FCC SAR TEST REPORT

FCC ID	**:**	**2ABZ2-EE103**
Equipment	**:**	**Smart Phone**
Brand Name	**:**	**ONEPLUS**
Model Name	**:**	**IN2017**
Applicant	**:**	**OnePlus Technology (Shenzhen) Co., Ltd 18C02, 18C03, 18C04 and 18C05, Shum Yip Terra Building, Binhe Avenue North, Futian District, Shenzhen**
Manufacturer	**:**	**OnePlus Technology (Shenzhen) Co., Ltd 18C02, 18C03, 18C04 and 18C05, Shum Yip Terra Building, Binhe Avenue North, Futian District, Shenzhen**
Standard	**:**	**FCC 47 CFR Part 2 (2.1093) ANSI/IEEE C95.1-1992 IEEE 1528-2013**

The product was received on Jun. 22, 2020 and testing was started from Jul. 07, 2020 and completed on Jul. 09, 2020. We, Sporton International (ShenZhen) Inc., would like to declare that the tested sample has been evaluated in accordance with the test procedures and has been in compliance with the applicable technical standards.

The test results in this report apply exclusively to the tested model / sample. Without written approval of Sporton International (ShenZhen) Inc., the test report shall not be reproduced except in full.

Long Liang

Reviewed by: Long Liang / Supervisor

Johnny Chen

Approved by: Johnny Chen / Manager

ACCREDITED Cert #5145.01

Sporton International (ShenZhen) Inc.

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History of this test report

Report No.	Version	Description	Issued Date
FA062208	01	Initial issue of report	Jul. 17, 2020

1. Statement of Compliance

The maximum results of Specific Absorption Rate (SAR) found during testing for **OnePlus Technology (Shenzhen) Co., Ltd, Smart Phone, IN2017**, are as follows.

Equipment Class	Frequency Band	Highest SAR Summary			Highest Simultaneous Transmission 1g SAR (W/kg)
		Head (Separation 0mm)	Body-worn (Separation 15mm)	Hotspot (Separation 10mm)	
		1g SAR (W/kg)			
Licensed	N66	**0.98**	0.31	**0.79**	1.25
	N2	0.80	**0.34**	0.66	
DTS	2.4GHz WLAN				1.25
NII	5GHz WLAN				1.25
DSS	Bluetooth				1.23
Date of Testing:		2020/7/7 ~ 2020/7/9			

This device is in compliance with Specific Absorption Rate (SAR) for general population/uncontrolled exposure limits (1.6W/kg as averaged over any 1 gram of tissue; 10-gram SAR for Product Specific 10g SAR, limit: 4.0W/kg) specified in FCC 47 CFR part 2 (2.1093) and ANSI/IEEE C95.1-1992, and had been tested in accordance with the measurement methods and procedures specified in IEEE 1528-2013 and FCC KDB publications.

2. Administration Data

Sporton International (Shenzhen) Inc. is accredited to ISO/IEC 17025:2017 by American Association for Laboratory Accreditation with Certificate Number 5145.01.

Testing Laboratory		
Test Firm	Sporton International (Shenzhen) Inc.	
Test Site Location	1/F, 2/F, Bldg 5, Shiling Industrial Zone, Xinwei Village, Xili, Nanshan, Shenzhen, 518055 People's Republic of China TEL: +86-755-86379589 FAX: +86-755-86379595	
Test Site No.	FCC Designation No.	FCC Test Firm Registration No.
	CN1256	421272

3. Guidance Applied

The Specific Absorption Rate (SAR) testing specification, method, and procedure for this device is in accordance with the following standards:

- FCC 47 CFR Part 2 (2.1093)
- ANSI/IEEE C95.1-1992
- IEEE 1528-2013
- FCC KDB 865664 D01 SAR Measurement 100 MHz to 6 GHz v01r04
- FCC KDB 865664 D02 SAR Reporting v01r02
- FCC KDB 447498 D01 General RF Exposure Guidance v06
- FCC KDB 648474 D04 SAR Evaluation Considerations for Wireless Handsets v01r03
- FCC KDB 248227 D01 802.11 Wi-Fi SAR v02r02
- FCC KDB 941225 D01 3G SAR Procedures v03r01
- FCC KDB 941225 D05 SAR for LTE Devices v02r05
- FCC KDB 941225 D05A Rel.10 LTE SAR Test Guidance v01r02
- FCC KDB 941225 D06 Hotspot Mode SAR v02r01
- FCC KDB 941225 D07 UMPC Mini Tablet v01r02

4. Equipment Under Test (EUT) Information

4.1 General Information

Product Feature & Specification	
Equipment Name	Smart Phone
Brand Name	ONEPLUS
Model Name	IN2017
FCC ID	2ABZ2-EE103
IMEI Code	990015970539383
Wireless Technology and Frequency Range	GSM850: 824.2 MHz ~ 848.8 MHz GSM1900: 1850.2 MHz ~ 1909.8 MHz WCDMA Band II: 1852.4 MHz ~ 1907.6 MHz WCDMA Band IV: 1712.4 MHz ~ 1752.6 MHz WCDMA Band V: 826.4 MHz ~ 846.6 MHz CDMA2000 BC0: 824.7 MHz ~ 848.31 MHz CDMA 2000 BC1: 1851.25 MHz ~ 1908.75 MHz CDMA 2000 BC10: 817.9 MHz ~ 823.1 MHz LTE Band 2: 1850.7 MHz ~ 1909.3 MHz LTE Band 4: 1710.7 MHz ~ 1754.3 MHz LTE Band 5: 824.7 MHz ~ 848.3 MHz LTE Band 7: 2502.5 MHz ~ 2567.5 MHz LTE Band 12: 699.7 MHz ~ 715.3 MHz LTE Band 13: 779.5 MHz ~ 784.5 MHz LTE Band 17: 706.5 MHz ~ 713.5 MHz LTE Band 25: 1850.7 MHz ~ 1914.3 MHz LTE Band 26: 814.7 MHz ~ 848.3 MHz LTE Band 30: 2307.5 MHz ~ 2312.5 MHz LTE Band 38: 2572.5 MHz ~ 2617.5 MHz LTE Band 41: 2498.5 MHz ~ 2687.5 MHz LTE Band 48: 3552.5 MHz ~ 3697.5 MHz LTE Band 66: 1710.7 MHz ~ 1779.3 MHz LTE Band 71: 665.5 MHz ~ 695.5 MHz 5G NR n2 : 1852.5 MHz ~ 1907.5 MHz 5G NR n5 : 826.5 MHz ~ 846.5 MHz 5G NR n41 : 2506.02 MHz ~ 2679.99MHz 5G NR n66 : 1712.5 MHz ~ 1777.5 MHz 5G NR n71 : 665.5 MHz ~ 695.5 MHz WLAN 2.4GHz Band: 2412 MHz ~ 2462 MHz WLAN 5.2GHz Band: 5180 MHz ~ 5240 MHz WLAN 5.3GHz Band: 5260 MHz ~ 5320 MHz WLAN 5.5GHz Band: 5500 MHz ~ 5720 MHz WLAN 5.8GHz Band: 5745 MHz ~ 5825 MHz Bluetooth: 2402 MHz ~ 2480 MHz NFC: 13.56 MHz
Mode	GSM/GPRS/EGPRS AMR / RMC 12.2Kbps HSDPA HSUPA DC-HSDPA HSPA+ (16QAM uplink) CDMA2000 : 1xRTT/1xEv-Do(Rel.0)/1xEv-Do(Rev.A) LTE: QPSK, 16QAM, 64QAM, 256QAM 5G NR : CP-OFDM / DFT-s-OFDM , PI/2 BPSK, QPSK, 16QAM, 64QAM, 256QAM WLAN 2.4GHz : 802.11b/g/n /ax HT20/HT40/ HE20/HE40 WLAN 5GHz : 802.11a/n/ac/ax HT20/HT40/VHT20/VHT40/VHT80/HE20/HE40/HE80 Bluetooth BR/EDR/LE NFC:ASK
GSM / (E)GPRS Transfer mode	Class B – EUT cannot support Packet Switched and Circuit Switched Network simultaneously but can automatically switch between Packet and Circuit Switched Network.
HW Version	15
SW Version	10.5.IN55CB
EUT Stage	Production Unit

Remark:

1. This device has WWAN UAT and LAT transmitter antennas which can refer to antenna location chapter.
2. The 2.4GHz/5GHz WLAN can transmit in MIMO antenna mode only and it has no SISO antenna mode.
3. This device WLAN 2.4GHz / 5.2GHz / 5.8GHz supports Hotspot operation and Bluetooth support tethering applications.
4. For WWAN UAT antenna, when the audio is actively routed through the earpiece receiver, and the LCD display is off, and the proximity sensor is triggered which indicating the next-to-head condition then power reduction will be implemented immediately at 5G NR n2/ n66.
5. For WWAN LAT antenna, hotspot mode is enabled, power reduction will be activated to limit the maximum power of 5G NR n2.
6. This is a variant report for IN2017. The new SA mode 5G NR n2/n66 is opened by the software. Based on the similarity between current and previous project. 5G NR n2/n66 for full SAR test, the others data can refer to original test report (Sporton Report Number FA9N2025-08).

4.2 General LTE SAR Test and Reporting Considerations

Summarized necessary items addressed in KDB 941225 D05 v02r05	
FCC ID	2ABZ2-EE103
Equipment Name	Smart Phone
Operating Frequency Range of each LTE transmission band	LTE Band 2: 1850.7 MHz ~ 1909.3 MHz LTE Band 4: 1710.7 MHz ~ 1754.3 MHz LTE Band 5: 824.7 MHz ~ 848.3 MHz LTE Band 7: 2502.5 MHz ~ 2567.5 MHz LTE Band 12: 699.7 MHz ~ 715.3 MHz LTE Band 13: 779.5 MHz ~ 784.5 MHz LTE Band 17: 706.5 MHz ~ 713.5 MHz LTE Band 25: 1850.7 MHz ~ 1914.3 MHz LTE Band 26: 814.7 MHz ~ 848.3 MHz LTE Band 30: 2307.5 MHz ~ 2312.5 MHz LTE Band 38: 2572.5 MHz ~ 2617.5 MHz LTE Band 41: 2498.5 MHz ~ 2687.5 MHz LTE Band 48: 3552.5 MHz ~ 3697.5 MHz LTE Band 66: 1710.7 MHz ~ 1779.3 MHz LTE Band 71: 665.5 MHz ~ 695.5 MHz
Channel Bandwidth	LTE Band 02:1.4MHz, 3MHz, 5MHz, 10MHz, 15MHz, 20MHz LTE Band 04:1.4MHz, 3MHz, 5MHz, 10MHz, 15MHz, 20MHz LTE Band 05:1.4MHz, 3MHz, 5MHz, 10MHz LTE Band 07: 5MHz, 10MHz, 15MHz, 20MHz LTE Band 12:1.4MHz, 3MHz, 5MHz, 10MHz LTE Band 13: 5MHz, 10MHz LTE Band 17: 5MHz, 10MHz LTE Band 25:1.4MHz, 3MHz, 5MHz, 10MHz, 15MHz, 20MHz LTE Band 26:1.4MHz, 3MHz, 5MHz, 10MHz, 15MHz LTE Band 30: 5MHz, 10MHz LTE Band 38: 5MHz, 10MHz, 15MHz, 20MHz LTE Band 41: 5MHz, 10MHz, 15MHz, 20MHz LTE Band 48: 5MHz, 10MHz, 15MHz, 20MHz LTE Band 66:1.4MHz, 3MHz, 5MHz, 10MHz, 15MHz, 20MHz LTE Band 71: 5MHz, 10MHz, 15MHz, 20MHz
uplink modulations used	QPSK / 16QAM / 64QAM / 256QAM
LTE Voice / Data requirements	Voice and Data
LTE MPR permanently built-in by design	Table 6.2.3-1: Maximum Power Reduction (MPR) for Power Class 1, 2 and 3

Modulation	Channel bandwidth / Transmission bandwidth (N_{RB})						MPR (dB)
	1.4 MHz	3.0 MHz	5 MHz	10 MHz	15 MHz	20 MHz	
QPSK	> 5	> 4	> 8	> 12	> 16	> 18	≤ 1
16 QAM	≤ 5	≤ 4	≤ 8	≤ 12	≤ 16	≤ 18	≤ 1
16 QAM	> 5	> 4	> 8	> 12	> 16	> 18	≤ 2
64 QAM	≤ 5	≤ 4	≤ 8	≤ 12	≤ 16	≤ 18	≤ 2
64 QAM	> 5	> 4	> 8	> 12	> 16	> 18	≤ 3
256 QAM	≥ 1						≤ 5

LTE A-MPR	In the base station simulator configuration, Network Setting value is set to NS_01 to disable A-MPR during SAR testing and the LTE SAR tests was transmitting on all TTI frames (Maximum TTI)
Spectrum plots for RB configuration	A properly configured base station simulator was used for the SAR and power measurement; therefore, spectrum plots for each RB allocation and offset configuration are not included in the SAR report.

Transmission (H, M, L) channel numbers and frequencies in each LTE band

LTE Band 2

	Bandwidth 1.4 MHz		Bandwidth 3 MHz		Bandwidth 5 MHz		Bandwidth 10 MHz		Bandwidth 15 MHz		Bandwidth 20 MHz	
	Ch. #	Freq. (MHz)	Ch. #	Freq. (MHz)	Ch. #	Freq. (MHz)	Ch. #	Freq. (MHz)	Ch. #	Freq. (MHz)	Ch. #	Freq. (MHz)
L	18607	1850.7	18615	1851.5	18625	1852.5	18650	1855	18675	1857.5	18700	1860
M	18900	1880	18900	1880	18900	1880	18900	1880	18900	1880	18900	1880
H	19193	1909.3	19185	1908.5	19175	1907.5	19150	1905	19125	1902.5	19100	1900

LTE Band 4

	Bandwidth 1.4 MHz		Bandwidth 3 MHz		Bandwidth 5 MHz		Bandwidth 10 MHz		Bandwidth 15 MHz		Bandwidth 20 MHz	
	Ch. #	Freq. (MHz)	Ch. #	Freq. (MHz)	Ch. #	Freq. (MHz)	Ch. #	Freq. (MHz)	Ch. #	Freq. (MHz)	Ch. #	Freq. (MHz)
L	19957	1710.7	19965	1711.5	19975	1712.5	20000	1715	20025	1717.5	20050	1720
M	20175	1732.5	20175	1732.5	20175	1732.5	20175	1732.5	20175	1732.5	20175	1732.5
H	20393	1754.3	20385	1753.5	20375	1752.5	20350	1750	20325	1747.5	20300	1745

LTE Band 5

	Bandwidth 1.4 MHz		Bandwidth 3 MHz		Bandwidth 5 MHz		Bandwidth 10 MHz	
	Ch. #	Freq. (MHz)	Ch. #	Freq. (MHz)	Ch. #	Freq. (MHz)	Ch. #	Freq. (MHz)
L	20407	824.7	20415	825.5	20425	826.5	20450	829
M	20525	836.5	20525	836.5	20525	836.5	20525	836.5
H	20643	848.3	20635	847.5	20625	846.5	20600	844

LTE Band 7

	Bandwidth 5 MHz		Bandwidth 10 MHz		Bandwidth 15 MHz		Bandwidth 20 MHz	
	Ch. #	Freq. (MHz)	Ch. #	Freq. (MHz)	Ch. #	Freq. (MHz)	Ch. #	Freq. (MHz)
L	20775	2502.5	20800	2505	20825	2507.5	20850	2510
M	21100	2535	21100	2535	21100	2535	21100	2535
H	21425	2567.5	21400	2565	21375	2562.5	21350	2560

LTE Band 12

	Bandwidth 1.4 MHz		Bandwidth 3 MHz		Bandwidth 5 MHz		Bandwidth 10 MHz	
	Ch. #	Freq. (MHz)	Ch. #	Freq. (MHz)	Ch. #	Freq. (MHz)	Ch. #	Freq. (MHz)
L	23017	699.7	23025	700.5	23035	701.5	23060	704
M	23095	707.5	23095	707.5	23095	707.5	23095	707.5
H	23173	715.3	23165	714.5	23155	713.5	23130	711

LTE Band 13

	Bandwidth 5 MHz		Bandwidth 10 MHz	
	Channel #	Freq.(MHz)	Channel #	Freq.(MHz)
L	23205	779.5		
M	23230	782	23230	782
H	23255	784.5		

LTE Band 17

	Bandwidth 5 MHz		Bandwidth 10 MHz	
	Channel #	Freq.(MHz)	Channel #	Freq. (MHz)
L	23755	706.5	23780	709
M	23790	710	23790	710
H	23825	713.5	23800	711

LTE Band 25

	Bandwidth 1.4 MHz		Bandwidth 3 MHz		Bandwidth 5 MHz		Bandwidth 10 MHz		Bandwidth 15 MHz		Bandwidth 20 MHz	
	Ch. #	Freq. (MHz)	Ch. #	Freq. (MHz)	Ch. #	Freq. (MHz)	Ch. #	Freq. (MHz)	Ch. #	Freq. (MHz)	Ch. #	Freq. (MHz)
L	26047	1850.7	26055	1851.5	26065	1852.5	26090	1855	26115	1857.5	26140	1860
M	26340	1880	26340	1880	26340	1880	26340	1880	26340	1880	26340	1880
H	26683	1914.3	26675	1913.5	26665	1912.5	26640	1910	26615	1907.5	26590	1905

LTE Band 26										
	Bandwidth 1.4 MHz		Bandwidth 3 MHz		Bandwidth 5 MHz		Bandwidth 10 MHz		Bandwidth 15 MHz	
	Ch. #	Freq. (MHz)	Ch. #	Freq. (MHz)	Ch. #	Freq. (MHz)	Ch. #	Freq. (MHz)	Ch. #	Freq. (MHz)
L	26697	814.7	26705	815.5	26715	816.5	26740	819	26765	821.5
M	26865	831.5	26865	831.5	26865	831.5	26865	831.5	26865	831.5
H	27033	848.3	27025	847.5	27015	846.5	26990	844	26965	841.5

LTE Band 30				
	Bandwidth 5 MHz		Bandwidth 10 MHz	
	Channel #	Freq.(MHz)	Channel #	Freq.(MHz)
L	27685	2307.5		
M	27710	2310	27710	2310
H	27735	2312.5		

LTE Band 38								
	Bandwidth 5 MHz		Bandwidth 10 MHz		Bandwidth 15 MHz		Bandwidth 20 MHz	
	Ch. #	Freq. (MHz)	Ch. #	Freq. (MHz)	Ch. #	Freq. (MHz)	Ch. #	Freq. (MHz)
L	37775	2572.5	37800	2575	37825	2577.5	37850	2580
M	38000	2595	38000	2595	38000	2595	38000	2595
H	38225	2617.5	38200	2615	38175	2612.5	38150	2610

LTE Band 41								
	Bandwidth 5 MHz		Bandwidth 10 MHz		Bandwidth 15 MHz		Bandwidth 20 MHz	
	Ch. #	Freq. (MHz)	Ch. #	Freq. (MHz)	Ch. #	Freq. (MHz)	Ch. #	Freq. (MHz)
L	39675	2498.5	39700	2501	39725	2503.5	39750	2506
LM	40148	2545.8	40160	2547	40173	2548.3	40185	2549.5
M	40620	2593	40620	2593	40620	2593	40620	2593
HM	41093	2640.3	41080	2639	41068	2637.8	41055	2636.5
H	41565	2687.5	41540	2685	41515	2682.5	41490	2680

LTE Band 48								
	Bandwidth 5 MHz		Bandwidth 10 MHz		Bandwidth 15 MHz		Bandwidth 20 MHz	
	Ch. #	Freq. (MHz)	Ch. #	Freq. (MHz)	Ch. #	Freq. (MHz)	Ch. #	Freq. (MHz)
L	55265	3552.5	55290	3555	55315	3557.5	55340	3560
LM	55810	3607	55815	3607.5	55820	3608	55830	3609
MH	56170	3643	56165	3642.5	56160	3642	56150	3641
H	56715	3697.5	56690	3695	56665	3692.5	56640	3690

LTE Band 66												
	Bandwidth 1.4 MHz		Bandwidth 3 MHz		Bandwidth 5 MHz		Bandwidth 10 MHz		Bandwidth 15 MHz		Bandwidth 20 MHz	
	Ch. #	Freq. (MHz)	Ch. #	Freq. (MHz)	Ch. #	Freq. (MHz)	Ch. #	Freq. (MHz)	Ch. #	Freq. (MHz)	Ch. #	Freq. (MHz)
L	131979	1710.7	131987	1711.5	131997	1712.5	132022	1715	132047	1717.5	132072	1720
M	132322	1745	132322	1745	132322	1745	132322	1745	132322	1745	132322	1745
H	132665	1779.3	132657	1778.5	132647	1777.5	132622	1775	132597	1772.5	132572	1770

LTE Band 71								
	Bandwidth 5 MHz		Bandwidth 10 MHz		Bandwidth 15 MHz		Bandwidth 20 MHz	
	Ch. #	Freq. (MHz)	Ch. #	Freq. (MHz)	Ch. #	Freq. (MHz)	Ch. #	Freq. (MHz)
L	133147	665.5	133172	668	133197	670.5	133222	673
M	133297	680.5	133297	680.5	133297	680.5	133297	680.5
H	133447	695.5	133422	693	133397	690.5	133372	688

5. RF Exposure Limits

5.1 Uncontrolled Environment

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

5.2 Controlled Environment

Controlled Environments are defined as locations where there is exposure that may be incurred by persons who are aware of the potential for exposure, (i.e. as a result of employment or occupation). In general, occupational/controlled exposure limits are applicable to situations in which persons are exposed as a consequence of their employment, who have been made fully aware of the potential for exposure and can exercise control over their exposure. The 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.

Limits for Occupational/Controlled Exposure (W/kg)

Whole-Body	Partial-Body	Hands, Wrists, Feet and Ankles
0.4	8.0	20.0

Limits for General Population/Uncontrolled Exposure (W/kg)

Whole-Body	Partial-Body	Hands, Wrists, Feet and Ankles
0.08	1.6	4.0

1. Whole-Body SAR is averaged over the entire body, partial-body SAR is averaged over any 1gram of tissue defined as a tissue volume in the shape of a cube. SAR for hands, wrists, feet and ankles is averaged over any 10 grams of tissue defined as a tissue volume in the shape of a cube.

6. Specific Absorption Rate (SAR)

6.1 Introduction

SAR is related to the rate at which energy is absorbed per unit mass in an object exposed to a radio field. The SAR distribution in a biological body is complicated and is usually carried out by experimental techniques or numerical modeling. The standard recommends limits for two tiers of groups, occupational/controlled and general population/uncontrolled, based on a person's awareness and ability to exercise control over his or her exposure. In general, occupational/controlled exposure limits are higher than the limits for general population/uncontrolled.

6.2 SAR Definition

The SAR definition is the time derivative (rate) of the incremental energy (dW) absorbed by (dissipated in) an incremental mass (dm) contained in a volume element (dv) of a given density (ρ). The equation description is as below:

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

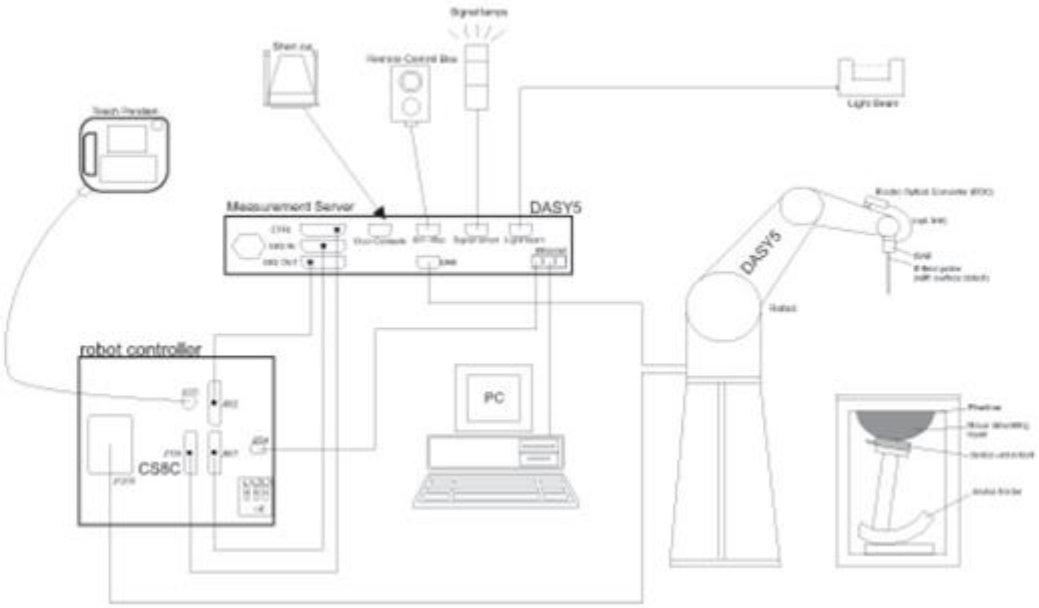
SAR is expressed in units of Watts per kilogram (W/kg)

$$\mathbf{SAR} = \frac{\boldsymbol{\sigma}|\mathbf{E}|^2}{\boldsymbol{\rho}}$$

Where: σ is the conductivity of the tissue, ρ is the mass density of the tissue and E is the RMS electrical field strength.

7. System Description and Setup

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



- A standard high precision 6-axis robot with controller, teach pendant and software. An arm extension for accommodating the data acquisition electronics (DAE).
- An isotropic Field probe optimized and calibrated for the targeted measurement.
- A data acquisition electronics (DAE) which performs the signal amplification, signal multiplexing, AD-conversion, offset measurements, mechanical surface detection, collision detection, etc. The unit is battery powered with standard or rechargeable batteries. The signal is optically transmitted to the EOC.
- The Electro-optical converter (EOC) performs the conversion from optical to electrical signals for the digital communication to the DAE. To use optical surface detection, a special version of the EOC is required. The EOC signal is transmitted to the measurement server.
- The function of the measurement server is to perform the time critical tasks such as signal filtering, control of the robot operation and fast movement interrupts.
- The Light Beam used is for probe alignment. This improves the (absolute) accuracy of the probe positioning.
- A computer running WinXP or Win7 and the DASY5 software.
- Remote control and teach pendant as well as additional circuitry for robot safety such as warning lamps, etc.
- The phantom, the device holder and other accessories according to the targeted measurement.

7.1 E-Field Probe

The SAR measurement is conducted with the dosimetric probe (manufactured by SPEAG).The probe is specially designed and calibrated for use in liquid with high permittivity. The dosimetric probe has special calibration in liquid at different frequency. This probe has a built in optical surface detection system to prevent from collision with phantom.

<EX3DV4 Probe>

Construction	Symmetric design with triangular core Built-in shielding against static charges PEEK enclosure material (resistant to organic solvents, e.g., DGBE)	
Frequency	10 MHz – >6 GHz Linearity: ±0.2 dB (30 MHz – 6 GHz)	
Directivity	±0.3 dB in TSL (rotation around probe axis) ±0.5 dB in TSL (rotation normal to probe axis)	
Dynamic Range	10 µW/g – >100 mW/g Linearity: ±0.2 dB (noise: typically <1 µW/g)	
Dimensions	Overall length: 337 mm (tip: 20 mm) Tip diameter: 2.5 mm (body: 12 mm) Typical distance from probe tip to dipole centers: 1 mm	

7.2 Data Acquisition Electronics (DAE)

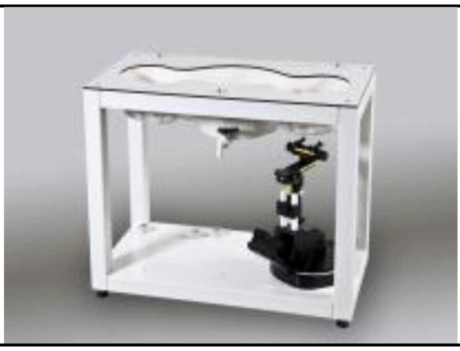
The data acquisition electronics (DAE) consists of a highly sensitive electrometer-grade preamplifier with auto-zeroing, a channel and gain-switching multiplexer, a fast 16 bit AD-converter and a command decoder and control logic unit. Transmission to the measurement server is accomplished through an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

The input impedance of the DAE is 200 MOhm; the inputs are symmetrical and floating. Common mode rejection is above 80 dB.

Fig 5.1 Photo of DAE

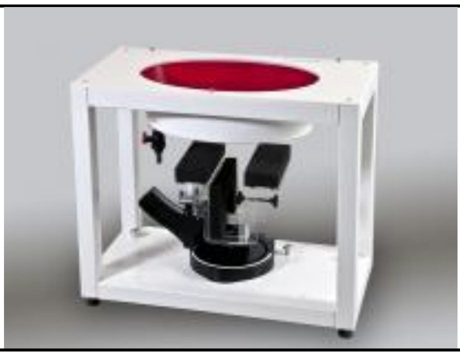
7.3 Phantom

<SAM Twin Phantom>

Shell Thickness	2 ± 0.2 mm; Center ear point: 6 ± 0.2 mm	
Filling Volume	Approx. 25 liters	
Dimensions	Length: 1000 mm; Width: 500 mm; Height: adjustable feet	
Measurement Areas	Left Hand, Right Hand, Flat Phantom	

The bottom plate contains three pair of bolts for locking the device holder. The device holder positions are adjusted to the standard measurement positions in the three sections. A white cover is provided to tap the phantom during off-periods to prevent water evaporation and changes in the liquid parameters. On the phantom top, three reference markers are provided to identify the phantom position with respect to the robot.

<ELI Phantom>

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

The ELI phantom is intended for compliance testing of handheld and body-mounted wireless devices in the frequency range of 30 MHz to 6 GHz. ELI4 is fully compatible with standard and all known tissue simulating liquids.

7.4 Device Holder

<Mounting Device for Hand-Held Transmitter>

In combination with the Twin SAM V5.0/V5.0c or ELI phantoms, the Mounting Device for Hand-Held Transmitters enables rotation of the mounted transmitter device to specified spherical coordinates. At the heads, the rotation axis is at the ear opening. Transmitter devices can be easily and accurately positioned according to IEC 62209-1, IEEE 1528, FCC, or other specifications. The device holder can be locked for positioning at different phantom sections (left head, right head, flat). And upgrade kit to Mounting Device to enable easy mounting of wider devices like big smart-phones, e-books, small tablets, etc. It holds devices with width up to 140 mm.

Mounting Device for Hand-Held Transmitters

Mounting Device Adaptor for Wide-Phones

<Mounting Device for Laptops and other Body-Worn Transmitters>

The extension is lightweight and made of POM, acrylic glass and foam. It fits easily on the upper part of the mounting device in place of the phone positioned. The extension is fully compatible with the SAM Twin and ELI phantoms.

Mounting Device for Laptops

8. Measurement Procedures

The measurement procedures are as follows:

<Conducted power measurement>

(a) For WWAN power measurement, use base station simulator to configure EUT WWAN transmission in conducted connection with RF cable, at maximum power in each supported wireless interface and frequency band.
(b) Read the WWAN RF power level from the base station simulator.
(c) For WLAN/BT power measurement, use engineering software to configure EUT WLAN/BT continuously transmission, at maximum RF power in each supported wireless interface and frequency band
(d) Connect EUT RF port through RF cable to the power meter, and measure WLAN/BT output power

<SAR measurement>

(a) Use base station simulator to configure EUT WWAN transmission in radiated connection, and engineering software to configure EUT WLAN/BT continuously transmission, at maximum RF power, in the highest power channel.
(b) Place the EUT in the positions as Appendix D demonstrates.
(c) Set scan area, grid size and other setting on the DASY software.
(d) Measure SAR results for the highest power channel on each testing position.
(e) Find out the largest SAR result on these testing positions of each band
(f) Measure SAR results for other channels in worst SAR testing position if the reported SAR of highest power channel is larger than 0.8 W/kg

According to the test standard, the recommended procedure for assessing the peak spatial-average SAR value consists of the following steps:

(a) Power reference measurement
(b) Area scan
(c) Zoom scan
(d) Power drift measurement

8.1 Spatial Peak SAR Evaluation

The procedure for spatial peak SAR evaluation has been implemented according to the test standard. It can be conducted for 1g and 10g, as well as for user-specific masses. The DASY software includes all numerical procedures necessary to evaluate the spatial peak SAR value.

The base for the evaluation is a "cube" measurement. The measured volume must include the 1g and 10g cubes with the highest averaged SAR values. For that purpose, the center of the measured volume is aligned to the interpolated peak SAR value of a previously performed area scan.

The entire evaluation of the spatial peak values is performed within the post-processing engine (SEMCAD). The system always gives the maximum values for the 1g and 10g cubes. The algorithm to find the cube with highest averaged SAR is divided into the following stages:

(a) Extraction of the measured data (grid and values) from the Zoom Scan
(b) Calculation of the SAR value at every measurement point based on all stored data (A/D values and measurement parameters)
(c) Generation of a high-resolution mesh within the measured volume
(d) Interpolation of all measured values form the measurement grid to the high-resolution grid
(e) Extrapolation of the entire 3-D field distribution to the phantom surface over the distance from sensor to surface
(f) Calculation of the averaged SAR within masses of 1g and 10g

8.2 Power Reference Measurement

The Power Reference Measurement and Power Drift Measurements are for monitoring the power drift of the device under test in the batch process. The minimum distance of probe sensors to surface determines the closest measurement point to phantom surface. This distance cannot be smaller than the distance of sensor calibration points to probe tip as defined in the probe properties.

8.3 Area Scan

The area scan is used as a fast scan in two dimensions to find the area of high field values, before doing a fine measurement around the hot spot. The sophisticated interpolation routines implemented in DASY software can find the maximum found in the scanned area, within a range of the global maximum. The range (in dB0 is specified in the standards for compliance testing. For example, a 2 dB range is required in IEEE standard 1528 and IEC 62209 standards, whereby 3 dB is a requirement when compliance is assessed in accordance with the ARIB standard (Japan), if only one zoom scan follows the area scan, then only the absolute maximum will be taken as reference. For cases where multiple maximums are detected, the number of zoom scans has to be increased accordingly.

Area scan parameters extracted from FCC KDB 865664 D01v01r04 SAR measurement 100 MHz to 6 GHz.

	≤ 3 GHz	> 3 GHz
Maximum distance from closest measurement point (geometric center of probe sensors) to phantom surface	5 ± 1 mm	½·δ·ln(2) ± 0.5 mm
Maximum probe angle from probe axis to phantom surface normal at the measurement location	30° ± 1°	20° ± 1°
Maximum area scan spatial resolution: Δx_{Area}, Δy_{Area}	≤ 2 GHz: ≤ 15 mm 2 – 3 GHz: ≤ 12 mm	3 – 4 GHz: ≤ 12 mm 4 – 6 GHz: ≤ 10 mm
	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 ≤ the corresponding x or y dimension of the test device with at least one measurement point on the test device.	

8.4 Zoom Scan

Zoom scans are used assess the peak spatial SAR values within a cubic averaging volume containing 1 gram and 10 gram of simulated tissue. The zoom scan measures points (refer to table below) within a cube shoes base faces are centered on the maxima found in a preceding area scan job within the same procedure. When the measurement is done, the zoom scan evaluates the averaged SAR for 1 gram and 10 gram and displays these values next to the job's label.

Zoom scan parameters extracted from FCC KDB 865664 D01v01r04 SAR measurement 100 MHz to 6 GHz.

<table>
<tr><th colspan="3"></th><th>$\leq$ 3 GHz</th><th>> 3 GHz</th></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">$\leq 1.5 \cdot \Delta z_{Zoom}(n-1)$</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 draft standard IEEE P1528-2011 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 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>

8.5 Volume Scan Procedures

The volume scan is used for assess overlapping SAR distributions for antennas transmitting in different frequency bands. It is equivalent to an oversized zoom scan used in standalone measurements. The measurement volume will be used to enclose all the simultaneous transmitting antennas. For antennas transmitting simultaneously in different frequency bands, the volume scan is measured separately in each frequency band. In order to sum correctly to compute the 1g aggregate SAR, the EUT remain in the same test position for all measurements and all volume scan use the same spatial resolution and grid spacing. When all volume scan were completed, the software, SEMCAD postprocessor can combine and subsequently superpose these measurement data to calculating the multiband SAR.

8.6 Power Drift Monitoring

All SAR testing is under the EUT install full charged battery and transmit maximum output power. In DASY measurement software, the power reference measurement and power drift measurement procedures are used for monitoring the power drift of EUT during SAR test. Both these procedures measure the field at a specified reference position before and after the SAR testing. The software will calculate the field difference in dB. If the power drifts more than 5%, the SAR will be retested.

9. Test Equipment List

Manufacturer	Name of Equipment	Type/Model	Serial Number	Calibration	
				Last Cal.	Due Date
SPEAG	1750MHz System Validation Kit	D1750V2	1137	Jul. 30, 2018	Jul. 29, 2021
SPEAG	1900MHz System Validation Kit	D1900V2	5d182	Dec. 07, 2018	Dec. 06, 2021
SPEAG	Data Acquisition Electronics	DAE3	528	Mar. 16, 2020	Mar. 15, 2021
SPEAG	Dosimetric E-Field Probe	EX3DV4	7576	Jan. 22, 2020	Jan. 21, 2021
SPEAG	SAM Twin Phantom	SAM V5.0	1795	NCR	NCR
Agilent	Network Analyzer	E5071C	MY46523671	Oct. 17, 2019	Oct. 16, 2020
Speag	Dielectric Assessment KIT	DAK-3.5	1071	Oct. 28, 2019	Oct. 27, 2020
Agilent	Signal Generator	N5181A	MY50145381	Dec. 26, 2019	Dec. 25, 2020
Anritsu	Power Senor	MA2411B	1306099	Jul. 22, 2019	Jul. 21, 2020
Anritsu	Power Meter	ML2495A	1349001	Jul. 22, 2019	Jul. 21, 2020
Anritsu	Power Sensor	MA2411B	1207253	Dec. 26, 2019	Dec. 25, 2020
Anritsu	Power Meter	ML2495A	1218010	Dec. 26, 2019	Dec. 25, 2020
LKM electronic	Hygrometer	DTM3000	3241	Jul. 25, 2019	Jul. 24, 2020
Anymetre	Thermo-Hygrometer	JR593	2015102801	Dec. 30, 2019	Dec. 29, 2020
ARRA	Power Divider	A3200-2	N/A	Note 1	
PASTERNACK	Dual Directional Coupler	PE2214-10	N/A	Note 1	
Agilent	Dual Directional Coupler	778D	50422	Note 1	
MCL	Attenuation1	BW-S10W5	N/A	Note 1	
Weinschel	Attenuation2	3M-20	N/A	Note 1	
Zhongjilianhe	Attenuation3	MVE2214-03	N/A	Note 1	
AR	Amplifier	5S1G4	0333096	Note 1	

General Note:

1. Prior to system verification and validation, the path loss from the signal generator to the system check source and the power meter, which includes the amplifier, cable, attenuator and directional coupler, was measured by the network analyzer. The reading of the power meter was offset by the path loss difference between the path to the power meter and the path to the system check source to monitor the actual power level fed to the system check source.
2. Referring to KDB 865664 D01v01r04, the dipole calibration interval can be extended to 3 years with justification. The dipoles are also not physically damaged, or repaired during the interval.
3. The justification data of dipole can be found in appendix C. The return loss is < -20dB, within 20% of prior calibration, the impedance is within 5 ohm of prior calibration.

10. System Verification

10.1 Tissue Simulating Liquids

For the measurement of the field distribution inside the SAM phantom with DASY, the phantom must be filled with around 25 liters of homogeneous body tissue simulating liquid. For head SAR testing, the liquid height from the ear reference point (ERP) of the phantom to the liquid top surface is larger than 15 cm, which is shown in Fig. 10.1. For body SAR testing, the liquid height from the center of the flat phantom to the liquid top surface is larger than 15 cm, which is shown in Fig. 10.2.

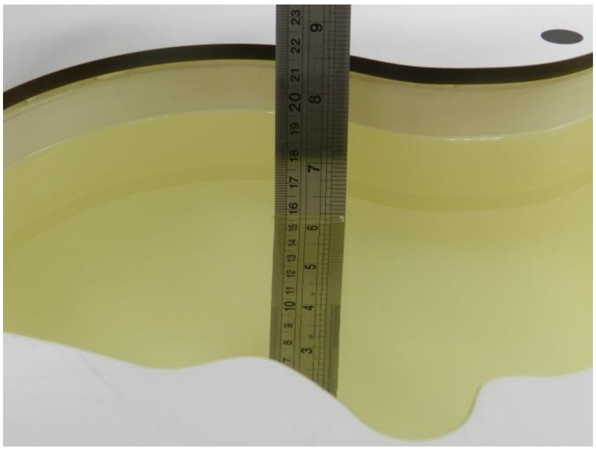


Fig 10.1Photo of Liquid Height for Head SAR

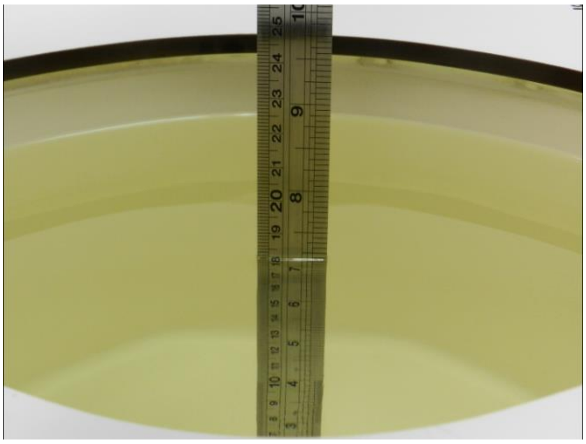


Fig 10.2 Photo of Liquid Height for Body SAR

10.2 Tissue Verification

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

Frequency (MHz)	Water (%)	Sugar (%)	Cellulose (%)	Salt (%)	Preventol (%)	DGBE (%)	Conductivity (σ)	Permittivity (εr)
1800, 1900, 2000	55.2	0	0	0.3	0	44.5	1.40	40.0

<Tissue Dielectric Parameter Check Results>

Frequency (MHz)	Liquid Temp. (℃)	Conductivity (σ)	Permittivity (ε_r)	Conductivity Target (σ)	Permittivity Target (ε_r)	Delta (σ) (%)	Delta (ε_r) (%)	Limit (%)	Date
1750	22.4	1.395	40.742	1.37	40.10	1.82	1.60	±5	2020/7/7
1900	22.5	1.443	40.030	1.40	40.00	3.07	0.08	±5	2020/7/9

10.3 System Performance Check Results

Comparing to the original SAR value provided by SPEAG, the verification data should be within its specification of 10 %. Below table shows the target SAR and measured SAR after normalized to 1W input power. The table below indicates the system performance check can meet the variation criterion and the plots can be referred to Appendix A of this report.

Date	Frequency (MHz)	Input Power (mW)	Dipole S/N	Probe S/N	DAE S/N	Measured 1g SAR (W/kg)	Targeted 1g SAR (W/kg)	Normalized 1g SAR (W/kg)	Deviation (%)
2020/7/7	1750	250	1137	7576	528	8.97	36.50	35.88	-1.70
2020/7/9	1900	250	5d182	7576	528	9.85	39.60	39.4	-0.51

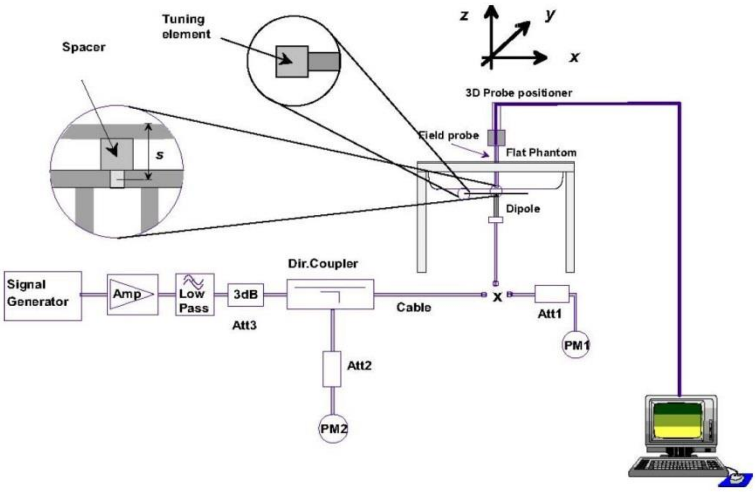


Fig 8.3.1 System Performance Check Setup

Fig 8.3.2 Setup Photo

11. RF Exposure Positions

11.1 Ear and handset reference point

Figure 9.1.1 shows the front, back, and side views of the SAM phantom. The center-of-mouth reference point is labeled “M,” the left ear reference point (ERP) is marked “LE,” and the right ERP is marked “RE.” Each ERP is 15 mm along the B-M (back-mouth) line behind the entrance-to-ear-canal (EEC) point, as shown in Figure 9.1.2 The Reference Plane is defined as passing through the two ear reference points and point M. The line N-F (neck-front), also called the reference pivoting line, is normal to the Reference Plane and perpendicular to both a line passing through RE and LE and the B-M line (see Figure 9.1.3). Both N-F and B-M lines should be marked on the exterior of the phantom shell to facilitate handset positioning. Posterior to the N-F line the ear shape is a flat surface with 6 mm thickness at each ERP, and forward of the N-F line the ear is truncated, as illustrated in Figure 9.1.2. The ear truncation is introduced to preclude the ear lobe from interfering with handset tilt, which could lead to unstable positioning at the cheek.

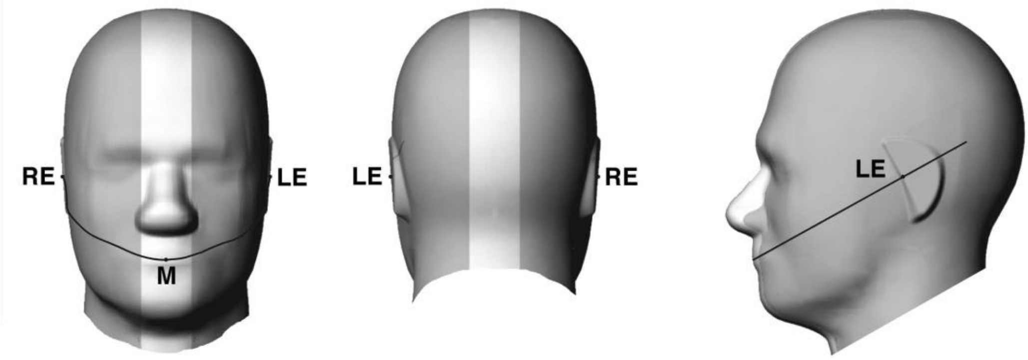


Fig 9.1.1 Front, back, and side views of SAM twin phantom

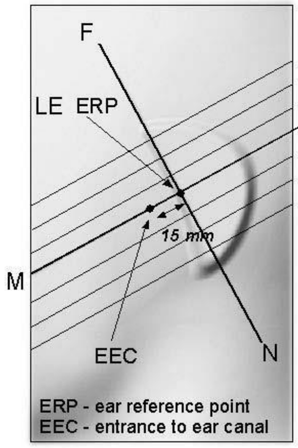


Fig 9.1.2 Close-up side view of phantom showing the ear region.

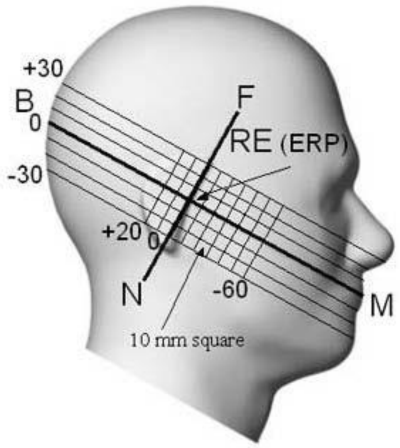


Fig 9.1.3 Side view of the phantom showing relevant markings and seven cross-sectional plane locations

11.2 Definition of the cheek position

1. Ready the handset for talk operation, if necessary. For example, for handsets with a cover piece (flip cover), open the cover. If the handset can transmit with the cover closed, both configurations must be tested.
2. Define two imaginary lines on the handset—the vertical centerline and the horizontal line. The vertical centerline passes through two points on the front side of the handset—the midpoint of the width wt of the handset at the level of the acoustic output (point A in Figure 9.2.1 and Figure 9.2.2), and the midpoint of the width wb of the bottom of the handset (point B). The horizontal line is perpendicular to the vertical centerline and passes through the center of the acoustic output (see Figure 9.2.1). The two lines intersect at point A. Note that for many handsets, point A coincides with the center of the acoustic output; however, the acoustic output may be located elsewhere on the horizontal line. Also note that the vertical centerline is not necessarily parallel to the front face of the handset (see Figure 9.2.2), especially for clamshell handsets, handsets with flip covers, and other irregularly-shaped handsets.
3. Position the handset close to the surface of the phantom such that point A is on the (virtual) extension of the line passing through points RE and LE on the phantom (see Figure 9.2.3), such that the plane defined by the vertical centerline and the horizontal line of the handset is approximately parallel to the sagittal plane of the phantom.
4. Translate the handset towards the phantom along the line passing through RE and LE until handset point A touches the pinna at the ERP.
5. While maintaining the handset in this plane, rotate it around the LE-RE line until the vertical centerline is in the plane normal to the plane containing B-M and N-F lines, i.e., the Reference Plane.
6. Rotate the handset around the vertical centerline until the handset (horizontal line) is parallel to the N-F line.
7. While maintaining the vertical centerline in the Reference Plane, keeping point A on the line passing through RE and LE, and maintaining the handset contact with the pinna, rotate the handset about the N-F line until any point on the handset is in contact with a phantom point below the pinna on the cheek. See Figure 9.2.3. The actual rotation angles should be documented in the test report.

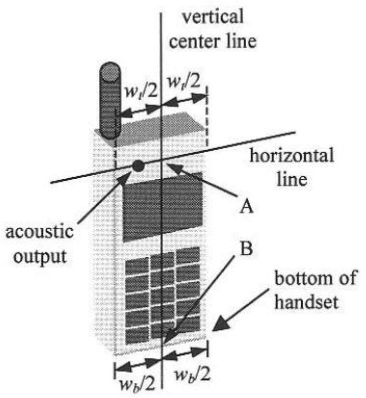


Fig 9.2.1 Handset vertical and horizontal reference lines—"fixed case

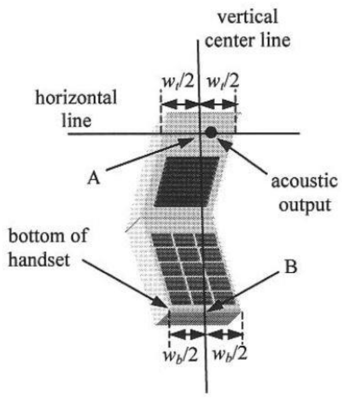


Fig 9.2.2 Handset vertical and horizontal reference lines—"clam-shell case"

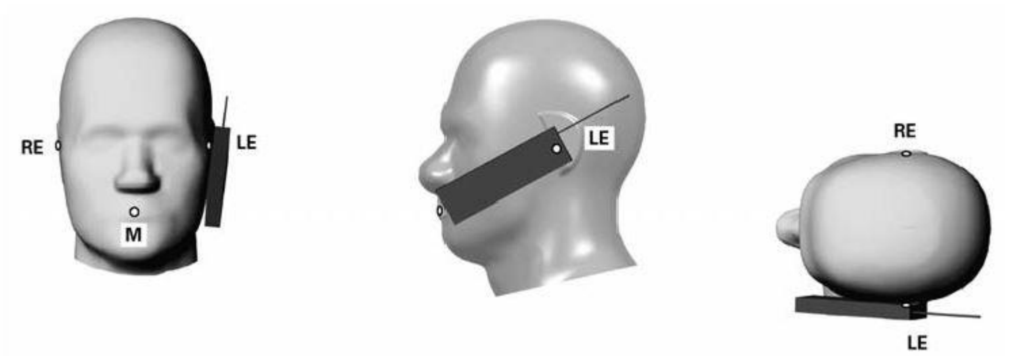


Fig 9.2.3 cheek or touch position. The reference points for the right ear (RE), left ear (LE), and mouth (M), which establish the Reference Plane for handset positioning, are indicated.

11.3 Definition of the tilt position

1. Ready the handset for talk operation, if necessary. For example, for handsets with a cover piece (flip cover), open the cover. If the handset can transmit with the cover closed, both configurations must be tested.
2. While maintaining the orientation of the handset, move the handset away from the pinna along the line passing through RE and LE far enough to allow a rotation of the handset away from the cheek by 15°.
3. Rotate the handset around the horizontal line by 15°.
4. While maintaining the orientation of the handset, move the handset towards the phantom on the line passing through RE and LE until any part of the handset touches the ear. The tilt position is obtained when the contact point is on the pinna. See Figure 9.3.1. If contact occurs at any location other than the pinna, e.g., the antenna at the back of the phantom head, the angle of the handset should be reduced. In this case, the tilt position is obtained if any point on the handset is in contact with the pinna and a second point

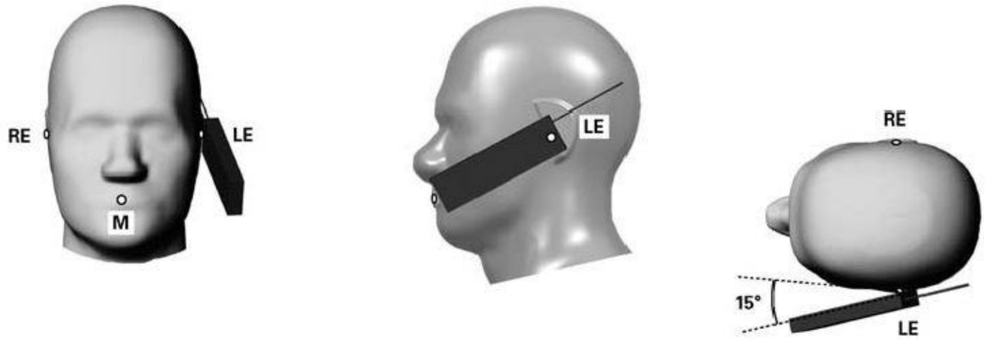


Fig 9.3.1 Tilt position. The reference points for the right ear (RE), left ear (LE), and mouth (M), which define the Reference Plane for handset positioning, are indicated.

11.4 Body Worn Accessory

Body-worn operating configurations are tested with the belt-clips and holsters attached to the device and positioned against a flat phantom in a normal use configuration (see Figure 9.4). Per KDB648474 D04v01r03, body-worn accessory exposure is typically related to voice mode operations when handsets are carried in body-worn accessories. The body-worn accessory procedures in FCC KDB 447498 D01v06 should be used to test for body-worn accessory SAR compliance, without a headset connected to it. This enables the test results for such configuration to be compatible with that required for hotspot mode when the body-worn accessory test separation distance is greater than or equal to that required for hotspot mode, when applicable. When the reported SAR for body-worn accessory, measured without a headset connected to the handset is > 1.2 W/kg, the highest reported SAR configuration for that wireless mode and frequency band should be repeated for that body-worn accessory with a handset attached to the handset.

Accessories for body-worn operation configurations are divided into two categories: those that do not contain metallic components and those that do contain metallic components and those that do contain metallic components. When multiple accessories that do not contain metallic components are supplied with the device, the device is tested with only the accessory that dictates the closest spacing to the body. Then multiple accessories that contain metallic components are test with the device with each accessory. If multiple accessories share an identical metallic component (i.e. the same metallic belt-chip used with different holsters with no other metallic components) only the accessory that dictates the closest spacing to the body is tested.

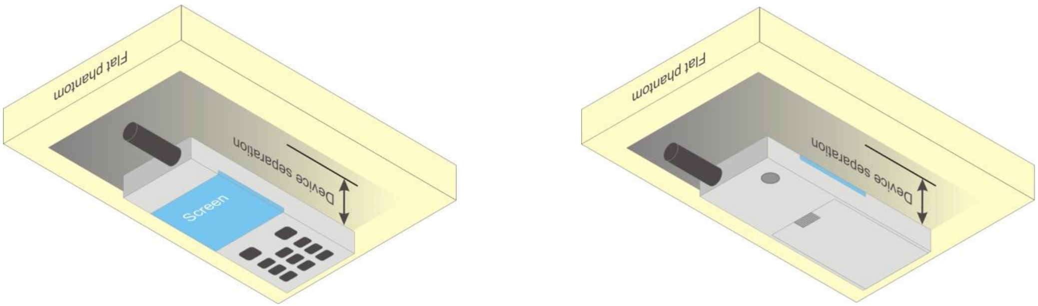


Fig 9.4 Body Worn Position

11.5 Product Specific Exposure

For smart phones with a display diagonal dimension > 15.0 cm or an overall diagonal dimension > 16.0 cm that provide similar mobile web access and multimedia support found in mini-tablets or UMPC mini-tablets that support voice calls next to the ear, According to KDB648474 D04v01r03, the following phablet procedures should be applied to evaluate SAR compliance for each applicable wireless modes and frequency band. Devices marketed as phablets, regardless of form factors and operating characteristics must be tested as a phablet to determine SAR compliance

1. The normally required head and body-worn accessory SAR test procedures for handsets, including hotspot mode, must be applied.

2. The UMPC mini-tablet procedures must also be applied to test the SAR of all surfaces and edges with an antenna located at ≤ 25 mm from that surface or edge, in direct contact with a flat phantom, for 10-g extremity SAR according to the body-equivalent tissue dielectric parameters in KDB 865664 to address interactive hand use exposure conditions.6 The UMPC mini-tablet 1-g SAR at 5 mm is not required. When hotspot mode applies, 10-g extremity SAR is required only for the surfaces and edges with hotspot mode 1-g reported SAR > 1.2 W/kg.

11.6 Wireless Router

Some battery-operated handsets have the capability to transmit and receive user through simultaneous transmission of WIFI simultaneously with a separate licensed transmitter. The FCC has provided guidance in FCC KDB Publication 941225 D06 v02r01 where SAR test considerations for handsets (L x W ≥ 9 cm x 5 cm) are based on a composite test separation distance of 10mm from the front, back and edges of the device containing transmitting antennas within 2.5cm of their edges, determined form general mixed use conditions for this type of devices. Since the hotspot SAR results may overlap with the body-worn accessory SAR requirements, the more conservative configurations can be considered, thus excluding some body-worn accessory SAR tests.

When the user enables the personal wireless router functions for the handset, actual operations include simultaneous transmission of both the WIFI transmitter and another licensed transmitter. Both transmitters often do not transmit at the same transmitting frequency and thus cannot be evaluated for SAR under actual use conditions due to the limitations of the SAR assessment probes. Therefore, SAR must be evaluated for each frequency transmission and mode separately and spatially summed with the WIFI transmitter according to FCC KDB Publication 447498 D01v06 publication procedures. The “Portable Hotspot” feature on the handset was NOT activated during SAR assessments, to ensure the SAR measurements were evaluated for a single transmission frequency RF signal at a time.

12. 5G NR Output Power (Unit: dBm)

General Note:

1. For 5G NR test procedure was following step similar FCC KDB 941225 D05:
   a. For DFT-OFDM and CP-OFDM output power measurement reduction, according to 38.101 maximum power reduction for power class2 and 3, the CP-OFDM mode will not higher than DFT-OFDM mode, therefore, similar FCC KDB 941225 D05 procedure for other modulation output power for each RB allocation configuration is > not ½ dB higher than the same configuration in DFT-QPSK and the reported SAR for the DFT-QPSK configuration is ≤ 1.45 W/kg; CP-OFDM testing is not required.
   b. For DFT-OFDM output power measurement reduction, according to 38.101 maximum power reduction for power class2 and 3, for 16QAM/64QMA/256QAM and smaller bandwidth output power will spot check largest channel bandwidth worst RB configuration to ensure the 16QAM/64QMA/256QAM and smaller bandwidth output power will not ½ dB higher than the same configuration in the largest supported bandwidth.
   c. SAR testing start with the largest channel bandwidth and measure SAR for PI/2 BPSK with 1 RB allocation, using the RB offset and required test channel combination with the highest maximum output power for RB offsets at the upper edge, middle and lower edge of each required test channel
   d. 50% RB allocation for PI/2 BPSK SAR testing follows 1RB PI/2 BPSK allocation procedure
   e. PI/2 BPSK with 100% RB allocation, SAR is not required when the highest maximum output power for 100 % RB allocation is less than the highest maximum output power in 50% and 1 RB allocations and the highest reported SAR for 1 RB and 50% RB allocation are ≤ 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
   f. QPSK/16QAM/64QAM/256QAM output powers according to 3GPP MPR will not ½ dB higher than the same configuration in PI/2 BPSK, also reported SAR for the PI/2 BPSK configuration is less than 1.45 W/kg, QPSK/16QAM/64QAM/256QAM SAR testing are not required.
   g. Smaller bandwidth output power for each RB allocation configuration for this device will not ½ dB higher than the same configuration in the largest supported bandwidth, and the reported SAR for the largest supported bandwidth is ≤ 1.45 W/kg, smaller bandwidth SAR testing is not required for this device
2. Due to test setup limitations, SAR testing for NR was performed using Factory Test Mode software to establish the connection and perform SAR with 100% transmission.
3. For DFT-s-OFDM and CP-OFDM output power measurement reduction, according to 38.101 maximum power reduction for the CP-OFDM mode will not higher than DFT-s-OFDM mode, therefore, CP-OFDM measurement is unnecessary

<3GPP 38.101 MPR for EN-DC>

Table 6.2.2-1 Maximum power reduction (MPR) for power class 3

Modulation		MPR (dB)		
		Edge RB allocations	Outer RB allocations	Inner RB allocations
DFT-s-OFDM	Pi/2 BPSK	≤ 3.5[1]	≤ 1.2[1]	≤ 0.2[1]
		≤ 0.5[2]	≤ 0.5[2]	0[2]
	QPSK	≤ 1		0
	16 QAM	≤ 2		≤ 1
	64 QAM	≤ 2.5		
	256 QAM	≤ 4.5		
CP-OFDM	QPSK	≤ 3		≤ 1.5
	16 QAM	≤ 3		≤ 2
	64 QAM	≤ 3.5		
	256 QAM	≤ 6.5		

NOTE 1: Applicable for UE operating in TDD mode with Pi/2 BPSK modulation and UE indicates support for UE capability *powerBoosting-pi2BPSK* and if the IE *powerBoostPi2BPSK* is set to 1 and 40 % or less slots in radio frame are used for UL transmission for bands n40, n41, n77, n78 and n79. The reference power of 0 dB MPR is 26 dBm.

NOTE 2: Applicable for UE operating in FDD mode, or in TDD mode in bands other than n40, n41, n77, n78 and n79 with Pi/2 BPSK modulation and if the IE *powerBoostPi2BPSK* is set to 0 and if more than 40 % of slots in radio frame are used for UL transmission for bands n40, n41, n77, n78 and n79.

Table 6.2.2-2 Maximum power reduction (MPR) for power class 2

Modulation		MPR (dB)		
		Edge RB allocations	Outer RB allocations	Inner RB allocations
DFT-s-OFDM	Pi/2 BPSK	≤ 3.5	≤ 0.5	0
	QPSK	≤ 3.5	≤ 1	0
	16 QAM	≤ 3.5	≤ 2	≤ 1
	64 QAM	≤ 3.5	≤ 2.5	
	256 QAM	≤ 4.5		
CP-OFDM	QPSK	≤ 3.5	≤ 3	≤ 1.5
	16 QAM	≤ 3.5	≤ 3	≤ 2
	64 QAM	≤ 3.5		
	256 QAM	≤ 6.5		

<SA mode>
<DFT-s-OFDM --Full Power>

<n2 – UAT>

BW [MHz]	Modulation	RB Size	RB Offset	Power Low Ch. / Freq.	Power Middle Ch. / Freq.	Power High Ch. / Freq.	Tune-up limit (dBm)	MPR (dB)
Channel				372000	376000	380000	Tune-up limit (dBm)	MPR (dB)
Frequency (MHz)				1860	1880	1900		
20	QPSK	1	1	20.32	**20.36**	20.26	21.0	0.0
20	QPSK	1	53	20.29	20.33	20.23		
20	QPSK	1	104	20.26	20.33	20.20		
20	QPSK	50	0	19.70	19.68	19.69	21.0	0.0
20	QPSK	50	28	20.27	20.32	20.21		
20	QPSK	50	56	19.73	19.76	19.68		
20	QPSK	100	0	19.66	19.75	19.62	21.0	0.0
20	16QAM	1	1	20.16	20.17	20.10	20.0	1.0
20	64QAM	1	1	18.37	18.40	18.41	18.5	2.5
20	256QAM	1	1	16.28	16.27	16.34	16.5	4.5
Channel				371500	376000	380500	Tune-up limit (dBm)	MPR (dB)
Frequency (MHz)				1857.5	1880	1902.5		
15	QPSK	1	1	20.28	20.33	20.20	21.0	0.0
Channel				371000	376000	381000	Tune-up limit (dBm)	MPR (dB)
Frequency (MHz)				1855	1880	1905		
10	QPSK	1	1	20.22	20.28	20.15	21.0	0.0
Channel				370500	376000	381500	Tune-up limit (dBm)	MPR (dB)
Frequency (MHz)				1852.5	1880	1907.5		
5	QPSK	1	1	20.20	20.30	20.18	21.0	0.0

<n66 – UAT>

BW [MHz]	Modulation	RB Size	RB Offset	Power Low Ch. / Freq.	Power Middle Ch. / Freq.	Power High Ch. / Freq.	Tune-up limit (dBm)	MPR (dB)
Channel				344000	349000	354000	Tune-up limit (dBm)	MPR (dB)
Frequency (MHz)				1720	1745	1770		
20	QPSK	1	1	**20.39**	20.27	20.20	21.3	0.0
20	QPSK	1	53	20.23	20.22	20.09		
20	QPSK	1	104	20.19	20.10	20.01		
20	QPSK	50	0	19.70	19.60	19.56	21.3	0.0
20	QPSK	50	28	20.28	20.16	20.05		
20	QPSK	50	56	19.54	19.66	19.47		
20	QPSK	100	0	19.62	19.60	19.52	21.3	0.0
20	16QAM	1	1	20.12	20.19	20.00	20.3	1.0
20	64QAM	1	1	18.44	18.24	18.28	18.8	2.5
20	256QAM	1	1	16.31	16.14	16.16	16.8	4.5
Channel				343500	349000	354500	Tune-up limit (dBm)	MPR (dB)
Frequency (MHz)				1717.5	1745	1772.5		
15	QPSK	1	1	20.30	20.21	20.13	21.3	0.0
Channel				343000	349000	355000	Tune-up limit (dBm)	MPR (dB)
Frequency (MHz)				1715	1745	1775		
10	QPSK	1	1	20.28	20.18	20.10	21.3	0.0
Channel				342500	349000	355500	Tune-up limit (dBm)	MPR (dB)
Frequency (MHz)				1712.5	1745	1777.5		
5	QPSK	1	1	20.33	20.22	20.12	21.3	0.0

<n2 – LAT>

BW [MHz]	Modulation	RB Size	RB Offset	Power Low Ch. / Freq.	Power Middle Ch. / Freq.	Power High Ch. / Freq.	Tune-up limit (dBm)	MPR (dB)
Channel				372000	376000	380000	Tune-up limit (dBm)	MPR (dB)
Frequency (MHz)				1860	1880	1900		
20	QPSK	1	1	22.08	22.14	22.02	23.0	0.0
20	QPSK	1	53	22.02	22.13	21.99		
20	QPSK	1	104	22.02	22.11	21.97		
20	QPSK	50	0	21.48	21.52	21.48	23.0	0.0
20	QPSK	50	28	22.00	22.03	21.98		
20	QPSK	50	56	21.53	21.58	21.49		
20	QPSK	100	0	21.51	21.53	21.50	23.0	0.0
20	16QAM	1	1	21.55	21.62	21.52	22.0	1.0
20	64QAM	1	1	20.37	20.39	20.32	20.5	2.5
20	256QAM	1	1	18.25	18.30	18.17	18.5	4.5
Channel				371500	376000	380500	Tune-up limit (dBm)	MPR (dB)
Frequency (MHz)				1857.5	1880	1902.5		
15	QPSK	1	1	22.00	22.05	21.93	23.0	0.0
Channel				371000	376000	381000	Tune-up limit (dBm)	MPR (dB)
Frequency (MHz)				1855	1880	1905		
10	QPSK	1	1	22.01	22.08	21.95	23.0	0.0
Channel				370500	376000	381500	Tune-up limit (dBm)	MPR (dB)
Frequency (MHz)				1852.5	1880	1907.5		
5	QPSK	1	1	22.05	22.11	21.99	23.0	0.0

<n66 – LAT>

BW [MHz]	Modulation	RB Size	RB Offset	Power Low Ch. / Freq.	Power Middle Ch. / Freq.	Power High Ch. / Freq.	Tune-up limit (dBm)	MPR (dB)
Channel				344000	349000	354000	Tune-up limit (dBm)	MPR (dB)
Frequency (MHz)				1720	1745	1770		
20	QPSK	1	1	**22.52**	22.37	22.36	23.3	0.0
20	QPSK	1	53	22.51	22.30	22.33		
20	QPSK	1	104	22.39	22.35	22.28		
20	QPSK	50	0	21.81	21.70	21.69	23.3	0.0
20	QPSK	50	28	22.42	22.31	22.23		
20	QPSK	50	56	21.77	21.78	21.62		
20	QPSK	100	0	21.75	21.72	21.68	23.3	0.0
20	16QAM	1	1	21.85	21.96	21.99	22.3	1.0
20	64QAM	1	1	20.78	20.22	20.26	20.8	2.5
20	256QAM	1	1	18.52	18.58	18.58	18.8	4.5
Channel				343500	349000	354500	Tune-up limit (dBm)	MPR (dB)
Frequency (MHz)				1717.5	1745	1772.5		
15	QPSK	1	1	22.45	22.29	22.28	23.3	0.0
Channel				343000	349000	355000	Tune-up limit (dBm)	MPR (dB)
Frequency (MHz)				1715	1745	1775		
10	QPSK	1	1	22.42	22.33	22.25	23.3	0.0
Channel				342500	349000	355500	Tune-up limit (dBm)	MPR (dB)
Frequency (MHz)				1712.5	1745	1777.5		
5	QPSK	1	1	22.50	22.34	22.30	23.3	0.0

<DFT-s-OFDM --Reduced Power for Standalone/Simultaneous>

<n2 – UAT>

BW [MHz]	Modulation	RB Size	RB Offset	Power Low Ch. / Freq.	Power Middle Ch. / Freq.	Power High Ch. / Freq.	Tune-up limit (dBm)	MPR (dB)
Channel				372000	376000	380000	Tune-up limit (dBm)	MPR (dB)
Frequency (MHz)				1860	1880	1900		
20	QPSK	1	1	15.89	**15.92**	15.80	16.5	0.0
20	QPSK	1	53	15.82	15.88	15.75		
20	QPSK	1	104	15.78	15.85	15.72		
20	QPSK	50	0	15.74	15.86	15.73	16.5	0.0
20	QPSK	50	28	15.87	15.90	15.78		
20	QPSK	50	56	15.85	15.84	15.72		
20	QPSK	100	0	15.85	15.89	15.77	16.5	0.0
20	16QAM	1	1	15.58	15.67	15.52	16.5	0.0
20	64QAM	1	1	15.78	15.89	15.75	16.5	0.0
20	256QAM	1	1	15.82	15.87	15.77	16.5	0.0
Channel				371500	376000	380500	Tune-up limit (dBm)	MPR (dB)
Frequency (MHz)				1857.5	1880	1902.5		
15	QPSK	1	1	15.85	15.89	15.76	16.5	0.0
Channel				371000	376000	381000	Tune-up limit (dBm)	MPR (dB)
Frequency (MHz)				1855	1880	1905		
10	QPSK	1	1	15.80	15.84	15.68	16.5	0.0
Channel				370500	376000	381500	Tune-up limit (dBm)	MPR (dB)
Frequency (MHz)				1852.5	1880	1907.5		
5	QPSK	1	1	15.83	15.88	15.74	16.5	0.0

<n66 – UAT>

BW [MHz]	Modulation	RB Size	RB Offset	Power Low Ch. / Freq.	Power Middle Ch. / Freq.	Power High Ch. / Freq.	Tune-up limit (dBm)	MPR (dB)
Channel				344000	349000	354000	Tune-up limit (dBm)	MPR (dB)
Frequency (MHz)				1720	1745	1770		
20	QPSK	1	1	15.91	15.84	15.70	16.8	0.0
20	QPSK	1	53	15.83	15.76	15.68		
20	QPSK	1	104	15.76	15.72	15.60		
20	QPSK	50	0	15.80	15.75	15.66	16.8	0.0
20	QPSK	50	28	15.89	15.79	15.68		
20	QPSK	50	56	15.67	15.73	15.64		
20	QPSK	100	0	15.86	15.78	15.65	16.8	0.0
20	16QAM	1	1	15.73	15.65	15.54	16.8	0.0
20	64QAM	1	1	15.86	15.75	15.69	16.8	0.0
20	256QAM	1	1	15.83	15.73	15.64	16.8	0.0
Channel				343500	349000	354500	Tune-up limit (dBm)	MPR (dB)
Frequency (MHz)				1717.5	1745	1772.5		
15	QPSK	1	1	15.85	15.80	15.65	16.8	0.0
Channel				343000	349000	355000	Tune-up limit (dBm)	MPR (dB)
Frequency (MHz)				1715	1745	1775		
10	QPSK	1	1	15.77	15.78	15.58	16.8	0.0
Channel				342500	349000	355500	Tune-up limit (dBm)	MPR (dB)
Frequency (MHz)				1712.5	1745	1777.5		
5	QPSK	1	1	15.82	15.75	15.60	16.8	0.0

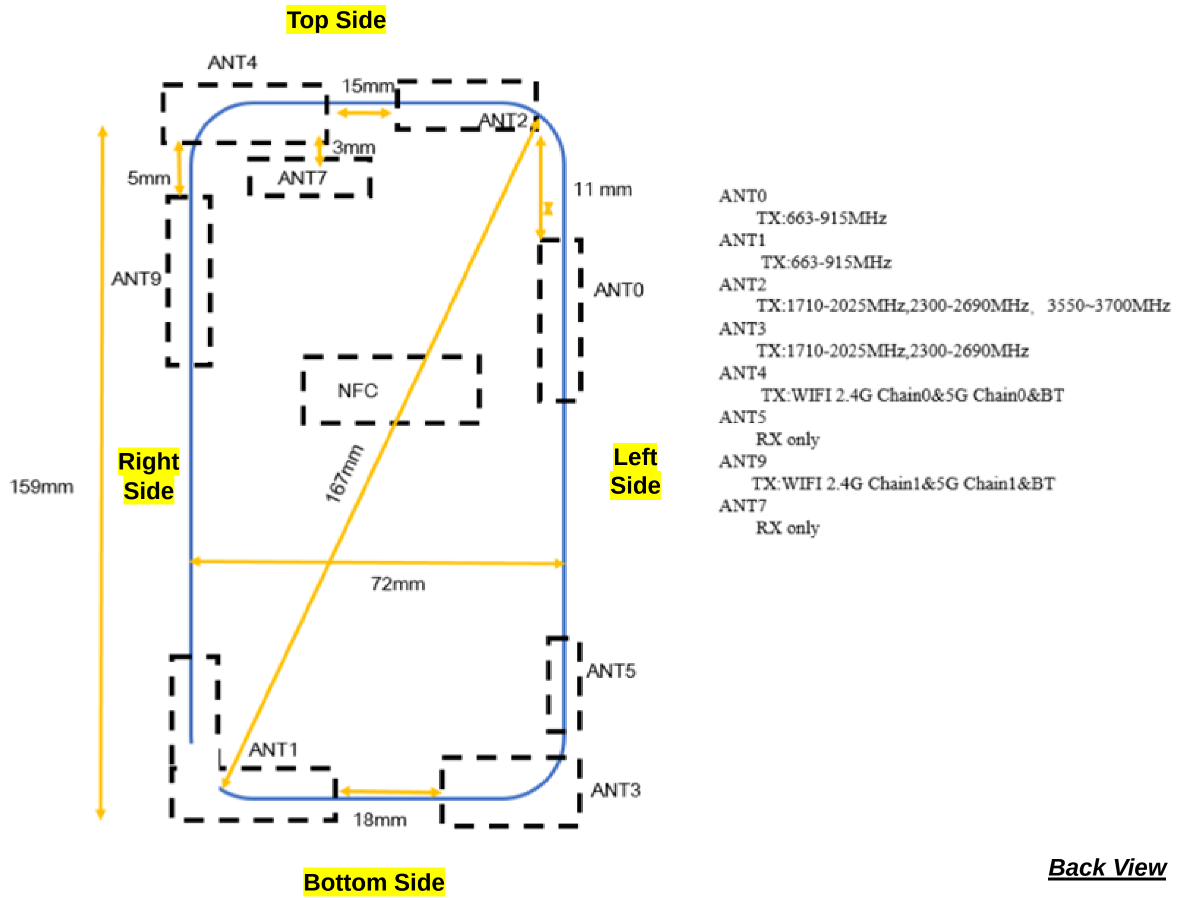
<DFT-s-OFDM --Reduced Power for Hotspot On>

<n2 – LAT>

BW [MHz]	Modulation	RB Size	RB Offset	Power Low Ch. / Freq.	Power Middle Ch. / Freq.	Power High Ch. / Freq.	Tune-up limit (dBm)	MPR (dB)
Channel				372000	376000	380000	Tune-up limit (dBm)	MPR (dB)
Frequency (MHz)				1860	1880	1900		
20	QPSK	1	1	21.06	**21.19**	21.02	22.0	0.0
20	QPSK	1	53	21.04	21.17	20.99		
20	QPSK	1	104	21.00	21.11	20.96		
20	QPSK	50	0	21.02	21.03	20.95	22.0	0.0
20	QPSK	50	28	21.04	21.15	20.98		
20	QPSK	50	56	20.99	21.05	20.90		
20	QPSK	100	0	21.00	21.09	20.95	22.0	0.0
20	16QAM	1	1	21.02	21.07	20.97	22.0	0.0
20	64QAM	1	1	20.07	20.18	20.01	21.0	1.0
20	256QAM	1	1	18.13	18.17	18.05	19.0	3.0
Channel				371500	376000	380500	Tune-up limit (dBm)	MPR (dB)
Frequency (MHz)				1857.5	1880	1902.5		
15	QPSK	1	1	21.00	21.15	20.99	22.0	0.0
Channel				371000	376000	381000	Tune-up limit (dBm)	MPR (dB)
Frequency (MHz)				1855	1880	1905		
10	QPSK	1	1	20.90	21.02	20.85	22.0	0.0
Channel				370500	376000	381500	Tune-up limit (dBm)	MPR (dB)
Frequency (MHz)				1852.5	1880	1907.5		
5	QPSK	1	1	20.94	21.09	20.90	22.0	0.0

13. Antenna Location

<Mobile Phone>



Back View

Antennas Description	
WWAN UAT	ANT 0 / ANT 2
WWAN LAT	ANT 1 / ANT 3

Note：For this variant application, 5GNR SA mode, n2/n66 Ant2 located UAT, n2/n66 Ant3 located LAT.

Distance of the Antenna to the EUT surface/edge						
Antennas	Back	Front	Top Side	Bottom Side	Right Side	Left Side
WWAN UAT	≤ 25mm	≤ 25mm	≤ 25mm	>25mm	≤ 25mm	≤ 25mm
WWAN LAT	≤ 25mm	≤ 25mm	>25mm	≤ 25mm	≤ 25mm	≤ 25mm
BT&WLAN	≤ 25mm	≤ 25mm	≤ 25mm	>25mm	≤ 25mm	>25mm

Positions for SAR tests; Hotspot mode						
Antennas	Back	Front	Top Side	Bottom Side	Right Side	Left Side
WWAN UAT	Yes	Yes	Yes	No	Yes	Yes
WWAN LAT	Yes	Yes	No	Yes	Yes	Yes
BT&WLAN	Yes	Yes	Yes	No	Yes	No

General Note:

1. Referring to KDB 941225 D06 v02r01, when the overall device length and width are ≥ 9cm*5cm, the test distance is 10 mm. SAR must be measured for all sides and surfaces with a transmitting antenna located within 25mm from that surface or edge

14. SAR Test Results

General Note:

1. Per KDB 447498 D01v06, the reported SAR is the measured SAR value adjusted for maximum tune-up tolerance.
   a. Tune-up scaling Factor = tune-up limit power (mW) / EUT RF power (mW), where tune-up limit is the maximum rated power among all production units.
   b. For SAR testing of WLAN signal with non-100% duty cycle, the measured SAR is scaled-up by the duty cycle scaling factor which is equal to "1/(duty cycle)"
   c. For WWAN/Bluetooth: Reported SAR(W/kg)= Measured SAR(W/kg)*Tune-up Scaling Factor
2. Per KDB 447498 D01v06, for each exposure position, testing of other required channels within the operating mode of a frequency band is not required when the *reported* 1-g or 10-g SAR for the mid-band or highest output power channel is:
   · ≤ 0.8 W/kg or 2.0 W/kg, for 1-g or 10-g respectively, when the transmission band is ≤ 100 MHz
   · ≤ 0.6 W/kg or 1.5 W/kg, for 1-g or 10-g respectively, when the transmission band is between 100 MHz and 200 MHz
   · ≤ 0.4 W/kg or 1.0 W/kg, for 1-g or 10-g respectively, when the transmission band is ≥ 200 MHz
3. Per KDB 865664 D01v01r04, for each frequency band, repeated SAR measurement is required only when the measured SAR is ≥0.8W/kg.
4. For WWAN UAT antenna, when the audio is actively routed through the earpiece receiver, and the LCD display is off, and the proximity sensor is triggered which indicating the next-to-head condition then power reduction will be implemented immediately at 5G NR n2/ n66.
5. For WWAN LAT antenna, hotspot mode is enabled, power reduction will be activated to limit the maximum power of 5G NR n2.
6. This is a variant report for IN2017. The new SA mode 5G NR n2/n66 is opened by the software. Based on the similarity between current and previous project. 5G NR n2/n66 for full SAR test, the others data can refer to original test report (Sporton Report Number FA9N2025-08).

5G NR Note:

1. For 5G NR test procedure was following step similar FCC KDB 941225 D05:
2. SAR testing start with the largest channel bandwidth and measure SAR for QPSK with 1 RB allocation, using the RB offset and required test channel combination with the highest maximum output power for RB offsets at the upper edge, middle and lower edge of each required test channel
3. 50% RB allocation for QPSK SAR testing follows 1RB QPSK allocation procedure
4. QPSK with 100% RB allocation, SAR is not required when the highest maximum output power for 100 % RB allocation is less than the highest maximum output power in 50% and 1 RB allocations and the highest reported SAR for 1 RB and 50% RB allocation are ≤ 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
5. 16QAM/64QAM/256QAM output powers according to 3GPP MPR will not ½ dB higher than the same configuration in QPSK, also reported SAR for the QPSK configuration is less than 1.45 W/kg, 16QAM/64QAM/256QAM SAR testing are not required.
6. Smaller bandwidth output power for each RB allocation configuration for this device will not ½ dB higher than the same configuration in the largest supported bandwidth, and the reported SAR for the largest supported bandwidth is ≤ 1.45 W/kg, smaller bandwidth SAR testing is not required for this device

14.1 Head SAR

<5G NR SA SAR>

Plot No.	Band	BW (MHz)	Modulation	RB Size	RB offset	Mode	Test Position	Gap (mm)	Ant	Power Reduction	Ch.	Freq. (MHz)	Average Power (dBm)	Tune-Up Limit (dBm)	Tune-up Scaling Factor	Power Drift (dB)	Measured 1g SAR (W/kg)	Reported 1g SAR (W/kg)
	N66_UAT	20M	QPSK	1	1	DFT-15	Right Cheek	0mm	Ant2	Reduced	344000	1720	15.91	16.80	1.227	0.02	0.450	0.552
	N66_UAT	20M	QPSK	1	1	DFT-15	Right Tilted	0mm	Ant2	Reduced	344000	1720	15.91	16.80	1.227	0.01	0.476	0.584
	N66_UAT	20M	QPSK	1	1	DFT-15	Left Cheek	0mm	Ant2	Reduced	344000	1720	15.91	16.80	1.227	0.13	0.280	0.344
	N66_UAT	20M	QPSK	1	1	DFT-15	Left Tilted	0mm	Ant2	Reduced	344000	1720	15.91	16.80	1.227	0.12	0.339	0.416
	N66_UAT	20M	QPSK	50	28	DFT-15	Right Cheek	0mm	Ant2	Reduced	344000	1720	15.89	16.80	1.233	0.03	0.481	0.593
	N66_UAT	20M	QPSK	50	28	DFT-15	Right Tilted	0mm	Ant2	Reduced	344000	1720	15.89	16.80	1.233	-0.02	0.491	0.605
	N66_UAT	20M	QPSK	50	28	DFT-15	Left Cheek	0mm	Ant2	Reduced	344000	1720	15.89	16.80	1.233	-0.05	0.283	0.349
	N66_UAT	20M	QPSK	50	28	DFT-15	Left Tilted	0mm	Ant2	Reduced	344000	1720	15.89	16.80	1.233	0.06	0.342	0.422
	N66_UAT	20M	QPSK	50	28	DFT-15	Right Tilted	0mm	Ant2	Reduced	349000	1745	15.79	16.80	1.262	0.13	0.662	0.835
01	N66_UAT	20M	QPSK	50	28	DFT-15	Right Tilted	0mm	Ant2	Reduced	354000	1770	15.68	16.80	1.294	-0.01	0.759	**0.982**
	N66_UAT	20M	QPSK	100	0	DFT-15	Right Tilted	0mm	Ant2	Reduced	344000	1720	15.86	16.80	1.242	0.12	0.499	0.620
	N66_LAT	20M	QPSK	1	1	DFT-15	Right Cheek	0mm	Ant3	Full Power	344000	1720	22.52	23.30	1.197	0.13	0.080	0.096
	N66_LAT	20M	QPSK	1	1	DFT-15	Right Tilted	0mm	Ant3	Full Power	344000	1720	22.52	23.30	1.197	0.03	0.069	0.083
	N66_LAT	20M	QPSK	1	1	DFT-15	Left Cheek	0mm	Ant3	Full Power	344000	1720	22.52	23.30	1.197	0.02	0.103	0.123
	N66_LAT	20M	QPSK	1	1	DFT-15	Left Tilted	0mm	Ant3	Full Power	344000	1720	22.52	23.30	1.197	0.06	0.068	0.081
	N66_LAT	20M	QPSK	50	28	DFT-15	Right Cheek	0mm	Ant3	Full Power	344000	1720	22.42	23.30	1.225	0.08	0.089	0.109
	N66_LAT	20M	QPSK	50	28	DFT-15	Right Tilted	0mm	Ant3	Full Power	344000	1720	22.42	23.30	1.225	0.06	0.076	0.093
	N66_LAT	20M	QPSK	50	28	DFT-15	Left Cheek	0mm	Ant3	Full Power	344000	1720	22.42	23.30	1.225	0.02	0.109	0.133
	N66_LAT	20M	QPSK	50	28	DFT-15	Left Tilted	0mm	Ant3	Full Power	344000	1720	22.42	23.30	1.225	0.06	0.070	0.086
	N66_LAT	20M	QPSK	50	28	DFT-15	Left Cheek	0mm	Ant3	Full Power	349000	1745	22.31	23.30	1.256	0.05	0.113	0.142
	N66_LAT	20M	QPSK	50	28	DFT-15	Left Cheek	0mm	Ant3	Full Power	354000	1770	22.23	23.30	1.279	0.02	0.128	0.164
	N2_UAT	20M	QPSK	1	1	DFT-15	Right Cheek	0mm	Ant2	Reduced	376000	1880	15.92	16.50	1.143	-0.02	0.528	0.603
	N2_UAT	20M	QPSK	1	1	DFT-15	Right Tilted	0mm	Ant2	Reduced	376000	1880	15.92	16.50	1.143	-0.05	0.636	0.727
	N2_UAT	20M	QPSK	1	1	DFT-15	Left Cheek	0mm	Ant2	Reduced	376000	1880	15.92	16.50	1.143	0.06	0.301	0.344
	N2_UAT	20M	QPSK	1	1	DFT-15	Left Tilted	0mm	Ant2	Reduced	376000	1880	15.92	16.50	1.143	0.12	0.401	0.458
	N2_UAT	20M	QPSK	50	28	DFT-15	Right Cheek	0mm	Ant2	Reduced	376000	1880	15.90	16.50	1.148	0.06	0.553	0.635
	N2_UAT	20M	QPSK	50	28	DFT-15	Right Tilted	0mm	Ant2	Reduced	376000	1880	15.90	16.50	1.148	0.02	0.654	0.751
	N2_UAT	20M	QPSK	50	28	DFT-15	Left Cheek	0mm	Ant2	Reduced	376000	1880	15.90	16.50	1.148	-0.05	0.325	0.373
	N2_UAT	20M	QPSK	50	28	DFT-15	Left Tilted	0mm	Ant2	Reduced	376000	1880	15.90	16.50	1.148	0.16	0.406	0.466
	N2_UAT	20M	QPSK	50	28	DFT-15	Right Tilted	0mm	Ant2	Reduced	372000	1860	15.87	16.50	1.156	0.18	0.610	0.705
02	N2_UAT	20M	QPSK	50	28	DFT-15	Right Tilted	0mm	Ant2	Reduced	380000	1900	15.78	16.50	1.180	-0.11	0.680	**0.803**
	N2_UAT	20M	QPSK	100	0	DFT-15	Right Tilted	0mm	Ant2	Reduced	376000	1880	15.89	16.50	1.151	-0.08	0.619	0.712
	N2_LAT	20M	QPSK	1	1	DFT-15	Right Cheek	0mm	Ant3	Full Power	376000	1880	22.14	23.00	1.219	0.03	0.108	0.132
	N2_LAT	20M	QPSK	1	1	DFT-15	Right Tilted	0mm	Ant3	Full Power	376000	1880	22.14	23.00	1.219	0.02	0.066	0.080
	N2_LAT	20M	QPSK	1	1	DFT-15	Left Cheek	0mm	Ant3	Full Power	376000	1880	22.14	23.00	1.219	-0.05	0.083	0.101
	N2_LAT	20M	QPSK	1	1	DFT-15	Left Tilted	0mm	Ant3	Full Power	376000	1880	22.14	23.00	1.219	0.06	0.059	0.072
	N2_LAT	20M	QPSK	50	28	DFT-15	Right Cheek	0mm	Ant3	Full Power	376000	1880	22.03	23.00	1.250	0.03	0.137	0.171
	N2_LAT	20M	QPSK	50	28	DFT-15	Right Tilted	0mm	Ant3	Full Power	376000	1880	22.03	23.00	1.250	0.16	0.073	0.091
	N2_LAT	20M	QPSK	50	28	DFT-15	Left Cheek	0mm	Ant3	Full Power	376000	1880	22.03	23.00	1.250	-0.11	0.094	0.118
	N2_LAT	20M	QPSK	50	28	DFT-15	Left Tilted	0mm	Ant3	Full Power	376000	1880	22.03	23.00	1.250	0.06	0.067	0.084
	N2_LAT	20M	QPSK	50	28	DFT-15	Right Cheek	0mm	Ant3	Full Power	372000	1860	22.00	23.00	1.259	0.02	0.103	0.130
	N2_LAT	20M	QPSK	50	28	DFT-15	Right Cheek	0mm	Ant3	Full Power	380000	1900	21.98	23.00	1.265	-0.08	0.119	0.151

14.2 Hotspot SAR

<5G NR SA SAR>

Plot No.	Band	BW (MHz)	Modulation	RB Size	RB offset	Mode	Test Position	Gap (mm)	Ant	Power Reduction	Ch.	Freq. (MHz)	Average Power (dBm)	Tune-Up Limit (dBm)	Tune-up Scaling Factor	Power Drift (dB)	Measured 1g SAR (W/kg)	Reported 1g SAR (W/kg)
	N66_UAT	20M	QPSK	1	1	DFT-15	Front	10mm	Ant2	Full Power	344000	1720	20.39	21.30	1.233	0.06	0.325	0.401
	N66_UAT	20M	QPSK	1	1	DFT-15	Back	10mm	Ant2	Full Power	344000	1720	20.39	21.30	1.233	0.02	0.333	0.411
	N66_UAT	20M	QPSK	1	1	DFT-15	Left Side	10mm	Ant2	Full Power	344000	1720	20.39	21.30	1.233	-0.05	0.125	0.154
	N66_UAT	20M	QPSK	1	1	DFT-15	Right Side	10mm	Ant2	Full Power	344000	1720	20.39	21.30	1.233	0.16	0.016	0.020
	N66_UAT	20M	QPSK	1	1	DFT-15	Top Side	10mm	Ant2	Full Power	344000	1720	20.39	21.30	1.233	0.07	0.385	0.475
	N66_UAT	20M	QPSK	50	28	DFT-15	Front	10mm	Ant2	Full Power	344000	1720	20.28	21.30	1.265	0.18	0.325	0.411
	N66_UAT	20M	QPSK	50	28	DFT-15	Back	10mm	Ant2	Full Power	344000	1720	20.28	21.30	1.265	-0.11	0.348	0.440
	N66_UAT	20M	QPSK	50	28	DFT-15	Left Side	10mm	Ant2	Full Power	344000	1720	20.28	21.30	1.265	0.03	0.138	0.175
	N66_UAT	20M	QPSK	50	28	DFT-15	Right Side	10mm	Ant2	Full Power	344000	1720	20.28	21.30	1.265	0.1	0.018	0.022
	N66_UAT	20M	QPSK	50	28	DFT-15	Top Side	10mm	Ant2	Full Power	344000	1720	20.28	21.30	1.265	0.12	0.401	0.507
	N66_UAT	20M	QPSK	50	28	DFT-15	Top Side	10mm	Ant2	Full Power	349000	1745	20.16	21.30	1.300	0.16	0.541	0.703
03	N66_UAT	20M	QPSK	50	28	DFT-15	Top Side	10mm	Ant2	Full Power	354000	1770	20.05	21.30	1.334	0.1	0.589	**0.785**
	N66_LAT	20M	QPSK	1	1	DFT-15	Front	10mm	Ant3	Full Power	344000	1720	22.52	23.30	1.197	0.08	0.409	0.489
	N66_LAT	20M	QPSK	1	1	DFT-15	Back	10mm	Ant3	Full Power	344000	1720	22.52	23.30	1.197	0.06	0.441	0.528
	N66_LAT	20M	QPSK	1	1	DFT-15	Left Side	10mm	Ant3	Full Power	344000	1720	22.52	23.30	1.197	0.02	0.164	0.196
	N66_LAT	20M	QPSK	1	1	DFT-15	Right Side	10mm	Ant3	Full Power	344000	1720	22.52	23.30	1.197	0.06	0.117	0.140
	N66_LAT	20M	QPSK	1	1	DFT-15	Bottom Side	10mm	Ant3	Full Power	344000	1720	22.52	23.30	1.197	0.05	0.530	0.634
	N66_LAT	20M	QPSK	50	28	DFT-15	Front	10mm	Ant3	Full Power	344000	1720	22.42	23.30	1.225	0.03	0.423	0.518
	N66_LAT	20M	QPSK	50	28	DFT-15	Back	10mm	Ant3	Full Power	344000	1720	22.42	23.30	1.225	0.05	0.443	0.543
	N66_LAT	20M	QPSK	50	28	DFT-15	Left Side	10mm	Ant3	Full Power	344000	1720	22.42	23.30	1.225	0.12	0.171	0.209
	N66_LAT	20M	QPSK	50	28	DFT-15	Right Side	10mm	Ant3	Full Power	344000	1720	22.42	23.30	1.225	0.11	0.122	0.149
	N66_LAT	20M	QPSK	50	28	DFT-15	Bottom Side	10mm	Ant3	Full Power	344000	1720	22.42	23.30	1.225	0.13	0.550	0.674
	N66_LAT	20M	QPSK	50	28	DFT-15	Bottom Side	10mm	Ant3	Full Power	349000	1745	22.31	23.30	1.256	-0.02	0.477	0.599
	N66_LAT	20M	QPSK	50	28	DFT-15	Bottom Side	10mm	Ant3	Full Power	354000	1770	22.23	23.30	1.279	0.15	0.547	0.700
	N2_UAT	20M	QPSK	1	1	DFT-15	Front	10mm	Ant2	Full Power	376000	1880	20.36	21.00	1.159	-0.02	0.286	0.331
	N2_UAT	20M	QPSK	1	1	DFT-15	Back	10mm	Ant2	Full Power	376000	1880	20.36	21.00	1.159	0.13	0.337	0.391
	N2_UAT	20M	QPSK	1	1	DFT-15	Left Side	10mm	Ant2	Full Power	376000	1880	20.36	21.00	1.159	0.12	0.048	0.056
	N2_UAT	20M	QPSK	1	1	DFT-15	Right Side	10mm	Ant2	Full Power	376000	1880	20.36	21.00	1.159	0.06	0.035	0.041
	N2_UAT	20M	QPSK	1	1	DFT-15	Top Side	10mm	Ant2	Full Power	376000	1880	20.36	21.00	1.159	0.09	0.518	0.600
	N2_UAT	20M	QPSK	50	28	DFT-15	Front	10mm	Ant2	Full Power	376000	1880	20.32	21.00	1.169	0.06	0.306	0.358
	N2_UAT	20M	QPSK	50	28	DFT-15	Back	10mm	Ant2	Full Power	376000	1880	20.32	21.00	1.169	0.02	0.357	0.418
	N2_UAT	20M	QPSK	50	28	DFT-15	Left Side	10mm	Ant2	Full Power	376000	1880	20.32	21.00	1.169	-0.05	0.052	0.061
	N2_UAT	20M	QPSK	50	28	DFT-15	Right Side	10mm	Ant2	Full Power	376000	1880	20.32	21.00	1.169	0.16	0.037	0.043
	N2_UAT	20M	QPSK	50	28	DFT-15	Top Side	10mm	Ant2	Full Power	376000	1880	20.32	21.00	1.169	0.18	0.524	0.613
	N2_UAT	20M	QPSK	50	28	DFT-15	Top Side	10mm	Ant2	Full Power	372000	1860	20.27	21.00	1.183	-0.11	0.502	0.594
04	N2_UAT	20M	QPSK	50	28	DFT-15	Top Side	10mm	Ant2	Full Power	380000	1900	20.21	21.00	1.199	0.12	0.549	**0.659**
	N2_LAT	20M	QPSK	1	1	DFT-15	Front	10mm	Ant3	Reduced	376000	1880	21.19	22.00	1.205	0.04	0.331	0.399
	N2_LAT	20M	QPSK	1	1	DFT-15	Back	10mm	Ant3	Reduced	376000	1880	21.19	22.00	1.205	0.02	0.419	0.505
	N2_LAT	20M	QPSK	1	1	DFT-15	Left Side	10mm	Ant3	Reduced	376000	1880	21.19	22.00	1.205	-0.07	0.130	0.157
	N2_LAT	20M	QPSK	1	1	DFT-15	Right Side	10mm	Ant3	Reduced	376000	1880	21.19	22.00	1.205	0.14	0.087	0.105
	N2_LAT	20M	QPSK	1	1	DFT-15	Bottom Side	10mm	Ant3	Reduced	376000	1880	21.19	22.00	1.205	0.16	0.507	0.611
	N2_LAT	20M	QPSK	50	28	DFT-15	Front	10mm	Ant3	Reduced	376000	1880	21.15	22.00	1.216	0.16	0.366	0.445
	N2_LAT	20M	QPSK	50	28	DFT-15	Back	10mm	Ant3	Reduced	376000	1880	21.15	22.00	1.216	0.18	0.432	0.525
	N2_LAT	20M	QPSK	50	28	DFT-15	Left Side	10mm	Ant3	Reduced	376000	1880	21.15	22.00	1.216	-0.11	0.135	0.164
	N2_LAT	20M	QPSK	50	28	DFT-15	Right Side	10mm	Ant3	Reduced	376000	1880	21.15	22.00	1.216	0.14	0.092	0.112
	N2_LAT	20M	QPSK	50	28	DFT-15	Bottom Side	10mm	Ant3	Reduced	376000	1880	21.15	22.00	1.216	0.16	0.522	0.635
	N2_LAT	20M	QPSK	50	28	DFT-15	Bottom Side	10mm	Ant3	Reduced	372000	1860	21.04	22.00	1.247	0.05	0.414	0.516
	N2_LAT	20M	QPSK	50	28	DFT-15	Bottom Side	10mm	Ant3	Reduced	380000	1900	21.98	22.00	1.005	0.1	0.483	0.485

14.3 Body Worn Accessory SAR

<5G NR SA SAR>

Plot No.	Band	BW (MHz)	Modulation	RB Size	RB offset	Mode	Test Position	Gap (mm)	Ant	Power Reduction	Ch.	Freq. (MHz)	Average Power (dBm)	Tune-Up Limit (dBm)	Tune-up Scaling Factor	Power Drift (dB)	Measured 1g SAR (W/kg)	Reported 1g SAR (W/kg)
	N66_UAT	20M	QPSK	1	1	DFT-15	Front	15mm	Ant2	Full Power	344000	1720	20.39	21.30	1.233	0.02	0.162	0.200
	N66_UAT	20M	QPSK	1	1	DFT-15	Back	15mm	Ant2	Full Power	344000	1720	20.39	21.30	1.233	0.15	0.183	0.226
	N66_UAT	20M	QPSK	50	28	DFT-15	Front	15mm	Ant2	Full Power	344000	1720	20.28	21.30	1.265	0.03	0.166	0.210
	N66_UAT	20M	QPSK	50	28	DFT-15	Back	15mm	Ant2	Full Power	344000	1720	20.28	21.30	1.265	0.02	0.188	0.238
	N66_UAT	20M	QPSK	50	28	DFT-15	Back	15mm	Ant2	Full Power	349000	1745	20.16	21.30	1.300	-0.03	0.217	0.282
	N66_UAT	20M	QPSK	50	28	DFT-15	Back	15mm	Ant2	Full Power	354000	1770	20.05	21.30	1.334	-0.02	0.213	0.284
05	N66_LAT	20M	QPSK	1	1	DFT-15	Front	15mm	Ant3	Full Power	344000	1720	22.52	23.30	1.197	0.15	0.257	**0.308**
	N66_LAT	20M	QPSK	1	1	DFT-15	Back	15mm	Ant3	Full Power	344000	1720	22.52	23.30	1.197	0.13	0.256	0.306
	N66_LAT	20M	QPSK	1	1	DFT-15	Front	15mm	Ant3	Full Power	349000	1745	22.37	23.30	1.239	0.05	0.229	0.284
	N66_LAT	20M	QPSK	1	1	DFT-15	Front	15mm	Ant3	Full Power	354000	1770	22.36	23.30	1.242	0.03	0.228	0.283
	N66_LAT	20M	QPSK	50	28	DFT-15	Front	15mm	Ant3	Full Power	344000	1720	22.42	23.30	1.225	0.15	0.251	0.307
	N66_LAT	20M	QPSK	50	28	DFT-15	Back	15mm	Ant3	Full Power	344000	1720	22.42	23.30	1.225	0.12	0.245	0.300
	N2_UAT	20M	QPSK	1	1	DFT-15	Front	15mm	Ant2	Full Power	376000	1880	20.36	21.00	1.159	0.03	0.139	0.161
	N2_UAT	20M	QPSK	1	1	DFT-15	Back	15mm	Ant2	Full Power	376000	1880	20.36	21.00	1.159	0.02	0.178	0.206
	N2_UAT	20M	QPSK	50	28	DFT-15	Front	15mm	Ant2	Full Power	376000	1880	20.32	21.00	1.169	0.06	0.141	0.165
	N2_UAT	20M	QPSK	50	28	DFT-15	Back	15mm	Ant2	Full Power	376000	1880	20.32	21.00	1.169	0.02	0.179	0.209
	N2_UAT	20M	QPSK	50	28	DFT-15	Back	15mm	Ant2	Full Power	372000	1860	20.27	21.00	1.183	-0.05	0.169	0.200
	N2_UAT	20M	QPSK	50	28	DFT-15	Back	15mm	Ant2	Full Power	380000	1900	20.21	21.00	1.199	0.16	0.195	0.234
	N2_LAT	20M	QPSK	1	1	DFT-15	Front	15mm	Ant3	Full Power	376000	1880	22.14	23.00	1.219	0.12	0.225	0.274
	N2_LAT	20M	QPSK	1	1	DFT-15	Back	15mm	Ant3	Full Power	376000	1880	22.14	23.00	1.219	0.06	0.257	0.313
	N2_LAT	20M	QPSK	50	28	DFT-15	Front	15mm	Ant3	Full Power	376000	1880	22.03	23.00	1.250	0.05	0.250	0.313
06	N2_LAT	20M	QPSK	50	28	DFT-15	Back	15mm	Ant3	Full Power	376000	1880	22.03	23.00	1.250	0.03	0.272	**0.340**
	N2_LAT	20M	QPSK	50	28	DFT-15	Back	15mm	Ant3	Full Power	372000	1860	22.00	23.00	1.259	0.12	0.225	0.283
	N2_LAT	20M	QPSK	50	28	DFT-15	Back	15mm	Ant3	Full Power	380000	1900	21.98	23.00	1.265	0.13	0.257	0.325

15. Simultaneous Transmission Analysis

NO.	Simultaneous Transmission Configurations	Portable Handset			
		Head	Body-worn	Hotspot	Product Specific
1.	FR1 + BT	Yes	Yes	Yes	Yes
2.	WLAN 5GHz + BT	Yes	Yes	**No**	Yes
3.	WLAN2.4GHz + WLAN5GHz	Yes	Yes	**No**	Yes
4.	FR1 + WLAN2.4GHz	Yes	Yes	Yes	Yes
5.	FR1 + WLAN5GHz	Yes	Yes	Yes	Yes
6.	FR1 + WLAN5GHz + Bluetooth	Yes	Yes	Yes	Yes
7.	FR1 + WLAN2.4GHz + WLAN5GHz	Yes	Yes	Yes	Yes

General Note:

1. For simultaneously transmission SAR analysis, SAR values only considered 5G NR SA n2/n66 which we did perform SAR testing on FA062208. BT/WLAN test results were chosen from the original data which released from original report (Sporton Report Number FA9N2025-08) to do co-located analysis.
2. This device WLAN 2.4GHz / 5.2GHz / 5.8GHz supports Hotspot operation and Bluetooth support tethering applications.
3. 2.4GHz WLAN and Bluetooth share the same antenna, and cannot transmit simultaneously.
4. All licensed modes share the same antenna part and cannot transmit simultaneously.
5. The Scaled SAR summation is calculated based on the same configuration and test position.
6. Per KDB 447498 D01v06, simultaneous transmission SAR is compliant if,
   i) Scalar SAR summation < 1.6W/kg.
   ii) SPLSR = (SAR1 + SAR2)^1.5 / (min. separation distance, mm), and the peak separation distance is determined from the square root of [(x1-x2)2 + (y1-y2)2 + (z1-z2)2], where (x1, y1, z1) and (x2, y2, z2) are the coordinates of the extrapolated peak SAR locations in the zoom scan.
   iii) If SPLSR ≤ 0.04, simultaneously transmission SAR measurement is not necessary.
   iv) Simultaneously transmission SAR measurement, and the reported multi-band SAR < 1.6W/kg.

15.1 Head Exposure Conditions

General Note:
For simultaneously transmission SAR analysis, SAR values only considered 5G NR SA n2/n66 which we did perform SAR testing on FA062208. BT/WLAN test results were chosen from the original data which released from original report (Sporton Report Number FA9N2025-08) to do co-located analysis.

WWAN Band		Exposure Position	1 WWAN 1g SAR (W/kg)	6 Bluetooth Chain 0 1g SAR (W/kg)	7 Bluetooth Chain 1 1g SAR (W/kg)	1+6 Summed 1g SAR (W/kg)	1+7 Summed 1g SAR (W/kg)
5G NR	N66_UAT	Right Cheek	0.593	0.033	0.063	0.626	0.656
		Right Tilted	0.982	0.021	0.059	1.003	1.041
		Left Cheek	0.349	0.276	0.222	0.625	0.571
		Left Tilted	0.422	0.071	0.192	0.493	0.614
	N66_LAT	Right Cheek	0.109	0.033	0.063	0.142	0.172
		Right Tilted	0.093	0.021	0.059	0.114	0.152
		Left Cheek	0.164	0.276	0.222	0.440	0.386
		Left Tilted	0.086	0.071	0.192	0.157	0.278
	N2_UAT	Right Cheek	0.635	0.033	0.063	0.668	0.698
		Right Tilted	0.803	0.021	0.059	0.824	0.862
		Left Cheek	0.373	0.276	0.222	0.649	0.595
		Left Tilted	0.466	0.071	0.192	0.537	0.658
	N2_LAT	Right Cheek	0.171	0.033	0.063	0.204	0.234
		Right Tilted	0.091	0.021	0.059	0.112	0.150
		Left Cheek	0.118	0.276	0.222	0.394	0.340
		Left Tilted	0.084	0.071	0.192	0.155	0.276

WWAN Band		Exposure Position	1 WWAN 1g SAR (W/kg)	2 2.4GHz WLAN 1g SAR (W/kg)	4 5GHz WLAN 1g SAR (W/kg)	1+2 Summed 1g SAR (W/kg)	1+4 Summed 1g SAR (W/kg)
5G NR	N66_UAT	Right Cheek	0.593	0.136	0.234	0.729	0.827
		Right Tilted	0.982	0.130	0.270	1.112	**1.252**
		Left Cheek	0.349	0.488	0.322	0.837	0.671
		Left Tilted	0.422	0.420	0.561	0.842	0.983
	N66_LAT	Right Cheek	0.109	0.136	0.234	0.245	0.343
		Right Tilted	0.093	0.130	0.270	0.223	0.363
		Left Cheek	0.164	0.488	0.322	0.652	0.486
		Left Tilted	0.086	0.420	0.561	0.506	0.647
	N2_UAT	Right Cheek	0.635	0.136	0.234	0.771	0.869
		Right Tilted	0.803	0.130	0.270	0.933	1.073
		Left Cheek	0.373	0.488	0.322	0.861	0.695
		Left Tilted	0.466	0.420	0.561	0.886	1.027
	N2_LAT	Right Cheek	0.171	0.136	0.234	0.307	0.405
		Right Tilted	0.091	0.130	0.270	0.221	0.361
		Left Cheek	0.118	0.488	0.322	0.606	0.440
		Left Tilted	0.084	0.420	0.561	0.504	0.645

WWAN Band		Exposure Position	1 WWAN 1g SAR (W/kg)	2 2.4GHz WLAN 1g SAR (W/kg)	4 5GHz WLAN 1g SAR (W/kg)	6 Bluetooth Chain 0 1g SAR (W/kg)	7 Bluetooth Chain 1 1g SAR (W/kg)	1+2+4 Summed 1g SAR (W/kg)	1+4+6 Summed 1g SAR (W/kg)	1+4+7 Summed 1g SAR (W/kg)
5G NR	N66_UAT	Right Cheek	0.593	0.087	0.140	0.033	0.063	0.820	0.766	0.796
		Right Tilted	0.982	0.083	0.186	0.021	0.059	1.251	1.189	1.227
		Left Cheek	0.349	0.309	0.259	0.276	0.222	0.917	0.884	0.830
		Left Tilted	0.422	0.266	0.323	0.071	0.192	1.011	0.816	0.937
	N66_LAT	Right Cheek	0.109	0.087	0.140	0.033	0.063	0.336	0.282	0.312
		Right Tilted	0.093	0.083	0.186	0.021	0.059	0.362	0.300	0.338
		Left Cheek	0.164	0.309	0.259	0.276	0.222	0.732	0.699	0.645
		Left Tilted	0.086	0.266	0.323	0.071	0.192	0.675	0.480	0.601
	N2_UAT	Right Cheek	0.635	0.087	0.140	0.033	0.063	0.862	0.808	0.838
		Right Tilted	0.803	0.083	0.186	0.021	0.059	1.072	1.010	1.048
		Left Cheek	0.373	0.309	0.259	0.276	0.222	0.941	0.908	0.854
		Left Tilted	0.466	0.266	0.323	0.071	0.192	1.055	0.860	0.981
	N2_LAT	Right Cheek	0.171	0.087	0.140	0.033	0.063	0.398	0.344	0.374
		Right Tilted	0.091	0.083	0.186	0.021	0.059	0.360	0.298	0.336
		Left Cheek	0.118	0.309	0.259	0.276	0.222	0.686	0.653	0.599
		Left Tilted	0.084	0.266	0.323	0.071	0.192	0.673	0.478	0.599

15.2 Hotspot Exposure Conditions

WWAN Band		Exposure Position	1	6	7	1+6	1+7
			WWAN	Bluetooth Chain 0	Bluetooth Chain 1	Summed	Summed
			1g SAR (W/kg)	1g SAR (W/kg)	1g SAR (W/kg)	1g SAR (W/kg)	1g SAR (W/kg)
5G NR	N66_UAT	Front	0.411	0.048	0.041	0.459	0.452
		Back	0.440	0.197	0.190	0.637	0.630
		Left side	0.175			0.175	0.175
		Right side	0.022	0.127	0.133	0.149	0.155
		Top side	0.785	0.309	0.054	1.094	0.839
		Bottom side					
	N66_LAT	Front	0.518	0.048	0.041	0.566	0.559
		Back	0.543	0.197	0.190	0.740	0.733
		Left side	0.209			0.209	0.209
		Right side	0.149	0.127	0.133	0.276	0.282
		Top side		0.309	0.054	0.309	0.054
		Bottom side	0.700			0.700	0.700
	N2_UAT	Front	0.358	0.048	0.041	0.406	0.399
		Back	0.418	0.197	0.190	0.615	0.608
		Left side	0.061			0.061	0.061
		Right side	0.043	0.127	0.133	0.170	0.176
		Top side	0.659	0.309	0.054	0.968	0.713
		Bottom side					
	N2_LAT	Front	0.445	0.048	0.041	0.493	0.486
		Back	0.525	0.197	0.190	0.722	0.715
		Left side	0.164			0.164	0.164
		Right side	0.112	0.127	0.133	0.239	0.245
		Top side		0.309	0.054	0.309	0.054
		Bottom side	0.635			0.635	0.635

WWAN Band		Exposure Position	1 WWAN 1g SAR (W/kg)	2 2.4GHz WLAN 1g SAR (W/kg)	4 5GHz WLAN 1g SAR (W/kg)	1+2 Summed 1g SAR (W/kg)	1+4 Summed 1g SAR (W/kg)
5G NR	N66_UAT	Front	0.411	0.122	0.003	0.533	0.414
		Back	0.440	0.618	0.585	1.058	1.025
		Left side	0.175			0.175	0.175
		Right side	0.022	0.238	0.674	0.260	0.696
		Top side	0.785	0.158	0.108	0.943	0.893
		Bottom side					
	N66_LAT	Front	0.518	0.122	0.003	0.640	0.521
		Back	0.543	0.618	0.585	1.161	1.128
		Left side	0.209			0.209	0.209
		Right side	0.149	0.238	0.674	0.387	0.823
		Top side		0.158	0.108	0.158	0.108
		Bottom side	0.700			0.700	0.700
	N2_UAT	Front	0.358	0.122	0.003	0.480	0.361
		Back	0.418	0.618	0.585	1.036	1.003
		Left side	0.061			0.061	0.061
		Right side	0.043	0.238	0.674	0.281	0.717
		Top side	0.659	0.158	0.108	0.817	0.767
		Bottom side					
	N2_LAT	Front	0.445	0.122	0.003	0.567	0.448
		Back	0.525	0.618	0.585	1.143	1.110
		Left side	0.164			0.164	0.164
		Right side	0.112	0.238	0.674	0.350	0.786
		Top side		0.158	0.108	0.158	0.108
		Bottom side	0.635			0.635	0.635

WWAN Band		Exposure Position	1 WWAN 1g SAR (W/kg)	2 2.4GHz WLAN 1g SAR (W/kg)	4 5GHz WLAN 1g SAR (W/kg)	6 Bluetooth Chain 0 1g SAR (W/kg)	7 Bluetooth Chain 1 1g SAR (W/kg)	1+2+4 Summed 1g SAR (W/kg)	1+4+6 Summed 1g SAR (W/kg)	1+4+7 Summed 1g SAR (W/kg)
5G NR	N66_UAT	Front	0.411	0.061	0.002	0.048	0.041	0.474	0.461	0.454
		Back	0.440	0.314	0.343	0.197	0.190	1.097	0.980	0.973
		Left side	0.175					0.175	0.175	0.175
		Right side	0.022	0.120	0.420	0.127	0.133	0.562	0.569	0.575
		Top side	0.785	0.081	0.068	0.309	0.054	0.934	1.162	0.907
		Bottom side								
	N66_LAT	Front	0.518	0.061	0.002	0.048	0.041	0.581	0.568	0.561
		Back	0.543	0.314	0.343	0.197	0.190	1.200	1.083	1.076
		Left side	0.209					0.209	0.209	0.209
		Right side	0.149	0.120	0.420	0.127	0.133	0.689	0.696	0.702
		Top side		0.081	0.068	0.309	0.054	0.149	0.377	0.122
		Bottom side	0.700					0.700	0.700	0.700
	N2_UAT	Front	0.358	0.061	0.002	0.048	0.041	0.421	0.408	0.401
		Back	0.418	0.314	0.343	0.197	0.190	1.075	0.958	0.951
		Left side	0.061					0.061	0.061	0.061
		Right side	0.043	0.120	0.420	0.127	0.133	0.583	0.590	0.596
		Top side	0.659	0.081	0.068	0.309	0.054	0.808	1.036	0.781
		Bottom side								
	N2_LAT	Front	0.445	0.061	0.002	0.048	0.041	0.508	0.495	0.488
		Back	0.525	0.314	0.343	0.197	0.190	1.182	1.065	1.058
		Left side	0.164					0.164	0.164	0.164
		Right side	0.112	0.120	0.420	0.127	0.133	0.652	0.659	0.665
		Top side		0.081	0.068	0.309	0.054	0.149	0.377	0.122
		Bottom side	0.635					0.635	0.635	0.635

15.3 Body-Worn Accessory Exposure Conditions

WWAN Band		Exposure Position	1 WWAN 1g SAR (W/kg)	6 Bluetooth Chain 0 1g SAR (W/kg)	7 Bluetooth Chain 1 1g SAR (W/kg)	1+6 Summed 1g SAR (W/kg)	1+7 Summed 1g SAR (W/kg)
5G NR	N66_UAT	Front	0.210	0.008	0.011	0.218	0.221
		Back	0.284	0.067	0.076	0.351	0.360
	N66_LAT	Front	0.308	0.008	0.011	0.316	0.319
		Back	0.306	0.067	0.076	0.373	0.382
	N2_UAT	Front	0.165	0.008	0.011	0.173	0.176
		Back	0.234	0.067	0.076	0.301	0.310
	N2_LAT	Front	0.313	0.008	0.011	0.321	0.324
		Back	0.340	0.067	0.076	0.407	0.416

WWAN Band		Exposure Position	1 WWAN 1g SAR (W/kg)	2 2.4GHz WLAN 1g SAR (W/kg)	4 5GHz WLAN 1g SAR (W/kg)	1+6 Summed 1g SAR (W/kg)	1+7 Summed 1g SAR (W/kg)
5G NR	N66_UAT	Front	0.210	0.086	0.099	0.296	0.309
		Back	0.284	0.547	0.697	0.831	0.981
	N66_LAT	Front	0.308	0.086	0.099	0.394	0.407
		Back	0.306	0.547	0.697	0.853	1.003
	N2_UAT	Front	0.165	0.086	0.099	0.251	0.264
		Back	0.234	0.547	0.697	0.781	0.931
	N2_LAT	Front	0.313	0.086	0.099	0.399	0.412
		Back	0.340	0.547	0.697	0.887	1.037

WWAN Band		Exposure Position	1 WWAN 1g SAR (W/kg)	2 2.4GHz WLAN 1g SAR (W/kg)	4 5GHz WLAN 1g SAR (W/kg)	6 Bluetooth Chain 0 1g SAR (W/kg)	7 Bluetooth Chain 1 1g SAR (W/kg)	1+2+4 Summed 1g SAR (W/kg)	1+4+6 Summed 1g SAR (W/kg)	1+4+7 Summed 1g SAR (W/kg)
5G NR	N66_UAT	Front	0.210	0.054	0.063	0.008	0.011	0.327	0.281	0.284
		Back	0.284	0.352	0.455	0.067	0.076	1.091	0.806	0.815
	N66_LAT	Front	0.308	0.054	0.063	0.008	0.011	0.425	0.379	0.382
		Back	0.306	0.352	0.455	0.067	0.076	1.113	0.828	0.837
	N2_UAT	Front	0.165	0.054	0.063	0.008	0.011	0.282	0.236	0.239
		Back	0.234	0.352	0.455	0.067	0.076	1.041	0.756	0.765
	N2_LAT	Front	0.313	0.054	0.063	0.008	0.011	0.430	0.384	0.387
		Back	0.340	0.352	0.455	0.067	0.076	1.147	0.862	0.871

Test Engineer : Changlin Huang, Bin He, Mengming Dai

16. Uncertainty Assessment

Per KDB 865664 D01 SAR measurement 100MHz to 6GHz, when the highest measured 1-g SAR within a frequency band is < 1.5 W/kg and the measured 10-g SAR within a frequency band is < 3.75 W/kg. The expanded SAR measurement uncertainty must be ≤ 30%, for a confidence interval of k = 2. If these conditions are met, extensive SAR measurement uncertainty analysis described in IEEE Std 1528-2013 is not required in SAR reports submitted for equipment approval. For this device, the highest measured 1-g SAR is less 1.5W/kg and highest measured 10-g SAR is less 3.75W/kg. Therefore, the measurement uncertainty table is not required in this report.

17. References

[1] FCC 47 CFR Part 2 “Frequency Allocations and Radio Treaty Matters; General Rules and Regulations”
[2] ANSI/IEEE Std. C95.1-1992, “IEEE Standard for Safety Levels with Respect to Human Exposure to Radio Frequency Electromagnetic Fields, 3 kHz to 300 GHz”, September 1992
[3] IEEE Std. 1528-2013, “IEEE Recommended Practice for Determining the Peak Spatial-Average Specific Absorption Rate (SAR) in the Human Head from Wireless Communications Devices: Measurement Techniques”, Sep 2013
[4] SPEAG DASY System Handbook
[5] FCC KDB 248227 D01 v02r02, “SAR Guidance for IEEE 802.11 (WiFi) Transmitters”, Oct 2015.
[6] FCC KDB 447498 D01 v06, “Mobile and Portable Device RF Exposure Procedures and Equipment Authorization Policies”, Oct 2015
[7] FCC KDB 648474 D04 v01r03, “SAR Evaluation Considerations for Wireless Handsets”, Oct 2015.
[8] FCC KDB 941225 D01 v03r01, “3G SAR MEAUREMENT PROCEDURES”, Oct 2015
[9] FCC KDB 941225 D05 v02r05, “SAR Evaluation Considerations for LTE Devices”, Dec 2015
[10] FCC KDB 941225 D05A v01r02, “Rel. 10 LTE SAR Test Guidance and KDB Inquiries”, Oct 2015
[11] FCC KDB 941225 D06 v02r01, "SAR Evaluation Procedures for Portable Devices with Wireless Router Capabilities", Oct 2015.
[12] FCC KDB 941225 D07 v01r02, " SAR Evaluation Procedures for UMPC Mini-Tablet Devices", Oct 2015.
[13] FCC KDB 865664 D01 v01r04, "SAR Measurement Requirements for 100 MHz to 6 GHz", Aug 2015.
[14] FCC KDB 865664 D02 v01r02, “RF Exposure Compliance Reporting and Documentation Considerations” Oct 2015.

Appendix A. Plots of System Performance Check

The plots are shown as follows.

Test Laboratory: Sporton International Inc. SAR/HAC Testing Lab Date: 2020.07.07

System Check_Head_1750MHz

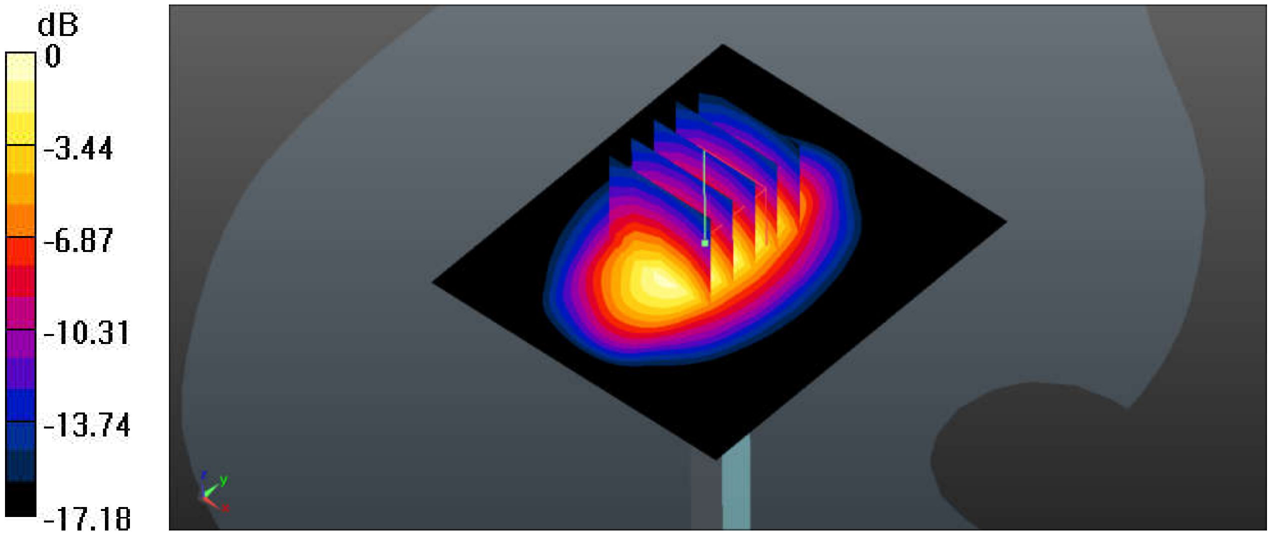
DUT: D1750V2-SN:1137

Communication System: UID 0, CW; Frequency: 1750 MHz;Duty Cycle: 1:1
Medium: HSL_1750_200707 Medium parameters used: f = 1750 MHz; σ = 1.395 S/m; ε_r = 40.742; ρ = 1000 kg/m^3
Ambient Temperature：23.4 ℃; Liquid Temperature：22.4 ℃

DASY5 Configuration:
- Probe: EX3DV4 - SN7576; ConvF(8.88, 8.88, 8.88); Calibrated: 2020.01.22;
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn528; Calibrated: 2020.03.16
- Phantom: SAM (Front) with CRP v5.0; Type: QD000P40CD; Serial: TP:1795
- Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7331)

Pin=250mW/Area Scan (61x71x1): Interpolated grid: dx=1.500 mm, dy=1.500 mm
Maximum value of SAR (interpolated) = 13.3 W/kg

Pin=250mW/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 92.06 V/m; Power Drift = 0.04 dB
Peak SAR (extrapolated) = 15.7 W/kg
SAR(1 g) = 8.97 W/kg; SAR(10 g) = 4.84 W/kg
Maximum value of SAR (measured) = 12.3 W/kg



0 dB = 12.3 W/kg

Test Laboratory: Sporton International Inc. SAR/HAC Testing Lab Date: 2020.07.09

System Check_Head_1900MHz

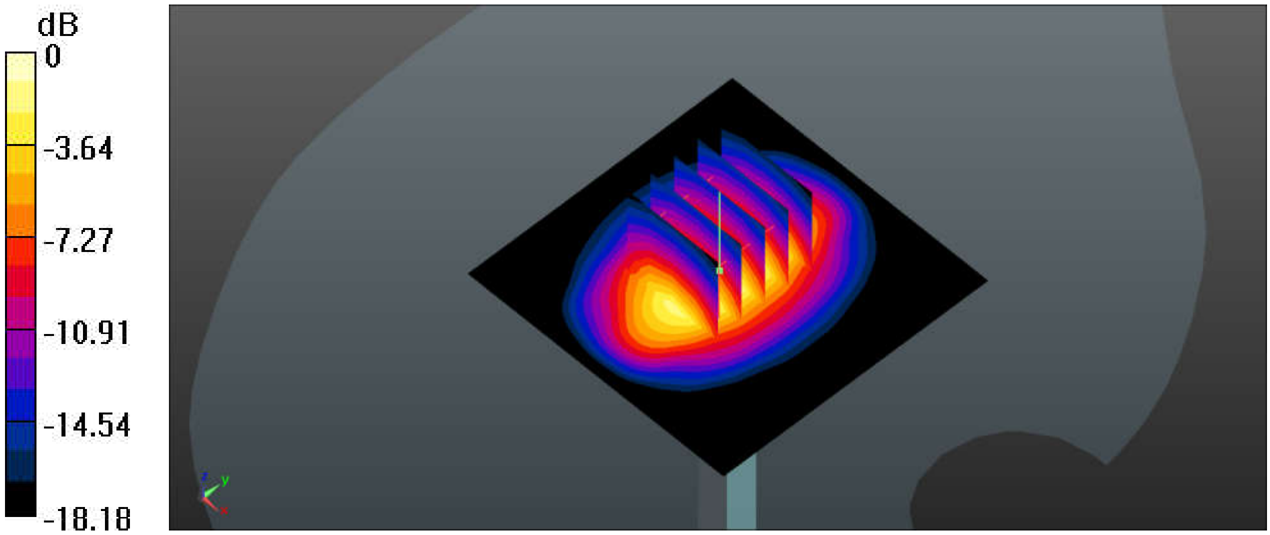
DUT: D1900V2-SN:5d182

Communication System: UID 0, CW; Frequency: 1900 MHz;Duty Cycle: 1:1
Medium: HSL_1900_200709 Medium parameters used: f = 1900 MHz; σ = 1.443 S/m; ε_r = 40.03; ρ = 1000 kg/m^3
Ambient Temperature：23.4 ℃; Liquid Temperature：22.5 ℃

DASY5 Configuration:
- Probe: EX3DV4 - SN7576; ConvF(8.58, 8.58, 8.58); Calibrated: 2020.01.22;
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn528; Calibrated: 2020.03.16
- Phantom: SAM (Front) with CRP v5.0; Type: QD000P40CD; Serial: TP:1795
- Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7331)

Pin=250mW/Area Scan (61x61x1): Interpolated grid: dx=1.500 mm, dy=1.500 mm
Maximum value of SAR (interpolated) = 14.1 W/kg

Pin=250mW/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 98.15 V/m; Power Drift = 0.16 dB
Peak SAR (extrapolated) = 18.2 W/kg
SAR(1 g) = 9.85 W/kg; SAR(10 g) = 5.08 W/kg
Maximum value of SAR (measured) = 14.3 W/kg



0 dB = 14.3 W/kg

Appendix B. Plots of SAR Measurement

The plots are shown as follows.

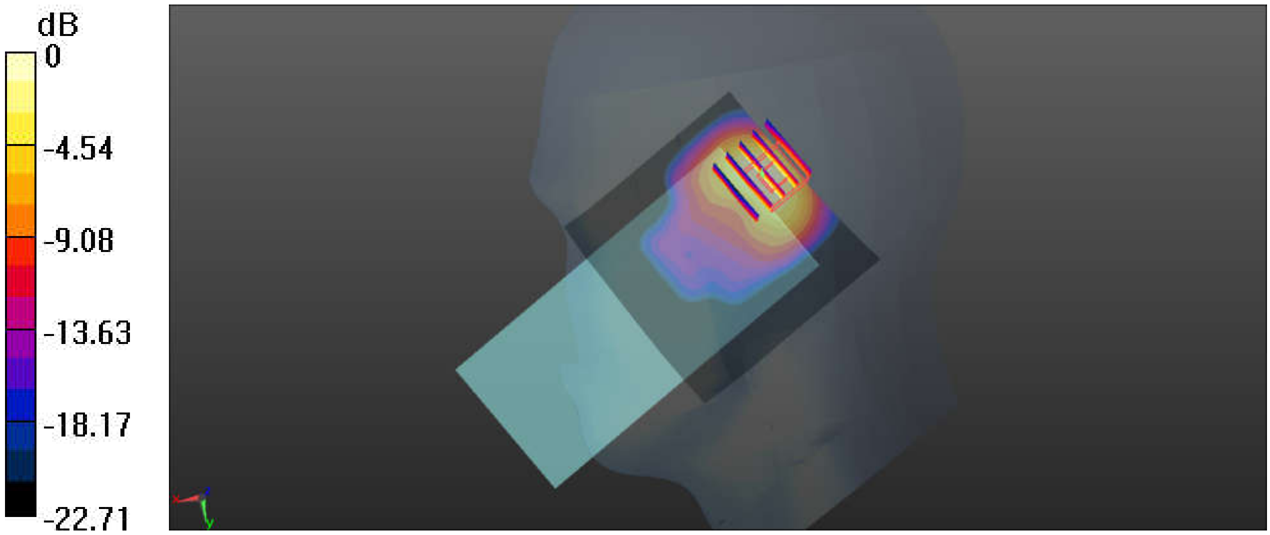
01_N66_20M_QPSK_50RB_28Offset_DFT-15_Right Tilted_Ch354000

Communication System: UID 0, 5G NR (0); Frequency: 1770 MHz;Duty Cycle: 1:1
Medium: HSL_1750_200707 Medium parameters used: f = 1770 MHz; σ = 1.413 S/m; ε_r = 40.683; ρ = 1000 kg/m^3
Ambient Temperature：23.4 ℃; Liquid Temperature：22.4 ℃

DASY5 Configuration:
- Probe: EX3DV4 - SN7576; ConvF(8.88, 8.88, 8.88); Calibrated: 2020.01.22;
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn528; Calibrated: 2020.03.16
- Phantom: SAM (Front) with CRP v5.0; Type: QD000P40CD; Serial: TP:1795
- Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7331)

Ch354000/Area Scan (71x71x1): Interpolated grid: dx=1.500 mm, dy=1.500 mm
Maximum value of SAR (interpolated) = 1.13 W/kg

Ch354000/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 19.59 V/m; Power Drift = -0.01 dB
Peak SAR (extrapolated) = 1.57 W/kg
SAR(1 g) = 0.759 W/kg; SAR(10 g) = 0.345 W/kg
Maximum value of SAR (measured) = 1.08 W/kg



0 dB = 1.08 W/kg

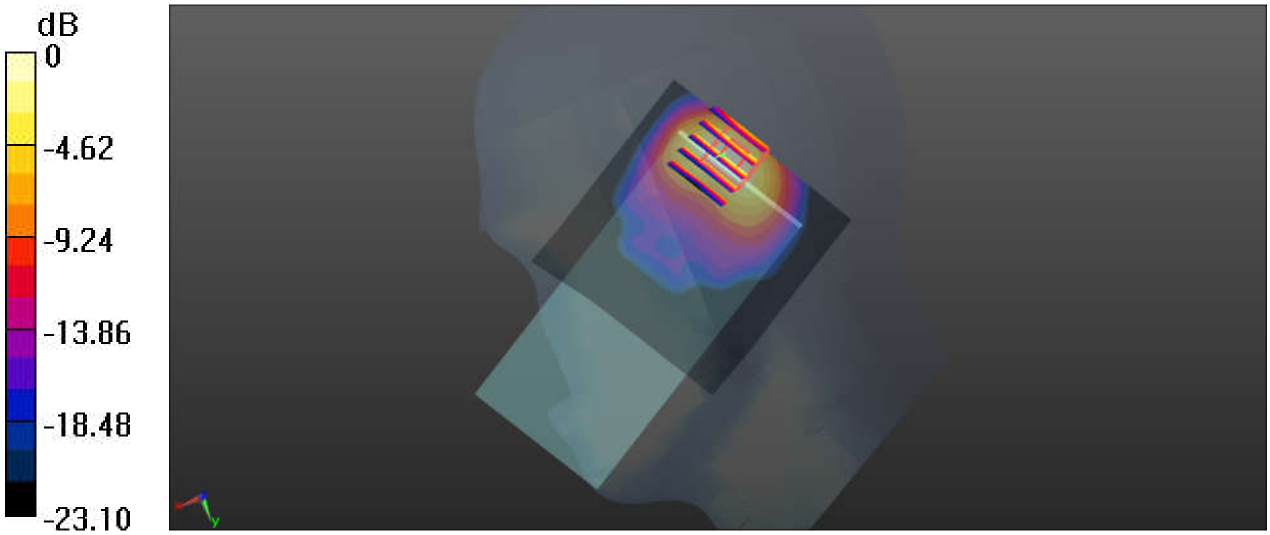
02_N2_20M_QPSK_50RB_28Offset_DFT-15_Right Tilted_Ch380000

Communication System: UID 0, 5G NR (0); Frequency: 1900 MHz;Duty Cycle: 1:1
Medium: HSL_1900_200709 Medium parameters used: f = 1900 MHz; σ = 1.443 S/m; ε_r = 40.03; ρ = 1000 kg/m^3
Ambient Temperature：23.4 ℃; Liquid Temperature：22.5 ℃

DASY5 Configuration:
- Probe: EX3DV4 - SN7576; ConvF(8.58, 8.58, 8.58); Calibrated: 2020.01.22;
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn528; Calibrated: 2020.03.16
- Phantom: SAM (Front) with CRP v5.0; Type: QD000P40CD; Serial: TP:1795
- Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7331)

Ch380000/Area Scan (71x71x1): Interpolated grid: dx=1.500 mm, dy=1.500 mm
Maximum value of SAR (interpolated) = 1.00 W/kg

Ch380000/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 19.01 V/m; Power Drift = -0.11 dB
Peak SAR (extrapolated) = 1.50 W/kg
SAR(1 g) = 0.680 W/kg; SAR(10 g) = 0.301 W/kg
Maximum value of SAR (measured) = 0.964 W/kg



0 dB = 0.964 W/kg

Test Laboratory: Sporton International Inc. SAR/HAC Testing Lab   Date: 2020.07.07

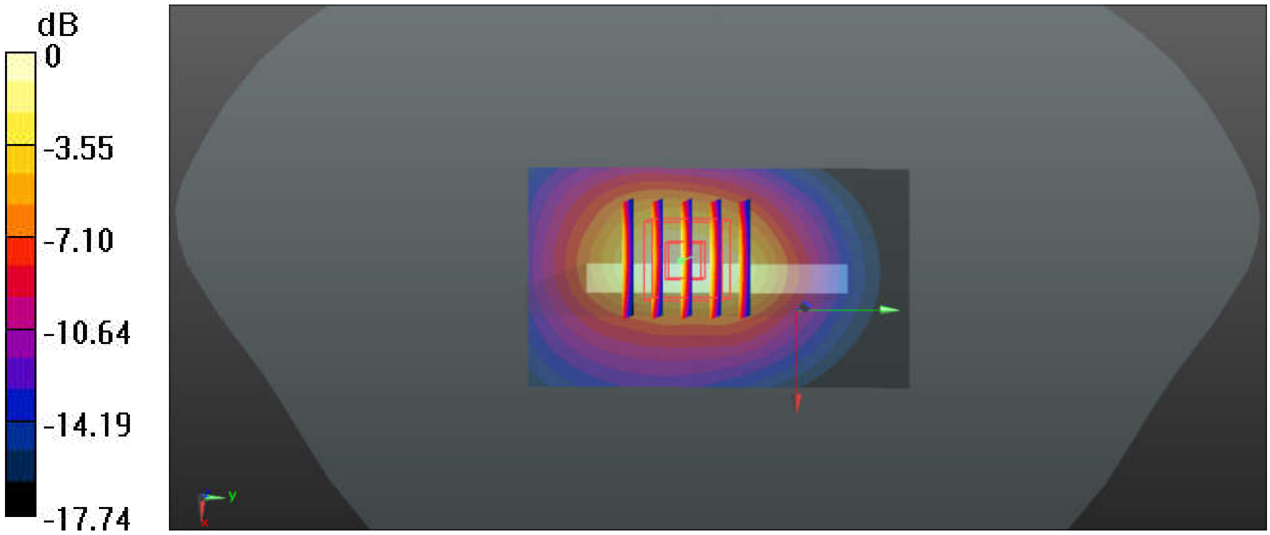
03_N66_20M_QPSK_50_28_DFT-15_Top Side_10mm_Ch354000

Communication System: UID 0, 5G NR (0); Frequency: 1770 MHz;Duty Cycle: 1:1
Medium: HSL_1750_200707 Medium parameters used: f = 1770 MHz; σ = 1.413 S/m; ε_r = 40.683; ρ = 1000 kg/m^3
Ambient Temperature：23.4 ℃; Liquid Temperature：22.4 ℃

DASY5 Configuration:
- Probe: EX3DV4 - SN7576; ConvF(8.88, 8.88, 8.88); Calibrated: 2020.01.22;
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn528; Calibrated: 2020.03.16
- Phantom: SAM (Front) with CRP v5.0; Type: QD000P40CD; Serial: TP:1795
- Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7331)

Ch354000/Area Scan (41x71x1): Interpolated grid: dx=1.500 mm, dy=1.500 mm
Maximum value of SAR (interpolated) = 0.788 W/kg

Ch354000/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 21.08 V/m; Power Drift = 0.10 dB
Peak SAR (extrapolated) = 0.997 W/kg
SAR(1 g) = 0.589 W/kg; SAR(10 g) = 0.314 W/kg
Maximum value of SAR (measured) = 0.824 W/kg



0 dB = 0.824 W/kg

Test Laboratory: Sporton International Inc. SAR/HAC Testing Lab Date: 2020.07.09

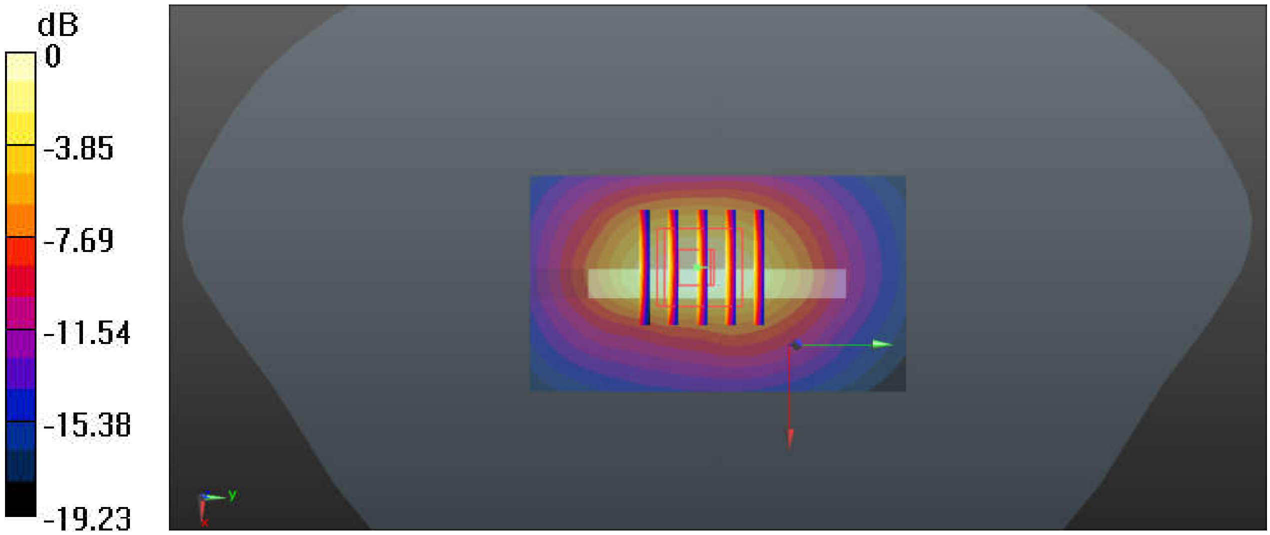
04_N2_20M_QPSK_50RB_28Offset_DFT-15_Top Side_10mm_Ch380000

Communication System: UID 0, 5G NR (0); Frequency: 1900 MHz;Duty Cycle: 1:1
Medium: HSL_1900_200709 Medium parameters used: f = 1900 MHz; σ = 1.443 S/m; ε_r = 40.03; ρ = 1000 kg/m^3
Ambient Temperature：23.4 ℃; Liquid Temperature：22.5 ℃

DASY5 Configuration:
- Probe: EX3DV4 - SN7576; ConvF(8.58, 8.58, 8.58); Calibrated: 2020.01.22;
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn528; Calibrated: 2020.03.16
- Phantom: SAM (Front) with CRP v5.0; Type: QD000P40CD; Serial: TP:1795
- Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7331)

Ch380000/Area Scan (41x71x1): Interpolated grid: dx=1.500 mm, dy=1.500 mm
Maximum value of SAR (interpolated) = 0.765 W/kg

Ch380000/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 21.16 V/m; Power Drift = 0.12 dB
Peak SAR (extrapolated) = 0.979 W/kg
SAR(1 g) = 0.549 W/kg; SAR(10 g) = 0.283 W/kg
Maximum value of SAR (measured) = 0.781 W/kg



0 dB = 0.781 W/kg

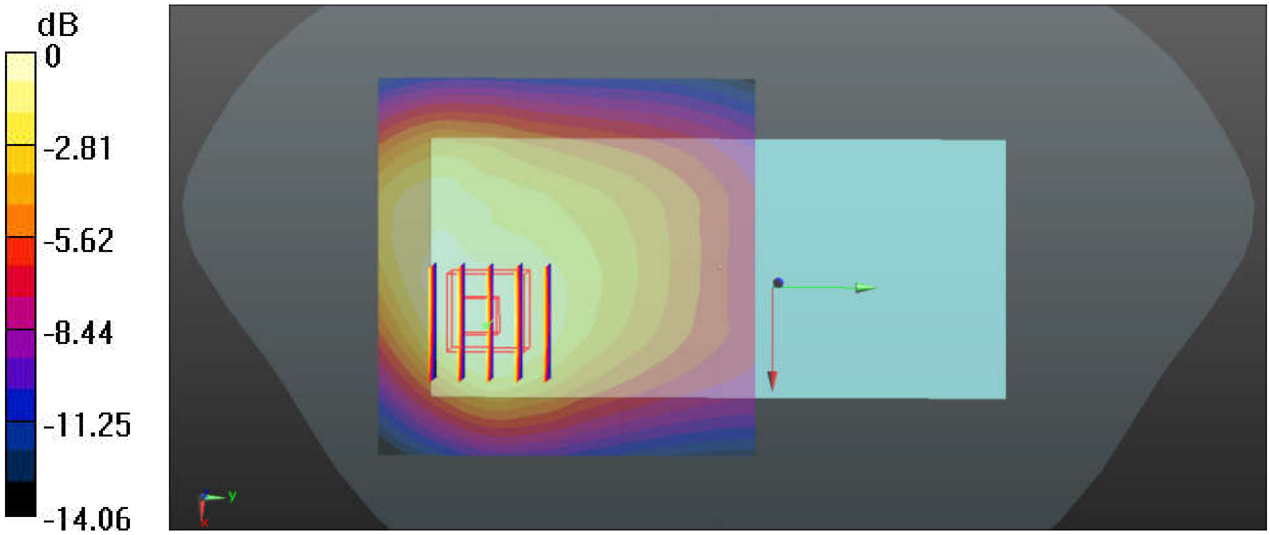
05_N66_20M_QPSK_1RB_1Offset_DFT-15_Front_15mm_Ch344000

Communication System: UID 0, 5G NR (0); Frequency: 1720 MHz;Duty Cycle: 1:1
Medium: HSL_1750_200707 Medium parameters used: f = 1720 MHz; σ = 1.364 S/m; ε_r = 40.843; ρ = 1000 kg/m^3
Ambient Temperature：23.4 ℃; Liquid Temperature：22.4 ℃

DASY5 Configuration:
- Probe: EX3DV4 - SN7576; ConvF(8.88, 8.88, 8.88); Calibrated: 2020.01.22;
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn528; Calibrated: 2020.03.16
- Phantom: SAM (Front) with CRP v5.0; Type: QD000P40CD; Serial: TP:1795
- Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7331)

Ch344000/Area Scan (71x71x1): Interpolated grid: dx=1.500 mm, dy=1.500 mm
Maximum value of SAR (interpolated) = 0.328 W/kg

Ch344000/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 7.619 V/m; Power Drift = 0.15 dB
Peak SAR (extrapolated) = 0.383 W/kg
SAR(1 g) = 0.257 W/kg; SAR(10 g) = 0.164 W/kg
Maximum value of SAR (measured) = 0.321 W/kg



0 dB = 0.321 W/kg

Test Laboratory: Sporton International Inc. SAR/HAC Testing Lab Date: 2020.07.09

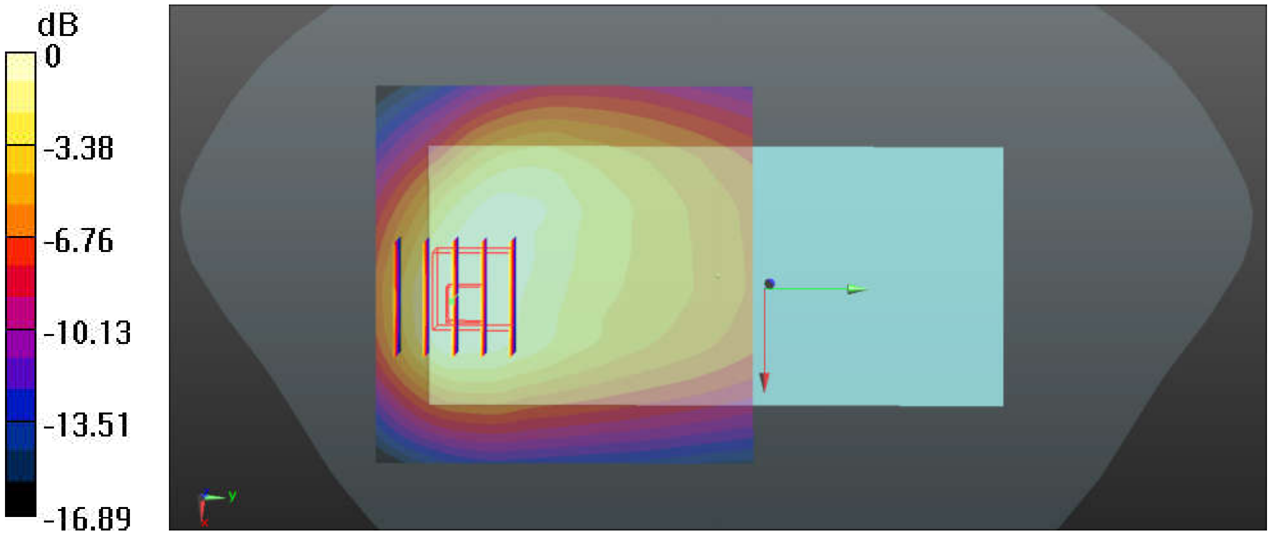
06_N2_20M_QPSK_50RB_28Offset_DFT-15_Back_15mm_Ch376000

Communication System: UID 0, 5G NR (0); Frequency: 1880 MHz;Duty Cycle: 1:1
Medium: HSL_1900_200709 Medium parameters used: f = 1880 MHz; σ = 1.423 S/m; ε_r = 40.121; ρ = 1000 kg/m^3
Ambient Temperature：23.4 ℃; Liquid Temperature：22.5 ℃

DASY5 Configuration:
- Probe: EX3DV4 - SN7576; ConvF(8.58, 8.58, 8.58); Calibrated: 2020.01.22;
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn528; Calibrated: 2020.03.16
- Phantom: SAM (Front) with CRP v5.0; Type: QD000P40CD; Serial: TP:1795
- Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7331)

Ch376000/Area Scan (71x71x1): Interpolated grid: dx=1.500 mm, dy=1.500 mm
Maximum value of SAR (interpolated) = 0.367 W/kg

Ch376000/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 9.036 V/m; Power Drift = 0.03 dB
Peak SAR (extrapolated) = 0.448 W/kg
SAR(1 g) = 0.272 W/kg; SAR(10 g) = 0.164 W/kg
Maximum value of SAR (measured) = 0.353 W/kg



0 dB = 0.353 W/kg

Appendix C. DASY Calibration Certificate

The DASY calibration certificates are shown as follows.

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Client **Sporton** **Certificate No: Z18-60258**

CALIBRATION CERTIFICATE

Object D1750V2 - SN: 1137

Calibration Procedure(s) FF-Z11-003-01
Calibration Procedures for dipole validation kits

Calibration date: July 30, 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)℃ and humidity<70%.

Calibration Equipment used (M&TE critical for calibration)

Primary Standards	ID #	Cal Date(Calibrated by, Certificate No.)	Scheduled Calibration
Power Meter NRVD	102083	01-Nov-17 (CTTL, No.J17X08756)	Oct-18
Power sensor NRV-Z5	100542	01-Nov-17 (CTTL, No.J17X08756)	Oct-18
Reference Probe EX3DV4	SN 7464	12-Sep-17(SPEAG,No.EX3-7464_Sep17)	Sep-18
DAE4	SN 1524	13-Sep-17(SPEAG,No.DAE4-1524_Sep17)	Sep-18
Secondary Standards	**ID #**	**Cal Date(Calibrated by, Certificate No.)**	**Scheduled Calibration**
Signal Generator E4438C	MY49071430	23-Jan-18 (CTTL, No.J18X00560)	Jan-19
NetworkAnalyzer E5071C	MY46110673	24-Jan-18 (CTTL, No.J18X00561)	Jan-19

	Name	Function	Signature
Calibrated by:	Zhao Jing	SAR Test Engineer	
Reviewed by:	Lin Hao	SAR Test Engineer	
Approved by:	Qi Dianyuan	SAR Project Leader	

Issued: August 3, 2018

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Glossary:

TSL	tissue simulating liquid
ConvF	sensitivity in TSL / NORMx,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 assessment of specific absorption rate of human exposure to radio frequency fields from hand-held and body-mounted wireless communication devices- Part 1: Device used next to the ear (Frequency range of 300MHz to 6GHz)", July 2016

c) IEC 62209-2, "Procedure to measure the Specific Absorption Rate (SAR) For wireless communication devices used in close proximity to the human body (frequency range of 30MHz to 6GHz)", March 2010

d) KDB865664, 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%.

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Measurement Conditions

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

DASY Version	DASY52	52.10.1.1476
Extrapolation	Advanced Extrapolation	
Phantom	Triple Flat Phantom 5.1C	
Distance Dipole Center - TSL	10 mm	with Spacer
Zoom Scan Resolution	dx, dy, dz = 5 mm	
Frequency	1750 MHz ± 1 MHz	

Head TSL parameters

The following parameters and calculations were applied.

	Temperature	**Permittivity**	**Conductivity**
Nominal Head TSL parameters	22.0 °C	40.1	1.37 mho/m
Measured Head TSL parameters	(22.0 ± 0.2) °C	41.2 ± 6 %	1.33 mho/m ± 6 %
Head TSL temperature change during test	<1.0 °C	----	----

SAR result with Head TSL

SAR averaged over 1 cm^3 (1 g) of Head TSL	Condition	
SAR measured	250 mW input power	8.91 mW / g
SAR for nominal Head TSL parameters	normalized to 1W	**36.5 mW /g ± 18.8 % (k=2)**

SAR averaged over 10 cm^3 (10 g) of Head TSL	Condition	
SAR measured	250 mW input power	4.81 mW / g
SAR for nominal Head TSL parameters	normalized to 1W	**19.5 mW /g ± 18.7 % (k=2)**

Body TSL parameters

The following parameters and calculations were applied.

	Temperature	**Permittivity**	**Conductivity**
Nominal Body TSL parameters	22.0 °C	53.4	1.49 mho/m
Measured Body TSL parameters	(22.0 ± 0.2) °C	53.8 ± 6 %	1.48 mho/m ± 6 %
Body TSL temperature change during test	<1.0 °C	----	----

SAR result with Body TSL

SAR averaged over 1 cm^3 (1 g) of Body TSL	Condition	
SAR measured	250 mW input power	9.17 mW / g
SAR for nominal Body TSL parameters	normalized to 1W	**37.0 mW /g ± 18.8 % (k=2)**

SAR averaged over 10 cm^3 (10 g) of Body TSL	Condition	
SAR measured	250 mW input power	5.05 mW / g
SAR for nominal Body TSL parameters	normalized to 1W	**20.3 mW /g ± 18.7 % (k=2)**

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Appendix (Additional assessments outside the scope of CNAS L0570)

Antenna Parameters with Head TSL

Impedance, transformed to feed point	50.3- 0.87 jΩ
Return Loss	- 40.7 dB

Antenna Parameters with Body TSL

Impedance, transformed to feed point	44.8Ω- 2.59 jΩ
Return Loss	- 24.3 dB

General Antenna Parameters and Design

Electrical Delay (one direction)	1.087 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

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Date: 07.30.2018

DASY5 Validation Report for Head TSL

Test Laboratory: CTTL, Beijing, China

DUT: Dipole 1750 MHz; Type: D1750V2; Serial: D1750V2 - SN: 1137

Communication System: UID 0, CW; Frequency: 1750 MHz; Duty Cycle: 1:1

Medium parameters used: f = 1750 MHz; σ = 1.332 S/m; εr = 41.17; ρ = 1000 kg/m3

Phantom section: Center Section

DASY5 Configuration:

- Probe: EX3DV4 - SN7464; ConvF(8.7, 8.7, 8.7) @ 1750 MHz; Calibrated: 9/12/2017
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1524; Calibrated: 9/13/2017
- Phantom: MFP_V5.1C ; Type: QD 000 P51CA; Serial: 1062
- Measurement SW: DASY52, Version 52.10 (1); SEMCAD X Version 14.6.11 (7439)

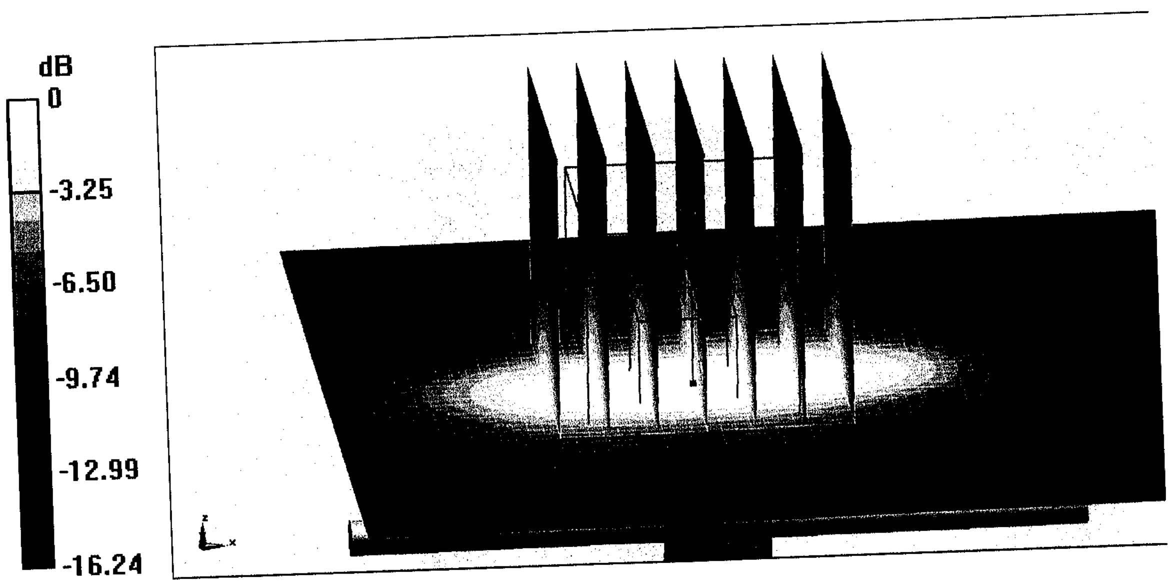
System Performance Check/Zoom Scan (7x7x7) (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 96.50 V/m; Power Drift = 0.00 dB

Peak SAR (extrapolated) = 16.1 W/kg

SAR(1 g) = 8.91 W/kg; SAR(10 g) = 4.81 W/kg

Maximum value of SAR (measured) = 13.5 W/kg



0 dB = 13.5 W/kg = 11.30 dBW/kg

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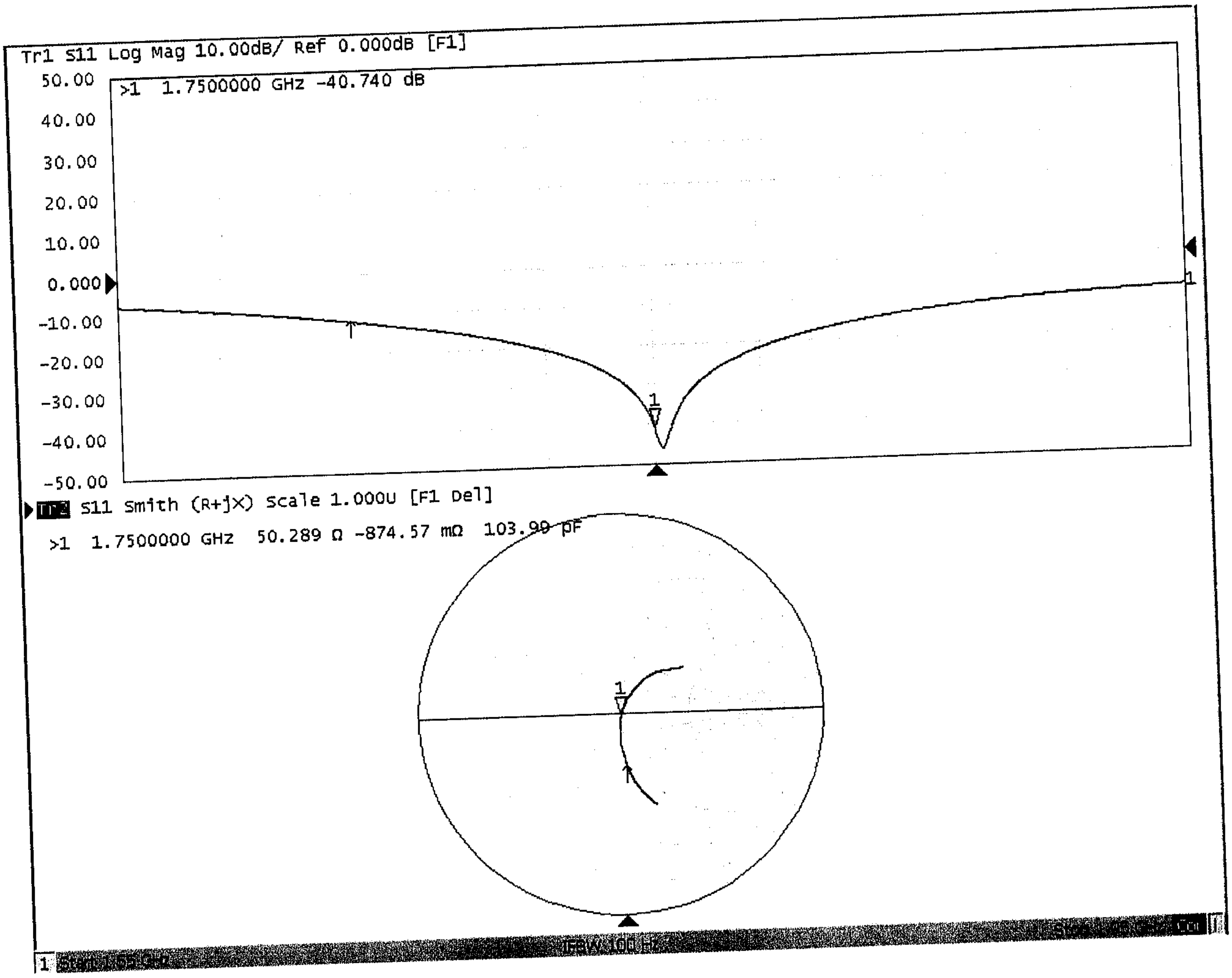
Impedance Measurement Plot for Head TSL



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Date: 07.30.2018

DASY5 Validation Report for Body TSL

Test Laboratory: CTTL, Beijing, China

DUT: Dipole 1750 MHz; Type: D1750V2; Serial: D1750V2 - SN: 1137

Communication System: UID 0, CW; Frequency: 1750 MHz; Duty Cycle: 1:1

Medium parameters used: f = 1750 MHz; σ = 1.477 S/m; εr = 53.84; ρ = 1000 kg/m3

Phantom section: Left Section

DASY5 Configuration:

- Probe: EX3DV4 - SN7464; ConvF(8.6, 8.6, 8.6) @ 1750 MHz; Calibrated: 9/12/2017
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1524; Calibrated: 9/13/2017
- Phantom: MFP_V5.1C ; Type: QD 000 P51CA; Serial: 1062
- Measurement SW: DASY52, Version 52.10 (1); SEMCAD X Version 14.6.11 (7439)

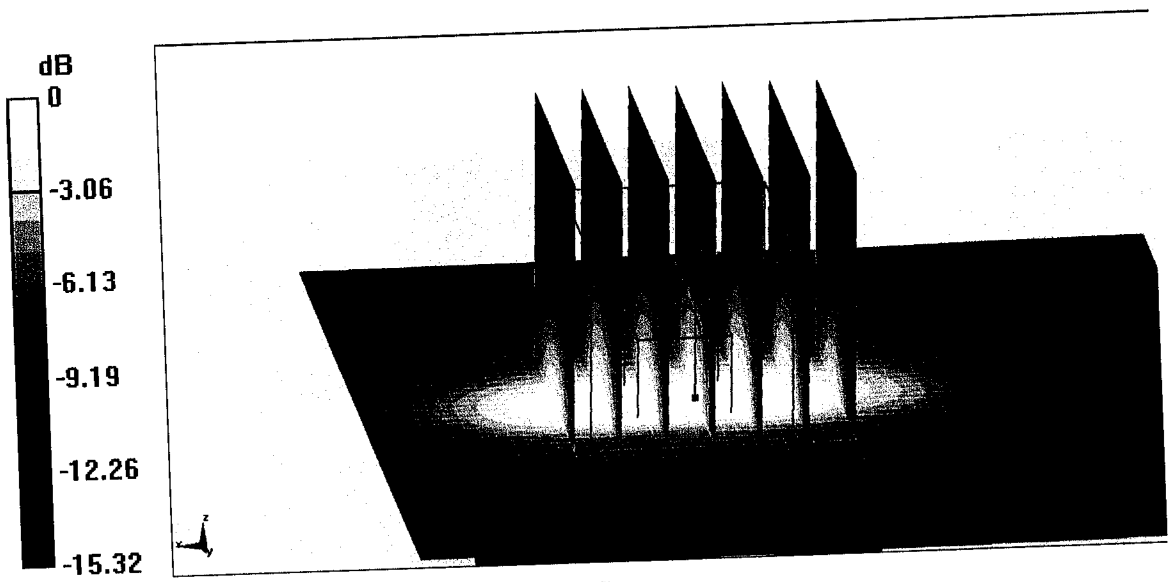
System Performance Check/Zoom Scan (7x7x7) (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 77.55 V/m; Power Drift = 0.06 dB

Peak SAR (extrapolated) = 16.0 W/kg

SAR(1 g) = 9.17 W/kg; SAR(10 g) = 5.05 W/kg

Maximum value of SAR (measured) = 13.7 W/kg



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

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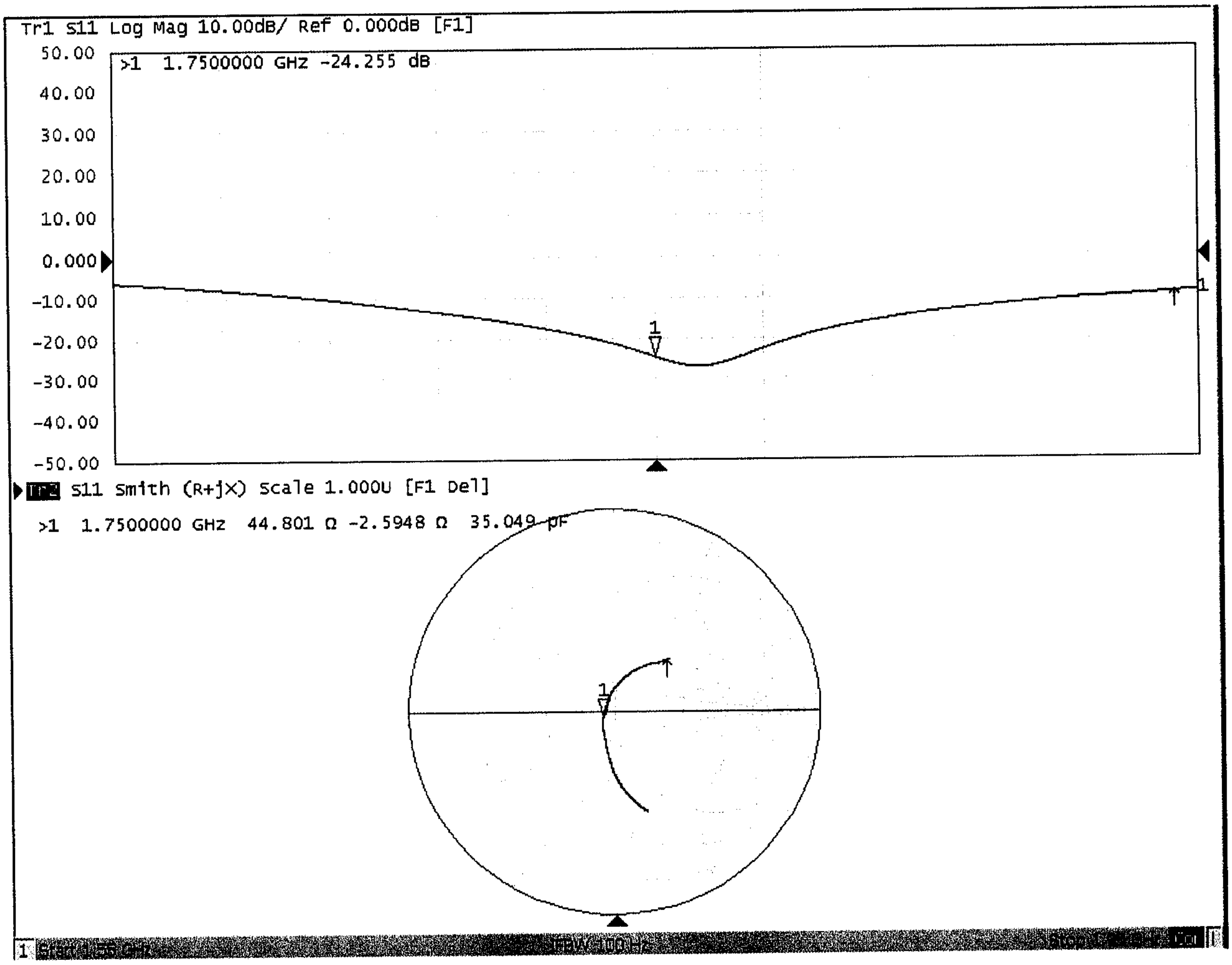
Impedance Measurement Plot for Body TSL



D1750V2, Serial No. 1137 Extended Dipole Calibrations

Referring to KDB 865664 D01 v01r02, if dipoles are verified in return loss (<-20dB, within 20% of prior calibration), and in impedance (within 5 ohm of prior calibration), the annual calibration is not necessary and the calibration interval can be extended.

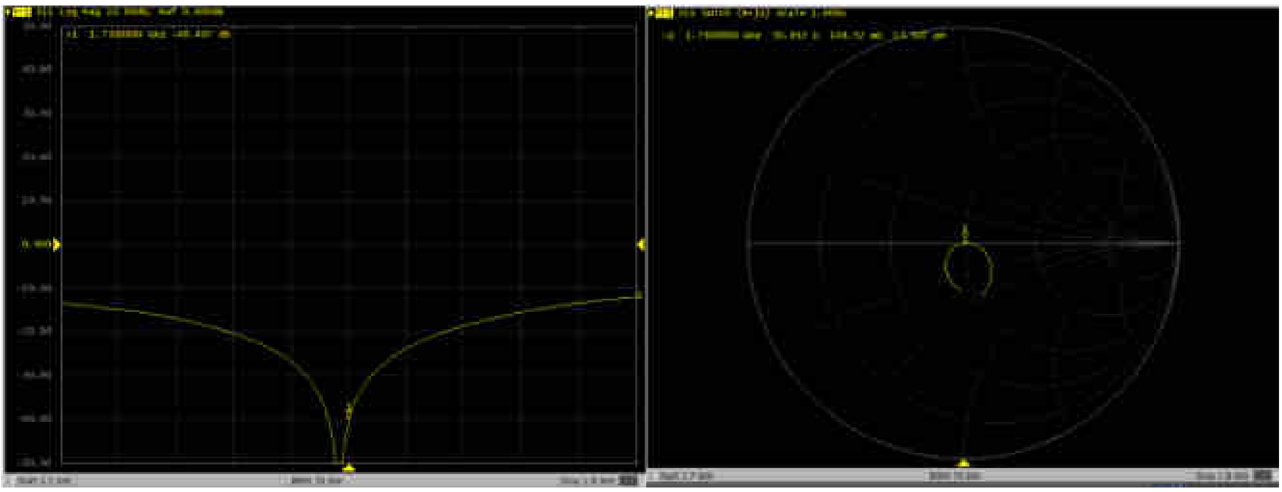
D1750V2 – serial no. 1137												
	1750 Head						1750 Body					
Date of Measurement	Return-Loss (dB)	Delta (%)	Real Impedance (ohm)	Delta (ohm)	Imaginary Impedance (ohm)	Delta (ohm)	Return-Loss (dB)	Delta (%)	Real Impedance (ohm)	Delta (ohm)	Imaginary Impedance (ohm)	Delta (ohm)
2018.07.30	-40.7		50.3		-0.87		-24.3		44.8		-2.59	
2019.10.23	-40.4	0.7	51	0.7	-0.15	0.72	-24.7	-1.6	46.1	1.3	-2.1	0.49

<Justification of the extended calibration>

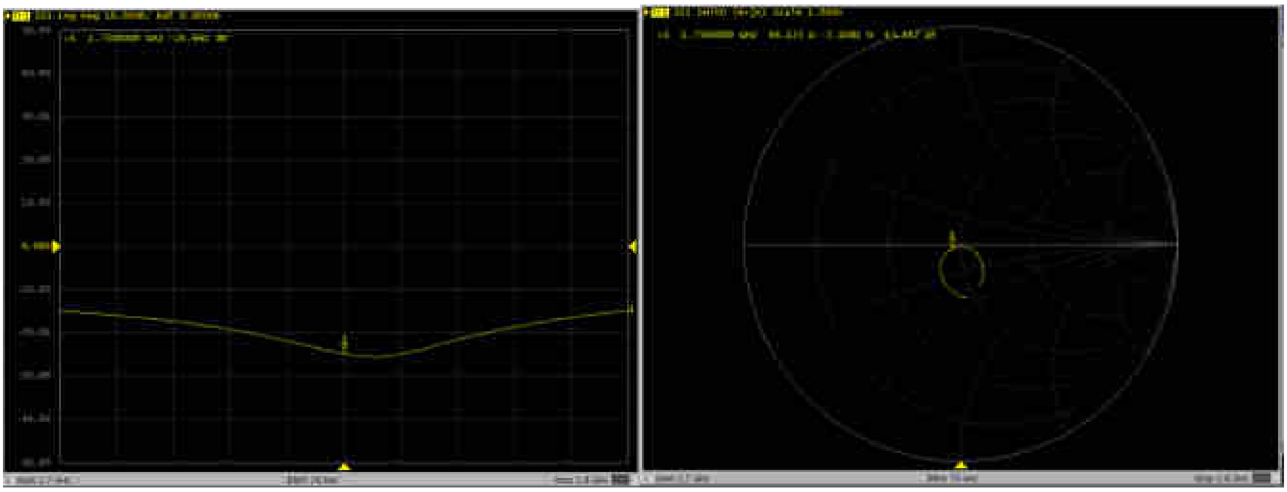
The return loss is < -20dB, within 20% of prior calibration; the impedance is within 5 ohm of prior calibration. Therefore the verification result should support extended calibration.

Dipole Verification Data> D1750V2, serial no. 1137

1750MHz - Head



1750MHz – Body



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Client Sporton **Certificate No:** Z18-60536

CALIBRATION CERTIFICATE

Object	D1900V2 - SN: 5d182
Calibration Procedure(s)	FF-Z11-003-01 Calibration Procedures for dipole validation kits
Calibration date:	December 7, 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)℃ and humidity<70%.

Calibration Equipment used (M&TE critical for calibration)

Primary Standards	ID #	Cal Date(Calibrated by, Certificate No.)	Scheduled Calibration
Power Meter NRVD	102196	07-Mar-18 (CTTL, No.J18X01510)	Mar-19
Power sensor NRV-Z5	100596	07-Mar-18 (CTTL, No.J18X01510)	Mar-19
Reference Probe EX3DV4	SN 7514	27-Aug-18(SPEAG,No.EX3-7514_Aug18)	Aug-19
DAE4	SN 1555	20-Aug-18(SPEAG,No.DAE4-1555_Aug18)	Aug-19
Secondary Standards	**ID #**	**Cal Date(Calibrated by, Certificate No.)**	**Scheduled Calibration**
Signal Generator E4438C	MY49071430	23-Jan-18 (CTTL, No.J18X00560)	Jan-19
NetworkAnalyzer E5071C	MY46110673	24-Jan-18 (CTTL, No.J18X00561)	Jan-19

	Name	Function	Signature
Calibrated by:	Zhao Jing	SAR Test Engineer	
Reviewed by:	Lin Hao	SAR Test Engineer	
Approved by:	Qi Dianyuan	SAR Project Leader	

Issued: December 10, 2018

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lossary:

TSL	tissue simulating liquid
ConvF	sensitivity in TSL / NORMx,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 assessment of specific absorption rate of human exposure to radio frequency fields from hand-held and body-mounted wireless communication devices- Part 1: Device used next to the ear (Frequency range of 300MHz to 6GHz)", July 2016

c) IEC 62209-2, "Procedure to measure the Specific Absorption Rate (SAR) For wireless communication devices used in close proximity to the human body (frequency range of 30MHz to 6GHz)", March 2010

d) KDB865664, 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%.

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Measurement Conditions

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

DASY Version	DASY52	52.10.2.1495
Extrapolation	Advanced Extrapolation	
Phantom	Triple Flat Phantom 5.1C	
Distance Dipole Center - TSL	10 mm	with Spacer
Zoom Scan Resolution	dx, dy, dz = 5 mm	
Frequency	1900 MHz ± 1 MHz	

Head TSL parameters

The following parameters and calculations were applied.

	Temperature	**Permittivity**	**Conductivity**
Nominal Head TSL parameters	22.0 °C	40.0	1.40 mho/m
Measured Head TSL parameters	(22.0 ± 0.2) °C	39.6 ± 6 %	1.44 mho/m ± 6 %
Head TSL temperature change during test	<1.0 °C	----	----

SAR result with Head TSL

SAR averaged over 1 cm^3 (1 g) of Head TSL	Condition	
SAR measured	250 mW input power	10.1 mW / g
SAR for nominal Head TSL parameters	normalized to 1W	**39.6 mW /g ± 18.8 % (k=2)**
SAR averaged over 10 cm^3 (10 g) of Head TSL	Condition	
SAR measured	250 mW input power	5.25 mW / g
SAR for nominal Head TSL parameters	normalized to 1W	**20.7 mW /g ± 18.7 % (k=2)**

Body TSL parameters

The following parameters and calculations were applied.

	Temperature	**Permittivity**	**Conductivity**
Nominal Body TSL parameters	22.0 °C	53.3	1.52 mho/m
Measured Body TSL parameters	(22.0 ± 0.2) °C	51.8 ± 6 %	1.56 mho/m ± 6 %
Body TSL temperature change during test	<1.0 °C	----	----

SAR result with Body TSL

SAR averaged over 1 cm^3 (1 g) of Body TSL	Condition	
SAR measured	250 mW input power	10.2 mW / g
SAR for nominal Body TSL parameters	normalized to 1W	**39.9 mW /g ± 18.8 % (k=2)**
SAR averaged over 10 cm^3 (10 g) of Body TSL	Condition	
SAR measured	250 mW input power	5.31 mW / g
SAR for nominal Body TSL parameters	normalized to 1W	**20.9 mW /g ± 18.7 % (k=2)**

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Appendix (Additional assessments outside the scope of CNAS L0570)

Antenna Parameters with Head TSL

Impedance, transformed to feed point	52.1Ω+ 5.35jΩ
Return Loss	- 25.0dB

Antenna Parameters with Body TSL

Impedance, transformed to feed point	48.9Ω+ 6.19jΩ
Return Loss	- 24.0dB

General Antenna Parameters and Design

Electrical Delay (one direction)	1.067 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

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E-mail: cttl@chinattl.com http://www.chinattl.cn

Date: 12.06.2018

DASY5 Validation Report for Head TSL

Test Laboratory: CTTL, Beijing, China

DUT: Dipole 1900 MHz; Type: D1900V2; Serial: D1900V2 - SN: 5d182

Communication System: UID 0, CW; Frequency: 1900 MHz; Duty Cycle: 1:1

Medium parameters used: f = 1900 MHz; σ = 1.441 S/m; ε_r = 39.59; ρ = 1000 kg/m3

Phantom section: Center Section

DASY5 Configuration:

- Probe: EX3DV4 - SN7514; ConvF(7.73, 7.73, 7.73) @ 1900 MHz; Calibrated: 8/27/2018
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1555; Calibrated: 8/20/2018
- Phantom: MFP_V5.1C ; Type: QD 000 P51CA; Serial: 1062
- Measurement SW: DASY52, Version 52.10 (2); SEMCAD X Version 14.6.12 (7450)

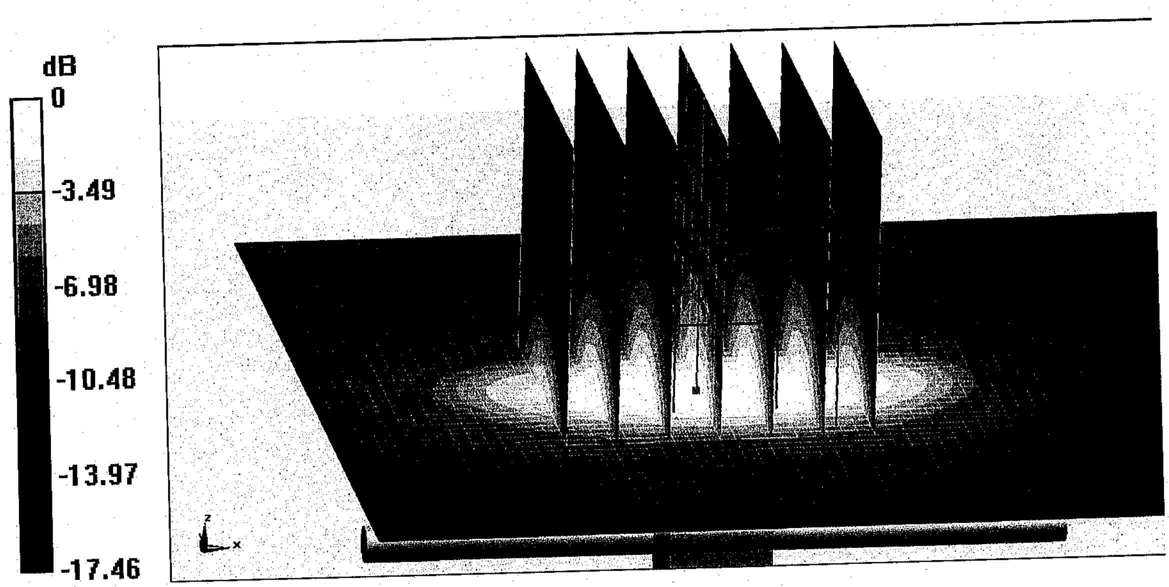
System Performance Check/Zoom Scan (7x7x7) (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 95.91 V/m; Power Drift = 0.00 dB

Peak SAR (extrapolated) = 19.3 W/kg

SAR(1 g) = 10.1 W/kg; SAR(10 g) = 5.25 W/kg

Maximum value of SAR (measured) = 15.8 W/kg



0 dB = 15.8 W/kg = 11.99 dBW/kg

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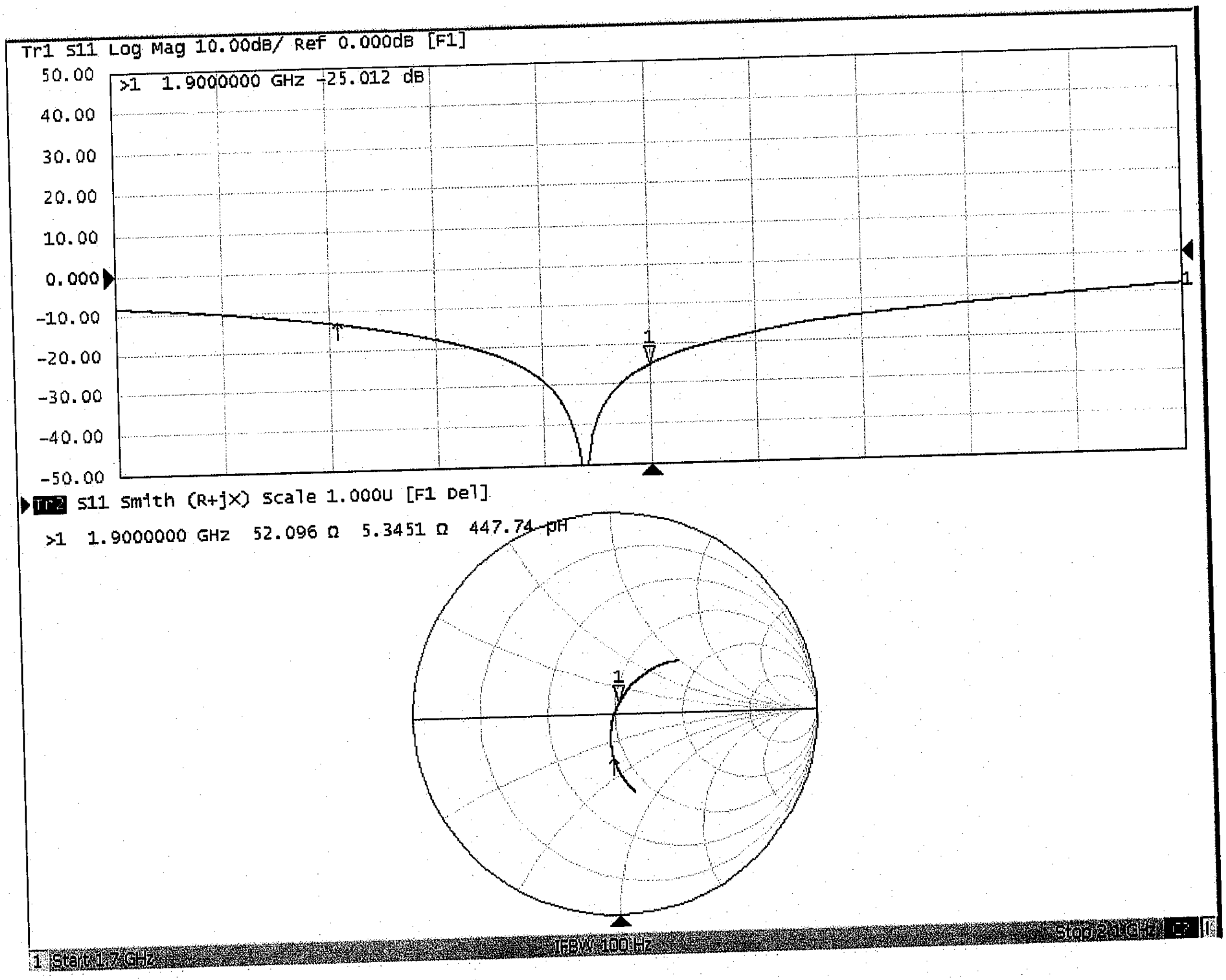
Impedance Measurement Plot for Head TSL



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DASY5 Validation Report for Body TSL

Date: 12.05.2018

Test Laboratory: CTTL, Beijing, China

DUT: Dipole 1900 MHz; Type: D1900V2; Serial: D1900V2 - SN: 5d182

Communication System: UID 0, CW; Frequency: 1900 MHz; Duty Cycle: 1:1

Medium parameters used: f = 1900 MHz; σ = 1.564 S/m; ε_r = 51.82; ρ = 1000 kg/m3

Phantom section: Right Section

DASY5 Configuration:

- Probe: EX3DV4 - SN7514; ConvF(7.53, 7.53, 7.53) @ 1900 MHz; Calibrated: 8/27/2018
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1555; Calibrated: 8/20/2018
- Phantom: MFP_V5.1C ; Type: QD 000 P51CA; Serial: 1062
- Measurement SW: DASY52, Version 52.10 (2); SEMCAD X Version 14.6.12 (7450)

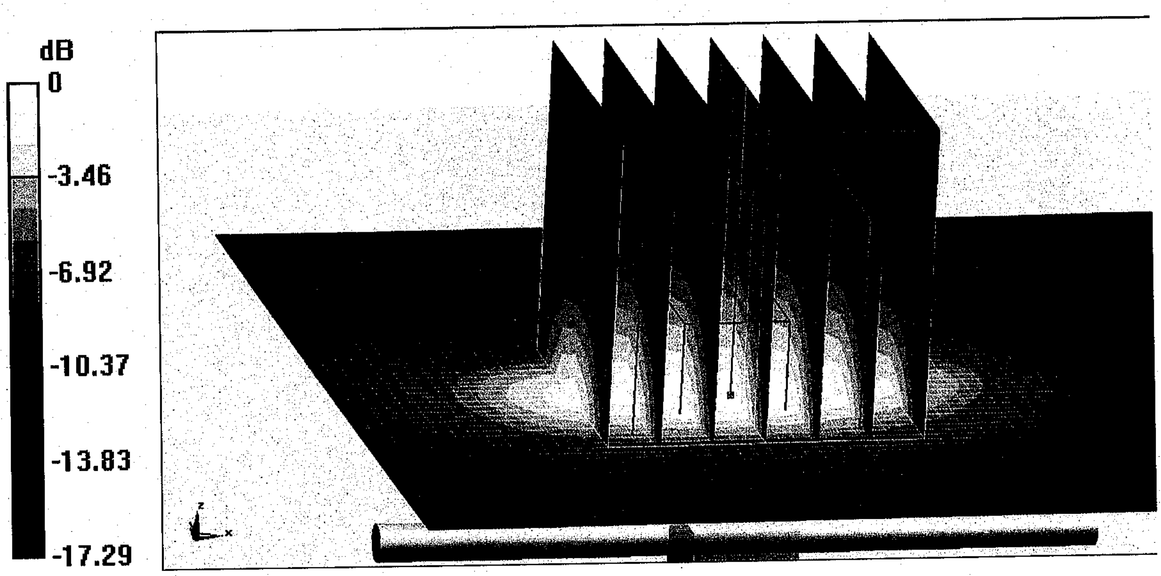
System Performance Check/Zoom Scan (7x7x7) (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 84.07 V/m; Power Drift = -0.04 dB

Peak SAR (extrapolated) = 18.9 W/kg

SAR(1 g) = 10.2 W/kg; SAR(10 g) = 5.31 W/kg

Maximum value of SAR (measured) = 15.7 W/kg



0 dB = 15.7 W/kg = 11.96 dBW/kg

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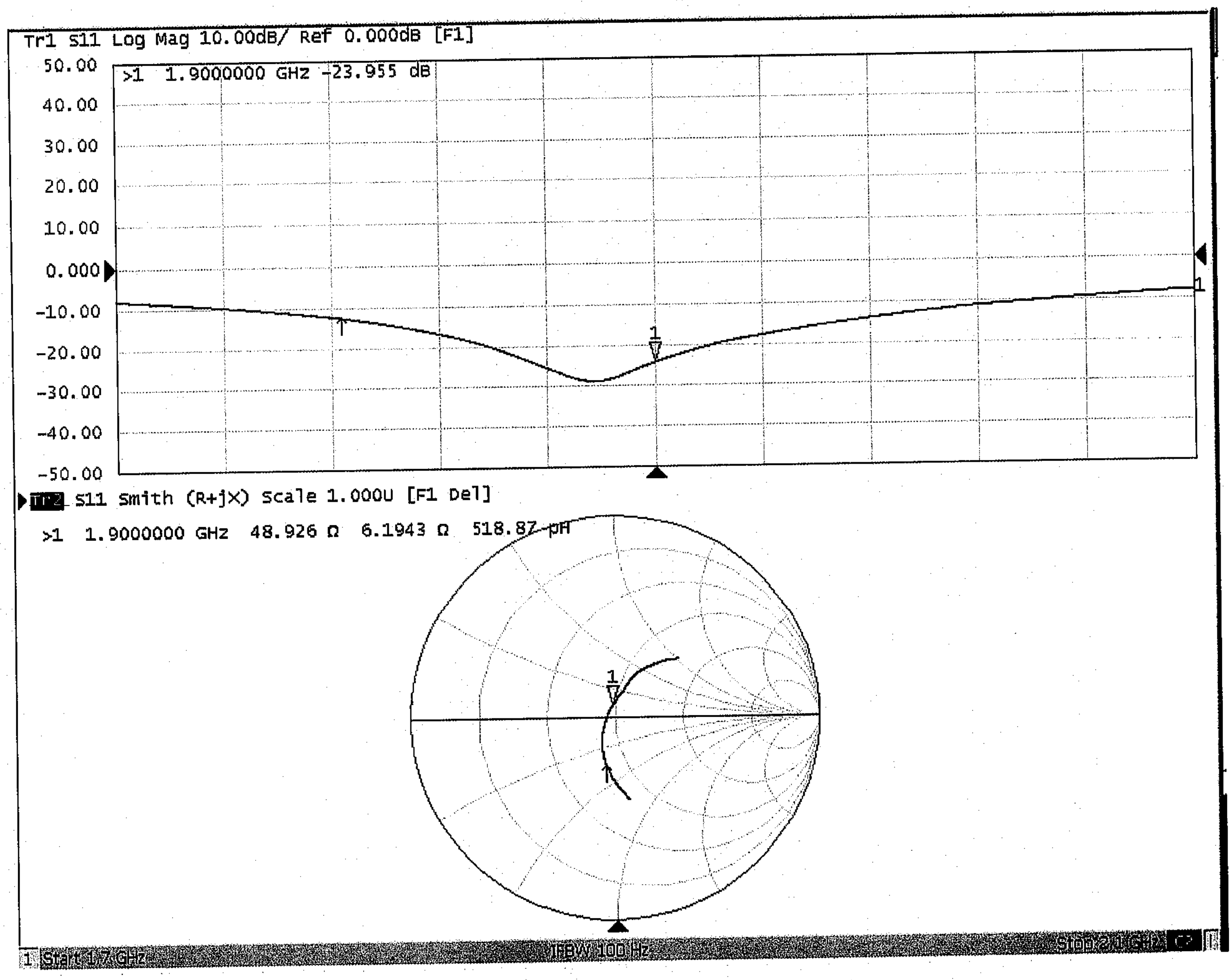
Impedance Measurement Plot for Body TSL



D1900V2, Serial No. 5d182 Extended Dipole Calibrations

Referring to KDB 865664 D01 v01r02, if dipoles are verified in return loss (<-20dB, within 20% of prior calibration), and in impedance (within 5 ohm of prior calibration), the annual calibration is not necessary and the calibration interval can be extended.

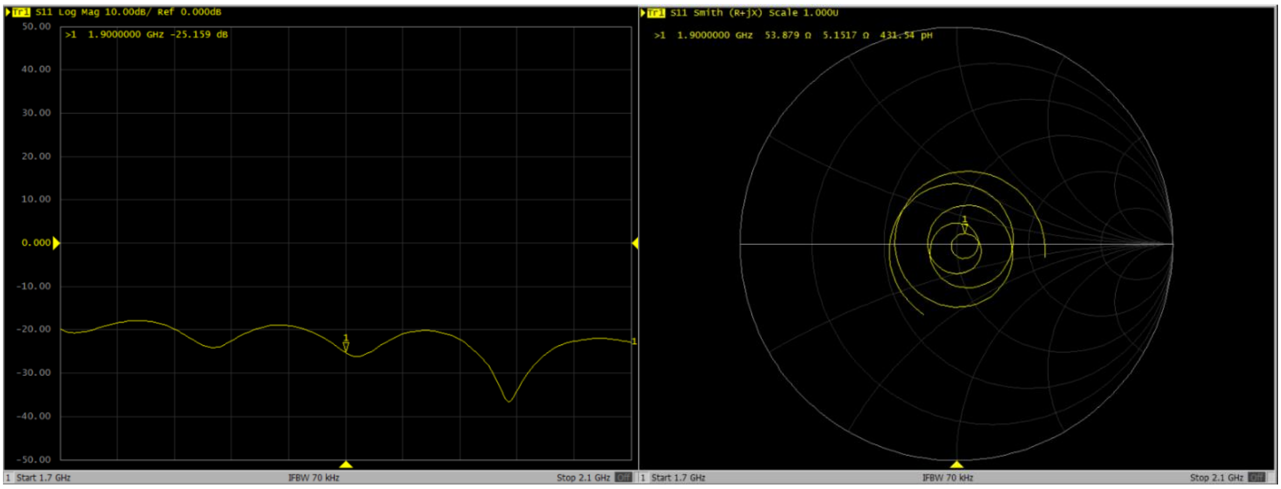
D1900V2 – serial no. 5d182												
	1900 Head						1900 Body					
Date of Measurement	Return-Loss (dB)	Delta (%)	Real Impedance (ohm)	Delta (ohm)	Imaginary Impedance (ohm)	Delta (ohm)	Return-Loss (dB)	Delta (%)	Real Impedance (ohm)	Delta (ohm)	Imaginary Impedance (ohm)	Delta (ohm)
2018.12.7	-25		52.1		5.35		-24		48.9		6.19	
2019.11.25	-25.2	-0.8	53.9	1.8	5.15	-0.2	-24.2	-0.8	48.7	-0.2	5.93	-0.26

<Justification of the extended calibration>

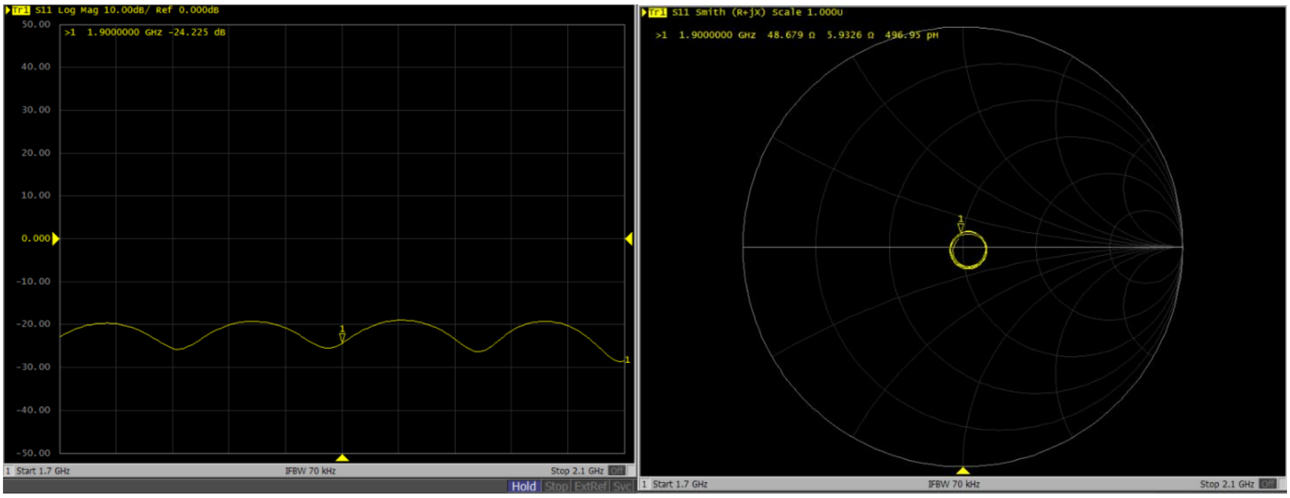
The return loss is < -20dB, within 20% of prior calibration; the impedance is within 5 ohm of prior calibration. Therefore the verification result should support extended calibration.

Dipole Verification Data> D1900V2, serial no. 5d182

1900MHz - Head



1900MHz – Body



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Accreditation No.: SCS 0108

Client **Auden**

Certificate No: DAE3-528_Mar20

CALIBRATION CERTIFICATE

Object	DAE3 - SD 000 D03 AA - SN: 528
Calibration procedure(s)	QA CAL-06.v30 Calibration procedure for the data acquisition electronics (DAE)
Calibration date:	March 16, 2020

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

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

Calibration Equipment used (M&TE critical for calibration)

Primary Standards	ID #	Cal Date (Certificate No.)	Scheduled Calibration
Keithley Multimeter Type 2001	SN: 0810278	03-Sep-19 (No:25949)	Sep-20
Secondary Standards	**ID #**	**Check Date (in house)**	**Scheduled Check**
Auto DAE Calibration Unit	SE UWS 053 AA 1001	09-Jan-20 (in house check)	In house check: Jan-21
Calibrator Box V2.1	SE UMS 006 AA 1002	09-Jan-20 (in house check)	In house check: Jan-21

	Name	Function	Signature
Calibrated by:	Eric Hainfeld	Laboratory Technician	
Approved by:	Sven Kühn	Deputy Manager	i.V.

Issued: March 16, 2020

Glossary

DAE	data acquisition electronics
Connector angle	information used in DASY system to align probe sensor X to the robot coordinate system.

Methods Applied and Interpretation of Parameters

- *DC Voltage Measurement:* Calibration Factor assessed for use in DASY system by comparison with a calibrated instrument traceable to national standards. The figure given corresponds to the full scale range of the voltmeter in the respective range.
- *Connector angle*: The angle of the connector is assessed measuring the angle mechanically by a tool inserted. Uncertainty is not required.
- The following parameters as documented in the Appendix contain technical information as a result from the performance test and require no uncertainty.
    - *DC Voltage Measurement Linearity:* Verification of the Linearity at +10% and -10% of the nominal calibration voltage. Influence of offset voltage is included in this measurement.
    - *Common mode sensitivity:* Influence of a positive or negative common mode voltage on the differential measurement.
    - *Channel separation:* Influence of a voltage on the neighbor channels not subject to an input voltage.
    - *AD Converter Values with inputs shorted:* Values on the internal AD converter corresponding to zero input voltage
    - *Input Offset Measurement*: Output voltage and statistical results over a large number of zero voltage measurements.
    - *Input Offset Current:* Typical value for information; Maximum channel input offset current, not considering the input resistance.
    - *Input resistance:* Typical value for information: DAE input resistance at the connector, during internal auto-zeroing and during measurement.
    - *Low Battery Alarm Voltage:* Typical value for information. Below this voltage, a battery alarm signal is generated.
    - *Power consumption:* Typical value for information. Supply currents in various operating modes.

DC Voltage Measurement

A/D - Converter Resolution nominal

High Range: 1LSB = 6.1μV , full range = -100...+300 mV

Low Range: 1LSB = 61nV , full range = -1.......+3mV

DASY measurement parameters: Auto Zero Time: 3 sec; Measuring time: 3 sec

Calibration Factors	X	Y	Z
High Range	404.513 ± 0.02% (k=2)	404.615 ± 0.02% (k=2)	404.537 ± 0.02% (k=2)
Low Range	3.97109 ± 1.50% (k=2)	3.95930 ± 1.50% (k=2)	3.96568 ± 1.50% (k=2)

Connector Angle

Connector Angle to be used in DASY system	50.0 ° ± 1 °

Appendix (Additional assessments outside the scope of SCS0108)

1. DC Voltage Linearity

High Range		Reading (µV)	Difference (µV)	Error (%)
Channel X	+ Input	200037.58	3.28	0.00
Channel X	+ Input	20009.65	3.92	0.02
Channel X	- Input	-20001.89	3.62	-0.02
Channel Y	+ Input	200037.90	3.50	0.00
Channel Y	+ Input	20005.83	0.31	0.00
Channel Y	- Input	-20005.73	-0.03	0.00
Channel Z	+ Input	200033.51	-0.62	-0.00
Channel Z	+ Input	20006.48	0.89	0.00
Channel Z	- Input	-20006.01	-0.27	0.00

Low Range		Reading (µV)	Difference (µV)	Error (%)
Channel X	+ Input	2001.68	0.24	0.01
Channel X	+ Input	201.09	-0.22	-0.11
Channel X	- Input	-198.93	-0.12	0.06
Channel Y	+ Input	2001.70	0.49	0.02
Channel Y	+ Input	200.70	-0.24	-0.12
Channel Y	- Input	-199.76	-0.76	0.38
Channel Z	+ Input	2001.03	-0.04	-0.00
Channel Z	+ Input	201.25	0.40	0.20
Channel Z	- Input	-199.29	-0.32	0.16

2. Common mode sensitivity

DASY measurement parameters: Auto Zero Time: 3 sec; Measuring time: 3 sec

	Common mode Input Voltage (mV)	High Range Average Reading (µV)	Low Range Average Reading (µV)
Channel X	200	9.59	7.82
	- 200	-7.34	-8.76
Channel Y	200	14.74	14.93
	- 200	-16.81	-17.15
Channel Z	200	-3.39	-3.82
	- 200	3.03	3.16

3. Channel separation

DASY measurement parameters: Auto Zero Time: 3 sec; Measuring time: 3 sec

	Input Voltage (mV)	Channel X (µV)	Channel Y (µV)	Channel Z (µV)
Channel X	200	-	3.19	-1.66
Channel Y	200	6.79	-	4.73
Channel Z	200	7.16	5.28	-

4. AD-Converter Values with inputs shorted

DASY measurement parameters: Auto Zero Time: 3 sec; Measuring time: 3 sec

	High Range (LSB)	Low Range (LSB)
Channel X	15972	16183
Channel Y	15900	16376
Channel Z	16167	15841

5. Input Offset Measurement

DASY measurement parameters: Auto Zero Time: 3 sec; Measuring time: 3 sec
Input 10MΩ

	Average (μV)	min. Offset (μV)	max. Offset (μV)	Std. Deviation (μV)
Channel X	1.19	0.18	2.38	0.46
Channel Y	0.15	-1.39	1.24	0.47
Channel Z	0.36	-1.22	1.42	0.42

6. Input Offset Current

Nominal Input circuitry offset current on all channels: <25fA

7. Input Resistance (Typical values for information)

	Zeroing (kOhm)	Measuring (MOhm)
Channel X	200	200
Channel Y	200	200
Channel Z	200	200

8. Low Battery Alarm Voltage (Typical values for information)

Typical values	Alarm Level (VDC)
Supply (+ Vcc)	+7.9
Supply (- Vcc)	-7.6

9. Power Consumption (Typical values for information)

Typical values	Switched off (mA)	Stand by (mA)	Transmitting (mA)
Supply (+ Vcc)	+0.01	+6	+14
Supply (- Vcc)	-0.01	-8	-9

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Accreditation No.: SCS 0108

Client **Sporton**

Certificate No: EX3-7576_Jan20

CALIBRATION CERTIFICATE

Object: EX3DV4 - SN:7576

Calibration procedure(s): QA CAL-01.v9, QA CAL-14.v5, QA CAL-23.v5, QA CAL-25.v7
Calibration procedure for dosimetric E-field probes

Calibration date: January 22, 2020

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

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

Calibration Equipment used (M&TE critical for calibration)

Primary Standards	ID	Cal Date (Certificate No.)	Scheduled Calibration
Power meter NRP	SN: 104778	03-Apr-19 (No. 217-02892/02893)	Apr-20
Power sensor NRP-Z91	SN: 103244	03-Apr-19 (No. 217-02892)	Apr-20
Power sensor NRP-Z91	SN: 103245	03-Apr-19 (No. 217-02893)	Apr-20
Reference 20 dB Attenuator	SN: S5277 (20x)	04-Apr-19 (No. 217-02894)	Apr-20
DAE4	SN: 660	27-Dec-19 (No. DAE4-660_Dec19)	Dec-20
Reference Probe ES3DV2	SN: 3013	31-Dec-19 (No. ES3-3013_Dec19)	Dec-20
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-19)	In house check: Oct-20

	Name	Function	Signature
Calibrated by:	Jeton Kastrati	Laboratory Technician	
Approved by:	Katja Pokovic	Technical Manager	

Issued: January 25, 2020

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).

DASY/EASY - Parameters of Probe: EX3DV4 - SN:7576

Basic Calibration Parameters

	Sensor X	Sensor Y	Sensor Z	Unc (k=2)
Norm ($\mu V/(V/m)^2$)[A]	0.48	0.63	0.63	± 10.1 %
DCP (mV)[B]	103.8	99.8	103.6	

Calibration Results for Modulation Response

UID	Communication System Name		A dB	B dB√μV	C	D dB	VR mV	Max dev.	Unc[E] (k=2)
0	CW	X	0.0	0.0	1.0	0.00	164.4	± 2.7 %	± 4.7 %
		Y	0.0	0.0	1.0		161.8		
		Z	0.0	0.0	1.0		164.7		

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 Page 5).
[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:7576

Other Probe Parameters

Sensor Arrangement	Triangular
Connector Angle (°)	112.2
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

DASY/EASY - Parameters of Probe: EX3DV4 - SN:7576

Calibration Parameter Determined in Head Tissue Simulating Media

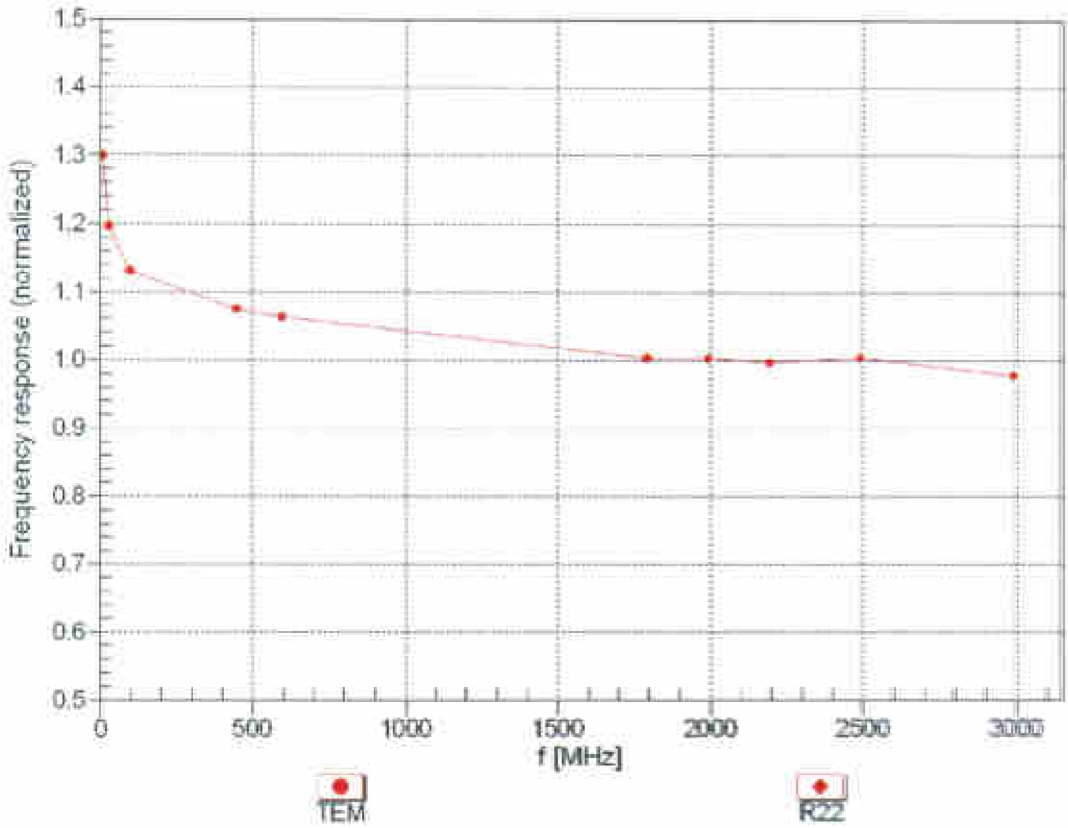
f (MHz) [C]	Relative Permittivity [F]	Conductivity (S/m) [F]	ConvF X	ConvF Y	ConvF Z	Alpha [G]	Depth [G] (mm)	Unc (k=2)
750	41.9	0.89	10.71	10.71	10.71	0.62	0.80	± 12.0 %
835	41.5	0.90	10.45	10.45	10.45	0.46	0.94	± 12.0 %
900	41.5	0.97	10.16	10.16	10.16	0.33	1.09	± 12.0 %
1750	40.1	1.37	8.88	8.88	8.88	0.42	0.86	± 12.0 %
1900	40.0	1.40	8.58	8.58	8.58	0.38	0.86	± 12.0 %
2000	40.0	1.40	8.48	8.48	8.48	0.39	0.86	± 12.0 %
2300	39.5	1.67	8.03	8.03	8.03	0.41	0.90	± 12.0 %
2450	39.2	1.80	7.76	7.76	7.76	0.44	0.90	± 12.0 %
2600	39.0	1.96	7.47	7.47	7.47	0.41	0.96	± 12.0 %
3300	38.2	2.71	7.08	7.08	7.08	0.30	1.35	± 14.0 %
3500	37.9	2.91	6.77	6.77	6.77	0.30	1.35	± 14.0 %
3700	37.7	3.12	6.74	6.74	6.74	0.30	1.35	± 14.0 %
3900	37.5	3.32	6.56	6.56	6.56	0.40	1.40	± 14.0 %
4100	37.2	3.53	6.26	6.26	6.26	0.40	1.40	± 14.0 %
4400	36.9	3.84	6.19	6.19	6.19	0.40	1.60	± 14.0 %
4600	36.7	4.04	6.06	6.06	6.06	0.40	1.60	± 14.0 %
4800	36.4	4.25	5.89	5.89	5.89	0.40	1.80	± 14.0 %
4950	36.3	4.40	5.59	5.59	5.59	0.40	1.80	± 14.0 %
5250	35.9	4.71	5.20	5.20	5.20	0.40	1.80	± 14.0 %
5600	35.5	5.07	4.62	4.62	4.62	0.40	1.80	± 14.0 %
5750	35.4	5.22	4.83	4.83	4.83	0.40	1.80	± 14.0 %

[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. Validity of ConvF assessed at 6 MHz is 4-9 MHz, and ConvF assessed at 13 MHz is 9-19 MHz. Above 5 GHz frequency validity can be extended to ± 110 MHz.

[F] At frequencies up to 6 GHz, the validity of tissue parameters (ε and σ) can be relaxed to ± 10% if liquid compensation formula is applied to measured SAR values. 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.

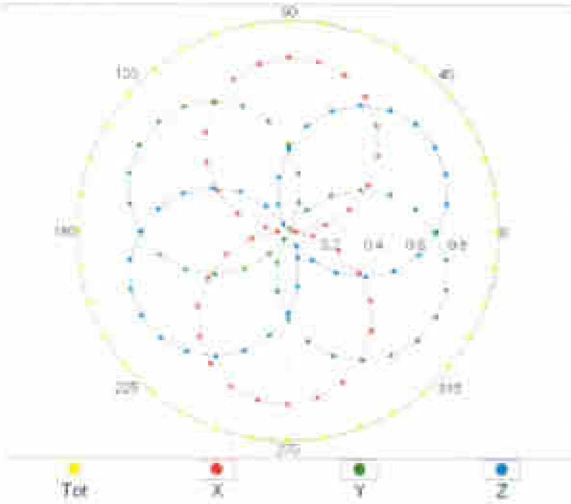
Frequency Response of E-Field
(TEM-Cell:ifi110 EXX, Waveguide: R22)



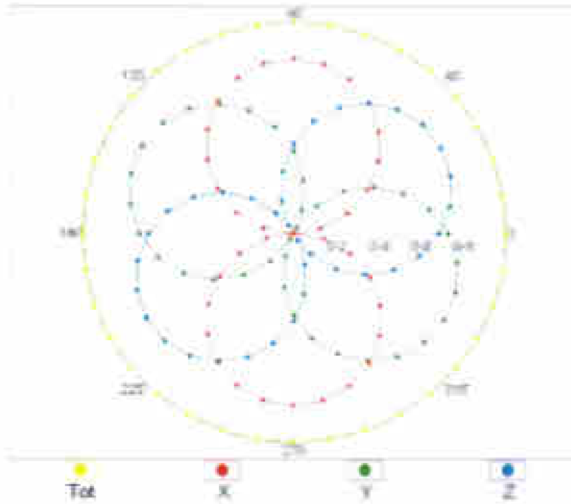
Uncertainty of Frequency Response of E-field: ± 6.3% (k=2)

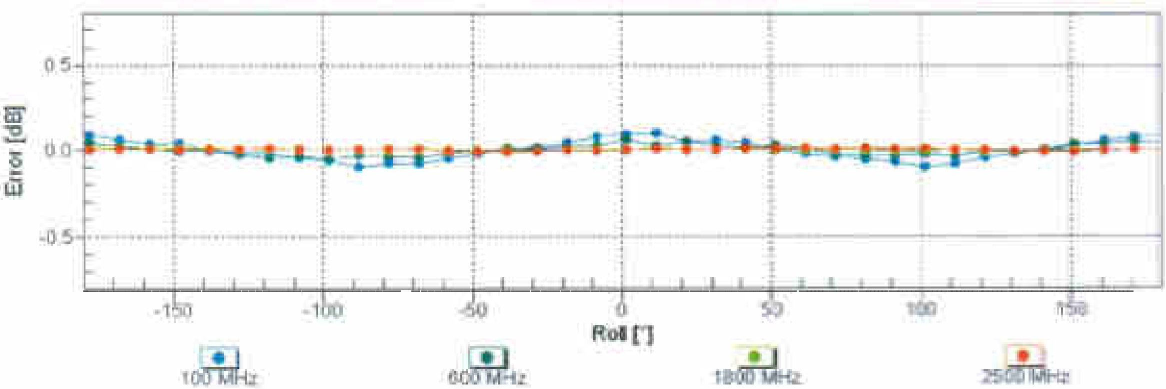
Receiving Pattern (ϕ), ϑ = 0°

f=600 MHz,TEM



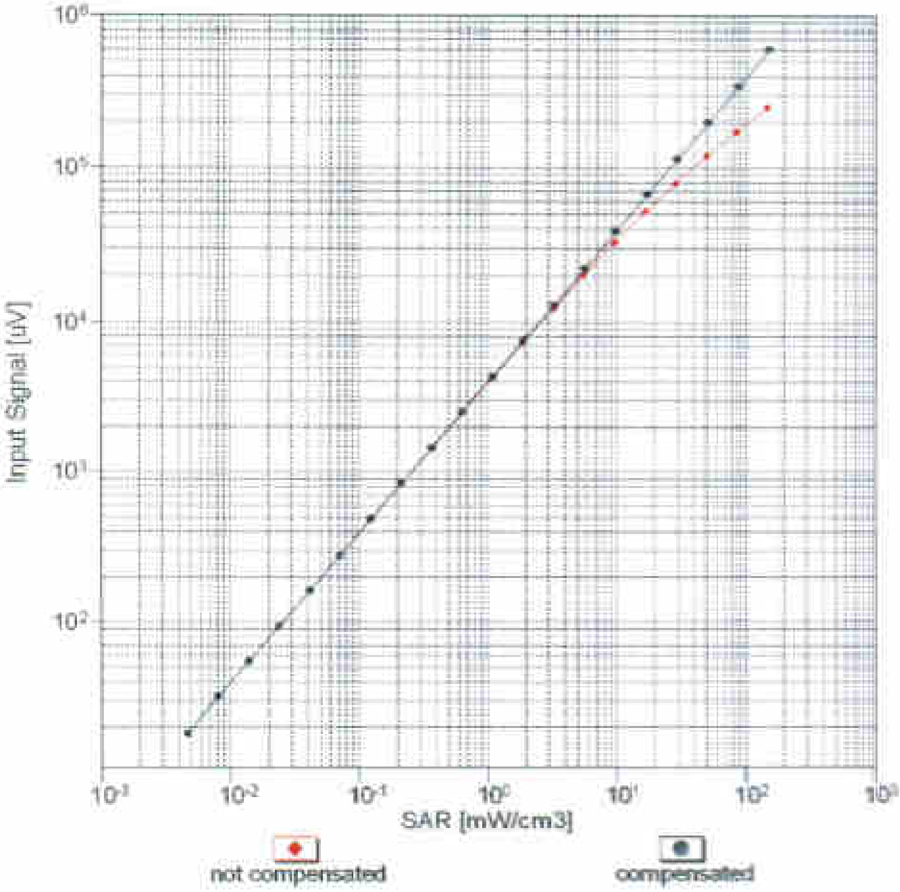
f=1800 MHz,R22

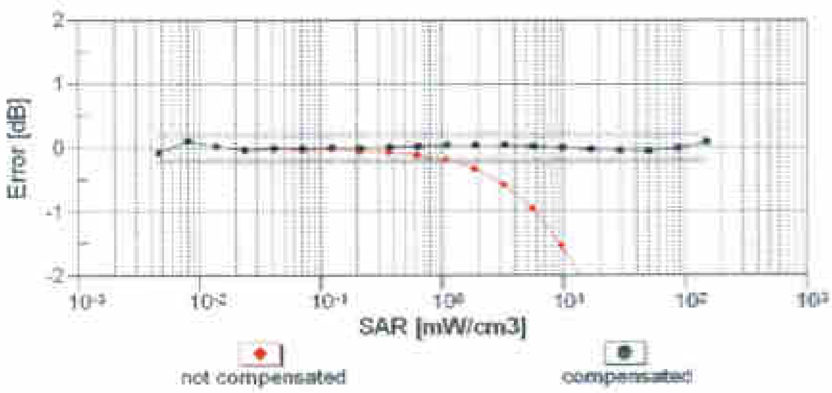




Uncertainty of Axial Isotropy Assessment: ± 0.5% (k=2)

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

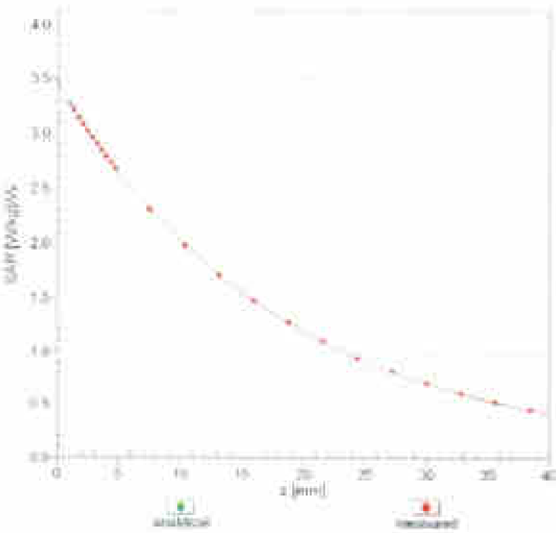




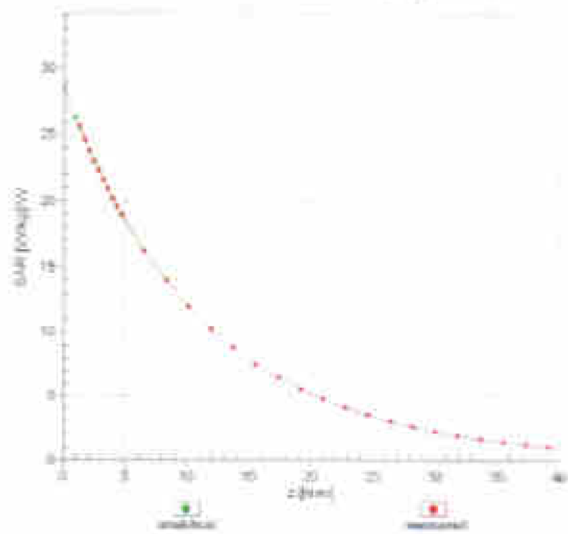
Uncertainty of Linearity Assessment: ± 0.6% (k=2)

Conversion Factor Assessment

f = 835 MHz,WGLS R9 (H_convF)

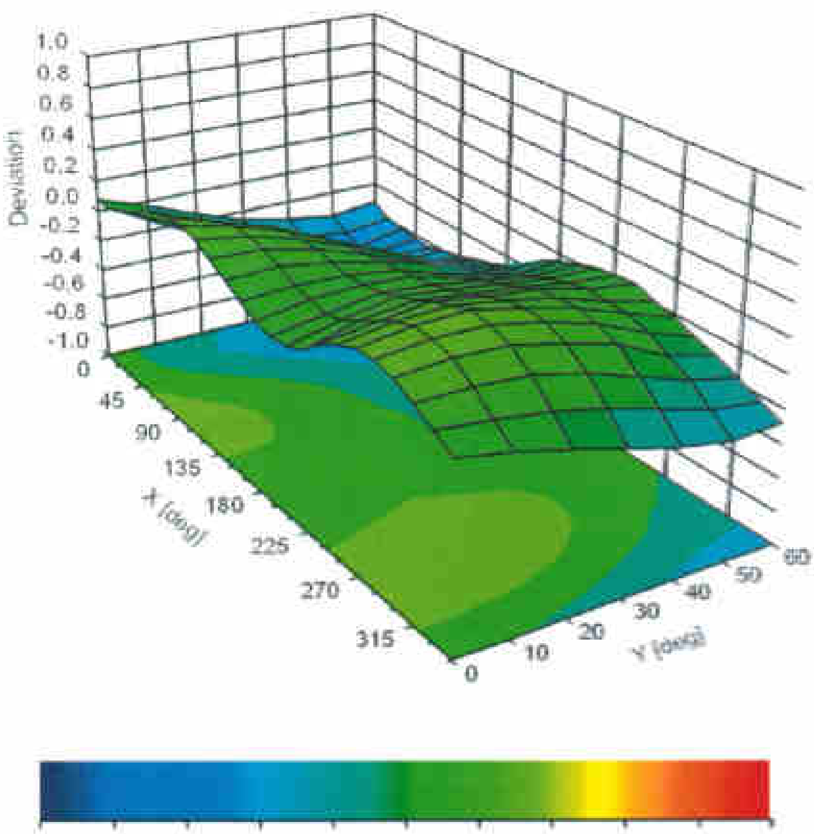


f = 1900 MHz,WGLS R22 (H_convF)



Deviation from Isotropy in Liquid

Error (ϕ, θ), f = 900 MHz



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