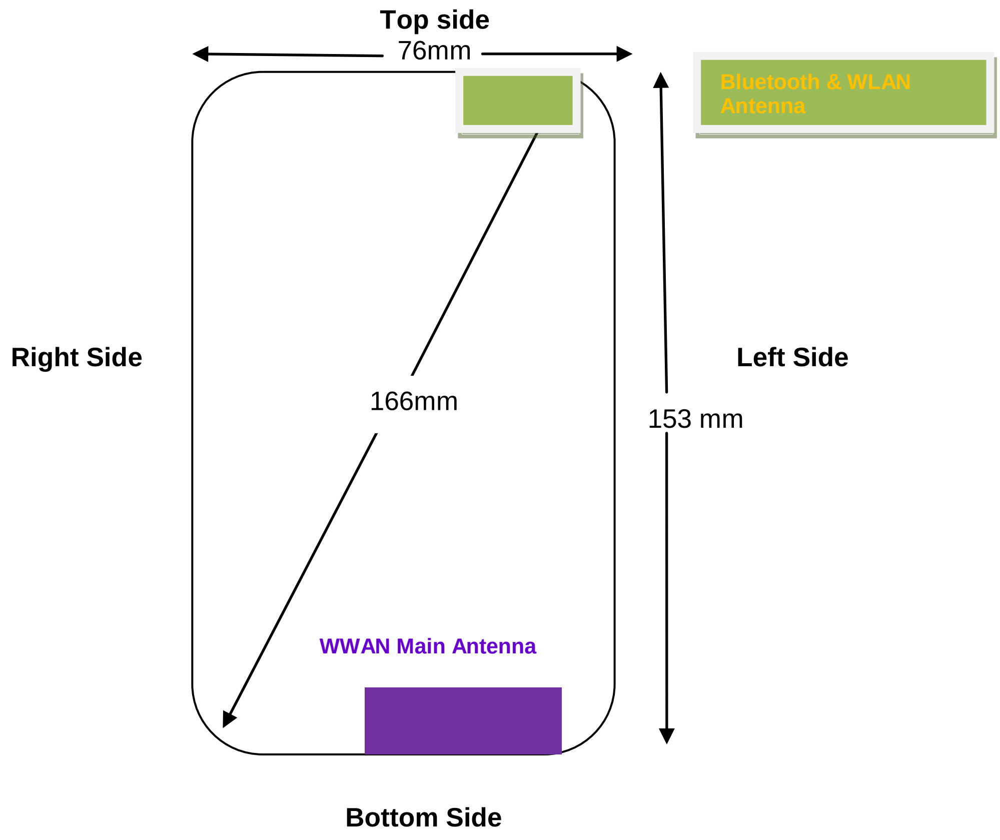
IEEE 802.11a (Average)			
Channel	Channel 5180	Channel 5200	Channel 5240
Target (dBm)	16.0	16.0	16.0
Tolerance ±(dB)	1.0	1.0	1.0

IEEE 802.11n HT20 (Average)			
Channel	Channel 5180	Channel 5200	Channel 5240
Target (dBm)	15.0	15.0	15.0
Tolerance ±(dB)	1.0	1.0	1.0

Bluetooth

GFSK (Average)			
Channel	Channel 0	Channel 39	Channel 78
Target (dBm)	4.0	4.0	4.0
Tolerance ±(dB)	1.0	1.0	1.0
8DPSK (Average)			
Channel	Channel 0	Channel 39	Channel 78
Target (dBm)	3.0	3.0	3.0
Tolerance ±(dB)	1.0	1.0	1.0
π/4DQPSK (Average)			
Channel	Channel 0	Channel 39	Channel 78
Target (dBm)	3.0	3.0	3.0
Tolerance ±(dB)	1.0	1.0	1.0
BLE (Average)			
Channel	Channel 0	Channel 19	Channel 39
Target (dBm)	-3.0	-3.0	-3.0
Tolerance ±(dB)	1.0	1.0	1.0

5.2. Transmit Antennas and SAR Measurement Position



Back View

Distance of The Antenna to the EUT surface and edge						
Antennas	Front	Back	Top Side	Bottom Side	Left Side	Right Side
WWAN	<5mm	<5mm	>25mm	<5mm	<5mm	<5mm
BT&WLAN	<5mm	<5mm	<5mm	>25mm	<5mm	>25mm

Positions for SAR tests; Hotspot mode						
Antennas	Front	Back	Top Side	Bottom Side	Left Side	Right Side
WWAN	Yes	Yes	No	Yes	Yes	Yes
BT&WLAN	Yes	Yes	Yes	No	Yes	No

Note:
1). Per KDB648474 D04, because the overall diagonal distance of this devices is 166m＞160mm, it is considered a “Phablet“ device.
2). Per KDB648474 D04, 10-g extremity SAR is not required when Body-Worn mode 1-g reported SAR < 1.2 W/Kg.
3). According to the KDB941225 D06 Hot Spot SAR v02, the edges with less than 2.5 cm distance to the antennas need to be tested for SAR.

5.3. Standalone SAR Test Exclusion Considerations

Per KDB447498 for standalone 1-g head or body SAR evaluation by measurement or numerical simulation is not required when the corresponding SAR Exclusion Threshold condition, listed below, is satisfied.
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
● 3.0 and 7.5 are referred to as the numeric thresholds in the step 2 below

Standalone SAR test exclusion considerations							
Modulation	Frequency (MHz)	Configuration	Maximum Average Power (dBm)	Separation Distance (mm)	Calculation Result	SAR Exclusion Thresholds	Standalone SAR Exclusion
WIFI 2.4G	2450	Head	17.0	5	15.69	3.0	no
		Body*	17.0	10	7.85	3.0	no
WIFI 5G	5200	Head	17.0	5	22.86	3.0	no
		Body*	17.0	10	11.43	3.0	no
Bluetooth*	2450	Head	5.00	5	0.99	3.0	yes
		Body*	5.00	10	0.50	3.0	yes

Remark:
1. *Maximum average power including tune-up tolerance;*
2. *Bluetooth including Lower Energy Bluetooth and classical Bluetooth;*
3. *When the minimum test separation distance is < 5 mm, a distance of 5 mm is applied to determine SAR test exclusion*
4. *Body including Hotspot mode as body use distance is 10mm from manufacturer declaration of user manual.*

5.4. Estimated SAR

Per KDB447498 requires when the standalone SAR test exclusion of section 4.3.1 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

Per FCC KD B447498 D01,simultaneous transmission SAR test exclusion may be applied when the sum of the 1-g SAR for all the transmitting antenna in a specific a physical test configuration is ≤1.6 W/Kg.When the sum is greater than the SAR limit,SAR test exclusion is determined by the SAR to peak location separation ratio.

$$\text{Ratio}=\frac{(\text{SAR}_1+\text{SAR}_2)^{1.5}}{(\text{peak location separation,mm})}<0.04$$

Estimated stand alone SAR					
Communication system	Frequency (MHz)	Configuration	Maximum Power (dBm)	Separation Distance (mm)	Estimated SAR_{1-g} (W/kg)
Bluetooth*	2450	Head	5.00	5	0.13
Bluetooth*	2450	Hotspot	5.00	10	0.07
Bluetooth*	2450	Body Worn	5.00	10	0.07

Remark:
1. *Maximum average power including tune-up tolerance;*
2. *Bluetooth including Lower Energy Bluetooth and classical Bluetooth;*
3. *When the minimum test separation distance is < 5 mm, a distance of 5 mm is applied to determine SAR test exclusion*
4. *Body including Hotspot mode as body use distance is 10mm from manufacturer declaration of user manual.*

5.5. SAR Measurement Results

It is determined by user manual for the distance between the EUT and the phantom bottom.
The distance is 10mm and just applied to the condition of body worn accessory.
The calculated SAR is obtained by the following formula:
Reported SAR=Measured SAR$\times 10^{(PTarget-Pmeasured)/10}$
Where P_{Target} is the power of manufacturing upper limit;
$P_{Measured}$ is the measured power
SAR meausred at SIM 1 as power highest at SIM 1;

Duty Cycle

Mode	Duty Cycle
Speech for GSM850/1900	1:8
GPRS for GSM850	1:2
GPRS for GSM1900	1:2
WCDMA	1:1
LTE	1:1
WIFI	1:1

SAR Values [GSM 850]

Ch.	Freq. (MHz)	Time slots	Test Position	Conducted Power (dBm)	Maximum Allowed Power (dBm)	Power drift	Scaling Factor	SAR_{1-g} results(W/kg)		Graph Results
								Measured	Reported	
measured / reported SAR numbers - Head										
190	836.6	GSM	Left Cheek	32.65	33.00	0.12	1.08	**0.116**	**0.13**	**#1**
190	836.6	GSM	Left Tilt	32.65	33.00	-0.09	1.08	0.089	0.10	
190	836.6	GSM	Right Cheek	32.65	33.00	-0.05	1.08	0.109	0.12	
190	836.6	GSM	Right Tilt	32.65	33.00	-0.04	1.08	0.087	0.09	
measured / reported SAR numbers - Body (hotspot open, distance 10mm)										
190	836.6	4Txslots	Front	27.14	27.50	-0.09	1.09	0.215	0.23	
190	836.6	4Txslots	Back	27.14	27.50	0.08	1.09	**0.325**	**0.35**	**#2**
190	836.6	4Txslots	Left Side	27.14	27.50	-0.04	1.09	0.143	0.16	
190	836.6	4Txslots	Right Side	27.14	27.50	-0.08	1.09	0.104	0.11	
190	836.6	4Txslots	Bottom Side	27.14	27.50	-0.06	1.09	0.185	0.20	
measured / reported SAR numbers- Body worn (distance 10mm)										
190	836.6	4Txslots	Front	27.14	27.50	-0.09	1.09	0.215	0.23	
190	836.6	4Txslots	Back	27.14	27.50	0.08	1.09	**0.325**	**0.35**	

SAR Values [GSM 1900]

Ch.	Freq. (MHz)	time slots	Test Position	Conducted Power (dBm)	Maximum Allowed Power (dBm)	Power drift	Scaling Factor	SAR_{1-g} results(W/kg)		Graph Results
								Measured	Reported	
measured / reported SAR numbers - Head										
661	1880.0	GSM	Left Cheek	29.66	30.00	-0.12	1.08	**0.162**	**0.18**	**#3**
661	1880.0	GSM	Left Tilt	29.66	30.00	0.10	1.08	0.120	0.13	
661	1880.0	GSM	Right Cheek	29.66	30.00	0.06	1.08	0.149	0.16	
661	1880.0	GSM	Right Tilt	29.66	30.00	-0.05	1.08	0.113	0.12	
measured / reported SAR numbers – Body (hotspot open, distance 10mm)										
661	1880.0	4Txslots	Front	24.66	25.00	-0.09	1.08	0.279	0.30	
661	1880.0	4Txslots	Back	24.66	25.00	-0.13	1.08	**0.428**	**0.46**	**#4**
661	1880.0	4Txslots	Left Side	24.66	25.00	-0.08	1.08	0.186	0.20	
661	1880.0	4Txslots	Right SIde	24.66	25.00	-0.06	1.08	0.142	0.15	
661	1880.0	4Txslots	Bottom Side	24.66	25.00	0.04	1.08	0.244	0.26	
measured / reported SAR numbers- Body worn (distance 10mm)										
661	1880.0	4Txslots	Front	24.66	25.00	-0.09	1.08	0.279	0.30	
661	1880.0	4Txslots	Back	24.66	25.00	-0.13	1.08	**0.428**	**0.46**	

SAR Values [WCDMA Band V]

Ch.	Freq. (MHz)	Channel Type	Test Position	Conducted Power (dBm)	Maximum Allowed Power (dBm)	Power drift	Scaling Factor	SAR_{1-g} results(W/kg)		Graph Results
								Measured	Reported	
measured / reported SAR numbers - Head										
4183	836.6	RMC	Left Cheek	22.02	22.50	0.17	1.12	**0.117**	**0.13**	**#5**
4183	836.6	RMC	Left Tilt	22.02	22.50	-0.12	1.12	0.096	0.11	
4183	836.6	RMC	Right Cheek	22.02	22.50	0.13	1.12	0.111	0.12	
4183	836.6	RMC	Right Tilt	22.02	22.50	-0.11	1.12	0.090	0.10	
measured / reported SAR numbers - Body (hotspot open, distance 10mm)										
4183	836.6	RMC	Front	22.02	22.50	-0.12	1.12	0.241	0.27	
4183	836.6	RMC	Back	22.02	22.50	-0.12	1.12	**0.339**	**0.38**	**#6**
4183	836.6	RMC	Left Side	22.02	22.50	-0.09	1.12	0.161	0.18	
4183	836.6	RMC	Right Side	22.02	22.50	0.10	1.12	0.150	0.17	
4183	836.6	RMC	Bottom Side	22.02	22.50	-0.08	1.12	0.193	0.22	
measured / reported SAR numbers- Body worn (distance 10mm)										
4183	836.6	RMC	Front	22.02	22.50	-0.12	1.12	0.241	0.27	
4183	836.6	RMC	Back	22.02	22.50	-0.12	1.12	**0.339**	**0.38**	