JQA File No. : KL80140075
Issue Date : June 23, 2014

TEST REPORT (SAR EVALUATION)

Applicant	:	Sharp Corporation, Communication Systems Division
Address	:	2-13-1, Iida, Hachihonmatsu, Higashi-Hiroshima City, Hiroshima, 739-0192, Japan
Products	:	Cellular Phone
Model No.	:	305SH
Serial No.	:	004401/11/514865/8
FCC ID	:	APYHRO00210
Test Standard	:	CFR 47 FCC Rules and Regulations Part 2
Test Results	:	**Passed**
Date of Test	:	June 3 ~ 5, 2014

VLAC Lab Accreditation
VLAC-001-2

Kousei Shibata
Manager
Japan Quality Assurance Organization
KITA-KANSAI Testing Center
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- The measurement values stated in Test Report was made with traceable to National Institute of Advanced Industrial Science and Technology (AIST) of Japan, National Institute of Information and Communications Technology (NICT) of Japan , and Laboratory for EMF and Microwave Electronics at the Swiss Federal Institute of Technology (ETH) in Zürich, Switzerland.
- The applicable standard, testing condition and testing method which were used for the tests are based on the request of the applicant.
- The test results presented in this report relate only to the offered test sample.
- The contents of this test report cannot be used for the purposes, such as advertisement for consumers.
- This test report shall not be reproduced except in full without the written approval of JQA.
- VLAC does not approve, certify or warrant the product by this test report.

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1 Description of the Device Under Test (DUT)

1.	Manufacturer	:	Sharp Corporation, Communication Systems Division 2-13-1, Iida, Hachihonmatsu, Higashi-Hiroshima City, Hiroshima, 739-0192, Japan
2.	Products	:	Cellular Phone
3.	Model No.	:	305SH
4.	Serial No.	:	004401/11/514865/8
5.	Product Type	:	Pre-production
6.	Date of Manufacture	:	April, 2014
7.	Transmitting Frequency	:	PCS 1900 (1850 MHz – 1910 MHz) WLAN 2.4 GHz (DTS : 2412 MHz – 2462 MHz) Bluetooth (2402 MHz – 2480 MHz)
8.	Battery Option	:	Lithium-ion Battery Pack UBATIA246AFN1 (2040mAh)
9.	Power Rating	:	4.0VDC
10.	EUT Grounding	:	None
11.	Device Category	:	Portable Device (§2.1093)
12.	Exposure Category	:	General Population/Uncontrolled Exposure
13.	FCC Rule Part(s)	:	24(E), 15.247
14.	EUT Authorization	:	Certification
15.	Received Date of DUT	:	June 2, 2014

2 Summary of Test Results

Applied Standard : CFR 47 FCC Rules and Regulations Part 2 – Frequency Allocations and Radio Treaty Matters; General Rules and Regulations

Test Configuration	Reported 1 g SAR (W/kg)			Limit (W/kg)
	Licensed	DTS	U-NII	
Head	0.35	< 0.10	N/A	1.6
Body-worn Accessory	0.35	< 0.10	N/A	
Wireless Router (Hotspot)	0.35	< 0.10	N/A	
Simultaneous Transmission	0.41	0.41	N/A	

The test results are passed for exposure limits specified in ANSI/IEEE Std. C95.1–1991.

In the approval of test results,
- Determining compliance with the limits in this report was based on the results of the compliance measurement, not taking into account measurement instrumentation uncertainty.
- No deviations were employed from the applied standard.
- No modifications were conducted by JQA to achieve compliance to the limitations.

Reviewed by:

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3 Test Procedure

The tests documented in this report were performed in accordance with CFR 47 FCC Parts 1 and 2, IEEE Std.1528–2013 and the following KDB Procedures.

248227 D01 SAR meas for 802 11 a b g v01r02
447498 D01 General RF Exposure Guidance v05r02
648474 D04 SAR Handset SAR v01r02
865664 D01 SAR Measurement 100 MHz to 6 GHz v01r03
865664 D02 RF Exposure Reporting v01r01
941225 D03 SAR Test Reduction GSM GPRS EDGE v01
941225 D06 Hot Spot Mode SAR v01r01

4 Test Location

Japan Quality Assurance Organization (JQA)
KITA-KANSAI Testing Center
7-7, Ishimaru, 1-chome, Minoh-shi, Osaka, 562-0027, Japan
SAITO EMC Branch
7-3-10, Saito-asagi, Ibaraki-shi, Osaka 567-0085, Japan

5 Recognition of Test Laboratory

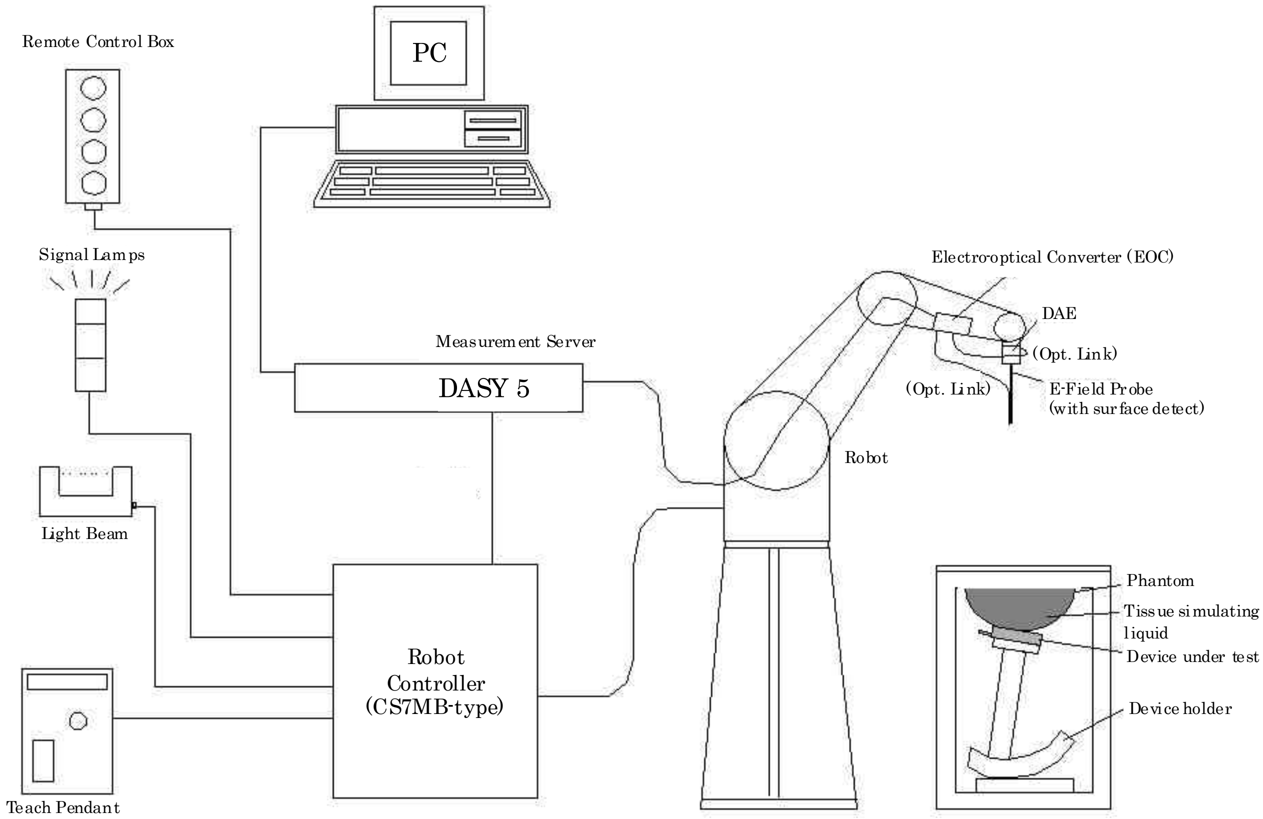
JQA KITA-KANSAI Testing Center SAITO EMC Branch is accredited under ISO/IEC 17025 by following accreditation bodies and the test facility is registered by the following bodies.

VLAC Accreditation No.	:	VLAC-001-2 (Expiry date : March 30, 2016)
VCCI Registration No.	:	A-0002 (Expiry date : March 30, 2016)
BSMI Registration No.	:	SL2-IS-E-6006, SL2-IN-E-6006, SL2-R1/R2-E-6006, SL2-A1-E-6006 (Expiry date : September 14, 2016)
IC Registration No.	:	2079E-3, 2079E-4 (Expiry date : July 20, 2014)

Accredited as conformity assessment body for Japan electrical appliances and material law by METI. (Expiry date : February 22, 2016)

6 Measurement System Diagram

These measurements are performed using the DASY5 automated dosimetric assessment system (manufactured by Schmid & Partner Engineering AG (SPEAG) in Zürich, Switzerland). It consists of high precision robotics system, cell controller system, DASY5 measurement server, personal computer with DASY5 software, data acquisition electronic (DAE) circuit, the Electro-optical converter (EOC), near-field probe, and the twin SAM phantom containing the equivalent tissue. The robot is a six-axis industrial robot performing precise movements to position the probe to the location (points) of maximum electromagnetic field (EMF).
The Robot is connected to the cell controller to allow software manipulation of the robot. The DAE is connected to the EOC. The DAE performs the signal amplification, signal multiplexing, A/D conversion, offset measurements, mechanical surface detection, collision detection, etc. The EOC performs the conversion from the optical into digital electric signal of the DAE and transfers data to the DASY5 measurement server.



7 System Components

7.1 Probe Specification ET3DV6

Construction : Symmetrical design with triangular core
Built-in optical fiber for surface detection system
Built-in shielding against static changes
PEEK enclosure material (resistant to organic solvents, e.g., DGBE)

Calibration : In air form 10 MHz to 2.3 GHz
In head tissue simulating liquid (HSL) and
muscle tissue simulating liquid
835 MHz (accuracy ± 12.0%; k=2)
900 MHz (accuracy ± 12.0%; k=2)
1450 MHz (accuracy ± 12.0%; k=2)
1750 MHz (accuracy ± 12.0%; k=2)
1900 MHz (accuracy ± 12.0%; k=2)
1950 MHz (accuracy ± 12.0%; k=2)

Frequency : 10 MHz to 2.3 GHz
Linearity: ± 0.2 dB (30 MHz to 2.3 GHz)

Directivity : ± 0.2 dB in HSL (rotation around probe axis)
± 0.4 dB in HSL (rotation normal to probe axis)

Dynamic Range : 5 µW/g to >100 mW/g; Linearity: ± 0.2 dB

Surface Detection : ± 0.2 mm repeatability in air and clear liquids over diffuse reflecting surfaces

Dimensions : Overall length 337 mm
Tip length 16 mm
Body diameter 12 mm
Tip diameter 6.8 mm
Distance from probe tip to dipole centers 2.7 mm

7.2 Probe Specification EX3DV4

Construction : Symmetrical design with triangular core
Built-in shielding against static changes
PEEK enclosure material (resistant to organic solvents, e.g., DGBE)

Calibration : In air form 10 MHz to 6 GHz
In head tissue simulating liquid (HSL) and
muscle tissue simulating liquid
2450 MHz (accuracy ± 12.0%; k=2)
2600 MHz (accuracy ± 12.0%; k=2)
5200 MHz (accuracy ± 13.1%; k=2)
5300 MHz (accuracy ± 13.1%; k=2)
5500 MHz (accuracy ± 13.1%; k=2)
5600 MHz (accuracy ± 13.1%; k=2)
5800 MHz (accuracy ± 13.1%; k=2)

Frequency : 10 MHz to 6 GHz
Linearity: ± 0.2 dB (30 MHz to 6 GHz)

Directivity : ± 0.3 dB in HSL (rotation around probe axis)
± 0.5 dB in tissue material (rotation normal to probe axis)

Dynamic Range : 10 μW/g to >100 mW/g; Linearity: ± 0.2 dB (noise: typically < 1 μW/g)

Dimensions : Overall length 337 mm
Tip length 20 mm
Body diameter 12 mm
Tip diameter 2.5 mm
Distance from probe tip to dipole centers 1 mm

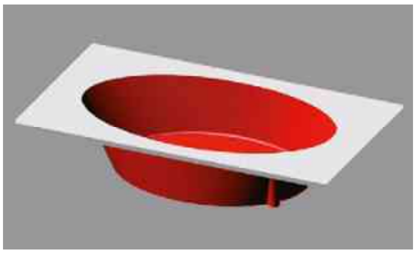
7.3 Twin SAM Phantom

The shell corresponds to the specifications of the Specific Anthropomorphic Mannequin (SAM) phantom defined in IEEE 1528 and IEC 62209-1. It enables the dosimetric evaluation of left and right hand phone usage as well as body mounted usage at the flat phantom region. A cover prevents evaporation of the liquid. Reference markings on the phantom allow the complete setup of all predefined phantom positions and measurement grids by teaching three points with the robot.

Shell Thickness	:	2 ± 0.2 mm; Center ear point: 6 ± 0.2 mm
Filling Volume	:	Volume Approx. 25 liters
Dimensions	:	810 × 1000 × 500 mm (H × L × W)

7.4 ELI4 Flat Phantom

Phantom for compliance testing of handheld and body-mounted wireless devices in the frequency range of 30 MHz to 6 GHz. ELI is fully compatible with the IEC 62209-2 standard and all known tissue simulating liquids. ELI has been optimized regarding its performance and can be integrated into our standard phantom tables. A cover prevents evaporation of the liquid. Reference markings on the phantom allow installation of the complete setup, including all predefined phantom positions and measurement grids, by teaching three points. The phantom is compatible with all SPEAG dosimetric probes and dipoles.



Shell Thickness	:	2 ± 0.2 mm (sagging: <1%)
Filling Volume	:	Volume Approx. 30 liters
Dimensions	:	Major ellipse axis : 600 mm
		Minor axis : 400 mm

7.5 Mounting Device for Transmitters

In combination with the Twin SAM Phantom V4.0/V4.0c or ELI4, the Mounting Device enables the rotation of the mounted transmitter device in spherical coordinates. Rotation point is the ear opening point. Transmitter devices can be easily and accurately positioned according to IEC, IEEE, CENELEC, FCC or other specifications. The device holder can be locked for positioning at different phantom sections (left head, right head, flat point).

8 Measurement Process

Step 1 : Power Reference Measurement

The power reference job measures the field at a specified reference position, at a selectable distance from the phantom surface. The reference position can be either the selected section's grid reference point or a user point in this section. The reference job projects the selected point onto the phantom surface, orients the probe perpendicularly to the surface, and approaches the surface using the selected detection method. The minimum distance of probe sensors to surface set to 4 mm for an ET3DV6 probe, or 2 mm for EX3DV4 probe. This distance cannot be smaller than the distance of sensor calibration points to probe tip as defined in the probe properties.

Step 2 : Area Scan

The area scan is used as a fast scan in two dimensions to find the area of high field values, before doing a fine measurement around the hot spot. The sophisticated interpolation routines implemented in DASY software can find the maximum locations in relatively coarse grids. When an area scan has measured all reachable points, it computes the field maximal found in the scanned area, within a range of the global maximum. If only one zoom scan follows the area scan, then only the absolute maximum will be taken as reference. For cases where multiple maxima within 2 dB of the maximum SAR value are detected, the number of zoom scans has to be increased accordingly.

Step 3 : Zoom Scan

Zoom scans are used to assess the peak spatial SAR values within a cubic averaging volume containing 1 g and 10 g of simulated tissue. The zoom scan measures points specified in standards within a cube whose base faces are centered on the maxima found in a preceding area scan job within the same procedure.

Step 4 : Z Scan

The Z scan measures points along a vertical straight line. The line runs along the Z axis of a one-dimensional grid. In order to get a reasonable extrapolation, the extrapolated distance should not be larger than the step size in Z-direction.

Step 5 : Power Drift Measurement

The power drift measurement measures the field at the same location as the most recent power reference measurement job within the same procedure, and with the same settings. The power drift measurement gives the field difference in dB from the reading conducted within the last power reference measurement. The power reference measurement and power drift measurement are for monitoring the power drift of the device under test in the batch process.

9 Measurement Uncertainties

9.1 300 MHz to 3 GHz

Uncertainty Component	Tol. (± %)	Prob. Dist.	Div.	c_i (1g)	c_i (10g)	Std. Unc. (± %) 1g	Std. Unc. (± %) 10g	v_i
Measurement System								
Probe calibration	6.0	N	1	1	1	6.0	6.0	∞
Axial isotropy	4.7	R	√3	0.7	0.7	1.9	1.9	∞
Hemispherical isotropy	9.6	R	√3	0.7	0.7	3.9	3.9	∞
Boundary effects	1.0	R	√3	1	1	0.6	0.6	∞
Linearity	4.7	R	√3	1	1	2.7	2.7	∞
System detection limits	1.0	R	√3	1	1	0.6	0.6	∞
Modulation response	2.4	R	√3	1	1	1.4	1.4	∞
Readout electronics	0.3	N	1	1	1	0.3	0.3	∞
Response time	0.8	R	√3	1	1	0.5	0.5	∞
Integration time	2.6	R	√3	1	1	1.5	1.5	∞
RF ambient conditions – noise	3.0	R	√3	1	1	1.7	1.7	∞
RF ambient conditions – reflections	3.0	R	√3	1	1	1.7	1.7	∞
Probe positioner mechanical tolerance	0.4	R	√3	1	1	0.2	0.2	∞
Probe positioning with respect to phantom shell	2.9	R	√3	1	1	1.7	1.7	∞
Extrapolation, interpolation and integration algorithms for max. SAR evaluation	2.0	R	√3	1	1	1.2	1.2	∞
Test Sample Related								
Device holder uncertainty	2.9	N	1	1	1	2.9	2.9	5
Test sample positioning	3.4	N	1	1	1	3.4	3.4	23
Output power variation – SAR drift measurement	5.0	R	√3	1	1	2.9	2.9	∞
Power Scaling	0.0	R	√3	1	1	0.0	0.0	∞
Phantom and Tissue Parameters								
Phantom uncertainty	6.1	R	√3	1	1	3.5	3.5	∞
Algorithms for correcting SAR for deviations	1.9	R	√3	1	0.84	1.1	0.9	∞
Liquid Conductivity – measurement uncertainty	3.2	N	1	0.78	0.71	2.5	2.3	5
Liquid Permittivity – measurement uncertainty	3.0	N	1	0.26	0.26	0.8	0.8	5
Liquid Conductivity – temperature uncertainty	5.2	R	√3	0.78	0.71	2.3	2.1	∞
Liquid Permittivity – temperature uncertainty	0.8	R	√3	0.23	0.26	0.1	0.1	∞
Combined Standard Uncertainty		RSS				11.5	11.4	
Expanded Uncertainty (95% Confidence Interval)		k=2				22.9	22.7	

NOTES
1. Tol. : tolerance in influence quantity
2. Prob. Dist. : probability distributions
3. N, R : normal, rectanglar
4. Div. : divisor used to obtain standard uncertainty
5. c_i : sensitivity coefficient
6. Std. Unc. : standard uncertainty
7. Measurement uncertainties are according to IEEE Std.1528 and IEC 62209-1.

9.2 3 GHz to 6 GHz

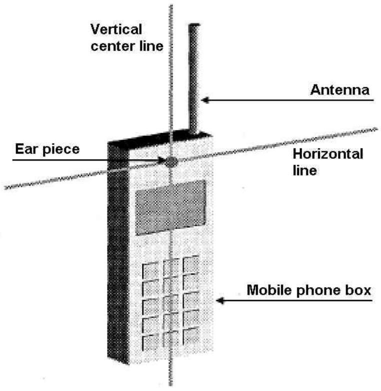
Uncertainty Component	Tol. (± %)	Prob. Dist.	Div.	c_i (1g)	c_i (10g)	Std. Unc. (± %)		v_i
						1g	10g	
Measurement System								
Probe calibration	6.6	N	1	1	1	6.6	6.6	∞
Axial isotropy	4.7	R	√3	0.7	0.7	1.9	1.9	∞
Hemispherical isotropy	9.6	R	√3	0.7	0.7	3.9	3.9	∞
Boundary effects	2.0	R	√3	1	1	1.2	1.2	∞
Linearity	4.7	R	√3	1	1	2.7	2.7	∞
System detection limits	1.0	R	√3	1	1	0.6	0.6	∞
Modulation response	2.4	R	√3	1	1	1.4	1.4	∞
Readout electronics	0.3	N	1	1	1	0.3	0.3	∞
Response time	0.8	R	√3	1	1	0.5	0.5	∞
Integration time	2.6	R	√3	1	1	1.5	1.5	∞
RF ambient conditions – noise	3.0	R	√3	1	1	1.7	1.7	∞
RF ambient conditions – reflections	3.0	R	√3	1	1	1.7	1.7	∞
Probe positioner mechanical tolerance	0.8	R	√3	1	1	0.5	0.5	∞
Probe positioning with respect to phantom shell	6.7	R	√3	1	1	3.9	3.9	∞
Extrapolation, interpolation and integration algorithms for max. SAR evaluation	4.0	R	√3	1	1	2.3	2.3	∞
Test Sample Related								
Device holder uncertainty	2.9	N	1	1	1	2.9	2.9	5
Test sample positioning	3.4	N	1	1	1	3.4	3.4	23
Output power variation – SAR drift measurement	5.0	R	√3	1	1	2.9	2.9	∞
Power Scaling	0.0	R	√3	1	1	0.0	0.0	∞
Phantom and Tissue Parameters								
Phantom uncertainty	6.6	R	√3	1	1	3.8	3.8	∞
Algorithms for correcting SAR for deviations	1.9	R	√3	1	0.84	1.1	0.9	∞
Liquid Conductivity – measurement uncertainty	3.2	N	1	0.78	0.71	2.5	2.3	5
Liquid Permittivity – measurement uncertainty	3.0	N	1	0.26	0.26	0.8	0.8	5
Liquid Conductivity – temperature uncertainty	3.4	R	√3	0.78	0.71	1.5	1.4	∞
Liquid Permittivity – temperature uncertainty	0.4	R	√3	0.23	0.26	0.1	0.1	∞
Combined Standard Uncertainty		RSS				12.5	12.4	
Expanded Uncertainty (95% Confidence Interval)		k=2				24.9	24.8	

NOTES
1. Tol. : tolerance in influence quantity
2. Prob. Dist. : probability distributions
3. N, R : normal, rectanglar
4. Div. : divisor used to obtain standard uncertainty
5. c_i : sensitivity coefficient
6. Std. Unc. : standard uncertainty
7. Measurement uncertainties are according to IEEE Std.1528 and IEC 62209-1.

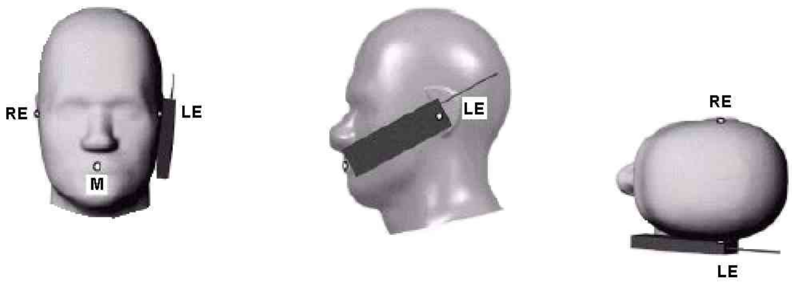
10 Test Arrangement

10.1 Head Exposure Conditions

10.1.1 Cheek-Touch Position

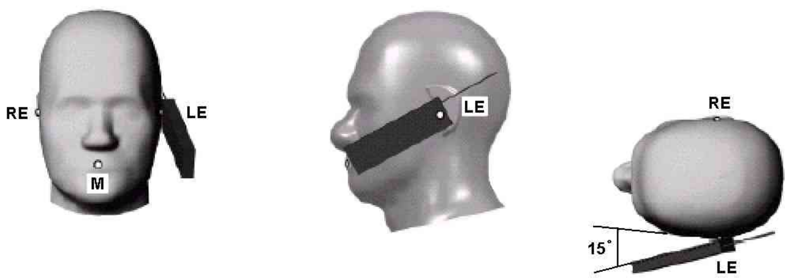


1. Position the device with the vertical center line of the body of the device and the horizontal line crossing the center of the ear piece in a plane parallel to the sagittal plane of the phantom.
2. While maintaining the device in this plane, align the vertical center line with the reference plane containing the three ear and mouth reference points (M, RE and LE) and align the center of the ear piece with the line RE-LE.
3. Translate the mobile phone box towards the phantom with the ear piece aligned with the line RE-LE until the phone touches the ear.
4. While maintaining the device in the reference plane and maintaining the phone contact with the ear, move the bottom of the box until any point on the front side is in contact with the cheek of the phantom or until contact with the ear is lost.



10.1.2 Ear-Tilt Position

1. Position the device in the “Cheek-Touch Position”.
2. While maintaining the device in the reference plane and pivoting against the ear, move it outward away from the mouth by an angle of 15 degrees or until contact with the ear is lost.



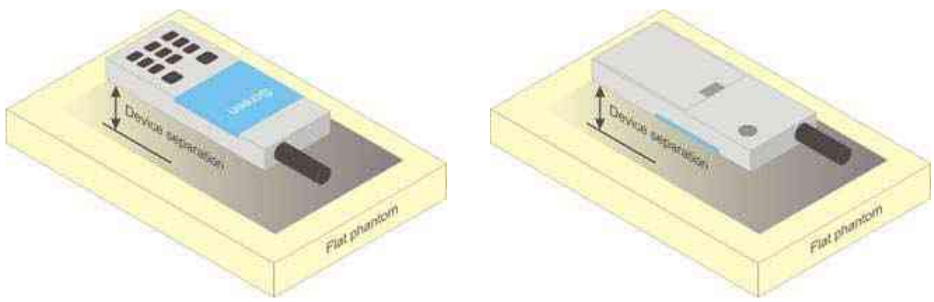
10.2 Body-worn Accessory Exposure Conditions

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. Both the physical spacing to the body of the user as dictated by the accessory and the materials used in an accessory affect the SAR produced by the transmitting device. For purpose of determining test requirements, accessories may be divided into two categories: those that do not contain metallic components and those that do.

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 surface 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.

When the reported SAR for a body-worn accessory, measured without a headset connected to the handset, is > 1.2 W/kg, the highest reported SAR configuration for that wireless mode and frequency band should be repeated for that body-worn accessory with a headset attached to the handset.



10.3 Hotspot Mode Exposure Conditions

For cell phones that support hotspot mode operations, with wireless router capabilities and various web browsing functions, the relevant hand and body exposure conditions are tested according to the hotspot SAR procedures in KDB 941225. A test separation distance of 10 mm is required between the phantom and all surfaces and edges with a transmitting antenna located within 25 mm from that surface or edge. When the form factor of a handset is smaller than 9 cm × 5 cm, a test separation distance of 5 mm (instead of 10 mm) is required for testing hotspot mode. When the separation distance required for body-worn accessory testing is larger than or equal to that tested for hotspot mode, in the same wireless mode and for the same surface of the phone, the hotspot mode SAR data may be used to support body-worn accessory SAR compliance for that particular configuration (surface).

10.4 RF Exposure Conditions

Handsets are tested for SAR compliance in head, body-worn accessory and other use configurations according to the procedures described in KDB 648474 D04.

10.4.1 Head Exposure Conditions

Test Position	SAR Required	Note
Left Touch	YES	
Left Tilt (15°)	YES	
Right Touch	YES	
Right Tilt (15°)	YES	

10.4.2 Body-worn Accessory Exposure Conditions

Test Position	SAR Required	Note
Rear	YES	
Front	YES	

10.4.3 Hotspot Mode Exposure Conditions

For WWAN

Test Position	Antenna-to-edge/surface	SAR Required	Note
Rear	< 25 mm	YES	
Front	< 25 mm	YES	
Top Edge	123.2 mm	NO	SAR is not required because the distance from the antenna to the edge is > 25 mm as per KDB 941225 D06.
Bottom Edge	1.5 mm	YES	
Left Edge	47.7 mm	NO	SAR is not required because the distance from the antenna to the edge is > 25 mm as per KDB 941225 D06.
Right Edge	1.5 mm	YES	

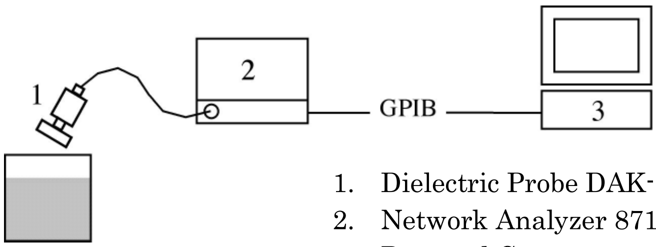
For WLAN and Bluetooth

Test Position	Antenna-to-edge/surface	SAR Required	Note
Rear	< 25 mm	YES	
Front	< 25 mm	YES	
Top Edge	1.5 mm	YES	
Bottom Edge	111.9 mm	NO	SAR is not required because the distance from the antenna to the edge is > 25 mm as per KDB 941225 D06.
Left Edge	1.5 mm	YES	
Right Edge	48.0 mm	NO	SAR is not required because the distance from the antenna to the edge is > 25 mm as per KDB 941225 D06.

11 Tissue Verification

11.1 Tissue Verification Measurement Condition

The tissue dielectric parameters must be measured before the tissue-equivalent medium is used in a series of SAR measurements. The parameters should be re-measured after each 3 – 4 days of use, or earlier if dielectric parameters can become out of tolerance; for example, when the parameters are marginal at the beginning of the measurement series.
The temperature of the tissue-equivalent medium used during measurement must be within 18°C to 25°C and within ± 2°C of the temperature when the tissue parameters are characterized.
It is verified by using the dielectric probe and the network analyzer.



1. Dielectric Probe DAK-3.5
2. Network Analyzer 8719ET
3. Personal Computer

11.2 Tissue Dielectric Properties

The tissue dielectric properties are specified in KDB 865664 D01.

Target Frequency [MHz]	Head		Body	
	Permittivity (ε_r)	Conductivity (σ)	Permittivity (ε_r)	Conductivity (σ)
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

For tissue dielectric properties at other frequencies within the range, a linear interpolation method shall be used.

11.3 Composition of Ingredients for the Tissue Material Used in the SAR Tests

The following tissue formulations are provided for reference only as some of the parameters have not been thoroughly verified. The composition of ingredients may be modified accordingly to achieve the desired target tissue parameters required for routine SAR evaluation.

Ingredients (% by weight)	Frequency (MHz)									
	450		835		915		1900		2450	
	Head	Body	Head	Body	Head	Body	Head	Body	Head	Body
Water	38.56	51.16	41.45	52.40	41.05	56.00	54.9	40.40	62.70	73.20
Salt (NaCl)	3.95	1.49	1.45	1.40	1.35	0.76	0.18	0.50	0.50	0.04
Sugar	56.32	46.78	56.00	45.00	56.50	41.76	0.00	58.00	0.00	0.00
HEC	0.98	0.52	1.00	1.00	1.00	1.21	0.00	1.00	0.00	0.00
Bactericide	0.19	0.04	0.10	0.10	0.10	0.27	0.00	0.10	0.00	0.00
Triton X-100	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	36.80	0.00
DGBE	0.00	0.00	0.00	0.00	0.00	0.00	44.92	0.00	0.00	26.70

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

HBBL 3500-5800 (Head Liquids for 3 – 6 GHz)

Item	Head Broad Band Tissue Simulation Liquids HBBL 3500-5800
Water	50 – 65 %
Mineral oil	10 – 30 %
Emulsifiers	8 – 25 %
Sodium salt	0 – 1.5 %
Safety relevant ingredients according to EU directives: EINECS-No 203-489-0　1.0 – 2.8 %　2-Methyl-pentane-2,4-diol (Hexylene Glycol): CAS-No 107-41-5　(Xi irritant, R36/38 irritant for eyes and skin)	

MBBL 3500-5800 (Body Liquids for 3 – 6 GHz)

Item	Muscle Broad Band Tissue Simulation Liquids MBBL 3500-5800
Water	60 – 80 %
Esters, Emulsifiers, Inhibitors	20 – 40 %
Sodium salt	0 – 1.5 %
Safety relevant ingredients according to EU directives: none Safety relevant ingredients according to other directives: CAS-No 26399-02-0　10 – 28 %　Oleic acid, alkylester	

11.4 Tissue Verification Results

Tissue dielectric parameters are measured at the low, middle and high frequency of each operating frequency range of the test device.

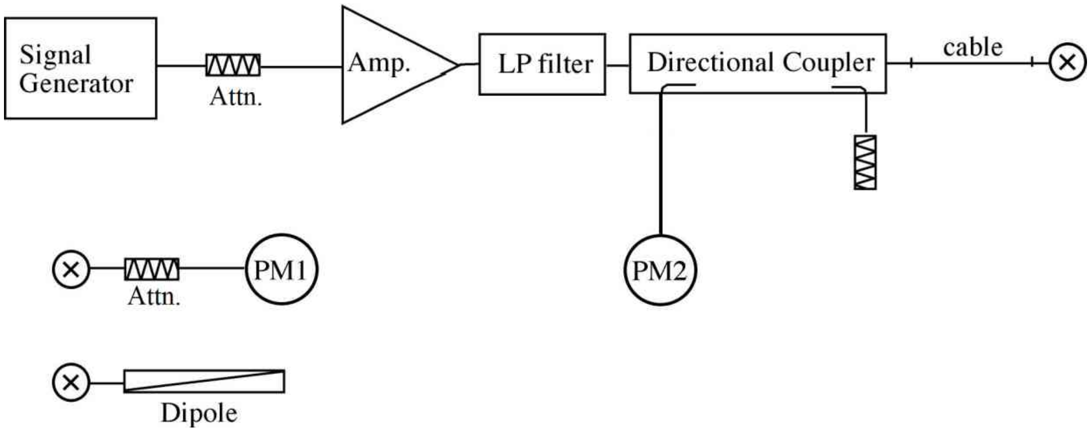
Date	Liquid	Frequency [MHz]	Parameters	Target	Measured	Deviation [%]	Limit [%]
6/4/2014	Head	1850	Permittivity (ε_r)	40.0	39.47	-1.33	± 5
			Conductivity (σ)	1.40	1.373	-1.93	± 5
		1900	Permittivity (ε_r)	40.0	39.24	-1.90	± 5
			Conductivity (σ)	1.40	1.426	+1.86	± 5
		1910	Permittivity (ε_r)	40.0	39.18	-2.05	± 5
			Conductivity (σ)	1.40	1.439	+2.79	± 5
6/4/2014	Body	1850	Permittivity (ε_r)	53.3	52.49	-1.52	± 5
			Conductivity (σ)	1.52	1.508	-0.79	± 5
		1900	Permittivity (ε_r)	53.3	52.32	-1.84	± 5
			Conductivity (σ)	1.52	1.567	+3.09	± 5
		1910	Permittivity (ε_r)	53.3	52.29	-1.89	± 5
			Conductivity (σ)	1.52	1.580	+3.95	± 5
6/5/2014	Head	2410	Permittivity (ε_r)	39.3	39.57	+0.69	± 5
			Conductivity (σ)	1.76	1.814	+3.07	± 5
		2450	Permittivity (ε_r)	39.2	39.53	+0.84	± 5
			Conductivity (σ)	1.80	1.867	+3.72	± 5
		2465	Permittivity (ε_r)	39.2	39.48	+0.71	± 5
			Conductivity (σ)	1.82	1.885	+3.57	± 5
6/5/2014	Body	2410	Permittivity (ε_r)	52.8	51.84	-1.82	± 5
			Conductivity (σ)	1.91	1.921	+0.58	± 5
		2450	Permittivity (ε_r)	52.7	51.68	-1.94	± 5
			Conductivity (σ)	1.95	1.973	+1.18	± 5
		2465	Permittivity (ε_r)	52.7	51.61	-2.07	± 5
			Conductivity (σ)	1.97	1.998	+1.42	± 5

12 System Performance Check

12.1 System Performance Check Measurement Condition

The power meter PM1 (including Attenuator) measures the forward power at the location of the validation dipole connector. The signal generator is adjusted for 250 mW at the dipole connector and the power meter PM2 is read at that level. After connecting the cable to the dipole, the signal generator is readjusted for the same reading at power meter PM2.

The dipole antenna is matched to be used near flat phantom filled with tissue simulating solution. A specific distance holder is used in the positioning of the antenna to ensure correct spacing between the phantom and the dipole.



12.2 Target SAR Values for System Performance Check

The target SAR values can be obtained from the calibration certificate of system validation dipoles.

System Dipole		Cal. Date	Frequency [MHz]	Target SAR Values [W/kg]		
Type	Serial			1g/10g	Head	Body
D1900V2	5d112	8/22/2013	1900	1g	40.6	41.1
				10g	21.3	21.8
D2450V2	714	11/14/2013	2450	1g	52.8	49.8
				10g	24.6	23.3

12.3 System Performance Check Results

The SAR measured with a system validation dipole, using the required tissue-equivalent medium at the test frequency, must be within 10 % of the manufacturer calibrated dipole SAR target.

Date	System Dipole		Liquid	Measured SAR [W/kg] (Normalized to 1 W)		Target	Deviation [%]	Limit [%]
	Type	Serial						
6/4/2014	D1900V2	5d112	Head	1 g	38.80	40.6	-4.43	± 10
				10 g	20.64	21.3	-3.10	± 10
6/4/2014	D1900V2	5d112	Body	1 g	41.20	41.1	+0.24	± 10
				10 g	22.16	21.8	+1.65	± 10
6/5/2014	D2450V2	714	Head	1 g	52.00	52.8	-1.52	± 10
				10 g	24.12	24.6	-1.95	± 10
6/5/2014	D2450V2	714	Body	1 g	49.20	49.8	-1.20	± 10
				10 g	23.24	23.3	-0.26	± 10

13 RF Output Power Measurements

13.1 GSM

Settings	Mode	Parameter
General Settings	Band Indicator	PCS 1900
	Power Control Level	0 (30 dBm)
GPRS Specific Settings	Connection Type	Test Mode A
	Multi Slot Class	12 (4 down / 4 up / 5 sum)
	Coding Scheme	CS1 (GMSK)

PCS 1900

Mode		Conducted Average Power (dBm)					
		512 ch (1850.2 MHz)		661 ch (1880.0 MHz)		810 ch (1909.8 MHz)	
		Burst	Frame	Burst	Frame	Burst	Frame
GSM	Voice	29.50	20.47	29.47	20.44	29.56	20.53
GPRS	1 slot	29.51	20.48	29.48	20.45	29.57	20.54
	2 slots	27.12	21.10	27.11	21.09	27.09	21.07
	3 slots	25.35	21.09	25.30	21.04	25.42	21.16
	4 slots	24.15	21.14	24.23	21.22	24.25	21.24

Note(s):
KDB 941225 D03 – The worst-case configuration for SAR testing is determined to be as follows.
1. Body : GPRS mode with 4 time slots, based on the output power above
2. Head : Same mode as Body SAR testing (VoIP applicable using GPRS multi-slot)

13.2 WLAN (DTS Band)

Band	Mode	Channel	Frequency (MHz)	Average Power (dBm)
2.4 GHz (DTS)	802.11b	1	2412	13.56
		6	2437	13.58
		11	2462	13.48
	802.11g	1	2412	11.45
		6	2437	11.37
		11	2462	11.46
	802.11n [HT20]	1	2412	10.34
		6	2437	10.42
		11	2462	10.39

Note(s):
KDB 248227 D01 – SAR is not required for 802.11g/n channels when the maximum average output power is less than ¼ dB higher than that measured on the corresponding 802.11b channels.

13.3 Bluetooth

Maximum tune-up tolerance limit is 8.0 dBm from the rated nominal maximum output power.
This power level qualifies for exclusion of SAR testing.

13.4 Standalone SAR Test Exclusion Considerations (KDB 447498 D01)

The 1 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, where

- f (GHz) is the RF channel transmit frequency in GHz.
- Power and distance are rounded to the nearest mW and mm before calculation.
- The result is rounded to one decimal place for comparison.
- When the minimum test separation distance is < 5 mm, a distance of 5 mm is applied.

Band	Frequency (MHz)	Max. Power		Test Position	Distance (mm)	Threshold	Test Exclusion
		(dBm)	(mW)				
WLAN 2.4 GHz	2462	15.0	32	Head	< 5	10.0	NO
				Body	10	5.0	NO
Bluetooth	2480	8.0	6	Head	< 5	1.9	YES
				Body	10	0.9	YES

14 SAR Measurements

14.1 PCS 1900

Head

GPRS 4 slots (CS1) – Duty Cycle 48.0%							
Test Position	Ch#	Freq. [MHz]	Power [dBm]		1 g SAR [W/kg]		Plot No.
			Tune-up Limit	Meas.	Meas.	Scaled	
Left Touch	661	1880.0	24.5	24.23	0.218	**0.232**	
Left Tilt	661	1880.0	24.5	24.23	0.108	**0.115**	
Right Touch	661	1880.0	24.5	24.23	0.324	0.345	1
Right Tilt	661	1880.0	24.5	24.23	0.114	**0.121**	

Body-worn Accessory & Hotspot mode

GPRS 4 slots (CS1) – Duty Cycle 48.0%								
Test Position	Dist. [mm]	Ch#	Freq. [MHz]	Power [dBm]		1 g SAR [W/kg]		Plot No.
				Tune-up Limit	Meas.	Meas.	Scaled	
Rear	10	661	1880.0	24.5	24.23	0.318	**0.338**	
Front	10	661	1880.0	24.5	24.23	0.326	0.347	2
Bottom Edge	10	661	1880.0	24.5	24.23	0.142	**0.151**	
Right Edge	10	661	1880.0	24.5	24.23	0.293	**0.312**	

Note(s):

1. KDB 447498 D01 – Testing of other required channels within the operating mode of a frequency band is not required when the reported 1 g SAR for the mid-band or highest output power channel is:
   - ≤ 0.8 W/kg when the transmission band is ≤ 100 MHz
   - ≤ 0.6 W/kg when the transmission band is between 100 MHz and 200 MHz
   - ≤ 0.4 W/kg when the transmission band is ≥ 200 MHz

14.2 WLAN (DTS Band)

Head

802.11b (1 Mbps) – Duty Cycle 100%							
Test Position	Ch#	Freq. [MHz]	Power [dBm]		1 g SAR [W/kg]		Plot No.
			Tune-up Limit	Meas.	Meas.	Scaled	
Left Touch	6	2437	15.0	13.58	0.023	0.032	
Left Tilt	6	2437	15.0	13.58	0.033	0.046	3
Right Touch	6	2437	15.0	13.58	0.028	0.039	
Right Tilt	6	2437	15.0	13.58	0.030	0.042	

Body-worn Accessory & Hotspot mode

802.11b (1 Mbps) – Duty Cycle 100%								
Test Position	Dist. [mm]	Ch#	Freq. [MHz]	Power [dBm]		1 g SAR [W/kg]		Plot No.
				Tune-up Limit	Meas.	Meas.	Scaled	
Rear	10	6	2437	15.0	13.58	0.052	0.072	4
Front	10	6	2437	15.0	13.58	0.007	0.010	
Top Edge	10	6	2437	15.0	13.58	0.020	0.028	
Left Edge	10	6	2437	15.0	13.58	0.008	0.011	

Note(s):
1. KDB 447498 D01 – Testing of other required channels within the operating mode of a frequency band is not required when the reported 1 g SAR for the mid-band or highest output power channel is:
   - ≤ 0.8 W/kg when the transmission band is ≤ 100 MHz
   - ≤ 0.6 W/kg when the transmission band is between 100 MHz and 200 MHz
   - ≤ 0.4 W/kg when the transmission band is ≥ 200 MHz

14.3 SAR Measurement Variability

In accordance with the KDB 865664 D01, these additional measurements are repeated after the completion of all measurements requiring the same head or body tissue-equivalent medium in a frequency band. The DUT should be returned to ambient conditions (normal room temperature) with the battery fully charged before it is re-mounted on the device holder for the repeated measurement(s) to minimize any unexpected variations in the repeated results.

1) Repeated measurement is not required when the original highest measured SAR is < 0.80 W/kg; steps 2) through 4) do not apply.
2) When the original highest measured SAR is ≥ 0.80 W/kg, repeat that measurement once.
3) Perform a 2nd repeated measurement only if the ratio of largest to smallest SAR for the original and first repeated measurements is > 1.20 or when the original or repeated measurement is ≥ 1.45 W/kg (~ 10% from the 1-g SAR limit).
4) Perform a 3rd repeated measurement only if the original, first or second repeated measurement is ≥1.5 W/kg and the ratio of largest to smallest SAR for the original, first and second repeated measurements is > 1.20.

14.3.1 Highest Measured SAR Configuration in Each Frequency Band

Frequency Band [MHz]	Air Interface	Standalone SAR [W/kg]	
		Head	Body
1900	PCS 1900	0.324	0.326
2450	WLAN 802.11b	0.033	0.052

14.3.2 Repeated SAR Measurement Results

Repeated SAR measurement is not required because the highest measured SAR is < 0.80 W/kg.

14.4 Simultaneous Transmission SAR Analysis (KDB 447498 D01)

14.4.1 Simultaneous Transmission

WWAN can transmit simultaneously with WLAN/Bluetooth.
WLAN in 2.4 GHz band cannot transmit simultaneously with Bluetooth.

No.	Conditions	Head	Body	Hotspot
1	PCS 1900 + WLAN 2.4 GHz	YES	YES	YES
2	PCS 1900 + Bluetooth	YES	YES	NO

14.4.2 Standalone SAR Estimation

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*)] · [$\sqrt{f_{(GHz)}}$ / 7.5] W/kg for 1 g SAR, *test separation distances* ≤ 50 mm
When the minimum test separation distance is < 5 mm, a distance of 5 mm is applied.

Band	Frequency (MHz)	Max. Power (dBm)	Max. Power (mW)	Test Position	Distance (mm)	Estimated SAR (W/kg)
Bluetooth	2480	8.0	6	Head	< 5	0.252
				Body	10	0.126

14.4.3 Sum of the SAR for PCS 1900 + WLAN & Bluetooth

14.4.3.1 Head

Test Position	Simultaneous Transmission Scenario			Σ 1 g SAR (W/kg)
	PCS 1900	WLAN DTS Band	Bluetooth	
Left Touch	0.232	0.032		**0.264**
	0.232		0.252	**0.484**
Left Tilt	0.115	0.046		**0.161**
	0.115		0.252	**0.367**
Right Touch	0.345	0.039		**0.384**
	0.345		0.252	**0.597**
Right Tilt	0.121	0.042		**0.163**
	0.121		0.252	**0.373**

SAR to Peak Location Separation Ratio (SPLSR)
As the sum of the 1 g SAR is < 1.6 W/kg, SPLSR assessment is not required.

Conclusion:
Simultaneous transmission SAR measurement (Volume Scan) is not required because the sum of the 1 g SAR is < 1.6 W/kg.

14.4.3.2 Body-worn Accessory and Hotspot mode

Test Position	Simultaneous Transmission Scenario			Σ 1 g SAR (W/kg)
	PCS 1900	WLAN DTS Band	Bluetooth	
Rear	0.338	0.072		0.410
	0.338		0.126	0.464
Front	0.347	0.010		0.357
	0.347		0.126	0.473
Top Edge	N/A	0.028		N/A
Bottom Edge	0.151	N/A		N/A
Left Edge	N/A	0.011		N/A
Right Edge	0.312	N/A		N/A

SAR to Peak Location Separation Ratio (SPLSR)

As the sum of the 1 g SAR is < 1.6 W/kg, SPLSR assessment is not required.

Conclusion:

Simultaneous transmission SAR measurement (Volume Scan) is not required because the sum of the 1 g SAR is < 1.6 W/kg.

16 Test Instruments

Shielded Room S3					
Type	**Model**	**Manufacturer**	**ID No.**	**Last Cal.**	**Interval**
E-Field Probe	ET3DV6	SPEAG	S-2	2013/8	1 Year
E-Field Probe	EX3DV4	SPEAG	S-17	2013/9	1 Year
DAE	DAE4	SPEAG	S-3	2013/11	1 Year
Robot	RX60L	Stäubli	S-7	------	N/A
Probe Alignment Unit	LB5/80	SPEAG	S-13	------	N/A
Network Analyzer	8719ET	Agilent	B-53	2013/9	1 Year
Dielectric Probe	DAK-3.5	SPEAG	S-32	2013/7	1 Year
1900MHz Dipole	D1900V2	SPEAG	S-25	2013/8	1 Year
2450MHz Dipole	D2450V2	SPEAG	S-6	2013/11	1 Year
Signal Generator	E8257D	Agilent	B-39	2013/8	1 Year
RF Power Amplifier	CGA020M602-2633R	R&K	A-51	------	N/A
Directional Coupler	4226-20	Narda	D-87	------	N/A
Radio Communication Analyzer	MT8820C	Anritsu	B-5	2014/2	1 Year
Power Meter	E4417A	Agilent	B-51	2013/11	1 Year
Power Sensor	E9323A	Agilent	B-59	2013/6	1 Year
Power Meter	N1911A	Agilent	B-63	2013/7	1 Year
Power Sensor	N1921A	Agilent	B-64	2013/7	1 Year
Attenuator	54A-10	Weinschel	D-28	2013/10	1 Year
Attenuator	2-20	Weinschel	D-36	2013/10	1 Year

17 Appendix

Refer to separated files for the following appendixes.

Appendix 1 – System Performance Check Plots

Appendix 2 – Highest SAR Test Plots

Appendix 3 – Dosimetric E-Field Probe Calibration Data

Appendix 4 – System Validation Dipole Calibration Data