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SAR EVALUATION REPORT

Applicant Name:
Apple, Inc.
One Apple Park Way
Cupertino, CA 95014 USA

Dates of Testing:
07/04/2020 – 08/28/2020
Test Site/Location:
PCTEST Lab, Morgan Hill, CA, USA
Document Serial No.:
1C2004270024-01-R1.BCG

FCC ID:	**BCG-A2355**
APPLICANT:	**APPLE, INC.**

DUT Type:	Watch
Application Type:	Certification
FCC Rule Part(s):	CFR §2.1093
Model:	A2355

Equipment Class	Band & Mode	Tx Frequency	SAR	
			1g Head (W/kg)	10g Extremity (W/kg)
PCT	UMTS 850	826.40 - 846.60 MHz	< 0.1	0.24
PCT	UMTS 1750	1712.4 - 1752.6 MHz	0.38	< 0.1
PCT	UMTS 1900	1852.4 - 1907.6 MHz	0.31	0.11
PCT	LTE Band 26 (Cell)	814.7 - 848.3 MHz	< 0.1	0.19
PCT	LTE Band 5 (Cell)	824.7 - 848.3 MHz	< 0.1	0.22
PCT	LTE Band 66 (AWS)	1710.7 - 1779.3 MHz	0.44	< 0.1
PCT	LTE Band 4 (AWS)	1710.7 - 1754.3 MHz	N/A	N/A
PCT	LTE Band 25 (PCS)	1850.7 - 1914.3 MHz	0.36	0.13
PCT	LTE Band 2 (PCS)	1850.7 - 1909.3 MHz	N/A	N/A
PCT	LTE Band 7	2502.5 - 2567.5 MHz	0.51	0.15
PCT	LTE Band 41	2498.5 - 2687.5 MHz	0.48	0.11
DTS	2.4 GHz WLAN	2412 - 2472 MHz	0.29	< 0.1
DSS/DTS	Bluetooth	2402 - 2480 MHz	0.14	< 0.1
Simultaneous SAR per KDB 690783 D01v01r03:			0.80	0.29

Note: This revised Test Report (S/N: 1C2004270024-01-R1.BCG) supersedes and replaces the previously issued test report on the same subject device for the same type of testing as indicated. Please discard or destroy the previously issued test report(s) and dispose of it accordingly.

This watch has been shown to be capable of compliance for localized specific absorption rate (SAR) for uncontrolled environment/general population exposure limits specified in ANSI/IEEE C95.1-1992 and has been tested in accordance with the measurement procedures specified in Section 1.8 of this report; for North American frequency bands only.

I attest to the accuracy of data. All measurements reported herein were performed by me or were made under my supervision and are correct to the best of my knowledge and belief. I assume full responsibility for the completeness of these measurements and vouch for the qualifications of all persons taking them. Test results reported herein relate only to the item(s) tested.

Randy Ortanez
President

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ACCREDITED CERT #2041.02

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1 DEVICE UNDER TEST

1.1 Device Overview

Band & Mode	Operating Modes	Tx Frequency
UMTS 850	Voice/Data	826.40 - 846.60 MHz
UMTS 1750	Voice/Data	1712.4 - 1752.6 MHz
UMTS 1900	Voice/Data	1852.4 - 1907.6 MHz
LTE Band 26 (Cell)	Voice/Data	814.7 - 848.3 MHz
LTE Band 5 (Cell)	Voice/Data	824.7 - 848.3 MHz
LTE Band 66 (AWS)	Voice/Data	1710.7 - 1779.3 MHz
LTE Band 4 (AWS)	Voice/Data	1710.7 - 1754.3 MHz
LTE Band 25 (PCS)	Voice/Data	1850.7 - 1914.3 MHz
LTE Band 2 (PCS)	Voice/Data	1850.7 - 1909.3 MHz
LTE Band 7	Voice/Data	2502.5 - 2567.5 MHz
LTE Band 41	Voice/Data	2498.5 - 2687.5 MHz
2.4 GHz WLAN	Voice/Data	2412 - 2472 MHz
Bluetooth	Data	2402 - 2480 MHz
NFC	Data	13.56 MHz

1.2 Power Reduction for SAR

There is no power reduction used for any band/mode implemented in this device for SAR purposes.

1.3 Nominal and Maximum Output Power Specifications

This device operates using the following maximum and nominal output power specifications. SAR values were scaled to the maximum allowed power to determine compliance per KDB Publication 447498 D01v06.

1.3.1 Summary Maximum and Nominal Conducted Powers – UMTS Mode

Mode/Band		Modulated Average Output Power (in dBm)		
		3GPP WCDMA Rel 99	3GPP HSDPA Rel 5	3GPP HSUPA Rel 6
UMTS B5 (850 MHz)	Max allowed power	25.0	25.0	24.0
	Nominal	24.0	24.0	23.0
UMTS B4 (1750 MHz)	Max allowed power	24.0	24.0	23.0
	Nominal	23.0	23.0	22.0
UMTS B2 (1900 MHz)	Max allowed power	24.0	24.0	23.0
	Nominal	23.0	23.0	22.0

1.3.2 Summary Maximum and Nominal Conducted Powers – LTE Mode

Mode / Band		Modulated Average Output Power (in dBm)
LTE FDD Band 26 (Cell)	Max allowed power	25.0
	Nominal	24.0
LTE FDD Band 5 (Cell)	Max allowed power	25.0
	Nominal	24.0
LTE FDD Band 66 (AWS)	Max allowed power	24.0
	Nominal	23.0
LTE FDD Band 4 (AWS)	Max allowed power	24.0
	Nominal	23.0
LTE FDD Band 25 (PCS)	Max allowed power	24.0
	Nominal	23.0
LTE FDD Band 2 (PCS)	Max allowed power	24.0
	Nominal	23.0
LTE FDD Band 7	Max allowed power	23.5
	Nominal	22.5
LTE TDD Band 41	Max allowed power	23.5
	Nominal	22.5

1.3.3 Summary Maximum and Nominal Conducted Powers – WiFi Mode

Mode/ Band			IEEE 802.11b (2.4 GHz)		IEEE 802.11g (2.4 GHz)		IEEE 802.11n (2.4 GHz)	
		Channel	Maximum	Nominal	Maximum	Nominal	Maximum	Nominal
Modulated Average - Single Tx Chain (dBm)	20 MHz Bandwidth	1	19.00	18.00	17.50	16.50	17.50	16.50
		2	19.00	18.00	18.50	17.50	18.50	17.50
		3	19.00	18.00	18.50	17.50	18.50	17.50
		4	19.00	18.00	18.50	17.50	18.50	17.50
		5	19.00	18.00	18.50	17.50	18.50	17.50
		6	19.00	18.00	18.50	17.50	18.50	17.50
		7	19.00	18.00	18.50	17.50	18.50	17.50
		8	19.00	18.00	18.50	17.50	18.50	17.50
		9	19.00	18.00	18.50	17.50	18.50	17.50
		10	19.00	18.00	18.50	17.50	18.50	17.50
		11	19.00	18.00	16.50	15.50	16.50	15.50
		12	19.00	18.00	15.00	14.00	15.00	14.00
		13	18.00	17.00	6.50	5.50	6.50	5.50

1.3.4 Summary Maximum and Nominal Conducted Powers – Bluetooth Mode

Mode / Band		Modulated Average - Single Tx Chain (dBm)
Bluetooth BDR/LE	Maximum	**17.50**
	Nominal	**16.50**
Bluetooth EDR	Maximum	**14.00**
	Nominal	**13.00**
Bluetooth HDR	Maximum	**13.50**
	Nominal	**12.50**

1.4 DUT Antenna Locations

A diagram showing the location of the device antennas can be found in Appendix E.

1.5 Near Field Communications (NFC) Antenna

This DUT has NFC operations. The NFC antenna is integrated into the device for this model. Therefore, all SAR tests were performed with the device which already incorporates the NFC antenna. A diagram showing the location of the NFC antenna can be found in Appendix E.

1.6 Simultaneous Transmission Capabilities

According to FCC KDB Publication 447498 D01v06, transmitters are considered to be operating simultaneously when there is overlapping transmission, with the exception of transmissions during network hand-offs with maximum hand-off duration less than 30 seconds.

This device contains multiple transmitters that may operate simultaneously, and therefore requires a simultaneous transmission analysis according to FCC KDB Publication 447498 D01v06 4.3.2 procedures.

Table 1-1
Simultaneous Transmission Scenarios

No.	Capable Transmit Configuration	Head	Extremity
1	UMTS + 2.4 GHz WI-FI	Yes	Yes
2	UMTS + 2.4 GHz Bluetooth	Yes	Yes
3	LTE + 2.4 GHz WI-FI	Yes	Yes
4	LTE + 2.4 GHz Bluetooth	Yes	Yes

1. 2.4 GHz WLAN and 2.4 GHz Bluetooth cannot transmit simultaneously.
2. All licensed modes cannot transmit simultaneously.
3. When the user utilizes multiple services in UMTS 3G mode it uses multi-Radio Access Bearer or multi-RAB. The power control is based on a physical control channel (Dedicated Physical Control Channel [DPCCH]) and power control will be adjusted to meet the needs of both services. Therefore, the UMTS+WLAN scenario also represents the UMTS Voice/DATA + WLAN scenario.
4. This device supports VoLTE and VoWIFI.

1.7 Miscellaneous SAR Test Considerations

(A) WIFI/BT

This device supports channel 1-13 for 2.4 GHz WLAN. However, since channels 12 and 13 have equal or less maximum output power, channels 1, 6, and 11 were considered for SAR testing per KDB 248227 D01v02r02.

(B) Licensed Transmitter(s)

This device is only capable of QPSK HSUPA in the uplink. Therefore, no additional SAR tests are required beyond that described for devices with HSUPA in KDB 941225 D01v03r01.

LTE SAR for the higher modulations and lower bandwidths were not tested since the maximum average output power of all required channels and configurations was not more than 0.5 dB higher than the highest bandwidth; and the reported LTE SAR for the highest bandwidth was less than 1.45 W/kg for all configurations according to FCC KDB 941225 D05v02r04. This device is limited to 27 RB on the uplink for 16QAM modulation. Additional measurements were evaluated to support SAR test exclusion for 16 QAM as described in Section 7.5.4.

This device supports LTE capabilities with overlapping transmission frequency ranges. When the supported frequency range of an LTE Band falls completely within an LTE band with a larger transmission frequency range, both LTE bands have the same target power (or the band with the larger transmission frequency range has a higher target power), and both LTE bands share the same transmission path and signal characteristics, SAR was only assessed for the band with the larger transmission frequency range.

1.8 Guidance Applied

- FCC KDB Publication 941225 D01v03r01, D05v02r04 (3G/4G)
- FCC KDB Publication 248227 D01v02r02 (SAR Considerations for 802.11 Devices)
- FCC KDB Publication 447498 D01v06 (General SAR Guidance, Wrist-worn Device Guidance)
- FCC KDB Publication 865664 D01v01r04, D02v01r02 (SAR Measurements up to 6 GHz)

1.9 Device Serial Numbers

Several samples with identical hardware were used to support SAR testing. The manufacturer has confirmed that the device(s) tested have the same physical, mechanical, and thermal characteristics and are within operational tolerances expected for production units. The serial numbers used for each test are indicated alongside the results in Section 10.

1.10 Device Housing Types and Wristband Types

Only one housing type, aluminum, is available for this model. The device can also be used with different wristband accessories. The non-metallic wrist accessory, sport band, was evaluated for all exposure conditions. The available metallic wrist accessories, metal links band and metal loop band, were additionally evaluated.

2 LTE INFORMATION

LTE Information					
Form Factor	Watch				
Frequency Range of each LTE transmission band	LTE Band 26 (Cell) (814.7 - 848.3 MHz)				
	LTE Band 5 (Cell) (824.7 - 848.3 MHz)				
	LTE Band 66 (AWS) (1710.7 - 1779.3 MHz)				
	LTE Band 4 (AWS) (1710.7 - 1754.3 MHz)				
	LTE Band 25 (PCS) (1850.7 - 1914.3 MHz)				
	LTE Band 2 (PCS) (1850.7 - 1909.3 MHz)				
	LTE Band 7 (2502.5 - 2567.5 MHz)				
	LTE Band 41 (2498.5 - 2687.5 MHz)				
Channel Bandwidths	LTE Band 26 (Cell): 1.4 MHz, 3 MHz, 5 MHz, 10 MHz				
	LTE Band 5 (Cell): 1.4 MHz, 3 MHz, 5 MHz, 10 MHz				
	LTE Band 66 (AWS): 1.4 MHz, 3 MHz, 5 MHz, 10 MHz, 15 MHz, 20 MHz				
	LTE Band 4 (AWS): 1.4 MHz, 3 MHz, 5 MHz, 10 MHz, 15 MHz, 20 MHz				
	LTE Band 25 (PCS): 1.4 MHz, 3 MHz, 5 MHz, 10 MHz, 15 MHz, 20 MHz				
	LTE Band 2 (PCS): 1.4 MHz, 3 MHz, 5 MHz, 10 MHz, 15 MHz, 20 MHz				
	LTE Band 7: 5 MHz, 10 MHz, 15 MHz, 20 MHz				
	LTE Band 41: 5 MHz, 10 MHz, 15 MHz, 20 MHz				
Channel Numbers and Frequencies (MHz)	Low	Low-Mid	Mid	Mid-High	High
LTE Band 26 (Cell): 1.4 MHz	814.7 (26697)		831.5 (26865)	848.3 (27033)	
LTE Band 26 (Cell): 3 MHz	815.5 (26705)		831.5 (26865)	847.5 (27025)	
LTE Band 26 (Cell): 5 MHz	816.5 (26715)		831.5 (26865)	846.5 (27015)	
LTE Band 26 (Cell): 10 MHz	819 (26740)		831.5 (26865)	844 (26990)	
LTE Band 5 (Cell): 1.4 MHz	824.7 (20407)		836.5 (20525)	848.3 (20643)	
LTE Band 5 (Cell): 3 MHz	825.5 (20415)		836.5 (20525)	847.5 (20635)	
LTE Band 5 (Cell): 5 MHz	826.5 (20425)		836.5 (20525)	846.5 (20625)	
LTE Band 5 (Cell): 10 MHz	829 (20450)		836.5 (20525)	844 (20600)	
LTE Band 66 (AWS): 1.4 MHz	1710.7 (131979)		1745 (132322)	1779.3 (132665)	
LTE Band 66 (AWS): 3 MHz	1711.5 (131987)		1745 (132322)	1778.5 (132657)	
LTE Band 66 (AWS): 5 MHz	1712.5 (131997)		1745 (132322)	1777.5 (132647)	
LTE Band 66 (AWS): 10 MHz	1715 (132022)		1745 (132322)	1775 (132622)	
LTE Band 66 (AWS): 15 MHz	1717.5 (132047)		1745 (132322)	1772.5 (132597)	
LTE Band 66 (AWS): 20 MHz	1720 (132072)		1745 (132322)	1770 (132572)	
LTE Band 4 (AWS): 1.4 MHz	1710.7 (19957)		1732.5 (20175)	1754.3 (20393)	
LTE Band 4 (AWS): 3 MHz	1711.5 (19965)		1732.5 (20175)	1753.5 (20385)	
LTE Band 4 (AWS): 5 MHz	1712.5 (19975)		1732.5 (20175)	1752.5 (20375)	
LTE Band 4 (AWS): 10 MHz	1715 (20000)		1732.5 (20175)	1750 (20350)	
LTE Band 4 (AWS): 15 MHz	1717.5 (20025)		1732.5 (20175)	1747.5 (20325)	
LTE Band 4 (AWS): 20 MHz	1720 (20050)		1732.5 (20175)	1745 (20300)	
LTE Band 25 (PCS): 1.4 MHz	1850.7 (26047)		1882.5 (26365)	1914.3 (26683)	
LTE Band 25 (PCS): 3 MHz	1851.5 (26055)		1882.5 (26365)	1913.5 (26675)	
LTE Band 25 (PCS): 5 MHz	1852.5 (26065)		1882.5 (26365)	1912.5 (26665)	
LTE Band 25 (PCS): 10 MHz	1855 (26090)		1882.5 (26365)	1910 (26640)	
LTE Band 25 (PCS): 15 MHz	1857.5 (26115)		1882.5 (26365)	1907.5 (26615)	
LTE Band 25 (PCS): 20 MHz	1860 (26140)		1882.5 (26365)	1905 (26590)	
LTE Band 2 (PCS): 1.4 MHz	1850.7 (18607)		1880 (18900)	1909.3 (19193)	
LTE Band 2 (PCS): 3 MHz	1851.5 (18615)		1880 (18900)	1908.5 (19185)	
LTE Band 2 (PCS): 5 MHz	1852.5 (18625)		1880 (18900)	1907.5 (19175)	
LTE Band 2 (PCS): 10 MHz	1855 (18650)		1880 (18900)	1905 (19150)	
LTE Band 2 (PCS): 15 MHz	1857.5 (18675)		1880 (18900)	1902.5 (19125)	
LTE Band 2 (PCS): 20 MHz	1860 (18700)		1880 (18900)	1900 (19100)	
LTE Band 7: 5 MHz	2502.5 (20775)		2535 (21100)	2567.5 (21425)	
LTE Band 7: 10 MHz	2505 (20800)		2535 (21100)	2565 (21400)	
LTE Band 7: 15 MHz	2507.5 (20825)		2535 (21100)	2562.5 (21375)	
LTE Band 7: 20 MHz	2510 (20850)		2535 (21100)	2560 (21350)	
LTE Band 41: 5 MHz	2506 (39750)	2549.5 (40185)	2593 (40620)	2636.5 (41055)	2680 (41490)
LTE Band 41: 10 MHz	2506 (39750)	2549.5 (40185)	2593 (40620)	2636.5 (41055)	2680 (41490)
LTE Band 41: 15 MHz	2506 (39750)	2549.5 (40185)	2593 (40620)	2636.5 (41055)	2680 (41490)
LTE Band 41: 20 MHz	2506 (39750)	2549.5 (40185)	2593 (40620)	2636.5 (41055)	2680 (41490)
UE Category	1				
Modulations Supported in UL	QPSK, 16QAM				
LTE MPR Permanently implemented per 3GPP TS 36.101 section 6.2.3~6.2.5? (manufacturer attestation to be provided)	YES				
A-MPR (Additional MPR) disabled for SAR Testing?	YES				
LTE Additional Information	This device does not support full CA features on 3GPP Release 12. All uplink communications are identical to the Release 8 Specifications. The following LTE Release 12 Features are not supported: Carrier Aggregation, Relay, HetNet, Enhanced MIMO, eICIC, WIFI Offloading, eMBMS, Cross-Carrier Scheduling, Enhanced SC-FDMA.				

3 INTRODUCTION

The FCC and Innovation, Science, and Economic Development Canada have adopted the guidelines for evaluating the environmental effects of radio frequency (RF) radiation in ET Docket 93-62 on Aug. 6, 1996 and Health Canada Safety Code 6 to protect the public and workers from the potential hazards of RF emissions due to FCC-regulated portable devices. [1]

The safety limits used for the environmental evaluation measurements are based on the criteria published by the American National Standards Institute (ANSI) for localized specific absorption rate (SAR) in IEEE/ANSI C95.1-1992 Standard for Safety Levels with Respect to Human Exposure to Radio Frequency Electromagnetic Fields, 3 kHz to 300 GHz [3] and Health Canada RF Exposure Guidelines Safety Code 6 [22]. The measurement procedure described in IEEE/ANSI C95.3-2002 Recommended Practice for the Measurement of Potentially Hazardous Electromagnetic Fields - RF and Microwave [4] is used for guidance in measuring the Specific Absorption Rate (SAR) due to the RF radiation exposure from the Equipment Under Test (EUT). These criteria for SAR evaluation are similar to those recommended by the International Committee for Non-Ionizing Radiation Protection (ICNIRP) in Biological Effects and Exposure Criteria for Radiofrequency Electromagnetic Fields," Report No. Vol 74. SAR is a measure of the rate of energy absorption due to exposure to an RF transmitting source. SAR values have been related to threshold levels for potential biological hazards.

3.1 SAR Definition

Specific Absorption Rate is defined as the time derivative (rate) of the incremental energy (dU) absorbed by (dissipated in) an incremental mass (dm) contained in a volume element (dV) of a given density (ρ). It is also defined as the rate of RF energy absorption per unit mass at a point in an absorbing body (see Equation 3-1).

Equation 3-1
SAR Mathematical Equation

$$SAR = \frac{d}{dt}\left(\frac{dU}{dm}\right) = \frac{d}{dt}\left(\frac{dU}{\rho dv}\right)$$

SAR is expressed in units of Watts per Kilogram (W/kg).

$$SAR = \frac{\sigma \cdot E^2}{\rho}$$

where:

σ = conductivity of the tissue-simulating material (S/m)
ρ = mass density of the tissue-simulating material (kg/m^3)
E = Total RMS electric field strength (V/m)

NOTE: The primary factors that control rate of energy absorption were found to be the wavelength of the incident field in relation to the dimensions and geometry of the irradiated organism, the orientation of the organism in relation to the polarity of field vectors, the presence of reflecting surfaces, and whether conductive contact is made by the organism with a ground plane.[6]

4 DOSIMETRIC ASSESSMENT

4.1 Measurement Procedure

The evaluation was performed using the following procedure compliant to FCC KDB Publication 865664 D01v01r04:

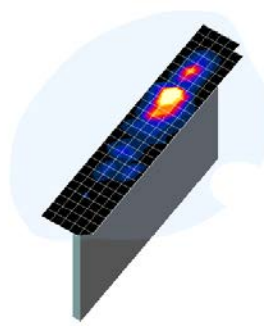

Figure 4-1
Sample SAR Area Scan

1. The SAR distribution at the exposed side of the head or body was measured at a distance no greater than 5.0 mm from the inner surface of the shell. The area covered the entire dimension of the device-head and body interface and the horizontal grid resolution was determined per FCC KDB Publication 865664 D01v01r04 (See Table 4-1).
2. The point SAR measurement was taken at the maximum SAR region determined from Step 1 to enable the monitoring of SAR fluctuations/drifts during the 1g/10g cube evaluation. SAR at this fixed point was measured and used as a reference value.
3. Based on the area scan data, the peak of the region with maximum SAR was determined by spline interpolation. Around this point, a volume was assessed according to the measurement resolution and volume size requirements of FCC KDB Publication 865664 D01v01r04 (See Table 4-1) On the basis of this data set, the spatial peak SAR value was evaluated with the following procedure (see references or the DASY manual online for more details):
    a. SAR values at the inner surface of the phantom are extrapolated from the measured values along the line away from the surface with spacing no greater than that in Table 4-1. The extrapolation was based on a least-squares algorithm. A polynomial of the fourth order was calculated through the points in the z-axis (normal to the phantom shell).
    b. After the maximum interpolated values were calculated between the points in the cube, the SAR was averaged over the spatial volume (1g or 10g) using a 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 then integrated with the trapezoidal algorithm. One thousand points (10 x 10 x 10) were obtained through interpolation, in order to calculate the averaged SAR.
    c. All neighboring volumes were evaluated until no neighboring volume with a higher average value was found.
4. The SAR reference value, at the same location as step 2, was re-measured after the zoom scan was complete to calculate the SAR drift. If the drift deviated by more than 5%, the SAR test and drift measurements were repeated.

Table 4-1
Area and Zoom Scan Resolutions per FCC KDB Publication 865664 D01v01r04*

Frequency	Maximum Area Scan Resolution (mm) (Δx_{area}, Δy_{area})	Maximum Zoom Scan Resolution (mm) (Δx_{zoom}, Δy_{zoom})	Maximum Zoom Scan Spatial Resolution (mm)			Minimum Zoom Scan Volume (mm) (x,y,z)
			Uniform Grid	Graded Grid		
			$\Delta z_{zoom}(n)$	$\Delta z_{zoom}(1)$*	$\Delta z_{zoom}(n>1)$*	
≤ 2 GHz	≤ 15	≤ 8	≤ 5	≤ 4	≤ 1.5*$\Delta z_{zoom}(n-1)$	≥ 30
2-3 GHz	≤ 12	≤ 5	≤ 5	≤ 4	≤ 1.5*$\Delta z_{zoom}(n-1)$	≥ 30
3-4 GHz	≤ 12	≤ 5	≤ 4	≤ 3	≤ 1.5*$\Delta z_{zoom}(n-1)$	≥ 28
4-5 GHz	≤ 10	≤ 4	≤ 3	≤ 2.5	≤ 1.5*$\Delta z_{zoom}(n-1)$	≥ 25
5-6 GHz	≤ 10	≤ 4	≤ 2	≤ 2	≤ 1.5*$\Delta z_{zoom}(n-1)$	≥ 22

5 TEST CONFIGURATION POSITIONS

5.1 Device Holder

The device holder is made out of low-loss POM material having the following dielectric parameters: relative permittivity ε = 3 and loss tangent δ = 0.02. Additionally, a manufacturer provided low-loss foam was used to position the device for head SAR evaluations.

5.2 Positioning for Head

Devices that are designed to be worn on the wrist may operate in speaker mode for voice communication, with the device worn on the wrist and positioned next to the mouth. When next-to-mouth SAR evaluation is required, the device is positioned at 10 mm from a flat phantom filled with head tissue-equivalent medium. The device is evaluated with wrist bands strapped together to represent normal use conditions.

5.3 Extremity Exposure Configurations

Devices that are designed or intended for use on extremities or mainly operated in extremity only exposure conditions; i.e., hands, wrists, feet and ankles, may require extremity SAR evaluation. When the device also operates in close proximity to the user's body, SAR compliance for the body is also required. When extremity SAR evaluation is required, the device is evaluated with the back of the device touching the flat phantom, which is filled with body tissue-equivalent medium. The device was evaluated with Sport wristband unstrapped and touching the phantom. For Metal Loop and Metal Links wristbands, the device was evaluated with wristbands strapped and the distance between wristbands and the phantom was minimized to represent the spacing created by actual use conditions.

6 RF EXPOSURE LIMITS

6.1 Uncontrolled Environment

UNCONTROLLED ENVIRONMENTS are defined as locations where there is the exposure of individuals who have no knowledge or control of their exposure. The general population/uncontrolled exposure limits are applicable to situations in which the general public may be exposed or in which persons who are exposed as a consequence of their employment may not be made fully aware of the potential for exposure or cannot exercise control over their exposure. Members of the general public would come under this category when exposure is not employment-related; for example, in the case of a wireless transmitter that exposes persons in its vicinity.

6.2 Controlled Environment

CONTROLLED ENVIRONMENTS are defined as locations where there is exposure that may be incurred by persons who are aware of the potential for exposure, (i.e. as a result of employment or occupation). In general, occupational/controlled exposure limits are applicable to situations in which persons are exposed as a consequence of their employment, who have been made fully aware of the potential for exposure and can exercise control over their exposure. This exposure category is also applicable when the exposure is of a transient nature due to incidental passage through a location where the exposure levels may be higher than the general population/uncontrolled limits, but the exposed person is fully aware of the potential for exposure and can exercise control over his or her exposure by leaving the area or by some other appropriate means.

Table 6-1
SAR Human Exposure Specified in ANSI/IEEE C95.1-1992 and Health Canada Safety Code 6

HUMAN EXPOSURE LIMITS		
	UNCONTROLLED ENVIRONMENT *General Population* (W/kg) or (mW/g)	CONTROLLED ENVIRONMENT *Occupational* (W/kg) or (mW/g)
Peak Spatial Average SAR Head	1.6	8.0
Whole Body SAR	0.08	0.4
Peak Spatial Average SAR Hands, Feet, Ankle, Wrists, etc.	4.0	20

1. The Spatial Peak value of the SAR averaged over any 1 gram of tissue (defined as a tissue volume in the shape of a cube) and over the appropriate averaging time.
2. The Spatial Average value of the SAR averaged over the whole body.
3. The Spatial Peak value of the SAR averaged over any 10 grams of tissue (defined as a tissue volume in the shape of a cube) and over the appropriate averaging time.

7 FCC MEASUREMENT PROCEDURES

Power measurements for licensed transmitters are performed using a base station simulator under digital average power.

7.1 Measured and Reported SAR

Per FCC KDB Publication 447498 D01v06, when SAR is not measured at the maximum power level allowed for production units, the results must be scaled to the maximum tune-up tolerance limit according to the power applied to the individual channels tested to determine compliance. For simultaneous transmission, the measured aggregate SAR must be scaled according to the sum of the differences between the maximum tune-up tolerance and actual power used to test each transmitter. When SAR is measured at or scaled to the maximum tune-up tolerance limit, the results are referred to as *reported* SAR. The highest *reported* SAR results are identified on the grant of equipment authorization according to procedures in KDB 690783 D01v01r03.

7.2 3G SAR Test Reduction Procedure

In FCC KDB Publication 941225 D01v03r01, certain transmission modes within a frequency band and wireless mode evaluated for SAR are defined as primary modes. The equivalent modes considered for SAR test reduction are denoted as secondary modes. When the maximum output power including tune-up tolerance specified for production units in a secondary mode is ≤ 0.25 dB higher than the primary mode or when the highest reported SAR of the primary mode, scaled by the ratio of specified maximum output power and tune-up tolerance of secondary to primary mode, is ≤ 1.2 W/kg, SAR measurements are not required for the secondary mode. These criteria are referred to as the 3G SAR test reduction procedure. When the 3G SAR test reduction procedure is not satisfied, SAR measurements are additionally required for the secondary mode.

7.3 Procedures Used to Establish RF Signal for SAR

The following procedures are according to FCC KDB Publication 941225 D01v03r01 “3G SAR Measurement Procedures.”

The device is placed into a simulated call using a base station simulator in a RF shielded chamber. Establishing connections in this manner ensure a consistent means for testing SAR and are recommended for evaluating SAR [4]. Devices under test are evaluated prior to testing, with a fully charged battery and were configured to operate at maximum output power. In order to verify that the device is tested throughout the SAR test at maximum output power, the SAR measurement system measures a “point SAR” at an arbitrary reference point at the start and end of the 1 gram SAR evaluation, to assess for any power drifts during the evaluation. If the power drift deviates by more than 5%, the SAR test and drift measurements are repeated.

7.4 SAR Measurement Conditions for UMTS

7.4.1 Output Power Verification

Maximum output power is verified on the High, Middle and Low channels according to the general descriptions in section 5.2 of 3GPP TS 34.121, using the appropriate RMC with TPC (transmit power control) set to all “1s” or applying the required inner loop power control procedures to maintain maximum output power while HSUPA is active. Results for all applicable physical channel configurations (DPCCH, DPDCHn and spreading codes, HS-DPCCH etc) are tabulated in this test report. All configurations that are not supported by the DUT or cannot be measured due to technical or equipment limitations are identified.

7.4.2 Head SAR Measurements

SAR for head exposure configurations is measured using 12.2 kbps RMC with TPC bits configured to all “1s”. SAR in AMR configurations is not required when the maximum average output of each RF channel for 12.2 kbps AMR is less than 0.25 dB higher than that measured in 12.2 kbps RMC. Otherwise, SAR is measured on the maximum output channel in 12.2 AMR with a 3.4 kbps SRB (signaling radio bearer) using the exposure configuration that resulted in the highest SAR for that RF channel in the 12.2 kbps RMC mode.

7.4.3 Body SAR Measurements

SAR for body exposure configurations is measured using the 12.2 kbps RMC with the TPC bits all “1s”. The 3G SAR test reduction procedure is applied to other spreading codes and multiple $DPDCH_n$ configurations supported by the handset with 12.2 kbps RMC as the primary mode. Otherwise, SAR is measured using an applicable RMC configuration with the corresponding spreading code or $DPDCH_n$, for the highest reported SAR configuration in 12.2 kbps RMC.

7.4.4 SAR Measurements with Rel 5 HSDPA

The 3G SAR test reduction procedure is applied to HSDPA body configurations with 12.2 kbps RMC as the primary mode. Otherwise, Body SAR for HSDPA is measured using an FRC with H-Set 1 in Sub-test 1 and a 12.2 kbps RMC configured in Test Loop Mode 1, for the highest reported SAR configuration in 12.2 kbps RMC without HSDPA. Handsets with both HSDPA and HSUPA are tested according to Release 6 HSPA test procedures.

7.4.5 SAR Measurements with Rel 6 HSUPA

The 3G SAR test reduction procedure is applied to HSPA (HSUPA/HSDPA with RMC) body configurations with 12.2 kbps RMC as the primary mode. Otherwise, Body SAR for HSPA is measured with E-DCH Sub-test 5, using H-Set 1 and QPSK for FRC and a 12.2 kbps RMC configured in Test Loop Mode 1 and power control algorithm 2, according to the highest reported body SAR configuration in 12.2 kbps RMC without HSPA.

When VOIP applies to head exposure, the 3G SAR test reduction procedure is applied with 12.2 kbps RMC as the primary mode; otherwise, the same HSPA configuration used for body SAR measurements are applied to head exposure testing.

7.5 SAR Measurement Conditions for LTE

LTE modes are tested according to FCC KDB 941225 D05v02r04 publication. Establishing connections with base station simulators ensure a consistent means for testing SAR and are recommended for evaluating SAR [4]. The R&S CMW500 or Anritsu MT8820C simulators are used for LTE output power measurements and SAR testing. Closed loop power control was used so the UE transmits with maximum output power during SAR testing. SAR tests were performed with the same number of RB and RB offsets transmitting on all TTI frames (maximum TTI).

7.5.1 Spectrum Plots for RB Configurations

A properly configured base station simulator was used for SAR tests and power measurements. Therefore, spectrum plots for RB configurations were not required to be included in this report.

7.5.2 MPR

MPR is permanently implemented for this device by the manufacturer. The specific manufacturer target MPR is indicated alongside the SAR results. MPR is enabled for this device, according to 3GPP TS36.101 Section 6.2.3 – 6.2.5 under Table 6.2.3-1.

7.5.3 A-MPR

A-MPR (Additional MPR) has been disabled for all SAR tests by setting NS=01 on the base station simulator.

7.5.4 Required RB Size and RB Offsets for SAR Testing

According to FCC KDB 941225 D05v02r04:

a. Per Section 5.2.1, SAR is required for QPSK 1 RB Allocation for the largest bandwidth
   i. The required channel and offset combination with the highest maximum output power is required for SAR.
   ii. When the reported SAR is ≤ 0.8 W/kg, testing of the remaining RB offset configurations and required test channels is not required. Otherwise, SAR is required for the remaining required test channels using the RB offset configuration with highest output power for that channel.
   iii. When the reported SAR for a required test channel is > 1.45 W/kg, SAR is required for all RB offset configurations for that channel.
b. Per Section 5.2.2, SAR is required for 50% RB allocation using the largest bandwidth following the same procedures outlined in Section 5.2.1.
c. Per Section 5.2.3, QPSK SAR is not required for the 100% allocation when the highest maximum output power for the 100% allocation is less than the highest maximum output power of the 1 RB and 50% RB allocations and the reported SAR for the 1 RB and 50% RB allocations is < 0.8 W/kg and < 2.0 W/kg for 10g SAR..
d. Per Section 5.2.4 and 5.3, SAR tests for higher order modulations and lower bandwidths configurations are not required when the conducted power of the required test configurations determined by Sections 5.2.1 through 5.2.3 is less than or equal to ½ dB higher than the equivalent configuration using QPSK modulation and when the QPSK SAR for those configurations is <1.45 W/kg for 1g SAR and < 3.625 W/kg for 10g SAR.
e. This device can only operate with 16QAM on the uplink with less than or equal to 27 RB. For 16 QAM configurations with 10 MHz, 15 MHz, and 20 MHz bandwidths, LTE powers for RB size or 15 ("50% RB") and 27 ("100% RB) with offsets to upper edge, middle, and lower edge of the channel are additionally measured for both QPSK and 16 QAM modulations to support comparison and SAR test exclusion per section 5.2.4 and 5.3.

7.5.5 TDD

LTE TDD testing is performed using the SAR test guidance provided in FCC KDB 941225 D05v02r04. TDD is tested at the highest duty factor using UL-DL configuration 0 with special subframe configuration 6 and applying the FDD LTE procedures in KDB 941225 D05v02r04. SAR testing is performed using the extended cyclic prefix listed in 3GPP TS 36.211 Section 4.

7.6 SAR Testing with 802.11 Transmitters

The normal network operating configurations of 802.11 transmitters are not suitable for SAR measurements. Unpredictable fluctuations in network traffic and antenna diversity conditions can introduce undesirable variations in SAR results. The SAR for these devices should be measured using chipset based test mode software to ensure the results are consistent and reliable. See KDB Publication 248227 D01v02r02 for more details.

7.6.1 General Device Setup

Chipset based test mode software is hardware dependent and generally varies among manufacturers. The device operating parameters established in test mode for SAR measurements must be identical to those programmed in production units, including output power levels, amplifier gain settings and other RF performance tuning parameters.

A periodic duty factor is required for current generation SAR systems to measure SAR. When 802.11 frame gaps are accounted for in the transmission, a maximum transmission duty factor of 92 - 96% is typically achievable in most test mode configurations. A minimum transmission duty factor of 85% is required to avoid certain hardware and device implementation issues related to wide range SAR scaling. The reported SAR is scaled to 100% transmission duty factor to determine compliance at the maximum tune-up tolerance limit.

7.6.2 2.4 GHz SAR Test Requirements

SAR is measured for 2.4 GHz 802.11b DSSS using either the fixed test position or, when applicable, the initial test position procedure. SAR test reduction is determined according to the following:

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.

2) When the reported SAR is > 0.8 W/kg, SAR is required for that position 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.

2.4 GHz 802.11 g/n OFDM are additionally evaluated for SAR if the highest reported SAR for 802.11b, adjusted by the ratio of the OFDM to DSSS specified maximum output power, is > 1.2 W/kg. When SAR is required for OFDM modes in 2.4 GHz band, the Initial Test Configuration Procedures should be followed. When 10g SAR measurement is considered, a factor of 2.5 is applied to the thresholds above.

8 RF CONDUCTED POWERS

8.1 UMTS Conducted Powers

Table 8-1
Maximum Conducted Powers

3GPP Release Version	Mode	3GPP 34.121 Subtest	Cellular Band [dBm]			AWS Band [dBm]			PCS Band [dBm]			3GPP MPR [dB]
			4132	4183	4233	1312	1412	1513	9262	9400	9538	
99	WCDMA	12.2 kbps RMC	24.00	23.95	23.90	22.86	22.98	22.71	22.86	23.00	22.90	-
99		12.2 kbps AMR	23.91	23.84	23.80	22.69	22.75	22.65	22.84	22.76	22.91	-
6	HSDPA	Subtest 1	23.94	23.87	23.84	22.83	22.91	22.68	22.74	22.98	22.87	0
6		Subtest 2	23.96	23.71	23.80	22.82	22.91	22.56	22.47	22.83	22.77	0
6		Subtest 3	22.61	23.37	23.31	22.30	22.41	22.18	22.21	22.46	22.36	0.5
6		Subtest 4	23.19	23.08	23.07	22.01	22.16	21.90	22.13	22.24	22.11	0.5
6	HSUPA	Subtest 1	23.78	23.86	23.90	22.70	22.81	22.74	22.56	22.68	22.54	0
6		Subtest 2	21.45	21.53	21.48	20.50	20.76	20.83	20.34	20.47	20.29	2
6		Subtest 3	22.67	22.64	22.75	21.43	21.57	21.58	21.58	21.36	21.44	1
6		Subtest 4	21.52	21.57	21.46	20.85	20.98	20.81	20.65	20.68	20.67	2
6		Subtest 5	23.69	23.57	23.74	22.65	22.73	22.69	22.89	22.74	22.75	0

This device does not support DC-HSDPA.

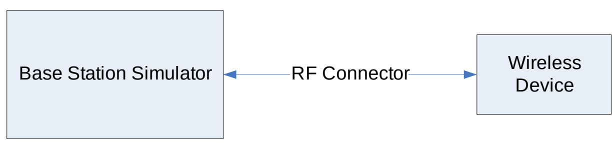

Figure 8-1
Power Measurement Setup

8.2 LTE Conducted Powers

8.2.1 LTE Band 26

Table 8-2
LTE Band 26 Conducted Powers – 10 MHz Bandwidth

LTE Band 26 (Cell) 10 MHz Bandwidth						
Modulation	RB Size	RB Offset	Low Channel 26740 (819.0 MHz)	Mid Channel 26865 (831.5 MHz)	High Channel 26990 (844.0 MHz)	Design MPR [dB]
			Conducted Power [dBm]			
QPSK	1	0	**23.91**	23.74	23.69	0
	1	25	23.78	23.76	23.70	0
	1	49	23.75	23.77	23.69	0
	25	0	**22.90**	22.82	22.79	1
	25	12	22.79	22.80	22.76	1
	25	25	22.79	22.82	22.75	1
	50	0	22.89	22.88	22.87	1
	15	0	22.92	22.80	22.74	1
	15	17	22.78	22.79	22.75	1
	15	35	22.81	22.81	22.74	1
	27	0	22.82	22.80	22.76	1
	27	12	22.80	22.79	22.77	1
	27	23	22.79	22.81	22.76	1
16QAM	1	0	23.00	22.86	22.69	1
	1	25	22.95	22.91	22.71	1
	1	49	22.95	22.90	22.68	1
	25	0	21.61	21.56	21.52	2
	25	12	21.55	21.55	21.49	2
	25	25	21.56	21.59	21.52	2
	15	0	21.68	21.55	21.47	2
	15	17	21.56	21.57	21.50	2
	15	35	21.60	21.58	21.51	2
	27	0	21.57	21.55	21.51	2
	27	12	21.58	21.56	21.52	2
	27	23	21.54	21.58	21.53	2

Table 8-3
LTE Band 26 Conducted Powers – 5 MHz Bandwidth

LTE Band 26 (Cell) 5 MHz Bandwidth						
Modulation	RB Size	RB Offset	Low Channel	Mid Channel	High Channel	Design MPR [dB]
			26715 (816.5 MHz)	26865 (831.5 MHz)	27015 (846.5 MHz)	
			Conducted Power [dBm]			
QPSK	1	0	23.63	23.25	23.33	0
	1	12	23.78	23.44	23.48	0
	1	24	23.78	23.57	23.59	0
	12	0	22.46	22.41	22.36	1
	12	6	22.55	22.50	22.39	1
	12	13	22.59	22.55	22.49	1
	25	0	22.57	22.51	22.43	1
16QAM	1	0	22.73	22.77	22.51	1
	1	12	23.00	23.00	22.63	1
	1	24	23.00	23.00	22.73	1
	12	0	21.64	21.57	21.47	2
	12	6	21.61	21.45	21.53	2
	12	13	21.54	21.46	21.43	2
	25	0	21.57	21.55	21.40	2

Table 8-4
LTE Band 26 Conducted Powers – 3 MHz Bandwidth

LTE Band 26 (Cell) 3 MHz Bandwidth						
Modulation	RB Size	RB Offset	Low Channel	Mid Channel	High Channel	Design MPR [dB]
			26705 (815.5 MHz)	26865 (831.5 MHz)	27025 (847.5 MHz)	
			Conducted Power [dBm]			
QPSK	1	0	23.31	23.32	23.27	0
	1	7	23.43	23.49	23.44	0
	1	14	23.53	23.52	23.34	0
	8	0	22.41	22.43	22.42	1
	8	4	22.43	22.49	22.48	1
	8	7	22.53	22.52	22.48	1
	15	0	22.44	22.52	22.50	1
16QAM	1	0	22.64	22.88	22.71	1
	1	7	22.78	22.95	22.71	1
	1	14	22.83	23.00	22.71	1
	8	0	21.48	21.58	21.56	2
	8	4	21.45	21.61	21.34	2
	8	7	21.47	21.57	21.53	2
	15	0	21.44	21.53	21.49	2

Table 8-5
LTE Band 26 Conducted Powers – 1.4 MHz Bandwidth

LTE Band 26 (Cell) 1.4 MHz Bandwidth						
Modulation	RB Size	RB Offset	Low Channel 26697 (814.7 MHz)	Mid Channel 26865 (831.5 MHz)	High Channel 27033 (848.3 MHz)	Design MPR [dB]
			Conducted Power [dBm]			
QPSK	1	0	23.36	23.42	23.56	0
	1	2	23.37	23.46	23.56	0
	1	5	23.45	23.52	23.56	0
	3	0	23.46	23.48	23.47	0
	3	2	23.41	23.50	23.47	0
	3	3	23.43	23.53	23.48	0
	6	0	22.38	22.49	22.45	1
16QAM	1	0	22.48	22.86	22.81	1
	1	2	22.67	23.00	22.65	1
	1	5	22.70	22.95	22.81	1
	3	0	22.53	22.67	22.57	1
	3	2	22.52	22.63	22.47	1
	3	3	22.45	22.54	22.39	1
	6	0	21.48	21.58	21.54	2

8.2.2 LTE Band 5

Table 8-6
LTE Band 5 Conducted Powers – 10 MHz Bandwidth

LTE Band 5 (Cell) 10 MHz Bandwidth				
Modulation	RB Size	RB Offset	Mid Channel 20525 (836.5 MHz) Conducted Power [dBm]	Design MPR [dB]
QPSK	1	0	**23.77**	0
	1	25	23.68	0
	1	49	23.69	0
	25	0	**22.80**	1
	25	12	22.77	1
	25	25	22.75	1
	50	0	22.79	1
	15	0	22.79	1
	15	17	22.76	1
	15	35	22.72	1
	27	0	22.79	1
	27	12	22.76	1
	27	23	22.75	1
16QAM	1	0	22.93	1
	1	25	22.84	1
	1	49	22.83	1
	25	0	21.54	2
	25	12	21.54	2
	25	25	21.51	2
	15	0	21.58	2
	15	17	21.55	2
	15	35	21.50	2
	27	0	21.56	2
	27	12	21.54	2
	27	23	21.50	2

Note: LTE Band 5 (Cell) at 10 MHz bandwidth does not support three non-overlapping channels. Per KDB Publication 941225 D05v02, when a device supports overlapping channel assignment in a channel bandwidth configuration, the middle channel of the group of overlapping channels should be selected for testing.

Table 8-7
LTE Band 5 Conducted Powers – 5 MHz Bandwidth

LTE Band 5 (Cell) 5 MHz Bandwidth						
Modulation	RB Size	RB Offset	Low Channel 20425 (826.5 MHz)	Mid Channel 20525 (836.5 MHz)	High Channel 20625 (846.5 MHz)	Design MPR [dB]
			Conducted Power [dBm]			
QPSK	1	0	23.67	23.76	23.86	0
	1	12	23.70	23.69	23.87	0
	1	24	23.81	23.65	23.72	0
	12	0	22.73	22.75	22.67	1
	12	6	22.71	22.73	22.69	1
	12	13	22.73	22.71	22.67	1
	25	0	22.74	22.75	22.71	1
16QAM	1	0	22.80	22.92	22.64	1
	1	12	22.84	22.96	22.67	1
	1	24	22.85	22.75	22.63	1
	12	0	21.54	21.49	21.47	2
	12	6	21.53	21.41	21.48	2
	12	13	21.50	21.43	21.43	2
	25	0	21.48	21.45	21.45	2

Table 8-8
LTE Band 5 Conducted Powers – 3 MHz Bandwidth

LTE Band 5 (Cell) 3 MHz Bandwidth						
Modulation	RB Size	RB Offset	Low Channel 20415 (825.5 MHz)	Mid Channel 20525 (836.5 MHz)	High Channel 20635 (847.5 MHz)	Design MPR [dB]
			Conducted Power [dBm]			
QPSK	1	0	23.52	23.68	23.62	0
	1	7	23.63	23.70	23.64	0
	1	14	23.62	23.61	23.44	0
	8	0	22.62	22.73	22.71	1
	8	4	22.66	22.72	22.68	1
	8	7	22.68	22.71	22.64	1
	15	0	22.68	22.73	22.69	1
16QAM	1	0	22.66	22.65	22.89	1
	1	7	22.76	22.76	22.90	1
	1	14	22.79	22.68	22.73	1
	8	0	21.53	21.58	21.56	2
	8	4	21.46	21.43	21.45	2
	8	7	21.52	21.47	21.50	2
	15	0	21.48	21.49	21.42	2

Table 8-9
LTE Band 5 Conducted Powers – 1.4 MHz Bandwidth

LTE Band 5 (Cell) 1.4 MHz Bandwidth						
Modulation	RB Size	RB Offset	Low Channel 20407 (824.7 MHz)	Mid Channel 20525 (836.5 MHz)	High Channel 20643 (848.3 MHz)	Design MPR [dB]
			Conducted Power [dBm]			
QPSK	1	0	23.57	23.68	23.78	0
	1	2	23.53	23.68	23.74	0
	1	5	23.63	23.67	23.71	0
	3	0	23.64	23.72	23.62	0
	3	2	23.63	23.74	23.59	0
	3	3	23.65	23.74	23.56	0
	6	0	22.62	22.72	22.62	1
16QAM	1	0	22.78	22.90	22.54	1
	1	2	22.67	22.49	22.56	1
	1	5	22.70	22.68	22.46	1
	3	0	22.67	22.75	22.47	1
	3	2	22.73	22.68	22.51	1
	3	3	22.75	22.66	22.60	1
	6	0	21.43	21.60	21.44	2

8.2.3 LTE Band 66

Table 8-10
LTE Band 66 Conducted Powers – 20 MHz Bandwidth

LTE Band 66 (AWS) 20 MHz Bandwidth						
Modulation	RB Size	RB Offset	Low Channel 132072 (1720.0 MHz)	Mid Channel 132322 (1745.0 MHz)	High Channel 132572 (1770.0 MHz)	Design MPR [dB]
			Conducted Power [dBm]			
QPSK	1	0	22.29	**22.36**	22.14	0
	1	50	22.35	22.32	22.10	0
	1	99	22.15	22.26	22.20	0
	50	0	21.78	21.48	21.29	1
	50	25	**21.81**	21.53	21.35	1
	50	50	21.71	21.52	21.45	1
	100	0	21.80	21.61	21.72	1
	15	0	22.48	22.36	22.12	0
	15	42	22.58	22.31	22.12	0
	15	85	22.36	22.25	22.24	0
	27	0	21.73	21.58	21.30	1
	27	37	21.87	21.57	21.38	1
	27	73	21.76	21.45	21.44	1
16QAM	1	0	21.70	21.69	21.70	1
	1	50	21.89	21.55	21.73	1
	1	99	21.81	21.58	21.79	1
	15	0	21.75	21.66	21.37	1
	15	42	21.80	21.54	21.40	1
	15	85	21.65	21.49	21.44	1
	27	0	20.89	20.73	20.45	2
	27	37	20.95	20.68	20.48	2
	27	73	20.73	20.57	20.56	2

Table 8-11
LTE Band 66 Conducted Powers – 15 MHz Bandwidth

LTE Band 66 (AWS) 15 MHz Bandwidth						
Modulation	RB Size	RB Offset	Low Channel	Mid Channel	High Channel	Design MPR [dB]
			132047 (1717.5 MHz)	132322 (1745.0 MHz)	132597 (1772.5 MHz)	
			Conducted Power [dBm]			
QPSK	1	0	22.49	22.24	22.00	0
	1	36	22.69	22.21	22.02	0
	1	74	22.62	22.04	22.01	0
	36	0	21.41	21.36	21.14	1
	36	18	21.53	21.41	21.22	1
	36	37	21.53	21.34	21.25	1
	75	0	21.69	21.42	21.43	1
	15	0	22.36	22.16	22.00	0
	15	30	22.50	22.24	22.12	0
	15	60	22.40	22.12	22.12	0
	27	0	21.43	21.29	21.15	1
	27	24	21.57	21.35	21.24	1
	27	48	21.54	21.27	21.25	1
16QAM	1	0	21.48	21.73	21.47	1
	1	36	21.68	21.72	21.31	1
	1	74	21.75	21.52	21.67	1
	15	0	21.42	21.37	21.15	1
	15	30	21.64	21.42	21.25	1
	15	60	21.52	21.34	21.25	1
	27	0	20.46	20.40	20.27	2
	27	24	20.63	20.52	20.38	2
	27	48	20.58	20.37	20.39	2

Table 8-12
LTE Band 66 Conducted Powers – 10 MHz Bandwidth

LTE Band 66 (AWS) 10 MHz Bandwidth						
Modulation	RB Size	RB Offset	Low Channel 132022 (1715.0 MHz)	Mid Channel 132322 (1745.0 MHz)	High Channel 132622 (1775.0 MHz)	Design MPR [dB]
			Conducted Power [dBm]			
QPSK	1	0	22.18	22.19	22.05	0
	1	25	22.22	22.10	22.06	0
	1	49	22.28	22.08	22.08	0
	25	0	21.38	21.27	21.19	1
	25	12	21.37	21.34	21.26	1
	25	25	21.46	21.32	21.33	1
	50	0	21.50	21.38	21.30	1
	15	0	21.33	21.35	21.18	1
	15	17	21.38	21.36	21.23	1
	15	35	21.47	21.33	21.32	1
	27	0	21.37	21.32	21.20	1
	27	12	21.44	21.33	21.21	1
	27	23	21.47	21.31	21.25	1
16QAM	1	0	21.54	21.86	21.47	1
	1	25	21.72	21.64	21.60	1
	1	49	21.62	21.58	21.66	1
	25	0	20.51	20.39	20.31	2
	25	12	20.54	20.47	20.36	2
	25	25	20.58	20.49	20.42	2
	15	0	20.46	20.56	20.34	2
	15	17	20.53	20.47	20.38	2
	15	35	20.66	20.46	20.43	2
	27	0	20.50	20.37	20.37	2
	27	12	20.54	20.49	20.41	2
	27	23	20.54	20.47	20.45	2

Table 8-13
LTE Band 66 Conducted Powers – 5 MHz Bandwidth

LTE Band 66 (AWS) 5 MHz Bandwidth						
Modulation	RB Size	RB Offset	Low Channel 131997 (1712.5 MHz)	Mid Channel 132322 (1745.0 MHz)	High Channel 132647 (1777.5 MHz)	Design MPR [dB]
			Conducted Power [dBm]			
QPSK	1	0	22.26	22.22	22.06	0
	1	12	22.23	22.22	22.04	0
	1	24	22.19	22.14	22.00	0
	12	0	21.28	21.29	21.22	1
	12	6	21.33	21.27	21.24	1
	12	13	21.33	21.28	21.23	1
	25	0	21.35	21.29	21.28	1
16QAM	1	0	21.63	21.60	21.52	1
	1	12	21.53	21.67	21.44	1
	1	24	21.63	21.61	21.52	1
	12	0	20.45	20.50	20.44	2
	12	6	20.50	20.46	20.46	2
	12	13	20.50	20.42	20.46	2
	25	0	20.46	20.45	20.36	2

Table 8-14
LTE Band 66 Conducted Powers – 3 MHz Bandwidth

LTE Band 66 (AWS) 3 MHz Bandwidth						
Modulation	RB Size	RB Offset	Low Channel 131987 (1711.5 MHz)	Mid Channel 132322 (1745.0 MHz)	High Channel 132657 (1778.5 MHz)	Design MPR [dB]
			Conducted Power [dBm]			
QPSK	1	0	22.13	22.08	22.11	0
	1	7	22.13	22.10	22.11	0
	1	14	22.08	22.00	22.00	0
	8	0	21.31	21.29	21.25	1
	8	4	21.28	21.29	21.29	1
	8	7	21.36	21.27	21.31	1
	15	0	21.29	21.30	21.31	1
16QAM	1	0	21.39	21.59	21.78	1
	1	7	21.48	21.67	21.60	1
	1	14	21.44	21.53	21.75	1
	8	0	20.51	20.49	20.50	2
	8	4	20.52	20.46	20.48	2
	8	7	20.60	20.45	20.50	2
	15	0	20.44	20.47	20.39	2

Table 8-15
LTE Band 66 Conducted Powers – 1.4 MHz Bandwidth

LTE Band 66 (AWS) 1.4 MHz Bandwidth						
Modulation	RB Size	RB Offset	Low Channel 131979 (1710.7 MHz)	Mid Channel 132322 (1745.0 MHz)	High Channel 132665 (1779.3 MHz)	Design MPR [dB]
			Conducted Power [dBm]			
QPSK	1	0	22.21	22.10	22.31	0
	1	2	22.14	22.08	22.30	0
	1	5	22.10	22.09	22.25	0
	3	0	22.19	22.19	22.14	0
	3	2	22.17	22.17	22.10	0
	3	3	22.19	22.18	22.10	0
	6	0	21.30	21.29	21.30	1
16QAM	1	0	21.48	21.57	21.50	1
	1	2	21.54	21.74	21.45	1
	1	5	21.57	21.60	21.38	1
	3	0	21.59	21.56	21.51	1
	3	2	21.56	21.54	21.52	1
	3	3	21.63	21.55	21.50	1
	6	0	20.52	20.51	20.58	2

8.2.4 LTE Band 25

Table 8-16
LTE Band 25 Conducted Powers – 20 MHz Bandwidth

LTE Band 25 (PCS) 20 MHz Bandwidth						
Modulation	RB Size	RB Offset	Low Channel 26140 (1860.0 MHz)	Mid Channel 26365 (1882.5 MHz)	High Channel 26590 (1905.0 MHz)	Design MPR [dB]
			Conducted Power [dBm]			
QPSK	1	0	22.60	22.50	22.55	0
	1	50	22.70	22.67	22.50	0
	1	99	22.59	**22.75**	22.22	0
	50	0	21.67	**21.85**	21.67	1
	50	25	21.74	21.73	21.74	1
	50	50	21.75	21.78	21.67	1
	100	0	21.81	21.83	21.84	1
	15	0	22.63	22.67	22.67	0
	15	42	22.72	22.72	22.66	0
	15	85	22.72	22.76	22.53	0
	27	0	21.71	21.68	21.62	1
	27	37	21.77	21.69	21.64	1
	27	73	21.75	21.74	21.53	1
16QAM	1	0	22.00	21.70	21.85	1
	1	50	22.00	21.79	21.82	1
	1	99	22.00	21.83	21.70	1
	15	0	21.76	21.78	21.77	1
	15	42	21.81	21.82	21.76	1
	15	85	21.78	21.88	21.50	1
	27	0	20.69	20.83	20.92	2
	27	37	20.77	20.78	20.72	2
	27	73	20.78	20.80	20.59	2

Table 8-17
LTE Band 25 Conducted Powers – 15 MHz Bandwidth

LTE Band 25 (PCS) 15 MHz Bandwidth						
Modulation	RB Size	RB Offset	Low Channel 26115 (1857.5 MHz)	Mid Channel 26365 (1882.5 MHz)	High Channel 26615 (1907.5 MHz)	Design MPR [dB]
			Conducted Power [dBm]			
QPSK	1	0	22.48	22.56	22.55	0
	1	36	22.67	22.80	22.59	0
	1	74	22.70	22.79	22.24	0
	36	0	21.59	21.71	21.70	1
	36	18	21.70	21.85	21.71	1
	36	37	21.74	21.86	21.60	1
	75	0	21.79	21.94	21.91	1
	15	0	22.53	22.67	22.56	0
	15	30	22.71	22.86	22.62	0
	15	60	22.69	22.79	22.42	0
	27	0	21.57	21.70	21.64	1
	27	24	21.71	21.85	21.65	1
	27	48	21.74	21.85	21.48	1
16QAM	1	0	21.64	21.65	21.58	1
	1	36	21.74	21.80	21.61	1
	1	74	21.63	21.98	21.31	1
	15	0	21.40	21.45	21.47	1
	15	30	21.51	21.64	21.53	1
	15	60	21.48	21.64	21.19	1
	27	0	20.34	20.48	20.51	2
	27	24	20.51	20.64	20.49	2
	27	48	20.52	20.67	20.27	2

Table 8-18
LTE Band 25 Conducted Powers – 10 MHz Bandwidth

LTE Band 25 (PCS) 10 MHz Bandwidth						
Modulation	RB Size	RB Offset	Low Channel 26090 (1855.0 MHz)	Mid Channel 26365 (1882.5 MHz)	High Channel 26640 (1910.0 MHz)	Design MPR [dB]
			Conducted Power [dBm]			
QPSK	1	0	22.60	22.64	22.59	0
	1	25	22.64	22.74	22.40	0
	1	49	22.78	22.84	22.30	0
	25	0	21.56	21.79	21.61	1
	25	12	21.58	21.81	21.54	1
	25	25	21.65	21.83	21.52	1
	50	0	21.63	21.83	21.63	1
	15	0	21.55	21.72	21.57	1
	15	17	21.59	21.80	21.53	1
	15	35	21.66	21.85	21.36	1
	27	0	21.55	21.78	21.59	1
	27	12	21.58	21.80	21.52	1
	27	23	21.62	21.83	21.50	1
16QAM	1	0	21.84	22.00	21.92	1
	1	25	21.90	21.98	21.95	1
	1	49	22.00	22.00	21.82	1
	25	0	20.60	20.69	20.58	2
	25	12	20.61	20.69	20.48	2
	25	25	20.67	20.70	20.45	2
	15	0	20.58	20.65	20.57	2
	15	17	20.62	20.71	20.47	2
	15	35	20.69	20.79	20.39	2
	27	0	20.58	20.68	20.53	2
	27	12	20.60	20.68	20.46	2
	27	23	20.64	20.69	20.43	2

Table 8-19
LTE Band 25 Conducted Powers – 5 MHz Bandwidth

LTE Band 25 (PCS) 5 MHz Bandwidth						
Modulation	RB Size	RB Offset	Low Channel 26065 (1852.5 MHz)	Mid Channel 26365 (1882.5 MHz)	High Channel 26665 (1912.5 MHz)	Design MPR [dB]
			Conducted Power [dBm]			
QPSK	1	0	22.78	22.88	22.80	0
	1	12	22.80	22.89	22.80	0
	1	24	22.85	22.94	22.70	0
	12	0	21.75	21.95	21.72	1
	12	6	21.75	21.96	21.68	1
	12	13	21.78	21.97	21.57	1
	25	0	21.78	21.98	21.72	1
16QAM	1	0	21.83	21.98	21.70	1
	1	12	21.84	22.00	21.66	1
	1	24	21.88	21.99	21.73	1
	12	0	20.52	20.70	20.39	2
	12	6	20.51	20.67	20.38	2
	12	13	20.53	20.70	20.31	2
	25	0	20.48	20.65	20.37	2

Table 8-20
LTE Band 25 Conducted Powers – 3 MHz Bandwidth

LTE Band 25 (PCS) 3 MHz Bandwidth						
Modulation	RB Size	RB Offset	Low Channel 26055 (1851.5 MHz)	Mid Channel 26365 (1882.5 MHz)	High Channel 26675 (1913.5 MHz)	Design MPR [dB]
			Conducted Power [dBm]			
QPSK	1	0	22.81	22.83	22.53	0
	1	7	22.83	22.92	22.51	0
	1	14	22.80	22.88	22.41	0
	8	0	21.77	21.95	21.69	1
	8	4	21.78	21.95	21.57	1
	8	7	21.78	21.96	21.58	1
	15	0	21.76	21.98	21.57	1
16QAM	1	0	21.79	21.98	21.68	1
	1	7	21.82	22.00	21.75	1
	1	14	21.80	21.92	21.71	1
	8	0	20.54	20.72	20.35	2
	8	4	20.51	20.71	20.36	2
	8	7	20.53	20.70	20.33	2
	15	0	20.47	20.65	20.29	2

Table 8-21
LTE Band 25 Conducted Powers – 1.4 MHz Bandwidth

LTE Band 25 (PCS) 1.4 MHz Bandwidth						
Modulation	RB Size	RB Offset	Low Channel 26047 (1850.7 MHz)	Mid Channel 26365 (1882.5 MHz)	High Channel 26683 (1914.3 MHz)	Design MPR [dB]
			Conducted Power [dBm]			
QPSK	1	0	22.82	22.90	22.77	0
	1	2	22.80	22.90	22.71	0
	1	5	22.84	22.93	22.71	0
	3	0	22.76	22.97	22.59	0
	3	2	22.77	22.98	22.56	0
	3	3	22.78	22.97	22.57	0
	6	0	21.76	21.97	21.55	1
16QAM	1	0	21.73	21.94	21.59	1
	1	2	21.68	21.92	21.53	1
	1	5	21.72	21.87	21.56	1
	3	0	21.65	21.83	21.43	1
	3	2	21.63	21.75	21.46	1
	3	3	21.62	21.80	21.38	1
	6	0	20.58	20.78	20.40	2

8.2.5 LTE Band 7

Table 8-22
LTE Band 7 Conducted Powers – 20 MHz Bandwidth

LTE Band 7 20 MHz Bandwidth						
Modulation	RB Size	RB Offset	Low Channel 20850 (2510.0 MHz)	Mid Channel 21100 (2535.0 MHz)	High Channel 21350 (2560.0 MHz)	Design MPR [dB]
			Conducted Power [dBm]			
QPSK	1	0	21.66	21.91	21.61	0
	1	50	21.97	21.71	21.56	0
	1	99	**22.00**	21.69	21.96	0
	50	0	20.77	20.77	20.62	1
	50	25	20.91	20.70	20.66	1
	50	50	**20.97**	20.70	20.85	1
	100	0	20.92	20.95	20.91	1
	15	0	21.73	21.84	21.50	0
	15	42	21.95	21.79	21.54	0
	15	85	21.99	21.71	21.91	0
	27	0	20.76	20.78	20.51	1
	27	37	20.95	20.68	20.58	1
	27	73	21.00	20.65	20.91	1
16QAM	1	0	21.46	20.91	21.09	1
	1	50	21.49	20.81	21.12	1
	1	99	21.61	20.89	21.41	1
	15	0	21.19	20.63	20.63	1
	15	42	21.08	20.60	20.73	1
	15	85	21.01	20.67	21.07	1
	27	0	20.15	19.58	19.56	2
	27	37	20.10	19.59	19.64	2
	27	73	19.95	19.61	20.04	2

Table 8-23
LTE Band 7 Conducted Powers – 15 MHz Bandwidth

LTE Band 7 15 MHz Bandwidth						
Modulation	RB Size	RB Offset	Low Channel	Mid Channel	High Channel	Design MPR [dB]
			20825 (2507.5 MHz)	21100 (2535.0 MHz)	21375 (2562.5 MHz)	
			Conducted Power [dBm]			
QPSK	1	0	22.17	22.34	22.13	0
	1	36	22.49	22.37	22.31	0
	1	74	22.50	22.26	22.50	0
	36	0	21.25	21.34	21.28	1
	36	18	21.41	21.39	21.41	1
	36	37	21.45	21.31	21.50	1
	75	0	21.44	21.44	21.50	1
	15	0	22.25	22.35	22.18	0
	15	30	22.42	22.40	22.37	0
	15	60	22.48	22.29	22.49	0
	27	0	21.23	21.33	21.20	1
	27	24	21.38	21.38	21.41	1
	27	48	21.44	21.28	21.50	1
16QAM	1	0	20.85	21.37	21.04	1
	1	36	21.45	21.24	21.06	1
	1	74	21.48	21.10	21.48	1
	15	0	20.73	20.89	20.83	1
	15	30	20.96	20.95	20.95	1
	15	60	20.97	20.81	21.03	1
	27	0	19.70	19.91	19.77	2
	27	24	19.87	19.90	19.92	2
	27	48	19.97	19.80	20.08	2

Table 8-24
LTE Band 7 Conducted Powers – 10 MHz Bandwidth

LTE Band 7 10 MHz Bandwidth						
Modulation	RB Size	RB Offset	Low Channel	Mid Channel	High Channel	Design MPR [dB]
			20800 (2505.0 MHz)	21100 (2535.0 MHz)	21400 (2565.0 MHz)	
			Conducted Power [dBm]			
QPSK	1	0	22.12	22.08	22.06	0
	1	25	22.20	22.04	22.17	0
	1	49	22.40	22.04	22.36	0
	25	0	21.03	21.12	21.09	1
	25	12	21.03	21.07	21.22	1
	25	25	21.12	21.09	21.24	1
	50	0	21.07	21.10	21.29	1
	15	0	21.00	21.08	21.07	1
	15	17	21.02	21.13	21.22	1
	15	35	21.13	21.08	21.27	1
	27	0	21.02	21.15	21.08	1
	27	12	21.02	21.11	21.21	1
	27	23	21.10	21.08	21.23	1
16QAM	1	0	21.12	21.25	20.99	1
	1	25	21.09	21.21	21.36	1
	1	49	21.45	21.31	21.48	1
	25	0	19.78	19.86	19.91	2
	25	12	19.79	19.82	20.01	2
	25	25	19.89	19.85	19.98	2
	15	0	19.74	19.86	19.86	2
	15	17	19.79	19.88	20.08	2
	15	35	19.97	19.82	20.07	2
	27	0	19.80	19.91	19.86	2
	27	12	19.77	19.84	20.05	2
	27	23	19.85	19.83	20.00	2

Table 8-25
LTE Band 7 Conducted Powers – 5 MHz Bandwidth

LTE Band 7 5 MHz Bandwidth						
Modulation	RB Size	RB Offset	Low Channel	Mid Channel	High Channel	Design MPR [dB]
			20775 (2502.5 MHz)	21100 (2535.0 MHz)	21425 (2567.5 MHz)	
			Conducted Power [dBm]			
QPSK	1	0	22.03	22.25	22.19	0
	1	12	22.10	22.23	22.23	0
	1	24	22.14	22.15	22.38	0
	12	0	20.98	21.12	21.25	1
	12	6	20.94	21.10	21.24	1
	12	13	21.01	21.08	21.30	1
	25	0	20.95	21.12	21.25	1
16QAM	1	0	20.75	21.23	21.24	1
	1	12	20.75	21.17	21.29	1
	1	24	20.93	21.07	21.31	1
	12	0	20.37	19.90	20.27	2
	12	6	20.41	19.92	20.31	2
	12	13	20.43	19.95	20.39	2
	25	0	20.36	19.64	19.72	2

8.2.6 LTE Band 41

Table 8-26
LTE Band 41 Conducted Powers – 20 MHz Bandwidth

LTE Band 41 20 MHz Bandwidth								
Modulation	RB Size	RB Offset	Low Channel	Low-Mid Channel	Mid Channel	Mid-High Channel	High Channel	Design MPR [dB]
			39750 (2506.0 MHz)	40185 (2549.5 MHz)	40620 (2593.0 MHz)	41055 (2636.5 MHz)	41490 (2680.0 MHz)	
			Conducted Power [dBm]					
QPSK	1	0	22.22	22.24	22.49	22.22	22.49	0
	1	50	22.49	22.15	**22.50**	22.20	22.48	0
	1	99	22.48	22.25	22.47	22.29	22.45	0
	50	0	21.35	21.23	21.46	21.23	21.47	1
	50	25	21.47	21.22	**21.50**	21.21	21.46	1
	50	50	21.47	21.21	21.45	21.24	21.46	1
	100	0	21.48	21.33	21.46	21.26	21.46	1
	15	0	22.32	22.23	22.47	22.28	22.47	0
	15	42	22.48	22.16	22.49	22.23	22.48	0
	15	85	22.49	22.18	22.48	22.30	22.47	0
	27	0	21.35	21.17	21.49	21.23	21.48	1
	27	37	21.45	21.13	21.48	21.20	21.49	1
	27	73	21.48	21.13	21.48	21.25	21.44	1
16QAM	1	0	20.92	21.00	21.34	21.08	21.47	1
	1	50	21.22	20.93	21.31	20.97	21.48	1
	1	99	21.31	20.90	21.20	21.10	21.44	1
	15	0	21.03	20.95	21.38	21.02	21.28	1
	15	42	21.16	20.86	21.34	21.04	21.29	1
	15	85	21.29	20.86	21.25	21.03	21.30	1
	27	0	20.01	19.95	20.29	20.02	20.25	2
	27	37	20.14	19.84	20.25	19.96	20.26	2
	27	73	20.30	19.83	20.21	20.01	20.23	2

Table 8-27
LTE Band 41 Conducted Powers – 15 MHz Bandwidth

LTE Band 41 15 MHz Bandwidth								
Modulation	RB Size	RB Offset	Low Channel	Low-Mid Channel	Mid Channel	Mid-High Channel	High Channel	Design MPR [dB]
			39750 (2506.0 MHz)	40185 (2549.5 MHz)	40620 (2593.0 MHz)	41055 (2636.5 MHz)	41490 (2680.0 MHz)	
			Conducted Power [dBm]					
QPSK	1	0	21.93	21.81	22.20	21.72	22.15	0
	1	36	22.14	21.87	22.29	21.67	22.29	0
	1	74	22.26	21.70	22.06	21.66	22.24	0
	36	0	20.77	20.67	21.07	20.61	21.09	1
	36	18	20.94	20.72	21.11	20.60	21.18	1
	36	37	21.08	20.67	21.06	20.59	21.13	1
	75	0	21.02	20.72	21.11	20.61	21.19	1
	15	0	21.75	21.68	22.06	21.59	22.05	0
	15	30	22.03	21.73	22.15	21.61	22.22	0
	15	60	22.10	21.62	21.99	21.55	22.14	0
	27	0	20.77	20.68	21.07	20.58	21.09	1
	27	24	21.00	20.72	21.13	20.60	21.20	1
	27	48	21.11	20.63	20.97	20.57	21.14	1
16QAM	1	0	21.29	20.92	21.36	20.94	21.39	1
	1	36	21.49	21.25	21.29	21.34	21.39	1
	1	74	21.31	21.22	21.37	21.15	21.34	1
	15	0	21.30	20.94	21.24	20.84	21.30	1
	15	30	21.40	20.96	21.32	20.91	21.48	1
	15	60	21.24	20.77	21.17	20.85	21.36	1
	27	0	20.33	19.92	20.25	19.87	20.32	2
	27	24	20.36	19.94	20.30	19.87	20.46	2
	27	48	20.23	19.82	20.19	19.83	20.37	2

Table 8-28
LTE Band 41 Conducted Powers – 10 MHz Bandwidth

LTE Band 41 10 MHz Bandwidth								
Modulation	RB Size	RB Offset	Low Channel	Low-Mid Channel	Mid Channel	Mid-High Channel	High Channel	Design MPR [dB]
			39750 (2506.0 MHz)	40185 (2549.5 MHz)	40620 (2593.0 MHz)	41055 (2636.5 MHz)	41490 (2680.0 MHz)	
			Conducted Power [dBm]					
QPSK	1	0	21.93	21.75	22.19	21.77	22.22	0
	1	25	22.12	21.81	22.26	21.72	22.30	0
	1	49	22.22	21.77	22.17	21.76	22.28	0
	25	0	20.91	20.63	21.12	20.69	21.12	1
	25	12	20.97	20.63	21.07	20.62	21.15	1
	25	25	21.07	20.60	21.08	20.64	21.12	1
	50	0	21.02	20.67	21.09	20.65	21.18	1
	15	0	20.89	20.66	21.10	20.70	21.14	1
	15	17	21.01	20.67	21.11	20.65	21.17	1
	15	35	21.13	20.64	21.09	20.66	21.15	1
	27	0	20.88	20.63	21.08	20.63	21.14	1
	27	12	20.94	20.65	21.07	20.57	21.16	1
	27	23	21.00	20.63	21.07	20.59	21.14	1
16QAM	1	0	21.40	21.08	21.22	21.21	21.35	1
	1	25	21.50	21.10	21.31	21.26	21.34	1
	1	49	21.50	21.12	21.24	21.31	21.33	1
	25	0	20.19	19.91	20.20	19.95	20.14	2
	25	12	20.31	19.94	20.14	19.90	20.14	2
	25	25	20.38	19.93	20.09	19.89	20.20	2
	15	0	20.18	19.93	20.17	19.95	20.18	2
	15	17	20.32	19.95	20.15	19.92	20.14	2
	15	35	20.39	19.92	20.12	19.94	20.22	2
	27	0	20.21	19.88	20.17	19.91	20.13	2
	27	12	20.25	19.91	20.15	19.87	20.13	2
	27	23	20.36	19.93	20.09	19.89	20.14	2

Table 8-29
LTE Band 41 Conducted Powers – 5 MHz Bandwidth

LTE Band 41 5 MHz Bandwidth								
Modulation	RB Size	RB Offset	Low Channel	Low-Mid Channel	Mid Channel	Mid-High Channel	High Channel	Design MPR [dB]
			39750 (2506.0 MHz)	40185 (2549.5 MHz)	40620 (2593.0 MHz)	41055 (2636.5 MHz)	41490 (2680.0 MHz)	
			Conducted Power [dBm]					
QPSK	1	0	22.02	21.72	22.16	21.74	22.15	0
	1	12	22.01	21.74	22.16	21.79	22.18	0
	1	24	22.11	21.74	22.19	21.81	22.10	0
	12	0	20.95	20.66	21.14	20.71	21.15	1
	12	6	20.98	20.72	21.13	20.63	21.17	1
	12	13	21.03	20.71	21.13	20.66	21.12	1
	25	0	21.00	20.73	21.15	20.65	21.19	1
16QAM	1	0	21.44	21.04	21.14	21.08	21.25	1
	1	12	21.50	21.04	21.23	21.04	21.22	1
	1	24	21.50	21.13	21.23	21.13	21.32	1
	12	0	20.38	19.97	20.21	20.00	20.22	2
	12	6	20.44	19.99	20.18	19.94	20.18	2
	12	13	20.47	19.99	20.17	19.95	20.19	2
	25	0	20.37	20.00	20.19	19.93	20.18	2

8.3 WLAN Conducted Powers

Table 8-30
2.4 GHz WLAN Average RF Power

2.4GHz Conducted Power [dBm]				
Freq [MHz]	Channel	IEEE Transmission Mode		
		802.11b	802.11g	802.11n
		Average	Average	Average
2412	1	18.28	16.54	16.49
2417	2		17.30	17.26
2437	6	18.20	17.22	17.24
2457	10		17.09	17.13
2462	11	18.15	15.55	15.61

Justification for test configurations for WLAN per KDB Publication 248227 D01v02r02:

- Power measurements were performed for the transmission mode configuration with the highest maximum output power specified for production units.
- For transmission modes with the same maximum output power specification, powers were measured for the largest channel bandwidth, lowest order modulation and lowest data rate.
- For transmission modes with identical maximum specified output power, channel bandwidth, modulation and data rates, power measurements were required for all identical configurations.
- For each transmission mode configuration, powers were measured for the highest and lowest channels; and at the mid-band channel(s) when there were at least 3 channels supported. For configurations with multiple mid-band channels, due to an even number of channels, both channels were measured.

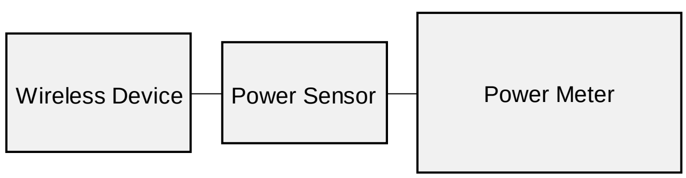

Figure 8-2
Power Measurement Setup

8.4 Bluetooth Conducted Powers

Table 8-31
Bluetooth Average RF Power

Frequency [MHz]	Modulation	Data Rate [Mbps]	Channel No.	Avg Conducted Power	
				[dBm]	[mW]
2402	GFSK	1.0	0	16.44	44.055
2441	GFSK	1.0	39	16.54	45.082
2480	GFSK	1.0	78	16.57	45.394

Note: Bluetooth was evaluated with a test mode with 100% transmission duty factor.

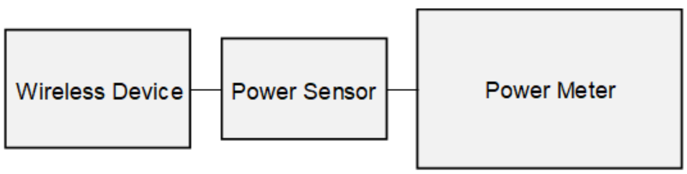

Figure 8-3
Power Measurement Setup

9 SYSTEM VERIFICATION

9.1 Tissue Verification

Table 9-1
Measured Head Tissue Properties

Calibrated for Tests Performed on:	Tissue Type	Tissue Temp During Calibration (˚C)	Measured Frequency (MHz)	Measured Conductivity, σ (S/m)	Measured Dielectric Constant, ε	TARGET Conductivity, σ (S/m)	TARGET Dielectric Constant, ε	% dev σ	% dev ε
7/9/2020	835H	21.4	800	0.910	42.228	0.897	41.682	1.45%	1.31%
			820	0.917	42.167	0.899	41.578	2.00%	1.42%
			835	0.923	42.129	0.900	41.500	2.56%	1.52%
			850	0.929	42.092	0.916	41.500	1.42%	1.43%
7/10/2020	835H	22.2	820	0.939	41.844	0.899	41.578	4.45%	0.64%
			835	0.944	41.809	0.900	41.500	4.89%	0.74%
			850	0.949	41.782	0.916	41.500	3.60%	0.68%
7/10/2020	1750H	22.2	1710	1.340	40.230	1.348	40.142	-0.59%	0.22%
			1750	1.364	40.197	1.371	40.079	-0.51%	0.29%
			1790	1.387	40.147	1.394	40.016	-0.50%	0.33%
8/28/2020	1750H	21.3	1710	1.325	38.916	1.348	40.142	-1.71%	-3.05%
			1750	1.349	38.852	1.371	40.079	-1.60%	-3.06%
			1790	1.373	38.775	1.394	40.016	-1.51%	-3.10%
7/8/2020	1900H	21.7	1850	1.395	39.558	1.400	40.000	-0.36%	-1.11%
			1880	1.425	39.425	1.400	40.000	1.79%	-1.44%
			1910	1.455	39.316	1.400	40.000	3.93%	-1.71%
7/13/2020	2450H-2600H	22.6	2400	1.821	39.137	1.756	39.289	3.70%	-0.39%
			2450	1.871	38.967	1.800	39.200	3.94%	-0.59%
			2500	1.934	38.782	1.855	39.136	4.26%	-0.90%
			2550	1.981	38.578	1.909	39.073	3.77%	-1.27%
			2600	2.044	38.406	1.964	39.009	4.07%	-1.55%
			2650	2.095	38.186	2.018	38.945	3.82%	-1.95%
			2700	2.155	38.028	2.073	38.882	3.96%	-2.20%
7/13/2020	2450H-2600H	21.4	2400	1.730	38.082	1.756	39.289	-1.48%	-3.07%
			2450	1.766	38.033	1.800	39.200	-1.89%	-2.98%
			2500	1.813	37.963	1.855	39.136	-2.26%	-3.00%
			2550	1.848	37.880	1.909	39.073	-3.20%	-3.05%
			2600	1.896	37.816	1.964	39.009	-3.46%	-3.06%
			2650	1.933	37.724	2.018	38.945	-4.21%	-3.14%
			2700	1.978	37.658	2.073	38.882	-4.58%	-3.15%

Table 9-2
Measured Body Tissue Properties

Calibrated for Tests Performed on:	Tissue Type	Tissue Temp During Calibration (˚C)	Measured Frequency (MHz)	Measured Conductivity, σ (S/m)	Measured Dielectric Constant, ε	TARGET Conductivity, σ (S/m)	TARGET Dielectric Constant, ε	% dev σ	% dev ε
7/13/2020	835B	20.9	815	0.992	53.080	0.969	55.278	2.37%	-3.98%
			820	0.994	53.065	0.969	55.258	2.58%	-3.97%
			835	1.000	53.037	0.970	55.200	3.09%	-3.92%
			850	1.006	53.012	0.988	55.154	1.82%	-3.88%
7/16/2020	835B	21.5	820	0.973	53.907	0.969	55.258	0.41%	-2.44%
			835	0.988	53.755	0.970	55.200	1.86%	-2.62%
			850	1.003	53.623	0.988	55.154	1.52%	-2.78%
7/8/2020	1750B	21.3	1710	1.438	52.504	1.463	53.537	-1.71%	-1.93%
			1750	1.464	52.473	1.488	53.432	-1.61%	-1.79%
			1790	1.493	52.434	1.514	53.326	-1.39%	-1.67%
7/13/2020	1900B	20.9	1850	1.544	51.247	1.520	53.300	1.58%	-3.85%
			1880	1.569	51.216	1.520	53.300	3.22%	-3.91%
			1910	1.592	51.187	1.520	53.300	4.74%	-3.96%
7/20/2020	1900B	21.6	1850	1.529	51.362	1.520	53.300	0.59%	-3.64%
			1880	1.547	51.327	1.520	53.300	1.78%	-3.70%
			1910	1.566	51.299	1.520	53.300	3.03%	-3.75%
7/4/2020	2450B-2600B	22.3	2400	1.956	52.193	1.902	52.767	2.84%	-1.09%
			2450	2.024	52.015	1.950	52.700	3.79%	-1.30%
			2500	2.097	51.850	2.021	52.636	3.76%	-1.49%
			2550	2.167	51.639	2.092	52.573	3.59%	-1.78%
			2600	2.238	51.462	2.163	52.509	3.47%	-1.99%
			2650	2.310	51.243	2.234	52.445	3.40%	-2.29%
			2700	2.384	51.031	2.305	52.382	3.43%	-2.58%
7/13/2020	2450B	21.8	2400	1.971	51.925	1.902	52.767	3.63%	-1.60%
			2450	2.031	51.758	1.950	52.700	4.15%	-1.79%
			2500	2.109	51.589	2.021	52.636	4.35%	-1.99%
7/13/2020	2450B	21.7	2400	1.966	51.712	1.902	52.767	3.36%	-2.00%
			2450	2.033	51.514	1.950	52.700	4.26%	-2.25%
			2500	2.101	51.320	2.021	52.636	3.96%	-2.50%
7/15/2020	2450B-2600B	22.2	2400	1.945	52.206	1.902	52.767	2.26%	-1.06%
			2450	2.013	52.035	1.950	52.700	3.23%	-1.26%
			2500	2.087	51.835	2.021	52.636	3.27%	-1.52%
			2550	2.156	51.620	2.092	52.573	3.06%	-1.81%
			2600	2.229	51.421	2.163	52.509	3.05%	-2.07%
			2650	2.298	51.209	2.234	52.445	2.86%	-2.36%
			2700	2.371	51.006	2.305	52.382	2.86%	-2.63%

The above measured tissue parameters were used in the DASY software. The DASY software was used to perform interpolation to determine the dielectric parameters at the SAR test device frequencies (per KDB Publication 865664 D01v01r04). The tissue parameters listed in the SAR test plots may slightly differ from the table above due to significant digit rounding in the software.

9.2 Test System Verification

Prior to SAR assessment, the system is verified to ±10% of the SAR measurement on the reference dipole at the time of calibration by the calibration facility. Full system validation status and result summary can be found in Appendix D.

Table 9-3
System Verification Results – 1g

System Verification TARGET & MEASURED												
SAR System #	Tissue Frequency (MHz)	Tissue Type	Date	Amb. Temp (°C)	Liquid Temp (°C)	Input Power (W)	Source SN	Probe SN	Measured SAR_{1g} (W/kg)	1 W Target SAR_{1g} (W/kg)	1 W Normalized SAR_{1g} (W/kg)	$Deviation_{1g}$ (%)
AM6	835	HEAD	07/09/2020	22.3	20.5	0.200	4d040	3837	2.000	9.500	10.000	5.26%
AM2	835	HEAD	07/10/2020	22.0	21.5	0.200	4d040	7420	1.980	9.500	9.900	4.21%
AM2	1750	HEAD	07/10/2020	22.0	21.5	0.100	1083	7420	3.580	36.100	35.800	-0.83%
AM6	1750	HEAD	08/28/2020	22.1	20.8	0.100	1083	3837	3.850	36.100	38.500	6.65%
AM6	1900	HEAD	07/08/2020	23.5	21.3	0.100	5d030	3837	4.240	39.900	42.400	6.27%
AM7	2450	HEAD	07/13/2020	21.1	20.7	0.100	750	7490	5.210	53.100	52.100	-1.88%
AM1	2450	HEAD	07/13/2020	22.5	21.4	0.100	921	7427	5.410	53.100	54.100	1.88%
AM7	2600	HEAD	07/13/2020	21.1	20.7	0.100	1042	7490	5.590	57.700	55.900	-3.12%
AM1	2600	HEAD	07/13/2020	22.5	21.4	0.100	1069	7427	5.570	56.900	55.700	-2.11%

Table 9-4
System Verification Results – 10g

System Verification TARGET & MEASURED												
SAR System #	Tissue Frequency (MHz)	Tissue Type	Date	Amb. Temp (°C)	Liquid Temp (°C)	Input Power (W)	Source SN	Probe SN	Measured SAR_{10g} (W/kg)	1 W Target SAR_{10g} (W/kg)	1 W Normalized SAR_{10g} (W/kg)	$Deviation_{10g}$ (%)
AM6	835	BODY	07/13/2020	24.4	20.5	0.200	4d040	3837	1.330	6.240	6.650	6.57%
AM4	850	BODY	07/16/2020	23.0	22.3	0.200	1010	7421	1.420	6.680	7.100	6.29%
AM8	1750	BODY	07/08/2020	22.0	20.9	0.100	1092	7532	1.990	19.400	19.900	2.58%
AM6	1900	BODY	07/13/2020	23.6	20.5	0.100	5d030	3837	2.210	21.100	22.100	4.74%
AM6	1900	BODY	07/20/2020	21.9	21.0	0.100	5d030	3837	2.180	21.100	21.800	3.32%
AM3	2450	BODY	07/04/2020	22.7	22.2	0.100	921	3949	2.520	23.800	25.200	5.88%
AM3	2450	BODY	07/13/2020	23.3	21.9	0.100	921	3949	2.550	23.800	25.500	7.14%
AM5	2450	BODY	07/13/2020	21.3	19.7	0.100	945	7416	2.280	23.200	22.800	-1.72%
AM5	2450	BODY	07/15/2020	22.7	20.5	0.100	921	7416	2.230	23.800	22.300	-6.30%
AM3	2600	BODY	07/04/2020	22.7	22.2	0.100	1069	3949	2.550	24.800	25.500	2.82%
AM5	2600	BODY	07/15/2020	22.7	20.5	0.100	1009	7416	2.340	25.000	23.400	-6.40%

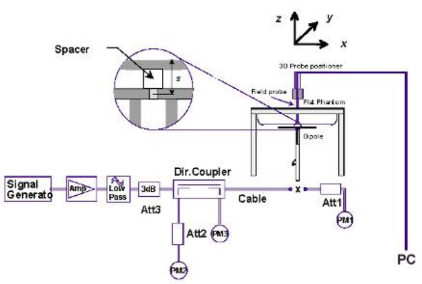

Figure 9-1
System Verification Setup Diagram

Figure 9-2
System Verification Setup Photo

10 SAR DATA SUMMARY

10.1 Standalone Head SAR Data

Table 10-1
UMTS 850 Head SAR

MEASUREMENT RESULTS																
FREQUENCY		Mode	Service	Maximum Allowed Power [dBm]	Conducted Power [dBm]	Power Drift [dB]	Side	Spacing	Housing Type	Wristband Type	Device Serial Number	Duty Cycle	SAR (1g)	Scaling Factor	Reported SAR (1g)	Plot #
MHz	Ch.												(W/kg)		(W/kg)	
836.60	4183	UMTS 850	RMC	25.0	23.95	0.17	Front	10 mm	Aluminum	Sport	DVPCR03TQ7TP	1:1	0.000	1.274	0.000	
836.60	4183	UMTS 850	RMC	25.0	23.95	-0.16	Front	10 mm	Aluminum	Metal Links	DVPCR03NQ7TP	1:1	0.001	1.274	0.001	A1
836.60	4183	UMTS 850	RMC	25.0	23.95	0.14	Front	10 mm	Aluminum	Metal Loop	DVPCR03TQ7TP	1:1	0.000	1.274	0.000	
ANSI / IEEE C95.1 1992 - SAFETY LIMIT Spatial Peak Uncontrolled Exposure/General Population							Head 1.6 W/kg (mW/g) averaged over 1 gram									

Table 10-2
UMTS 1750 Head SAR

MEASUREMENT RESULTS																
FREQUENCY		Mode	Service	Maximum Allowed Power [dBm]	Conducted Power [dBm]	Power Drift [dB]	Side	Spacing	Housing Type	Wristband Type	Device Serial Number	Duty Cycle	SAR (1g)	Scaling Factor	Reported SAR (1g)	Plot #
MHz	Ch.												(W/kg)		(W/kg)	
1732.40	1412	UMTS 1750	RMC	24.0	22.98	0.06	Front	10 mm	Aluminum	Sport	DVPCR03MQ7TP	1:1	0.126	1.265	0.159	
1732.40	1412	UMTS 1750	RMC	24.0	22.98	-0.15	Front	10 mm	Aluminum	Metal Links	DVPCR04JQ7TP	1:1	0.220	1.265	0.278	
1732.40	1412	UMTS 1750	RMC	24.0	22.98	-0.05	Front	10 mm	Aluminum	Metal Loop	DVPCR04JQ7TP	1:1	0.303	1.265	0.383	A2
ANSI / IEEE C95.1 1992 - SAFETY LIMIT Spatial Peak Uncontrolled Exposure/General Population							Head 1.6 W/kg (mW/g) averaged over 1 gram									

Table 10-3
UMTS 1900 Head SAR

MEASUREMENT RESULTS																
FREQUENCY		Mode	Service	Maximum Allowed Power [dBm]	Conducted Power [dBm]	Power Drift [dB]	Side	Spacing	Housing Type	Wristband Type	Device Serial Number	Duty Cycle	SAR (1g)	Scaling Factor	Reported SAR (1g)	Plot #
MHz	Ch.												(W/kg)		(W/kg)	
1880.00	9400	UMTS 1900	RMC	24.0	23.00	-0.01	Front	10 mm	Aluminum	Sport	DVPCR03TQ7TP	1:1	0.130	1.259	0.164	
1880.00	9400	UMTS 1900	RMC	24.0	23.00	0.01	Front	10 mm	Aluminum	Metal Links	DVPCR032Q7TP	1:1	0.222	1.259	0.279	
1880.00	9400	UMTS 1900	RMC	24.0	23.00	0.13	Front	10 mm	Aluminum	Metal Loop	DVPCR04JQ7TP	1:1	0.243	1.259	0.306	A3
ANSI / IEEE C95.1 1992 - SAFETY LIMIT Spatial Peak Uncontrolled Exposure/General Population							Head 1.6 W/kg (mW/g) averaged over 1 gram									

Table 10-4
LTE Band 26 Head SAR

MEASUREMENT RESULTS

FREQUENCY MHz	Ch.		Mode	Bandwidth [MHz]	Wristband Type	Maximum Allowed Power [dBm]	Conducted Power [dBm]	Power Drift [dB]	MPR [dB]	Side	Spacing	Housing Type	Modulation	RB Size	RB Offset	Device Serial Number	Duty Cycle	SAR (1g) (W/kg)	Scaling Factor	Reported SAR (1g) (W/kg)	Plot #
819.00	26740	Low	LTE Band 26 (Cell)	10	Sport	25.0	23.91	0.01	0	Front	10 mm	Aluminum	QPSK	1	0	DVPCR03TQ7TP	1:1	0.000	1.285	0.000	A4
819.00	26740	Low	LTE Band 26 (Cell)	10	Sport	24.0	22.90	0.01	1	Front	10 mm	Aluminum	QPSK	25	0	DVPCR03TQ7TP	1:1	0.000	1.288	0.000	
819.00	26740	Low	LTE Band 26 (Cell)	10	Metal Links	25.0	23.91	0.03	0	Front	10 mm	Aluminum	QPSK	1	0	DVPCR032Q7TP	1:1	0.000	1.285	0.000	
819.00	26740	Low	LTE Band 26 (Cell)	10	Metal Links	24.0	22.90	0.04	1	Front	10 mm	Aluminum	QPSK	25	0	DVPCR032Q7TP	1:1	0.000	1.288	0.000	
819.00	26740	Low	LTE Band 26 (Cell)	10	Metal Loop	25.0	23.91	0.01	0	Front	10 mm	Aluminum	QPSK	1	0	DVPCR03TQ7TP	1:1	0.000	1.285	0.000	
819.00	26740	Low	LTE Band 26 (Cell)	10	Metal Loop	24.0	22.90	0.01	1	Front	10 mm	Aluminum	QPSK	25	0	DVPCR03TQ7TP	1:1	0.000	1.288	0.000	

ANSI / IEEE C95.1 1992 - SAFETY LIMIT Spatial Peak Uncontrolled Exposure/General Population	Head 1.6 W/kg (mW/g) averaged over 1 gram

Table 10-5
LTE Band 5 Head SAR

MEASUREMENT RESULTS

FREQUENCY MHz	Ch.		Mode	Bandwidth [MHz]	Wristband Type	Maximum Allowed Power [dBm]	Conducted Power [dBm]	Power Drift [dB]	MPR [dB]	Side	Spacing	Housing Type	Modulation	RB Size	RB Offset	Device Serial Number	Duty Cycle	SAR (1g) (W/kg)	Scaling Factor	Reported SAR (1g) (W/kg)	Plot #
836.50	20525	Mid	LTE Band 5 (Cell)	10	Sport	25.0	23.77	0.13	0	Front	10 mm	Aluminum	QPSK	1	0	DVPCR032Q7TP	1:1	0.000	1.327	0.000	A5
836.50	20525	Mid	LTE Band 5 (Cell)	10	Sport	24.0	22.80	-0.06	1	Front	10 mm	Aluminum	QPSK	25	0	DVPCR032Q7TP	1:1	0.000	1.318	0.000	
836.50	20525	Mid	LTE Band 5 (Cell)	10	Metal Links	25.0	23.77	0.01	0	Front	10 mm	Aluminum	QPSK	1	0	DVPCR04JQ7TP	1:1	0.000	1.327	0.000	
836.50	20525	Mid	LTE Band 5 (Cell)	10	Metal Links	24.0	22.80	0.01	1	Front	10 mm	Aluminum	QPSK	25	0	DVPCR04JQ7TP	1:1	0.000	1.318	0.000	
836.50	20525	Mid	LTE Band 5 (Cell)	10	Metal Loop	25.0	23.77	0.16	0	Front	10 mm	Aluminum	QPSK	1	0	DVPCR03TQ7TP	1:1	0.000	1.327	0.000	
836.50	20525	Mid	LTE Band 5 (Cell)	10	Metal Loop	24.0	22.80	0.16	1	Front	10 mm	Aluminum	QPSK	25	0	DVPCR03TQ7TP	1:1	0.000	1.318	0.000	

ANSI / IEEE C95.1 1992 - SAFETY LIMIT Spatial Peak Uncontrolled Exposure/General Population	Head 1.6 W/kg (mW/g) averaged over 1 gram

Table 10-6
LTE Band 66 Head SAR

MEASUREMENT RESULTS

FREQUENCY MHz	Ch.		Mode	Bandwidth [MHz]	Wristband Type	Maximum Allowed Power [dBm]	Conducted Power [dBm]	Power Drift [dB]	MPR [dB]	Side	Spacing	Housing Type	Modulation	RB Size	RB Offset	Device Serial Number	Duty Cycle	SAR (1g) (W/kg)	Scaling Factor	Reported SAR (1g) (W/kg)	Plot #
1745.00	132322	Mid	LTE Band 66 (AWS)	20	Sport	24.0	22.36	0.02	0	Front	10 mm	Aluminum	QPSK	1	0	DVPCR03TQ7TP	1:1	0.138	1.459	0.201	
1720.00	132072	Low	LTE Band 66 (AWS)	20	Sport	23.0	21.81	0.06	1	Front	10 mm	Aluminum	QPSK	50	25	DVPCR03TQ7TP	1:1	0.112	1.315	0.147	
1745.00	132322	Mid	LTE Band 66 (AWS)	20	Metal Links	24.0	22.36	0.01	0	Front	10 mm	Aluminum	QPSK	1	0	DVPCR04KQ7TP	1:1	0.225	1.459	0.328	
1720.00	132072	Low	LTE Band 66 (AWS)	20	Metal Links	23.0	21.81	-0.05	1	Front	10 mm	Aluminum	QPSK	50	25	DVPCR04KQ7TP	1:1	0.185	1.315	0.243	
1745.00	132322	Mid	LTE Band 66 (AWS)	20	Metal Loop	24.0	22.36	-0.12	0	Front	10 mm	Aluminum	QPSK	1	0	DVPCR032Q7TP	1:1	0.304	1.459	0.444	A6
1720.00	132072	Low	LTE Band 66 (AWS)	20	Metal Loop	23.0	21.81	-0.13	1	Front	10 mm	Aluminum	QPSK	50	25	DVPCR032Q7TP	1:1	0.246	1.315	0.323	

ANSI / IEEE C95.1 1992 - SAFETY LIMIT Spatial Peak Uncontrolled Exposure/General Population	Head 1.6 W/kg (mW/g) averaged over 1 gram

Table 10-7
LTE Band 25 Head SAR

MEASUREMENT RESULTS

FREQUENCY MHz	Ch.		Mode	Bandwidth [MHz]	Wristband Type	Maximum Allowed Power [dBm]	Conducted Power [dBm]	Power Drift [dB]	MPR [dB]	Side	Spacing	Housing Type	Modulation	RB Size	RB Offset	Device Serial Number	Duty Cycle	SAR (1g) (W/kg)	Scaling Factor	Reported SAR (1g) (W/kg)	Plot #
1882.50	26365	Mid	LTE Band 25 (PCS)	20	Sport	24.0	22.75	-0.02	0	Front	10 mm	Aluminum	QPSK	1	99	DVPCR04KQ7TP	1:1	0.120	1.334	0.160	
1882.50	26365	Mid	LTE Band 25 (PCS)	20	Sport	23.0	21.85	0.04	1	Front	10 mm	Aluminum	QPSK	50	0	DVPCR04KQ7TP	1:1	0.097	1.303	0.126	
1882.50	26365	Mid	LTE Band 25 (PCS)	20	Metal Links	24.0	22.75	0.07	0	Front	10 mm	Aluminum	QPSK	1	99	DVPCR03TQ7TP	1:1	0.177	1.334	0.236	
1882.50	26365	Mid	LTE Band 25 (PCS)	20	Metal Links	23.0	21.85	-0.01	1	Front	10 mm	Aluminum	QPSK	50	0	DVPCR03TQ7TP	1:1	0.145	1.303	0.189	
1882.50	26365	Mid	LTE Band 25 (PCS)	20	Metal Loop	24.0	22.75	0.01	0	Front	10 mm	Aluminum	QPSK	1	99	DVPCR03TQ7TP	1:1	0.270	1.334	0.360	A7
1882.50	26365	Mid	LTE Band 25 (PCS)	20	Metal Loop	23.0	21.85	0.06	1	Front	10 mm	Aluminum	QPSK	50	0	DVPCR03TQ7TP	1:1	0.229	1.303	0.298	

ANSI / IEEE C95.1 1992 - SAFETY LIMIT Spatial Peak Uncontrolled Exposure/General Population	Head 1.6 W/kg (mW/g) averaged over 1 gram

Table 10-8
LTE Band 7 Head SAR

MEASUREMENT RESULTS																					
FREQUENCY			Mode	Bandwidth [MHz]	Wristband Type	Maximum Allowed Power [dBm]	Conducted Power [dBm]	Power Drift [dB]	MPR [dB]	Side	Spacing	Housing Type	Modulation	RB Size	RB Offset	Device Serial Number	Duty Cycle	SAR (1g)	Scaling Factor	Reported SAR (1g)	Plot #
MHz	Ch.																	(W/kg)		(W/kg)	
2510.00	20850	Low	LTE Band 7	20	Sport	23.5	22.00	-0.08	0	Front	10 mm	Aluminum	QPSK	1	99	DVPCR04JQ7TP	1:1	0.359	1.413	0.507	A8
2535.00	21100	Mid	LTE Band 7	20	Sport	23.5	21.91	0.01	0	Front	10 mm	Aluminum	QPSK	1	0	DVPCR04JQ7TP	1:1	0.219	1.442	0.316	
2560.00	21350	High	LTE Band 7	20	Sport	23.5	21.96	-0.19	0	Front	10 mm	Aluminum	QPSK	1	99	DVPCR04JQ7TP	1:1	0.220	1.426	0.314	
2510.00	20850	Low	LTE Band 7	20	Sport	22.5	20.97	-0.02	1	Front	10 mm	Aluminum	QPSK	50	50	DVPCR04JQ7TP	1:1	0.261	1.422	0.371	
2510.00	20850	Low	LTE Band 7	20	Metal Links	23.5	22.00	0.10	0	Front	10 mm	Aluminum	QPSK	1	99	DVPCR04KQ7TP	1:1	0.195	1.413	0.276	
2510.00	20850	Low	LTE Band 7	20	Metal Links	22.5	20.97	0.13	1	Front	10 mm	Aluminum	QPSK	50	50	DVPCR04KQ7TP	1:1	0.152	1.422	0.216	
2510.00	20850	Low	LTE Band 7	20	Metal Loop	23.5	22.00	-0.19	0	Front	10 mm	Aluminum	QPSK	1	99	DVPCR04JQ7TP	1:1	0.235	1.413	0.332	
2510.00	20850	Low	LTE Band 7	20	Metal Loop	22.5	20.97	-0.01	1	Front	10 mm	Aluminum	QPSK	50	50	DVPCR04JQ7TP	1:1	0.183	1.422	0.260	
ANSI / IEEE C95.1 1992 - SAFETY LIMIT Spatial Peak Uncontrolled Exposure/General Population										Head 1.6 W/kg (mW/g) averaged over 1 gram											

Table 10-9
LTE Band 41 Head SAR

MEASUREMENT RESULTS																					
FREQUENCY			Mode	Bandwidth [MHz]	Wristband Type	Maximum Allowed Power [dBm]	Conducted Power [dBm]	Power Drift [dB]	MPR [dB]	Side	Spacing	Housing Type	Modulation	RB Size	RB Offset	Device Serial Number	Duty Cycle	SAR (1g)	Scaling Factor	Reported SAR (1g)	Plot #
MHz	Ch.																	(W/kg)		(W/kg)	
2593.00	40620	Mid	LTE Band 41	20	Sport	23.5	22.50	0.01	0	Front	10 mm	Aluminum	QPSK	1	50	DVPCR04KQ7TP	1:1.58	0.380	1.259	0.478	A9
2593.00	40620	Mid	LTE Band 41	20	Sport	22.5	21.50	0.01	1	Front	10 mm	Aluminum	QPSK	50	25	DVPCR04KQ7TP	1:1.58	0.269	1.259	0.339	
2593.00	40620	Mid	LTE Band 41	20	Metal Links	23.5	22.50	0.02	0	Front	10 mm	Aluminum	QPSK	1	50	DVPCR04JQ7TP	1:1.58	0.282	1.259	0.355	
2593.00	40620	Mid	LTE Band 41	20	Metal Links	22.5	21.50	0.12	1	Front	10 mm	Aluminum	QPSK	50	25	DVPCR04JQ7TP	1:1.58	0.232	1.259	0.292	
2593.00	40620	Mid	LTE Band 41	20	Metal Loop	23.5	22.50	-0.03	0	Front	10 mm	Aluminum	QPSK	1	50	DVPCR04LQ7TP	1:1.58	0.226	1.259	0.285	
2593.00	40620	Mid	LTE Band 41	20	Metal Loop	22.5	21.50	0.03	1	Front	10 mm	Aluminum	QPSK	50	25	DVPCR04LQ7TP	1:1.58	0.206	1.259	0.259	
ANSI / IEEE C95.1 1992 - SAFETY LIMIT Spatial Peak Uncontrolled Exposure/General Population										Head 1.6 W/kg (mW/g) averaged over 1 gram											

Table 10-10
2.4 GHz WLAN Head SAR

MEASUREMENT RESULTS																			
FREQUENCY		Mode	Service	Bandwidth [MHz]	Maximum Allowed Power [dBm]	Conducted Power [dBm]	Power Drift [dB]	Side	Spacing	Housing Type	Wristband Type	Device Serial Number	Data Rate (Mbps)	Duty Cycle (%)	SAR (1g)	Scaling Factor (Power)	Scaling Factor (Duty Cycle)	Reported SAR (1g)	Plot #
MHz	Ch.														(W/kg)			(W/kg)	
2412	1	802.11b	DSSS	22	19.0	18.28	0.01	Front	10 mm	Aluminum	Sport	DVPCR04JQ7TP	1	100.0	0.248	1.180	1.000	0.293	A10
2412	1	802.11b	DSSS	22	19.0	18.28	-0.01	Front	10 mm	Aluminum	Metal Links	DVPCR04JQ7TP	1	100.0	0.147	1.180	1.000	0.173	
2412	1	802.11b	DSSS	22	19.0	18.28	-0.07	Front	10 mm	Aluminum	Metal Loop	DVPCR04JQ7TP	1	100.0	0.169	1.180	1.000	0.199	
ANSI / IEEE C95.1 1992 - SAFETY LIMIT Spatial Peak Uncontrolled Exposure/General Population									Head 1.6 W/kg (mW/g) averaged over 1 gram										

Table 10-11
Bluetooth Head SAR

MEASUREMENT RESULTS																	
FREQUENCY		Mode	Service	Maximum Allowed Power [dBm]	Conducted Power [dBm]	Power Drift [dB]	Side	Spacing	Housing Type	Wristband Type	Device Serial Number	Data Rate (Mbps)	Duty Cycle (%)	SAR (1g)	Scaling Factor (Cond Power)	Scaling Factor (Duty Cycle)	Reported SAR (1g)	Plot #
MHz	Ch.													(W/kg)			(W/kg)	
2480.00	78	Bluetooth	FHSS	17.5	16.57	0.01	Front	10 mm	Aluminum	Sport	DVPCR03NQ7TP	1	100	0.114	1.239	1.000	0.141	A11
2480.00	78	Bluetooth	FHSS	17.5	16.57	0.14	Front	10 mm	Aluminum	Metal Links	DVPCR03NQ7TP	1	100	0.064	1.239	1.000	0.079	
2480.00	78	Bluetooth	FHSS	17.5	16.57	0.08	Front	10 mm	Aluminum	Metal Loop	DVPCR03NQ7TP	1	100	0.076	1.239	1.000	0.094	
ANSI / IEEE C95.1 1992 - SAFETY LIMIT Spatial Peak Uncontrolled Exposure/General Population							Head 1.6 W/kg (mW/g) averaged over 1 gram											

10.2 Standalone Extremity SAR Data

Table 10-12
UMTS 850 Extremity SAR

MEASUREMENT RESULTS																
FREQUENCY		Mode	Service	Maximum Allowed Power [dBm]	Conducted Power [dBm]	Power Drift [dB]	Spacing	Housing Type	Wristband Type	Device Serial Number	Duty Cycle	Side	Scaling Factor	SAR (10g)	Reported SAR (10g)	Plot #
MHz	Ch.													(W/kg)	(W/kg)	
836.60	4183	UMTS 850	RMC	25.0	23.95	0.13	0 mm	Aluminum	Sport	DVPCR04KQ7TP	1:1	back	1.274	0.100	0.127	
826.40	4132	UMTS 850	RMC	25.0	24.00	0.01	0 mm	Aluminum	Metal Links	DVPCR032Q7TP	1:1	back	1.259	0.141	0.178	
836.60	4183	UMTS 850	RMC	25.0	23.95	0.08	0 mm	Aluminum	Metal Links	DVPCR032Q7TP	1:1	back	1.274	0.189	0.241	A12
846.60	4233	UMTS 850	RMC	25.0	23.90	0.01	0 mm	Aluminum	Metal Links	DVPCR032Q7TP	1:1	back	1.288	0.185	0.238	
836.60	4183	UMTS 850	RMC	25.0	23.95	0.01	0 mm	Aluminum	Metal Loop	DVPCR04LQ7TP	1:1	back	1.274	0.132	0.168	
ANSI / IEEE C95.1 1992 - SAFETY LIMIT Spatial Peak Uncontrolled Exposure/General Population							Extremity 4.0 W/kg (mW/g) averaged over 10 grams									

Table 10-13
UMTS 1750 Extremity SAR

MEASUREMENT RESULTS																
FREQUENCY		Mode	Service	Maximum Allowed Power [dBm]	Conducted Power [dBm]	Power Drift [dB]	Spacing	Housing Type	Wristband Type	Device Serial Number	Duty Cycle	Side	Scaling Factor	SAR (10g)	Reported SAR (10g)	Plot #
MHz	Ch.													(W/kg)	(W/kg)	
1732.40	1412	UMTS 1750	RMC	24.0	22.98	0.16	0 mm	Aluminum	Sport	DVPCR03NQ7TP	1:1	back	1.265	0.056	0.071	A13
1732.40	1412	UMTS 1750	RMC	24.0	22.98	-0.13	0 mm	Aluminum	Metal Links	DVPCR03NQ7TP	1:1	back	1.265	0.029	0.037	
1732.40	1412	UMTS 1750	RMC	24.0	22.98	-0.11	0 mm	Aluminum	Metal Loop	DVPCR04LQ7TP	1:1	back	1.265	0.016	0.020	
ANSI / IEEE C95.1 1992 - SAFETY LIMIT Spatial Peak Uncontrolled Exposure/General Population							Extremity 4.0 W/kg (mW/g) averaged over 10 grams									

Table 10-14
UMTS 1900 Extremity SAR

MEASUREMENT RESULTS																
FREQUENCY		Mode	Service	Maximum Allowed Power [dBm]	Conducted Power [dBm]	Power Drift [dB]	Spacing	Housing Type	Wristband Type	Device Serial Number	Duty Cycle	Side	Scaling Factor	SAR (10g)	Reported SAR (10g)	Plot #
MHz	Ch.													(W/kg)	(W/kg)	
1880.00	9400	UMTS 1900	RMC	24.0	23.00	0.15	0 mm	Aluminum	Sport	DVPCR03NQ7TP	1:1	back	1.259	0.040	0.050	
1880.00	9400	UMTS 1900	RMC	24.0	23.00	-0.19	0 mm	Aluminum	Metal Links	DVPCR04KQ7TP	1:1	back	1.259	0.084	0.106	A14
1880.00	9400	UMTS 1900	RMC	24.0	23.00	-0.12	0 mm	Aluminum	Metal Loop	DVPCR03NQ7TP	1:1	back	1.259	0.023	0.029	
ANSI / IEEE C95.1 1992 - SAFETY LIMIT Spatial Peak Uncontrolled Exposure/General Population							Extremity 4.0 W/kg (mW/g) averaged over 10 grams									

Table 10-15
LTE Band 26 Extremity SAR

MEASUREMENT RESULTS																					
FREQUENCY			Mode	Bandwidth [MHz]	Wristband Type	Maximum Allowed Power [dBm]	Conducted Power [dBm]	Power Drift [dB]	MPR [dB]	Housing Type	Device Serial Number	Modulation	RB Size	RB Offset	Spacing	Side	Duty Cycle	Scaling Factor	SAR (10g)	Reported SAR (10g)	Plot #
MHz	Ch.																		(W/kg)	(W/kg)	
819.00	26740	Low	LTE Band 26 (Cell)	10	Sport	25.0	23.91	0.12	0	Aluminum	DVPCR032Q7TP	QPSK	1	0	0 mm	back	1:1	1.285	0.110	0.141	
819.00	26740	Low	LTE Band 26 (Cell)	10	Sport	24.0	22.90	0.01	1	Aluminum	DVPCR032Q7TP	QPSK	25	0	0 mm	back	1:1	1.288	0.100	0.129	
819.00	26740	Low	LTE Band 26 (Cell)	10	Metal Links	25.0	23.91	-0.15	0	Aluminum	DVPCR035Q7TP	QPSK	1	0	0 mm	back	1:1	1.285	0.146	0.188	A15
819.00	26740	Low	LTE Band 26 (Cell)	10	Metal Links	24.0	22.90	-0.15	1	Aluminum	DVPCR035Q7TP	QPSK	25	0	0 mm	back	1:1	1.288	0.104	0.134	
819.00	26740	Low	LTE Band 26 (Cell)	10	Metal Loop	25.0	23.91	0.01	0	Aluminum	DVPCR03TQ7TP	QPSK	1	0	0 mm	back	1:1	1.285	0.100	0.129	
819.00	26740	Low	LTE Band 26 (Cell)	10	Metal Loop	24.0	22.90	0.12	1	Aluminum	DVPCR03TQ7TP	QPSK	25	0	0 mm	back	1:1	1.288	0.075	0.097	
ANSI / IEEE C95.1 1992 - SAFETY LIMIT Spatial Peak Uncontrolled Exposure/General Population									Extremity 4.0 W/kg (mW/g) averaged over 10 grams												

Table 10-16
LTE Band 5 Extremity SAR

MEASUREMENT RESULTS																					
FREQUENCY			Mode	Bandwidth [MHz]	Wristband Type	Maximum Allowed Power [dBm]	Conducted Power [dBm]	Power Drift [dB]	MPR [dB]	Housing Type	Device Serial Number	Modulation	RB Size	RB Offset	Spacing	Side	Duty Cycle	Scaling Factor	SAR (10g)	Reported SAR (10g)	Plot #
MHz	Ch.																		(W/kg)	(W/kg)	
836.50	20525	Mid	LTE Band 5 (Cell)	10	Sport	25.0	23.77	-0.13	0	Aluminum	DVPCR035Q7TP	QPSK	1	0	0 mm	back	1:1	1.327	0.110	0.146	
836.50	20525	Mid	LTE Band 5 (Cell)	10	Sport	24.0	22.80	-0.13	1	Aluminum	DVPCR035Q7TP	QPSK	25	0	0 mm	back	1:1	1.318	0.080	0.105	
836.50	20525	Mid	LTE Band 5 (Cell)	10	Metal Links	25.0	23.77	-0.18	0	Aluminum	DVPCR032Q7TP	QPSK	1	0	0 mm	back	1:1	1.327	0.168	0.223	A16
836.50	20525	Mid	LTE Band 5 (Cell)	10	Metal Links	24.0	22.80	0.01	1	Aluminum	DVPCR032Q7TP	QPSK	25	0	0 mm	back	1:1	1.318	0.146	0.192	
836.50	20525	Mid	LTE Band 5 (Cell)	10	Metal Loop	25.0	23.77	-0.12	0	Aluminum	DVPCR03TQ7TP	QPSK	1	0	0 mm	back	1:1	1.327	0.125	0.166	
836.50	20525	Mid	LTE Band 5 (Cell)	10	Metal Loop	24.0	22.80	-0.12	1	Aluminum	DVPCR03TQ7TP	QPSK	25	0	0 mm	back	1:1	1.318	0.090	0.119	
ANSI / IEEE C95.1 1992 - SAFETY LIMIT Spatial Peak Uncontrolled Exposure/General Population									Extremity 4.0 W/kg (mW/g) averaged over 10 grams												

Table 10-17
LTE Band 66 Extremity SAR

MEASUREMENT RESULTS																					
FREQUENCY			Mode	Bandwidth [MHz]	Wristband Type	Maximum Allowed Power [dBm]	Conducted Power [dBm]	Power Drift [dB]	MPR [dB]	Housing Type	Device Serial Number	Modulation	RB Size	RB Offset	Spacing	Side	Duty Cycle	Scaling Factor	SAR (10g)	Reported SAR (10g)	Plot #
MHz	Ch.																		(W/kg)	(W/kg)	
1745.00	132322	Mid	LTE Band 66 (AWS)	20	Sport	24.0	22.36	0.12	0	Aluminum	DVPCR03NQ7TP	QPSK	1	0	0 mm	back	1:1	1.459	0.056	0.082	A17
1720.00	132072	Low	LTE Band 66 (AWS)	20	Sport	23.0	21.81	0.15	1	Aluminum	DVPCR03NQ7TP	QPSK	50	25	0 mm	back	1:1	1.315	0.041	0.054	
1745.00	132322	Mid	LTE Band 66 (AWS)	20	Metal Links	24.0	22.36	-0.03	0	Aluminum	DVPCR04LQ7TP	QPSK	1	0	0 mm	back	1:1	1.459	0.023	0.034	
1720.00	132072	Low	LTE Band 66 (AWS)	20	Metal Links	23.0	21.81	0.06	1	Aluminum	DVPCR04LQ7TP	QPSK	50	25	0 mm	back	1:1	1.315	0.015	0.020	
1745.00	132322	Mid	LTE Band 66 (AWS)	20	Metal Loop	24.0	22.36	0.15	0	Aluminum	DVPCR04LQ7TP	QPSK	1	0	0 mm	back	1:1	1.459	0.011	0.016	
1720.00	132072	Low	LTE Band 66 (AWS)	20	Metal Loop	23.0	21.81	0.13	1	Aluminum	DVPCR04LQ7TP	QPSK	50	25	0 mm	back	1:1	1.315	0.007	0.009	
ANSI / IEEE C95.1 1992 - SAFETY LIMIT Spatial Peak Uncontrolled Exposure/General Population									Extremity 4.0 W/kg (mW/g) averaged over 10 grams												

Table 10-18
LTE Band 25 Extremity SAR

MEASUREMENT RESULTS																					
FREQUENCY			Mode	Bandwidth [MHz]	Wristband Type	Maximum Allowed Power [dBm]	Conducted Power [dBm]	Power Drift [dB]	MPR [dB]	Housing Type	Device Serial Number	Modulation	RB Size	RB Offset	Spacing	Side	Duty Cycle	Scaling Factor	SAR (10g)	Reported SAR (10g)	Plot #
MHz	Ch.																		(W/kg)	(W/kg)	
1882.50	26365	Mid	LTE Band 25 (PCS)	20	Sport	24.0	22.75	-0.01	0	Aluminum	DVPCR03NQ7TP	QPSK	1	99	0 mm	back	1:1	1.334	0.046	0.061	
1882.50	26365	Mid	LTE Band 25 (PCS)	20	Sport	23.0	21.85	0.13	1	Aluminum	DVPCR03NQ7TP	QPSK	50	0	0 mm	back	1:1	1.303	0.036	0.047	
1882.50	26365	Mid	LTE Band 25 (PCS)	20	Metal Links	24.0	22.75	-0.14	0	Aluminum	DVPCR04KQ7TP	QPSK	1	99	0 mm	back	1:1	1.334	0.099	0.132	A18
1882.50	26365	Mid	LTE Band 25 (PCS)	20	Metal Links	23.0	21.85	-0.12	1	Aluminum	DVPCR04KQ7TP	QPSK	50	0	0 mm	back	1:1	1.303	0.092	0.120	
1882.50	26365	Mid	LTE Band 25 (PCS)	20	Metal Loop	24.0	22.75	0.11	0	Aluminum	DVPCR04JQ7TP	QPSK	1	99	0 mm	back	1:1	1.334	0.072	0.096	
1882.50	26365	Mid	LTE Band 25 (PCS)	20	Metal Loop	23.0	21.85	-0.01	1	Aluminum	DVPCR04JQ7TP	QPSK	50	0	0 mm	back	1:1	1.303	0.038	0.050	
ANSI / IEEE C95.1 1992 - SAFETY LIMIT Spatial Peak Uncontrolled Exposure/General Population									Extremity 4.0 W/kg (mW/g) averaged over 10 grams												

Table 10-19
LTE Band 7 Extremity SAR

MEASUREMENT RESULTS

FREQUENCY MHz	Ch.		Mode	Bandwidth [MHz]	Wristband Type	Maximum Allowed Power [dBm]	Conducted Power [dBm]	Power Drift [dB]	MPR [dB]	Housing Type	Device Serial Number	Modulation	RB Size	RB Offset	Spacing	Side	Duty Cycle	Scaling Factor	SAR (10g) (W/kg)	Reported SAR (10g) (W/kg)	Plot #
2510.00	20850	Low	LTE Band 7	20	Sport	23.5	22.00	-0.18	0	Aluminum	DVPCR04LQ7TP	QPSK	1	99	0 mm	back	1:1	1.413	0.060	0.085	
2510.00	20850	Low	LTE Band 7	20	Sport	22.5	20.97	-0.11	1	Aluminum	DVPCR04LQ7TP	QPSK	50	50	0 mm	back	1:1	1.422	0.044	0.063	
2510.00	20850	Low	LTE Band 7	20	Metal Links	23.5	22.00	-0.18	0	Aluminum	DVPCR04JQ7TP	QPSK	1	99	0 mm	back	1:1	1.413	0.107	0.151	A19
2510.00	20850	Low	LTE Band 7	20	Metal Links	22.5	20.97	0.03	1	Aluminum	DVPCR04JQ7TP	QPSK	50	50	0 mm	back	1:1	1.422	0.075	0.107	
2510.00	20850	Low	LTE Band 7	20	Metal Loop	23.5	22.00	-0.15	0	Aluminum	DVPCR03TQ7TP	QPSK	1	99	0 mm	back	1:1	1.413	0.071	0.100	
2510.00	20850	Low	LTE Band 7	20	Metal Loop	22.5	20.97	-0.20	1	Aluminum	DVPCR03TQ7TP	QPSK	50	50	0 mm	back	1:1	1.422	0.057	0.081	

ANSI / IEEE C95.1 1992 - SAFETY LIMIT Spatial Peak Uncontrolled Exposure/General Population	Extremity 4.0 W/kg (mW/g) averaged over 10 grams

Table 10-20
LTE Band 41 Extremity SAR

MEASUREMENT RESULTS

FREQUENCY MHz	Ch.		Mode	Bandwidth [MHz]	Wristband Type	Maximum Allowed Power [dBm]	Conducted Power [dBm]	Power Drift [dB]	MPR [dB]	Housing Type	Device Serial Number	Modulation	RB Size	RB Offset	Spacing	Side	Duty Cycle	Scaling Factor	SAR (10g) (W/kg)	Reported SAR (10g) (W/kg)	Plot #
2593.00	40620	Mid	LTE Band 41	20	Sport	23.5	22.50	-0.14	0	Aluminum	DVPCR03MQ7TP	QPSK	1	50	0 mm	back	1:1.58	1.259	0.068	0.086	
2593.00	40620	Mid	LTE Band 41	20	Sport	22.5	21.50	-0.01	1	Aluminum	DVPCR03MQ7TP	QPSK	50	25	0 mm	back	1:1.58	1.259	0.055	0.069	
2593.00	40620	Mid	LTE Band 41	20	Metal Links	23.5	22.50	0.09	0	Aluminum	DVPCR04KQ7TP	QPSK	1	50	0 mm	back	1:1.58	1.259	0.088	0.111	A20
2593.00	40620	Mid	LTE Band 41	20	Metal Links	22.5	21.50	0.04	1	Aluminum	DVPCR04KQ7TP	QPSK	50	25	0 mm	back	1:1.58	1.259	0.076	0.096	
2593.00	40620	Mid	LTE Band 41	20	Metal Loop	23.5	22.50	0.13	0	Aluminum	DVPCR04JQ7TP	QPSK	1	50	0 mm	back	1:1.58	1.259	0.087	0.110	
2593.00	40620	Mid	LTE Band 41	20	Metal Loop	22.5	21.50	0.13	1	Aluminum	DVPCR04JQ7TP	QPSK	50	25	0 mm	back	1:1.58	1.259	0.082	0.103	

ANSI / IEEE C95.1 1992 - SAFETY LIMIT Spatial Peak Uncontrolled Exposure/General Population	Extremity 4.0 W/kg (mW/g) averaged over 10 grams

Table 10-21
2.4 GHz WLAN Extremity SAR

MEASUREMENT RESULTS

FREQUENCY MHz	Ch.	Mode	Service	Bandwidth [MHz]	Maximum Allowed Power [dBm]	Conducted Power [dBm]	Power Drift [dB]	Spacing	Housing Type	Wristband Type	Device Serial Number	Data Rate (Mbps)	Side	Duty Cycle (%)	Scaling Factor (Power)	Scaling Factor (Duty Cycle)	SAR (10g) (W/kg)	Reported SAR (10g) (W/kg)	Plot #
2412	1	802.11b	DSSS	22	19.0	18.28	0.11	0 mm	Aluminum	Sport	DVPCR03TQ7TP	1	back	100.0	1.180	1.000	0.038	0.045	
2412	1	802.11b	DSSS	22	19.0	18.28	-0.19	0 mm	Aluminum	Metal Links	DVPCR035Q7TP	1	back	100.0	1.180	1.000	0.041	0.048	A21
2412	1	802.11b	DSSS	22	19.0	18.28	0.12	0 mm	Aluminum	Metal Loop	DVPCR032Q7TP	1	back	100.0	1.180	1.000	0.022	0.026	

ANSI / IEEE C95.1 1992 - SAFETY LIMIT Spatial Peak Uncontrolled Exposure/General Population	Extremity 4.0 W/kg (mW/g) averaged over 10 grams

Table 10-22
Bluetooth Extremity SAR

MEASUREMENT RESULTS

FREQUENCY MHz	Ch.	Mode	Service	Maximum Allowed Power [dBm]	Conducted Power [dBm]	Power Drift [dB]	Spacing	Housing Type	Wristband Type	Device Serial Number	Data Rate (Mbps)	Side	Duty Cycle (%)	Scaling Factor (Cond Power)	Scaling Factor (Duty Cycle)	SAR (10g) (W/kg)	Reported SAR (10g) (W/kg)	Plot #
2480	78	Bluetooth	FHSS	17.5	16.57	0.01	0 mm	Aluminum	Sport	DVPCR04KQ7TP	1	back	100	1.239	1.000	0.025	0.031	
2480	78	Bluetooth	FHSS	17.5	16.57	0.14	0 mm	Aluminum	Metal Links	DVPCR04KQ7TP	1	back	100	1.239	1.000	0.032	0.040	
2480	78	Bluetooth	FHSS	17.5	16.57	0.15	0 mm	Aluminum	Metal Loop	DVPCR04KQ7TP	1	back	100	1.239	1.000	0.033	0.041	A22

ANSI / IEEE C95.1 1992 - SAFETY LIMIT Spatial Peak Uncontrolled Exposure/General Population	Extremity 4.0 W/kg (mW/g) averaged over 10 grams

10.3 SAR Test Notes

General Notes:

1. The test data reported are the worst-case SAR values according to test procedures specified in FCC KDB Publication 447498 D01v06.
2. Batteries are fully charged at the beginning of the SAR measurements.
3. Liquid tissue depth was at least 15.0 cm for all frequencies.
4. The manufacturer has confirmed that the device(s) tested have the same physical, mechanical and thermal characteristics and are within operational tolerances expected for production units.
5. SAR results were scaled to the maximum allowed power to demonstrate compliance per FCC KDB Publication 447498 D01v06.
6. Per FCC KDB Publication 865664 D01v01r04, variability SAR tests were not required since measured SAR results for all frequency bands were less than 0.8 W/kg for 1g SAR and 2.0 W/Kg for 10g SAR.
7. This device has one housing type: Aluminum. The non-metallic wrist accessory, sport band, was evaluated for all exposure conditions. The available metallic wrist accessories, metal links band and metal loop band, were additionally evaluated.
8. This device is a portable wrist-worn device and does not support any other use conditions. Therefore, the procedures in FCC KDB Publication 447498 D01v06 Section 6.2 have been applied for extremity and next to mouth (head) conditions.
9. Unless otherwise noted, when 10g SAR measurement is considered, a factor of 2.5 is applied to the thresholds below.

UMTS Notes:

1. UMTS mode was tested under RMC 12.2 kbps with HSPA Inactive per KDB Publication 941225 D01v03r01. AMR and HSPA SAR was not required per the 3G Test Reduction Procedure in KDB Publication 941225 D01v03r01.
2. Per FCC KDB Publication 447498 D01v06, if the reported (scaled) SAR measured at the middle channel or highest output power channel for each test configuration is ≤ 0.8 W/kg for 1g evaluations and ≤ 2.0 W/kg for 10g SAR then testing at the other channels is not required for such test configuration(s). When the maximum output power variation across the required test channels is > ½ dB, instead of the middle channel, the highest output power channel was used.

LTE Notes:

1. LTE test configurations are determined according to SAR Evaluation Considerations for LTE Devices in FCC KDB Publication 941225 D05v02r04. The general test procedures used for testing can be found in Section 7.5.4.
2. MPR is permanently implemented for this device by the manufacturer. The specific manufacturer target MPR is indicated alongside the SAR results. MPR is enabled for this device, according to 3GPP TS36.101 Section 6.2.3 – 6.2.5 under Table 6.2.3-1.
3. A-MPR was disabled for all SAR tests by setting NS=01 and MCC=001 on the base station simulator. SAR tests were performed with the same number of RB and RB offsets transmitting on all TTI frames (maximum TTI).
4. Per FCC KDB Publication 447498 D01v06, when the reported LTE Band 41 SAR measured at the highest output power channel in a given a test configuration was > 0.6 W/kg for 1g evaluations and >1.5 W/kg for 10g SAR, testing at the other channels was required for such test configurations.
5. TDD LTE was tested per the guidance provided in FCC KDB Publication 941225 D05v02r04. Testing was performed using UL-DL configuration 0 with 6 UL subframes and 2 S subframes using extended cyclic prefix only and special subframe configuration 6. SAR tests were performed at maximum output power and worst-case transmission duty factor in extended cyclic prefix. Per 3GPP 36.211 Section 4, the duty factor for special subframe configuration 6 using extended cyclic prefix is 0.633.

6. This device can only operate with 16 WAM on the uplink with less than or equal to 27RB. QPSK and 16QAM LTE powers for RB size of 15 (“50%RB) and 27 (“100% RB”) were additionally measured to support comparison and SAR test exclusion per KDB 941225 D05v02r04 Section 5.2.4 and 5.3.

WLAN Notes:

1. Justification for test configurations for WLAN per KDB Publication 248227 D01v02r02 for 2.4 GHz WIFI single transmission chain operations, the highest measured maximum output power channel for DSSS was selected for SAR measurement. SAR for OFDM modes (2.4 GHz 802.11g/n) was not required due to the maximum allowed powers and the highest reported DSSS SAR. See Section 7.6.2 for more information.
2. When the maximum reported 1g averaged SAR is ≤0.8 W/kg, SAR testing on additional channels was not required. Otherwise, SAR for the next highest output power channel was required until the reported SAR result was ≤ 1.20 W/kg for 1g evaluations or all test channels were measured. When 10g SAR measurement is considered, a factor of 2.5 is applied to the thresholds above.
3. The device was configured to transmit continuously at the required data rate, channel bandwidth and signal modulation, using the highest transmission duty factor supported by the test mode tools. The reported SAR was scaled to the 100% transmission duty factor to determine compliance. The maximum achievable duty cycles for all modes were determined based on measurements performed on a spectrum analyzer in zero-span mode with RBW = 8 MHz, VBW = 50 MHz, and detector = peak per guidance of Section 6.0 b) of ANSI C63. 10-2013 and KDB 558074 D01 v04. The RBW and VBW were both greater than 50/T, where T is the minimum transmission duration, and the number of sweep points across T was greater than 100.

Bluetooth Notes

1. To determine compliance, Bluetooth SAR was measured with the maximum power condition. Bluetooth was evaluated with a test mode with 100% transmission duty factor.

11 FCC MULTI-TX AND ANTENNA SAR CONSIDERATIONS

11.1 Introduction

The following procedures adopted from FCC KDB Publication 447498 D01v06 are applicable to devices with built-in unlicensed transmitters such as 802.11 and Bluetooth devices which may simultaneously transmit with the licensed transmitter.

11.2 Simultaneous Transmission Procedures

This device contains transmitters that may operate simultaneously. Therefore, simultaneous transmission analysis is required. Per FCC KDB Publication 447498 D01v06 4.3.2, simultaneous transmission SAR test exclusion may be applied when the sum of the 1g SAR for all the simultaneous transmitting antennas in a specific a physical test configuration is ≤1.6 W/kg. The different test positions in an exposure condition may be considered collectively to determine SAR test exclusion according to the sum of 1g or 10g SAR.

11.3 Head SAR Simultaneous Transmission Analysis

For SAR summation, the highest reported SAR across all housing and wristband types were used as a conservative evaluation for the simultaneous transmission analysis.

Table 11-1
Cellular Band Simultaneous Transmission Scenario with 2.4 GHz WLAN (Head at 1.0 cm)

Exposure Condition	Mode	3G/4G SAR (W/kg)	2.4 GHz WLAN SAR (W/kg)	Σ SAR (W/kg)
		1	2	1+2
Head SAR	UMTS 850	0.001	0.293	0.294
	UMTS 1750	0.383	0.293	0.676
	UMTS 1900	0.306	0.293	0.599
	LTE Band 26 (Cell)	0.000	0.293	0.293
	LTE Band 5 (Cell)	0.000	0.293	0.293
	LTE Band 66 (AWS)	0.444	0.293	0.737
	LTE Band 25 (PCS)	0.360	0.293	0.653
	LTE Band 7	0.507	0.293	**0.800**
	LTE Band 41	0.478	0.293	0.771

Table 11-2
Cellular Band Simultaneous Transmission Scenario with Bluetooth (Head at 1.0 cm)

Exposure Condition	Mode	3G/4G SAR (W/kg)	Bluetooth SAR (W/kg)	Σ SAR (W/kg)
		1	2	1+2
Head SAR	UMTS 850	0.001	0.141	0.142
	UMTS 1750	0.383	0.141	0.524
	UMTS 1900	0.306	0.141	0.447
	LTE Band 26 (Cell)	0.000	0.141	0.141
	LTE Band 5 (Cell)	0.000	0.141	0.141
	LTE Band 66 (AWS)	0.444	0.141	0.585
	LTE Band 25 (PCS)	0.360	0.141	0.501
	LTE Band 7	0.507	0.141	**0.648**
	LTE Band 41	0.478	0.141	0.619

11.4 Extremity SAR Simultaneous Transmission Analysis

For SAR summation, the highest reported SAR across all housing and wristband types were used as a conservative evaluation for the simultaneous transmission analysis.

Table 11-3
Cellular Band Simultaneous Transmission Scenario with 2.4 GHz WLAN (Extremity at 0.0 cm)

Exposure Condition	Mode	3G/4G SAR (W/kg)	2.4 GHz WLAN SAR (W/kg)	Σ SAR (W/kg)
		1	2	1+2
Extremity SAR	UMTS 850	0.241	0.048	**0.289**
	UMTS 1750	0.071	0.048	0.119
	UMTS 1900	0.106	0.048	0.154
	LTE Band 26 (Cell)	0.188	0.048	0.236
	LTE Band 5 (Cell)	0.223	0.048	0.271
	LTE Band 66 (AWS)	0.082	0.048	0.130
	LTE Band 25 (PCS)	0.132	0.048	0.180
	LTE Band 7	0.151	0.048	0.199
	LTE Band 41	0.111	0.048	0.159

Table 11-4
Cellular Band Simultaneous Transmission Scenario with Bluetooth (Extremity at 0.0 cm)

Exposure Condition	Mode	3G/4G SAR (W/kg)	Bluetooth SAR (W/kg)	Σ SAR (W/kg)
		1	2	1+2
Extremity SAR	UMTS 850	0.241	0.041	**0.282**
	UMTS 1750	0.071	0.041	0.112
	UMTS 1900	0.106	0.041	0.147
	LTE Band 26 (Cell)	0.188	0.041	0.229
	LTE Band 5 (Cell)	0.223	0.041	0.264
	LTE Band 66 (AWS)	0.082	0.041	0.123
	LTE Band 25 (PCS)	0.132	0.041	0.173
	LTE Band 7	0.151	0.041	0.192
	LTE Band 41	0.111	0.041	0.152

11.5 Simultaneous Transmission Conclusion

The above numerical summed SAR results for all the worst-case simultaneous transmission conditions were below the SAR limit. Therefore, the above analysis is sufficient to determine that simultaneous transmission cases will not exceed the SAR limit and therefore no measured volumetric simultaneous SAR summation is required per FCC KDB Publication 447498 D01v06.

12 SAR MEASUREMENT VARIABILITY

12.1 Measurement Variability

Per FCC KDB Publication 865664 D01v01, SAR measurement variability was not assessed for each frequency band since all measured SAR values are < 0.80 W/kg for 1g SAR and < 2.0 W/kg for 10g SAR.

12.2 Measurement Uncertainty

The measured SAR was <1.5 W/kg for 1g and <3.75 W/kg for 10g for all frequency bands. Therefore, per KDB Publication 865664 D01v01r04, the extended measurement uncertainty analysis was not required.

13 EQUIPMENT LIST

Manufacturer	Model	Description	Cal Date	Cal Interval	Cal Due	Serial Number
Agilent	85033E	3.5mm Standard Calibration Kit	6/6/2020	Annual	6/6/2021	MY53402352
Agilent	8753ES	S-Parameter Network Analyzer	1/16/2020	Annual	1/16/2021	US39170118
Agilent	E4438C	ESG Vector Signal Generator	9/11/2019	Annual	9/11/2020	MY45093678
Agilent	N5182A	MXG Vector Signal Generator	5/13/2020	Annual	5/13/2021	MY47420603
Agilent	E4438C	ESG Vector Signal Generator	9/30/2019	Annual	9/30/2020	US41460739
Agilent	E4438C	ESG Vector Signal Generator	9/13/2019	Annual	9/13/2020	MY42081752
Agilent	E5515C	Wireless Communications Test Set	5/18/2020	Biennial	5/18/2022	GB43193591
Amplifier Research	15S1G6	Amplifier	CBT	N/A	CBT	343972
Amplifier Research	15S1G6	Amplifier	CBT	N/A	CBT	343971
Amplifier Research	150A100C	Amplifier	CBT	N/A	CBT	350132
Anritsu	MA24106A	USB Power Sensor	2/27/2020	Annual	2/27/2021	1520503
Anritsu	MA24106A	USB Power Sensor	2/27/2020	Annual	2/27/2021	1520501
Anritsu	MA2411B	Pulse Power Sensor	1/21/2020	Annual	1/21/2021	1339007
Anritsu	ML2495A	Power Meter	11/15/2019	Annual	11/15/2020	1039008
Anritsu	ML2496A	Power Meter	12/17/2019	Annual	12/17/2020	1138001
Control Company	4352	Ultra Long Stem Thermometer	11/29/2018	Biennial	11/29/2020	181766817
Control Company	4352	Ultra Long Stem Thermometer	11/29/2018	Biennial	11/29/2020	181766801
Control Company	4040	Therm./Clock/Humidity Monitor	6/29/2019	Biennial	6/29/2021	192291470
Control Company	4040	Therm./Clock/Humidity Monitor	6/29/2019	Biennial	6/29/2021	192291455
Control Company	4040	Therm./Clock/Humidity Monitor	6/29/2019	Biennial	6/29/2021	192291460
Insize	1108-150	Digital Caliper	1/17/2020	Biennial	1/17/2022	0409193536
MCL	BW-N3W5+	3dB Attenuator	CBT	N/A	CBT	1812
MCL	BW-N6W5+	6dB Attenuator	CBT	N/A	CBT	1311
MCL	BW-N10W5+	10dB Attenuator	CBT	N/A	CBT	1611
Mini-Circuits	NLP-1000+	Low Pass Filter	CBT	N/A	CBT	N/A
Mini-Circuits	NLP-1200+	Low Pass Filter	CBT	N/A	CBT	N/A
Mini-Circuits	NLP-2950+	Low Pass Filter	CBT	N/A	CBT	N/A
Mini-Circuits	VLF-6000+	Low Pass Filter	CBT	N/A	CBT	N/A
Pasternack	PE2208-6	Bidirectional Coupler	CBT	N/A	CBT	N/A
Pasternack	PE2209-10	Bidirectional Coupler	CBT	N/A	CBT	N/A
Keysight	772D	Dual Directional Coupler	CBT	N/A	CBT	MY52180215
Mini-Circuits	ZHDC-16-63-S+	50-6000MHz Bidirectional Coupler	CBT	N/A	CBT	N/A
Rohde & Schwarz	CMW500	Radio Communication Tester	10/15/2019	Annual	10/15/2020	109366
Rohde & Schwarz	FSP-7	Spectrum Analyzer	1/9/2020	Annual	1/9/2022	100288
Rohde & Schwarz	CMW500	Wideband Radio Communication Tester	2/4/2020	Annual	2/4/2021	162125
SPEAG	D835V2	835 MHz SAR Dipole	6/20/2019	Biennial	6/20/2021	4d040
SPEAG	D850V2	850 MHz SAR Dipole	9/8/2017	Triennial	9/8/2020	1010
SPEAG	D1750V2	1750 MHz SAR Dipole	5/15/2018	Triennial	5/15/2021	1092
SPEAG	D1750V2	1750 MHz SAR Dipole	6/19/2019	Biennial	6/19/2021	1083
SPEAG	D1900V2	1900 MHz SAR Dipole	6/19/2019	Biennial	6/19/2021	5d030
SPEAG	D2450V2	2450 MHz SAR Dipole	6/14/2019	Biennial	6/14/2021	750
SPEAG	D2450V2	2450 MHz SAR Dipole	11/12/2018	Biennial	11/12/2020	921
SPEAG	D2450V2	2450 MHz SAR Dipole	5/16/2018	Triennial	5/16/2021	945
SPEAG	D2600V2	2600 MHz SAR Dipole	6/14/2019	Biennial	6/14/2021	1042
SPEAG	D2600V2	2600 MHz SAR Dipole	9/11/2017	Triennial	9/11/2020	1069
SPEAG	D2600V2	2600 MHz SAR Dipole	6/19/2018	Triennial	6/19/2021	1009
SPEAG	EX3DV4	SAR Probe	2/19/2020	Annual	2/19/2021	7427
SPEAG	EX3DV4	SAR Probe	4/20/2020	Annual	4/20/2021	7532
SPEAG	EX3DV4	SAR Probe	12/13/2019	Annual	12/13/2020	7490
SPEAG	EX3DV4	SAR Probe	11/21/2019	Annual	11/21/2020	7420
SPEAG	EX3DV4	SAR Probe	3/20/2020	Annual	3/20/2021	7421
SPEAG	EX3DV4	SAR Probe	1/20/2020	Annual	1/20/2021	3837
SPEAG	EX3DV4	SAR Probe	8/29/2019	Annual	8/29/2020	3949
SPEAG	EX3DV4	SAR Probe	6/22/2020	Annual	6/22/2021	7416
SPEAG	DAE4	Dasy Data Acquisition Electronics	2/13/2020	Annual	2/13/2021	1403
SPEAG	DAE4	Dasy Data Acquisition Electronics	4/15/2020	Annual	4/15/2021	501
SPEAG	DAE4	Dasy Data Acquisition Electronics	4/14/2020	Annual	4/14/2021	1532
SPEAG	DAE4	Dasy Data Acquisition Electronics	11/13/2019	Annual	11/13/2020	1213
SPEAG	DAE4	Dasy Data Acquisition Electronics	3/19/2020	Annual	3/19/2021	604
SPEAG	DAE4	Dasy Data Acquisition Electronics	1/14/2020	Annual	1/14/2021	793
SPEAG	DAE4	Dasy Data Acquisition Electronics	8/12/2019	Annual	8/12/2020	1408
SPEAG	DAE4	Dasy Data Acquisition Electronics	6/11/2020	Annual	6/11/2021	701
SPEAG	DAKS-3.5	Portable DAK	9/10/2019	Annual	9/10/2020	1045

Note: All equipment was used strictly during calibration date.

Note: CBT (Calibrated Before Testing). Prior to testing, the measurement paths containing a cable, amplifier, attenuator, coupler or filter were connected to a calibrated source (i.e. a signal generator) to determine the losses of the measurement path. The power meter offset was then adjusted to compensate for the measurement system losses. This level offset is stored within the power meter before measurements are made. This calibration verification procedure applies to the system verification and output power measurements. The calibrated reading is then taken directly from the power meter after compensation of the losses for all final power measurements. Each equipment item was used solely within its respective calibration period.

14 MEASUREMENT UNCERTAINTIES

a	c	d	e= f(d,k)	f	g	h = c x f/e	i = c x g/e	k
Uncertainty Component	**Tol. (± %)**	**Prob. Dist.**	**Div.**	**c_i 1gm**	**c_i 10 gms**	**1gm u_i (± %)**	**10gms u_i (± %)**	**v_i**
Measurement System								
Probe Calibration	6.55	N	1	1.0	1.0	6.6	6.6	∞
Axial Isotropy	0.25	N	1	0.7	0.7	0.2	0.2	∞
Hemishperical Isotropy	1.3	N	1	0.7	0.7	0.9	0.9	∞
Boundary Effect	2.0	R	1.73	1.0	1.0	1.2	1.2	∞
Linearity	0.3	N	1	1.0	1.0	0.3	0.3	∞
System Detection Limits	0.25	R	1.73	1.0	1.0	0.1	0.1	∞
Readout Electronics	0.3	N	1	1.0	1.0	0.3	0.3	∞
Response Time	0.8	R	1.73	1.0	1.0	0.5	0.5	∞
Integration Time	2.6	R	1.73	1.0	1.0	1.5	1.5	∞
RF Ambient Conditions - Noise	3.0	R	1.73	1.0	1.0	1.7	1.7	∞
RF Ambient Conditions - Reflections	3.0	R	1.73	1.0	1.0	1.7	1.7	∞
Probe Positioner Mechanical Tolerance	0.4	R	1.73	1.0	1.0	0.2	0.2	∞
Probe Positioning w/ respect to Phantom	6.7	R	1.73	1.0	1.0	3.9	3.9	∞
Extrapolation, Interpolation & Integration algorithms for Max. SAR Evaluation	4.0	R	1.73	1.0	1.0	2.3	2.3	∞
Test Sample Related								
Test Sample Positioning	2.7	N	1	1.0	1.0	2.7	2.7	35
Device Holder Uncertainty	1.67	N	1	1.0	1.0	1.7	1.7	5
Output Power Variation - SAR drift measurement	5.0	R	1.73	1.0	1.0	2.9	2.9	∞
SAR Scaling	0.0	R	1.73	1.0	1.0	0.0	0.0	∞
Phantom & Tissue Parameters								
Phantom Uncertainty (Shape & Thickness tolerances)	7.6	R	1.73	1.0	1.0	4.4	4.4	∞
Liquid Conductivity - measurement uncertainty	4.2	N	1	0.78	0.71	3.3	3.0	10
Liquid Permittivity - measurement uncertainty	4.1	N	1	0.23	0.26	1.0	1.1	10
Liquid Conductivity - Temperature Uncertainty	3.4	R	1.73	0.78	0.71	1.5	1.4	∞
Liquid Permittivity - Temperature Unceritainty	0.6	R	1.73	0.23	0.26	0.1	0.1	∞
Liquid Conductivity - deviation from target values	5.0	R	1.73	0.64	0.43	1.8	1.2	∞
Liquid Permittivity - deviation from target values	5.0	R	1.73	0.60	0.49	1.7	1.4	∞
Combined Standard Uncertainty (k=1)		RSS				11.5	11.3	60
Expanded Uncertainty (95% CONFIDENCE LEVEL)		k=2				23.0	22.6	

15 CONCLUSION

15.1 Measurement Conclusion

The SAR evaluation indicates that the EUT complies with the RF radiation exposure limits of the FCC and Innovation, Science, and Economic Development Canada, with respect to all parameters subject to this test. These measurements were taken to simulate the RF effects of RF exposure under worst-case conditions. Precise laboratory measures were taken to assure repeatability of the tests. The results and statements relate only to the item(s) tested.

Please note that the absorption and distribution of electromagnetic energy in the body are very complex phenomena that depend on the mass, shape, and size of the body, the orientation of the body with respect to the field vectors, and the electrical properties of both the body and the environment. Other variables that may play a substantial role in possible biological effects are those that characterize the environment (e.g. ambient temperature, air velocity, relative humidity, and body insulation) and those that characterize the individual (e.g. age, gender, activity level, debilitation, or disease). Because various factors may interact with one another to vary the specific biological outcome of an exposure to electromagnetic fields, any protection guide should consider maximal amplification of biological effects as a result of field-body interactions, environmental conditions, and physiological variables. [3]

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APPENDIX A: SAR TEST DATA

PCTEST

DUT: BCG-A2355; Type: Watch; Serial: DVPCR03NQ7TP

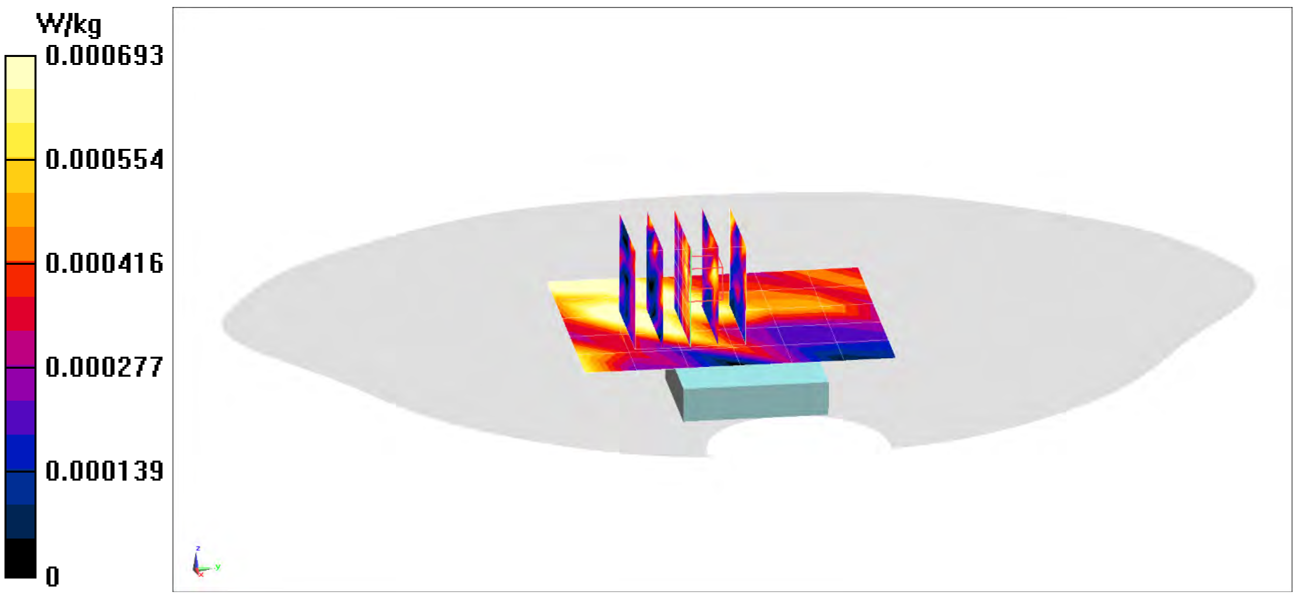
Communication System: UID 0, UMTS; Frequency: 836.6 MHz; Duty Cycle: 1:1
Medium: 835 MHz Head Medium parameters used (interpolated):
f = 836.6 MHz; σ = 0.945 S/m; ε_r = 41.806; ρ = 1000 kg/m^3
Phantom section: Flat Section; Space: 1.0 cm

Test Date: 07-10-2020; Ambient Temp: 22.0°C; Tissue Temp: 21.5°C

Probe: EX3DV4 - SN7420; ConvF(9.71, 9.71, 9.71) @ 836.6 MHz; Calibrated: 11/21/2019
Sensor-Surface: 1.4mm (Mechanical Surface Detection)
Electronics: DAE4 Sn1213; Calibrated: 11/13/2019
Phantom: Twin-SAM V4.0; Type: QD 000 P40 CA; Serial: 1275
Measurement SW: DASY52, Version 52.10 (4);SEMCAD X Version 14.6.14 (7483)

Mode: UMTS 850, Head SAR, Front side, Mid.ch
Aluminum, Metal Links Wristband

Area Scan (6x7x1): Measurement grid: dx=15mm, dy=15mm
Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 0.6110 V/m; Power Drift = -0.16 dB
Peak SAR (extrapolated) = 0.00161 W/kg
SAR(1 g) = 0.000794 W/kg
Smallest distance from peaks to all points 3 dB below: Larger than measurement grid
Ratio of SAR at M2 to SAR at M1 = 65.4%



PCTEST

DUT: BCG-A2355; Type: Watch; Serial: DVPCR04JQ7TP

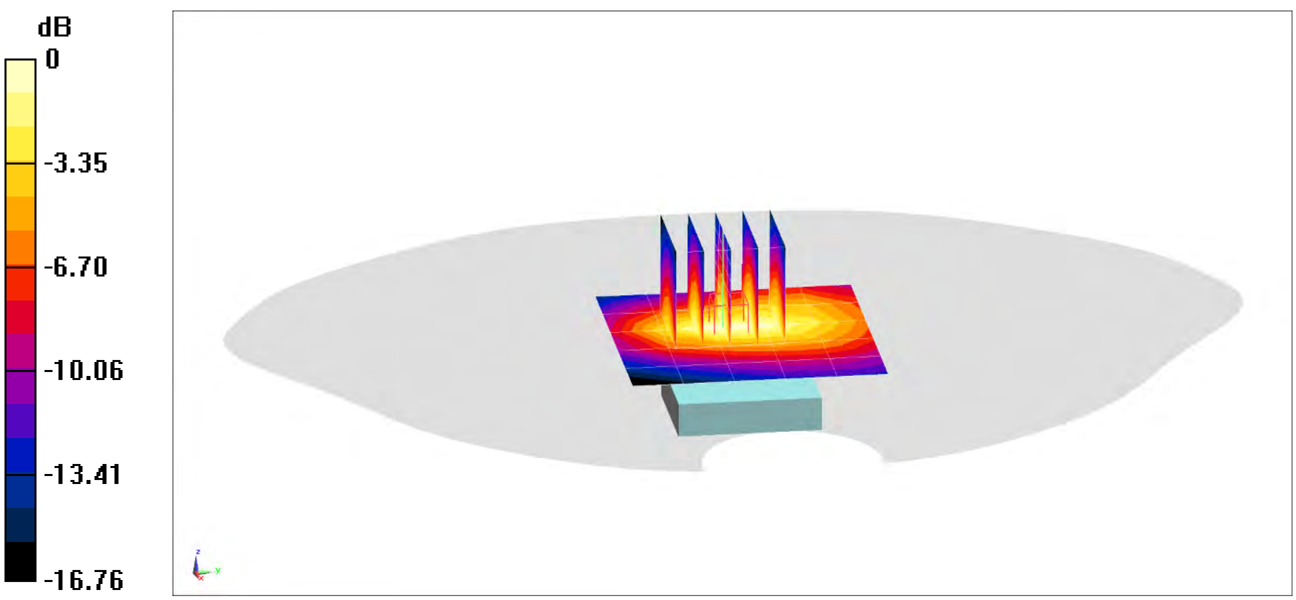
Communication System: UID 0, UMTS; Frequency: 1732.4 MHz; Duty Cycle: 1:1
Medium: 1750 MHz Head Medium parameters used (interpolated):
f = 1732.4 MHz; σ = 1.353 S/m; ε_r = 40.212; ρ = 1000 kg/m^3
Phantom section: Flat Section; Space: 1.0 cm

Test Date: 07-10-2020; Ambient Temp: 22.0°C; Tissue Temp: 21.5°C

Probe: EX3DV4 - SN7420; ConvF(8.39, 8.39, 8.39) @ 1732.4 MHz; Calibrated: 11/21/2019
Sensor-Surface: 1.4mm (Mechanical Surface Detection)
Electronics: DAE4 Sn1213; Calibrated: 11/13/2019
Phantom: Twin-SAM V4.0; Type: QD 000 P40 CA; Serial: 1275
Measurement SW: DASY52, Version 52.10 (4);SEMCAD X Version 14.6.14 (7483)

Mode: UMTS 1750, Head SAR, Front side, Mid.ch Aluminum, Metal Loop Wristband

Area Scan (6x6x1): Measurement grid: dx=15mm, dy=15mm
Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 15.74 V/m; Power Drift = -0.05 dB
Peak SAR (extrapolated) = 0.502 W/kg
SAR(1 g) = 0.303 W/kg
Smallest distance from peaks to all points 3 dB below = 11.2 mm
Ratio of SAR at M2 to SAR at M1 = 63.2%



0 dB = 0.428 W/kg = -3.69 dBW/kg

PCTEST

DUT: BCG-A2355; Type: Watch; Serial: DVPCR04JQ7TP

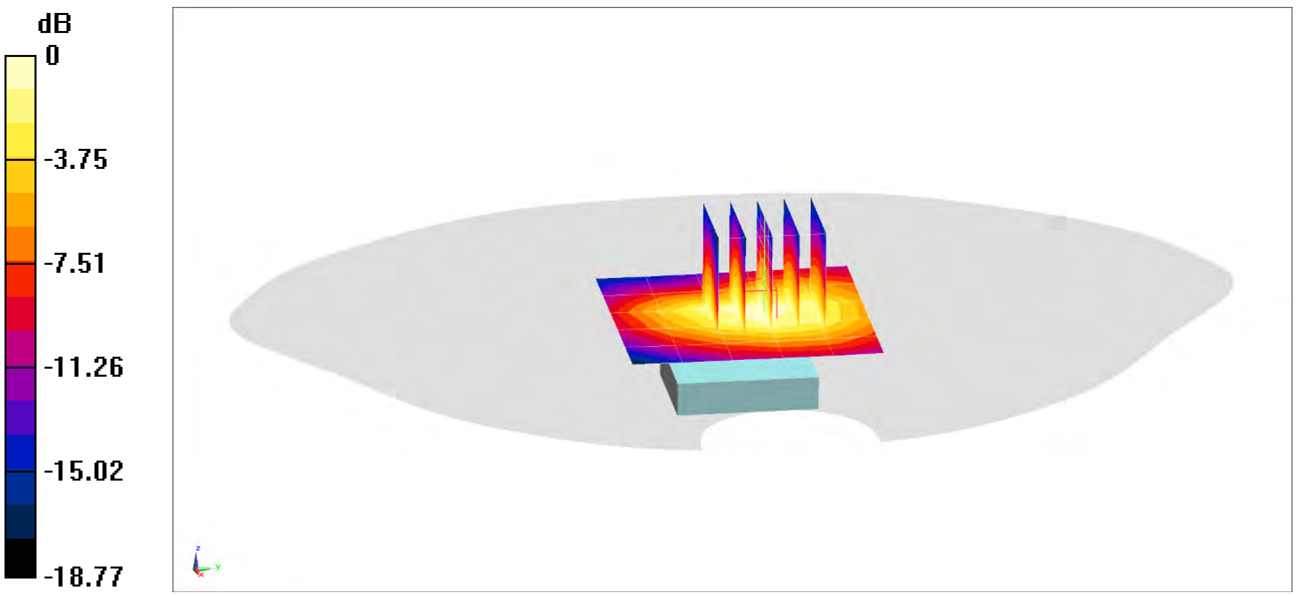
Communication System: UID 0, UMTS; Frequency: 1880 MHz; Duty Cycle: 1:1
Medium: 1900 MHz Head Medium parameters used:
f = 1880 MHz; σ = 1.425 S/m; ε_r = 39.425; ρ = 1000 kg/m^3
Phantom section: Flat Section; Space: 1.0 cm

Test Date: 07-08-2020; Ambient Temp: 23.5°C; Tissue Temp: 21.3°C

Probe: EX3DV4 - SN3837; ConvF(8.28, 8.28, 8.28) @ 1880 MHz; Calibrated: 1/20/2020
Sensor-Surface: 1.4mm (Mechanical Surface Detection)
Electronics: DAE4 Sn793; Calibrated: 1/14/2020
Phantom: Twin-SAM V4.0 Main; Type: QD 000 P40 CC; Serial: 1114
Measurement SW: DASY52, Version 52.10 (4);SEMCAD X Version 14.6.14 (7483)

Mode: UMTS 1900, Head SAR, Front side, Mid.ch
Aluminum, Metal Loop Wristband

Area Scan (6x6x1): Measurement grid: dx=15mm, dy=15mm
Zoom Scan 1 (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 13.43 V/m; Power Drift = 0.13 dB
Peak SAR (extrapolated) = 0.424 W/kg
SAR(1 g) = 0.243 W/kg
Smallest distance from peaks to all points 3 dB below = 12.9 mm
Ratio of SAR at M2 to SAR at M1 = 58.4%



0 dB = 0.352 W/kg = -4.53 dBW/kg

PCTEST

DUT: BCG-A2355; Type: Watch; Serial: DVPCR03TQ7TP

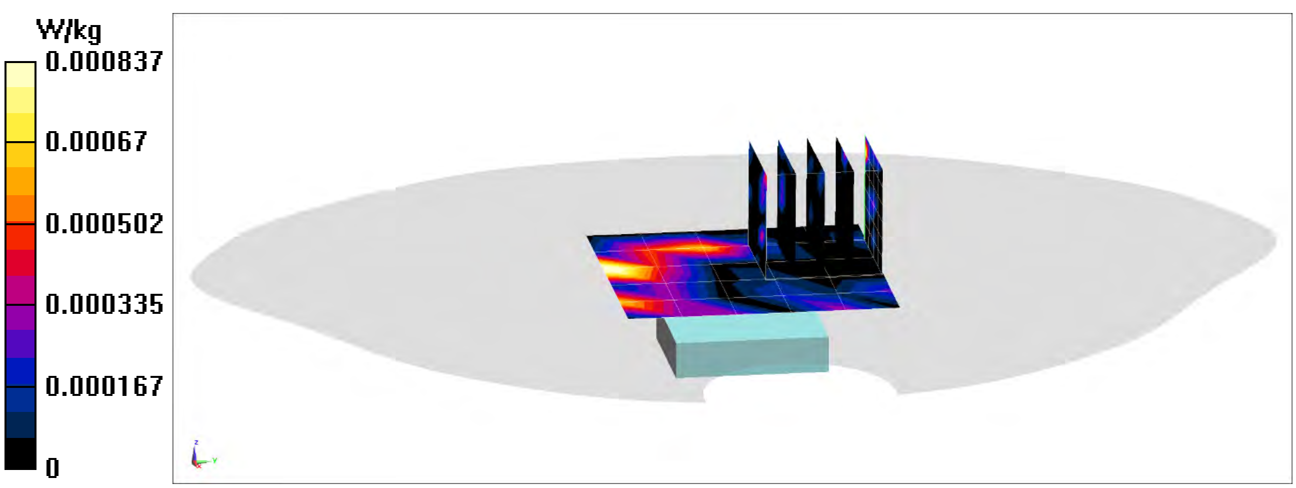
Communication System: UID 0, _LTE Band 26; Frequency: 819 MHz; Duty Cycle: 1:1
Medium: 835 MHz Head Medium parameters used (interpolated):
f = 819 MHz; σ = 0.917 S/m; ε_r = 42.17; ρ = 1000 kg/m^3
Phantom section: Flat Section; Space: 1.0 cm

Test Date: 07-09-2020; Ambient Temp: 22.3°C; Tissue Temp: 20.5°C

Probe: EX3DV4 - SN3837; ConvF(9.72, 9.72, 9.72) @ 819 MHz; Calibrated: 1/20/2020
Sensor-Surface: 1.4mm (Mechanical Surface Detection)
Electronics: DAE4 Sn793; Calibrated: 1/14/2020
Phantom: Twin-SAM V4.0 Sub; Type: QD 000 P40 CC; Serial: 1357
Measurement SW: DASY52, Version 52.10 (4);SEMCAD X Version 14.6.14 (7483)

Mode: LTE Band 26 (Cell.), Head SAR, Front side, Low.ch, 10 MHz Bandwidth, QPSK, 1 RB, 0 RB Offset, Aluminum, Sport Wristband

Area Scan (6x6x1): Measurement grid: dx=15mm, dy=15mm
Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 0 V/m; Power Drift = 0.01 dB
Peak SAR (extrapolated) = 0 W/kg
SAR(1 g) = n.a.
Smallest distance from peaks to all points 3 dB below: Larger than measurement grid
Ratio of SAR at M2 to SAR at M1 = N/A



PCTEST

DUT: BCG-A2355; Type: Watch; Serial: DVPCR032Q7TP

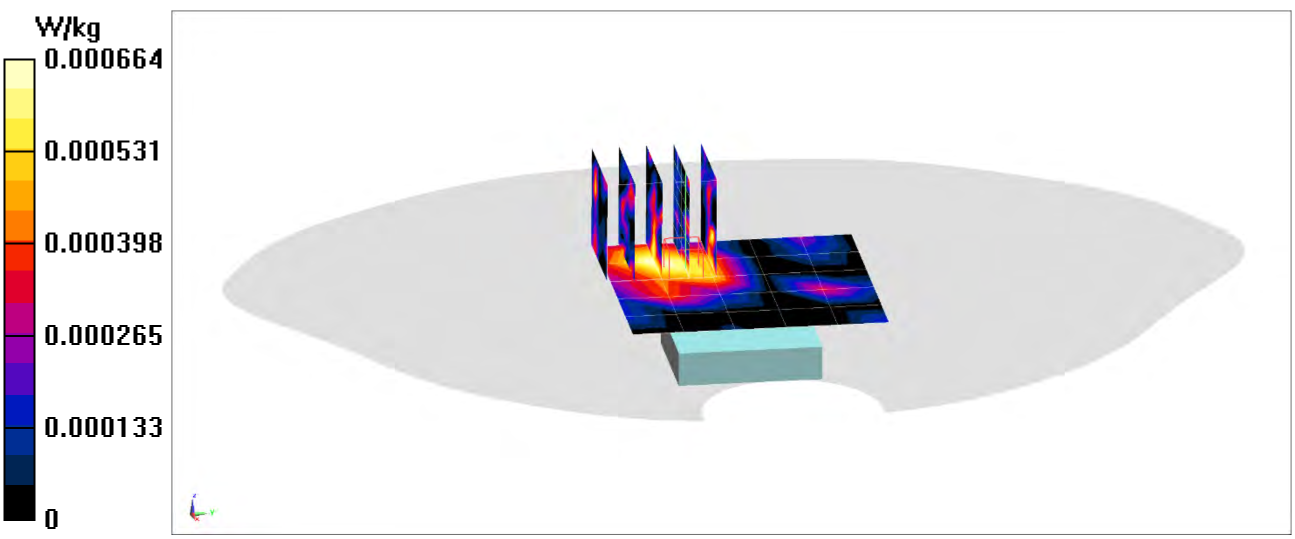
Communication System: UID 0, LTE Band 5 (Cell.); Frequency: 836.5 MHz; Duty Cycle: 1:1
Medium: 835 MHz Head Medium parameters used (interpolated):
f = 836.5 MHz; σ = 0.924 S/m; ε_r = 42.125; ρ = 1000 kg/m^3
Phantom section: Flat Section; Space: 1.0 cm

Test Date: 07-09-2020; Ambient Temp: 22.3°C; Tissue Temp: 20.5°C

Probe: EX3DV4 - SN3837; ConvF(9.72, 9.72, 9.72) @ 836.5 MHz; Calibrated: 1/20/2020
Sensor-Surface: 1.4mm (Mechanical Surface Detection)
Electronics: DAE4 Sn793; Calibrated: 1/14/2020
Phantom: Twin-SAM V4.0 Sub; Type: QD 000 P40 CC; Serial: 1357
Measurement SW: DASY52, Version 52.10 (4);SEMCAD X Version 14.6.14 (7483)

Mode: LTE Band 5 (Cell.), Head SAR, Front side, Mid.ch, 10 MHz Bandwidth, QPSK, 1 RB, 0 RB Offset, Aluminum, Sport Wristband

Area Scan (6x6x1): Measurement grid: dx=15mm, dy=15mm
Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 0.6720 V/m; Power Drift = 0.13 dB
Peak SAR (extrapolated) = 0.00124 W/kg
SAR(1 g) = 0.000197 W/kg
Smallest distance from peaks to all points 3 dB below: Larger than measurement grid
Ratio of SAR at M2 to SAR at M1 = 36.6%



PCTEST

DUT: BCG-A2355; Type: Watch; Serial: DVPCR032Q7TP

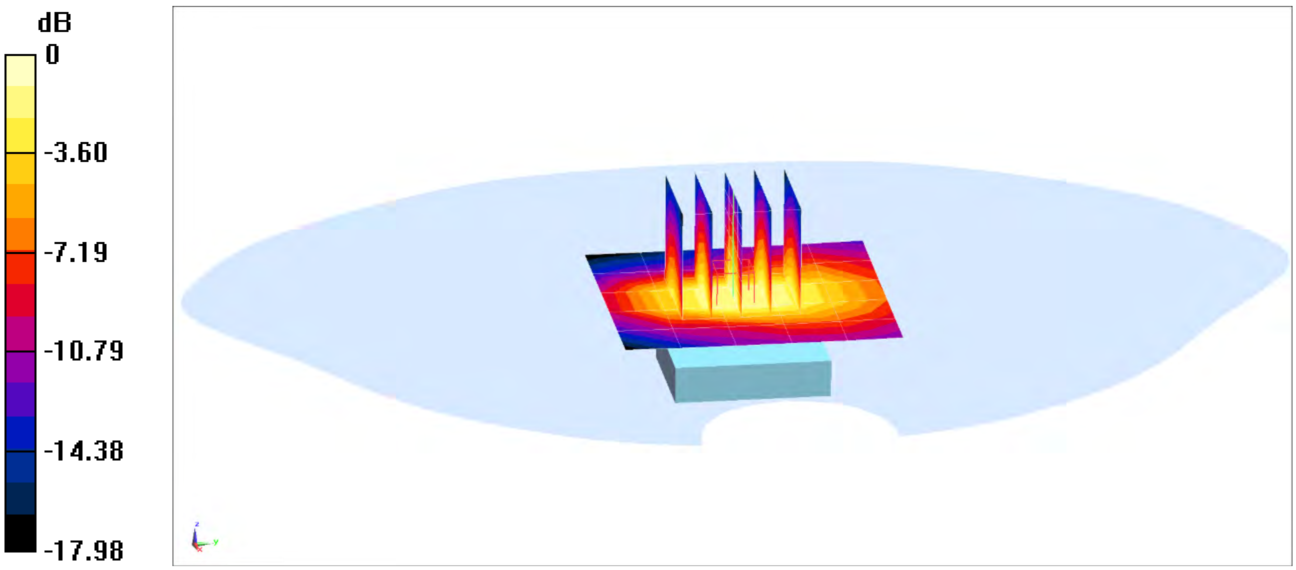
Communication System: UID 0, LTE Band 66 (AWS); Frequency: 1745 MHz; Duty Cycle: 1:1
Medium: 1750 MHz Head Medium parameters used (interpolated):
f = 1745 MHz; σ = 1.346 S/m; ε_r = 38.86; ρ = 1000 kg/m^3
Phantom section: Flat Section; Space: 1.0 cm

Test Date: 08-28-2020; Ambient Temp: 22.1°C; Tissue Temp: 20.8°C

Probe: EX3DV4 - SN3837; ConvF(8.62, 8.62, 8.62) @ 1745 MHz; Calibrated: 1/20/2020
Sensor-Surface: 1.4mm (Mechanical Surface Detection)
Electronics: DAE4 Sn793; Calibrated: 1/14/2020
Phantom: SAM Main; Type: SAM 4.0; Serial: TP-1406
Measurement SW: DASY52, Version 52.10 (4);SEMCAD X Version 14.6.14 (7483)

Mode: LTE Band 66 (AWS), Head SAR, Front side, Mid.ch, 20 MHz Bandwidth, QPSK, 1 RB, 0 RB Offset, Aluminum, Metal Loop Wristband

Area Scan (6x6x1): Measurement grid: dx=15mm, dy=15mm
Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 15.68 V/m; Power Drift = -0.12 dB
Peak SAR (extrapolated) = 0.532 W/kg
SAR(1 g) = 0.304 W/kg
Smallest distance from peaks to all points 3 dB below = 11.2 mm
Ratio of SAR at M2 to SAR at M1 = 61.8%



0 dB = 0.439 W/kg = -3.58 dBW/kg

PCTEST

DUT: BCG-A2355; Type: Watch; Serial: DVPCR03TQ7TP

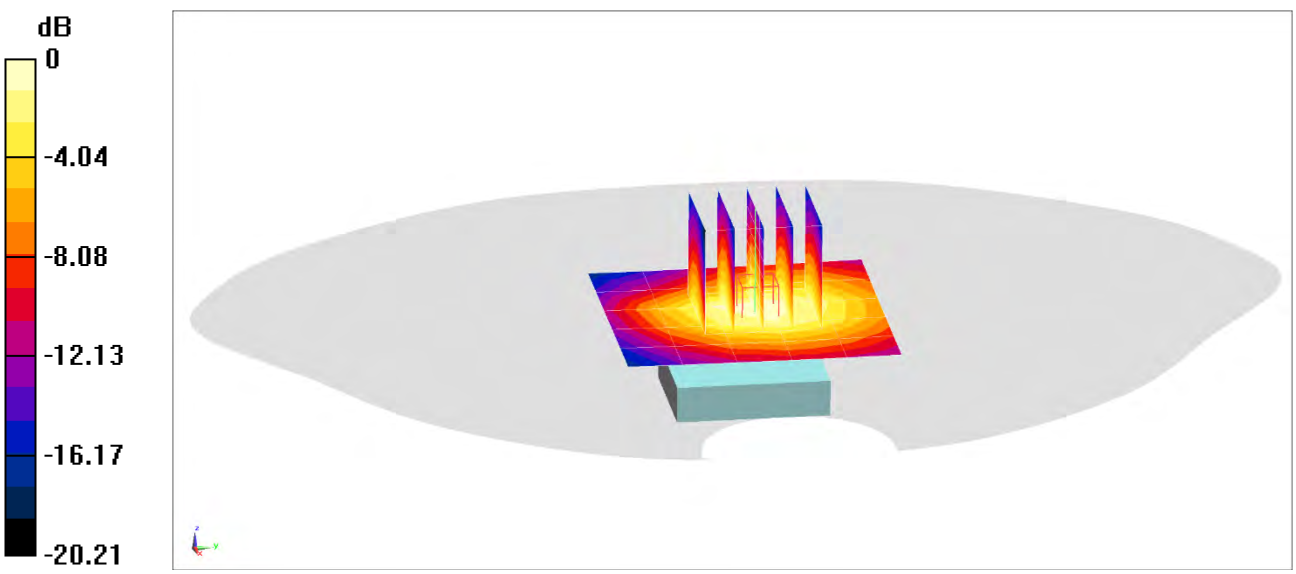
Communication System: UID 0, LTE Band 25 (PCS); Frequency: 1882.5 MHz; Duty Cycle: 1:1
Medium: 1900 MHz Head Medium parameters used (interpolated):
f = 1882.5 MHz; σ = 1.428 S/m; ε_r = 39.416; ρ = 1000 kg/m^3
Phantom section: Flat Section; Space: 1.0 cm

Test Date: 07-08-2020; Ambient Temp: 23.5°C; Tissue Temp: 21.3°C

Probe: EX3DV4 - SN3837; ConvF(8.28, 8.28, 8.28) @ 1882.5 MHz; Calibrated: 1/20/2020
Sensor-Surface: 1.4mm (Mechanical Surface Detection)
Electronics: DAE4 Sn793; Calibrated: 1/14/2020
Phantom: Twin-SAM V4.0 Main; Type: QD 000 P40 CC; Serial: 1114
Measurement SW: DASY52, Version 52.10 (4);SEMCAD X Version 14.6.14 (7483)

Mode: LTE Band 25 (PCS), Head SAR, Front side, Mid.ch, 20 MHz Bandwidth, QPSK, 1 RB, 99 RB Offset, Aluminum, Metal Loop Wristband

Area Scan (6x6x1): Measurement grid: dx=15mm, dy=15mm
Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 14.19 V/m; Power Drift = 0.01 dB
Peak SAR (extrapolated) = 0.474 W/kg
SAR(1 g) = 0.270 W/kg
Smallest distance from peaks to all points 3 dB below = 14.8 mm
Ratio of SAR at M2 to SAR at M1 = 59.1%



0 dB = 0.392 W/kg = -4.07 dBW/kg

PCTEST

DUT: BCG-A2355; Type: Watch; Serial: DVPCR04JQ7TP

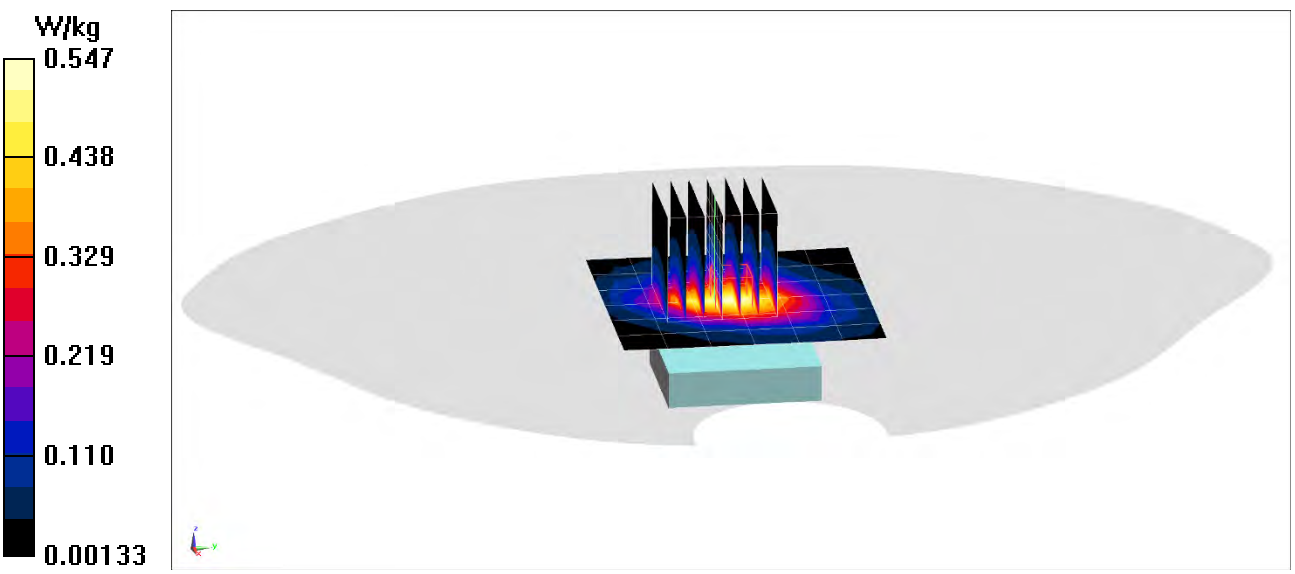
Communication System: UID 0, _LTE Band 7; Frequency: 2510 MHz; Duty Cycle: 1:1
Medium: 2450-2600 MHz Head Medium parameters used (interpolated):
f = 2510 MHz; σ = 1.943 S/m; ε_r = 38.741; ρ = 1000 kg/m^3
Phantom section: Flat Section; Space: 1.0 cm

Test Date: 07-13-2020; Ambient Temp: 21.1°C; Tissue Temp: 20.7°C

Probe: EX3DV4 - SN7490; ConvF(7.84, 7.84, 7.84) @ 2510 MHz; Calibrated: 12/13/2019
Sensor-Surface: 1.4mm (Mechanical Surface Detection)
Electronics: DAE4 Sn1532; Calibrated: 12/5/2019
Phantom: Twin-SAM V4.0 SUB use; Type: QD 000 P40 CC; Serial: 1403
Measurement SW: DASY52, Version 52.10 (4);SEMCAD X Version 14.6.14 (7483)

Mode: LTE Band 7, Head SAR, Front side, Low.ch, 20 MHz Bandwidth, QPSK, 1 RB, 99 RB Offset, Aluminum, Sport Wristband

Area Scan (7x7x1): Measurement grid: dx=12mm, dy=12mm
Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 14.07 V/m; Power Drift = -0.08 dB
Peak SAR (extrapolated) = 0.684 W/kg
SAR(1 g) = 0.359 W/kg
Smallest distance from peaks to all points 3 dB below = 11.7 mm
Ratio of SAR at M2 to SAR at M1 = 52.5%



PCTEST

DUT: BCG-A2355; Type: Watch; Serial: DVPCR04KQ7TP

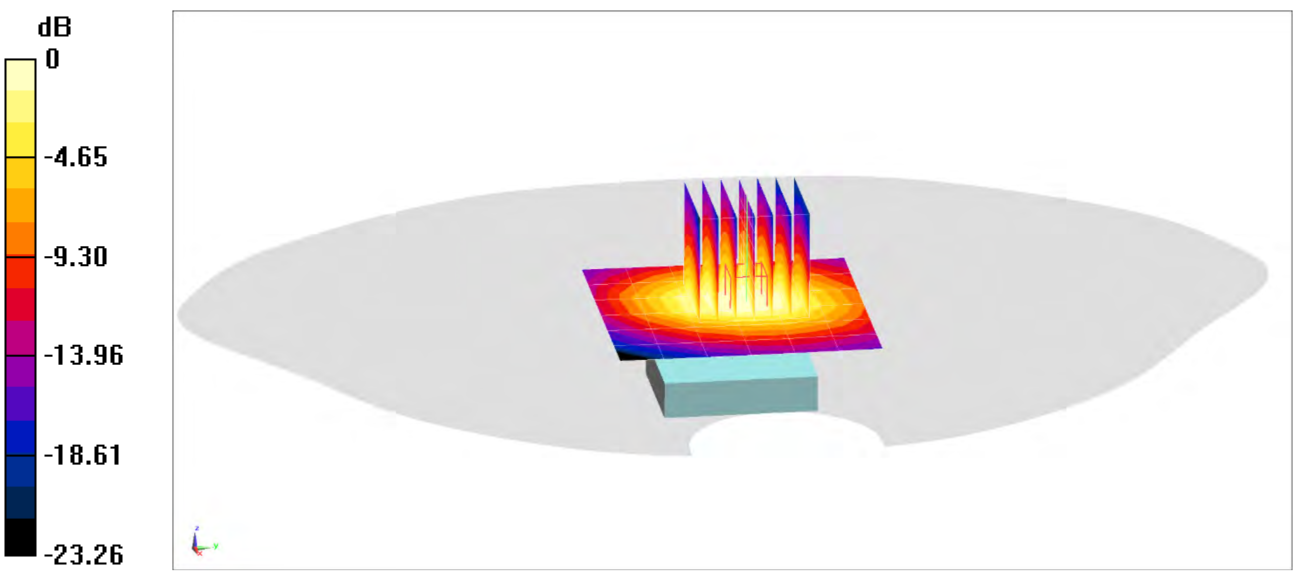
Communication System: UID 0, _LTE Band 41; Frequency: 2593 MHz; Duty Cycle: 1:1.58
Medium: 2450-2600 MHz Head Medium parameters used (interpolated):
f = 2593 MHz; σ = 1.889 S/m; ε_r = 37.825; ρ = 1000 kg/m^3
Phantom section: Flat Section; Space: 1.0 cm

Test Date: 07-13-2020; Ambient Temp: 22.5°C; Tissue Temp: 21.4°C

Probe: EX3DV4 - SN7427; ConvF(7, 7, 7) @ 2593 MHz; Calibrated: 2/19/2020
Sensor-Surface: 1.4mm (Mechanical Surface Detection)
Electronics: DAE4 Sn1403; Calibrated: 2/13/2020
Phantom: Twin-SAM V4.0; Type: QD 000 P40 CD; Serial: 1736
Measurement SW: DASY52, Version 52.10 (4);SEMCAD X Version 14.6.14 (7483)

Mode: LTE Band 41, Head SAR, Front side, Mid.ch, 20 MHz Bandwidth, QPSK, 1 RB, 50 RB Offset, Aluminum, Sport Wristband

Area Scan (7x7x1): Measurement grid: dx=12mm, dy=12mm
Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 14.92 V/m; Power Drift = 0.01 dB
Peak SAR (extrapolated) = 0.675 W/kg
SAR(1 g) = 0.380 W/kg
Smallest distance from peaks to all points 3 dB below = 14 mm
Ratio of SAR at M2 to SAR at M1 = 56.7%



0 dB = 0.565 W/kg = -2.48 dBW/kg

PCTEST

DUT: BCG-A2355; Type: Watch; Serial: DVPCR04JQ7TP

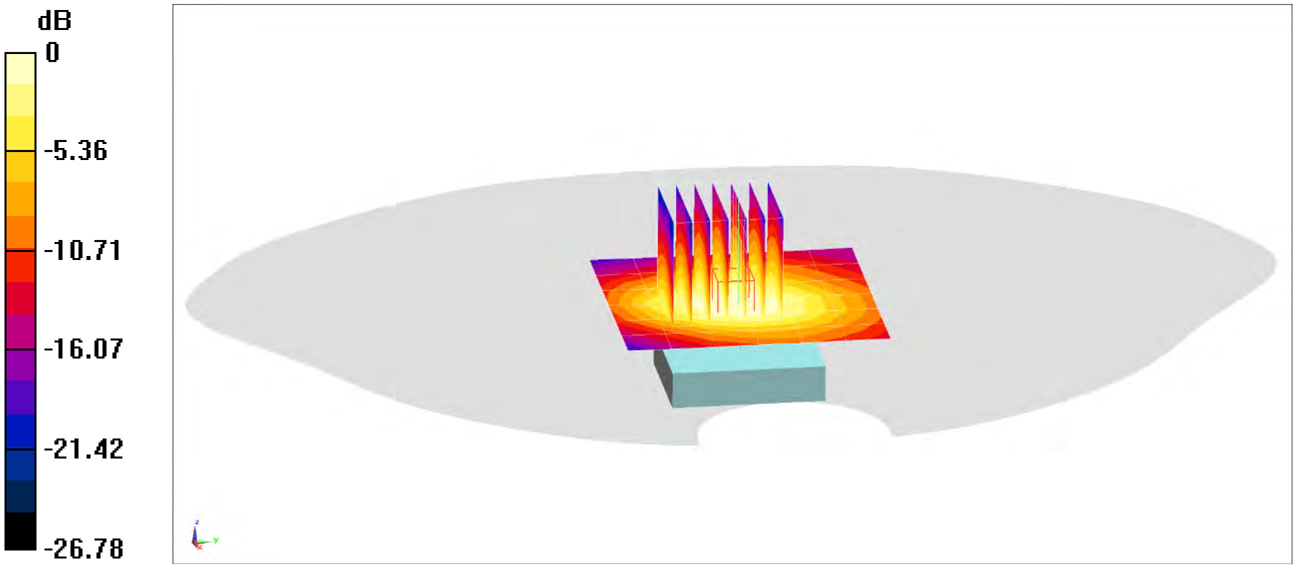
Communication System: UID 0, IEEE 802.11b; Frequency: 2412 MHz; Duty Cycle: 1:1
Medium: 2450-2600 MHz Head Medium parameters used (interpolated):
f = 2412 MHz; σ = 1.833 S/m; ε_r = 39.096; ρ = 1000 kg/m^3
Phantom section: Flat Section; Space: 1.0 cm

Test Date: 07-13-2020; Ambient Temp: 21.1°C; Tissue Temp: 20.7°C

Probe: EX3DV4 - SN7490; ConvF(7.84, 7.84, 7.84) @ 2412 MHz; Calibrated: 12/13/2019
Sensor-Surface: 1.4mm (Mechanical Surface Detection)
Electronics: DAE4 Sn1532; Calibrated: 12/5/2019
Phantom: Twin-SAM V4.0 SUB use; Type: QD 000 P40 CC; Serial: 1403
Measurement SW: DASY52, Version 52.10 (4);SEMCAD X Version 14.6.14 (7483)

Mode: IEEE 802.11b, 22 MHz Bandwidth, Head SAR, Ch 1, 1 Mbps, Front Side, Aluminum, Sport Wristband

Area Scan (7x7x1): Measurement grid: dx=12mm, dy=12mm
Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 12.10 V/m; Power Drift = 0.01 dB
Peak SAR (extrapolated) = 0.454 W/kg
SAR(1 g) = 0.248 W/kg
Smallest distance from peaks to all points 3 dB below = 9.9 mm
Ratio of SAR at M2 to SAR at M1 = 57.2%



0 dB = 0.365 W/kg = -4.38 dBW/kg

PCTEST

DUT: BCG-A2355; Type: Watch; Serial: DVPCR03NQ7TP

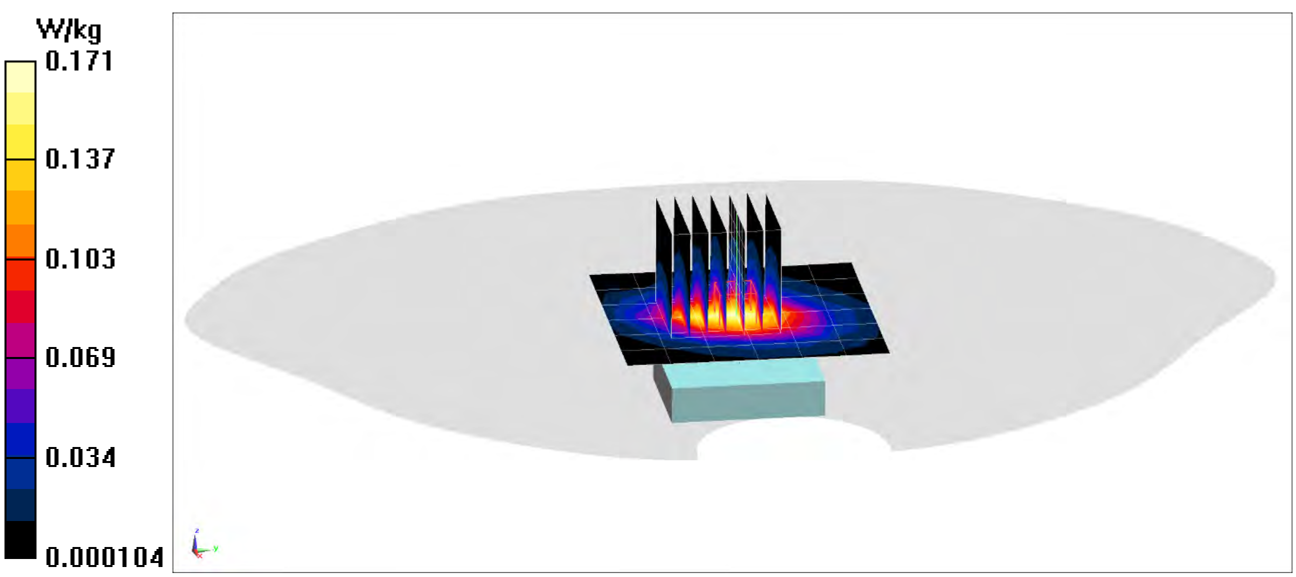
Communication System: UID 0, Bluetooth; Frequency: 2480 MHz; Duty Cycle: 1:1
Medium: 2450-2600 MHz Head Medium parameters used (interpolated):
f = 2480 MHz; σ = 1.909 S/m; ε_r = 38.856; ρ = 1000 kg/m^3
Phantom section: Flat Section; Space: 1.0 cm

Test Date: 07-13-2020; Ambient Temp: 21.1°C; Tissue Temp: 20.7°C

Probe: EX3DV4 - SN7490; ConvF(7.84, 7.84, 7.84) @ 2480 MHz; Calibrated: 12/13/2019
Sensor-Surface: 1.4mm (Mechanical Surface Detection)
Electronics: DAE4 Sn1532; Calibrated: 12/5/2019
Phantom: Twin-SAM V4.0 SUB use; Type: QD 000 P40 CC; Serial: 1403
Measurement SW: DASY52, Version 52.10 (4);SEMCAD X Version 14.6.14 (7483)

Mode: Bluetooth, Head SAR, Ch 78, 1 Mbps, Front Side, Aluminum, Sport Wristband

Area Scan (7x7x1): Measurement grid: dx=12mm, dy=12mm
Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 8.074 V/m; Power Drift = 0.01 dB
Peak SAR (extrapolated) = 0.217 W/kg
SAR(1 g) = 0.114 W/kg
Smallest distance from peaks to all points 3 dB below = 12.1 mm
Ratio of SAR at M2 to SAR at M1 = 54.8%



PCTEST

DUT: BCG-A2355; Type: Watch; Serial: DVPCR032Q7TP

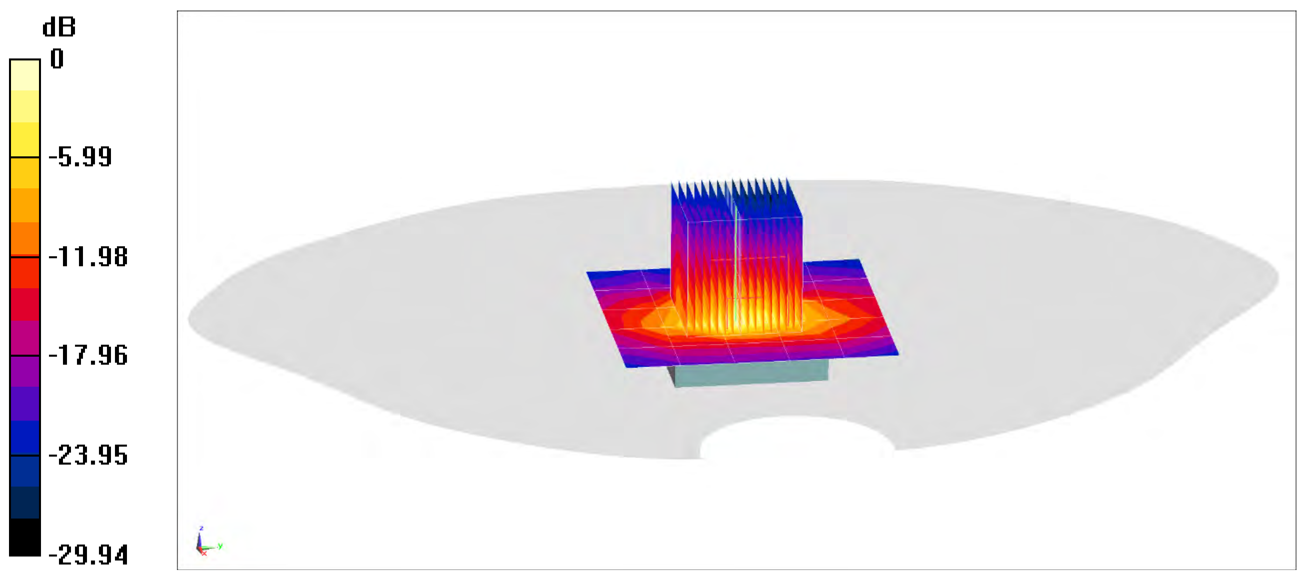
Communication System: UID 0, UMTS; Frequency: 836.6 MHz; Duty Cycle: 1:1
Medium: 835 MHz Body Medium parameters used (interpolated):
f = 836.6 MHz; σ = 0.99 S/m; ε_r = 53.741; ρ = 1000 kg/m^3
Phantom section: Flat Section; Space: 0.0 cm

Test Date: 07-16-2020; Ambient Temp: 23.0°C; Tissue Temp: 22.3°C

Probe: EX3DV4 - SN7421; ConvF(9.42, 9.42, 9.42) @ 836.6 MHz; Calibrated: 3/20/2020
Sensor-Surface: 1.4mm (Mechanical Surface Detection)
Electronics: DAE4 Sn604; Calibrated: 3/19/2020
Phantom: Twin-SAM V4.0; Type: QD 000 P40 CC; Serial: 1179
Measurement SW: DASY52, Version 52.10 (4);SEMCAD X Version 14.6.14 (7483)

Mode: UMTS 850, Extremity SAR, Back side, Mid.ch
Aluminum, Metal Links Wristband

Area Scan (6x6x1): Measurement grid: dx=15mm, dy=15mm
Zoom Scan (16x16x8)/Cube 0: Measurement grid: dx=2.1mm, dy=2.1mm, dz=1.4mm; Graded Ratio: 1.4
Reference Value = 15.56 V/m; Power Drift = 0.08 dB
Peak SAR (extrapolated) = 3.79 W/kg
SAR(10 g) = 0.189 W/kg
Smallest distance from peaks to all points 3 dB below = 3.4 mm
Ratio of SAR at M2 to SAR at M1 = 51.8%



0 dB = 1.43 W/kg = 1.55 dBW/kg

PCTEST

DUT: BCG-A2355; Type: Watch; Serial: DVPCR03NQ7TP

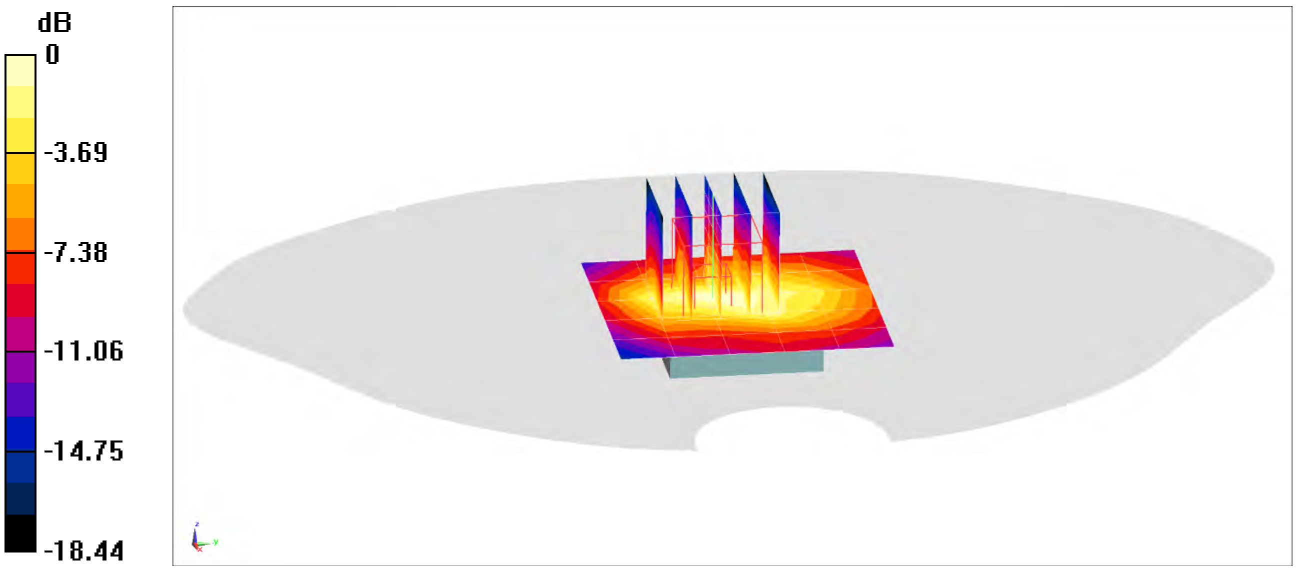
Communication System: UID 0, UMTS; Frequency: 1732.4 MHz; Duty Cycle: 1:1
Medium: 1750 MHz Body Medium parameters used (interpolated):
f = 1732.4 MHz; σ = 1.453 S/m; ε_r = 52.487; ρ = 1000 kg/m^3
Phantom section: Flat Section; Space: 0.0 cm

Test Date: 07-08-2020; Ambient Temp: 22.0°C; Tissue Temp: 20.9°C

Probe: EX3DV4 - SN7532; ConvF(8.34, 8.34, 8.34) @ 1732.4 MHz; Calibrated: 4/20/2020
Sensor-Surface: 1.4mm (Mechanical Surface Detection)
Electronics: DAE4 Sn501; Calibrated: 4/15/2020
Phantom: Twin-SAM V8.0_Left; Type: QD 000 P41 AA; Serial: 1935
Measurement SW: DASY52, Version 52.10 (4);SEMCAD X Version 14.6.14 (7483)

Mode: UMTS 1750, Extremity SAR, Back side, Mid.ch Aluminum, Sport Wristband

Area Scan (6x6x1): Measurement grid: dx=15mm, dy=15mm
Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 8.635 V/m; Power Drift = 0.16 dB
Peak SAR (extrapolated) = 0.229 W/kg
SAR(10 g) = 0.056 W/kg
Smallest distance from peaks to all points 3 dB below = 10.7 mm
Ratio of SAR at M2 to SAR at M1 = 46.7%



0 dB = 0.171 W/kg = -7.67 dBW/kg

PCTEST

DUT: BCG-A2355; Type: Watch; Serial: DVPCR04KQ7TP

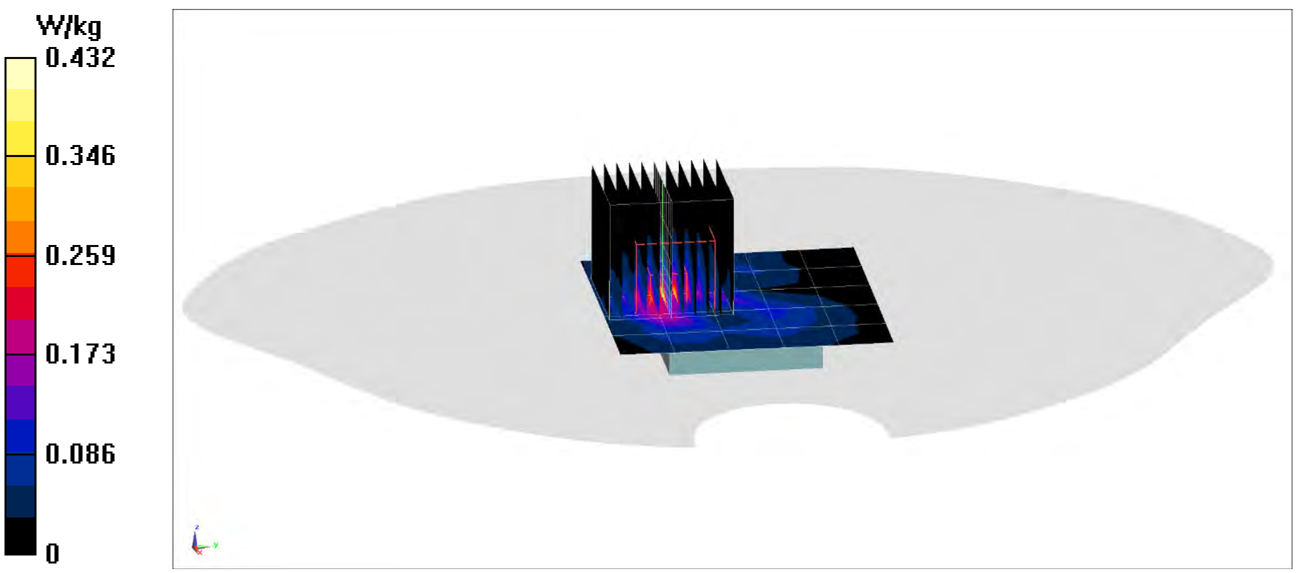
Communication System: UID 0, UMTS; Frequency: 1880 MHz; Duty Cycle: 1:1
Medium: 1900 MHz Body Medium parameters used:
f = 1880 MHz; σ = 1.569 S/m; ε_r = 51.216; ρ = 1000 kg/m^3
Phantom section: Flat Section; Space: 0.0 cm

Test Date: 07-13-2020; Ambient Temp: 23.6°C; Tissue Temp: 20.5°C

Probe: EX3DV4 - SN3837; ConvF(7.68, 7.68, 7.68) @ 1880 MHz; Calibrated: 1/20/2020
Sensor-Surface: 1.4mm (Mechanical Surface Detection)
Electronics: DAE4 Sn793; Calibrated: 1/14/2020
Phantom: Twin-SAM V4.0 Main; Type: QD 000 P40 CC; Serial: 1114
Measurement SW: DASY52, Version 52.10 (4);SEMCAD X Version 14.6.14 (7483)

Mode: UMTS 1900, Extremity SAR, Back side, Mid.ch
Aluminum, Metal Links Wristband

Area Scan (6x6x1): Measurement grid: dx=15mm, dy=15mm
Zoom Scan (11x11x8)/Cube 0: Measurement grid: dx=3.4mm, dy=3.4mm, dz=1.4mm; Graded Ratio: 1.4
Reference Value = 11.78 V/m; Power Drift = -0.19 dB
Peak SAR (extrapolated) = 0.672 W/kg
SAR(10 g) = 0.084 W/kg
Smallest distance from peaks to all points 3 dB below = 6.3 mm
Ratio of SAR at M2 to SAR at M1 = 75.5%



PCTEST

DUT: BCG-A2355; Type: Watch; Serial: DVPCR035Q7TP

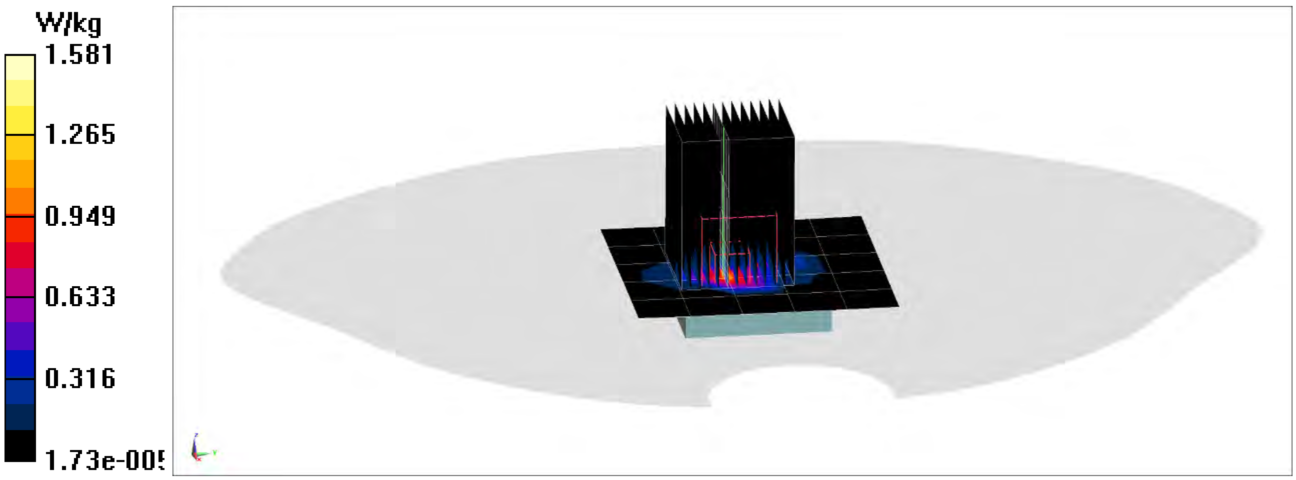
Communication System: UID 0, _LTE Band 26; Frequency: 819 MHz; Duty Cycle: 1:1
Medium: 835 MHz Body Medium parameters used (interpolated):
f = 819 MHz; σ = 0.994 S/m; ε_r = 53.068; ρ = 1000 kg/m^3
Phantom section: Flat Section; Space: 0.0 cm

Test Date: 07-13-2020; Ambient Temp: 24.4°C; Tissue Temp: 20.5°C

Probe: EX3DV4 - SN3837; ConvF(9.37, 9.37, 9.37) @ 819 MHz; Calibrated: 1/20/2020
Sensor-Surface: 1.4mm (Mechanical Surface Detection)
Electronics: DAE4 Sn793; Calibrated: 1/14/2020
Phantom: Twin-SAM V4.0 Main; Type: QD 000 P40 CC; Serial: 1114
Measurement SW: DASY52, Version 52.10 (4);SEMCAD X Version 14.6.14 (7483)

Mode: LTE Band 26 (Cell.), Extremity SAR, Back side, Low.ch, 10 MHz Bandwidth, QPSK, 1 RB, 0 RB Offset, Aluminum, Metal Links Wristband

Area Scan (6x6x1): Measurement grid: dx=15mm, dy=15mm
Zoom Scan (13x13x8)/Cube 0: Measurement grid: dx=2.7mm, dy=2.7mm, dz=1.4mm; Graded Ratio: 1.4
Reference Value = 17.08 V/m; Power Drift = -0.15 dB
Peak SAR (extrapolated) = 6.72 W/kg
SAR(10 g) = 0.146 W/kg
Smallest distance from peaks to all points 3 dB below is larger than 2.7 mm
Ratio of SAR at M2 to SAR at M1 = 41.5%



DUT: BCG-A2355; Type: Watch; Serial: DVPCR032Q7TP

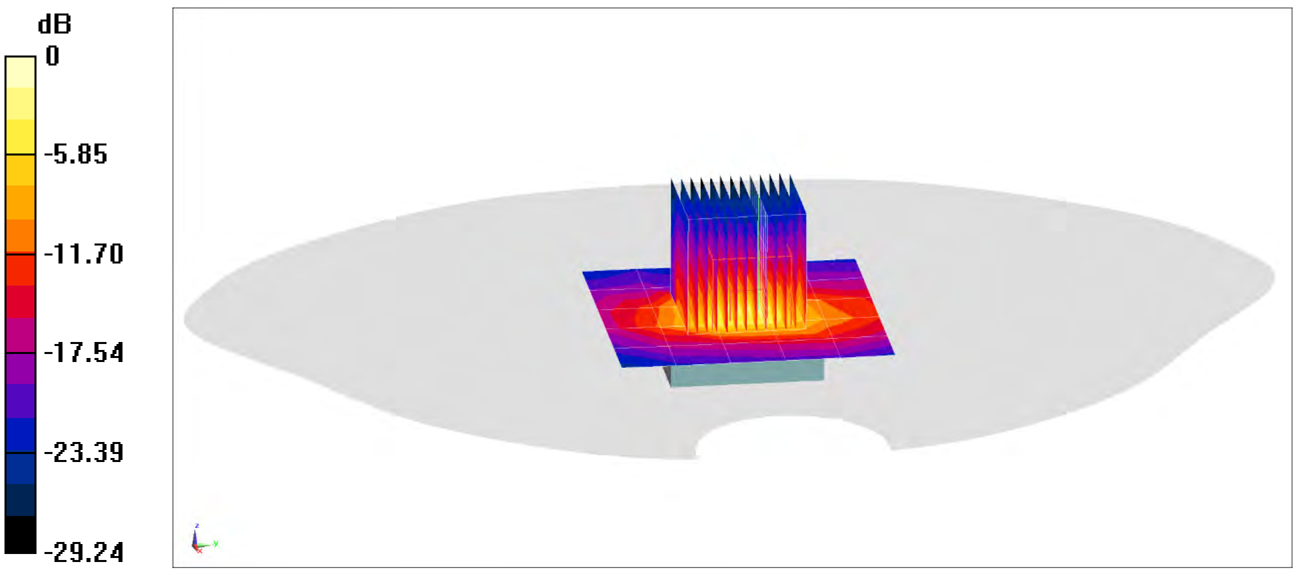
Communication System: UID 0, LTE Band 5; Frequency: 836.5 MHz; Duty Cycle: 1:1
Medium: 835 MHz Body Medium parameters used (interpolated):
f = 836.5 MHz; σ = 0.99 S/m; ε_r = 53.742; ρ = 1000 kg/m^3
Phantom section: Flat Section; Space: 0.0 cm

Test Date: 07-16-2020; Ambient Temp: 23.0°C; Tissue Temp: 22.3°C

Probe: EX3DV4 - SN7421; ConvF(9.42, 9.42, 9.42) @ 836.5 MHz; Calibrated: 3/20/2020
Sensor-Surface: 1.4mm (Mechanical Surface Detection)
Electronics: DAE4 Sn604; Calibrated: 3/19/2020
Phantom: Twin-SAM V4.0; Type: QD 000 P40 CC; Serial: 1179
Measurement SW: DASY52, Version 52.10 (4);SEMCAD X Version 14.6.14 (7483)

Mode: LTE Band 5 (Cell.), Extremity SAR, Back side, Mid.ch, 10 MHz Bandwidth, QPSK, 1 RB, 0 RB Offset, Aluminum, Metal Links Wristband

Area Scan (6x6x1): Measurement grid: dx=15mm, dy=15mm
Zoom Scan (13x13x8)/Cube 0: Measurement grid: dx=2.7mm, dy=2.7mm, dz=1.4mm; Graded Ratio: 1.4
Reference Value = 13.94 V/m; Power Drift = -0.18 dB
Peak SAR (extrapolated) = 4.80 W/kg
SAR(10 g) = 0.168 W/kg
Smallest distance from peaks to all points 3 dB below = 2.9 mm
Ratio of SAR at M2 to SAR at M1 = 45.3%



0 dB = 1.50 W/kg = 1.76 dBW/kg

PCTEST

DUT: BCG-A2355; Type: Watch; Serial: DVPCR03NQ7TP

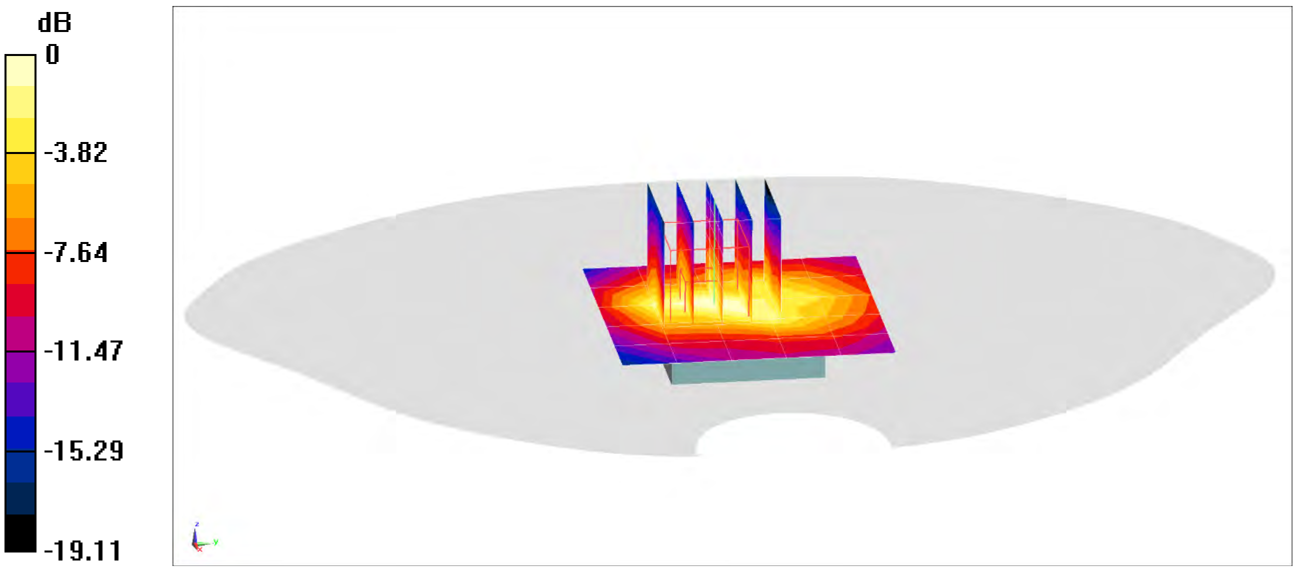
Communication System: UID 0, LTE Band 66 (AWS); Frequency: 1745 MHz; Duty Cycle: 1:1
Medium: 1750 MHz Body Medium parameters used (interpolated):
f = 1745 MHz; σ = 1.461 S/m; ε_r = 52.477; ρ = 1000 kg/m^3
Phantom section: Flat Section; Space: 0.0 cm

Test Date: 07-08-2020; Ambient Temp: 22.0°C; Tissue Temp: 20.9°C

Probe: EX3DV4 - SN7532; ConvF(8.34, 8.34, 8.34) @ 1745 MHz; Calibrated: 4/20/2020
Sensor-Surface: 1.4mm (Mechanical Surface Detection)
Electronics: DAE4 Sn501; Calibrated: 4/15/2020
Phantom: Twin-SAM V8.0_Left; Type: QD 000 P41 AA; Serial: 1935
Measurement SW: DASY52, Version 52.10 (4);SEMCAD X Version 14.6.14 (7483)

Mode: LTE Band 66 (AWS), Extremity SAR, Back side, Mid.ch, 20 MHz Bandwidth, QPSK, 1 RB, 0 RB Offset, Aluminum, Sport Wristband

Area Scan (6x6x1): Measurement grid: dx=15mm, dy=15mm
Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 8.868 V/m; Power Drift = 0.12 dB
Peak SAR (extrapolated) = 0.227 W/kg
SAR(10 g) = 0.056 W/kg
Smallest distance from peaks to all points 3 dB below = 10.1 mm
Ratio of SAR at M2 to SAR at M1 = 46.6%



0 dB = 0.177 W/kg = -7.52 dBW/kg

PCTEST

DUT: BCG-A2355; Type: Watch; Serial: DVPCR04KQ7TP

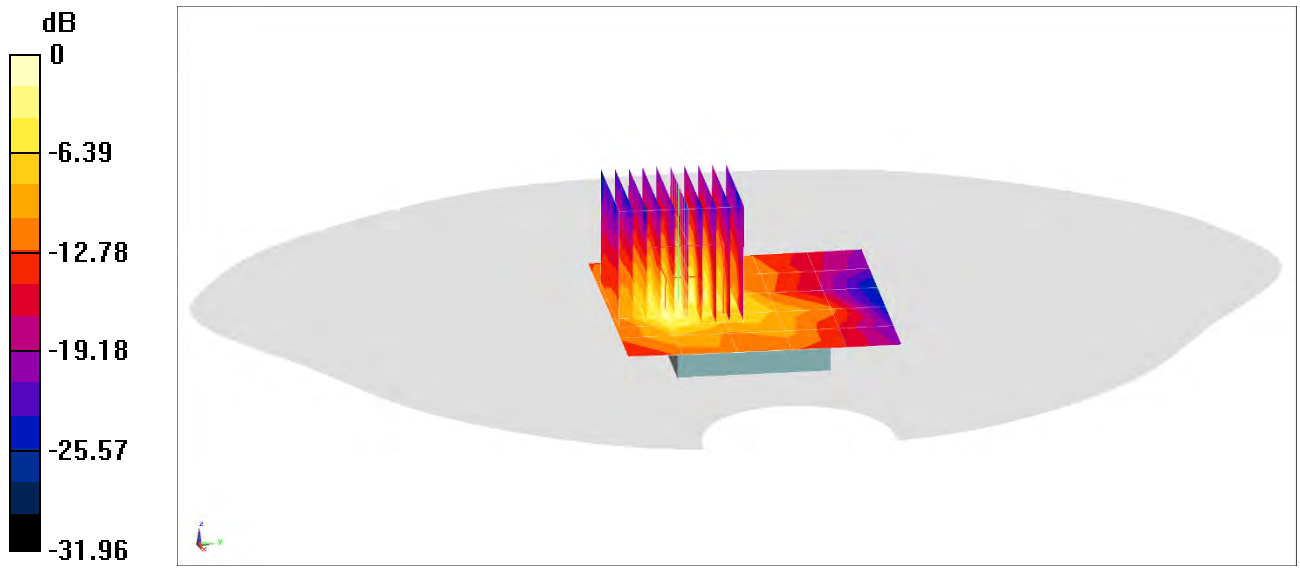
Communication System: UID 0, LTE Band 25 (PCS); Frequency: 1882.5 MHz; Duty Cycle: 1:1
Medium: 1900 MHz Body Medium parameters used (interpolated):
f = 1882.5 MHz; σ = 1.549 S/m; ε_r = 51.325; ρ = 1000 kg/m^3
Phantom section: Flat Section; Space: 0.0 cm

Test Date: 07-20-2020; Ambient Temp: 21.9°C; Tissue Temp: 21.0°C

Probe: EX3DV4 - SN3837; ConvF(7.68, 7.68, 7.68) @ 1882.5 MHz; Calibrated: 1/20/2020
Sensor-Surface: 1.4mm (Mechanical Surface Detection)
Electronics: DAE4 Sn793; Calibrated: 1/14/2020
Phantom: Twin-SAM V4.0 Main; Type: QD 000 P40 CC; Serial: 1114
Measurement SW: DASY52, Version 52.10 (4);SEMCAD X Version 14.6.14 (7483)

Mode: LTE Band 25 (PCS), Extremity SAR, Back side, Mid.ch, 20 MHz Bandwidth, QPSK, 1 RB, 99 RB Offset, Aluminum, Metal Links Wristband

Area Scan (6x6x1): Measurement grid: dx=15mm, dy=15mm
Zoom Scan (10x10x8)/Cube 0: Measurement grid: dx=3.8mm, dy=3.8mm, dz=1.4mm; Graded Ratio: 1.4
Reference Value = 16.16 V/m; Power Drift = -0.14 dB
Peak SAR (extrapolated) = 0.754 W/kg
SAR(10 g) = 0.099 W/kg
Smallest distance from peaks to all points 3 dB below = 6.1 mm
Ratio of SAR at M2 to SAR at M1 = 75.3%



0 dB = 0.533 W/kg = -2.73 dBW/kg

PCTEST

DUT: BCG-A2355; Type: Watch; Serial: DVPCR04JQ7TP

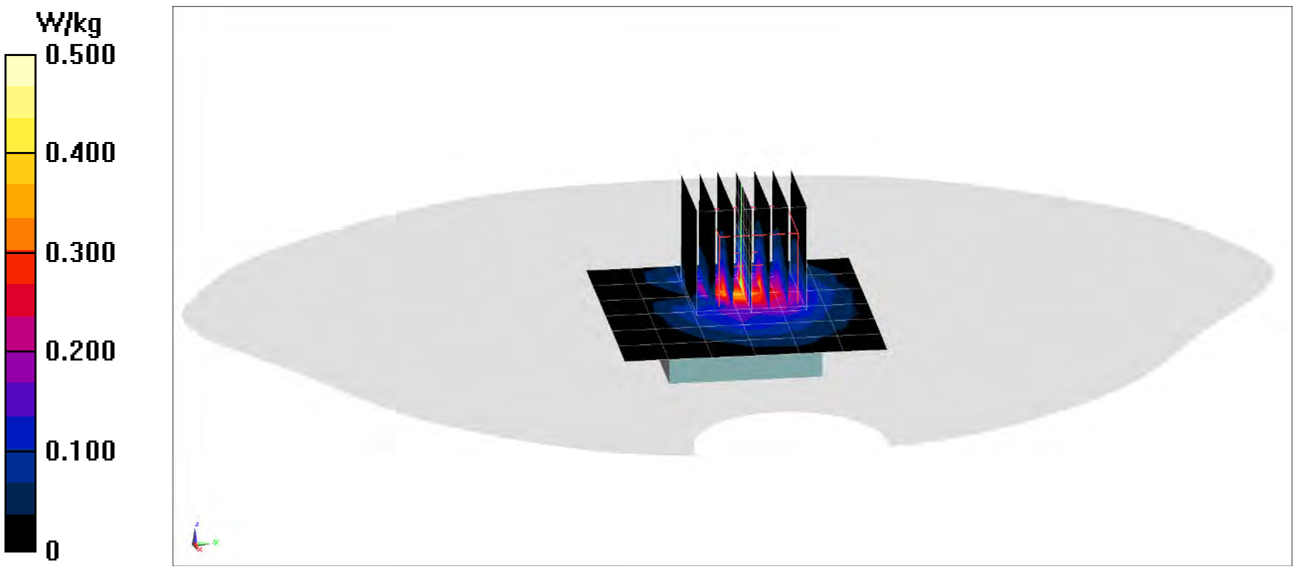
Communication System: UID 0, _LTE Band 7; Frequency: 2510 MHz; Duty Cycle: 1:1
Medium: 2450-2600 MHz Body Medium parameters used (interpolated):
f = 2510 MHz; σ = 2.111 S/m; ε_r = 51.808; ρ = 1000 kg/m^3
Phantom section: Flat Section; Space: 0.0 cm

Test Date: 07-04-2020; Ambient Temp: 22.7°C; Tissue Temp: 22.2°C

Probe: EX3DV4 - SN3949; ConvF(7.75, 7.75, 7.75) @ 2510 MHz; Calibrated: 8/29/2019
Sensor-Surface: 1.4mm (Mechanical Surface Detection)
Electronics: DAE4 Sn1408; Calibrated: 8/12/2019
Phantom: Twin-SAM V4.0; Type: QD 000 P40 CC; Serial: 1596
Measurement SW: DASY52, Version 52.10 (4);SEMCAD X Version 14.6.14 (7483)

Mode: LTE Band 7, Extremity SAR, Back side, Low.ch, 20 MHz Bandwidth, QPSK, 1 RB, 99 RB Offset, Aluminum, Metal Links Wristband

Area Scan (7x7x1): Measurement grid: dx=12mm, dy=12mm
Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 11.78 V/m; Power Drift = -0.18 dB
Peak SAR (extrapolated) = 0.622 W/kg
SAR(10 g) = 0.107 W/kg
Smallest distance from peaks to all points 3 dB below = 6.7 mm
Ratio of SAR at M2 to SAR at M1 = 48.2%



PCTEST

DUT: BCG-A2355; Type: Watch; Serial: DVPCR04KQ7TP

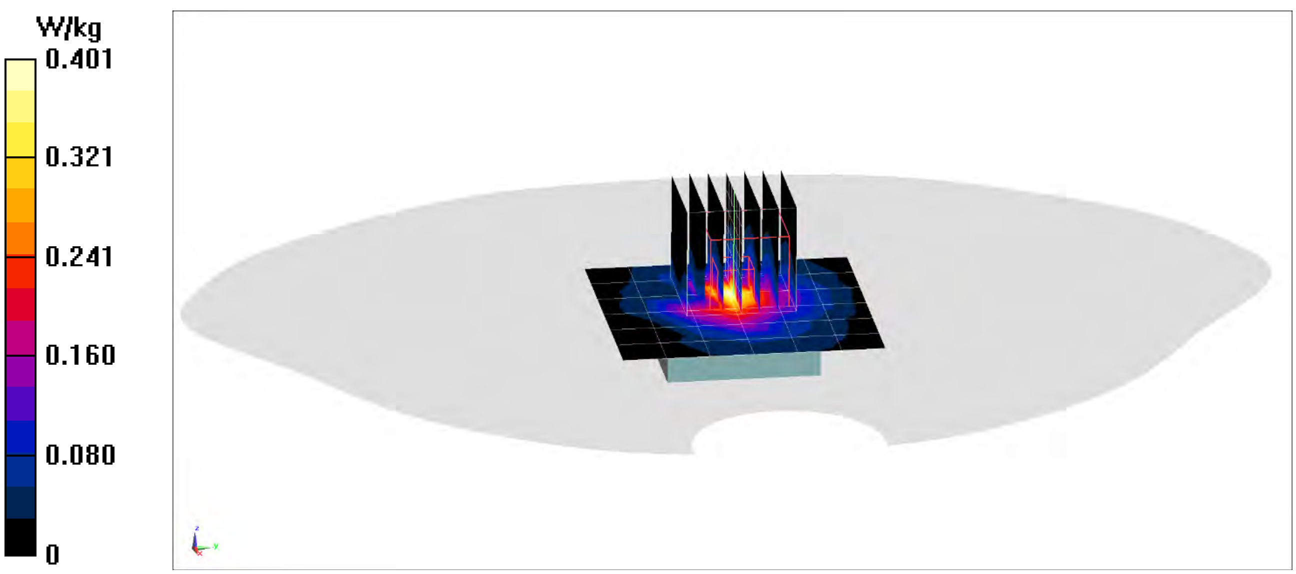
Communication System: UID 0, LTE Band 41 (Class 3); Frequency: 2593 MHz; Duty Cycle: 1:1.58
Medium: 2450-2600 MHz Body Medium parameters used (interpolated):
f = 2593 MHz; σ = 2.219 S/m; ε_r = 51.449; ρ = 1000 kg/m^3
Phantom section: Flat Section; Space: 0.0 cm

Test Date: 07-15-2020; Ambient Temp: 22.7°C; Tissue Temp: 20.5°C

Probe: EX3DV4 - SN7416; ConvF(7.23, 7.23, 7.23) @ 2593 MHz; Calibrated: 6/22/2020
Sensor-Surface: 1.4mm (Mechanical Surface Detection)
Electronics: DAE4 Sn701; Calibrated: 6/11/2020
Phantom: Twin-SAM V8.0; Type: QD 000 P41 Ax; Serial: 1936
Measurement SW: DASY52, Version 52.10 (4);SEMCAD X Version 14.6.14 (7483)

Mode: LTE Band 41, Extremity SAR, Back side, Mid Ch, 20 MHz Bandwidth, QPSK, 1 RB, 50 RB Offset, Aluminum, Metal Links Wristband

Area Scan (7x7x1): Measurement grid: dx=12mm, dy=12mm
Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 11.02 V/m; Power Drift = 0.09 dB
Peak SAR (extrapolated) = 0.518 W/kg
SAR(10 g) = 0.088 W/kg
Smallest distance from peaks to all points 3 dB below = 7 mm
Ratio of SAR at M2 to SAR at M1 = 49%



PCTEST

DUT: BCG-A2355; Type: Watch; Serial: DVPCR035Q7TP

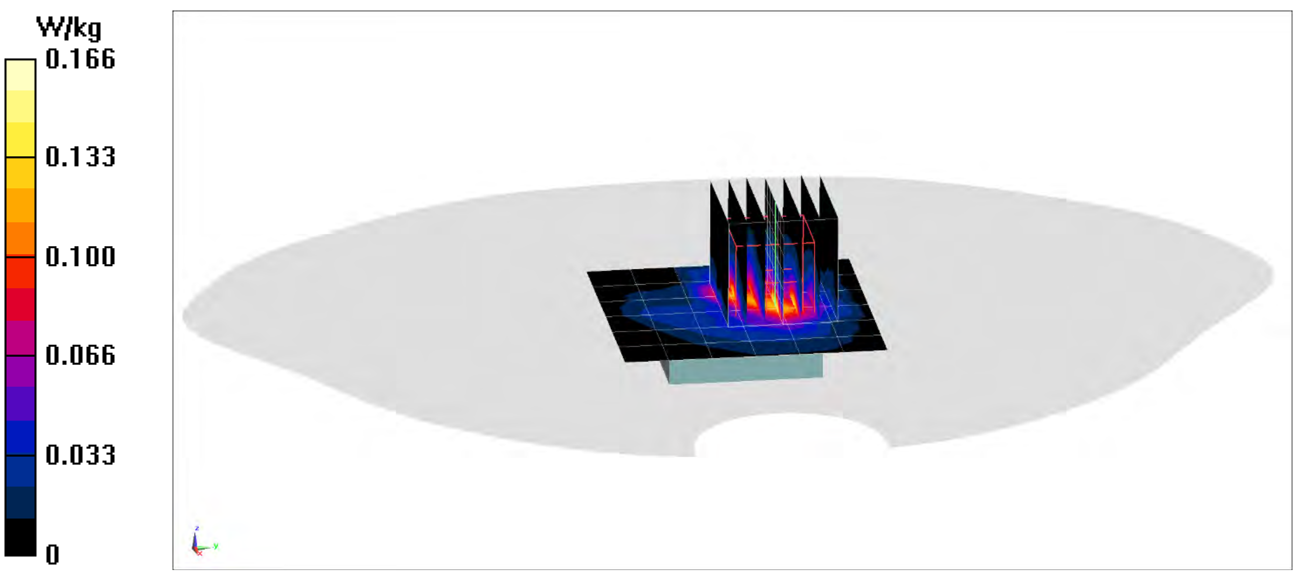
Communication System: UID 0, _IEEE 802.11b; Frequency: 2412 MHz; Duty Cycle: 1:1
Medium: 2450 MHz Body Medium parameters used (interpolated):
f = 2412 MHz; σ = 1.985 S/m; ε_r = 51.885; ρ = 1000 kg/m^3
Phantom section: Flat Section; Space: 0.0 cm

Test Date: 07-13-2020; Ambient Temp: 23.3°C; Tissue Temp: 21.9°C

Probe: EX3DV4 - SN3949; ConvF(7.75, 7.75, 7.75) @ 2412 MHz; Calibrated: 8/29/2019
Sensor-Surface: 1.4mm (Mechanical Surface Detection)
Electronics: DAE4 Sn1408; Calibrated: 8/12/2019
Phantom: Twin-SAM V4.0; Type: QD 000 P40 CC; Serial: 1596
Measurement SW: DASY52, Version 52.10 (4);SEMCAD X Version 14.6.14 (7483)

Mode: IEEE 802.11b, 22 MHz Bandwidth, Extremity SAR, Ch 1, 1 Mbps, Back Side, Aluminum, Metal Links Wristband

Area Scan (7x7x1): Measurement grid: dx=12mm, dy=12mm
Zoom Scan (8x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 7.094 V/m; Power Drift = -0.19 dB
Peak SAR (extrapolated) = 0.216 W/kg
SAR(10 g) = 0.041 W/kg
Smallest distance from peaks to all points 3 dB below = 7.1 mm
Ratio of SAR at M2 to SAR at M1 = 42.3%



PCTEST

DUT: BCG-A2355; Type: Watch; Serial: DVPCR04KQ7TP

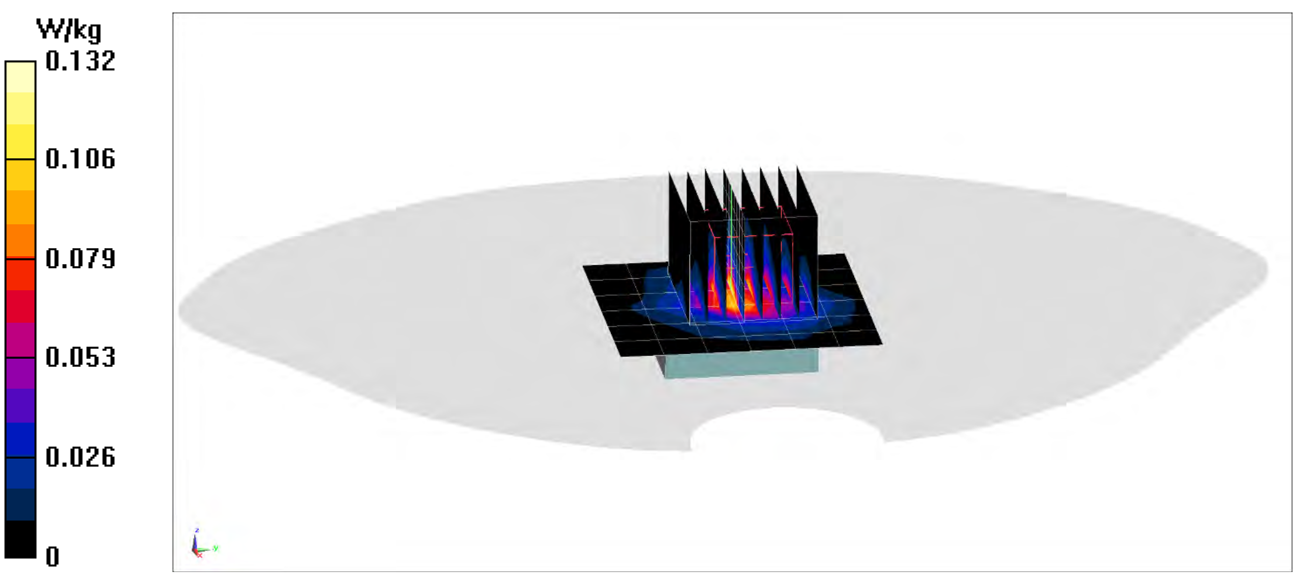
Communication System: UID 0, Bluetooth; Frequency: 2480 MHz; Duty Cycle: 1:1
Medium: 2450 MHz Body Medium parameters used (interpolated):
f = 2480 MHz; σ = 2.074 S/m; ε_r = 51.398; ρ = 1000 kg/m^3
Phantom section: Flat Section; Space: 0.0 cm

Test Date: 07-13-2020; Ambient Temp: 21.3°C; Tissue Temp: 19.7°C

Probe: EX3DV4 - SN7416; ConvF(7.28, 7.28, 7.28) @ 2480 MHz; Calibrated: 6/22/2020
Sensor-Surface: 1.4mm (Mechanical Surface Detection)
Electronics: DAE4 Sn701; Calibrated: 6/11/2020
Phantom: Twin-SAM V8.0; Type: QD 000 P41 Ax; Serial: 1936
Measurement SW: DASY52, Version 52.10 (4);SEMCAD X Version 14.6.14 (7483)

Mode: Bluetooth, Extremity SAR, Ch 78, 1 Mbps, Back Side, Aluminum, Metal Loop Wristband

Area Scan (7x7x1): Measurement grid: dx=12mm, dy=12mm
Zoom Scan (9x8x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 5.001 V/m; Power Drift = 0.15 dB
Peak SAR (extrapolated) = 0.168 W/kg
SAR(10 g) = 0.033 W/kg
Smallest distance from peaks to all points 3 dB below = 7.1 mm
Ratio of SAR at M2 to SAR at M1 = 53.8%



APPENDIX B: SYSTEM VERIFICATION

PCTEST

DUT: Dipole 835 MHz; Type: D835V2; Serial: 4d040

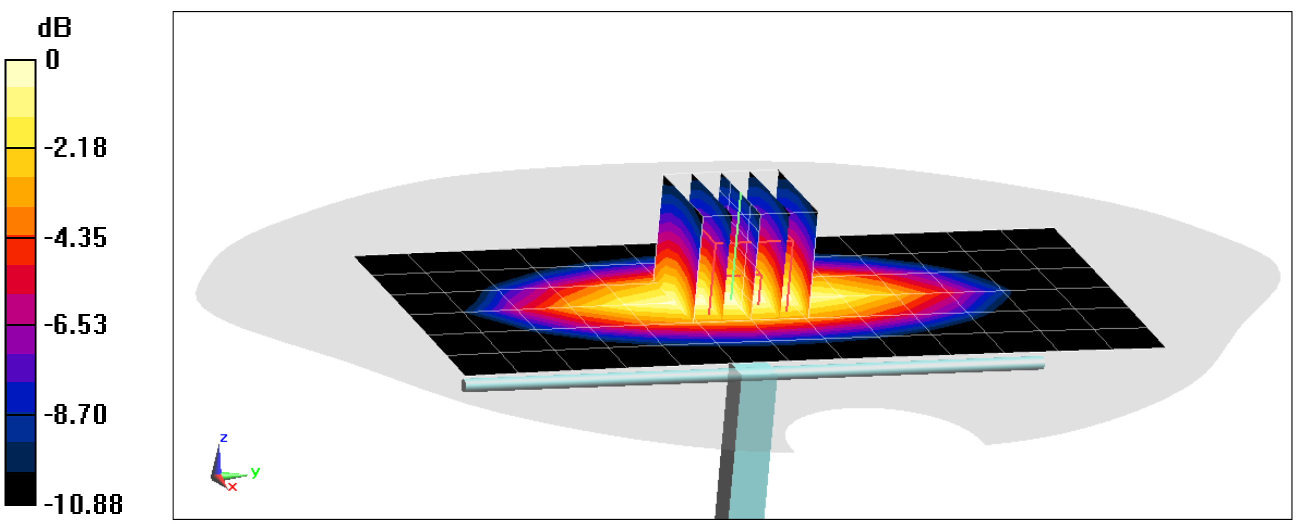
Communication System: UID 0, CW; Frequency: 835 MHz; Duty Cycle: 1:1
Medium: 835 MHz Head Medium parameters used:
f = 835 MHz; σ = 0.923 S/m; ε_r = 42.129; ρ = 1000 kg/m^3
Phantom section: Flat Section; Space: 1.5 cm

Test Date: 07-09-2020; Ambient Temp: 22.3°C; Tissue Temp: 20.5°C

Probe: EX3DV4 - SN3837; ConvF(9.72, 9.72, 9.72) @ 835 MHz; Calibrated: 1/20/2020
Sensor-Surface: 1.4mm (Mechanical Surface Detection)
Electronics: DAE4 Sn793; Calibrated: 1/14/2020
Phantom: Twin-SAM V4.0 Sub; Type: QD 000 P40 CC; Serial: 1357
Measurement SW: DASY52, Version 52.10 (4);SEMCAD X Version 14.6.14 (7483)

835 MHz System Verification at 23.0 dBm (200 mW)

Area Scan (7x14x1): Measurement grid: dx=15mm, dy=15mm
Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Peak SAR (extrapolated) = 3.04 W/kg
SAR(1 g) = 2 W/kg
Deviation(1 g) = 5.26%



0 dB = 2.69 W/kg = 4.30 dBW/kg

PCTEST

DUT: Dipole 835 MHz; Type: D835V2; Serial: 4d040

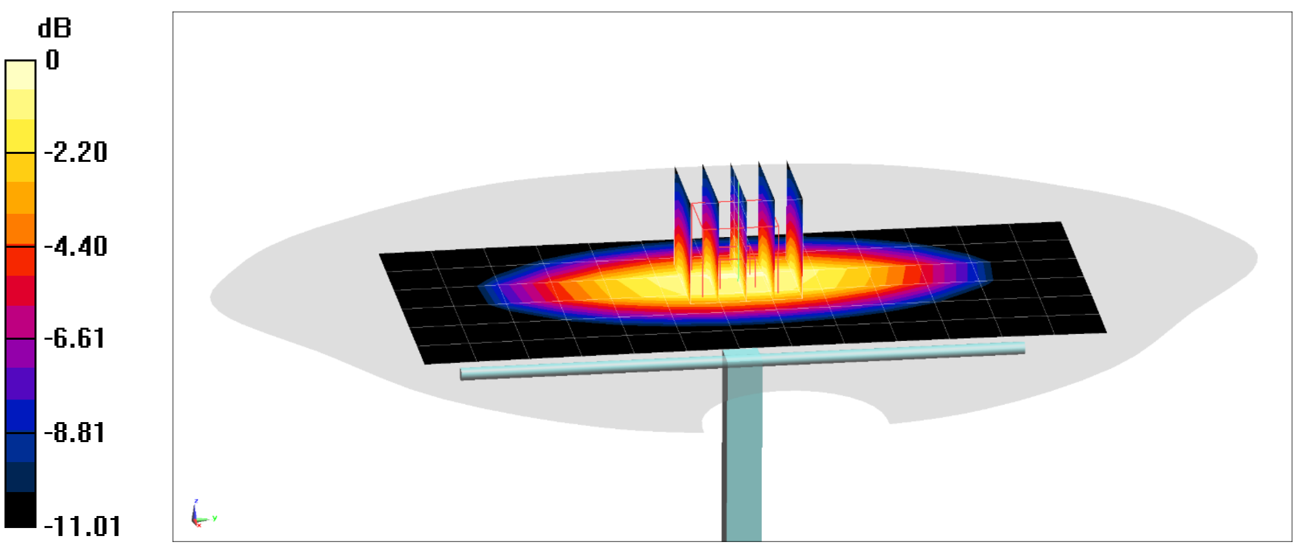
Communication System: UID 0, CW; Frequency: 835 MHz; Duty Cycle: 1:1
Medium: 835 MHz Head Medium parameters used:
f = 835 MHz; $\sigma = 0.944$ S/m; $\varepsilon_r = 41.809$; $\rho = 1000$ kg/m^3
Phantom section: Flat Section; Space: 1.5 cm

Test Date: 07-10-2020; Ambient Temp: 22.0°C; Tissue Temp: 21.5°C

Probe: EX3DV4 - SN7420; ConvF(9.71, 9.71, 9.71) @ 835 MHz; Calibrated: 11/21/2019
Sensor-Surface: 1.4mm (Mechanical Surface Detection)
Electronics: DAE4 Sn1213; Calibrated: 11/13/2019
Phantom: Twin-SAM V4.0; Type: QD 000 P40 CA; Serial: 1275
Measurement SW: DASY52, Version 52.10 (4);SEMCAD X Version 14.6.14 (7483)

835 MHz System Verification at 23.0 dBm (200 mW)

Area Scan (7x14x1): Measurement grid: dx=15mm, dy=15mm
Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Peak SAR (extrapolated) = 3.07 W/kg
SAR(1 g) = 1.98 W/kg
Deviation(1 g) = 4.21%



0 dB = 2.34 W/kg = 3.69 dBW/kg

PCTEST

DUT: Dipole 1750 MHz; Type: D1750V2; Serial: 1083

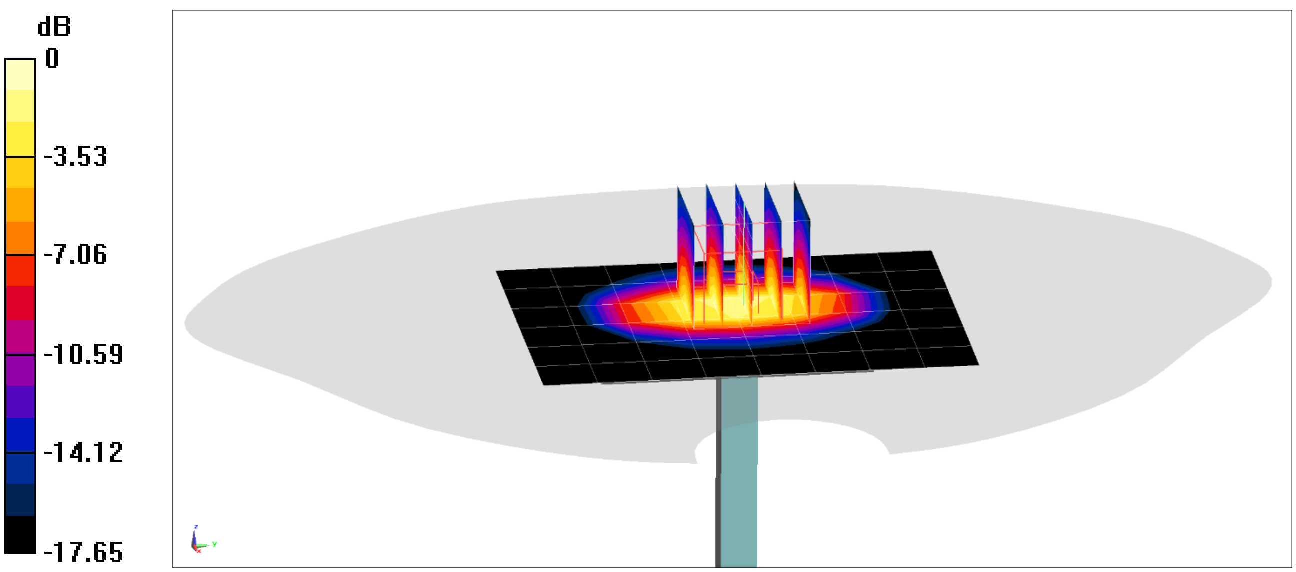
Communication System: UID 0, CW; Frequency: 1750 MHz; Duty Cycle: 1:1
Medium: 1750 MHz Head Medium parameters used:
f = 1750 MHz; σ = 1.364 S/m; ε_r = 40.197; ρ = 1000 kg/m^3
Phantom section: Flat Section; Space: 1.0 cm

Test Date: 07-10-2020; Ambient Temp: 22.0°C; Tissue Temp: 21.5°C

Probe: EX3DV4 - SN7420; ConvF(8.39, 8.39, 8.39) @ 1750 MHz; Calibrated: 11/21/2019
Sensor-Surface: 1.4mm (Mechanical Surface Detection)
Electronics: DAE4 Sn1213; Calibrated: 11/13/2019
Phantom: Twin-SAM V4.0; Type: QD 000 P40 CA; Serial: 1275
Measurement SW: DASY52, Version 52.10 (4);SEMCAD X Version 14.6.14 (7483)

1750 MHz System Verification at 20.0 dBm (100 mW)

Area Scan (7x9x1): Measurement grid: dx=15mm, dy=15mm
Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Peak SAR (extrapolated) = 6.52 W/kg
SAR(1 g) = 3.58 W/kg
Deviation(1 g) = -0.83%



0 dB = 3.96 W/kg = 5.98 dBW/kg

PCTEST

DUT: Dipole 1750 MHz; Type: D1750V2; Serial: 1083

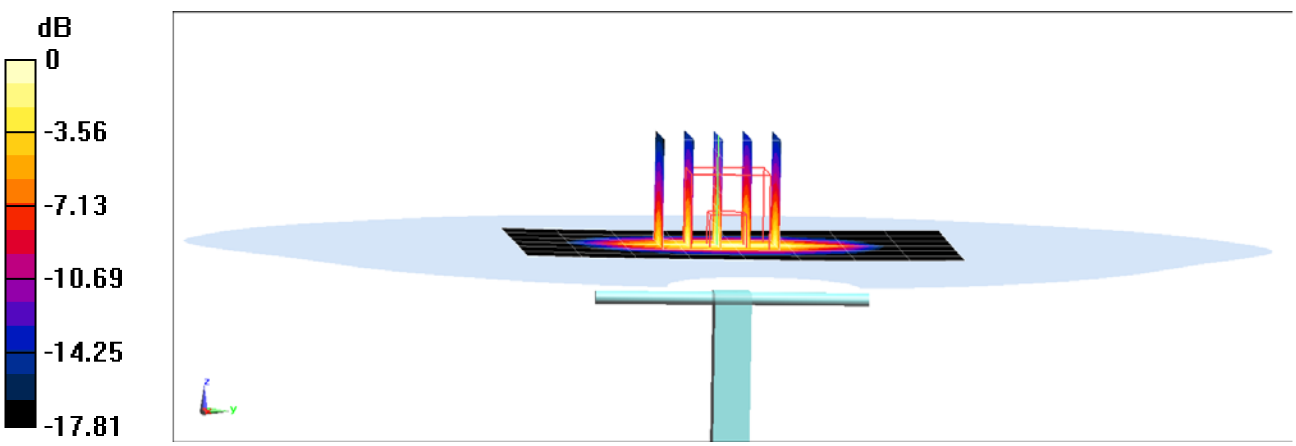
Communication System: UID 0, CW; Frequency: 1750 MHz; Duty Cycle: 1:1
Medium: 1750 MHz Head Medium parameters used:
f = 1750 MHz; σ = 1.349 S/m; ε_r = 38.852; ρ = 1000 kg/m^3
Phantom section: Flat Section; Space: 1.0 cm

Test Date: 08-28-2020; Ambient Temp: 22.1°C; Tissue Temp: 20.8°C

Probe: EX3DV4 - SN3837; ConvF(8.62, 8.62, 8.62) @ 1750 MHz; Calibrated: 1/20/2020
Sensor-Surface: 1.4mm (Mechanical Surface Detection)
Electronics: DAE4 Sn793; Calibrated: 1/14/2020
Phantom: SAM Main; Type: SAM 4.0; Serial: TP-1406
Measurement SW: DASY52, Version 52.10 (4);SEMCAD X Version 14.6.14 (7483)

1750 MHz System Verification at 20.0 dBm (100 mW)

Area Scan (7x9x1): Measurement grid: dx=15mm, dy=15mm
Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Peak SAR (extrapolated) = 7.21 W/kg
SAR(1 g) = 3.85 W/kg
Deviation(1 g) = 6.65%



0 dB = 5.95 W/kg = 7.75 dBW/kg

PCTEST

DUT: Dipole 1900 MHz; Type: D1900V2; Serial: 5d030

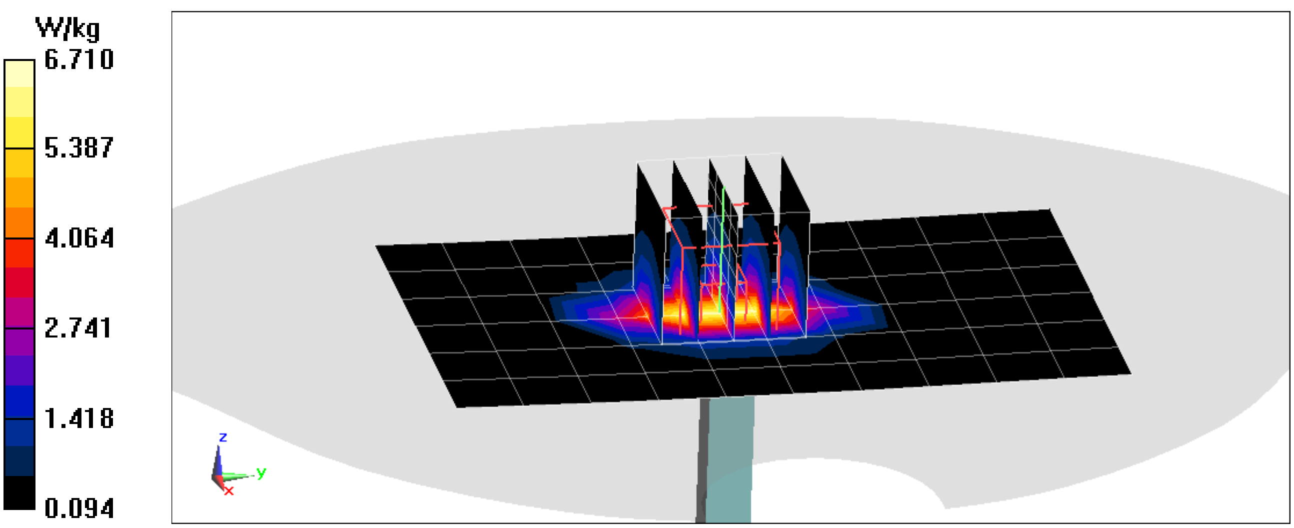
Communication System: UID 0, CW; Frequency: 1900 MHz; Duty Cycle: 1:1
Medium: 1900 MHz Head Medium parameters used (interpolated):
f = 1900 MHz; σ = 1.445 S/m; ε_r = 39.352; ρ = 1000 kg/m^3
Phantom section: Flat Section; Space: 1.0 cm

Test Date: 07-08-2020; Ambient Temp: 23.5°C; Tissue Temp: 21.3°C

Probe: EX3DV4 - SN3837; ConvF(8.28, 8.28, 8.28) @ 1900 MHz; Calibrated: 1/20/2020
Sensor-Surface: 1.4mm (Mechanical Surface Detection)
Electronics: DAE4 Sn793; Calibrated: 1/14/2020
Phantom: Twin-SAM V4.0 Main; Type: QD 000 P40 CC; Serial: 1114
Measurement SW: DASY52, Version 52.10 (4);SEMCAD X Version 14.6.14 (7483)

1900 MHz System Verification at 20.0 dBm (100 mW)

Area Scan (7x11x1): Measurement grid: dx=15mm, dy=15mm
Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Peak SAR (extrapolated) = 8.10 W/kg
SAR(1 g) = 4.24 W/kg
Deviation(1 g) = 6.27%



PCTEST

DUT: Dipole 2450 MHz; Type: D2450V2; Serial: 750

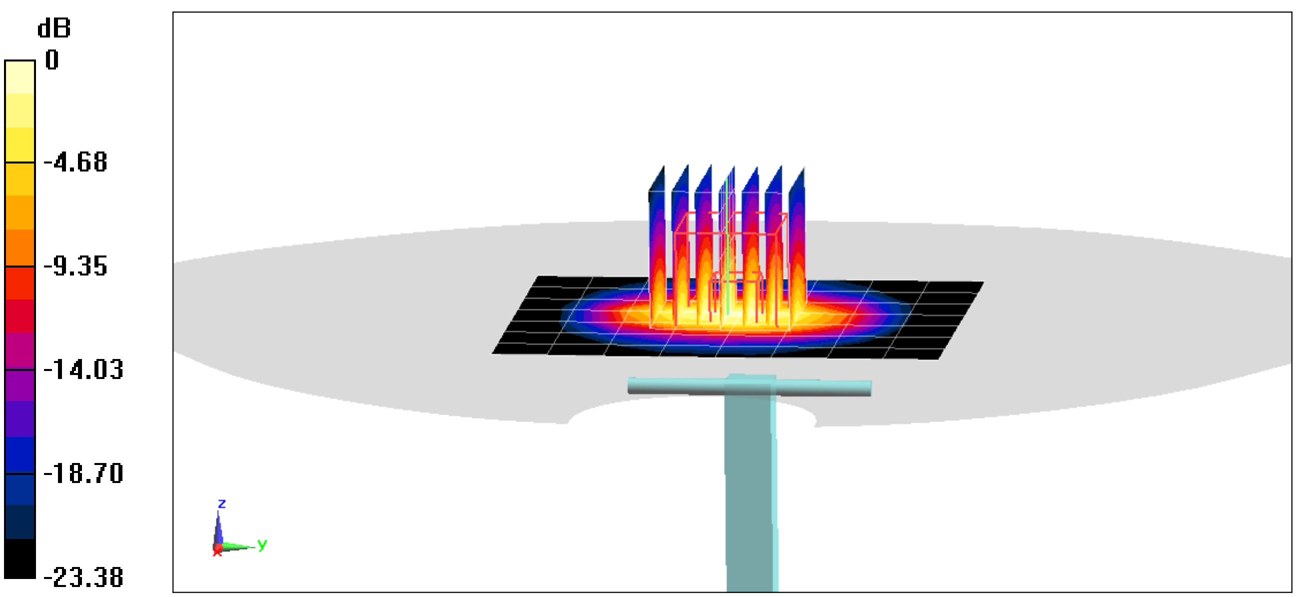
Communication System: UID 0, CW; Frequency: 2450 MHz; Duty Cycle: 1:1
Medium: 2450-2600 MHz Head Medium parameters used:
f = 2450 MHz; σ = 1.871 S/m; ε_r = 38.967; ρ = 1000 kg/m^3
Phantom section: Flat Section; Space: 1.0 cm

Test Date: 07-13-2020; Ambient Temp: 21.1°C; Tissue Temp: 20.7°C

Probe: EX3DV4 - SN7490; ConvF(7.84, 7.84, 7.84) @ 2450 MHz; Calibrated: 12/13/2019
Sensor-Surface: 1.4mm (Mechanical Surface Detection)
Electronics: DAE4 Sn1532; Calibrated: 12/5/2019
Phantom: Twin-SAM V4.0 SUB use; Type: QD 000 P40 CC; Serial: 1403
Measurement SW: DASY52, Version 52.10 (4);SEMCAD X Version 14.6.14 (7483)

2450 MHz System Verification at 20.0 dBm (100 mW)

Area Scan (8x9x1): Measurement grid: dx=12mm, dy=12mm
Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Peak SAR (extrapolated) = 11.8 W/kg
SAR(1 g) = 5.21 W/kg
Deviation(1 g) = -1.88%



0 dB = 8.77 W/kg = 9.43 dBW/kg

PCTEST

DUT: Dipole 2450 MHz; Type: D2450V2; Serial: 921

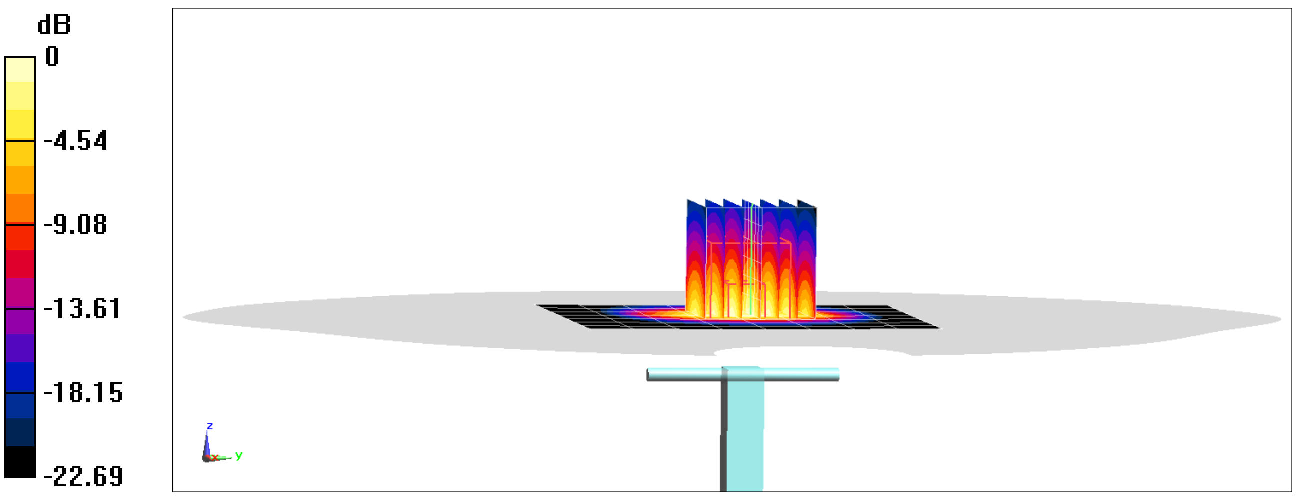
Communication System: UID 0, CW; Frequency: 2450 MHz; Duty Cycle: 1:1
Medium: 2450-2600 MHz Head Medium parameters used:
f = 2450 MHz; σ = 1.766 S/m; ε_r = 38.033; ρ = 1000 kg/m^3
Phantom section: Flat Section; Space: 1.0 cm

Test Date: 07-13-2020; Ambient Temp: 22.5°C; Tissue Temp: 21.4°C

Probe: EX3DV4 - SN7427; ConvF(7.22, 7.22, 7.22) @ 2450 MHz; Calibrated: 2/19/2020
Sensor-Surface: 1.4mm (Mechanical Surface Detection)
Electronics: DAE4 Sn1403; Calibrated: 2/13/2020
Phantom: Twin-SAM V4.0; Type: QD 000 P40 CD; Serial: 1736
Measurement SW: DASY52, Version 52.10 (4);SEMCAD X Version 14.6.14 (7483)

2450 MHz System Verification at 20.0 dBm (100 mW)

Area Scan (8x9x1): Measurement grid: dx=12mm, dy=12mm
Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Peak SAR (extrapolated) = 11.3 W/kg
SAR(1 g) = 5.41 W/kg
Deviation(1 g) = 1.88%



0 dB = 9.00 W/kg = 9.54 dBW/kg

PCTEST

DUT: Dipole 2600 MHz; Type: D2600V2; Serial: 1042

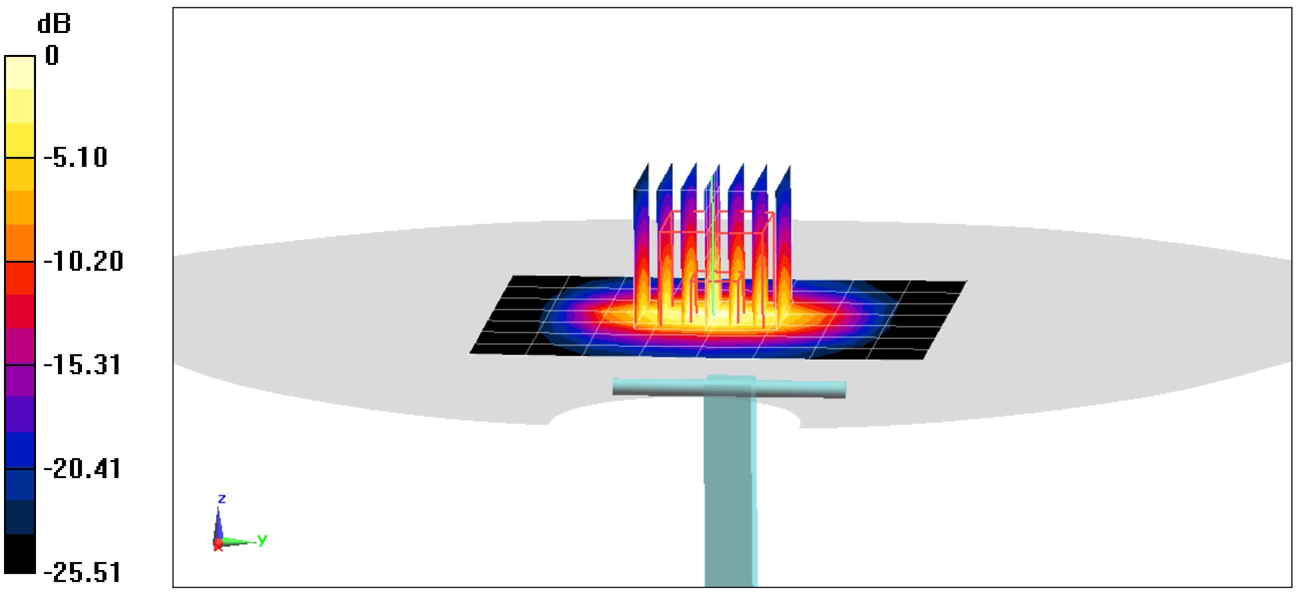
Communication System: UID 0, CW; Frequency: 2600 MHz; Duty Cycle: 1:1
Medium: 2450-2600 MHz Head Medium parameters used:
f = 2600 MHz; σ = 2.044 S/m; ε_r = 38.406; ρ = 1000 kg/m^3
Phantom section: Flat Section; Space: 1.0 cm

Test Date: 07-13-2020; Ambient Temp: 21.1°C; Tissue Temp: 20.7°C

Probe: EX3DV4 - SN7490; ConvF(7.64, 7.64, 7.64) @ 2600 MHz; Calibrated: 12/13/2019
Sensor-Surface: 1.4mm (Mechanical Surface Detection)
Electronics: DAE4 Sn1532; Calibrated: 12/5/2019
Phantom: Twin-SAM V4.0 SUB use; Type: QD 000 P40 CC; Serial: 1403
Measurement SW: DASY52, Version 52.10 (4);SEMCAD X Version 14.6.14 (7483)

2600 MHz System Verification at 20.0 dBm (100 mW)

Area Scan (8x9x1): Measurement grid: dx=12mm, dy=12mm
Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Peak SAR (extrapolated) = 13.6 W/kg
SAR(1 g) = 5.59 W/kg
Deviation(1 g) = -3.12%



0 dB = 9.75 W/kg = 9.89 dBW/kg

PCTEST

DUT: Dipole 2600 MHz; Type: D2600V2; Serial: 1069

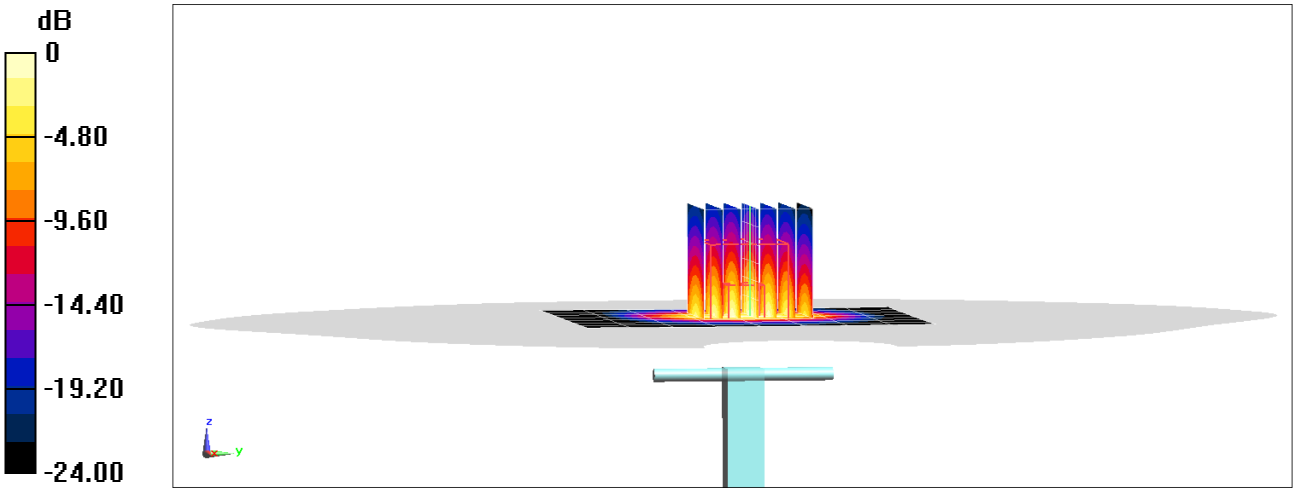
Communication System: UID 0, CW; Frequency: 2600 MHz; Duty Cycle: 1:1
Medium: 2450-2600 MHz Head Medium parameters used:
f = 2600 MHz; σ = 1.896 S/m; ε_r = 37.816; ρ = 1000 kg/m^3
Phantom section: Flat Section; Space: 1.0 cm

Test Date: 07-13-2020; Ambient Temp: 22.5°C; Tissue Temp: 21.4°C

Probe: EX3DV4 - SN7427; ConvF(7, 7, 7) @ 2600 MHz; Calibrated: 2/19/2020
Sensor-Surface: 1.4mm (Mechanical Surface Detection)
Electronics: DAE4 Sn1403; Calibrated: 2/13/2020
Phantom: Twin-SAM V4.0; Type: QD 000 P40 CD; Serial: 1736
Measurement SW: DASY52, Version 52.10 (4);SEMCAD X Version 14.6.14 (7483)

2600 MHz System Verification at 20.0 dBm (100 mW)

Area Scan (8x9x1): Measurement grid: dx=12mm, dy=12mm
Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Peak SAR (extrapolated) = 12.1 W/kg
SAR(1 g) = 5.57 W/kg
Deviation(1 g) = -2.11%



0 dB = 9.55 W/kg = 9.80 dBW/kg

PCTEST

DUT: Dipole 835 MHz; Type: D835V2; Serial: 4d040

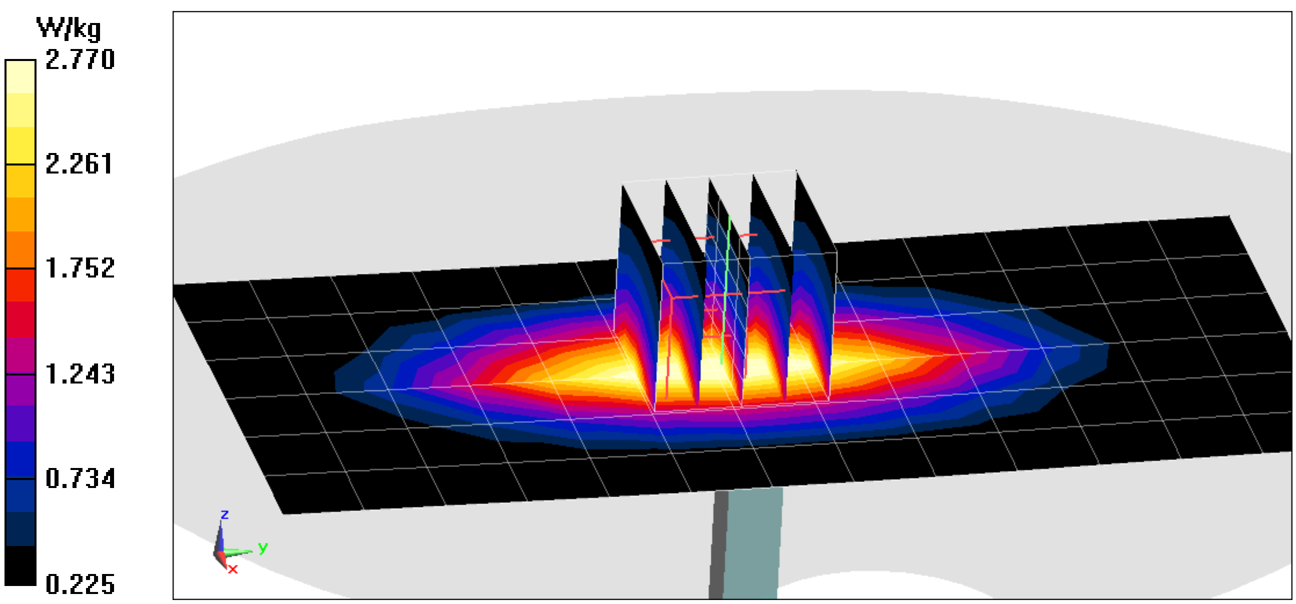
Communication System: UID 0, CW; Frequency: 835 MHz; Duty Cycle: 1:1
Medium: 835 MHz Body Medium parameters used:
f = 835 MHz; σ = 1 S/m; ε_r = 53.037; ρ = 1000 kg/m^3
Phantom section: Flat Section; Space: 1.5 cm

Test Date: 07-13-2020; Ambient Temp: 24.4°C; Tissue Temp: 20.5°C

Probe: EX3DV4 - SN3837; ConvF(9.37, 9.37, 9.37) @ 835 MHz; Calibrated: 1/20/2020
Sensor-Surface: 1.4mm (Mechanical Surface Detection)
Electronics: DAE4 Sn793; Calibrated: 1/14/2020
Phantom: Twin-SAM V4.0 Main; Type: QD 000 P40 CC; Serial: 1114
Measurement SW: DASY52, Version 52.10 (4);SEMCAD X Version 14.6.14 (7483)

835 MHz System Verification at 23.0 dBm (200 mW)

Area Scan (7x14x1): Measurement grid: dx=15mm, dy=15mm
Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Peak SAR (extrapolated) = 3.18 W/kg
SAR(10 g) = 1.33 W/kg
Deviation(10 g) = 6.57%



PCTEST

DUT: Dipole 850 MHz; Type: D850V2; Serial: 1010

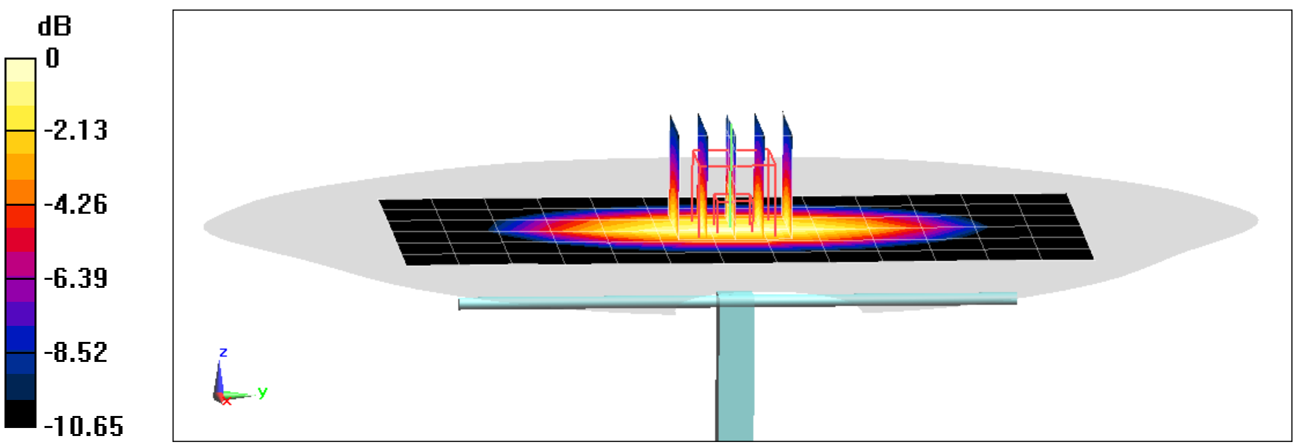
Communication System: UID 0, CW; Frequency: 850 MHz; Duty Cycle: 1:1
Medium: 835 MHz Body Medium parameters used:
f = 850 MHz; σ = 1.003 S/m; ε_r = 53.623; ρ = 1000 kg/m^3
Phantom section: Flat Section; Space: 1.5 cm

Test Date: 07-16-2020; Ambient Temp: 23.0°C; Tissue Temp: 22.3°C

Probe: EX3DV4 - SN7421; ConvF(9.42, 9.42, 9.42) @ 850 MHz; Calibrated: 3/20/2020
Sensor-Surface: 1.4mm (Mechanical Surface Detection)
Electronics: DAE4 Sn604; Calibrated: 3/19/2020
Phantom: Twin-SAM V4.0; Type: QD 000 P40 CC; Serial: 1179
Measurement SW: DASY52, Version 52.10 (4);SEMCAD X Version 14.6.14 (7483)

850 MHz System Verification at 23.0 dBm (200 mW)

Area Scan (7x14x1): Measurement grid: dx=15mm, dy=15mm
Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Peak SAR (extrapolated) = 3.24 W/kg
SAR(10 g) = 1.42 W/kg
Deviation(10 g) = 6.29%



0 dB = 2.90 W/kg = 4.62 dBW/kg

PCTEST

DUT: Dipole 1750 MHz; Type: D1750V2; Serial: 1092

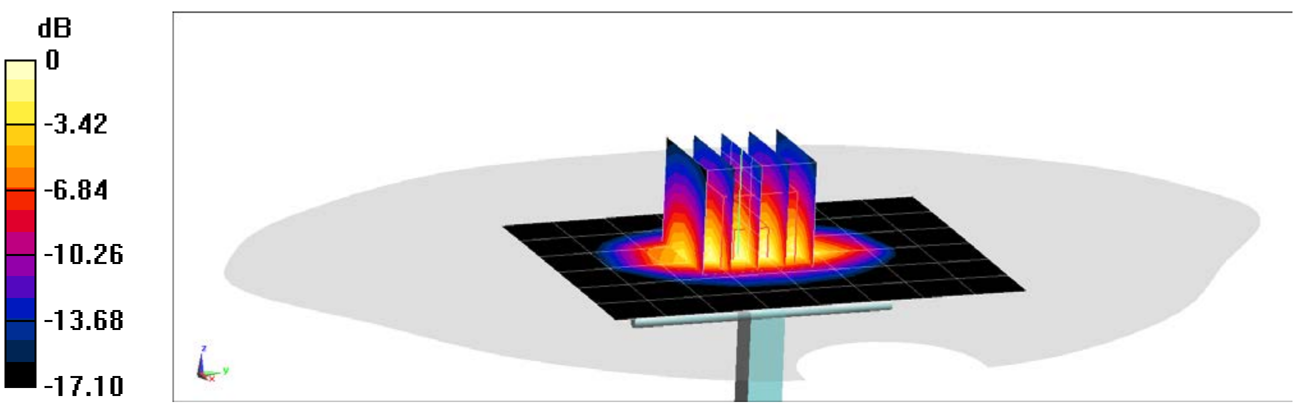
Communication System: UID 0, CW; Frequency: 1750 MHz; Duty Cycle: 1:1
Medium: 1750 MHz Body Medium parameters used:
f = 1750 MHz; σ = 1.464 S/m; ε_r = 52.473; ρ = 1000 kg/m^3
Phantom section: Flat Section; Space: 1.0 cm

Test Date: 07-08-2020; Ambient Temp: 22.0°C; Tissue Temp: 20.9°C

Probe: EX3DV4 - SN7532; ConvF(8.34, 8.34, 8.34) @ 1750 MHz; Calibrated: 4/20/2020
Sensor-Surface: 1.4mm (Mechanical Surface Detection)
Electronics: DAE4 Sn501; Calibrated: 4/15/2020
Phantom: Twin-SAM V8.0_Left; Type: QD 000 P41 AA; Serial: 1935
Measurement SW: DASY52, Version 52.10 (4);SEMCAD X Version 14.6.14 (7483)

1750 MHz System Verification at 20.0 dBm (100 mW)

Area Scan (7x9x1): Measurement grid: dx=15mm, dy=15mm
Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Peak SAR (extrapolated) = 6.81 W/kg
SAR(10 g) = 1.99 W/kg
Deviation(10 g) = 2.58%



0 dB = 5.75 W/kg = 7.60 dBW/kg

PCTEST

DUT: Dipole 1900 MHz; Type: D1900V2; Serial: 5d030

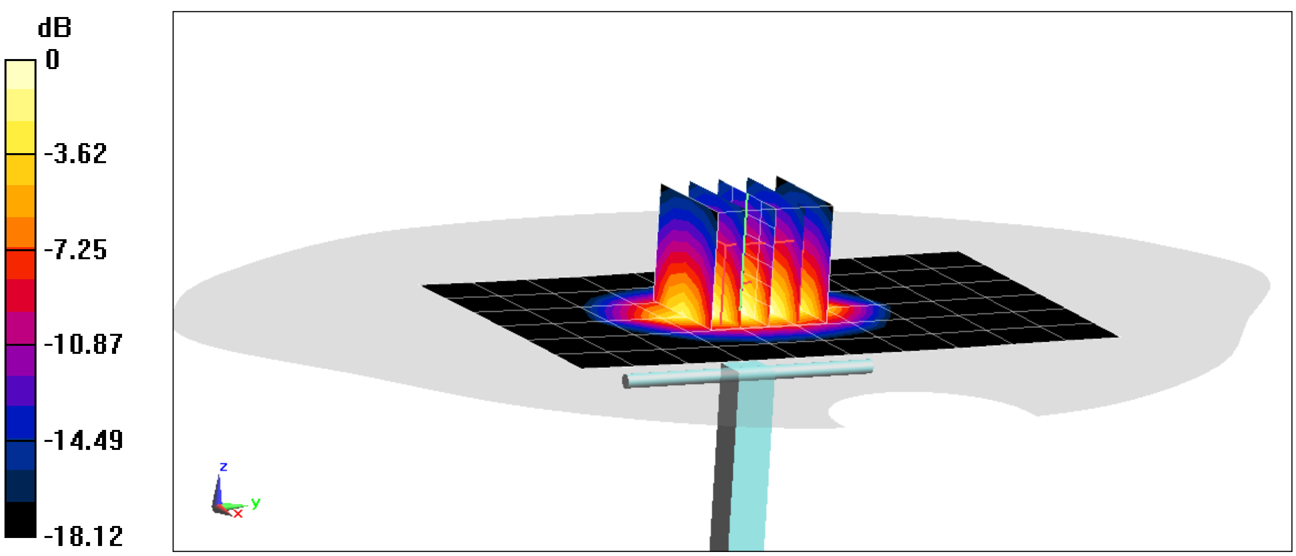
Communication System: UID 0, CW; Frequency: 1900 MHz; Duty Cycle: 1:1
Medium: 1900 MHz Body Medium parameters used (interpolated):
f = 1900 MHz; σ = 1.584 S/m; ε_r = 51.197; ρ = 1000 kg/m^3
Phantom section: Flat Section; Space: 1.0 cm

Test Date: 07-13-2020; Ambient Temp: 23.6°C; Tissue Temp: 20.5°C

Probe: EX3DV4 - SN3837; ConvF(7.68, 7.68, 7.68) @ 1900 MHz; Calibrated: 1/20/2020
Sensor-Surface: 1.4mm (Mechanical Surface Detection)
Electronics: DAE4 Sn793; Calibrated: 1/14/2020
Phantom: Twin-SAM V4.0 Main; Type: QD 000 P40 CC; Serial: 1114
Measurement SW: DASY52, Version 52.10 (4);SEMCAD X Version 14.6.14 (7483)

1900 MHz System Verification at 20.0 dBm (100 mW)

Area Scan (7x11x1): Measurement grid: dx=15mm, dy=15mm
Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Peak SAR (extrapolated) = 7.94 W/kg
SAR(10 g) = 2.21 W/kg
Deviation(10 g) = 4.74%



0 dB = 6.70 W/kg = 8.26 dBW/kg

PCTEST

DUT: Dipole 1900 MHz; Type: D1900V2; Serial: 5d030

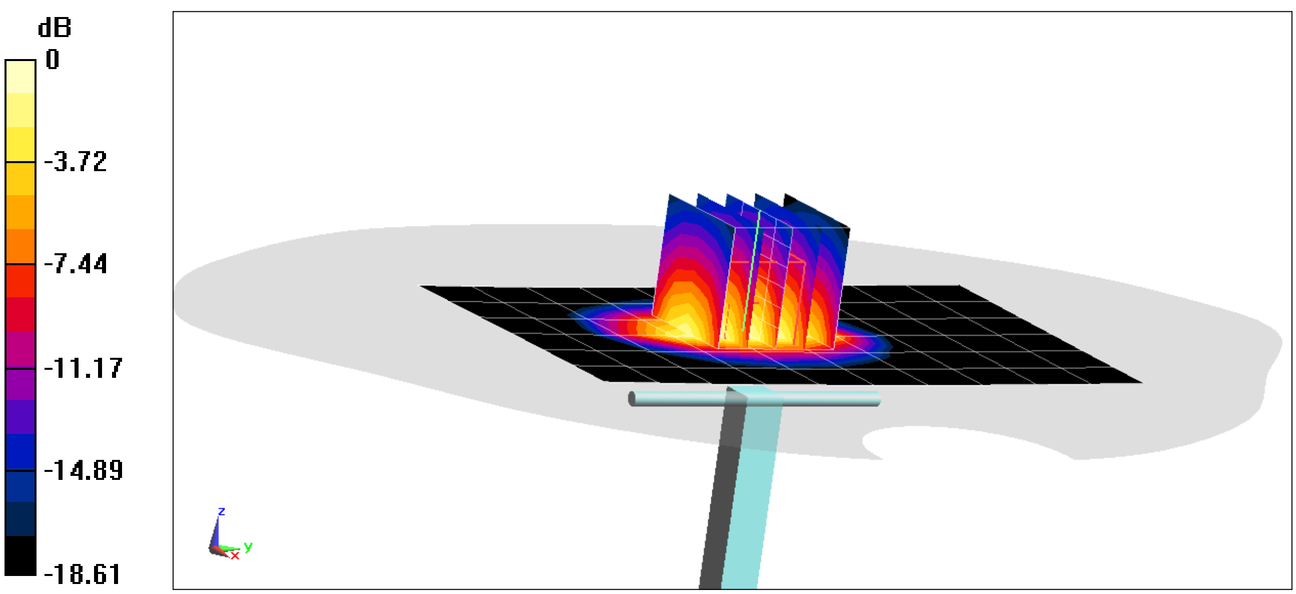
Communication System: UID 0, CW; Frequency: 1900 MHz; Duty Cycle: 1:1
Medium: 1900 MHz Body Medium parameters used (interpolated):
f = 1900 MHz; σ = 1.56 S/m; ε_r = 51.308; ρ = 1000 kg/m^3
Phantom section: Flat Section; Space: 1.0 cm

Test Date: 07-20-2020; Ambient Temp: 21.9°C; Tissue Temp: 21.0°C

Probe: EX3DV4 - SN3837; ConvF(7.68, 7.68, 7.68) @ 1900 MHz; Calibrated: 1/20/2020
Sensor-Surface: 1.4mm (Mechanical Surface Detection)
Electronics: DAE4 Sn793; Calibrated: 1/14/2020
Phantom: Twin-SAM V4.0 Main; Type: QD 000 P40 CC; Serial: 1114
Measurement SW: DASY52, Version 52.10 (4);SEMCAD X Version 14.6.14 (7483)

1900 MHz System Verification at 20.0 dBm (100 mW)

Area Scan (7x11x1): Measurement grid: dx=15mm, dy=15mm
Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Peak SAR (extrapolated) = 7.92 W/kg
SAR(10 g) = 2.18 W/kg
Deviation(10 g) = 3.32%



0 dB = 6.57 W/kg = 8.18 dBW/kg

PCTEST

DUT: Dipole 2450 MHz; Type: D2450V2; Serial: 921

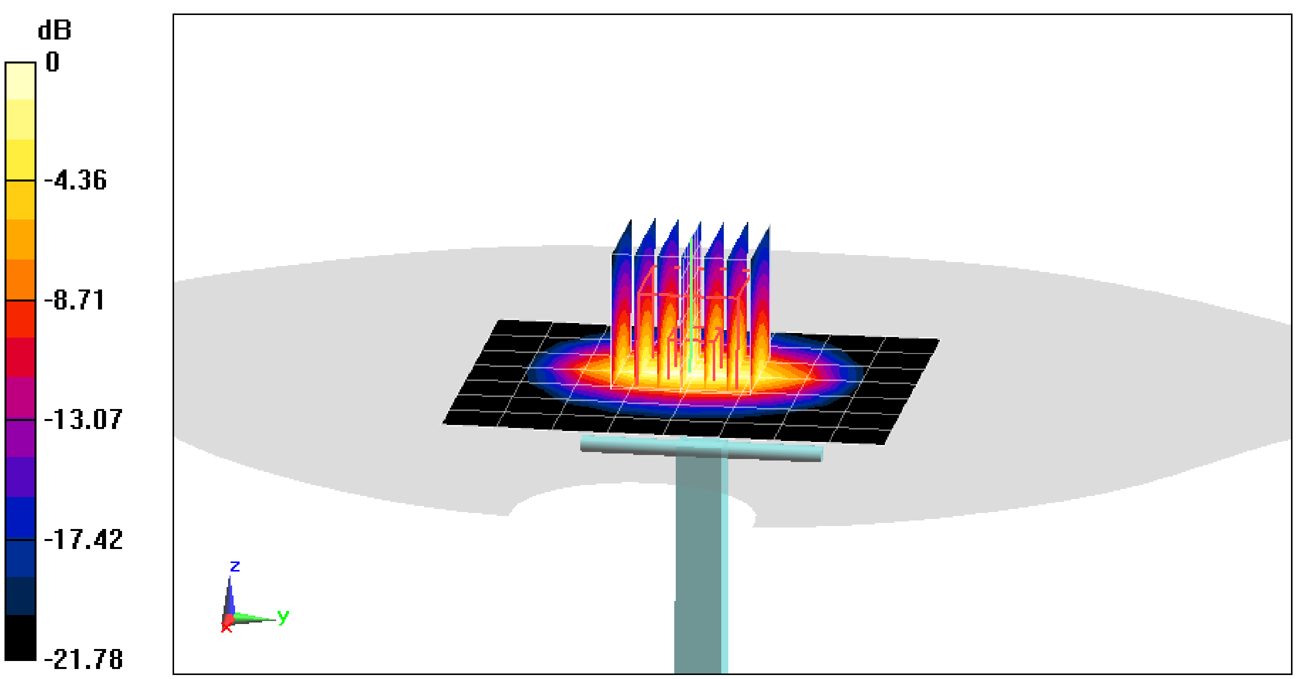
Communication System: UID 0, CW; Frequency: 2450 MHz; Duty Cycle: 1:1
Medium: 2450-2600 MHz Body Medium parameters used:
f = 2450 MHz; σ = 2.024 S/m; ε_r = 52.015; ρ = 1000 kg/m^3
Phantom section: Flat Section; Space: 1.0 cm

Test Date: 07-04-2020; Ambient Temp: 22.7°C; Tissue Temp: 22.2°C

Probe: EX3DV4 - SN3949; ConvF(7.75, 7.75, 7.75) @ 2450 MHz; Calibrated: 8/29/2019
Sensor-Surface: 1.4mm (Mechanical Surface Detection)
Electronics: DAE4 Sn1408; Calibrated: 8/12/2019
Phantom: Twin-SAM V4.0; Type: QD 000 P40 CC; Serial: 1596
Measurement SW: DASY52, Version 52.10 (4);SEMCAD X Version 14.6.14 (7483)

2450 MHz System Verification at 20.0 dBm (100 mW)

Area Scan (8x9x1): Measurement grid: dx=12mm, dy=12mm
Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Peak SAR (extrapolated) = 11.1 W/kg
SAR(10 g) = 2.52 W/kg
Deviation(10 g) = 5.88%



0 dB = 8.99 W/kg = 9.54 dBW/kg

PCTEST

DUT: Dipole 2450 MHz; Type: D2450V2; Serial: 921

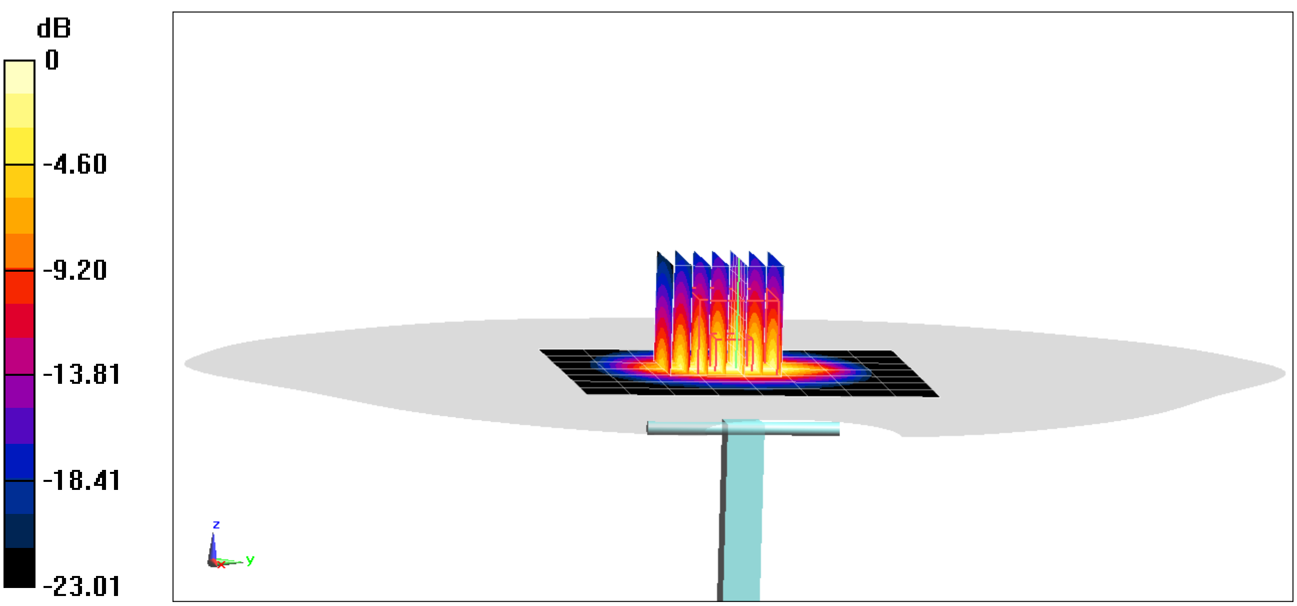
Communication System: UID 0, CW; Frequency: 2450 MHz; Duty Cycle: 1:1
Medium: 2450 MHz Body Medium parameters used:
f = 2450 MHz; $\sigma = 2.031$ S/m; $\varepsilon_r = 51.758$; $\rho = 1000$ kg/m^3
Phantom section: Flat Section; Space: 1.0 cm

Test Date: 07-13-2020; Ambient Temp: 23.3°C; Tissue Temp: 21.9°C

Probe: EX3DV4 - SN3949; ConvF(7.75, 7.75, 7.75) @ 2450 MHz; Calibrated: 8/29/2019
Sensor-Surface: 1.4mm (Mechanical Surface Detection)
Electronics: DAE4 Sn1408; Calibrated: 8/12/2019
Phantom: Twin-SAM V4.0; Type: QD 000 P40 CC; Serial: 1596
Measurement SW: DASY52, Version 52.10 (4);SEMCAD X Version 14.6.14 (7483)

2450 MHz System Verification at 20.0 dBm (100 mW)

Area Scan (8x9x1): Measurement grid: dx=12mm, dy=12mm
Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Peak SAR (extrapolated) = 11.3 W/kg
SAR(10 g) = 2.55 W/kg
Deviation(10 g) = 7.14%



0 dB = 9.19 W/kg = 9.63 dBW/kg

PCTEST

DUT: Dipole 2450 MHz; Type: D2450V2; Serial: 945

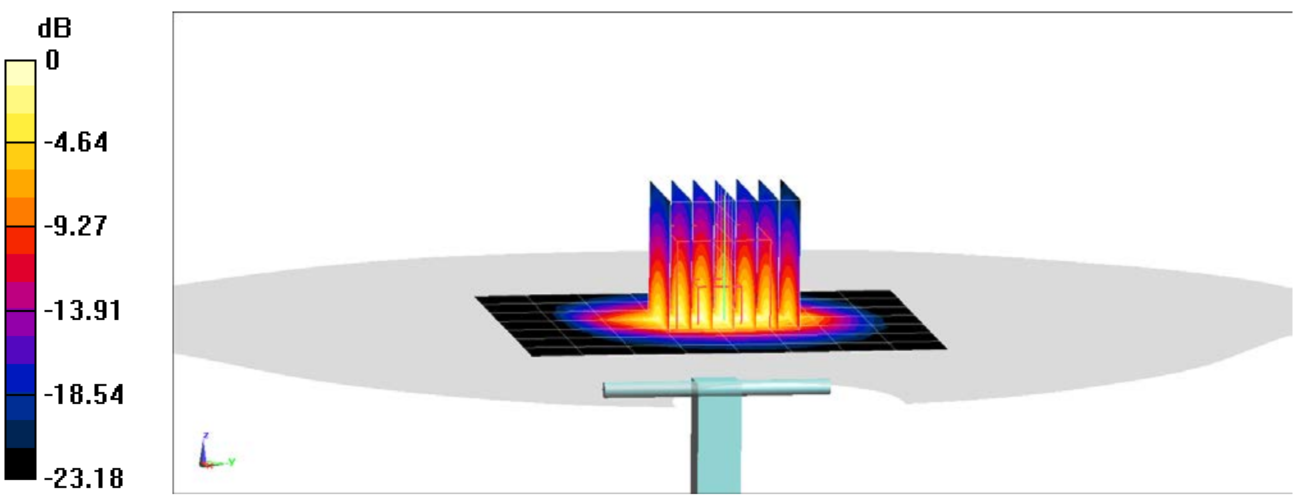
Communication System: UID 0, CW; Frequency: 2450 MHz; Duty Cycle: 1:1
Medium: 2450 MHz Body Medium parameters used:
f = 2450 MHz; σ = 2.033 S/m; ε_r = 51.514; ρ = 1000 kg/m^3
Phantom section: Flat Section; Space: 1.0 cm

Test Date: 07-13-2020; Ambient Temp: 21.3°C; Tissue Temp: 19.7°C

Probe: EX3DV4 - SN7416; ConvF(7.28, 7.28, 7.28) @ 2450 MHz; Calibrated: 6/22/2020
Sensor-Surface: 1.4mm (Mechanical Surface Detection)
Electronics: DAE4 Sn701; Calibrated: 6/11/2020
Phantom: Twin-SAM V8.0; Type: QD 000 P41 Ax; Serial: 1936
Measurement SW: DASY52, Version 52.10 (4);SEMCAD X Version 14.6.14 (7483)

2450 MHz System Verification at 20.0 dBm (100 mW)

Area Scan (8x9x1): Measurement grid: dx=12mm, dy=12mm
Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Peak SAR (extrapolated) = 10.9 W/kg
SAR(10 g) = 2.28 W/kg
Deviation(10 g) = -1.72%



0 dB = 8.72 W/kg = 9.41 dBW/kg

PCTEST

DUT: Dipole 2450 MHz; Type: D2450V2; Serial: 921

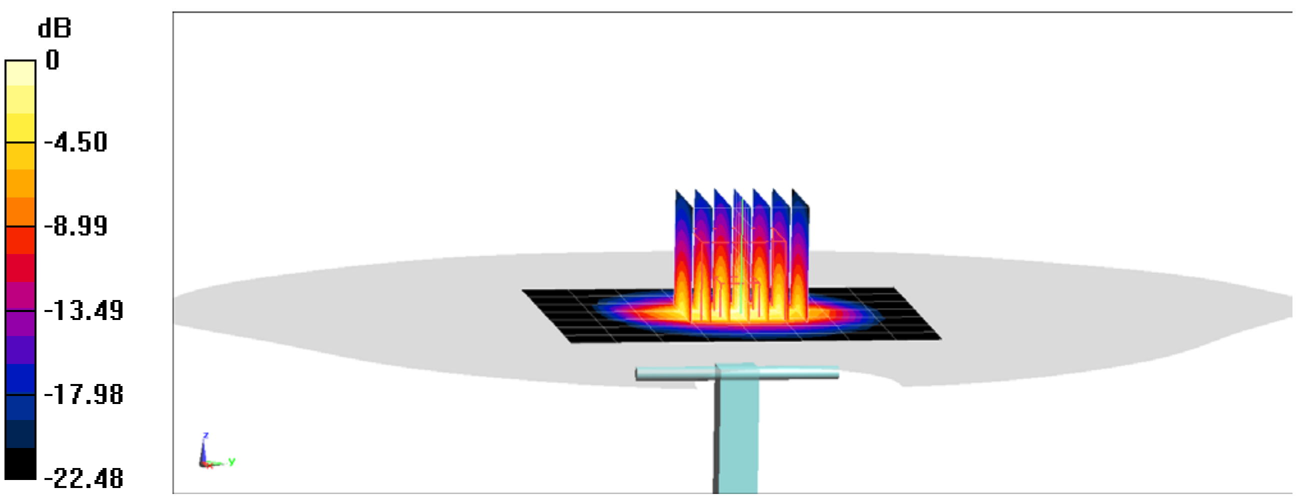
Communication System: UID 0, CW; Frequency: 2450 MHz; Duty Cycle: 1:1
Medium: 2450-2600 MHz Body Medium parameters used:
f = 2450 MHz; σ = 2.013 S/m; ε_r = 52.035; ρ = 1000 kg/m^3
Phantom section: Flat Section; Space: 1.0 cm

Test Date: 07-15-2020; Ambient Temp: 22.7°C; Tissue Temp: 20.5°C

Probe: EX3DV4 - SN7416; ConvF(7.28, 7.28, 7.28) @ 2450 MHz; Calibrated: 6/22/2020
Sensor-Surface: 1.4mm (Mechanical Surface Detection)
Electronics: DAE4 Sn701; Calibrated: 6/11/2020
Phantom: Twin-SAM V8.0; Type: QD 000 P41 Ax; Serial: 1936
Measurement SW: DASY52, Version 52.10 (4);SEMCAD X Version 14.6.14 (7483)

2450 MHz System Verification at 20.0 dBm (100 mW)

Area Scan (8x9x1): Measurement grid: dx=12mm, dy=12mm
Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Peak SAR (extrapolated) = 10.3 W/kg
SAR(10 g) = 2.23 W/kg
Deviation(10 g) = -6.30%



0 dB = 8.28 W/kg = 9.18 dBW/kg

PCTEST

DUT: Dipole 2600 MHz; Type: D2600V2; Serial: 1069

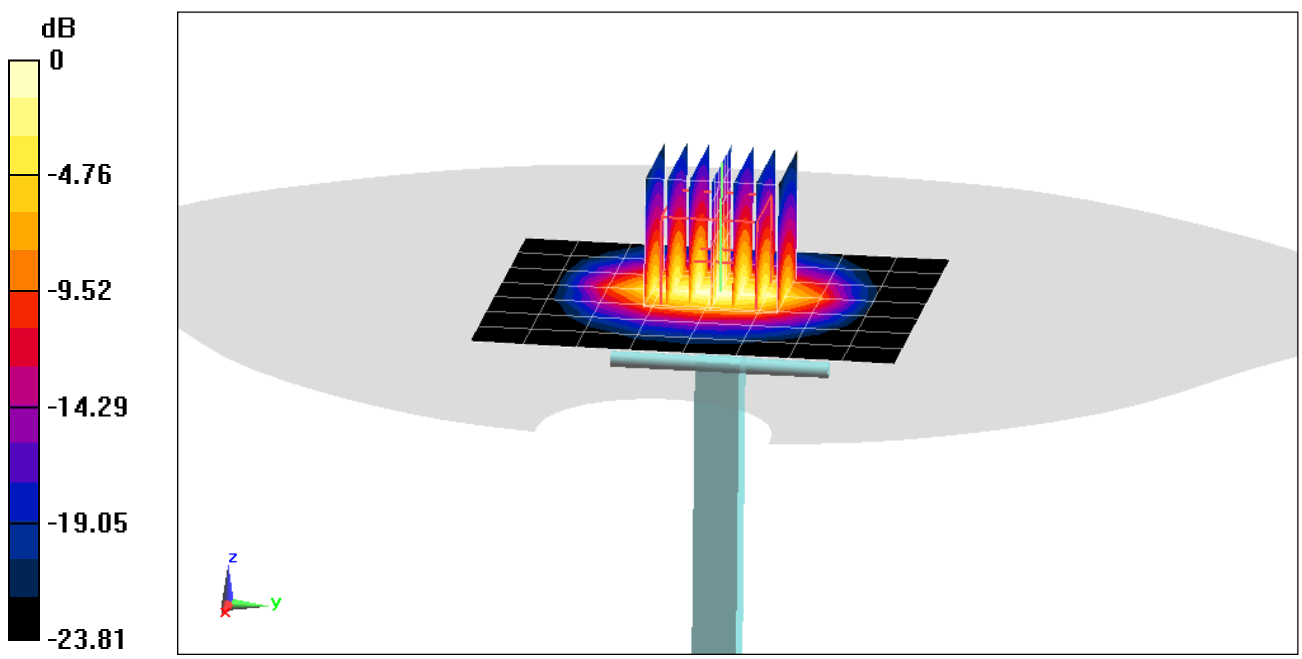
Communication System: UID 0, CW; Frequency: 2600 MHz; Duty Cycle: 1:1
Medium: 2450-2600 MHz Body Medium parameters used:
f = 2600 MHz; σ = 2.238 S/m; ε_r = 51.462; ρ = 1000 kg/m^3
Phantom section: Flat Section; Space: 1.0 cm

Test Date: 07-04-2020; Ambient Temp: 22.7°C; Tissue Temp: 22.2°C

Probe: EX3DV4 - SN3949; ConvF(7.69, 7.69, 7.69) @ 2600 MHz; Calibrated: 8/29/2019
Sensor-Surface: 1.4mm (Mechanical Surface Detection)
Electronics: DAE4 Sn1408; Calibrated: 8/12/2019
Phantom: Twin-SAM V4.0; Type: QD 000 P40 CC; Serial: 1596
Measurement SW: DASY52, Version 52.10 (4);SEMCAD X Version 14.6.14 (7483)

2600 MHz System Verification at 20.0 dBm (100 mW)

Area Scan (8x9x1): Measurement grid: dx=12mm, dy=12mm
Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Peak SAR (extrapolated) = 12.8 W/kg
SAR(10 g) = 2.55 W/kg
Deviation(10 g) = 2.82%



0 dB = 10.0 W/kg = 10.00 dBW/kg

PCTEST

DUT: Dipole 2600 MHz; Type: D2600V2; Serial: 1009

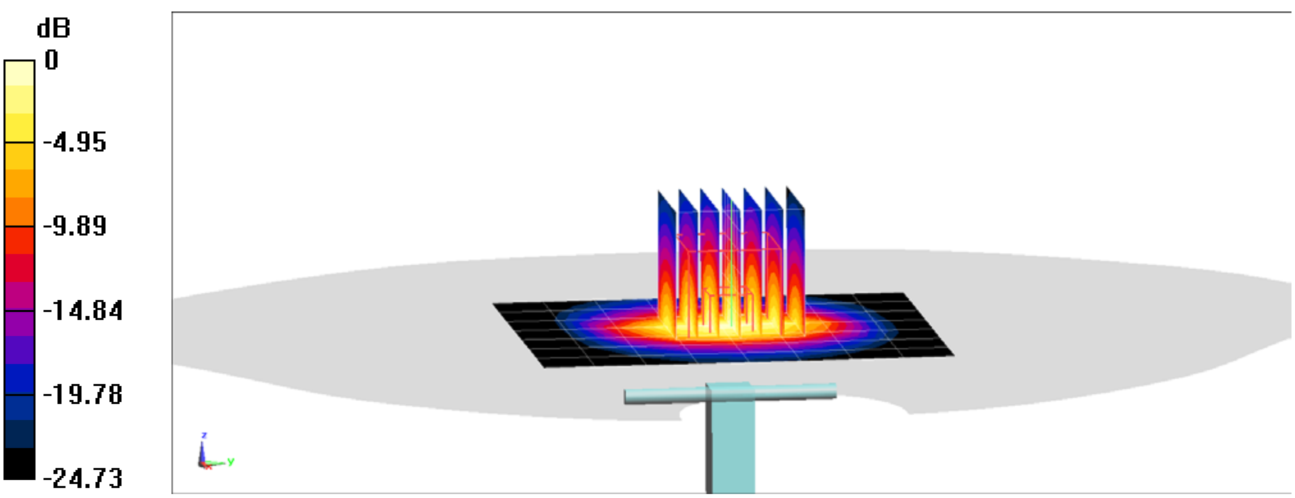
Communication System: UID 0, CW; Frequency: 2600 MHz; Duty Cycle: 1:1
Medium: 2450-2600 MHz Body Medium parameters used:
f = 2600 MHz; $\sigma = 2.229$ S/m; $\varepsilon_r = 51.421$; $\rho = 1000$ kg/m^3
Phantom section: Flat Section; Space: 1.0 cm

Test Date: 07-15-2020; Ambient Temp: 22.7°C; Tissue Temp: 20.5°C

Probe: EX3DV4 - SN7416; ConvF(7.23, 7.23, 7.23) @ 2600 MHz; Calibrated: 6/22/2020
Sensor-Surface: 1.4mm (Mechanical Surface Detection)
Electronics: DAE4 Sn701; Calibrated: 6/11/2020
Phantom: Twin-SAM V8.0; Type: QD 000 P41 Ax; Serial: 1936
Measurement SW: DASY52, Version 52.10 (4);SEMCAD X Version 14.6.14 (7483)

2600 MHz System Verification at 20.0 dBm (100 mW)

Area Scan (8x9x1): Measurement grid: dx=12mm, dy=12mm
Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Peak SAR (extrapolated) = 12.3 W/kg
SAR(10 g) = 2.34 W/kg
Deviation(10 g) = -6.40%



0 dB = 9.58 W/kg = 9.81 dBW/kg

APPENDIX C: SAR TISSUE SPECIFICATIONS

Measurement Procedure for Tissue verification:

1) The network analyzer and probe system was configured and calibrated.
2) The probe was immersed in the tissue. The tissue was placed in a nonmetallic container. Trapped air bubbles beneath the flange were minimized by placing the probe at a slight angle.
3) The complex admittance with respect to the probe aperture was measured
4) The complex relative permittivity ε' can be calculated from the below equation (Pournaropoulos and Misra):

$$Y = \frac{j2\omega\varepsilon_r\varepsilon_0}{[\ln(b/a)]^2}\int_a^b\int_a^b\int_0^\pi \cos\phi' \frac{\exp\left[-j\omega r(\mu_0\varepsilon_r'\varepsilon_0)^{1/2}\right]}{r} d\phi' d\rho' d\rho$$

where *Y* is the admittance of the probe in contact with the sample, the primed and unprimed coordinates refer to source and observation points, respectively, $r^2 = \rho^2 + \rho'^2 - 2\rho\rho'\cos\phi'$, ω is the angular frequency, and $j = \sqrt{-1}$.

3 Composition / Information on ingredients

3.2 Mixtures
Description: Aqueous solution with surfactants and inhibitors
Declarable, or hazardous components:

CAS: 107-21-1 EINECS: 203-473-3 Reg.nr.: 01-2119456816-28-0000	**Ethanediol** STOT RE 2, H373; Acute Tox. 4, H302	>1.0-4.9%
CAS: 68608-26-4 EINECS: 271-781-5 Reg.nr.: 01-2119527859-22-0000	**Sodium petroleum sulfonate** Eye Irrit. 2, H319	< 2.9%
CAS: 107-41-5 EINECS: 203-489-0 Reg.nr.: 01-2119539582-35-0000	**Hexylene Glycol / 2-Methyl-pentane-2,4-diol** Skin Irrit. 2, H315; Eye Irrit. 2, H319	< 2.9%
CAS: 68920-66-1 NLP: 500-236-9 Reg.nr.: 01-2119489407-26-0000	**Alkoxylated alcohol, > C_{16}** Aquatic Chronic 2, H411; Skin Irrit. 2, H315; Eye Irrit. 2, H319	< 2.0%

Additional information:
For the wording of the listed risk phrases refer to section 16.
Not mentioned CAS-, EINECS- or registration numbers are to be regarded as Proprietary/Confidential.
The specific chemical identity and/or exact percentage concentration of proprietary components is withheld as a trade secret.

Figure C-1

Note: Liquid recipes are proprietary SPEAG. Since the composition is approximate to the actual liquids utilized, the manufacturer tissue-equivalent liquid data sheets are provided below.

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Measurement Certificate / Material Test

Item Name	**Body Tissue Simulating Liquid (MBBL600-6000V6)**
Product No.	SL AAM U16 BC (Batch: 181029-1)
Manufacturer	SPEAG

Measurement Method

TSL dielectric parameters measured using calibrated DAK probe.

Target Parameters

Target parameters as defined in the KDB 865664 compliance standard.

Test Condition

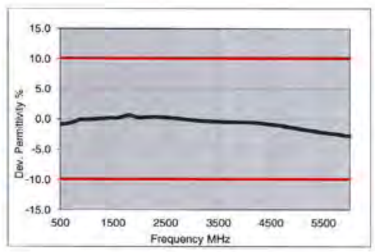
Ambient Condition	22°C ; 30% humidity
TSL Temperature	22°C
Test Date	30-Oct-18
Operator	CL

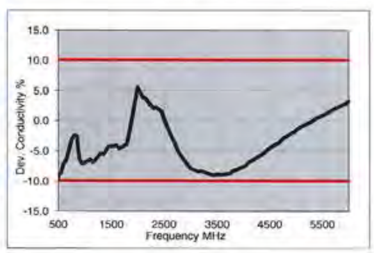
Additional Information

TSL Density
TSL Heat-capacity

Results

	Measured			Target		Diff.to Target [%]	
f [MHz]	e'	e''	sigma	eps	sigma	Δ-eps	Δ-sigma
800	55.1	21.3	0.95	55.3	0.97	-0.4	-2.1
825	55.1	20.8	0.96	55.2	0.98	-0.3	-2.0
835	55.1	20.6	0.06	55.1	0.99	0.0	-2.5
850	55.1	20.4	0.96	55.2	0.99	-0.1	-3.0
900	55.0	19.7	0.98	55.0	1.05	0.0	-6.7
1400	54.2	15.6	1.22	54.1	1.28	0.2	-4.7
1450	54.1	15.4	1.24	54.0	1.30	0.2	-4.6
1500	54.1	15.3	1.27	53.9	1.33	0.3	-4.5
1550	54.0	15.1	1.30	53.9	1.36	0.2	-4.4
1600	53.9	15.0	1.33	53.8	1.39	0.2	-4.3
1625	53.9	14.9	1.35	53.8	1.41	0.3	-4.3
1640	53.9	14.9	1.36	53.7	1.42	0.3	-4.2
1650	53.8	14.9	1.36	53.7	1.43	0.2	-4.9
1700	53.8	14.8	1.40	53.6	1.46	0.4	-4.1
1750	53.7	14.7	1.43	53.4	1.49	0.5	-4.0
1800	53.7	14.6	1.46	53.3	1.52	0.8	-3.9
1810	53.7	14.6	1.47	53.3	1.52	0.8	-3.3
1825	53.7	14.6	1.48	53.3	1.52	0.8	-2.6
1850	53.6	14.5	1.50	53.3	1.52	0.6	-1.3
1900	53.5	14.5	1.53	53.3	1.52	0.4	0.7
1950	53.5	14.5	1.57	53.3	1.52	0.4	3.3
2000	53.4	14.4	1.60	53.3	1.52	0.2	5.3
2050	53.4	14.4	1.64	53.2	1.57	0.3	4.5
2100	53.3	14.4	1.68	53.2	1.62	0.2	3.7
2150	53.3	14.4	1.72	53.1	1.66	0.4	3.6
2200	53.2	14.4	1.76	53.0	1.71	0.3	2.9
2250	53.1	14.4	1.81	53.0	1.76	0.2	2.8
2300	53.1	14.4	1.85	52.9	1.81	0.4	2.2
2350	53.0	14.5	1.89	52.8	1.85	0.3	2.2
2400	52.9	14.5	1.94	52.8	1.90	0.2	2.1
2450	52.9	14.5	1.98	52.7	1.95	0.4	1.5
2500	52.8	14.6	2.03	52.6	2.02	0.3	0.5
2550	52.7	14.6	2.07	52.6	2.09	0.2	-1.0
2600	52.6	14.7	2.12	52.5	2.16	0.2	-1.9
3500	51.1	15.5	3.02	51.3	3.31	-0.4	-8.8
3700	50.8	15.7	3.24	51.1	3.55	-0.5	-8.8
5200	48.1	18.2	5.27	49.0	5.30	-1.8	-0.6
5250	48.0	18.3	5.34	49.0	5.36	-1.9	-0.4
5300	47.9	18.4	5.41	48.9	5.42	-2.0	-0.2
5500	47.6	18.6	5.70	48.6	5.65	-2.2	0.8
5600	47.3	18.8	5.84	48.5	5.77	-2.3	1.3
5700	47.1	18.9	5.99	48.3	5.88	-2.5	1.8
5800	47.0	19.0	6.14	48.2	6.00	-2.6	2.3





TSL Dielectric Parameters 1

Figure C-2
600 – 5800 MHz Body Tissue Equivalent Matter

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Measurement Certificate / Material Test

Item Name	**Head Tissue Simulating Liquid (HBBL600-10000V6)**
Product No.	SL AAH U16 BC (Batch: 181031-2)
Manufacturer	SPEAG

Measurement Method

TSL dielectric parameters measured using calibrated DAK probe.

Target Parameters

Target parameters as defined in the IEEE 1528 and IEC 62209 compliance standards.

Test Condition

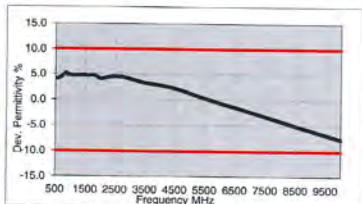
Ambient Condition	22°C ; 30% humidity
TSL Temperature	22°C
Test Date	31-Oct-18
Operator	CL

Additional Information

TSL Density
TSL Heat-capacity

Results

	Measured			Target		Diff.to Target [%]	
f [MHz]	e'	e''	sigma	eps	sigma	Δ-eps	Δ-sigma
800	43.8	20.5	0.91	41.7	0.90	5.1	1.4
825	43.8	20.1	0.92	41.6	0.91	5.3	1.5
835	43.8	19.9	0.93	41.5	0.91	5.4	2.0
850	43.7	19.7	0.93	41.5	0.92	5.3	1.5
900	43.5	18.9	0.95	41.5	0.97	4.8	-2.1
1400	42.5	15.0	1.17	40.6	1.18	4.7	-0.8
1450	42.5	14.8	1.19	40.5	1.20	4.9	-0.8
1600	42.2	14.3	1.27	40.3	1.28	4.7	-1.1
1625	42.2	14.2	1.29	40.3	1.30	4.8	-0.7
1640	42.2	14.2	1.30	40.3	1.31	4.8	-0.5
1650	42.1	14.2	1.30	40.2	1.31	4.6	-1.0
1700	42.1	14.0	1.33	40.2	1.34	4.8	-0.9
1750	42.0	13.9	1.36	40.1	1.37	4.8	-0.8
1800	41.9	13.9	1.39	40.0	1.40	4.7	-0.7
1810	41.9	13.8	1.40	40.0	1.40	4.7	0.0
1825	41.9	13.8	1.41	40.0	1.40	4.7	0.7
1850	41.8	13.8	1.42	40.0	1.40	4.5	1.4
1900	41.8	13.7	1.45	40.0	1.40	4.5	3.6
1950	41.7	13.7	1.48	40.0	1.40	4.3	5.7
2000	41.6	13.6	1.51	40.0	1.40	4.0	7.9
2050	41.6	13.6	1.55	39.9	1.44	4.2	7.3
2100	41.5	13.5	1.58	39.8	1.49	4.2	6.1
2150	41.4	13.5	1.62	39.7	1.53	4.2	5.7
2200	41.4	13.5	1.65	39.6	1.58	4.4	4.6
2250	41.3	13.5	1.69	39.6	1.62	4.4	4.2
2300	41.2	13.5	1.72	39.5	1.67	4.4	3.2
2350	41.1	13.5	1.76	39.4	1.71	4.4	2.9
2400	41.1	13.5	1.80	39.3	1.76	4.6	2.5
2450	41.0	13.5	1.84	39.2	1.80	4.6	2.2
2500	40.9	13.5	1.88	39.1	1.85	4.5	1.4
2550	40.8	13.5	1.92	39.1	1.91	4.4	0.6
2600	40.8	13.6	1.96	39.0	1.96	4.6	-0.2
3500	39.2	14.1	2.74	37.9	2.91	3.3	-5.8
3700	38.9	14.2	2.93	37.7	3.12	3.1	-6.1
5200	36.3	15.8	4.57	36.0	4.66	0.9	-1.7
5250	36.2	15.9	4.63	35.9	4.71	0.8	-1.6
5300	36.1	15.9	4.69	35.9	4.76	0.7	-1.4
5500	35.8	16.1	4.92	35.6	4.96	0.3	-0.9
5600	35.6	16.2	5.04	35.5	5.07	0.1	-0.6
5700	35.4	16.2	5.15	35.4	5.17	0.0	-0.3
5800	35.2	16.3	5.27	35.3	5.27	-0.2	0.0
6000	34.9	16.5	5.50	35.1	5.48	-0.6	0.5
6500	34.0	16.9	6.12	34.5	6.07	-1.4	0.9
7000	33.1	17.3	6.74	33.9	6.65	-2.3	1.3
7500	32.2	17.6	7.36	33.3	7.24	-3.2	1.6
8000	31.4	17.9	7.97	32.7	7.84	-4.1	1.7
8500	30.5	18.2	8.59	32.1	8.45	-5.0	1.6
9000	29.7	18.4	9.20	31.5	9.08	-5.9	1.3
9500	28.9	18.5	9.80	31.0	9.71	-6.8	0.9
10000	28.1	18.7	10.40	30.4	10.36	-7.6	0.4



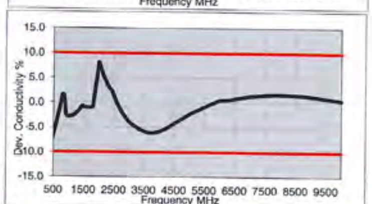


Figure C-3
600 – 5800 MHz Head Tissue Equivalent Matter

APPENDIX D: SAR SYSTEM VALIDATION SUMMARY

Per FCC KDB Publication 865664 D02v01r02, SAR system validation status should be documented to confirm measurement accuracy. The SAR systems (including SAR probes, system components and software versions) used for this device were validated against its performance specifications prior to the SAR measurements. Reference dipoles were used with the required tissue- equivalent media for system validation, according to the procedures outlined in FCC KDB Publication 865664 D01v01r04. Since SAR probe calibrations are frequency dependent, each probe calibration point was validated at a frequency within the valid frequency range of the probe calibration point, using the system that normally operates with the probe for routine SAR measurements and according to the required tissue-equivalent media.

A tabulated summary of the system validation status including the validation date(s), measurement frequencies, SAR probes and tissue dielectric parameters has been included.

Table D-1
SAR System Validation Summary – 1g

SAR System	Freq. (MHz)	Date	Probe SN	Probe Cal Point		Cond. (σ)	Perm. (εr)	CW VALIDATION			MOD. VALIDATION		
								SENSITIVITY	PROBE LINEARITY	PROBE ISOTROPY	MOD. TYPE	DUTY FACTOR	PAR
AM6	835	3/10/2020	3837	835	Head	0.884	42.86	PASS	PASS	PASS	GMSK	PASS	N/A
AM2	835	12/5/2019	7420	835	Head	0.879	42.987	PASS	PASS	PASS	GMSK	PASS	N/A
AM2	1750	12/6/2019	7420	1750	Head	1.345	41.1	PASS	PASS	PASS	N/A	N/A	N/A
AM6	1750	3/10/2020	3837	1750	Head	1.34	40.969	PASS	PASS	PASS	N/A	N/A	N/A
AM6	1900	3/10/2020	3837	1900	Head	1.437	40.78	PASS	PASS	PASS	GMSK	PASS	N/A
AM7	2450	5/22/2020	7490	2450	Head	1.788	38.887	PASS	PASS	PASS	OFDM/TDD	PASS	PASS
AM1	2450	3/13/2020	7427	2450	Head	1.788	38.75	PASS	PASS	PASS	OFDM/TDD	PASS	PASS
AM7	2600	5/22/2020	7490	2600	Head	1.903	38.634	PASS	PASS	PASS	TDD	PASS	N/A
AM1	2600	3/13/2020	7427	2600	Head	1.902	38.47	PASS	PASS	PASS	TDD	PASS	N/A

Table D-2
SAR System Validation Summary – 10g

SAR System	Freq. (MHz)	Date	Probe SN	Probe Cal Point		Cond. (σ)	Perm. (εr)	CW VALIDATION			MOD. VALIDATION		
								SENSITIVITY	PROBE LINEARITY	PROBE ISOTROPY	MOD. TYPE	DUTY FACTOR	PAR
AM6	835	3/10/2020	3837	835	Body	0.992	54.144	PASS	PASS	PASS	GMSK	PASS	N/A
AM4	835	4/22/2020	7421	835	Body	0.992	54.556	PASS	PASS	PASS	GMSK	PASS	N/A
AM8	1750	5/27/2020	7532	1750	Body	1.454	51.143	PASS	PASS	PASS	N/A	N/A	N/A
AM6	1900	3/4/2020	3837	1900	Body	1.583	51.67	PASS	PASS	PASS	GMSK	PASS	N/A
AM3	2450	9/4/2019	3949	2450	Body	1.955	52.22	PASS	PASS	PASS	OFDM/TDD	PASS	PASS
AM5	2450	7/6/2020	7416	2450	Body	1.996	51.99	PASS	PASS	PASS	OFDM/TDD	PASS	PASS
AM3	2600	9/4/2019	3949	2600	Body	2.096	51.97	PASS	PASS	PASS	TDD	PASS	N/A
AM5	2600	7/6/2020	7416	2600	Body	2.226	51.419	PASS	PASS	PASS	TDD	PASS	N/A

NOTE: While the probes have been calibrated for both CW and modulated signals, all measurements were performed using communication systems calibrated for CW signals only. Modulations in the table above represent test configurations for which the measurement system has been validated per FCC KDB Publication 865664 D01v01r04 for scenarios when CW probe calibrations are used with other signal types. SAR systems were validated for modulated signals with a periodic duty cycle, such as GMSK, or with a high peak to average ratio (>5 dB), such as OFDM according to FCC KDB Publication 865664 D01v01r04.

APPENDIX F: PROBE AND DIPOLE CALIBRATION CERTIFICATES

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

S Schweizerischer Kalibrierdienst
C Service suisse d'étalonnage
Servizio svizzero di taratura
S 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 **PC Test**

Certificate No: **D835V2-4d040_Jun19**

CALIBRATION CERTIFICATE

Object: D835V2 - SN:4d040

Calibration procedure(s): QA CAL-05.v11
Calibration Procedure for SAR Validation Sources between 0.7-3 GHz

Calibration date: June 20, 2019

ATM 6/28/19
ATM 1/2/20

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	03-Apr-19 (No. 217-02892/02893)	Apr-20
Power sensor NRP-Z91	SN: 103244	03-Apr-19 (No. 217-02892)	Apr-20
Power sensor NRP-Z91	SN: 103245	03-Apr-19 (No. 217-02893)	Apr-20
Reference 20 dB Attenuator	SN: 5058 (20k)	04-Apr-19 (No. 217-02894)	Apr-20
Type-N mismatch combination	SN: 5047.2 / 06327	04-Apr-19 (No. 217-02895)	Apr-20
Reference Probe EX3DV4	SN: 7349	29-May-19 (No. EX3-7349_May19)	May-20
DAE4	SN: 601	30-Apr-19 (No. DAE4-601_Apr19)	Apr-20

Secondary Standards	ID #	Check Date (in house)	Scheduled Check
Power meter E4419B	SN: GB39512475	30-Oct-14 (in house check Feb-19)	In house check: Oct-20
Power sensor HP 8481A	SN: US37292783	07-Oct-15 (in house check Oct-18)	In house check: Oct-20
Power sensor HP 8481A	SN: MY41092317	07-Oct-15 (in house check Oct-18)	In house check: Oct-20
RF generator R&S SMT-06	SN: 100972	15-Jun-15 (in house check Oct-18)	In house check: Oct-20
Network Analyzer Agilent E8358A	SN: US41080477	31-Mar-14 (in house check Oct-18)	In house check: Oct-19

	Name	Function	Signature
Calibrated by:	Manu Seitz	Laboratory Technician	
Approved by:	Katja Pokovic	Technical Manager	

Issued: June 21, 2019

Glossary:

TSL	tissue simulating liquid
ConvF	sensitivity in TSL / NORM x,y,z
N/A	not applicable or not measured

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, "Measurement procedure for the assessment of Specific Absorption Rate (SAR) from hand-held and body-mounted devices used next to the ear (frequency range of 300 MHz to 6 GHz)", July 2016
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"

Additional Documentation:

e) DASY4/5 System Handbook

Methods Applied and Interpretation of Parameters:

- *Measurement Conditions:* Further details are available from the Validation Report at the end of the certificate. All figures stated in the certificate are valid at the frequency indicated.
- *Antenna Parameters with TSL:* The dipole is mounted with the spacer to position its feed point exactly below the center marking of the flat phantom section, with the arms oriented parallel to the body axis.
- *Feed Point Impedance and Return Loss:* These parameters are measured with the dipole positioned under the liquid filled phantom. The impedance stated is transformed from the measurement at the SMA connector to the feed point. The Return Loss ensures low reflected power. No uncertainty required.
- *Electrical Delay:* One-way delay between the SMA connector and the antenna feed point. No uncertainty required.
- *SAR measured:* SAR measured at the stated antenna input power.
- *SAR normalized:* SAR as measured, normalized to an input power of 1 W at the antenna connector.
- *SAR for nominal TSL parameters:* The measured TSL parameters are used to calculate the nominal SAR result.

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%.

Measurement Conditions

DASY system configuration, as far as not given on page 1.

DASY Version	DASY5	V52.10.2
Extrapolation	Advanced Extrapolation	
Phantom	Modular Flat Phantom	
Distance Dipole Center - TSL	15 mm	with Spacer
Zoom Scan Resolution	dx, dy, dz = 5 mm	
Frequency	835 MHz ± 1 MHz	

Head TSL parameters

The following parameters and calculations were applied.

	Temperature	**Permittivity**	**Conductivity**
Nominal Head TSL parameters	22.0 °C	41.5	0.90 mho/m
Measured Head TSL parameters	(22.0 ± 0.2) °C	41.8 ± 6 %	0.91 mho/m ± 6 %
Head TSL temperature change during test	< 0.5 °C	----	----

SAR result with Head TSL

SAR averaged over 1 cm^3 (1 g) of Head TSL	Condition	
SAR measured	250 mW input power	2.39 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	**9.50 W/kg ± 17.0 % (k=2)**

SAR averaged over 10 cm^3 (10 g) of Head TSL	condition	
SAR measured	250 mW input power	1.54 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	**6.13 W/kg ± 16.5 % (k=2)**

Body TSL parameters

The following parameters and calculations were applied.

	Temperature	**Permittivity**	**Conductivity**
Nominal Body TSL parameters	22.0 °C	55.2	0.97 mho/m
Measured Body TSL parameters	(22.0 ± 0.2) °C	55.4 ± 6 %	0.98 mho/m ± 6 %
Body TSL temperature change during test	< 0.5 °C	----	----

SAR result with Body TSL

SAR averaged over 1 cm^3 (1 g) of Body TSL	Condition	
SAR measured	250 mW input power	2.40 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	**9.53 W/kg ± 17.0 % (k=2)**

SAR averaged over 10 cm^3 (10 g) of Body TSL	condition	
SAR measured	250 mW input power	1.57 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	**6.24 W/kg ± 16.5 % (k=2)**

Appendix (Additional assessments outside the scope of SCS 0108)

Antenna Parameters with Head TSL

Impedance, transformed to feed point	49.6 Ω - 4.1 jΩ
Return Loss	- 27.7 dB

Antenna Parameters with Body TSL

Impedance, transformed to feed point	46.6 Ω - 6.5 jΩ
Return Loss	- 22.4 dB

General Antenna Parameters and Design

Electrical Delay (one direction)	1.393 ns

After long term use with 100W radiated power, only a slight warming of the dipole near the feedpoint can be measured.

The dipole is made of standard semirigid coaxial cable. The center conductor of the feeding line is directly connected to the second arm of the dipole. The antenna is therefore short-circuited for DC-signals. On some of the dipoles, small end caps are added to the dipole arms in order to improve matching when loaded according to the position as explained in the "Measurement Conditions" paragraph. The SAR data are not affected by this change. The overall dipole length is still according to the Standard.
No excessive force must be applied to the dipole arms, because they might bend or the soldered connections near the feedpoint may be damaged.

Additional EUT Data

Manufactured by	SPEAG

DASY5 Validation Report for Head TSL

Date: 20.06.2019

Test Laboratory: SPEAG, Zurich, Switzerland

DUT: Dipole 835 MHz; Type: D835V2; Serial: D835V2 - SN:4d040

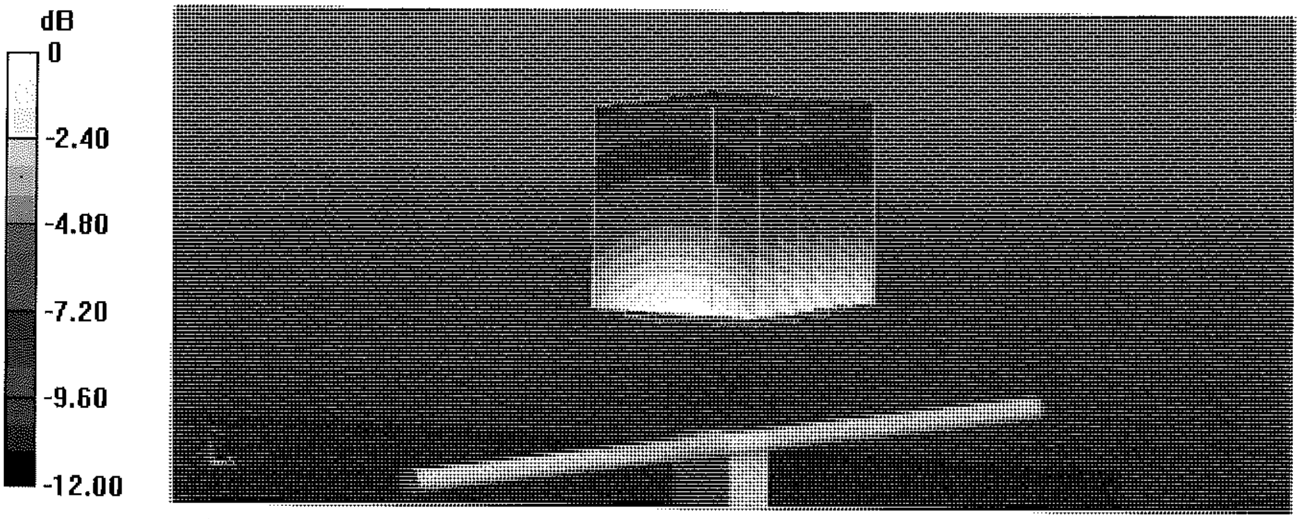
Communication System: UID 0 - CW; Frequency: 835 MHz
Medium parameters used: f = 835 MHz; $\sigma = 0.91$ S/m; $\varepsilon_r = 41.8$; $\rho = 1000$ kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2011)

DASY52 Configuration:

- Probe: EX3DV4 - SN7349; ConvF(9.89, 9.89, 9.89) @ 835 MHz; Calibrated: 29.05.2019
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 30.04.2019
- Phantom: Flat Phantom 4.9 (front); Type: QD 00L P49 AA; Serial: 1001
- DASY52 52.10.2(1504); SEMCAD X 14.6.12(7470)

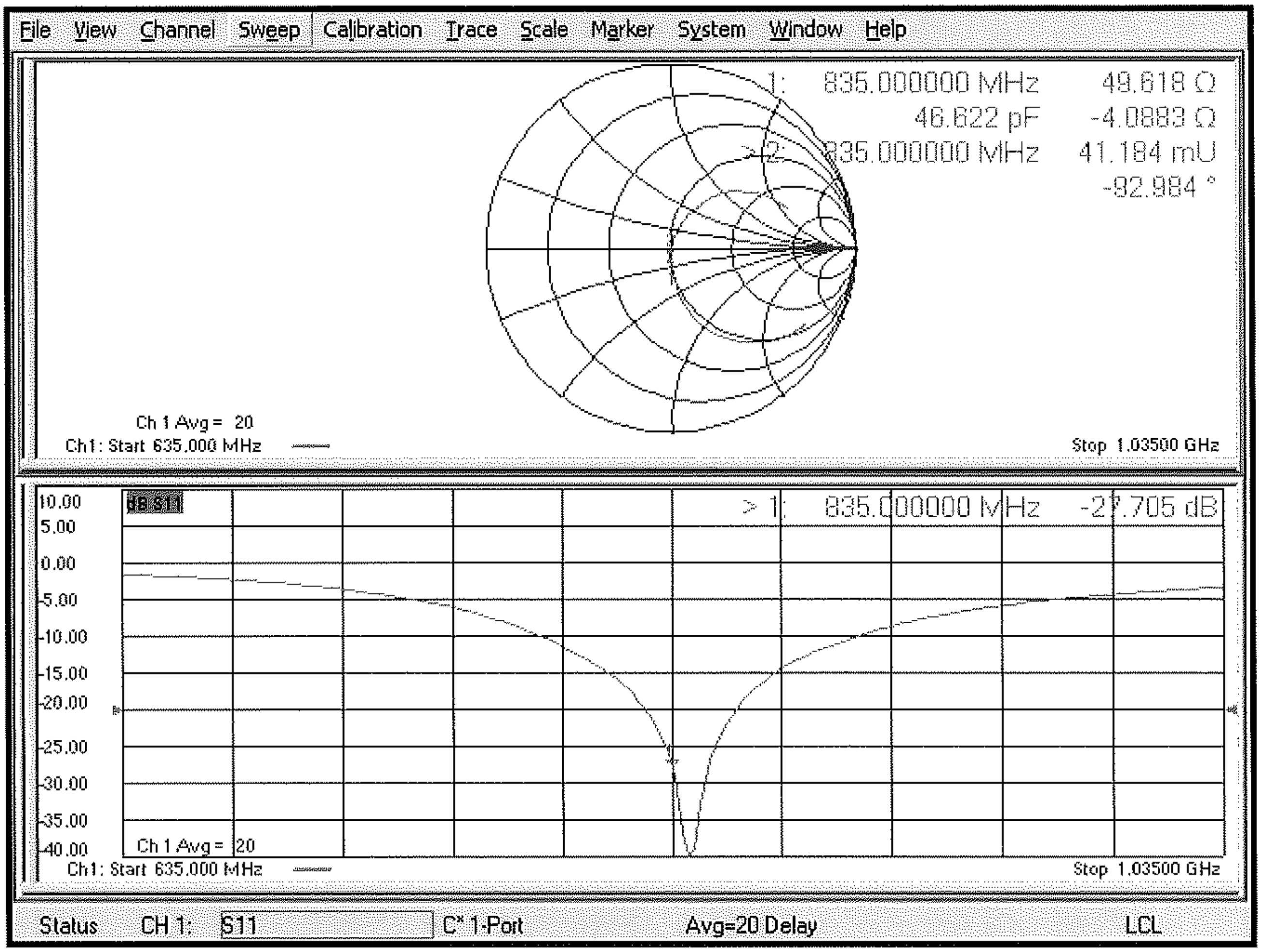
Dipole Calibration for Head Tissue/Pin=250 mW, d=15mm/Zoom Scan (7x7x7)/Cube 0:

Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 63.05 V/m; Power Drift = -0.08 dB
Peak SAR (extrapolated) = 3.60 W/kg
SAR(1 g) = 2.39 W/kg; SAR(10 g) = 1.54 W/kg
Maximum value of SAR (measured) = 3.19 W/kg



0 dB = 3.19 W/kg = 5.04 dBW/kg

Impedance Measurement Plot for Head TSL



DASY5 Validation Report for Body TSL

Date: 13.06.2019

Test Laboratory: SPEAG, Zurich, Switzerland

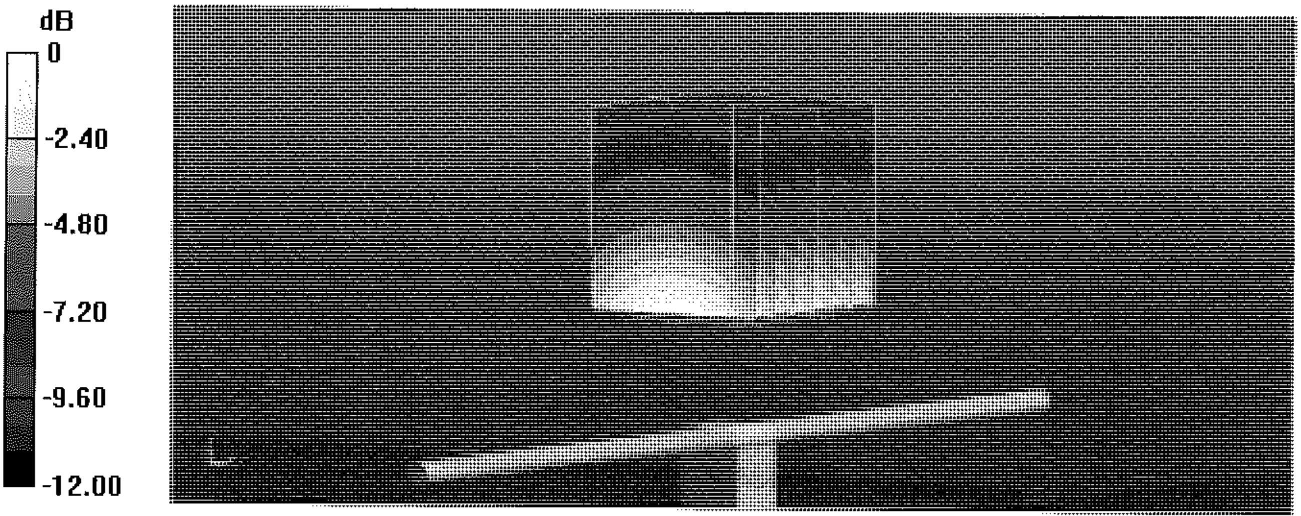
DUT: Dipole 835 MHz; Type: D835V2; Serial: D835V2 - SN:4d040

Communication System: UID 0 - CW; Frequency: 835 MHz
Medium parameters used: f = 835 MHz; σ = 0.98 S/m; ε_r = 55.4; ρ = 1000 kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2011)

DASY52 Configuration:

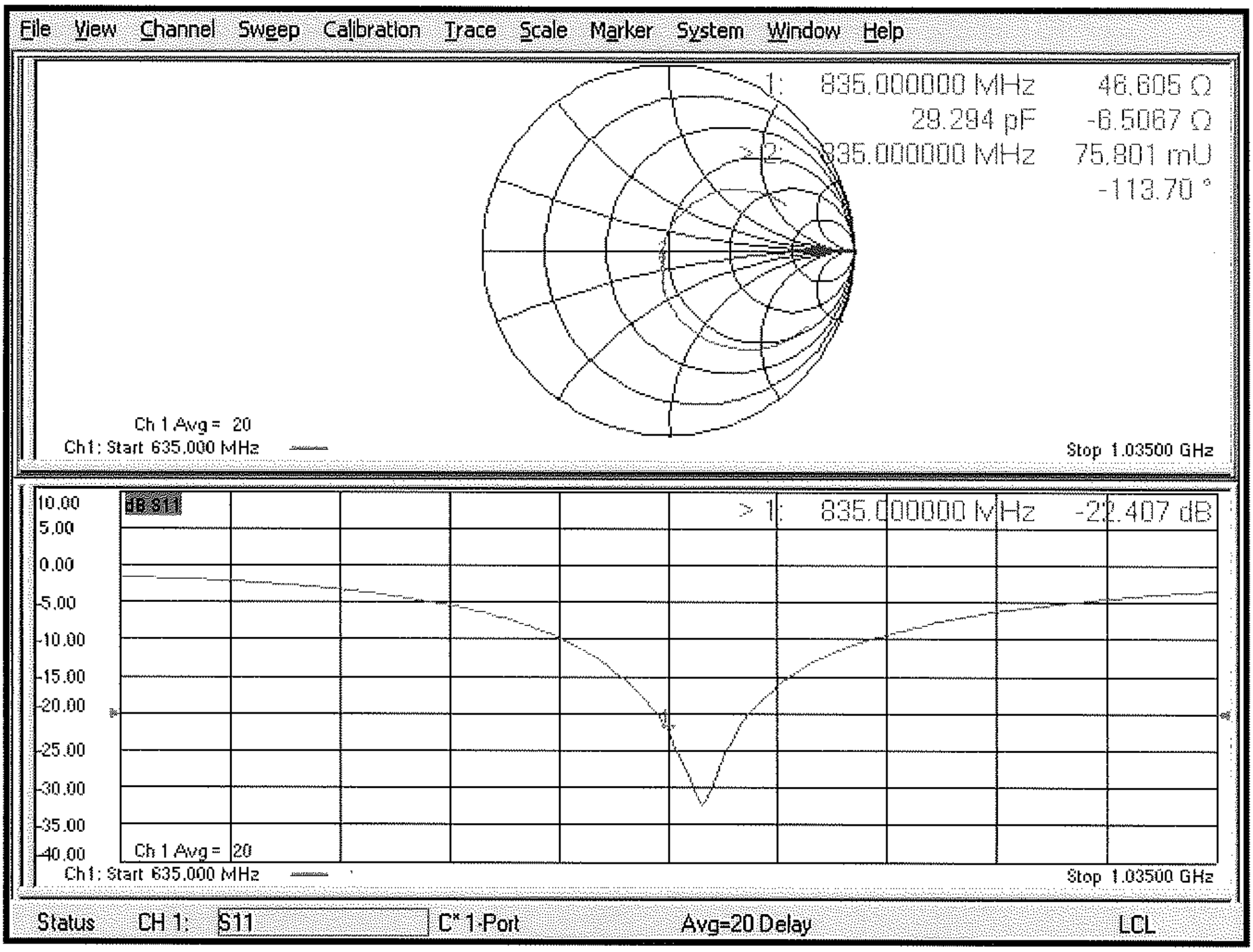
- Probe: EX3DV4 - SN7349; ConvF(10.16, 10.16, 10.16) @ 835 MHz; Calibrated: 29.05.2019
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 30.04.2019
- Phantom: Flat Phantom 4.9 (Back); Type: QD 00R P49 AA; Serial: 1005
- DASY52 52.10.2(1504); SEMCAD X 14.6.12(7470)

Dipole Calibration for Body Tissue/Pin=250 mW, d=15mm/Zoom Scan (7x7x7)/Cube 0:
Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 57.73 V/m; Power Drift = -0.08 dB
Peak SAR (extrapolated) = 3.59 W/kg
SAR(1 g) = 2.4 W/kg; SAR(10 g) = 1.57 W/kg
Maximum value of SAR (measured) = 3.21 W/kg



0 dB = 3.21 W/kg = 5.07 dBW/kg

Impedance Measurement Plot for Body TSL



PCTEST
18855 Adams Ct, Morgan Hill, CA 95037 USA
Tel. +1.410.290.6652 / Fax +1.410.290.6654
http://www.pctest.com

Certification of Calibration

Object	D835V2 – SN: 4d040
Calibration procedure(s)	Procedure for Calibration Extension for SAR Dipoles.
Extended Calibration date:	June 20, 2020
Description:	SAR Validation Dipole at 835 MHz.

Calibration Equipment used:

Manufacturer	Model	Description	Cal Date	Cal Interval	Cal Due	Serial Number
Agilent	8753ES	S-Parameter Network Analyzer	1/16/2020	Annual	1/16/2021	US39170118
Agilent	N5182A	MXG Vector Signal Generator	8/19/2019	Annual	8/19/2020	MY47420837
Amplifier Research	15S1G6	Amplifier	CBT	N/A	CBT	343972
Anritsu	MA2411B	Pulse Power Sensor	1/21/2020	Annual	1/21/2021	1207470
Anritsu	MA2411B	Pulse Power Sensor	1/21/2020	Annual	1/21/2021	1339007
Anritsu	ML2495A	Power Meter	1/15/2020	Annual	1/15/2021	1328004
Control Company	62344-734	Therm./ Clock/ Humidity Monitor	3/18/2019	Biennial	3/18/2021	192038436
Control Company	4352	Ultra Long Stem Thermometer	8/2/2018	Biennial	8/2/2020	181292000
Keysight Technologies	85033E	Standard Mechanical Calibration Kit (DC to 9GHz, 3.5mm)	7/2/2019	Annual	7/2/2020	MY53401181
MiniCircuits	VLF-6000+	Low Pass Filter	CBT	N/A	CBT	N/A
Mini-Circuits	BW-N20W5+	DC to 18 GHz Precision Fixed 20 dB Attenuator	CBT	N/A	CBT	N/A
Narda	4772-3	Attenuator (3dB)	CBT	N/A	CBT	9406
Pasternack	PE2208-6	Bidirectional Coupler	CBT	N/A	CBT	N/A
Seekonk	NC-100	Torque Wrench	7/18/2019	Annual	7/18/2020	N/A
SPEAG	DAE4	Dasy Data Acquisition Electronics	1/14/2020	Annual	1/14/2021	793
SPEAG	DAE4	Dasy Data Acquisition Electronics	3/19/2020	Annual	3/19/2021	604
SPEAG	DAK-3.5	Dielectric Assessment Kit	5/12/2020	Annual	5/12/2021	1070
SPEAG	EX3DV4	SAR Probe	1/20/2020	Annual	1/20/2021	3837
SPEAG	EX3DV4	SAR Probe	3/20/2020	Annual	3/20/2021	7421

Measurement Uncertainty = ±23% (k=2)

	Name	Function	Signature
Calibrated By:	Parker Jones	Team Lead Engineer	Parker Jones
Approved By:	Kaitlin O'Keefe	Managing Director	KOK

DIPOLE CALIBRATION EXTENSION

Per KDB 865664 D01, calibration intervals of up to three years may be considered for reference dipoles when it is demonstrated that the SAR target, impedance and return loss of a dipole have remained stable according to the following requirements:

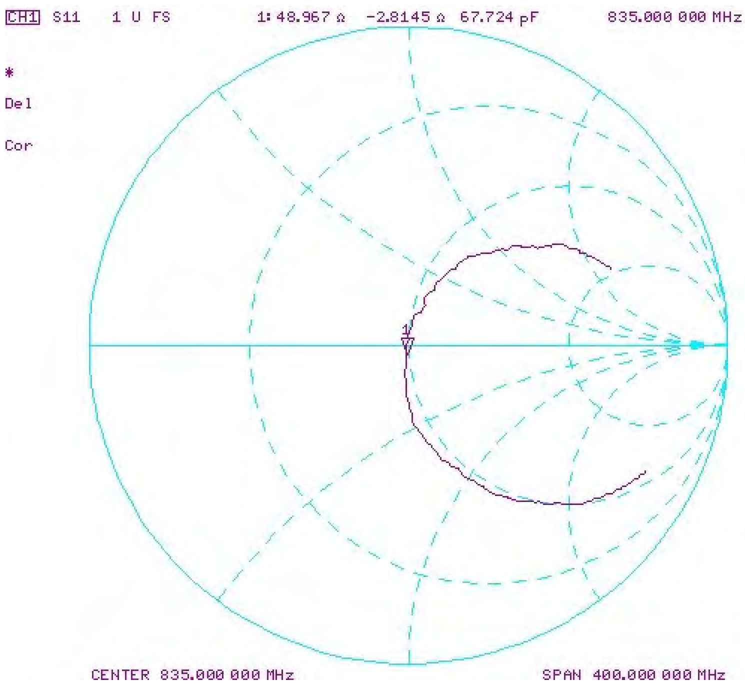
1. The measured SAR does not deviate more than 10% from the target on the calibration certificate.
2. The return-loss does not deviate more than 20% from the previous measurement and meets the required 20dB minimum return-loss requirement.
3. The measurement of real or imaginary parts of impedance does not deviate more than 5Ω from the previous measurement.

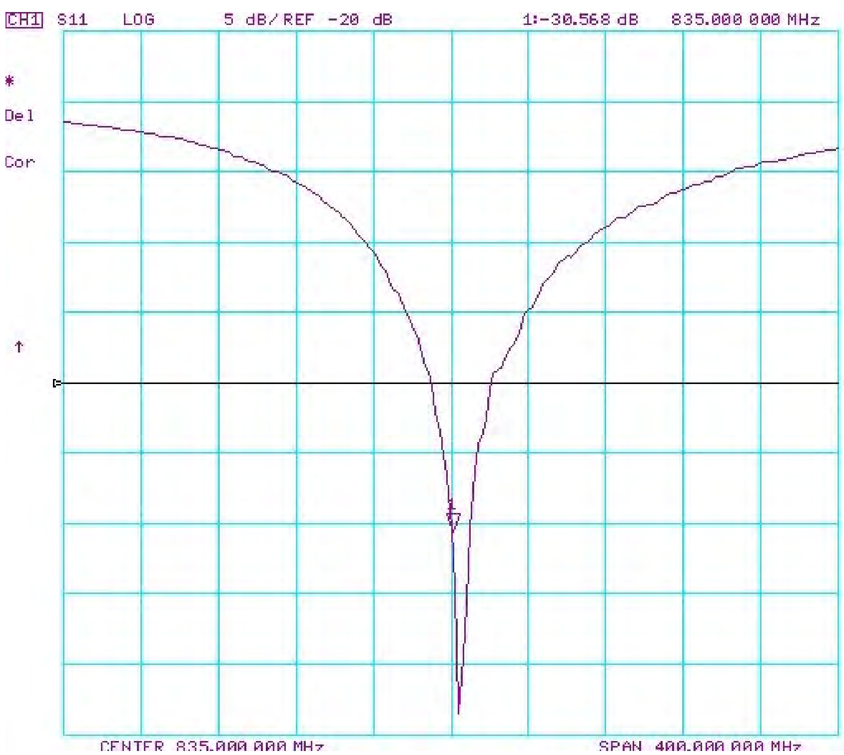
The following dipole was checked to pass the above 3 requirements to have 2-year calibration period from the calibration date:

Calibration Date	Extension Date	Certificate Electrical Delay (ns)	Certificate SAR Target Head (1g) W/kg @ 23.0 dBm	Measured Head SAR (1g) W/kg @ 23.0 dBm	Deviation 1g (%)	Certificate SAR Target Head (10g) W/kg @ 23.0 dBm	Measured Head SAR (10g) W/kg @ 23.0 dBm	Deviation 10g (%)	Certificate Impedance Head (Ohm) Real	Measured Impedance Head (Ohm) Real	Difference (Ohm) Real	Certificate Impedance Head (Ohm) Imaginary	Measured Impedance Head (Ohm) Imaginary	Difference (Ohm) Imaginary	Certificate Return Loss Head (dB)	Measured Return Loss Head (dB)	Deviation (%)	PASS/FAIL
6/20/2019	6/20/2020	1.393	1.900	2	5.26%	1.226	1.31	6.85%	49.6	49	0.6	-4.1	-2.8	1.3	-27.7	-30.6	-10.50%	PASS

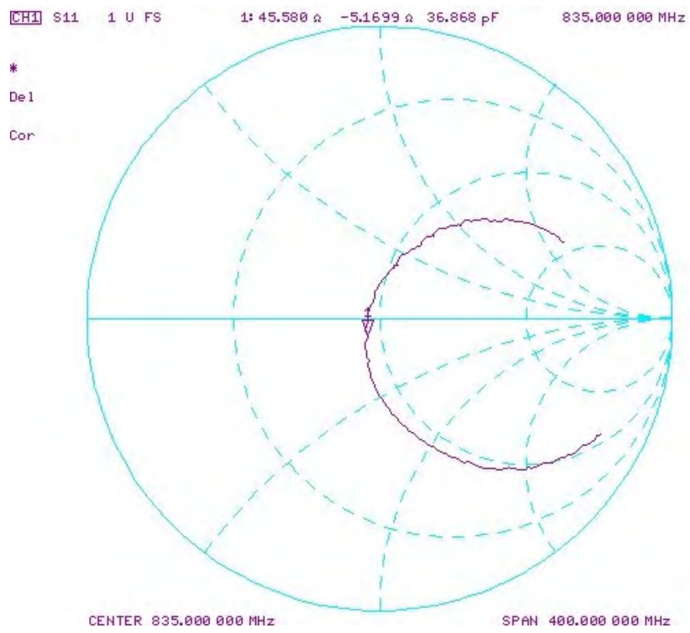
Calibration Date	Extension Date	Certificate Electrical Delay (ns)	Certificate SAR Target Body (1g) W/kg @ 23.0 dBm	Measured Body SAR (1g) W/kg @ 23.0 dBm	Deviation 1g (%)	Certificate SAR Target Body (10g) W/kg @ 23.0 dBm	Measured Body SAR (10g) W/kg @ 23.0 dBm	Deviation 10g (%)	Certificate Impedance Body (Ohm) Real	Measured Impedance Body (Ohm) Real	Difference (Ohm) Real	Certificate Impedance Body (Ohm) Imaginary	Measured Impedance Body (Ohm) Imaginary	Difference (Ohm) Imaginary	Certificate Return Loss Body (dB)	Measured Return Loss Body (dB)	Deviation (%)	PASS/FAIL
6/20/2019	6/20/2020	1.393	1.906	2.04	7.03%	1.248	1.34	7.37%	46.6	45.6	1	-6.5	-5.2	1.3	-22.4	-23.1	-3.10%	PASS

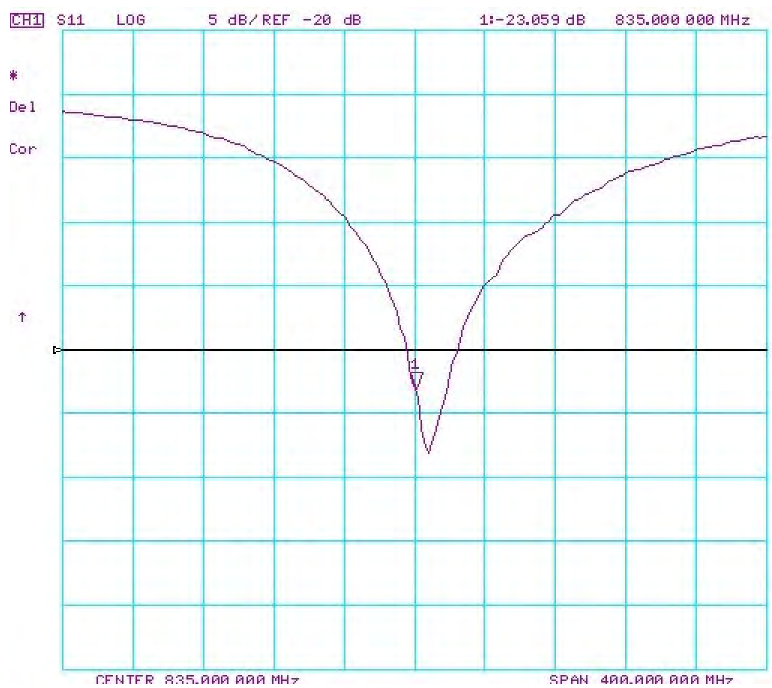
Impedance & Return-Loss Measurement Plot for Head TSL





Impedance & Return-Loss Measurement Plot for Body TSL





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

S Schweizerischer Kalibrierdienst
C Service suisse d'étalonnage
Servizio svizzero di taratura
S 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 PC Test

Certificate No: **D850V2-1010_Sep17**

CALIBRATION CERTIFICATE

Object: D850V2 - SN:1010

Calibration procedure(s): QA CAL-05.v9
Calibration procedure for dipole validation kits above 700 MHz

SCV 10/03/2017

Calibration date: September 08, 2017

SCV 9/9/2018

BN 10/10/2019

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	04-Apr-17 (No. 217-02521/02522)	Apr-18
Power sensor NRP-Z91	SN: 103244	04-Apr-17 (No. 217-02521)	Apr-18
Power sensor NRP-Z91	SN: 103245	04-Apr-17 (No. 217-02522)	Apr-18
Reference 20 dB Attenuator	SN: 5058 (20k)	07-Apr-17 (No. 217-02528)	Apr-18
Type-N mismatch combination	SN: 5047.2 / 06327	07-Apr-17 (No. 217-02529)	Apr-18
Reference Probe EX3DV4	SN: 7349	31-May-17 (No. EX3-7349_May17)	May-18
DAE4	SN: 601	28-Mar-17 (No. DAE4-601_Mar17)	Mar-18

Secondary Standards	ID #	Check Date (in house)	Scheduled Check
Power meter EPM-442A	SN: GB37480704	07-Oct-15 (in house check Oct-16)	In house check: Oct-18
Power sensor HP 8481A	SN: US37292783	07-Oct-15 (in house check Oct-16)	In house check: Oct-18
Power sensor HP 8481A	SN: MY41092317	07-Oct-15 (in house check Oct-16)	In house check: Oct-18
RF generator R&S SMT-06	SN: 100972	15-Jun-15 (in house check Oct-16)	In house check: Oct-18
Network Analyzer HP 8753E	SN: US37390585	18-Oct-01 (in house check Oct-16)	In house check: Oct-17

	Name	Function	Signature
Calibrated by:	Claudio Leubler	Laboratory Technician	
Approved by:	Katja Pokovic	Technical Manager	

Issued: September 8, 2017

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

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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**

Glossary:

TSL	tissue simulating liquid
ConvF	sensitivity in TSL / NORM x,y,z
N/A	not applicable or not measured

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, "Measurement procedure for the assessment of Specific Absorption Rate (SAR) from hand-held and body-mounted devices used next to the ear (frequency range of 300 MHz to 6 GHz)", July 2016
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"

Additional Documentation:

e) DASY4/5 System Handbook

Methods Applied and Interpretation of Parameters:

- *Measurement Conditions:* Further details are available from the Validation Report at the end of the certificate. All figures stated in the certificate are valid at the frequency indicated.
- *Antenna Parameters with TSL:* The dipole is mounted with the spacer to position its feed point exactly below the center marking of the flat phantom section, with the arms oriented parallel to the body axis.
- *Feed Point Impedance and Return Loss:* These parameters are measured with the dipole positioned under the liquid filled phantom. The impedance stated is transformed from the measurement at the SMA connector to the feed point. The Return Loss ensures low reflected power. No uncertainty required.
- *Electrical Delay:* One-way delay between the SMA connector and the antenna feed point. No uncertainty required.
- *SAR measured:* SAR measured at the stated antenna input power.
- *SAR normalized:* SAR as measured, normalized to an input power of 1 W at the antenna connector.
- *SAR for nominal TSL parameters:* The measured TSL parameters are used to calculate the nominal SAR result.

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%.

Measurement Conditions

DASY system configuration, as far as not given on page 1.

DASY Version	DASY5	V52.10.0
Extrapolation	Advanced Extrapolation	
Phantom	Modular Flat Phantom	
Distance Dipole Center - TSL	15 mm	with Spacer
Zoom Scan Resolution	dx, dy, dz = 5 mm	
Frequency	850 MHz ± 1 MHz	

Head TSL parameters

The following parameters and calculations were applied.

	Temperature	**Permittivity**	**Conductivity**
Nominal Head TSL parameters	22.0 °C	41.5	0.92 mho/m
Measured Head TSL parameters	(22.0 ± 0.2) °C	40.9 ± 6 %	0.94 mho/m ± 6 %
Head TSL temperature change during test	< 0.5 °C	----	----

SAR result with Head TSL

SAR averaged over 1 cm^3 (1 g) of Head TSL	Condition	
SAR measured	250 mW input power	2.53 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	**9.93 W/kg ± 17.0 % (k=2)**

SAR averaged over 10 cm^3 (10 g) of Head TSL	condition	
SAR measured	250 mW input power	1.63 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	**6.42 W/kg ± 16.5 % (k=2)**

Body TSL parameters

The following parameters and calculations were applied.

	Temperature	**Permittivity**	**Conductivity**
Nominal Body TSL parameters	22.0 °C	55.2	0.99 mho/m
Measured Body TSL parameters	(22.0 ± 0.2) °C	55.3 ± 6 %	0.99 mho/m ± 6 %
Body TSL temperature change during test	< 0.5 °C	----	----

SAR result with Body TSL

SAR averaged over 1 cm^3 (1 g) of Body TSL	Condition	
SAR measured	250 mW input power	2.55 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	**10.2 W/kg ± 17.0 % (k=2)**

SAR averaged over 10 cm^3 (10 g) of Body TSL	condition	
SAR measured	250 mW input power	1.67 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	**6.68 W/kg ± 16.5 % (k=2)**

Appendix (Additional assessments outside the scope of SCS 0108).

Antenna Parameters with Head TSL

Impedance, transformed to feed point	50.2 Ω - 3.1 jΩ
Return Loss	- 30.2 dB

Antenna Parameters with Body TSL

Impedance, transformed to feed point	46.6 Ω - 5.8 jΩ
Return Loss	- 23.2 dB

General Antenna Parameters and Design

Electrical Delay (one direction)	1.432 ns

After long term use with 100W radiated power, only a slight warming of the dipole near the feedpoint can be measured.

The dipole is made of standard semirigid coaxial cable. The center conductor of the feeding line is directly connected to the second arm of the dipole. The antenna is therefore short-circuited for DC-signals. On some of the dipoles, small end caps are added to the dipole arms in order to improve matching when loaded according to the position as explained in the "Measurement Conditions" paragraph. The SAR data are not affected by this change. The overall dipole length is still according to the Standard.
No excessive force must be applied to the dipole arms, because they might bend or the soldered connections near the feedpoint may be damaged.

Additional EUT Data

Manufactured by	SPEAG
Manufactured on	September 04, 2012

DASY5 Validation Report for Head TSL

Date: 08.09.2017

Test Laboratory: SPEAG, Zurich, Switzerland

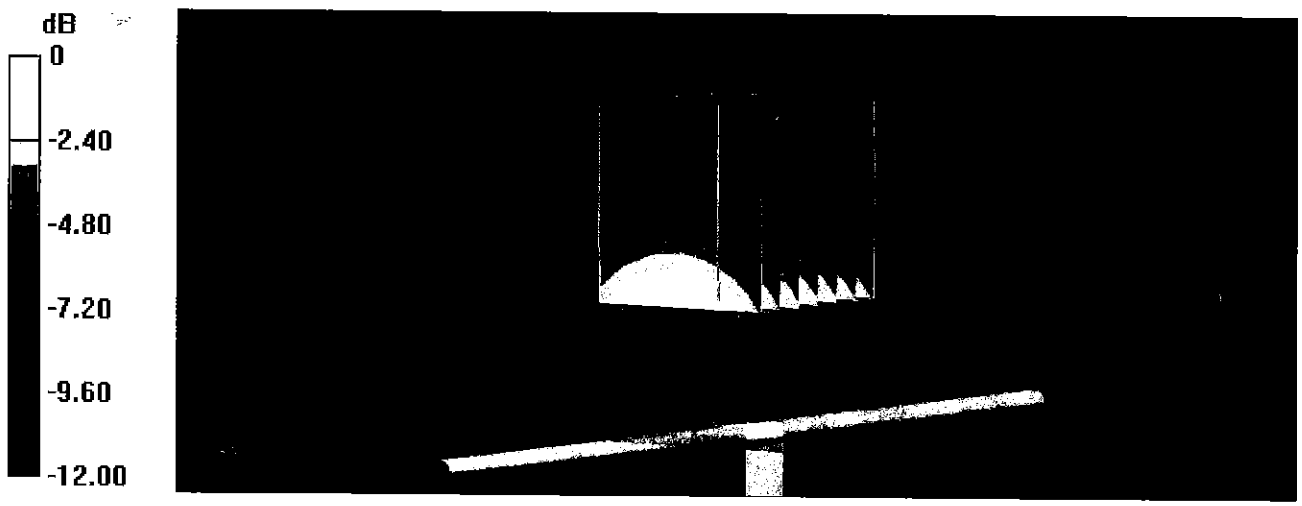
DUT: Dipole 850 MHz; Type: D850V2; Serial: D850V2 - SN:1010

Communication System: UID 0 - CW; Frequency: 850 MHz
Medium parameters used: f = 850 MHz; σ = 0.94 S/m; ε_r = 40.9; ρ = 1000 kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2011)

DASY52 Configuration:

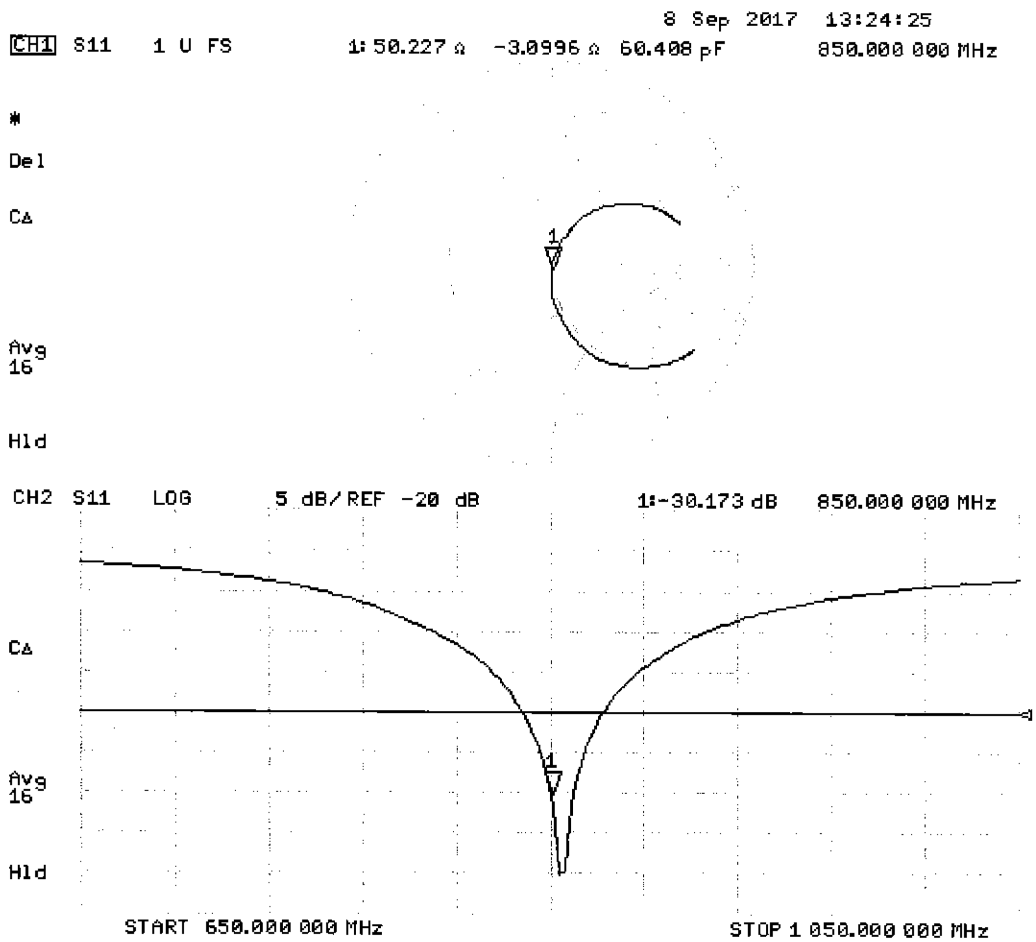
- Probe: EX3DV4 - SN7349; ConvF(9.93, 9.93, 9.93); Calibrated: 31.05.2017;
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 28.03.2017
- Phantom: Flat Phantom 4.9 (front); Type: QD 00L P49 AA; Serial: 1001
- DASY52 52.10.0(1446); SEMCAD X 14.6.10(7417)

Dipole Calibration for Head Tissue/Pin=250 mW, d=15mm/Zoom Scan (7x7x7)/Cube 0:
Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 63.32 V/m; Power Drift = -0.01 dB
Peak SAR (extrapolated) = 3.85 W/kg
SAR(1 g) = 2.53 W/kg; SAR(10 g) = 1.63 W/kg
Maximum value of SAR (measured) = 3.41 W/kg



0 dB = 3.41 W/kg = 5.33 dBW/kg

Impedance Measurement Plot for Head TSL



DASY5 Validation Report for Body TSL

Date: 08.09.2017

Test Laboratory: SPEAG, Zurich, Switzerland

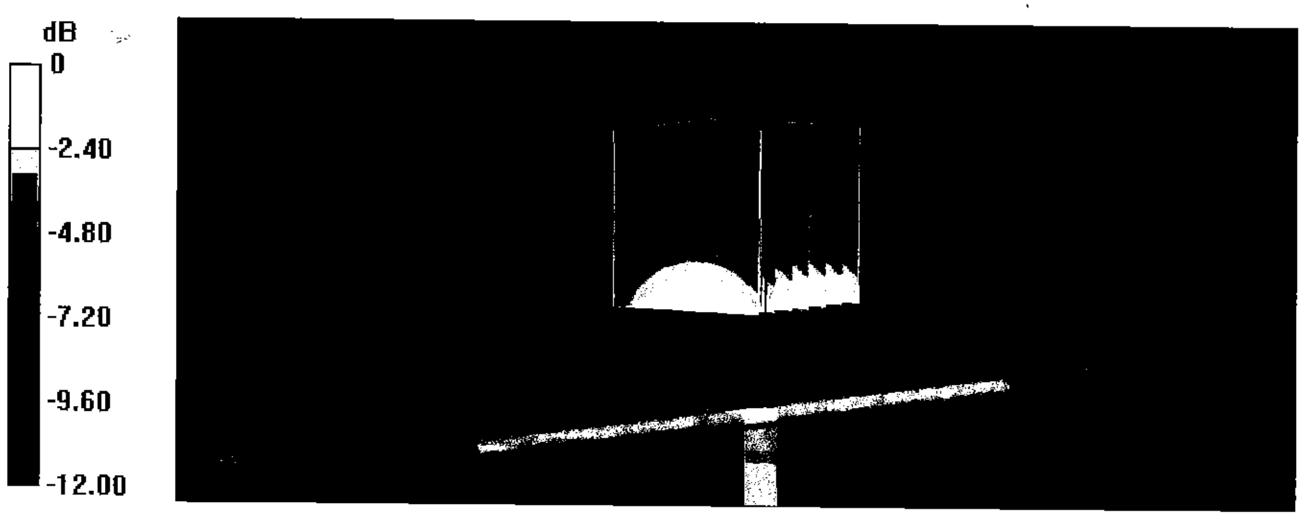
DUT: Dipole 850 MHz; Type: D850V2; Serial: D850V2 - SN:1010

Communication System: UID 0 - CW; Frequency: 850 MHz
Medium parameters used: f = 850 MHz; σ = 0.99 S/m; ε_r = 55.3; ρ = 1000 kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2011)

DASY52 Configuration:

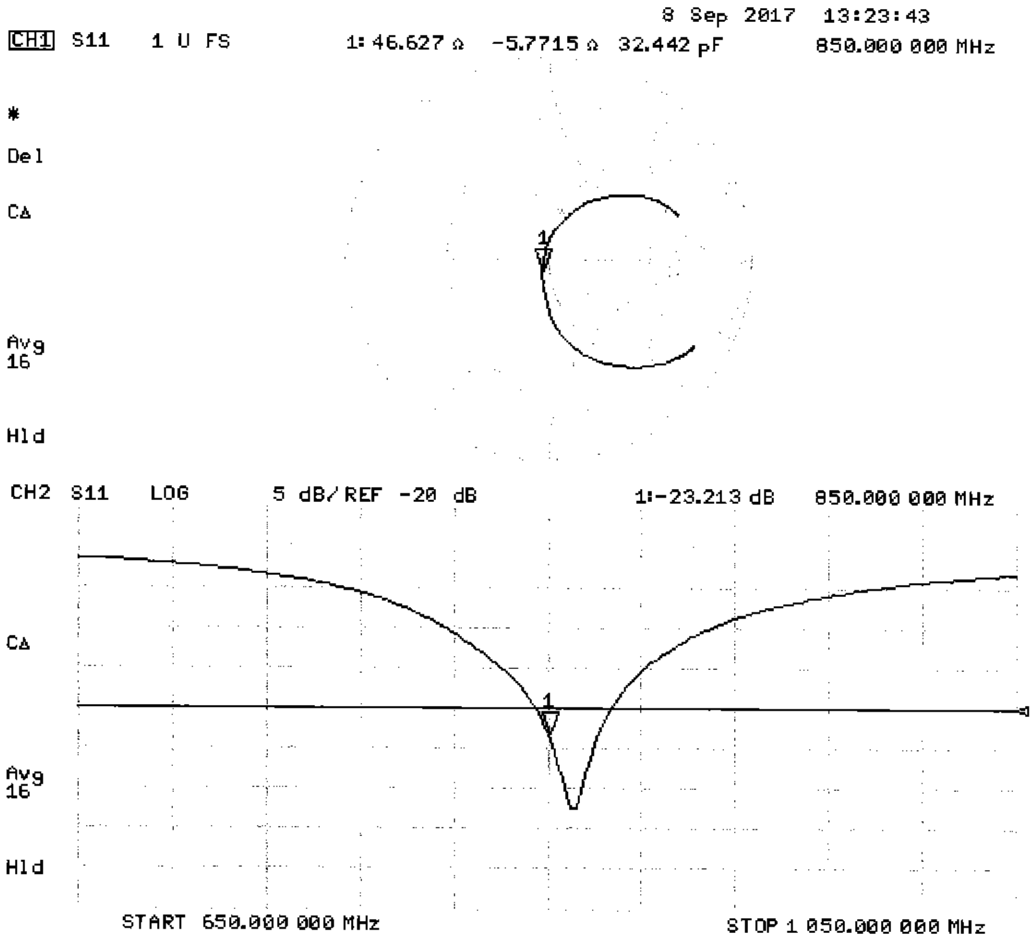
- Probe: EX3DV4 - SN7349; ConvF(10.11, 10.11, 10.11); Calibrated: 31.05.2017;
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 28.03.2017
- Phantom: Flat Phantom 4.9 (Back); Type: QD 00R P49 AA; Serial: 1005
- DASY52 52.10.0(1446); SEMCAD X 14.6.10(7417)

Dipole Calibration for Body Tissue/Pin=250 mW, d=15mm/Zoom Scan (7x7x7)/Cube 0:
Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 61.09 V/m; Power Drift = -0.02 dB
Peak SAR (extrapolated) = 3.79 W/kg
SAR(1 g) = 2.55 W/kg; SAR(10 g) = 1.67 W/kg
Maximum value of SAR (measured) = 3.36 W/kg



0 dB = 3.36 W/kg = 5.26 dBW/kg

Impedance Measurement Plot for Body TSL



Certification of Calibration

Object D850V2 – SN: 1010

Calibration procedure(s) Procedure for Calibration Extension for SAR Dipoles.

Extended Calibration date: September 08, 2018

Description: SAR Validation Dipole at 850 MHz.

Calibration Equipment used:

Manufacturer	Model	Description	Cal Date	Cal Interval	Cal Due	Serial Number
Agilent	8753ES	S-Parameter Network Analyzer	9/14/2017	Annual	9/14/2018	US39170118
Agilent	N5182A	MXG Vector Signal Generator	3/19/2018	Annual	3/19/2019	US46240505
Amplifier Research	15S1G6	Amplifier	CBT	N/A	CBT	343972
Anritsu	ML2496A	Power Meter	10/9/2017	Annual	10/9/2018	1138001
Anritsu	MA2411B	Pulse Power Sensor	11/15/2017	Annual	11/15/2018	1339007
Anritsu	MA2411B	Pulse Power Sensor	11/22/2017	Annual	11/22/2018	1339008
Control Company	4040	Temperature / Humidity Monitor	2/28/2018	Biennial	2/28/2020	150761911
Control Company	4352	Ultra Long Stem Thermometer	2/14/2017	Biennial	2/14/2019	170112507
Keysight	772D	Dual Directional Coupler	CBT	N/A	CBT	MY52180215
Keysight Technologies	85033E	Standard Mechanical Calibration Kit (DC to 9GHz, 3.5mm)	6/4/2018	Annual	6/4/2019	MY53401181
Mini-Circuits	BW-N20W5+	DC to 18 GHz Precision Fixed 20 dB Attenuator	CBT	N/A	CBT	N/A
Mini-Circuits	NLP-2950+	Low Pass Filter DC to 2700 MHz	CBT	N/A	CBT	N/A
Narda	4772-3	Attenuator (3dB)	CBT	N/A	CBT	9406
Pasternack	PE2209-10	Bidirectional Coupler	CBT	N/A	CBT	N/A
Pasternack	PE5011-1	Torque Wrench	7/19/2017	Biennial	7/19/2019	N/A
SPEAG	DAK-3.5	Dielectric Assessment Kit	5/15/2018	Annual	5/15/2019	1070
SPEAG	ES3DV3	SAR Probe	9/18/2017	Annual	9/18/2018	3287
SPEAG	DAE4	Data Acquisition Electronics	1/26/2018	Annual	1/26/2019	1533
SPEAG	EX3DV4	SAR Probe	1/26/2018	Annual	1/26/2019	7490
SPEAG	DAE4	Data Acquisition Electronics	1/26/2018	Annual	1/26/2019	1532

Measurement Uncertainty = ±23% (k=2)

	Name	Function	Signature
Calibrated By:	Sangmin Cha	Team Lead Engineer	
Approved By:	Kaitlin O'Keefe	Senior Technical Manager	

DIPOLE CALIBRATION EXTENSION

Per KDB 865664 D01, calibration intervals of up to three years may be considered for reference dipoles when it is demonstrated that the SAR target, impedance and return loss of a dipole have remained stable according to the following requirements:

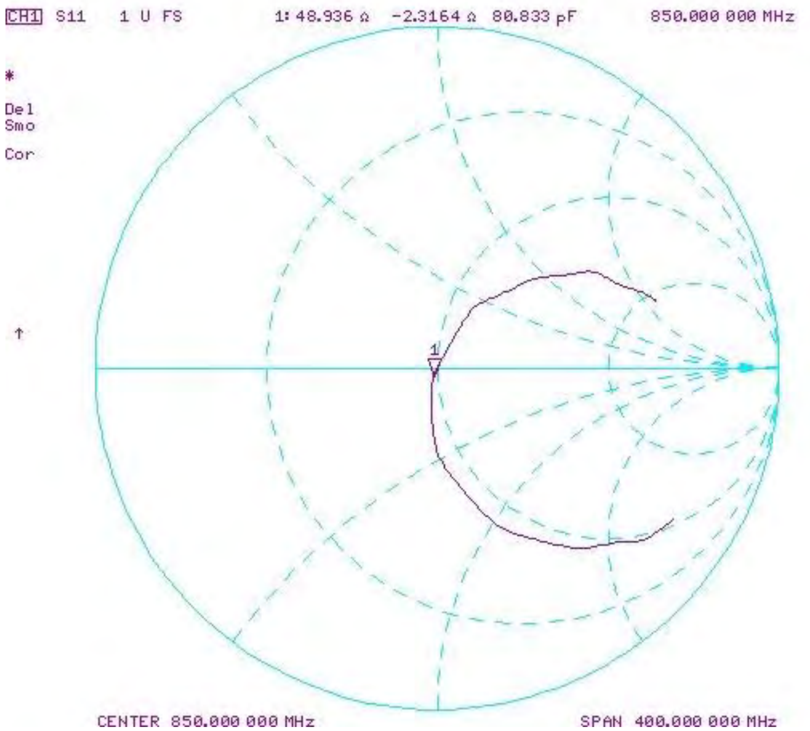
1. The measured SAR does not deviate more than 10% from the target on the calibration certificate.
2. The return-loss does not deviate more than 20% from the previous measurement and meets the required 20dB minimum return-loss requirement.
3. The measurement of real or imaginary parts of impedance does not deviate more than 5Ω from the previous measurement.

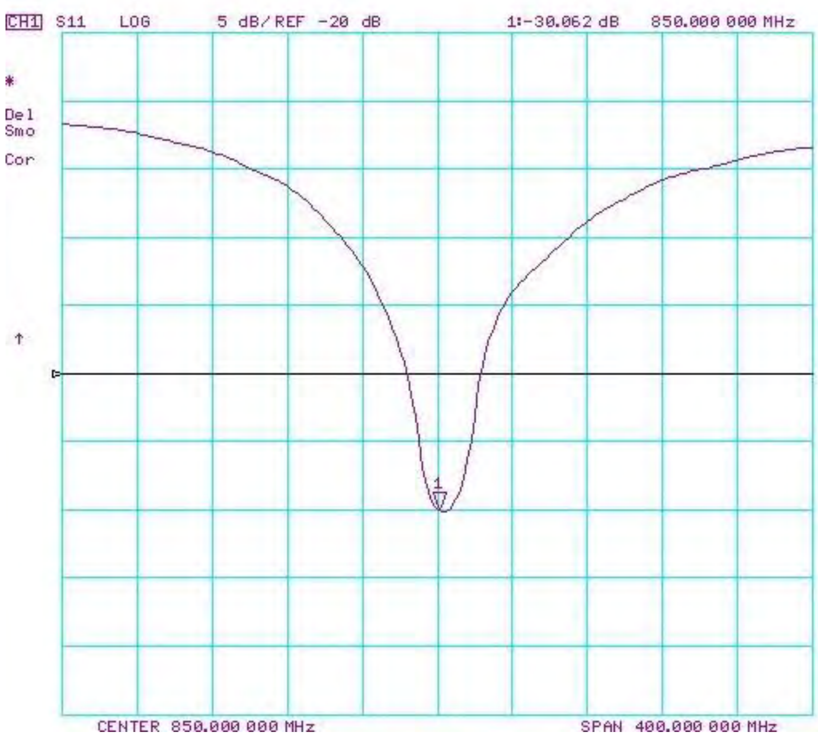
The following dipole was checked to pass the above 3 requirements to have 2-year calibration period from the calibration date:

Calibration Date	Extension Date	Certificate Electrical Delay (ns)	Certificate SAR Target Head (1g) W/kg @ 23.0 dBm	Measured Head SAR (1g) W/kg @ 23.0 dBm	Deviation 1g (%)	Certificate SAR Target Head (10g) W/kg @ 23.0 dBm	Measured Head SAR (10g) W/kg @ 23.0 dBm	Deviation 10g (%)	Certificate Impedance Head (Ohm) Real	Measured Impedance Head (Ohm) Real	Difference (Ohm) Real	Certificate Impedance Head (Ohm) Imaginary	Measured Impedance Head (Ohm) Imaginary	Difference (Ohm) Imaginary	Certificate Return Loss Head (dB)	Measured Return Loss Head (dB)	Deviation (%)	PASS/FAIL
9/8/2017	9/8/2018	1.432	1.986	2.01	1.21%	1.284	1.31	2.02%	50.2	48.9	1.3	-3.1	-2.3	0.8	-30.2	-30.1	0.30%	PASS

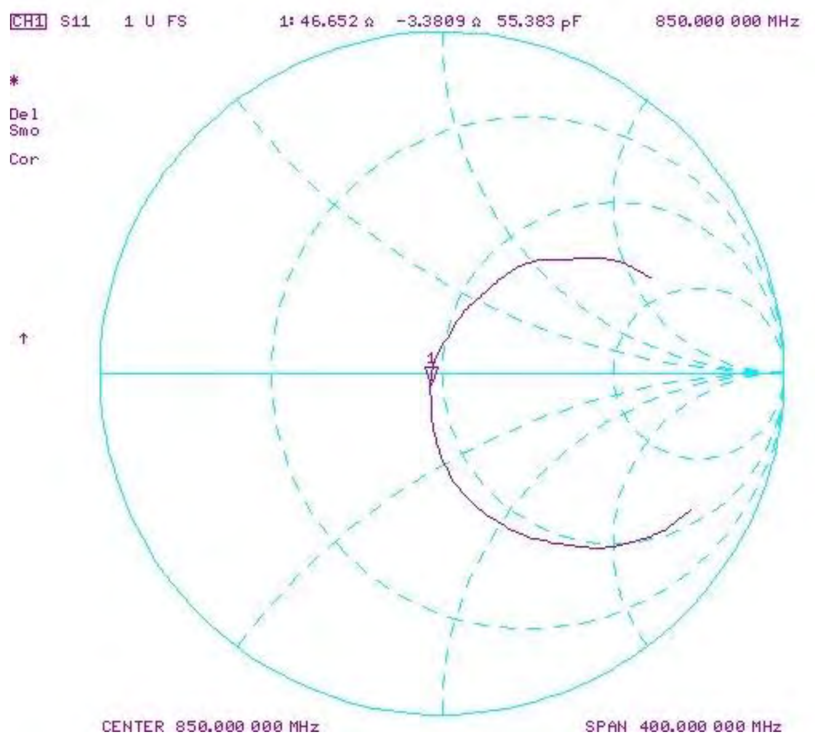
Calibration Date	Extension Date	Certificate Electrical Delay (ns)	Certificate SAR Target Body (1g) W/kg @ 23.0 dBm	Measured Body SAR (1g) W/kg @ 23.0 dBm	Deviation 1g (%)	Certificate SAR Target Body (10g) W/kg @ 23.0 dBm	Measured Body SAR (10g) W/kg @ 23.0 dBm	Deviation 10g (%)	Certificate Impedance Body (Ohm) Real	Measured Impedance Body (Ohm) Real	Difference (Ohm) Real	Certificate Impedance Body (Ohm) Imaginary	Measured Impedance Body (Ohm) Imaginary	Difference (Ohm) Imaginary	Certificate Return Loss Body (dB)	Measured Return Loss Body (dB)	Deviation (%)	PASS/FAIL
9/8/2017	9/8/2017	1.432	2.04	2.01	-1.47%	1.336	1.32	-1.20%	46.6	46.7	0.1	-5.8	-3.4	2.4	-23.2	-25.8	-11.20%	PASS

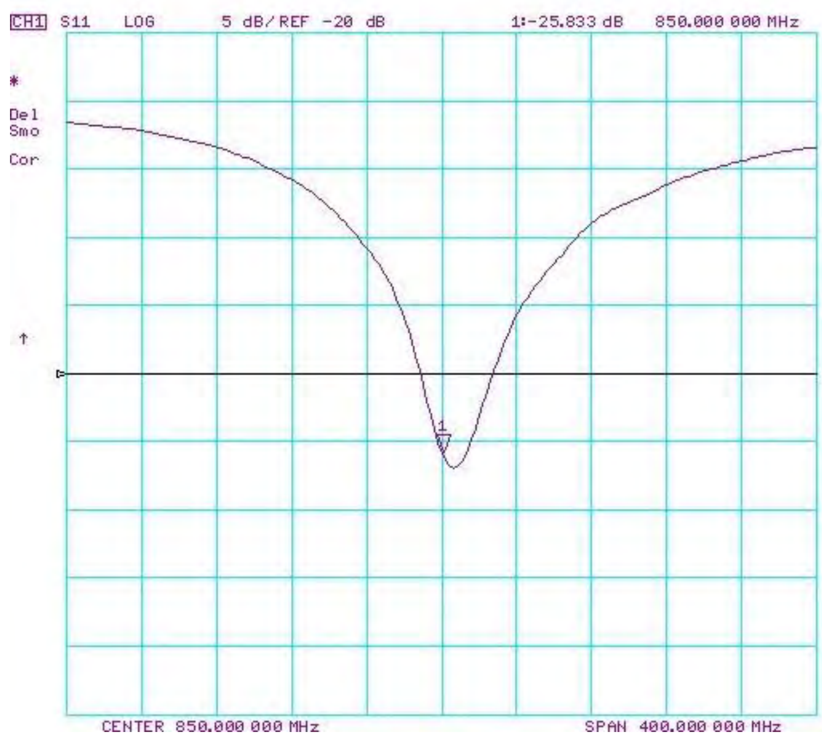
Impedance & Return-Loss Measurement Plot for Head TSL





Impedance & Return-Loss Measurement Plot for Body TSL





Certification of Calibration

Object	D850V2 – SN: 1010
Calibration procedure(s)	Procedure for Calibration Extension for SAR Dipoles.
Extended Calibration date:	September 8, 2019
Description:	SAR Validation Dipole at 850 MHz.

Calibration Equipment used:

Manufacturer	Model	Description	Cal Date	Cal Interval	Cal Due	Serial Number
Agilent	8753ES	S-Parameter Network Analyzer	10/2/2018	Annual	10/2/2019	US39170118
Agilent	E4438C	ESG Vector Signal Generator	6/27/2019	Annual	6/27/2020	MY45093852
Amplifier Research	15S1G6	Amplifier	CBT	N/A	CBT	343972
Anritsu	ML2495A	Power Meter	10/21/2018	Annual	10/21/2019	941001
Anritsu	MA2411B	Pulse Power Sensor	10/30/2018	Annual	10/30/2019	1207470
Anritsu	MA2411B	Pulse Power Sensor	11/20/2018	Annual	11/20/2019	1339007
Control Company	4040	Temperature / Humidity Monitor	2/28/2018	Biennial	2/28/2020	150761911
Control Company	4352	Ultra Long Stem Thermometer	2/28/2018	Biennial	2/28/2020	170330160
Keysight Technologies	85033E	Standard Mechanical Calibration Kit (DC to 9GHz, 3.5mm)	7/2/2019	Annual	7/2/2020	MY53401181
Keysight	772D	Dual Directional Coupler	CBT	N/A	CBT	MY52180215
Mini-Circuits	BW-N20W5+	DC to 18 GHz Precision Fixed 20 dB Attenuator	CBT	N/A	CBT	N/A
Mini-Circuits	NLP-2950+	Low Pass Filter DC to 2700 MHz	CBT	N/A	CBT	N/A
Narda	4772-3	Attenuator (3dB)	CBT	N/A	CBT	9406
Pasternack	PE2208-6	Bidirectional Coupler	CBT	N/A	CBT	N/A
Pasternack	NC-100	Torque Wrench	11/1/2017	Biennial	11/1/2019	N/A
SPEAG	DAK-3.5	Dielectric Assessment Kit	5/7/2019	Annual	5/7/2020	1070
SPEAG	EX3DV4	SAR Probe	1/24/2019	Annual	1/24/2020	7490
SPEAG	DAE4	Data Acquisition Electronics	1/15/2019	Annual	1/15/2020	1532

Measurement Uncertainty = ±23% (k=2)

	Name	Function	Signature
Calibrated By:	Parker Jones	Team Lead Engineer	Parker Jones
Approved By:	Kaitlin O'Keefe	Senior Technical Manager	KOK

DIPOLE CALIBRATION EXTENSION

Per KDB 865664 D01, calibration intervals of up to three years may be considered for reference dipoles when it is demonstrated that the SAR target, impedance and return loss of a dipole have remained stable according to the following requirements:

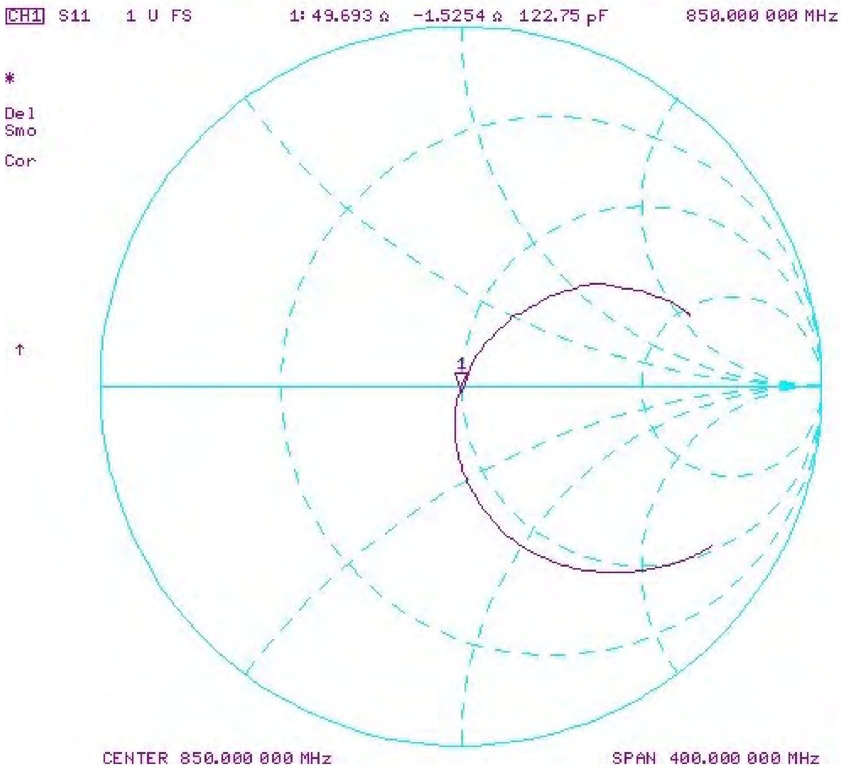
1. The measured SAR does not deviate more than 10% from the target on the calibration certificate.
2. The return-loss does not deviate more than 20% from the previous measurement and meets the required 20dB minimum return-loss requirement.
3. The measurement of real or imaginary parts of impedance does not deviate more than 5Ω from the previous measurement.

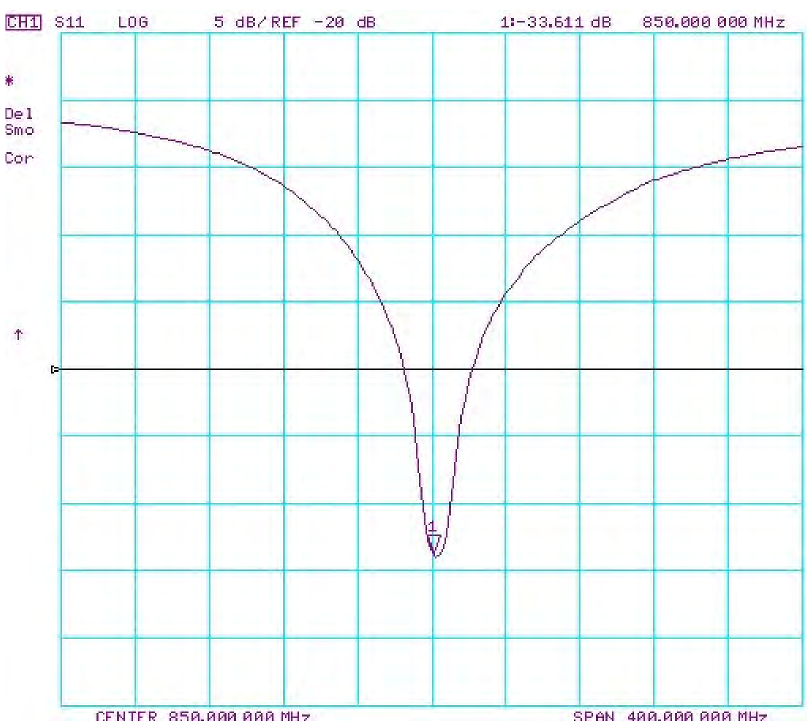
The following dipole was checked to pass the above 3 requirements to have 3-year calibration period from the calibration date:

Calibration Date	Extension Date	Certificate Electrical Delay (ns)	Certificate SAR Target Head (1g) W/kg @ 23.0 dBm	Measured Head SAR (1g) W/kg @ 23.0 dBm	Deviation 1g (%)	Certificate SAR Target Head (10g) W/kg @ 23.0 dBm	Measured Head SAR (10g) W/kg @ 23.0 dBm	Deviation 10g (%)	Certificate Impedance Head (Ohm) Real	Measured Impedance Head (Ohm) Real	Difference (Ohm) Real	Certificate Impedance Head (Ohm) Imaginary	Measured Impedance Head (Ohm) Imaginary	Difference (Ohm) Imaginary	Certificate Return Loss Head (dB)	Measured Return Loss Head (dB)	Deviation (%)	PASS/FAIL
9/8/2017	9/8/2019	1.432	1.986	2.03	2.22%	1.284	1.33	3.58%	50.2	49.7	0.5	-3.1	-1.5	1.6	-30.2	-33.6	-11.30%	PASS

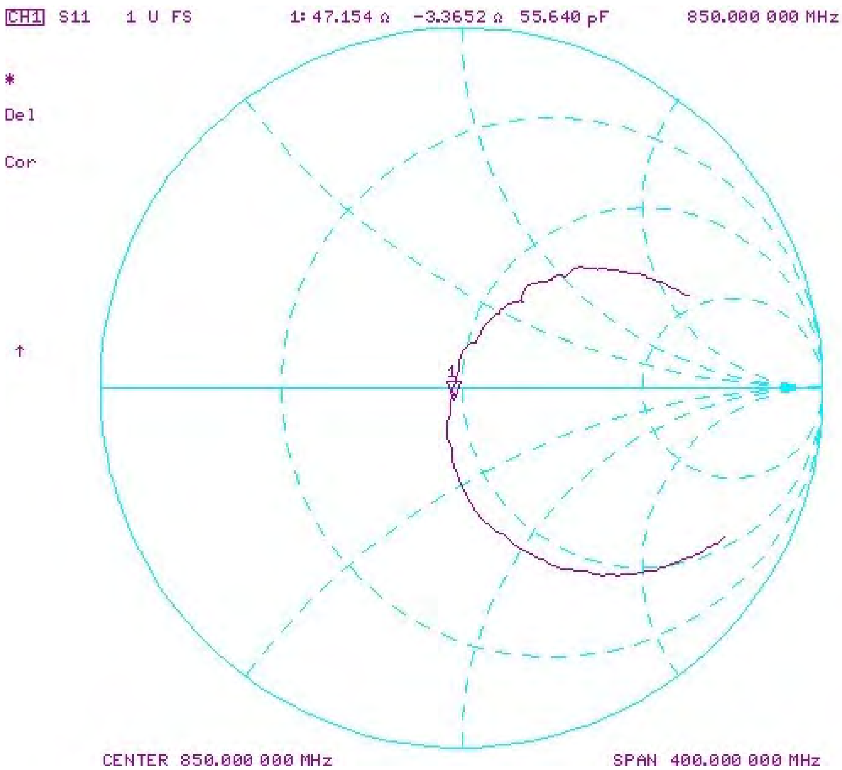
Calibration Date	Extension Date	Certificate Electrical Delay (ns)	Certificate SAR Target Body (1g) W/kg @ 23.0 dBm	Measured Body SAR (1g) W/kg @ 23.0 dBm	Deviation 1g (%)	Certificate SAR Target Body (10g) W/kg @ 23.0 dBm	Measured Body SAR (10g) W/kg @ 23.0 dBm	Deviation 10g (%)	Certificate Impedance Body (Ohm) Real	Measured Impedance Body (Ohm) Real	Difference (Ohm) Real	Certificate Impedance Body (Ohm) Imaginary	Measured Impedance Body (Ohm) Imaginary	Difference (Ohm) Imaginary	Certificate Return Loss Body (dB)	Measured Return Loss Body (dB)	Deviation (%)	PASS/FAIL
9/8/2017	9/8/2019	1.432	2.04	2.05	0.49%	1.336	1.36	1.80%	46.6	47.2	0.6	-5.8	-3.4	2.4	-23.2	-27.1	-16.80%	PASS

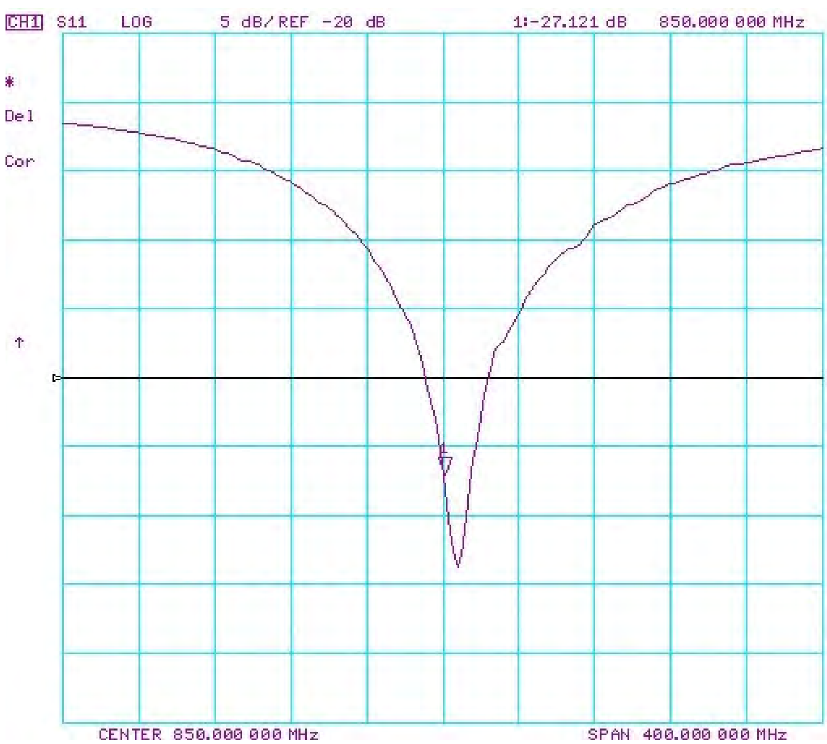
Impedance & Return-Loss Measurement Plot for Head TSL





Impedance & Return-Loss Measurement Plot for Body TSL





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

S Schweizerischer Kalibrierdienst
C Service suisse d'étalonnage
Servizio svizzero di taratura
S 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 **PC Test**

Certificate No: **D1750V2-1092_May18**

CALIBRATION CERTIFICATE

Object	D1750V2 - SN:1092
Calibration procedure(s)	QA CAL-05.v10 Calibration procedure for dipole validation kits above 700 MHz
Calibration date:	May 15, 2018

SC ✓ 5/31/2018
BN ✓ 06/01/2019
ATM ✓ 06/11/2020

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	04-Apr-18 (No. 217-02672/02673)	Apr-19
Power sensor NRP-Z91	SN: 103244	04-Apr-18 (No. 217-02672)	Apr-19
Power sensor NRP-Z91	SN: 103245	04-Apr-18 (No. 217-02673)	Apr-19
Reference 20 dB Attenuator	SN: 5058 (20k)	04-Apr-18 (No. 217-02682)	Apr-19
Type-N mismatch combination	SN: 5047.2 / 06327	04-Apr-18 (No. 217-02683)	Apr-19
Reference Probe EX3DV4	SN: 7349	30-Dec-17 (No. EX3-7349_Dec17)	Dec-18
DAE4	SN: 601	26-Oct-17 (No. DAE4-601_Oct17)	Oct-18

Secondary Standards	ID #	Check Date (in house)	Scheduled Check
Power meter EPM-442A	SN: GB37480704	07-Oct-15 (in house check Oct-16)	In house check: Oct-18
Power sensor HP 8481A	SN: US37292783	07-Oct-15 (in house check Oct-16)	In house check: Oct-18
Power sensor HP 8481A	SN: MY41092317	07-Oct-15 (in house check Oct-16)	In house check: Oct-18
RF generator R&S SMT-06	SN: 100972	15-Jun-15 (in house check Oct-16)	In house check: Oct-18
Network Analyzer HP 8753E	SN: US37390585	18-Oct-01 (in house check Oct-17)	In house check: Oct-18

	Name	Function	Signature
Calibrated by:	Manu Seitz	Laboratory Technician	
Approved by:	Katja Pokovic	Technical Manager	

Issued: May 17, 2018

Glossary:

TSL	tissue simulating liquid
ConvF	sensitivity in TSL / NORM x,y,z
N/A	not applicable or not measured

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, "Measurement procedure for the assessment of Specific Absorption Rate (SAR) from hand-held and body-mounted devices used next to the ear (frequency range of 300 MHz to 6 GHz)", July 2016
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"

Additional Documentation:

e) DASY4/5 System Handbook

Methods Applied and Interpretation of Parameters:

- *Measurement Conditions:* Further details are available from the Validation Report at the end of the certificate. All figures stated in the certificate are valid at the frequency indicated.
- *Antenna Parameters with TSL:* The dipole is mounted with the spacer to position its feed point exactly below the center marking of the flat phantom section, with the arms oriented parallel to the body axis.
- *Feed Point Impedance and Return Loss:* These parameters are measured with the dipole positioned under the liquid filled phantom. The impedance stated is transformed from the measurement at the SMA connector to the feed point. The Return Loss ensures low reflected power. No uncertainty required.
- *Electrical Delay:* One-way delay between the SMA connector and the antenna feed point. No uncertainty required.
- *SAR measured:* SAR measured at the stated antenna input power.
- *SAR normalized:* SAR as measured, normalized to an input power of 1 W at the antenna connector.
- *SAR for nominal TSL parameters:* The measured TSL parameters are used to calculate the nominal SAR result.

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%.

Measurement Conditions

DASY system configuration, as far as not given on page 1.

DASY Version	DASY5	V52.10.1
Extrapolation	Advanced Extrapolation	
Phantom	Modular Flat Phantom	
Distance Dipole Center - TSL	10 mm	with Spacer
Zoom Scan Resolution	dx, dy, dz = 5 mm	
Frequency	1750 MHz ± 1 MHz	

Head TSL parameters

The following parameters and calculations were applied.

	Temperature	**Permittivity**	**Conductivity**
Nominal Head TSL parameters	22.0 °C	40.1	1.37 mho/m
Measured Head TSL parameters	(22.0 ± 0.2) °C	39.0 ± 6 %	1.34 mho/m ± 6 %
Head TSL temperature change during test	< 0.5 °C	----	----

SAR result with Head TSL

SAR averaged over 1 cm^3 (1 g) of Head TSL	Condition	
SAR measured	250 mW input power	8.95 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	**36.1 W/kg ± 17.0 % (k=2)**

SAR averaged over 10 cm^3 (10 g) of Head TSL	condition	
SAR measured	250 mW input power	4.73 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	**19.0 W/kg ± 16.5 % (k=2)**

Body TSL parameters

The following parameters and calculations were applied.

	Temperature	**Permittivity**	**Conductivity**
Nominal Body TSL parameters	22.0 °C	53.4	1.49 mho/m
Measured Body TSL parameters	(22.0 ± 0.2) °C	53.2 ± 6 %	1.46 mho/m ± 6 %
Body TSL temperature change during test	< 0.5 °C	----	----

SAR result with Body TSL

SAR averaged over 1 cm^3 (1 g) of Body TSL	Condition	
SAR measured	250 mW input power	8.99 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	**36.4 W/kg ± 17.0 % (k=2)**

SAR averaged over 10 cm^3 (10 g) of Body TSL	condition	
SAR measured	250 mW input power	4.81 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	**19.4 W/kg ± 16.5 % (k=2)**

Appendix (Additional assessments outside the scope of SCS 0108)

Antenna Parameters with Head TSL

Impedance, transformed to feed point	49.2 Ω - 1.0 jΩ
Return Loss	- 37.8 dB

Antenna Parameters with Body TSL

Impedance, transformed to feed point	44.8 Ω - 0.6 jΩ
Return Loss	- 25.2 dB

General Antenna Parameters and Design

Electrical Delay (one direction)	1.217 ns

After long term use with 100W radiated power, only a slight warming of the dipole near the feedpoint can be measured.

The dipole is made of standard semirigid coaxial cable. The center conductor of the feeding line is directly connected to the second arm of the dipole. The antenna is therefore short-circuited for DC-signals. On some of the dipoles, small end caps are added to the dipole arms in order to improve matching when loaded according to the position as explained in the "Measurement Conditions" paragraph. The SAR data are not affected by this change. The overall dipole length is still according to the Standard.
No excessive force must be applied to the dipole arms, because they might bend or the soldered connections near the feedpoint may be damaged.

Additional EUT Data

Manufactured by	SPEAG
Manufactured on	November 07, 2012

DASY5 Validation Report for Head TSL

Date: 15.05.2018

Test Laboratory: SPEAG, Zurich, Switzerland

DUT: Dipole 1750 MHz; Type: D1750V2; Serial: D1750V2 - SN:1092

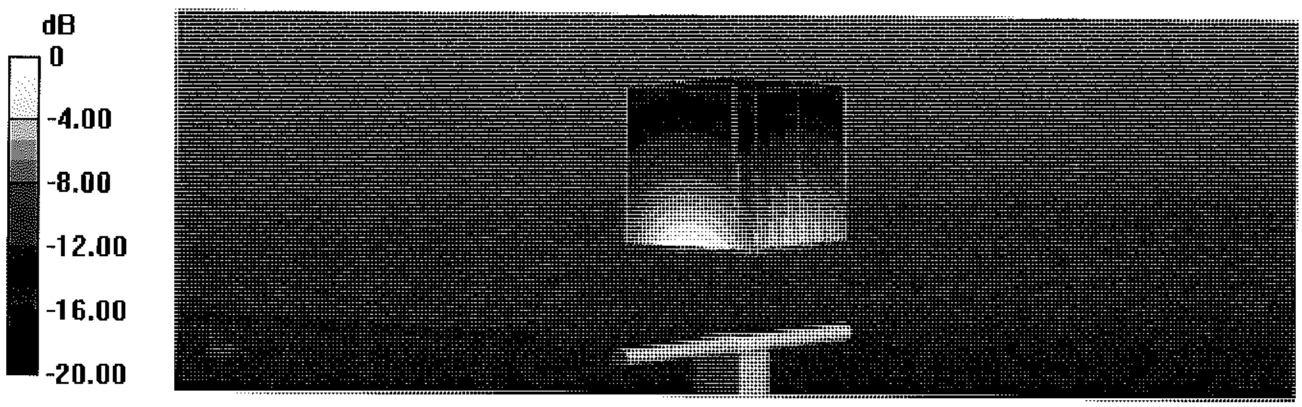
Communication System: UID 0 - CW; Frequency: 1750 MHz
Medium parameters used: f = 1750 MHz; σ = 1.34 S/m; ε_r = 39; ρ = 1000 kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2011)

DASY52 Configuration:

- Probe: EX3DV4 - SN7349; ConvF(8.5, 8.5, 8.5) @ 1750 MHz; Calibrated: 30.12.2017
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 26.10.2017
- Phantom: Flat Phantom 5.0 (front); Type: QD 000 P50 AA; Serial: 1001
- DASY52 52.10.1(1476); SEMCAD X 14.6.11(7439)

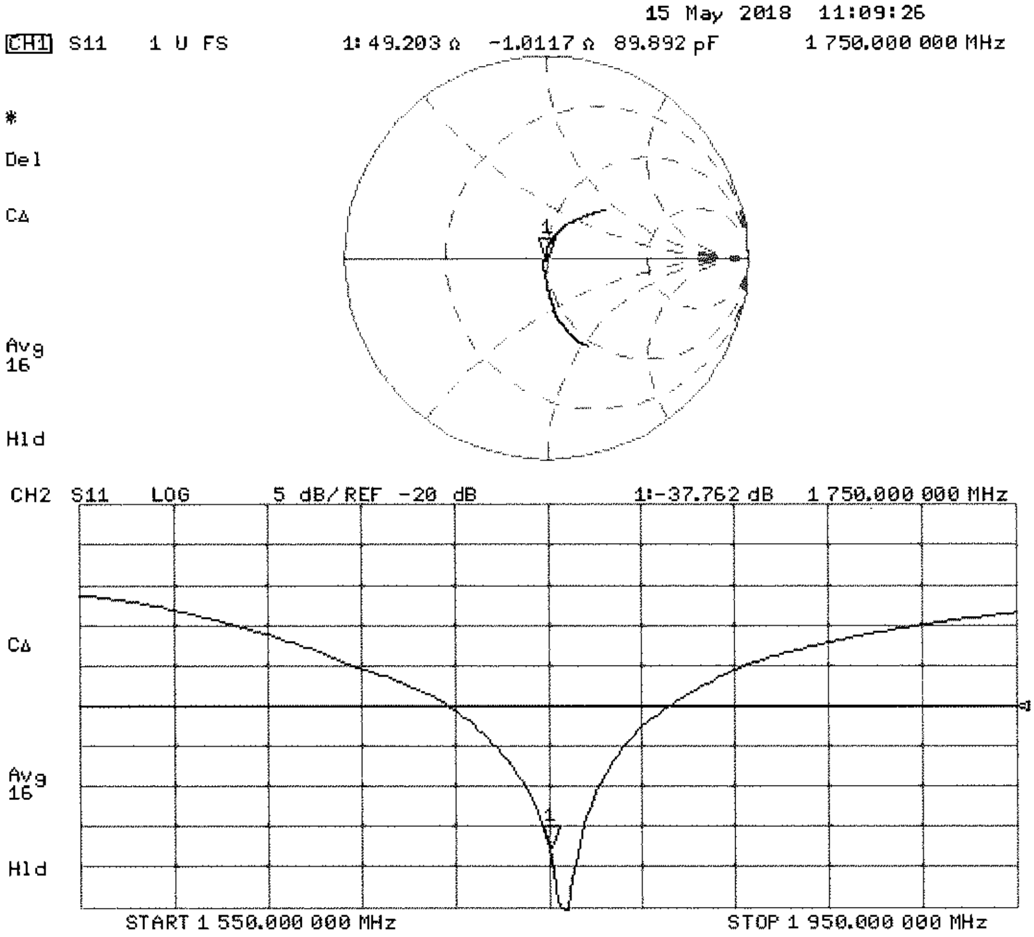
Dipole Calibration for Head Tissue/Pin=250 mW, d=10mm/Zoom Scan (7x7x7)/Cube 0:

Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 106.8 V/m; Power Drift = -0.09 dB
Peak SAR (extrapolated) = 16.3 W/kg
SAR(1 g) = 8.95 W/kg; SAR(10 g) = 4.73 W/kg
Maximum value of SAR (measured) = 13.8 W/kg



0 dB = 13.8 W/kg = 11.40 dBW/kg

Impedance Measurement Plot for Head TSL



DASY5 Validation Report for Body TSL

Date: 15.05.2018

Test Laboratory: SPEAG, Zurich, Switzerland

DUT: Dipole 1750 MHz; Type: D1750V2; Serial: D1750V2 - SN:1092

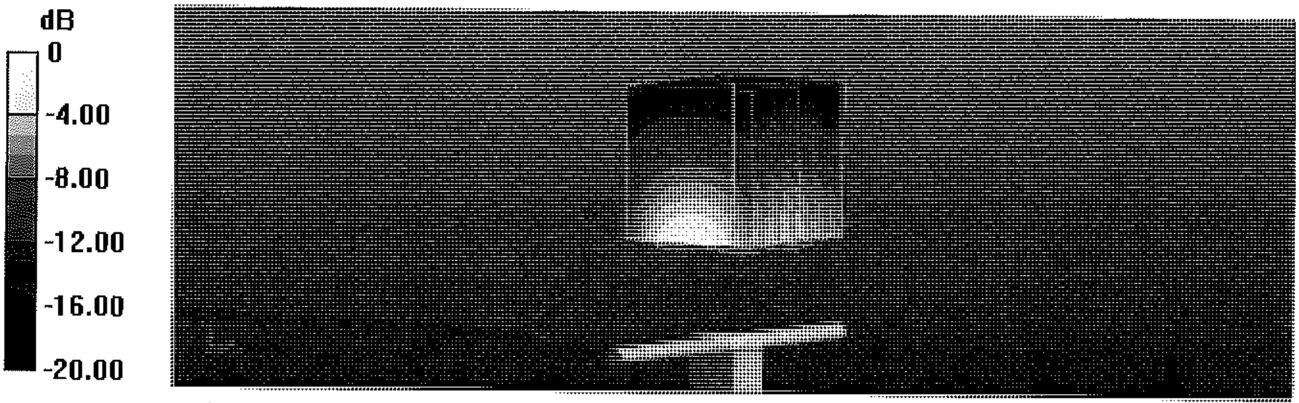
Communication System: UID 0 - CW; Frequency: 1750 MHz
Medium parameters used: f = 1750 MHz; σ = 1.46 S/m; ε_r = 53.2; ρ = 1000 kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2011)

DASY52 Configuration:

- Probe: EX3DV4 - SN7349; ConvF(8.35, 8.35, 8.35) @ 1750 MHz; Calibrated: 30.12.2017
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 26.10.2017
- Phantom: Flat Phantom 5.0 (back); Type: QD 000 P50 AA; Serial: 1002
- DASY52 52.10.1(1476); SEMCAD X 14.6.11(7439)

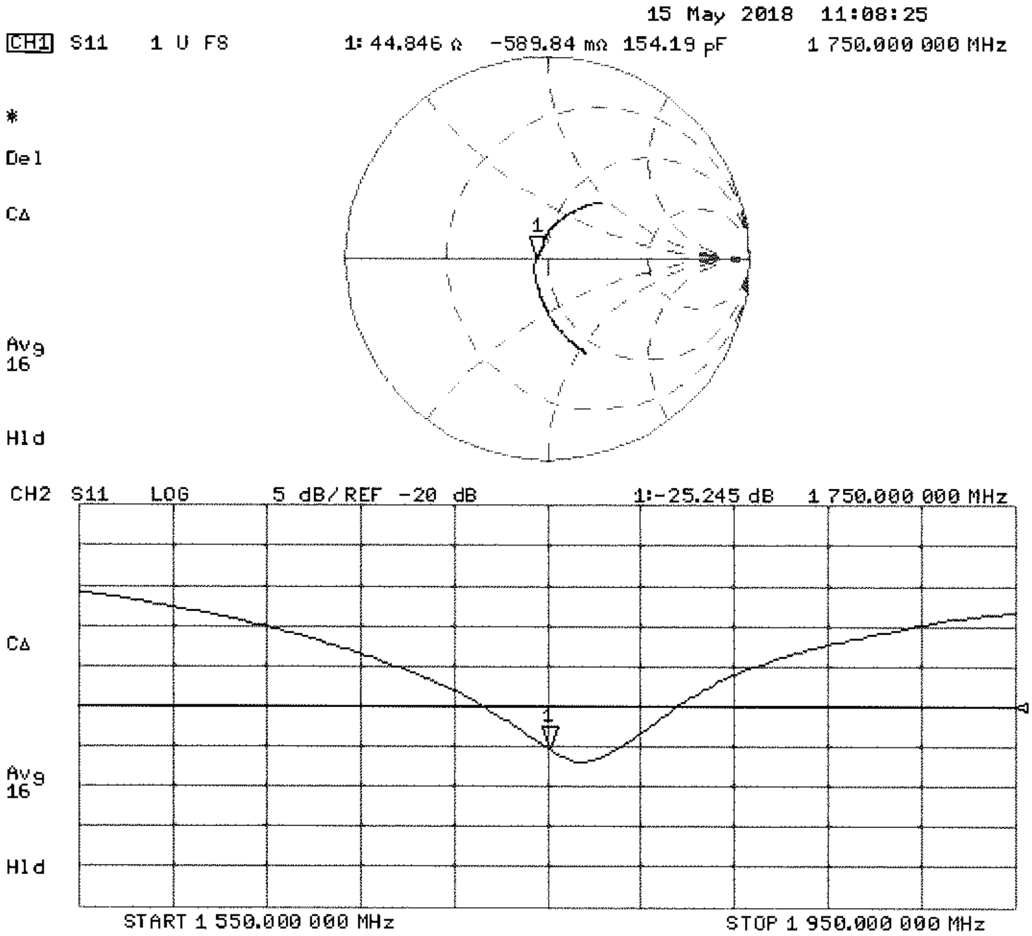
Dipole Calibration for Body Tissue/Pin=250 mW, d=10mm/Zoom Scan (7x7x7)/Cube 0:

Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 101.4 V/m; Power Drift = -0.06 dB
Peak SAR (extrapolated) = 15.8 W/kg
SAR(1 g) = 8.99 W/kg; SAR(10 g) = 4.81 W/kg
Maximum value of SAR (measured) = 13.4 W/kg



0 dB = 13.4 W/kg = 11.27 dBW/kg

Impedance Measurement Plot for Body TSL



Certification of Calibration

Object	D1750V2 – SN: 1092
Calibration procedure(s)	Procedure for Calibration Extension for SAR Dipoles.
Extended Calibration date:	May 15, 2019
Description:	SAR Validation Dipole at 1750 MHz.

Calibration Equipment used:

Manufacturer	Model	Description	Cal Date	Cal Interval	Cal Due	Serial Number
Agilent	8753ES	S-Parameter Network Analyzer	10/2/2018	Annual	10/2/2019	US39170118
Agilent	N5182A	MXG Vector Signal Generator	6/15/2018	Annual	6/15/2019	MY47420837
Amplifier Research	15S1G6	Amplifier	CBT	N/A	CBT	343972
Anritsu	ML2495A	Power Meter	10/21/2018	Annual	10/21/2019	941001
Anritsu	MA2411B	Pulse Power Sensor	10/30/2018	Annual	10/30/2019	1207470
Anritsu	MA2411B	Pulse Power Sensor	11/20/2018	Annual	11/20/2019	1339007
Control Company	4040	Temperature / Humidity Monitor	2/28/2018	Biennial	2/28/2020	150761911
Control Company	4352	Ultra Long Stem Thermometer	2/28/2018	Biennial	2/28/2020	170330160
Keysight	772D	Dual Directional Coupler	CBT	N/A	CBT	MY52180215
Keysight Technologies	85033E	Standard Mechanical Calibration Kit (DC to 9GHz, 3.5mm)	6/4/2018	Annual	6/4/2019	MY53401181
Mini-Circuits	BW-N20W5+	DC to 18 GHz Precision Fixed 20 dB Attenuator	CBT	N/A	CBT	N/A
Mini-Circuits	NLP-2950+	Low Pass Filter DC to 2700 MHz	CBT	N/A	CBT	N/A
Narda	4772-3	Attenuator (3dB)	CBT	N/A	CBT	9406
Pasternack	PE2209-10	Bidirectional Coupler	CBT	N/A	CBT	N/A
Pasternack	PE5011-1	Torque Wrench	7/19/2017	Biennial	7/19/2019	N/A
SPEAG	DAKS-3.5	Portable DAK	9/11/2018	Annual	9/11/2019	1045
SPEAG	EX3DV4	SAR Probe	7/20/2018	Annual	7/20/2019	7416
SPEAG	DAE4	Dasy Data Acquisition Electronics	7/10/2018	Annual	7/10/2019	1402

Measurement Uncertainty = ±23% (k=2)

	Name	Function	Signature
Calibrated By:	Parker Jones	Team Lead Engineer	Parker Jones
Approved By:	Kaitlin O'Keefe	Senior Technical Manager	KOK

DIPOLE CALIBRATION EXTENSION

Per KDB 865664 D01, calibration intervals of up to three years may be considered for reference dipoles when it is demonstrated that the SAR target, impedance and return loss of a dipole have remained stable according to the following requirements:

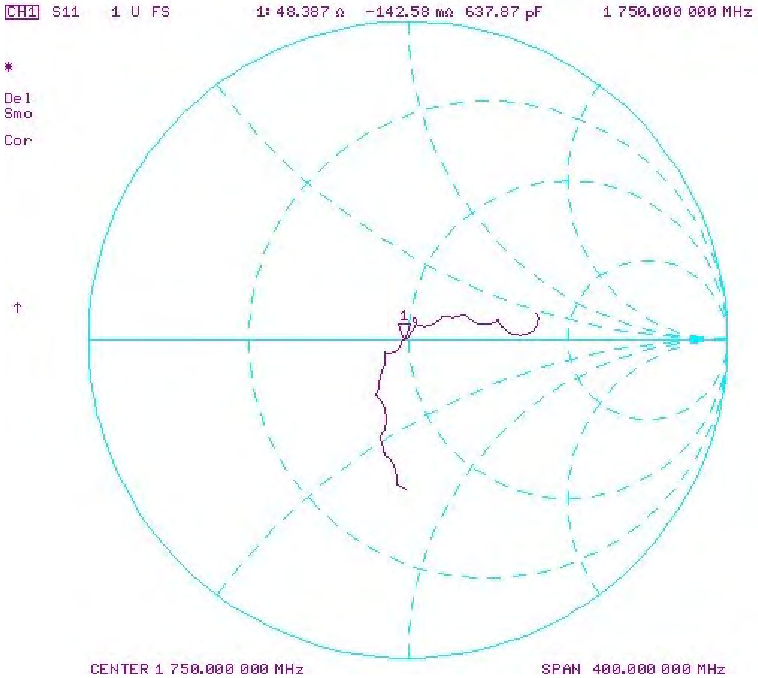
1. The measured SAR does not deviate more than 10% from the target on the calibration certificate.
2. The return-loss does not deviate more than 20% from the previous measurement and meets the required 20dB minimum return-loss requirement.
3. The measurement of real or imaginary parts of impedance does not deviate more than 5Ω from the previous measurement.

The following dipole was checked to pass the above 3 requirements to have 2-year calibration period from the calibration date:

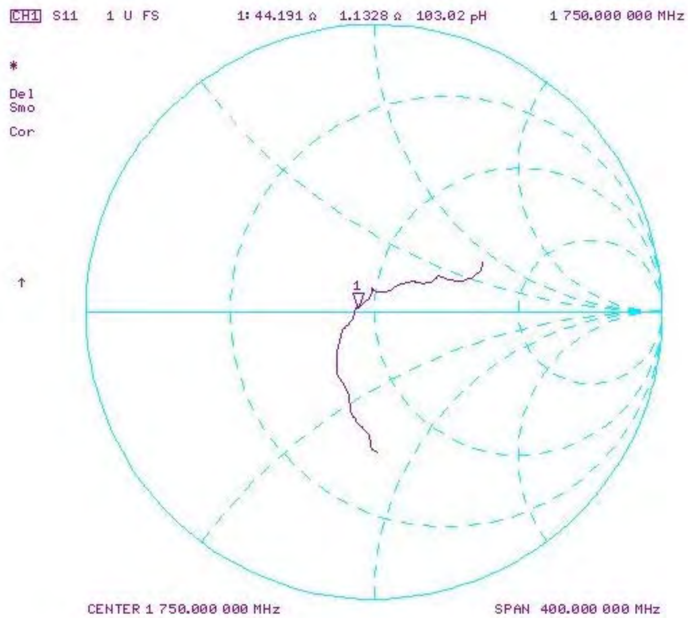
Calibration Date	Extension Date	Certificate Electrical Delay (ns)	Certificate SAR Target Head (1g) W/kg @ 20.0 dBm	Measured Head SAR (1g) W/kg @ 20.0 dBm	Deviation 1g (%)	Certificate SAR Target Head (10g) W/kg @ 20.0 dBm	Measured Head SAR (10g) W/kg @ 20.0 dBm	Deviation 10g (%)	Certificate Impedance Head (Ohm) Real	Measured Impedance Head (Ohm) Real	Difference (Ohm) Real	Certificate Impedance Head (Ohm) Imaginary	Measured Impedance Head (Ohm) Imaginary	Difference (Ohm) Imaginary	Certificate Return Loss Head (dB)	Measured Return Loss Head (dB)	Deviation (%)	PASS/FAIL
5/15/2018	5/15/2019	1.217	3.61	3.59	-0.55%	1.9	1.89	-0.53%	49.2	48.4	0.8	-1	-0.1	0.9	-37.8	-38.2	-1.00%	PASS

Calibration Date	Extension Date	Certificate Electrical Delay (ns)	Certificate SAR Target Body (1g) W/kg @ 20.0 dBm	Measured Body SAR (1g) W/kg @ 20.0 dBm	Deviation 1g (%)	Certificate SAR Target Body (10g) W/kg @ 20.0 dBm	Measured Body SAR (10g) W/kg @ 20.0 dBm	Deviation 10g (%)	Certificate Impedance Body (Ohm) Real	Measured Impedance Body (Ohm) Real	Difference (Ohm) Real	Certificate Impedance Body (Ohm) Imaginary	Measured Impedance Body (Ohm) Imaginary	Difference (Ohm) Imaginary	Certificate Return Loss Body (dB)	Measured Return Loss Body (dB)	Deviation (%)	PASS/FAIL
5/15/2018	5/15/2019	1.217	3.64	3.62	-0.55%	1.94	1.91	-1.55%	44.8	44.2	0.6	-0.6	1.1	1.7	-25.2	-24.2	3.90%	PASS

Impedance & Return-Loss Measurement Plot for Head TSL



Impedance & Return-Loss Measurement Plot for Body TSL



Object:	Date Issued:	Page 4 of 4
D1750V2 – SN: 1092	05/15/2019	

Certification of Calibration

Object	D1750V2 – SN: 1092
Calibration procedure(s)	Procedure for Calibration Extension for SAR Dipoles.
Extended Calibration date:	May 15, 2020
Description:	SAR Validation Dipole at 1750 MHz.

Calibration Equipment used:

Manufacturer	Model	Description	Cal Date	Cal Interval	Cal Due	Serial Number
Agilent	8753ES	S-Parameter Network Analyzer	1/16/2020	Annual	1/16/2021	US39170118
Agilent	N5182A	MXG Vector Signal Generator	8/19/2019	Annual	8/19/2020	MY47420837
Amplifier Research	15S1G6	Amplifier	CBT	N/A	CBT	343972
Anritsu	MA2411B	Pulse Power Sensor	1/21/2020	Annual	1/21/2021	1207470
Anritsu	MA2411B	Pulse Power Sensor	1/21/2020	Annual	1/21/2021	1339007
Anritsu	ML2495A	Power Meter	1/15/2020	Annual	1/15/2021	1328004
Control Company	62344-734	Therm./ Clock/ Humidity Monitor	3/18/2019	Biennial	3/18/2021	192038436
Control Company	4352	Ultra Long Stem Thermometer	8/2/2018	Biennial	8/2/2020	181292000
Keysight Technologies	85033E	Standard Mechanical Calibration Kit (DC to 9GHz, 3.5mm)	7/2/2019	Annual	7/2/2020	MY53401181
MiniCircuits	VLF-6000+	Low Pass Filter	CBT	N/A	CBT	N/A
Mini-Circuits	BW-N20W5+	DC to 18 GHz Precision Fixed 20 dB Attenuator	CBT	N/A	CBT	N/A
Narda	4772-3	Attenuator (3dB)	CBT	N/A	CBT	9406
Pasternack	PE2208-6	Bidirectional Coupler	CBT	N/A	CBT	N/A
Pasternack	NC-100	Torque Wrench	5/23/2018	Biennial	5/23/2020	N/A
SPEAG	DAE4	Dasy Data Acquisition Electronics	2/13/2020	Annual	2/13/2021	1403
SPEAG	DAE4	Dasy Data Acquisition Electronics	3/19/2020	Annual	3/19/2021	604
SPEAG	DAK-3.5	Dielectric Assessment Kit	5/12/2020	Annual	5/12/2021	1070
SPEAG	EX3DV4	SAR Probe	2/19/2020	Annual	2/19/2021	7427
SPEAG	EX3DV4	SAR Probe	3/20/2020	Annual	3/20/2021	7421

Measurement Uncertainty = ±23% (k=2)

	Name	Function	Signature
Calibrated By:	Parker Jones	Team Lead Engineer	Parker Jones
Approved By:	Kaitlin O'Keefe	Managing Director	KOK

DIPOLE CALIBRATION EXTENSION

Per KDB 865664 D01, calibration intervals of up to three years may be considered for reference dipoles when it is demonstrated that the SAR target, impedance and return loss of a dipole have remained stable according to the following requirements:

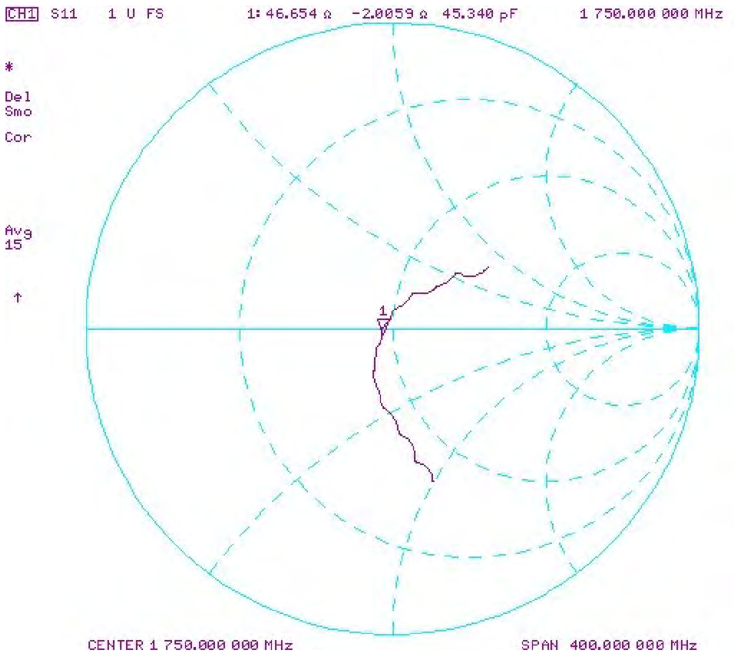
1. The measured SAR does not deviate more than 10% from the target on the calibration certificate.
2. The return-loss does not deviate more than 20% from the previous measurement and meets the required 20dB minimum return-loss requirement.
3. The measurement of real or imaginary parts of impedance does not deviate more than 5Ω from the previous measurement.

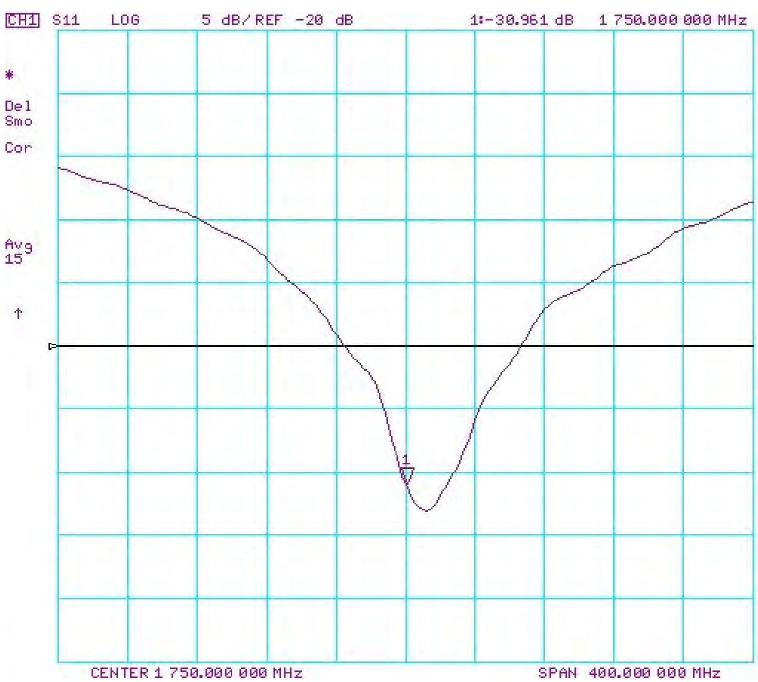
The following dipole was checked to pass the above 3 requirements to have 3-year calibration period from the calibration date:

Calibration Date	Extension Date	Certificate Electrical Delay (ns)	Certificate SAR Target Head (1g) W/kg @ 20.0 dBm	Measured Head SAR (1g) W/kg @ 20.0 dBm	Deviation 1g (%)	Certificate SAR Target Head (10g) W/kg @ 20.0 dBm	Measured Head SAR (10g) W/kg @ 20.0 dBm	Deviation 10g (%)	Certificate Impedance Head (Ohm) Real	Measured Impedance Head (Ohm) Real	Difference (Ohm) Real	Certificate Impedance Head (Ohm) Imaginary	Measured Impedance Head (Ohm) Imaginary	Difference (Ohm) Imaginary	Certificate Return Loss Head (dB)	Measured Return Loss Head (dB)	Deviation (%)	PASS/FAIL
5/15/2018	5/15/2020	1.217	3.61	3.7	2.49%	1.9	1.97	3.68%	49.2	46.7	2.5	-1	-2	1	-37.8	-31	18.00%	PASS

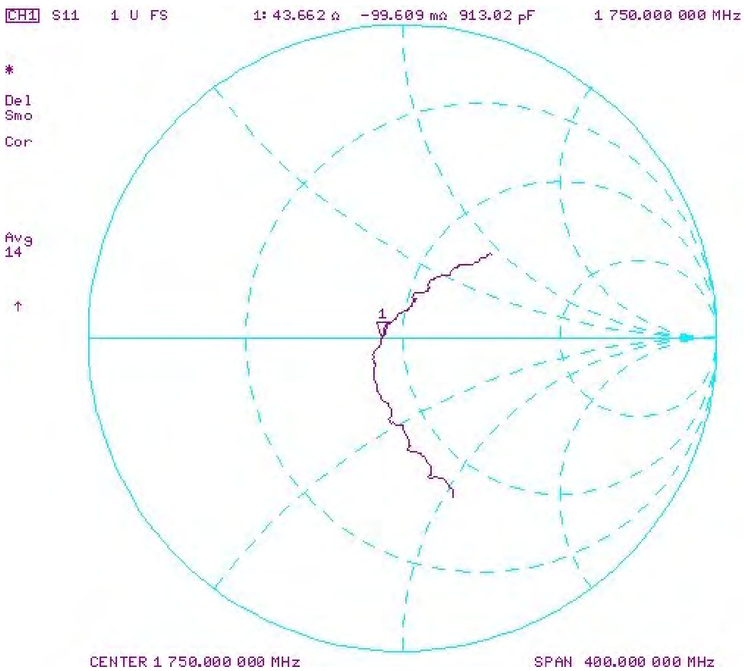
Calibration Date	Extension Date	Certificate Electrical Delay (ns)	Certificate SAR Target Body (1g) W/kg @ 20.0 dBm	Measured Body SAR (1g) W/kg @ 20.0 dBm	Deviation 1g (%)	Certificate SAR Target Body (10g) W/kg @ 20.0 dBm	Measured Body SAR (10g) W/kg @ 20.0 dBm	Deviation 10g (%)	Certificate Impedance Body (Ohm) Real	Measured Impedance Body (Ohm) Real	Difference (Ohm) Real	Certificate Impedance Body (Ohm) Imaginary	Measured Impedance Body (Ohm) Imaginary	Difference (Ohm) Imaginary	Certificate Return Loss Body (dB)	Measured Return Loss Body (dB)	Deviation (%)	PASS/FAIL
5/15/2018	5/15/2020	1.217	3.64	3.77	3.57%	1.94	2	3.09%	44.8	43.7	1.1	-0.6	-0.1	0.5	-25.2	-23.6	6.30%	PASS

Impedance & Return-Loss Measurement Plot for Head TSL





Impedance & Return-Loss Measurement Plot for Body TSL



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

S Schweizerischer Kalibrierdienst
C Service suisse d'étalonnage
Servizio svizzero di taratura
S 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 **PC Test**

Certificate No: **D1750V2-1083_Jun19**

CALIBRATION CERTIFICATE

Object	D1750V2 - SN:1083
Calibration procedure(s)	QA CAL-05.v11 Calibration Procedure for SAR Validation Sources between 0.7-3 GHz
Calibration date:	June 19, 2019

ATM 6/29/19
ATM 1/2/20

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	03-Apr-19 (No. 217-02892/02893)	Apr-20
Power sensor NRP-Z91	SN: 103244	03-Apr-19 (No. 217-02892)	Apr-20
Power sensor NRP-Z91	SN: 103245	03-Apr-19 (No. 217-02893)	Apr-20
Reference 20 dB Attenuator	SN: 5058 (20k)	04-Apr-19 (No. 217-02894)	Apr-20
Type-N mismatch combination	SN: 5047.2 / 06327	04-Apr-19 (No. 217-02895)	Apr-20
Reference Probe EX3DV4	SN: 7349	29-May-19 (No. EX3-7349_May19)	May-20
DAE4	SN: 601	30-Apr-19 (No. DAE4-601_Apr19)	Apr-20

Secondary Standards	ID #	Check Date (in house)	Scheduled Check
Power meter E4419B	SN: GB39512475	30-Oct-14 (in house check Feb-19)	In house check: Oct-20
Power sensor HP 8481A	SN: US37292783	07-Oct-15 (in house check Oct-18)	In house check: Oct-20
Power sensor HP 8481A	SN: MY41092317	07-Oct-15 (in house check Oct-18)	In house check: Oct-20
RF generator R&S SMT-06	SN: 100972	15-Jun-15 (in house check Oct-18)	In house check: Oct-20
Network Analyzer Agilent E8358A	SN: US41080477	31-Mar-14 (in house check Oct-18)	In house check: Oct-19

	Name	Function	Signature
Calibrated by:	Claudio Leubler	Laboratory Technician	
Approved by:	Katja Pokovic	Technical Manager	

Issued: June 20, 2019

Glossary:

TSL	tissue simulating liquid
ConvF	sensitivity in TSL / NORM x,y,z
N/A	not applicable or not measured

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, "Measurement procedure for the assessment of Specific Absorption Rate (SAR) from hand-held and body-mounted devices used next to the ear (frequency range of 300 MHz to 6 GHz)", July 2016
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"

Additional Documentation:

e) DASY4/5 System Handbook

Methods Applied and Interpretation of Parameters:

- *Measurement Conditions:* Further details are available from the Validation Report at the end of the certificate. All figures stated in the certificate are valid at the frequency indicated.
- *Antenna Parameters with TSL:* The dipole is mounted with the spacer to position its feed point exactly below the center marking of the flat phantom section, with the arms oriented parallel to the body axis.
- *Feed Point Impedance and Return Loss:* These parameters are measured with the dipole positioned under the liquid filled phantom. The impedance stated is transformed from the measurement at the SMA connector to the feed point. The Return Loss ensures low reflected power. No uncertainty required.
- *Electrical Delay:* One-way delay between the SMA connector and the antenna feed point. No uncertainty required.
- *SAR measured:* SAR measured at the stated antenna input power.
- *SAR normalized:* SAR as measured, normalized to an input power of 1 W at the antenna connector.
- *SAR for nominal TSL parameters:* The measured TSL parameters are used to calculate the nominal SAR result.

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%.

Measurement Conditions

DASY system configuration, as far as not given on page 1.

DASY Version	DASY5	V52.10.2
Extrapolation	Advanced Extrapolation	
Phantom	Modular Flat Phantom	
Distance Dipole Center - TSL	10 mm	with Spacer
Zoom Scan Resolution	dx, dy, dz = 5 mm	
Frequency	1750 MHz ± 1 MHz	

Head TSL parameters

The following parameters and calculations were applied.

	Temperature	**Permittivity**	**Conductivity**
Nominal Head TSL parameters	22.0 °C	40.1	1.37 mho/m
Measured Head TSL parameters	(22.0 ± 0.2) °C	40.0 ± 6 %	1.34 mho/m ± 6 %
Head TSL temperature change during test	< 0.5 °C	----	----

SAR result with Head TSL

SAR averaged over 1 cm^3 (1 g) of Head TSL	Condition	
SAR measured	250 mW input power	8.91 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	**36.1 W/kg ± 17.0 % (k=2)**

SAR averaged over 10 cm^3 (10 g) of Head TSL	condition	
SAR measured	250 mW input power	4.70 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	**19.0 W/kg ± 16.5 % (k=2)**

Body TSL parameters

The following parameters and calculations were applied.

	Temperature	**Permittivity**	**Conductivity**
Nominal Body TSL parameters	22.0 °C	53.4	1.49 mho/m
Measured Body TSL parameters	(22.0 ± 0.2) °C	53.9 ± 6 %	1.46 mho/m ± 6 %
Body TSL temperature change during test	< 0.5 °C	----	----

SAR result with Body TSL

SAR averaged over 1 cm^3 (1 g) of Body TSL	Condition	
SAR measured	250 mW input power	9.14 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	**37.1 W/kg ± 17.0 % (k=2)**

SAR averaged over 10 cm^3 (10 g) of Body TSL	condition	
SAR measured	250 mW input power	4.88 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	**19.7 W/kg ± 16.5 % (k=2)**

Appendix (Additional assessments outside the scope of SCS 0108)

Antenna Parameters with Head TSL

Impedance, transformed to feed point	50.6 Ω - 1.1 jΩ
Return Loss	- 38.0 dB

Antenna Parameters with Body TSL

Impedance, transformed to feed point	46.1 Ω - 2.4 jΩ
Return Loss	- 28.0 dB

General Antenna Parameters and Design

Electrical Delay (one direction)	1.220 ns

After long term use with 100W radiated power, only a slight warming of the dipole near the feedpoint can be measured.

The dipole is made of standard semirigid coaxial cable. The center conductor of the feeding line is directly connected to the second arm of the dipole. The antenna is therefore short-circuited for DC-signals. On some of the dipoles, small end caps are added to the dipole arms in order to improve matching when loaded according to the position as explained in the "Measurement Conditions" paragraph. The SAR data are not affected by this change. The overall dipole length is still according to the Standard.
No excessive force must be applied to the dipole arms, because they might bend or the soldered connections near the feedpoint may be damaged.

Additional EUT Data

Manufactured by	SPEAG

DASY5 Validation Report for Head TSL

Date: 19.06.2019

Test Laboratory: SPEAG, Zurich, Switzerland

DUT: Dipole 1750 MHz; Type: D1750V2; Serial: D1750V2 - SN:1083

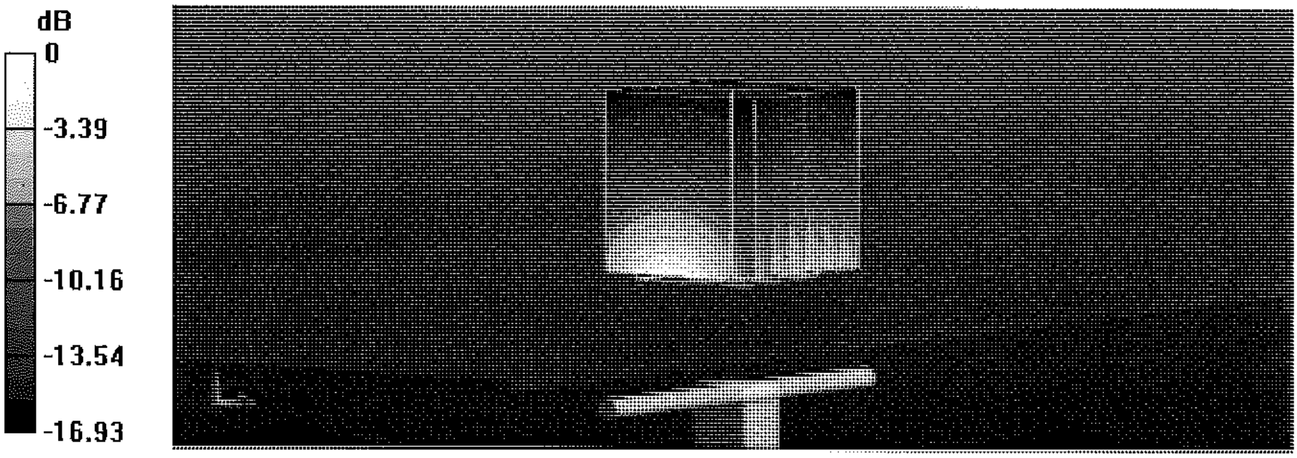
Communication System: UID 0 - CW; Frequency: 1750 MHz
Medium parameters used: f = 1750 MHz; σ = 1.34 S/m; ε_r = 40; ρ = 1000 kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2011)

DASY52 Configuration:

- Probe: EX3DV4 - SN7349; ConvF(8.67, 8.67, 8.67) @ 1750 MHz; Calibrated: 29.05.2019
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 30.04.2019
- Phantom: Flat Phantom 5.0 (front); Type: QD 000 P50 AA; Serial: 1001
- DASY52 52.10.2(1504); SEMCAD X 14.6.12(7470)

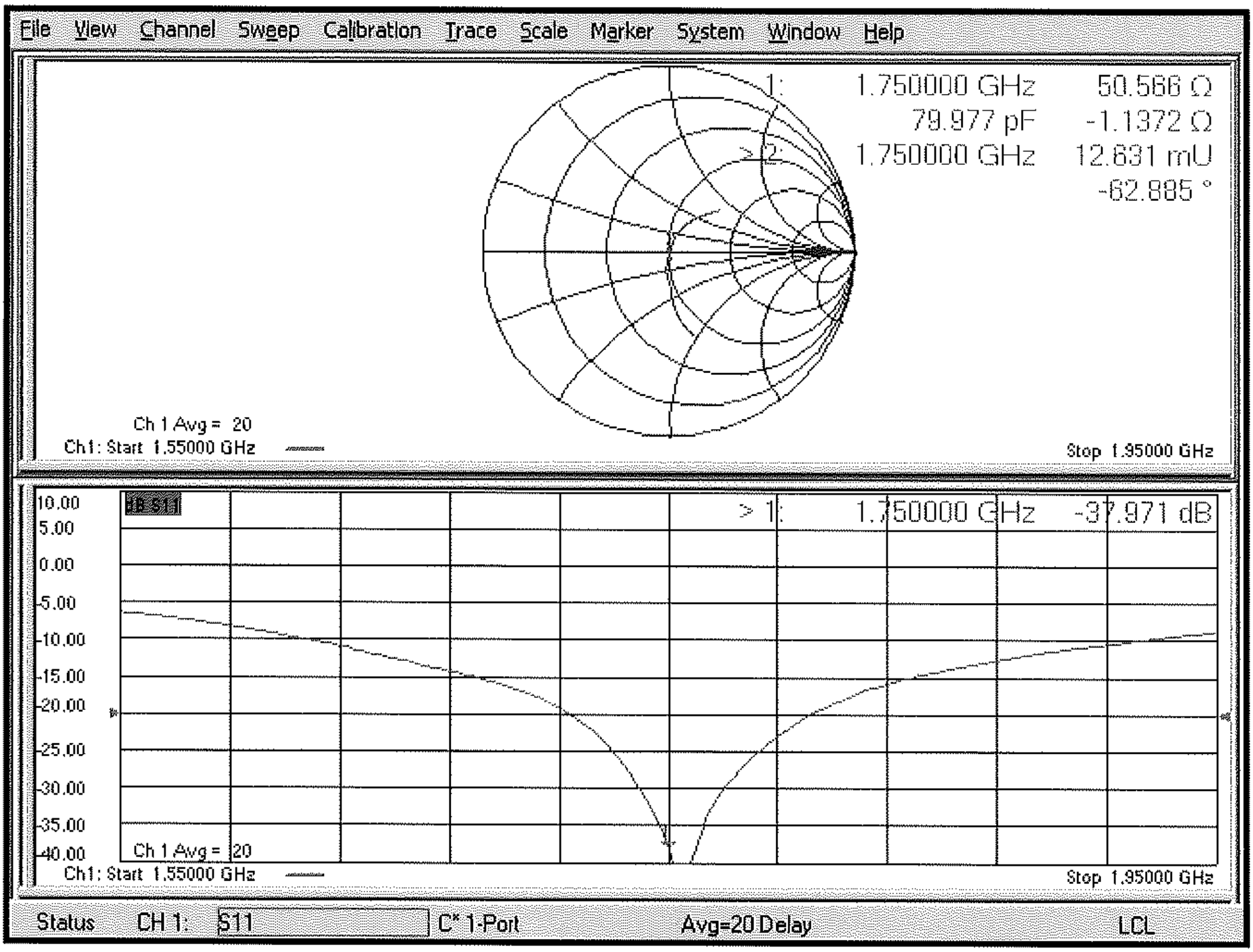
Dipole Calibration for Head Tissue/Pin=250 mW, d=10mm/Zoom Scan (7x7x7)/Cube 0:

Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 105.8 V/m; Power Drift = 0.04 dB
Peak SAR (extrapolated) = 16.7 W/kg
SAR(1 g) = 8.91 W/kg; SAR(10 g) = 4.7 W/kg
Maximum value of SAR (measured) = 13.9 W/kg



0 dB = 13.9 W/kg = 11.43 dBW/kg

Impedance Measurement Plot for Head TSL



DASY5 Validation Report for Body TSL

Date: 13.06.2019

Test Laboratory: SPEAG, Zurich, Switzerland

DUT: Dipole 1750 MHz; Type: D1750V2; Serial: D1750V2 - SN:1083

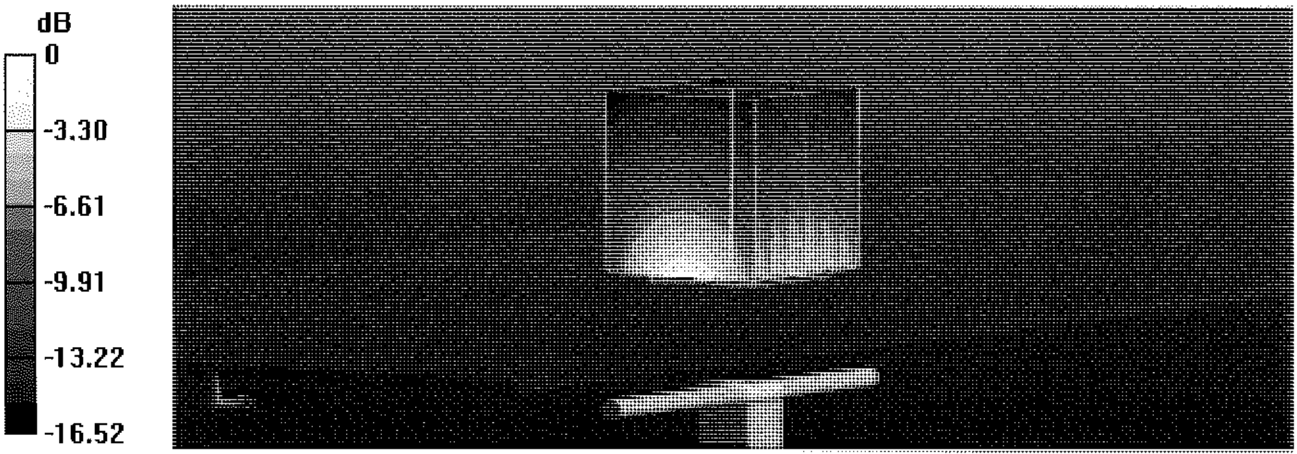
Communication System: UID 0 - CW; Frequency: 1750 MHz
Medium parameters used: f = 1750 MHz; σ = 1.46 S/m; ε_r = 53.9; ρ = 1000 kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2011)

DASY52 Configuration:

- Probe: EX3DV4 - SN7349; ConvF(8.45, 8.45, 8.45) @ 1750 MHz; Calibrated: 29.05.2019
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 30.04.2019
- Phantom: Flat Phantom 5.0 (back); Type: QD 000 P50 AA; Serial: 1002
- DASY52 52.10.2(1504); SEMCAD X 14.6.12(7470)

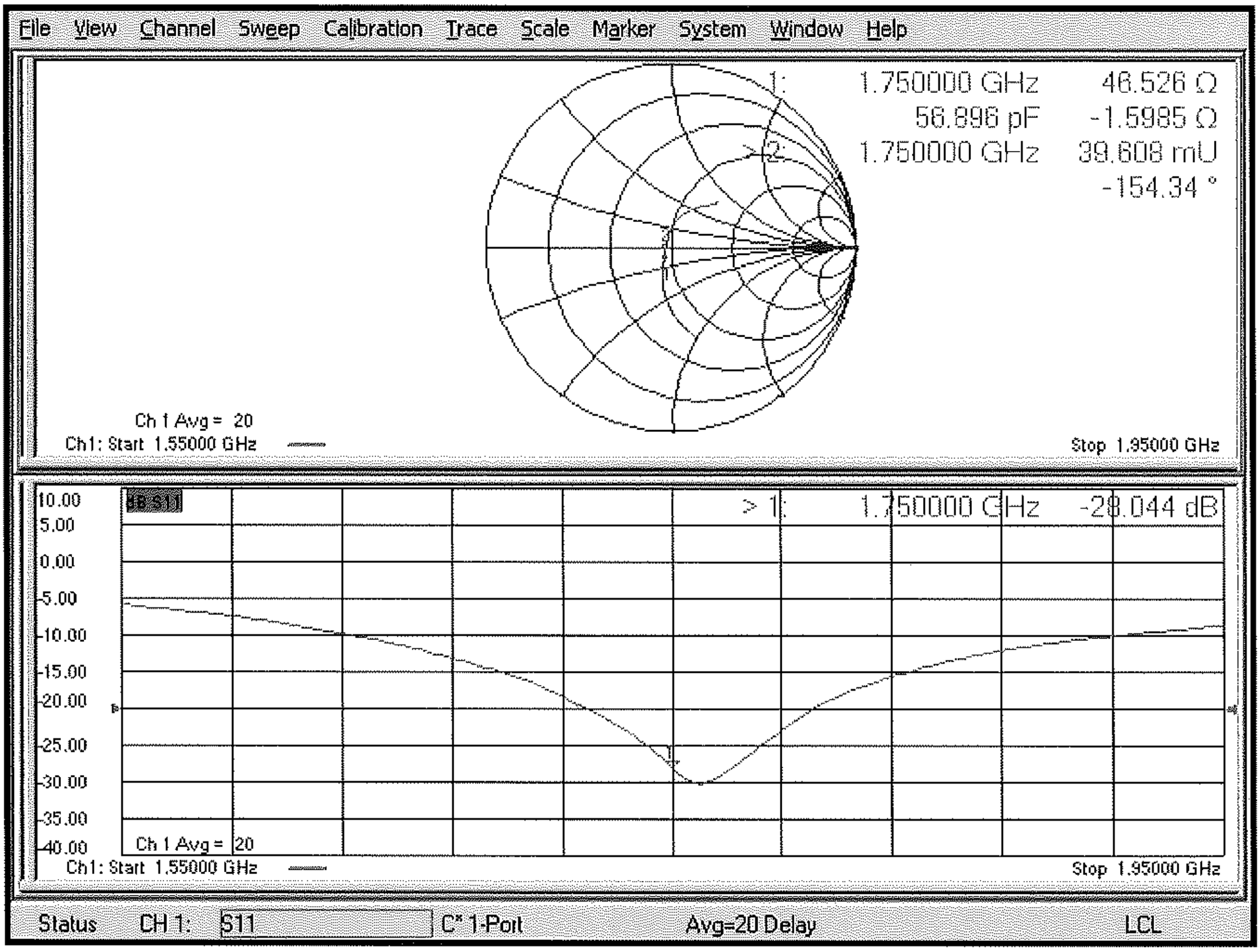
Dipole Calibration for Body Tissue/Pin=250 mW, d=10mm/Zoom Scan (7x7x7)/Cube 0:

Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 101.8 V/m; Power Drift = -0.04 dB
Peak SAR (extrapolated) = 16.2 W/kg
SAR(1 g) = 9.14 W/kg; SAR(10 g) = 4.88 W/kg
Maximum value of SAR (measured) = 13.7 W/kg



0 dB = 13.7 W/kg = 11.37 dBW/kg

Impedance Measurement Plot for Body TSL



Certification of Calibration

Object	D1750V2 – SN: 1083
Calibration procedure(s)	Procedure for Calibration Extension for SAR Dipoles.
Extended Calibration date:	June 19, 2020
Description:	SAR Validation Dipole at 1750 MHz.

Calibration Equipment used:

Manufacturer	Model	Description	Cal Date	Cal Interval	Cal Due	Serial Number
Agilent	8753ES	S-Parameter Network Analyzer	1/16/2020	Annual	1/16/2021	US39170118
Agilent	N5182A	MXG Vector Signal Generator	8/19/2019	Annual	8/19/2020	MY47420837
Amplifier Research	15S1G6	Amplifier	CBT	N/A	CBT	343972
Anritsu	MA2411B	Pulse Power Sensor	1/21/2020	Annual	1/21/2021	1207470
Anritsu	MA2411B	Pulse Power Sensor	1/21/2020	Annual	1/21/2021	1339007
Anritsu	ML2495A	Power Meter	1/15/2020	Annual	1/15/2021	1328004
Control Company	62344-734	Therm./ Clock/ Humidity Monitor	3/18/2019	Biennial	3/18/2021	192038436
Control Company	4352	Ultra Long Stem Thermometer	8/2/2018	Biennial	8/2/2020	181292000
Keysight Technologies	85033E	Standard Mechanical Calibration Kit (DC to 9GHz, 3.5mm)	7/2/2019	Annual	7/2/2020	MY53401181
MiniCircuits	VLF-6000+	Low Pass Filter	CBT	N/A	CBT	N/A
Mini-Circuits	BW-N20W5+	DC to 18 GHz Precision Fixed 20 dB Attenuator	CBT	N/A	CBT	N/A
Narda	4772-3	Attenuator (3dB)	CBT	N/A	CBT	9406
Pasternack	PE2208-6	Bidirectional Coupler	CBT	N/A	CBT	N/A
Seekonk	NC-100	Torque Wrench	7/18/2019	Annual	7/18/2020	N/A
SPEAG	DAE4	Dasy Data Acquisition Electronics	1/14/2020	Annual	1/14/2021	793
SPEAG	DAE4	Dasy Data Acquisition Electronics	8/12/2019	Annual	8/12/2020	1408
SPEAG	DAK-3.5	Dielectric Assessment Kit	5/12/2020	Annual	5/12/2021	1070
SPEAG	EX3DV4	SAR Probe	1/20/2020	Annual	1/20/2021	3837
SPEAG	EX3DV4	SAR Probe	8/29/2019	Annual	8/29/2020	3949

Measurement Uncertainty = ±23% (k=2)

	Name	Function	Signature
Calibrated By:	Parker Jones	Team Lead Engineer	Parker Jones
Approved By:	Kaitlin O'Keefe	Managing Director	KOK

DIPOLE CALIBRATION EXTENSION

Per KDB 865664 D01, calibration intervals of up to three years may be considered for reference dipoles when it is demonstrated that the SAR target, impedance and return loss of a dipole have remained stable according to the following requirements:

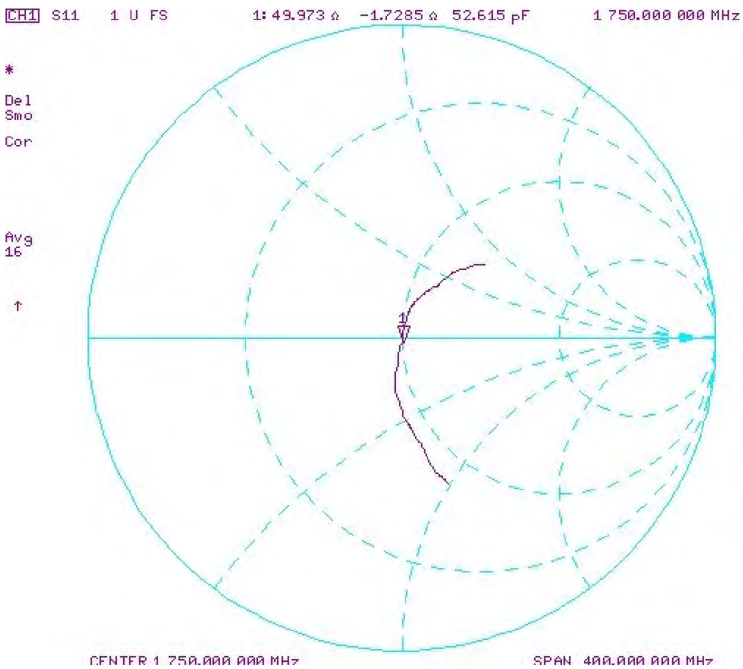
1. The measured SAR does not deviate more than 10% from the target on the calibration certificate.
2. The return-loss does not deviate more than 20% from the previous measurement and meets the required 20dB minimum return-loss requirement.
3. The measurement of real or imaginary parts of impedance does not deviate more than 5Ω from the previous measurement.

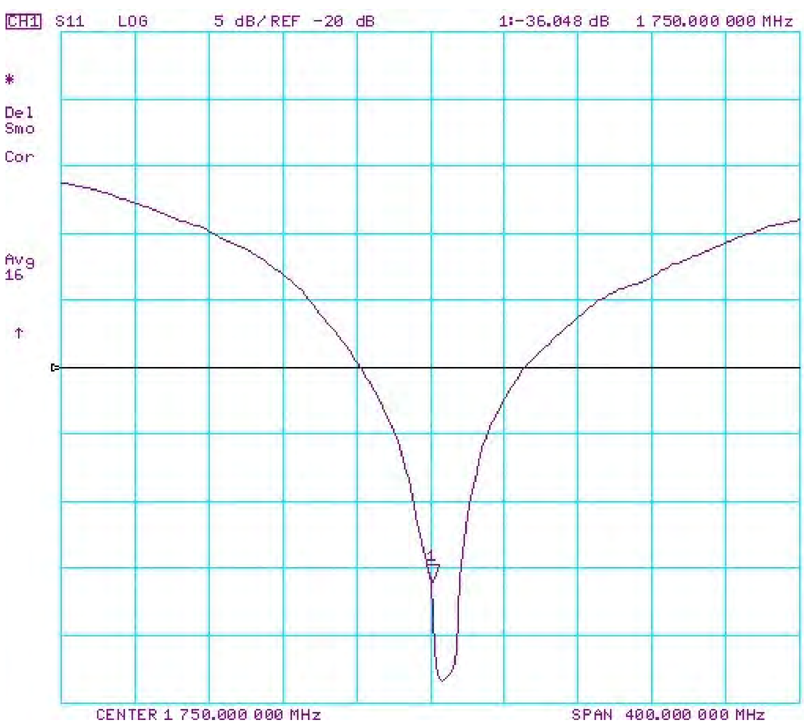
The following dipole was checked to pass the above 3 requirements to have 2-year calibration period from the calibration date:

Calibration Date	Extension Date	Certificate Electrical Delay (ns)	Certificate SAR Target Head (1g) W/kg @ 20.0 dBm	Measured Head SAR (1g) W/kg @ 20.0 dBm	Deviation 1g (%)	Certificate SAR Target Head (10g) W/kg @ 20.0 dBm	Measured Head SAR (10g) W/kg @ 20.0 dBm	Deviation 10g (%)	Certificate Impedance Head (Ohm) Real	Measured Impedance Head (Ohm) Real	Difference (Ohm) Real	Certificate Impedance Head (Ohm) Imaginary	Measured Impedance Head (Ohm) Imaginary	Difference (Ohm) Imaginary	Certificate Return Loss Head (dB)	Measured Return Loss Head (dB)	Deviation (%)	PASS/FAIL
6/19/2019	6/19/2020	1.22	3.61	3.69	2.22%	1.9	1.94	2.11%	50.6	50	0.6	-1.1	-1.7	0.6	-38	-36	5.30%	PASS

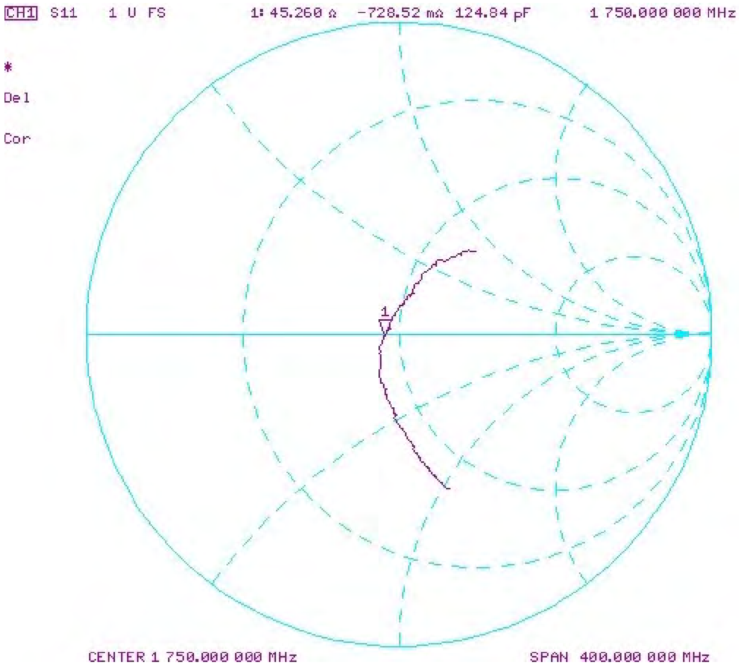
Calibration Date	Extension Date	Certificate Electrical Delay (ns)	Certificate SAR Target Body (1g) W/kg @ 20.0 dBm	Measured Body SAR (1g) W/kg @ 20.0 dBm	Deviation 1g (%)	Certificate SAR Target Body (10g) W/kg @ 20.0 dBm	Measured Body SAR (10g) W/kg @ 20.0 dBm	Deviation 10g (%)	Certificate Impedance Body (Ohm) Real	Measured Impedance Body (Ohm) Real	Difference (Ohm) Real	Certificate Impedance Body (Ohm) Imaginary	Measured Impedance Body (Ohm) Imaginary	Difference (Ohm) Imaginary	Certificate Return Loss Body (dB)	Measured Return Loss Body (dB)	Deviation (%)	PASS/FAIL
6/19/2019	6/19/2020	1.22	3.71	3.83	3.23%	1.97	2.04	3.55%	46.1	45.3	0.8	-2.4	-0.7	1.7	-28	-25.9	7.50%	PASS

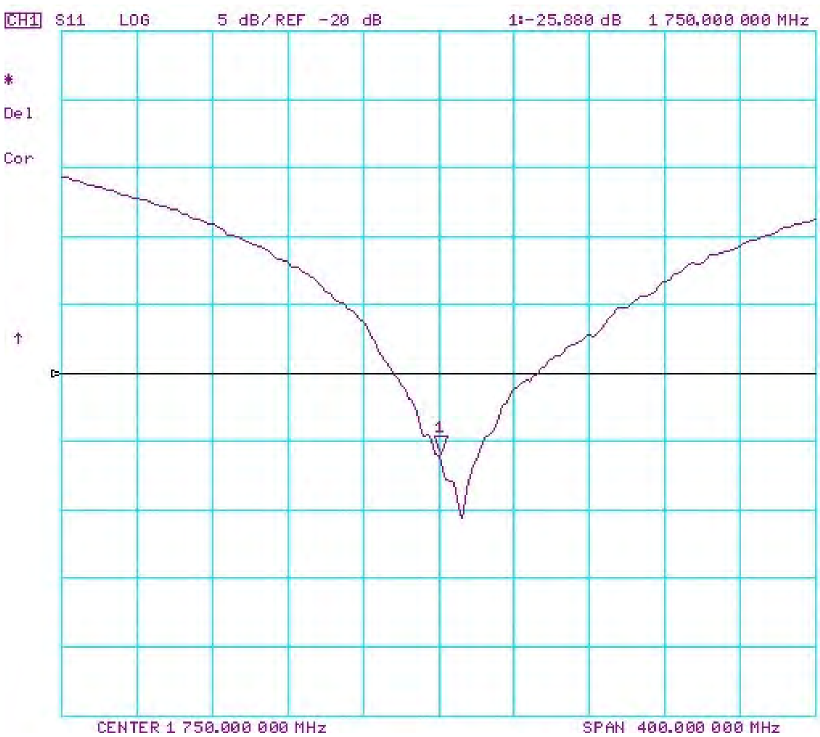
Impedance & Return-Loss Measurement Plot for Head TSL





Impedance & Return-Loss Measurement Plot for Body TSL





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

S Schweizerischer Kalibrierdienst
C Service suisse d'étalonnage
Servizio svizzero di taratura
S 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 PC Test

Certificate No: **D1900V2-5d030_Jun19**

CALIBRATION CERTIFICATE

Object	D1900V2 - SN:5d030
Calibration procedure(s)	QA CAL-05.v11 Calibration Procedure for SAR Validation Sources between 0.7-3 GHz
Calibration date:	June 19, 2019

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	03-Apr-19 (No. 217-02892/02893)	Apr-20
Power sensor NRP-Z91	SN: 103244	03-Apr-19 (No. 217-02892)	Apr-20
Power sensor NRP-Z91	SN: 103245	03-Apr-19 (No. 217-02893)	Apr-20
Reference 20 dB Attenuator	SN: 5058 (20k)	04-Apr-19 (No. 217-02894)	Apr-20
Type-N mismatch combination	SN: 5047.2 / 06327	04-Apr-19 (No. 217-02895)	Apr-20
Reference Probe EX3DV4	SN: 7349	29-May-19 (No. EX3-7349_May19)	May-20
DAE4	SN: 601	30-Apr-19 (No. DAE4-601_Apr19)	Apr-20

Secondary Standards	ID #	Check Date (in house)	Scheduled Check
Power meter E4419B	SN: GB39512475	30-Oct-14 (in house check Feb-19)	In house check: Oct-20
Power sensor HP 8481A	SN: US37292783	07-Oct-15 (in house check Oct-18)	In house check: Oct-20
Power sensor HP 8481A	SN: MY41092317	07-Oct-15 (in house check Oct-18)	In house check: Oct-20
RF generator R&S SMT-06	SN: 100972	15-Jun-15 (in house check Oct-18)	In house check: Oct-20
Network Analyzer Agilent E8358A	SN: US41080477	31-Mar-14 (in house check Oct-18)	In house check: Oct-19

	Name	Function	Signature
Calibrated by:	Claudio Leubler	Laboratory Technician	
Approved by:	Katja Pokovic	Technical Manager	

Issued: June 20, 2019

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

Glossary:

TSL	tissue simulating liquid
ConvF	sensitivity in TSL / NORM x,y,z
N/A	not applicable or not measured

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, "Measurement procedure for the assessment of Specific Absorption Rate (SAR) from hand-held and body-mounted devices used next to the ear (frequency range of 300 MHz to 6 GHz)", July 2016
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"

Additional Documentation:

e) DASY4/5 System Handbook

Methods Applied and Interpretation of Parameters:

- *Measurement Conditions:* Further details are available from the Validation Report at the end of the certificate. All figures stated in the certificate are valid at the frequency indicated.
- *Antenna Parameters with TSL:* The dipole is mounted with the spacer to position its feed point exactly below the center marking of the flat phantom section, with the arms oriented parallel to the body axis.
- *Feed Point Impedance and Return Loss:* These parameters are measured with the dipole positioned under the liquid filled phantom. The impedance stated is transformed from the measurement at the SMA connector to the feed point. The Return Loss ensures low reflected power. No uncertainty required.
- *Electrical Delay:* One-way delay between the SMA connector and the antenna feed point. No uncertainty required.
- *SAR measured:* SAR measured at the stated antenna input power.
- *SAR normalized:* SAR as measured, normalized to an input power of 1 W at the antenna connector.
- *SAR for nominal TSL parameters:* The measured TSL parameters are used to calculate the nominal SAR result.

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%.

Measurement Conditions

DASY system configuration, as far as not given on page 1.

DASY Version	DASY5	V52.10.2
Extrapolation	Advanced Extrapolation	
Phantom	Modular Flat Phantom	
Distance Dipole Center - TSL	10 mm	with Spacer
Zoom Scan Resolution	dx, dy, dz = 5 mm	
Frequency	1900 MHz ± 1 MHz	

Head TSL parameters

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Head TSL parameters	22.0 °C	40.0	1.40 mho/m
Measured Head TSL parameters	(22.0 ± 0.2) °C	41.4 ± 6 %	1.39 mho/m ± 6 %
Head TSL temperature change during test	< 0.5 °C	----	----

SAR result with Head TSL

SAR averaged over 1 cm^3 (1 g) of Head TSL	Condition	
SAR measured	250 mW input power	9.85 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	**39.9 W/kg ± 17.0 % (k=2)**

SAR averaged over 10 cm^3 (10 g) of Head TSL	condition	
SAR measured	250 mW input power	5.19 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	**20.9 W/kg ± 16.5 % (k=2)**

Body TSL parameters

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Body TSL parameters	22.0 °C	53.3	1.52 mho/m
Measured Body TSL parameters	(22.0 ± 0.2) °C	54.2 ± 6 %	1.50 mho/m ± 6 %
Body TSL temperature change during test	< 0.5 °C	----	----

SAR result with Body TSL

SAR averaged over 1 cm^3 (1 g) of Body TSL	Condition	
SAR measured	250 mW input power	9.86 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	**39.9 W/kg ± 17.0 % (k=2)**

SAR averaged over 10 cm^3 (10 g) of Body TSL	condition	
SAR measured	250 mW input power	5.24 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	**21.1 W/kg ± 16.5 % (k=2)**

Appendix (Additional assessments outside the scope of SCS 0108)

Antenna Parameters with Head TSL

Impedance, transformed to feed point	50.0 Ω + 4.2 jΩ
Return Loss	- 27.6 dB

Antenna Parameters with Body TSL

Impedance, transformed to feed point	47.0 Ω + 5.4 jΩ
Return Loss	- 24.0 dB

General Antenna Parameters and Design

Electrical Delay (one direction)	1.191 ns

After long term use with 100W radiated power, only a slight warming of the dipole near the feedpoint can be measured.

The dipole is made of standard semirigid coaxial cable. The center conductor of the feeding line is directly connected to the second arm of the dipole. The antenna is therefore short-circuited for DC-signals. On some of the dipoles, small end caps are added to the dipole arms in order to improve matching when loaded according to the position as explained in the "Measurement Conditions" paragraph. The SAR data are not affected by this change. The overall dipole length is still according to the Standard.
No excessive force must be applied to the dipole arms, because they might bend or the soldered connections near the feedpoint may be damaged.

Additional EUT Data

Manufactured by	SPEAG

DASY5 Validation Report for Head TSL

Date: 19.06.2019

Test Laboratory: SPEAG, Zurich, Switzerland

DUT: Dipole 1900 MHz; Type: D1900V2; Serial: D1900V2 - SN:5d030

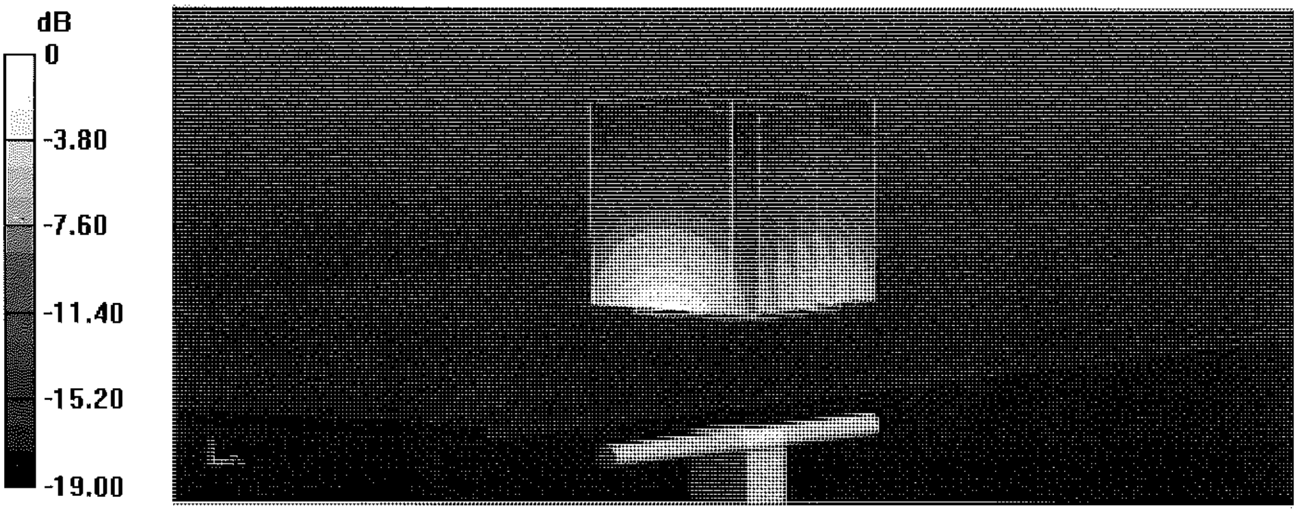
Communication System: UID 0 - CW; Frequency: 1900 MHz
Medium parameters used: f = 1900 MHz; σ = 1.39 S/m; ε_r = 41.4; ρ = 1000 kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2011)

DASY52 Configuration:

- Probe: EX3DV4 - SN7349; ConvF(8.44, 8.44, 8.44) @ 1900 MHz; Calibrated: 29.05.2019
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 30.04.2019
- Phantom: Flat Phantom 5.0 (front); Type: QD 000 P50 AA; Serial: 1001
- DASY52 52.10.2(1504); SEMCAD X 14.6.12(7470)

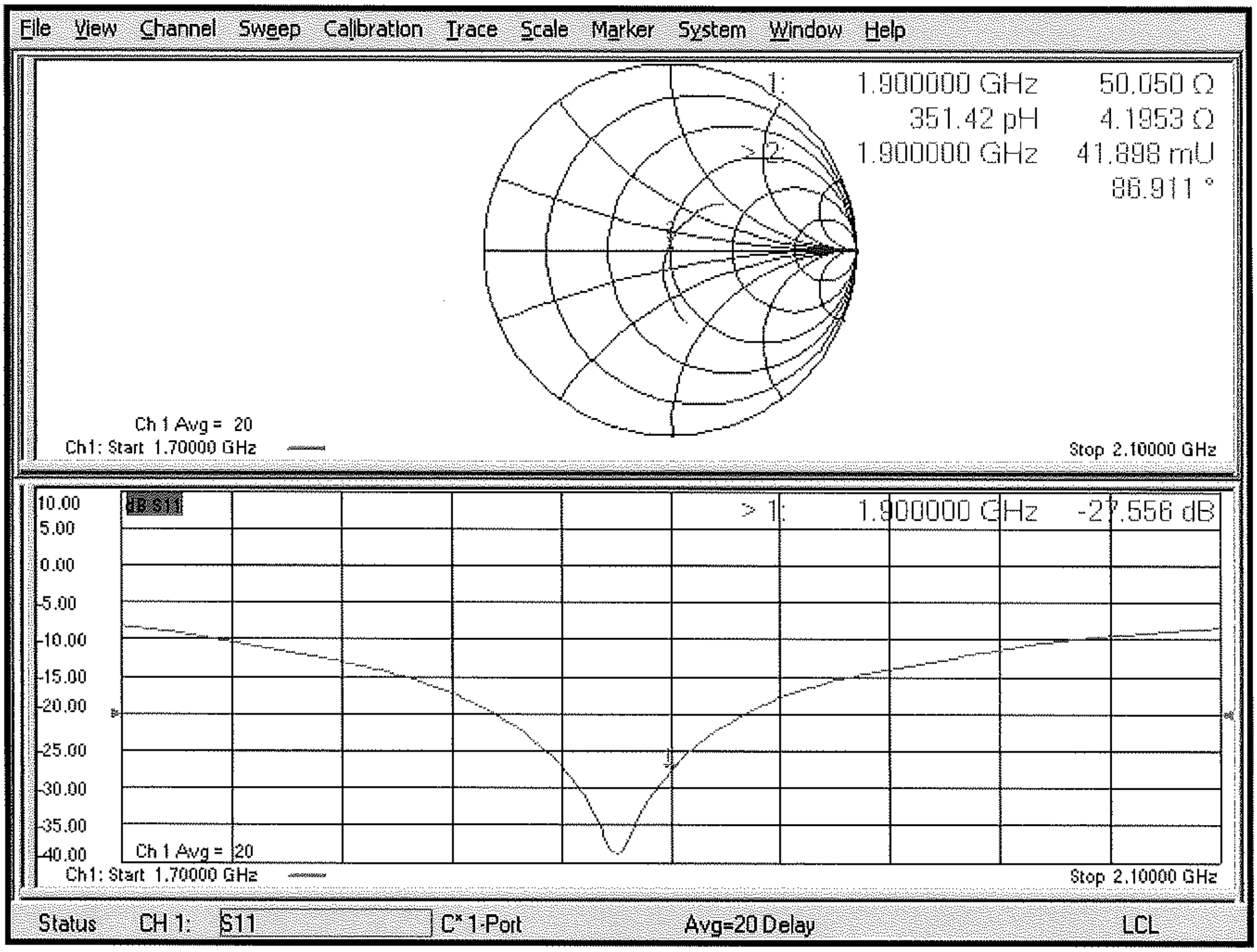
Dipole Calibration for Head Tissue/Pin=250 mW, d=10mm/Zoom Scan (7x7x7)/Cube 0:

Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 109.2 V/m; Power Drift = 0.03 dB
Peak SAR (extrapolated) = 18.2 W/kg
SAR(1 g) = 9.85 W/kg; SAR(10 g) = 5.19 W/kg
Maximum value of SAR (measured) = 15.3 W/kg



0 dB = 15.3 W/kg = 11.85 dBW/kg

Impedance Measurement Plot for Head TSL



DASY5 Validation Report for Body TSL

Date: 19.06.2019

Test Laboratory: SPEAG, Zurich, Switzerland

DUT: Dipole 1900 MHz; Type: D1900V2; Serial: D1900V2 - SN:5d030

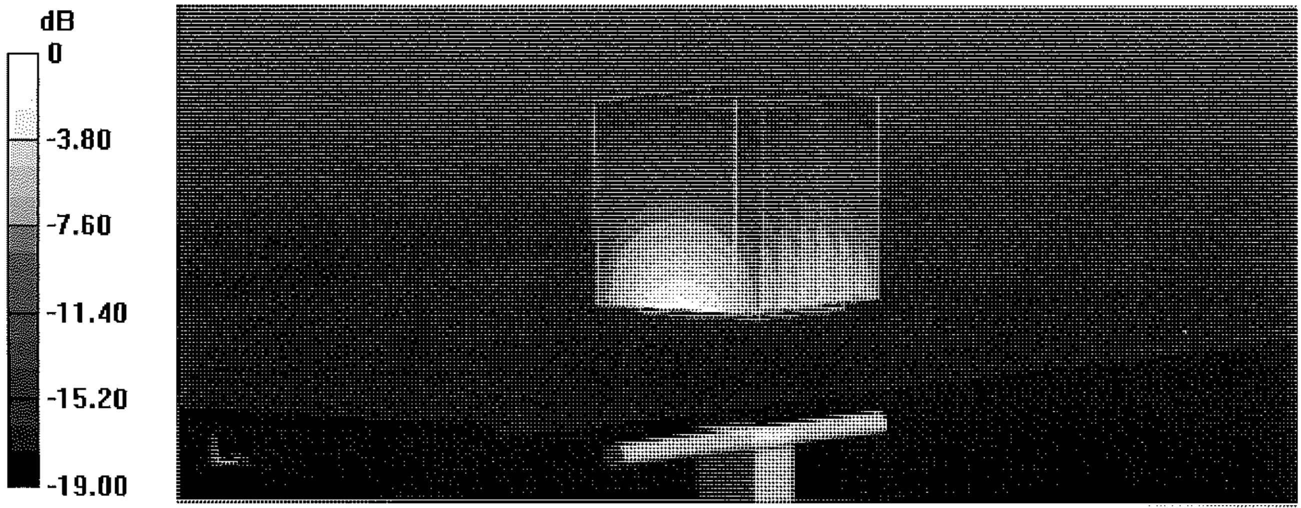
Communication System: UID 0 - CW; Frequency: 1900 MHz
Medium parameters used: f = 1900 MHz; σ = 1.5 S/m; ε_r = 54.2; ρ = 1000 kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2011)

DASY52 Configuration:

- Probe: EX3DV4 - SN7349; ConvF(8.42, 8.42, 8.42) @ 1900 MHz; Calibrated: 29.05.2019
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 30.04.2019
- Phantom: Flat Phantom 5.0 (back); Type: QD 000 P50 AA; Serial: 1002
- DASY52 52.10.2(1504); SEMCAD X 14.6.12(7470)

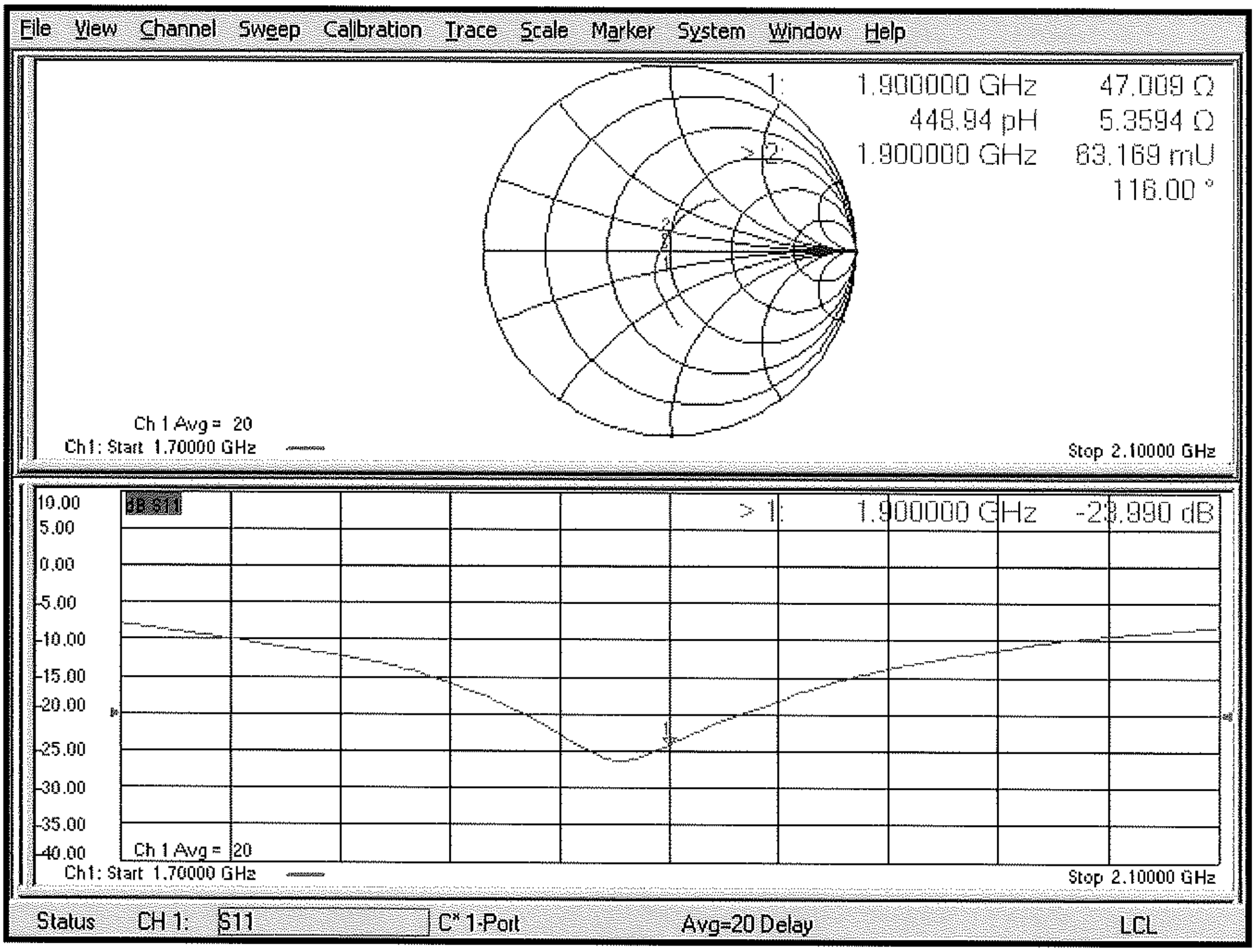
Dipole Calibration for Body Tissue/Pin=250 mW, d=10mm/Zoom Scan (7x7x7)/Cube 0:

Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 104.1 V/m; Power Drift = -0.06 dB
Peak SAR (extrapolated) = 17.6 W/kg
SAR(1 g) = 9.86 W/kg; SAR(10 g) = 5.24 W/kg
Maximum value of SAR (measured) = 15.0 W/kg



0 dB = 15.0 W/kg = 11.76 dBW/kg

Impedance Measurement Plot for Body TSL



Certification of Calibration

Object	D1900V2 – SN: 5d030
Calibration procedure(s)	Procedure for Calibration Extension for SAR Dipoles.
Extended Calibration date:	June 19, 2020
Description:	SAR Validation Dipole at 1900 MHz.

Calibration Equipment used:

Manufacturer	Model	Description	Cal Date	Cal Interval	Cal Due	Serial Number
Agilent	8753ES	S-Parameter Network Analyzer	1/16/2020	Annual	1/16/2021	US39170118
Agilent	N5182A	MXG Vector Signal Generator	8/19/2019	Annual	8/19/2020	MY47420837
Amplifier Research	15S1G6	Amplifier	CBT	N/A	CBT	343972
Anritsu	MA2411B	Pulse Power Sensor	1/21/2020	Annual	1/21/2021	1207470
Anritsu	MA2411B	Pulse Power Sensor	1/21/2020	Annual	1/21/2021	1339007
Anritsu	ML2495A	Power Meter	1/15/2020	Annual	1/15/2021	1328004
Control Company	62344-734	Therm./ Clock/ Humidity Monitor	3/18/2019	Biennial	3/18/2021	192038436
Control Company	4352	Ultra Long Stem Thermometer	8/2/2018	Biennial	8/2/2020	181292000
Keysight Technologies	85033E	Standard Mechanical Calibration Kit (DC to 9GHz, 3.5mm)	7/2/2019	Annual	7/2/2020	MY53401181
MiniCircuits	VLF-6000+	Low Pass Filter	CBT	N/A	CBT	N/A
Mini-Circuits	BW-N20W5+	DC to 18 GHz Precision Fixed 20 dB Attenuator	CBT	N/A	CBT	N/A
Narda	4772-3	Attenuator (3dB)	CBT	N/A	CBT	9406
Pasternack	PE2208-6	Bidirectional Coupler	CBT	N/A	CBT	N/A
Seekonk	NC-100	Torque Wrench	7/18/2019	Annual	7/18/2020	N/A
SPEAG	DAE4	Dasy Data Acquisition Electronics	1/14/2020	Annual	1/14/2021	793
SPEAG	DAK-3.5	Dielectric Assessment Kit	5/12/2020	Annual	5/12/2021	1070
SPEAG	EX3DV4	SAR Probe	1/20/2020	Annual	1/20/2021	3837

Measurement Uncertainty = ±23% (k=2)

	Name	Function	Signature
Calibrated By:	Parker Jones	Team Lead Engineer	Parker Jones
Approved By:	Kaitlin O'Keefe	Managing Director	KOK

DIPOLE CALIBRATION EXTENSION

Per KDB 865664 D01, calibration intervals of up to three years may be considered for reference dipoles when it is demonstrated that the SAR target, impedance and return loss of a dipole have remained stable according to the following requirements:

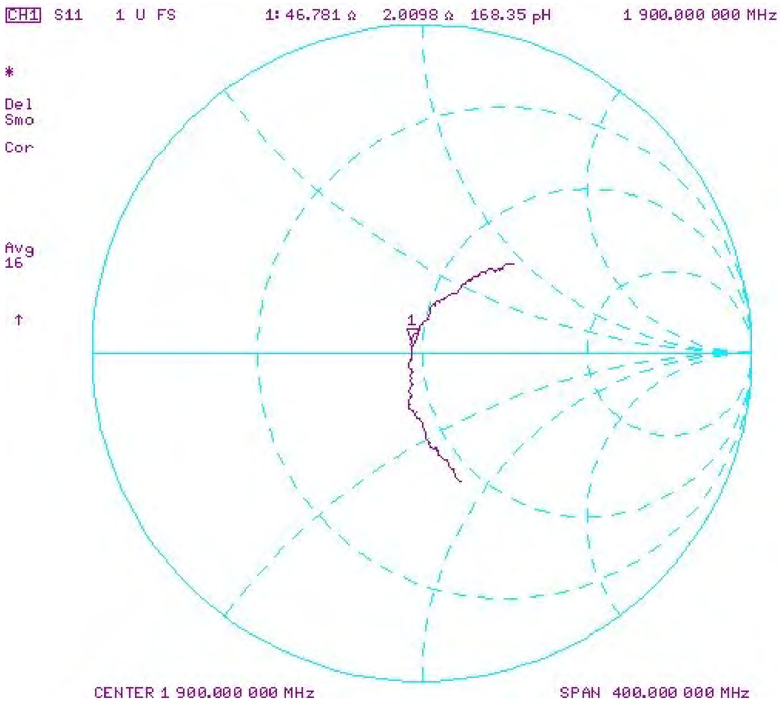
1. The measured SAR does not deviate more than 10% from the target on the calibration certificate.
2. The return-loss does not deviate more than 20% from the previous measurement and meets the required 20dB minimum return-loss requirement.
3. The measurement of real or imaginary parts of impedance does not deviate more than 5Ω from the previous measurement.

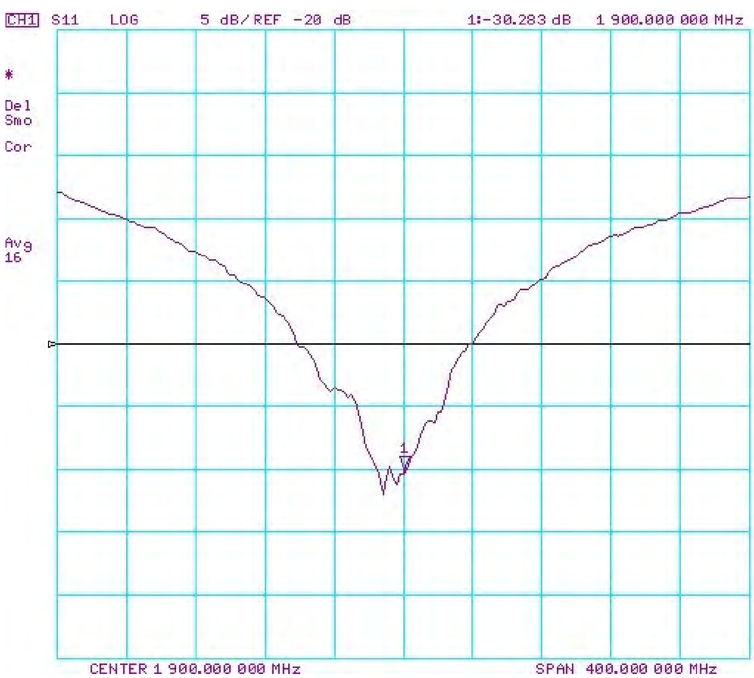
The following dipole was checked to pass the above 3 requirements to have 2-year calibration period from the calibration date:

Calibration Date	Extension Date	Certificate Electrical Delay (ns)	Certificate SAR Target Head (1g) W/kg @ 20.0 dBm	Measured Head SAR (1g) W/kg @ 20.0 dBm	Deviation 1g (%)	Certificate SAR Target Head (10g) W/kg @ 20.0 dBm	Measured Head SAR (10g) W/kg @ 20.0 dBm	Deviation 10g (%)	Certificate Impedance Head (Ohm) Real	Measured Impedance Head (Ohm) Real	Difference (Ohm) Real	Certificate Impedance Head (Ohm) Imaginary	Measured Impedance Head (Ohm) Imaginary	Difference (Ohm) Imaginary	Certificate Return Loss Head (dB)	Measured Return Loss Head (dB)	Deviation (%)	PASS/FAIL
6/19/2019	6/19/2020	1.191	3.99	4.3	7.77%	2.09	2.2	5.26%	50	46.8	3.2	4.2	2	2.2	-27.6	-30.3	-9.80%	PASS

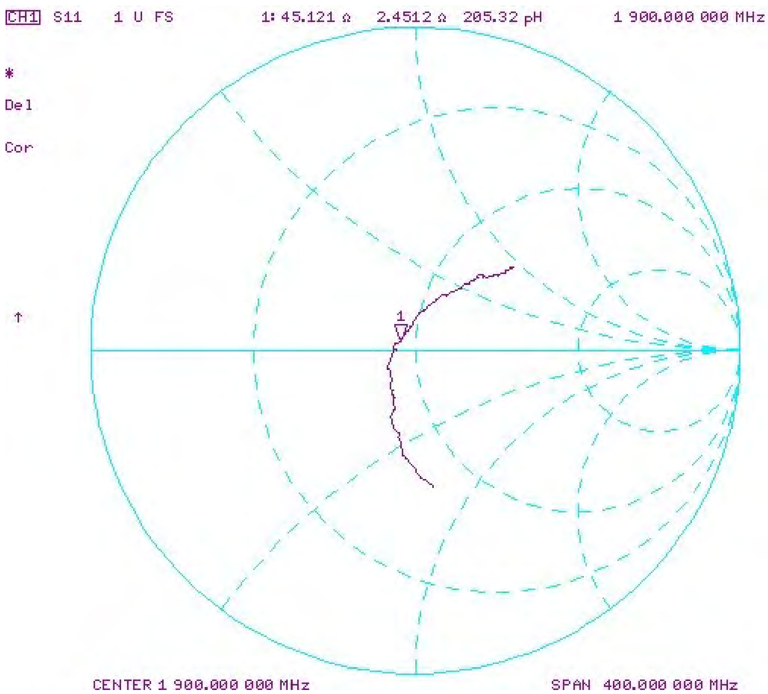
Calibration Date	Extension Date	Certificate Electrical Delay (ns)	Certificate SAR Target Body (1g) W/kg @ 20.0 dBm	Measured Body SAR (1g) W/kg @ 20.0 dBm	Deviation 1g (%)	Certificate SAR Target Body (10g) W/kg @ 20.0 dBm	Measured Body SAR (10g) W/kg @ 20.0 dBm	Deviation 10g (%)	Certificate Impedance Body (Ohm) Real	Measured Impedance Body (Ohm) Real	Difference (Ohm) Real	Certificate Impedance Body (Ohm) Imaginary	Measured Impedance Body (Ohm) Imaginary	Difference (Ohm) Imaginary	Certificate Return Loss Body (dB)	Measured Return Loss Body (dB)	Deviation (%)	PASS/FAIL
6/19/2019	6/19/2020	1.191	3.99	4.29	7.52%	2.11	2.2	4.27%	47	45.1	1.9	5.4	2.5	2.9	-24	-25	-4.20%	PASS

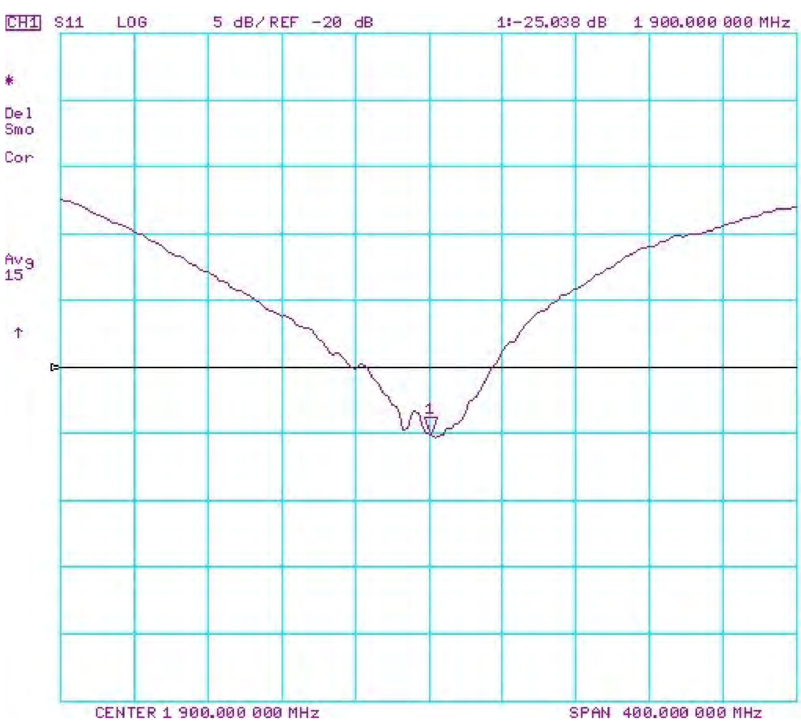
Impedance & Return-Loss Measurement Plot for Head TSL





Impedance & Return-Loss Measurement Plot for Body TSL





Calibration Laboratory of
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Engineering AG
Zeughausstrasse 43, 8004 Zurich, Switzerland

S Schweizerischer Kalibrierdienst
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S 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 **PC Test**

Certificate No: **D2450V2-750_Jun19**

CALIBRATION CERTIFICATE

Object: D2450V2 - SN:750

✓ATM 6/28/19

Calibration procedure(s): QA CAL-05.v11
Calibration Procedure for SAR Validation Sources between 0.7-3 GHz

✓ATM 7/3/20

Calibration date: June 14, 2019

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	03-Apr-19 (No. 217-02892/02893)	Apr-20
Power sensor NRP-Z91	SN: 103244	03-Apr-19 (No. 217-02892)	Apr-20
Power sensor NRP-Z91	SN: 103245	03-Apr-19 (No. 217-02893)	Apr-20
Reference 20 dB Attenuator	SN: 5058 (20k)	04-Apr-19 (No. 217-02894)	Apr-20
Type-N mismatch combination	SN: 5047.2 / 06327	04-Apr-19 (No. 217-02895)	Apr-20
Reference Probe EX3DV4	SN: 7349	29-May-19 (No. EX3-7349_May19)	May-20
DAE4	SN: 601	30-Apr-19 (No. DAE4-601_Apr19)	Apr-20

Secondary Standards	ID #	Check Date (in house)	Scheduled Check
Power meter E4419B	SN: GB39512475	30-Oct-14 (in house check Feb-19)	In house check: Oct-20
Power sensor HP 8481A	SN: US37292783	07-Oct-15 (in house check Oct-18)	In house check: Oct-20
Power sensor HP 8481A	SN: MY41092317	07-Oct-15 (in house check Oct-18)	In house check: Oct-20
RF generator R&S SMT-06	SN: 100972	15-Jun-15 (in house check Oct-18)	In house check: Oct-20
Network Analyzer Agilent E8358A	SN: US41080477	31-Mar-14 (in house check Oct-18)	In house check: Oct-19

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

Issued: June 20, 2019

Glossary:

TSL	tissue simulating liquid
ConvF	sensitivity in TSL / NORM x,y,z
N/A	not applicable or not measured

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, "Measurement procedure for the assessment of Specific Absorption Rate (SAR) from hand-held and body-mounted devices used next to the ear (frequency range of 300 MHz to 6 GHz)", July 2016
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"

Additional Documentation:

e) DASY4/5 System Handbook

Methods Applied and Interpretation of Parameters:

- *Measurement Conditions:* Further details are available from the Validation Report at the end of the certificate. All figures stated in the certificate are valid at the frequency indicated.
- *Antenna Parameters with TSL:* The dipole is mounted with the spacer to position its feed point exactly below the center marking of the flat phantom section, with the arms oriented parallel to the body axis.
- *Feed Point Impedance and Return Loss:* These parameters are measured with the dipole positioned under the liquid filled phantom. The impedance stated is transformed from the measurement at the SMA connector to the feed point. The Return Loss ensures low reflected power. No uncertainty required.
- *Electrical Delay:* One-way delay between the SMA connector and the antenna feed point. No uncertainty required.
- *SAR measured:* SAR measured at the stated antenna input power.
- *SAR normalized:* SAR as measured, normalized to an input power of 1 W at the antenna connector.
- *SAR for nominal TSL parameters:* The measured TSL parameters are used to calculate the nominal SAR result.

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%.

Measurement Conditions

DASY system configuration, as far as not given on page 1.

DASY Version	DASY5	V52.10.2
Extrapolation	Advanced Extrapolation	
Phantom	Modular Flat Phantom	
Distance Dipole Center - TSL	10 mm	with Spacer
Zoom Scan Resolution	dx, dy, dz = 5 mm	
Frequency	2450 MHz ± 1 MHz	

Head TSL parameters

The following parameters and calculations were applied.

	Temperature	**Permittivity**	**Conductivity**
Nominal Head TSL parameters	22.0 °C	39.2	1.80 mho/m
Measured Head TSL parameters	(22.0 ± 0.2) °C	37.9 ± 6 %	1.86 mho/m ± 6 %
Head TSL temperature change during test	< 0.5 °C	----	----

SAR result with Head TSL

SAR averaged over 1 cm^3 (1 g) of Head TSL	Condition	
SAR measured	250 mW input power	13.6 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	**53.1 W/kg ± 17.0 % (k=2)**

SAR averaged over 10 cm^3 (10 g) of Head TSL	condition	
SAR measured	250 mW input power	6.34 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	**25.0 W/kg ± 16.5 % (k=2)**

Body TSL parameters

The following parameters and calculations were applied.

	Temperature	**Permittivity**	**Conductivity**
Nominal Body TSL parameters	22.0 °C	52.7	1.95 mho/m
Measured Body TSL parameters	(22.0 ± 0.2) °C	51.0 ± 6 %	2.03 mho/m ± 6 %
Body TSL temperature change during test	< 0.5 °C	----	----

SAR result with Body TSL

SAR averaged over 1 cm^3 (1 g) of Body TSL	Condition	
SAR measured	250 mW input power	13.1 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	**51.0 W/kg ± 17.0 % (k=2)**

SAR averaged over 10 cm^3 (10 g) of Body TSL	condition	
SAR measured	250 mW input power	6.12 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	**24.1 W/kg ± 16.5 % (k=2)**

Appendix (Additional assessments outside the scope of SCS 0108)

Antenna Parameters with Head TSL

Impedance, transformed to feed point	53.7 Ω + 3.9 jΩ
Return Loss	- 25.7 dB

Antenna Parameters with Body TSL

Impedance, transformed to feed point	50.3 Ω + 6.2 jΩ
Return Loss	- 24.2 dB

General Antenna Parameters and Design

Electrical Delay (one direction)	1.154 ns

After long term use with 100W radiated power, only a slight warming of the dipole near the feedpoint can be measured.

The dipole is made of standard semirigid coaxial cable. The center conductor of the feeding line is directly connected to the second arm of the dipole. The antenna is therefore short-circuited for DC-signals. On some of the dipoles, small end caps are added to the dipole arms in order to improve matching when loaded according to the position as explained in the "Measurement Conditions" paragraph. The SAR data are not affected by this change. The overall dipole length is still according to the Standard.
No excessive force must be applied to the dipole arms, because they might bend or the soldered connections near the feedpoint may be damaged.

Additional EUT Data

Manufactured by	SPEAG

DASY5 Validation Report for Head TSL

Date: 14.06.2019

Test Laboratory: SPEAG, Zurich, Switzerland

DUT: Dipole 2450 MHz; Type: D2450V2; Serial: D2450V2 - SN:750

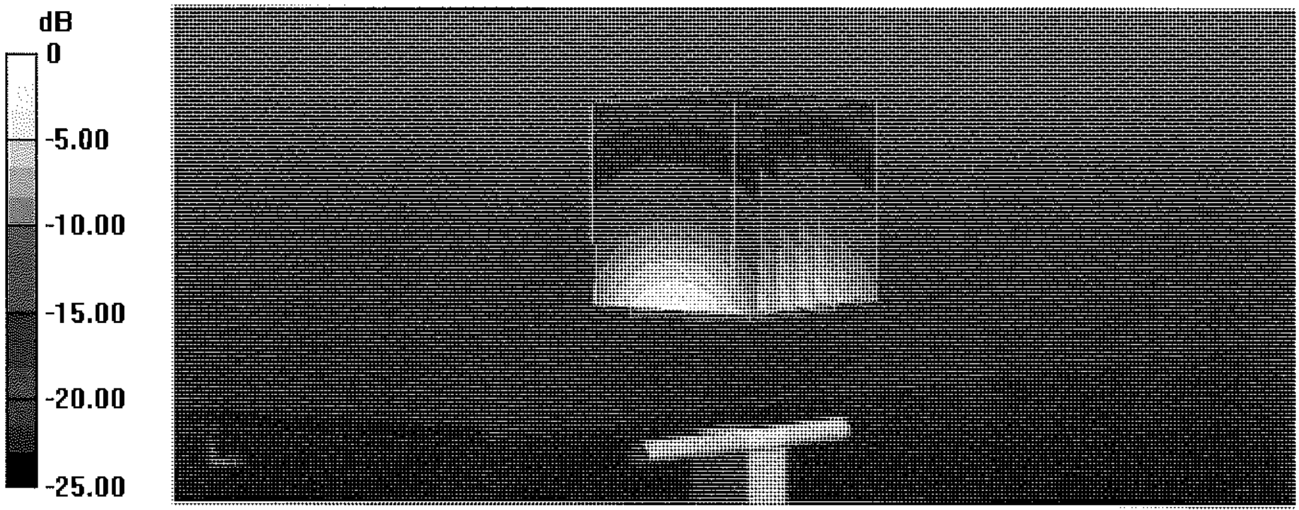
Communication System: UID 0 - CW; Frequency: 2450 MHz
Medium parameters used: f = 2450 MHz; σ = 1.86 S/m; ε_r = 37.9; ρ = 1000 kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2011)

DASY52 Configuration:

- Probe: EX3DV4 - SN7349; ConvF(7.9, 7.9, 7.9) @ 2450 MHz; Calibrated: 29.05.2019
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 30.04.2019
- Phantom: Flat Phantom 5.0 (front); Type: QD 000 P50 AA; Serial: 1001
- DASY52 52.10.2(1504); SEMCAD X 14.6.12(7470)

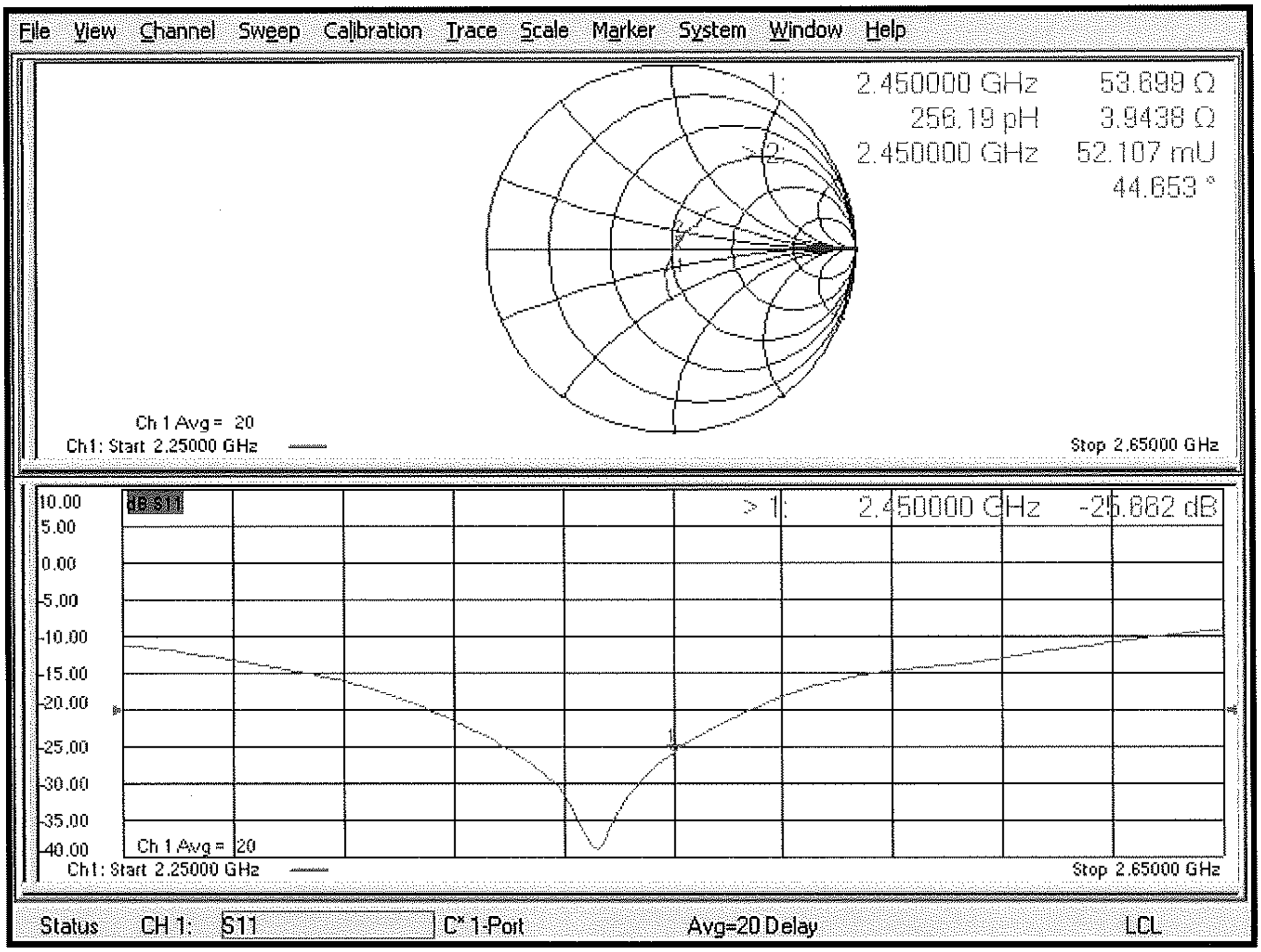
Dipole Calibration for Head Tissue/Pin=250 mW, d=10mm/Zoom Scan (7x7x7)/Cube 0:

Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 117.9 V/m; Power Drift = -0.02 dB
Peak SAR (extrapolated) = 26.7 W/kg
SAR(1 g) = 13.6 W/kg; SAR(10 g) = 6.34 W/kg
Maximum value of SAR (measured) = 22.3 W/kg



0 dB = 22.3 W/kg = 13.48 dBW/kg

Impedance Measurement Plot for Head TSL



DASY5 Validation Report for Body TSL

Date: 14.06.2019

Test Laboratory: SPEAG, Zurich, Switzerland

DUT: Dipole 2450 MHz; Type: D2450V2; Serial: D2450V2 - SN:750

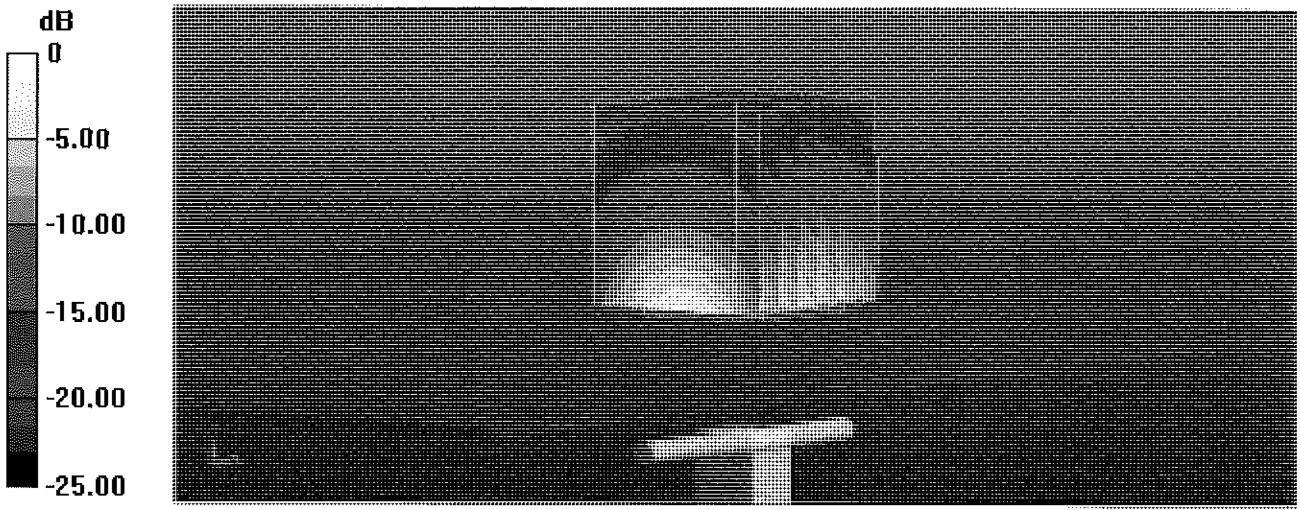
Communication System: UID 0 - CW; Frequency: 2450 MHz
Medium parameters used: f = 2450 MHz; σ = 2.03 S/m; ε_r = 51; ρ = 1000 kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2011)

DASY52 Configuration:

- Probe: EX3DV4 - SN7349; ConvF(7.94, 7.94, 7.94) @ 2450 MHz; Calibrated: 29.05.2019
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 30.04.2019
- Phantom: Flat Phantom 5.0 (back); Type: QD 000 P50 AA; Serial: 1002
- DASY52 52.10.2(1504); SEMCAD X 14.6.12(7470)

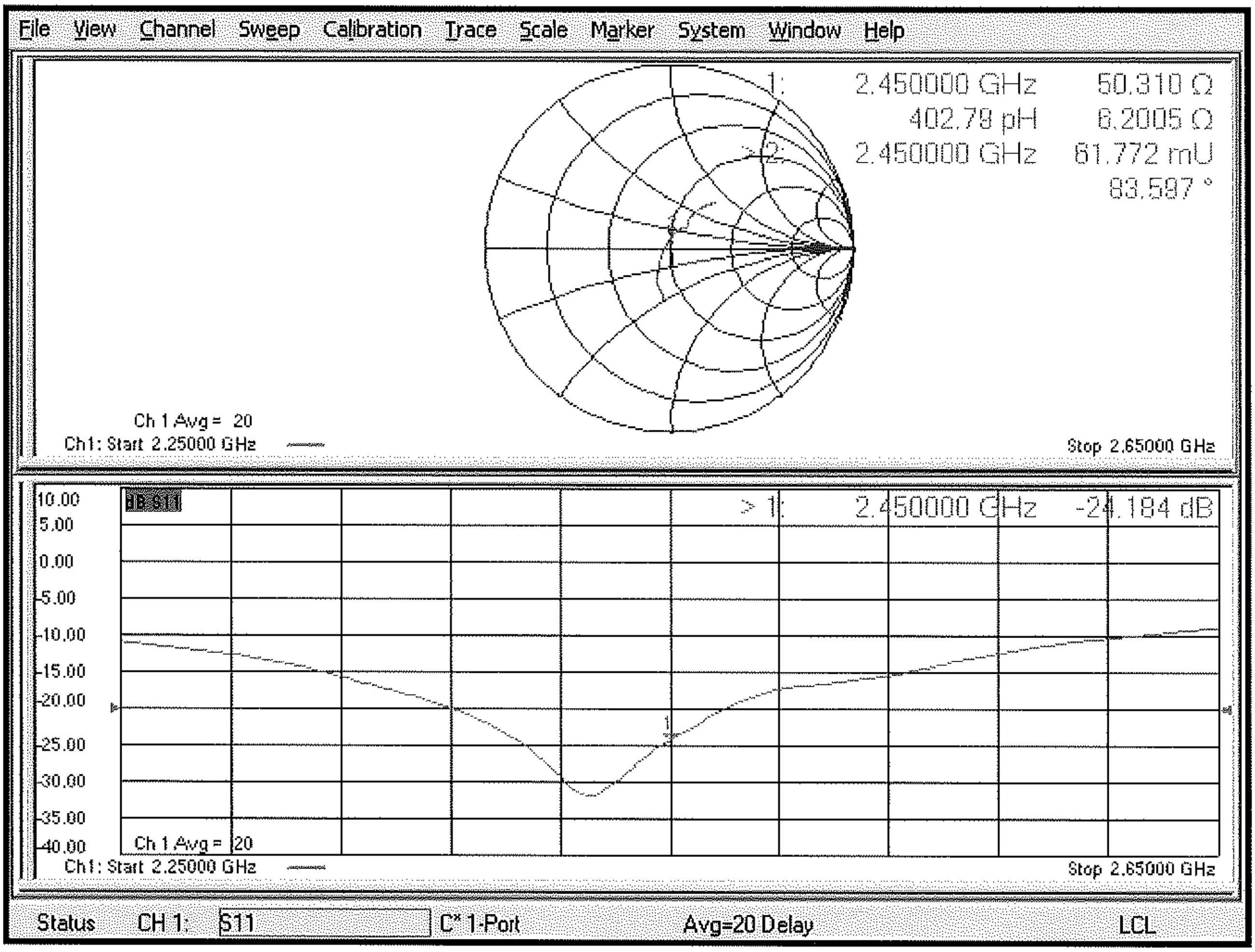
Dipole Calibration for Body Tissue/Pin=250 mW, d=10mm/Zoom Scan (7x7x7)/Cube 0:

Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 108.6 V/m; Power Drift = -0.06 dB
Peak SAR (extrapolated) = 25.9 W/kg
SAR(1 g) = 13.1 W/kg; SAR(10 g) = 6.12 W/kg
Maximum value of SAR (measured) = 21.2 W/kg



0 dB = 21.2 W/kg = 13.26 dBW/kg

Impedance Measurement Plot for Body TSL



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Certification of Calibration

Object D2450V2 – SN: 750

Calibration procedure(s) Procedure for Calibration Extension for SAR Dipoles.

Extended Calibration date: June 14, 2020

Description: SAR Validation Dipole at 2450 MHz.

Calibration Equipment used:

Manufacturer	Model	Description	Cal Date	Cal Interval	Cal Due	Serial Number
Agilent	8753ES	S-Parameter Network Analyzer	1/16/2020	Annual	1/16/2021	US39170118
Agilent	N5182A	MXG Vector Signal Generator	8/19/2019	Annual	8/19/2020	MY47420837
Amplifier Research	15S1G6	Amplifier	CBT	N/A	CBT	343972
Anritsu	MA2411B	Pulse Power Sensor	1/21/2020	Annual	1/21/2021	1207470
Anritsu	MA2411B	Pulse Power Sensor	1/21/2020	Annual	1/21/2021	1339007
Anritsu	ML2495A	Power Meter	1/15/2020	Annual	1/15/2021	1328004
Control Company	62344-734	Therm./ Clock/ Humidity Monitor	3/18/2019	Biennial	3/18/2021	192038436
Control Company	4352	Ultra Long Stem Thermometer	8/2/2018	Biennial	8/2/2020	181292000
Keysight	772D	Dual Directional Coupler	CBT	N/A	CBT	MY52180215
Keysight Technologies	85033E	Standard Mechanical Calibration Kit (DC to 9GHz, 3.5mm)	7/2/2019	Annual	7/2/2020	MY53401181
MiniCircuits	VLF-6000+	Low Pass Filter	CBT	N/A	CBT	N/A
Mini-Circuits	BW-N20W5+	DC to 18 GHz Precision Fixed 20 dB Attenuator	CBT	N/A	CBT	N/A
Narda	4772-3	Attenuator (3dB)	CBT	N/A	CBT	9406
Seekonk	NC-100	Torque Wrench	7/18/2019	Annual	7/18/2020	N/A
SPEAG	DAE4	Dasy Data Acquisition Electronics	1/14/2020	Annual	1/14/2021	793
SPEAG	DAE4	Dasy Data Acquisition Electronics	8/12/2019	Annual	8/12/2020	1408
SPEAG	DAK-3.5	Dielectric Assessment Kit	5/12/2020	Annual	5/12/2021	1070
SPEAG	EX3DV4	SAR Probe	1/20/2020	Annual	1/20/2021	3837
SPEAG	EX3DV4	SAR Probe	8/29/2019	Annual	8/29/2020	3949

Measurement Uncertainty = ±23% (k=2)

	Name	Function	Signature
Calibrated By:	Parker Jones	Team Lead Engineer	Parker Jones
Approved By:	Kaitlin O'Keefe	Managing Director	KOK

DIPOLE CALIBRATION EXTENSION

Per KDB 865664 D01, calibration intervals of up to three years may be considered for reference dipoles when it is demonstrated that the SAR target, impedance and return loss of a dipole have remained stable according to the following requirements:

1. The measured SAR does not deviate more than 10% from the target on the calibration certificate.
2. The return-loss does not deviate more than 20% from the previous measurement and meets the required 20dB minimum return-loss requirement.
3. The measurement of real or imaginary parts of impedance does not deviate more than 5Ω from the previous measurement.

The following dipole was checked to pass the above 3 requirements to have 2-year calibration period from the calibration date:

Calibration Date	Extension Date	Certificate Electrical Delay (ns)	Certificate SAR Target Head (1g) W/kg @ 20.0 dBm	Measured Head SAR (1g) W/kg @ 20.0 dBm	Deviation 1g (%)	Certificate SAR Target Head (10g) W/kg @ 20.0 dBm	Measured Head SAR (10g) W/kg @ 20.0 dBm	Deviation 10g (%)	Certificate Impedance Head (Ohm) Real	Measured Impedance Head (Ohm) Real	Difference (Ohm) Real	Certificate Impedance Head (Ohm) Imaginary	Measured Impedance Head (Ohm) Imaginary	Difference (Ohm) Imaginary	Certificate Return Loss Head (dB)	Measured Return Loss Head (dB)	Deviation (%)	PASS/FAIL
6/14/2019	6/14/2020	1.154	5.31	5.54	4.33%	2.5	2.56	2.40%	53.7	53.2	0.5	3.9	0.9	3	-25.7	-30	-16.70%	PASS

Calibration Date	Extension Date	Certificate Electrical Delay (ns)	Certificate SAR Target Body (1g) W/kg @ 20.0 dBm	Measured Body SAR (1g) W/kg @ 20.0 dBm	Deviation 1g (%)	Certificate SAR Target Body (10g) W/kg @ 20.0 dBm	Measured Body SAR (10g) W/kg @ 20.0 dBm	Deviation 10g (%)	Certificate Impedance Body (Ohm) Real	Measured Impedance Body (Ohm) Real	Difference (Ohm) Real	Certificate Impedance Body (Ohm) Imaginary	Measured Impedance Body (Ohm) Imaginary	Difference (Ohm) Imaginary	Certificate Return Loss Body (dB)	Measured Return Loss Body (dB)	Deviation (%)	PASS/FAIL
6/14/2019	6/14/2020	1.154	5.1	5.33	4.51%	2.41	2.47	2.49%	50.3	49.9	0.4	6.2	5	1.2	-24.2	-25.8	-6.60%	PASS

Impedance & Return-Loss Measurement Plot for Head TSL