SAR EVALUATION REPORT

For

GlobalSat WorldCom Corporation

16 F., No. 186, Jian 1st Rd., Zhonghe Dist., New Taipei City, Taiwan

FCC ID: RID-MDPANIC

Report Type: Original Report	**Product Type:** Personal Tracker
Prepared By:	Tri Pham Associate Test Engineer
Report Number:	R2005213-SAR
Report Date:	2020-05-26
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<tr><td>Rule Part(s):</td><td colspan="3">FCC §2.1093</td></tr>
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<tr><td>Device Category:
Exposure Category:</td><td colspan="3">Portable Device
General Population/Uncontrolled Exposure</td></tr>
<tr><td>Device Type:</td><td colspan="3">Portable Device</td></tr>
<tr><td>Modulation Type:</td><td colspan="3">LoRa (FSK)</td></tr>
<tr><td>TX Frequency Range:</td><td colspan="3">902.3 – 914.9 MHz (125 kHz mode)
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<tr><td rowspan="2">Maximum Conducted Power:</td><td colspan="2">18.29 dBm</td><td>125 kHz</td></tr>
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<tr><td>Antenna Type(s) Tested:</td><td colspan="3">FPC</td></tr>
<tr><td>Body-Worn Accessories:</td><td colspan="3">Lanyard</td></tr>
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<tr><td>0.1848</td><td>1g Body</td><td>125 kHz</td></tr>
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DOCUMENT REVISION HISTORY

Revision Number	Report Number	Description of Revision	Date of Revision
0	R2005213-SAR	Original Report	2020-05-26

1 General Description

1.1 Product Description for Equipment under Test (EUT)

This test report was prepared on behalf of *GlobalSat Worldcom Corporation,* and their product model: *MD-Panic,* FCC ID: RID-MDPANIC which henceforth is referred to as the EUT (Equipment under Test). The EUT is a Personal Tracker with LoRa radio.

1.2 EUT Technical Specification

Item	Description	
Modulation	LoRa (FSK)	
Frequency Range	902.3 – 914.9 MHz (125 kHz mode) 903.0 – 914.2 MHz (500 kHz mode)	
Maximum Conducted Power Tested	18.29 dBm	125 kHz
	19.29 dBm	500 kHz
Power Source	Li-Ion: 3.7V/1A	
Normal Operation	Lanyard	

2 Test Facility

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 3297.02)*****,** in the fields of: Electromagnetic Compatibility and Telecommunications. Unless noted by an Asterisk (*) in the Compliance Matrix (See Section 3 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 Accreditation Certificate Number 3297.03)*** to certify

- 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 3297.01)*** 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: (Innovation, Science and Economic development Canada - ISEDC) 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 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 Media Development Authority - IMDA) 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;

3 Reference and Guidelines

FCC/IC:
The Report and Order requires routine SAR evaluation prior to equipment authorization of portable transmitter devices, including portable telephones. For consumer products, the applicable limit is 1.6 mW/g as recommended by the ANSI/IEEE standard C95.1-1992 [6] for an uncontrolled environment (Paragraph 65). According to the FCC KDB 447498 D01 “RF Exposure Procedures and Equipment Authorization Polices for Mobile and Portable Devices”, RF Exposure compliance must be determined at the maximum average power level according to source-based time-averaging requirements to determine compliance for general population exposure conditions.

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

3.1 SAR Limits

FCC/ISEDC 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)	1.60	8.0
Spatial Peak (hands/wrists/feet/ankles averaged over 10 g)	4.0	20.0

CE 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 10 g of tissue)	2.0	10
Spatial Peak (hands/wrists/feet/ankles averaged over 10 g)	4.0	20.0

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

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

General Population/Uncontrolled environments Spatial Peak limit 1.6 W/kg (FCC/ISEDC) applied to the EUT for body-worn and handheld configurations.

4 Equipment List and Calibration

Type/Model	Cal. Due Date	S/N
DASY6 Professional Dosimetric System	NCR	None
Robot TX90XL	NCR	F17/5DBKA1/A/01
Robot Controller CS8Cspeag-TX90	NCR	F17/5DBKA1/C/01
Pendant Control Box D21142607B	NCR	013151
Robot Remote Control Box SE UWS032 AA	NCR	None
HP Elitedesk 800 G3 TWR	NCR	CZC048171C
HP Elitedisplay E271i LED Backlit Monitor	NCR	3CM7208TJZ
SPEAG DAE4	2020-09-13	530
DASY6 Measurement Server SE UMS 028BB	NCR	1551
SPEAG E-Field Probe EX3DV4	2020-09-26	3619
Antenna, Dipole D900V2	2021-09-11	122
SPEAG Twin-Sam Phantom V4.0 (30 degree)	NCR	2074
Head Tissue Simulating Liquid HBBL600-6000V6	Each Time	170927-1
Power Meter Agilent E4419B EPM Series	2021-01-29	MY40510985
Power Sensor HP 8481A	2021-02-18	1926A28848
Power Sensor HP 8481A	2021-01-24	US37290516
Dielectric Probe Kit SPEAG DAK-3.5 Probe	NCR	1252
HEWLETT PACKARD 779D Directional Coupler	NCR	1144A05102
Agilent Signal Generator E4438C	2020-11-15	MY45091309
HP Network Analyzer 8753D	2021-03-16	3410A04346

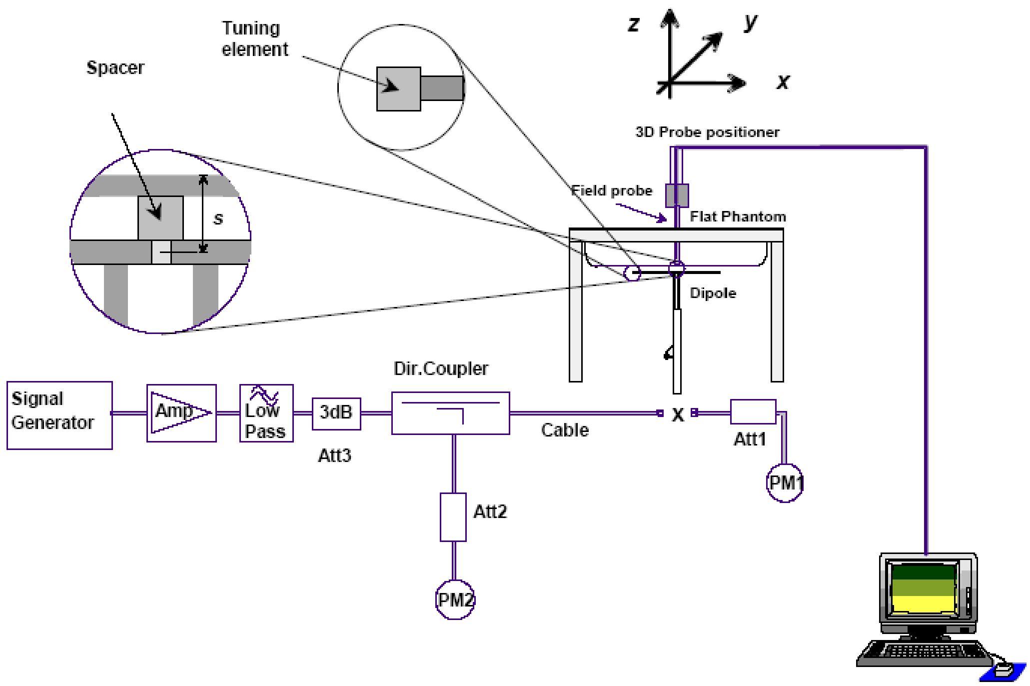
Note: NCR=No Calibration Required
Statement of Traceability: BACL Corp. attests that all of the calibrations on the equipment items listed above were traceable to NIST or to another internationally recognized National Metrology Institute (NMI), and were compliant with A2LA Policy P102 (dated 02 October 2018) “A2LA Policy on Metrological Traceability”.

5 SAR Measurement System Verification

5.1 System Accuracy Verification

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

5.2 System Setup Block Diagram



5.3 Liquid and System Validation

Date	Simulant	Freq. [MHz]	Parameters	Liquid Temp [ºC]	Target Value	Measured Value	Normalized to 1W	Deviation [%]	Limits [%]
2020-05-22	Head	900	εr	23	41.5	42.924	-	3.43	± 5
			σ (S/m)	23	0.97	0.942	-	-2.89	± 5
			1g SAR (W/kg)	23	10.7	0.296	10.76	0.56	± 10

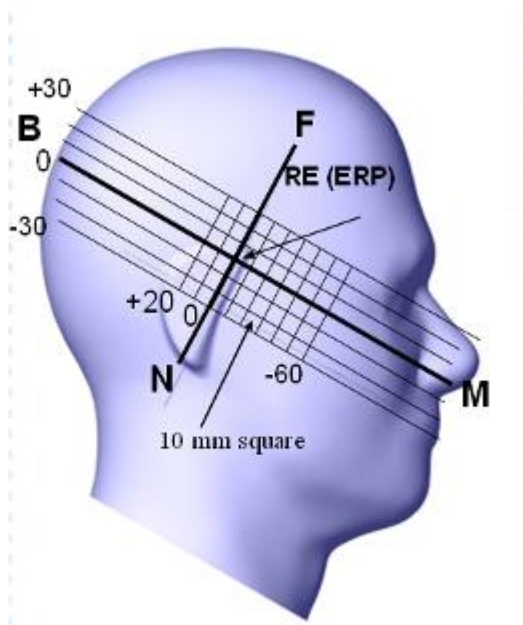
εr = relative permittivity, σ = conductivity and ρ=1000 kg/m³

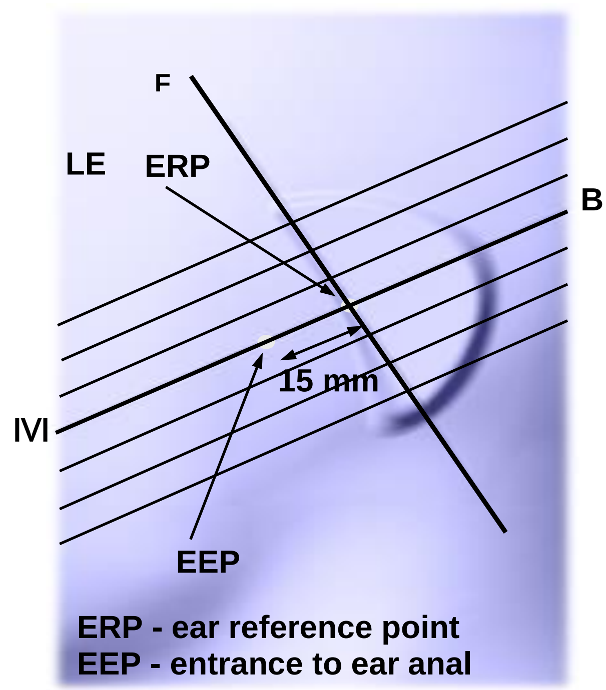
6 EUT Test Strategy and Methodology

6.1 Test Positions for Device Operating Next to a Person's Ear

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

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





N

6.2 Cheek/Touch Position

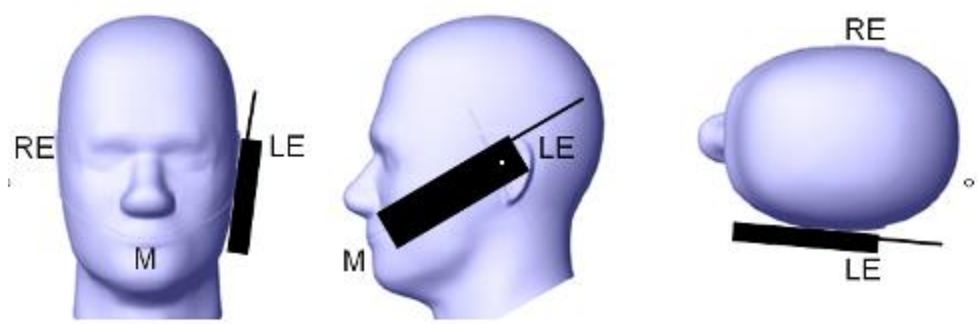
The device is brought toward the mouth of the head phantom by pivoting against the "ear reference point" or along the "N-F" line for the SCC-34/SC-2 head phantom.

This test position is established:

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

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

Cheek /Touch Position

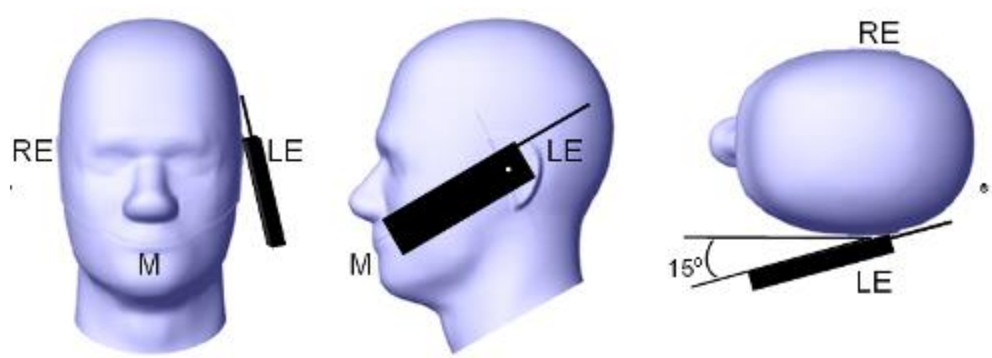


6.3 Ear/Tilt Position

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

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

<u>Ear /Tilt 15° Position</u>



6.4 Test position for body-support device and other configurations

A typical example of a body supported device is a wireless enabled laptop device that among other orientations may be supported on the thighs of a sitting use. To represent this orientation, the device shall be positioned with its base against the flat phantom. Other orientations may be specified by the manufactures in the user instructions. If the intended use is not specified, the device shall be tested directly against the flat phantom in all usable orientations.

The screen portion of the device shall be in an open position at a 90° angle, or at an operating angle specified for intended use by the manufacturer in the operating instructions. Where a body supported device has an integral screen required for normal operation, then the screen-side will not need to be tested if it ordinarily remains 200 mm from the body. Where a screen mounted antenna is present, this position shall be repeated with the screen against the flat phantom, if this is consistent with the intended use.

Other devices that fall into this category include tablet type portable computers and credit card transaction authorization terminals, point-of-sale and/or inventory terminals. Where these devices may be torso or limb-supported, the same principles for body-supported devices are applied.

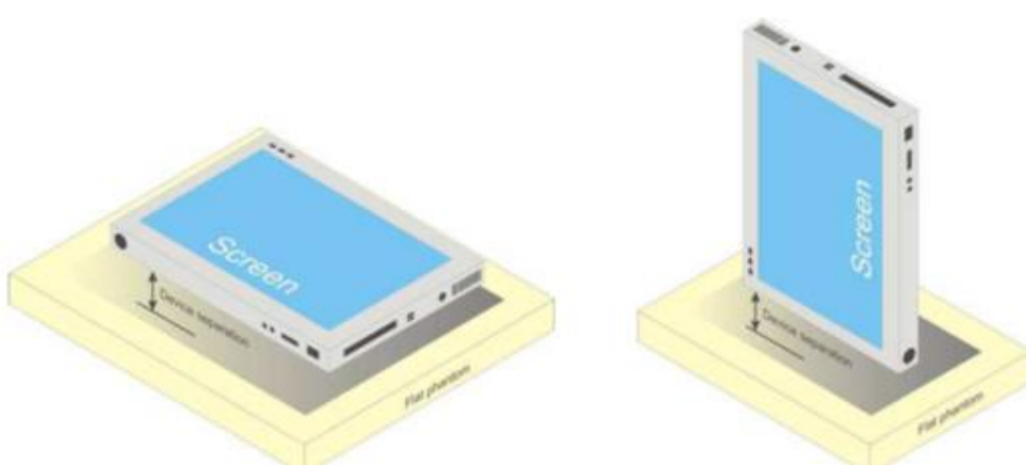
The example in Figure b) shows a tablet from factor portable computer for which SAR should be separately assessed with

a) Each surface and

b) The separation distances

Positioned against the flat phantom that correspond to the intended use as specified by the manufacturer. If the intended use is not specified in the user instructions, the device shall be tested directly against the flat phantom in all usable orientations.

Some body-supported devices may allow testing with an external power supply (e.g. a.c. adapter) supplemental to the battery, but it shall be verified and documented in the measurement report that SAR is still conservative

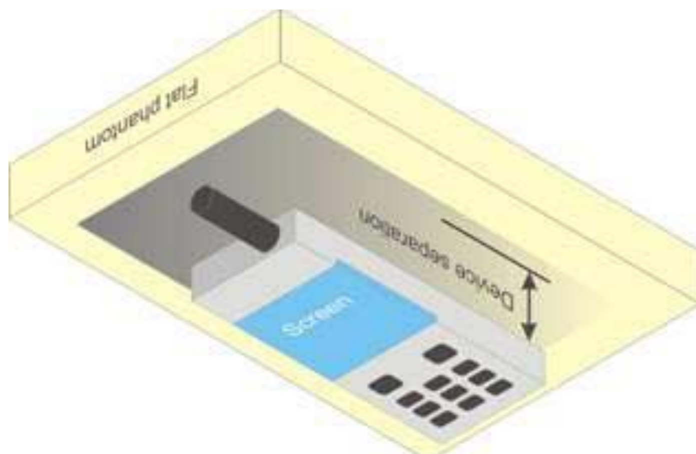


b) Tablet form factor portable computer

6.5 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.



6.6 SAR Evaluation Procedure

The evaluation was performed with the following procedure:

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

Step 2: The SAR distribution at the exposed side of the head was measured at a distance of 4 mm from the inner surface of the shell. The area covered the entire dimension of the head or EUT and the horizontal grid spacing was 15 mm x 15 mm. Based on these data, the area of the maximum absorption was determined by line interpolation. The first Area Scan covers the entire dimension of the EUT to ensure that the hotspot was correctly identified.

Step 3: Around this point, a volume of 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.

6.7 Test Methodology

IEEE 1528: 2013
IEC 62209-2: 2010
KDB 447498 D01 General RF Exposure Guidance v06
KDB 248227 D01 802.11 Wi-Fi SAR v02r02
KDB 865664 D01 SAR Measurement 100 MHz to 6 GHz v01r04

7 DASY52 SAR Evaluation Procedure

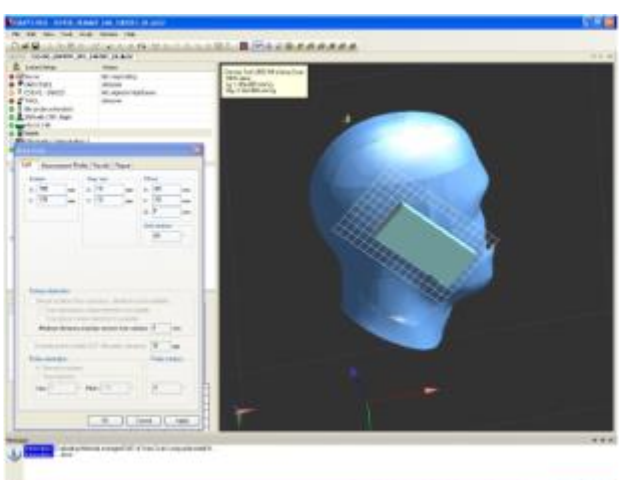
7.1 Power Reference Measurement

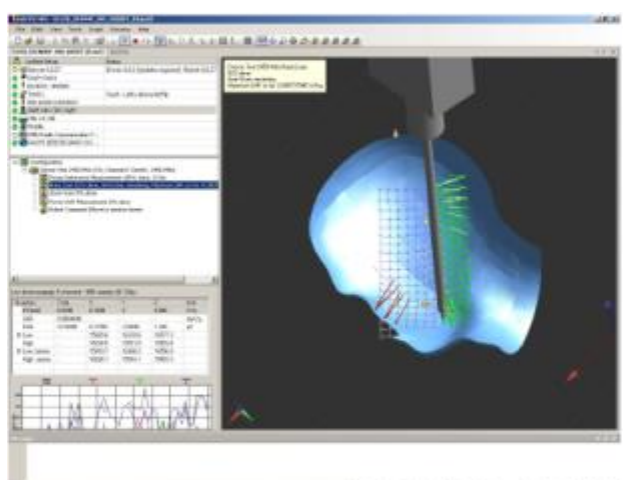
The Power Reference Measurement and Power Drift Measurement jobs are useful jobs for monitoring the power drift of the device under test in the batch process. Both jobs measure the field at a specified reference position, at a selectable distance from the phantom surface. The reference position can be 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.

7.2 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 DASY52 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, EN 50361 and IEC 62209 standards, whereby 3 dB is a requirement when compliance is assessed in accordance with the ARIB standard (Japan). 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 (see Section 3.3.2.14 Zoom Scan for details). 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. 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.





7.3 Zoom Scan

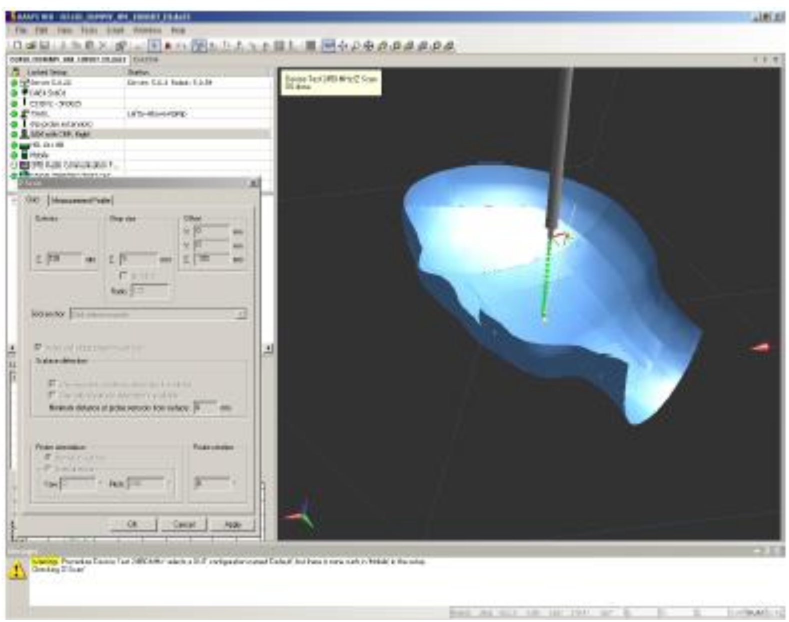
Zoom Scans are used to assess the peak spatial SAR values within a cubic averaging volume containing 1 g and 10 g of simulated tissue. The default Zoom Scan measures 5 x 5 x 7 points within a cube whose base faces are centered around the maxima found in a preceding area scan job within the same procedure. 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.

7.4 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.

7.5 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.



8 Description of Test System

These measurements were performed with the automated near-field scanning system DASY6 from Schmid & Partner Engineering AG (SPEAG) which is the sixth generation of the system shown in the figure hereinafter:

The system is based on a high precision robot (working range greater than 1.45m), 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.

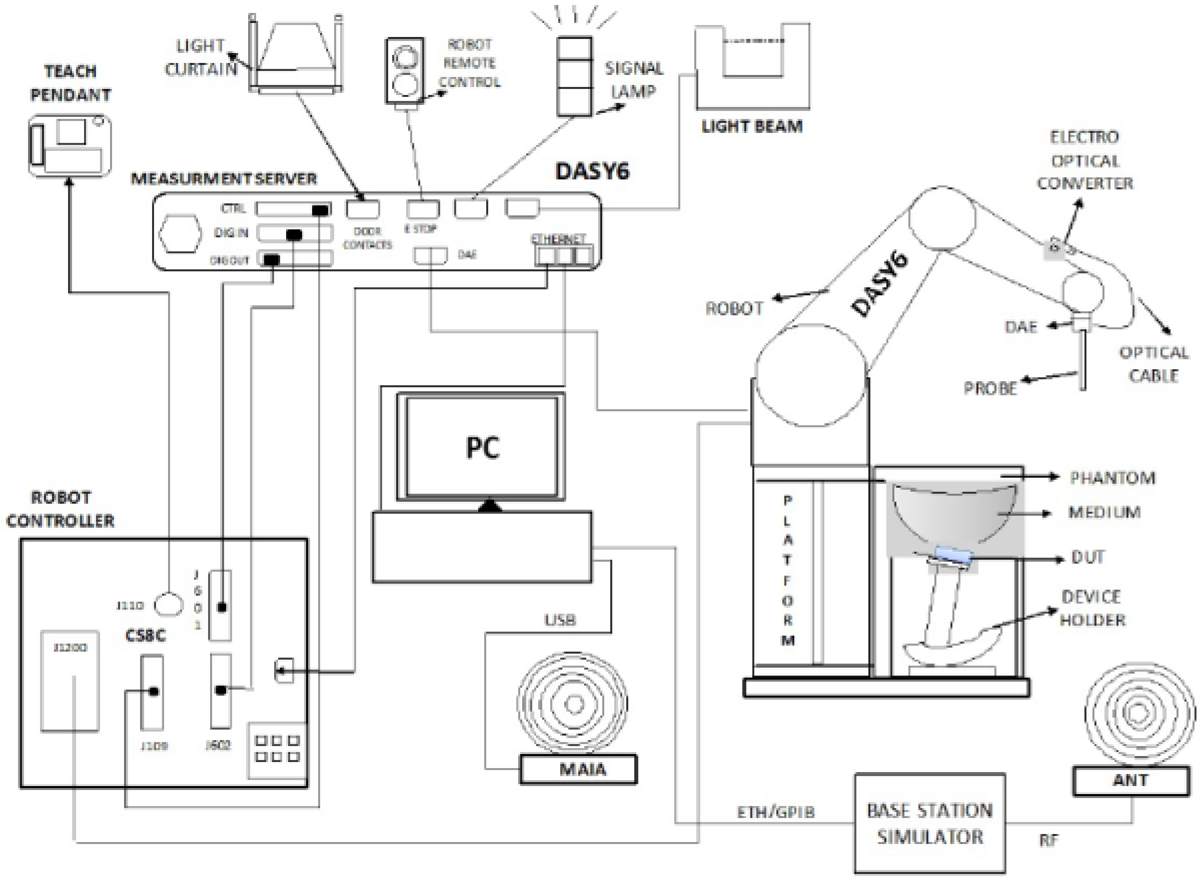
The SAR measurements were conducted with the dosimetric probe EX3DV4 SN: 3619 (manufactured by SPEAG), designed in the classical triangular configuration and optimized for dosimetric evaluation. The probe has been calibrated according to the procedure with accuracy of better than ±10%. The spherical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

8.1 IEC 62209-1: 2016 Table A.3 Dielectric properties of the head tissue-equivalent liquid

Frequency MHz	Relative permittivity ε_r	Conductivity (σ) S/m
300	45,3	0,87
450	43,5	0,87
750	*41,9*	*0,89*
835	41,5	0,90
900	41,5	0,97
1 450	40,5	1,20
1 500	*40,4*	*1,23*
1 640	*40,2*	*1,31*
1 750	*40,1*	*1,37*
1 800	40,0	1,40
1 900	40,0	1,40
2 000	40,0	1,40
2 100	*39,8*	*1,49*
2 300	*39,5*	*1,67*
2 450	39,2	1,80
2 600	*39,0*	*1,96*
3 000	38,5	2,40
3 500	*37,9*	*2,91*
4 000	*37,4*	*3,43*
4 500	*36,8*	*3,94*
5 000	*36,2*	*4,45*
5 200	*36,0*	*4,66*
5 400	*35,8*	*4,86*
5 600	*35,5*	*5,07*
5 800	*35,3*	*5,27*
6 000	*35,1*	*5,48*

NOTE For convenience, permittivity and conductivity values at those frequencies which are not part of the original data provided by Drossos et al. [33] or the extension to 5 800 MHz are provided (i.e. the values shown *in italics*). These values were linearly interpolated between the values in this table that are immediately above and below these values, except the values at 6 000 MHz that were linearly extrapolated from the values at 3 000 MHz and 5 800 MHz.

8.2 Measurement System Diagram



The DASY6 system for performing compliance tests consists of the following items:

- A standard high precision 6-axis robot arm (Stäubli TX90XL) 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 (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 2000 or Windows XP.

• DASY52 software.

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

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

• The ELI V8.0 phantom.

• The device holder for handheld mobile phones.

• Tissue simulating liquid mixed according to the given recipes.

• Validation dipole kits allowing system validation.

8.3 System Components

• DASY6 Measurement Server
• Data Acquisition Electronics
• Probes
• Light Beam Unit
• Medium
• SAM Twin Phantom
• ELI V8.0 Phantom
• Device Holder for SAM Twin Phantom
• System Validation Kits
• Robot

8.4 DASY6 Measurement Server

The DASY6 measurement server is based on a PC/104 CPU board with a 400MHz intel ULV Celeron, 128MB chip-disk and 128MB RAM. The necessary circuits for communication with the DAE4 (or DAE3) electronics box, as well as the 16-bit AD converter system for optical detection and digital I/O interface are contained on the DASY6 I/O board, which is directly connected to the PC/104 bus of the CPU board.

The measurement server performs all real-time data evaluations of field measurements and surface detection, controls robot movements, and handles safety operations. 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 an expansion port, which is reserved for future applications. Please note that this expansion port does not have a standardized pinout, and therefore only devices provided by SPEAG can be connected. Connection of devices from any other supplier could seriously damage the measurement server.

8.5 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.

8.6 Probes

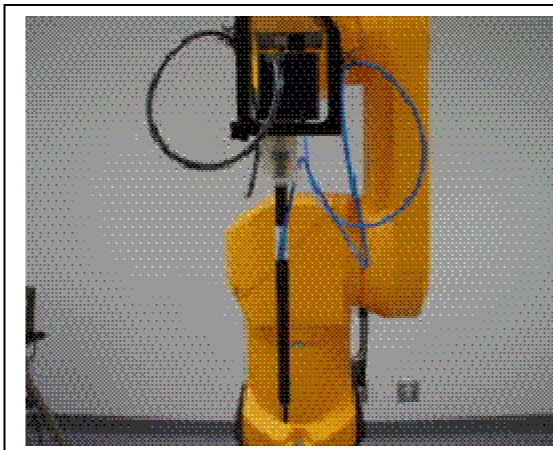
The DASY system can support many different probe types.

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.

8.7 ET3DV6 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.

8.8 Data Evaluation

The DASY6 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:

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

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

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.

8.9 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.

8.10 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).

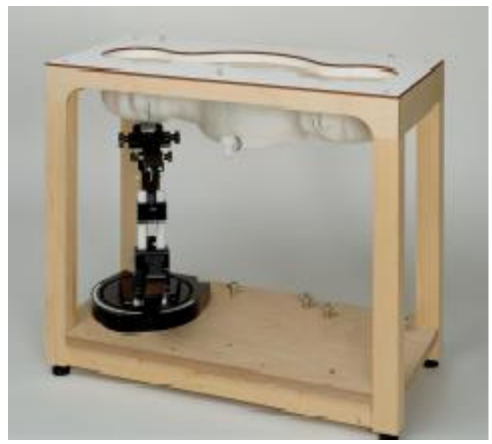
Parameter measurements

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 accuracy. It is calibrated with open, short, and deionized water and the calibrations a critical process.

8.11 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

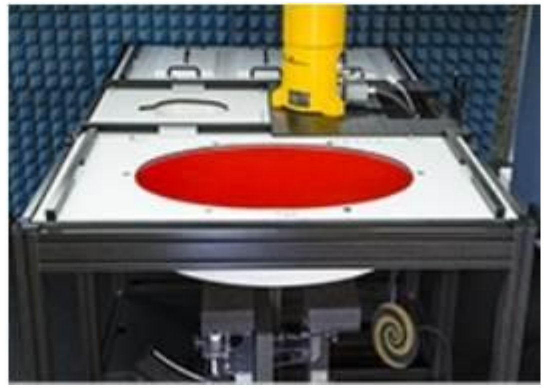
The phantom table comes in two sizes: A 100 x 50 x 85 cm (L x W x H) table for use with free standing robots (DASY6 professional system option) or as a second phantom and a 100 x 75 x 85 cm(L x W x H) table with reinforcements for table mounted robots (DASY6 compact system option) . The bottom plate 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 can be left permanently in the phantom. Always cover the liquid if the system is not used, otherwise the parameters will change due to water evaporation.

- Glycol based liquids should be used with care. As glycol is a softener for most plastics, the liquid should be taken out of the phantom and the phantom should be dried when the system is not used (desirable at least once a week).
- Do not use other organic solvents without previously testing the phantom’s compatibility.

8.12 ELI Phantom



- The ELI phantom is a fiberglass shell phantom with 2mm shell thickness (except the ear region where shell thickness increases to 6mm). It has one measurement area: Flat Phantom
- Dimensions: Major Axis: 600mm, Minor Axis: 400mm
- Filling Volume: ≈ 30 Liters
- Support: DASY6: standard-size platform slot, DASY52 stand-alone: SPEAG standard phantom table
- The phantom can be used with the following tissue simulating liquids:

  -Water-sugar based liquids can be left permanently in the phantom. Always cover the liquid if the system is not used, otherwise the parameters will change due to water evaporation.

  -Glycol based liquids should be used with care. As glycol is a softener for most plastics, the liquid should be taken out of the phantom and the phantom should be dried when the system is not used (desirable at least once a week).

  -Do not use other organic solvents without previously testing the phantom's compatibility.

8.13 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 or ELI 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.

8.14 Robot

BACL's DASY6 system uses the Stäubli TX90XL 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)

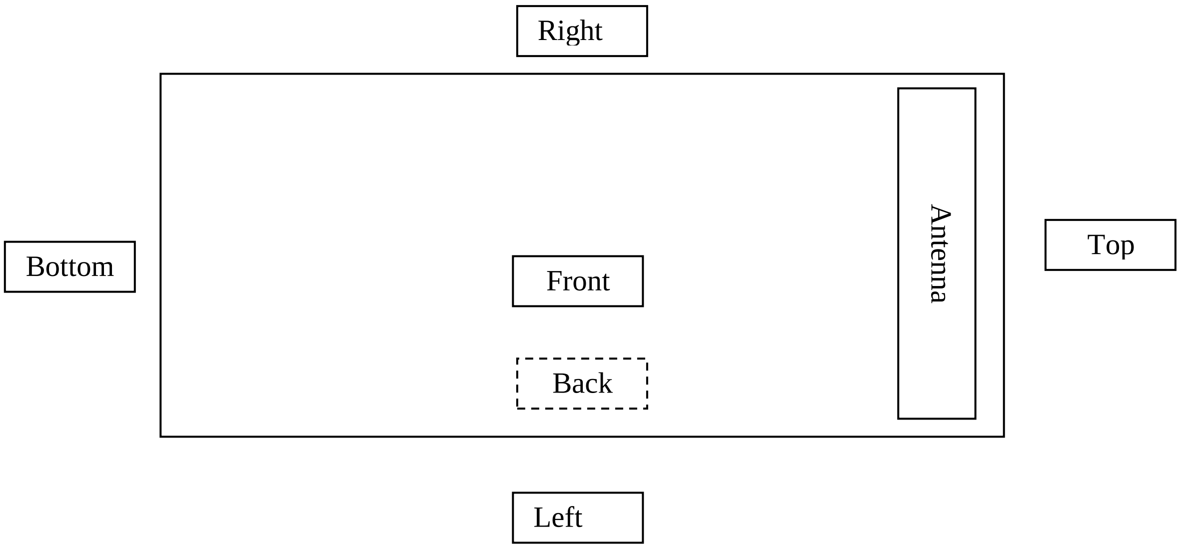
BACL's DASY6 system uses the SP1 controller with S/N D21142607B.

9 SAR Measurement Consideration and Reduction

9.1 SAR Exclusion Consideration

EUT Antenna Location

(Front Side View)



The antenna of the EUT is located at the top section on front side of the EUT. Since the EUT is worn on the neck with lanyard, the top and bottom side are not going to be touched in normal use. Thus, only front, back, left, and right side will be in close proximity to human body during normal operation.

9.2 SAR Reduction

Mode	Side	Channel	Result
125 kHz	Front Side	Low Channel-902.3 MHz	Tested
		Mid Channel-908.5 MHz	Tested
		High Channel-914.9 MHz	Tested
	Left Side	Low Channel-902.3 MHz	Reduced
		Mid Channel-908.5 MHz	Tested
		High Channel-914.9 MHz	Reduced
	Right Side	Low Channel-902.3 MHz	Reduced
		Mid Channel-908.5 MHz	Tested
		High Channel-914.9 MHz	Reduced
	Back Side	Low Channel-902.3 MHz	Reduced
		Mid Channel-908.5 MHz	Tested
		High Channel-914.9 MHz	Reduced
500 kHz	Front Side	Low Channel-903 MHz	Tested
		Mid Channel-907.8 MHz	Tested
		High Channel-914.2 MHz	Tested
	Left Side	Low Channel-903 MHz	Reduced
		Mid Channel-907.8 MHz	Tested
		High Channel-914.2 MHz	Reduced
	Right Side	Low Channel-903 MHz	Reduced
		Mid Channel-907.8 MHz	Tested
		High Channel-914.2 MHz	Reduced
	Back Side	Low Channel-903 MHz	Reduced
		Mid Channel-907.8 MHz	Tested
		High Channel-914.2 MHz	Reduced

Reduced:
According to KDB 447498 Section 4.4.1 (a), testing for other required channels within the operating mode of a frequency band is not required if 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.

10 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, could be found in Appendix E.

10.1 Test Environmental Conditions

Temperature:	24° C
Relative Humidity:	47 %
ATM Pressure:	102.9 kPa

Testing was performed by Tri Pham in SAR chamber from 05-22-2020.

10.2 Standalone SAR Results

Note: all the results are measured with EUT directly touch to the phantom.

Radio Mode	EUT Position	Frequency (MHz)	Test Type	Output Power (dBm)		Scale Factor	Measured 1g SAR (W/kg)	Scaled 1g SAR (W/kg)	Limit (W/kg) 1g Tissue	Plot #
				Measured	Rated Tuned-up Power					
125 kHz	Front Side	908.5	Body	18.25	18.5	1.06	0.157	0.166	1.6	-
	Right Side	908.5	Body	18.25	18.5	1.06	0.126	0.134	1.6	-
	Left Side	908.5	Body	18.25	18.5	1.06	0.149	0.158	1.6	-
	Back Side	908.5	Body	18.25	18.5	1.06	0.116	0.123	1.6	-
	Front Side	**902.3**	**Body**	**18.29**	**18.5**	**1.05**	**0.176**	**0.185**	**1.6**	**1**
	Front Side	914.9	Body	18.22	18.5	1.07	0.142	0.152	1.6	-
500 kHz	**Front Side**	**907.8**	**Body**	**19.25**	**19.5**	**1.06**	**0.011**	**0.012**	**1.6**	**2**
	Right Side	907.8	Body	19.25	19.5	1.06	0.00746	0.008	1.6	-
	Left Side	907.8	Body	19.25	19.5	1.06	0.00832	0.009	1.6	-
	Back Side	907.8	Body	19.25	19.5	1.06	0.00694	0.007	1.6	-
	Front Side	903	Body	19.29	19.5	1.05	0.0106	0.011	1.6	-
	Front Side	914.2	Body	19.21	19.5	1.07	0.00884	0.009	1.6	-

11 Appendix A – Measurement Uncertainty

The uncertainty budget has been determined for the DASY6 measurement system and is given in the following Table.

DASY6 Uncertainty Budget 30 MHz – 6 GHz								
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	± 6.65 %	N	1	1	1	± 6.65 %	± 6.65 %	∝
Axial Isotropy	± 0.25 %	R	$\sqrt{3}$	0.7	0.7	± 0.10 %	± 0.10 %	∝
Hemispherical Isotropy	± 1.3 %	R	$\sqrt{3}$	0.7	0.7	± 0.53 %	± 0.53 %	∝
Linearity	± 0.3 %	R	$\sqrt{3}$	1	1	± 0.17 %	± 0.17 %	∝
Modulation Response	± 4.8 %	R	$\sqrt{3}$	1	1	± 2.77 %	± 2.77 %	∝
System Detection Limits	± 1.0 %	R	$\sqrt{3}$	1	1	± 0.6 %	± 0.6 %	∝
Boundary Effects	± 1.0 %	R	$\sqrt{3}$	1	1	± 0.58 %	± 0.58 %	∝
Readout Electronics	± 0.3 %	N	1	1	1	± 0.3 %	± 0.3 %	∝
Response Time	± 0.8 %	R	$\sqrt{3}$	1	1	± 0.46 %	± 0.46 %	∝
Integration Time	± 2.6 %	R	$\sqrt{3}$	1	1	± 1.5 %	± 1.5 %	∝
RF Ambient Noise	± 3.0 %	R	$\sqrt{3}$	1	1	± 1.7 %	± 1.7 %	∝
RF Ambient Reflections	± 3.0 %	R	$\sqrt{3}$	1	1	± 1.7 %	± 1.7 %	∝
Probe Positioner	± 0.04 %	R	$\sqrt{3}$	1	1	± 0.0 %	± 0.0 %	∝
Probe Positioning	± 0.8 %	R	$\sqrt{3}$	1	1	± 0.5 %	± 0.5 %	∝
Post-processing	± 4.0 %	R	$\sqrt{3}$	1	1	± 2.3 %	± 2.3 %	∝
Test Sample Related								
Device Holder	± 3.6 %	N	1	1	1	± 3.6 %	± 3.6 %	5
Device Positioning	± 2.9 %	N	1	1	1	± 2.9 %	± 2.9 %	145
SAR Scaling	± 0.0 %	R	$\sqrt{3}$	1	1	± 0.0 %	± 0.0 %	∝
Power Drift	± 5.0 %	R	$\sqrt{3}$	1	1	± 2.9 %	± 2.9 %	∝
Phantom and Setup								
Phantom Uncertainty	± 6.6 %	R	$\sqrt{3}$	1	1	± 3.8 %	± 3.8 %	∝
SAR Correction	± 1.9 %	N	1	1	0.84	± 1.9 %	± 1.6 %	∝
Liquid Conductivity (meas.)^{DAK}	± 2.5 %	N	1	0.78	0.71	± 2.0 %	± 1.8 %	∝
Liquid Permittivity (meas.)^{DAK}	± 2.5 %	N	1	0.23	0.26	± 0.6 %	± 0.7 %	∝
Temp. unc. - Conductivity (meas.)^{BB}	± 3.4 %	R	$\sqrt{3}$	0.78	0.71	± 1.5 %	± 1.4 %	∝
Temp. unc. - Permittivity (meas.)^{BB}	± 0.4 %	R	$\sqrt{3}$	0.23	0.26	± 0.1 %	± 0.1 %	∝
Combined Std. Uncertainty	-	-	-	-	-	± 10.9 %	± 10.7 %	414
Expanded STD Uncertainty	-	-	-	-	-	± 21.8 %	± 21.5 %	-

12 Appendix B - Probe Calibration Certificates

Please refer to the attachment.

13 Appendix C – Dipole Calibration Certificates

Please refer to the attachment.

14 Appendix D - Test System Verifications Scans

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

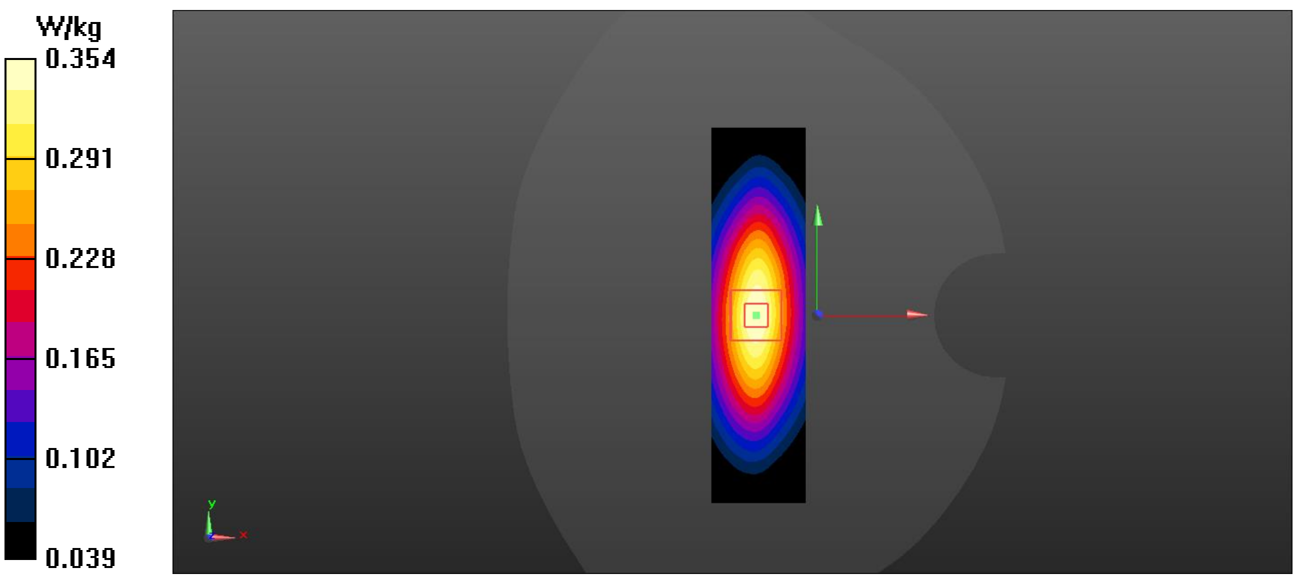
900 Head System Validation

DUT: Dipole 900 MHz; Type: D900V2; S/N: 122
Phantom: Twin-SAM V4.0 (30deg probe tilt)
Probe: EX3DV4 - SN3619 , ConvF(8.54, 8.54, 8.54) @ 900 MHz
Electronics: DAE4 Sn530 Calibrated: 9/13/2019
Communication System Band: Generic
Frequency: 900 MHz
Medium: HBBL-600-6000v5 Medium parameters used: f = 900 MHz; σ = 0.942 S/m; εr = 42.924; ρ = 1000 kg/m3

System/SAM HSL 900 MHz System Validation 14 dBm/Area Scan (41x161x1): Interpolated grid: dx=1.000 mm, dy=1.000 mm
Reference Value = 17.27 V/m; Power Drift = -0.08 dB
Maximum value of SAR (interpolated) = 0.356 W/kg

System/SAM HSL 900 MHz System Validation 14 dBm/Zoom Scan (8x8x7)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=1.4mm
Reference Value = 17.27 V/m; Power Drift = -0.08 dB
Peak SAR (extrapolated) = 0.418 W/kg

SAR(1 g) = 0.269 W/kg; SAR(10 g) = 0.170 W/kg (SAR corrected for target medium)
Maximum value of SAR (measured) = 0.354 W/kg



15 Appendix E - EUT Scan Results

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

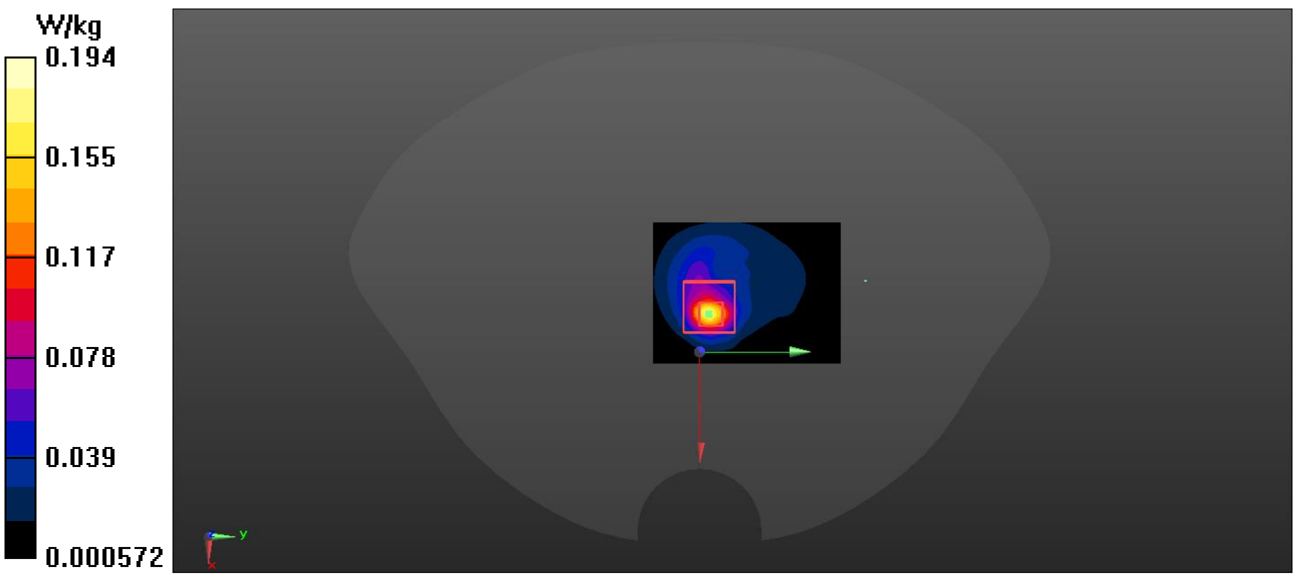
LoRa Front Side Low Channel 902.3 MHz – 125 kHz Mode

- DUT: LoRa; Type: Personal Tracker; Serial:R2005213-1
- Phantom: Twin-SAM V4.0 (30deg probe tilt)
- Probe: EX3DV4 - SN3619, ConvF(8.54, 8.54, 8.54) @ 902.3 MHz
- Electronics: DAE4 Sn530 Calibrated: 9/13/2019
- Communication System Band: LoRa
- Frequency: 902.3 MHz
- Medium: HBBL-600-6000v5 Medium parameters used (interpolated): f = 902.3 MHz; σ = 0.943 S/m; εr = 42.921; ρ = 1000 kg/m3

LoRa/902.3 MHz Front Side/Area Scan (61x81x1): Interpolated grid: dx=1.000 mm, dy=1.000 mm
Reference Value = 9.279 V/m; Power Drift = -0.08 dB
Maximum value of SAR (interpolated) = 0.176 W/kg

LoRa/902.3 MHz Front Side/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 9.279 V/m; Power Drift = -0.13 dB
Peak SAR (extrapolated) = 0.838 W/kg

SAR(1 g) = 0.176 W/kg; SAR(10 g) = 0.054 W/kg (SAR corrected for target medium)
Maximum value of SAR (measured) = 0.194 W/kg



Plot #1

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

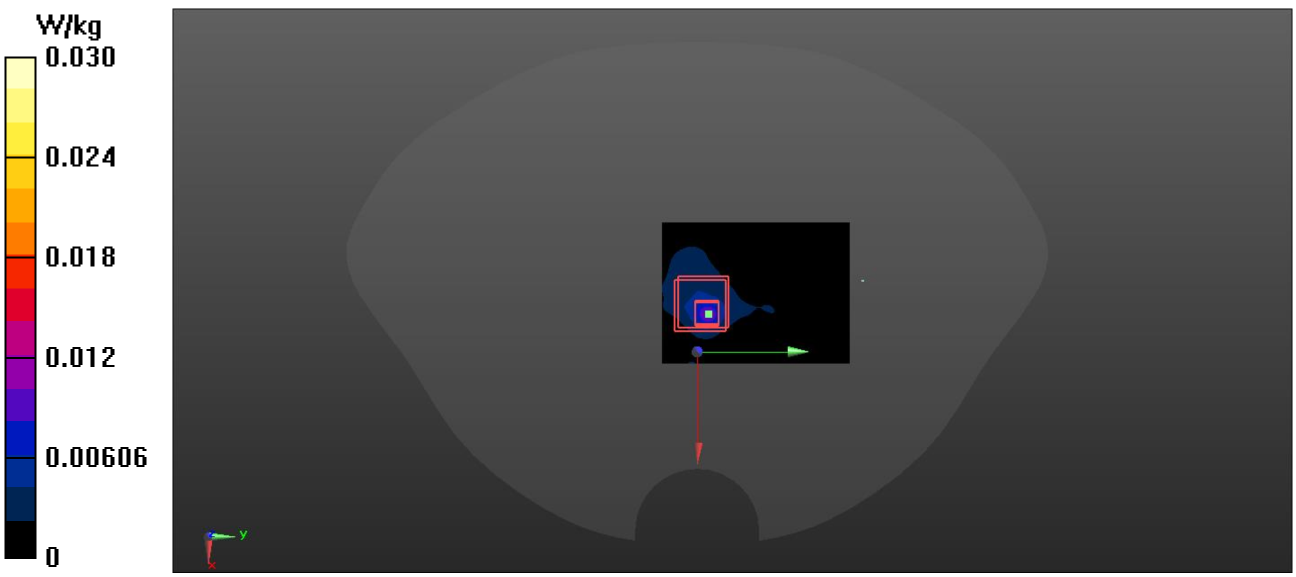
LoRa Front Side Middle Channel 907.8 MHz – 500 kHz Mode

- DUT: LoRa; Type: Personal Tracker; Serial:R2005213-1
- Phantom: Twin-SAM V4.0 (30deg probe tilt)
- Probe: EX3DV4 - SN3619, ConvF(8.54, 8.54, 8.54) @ 907.8 MHz
- Electronics: DAE4 Sn530 Calibrated: 9/13/2019
- Communication System Band: LoRa
- Frequency: 907.8 MHz
- Medium: HBBL-600-6000v5 Medium parameters used (interpolated): f = 907.8 MHz; σ = 0.945 S/m; εr = 42.914; ρ = 1000 kg/m3

LoRa/907.8 MHz Front Side/Area Scan (61x81x1): Interpolated grid: dx=1.000 mm, dy=1.000 mm
Reference Value = 2.326 V/m; Power Drift = 0.15 dB
Maximum value of SAR (interpolated) = 0.0105 W/kg

LoRa/907.8 MHz Front Side/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=1.4mm
Reference Value = 2.326 V/m; Power Drift = 0.14 dB
Peak SAR (extrapolated) = 0.0670 W/kg

SAR(1 g) = 0.011 W/kg; SAR(10 g) = 0.00319 W/kg (SAR corrected for target medium)
Maximum value of SAR (measured) = 0.0303 W/kg



Plot #2

16 Appendix F- RF Output Power Measurement

16.1 FCC Output Power Measurement Results

Modulation	Frequency (MHz)	Output Power Conducted (dBm)	
		Measured	Maximum tune-up power
125 kHz	902.3	18.29	18.5
	908.5	18.25	18.5
	914.9	18.22	18.5
500 kHz	903	19.29	19.5
	907.8	19.25	19.5
	914.2	19.21	19.5

17 Appendix G - Test Setup Photographs

Please see the attachment R2005213-SAR Setup Photos for details.

18 Appendix H - Informative References

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19 Appendix I (Normative) - A2LA Electrical Testing Certificate

ilac-MRA A2LA

Accredited Laboratory

A2LA has accredited

BAY AREA COMPLIANCE LABORATORIES CORP.

Sunnyvale, CA

for technical competence in the field of

Electrical Testing

This laboratory is accredited in accordance with the recognized International Standard ISO/IEC 17025:2005 *General requirements for the competence of testing and calibration laboratories*. This laboratory also meets A2LA *R222 - Specific Requirements EPA ENERGY STAR Accreditation Program*. This accreditation demonstrates technical competence for a defined scope and the operation of a laboratory quality management system (*refer to joint ISO-ILAC-IAF Communiqué dated April 2017*).

Presented this 2nd day of October 2018.

Vice President, Accreditation Services
For the Accreditation Council
Certificate Number 3297.02
Valid to September 30, 2020
Revised February 21, 2019

For the tests to which this accreditation applies, please refer to the laboratory's Electrical Scope of Accreditation.

Please follow the web link below for a full ISO 17025 scope

https://www.a2la.org/scopepdf/3297-02.pdf

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