SAR EVALUATION REPORT

For

QBEX AMERICA LLC

11142 NW 71 Terrace. Doral, FL 33178, United States

FCC ID:2AEZN-QBA769PLUS

Report Type:	**Product Type:**
Original Report	Smart phone

Test Engineer:	Terry XiaHou
Report Number:	RDG150610005-20A
Report Date:	2015-06-24
Reviewed By:	Bell Hu SAR Engineer
Prepared By:	Bay Area Compliance Laboratories Corp. (Shenzhen) 6/F, the 3rd Phase of WanLi Industrial Building, ShiHua Road, FuTian Free Trade Zone Shenzhen, Guangdong, China Tel: +86-755-33320018 Fax: +86-755-33320008 www.baclcorp.com.cn

Attestation of Test Results		
EUT Information	**Company Name**	QBEX AMERICA LLC
	EUT Description	Mobile phone
	Product name	smart phone
	FCC ID	2AEZN-QBA769PLUS
	Model Number	QBA769PLUS
	Test Date	2015-06-16

Frequency	**Max. SAR Level(s) Reported**	**Limit(W/Kg)**
LTE Band 17	0.084 W/kg 1g Head SAR 0.195 W/kg 1g Body SAR	**1.6**
Simultaneous	0.483 W/kg 1g Head SAR 0.395 W/kg 1g Body SAR	

Applicable Standards	**ANSI / IEEE C95.1 : 2005** IEEE Standard for Safety Levels with Respect to Human Exposure to Radio Frequency Electromagnetic Fileds,3 kHz to 300 GHz.
	ANSI / IEEE C95.3 : 2002 IEEE Recommended Practice for Measurements and Computations of Radio Frequency Electromagnetic Fields With Respect to Human Exposure to SuchFields,100 kHz—300 GHz.
	IEEE1528:2013 IEEE Recommended Practice for Determining the Peak Spatial-Average Specific Absorption Rate (SAR) in the Human Head from Wireless Communications Devices: Measurement Techniques
	KDB procedures KDB 447498 D01 General RF Exposure Guidance v05r02. KDB 648474 D04 Handset SAR v01r02. KDB 865664 D01 SAR measurement 100 MHz to 6 GHz v01r03 KDB 865664 D02 RF Exposure Reporting v01r01 KDB 941225 D01 3G SAR Procedures v03 KDB 941225 D05 SAR for LTE Devices v02r03 KDB 941225 D06 Hotspot Mode v02

Note: This wireless device has been shown to be capable of compliance for localized specific absorption rate (SAR) for General Population/Uncontrolled Exposure limits specified in ANSI/IEEE Standards and has been tested in accordance with the measurement procedures specified in IEEE 1528-2013 and RF exposure KDB procedures.

The results and statements contained in this report pertain only to the device(s) evaluated.

TABLE OF CONTENTS

DOCUMENT REVISION HISTORY

Revision Number	Report Number	Description of Revision	Date of Revision
0	RDG150610005-20A	Original Report	2015-06-24

Note:
For GSM 850,PCS 1900,WCDMA 850,WCDMA 1900,LTE Band 2,LTE Band 4,LTE Band 7 SAR data, please refer to the report RDG150610005-20.

EUT DESCRIPTION

This report has been prepared on behalf of QBEX AMERICA LLC and their product, FCC ID: 2AEZN-QBA769PLUS, Model: QBA769PLUS or the EUT (Equipment under Test) as referred to in the rest of this report.

Technical Specification

Product Type	Portable
Exposure Category:	Population / Uncontrolled
Antenna Type(s):	Internal Antenna
Body-Worn Accessories:	Headset
Face-Head Accessories:	None
Multi-slot Class:	Class12
Operation Mode :	GSM Voice, EDGE/GPRS Data, WCDMA, LTE,Wi-Fi and Bluetooth
Frequency Band:	GSM 850 : 824-849 MHz(TX) ; 869-894 MHz(RX) PCS 1900: 1850-1910 MHz(TX) ; 1930-1990 MHz(RX) WCDMA850: 824-849 MHz(TX) ; 869-894 MHz(RX) WCDMA1900: 1850-1910 MHz(TX) ; 1930-1990 MHz(RX) LTE Band 2: 1850-1910MHz(TX) ; 1930-1990MHz(RX) LTE Band 4: 1710-1755MHz(TX) ; 2110-2155MHz(RX) LTE Band 7: 2500-2570MHz(TX) ; 2620-2690MHz(RX) LTE Band 17: 704-716MHz(TX) ; 734-746MHz(RX) Wi-Fi(802.11b/g/n20): 2412MHz-2462MHz Wi-Fi(802.11n40): 2422MHz-2452MHz Bluetooth3.0 : 2402MHz-2480MHz BLTE:2402MHz-2480MHz
Conducted RF Power:	GSM 850 : 32.90 dBm PCS 1900: 29.70 dBm WCDMA 850: 22.25 dBm WCDMA 1900: 22.02 dBm LTE Band 2: 22.87 dBm LTE Band 4: 22.10 dBm LTE Band 7: 22.90 dBm LTE Band 17: 22.86 dBm Wi-Fi(802.11b/g/n20): 9.79 dBm Wi-Fi(802.11n40) : 9.68 dBm Bluetooth:5.52 dBm BLTE: 2.04 dBm
Dimensions (L*W*H):	157 mm (L) × 78 mm (W) × 8 mm (H)
Power Source:	3.7 V_{DC} Rechargeable Battery
Normal Operation:	Head and Body-worn

Note:
For GSM 850,PCS 1900,WCDMA 850,WCDMA 1900,LTE Band 2,LTE Band 4,LTE Band 7 SAR data, please refer to the report RDG150610005-20.

REFERENCE, STANDARDS, AND GUILDELINES

FCC:

The Report and Order requires routine SAR evaluation prior to equipment authorization of portable transmitter devices, including portable telephones. For consumer products, the applicable limit is 1.6 mW/g as recommended by the ANSI/IEEE standard C95.1-1992 [6] for an uncontrolled environment (Paragraph 65). According to the Supplement C of OET Bulletin 65 “Evaluating Compliance with FCC Guide-lines for Human Exposure to Radio frequency Electromagnetic Fields", released on Jun 29, 2001 by the FCC, the device should be evaluated at maximum output power (radiated from the antenna) under “worst-case” conditions for normal or intended use, incorporating normal antenna operating positions, device peak performance frequencies and positions for maximum RF energy coupling.

This report describes the methodology and results of experiments performed on wireless data terminal. The objective was to determine if there is RF radiation and if radiation is found, what is the extent of radiation with respect to safety limits. SAR (Specific Absorption Rate) is the measure of RF exposure determined by the amount of RF energy absorbed by human body (or its parts) – to determine how the RF energy couples to the body or head which is a primary health concern for body worn devices. The limit below which the exposure to RF is considered safe by regulatory bodies in North America is 1.6 mW/g average over 1 gram of tissue mass.

CE:

The order requires routine SAR evaluation prior to equipment authorization of portable transmitter devices, including portable telephones. For consumer products, the applicable limit is 2 mW/g as recommended by EN62209-1 for an uncontrolled environment. According to the Standard, the device should be evaluated at maximum output power (radiated from the antenna) under “worst-case” conditions for normal or intended use, incorporating normal antenna operating positions, device peak performance frequencies and positions for maximum RF energy coupling.

This report describes the methodology and results of experiments performed on wireless data terminal. The objective was to determine if there is RF radiation and if radiation is found, what is the extent of radiation with respect to safety limits. SAR (Specific Absorption Rate) is the measure of RF exposure determined by the amount of RF energy absorbed by human body (or its parts) – to determine how the RF energy couples to the body or head which is a primary health concern for body worn devices. The limit below which the exposure to RF is considered safe by regulatory bodies in Europe is 2 mW/g average over 10 gram of tissue mass.

The test configurations were laid out on a specially designed test fixture to ensure the reproducibility of measurements. Each configuration was scanned for SAR. Analysis of each scan was carried out to characterize the above effects in the device.

SAR Limits

FCC Limit (1g Tissue)

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

CE Limit (10g Tissue)

EXPOSURE LIMITS	SAR (W/kg)	
	(General Population / Uncontrolled Exposure Environment)	(Occupational / Controlled Exposure Environment)
Spatial Average (averaged over the whole body)	0.08	0.4
Spatial Peak (averaged over any 10 g of tissue)	2.0	10
Spatial Peak (hands/wrists/feet/ankles averaged over 10 g)	4.0	20.0

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

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

General Population/Uncontrolled environments Spatial Peak limit 1.6W/kg (FCC) & 2 W/kg (CE) applied to the EUT.

FACILITIES

The test site used by Bay Area Compliance Laboratories Corp. (Shenzhen) to collect data is located at 6/F, the 3rd Phase of WanLi Industrial Building, Shi Hua Road, Fu Tian Free Trade Zone, Shenzhen, Guangdong, P.R. of China

DESCRIPTION OF TEST SYSTEM

These measurements were performed with ALSAS 10 Universal Integrated SAR Measurement system from APREL Laboratories.

ALSAS-10U System Description

ALSAS-10-U is fully compliant with the technical and scientific requirements of IEEE 1528, IEC 62209, CENELEC, ARIB, ACA, and the Federal Communications Commission. The system comprises of a six axes articulated robot which utilizes a dedicated controller. ALSAS-10U uses the latest methodologies. And FDTD modeling to provide a platform which is repeatable with minimum uncertainty.

Applications

Predefined measurement procedures compliant with the guidelines of CENELEC, IEEE, IEC, FCC, etc are utilized during the assessment for the device. Automatic detection for all SAR maxima are embedded within the core architecture for the system, ensuring that peak locations used for centering the zoom scan are within a 1mm resolution and a 0.05mm repeatable position. System operation range currently available up-to 6 GHz in simulated tissue.

Area Scans

Area scans are defined prior to the measurement process being executed with a user defined variable spacing between each measurement point (integral) allowing low uncertainty measurements to be conducted. Scans defined for FCC applications utilize a 10mm2 step integral, with 1mm interpolation used to locate the peak SAR area used for zoom scan assessments.

Where the system identifies multiple SAR peaks (which are within 25% of peak value) the system will provide the user with the option of assessing each peak location individually for zoom scan averaging.

Zoom Scan (Cube Scan Averaging)

The averaging zoom scan volume utilized in the ALSAS-10U software is in the shape of a cube and the side dimension of a 1 g or 10 g mass is dependent on the density of the liquid representing the simulated tissue. A density of 1000 kg/m3 is used to represent the head and body tissue density and not the phantom liquid density, in order to be consistent with the definition of the liquid dielectric properties, i.e. the side length of the 1 g cube is 10mm,with the side length of the 10 g cube 21,5mm.

When the cube intersects with the surface of the phantom, it is oriented so that 3 vertices touch the surface of the shell or the center of a face is tangent to the surface. The face of the cube closest to the surface is modified in order to conform to the tangent surface.

The zoom scan integer steps can be user defined so as to reduce uncertainty, but normal practice for typical test applications (including FCC) utilize a physical step of 5x5x8 (8mmx8mmx5mm) providing a volume of 32mm in the X & Y axis, and 35mm in the Z axis.

ALSAS-10U Interpolation and Extrapolation Uncertainty

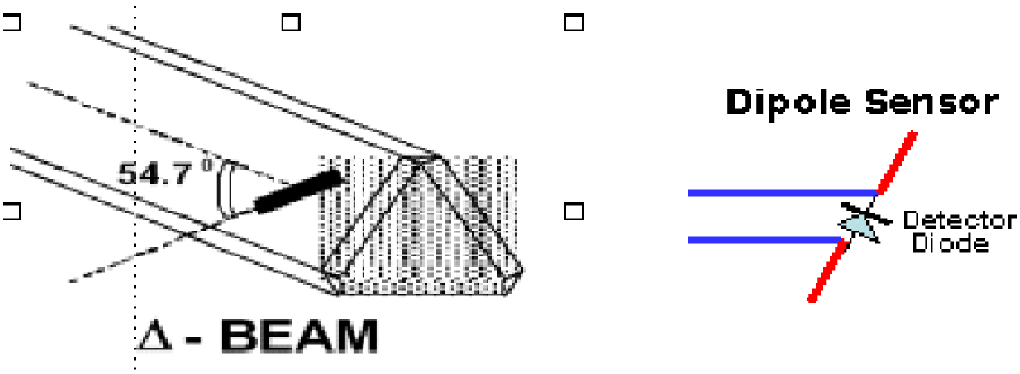
The overall uncertainty for the methodology and algorithms the used during the SAR calculation was evaluated using the data from IEEE 1528 based on the example f3 algorithm:

$$f_3(x, y, z) = A \frac{a^2}{\frac{a^2}{4} + x'^2 + y'^2} \cdot \left(e^{-\frac{2z}{a}} + \frac{a^2}{2(a + 2z)^2} \right)$$

Isotropic E-Field Probe

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

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



SAR is assessed with a calibrated probe which moves at a default height of 5mm from the center of the diode, which is mounted to the sensor, to the phantom surface (in the Z Axis). The 5mm offset height has been selected so as to minimize any resultant boundary effect due to the probe being in close proximity to the phantom surface.

The following algorithm is an example of the function used by the system for linearization of the output from the probe when measuring complex modulation schemes.

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

Isotropic E-Field Probe Specification

Calibration Method	Frequency Dependent Below 1 GHz Calibration in air performed in a TEM Cell Above 1 GHz Calibration in air performed in waveguide
Sensitivity	0.70 μV/(V/m)^2 to 0.85 μV/(V/m)^2
Dynamic Range	0.0005 W/kg to 100 W/kg
Isotropic Response	Better than 0.1 dB
Diode Compression Point (DCP)	Calibration for Specific Frequency
Probe Tip Diameter	< 2.9 mm
Sensor Offset	1.56 (+/- 0.02 mm)
Probe Length	289 mm
Video Bandwidth	@ 500 Hz: 1 dB @ 1.02 kHz: 3 dB
Boundary Effect	Less than 2.1% for distance greater than 0.58 mm
Spatial Resolution	The spatial resolution uncertainty is less than 1.5% for 4.9mm diameter probe. The spatial resolution uncertainty is less than 1.0% for 2.5mm diameter probe

Boundary Detection Unit and Probe Mounting Device

ALSAS-10U incorporates a boundary detection unit with a sensitivity of 0.05mm for detecting all types of surfaces. The robust design allows for detection during probe tilt (probe normalize) exercises, and utilizes a second stage emergency stop. The signal electronics are fed directly into the robot controller for high accuracy surface detection in lateral and axial detection modes (X, Y, & Z).

The probe is mounted directly onto the Boundary Detection unit for accurate tooling and displacement calculations controlled by the robot kinematics. The probe is connect to an isolated probe interconnect where the output stage of the probe is fed directly into the amplifier stage of the Daq-Paq.

Daq-Paq (Analog to Digital Electronics)

ALSAS-10U incorporates a fully calibrated Daq-Paq (analog to digital conversion system) which has a 4 channel input stage, sent via a 2 stage auto-set amplifier module. The input signal is amplified accordingly so as to offer a dynamic range from 5μV to 800mV. Integration of the fields measured is carried out at board level utilizing a Co-Processor which then sends the measured fields down into the main computational module in digitized form via an RS232 communications port. Probe linearity and duty cycle compensation is carried out within the main Daq-Paq module.

ADC	12 Bit
Amplifier Range	20 mV to 200 mV and 150 mV to 800 mV
Field Integration	Local Co-Processor utilizing proprietary integration algorithms
Number of Input Channels	4 in total 3 dedicated and 1 spare
Communication	Packet data via RS232

Axis Articulated Robot

ALSAS-10U utilizes a six axis articulated robot, which is controlled using a Pentium based real-time movement controller. The movement kinematics engine utilizes proprietary (Thermo CRS) interpolation and extrapolation algorithms, which allow full freedom of movement for each of the six joints within the working envelope. Utilization of joint 6 allows for full probe rotation with a tolerance better than 0.05mm around the central axis.

Robot/Controller Manufacturer	Thermo CRS
Number of Axis	Six independently controlled axis
Positioning Repeatability	0.05 mm
Controller Type	Single phase Pentium based C500C
Robot Reach	710 mm
Communication	RS232 and LAN compatible

ALSAS Universal Workstation

ALSAS Universal workstation allows for repeatability and fast adaptability. It allows users to do calibration, testing and measurements using different types of phantoms with one set up, which significantly speeds up the measurement process.

Universal Device Positioner

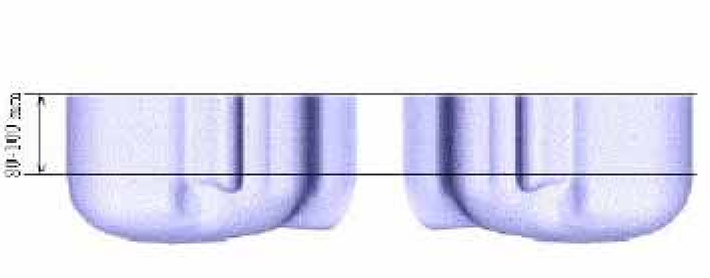
The universal device positioner allows complete freedom of movement of the EUT. Developed to hold a EUT in a free-space scenario any additional loading attributable to the material used in the construction of the positioner has been eliminated. Repeatability has been enhanced through the linear scales which form the design used to indicate positioning for any given test scenario in all major axes. A 15° tilt indicator is included for the of aid cheek to tilt movements for head SAR analysis. Overall uncertainty for measurements have been reduced due to the design of the Universal device positioner, which allows positioning of a device in as near to a free-space scenario as possible, and by providing the means for complete repeatability.

Phantom Types

The ALSAS-10U allows the integration of multiple phantom types. SAM Phantoms fully compliant with IEEE 1528, Universal Phantom, and Universal Flat.

APREL SAM Phantoms

The SAM phantoms developed using the IEEE SAM CAD file. They are fully compliant with the requirements for both IEEE 1528 and FCC Supplement C. Both the left and right SAM phantoms are interchangeable, transparent and include the IEEE 1528 grid with visible NF and MB lines.



APREL Laboratories Universal Phantom

The Universal Phantom is used on the ALSAS-10U as a system validation phantom. The Universal Phantom has been fully validated both experimentally from 800MHz to 6GHz and numerically using XFDTD numerical software.

The shell thickness is 2mm overall, with a 4mm spacer located at the NF/MB intersection providing an overall thickness of 6mm in line with the requirements of IEEE-1528.

The design allows for fast and accurate measurements, of handsets, by allowing the conservative SAR to be evaluated at on frequency for both left and right head experiments in one measurement.

Tissue Dielectric Parameters for Head and Body Phantoms

The head tissue dielectric parameters recommended by the IEEE SCC-34/SC-2 in P1528 have been incorporated in the following table. These head parameters are derived from planar layer models simulating the highest expected SAR for the dielectric properties and tissue thickness variations in a human head. Other head and body tissue parameters that have not been specified in P1528 are derived from the tissue dielectric parameters computed from the 4-Cole-Cole equations described in Reference [12] and extrapolated according to the head parameters specified in P1528.

Ingredients (% by weight)	Frequency (MHz)									
	450		835		915		1900		2450	
Tissue Type	Head	Body	Head	Body	Head	Body	Head	Body	Head	Body
Water	38.56	51.16	41.45	52.4	41.05	56.0	54.9	40.4	62.7	73.2
Salt (Nacl)	3.95	1.49	1.45	1.4	1.35	0.76	0.18	0.5	0.5	0.04
Sugar	56.32	46.78	56.0	45.0	56.5	41.76	0.0	58.0	0.0	0.0
HEC	0.98	0.52	1.0	1.0	1.0	1.21	0.0	1.0	0.0	0.0
Bactericide	0.19	0.05	0.1	0.1	0.1	0.27	0.0	0.1	0.0	0.0
Triton x-100	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	36.8	0.0
DGBE	0.0	0.0	0.0	0.0	0.0	0.0	44.92	0.0	0.0	26.7
Dielectric Constant	43.42	58.0	42.54	56.1	42.0	56.8	39.9	54.0	39.8	52.5
Conductivity (s/m)	0.85	0.83	0.91	0.95	1.0	1.07	1.42	1.45	1.88	1.78

Recommended Tissue Dielectric Parameters for Head and Body

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

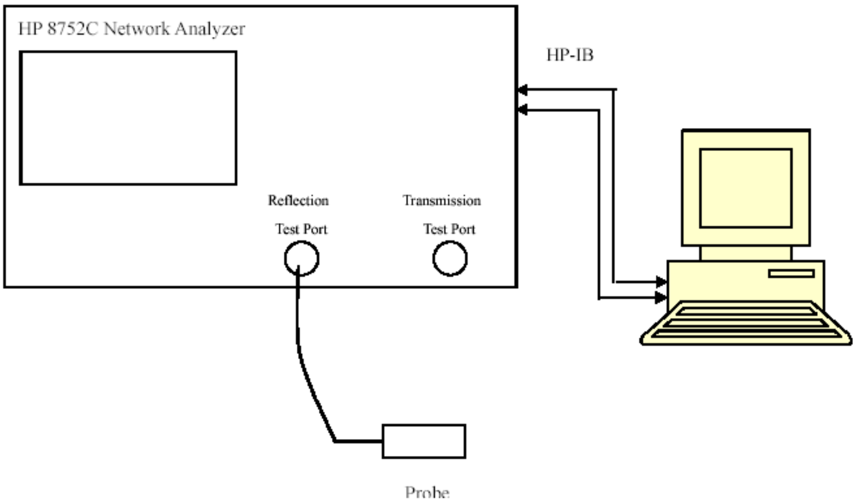
EQUIPMENT LIST AND CALIBRATION

Equipments List & Calibration Information

Equipment	Model	Calibration Date	S/N
CRS F3 robot	ALS-F3	N/A	RAF0805352
CRS F3 Software	ALS-F3-SW	N/A	N/A
CRS C500C controller	ALS-C500	N/A	RCF0805379
Probe mounting device & Boundary	ALS-PMDPS-3	N/A	120-00270
Universal Work Station	ALS-UWS	N/A	100-00157
Data Acquisition Package	ALS-DAQ-PAQ-3	2014-10-14	110-00212
Miniature E-Field Probe	ALS-E-020	2014-10-14	500-00283
Dipole, 750MHz	ALS-D-750-S-2	2013-10-08	177-00505
Dipole, 835MHz	ALS-D-835-S-2	2014-10-08	180-00558
Dipole, 1750MHz	ALS-D-1750-S-2	2013-10-08	198-00304
Dipole, 1900MHz	ALS-D-1900-S-2	2014-10-09	210-00710
Dipole, 2450MHz	ALS-D-2450-S-2	2014-10-09	220-00758
Dipole Spacer	ALS-DS-U	N/A	250-00907
Device holder/Positioner	ALS-H-E-SET-2	N/A	170-00510
Left ear SAM phantom	ALS-P-SAM-L	N/A	130-00311
Right ear SAM phantom	ALS-P-SAM-R	N/A	140-00359
UniPhantom	ALS-P-UP-1	N/A	150-00413
Simulated Tissue 750 MHz Head	ALS-TS-750-H	Each Time	269-01008
Simulated Tissue 750 MHz Body	ALS-TS-750-B	Each Time	269-02107
Simulated Tissue 835 MHz Head	ALS-TS-835-H	Each Time	270-01002
Simulated Tissue 835 MHz Body	ALS-TS-835-B	Each Time	270-02101
Simulated Tissue 1750 MHz Head	ALS-TS-1750-H	Each Time	295-01103
Simulated Tissue 1750 MHz Body	ALS-TS-1750-B	Each Time	295-02102
Simulated Tissue 1900 MHz Head	ALS-TS-1900-H	Each Time	295-01103
Simulated Tissue 1900 MHz Body	ALS-TS-1900-B	Each Time	295-02102
Simulated Tissue 2450 MHz Head	ALS-TS-2450-H	Each Time	290-01108
Simulated Tissue 2450 MHz Body	ALS-TS-2450-B	Each Time	290-01109
Directional couple	DC6180A	N/A	0325849
Power Amplifier	5S1G4	N/A	71377
Dielectric probe kit	HP85070B	2015-06-12	N/A
Attenuator	3dB	2015-05-07	5402
Network analyzer	8752C	2015-06-02	3410A02356
Synthesized Sweeper	HP 8341B	2015-06-02	2624A00116
UNIVERSAL RADIO COMMUNICATION TESTER	CMU200	2014-11-23	106891
WIDEBAND RADIO COMMUNICATION TESTER	CMW500	2015-04-18	114772
EMI Test Receiver	ESCI	2015-06-12	101746

SAR MEASUREMENT SYSTEM VERIFICATION

Liquid Verification



Liquid Verification Setup Block Diagram

Liquid Verification Results

Frequency	Liquid Type	Liquid Parameter		Target Value		Delta (%)		Tolerance (%)
		ε_r	Ơ (S/m)	ε_r	Ơ (S/m)	$\Delta\varepsilon_r$	ΔƠ (S/m)	
709.0	Head	42.31	0.89	41.95	0.89	0.858	0.000	±5
	Body	54.57	0.93	55.50	0.96	-1.676	-3.125	±5
710.0	Head	42.34	0.88	41.95	0.89	0.930	-1.124	±5
	Body	54.64	0.94	55.50	0.96	-1.550	-2.083	±5
711.0	Head	41.89	0.88	41.95	0.89	-0.143	-1.124	±5
	Body	54.54	0.93	55.50	0.96	-1.730	-3.125	±5

**Liquid Verification was performed on 2015-06-16.*

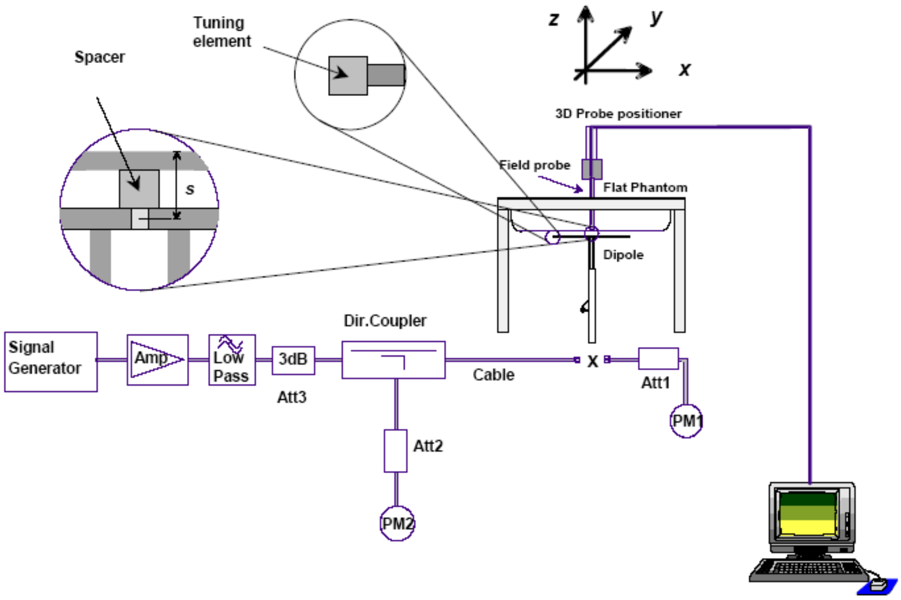
Please refer to the following tables.

750 MHz Head				750 MHz Body		
Frequency (MHz)	e'	e''		Frequency (MHz)	e'	e''
701.0	42.2392	22.5143		701.0	54.6128	23.7548
702.0	41.7891	22.5592		702.0	54.6091	23.6122
703.0	42.1033	22.5447		703.0	54.6352	23.5697
704.0	42.1386	22.2873		704.0	54.5996	23.7407
705.0	41.9077	22.1208		705.0	54.5423	23.7663
706.0	42.0234	22.4911		706.0	54.6425	23.7102
707.0	41.8384	22.4974		707.0	54.6288	23.4516
708.0	42.0156	22.4865		708.0	54.5425	23.5579
709.0	42.3107	22.4989		709.0	54.5650	23.5251
710.0	42.3352	22.3114		710.0	54.6358	23.6939
711.0	41.8892	22.2643		711.0	54.5405	23.5709
712.0	41.9756	21.9685		712.0	54.6323	23.4614
713.0	41.8840	22.2538		713.0	54.5721	23.6221
714.0	42.0001	22.0362		714.0	54.5568	23.7124
715.0	42.0429	22.4338		715.0	54.5990	23.6162
716.0	42.2228	22.5163		716.0	54.6392	23.4254
717.0	41.8738	22.1537		717.0	54.5783	23.4217
718.0	41.8199	22.3412		718.0	54.5674	23.6946
719.0	41.9414	22.4390		719.0	54.6217	23.6823
720.0	42.2001	22.2399		720.0	54.6054	23.7402
721.0	41.7726	22.1541		721.0	54.5687	23.5348
722.0	42.0033	22.2166		722.0	54.5845	23.6669
723.0	42.0908	22.3398		723.0	54.6283	23.4655
724.0	42.1918	22.2645		724.0	54.6199	23.7408
725.0	42.2151	22.2961		725.0	54.5809	23.5450
726.0	42.0779	22.3105		726.0	54.6153	23.7358
727.0	42.0134	22.1472		727.0	54.5571	23.4771
728.0	41.7600	22.4832		728.0	54.5494	23.6352
729.0	41.9560	22.5263		729.0	54.6332	23.6529
730.0	41.8215	22.0584		730.0	54.6467	23.4410
731.0	42.2403	22.0406		731.0	54.6015	23.6875
732.0	41.7629	22.0527		732.0	54.6466	23.5763
733.0	41.9359	21.9269		733.0	54.6341	23.4779
734.0	42.1605	21.9773		734.0	54.6332	23.6648
735.0	42.2228	21.7116		735.0	54.6473	23.5992
736.0	42.3235	21.7863		736.0	54.6284	23.5099
737.0	42.2066	22.3133		737.0	54.6415	23.3971
738.0	41.9069	21.8764		738.0	54.5744	23.7181
739.0	41.8541	21.8769		739.0	54.6224	23.4345
740.0	42.2472	21.9014		740.0	54.6499	23.5686
741.0	42.0611	22.2820		741.0	54.5812	23.3884
742.0	42.0506	22.2759		742.0	54.5923	23.3883
743.0	41.8962	21.7501		743.0	54.5804	23.5889
744.0	42.2017	21.9942		744.0	54.6224	23.4907
745.0	42.0653	21.7847		745.0	54.5708	23.4539
746.0	42.0153	22.1215		746.0	54.6160	23.5227
747.0	42.0779	22.0449		747.0	54.6084	23.4900
748.0	42.0076	21.8783		748.0	54.6032	23.6776
749.0	42.2241	21.8384		749.0	54.5938	23.7543
750.0	41.9440	22.1024		750.0	54.5931	23.5122
751.0	41.8467	21.6843		751.0	54.5580	23.5751

System Accuracy Verification

Prior to the assessment, the system validation kit was used to test whether the system was operating within its specifications of ±10%. The validation results are tabulated below. And also the corresponding SAR plot is attached as well in the SAR plots files.

System Verification Setup Block Diagram



Probe and dipole antenna List and Detail

Manufacturer	Description	Model	Serial Number	Calibration Date	Calibration Due Date
APREL	Probe	ALS-E-020	500-00283	2014-10-14	2015-10-13
APREL	Dipole antenna(750MHz)	ALS-D-750-S-2	177-00505	2013-10-08	2016-10-07

System Accuracy Check Results

Date	Frequency Band	Liquid Type	Measured SAR (W/Kg)		Target Value (W/Kg)	Delta (%)	Tolerance (%)
2015-06-16	750	Head	1g	8.635	8.500	1.588	±10
		Body	1g	8.596	8.540	0.656	±10

*All SAR values are normalized to 1 Watt forward power.

SAR SYSTEM VALIDATION DATA

Test Laboratory: Bay Area Compliance Lab Corp. (Shenzhen)

System Performance Check 750 MHz Head Liquid

Dipole 750 MHz; Type: ALS-D-750-S-2; S/N: 177-00505

Product Data	
Device Name	: Dipole 750 MHz
Serial No.	: 177-00505
Type	: Dipole
Model	: ALS-D-750-S-2
Frequency Band	: 750
Max. Transmit Pwr	: 1 W
Drift Time	: 3 min(s)
Power Drift-Start	: 8.102 W/kg
Power Drift-Finish	: 8.035 W/kg
Power Drift (%)	: -1.358

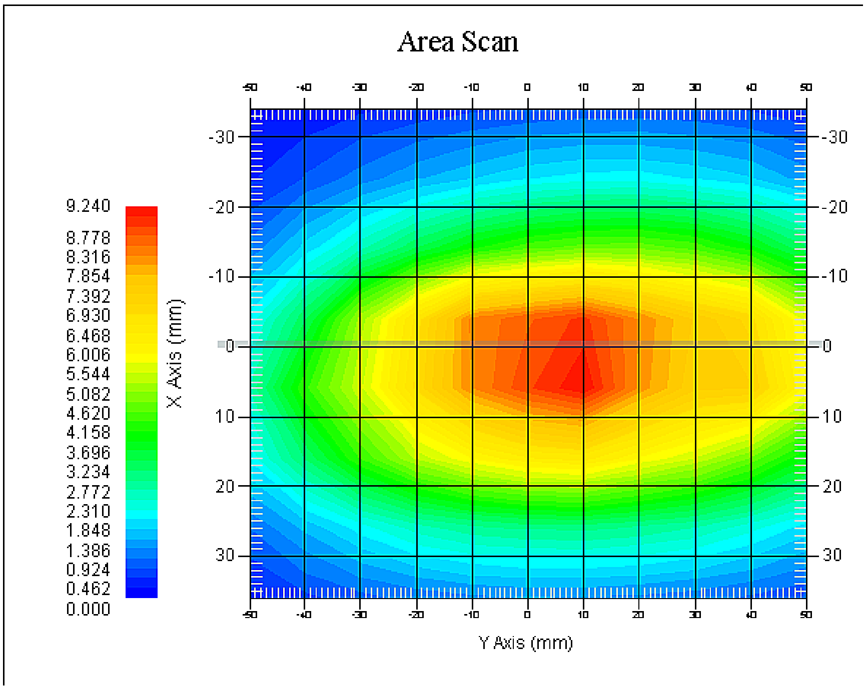
Phantom Data	
Name	: APREL-Uni
Type	: Uni-Phantom
Serial No.	: System Default
Location	: Center
Description	: Default
Phantom Data	

Tissue Data	
Type	: Head
Serial No.	: 269-01008
Frequency	: 750.0 MHz
Last Calib. Date	: 16-Jun-2015
Temperature	: 20.00 °C
Ambient Temp.	: 21.00 °C
Humidity	: 56.00 RH%
Epsilon	: 41.94 F/m
Sigma	: 0.92 S/m
Density	: 1000.00 kg/cu. m

Probe Data	
Name	: E-Field
Model	: E-020
Type	: E-Field Triangle
Serial No.	: 500-00283
Last Calib. Date	: 14-Oct-2014
Frequency Band	: 750
Duty Cycle Factor	: 1
Conversion Factor	: 6.0
Probe Sensitivity	: 1.20 1.20 1.20 µV/(V/m)2
Compression Point	: 95.00 mV
Offset	: 1.56 mm

Measurement Data	
Crest Factor	: 1
Scan Type	: Complete
Tissue Temp.	: 21.00 °C
Ambient Temp.	: 21.00 °C
Area Scan	: 7x9x1 : Measurement x=10mm, y=10mm, z=4mm
Zoom Scan	: 7x7x7 : Measurement x=5mm, y=5mm, z=5mm

1 gram SAR value : 8.635 W/kg
10 gram SAR value : 5.687 W/kg
Area Scan Peak SAR : 9.236 W/kg
Zoom Scan Peak SAR : 14.294 W/kg



750 MHz System Validation with Head Tissue

Test Laboratory: Bay Area Compliance Lab Corp. (Shenzhen)

System Performance Check 750 MHz Body Liquid

Dipole 750 MHz; Type: ALS-D-750-S-2; S/N: 177-00505

Product Data	
Device Name	: Dipole 750 MHz
Serial No.	: 177-00505
Type	: Dipole
Model	: ALS-D-750-S-2
Frequency Band	: 750
Max. Transmit Pwr	: 1 W
Drift Time	: 3 min(s)
Power Drift-Start	: 8.203 W/kg
Power Drift-Finish	: 8.269 W/kg
Power Drift (%)	: 0.794

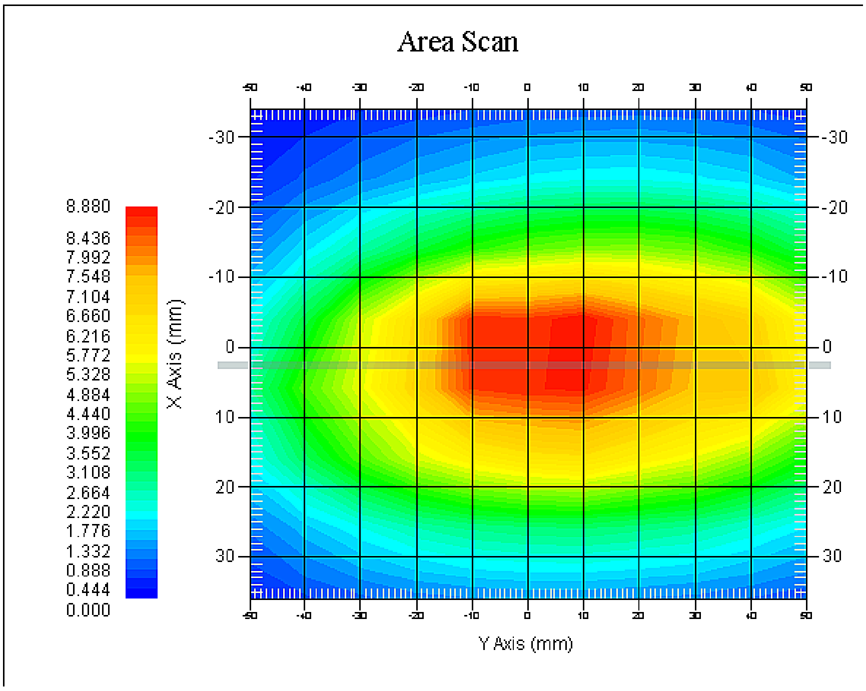
Phantom Data	
Name	: APREL-Uni
Type	: Uni-Phantom
Serial No.	: System Default
Location	: Center
Description	: Default
Phantom Data	

Tissue Data	
Type	: Body
Serial No.	: 269-02107
Frequency	: 750.0 MHz
Last Calib. Date	: 16-Jun-2015
Temperature	: 20.00 °C
Ambient Temp.	: 21.00 °C
Humidity	: 56.00 RH%
Epsilon	: 54.59 F/m
Sigma	: 0.98 S/m
Density	: 1000.00 kg/cu. m

Probe Data	
Name	: E-Field
Model	: E-020
Type	: E-Field Triangle
Serial No.	: 500-00283
Last Calib. Date	: 14-Oct-2014
Frequency Band	: 750
Duty Cycle Factor	: 1
Conversion Factor	: 5.5
Probe Sensitivity	: 1.20 1.20 1.20 µV/(V/m)2
Compression Point	: 95.00 mV
Offset	: 1.56 mm

Measurement Data	
Crest Factor	: 1
Scan Type	: Complete
Tissue Temp.	: 21.00 °C
Ambient Temp.	: 21.00 °C
Area Scan	: 7x9x1 : Measurement x=10mm, y=10mm, z=4mm
Zoom Scan	: 7x7x7 : Measurement x=5mm, y=5mm, z=5mm

1 gram SAR value	: 8.596 W/kg
10 gram SAR value	: 5.998 W/kg
Area Scan Peak SAR	: 8.877 W/kg
Zoom Scan Peak SAR	: 13.884 W/kg



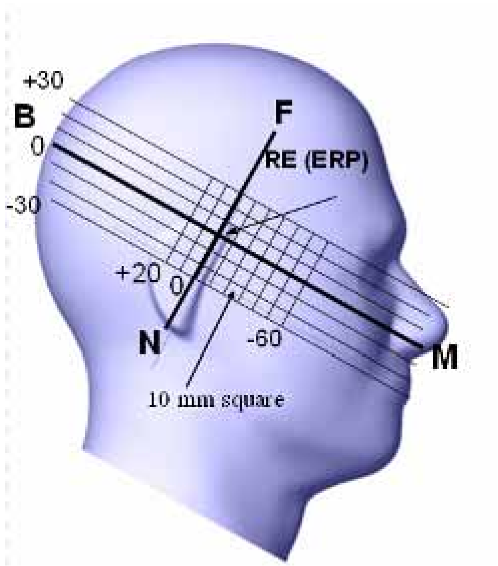
750 MHz System Validation with Body Tissue

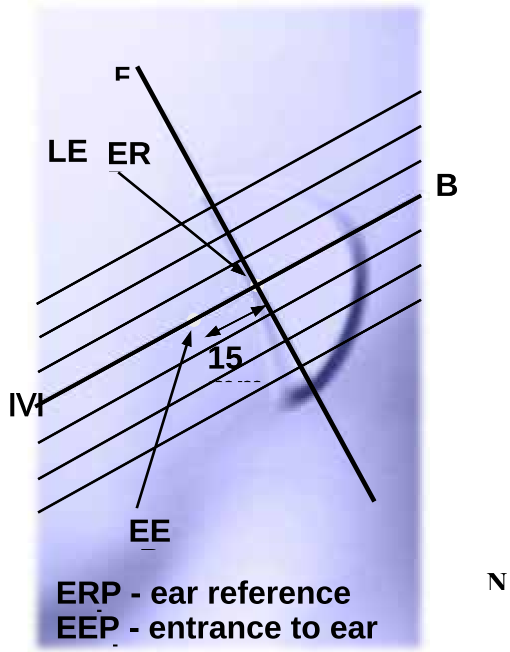
EUT TEST STRATEGY AND METHODOLOGY

Test Positions for Device Operating Next to a Person’s Ear

This category includes most wireless handsets with fixed, retractable or internal antennas located toward the top half of the device, with or without a foldout, sliding or similar keypad cover. The handset should have its earpiece located within the upper ¼ of the device, either along the centerline or off-centered, as perceived by its users. This type of handset should be positioned in a normal operating position with the “test device reference point” located along the “vertical centerline” on the front of the device aligned to the “ear reference point”. The “test device reference point” should be located at the same level as the center of the earpiece region. The “vertical centerline” should bisect the front surface of the handset at its top and bottom edges. A “ear reference point” is located on the outer surface of the head phantom on each ear spacer. It is located 1.5 cm above the center of the ear canal entrance in the “phantom reference plane” defined by the three lines joining the center of each “ear reference point” (left and right) and the tip of the mouth.

A handset should be initially positioned with the earpiece region pressed against the ear spacer of a head phantom. For the SCC-34/SC-2 head phantom, the device should be positioned parallel to the “N-F” line defined along the base of the ear spacer that contains the “ear reference point”. For interim head phantoms, the device should be positioned parallel to the cheek for maximum RF energy coupling. The “test device reference point” is aligned to the “ear reference point” on the head phantom and the “vertical centerline” is aligned to the “phantom reference plane”. This is called the “initial ear position”. While maintaining these three alignments, the body of the handset is gradually adjusted to each of the following positions for evaluating SAR:





Cheek/Touch Position

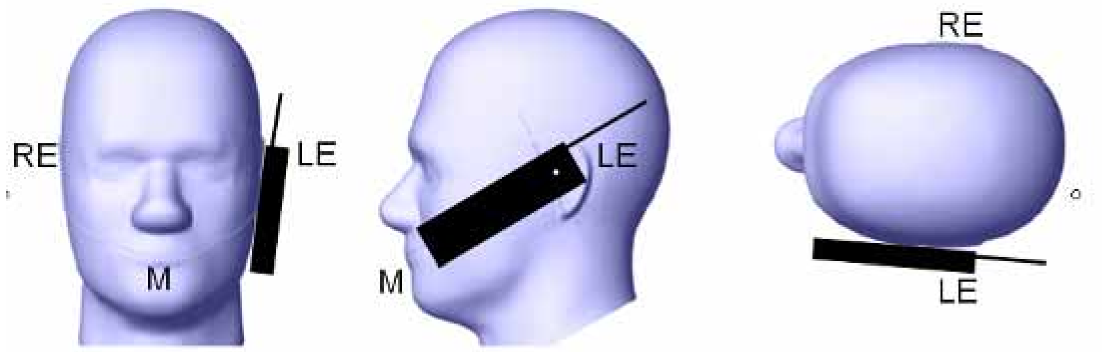
The device is brought toward the mouth of the head phantom by pivoting against the "ear reference point" or along the "N-F" line for the SCC-34/SC-2 head phantom.

This test position is established:

- When any point on the display, keypad or mouthpiece portions of the handset is in contact with the phantom.
- (or) When any portion of a foldout, sliding or similar keypad cover opened to its intended self-adjusting normal use position is in contact with the cheek or mouth of the phantom.

For existing head phantoms – when the handset loses contact with the phantom at the pivoting point, rotation should continue until the device touches the cheek of the phantom or breaks its last contact from the ear spacer.

Cheek /Touch Position



Ear/Tilt Position

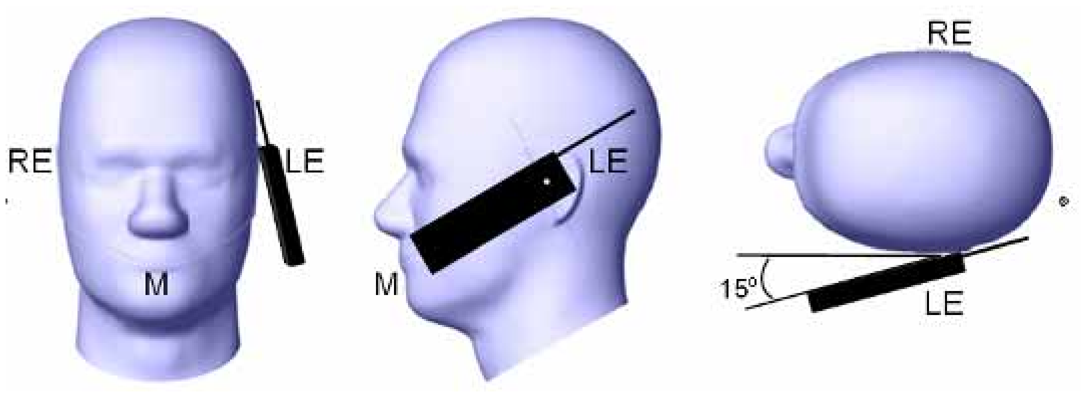
With the handset aligned in the "Cheek/Touch Position":

1) If the earpiece of the handset is not in full contact with the phantom's ear spacer (in the "Cheek/Touch position") and the peak SAR location for the "Cheek/Touch" position is located at the ear spacer region or corresponds to the earpiece region of the handset, the device should be returned to the "initial ear position" by rotating it away from the mouth until the earpiece is in full contact with the ear spacer.

2) (otherwise) The handset should be moved (translated) away from the cheek perpendicular to the line passes through both "ear reference points" (note: one of these ear reference points may not physically exist on a split head model) for approximate 2-3 cm. While it is in this position, the device handset is tilted away from the mouth with respect to the "test device reference point" until the inside angle between the vertical centerline on the front surface of the phone and the horizontal line passing through the ear reference point isby 15 80°. After the tilt, it is then moved (translated) back toward the head perpendicular to the line passes through both "ear reference points" until the device touches the phantom or the ear spacer. If the antenna touches the head first, the positioning process should be repeated with a tilt angle less than 15° so that the device and its antenna would touch the phantom simultaneously. This test position may require a device holder or positioner to achieve the translation and tilting with acceptable positioning repeatability.

If a device is also designed to transmit with its keypad cover closed for operating in the head position, such positions should also be considered in the SAR evaluation. The device should be tested on the left and right side of the head phantom in the "Cheek/Touch" and "Ear/Tilt" positions. When applicable, each configuration should be tested with the antenna in its fully extended and fully retracted positions. These test configurations should be tested at the high, middle and low frequency channels of each operating mode; for example, AMPS, CDMA, and TDMA. If the SAR measured at the middle channel for each test configuration (left, right, Cheek/Touch, Tilt/Ear, extended and retracted) is at least 2.0 dB lower than the SAR limit, testing at the high and low channels is optional for such test configuration(s). If the transmission band of the test device is less than 10 MHz, testing at the high and low frequency channels is optional.

Ear /Tilt 15° Position



Test positions for body-worn and other configurations

Body-worn operating configurations should be tested with the belt-clips and holsters attached to the device and positioned against a flat phantom in normal use configurations. Devices with a headset output should be tested with a headset connected to the device. When multiple accessories that do not contain metallic components are supplied with the device, the device may be tested with only the accessory that dictates the closest spacing to the body. When multiple accessories that contain metallic components are supplied with the device, the device must be tested with each accessory that contains a unique metallic component. If multiple accessories share an identical metallic component (e.g., the same metallic belt-clip used with different holsters with no other metallic components), only the accessory that dictates the closest spacing to the body must be tested.

Body-worn accessories may not always be supplied or available as options for some devices that are intended to be authorized for body-worn use. A separation distance of 1.5 cm between the back of the device and a flat phantom is recommended for testing body-worn SAR compliance under such circumstances. Other separation distances may be used, but they should not exceed 2.5 cm. In these cases, the device may use body-worn accessories that provide a separation distance greater than that tested for the device provided however that the accessory contains no metallic components.

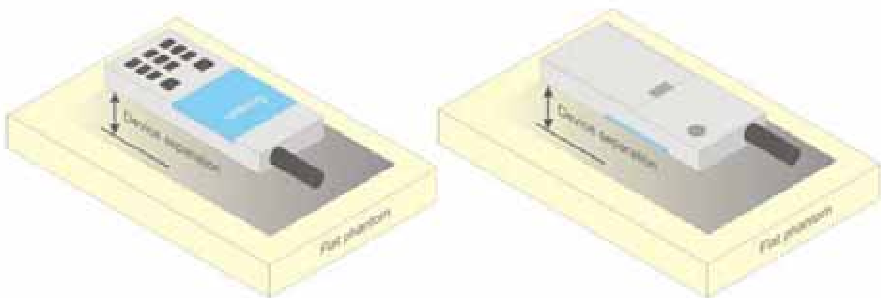


Figure 5 – Test positions for body-worn devices

SAR Evaluation Procedure

The evaluation was performed with the following procedure:

Step 1: Measurement of the SAR value at a fixed location above the ear point or central position was used as a reference value for assessing the power drop. The SAR at this point is measured at the start of the test and then again at the end of the testing.

Step 2: The SAR distribution at the exposed side of the head was measured at a distance of 4 mm from the inner surface of the shell. The area covered the entire dimension of the head or EUT and the horizontal grid spacing was 10 mm x 10 mm. Based on these data, the area of the maximum absorption was determined by spline interpolation. The first Area Scan covers the entire dimension of the EUT to ensure that the hotspot was correctly identified.

Step 3: Around this point, a volume of 35 mm x 35 mm x 35 mm was assessed by measuring 7x 7 x 7 points. On the basis of this data set, the spatial peak SAR value was evaluated under the following procedure:

1) The data at the surface were extrapolated, since the center of the dipoles is 1.2 mm away from the tip of the probe and the distance between the surface and the lowest measuring point is 1.3 mm. The extrapolation was based on a least square algorithm. A polynomial of the fourth order was calculated through the points in z-axes. This polynomial was then used to evaluate the points between the surface and the probe tip.

2) The maximum interpolated value was searched with a straightforward algorithm. Around this maximum the SAR values averaged over the spatial volumes (1 g or 10 g) were computed by the 3D-Spline interpolation algorithm. The 3D-Spline is composed of three one dimensional splines with the “Not a knot"-condition (in x, y and z-directions). The volume was integrated with the trapezoidal-algorithm. One thousand points (10 x 10 x 10) were interpolated to calculate the averages.

All neighboring volumes were evaluated until no neighboring volume with a higher average value was found.

Step 4: Re-measurement of the SAR value at the same location as in Step 1. If the value changed by more than 5%, the evaluation was repeated.

Test methodology

KDB 447498 D01 General RF Exposure Guidance v05r02.
KDB 648474 D04 Handset SAR v01r02.
KDB 865664 D01 SAR measurement 100 MHz to 6 GHz v01r03
KDB 865664 D02 RF Exposure Reporting v01r01
KDB 941225 D01 3G SAR Procedures v03
KDB 941225 D05 SAR for LTE Devices v02r03
KDB 941225 D06 Hotspot Mode v02

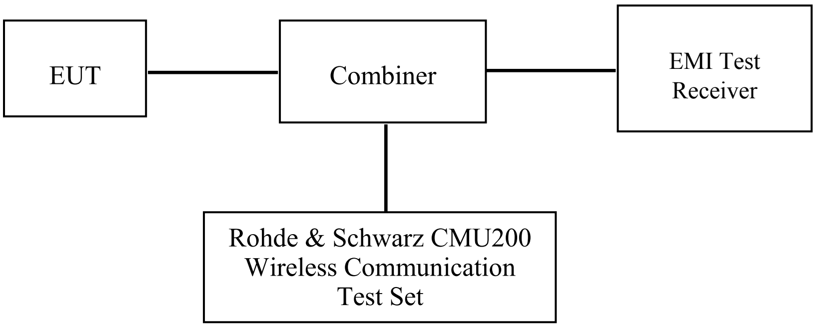
CONDUCTED OUTPUT POWER MEASUREMENT

Provision Applicable

The measured peak output power should be greater and within 5% than EMI measurement.

Test Procedure

The RF output of the transmitter was connected to the input of the EMI Test Receiver through sufficient attenuation.



GSM&3G

Maximum Output Power among production units

Max Target Power for Production Unit (dBm)			
Mode/Band	Channel		
	Low	Middle	High
GSM 850	33.00	33.00	33.00
GPRS 1 slot	32.70	32.70	32.70
GPRS 2 slot	31.70	31.70	31.70
GPRS 3 slot	30.30	30.30	30.30
GPRS 4 slot	29.20	29.20	29.20
EGPRS 1 slot	26.20	26.20	26.20
EGPRS 2 slot	25.20	25.20	25.20
EGPRS 3 slot	22.80	22.80	22.80
EGPRS 4 slot	21.60	21.60	21.60
PCS 1900	29.80	29.80	29.80
GPRS 1 slot	29.30	29.30	29.30
GPRS 2 slot	28.20	28.20	28.20
GPRS 3 slot	27.60	27.60	27.60
GPRS 4 slot	27.10	27.10	27.10
EGPRS 1 slot	25.20	25.20	25.20
EGPRS 2 slot	24.00	24.00	24.00
EGPRS 3 slot	22.60	22.60	22.60
EGPRS 4 slot	21.40	21.40	21.40
WCDMA850	22.30	22.30	22.30
WCDMA1900	22.10	22.10	22.10
LTE Band2	22.90	22.90	22.90
LTE Band4	22.20	22.20	22.20
LTE Band7	23.00	23.00	23.00
LTE Band17	22.90	22.90	22.90
Wi-Fi	9.80	9.80	9.80
Bluetooth	4.80 (2413MHz)	4.40 (2441 MHz)	5.60 (2448MHz)

Test Results:

GSM:

Band	Frequency (MHz)	Conducted Output Power	
		Meas. Power (dBm)	Meas. Power (W)
GSM 850	824.2	**32.90**	1.950
	836.6	32.80	1.905
	848.8	32.60	1.820
PCS 1900	1850.2	29.60	0.912
	1880.0	29.60	0.912
	1909.8	**29.70**	0.933

GPRS:

Band	Channel No.	Frequency (MHz)	RF Output Power (dBm)			
			1 slot	2 slot	3 slots	4 slots
GSM 850	128	824.2	32.68	31.69	30.22	29.15
	190	836.6	32.57	31.56	30.13	29.08
	251	848.8	32.43	31.41	30.01	29.03
PCS 1900	512	1850.2	28.71	27.59	27.53	26.49
	661	1880.0	28.96	27.75	26.79	26.65
	810	1909.8	29.22	28.10	27.07	27.01

EGPRS:

Band	Channel No.	Frequency (MHz)	RF Output Power (dBm)			
			1 slot	2 slot	3 slots	4 slots
GSM 850	128	824.2	26.08	24.92	22.58	21.34
	190	836.6	26.15	25.01	22.69	21.47
	251	848.8	26.19	25.17	22.73	21.53
PCS 1900	512	1850.2	25.04	23.89	22.58	21.29
	661	1880.0	24.63	23.41	22.04	20.86
	810	1909.8	25.16	23.94	22.71	21.38

For SAR, the time based average power is relevant, the difference in between depends on the duty cycle of the TDMA signal.

Number of Time slot	1	2	3	4
Duty Cycle	1:8	1:4	1:2.66	1:2
Time based Ave. power compared to slotted Ave. power	-9 dB	-6 dB	-4.25 dB	-3 dB
Crest Factor	8	4	2.66	2

The time based average power for GPRS

Band	Channel No.	Frequency (MHz)	Time based average Power (dBm)			
			1 slot	2 slot	3 slots	4 slots
GSM 850	128	824.2	23.68	25.69	25.97	**26.15**
	190	836.6	23.57	25.56	25.88	26.08
	251	848.8	23.43	25.41	25.76	26.03
PCS 1900	512	1850.2	19.71	21.59	23.28	23.49
	661	1880.0	19.96	21.75	22.54	23.65
	810	1909.8	20.22	22.10	22.82	**24.01**

The time based average power for EGPRS

Band	Channel No.	Frequency (MHz)	Time based average Power (dBm)			
			1 slot	2 slot	3 slots	4 slots
GSM 850	128	824.2	17.08	18.92	18.33	18.34
	190	836.6	17.15	19.01	18.44	18.47
	251	848.8	17.19	**19.17**	18.48	18.53
PCS 1900	512	1850.2	16.04	17.89	18.33	18.29
	661	1880.0	15.63	17.41	17.79	17.86
	810	1909.8	16.16	17.94	**18.46**	18.38

Note:
1. Rohde & Schwarz Radio Communication Tester (CMU200) was used for the measurement of GSM peak and average output power for active timeslots.
2. For GSM voice, 1 timeslot has been activated with power level 5 (850 MHz band) and 0 (1900 MHz band).
3. For GPRS, 1, 2, 3 and 4 timeslots has been activated separately with power level 3(850 MHz band) and 3(1900 MHz band).
4. For EGPRS, 1, 2, 3 and 4 timeslots has been activated separately with power level 6(850 MHz band) and 5(1900 MHz band).
5. According to KDB941225D06-SAR for GPRS and EDGE modes are not required when the source-based time-averaged output power for each data mode is lower than that in the normal GSM voice mode

WCDMA-Release 99:

The following tests were conducted according to the test requirements outlines in section 5.2 of the 3GPP TS34.121-1 specification. The EUT has a nominal maximum output power of 24dBm (+1.7/-3.7).

WCDMA General Settings	**Loopback Mode**	Test Mode 1
	Rel99 RMC	12.2kbps RMC
	Power Control Algorithm	Algorithm2
	βc /βd	8/15

WCDMA HSDPA

The following tests were conducted according to the test requirements outlines in section 5.2 of the 3GPP TS34.121-1 specification.

	Mode	HSDPA	HSDPA	HSDPA	HSDPA
	Subset	1	2	3	4
WCDMA General Settings	Loopback Mode	Test Mode 1			
	Rel99 RMC	12.2kbps RMC			
	HSDPA FRC	H-Set1			
	Power Control Algorithm	Algorithm2			
	βc	2/15	12/15	15/15	15/15
	βd	15/15	15/15	8/15	4/15
	βd (SF)	64			
	βc/ βd	2/15	12/15	15/8	15/4
	βhs	4/15	24/15	30/15	30/15
	MPR(dB)	0	0	0.5	0.5
HSDPA Specific Settings	D_{ACK}	8			
	D_{NAK}	8			
	D_{CQI}	8			
	Ack-Nack repetition factor	3			
	CQI Feedback	4ms			
	CQI Repetition Factor	2			
	Ahs= βhs/ βc	30/15			

WCDMA HSUPA

The following tests were conducted according to the test requirements outlines in section 5.2 of the 3GPP TS34.121-1 specification.

	Mode	HSUPA	HSUPA	HSUPA	HSUPA	HSUPA
	Subset	1	2	3	4	5
WCDMA General Settings	Loopback Mode	Test Mode 1				
	Rel99 RMC	12.2kbps RMC				
	HSDPA FRC	H-Set1				
	HSUPA Test	HSUPA Loopback				
	Power Control Algorithm	Algorithm2				
	βc	11/15	6/15	15/15	2/15	15/15
	βd	15/15	15/15	9/15	15/15	0
	βec	209/225	12/15	30/15	2/15	5/15
	βc/ βd	11/15	6/15	15/9	2/15	-
	βhs	22/15	12/15	30/15	4/15	5/15
	CM(dB)	1.0	3.0	2.0	3.0	1.0
	MPR(dB)	0	2	1	2	0
HSDPA Specific Settings	DACK	8				
	DNAK	8				
	DCQI	8				
	Ack-Nack repetition factor	3				
	CQI Feedback	4ms				
	CQI Repetition Factor	2				
	Ahs= βhs/ βc	30/15				
HSUPA Specific Settings	DE-DPCCH	6	8	8	5	7
	DHARQ	0	0	0	0	0
	AG Index	20	12	15	17	21
	ETFCI	75	67	92	71	81
	Associated Max UL Data Rate kbps	242.1	174.9	482.8	205.8	308.9
	Reference E_FCls	E-TFCI 11 E E-TFCI PO 4 E-TFCI 67 E-TFCI PO 18 E-TFCI 71 E-TFCI PO23 E-TFCI 75 E-TFCI PO26 E-TFCI 81 E-TFCI PO 27		E-TFCI 11 E-TFCI PO4 E-TFCI 92 E-TFCI PO 18	E-TFCI 11 E E-TFCI PO 4 E-TFCI 67 E-TFCI PO 18 E-TFCI 71 E-TFCI PO23 E-TFCI 75 E-TFCI PO26 E-TFCI 81 E-TFCI PO 27	

HSPA+

The following tests were conducted according to the test requirements in Table C.11.1.4 of 3GPP TS 34.121-1

Sub-test	β_c (Note3)	β_d	β_{HS} (Note1)	β_{ec}	β_{ed} (2xSF2) (Note 4)	β_{ed} (2xSF4) (Note 4)	CM (dB) (Note 2)	MPR (dB) (Note 2)	AG Index (Note 4)	E-TFCI (Note 5)	E-TFCI (boost)
1	1	0	30/15	30/15	β_{ed}1: 30/15 β_{ed}2: 30/15	β_{ed}3: 24/15 β_{ed}4: 24/15	3.5	2.5	14	105	105

Note 1: Δ_{ACK}, Δ_{NACK} and Δ_{CQI} = 30/15 with β_{hs} = 30/15 * β_c .
Note 2: CM = 3.5 and the MPR is based on the relative CM difference, MPR = MAX(CM-1,0).
Note 3: DPDCH is not configured, therefore the β_c is set to 1 and β_d = 0 by default.
Note 4: β_{ed} can not be set directly; it is set by Absolute Grant Value.
Note 5: All the sub-tests require the UE to transmit 2SF2+2SF4 16QAM EDCH and they apply for UE using E-DPDCH category 7. E-DCH TTI is set to 2ms TTI and E-DCH table index = 2. To support these E-DCH configurations DPDCH is not allocated. The UE is signalled to use the extrapolation algorithm.

DC-HSDPA

The following tests were conducted according to the test requirements in Table Table C.8.1.12 of 3GPP TS 34.121-1

Table C.8.1.12: Fixed Reference Channel H-Set 12

Parameter	Unit	Value
Nominal Avg. Inf. Bit Rate	kbps	60
Inter-TTI Distance	TTI's	1
Number of HARQ Processes	Processes	6
Information Bit Payload (N_{INF})	Bits	120
Number Code Blocks	Blocks	1
Binary Channel Bits Per TTI	Bits	960
Total Available SML's in UE	SML's	19200
Number of SML's per HARQ Proc.	SML's	3200
Coding Rate		0.15
Number of Physical Channel Codes	Codes	1
Modulation		QPSK

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.
Note 2: Maximum number of transmission is limited to 1, i.e., retransmission is not allowed. The redundancy and constellation version 0 shall be used.

WCDMA 850

Mode	3GPP Sub Test	Conducted Output Power (dBm)					
		Low Channel (Ave. Power)	Low Channel (PAR)	Middle Channel (Ave. Power)	Middle Channel (PAR)	High Channel (Ave. Power)	High Channel (PAR)
Rel 99	1	22.09	2.20	**22.25**	2.92	22.18	2.60
HSDPA	1	20.97	2.39	21.22	2.94	21.10	2.82
	2	20.92	2.34	21.26	2.90	21.06	2.89
	3	20.98	2.36	21.20	2.97	21.09	2.84
	4	20.95	2.43	21.24	2.91	21.00	2.90
HSUPA	1	21.01	2.46	21.16	2.95	21.02	2.88
	2	20.94	2.40	21.21	2.99	21.13	2.85
	3	21.06	2.48	21.19	2.93	21.10	2.87
	4	21.02	2.42	21.13	2.98	21.12	2.79
	5	21.09	2.47	21.18	2.95	21.17	2.83
DC-HSDPA	1	21.05	2.38	21.15	2.92	21.14	2.86
	2	21.00	2.32	21.10	2.86	21.11	2.78
	3	21.07	2.30	21.14	2.89	21.15	2.74
	4	20.99	2.37	21.11	2.85	21.08	2.71
HSPA+	1	20.96	2.35	21.17	2.88	21.05	2.79

WCDMA 1900

Mode	3GPP Sub Test	Conducted Output Power (dBm)					
		Low Channel (Ave. Power)	Low Channel (PAR)	Middle Channel (Ave. Power)	Middle Channel (PAR)	High Channel (Ave. Power)	High Channel (PAR)
Rel 99	1	21.87	2.80	21.97	2.88	**22.02**	2.84
HSDPA	1	20.81	2.89	20.88	2.92	20.93	2.86
	2	20.78	2.85	20.82	2.97	20.98	2.79
	3	20.75	2.78	20.89	2.94	20.84	2.81
	4	20.80	2.87	20.85	2.90	20.91	2.87
HSUPA	1	20.74	2.81	20.84	2.96	20.96	2.80
	2	20.71	2.75	20.81	2.98	20.89	2.85
	3	20.77	2.86	20.86	2.84	20.87	2.78
	4	20.69	2.82	20.79	2.89	20.99	2.74
	5	20.64	2.79	20.73	2.91	20.90	2.79
DC-HSDPA	1	20.7	2.83	20.77	2.95	20.86	2.84
	2	20.73	2.85	20.80	2.88	20.82	2.76
	3	20.65	2.77	20.83	2.93	20.82	2.89
	4	20.72	2.72	20.74	2.86	20.94	2.77
HSPA+	1	20.66	2.76	20.78	2.83	20.88	2.82

Note:

1.The default test configuration is to measure SAR with an established radio link between the EUT and a communication test set using a 12.2 kbps RMC (reference measurement Channel) Configured in Test Loop Model 1.

2. KDB 941225 D01-Body SAR is not required for HSDPA when the maximum average output of each RF channel with HSDPA active is less than ¼ dB higher than measured without HSDPA using 12.2kbps RMC or the maximum SAR for 12.2kbps RMC is < 75% of SAR limit.
3. KDB 941225 D01-Body SAR is not required for HSUPA when the maximum average output of each RF channel with HSUPA active is less than ¼ dB higher than measured without HSUPA using 12.2kbps RMC and the maximum SAR for 12.2kbps RMC is < 75% of SAR limit.
4. KDB 941225 D01-SAR is not required for HSPA+, when SAR is required for Rel. 6 HSPA; SAR is not required for DC-HSDPA when SAR is required for Rel. 5 HSDPA.

LTE

The following tests were conducted according to the test requirements outlined in section 6.2 of the 3GPP TS36.101 specification.

UE Power Class: 3 (23 +/- 2dBm). The allowed Maximum Power Reduction (MPR) for the maximum output power due to higher order modulation and transmit bandwidth configuration (resource blocks) is specified in Table 6.2.3-1 of the 3GPP TS36.101.

Table 6.2.3-1: Maximum Power Reduction (MPR) for Power Class 3

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

The allowed A-MPR values specified below in Table 6.2.4.-1 of 3GPP TS36.101 are in addition to the allowed MPR requirements. All the measurements below were performed with A-MPR disabled, by using Network Signaling Value of "NS_01".

Table 6.2.4-1: Additional Maximum Power Reduction (A-MPR)

Network Signalling value	Requirements (sub-clause)	E-UTRA Band	Channel bandwidth (MHz)	Resources Blocks (N_{RB})	A-MPR (dB)
NS_01	6.6.2.1.1	Table 5.5-1	1.4, 3, 5, 10, 15, 20	Table 5.6-1	NA
NS_03	6.6.2.2.1	2, 4,10, 23, 25, 35, 36	3	>5	≤ 1
			5	>6	≤ 1
			10	>6	≤ 1
			15	>8	≤ 1
			20	>10	≤ 1
NS_04	6.6.2.2.2	41	5	>6	≤ 1
			10, 15, 20	See Table 6.2.4-4	
NS_05	6.6.3.3.1	1	10,15,20	≥ 50	≤ 1
NS_06	6.6.2.2.3	12, 13, 14, 17	1.4, 3, 5, 10	Table 5.6-1	n/a
NS_07	6.6.2.2.3 6.6.3.3.2	13	10	Table 6.2.4-2	Table 6.2.4-2
NS_08	6.6.3.3.3	19	10, 15	> 44	≤ 3
NS_09	6.6.3.3.4	21	10, 15	> 40	≤ 1
				> 55	≤ 2
NS_10		20	15, 20	Table 6.2.4-3	Table 6.2.4-3
NS_11	6.6.2.2.1	23[1]	1.4, 3, 5, 10	Table 6.2.4-5	Table 6.2.4-5
..					
NS_32	-	-	-	-	-
Note 1: Applies to the lower block of Band 23, i.e. a carrier placed in the 2000-2010 MHz region.					

LTE Band 2:

BW	Modulation	Resource Block Size& Resource Block Offset	Ave Tx Power(dBm)		
			Low Channel	Mid Channel	High Channel
1.4M	QPSK	RB Size=1, RB Offset=0	22.79	22.98	22.65
1.4M	QPSK	RB Size=1, RB Offset=3	22.93	23.07	22.72
1.4M	QPSK	RB Size=1, RB Offset=5	22.81	23.03	22.69
1.4M	QPSK	RB Size=3, RB Offset=0	22.21	22.37	22.01
1.4M	QPSK	RB Size=3, RB Offset=1	22.09	22.30	22.00
1.4M	QPSK	RB Size=3, RB Offset=3	22.13	22.34	22.01
1.4M	QPSK	RB Size=6, RB Offset=0	21.77	21.99	21.61
1.4M	16-QAM	RB Size=1, RB Offset=0	22.17	22.39	22.04
1.4M	16-QAM	RB Size=1, RB Offset=3	22.32	22.50	22.19
1.4M	16-QAM	RB Size=1, RB Offset=5	22.23	22.37	22.03
1.4M	16-QAM	RB Size=3, RB Offset=0	21.49	21.69	21.29
1.4M	16-QAM	RB Size=3, RB Offset=1	21.30	21.51	21.18
1.4M	16-QAM	RB Size=3, RB Offset=3	21.39	21.60	21.30
1.4M	16-QAM	RB Size=6, RB Offset=0	20.90	21.04	20.70
3M	QPSK	RB Size=1, RB Offset=0	22.78	22.94	22.56
3M	QPSK	RB Size=1, RB Offset=7	22.86	23.02	22.62
3M	QPSK	RB Size=1, RB Offset=14	22.86	22.99	22.66
3M	QPSK	RB Size=8, RB Offset=0	22.39	22.53	22.11
3M	QPSK	RB Size=8, RB Offset=4	22.39	22.60	22.34
3M	QPSK	RB Size=8, RB Offset=7	22.28	22.47	22.17
3M	QPSK	RB Size=15, RB Offset=0	21.94	22.09	21.75
3M	16-QAM	RB Size=1, RB Offset=0	22.42	22.56	22.17
3M	16-QAM	RB Size=1, RB Offset=7	22.48	22.61	22.23
3M	16-QAM	RB Size=1, RB Offset=14	22.34	22.51	22.14
3M	16-QAM	RB Size=8, RB Offset=0	21.04	21.23	20.91
3M	16-QAM	RB Size=8, RB Offset=4	21.23	21.39	21.13
3M	16-QAM	RB Size=8, RB Offset=7	21.07	21.28	20.96
3M	16-QAM	RB Size=15, RB Offset=0	20.91	21.08	20.77
5M	QPSK	RB Size=1, RB Offset=0	22.90	23.06	22.74
5M	QPSK	RB Size=1, RB Offset=12	22.91	23.10	22.75
5M	QPSK	RB Size=1, RB Offset=24	22.81	23.01	22.62
5M	QPSK	RB Size=12, RB Offset=0	22.35	22.49	22.16
5M	QPSK	RB Size=12, RB Offset=6	22.29	22.51	22.12
5M	QPSK	RB Size=12, RB Offset=11	22.30	22.43	22.03
5M	QPSK	RB Size=25, RB Offset=0	21.79	21.97	21.64
5M	16-QAM	RB Size=1, RB Offset=0	22.38	22.57	22.21
5M	16-QAM	RB Size=1, RB Offset=12	22.42	22.59	22.25
5M	16-QAM	RB Size=1, RB Offset=24	22.37	22.51	22.25
5M	16-QAM	RB Size=12, RB Offset=0	21.45	21.60	21.34
5M	16-QAM	RB Size=12, RB Offset=6	21.58	21.79	21.41
5M	16-QAM	RB Size=12, RB Offset=11	21.52	21.71	21.40
5M	16-QAM	RB Size=25, RB Offset=0	20.82	21.01	20.65

10M	QPSK	RB Size=1, RB Offset=0	22.58	22.71	22.35
		RB Size=1, RB Offset=24	22.62	22.83	22.51
		RB Size=1, RB Offset=49	22.60	22.80	22.48
		RB Size=25, RB Offset=0	22.05	22.26	21.90
		RB Size=25, RB Offset=12	22.13	22.31	21.94
		RB Size=25, RB Offset=24	22.07	22.23	21.88
		RB Size=50, RB Offset=0	21.67	21.83	21.40
	16-QAM	RB Size=1, RB Offset=0	22.02	22.19	21.90
		RB Size=1, RB Offset=24	22.09	22.30	21.93
		RB Size=1, RB Offset=49	22.13	22.25	21.91
		RB Size=25, RB Offset=0	21.41	21.58	21.19
		RB Size=25, RB Offset=12	21.42	21.63	21.28
		RB Size=25, RB Offset=24	21.39	21.51	21.15
		RB Size=50, RB Offset=0	20.77	20.92	20.61
15M	QPSK	RB Size=1, RB Offset=0	22.91	23.04	22.73
		RB Size=1, RB Offset=37	23.00	23.16	22.86
		RB Size=1, RB Offset=74	22.84	23.01	22.74
		RB Size=36, RB Offset=0	22.19	22.38	22.12
		RB Size=36, RB Offset=18	22.32	22.45	22.10
		RB Size=36, RB Offset=37	22.20	22.36	22.04
		RB Size=75, RB Offset=0	21.58	21.78	21.47
	16-QAM	RB Size=1, RB Offset=0	22.18	22.37	22.10
		RB Size=1, RB Offset=37	22.26	22.42	22.06
		RB Size=1, RB Offset=74	22.12	22.30	21.96
		RB Size=36, RB Offset=0	21.37	21.49	21.24
		RB Size=36, RB Offset=18	21.38	21.58	21.26
		RB Size=36, RB Offset=37	21.26	21.40	21.04
		RB Size=75, RB Offset=0	20.72	20.93	20.63
20M	QPSK	RB Size=1, RB Offset=0	22.65	22.80	22.47
		RB Size=1, RB Offset=49	22.57	22.73	22.47
		RB Size=1, RB Offset=99	22.66	**22.87**	22.50
		RB Size=50, RB Offset=0	21.91	**22.09**	21.72
		RB Size=50, RB Offset=24	21.86	22.07	21.73
		RB Size=50, RB Offset=49	21.80	22.02	21.70
		RB Size=100, RB Offset=0	21.44	21.64	21.32
	16-QAM	RB Size=1, RB Offset=0	21.88	22.02	21.62
		RB Size=1, RB Offset=49	21.95	22.14	21.87
		RB Size=1, RB Offset=99	21.94	22.07	21.77
		RB Size=50, RB Offset=0	21.13	21.29	21.04
		RB Size=50, RB Offset=24	21.12	21.31	20.99
		RB Size=50, RB Offset=49	21.03	21.23	20.90
		RB Size=100, RB Offset=0	20.66	20.80	20.41

LTE Band 4:

BW	Modulation	Resource Block Size& Resource Block Offset	Ave Tx Power (dBm)		
			Low Channel	Mid Channel	High Channel
1.4M	QPSK	RB Size=1, RB Offset=0	22.76	22.56	22.32
		RB Size=1, RB Offset=3	22.58	22.37	22.23
		RB Size=1, RB Offset=5	22.77	22.51	22.31
		RB Size=3, RB Offset=0	22.68	22.49	22.31
		RB Size=3, RB Offset=1	22.55	22.34	22.19
		RB Size=3, RB Offset=3	22.58	22.45	22.28
		RB Size=6, RB Offset=0	21.76	21.47	21.28
	16QAM	RB Size=1, RB Offset=0	21.86	21.63	21.46
		RB Size=1, RB Offset=3	21.71	21.49	21.29
		RB Size=1, RB Offset=5	21.90	21.60	21.48
		RB Size=3, RB Offset=0	21.81	21.56	21.39
		RB Size=3, RB Offset=1	21.65	21.53	21.29
		RB Size=3, RB Offset=3	21.82	21.59	21.51
		RB Size=6, RB Offset=0	20.88	20.62	20.55
3M	QPSK	RB Size=1, RB Offset=0	22.62	22.37	22.17
		RB Size=1, RB Offset=7	22.34	22.16	22.01
		RB Size=1, RB Offset=14	22.57	22.30	22.07
		RB Size=8, RB Offset=0	22.45	22.17	21.97
		RB Size=8, RB Offset=4	22.33	22.11	21.88
		RB Size=8, RB Offset=7	22.31	22.13	21.97
		RB Size=15, RB Offset=0	21.61	21.42	21.30
	16QAM	RB Size=1, RB Offset=0	22.20	21.97	21.78
		RB Size=1, RB Offset=7	21.97	21.85	21.65
		RB Size=1, RB Offset=14	22.02	21.90	21.74
		RB Size=8, RB Offset=0	21.60	21.37	21.22
		RB Size=8, RB Offset=4	21.49	21.31	21.16
		RB Size=8, RB Offset=7	21.48	21.33	21.19
		RB Size=15, RB Offset=0	20.76	20.55	20.41
5M	QPSK	RB Size=1, RB Offset=0	22.58	22.46	22.37
		RB Size=1, RB Offset=12	22.60	22.40	22.30
		RB Size=1, RB Offset=24	22.83	22.57	22.41
		RB Size=12, RB Offset=0	22.08	21.97	21.88
		RB Size=12, RB Offset=6	22.08	21.91	21.67
		RB Size=12, RB Offset=11	22.16	21.98	21.83
		RB Size=25, RB Offset=0	21.51	21.40	21.26
	16QAM	RB Size=1, RB Offset=0	21.73	21.52	21.35
		RB Size=1, RB Offset=12	21.47	21.32	21.11
		RB Size=1, RB Offset=24	21.58	21.46	21.27
		RB Size=12, RB Offset=0	21.26	21.15	21.07
		RB Size=12, RB Offset=6	21.31	21.07	20.89
		RB Size=12, RB Offset=11	21.23	21.11	21.04
		RB Size=25, RB Offset=0	20.85	20.66	20.41

10M	QPSK	RB Size=1, RB Offset=0	22.16	22.05	21.94
		RB Size=1, RB Offset=24	22.27	22.02	21.82
		RB Size=1, RB Offset=49	22.37	22.14	22.00
		RB Size=25, RB Offset=0	21.92	21.73	21.54
		RB Size=25, RB Offset=12	22.04	21.79	21.53
		RB Size=25, RB Offset=24	22.04	21.87	21.66
		RB Size=50, RB Offset=0	21.34	21.19	21.03
	16QAM	RB Size=1, RB Offset=0	21.71	21.53	21.36
		RB Size=1, RB Offset=24	21.56	21.39	21.24
		RB Size=1, RB Offset=49	21.68	21.48	21.39
		RB Size=25, RB Offset=0	21.11	21.01	20.87
		RB Size=25, RB Offset=12	21.09	20.94	20.78
		RB Size=25, RB Offset=24	21.27	21.08	20.96
		RB Size=50, RB Offset=0	20.47	20.26	20.12
15M	QPSK	RB Size=1, RB Offset=0	22.13	21.94	21.68
		RB Size=1, RB Offset=37	22.18	21.98	21.72
		RB Size=1, RB Offset=74	22.07	21.90	21.81
		RB Size=36, RB Offset=0	21.78	21.57	21.33
		RB Size=36, RB Offset=18	21.63	21.52	21.36
		RB Size=36, RB Offset=37	21.74	21.63	21.53
		RB Size=75, RB Offset=0	21.10	20.90	20.78
	16QAM	RB Size=1, RB Offset=0	21.53	21.27	21.09
		RB Size=1, RB Offset=37	21.38	21.23	21.13
		RB Size=1, RB Offset=74	21.55	21.36	21.22
		RB Size=36, RB Offset=0	20.98	20.87	20.64
		RB Size=36, RB Offset=18	20.95	20.80	20.57
		RB Size=36, RB Offset=37	21.08	20.93	20.80
		RB Size=75, RB Offset=0	20.23	20.02	19.81
20M	QPSK	RB Size=1, RB Offset=0	21.95	21.79	21.64
		RB Size=1, RB Offset=49	22.04	21.84	21.72
		RB Size=1, RB Offset=99	**22.10**	21.91	21.69
		RB Size=50, RB Offset=0	21.55	21.35	21.22
		RB Size=50, RB Offset=24	21.39	21.26	21.06
		RB Size=50, RB Offset=49	**21.57**	21.41	21.20
		RB Size=100, RB Offset=0	20.90	20.66	20.48
	16QAM	RB Size=1, RB Offset=0	21.24	21.04	20.78
		RB Size=1, RB Offset=49	21.37	21.15	21.05
		RB Size=1, RB Offset=99	21.20	21.09	20.90
		RB Size=50, RB Offset=0	20.91	20.67	20.48
		RB Size=50, RB Offset=24	21.74	21.55	21.31
		RB Size=50, RB Offset=49	21.81	21.61	21.53
		RB Size=100, RB Offset=0	19.97	19.83	19.63

LTE Band 7:

BW	Modulation	Resource Block Size& Resource Block Offset	Ave Tx Power (dBm)		
			Low Channel	Mid Channel	High Channel
5M	QPSK	RB Size=1, RB Offset=0	22.61	22.83	22.40
		RB Size=1, RB Offset=12	22.57	22.85	22.35
		RB Size=1, RB Offset=24	22.55	22.79	22.25
		RB Size=12, RB Offset=0	21.90	22.16	21.71
		RB Size=12, RB Offset=6	21.96	22.23	21.71
		RB Size=12, RB Offset=11	21.89	22.10	21.62
		RB Size=25, RB Offset=0	21.52	21.78	21.28
	16QAM	RB Size=1, RB Offset=0	21.43	21.69	21.17
		RB Size=1, RB Offset=12	21.42	21.63	21.18
		RB Size=1, RB Offset=24	21.44	21.67	21.22
		RB Size=12, RB Offset=0	20.98	21.19	20.66
		RB Size=12, RB Offset=6	20.91	21.10	20.68
		RB Size=12, RB Offset=11	21.02	21.24	20.79
		RB Size=25, RB Offset=0	20.61	20.84	20.35
10M	QPSK	RB Size=1, RB Offset=0	22.65	22.86	22.43
		RB Size=1, RB Offset=24	22.74	22.93	22.42
		RB Size=1, RB Offset=49	22.56	22.79	22.29
		RB Size=25, RB Offset=0	21.85	22.05	21.52
		RB Size=25, RB Offset=12	21.90	22.13	21.72
		RB Size=25, RB Offset=24	21.90	22.09	21.65
		RB Size=50, RB Offset=0	21.64	21.84	21.44
	16QAM	RB Size=1, RB Offset=0	21.93	22.19	21.82
		RB Size=1, RB Offset=24	21.98	22.24	21.70
		RB Size=1, RB Offset=49	21.91	22.13	21.65
		RB Size=25, RB Offset=0	21.15	21.34	20.80
		RB Size=25, RB Offset=12	21.09	21.30	20.82
		RB Size=25, RB Offset=24	21.16	21.39	20.97
		RB Size=50, RB Offset=0	20.59	20.82	20.37
15M	QPSK	RB Size=1, RB Offset=0	22.70	22.93	22.52
		RB Size=1, RB Offset=37	22.65	22.90	22.49
		RB Size=1, RB Offset=74	22.63	22.87	22.36
		RB Size=36, RB Offset=0	21.77	22.03	21.58
		RB Size=36, RB Offset=18	21.73	21.99	21.50
		RB Size=36, RB Offset=37	21.82	22.07	21.64
		RB Size=75, RB Offset=0	21.52	21.80	21.27
	16QAM	RB Size=1, RB Offset=0	21.99	22.19	21.76
		RB Size=1, RB Offset=37	21.99	22.23	21.81
		RB Size=1, RB Offset=74	21.92	22.14	21.72
		RB Size=36, RB Offset=0	21.25	21.49	21.05
		RB Size=36, RB Offset=18	21.38	21.58	21.12
		RB Size=36, RB Offset=37	21.20	21.43	20.90
		RB Size=75, RB Offset=0	20.70	20.92	20.47

20M	QPSK	RB Size=1, RB Offset=0	22.62	22.83	22.32
		RB Size=1, RB Offset=49	22.67	**22.90**	22.46
		RB Size=1, RB Offset=99	22.58	22.79	22.26
		RB Size=50, RB Offset=0	21.54	21.74	21.24
		RB Size=50, RB Offset=24	21.60	**21.83**	21.37
		RB Size=50, RB Offset=49	21.55	21.80	21.33
		RB Size=100, RB Offset=0	21.75	21.95	21.52
	16QAM	RB Size=1, RB Offset=0	21.84	22.03	21.61
		RB Size=1, RB Offset=49	21.83	22.10	21.70
		RB Size=1, RB Offset=99	21.79	22.02	21.59
		RB Size=50, RB Offset=0	21.01	21.29	20.83
		RB Size=50, RB Offset=24	21.16	21.36	20.89
		RB Size=50, RB Offset=49	21.12	21.40	20.89
		RB Size=100, RB Offset=0	20.65	20.89	20.39

LTE Band 17:

BW	Modulation	Resource Block Size& Resource Block Offset	Ave Tx Power (dBm)		
			Low Channel	Mid Channel	High Channel
5M	QPSK	RB Size=1, RB Offset=0	22.44	22.69	22.33
		RB Size=1, RB Offset=12	22.53	22.73	22.43
		RB Size=1, RB Offset=24	22.62	22.84	22.48
		RB Size=12, RB Offset=0	21.97	22.17	21.92
		RB Size=12, RB Offset=6	21.97	22.23	21.82
		RB Size=12, RB Offset=11	21.91	22.12	21.82
		RB Size=25, RB Offset=0	21.41	21.62	21.27
	16QAM	RB Size=1, RB Offset=0	21.54	21.79	21.41
		RB Size=1, RB Offset=12	21.39	21.67	21.39
		RB Size=1, RB Offset=24	21.46	21.70	21.47
		RB Size=12, RB Offset=0	20.78	21.06	20.82
		RB Size=12, RB Offset=6	20.96	21.17	20.82
		RB Size=12, RB Offset=11	20.78	21.03	20.74
		RB Size=25, RB Offset=0	20.61	20.85	20.51
10M	QPSK	RB Size=1, RB Offset=0	22.61	**22.86**	22.59
		RB Size=1, RB Offset=24	22.51	22.78	22.51
		RB Size=1, RB Offset=49	22.65	22.84	22.59
		RB Size=25, RB Offset=0	21.78	22.03	21.73
		RB Size=25, RB Offset=12	21.95	**22.16**	21.81
		RB Size=25, RB Offset=24	21.81	22.09	21.81
		RB Size=50, RB Offset=0	21.56	21.74	21.47
	16QAM	RB Size=1, RB Offset=0	21.86	22.06	21.75
		RB Size=1, RB Offset=24	21.71	21.97	21.67
		RB Size=1, RB Offset=49	21.77	21.96	21.61
		RB Size=25, RB Offset=0	21.35	21.57	21.19
		RB Size=25, RB Offset=12	21.39	21.61	21.28
		RB Size=25, RB Offset=24	21.25	21.50	21.18
		RB Size=50, RB Offset=0	20.76	20.97	20.58

Note:

1. SAR for LTE band exposure configurations is measured according to the procedures of KDB 941225 D05 SAR for LTE Devices v02.
2. The CMW500 Wideband Radio Communication tester is used for LTE output power measurements and SAR testing. Closed loop power control is used to keep the radio transmitters the max output power during the test.
3. KDB941225D05v02- SAR for higher order modulation is required only when the highest maximum output power for the configuration in the higher order modulation is > ½ dB higher than the same configuration in QPSK or when the reported SAR for the QPSK configuration is > 1.45 W/kg

Bluetooth

Mode	Channel frequency (MHz)	Conducted Output Power	
		(dBm)	(mw)
BDR(GFSK)	2402	3.07	2.028
	2413	4.72	2.965
	2441	4.37	2.735
	2448	**5.52**	3.565
	2480	0.05	1.012
EDR(4-DQPSK)	2402	1.72	1.486
	2416	3.19	2.084
	2441	2.87	1.936
	2449	4.00	2.512
	2480	-1.06	0.783
EDR-8DPSK	2402	1.84	1.528
	2413	3.40	2.188
	2441	2.98	1.986
	2448	4.12	2.582
	2480	-0.97	0.800
BT4.0	2402	-3.91	0.406
	2414	-2.64	0.545
	2440	-3.22	0.476
	2450	2.04	1.600
	2480	-6.40	0.229

Wi-Fi

Band	Frequency (MHz)	Conducted Output Power	
		(dBm)	(mw)
802.11b	2412	9.50	9.616
	2437	9.63	9.795
	2462	**9.79**	9.840
802.11g	2412	9.62	9.141
	2437	9.79	9.528
	2462	9.57	9.772
802.11n HT20	2412	9.35	7.962
	2437	9.67	8.790
	2462	9.72	9.528
802.11n HT40	2422	9.31	8.395
	2437	9.62	8.872
	2452	9.68	8.790

Note:

1. The output power was tested under data rate 1Mbps for 802.11b, 6Mbps for 802.11g and 6.5Mbps for 802.11n HT20.
2. KDB 248227 D01 802.11 Wi-Fi SAR v02,§5.2.2: When the highest reported SAR for DSSS is adjusted by the ratio of OFDM to DSSS specified maximum output power and the adjusted SAR is ≤ 1.2 W/kg.

SAR MEASUREMENT RESULTS

This page summarizes the results of the performed dosimetric evaluation.

SAR Test Data

Environmental Conditions

Temperature:	21-24 ℃
Relative Humidity:	50-53 %
ATM Pressure:	1001-1002 mbar

Testing was performed by Terry XiaHou on 2015-06-16

LTE Band 17:

EUT Position	Frequency (MHz)	Test Mode	Power Drift (%)	Max. Meas. Power (dBm)	Max. Rated Power (dBm)	1g SAR (W/Kg)			
						Scaled Factor	Meas. SAR	Scaled SAR	Plot
Left Head Cheek	709	1RB,0ffset=0	/	/	/	/	/	/	/
	710	1RB,0ffset=0	-2.639	22.86	22.90	1.009	0.083	**0.084**	**1#**
	711	1RB,0ffset=0	/	/	/	/	/	/	/
	710	50% RB,offset=12	2.864	22.16	22.90	1.186	0.052	0.062	/
Left Head Tilt	709	1RB,0ffset=0	/	/	/	/	/	/	/
	710	1RB,0ffset=0	-1.260	22.86	22.90	1.009	0.041	0.041	/
	711	1RB,0ffset=0	/	/	/	/	/	/	/
	710	50% RB,offset=12	-1.522	22.16	22.90	1.186	0.027	0.032	
Right Head Cheek	709	1RB,0ffset=0	/	/	/	/	/	/	/
	710	1RB,0ffset=0	2.916	22.86	22.90	1.009	0.080	0.081	/
	711	1RB,0ffset=0	/	/	/	/	/	/	/
	710	50% RB,offset=12	3.199	22.16	22.90	1.186	0.051	0.060	
Right Head Tilt	709	1RB,0ffset=0	/	/	/	/	/	/	/
	710	1RB,0ffset=0	-0.995	22.86	22.90	1.009	0.035	0.035	/
	711	1RB,0ffset=0	/	/	/	/	/	/	/
	710	50% RB,offset=12	2.717	22.16	22.90	1.186	0.030	0.036	

Note:

1. When the 1-g SAR is ≤ 0.8W/Kg, testing for other channels are optional.
2. SAR for LTE band exposure configurations is measured according to the procedures of KDB 941225 D05 SAR for LTE Devices v02.
3. KDB941225D05- SAR for higher order modulation is required only when the highest maximum output power for the configuration in the higher order modulation is > ½ dB higher than the same configuration in QPSK or when the reported SAR for the QPSK configuration is > 1.45 W/kg
4. KDB941225D05- For QPSK with 100% RB allocation, when the reported SAR measured for the Highest output power channel is <1.45 W/kg, tests for the remaining required test channels are optional.

5.KDB941225D05- For QPSK with 100% RB allocation, SAR is not required when the highest maximum output power for 100 % RB allocation is less than the highest maximum output power in 50% and 1 RB allocations and the highest reported SAR for 1 RB and 50% RB allocation are ≤ 0.8 W/kg.
6. KDB941225D05- Start with the largest channel bandwidth and measure SAR for QPSK with 1 RB allocation, using the RB offset and required test channel combination with the highest maximum output power among RB offset the upper edge, middle and lower edge of each required test channel.
7. Worst case SAR for 50% RB allocation is selected to be tested.

Mobile Hot-Spot Test Result

The DUT is capable of functioning as a Wi-Fi to Cellular Mobile hotspot. Additional SAR testing was performed according to KDB 941225 D06. Testing was performed with a separation of 1cm between the DUT and the flat phantom. The DUT was positioned for SAR tests with the front and back surfaces facing the phantom, and also with the edges facing the phantom in which the transmitting antenna is <2.5 cm from the edge. Each transmit band was utilized for SAR testing. The tested mode has been selected within each band that exhibits the highest time average output power.

LTE Band 17:

EUT Position	Frequency (MHz)	Test Mode	Power Drift (%)	Max. Meas. Power (dBm)	Max. Rated Power (dBm)	1g SAR (W/Kg)			
						Scaled Factor	Meas. SAR	Scaled SAR	Plot
Body-Back (10mm)	709	1RB,0ffset=0	/	/	/	/	/	/	2#
	710	1RB,0ffset=0	1.236	22.86	22.90	1.009	0.193	**0.195**	/
	711	1RB,0ffset=0	/	/	/	/	/	/	/
	710	50% RB,offset=12	1.881	22.16	22.90	1.186	0.161	0.191	/
Body-Left (10mm)	709	1RB,0ffset=0	/	/	/	/	/	/	/
	710	1RB,0ffset=0	-1.623	22.86	22.90	1.009	0.115	0.116	/
	711	1RB,0ffset=0	/	/	/	/	/	/	/
	710	50% RB,offset=12	3.151	22.16	22.90	1.186	0.082	0.097	
Body- Right (10mm)	709	1RB,0ffset=0	/	/	/	/	/	/	/
	710	1RB,0ffset=0	-1.627	22.86	22.90	1.009	0.089	0.090	/
	711	1RB,0ffset=0	/	/	/	/	/	/	/
	710	50% RB,offset=12	-3.036	22.16	22.90	1.186	0.063	0.075	
Body-Bottom (10mm)	709	1RB,0ffset=0	/	/	/	/	/	/	/
	710	1RB,0ffset=0	-2.372	22.86	22.90	1.009	0.036	0.036	/
	711	1RB,0ffset=0	/	/	/	/	/	/	/
	710	50% RB,offset=12	2.247	22.16	22.90	1.186	0.027	0.032	

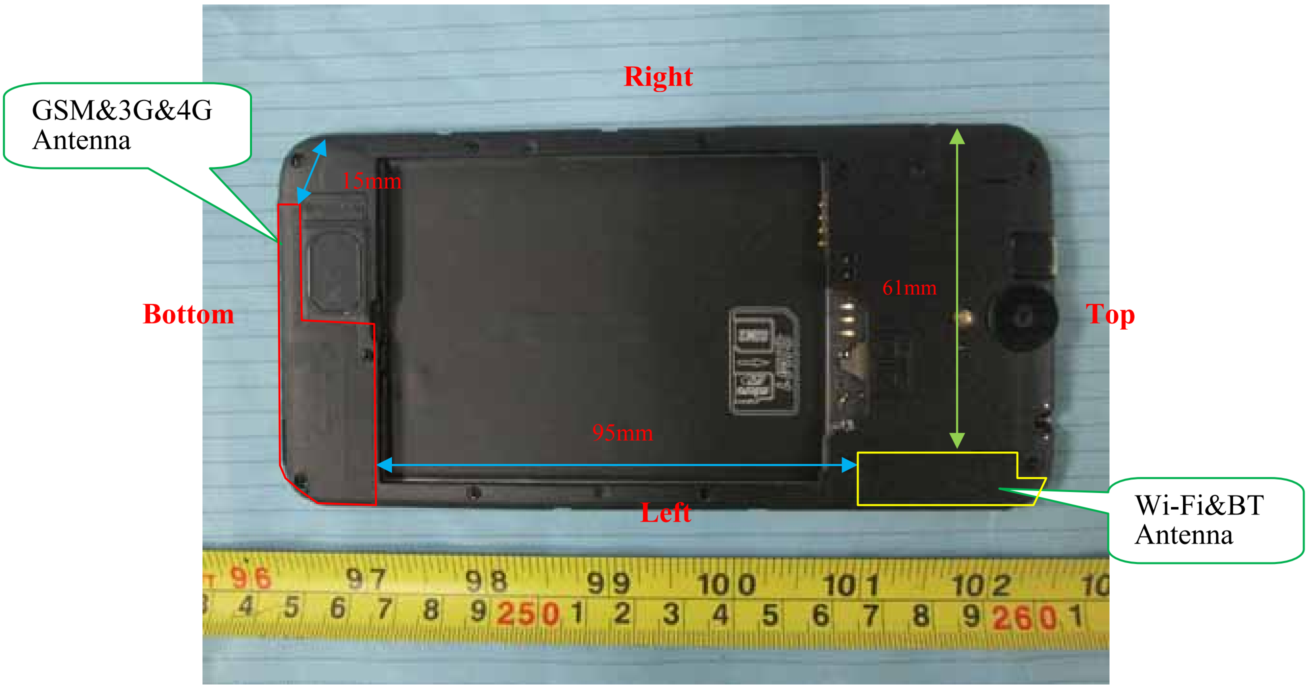
Note:

1. When the 1-g SAR is ≤ 0.8W/Kg, testing for other channels are optional.
2. SAR for LTE band exposure configurations is measured according to the procedures of KDB 941225 D05 SAR for LTE Devices v02.
3. KDB941225D05- SAR for higher order modulation is required only when the highest maximum output power for the configuration in the higher order modulation is > ½ dB higher than the same configuration in QPSK or when the reported SAR for the QPSK configuration is > 1.45 W/kg
4. KDB941225D05- For QPSK with 100% RB allocation, when the reported SAR measured for the Highest output power channel is <1.45 W/kg, tests for the remaining required test channels are optional.
5.KDB941225D05- For QPSK with 100% RB allocation, SAR is not required when the highest maximum output power for 100 % RB allocation is less than the highest maximum output power in 50% and 1 RB allocations and the highest reported SAR for 1 RB and 50% RB allocation are ≤ 0.8 W/kg.

6. KDB941225D05- Start with the largest channel bandwidth and measure SAR for QPSK with 1 RB allocation, using the RB offset and required test channel combination with the highest maximum output power among RB offset the upper edge, middle and lower edge of each required test channel.
7. Worst case SAR for 50% RB allocation is selected to be tested.

SAR SIMULTANEOUS TRANSMISSION DESCRIPTION

BT& Wi-Fi and GSM&3G&4G Antennas Location:



Simultaneous Transmission:

Description of Simultaneous Transmit Capabilities			Antennas Distance (mm)
Transmitter Combination	Simultaneous?	Hotspot?	
GSM + WCDMA	×	×	0
GSM + LTE	×	×	0
GSM + Bluetooth	√	×	95
GSM + Wi-Fi	√	√	95
WCDMA + LTE	×	×	0
WCDMA + Bluetooth	√	×	95
WCDMA + Wi-Fi	√	√	95
LTE+ Bluetooth	√	×	95
LTE++ Wi-Fi	√	√	95

Standalone SAR test exclusion considerations

Head Position:

Mode	Frequency (MHz)	P_{avg} (dBm)	P_{avg} (mW)	Distance (mm)	Calculated value	Threshold (1-g)	SAR Test Exclusion
LTE Band 17	710	22.90	194.98	0	32.86	3.0	No
Wi-Fi	2450	9.80	9.55	0	**3.00**	3.0	Yes
Bluetooth	2450	5.60	3.63	0	**1.14**	3.0	Yes

Body Position:

Mode	Frequency (MHz)	P_{avg} (dBm)	P_{avg} (mW)	Distance (mm)	Calculated value	Threshold (1-g)	SAR Test Exclusion
LTE Band 17	710	22.90	194.98	0	16.43	3.0	No
Wi-Fi	2450	9.80	9.55	0	**1.50**	3.0	Yes
Bluetooth	2450	5.60	3.63	0	**0.57**	3.0	Yes

The 1-g and 10-g SAR test exclusion thresholds for 100 MHz to 6 GHz at *test separation distances* ≤ 50 mm are determined by:
[(*max. power of channel, including tune-up tolerance, mW*)/(*min. test separation distance, mm*)] · [√f(GHz)] ≤ 3.0 for 1-g SAR and ≤ 7.5 for 10-g extremity SAR, where
1. f(GHz) is the RF channel transmit frequency in GHz.
2. Power and distance are rounded to the nearest mW and mm before calculation.
3. The result is rounded to one decimal place for comparison.
4. When the minimum test separation distance is < 5 mm, a distance of 5 mm is applied to determine SAR test Exclusion.

Standalone SAR estimation:

Mode	Frequency (GHz)	Distance (mm)	P_{avg} (dBm)	P_{avg} (mW)	Estimated $_{1\text{-}g}$ (W/kg)
Wi-Fi Head	2.472	0	9.80	9.55	0.399
Wi-Fi Body	2.472	10	9.80	9.55	0.200
BT Head	2.480	0	5.60	3.63	0.152
BT Body	2.480	10	5.60	3.63	0.076

When standalone SAR test exclusion applies to an antenna that transmits simultaneously with other antennas, the standalone SAR must be estimated according to following to determine simultaneous transmission SAR test exclusion:
[(*max. power of channel, including* ***tune-up tolerance***, *mW*)/(*min. test separation distance,mm*)]·[√f(GHz)/*x*] W/kg for *test separation distances* ≤ 50 mm;
where *x* = 7.5 for 1-g SAR.
When the minimum test separation distance is < 5 mm, a distance of 5 mm is applied to determine SAR test Exclusion

Simultaneous SAR test exclusion considerations:

LTE with BT:

Mode	Position	Reported SAR (W/kg)		ΣSAR
		WCDMA	BT	< 1.6W/kg
LTE Band 17	Left Head Cheek	0.084	0.152	0.236
	Left Head Tilt	0.041	0.152	0.193
	Right Head Cheek	0.081	0.152	0.233
	Right Head Tilt	0.036	0.152	0.188

LTE with Wi-Fi:

Mode	Position	Reported SAR (W/kg)		ΣSAR
		WCDMA	Wi-Fi	< 1.6W/kg
LTE Band 17	Left Head Cheek	0.084	0.399	**0.483**
	Left Head Tilt	0.041	0.399	0.440
	Right Head Cheek	0.081	0.399	0.480
	Right Head Tilt	0.036	0.399	0.435

Conclusion:
ΣSAR < 1.6 W/kg therefore simultaneous transmission SAR with Volume Scans is **not** required.

Evaluations for Simultaneous SAR, BT+GSM/3G					
Test Position	Body-Back (1.0cm)	Body-Left (1.0cm)	Body-Right (1.0cm)	Body-Bottom (1.0cm)	Body-Top (1.0cm)
Mode	Stand Alone 1-g SAR (W/Kg)				
LTE Band 17	0.195	0.116	0.090	0.036	/
BT	0.076	0.076	0.076	0.076	0.076
	∑ 1-g SAR(W/Kg)				
LTE Band 17 + BT	0.271	0.192	0.166	0.112	/
Test Position	Body-Back (1.0cm)	Body-Left (1.0cm)	Body-Right (1.0cm)	Body-Bottom (1.0cm)	Body-Top (1.0cm)
Mode	Stand Alone 1-g SAR (W/Kg)				
LTE Band 17	0.195	0.116	0.090	0.036	/
Wi-Fi	0.200	0.200	0.200	0.200	/
	∑ 1-g SAR(W/Kg)				
LTE Band 17 +Wi-Fi	**0.395**	0.316	0.290	0.236	/

Note:

1. If the sum of the 1g SAR measured for the simultaneously transmitting antennas is less than the SAR limit, SAR measurement for simultaneous transmission is not required.
2. For the Simultaneous SAR test exclusion considerations of the other Frequency, please refer to the report RDG150610005-20.

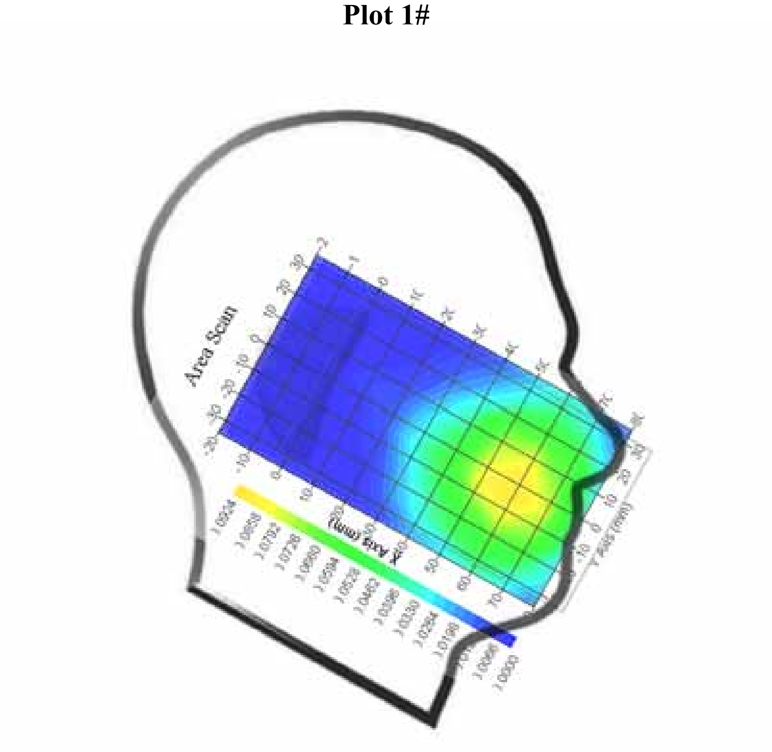
SAR Plots (Summary of the Highest SAR Values)

Test Laboratory: Bay Area Compliance Lab Corp. (Shenzhen)

LTE FDD Band17; Left-Head-Cheek (710 MHz Middle Channel);

Measurement Data	
Test mode	: RB1
Crest Factor	: 1
Scan Type：	: Complete
Area Scan	: 8x11x1 : Measurement x=10mm, y=10mm, z=4mm
Zoom Scan	: 7x7x7 : Measurement x=5mm, y=5mm, z=5mm
Power Drift-Start	: 0.002 W/kg
Power Drift-Finish	: 0.002 W/kg
Power Drift (%)	: -2.639
Tissue Data	
Type	: Head
Frequency	: 710 MHz
Epsilon	: 42.34 F/m
Sigma	: 0.88 S/m
Density	: 1000.00 kg/cu. m
Probe Data	
Serial No.	: 500-00283
Frequency Band	: 750
Duty Cycle Factor	: 1
Conversion Factor	: 6.0
Probe Sensitivity	: 1.20 1.20 1.20 µV/(V/m)2
Compression Point	: 95.00 mV
Offset	: 1.56 mm
1 gram SAR value	: 0.083 W/kg
10 gram SAR value	: 0.047 W/kg
Area Scan Peak SAR	: 0.090 W/kg
Zoom Scan Peak SAR	: 0.146 W/kg

Plot 1#

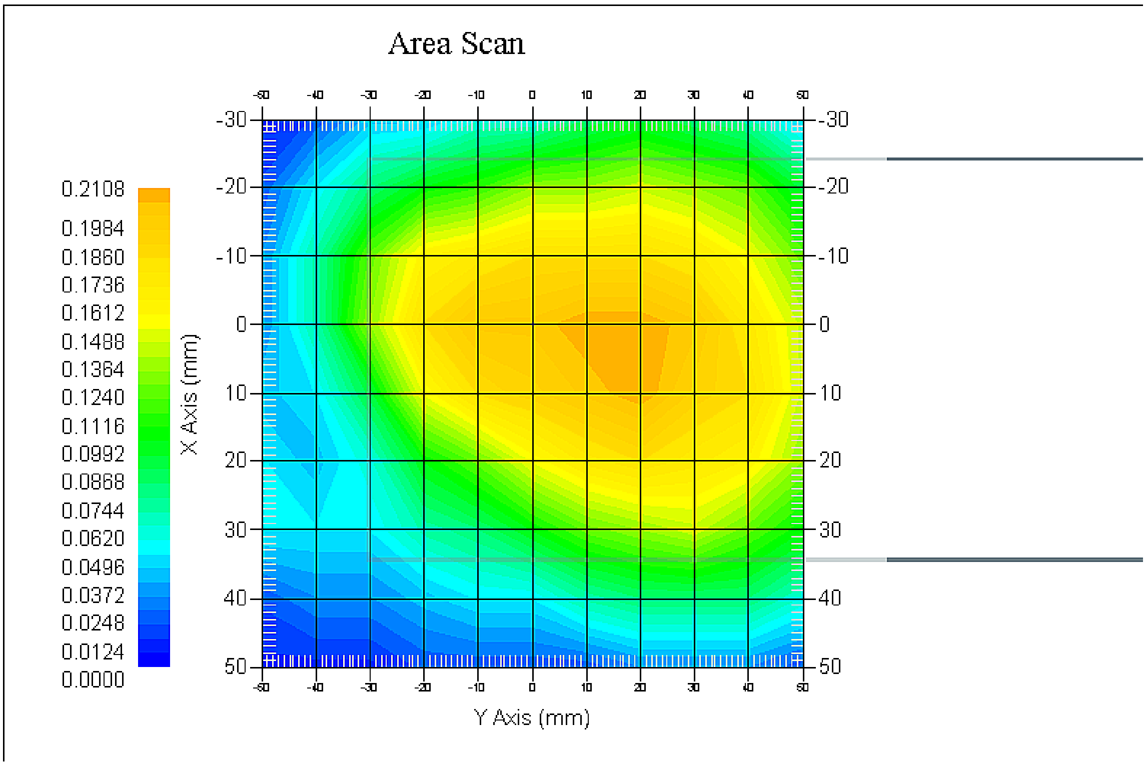


Test Laboratory: Bay Area Compliance Lab Corp. (Shenzhen)

LTE FDD Band17; Body-Worn-Back (710 MHz Middle Channel);

Measurement Data	
Test mode	: 1RB
Crest Factor	: 1
Scan Type：	: Complete
Area Scan	: 8x11x1 : Measurement x=10mm, y=10mm, z=4mm
Zoom Scan	: 7x7x7 : Measurement x=5mm, y=5mm, z=5mm
Power Drift-Start	: 0.163 W/kg
Power Drift-Finish	: 0.165 W/kg
Power Drift (%)	: 1.236
Tissue Data	
Type	: Body
Frequency	: 710 MHz
Epsilon	: 54.64 F/m
Sigma	: 0.94 S/m
Density	: 1000.00 kg/cu. m
Probe Data	
Serial No.	: 500-00283
Frequency Band	: 750
Duty Cycle Factor	: 1
Conversion Factor	: 5.5
Probe Sensitivity	: 1.20 1.20 1.20 µV/(V/m)2
Compression Point	: 95.00 mV
Offset	: 1.56 mm
1 gram SAR value	: 0.193 W/kg
10 gram SAR value	: 0.155 W/kg
Area Scan Peak SAR	: 0.210 W/kg
Zoom Scan Peak SAR	: 0.304 W/kg

Plot 2#



APPENDIX A MEASUREMENT UNCERTAINTY

According to **IEEE1528:2013**, the uncertainty budget has been determined for the Head SAR measurement system and is given in the following Table.

Source of Uncertainty	Tolerance Value	Probability Distribution	Divisor	c_i^1 (1-g)	c_i^1 (10-g)	Standard Uncertainty (1-g) %	Standard Uncertainty (10-g) %
Measurement System							
Probe Calibration	3.5	normal	1	1	1	3.5	3.5
Axial Isotropy	3.7	rectangular	$\sqrt{3}$	$(1-cp)^{1/2}$	$(1-cp)^{1/2}$	1.5	1.5
Hemispherical Isotropy	10.9	rectangular	$\sqrt{3}$	$\sqrt{cp}$	$\sqrt{cp}$	4.4	4.4
Boundary Effect	1.0	rectangular	$\sqrt{3}$	1	1	0.6	0.6
Linearity	4.7	rectangular	$\sqrt{3}$	1	1	2.7	2.7
Detection Limit	1.0	rectangular	$\sqrt{3}$	1	1	0.6	0.6
Readout Electronics	1.0	normal	1	1	1	1.0	1.0
Response Time	0.8	rectangular	$\sqrt{3}$	1	1	0.5	0.5
Integration Time	1.7	rectangular	$\sqrt{3}$	1	1	1.0	1.0
RF Ambient Condition -Noise	0.6	rectangular	$\sqrt{3}$	1	1	0.3	0.3
RF Ambient Condition - Reflections	3.0	rectangular	$\sqrt{3}$	1	1	1.7	1.7
Probe Positioner Mech. Restrictions	0.4	rectangular	$\sqrt{3}$	1	1	0.2	0.2
Probe Positioning with respect to Phantom Shell	2.9	rectangular	$\sqrt{3}$	1	1	1.7	1.7
Extrapolation and Integration	3.7	rectangular	$\sqrt{3}$	1	1	2.1	2.1
Test sample related							
Test sample positioning	2.0	normal	1	1	1	2.0	2.0
Device Holder Uncertainty	4.0	normal	1	1	1	6.215	6.215
Drift of Output Power	5.0	rectangular	$\sqrt{3}$	1	1	2.67	2.67
Phantom and Setup							
Phantom Uncertainty	3.4	rectangular	$\sqrt{3}$	1	1	2.0	2.0
SAR correction in permittivity and conductivity	1.2	normal	1	1	0.85	1.2	1.0
Liquid conductivity measurement	5.0	normal	1	0.78	0.71	3.9	3.6
Liquid permittivity measurement	5.0	normal	1	0.25	0.29	1.3	1.5
conductivity—temperature	1.1	rectangular	$\sqrt{3}$	0.78	0.71	0.5	0.5
permittivity—temperature	1.3	rectangular	$\sqrt{3}$	0.23	0.23	0.2	0.2
Combined Uncertainty		RSS				10.78	10.55
Expanded uncertainty (coverage factor=2)		Normal(k=2)				21.56	21.10

According to **IEC62209-2:2010**, the uncertainty budget has been determined for the Body SAR measurement system and is given in the following Table.

Source of Uncertainty	Tolerance Value	Probability Distribution	Divisor	c_i^1 (1-g)	c_i^1 (10-g)	Standard Uncertainty (1-g) %	Standard Uncertainty (10-g) %
Measurement System							
Probe Calibration	3.5	normal	1	1	1	3.5	3.5
Axial Isotropy	3.7	rectangular	$\sqrt{3}$	1	1	1.5	1.5
Boundary Effect	1.0	rectangular	$\sqrt{3}$	1	1	0.6	0.6
Linearity	4.7	rectangular	$\sqrt{3}$	1	1	2.7	2.7
Detection Limit	1.0	rectangular	$\sqrt{3}$	1	1	0.6	0.6
Readout Electronics	1.0	normal	1	1	1	1.0	1.0
Response Time	0.8	rectangular	$\sqrt{3}$	1	1	0.5	0.5
Integration Time	1.7	rectangular	$\sqrt{3}$	1	1	1.0	1.0
RF Ambient Condition -Noise	0.6	rectangular	$\sqrt{3}$	1	1	0.3	0.3
RF Ambient Condition - Reflections	3.0	rectangular	$\sqrt{3}$	1	1	1.7	1.7
Probe Positioner Mech. Restrictions	0.4	rectangular	$\sqrt{3}$	1	1	0.2	0.2
Probe Positioning with respect to Phantom Shell	2.9	rectangular	$\sqrt{3}$	1	1	1.7	1.7
Extrapolation and Integration	3.7	rectangular	$\sqrt{3}$	1	1	2.1	2.1
Test sample related							
Test sample positioning	2.0	normal	1	1	1	2.0	2.0
Device Holder Uncertainty	4.0	normal	1	1	1	6.215	6.215
Drift of Output Power	5.0	rectangular	$\sqrt{3}$	1	1	2.67	2.67
Phantom and Setup							
Phantom Uncertainty	3.4	rectangular	$\sqrt{3}$	1	1	2.0	2.0
SAR correction in permittivity and conductivity	1.2	normal	1	1	0.84	1.2	1.0
Liquid conductivity measurement	5.0	normal	1	0.78	0.71	3.9	3.6
Liquid permittivity measurement	5.0	normal	1	0.23	0.26	1.3	1.5
conductivity—temperature	1.1	rectangular	$\sqrt{3}$	0.78	0.71	0.5	0.5
permittivity—temperature	1.3	rectangular	$\sqrt{3}$	0.23	0.26	0.2	0.2
Combined Uncertainty		RSS				9.58	9.49
Expanded uncertainty (coverage factor=2)		Normal(k=2)				19.16	18.98

APPENDIX B – PROBE CALIBRATION CERTIFICATES

NCL CALIBRATION LABORATORIES

Calibration File No.: PC-1598

Task No: BACL-5778

CERTIFICATE OF CALIBRATION

It is certified that the equipment identified below has been calibrated in the **NCL CALIBRATION LABORATORIES** by qualified personnel following recognized procedures and using transfer standards traceable to NRC/NIST.

Equipment: Miniature Isotropic RF Probe
Record of Calibration
Head and Body
Manufacturer: APREL Laboratories
Model No.: E-020
Serial No.: 500-00283

Calibration Procedure: D01-032-E020-V2, D22-012-Tissue, D28-002-Dipole
Project No: BACL-5745

Calibrated: 14th October 2014
Released on: 14th October 2014

This Calibration Certificate is Incomplete Unless Accompanied with the Calibration Results Summary

Released By: ______________________
Art Brennan, Quality Manager

NCL CALIBRATION LABORATORIES

Suite 102, 303 Terry Fox Dr,
OTTAWA, ONTARIO
CANADA K2K 3J1

Division of APREL Lab.
TEL: (613) 435-8300
FAX: (613) 435-8306

Introduction

This Calibration Report reproduces the results of the calibration performed in line with the references listed below. Calibration is performed using accepted methodologies as per the references listed below. Probes are calibrated for air, and tissue and the values reported are the results from the physical quantification of the probe through meteorgical practices.

Calibration Method

Probes are calibrated using the following methods.

<1000MHz
TEM Cell for sensitivity in air
Standard phantom using temperature transfer method for sensitivity in tissue

>1000MHz
Waveguide* method to determine sensitivity in air and tissue
*Waveguide is numerically (simulation) assessed to determine the field distribution and power

The boundary effect for the probe is assessed using a standard flat phantom where the probe output is compared against a numerically simulated series of data points

References

- IEEE Standard 1528
  IEEE Recommended Practice for Determining the Peak Spatial-Average Specific Absorption Rate (SAR) in the Human Head from Wireless Communications Devices: Measurement Techniques
- EN 62209-1
  Human Exposure to RF Fields from hand-held and body-mounted wireless communication devices - Human models. instrumentation, and procedures-Part 1: Procedure to measure the Specific Absorption Rate (SAR) for hand-held mobile wireless devices
- IEC 62209-2
  Human exposure to RF fields from hand-held and body-mounted wireless devices - Human models, instrumentation, and procedures - Part 2: specific absorption rate (SAR) for wireless communication devices (30 MHz - 6 GHz)
- TP-D01-032-E020-V2 E-Field probe calibration procedure
- D22-012-Tissue dielectric tissue calibration procedure
- D28-002-Dipole procedure for validation of SAR system using a dipole
- IEEE 1309 Standard for Calibration of Electromagnetic Field Sensors and Probes, Excluding Antennas, from 9kHz to 40GHz

NCL Calibration Laboratories
Division of APREL Inc.

Conditions

Probe 500-00283 was a recalibration.

Ambient Temperature of the Laboratory:	22 °C +/- 1.5°C
Temperature of the Tissue:	21 °C +/- 1.5°C
Relative Humidity:	< 60%

Primary Measurement Standards

Instrument	Serial Number	Cal due date
Tektronix USB Power Meter	11C940	May 14, 2015
Signal Generator HP 83640B	3844A00689	Feb 12, 2015

Secondary Measurement Standards

Network Analyzer Anritsu 37347C	002106	Feb. 20, 2015

Attestation

The below named signatories have conducted the calibration and review of the data which is presented in this calibration report.

We the undersigned attest that to the best of our knowledge the calibration of this subject has been accurately conducted and that all information contained within the results pages have been reviewed for accuracy.

Art Brennan, Quality Manager

Dan Brooks, Test Engineer

Page 3 of 10
This page has been reviewed for content and attested to on Page 2 of this document.

NCL Calibration Laboratories
Division of APREL Inc.

Probe Summary

Probe Type:	E-Field Probe E020
Serial Number:	500-00283
Frequency:	As presented on page 5
Sensor Offset:	1.56
Sensor Length:	2.5
Tip Enclosure:	Composite*
Tip Diameter:	< 2.9 mm
Tip Length:	55 mm
Total Length:	289 mm

*Resistive to recommended tissue recipes per IEEE-1528

Sensitivity in Air

Channel X:	1.2 μV/(V/m)^2
Channel Y:	1.2 μV/(V/m)^2
Channel Z:	1.2 μV/(V/m)^2
Diode Compression Point:	95 mV

NCL Calibration Laboratories

Division of APREL Inc.

Calibration for Tissue (Head H, Body B)

Frequency	Tissue Type	Measured Epsilon	Measured Sigma	Standard Uncertainty (%)	Calibration Frequency Range (MHz)	Conversion Factor
450 H	Head	43.59	0.86	3.5	±50	5.7
450 B	Body	56.74	0.94	3.5	±50	5.8
750 H	Head	42.98	0.92	3.5	±50	6.0
750 B	Body	43.05	0.93	3.5	±50	5.5
835 H	Head	43.42	0.94	3.5	±50	5.9
835 B	Body	55.77	1.01	3.5	±50	5.9
900 H	Head	41.87	1.06	3.5	±50	6.0
900 B	Body	55.62	1.05	3.5	±50	5.9
1450 H	Head	X	X	X	X	X
1450 B	Body	X	X	X	X	X
1500 H	Head	X	X	X	X	X
1500 B	Body	X	X	X	X	X
1640 H	Head	X	X	X	X	X
1640 B	Body	X	X	X	X	X
1750 H	Head	38.23	1.38	3.5	±75	5.4
1750 B	Body	52.86	1.54	3.5	±75	5.3
1800 H	Head	X	X	X	X	X
1800 B	Body	X	X	X	X	X
1900 H	Head	40.20	1.38	3.5	±75	4.8
1900 B	Body	52.63	1.46	3.5	±75	4.5
2000 H	Head	X	X	X	X	X
2000 B	Body	X	X	X	X	X
2100 H	Head	X	X	X	X	X
2100 B	Body	X	X	X	X	X
2300 H	Head	X	X	X	X	X
2300 B	Body	X	X	X	X	X
2450 H	Head	37.26	1.84	3.5	±75	4.9
2450B	Body	53.61	1.9	3.5	±75	4.3
3000 H	Head	X	X	X	X	X
3000 B	Body	X	X	X	X	X
3600 H	Head	37.49	3.16	3.5	±100	4.5
3600 B	Body	49.94	3.86	3.5	±100	4.0
5250 H	Head	35.51	4.78	3.5	±100	3.0
5250 B	Body	47.54	5.11	3.5	±100	2.8
5600 H	Head	36.05	5.15	3.5	±100	2.8
5600 B	Body	46.49	5.72	3.5	±100	2.2
5800 H	Head	45.99	6.01	3.5	±100	3.2
5800 B	Body	35.6	5.37	3.5	±100	2.5

Page 5 of 10

This page has been reviewed for content and attested to on Page 2 of this document.

Boundary Effect:

Uncertainty resulting from the boundary effect is less than 2.1% for the distance between the tip of the probe and the tissue boundary, when less than 0.58mm.

Spatial Resolution:

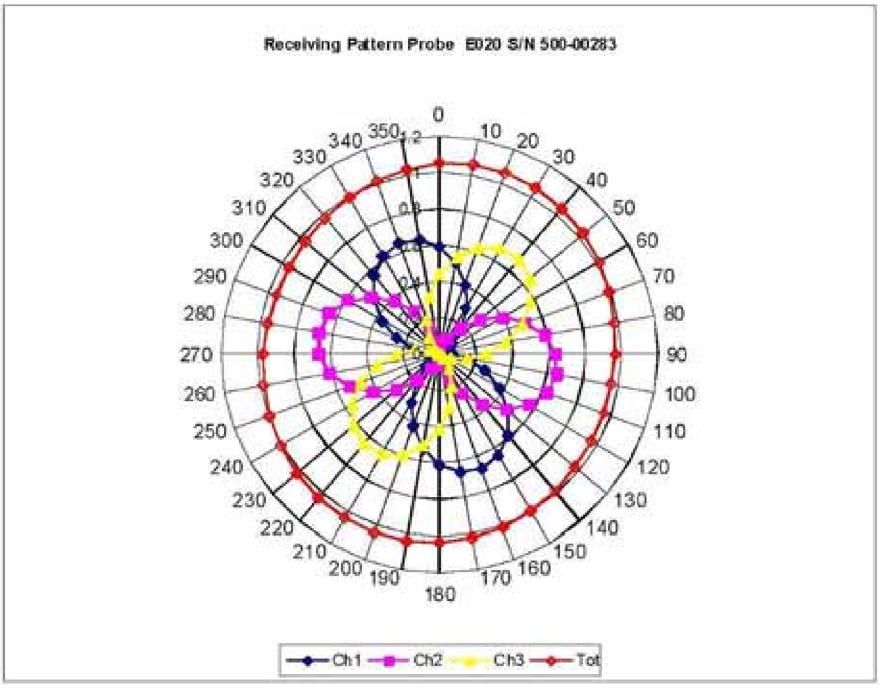
The spatial resolution uncertainty is less than 1.5% for 4.9mm diameter probe.
The spatial resolution uncertainty is less than 1.0% for 2.5mm diameter probe.

DAQ-PAQ Contribution

To minimize the uncertainty calculation all tissue sensitivity values were calculated using a load impedance of 5 MΩ.

NCL Calibration Laboratories
Division of APREL Inc.

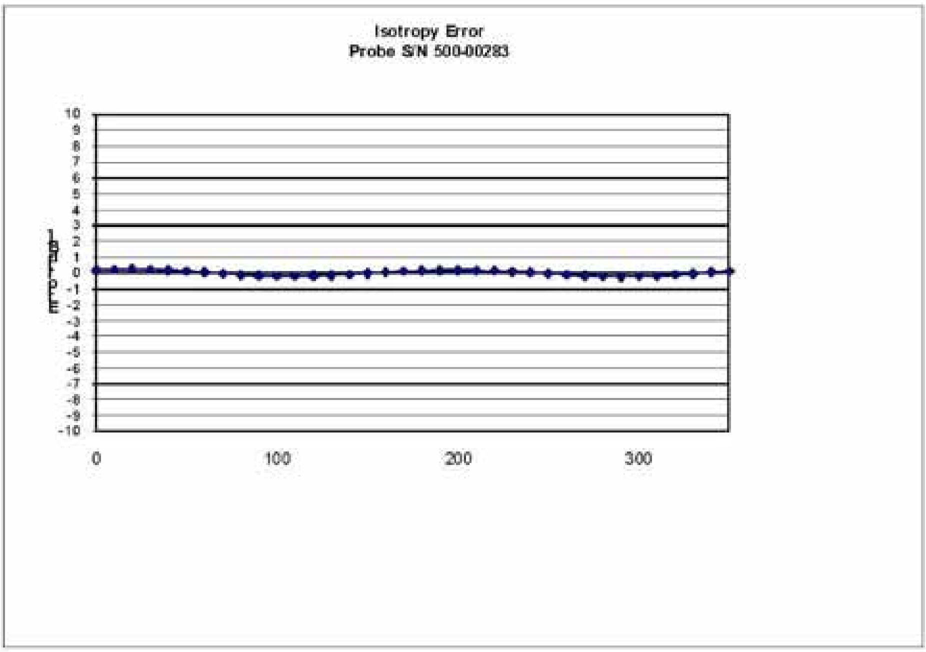
Receiving Pattern Air

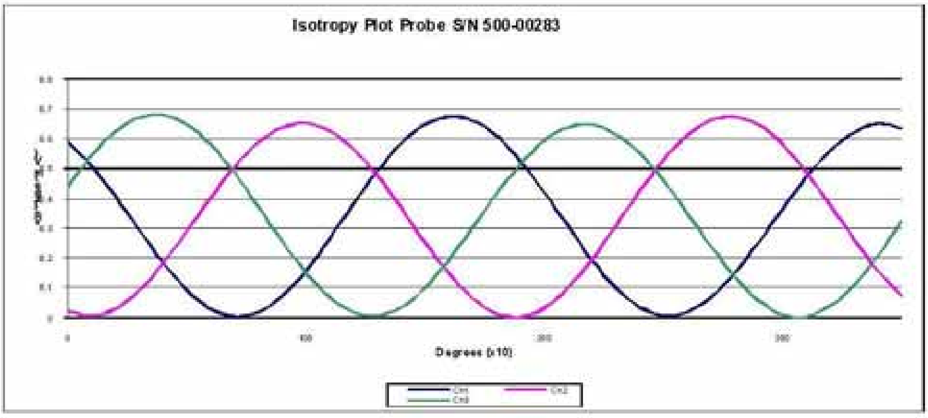


Page 7 of 10
This page has been reviewed for content and attested to on Page 2 of this document.

NCL Calibration Laboratories
Division of APREL Inc.

Isotropy Error Air





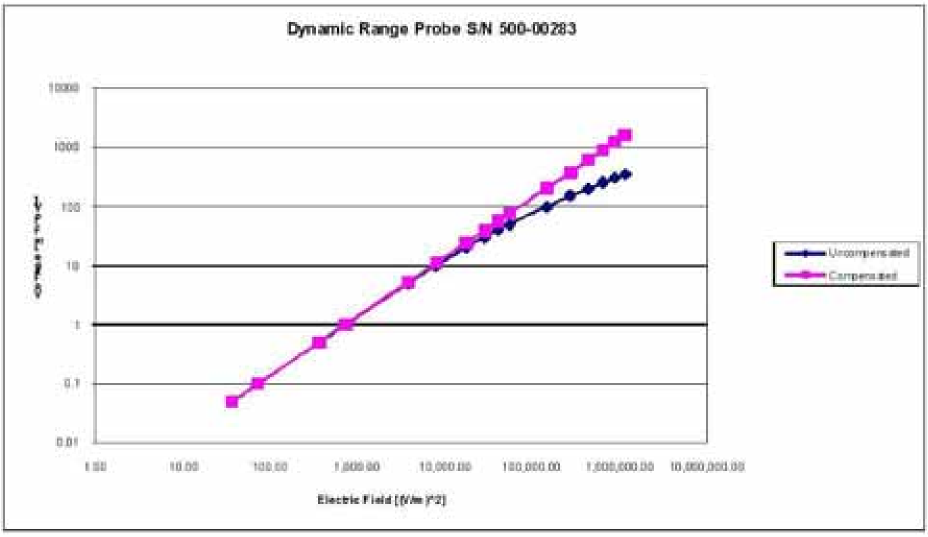
Isotropicity Tissue: 0.10 dB

Page 8 of 10
This page has been reviewed for content and attested to on Page 2 of this document.

NCL Calibration Laboratories

Division of APREL Inc.

Dynamic Range

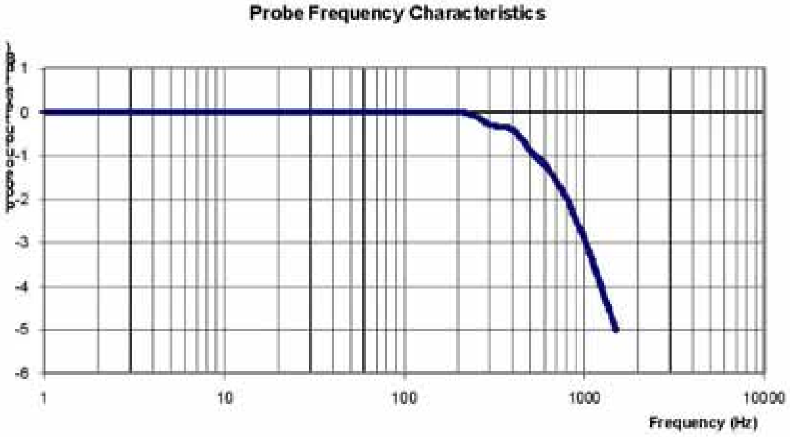


Page 9 of 10

This page has been reviewed for content and attested to on Page 2 of this document.

NCL Calibration Laboratories
Division of APREL Inc.

Video Bandwidth



Video Bandwidth at 500 Hz	1 dB
Video Bandwidth at 1.02 KHz:	3 dB

Test Equipment

The test equipment used during Probe Calibration, manufacturer, model number and, current calibration status are listed and located on the main APREL server R:\NCL\Calibration Equipment\Instrument List May 2014.

Page 10 of 10
This page has been reviewed for content and attested to on Page 2 of this document.

APPENDIX C DIPOLE CALIBRATION CERTIFICATES

NCL CALIBRATION LABORATORIES

Calibration File No: DC-1532
Project Number: BACL-5745

CERTIFICATE OF CALIBRATION

It is certified that the equipment identified below has been calibrated in the **NCL CALIBRATION LABORATORIES** by qualified personnel following recognized procedures and using transfer standards traceable to NRC/NIST.

Validation Dipole

Manufacturer: APREL Laboratories
Part number: ALS-D-750-S-2
Frequency: 750 MHz
Serial No: 177-00505

Customer: BACL

Calibrated: 8th of October 2013
Released on: 8th of October 2013

This Calibration Certificate is Incomplete Unless Accompanied with the Calibration Results Summary

Released By: ______________________

Art Brennan, Quality Manager

NCL CALIBRATION LABORATORIES

303 Terry Fox Drive, Suite 102
Kanata, Ontario
CANADA K2K 3J1

Division of APREL
TEL: (613) 435-8300
FAX: (613) 435-8306

NCL Calibration Laboratories
Division of APREL Laboratories.

Conditions

Dipole 177-00505 was a new calibration, removed from stock.

Ambient Temperature of the Laboratory: 22 °C +/- 0.5°C
Temperature of the Tissue: 21 °C +/- 0.5°C

We the undersigned attest that to the best of our knowledge the calibration of this device has been accurately conducted and that all information contained within this report has been reviewed for accuracy.

We the undersigned attest that to the best of our knowledge the calibration of this subject has been accurately conducted and that all information contained within the results pages have been reviewed for accuracy.

Art Brennan, Quality Manager

Dan Brooks, Test Engineer

This page has been reviewed for content and attested to by signature within this document.

NCL Calibration Laboratories
Division of APREL Laboratories.

Calibration Results Summary

The following results relate the Calibrated Dipole and should be used as a quick reference for the user.

Mechanical Dimensions

Length: 180.2 mm
Height: 97.0 mm

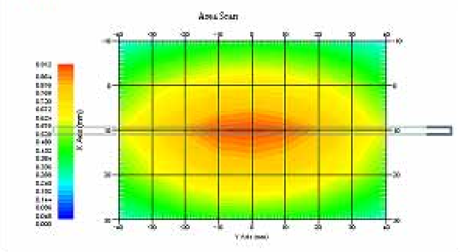
Electrical Calibration

Test	Result Head	Result Body
S11 R/L	-27.621 dB	-21.672 dB
SWR	1.106 U	1.201 U
Impedance	52.505 Ω	55.933 Ω

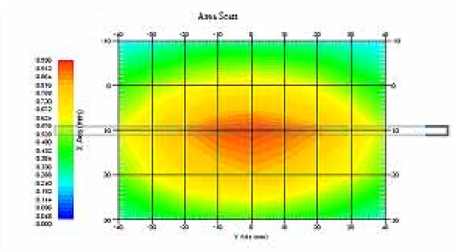
System Validation Results

Frequency 750 MHz	1 Gram	10 Gram
Head	8.5	54.0
Body	8.54	5.42

Head



Body



3

This page has been reviewed for content and attested to by signature within this document.

NCL Calibration Laboratories

Division of APREL Laboratories.

Introduction

This Calibration Report has been produced in line with the SSI Dipole Calibration Procedure SSI-TP-018-ALSAS. The results contained within this report are for Validation Dipole 177-00505. The calibration routine consisted of a three-step process. Step 1 was a mechanical verification of the dipole to ensure that it meets the mechanical specifications. Step 2 was an Electrical Calibration for the Validation Dipole, where the SWR, Impedance, and the Return loss were assessed. Step 3 involved a System Validation using the ALSAS-10U, along with APREL E-020 130 MHz to 26 GHz E-Field Probe Serial Number 2225.

References

- SSI-TP-018-ALSAS Dipole Calibration Procedure
- SSI-TP-016 Tissue Calibration Procedure
- IEEE 1528 "Recommended Practice for Determining the Peak Spatial-Average Specific Absorption Rate (SAR) in the Human Body Due to Wireless Communications Devices: Experimental Techniques"
- IEC-62209 "Human exposure to radio frequency fields from hand-held and body-mounted wireless communication devices – Human models, instrumentation, and procedures"
- Part 1: "Procedure to determine the Specific Absorption Rate (SAR) for hand-held devices used in close proximity of the ear (frequency range of 300 MHz to 3 GHz)"
- IEC-62209 "Human exposure to radio frequency fields from hand-held and body-mounted wireless communication devices – Human models, instrumentation, and procedures"
- Part 2: "Procedure to determine the Specific Absorption Rate (SAR) for hand-held devices used in close proximity of the ear (frequency range of 30 MHz to 6 GHz)"
- TP-D01-032-E020-V2 E-Field probe calibration procedure
- D22-012-Tissue dielectric tissue calibration procedure
- D28-002-Dipole procedure for validation of SAR system using a dipole
- IEEE 1309 Draft Standard for Calibration of Electromagnetic Field Sensors and Probes, Excluding Antennas, from 9kHz to 40GHz

Conditions

Dipole 177-00505 was a new calibration.

Ambient Temperature of the Laboratory: 22 °C +/- 0.5°C
Temperature of the Tissue: 20 °C +/- 0.5°C

This page has been reviewed for content and attested to by signature within this document.

NCL Calibration Laboratories
Division of APREL Laboratories.

Dipole Calibration Results

Mechanical Verification

APREL Length	APREL Height	Measured Length	Measured Height
180.0 mm	97.8 mm	180.2 mm	97.0 mm

Tissue Validation

Tissue 750MHz	Measured Head	Measured Body
Dielectric constant, ε_r	42.7	56.6
Conductivity, σ [S/m]	0.85	0.94

Dipole Calibration uncertainty

The calibration uncertainty for the dipole is made up of various parameters presented below.

Mechanical	1%
Positioning Error	1.22%
Electrical	1.7%
Tissue	2.2%
Dipole Validation	2.2%
TOTAL	**8.32% (16.64% K=2)**

This page has been reviewed for content and attested to by signature within this document.

NCL Calibration Laboratories

Division of APREL Laboratories.

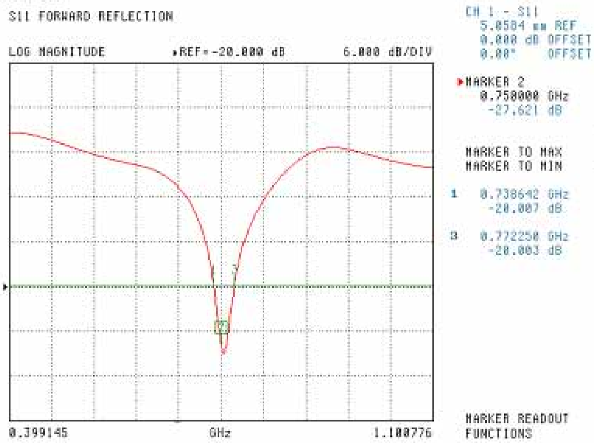
Electrical Calibration

Test	Result Head	Result Body
S11 R/L	-27.621 dB	-21.672 dB
SWR	1.106 U	1.201 U
Impedance	52.505 Ω	55.933 Ω

The Following Graphs are the results as displayed on the Vector Network Analyzer.

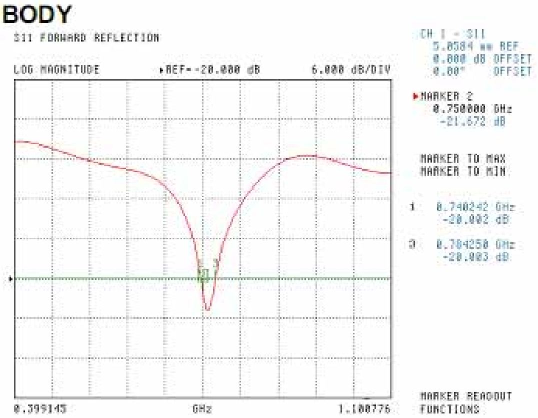
S11 Parameter Return Loss

HEAD



Frequency Range 738 MHz to 772 MHz

BODY



Frequency Range 740 MHz to 784 MHz

6

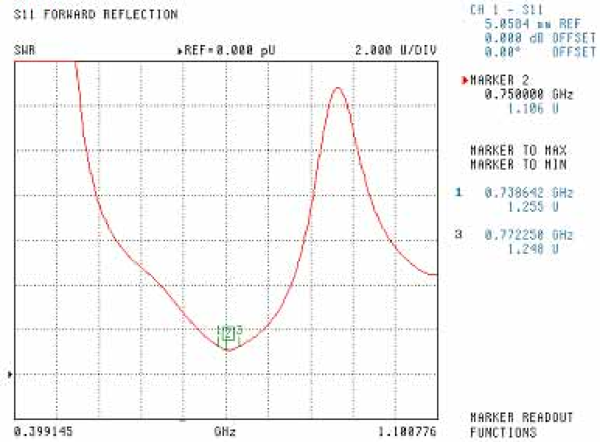
This page has been reviewed for content and attested to by signature within this document.

NCL Calibration Laboratories

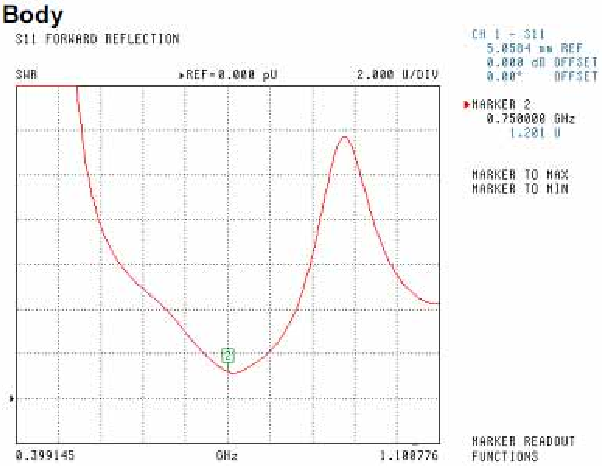
Division of APREL Laboratories.

SWR

Head



Body



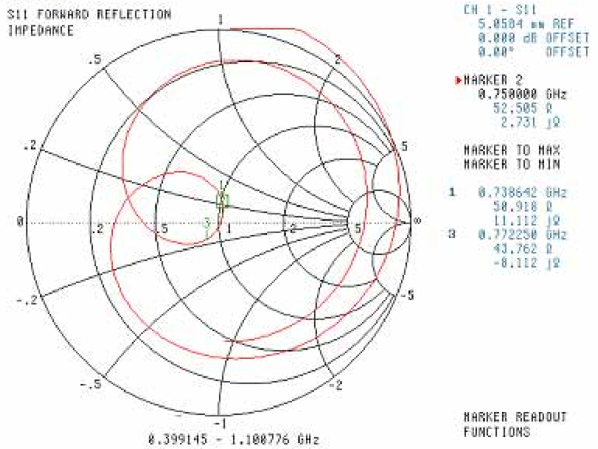
This page has been reviewed for content and attested to by signature within this document. 7

NCL Calibration Laboratories

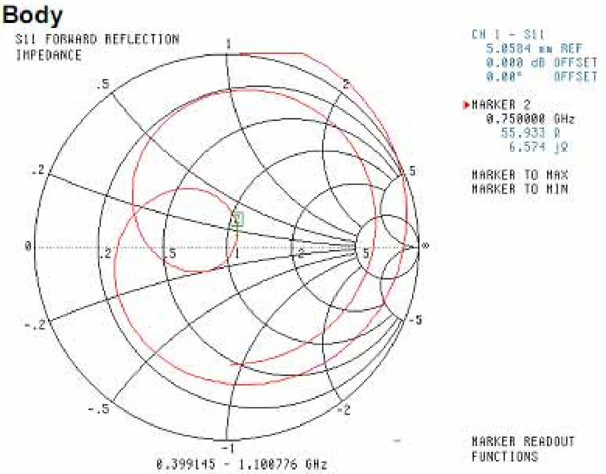
Division of APREL Laboratories.

Smith Chart Dipole Impedance

Head



Body



8

This page has been reviewed for content and attested to by signature within this document.

NCL Calibration Laboratories
Division of APREL Laboratories.

Test Equipment

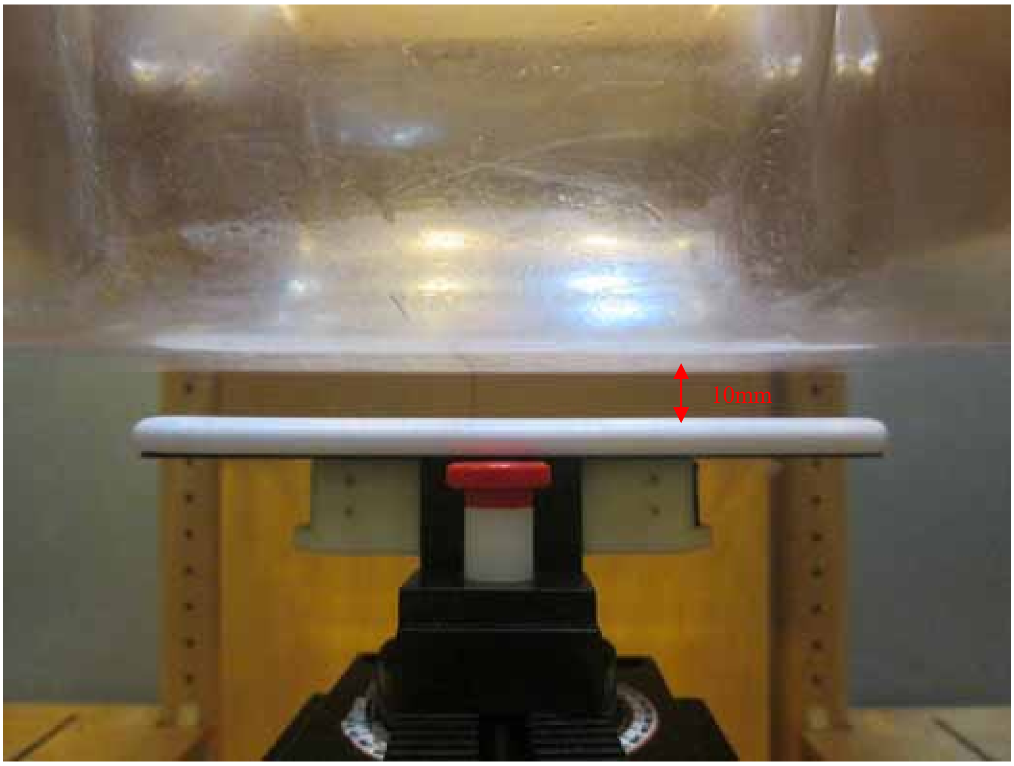
The test equipment used during Probe Calibration, manufacturer, model number and, current calibration status are listed and located on the main APREL server R:\NCL\Calibration Equipment\Instrument List May 2013.

This page has been reviewed for content and attested to by signature within this document.

APPENDIX D EUT TEST POSITION PHOTOS

Liquid depth ≥ 15cm

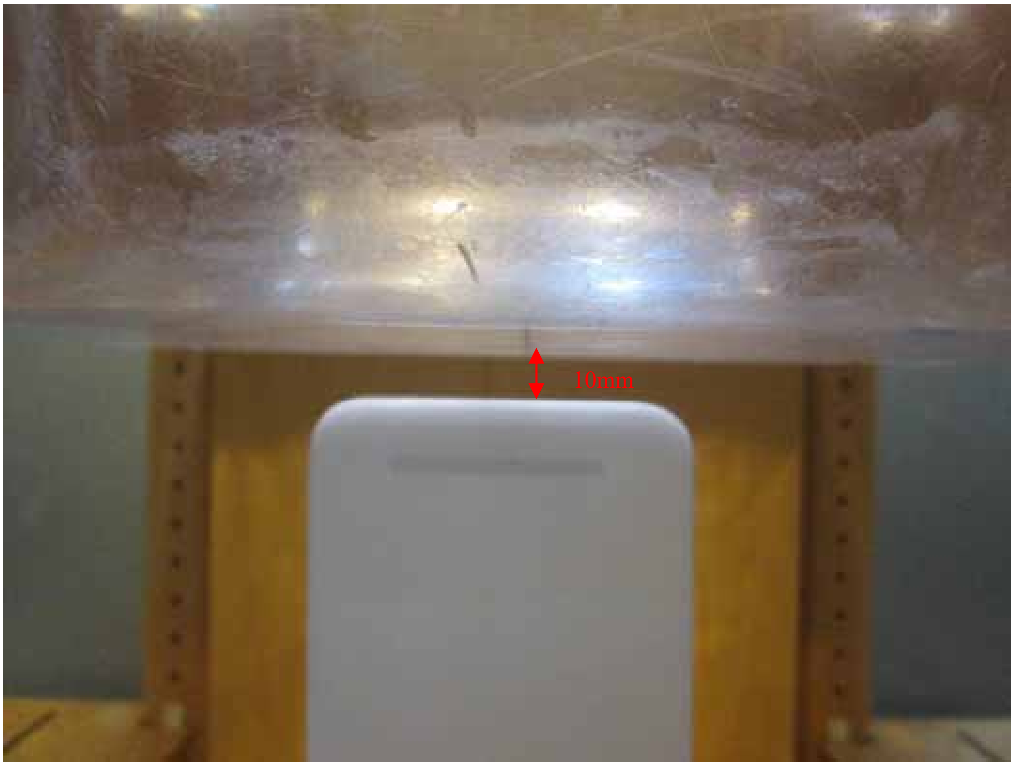
Body-worn Back Setup Photo (10mm)



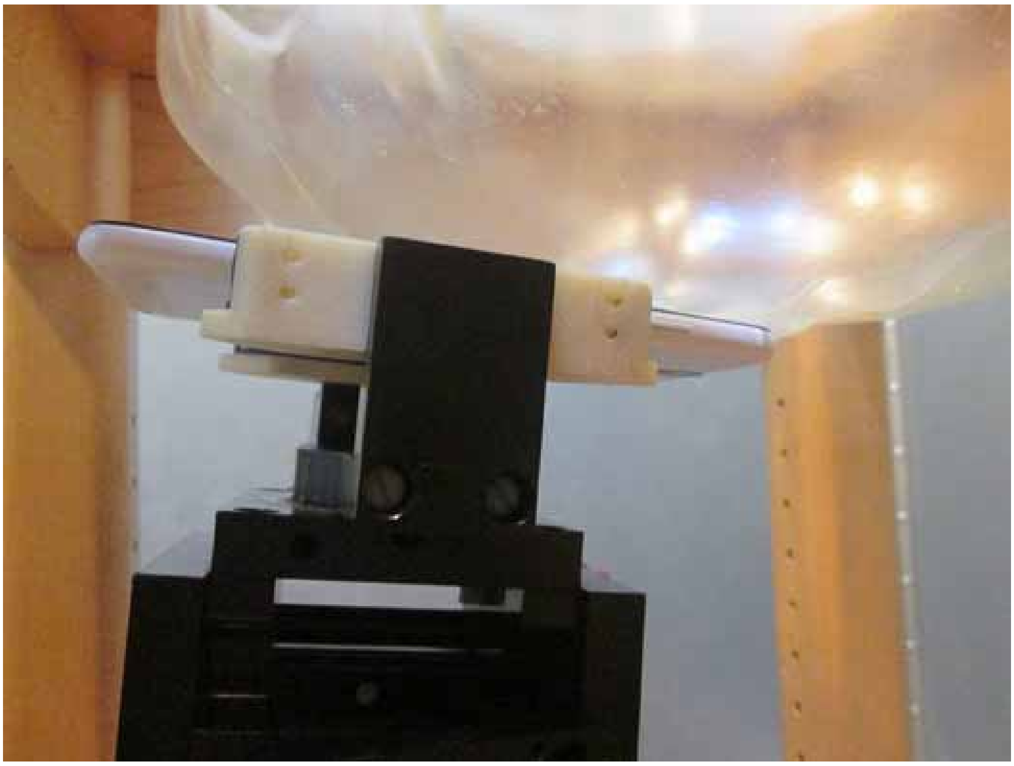
Body-worn Left Setup Photo (10mm)

Body-worn Right Setup Photo (10mm)

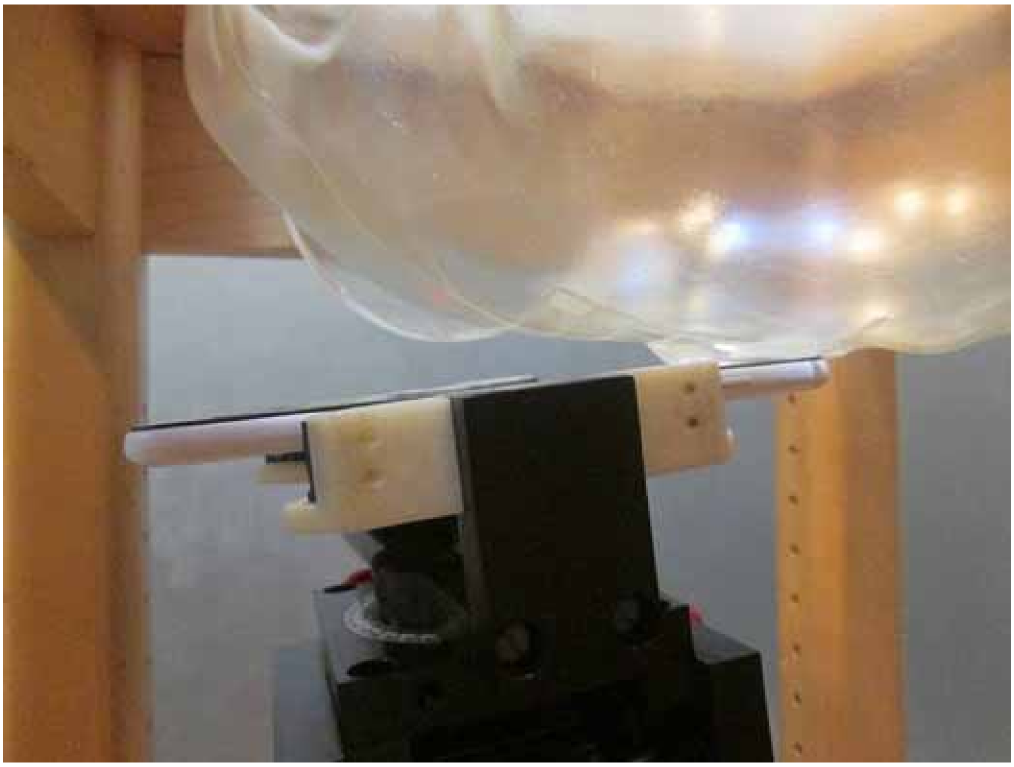
Body-worn Bottom Setup Photo (10mm)



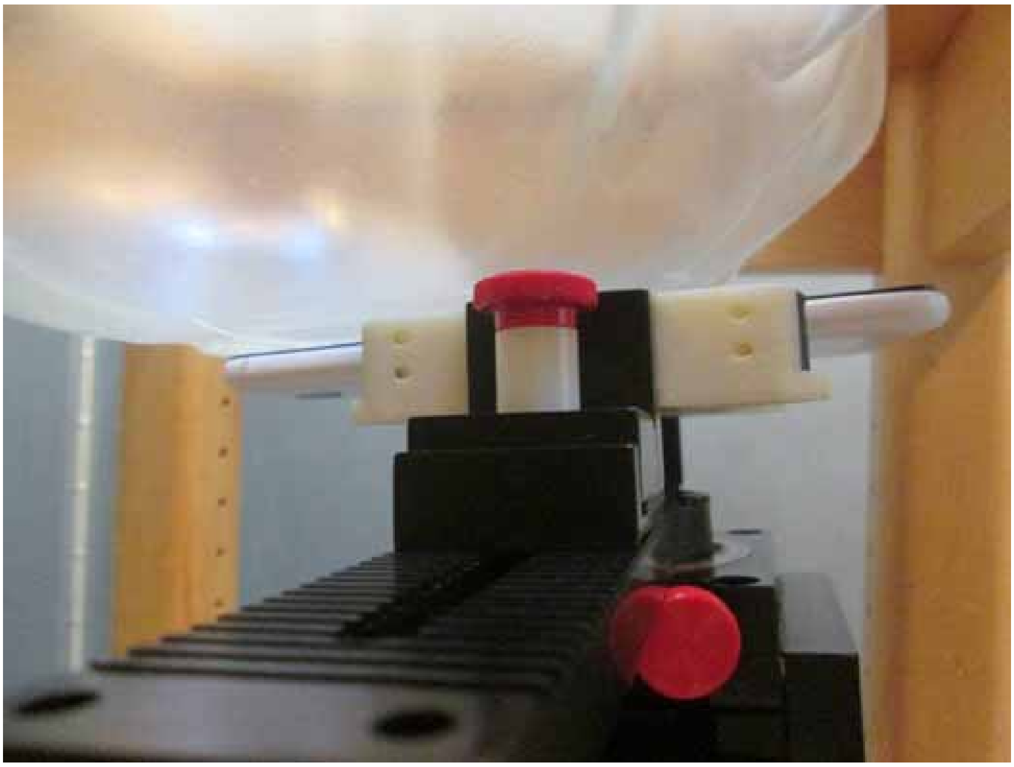
Left Head Touch Setup Photo



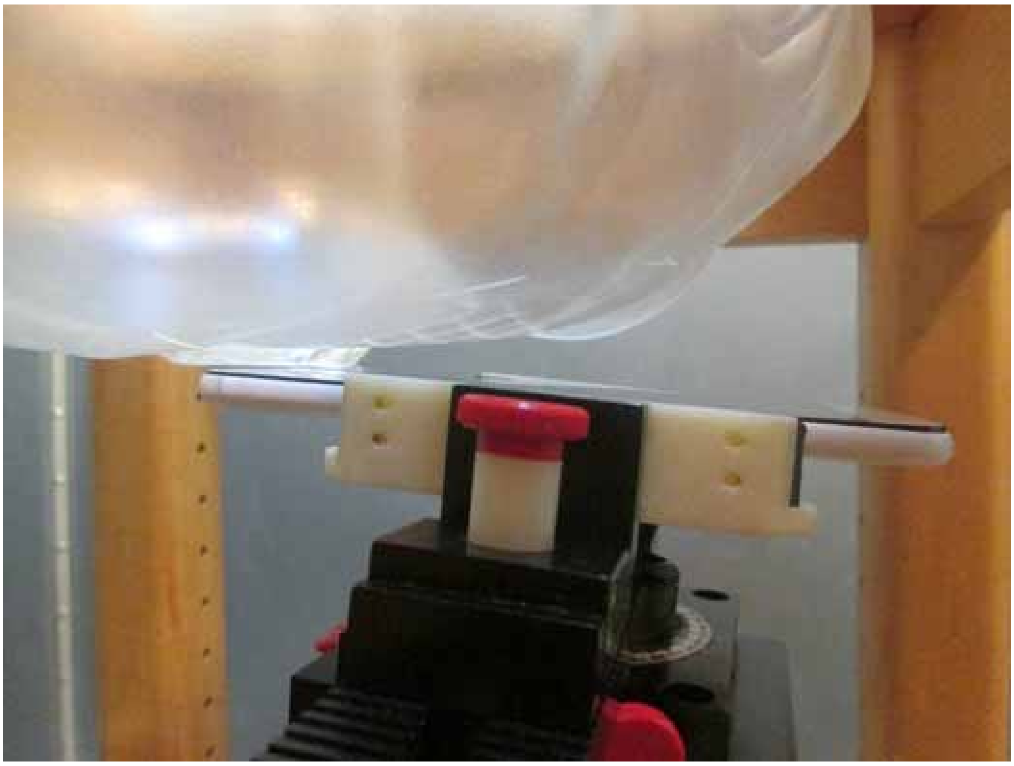
Left Head Tilt Setup Photo



Right Head Touch Setup Photo



Right Head Tilt Setup Photo

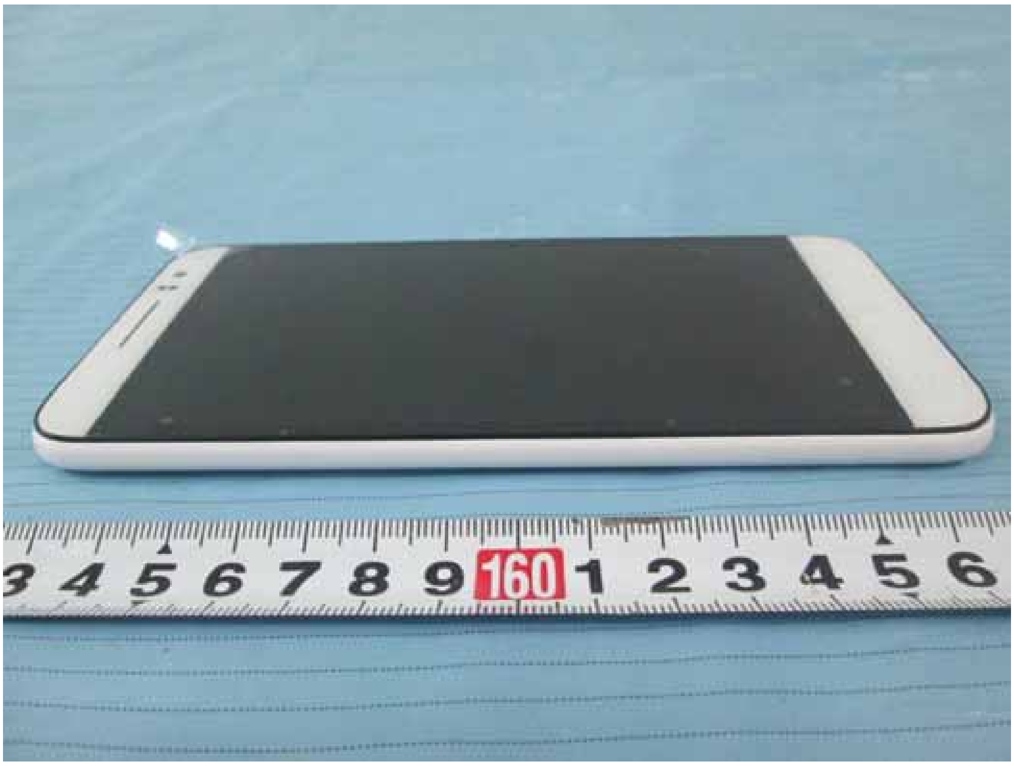


APPENDIX E EUT PHOTOS

EUT – Front View

EUT – Back View

EUT –Left Side View



EUT – Right Side View

EUT – Top View

EUT – Bottom View

EUT – Uncover View

APPENDIX F INFORMATIVE REFERENCES

[1] Federal Communications Commission, \Report and order: Guidelines for evaluating the environmental effects of radiofrequency radiation", Tech. Rep. FCC 96-326, FCC, Washington, D.C. 20554, 1996.

[2] David L. Means Kwok Chan, Robert F. Cleveland, \Evaluating compliance with FCC guidelines for human exposure to radiofrequency electromagnetic fields", Tech. Rep., Federal Communication Commission, O_ce of Engineering & Technology, Washington, DC, 1997.

[3] Thomas Schmid, Oliver Egger, and Niels Kuster, \Automated E-_eld scanning system for dosimetricPage 83 of 83
assessments", IEEE Transactions on Microwave Theory and Techniques, vol. 44, pp. 105{113, Jan. 1996.

[4] Niels Kuster, Ralph K.astle, and Thomas Schmid, \Dosimetric evaluation of mobile communications equipment with known precision", IEICE Transactions on Communications, vol. E80-B, no. 5, pp. 645{652, May 1997.

[5] CENELEC, \Considerations for evaluating of human exposure to electromagnetic fields (EMFs) from mobile telecommunication equipment (MTE) in the frequency range 30MHz - 6GHz", Tech. Rep., CENELEC, European Committee for Electrotechnical Standardization, Brussels, 1997.

[6] ANSI, ANSI/IEEE C95.1-1992: IEEE Standard for Safety Levels with Respect to Human Exposure to Radio Frequency Electromagnetic Fields, 3 kHz to 300 GHz, The Institute of Electrical and Electronics Engineers, Inc., New York, NY 10017, 1992.

[7] Katja Pokovic, Thomas Schmid, and Niels Kuster, \Robust setup for precise calibration of E-field probes in tissue simulating liquids at mobile communications frequencies", in ICECOM _ 97, Dubrovnik, October 15{17, 1997, pp. 120-24.

[8] Katja Pokovic, Thomas Schmid, and Niels Kuster, \E-field probe with improved isotropy in brain simulating liquids", in Proceedings of the ELMAR, Zadar, Croatia, 23{25 June, 1996, pp. 172-175.

[9] Volker Hombach, Klaus Meier, Michael Burkhardt, Eberhard K. uhn, and Niels Kuster, \The depen-dence of EM energy absorption upon human head modeling at 900 MHz", IEEE Transactions on Microwave Theory and Techniques, vol. 44, no. 10, pp. 1865-1873, Oct. 1996.

[10] Klaus Meier, Ralf Kastle, Volker Hombach, Roger Tay, and Niels Kuster, \The dependence of EM energy absorption upon human head modeling at 1800 MHz", IEEE Transactions on Microwave Theory and Techniques, Oct. 1997, in press.

[11] W. Gander, Computermathematik, Birkhaeuser, Basel, 1992.

[12] W. H. Press, S. A. Teukolsky,W. T. Vetterling, and B. P. Flannery, Numerical Recepies in C, The Art of Scientific Computing, Second Edition, Cambridge University Press, 1992.Dosimetric Evaluation of Sample device, month 1998 9

[13] NIS81 NAMAS, \The treatment of uncertainity in EMC measurement", Tech. Rep., NAMAS Executive, National Physical Laboratory, Teddington, Middlesex, England, 1994.

[14] Barry N. Taylor and Christ E. Kuyatt, \Guidelines for evaluating and expressing the uncertainty of NIST measurement results", Tech. Rep., National Institute of Standards and Technology, 1994. Dosimetric Evaluation of Sample device, month 1998 10.

******* END OF REPORT *******