ACCREDITED
TESTING LABORATORY
CERTIFICATE NUMBER: 3297.02

Bay Area Compliance Labs Corp.

SAR EVALUATION REPORT

For

Intel Corporation.

2200 Mission College Blvd.,

Santa Clara, CA 95054, USA

FCC ID: 2AB8ZND24
IC: 1000X-ND24

Report Type: Original Report	**Product Type:** Smart Watch

Prepared By:	Jin Yang Test Engineer
Report Number:	R1610053-SAR Rev B
Report Date:	2017-08-31
Reviewed By:	Simon Ma RF Lead Engineer
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Summary of Test Results			
Rule Part(s):	FCC §2.1093, ISED RSS-102 Issue 5		
Test Procedure(s):	IEEE 1528: 2013, KDB 248227, KDB 447498, KDB 865664, KDB 616217, IEC 62209-2: 2010 IEEE C95.3-2002		
Device Category: Exposure Category:	Portable Device General Population/Uncontrolled Exposure		
Device Type:	Portable Device		
Modulation Type:	DSSS, OFDM, GFSK, QPSK, 8PSK, ASK		
TX Frequency Range:	802.11b/g/n: 2412-2462 MHz Bluetooth: 2402-2480 MHz BLE: 2402-2480 MHz NFC: 13.56 MHz		
Maximum Average Conducted Power:	Bluetooth: 9.82 dBm		2.4 GHz
	Bluetooth LE: 8.7 dBm		2.4 GHz
	802.11b/g/n: 16.72 dBm		2.4 GHz
	NFC: 43.09 dBµV/m @ 3m		13.56 MHz
Antenna Type(s) Tested:	Internal Antennas		
Body-Worn Accessories:	Wrist Band*		
Face-Head Accessories:	-		
Battery Type (s) Tested:	Li-Polymer 3.8 V/400mAh		
Max. SAR Level (s) Measured:	**Level (W/Kg)**	**Position**	**Operational Mode**
	0.0678	Front, Speaker on	2.4 GHz
	0.0254	Rear, Wrist-worn	2.4 GHz

**Note: The wrist band was removed from the EUT during SAR measurements, due to the additional space that it created between the back surface of the EUT and the phantom.*

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DOCUMENT REVISION HISTORY

Revision Number	Report Number	Description of Revision	Date of Revision
0	R1610053-SAR	Original Report	2016-11-09
A	R1610053-SAR Rev A	To incorporate review comments from the FCC	2017-08-18
B	R1610053-SAR Rev B	Section 2 & 5	2017-08-31

1 General Description

1.1 Product Description for Equipment under Test (EUT)

This SAR Evaluation Report was prepared on behalf of *Intel Corporation* for their product model: *SBF8A,* FCC ID: 2AB8ZND24, IC: 1000X-ND24. This product model is referred to as the "EUT". The EUT was a smart watch with Wi-Fi, Bluetooth/BLE and NFC capabilities.

1.2 EUT Technical Specification

Item	Description	
Modulation	DSSS, OFDM, GFSK, QPSK, 8PSK, ASK	
Frequency Range	802.11b/g/n: 2412-2462 MHz Bluetooth: 2402-2480 MHz BLE: 2402-2480 MHz NFC: 13.56 MHz	
Maximum Conducted Power Tested	Bluetooth: 9.82 dBm	2.4 GHz
	Bluetooth LE: 8.7 dBm	2.4 GHz
	802.11b/g/n: 16.72 dBm	2.4 GHz
	NFC: 43.09 dBμV/m @ 3m	13.56 MHz
Power Source	Li-Polymer 3.8V/400mAh	
Dimensions (L*W*H):	5 cm (L) x 5 cm (W) x 1.5 cm (H)	
Normal Operation	Speaker on; Wrist-worn with accessories	

1.3 Test Facility Accreditations

Bay Area Compliance Laboratories Corp. (BACL) is:

A- ***An independent, 3rd-Party, Commercial Test Laboratory accredited to ISO/IEC 17025:2005 by A2LA (Test Laboratory Accreditation Certificate Number 3279.02)***, in the fields of: Electromagnetic Compatibility and Telecommunications. Unless noted by an Asterisk (*) in the Compliance Matrix (See Section 8 of this Test Report), BACL's ISO/IEC 17025:2005 Scope of Accreditation includes all of the Test Method Standards and/or the Product Family Standards detailed in this Test Report..

BACL's ISO/IEC 17025:2005 Scope of Accreditation includes a comprehensive suite of EMC Emissions, EMC Immunity, Radio, RF Exposure, Safety and wireline Telecommunications test methods applicable to a wide range of product categories. These product categories include Central Office Telecommunications Equipment [including NEBS - Network Equipment Building Systems], Unlicensed and Licensed Wireless and RF devices, Information Technology Equipment (ITE); Telecommunications Terminal Equipment (TTE); Medical Electrical Equipment; Industrial, Scientific and Medical Test Equipment; Professional Audio and Video Equipment; Industrial and Scientific Instruments and Laboratory Apparatus; Cable Distribution Systems, and Energy Efficient Lighting.

B- ***A Product Certification Body accredited to ISO/IEC 17065:2012 by A2LA (Product Certification Body***
- - For the USA (Federal Communications Commission):
  1- All Unlicensed radio frequency devices within FCC Scopes A1, A2, A3, and A4;
  2- All Licensed radio frequency devices within FCC Scopes B1, B2, B3, and B4;
  3- All Telephone Terminal Equipment within FCC Scope C.
- For the Canada (Industry Canada):
  1- All Scope 1-Licence-Exempt Radio Frequency Devices;
  2- All Scope 2-Licensed Personal Mobile Radio Services;
  3- All Scope 3-Licensed General Mobile & Fixed Radio Services;
  4- All Scope 4-Licensed Maritime & Aviation Radio Services;
  5- All Scope 5-Licensed Fixed Microwave Radio Services
  6- All Broadcasting Technical Standards (BETS) in the Category I Equipment Standards List.

For Singapore (Info-Communications Development Authority (IDA)):
  1 All Line Terminal Equipment: All Technical Specifications for Line Terminal Equipment – Table 1 of IDA MRA Recognition Scheme: 2011, Annex 2
  2. All Radio-Communication Equipment: All Technical Specifications for Radio-Communication Equipment – Table 2 of IDA MRA Recognition Scheme: 2011, Annex 2
- For the Hong Kong Special Administrative Region:
  1 All Radio Equipment, per KHCA 10XX-series Specifications;
  2 All GMDSS Marine Radio Equipment, per HKCA 12XX-series Specifications;
  3 All Fixed Network Equipment, per HKCA 20XX-series Specifications.
- For Japan:
  1 MIC Telecommunication Business Law (Terminal Equipment):
    - All Scope A1 - Terminal Equipment for the Purpose of Calls;
    - All Scope A2 - Other Terminal Equipment
  2 Radio Law (Radio Equipment):
    - All Scope B1 - Specified Radio Equipment specified in Article 38-2-2, paragraph 1, item 1 of the Radio Law
    - All Scope B2 - Specified Radio Equipment specified in Article 38-2-2, paragraph 1, item 2 of the Radio Law
    - All Scope B3 - Specified Radio Equipment specified in Article 38-2-2, paragraph 1, item 3 of the Radio Law

C- ***A Product Certification Body accredited to ISO/IEC 17065:2012 by A2LA (Product Certification Body Accreditation Certificate Number 3279.01)*** to certify Products to USA's Environmental Protection Agency (EPA) ENERGY STAR Product Specifications for:
  1 Electronics and Office Equipment:
    - for Telephony (ver. 3.0)

- for Audio/Video (ver. 3.0)
- for Battery Charging Systems (ver. 1.1)
- for Set-top Boxes & Cable Boxes (ver. 4.1)
- for Televisions (ver. 6.1)
- for Computers (ver. 6.0)
- for Displays (ver. 6.0)
- for Imaging Equipment (ver. 2.0)
- for Computer Servers (ver. 2.0)

2 Commercial Food Service Equipment
- for Commercial Dishwashers (ver. 2.0)
- for Commercial Ice Machines (ver. 2.0)
- for Commercial Ovens (ver. 2.1)
- for Commercial Refrigerators and Freezers

3 Lighting Products
- For Decorative Light Strings (ver. 1.5)
- For Luminaires (including sub-components) and Lamps (ver. 1.2)
- For Compact Fluorescent Lamps (CFLs) (ver. 4.3)
- For Integral LED Lamps (ver. 1.4)

4 Heating, Ventilation, and AC Products
- for Residential Ceiling Fans (ver. 3.0)
- for Residential Ventilating Fans (ver. 3.2)

5 Other
- For Water Coolers (ver. 3.0)

D. A NIST Designated Phase-I and Phase-II Conformity Assessment Body (CAB) for the following economies and regulatory authorities under the terms of the stated MRAs/Treaties:

- Australia: ACMA (Australian Communication and Media Authority) – APEC Tel MRA -Phase I;
- Canada: (Industry Canada - IC) Foreign Certification Body – FCB – APEC Tel MRA -Phase I & Phase II;
- Chinese Taipei (Republic of China – Taiwan):
    - BSMI (Bureau of Standards, Metrology and Inspection) APEC Tel MRA -Phase I;
    - NCC (National Communications Commission) APEC Tel MRA -Phase I;
- European Union:
    - EMC Directive 2014/30/EU US-EU EMC & Telecom MRA CAB (NB)
    - Radio & Teleterminal Equipment (R&TTE) Directive 1995/5/EC US -EU EMC & Telecom MRA CAB (NB)
    - Radio Equipment (RE) Directive 2014/53/EU US-EU EMC & Telecom MRA CAB (NB)
    - Low Voltage Directive (LVD) 2014/35/EU
- Hong Kong Special Administrative Region: (Office of the Telecommunications Authority – OFTA) APEC Tel MRA -Phase I & Phase II
- Israel – US-Israel MRA Phase I
- Republic of Korea (Ministry of Communications - Radio Research Laboratory) APEC Tel MRA -Phase I
- Singapore: (Infocomm Development Authority - IDA) APEC Tel MRA -Phase I & Phase II;
- Japan: VCCI - Voluntary Control Council for Interference US-Japan Telecom Treaty VCCI Side Letter
- USA:
    - ENERGY STAR Recognized Test Laboratory – US EPA
    - Telecommunications Certification Body (TCB) – US FCC;
    - Nationally Recognized Test Laboratory (NRTL) – US OSHA
- Vietnam: APEC Tel MRA -Phase I;

2 Reference, Standards and Guidelines

2.1 SAR Limits

FCC/IC Limit

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)	1.6	8
Spatial Peak (hands/wrists/feet/ankles averaged over 10 g)	4	20

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 4.0 W/kg (FCC) applied to the EUT Wrist-worn configuration.

General Population/Uncontrolled environments Spatial Peak limit 1.6 W/kg (FCC) applied to the EUT Speaker on configuration.

2.2 Test Guidelines

- IEEE C95.3-2002
- IEEE 1528-2013
- IEC 62209-2 Edition 1.0, 2010-03
- KDB 447498 D01 (General SAR Guidance)
- KDB 648474 D01 (SAR Handsets Multi Xmitter and Ant)
- KDB 248227 D01 (SAR Consideration for 802.11 Devices)
- KDB 865664 D01 (SAR Measurements up to 6 GHz)

3 Equipment List and Calibration

Type/Model	Cal. Due Date	S/N
DASY4 Professional Dosimetric System	NCR	N/A
Robot RX60L	NCR	CS7MBSP/467
Robot Controller	NCR	F01/5J72A1/A/01
Dell Computer Dimension 3000	NCR	N/A
SPEAG EDC3	NCR	N/A
SPEAG DAE4	2017-09-21	530
DASY4 Measurement Server	NCR	1176
SPEAG E-Field Probe EX3DV4	2017-09-23	3619
Antenna, Dipole, D-2450-S-1	2017-08-19	BCL-141
SPEAG Twin SAM Phantom	NCR	TP-1032
Muscle Tissue Simulating Liquid (2450 MHz)	Each Time	N/A
Head Tissue Simulating Liquid (2450 MHz)	Each Time	N/A
Agilent, Spectrum Analyzer, E4440A	2017-01-19	US45303156
Mini Circuits, Amplifier ZHL-42	2016-11-05	QA1326001
Power Sensor Agilent E9304A	2017-08-31	MY54280008
Power Sensor Agilent E9304A	2017-0831	MY54280006
Dielectric Probe Kit HP85070A	NCR	US99360201
HP, Signal Generator, 83650B	2017-09-09	3614A00276
Mini Circuits, AMPLIFIER ZVE-8G+	2016-11-05	N605601404

Note: NCR=No Calibration Required

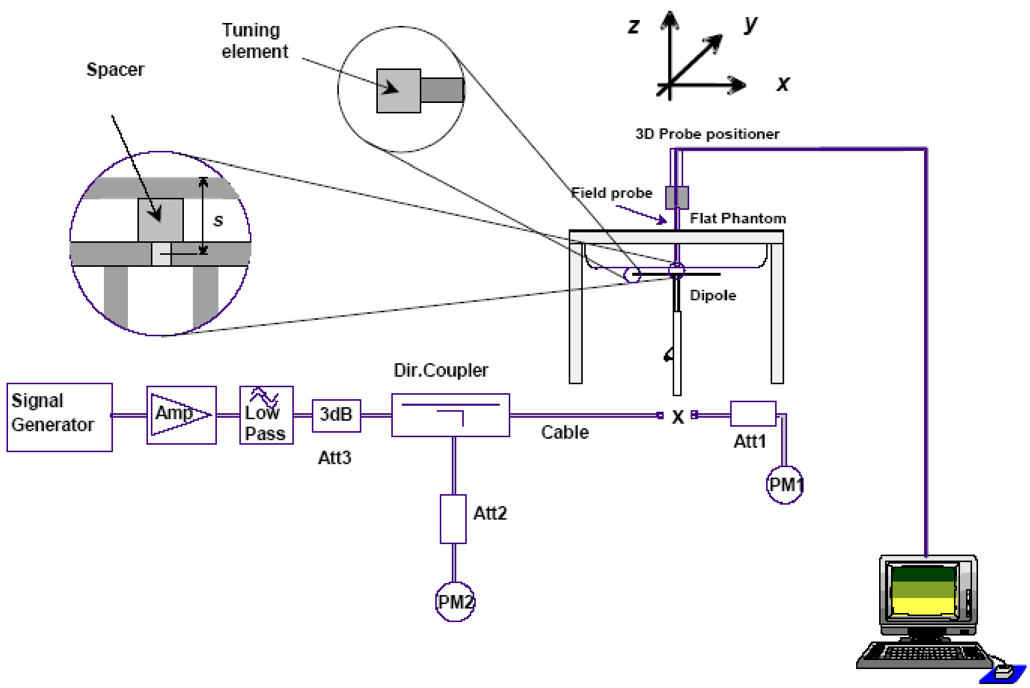
Statement of Traceability: BACL Corp. *attests that all of the calibrations on the equipment items listed above were traceable to NIST or to another internationally recognized National Metrology Institute (NMI), and were compliant with A2LA Policy P102 (dated 09 June 2016) “A2LA Policy on Metrological Traceability”.*

4 SAR Measurement System Verification

4.1 System Accuracy Verification

SAR system verification is required to confirm measurement accuracy. The system verification must be performed for each frequency band. A system verification must be performed before each series of SAR measurements.

4.2 SAR System Verification Setup and procedure



Procedure:

1) The SAR system verification measurements were performed in the flat section of TWIN SAM or flat phantom as applicable with shell thickness of 2±0.2mm filled with head or body liquid.

2) The depth of liquid in phantom was ≥15 cm for SAR measurement made at less than 3 GHz and ≥10 cm for SAR measurement made above 3 GHz.

3) The dipole was mounted below the center of flat phantom, and oriented parallel to the Y-Axis. The standard measurement distance is 15mm (below 1 GHz) and 10mm (above 1 GHz) from dipole center to the liquid surface.

4) The dipole input power was 250 mW or 100 mW as applicable.

5) The SAR results are normalized to 1 Watt input power.

6) The normalized the SAR results were then compared to the dipole calibration results.

4.3 Tissue Simulating Liquid and System Validation

Date	Simulant	Freq. [MHz]	Parameters	Liquid Temp [ºC]	Target Value	Measured Value	Deviation [%]	Limits [%]
2016-10-24	Body	2450	ε_r	22	52.7	53.41	1.35	± 5
			σ	22	1.95	1.97	1.03	± 5
			1g SAR	22	56.519	55.3	-2.16	± 10

Date	Simulant	Freq. [MHz]	Parameters	Liquid Temp [ºC]	Target Value	Measured Value	Deviation [%]	Limits [%]
2016-10-21	Head	2450	ε_r	22	39.2	38.9	-0.77	± 5
			σ	22	1.8	1.79	-0.56	± 5
			1g SAR	22	52.985	52.6	-0.73	± 10

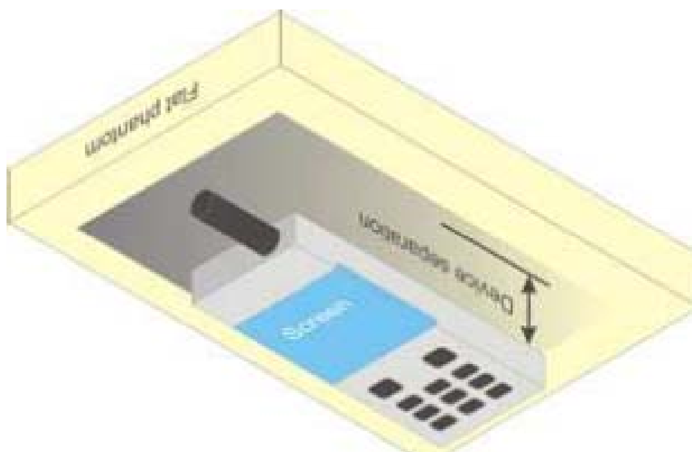
ε_r = relative permittivity, σ = conductivity and ρ=1000 kg/m^3

5 EUT Test Strategy and Procedure

5.1 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.



5.2 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 was 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 15 mm x 15 mm. Based on these data, the area of the maximum absorption was determined by line interpolation. The first Area Scan covered the entire dimension of the EUT to ensure that the hotspot was correctly identified.

Step 3: Around this point, a volume of 30 mm x 30 mm x 21 mm was assessed by measuring 5 x 5 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.

3. 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.

6 DASY4 SAR Evaluation Procedure

6.1 Power Reference Measurement

The Power Reference Measurement and Power Drift Measurement jobs are useful jobs for monitoring the power drift of the device under test in the batch process. Both jobs measure 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 determines the closest measurement point to phantom surface. By default, the Minimum distance of probe sensors to surface is 4mm. This distance can be modified by the user, but cannot be smaller than the Distance of sensor calibration points to probe tip as defined in the probe properties.

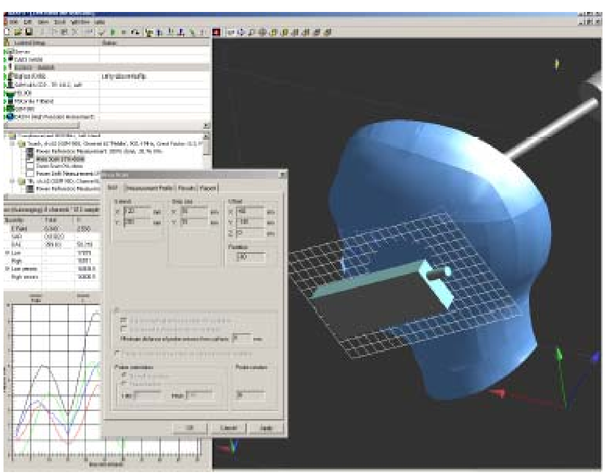
6.2 Area Scan

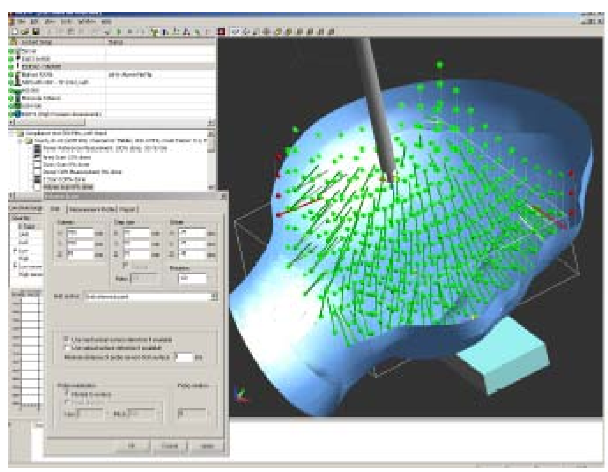
The Area Scan is used as a fast scan in two dimensions to find the area of high field values, before doing a finer measurement around the hot spot. The sophisticated interpolation routines implemented in DASY4 software can find the maximum locations even in relatively coarse grids.

The scanning area is defined by an editable grid. This grid is anchored at the grid reference point of the selected section in the phantom. When the Area Scan's property sheet is brought-up, grid settings can be edited by a user.

When an Area Scan has measured all reachable points, it computes the field maxima found in the scanned area, within a range of the global maximum. The range (in dB) is specified in the standards for compliance testing. For example, a 2 dB range is required in IEEE 1528-2013 and IEC 62209 standards. If only one Zoom Scan follows the Area Scan, then only the absolute maximum will be taken as reference. For cases where multiple maximums are detected, the number of Zoom Scans has to be increased accordingly.

After measurement is completed, all maxima and their coordinates are listed in the Results property page. The maximum selected in the list is highlighted in the 3-D view. For the secondary maxima returned from an Area Scan, the user can specify a lower limit (peak SAR value), in addition to the Find secondary maxima within x dB condition. Only the primary maximum and any secondary maxima within x dB from the primary maximum and above this limit will be measured.





6.3 Zoom Scan

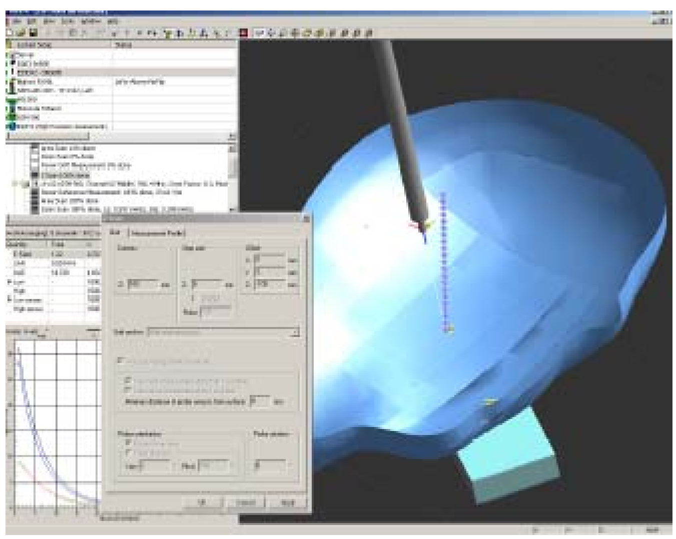
Zoom Scans are used to assess the peak spatial SAR values within a cubic averaging volume containing 1 g and 10 g of simulated tissue. The default Zoom Scan measures 5 x 5 x 7 points within a cube whose base faces are centered around the maxima found in a preceding area scan job within the same procedure. When the measurement is done, the Zoom Scan evaluates the averaged SAR for 1 g and 10 g and displays these values next to the job's label.

6.4 Power drift measurement

The Power Drift Measurement job 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. Several drift measurements are possible for one reference measurement. This allows a user to monitor the power drift of the device under test within a batch process. The measurement procedure is the same as Step 1.

6.5 Z-Scan

The Z Scan job measures points along a vertical straight line. The line runs along the Z axis of a one-dimensional grid. A user can anchor the grid to the section reference point, to any defined user point or to the current probe location. As with any other grids, the local Z axis of the anchor location establishes the Z axis of the grid.



7 Description of Test System

These measurements were performed with the automated near-field scanning system DASY4 from Schmid & Partner Engineering AG (SPEAG) which is the fourth generation of the system.

The system is based on a high precision robot (working range greater than 0.9m), which positions the probes with a positional repeatability of better than ±0.02mm. Special E- and H-field probes have been developed for measurements close to material discontinuity, the sensors of which are directly loaded with a Schottky diode and connected via highly resistive lines to the data acquisition unit.

The SAR measurements were conducted with the dosimetric probe EX3DV4 SN: 3619 (manufactured by SPEAG), designed in the classical triangular configuration and optimized for dosimetric evaluation. The probe has been calibrated according to the procedure with accuracy of better than ±10%. The spherical isotropy was evaluated with the procedure and found to be better than ±0.25 dB.

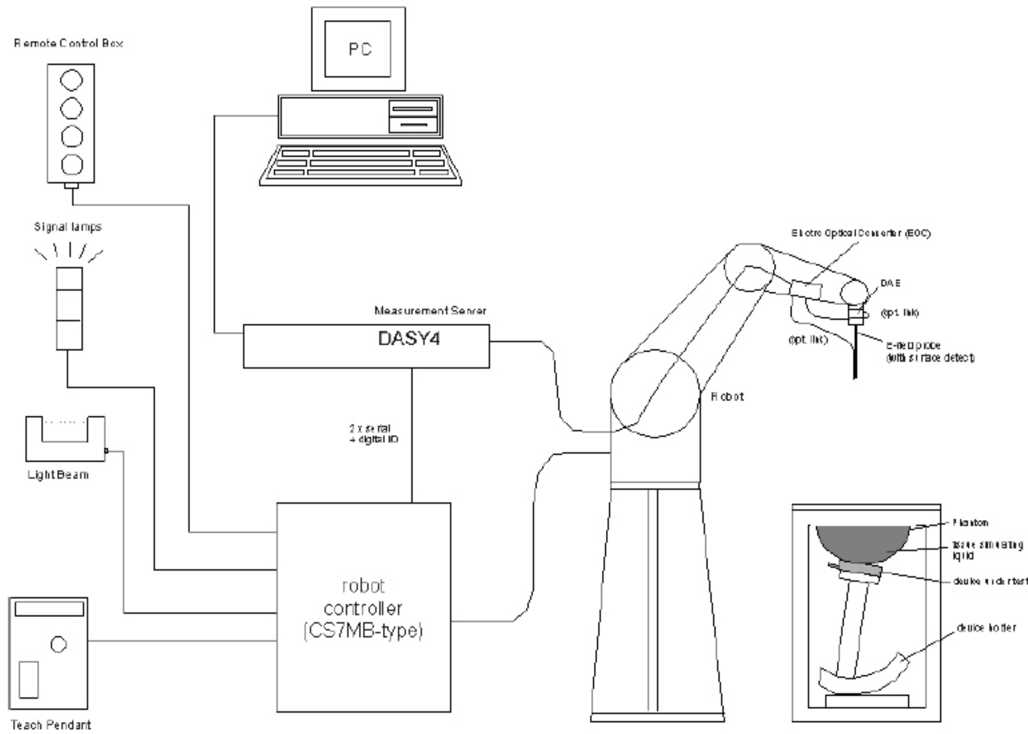
7.1 IEEE 1528-2013 Recommended Tissue Dielectric Parameters

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

7.2 DASY4 user's Manual Recommended Tissue Dielectric Parameters

Frequency (MHz)	Head Tissue		Body Tissue	
	ε_r	σ (S/m)	ε_r	σ (S/m)
2450	39.2	1.8	52.7	1.95
5200	36.0	4.66	49.0	5.30
5500	35.6	4.96	48.6	5.65
5800	35.3	5.27	48.2	6.00

7.3 Measurement System Diagram



The DASY4 system for performing compliance tests consists of the following items:

- A standard high precision 6-axis robot (Stäubli RX90) with controller, teach pendant and software. An arm extension for accommodating the data acquisition electronics (DAE).

- A dosimetric probe, i.e., an isotropic E-field probe optimized and calibrated for usage in tissue simulating liquid. The probe is equipped with an optical surface detector system.

- A data acquisition electronics unit (DAE4) which performs the signal amplification, signal multiplexing, AD-conversion, offset measurements, mechanical surface detection, collision detection, etc. The unit is battery powered with standard or rechargeable batteries. The signal is optically transmitted to the EOC.

- The Electro-optical converter (EOC) performs the conversion between optical and electrical of the signals for the digital communication to the DAE and for the analog signal from the optical surface detection. The EOC is connected to the measurement server.

- The function of the measurement server is to perform the time critical tasks such as signal filtering, control of the robot operation and fast movement interrupts.

- A probe alignment unit which improves the (absolute) accuracy of the probe positioning.

- A computer operating Windows XP.

- DASY4 software V4.7.

• Remote control with teach pendant and additional circuitry for robot safety such as warning lamps, etc.

• The SAM twin phantom enabling testing left-hand and right-hand usage.

• The device holder for handheld mobile phones.

• Tissue simulating liquid mixed according to the given recipes.

• Validation dipole kits allowing system validation.

7.4 System Components

• DASY4 Measurement Server
• Data Acquisition Electronics
• Probes
• Light Beam Unit
• Medium
• SAM Twin Phantom
• Device Holder for SAM Twin Phantom
• System Validation Kits
• Robot

DASY4 Measurement Server

The DASY4 measurement server is based on a PC/104 CPU board with a 166MHz low-power Pentium, 32 MB chip disk and 64MB RAM. The necessary circuits for communication with either the DAE4 (or DAE3) electronic box as well as the 16-bit AD-converter system for optical detection and digital I/O interface are contained on the DASY4 I/O-board, which is directly connected to the PC/104 bus of the CPU board.

The measurement server performs all real-time data evaluation for field measurements and surface detection, controls robot movements and handles safety operation. The PC-operating system cannot interfere with these time critical processes. All connections are supervised by a watchdog, and disconnection of any of the cables to the measurement server will automatically disarm the robot and disable all program-controlled robot movements. Furthermore, the measurement server is equipped with two expansion slots which are reserved for future applications. Please note that the expansion slots do not have a standardized pin out and therefore only the expansion cards provided by SPEAG can be inserted. Expansion cards from any other supplier could seriously damage the measurement server.

Data Acquisition Electronics

The data acquisition electronics DAE4 consists of a highly sensitive electrometer grade preamplifier with auto-zeroing, a channel and gain-switching multiplexer, a fast 16 bit AD-converter and a command decoder and control logic unit. Transmission to the measurement server is accomplished through an optical downlink for data and status information as well as an optical uplink for commands and the clock.

Probes

The DASY system can support many different probe types.

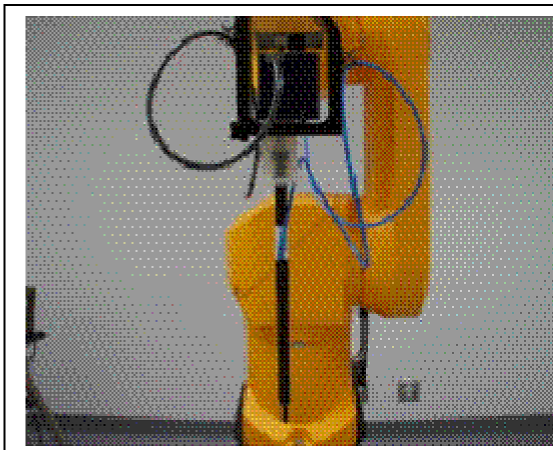
Dosimetric Probes: These probes are specially designed and calibrated for use in liquids with high permittivities. They should not be used in air, since the spherical isotropy in air is poor (±2 dB). The dosimetric probes have special calibrations in various liquids at different frequencies.

Free Space Probes: These are electric and magnetic field probes specially designed for measurements in free space. The z-sensor is aligned to the probe axis and the rotation angle of the x-sensor is specified.
This allows the DASY system to automatically align the probe to the measurement grid for field component measurement. The free space probes are generally not calibrated in liquid. (The H-field probes can be used in liquids without any change of parameters.)

Temperature Probes: Small and sensitive temperature probes for general use. They use a completely different parameter set and different evaluation procedures. Temperature rise features allow direct SAR evaluations with these probes.

EX3DV4 Probe Specification

Construction Symmetrical design with triangular core
Built-in shielding against static charges
Calibration In air from 4 MHz to 10 GHz
In brain and muscle simulating tissue at
frequencies of 450 MHz, 600 MHz, 750 MHz, 835 MHz, 1750 MHz, 1900 MHz, 2450 MHz, 2600 MHz, 5250 MHz, 5600 MHz, and 5800 MHz (accuracy ± 13.3%).
Frequency 4 MHz to 10 GHz; Linearity: ± 0.2 dB
(30 MHz to 10 GHz)
Directivity ± 0.1 dB in TSL (rotation around probe axis)
± 0.3 dB in TSL (rotation normal probe axis)
Dynamic Range: 10 µW/g to > 100 mW/g;
Dynamic Range Linearity: ± 0.2 dB



Photograph of the probe

Dimensions Overall length: 337 mm; Tip length: 20 mm; Body diameter: 12 mm; Tip diameter: 2.5 mm
Typical distance from probe tip to dipole centers: 1 mm
Application: High precision dosimetric measurements in ant exposure scenario (e.g., very strong gradient fields); the only probe that enables compliance testing for frequencies up to 6 GHz with precision of better than 30%.

E-Field Probe Calibration Process

Each probe is calibrated according to a dosimetric assessment procedure described in [6] with accuracy better than +/- 10%. The spherical isotropy was evaluated with the procedure described in [7] and found to be better than +/-0.25dB. The sensitivity parameters (NormX, NormY, NormZ), the diode compression parameter (DCP) and the conversion factor (ConvF) of the probe are tested.

The free space E-field from amplified probe outputs is determined in a test chamber. This is performed in a TEM cell for frequencies bellow 1 GHz, and in a waveguide above 1 GHz for free space. For the free space calibration, the probe is placed in the volumetric center of the cavity and at the proper orientation with the field. The probe is then rotated 360 degrees.

E-field temperature correlation calibration is performed in a flat phantom filled with the appropriate simulated brain tissue. The measured free space E-field in the medium correlates to temperature rise in dielectric medium. For temperature correlation calibration a RF transparent thermistor-based temperature probe is used in conjunction with the E-field probe.

Data Evaluation

The DASY4 post-processing software (SEMCAD) automatically executes the following procedures to calculate the field units from the microvolt readings at the probe connector. The parameters used in the evaluation are stored in the configuration modules of the software:

Probe parameters:	- Sensitivity	Normi, ai0, ai1, ai2
	- Conversion factor	ConvFi
	- Diode compression point	dcpi
Device parameters:	- Frequency	f
	- Crest factor	cf
Media parameters:	- Conductivity	σ
	- Density	ρ

These parameters must be set correctly in the software. They can be found in the component documents or they can be imported into the software from the configuration files issued for the DASY components. In the direct measuring mode of the multimeter option, the parameters of the actual system setup are used. In the scan visualization and export modes, the parameters stored in the corresponding document files are used.
The first step of the evaluation is a linearization of the filtered input signal to account for the compression characteristics of the detector diode. The compensation depends on the input signal, the diode type and the DC-transmission factor from the diode to the evaluation electronics. If the exciting field is pulsed, the crest factor of the signal must be known to correctly compensate for peak power. The formula for each channel can be given as:

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

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

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

$$\mathrm{E-fieldprobes:} \qquad E_i = \sqrt{\frac{V_i}{Norm_i \cdot ConvF}}$$

$$\mathrm{H-fieldprobes:} \qquad H_i = \sqrt{V_i} \cdot \frac{a_{i0} + a_{i1} f + a_{i2} f^2}{f}$$

With Vi = compensated signal of channel i (i =x, y, z)
$Norm_i$ = sensor sensitivity of channel i (i =x, y, z)
μV/ $(V/m)^2$ for E-field probes
ConF = sensitivity enhancement in solution
a_{ij} = sensor sensitivity factors for H-field probes
f = carrier frequency [GHz]
Ei = electric field strenggy of channel i in V/m
H_i = diode compression point (DASY parameter)

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

$$E_{tot} = \sqrt{E_x^2 + E_y^2 + E_z^2}$$

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

$$SAR = E_{tot}^2 \cdot \frac{\sigma}{\rho \cdot 1'000}$$

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

Note that the density is normally set to 1, to account for actual brain density rather than the density of the simulation liquid.

Light Beam Unit

The light beam switch allows automatic “tooling” of the probe. During the process, the actual position of the probe tip with respect to the robot arm is measured, as well as the probe length and the horizontal probe offset. The software then corrects all movements, so that the robot coordinates are valid for the probe tip. The repeatability of this process is better than 0.1 mm. If a position has been taught with an aligned probe, the same position will be reached with another aligned probe within 0.1 mm, even if the other probe has different dimensions. During probe rotations, the probe tip will keep its actual position.

Tissue Simulating Liquids

Parameters

The parameters of the tissue simulating liquid strongly influence the SAR in the liquid. The parameters for the different frequencies are defined in the corresponding compliance standards (e.g., EN 50361, IEEE 1528-2003).

Parameter measurements

The following measurement system was applied for measuring the dielectric parameters of liquids:

- The open coax test method (e.g., HP85070 dielectric probe kit) is easy to use, but has only moderate acuracy. It is calibrated with open, short, and deionized water and the calibrations a critical process.

SAM Twin Phantom

The SAM twin phantom is a fiberglass shell phantom with 2mm shell thickness (except the ear region where shell thickness increases to 6mm). It has three measurement areas:

- Left hand
- Right hand
- Flat phantom

The phantom table comes in two sizes: A 100 x 50 x 85 cm (L x W x H) table for use with free standing robots (DASY4 professional system option) or as a second phantom and a 100 x 75 x 85 cm (L x W x H) table with reinforcements for table mounted robots (DASY4 compact system option). The bottom plate contains three pair of bolts for locking the device holder. The device holder positions are adjusted to the standard measurement positions in the three sections. Only one device holder is necessary if two phantoms are used (e.g., for different liquids) A white cover is provided to tap the phantom during o_-periods to prevent water evaporation and changes in the liquid parameters. Free space scans of devices on the cover are possible. On the phantom top, three reference markers are provided to identify the phantom position with respect to the robot.

The phantom can be used with the following tissue simulating liquids:

- Water-sugar based liquids (which can be left permanently in the phantom as long as the phantom is covered when not in use in order to prevent water evaporation, which would change the parameters).

- Glycol based liquids (which should be used with care because glycol is a plastic softener. Glycol based liquids should be taken out of the phantom and the phantom should be dried at least weekly when the system is not used.

Device Holder for SAM Twin Phantom

The SAR in the phantom is approximately inversely proportional to the square of the distance between the source and the liquid surface. For a source in 5mm distance, a positioning uncertainty of ±0.5mm would produce a SAR uncertainty of ±20%. An accurate device positioning is therefore crucial for accurate and repeatable measurements. The positions, in which the devices must be measured, are defined by the standards.

The DASY device holder is designed to cope with different positions given in the standard. It has two scales for the device rotation (with respect to the body axis) and the device inclination (with respect to the line between the ear reference points). The rotation center for both scales is the ear reference point ERP). Thus the device needs no repositioning when changing the angles.


The DASY device holder has been made out of low-loss POM material having the following dielectric parameters: relative permittivity ε_r=3 and loss tangent σ=0.02. The amount of dielectric material has been reduced in the closest vicinity of the device, since measurements have suggested that the influence of the clamp on the test results could thus be lowered.

System Validation Kits

Each DASY system is equipped with one or more system validation kits. These units, together with the predefined measurement procedures within the DASY software, enable the user to conduct the system performance check and system validation. For that purpose a well-defined SAR distribution in the flat section of the SAM twin phantom is produced.

System validation kit includes a dipole, tripod holder to fix it underneath the flat phantom and a corresponding distance holder. Dipoles are available for the variety of frequencies between 300MHz and 6 GHz (dipoles for other frequencies or media and other calibration conditions are available upon request).

The dipoles are highly symmetric and matched at the center frequency for the specified liquid and distance to the flat phantom (or flat section of the SAM-twin phantom). The accurate distance between the liquid surface and the dipole center is achieved with a distance holder that snaps on the dipole.

Robot

BACL's DASY4 system uses the Stäubli RX90 high precision industrial robots. This robot has many features:

- High precision (repeatability 0.02mm)
- High reliability (industrial design)
- Low maintenance costs (virtually maintenance-free due to direct drive gears; no belt drives)
- Jerk-free straight movements (brushless synchronous motors; no stepper motors)
- Low ELF interference (the closed metallic construction shields against motor control fields)

BACL's DASY4 system uses the CS7MB controller with software version 4.7.

8 SAR Measurement Consideration and Reduction

8.1 SAR Reductions

(EUT Front Side View)

Top

Left

Please refer to SAR test set-up photo for details.

Right

Bottom

Note1: two positions were chosen for SAR testing, rear side wrist-worn extremity and front side 10mm next to mouth for normal operation.

Note2: According to KDB 248227 Section 1, while 1-g SAR thresholds are specified in the procedure for SAR test reduction and exclusion, these thresholds should be multiplied by 2.5 when 10-g extremity SAR is considered.

Note3: The wrist band was removed from the EUT during SAR measurements, due to the additional space that it created between the back surface of the EUT and the phantom.

Reduced[1]

According to KDB 248227 Section 5.2.1, when the reported SAR of the highest measured maximum output power channel for the exposure configuration is ≤ 0.8 W/kg, no further SAR testing is required for 802.11b DSSS in that exposure configuration. When the reported SAR is > 0.8 W/kg, SAR is required for that exposure configuration using the next highest measured output power channel. When any reported SAR is > 1.2 W/kg, SAR is required for the third channel; i.e., all channels require testing.

Reduced[2]

According to KDB 248227 Section 5.3.4 (b), when the highest reported SAR for the initial test configuration, according to the initial test position or fixed exposure position requirements, is adjusted by the ratio of the subsequent test configuration to initial test configuration specified maximum output power and the adjusted SAR is ≤ 1.2 W/kg, SAR is not required for that subsequent test configuration.

Reduced[3]

According to KDB 248227 Section 5.3.3, OFDM when the reported SAR of the initial test configuration is > 0.8 W/kg, SAR measurement is required for subsequent next highest measured output power channel(s) in the initial test configuration until reported SAR is ≤ 1.2 W/kg or all required channels are tested.

8.2 SAR Consideration

Mode	Side	Channel	Result
2.4 GHz 802.11b	Front Side 10mm	Low Channel-2412	Tested & Compliant
		Mid Channel-2437	Tested & Compliant
		High Channel-2462	Tested & Compliant
	Rear Side Touch	Low Channel-2412	Reduced[1]
		Mid Channel-2437	Tested & Compliant
		High Channel-2462	Reduced[1]
2.4 GHz 802.11g	Front Side 10mm	Low Channel-2412	Tested & Compliant
		Mid Channel-2437	Tested & Compliant
		High Channel-2462	Tested & Compliant
	Rear Side Touch	Low Channel-2412	Reduced[3]
		Mid Channel-2437	Tested & Compliant
		High Channel-2462	Reduced[3]
2.4 GHz 802.11n20	Front Side 10mm	Low Channel-2412	Reduced[2]
		Mid Channel-2437	Reduced[2]
		High Channel-2462	Reduced[2]
	Rear Side Touch	Low Channel-2412	Reduced[2]
		Mid Channel-2437	Reduced[2]
		High Channel-2462	Reduced[2]
2.4 GHz BT/BLE	Front Side 10mm	Low Channel-2402	Reduced[1]
		Mid Channel-2441	Tested & Compliant
		High Channel-2480	Reduced[1]
	Rear Side Touch	Low Channel-2402	Reduced[1]
		Mid Channel-2441	Tested & Compliant
		High Channel-2480	Reduced[1]

9 SAR Measurement Results

This page summarizes the results of the performed SAR evaluation. The plots with the corresponding SAR distributions, which reveal information about the location of the maximum SAR with respect to the device, are in Appendix E of this report.

9.1 Test Environmental Conditions

Temperature:	23° C
Relative Humidity:	43 %
ATM Pressure:	101.89 kPa

Testing was performed by Jin Yang in SAR chamber on 10-21-2016 and 10-24-2016.

9.2 Standalone SAR Results

Please refer to the following table.

2.4 GHz Band										
Radio Mode	EUT Position	Frequency (MHz)	Test Type	Output Power (dBm)		Scale Factor	Measured (W/kg)	Scaled (W/kg)	Limit (W/kg)	Plot #
				Measured	Target					
802.11b	Front side 10mm (Middle CH)	2437	Head	16.18	16.50	1.08	0.0525	0.0565	1.6	-
	Front side 10mm (Low CH)	2412	Head	15.78	16.50	1.18	0.0418	0.0493	1.6	-
	Front side 10mm (High CH)	2462	Head	16.11	16.50	1.09	0.0535	0.0585	1.6	1
	Rear Side Touch (Middle CH)	2437	Body	16.18	16.50	1.08	0.0227	0.0245	4	2
802.11g	Front side 10mm (Middle CH)	2437	Head	16.72	17.00	1.07	0.0537	0.0573	1.6	-
	Front side 10mm (Low CH)	2412	Head	16.4	17.00	1.15	0.0505	0.0580	1.6	-
	Front side 10mm (High CH)	2462	Head	16.52	17.00	1.12	**0.0607**	**0.0678**	1.6	3
	Rear Side Touch (Middle CH)	2437	Body	16.72	17.00	1.07	0.0237	0.0254	4	4
BT (GFSK)	Front side 10mm (Middle CH)	2441	Head	9.82	10.00	1.04	<0.01	<0.01	1.6	-
	Rear Side Touch (Middle CH)	2441	Body	9.82	10.00	1.04	<0.01	<0.01	4	-

Note[1]: NOTICE 2012-DRS1203: Based on the IEEE 1528 and IEC 62209 requirements, the high, mid and low channels for the configuration with the highest SAR value must be tested regardless of the SAR value measured.

Note[2]: for rear side touch position, the measured SAR value and limit are in 10 g SAR (W/kg); for front side 10mm position, the measured SAR value and limit are in 1 g SAR (W/kg)

Note[3]: the EUT maximum antenna gain is -5.5dBi for Wi-Fi/Bluetooth, please refer to Test Set-up Photo for the antenna location.

Note[4]: we believe that the rear side SAR value was lower than the front side SAR value was because of the EUT's metal cover, which could be shielding the RF exposure.

Note[5]: bolded entry indicated the highest SAR value.

Corrected SAR Evaluation Table

Frequency (MHz)	Liquid Type	C_{ε}	$\triangle\varepsilon_{r}$	C_{δ}	$\triangle_{\delta}$	$\triangle$SAR
2412	Body	-0.225	1.137	0.489	1.047	0.256
2437	Body	-0.225	0.986	0.483	0.515	0.027
2462	Body	-0.225	0.740	0.478	0.508	0.076
2480	Body	-0.225	0.418	0.474	0.503	0.144

Frequency (MHz)	Liquid Type	C_{ε}	$\triangle\varepsilon_{r}$	C_{δ}	$\triangle_{\delta}$	$\triangle$SAR
2412	Head	-0.225	-0.815	0.489	0.226	0.294
2437	Head	-0.225	-0.765	0.483	0.279	0.307
2462	Head	-0.225	-0.817	0.478	0.110	0.236
2480	Head	-0.225	-0.970	0.474	0.328	0.373

$$\Delta SAR = c_{\varepsilon}\ \Delta\varepsilon_{r} + c_{\sigma}\ \Delta\sigma$$

$$c_{\varepsilon} = -7{,}854 \times 10^{-4} f^{3} + 9{,}402 \times 10^{-3} f^{2} - 2{,}742 \times 10^{-2} f - 0{,}202\ 6$$

$$c_{\sigma} = 9{,}804 \times 10^{-3} f^{3} - 8{,}661 \times 10^{-2} f^{2} + 2{,}981 \times 10^{-2} f + 0{,}782\ 9$$

where

f is the frequency in GHz.

Note 1: According NOTICE 2012-DRS0529, if the correction △SAR has a negative sign, the measured SAR result should be corrected, and has a positive sign, the measured SAR result shall not be corrected.

10 Appendix A - Measurement Uncertainty

The uncertainty budget has been determined for the DASY4 measurement system and is given in the following Table.

Below 3 GHz

DASY4 Uncertainty Budget According to IEC 62209-2								
Error Description	Uncertainty Value	Prob. Dist.	Div.	(c i) 1g	(c i) 10g	Std. Unc. (1g)	Std. Unc. (10g)	(v i) veff
Measurement System								
Probe Calibration (2450 MHz)	± 6.00 %	N	1	1	1	± 6.00 %	± 6.00 %	∝
Isotropy	± 0.94 %	R	$\sqrt{3}$	1	1	± 0.54 %	± 0.54 %	∝
Linearity	± 0.30 %	R	$\sqrt{3}$	1	1	± 0.17 %	± 0.17 %	∝
Modulation Response	± 1.65 %	R	$\sqrt{3}$	1	1	± 0.95 %	± 0.95 %	∝
System Detection Limits	± 1.00 %	R	$\sqrt{3}$	1	1	± 0.58 %	± 0.58 %	∝
Boundary Effects	± 0.50 %	R	$\sqrt{3}$	1	1	± 0.29 %	± 0.29 %	∝
Readout Electronics	± 0.30 %	N	1	1	1	± 0.30 %	± 0.30 %	∝
Response Time	± 0.80 %	R	$\sqrt{3}$	1	1	± 0.46 %	± 0.46 %	∝
Integration Time	± 2.60 %	R	$\sqrt{3}$	1	1	± 1.50 %	± 1.50 %	∝
RF Ambient Noise	± 0.00 %	R	$\sqrt{3}$	1	1	± 0.00 %	± 0.00 %	∝
RF Ambient Reflections	± 3.00 %	R	$\sqrt{3}$	1	1	± 1.73 %	± 1.73 %	∝
Probe Positioner	± 0.40 %	R	$\sqrt{3}$	1	1	± 0.23 %	± 0.23 %	∝
Probe Positioning	± 2.90 %	R	$\sqrt{3}$	1	1	± 1.67 %	± 1.67 %	∝
Post-processing	± 1.00 %	R	$\sqrt{3}$	1	1	± 0.58 %	± 0.58 %	∝
Test Sample Related								
Device Holder	± 3.60 %	N	1	1	1	± 3.60 %	± 3.60 %	5
Device Positioning	± 2.90 %	N	1	1	1	± 2.90 %	± 2.90 %	145
SAR Scaling	± 0.00 %	R	$\sqrt{3}$	1	1	± 0.00 %	± 0.00 %	∝
Power Drift	± 5.00 %	R	$\sqrt{3}$	1	1	± 2.89 %	± 2.89 %	∝
Phantom and Setup								
Phantom Uncertainty	± 4.00 %	R	$\sqrt{3}$	1	1	± 2.31 %	± 2.31 %	∝
SAR Correction	± 0.00 %	N	1	1	1	± 0.00 %	± 0.00 %	∝
Liquid Conductivity (Target)	± 5.00 %	R	$\sqrt{3}$	0.78	0.71	± 2.25 %	± 2.05 %	∝
Liquid Conductivity (meas.)	± 2.50 %	N	1	0.78	0.71	± 1.95 %	± 1.78 %	∝
Liquid Permittivity (Target)	± 5.00 %	R	$\sqrt{3}$	0.23	0.26	± 0.66 %	± 0.75 %	∝
Liquid Permittivity (meas.)	± 2.50 %	N	1	0.23	0.26	± 0.58 %	± 0.65 %	∝
Combined Std. Uncertainty	-	RSS	-	-	-	± 9.54 %	± 9.48 %	330
Expanded STD Uncertainty	-	2	-	-	-	± 19.09 %	± 18.96 %	-

11 Appendix B - Probe Calibration Certificates

Calibration Laboratory of
Schmid & Partner
Engineering AG
Zeughausstrasse 43, 8004 Zurich, Switzerland

S Schweizerischer Kalibrierdienst
C Service suisse d'étalonnage
S Servizio svizzero di taratura
Swiss Calibration Service

Accredited by the Swiss Accreditation Service (SAS)
The Swiss Accreditation Service is one of the signatories to the EA Multilateral Agreement for the recognition of calibration certificates

Accreditation No.: **SCS 0108**

Client **BACL**

Certificate No: **EX3-3619_Sep16**

CALIBRATION CERTIFICATE

Object: EX3DV4 - SN:3619

Calibration procedure(s): QA CAL-01.v9, QA CAL-12.v9, QA CAL-14.v4, QA CAL-23.v5, QA CAL-25.v6
Calibration procedure for dosimetric E-field probes

Calibration date: September 23, 2016

This calibration certificate documents the traceability to national standards, which realize the physical units of measurements (SI). The measurements and the uncertainties with confidence probability are given on the following pages and are part of the certificate.

All calibrations have been conducted in the closed laboratory facility: environment temperature (22 ± 3)°C and humidity < 70%.

Calibration Equipment used (M&TE critical for calibration)

Primary Standards	ID	Cal Date (Certificate No.)	Scheduled Calibration
Power meter NRP	SN: 104778	06-Apr-16 (No. 217-02288/02289)	Apr-17
Power sensor NRP-Z91	SN: 103244	06-Apr-16 (No. 217-02288)	Apr-17
Power sensor NRP-Z91	SN: 103245	06-Apr-16 (No. 217-02289)	Apr-17
Reference 20 dB Attenuator	SN: S5277 (20x)	05-Apr-16 (No. 217-02293)	Apr-17
Reference Probe ES3DV2	SN: 3013	31-Dec-15 (No. ES3-3013_Dec15)	Dec-16
DAE4	SN: 660	23-Dec-15 (No. DAE4-660_Dec15)	Dec-16
Secondary Standards	ID	Check Date (in house)	Scheduled Check
Power meter E4419B	SN: GB41293874	06-Apr-16 (in house check Jun-16)	In house check: Jun-18
Power sensor E4412A	SN: MY41498087	06-Apr-16 (in house check Jun-16)	In house check: Jun-18
Power sensor E4412A	SN: 000110210	06-Apr-16 (in house check Jun-16)	In house check: Jun-18
RF generator HP 8648C	SN: US3642U01700	04-Aug-99 (in house check Jun-16)	In house check: Jun-18
Network Analyzer HP 8753E	SN: US37390585	18-Oct-01 (in house check Oct-15)	In house check: Oct-16

	Name	Function	Signature
Calibrated by:	Michael Weber	Laboratory Technician	M.Weber
Approved by:	Katja Pokovic	Technical Manager	

Issued: September 28, 2016

This calibration certificate shall not be reproduced except in full without written approval of the laboratory.

Certificate No: EX3-3619_Sep16 Page 1 of 11

Calibration Laboratory of
Schmid & Partner
Engineering AG
Zeughausstrasse 43, 8004 Zurich, Switzerland

S Schweizerischer Kalibrierdienst
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Servizio svizzero di taratura
S Swiss Calibration Service

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Accreditation No.: **SCS 0108**

Glossary:

TSL	tissue simulating liquid
NORMx,y,z	sensitivity in free space
ConvF	sensitivity in TSL / NORMx,y,z
DCP	diode compression point
CF	crest factor (1/duty_cycle) of the RF signal
A, B, C, D	modulation dependent linearization parameters
Polarization φ	φ rotation around probe axis
Polarization ϑ	ϑ rotation around an axis that is in the plane normal to probe axis (at measurement center), i.e., ϑ = 0 is normal to probe axis
Connector Angle	information used in DASY system to align probe sensor X to the robot coordinate system

Calibration is Performed According to the Following Standards:

a) IEEE Std 1528-2013, "IEEE Recommended Practice for Determining the Peak Spatial-Averaged Specific Absorption Rate (SAR) in the Human Head from Wireless Communications Devices: Measurement Techniques", June 2013
b) IEC 62209-1, "Procedure to measure the Specific Absorption Rate (SAR) for hand-held devices used in close proximity to the ear (frequency range of 300 MHz to 3 GHz)", February 2005
c) IEC 62209-2, "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)", March 2010
d) KDB 865664, "SAR Measurement Requirements for 100 MHz to 6 GHz"

Methods Applied and Interpretation of Parameters:

- *NORMx,y,z:* Assessed for E-field polarization ϑ = 0 (f ≤ 900 MHz in TEM-cell; f > 1800 MHz: R22 waveguide). NORMx,y,z are only intermediate values, i.e., the uncertainties of NORMx,y,z does not affect the E^2-field uncertainty inside TSL (see below *ConvF*).
- *NORM(f)x,y,z = NORMx,y,z * frequency_response* (see Frequency Response Chart). This linearization is implemented in DASY4 software versions later than 4.2. The uncertainty of the frequency response is included in the stated uncertainty of *ConvF*.
- *DCPx,y,z:* DCP are numerical linearization parameters assessed based on the data of power sweep with CW signal (no uncertainty required). DCP does not depend on frequency nor media.
- *PAR:* PAR is the Peak to Average Ratio that is not calibrated but determined based on the signal characteristics
- *Ax,y,z; Bx,y,z; Cx,y,z; Dx,y,z; VRx,y,z*: *A, B, C, D* are numerical linearization parameters assessed based on the data of power sweep for specific modulation signal. The parameters do not depend on frequency nor media. *VR* is the maximum calibration range expressed in RMS voltage across the diode.
- *ConvF and Boundary Effect Parameters:* Assessed in flat phantom using E-field (or Temperature Transfer Standard for f ≤ 800 MHz) and inside waveguide using analytical field distributions based on power measurements for f > 800 MHz. The same setups are used for assessment of the parameters applied for boundary compensation (alpha, depth) of which typical uncertainty values are given. These parameters are used in DASY4 software to improve probe accuracy close to the boundary. The sensitivity in TSL corresponds to *NORMx,y,z * ConvF* whereby the uncertainty corresponds to that given for *ConvF*. A frequency dependent *ConvF* is used in DASY version 4.4 and higher which allows extending the validity from ± 50 MHz to ± 100 MHz.
- *Spherical isotropy (3D deviation from isotropy)*: in a field of low gradients realized using a flat phantom exposed by a patch antenna.
- *Sensor Offset*: The sensor offset corresponds to the offset of virtual measurement center from the probe tip (on probe axis). No tolerance required.
- *Connector Angle*: The angle is assessed using the information gained by determining the *NORMx* (no uncertainty required).

Certificate No: EX3-3619_Sep16 Page 2 of 11

Probe EX3DV4

SN:3619

Manufactured: July 3, 2007
Calibrated: September 23, 2016

Calibrated for DASY/EASY Systems
(Note: non-compatible with DASY2 system!)

DASY/EASY - Parameters of Probe: EX3DV4 - SN:3619

Basic Calibration Parameters

	Sensor X	Sensor Y	Sensor Z	Unc (k=2)
Norm ($\mu V/(V/m)^2$)[A]	0.44	0.36	0.39	± 10.1 %
DCP (mV)[B]	101.0	98.1	99.9	

Modulation Calibration Parameters

UID	Communication System Name		A dB	B dB√μV	C	D dB	VR mV	Unc[E] (k=2)
0	CW	X	0.0	0.0	1.0	0.00	176.2	±3.3 %
		Y	0.0	0.0	1.0		178.2	
		Z	0.0	0.0	1.0		177.1	

The reported uncertainty of measurement is stated as the standard uncertainty of measurement multiplied by the coverage factor k=2, which for a normal distribution corresponds to a coverage probability of approximately 95%.

[A] The uncertainties of Norm X,Y,Z do not affect the E^2-field uncertainty inside TSL (see Pages 5 and 6).
[B] Numerical linearization parameter: uncertainty not required.
[E] Uncertainty is determined using the max. deviation from linear response applying rectangular distribution and is expressed for the square of the field value.

DASY/EASY - Parameters of Probe: EX3DV4 - SN:3619

Calibration Parameter Determined in Head Tissue Simulating Media

f (MHz) [C]	Relative Permittivity [F]	Conductivity (S/m) [F]	ConvF X	ConvF Y	ConvF Z	Alpha [G]	Depth [G] (mm)	Unc (k=2)
450	43.5	0.87	9.60	9.60	9.60	0.17	1.15	± 13.3 %
600	42.7	0.88	8.83	8.83	8.83	0.14	1.15	± 13.3 %
750	41.9	0.89	9.88	9.88	9.88	0.64	0.80	± 12.0 %
835	41.5	0.90	9.28	9.28	9.28	0.54	0.80	± 12.0 %
1750	40.1	1.37	7.56	7.56	7.56	0.30	0.80	± 12.0 %
1900	40.0	1.40	7.21	7.21	7.21	0.34	0.87	± 12.0 %
2450	39.2	1.80	6.64	6.64	6.64	0.34	0.85	± 12.0 %
2600	39.0	1.96	6.59	6.59	6.59	0.32	0.97	± 12.0 %
5250	35.9	4.71	4.52	4.52	4.52	0.40	1.80	± 13.1 %
5600	35.5	5.07	4.00	4.00	4.00	0.50	1.80	± 13.1 %
5800	35.3	5.27	4.05	4.05	4.05	0.50	1.80	± 13.1 %

[C] Frequency validity above 300 MHz of ± 100 MHz only applies for DASY v4.4 and higher (see Page 2), else it is restricted to ± 50 MHz. The uncertainty is the RSS of the ConvF uncertainty at calibration frequency and the uncertainty for the indicated frequency band. Frequency validity below 300 MHz is ± 10, 25, 40, 50 and 70 MHz for ConvF assessments at 30, 64, 128, 150 and 220 MHz respectively. Above 5 GHz frequency validity can be extended to ± 110 MHz.
[F] At frequencies below 3 GHz, the validity of tissue parameters (ε and σ) can be relaxed to ± 10% if liquid compensation formula is applied to measured SAR values. At frequencies above 3 GHz, the validity of tissue parameters (ε and σ) is restricted to ± 5%. The uncertainty is the RSS of the ConvF uncertainty for indicated target tissue parameters.
[G] Alpha/Depth are determined during calibration. SPEAG warrants that the remaining deviation due to the boundary effect after compensation is always less than ± 1% for frequencies below 3 GHz and below ± 2% for frequencies between 3-6 GHz at any distance larger than half the probe tip diameter from the boundary.

DASY/EASY - Parameters of Probe: EX3DV4 - SN:3619

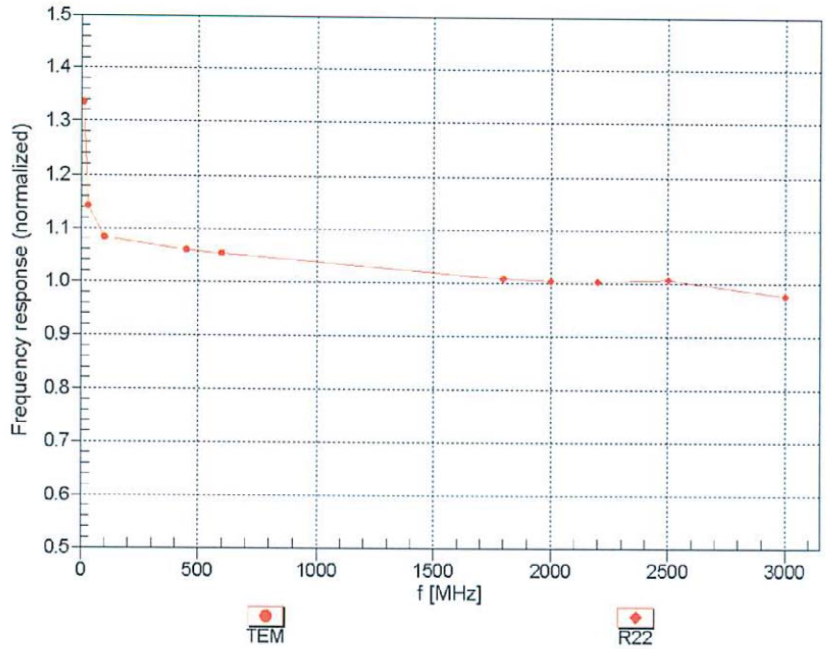
Calibration Parameter Determined in Body Tissue Simulating Media

f (MHz) [C]	Relative Permittivity [F]	Conductivity (S/m) [F]	ConvF X	ConvF Y	ConvF Z	Alpha [G]	Depth [G] (mm)	Unc (k=2)
450	56.7	0.94	10.05	10.05	10.05	0.08	1.15	± 13.3 %
600	56.1	0.95	9.19	9.19	9.19	0.12	1.15	± 13.3 %
750	55.5	0.96	8.36	8.36	8.36	0.45	0.80	± 12.0 %
835	55.2	0.97	8.20	8.20	8.20	0.44	0.80	± 12.0 %
1750	53.4	1.49	7.26	7.26	7.26	0.27	1.05	± 12.0 %
1900	53.3	1.52	7.00	7.00	7.00	0.39	0.84	± 12.0 %
2450	52.7	1.95	6.69	6.69	6.69	0.35	0.85	± 12.0 %
2600	52.5	2.16	6.54	6.54	6.54	0.26	0.95	± 12.0 %
5250	48.9	5.36	4.05	4.05	4.05	0.50	1.90	± 13.1 %
5600	48.5	5.77	3.39	3.39	3.39	0.60	1.90	± 13.1 %
5800	48.2	6.00	3.68	3.68	3.68	0.60	1.90	± 13.1 %

[C] Frequency validity above 300 MHz of ± 100 MHz only applies for DASY v4.4 and higher (see Page 2), else it is restricted to ± 50 MHz. The uncertainty is the RSS of the ConvF uncertainty at calibration frequency and the uncertainty for the indicated frequency band. Frequency validity below 300 MHz is ± 10, 25, 40, 50 and 70 MHz for ConvF assessments at 30, 64, 128, 150 and 220 MHz respectively. Above 5 GHz frequency validity can be extended to ± 110 MHz.
[F] At frequencies below 3 GHz, the validity of tissue parameters (ε and σ) can be relaxed to ± 10% if liquid compensation formula is applied to measured SAR values. At frequencies above 3 GHz, the validity of tissue parameters (ε and σ) is restricted to ± 5%. The uncertainty is the RSS of the ConvF uncertainty for indicated target tissue parameters.
[G] Alpha/Depth are determined during calibration. SPEAG warrants that the remaining deviation due to the boundary effect after compensation is always less than ± 1% for frequencies below 3 GHz and below ± 2% for frequencies between 3-6 GHz at any distance larger than half the probe tip diameter from the boundary.

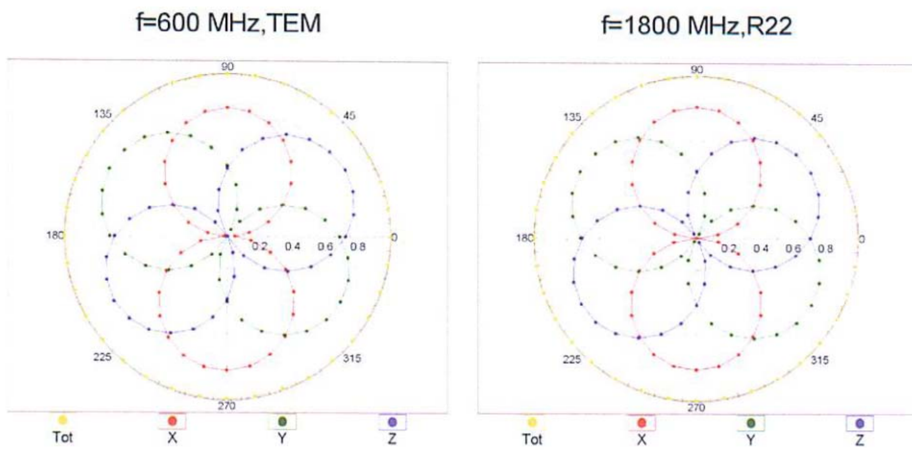
EX3DV4– SN:3619 September 23, 2016

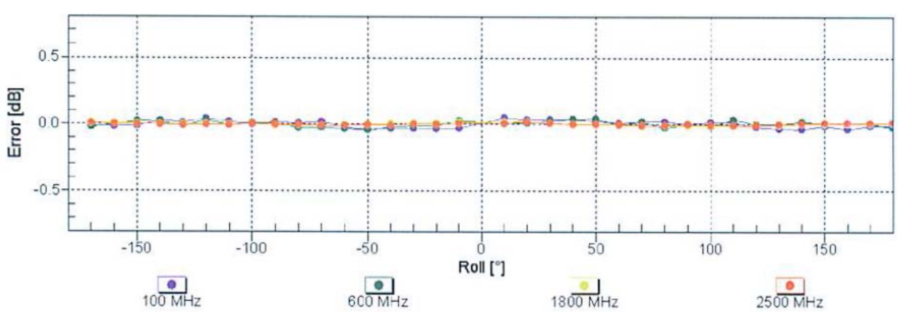
Frequency Response of E-Field
(TEM-Cell:ifi110 EXX, Waveguide: R22)



Uncertainty of Frequency Response of E-field: ± 6.3% (k=2)

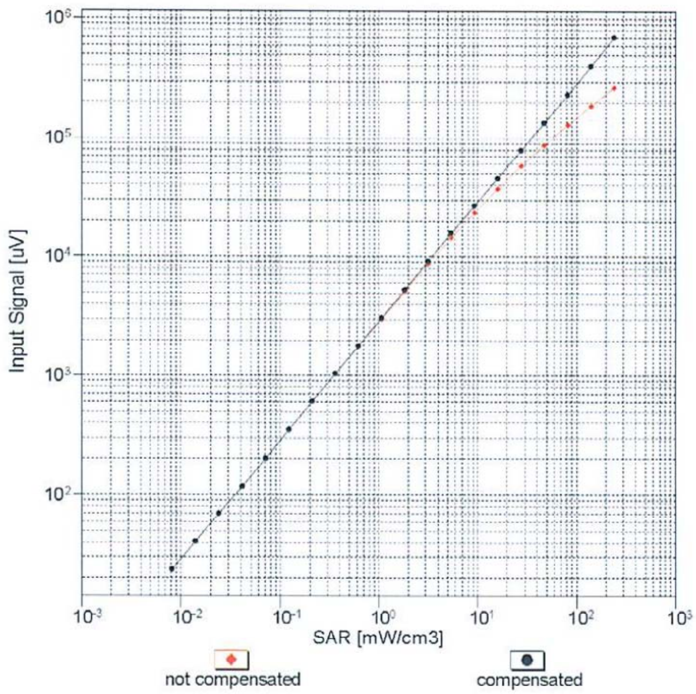
Receiving Pattern (ϕ), ϑ = 0°

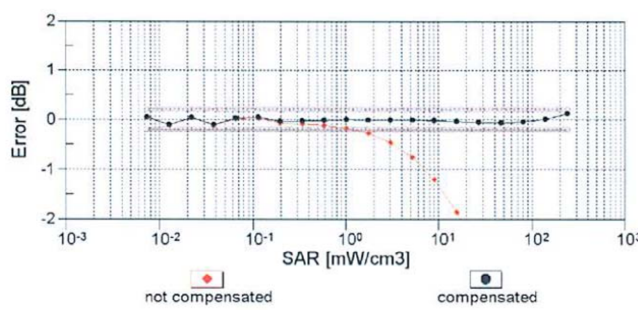




Uncertainty of Axial Isotropy Assessment: ± 0.5% (k=2)

Dynamic Range f(SAR_{head})
(TEM cell , f_{eval}= 1900 MHz)



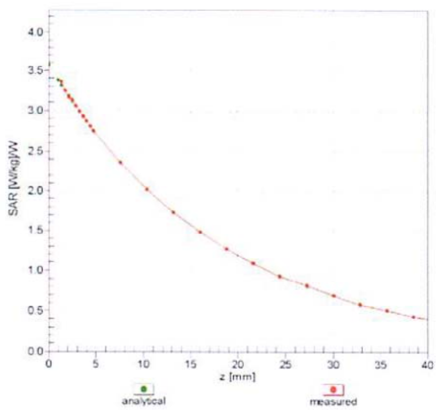


Uncertainty of Linearity Assessment: ± 0.6% (k=2)

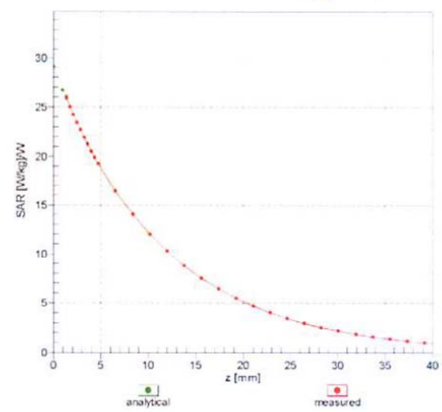
EX3DV4– SN:3619 September 23, 2016

Conversion Factor Assessment

f = 835 MHz,WGLS R9 (H_convF)

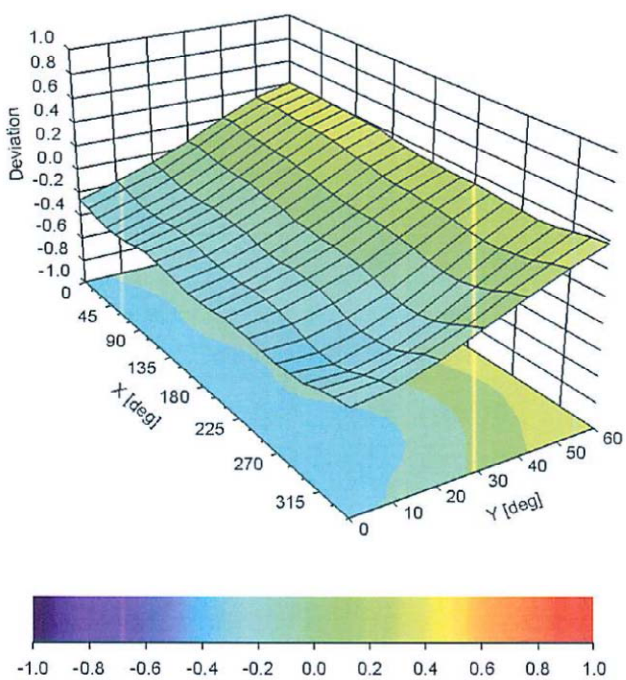


f = 1900 MHz,WGLS R22 (H_convF)



Deviation from Isotropy in Liquid

Error (ϕ, ϑ), f = 900 MHz



Uncertainty of Spherical Isotropy Assessment: ± 2.6% (k=2)

Certificate No: EX3-3619_Sep16 Page 10 of 11

DASY/EASY - Parameters of Probe: EX3DV4 - SN:3619

Other Probe Parameters

Sensor Arrangement	Triangular
Connector Angle (°)	30
Mechanical Surface Detection Mode	enabled
Optical Surface Detection Mode	disabled
Probe Overall Length	337 mm
Probe Body Diameter	10 mm
Tip Length	9 mm
Tip Diameter	2.5 mm
Probe Tip to Sensor X Calibration Point	1 mm
Probe Tip to Sensor Y Calibration Point	1 mm
Probe Tip to Sensor Z Calibration Point	1 mm
Recommended Measurement Distance from Surface	1.4 mm

12 Appendix C - Dipole Calibration Certificates

NCL CALIBRATION LABORATORIES

Calibration File No: DC-1578
Project Number: BACL-dipole-cal-5774

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.

BACL Validation Dipole (Head & Body)

Manufacturer: APREL Laboratories
Part number: D-2450-S-1
Frequency: 2450 MHz
Serial No: BCL-141

Customer: Bay Area Compliance Laboratory

Calibrated: 19th August 2014
Released on: 20th August 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) 432-8306

NCL Calibration Laboratories
Division of APREL Laboratories.

Conditions

Dipole BCL-141 was received from customer in good condition for re-calibration, SMA connector required cleaning prior to 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

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

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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: 49.8 mm
Height: 29.9 mm

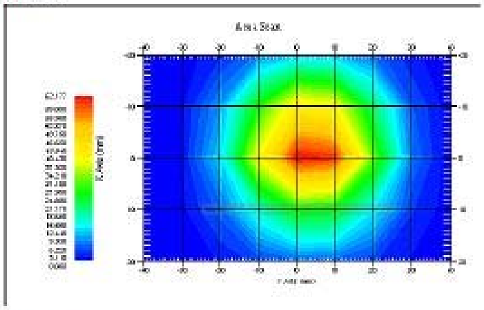
Electrical Calibration

Test	Result Head	Result Body
S11 R/L	-28.771 dB	-24.946 dB
SWR	1.075 U	1.120 U
Impedance	53.072 Ω	55.701 Ω

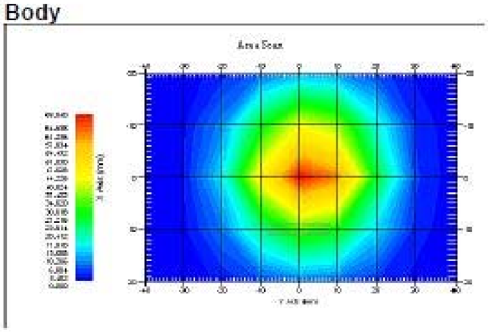
System Validation Results

Frequency 2450 MHz	1 Gram	10 Gram
Head	52.985	24.065
Body	56.519	24.855

Head



Body



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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 BCL-141. 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

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

Conditions

Dipole BCL-141 was received from customer in good condition for re-calibration, SMA connector required cleaning prior to calibration.

Ambient Temperature of the Laboratory: 21 °C ± 0.5°C
Temperature of the Tissue: 20 °C ± 0.5°C

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Dipole Calibration Results

Mechanical Verification

APREL Length	APREL Height	Measured Length	Measured Height
51.0 mm	30.0 mm	49.8 mm	29.9 mm

Tissue Validation

Tissue 2450MHz	Measured Head	Measured Body
Dielectric constant, ε_r	37.61	53.69
Conductivity, σ [S/m]	1.86	1.96

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)**

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
Agilent Signal Generator	MY45094463	Dec. 2015

We have a two year calibration interval.

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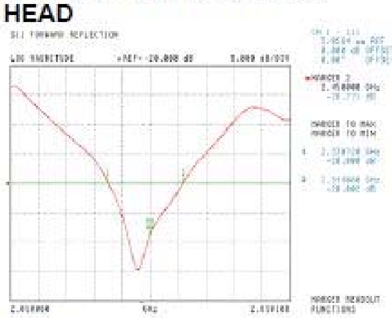
Electrical Calibration

Test	Result Head	Result Body
S11 R/L	-28.771 dB	-24.946 dB
SWR	1.075 U	1.120 U
Impedance	53.072 Ω	55.701 Ω

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

S11 Parameter Return Loss
HEAD



Frequency Range 2330 MHz to 2544 MHz

BODY

Frequency Range 2342 MHz to 2532 MHz

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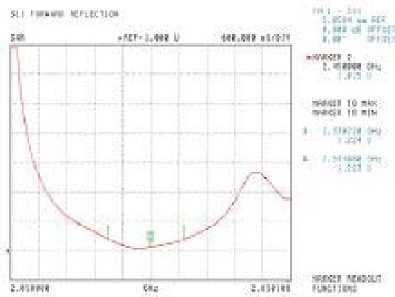
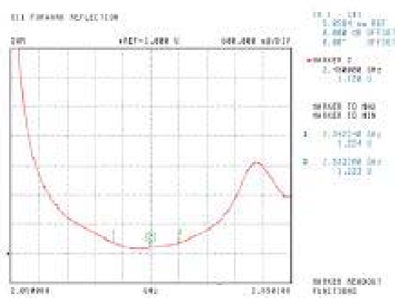
SWR

Head



Body



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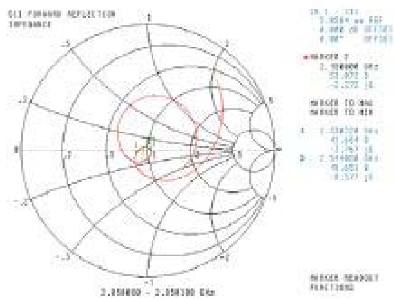
Smith Chart Dipole Impedance

Head



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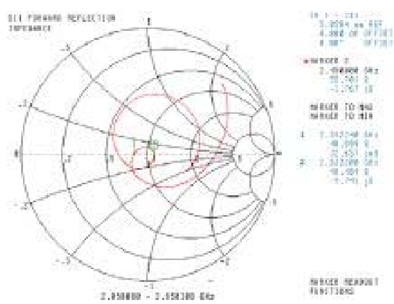

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Test Equipment

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.

13 Appendix D - Test System Verifications Scans

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

2450 MHz Body System Validation

DUT: Dipole 2450 MHz; Type: D-2450-S-1, S/N: BCL-141

Communication System: CW; Frequency: 2450 MHz;Duty Cycle: 1:1
Medium parameters used: f = 2450 MHz; σ = 1.97 mho/m; ε_r = 53.41; ρ = 1000 kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY4 (High Precision Assessment)

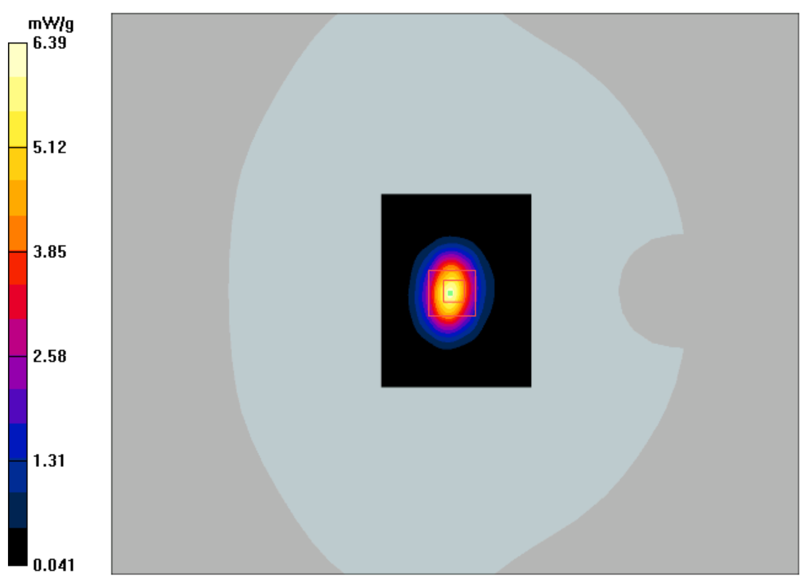
DASY4 Configuration:

- Probe: EX3DV4 - SN3619; ConvF(6.69, 6.69, 6.69); Calibrated: 9/23/2016
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn530; Calibrated: 9/21/2016
- Phantom: SAM with CRP; Type: SAM; Serial: TP-1032
- Measurement SW: DASY4, V4.7 Build 80; Postprocessing SW: SEMCAD, V1.8 Build 186

d = 10mm, Pin = 0.1 W/Area Scan (71x91x1): Measurement grid: dx=10mm, dy=10mm
Maximum value of SAR (interpolated) = 6.15 mW/g

d = 10mm, Pin = 0.1 W/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 55.2 V/m; Power Drift = 0.289 dB
Peak SAR (extrapolated) = 11.9 W/kg

SAR (1 g) = 5.53 mW/g; SAR (10 g) = 2.49 mW/g
Maximum value of SAR (measured) = 6.39 mW/g



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

2450 MHz Head System Validation

DUT: Dipole 2450 MHz; Type: D-2450-S-1, S/N: BCL-141

Communication System: CW; Frequency: 2450 MHz;Duty Cycle: 1:1
Medium parameters used: f = 2450 MHz; σ = 1.79 mho/m; ε_r = 38.9; ρ = 1000 kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY4 (High Precision Assessment)

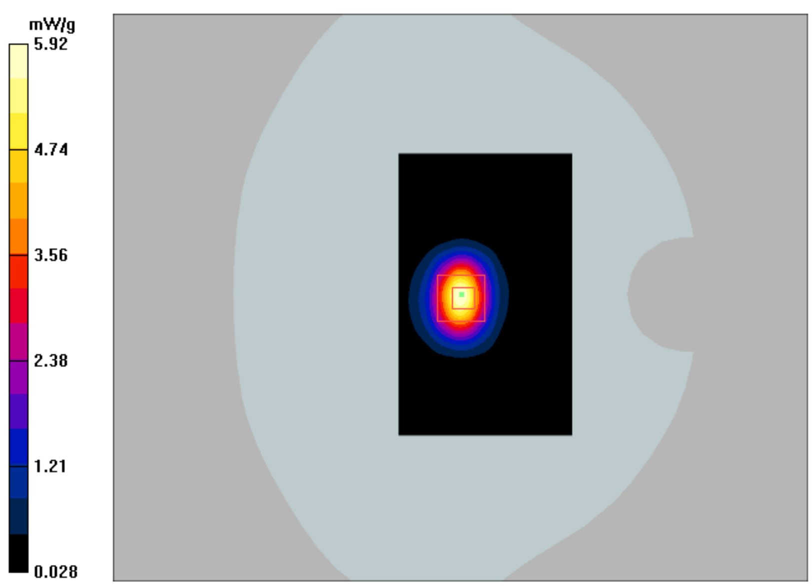
DASY4 Configuration:

- Probe: EX3DV4 - SN3619; ConvF(6.64, 6.64, 6.64); Calibrated: 9/23/2016
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn530; Calibrated: 9/21/2016
- Phantom: SAM with CRP; Type: Twin SAM; Serial: TP-1032
- Measurement SW: DASY4, V4.7 Build 80; Postprocessing SW: SEMCAD, V1.8 Build 186

d =10 mm, Pin = 0.1 W/Area Scan (81x131x1): Measurement grid: dx=10mm, dy=10mm
Maximum value of SAR (interpolated) = 5.96 mW/g

d =10 mm, Pin = 0.1 W/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 55.0 V/m; Power Drift = 0.313 dB
Peak SAR (extrapolated) = 11.7 W/kg

SAR (1 g) = 5.26 mW/g; SAR (10 g) = 2.4 mW/g
Maximum value of SAR (measured) = 5.92 mW/g



14 Appendix E - EUT Scan Results

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

Head Front 10mm to Phantom, 802.11 b mode, 2462 MHz

DUT: Intel; Type: Watch; Serial: AEDV05HR635000R

Communication System: 802.11B/G; Frequency: 2462 MHz;Duty Cycle: 1:1
Medium parameters used: f = 2462 MHz; σ = 1.8 mho/m; ε_r = 38.9; ρ = 1000 kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY4 (High Precision Assessment)

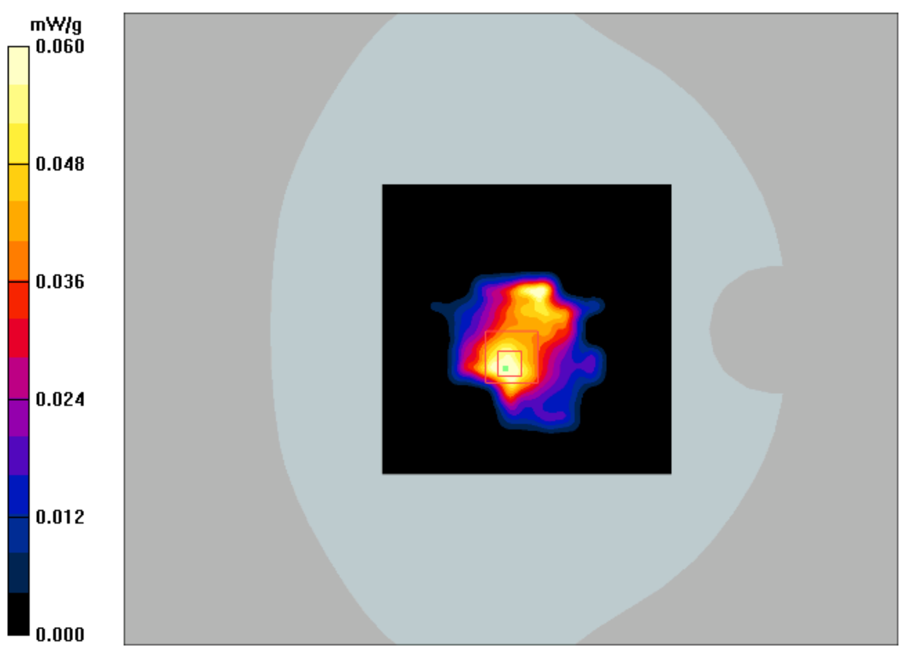
DASY4 Configuration:

- Probe: EX3DV4 - SN3619; ConvF(6.64, 6.64, 6.64); Calibrated: 9/23/2016
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn530; Calibrated: 9/21/2016
- Phantom: SAM with CRP; Type: Twin SAM; Serial: TP-1032
- Measurement SW: DASY4, V4.7 Build 80; Postprocessing SW: SEMCAD, V1.8 Build 186

Front 10mm to Phantom High Channel/Area Scan (121x121x1): Measurement grid: dx=10mm, dy=10mm
Maximum value of SAR (interpolated) = 0.067 mW/g

Front 10mm to Phantom High Channel/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 5.08 V/m; Power Drift = -0.076 dB
Peak SAR (extrapolated) = 0.094 W/kg

SAR (1 g) = 0.053 mW/g; SAR (10 g) = 0.027 mW/g
Maximum value of SAR (measured) = 0.060 mW/g



 # 1

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

Body Rear Touch Phantom, 802.11b mode, 2437 MHz

DUT: Intel; Type: Watch; Serial: AEDV05HR635000R

Communication System: 802.11B/G; Frequency: 2437 MHz;Duty Cycle: 1:1
Medium parameters used: f = 2437 MHz; σ = 1.95 mho/m; ε_r = 53.2; ρ = 1000 kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY4 (High Precision Assessment)

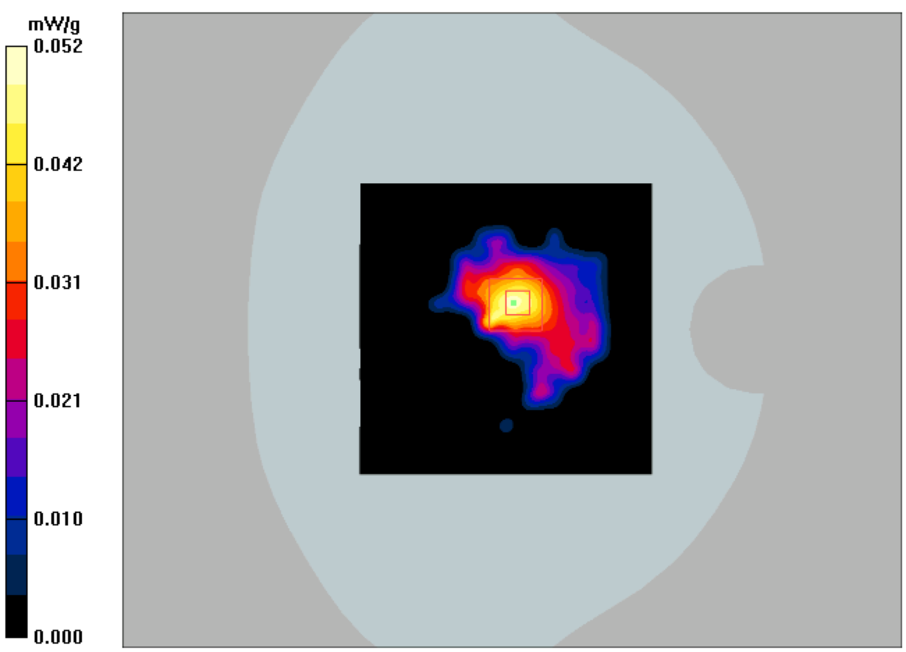
DASY4 Configuration:

- Probe: EX3DV4 - SN3619; ConvF(6.69, 6.69, 6.69); Calibrated: 9/23/2016
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn530; Calibrated: 9/21/2016
- Phantom: SAM with CRP; Type: Twin SAM; Serial: TP-1032
- Measurement SW: DASY4, V4.7 Build 80; Postprocessing SW: SEMCAD, V1.8 Build 186

Rear Touch to Phantom Mid Channel/Area Scan (121x121x1): Measurement grid: dx=10mm, dy=10mm
Maximum value of SAR (interpolated) = 0.051 mW/g

Rear Touch to Phantom Mid Channel/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 3.49 V/m; Power Drift = 0.131 dB
Peak SAR (extrapolated) = 0.087 W/kg

SAR (1 g) = 0.045 mW/g; SAR (10 g) = 0.023 mW/g
Maximum value of SAR (measured) = 0.052 mW/g



 # 2

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

Head Front 10mm to Phantom, 802.11 g mode, 2462 MHz

DUT: Intel; Type: Watch; Serial: AEDV05HR635000R

Communication System: 802.11B/G; Frequency: 2462 MHz;Duty Cycle: 1:1
Medium parameters used: f = 2462 MHz; σ = 1.8 mho/m; ε_r = 38.9; ρ = 1000 kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY4 (High Precision Assessment)

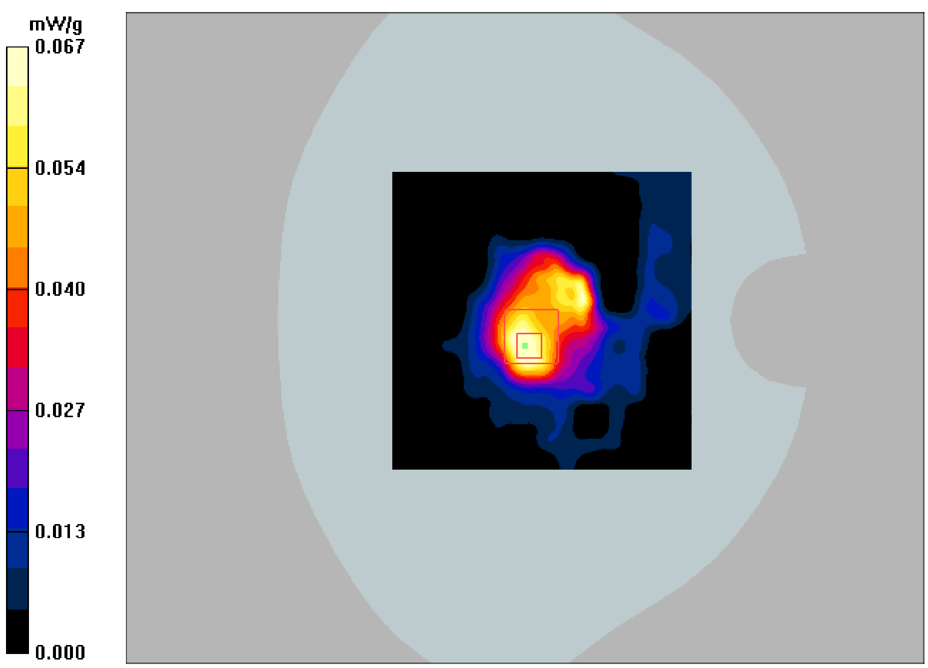
DASY4 Configuration:

- Probe: EX3DV4 - SN3619; ConvF(6.64, 6.64, 6.64); Calibrated: 9/23/2016
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn530; Calibrated: 9/21/2016
- Phantom: SAM with CRP; Type: Twin SAM; Serial: TP-1032
- Measurement SW: DASY4, V4.7 Build 80; Postprocessing SW: SEMCAD, V1.8 Build 186

Front 10mm to Phantom High Channel/Area Scan (121x121x1): Measurement grid: dx=10mm, dy=10mm
Maximum value of SAR (interpolated) = 0.074 mW/g

Front 10mm to Phantom High Channel/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 5.01 V/m; Power Drift = 0.775 dB
Peak SAR (extrapolated) = 0.116 W/kg

SAR (1 g) = 0.061 mW/g; SAR (10 g) = 0.030 mW/g
Maximum value of SAR (measured) = 0.067 mW/g



 # 3

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

Body Rear Touch Phantom, 802.11g mode, 2437 MHz

DUT: Intel; Type: Watch; Serial: AEDV05HR635000R

Communication System: 802.11B/G; Frequency: 2437 MHz;Duty Cycle: 1:1
Medium parameters used: f = 2437 MHz; σ = 1.95 mho/m; ε_r = 53.2; ρ = 1000 kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY4 (High Precision Assessment)

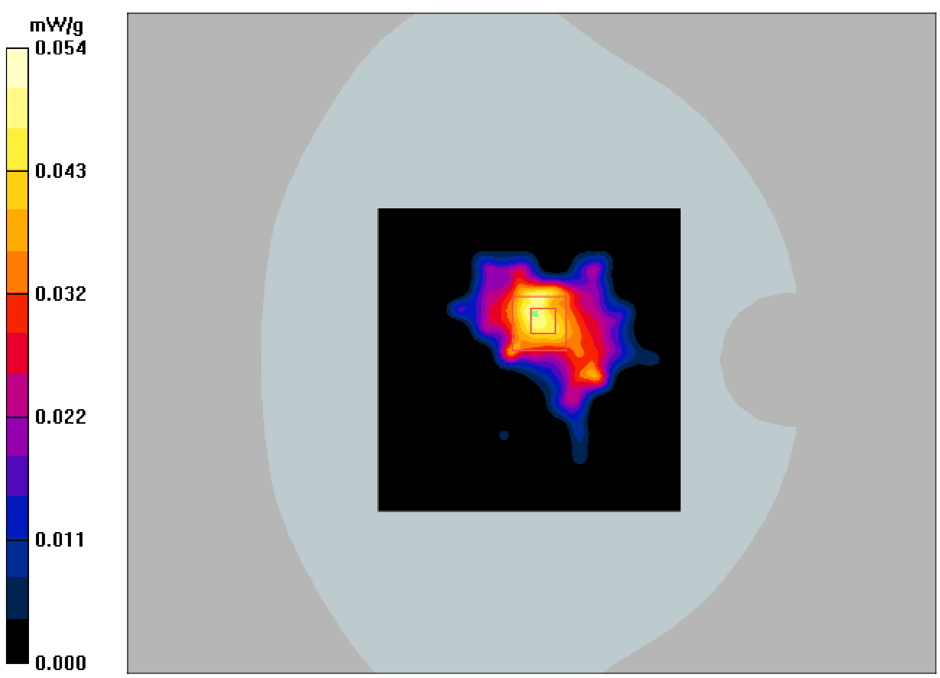
DASY4 Configuration:

- Probe: EX3DV4 - SN3619; ConvF(6.69, 6.69, 6.69); Calibrated: 9/23/2016
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn530; Calibrated: 9/21/2016
- Phantom: SAM with CRP; Type: Twin SAM; Serial: TP-1032
- Measurement SW: DASY4, V4.7 Build 80; Postprocessing SW: SEMCAD, V1.8 Build 186

Rear Touch to Phantom Mid Channel/Area Scan (121x121x1): Measurement grid: dx=10mm, dy=10mm
Maximum value of SAR (interpolated) = 0.051 mW/g

Rear Touch to Phantom Mid Channel/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 3.10 V/m; Power Drift = 0.122 dB
Peak SAR (extrapolated) = 0.161 W/kg

SAR (1 g) = 0.047 mW/g; SAR (10 g) = 0.024 mW/g
Maximum value of SAR (measured) = 0.054 mW/g



 # 4

15 Appendix F- RF Output Power Measurement

RF Output Power Measurement Results

2.4 GHz WLAN:

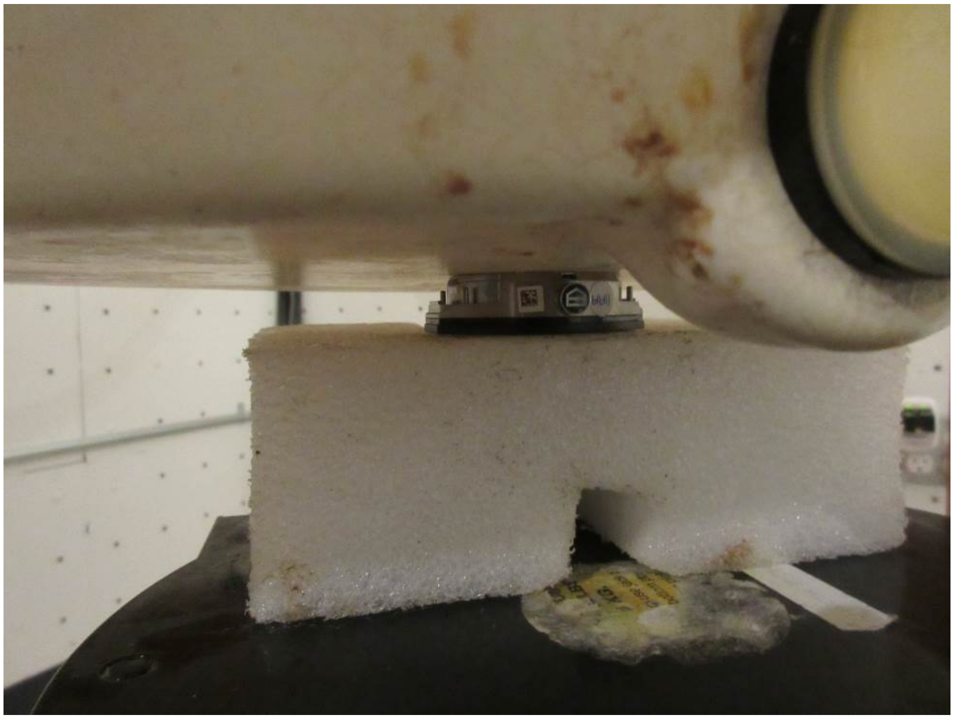
Modulation	Frequency (MHz)	Output Average Power Conducted (dBm)	
		Measured	Target
2.4 GHz 802.11b	2412	15.78	16.50
	2437	16.18	16.50
	2462	16.11	16.50
2.4 GHz 802.11g	2412	16.40	17.00
	2437	16.72	17.00
	2462	16.52	17.00
2.4 GHz 802.11n20	2412	16.28	17.00
	2437	16.55	17.00
	2462	16.35	17.00

2.4 GHz Bluetooth:

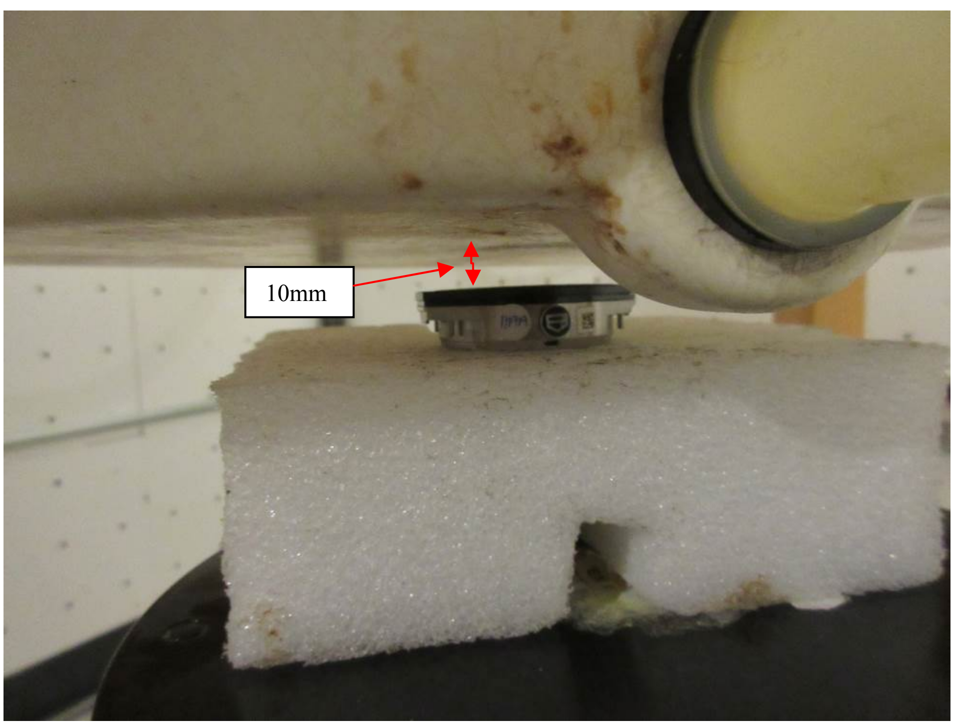
Modulation	Frequency (MHz)	Output Average Power Conducted (dBm)	
		Measured	Target
BT-GFSK	2402	9.21	10.00
	2441	9.82	10.00
	2480	8.80	10.00
BT- DQPSK	2402	5.25	6.50
	2441	6.21	6.50
	2480	5.60	6.50
BT-8DPSK	2402	5.19	6.50
	2441	6.23	6.50
	2480	5.57	6.50
BLE	2402	7.95	9.00
	2440	8.70	9.00
	2480	7.83	9.00

16 Appendix G - Test Setup Photos

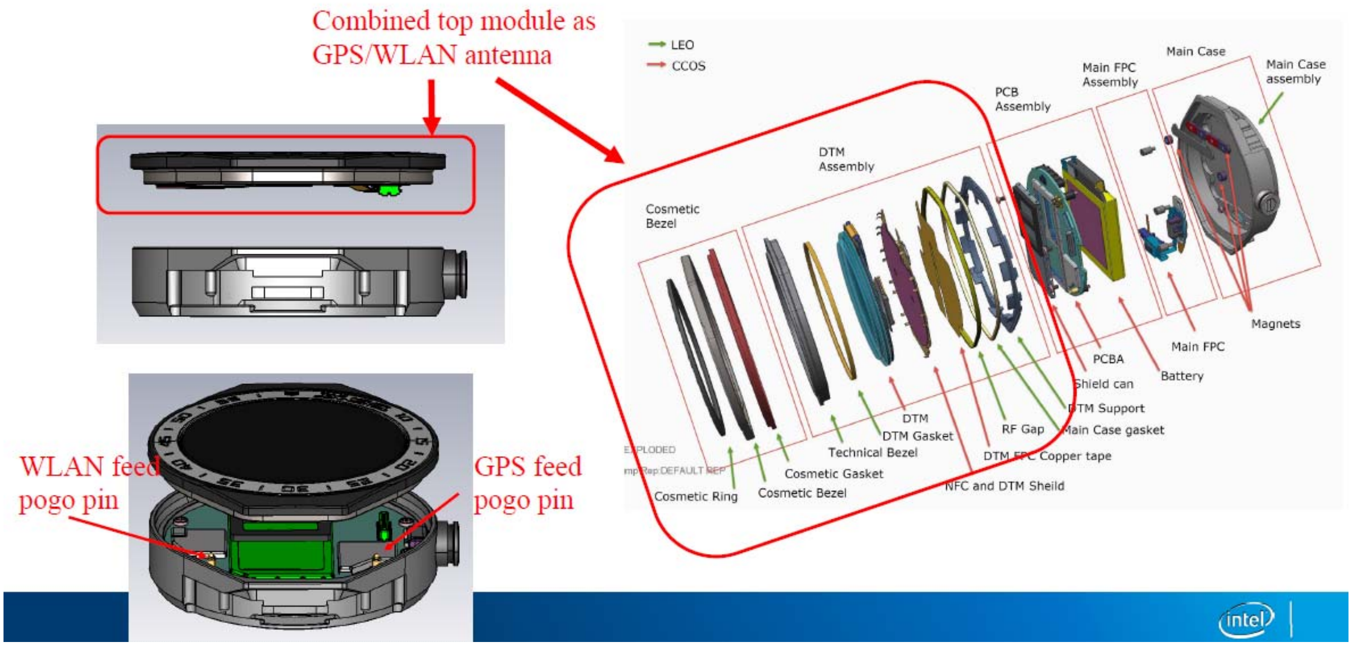
16.1 EUT Back Side Touch to the Flat Phantom



16.2 EUT Front Side 10mm to the Flat Phantom



16.3 EUT Antenna Location



17 Appendix H - EUT Photos

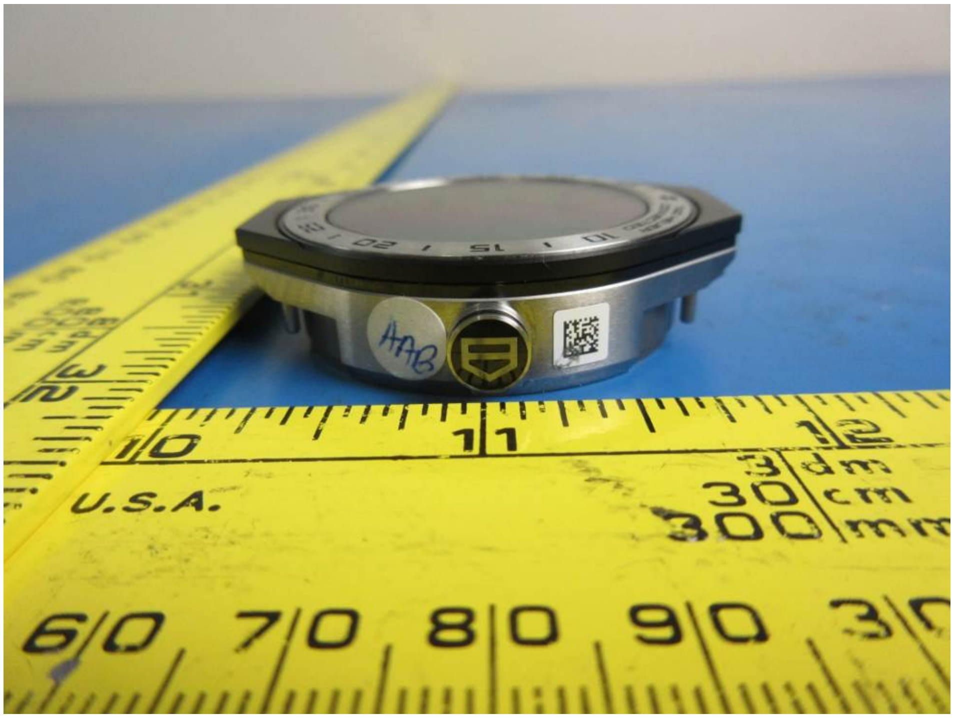
17.1 EUT Front Side View

17.2 EUT Back Side View

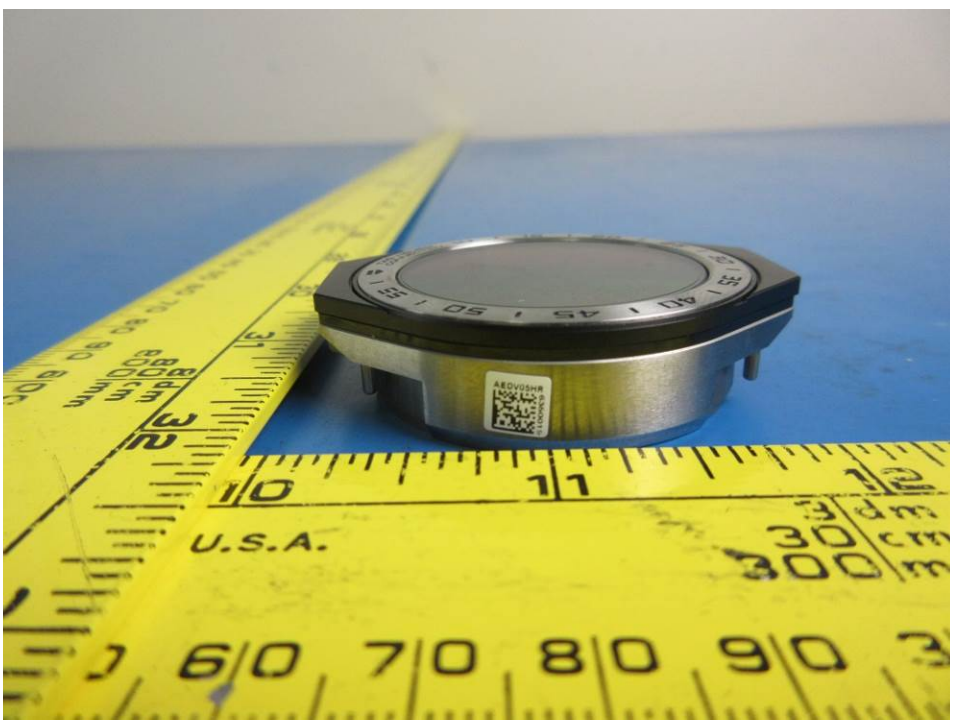
17.3 EUT Top Side View

17.4 EUT Bottom Side View

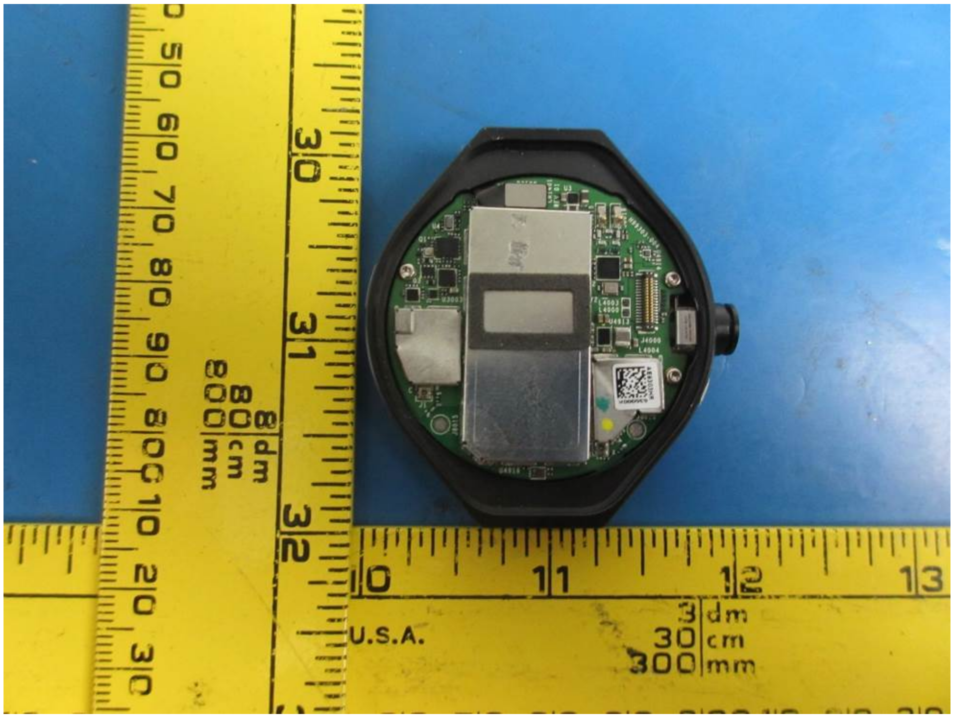
17.5 EUT Right Side View



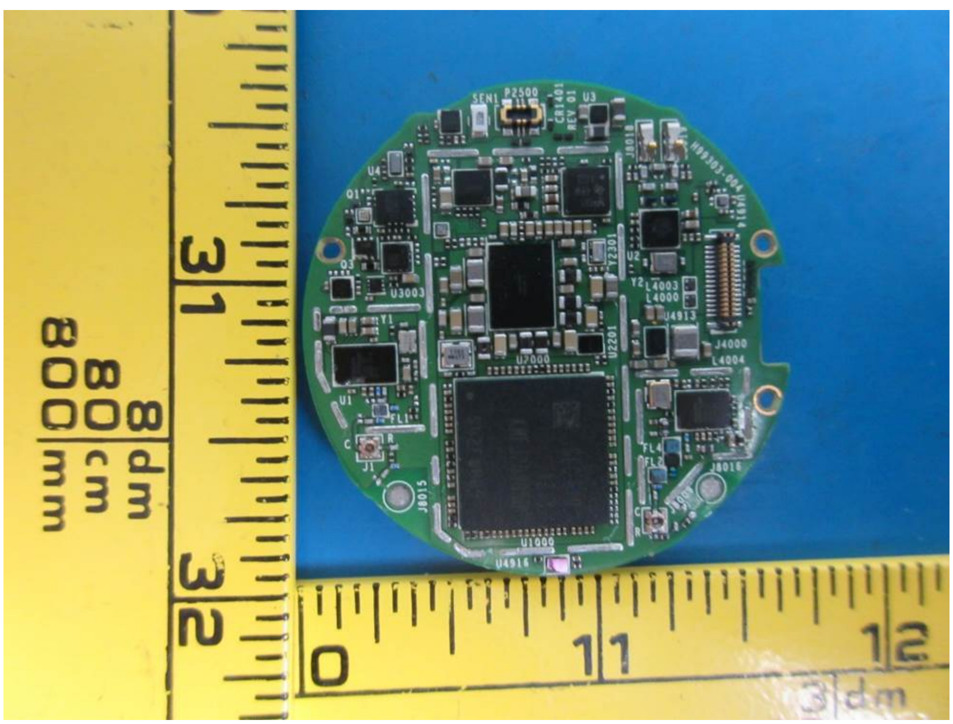
17.6 EUT Left Side View



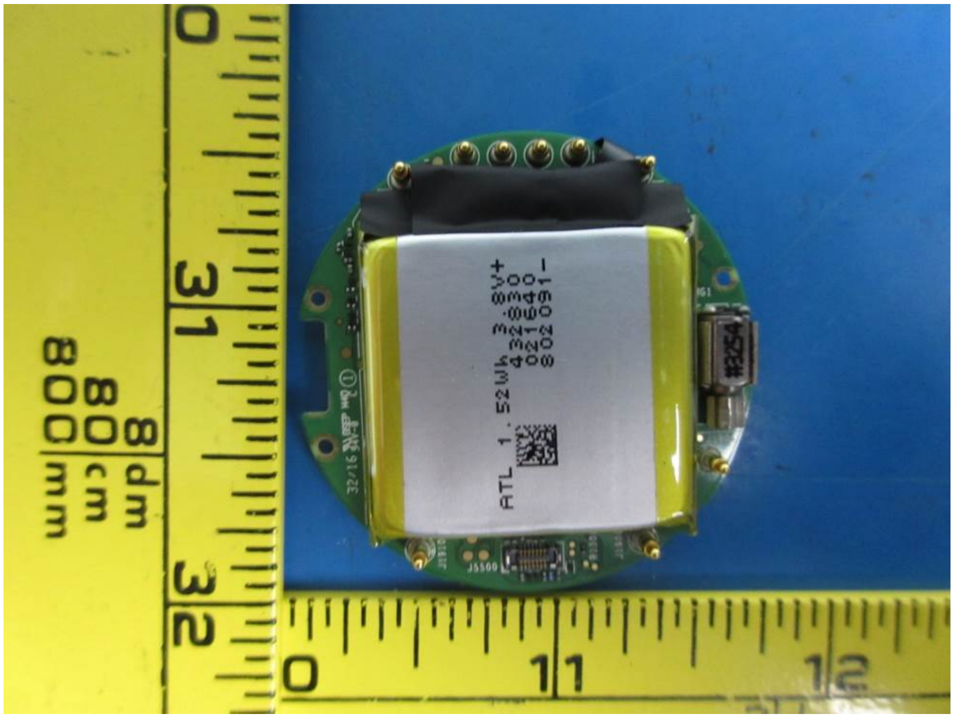
17.7 EUT Open Case



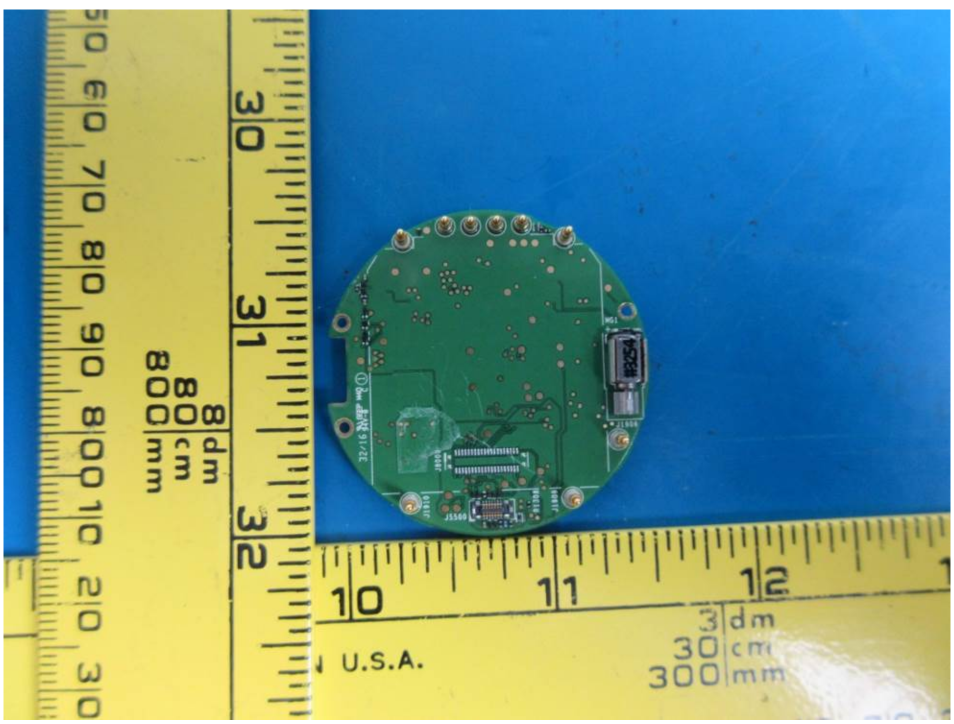
17.8 EUT Main Board Top View



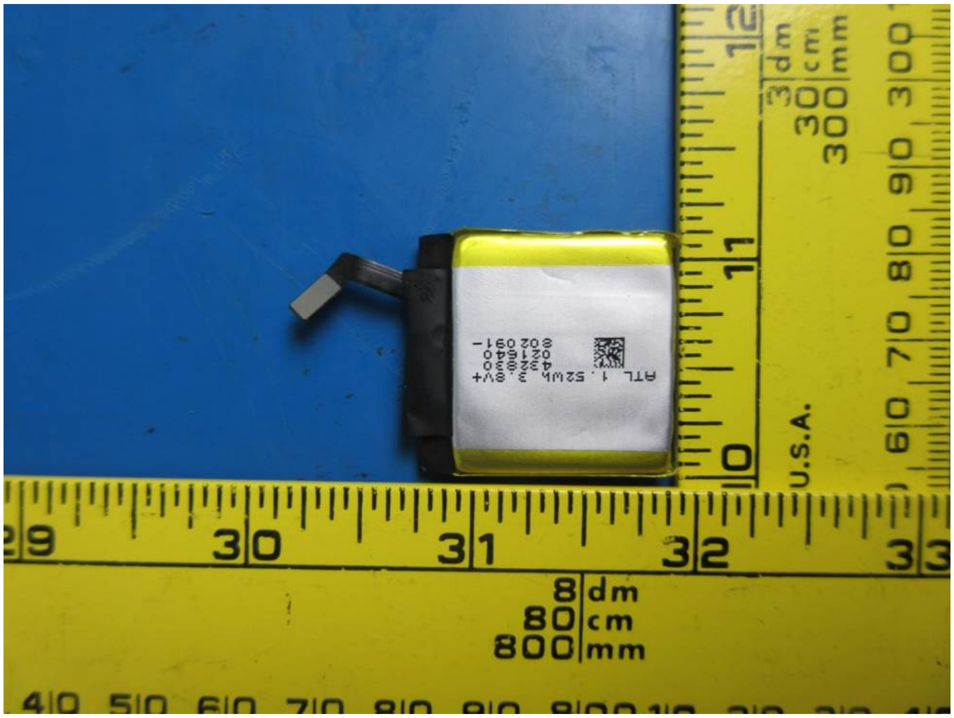
17.9 EUT Main Board Bottom View w/ Battery



17.10 EUT Main Board Bottom View w/o Battery



17.11 EUT Battery Top View



17.12 EUT Battery Bottom View

18 Appendix I - Informative References

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