SAR EVALUATION REPORT

For

Key Ingredient Corporation

512 E Riverside Dr, Suite 100 Austin, Texas, United States

FCC ID: 2AF4LKIRE3US

Report Type:	Product Type:
Original Report	Tablet PC

Test Engineer:	Terry XiaHou
Report Number:	RSZ150928006-20
Report Date:	2015-11-02
Reviewed By:	Bell Hu SAR Engineer
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Attestation of Test Results			
EUT Information	**Company Name**	Key Ingredient Corporation	
	EUT Description	Tablet PC	
	FCC ID	2AF4LKIRE3US	
	Model Number	KIRE3US	
	Test Date	2015-10-06	
Frequency	**Max. SAR Level(s) Reported**		**Limit(W/Kg)**
GSM 850	1.197 W/kg 1g Body SAR		**1. 6**
PCS 1900	1.130 W/kg 1g Body SAR		
WCDMA 850	1.028 W/kg 1g Body SAR		
WCDMA 1900	1.086 W/kg 1g Body SAR		
LTE Band 7	1.145 W/kg 1g Body SAR		
Simultaneous	1.588 W/kg 1g Body SAR		
Hotspot	1.588 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.		
	FCC 47 CFR part 2.1093 Radiofrequency radiation exposure evaluation: portable devices		
	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		
	IEC 62209-2:2010 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 wireless communication devices used in close proximity to the human body (frequency range of 30 MHz to 6 GHz)		
	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 KDB 616217 D04 SAR for laptop and tablets v01r01		

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.

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DOCUMENT REVISION HISTORY

Revision Number	Report Number	Description of Revision	Date of Revision
0	RSZ150928006-20	Original Report	2015-11-02

EUT DESCRIPTION

This report has been prepared on behalf of Key Ingredient Corporation and their product, FCC ID: 2AF4LKIRE3US, Model: KIRE3US 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, EGPRS/GPRS Data, WCDMA(Rel99, HSUPA, HSDPA,DC-HSDPA,HSPA+),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) WCDMA 850: 824-849 MHz(TX) ; 869-894 MHz(RX) WCDMA 1900: 1850-1910 MHz(TX) ; 1930-1990 MHz(RX) LTE Band 7: 2500-2570 MHz(TX) ; 2620-2690 MHz(RX) Wi-Fi(802.11b/g/n20): 2412 MHz-2462 MHz Wi-Fi(802.11n40): 2422 MHz-2452 MHz Bluetooth : 2402 MHz-2480 MHz BLE:2402 MHz-2480 MHz
Conducted RF Power:	GSM 850 : 32.15 dBm PCS 1900: 29.16 dBm WCDMA 850: 20.43 dBm WCDMA 1900: 20.71 dBm LTE Band 7: 19.83 dBm Wi-Fi(802.11b/g/n20): 9.67 dBm Wi-Fi(802.11n40) : 9.60 dBm Bluetooth: 7.22 dBm BLE: -0.23 dBm
Dimensions (L*W*H):	240 mm (L) × 170 mm (W) × 9 mm (H)
Power Source:	3.7 V_{DC} Rechargeable Battery
Normal Operation:	Body-worn

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

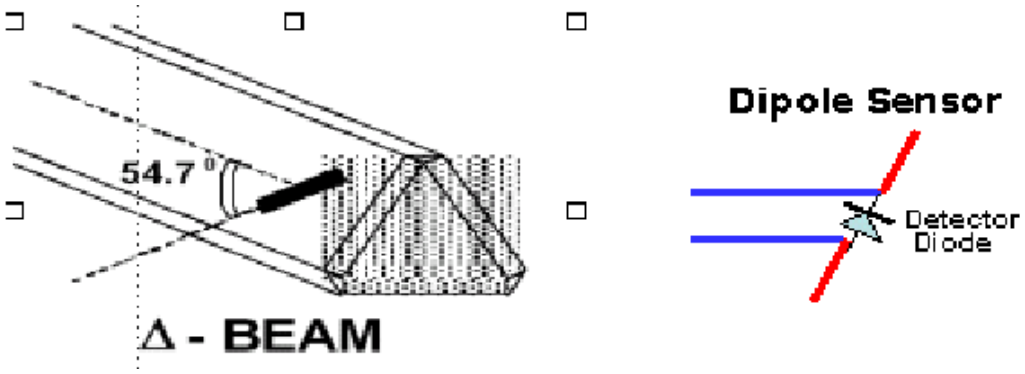
The overall uncertainty for the methodology and algorithms the used during the SAR calculation was evaluated using the data from IEEE 1528 based on the example f3 algorithm:

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

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

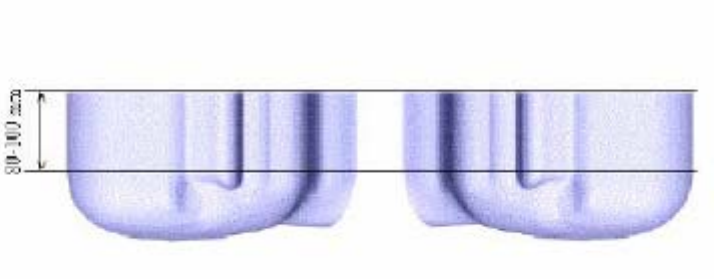
The universal device positioner allows complete freedom of movement of the EUT. Developed to hold a EUT in a free-space scenario any additional loading attributable to the material used in the construction of the positioner has been eliminated. Repeatability has been enhanced through the linear scales 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	
	εr	σ (S/m)	εr	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

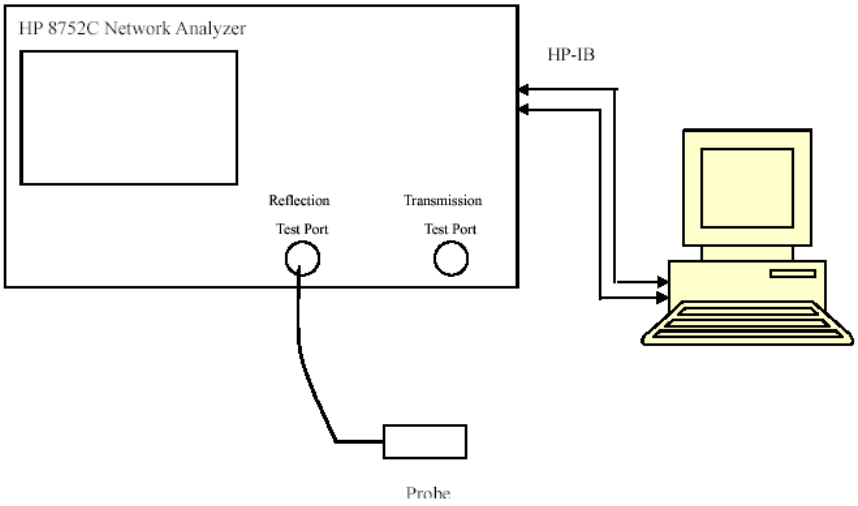
EQUIPMENT LIST AND CALIBRATION

Equipments List & Calibration Information

Equipment	Model	Calibration Date	Calibration Due Date	S/N
CRS F3 robot	ALS-F3	N/A	N/A	RAF0805352
CRS F3 Software	ALS-F3-SW	N/A	N/A	N/A
CRS C500C controller	ALS-C500	N/A	N/A	RCF0805379
Probe mounting device & Boundary Detection Sensor System	ALS-PMDPS-3	N/A	N/A	120-00270
Universal Work Station	ALS-UWS	N/A	N/A	100-00157
Data Acquisition Package	ALS-DAQ-PAQ-3	2014-10-14	2015-10-14	110-00212
Miniature E-Field Probe	ALS-E-020	2014-10-14	2015-10-14	500-00283
Dipole, 835MHz	ALS-D-835-S-2	2014-10-08	2017-10-08	180-00558
Dipole, 1900MHz	ALS-D-1900-S-2	2014-10-09	2017-10-09	210-00710
Dipole, 2450MHz	ALS-D-2450-S-2	2014-10-09	2014-10-09	220-00758
Dipole Spacer	ALS-DS-U	N/A	N/A	250-00907
Device holder/Positioner	ALS-H-E-SET-2	N/A	N/A	170-00510
Left ear SAM phantom	ALS-P-SAM-L	N/A	N/A	130-00311
Right ear SAM phantom	ALS-P-SAM-R	N/A	N/A	140-00359
UniPhantom	ALS-P-UP-1	N/A	N/A	150-00413
Simulated Tissue 835 MHz Head	ALS-TS-835-H	Each Time	Each Time	270-01002
Simulated Tissue 835 MHz Body	ALS-TS-835-B	Each Time	Each Time	270-02101
Simulated Tissue 1900 MHz Head	ALS-TS-1900-H	Each Time	Each Time	295-01103
Simulated Tissue 1900 MHz Body	ALS-TS-1900-B	Each Time	Each Time	295-02102
Simulated Tissue 2450 MHz Head	ALS-TS-2450-H	Each Time	Each Time	290-01108
Simulated Tissue 2450 MHz Body	ALS-TS-2450-B	Each Time	Each Time	290-01109
Directional couple	DC6180A	N/A	N/A	0325849
Power Amplifier	5S1G4	N/A	N/A	71377
Attenuator	3dB	N/A	N/A	5402
Dielectric probe kit	HP85070B	2015-06-13	2016-06-13	US33020324
Network analyzer	8752C	2015-06-03	2016-06-03	3410A02356
Synthesized Sweeper	HP 8341B	2015-06-03	2016-06-03	2624A00116
UNIVERSAL RADIO COMMUNICATION TESTER	CMU200	2014-11-23	2015-11-23	106891
WIDEBAND RADIO COMMUNICATION TESTER	CMW500	2015-04-19	2016-04-19	114772
8960 Series 10 Wireless Communication Test Set	E5515C	2015-01-13	2016-01-13	MY50266471
EMI Test Receiver	ESCI	2015-06-13	2016-06-13	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	σ (S/m)	ε_r	σ (S/m)	$\Delta\varepsilon_r$	$\Delta\sigma$ (S/m)	
824.2	Head	41.05	0.90	41.50	0.90	-1.084	0.000	±5
	Body	53.82	0.95	55.20	0.97	-2.500	-2.062	±5
826.4	Head	41.10	0.91	41.50	0.90	-0.964	1.111	±5
	Body	53.86	0.95	55.20	0.97	-2.428	-2.062	±5
836.6	Head	41.08	0.92	41.50	0.90	-1.012	2.222	±5
	Body	53.80	0.96	55.20	0.97	-2.536	-1.031	±5
846.6	Head	41.01	0.92	41.50	0.90	-1.181	2.222	±5
	Body	53.80	0.97	55.20	0.97	-2.536	0.000	±5
848.8	Head	41.02	0.92	41.50	0.90	-1.157	2.222	±5
	Body	53.84	0.97	55.20	0.97	-2.464	0.000	±5
1850.2	Head	39.59	1.37	40.00	1.40	-1.025	-2.143	±5
	Body	52.00	1.50	53.30	1.52	-2.439	-1.316	±5
1852.4	Head	39.74	1.36	40.00	1.40	-0.650	-2.857	±5
	Body	52.04	1.49	53.30	1.52	-2.364	-1.974	±5
1880.0	Head	39.66	1.39	40.00	1.40	-0.850	-0.714	±5
	Body	52.03	1.50	53.30	1.52	-2.383	-1.316	±5
1907.6	Head	39.70	1.39	40.00	1.40	-0.750	-0.714	±5
	Body	51.88	1.52	53.30	1.52	-2.664	0.000	±5
1909.8	Head	39.56	1.40	40.00	1.40	-1.100	0.000	±5
	Body	51.88	1.53	53.30	1.52	-2.664	0.658	±5
2510	Head	39.61	1.87	39.12	1.87	1.253	0.000	±5
	Body	51.98	1.99	52.62	2.04	-1.216	-2.451	±5
2535	Head	39.64	1.88	39.09	1.89	1.407	-0.529	±5
	Body	51.88	2.01	52.59	2.07	-1.350	-2.899	±5
2560	Head	39.61	1.89	39.06	1.92	1.408	-1.563	±5
	Body	51.76	2.04	52.56	2.11	-1.522	-3.318	±5

**Liquid Verification was performed on 2015-10-06.*

Please refer to the following tables.

835 MHz Head				835 MHz Body		
Frequency (MHz)	e'	e''		Frequency (MHz)	e'	e''
824.0	41.0508	19.7364		824.0	53.8157	20.6737
824.5	41.0616	19.7457		824.5	53.8655	20.6535
825.0	41.0958	19.7108		825.0	53.7795	20.6902
825.5	41.0107	19.7309		825.5	53.8287	20.6958
826.0	41.0323	19.7694		826.0	53.8313	20.7076
826.5	41.1043	19.7225		826.5	53.8573	20.6473
827.0	41.0630	19.6839		827.0	53.8182	20.6803
827.5	41.0456	19.6700		827.5	53.7873	20.6215
828.0	41.0716	19.7159		828.0	53.8559	20.6626
828.5	41.0279	19.7275		828.5	53.8156	20.6311
829.0	41.0428	19.7002		829.0	53.8308	20.7042
829.5	41.0414	19.7279		829.5	53.8251	20.6263
830.0	41.0165	19.7646		830.0	53.7935	20.6347
830.5	41.0503	19.7584		830.5	53.7735	20.6667
831.0	41.0269	19.7490		831.0	53.8227	20.6905
831.5	41.0912	19.7294		831.5	53.8040	20.6227
832.0	41.0916	19.7275		832.0	53.7987	20.6185
832.5	41.0247	19.7372		832.5	53.7671	20.7102
833.0	41.0875	19.7397		833.0	53.8042	20.7053
833.5	41.0515	19.6822		833.5	53.8407	20.6519
834.0	41.0535	19.7334		834.0	53.8011	20.6353
834.5	41.0369	19.7261		834.5	53.7718	20.6284
835.0	41.0285	19.6784		835.0	53.8089	20.6154
835.5	41.0787	19.7053		835.5	53.7981	20.6764
836.0	41.0475	19.7467		836.0	53.8566	20.7031
836.5	41.0250	19.7261		836.5	53.7788	20.6902
837.0	41.0361	19.7700		837.0	53.8520	20.7024
837.5	41.0186	19.7600		837.5	53.8006	20.6293
838.0	41.0857	19.7196		838.0	53.8458	20.6407
838.5	41.0845	19.7670		838.5	53.7666	20.6925
839.0	41.0107	19.6788		839.0	53.8732	20.6925
839.5	41.0042	19.7416		839.5	53.7814	20.6482
840.0	41.0016	19.3846		840.0	53.8611	20.6313
840.5	41.0622	19.4028		840.5	53.8680	20.6881
841.0	41.0940	19.4643		841.0	53.7852	20.6667
841.5	41.1042	19.4534		841.5	53.8576	20.6678
842.0	41.0952	19.4468		842.0	53.8475	20.6245
842.5	41.0808	19.4050		842.5	53.7762	20.6744
843.0	41.0460	19.4061		843.0	53.7682	20.6674
843.5	41.0711	19.3897		843.5	53.7870	20.6278
844.0	41.0952	19.4636		844.0	53.7844	20.7062
844.5	41.0825	19.4706		844.5	53.8502	20.6292
845.0	41.0191	19.4485		845.0	53.8599	20.6931
845.5	41.0273	19.3728		845.5	53.7999	20.6157
846.0	41.0334	19.3833		846.0	53.7660	20.6403
846.5	41.0103	19.4563		846.5	53.7981	20.6821
847.0	41.0416	19.3863		847.0	53.8454	20.6538
847.5	41.0093	19.4054		847.5	53.8480	20.6600
848.0	41.0431	19.4698		848.0	53.8211	20.6131
848.5	41.0913	19.3879		848.5	53.8050	20.6328
849.0	41.0206	19.4223		849.0	53.8434	20.6320

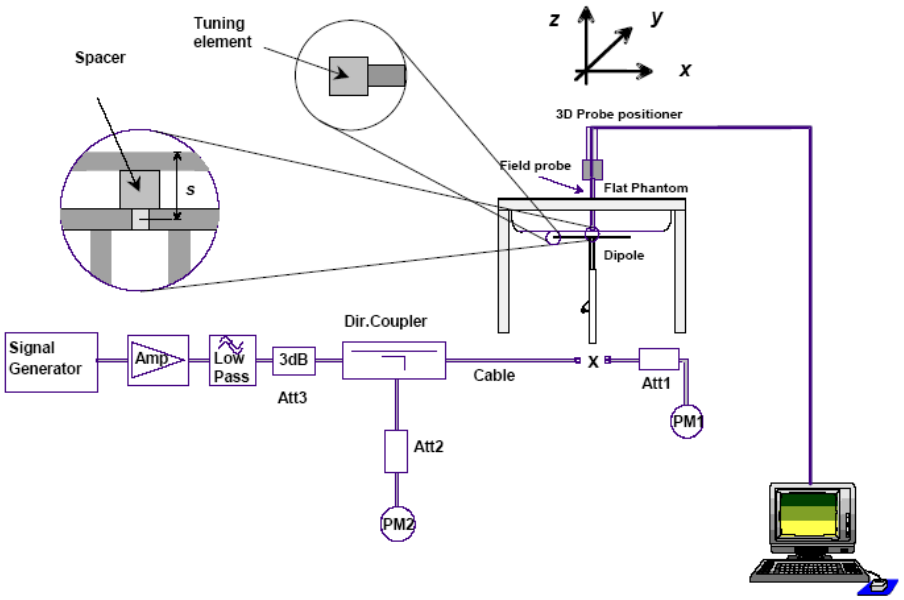
1900 MHz Head				1900 MHz Body		
Frequency (MHz)	e'	e''		Frequency (MHz)	e'	e''
1850.0	39.5908	13.3391		1850.0	51.9958	14.5484
1851.2	39.6348	13.3115		1851.2	52.0138	14.4493
1852.4	39.7431	13.2434		1852.4	52.0391	14.4510
1853.6	39.7141	13.3224		1853.6	51.9177	14.5141
1854.8	39.5836	13.2678		1854.8	52.0200	14.4633
1856.0	39.5523	13.4137		1856.0	51.8664	14.5331
1857.2	39.6123	13.2420		1857.2	51.9191	14.4456
1858.4	39.5439	13.2534		1858.4	51.9047	14.4290
1859.6	39.6758	13.4315		1859.6	51.9859	14.5188
1860.8	39.6028	13.4019		1860.8	52.0978	14.4640
1862.0	39.6846	13.4141		1862.0	51.8079	14.4609
1863.2	39.7195	13.2845		1863.2	52.0052	14.5567
1864.4	39.5935	13.2787		1864.4	51.9749	14.5047
1865.6	39.5602	13.3142		1865.6	51.8394	14.4564
1866.8	39.6002	13.3477		1866.8	52.0238	14.5780
1868.0	39.6359	13.4130		1868.0	51.8906	14.4409
1869.2	39.7108	13.2929		1869.2	51.9375	14.5211
1870.4	39.5551	13.4287		1870.4	51.8370	14.5230
1871.6	39.6580	13.3664		1871.6	52.0486	14.5092
1872.8	39.6519	13.3916		1872.8	52.0039	14.4170
1874.0	39.5780	13.4001		1874.0	51.8475	14.4390
1875.2	39.6962	13.2717		1875.2	51.9573	14.4290
1876.4	39.7024	13.4281		1876.4	51.8931	14.4935
1877.6	39.6869	13.2663		1877.6	52.0863	14.5121
1878.8	39.6977	13.3574		1878.8	52.0204	14.4297
1880.0	39.6992	13.3181		1880.0	51.8819	14.5028
1881.2	39.6493	13.2818		1881.2	52.0066	14.5599
1882.4	39.6118	13.4153		1882.4	51.8670	14.4949
1883.6	39.7218	13.3503		1883.6	51.9109	14.4607
1884.8	39.6264	13.2684		1884.8	51.9860	14.4152
1886.0	39.6179	13.4072		1886.0	51.7690	14.5311
1887.2	39.6773	13.4161		1887.2	51.8761	14.4813
1888.4	39.7123	13.2805		1888.4	51.7764	14.5182
1889.6	39.5819	13.3662		1889.6	51.7853	14.4839
1890.8	39.6659	13.3364		1890.8	51.8918	14.5251
1892.0	39.6020	13.3876		1892.0	51.9986	14.5233
1893.2	39.7155	13.4193		1893.2	51.9993	14.5781
1894.4	39.6547	13.3742		1894.4	51.9230	14.5343
1895.6	39.6508	13.4041		1895.6	51.8845	14.5128
1896.8	39.6483	13.2505		1896.8	51.7408	14.4856
1898.0	39.6184	13.2797		1898.0	51.7795	14.4487
1899.2	39.6647	13.3620		1899.2	51.9770	14.4747
1900.4	39.5605	13.2830		1900.4	51.8418	14.4448
1901.6	39.6358	13.3496		1901.6	51.9886	14.4721
1902.8	39.6024	13.4282		1902.8	51.9643	14.5199
1904.0	39.6498	13.3375		1904.0	52.0336	14.4429
1905.2	39.7258	13.2556		1905.2	51.8869	14.5239
1906.4	39.6966	13.2650		1906.4	51.7554	14.5209
1907.6	39.7313	13.4216		1907.6	51.9541	14.4734
1908.8	39.5502	13.2423		1908.8	51.8869	14.4345
1910.0	39.6840	13.3611		1910.0	51.8456	14.5579

2535 MHz Head				2535 MHz Body		
Frequency (MHz)	e'	e''		Frequency (MHz)	e'	e''
2500.0	39.5659	13.2439		2500.0	51.7378	14.2914
2501.5	39.6846	13.2686		2501.5	51.7339	14.2302
2503.0	39.6477	13.3006		2503.0	51.9125	14.2747
2504.5	39.6586	13.4271		2504.5	51.9708	14.2980
2506.0	39.6285	13.3801		2506.0	51.8515	14.3264
2507.5	39.5586	13.4077		2507.5	51.9116	14.2320
2509.0	39.5725	13.4286		2509.0	52.0705	14.2151
2510.5	39.6202	13.4167		2510.5	51.9469	14.2436
2512.0	39.5804	13.3004		2512.0	51.8219	14.3143
2513.5	39.6642	13.2499		2513.5	51.9316	14.2248
2515.0	39.5780	13.3781		2515.0	51.9617	14.2410
2516.5	39.7259	13.4336		2516.5	51.9600	14.2666
2518.0	39.5573	13.3164		2518.0	52.0771	14.2450
2519.5	39.6491	13.3362		2519.5	51.8457	14.3111
2521.0	39.6475	13.3762		2521.0	51.9994	14.2825
2522.5	39.6607	13.3727		2522.5	52.0062	14.2616
2524.0	39.7369	13.3892		2524.0	51.7965	14.3591
2525.5	39.7173	13.2968		2525.5	52.0474	14.2849
2527.0	39.5738	13.2664		2527.0	52.0292	14.3436
2528.5	39.6293	13.4264		2528.5	51.8875	14.2199
2530.0	39.6966	13.4121		2530.0	52.0613	14.2226
2531.5	39.7376	13.3200		2531.5	51.7609	14.3204
2533.0	39.5740	13.3332		2533.0	51.8946	14.3768
2534.5	39.6235	13.3298		2534.5	51.8666	14.2778
2536.0	39.6696	13.2738		2536.0	51.9079	14.2928
2537.5	39.6573	13.3785		2537.5	51.8871	14.2992
2539.0	39.5543	13.3016		2539.0	51.9237	14.2135
2540.5	39.7062	13.3933		2540.5	51.9281	14.2748
2542.0	39.6840	13.2997		2542.0	51.9894	14.3475
2543.5	39.5516	13.3643		2543.5	51.8968	14.3372
2545.0	39.6307	13.2928		2545.0	51.9694	14.3262
2546.5	39.6455	13.2674		2546.5	51.8173	14.2603
2548.0	39.6912	13.2423		2548.0	52.0194	14.2882
2549.5	39.5558	13.2714		2549.5	51.8741	14.2183
2551.0	39.6009	13.3495		2551.0	51.8552	14.3022
2552.5	39.6760	13.2520		2552.5	51.9703	14.3760
2554.0	39.6634	13.2783		2554.0	51.8024	14.3165
2555.5	39.6833	13.4073		2555.5	51.7456	14.2765
2557.0	39.5474	13.3991		2557.0	51.9411	14.3787
2558.5	39.6725	13.2622		2558.5	52.0597	14.3471
2560.0	39.6069	13.2783		2560.0	51.7555	14.3010
2561.5	39.6581	13.3105		2561.5	51.9973	14.3781
2563.0	39.5838	13.3537		2563.0	51.8034	14.2312
2564.5	39.6282	13.3177		2564.5	51.7747	14.2416
2566.0	39.5797	13.2646		2566.0	51.7686	14.2747
2567.5	39.7241	13.3511		2567.5	51.7923	14.2129
2569.0	39.6082	13.3875		2569.0	51.9259	14.2948
2570.5	39.7334	13.3279		2570.5	51.9496	14.2561
2572.0	39.7025	13.4266		2572.0	51.8807	14.2976
2573.5	39.6206	13.4118		2573.5	51.8643	14.2876
2575.0	39.5707	13.4166		2575.0	51.8859	14.3207

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	2015-10-14
APREL	Dipole antenna(835MHz)	ALS-D-835-S-2	180-00558	2014-10-08	2017-10-08
APREL	Dipole antenna(1900MHz)	ALS-D-1900-S-2	210-00710	2014-10-09	2017-10-09
APREL	Dipole antenna(2450MHz)	ALS-D-2450-S-2	220-00758	2014-10-09	2017-10-09

System Accuracy Check Results:

Date	Frequency Band	Liquid Type	Measured SAR (W/Kg)		Target Value (W/Kg)	Delta (%)	Tolerance (%)
2015-10-06	835	Head	1g	9.736	9.773	-0.379	±10
		Body	1g	9.850	9.736	1.171	±10
	1900	Head	1g	39.430	39.481	-0.129	±10
		Body	1g	40.976	39.715	3.175	±10
	2450	Head	1g	51.696	54.916	-5.864	±10
		Body	1g	52.966	52.418	1.045	±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 835 MHz Head Liquid

Dipole 835 MHz; Type: ALS-D-835-S-2; S/N: 180-00558

Product Data
Device Name : Dipole 835 MHz
Serial No. : 180-00558
Type : Dipole
Model : ALS-D-835-S-2
Frequency Band : 835
Max. Transmit Pwr : 1 W
Drift Time : 3 min(s)
Power Drift-Start : 9.823 W/kg
Power Drift-Finish : 9.536 W/kg
Power Drift (%) : -3.839

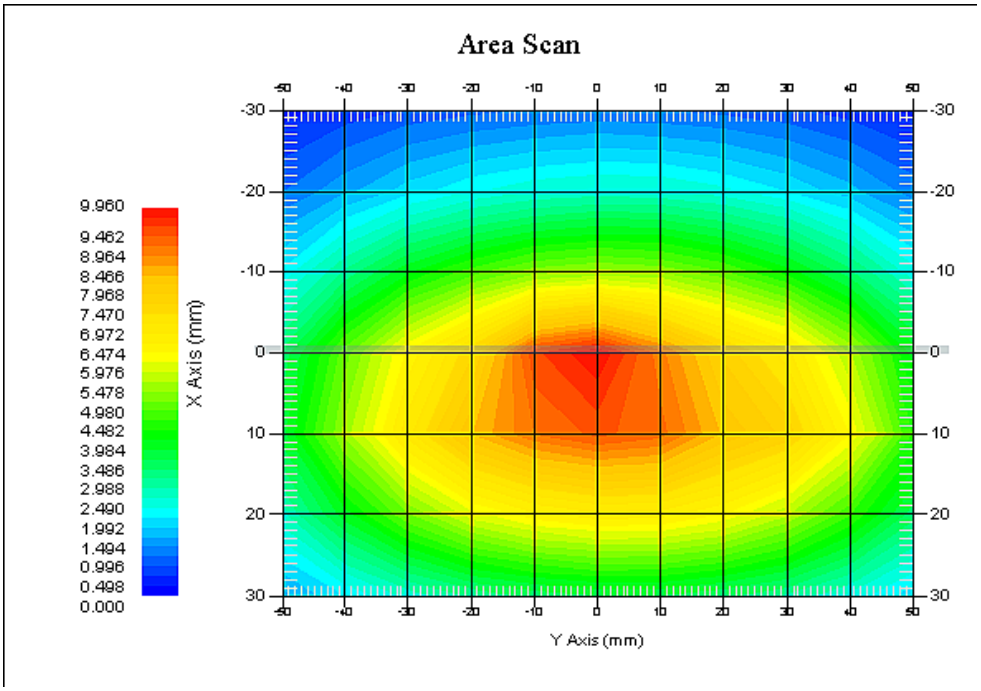
Phantom Data
Name : APREL-Uni
Type : Uni-Phantom
Serial No. : System Default
Location : Center
Description : Default
Phantom Data

Tissue Data
Type : Head
Serial No. : 270-01002
Frequency : 835.0 MHz
Last Calib. Date : 06-Oct-2015
Temperature : 20.00 °C
Ambient Temp. : 21.00 °C
Humidity : 56.00 RH%
Epsilon : 41.03 F/m
Sigma : 0.91 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 : 835
Duty Cycle Factor : 1
Conversion Factor : 5.9
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 : 9.736 W/kg
10 gram SAR value : 6.416 W/kg
Area Scan Peak SAR : 9.948 W/kg
Zoom Scan Peak SAR : 15.722 W/kg



835 MHz System Validation with Head Tissue

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

System Performance Check 835 MHz Body Liquid

Dipole 835 MHz; Type: ALS-D-835-S-2; S/N: 180-00558

Product Data
Device Name : Dipole 835 MHz
Serial No. : 180-00558
Type : Dipole
Model : ALS-D-835-S-2
Frequency Band : 835
Max. Transmit Pwr : 1 W
Drift Time : 3 min(s)
Power Drift-Start : 9.315 W/kg
Power Drift-Finish : 9.128 W/kg
Power Drift (%) : -2.037

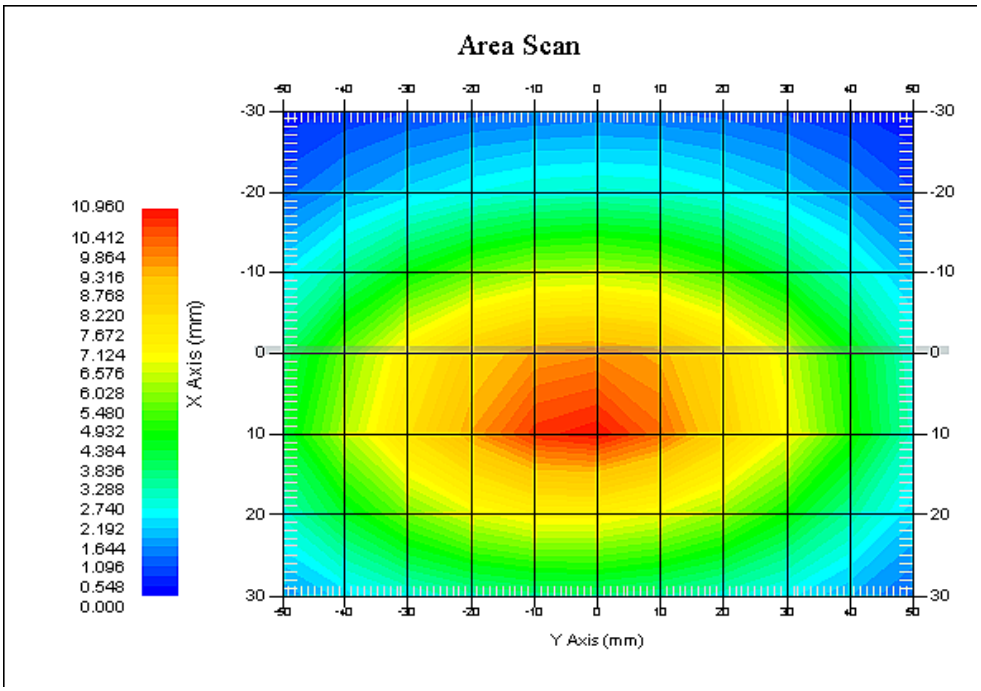
Phantom Data
Name : APREL-Uni
Type : Uni-Phantom
Serial No. : System Default
Location : Center
Description : Default
Phantom Data

Tissue Data
Type : Body
Serial No. : 270-02101
Frequency : 835.0 MHz
Last Calib. Date : 06-Oct-2015
Temperature : 20.00 °C
Ambient Temp. : 21.00 °C
Humidity : 56.00 RH%
Epsilon : 53.81 F/m
Sigma : 0.96 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 : 835
Duty Cycle Factor : 1
Conversion Factor : 5.9
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 : 9.850 W/kg
10 gram SAR value : 6.406 W/kg
Area Scan Peak SAR : 10.929 W/kg
Zoom Scan Peak SAR : 17.208 W/kg



835 MHz System Validation with Body Tissue

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

System Performance Check 1900 MHz Head Liquid

Dipole 1900 MHz; Type: ALS-D-1900-S-2; S/N: 210-00710

Product Data
Device Name : Dipole 1900MHz
Serial No. : 210-00710
Type : Dipole
Model : ALS-D-1900-S-2
Frequency Band : 1900
Max. Transmit Pwr : 1 W
Drift Time : 3 min(s)
Power Drift-Start : 39.226 W/kg
Power Drift-Finish : 39.886 W/kg
Power Drift (%) : 1.509

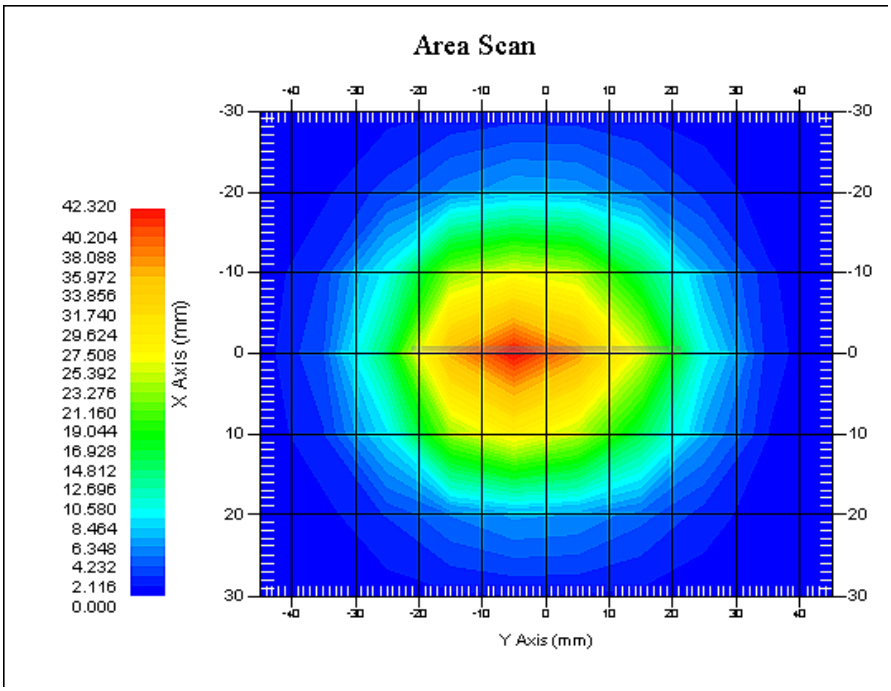
Phantom Data
Name : APREL-Uni
Type : Uni-Phantom
Serial No. : System Default
Location : Center
Description : Default

Tissue Data
Type : Head
Serial No. : 295-01103
Frequency : 1900.00 MHz
Last Calib. Date : 06-Oct-2015
Temperature : 20.00 °C
Ambient Temp. : 21.00 °C
Humidity : 56.00 RH%
Epsilon : 39.56 F/m
Sigma : 1.40 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 : 1900
Duty Cycle Factor : 1
Conversion Factor : 4.8
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. : 20.00 °C
Ambient Temp. : 20.00 °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 : 39.430 W/kg
10 gram SAR value : 20.406 W/kg
Area Scan Peak SAR : 42.308 W/kg
Zoom Scan Peak SAR : 67.272 W/kg



1900 MHz System Validation with Head Tissue

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

System Performance Check 1900 MHz Body Liquid

Dipole 1900 MHz; Type: ALS-D-1900-S-2; S/N: 210-00710

Product Data
Device Name : Dipole 1900MHz
Serial No. : 210-00710
Type : Dipole
Model : ALS-D-1900-S-2
Frequency Band : 1900
Max. Transmit Pwr : 1 W
Drift Time : 3 min(s)
Power Drift-Start : 40.403 W/kg
Power Drift-Finish : 40.912 W/kg
Power Drift (%) : 1.263

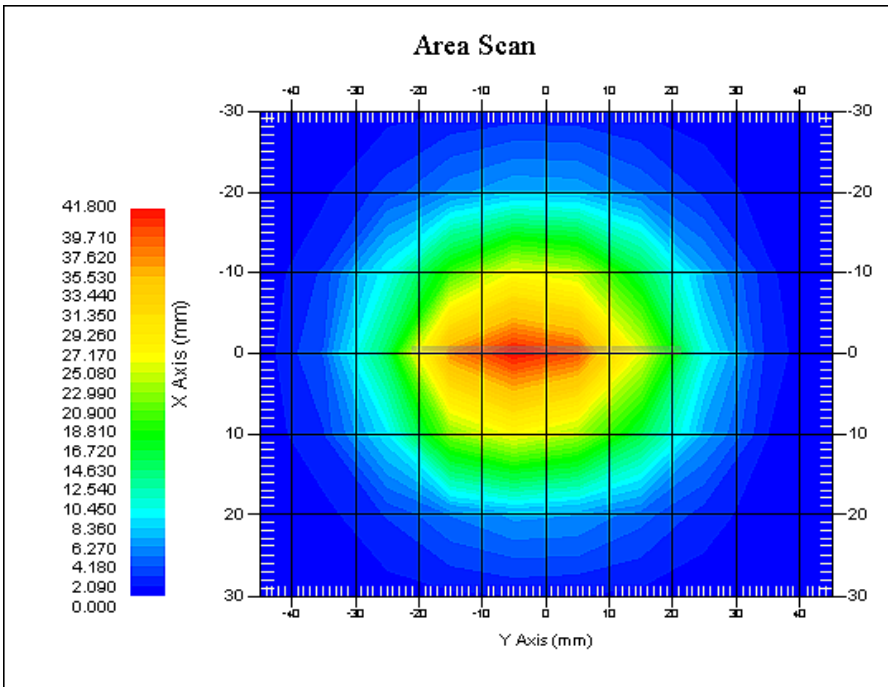
Phantom Data
Name : APREL-Uni
Type : Uni-Phantom
Serial No. : System Default
Location : Center
Description : Default

Tissue Data
Type : Body
Serial No. : 295-02102
Frequency : 1900.00 MHz
Last Calib. Date : 06-Oct-2015
Temperature : 20.00 °C
Ambient Temp. : 21.00 °C
Humidity : 56.00 RH%
Epsilon : 51.88 F/m
Sigma : 1.53 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 : 1900
Duty Cycle Factor : 1
Conversion Factor : 4.5
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. : 20.00 °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 : 40.976 W/kg
10 gram SAR value : 21.353 W/kg
Area Scan Peak SAR : 41.772 W/kg
Zoom Scan Peak SAR : 73.560 W/kg



1900 MHz System Validation with Body Tissue

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

System Performance Check 2450 MHz Head Liquid

Dipole 2450 MHz; Type: ALS-D-2450-S-2; S/N: 220-00758

Product Data
Device Name : Dipole 2450MHz
Serial No. : 220-00758
Type : Dipole
Model : ALS-D-2450-S-2
Frequency Band : 2450 MHz
Max. Transmit Pwr : 1 W
Drift Time : 3 min(s)
Power Drift-Start : 48.374 W/kg
Power Drift-Finish : 49.269 W/kg
Power Drift (%) : 1.736

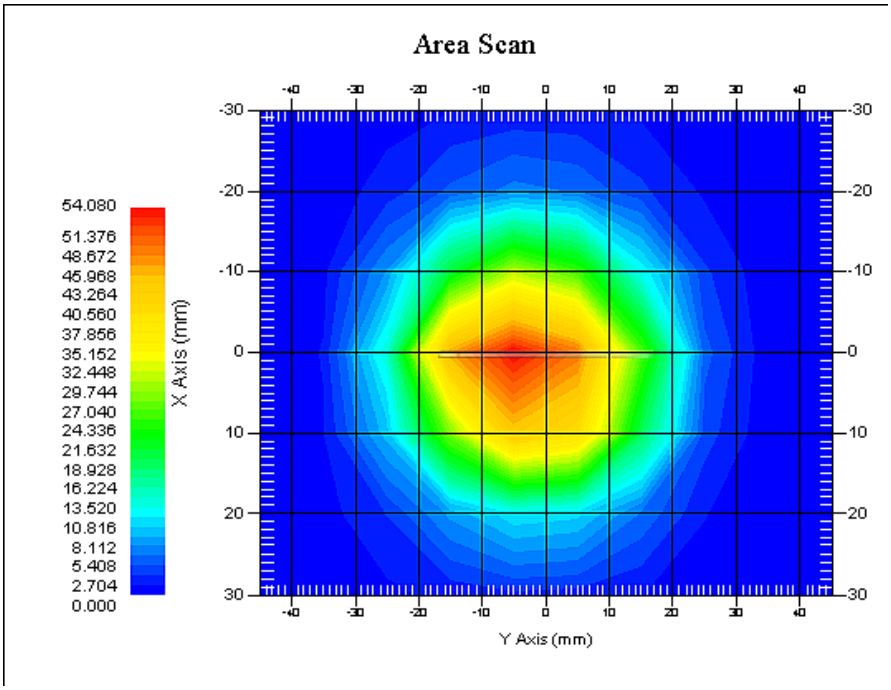
Phantom Data
Name : APREL-Uni
Type : Uni-Phantom
Serial No. : System Default
Location : Center
Description : Default

Tissue Data
Type : Head
Serial No. : 290-01109
Frequency : 2450.0 MHz
Last Calib. Date : 06-Oct-2015
Temperature : 20.00 °C
Ambient Temp. : 21.00 °C
Humidity : 50.00 RH%
Epsilon : 39.61 F/m
Sigma : 1.80 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 : 2450 MHz
Duty Cycle Factor : 1
Conversion Factor : 4.3
Probe Sensitivity : 1.20 1.20 1.20 $\mu V/(V/m)^2$
Compression Point : 95.00 mV
Offset : 1.56 mm

Measurement Data
Crest Factor : 1
Scan Type : Complete
Tissue Temp. : 20.00 °C
Ambient Temp. : 20.00 °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 : 51.696 W/kg
10 gram SAR value : 22.718 W/kg
Area Scan Peak SAR : 54.025 W/kg
Zoom Scan Peak SAR : 92.689 W/kg



2450 MHz System Validation with Head Tissue

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

System Performance Check 2450 MHz Body Liquid

Dipole 2450 MHz; Type: ALS-D-2450-S-2; S/N: 220-00758

Product Data
Device Name : Dipole 2450MHz
Serial No. : 220-00758
Type : Dipole
Model : ALS-D-2450-S-2
Frequency Band : 2450 MHz
Max. Transmit Pwr : 1 W
Drift Time : 3 min(s)
Power Drift-Start : 54.355 W/kg
Power Drift-Finish : 52.986 W/kg
Power Drift (%) : 2.367

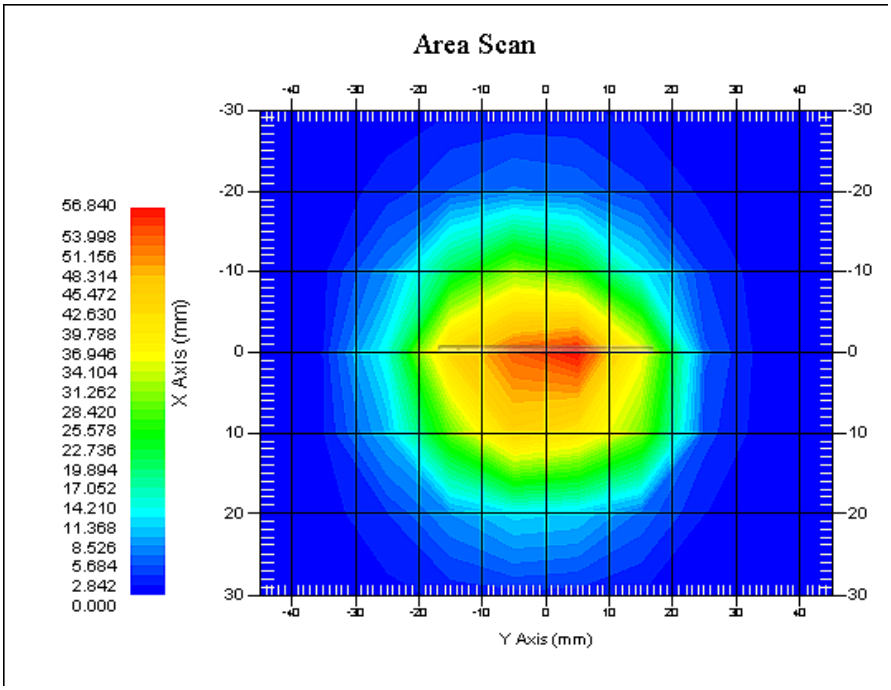
Phantom Data
Name : APREL-Uni
Type : Uni-Phantom
Serial No. : System Default
Location : Center
Description : Default

Tissue Data
Type : BODY
Serial No. : 290-01109
Frequency : 2450.0 MHz
Last Calib. Date : 06-Oct-2015
Temperature : 20.00 °C
Ambient Temp. : 21.00 °C
Humidity : 50.00 RH%
Epsilon : 51.74 F/m
Sigma : 1.90 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 : 2450 MHz
Duty Cycle Factor : 1
Conversion Factor : 4.3
Probe Sensitivity : 1.20 1.20 1.20 $\mu V/(V/m)^2$
Compression Point : 95.00 mV
Offset : 1.56 mm

Measurement Data
Crest Factor : 1
Scan Type : Complete
Tissue Temp. : 20.00 °C
Ambient Temp. : 20.00 °C
Area Scan : 8x9x1 : Measurement x=10mm, y=10mm, z=4mm
Zoom Scan : 7x7x7 : Measurement x=5mm, y=5mm, z=5mm

1 gram SAR value : 52.966 W/kg
10 gram SAR value : 23.711 W/kg
Area Scan Peak SAR : 56.655 W/kg
Zoom Scan Peak SAR : 95.396 W/kg



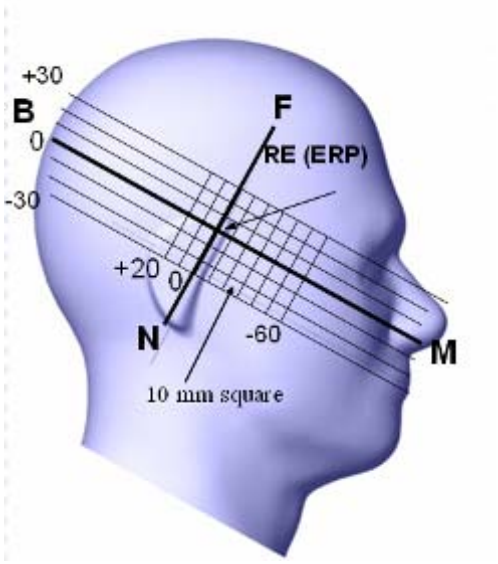
2450 MHz System Validation with Body Tissue

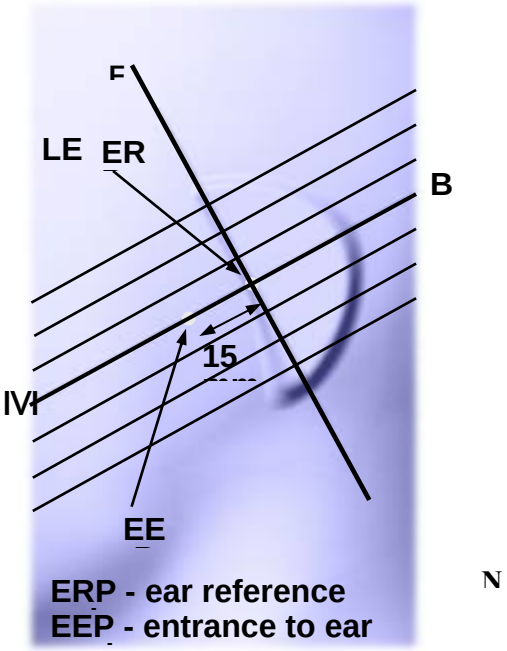
EUT TEST STRATEGY AND METHODOLOGY

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

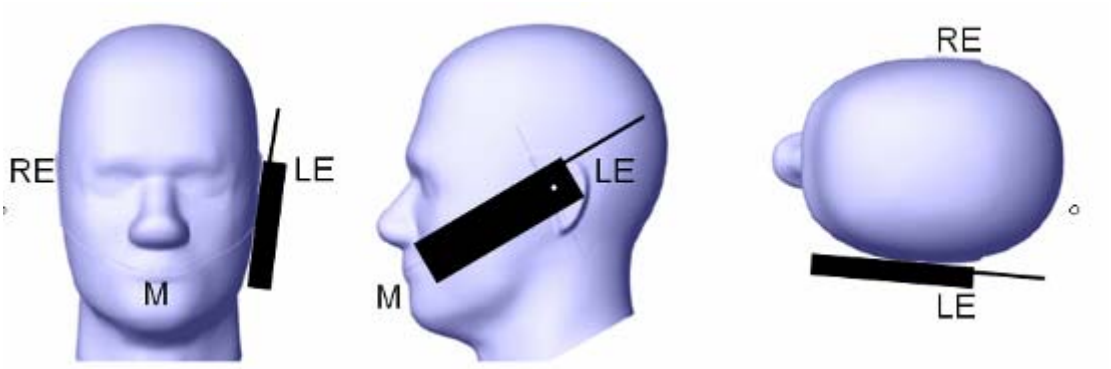
The device is brought toward the mouth of the head phantom by pivoting against the "ear reference point" or along the "N-F" line for the SCC-34/SC-2 head phantom.

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

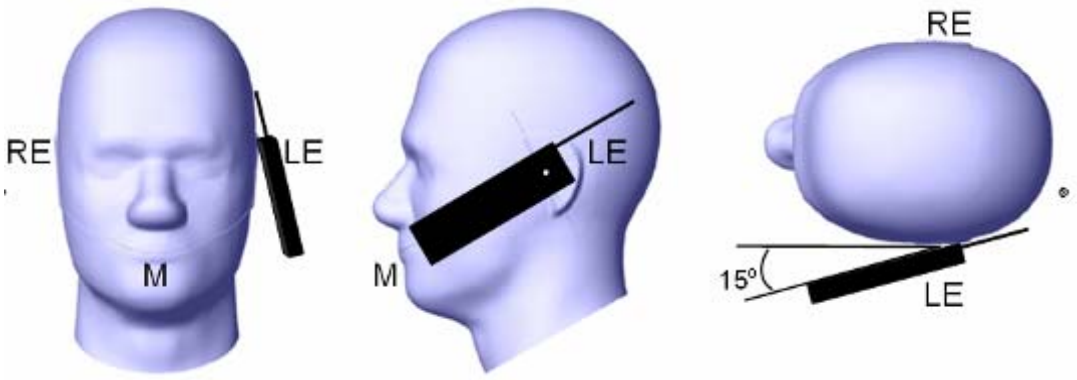
With the handset aligned in the "Cheek/Touch Position":

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.

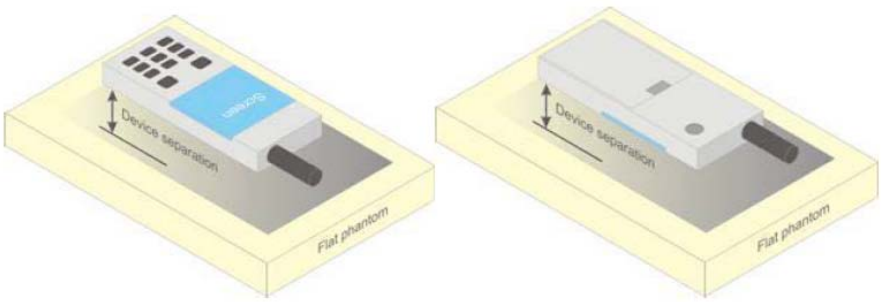


Figure 5 – Test positions for body-worn devices

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
KDB 616217 D04 SAR for laptop and tablets v01r01

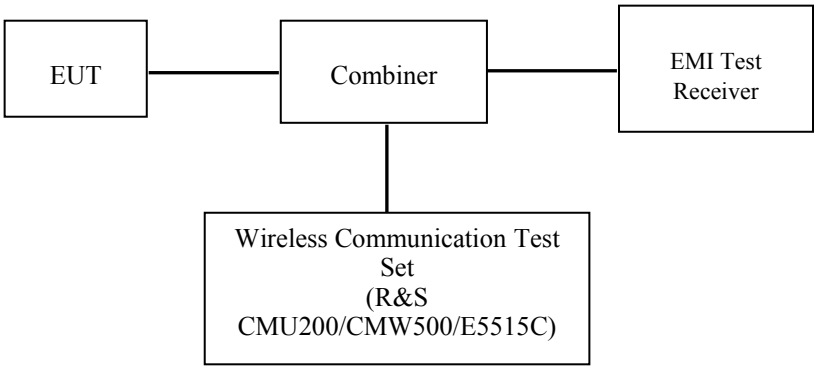
CONDUCTED OUTPUT POWER MEASUREMENT

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/WCDMA/LTE

Radio Configuration

The power measurement was configured by the Wireless Communication Test Set CMU200 & CMW500 for all Radio configurations except the HSPA+/DC-HSDPA configured by E5515C..

GSM

Function: Menu select > GSM Mobile Station > GSM 850/1900
Press Connection control to choose the different menus
Press RESET > choose all the reset all settings
Connection: Press Signal Off to turn off the signal and change settings
Network Support > GSM + only
MS Signal
> 33 dBm for GSM 850
> 30 dBm for PCS 1900
BS Signal:Enter the same channel number for TCH channel (test channel) and BCCH channel
Frequency Offset >+ 0 Hz
Mode > BCCH and TCH
BCCH Level > -85 dBm (May need to adjust if link is not stabe)
BCCH Channel >choose desire test channel [Enter the same channel number for TCH channel (test channel) and BCCH channel]
Channel Type > Off
P0 > 4 dB
TCH > choose desired test channel
Hopping >Off
AF/RF: Enter appropriate offsets for Ext. Att. Output and Ext. Att. Input
Connection: Press Signal on to turn on the signal and change settings

GPRS

Function: Menu select > GSM Mobile Station > GSM 850/1900
Press Connection control to choose the different menus
Press RESET > choose all the reset all settings
Connection:Press Signal Off to turn off the signal and change settings
Network Support > GSM + GPRS or GSM + EGSM
Main Service > Packet Data

Service selection > Test Mode A – Auto Slot Config. off
MS Signal:Press Slot Config Bottom on the right twice to select and change the number of time slots and power setting
> Slot configuration > Uplink/Gamma
> 33 dBm for GPRS 850
> 30 dBm for GPRS 1900
BS Signal: Enter the same channel number for TCH channel (test channel) and BCCH channel
Frequency Offset >+ 0 Hz
Mode >BCCH and TCH
BCCH Level >-85 dBm (May need to adjust if link is not stabe)
BCCH Channel > choose desire test channel [Enter the same channel number for TCH channel (test channel) and BCCH channel]

Channel Type > Off
P0 > 4 dB
Slot Config > Unchanged (if already set under MS signal)
TCH > choose desired test channel
Hopping >Off
Main Timeslot >3
Network:Coding Scheme >CS4 (GPRS)
Bit Stream >2E9-1 PSR Bit Stream
AF/RF: Enter appropriate offsets for Ext. Att. Output and Ext. Att. Input
Connection: Press Signal on to turn on the signal and change settings

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

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			
	β c	2/15	12/15	15/15	15/15
	β d	15/15	15/15	8/15	4/15
	β d (SF)	64			
	β c/ β d	2/15	12/15	15/8	15/4
	β hs	4/15	24/15	30/15	30/15
	MPR(dB)	0	0	0.5	0.5
HSDPA Specific Settings	DACK	8			
	DNAK	8			
	DCQI	8			
	Ack-Nack repetition factor	3			
	CQI Feedback	4ms			
	CQI Repetition Factor	2			
	Ahs= β hs/ β c	30/15			

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_FCIs	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	$\beta_{ed}1$: 30/15 $\beta_{ed}2$: 30/15	$\beta_{ed}3$: 24/15 $\beta_{ed}4$: 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.

LTE

For UE Power Class 1 and 3, the allowed Maximum Power Reduction (MPR) for the maximum output power in Table 6.2.2-1due to higher order modulation and transmit bandwidth configuration (resource blocks) is specified in Table 6.2.3-1.

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

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

For UE Power Class 1 and 3 the specific requirements and identified subclauses are specified in Table 6.2.4-1 along with the allowed A-MPR values that may be used to meet these requirements. The allowed A-MPR values specified below in Table 6.2.4.-1 to 6.2.4-15 are in addition to the allowed MPR requirements specified in subclause 6.2.3.

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

Network Signalling value	Requirements (subclause)	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	N/A
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	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	
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	
NS_11	6.6.2.2.1	23	1.4, 3, 5, 10, 15, 20	Table 6.2.4-5	
NS_12	6.6.3.3.5	26	1.4, 3, 5	Table 6.2.4-6	
NS_13	6.6.3.3.6	26	5	Table 6.2.4-7	
NS_14	6.6.3.3.7	26	10, 15	Table 6.2.4-8	
NS_15	6.6.3.3.8	26	1.4, 3, 5, 10, 15	Table 6.2.4-9 Table 6.2.4-10	
NS_16	6.6.3.3.9	27	3, 5, 10	Table 6.2.4-11, Table 6.2.4-12, Table 6.2.4-13	
NS_17	6.6.3.3.10	28	5, 10	Table 5.6-1	N/A
NS_18	6.6.3.3.11	28	5	≥ 2	≤ 1
			10, 15, 20	≥ 1	≤ 4
NS_19	6.6.3.3.12	44	10, 15, 20	Table 6.2.4-14	
NS_20	6.2.2 6.6.2.2.1 6.6.3.2	23	5, 10, 15, 20	Table 6.2.4-15	
...					
NS_32	-	-	-	-	-

Maximum Output Power among production units

Max Target Power for Production Unit (dBm)				
Mode/Band		Channel		
		Low	Middle	High
GSM 850		32.20	32.20	32.20
GPRS 1 TX Slot		32.00	32.00	32.00
GPRS 2 TX Slot		30.60	30.60	30.60
GPRS 3 TX Slot		29.10	29.10	29.10
GPRS 4 TX Slot		28.00	28.00	28.00
EDGE 1 TX Slot		26.30	26.30	26.30
EDGE 2 TX Slot		24.80	24.80	24.80
EDGE 3 TX Slot		23.70	23.70	23.70
EDGE 4 TX Slot		22.30	22.30	22.30
PCS 1900		29.20	29.20	29.20
GPRS 1 TX Slot		29.20	29.20	29.20
GPRS 2 TX Slot		27.70	27.70	27.70
GPRS 3 TX Slot		26.40	26.40	26.40
GPRS 4 TX Slot		25.20	25.20	25.20
EDGE 1 TX Slot		25.00	25.00	25.00
EDGE 2 TX Slot		23.80	23.80	23.80
EDGE 3 TX Slot		22.60	22.60	22.60
EDGE 4 TX Slot		21.00	21.00	21.00
WCDMA 850	RMC	20.50	20.50	20.50
	HSDPA	19.60	19.60	19.60
	HSUPA	19.50	19.50	19.50
	DC-HSDPA	19.50	19.50	19.50
	HSPA+	19.20	19.20	19.20
WCDMA 1900	RMC	20.80	20.80	20.80
	HSDPA	19.80	19.80	19.80
	HSUPA	19.50	19.50	19.50
	DC-HSDPA	19.40	19.40	19.40
	HSPA+	19.10	19.10	19.10
LTE Band 7		19.90	19.90	19.90
Wi-Fi(b/g/n20)		9.70	9.70	9.70
Wi-Fi(n40)		9.70	9.70	9.70
Bluetooth3.0		7.30	7.30	7.30
BLE		-0.20	-0.20	-0.20

Test Results:

GSM:

Band	Channel No.	Frequency (MHz)	Conducted Output Power	
			Meas. Power (dBm)	Meas. Power (W)
GSM 850	128	824.2	31.47	1.403
	190	836.6	31.53	1.422
	251	848.8	**32.15**	1.641
PCS 1900	512	1850.2	29.13	0.818
	661	1880.0	29.00	0.794
	810	1909.8	**29.16**	0.824

GPRS:

Band	Channel No.	Frequency (MHz)	RF Output Power (dBm)			
			1 slot	2 slot	3 slots	4 slots
GSM 850	128	824.2	31.27	29.73	28.40	27.09
	190	836.6	31.17	29.86	28.38	27.14
	251	848.8	31.97	30.57	29.04	27.92
PCS 1900	512	1850.2	29.13	27.62	26.37	24.99
	661	1880.0	28.81	27.33	26.38	24.88
	810	1909.8	28.90	27.65	26.27	25.14

EGPRS:

Band	Channel No.	Frequency (MHz)	RF Output Power (dBm)			
			1 slot	2 slot	3 slots	4 slots
GSM 850	128	824.2	25.98	24.45	23.08	21.94
	190	836.6	26.22	24.62	23.27	22.22
	251	848.8	26.22	24.75	23.67	22.27
PCS 1900	512	1850.2	24.37	23.06	21.71	20.28
	661	1880.0	24.98	23.75	22.52	20.92
	810	1909.8	24.60	23.23	21.89	20.45

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	22.27	23.73	24.15	24.09
	190	836.6	22.17	23.86	24.13	24.14
	251	848.8	22.97	24.57	24.79	**24.92**
PCS 1900	512	1850.2	20.13	21.62	22.12	21.99
	661	1880.0	19.81	21.33	22.13	21.88
	810	1909.8	19.90	21.65	22.02	**22.14**

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	16.98	18.45	18.83	18.94
	190	836.6	17.22	18.62	19.02	19.22
	251	848.8	17.22	18.75	**19.42**	19.27
PCS 1900	512	1850.2	15.37	17.06	17.46	17.28
	661	1880.0	15.98	17.75	**18.27**	17.92
	810	1909.8	15.60	17.23	17.64	17.45

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 KDB941225D01-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 850

Test Condition	Test Mode	3GPP Sub Test	Averaged Mean Power (dBm)		
			Low Frequency	Mid Frequency	High Frequency
Normal	RMC12.2k		20.38	20.13	**20.43**
	HSDPA	1	19.32	19.29	19.56
		2	19.18	19.11	19.39
		3	19.37	19.15	19.54
		4	19.22	19.10	19.42
	HSUPA	1	19.20	19.16	19.43
		2	19.20	19.01	19.44
		3	19.23	19.13	19.33
		4	19.36	18.96	19.34
		5	19.28	19.08	19.35
	DC-HSDPA	1	19.33	18.97	19.37
		2	19.28	19.14	19.38
		3	19.41	19.13	19.31
		4	19.37	18.96	19.33
	HSPA+ (16QAM)	1	19.10	18.81	18.99

WCDMA 1900

Test Condition	Test Mode	3GPP Sub Test	Averaged Mean Power (dBm)		
			Low Frequency	Mid Frequency	High Frequency
Normal	RMC12.2k		**20.71**	20.22	20.15
	HSDPA	1	19.74	19.27	19.19
		2	19.62	19.33	19.08
		3	19.65	19.18	19.02
		4	19.63	19.26	19.05
	HSUPA	1	19.49	19.32	19.08
		2	19.46	19.28	18.91
		3	19.48	19.28	18.85
		4	19.45	19.22	19.01
		5	19.49	19.17	19.06
	DC-HSDPA	1	19.36	19.14	18.95
		2	19.24	19.17	19.04
		3	19.29	19.09	18.77
		4	19.25	19.00	18.79
	HSPA+ (16QAM)	1	19.02	18.80	18.64

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/HSUPA/DC-HSDPA/HSPA+ when the maximum average output of each RF channel is less than ¼ dB higher than measured 12.2kbps RMC or the maximum SAR for 12.2kbps RMC is < 75% of SAR limit.

LTE Band 7:

BW	Modulation	Resource Block Size& Resource Block Offset	Target MPR	Meas MPR	Ave Tx Power (dBm)		
					Low Channel	Mid Channel	High Channel
					2502.5MHz	2535MHz	2567.5MHz
5M	QPSK	RB Size=1, RB Offset=0	0	0	19.54	19.63	19.31
		RB Size=1, RB Offset=12	0	0	19.63	19.54	19.22
		RB Size=1, RB Offset=24	0	0	19.44	19.73	19.21
		RB Size=12, RB Offset=0	1	1	18.97	18.86	18.73
		RB Size=12, RB Offset=6	1	1	18.91	18.78	18.63
		RB Size=12, RB Offset=11	1	1	19.02	18.89	18.49
		RB Size=25, RB Offset=0	1	1	18.56	18.19	18.21
	16QAM	RB Size=1, RB Offset=0	1	1	19.08	18.80	18.92
		RB Size=1, RB Offset=12	1	1	19.02	18.73	18.73
		RB Size=1, RB Offset=24	1	1	19.04	18.80	18.82
		RB Size=12, RB Offset=0	2	2	18.18	18.19	17.93
		RB Size=12, RB Offset=6	2	2	18.02	18.12	17.98
		RB Size=12, RB Offset=11	2	2	17.99	18.04	17.99
		RB Size=25, RB Offset=0	2	2	17.50	17.70	17.48
BW	Modulation	Resource Block Size& Resource Block Offset	Target MPR	Meas MPR	Ave Tx Power (dBm)		
					Low Channel	Mid Channel	High Channel
					2505MHz	2535MHz	2565MHz
10M	QPSK	RB Size=1, RB Offset=0	0	0	19.66	19.81	19.30
		RB Size=1, RB Offset=24	0	0	19.75	19.71	19.23
		RB Size=1, RB Offset=49	0	0	19.45	19.83	19.47
		RB Size=25, RB Offset=0	1	1	18.77	18.79	18.63
		RB Size=25, RB Offset=12	1	1	18.77	18.73	18.62
		RB Size=25, RB Offset=24	1	1	18.76	18.83	18.73
		RB Size=50, RB Offset=0	1	1	18.52	18.19	18.39
	16QAM	RB Size=1, RB Offset=0	1	1	19.03	18.79	18.86
		RB Size=1, RB Offset=24	1	1	18.98	18.67	18.89
		RB Size=1, RB Offset=49	1	1	18.84	18.76	18.86
		RB Size=25, RB Offset=0	2	2	18.19	17.92	17.98
		RB Size=25, RB Offset=12	2	2	18.20	17.91	18.08
		RB Size=25, RB Offset=24	2	2	18.08	17.87	17.86
		RB Size=50, RB Offset=0	2	2	17.52	17.49	17.50
BW	Modulation	Resource Block Size& Resource Block Offset	Target MPR	Meas MPR	Ave Tx Power (dBm)		
					Low Channel	Mid Channel	High Channel
					2507.5MHz	2535MHz	2562.5MHz
15M	QPSK	RB Size=1, RB Offset=0	0	0	19.72	19.82	19.43
		RB Size=1, RB Offset=37	0	0	19.70	19.97	19.24
		RB Size=1, RB Offset=74	0	0	19.61	19.88	19.39

		RB Size=36, RB Offset=0	1	1	18.88	18.97	18.51
		RB Size=36, RB Offset=18	1	1	18.59	19.02	18.52
		RB Size=36, RB Offset=37	1	1	18.87	19.06	18.65
		RB Size=75, RB Offset=0	1	1	18.50	18.15	18.14
	16QAM	RB Size=1, RB Offset=0	1	1	18.94	18.86	18.63
		RB Size=1, RB Offset=37	1	1	18.83	18.76	18.65
		RB Size=1, RB Offset=74	1	1	18.89	18.95	18.57
		RB Size=36, RB Offset=0	2	2	18.04	18.03	18.11
		RB Size=36, RB Offset=18	2	2	18.06	18.07	18.18
		RB Size=36, RB Offset=37	2	2	18.11	17.92	17.91
		RB Size=75, RB Offset=0	2	2	17.40	17.50	17.23
BW	**Modulation**	**Resource Block Size& Resource Block Offset**	**Target MPR**	**Meas MPR**	**Ave Tx Power (dBm)**		
					Low Channel	**Mid Channel**	**High Channel**
					2510MHz	2535MHz	2560MHz
20M	QPSK	RB Size=1, RB Offset=0	0	0	19.56	19.73	19.23
		RB Size=1, RB Offset=49	0	0	19.74	19.73	19.39
		RB Size=1, RB Offset=99	0	0	19.63	**19.83**	19.23
		RB Size=50, RB Offset=0	1	1	19.02	18.78	18.49
		RB Size=50, RB Offset=24	1	1	19.02	18.92	18.38
		RB Size=50, RB Offset=49	1	1	18.97	18.78	18.36
		RB Size=100, RB Offset=0	1	1	18.33	18.26	18.42
	16QAM	RB Size=1, RB Offset=0	1	1	19.00	18.90	18.39
		RB Size=1, RB Offset=49	1	1	18.73	18.86	18.56
		RB Size=1, RB Offset=99	1	1	19.05	19.03	18.55
		RB Size=50, RB Offset=0	2	2	18.07	18.03	17.77
		RB Size=50, RB Offset=24	2	2	18.01	18.07	17.94
		RB Size=50, RB Offset=49	2	2	17.96	18.00	17.80
		RB Size=100, RB Offset=0	2	2	17.54	17.49	17.41

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 No.	Frequency (MHz)	Conducted Output Power	
			(dBm)	(mW)
BDR(GFSK)	0	2402	3.69	2.339
	17	2419	6.46	4.426
	39	2441	4.48	2.805
	48	2450	**7.22**	5.272
	78	2480	4.46	2.793
EDR(4-DQPSK)	0	2402	2.45	1.758
	17	2419	5.14	3.266
	39	2441	3.47	2.223
	48	2450	5.94	3.926
	78	2480	3.33	2.153
EDR-8DPSK	0	2402	2.54	1.795
	17	2419	5.20	3.311
	39	2441	3.57	2.275
	48	2450	6.02	3.999
	78	2480	3.28	2.128
BLE	0	2402	-3.07	0.493
	9	2420	-1.01	0.793
	19	2440	-1.81	0.659
	24	2450	-0.23	0.948
	39	2480	-2.96	0.506

Wi-Fi

Band	Channel No.	Frequency (MHz)	Conducted Output Power	
			(dBm)	(mw)
802.11b	1	2412	9.27	8.453
	6	2437	9.20	8.318
	11	2462	9.29	8.492
802.11g	1	2412	9.52	8.954
	6	2437	9.38	8.670
	11	2462	9.35	8.610
802.11n HT20	1	2412	9.49	8.892
	6	2437	9.64	9.204
	11	2462	**9.67**	9.268
802.11n HT40	1	2422	9.60	9.120
	4	2437	9.39	8.690
	7	2452	9.56	9.036

Note:

1. The output power was tested under data rate 1Mbps for 802.11b, 6Mbps for 802.11g, 6.5Mbps for 802.11n HT20, 13.5Mbps for 802.11n HT40.

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 2015-10-06

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.

GSM 850

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-Headset-Back (0mm)	824.2	GSM	1.631	31.47	32.20	1.183	0.765	0.905	/
	836.6	GSM	-2.622	31.53	32.20	1.167	0.736	0.859	/
	848.8	GSM	-1.540	32.15	32.20	1.012	0.887	0.897	/
Body-Back (0mm)	824.2	GPRS	2.691	27.09	28.00	1.233	0.944	1.164	/
	836.6	GPRS	1.104	27.14	28.00	1.219	0.917	1.118	/
	848.8	GPRS	-1.436	27.92	28.00	1.019	1.175	**1.197**	**1#**
Body-Left (0mm)	824.2	GPRS	/	/	/	/	/	/	/
	836.6	GPRS	/	/	/	/	/	/	/
	848.8	GPRS	2.291	27.92	28.00	1.019	0.775	0.789	/
Body-Top (0mm)	824.2	GPRS	/	/	/	/	/	/	/
	836.6	GPRS	/	/	/	/	/	/	/
	848.8	GPRS	-0.928	27.92	28.00	1.019	0.569	0.580	/

Note:
1 .When the 1-g SAR is ≤ 0.8W/Kg, testing for other channels are optional.
2. According to IEEE 1528-2013, the middle channel is required to be tested first.
3. KDB 447498D01- When the maximum output power variation across the required test channels is > ½ dB, instead of the middle channel, the highest output power channel must be used.
4. The EUT is a Capability Class B mobile phone which can be attached to both GPRS and GSM services.
5. The Multi-slot Classes of EUT is Class12 which has maximum 4 Downlink slots and 4 Uplink slots, the maximum active slots is 5, when perform the multiple slots scan, 1DL+4UL is the worst case.
6. The EUT transmit and receive through the same GSM antenna while testing SAR.
7. When SAR or MPE is not measured at the maximum power level allowed for production units, the results must be scaled to the maximum tune-up tole rance limit according to the power applied to the individual channels tested to determine compliance.

PCS 1900

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-Headset-Back (0mm)	1850.2	GSM	/	/	/	/	/	/	/
	1880.0	GSM	-2.586	29.00	29.20	1.047	0.659	0.690	/
	1909.8	GSM	/	/	/	/	/	/	/
Body-Back (0mm)	1850.2	GPRS	1.987	24.99	25.20	1.050	1.077	**1.130**	**2#**
	1880.0	GPRS	2.345	24.88	25.20	1.076	0.869	0.935	/
	1909.8	GPRS	-1.982	25.14	25.20	1.014	1.102	1.117	/
Body- Left (0mm)	1850.2	GPRS	/	/	/	/	/	/	/
	1880.0	GPRS	-3.465	24.88	25.20	1.076	0.520	0.560	/
	1909.8	GPRS	/	/	/	/	/	/	/
Body-Top (0mm)	1850.2	GPRS	0.588	24.99	25.20	1.050	0.885	0.929	/
	1880.0	GPRS	-2.696	24.88	25.20	1.076	0.733	0.789	/
	1909.8	GPRS	2.441	25.14	25.20	1.014	0.912	0.925	/

Note:

1 .When the 1-g SAR is ≤ 0.8W/Kg, testing for other channels are optional.
2. According to IEEE 1528-2013, the middle channel is required to be tested first.
3. KDB 447498D01- When the maximum output power variation across the required test channels is > ½ dB, instead of the middle channel, the highest output power channel must be used.
4. The EUT is a Capability Class B mobile phone which can be attached to both GPRS and GSM services.
5. The Multi-slot Classes of EUT is Class12 which has maximum 4 Downlink slots and 4 Uplink slots, the maximum active slots is 5, when perform the multiple slots scan, 1DL+4UL is the worst case.
6. The EUT transmit and receive through the same GSM antenna while testing SAR.
7. When SAR or MPE is not measured at the maximum power level allowed for production units, the results must be scaled to the maximum tune-up tole rance limit according to the power applied to the individual channels tested to determine compliance.

WCDMA 850

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 (0mm)	826.4	RMC	0.869	20.38	20.50	1.028	0.882	0.907	/
	836.6	RMC	-1.586	20.13	20.50	1.089	0.944	**1.028**	**3#**
	846.6	RMC	-1.771	20.43	20.50	1.016	0.976	0.992	/
Body- Left (0mm)	826.4	RMC	/	/	/	/	/	/	/
	836.6	RMC	-2.111	20.13	20.50	1.089	0.610	0.664	/
	846.6	RMC	/	/	/	/	/	/	/
Body-Top (0mm)	826.4	RMC	/	/	/	/	/	/	/
	836.6	RMC	1.092	20.13	20.50	1.089	0.443	0.482	/
	846.6	RMC	/	/	/	/	/	/	/

WCDMA 1900

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 (0mm)	1852.4	RMC	-1.746	20.71	20.80	1.021	1.030	1.052	/
	1880.0	RMC	0.766	20.22	20.80	1.143	0.950	**1.086**	**4#**
	1907.6	RMC	-1.154	20.15	20.80	1.161	0.912	1.059	/
Body- Left (0mm)	1852.4	RMC	/	/	/	/	/	/	/
	1880.0	RMC	0.987	20.22	20.80	1.143	0.527	0.602	/
	1907.6	RMC	/	/	/	/	/	/	/
Body-Top (0mm)	1852.4	RMC	-2.979	20.71	20.80	1.021	0.893	0.912	/
	1880.0	RMC	2.034	20.22	20.80	1.143	0.828	0.946	/
	1907.6	RMC	3.323	20.15	20.80	1.161	0.746	0.866	/

Note:

1. When the 1-g SAR is ≤ 0.8W/Kg, testing for other channels are optional.
2. According to IEEE 1528-2013, the middle channel is required to be tested first.
3. KDB 447498D01- When the maximum output power variation across the required test channels is > ½ dB, instead of the middle channel, the highest output power channel must be used.
4. The default test configuration is to measure SA R with an established radio link between the EUT and a communication test set using a 12.2 kbps RMC (refere nce measurement Channel) Configured in Test Loop Model.
5. KDB 941225 D01-Body SAR is not required for HSDPA/HSUPA/DC-HSDPA/HSPA+ when the maximum average output of each RF channel is less than ¼ dB higher than measured 12.2kbps RMC or the maximum SAR for 12.2kbps RMC is < 75% of SAR limit.
6. When SAR or MPE is not measured at the maximum power level allowed for production units, the results must be scaled to the maximum tune-up tole rance limit according to the power applied to the individual channels tested to determine compliance.

LTE Band 7

EUT Position	Frequency (MHz)	Bandwith（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 (0mm)	2510	20	1RB, Offset=99	-1.737	19.63	19.90	1.064	0.965	1.027	/
	2535	20	1RB, Offset=99	1.619	19.83	19.90	1.016	1.127	**1.145**	**5#**/
	2560	20	1RB, Offset=99	-2.403	19.23	19.90	1.167	0.862	1.006	/
	2535	20	50%RB, Offset=49	0.738	18.78	19.90	1.294	0.811	1.050	/
Body- Left (0mm)	2510	20	1RB, Offset=99	/	/	/	/	/	/	/
	2535	20	1RB, Offset=99	1.496	19.83	19.90	1.016	0.533	0.542	/
	2560	20	1RB, Offset=99	/	/	/	/	/	/	/
	2535	20	50%RB, Offset=49	-0.661	18.78	19.90	1.294	0.385	0.498	/
Body-Top (0mm)	2510	20	1RB, Offset=99	-2.236	19.63	19.90	1.064	0.811	0.863	/
	2535	20	1RB, Offset=99	3.428	19.83	19.90	1.016	0.896	0.911	/
	2560	20	1RB, Offset=99	1.140	19.23	19.90	1.167	0.672	0.784	/
	2535	20	50%RB, Offset=49	-0.709	18.78	19.90	1.294	0.613	0.793	/

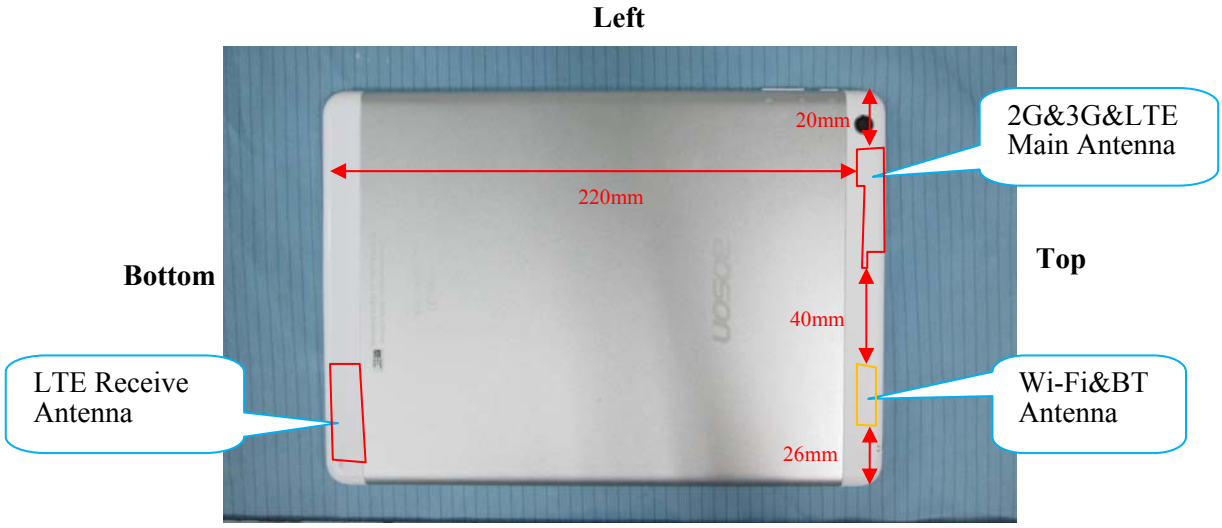
Note:

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 (20M) 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 LTE&GSM&3G Antennas Location:



Simultaneous Transmission:

Description of Simultaneous Transmit Capabilities			Antennas Distance (mm)
Transmitter Combination	Simultaneous?	Hotspot?	
GSM + WCDMA	×	×	0
GSM + LTE	×	×	0
GSM + Bluetooth	√	×	40
GSM + Wi-Fi	√	√	40
WCDMA + LTE	×	×	0
WCDMA + Bluetooth	√	×	40
WCDMA + Wi-Fi	√	√	40
LTE+ Bluetooth	√	×	40
LTE+ Wi-Fi	√	√	40

Standalone SAR test exclusion considerations

Body Position:

Mode	Frequency (MHz)	P_{avg} (dBm)	P_{avg} (mW)	Distance (mm)	Calculated value	Threshold (1-g)	SAR Test Exclusion
Wi-Fi	2462	9.70	9.33	0	2.9	3.0	Yes
Bluetooth	2480	7.30	5.37	0	1.7	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 $_{1-g}$ (W/kg)
BT Body	2.48	0	7.30	5.37	0.226
Wi-Fi Body	2.462	0	9.70	9.33	0.391

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:

GSM with BT:

Mode	Position	Reported SAR (W/kg)		ΣSAR
		GSM	BT	< 1.6W/kg
GSM 850	Body–Headset-Back	0.905	0.226	1.131
PCS 1900	Body–Headset-Back	0.690	0.226	0.916

GSM with Wi-Fi:

Mode	Position	Reported SAR (W/kg)		ΣSAR
		GSM	Wi-Fi	< 1.6W/kg
GSM 850	Body–Headset-Back	0.905	0.391	1.296
PCS 1900	Body–Headset-Back	0.690	0.391	1.081

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

Evaluations for Simultaneous SAR, BT+GSM/3G/4G					
Test Position	Body-Back (0cm)	Body-Left (0cm)	Body-Right (0cm)	Body-Bottom (0cm)	Body-Top (0cm)
Mode	Stand Alone 1-g SAR (W/Kg)				
GPRS 850	1.197	0.789	/	/	0.580
GPRS 1900	1.130	0.560	/	/	0.929
WCDMA 850	1.028	0.664	/	/	0.482
WCDMA 1900	1.086	0.602	/	/	0.946
LTE Band 7	1.145	0.542	/	/	0.911
BT	0.226	0.226	0.226	0.226	0.226
	∑ 1-g SAR(W/Kg)				
GPRS 850 + BT	1.423	1.015	/	/	0.806
GPRS 1900 + BT	1.356	0.786	/	/	1.155
WCDMA 850 + BT	1.254	0.890	/	/	0.708
WCDMA 1900+ BT	1.312	0.828	/	/	1.172
LTE Band 7+ BT	1.371	0.768	/	/	1.137

Evaluations for Simultaneous SAR, Mobile Hot Spot Positions					
Test Position	Body-Back (0cm)	Body-Left (0cm)	Body-Right (0cm)	Body-Bottom (0cm)	Body-Top (0cm)
Mode	Stand Alone 1-g SAR (W/Kg)				
GPRS 850	1.197	0.789	/	/	0.580
GPRS 1900	1.130	0.560	/	/	0.929
WCDMA 850	1.028	0.664	/	/	0.482
WCDMA 1900	1.086	0.602	/	/	0.946
LTE Band 7	1.145	0.542	/	/	0.911
Wi-Fi	0.391	0.391	0.391	0.391	0.391
	∑ 1-g SAR(W/Kg)				
GPRS 850 + Wi-Fi	**1.588**	1.180	/	/	0.971
GPRS 1900 + Wi-Fi	1.521	0.951	/	/	1.320
WCDMA 850 + Wi-Fi	1.419	1.055	/	/	0.873
WCDMA 1900+ Wi-Fi	1.477	0.993	/	/	1.337
LTE Band 7+ Wi-Fi	1.536	0.933	/	/	1.302

Note:

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.

SAR Plots (Summary of the Highest SAR Values)

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

Body-worn-Back (848.8 MHz High Channel)

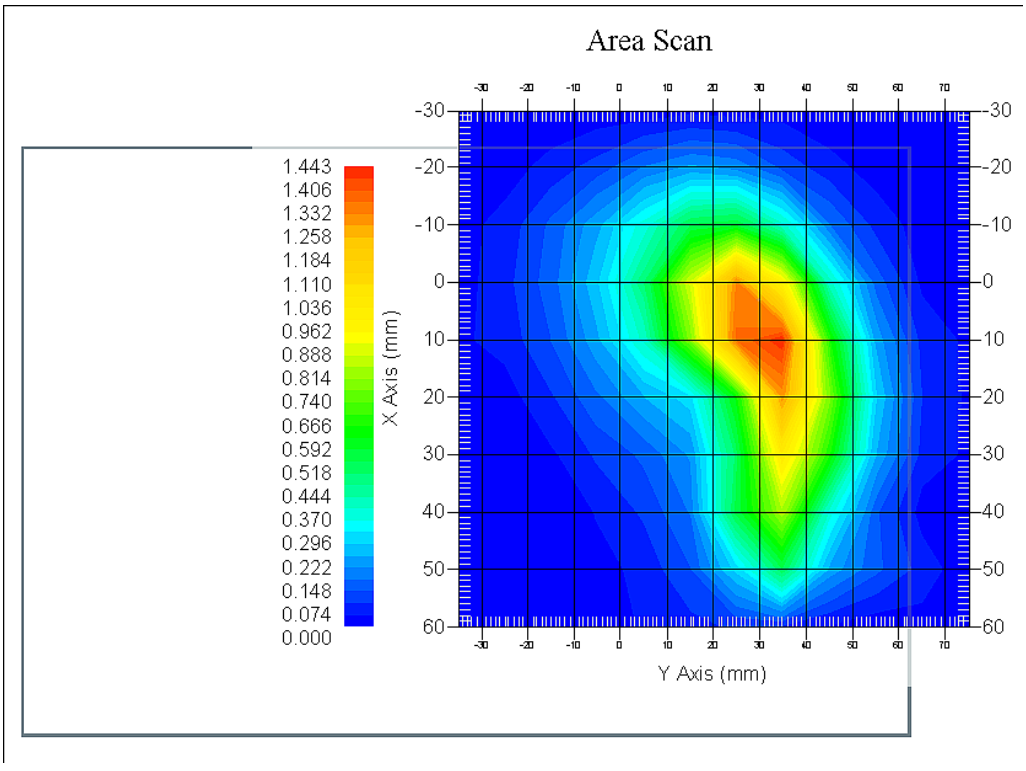
Measurement Data
Test mode : GPRS
Crest Factor : 2
Scan Type： : Complete
Area Scan : 8x11x1 : Measurement x=10mm, y=10mm, z=4mm
Zoom Scan : 7x7x7 : Measurement x=5mm, y=5mm, z=5mm
Power Drift-Start : 0.356 W/kg
Power Drift-Finish : 0.351 W/kg
Power Drift (%) : -1.436

Tissue Data
Type : Body
Frequency : 848.8 MHz
Epsilon : 53.84 F/m
Sigma : 0.97 S/m
Density : 1000.00 kg/cu. m

Probe Data
Serial No. : 500-00283
Frequency Band : 835
Duty Cycle Factor : 2
Conversion Factor : 5.9
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 : 1.175 W/kg
10 gram SAR value : 0.677 W/kg
Area Scan Peak SAR : 1.422 W/kg
Zoom Scan Peak SAR : 1.850 W/kg

Plot 1#



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

Body-worn-Back (1850.2 MHz Low Channel)

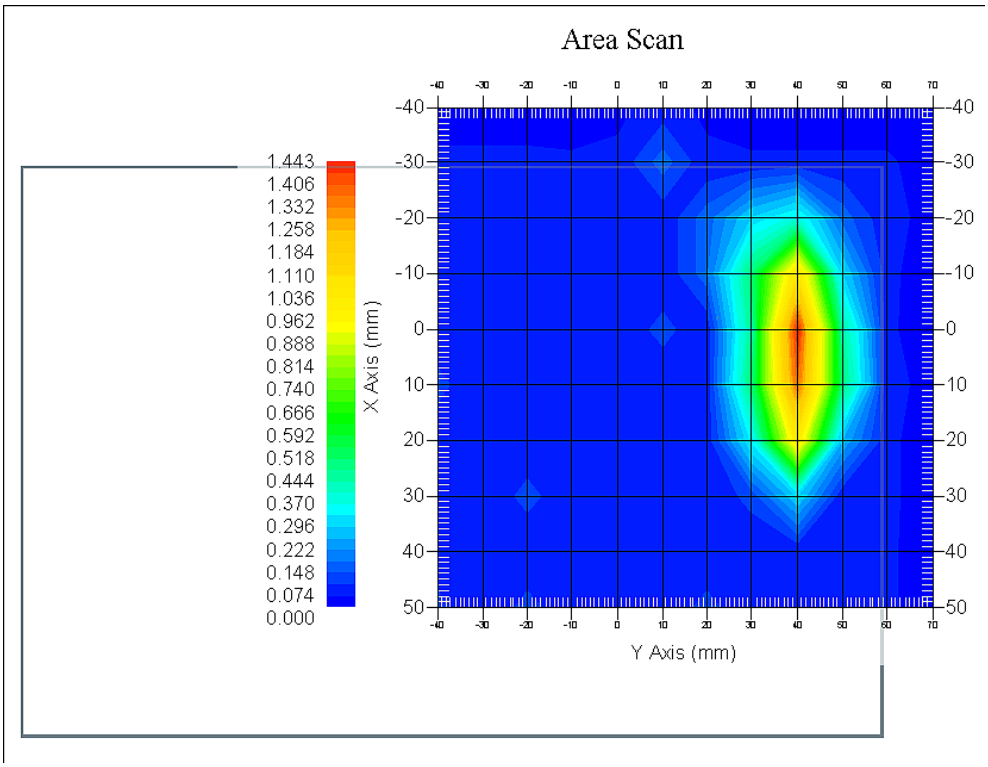
Measurement Data
Test mode : GPRS
Crest Factor : 2
Scan Type : Complete
Area Scan : 8x11x1 : Measurement x=10mm, y=10mm, z=4mm
Zoom Scan : 7x7x7 : Measurement x=5mm, y=5mm, z=5mm
Power Drift-Start : 0.102 W/kg
Power Drift-Finish : 0.104 W/kg
Power Drift (%) : 1.987

Tissue Data
Type : Body
Frequency : 1850.2 MHz
Epsilon : 52.00 F/m
Sigma : 1.50 S/m
Density : 1000.00 kg/cu. m

Probe Data
Serial No. : 500-00283
Frequency Band : 1900
Duty Cycle Factor : 2
Conversion Factor : 4.5
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 : 1.077 W/kg
10 gram SAR value : 0.493 W/kg
Area Scan Peak SAR : 1.416 W/kg
Zoom Scan Peak SAR : 2.363 W/kg

Plot 2#



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

WCDMA850; Body-Worn-Back (836.6 MHz Middle Channel)

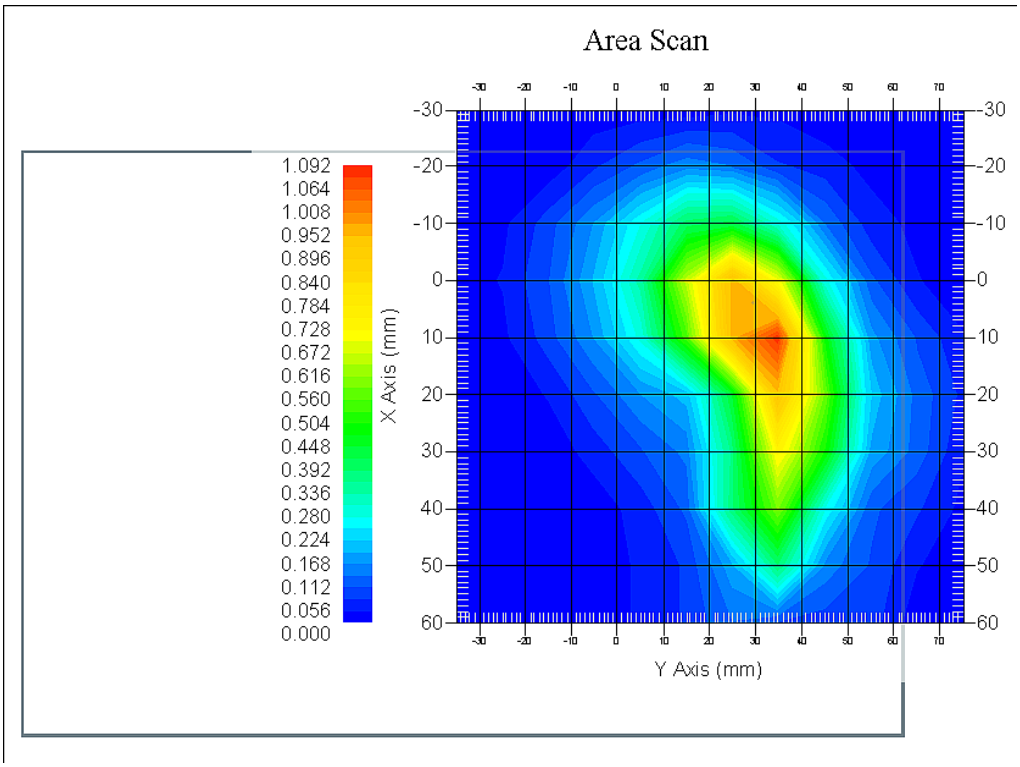
Measurement Data
Test mode : RMC
Crest Factor : 1
Scan Type : Complete
Area Scan : 11x8x1: Measurement x=10mm, y=10mm, z=4mm
Zoom Scan : 7x7x7: Measurement x=5mm, y=5mm, z=5mm
Power Drift-Start : 0.255 W/kg
Power Drift-Finish : 0.251 W/kg
Power Drift (%) : -1.586

Tissue Data
Type : Body
Frequency : 836.6 MHz
Epsilon : 53.80 F/m
Sigma : 0.96 S/m
Density : 1000.00 kg/cu. m

Probe Data
Serial No. : 500-00283
Frequency Band : 835
Duty Cycle Factor : 1
Conversion Factor : 5.9
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 : 0.944 W/kg
10 gram SAR value : 0.527 W/kg
Area Scan Peak SAR : 1.051 W/kg
Zoom Scan Peak SAR : 1.376 W/kg

Plot 3#



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

WCDMA1900; Body-Worn-Back (1880 MHz Middle Channel)

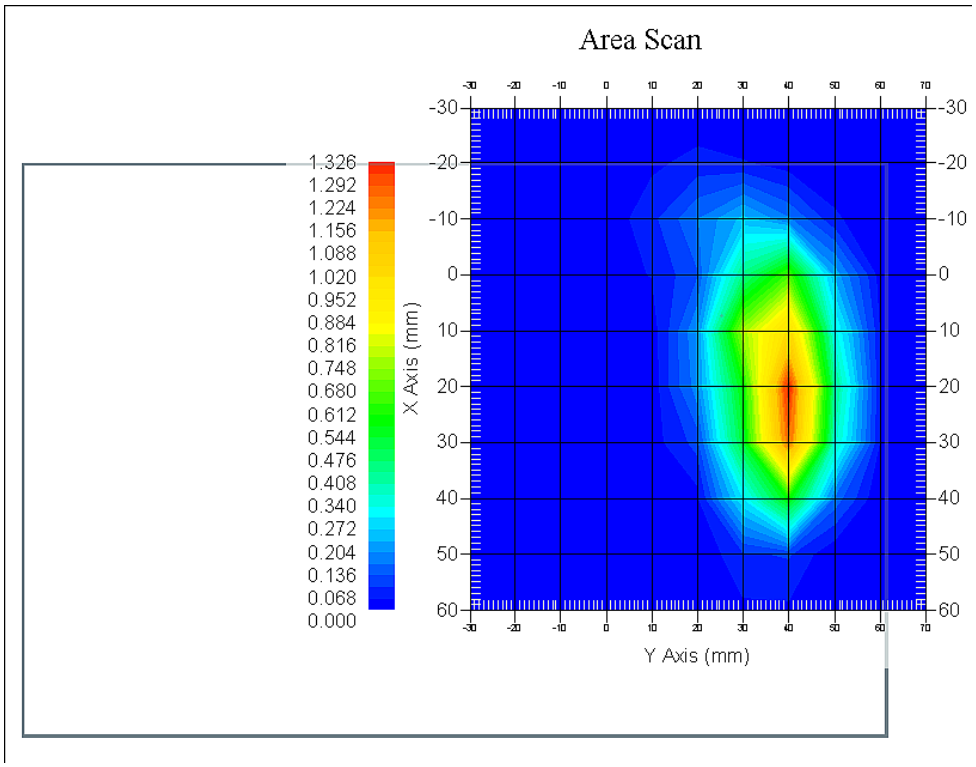
Measurement Data
Test mode : RMC
Crest Factor : 1
Scan Type : Complete
Area Scan : 11x9x1: Measurement x=10mm, y=10mm, z=4mm
Zoom Scan : 7x7x7: Measurement x=5mm, y=5mm, z=5mm
Power Drift-Start : 0.120 W/kg
Power Drift-Finish : 0.120 W/kg
Power Drift (%) : 0.766

Tissue Data
Type : Body
Frequency : 1880.0 MHz
Epsilon : 52.03 F/m
Sigma : 1.50 S/m
Density : 1000.00 kg/cu. m

Probe Data
Serial No. : 500-00283
Frequency Band : 1900
Duty Cycle Factor : 1
Conversion Factor : 4.8
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 : 0.950 W/kg
10 gram SAR value : 0.415 W/kg
Area Scan Peak SAR : 1.297 W/kg
Zoom Scan Peak SAR : 2.117 W/kg

Plot 4#



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

LTE FDD Band7; Body-Worn-Back (2535 MHz Middle Channel);

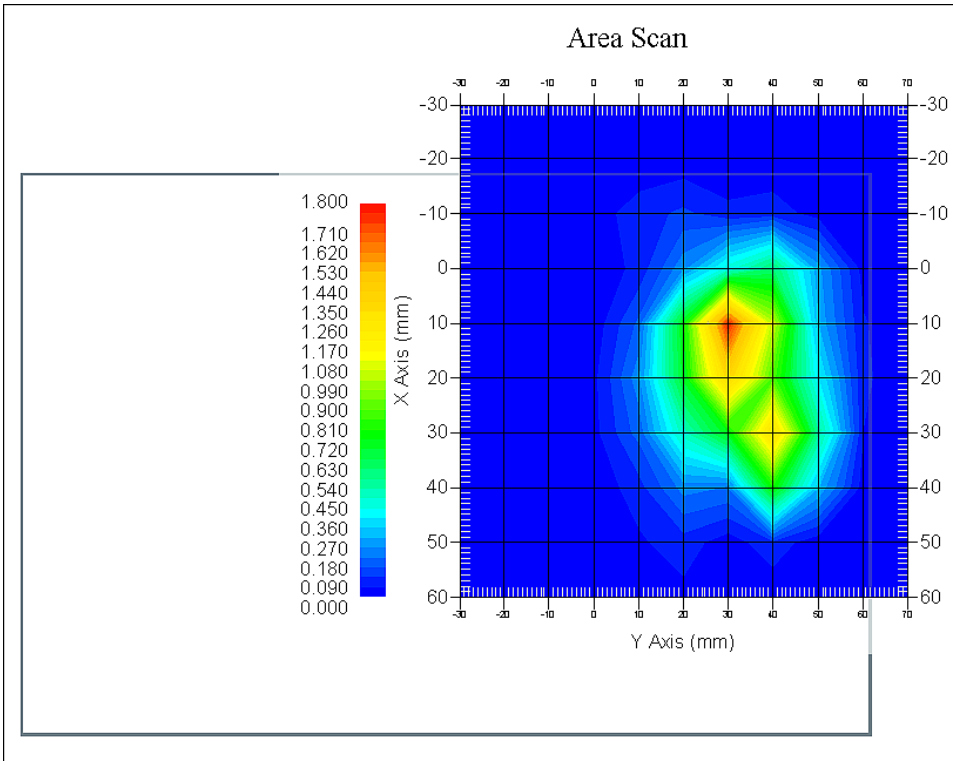
Measurement Data
Test mode : 1RB
Crest Factor : 1
Scan Type： : Complete
Area Scan : 8x11x1 : Measurement x=10mm, y=10mm, z=4mm
Zoom Scan : 7x7x7 : Measurement x=5mm, y=5mm, z=5mm
Power Drift-Start : 0.182 W/kg
Power Drift-Finish : 0.185 W/kg
Power Drift (%) : 1.619

Tissue Data
Type : Body
Frequency : 2535 MHz
Epsilon : 51.88 F/m
Sigma : 2.01 S/m
Density : 1000.00 kg/cu. m

Probe Data
Serial No. : 500-00283
Frequency Band : 2450
Duty Cycle Factor : 1
Conversion Factor : 4.3
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 : 1.127 W/kg
10 gram SAR value : 0.533 W/kg
Area Scan Peak SAR : 1.762 W/kg
Zoom Scan Peak SAR : 2.685 W/kg

Plot 5#



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	$\sqrt{3}$	$(1\text{-cp})^{1/2}$	$(1\text{-cp})^{1/2}$	1.5	1.5
Hemispherical Isotropy	10.9	rectangular	$\sqrt{3}$	√cp	√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

NCL Calibration Laboratories
Division of APREL Inc.

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

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

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

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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.

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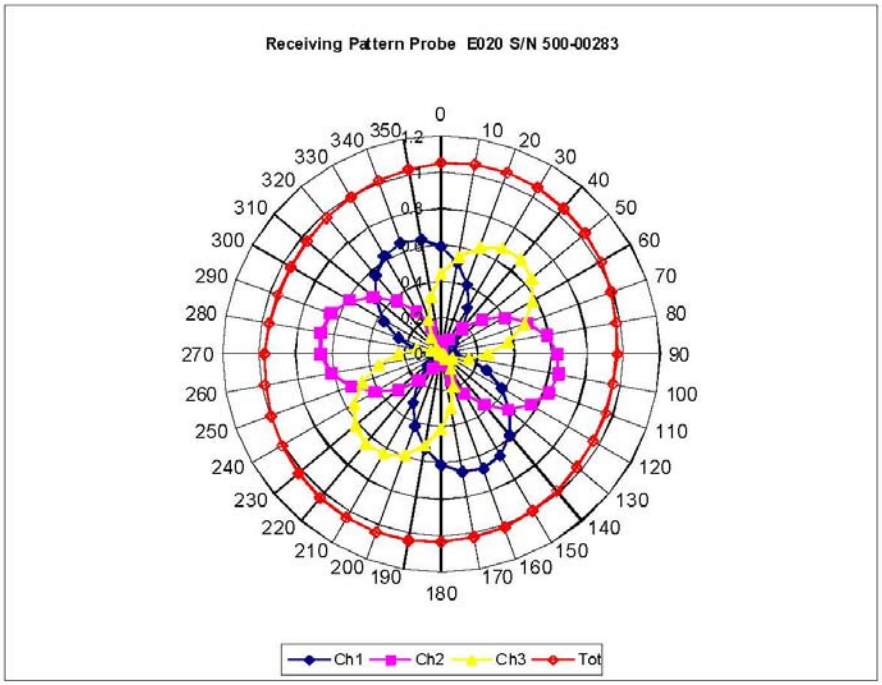
Receiving Pattern Air



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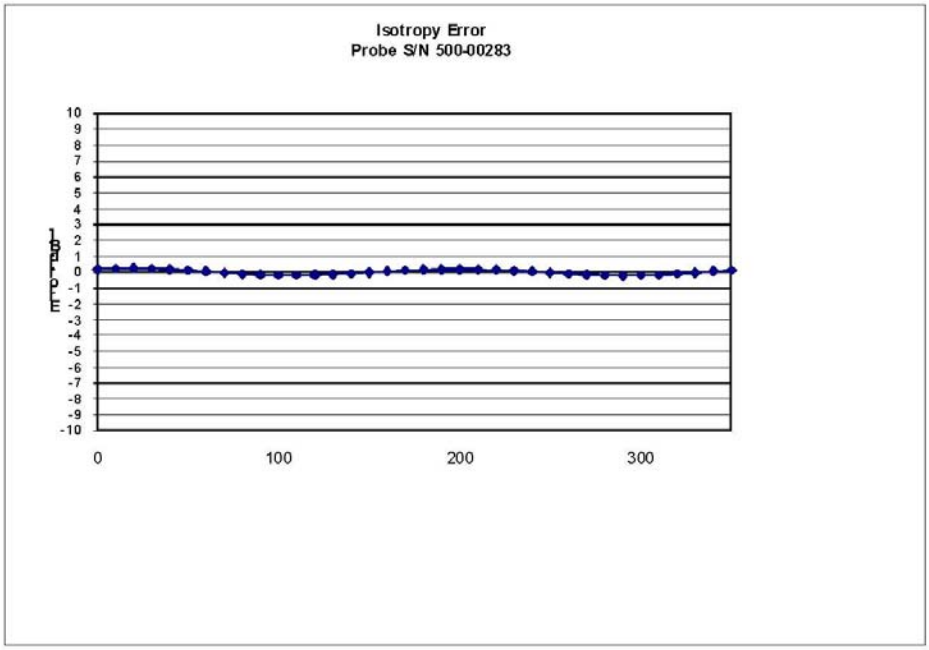
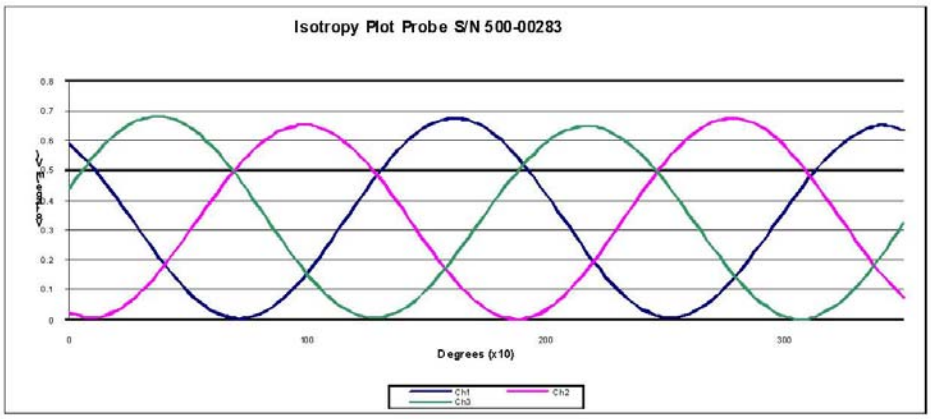
Isotropy Error Air





Isotropicity Tissue: 0.10 dB

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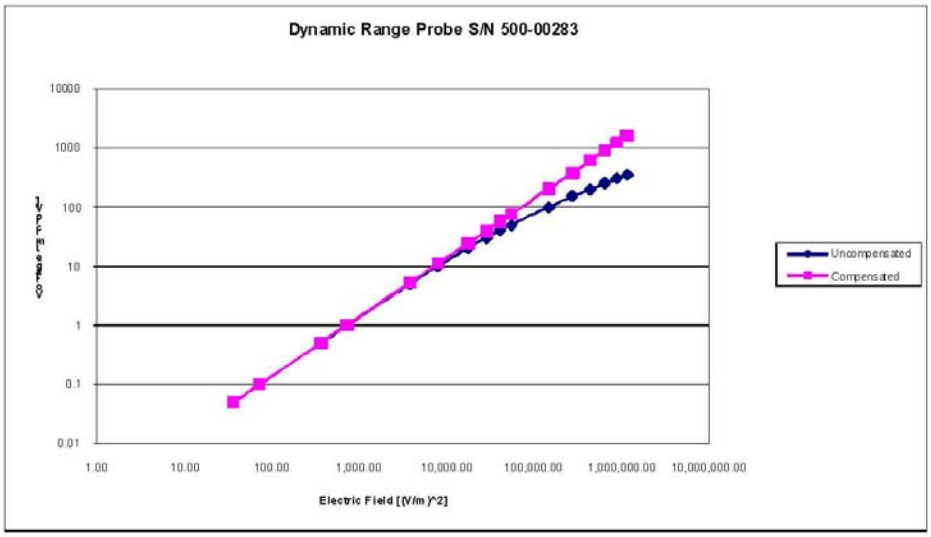
Dynamic Range



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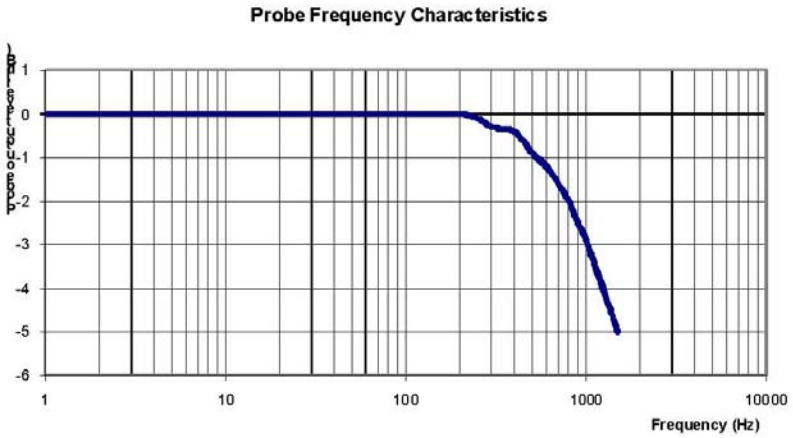
Video Bandwidth



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.

APPENDIX C DIPOLE CALIBRATION CERTIFICATES

NCL CALIBRATION LABORATORIES

Calibration File No: DC-1599
Project Number: BAC-dipole-cal-5779

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(Head and Body)

Manufacturer: APREL Laboratories
Part number: ALS-D-835-S-2
Frequency: 835 MHz
Serial No: 180-00558

Customer: Bay Area Compliance Laboratory (China)

Calibrated: 8th October 2014
Released on: 8th 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.
Kanata, ONTARIO
CANADA K2K 3J1
Division of APREL Lab.
TEL: (613) 435-8300
FAX: (613)435-8306

NCL Calibration Laboratories
Division of APREL Laboratories.

Conditions

Dipole 180-00558 was received with a damaged connection for a re-calibration.

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

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

Maryna Nesterova Calibration Engineer

Primary Measurement Standards

Instrument	**Serial Number**	**Cal due date**
Tektronix USB Power Meter	11C940	May 14, 2015
Network Analyzer Anritsu 37347C	002106	Feb. 20, 2015

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

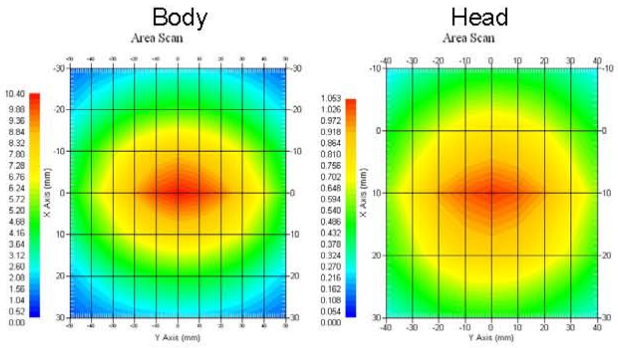
Length: 162.2 mm
Height: 89.4 mm

Electrical Specification

Tissue	Frequency	SWR:	Return Loss	Impedance
Head	835 MHz	1.066 U	-30.344 dB	49.001 Ω
Body	835 MHz	1.089 U	-28.118 dB	53.117 Ω

System Validation Results

Tissue	Frequency	1 Gram	10 Gram	Peak
Head	835 MHz	9.773	6.174	14.713
Body	835 MHz	9.736	6.297	14.513



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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 180-00558. 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 30 MHz to 6 GHz E-Field Probe Serial Number 225.

References

- 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 180-00558 was repaired prior to this calibration. The repair reliability depends upon correct usage of the dipole.

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

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)**

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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
161.0 mm	89.8 mm	162.2 mm	89.4 mm

Electrical Verification

Tissue Type	Return Loss:	SWR:	Impedance:
Head	-30.344 dB	1.066 U	49.001Ω
Body	-28.118 dB	1.089 U	53.117 Ω □

Tissue Validation

	Dielectric constant, ε_r	Conductivity, σ [S/m]
Head Tissue 835MHz	43.42	0.94
Body Tissue 835MHz	55.77	1.01

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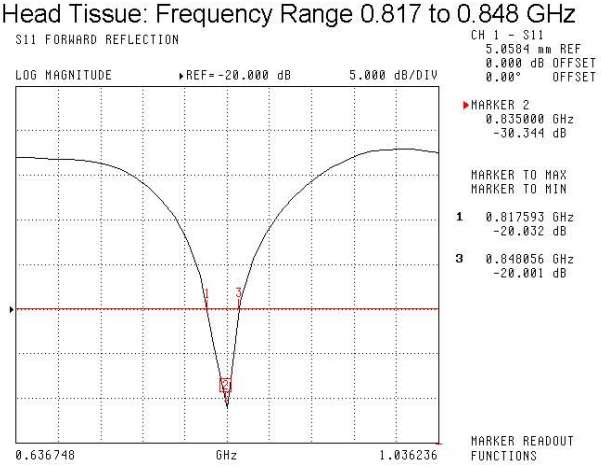
NCL Calibration Laboratories
Division of APREL Laboratories.

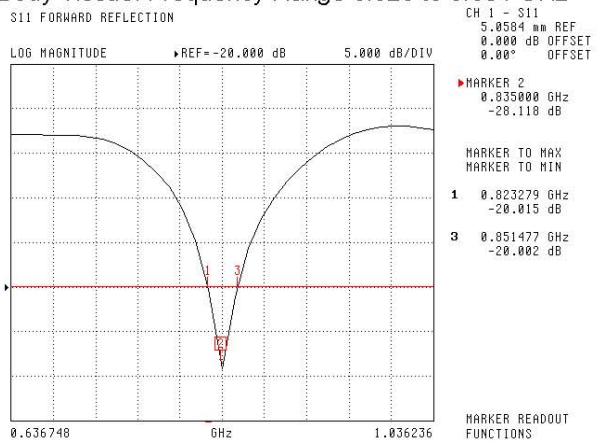
The Following Graphs are the results as displayed on the Vector Network Analyzer.

S11 Parameter Return Loss

Head Tissue: Frequency Range 0.817 to 0.848 GHz



Body Tissue: Frequency Range 0.823 to 0.851 GHz



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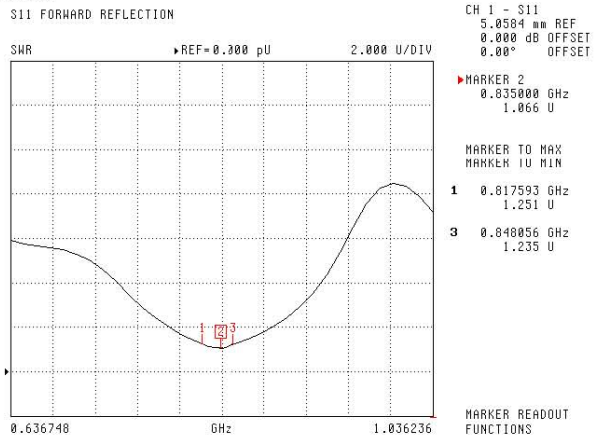
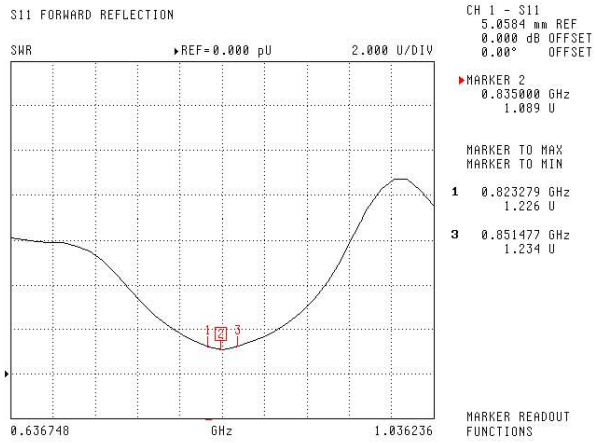
NCL Calibration Laboratories
Division of APREL Laboratories.

SWR

Head



Body



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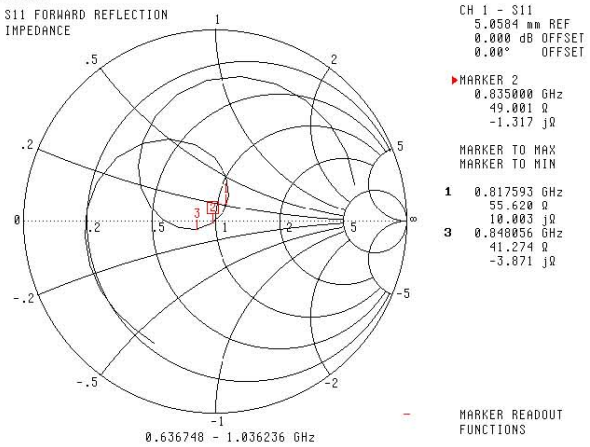
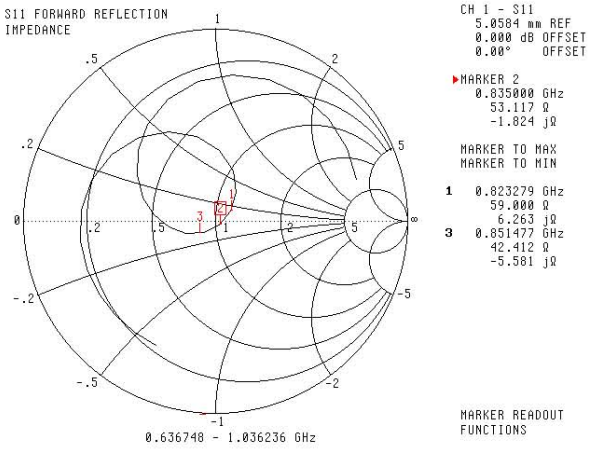
NCL Calibration Laboratories
Division of APREL Laboratories.

Smith Chart Dipole Impedance

Head



Body



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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 2014.

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

NCL CALIBRATION LABORATORIES

Calibration File No: DC-1601
Project Number: BAC-dipole –cal-5779

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 (Head & Body)

Manufacturer: APREL Laboratories
Part number: ALS-D-1900-S-2
Frequency: 1900 MHz
Serial No: 210-00710

Customer: Bay Area Compliance Laboratory (China)

Calibrated: 9th October, 2014
Released on: 9th 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.
Kanata, ONTARIO
CANADA K2K 3J1
Division of APREL Lab.
TEL: (613) 435-8300
FAX: (613)435-8306

NCL Calibration Laboratories
Division of APREL Laboratories.

Conditions

Dipole 210-00710 was received in good condition and was a re-calibration.

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

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

Maryna Nesterova Calibration Engineer

Primary Measurement Standards

Instrument	Serial Number	Cal due date
Tektronix USB Power Meter	11C940	May 14, 2015
Network Analyzer Anritsu 37347C	002106	Feb. 20, 2015

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

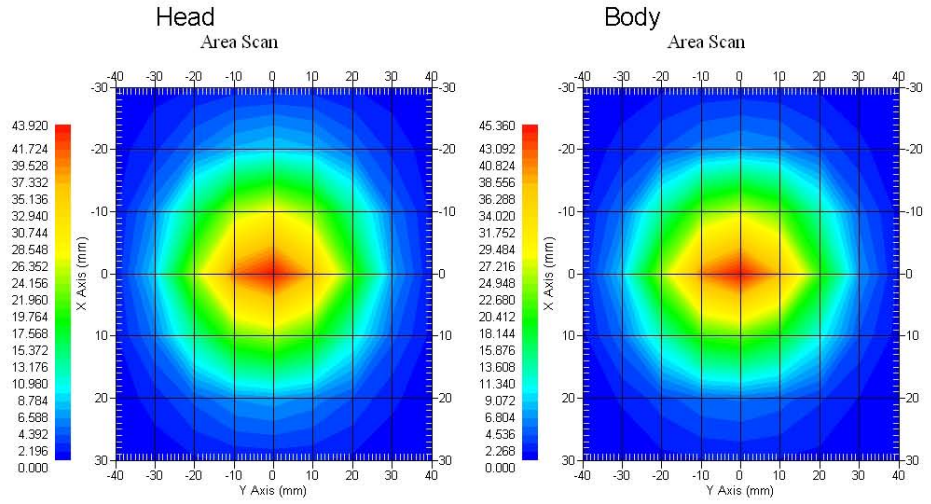
Length: 67.1 mm
Height: 38.9 mm

Electrical Specification

Tissue	Frequency	SWR:	Return Loss	Impedance
Head	1900MHz	1.084 U	-27.92 dB	52.247 Ω
Body	1900MHz	1.128 U	-24.40 dB	52.618 Ω

System Validation Results

Tissue	Frequency	1 Gram	10 Gram	Peak
Head	1900 MHz	39.481	20.44	73.364
Body	1900 MHz	39.715	20.552	73.565



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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 210-00710. 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 30 MHz to 6 GHz E-Field Probe Serial Number 225.

References

- 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 210-00710 was a recalibration.

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

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)**

4

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
68.0 mm	39.5 mm	67.1mm	38.9 mm

Electrical Validation

Tissue	Frequency	SWR:	Return Loss	Impedance
Head	1900MHz	1.084 U	-27.92 dB	52.247 Ω
Body	1900MHz	1.128 U	-24.40 dB	52.618 Ω

Tissue Validation

	Dielectric constant, ε_r	Conductivity, σ [S/m]
Head Tissue 1900MHz	40.20	1.38
Body Tissue 1900MHz	52.63	1.46

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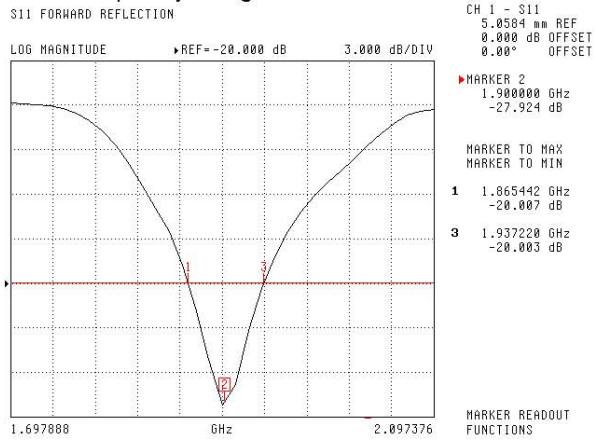
This page has been reviewed for content and attested to by signature within this document.

NCL Calibration Laboratories
Division of APREL Laboratories.

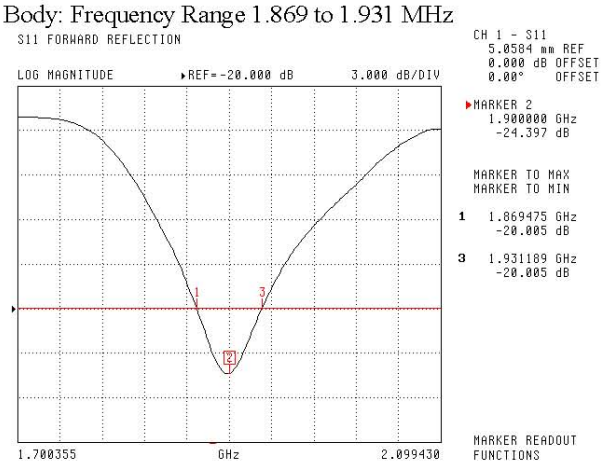
The Following Graphs are the results as displayed on the Vector Network Analyzer.

S11 Parameter Return Loss

Head: Frequency Range 1.865 to 1.937 GHz



Body: Frequency Range 1.869 to 1.931 MHz



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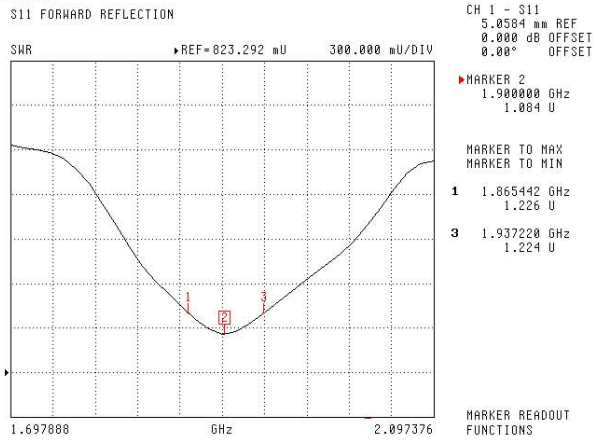
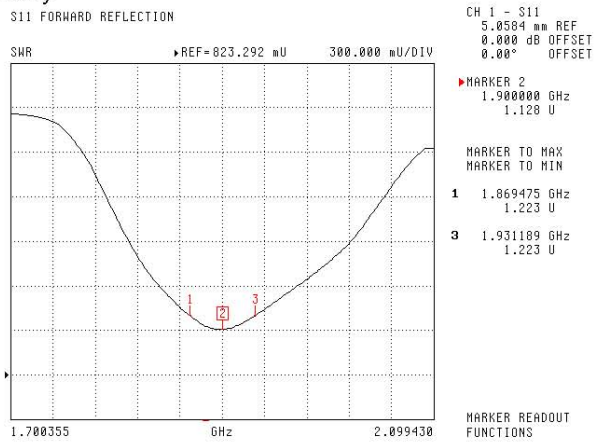
Division of APREL Laboratories.

SWR

Head



Body



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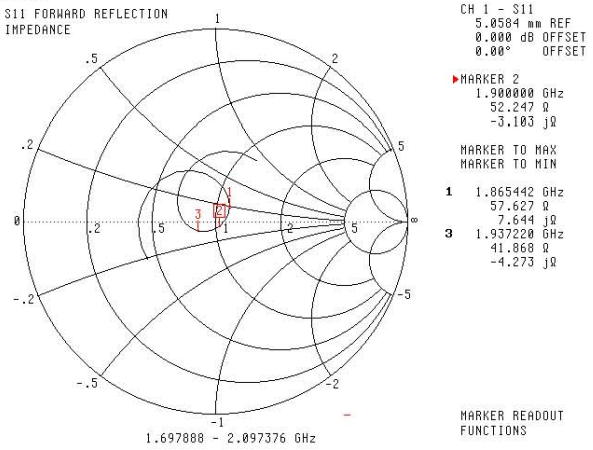
NCL Calibration Laboratories
Division of APREL Laboratories.

Smith Chart Dipole Impedance

Head



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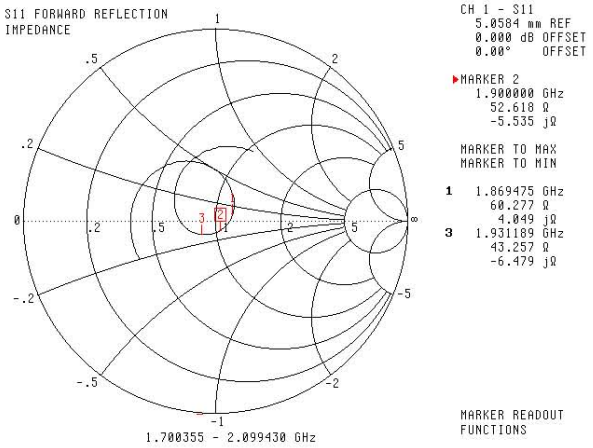

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NCL Calibration Laboratories
Division of APREL Laboratories.

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 2014

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