



FCC SAR Compliance Test Report

Project Name: HUAWEI MediaPad 10 FHD
Model : S10-102u
FCC ID : QISS10-102U
Report No. : SYBH(Z-SAR) 009072012-2

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DATE	2012-09-21	2012-09-21	2012-09-21

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Table of Contents

1	General Information	4
1.1	Statement of Compliance	4
1.2	RF exposure limits.....	4
1.3	EUT Description	5
1.3.1	General Description	6
1.3.2	Proximity Sensor Operational Theory for Power Back Off.....	6
1.4	Test specification(s)	19
1.5	Testing laboratory.....	19
1.6	Applicant and Manufacturer	19
1.7	Application details	19
1.8	Ambient Condition.....	20
2	SAR Measurement System	20
2.1	SAR Measurement Set-up.....	20
2.2	Test environment.....	22
2.3	Data Acquisition Electronics description.....	22
2.4	Probe description	23
2.5	Phantom description	24
2.6	Device holder description.....	24
2.7	Test Equipment List	25
3	SAR Measurement Procedure	26
3.1	Scanning procedure.....	26
3.2	Spatial Peak SAR Evaluation	27
3.3	Data Storage and Evaluation.....	28
4	System Verification Procedure.....	30
4.1	Tissue Verification	30
4.2	System Check.....	32
4.3	Validation Procedure.....	32
5	Measurement Uncertainty Evaluation	33
5.1	Measurement uncertainty evaluation for SAR test.....	33
5.2	Measurement uncertainty evaluation for system validation	34
6	SAR Test Configuration	35
6.1	GSM Test Configuration.....	35
6.2	UMTS Test Configuration.....	36
6.3	WiFi Test Configuration.....	41
7	SAR Measurement Results	42
7.1	Conducted power measurements.....	42
7.1.1	Conducted power measurements of GSM850	43
7.1.2	Conducted power measurements of GSM1900	44
7.1.3	Conducted power measurements of UMTS Band V	45
7.1.4	Conducted power measurements of UMTS Band II	46
7.2	SAR measurement Result.....	47
7.2.1	SAR measurement Result of GSM850.....	47
7.2.2	SAR measurement Result of GSM1900.....	48
7.2.3	SAR measurement Result of UMTS Band V	49
7.2.4	SAR measurement Result of UMTS Band II.....	50
7.2.5	SAR measurement Result of WiFi.....	51
7.3	Multiple Transmitter Evaluation	52
Appendix A.	System Check Plots	55
Appendix B.	SAR Measurement Plots	55
Appendix C.	Calibration Certificate	55
Appendix D.	Photo documentation.....	55

※ ※ Modified History ※ ※

REV.	DESCRIPTION	ISSUED DATE	REMARK
Rev. 1.0	Initial Test Report Release	2012-08-13	Gongzhong
Rev. 1.1	1.Revised the frequency band of WiFi in table 3 page 5 2.Added the test sample type in table 3, page 5. 3.Added dimension of the device in table 3, page 5. 4.Updated the test standards list in chapter 1.4, page 19. 5.Added the simultaneous transmission configuration list in page 53 6.Revised the “WCDMA” to “UMTS” of the report and Appendix B.	2012-09-17	Gongzhong
Rev. 1.2	1.Revised the frequency band of BT in table 3 page 5. 2.Updated the test standards list in chapter 1.4, page 19. 3.Added the description for specified power reduction values from page 43 to 46. 4.Replaced the antenna picture in page 52.	2012-09-20	Gongzhong
Rev. 1.3	1.Updated the content of table 1 in page 4. 2.Added the “Note” about proximity sensor information in page 6. 3.Updated the description for specified power reduction and target values from page 43 to 46. 4.Added the description for specified power reduction and target values from page 47 to 50.	2012-09-21	Gongzhong

1 General Information

1.1 Statement of Compliance

The maximum results of Specific Absorption Rate (SAR) found during testing for S10-102u is as below Table 1.

Band	Proximity sensor	Position	Measured MAX SAR _{1g} (W/kg)	Conducted Power (dBm)	MAX Tune-up Power (dBm)	Extrapolated Result (W/kg)
GSM850	Activated	Rear side(0mm)	0.540	26.71	28.50	0.815
	Deactivated	Rear side(11mm)	0.184	32.43	32.50	0.187
GSM1900	Activated	Rear side(0mm)	0.303	20.93	22.00	0.388
	Deactivated	Top side(9mm)	0.140	28.30	29.00	0.164
UMTS Band V	Activated	Rear side(0mm)	0.515	18.75	20.00	0.687
	Deactivated	Top side(9mm)	0.174	22.79	24.00	0.230
UMTS Band II	Activated	Rear side (0mm)	0.451	15.69	17.00	0.610
	Deactivated	Top side(9mm)	0.220	22.62	24.00	0.302
WiFi 2450	/	Rear side(0mm)	1.020	14.29	/	/
Simultaneous SAR_{Max} is 1.560W/kg						

Table 1: Summary of test result

The device is in compliance with Specific Absorption Rate(SAR)for general population/uncontrolled 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 95.1:1992, 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 Std 1528-2003&IEEE Std 1528a-2005 and FCC OET Bulletin 65 Supplement.

1.2 RF exposure limits

Human Exposure	Uncontrolled Environment General Population	Controlled Environment Occupational
Spatial Peak SAR* (Brain/Body/Arms/Legs)	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

Device Information:			
DUT Name:	HUAWEI MediaPad 10 FHD		
Type Identification:	S10-102u		
FCC ID :	QISS10-102U		
SN No.:	G9K6RA9251100192		
Device Type :	portable device		
Test Sample:	Production unit		
Dimension	257.44mm(length)×175.9mm(width)×8.87mm(height)(mm ³)		
Exposure Category:	uncontrolled environment / general population		
Hardware Version :	SH4101UM		
Software Version :	S10-102u V100R001C001		
Antenna Type :	internal antenna		
Battery Options:	Huawei Technologies Co., Ltd. Rechargeable Li-ion Battery Model: HB3S1 Rated capacity: 6400mAh Nominal Voltage: --- +3.7V; Charging Voltage: --- +4.2V		
Others Accessories	Headset		
Device Operating Configurations:			
Supporting Mode(s)	GSM850/1900,UMTS Band V/Band II,WiFi(Tested)		
Test Modulation	GSM(GMSK), UMTS(QPSK)		
Device Class	B		
Operating Frequency Range(s)	Band	Tx (MHz)	Rx (MHz)
	GSM850	824~849	869~894
	GSM1900	1850~1910	1930~1990
	UMTS Band V	824~849	869~894
	UMTS Band II	1850~1910	1930~1990
	Bluetooth	2402-2480	
	Wi-Fi	2412-2462	
GPRS Multislot Class (12)	Max Number of Timeslots in Uplink:	4	
	Max Number of Timeslots in Downlink:	4	
	Max Total Timeslot:	5	
EGPRS Multislot Class (12)	Max Number of Timeslots in Uplink:	4	
	Max Number of Timeslots in Downlink:	4	
	Max Total Timeslot:	5	
HSDPA UE Category	14		
HSUPA UE Category	6		
DC-HSDPA UE Category	24		
Power Class :	4, tested with power level 5 (GSM 850)		
	1, tested with power level 0 (GSM 1900)		
	3, tested with power control "all 1"(UMTS Band V)		
	3, tested with power control "all 1"(UMTS Band II)		
Test Channels (low-mid-high) :	128-190-251(GSM850)		
	512-661-810 (GSM1900)		
	4132-4182-4233(UMTS Band V)		
	9262-9400-9538(UMTS Band II)		
	1-6-11(WiFi)		

Table 3: Device information and operating configuration

1.3.1 General Description

DC-HSDPA/HSPA+/HSDPA/HSUPA/UMTS/EDGE/GPRS/GSM information terminal HUAWEI MediaPad 10 FHD with Bluetooth and Wi-Fi is subscriber equipment in the UMTS/GSM system. The DC-HSDPA/HSPA+/HSDPA/HSUPA/UMTS frequency band is Band I ,band II and Band V. The EDGE/GPRS/GSM frequency band includes GSM850 and GSM900 and DCS1800 and PCS1900. Band II/Band V/ GSM850/PCS1900 test data included in the report.

HUAWEI MediaPad 10 FHD (MediaPad 10 FHD for short) is a 10.1-inch tablet computer that simultaneously supports 3G and Wi-Fi data services, and has an ultra high definition IPS screen with a resolution of up to 1920 × 1200 pixels. MediaPad 10 FHD incorporates Huawei's own Hislicon processor and is based on the Android operating system, enjoying both Google Android Play Store and Huawei's unique Cloud+ solutions.

MediaPad 10 FHD has a stylish exterior. It is light, slim, and easy to carry; its ultra-thin 8.8 mm design creating an outstanding hand held user experience. MediaPad 10 FHD comes with up to a 1.3-megapixel front camera, and an 8-megapixel rear camera that supports high definition video recording as well as an autofocus function. In addition, the Dolby surround sound technology employed by MediaPad 10 FHD produces superb audiovisual effects, making users feel as if they are actually there whether taking photos, playing games, watching high definition films, or listening to music. In terms of network capabilities, MediaPad 10 FHD supports a high speed wireless connection of up to 42 Mbit/s (HSPA+ 5.76/42 Mbit/s), bringing users the perfect high speed Internet experience.

1.3.2 Proximity Sensor Operational Theory for Power Back Off

There is only one sensor (proximity) built in this EUT. The proximity sensor is only used for power reduction in 2/3G antenna. It can cover the rear side and the top side of EUT. When users approach the rear side within 12mm of EUT and top side within 10mm of EUT, the power of 2/3G antenna will be reduced. It doesn't be activated for other sides.

Since the back-off sensor activation distance for rear side is 12mm, a conservative distance of 11mm is tested for the rear side. To test SAR with the sensor deactivated and full power of rear side at 11mm. The sensor will be deactivated until the device tilt 120 degree at rear-top edge (rear side tilted 120°).

Since the back-off sensor activation distance for top side is 10mm, a conservative distance of 9mm is tested for the rear side. To test SAR with the sensor deactivated and full power of back side at 9mm. The sensor will be deactivated until the device tilt 34 degree at top-left corner (top side tilted 34°).

Note:

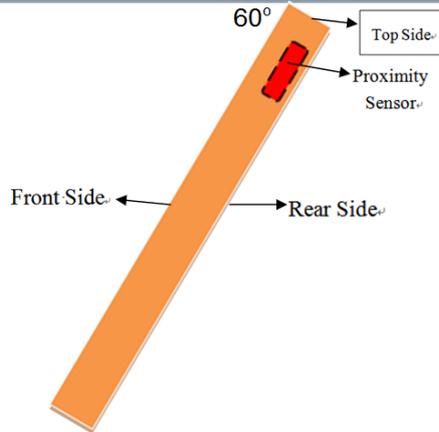
1. Detail description of proximity sensor is referred to the document "S10-102u sensor additional information".

2. Power back-off and tune-up values are referred to the document "Huawei Mediapad S10-102u Tune-up Procedure".

To evaluate the proximity sensor coverage at the Rear side of the device is determined by changing the angle of the device relation to the phantom and observing the angle at which the proximity sensor is no longer triggered. In this case, the consecutive angle at which proximity sensor stops triggering is at 120°.

Rear-top edge tilted angle against to the Phantom.

Angle of DUT(°)	0--118	119	120	121	122	123
Proximity Sensor Status in the rear-top edge of the device	ON	ON	ON	OFF	OFF	OFF

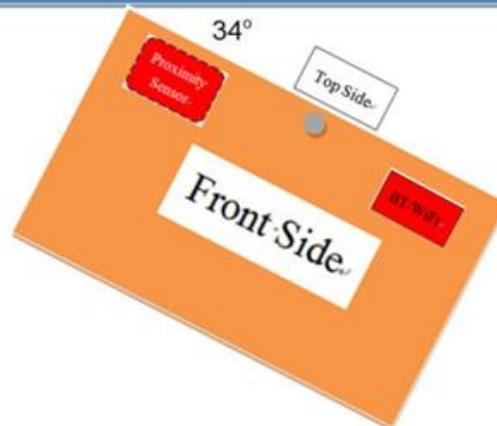


Rear-top edge(Rear side tilted 120°)

To evaluate the proximity sensor coverage at the Top side of the device is determined by changing the angle of the device relation to the phantom and observing the angle at which the proximity sensor is no longer triggered. In this case, the consecutive angle at which proximity sensor stops triggering is at 34°.

Top-left corner tilted angle against the Phantom.

Angle of DUT(°)	0--32	33	34	35	36	37
Proximity Sensor Status in the top-left corner of the device	ON	ON	ON	OFF	OFF	OFF



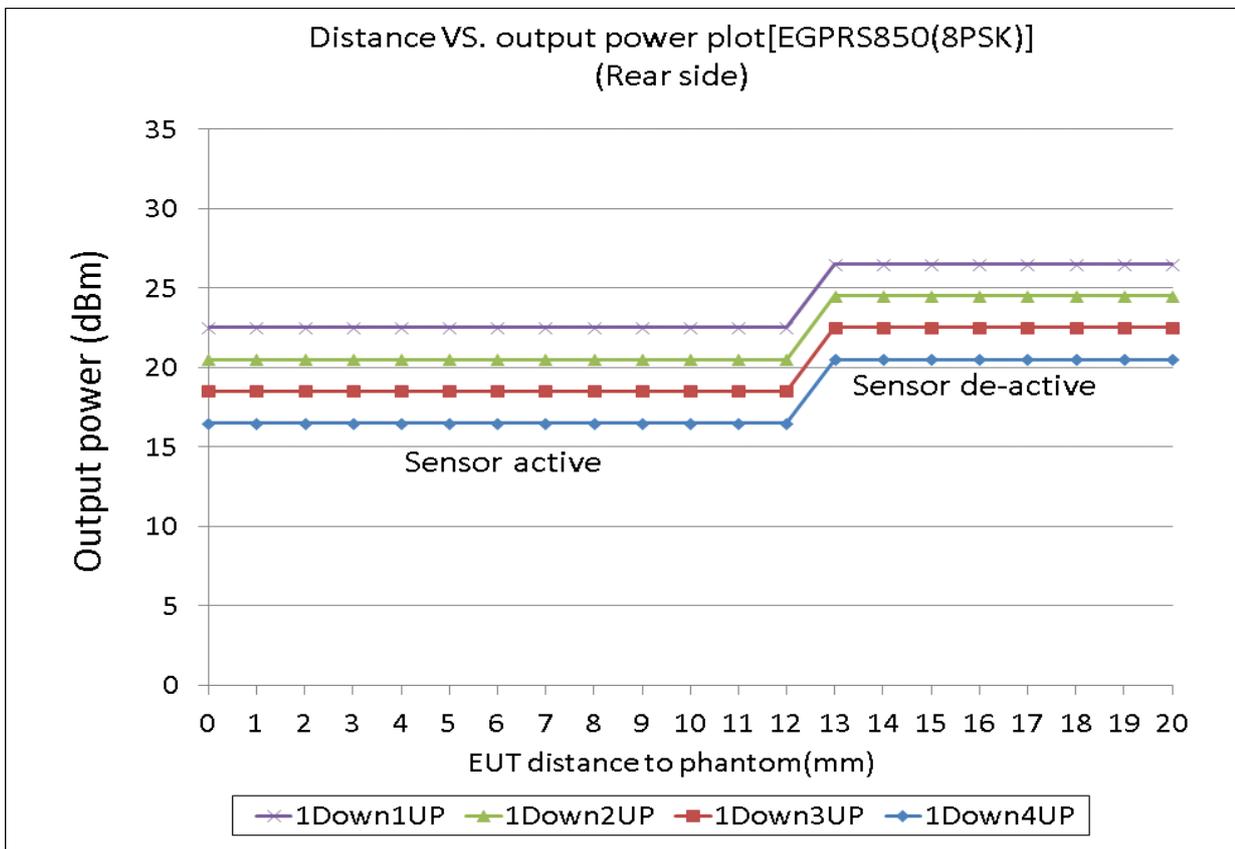
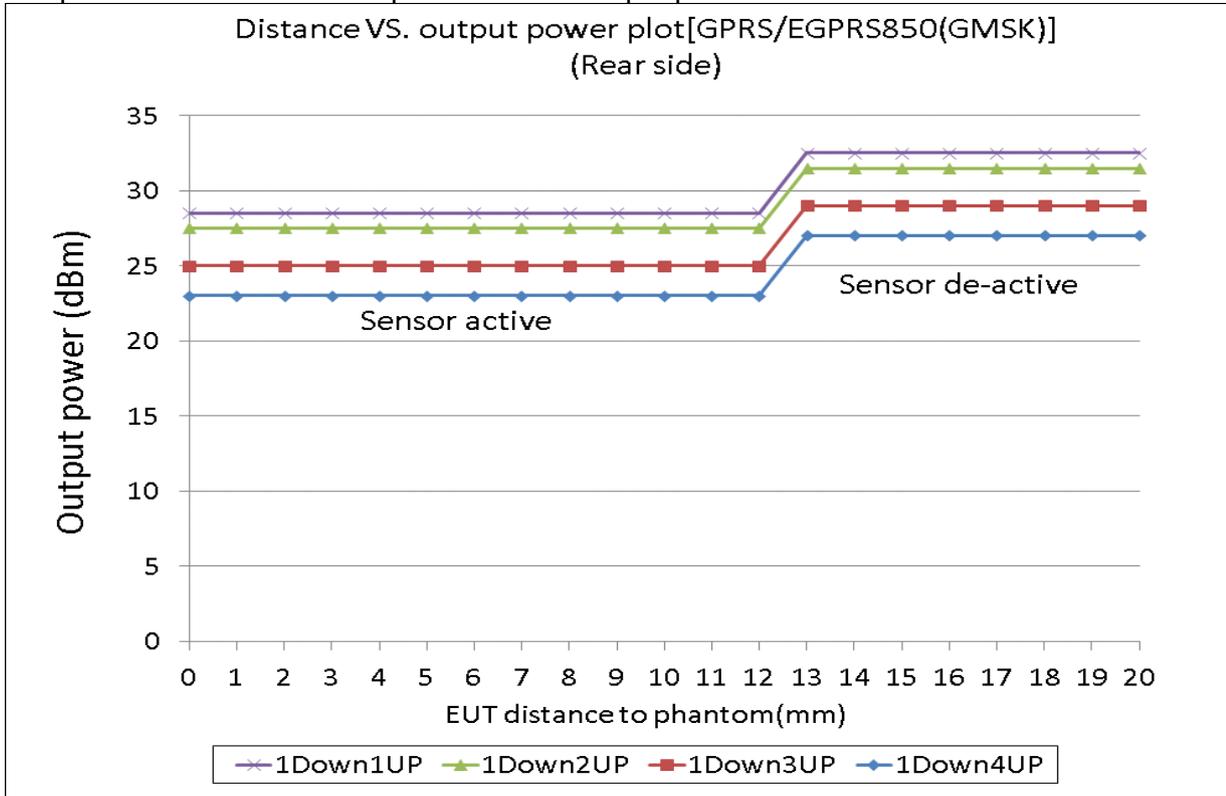
Top-left corner(Top side tilted 34°)

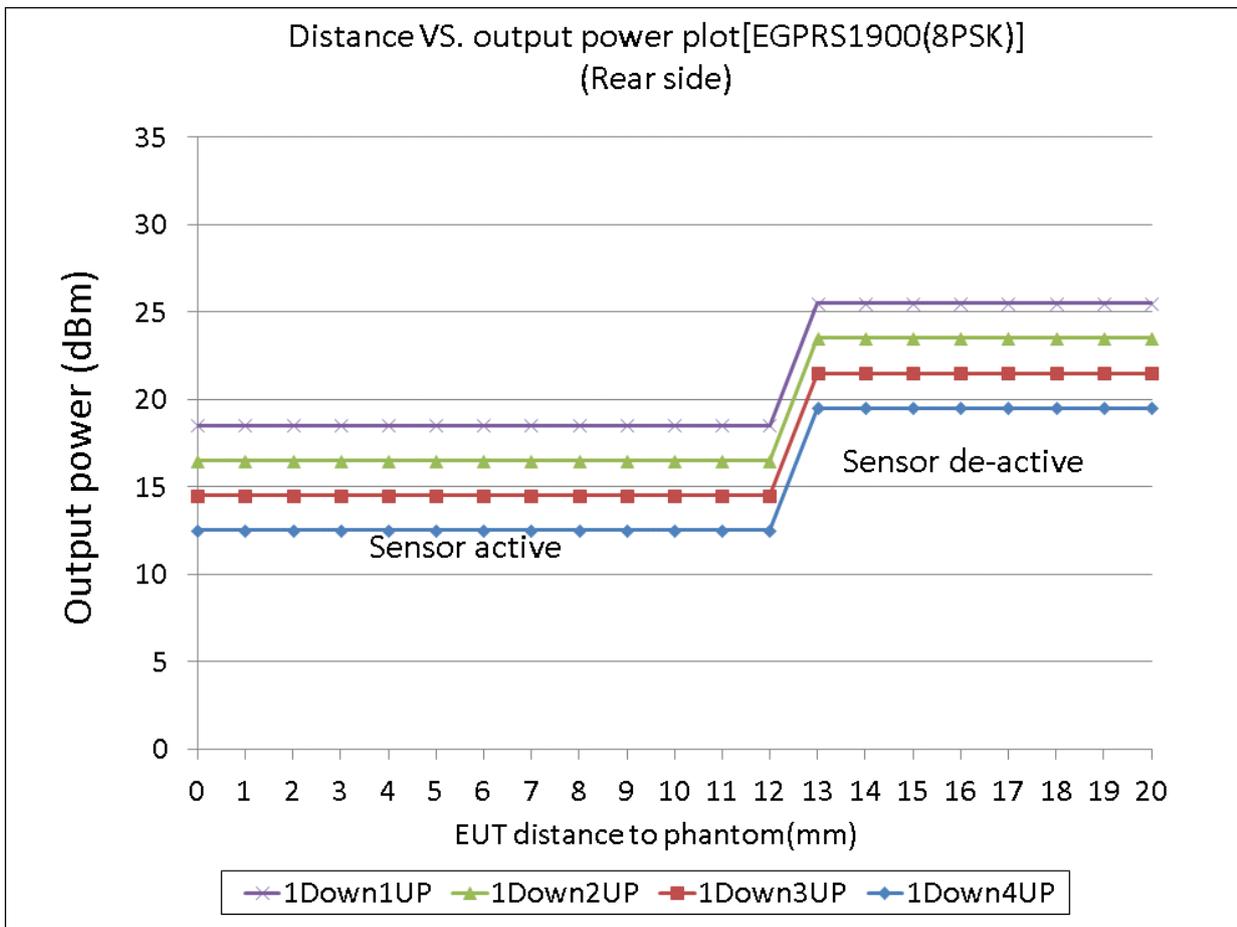
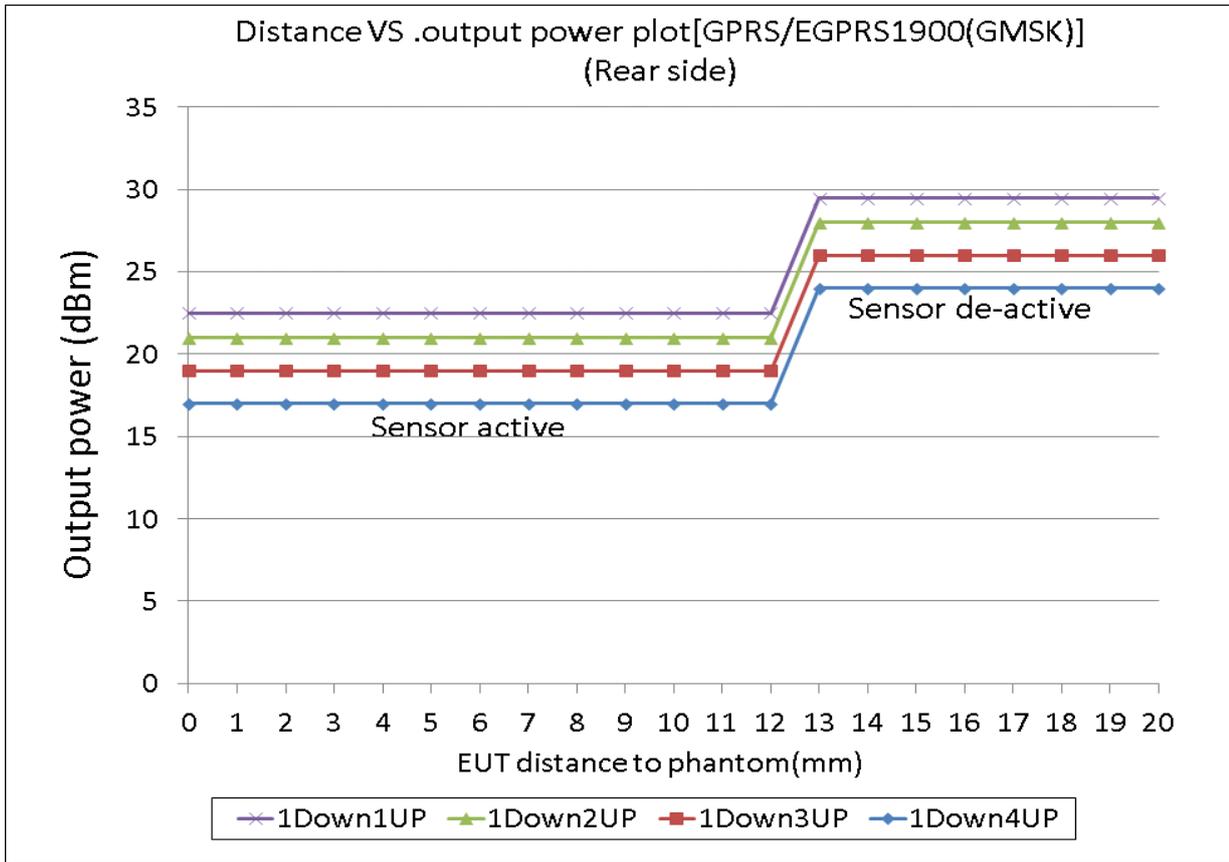
Rear side(0 degree angle) Distance from the user in 2/3G antenna

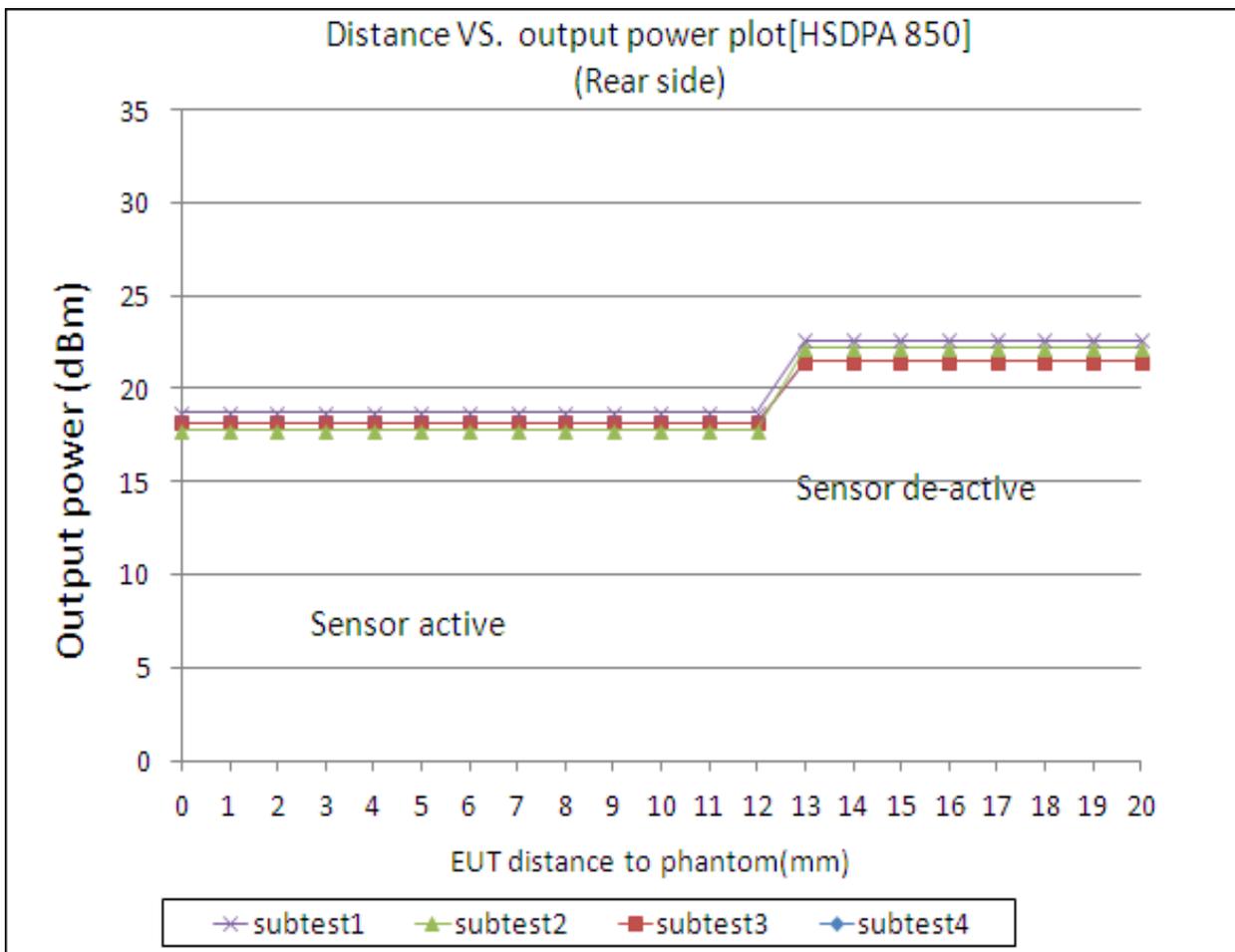
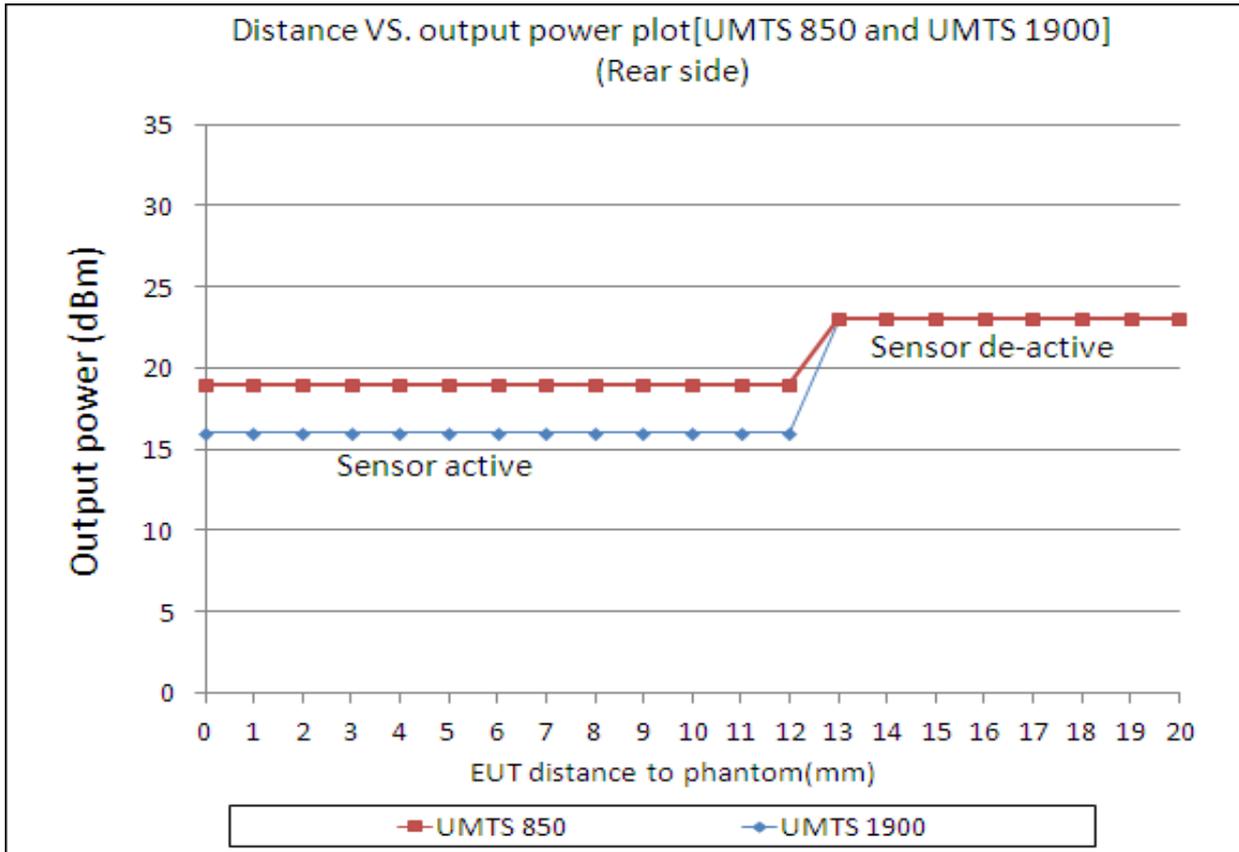
Distance in mm	0--10	11	12	13	14	15
Proximity Sensor Status in the rear side of the device	ON	ON	ON	OFF	OFF	OFF

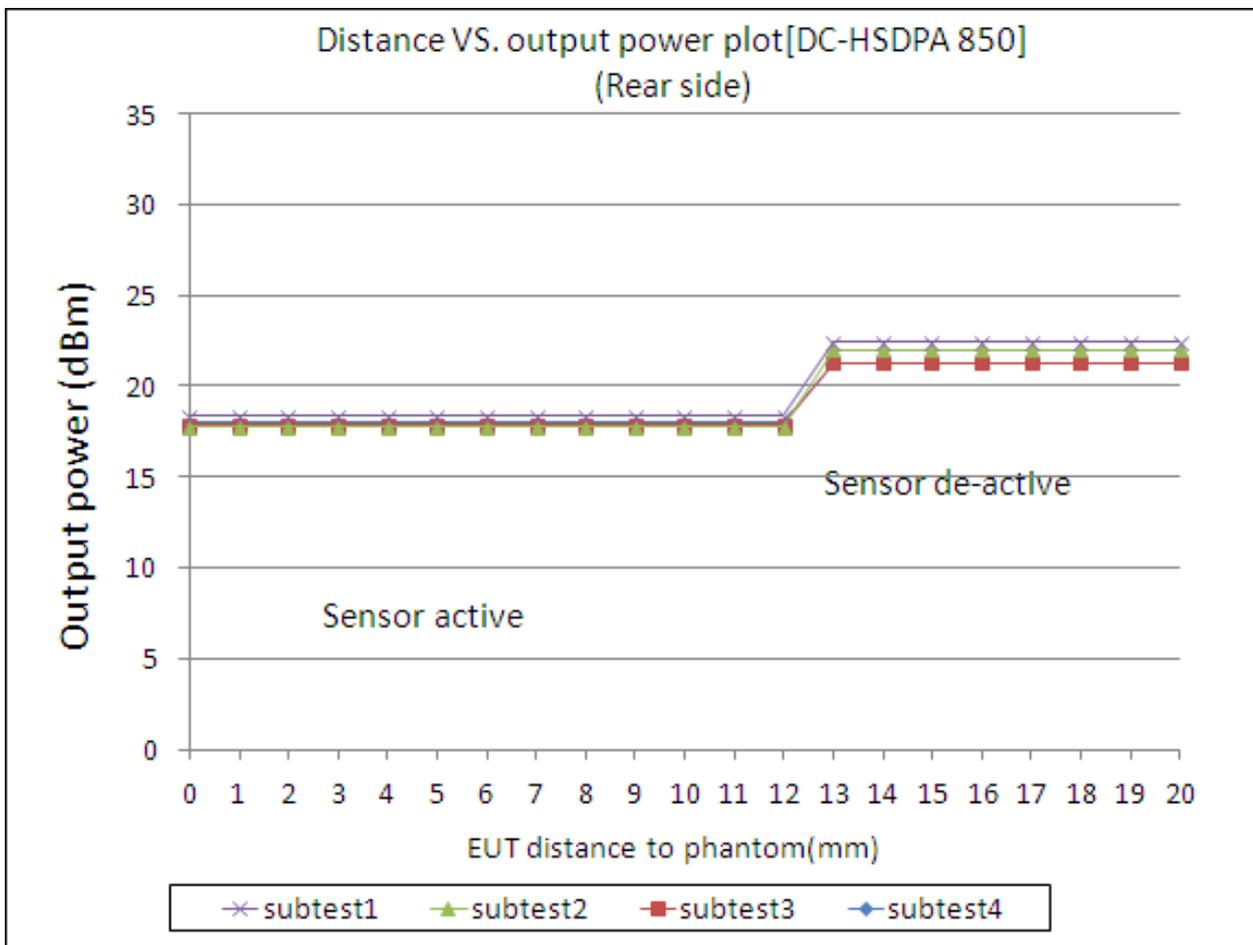
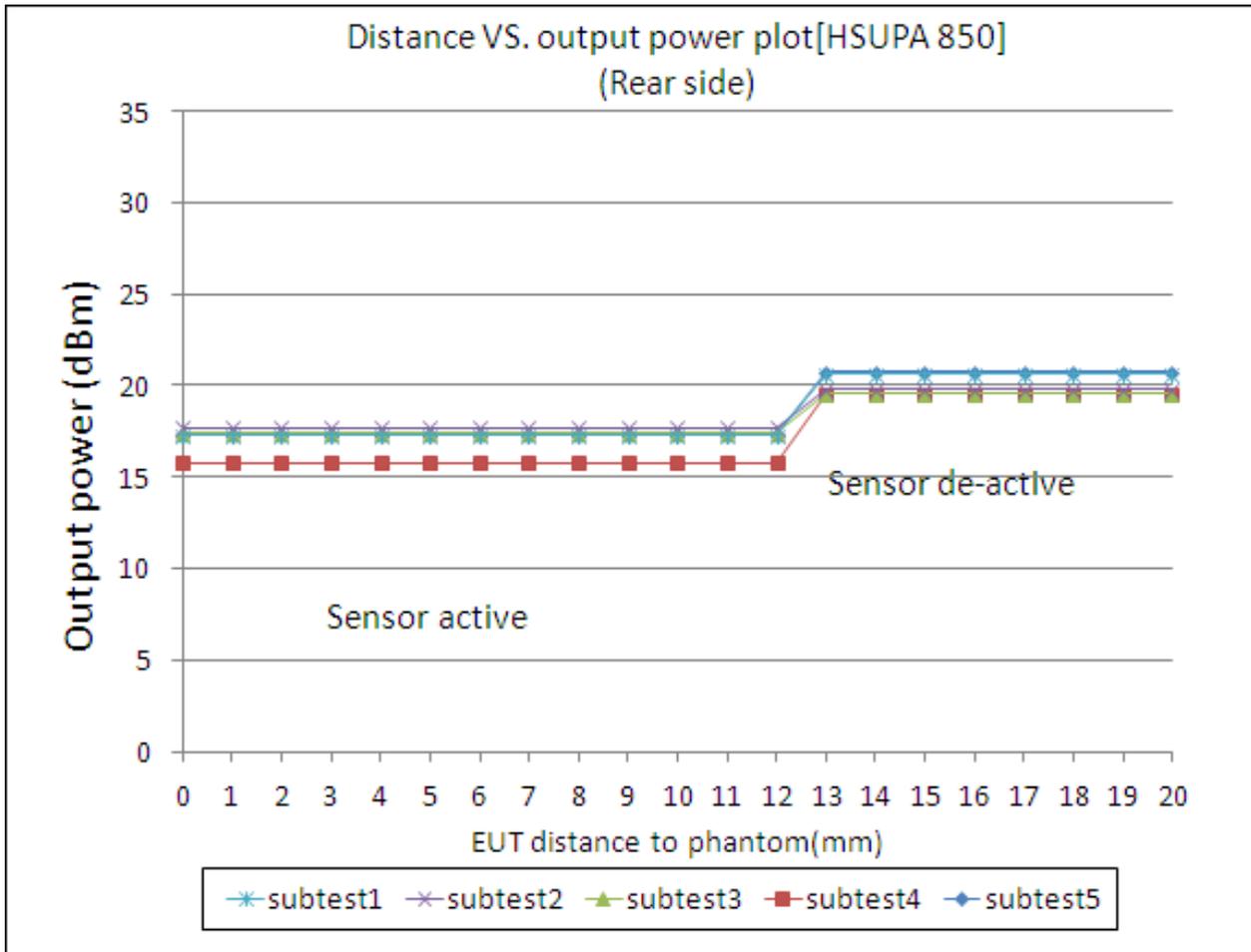
Table 4: The distance from the rear side of the EUT to the bottom of the Phantom is 11mm.

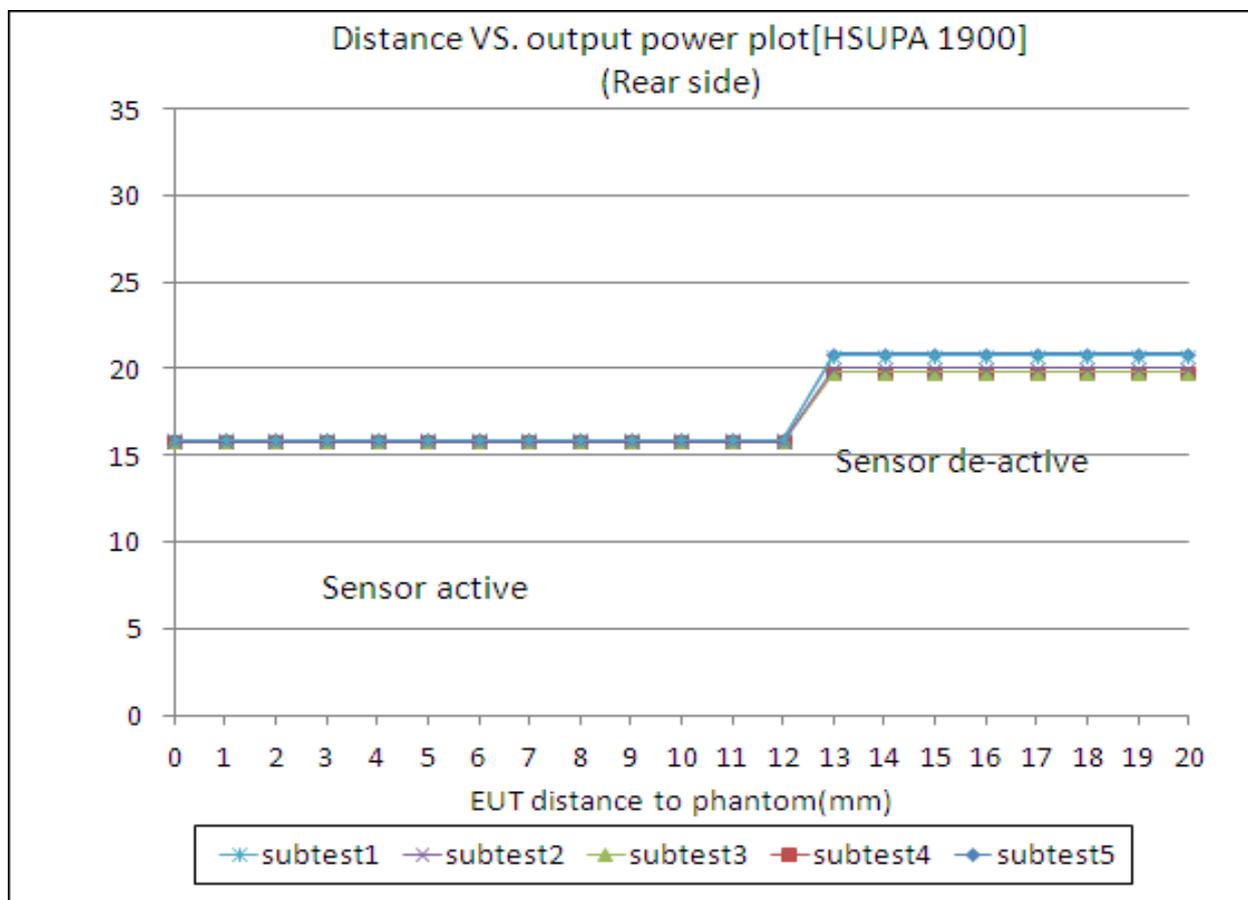
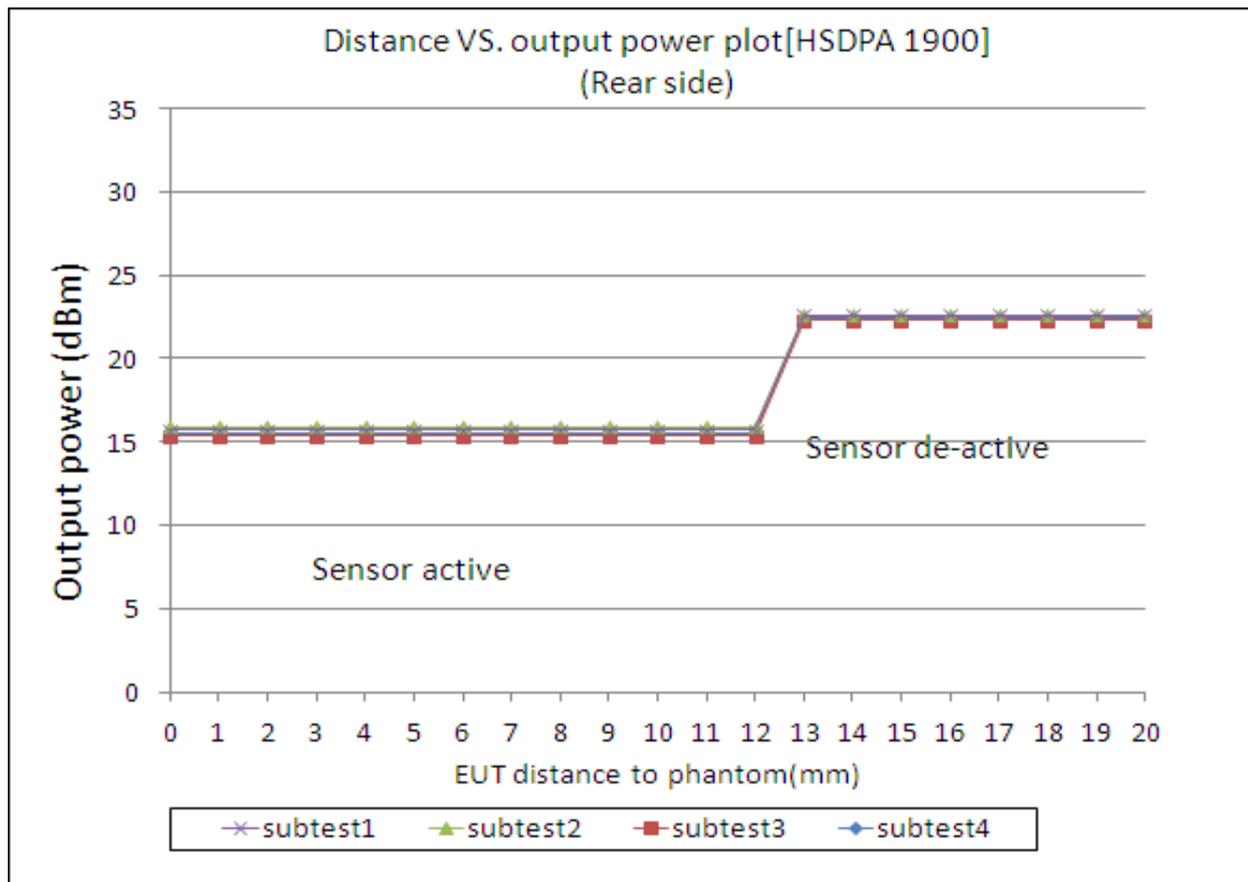
The plots show the relationship between the output power and the EUT distance to Phantom.

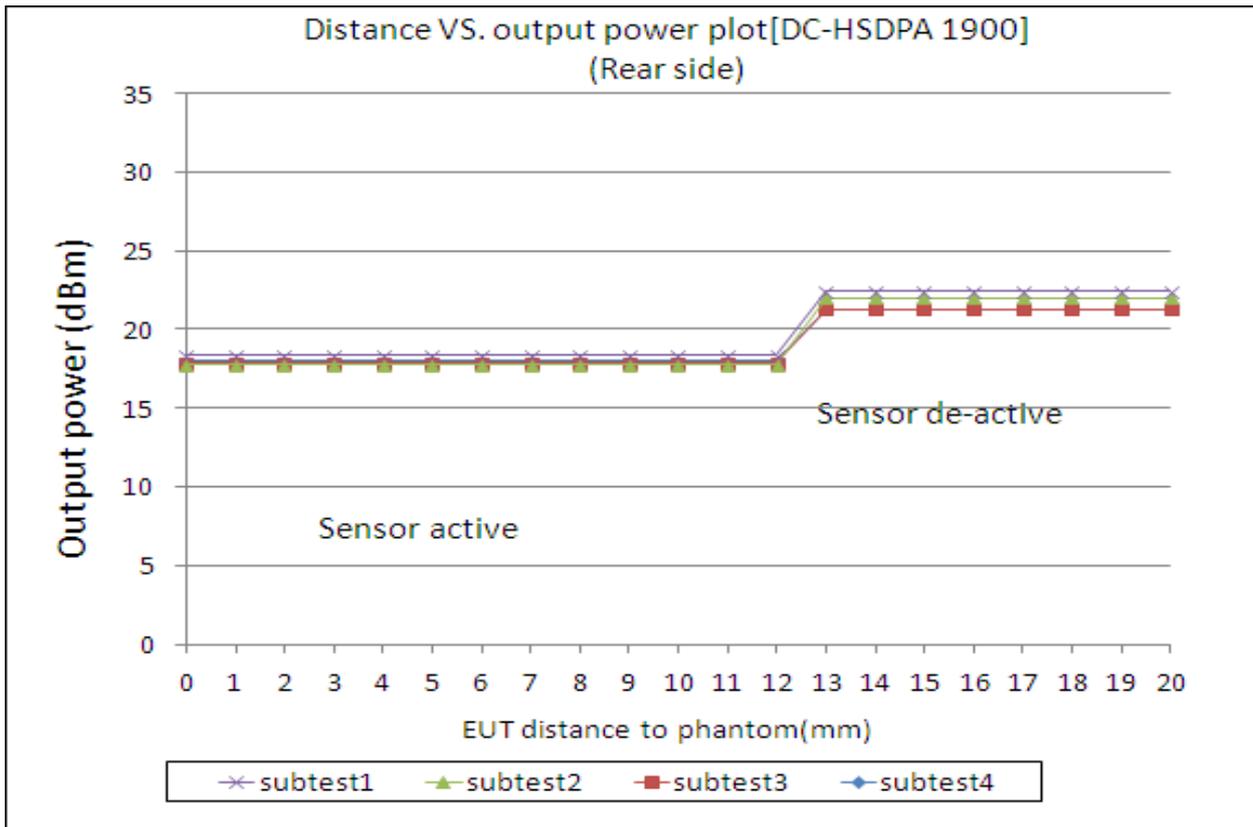










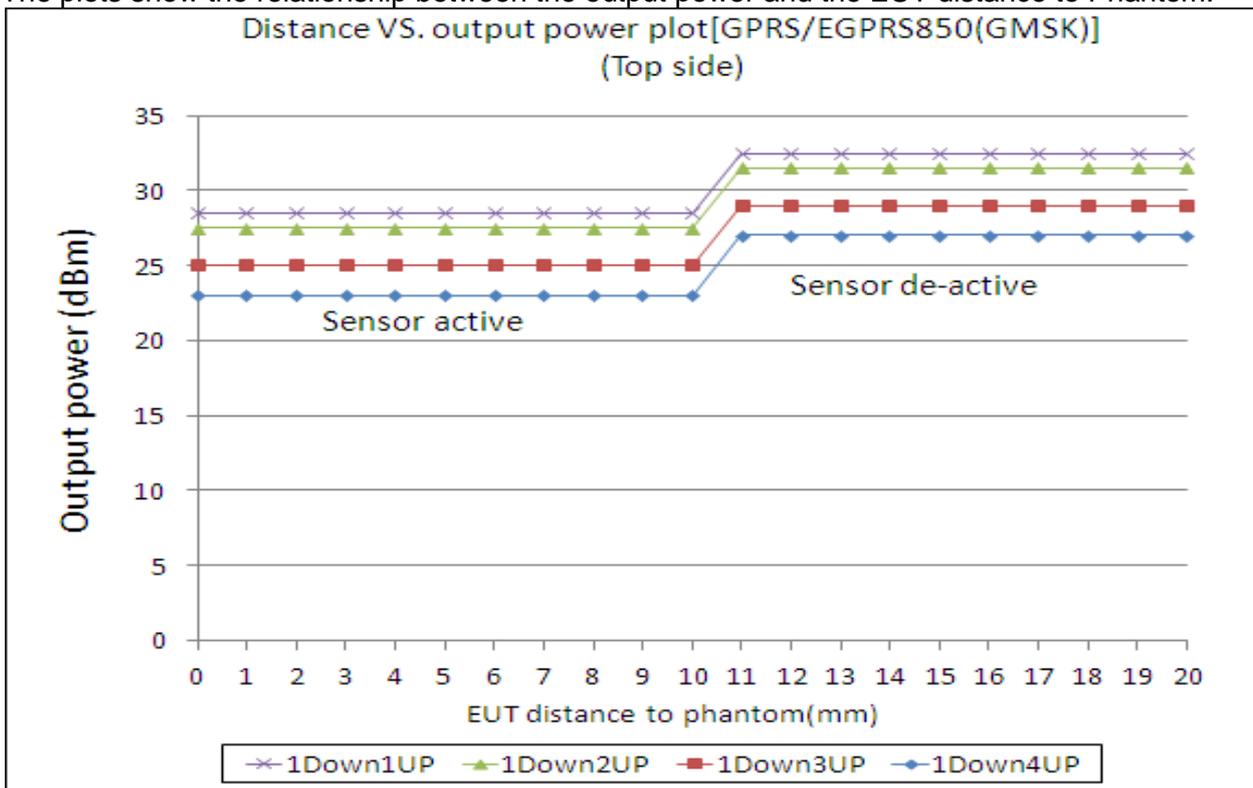


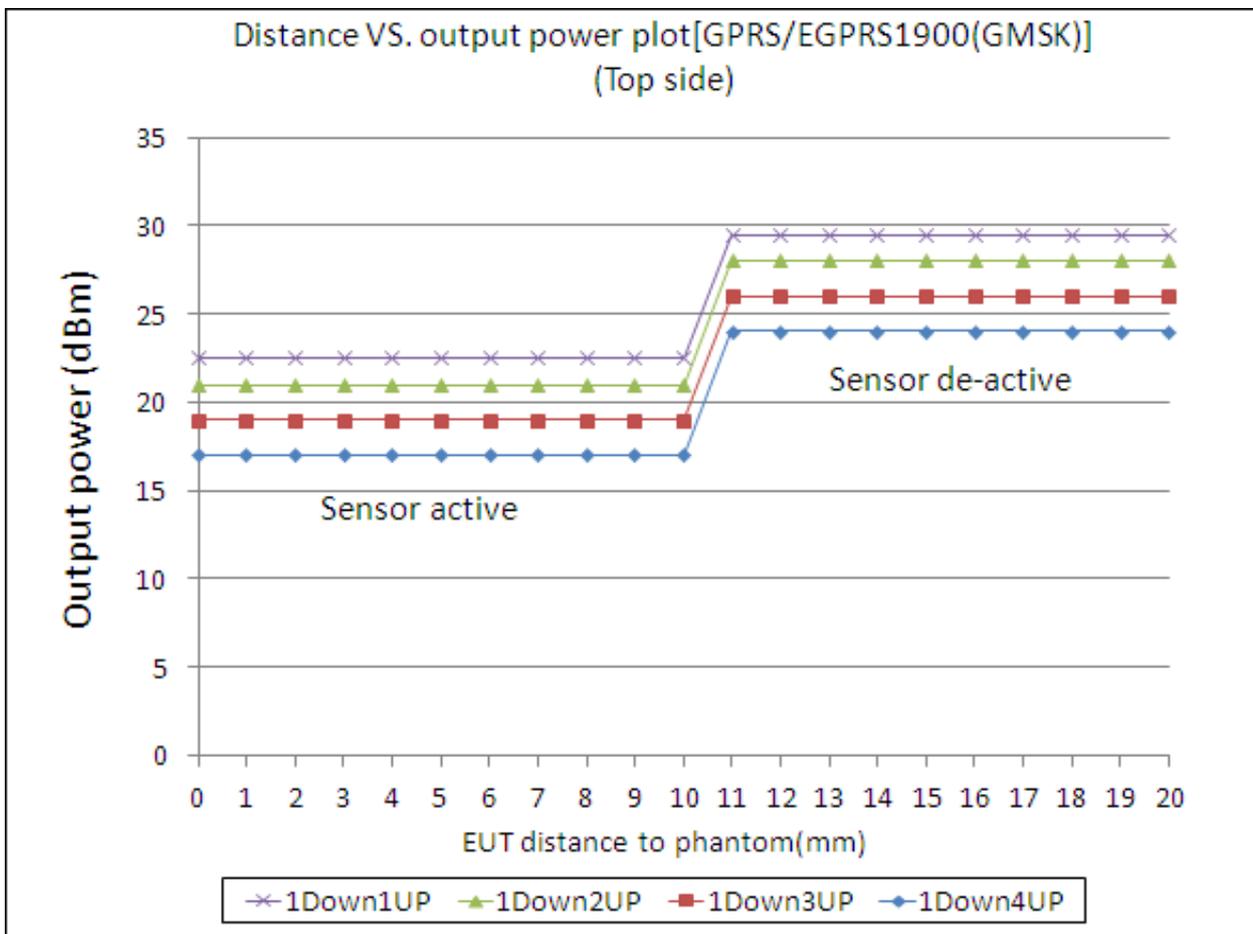
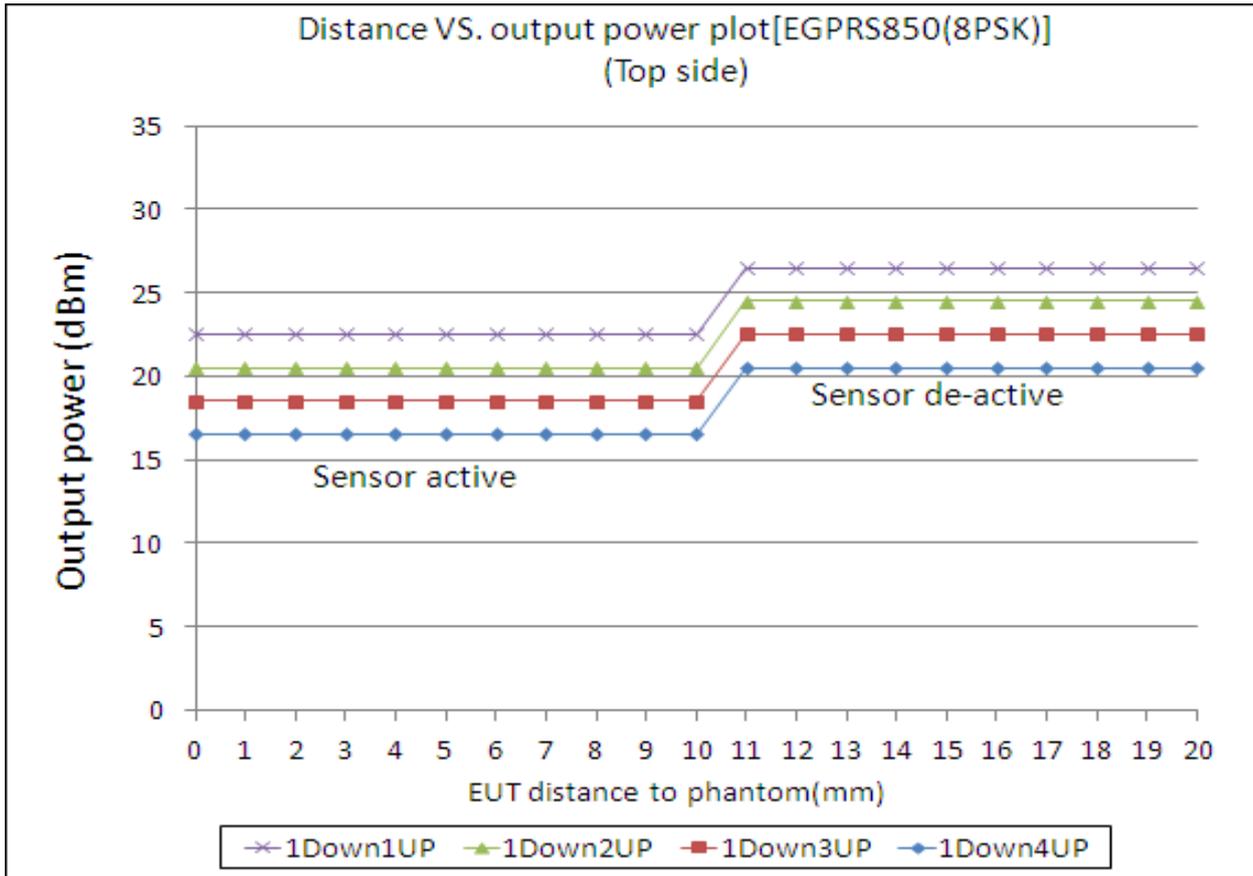
Top side(0 degree angle) Distance from the user in 2/3G antenna

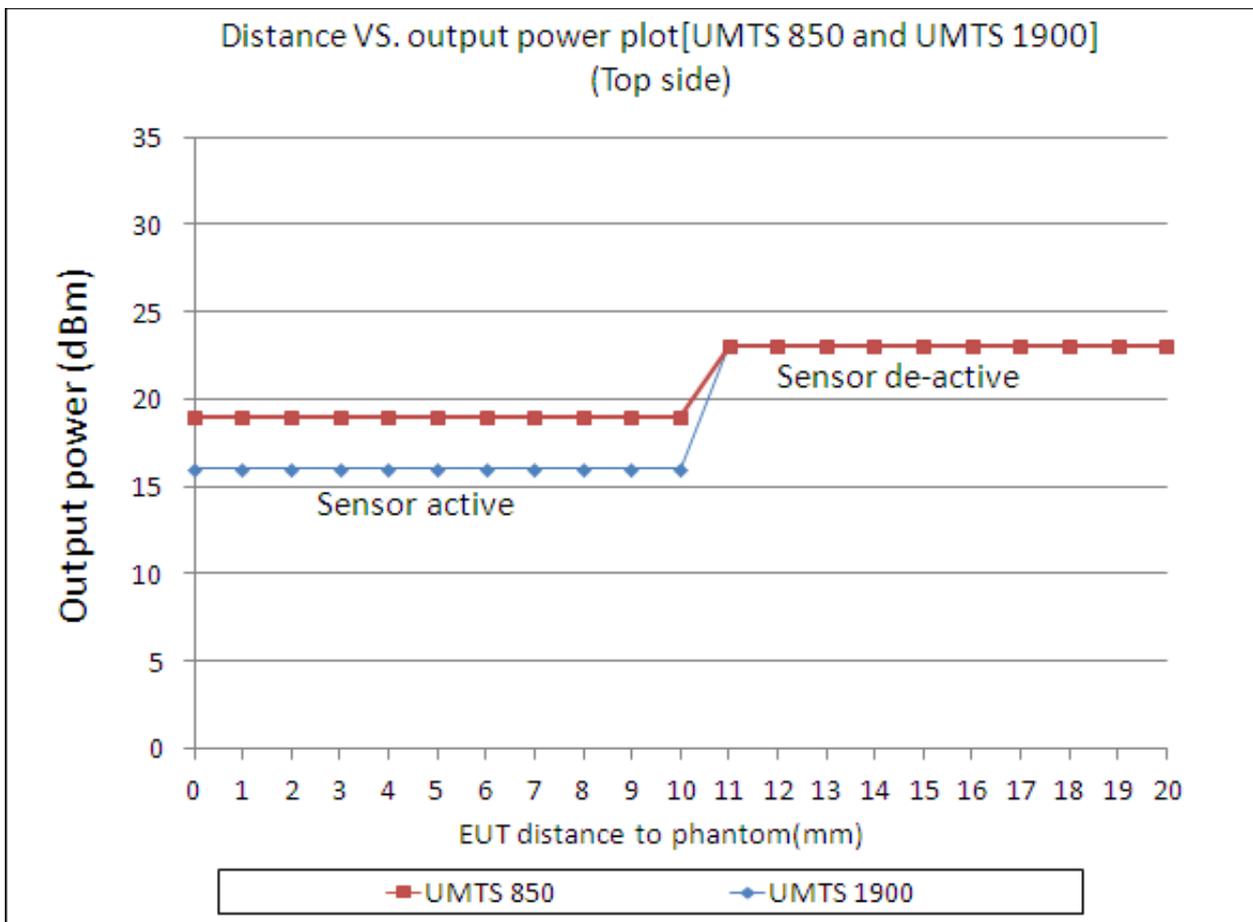
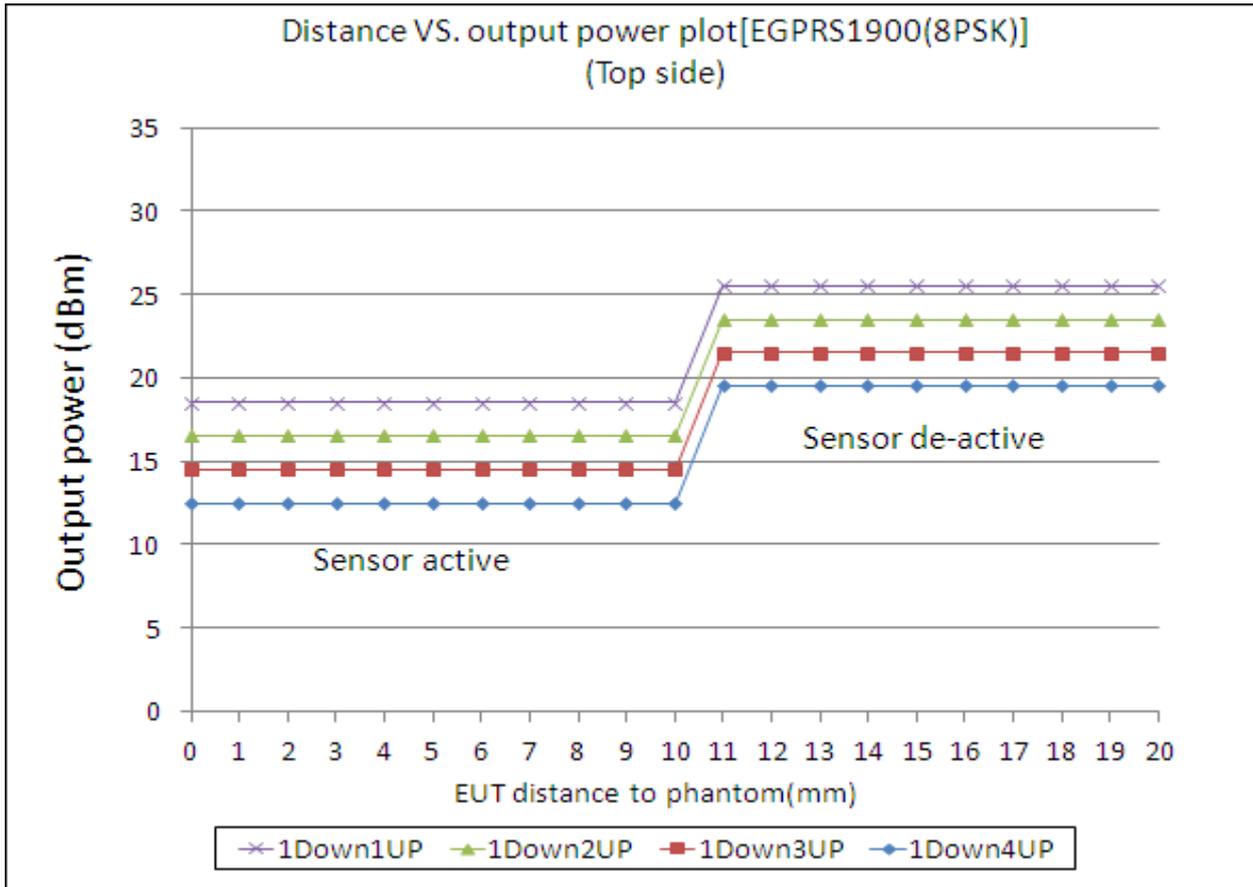
Distance in mm	0--8	9	10	11	12	13
Proximity Sensor Status in the top side of the device	ON	ON	ON	OFF	OFF	OFF

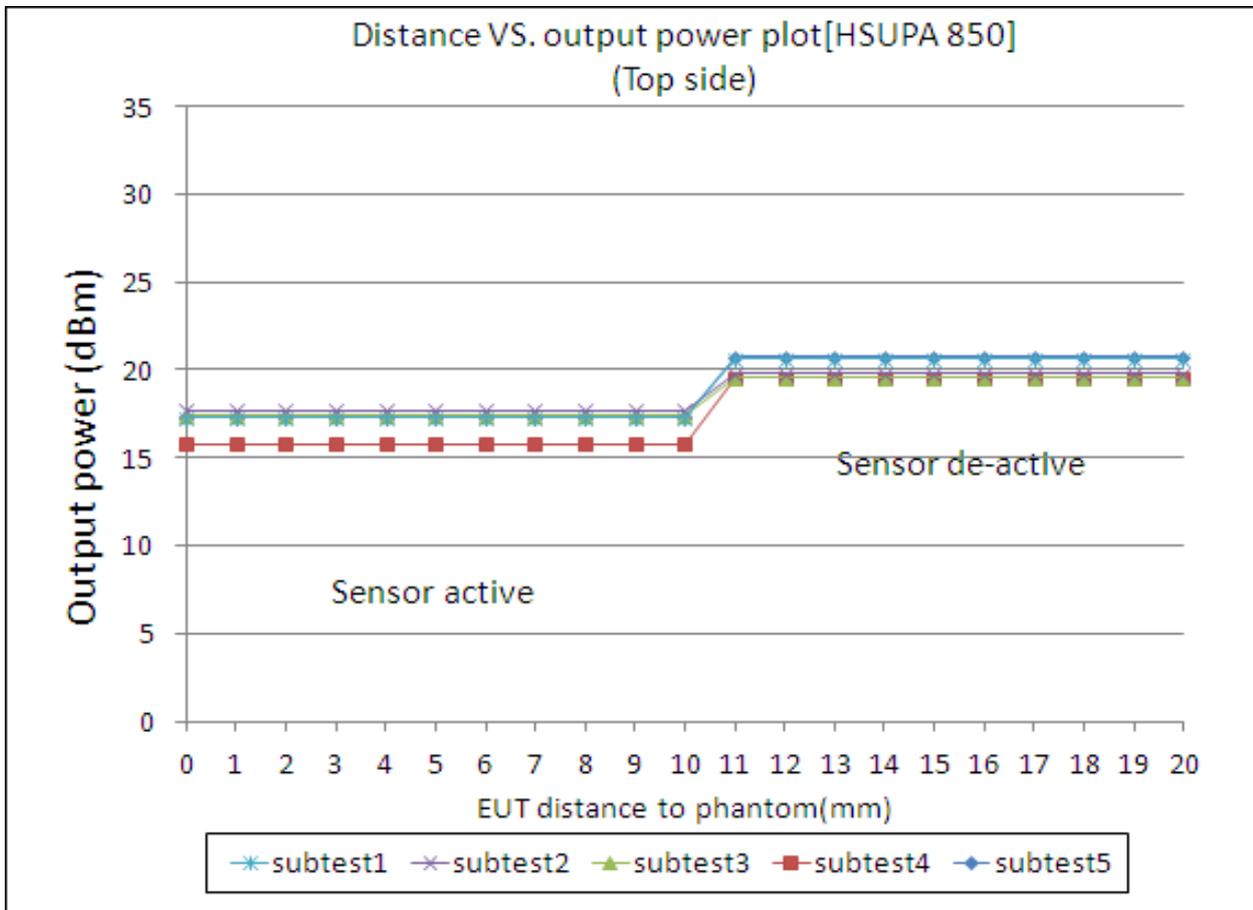
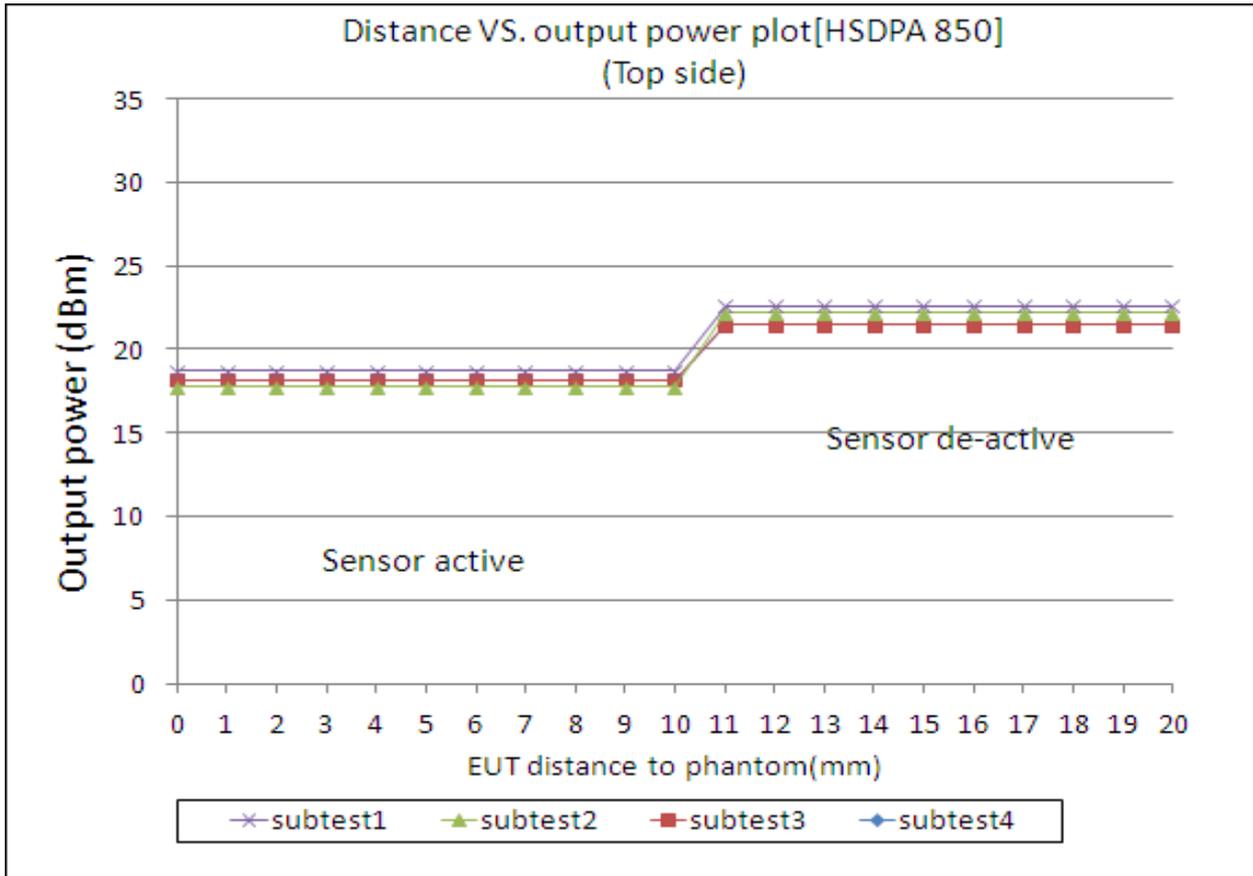
Table 5: The distance from the top side of the EUT to the bottom of the Phantom is 9mm.

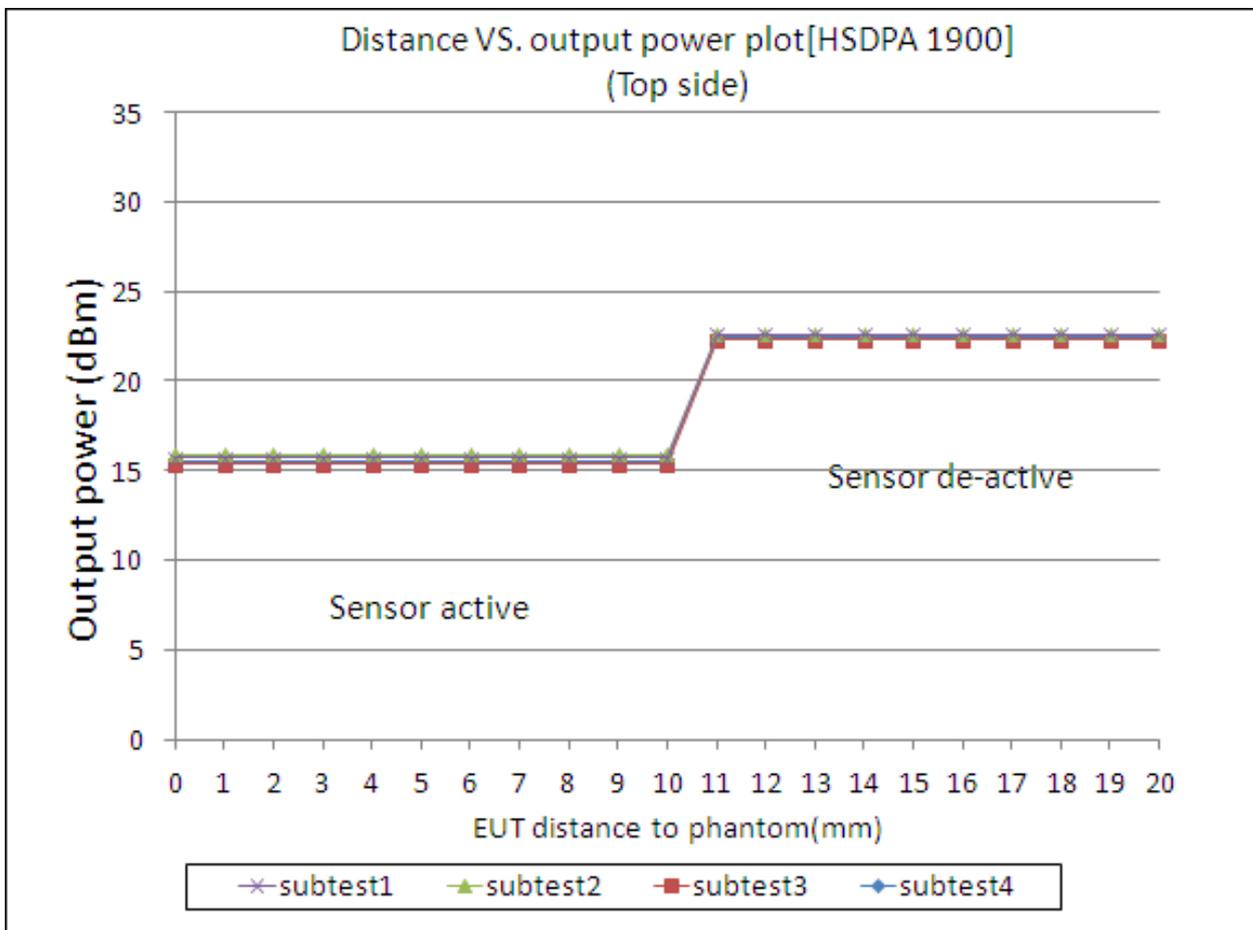
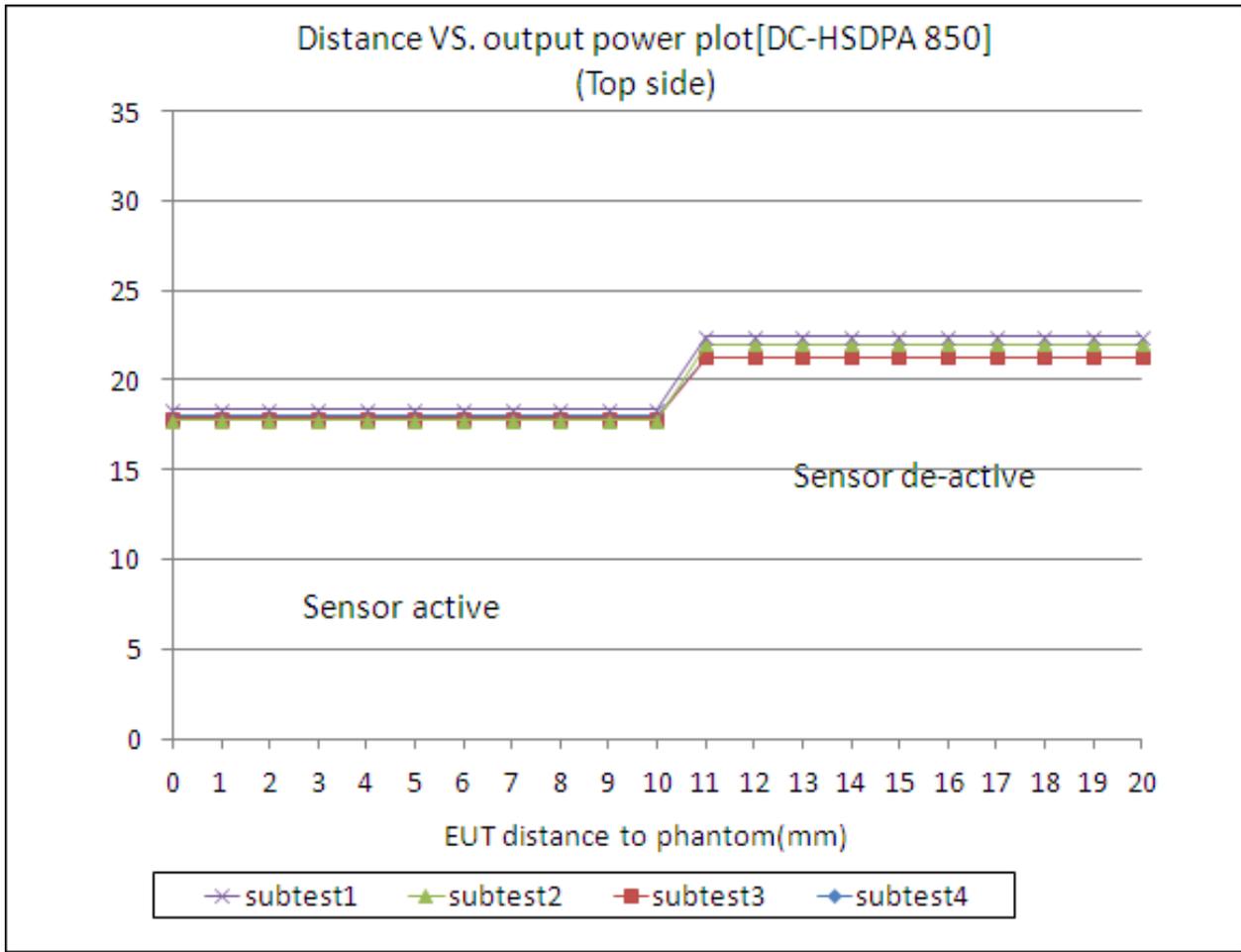
The plots show the relationship between the output power and the EUT distance to Phantom.

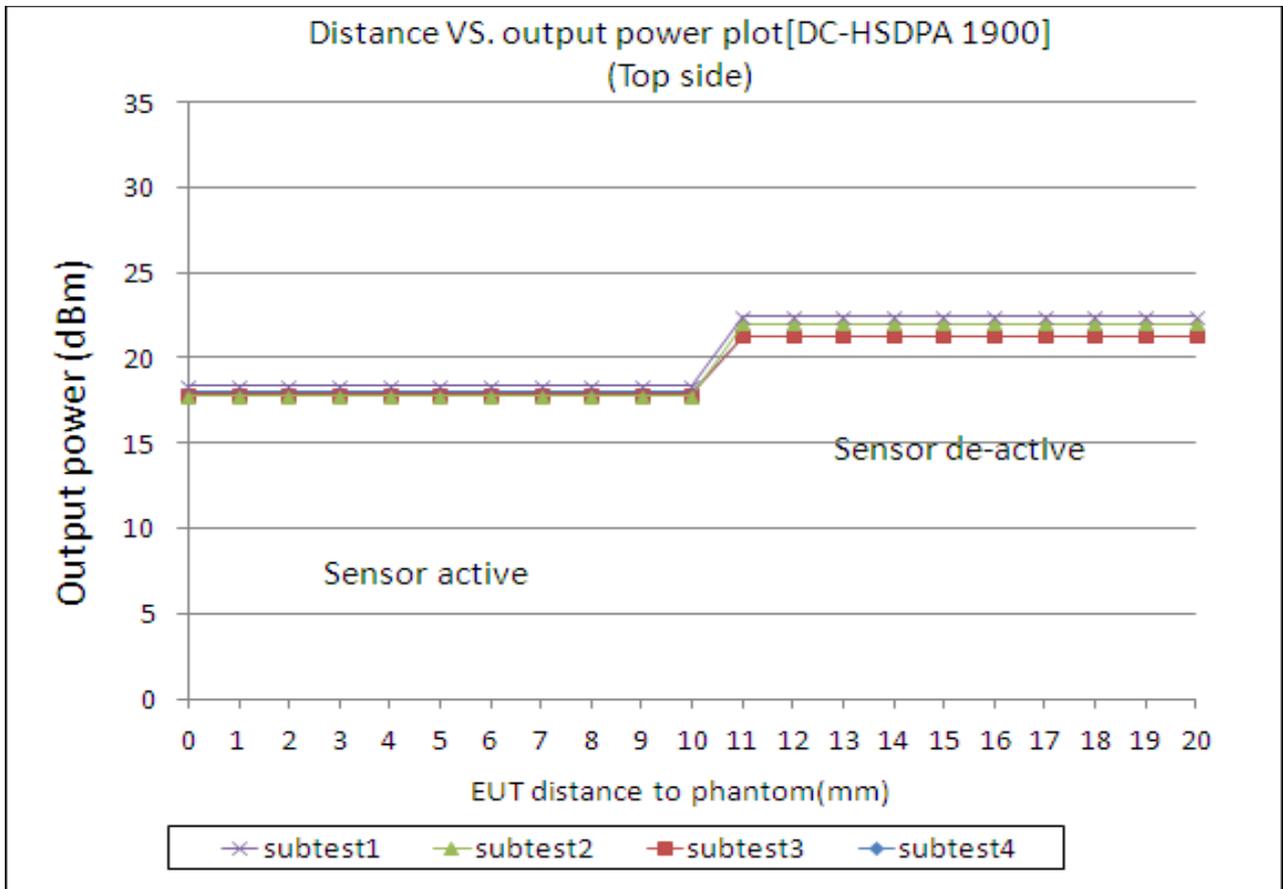
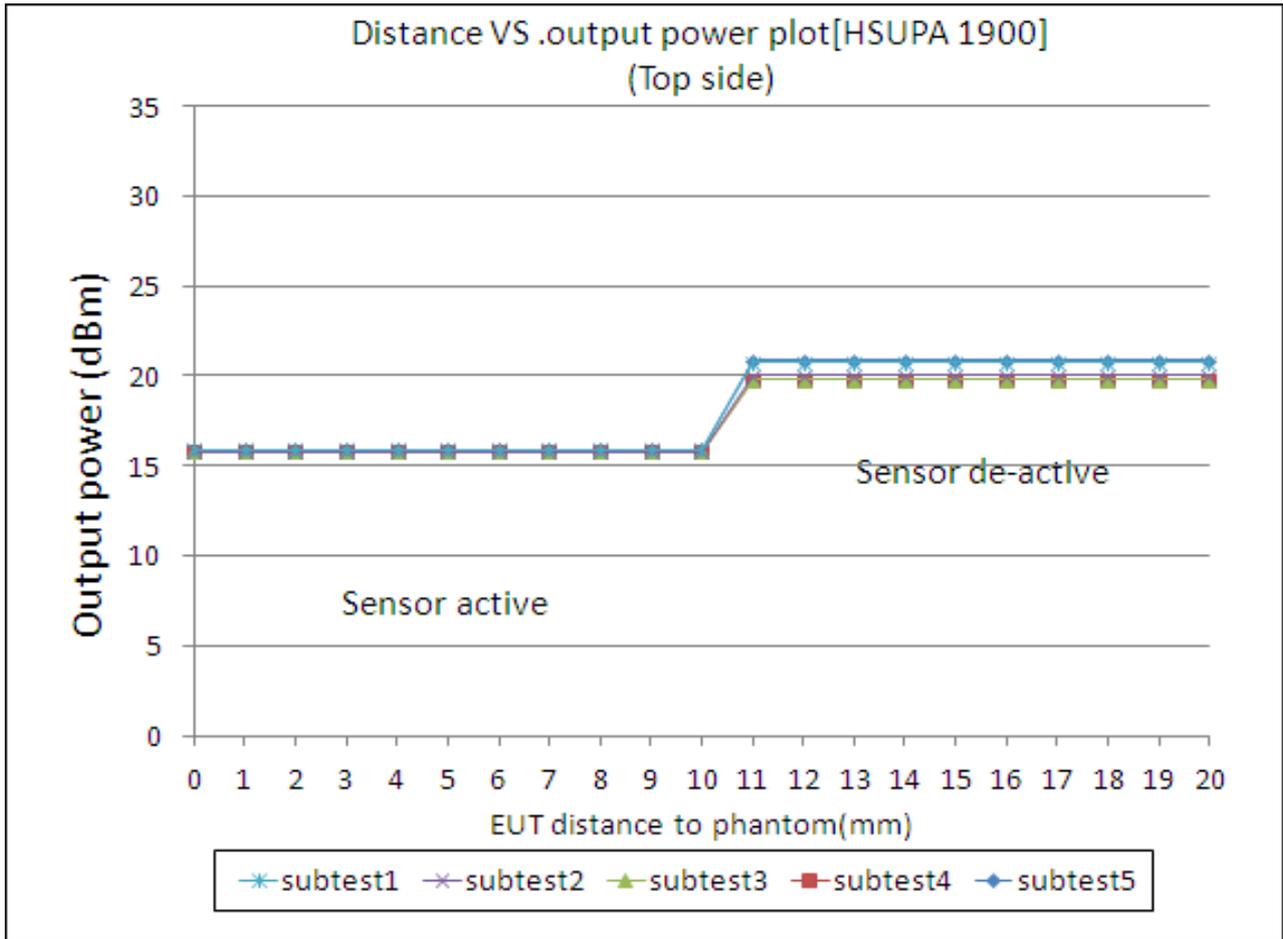












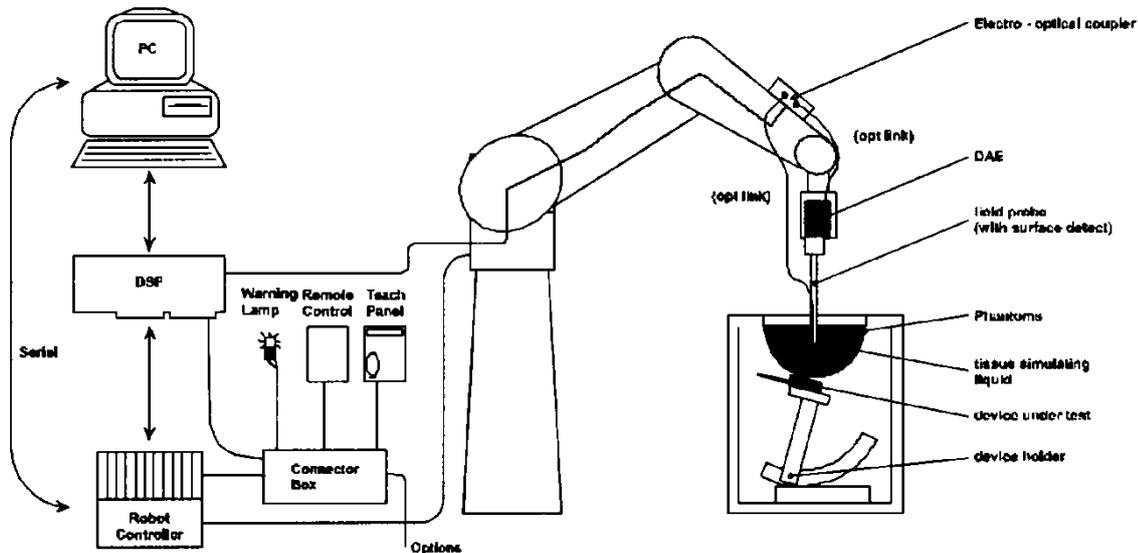
End Date of test	2012-07-07
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1.8 Ambient Condition

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 m³, 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 m² 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.

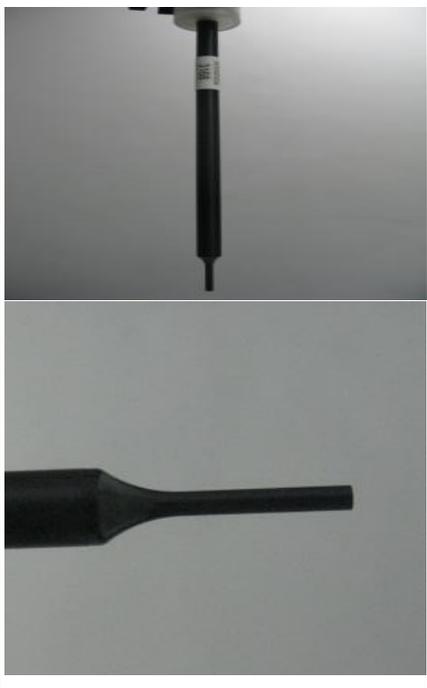
DAE4

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 μ W/g to > 100 mW/g; Linearity: ± 0.2 dB	
Dimensions	Overall length: 337 mm (Tip: 20 mm) Tip diameter: 3.9 mm (Body: 12 mm) Distance from probe tip to dipole centers: 2.0 mm	
Application	General dosimetry up to 4 GHz Dosimetry in strong gradient fields Compliance tests of mobile phones	

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	ISO/IEC 17025 calibration service available.	
Frequency	10 MHz to 6 GHz (dosimetry); Linearity: ± 0.2 dB (30 MHz to 6 GHz)	
Directivity	± 0.3 dB in HSL (rotation around probe axis) ± 0.5 dB in HSL (rotation normal to probe axis)	
Dynamic range	10 μ W/g to > 100 mW/g; Linearity: ± 0.2 dB	
Dimensions	Overall length: 337 mm Tip length: 20 mm Body diameter: 12 mm Tip diameter: 2.5 mm Distance from probe tip to dipole centers: 1.0 mm	
Application	High precision dosimetric measurements in any exposure scenario (e.g., very strong gradient fields). Only probe which enables compliance testing for frequencies up to 6 GHz with precision of better 30%.	

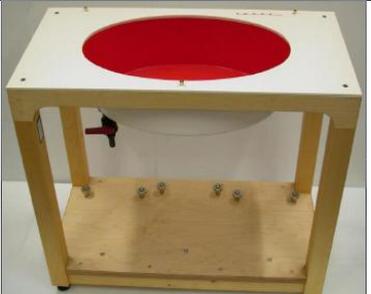
2.5 Phantom description

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)*
<input checked="" type="checkbox"/>	SPEAG	Dosimetric E-Field Probe	EX3DV3	3736	2012-04-26
<input type="checkbox"/>	SPEAG	Dosimetric E-Field Probe	ES3DV4	3168	2011-09-27
<input checked="" type="checkbox"/>	SPEAG	835 MHz Validation Dipole	D835V2	4d126	2011-11-07
<input type="checkbox"/>	SPEAG	1800 MHz Validation Dipole	D1800V2	2d184	2011-03-08
<input checked="" type="checkbox"/>	SPEAG	1900 MHz Validation Dipole	D1900V2	5d143	2011-09-26
<input type="checkbox"/>	SPEAG	2000 MHz Validation Dipole	D2000V2	1052	2011-03-10
<input type="checkbox"/>	SPEAG	2300 MHz Validation Dipole	D2300V2	1016	2011-11-22
<input checked="" type="checkbox"/>	SPEAG	2450 MHz Validation Dipole	D2450V2	860	2011-03-08
<input type="checkbox"/>	SPEAG	2600 MHz Validation Dipole	D2600V2	1021	2011-11-21
<input checked="" type="checkbox"/>	SPEAG	Data acquisition electronics	DAE4	852	2011-11-16
<input type="checkbox"/>	SPEAG	Data acquisition electronics	DAE4	1236	2012-03-28
<input checked="" type="checkbox"/>	SPEAG	Software	DASY 5	N/A	N/A
<input type="checkbox"/>	SPEAG	Twin Phantom	SAM1	TP-1475	N/A
<input type="checkbox"/>	SPEAG	Twin Phantom	SAM2	TP-1474	N/A
<input checked="" type="checkbox"/>	SPEAG	Twin Phantom	SAM3	TP-1597	N/A
<input checked="" type="checkbox"/>	SPEAG	Twin Phantom	SAM4	TP-1620	N/A
<input type="checkbox"/>	SPEAG	Flat Phantom	ELI 4.0	TP-1038	N/A
<input type="checkbox"/>	SPEAG	Flat Phantom	ELI 4.0	TP-1111	N/A
<input checked="" type="checkbox"/>	R & S	Universal Radio Communication Tester	CMU 200	111379	2011-08-06
<input checked="" type="checkbox"/>	Agilent)*	Network Analyser	E5071B	MY42404956	2012-02-14
<input checked="" type="checkbox"/>	Agilent	Dielectric Probe Kit	85070E	2484	N/A
<input checked="" type="checkbox"/>	Agilent	Signal Generator	N5181A	MY47420989	2012-02-14
<input checked="" type="checkbox"/>	MINI-CIRCUITS	Amplifier	ZHL-42W	QA0746001	N/A
<input checked="" type="checkbox"/>	Agilent	Power Meter	E4417A	MY45101339	2012-02-14
<input checked="" type="checkbox"/>	Agilent	Power Meter Sensor	E9321A	MY44420359	2012-02-14

Note: All the test equipments are calibrated once a year, except the dipoles, which are calibrated every three years. Moreover, we have self-calibration every year to the dipoles.

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 in Appendix C

- 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 $\pm 0.1\text{mm}$). To prevent wrong results tests are only executed when the liquid is free of air bubbles. The difference between the optical surface detection and the actual surface depends on the probe and is specified with each probe. (It does not depend on the surface reflectivity or the probe angle to the surface within $\pm 30^\circ$.)
- 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 Appendix B.
- 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 Appendix B. Test results relevant for the specified standard (see chapter 1.4.) are shown in table form in chapter 7.2.
- A Z-axis scan measures the total SAR value at the x-and y-position of the maximum SAR value found during the cube 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 Appendix B.

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 compensate 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 "DAE4". The software evaluates the desired unit and format for output each time the data is visualized or exported. This allows verification of the complete software setup even after the measurement and allows correction of incorrect parameter settings. For example, if a measurement has been performed with a wrong crest factor parameter in the device setup, the parameter can be corrected afterwards and the data can be re-evaluated.

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

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 ₁₀ , a ₁₁ , a ₁₂
	- 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:
$$H_i = (V_i)^{1/2} \cdot (a_{i0} + a_{i1}f + a_{i2}f^2)/f$$

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

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

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

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

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

with SAR = local specific absorption rate in mW/g
 E_{tot} = total field strength in V/m
 σ = conductivity in [mho/m] or [Siemens/m]
 ρ = equivalent tissue density in g/cm³

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

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

with P_{pwe} = equivalent power density of a plane wave in mW/cm²
 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 dielectric parameter are within the tolerances of the specified target values. The measured conductivity and relative permittivity should be within $\pm 5\%$ of the target values.

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

Ingredients (% of weight)	Head Tissue					
Frequency Band (MHz)	450	835	900	1800	1900	2450
Water	38.56	41.45	40.92	52.64	55.242	62.7
Salt (NaCl)	3.95	1.45	1.48	0.36	0.306	0.5
Sugar	56.32	56.0	56.5	0.0	0.0	0.0
HEC	0.98	1.0	1.0	0.0	0.0	0.0
Bactericide	0.19	0.1	0.1	0.0	0.0	0.0
Triton X-100	0.0	0.0	0.0	0.0	0.0	0.0
DGBE	0.0	0.0	0.0	47.0	44.542	36.8
Ingredients (% of weight)	Body Tissue					
Frequency Band (MHz)	450	835	900	1800	1900	2450
Water	51.16	52.4	56.0	69.91	69.91	73.2
Salt (NaCl)	1.49	1.40	0.76	0.13	0.13	0.04
Sugar	46.78	45.0	41.76	0.0	0.0	0.0
HEC	0.52	1.0	1.21	0.0	0.0	0.0
Bactericide	0.05	0.1	0.27	0.0	0.0	0.0
Triton X-100	0.0	0.0	0.0	0.0	0.0	0.0
DGBE	0.0	0.0	0.0	29.96	29.96	26.7

Table 6: Tissue Dielectric Properties

Salt: 99+% Pure Sodium Chloride; Sugar: 98+% Pure Sucrose; Water: De-ionized, 16M Ω + 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
		ϵ_r (+/-5%)	σ (S/m) (+/-5%)	ϵ_r	σ (S/m)		
835 Body	825	55.20 (52.44~57.96)	0.97 (0.92~1.02)	55.11	0.993	21.4°C	2012-07-03
	835	55.2 (52.44~57.96)	0.97 (0.92~1.02)	55.06	0.990		
	850	55.20 (52.44~57.96)	0.97 (0.92~1.02)	54.84	1.015		
1900 Body	1850	53.30 (50.64~55.97)	1.52 (1.44~1.60)	52.60	1.534	21.4°C	2012-07-05
	1880	53.30 (50.64~55.97)	1.52 (1.44~1.60)	52.49	1.560		
	1910	53.30 (50.64~55.97)	1.52 (1.44~1.60)	52.34	1.590		
	1900	53.30 (50.64~55.97)	1.52 (1.44~1.60)	52.37	1.584		
2450 Body	2410	52.80 (50.16~55.44)	1.91 (1.81~2.00)	52.10	1.938	21.4°C	2012-07-06
	2435	52.70 (50.07~55.34)	1.94 (1.84~2.04)	52.03	1.969		
	2460	52.70 (50.07~55.34)	1.96 (1.86~2.06)	51.96	2.000		
	2450	52.70 (50.07~55.34)	1.95 (1.85~2.05)	51.98	1.986		

ϵ_r = Relative permittivity, σ = Conductivity

Table 7: Measured Tissue Parameter

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.

Note:

- 1) KDB 450824 was ensured to be applied for probe calibration frequencies greater than or equal to 50MHz of the EUT frequencies.
- 2)The above measured tissue parameters were used in the DASY software to perform interpolation via the DASY software to determine actual dielectric parameters at the test frequencies. The SAR test plots may slightly differ from the table above since the DASY rounds to three significant digits.

4.2 System Check

The system check is performed for verifying the accuracy of the complete measurement system and performance of the software. The system 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).

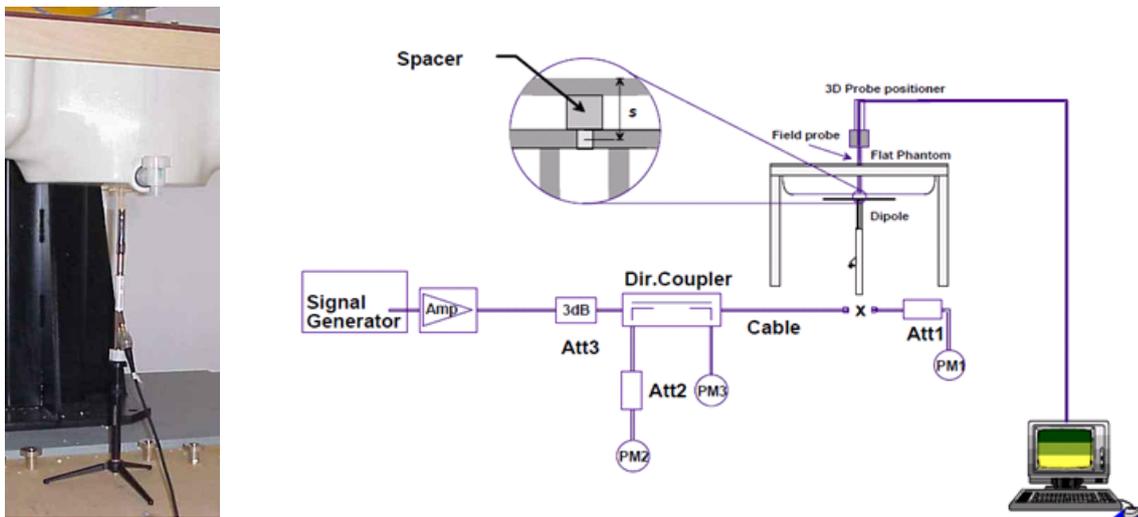
System Check	Target SAR (1W) (+/-10%)		Measured SAR (Normalized to 1W)		Liquid Temp.	Test Date
	1-g (mW/g)	10-g (mW/g)	1-g (mW/g)	10-g (mW/g)		
D835V2 Body	9.54 (8.59~10.49)	6.29 (5.66~6.92)	10.48	6.88	21.4°C	2012-07-03
D1900V2 Body	41.40 (37.26~45.54)	21.80 (19.62~23.98)	41.60	21.56	21.4°C	2012-07-05
D2450V2 Body	52.80 (47.52~58.08)	24.50 (22.05~26.95)	54.00	25.12	21.4°C	2012-07-06

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 $\pm 10.9\%$ ($K=1$).

The expanded uncertainty ($k=2$) is assessed to be $\pm 21.9\%$

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	$\pm 6.0\%$	Normal	1	1	1	$\pm 6.0\%$	$\pm 6.0\%$	∞
Axial isotropy	$\pm 4.7\%$	Rectangular	$\sqrt{3}$	0.7	0.7	$\pm 1.9\%$	$\pm 1.9\%$	∞
Hemispherical isotropy	$\pm 9.6\%$	Rectangular	$\sqrt{3}$	0.7	0.7	$\pm 3.9\%$	$\pm 3.9\%$	∞
Spatial resolution	$\pm 0.0\%$	Rectangular	$\sqrt{3}$	1	1	$\pm 0.0\%$	$\pm 0.0\%$	∞
Boundary effects	$\pm 1.0\%$	Rectangular	$\sqrt{3}$	1	1	$\pm 0.6\%$	$\pm 0.6\%$	∞
Probe linearity	$\pm 4.7\%$	Rectangular	$\sqrt{3}$	1	1	$\pm 2.7\%$	$\pm 2.7\%$	∞
System detection limits	$\pm 1.0\%$	Rectangular	$\sqrt{3}$	1	1	$\pm 0.6\%$	$\pm 0.6\%$	∞
Readout electronics	$\pm 0.3\%$	Normal	1	1	1	$\pm 0.3\%$	$\pm 0.3\%$	∞
Response time	$\pm 0.8\%$	Rectangular	$\sqrt{3}$	1	1	$\pm 0.5\%$	$\pm 0.5\%$	∞
Integration time	$\pm 2.6\%$	Rectangular	$\sqrt{3}$	1	1	$\pm 1.5\%$	$\pm 1.5\%$	∞
RF ambient conditions	$\pm 3.0\%$	Rectangular	$\sqrt{3}$	1	1	$\pm 1.7\%$	$\pm 1.7\%$	∞
Probe positioner	$\pm 0.4\%$	Rectangular	$\sqrt{3}$	1	1	$\pm 0.2\%$	$\pm 0.2\%$	∞
Probe positioning	$\pm 2.9\%$	Rectangular	$\sqrt{3}$	1	1	$\pm 1.7\%$	$\pm 1.7\%$	∞
Max. SAR evaluation	$\pm 1.0\%$	Rectangular	$\sqrt{3}$	1	1	$\pm 0.6\%$	$\pm 0.6\%$	∞
Test Sample Related								
Device positioning	$\pm 2.9\%$	Normal	1	1	1	$\pm 2.9\%$	$\pm 2.9\%$	145
Device holder uncertainty	$\pm 3.6\%$	Normal	1	1	1	$\pm 3.6\%$	$\pm 3.6\%$	5
Power drift	$\pm 5.0\%$	Rectangular	$\sqrt{3}$	1	1	$\pm 2.9\%$	$\pm 2.9\%$	∞
Phantom and Set-up								
Phantom uncertainty	$\pm 4.0\%$	Rectangular	$\sqrt{3}$	1	1	$\pm 2.3\%$	$\pm 2.3\%$	∞
Liquid conductivity (target)	$\pm 5.0\%$	Rectangular	$\sqrt{3}$	0.64	0.43	$\pm 1.8\%$	$\pm 1.2\%$	∞
Liquid conductivity (meas.)	$\pm 2.5\%$	Normal	1	0.64	0.43	$\pm 1.6\%$	$\pm 1.1\%$	∞
Liquid permittivity (target)	$\pm 5.0\%$	Rectangular	$\sqrt{3}$	0.6	0.49	$\pm 1.7\%$	$\pm 1.4\%$	∞
Liquid permittivity (meas.)	$\pm 2.5\%$	Normal	1	0.6	0.49	$\pm 1.5\%$	$\pm 1.2\%$	∞
Combined Uncertainty	$u_c = \sqrt{\sum_{i=1}^{21} c_i^2 u_i^2}$					$\pm 10.9\%$	$\pm 10.7\%$	387
Expanded Std. Uncertainty	$u_e = 2u_c$	Normal		k=2		$\pm 21.9\%$	$\pm 21.4\%$	

Table 9: Measurement uncertainties

5.2 Measurement uncertainty evaluation for system validation

The overall combined measurement uncertainty of the measurement system is $\pm 9.5\%$ ($K=1$).

The expanded uncertainty ($k=2$) is assessed to be $\pm 18.9\%$

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	Divisor	c_i 1g	c_i 10g	Standard Uncertainty 1g	Standard Uncertainty 10g	v_i^2 or v_{eff}
Measurement System								
Probe calibration	$\pm 6.0\%$	Normal	1	1	1	$\pm 6.0\%$	$\pm 6.0\%$	∞
Axial isotropy	$\pm 4.7\%$	Rectangular	$\sqrt{3}$	1	1	$\pm 2.7\%$	$\pm 2.7\%$	∞
Hemispherical isotropy	$\pm 9.6\%$	Rectangular	$\sqrt{3}$	0.7	0.7	$\pm 0.0\%$	$\pm 0.0\%$	∞
Boundary effects	$\pm 1.0\%$	Rectangular	$\sqrt{3}$	1	1	$\pm 0.6\%$	$\pm 0.6\%$	∞
Probe linearity	$\pm 4.7\%$	Rectangular	$\sqrt{3}$	1	1	$\pm 2.7\%$	$\pm 2.7\%$	∞
System detection limits	$\pm 1.0\%$	Rectangular	$\sqrt{3}$	1	1	$\pm 0.6\%$	$\pm 0.6\%$	∞
Readout electronics	$\pm 0.3\%$	Normal	1	1	1	$\pm 0.3\%$	$\pm 0.3\%$	∞
Response time	$\pm 0.0\%$	Rectangular	$\sqrt{3}$	1	1	$\pm 0.0\%$	$\pm 0.0\%$	∞
Integration time	$\pm 0.0\%$	Rectangular	$\sqrt{3}$	1	1	$\pm 0.0\%$	$\pm 0.0\%$	∞
RF ambient conditions	$\pm 1.0\%$	Rectangular	$\sqrt{3}$	1	1	$\pm 0.6\%$	$\pm 0.6\%$	∞
Probe positioner	$\pm 0.4\%$	Rectangular	$\sqrt{3}$	1	1	$\pm 0.2\%$	$\pm 0.2\%$	∞
Probe positioning	$\pm 2.9\%$	Rectangular	$\sqrt{3}$	1	1	$\pm 1.7\%$	$\pm 1.7\%$	∞
Max. SAR evaluation	$\pm 1.0\%$	Rectangular	$\sqrt{3}$	1	1	$\pm 0.6\%$	$\pm 0.6\%$	∞
Dipole								
Deviation of experimental dipole	$\pm 5.5\%$	Rectangular	$\sqrt{3}$	1	1	$\pm 3.2\%$	$\pm 3.2\%$	∞
Dipole axis to liquid distance	$\pm 2.0\%$	Rectangular	1	1	1	$\pm 1.2\%$	$\pm 1.2\%$	∞
Power drift	$\pm 4.7\%$	Rectangular	$\sqrt{3}$	1	1	$\pm 2.7\%$	$\pm 2.7\%$	∞
Phantom and Set-up								
Phantom uncertainty	$\pm 4.0\%$	Rectangular	$\sqrt{3}$	1	1	$\pm 2.3\%$	$\pm 2.3\%$	∞
Liquid conductivity (target)	$\pm 5.0\%$	Rectangular	$\sqrt{3}$	0.64	0.43	$\pm 1.8\%$	$\pm 1.2\%$	∞
Liquid conductivity (meas.)	$\pm 2.5\%$	Normal	1	0.64	0.43	$\pm 1.6\%$	$\pm 1.1\%$	∞
Liquid permittivity (target)	$\pm 5.0\%$	Rectangular	$\sqrt{3}$	0.6	0.49	$\pm 1.7\%$	$\pm 1.4\%$	∞
Liquid permittivity (meas.)	$\pm 2.5\%$	Normal	1	0.6	0.49	$\pm 1.5\%$	$\pm 1.2\%$	∞
Combined Uncertainty	$u_c = \sqrt{\sum_{i=1}^{21} c_i^2 u_i^2}$					$\pm 9.5\%$	$\pm 9.2\%$	
Expanded Std. Uncertainty	$u_e = 2u_c$	Normal		k=2		$\pm 18.9\%$	$\pm 18.4\%$	

Table 10: Measurement uncertainties

6 SAR Test Configuration

6.1 GSM Test Configuration

SAR tests for GSM850 and GSM1900, a communication link is set up with a base station by air link. Using CMU200 the power lever is set to “5”and “0” in SAR of GSM850 and GSM1900. The tests in the band of GSM850 and GSM1900 are performed in the mode of GPRS/EGPRS function. Since the GPRS class is 12 for this EUT, it has at most 4 timeslots in uplink and at most 4 timeslots in downlink, the maximum total timeslot is 5. The EGPRS class is 12 for this EUT, it has at most 4 timeslots in uplink, and at most 4 timeslots in downlink, the maximum total timeslot is 5.

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

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

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

Number of timeslots in uplink assignment		Reduction of maximum output power, (dB)		
Band	Time Slots	GPRS (GMSK)	EGPRS (GMSK)	EGPRS (8PSK)
GSM850	1 TX slot	0	0	0
	2 TX slots	2	2	2
	3 TX slots	4	4	4
	4 TX slots	6	6	6
GSM1900	1 TX slot	0	0	0
	2 TX slots	2	2	2
	3 TX slots	4	4	4
	4 TX slots	6	6	6

Table 11: The allowed power reduction in the multi-slot configuration of GSM

6.2 UMTS Test Configuration

1) RMC

As the SAR body tests for UMTS Band II/V, we established the radio link through call processing. The maximum output power were verified on high, middle and low channels for each test band according to 3GPP TS 34.121 with the following configuration:

- 1) 12.2kbps RMC, 64,144,384 kbps RMC with TPC set to 'all 1'.
- 2) Test loop Mode 1.

For the output power, the configurations for the DPCCH and DPDCH₁ are as followed (EUT do not support the DPDCH_{2-n})

	Channel Bit Rate (kbps)	Channel Symbol Rate (ksps)	Spreading Factor	Spreading Code Number	Bits/Slot
DPCCH	15	15	256	0	10
DPDCH ₁	15	15	256	64	10
	30	30	128	32	20
	60	60	64	16	40
	120	120	32	8	80
	240	240	16	4	160
	480	480	8	2	320
	960	960	4	1	640
DPDCH _n	960	960	4	1, 2, 3	640

SAR for body exposure configurations is measured using the 12.2 kbps RMC with the TPC bits configured to all "1s". SAR for other spreading codes and multiple DPDCH_n, when supported by the EUT, are not required when the maximum average outputs of each RF channel, for each spreading code and DPDCH_n configuration, are less than ¼ dB higher than those measured in 12.2 kbps RMC.

2) HSDPA

SAR for body exposure configurations is measured according to the "Body SAR Measurements" procedures of 3G device. In addition, body SAR is also measured for HSDPA when the maximum average outputs of each RF channel with HSDPA active is at ¼ dB higher than that measured without HSDPA using 12.2kbps RMC or the maximum SAR 12.2kbps RMC is above 75% of the SAR limit. Body SAR for HSDPA is measured using an FRC with H-Set 1 in Sub-test 1 and a 12.2kbps RMC configured in Test Loop Mode 1, using the highest body SAR configuration in 12.2 kbps RMC without HSDPA.

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

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

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

Note 2: CM=1 for $\beta_c/\beta_d = 12/15$, $\beta_{hs}/\beta_c = 24/15$. For all other combinations of DPDCH, DPCCH and HS-DPCCH the MPR is based on the relative CM difference. This is applicable for only UEs that support HSDPA in release 6 and later releases.

Note 3: For subtest 2 the β_c/β_d ratio of 12/15 for the TFC during the measurement period (TF1, TF0) is achieved by setting the signalled gain factors for the reference TFC (TF1, TF1) to $\beta_c = 11/15$ and $\beta_d = 15/15$.

Table 12: Sub-tests for UMTS Release 5 HSDPA

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

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

Table 13: settings of required H-Set 1 QPSK acc. to 3GPP 34.121

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

Table 14: HSDPA UE category

3) HSUPA

Body SAR is also measured for HSDPA when the maximum average outputs of each RF channel with HSDPA active is at ¼ dB higher than that measured without HSDPA using 12.2kbps RMC or the maximum SAR 12.2kbps RMC is above 75% of the SAR limit. Body SAR for HSPA is measured with E-DCH Sub-test 5, using H-set 1 and QPSK for FRC and 12.2kbps RMC configured in Test Loop Mode 1 with power control algorithm 2, according to the highest body SAR configuration in 12.2 kbps RMC without HSPA.

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

Sub-test	β_c	β_d	β_d (SF)	β_c/β_d	$\beta_{hs(1)}$	β_{ec}	β_{ed}	β_c (S F)	β_{ed} (code)	CM ⁽²⁾ (dB)	MP R ^(d) (dB)	AG ⁽⁴⁾ Index	E-TFC I
1	11/15 ⁽³⁾	15/15 ⁽³⁾	64	11/15 ⁽³⁾	22/15	209/25	1039/25	4	1	1.0	0.0	20	75
2	6/15	15/15	64	6/15	12/15	12/15	94/75	4	1	3.0	2.0	12	67
3	15/15	9/15	64	15/9	30/15	30/15	$\beta_{ed1}:47/15$ $\beta_{ed2}:47/15$	4	2	2.0	1.0	15	92
4	2/15	15/15	64	2/15	4/15	2/15	56/75	4	1	3.0	2.0	17	71
5	15/15 ⁽⁴⁾	15/15 ⁽⁴⁾	64	15/15 ⁽⁴⁾	30/15	24/15	134/15	4	1	1.0	0.0	21	81

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

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

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

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

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

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

Table 15: Subtests for HSUPA.

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

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

Table 16: HSUPA UE category

4) DC-HSDPA

In DC-HSDPA implementation of this device, the uplink parameters are the same as HSDPA. No additional channels and modulations (16 QAM, and 64 QAM) are supported in uplink. The difference is only in the downlink parameters, where two carriers are supported. HSDPA settings were used on uplink.

According to the KDB Inquiry 449833, for Rel. 8 DC-HSDPA apply the four subtests from HSDPA Release 5 except use fixed reference channel H-Set 12 for DC-HSDPA. And we can apply the same SAR test exclusion criteria used for Rel. 6 HSPA for Rel. 7 HSPA+ and Rel. 8 DC-HSDPA. That is, if the HSPA, HSPA+, or the DC-HSDPA maximum output is not more than 0.25 dB higher than WCDMA, SAR measurement for those modes is not required.

The following tests were completed according to procedures in section 7.3.13 of 3GPP TS34.108 v9.5.0. A summary of these settings are illustrated below:

Downlink Physical Channels are set as per 3GPP TS34.121-1 v9.0.0 E.5.0

Table E.5.0: Levels for HSDPA connection setup

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

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

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

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

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

Table 17: settings of required H-Set 12 QPSK acc. to 3GPP 34.121

Note:

- 1.The RMC is intended to be used for DC-HSDPA mode and both cells shall transmit with identical parameters as listed in the table above.
- 2.Maximum number of transmission is limited to 1,i.e.,retransmission is not allowed. The redundancy and constellation version 0 shall be used.

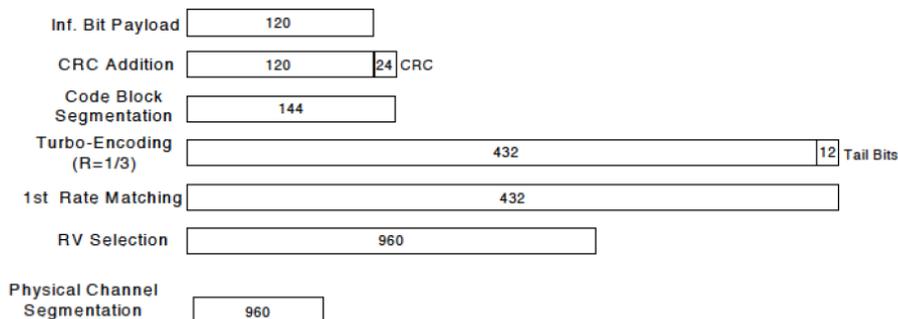


Figure C.8.19: Coding rate for Fixed reference Channel H-Set 12 (QPSK)

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

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

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

Note 2: CM=1 for $\beta_c / \beta_d = 12/15$, $\beta_{hs} / \beta_c = 24/15$. For all other combinations of DPDCH, DPCCH and HS-DPCCH the MPR is based on the relative CM difference. This is applicable for only UEs that support HSDPA in release 6 and later releases.

Note 3: For subtest 2 the β_c / β_d ratio of 12/15 for the TFC during the measurement period (TF1, TF0) is achieved by setting the signalled gain factors for the reference TFC (TF1, TF1) to $\beta_c = 11/15$ and $\beta_d = 15/15$

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

Note:1.The Dual Carriers transmission only applies to HSDPA physical channels

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

6.3 WiFi Test Configuration

For the 802.11b/g/n 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, 6 and 11 respectively in the case of 2450 MHz. During the test, at the each test frequency channel, the EUT is operated at the RF continuous emission mode. Each channel should be tested at the lowest data rate.

802.11b/g/n operating modes are tested independently according to the service requirements in each frequency band. 802.11b/g/n modes are tested on 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/n channels when the maximum average output power is less than 0.25 dB higher than that measured on the corresponding 802.11b channels.

Mode	Band	GHz	Channel	"Default Test Channels"	
				802.11b	802.11g
802.11b/g	2.4 GHz	2.412	1#	√	△
		2.437	6	√	△
		2.462	11#	√	△

Notes:

√ = "default test channels"

△ = possible 802.11g channels with maximum average output $\frac{1}{4}$ dB the "default test channels"

= when output power is reduced for channel 1 and/or 11 to meet restricted band requirements the highest output channels closest to each of these channels should be tested.

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 was used.

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

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

No. of timeslots	1	2	3	4
Duty Cycle	1:8	1:4	1:2.66	1:2
timebased avg. power compared to slotted avg. power	-9dB	-6dB	-4.25dB	-3dB

The signalling modes differ as follows:

mode	coding scheme	modulation
GPRS	CS1 to CS4	GMSK
EDGE	MCS1 to MCS4	GMSK
EDGE	MCS5 to MCS9	8PSK

Apart from modulation change (GMSK/8PSK) coding schemes differ in code rate without influence on the RF signal. Therefore one coding scheme per mode was selected for conducted power measurements.

7.1.1 Conducted power measurements of GSM850

GSM850		Burst-Averaged output Power (dBm)			Division Factors	Frame-Averaged output Power (dBm)		
		128CH	190CH	251CH		128CH	190CH	251CH
GPRS (GMSK)	1 Tx Slot	32.71	32.82	32.87	-9	23.71	23.82	23.87
	2 Tx Slots	31.27	32.43	31.49	-6	25.27	26.43	25.49
	3 Tx Slots	29.31	29.42	29.51	-4.25	25.06	25.17	25.26
	4 Tx Slots	27.27	27.42	27.54	-3	24.27	24.42	24.54
EDGE (GMSK)	1 Tx Slot	32.70	32.84	32.84	-9	23.70	23.84	23.84
	2 Tx Slots	31.25	32.39	31.50	-6	25.25	26.39	25.50
	3 Tx Slots	29.33	29.41	29.48	-4.25	25.08	25.16	25.23
	4 Tx Slots	27.30	27.46	27.54	-3	24.30	24.46	24.54
EDGE (8PSK)	1 Tx Slot	26.83	26.70	26.49	-9	17.83	17.70	17.49
	2 Tx Slots	24.98	24.86	24.75	-6	19.00	18.86	18.75
	3 Tx Slots	22.81	22.61	22.50	-4.25	18.56	18.36	18.25
	4 Tx Slots	21.02	20.91	20.73	-3	18.02	17.91	17.73

Table 18: Test results conducted power measurement GSM850 with Proximity sensor deactivated

GSM850		Burst-Averaged output Power (dBm)			Division Factors	Frame-Averaged output Power (dBm)		
		128CH	190CH	251CH		128CH	190CH	251CH
GPRS (GMSK)	1 Tx Slot	28.58	28.65	28.70	-9	19.58	19.65	19.70
	2 Tx Slots	26.61	26.71	26.74	-6	20.61	20.71	20.74
	3 Tx Slots	24.59	24.71	24.86	-4.25	20.34	20.46	20.61
	4 Tx Slots	22.62	22.76	22.84	-3	19.62	19.76	19.84
EDGE (GMSK)	1 Tx Slot	28.56	28.65	28.68	-9	19.56	19.65	19.68
	2 Tx Slots	26.61	26.68	26.74	-6	20.61	20.68	20.74
	3 Tx Slots	24.59	24.71	24.85	-4.25	20.34	20.46	20.60
	4 Tx Slots	22.66	22.78	22.83	-3	19.66	19.78	19.83
EDGE (8PSK)	1 Tx Slot	22.51	22.30	22.09	-9	13.51	13.30	13.09
	2 Tx Slots	20.25	19.95	19.82	-6	14.25	13.95	13.82
	3 Tx Slots	17.98	17.92	17.80	-4.25	13.73	13.67	13.55
	4 Tx Slots	15.94	15.79	15.66	-3	12.94	12.79	12.66

Table 19: Test results conducted power measurement GSM850 with Proximity sensor activated

Note:

1. The conducted power of GSM850 is measured with RMS detector.
2. Frame-averaged output power was calculated from the measured burst-averaged output power by converting the slot powers into linear units and calculating the energy over 8 timeslots.
3. The specified power reduction and target values are listed in the tune-up information document.

7.1.2 Conducted power measurements of GSM1900

GSM1900		Burst-Averaged output Power (dBm)			Division Factors	Frame-Averaged output Power (dBm)		
		512CH	661CH	810CH		512CH	661CH	810CH
GPRS (GMSK)	1 Tx Slot	29.96	29.86	29.72	-9	20.96	20.86	20.72
	2 Tx Slots	28.40	28.30	28.23	-6	22.40	22.30	22.23
	3 Tx Slots	26.39	26.29	26.21	-4.25	22.14	22.04	21.96
	4 Tx Slots	24.43	24.39	24.33	-3	21.43	21.39	21.33
EDGE (GMSK)	1 Tx Slot	30.00	29.87	29.70	-9	21.00	20.87	20.70
	2 Tx Slots	28.41	28.29	28.22	-6	22.41	22.29	22.22
	3 Tx Slots	26.39	26.34	26.24	-4.25	22.14	22.09	21.99
	4 Tx Slots	24.40	24.37	24.33	-3	21.40	21.37	21.33
EDGE (8PSK)	1 Tx Slot	25.72	25.50	25.26	-9	16.72	16.50	16.26
	2 Tx Slots	24.06	23.87	23.66	-6	18.06	17.87	17.66
	3 Tx Slots	22.01	21.91	21.69	-4.25	17.76	17.66	17.44
	4 Tx Slots	19.80	19.65	19.48	-3	16.80	16.65	16.48

Table 20: Test results conducted power measurement GSM1900 with Proximity sensor deactivated

GSM1900		Burst-Averaged output Power (dBm)			Division Factors	Frame-Averaged output Power (dBm)		
		512CH	661CH	810CH		512CH	661CH	810CH
GPRS (GMSK)	1 Tx Slot	22.88	22.82	22.75	-9	13.88	13.82	13.75
	2 Tx Slots	20.98	20.93	20.89	-6	14.98	14.93	14.89
	3 Tx Slots	19.11	18.98	18.94	-4.25	14.86	14.73	14.69
	4 Tx Slots	17.12	17.01	17.02	-3	14.12	14.01	14.02
EDGE (GMSK)	1 Tx Slot	22.90	22.82	22.74	-9	13.90	13.82	13.74
	2 Tx Slots	20.96	20.94	20.90	-6	14.96	14.94	14.90
	3 Tx Slots	19.09	19.01	18.96	-4.25	14.84	14.76	14.71
	4 Tx Slots	17.11	17.01	17.04	-3	14.11	14.01	14.04
EDGE (8PSK)	1 Tx Slot	19.30	18.97	18.73	-9	10.30	9.97	9.73
	2 Tx Slots	16.80	16.52	16.26	-6	10.80	10.52	10.26
	3 Tx Slots	14.76	14.47	14.16	-4.25	10.51	10.22	9.91
	4 Tx Slots	12.54	12.21	11.96	-3	9.54	9.21	8.96

Table 21: Test results conducted power measurement GSM1900 with Proximity sensor activated

Note:

1. The conducted power of GSM1900 is measured with RMS detector.
2. Frame-averaged output power was calculated from the measured burst-averaged output power by converting the slot powers into linear units and calculating the energy over 8 timeslots.
3. The specified power reduction and target values are listed in the tune-up information document.

7.1.3 Conducted power measurements of UMTS Band V

UMTS Band V		Averaged Power (dBm)		
		4132CH	4182CH	4233CH
WCDMA	12.2kbps RMC	23.00	22.79	22.86
	64kbps RMC	22.96	22.79	22.94
	144kbps RMC	22.93	22.80	23.00
	384kbps RMC	23.01	22.76	23.04
HSDPA	Subtest 1	22.99	22.72	22.99
	Subtest 2	22.60	22.22	22.41
	Subtest 3	21.86	21.59	21.77
	Subtest 4	21.85	21.57	21.79
HSUPA	Subtest 1	21.17	20.83	21.14
	Subtest 2	20.21	19.88	20.13
	Subtest 3	20.11	19.81	20.04
	Subtest 4	19.90	19.69	19.94
	Subtest 5	21.20	20.90	21.13
DC-HSDPA	Subtest 1	22.97	22.71	22.95
	Subtest 2	22.57	22.24	22.41
	Subtest 3	21.83	21.56	21.76
	Subtest 4	21.85	21.55	21.75

Table 22: Test results conducted power measurement UMTS Band V with Proximity sensor deactivated

UMTS Band V		Averaged Power (dBm)		
		4132CH	4182CH	4233CH
WCDMA	12.2kbps RMC	18.89	18.75	18.91
	64kbps RMC	18.90	18.79	18.90
	144kbps RMC	18.86	18.80	18.98
	384kbps RMC	18.95	18.70	18.99
HSDPA	Subtest 1	18.96	18.76	18.85
	Subtest 2	18.18	17.88	17.66
	Subtest 3	18.17	18.24	17.85
	Subtest 4	18.60	18.31	17.98
HSUPA	Subtest 1	18.48	17.34	17.46
	Subtest 2	17.99	17.77	17.92
	Subtest 3	17.70	17.47	17.62
	Subtest 4	17.74	15.87	16.09
	Subtest 5	16.73	17.33	17.53
DC-HSDPA	Subtest 1	18.98	18.74	18.86
	Subtest 2	18.15	17.85	17.63
	Subtest 3	18.18	18.22	17.87
	Subtest 4	18.62	18.33	17.96

Table 23: Test results conducted power measurement UMTS Band V with Proximity sensor activated

Note:

1. The conducted power of UMTS Band V is measured with RMS detector.
2. The specified power reduction and target values are listed in the tune-up information document.

7.1.4 Conducted power measurements of UMTS Band II

UMTS Band II		Averaged Power (dBm)		
		9262CH	9400CH	9538CH
WCDMA	12.2kbps RMC	22.77	22.62	22.79
	64kbps RMC	22.77	22.69	22.78
	144kbps RMC	22.77	22.65	22.74
	384kbps RMC	22.73	22.74	22.71
HSDPA	Subtest 1	22.78	22.70	22.78
	Subtest 2	22.67	22.72	22.80
	Subtest 3	22.36	22.41	22.56
	Subtest 4	22.43	22.52	22.59
HSUPA	Subtest 1	20.91	20.91	20.96
	Subtest 2	19.97	20.09	20.01
	Subtest 3	19.86	19.90	19.91
	Subtest 4	19.82	19.84	19.84
	Subtest 5	20.90	20.96	20.92
DC-HSDPA	Subtest 1	22.74	22.72	22.76
	Subtest 2	22.68	22.70	22.81
	Subtest 3	22.36	22.41	22.56
	Subtest 4	22.45	22.53	22.58

Table 24: Test results conducted power measurement UMTS Band II with Proximity sensor deactivated

UMTS Band II		Averaged Power (dBm)		
		9262CH	9400CH	9538CH
WCDMA	12.2kbps RMC	15.79	15.69	15.72
	64kbps RMC	15.77	15.69	15.78
	144kbps RMC	15.77	15.65	15.74
	384kbps RMC	15.73	15.74	15.71
HSDPA	Subtest 1	15.78	15.76	15.77
	Subtest 2	15.91	15.98	15.92
	Subtest 3	15.66	15.48	15.48
	Subtest 4	15.77	15.60	15.60
HSUPA	Subtest 1	15.78	15.97	15.80
	Subtest 2	15.71	15.87	15.72
	Subtest 3	15.49	15.88	15.73
	Subtest 4	15.17	15.84	15.72
	Subtest 5	15.77	15.97	15.78
DC-HSDPA	Subtest 1	15.76	15.78	15.77
	Subtest 2	15.90	15.96	15.93
	Subtest 3	15.68	15.45	15.47
	Subtest 4	15.75	15.60	15.61

Table 25: Test results conducted power measurement UMTS Band II with Proximity sensor activated

Note:

1. The conducted power of UMTS Band II is measured with RMS detector.
2. The specified power reduction and target values are listed in the tune-up information document.

7.2 SAR measurement Result

7.2.1 SAR measurement Result of GSM850

Test Position of Body	Test channel /Frequency	Test Mode	SAR Value (W/kg)		Power Drift (dB)	Conducted Power (dBm)	Liquid Temp
			1-g	10-g			
proximity sensor is activated (0mm)							
Rear Side	190/836.6	GPRS 1TS	0.486	0.298	0.160	28.65	21.4°C
		GPRS 2TS	0.540	0.338	0.040	26.71	21.4°C
		GPRS 3TS	0.519	0.324	0.010	24.71	21.4°C
		GPRS 4TS	0.445	0.276	0.050	22.76	21.4°C
Top Side	190/836.6	GPRS 2TS	0.524	0.325	0.060	26.71	21.4°C
proximity sensor is not activated (11mm)							
Rear Side	190/836.6	GPRS 1TS	0.128	0.083	-0.030	32.82	21.4°C
		GPRS 2TS	0.184	0.120	-0.050	32.43	21.4°C
		GPRS 3TS	0.172	0.112	-0.040	29.42	21.4°C
		GPRS 4TS	0.142	0.092	-0.100	27.42	21.4°C
proximity sensor is not activated (0mm)							
Left Side	190/836.6	GPRS 2TS	0.049	0.028	-0.070	32.43	21.4°C
proximity sensor is not activated (9mm)							
Top Side	190/836.6	GPRS 2TS	0.085	0.055	0.110	32.43	21.4°C
proximity sensor is not activated (0mm)							
Top Side tilted 34°	190/836.6	GPRS 2TS	0.034	0.017	-0.100	32.43	21.4°C
Worst position of GPRS with EGPRS (proximity sensor is activated (0mm))							
Rear Side	190/836.6	EDGE 2TS	0.506	0.302	-0.100	26.68	21.4°C

Table 26: Test results body SAR GSM850

Note:

- 1) The maximum SAR value of each test band is shown in **bold** letters.
- 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) The addition body test was performed at worst case.
- 4) For the device is a large tablet with a display and overall diagonal dimension > 20 cm, so SAR for the Front side and the Rear-Top edge(Rear side tilted 120°) are not required.
- 5) For it is not the most conservative antenna-to-user distance at edge mode as per KDB 447498 D01, so the Bottom and Right sides don't need to be tested.
- 6) The specified power reduction and target values are listed in the tune-up information document.

7.2.2 SAR measurement Result of GSM1900

Test Position of Body	Test channel /Frequency	Test Mode	SAR Value (W/kg)		Power Drift (dB)	Conducted Power (dBm)	Liquid Temp.
			1-g	10-g			
proximity sensor is activated (0mm)							
Rear Side	661/1880	GPRS 1TS	0.244	0.101	-0.150	22.82	21.4°C
		GPRS 2TS	0.303	0.125	0.030	20.93	21.4°C
		GPRS 3TS	0.300	0.123	-0.150	18.98	21.4°C
		GPRS 4TS	0.251	0.103	0.000	17.01	21.4°C
Top Side	661/1880	GPRS 2TS	0.200	0.063	0.120	20.93	21.4°C
proximity sensor is not activated (11mm)							
Rear Side	661/1880	GPRS 1TS	0.080	0.037	0.000	29.86	21.4°C
		GPRS 2TS	0.114	0.053	0.040	28.30	21.4°C
		GPRS 3TS	0.108	0.050	-0.010	26.29	21.4°C
		GPRS 4TS	0.095	0.044	-0.130	24.39	21.4°C
proximity sensor is not activated (0mm)							
Left Side	661/1880	GPRS 2TS	0.043	0.024	0.170	28.30	21.4°C
proximity sensor is not activated (9mm)							
Top Side	661/1880	GPRS 2TS	0.140	0.070	-0.180	28.30	21.4°C
proximity sensor is not activated(0mm)							
Top Side tilted 34°	661/1880	GPRS 2TS	0.067	0.035	-0.01	28.30	21.4°C
Worst position of GPRS with EGPRS (proximity sensor is activated(0mm))							
Rear Side	661/1880	EDGE 2TS	0.293	0.119	-0.100	20.94	21.4°C

Table 27: Test results body SAR GSM1900

Note:

- 1) The maximum SAR value of each test band is shown in **bold** letters.
- 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) The addition body test was performed at worst case.
- 4) For the device is a large tablet with a display and overall diagonal dimension > 20 cm, so SAR for the Front side and the Rear-Top edge(Rear side tilted 120°) are not required.
- 5) For it is not the most conservative antenna-to-user distance at edge mode as per KDB 447498 D01, so the Bottom and Right sides don't need to be tested.
- 6) The specified power reduction and target values are listed in the tune-up information document.

7.2.3 SAR measurement Result of UMTS Band V

Test Position of Body	Test channel /Frequency	Test Mode	SAR Value (W/kg)		Power Drift (dB)	Conducted Power (dBm)	Liquid Temp.
			1-g	10-g			
proximity sensor is activated (0mm)							
Rear Side	4182/836.4	RMC	0.515	0.304	0.110	18.75	21.4°C
Top Side			0.454	0.281	0.150		21.4°C
proximity sensor is not activated (11mm)							
Rear Side	4182/836.4	RMC	0.162	0.105	-0.160	22.79	21.4°C
proximity sensor is not activated (0mm)							
Left Side	4182/836.4	RMC	0.042	0.023	0.050	22.79	21.4°C
proximity sensor is not activated (9mm)							
Top Side	4182/836.4	RMC	0.174	0.110	0.170	22.79	21.4°C
proximity sensor is not activated (0mm)							
Top Side tilted 34°	4182/836.4	RMC	0.068	0.034	-0.02	22.79	21.4°C
Worst position of RMC with HSDPA/HSUPA (proximity sensor is activated (0mm))							
Rear Side	4182/836.4	HSDPA	0.442	0.266	-0.020	18.76	21.4°C
		HSUPA	0.411	0.243	0.040	17.33	21.4°C

Table 28: Test results body SAR UMTS Band V

Note:

- 1) The maximum SAR value of each test band is shown in **bold** letters.
- 2) Per KDB447498 D01, 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 KDB Inquiry 449833, if the the DC-HSDPA maximum output is not more than 0.25 dB higher than WCDMA, SAR measurement for this mode is not required
- 4) The addition body test was performed at worst case.
- 4) For the device is a large tablet with a display and overall diagonal dimension > 20 cm, so SAR for the Front side and the Rear-Top edge(Rear side tilted 120°) are not required.
- 5) For it is not the most conservative antenna-to-user distance at edge mode as per KDB 447498 D01, so the Bottom and Right sides don't need to be tested.
- 6) The specified power reduction and target values are listed in the tune-up information document.

7.2.4 SAR measurement Result of UMTS Band II

Test Position of Body	Test channel /Frequency	Test Mode	SAR Value (W/kg)		Power Drift (dB)	Conducted Power (dBm)	Liquid Temp.
			1-g	10-g			
proximity sensor is activated(0mm)							
Rear Side	9400/1880	RMC	0.451	0.192	0.020	15.69	21.4°C
Top Side			0.369	0.127	-0.170		21.4°C
proximity sensor is not activated(11mm)							
Rear Side	9400/1880	RMC	0.196	0.090	-0.070	22.62	21.4°C
proximity sensor is not activated(0mm)							
Left Side	9400/1880	RMC	0.097	0.051	0.160	22.62	21.4°C
proximity sensor is not activated(9mm)							
Top Side	9400/1880	RMC	0.220	0.110	0.020	22.62	21.4°C
proximity sensor is not activated(0mm)							
Top Side tilted 34°	9400/1880	RMC	0.116	0.060	0.040	22.62	21.4°C
Worst position of RMC with HSDPA/HSUPA (proximity sensor is activated(0mm))							
Rear Side	9400/1880	HSDPA	0.447	0.190	0.100	15.76	21.4°C
		HSUPA	0.381	0.158	0.110	15.97	21.4°C

Table 29: Test results body SAR UMTS Band II

Note:

- 1) The maximum SAR value of each test band is shown in **bold** letters.
- 2) Per KDB447498 D01, 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 KDB Inquiry 449833, if the the DC-HSDPA maximum output is not more than 0.25 dB higher than WCDMA, SAR measurement for this mode is not required
- 4) The addition body test was performed at worst case.
- 4) For the device is a large tablet with a display and overall diagonal dimension > 20 cm, so SAR for the Front side and the Rear-Top edge(Rear side tilted 120°) are not required.
- 5) For it is not the most conservative antenna-to-user distance at edge mode as per KDB 447498 D01, so the Bottom and Right sides don't need to be tested.
- 6) The specified power reduction and target values are listed in the tune-up information document.

7.2.5 SAR measurement Result of WiFi

Test Position of Body	Test channel /Frequency	Test Mode	SAR Value (W/kg)		Power Drift (dB)	Conducted Power (dBm)	Liquid Temp.
			1-g	10-g			
Test separation distance is performed 0mm							
Rear Side	1/2412	802.11b	0.936	0.365	-0.090	14.45	21.4°C
	6/2437		1.020	0.397	-0.190	14.51	21.4°C
	11/2462		0.915	0.352	-0.100	14.40	21.4°C
Right Side	6/2437	802.11b	0.208	0.089	-0.080	14.51	21.4°C
Top Side			0.688	0.295	0.150		21.4°C
Top Side tilted 34°			0.349	0.158	0.110		21.4°C

Table 30: Test results body SAR WiFi 2450

Note:

- 1) the maximum SAR value of each test band is shown in **bold** colour.
- 2) 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) Per KDB447498 D01, 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) For the device is a large tablet with a display and overall diagonal dimension > 20 cm, so SAR for the Front side and the Rear-Top edge(Rear side tilted 120°) are not required.
- 6) For it is not the most conservative antenna-to-user distance at edge mode as per KDB 447498 D01, so the Bottom and Left sides don't need to be tested.
- 7) The proximity sensor is not used for power reduction in WiFi mode, so the test separation distance is only performed 0mm.
- 8) The value test of Top Side tilted 34° is provided solely for purposes of evaluating the Simultaneous SAR for 2G&3G and WiFi.

7.3 Multiple Transmitter Evaluation

Per KDB447498 D01 Mobile portable RF exposure v04, SAR is not required for the following simultaneous condition:

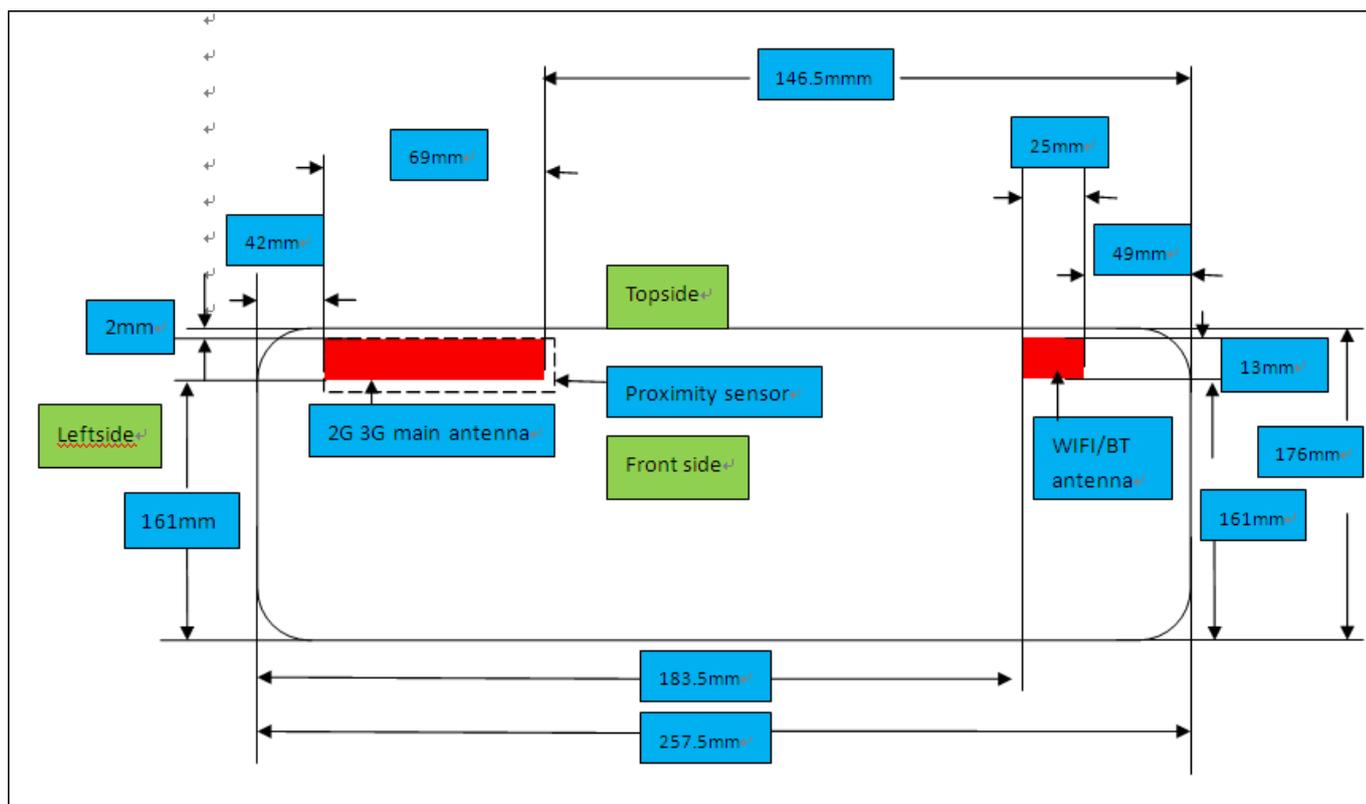
For the antennas that are located < 5cm from persons, where

- a. The closest antenna separation distance is > 5cm for all simultaneous transmitting antennas within the host or device; and
- b. The sum of the 1-g SAR is < 1.6W/kg for all simultaneous transmitting antennas that require stand-alone SAR evaluation or the SAR to peak location separation ratios are < 0.3 for all simultaneous transmitting antenna pairs; and
- c. The output power is $\leq 60/f(\text{GHz})$ mW for any simultaneous transmitting antenna(s) for which stand-alone SAR evaluation is not required.

	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 31: Output Power Thresholds for Unlicensed Transmitters

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



The output power of BT antenna is as following:

BT 2450MHz	Average Conducted Power (dBm)		
	0CH	39CH	78CH
	4.05	6.17	5.49

Table 32: Test results conducted power measurement BT.

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	14.45	14.48	14.45	14.44	/	/	/	/
	6	14.51	14.31	14.49	14.41	/	/	/	/
	11	14.40	14.26	14.30	14.32	/	/	/	/
802.11g	Channel	6	9	12	18	24	36	48	54
	1	13.77	13.80	13.77	13.71	13.76	13.70	13.73	13.73
	6	13.60	13.51	13.54	13.50	13.49	13.53	13.52	13.55
	11	13.32	13.30	13.33	13.29	13.22	13.24	13.28	13.28
802.11n HT20	Channel	6.5	13	19.5	26	39	52	58.5	65
	1	13.82	13.55	13.71	13.69	13.71	13.67	13.67	13.69
	6	13.64	13.61	13.61	13.63	13.69	13.59	13.58	13.60
	11	13.56	13.39	13.42	13.45	13.47	13.31	13.37	13.44

Table 33:Test results conducted power measurement WiFi .

Stand-alone SAR

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

Stand-alone SAR evaluation is not required for BT, because the Max output power of BT unlicensed transmitter is 6.17dBm≤24mW (13.8dBm) and its antenna(s) is 7.25 cm>5 cm from main antenna.

Stand-alone SAR evaluation is required for WiFi, because the output power of WiFi unlicensed transmitter is 14.51dBm >24mW (13.8dBm).

Simultaneous SAR

Simultaneous Transmission Configuration			
Mode	2G Data	3G Data	WLAN
2G Data	---	No	Yes
3G Data	No	---	Yes
WLAN	Yes	Yes	---

Note:

This mode doesn't support simultaneous 2G and 3G, because they share the same antenna and can't transmit simultaneously by design.

Test Position		GSM&UMTS SAR _{Max} (W/kg)	WiFi SAR (W/kg)	Σ1-g SAR _{max} (W/kg)
Body SAR	Rear side	0.540	1.020	1.560
	Left side	0.097	NA	0.097
	Right side	NA	0.208	0.208
	Top side	0.524	0.688	1.212
	Top Side tilted 34°	0.116	0.349	0.465

Simultaneous Transmission SAR evaluation is not required for BT and GSM&UMTS, because stand-alone SAR are not required for BT and its antenna(s) is 7.25cm>5.0 cm from main antenna.

Simultaneous Transmission SAR evaluation is not required for WiFi and GSM&UMTS, because the sum of the 1g SAR is $1.560\text{W/kg} < 1.6\text{W/kg}$ for WiFi and GSM&UMTS.

Simultaneous Transmission SAR evaluation is not required for BT and WiFi, because they share the same antenna .

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