TEST REPORT

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1. Report No : DRRFCC1908-0066(1)
2. Customer
   - Name : KCTNS Co.,Ltd.
   - Address : 552, Yeoksam-ro, Gangnam-gu, Seoul, 06187 South Korea
3. Use of Report : Class II Permissive Change
4. Product Name / Model Name : RFID/USN Wireless Device / DOTR-3000
   FCC ID: 2ARHHDOTR3000
5. Test Method Used : IEEE 1528-2013 , FCC SAR KDB Publications (Details in test report)
   Test Specification : CFR §2.1093
6. Date of Test : 2019.07.01 ~ 2019.07.10, 2019.07.22
7. Testing Environment : See appended test report.
8. Test Result : Refer to the attached test result.

Affirmation	Tested by Name : ChangWon Lee (Signature)	Reviewed by Name : HakMin Kim (Signature)

2019 . 08 . 16 .

DT&C Co., Ltd.

If this report is required to confirmation of authenticity, please contact to report@dtnc.net

Test Report Version

Test Report No.	Date	Description
DRRFCC1908-0066	Aug. 09, 2019	Initial issue
DRRFCC1908-0066(1)	Aug. 16, 2019	Revise of Section 1.1

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1. DESCRIPTION OF DEVICE

1.1 General Information

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<tr><td>Equipment add model name[Note]</td><td colspan="5">RF800, KCTR-3085, RF850</td></tr>
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KCTR-3085, RF850 – The terminal that connects to PM85G(FCC ID: V2X-PM85G) has been added.</td></tr>
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SAR Summary Table (RFID/USN Wireless Device)

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<tr><td>Antenna Type</td><td colspan="2">Internal Antenna</td></tr>
<tr><td>Information</td><td colspan="2">● The Body SAR is not applicable because the RFID reader only transmits when user presses the scanning button and big separation distance from the human body in normal usage condition.
● When evaluating SAR only for RFID readers, test was performed 6 sides (Top, Bottom, Rear, Right, Left, Pistol grip) for conservative evaluation. And the Extremity SAR for RFID readers with PDA of Bottom and Pistol grip sides was performed.
● Top, Front, Rear, Right and Left sides are not typically touched by Extremity, so Extremity SAR for RFID readers with PDA wad not performed for these positions.
● The SAR of modified (i.e. break/cut) device so the side in question can be placed against the flat phantom was performed.
● A non-standard setup was used for SAR testing based on guidance from the FCC.
● The operational description contains additional information.
● This unit (FCC ID: 2ARHHDOTR3000) can be operated separately or as part of the accessory of the certified device V2X-PM85G (Mobile Computer).
● Therefore, simultaneous transmission of FCC ID: 2ARHHDOTR3000) and FCC ID: V2X-PM85G (Mobile Computer) are considered and tested.</td></tr>
</table>

EUT type	Mobile Computer				
Equipment serial no.	Identical prototype				
Mode(s) of Operation (Mobile Computer)	GSM 850, GSM 1900, WCDMA 850, WCDMA 1700, WCDMA 1900, LTE Band 12, 17, 13, 14, 5, 4, 2, 7, 41, 2.4 G W-LAN (802.11b/g/n-HT20/ac-VHT20), 5 G W-LAN (802.11a/n-HT20/n-HT40/ac-VHT20/ac-VHT40/ac-VHT80), Bluetooth				
	Band	**Mode**	**Operating Modes**	**Bandwidth**	**Frequency**
TX Frequency Range (Mobile Computer)	GSM 850	GSM/GPRS/EDGE	Voice/Data	-	824.2 ~ 848.8 MHz
	GSM 1900	GSM/GPRS/EDGE	Voice/Data	-	1850.2 ~ 1909.8 MHz
	WCDMA 850	WCDMA	Voice/Data	-	826.4 ~ 846.6 MHz
	WCDMA 1700	WCDMA	Voice/Data	-	1712.4 ~ 1752.6 MHz
	WCDMA 1900	WCDMA	Voice/Data	-	1852.4 ~ 1907.6 MHz
	LTE Band 12	LTE	Voice/Data	1.4/3/5/10MHz	699.7 ~ 715.3 MHz
	LTE Band 17	LTE	Voice/Data	5/10MHz	706.5 ~ 713.5 MHz
	LTE Band 13	LTE	Voice/Data	5/10MHz	779.5 ~ 784.5 MHz
	LTE Band 14	LTE	Voice/Data	5/10MHz	790.5 ~ 795.5 MHz
	LTE Band 5	LTE	Voice/Data	1.4/3/5/10MHz	824.7 ~ 848.3 MHz
	LTE Band 4	LTE	Voice/Data	1.4/3/5/10/15/20MHz	1710.7 ~ 1754.3 MHz
	LTE Band 2	LTE	Voice/Data	1.4/3/5/10/15/20MHz	1850.7 ~ 1909.3 MHz
	LTE Band 7	LTE	Voice/Data	5/10/15/20MHz	2502.5 ~ 2567.5 MHz
	LTE Band 41	LTE	Voice/Data	5/10/15/20MHz	2498.5 ~ 2687.5 MHz
	2.4 GHz W-LAN	802.11b/g/n/ac	Voice/Data	HT20/VHT20	2412 ~ 2472 MHz
	5.2 GHz W-LAN	802.11a/n/ac	Voice/Data	HT20/VHT20	5180 ~ 5240 MHz
		802.11n/ac	Voice/Data	HT40/VHT40	5190 ~ 5230 MHz
		802.11ac	Voice/Data	VHT80	5210 MHz
	5.3 GHz W-LAN	802.11a/n/ac	Voice/Data	HT20/VHT20	5260 ~ 5320 MHz
		802.11n/ac	Voice/Data	HT40/VHT40	5270 ~ 5310 MHz
		802.11ac	Voice/Data	VHT80	5290 MHz
	5.6 GHz W-LAN	802.11a/n/ac	Voice/Data	HT20/VHT20	5500 ~ 5720 MHz
		802.11n/ac	Voice/Data	HT40/VHT40	5510 ~ 5710 MHz
		802.11ac	Voice/Data	VHT80	5530 ~ 5690 MHz
	5.8 GHz W-LAN	802.11a/n/ac	Voice/Data	HT20/VHT20	5745 ~ 5825 MHz
		802.11n/ac	Voice/Data	HT40/VHT40	5755 ~ 5795 MHz
		802.11ac	Voice/Data	VHT80	5775 MHz
	Bluetooth	-	Data	-	2402 ~ 2480 MHz
RX Frequency Range (Mobile Computer)	GSM 850	GSM/GPRS/EDGE	Voice/Data	-	869.2 ~ 893.8 MHz
	GSM 1900	GSM/GPRS/EDGE	Voice/Data	-	1930.2 ~ 1989.8 MHz
	WCDMA 850	WCDMA	Voice/Data	-	871.4 ~ 891.6 MHz
	WCDMA 1700	WCDMA	Voice/Data	-	2112.4 ~ 2152.6 MHz
	WCDMA 1900	WCDMA	Voice/Data	-	1932.4 ~ 1987.6 MHz
	LTE Band 12	LTE	Voice/Data	1.4/3/5/10MHz	729.7 ~ 745.3 MHz
	LTE Band 17	LTE	Voice/Data	5/10MHz	736.5 ~ 743.5 MHz
	LTE Band 13	LTE	Voice/Data	5/10MHz	748.5 ~ 753.5 MHz
	LTE Band 14	LTE	Voice/Data	5/10MHz	760.5 ~ 765.5 MHz
	LTE Band 5	LTE	Voice/Data	1.4/3/5/10MHz	869.7 ~ 893.3 MHz
	LTE Band 4	LTE	Voice/Data	1.4/3/5/10/15/20MHz	2110.7 ~ 2154.3 MHz
	LTE Band 2	LTE	Voice/Data	1.4/3/5/10/15/20MHz	1930.7 ~ 1989.3 MHz
	LTE Band 7	LTE	Voice/Data	5/10/15/20MHz	2622.5 ~ 2687.5 MHz
	LTE Band 41	LTE	Voice/Data	5/10/15/20MHz	2498.5 ~ 2687.5 MHz
	2.4 GHz W-LAN	802.11b/g/n/ac	Voice/Data	HT20/VHT20	2412 ~ 2472 MHz
	5.2 GHz W-LAN	802.11a/n/ac	Voice/Data	HT20/VHT20	5180 ~ 5240 MHz
		802.11n/ac	Voice/Data	HT40/VHT40	5190 ~ 5230 MHz
		802.11ac	Voice/Data	VHT80	5210 MHz
	5.3 GHz W-LAN	802.11a/n/ac	Voice/Data	HT20/VHT200	5260 ~ 5320 MHz
		802.11n/ac	Voice/Data	HT40/VHT40	5270 ~ 5310 MHz
		802.11ac	Voice/Data	VHT80	5290 MHz
	5.6 GHz W-LAN	802.11a/n/ac	Voice/Data	HT20/VHT20	5500 ~ 5720 MHz
		802.11n/ac	Voice/Data	HT40/VHT40	5510 ~ 5710 MHz
		802.11ac	Voice/Data	VHT80	5530 ~ 5690 MHz
	5.8 GHz W-LAN	802.11a/n/ac	Voice/Data	HT20/VHT20	5745 ~ 5825 MHz
		802.11n/ac	Voice/Data	HT40/VHT40	5755 ~ 5795 MHz
		802.11ac	Voice/Data	VHT80	5775 MHz
	Bluetooth	-	Data	-	2402 ~ 2480 MHz

SAR Summary Table (Mobile Computer)

Equipment Class	Band	Reported SAR 10g SAR (W/kg) Extremity
PCE	GSM 850	0.24
	GPRS 850	0.38
	GSM 1900	0.10
	GPRS 1900	0.15
	WCDMA 850	0.24
	WCDMA 1700	0.12
	WCDMA 1900	0.18
	LTE Band 12	0.17
	LTE Band 17	-
	LTE Band 13	0.29
	LTE Band 14	0.20
	LTE Band 5	0.24
	LTE Band 4	0.13
	LTE Band 2	0.19
	LTE Band 7	0.19
	LTE Band 41	0.15
DTS	2.4 GHz W-LAN	< 0.1
U-NII-1	5.2 GHz W-LAN	-
U-NII-2A	5.3 GHz W-LAN	< 0.1
U-NII-2C	5.6 GHz W-LAN	< 0.1
U-NII-3	5.8 GHz W-LAN	< 0.1
DSS	Bluetooth	0.11 [Note]
Simultaneous SAR per KDB 690783 D01v01r03		0.98

FCC Equipment Class	Licensed Portable Transmitter Held to Ear (PCE) Part 15 Spread Spectrum Transmitter(DSS) Digital Transmission System(DTS) Unlicensed National Information Infrastructure (UNII)
Date(s) of Tests	2019.07.01 ~ 2019.07.10
Note	Bluetooth SAR was estimated.
Antenna Type	Internal Antenna
Functions	● GSM/GPRS/EDGE (GPRS/EDGE Class: 12) supported. * DTM not supported. ● No simultaneous transmission between BT & 2.4GHz WLAN
Information	● The Body SAR is not applicable because the RFID reader only transmits when user presses the scanning button and big separation distance from the human body in normal usage condition. ● When evaluating SAR only for RFID readers, test was performed 6 sides (Top, Bottom, Rear, Right, Left, Pistol grip) for conservative evaluation. And the Extremity SAR for RFID readers with PDA of Bottom and Pistol grip sides was performed. ● Top, Front, Rear, Right and Left sides are not typically touched by Extremity, so Extremity SAR for RFID readers with PDA wad not performed for these positions. ● The SAR of modified (i.e. break/cut) device so the side in question can be placed against the flat phantom was performed. ● A non-standard setup was used for SAR testing based on guidance from the FCC. ● The operational description contains additional information. ● This unit (FCC ID: 2ARHHDOTR3000) can be operated separately or as part of the accessory of the certified device V2X-PM85G (Mobile Computer). ● Therefore, simultaneous transmission of FCC ID: 2ARHHDOTR3000) and FCC ID: V2X-PM85G (Mobile Computer) are considered and tested.

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

The Nominal and Maximum Output Power Specifications are in section 7 of this test report.

1.4 Simultaneous Transmission Capabilities

The Simultaneous Transmission Capabilities are in section 10 of this test report.

1.5 Miscellaneous SAR Test Considerations

(A) WIFI/BT

$$\frac{Max\ Power\ of\ Channel\ (mW)}{Test\ Separation\ Dist\ (mm)} * \sqrt{Frequency(GHz)} \leq 7.5$$

Table 1.1 SAR exclusion threshold for distances < 50 mm

Band	Equation	Result	SAR exclusion threshold	Required SAR
Bluetooth (Mobile Computer)	[(8/5)* √2.441]	2.0	7.5	X
Bluetooth (RFID/USN Wireless Device)	[(9/5)* √2.480]	2.8	7.5	X

Per KDB Publication 447498 D01v06, the maximum power of the channel was rounded to the nearest mW before calculation.

(B) Licensed Transmitter(s)

GSM/GPRS/EDGE DTM is not supported for US bands. Therefore, the GSM Voice modes in this report do not transmit simultaneously with GPRS Data.

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 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 lager 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.

1.6 Guidance Applied

- IEEE 1528-2013
- FCC KDB Publication 941225 D01v03r01 (3G SAR Procedures)
- FCC KDB Publication 941225 D05v02r05 (SAR for LTE Devices)
- FCC KDB Publication 941225 D05Av01r02 (LTE Rel.10 KDB Inquiry Sheet)
- FCC KDB Publication 248227 D01v02r02 (802.11 Wi-Fi SAR)
- FCC KDB Publication 447498 D01v06 (General RF Exposure Guidance)
- FCC KDB Publication 648474 D04v01r03 (Handset SAR)
- FCC KDB Publication 690783 D01v01r03 (SAR Listings on Grants)
- FCC KDB Publication 865664 D01v01r04 (SAR Measurement 100 MHz to 6 GHz)
- FCC KDB Publication 865664 D02v01r02 (RF Exposure Reporting)
- October 2013 TCB Workshop Notes (GPRS testing criteria)
- April 2015 TCB Workshop Notes (Simultaneous transmission summation clarified)
- May 2017 TCB Workshop Notes (SAR Testing for Handheld RFID/Barcode Scanners)

2. LTE INFORMATION

LTE Information (Mobile Computer)					
Frequency Range of each LTE transmission Band	LTE Band 12 (699.7 ~ 715.3 MHz) LTE Band 17 (706.5 ~ 713.5 MHz) LTE Band 13 (779.5 ~ 784.5 MHz) LTE Band 14 (790.5 ~ 795.5 MHz) LTE Band 5 (Cell) (824.7 ~ 848.3 MHz) LTE Band 4 (AWS) (1710.7 ~ 1754.3 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 12 : 1.4 MHz, 3 MHz, 5 MHz, 10 MHz LTE Band 17 : 5 MHz, 10 MHz LTE Band 13 : 5 MHz, 10 MHz LTE Band 14 : 5 MHz, 10 MHz LTE Band 5 : 1.4 MHz, 3 MHz, 5 MHz, 10 MHz LTE Band 4 : 1.4 MHz, 3 MHz, 5 MHz, 10 MHz, 15 MHz, 20 MHz LTE Band 2 : 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 Number and Frequencies(MHz)	Low	Low-Mid	Mid	Mid-High	High
LTE Band 12: 1.4 MHz	699.7 (23017)	N/A	707.5 (23095)	N/A	715.3 (23173)
LTE Band 12: 3 MHz	700.5 (23025)	N/A	707.5 (23095)	N/A	714.5 (23165)
LTE Band 12: 5 MHz	701.5 (23035)	N/A	707.5 (23095)	N/A	713.5 (23155)
LTE Band 12: 10 MHz	704.0 (23060)	N/A	**707.5 (23095)**[Note1]	N/A	711.0 (23130)
LTE Band 17: 5 MHz	706.5(23755)	N/A	710.0(23790)	N/A	713.5(23825)
LTE Band 17: 10 MHz	709.0(23780)	N/A	710.0(23790)	N/A	711.0(23800)
LTE Band 13: 5 MHz	779.5(23205)	N/A	782.0(23230)[Note2]	N/A	784.5(23255)
LTE Band 13: 10 MHz	N/A	N/A	**782.0(23230)**	N/A	N/A
LTE Band 14: 5 MHz	790.5(23305)	N/A	793.0(23330)[Note3]	N/A	795.5(23355)
LTE Band 14: 10 MHz	N/A	N/A	**793.0(23330)**	N/A	N/A
LTE Band 5 (Cell): 1.4 MHz	824.7 (20407)	N/A	836.5 (20525)	N/A	848.3 (20643)
LTE Band 5 (Cell): 3 MHz	825.5 (20415)	N/A	836.5 (20525)	N/A	847.5 (20635)
LTE Band 5 (Cell): 5 MHz	826.5 (20425)	N/A	836.5 (20525)	N/A	846.5 (20625)
LTE Band 5 (Cell): 10 MHz	829.0 (20450)	N/A	**836.5 (20525)**[Note4]	N/A	844.0 (20600)
LTE Band 4 (AWS): 1.4 MHz	1710.7 (19957)	N/A	1732.5 (20175)	N/A	1754.3 (20393)
LTE Band 4 (AWS): 3 MHz	1711.5 (19965)	N/A	1732.5 (20175)	N/A	1753.5 (20385)
LTE Band 4 (AWS): 5 MHz	1712.5 (19975)	N/A	1732.5 (20175)	N/A	1752.5 (20375)
LTE Band 4 (AWS): 10 MHz	1715.0 (20000)	N/A	1732.5 (20175)	N/A	1750.0 (20350)
LTE Band 4 (AWS): 15 MHz	1717.5 (20025)	N/A	1732.5 (20175)	N/A	1747.5 (20325)
LTE Band 4 (AWS): 20 MHz	1720.0 (20050)	N/A	**1732.5 (20175)**[Note5]	N/A	1745.0 (20300)
LTE Band 2 (PCS): 1.4 MHz	1850.7 (18607)	N/A	1880.0 (18900)	N/A	1909.3 (19193)
LTE Band 2 (PCS): 3 MHz	1851.5 (18615)	N/A	1880.0 (18900)	N/A	1908.5 (19185)
LTE Band 2 (PCS): 5 MHz	1852.5 (18625)	N/A	1880.0 (18900)	N/A	1907.5 (19175)
LTE Band 2 (PCS): 10 MHz	1855.0 (18650)	N/A	1880.0 (18900)	N/A	1905.0 (19150)
LTE Band 2 (PCS): 15 MHz	1857.5 (18675)	N/A	1880.0 (18900)	N/A	1902.5 (19125)
LTE Band 2 (PCS): 20 MHz	1860.0 (18700)	N/A	1880.0 (18900)	N/A	**1900.0 (19100)**
LTE Band 7: 5 MHz	2502.5 (20775)	N/A	2535.0 (21100)	N/A	2567.5 (21425)
LTE Band 7: 10 MHz	2505.0 (20800)	N/A	2535.0 (21100)	N/A	2565.0 (21400)
LTE Band 7: 15 MHz	2507.5 (20825)	N/A	2535.0 (21100)	N/A	2562.5 (21375)
LTE Band 7: 20 MHz	2510.0 (20850)	N/A	**2535.0 (21100)**	N/A	2560.0 (21350)
LTE Band 41: 5 MHz	2498.5 (39675)	2545.8 (40148)	2593.0 (40620)	2640.3 (41093)	2687.5 (41565)
LTE Band 41: 10 MHz	2501.0 (39700)	2547.0 (40160)	2593.0 (40620)	2639.0 (41080)	2685.0 (41540)
LTE Band 41: 15 MHz	2503.5 (39725)	2548.3 (40173)	2593.0 (40620)	2637.8 (41068)	2682.5 (41515)
LTE Band 41: 20 MHz	2506.0 (39750)	2549.5 (40185)	**2593.0 (40620)**	2636.5 (41055)	2680.0 (41490)
UE Category	LTE Rel.10, UE Cat 6				
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 Carrier Aggregation Possible Combinations	LTE Carrier Aggregation is not supported.				
LTE Additional Information	This device does not support CA features on 3GPP Release 10. All uplink communications are identical to the Release 8 Specifications. The following LTE Release 10 Features are not supported: Relay, HetNet, Enhanced MIMO, eICIC, WIFI Offloading, MDH, eMBMS, Cross-Carrier Scheduling, Enhanced SC-FDMA.				

Note(s)
1. LTE B12 can not contain three non-overlapping channels of 10 MHz bandwidth.
   Per KDB 941225 D05v02r05, 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.
2. LTE B13 can not contain three non-overlapping channels of 5 MHz bandwidth.
   Per KDB 941225 D05v02r05, 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.
3. LTE B14 can not contain three non-overlapping channels of 5 MHz bandwidth.
   Per KDB 941225 D05v02r05, 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.
4. LTE B5 (Cell) can not contain three non-overlapping channels of 10 MHz bandwidth.
   Per KDB 941225 D05v02r05, 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.
5. LTE B4 (AWS) can not contain three non-overlapping channels of 20 MHz bandwidth.
   Per KDB 941225 D05v02r05, 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.

3. INTROCUCTION

The FCC and Industry 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.

The FCC has adopted the guidelines for evaluating the environmental effects of radio frequency radiation in ET Docket 93-62 on Aug. 6, 1996 to protect the public and workers from the potential hazards of RF emissions due to FCC-regulated portable devices. 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. The measurement procedure described in IEEE/ANSI C95.3-2002 Recommended Practice for the Measurement of Potentially Hazardous Electromagnetic Fields - RF and Microwave is used for guidance in measuring 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 National Council on Radiation Protection and Measurements (NCRP) in Biological Effects and Exposure Criteria for Radio frequency Electromagnetic Fields," NCRP Report No. 86 NCRP, 1986, Bethesda, MD 20814. 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.

SAR Definition

Specific Absorption Rate (SAR) 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 Fig. 3.1)

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

Fig. 3.1 SAR Mathematical Equation

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 relations 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.

4. DOSIMETRIC ASSESSMENT

4.1 Measurement Procedure

The evaluation was performed using the following procedure compliant to FCC KDB Publication 865664 D01v01r04 and IEEE 1528-2013:

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) and IEEE1528-2013.

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.

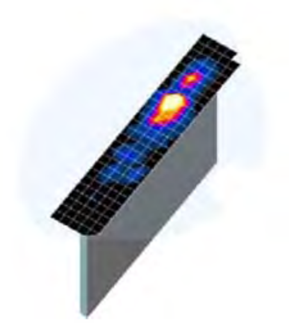


Figure 4.1
Sample SAR Area Scan

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) and IEEE 1528-2013. 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>
<tr><td colspan="3"></td><td>$\leq$ 3 GHz</td><td>> 3 GHz</td></tr>
<tr><td colspan="3">Maximum distance from closest measurement point (geometric center of probe sensors) to phantom surface</td><td>5 mm ± 1 mm</td><td>$\frac{1}{2} \cdot \delta \cdot \ln(2)$ mm ± 0.5 mm</td></tr>
<tr><td colspan="3">Maximum probe angle from probe axis to phantom surface normal at the measurement location</td><td>30° ± 1°</td><td>20° ± 1°</td></tr>
<tr><td colspan="3" rowspan="2">Maximum area scan spatial resolution: Δx_{Area}, Δy_{Area}</td><td>$\leq$ 2 GHz: $\leq$ 15 mm
2 – 3 GHz: $\leq$ 12 mm</td><td>3 – 4 GHz: $\leq$ 12 mm
4 – 6 GHz: $\leq$ 10 mm</td></tr>
<tr><td colspan="2">When the x or y dimension of the test device, in the measurement plane orientation, is smaller than the above, the measurement resolution must be $\leq$ the corresponding x or y dimension of the test device with at least one measurement point on the test device.</td></tr>
<tr><td colspan="3">Maximum zoom scan spatial resolution: Δx_{Zoom}, Δy_{Zoom}</td><td>$\leq$ 2 GHz: $\leq$ 8 mm
2 – 3 GHz: $\leq$ 5 mm*</td><td>3 – 4 GHz: $\leq$ 5 mm*
4 – 6 GHz: $\leq$ 4 mm*</td></tr>
<tr><td rowspan="3">Maximum zoom scan spatial resolution, normal to phantom surface</td><td colspan="2">uniform grid: $\Delta z_{Zoom}(n)$</td><td>$\leq$ 5 mm</td><td>3 – 4 GHz: $\leq$ 4 mm
4 – 5 GHz: $\leq$ 3 mm
5 – 6 GHz: $\leq$ 2 mm</td></tr>
<tr><td rowspan="2">graded grid</td><td>$\Delta z_{Zoom}(1)$: between 1st two points closest to phantom surface</td><td>$\leq$ 4 mm</td><td>3 – 4 GHz: $\leq$ 3 mm
4 – 5 GHz: $\leq$ 2.5 mm
5 – 6 GHz: $\leq$ 2 mm</td></tr>
<tr><td>$\Delta z_{Zoom}(n>1)$: between subsequent points</td><td colspan="2">$\leq 1.5 \cdot \Delta z_{Zoom}(n-1)$ mm</td></tr>
<tr><td>Minimum zoom scan volume</td><td colspan="2">x, y, z</td><td>$\geq$ 30 mm</td><td>3 – 4 GHz: $\geq$ 28 mm
4 – 5 GHz: $\geq$ 25 mm
5 – 6 GHz: $\geq$ 22 mm</td></tr>
<tr><td colspan="5">Note: δ is the penetration depth of a plane-wave at normal incidence to the tissue medium; see IEEE Std 1528-2013 for details.
* When zoom scan is required and the <u>reported</u> SAR from the area scan based 1-g SAR estimation procedures of KDB Publication 447498 is $\leq$ 1.4 W/kg, $\leq$ 8 mm, $\leq$ 7 mm and $\leq$ 5 mm zoom scan resolution may be applied, respectively, for 2 GHz to 3 GHz, 3 GHz to 4 GHz and 4 GHz to 6 GHz.</td></tr>
</table>

Table 4.1 Area and Zoom Scan Resolutions per FCC KDB Publication 865664 D01v01r04*

5. RF EXPOSURE LIMITS

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.

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 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 5.1.SAR Human Exposure Specified in ANSI/IEEE C95.1-1992

	HUMAN EXPOSURE LIMITS	
	General Public Exposure (W/kg) or (mW/g)	Occupational Exposure (W/kg) or (mW/g)
SPATIAL PEAK SAR * (Brain)	1.60	8.00
SPATIAL AVERAGE SAR ** (Whole Body)	0.08	0.40
SPATIAL PEAK SAR *** (Hands / Feet / Ankle / Wrist)	4.00	20.0

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.

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

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).

6. FCC MEASUREMENT PROCEDURES

Power measurements were performed using a base station simulator under digital average power.

6.1 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.

6.2 Procedures Used to Establish RF Signal for SAR

The following procedures are according to FCC KDB Publication 941225 D01v03r01.

The device was 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 were 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 was 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 deviated by more than 5%, the SAR test and drift measurements were repeated.

6.3 SAR Measurement Conditions for WCDMA (UMTS)

6.3.1 Output Power Verification

Maximum output power is measured on the High, Middle and Low channels for each applicable transmission band according to the general descriptions in section 5.2 of 3GPP TS 34.121, using the appropriate RMC or AMR with TPC (transmit power control) set to all “1s”.

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 (release 5), 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.

6.3.2 Head SAR Measurements for Handsets

SAR for head exposure configurations is measured using the 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 in12.2 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.

6.3.3 Body SAR Measurements

SAR for body exposure configurations is measured using the 12.2 kbps RMC with the TPC bits all“1s”.

6.3.4 Release 5 HSDPA Data Devices

The following procedures are applicable to HSDPA data devices operating under 3GPP Release 5. SAR is required for devices in body-worn accessory and other body exposure conditions, including handsets and data modems operating in various electronic devices. HSDPA operates in conjunction with WCDMA and requires an active DPCCH. The default test configuration is to measure SAR in WCDMA with HSDPA remain inactive, to establish a radio link between the test device and a communication test set using a 12.2 kbps RMC configured in Test Loop Mode 1. SAR for HSDPA is selectively measured using the highest reported SAR configuration in WCDMA, with an FRC in H-set 1 and a 12.2 kbps RMC. SAR is selectively confirmed for other physical channel configurations (DPCCH & DPDCHn) according to exposure conditions, device operating capabilities and maximum output power specified for production units, including tune-up tolerance by applying the 3G SAR test reduction procedures. Maximum output power is verified according to the applicable versions of 3GPP TS 34.121. SAR must be measured based on these maximum output conditions and requirements in KDB Publication 447498, with respect to the UE Categories, and explained in the SAR report. When Maximum Power Reduction (MPR) applies, the implementations must be clearly identified in the SAR report to support test results according to Cubic Metric (CM) and, as appropriate, Enhanced MPR (E-MPR) requirements.

Sub-test	β_c	β_d	β_d *(SF)*	β_c/β_d	β_{hs} $^{(1)}$	CM (dB)$^{(2)}$
1	2/15	15/15	64	2/15	4/15	0.0
2	12/15$^{(3)}$	15/15$^{(3)}$	64	12/15$^{(3)}$	24/15	1.0
3	15/15	8/15	64	15/8	30/15	1.5
4	15/15	4/15	64	15/4	30/15	1.5

Note 1: Δ_{ACK}, Δ_{NACK} and $\Delta_{CQI} = 8 \Leftrightarrow A_{hs} = \beta_{hs}/\beta_c = 30/15 \Leftrightarrow \beta_{hs} = 30/15 * \beta_c$
Note 2: CM = 1 for $\beta_c/\beta_d = 12/15$, $\beta_{hs}/\beta_c = 24/15$.
Note 3: For subtest 2 the β_c/β_d ratio of 12/15 for the TFC during the measurement period (TF1, TF0) is achieved by setting the signaled gain factors for the reference TFC (TF1, TF1) to $\beta_c = 11/15$ and $\beta_d = 15/15$.

Figure 6.1 Table 1

6.3.5 Release 6 HSUPA Data Devices

The following procedures are applicable to HSPA (HSUPA/HSDPA) data devices operating under 3GPP Release 6. SAR is required for devices in body-worn accessory and other body exposure conditions, including handsets and data modems operating in various electronic devices. HSUPA operates in conjunction with WCDMA and HSDPA. SAR is initially measured in WCDMA test configurations with HSPA remain inactive. The default test configuration is to establish a radio link between the test device and a communication test set to configure a 12.2 kbps RMC in Test Loop Mode 1. SAR for HSPA is selectively measured with HS-DPCCH, E-DPCCH and E-DPDCH, all enabled, along with a 12.2 kbps RMC using the highest reported SAR configuration in WCDMA with 12.2 kbps RMC only.
An FRC is configured according to HS-DPCCH Sub-test 1 using H-set 1 and QPSK. HSPA is configured according to E-DCH Sub-test 5 requirements. SAR for other HSPA sub-test configurations is confirmed selectively according to exposure conditions, E-DCH UE Category and maximum output power of production units, including tune-up tolerance by applying the 3G SAR test reduction procedure. Maximum output power is verified according to procedures in applicable versions of 3GPP TS 34.121. SAR must be measured based on these maximum output conditions and requirements in KDB Publication 447498, with respect to the UE Categories for HS-DPCCH and HSPA, and explained in the SAR report. When Maximum Power Reduction (MPR) applies, the implementations must be clearly identified in the SAR report to support test results according to Cubic Metric (CM) and, as appropriate, Enhanced MPR (E-MPR) requirements.

Sub-test	β_c	β_d	β_d (SF)	β_c/β_d	β_{hs} (1)	β_{ec}	β_{ed}	β_{ed} (SF)	β_{ed} (codes)	CM (2) (dB)	MPR (dB)	AG (4) Index	E-TFCI
1	11/15 (3)	15/15 (3)	64	11/15 (3)	22/15	209/225	1039/225	4	1	1.0	0.0	20	75
2	6/15	15/15	64	6/15	12/15	12/15	94/75	4	1	3.0	2.0	12	67
3	15/15	9/15	64	15/9	30/15	30/15	β_{ed1}: 47/15 β_{ed2}: 47/15	4	2	2.0	1.0	15	92
4	2/15	15/15	64	2/15	4/15	2/15	56/75	4	1	3.0	2.0	17	71
5	15/15 (4)	15/15 (4)	64	15/15 (4)	30/15	24/15	134/15	4	1	1.0	0.0	21	81

Note 1: Δ_{ACK}, Δ_{NACK} and Δ_{CQI} = 8 ⇔ $A_{hs} = \beta_{hs}/\beta_c = 30/15$ ⇔ $\beta_{hs} = 30/15 * \beta_c$.
Note 2: CM = 1 for β_c/β_d =12/15, β_{hs}/β_c=24/15. For all other combinations of DPDCH, DPCCH, HS- DPCCH, E-DPDCH and E-DPCCH the MPR is based on the relative CM difference.
Note 3: For subtest 1 the β_c/β_d ratio of 11/15 for the TFC during the measurement period (TF1, TF0) is achieved by setting the signaled gain factors for the reference TFC (TF1, TF1) to β_c = 10/15 and β_d = 15/15.
Note 4: For subtest 5 the β_c/β_d ratio of 15/15 for the TFC during the measurement period (TF1, TF0) is achieved by setting the signaled gain factors for the reference TFC (TF1, TF1) to β_c = 14/15 and β_d = 15/15.
Note 5: Testing UE using E-DPDCH Physical Layer category 1 Sub-test 3 is not required according to TS 25.306 Table 5.1g.
Note 6: β_{ed} cannot be set directly; it is set by Absolute Grant Value.

Figure 6.2 Table 2

6.3.6 SAR Measurement Conditions for DC-HSDPA

In the following DB 941225 D01v03r01 procedures, the mode tested for SAR is referred to as the primary mode. The equivalent modes considered for SAR test reduction are denoted as secondary modes. Both primary and secondary modes must be in the same frequency band. When the maximum output power and tune-up tolerance specified for production units in a secondary mode is ≤ ¼ dB higher than the primary mode or when the highest reported SAR of the primary mode is scaled by the ratio of specified maximum output power and tune-up tolerance of secondary to primary mode and the adjusted SAR is ≤ 1.2 W/kg, SAR measurement is not required for the secondary mode. This is referred to as the 3G SAR test reduction procedure in the following SAR test guidance, where the primary mode is identified in the applicable wireless mode test procedures and the secondary mode is wireless mode being considered for SAR test reduction by that procedure. When the 3G SAR test reduction procedure is not satisfied, it is identified as “otherwise” in the applicable procedures; SAR measurement is required for the secondary mode.

SAR is required for Rel. 8 DC-HSDPA when SAR is required for Rel. 5 HSDPA; otherwise, the 3G SAR test reduction procedure is applied to DC-HSDPA with 12.2 kbps RMC as the primary mode. Power is measured for DC-HSDPA according to the H-Set 12, FRC configuration in Table C.8.1.12 of 3GPP TS 34.121-1 to determine SAR test reduction. A primary and a secondary serving HS-DSCH Cell are required to perform the power measurement and for the results to be acceptable.

6.4 SAR Measurement Conditions for LTE

LTE modes were tested according to FCC KDB 941225 D05v02r05 publication. Please see notes after the tabulated SAR data for required test configurations. Establishing connections with base station simulators ensure a consistent means for testing SAR and are recommended for evaluating SAR. The call simulator was used for LTE output power measurement 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).

6.4.1 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.

6.4.2 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.

6.4.3 A-MPR

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

6.4.4 Required RB Size and RB Offsets for SAR Testing

According to FCC KDB 941225 D05v02r05:

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 channel 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. Otherwise, SAR is measured for the highest output power channel; and if the reported SAR is > 1.45 W/kg, the remaining required test channels must also be tested.
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 0.5 dB higher than the equivalent configuration using QPSK modulation and when the QPSK SAR for those configurations is < 1.45 W/kg.

6.4.5 LTE TDD Consideration setup for SAR measurement

According to KDB 941225 D05 SAR for LTE Devices v02r05 for Time-Division Duplex (TDD) systems, SAR must be tested using a fixed periodic duty factor according to the highest transmission duty factor implemented for the device and supported by the defined 3GPP LTE TDD configurations.

SAR was tested with the highest transmission duty factor (63.33 %) using Uplink-downlink configuration 0 and Special subframe configuration 6.

LTE TDD Band 41 supports 3GPP TS 36.211 section 4.2 for Type 2 Frame and Table 4.2-2 for uplink-downlink configuration and Table 4.2-1 for Special subframe configurations.

Table 4.2-1: Configuration of special subframe (lengths of DwPTS/GP/UpPTS).

<table>
<tr><th rowspan="3">Special subframe configuration</th><th colspan="3">Normal cyclic prefix in downlink</th><th colspan="3">Extended cyclic prefix in downlink</th></tr>
<tr><th rowspan="2">DwPTS</th><th colspan="2">UpPTS</th><th rowspan="2">DwPTS</th><th colspan="2">UpPTS</th></tr>
<tr><th>Normal cyclic prefix in uplink</th><th>Extended cyclic prefix in uplink</th><th>Normal cyclic prefix in uplink</th><th>Extended cyclic prefix in uplink</th></tr>
<tr><td>0</td><td>$6592 \cdot T_s$</td><td rowspan="5">$2192 \cdot T_s$</td><td rowspan="5">$2560 \cdot T_s$</td><td>$7680 \cdot T_s$</td><td rowspan="4">$2192 \cdot T_s$</td><td rowspan="4">$2560 \cdot T_s$</td></tr>
<tr><td>1</td><td>$19760 \cdot T_s$</td><td>$20480 \cdot T_s$</td></tr>
<tr><td>2</td><td>$21952 \cdot T_s$</td><td>$23040 \cdot T_s$</td></tr>
<tr><td>3</td><td>$24144 \cdot T_s$</td><td>$25600 \cdot T_s$</td></tr>
<tr><td>4</td><td>$26336 \cdot T_s$</td><td>$7680 \cdot T_s$</td><td rowspan="3">$4384 \cdot T_s$</td><td rowspan="3">$5120 \cdot T_s$</td></tr>
<tr><td>5</td><td>$6592 \cdot T_s$</td><td rowspan="4">$4384 \cdot T_s$</td><td rowspan="4">$5120 \cdot T_s$</td><td>$20480 \cdot T_s$</td></tr>
<tr><td>6</td><td>$19760 \cdot T_s$</td><td>$23040 \cdot T_s$</td></tr>
<tr><td>7</td><td>$21952 \cdot T_s$</td><td>-</td><td>-</td><td>-</td></tr>
<tr><td>8</td><td>$24144 \cdot T_s$</td><td>-</td><td>-</td><td>-</td></tr>
</table>

Table 4.2-2: Uplink-downlink configurations.

Uplink-downlink configuration	Downlink-to-Uplink Switch-point periodicity	Subframe number									
		0	1	2	3	4	5	6	7	8	9
0	5 ms	D	S	U	U	U	D	S	U	U	U
1	5 ms	D	S	U	U	D	D	S	U	U	D
2	5 ms	D	S	U	D	D	D	S	U	D	D
3	10 ms	D	S	U	U	U	D	D	D	D	D
4	10 ms	D	S	U	U	D	D	D	D	D	D
5	10 ms	D	S	U	D	D	D	D	D	D	D
6	5 ms	D	S	U	U	U	D	S	U	U	D

Calculated Duty Cycle = Extended cyclic prefix in uplink * (Ts) * # of S + # of U

Ts = 1/(15000 * 2048) seconds

Example for calculated Duty Cycle for Uplink-Downlink Configuration 0:

Calculated Duty Cycle = 5120 * [1/(15000 * 2048)] * 2 + 6 ms = 63.33 %

6.5 SAR Testing with 802.11 Transmitters

The normal network operating configurations are not suitable for measuring the SAR of 802.11 b/g/n transmitters. 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 248227D01v02r02 for more details.

6.5.1 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. The test frequencies should correspond to actual channel frequencies defined for domestic use. SAR for devices with switched diversity should be measured with only one antenna transmitting at a time during each SAR measurement, according to a fixed modulation and data rate. The same data pattern should be used for all measurements.

A periodic duty factor is required for current generation SAR systems to measure SAR. When 802.11 frame gaps are accounted for in the 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.

6.5.2 U-NII and U-NII-2A

For devices that operate in only one of the U-NII-1 and U-NII-2A bands, the normally required SAR procedures for OFDM configurations are applied. For devices that operate in both U-NII bands using the same transmitter and antenna(s), SAR test reduction is determined according to the following, with respect to the highest reported SAR and maximum output power specified for production units. The procedures are applied independently to each exposure configuration; for example, head, body, hotspot mode etc.

1) When the same maximum output power is specified for both bands, begin SAR measurement in U-NII-2A band by applying the OFDM SAR requirements. If the highest reported SAR for a test configuration is ≤ 1.2 W/kg, SAR is not required for U-NII-1 band for that configuration (802.11 mode and exposure condition); otherwise, each band is tested independently for SAR.
2) When different maximum output power is specified for the bands, begin SAR measurement in the band with higher specified maximum output power. The highest reported SAR for the tested configuration is adjusted by the ratio of lower to higher specified maximum output power for the two bands. When the adjusted SAR is ≤ 1.2 W/kg, SAR is not required for the band with lower maximum output power in that test configuration; otherwise, each band is tested independently for SAR.

6.5.3 U-NII-2C and U-NII-3

The frequency range covered by U-NII-2C and U-NII-3 is 380 MHz (5.47 – 5.85 GHz), which requires a minimum of at least two SAR probe calibration frequency points to support SAR measurements.

When Terminal Doppler Weather Rader (TDWR) restriction applies, the channels at 5.60 – 5.65 GHz in U-NII-2C band must be disabled with acceptable mechanisms and documented in the equipment certification.

Unless band gap channels are permanently disabled, SAR must be considered for these channels. When band gap channels are disabled, each band is tested independently according to the normally required OFDM SAR measurements and probe calibration frequency points requirements.

6.5.4 Initial Test Position Procedure

For exposure conditions with multiple test positions, such as handset operating next to the ear, devices with hotspot mode or UMPC mini-tablet, procedures for initial test position can be applied. Using the transmission mode determined by the DSSS procedure or initial test configuration, area scans are measured for all position in an exposure condition. The test position with the highest extrapolated (peak) SAR is used as the initial test position. When reported SAR for the initial test position is ≤ 0.4 W/kg, no additional testing for the remaining test positions is required. Otherwise, SAR is evaluated at the subsequent highest peak SAR position until the reported SAR result is ≤ 0.8 W/kg or all test position are measured.

6.5.5 2.4 GHz SAR Test Requirements

SAR is measured for 2.4 GHz 802.11b DSSS using either a 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 exposure configuration using the next highest measured output power channel. When any reported SAR is > 1.2 W/kg, SAR is required for the third channel; i.e., all channels require testing.

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.

6.5.6 OFDM Transmission Mode and SAR Test Channel Selection

For the 2.4 GHz and 5 GHz bands, when the same maximum output power was specified for multiple OFDM transmission mode configurations in a frequency band or aggregated band, SAR is measured using the configuration with the largest channel bandwidth, lowest order modulation and lowest data rate. When the maximum output power of a channel is the same for equivalent OFDM configurations; for example, 802.11a and 802.11n or 802.11g and 802.11n with the same channel bandwidth, modulation and data rate etc., the lower order 802.11 mode i.e., 802.11a, then 80211n or 802.11g then 802.11n is used for SAR measurement. When the maximum output power ware the same for multiple test channels, either according to the default or additional power measurement requirements, SAR is measured using the channel closest to the middle of the frequency band or aggregated band. When there are multiple channels with the same maximum output power, SAR is measured using the higher number channel.

6.5.7 Initial Test Configuration Procedure

For OFDM, in both 2.4 and 5 GHz bands, an initial test configuration is determined for each frequency band and aggregated band, according to the transmission mode with the highest maximum output power specified for SAR measurements. When the same maximum output is specified for multiple OFDM transmission mode configurations in a frequency band or aggregated band, SAR is measured using the configuration(s) with the largest channel bandwidth, lowest order modulation, and lowest data rate. The channel of the transmission mode with the highest average RF output conducted power will be the initial test configuration.

When the reported SAR is ≤ 0.8 W/kg, no additional measurements on other test channels are required.
Otherwise, SAR is evaluated using the subsequent highest average RF output channel until the reported SAR result is ≤ 1.2 W/kg or all channels are measured.

6.5.8 Subsequent Test Configuration Procedures

For OFDM configurations, in each frequency band and aggregated band, SAR is evaluated for initial test configuration using the fixed test position or the initial test position procedure, when applicable. When the highest reported SAR for the initial test configuration, adjusted by the ratio of the subsequent test configuration to initial test configuration specified maximum output power is ≤ 1.2 W/kg, no additional SAR testing for the subsequent test configurations is required.

6.6 Generic device

The SAR evaluation shall be performed for all surfaces of the DUT that are accessible during intended use, as indicated in Figure 7.1. The separation distance in testing shall correspond to the intended use distance as specified in the user instructions provided by the manufacturer. If the intended use is not specified, all surfaces of the DUT shall be tested directly against the flat phantom.

The surface of the generic device (or the surface of the carry accessory holding the DUT) pointing towards the flat phantom shall be parallel to the surface of the phantom.

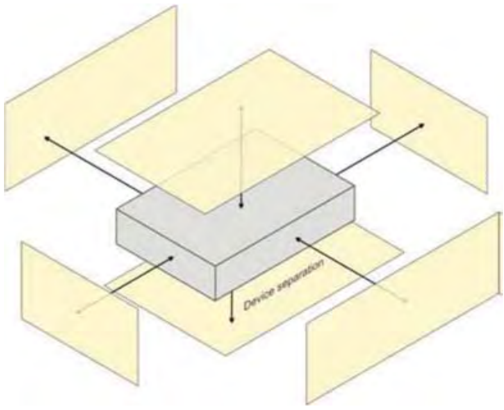


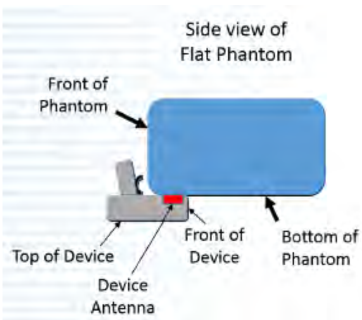
Figure 6.1 Test positions for a generic device

6.7 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. The 1-g body and 10-g extremity SAR Exclusion Thresholds found in KDB Publication 447498 D01v06 should be applied to determine SAR test requirements.

6.8 Handheld Devices Test Solutions (May 2017 TCB Workshop Notes)

Invert the barcode scanner so the pistol grip is facing upwards but outside the front of the flat phantom (near the spigot).



7. Nominal and Maximum Output Power Spec and RF Conducted Powers

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.

7.1 GSM Nominal and Maximum Output Power Spec and Conducted Powers

Band & Mode		Voice[dBm]	Burst Average GMSK [dBm]				Burst Average GMSK [dBm]			
		1 TX Slot	1 TX Slot	2 TX Slot	3 TX Slot	4 TX Slot	1 TX Slot	2 TX Slot	3 TX Slot	4 TX Slot
GSM/GPRS/EDGE 850	Maximum	33.0	33.0	31.5	30.0	29.0	27.5	26.5	24.5	23.0
	Nominal	32.0	32.0	30.5	29.0	28.0	26.5	25.5	23.5	22.0
GSM/GPRSEDGE 1900	Maximum	30.0	30.0	28.5	27.0	26.0	26.5	25.0	23.5	21.5
	Nominal	29.0	29.0	27.5	26.0	25.0	25.5	24.0	22.5	20.5

Table 7.1.1 GSM Nominal and Maximum Output Power Spec

Band	Channel	Maximum Burst-Averaged Output Power(dBm)								
		Voice	GPRS/EDGE Data (GMSK)				EDGE Data (8-PSK)			
		GSM CS 1 Slot	GPRS 1 TX Slot	GPRS 2 TX Slot	GPRS 3 TX Slot	GPRS 4 TX Slot	EDGE 1 TX Slot	EDGE 2 TX Slot	EDGE 3 TX Slot	EDGE 4 TX Slot
GSM850	128	32.51	32.51	31.14	29.93	28.75	27.49	26.39	24.45	22.95
	190	32.60	32.60	31.15	29.95	28.76	27.42	26.24	24.32	22.63
	251	32.47	32.47	31.21	29.94	28.76	27.19	26.12	24.12	22.85
PCS 1900	512	29.75	29.75	28.41	26.68	25.46	26.13	24.74	23.09	21.19
	661	29.89	29.89	28.49	26.82	25.71	26.23	24.79	23.12	21.21
	810	29.73	29.73	28.34	26.52	25.64	25.93	24.65	23.96	21.08
Band	Channel	Calculated Maximum Frame-Averaged Output Power(dBm)								
		Voice	GPRS/EDGE Data (GMSK)				EDGE Data (8-PSK)			
		GSM CS 1 Slot	GPRS 1 TX Slot	GPRS 2 TX Slot	GPRS 3 TX Slot	GPRS 4 TX Slot	EDGE 1 TX Slot	EDGE 2 TX Slot	EDGE 3 TX Slot	EDGE 4 TX Slot
GSM850	128	23.48	23.48	25.12	25.67	25.74	18.46	20.37	20.19	19.94
	190	23.57	23.57	25.13	25.69	25.75	18.39	20.22	20.06	19.62
	251	23.44	23.44	25.19	25.68	25.75	18.16	20.10	19.86	19.84
PCS 1900	512	20.72	20.72	22.39	22.42	22.45	17.10	18.72	18.83	18.18
	661	20.86	20.86	22.47	22.56	22.70	17.20	18.77	18.86	18.20
	810	20.70	20.70	22.32	22.26	22.63	16.90	18.63	19.70	18.07
GSM850	Frame Avg. Targets:	22.97	22.97	24.48	24.74	24.99	17.47	19.48	19.24	18.99
PCS 1900		19.97	19.97	21.48	21.74	21.99	16.47	17.98	18.24	17.49

Table 7.1.2 GSM Conducted Power

Note:

1. Both burst-averaged and calculated frame-averaged powers are included. Frame-averaged power was calculated from the measured burst-averaged power by converting the slot powers into linear units and calculating the energy over 8 timeslots.
2. GPRS (GMSK) output powers were measured with coding scheme setting of 1 (CS1) on the base station simulator. CS1 was configured to measure GPRS output power measurements and SAR to ensure GMSK modulation in the signal. Our Investigation has shown that CS1 - CS4 settings do not have any impact on the output levels or modulation in the GPRS modes.
3. EDGE (8-PSK) output powers were measured with MCS7 on the base station simulator. MCS7 coding scheme was used to measure the output powers for EDGE since investigation has shown that choosing MCS7 coding scheme will ensure 8-PSK modulation. It has been shown that MCS levels that produce 8PSK modulation do not have an impact on output power.

GPRS Multislot class: 12 (max 4 TX Uplink slots)
EDGE Multislot class: 12 (max 4 TX Uplink slots)
DTM Multislot Class: N/A

Figure 7.1 Power Measurement Setup

7.2 WCDMA Nominal and Maximum Output Power Spec and Conducted Powers

3GPP Release Version	Mode			Cellular Band (dBm)	AWS Band (dBm)	PCS Band (dBm)	3GPP MPR (dB)
99	WCDMA	Voice	Maximum	22.4	23.0	23.0	-
			Nominal	21.9	22.5	22.5	
5	HSDPA	Subtest 1	Maximum	22.4	23.0	23.0	0
			Nominal	21.9	22.5	22.5	
5		Subtest 2	Maximum	22.4	23.0	23.0	0
			Nominal	21.9	22.5	22.5	
5		Subtest 3	Maximum	21.9	22.5	22.5	0.5
			Nominal	21.4	22.0	22.0	
5		Subtest 4	Maximum	21.9	22.5	22.5	0.5
			Nominal	21.4	22.0	22.0	
6	HSUPA	Subtest 1	Maximum	22.4	23.0	23.0	0
			Nominal	21.9	22.5	22.5	
6		Subtest 2	Maximum	20.4	21.0	21.0	2
			Nominal	19.9	20.5	20.5	
6		Subtest 3	Maximum	21.4	22.0	22.0	1
			Nominal	20.9	21.5	21.5	
6		Subtest 4	Maximum	20.4	21.0	21.0	2
			Nominal	19.9	20.5	20.5	
6		Subtest 5	Maximum	22.4	23.0	23.0	0
			Nominal	21.9	22.5	22.5	
8	DC-HSDPA	Subtest 1	Maximum	22.4	23.0	23.0	0
			Nominal	21.9	22.5	22.5	
8		Subtest 2	Maximum	22.4	23.0	23.0	0
			Nominal	21.9	22.5	22.5	
8		Subtest 3	Maximum	21.9	22.5	22.5	0.5
			Nominal	21.4	22.0	22.0	
8		Subtest 4	Maximum	21.9	22.5	22.5	0.5
			Nominal	21.4	22.0	22.0	

Table 7.2.1 WCDMA Nominal and Maximum Output Power Spec

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	22.14	22.26	22.16	22.94	22.97	22.96	22.76	22.91	22.94	-
99		12.2 kbps AMR	22.13	22.25	22.15	22.92	22.95	22.94	22.75	22.90	22.92	-
5	HSDPA	Subtest 1	22.16	22.28	22.14	22.13	22.25	22.16	22.73	22.87	22.95	0
5		Subtest 2	22.14	22.25	22.15	22.13	22.27	22.15	22.73	22.90	22.94	0
5		Subtest 3	21.65	21.75	21.65	21.63	21.76	21.65	22.26	22.41	22.44	0.5
5		Subtest 4	21.66	21.74	21.64	21.63	21.77	21.68	22.25	22.41	22.43	0.5
6	HSUPA	Subtest 1	22.13	22.26	22.14	22.15	22.27	22.18	22.75	22.91	22.93	0
6		Subtest 2	20.22	20.34	20.23	20.13	20.26	20.17	20.74	20.91	20.94	2
6		Subtest 3	21.22	21.32	21.16	21.11	21.27	21.17	21.75	21.89	21.94	1
6		Subtest 4	20.22	20.35	20.22	20.11	20.27	20.18	20.76	20.89	20.94	2
6		Subtest 5	22.14	22.27	22.10	22.16	22.28	22.19	22.77	22.92	22.94	0
8	DC-HSDPA	Subtest 1	22.14	22.26	22.12	22.11	22.23	22.14	22.71	22.85	22.92	0
8		Subtest 2	22.12	22.24	22.14	22.11	22.26	22.13	22.70	22.88	22.92	0
8		Subtest 3	21.63	21.73	21.63	21.62	21.74	21.63	22.24	22.39	22.43	0.5
8		Subtest 4	21.64	21.73	21.62	21.61	21.75	21.66	22.23	22.40	22.41	0.5

Table 7.2.2 WCDMA Conducted Power

WCDMA SAR was tested under RMC 12.2 kbps with HSPA Inactive per KDB Publication 941225 D01v03r01. HSPA SAR was not required since the average output power of the HSPA subtests was not more than 0.25 dB higher than the RMC level and SAR was less than 1.2 W/kg.

The manufacturer declares that the HSDPA, HSUPA and DC-HSDPA transmitter's power will not exceed the R99 maximum transmit power in devices based on Qualcomm's HSPA chipset solutions.

DC-HSDPA considerations

- 3GPP Specification 34.121-1 Release 8 Ver 8.10.0 was used for DC-HSDPA guidance.
- H-Set 12 (QPSK) was confirmed to be used during DC-HSDPA measurements.
- The DUT supports UE category 24 for HSDPA.

Figure 7.2 Power Measurement Setup

7.3 LTE Nominal and Maximum Output Power Spec and Conducted Powers

Band & Mode		Modulated Average[dBm]
LTE Band 12	Maximum	24.0
	Nominal	23.0

Table 7.3.1.1 Nominal and Maximum Output Power Spec

1) LTE Band 12

LTE Band 12 Conducted Power– 10 MHz Bandwidth					
Modulation	RB Size	RB Offset	Mid Channel 23095 (707.5 MHz) Conducted Power (dBm)	MPR Allowed Per 3GPP(dB)	MPR (dB)
QPSK	1	0	23.86	0	0
	1	25	23.81		
	1	**49**	**23.87**		
	25	**0**	**22.76**	0-1	1
	25	12	22.70		
	25	25	22.65		
	50	0	22.61	0-1	1
16QAM	1	0	22.92	0-1	1
	1	25	22.70		
	1	49	22.94		
	25	0	21.68	0-2	2
	25	12	21.74		
	25	25	21.77		
	50	0	21.68	0-2	2

Table 7.3.1.2 LTE Conducted Power

Note : LTE B12 can not contain three non-overlapping channels of 10 MHz bandwidth.
Per KDB 941225 D05v02r05, 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.

LTE Band 12 Conducted Power– 5 MHz Bandwidth							
Modulation	RB Size	RB Offset	Low Channel 23035 (701.5 MHz)	Mid Channel 23095 (707.5 MHz)	High Channel 23155 (713.5 MHz)	MPR Allowed Per 3GPP(dB)	MPR (dB)
			Conducted Power (dBm)				
QPSK	1	0	23.68	23.90	23.86	0	0
	1	12	23.73	23.60	23.79		
	1	24	23.96	23.80	23.84		
	12	0	22.67	22.65	22.77	0-1	1
	12	6	22.71	22.79	22.72		
	12	13	22.67	22.73	22.72		
	25	0	22.72	22.71	22.75	0-1	1
16QAM	1	0	22.88	22.95	22.98	0-1	1
	1	12	22.90	22.79	22.94		
	1	24	22.85	22.98	22.96		
	12	0	21.60	21.75	21.66	0-2	2
	12	6	21.56	21.69	21.68		
	12	13	21.55	21.70	21.64		
	25	0	21.64	21.73	21.77	0-2	2

Table 7.3.1.3 LTE Conducted Power

LTE Band 12 Conducted Power– 3 MHz Bandwidth							
Modulation	RB Size	RB Offset	Low Channel 23025 (700.5 MHz)	Mid Channel 23095 (707.5 MHz)	High Channel 23165 (714.5 MHz)	MPR Allowed Per 3GPP(dB)	MPR (dB)
			Conducted Power (dBm)				
QPSK	1	0	23.78	23.80	23.74	0	0
	1	7	23.85	23.86	23.96		
	1	14	23.69	23.98	23.98		
	8	0	22.62	22.77	22.67	0-1	1
	8	4	22.71	22.74	22.73		
	8	7	22.64	22.72	22.65		
	15	0	22.65	22.69	22.70	0-1	1
16QAM	1	0	22.95	22.98	22.90	0-1	1
	1	7	22.87	22.96	22.95		
	1	14	22.86	22.89	22.96		
	8	0	21.59	21.70	21.62	0-2	2
	8	4	21.67	21.78	21.65		
	8	7	21.54	21.58	21.57		
	15	0	21.77	21.74	21.82	0-2	2

Table 7.3.1.4 LTE Conducted Power

LTE Band 12 Conducted Power– 1.4 MHz Bandwidth							
Modulation	RB Size	RB Offset	Low Channel 23017 (699.7 MHz)	Mid Channel 23095 (707.5 MHz)	High Channel 23173 (715.3 MHz)	MPR Allowed Per 3GPP(dB)	MPR (dB)
			Conducted Power (dBm)				
QPSK	1	0	23.96	23.90	23.98	0	0
	1	2	23.94	23.79	23.92		
	1	5	23.98	23.85	23.95		
	3	0	23.81	23.66	23.74	0	0
	3	2	23.93	23.56	23.68		
	3	3	23.82	23.58	23.70		
	6	0	22.61	22.71	22.62	0-1	1
16QAM	1	0	22.95	22.90	22.88	0-1	1
	1	2	22.94	22.98	22.93		
	1	5	22.92	22.92	22.96		
	3	0	22.71	22.54	22.62	0-1	1
	3	2	22.85	22.42	22.63		
	3	3	22.78	22.40	22.66		
	6	0	21.80	21.83	21.79	0-2	2

Table 7.3.1.5 LTE Conducted Power

Band & Mode		Modulated Average[dBm]
LTE Band 13	Maximum	24.0
	Nominal	23.0

Table 7.3.2.1 Nominal and Maximum Output Power Spec

2) LTE Band 13

LTE Band 13 Conducted Power– 10 MHz Bandwidth					
Modulation	RB Size	RB Offset	Mid Channel 23230 (782.0 MHz) Conducted Power (dBm)	MPR Allowed Per 3GPP(dB)	MPR (dB)
QPSK	1	0	23.50	0	0
	1	25	23.56		
	1	**49**	23.78		
	25	0	22.55	0-1	1
	25	12	22.53		
	25	**25**	22.59		
	50	0	22.55	0-1	1
16QAM	1	0	22.68	0-1	1
	1	25	22.75		
	1	49	22.85		
	25	0	21.43	0-2	2
	25	12	21.46		
	25	25	21.58		
	50	0	21.53	0-2	2

Table 7.3.2.2 LTE Conducted Power

LTE Band 13 Conducted Power– 5 MHz Bandwidth					
Modulation	RB Size	RB Offset	Mid Channel 23230 (782.0 MHz) Conducted Power (dBm)	MPR Allowed Per 3GPP(dB)	MPR (dB)
QPSK	1	0	23.55	0	0
	1	12	23.71		
	1	24	23.50		
	12	0	22.65	0-1	1
	12	6	22.63		
	12	13	22.59		
	25	0	22.58	0-1	1
16QAM	1	0	22.74	0-1	1
	1	12	22.90		
	1	24	22.68		
	12	0	21.69	0-2	2
	12	6	21.64		
	12	13	21.56		
	25	0	21.42	0-2	2

Table 7.3.2.3 LTE Conducted Power

Note : LTE B13 can not contain three non-overlapping channels of 5 MHz bandwidth.
Per KDB 941225 D05v02r05, 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.

Band & Mode		Modulated Average[dBm]
LTE Band 14	Maximum	23.5
	Nominal	22.5

Table 7.3.3.1 Nominal and Maximum Output Power Spec

3) LTE Band 14

LTE Band 14 Conducted Power– 10 MHz Bandwidth					
Modulation	RB Size	RB Offset	Mid Channel 23330 (793.0 MHz) Conducted Power (dBm)	MPR Allowed Per 3GPP(dB)	MPR (dB)
QPSK	1	0	23.19	0	0
	1	**25**	23.48		
	1	49	23.05		
	25	0	22.35	0-1	1
	25	**12**	22.43		
	25	25	22.31		
	50	0	22.31	0-1	1
16QAM	1	0	22.38	0-1	1
	1	25	22.49		
	1	49	22.21		
	25	0	21.39	0-2	2
	25	12	21.41		
	25	25	21.32		
	50	0	21.41	0-2	2

Table 7.3.3.2 LTE Conducted Power

LTE Band 14 Conducted Power– 5 MHz Bandwidth					
Modulation	RB Size	RB Offset	Mid Channel 23330 (793.0 MHz) Conducted Power (dBm)	MPR Allowed Per 3GPP(dB)	MPR (dB)
QPSK	1	0	23.39	0	0
	1	12	23.36		
	1	24	23.37		
	12	0	23.36	0-1	1
	12	6	23.38		
	12	13	23.37		
	25	0	23.34	0-1	1
16QAM	1	0	22.43	0-1	1
	1	12	22.40		
	1	24	22.38		
	12	0	22.41	0-2	2
	12	6	22.41		
	12	13	22.41		
	25	0	22.41	0-2	2

Table 7.3.3.3 LTE Conducted Power

Note : LTE B14 can not contain three non-overlapping channels of 5 MHz bandwidth.
Per KDB 941225 D05v02r05, 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.

Band & Mode		Modulated Average[dBm]
LTE Band 5	Maximum	24.0
	Nominal	23.0

Table 7.3.4.1 Nominal and Maximum Output Power Spec

4) LTE Band 5 (Cell)

LTE Band 5 (Cell) Conducted Power– 10 MHz Bandwidth					
Modulation	RB Size	RB Offset	Mid Channel 20525 (836.5 MHz) Conducted Power (dBm)	MPR Allowed Per 3GPP(dB)	MPR (dB)
QPSK	1	0	23.40	0	0
	1	25	23.39		
	1	**49**	**23.72**		
	25	0	22.37	0-1	1
	25	12	22.41		
	25	**25**	**22.49**		
	50	0	22.49	0-1	1
16QAM	1	0	22.58	0-1	1
	1	25	22.57		
	1	49	22.81		
	25	0	21.28	0-2	2
	25	12	21.30		
	25	25	21.40		
	50	0	21.34	0-2	2

Table 7.3.4.2 LTE Conducted Power

Note : LTE B5(Cell) can not contain three non-overlapping channels of 10 MHz bandwidth.
Per KDB 941225 D05v02r05, 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.

LTE Band 5 (Cell) Conducted Power– 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)	MPR Allowed Per 3GPP(dB)	MPR (dB)
			Conducted Power (dBm)				
QPSK	1	0	23.28	23.33	23.43	0	0
	1	12	23.24	23.36	23.45		
	1	24	23.29	23.40	23.43		
	12	0	22.29	22.37	22.54	0-1	1
	12	6	22.27	22.39	22.55		
	12	13	22.34	22.42	22.53		
	25	0	22.21	22.39	22.52	0-1	1
16QAM	1	0	22.47	22.51	22.63	0-1	1
	1	12	22.43	22.54	22.65		
	1	24	22.48	22.58	22.59		
	12	0	21.23	21.33	21.58	0-2	2
	12	6	21.21	21.35	21.62		
	12	13	21.28	21.35	21.60		
	25	0	21.13	21.28	21.51	0-2	2

Table 7.3.4.3 LTE Conducted Power

LTE Band 5 (Cell) Conducted Power– 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)	MPR Allowed Per 3GPP(dB)	MPR (dB)
			Conducted Power (dBm)				
QPSK	1	0	23.27	23.32	23.44	**0**	**0**
	1	7	23.27	23.35	23.47		
	1	14	23.23	23.34	23.41		
	8	0	22.25	22.42	22.48	**0-1**	**1**
	8	4	22.26	22.42	22.56		
	8	7	22.26	22.46	22.49		
	15	0	22.24	22.40	22.54	**0-1**	**1**
16QAM	1	0	22.43	22.47	22.61	**0-1**	**1**
	1	7	22.46	22.52	22.58		
	1	14	22.36	22.49	22.60		
	8	0	21.37	21.40	21.60	**0-2**	**2**
	8	4	21.26	21.37	21.64		
	8	7	21.25	21.45	21.62		
	15	0	21.21	21.30	21.54	**0-2**	**2**

Table 7.3.4.4 LTE Conducted Power

LTE Band 5 (Cell) Conducted Power– 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)	MPR Allowed Per 3GPP(dB)	MPR (dB)
			Conducted Power (dBm)				
QPSK	1	0	23.20	23.39	23.51	**0**	**0**
	1	2	23.26	23.34	23.43		
	1	5	23.21	23.31	23.50		
	3	0	23.24	23.27	23.37	**0**	**0**
	3	2	23.27	23.32	23.42		
	3	3	23.20	23.25	23.36		
	6	0	22.24	22.33	22.45	**0-1**	**1**
16QAM	1	0	22.31	22.48	22.71	**0-1**	**1**
	1	2	22.43	22.54	22.61		
	1	5	22.33	22.50	22.70		
	3	0	22.35	22.36	22.48	**0-1**	**1**
	3	2	22.34	22.36	22.47		
	3	3	22.32	22.34	22.49		
	6	0	21.24	21.24	21.46	**0-2**	**2**

Table 7.3.4.5 LTE Conducted Power

Band & Mode		Modulated Average[dBm]
LTE Band 4	Maximum	23.5
	Nominal	22.5

Table 7.3.5.1 Nominal and Maximum Output Power Spec

5) LTE Band 4

LTE Band 4 (AWS) Conducted Power– 20 MHz Bandwidth					
Modulation	RB Size	RB Offset	Mid Channel 20175 (1732.5 MHz) Conducted Power (dBm)	MPR Allowed Per 3GPP(dB)	MPR (dB)
QPSK	1	0	23.26	0	0
	1	**50**	23.46		
	1	99	23.10		
	50	0	22.09	0-1	1
	50	**25**	22.19		
	50	50	21.99		
	100	0	22.06	0-1	1
16QAM	1	0	22.45	0-1	1
	1	50	22.46		
	1	99	22.28		
	50	0	21.12	0-2	2
	50	25	21.04		
	50	50	21.01		
	100	0	21.02	0-2	2

Table 7.3.5.2 LTE Conducted Power

Note: LTE B4 (AWS) can not contain three non-overlapping channels of 20 MHz bandwidth.
Per KDB 941225 D05v02r05, 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.

LTE Band 4 (AWS) Conducted Power– 15 MHz Bandwidth							
Modulation	RB Size	RB Offset	Low Channel 20025 (1717.5 MHz)	Mid Channel 20175 (1732.5 MHz)	High Channel 20325 (1747.5 MHz)	MPR Allowed Per 3GPP(dB)	MPR (dB)
			Conducted Power (dBm)				
QPSK	1	0	23.31	23.38	23.22	0	0
	1	36	23.09	23.27	23.23		
	1	74	23.22	23.21	23.20		
	36	0	22.06	22.11	22.12	0-1	1
	36	18	22.05	21.97	22.09		
	36	37	22.01	22.02	22.01		
	75	0	21.93	22.01	22.07	0-1	1
16QAM	1	0	22.49	22.48	22.41	0-1	1
	1	36	22.27	22.45	22.26		
	1	74	22.41	22.37	22.37		
	36	0	21.06	21.20	21.14	0-2	2
	36	18	21.10	21.12	21.06		
	36	37	21.00	21.08	21.01		
	75	0	21.10	21.07	21.14	0-2	2

Table 7.3.5.3 LTE Conducted Power

LTE Band 4 (AWS) Conducted Power– 10 MHz Bandwidth							
Modulation	RB Size	RB Offset	Low Channel 20000 (1715.0 MHz)	Mid Channel 20175 (1732.5 MHz)	High Channel 20350 (1750.0 MHz)	MPR Allowed Per 3GPP(dB)	MPR (dB)
			Conducted Power (dBm)				
QPSK	1	0	23.27	23.23	23.15	0	0
	1	25	23.12	23.06	23.02		
	1	49	23.14	23.02	23.07		
	25	0	22.15	22.00	21.99	0-1	1
	25	12	22.05	21.96	21.96		
	25	25	22.07	21.93	21.90		
	50	0	22.07	21.92	22.01	0-1	1
16QAM	1	0	22.46	22.40	22.32	0-1	1
	1	25	22.26	22.25	22.20		
	1	49	22.33	22.21	22.26		
	25	0	21.29	21.07	21.04	0-2	2
	25	12	21.23	21.04	21.02		
	25	25	21.27	20.97	21.03		
	50	0	21.27	21.01	21.05	0-2	2

Table 7.3.5.4 LTE Conducted Power

LTE Band 4 (AWS) Conducted Power– 5 MHz Bandwidth							
Modulation	RB Size	RB Offset	Low Channel 19975 (1712.5 MHz)	Mid Channel 20175 (1732.5 MHz)	High Channel 20375 1752.5 MHz)	MPR Allowed Per 3GPP(dB)	MPR (dB)
			Conducted Power (dBm)				
QPSK	1	0	23.21	23.11	23.13	0	0
	1	12	23.06	23.03	23.01		
	1	24	23.04	22.99	22.95		
	12	0	22.23	21.97	21.99	0-1	1
	12	6	22.07	21.96	21.97		
	12	13	22.04	21.88	21.91		
	25	0	22.03	21.92	21.92	0-1	1
16QAM	1	0	22.39	22.30	22.27	0-1	1
	1	12	22.24	22.22	22.18		
	1	24	22.22	22.18	22.13		
	12	0	21.35	21.14	21.08	0-2	2
	12	6	21.23	21.15	21.00		
	12	13	21.22	21.03	20.98		
	25	0	21.22	21.01	21.01	0-2	2

Table 7.3.5.5 LTE Conducted Power

LTE Band 4 (AWS) Conducted Power– 3 MHz Bandwidth							
Modulation	RB Size	RB Offset	Low Channel	Mid Channel	High Channel	MPR Allowed Per 3GPP(dB)	MPR (dB)
			19965 (1711.5 MHz)	20175 (1732.5 MHz)	20385 (1753.5 MHz)		
			Conducted Power (dBm)				
QPSK	1	0	23.25	22.98	22.99	0	0
	1	7	23.25	22.93	22.97		
	1	14	23.16	22.82	22.89		
	8	0	22.19	21.95	21.92	0-1	1
	8	4	22.12	21.96	21.91		
	8	7	22.12	21.91	21.97		
	15	0	22.15	21.90	21.98	0-1	1
16QAM	1	0	22.43	22.16	22.18	0-1	1
	1	7	22.42	22.06	22.16		
	1	14	22.35	22.01	22.05		
	8	0	21.30	21.15	21.03	0-2	2
	8	4	21.32	21.16	21.07		
	8	7	21.25	21.10	20.96		
	15	0	21.32	20.99	21.01	0-2	2

Table 7.3.5.6 LTE Conducted Power

TE Band 4 (AWS) Conducted Power– 1.4 MHz Bandwidth							
Modulation	RB Size	RB Offset	Low Channel	Mid Channel	High Channel	MPR Allowed Per 3GPP(dB)	MPR (dB)
			19957 (1710.7 MHz)	20175 (1732.5 MHz)	20393 (1754.3 MHz)		
			Conducted Power (dBm)				
QPSK	1	0	23.12	22.85	22.94	0	0
	1	2	23.14	22.89	22.95		
	1	5	23.06	22.85	22.92		
	3	0	22.96	22.87	22.71	0	0
	3	2	23.06	22.90	22.82		
	3	3	22.94	22.83	22.71		
	6	0	22.03	21.84	21.84	0-1	1
16QAM	1	0	22.28	22.02	22.11	0-1	1
	1	2	22.30	22.08	22.13		
	1	5	22.24	21.94	22.12		
	3	0	22.16	21.99	21.89	0-1	1
	3	2	22.25	22.07	21.96		
	3	3	22.14	22.01	21.88		
	6	0	21.22	20.93	20.91	0-2	2

Table 7.3.5.7 LTE Conducted Power

Band & Mode		Modulated Average[dBm]
LTE Band 2(PCS)	Maximum	24.0
	Nominal	23.0

Table 7.3.6.1 Nominal and Maximum Output Power Spec

6) LTE Band 2 (PCS)

LTE Band 2 (PCS) Conducted Power– 20 MHz Bandwidth							
Modulation	RB Size	RB Offset	Low Channel	Mid Channel	High Channel	MPR Allowed Per 3GPP(dB)	MPR (dB)
			18700 (1860.0 MHz)	18900 (1880.0 MHz)	19100 (1900.0 MHz)		
			Conducted Power (dBm)				
QPSK	1	0	23.59	23.56	23.68	0	0
	1	**50**	23.69	23.62	23.98		
	1	99	23.26	23.37	23.28		
	50	0	22.75	22.59	22.73	0-1	1
	50	**25**	22.86	22.63	22.87		
	50	50	22.46	22.48	22.64		
	100	0	22.58	22.50	22.80	0-1	1
16QAM	1	0	22.79	22.75	22.87	0-1	1
	1	50	22.88	22.77	22.98		
	1	99	22.44	22.48	22.45		
	50	0	21.78	21.59	21.77	0-2	2
	50	25	21.76	21.59	21.84		
	50	50	21.52	21.50	21.69		
	100	0	21.62	21.50	21.62	0-2	2

Table 7.3.6.2 LTE Conducted Power

LTE Band 2 (PCS) Conducted Power– 15 MHz Bandwidth							
Modulation	RB Size	RB Offset	Low Channel	Mid Channel	High Channel	MPR Allowed Per 3GPP(dB)	MPR (dB)
			18675 (1857.5 MHz)	18900 (1880.0 MHz)	19125 (1902.5 MHz)		
			Conducted Power (dBm)				
QPSK	1	0	23.77	23.63	23.75	0	0
	1	36	23.66	23.48	23.77		
	1	74	23.79	23.75	23.88		
	36	0	22.73	22.56	22.82	0-1	1
	36	18	22.79	22.59	22.86		
	36	37	22.79	22.52	22.71		
	75	0	22.75	22.54	22.77	0-1	1
16QAM	1	0	22.82	22.79	22.90	0-1	1
	1	36	22.84	22.65	22.90		
	1	74	22.89	22.88	22.96		
	36	0	21.76	21.58	21.73	0-2	2
	36	18	21.85	21.60	21.85		
	36	37	21.70	21.52	21.71		
	75	0	21.75	21.56	21.80	0-2	2

Table 7.3.6.3 LTE Conducted Power

LTE Band 2 (PCS) Conducted Power– 10 MHz Bandwidth							
Modulation	RB Size	RB Offset	Low Channel	Mid Channel	High Channel	MPR Allowed Per 3GPP(dB)	MPR (dB)
			18650 (1855.0 MHz)	18900 (1880.0 MHz)	19150 (1905.0 MHz)		
			Conducted Power (dBm)				
QPSK	1	0	23.74	23.74	23.96	0	0
	1	25	23.68	23.64	23.96		
	1	49	23.66	23.70	23.89		
	25	0	22.78	22.74	23.00	0-1	1
	25	12	22.77	22.60	22.90		
	25	25	22.65	22.67	22.82		
	50	0	22.69	22.58	22.87	0-1	1
16QAM	1	0	22.86	22.92	22.99	0-1	1
	1	25	22.87	22.76	22.86		
	1	49	22.84	22.86	22.84		
	25	0	21.75	21.67	21.94	0-2	2
	25	12	21.71	21.60	21.88		
	25	25	21.67	21.64	21.80		
	50	0	21.71	21.63	21.86	0-2	2

Table 7.3.6.4 LTE Conducted Power

LTE Band 2 (PCS) Conducted Power– 5 MHz Bandwidth							
Modulation	RB Size	RB Offset	Low Channel	Mid Channel	High Channel	MPR Allowed Per 3GPP(dB)	MPR (dB)
			18625 (1852.5 MHz)	18900 (1880.0 MHz)	19175 (1907.5 MHz)		
			Conducted Power (dBm)				
QPSK	1	0	23.82	23.76	23.85	0	0
	1	12	23.78	23.60	23.89		
	1	24	23.76	23.76	23.91		
	12	0	22.83	22.69	22.95	0-1	1
	12	6	22.84	22.67	22.92		
	12	13	22.73	22.66	22.87		
	25	0	22.79	22.71	22.92	0-1	1
16QAM	1	0	22.91	22.89	22.92	0-1	1
	1	12	22.98	22.73	22.84		
	1	24	22.95	22.88	22.80		
	12	0	21.87	21.67	21.94	0-2	2
	12	6	21.89	21.67	21.91		
	12	13	21.72	21.69	21.85		
	25	0	21.87	21.64	21.81	0-2	2

Table 7.3.6.5 LTE Conducted Power

LTE Band 2 (PCS) Conducted Power– 3 MHz Bandwidth							
Modulation	RB Size	RB Offset	Low Channel 18615 (1851.5 MHz)	Mid Channel 18900 (1880.0 MHz)	High Channel 19185 (1908.5 MHz)	MPR Allowed Per 3GPP(dB)	MPR (dB)
			Conducted Power (dBm)				
QPSK	1	0	23.70	23.69	23.96	0	0
	1	7	23.74	23.70	23.92		
	1	14	23.69	23.68	23.93		
	8	0	22.76	22.64	22.86	0-1	1
	8	4	22.77	22.61	22.85		
	8	7	22.70	22.58	22.84		
	15	0	22.75	22.58	22.85	0-1	1
16QAM	1	0	22.84	22.88	22.82	0-1	1
	1	7	22.85	22.88	22.93		
	1	14	22.86	22.85	22.91		
	8	0	21.91	21.71	21.88	0-2	2
	8	4	21.82	21.67	21.90		
	8	7	21.77	21.63	21.88		
	15	0	21.69	21.71	21.89	0-2	2

Table 7.3.6.6 LTE Conducted Power

LTE Band 2 (PCS) Conducted Power– 1.4 MHz Bandwidth							
Modulation	RB Size	RB Offset	Low Channel 18607 (1850.7 MHz)	Mid Channel 18900 (1880.0 MHz)	High Channel 19193 (1909.3 MHz)	MPR Allowed Per 3GPP(dB)	MPR (dB)
			Conducted Power (dBm)				
QPSK	1	0	23.71	23.69	23.94	0	0
	1	2	23.69	23.76	23.97		
	1	5	23.69	23.70	23.93		
	3	0	23.54	23.52	23.94	0	0
	3	2	23.63	23.57	23.93		
	3	3	23.59	23.58	23.90		
	6	0	22.77	22.58	22.80	0-1	1
16QAM	1	0	22.85	22.81	22.98	0-1	1
	1	2	22.84	22.87	22.86		
	1	5	22.81	22.76	22.83		
	3	0	22.67	22.59	22.79	0-1	1
	3	2	22.70	22.61	22.81		
	3	3	22.64	22.57	22.87		
	6	0	21.69	21.66	21.93	0-2	2

Table 7.3.6.7 LTE Conducted Power

Band & Mode		Modulated Average[dBm]
LTE Band 7	Maximum	22.0
	Nominal	21.0

Table 7.3.7.1 Nominal and Maximum Output Power Spec

7) LTE Band 7

LTE Band 7 Conducted Power– 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)	MPR Allowed Per 3GPP(dB)	MPR (dB)
			Conducted Power (dBm)				
QPSK	1	0	21.64	21.75	21.67	0	0
	1	**50**	21.78	21.98	21.85		
	1	99	21.77	21.76	21.74		
	50	0	20.62	20.63	20.58	0-1	1
	50	**25**	20.69	20.87	20.68		
	50	50	20.62	20.67	20.50		
	100	0	20.68	20.75	20.66	0-1	1
16QAM	1	0	20.83	20.79	20.80	0-1	1
	1	50	20.96	20.92	20.96		
	1	99	20.92	20.83	20.91		
	50	0	19.52	19.45	19.55	0-2	2
	50	25	19.64	19.69	19.67		
	50	50	19.58	19.53	19.51		
	100	0	19.71	19.63	19.55	0-2	2

Table 7.3.7.2 LTE Conducted Power

LTE Band 7 Conducted Power– 15 MHz Bandwidth							
Modulation	RB Size	RB Offset	Low Channel 20825 (2507.5 MHz)	Mid Channel 21100 (2535.0 MHz)	High Channel 21375 (2562.5 MHz)	MPR Allowed Per 3GPP(dB)	MPR (dB)
			Conducted Power (dBm)				
QPSK	1	0	21.76	21.74	21.74	0	0
	1	36	21.87	21.84	21.85		
	1	74	21.73	21.71	21.71		
	36	0	20.72	20.56	20.66	0-1	1
	36	18	20.74	20.59	20.73		
	36	37	20.71	20.52	20.67		
	75	0	20.68	20.50	20.64	0-1	1
16QAM	1	0	20.96	20.80	20.89	0-1	1
	1	36	20.93	20.96	20.97		
	1	74	20.87	20.79	20.87		
	36	0	19.70	19.58	19.62	0-2	2
	36	18	19.73	19.62	19.72		
	36	37	19.68	19.51	19.67		
	75	0	19.61	19.49	19.62	0-2	2

Table 7.3.7.3 LTE Conducted Power

LTE Band 7 Conducted Power– 10 MHz Bandwidth							
Modulation	RB Size	RB Offset	Low Channel 20800 (2505.0 MHz)	Mid Channel 21100 (2535.0 MHz)	High Channel 21400 (2565.0 MHz)	MPR Allowed Per 3GPP(dB)	MPR (dB)
			Conducted Power (dBm)				
QPSK	1	0	21.96	21.80	21.80	0	0
	1	25	21.80	21.73	21.69		
	1	49	21.90	21.74	21.86		
	25	0	20.98	20.73	20.86	0-1	1
	25	12	20.87	20.67	20.68		
	25	25	20.85	20.60	20.73		
	50	0	20.81	20.61	20.68	0-1	1
16QAM	1	0	20.92	20.94	20.95	0-1	1
	1	25	20.93	20.85	20.84		
	1	49	20.85	20.86	20.91		
	25	0	19.88	19.61	19.72	0-2	2
	25	12	19.80	19.57	19.65		
	25	25	19.75	19.53	19.66		
	50	0	19.80	19.66	19.65	0-2	2

Table 7.3.7.4 LTE Conducted Power

LTE Band 7 Conducted Power– 5 MHz Bandwidth							
Modulation	RB Size	RB Offset	Low Channel 20775 (2502.5 MHz)	Mid Channel 21100 (2535.0 MHz)	High Channel 21425 (2567.5 MHz)	MPR Allowed Per 3GPP(dB)	MPR (dB)
			Conducted Power (dBm)				
QPSK	1	0	21.91	21.68	21.75	0	0
	1	12	21.88	21.68	21.71		
	1	24	21.82	21.64	21.74		
	12	0	20.77	20.66	20.76	0-1	1
	12	6	20.83	20.59	20.72		
	12	13	20.76	20.62	20.72		
	25	0	20.88	20.62	20.74	0-1	1
16QAM	1	0	20.95	20.87	20.92	0-1	1
	1	12	20.92	20.83	20.90		
	1	24	20.89	20.79	20.89		
	12	0	19.85	19.76	19.82	0-2	2
	12	6	19.93	19.72	19.79		
	12	13	19.87	19.71	19.80		
	25	0	19.79	19.59	19.68	0-2	2

Table 7.3.7.5 LTE Conducted Power

Band & Mode		Modulated Average[dBm]
LTE Band 41	Maximum	24.0
	Nominal	23.0

Table 7.3.8.1 Nominal and Maximum Output Power Spec

8) LTE Band 41

LTE Band 41 Conducted Power– 20 MHz Bandwidth									
Modulation	RB Size	RB Offset	Low Channel	Low-Mid Channel	Mid Channel	Mid-High Channel	High Channel	MPR Allowed Per 3GPP(dB)	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	23.25	23.68	23.67	23.68	23.53	0	0
	1	**50**	23.64	23.75	23.98	23.70	23.77		
	1	99	23.52	23.74	23.70	23.69	23.56		
	50	0	22.52	22.82	22.79	22.82	22.73	0-1	1
	50	**25**	22.60	22.70	22.83	22.68	22.72		
	50	50	22.59	22.74	22.80	22.72	22.64		
	100	0	22.67	22.69	22.72	22.70	22.71	0-1	1
16QAM	1	0	22.43	22.82	22.72	22.85	22.68	0-1	1
	1	50	22.79	22.73	22.84	22.75	22.82		
	1	99	22.65	22.89	22.77	22.88	22.54		
	50	0	21.61	21.90	21.92	21.86	21.75	0-2	2
	50	25	21.66	21.67	21.81	21.70	21.79		
	50	50	21.63	21.73	21.85	21.69	21.65		
	100	0	21.64	21.78	21.82	21.75	21.74	0-2	2

Table 7.3.8.2 LTE Conducted Power

LTE Band 41 Conducted Power– 15 MHz Bandwidth									
Modulation	RB Size	RB Offset	Low Channel	Low-Mid Channel	Mid Channel	Mid-High Channel	High Channel	MPR Allowed Per 3GPP(dB)	MPR (dB)
			39725 (2503.5 MHz)	40173 (2548.3 MHz)	40620 (2593.0 MHz)	41068 (2637.8 MHz)	41515 (2682.5 MHz)		
			Conducted Power (dBm)						
QPSK	1	0	23.53	23.80	23.87	23.81	23.85	0	0
	1	36	23.51	23.69	23.77	23.70	23.66		
	1	74	23.67	23.87	23.94	23.92	23.72		
	36	0	22.63	22.83	22.87	22.79	22.81	0-1	1
	36	18	22.51	22.72	22.74	22.66	22.74		
	36	37	22.58	22.71	22.78	22.73	22.70		
	75	0	22.60	22.73	22.75	22.70	22.68	0-1	1
16QAM	1	0	22.72	22.84	22.90	22.82	22.93	0-1	1
	1	36	22.66	22.72	22.80	22.77	22.79		
	1	74	22.81	22.89	22.97	22.95	22.84		
	36	0	21.66	21.91	21.93	21.89	21.82	0-2	2
	36	18	21.54	21.67	21.75	21.72	21.66		
	36	37	21.57	21.72	21.75	21.70	21.67		
	75	0	21.54	21.76	21.82	21.77	21.72	0-2	2

Table 7.3.8.3 LTE Conducted Power

LTE Band 41 Conducted Power– 10 MHz Bandwidth									
Modulation	RB Size	RB Offset	Low Channel	Low-Mid Channel	Mid Channel	Mid-High Channel	High Channel	MPR Allowed Per 3GPP(dB)	MPR (dB)
			39700 (2501.0 MHz)	40160 (2547.0 MHz)	40620 (2593.0 MHz)	41080 (2639.0 MHz)	41540 (2685.0 MHz)		
			Conducted Power (dBm)						
QPSK	1	0	23.87	23.84	23.87	23.84	23.89	0	0
	1	25	23.68	23.69	23.74	23.69	23.63		
	1	49	23.83	23.91	23.57	23.53	23.81		
	25	0	22.70	22.80	22.90	22.87	22.73	0-1	1
	25	12	22.64	22.70	22.81	22.77	22.66		
	25	25	22.72	22.76	22.87	22.84	22.67		
	50	0	22.64	22.68	22.83	22.78	22.66	0-1	1
16QAM	1	0	22.94	22.84	22.95	22.90	22.87	0-1	1
	1	25	22.86	22.76	22.84	22.80	22.68		
	1	49	22.95	22.89	22.69	22.62	22.85		
	25	0	21.68	21.85	21.92	21.89	21.77	0-2	2
	25	12	21.74	21.72	21.86	21.82	21.69		
	25	25	21.80	21.73	21.93	21.88	21.75		
	50	0	21.70	21.77	21.88	21.86	21.67	0-2	2

Table 7.3.8.4 LTE Conducted Power

LTE Band 41 Conducted Power– 5 MHz Bandwidth									
Modulation	RB Size	RB Offset	Low Channel	Low-Mid Channel	Mid Channel	Mid-High Channel	High Channel	MPR Allowed Per 3GPP(dB)	MPR (dB)
			39675 (2498.5 MHz)	40148 (2545.8 MHz)	40620 (2593.0 MHz)	41093 (2640.3 MHz)	41565 (2687.5 MHz)		
			Conducted Power (dBm)						
QPSK	1	0	23.81	23.85	23.93	23.76	23.79	0	0
	1	12	23.68	23.74	23.79	23.74	23.79		
	1	24	23.60	23.81	23.83	23.62	23.64		
	12	0	22.66	22.78	22.86	22.71	22.74	0-1	1
	12	6	22.58	22.66	22.74	22.63	22.66		
	12	13	22.61	22.71	22.77	22.56	22.60		
	25	0	22.64	22.74	22.77	22.63	22.66	0-1	1
16QAM	1	0	22.92	22.83	22.90	22.92	22.94	0-1	1
	1	12	22.88	22.76	22.84	22.92	22.95		
	1	24	22.80	22.78	22.84	22.74	22.82		
	12	0	21.77	21.92	21.99	21.83	21.86	0-2	2
	12	6	21.73	21.81	21.89	21.67	21.73		
	12	13	21.74	21.87	21.89	21.65	21.71		
	25	0	21.71	21.77	21.83	21.66	21.74	0-2	2

Table 7.3.8.5 LTE Conducted Power

7.4 WLAN Nominal and Maximum Output Power Spec and Conducted Powers

Band (GHz)	Mode	Ch	Modulated Average[dBm]	
			Maximum	Nominal
2.4	802.11b	1	13.3	12.3
		6	13.3	12.3
		11	13.3	12.3
	802.11g	1	13.3	12.3
		6	13.3	12.3
		11	13.3	12.3
	802.11n	1	13.3	12.3
		6	13.3	12.3
		11	13.3	12.3
	802.11ac	1	13.3	12.3
		6	13.3	12.3
		11	13.3	12.3

Table 7.4.1 Nominal and Maximum Output Power Spec

Mode	Freq. (MHz)	Channel	IEEE 802.11 (2.4 GHz) Conducted Power[dBm]
802.11b	2412	1	12.31
	2437	6	12.63
	2462	**11**	12.93
802.11g	2412	1	12.35
	2437	6	12.79
	2462	11	13.17
802.11n (HT-20)	2412	1	12.01
	2437	6	12.63
	2462	11	12.83
802.11ac (VHT-20)	2412	1	12.28
	2437	6	13.18
	2462	11	13.16

Table 7.4.2 IEEE 802.11 Average RF Power

Band (GHz)	Mode	Ch	Modulated Average[dBm]	
			Maximum	Nominal
5 (UNII)	802.11a	36	14.0	13.0
		40-48	14.0	13.0
		52-60	14.0	13.0
		64	14.0	13.0
		100	14.5	13.5
		104-140	14.5	13.5
		144	14.5	13.5
		149-161	14.0	13.0
		165	14.0	13.0
	802.11n (20MHz)	36	13.0	12.0
		40-48	13.0	12.0
		52-60	13.0	12.0
		64	13.0	12.0
		100	14.0	13.0
		104-140	14.0	13.0
		144	14.0	13.0
		149-161	13.0	12.0
		165	13.0	12.0
	802.11ac (20MHz)	36	12.0	11.0
		40-48	12.0	11.0
		52-60	12.0	11.0
		64	12.0	11.0
		100	12.5	11.5
		104-140	12.5	11.5
		144	12.5	11.5
		149-161	12.0	11.0
		165	12.0	11.0
	802.11n/ac (40MHz)	38	11.5	10.5
		46	11.5	10.5
		54	11.5	10.5
		62	11.5	10.5
		102	11.5	10.5
		110	11.5	10.5
		118	11.5	10.5
		126	11.5	10.5
		134	11.5	10.5
		142	11.5	10.5
		151	9.0	8.0
		159	9.0	8.0
	802.11ac (80MHz)	42	13.0	12.0
		58	13.0	12.0
		106	13.0	12.0
		122	13.0	12.0
		138	13.0	12.0
		155	11.5	10.5

Table 7.4.3 Nominal and Maximum Output Power Spec

Mode	Freq. (MHz)	Channel	IEEE 802.11a (5 GHz) Conducted Power[dBm]
802.11a	5180	36	13.58
	5200	40	13.63
	5220	44	13.60
	5240	48	13.71
	5260	52	13.85
	5280	56	13.84
	5300	**60**	**13.87**
	5320	64	13.80
	5500	100	13.50
	5600	120	14.21
	5660	132	14.28
	5700	**140**	**14.46**
	5745	**149**	**13.62**
	5785	157	13.27
	5825	165	13.51

Table 7.4.4 IEEE 802.11a Average RF Power

Mode	Freq. (MHz)	Channel	IEEE 802.11n HT20 (5 GHz) Conducted Power[dBm]
802.11n (HT-20)	5180	36	12.47
	5200	40	12.55
	5220	44	12.51
	5240	48	12.86
	5260	52	12.95
	5280	56	12.90
	5300	60	12.93
	5320	64	12.89
	5500	100	12.58
	5600	120	13.13
	5660	132	13.08
	5700	140	13.71
	5745	149	12.73
	5785	157	12.41
	5825	165	12.65

Table 7.4.5 IEEE 802.11n HT20 Average RF Power

Mode	Freq. (MHz)	Channel	IEEE 802.11ac VHT20 (5 GHz) Conducted Power[dBm]
802.11ac (VHT-20)	5180	36	11.56
	5200	40	11.59
	5220	44	11.56
	5240	48	11.73
	5260	52	11.69
	5280	56	11.76
	5300	60	11.82
	5320	64	11.74
	5500	100	11.51
	5600	120	12.15
	5660	132	12.09
	5700	140	12.49
	5745	149	11.72
	5785	157	11.41
	5825	165	11.46

Table 7.4.6 IEEE 802.11ac VHT20 Average RF Power

Mode	Freq. (MHz)	Channel	IEEE 802.11n HT40 (5 GHz) Conducted Power[dBm]
802.11n (HT-40)	5190	38	11.16
	5230	46	11.19
	5270	54	11.18
	5310	62	10.11
	5510	102	10.70
	5590	118	10.57
	5670	134	10.81
	5755	151	8.93
	5795	159	7.76

Table 7.4.7 IEEE 802.11n HT40 Average RF Power

Mode	Freq. (MHz)	Channel	IEEE 802.11ac VHT40 (5 GHz) Conducted Power[dBm]
802.11ac (VHT-40)	5190	38	11.17
	5230	46	11.13
	5270	54	11.07
	5310	62	9.96
	5510	102	10.55
	5590	118	10.54
	5670	134	10.97
	5755	151	8.84
	5795	159	7.81

Table 7.4.8 IEEE 802.11ac VHT40 Average RF Power

Mode	Freq. (MHz)	Channel	IEEE 802.11ac VHT80 (5 GHz) Conducted Power[dBm]
802.11ac (VHT-80)	5210	42	12.74
	5290	58	12.83
	5530	106	12.64
	5610	122	12.53
	5775	155	11.41

Table 7.4.9 IEEE 802.11ac VHT80 Average RF Power

Justification for reduced test configurations for WIFI channels 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, duo to an even number of channels, both channels were measured.
- Output Power and SAR is not required for 802.11 g/n HT20/ac VHT20 channels when the highest reported SAR for DSSS is adjusted by the ratio of OFDM to DSSS specified maximum output power and the adjust SAR is ≤ 1.2 W/kg.
- The underlined data rate and channel above were tested for SAR.

The average output powers of this device were tested by below configuration.

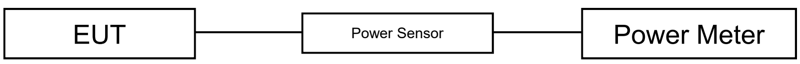


Figure 7.4 Power Measurement Setup

7.5 Bluetooth Conducted Powers

Frame Modulated Average[dBm]		Low Ch.	Mid Ch.	High Ch.
Bluetooth 1 Mbps	Maximum	7.0	8.0	7.0
	Nominal	6.0	7.0	6.0
Bluetooth 2 Mbps	Maximum	5.0	7.0	4.0
	Nominal	4.0	6.0	3.0
Bluetooth 3 Mbps	Maximum	5.0	7.0	4.0
	Nominal	4.0	6.0	3.0
Bluetooth LE	Maximum	-3.0	-1.0	-3.0
	Nominal	-4.0	-2.0	-4.0

Table 7.5.1 Nominal and Maximum Output Power Spec (Frame)

Channel	Frequency (MHz)	Frame AVG Output Power (1Mbps) (dBm)	Frame AVG Output Power (2Mbps) (dBm)	Frame AVG Output Power (3Mbps) (dBm)
Low	2402	6.41	4.89	4.89
Mid	2441	7.87	6.70	6.69
High	2480	6.10	3.93	3.92

Table 7.5.2 Bluetooth Frame Average RF Power

Channel	Frequency (MHz)	Frame AVG Output Power(LE) (dBm)
Low	2402	-3.08
Mid	2440	-1.77
High	2480	-3.15

Table 7.5.3 Bluetooth LE Frame Average RF Power

- **Bluetooth Conducted Powers procedures**

1. Bluetooth (BDR, EDR)
   1) Enter DUT mode in EUT and operate it.
      When it operating, The EUT is transmitting at maximum power level and duty cycle fixed.
   2) Instruments and EUT were connected like Figure 7.5.1(A).
   3) The maximum output powers of BDR(1 Mbps), EDR(2, 3 Mbps) and each frequency were set by a Bluetooth Tester.
   4) Power levels were measured by a Power Meter.

2. Bluetooth (LE)
   1) Enter LE mode in EUT and operate it.
      When it operating, The EUT is transmitting at maximum power level and duty cycle fixed.
   2) Instruments and EUT were connected like Figure 7.5.1(B).
   3) The average conducted output powers of LE and each frequency can measurement according to setting program in EUT.
   4) Power levels were measured by a Power Meter.

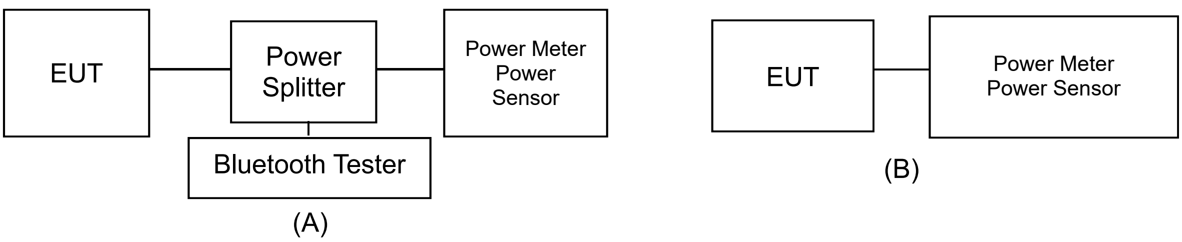


Figure 7.5.1 Average Power Measurement Setup

7.6 RFID Nominal and Maximum Output Power Spec and Conducted Powers

Band	Frequency [MHz]	Frame Modulated Average[dBm]	
		Maximum	Nominal
RFID	902.75 ~ 927.25 MHz	20.5	19.5

Table 7.6.1 RFID Nominal and Maximum Output Power Spec (Frame)

Band	Freq. (MHz)	Channel	RFID Frame AVG Conducted Power (dBm)
RFID	902.75	1	19.68
	914.75	25	19.45
	927.25	50	19.12

Table 7.6.2 RFID Frame Average RF Power

Figure 7.6.1 Power Measurement Setup

This device was tested with continuous modulated transmission and below duty cycle.

Duty Cycle = On time / (On time + OFF time)
= 41.67 ms / 204.3 ms
= 20.4 %

Channel	Frequency(MHz)	Duty Cycle [%]	Crest Factor
1	902.75	20.4	4.903
25	914.75	20.4	4.903
50	927.25	20.4	4.903

7.7 Bluetooth Conducted Powers

Frame Modulated Average[dBm]		
Bluetooth 1 Mbps	Maximum	9.5
	Nominal	8.5
Bluetooth 2 Mbps	Maximum	7.0
	Nominal	6.0
Bluetooth 3 Mbps	Maximum	7.0
	Nominal	6.0
Bluetooth (LE)	Maximum	6.5
	Nominal	5.5

Table 7.7.1 Nominal and Maximum Output Power Spec (Frame)

Channel	Frequency	Frame AVG Output Power (1Mbps)	Frame AVG Output Power (2Mbps)	Frame AVG Output Power (3Mbps)
	(MHz)	(dBm)	(dBm)	(dBm)
Low	2402	7.98	5.24	5.24
Mid	2441	8.25	5.49	5.49
High	2480	8.40	5.63	5.63

Table 7.7.2 Bluetooth Frame Average RF Power

Channel	Frequency	Frame AVG Output Power(LE)
	(MHz)	(dBm)
Low	2402	4.83
Mid	2440	5.32
High	2480	5.32

Table 7.7.3 Bluetooth LE Frame Average RF Power

- **Bluetooth Conducted Powers procedures**

1. Bluetooth (BDR, EDR)
   1) Enter DUT mode in EUT and operate it.
   When it operating, The EUT is transmitting at maximum power level and duty cycle fixed.
   2) Instruments and EUT were connected like Figure 7.7.1(A).
   3) The maximum output powers of BDR(1 Mbps), EDR(2, 3 Mbps) and each frequency were set by a Bluetooth Tester.
   4) Power levels were measured by a Power Meter.

2. Bluetooth (LE)
   1) Enter LE mode in EUT and operate it.
   When it operating, The EUT is transmitting at maximum power level and duty cycle fixed.
   2) Instruments and EUT were connected like Figure 7.7.1(B).
   3) The average conducted output powers of LE and each frequency can measurement according to setting program in EUT.
   4) Power levels were measured by a Power Meter.

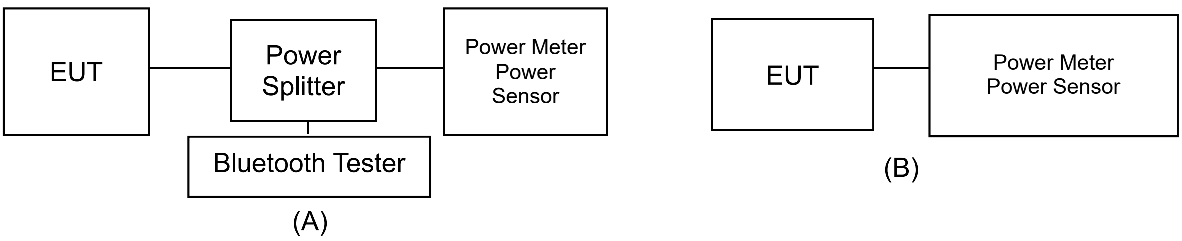


Figure 7.7.1 Average Power Measurement Setup

8. SYSTEM VERIFICATION

8.1 Tissue Verification

MEASURED TISSUE PARAMETERS										
Date(s)	Tissue Type	Ambient Temp.[°C]	Liquid Temp.[°C]	Measured Frequency [MHz]	Target Dielectric Constant, εr	Target Conductivity, σ (S/m)	Measured Dielectric Constant, εr	Measured Conductivity, σ (S/m)	Er Deviation [%]	σ Deviation [%]
Jul. 05. 2019	750 Body	21.5	21.7	707.5	55.699	0.960	56.964	0.925	2.27	-3.65
				750.0	55.531	0.963	56.591	0.962	1.91	-0.10
				782.0	55.406	0.966	56.295	0.994	1.60	2.90
				793.0	55.364	0.967	56.197	1.005	1.50	3.93
Jul. 01. 2019	835 Body	21.2	21.5	824.2	55.243	0.969	56.682	1.001	2.60	3.30
				826.4	55.235	0.969	56.668	1.002	2.59	3.41
				829.0	55.223	0.970	56.647	1.004	2.58	3.51
				835.0	55.200	0.970	56.598	1.008	2.53	3.92
				836.5	55.197	0.971	56.585	1.009	2.51	3.91
				836.6	55.197	0.971	56.583	1.009	2.51	3.91
				844.0	55.172	0.981	56.494	1.013	2.40	3.26
				846.6	55.166	0.984	56.461	1.015	2.35	3.15
				848.8	55.160	0.986	56.435	1.017	2.31	3.14
Jul. 22. 2019	900 Body	21.1	21.5	900.00	55.000	1.050	56.947	1.066	3.54	1.52
				902.75	55.000	1.051	56.929	1.068	3.51	1.62
				914.75	55.000	1.059	56.920	1.089	3.49	2.83
				927.25	54.978	1.065	56.821	1.100	3.35	3.29
Jul. 03. 2019	1800 Body	21.3	21.5	1712.4	53.596	1.464	52.519	1.492	-2.01	1.91
				1720.0	53.580	1.469	52.479	1.498	-2.05	1.97
				1732.4	53.556	1.477	52.426	1.509	-2.11	2.17
				1732.5	53.556	1.477	52.426	1.509	-2.11	2.17
				1745.0	53.530	1.485	52.381	1.520	-2.15	2.36
				1752.6	53.516	1.489	52.349	1.527	-2.18	2.55
				1800.0	53.300	1.520	52.170	1.563	-2.12	2.83
Jul. 02. 2019	1900 Body	21.4	21.6	1850.2	53.300	1.520	52.109	1.489	-2.23	-2.04
				1852.4	53.300	1.520	52.102	1.491	-2.25	-1.91
				1860.0	53.300	1.520	52.094	1.500	-2.26	-1.32
				1880.0	53.300	1.520	52.075	1.521	-2.30	0.07
				1900.0	53.300	1.520	52.039	1.537	-2.37	1.12
				1907.6	53.300	1.520	52.020	1.543	-2.40	1.51
				1909.8	53.300	1.520	52.015	1.544	-2.41	1.58
Jul. 08. 2019	2450 Body	21.1	21.3	2412.0	52.751	1.914	54.561	1.913	3.43	-0.05
				2437.0	52.717	1.938	54.485	1.940	3.35	0.10
				2450.0	52.700	1.950	54.441	1.957	3.30	0.36
				2462.0	52.685	1.967	54.409	1.973	3.27	0.31

MEASURED TISSUE PARAMETERS										
Date(s)	Tissue Type	Ambient Temp.[°C]	Liquid Temp.[°C]	Measured Frequency [MHz]	Target Dielectric Constant, εr	Target Conductivity, σ (S/m)	Measured Dielectric Constant, εr	Measured Conductivity, σ (S/m)	Er Deviation [%]	σ Deviation [%]
Jul. 04. 2019	2600 Body	21.2	21.3	2506.0	52.629	2.029	51.717	2.022	-1.73	-0.34
				2510.0	52.624	2.035	51.707	2.026	-1.74	-0.44
				2535.0	52.592	2.071	51.636	2.055	-1.82	-0.77
				2549.5	52.574	2.090	51.588	2.071	-1.88	-0.91
				2560.0	52.560	2.106	51.554	2.084	-1.91	-1.04
				2593.0	52.518	2.153	51.453	2.124	-2.03	-1.35
				2600.0	52.509	2.163	51.434	2.133	-2.05	-1.39
				2636.5	52.463	2.214	51.330	2.179	-2.16	-1.58
				2680.0	52.407	2.276	51.195	2.229	-2.31	-2.07
Jul. 09. 2019	5300 Body	21.5	21.8	5260.0	48.933	5.369	48.453	5.461	-0.98	1.71
				5270.0	48.919	5.381	48.430	5.477	-1.00	1.78
				5280.0	48.906	5.393	48.423	5.493	-0.99	1.85
				5290.0	48.892	5.404	48.414	5.504	-0.98	1.85
				5300.0	48.879	5.416	48.390	5.516	-1.00	1.85
				5310.0	48.865	5.428	48.353	5.529	-1.05	1.86
				5320.0	48.851	5.439	48.337	5.545	-1.05	1.95
Jul. 10. 2019	5600 Body	21.2	21.5	5500.0	48.607	5.650	47.611	5.791	-2.05	2.50
				5510.0	48.594	5.661	47.599	5.803	-2.05	2.51
				5530.0	48.566	5.685	47.546	5.829	-2.10	2.53
				5550.0	48.539	5.708	47.512	5.858	-2.12	2.63
				5580.0	48.499	5.743	47.435	5.898	-2.19	2.70
				5600.0	48.471	5.766	47.398	5.932	-2.21	2.88
				5660.0	48.390	5.836	47.285	6.017	-2.28	3.10
				5670.0	48.376	5.848	47.263	6.030	-2.30	3.11
				5690.0	48.349	5.872	47.209	6.059	-2.36	3.18
				5700.0	48.336	5.883	47.184	6.074	-2.38	3.25
Jul. 10. 2019	5800 Body	21.2	21.5	5745.0	48.275	5.936	47.099	6.142	-2.44	3.47
				5755.0	48.261	5.947	47.081	6.160	-2.45	3.58
				5775.0	48.234	5.971	47.048	6.187	-2.46	3.62
				5785.0	48.220	5.982	47.027	6.200	-2.47	3.64
				5795.0	48.207	5.994	46.999	6.214	-2.51	3.67
				5800.0	48.200	6.000	46.984	6.222	-2.52	3.70
				5825.0	48.166	6.029	46.936	6.262	-2.55	3.86

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 865664 and IEEE 1528-2013 6.6.1.2). The tissue parameters listed in the SAR test plots may slightly differ from the table above due to significant digit rounding in the software.

Measurement Procedure for Tissue verification:

1) The network analyzer and probe system was configured and calibrated.
2) The probe was immersed in the sample which 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 , for example 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 $j = \sqrt{-1}$.

8.2 Test System Verification

Prior to assessment, the system is verified to the ± 10 % of the specifications by using the SAR Dipole kit(s). (Graphic Plots Attached)

Table 8.2.1 System Verification Results (10g)

SYSTEM DIPOLE VERIFICATION TARGET & MEASURED												
SAR System #	Freq. [MHz]	SAR Dipole kits	Date(s)	Tissue Type	Ambient Temp. [°C]	Liquid Temp. [°C]	Probe S/N	Input Power (mW)	1 W Target SAR_{10g} (W/kg)	Measured SAR_{10g} (W/kg)	1 W Normalized SAR_{10g} (W/kg)	Deviation [%]
B	750	D750V3, SN:1049	Jul. 05. 2019	Body	21.5	21.7	3933	250	5.75	1.42	5.68	-1.22
B	835	D835V2, SN:4d159	Jul. 01. 2019	Body	21.2	21.5	3933	250	6.28	1.48	5.92	-5.73
B	900	D900V2, SN: 1d175	Jul. 22. 2019	Body	21.1	21.5	3933	250	7.16	1.72	6.88	-3.91
B	1800	D1800V2, SN:2d047	Jul. 03. 2019	Body	21.3	21.5	3933	100	20.0	1.83	18.30	-8.50
B	1900	D1900V2, SN:5d176	Jul. 02. 2019	Body	21.4	21.6	3933	100	20.9	2.05	20.50	-1.91
B	2450	D2450V2, SN: 920	Jul. 08. 2019	Body	21.1	21.3	3933	100	24.6	2.45	24.50	-0.41
B	2600	D2600V2, SN: 1016	Jul. 04. 2019	Body	21.2	21.3	3933	100	23.9	2.46	24.60	2.93
B	5300	D5GHzV2, SN:1103	Jul. 09. 2019	Body	21.5	21.8	3933	100	20.9	2.03	20.30	-2.87
B	5600	D5GHzV2, SN:1103	Jul. 10. 2019	Body	21.2	21.5	3933	100	22.3	2.19	21.90	-1.79
B	5800	D5GHzV2, SN:1103	Jul. 10. 2019	Body	21.2	21.5	3933	100	20.9	2.08	20.80	-0.48

Note: Full system validation status and results can be found in Attachment 3.

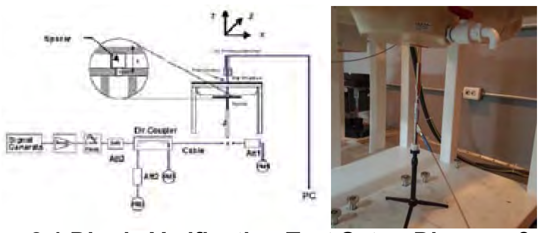


Figure 8.1 Dipole Verification Test Setup Diagram & Photo

9. SAR TEST RESULTS

9.1 Extremity SAR Results

Table 9.1.1 GSM/PCS/GPRS/WCDMA Extremity SAR

MEASUREMENT RESULTS														
FREQUENCY		Mode/ Band	Service	Maximum Allowed Power [dBm]	Conducted Power [dBm]	Drift Power [dB]	Spacing [Side]	Device Serial Number	# of Time Slots	Duty Cycle	10g SAR (W/kg)	Scaling Factor	10g Scaled SAR (W/kg)	Plots #
MHz	Ch													
836.6	190	GSM850	GSM	33.00	32.60	0.020	0 mm [Bottom and pistol grip]	FCC #1	1	1:8.3	0.219	1.096	0.240	
836.6	190	GSM850	GPRS	29.00	28.76	-0.060	0 mm [Bottom and pistol grip]	FCC #1	4	1:2.075	0.359	1.057	**0.379**	A1
1880.0	661	PCS1900	PCS	30.00	29.89	-0.040	0 mm [Bottom and pistol grip]	FCC #1	1	1:8.3	0.100	1.026	0.103	
1880.0	661	PCS1900	GPRS	26.00	25.71	-0.030	0 mm [Bottom and pistol grip]	FCC #1	4	1:2.075	0.136	1.069	**0.145**	A2
836.6	4183	WCDMA 850	RMC	22.40	22.26	-0.040	0 mm [Bottom and pistol grip]	FCC #1	N/A	1:1	0.229	1.033	**0.237**	A3
1732.4	1412	WCDMA 1700	RMC	23.00	22.97	-0.040	0 mm [Bottom and pistol grip]	FCC #1	N/A	1:1	0.119	1.007	**0.120**	A4
1880.0	9400	WCDMA 1900	RMC	23.00	22.91	0.030	0 mm [Bottom and pistol grip]	FCC #1	N/A	1:1	0.171	1.021	**0.175**	A5
ANSI / IEEE C95.1-1992– SAFETY LIMIT Spatial Peak Uncontrolled Exposure/General Population Exposure								**Extremity 4.0 W/kg (mW/g)** averaged over 10 gram						

Table 9.1.2 LTE B12, B13, B14, B4, B2, B7, B41 Extremity SAR

MEASUREMENT RESULTS																	
FREQUENCY		Mode/ Band	BW [MHz]	Max Allowed Power [dBm]	Cond. PWR [dBm]	Drift Power [dB]	MPR	Position	Device Serial Number	Mod.	RB Size	RB Offs.	Duty Cycle	10g SAR (W/kg)	Scaling Factor	10g Scaled SAR (W/kg)	Plots #
MHz	Ch																
707.5	23095	LTE B12	10	24.00	23.87	-0.190	0	0 mm [Bottom and pistol grip]	FCC #1	QPSK	1	49	1:1	0.164	1.030	**0.169**	A6
707.5	23095	LTE B12	10	23.00	22.76	0.030	1	0 mm [Bottom and pistol grip]	FCC #1	QPSK	25	0	1:1	0.115	1.057	0.122	
782.0	23230	LTE B13	10	24.00	23.78	0.160	0	0 mm [Bottom and pistol grip]	FCC #1	QPSK	1	49	1:1	0.275	1.052	**0.289**	A7
782.0	23230	LTE B13	10	23.00	22.59	-0.140	1	0 mm [Bottom and pistol grip]	FCC #1	QPSK	25	25	1:1	0.218	1.099	0.240	
793.0	23330	LTE B14	10	23.50	23.48	0.020	0	0 mm [Bottom and pistol grip]	FCC #1	QPSK	1	25	1:1	0.201	1.005	**0.202**	A8
793.0	23330	LTE B14	10	22.50	22.43	-0.000	1	0 mm [Bottom and pistol grip]	FCC #1	QPSK	25	12	1:1	0.172	1.016	0.175	
836.5	20525	LTE B5	10	24.00	23.72	-0.170	0	0 mm [Bottom and pistol grip]	FCC #1	QPSK	1	49	1:1	0.223	1.067	**0.238**	A9
836.5	20525	LTE B5	10	23.00	22.49	-0.030	1	0 mm [Bottom and pistol grip]	FCC #1	QPSK	25	25	1:1	0.175	1.125	0.197	
1732.5	20175	LTE B4	20	23.50	23.46	-0.000	0	0 mm [Bottom and pistol grip]	FCC #1	QPSK	1	50	1:1	0.127	1.009	**0.128**	A10
1732.5	20175	LTE B4	20	22.50	22.19	-0.010	1	0 mm [Bottom and pistol grip]	FCC #1	QPSK	50	25	1:1	0.100	1.074	0.107	
1900.0	19100	LTE B2	20	24.00	23.98	-0.070	0	0 mm [Bottom and pistol grip]	FCC #1	QPSK	1	50	1:1	0.191	1.005	**0.192**	A11
1900.0	19100	LTE B2	20	23.00	22.87	-0.020	1	0 mm [Bottom and pistol grip]	FCC #1	QPSK	50	25	1:1	0.145	1.030	0.149	
2535.0	21100	LTE B7	20	22.00	21.98	-0.000	0	0 mm [Bottom and pistol grip]	FCC #1	QPSK	1	50	1:1	0.185	1.005	**0.186**	A12
2535.0	21100	LTE B7	20	21.00	20.87	-0.070	1	0 mm [Bottom and pistol grip]	FCC #1	QPSK	50	25	1:1	0.160	1.030	0.165	
2593.0	40620	LTE B41	20	24.00	23.98	0.140	0	0 mm [Bottom and pistol grip]	FCC #1	QPSK	1	50	1:1.58	0.149	1.005	**0.150**	A13
2593.0	40620	LTE B41	20	23.00	22.83	0.040	1	0 mm [Bottom and pistol grip]	FCC #1	QPSK	50	25	1:1.58	0.122	1.040	0.127	
ANSI / IEEE C95.1-1992– SAFETY LIMIT Spatial Peak Uncontrolled Exposure/General Population Exposure									**Extremity 4.0 W/kg (mW/g)** averaged over 10 gram								

Table 9.1.3 DTS Extremity SAR

MEASUREMENT RESULTS															
FREQUENCY		Mode	Maximum Allowed Power [dBm]	Conducted Power [dBm]	Drift Power [dB]	Phantom Position	Device Serial Number	Peak SAR of Area Scan	Data Rate [Mbps]	Duty Cycle	10g SAR (W/kg)	Scaling Factor	Scaling Factor (Duty Cycle)	SAR (W/kg)	Plots #
MHz	Ch														
2462.0	11	802.11b	13.30	12.93	0.150	0 mm [Bottom and pistol grip]	FCC #1	0.013	1	97.5	0.006	1.089	1.026	**0.007**	A14
ANSI / IEEE C95.1-1992– SAFETY LIMIT Spatial Peak Uncontrolled Exposure/General Population Exposure								**Extremity 4.0 W/kg (mW/g)** averaged over 10 gram							

Adjusted SAR results for OFDM SAR												
FREQUENCY		Mode/ Antenna	Service	Maximum Allowed Power [dBm]	10g Scaled SAR (W/kg)	FREQUENCY [MHz]	Mode	Service	Maximum Allowed Power [dBm	Ratio of OFDM to DSSS	10g Adjusted SAR (W/kg)	Determine OFDM SAR
MHz	Ch											
2462.0	11	802.11b	DSSS	13.30	0.007	2437	802.11g	OFDM	13.30	1.000	**0.007**	X
2462.0	11	802.11b	DSSS	13.30	0.007	2437	802.11n	OFDM	13.30	1.000	**0.007**	X
2462.0	11	802.11b	DSSS	13.30	0.007	2437	802.11ac	OFDM	13.30	1.000	**0.007**	X
ANSI / IEEE C95.1-1992– SAFETY LIMIT Spatial Peak Uncontrolled Exposure/General Population Exposure						**Extremity 4.0 W/kg (mW/g)** averaged over 10 gram						

Note: SAR is not required for the following 2.4 GHz OFDM conditions. When the highest reported SAR for DSSS is adjusted by the ratio of OFDM to DSSS specified maximum output power and the adjusted SAR is ≤ 3.0 W/kg.

Table 9.1.4 UNII Extremity SAR

MEASUREMENT RESULTS														
FREQUENCY		Mode	Maximum Allowed Power [dBm]	Conducted Power [dBm]	Drift Power [dB]	Phantom Position	Device Serial Number	Peak SAR of Area Scan	Data Rate [Mbps]	Duty Cycle	10g SAR (W/kg)	Scaling Factor	Scaling Factor (Duty Cycle)	10g Scaled SAR (W/kg)	Plots #
MHz	Ch														
5300.0	60	802.11a	14.00	13.87	0.000	0 mm [Bottom and pistol grip]	FCC #1	0.032	6	86.6	0.026	1.030	1.155	**0.031**	A15
ANSI / IEEE C95.1-2005– SAFETY LIMIT Spatial Peak Uncontrolled Exposure/General Population Exposure								Extremity 4.0 W/kg (mW/g) averaged over 10 gram							

Adjusted SAR results for UNII-1 and UNII-2A SAR												
FREQUENCY		Mode/ Antenna	Service	Maximum Allowed Power [dBm]	10g Scaled SAR (W/kg)	FREQUENCY [MHz]	Mode	Service	Maximum Allowed Power [dBm	Adjusted Factor	10g Adjusted SAR (W/kg)	SAR for the band with lower maximum output power
MHz	Ch											
5300.0	60	802.11a	OFDM	14.0	0.031	5240	802.11a	OFDM	14.0	1.000	**0.031**	X
5300.0	60	802.11a	OFDM	14.0	0.031	5240	802.11a	OFDM	14.0	1.000	**0.031**	X
5300.0	60	802.11a	OFDM	14.0	0.031	5240	802.11a	OFDM	14.0	1.000	**0.031**	X
ANSI / IEEE C95.1-1992– SAFETY LIMIT Spatial Peak Uncontrolled Exposure/General Population Exposure						Extremity 4.0 W/kg (mW/g) averaged over 10 gram						

Note(s):

1. U-NII-1 and U-NII-2A Bands: When different maximum output power is specified for the bands, begin SAR measurement in the band with higher specified maximum output power. The highest reported SAR for the tested configuration is adjusted by the ratio of lower to higher specified maximum output power for the two bands. When the adjusted SAR is ≤ 3.0 W/kg, SAR is not required for the band with lower maximum output power in that test configuration.

Table 9.1.5 UNII Extremity SAR

MEASUREMENT RESULTS														
FREQUENCY		Mode	Maximum Allowed Power [dBm]	Conducted Power [dBm]	Drift Power [dB]	Phantom Position	Device Serial Number	Peak SAR of Area Scan	Data Rate [Mbps]	Duty Cycle	10g SAR (W/kg)	Scaling Factor	Scaling Factor (Duty Cycle)	10g Scaled SAR (W/kg)	Plots #
MHz	Ch														
5700.0	140	802.11a	14.50	14.46	-0.170	0 mm [Bottom and pistol grip]	FCC #1	0.049	6	87.3	0.043	1.009	1.145	**0.050**	A16
5745.0	149	802.11a	14.00	13.62	0.080	0 mm [Bottom and pistol grip]	FCC #1	0.036	6	87.3	0.033	1.091	1.145	**0.041**	A17
ANSI / IEEE C95.1-1992– SAFETY LIMIT Spatial Peak Uncontrolled Exposure/General Population Exposure								Extremity 4.0 W/kg (mW/g) averaged over 10 gram							

Table 9.1.6 RFID Extremity SAR

MEASUREMENT RESULTS											
FREQUENCY		Mode	Maximum Allowed Power [dBm]	Conducted Power [dBm]	Drift Power [dB]	Phantom Position	Device Serial Number	10g SAR (W/kg)	Scaling Factor	10g Scaled SAR (W/kg)	Plots #
MHz	Ch										
914.75	25	RFID	20.50	19.45	-0.040	0 mm [Top]	FCC #1	0.009	1.274	0.011	
914.75	25	RFID	20.50	19.45	-0.110	0 mm [Bottom]	FCC #1	0.095	1.274	0.121	
914.75	25	RFID	20.50	19.45	0.180	0 mm [Rear]	FCC #1	0.000441	1.274	0.001	
914.75	25	RFID	20.50	19.45	-0.040	0 mm [Right]	FCC #1	0.142	1.274	0.181	
914.75	25	RFID	20.50	19.45	0.100	0 mm [Left]	FCC #1	0.200	1.274	0.255	
914.75	25	RFID	20.50	19.45	-0.060	0 mm [pistol grip]	FCC #1	0.234	1.274	**0.298**	A18
ANSI / IEEE C95.1-1992– SAFETY LIMIT Spatial Peak Uncontrolled Exposure/General Population Exposure							Extremity 4.0 W/kg (mW/g) averaged over 10 gram				

9.2 SAR Test Notes

General Notes:

1. The test data reported are the worst-case SAR values according to test procedures specified in IEEE 1528-2013, and FCC KDB Publication 447498 D01v06.
2. Batteries are fully charged at the beginning of the SAR measurements. A standard battery was used for all 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. SAR measurements were performed using the DASY5 automated system. The procedure for spatial peak SAR evaluation has been implemented according to the IEEE 1528 standard. During a maximum search, global and local maxima searches are automatically performed in 2-D after each area scan measurement. The algorithm will find the global maximum and all local maxima within 2 dB of the global maxima for all SAR distributions. All local maxima within 2 dB of the global maximum were searched and passed for the Zoom Scan measurement.

GSM Notes:

1. Justification for reduced test configurations per KDB Publication 941225 D01v03r01 and October2013 TCB Workshop Notes: The source-based frame-averaged output power was evaluated for all GPRS/EDGE slot configurations.
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 then testing at the other channels is not required for such test configuration(s). Since the maximum output power variation across the required test channels is not > ½ dB, the middle channel was used for testing.

WCDMA (UMTS) Notes:

1. WCDMA (UMTS) mode in was tested under RMC 12.2 kbps with HSPA Inactive per KDB Publication 941225 D01v03r01. AMR and HSPA SAR was not required since the average output power of the HSPA subtests was not more than 0.25 dB higher than the RMC level and SAR was less than 1.2 W/kg.
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 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 Considerations: LTE test configurations are determined according to SAR Evaluation Considerations for LTE Devices in FCC KDB Publication 941225 D05v02r05. The general test procedures used for testing can be found in Section 6.4.4.
2. According to FCC KDB 941225 D05v02r05, when the reported SAR is ≤ 0.8 W/kg, testing of the 100% RB allocation and required test channels is not required.
   Otherwise, SAR is required for the remaining required test channels using the 1 RB, 50% RB and 100% RB allocation with highest output power for that channel.
   Only one channel, and as reported SAR values for 1 RB allocation and 50% RB allocation were less than 1.45 W/kg only the highest power RB offset for each allocation was required.
3. 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 TS 36.101 Section 6.2.3 – 6.2.5 under Table 6.2.3-1.
4. A-MPR was disabled for all SAR tests by setting NS=1 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).
5. Per FCC KDB Publication 447498 D01v06, when the reported (scaled) for 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, testing at the other channels was required for such test configurations.
6. TDD LTE was tested per the guidance provided in FCC KDB Publication 941225 D05v02r05. Testing was performed using UL-DL configuration 0 with 6 UL sub frames and 2S sub frames using extended cyclic prefix only and special sub frame configuration 6. SAR tests were performed at maximum output power and worst-case transmission duty factor in extended cyclic prefix. Per 3GPP 36.211 Sec. 4, the duty factor using extended cyclic prefix is 0.633 (cf=1.58).
7. SAR test reduction is applied using the following criteria:
   Start with the largest channel bandwidth and measure SAR for QPSK with 1 RB, and 50% RB allocation, using the RB offset and required test channel combination with the highest maximum output power among RB offsets at the upper edge, middle and lower edge of each required test channel. When the reported SAR is > 0.8 W/kg, testing for other channels is performed at the highest output power level for 1 RB, and 50% RB configuration for that channel. Testing for 100% RB configuration is performed at the highest output power level for 100% RB configuration across the Low, Mid and High channel when the highest reported SAR for 1 RB and 50% RB are > 0.8 W/kg, Testing for the remaining required channels is not needed because the reported SAR for 100% RB Allocation < 1.45 W/kg. Testing for 16QAM modulation is not required because the reported SAR for QPSK is < 1.45 W/kg and its output power is not more than 0.5 dB higher than that a QPSK. Testing for the other channel bandwidths is not required because the reported SAR for the highest channel bandwidth is < 1.45 W/kg and its output power is not more than 0.5 dB higher than that of the highest channel bandwidth.

WLAN Notes:

1. The initial test position procedures were applied. The test position with the highest extrapolated peak SAR will be used as the initial test position. When reported SAR for the initial test position is ≤ 0.4 W/kg, no additional testing for the remaining test positions was required. Otherwise, SAR is evaluated at the subsequent highest peak SAR positions until the reported SAR result is ≤ 0.8 W/kg or all test positions are measured.
2. 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 duo to the maximum allowed powers and the highest reported DSSS SAR when the highest reported SAR for DSSS is adjusted by the ratio of OFDM to DSSS specified maximum output and the adjust SAR is ≤ 1.2 W/kg.
3. Justification for test configurations for WLAN per KDB Publication 248227 D01v02r02 for 5 GHz WIFI single transmission chain operations, the initial test configuration was selected according to the transmission mode with the highest maximum allowed powers. Other transmission modes were not investigated since the highest reported SAR for initial test configuration adjusted by the ratio of maximum output powers is less than 1.2 W/kg.
4. When the maximum reported 1g averaged SAR ≤ 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 or all test channels were measured.
5. The device was configured to transmit continuously at the required data rate, channel bandwidth and signal modulation, using the highest transmission duty factor to determine compliance.

10. FCC MULTI-TX AND ANTENNA SAR CONSIDERATIONS

10.1 Introduction

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

10.2 Simultaneous Transmission Procedures

This device contains transmitters that may operate simultaneously. Therefore simultaneous transmission analysis is required. Per FCC KDB 447498 D01v06 4.3.2 and IEEE 1528-2013 Section 6.3.4.1.2,simultaneous transmission SAR test exclusion may be applied when the sum of the sum 1-g SAR for all the simultaneous transmitting antennas in a specific a physical test configuration is $\leq$ 1.6 W/kg. The different test positon in an exposure condition may be considered collectively to determine SAR test exclusion according to the sum of 1-g or 10-g SAR.

Table 10.2.1 Estimated SAR (Extremity)

Mode	Frequency	Maximum Allowed Power		Separation Distance (Extremity)	Estimated SAR (Extremity)
	[MHz]	[dBm]	[mW]	[mm]	[W/kg]
Bluetooth (Mobile Computer)	2441	8.0	6	5	0.105
Bluetooth (RFID/USN Wireless Device)	2480	9.5	9	5	0.150

10.3 Simultaneous Transmission Capabilities

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

Table 10.3.1 Simultaneous Transmission Scenarios

No.	Capable TX Configuration	GSM 850/1900 (Voice)	GPRS/EDGE 850/1900 (Data)	WCDMA B5/B4/B2 (Voice)	WCDMA B5/B4/B2 (Data)	LTE B12/B13/B14/B17 /B5/B4/B2/B41	WIFI 2.4GHz 802.11b/g/n/ac	WIFI 5GHz 802.11a/n/ac	Bluetooth 2.4GHz Mobile Computer	RFID 900MHz	Bluetooth 2.4GHz RFID/USN Wireless Device
1	GSM 850/1900 (Voice)		No	No	No	No	Yes	Yes	Yes	Yes	Yes
2	GPRS/EDGE 850/1900 (Data)	No		No	No	No	Yes	Yes	Yes	Yes	Yes
3	WCDMA B5/B4/B2 (Voice)	No	No		No	No	Yes	Yes	Yes	Yes	Yes
4	WCDMA B5/B4/B2 (Data)	No	No	No		No	Yes	Yes	Yes	Yes	Yes
5	LTE B12/B13/B14/B17 /B5/B4/B2/B41	No	No	No	No		Yes	Yes	Yes	Yes	Yes
6	WIFI 2.4GHz 802.11b/g/n/ac	Yes	Yes	Yes	Yes	Yes		Yes	No	Yes	Yes
7	WIFI 5GHz 802.11a/n/ac	Yes	Yes	Yes	Yes	Yes	Yes		Yes	Yes	Yes
7	Bluetooth 2.4GHz Mobile Computer	Yes	Yes	Yes	Yes	Yes	No	Yes		Yes	Yes
8	RFID 900MHz	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes		Yes
9	Bluetooth 2.4GHz RFID/USN Wireless Device	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	

Table 10.3.2 Simultaneous SAR Cases

No.	Capable Transmit Configuration	Extremity SAR	Note
1	GSM Voice + Wi-Fi 2.4 GHz	Yes	
2	GSM Voice + Wi-Fi 5 GHz	Yes	
3	GSM Voice + Bluetooth 2.4 GHz	Yes	
4	GSM Voice + Bluetooth 2.4 GHz + Wi-Fi 5GHz	Yes	
5	GSM Voice + Bluetooth 2.4 GHz + Wi-Fi 5GHz + RFID	Yes	
6	GSM Voice + Bluetooth 2.4 GHz + Wi-Fi 5GHz + RFID + Bluetooth 2.4 GHz	Yes	
7	WCDMA + Wi-Fi 2.4 GHz	Yes	
8	WCDMA + Wi-Fi 5 GHz	Yes	* Hotspot of UNII-1 & UNII-3 can be operated simultaneous transmission.
9	WCDMA + Bluetooth 2.4 GHz	Yes	
10	WCMDA + Bluetooth 2.4 GHz + Wi-Fi 5GHz	Yes	* Hotspot of UNII-1 & UNII-3 can be operated simultaneous transmission.
11	WCMDA + Bluetooth 2.4 GHz + Wi-Fi 5GHz + RFID	Yes	* Hotspot of UNII-1 & UNII-3 can be operated simultaneous transmission.
12	WCMDA + Bluetooth 2.4 GHz + Wi-Fi 5GHz + RFID + Bluetooth 2.4 GHz	Yes	* Hotspot of UNII-1 & UNII-3 can be operated simultaneous transmission.
13	LTE + Wi-Fi 2.4 GHz	Yes	
14	LTE + Wi-Fi 5 GHz	Yes	* Hotspot of UNII-1 & UNII-3 can be operated simultaneous transmission.
15	LTE + Bluetooth 2.4 GHz	Yes	
16	LTE + Bluetooth 2.4 GHz + Wi-Fi 5GHz	Yes	* Hotspot of UNII-1 & UNII-3 can be operated simultaneous transmission.
17	LTE + Bluetooth 2.4 GHz + Wi-Fi 5GHz + RFID	Yes	* Hotspot of UNII-1 & UNII-3 can be operated simultaneous transmission.
18	LTE + Bluetooth 2.4 GHz + Wi-Fi 5GHz + RFID + Bluetooth 2.4 GHz	Yes	* Hotspot of UNII-1 & UNII-3 can be operated simultaneous transmission.
19	GPRS/EDGE + Wi-Fi 2.4 GHz	Yes	
20	GPRS/EDGE + Wi-Fi 5 GHz	Yes	* Hotspot of UNII-1 & UNII-3 can be operated simultaneous transmission.
21	GPRS/EDGE + Bluetooth 2.4 GHz	Yes	
22	GPRS/EDGE + Bluetooth 2.4 GHz + Wi-Fi 5GHz	Yes	* Hotspot of UNII-1 & UNII-3 can be operated simultaneous transmission.
23	GPRS/EDGE + Bluetooth 2.4 GHz + Wi-Fi 5GHz + RFID	Yes	* Hotspot of UNII-1 & UNII-3 can be operated simultaneous transmission.
24	GPRS/EDGE + Bluetooth 2.4 GHz + Wi-Fi 5GHz + RFID + Bluetooth 2.4 GHz	Yes	* Hotspot of UNII-1 & UNII-3 can be operated simultaneous transmission.

Notes:

1. Bluetooth and WiFi can not transmit simultaneously at 2.4G band.
2. GSM, WCDMA and LTE can not transmit simultaneously since they share the same chip.

10.4 Extremity Simultaneous Transmission Analysis

Table 10.4.1 Simultaneous Transmission Scenario : 2G/3G/4G + Bluetooth + 5.3 GHz W-LAN + RFID + Bluetooth (Extremity at 0 mm)

Exposure Condition	Mode	Configuration	2G/3G/4G SAR (W/kg)	Bluetooth SAR (W/kg)	5.3G W-LAN SAR (W/kg)	RFID SAR (W/kg)	Bluetooth SAR (W/kg)	ΣSAR (W/kg)
			1	2	3	4	5	1+2+3+4+5
Extremity SAR	GSM 850	Bottom and pistol grip	0.240	0.105	0.031	0.298	0.150	0.824
	GPRS 850	Bottom and pistol grip	0.379	0.105	0.031	0.298	0.150	**0.963**
	GSM 1900	Bottom and pistol grip	0.103	0.105	0.031	0.298	0.150	0.687
	GPRS 1900	Bottom and pistol grip	0.145	0.105	0.031	0.298	0.150	0.729
	WCDMA 850	Bottom and pistol grip	0.237	0.105	0.031	0.298	0.150	0.821
	WCDMA 1700	Bottom and pistol grip	0.120	0.105	0.031	0.298	0.150	0.704
	WCDMA 1900	Bottom and pistol grip	0.175	0.105	0.031	0.298	0.150	0.759
	LTE Band 12	Bottom and pistol grip	0.169	0.105	0.031	0.298	0.150	0.753
	LTE Band 13	Bottom and pistol grip	0.289	0.105	0.031	0.298	0.150	0.873
	LTE Band 14	Bottom and pistol grip	0.202	0.105	0.031	0.298	0.150	0.786
	LTE Band 5	Bottom and pistol grip	0.238	0.105	0.031	0.298	0.150	0.822
	LTE Band 4	Bottom and pistol grip	0.128	0.105	0.031	0.298	0.150	0.712
	LTE Band 2	Bottom and pistol grip	0.192	0.105	0.031	0.298	0.150	0.776
	LTE Band 7	Bottom and pistol grip	0.186	0.105	0.031	0.298	0.150	0.770
	LTE Band 41	Bottom and pistol grip	0.150	0.105	0.031	0.298	0.150	0.734

Table 10.4.2 Simultaneous Transmission Scenario : 2G/3G/4G + Bluetooth + 5.6 GHz W-LAN + RFID + Bluetooth (Extremity at 0 mm)

Exposure Condition	Mode	Configuration	2G/3G/4G SAR (W/kg)	Bluetooth SAR (W/kg)	5.6G W-LAN SAR (W/kg)	RFID SAR (W/kg)	Bluetooth SAR (W/kg)	ΣSAR (W/kg)
			1	2	3	4	5	1+2+3+4+5
Extremity SAR	GSM 850	Bottom and pistol grip	0.240	0.105	0.050	0.298	0.150	0.843
	GPRS 850	Bottom and pistol grip	0.379	0.105	0.050	0.298	0.150	**0.982**
	GSM 1900	Bottom and pistol grip	0.103	0.105	0.050	0.298	0.150	0.706
	GPRS 1900	Bottom and pistol grip	0.145	0.105	0.050	0.298	0.150	0.748
	WCDMA 850	Bottom and pistol grip	0.237	0.105	0.050	0.298	0.150	0.840
	WCDMA 1700	Bottom and pistol grip	0.120	0.105	0.050	0.298	0.150	0.723
	WCDMA 1900	Bottom and pistol grip	0.175	0.105	0.050	0.298	0.150	0.778
	LTE Band 12	Bottom and pistol grip	0.169	0.105	0.050	0.298	0.150	0.772
	LTE Band 13	Bottom and pistol grip	0.289	0.105	0.050	0.298	0.150	0.892
	LTE Band 14	Bottom and pistol grip	0.202	0.105	0.050	0.298	0.150	0.805
	LTE Band 5	Bottom and pistol grip	0.238	0.105	0.050	0.298	0.150	0.841
	LTE Band 4	Bottom and pistol grip	0.128	0.105	0.050	0.298	0.150	0.731
	LTE Band 2	Bottom and pistol grip	0.192	0.105	0.050	0.298	0.150	0.795
	LTE Band 7	Bottom and pistol grip	0.186	0.105	0.050	0.298	0.150	0.789
	LTE Band 41	Bottom and pistol grip	0.150	0.105	0.050	0.298	0.150	0.753

Table 10.4.3 Simultaneous Transmission Scenario : 2G/3G/4G + Bluetooth + 5.8 GHz W-LAN + RFID + Bluetooth (Extremity at 0 mm)

Exposure Condition	Mode	Configuration	2G/3G/4G SAR (W/kg)	Bluetooth SAR (W/kg)	5.8G W-LAN SAR (W/kg)	RFID SAR (W/kg)	Bluetooth SAR (W/kg)	ΣSAR (W/kg)
			1	2	3	4	5	1+2+3+4+5
Extremity SAR	GSM 850	Bottom and pistol grip	0.240	0.105	0.041	0.298	0.150	0.834
	GPRS 850	Bottom and pistol grip	0.379	0.105	0.041	0.298	0.150	**0.973**
	GSM 1900	Bottom and pistol grip	0.103	0.105	0.041	0.298	0.150	0.697
	GPRS 1900	Bottom and pistol grip	0.145	0.105	0.041	0.298	0.150	0.739
	WCDMA 850	Bottom and pistol grip	0.237	0.105	0.041	0.298	0.150	0.831
	WCDMA 1700	Bottom and pistol grip	0.120	0.105	0.041	0.298	0.150	0.714
	WCDMA 1900	Bottom and pistol grip	0.175	0.105	0.041	0.298	0.150	0.769
	LTE Band 12	Bottom and pistol grip	0.169	0.105	0.041	0.298	0.150	0.763
	LTE Band 13	Bottom and pistol grip	0.289	0.105	0.041	0.298	0.150	0.883
	LTE Band 14	Bottom and pistol grip	0.202	0.105	0.041	0.298	0.150	0.796
	LTE Band 5	Bottom and pistol grip	0.238	0.105	0.041	0.298	0.150	0.832
	LTE Band 4	Bottom and pistol grip	0.128	0.105	0.041	0.298	0.150	0.722
	LTE Band 2	Bottom and pistol grip	0.192	0.105	0.041	0.298	0.150	0.786
	LTE Band 7	Bottom and pistol grip	0.186	0.105	0.041	0.298	0.150	0.780
	LTE Band 41	Bottom and pistol grip	0.150	0.105	0.041	0.298	0.150	0.744

Table 10.4.4 Simultaneous Transmission Scenario : 2G/3G/4G + Bluetooth + 5.3 GHz W-LAN + RFID (Extremity at 0 mm)

Exposure Condition	Mode	Configuration	2G/3G/4G SAR (W/kg)	Bluetooth SAR (W/kg)	5.3G W-LAN SAR (W/kg)	RFID SAR (W/kg)	ΣSAR (W/kg)
			1	2	3	4	1+2+3+4
Extremity SAR	GSM 850	Bottom and pistol grip	0.240	0.105	0.031	0.298	0.674
	GPRS 850	Bottom and pistol grip	0.379	0.105	0.031	0.298	**0.813**
	GSM 1900	Bottom and pistol grip	0.103	0.105	0.031	0.298	0.537
	GPRS 1900	Bottom and pistol grip	0.145	0.105	0.031	0.298	0.579
	WCDMA 850	Bottom and pistol grip	0.237	0.105	0.031	0.298	0.671
	WCDMA 1700	Bottom and pistol grip	0.120	0.105	0.031	0.298	0.554
	WCDMA 1900	Bottom and pistol grip	0.175	0.105	0.031	0.298	0.609
	LTE Band 12	Bottom and pistol grip	0.169	0.105	0.031	0.298	0.603
	LTE Band 13	Bottom and pistol grip	0.289	0.105	0.031	0.298	0.723
	LTE Band 14	Bottom and pistol grip	0.202	0.105	0.031	0.298	0.636
	LTE Band 5	Bottom and pistol grip	0.238	0.105	0.031	0.298	0.672
	LTE Band 4	Bottom and pistol grip	0.128	0.105	0.031	0.298	0.562
	LTE Band 2	Bottom and pistol grip	0.192	0.105	0.031	0.298	0.626
	LTE Band 7	Bottom and pistol grip	0.186	0.105	0.031	0.298	0.620
	LTE Band 41	Bottom and pistol grip	0.150	0.105	0.031	0.298	0.584

Table 10.4.5 Simultaneous Transmission Scenario : 2G/3G/4G + Bluetooth + 5.6 GHz W-LAN + RFID (Extremity at 0 mm)

Exposure Condition	Mode	Configuration	2G/3G/4G SAR (W/kg)	Bluetooth SAR (W/kg)	5.6G W-LAN SAR (W/kg)	RFID SAR (W/kg)	ΣSAR (W/kg)
			1	2	3	4	1+2+3+4
Extremity SAR	GSM 850	Bottom and pistol grip	0.240	0.105	0.050	0.298	0.693
	GPRS 850	Bottom and pistol grip	0.379	0.105	0.050	0.298	**0.832**
	GSM 1900	Bottom and pistol grip	0.103	0.105	0.050	0.298	0.556
	GPRS 1900	Bottom and pistol grip	0.145	0.105	0.050	0.298	0.598
	WCDMA 850	Bottom and pistol grip	0.237	0.105	0.050	0.298	0.690
	WCDMA 1700	Bottom and pistol grip	0.120	0.105	0.050	0.298	0.573
	WCDMA 1900	Bottom and pistol grip	0.175	0.105	0.050	0.298	0.628
	LTE Band 12	Bottom and pistol grip	0.169	0.105	0.050	0.298	0.622
	LTE Band 13	Bottom and pistol grip	0.289	0.105	0.050	0.298	0.742
	LTE Band 14	Bottom and pistol grip	0.202	0.105	0.050	0.298	0.655
	LTE Band 5	Bottom and pistol grip	0.238	0.105	0.050	0.298	0.691
	LTE Band 4	Bottom and pistol grip	0.128	0.105	0.050	0.298	0.581
	LTE Band 2	Bottom and pistol grip	0.192	0.105	0.050	0.298	0.645
	LTE Band 7	Bottom and pistol grip	0.186	0.105	0.050	0.298	0.639
	LTE Band 41	Bottom and pistol grip	0.150	0.105	0.050	0.298	0.603

Table 10.4.6 Simultaneous Transmission Scenario : 2G/3G/4G + Bluetooth + 5.8 GHz W-LAN + RFID (Extremity at 0 mm)

Exposure Condition	Mode	Configuration	2G/3G/4G SAR (W/kg)	Bluetooth SAR (W/kg)	5.8G W-LAN SAR (W/kg)	RFID SAR (W/kg)	ΣSAR (W/kg)
			1	2	3	4	1+2+3+4
Extremity SAR	GSM 850	Bottom and pistol grip	0.240	0.105	0.041	0.298	0.684
	GPRS 850	Bottom and pistol grip	0.379	0.105	0.041	0.298	**0.823**
	GSM 1900	Bottom and pistol grip	0.103	0.105	0.041	0.298	0.547
	GPRS 1900	Bottom and pistol grip	0.145	0.105	0.041	0.298	0.589
	WCDMA 850	Bottom and pistol grip	0.237	0.105	0.041	0.298	0.681
	WCDMA 1700	Bottom and pistol grip	0.120	0.105	0.041	0.298	0.564
	WCDMA 1900	Bottom and pistol grip	0.175	0.105	0.041	0.298	0.619
	LTE Band 12	Bottom and pistol grip	0.169	0.105	0.041	0.298	0.613
	LTE Band 13	Bottom and pistol grip	0.289	0.105	0.041	0.298	0.733
	LTE Band 14	Bottom and pistol grip	0.202	0.105	0.041	0.298	0.646
	LTE Band 5	Bottom and pistol grip	0.238	0.105	0.041	0.298	0.682
	LTE Band 4	Bottom and pistol grip	0.128	0.105	0.041	0.298	0.572
	LTE Band 2	Bottom and pistol grip	0.192	0.105	0.041	0.298	0.636
	LTE Band 7	Bottom and pistol grip	0.186	0.105	0.041	0.298	0.630
	LTE Band 41	Bottom and pistol grip	0.150	0.105	0.041	0.298	0.594

Table 10.4.7 Simultaneous Transmission Scenario : 2G/3G/4G + Bluetooth + 5.3 GHz W-LAN (Extremity at 0 mm)

Exposure Condition	Mode	Configuration	2G/3G/4G SAR (W/kg)	Bluetooth SAR (W/kg)	5.3G W-LAN SAR (W/kg)	ΣSAR (W/kg)
			1	2	3	1+2+3
Extremity SAR	GSM 850	Bottom and pistol grip	0.240	0.105	0.031	0.376
	GPRS 850	Bottom and pistol grip	0.379	0.105	0.031	**0.515**
	GSM 1900	Bottom and pistol grip	0.103	0.105	0.031	0.239
	GPRS 1900	Bottom and pistol grip	0.145	0.105	0.031	0.281
	WCDMA 850	Bottom and pistol grip	0.237	0.105	0.031	0.373
	WCDMA 1700	Bottom and pistol grip	0.120	0.105	0.031	0.256
	WCDMA 1900	Bottom and pistol grip	0.175	0.105	0.031	0.311
	LTE Band 12	Bottom and pistol grip	0.169	0.105	0.031	0.305
	LTE Band 13	Bottom and pistol grip	0.289	0.105	0.031	0.425
	LTE Band 14	Bottom and pistol grip	0.202	0.105	0.031	0.338
	LTE Band 5	Bottom and pistol grip	0.238	0.105	0.031	0.374
	LTE Band 4	Bottom and pistol grip	0.128	0.105	0.031	0.264
	LTE Band 2	Bottom and pistol grip	0.192	0.105	0.031	0.328
	LTE Band 7	Bottom and pistol grip	0.186	0.105	0.031	0.322
	LTE Band 41	Bottom and pistol grip	0.150	0.105	0.031	0.286

Table 10.4.8 Simultaneous Transmission Scenario : 2G/3G/4G + Bluetooth + 5.6 GHz W-LAN (Extremity at 0 mm)

Exposure Condition	Mode	Configuration	2G/3G/4G SAR (W/kg)	Bluetooth SAR (W/kg)	5.6G W-LAN SAR (W/kg)	ΣSAR (W/kg)
			1	2	3	1+2+3
Extremity SAR	GSM 850	Bottom and pistol grip	0.240	0.105	0.050	0.395
	GPRS 850	Bottom and pistol grip	0.379	0.105	0.050	**0.534**
	GSM 1900	Bottom and pistol grip	0.103	0.105	0.050	0.258
	GPRS 1900	Bottom and pistol grip	0.145	0.105	0.050	0.300
	WCDMA 850	Bottom and pistol grip	0.237	0.105	0.050	0.392
	WCDMA 1700	Bottom and pistol grip	0.120	0.105	0.050	0.275
	WCDMA 1900	Bottom and pistol grip	0.175	0.105	0.050	0.330
	LTE Band 12	Bottom and pistol grip	0.169	0.105	0.050	0.324
	LTE Band 13	Bottom and pistol grip	0.289	0.105	0.050	0.444
	LTE Band 14	Bottom and pistol grip	0.202	0.105	0.050	0.357
	LTE Band 5	Bottom and pistol grip	0.238	0.105	0.050	0.393
	LTE Band 4	Bottom and pistol grip	0.128	0.105	0.050	0.283
	LTE Band 2	Bottom and pistol grip	0.192	0.105	0.050	0.347
	LTE Band 7	Bottom and pistol grip	0.186	0.105	0.050	0.341
	LTE Band 41	Bottom and pistol grip	0.150	0.105	0.050	0.305

Table 10.4.9 Simultaneous Transmission Scenario : 2G/3G/4G + Bluetooth + 5.8 GHz W-LAN (Extremity at 0 mm)

Exposure Condition	Mode	Configuration	2G/3G/4G SAR (W/kg)	Bluetooth SAR (W/kg)	5.8G W-LAN SAR (W/kg)	ΣSAR (W/kg)
			1	2	3	1+2+3
Extremity SAR	GSM 850	Bottom and pistol grip	0.240	0.105	0.041	0.386
	GPRS 850	Bottom and pistol grip	0.379	0.105	0.041	**0.525**
	GSM 1900	Bottom and pistol grip	0.103	0.105	0.041	0.249
	GPRS 1900	Bottom and pistol grip	0.145	0.105	0.041	0.291
	WCDMA 850	Bottom and pistol grip	0.237	0.105	0.041	0.383
	WCDMA 1700	Bottom and pistol grip	0.120	0.105	0.041	0.266
	WCDMA 1900	Bottom and pistol grip	0.175	0.105	0.041	0.321
	LTE Band 12	Bottom and pistol grip	0.169	0.105	0.041	0.315
	LTE Band 13	Bottom and pistol grip	0.289	0.105	0.041	0.435
	LTE Band 14	Bottom and pistol grip	0.202	0.105	0.041	0.348
	LTE Band 5	Bottom and pistol grip	0.238	0.105	0.041	0.384
	LTE Band 4	Bottom and pistol grip	0.128	0.105	0.041	0.274
	LTE Band 2	Bottom and pistol grip	0.192	0.105	0.041	0.338
	LTE Band 7	Bottom and pistol grip	0.186	0.105	0.041	0.332
	LTE Band 41	Bottom and pistol grip	0.150	0.105	0.041	0.296

Table 10.4.10 Simultaneous Transmission Scenario : 2G/3G/4G + 2.4 GHz W-LAN (Extremity at 0 mm)

Exposure Condition	Mode	Configuration	2G/3G/4G SAR (W/kg)	2.4G W-LAN SAR (W/kg)	ΣSAR (W/kg)
			1	2	1+2
Extremity SAR	GSM 850	Bottom and pistol grip	0.240	0.007	0.247
	GPRS 850	Bottom and pistol grip	0.379	0.007	**0.386**
	GSM 1900	Bottom and pistol grip	0.103	0.007	0.110
	GPRS 1900	Bottom and pistol grip	0.145	0.007	0.152
	WCDMA 850	Bottom and pistol grip	0.237	0.007	0.244
	WCDMA 1700	Bottom and pistol grip	0.120	0.007	0.127
	WCDMA 1900	Bottom and pistol grip	0.175	0.007	0.182
	LTE Band 12	Bottom and pistol grip	0.169	0.007	0.176
	LTE Band 13	Bottom and pistol grip	0.289	0.007	0.296
	LTE Band 14	Bottom and pistol grip	0.202	0.007	0.209
	LTE Band 5	Bottom and pistol grip	0.238	0.007	0.245
	LTE Band 4	Bottom and pistol grip	0.128	0.007	0.135
	LTE Band 2	Bottom and pistol grip	0.192	0.007	0.199
	LTE Band 7	Bottom and pistol grip	0.186	0.007	0.193
	LTE Band 41	Bottom and pistol grip	0.150	0.007	0.157

Table 10.4.11 Simultaneous Transmission Scenario : 2G/3G/4G + 5.3 GHz W-LAN (Extremity at 0 mm)

Exposure Condition	Mode	Configuration	2G/3G/4G SAR (W/kg)	5.3G W-LAN SAR (W/kg)	ΣSAR (W/kg)
			1	2	1+2
Extremity SAR	GSM 850	Bottom and pistol grip	0.240	0.031	0.271
	GPRS 850	Bottom and pistol grip	0.379	0.031	**0.410**
	GSM 1900	Bottom and pistol grip	0.103	0.031	0.134
	GPRS 1900	Bottom and pistol grip	0.145	0.031	0.176
	WCDMA 850	Bottom and pistol grip	0.237	0.031	0.268
	WCDMA 1700	Bottom and pistol grip	0.120	0.031	0.151
	WCDMA 1900	Bottom and pistol grip	0.175	0.031	0.206
	LTE Band 12	Bottom and pistol grip	0.169	0.031	0.200
	LTE Band 13	Bottom and pistol grip	0.289	0.031	0.320
	LTE Band 14	Bottom and pistol grip	0.202	0.031	0.233
	LTE Band 5	Bottom and pistol grip	0.238	0.031	0.269
	LTE Band 4	Bottom and pistol grip	0.128	0.031	0.159
	LTE Band 2	Bottom and pistol grip	0.192	0.031	0.223
	LTE Band 7	Bottom and pistol grip	0.186	0.031	0.217
	LTE Band 41	Bottom and pistol grip	0.150	0.031	0.181

Table 10.4.12 Simultaneous Transmission Scenario : 2G/3G/4G + 5.6 GHz W-LAN (Extremity at 0 mm)

Exposure Condition	Mode	Configuration	2G/3G/4G SAR (W/kg)	5.6G W-LAN SAR (W/kg)	ΣSAR (W/kg)
			1	2	1+2
Extremity SAR	GSM 850	Bottom and pistol grip	0.240	0.050	0.290
	GPRS 850	Bottom and pistol grip	0.379	0.050	**0.429**
	GSM 1900	Bottom and pistol grip	0.103	0.050	0.153
	GPRS 1900	Bottom and pistol grip	0.145	0.050	0.195
	WCDMA 850	Bottom and pistol grip	0.237	0.050	0.287
	WCDMA 1700	Bottom and pistol grip	0.120	0.050	0.170
	WCDMA 1900	Bottom and pistol grip	0.175	0.050	0.225
	LTE Band 12	Bottom and pistol grip	0.169	0.050	0.219
	LTE Band 13	Bottom and pistol grip	0.289	0.050	0.339
	LTE Band 14	Bottom and pistol grip	0.202	0.050	0.252
	LTE Band 5	Bottom and pistol grip	0.238	0.050	0.288
	LTE Band 4	Bottom and pistol grip	0.128	0.050	0.178
	LTE Band 2	Bottom and pistol grip	0.192	0.050	0.242
	LTE Band 7	Bottom and pistol grip	0.186	0.050	0.236
	LTE Band 41	Bottom and pistol grip	0.150	0.050	0.200

Table 10.4.13 Simultaneous Transmission Scenario : 2G/3G/4G + 5.8 GHz W-LAN (Extremity at 0 mm)

Exposure Condition	Mode	Configuration	2G/3G/4G SAR (W/kg)	5.8G W-LAN SAR (W/kg)	ΣSAR (W/kg)
			1	2	1+2
Extremity SAR	GSM 850	Bottom and pistol grip	0.240	0.041	0.281
	GPRS 850	Bottom and pistol grip	0.379	0.041	**0.420**
	GSM 1900	Bottom and pistol grip	0.103	0.041	0.144
	GPRS 1900	Bottom and pistol grip	0.145	0.041	0.186
	WCDMA 850	Bottom and pistol grip	0.237	0.041	0.278
	WCDMA 1700	Bottom and pistol grip	0.120	0.041	0.161
	WCDMA 1900	Bottom and pistol grip	0.175	0.041	0.216
	LTE Band 12	Bottom and pistol grip	0.169	0.041	0.210
	LTE Band 13	Bottom and pistol grip	0.289	0.041	0.330
	LTE Band 14	Bottom and pistol grip	0.202	0.041	0.243
	LTE Band 5	Bottom and pistol grip	0.238	0.041	0.279
	LTE Band 4	Bottom and pistol grip	0.128	0.041	0.169
	LTE Band 2	Bottom and pistol grip	0.192	0.041	0.233
	LTE Band 7	Bottom and pistol grip	0.186	0.041	0.227
	LTE Band 41	Bottom and pistol grip	0.150	0.041	0.191

Table 10.4.14 Simultaneous Transmission Scenario : 2G/3G/4G + Bluetooth (Extremity at 0 mm)

Exposure Condition	Mode	Configuration	2G/3G/4G SAR (W/kg)	Bluetooth SAR (W/kg)	ΣSAR (W/kg)
			1	2	1+2
Extremity SAR	GSM 850	Bottom and pistol grip	0.240	0.105	0.345
	GPRS 850	Bottom and pistol grip	0.379	0.105	**0.484**
	GSM 1900	Bottom and pistol grip	0.103	0.105	0.208
	GPRS 1900	Bottom and pistol grip	0.145	0.105	0.250
	WCDMA 850	Bottom and pistol grip	0.237	0.105	0.342
	WCDMA 1700	Bottom and pistol grip	0.120	0.105	0.225
	WCDMA 1900	Bottom and pistol grip	0.175	0.105	0.280
	LTE Band 12	Bottom and pistol grip	0.169	0.105	0.274
	LTE Band 13	Bottom and pistol grip	0.289	0.105	0.394
	LTE Band 14	Bottom and pistol grip	0.202	0.105	0.307
	LTE Band 5	Bottom and pistol grip	0.238	0.105	0.343
	LTE Band 4	Bottom and pistol grip	0.128	0.105	0.233
	LTE Band 2	Bottom and pistol grip	0.192	0.105	0.297
	LTE Band 7	Bottom and pistol grip	0.186	0.105	0.291
	LTE Band 41	Bottom and pistol grip	0.150	0.105	0.255

Table 10.4.15 Simultaneous Transmission Scenario : Bluetooth + 5 GHz W-LAN (Extremity at 0 mm)

Exposure Condition	Mode	Configuration	Bluetooth SAR (W/kg)	5G W-LAN SAR (W/kg)	ΣSAR (W/kg)
			1	2	1+2
Extremity SAR	5.3G W-LAN	Bottom and pistol grip	0.105	0.031	0.136
	5.6G W-LAN	Bottom and pistol grip	0.105	0.050	**0.155**
	5.8G W-LAN	Bottom and pistol grip	0.105	0.041	0.146

10.5 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 and IEEE 1528-2013 Section 6.3.4.1.2.

11. SAR MEASUREMENT VARIABILITY

11.1 Measurement Variability

Per FCC KDB Publication 865664 D01v01r04, SAR measurement variability was assessed for each frequency band, which was determined by the SAR probe calibration point and tissue-equivalent medium used for the device measurements. When both head and body tissue-equivalent media were required for SAR measurements in a frequency band, the variability measurement procedures were applied to the tissue medium with the highest measured SAR, using the highest measured SAR configuration for that tissue-equivalent medium. These additional measurements were repeated after the completion of all measurements requiring the same head or body tissue-equivalent medium in a frequency band. The test device was returned to ambient conditions (normal room temperature) with the battery fully charged before it was re-mounted on the device holder for the repeated measurement(s) to minimize any unexpected variations in the repeated results.

SAR Measurement Variability was assessed using the following procedures for each frequency band:

1. When the original highest measured SAR is ≥ 0.80 W/kg, the measurement was repeated once.
2. A second repeated measurement was performed only if the ratio of largest to smallest SAR for the original and first repeated measurements was > 1.20 or when the original or repeated measurement was ≥ 1.45 W/kg (~ 10% from the 1-g SAR limit).
3. A third repeated measurement was performed only if the original, first or second repeated measurement was ≥ 1.5 W/kg and the ratio of largest to smallest SAR for the original, first and second repeated measurements is > 1.20.
4. Repeated measurements are not required when the original highest measured SAR is < 0.80 W/kg
5. The same procedures should be adapted for measurements according to extremity exposure limits by applying a factor of 2.5 for extremity exposure to the corresponding SAR thresholds.

11.2 Measurement Uncertainty

The measured SAR was < 3.75 W/kg for 10g for all frequency bands. Therefore, per KDB Publication 865664 D01v01r04, the extended measurement uncertainty analysis per IEEE 1528-2013 was not required.

12. EQUIPMENT LIST

Table 12.1.1 Test Equipment Calibration

	Type	Manufacturer	Model	Cal.Date	Next.Cal.Date	S/N
☒	SEMITEC Engineering	SEMITEC	N/A	N/A	N/A	Shield Room
☒	Robot	SPEAG	TX60L	N/A	N/A	F14/5VR2A1/A/01
☒	Robot Controller	SPEAG	CS8C	N/A	N/A	F14/5VR2A1/C/01
☒	Joystick	SPEAG	N/A	N/A	N/A	D21142605A
☒	Intel Core i7-4770 3.40 GHz Windows 7 Professional	N/A	N/A	N/A	N/A	N/A
☒	Probe Alignment Unit LB	N/A	LB5/80	N/A	N/A	SE UKS 030 AA
☒	Mounting Device	SPEAG	Holder	N/A	N/A	SD000H01KA
☒	Twin SAM Phantom	SPEAG	QD000P40CD	N/A	N/A	1220
☒	Data Acquisition Electronics	SPEAG	DAE4V1	2018-08-22	2019-08-22	1396
☒	Dosimetric E-Field Probe	SPEAG	EX3DV4	2018-09-25	2019-09-25	3933
☒	750MHz SAR Dipole	SPEAG	D750V3	2019-01-25	2021-01-25	1049
☒	835MHz SAR Dipole	SPEAG	D835V2	2018-08-23	2020-08-23	4d159
☒	900MHz SAR Dipole	SPEAG	D900V2	2018-07-24	2020-07-24	1d175
☒	1800MHz SAR Dipole	SPEAG	D1800V2	2019-04-24	2021-04-24	2d047
☒	1900MHz SAR Dipole	SPEAG	D1900V2	2018-08-27	2020-08-27	5d176
☒	2450MHz SAR Dipole	SPEAG	D2450V2	2018-08-24	2020-08-24	920
☒	2600MHz SAR Dipole	SPEAG	D2600V2	2019-02-27	2021-02-27	1016
☒	5GHz SAR Dipole	SPEAG	D5GHzV2	2019-02-28	2021-02-28	1103
☒	Network Analyzer	Agilent	E5071C	2018-12-19	2019-12-19	MY46111534
☒	Signal Generator	Agilent	E4438C	2019-06-24	2020-06-24	US41461520
☒	Amplifier	RFBAY.Inc	MPA-40-40	2018-12-20	2019-12-20	21151801
☒	Amplifier	EMPOWER	BBS3Q7ELU	2019-06-24	2020-06-24	1020
☒	High Power RF Amplifier	EMPOWER	BBS3Q8CCJ	2019-06-24	2020-06-24	1005
☒	Power Meter	HP	EPM-442A	2018-12-19	2019-12-19	GB37170267
☒	Power Meter	HP	EPM-442A	2018-12-18	2019-12-18	GB37170413
☒	Power Sensor	HP	8481A	2018-12-18	2019-12-18	US37294267
☒	Power Sensor	HP	8481A	2018-12-19	2019-12-19	3318A96566
☒	Power Sensor	HP	8481A	2018-12-19	2019-12-19	2702A65976
☒	Dual Directional Coupler	Agilent	778D-012	2018-12-19	2019-12-19	50228
☒	Directional Coupler	HP	772D	2019-06-24	2020-06-24	2889A01064
☒	Low Pass Filter 1GHz	Wainwright Instruments	WLK6-1000-1400-9000-60SS	2019-06-24	2020-06-24	165
☒	Low Pass Filter 1.5GHz	Micro LAB	LA-15N	2019-06-24	2020-06-24	2
☒	Low Pass Filter 3.0GHz	Micro LAB	LA-30N	2019-06-24	2020-06-24	2
☒	Low Pass Filter 6.0GHz	Micro LAB	LA-60N	2018-12-19	2019-12-19	03942
☒	Attenuators(10 dB)	WEINSCHEL	23-10-34	2018-12-19	2019-12-19	BP4387
☒	Attenuators	Cernexwave	CFADC2603U5	2019-06-27	2020-06-27	C11740
☒	Dielectric Probe kit	SPEAG	DAK-3.5	2018-07-24	2019-07-24	1046
☒	8960 Series 10 Wireless Comms. Test Set	Agilent	E5515C	2019-06-28	2020-06-28	GB41321164
☒	Wideband Radio Communication Tester	Rohde Schwarz	CMW500	2018-12-19	2019-12-19	101414
☒	Power Splitter	Anritsu	K241B	2018-12-18	2019-12-18	1301183
☒	Bluetooth Tester	TESCOM	TC-3000B	2018-12-18	2019-12-18	3000B770243

NOTE(S):
1. The E-field probe was calibrated by SPEAG, by temperature measurement procedure. Dipole Verification measurement is performed by DT&C before each test. The brain and muscle simulating material are calibrated by DT&C using the dielectric probe system and network analyzer to determine the conductivity and permittivity (dielectric constant) of the brain and muscle-equivalent material. Each equipment item was used solely within its respective calibration period.
2. 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. 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.

13. MEASUREMENT UNCERTAINTIES

750 MHz Body

Error Description	Uncertainty value ±%	Probability Distribution	Divisor	(Ci) 1g	(Ci) 10g	Standard (1g)	Standard (10g)	vi 2 or Veff
Measurement System								
Probe calibration	± 6.0	Normal	1	1	1	± 6.0 %	± 6.0 %	∞
Isotropy	± 1.3	Normal	1	1	1	± 1.3 %	± 1.3 %	∞
Boundary Effects	± 2.0	Rectangular	√3	1	1	± 1.2 %	± 1.2 %	∞
Probe Linearity	± 0.3	Normal	1	1	1	± 0.3 %	± 0.3 %	∞
Probe modulation response	± 0.0	Rectangular	√3	1	1	± 0.0 %	± 0.0 %	∞
Detection limits	± 0.25	Rectangular	√3	1	1	± 0.14 %	± 0.14 %	∞
Readout Electronics	± 0.3	Normal	1	1	1	± 0.3 %	± 0.3 %	∞
Response time	± 0.8	Rectangular	√3	1	1	± 0.46 %	± 0.46 %	∞
Integration time	± 2.6	Rectangular	√3	1	1	± 1.5 %	± 1.5 %	∞
RF Ambient Conditions – Noise	± 3.0	Rectangular	√3	1	1	± 1.7 %	± 1.7 %	∞
RF Ambient Conditions – Reflections	± 3.0	Rectangular	√3	1	1	± 1.7 %	± 1.7 %	∞
Probe Positioner	± 0.8	Rectangular	√3	1	1	± 0.46 %	± 0.46 %	∞
Probe Positioning	± 6.7	Rectangular	√3	1	1	± 3.9 %	± 3.9 %	∞
Algorithms for Max. SAR Eval.	± 4.0	Rectangular	√3	1	1	± 2.3 %	± 2.3 %	∞
Test Sample Related								
Device Positioning	± 2.9	Normal	1	1	1	± 2.9 %	± 2.9 %	145
Device Holder	± 3.6	Normal	1	1	1	± 3.6 %	± 3.6 %	5
Power Drift	± 5.0	Rectangular	√3	1	1	± 2.9 %	± 2.9 %	∞
SAR Scaling	± 0.0	Rectangular	√3	1	1	± 0.0 %	± 0.0 %	∞
Physical Parameters								
Phantom Shell	± 7.6	Rectangular	√3	1	1	± 4.4 %	± 4.4 %	∞
SAR correction	± 0.0	Normal	1	1	0.84	± 0.0 %	± 0.0 %	∞
Liquid conductivity (Target)	± 5.0	Rectangular	√3	0.64	0.43	± 1.8 %	± 1.2 %	∞
Liquid conductivity (Meas.)	± 4.1	Normal	1	0.78	0.71	± 3.2 %	± 2.9 %	10
Liquid permittivity (Target)	± 5.0	Rectangular	√3	0.60	0.49	± 1.7 %	± 1.4 %	∞
Liquid permittivity (Meas.)	± 3.7	Normal	1	0.23	0.26	± 0.9 %	± 1.0 %	10
Temp. unc. - Conductivity	± 1.8	Rectangular	√3	0.78	0.71	± 0.8 %	± 0.7 %	∞
Temp. unc. - Permittivity	± 1.8	Rectangular	√3	0.23	0.26	± 0.2 %	± 0.3 %	∞
Combined Standard Uncertainty						**± 11.6 %**	**± 11.4 %**	330
Expanded Uncertainty (k=2)						**± 23.2 %**	**± 22.8 %**	

The above measurement uncertainties are according to IEEE Std 1528

835 MHz Body

Error Description	Uncertainty value ±%	Probability Distribution	Divisor	(Ci) 1g	(Ci) 10g	Standard (1g)	Standard (10g)	vi 2 or Veff
Measurement System								
Probe calibration	± 6.0	Normal	1	1	1	± 6.0 %	± 6.0 %	∞
Isotropy	± 1.3	Normal	1	1	1	± 1.3 %	± 1.3 %	∞
Boundary Effects	± 2.0	Rectangular	√3	1	1	± 1.2 %	± 1.2 %	∞
Probe Linearity	± 0.3	Normal	1	1	1	± 0.3 %	± 0.3 %	∞
Probe modulation response	± 0.0	Rectangular	√3	1	1	± 0.0 %	± 0.0 %	∞
Detection limits	± 0.25	Rectangular	√3	1	1	± 0.14 %	± 0.14 %	∞
Readout Electronics	± 0.3	Normal	1	1	1	± 0.3 %	± 0.3 %	∞
Response time	± 0.8	Rectangular	√3	1	1	± 0.46 %	± 0.46 %	∞
Integration time	± 2.6	Rectangular	√3	1	1	± 1.5 %	± 1.5 %	∞
RF Ambient Conditions – Noise	± 3.0	Rectangular	√3	1	1	± 1.7 %	± 1.7 %	∞
RF Ambient Conditions – Reflections	± 3.0	Rectangular	√3	1	1	± 1.7 %	± 1.7 %	∞
Probe Positioner	± 0.8	Rectangular	√3	1	1	± 0.46 %	± 0.46 %	∞
Probe Positioning	± 6.7	Rectangular	√3	1	1	± 3.9 %	± 3.9 %	∞
Algorithms for Max. SAR Eval.	± 4.0	Rectangular	√3	1	1	± 2.3 %	± 2.3 %	∞
Test Sample Related								
Device Positioning	± 2.9	Normal	1	1	1	± 2.9 %	± 2.9 %	145
Device Holder	± 3.6	Normal	1	1	1	± 3.6 %	± 3.6 %	5
Power Drift	± 5.0	Rectangular	√3	1	1	± 2.9 %	± 2.9 %	∞
SAR Scaling	± 0.0	Rectangular	√3	1	1	± 0.0 %	± 0.0 %	∞
Physical Parameters								
Phantom Shell	± 7.6	Rectangular	√3	1	1	± 4.4 %	± 4.4 %	∞
SAR correction	± 0.0	Normal	1	1	0.84	± 0.0 %	± 0.0 %	∞
Liquid conductivity (Target)	± 5.0	Rectangular	√3	0.64	0.43	± 1.8 %	± 1.2 %	∞
Liquid conductivity (Meas.)	± 3.9	Normal	1	0.78	0.71	± 3.0 %	± 2.8 %	10
Liquid permittivity (Target)	± 5.0	Rectangular	√3	0.60	0.49	± 1.7 %	± 1.4 %	∞
Liquid permittivity (Meas.)	± 4.1	Normal	1	0.23	0.26	± 0.9 %	± 1.1 %	10
Temp. unc. - Conductivity	± 1.9	Rectangular	√3	0.78	0.71	± 0.9 %	± 0.8 %	∞
Temp. unc. - Permittivity	± 1.8	Rectangular	√3	0.23	0.26	± 0.2 %	± 0.3 %	∞
Combined Standard Uncertainty						**± 11.6 %**	**± 11.4 %**	330
Expanded Uncertainty (k=2)						**± 23.2 %**	**± 22.8 %**	

The above measurement uncertainties are according to IEEE Std 1528

900 MHz Body

Error Description	Uncertainty value ±%	Probability Distribution	Divisor	(Ci) 1g	(Ci) 10g	Standard (1g)	Standard (10g)	vi 2 or Veff
Measurement System								
Probe calibration	± 6.0	Normal	1	1	1	± 6.0 %	± 6.0 %	∞
Isotropy	± 1.3	Normal	1	1	1	± 1.3 %	± 1.3 %	∞
Boundary Effects	± 2.0	Rectangular	√3	1	1	± 1.2 %	± 1.2 %	∞
Probe Linearity	± 0.3	Normal	1	1	1	± 0.3 %	± 0.3 %	∞
Probe modulation response	± 0.0	Rectangular	√3	1	1	± 0.0 %	± 0.0 %	∞
Detection limits	± 0.25	Rectangular	√3	1	1	± 0.14 %	± 0.14 %	∞
Readout Electronics	± 0.3	Normal	1	1	1	± 0.3 %	± 0.3 %	∞
Response time	± 0.8	Rectangular	√3	1	1	± 0.46 %	± 0.46 %	∞
Integration time	± 2.6	Rectangular	√3	1	1	± 1.5 %	± 1.5 %	∞
RF Ambient Conditions – Noise	± 3.0	Rectangular	√3	1	1	± 1.7 %	± 1.7 %	∞
RF Ambient Conditions – Reflections	± 3.0	Rectangular	√3	1	1	± 1.7 %	± 1.7 %	∞
Probe Positioner	± 0.8	Rectangular	√3	1	1	± 0.46 %	± 0.46 %	∞
Probe Positioning	± 6.7	Rectangular	√3	1	1	± 3.9 %	± 3.9 %	∞
Algorithms for Max. SAR Eval.	± 4.0	Rectangular	√3	1	1	± 2.3 %	± 2.3 %	∞
Test Sample Related								
Device Positioning	± 2.9	Normal	1	1	1	± 2.9 %	± 2.9 %	145
Device Holder	± 3.6	Normal	1	1	1	± 3.6 %	± 3.6 %	5
Power Drift	± 5.0	Rectangular	√3	1	1	± 2.9 %	± 2.9 %	∞
SAR Scaling	± 0.0	Rectangular	√3	1	1	± 0.0 %	± 0.0 %	∞
Physical Parameters								
Phantom Shell	± 7.6	Rectangular	√3	1	1	± 4.4 %	± 4.4 %	∞
SAR correction	± 0.0	Normal	1	1	0.84	± 0.0 %	± 0.0 %	∞
Liquid conductivity (Target)	± 5.0	Rectangular	√3	0.64	0.43	± 1.8 %	± 1.2 %	∞
Liquid conductivity (Meas.)	± 4.1	Normal	1	0.78	0.71	± 3.2 %	± 2.9 %	10
Liquid permittivity (Target)	± 5.0	Rectangular	√3	0.60	0.49	± 1.7 %	± 1.4 %	∞
Liquid permittivity (Meas.)	± 4.3	Normal	1	0.23	0.26	± 1.0 %	± 1.1 %	10
Temp. unc. - Conductivity	± 1.9	Rectangular	√3	0.78	0.71	± 0.9 %	± 0.8 %	∞
Temp. unc. - Permittivity	± 1.8	Rectangular	√3	0.23	0.26	± 0.2 %	± 0.3 %	∞
Combined Standard Uncertainty						**± 11.6 %**	**± 11.5 %**	330
Expanded Uncertainty (k=2)						**± 23.2 %**	**± 23.0 %**	

The above measurement uncertainties are according to IEEE Std 1528

1800 MHz Body

Error Description	Uncertainty value ±%	Probability Distribution	Divisor	(Ci) 1g	(Ci) 10g	Standard (1g)	Standard (10g)	vi 2 or Veff
Measurement System								
Probe calibration	± 6.0	Normal	1	1	1	± 6.0 %	± 6.0 %	∞
Isotropy	± 1.3	Normal	1	1	1	± 1.3 %	± 1.3 %	∞
Boundary Effects	± 2.0	Rectangular	√3	1	1	± 1.2 %	± 1.2 %	∞
Probe Linearity	± 0.3	Normal	1	1	1	± 0.3 %	± 0.3 %	∞
Probe modulation response	± 0.0	Rectangular	√3	1	1	± 0.0 %	± 0.0 %	∞
Detection limits	± 0.25	Rectangular	√3	1	1	± 0.14 %	± 0.14 %	∞
Readout Electronics	± 0.3	Normal	1	1	1	± 0.3 %	± 0.3 %	∞
Response time	± 0.8	Rectangular	√3	1	1	± 0.46 %	± 0.46 %	∞
Integration time	± 2.6	Rectangular	√3	1	1	± 1.5 %	± 1.5 %	∞
RF Ambient Conditions – Noise	± 3.0	Rectangular	√3	1	1	± 1.7 %	± 1.7 %	∞
RF Ambient Conditions – Reflections	± 3.0	Rectangular	√3	1	1	± 1.7 %	± 1.7 %	∞
Probe Positioner	± 0.8	Rectangular	√3	1	1	± 0.46 %	± 0.46 %	∞
Probe Positioning	± 6.7	Rectangular	√3	1	1	± 3.9 %	± 3.9 %	∞
Algorithms for Max. SAR Eval.	± 4.0	Rectangular	√3	1	1	± 2.3 %	± 2.3 %	∞
Test Sample Related								
Device Positioning	± 2.9	Normal	1	1	1	± 2.9 %	± 2.9 %	145
Device Holder	± 3.6	Normal	1	1	1	± 3.6 %	± 3.6 %	5
Power Drift	± 5.0	Rectangular	√3	1	1	± 2.9 %	± 2.9 %	∞
SAR Scaling	± 0.0	Rectangular	√3	1	1	± 0.0 %	± 0.0 %	∞
Physical Parameters								
Phantom Shell	± 7.6	Rectangular	√3	1	1	± 4.4 %	± 4.4 %	∞
SAR correction	± 0.0	Normal	1	1	0.84	± 0.0 %	± 0.0 %	∞
Liquid conductivity (Target)	± 5.0	Rectangular	√3	0.64	0.43	± 1.8 %	± 1.2 %	∞
Liquid conductivity (Meas.)	± 3.8	Normal	1	0.78	0.71	± 3.0 %	± 2.7 %	10
Liquid permittivity (Target)	± 5.0	Rectangular	√3	0.60	0.49	± 1.7 %	± 1.4 %	∞
Liquid permittivity (Meas.)	± 4.0	Normal	1	0.23	0.26	± 0.9 %	± 1.0 %	10
Temp. unc. - Conductivity	± 1.8	Rectangular	√3	0.78	0.71	± 0.8 %	± 0.7 %	∞
Temp. unc. - Permittivity	± 1.8	Rectangular	√3	0.23	0.26	± 0.2 %	± 0.3 %	∞
Combined Standard Uncertainty						**± 11.6 %**	**± 11.4 %**	330
Expanded Uncertainty (k=2)						**± 23.2 %**	**± 22.8 %**	

The above measurement uncertainties are according to IEEE Std 1528

1900 MHz Body

Error Description	Uncertainty value ±%	Probability Distribution	Divisor	(Ci) 1g	(Ci) 10g	Standard (1g)	Standard (10g)	vi 2 or Veff
Measurement System								
Probe calibration	± 6.0	Normal	1	1	1	± 6.0 %	± 6.0 %	∞
Isotropy	± 1.3	Normal	1	1	1	± 1.3 %	± 1.3 %	∞
Boundary Effects	± 2.0	Rectangular	√3	1	1	± 1.2 %	± 1.2 %	∞
Probe Linearity	± 0.3	Normal	1	1	1	± 0.3 %	± 0.3 %	∞
Probe modulation response	± 0.0	Rectangular	√3	1	1	± 0.0 %	± 0.0 %	∞
Detection limits	± 0.25	Rectangular	√3	1	1	± 0.14 %	± 0.14 %	∞
Readout Electronics	± 0.3	Normal	1	1	1	± 0.3 %	± 0.3 %	∞
Response time	± 0.8	Rectangular	√3	1	1	± 0.46 %	± 0.46 %	∞
Integration time	± 2.6	Rectangular	√3	1	1	± 1.5 %	± 1.5 %	∞
RF Ambient Conditions – Noise	± 3.0	Rectangular	√3	1	1	± 1.7 %	± 1.7 %	∞
RF Ambient Conditions – Reflections	± 3.0	Rectangular	√3	1	1	± 1.7 %	± 1.7 %	∞
Probe Positioner	± 0.8	Rectangular	√3	1	1	± 0.46 %	± 0.46 %	∞
Probe Positioning	± 6.7	Rectangular	√3	1	1	± 3.9 %	± 3.9 %	∞
Algorithms for Max. SAR Eval.	± 4.0	Rectangular	√3	1	1	± 2.3 %	± 2.3 %	∞
Test Sample Related								
Device Positioning	± 2.9	Normal	1	1	1	± 2.9 %	± 2.9 %	145
Device Holder	± 3.6	Normal	1	1	1	± 3.6 %	± 3.6 %	5
Power Drift	± 5.0	Rectangular	√3	1	1	± 2.9 %	± 2.9 %	∞
SAR Scaling	± 0.0	Rectangular	√3	1	1	± 0.0 %	± 0.0 %	∞
Physical Parameters								
Phantom Shell	± 7.6	Rectangular	√3	1	1	± 4.4 %	± 4.4 %	∞
SAR correction	± 0.0	Normal	1	1	0.84	± 0.0 %	± 0.0 %	∞
Liquid conductivity (Target)	± 5.0	Rectangular	√3	0.64	0.43	± 1.8 %	± 1.2 %	∞
Liquid conductivity (Meas.)	± 4.1	Normal	1	0.78	0.71	± 3.2 %	± 2.9 %	10
Liquid permittivity (Target)	± 5.0	Rectangular	√3	0.60	0.49	± 1.7 %	± 1.4 %	∞
Liquid permittivity (Meas.)	± 3.9	Normal	1	0.23	0.26	± 0.9 %	± 1.0 %	10
Temp. unc. - Conductivity	± 1.8	Rectangular	√3	0.78	0.71	± 0.8 %	± 0.7 %	∞
Temp. unc. - Permittivity	± 1.8	Rectangular	√3	0.23	0.26	± 0.2 %	± 0.3 %	∞
Combined Standard Uncertainty						**± 11.6 %**	**± 11.4 %**	330
Expanded Uncertainty (k=2)						**± 23.2 %**	**± 22.8 %**	

The above measurement uncertainties are according to IEEE Std 1528

2450 MHz Body

Error Description	Uncertainty value ±%	Probability Distribution	Divisor	(Ci) 1g	(Ci) 10g	Standard (1g)	Standard (10g)	vi 2 or Veff
Measurement System								
Probe calibration	± 6.0	Normal	1	1	1	± 6.0 %	± 6.0 %	∞
Isotropy	± 1.3	Normal	1	1	1	± 1.3 %	± 1.3 %	∞
Boundary Effects	± 2.0	Rectangular	√3	1	1	± 1.2 %	± 1.2 %	∞
Probe Linearity	± 0.3	Normal	1	1	1	± 0.3 %	± 0.3 %	∞
Probe modulation response	± 0.0	Rectangular	√3	1	1	± 0.0 %	± 0.0 %	∞
Detection limits	± 0.25	Rectangular	√3	1	1	± 0.14 %	± 0.14 %	∞
Readout Electronics	± 0.3	Normal	1	1	1	± 0.3 %	± 0.3 %	∞
Response time	± 0.8	Rectangular	√3	1	1	± 0.46 %	± 0.46 %	∞
Integration time	± 2.6	Rectangular	√3	1	1	± 1.5 %	± 1.5 %	∞
RF Ambient Conditions – Noise	± 3.0	Rectangular	√3	1	1	± 1.7 %	± 1.7 %	∞
RF Ambient Conditions – Reflections	± 3.0	Rectangular	√3	1	1	± 1.7 %	± 1.7 %	∞
Probe Positioner	± 0.8	Rectangular	√3	1	1	± 0.46 %	± 0.46 %	∞
Probe Positioning	± 6.7	Rectangular	√3	1	1	± 3.9 %	± 3.9 %	∞
Algorithms for Max. SAR Eval.	± 4.0	Rectangular	√3	1	1	± 2.3 %	± 2.3 %	∞
Test Sample Related								
Device Positioning	± 2.9	Normal	1	1	1	± 2.9 %	± 2.9 %	145
Device Holder	± 3.6	Normal	1	1	1	± 3.6 %	± 3.6 %	5
Power Drift	± 5.0	Rectangular	√3	1	1	± 2.9 %	± 2.9 %	∞
SAR Scaling	± 0.0	Rectangular	√3	1	1	± 0.0 %	± 0.0 %	∞
Physical Parameters								
Phantom Shell	± 7.6	Rectangular	√3	1	1	± 4.4 %	± 4.4 %	∞
SAR correction	± 0.0	Normal	1	1	0.84	± 0.0 %	± 0.0 %	∞
Liquid conductivity (Target)	± 5.0	Rectangular	√3	0.64	0.43	± 1.8 %	± 1.2 %	∞
Liquid conductivity (Meas.)	± 3.7	Normal	1	0.78	0.71	± 2.9 %	± 2.6 %	10
Liquid permittivity (Target)	± 5.0	Rectangular	√3	0.60	0.49	± 1.7 %	± 1.4 %	∞
Liquid permittivity (Meas.)	± 4.2	Normal	1	0.23	0.26	± 1.0 %	± 1.1 %	10
Temp. unc. - Conductivity	± 1.9	Rectangular	√3	0.78	0.71	± 0.9 %	± 0.8 %	∞
Temp. unc. - Permittivity	± 1.9	Rectangular	√3	0.23	0.26	± 0.3 %	± 0.3 %	∞
Combined Standard Uncertainty						**± 11.6 %**	**± 11.4 %**	330
Expanded Uncertainty (k=2)						**± 23.2 %**	**± 22.8 %**	

The above measurement uncertainties are according to IEEE Std 1528

2600 MHz Body

Error Description	Uncertainty value ±%	Probability Distribution	Divisor	(Ci) 1g	(Ci) 10g	Standard (1g)	Standard (10g)	vi 2 or Veff
Measurement System								
Probe calibration	± 6.0	Normal	1	1	1	± 6.0 %	± 6.0 %	∞
Isotropy	± 1.3	Normal	1	1	1	± 1.3 %	± 1.3 %	∞
Boundary Effects	± 2.0	Rectangular	√3	1	1	± 1.2 %	± 1.2 %	∞
Probe Linearity	± 0.3	Normal	1	1	1	± 0.3 %	± 0.3 %	∞
Probe modulation response	± 0.0	Rectangular	√3	1	1	± 0.0 %	± 0.0 %	∞
Detection limits	± 0.25	Rectangular	√3	1	1	± 0.14 %	± 0.14 %	∞
Readout Electronics	± 0.3	Normal	1	1	1	± 0.3 %	± 0.3 %	∞
Response time	± 0.8	Rectangular	√3	1	1	± 0.46 %	± 0.46 %	∞
Integration time	± 2.6	Rectangular	√3	1	1	± 1.5 %	± 1.5 %	∞
RF Ambient Conditions – Noise	± 3.0	Rectangular	√3	1	1	± 1.7 %	± 1.7 %	∞
RF Ambient Conditions – Reflections	± 3.0	Rectangular	√3	1	1	± 1.7 %	± 1.7 %	∞
Probe Positioner	± 0.8	Rectangular	√3	1	1	± 0.46 %	± 0.46 %	∞
Probe Positioning	± 6.7	Rectangular	√3	1	1	± 3.9 %	± 3.9 %	∞
Algorithms for Max. SAR Eval.	± 4.0	Rectangular	√3	1	1	± 2.3 %	± 2.3 %	∞
Test Sample Related								
Device Positioning	± 2.9	Normal	1	1	1	± 2.9 %	± 2.9 %	145
Device Holder	± 3.6	Normal	1	1	1	± 3.6 %	± 3.6 %	5
Power Drift	± 5.0	Rectangular	√3	1	1	± 2.9 %	± 2.9 %	∞
SAR Scaling	± 0.0	Rectangular	√3	1	1	± 0.0 %	± 0.0 %	∞
Physical Parameters								
Phantom Shell	± 7.6	Rectangular	√3	1	1	± 4.4 %	± 4.4 %	∞
SAR correction	± 0.0	Normal	1	1	0.84	± 0.0 %	± 0.0 %	∞
Liquid conductivity (Target)	± 5.0	Rectangular	√3	0.64	0.43	± 1.8 %	± 1.2 %	∞
Liquid conductivity (Meas.)	± 3.8	Normal	1	0.78	0.71	± 3.0 %	± 2.7 %	10
Liquid permittivity (Target)	± 5.0	Rectangular	√3	0.60	0.49	± 1.7 %	± 1.4 %	∞
Liquid permittivity (Meas.)	± 4.1	Normal	1	0.23	0.26	± 0.9 %	± 1.1 %	10
Temp. unc. - Conductivity	± 1.9	Rectangular	√3	0.78	0.71	± 0.9 %	± 0.8 %	∞
Temp. unc. - Permittivity	± 1.8	Rectangular	√3	0.23	0.26	± 0.2 %	± 0.3 %	∞
Combined Standard Uncertainty						**± 11.6 %**	**± 11.4 %**	330
Expanded Uncertainty (k=2)						**± 23.2 %**	**± 22.8 %**	

The above measurement uncertainties are according to IEEE Std 1528

5200 MHz Body

Error Description	Uncertainty value ±%	Probability Distribution	Divisor	(Ci) 1g	(Ci) 10g	Standard (1g)	Standard (10g)	vi 2 or Veff
Measurement System								
Probe calibration	± 6.55	Normal	1	1	1	± 6.6 %	± 6.6 %	∞
Isotropy	± 1.3	Normal	1	1	1	± 1.3 %	± 1.3 %	∞
Boundary Effects	± 2.0	Rectangular	√3	1	1	± 1.2 %	± 1.2 %	∞
Probe Linearity	± 0.3	Normal	1	1	1	± 0.3 %	± 0.3 %	∞
Probe modulation response	± 0.0	Rectangular	√3	1	1	± 0.0 %	± 0.0 %	∞
Detection limits	± 0.25	Rectangular	√3	1	1	± 0.14 %	± 0.14 %	∞
Readout Electronics	± 0.3	Normal	1	1	1	± 0.3 %	± 0.3 %	∞
Response time	± 0.8	Rectangular	√3	1	1	± 0.46 %	± 0.46 %	∞
Integration time	± 2.6	Rectangular	√3	1	1	± 1.5 %	± 1.5 %	∞
RF Ambient Conditions – Noise	± 3.0	Rectangular	√3	1	1	± 1.7 %	± 1.7 %	∞
RF Ambient Conditions – Reflections	± 3.0	Rectangular	√3	1	1	± 1.7 %	± 1.7 %	∞
Probe Positioner	± 0.8	Rectangular	√3	1	1	± 0.46 %	± 0.46 %	∞
Probe Positioning	± 6.7	Rectangular	√3	1	1	± 3.9 %	± 3.9 %	∞
Algorithms for Max. SAR Eval.	± 4.0	Rectangular	√3	1	1	± 2.3 %	± 2.3 %	∞
Test Sample Related								
Device Positioning	± 2.9	Normal	1	1	1	± 2.9 %	± 2.9 %	145
Device Holder	± 3.6	Normal	1	1	1	± 3.6 %	± 3.6 %	5
Power Drift	± 5.0	Rectangular	√3	1	1	± 2.9 %	± 2.9 %	∞
SAR Scaling	± 0.0	Rectangular	√3	1	1	± 0.0 %	± 0.0 %	∞
Physical Parameters								
Phantom Shell	± 7.6	Rectangular	√3	1	1	± 4.4 %	± 4.4 %	∞
SAR correction	± 0.0	Normal	1	1	0.84	± 0.0 %	± 0.0 %	∞
Liquid conductivity (Target)	± 5.0	Rectangular	√3	0.64	0.43	± 1.8 %	± 1.2 %	∞
Liquid conductivity (Meas.)	± 3.8	Normal	1	0.78	0.71	± 3.0 %	± 2.7 %	10
Liquid permittivity (Target)	± 5.0	Rectangular	√3	0.60	0.49	± 1.7 %	± 1.4 %	∞
Liquid permittivity (Meas.)	± 4.3	Normal	1	0.23	0.26	± 1.0 %	± 1.1 %	10
Temp. unc. - Conductivity	± 1.9	Rectangular	√3	0.78	0.71	± 0.9 %	± 0.8 %	∞
Temp. unc. - Permittivity	± 1.8	Rectangular	√3	0.23	0.26	± 0.2 %	± 0.3 %	∞
Combined Standard Uncertainty						**± 11.9 %**	**± 11.7 %**	330
Expanded Uncertainty (k=2)						**± 23.8 %**	**± 23.4 %**	

The above measurement uncertainties are according to IEEE Std 1528

5300 MHz Body

Error Description	Uncertainty value ±%	Probability Distribution	Divisor	(Ci) 1g	(Ci) 10g	Standard (1g)	Standard (10g)	vi 2 or Veff
Measurement System								
Probe calibration	± 6.55	Normal	1	1	1	± 6.6 %	± 6.6 %	∞
Isotropy	± 1.3	Normal	1	1	1	± 1.3 %	± 1.3 %	∞
Boundary Effects	± 2.0	Rectangular	√3	1	1	± 1.2 %	± 1.2 %	∞
Probe Linearity	± 0.3	Normal	1	1	1	± 0.3 %	± 0.3 %	∞
Probe modulation response	± 0.0	Rectangular	√3	1	1	± 0.0 %	± 0.0 %	∞
Detection limits	± 0.25	Rectangular	√3	1	1	± 0.14 %	± 0.14 %	∞
Readout Electronics	± 0.3	Normal	1	1	1	± 0.3 %	± 0.3 %	∞
Response time	± 0.8	Rectangular	√3	1	1	± 0.46 %	± 0.46 %	∞
Integration time	± 2.6	Rectangular	√3	1	1	± 1.5 %	± 1.5 %	∞
RF Ambient Conditions – Noise	± 3.0	Rectangular	√3	1	1	± 1.7 %	± 1.7 %	∞
RF Ambient Conditions – Reflections	± 3.0	Rectangular	√3	1	1	± 1.7 %	± 1.7 %	∞
Probe Positioner	± 0.8	Rectangular	√3	1	1	± 0.46 %	± 0.46 %	∞
Probe Positioning	± 6.7	Rectangular	√3	1	1	± 3.9 %	± 3.9 %	∞
Algorithms for Max. SAR Eval.	± 4.0	Rectangular	√3	1	1	± 2.3 %	± 2.3 %	∞
Test Sample Related								
Device Positioning	± 2.9	Normal	1	1	1	± 2.9 %	± 2.9 %	145
Device Holder	± 3.6	Normal	1	1	1	± 3.6 %	± 3.6 %	5
Power Drift	± 5.0	Rectangular	√3	1	1	± 2.9 %	± 2.9 %	∞
SAR Scaling	± 0.0	Rectangular	√3	1	1	± 0.0 %	± 0.0 %	∞
Physical Parameters								
Phantom Shell	± 7.6	Rectangular	√3	1	1	± 4.4 %	± 4.4 %	∞
SAR correction	± 0.0	Normal	1	1	0.84	± 0.0 %	± 0.0 %	∞
Liquid conductivity (Target)	± 5.0	Rectangular	√3	0.64	0.43	± 1.8 %	± 1.2 %	∞
Liquid conductivity (Meas.)	± 3.9	Normal	1	0.78	0.71	± 3.0 %	± 2.8 %	10
Liquid permittivity (Target)	± 5.0	Rectangular	√3	0.60	0.49	± 1.7 %	± 1.4 %	∞
Liquid permittivity (Meas.)	± 4.1	Normal	1	0.23	0.26	± 0.9 %	± 1.1 %	10
Temp. unc. - Conductivity	± 1.8	Rectangular	√3	0.78	0.71	± 0.8 %	± 0.7 %	∞
Temp. unc. - Permittivity	± 1.9	Rectangular	√3	0.23	0.26	± 0.3 %	± 0.3 %	∞
Combined Standard Uncertainty						**± 11.9 %**	**± 11.7 %**	330
Expanded Uncertainty (k=2)						**± 23.8 %**	**± 23.4 %**	

The above measurement uncertainties are according to IEEE Std 1528

5500 MHz Body

Error Description	Uncertainty value ±%	Probability Distribution	Divisor	(Ci) 1g	(Ci) 10g	Standard (1g)	Standard (10g)	vi 2 or Veff
Measurement System								
Probe calibration	± 6.55	Normal	1	1	1	± 6.6 %	± 6.6 %	∞
Isotropy	± 1.3	Normal	1	1	1	± 1.3 %	± 1.3 %	∞
Boundary Effects	± 2.0	Rectangular	√3	1	1	± 1.2 %	± 1.2 %	∞
Probe Linearity	± 0.3	Normal	1	1	1	± 0.3 %	± 0.3 %	∞
Probe modulation response	± 0.0	Rectangular	√3	1	1	± 0.0 %	± 0.0 %	∞
Detection limits	± 0.25	Rectangular	√3	1	1	± 0.14 %	± 0.14 %	∞
Readout Electronics	± 0.3	Normal	1	1	1	± 0.3 %	± 0.3 %	∞
Response time	± 0.8	Rectangular	√3	1	1	± 0.46 %	± 0.46 %	∞
Integration time	± 2.6	Rectangular	√3	1	1	± 1.5 %	± 1.5 %	∞
RF Ambient Conditions – Noise	± 3.0	Rectangular	√3	1	1	± 1.7 %	± 1.7 %	∞
RF Ambient Conditions – Reflections	± 3.0	Rectangular	√3	1	1	± 1.7 %	± 1.7 %	∞
Probe Positioner	± 0.8	Rectangular	√3	1	1	± 0.46 %	± 0.46 %	∞
Probe Positioning	± 6.7	Rectangular	√3	1	1	± 3.9 %	± 3.9 %	∞
Algorithms for Max. SAR Eval.	± 4.0	Rectangular	√3	1	1	± 2.3 %	± 2.3 %	∞
Test Sample Related								
Device Positioning	± 2.9	Normal	1	1	1	± 2.9 %	± 2.9 %	145
Device Holder	± 3.6	Normal	1	1	1	± 3.6 %	± 3.6 %	5
Power Drift	± 5.0	Rectangular	√3	1	1	± 2.9 %	± 2.9 %	∞
SAR Scaling	± 0.0	Rectangular	√3	1	1	± 0.0 %	± 0.0 %	∞
Physical Parameters								
Phantom Shell	± 7.6	Rectangular	√3	1	1	± 4.4 %	± 4.4 %	∞
SAR correction	± 0.0	Normal	1	1	0.84	± 0.0 %	± 0.0 %	∞
Liquid conductivity (Target)	± 5.0	Rectangular	√3	0.64	0.43	± 1.8 %	± 1.2 %	∞
Liquid conductivity (Meas.)	± 3.8	Normal	1	0.78	0.71	± 3.0 %	± 2.7 %	10
Liquid permittivity (Target)	± 5.0	Rectangular	√3	0.60	0.49	± 1.7 %	± 1.4 %	∞
Liquid permittivity (Meas.)	± 4.3	Normal	1	0.23	0.26	± 1.0 %	± 1.1 %	10
Temp. unc. - Conductivity	± 1.9	Rectangular	√3	0.78	0.71	± 0.9 %	± 0.8 %	∞
Temp. unc. - Permittivity	± 1.9	Rectangular	√3	0.23	0.26	± 0.3 %	± 0.3 %	∞
Combined Standard Uncertainty						**± 11.9 %**	**± 11.7 %**	330
Expanded Uncertainty (k=2)						**± 23.8 %**	**± 23.4 %**	

The above measurement uncertainties are according to IEEE Std 1528

5600 MHz Body

Error Description	Uncertainty value ±%	Probability Distribution	Divisor	(Ci) 1g	(Ci) 10g	Standard (1g)	Standard (10g)	vi 2 or Veff
Measurement System								
Probe calibration	± 6.55	Normal	1	1	1	± 6.6 %	± 6.6 %	∞
Isotropy	± 1.3	Normal	1	1	1	± 1.3 %	± 1.3 %	∞
Boundary Effects	± 2.0	Rectangular	√3	1	1	± 1.2 %	± 1.2 %	∞
Probe Linearity	± 0.3	Normal	1	1	1	± 0.3 %	± 0.3 %	∞
Probe modulation response	± 0.0	Rectangular	√3	1	1	± 0.0 %	± 0.0 %	∞
Detection limits	± 0.25	Rectangular	√3	1	1	± 0.14 %	± 0.14 %	∞
Readout Electronics	± 0.3	Normal	1	1	1	± 0.3 %	± 0.3 %	∞
Response time	± 0.8	Rectangular	√3	1	1	± 0.46 %	± 0.46 %	∞
Integration time	± 2.6	Rectangular	√3	1	1	± 1.5 %	± 1.5 %	∞
RF Ambient Conditions – Noise	± 3.0	Rectangular	√3	1	1	± 1.7 %	± 1.7 %	∞
RF Ambient Conditions – Reflections	± 3.0	Rectangular	√3	1	1	± 1.7 %	± 1.7 %	∞
Probe Positioner	± 0.8	Rectangular	√3	1	1	± 0.46 %	± 0.46 %	∞
Probe Positioning	± 6.7	Rectangular	√3	1	1	± 3.9 %	± 3.9 %	∞
Algorithms for Max. SAR Eval.	± 4.0	Rectangular	√3	1	1	± 2.3 %	± 2.3 %	∞
Test Sample Related								
Device Positioning	± 2.9	Normal	1	1	1	± 2.9 %	± 2.9 %	145
Device Holder	± 3.6	Normal	1	1	1	± 3.6 %	± 3.6 %	5
Power Drift	± 5.0	Rectangular	√3	1	1	± 2.9 %	± 2.9 %	∞
SAR Scaling	± 0.0	Rectangular	√3	1	1	± 0.0 %	± 0.0 %	∞
Physical Parameters								
Phantom Shell	± 7.6	Rectangular	√3	1	1	± 4.4 %	± 4.4 %	∞
SAR correction	± 0.0	Normal	1	1	0.84	± 0.0 %	± 0.0 %	∞
Liquid conductivity (Target)	± 5.0	Rectangular	√3	0.64	0.43	± 1.8 %	± 1.2 %	∞
Liquid conductivity (Meas.)	± 4.0	Normal	1	0.78	0.71	± 3.1 %	± 2.8 %	10
Liquid permittivity (Target)	± 5.0	Rectangular	√3	0.60	0.49	± 1.7 %	± 1.4 %	∞
Liquid permittivity (Meas.)	± 4.1	Normal	1	0.23	0.26	± 0.9 %	± 1.1 %	10
Temp. unc. - Conductivity	± 1.9	Rectangular	√3	0.78	0.71	± 0.9 %	± 0.8 %	∞
Temp. unc. - Permittivity	± 1.9	Rectangular	√3	0.23	0.26	± 0.3 %	± 0.3 %	∞
Combined Standard Uncertainty						**± 11.9 %**	**± 11.7 %**	330
Expanded Uncertainty (k=2)						**± 23.8 %**	**± 23.4 %**	

The above measurement uncertainties are according to IEEE Std 1528

5800 MHz Body

Error Description	Uncertainty value ±%	Probability Distribution	Divisor	(Ci) 1g	(Ci) 10g	Standard (1g)	Standard (10g)	vi 2 or Veff
Measurement System								
Probe calibration	± 6.55	Normal	1	1	1	± 6.6 %	± 6.6 %	∞
Isotropy	± 1.3	Normal	1	1	1	± 1.3 %	± 1.3 %	∞
Boundary Effects	± 2.0	Rectangular	√3	1	1	± 1.2 %	± 1.2 %	∞
Probe Linearity	± 0.3	Normal	1	1	1	± 0.3 %	± 0.3 %	∞
Probe modulation response	± 0.0	Rectangular	√3	1	1	± 0.0 %	± 0.0 %	∞
Detection limits	± 0.25	Rectangular	√3	1	1	± 0.14 %	± 0.14 %	∞
Readout Electronics	± 0.3	Normal	1	1	1	± 0.3 %	± 0.3 %	∞
Response time	± 0.8	Rectangular	√3	1	1	± 0.46 %	± 0.46 %	∞
Integration time	± 2.6	Rectangular	√3	1	1	± 1.5 %	± 1.5 %	∞
RF Ambient Conditions – Noise	± 3.0	Rectangular	√3	1	1	± 1.7 %	± 1.7 %	∞
RF Ambient Conditions – Reflections	± 3.0	Rectangular	√3	1	1	± 1.7 %	± 1.7 %	∞
Probe Positioner	± 0.8	Rectangular	√3	1	1	± 0.46 %	± 0.46 %	∞
Probe Positioning	± 6.7	Rectangular	√3	1	1	± 3.9 %	± 3.9 %	∞
Algorithms for Max. SAR Eval.	± 4.0	Rectangular	√3	1	1	± 2.3 %	± 2.3 %	∞
Test Sample Related								
Device Positioning	± 2.9	Normal	1	1	1	± 2.9 %	± 2.9 %	145
Device Holder	± 3.6	Normal	1	1	1	± 3.6 %	± 3.6 %	5
Power Drift	± 5.0	Rectangular	√3	1	1	± 2.9 %	± 2.9 %	∞
SAR Scaling	± 0.0	Rectangular	√3	1	1	± 0.0 %	± 0.0 %	∞
Physical Parameters								
Phantom Shell	± 7.6	Rectangular	√3	1	1	± 4.4 %	± 4.4 %	∞
SAR correction	± 0.0	Normal	1	1	0.84	± 0.0 %	± 0.0 %	∞
Liquid conductivity (Target)	± 5.0	Rectangular	√3	0.64	0.43	± 1.8 %	± 1.2 %	∞
Liquid conductivity (Meas.)	± 4.2	Normal	1	0.78	0.71	± 3.3 %	± 3.0 %	10
Liquid permittivity (Target)	± 5.0	Rectangular	√3	0.60	0.49	± 1.7 %	± 1.4 %	∞
Liquid permittivity (Meas.)	± 3.8	Normal	1	0.23	0.26	± 0.9 %	± 1.0 %	10
Temp. unc. - Conductivity	± 1.9	Rectangular	√3	0.78	0.71	± 0.9 %	± 0.8 %	∞
Temp. unc. - Permittivity	± 2.0	Rectangular	√3	0.23	0.26	± 0.3 %	± 0.3 %	∞
Combined Standard Uncertainty						**± 11.9 %**	**± 11.8 %**	330
Expanded Uncertainty (k=2)						**± 23.8 %**	**± 23.6 %**	

The above measurement uncertainties are according to IEEE Std 1528

14. CONCLUSION

Measurement Conclusion

The SAR measurement indicates that the EUT complies with the RF radiation exposure limits of the FCC. These measurements are taken to simulate the RF effects exposure under the worst-case conditions. Precise laboratory measures were taken to assure repeatability of the tests. The tested device complies with the requirements in respect to all parameters subject to the test. The test results and statements relate only to the item(s) tested.

Please note that the absorption and distribution of electromagnetic energy in the body are every 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 impossible biological effect 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 innumerable factors may interact to determine the specific biological outcome of an exposure to electromagnetic fields, any protection guide shall consider maximal amplification of biological effects as a result of field-body interactions, environmental conditions, and physiological variables.

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APPENDIX A. – Probe Calibration Data

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 **DT&C (Dymstec)**

Certificate No: **EX3-3933_Sep18**

CALIBRATION CERTIFICATE

Object: EX3DV4 - SN:3933

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

Calibration date: September 25, 2018

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: S5277 (20x)	04-Apr-18 (No. 217-02682)	Apr-19
Reference Probe ES3DV2	SN: 3013	30-Dec-17 (No. ES3-3013_Dec17)	Dec-18
DAE4	SN: 660	21-Dec-17 (No. DAE4-660_Dec17)	Dec-18
Secondary Standards	ID	Check Date (in house)	Scheduled Check
Power meter E4419B	SN: GB41293874	06-Apr-16 (in house check Jun-18)	In house check: Jun-20
Power sensor E4412A	SN: MY41498087	06-Apr-16 (in house check Jun-18)	In house check: Jun-20
Power sensor E4412A	SN: 000110210	06-Apr-16 (in house check Jun-18)	In house check: Jun-20
RF generator HP 8648C	SN: US3642U01700	04-Aug-99 (in house check Jun-18)	In house check: Jun-20
Network Analyzer E8358A	SN: US41080477	31-Mar-14 (in house check Oct-17)	In house check: Oct-18

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

Issued: September 27, 2018

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

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

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

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

Accreditation No.: **SCS 0108**

Glossary:

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

Calibration is Performed According to the Following Standards:

a) IEEE Std 1528-2013, "IEEE Recommended Practice for Determining the Peak Spatial-Averaged Specific Absorption Rate (SAR) in the Human Head from Wireless Communications Devices: Measurement Techniques", June 2013
b) IEC 62209-1, ", "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"

Methods Applied and Interpretation of Parameters:

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

Probe EX3DV4

SN:3933

Manufactured: July 24, 2013
Calibrated: September 25, 2018

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

DASY/EASY - Parameters of Probe: EX3DV4 - SN:3933

Basic Calibration Parameters

	Sensor X	Sensor Y	Sensor Z	Unc (k=2)
Norm (μV/(V/m)^2)[A]	0.50	0.52	0.19	± 10.1 %
DCP (mV)[B]	104.5	98.7	93.5	

Modulation Calibration Parameters

UID	Communication System Name		A dB	B dB√μV	C	D dB	VR mV	Unc[E] (k=2)
0	CW	X	0.0	0.0	1.0	0.00	144.0	±2.7 %
		Y	0.0	0.0	1.0		147.5	
		Z	0.0	0.0	1.0		142.5	

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

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

DASY/EASY - Parameters of Probe: EX3DV4 - SN:3933

Calibration Parameter Determined in Head Tissue Simulating Media

f (MHz) [C]	Relative Permittivity [F]	Conductivity (S/m) [F]	ConvF X	ConvF Y	ConvF Z	Alpha [G]	Depth [G] (mm)	Unc (k=2)
750	41.9	0.89	10.76	10.76	10.76	0.35	1.00	± 12.0 %
835	41.5	0.90	10.26	10.26	10.26	0.46	0.83	± 12.0 %
900	41.5	0.97	9.91	9.91	9.91	0.43	0.80	± 12.0 %
1750	40.1	1.37	8.83	8.83	8.83	0.34	0.83	± 12.0 %
1900	40.0	1.40	8.54	8.54	8.54	0.25	0.80	± 12.0 %
2300	39.5	1.67	7.90	7.90	7.90	0.41	0.80	± 12.0 %
2450	39.2	1.80	7.61	7.61	7.61	0.21	1.16	± 12.0 %
2600	39.0	1.96	7.41	7.41	7.41	0.25	1.00	± 12.0 %
3500	37.9	2.91	7.30	7.30	7.30	0.27	1.20	± 13.1 %
3700	37.7	3.12	7.13	7.13	7.13	0.25	1.20	± 13.1 %
5200	36.0	4.66	5.24	5.24	5.24	0.40	1.80	± 13.1 %
5300	35.9	4.76	5.02	5.02	5.02	0.40	1.80	± 13.1 %
5500	35.6	4.96	4.87	4.87	4.87	0.40	1.80	± 13.1 %
5600	35.5	5.07	4.71	4.71	4.71	0.40	1.80	± 13.1 %
5800	35.3	5.27	4.77	4.77	4.77	0.40	1.80	± 13.1 %

[C] Frequency validity above 300 MHz of ± 100 MHz only applies for DASY v4.4 and higher (see Page 2), else it is restricted to ± 50 MHz. The uncertainty is the RSS of the ConvF uncertainty at calibration frequency and the uncertainty for the indicated frequency band. Frequency validity below 300 MHz is ± 10, 25, 40, 50 and 70 MHz for ConvF assessments at 30, 64, 128, 150 and 220 MHz respectively. Above 5 GHz frequency validity can be extended to ± 110 MHz.

[F] At frequencies below 3 GHz, the validity of tissue parameters (ε and σ) can be relaxed to ± 10% if liquid compensation formula is applied to measured SAR values. At frequencies above 3 GHz, the validity of tissue parameters (ε and σ) is restricted to ± 5%. The uncertainty is the RSS of the ConvF uncertainty for indicated target tissue parameters.

[G] Alpha/Depth are determined during calibration. SPEAG warrants that the remaining deviation due to the boundary effect after compensation is always less than ± 1% for frequencies below 3 GHz and below ± 2% for frequencies between 3-6 GHz at any distance larger than half the probe tip diameter from the boundary.

DASY/EASY - Parameters of Probe: EX3DV4 - SN:3933

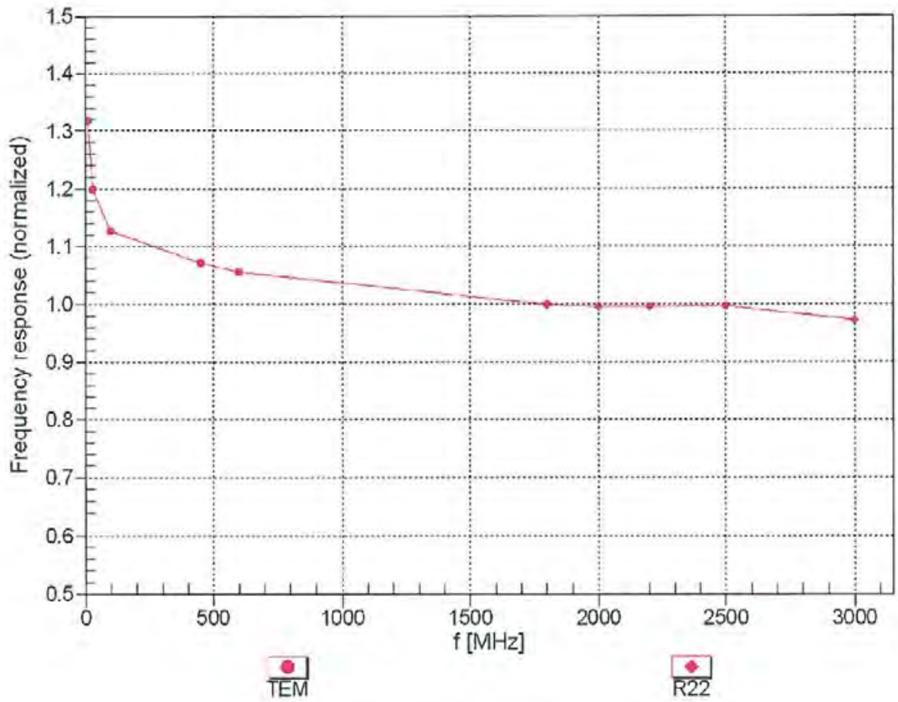
Calibration Parameter Determined in Body Tissue Simulating Media

f (MHz) [C]	Relative Permittivity [F]	Conductivity (S/m) [F]	ConvF X	ConvF Y	ConvF Z	Alpha [G]	Depth [G] (mm)	Unc (k=2)
750	55.5	0.96	10.43	10.43	10.43	0.32	1.02	± 12.0 %
835	55.2	0.97	10.27	10.27	10.27	0.44	0.80	± 12.0 %
900	55.0	1.05	10.20	10.20	10.20	0.42	0.80	± 12.0 %
1750	53.4	1.49	8.62	8.62	8.62	0.31	0.88	± 12.0 %
1900	53.3	1.52	8.21	8.21	8.21	0.38	0.80	± 12.0 %
2300	52.9	1.81	7.86	7.86	7.86	0.34	0.88	± 12.0 %
2450	52.7	1.95	7.75	7.75	7.75	0.34	0.95	± 12.0 %
2600	52.5	2.16	7.63	7.63	7.63	0.31	0.95	± 12.0 %
3500	51.3	3.31	7.13	7.13	7.13	0.30	1.25	± 13.1 %
3700	51.0	3.55	7.08	7.08	7.08	0.30	1.25	± 13.1 %
5200	49.0	5.30	4.67	4.67	4.67	0.50	1.90	± 13.1 %
5300	48.9	5.42	4.51	4.51	4.51	0.50	1.90	± 13.1 %
5500	48.6	5.65	4.14	4.14	4.14	0.50	1.90	± 13.1 %
5600	48.5	5.77	4.01	4.01	4.01	0.50	1.90	± 13.1 %
5800	48.2	6.00	4.10	4.10	4.10	0.50	1.90	± 13.1 %

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

Frequency Response of E-Field

(TEM-Cell:ifi110 EXX, Waveguide: R22)

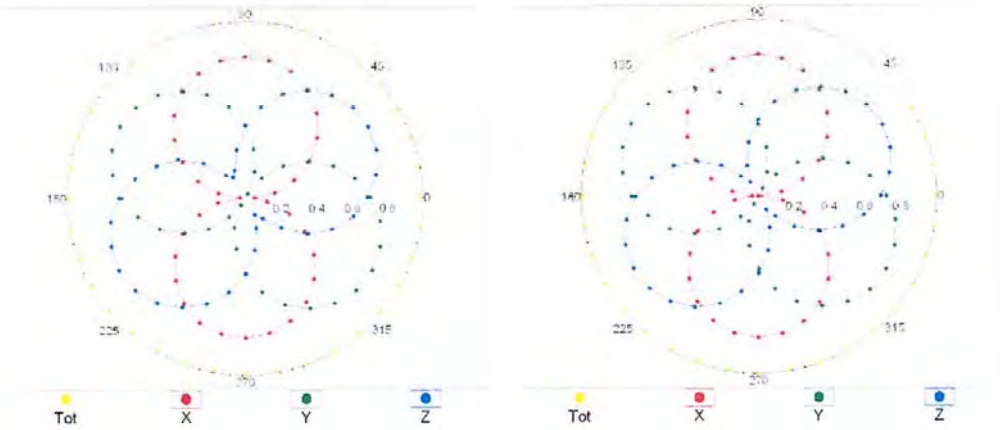


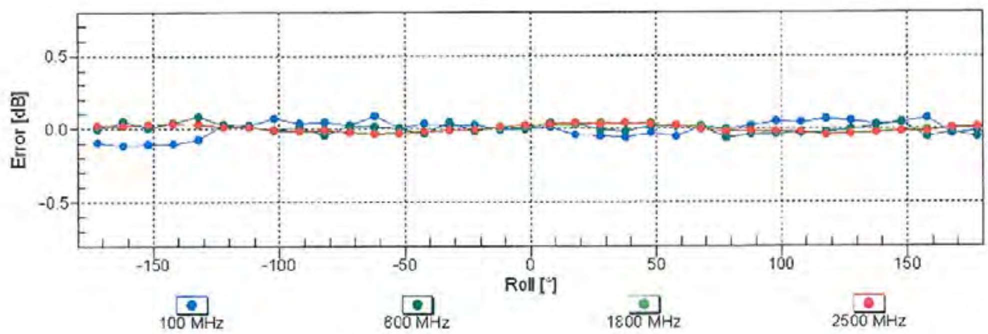
Uncertainty of Frequency Response of E-field: ± 6.3% (k=2)

EX3DV4– SN:3933 September 25, 2018

Receiving Pattern (φ), $\vartheta = 0°$

f=600 MHz,TEM f=1800 MHz,R22



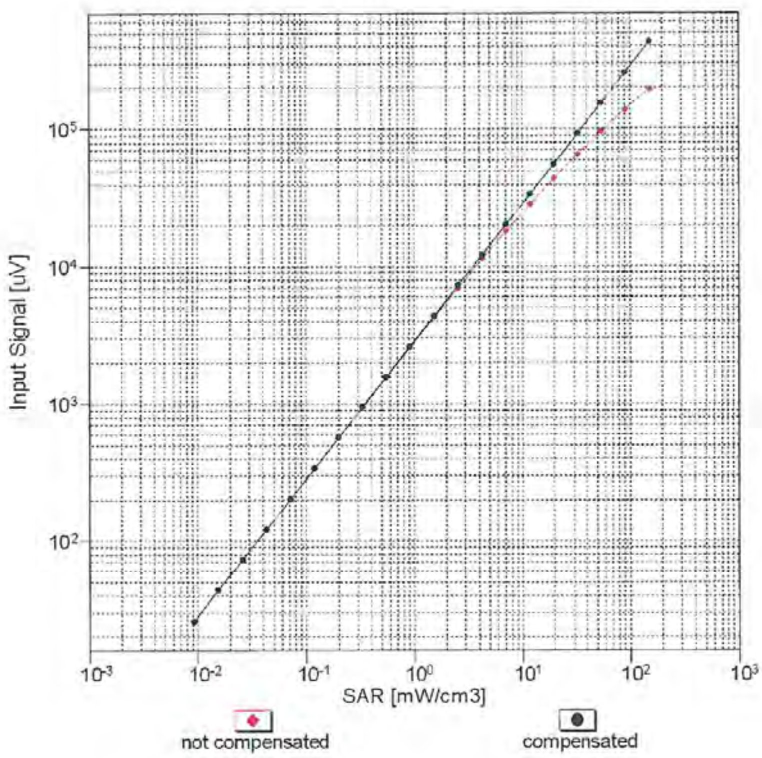


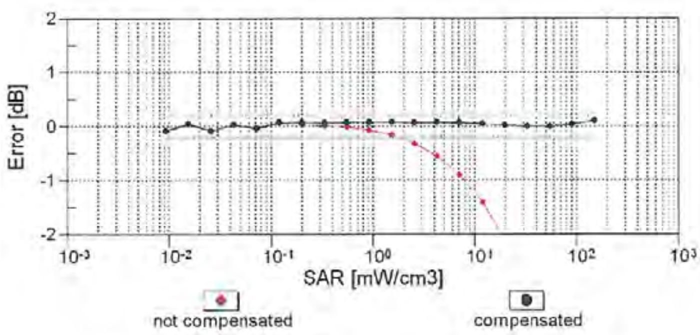
Uncertainty of Axial Isotropy Assessment: ± 0.5% (k=2)

EX3DV4– SN:3933 September 25, 2018

Dynamic Range f(SAR_{head})

(TEM cell , f_{eval}= 1900 MHz)



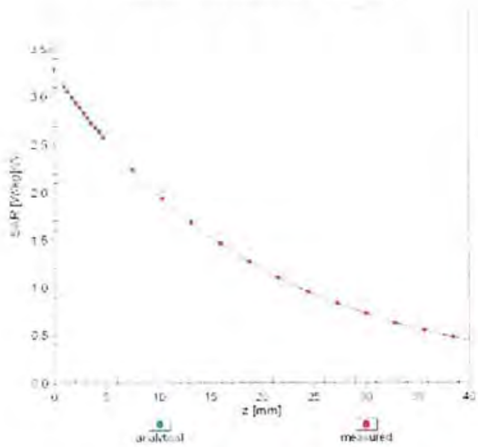


Uncertainty of Linearity Assessment: ± 0.6% (k=2)

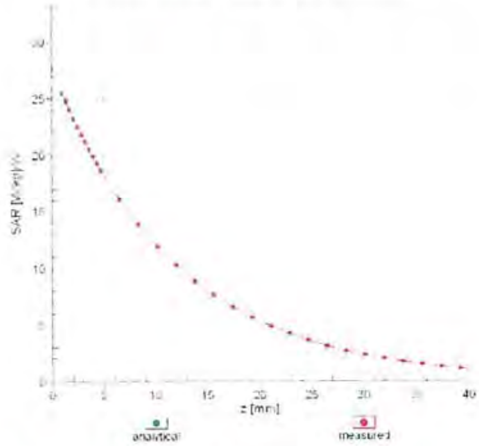
EX3DV4– SN:3933 September 25, 2018

Conversion Factor Assessment

f = 835 MHz,WGLS R9 (H_convF)

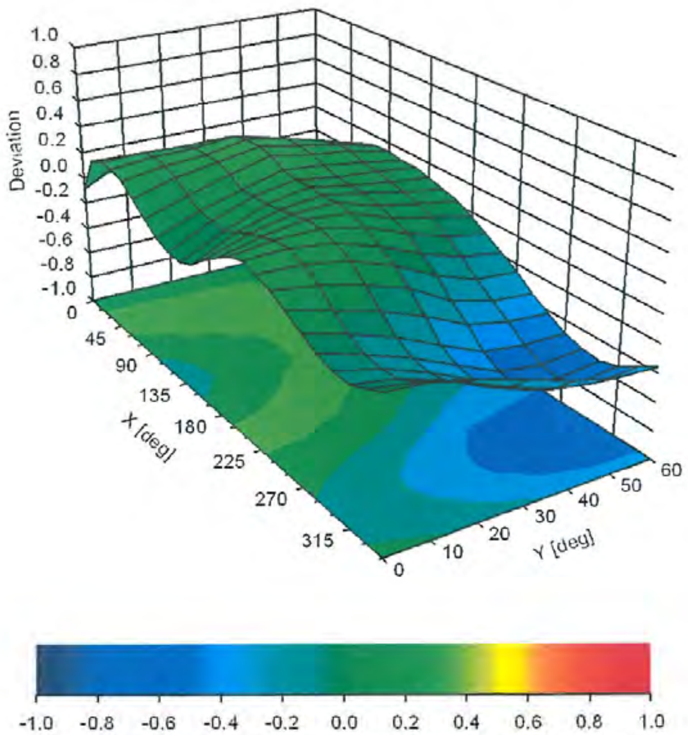


f = 1900 MHz,WGLS R22 (H_convF)



Deviation from Isotropy in Liquid

Error (ϕ, ϑ), f = 900 MHz



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

DASY/EASY - Parameters of Probe: EX3DV4 - SN:3933

Other Probe Parameters

Sensor Arrangement	Triangular
Connector Angle (°)	77.9
Mechanical Surface Detection Mode	enabled
Optical Surface Detection Mode	disabled
Probe Overall Length	337 mm
Probe Body Diameter	10 mm
Tip Length	9 mm
Tip Diameter	2.5 mm
Probe Tip to Sensor X Calibration Point	1 mm
Probe Tip to Sensor Y Calibration Point	1 mm
Probe Tip to Sensor Z Calibration Point	1 mm
Recommended Measurement Distance from Surface	1.4 mm

APPENDIX B. – Dipole Calibration Data

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

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

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

Accreditation No.: SCS 0108

Client **DT&C (Dymstec)**

Certificate No: **D750V3-1049_Jan19**

CALIBRATION CERTIFICATE

Object	D750V3 - SN:1049
Calibration procedure(s)	QA CAL-05.v11 Calibration Procedure for SAR Validation Sources between 0.7-3 GHz
Calibration date:	January 25, 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-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	31-Dec-18 (No. EX3-7349_Dec18)	Dec-19
DAE4	SN: 601	04-Oct-18 (No. DAE4-601_Oct18)	Oct-19

Secondary Standards	ID #	Check Date (in house)	Scheduled Check
Power meter EPM-442A	SN: GB37480704	07-Oct-15 (in house check Oct-18)	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: January 25, 2019

Calibration Laboratory of
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Zeughausstrasse 43, 8004 Zurich, Switzerland

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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	V52.10.2
Extrapolation	Advanced Extrapolation	
Phantom	Modular Flat Phantom	
Distance Dipole Center - TSL	15 mm	with Spacer
Zoom Scan Resolution	dx, dy, dz = 5 mm	
Frequency	750 MHz ± 1 MHz	

Head TSL parameters

The following parameters and calculations were applied.

	Temperature	**Permittivity**	**Conductivity**
Nominal Head TSL parameters	22.0 °C	41.9	0.89 mho/m
Measured Head TSL parameters	(22.0 ± 0.2) °C	41.5 ± 6 %	0.89 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	2.10 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	**8.38 W/kg ± 17.0 % (k=2)**

SAR averaged over 10 cm^3 (10 g) of Head TSL	condition	
SAR measured	250 mW input power	1.38 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	**5.51 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	55.5	0.96 mho/m
Measured Body TSL parameters	(22.0 ± 0.2) °C	54.8 ± 6 %	0.96 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	2.18 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	**8.70 W/kg ± 17.0 % (k=2)**

SAR averaged over 10 cm^3 (10 g) of Body TSL	condition	
SAR measured	250 mW input power	1.44 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	**5.75 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	54.9 Ω - 1.8 jΩ
Return Loss	- 26.1 dB

Antenna Parameters with Body TSL

Impedance, transformed to feed point	50.0 Ω - 5.2 jΩ
Return Loss	- 25.7 dB

General Antenna Parameters and Design

Electrical Delay (one direction)	1.037 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: 25.01.2019

Test Laboratory: SPEAG, Zurich, Switzerland

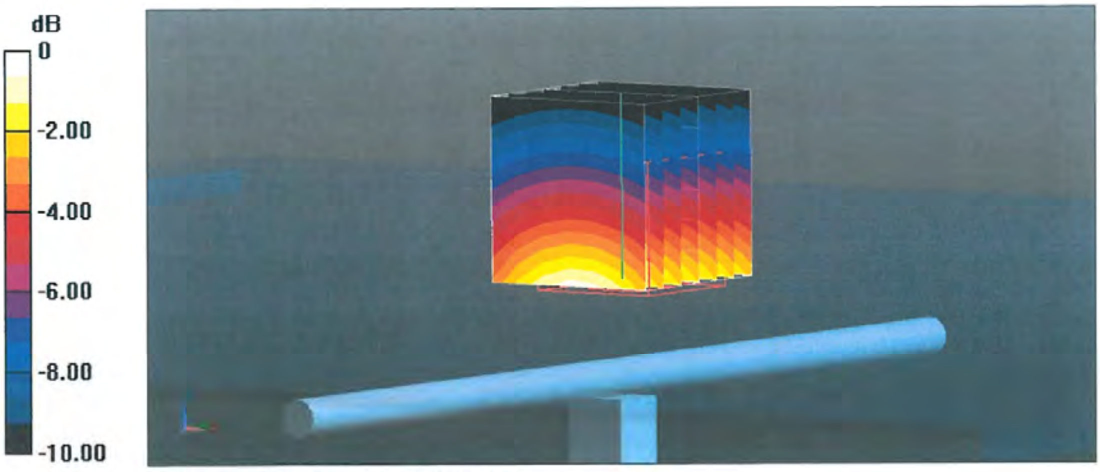
DUT: Dipole 750 MHz; Type: D750V3; Serial: D750V3 - SN:1049

Communication System: UID 0 - CW; Frequency: 750 MHz
Medium parameters used: f = 750 MHz; σ = 0.89 S/m; ε_r = 41.5; ρ = 1000 kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2011)

DASY52 Configuration:

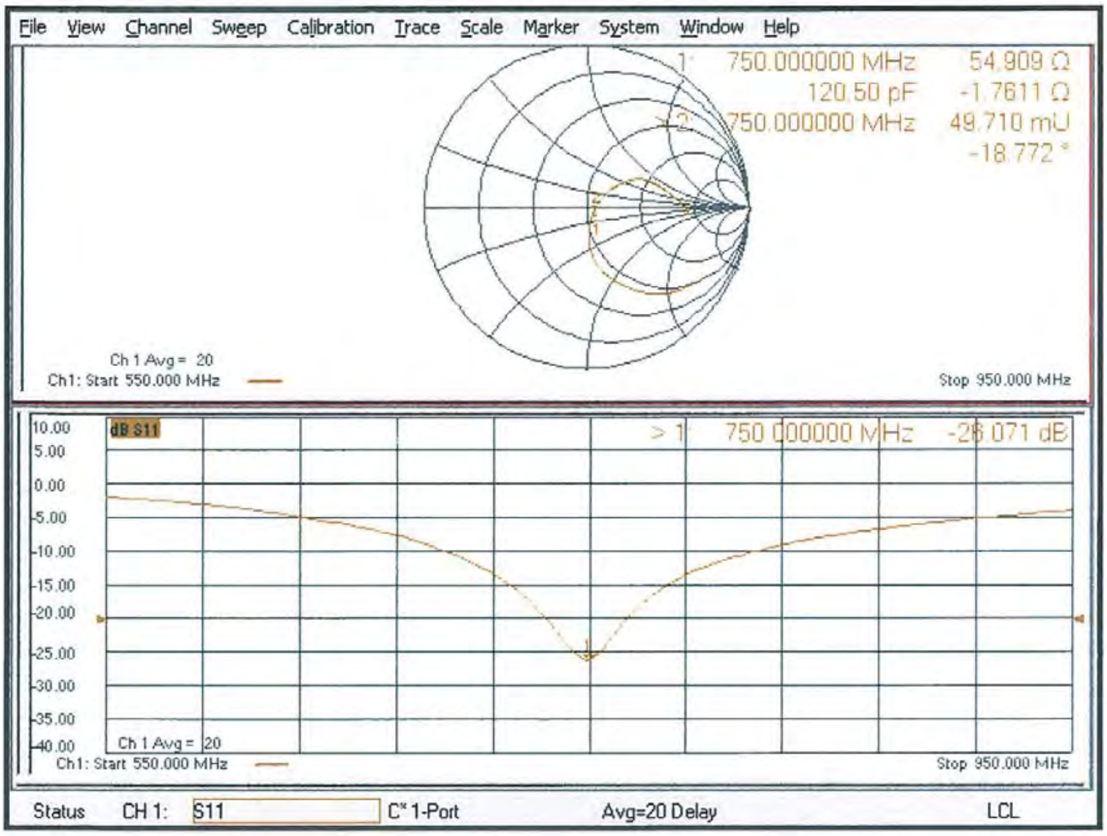
- Probe: EX3DV4 - SN7349; ConvF(10.32, 10.32, 10.32) @ 750 MHz; Calibrated: 31.12.2018
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 04.10.2018
- Phantom: Flat Phantom 4.9 (front); Type: QD 00L P49 AA; Serial: 1001
- DASY52 52.10.2(1495); SEMCAD X 14.6.12(7450)

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 = 59.22 V/m; Power Drift = -0.01 dB
Peak SAR (extrapolated) = 3.17 W/kg
SAR(1 g) = 2.1 W/kg; SAR(10 g) = 1.38 W/kg
Maximum value of SAR (measured) = 2.78 W/kg



0 dB = 2.78 W/kg = 4.44 dBW/kg

Impedance Measurement Plot for Head TSL



Certificate No: D750V3-1049_Jan19 Page 6 of 8

DASY5 Validation Report for Body TSL

Date: 25.01.2019

Test Laboratory: SPEAG, Zurich, Switzerland

DUT: Dipole 750 MHz; Type: D750V3; Serial: D750V3 - SN:1049

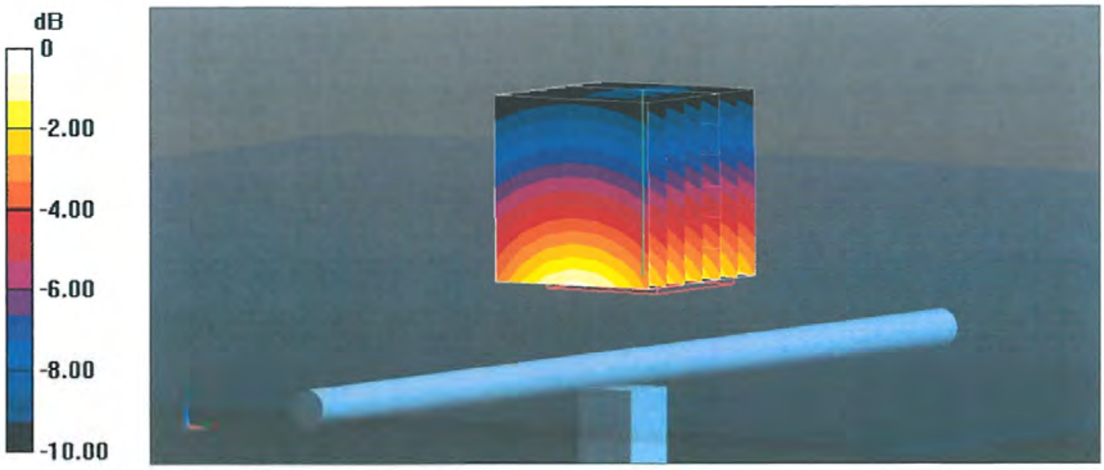
Communication System: UID 0 - CW; Frequency: 750 MHz
Medium parameters used: f = 750 MHz; σ = 0.96 S/m; ε_r = 54.8; ρ = 1000 kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2011)

DASY52 Configuration:

- Probe: EX3DV4 - SN7349; ConvF(10.29, 10.29, 10.29) @ 750 MHz; Calibrated: 31.12.2018
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 04.10.2018
- Phantom: Flat Phantom 4.9 (Back); Type: QD 00R P49 AA; Serial: 1005
- DASY52 52.10.2(1495); SEMCAD X 14.6.12(7450)

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

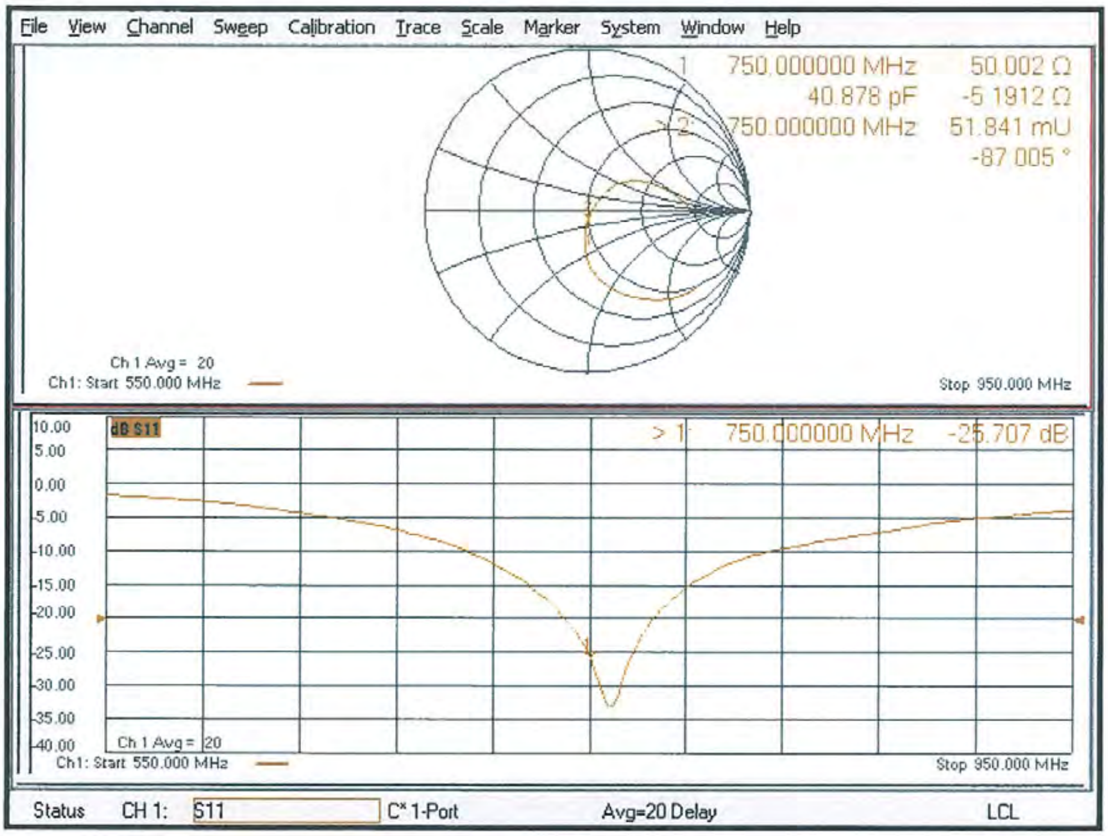
Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 56.84 V/m; Power Drift = 0.00 dB
Peak SAR (extrapolated) = 3.25 W/kg
SAR(1 g) = 2.18 W/kg; SAR(10 g) = 1.44 W/kg
Maximum value of SAR (measured) = 2.89 W/kg



0 dB = 2.89 W/kg = 4.61 dBW/kg

Certificate No: D750V3-1049_Jan19 Page 7 of 8

Impedance Measurement Plot for Body TSL



Certificate No: D750V3-1049_Jan19 Page 8 of 8

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Accreditation No.: SCS 0108

Client **DT&C (Dymstec)**

Certificate No: **D835V2-4d159_Aug18**

CALIBRATION CERTIFICATE

Object: D835V2 - SN:4d159

Calibration procedure(s): QA CAL-05.v10
Calibration procedure for dipole validation kits above 700 MHz

Calibration date: August 23, 2018

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 Agilent E8358A	SN: US41080477	31-Mar-14 (in house check Oct-17)	In house check: Oct-18

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

Issued: August 24, 2018

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

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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	V52.10.1
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	40.7 ± 6 %	0.92 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	**9.36 W/kg ± 17.0 % (k=2)**

SAR averaged over 10 cm^3 (10 g) of Head TSL	condition	
SAR measured	250 mW input power	1.53 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	**6.02 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	54.9 ± 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	2.43 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	**9.56 W/kg ± 17.0 % (k=2)**

SAR averaged over 10 cm^3 (10 g) of Body TSL	condition	
SAR measured	250 mW input power	1.59 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	**6.28 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	51.7 Ω - 3.5 jΩ
Return Loss	- 28.3 dB

Antenna Parameters with Body TSL

Impedance, transformed to feed point	48.8 Ω - 5.7 jΩ
Return Loss	- 24.5 dB

General Antenna Parameters and Design

Electrical Delay (one direction)	1.440 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	December 28, 2012

DASY5 Validation Report for Head TSL

Date: 22.08.2018

Test Laboratory: SPEAG, Zurich, Switzerland

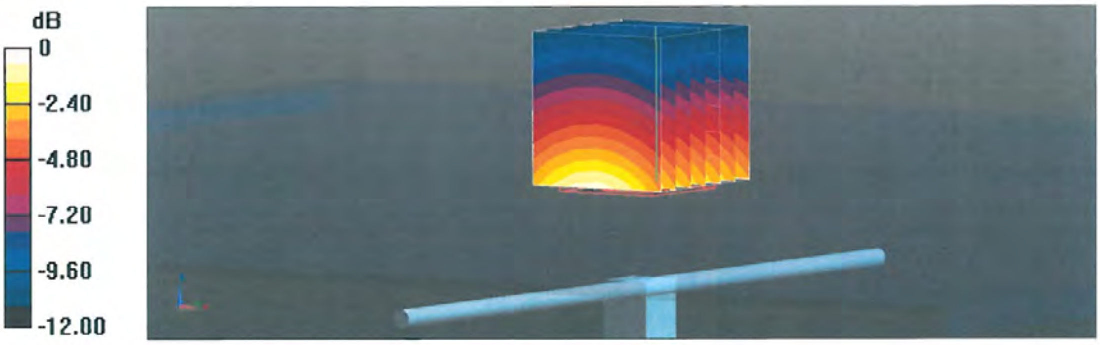
DUT: Dipole 835 MHz; Type: D835V2; Serial: D835V2 - SN:4d159

Communication System: UID 0 - CW; Frequency: 835 MHz
Medium parameters used: f = 835 MHz; σ = 0.92 S/m; ε_r = 40.7; ρ = 1000 kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2011)

DASY52 Configuration:

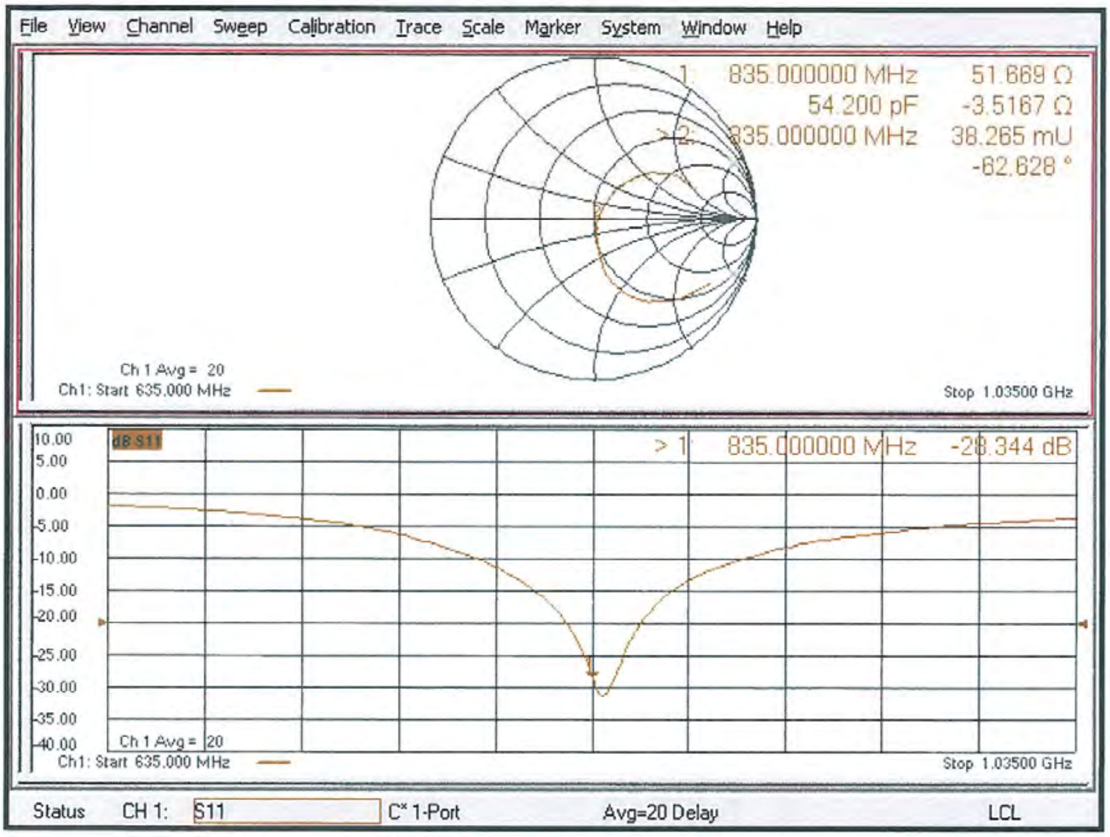
- Probe: EX3DV4 - SN7349; ConvF(9.9, 9.9, 9.9) @ 835 MHz; Calibrated: 30.12.2017
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 26.10.2017
- Phantom: Flat Phantom 4.9 (front); Type: QD 00L P49 AA; Serial: 1001
- DASY52 52.10.1(1476); SEMCAD X 14.6.11(7439)

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 = 62.11 V/m; Power Drift = -0.03 dB
Peak SAR (extrapolated) = 3.68 W/kg
SAR(1 g) = 2.39 W/kg; SAR(10 g) = 1.53 W/kg
Maximum value of SAR (measured) = 3.23 W/kg



0 dB = 3.23 W/kg = 5.09 dBW/kg

Impedance Measurement Plot for Head TSL



Certificate No: D835V2-4d159_Aug18 Page 6 of 8

DASY5 Validation Report for Body TSL

Date: 23.08.2018

Test Laboratory: SPEAG, Zurich, Switzerland

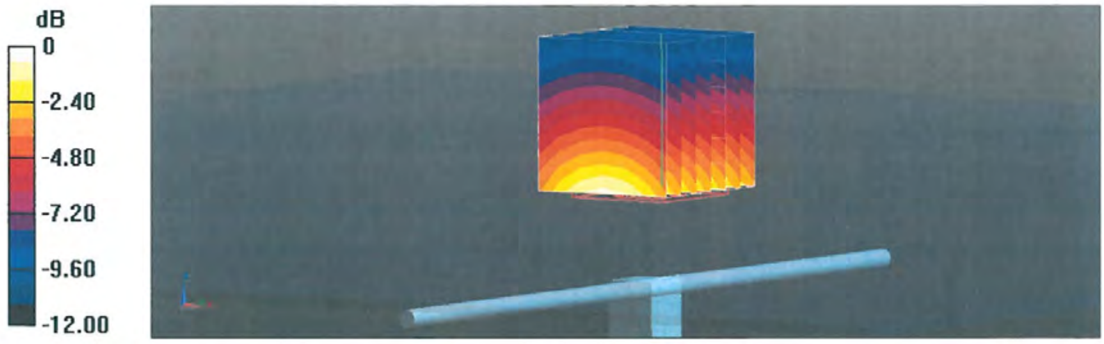
DUT: Dipole 835 MHz; Type: D835V2; Serial: D835V2 - SN:4d159

Communication System: UID 0 - CW; Frequency: 835 MHz
Medium parameters used: f = 835 MHz; σ = 0.99 S/m; ε_r = 54.9; ρ = 1000 kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2011)

DASY52 Configuration:

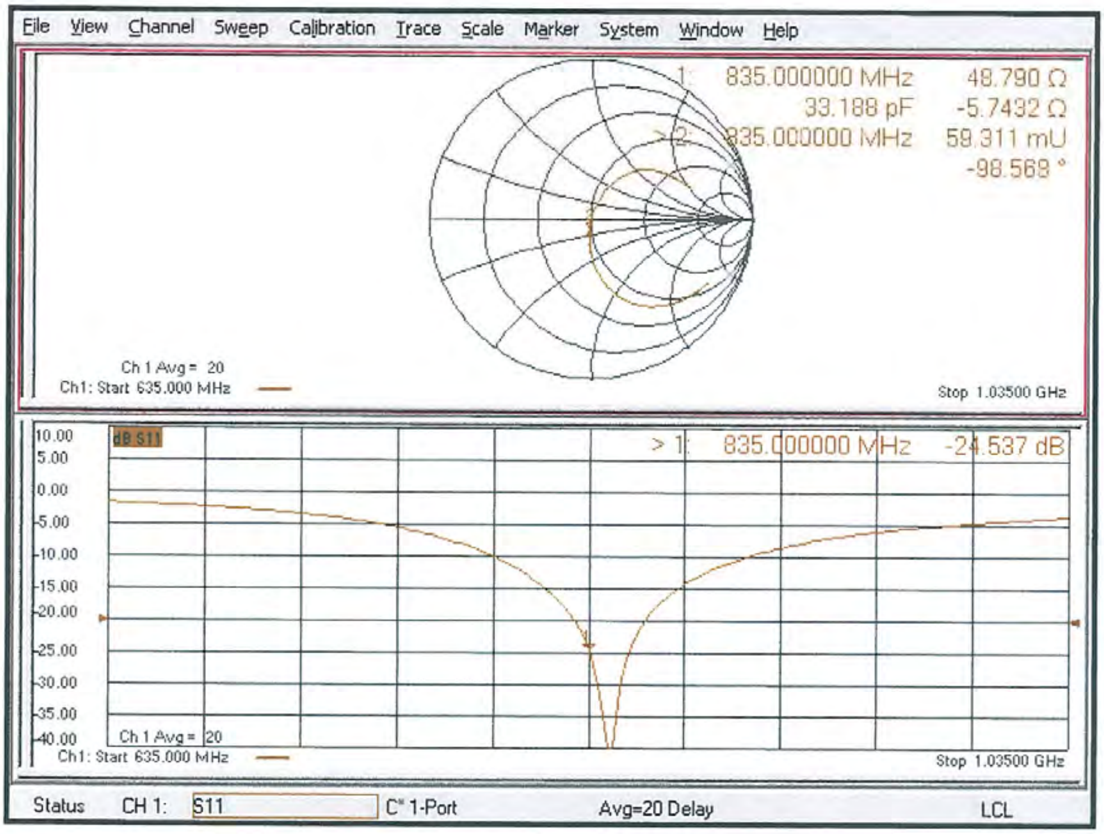
- Probe: EX3DV4 - SN7349; ConvF(10.05, 10.05, 10.05) @ 835 MHz; Calibrated: 30.12.2017
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 26.10.2017
- Phantom: Flat Phantom 4.9 (Back); Type: QD 00R P49 AA; Serial: 1005
- DASY52 52.10.1(1476); SEMCAD X 14.6.11(7439)

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 = 61.72 V/m; Power Drift = -0.09 dB
Peak SAR (extrapolated) = 3.63 W/kg
SAR(1 g) = 2.43 W/kg; SAR(10 g) = 1.59 W/kg
Maximum value of SAR (measured) = 3.24 W/kg



0 dB = 3.24 W/kg = 5.11 dBW/kg

Impedance Measurement Plot for Body TSL



Certificate No: D835V2-4d159_Aug18 Page 8 of 8