FCC SAR Compliance Test Report

Project Name: LTE/CDMA 1X/EVDO Mobile Phone with Bluetooth

Model : HUAWEI M920

FCC ID : QISM920

Report No. : SYBH(Z-SAR)010112011-2

	APPROVED	CHECKED	PREPARED
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DATE	2011-12-05	2011-12-05	2011-12-05

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※ ※ Modified History ※ ※

REV.	DESCRIPTION	ISSUED DATE	REMARK
---	Initial Release	2011-11-24	Lu Chaogan
Rev. 1.0	Updated report based on TCB reviewer's comments. 1) Supplement LTE Information summary per FCC KDB941225 D05 on page 7; 2) Supplement LTE specrum plots to demonstrate the tested RB allocations at the maximum output power on page 46; 3) Supplement the detail information of LTE test reduce judged by conduction power on page 42. 4) Add WiFi test reduce as note 3) on page 45.	2011-12-05	Lu Chaogan

1 General Information

1.1 Statement of Compliance

The maximum results of Specific Absorption Rate (SAR) found during testing for HUAWEI M920 are as below Table 1.

Band	Test Configuration	Test Mode	MAX Conducted Power (dBm)	Measured MAX SAR_{1g} (W/kg)
CDMA 800	Head (Voice& VoIP)	RC3 SO55	23.96	1.010
	Body-Worn (10mm)	RC3 SO32	24.21	**1.360**
CDMA 1700	Head (Voice& VoIP)	EVDORev.0	23.59	0.516
	Body-Worn (10mm)	RC3 SO32	23.49	**0.994**
CDMA 1900	Head (Voice& VoIP)	RC3 SO55	23.39	0.676
	Body(10mm)	RC3 SO32	23.82	**0.939**
LTE Band II	Head (VoIP)	QPSK	22.89	**1.330**
	Body-Worn(10mm)	QPSK	22.89	1.290
	Hotspot(10mm)	QPSK	22.89	1.290
LTE Band IV	Head (VoIP)	QPSK	22.32	**1.190**
	Body-Worn (10mm)	QPSK	22.13	1.030
	Hotspot(10mm)	QPSK	22.13	1.030
WiFi	Head (VoIP)	802.11 b	14.46	**0.171**
	Body-Worn (10mm)	802.11 b	14.46	0.025
	Hotspot(10mm)	802.11 b	14.46	0.030

Table 1: Summary of test result

The device is in compliance with Specific Absorption Rate（SAR）for general population/uncontraolled exposure limits of 1.6 W/Kg as averaged over any 1 g tissue according to the FCC rule §2.1093, the ANSI/IEEE C 95.1:1999, the NCRP Report Number 86 for uncontrolled environment, according to the Health Canada's Safety Code 6 and the Industry Canada Radio Standards Specification RSS-102 for General Population/Uncontrolled exposure, and had been tested in accordance with the measurement methods and procedures specified in IEEE 1528-2003 and FCC OET Bulletin 65 Supplement.

1.2 RF exposure limits

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

Table 2: RF exposure limits

The limit applied in this test report is shown in **bold** letters

Notes:

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

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

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

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

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

1.3 EUT Description

<table>
<tr><th colspan="4">Device Information:</th></tr>
<tr><td>DUT Name:</td><td colspan="3">LTE/CDMA 1X/EVDO Mobile Phone with Bluetooth</td></tr>
<tr><td>Type Identification:</td><td colspan="3">M920</td></tr>
<tr><td>FCC ID :</td><td colspan="3">QISM920</td></tr>
<tr><td>MEID No:</td><td colspan="3">B7PIEB1191400041</td></tr>
<tr><td>Device Type :</td><td colspan="3">portable device</td></tr>
<tr><td>Exposure Category:</td><td colspan="3">uncontrolled environment / general population</td></tr>
<tr><td>Hardware Version :</td><td colspan="3">Ver.A</td></tr>
<tr><td>Software Version :</td><td colspan="3">M920V100R001C177B202SP08</td></tr>
<tr><td>Antenna Type :</td><td colspan="3">Refer to table 4.</td></tr>
<tr><td>Battery Options :</td><td colspan="3">Huawei Technologies Co., Ltd.
Rechargeable Li-ion
Battery Model: HB5F1H;
Rated capacity: 1880mAh;
Nominal Voltage: ⎓ +3.7V;
Charging Voltage: ⎓ +4.2V.</td></tr>
<tr><td>Others Accessories</td><td colspan="3">Headset</td></tr>
<tr><th colspan="4">Device Operating Configurations:</th></tr>
<tr><td>Supporting Mode(s)</td><td colspan="3">CDMA 800,CDMA 1700,CDMA1900,LTE Band II,
LTE Band IV,WiFi（Tested）; Bluetooth</td></tr>
<tr><td>Test Modulation</td><td colspan="3">QPSK,16QAM</td></tr>
<tr><td rowspan="8">Operating Frequency Range(s)</td><td>Band</td><td>Tx (MHz)</td><td>Rx (MHz)</td></tr>
<tr><td>CDMA 800</td><td>824~849</td><td>869 ~894</td></tr>
<tr><td>CDMA1700</td><td>1710~1755</td><td>2110~2155</td></tr>
<tr><td>CDMA1900</td><td>1850~1910</td><td>1930~1990</td></tr>
<tr><td>LTE Band II</td><td>1850~1910</td><td>1930~1990</td></tr>
<tr><td>LTE Band IV</td><td>1710~1755</td><td>2110~2155</td></tr>
<tr><td>Bluetooth</td><td>2400-2483.5</td><td>2400-2483.5</td></tr>
<tr><td>WiFi</td><td>2400-2483.5</td><td>2400-2483.5</td></tr>
<tr><td rowspan="5">Power Class :</td><td colspan="3">Tested with power control all up (CDMA800)</td></tr>
<tr><td colspan="3">Tested with power control all up (CDMA1700)</td></tr>
<tr><td colspan="3">Tested with power control all up (CDMA1900)</td></tr>
<tr><td colspan="3">3, tested with power control all Max.(LTE Band II)</td></tr>
<tr><td colspan="3">3, tested with power control all Max.(LTE Band IV)</td></tr>
<tr><td rowspan="11">Test Channels (low-mid-high) :</td><td colspan="3">1013-384-777 (CDMA 800)</td></tr>
<tr><td colspan="3">25-450-850 (CDMA 1700)</td></tr>
<tr><td colspan="3">25-600-1175 (CDMA 1900)</td></tr>
<tr><td colspan="3">18607-18900-19193(LTE Band II BW=1.4MHz)</td></tr>
<tr><td colspan="3">18615-18900-19185(LTE Band II BW=3MHz)</td></tr>
<tr><td colspan="3">18625-18900-19175(LTE Band II BW=5MHz)</td></tr>
<tr><td colspan="3">18650-18900-19150(LTE Band II BW=10MHz)</td></tr>
<tr><td colspan="3">19957-20175-20393(LTE Band IV BW=1.4MHz)</td></tr>
<tr><td colspan="3">19965-20175-20385(LTE Band IV BW=3MHz)</td></tr>
<tr><td colspan="3">19975-20175-20375(LTE Band IV BW=5MHz)</td></tr>
<tr><td colspan="3">20000-20175-20350(LTE Band IV BW=10MHz)</td></tr>
</table>

Table 3: Device information and operating configuration

1.3.1 General Description

LTE/CDMA 1X/EVDO Mobile Phone with Bluetooth HUAWEI M920 is subscriber equipment in the LTE/CDMA system. The LTE frequency band is Band II and Band IV. The CDMA frequency band includes US Cellular, PCS, AWS, all bands test data included in this report. The Mobile Phone implements such functions as RF signal receiving/transmitting, LTE/CDMA protocol processing, voice, video, MMS service, GPS, AGPS and WIFI etc. Externally it provides micro SD card interface, earphone port (to provide voice service). It also provides Bluetooth module to synchronize data between a PC and the phone, or to use the built-in modem of the phone to access the Internet with a PC, or to exchange data with other Bluetooth devices.

Antenna Type	Function	Antenna Location
CDMA antenna	Transmit and receive signal from base staion	
CDMA DIV antenna	Only receive signal from base staion	
LTE antenna	Transmit and receive signal from base staion	
LTE MIMO antenna	Only receive signal from base staion.	
BT/WIFI antenna	BT transmit and receive signal from Other UE WIFI transmit and receive signal from AP	
GPS antenna	Only receive GPS signal from satellite.	

Table 4: Antenna Type

1.3.2 LTE information Summary

Items	Device Operating Configurations for LTE	Remark
1	Frequency Range of each LTE transmission band	Refer to table 3，Page 6
2	Channel Bandwidths	1.4MHz, 3MHz, 5MHz,10MHz BW
3	H,M,L channel numbers and frequencies	Refer to table 3，Page 6
4a	UE Category	3
4b	Modulations Supported in UL	QPSK, 16QAM
5	Description of LTE Tx and Ant. Implementation	Refer to table 4，Page 7
6	LTE Voice available	No,but VoIP via apps possible
	Hotspot with LTE＋WIFI	Yes
7	LTE MPR Permanently implement per 3GPP TS36.101 section 6.2.3~6.2.5?(manufacturer attestation to be provided)	Yes
8	Conducted power table provided for 1RB(Low and high offset),50%RB(centered),100%RB	Yes
9~10	Non-LTE operating Modes and Band	Refer to table 3，Section 1.3
11	Simultaneous Tx Conditions	Refer to Section 7.4.2
12	Power Reduction used for SAR Compliance	No
13~15	Supporting descriptions for power reduction	No

Table 5: LTE information Summary per FCC KDB 941225 D05

1.4 Test specification(s)

IEEE Std C95.1 – 1999	IEEE Standard for Safety Levels with Respect to Human Exposure to Radio Frequency Electromagnetic Fields, 3 kHz – 300 GHz.
IEEE 1528-2003	Recommended Practice for Determining the Peak Spatial-Average Specific Absorption Rate (SAR) in the Human Head from Wireless Communications Devices: Measurement Techniques
OET Bulletin No. 65, Supplement C– 2001	Evaluating Compliance with FCC Guidelines for Human Exposure to Radiofrequency Electromagnetic Fields---Additional Information for Evaluating Compliance of Mobile and Portable Devices with FCC Limits for Human Exposure to Radiofrequency Emissions
Canada's Safety Code 6	Limits of Human Exposure to Radiofrequency Electromagnetic Fields in the Frequency Range from 3 kHz to 300 GHz (99-EHD-237)
RSS-102	Radio Frequency Exposure Compliance of Radiocommunication Apparatus (All Frequency Bands (Issue 4 of March 2010)
KDB941225 D01	SAR test for 3G devices v02 ,Published on Nov 13 2009
KDB248227	SAR Measurement Procedures for 802.11 a，b，g Transmitters
KDB941225 D06	Hot Spot SAR v01
KDB941225 D05	SAR for LTE Devices v01
KDB648474 D01	SAR Handsets Multi Xmiter and Ant v01r05
LAB PBA	Tracking Number: 443841

1.5 Testing laboratory

Test Site	Reliability Laboratory of Huawei Technologies Co., Ltd.
Test Location	Huawei Base, Bantian, Longgang District, Shenzhen 518129, P.R. China
Telephone	+86-755-28785513
Fax	+86-755-36834474
State of accreditation	The Test laboratory (area of testing) is accredited according to ISO/IEC 17025. CNAS Registration number: L0310

1.6 Applicant and Manufacturer

Company Name	HUAWEI TECHNOLOGIES CO., LTD
Address	Huawei Base, Bantian, Longgang District, Shenzhen, P.R.China

1.7 Application details

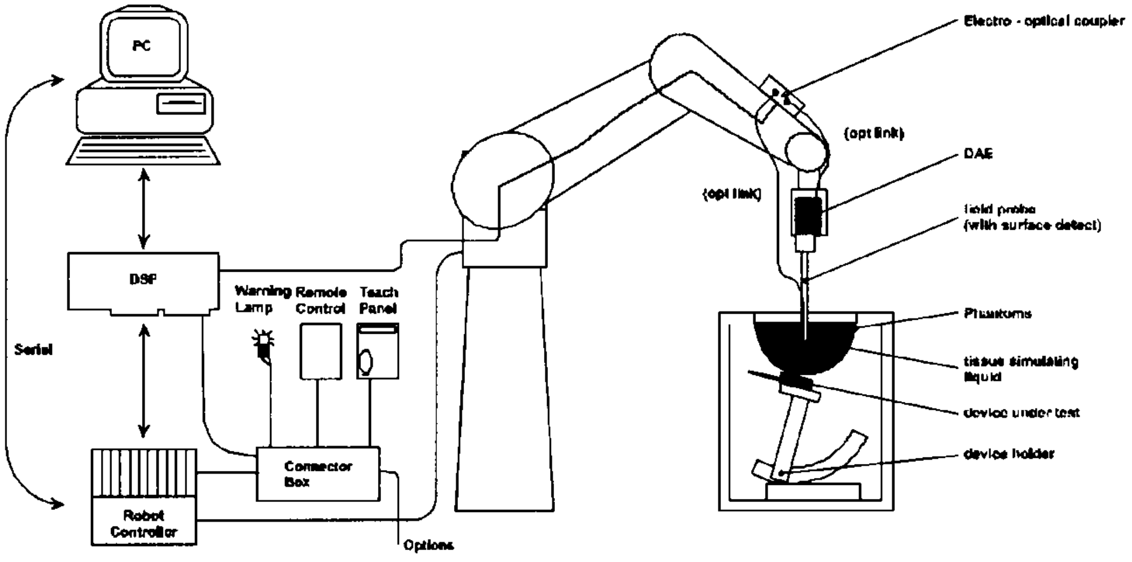
Start Date of test	2011-11-04
End Date of test	2011-11-22

1.8 Ambient Condition

Ambient temperature	20°C – 24°C
Relative Humidity	30% – 70%

2 SAR Measurement System

2.1 SAR Measurement Set-up



The DASY5 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 DASY5 measurement server.
- The DASY5 measurement server, which performs all real-time data evaluation for field measurements and surface detection, controls robot movements and handles safety operation. A computer operating Windows XP.
- DASY5 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.

2.2 Test environment

The DASY4 measurement system is placed at the head end of a room with dimensions:
5 x 2.5 x 3 m^3, the SAM phantom is placed in a distance of 75 cm from the side walls and 1.1m from the rear wall. Above the test system a 1.5 x 1.5 m^2 array of pyramid absorbers is installed to reduce reflections from the ceiling.
Picture 1 of the photo documentation shows a complete view of the test environment.
The system allows the measurement of SAR values larger than 0.005 mW/g.

2.3 Data Acquisition Electronics description

The data acquisition electronics (DAE) consist of a highly sensitive electrometer-grade preamplifier with auto-zeroing, a channel and gain-switching multiplexer, a fast 16 bit AD-converte and a command decoder with a control logic unit. Transmission to the measurement server is accomplished through an optical downlink for data and status information, as well as an optical uplink for commands and the clock.

The mechanical probe mounting device includes two different sensor systems for frontal and sideways probe contacts. They are used for mechanical surface detection and probe collision detection.

DAE4

Input Impedance	200MOhm
The Inputs	symmetrical and floating
Common mode rejection	above 80 dB

2.4 Probe description

These probes are specially designed and calibrated for use in liquids with high permittivities. They should not be used in air, since the spherical isotropy in air is poor (±2 dB). The dosimetric probes have special calibrations in various liquids at different frequencies.

Isotropic E-Field Probe ES3DV3 for Dosimetric Measurements

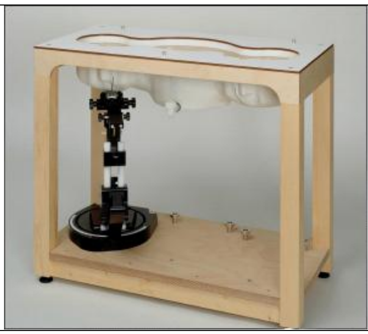
Construction	Symmetrical design with triangular core Interleaved sensors Built-in shielding against static charges PEEK enclosure material (resistant to organic solvents, e.g., DGBE)
Calibration	ISO/IEC 17025 calibration service available.
Frequency	10 MHz to 4 GHz; Linearity: ± 0.2 dB (30 MHz to 4 GHz)
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: 330 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

Isotropic E-Field Probe EX3DV4 for Dosimetric Measurements

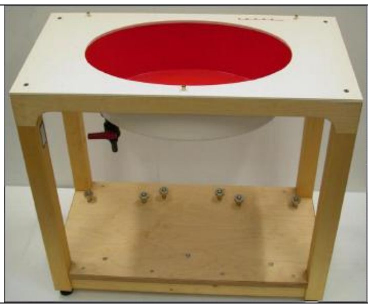
Construction	Symmetrical design with triangular core Built-in optical fiber for surface detection system Built-in shielding against static charges PEEK enclosure material (resistant to organic solvents, e.g., glycolether)
Calibration	In air from 10 MHz to 2.5 GHz In head tissue simulating liquid (HSL) at 900 (800-1000) MHz and 1.8 GHz (1700-1910 MHz) (accuracy ± 11%; k=2) Calibration for other liquids and frequencies upon request
Frequency	10 MHz to 3 GHz (dosimetry); Linearity: ± 0.2 dB (30 MHz to 3 GHz)
Directivity	± 0.2 dB in HSL (rotation around probe axis) ± 0.4 dB in HSL (rotation normal to probe axis)
Dynamic range	5 µW/g to > 100 mW/g; Linearity: ± 0.2 dB
Optical Surface Detection	± 0.2 mm repeatability in air and clear liquids over diffuse reflecting surfaces (EX3DV4 only)
Dimensions	Overall length: 337 mm Tip length: 9 mm Body diameter: 10 mm Tip diameter:2.5 mm Distance from probe tip to dipole centers: 1.0 mm
Application	General dosimetry up to 3 GHz Compliance tests of mobile phones Fast automatic scanning in arbitrary phantoms (EX3DV4)

2.5 Phantom description

SAM Twin Phantom

Shell Thickness	2mm +/- 0.2 mm; The ear region: 6mm	
Filling Volume	Approximately 30 liters	
Dimensions	Length:1000mm; Width:500mm; Height: adjustable feet	
Measurement Areas	Left hand Right hand Flat phantom	
The bottom plate contains three pairs of bolts for locking the device holder. The device holder positions are adjusted to the standard measurement positions in the three sections. A white cover is provided to cover the phantom during off-periods to prevent water evaporation and changes in the liquid parameters. Free space scans of devices on top of this phantom cover are possible. Three reference marks are provided on the phantom counter. These reference marks are used to teach the absolute phantom position relative to the robot.		

ELI4 Phantom

Shell Thickness	2mm +/- 0.2 mm	
Filling Volume	Approximately 30 liters	
Dimensions	Length:1000mm; Width:500mm; Height: adjustable feet	
Measurement Areas	Flat phantom	
The ELI4 phantom is intended for compliance testing of handheld and body-mounted wireless devices in the frequency range of 30MHz to 6GHz. ELI4 is fully compatible with the latest draft of the standard IEC 62209-2 and all known tissue simulating liquids.		

2.6 Device holder description

The DASY5 device holder has two scales for device rotation (with respect to the body axis) and the device inclination (with respect to the line between the ear openings). The plane between the ear openings and the mouth tip has a rotation angle of 65°. The bottom plate contains three pair of bolts for locking the device holder. The device holder positions are adjusted to the standard measurement positions in the three sections. This device holder is used for standard mobile phones or PDA's only. If necessary an additional support of polystyrene material is used.

Larger DUT's (e.g. notebooks) cannot be tested using this device holder. Instead a support of bigger polystyrene cubes and thin polystyrene plates is used to position the DUT in all relevant positions to find and measure spots with maximum SAR values.
Therefore those devices are normally only tested at the flat part of the SAM.

2.7 Test Equipment List

This table gives a complete overview of the SAR measurement equipment
Devices used during the test described are marked ☒

	Manufacturer	Device	Type	Serial number	Date of last calibration)*
☒	SPEAG	Dosimetric E-Field Probe	EX3DV4	3753	2010-12-13
☐	SPEAG	750 MHz Validation Dipole	D750V3	1044	2011-09-16
☒	SPEAG	835 MHz Validation Dipole	D835V2	4d092	2011-06-22
☒	SPEAG	1800 MHz Validation Dipole	D1800V2	2d184	2011-03-08
☒	SPEAG	1900 MHz Validation Dipole	D1900V2	5d143	2011-09-26
☒	SPEAG	2450 MHz Validation Dipole	D2450V2	860	2011-03-08
☒	SPEAG	Data acquisition electronics	DAE4	1291	2011-10-10
☒	SPEAG	Software	DASY 5	N/A	N/A
☒	SPEAG	Twin Phantom	SAM1	TP-1475	N/A
☒	SPEAG	Twin Phantom	SAM2	TP-1474	N/A
☐	SPEAG	Twin Phantom	SAM3	TP-1597	N/A
☐	SPEAG	Twin Phantom	SAM4	TP-1620	N/A
☐	SPEAG	Flat Phantom	ELI 4.0	TP-1038	N/A
☐	SPEAG	Flat Phantom	ELI 4.0	TP-1111	N/A
☒	R & S	WideBand Radio Communication Tester	CMW 500	112936	2011-08-17
☒	R & S	Universal Radio Communication Tester	CMU 200	113989	2011-06-02
☒	Agilent)*	Network Analyser	E5071B	MY42404956	2011-02-22
☒	Agilent	Dielectric Probe Kit	85070E	2484	N/A
☒	Agilent	Signal Generator	N5181A	MY47420989	2011-02-22
☒	MINI-CIRCUITS	Amplifier	ZHL-42W	QA0746001	N/A
☒	Agilent	Power Meter	E4417A	MY45101339	2011-02-22
☒	Agilent	Power Meter Sensor	E9321A	MY44420359	2011-02-22

Note: The calibration interval of validation dipoles is 3 years.

1) Per KDB 450824 D02 requirements for dipole calibration, Huawei SAR lab has adopted three years calibration interval. But each measured dipole is expected to evaluate with the following criteria at least on annual interval.
a) There is no physical damage on the dipole;
b) System validation with specific dipole is within 10% of calibrated value;
c) Return-loss is within 10% of calibrated measurement;
d) Impedance is within 5Ω from the previous measurement.

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

3 SAR Measurement Procedure

3.1 Scanning procedure

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

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

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

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

- A „7x7x7 zoom scan” measures the field in a volume around the 2D peak SAR value acquired in the previous „coarse“ scan. This is a fine 7x7 grid where the robot additionally moves the probe in 7 steps along the z-axis away from the bottom of the Phantom. Grid spacing for the cube measurement is 5 mm in x and y-direction and 5 mm in z-direction. DASY5 is also able to perform repeated zoom scans if more than 1 peak is found during area scan. In this document, the evaluated peak 1g and 10g averaged SAR values are shown in the 2D-graphics in annex 2. Test results relevant for the specified standard (see chapter 1.6.) are shown in table form in chapter 2.5.

- 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 2mm steps. This measurement shows the continuity of the liquid and can - depending in the field strength – also show the liquid depth. A z-axis scan of the measurement with maximum SAR value is shown in annex 2.

3.2 Spatial Peak SAR Evaluation

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

- The data between the dipole center of the probe and the surface of the phantom are extrapolated. This data cannot be measured since the center of the dipole is 2.7 mm away from the tip of the probe and the distance between the surface and the lowest measuring point is about 1 mm (see probe calibration sheet). The extrapolated data from a cube measurement can be visualized by selecting 'Graph Evaluated'.

- The maximum interpolated value is searched with a straight-forward algorithm. Around this maximum the SAR - values averaged over the spatial volumes (1g or 10 g) are computed using the 3d-spline interpolation algorithm. If the volume cannot be evaluated (i.e., if a part of the grid was cut off by the boundary of the measurement area) the evaluation will be started on the corners of the bottom plane of the cube.

- All neighboring volumes are evaluated until no neighboring volume with a higher average value is found.

Extrapolation

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

Interpolation

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

Volume Averaging

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

Advanced Extrapolation

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

3.3 Data Storage and Evaluation

Data Storage

The DASY5 software stores the acquired data from the data acquisition electronics as raw data (in microvolt readings from the probe sensors), together with all necessary software parameters for the data evaluation (probe calibration data, liquid parameters and device frequency and modulation data) in measurement files with the extension ".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 by SEMCAD

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

Probe parameters:	- Sensitivity	$Norm_i$, a_{i0}, a_{i1}, a_{i2}
	- Conversion factor	$ConvF_i$
	- 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 DASY5 components. In the direct measuring mode of the multimeter option, the parameters of the actual system setup are used. In the scan visualization and export modes, the parameters stored in the corresponding document files are used.

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

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

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

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

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

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

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

with V_i = compensated signal of channel i (i = x, y, z)
$Norm_i$ = sensor sensitivity of channel i (i = x, y, z)
[mV/(V/m)^2] for E-field Probes
ConvF = sensitivity enhancement in solution
a_{ij} = sensor sensitivity factors for H-field probes
f = carrier frequency [GHz]
E_i = electric field strength of channel i in V/m
H_i = magnetic field strength of channel i in A/m

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

$$E_{tot} = (E_x^2 + E_Y^2 + E_z^2)^{1/2}$$

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

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

with SAR = local specific absorption rate in mW/g
E_{tot} = total field strength in V/m
σ = conductivity in [mho/m] or [Siemens/m]
ρ = equivalent tissue density in g/cm^3

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

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

with P_{pwe} = equivalent power density of a plane wave in mW/cm^2
E_{tot} = total electric field strength in V/m
H_{tot} = total magnetic field strength in A/m

4 System Verification Procedure

4.1 Tissue Verification

The simulating liquids should be checked at the beginning of a series of SAR measurements to determine of the dielectic parameter are within the tolerances of the specified target values. The measured conductivity and relative permittivity should be within ± 5% of the target values.

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

Ingredients (% of weight)	Head Tissue					
Frequency Band (MHz)	750	**835**	900	**1800**	**1900**	**2450**
Water	39.2	41.45	40.92	52.64	55.242	62.7
Salt (NaCl)	2.7	1.45	1.48	0.36	0.306	0.5
Sugar	57.0	56.0	56.5	0.0	0.0	0.0
HEC	0.0	1.0	1.0	0.0	0.0	0.0
Bactericide	0.0	0.1	0.1	0.0	0.0	0.0
Cellulose	1.0	0.0	0.0	0.0	0.0	0.0
DGBE	0.0	0.0	0.0	47.0	44.542	36.8
Preventol	0.1	0.0	0.0	0.0	0.0	0.0
Ingredients (% of weight)	Body Tissue					
Frequency Band (MHz)	750	**835**	900	**1800**	**1900**	**2450**
Water	50.3	52.4	56.0	69.91	69.91	73.2
Salt (NaCl)	1.6	1.40	0.76	0.13	0.13	0.04
Sugar	47	45.0	41.76	0.0	0.0	0.0
HEC	0.0	1.0	1.21	0.0	0.0	0.0
Bactericide	0.0	0.1	0.27	0.0	0.0	0.0
Cellulose	1.0	0.0	0.0	0.0	0.0	0.0
DGBE	0.0	0.0	0.0	29.96	29.96	26.7
Preventol	0.1	0.0	0.0	0.0	0.0	0.0

Table 6: Tissue Dielectric Properties

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

Tissue Type	Measured Frequency （MHz）	Target Tissue		Measured Tissue		Liquid Temp.	Test Date
		εr (+/-5%)	σ (S/m) (+/-5%)	εr	σ (S/m)		
835H	825	41.6 (39.52~43.68)	0.90 (0.86~0.95)	41.42	0.878	21.5°C	Nov.4, 2011
	835	41.5 (39.43~43.58)	0.90 (0.86~0.95)	40.95	0.884	21.5°C	
	850	41.5 (39.43~43.58)	0.92 (0.87~0.96)	41.04	0.904	21.5°C	
835B	825	55.2 (52.44~57.96)	0.97 (0.92~1.02)	54.34	0.923	21.5°C	Nov.6, 2011
	835	55.2 (52.44~57.96)	0.97 (0.92~1.02)	54.34	0.928	21.5°C	
	850	55.2 (52.44~57.96)	0.99 (0.94~1.04)	54.05	0.951	21.5°C	
1800H	1710	40.1 (38.10~42.10)	1.35 (1.28~1.42)	39.42	1.348	21.5°C	Nov.6, 2011
	1730	40.1 (38.10~42.10)	1.36 (1.29~1.43)	39.36	1.366	21.5°C	
	1750	40.1 (38.10~42.10)	1.37 (1.31~1.43)	39.29	1.384	21.5°C	

	1800	40.0 (38.00~42.00)	1.40 (1.33~1.47)	39.12	1.428	21.5°C	
1800B	1710	53.5 (50.83~56.18)	1.46 (1.39~1.53)	51.65	1.421	21.5°C	Nov.5, 2011
	1730	53.5 (50.83~56.18)	1.48 (1.41~1.55)	51.60	1.441	21.5°C	
	1750	53.4 (50.73~56.07)	1.49 (1.42~1.56)	51.54	1.461	21.5°C	
	1800	53.3 (50.64~55.97)	1.52 (1.44~1.60)	51.44	1.510	21.5°C	
1800H	1710	40.1 (38.10~42.10)	1.35 (1.28~1.42)	38.64	1.335	21.5°C	Nov.21, 2011
	1730	40.1 (38.10~42.10)	1.36 (1.29~1.43)	38.65	1.350	21.5°C	
	1750	40.1 (38.10~42.10)	1.37 (1.31~1.43)	38.50	1.352	21.5°C	
	1800	40.0 (38.00~42.00)	1.40 (1.33~1.47)	38.27	1.440	21.5°C	
1800B	1710	53.5 (50.83~56.18)	1.46 (1.39~1.53)	53.31	1.502	21.5°C	Nov.21, 2011
	1730	53.5 (50.83~56.18)	1.48 (1.41~1.55)	53.07	1.509	21.5°C	
	1750	53.4 (50.73~56.07)	1.49 (1.42~1.56)	52.94	1.528	21.5°C	
	1800	53.3 (50.64~55.97)	1.52 (1.44~1.60)	52.87	1.565	21.5°C	
1900H	1850	40.0 (38.00~42.00)	1.40 (1.33~1.47)	39.57	1.406	21.5°C	Nov.5, 2011
	1880	40.0 (38.00~42.00)	1.40 (1.33~1.47)	39.57	1.433	21.5°C	
	1910	40.0 (38.00~42.00)	1.40 (1.33~1.47)	39.48	1.467	21.5°C	
	1900	40.0 (38.00~42.00)	1.40 (1.33~1.47)	39.53	1.462	21.5°C	
1900B	1850	53.3 (50.64~55.97)	1.52 (1.44~1.60)	51.54	1.544	21.5°C	Nov.5, 2011
	1880	53.3 (50.64~55.97)	1.52 (1.44~1.60)	51.47	1.573	21.5°C	
	1900	53.3 (50.64~55.97)	1.52 (1.44~1.60)	51.43	1.595	21.5°C	
	1910	53.3 (50.64~55.97)	1.52 (1.44~1.60)	51.44	1.594	21.5°C	
1900H	1850	40.0 (38.00~42.00)	1.40 (1.33~1.47)	40.52	1.377	21.5°C	Nov.18, 2011
	1880	40.0 (38.00~42.00)	1.40 (1.33~1.47)	40.42	1.405	21.5°C	
	1910	40.0 (38.00~42.00)	1.40 (1.33~1.47)	40.35	1.437	21.5°C	
	1900	40.0 (38.00~42.00)	1.40 (1.33~1.47)	40.38	1.428	21.5°C	
1900B	1850	53.3 (50.64~55.97)	1.52 (1.44~1.60)	51.63	1.523	21.5°C	Nov.19, 2011
	1880	53.3 (50.64~55.97)	1.52 (1.44~1.60)	51.58	1.555	21.5°C	

	1900	53.3 (50.64~55.97)	1.52 (1.44~1.60)	51.53	1.588	21.5°C	
	1910	53.3 (50.64~55.97)	1.52 (1.44~1.60)	51.54	1.577	21.5°C	
2450H	2410	39.3 (37.34~41.26)	1.76 (1.67~1.85)	39.30	1.747	21.5°C	Nov.7, 2011
	2435	39.2 (37.24~41.16)	1.79 (1.70~1.88)	39.09	1.779	21.5°C	
	2460	39.2 (37.24~41.16)	1.81 (1.72~1.90)	39.05	1.807	21.5°C	
	2450	39.2 (37.24~41.16)	1.80 (1.71~1.89)	39.00	1.808	21.5°C	
2450B	2410	52.8 (50.16~55.44)	1.91 (1.81~2.00)	50.91	1.952	21.5°C	Nov.7, 2011
	2435	52.7 (50.07~55.34)	1.94 (1.84~2.04)	50.77	1.974	21.5°C	
	2460	52.7 (50.07~55.34)	1.96 (1.86~2.06)	50.75	2.015	21.5°C	
	2450	52.7 (50.07~55.34)	1.95 (1.85~2.05)	50.76	1.994	21.5°C	
ε_r= Relative permittivity, σ= Conductivity							

Table 7: Measured Tissue Parameter

Note:

1）The dielectric parameters of the tissue-equivalent liquid should be measured under similar ambient conditions and within 2 °C of the conditions expected during the SAR evaluation to satisfy protocol requirements.

2） KDB 450824 was ensured to be applied for probe calibration frequencies greater than or equal to 50MHz of the EUT frequencies.

3）The above measured tissue parameters were used in the DASY software to perform interpolation via the DASY software to determine actual dielectric parameters at the test frequencies. The SAR test plots may slightly differ from the table above since the DASY rounds to three significant digits.

4）For LTE and CDMA measurements in AWS band, and for 1800 MHz system verification the same TSL and 1750 MHz SAR probe calibration point have been used.

4.2 System Check

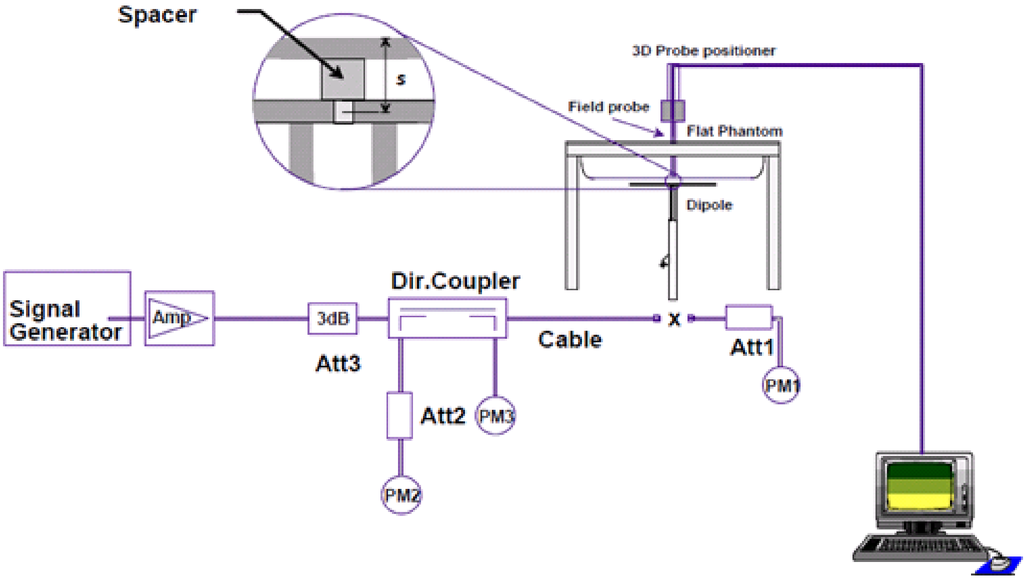
The system check is performed for verifying the accuracy of the complete measurement system and performance of the software. The system validation is performed with tissue equivalent material according to IEEE P1528 (described above). The following table shows validation results for all frequency bands and tissue liquids used during the tests (Graphic Plot(s) see Appendix A).

System Check	Target SAR (1W) (+/-10%)		Measured SAR (Normalized to 1W)		Liquid Temp.	Test Date
	1-g (mW/g)	10-g (mW/g)	1-g (mW/g)	10-g (mW/g)		
D835V2 Head	9.53 (8.56~10.48)	6.22 (5.60~6.84)	9.76	6.36	21.5°C	Nov.4,2011
D1800V2 Head	38.28 (34.44~42.12)	20.12 (18.12~22.2)	38.20	19.52	21.5°C	Nov.6,2011
D1800V2 Head	38.28 (34.44~42.12)	20.12 (18.12~22.2)	36.88	18.88	21.5°C	Nov.21,2011
D1900V2 Head	40.60 (36.54~44.66)	21.20 (19.08~23.32)	39.44	20.16	21.5°C	Nov.5,2011
D1900V2 Head	40.60 (36.54~44.66)	21.20 (19.08~23.32)	38.28	19.68	21.5°C	Nov.18,2011
D2450V2 Head	52.8 (47.52~58.08)	24.76 (22.28~27.24)	56.40	25.64	21.5°C	Nov.7,2011
D835V2 Body	9.65 (8.69~10.61)	6.38 (5.74~7.01)	10.16	6.64	21.5°C	Nov.6,2011
D1800V2 Body	37.96 (34.16~41.76)	20.08 (18.08~22.08)	39.48	20.44	21.5°C	Nov.5,2011
D1800V2 Body	37.96 (34.16~41.76)	20.08 (18.08~22.08)	37.08	19.12	21.5°C	Nov.21,2011
D1900V2 Body	41.40 (37.26~45.54)	21.80 (19.62~23.98)	42.00	21.28	21.5°C	Nov.5,2011
D1900V2 Body	41.40 (37.26~45.54)	21.80 (19.62~23.98)	40.80	20.20	21.5°C	Nov.19,2011
D2450V2 Body	52.8 (47.52~58.08)	24.52 (22.08~26.96)	55.20	25.12	21.5°C	Nov.7,2011

Table 8: System Check Results

4.3 Validation Procedure

The validation is performed by using a validation dipole which is positioned parallel to the planar part of the SAM phantom at the reference point. The distance of the dipole to the SAM phantom is determined by a plexiglass spacer. The dipole is connected to the signal source consisting of signal generator and amplifier via a directional coupler, N-connector cable and adaption to SMA. It is fed with a power of 250 mW. To adjust this power a power meter is used. The power sensor is connected to the cable before the validation to measure the power at this point and do adjustments at the signal generator. At the outputs of the directional coupler both return loss as well as forward power are controlled during the validation to make sure that emitted power at the dipole is kept constant. This can also be checked by the power drift measurement after the test (result on plot).
Validation results have to be equal or near the values determined during dipole calibration (target SAR in table above) with the relevant liquids and test system.



5 Measurement Uncertainty Evaluation

5.1 Measurement uncertainty evaluation for SAR test

The overall combined measurement uncertainty of the measurement system is ± 10.9% (K=1).
The expanded uncertainty (k=2) is assessed to be ± 21.9%
This measurement uncertainty budget is suggested by IEEE P1528 and determined by Schmid & Partner Engineering AG. The breakdown of the individual uncertainties is as follows:

Error Sources	Uncertainty Value	Probability Distribution	Divisor	c_i 1g	c_i 10g	Standard Uncertainty 1g	Standard Uncertainty 10g	v_i^2 or v_{eff}
Measurement System								
Probe calibration	± 6.0%	Normal	1	1	1	± 6.0%	± 6.0%	∞
Axial isotropy	± 4.7%	Rectangular	√3	0.7	0.7	± 1.9%	± 1.9%	∞
Hemispherical isotropy	± 9.6%	Rectangular	√3	0.7	0.7	± 3.9%	± 3.9%	∞
Spatial resolution	± 0.0%	Rectangular	√3	1	1	± 0.0%	± 0.0%	∞
Boundary effects	± 1.0%	Rectangular	√3	1	1	± 0.6%	± 0.6%	∞
Probe linearity	± 4.7%	Rectangular	√3	1	1	± 2.7%	± 2.7%	∞
System detection limits	± 1.0%	Rectangular	√3	1	1	± 0.6%	± 0.6%	∞
Readout electronics	± 0.3%	Normal	1	1	1	± 0.3%	± 0.3%	∞
Response time	± 0.8%	Rectangular	√3	1	1	± 0.5%	± 0.5%	∞
Integration time	± 2.6%	Rectangular	√3	1	1	± 1.5%	± 1.5%	∞
RF ambient conditions	± 3.0%	Rectangular	√3	1	1	± 1.7%	± 1.7%	∞
Probe positioner	± 0.4%	Rectangular	√3	1	1	± 0.2%	± 0.2%	∞
Probe positioning	± 2.9%	Rectangular	√3	1	1	± 1.7%	± 1.7%	∞
Max. SAR evaluation	± 1.0%	Rectangular	√3	1	1	± 0.6%	± 0.6%	∞
Test Sample Related								
Device positioning	± 2.9%	Normal	1	1	1	± 2.9%	± 2.9%	145
Device holder uncertainty	± 3.6%	Normal	1	1	1	± 3.6%	± 3.6%	5
Power drift	± 5.0%	Rectangular	√3	1	1	± 2.9%	± 2.9%	∞
Phantom and Set-up								
Phantom uncertainty	± 4.0%	Rectangular	√3	1	1	± 2.3%	± 2.3%	∞
Liquid conductivity (target)	± 5.0%	Rectangular	√3	0.64	0.43	± 1.8%	± 1.2%	∞
Liquid conductivity (meas.)	± 2.5%	Normal	1	0.64	0.43	± 1.6%	± 1.1%	∞
Liquid permittivity (target)	± 5.0%	Rectangular	√3	0.6	0.49	± 1.7%	± 1.4%	∞
Liquid permittivity (meas.)	± 2.5%	Normal	1	0.6	0.49	± 1.5%	± 1.2%	∞
Combined Uncertainty						± 10.9%	± 10.7%	387
Expanded Std. Uncertainty						**± 21.9%**	**± 21.4%**	

Table 9:Measurement uncertainties

5.2 Measurement uncertainty evaluation for system validation

The overall combined measurement uncertainty of the measurement system is ± 9.5% (K=1).
The expanded uncertainty (k=2) is assessed to be ± 18.9%
This measurement uncertainty budget is suggested by IEEE P1528 and determined by Schmid & Partner Engineering AG. The breakdown of the individual uncertainties is as follows:

Error Sources	Uncertainty Value	Probability Distribution	Divi-sor	c_i 1g	c_i 10g	Standard Uncertainty 1g	Standard Uncertainty10g	v_i^2 or v_{eff}
Measurement System								
Probe calibration	± 6.0%	Normal	1	1	1	± 6.0%	± 6.0%	∞
Axial isotropy	± 4.7%	Rectangular	√3	1	1	± 2.7%	± 2.7%	∞
Hemispherical isotropy	± 9.6%	Rectangular	√3	0.7	0.7	± 0.0%	± 0.0%	∞
Boundary effects	± 1.0%	Rectangular	√3	1	1	± 0.6%	± 0.6%	∞
Probe linearity	± 4.7%	Rectangular	√3	1	1	± 2.7%	± 2.7%	∞
System detection limits	± 1.0%	Rectangular	√3	1	1	± 0.6%	± 0.6%	∞
Readout electronics	± 0.3%	Normal	1	1	1	± 0.3%	± 0.3%	∞
Response time	± 0.0%	Rectangular	√3	1	1	± 0.0%	± 0.0%	∞
Integration time	± 0.0%	Rectangular	√3	1	1	± 0.0%	± 0.0%	∞
RF ambient conditions	± 1.0%	Rectangular	√3	1	1	± 0.6%	± 0.6%	∞
Probe positioner	± 0.4%	Rectangular	√3	1	1	± 0.2%	± 0.2%	∞
Probe positioning	± 2.9%	Rectangular	√3	1	1	± 1.7%	± 1.7%	∞
Max. SAR evaluation	± 1.0%	Rectangular	√3	1	1	± 0.6%	± 0.6%	∞
Dipole								
Deviation of experimental dipole	± 5.5%	Rectangular	√3	1	1	± 3.2%	± 3.2%	∞
Dipole axis to liquid distance	± 2.0%	Rectangular	1	1	1	± 1.2%	± 1.2%	∞
Power drift	± 4.7%	Rectangular	√3	1	1	± 2.7%	± 2.7%	∞
Phantom and Set-up								
Phantom uncertainty	± 4.0%	Rectangular	√3	1	1	± 2.3%	± 2.3%	∞
Liquid conductivity (target)	± 5.0%	Rectangular	√3	0.64	0.43	± 1.8%	± 1.2%	∞
Liquid conductivity (meas.)	± 2.5%	Normal	1	0.64	0.43	± 1.6%	± 1.1%	∞
Liquid permittivity (target)	± 5.0%	Rectangular	√3	0.6	0.49	± 1.7%	± 1.4%	∞
Liquid permittivity (meas.)	± 2.5%	Normal	1	0.6	0.49	± 1.5%	± 1.2%	∞
Combined Uncertainty						**± 9.5%**	**± 9.2%**	
Expanded Std. Uncertainty						**± 18.9%**	**± 18.4%**	

Table 10: Measurement uncertainties

6 SAR Test Configuration

6.1 CDMA Test Configuration

6.1.1 CDMA 1x Devices

For SAR test, the maximum power output is very important and essential; it is identical under the measurement uncertainty. It is proper to use typical Test Mode 3(FW RC3, RVS RC3, SO55) as the worst case for SAR test.

Test Parameter setup for maximum RF output power according to section 4.4.5 of 3GPP2;

Parameter	Units	Value
I or	dBm/1.23MHz	-104
PilotE c/I or	dB	-7
TrafficE c /I or	dB	-7.4

SAR for head exposure configurations is measured in RC3 with the DUT configured to transmit at full rate using Loopback Service Option SO55. SAR for RC1 is not required when the maximum average output of each channel is less than ¼ dB higher than that measured in RC3. Otherwise, SAR is measured on the maximum output channel in RC1 using the exposure configuration that results in the highest SAR for that channel in RC3.

SAR for body exposure configurations is measured in RC3 with the DUT configured using TDSO / SO32,to transmit at full rate on FCH with all other code channele disabled. SAR for multiple code channels (FCH + SCHn) is not required when the maximum average output of each RF channel is less than ¼ dB higher than that measured with FCH only. Otherwise, SAR is measured on the maximum output channel (FCH + SCHn) with FCH at full rate and SCH0 enabled at 9600 bps, using the exposure configuration that results in the highest SAR for that channel with FCH only. When multiple code channels are enabled, the DUT output may shift by more than 0.5 dB and lead to higher SAR drifts and SCH dropouts.

Body SAR in RC1 is not required when the maximum average output of each channel is less than ¼ dB higher than that measured in RC3. Otherwise, SAR is measured on the maximum output channel in RC1; with Loopback Service Option SO55, at full rate, using the body exposure configuration that results in the highest SAR for that channel in RC3.

Test communication setup meet as followings:

Communication standard between mobile station and base station simulator	3GPP2 C.S0011-B
Radio configuration	RC3(Supporting CDMA 1X)
Spreading Rate	SR1
Data Rate	9600bps
Service Options	SO55(Loopback service)
Service Options	SO32(Test Data service)
Multiplex Options	The mobile station does not support this service

6.1.2 CDMA Ev-Do Devices

For handsets with Ev-Do capabilities, when the maximum average output of each channel in Rev.0 is less than ¼ dB higher than that measured in RC3 (1x RTT), body SAR for Ev-Do is not required. Otherwise, SAR for Rev. 0 is measured on the maximum output channel at 153.6 kbps using the body exposure configuration that results in the highest SAR for that channel in RC3. SAR for Rev.A is not required when the maximum average output of each channel is less than that measured in Rev.0 or less than ¼ dB higher than that measured in RC3. Otherwise, SAR is measured on the maximum output channel for Rev.A using a Reverse Data Channel payload size of 4096 bits and a Termination Target of 16 slots defined for Subtype 2 Physical Layer configurations. A Forward Traffic Channel data rate corresponding to the 2-slot version of 307.2 kbps with the ACK Channel transmitting in all slots should be configured in the downlink for both Rev.0 and Rev.A.

6.2 LTE Test Configuration

SAR for LTE band exposure configurations is measured according to the Procedures of KDB941225 D05. The CMW500 WideBand Radio Communication Tester was used for LTE output power measurements and SAR testing. Closed loop power control was used so the UE transmits with maximum output power during SAR testing.

When MPR is implemented permanently within the UE, regardless of network requirements, only those RB configurations allowed (see 3GPP standards) for the channel bandwidth and modulation combinations may be tested with MPR. Configurations with RB allocations below the required RB thresholds must be tested without MPR. A-MPR must always be disabled.

LTE Band II / Band IV MPR as belows:

Modulation	Channel bandwidth / Transmission bandwidth configuration [RB]				MPR
	1.4 MHz	3 MHz	5 MHz	10 MHz	
QPSK	1	1	1	1	0
QPSK	≤ 5	≤ 4	≤ 8	≤ 12	0
QPSK	> 5	> 4	> 8	> 12	1
16 QAM	≤ 5	≤ 4	≤ 8	≤ 12	1
16 QAM	> 5	> 4	> 8	> 12	2

For each LTE frequency band, detail reduce test information is referred to section 7.2.4 to 7.2.6 and final test summary is as belows:

a. Per KDB941225 D05 page 4,3) A),QPSK with 50% RB is requied for the highest bandwide(10MHz).

b. Per KDB941225 D05 page 4,3) B),QPSK with 1 RB for both channel edges are requied for the highest bandwide(10MHz).

c. Per KDB941225 D05 page 4,4) A),16QAM with 50% RB is requied for the highest bandwide (10MHz).

d. Per KDB941225 D05 page 4,4) B),16QAM with 1 RB for both channel edges are requied for the highest bandwide(10MHz).

e. Per KDB941225 D05 page 4, 3) A) I and 4) A) I,100% RB allocation is not requied to be tested since SAR is not >1.45W/kg for the highest bandwide(10MHz).

f. Per KDB941225 D05 page 5,5) B), 5MHz/3MHz/1.4MHz BW is not requied to be tested since the max average conducted power is within ½ dB for 10MHzBW, and SAR of QPSK with 50% RB (10MHz) is < 1.45 W/kg.

Band II Head and Hotspot Body SAR

Bandwidth	Modulation Type	RB Size and Allocation	Test Channel	SAR Test
10MHz	QPSK	50% Centered	High Channel	Tested*
			Middle Channel	No Test*
			Low Channel	No Test*
		1RB Lower EDGE	High Channel	Tested
			Middle Channel	No Test
			Low Channel	No Test
		1RB Upper EDGE	High Channel	No Test
			Middle Channel	No Test
			Low Channel	Tested
	16QAM	50% Centered	High Channel	Tested
			Middle Channel	No Test
			Low Channel	No Test
		1RB Lower EDGE	High Channel	Tested
			Middle Channel	No Test
			Low Channel	No Test
		1RB Upper EDGE	High Channel	No Test
			Middle Channel	No Test
			Low Channel	Tested

*Please check SAR test result table of middle channel is <0.8W/kg, other channels are not required.

Band IV Head SAR

Bandwidth	Modulation Type	RB Size and Allocation	Test Channel	SAR Test
10MHz	QPSK	50% Centered	High Channel	No Test*
			Middle Channel	Tested*
			Low Channel	No Test*
		1RB Lower EDGE	High Channel	Tested
			Middle Channel	No Test
			Low Channel	No Test
		1RB Upper EDGE	High Channel	No Test
			Middle Channel	No Test
			Low Channel	Tested
	16QAM	50% Centered	High Channel	No Test
			Middle Channel	Tested
			Low Channel	No Test
		1RB Lower EDGE	High Channel	Tested
			Middle Channel	No Test
			Low Channel	No Test
		1RB Upper EDGE	High Channel	No Test
			Middle Channel	No Test
			Low Channel	Tested

*Please check SAR test result table of middle channel is <0.8W/kg, other channels are not required.

Band IV Hotspot Body SAR

Bandwidth	Modulation Type	RB Size and Allocation	Test Channel	SAR Test
10MHz	QPSK	50% Centered	High Channel	No Test*
			Middle Channel	Tested*
			Low Channel	No Test*
		1RB Lower EDGE	High Channel	Tested
			Middle Channel	No Test
			Low Channel	No Test
		1RB Upper EDGE	High Channel	No Test
			Middle Channel	No Test
			Low Channel	Tested
	16QAM	50% Centered	High Channel	No Test
			Middle Channel	No Test
			Low Channel	Tested
		1RB Lower EDGE	High Channel	Tested
			Middle Channel	No Test
			Low Channel	No Test
		1RB Upper EDGE	High Channel	No Test
			Middle Channel	No Test
			Low Channel	Tested

*Please check SAR test result table of middle channel is <0.8W/kg, other channels are not required.

6.3 WiFi Test Configuration

For the 802.11b/g SAR tests, a communication link is set up with the test mode software for WiFi mode test. The Absolute Radio Frequency Channel Number(ARFCN) is allocated to 1,6and 11 respectively in the case of 2450 MHz.During the test,at the each test frequency channel, theEUT is operated at the RF continuous emission mode.Each channel should be tested at the lowest data rate.

802.11b/g operating modes are tested independently according to the service requirements in each frquency band. 802.11b/g modes are tested on channel 1,6,11; however,if output power reduction is necessary for channels 1 and/or 11 to meet restricted band requirements the highest output channel closest to each of these channels must be tested instead.

SAR is not required for 802.11g channels when the maximum average output power is less than 0.25dB higher than that measured on the corresponding 802.11b channels.

Mode	GHz	Channel	Turbo Channel	"Default Test Channels" §15.247 802.11b	"Default Test Channels" §15.247 802.11g	"Default Test Channels" UNII
802.11 b/g	2.412	1		√	∇	
	2.437	6	6	√	∇	
	2.462	11		√	∇	

802.11 Test Channels per FCC Requirements

7 SAR Measurement Results

7.1 Conducted power measurements

For the measurements a Rohde & Schwarz Radio Communication Tester CMU 200 and WideBand Radio Communication Tester CMW 500 were used.

The output power was measured using an integrated RF connector and attached RF cable.

SAR drift measured at the same position in liquid before and after each SAR test as below 7.2 chapter.

7.1.1 Conducted power measurements CDMA 800 MHz

CDMA&EVDO 800		Conducted Power (dBm)		
		1013CH	384CH	777CH
RC1	SO55	24.50	24.23	24.03
RC3	SO55	24.33	24.11	23.96
	TDSO32（FCH）	24.34	24.21	23.99
	TDSO32（FCH+SCH）	24.39	24.12	23.97
Rev 0	RTAP 153.6	24.16	23.98	23.86
Rev A	RETAP 4096	24.47	24.37	24.14

Table 11: Test results conducted power measurement CDMA 800 MHz

7.1.2 Conducted power measurements CDMA 1700 MHz

CDMA&EVDO AWS		Conducted Power (dBm)		
		25CH	450CH	875CH
RC1	SO55	23.64	23.75	23.68
RC3	SO55	23.52	23.77	23.68
	TDSO32（FCH）	23.49	23.71	23.69
	TDSO32（FCH+SCH）	23.56	23.70	23.65
Rev 0	RTAP 153.6	23.35	23.59	23.51
Rev A	RETAP 4096	23.58	23.75	23.60

Table 12: Test results conducted power measurement CDMA 1700 MHz

7.1.3 Conducted power measurements CDMA 1900 MHz

CDMA&EVDO1900		Conducted Power (dBm)		
		25CH	600CH	1175CH
RC1	SO55	23.92	23.97	23.83
RC3	SO55	23.90	23.93	23.76
	TDSO32（FCH）	23.82	23.94	23.83
	TDSO32（FCH+SCH）	23.84	23.89	23.82
Rev 0	RTAP 153.6	23.79	23.87	23.73
Rev A	RETAP 4096	23.89	24.05	23.96

Table 13: Test results conducted power measurement CDMA 1900 MHz

7.1.4 Conducted power measurements LTE Band II Low Channel

Uplink Channel Number	BW [MHz]	RB Size	RB Offset	Mod	MPR Allowed by 3GPP(dB)	Target MPR(dB)	Conducted Power (dBm)
18607	1.4	1	0	QPSK	0~2	0	22.40
		1	5	QPSK	0~2	0	22.40
		3	2	QPSK	0~2	0	22.39
		6	0	QPSK	0~3	1	21.43
		1	0	16-QAM	0~3	1	22.08
		1	5	16-QAM	0~3	1	22.00
		3	2	16-QAM	0~3	1	21.58
		6	0	16-QAM	0~4	2	21.13
18615	3	1	0	QPSK	0~2	0	22.42
		1	14	QPSK	0~2	0	22.81
		7	4	QPSK	0~3	1	21.34
		15	0	QPSK	0~3	1	21.40
		1	0	16-QAM	0~3	1	21.98
		1	14	16-QAM	0~3	1	22.15
		7	4	16-QAM	0~4	2	21.08
		15	0	16-QAM	0~4	2	21.14
18625	5	1	0	QPSK	0~2	0	22.44
		1	24	QPSK	0~2	0	22.84
		12	7	QPSK	0~3	1	21.40
		25	0	QPSK	0~3	1	21.47
		1	0	16-QAM	0~3	1	21.55
		1	24	16-QAM	0~3	1	21.75
		12	7	16-QAM	0~4	2	21.02
		25	0	16-QAM	0~4	2	21.25
18650	10	1	0	QPSK	0~2	0	22.39
		1	49	QPSK	0~2	0	22.89
		25	13	QPSK	0~3	1	21.56
		50	0	QPSK	0~3	1	21.57
		1	0	16-QAM	0~3	1	21.97
		1	49	16-QAM	0~3	1	22.44
		25	13	16-QAM	0~4	2	21.34
		50	0	16-QAM	0~4	2	21.29

Table 14: Test results conducted power measurement LTE Band II (1900 MHz) Low Channel

7.1.5 Conducted power measurements LTE Band II Mid Channel

Uplink Channel Number	BW [MHz]	RB Size	RB Offset	Mod	MPR Allowed by 3GPP(dB)	Target MPR(dB)	Conducted Power (dBm)
18900	1.4	1	0	QPSK	0~2	0	22.55
		1	5	QPSK	0~2	0	22.47
		3	2	QPSK	0~2	0	22.33
		6	0	QPSK	0~3	1	21.49
		1	0	16-QAM	0~3	1	22.21
		1	5	16-QAM	0~3	1	22.26
		3	2	16-QAM	0~3	1	21.81
		6	0	16-QAM	0~4	2	21.15
	3	1	0	QPSK	0~2	0	22.31
		1	14	QPSK	0~2	0	22.65
		7	4	QPSK	0~3	1	21.24
		15	0	QPSK	0~3	1	21.43
		1	0	16-QAM	0~3	1	21.83
		1	14	16-QAM	0~3	1	22.22
		7	4	16-QAM	0~4	2	21.17
		15	0	16-QAM	0~4	2	20.93
	5	1	0	QPSK	0~2	0	22.26
		1	24	QPSK	0~2	0	22.58
		12	7	QPSK	0~3	1	21.21
		25	0	QPSK	0~3	1	21.43
		1	0	16-QAM	0~3	1	21.35
		1	24	16-QAM	0~3	1	21.80
		12	7	16-QAM	0~4	2	20.89
		25	0	16-QAM	0~4	2	21.06
	10	1	0	QPSK	0~2	0	22.21
		1	49	QPSK	0~2	0	22.64
		25	13	QPSK	0~3	1	21.27
		50	0	QPSK	0~3	1	21.18
		1	0	16-QAM	0~3	1	21.74
		1	49	16-QAM	0~3	1	22.22
		25	13	16-QAM	0~4	2	20.96
		50	0	16-QAM	0~4	2	20.90

Table 15: Test results conducted power measurement LTE Band II (1900 MHz) Mid Channel

7.1.6 Conducted power measurements LTE Band II High Channel

Uplink Channel Number	BW [MHz]	RB Size	RB Offset	Mod	MPR Allowed by 3GPP(dB)	Target MPR(dB)	Conducted Power (dBm)
19193	1.4	1	0	QPSK	0~2	0	22.89
		1	5	QPSK	0~2	0	22.69
		3	2	QPSK	0~2	0	22.66
		6	0	QPSK	0~3	1	21.76
		1	0	16-QAM	0~3	1	22.48
		1	5	16-QAM	0~3	1	22.35
		3	2	16-QAM	0~3	1	22.13
		6	0	16-QAM	0~4	2	21.48
19185	3	1	0	QPSK	0~2	0	22.71
		1	14	QPSK	0~2	0	22.84
		7	4	QPSK	0~3	1	21.55
		15	0	QPSK	0~3	1	21.63
		1	0	16-QAM	0~3	1	22.31
		1	14	16-QAM	0~3	1	22.30
		7	4	16-QAM	0~4	2	21.32
		15	0	16-QAM	0~4	2	21.34
19175	5	1	0	QPSK	0~2	0	22.83
		1	24	QPSK	0~2	0	22.78
		12	7	QPSK	0~3	1	21.70
		25	0	QPSK	0~3	1	21.70
		1	0	16-QAM	0~3	1	21.89
		1	24	16-QAM	0~3	1	21.98
		12	7	16-QAM	0~4	2	21.33
		25	0	16-QAM	0~4	2	21.34
19150	10	1	0	QPSK	0~2	0	23.23
		1	49	QPSK	0~2	0	22.82
		25	13	QPSK	0~3	1	21.56
		50	0	QPSK	0~3	1	21.75
		1	0	16-QAM	0~3	1	22.76
		1	49	16-QAM	0~3	1	22.39
		25	13	16-QAM	0~4	2	21.44
		50	0	16-QAM	0~4	2	21.43

Table 16: Test results conducted power measurement LTE Band II (1900 MHz) High Channel

7.1.7 Conducted power measurements LTE Band IV Low Channel

Uplink Channel Number	BW [MHz]	RB Size	RB Offset	Mod	MPR Allowed by 3GPP(dB)	Target MPR(dB)	Conducted Power (dBm)
19957	1.4	1	0	QPSK	0~2	0	22.28
		1	5	QPSK	0~2	0	22.33
		3	2	QPSK	0~2	0	22.21
		6	0	QPSK	0~3	1	21.31
		1	0	16-QAM	0~3	1	21.97
		1	5	16-QAM	0~3	1	21.89
		3	2	16-QAM	0~3	1	21.54
		6	0	16-QAM	0~4	2	20.85
19965	3	1	0	QPSK	0~2	0	22.35
		1	14	QPSK	0~2	0	22.23
		7	4	QPSK	0~3	1	21.05
		15	0	QPSK	0~3	1	21.23
		1	0	16-QAM	0~3	1	21.88
		1	14	16-QAM	0~3	1	21.85
		7	4	16-QAM	0~4	2	20.89
		15	0	16-QAM	0~4	2	20.73
19975	5	1	0	QPSK	0~2	0	22.42
		1	24	QPSK	0~2	0	22.36
		12	7	QPSK	0~3	1	21.08
		25	0	QPSK	0~3	1	21.17
		1	0	16-QAM	0~3	1	21.47
		1	24	16-QAM	0~3	1	21.29
		12	7	16-QAM	0~4	2	20.70
		25	0	16-QAM	0~4	2	20.87
20000	10	1	0	QPSK	0~2	0	22.25
		1	49	QPSK	0~2	0	22.13
		25	13	QPSK	0~3	1	21.09
		50	0	QPSK	0~3	1	21.15
		1	0	16-QAM	0~3	1	21.80
		1	49	16-QAM	0~3	1	21.71
		25	13	16-QAM	0~4	2	20.73
		50	0	16-QAM	0~4	2	20.78

Table 17: Test results conducted power measurement LTE Band IV (1700 MHz) Low Channel

7.1.8 Conducted power measurements LTE Band IV Mid Channel

Uplink Channel Number	BW [MHz]	RB Size	RB Offset	Mod	MPR Allowed by 3GPP(dB)	Target MPR(dB)	Conducted Power (dBm)
20175	1.4	1	0	QPSK	0~2	0	22.04
		1	5	QPSK	0~2	0	22.08
		3	2	QPSK	0~2	0	21.91
		6	0	QPSK	0~3	1	21.64
		1	0	16-QAM	0~3	1	21.80
		1	5	16-QAM	0~3	1	21.67
		3	2	16-QAM	0~3	1	21.32
		6	0	16-QAM	0~4	2	20.62
	3	1	0	QPSK	0~2	0	22.15
		1	14	QPSK	0~2	0	22.04
		7	4	QPSK	0~3	1	20.94
		15	0	QPSK	0~3	1	20.97
		1	0	16-QAM	0~3	1	21.63
		1	14	16-QAM	0~3	1	21.60
		7	4	16-QAM	0~4	2	20.52
		15	0	16-QAM	0~4	2	20.46
	5	1	0	QPSK	0~2	0	22.05
		1	24	QPSK	0~2	0	22.21
		12	7	QPSK	0~3	1	20.87
		25	0	QPSK	0~3	1	20.92
		1	0	16-QAM	0~3	1	21.16
		1	24	16-QAM	0~3	1	21.12
		12	7	16-QAM	0~4	2	20.45
		25	0	16-QAM	0~4	2	20.38
	10	1	0	QPSK	0~2	0	21.82
		1	49	QPSK	0~2	0	22.12
		25	13	QPSK	0~3	1	20.94
		50	0	QPSK	0~3	1	20.79
		1	0	16-QAM	0~3	1	21.55
		1	49	16-QAM	0~3	1	21.64
		25	13	16-QAM	0~4	2	20.34
		50	0	16-QAM	0~4	2	20.23

Table 18: Test results conducted power measurement LTE Band IV (1700 MHz) Mid Channel

7.1.9 Conducted power measurements LTE Band IV High Channel

Uplink Channel Number	BW [MHz]	RB Size	RB Offset	Mod	MPR Allowed by 3GPP(dB)	Target MPR(dB)	Conducted Power (dBm)
20393	1.4	1	0	QPSK	0~2	0	21.29
		1	5	QPSK	0~2	0	21.34
		3	2	QPSK	0~2	0	21.17
		6	0	QPSK	0~3	1	20.30
		1	0	16-QAM	0~3	1	20.99
		1	5	16-QAM	0~3	1	20.88
		3	2	16-QAM	0~3	1	20.54
		6	0	16-QAM	0~4	2	20.13
20385	3	1	0	QPSK	0~2	0	21.66
		1	14	QPSK	0~2	0	21.41
		7	4	QPSK	0~3	1	20.21
		15	0	QPSK	0~3	1	20.42
		1	0	16-QAM	0~3	1	21.09
		1	14	16-QAM	0~3	1	21.02
		7	4	16-QAM	0~4	2	20.02
		15	0	16-QAM	0~4	2	19.96
20375	5	1	0	QPSK	0~2	0	21.77
		1	24	QPSK	0~2	0	21.49
		12	7	QPSK	0~3	1	20.45
		25	0	QPSK	0~3	1	20.47
		1	0	16-QAM	0~3	1	20.93
		1	24	16-QAM	0~3	1	20.56
		12	7	16-QAM	0~4	2	20.03
		25	0	16-QAM	0~4	2	20.29
20350	10	1	0	QPSK	0~2	0	22.32
		1	49	QPSK	0~2	0	21.52
		25	13	QPSK	0~3	1	20.72
		50	0	QPSK	0~3	1	20.74
		1	0	16-QAM	0~3	1	21.87
		1	49	16-QAM	0~3	1	21.15
		25	13	16-QAM	0~4	2	20.33
		50	0	16-QAM	0~4	2	20.44

Table 19: Test results conducted power measurement LTE Band IV (1700 MHz) High Channel

7.2 SAR measurement Result

7.2.1 SAR measurement Result of CDMA 800

Test Position of Head	Test Mode	Test channel /Frequency	SAR Value (W/kg)		Power Drift(dB)	Limit (W/kg)	Liquid Temp.
			1-g	10-g			
Left Hand Touched	RC3 SO55	384/836.52	0.356	0.257	-0.021	1.60	21.5°C
Left Hand Tilted 15°	RC3 SO55	384/836.52	0.284	0.218	0.017	1.60	21.5°C
Right Hand Touched	RC3 SO55	777/848.31	**1.010**	0.695	-0.096	1.60	21.5°C
		384/836.52	0.854	0.591	-0.066	1.60	21.5°C
		1013/824.7	0.651	0.450	0.084	1.60	21.5°C
Right Hand Tilted 15°	RC3 SO55	384/836.52	0.334	0.252	-0.059	1.60	21.5°C
Left Hand Touched	EVDO Rev.0	384/836.52	0.446	0.324	0.186	1.60	21.5°C
Left Hand Tilted 15°	EVDO Rev.0	384/836.52	0.218	0.160	-0.104	1.60	21.5°C
Right Hand Touched	EVDO Rev.0	777/848.31	0.928	0.639	-0.046	1.60	21.5°C
		384/836.52	0.853	0.580	-0.172	1.60	21.5°C
		1013/824.7	0.435	0.293	-0.070	1.60	21.5°C
Right Hand Tilted 15°	EVDO Rev.0	384/836.52	0.245	0.183	-0.179	1.60	21.5°C

Table 20: Test results head SAR CDMA800

Test Position of Body with 10mm	Test Mode	Test channel /Frequency	SAR Value (W/kg)		Power Drift(dB)	Limit (W/kg)	Liquid Temp.
			1-g	10-g			
Towards Phantom	RC3 SO32	384/836.52	0.706	0.479	-0.190	1.60	21.5°C
Towards Ground	RC3 SO32	777/848.31	1.220	0.826	0.018	1.60	21.5°C
		384/836.52	**1.360**	0.910	-0.046	1.60	21.5°C
		1013/824.7	1.080	0.723	0.039	1.60	21.5°C
Towards Ground with Headset	RC3 SO55	384/836.52	1.240	0.820	0.026	1.60	21.5°C

Table 21: Test results body worn SAR CDMA800

7.2.2 SAR measurement Result of CDMA 1700

Test Position of Head	Test Mode	Test channel /Frequency	SAR Value (W/kg)		Power Drift (dB)	Limit (W/kg)	Liquid Temp.
			1-g	10-g			
Left Hand Touched	RC3 SO55	450/1732.5	0.278	0.176	0.070	1.60	21.5°C
Left Hand Tilted 15°	RC3 SO55	450/1732.5	0.137	0.083	-0.018	1.60	21.5°C
Right Hand Touched	RC3 SO55	450/1732.5	0.437	0.260	-0.118	1.60	21.5°C
Right Hand Tilted 15°	RC3 SO55	450/1732.5	0.172	0.105	0.036	1.60	21.5°C
Left Hand Touched	EVDO Rev.0	450/1732.5	0.301	0.195	0.155	1.60	21.5°C
Left Hand Tilted 15°	EVDO Rev.0	450/1732.5	0.165	0.099	-0.037	1.60	21.5°C
Right Hand Touched	EVDO Rev.0	450/1732.5	**0.516**	0.310	-0.152	1.60	21.5°C
Right Hand Tilted 15°	EVDO Rev.0	450/1732.5	0.199	0.122	0.017	1.60	21.5°C

Table 22: Test results head SAR CDMA AWS

Test Position of Body with 10mm	Test Mode	Test channel /Frequency	SAR Value (W/kg)		Power Drift(dB)	Limit (W/kg)	Liquid Temp.
			1-g	10-g			
Towards Phantom	RC3 SO32	450/1732.5	0.565	0.337	-0.194	1.60	21.5°C
Towards Ground	RC3 SO32	850/1752.5	0.965	0.546	-0.052	1.60	21.5°C
		450/1732.5	0.934	0.530	0.024	1.60	21.5°C
		25/1711.25	**0.994**	0.556	-0.194	1.60	21.5°C
Towards Ground with Headset	RC3 SO55	25/1711.25	0.952	0.535	-0.172	1.60	21.5°C

Table 23: Test results body worn SAR CDMA AWS

7.2.3 SAR measurement Result of CDMA 1900

Test Position of Head	Test Mode	Test channel /Frequency	SAR Value (W/kg)		Power Drift(dB)	Limit (W/kg)	Liquid Temp.
			1-g	10-g			
Left Hand Touched	RC3 SO55	600/1880	0.397	0.250	0.142	1.60	21.5°C
Left Hand Tilted 15°	RC3 SO55	600/1880	0.215	0.126	-0.097	1.60	21.5°C
Right Hand Touched	RC3 SO55	600/1880	**0.676**	0.399	-0.118	1.60	21.5°C
Right Hand Tilted 15°	RC3 SO55	600/1880	0.232	0.142	-0.148	1.60	21.5°C
Left Hand Touched	EVDO Rev.0	600/1880	0.419	0.262	-0.117	1.60	21.5°C
Left Hand Tilted 15°	EVDO Rev.0	600/1880	0.202	0.119	-0.153	1.60	21.5°C
Right Hand Touched	EVDO Rev.0	600/1880	0.676	0.393	0.162	1.60	21.5°C
Right Hand Tilted 15°	EVDO Rev.0	600/1880	0.218	0.135	-0.014	1.60	21.5°C

Table 24: Test results head SAR CDMA PCS

Test Position of Body with 10mm	Test Mode	Test channel /Frequency	SAR Value (W/kg)		Power Drift(dB)	Limit (W/kg)	Liquid Temp.
			1-g	10-g			
Towards Phantom	RC3 SO32	600/1880	0.724	0.443	-0.183	1.60	21.5°C
Towards Ground	RC3 SO32	1175/1908.75	0.855	0.486	-0.168	1.60	21.5°C
		600/1880	0.854	0.489	0.137	1.60	21.5°C
		25/1851.25	**0.939**	0.435	0.184	1.60	21.5°C
Towards Ground with Headset	RC3 SO55	25/1851.25	0.822	0.472	-0.177	1.60	21.5°C

Table 25: Test results body worn SAR CDMA PCS

Note: 1) The value with **bold** colour is the maximum SAR value of each test band.

2) The SAR test shall be performed at the high, middle and low frequency channels of each operating mode. If the SAR measured at mid-band channel for each test configuration is at least 3.0 dB lower than the SAR limit (< 0.8 W/kg), testing at the high and low channels is optional.

3) Per KDB941225 D01-Head SAR was tested with RC3+SO55，RC1+SO55 was not required since the average output power was not more than 0.25dB than the RC3+SO55 powers.

4) Per KDB443841-Head SAR was tested with EVDO Rev.0 was evaluated to cover EVDO VoIP applications that may result in EVDO being used near the head.

5) Per KDB941225 D01-Body SAR was tested with RC3+SO32 FCH, RC3+SO32 FCH+SCH and Ev-Do was not required since the average output power was not more than 0.25dB than the RC3+SO32 FCH powers.

6) This mode doesn't support Mobile Hotspot services function for CDMA network.

7.2.4 SAR measurement Result of LTE Band II

Test Position	Test channel /Frequency	LTE Configuration	SAR Value (W/kg)		Power Drift (dB)	Limit (W/kg)	Liquid Temp.
			1-g	10-g			
10M/QPSK							
Left Hand Touched	19150/1905	50%RB/#13	0.605	0.340	0.105	1.60	21.5°C
Left Hand Tilted 15°	19150/1905		0.169	0.099	0.040	1.60	21.5°C
Right Hand Touched	19150/1905		0.374	0.228	0.049	1.60	21.5°C
Right Hand Tilted15°	19150/1905		0.184	0.106	0.022	1.60	21.5°C
10M/QPSK							
Left Hand Touched	19150/1905	1RB/#0	0.888	0.501	-0.039	1.60	21.5°C
Left Hand Tilted 15°	19150/1905		0.253	0.153	0.029	1.60	21.5°C
Right Hand Touched	19150/1905		0.592	0.361	-0.072	1.60	21.5°C
Right Hand Tilted15°	19150/1905		0.275	0.155	-0.165	1.60	21.5°C
10M/QPSK							
Left Hand Touched	18650/1855	1RB/#49	**1.330**	0.761	0.014	1.60	21.5°C
Left Hand Tilted 15°	18650/1855		0.303	0.179	-0.085	1.60	21.5°C
Right Hand Touched	18650/1855		0.770	0.472	0.124	1.60	21.5°C
Right Hand Tilted15°	18650/1855		0.356	0.195	-0.068	1.60	21.5°C

Table 26: Test results head SAR LTE Band II QPSK

Test Position	Test channel /Frequency	LTE Configuration	SAR Value (W/kg)		Power Drift (dB)	Limit (W/kg)	Liquid Temp.
			1-g	10-g			
10M/16QAM							
Left Hand Touched	19150/1905	50%RB/#13	0.626	0.353	-0.074	1.60	21.5°C
Left Hand Tilted 15°	19150/1905		0.151	0.079	0.130	1.60	21.5°C
Right Hand Touched	19150/1905		0.372	0.228	-0.149	1.60	21.5°C
Right Hand Tilted15°	19150/1905		0.173	0.099	0.028	1.60	21.5°C
10M/16QAM							
Left Hand Touched	19150/1905	1RB/#0	0.817	0.458	-0.062	1.60	21.5°C
Left Hand Tilted 15°	19150/1905		0.224	0.133	0.061	1.60	21.5°C
Right Hand Touched	19150/1905		0.537	0.327	0.168	1.60	21.5°C
Right Hand Tilted15°	19150/1905		0.229	0.127	-0.178	1.60	21.5°C
10M/16QAM							
Left Hand Touched	18650/1855	1RB/#49	1.040	0.596	-0.189	1.60	21.5°C
Left Hand Tilted 15°	18650/1855		0.268	0.161	-0.058	1.60	21.5°C
Right Hand Touched	18650/1855		0.679	0.413	-0.092	1.60	21.5°C
Right Hand Tilted15°	18650/1855		0.312	0.181	-0.085	1.60	21.5°C

Table 27: Test results head SAR LTE Band II 16QAM

Test Position	Test channel /Frequency	LTE Configuration	SAR Value (W/kg)		Power Drift (dB)	Limit (W/kg)	Liquid Temp.
			1-g	10-g			
10M/QPSK							
Towards Phantom	19150/1905	50%RB/#13	0.447	0.249	-0.084	1.60	21.5°C
Towards Ground	19150/1905		0.556	0.318	-0.100	1.60	21.5°C
Left edge	19150/1905		0.239	0.135	0.126	1.60	21.5°C
Bottom edge	19150/1905		0.170	0.095	0.034	1.60	21.5°C
10M/QPSK							
Towards Phantom	19150/1905	1RB/#0	0.647	0.354	-0.002	1.60	21.5°C
Towards Ground	19150/1905		0.762	0.436	0.071	1.60	21.5°C
Left edge	19150/1905		0.354	0.196	0.074	1.60	21.5°C
Bottom edge	19150/1905		0.269	0.148	0.093	1.60	21.5°C
10M/QPSK							
Towards Phantom	18650/1855	1RB/#49	0.928	0.533	0.154	1.60	21.5°C
Towards Ground	18650/1855		**1.290**	0.742	-0.069	1.60	21.5°C
Left edge	18650/1855		0.475	0.275	-0.061	1.60	21.5°C
Bottom edge	18650/1855		0.330	0.200	0.032	1.60	21.5°C

Table 28: Test results Hotspot Body SAR LTE Band II QPSK

Test Position	Test channel /Frequency	LTE Configuration	SAR Value (W/kg)		Power Drift (dB)	Limit (W/kg)	Liquid Temp.
			1-g	10-g			
10M/16QAM							
Towards Phantom	19150/1905	50%RB/#13	0.531	0.297	0.085	1.60	21.5°C
Towards Ground	19150/1905		0.560	0.266	-0.076	1.60	21.5°C
Left edge	19150/1905		0.232	0.136	-0.045	1.60	21.5°C
Bottom edge	19150/1905		0.198	0.118	0.075	1.60	21.5°C
10M/16QAM							
Towards Phantom	19150/1905	1RB/#0	0.612	0.353	-0.134	1.60	21.5°C
Towards Ground	19150/1905		0.708	0.414	-0.027	1.60	21.5°C
Left edge	19150/1905		0.285	0.163	-0.128	1.60	21.5°C
Bottom edge	19150/1905		0.251	0.132	-0.159	1.60	21.5°C
10M/16QAM							
Towards Phantom	18650/1855	1RB/#49	0.776	0.448	-0.123	1.60	21.5°C
Towards Ground	18650/1855		0.899	0.551	0.125	1.60	21.5°C
Left edge	18650/1855		0.418	0.244	0.067	1.60	21.5°C
Bottom edge	18650/1855		0.270	0.169	0.102	1.60	21.5°C

Table 29: Test results Hotspot Body SAR LTE Band II 16QAM

7.2.5 SAR measurement Result of LTE Band IV

Test Position	Test channel /Frequency	LTE Configuration	SAR Value (W/kg) 1-g	SAR Value (W/kg) 10-g	Power Drift (dB)	Limit (W/kg)	Liquid Temp.
10M/QPSK							
Left Hand Touched	20350/1750	50%RB/#13	0.791	0.452	-0.164	1.60	21.5°C
	20175/1732.5		0.998	0.559	-0.037	1.60	21.5°C
	20000/1715		0.924	0.546	0.095	1.60	21.5°C
Left Hand Tilted 15°	20175/1732.5		0.199	0.120	0.161	1.60	21.5°C
Right Hand Touched	20175/1732.5		0.551	0.339	0.047	1.60	21.5°C
Right Hand Tilted15°	20175/1732.5		0.164	0.098	-0.009	1.60	21.5°C
10M/QPSK							
Left Hand Touched	20350/1750	1RB/#0	**1.190**	0.673	-0.177	1.60	21.5°C
Left Hand Tilted 15°	20350/1750		0.228	0.140	-0.023	1.60	21.5°C
Right Hand Touched	20350/1750		0.588	0.367	-0.116	1.60	21.5°C
Right Hand Tilted15°	20350/1750		0.192	0.114	-0.049	1.60	21.5°C
10M/QPSK							
Left Hand Touched	20000/1715	1RB/#49	1.070	0.620	0.079	1.60	21.5°C
Left Hand Tilted 15°	20000/1715		0.270	0.166	0.132	1.60	21.5°C
Right Hand Touched	20000/1715		0.645	0.395	-0.035	1.60	21.5°C
Right Hand Tilted15°	20000/1715		0.196	0.118	0.025	1.60	21.5°C

Table 30: Test results head SAR LTE Band IV QPSK

Test Position	Test channel /Frequency	LTE Configuration	SAR Value (W/kg) 1-g	SAR Value (W/kg) 10-g	Power Drift (dB)	Limit (W/kg)	Liquid Temp.
10M/16QAM							
Left Hand Touched	20175/1732.5	50%RB/#13	0.887	0.507	0.172	1.60	21.5°C
Left Hand Tilted 15°	20175/1732.5		0.220	0.133	-0.043	1.60	21.5°C
Right Hand Touched	20175/1732.5		0.495	0.306	0.086	1.60	21.5°C
Right Hand Tilted15°	20175/1732.5		0.129	0.078	0.179	1.60	21.5°C
10M/16QAM							
Left Hand Touched	20350/1750	1RB/#0	1.030	0.566	-0.067	1.60	21.5°C
Left Hand Tilted 15°	20350/1750		0.304	0.152	-0.111	1.60	21.5°C
Right Hand Touched	20350/1750		0.600	0.365	-0.146	1.60	21.5°C
Right Hand Tilted15°	20350/1750		0.159	0.093	0.007	1.60	21.5°C
10M/16QAM							
Left Hand Touched	20000/1715	1RB/#49	1.090	0.615	-0.171	1.60	21.5°C
Left Hand Tilted 15°	20000/1715		0.238	0.145	-0.029	1.60	21.5°C
Right Hand Touched	20000/1715		0.559	0.358	-0.049	1.60	21.5°C
Right Hand Tilted15°	20000/1715		0.182	0.111	-0.198	1.60	21.5°C

Table 31: Test results head SAR LTE Band IV 16QAM

Test Position	Test channel /Frequency	LTE Configuration	SAR Value (W/kg) 1-g	SAR Value (W/kg) 10-g	Power Drift (dB)	Limit (W/kg)	Liquid Temp.
10M/QPSK							
Towards Phantom	20175/1732.5	50%RB/#13	0.716	0.428	0.070	1.60	21.5°C
Towards Ground	20350/1750		0.763	0.457	-0.098	1.60	21.5°C
	20175/1732.5		0.862	0.527	0.008	1.60	21.5°C
	20000/1715		0.872	0.536	0.007	1.60	21.5°C
Left edge	20175/1732.5		0.291	0.172	0.051	1.60	21.5°C
Bottom edge	20175/1732.5		0.284	0.167	-0.123	1.60	21.5°C
10M/QPSK							
Towards Phantom	20350/1750	1RB/#0	0.853	0.501	-0.150	1.60	21.5°C
Towards Ground	20350/1750		0.973	0.589	-0.088	1.60	21.5°C
Left edge	20350/1750		0.288	0.175	-0.137	1.60	21.5°C
Bottom edge	20350/1750		0.357	0.204	-0.102	1.60	21.5°C
10M/QPSK							
Towards Phantom	20000/1715	1RB/#49	0.795	0.464	0.084	1.60	21.5°C
Towards Ground	20000/1715		**1.030**	0.628	-0.178	1.60	21.5°C
Left edge	20000/1715		0.302	0.179	0.153	1.60	21.5°C
Bottom edge	20000/1715		0.392	0.242	0.128	1.60	21.5°C

Table 32: Test results hotspot Body SAR LTE Band IV QPSK

Test Position 10mm	Test channel /Frequency	LTE Configuration	SAR Value (W/kg) 1-g	SAR Value (W/kg) 10-g	Power Drift (dB)	Limit (W/kg)	Liquid Temp.
10M/16QAM							
Towards Phantom	20000/1715	50%RB/#13	0.681	0.401	-0.110	1.60	21.5°C
Towards Ground	20000/1715		0.814	0.496	0.018	1.60	21.5°C
Left edge	20000/1715		0.199	0.120	-0.027	1.60	21.5°C
Bottom edge	20000/1715		0.328	0.195	-0.125	1.60	21.5°C
10M/16QAM							
Towards Phantom	20350/1750	1RB/#0	0.729	0.441	-0.126	1.60	21.5°C
Towards Ground	20350/1750		0.867	0.532	-0.118	1.60	21.5°C
Left edge	20350/1750		0.292	0.171	-0.093	1.60	21.5°C
Bottom edge	20350/1750		0.324	0.193	0.088	1.60	21.5°C
10M/16QAM							
Towards Phantom	20000/1715	1RB/#49	0.788	0.454	-0.116	1.60	21.5°C
Towards Ground	20000/1715		0.961	0.587	-0.074	1.60	21.5°C
Left edge	20000/1715		0.264	0.157	-0.140	1.60	21.5°C
Bottom edge	20000/1715		0.340	0.201	0.182	1.60	21.5°C

Table 33: Test results hotspot Body SAR LTE Band IV 16QAM

Note: 1）The value with **bold** colour is the maximum SAR value of each test band.

2) A-MPR was disabled by Radio Communication Tester for all SAR tests;

3) Per KDB443841- LTE Head SAR was evaluated to cover third-party VoIP applications that may result in LTE being used near the head.

4) Per KDB 941225 D06-we performed the SAR testing at 10mm from the front and rear surfaces（Towards Phantom & Towards Ground） and also from side edges with a transmitting antenna ≤ 2.5 cm from an edge（the distance refers to section 7.4 of Rear Side View picture）.

5) LTE Band II&Band IV test reduce is as below the following:

a. Per KDB941225 D05 page 4,3) A),QPSK with 50% RB is requied for the highest bandwide(10MHz).

When the maximum output power variation across H, M and L channels is ≤½ dB, start with the middle channel; otherwise, start with the highest output power channel. When the measured 1-g SAR for the middle or highest output power channel is≤ 0.8 W/kg, testing of the remaining two channels in that device and exposure configuration is not necessary.

LTE Band II	Uplink Channel Number	BW [MHz]	RB Size	RB Offset	Mod	Max Conducted Power (dBm)	Max Difference
Low Channel	18650	10	1	49	QPSK	22.89	**0.59**
Mid Channel	18900	10	1	49	QPSK	22.64	
High Channel	19150	10	1	0	QPSK	**23.23**	

➔**Band II, High channel, 10MHz BW, 25RB#13, QPSK has been selected.**

LTE Band IV	Uplink Channel Number	BW [MHz]	RB Size	RB Offset	Mod	Max Conducted Power (dBm)	Max Difference
Low Channel	20000	10	1	0	QPSK	22.25	**0.20**
Mid Channel	20175	10	1	49	QPSK	22.12	
High Channel	20350	10	1	0	QPSK	**22.32**	

➔**Band IV, Middle channel, 10MHz BW, 25RB#13, QPSK has been selected.**

b. Per KDB941225 D05 page 4,3) B),QPSK with 1 RB for both channel edges are requied for the highest bandwide.

If the maximum average conducted output power for a 1 RB allocation is > ½ dB higher than the 50% RB allocation, instead of using the highest SAR channel measured for QPSK and 50% RB allocation, measure SAR on the highest output power channel for the 1 RB allocation.

LTE Band II	Uplink Channel Number	BW [MHz]	RB Size	RB Offset	Mod	Max Conducted Power (dBm)	Difference
Low Channel	18650	10	1	49	QPSK	**22.89**	1.33
		10	25	13	QPSK	21.56	
Mid Channel	18900	10	1	49	QPSK	22.64	**1.37**
		10	25	13	QPSK	21.27	
High Channel	19150	10	1	49	QPSK	22.82	1.26
		10	25	13	QPSK	21.56	

➔**Band II, Low channel, 10 MHz BW, 1RB/#49, has been selected.**

LTE Band IV	Uplink Channel Number	BW [MHz]	RB Size	RB Offset	Mod	Max Conducted Power (dBm)	Difference
Low Channel	20000	10	1	49	QPSK	**22.13**	1.04
		10	25	13	QPSK	21.09	
Mid Channel	20175	10	1	49	QPSK	22.12	**1.18**
		10	25	13	QPSK	20.94	
High Channel	20350	10	1	49	QPSK	21.52	0.80
		10	25	13	QPSK	20.72	

➔**Band IV, Low channel, 10 MHz BW, 1RB/#49, has been selected.**

LTE Band II	Uplink Channel Number	BW [MHz]	RB Size	RB Offset	Mod	Max Conducted Power (dBm)	Difference
Low Channel	18650	10	1	0	QPSK	22.39	0.83
		10	25	13	QPSK	21.56	
Mid Channel	18900	10	1	0	QPSK	22.21	0.94
		10	25	13	QPSK	21.27	
High Channel	19150	10	1	0	QPSK	**23.23**	**1.67**
		10	25	13	QPSK	21.56	

➔ **Band II, High channel, 10 MHz BW, 1RB/#0, has been selected.**

LTE Band IV	Uplink Channel Number	BW [MHz]	RB Size	RB Offset	Mod	Max Conducted Power (dBm)	Difference
Low Channel	20000	10	1	0	QPSK	22.25	1.16
		10	25	13	QPSK	21.09	
Mid Channel	20175	10	1	0	QPSK	21.82	0.88
		10	25	13	QPSK	20.94	
High Channel	20350	10	1	0	QPSK	**22.32**	**1.60**
		10	25	13	QPSK	20.72	

➔ **Band IV, High channel, 10 MHz BW, 1RB/#0, has been selected.**

For measured SAR in QPSK with 1 RB is < 1.45 W/kg-> Test 1RB configuration on other channels is not required. (Refer to LTE SAR test result)

c. Per KDB941225 D05 page 4,4) A),16QAM with 50% RB is requied for the highest bandwide.

If the maximum average conducted output power for 16QAM is more than ¼ dB higher than QPSK, apply the procedures for QPSK in 3) to test 16QAM.

If the maximum average conducted output power for 16QAM with 50% RB allocation is > ½ dB higher than QPSK with 50% RB allocation, instead of using the highest SAR channel measured in QPSK measure SAR on the highest output power channel for 16QAM with 50% RB allocation.

LTE Band II	Uplink Channel Number	BW [MHz]	RB Size	RB Offset	Mod	Max Conducted Power (dBm)	Difference
Low Channel	18650	10	1	49	16QAM	22.44	-0.45
		10	1	49	QPSK	22.89	
Mid Channel	18900	10	1	49	16QAM	22.22	**-0.42**
		10	1	49	QPSK	22.64	
High Channel	19150	10	1	0	16QAM	22.76	-0.47
		10	1	0	QPSK	23.23	

➔ **Band II, using the highest SAR channel measured in 3) A).**

LTE Band IV	Uplink Channel Number	BW [MHz]	RB Size	RB Offset	Mod	Max Conducted Power (dBm)	Difference
Low Channel	20000	10	1	0	16QAM	21.80	**-0.45**
		10	1	0	QPSK	22.25	
Mid Channel	20175	10	1	49	16QAM	21.64	-0.48
		10	1	49	QPSK	22.12	
High Channel	20350	10	1	0	16QAM	21.87	**-0.45**
		10	1	0	QPSK	22.32	

➔ **Band IV, using the highest SAR channel measured in 3) A).**

d. Per KDB941225 D05 page 4,4) B), 16QAM with 1 RB for both channel edges are requied for the highest bandwide.

If the maximum average conducted output power for a 1 RB allocation is > ½ dB higher than the 50% RB allocation, instead of using the highest SAR channel measured for 16QAM and 50% RB measure SAR on the highest output power channel for the 1 RB allocation.

LTE Band II	Uplink Channel Number	BW [MHz]	RB Size	RB Offset	Mod	Max Conducted Power (dBm)	Difference
Low Channel	18650	10	1	49	16QAM	**22.44**	1.10
		10	25	13	16QAM	21.34	
Mid Channel	18900	10	1	49	16QAM	22.22	**1.26**
		10	25	13	16QAM	20.96	
High Channel	19150	10	1	49	16QAM	22.39	0.95
		10	25	13	16QAM	21.44	

➔ **Band II, Low channel, 10 MHz BW, 1RB/#49, has been selected.**

LTE Band IV	Uplink Channel Number	BW [MHz]	RB Size	RB Offset	Mod	Max Conducted Power (dBm)	Difference
Low Channel	20000	10	1	49	16QAM	**21.71**	0.98
		10	25	13	16QAM	20.73	
Mid Channel	20175	10	1	49	16QAM	21.64	**1.30**
		10	25	13	16QAM	20.34	
High Channel	20350	10	1	49	16QAM	21.15	0.82
		10	25	13	16QAM	20.33	

➔ **Band IV, Low channel, 10 MHz BW, 1RB/#49, has been selected.**

LTE Band II	Uplink Channel Number	BW [MHz]	RB Size	RB Offset	Mod	Max Conducted Power (dBm)	Difference
Low Channel	18650	10	1	0	16QAM	21.97	0.63
		10	25	13	16QAM	21.34	
Mid Channel	18900	10	1	0	16QAM	21.74	0.78
		10	25	13	16QAM	20.96	
High Channel	19150	10	1	0	16QAM	**22.76**	**1.32**
		10	25	13	16QAM	21.44	

➔ **Band II, High channel, 10 MHz BW, 1RB/#0, has been selected.**

LTE Band IV	Uplink Channel Number	BW [MHz]	RB Size	RB Offset	Mod	Max Conducted Power (dBm)	Difference
Low Channel	20000	10	1	0	16QAM	21.80	1.07
		10	25	13	16QAM	20.73	
Mid Channel	20175	10	1	0	16QAM	21.55	1.21
		10	25	13	16QAM	20.34	
High Channel	20350	10	1	0	16QAM	**21.87**	**1.54**
		10	25	13	16QAM	20.33	

➔ **Band IV, High channel, 10 MHz BW, 1RB/#0, has been selected.**

For measured SAR in QPSK with 1 RB is < 1.45 W/kg-> Test 1RB configuration on other channels is not required. (Refer to LTE SAR test result)

e. Per KDB941225 D05 page 5,5) B), 5MHz/3MHz/1.4MHz BW is not requied to be tested since the max average conducted power is within ½ dB for 10MHzBW, and SAR of QPSK with 50% RB (10MHz) is < 1.45 W/kg.

LTE Band II	10 MHz	5 MHz	3 MHz	1.4 MHz
Max Power	23.23	22.84	22.84	22.89
Difference	---	-0.39	-0.39	-0.34
LTE Band IV	10 MHz	5 MHz	3 MHz	1.4 MHz
Max Power	22.32	22.42	22.35	22.33
Difference	---	0.10	0.03	0.01

➔ **Band II and Band IV, lower BW is not required to be tested.**

7.2.6 SAR measurement Result of WiFi

Test Position of Head	Test Mode	Test channel /Frequency	SAR Value (W/kg)		Power Drift (dB)	Limit (W/kg)	Liquid Temp.
			1-g	10-g			
Left Hand Touched	802.11 b	11/2462	**0.171**	0.067	0.186	1.6	21.5°C
Left Hand Tilted 15°	802.11 b	11/2462	0.147	0.059	-0.092	1.6	21.5°C
Right Hand Touched	802.11 b	11/2462	0.155	0.059	0.124	1.6	21.5°C
Right Hand Tilted 15°	802.11 b	11/2462	0.128	0.051	-0.003	1.6	21.5°C

Table 34: Test results head SAR WiFi 2450 MHz

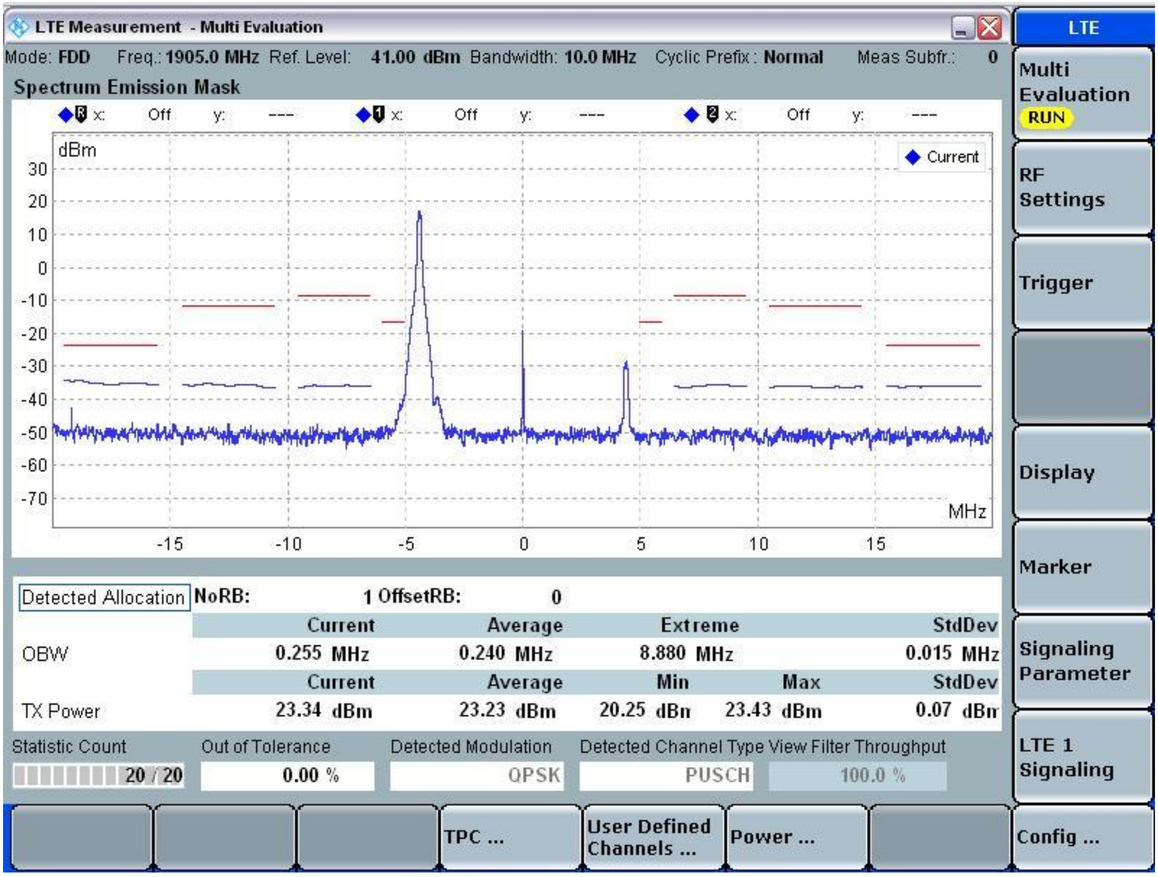
Test Position of Body with 10mm	Test Mode	Test channel /Frequency	SAR Value (W/kg)		Power Drift (dB)	Limit (W/kg)	Liquid Temp.
			1-g	10-g			
Towards Phantom	802.11 b	11/2462	0.025	0.010	-0.169	1.6	21.5°C
Towards Ground	802.11 b	11/2462	0.010	0.003	0.020	1.6	21.5°C
Right edge	802.11 b	11/2462	0.024	0.009	0.166	1.6	21.5°C
Top edge	802.11 b	11/2462	**0.030**	0.013	0.199	1.6	21.5°C

Table 35: Test results body SAR WiFi 2450 MHz

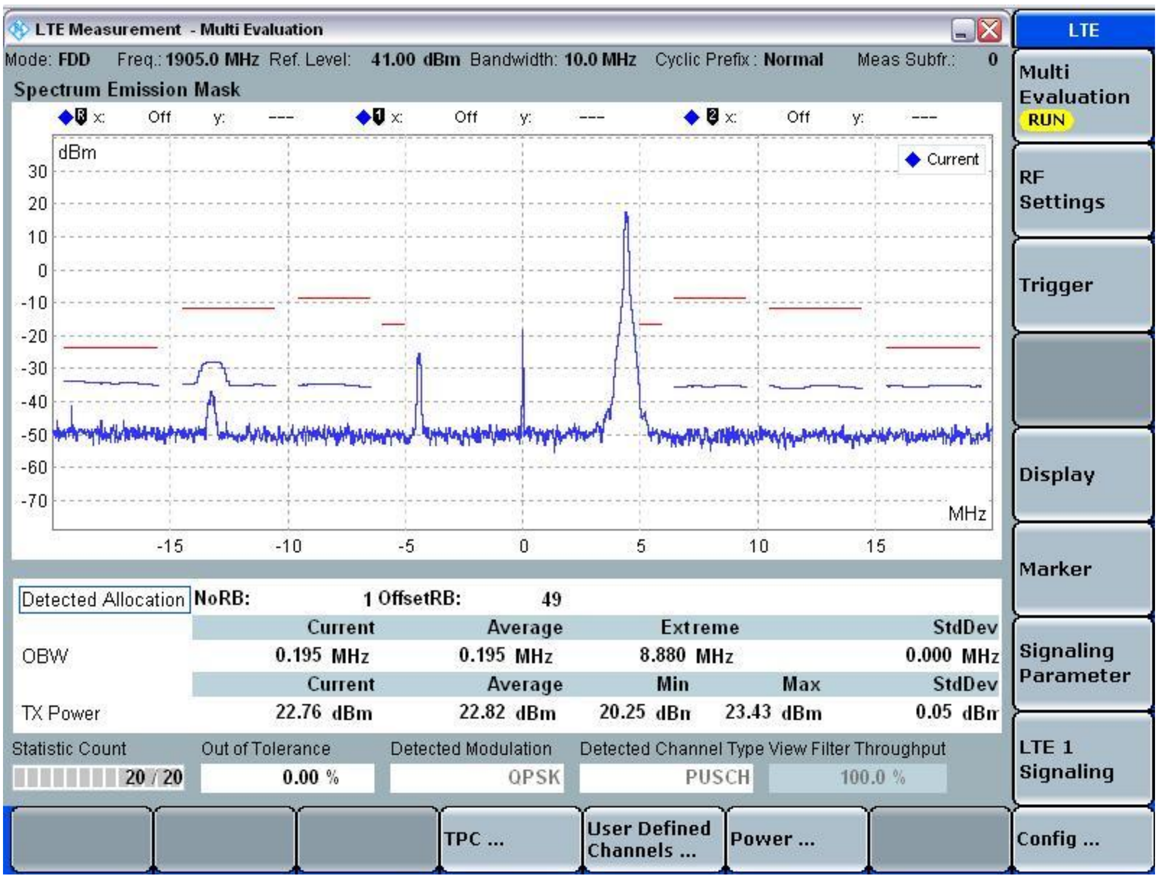
Note: 1) The value with **bold** colour is the maximum SAR value of each test band.
2) Per KDB248227，Tests high average RF output power channel for the lowest data rate, other modes including 802.11 g/n were not investigated since the average output powers were not greater than 0.25dB than that of the corresponding channel in the lowest data rate IEEE 802.11b mode.
3) Testing at higher data rates is not required, when the maximum average output power for each of these configurations is less than 1/4dB higher than those measured at the lowest data rate.
4) The SAR test shall be performed at the high, middle and low frequency channels of each operating mode. If the SAR measured for each test configuration is at least 3.0 dB lower than the SAR limit (< 0.8 W/kg), testing at the other two channels is optional.
5) Per KDB 941225 D06 hotspot procedures, we performed the SAR testing at 10mm from the front and rear surfaces（Towards Phantom & Towards Ground） and also from side edges with a transmitting antenna ≤ 2.5 cm from an edge（the distance refers to section 7.4 of Rear Side View picture）.

7.3 LTE specrum plots

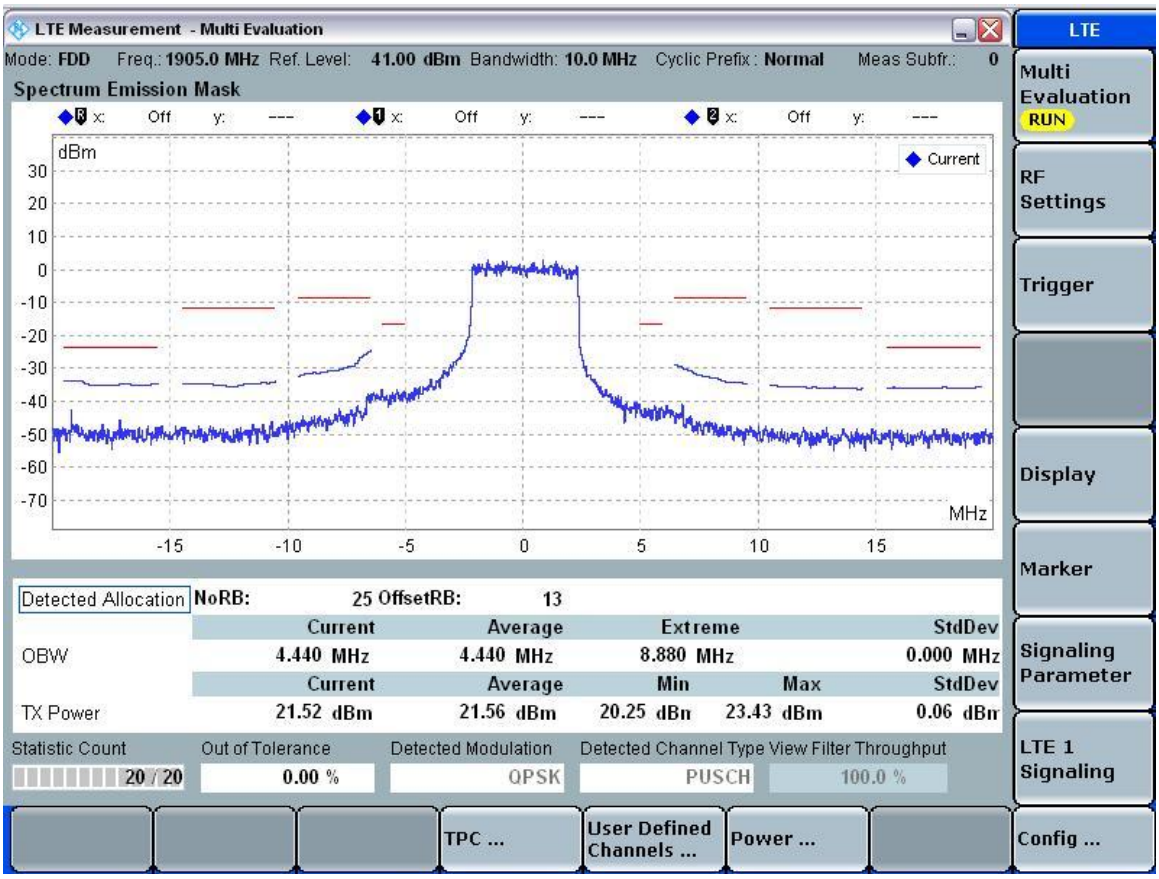
The following spectrum plots show the tested RB allocations at the LTE maximum output power conditions.



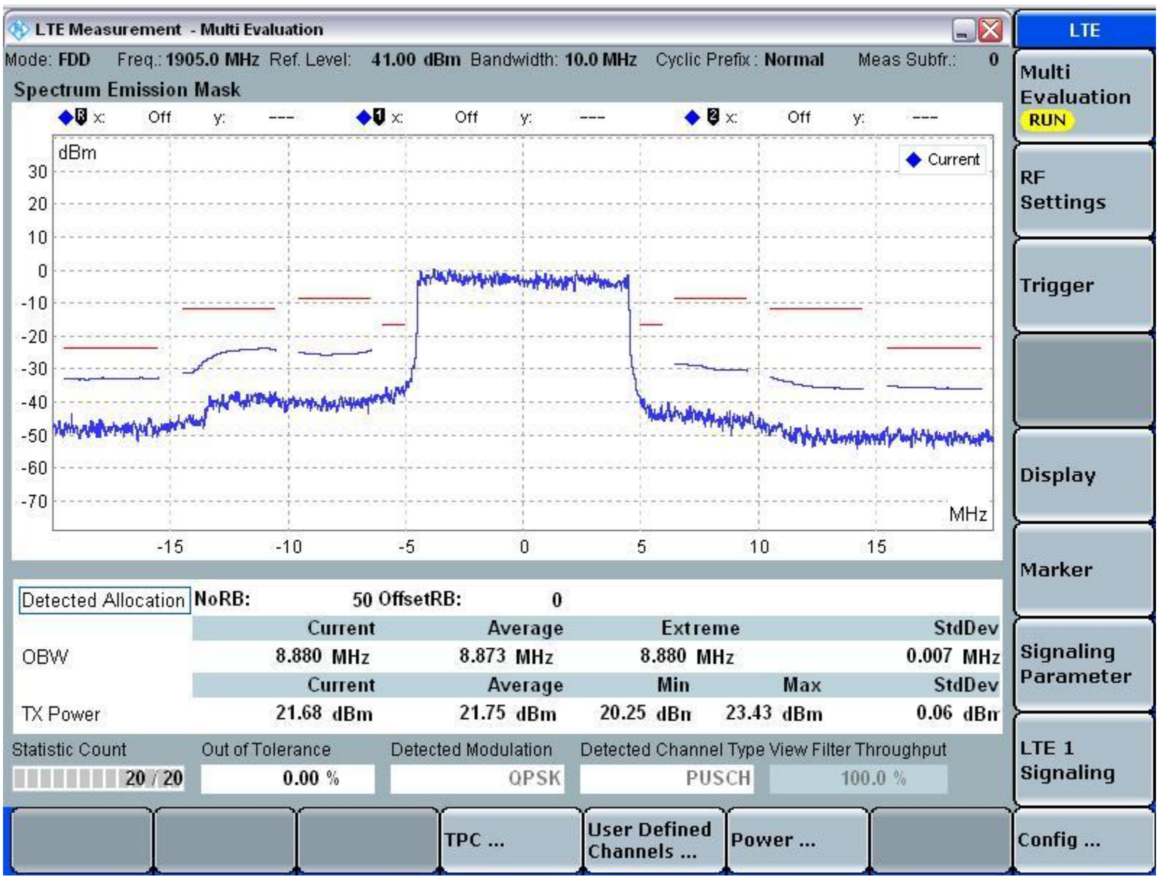
LTE Band II,10MHz BW,QPSK,1RB,Offset 0



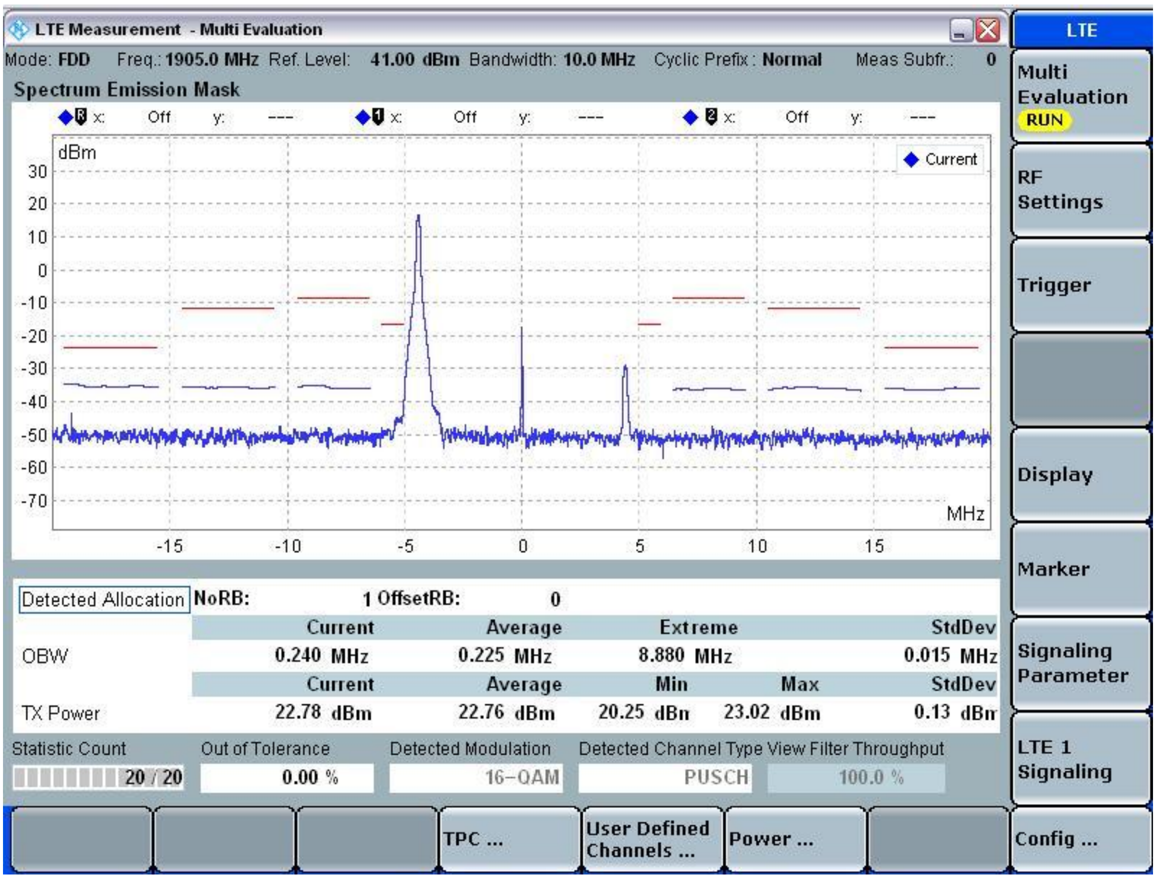
LTE Band II,10MHz BW,QPSK,1RB,Offset 49



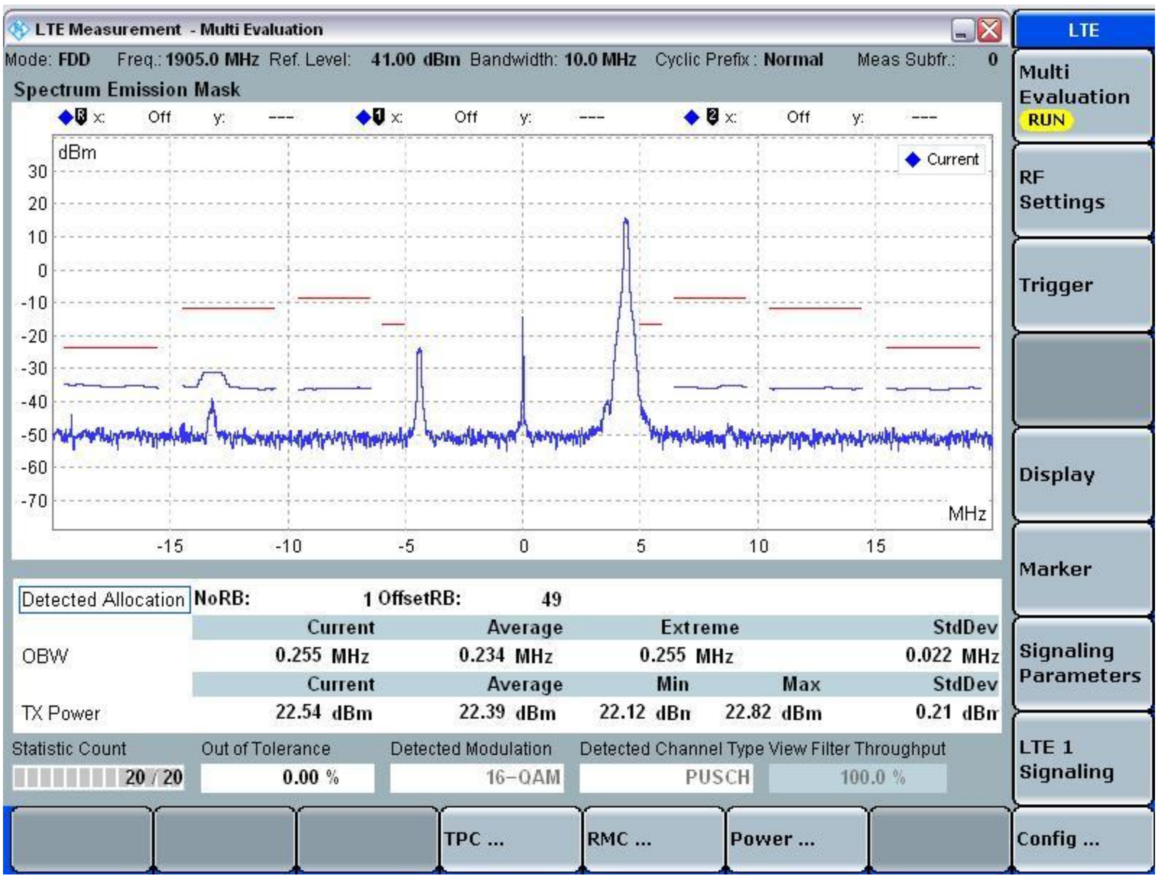
LTE Band II,10MHz BW,QPSK,50%RB,Offset 13



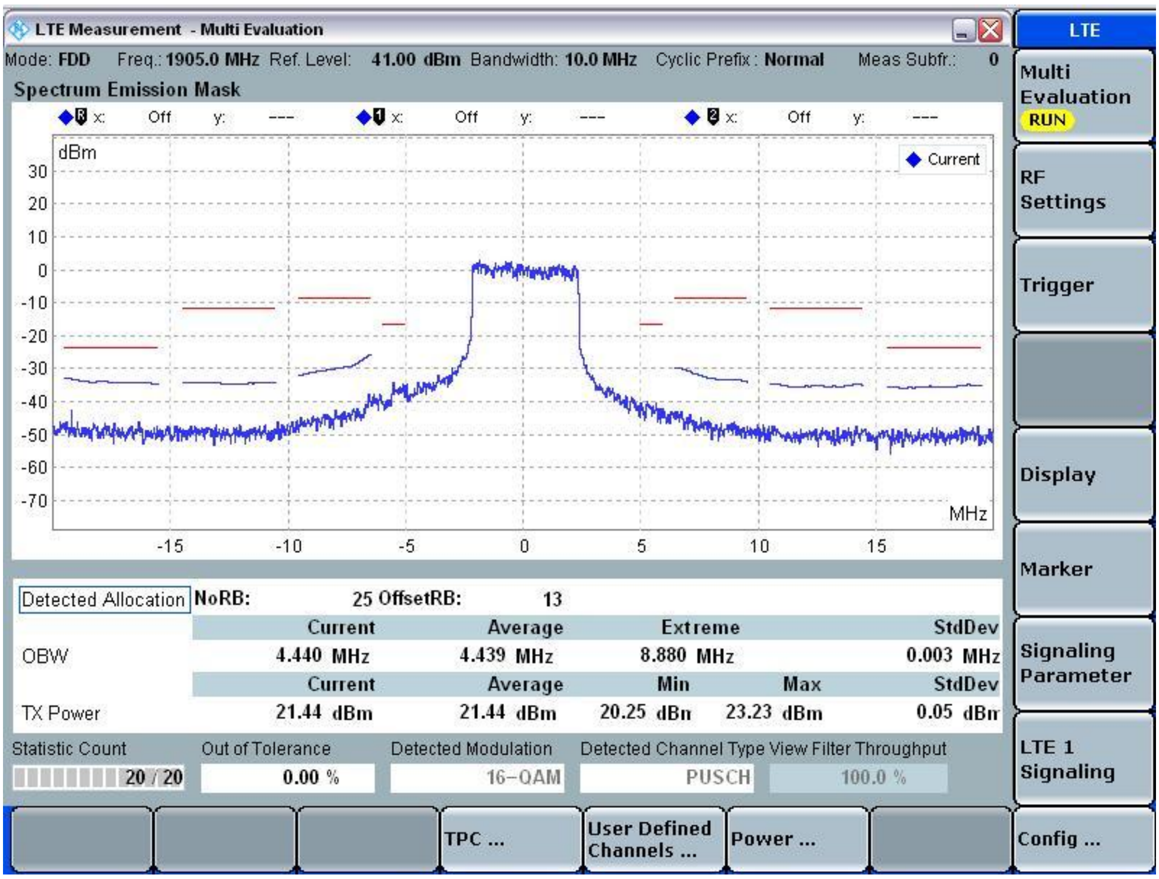
LTE Band II,10MHz BW,QPSK,100%RB,Offset 0



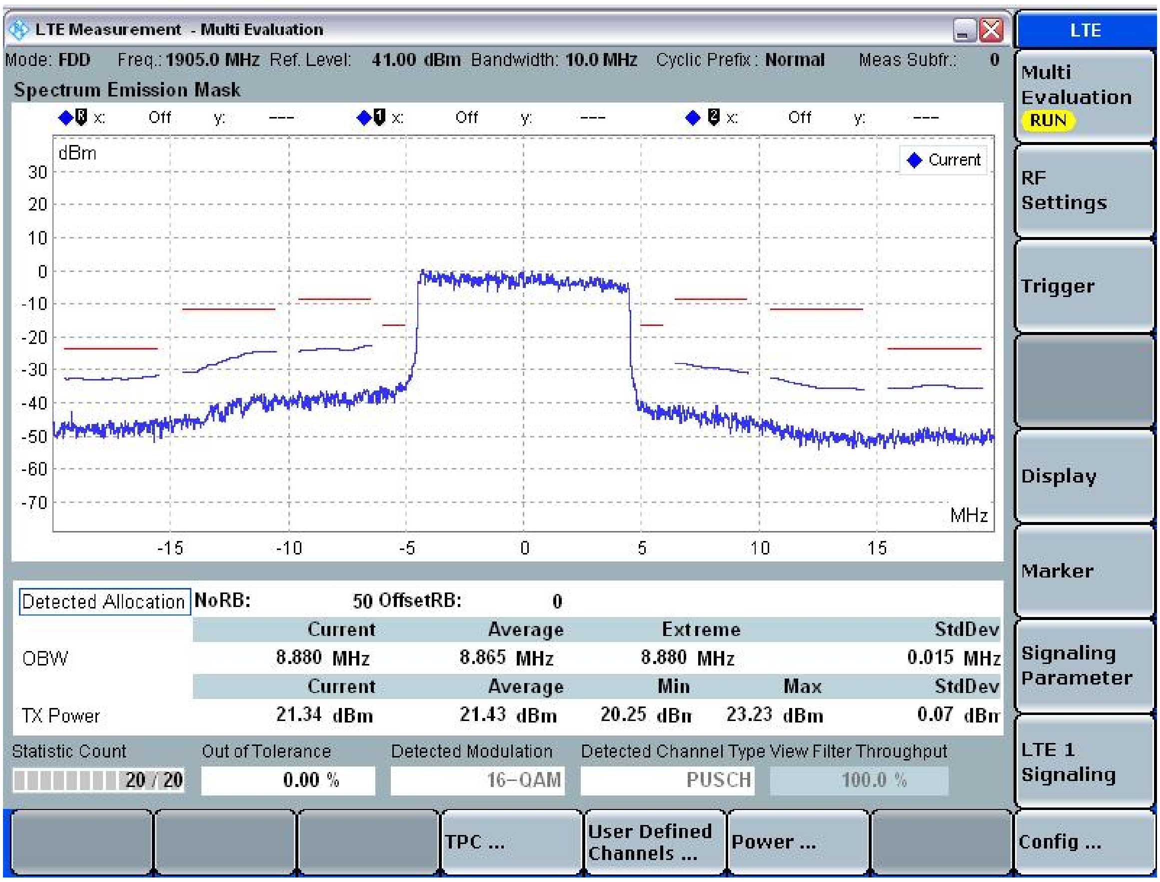
LTE Band II,10MHz BW,16QAM,1RB,Offset 0



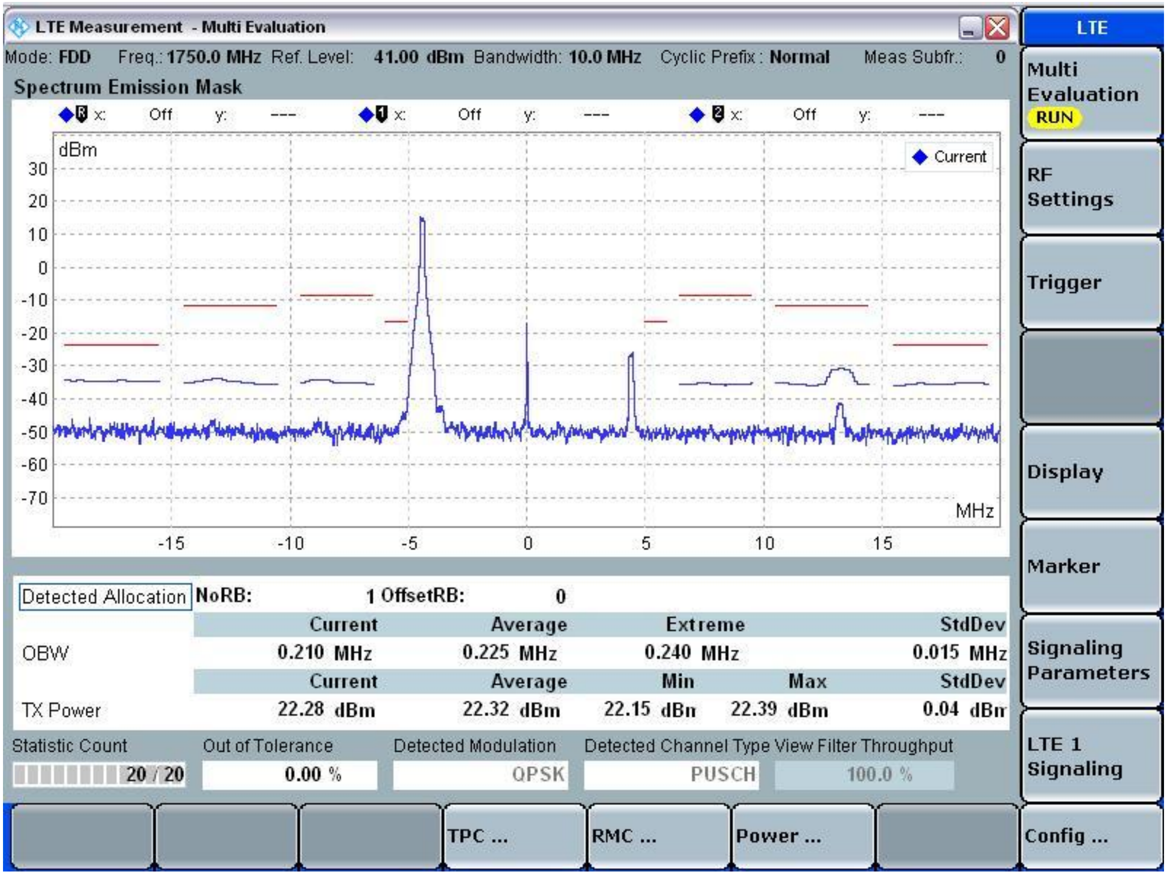
LTE Band II,10MHz BW,16QAM,1RB,Offset 49



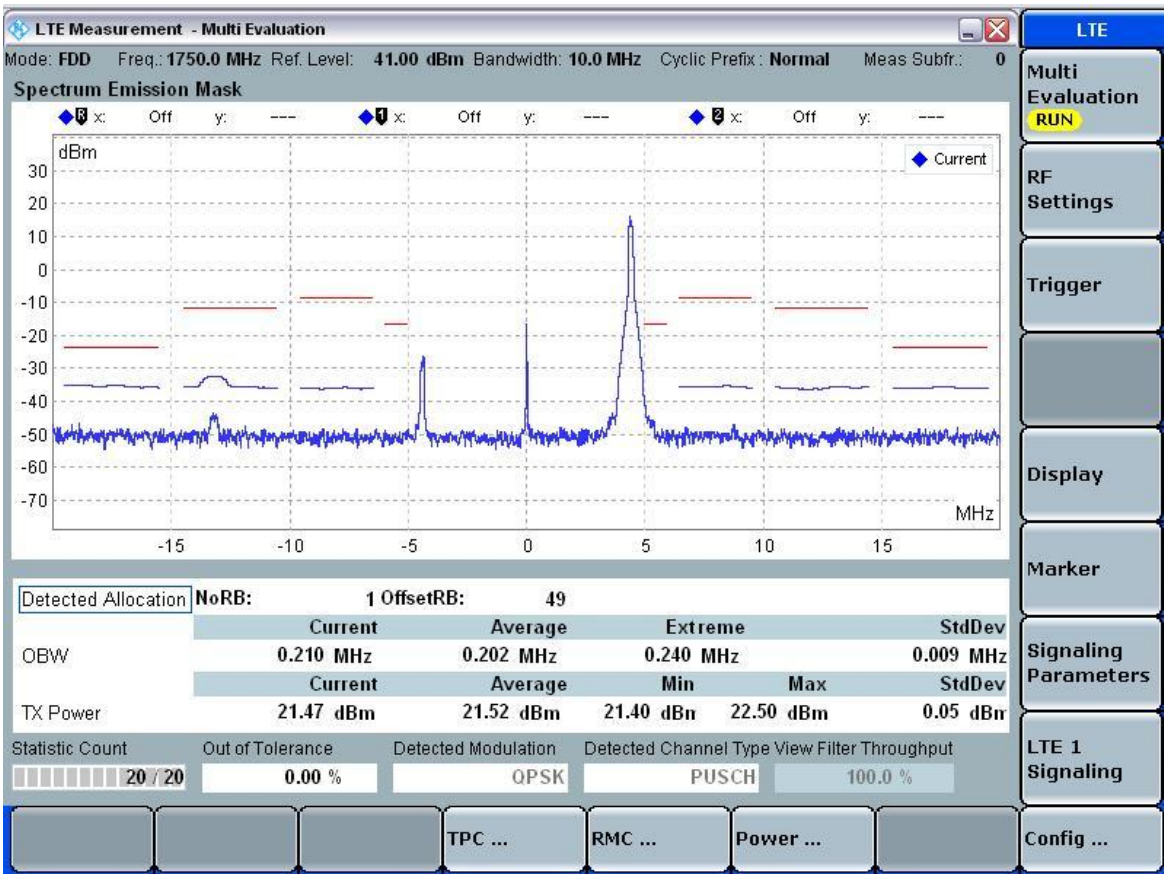
LTE Band II,10MHz BW,16QAM,50%RB,Offset 13



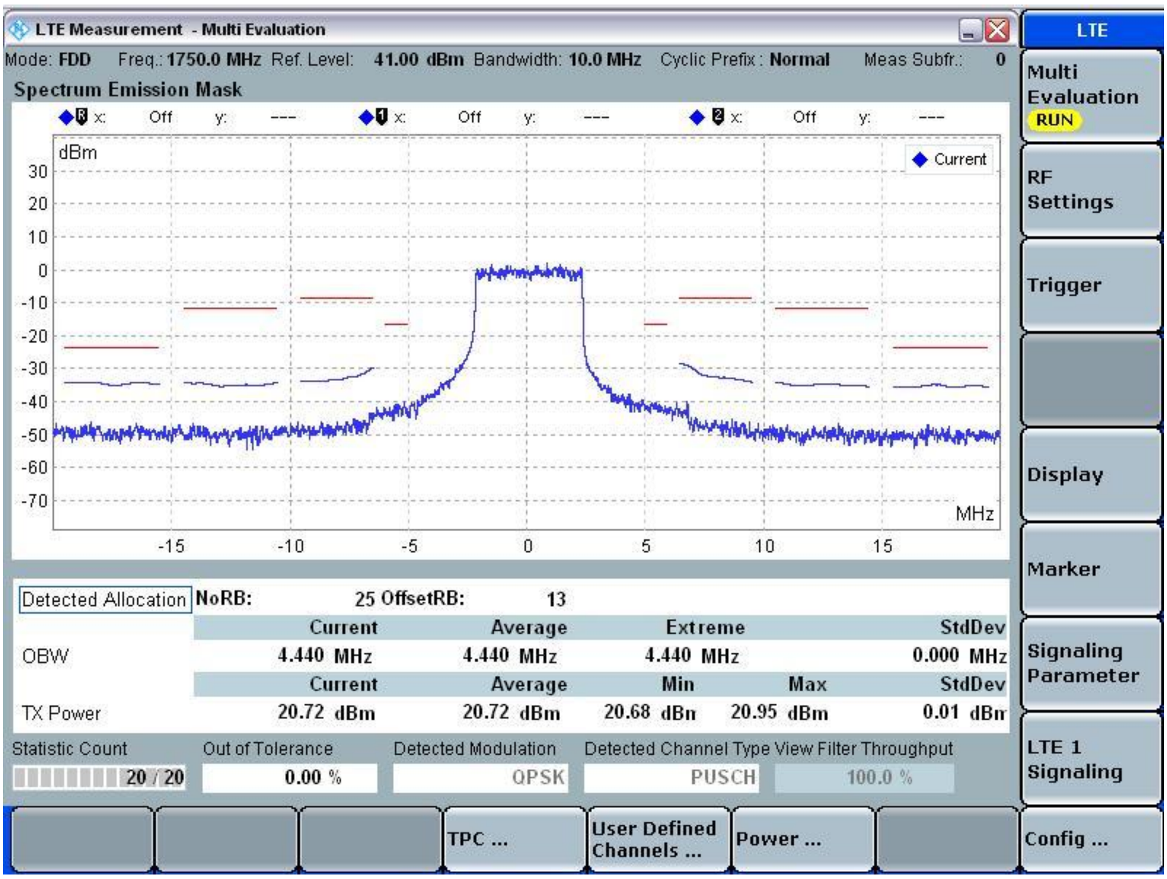
LTE Band II,10MHz BW,16QAM,100%RB,Offset 0



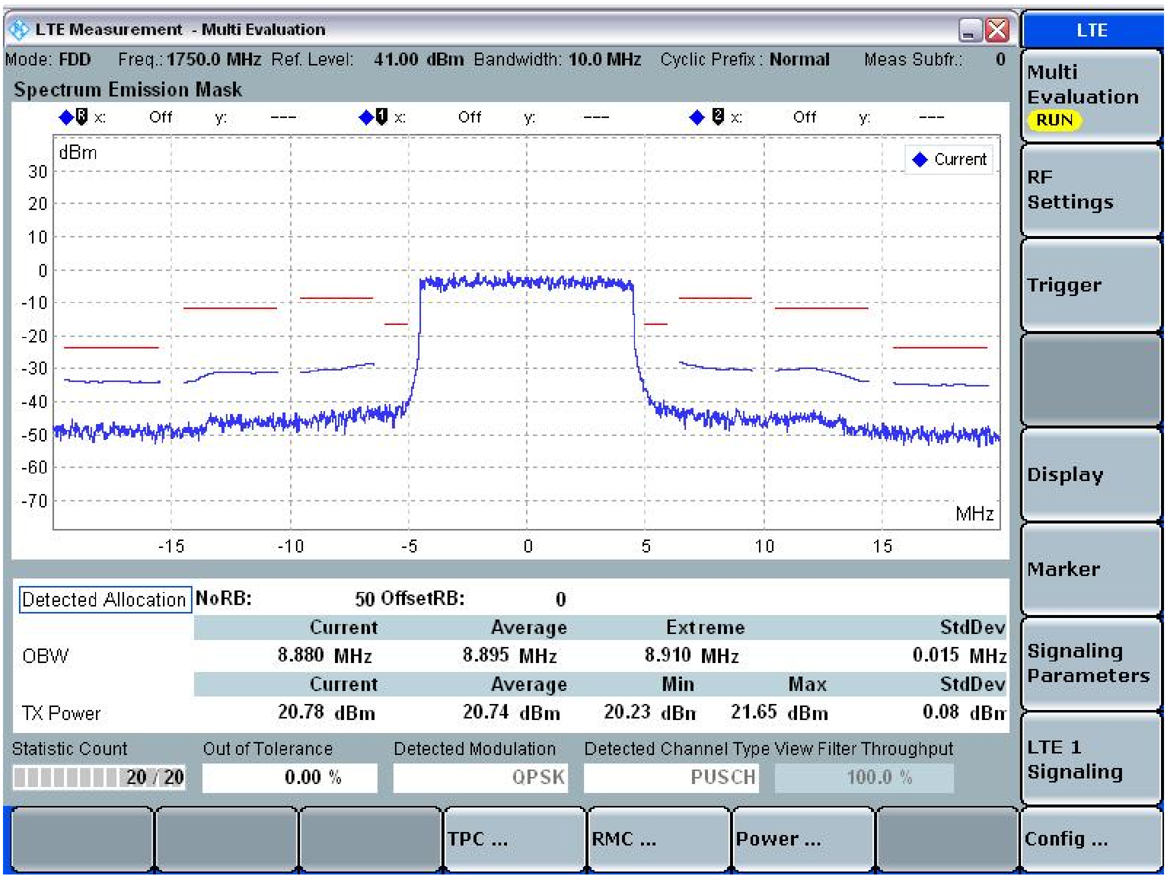
LTE Band IV,10MHz BW,QPSK,1RB,Offset 0



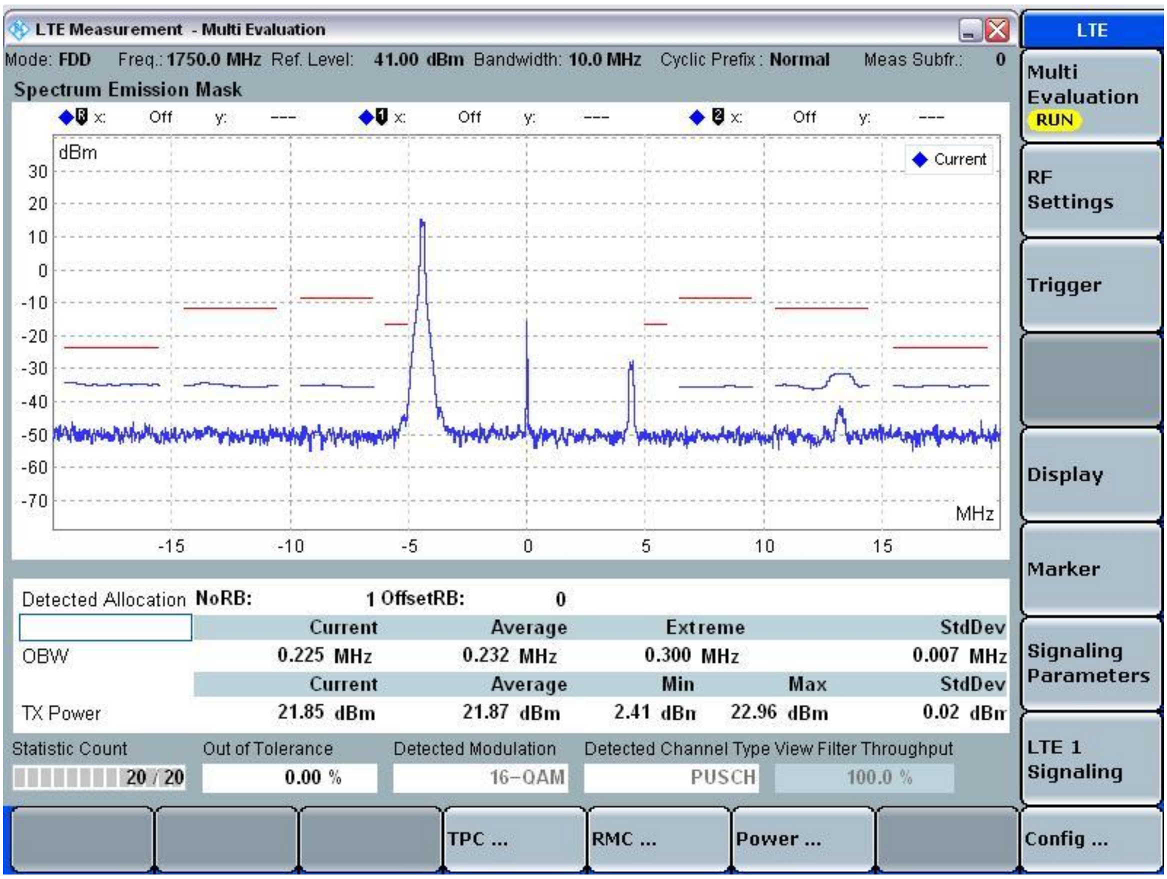
LTE Band IV,10MHz BW,QPSK,1RB,Offset 49



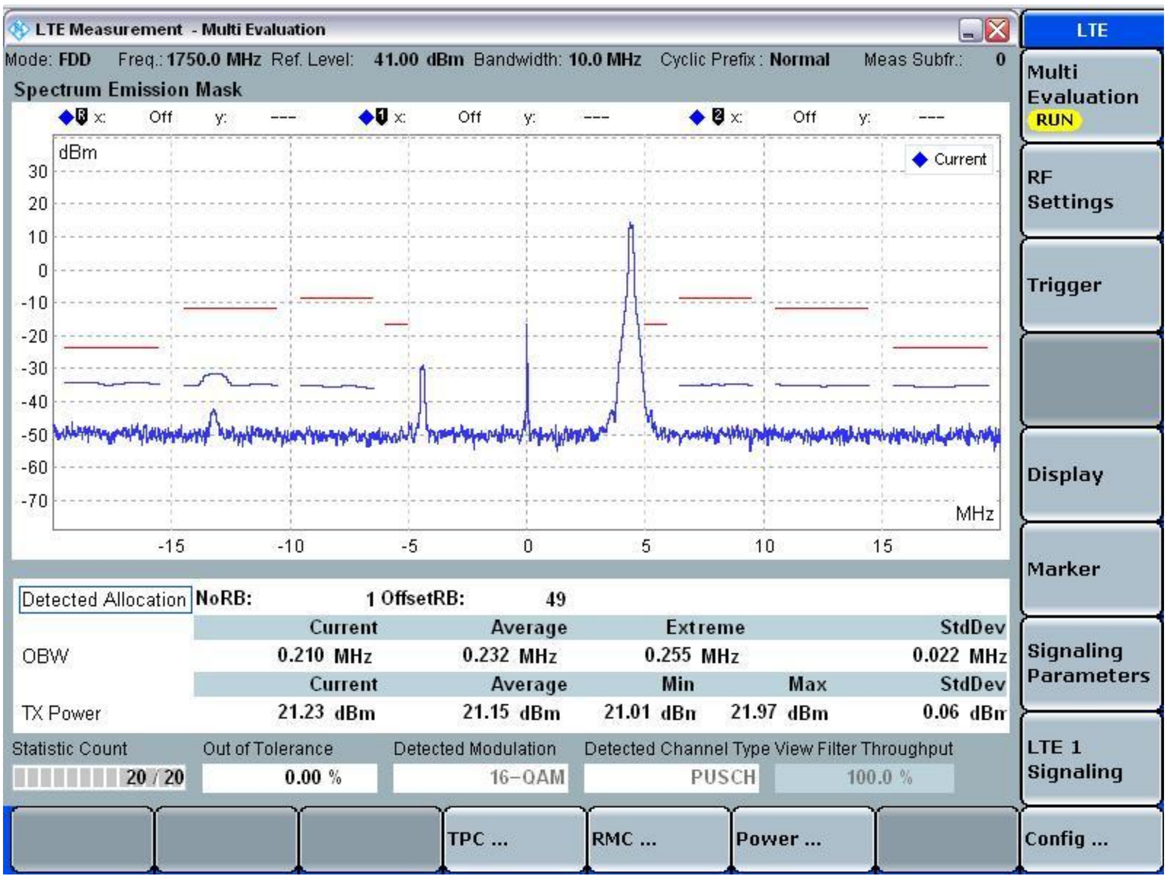
LTE Band IV,10MHz BW,QPSK,50%RB,Offset 13



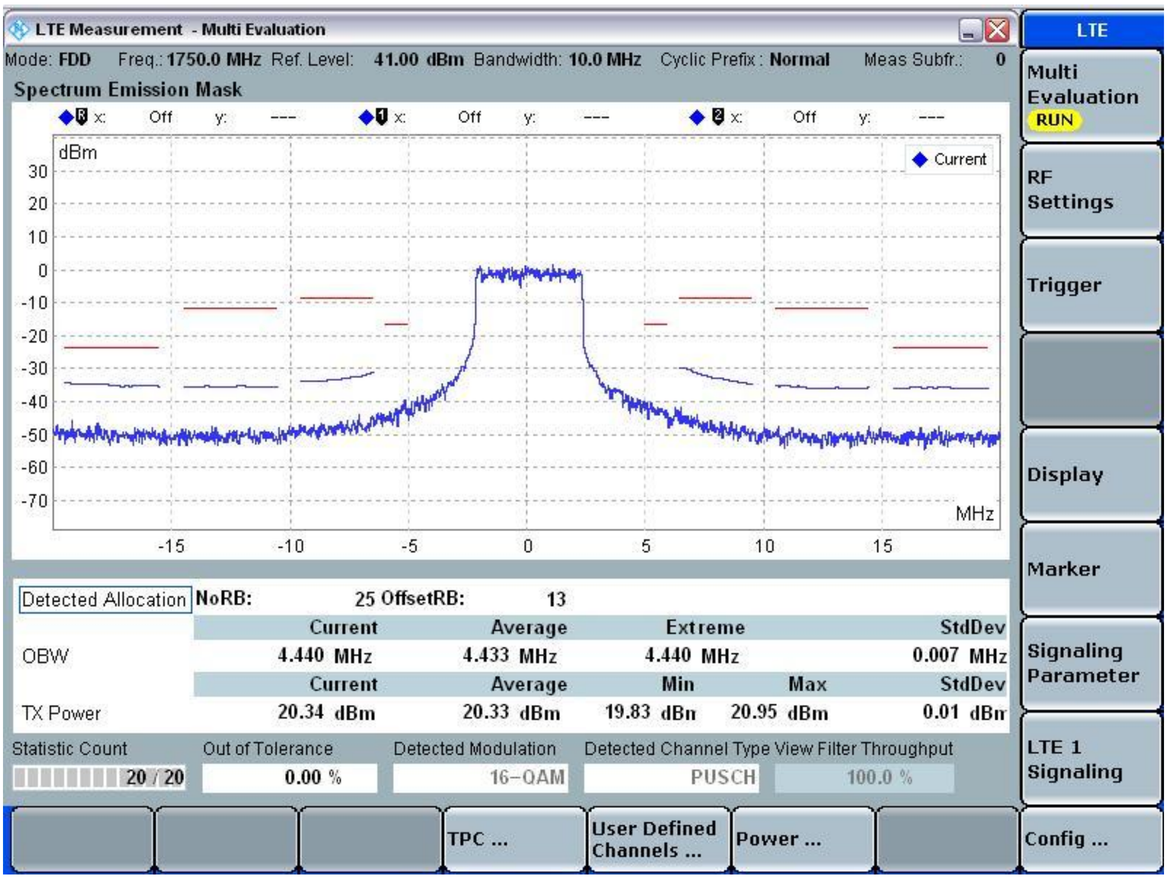
LTE Band IV,10MHz BW,QPSK,100%RB,Offset 0



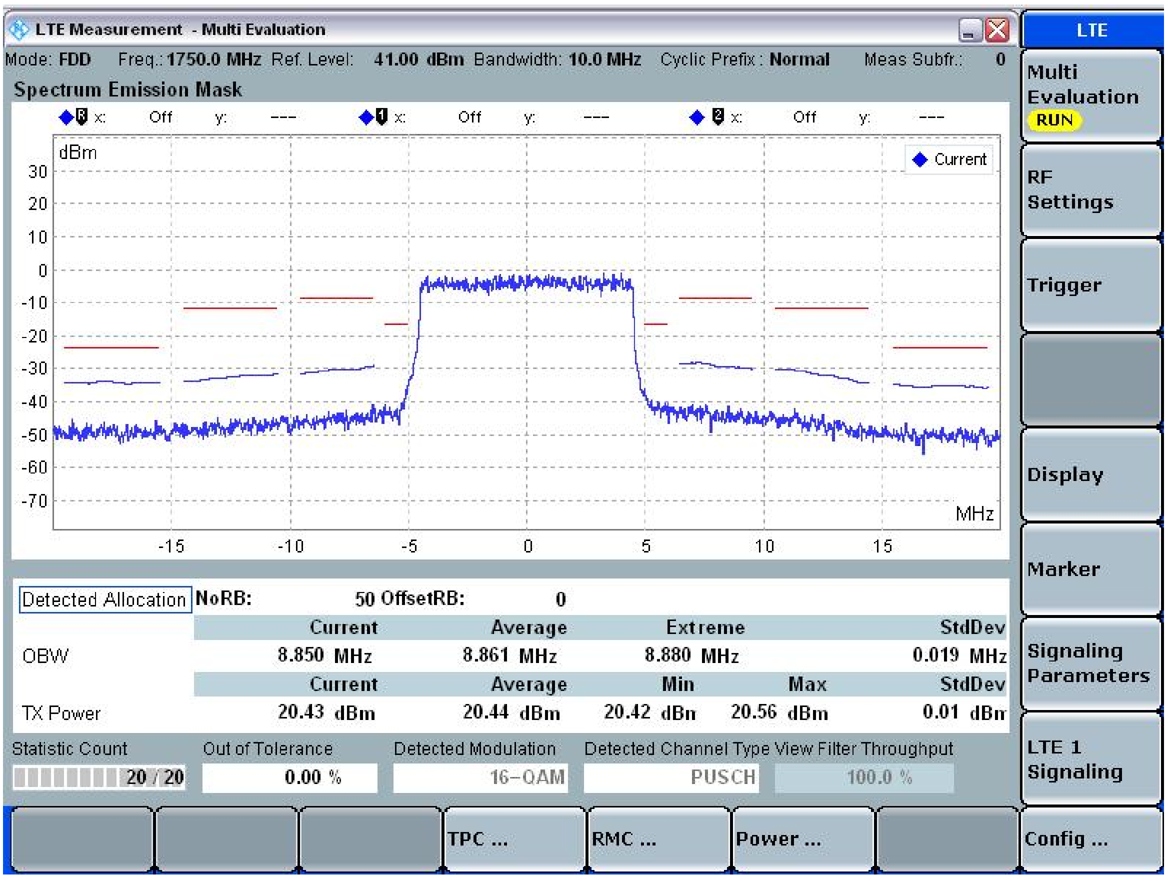
LTE Band IV,10MHz BW,16QAM,1RB,Offset 0



LTE Band IV,10MHz BW,16QAM,1RB,Offset 49



LTE Band IV,10MHz BW,16QAM,50%RB,Offset 13



LTE Band IV,10MHz BW,16QAM,100%RB,Offset 0

7.4 Multiple Transmitter Evaluation

7.4.1 Stand-alone SAR

These procedures were followed according to FCC "KDB648474 D01 SAR Handsets Multi Xmiter and Ant, v01r05", Sept 2008. The procedures are applicable to phones with built-in unlicensed transmitters, such as 802.11 a/b/g and Bluetooth devices.

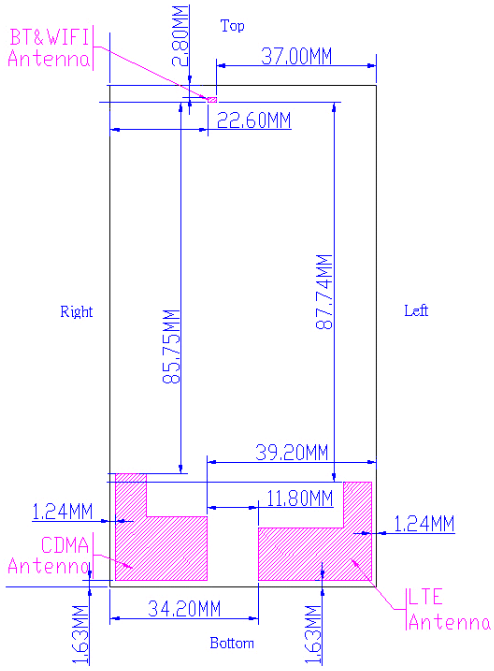
	2.45	5.15 - 5.35	5.47 - 5.85	GHz
P_{Ref}	12	6	5	mW
Device output power should be rounded to the nearest mW to compare with values specified in this table.				

Table 36: Output Power Thresholds for Unlicensed Transmitters

	Individual Transmitter	Simultaneous Transmission
Licensed Transmitters	Routine evaluation required	SAR not required: Unlicensed only ○ when stand-alone 1-g SAR is not required and antenna is ≥ 5 cm from other antennas Licensed & Unlicensed ○ when the sum of the 1-g SAR is < 1.6 W/kg for all simultaneous transmitting antennas ○ when SAR to peak location separation ratio of simultaneous transmitting antenna pair is < 0.3 SAR required: Licensed & Unlicensed antenna pairs with SAR to peak location separation ratio ≥ 0.3; test is only required for the configuration that results in the highest SAR in stand-alone configuration for each wireless mode and exposure condition Note: simultaneous transmission exposure conditions for head and body can be different for different style phones; therefore, different test requirements may apply
Unlicensed Transmitters	When there is no simultaneous transmission – ○ output ≤ 60/f: SAR not required ○ output > 60/f: stand-alone SAR required When there is simultaneous transmission – Stand-alone SAR not required when ○ output ≤ 2·P_{Ref} and antenna is ≥ 5.0 cm from other antennas ○ output ≤ P_{Ref} and antenna is ≥ 2.5 cm from other antennas ○ output ≤ P_{Ref} and antenna is < 2.5 cm from other antennas, each with either output power ≤ P_{Ref} or 1-g SAR < 1.2 W/kg Otherwise stand-alone SAR is required When stand-alone SAR is required ○ test SAR on highest output channel for each wireless mode and exposure condition ○ if SAR for highest output channel is > 50% of SAR limit, evaluate all channels according to normal procedures	

Table 37: Summary of SAR Evaluation Requirements for a Cell Phone with Multiple Transmitters

The closest distance between BT/WiFi antenna and main antenna is 8.57 or 8.77cm > 5cm, and the location of the antennas inside mobile phone is shown as below picture:



Rear Side View

The output power of BT antenna is as following:

BT 2450MHz	Average Conducted Power (dBm)		
	0CH	39CH	78CH
	5.46	6.51	7.45

Table 38: Test results conducted power measurement BT 2450 MHz

The output power of WiFi antenna is as following:

Wi-Fi 2450MHz	Channel	Average Power (dBm) for Data Rates (Mbps)							
		1	2	5.5	11	/	/	/	/
802.11b	1	13.99	14.23	13.89	13.64	/	/	/	/
	6	14.38	14.47	14.52	14.49	/	/	/	/
	11	14.46	14.41	14.53	14.44	/	/	/	/
802.11g	Channel	6	9	12	18	24	36	48	54
	1	13.67	13.54	13.55	12.95	11.80	10.35	9.19	9.27
	6	14.05	14.06	13.88	13.25	12.11	10.46	9.68	9.49
	11	13.96	13.85	13.91	13.43	12.06	10.44	9.36	9.40
802.11n (HT20)	Channel	6.5	13	19.5	26	39	52	58.5	65
	1	9.50	9.64	9.38	9.51	9.32	9.23	9.39	9.58
	6	9.54	9.55	9.56	9.52	9.55	9.57	9.50	9.55
	11	9.39	9.38	9.41	9.36	9.41	9.40	9.39	9.41

Table 39: Test results conducted power measurement WiFi 2450 MHz

According to the output power measurement results and the distance between WiFi/BT antenna and CDMA or LTE antenna we can draw the conclusion that:

1) stand-alone SAR evaluation is not required for BT, because the output power of BT unlicensed is 7.45 dBm ≤ 2PRef (13.8dBm) and antenna is >5cm from other antennas(CDMA or LTE antenna).
2) Stand-alone SAR evaluation is required for WiFi, because the output power of WiFi unlicensed transmitter is 14.53dBm ≥ 24mW (13.8dBm).

7.4.2 Simultaneous Transmission Possibilities

The following table shows exposure conditions for all transmitters:

Simultaneous Transmission Possibilities				
Simultaneous Tx Combination	**Configuration**	**Head**	**Body-Worn**	**Hotspot**
1	**CDMA Voice**	**Yes**	**Yes**	**-**
2	**CDMA Voice + BT**	**-**	**Yes**	**-**
3	**EVDO Data**	**-**	**Yes**	**-**
4	**EVDO Data + BT**	**-**	**Yes**	**-**
5	**EVDO VoIP**	**Yes**	**-**	**-**
6	**EVDO VoIP + BT**	**-**	**Yes**	**-**
7	**LTE Data**	**-**	**Yes**	**-**
8	**LTE Data + BT**	**-**	**Yes**	**-**
9	**LTE VoIP**	**Yes**	**-**	**-**
10	**LTE VoIP + BT**	**-**	**Yes**	**-**
11	**WLAN Data**	**-**	**Yes**	**-**
12	**WLAN VoIP**	**Yes**	**-**	**-**
13	**CDMA Voice + WLAN**	**Yes**	**Yes**	**-**
14	**LTE DATA + WLAN**	**-**	**-**	**Yes**
15	**LTE VoIP + WLAN**	**Yes**	**-**	**-**

Table 40: Simultaneous Transmission Possibilities

Note: 1) This mode doesn't support simultaneous voice and data with CDMA 1X voice and LTE data, since they may process origination procedure over CDMA in parallel with data suspension procedure over LTE in order to reduce call set up delay over CDMA.

2）This mode doesn't support simultaneous voice and data with CDMA 1X voice and EVDO data, since they share the antenna.

3）This mode shall not support Mobile Hotspot services function for CDMA network, but can support Mobile Hotspot services function for LTE network.

7.4.3 SAR Summation Scenario

Antenna	Antenna Use	Technologies	TX Bands
1	Voice 1x TX/RX+DO Data TX/RX	1x+DO	850/1700/1900
2	LTE Data TX/RX	LTE	1900/1700
3	WLAN/BT	802.11+Bluetooth	2450MHz

Table 41: Definition of Antennas

Test Position		LTE Band II SAR(W/kg)	LTE Band IV SAR(W/kg)	WiFi SAR (W/kg)	Σ1-g SARmax (W/kg)
Head SAR	Left Hand Touched	**1.33**	1.19	0.171	**1.501**
	Left Hand Tilted 15°	0.303	0.304	0.147	0.451
	Right Hand Touched	0.770	0.645	0.155	0.925
	Right Hand Tilted 15°	0.356	0.196	0.128	0.484

Table 42: Simultaneous Tx Combination (LTE VoIP+WLAN)

Test Position		LTE Band II SAR(W/kg)	LTE Band IV SAR(W/kg)	WiFi SAR (W/kg)	Σ1-g SARmax (W/kg)
Hotspot Body SAR	Towards Phantom	0.928	0.853	0.025	0.953
	Towards Ground	**1.29**	1.03	0.010	**1.300**
	Left edge	0.475	0.302	0	0.475
	Right edge	0	0	0.024	0.024
	Top edge	0	0	0.030	0.030
	Bottom edge	0.330	0.392	0	0.392

Table 43: Simultaneous Tx Combination (LTE DATA+WLAN)

Test Position		CDMA800 SAR(W/kg)	CDMA1700 SAR(W/kg)	CDMA1900 SAR(W/kg)	WiFi SAR (W/kg)	Σ1-g SARmax (W/kg)
Head SAR	Left Hand Touched	0.356	0.278	0.397	0.171	0.568
	Left Hand Tilted 15°	0.284	0.137	0.215	0.147	0.431
	Right Hand Touched	1.010	0.437	0.676	0.155	1.165
	Right Hand Tilted 15°	0.334	0.172	0.232	0.128	0.462
Body-Worn SAR	Towards Phantom	0.706	0.565	0.724	0.025	0.749
	Towards Ground	**1.360**	0.994	0.939	0.010	**1.370**

Table 44: Simultaneous Tx Combination (CDMA Voice+WLAN)

According to the output power measurement results and the distance between WiFi/BT antenna and CDMA or LTE antenna we can draw the conclusion that:

1) Simultaneous Transmission SAR evaluation is not required for CDMA or LTE& BT,because stand-alone SAR are not required for BT and the sum of 1-g SAR_{max} is 1.360W/kg < 1.6 W/kg for all simultaneous transmitting antennas.

2) Simultaneous Transmission SAR evaluation is not required for BT and WiFi, because the sum of the 1g SAR_{max} is 0.171W/kg < 1.6 W/kg for BT and WiFi.

3) Simultaneous Transmission SAR evaluation is not required for Head CDMA Voice & WiFi, because the sum of the 1g SAR_{max} is 1.370W/kg < 1.6W/kg for all simultaneous transmitting antennas.

4) Simultaneous Transmission SAR evaluation is not required for Hotspot LTE DATA & WiFi, because the sum of the 1g SAR_{max} is 1.300W/kg < 1.6W/kg for all simultaneous transmitting antennas.

5) Simultaneous Transmission SAR evaluation is not required for Head LTE Voice & WiFi, because the sum of the 1g SAR_{max} is 1.501W/kg < 1.6W/kg for all simultaneous transmitting antennas.

Appendix A. System Check Plots

(Pls See Appendix A.)

Appendix B. SAR Measurement Plots

(Pls See Appendix B.)

Appendix C. Calibration Certificate

(Pls See Appendix C.)

Appendix D. Photo documentation

(Pls See Appendix D.)

End