FCC SAR Test Report

APPLICANT	**: Motorola Mobility LLC**
EQUIPMENT	**: Mobile Cellular Phone**
BRAND NAME	**: Motorola**
MODEL NAME	**: XT2347-2**
FCC ID	**: IHDT56AN2**
STANDARD	**: FCC 47 CFR Part 2 (2.1093)**

We, Sporton International Inc. (Shenzhen), would like to declare that the tested sample has been evaluated in accordance with the test procedures given in 47 CFR Part 2.1093 and FCC KDB and has been in compliance with the applicable technical standards.

ACCREDITED
Cert #5145.01

Approved by: Si Zhang

Sporton International Inc. (Shenzhen)
1/F, 2/F, Bldg 5, Shiling Industrial Zone, Xinwei Village, Xili, Nanshan, Shenzhen, 518055
People's Republic of China

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Appendix D. Test Setup Photos
Appendix E. Conducted RF Output Power Table

Revision History

REPORT NO.	VERSION	DESCRIPTION	ISSUED DATE
FA352602-01	Rev. 02	Initial issue of report.	Jul. 27, 2023

1. Statement of Compliance

The maximum results of Specific Absorption Rate (SAR) found during testing for **Motorola Mobility LLC, Mobile Cellular Phone, XT2347-2,** are as follows.

Highest 1g SAR Summary						
Equipment Class	Frequency Band		Head (Separation 0mm) 1g SAR (W/kg)	Hotspot (Separation 5mm) 1g SAR (W/kg)	Body-worn (Separation 5mm) 1g SAR (W/kg)	Highest Simultaneous Transmission 1g SAR (W/kg)
Licensed	GSM	GSM850	0.83	1.25	1.25	1.59
		GSM1900	0.25	**1.28**	1.08	
	WCDMA	WCDMA II	0.39	1.15	1.17	
		WCDMA V	0.64	1.16	1.16	
	LTE	LTE Band 7	0.86	1.16	1.16	
		LTE Band 2	0.98	1.17	1.23	
		LTE Band 26/5	0.77	1.18	1.18	
		LTE Band 41/38	0.85	1.26	1.26	
		LTE Band 42	0.88	0.61	1.00	
	5G NR	FR1 n7	0.91	1.27	**1.27**	
		FR1 n26/5	0.99	1.27	**1.27**	
		FR1 n41/38	0.96	0.61	1.00	
		FR1 n77/78	0.90	1.27	0.93	
DTS	WLAN	2.4GHz WLAN	1.11	0.73	1.19	1.59
NII		5GHz WLAN	**1.14**	0.74	1.13	1.59
DSS	Bluetooth	2.4GHz Bluetooth	0.74	0.50	0.50	1.57

Highest 10g SAR Summary				
Equipment Class	Frequency Band		Product Specific 10g SAR (W/kg) (Separation 0mm)	Highest Simultaneous Transmission 10g SAR (W/kg)
Licensed	GSM	GSM850	2.85	3.97
		GSM1900	3.00	
	WCDMA	WCDMA II	2.92	
		WCDMA V	**3.17**	
	LTE	LTE Band 7	2.98	
		LTE Band 2	2.88	
		LTE Band 26/5	**3.17**	
		LTE Band 41/38	3.14	
		LTE Band 42	2.48	
	5G NR	FR1 n7	2.79	
		FR1 n26/5	2.52	
		FR1 n41/38	2.33	
		FR1 n77/78	2.87	
DTS	WLAN	2.4GHz WLAN	1.07	3.97
NII		5GHz WLAN	2.72	3.87
Date of Testing:			2023/7/5 ~ 2023/7/21	

Remark:
1. This device supports LTE B5 / B38 and B26 / B41. Since the supported frequency span for LTE B5 / B38 falls completely within the supports frequency span for LTE B26 / B41, both LTE bands have the same target power, and both LTE bands share the same transmission path; therefore, SAR was only assessed for LTE B26 / B41.
2. This device supports 5GNR n38/n5/n78 and n41/n26/n77. Since the supported frequency span for 5GNR n38/n5/n78 falls completely within the supports frequency span for n41/n26/n77, both 5GNR bands have the same target power, and both 5GNR bands share the same transmission path; therefore, SAR was only assessed for n41/n26/n77.

Declaration of Conformity:
The test results with all measurement uncertainty excluded are presented in accordance with the regulation limits or requirements declared by manufacturers.

Comments and Explanations:
The declared of product specification for EUT presented in the report are provided by the manufacturer, and the manufacturer takes all the responsibilities for the accuracy of product specification.

This device is in compliance with Specific Absorption Rate (SAR) for general population/uncontrolled exposure limits (1.6 W/kg for Partial-Body 1g SAR, 4.0 W/kg for Product Specific 10g SAR) 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 Inc. (Shenzhen) is accredited to ISO/IEC 17025:2017 by American Association for Laboratory Accreditation with Certificate Number 5145.01.

Testing Laboratory			
Test Firm	Sporton International Inc. (Shenzhen)		
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.	Sporton Site No.	FCC Designation No.	FCC Test Firm Registration No.
	SAR03-SZ SAR05-SZ	CN1256	421272

Applicant	
Company Name	Motorola Mobility LLC
Address	222 W,Merchandise Mart Plaza, Chicago IL 60654 USA

Manufacturer	
Company Name	Motorola Mobility LLC
Address	222 W,Merchandise Mart Plaza, Chicago IL 60654 USA

3. Data Reuse Approach

3.1 Introduction Section

This application re-uses data collected on a similar device, FCC ID: IHDT56AN1 (reference model) and FCC ID: IHDT56AN2 (variant model). Due to the same design are identical between parent model and variant model, SAR data reuse is requested and spot check data in this report is used to justify the SAR data reuse.

For variant model 1g SAR and 10g spot check SAR result does not exceed 30% and 1g SAR < 1.2W/kg, 10g SAR < 3.0W/kg of the reference model, the WWAN/WLAN max SAR summary was always choose the higher SAR between parent model and variant model.

The applicant should take full responsibility that the test data as referenced in this report represent compliance for this FCC ID: IHDT56AN2

3.2 Model Difference Information

The **main** difference between FCC ID: IHDT56AN1 and FCC ID: IHDT56AN2 is as below:

- Remove WCDMA Band IV, LTE Band 4/12/13/17/25/66/66B/66C and 5G NR n2/n66.
- Add LTE Band 18/19/20/32 and 5G NR n8/n20/n77;

Other differences and all the details of similarity and difference can be found in the confidential documents (XT2347-2_Operational Description of Product Equality Declaration).

3.3 Reference detail Section

Rule Part	Equipment Class	Wireless Technology	Frequency Band (MHz)	FCC ID (Reference)	Type Grant/ Permissive Change	Reference Title	FCC ID Filling (Variant)	Test on the variant
Part 2.1093	PCE	GSM	GSM850/1900	IHDT56AN1	Original Grant	FA352602	IHDT56AN2	Spot check
		WCDMA	B2/5	IHDT56AN1	Original Grant	FA352602	IHDT56AN2	Spot check
		LTE	B2/5/7(Ant1)/26/42	IHDT56AN1	Original Grant	FA352602	IHDT56AN2	Spot check
		LTE	B7(Ant4)/38/41				IHDT56AN2	Full Test
		5GNR FR1	n5/7/26/38/41	IHDT56AN1	Original Grant	FA352602	IHDT56AN2	Spot check
		5GNR FR1	n77/78				IHDT56AN2	Full Test
	DTS	BLE/ Wi-Fi	2400~2483.5	IHDT56AN1	Original Grant	FA352602	IHDT56AN2	Spot check
	NII	Wi-Fi	5150 ~ 5250 5250 ~ 5350 5470 ~ 5725 5725 ~ 5850	IHDT56AN1	Original Grant	FA352602	IHDT56AN2	Spot check
	DSS	Bluetooth	2400~2483.5	IHDT56AN1	Original Grant	FA352602	IHDT56AN2	Spot check

4. 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 616217 D04 SAR for laptop and tablets v01r02
- 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

5. Equipment Under Test (EUT) Information

5.1 General Information

Product Feature & Specification	
Equipment Name	Mobile Cellular Phone
Brand Name	Motorola
Model Name	XT2347-2
FCC ID	IHDT56AN2
IMEI Code	Sample 1: IMEI 1: 350162390019895 IMEI 2: 350162390019903 Sample 2: IMEI 1: 350162390028995 IMEI 2: 350162390029001
Wireless Technology and Frequency Range	GSM850: 824 MHz ~ 849 MHz GSM1900: 1850 MHz ~ 1910 MHz WCDMA Band II: 1850 MHz ~ 1910 MHz WCDMA Band V: 824 MHz ~ 849 MHz LTE Band 2: 1850 MHz ~ 1910 MHz LTE Band 5: 824 MHz ~ 849 MHz LTE Band 7: 2500 MHz ~ 2570 MHz LTE Band 26: 814 MHz ~ 849 MHz LTE Band 38: 2570 MHz ~ 2620 MHz LTE Band 41: 2496 MHz ~ 2690 MHz LTE Band 42: 3450 MHz ~3550 MHz 5G NR n5: 824 MHz ~ 849 MHz 5G NR n7: 2500 MHz ~ 2570 MHz 5G NR n26 : 814 MHz ~ 849 MHz 5G NR n38 : 2570 MHz ~ 2620 MHz 5G NR n41 : 2496 MHz ~ 2690 MHz 5G NR n77: 3700 MHz ~ 3980 MHz 5G NR n78: 3700 MHz ~ 3800 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 RMC/AMR 12.2Kbps HSDPA HSUPA HSPA+(16QAM uplink is supported) 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 HT20/HT40 WLAN 2.4GHz 802.11ac VHT20/VHT40 WLAN 5GHz 802.11a/n HT20/HT40 WLAN 5GHz 802.11ac VHT20/VHT40/VHT80 Bluetooth BR/EDR/LE NFC: ASK
HW Version	DVT2
SW Version	T3TC33.12
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.
EUT Stage	Identical Prototype
Remark: 1. This device supports VoIP in GPRS, EGPRS, WCDMA and LTE (e.g. for 3rd-party VoIP), LTE supports VoLTE	

operation.

2. This device 2.4GHz WLAN support hotspot operation and Bluetooth support tethering applications.
3. This device 5.2GHz WLAN/5.8GHz WLAN support hotspot operation, and 5.2GHz WLAN/5.8GHz WLAN supports WiFi Direct (GC/GO), and 5.3GHz / 5.5GHz supports WiFi Direct (GC only).
4. This device does not support DTM operation and supports GPRS/EGPRS mode up to multi-slot class 12.
5. The device implements the power management and proximity sensor /receiver detection/hotspot mode for SAR compliance at different exposure conditions (head, body-worn, hotspot, extremity) and the Qualcomm smart transmit will manage to ensure the power level not exceeding the associated power table. Details about the power management decision and sensor detection are provided in the operational description. And the device will invoke corresponding work scenarios power level base on frequency bands/antennas, which can refer to power table at appendix E.
6. This device supports HPUE for LTE Band 41 with class 2 level, HPUE power has been measured separately. For HPUE power is higher than power class 3 but with lower duty cycle, the maximum average power for class 2 and class 3 is almost the same, so we chose power class 3 full SAR testing and power class 2 verify the worst case of power class 3 SAR.
7. 5GNR n77/n78 supports HPUE mode, HPUE power and SAR testing performed separately.
8. For 5GNR n77/n78 HPUE with higher power, so we chose power class 2 full SAR testing and power class 2 SAR can represent power class 3 SAR.
9. For 5G NR bands test, using FTM (Factory Test Mode) with default 100% duty cycle transmission to perform SAR testing.
10. There are two samples, the different between them refer to the XT2347-2_Operational Description of Product Equality Declaration which is exhibit separately. According to the differences, we choose sample 1 to perform full SAR testing and sample 2 to verify the worst case of sample 1.
11. This device has NFC function and the NFC SAR report will be separately submitted.
12. This device supports 5GNR FR1 bands as following table, including NSA mode and SA mode. NSA and SA mode performed SAR separately.

<5G NR>

Mode	Band	Duplex	SCS(KHz)	Bandwidths(BW)
NSA	n5	FDD	15	5, 10, 15, 20
	n78	TDD	30	20, 30, 40, 50, 60, 70, 80, 90, 100
SA	n5	FDD	15	5, 10, 15, 20
	n7	FDD	15	5, 10, 15, 20, 25, 30, 40
	n26	FDD	15	5, 10, 15, 20
	n38	TDD	30	20, 30, 40
	n41	TDD	30	20, 30, 40, 50, 60, 70, 80, 90, 100
	n77	TDD	30	20, 30, 40, 50, 60, 70, 80, 90, 100
	n78	TDD	30	20, 30, 40, 50, 60, 70, 80, 90, 100

5.2 General LTE SAR Test and Reporting Considerations

<table>
<tr><th colspan="2">Summarized necessary items addressed in KDB 941225 D05 v02r05</th></tr>
<tr><td>FCC ID</td><td>IHDT56AN2</td></tr>
<tr><td>Equipment Name</td><td>Mobile Cellular Phone</td></tr>
<tr><td>Operating Frequency Range of each LTE transmission band</td><td>LTE Band 2: 1850 MHz ~ 1910 MHz
LTE Band 5: 824 MHz ~ 849 MHz
LTE Band 7: 2500 MHz ~ 2570 MHz
LTE Band 26: 814 MHz ~ 849 MHz
LTE Band 38: 2570 MHz ~ 2620 MHz
LTE Band 41: 2496 MHz ~ 2690 MHz
LTE Band 42: 3450 MHz ~ 3550 MHz</td></tr>
<tr><td>Channel Bandwidth</td><td>LTE Band 2:1.4MHz, 3MHz, 5MHz, 10MHz, 15MHz, 20MHz
LTE Band 5:1.4MHz, 3MHz, 5MHz, 10MHz
LTE Band 7: 5MHz, 10MHz, 15MHz, 20MHz
LTE Band 26:1.4MHz, 3MHz, 5MHz, 10MHz, 15MHz
LTE Band 38: 5MHz, 10MHz, 15MHz, 20MHz
LTE Band 41: 5MHz, 10MHz, 15MHz, 20MHz
LTE Band 42: 5MHz, 10MHz, 15MHz, 20MHz</td></tr>
<tr><td>uplink modulations used</td><td>QPSK / 16QAM / 64QAM / 256QAM</td></tr>
<tr><td>LTE Voice / Data requirements</td><td>Voice and Data</td></tr>
<tr><td>LTE Release Version</td><td>R15, Cat18</td></tr>
<tr><td>CA Support</td><td>Supported, Uplink and Downlink</td></tr>
<tr><td>LTE MPR permanently built-in by design</td><td>
Table 6.2.3-1: Maximum Power Reduction (MPR) for Power Class 1, 2 and 3
<table>
<tr><th rowspan="2">Modulation</th><th colspan="6">Channel bandwidth / Transmission bandwidth (N_{RB})</th><th rowspan="2">MPR (dB)</th></tr>
<tr><th>1.4 MHz</th><th>3.0 MHz</th><th>5 MHz</th><th>10 MHz</th><th>15 MHz</th><th>20 MHz</th></tr>
<tr><td>QPSK</td><td>> 5</td><td>> 4</td><td>> 8</td><td>> 12</td><td>> 16</td><td>> 18</td><td>≤ 1</td></tr>
<tr><td>16 QAM</td><td>≤ 5</td><td>≤ 4</td><td>≤ 8</td><td>≤ 12</td><td>≤ 16</td><td>≤ 18</td><td>≤ 1</td></tr>
<tr><td>16 QAM</td><td>> 5</td><td>> 4</td><td>> 8</td><td>> 12</td><td>> 16</td><td>> 18</td><td>≤ 2</td></tr>
<tr><td>64 QAM</td><td>≤ 5</td><td>≤ 4</td><td>≤ 8</td><td>≤ 12</td><td>≤ 16</td><td>≤ 18</td><td>≤ 2</td></tr>
<tr><td>64 QAM</td><td>> 5</td><td>> 4</td><td>> 8</td><td>> 12</td><td>> 16</td><td>> 18</td><td>≤ 3</td></tr>
<tr><td>256 QAM</td><td colspan="6">≥ 1</td><td>≤ 5</td></tr>
</table>
</td></tr>
<tr><td>LTE A-MPR</td><td>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)</td></tr>
<tr><td>Spectrum plots for RB configuration</td><td>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.</td></tr>
<tr><td>Power reduction applied to satisfy SAR compliance</td><td>Yes, when operating in Proximity sensors/receiver/hotspot detect mechanism, head/body -worn /hotspot/extremity will trigger reduced power for some bands applied to satisfy SAR compliance, the detail please referred to section 14.</td></tr>
<tr><td>LTE Carrier Aggregation Combinations</td><td>Intra-Band possible combinations and the detail power verification please referred to section 14.</td></tr>
<tr><td>LTE Carrier Aggregation Additional Information</td><td>1. This device supports LTE Carrier Aggregation (CA) in the uplink for intra-band with two component carriers in the uplink. SAR Measurements and conducted powers were evaluated per FCC Guidance.
2. This device supports maximum of 4 carriers in the downlink and 2 carriers in the uplink.</td></tr>
</table>

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 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 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 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 42								
	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	42115	3452.5	42140	3455	42165	3457.5	42190	3460
M	42590	3500	42590	3500	42590	3500	42590	3500
H	43065	3547.5	43040	3545	43015	3542.5	42990	3540

<For LTE Overlap Bands Description>

1) LTE Bands BW

Band	1.4 MHz	3 MHz	5 MHz	10 MHz	15 MHz	20 MHz
LTE Band 38	-	-	Yes	Yes	Yes	Yes
LTE Band 41	-	-	Yes	Yes	Yes	Yes
LTE Band 26	Yes	Yes	Yes	Yes	Yes	-
LTE Band 5	Yes	Yes	Yes	Yes	-	-

2) LTE Bands tune up:

Band	Antenna	Default	Head	Body Worn	Sensor off	Extremely	Hotspot
			DSI 2	DSI 3	DSI 4	DSI 6	DSI 7
		Tune-up Limit	Tune-up Limit	Tune-up Limit	Tune-up Limit	Tune-up Limit	Tune-up Limit
LTE Band 38_pc3	Ant 1	24	24	21	24	24	21
LTE Band 41_pc3		24	24	21	24	24	21
LTE Band 38_pc3	Ant 4	24	17	16.5	24	21.5	14.5
LTE Band 41_pc3		24	17	16.5	24	21.5	14.5
LTE Band 41_pc2		27	18.6	18.1	27	23.1	16.1
LTE Band 26	Ant 0	24	24	23.2	24	24	23.2
LTE Band 5		24	24	23.2	24	24	23.2
LTE Band 26	Ant 4	24	22.2	24	24	24	22.7
LTE Band 5		24	22.2	24	24	24	22.7

5.3 General 5G NR SAR Test and Reporting Considerations

5G NR Information	
Operating Frequency Range of each 5G NR transmission band	5G NR n5: 824 MHz ~ 849 MHz 5G NR n7: 2500 MHz ~ 2570 MHz 5G NR n26 : 814 MHz ~ 849 MHz 5G NR n38 : 2570 MHz ~ 2620 MHz 5G NR n41 : 2496 MHz ~ 2690 MHz 5G NR n77: 3700 MHz ~ 3980 MHz 5G NR n78: 3700 MHz ~ 3800 MHz
Channel Bandwidth	The detail please refers to section 4.1 5GNR FR1 bands table.
SCS	FDD: SCS15KHz, TDD: SCS30KHz
uplink modulations used	DFT-s-OFDM: PI/2 BPSK / QPSK / 16QAM / 64QAM / 256QAM CP-OFDM: QPSK / 16QAM / 64QAM / 256QAM
A-MPR (Additional MPR) disabled for SAR Testing?	Yes
LTE Anchor Bands for n5	LTE B7
LTE Anchor Bands for n78	LTE B5/7/38/41

Transmission (H, M, L) channel numbers and frequencies in each 5G NR band

NR Band 5

	Bandwidth 5MHz		Bandwidth 10MHz		Bandwidth 15MHz		Bandwidth 20MHz	
	Ch. #	Freq. (MHz)	Ch. #	Freq. (MHz)	Ch. #	Freq. (MHz)	Ch. #	Freq. (MHz)
L	165300	826.5	165800	829	166300	831.5	166800	834
M	167300	836.5	167300	836.5	167300	836.5	167300	836.5
H	169300	846.5	168800	844	168300	841.5	167800	839

NR Band 7

	Bandwidth 5MHz		Bandwidth 10MHz		Bandwidth 15MHz		Bandwidth 20MHz		Bandwidth 25MHz		Bandwidth 30MHz		Bandwidth 40MHz	
	Ch. #	Freq. (MHz)	Ch. #	Freq. (MHz)	Ch. #	Freq. (MHz)	Ch. #	Freq. (MHz)	Ch. #	Freq. (MHz)	Ch. #	Freq. (MHz)	Ch. #	Freq. (MHz)
L	500500	2502.5	501000	2505	501500	2507.5	502000	2510	502500	2512.5	503000	2515	504000	2520
M	507000	2535	507000	2535	507000	2535	507000	2535	507000	2535	507000	2535	507000	2535
H	513500	2567.5	513000	2565	512500	2562.5	512000	2560	511500	2557.5	511000	2555	510000	2550

NR Band 26

	Bandwidth 5MHz		Bandwidth 10MHz		Bandwidth 15MHz		Bandwidth 20MHz	
	Ch. #	Freq. (MHz)	Ch. #	Freq. (MHz)	Ch. #	Freq. (MHz)	Ch. #	Freq. (MHz)
L	163300	816.5	163800	819	164300	821.5	164800	824
M	166300	831.5	166300	831.5	166300	831.5	166300	831.5
H	169300	846.5	168800	844	168300	841.5	167800	839

NR Band 38

	Bandwidth 20MHz		Bandwidth 30MHz		Bandwidth 40MHz	
	Ch. #	Freq. (MHz)	Ch. #	Freq. (MHz)	Ch. #	Freq. (MHz)
L	516000	2580	517002	2585.01	518004	2590.02
M	519000	2595	519000	2595	519000	2595
H	522000	2610	520998	2604.99	519996	2599.98

NR Band 41

	Bandwidth 20MHz		Bandwidth 30MHz		Bandwidth 40MHz		Bandwidth 50MHz		Bandwidth 60MHz		Bandwidth 70MHz		Bandwidth 80MHz		Bandwidth 90MHz		Bandwidth 100MHz	
	Ch. #	Freq. (MHz)	Ch. #	Freq. (MHz)	Ch. #	Freq. (MHz)	Ch. #	Freq. (MHz)	Ch. #	Freq. (MHz)	Ch. #	Freq. (MHz)	Ch. #	Freq. (MHz)	Ch. #	Freq. (MHz)	Ch. #	Freq. (MHz)
L	501204	2506.02	502200	2511	503202	2516.01	504204	2521.02	505200	2526	506202	2531.01	507204	2536.02	508200	2541	509202	2546.01
M	518598	2592.99	518598	2592.99	518598	2592.99	518598	2592.99	518598	2592.99	518598	2592.99	518598	2592.99	518598	2592.99	518598	2592.99
H	535998	2679.99	534996	2674.98	534000	2670	532998	2664.99	531996	2659.98	531000	2655	529998	2649.99	528996	2644.98	528000	2640

For <3700MHz ~ 3980MHz>

NR Band 77																		
	Bandwidth 20MHz		Bandwidth 30MHz		Bandwidth 40MHz		Bandwidth 50MHz		Bandwidth 60MHz		Bandwidth 70MHz		Bandwidth 80MHz		Bandwidth 90MHz		Bandwidth 100MHz	
	Ch. #	Freq. (MHz)	Ch. #	Freq. (MHz)	Ch. #	Freq. (MHz)	Ch. #	Freq. (MHz)	Ch. #	Freq. (MHz)	Ch. #	Freq. (MHz)	Ch. #	Freq. (MHz)	Ch. #	Freq. (MHz)	Ch. #	Freq. (MHz)
L	647332	3709.98	647666	3714.99	648000	3720	648332	3724.98	648666	3729.99	649000	3735	649332	3739.98	649666	3744.99	650000	3750
M	656000	3840	656000	3840	656000	3840	656000	3840	656000	3840	656000	3840	656000	3840	656000	3840	656000	3840
H	664666	3969.99	664332	3964.98	664000	3960	663666	3954.99	663332	3949.98	663000	3945	662666	3939.99	662332	3934.98	662000	3930

NR Band 78																		
	Bandwidth 20MHz		Bandwidth 30MHz		Bandwidth 40MHz		Bandwidth 50MHz		Bandwidth 60MHz		Bandwidth 70MHz		Bandwidth 80MHz		Bandwidth 90MHz		Bandwidth 100MHz	
	Ch. #	Freq. (MHz)	Ch. #	Freq. (MHz)	Ch. #	Freq. (MHz)	Ch. #	Freq. (MHz)	Ch. #	Freq. (MHz)	Ch. #	Freq. (MHz)	Ch. #	Freq. (MHz)	Ch. #	Freq. (MHz)	Ch. #	Freq. (MHz)
L	647334	3710.01	647668	3715.02	648000	3720	648334	3725.01	648668	3730.02	649000	3735	649334	3740.01	649668	3745.02		
M	650000	3750	650000	3750	650000	3750	650000	3750	650000	3750	650000	3750	650000	3750	650000	3750	650000	3750
H	652668	3790.02	652334	3785.01	652000	3780	651668	3775.02	651334	3770.01	651000	3765	650668	3760.02	650334	3755.01		

<For NR Overlap Bands Description>

1) NR Bands BW

Mode	Band	Duplex	SCS(KHz)	Bandwidths(BW)
SA	n38	TDD	30	20,30,40
	n41	TDD	30	20,30,40,50,60,70,80,90,100
	n77	TDD	30	20,30,40,50,60,70,80,90,100
	n78	TDD	30	20,30,40,50,60,70,80,90,100

2) NR Bands Tune up:

Band	Antenna	Default	Head	Body Worn	Sensor off	Extremely	Hotspot
			DSI 2	DSI 3	DSI 4	DSI 6	DSI 7
		Tune-up Limit	Tune-up Limit	Tune-up Limit	Tune-up Limit	Tune-up Limit	Tune-up Limit
FR1 n38	Ant 4	24	14.5	15.5	24	19.5	13
FR1 n41		24	14.5	15.5	24	19.5	13
FR1 n77_pc3	Ant 5	24	14.5	14.5	24	20	13
FR1 n78_pc3		24	14.5	14	24	20	13
FR1 n77_pc3	Ant 2	18.5	18.5	15	18.5	18.5	12
FR1 n78_pc3		22	22	12	18.5	18.5	12
FR1 n77_pc3	Ant 8	24	24	16	22	22	14.5
FR1 n78_pc3		23	23	15	22	22	14.5
FR1 n77_pc3	Ant 1	18.5	18.5	18	18.5	18.5	18.5
FR1 n78_pc3		20	20	16.5	20	20	18.5
FR1 n77_pc2	Ant 5	27	14.5	14.5	27	20	13
FR1 n78_pc2		27	14.5	14	27	20	13
FR1 n77_pc2	Ant 2	21.5	21.5	15	18.5	18.5	12
FR1 n78_pc2		25	25	12	18.5	18.5	12
FR1 n77_pc2	Ant 8	26	26	16	22	22	14.5
FR1 n78_pc2		26	26	15	22	22	14.5
FR1 n77_pc2	Ant 1	21.5	21.5	18	21.5	21.5	19.5
FR1 n78_pc2		23	23	16.5	23	23	19.5

Note: For some bands/antennas at some exposure conditions which cannot be covered were fully tested for RF exposure compliance.

6. Smart Transmit feature for RF Exposure compliance

The RF exposure limit is defined based on time-averaged RF exposure. The product implements Qualcomm Smart Transmit feature which controls the instantaneous transmitting power for WWAN transmitter to ensure the product in compliance with RF exposure limit over a defined time window, for SAR (transmit frequency ≤ 6GHz). To control and manage transmitting power in real time and to ensure at all times the time-averaged RF exposure is compliant to the regulation requirement.

Note that WLAN/BT operations are not enabled with Smart Transmit.

This report describes the procedures for the SAR char generation, and the parameters obtained from SAR characterization (referred to as SAR char, respectively) will be used as input for Smart Transmit. SAR char will be entered via the Embedded File System (EFS) to enable the Smart Transmit Feature.

<Terminologies in this report>

P_{limit}	The time-averaged RF power which corresponds to SAR_design_target.
P_{max}	Maximum target power level
SAR_design_target:	The design target for SAR compliance. It should be less than regulatory SAR limit to account for all device design related uncertainty.
SAR char	P_{limit} for all the technologies/bands for all applicable DSI

<SAR Characterization>

SAR char must be generated to cover all radio configurations and usage scenarios that the wireless device supports for operating at 6 GHz or below. It will then be used as input for Smart Transmit to control and manage RF exposure for f < 6 GHz.

<SAR design target and uncertainty>

Item	Uncertainty dB (k=2)
Total uncertainty	1.5

To account for total uncertainty, SAR_design_target should be determined as:

$$SAR\_design\_target < SAR_{regulatory\_limit} \times 10^{\frac{-total\ uncertainty}{10}}$$

The Smart Transmit algorithm maintains the time-averaged transmit power, in turn, time-averaged RF exposure of SAR_design_target, below the predefined time-averaged power limit, for each characterized technology and band.

Smart Transmit allows the device to transmit at higher power instantaneously, as high as Pmax, when needed, but enforces power limiting to maintain time-averaged transmit power to Plimit. Below table shows Plimit EFS settings and maximum tune up output power Pmax configured for this EUT for various transmit conditions (Device State Index DSI).

<P_{limit} for supported technologies and bands (P_{limit} in EFS file)>

Band	Antenna	Head	Body-Worn	Sensor off	Extremity	Hotspot	Pmax*
		DSI2	DSI3	DSI4	DSI6	DSI7	
GSM850	Ant 0	27.1	22.0	24.5	24.5	22.0	24.5
GSM1900	Ant 0	28.4	17.0	21.0	21.0	16.5	21.0
WCDMA V	Ant 0	26.8	21.2	23.0	23.0	21.2	23.0
WCDMA II	Ant 0	28.2	16.5	23.0	20.0	15.0	23.0
LTE Band 26/5	Ant 4	21.2	23.0	23.0	23.0	21.7	23.0
LTE Band 26/5	Ant 0	27.2	22.2	23.0	23.0	22.2	23.0
LTE Band 2	Ant 4	17.0	19.0	23.0	20.5	16.0	23.0
LTE Band 2	Ant 0	29.8	17.0	23.0	20.5	15.5	23.0
LTE Band 7	Ant 1	25.7	18.5	23.0	20.0	18.5	23.0
LTE Band 7	Ant 4	14.5	15.0	23.0	19.5	12.5	23.0
LTE Band 41/38 (PC3)	Ant 4	14.0	13.5	22.4	18.5	11.5	21.0
LTE Band 41(PC2)	Ant 4	14.0	13.5	22.4	18.5	11.5	22.4
LTE Band 41/38 (PC3)	Ant 1	23.4	18.0	21.0	21.1	18.0	21.0
LTE Band 42	Ant 5	13.5	14.0	21.0	18.0	12.0	21.0
FR1 n26/5	Ant 4	22.0	23.4	23.0	23.0	22.0	23.0
FR1 n26/5	Ant 0	28.3	22.5	23.0	24.2	22.5	23.0
FR1 n7	Ant 4	13.5	15.0	23.0	18.5	11.5	23.0
FR1 n7	Ant 1	25.7	19.0	23.0	19.0	19.0	23.0
FR1 n41/38 (PC3)	Ant 4	13.5	14.5	23.0	18.5	12.0	23.0
FR1 n77 (PC3)	Ant 5	13.5	13.5	26.0	19.0	12.0	23.0
FR1 n77 (PC2)	Ant 5	13.5	13.5	26.0	19.0	12.0	26.0
FR1 n77 (PC3)	Ant 2	29.4	14.0	17.5	17.5	11.0	17.5
FR1 n77 (PC2)	Ant 2	29.4	14.0	17.5	17.5	11.0	20.5
FR1 n77 (PC3)	Ant 8	31.2	15.0	21.0	21.0	13.5	23.0
FR1 n77 (PC2)	Ant 8	31.2	15.0	21.0	21.0	13.5	25.0
FR1 n77 (PC3)	Ant 1	24.5	17.0	20.5	20.5	18.5	17.5
FR1 n77 (PC2)	Ant 1	24.5	17.0	20.5	20.5	18.5	20.5
FR1 n78 (PC3)	Ant 5	13.5	13.0	26.0	19.0	12.0	23.0
FR1 n78 (PC2)	Ant 5	13.5	13.0	26.0	19.0	12.0	26.0
FR1 n78 (PC3)	Ant 2	30.1	11.0	17.5	17.5	11.0	21.0
FR1 n78 (PC2)	Ant 2	30.1	11.0	17.5	17.5	11.0	24.0
FR1 n78 (PC3)	Ant 8	30.1	14.0	21.0	21.0	13.5	22.0
FR1 n78 (PC2)	Ant 8	30.1	14.0	21.0	21.0	13.5	25.0
FR1 n78 (PC3)	Ant 1	26.3	15.5	22.0	22.0	18.5	19.0
FR1 n78 (PC2)	Ant 1	26.3	15.5	22.0	22.0	18.5	22.0

Note:
1) *P_{max} is used for RF tune up procedure. The maximum allowed output power is equal to Pmax + 1.0 dB device uncertainty.
2) All Plimit power levels entered in the Table correspond to average power levels after accounting for duty cycle in the case TDD modulation schemes (for e.g., GSM & LTE TDD & NR TDD).
3) The max allowed output power is the Plimit + 1.0 dB device uncertainty, and if Plimit is higher than Pmax, the device output power will be Pmax instead.

7. RF Exposure Limits

7.1 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.

7.2 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

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.

8. Specific Absorption Rate (SAR)

8.1 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.

8.2 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:

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

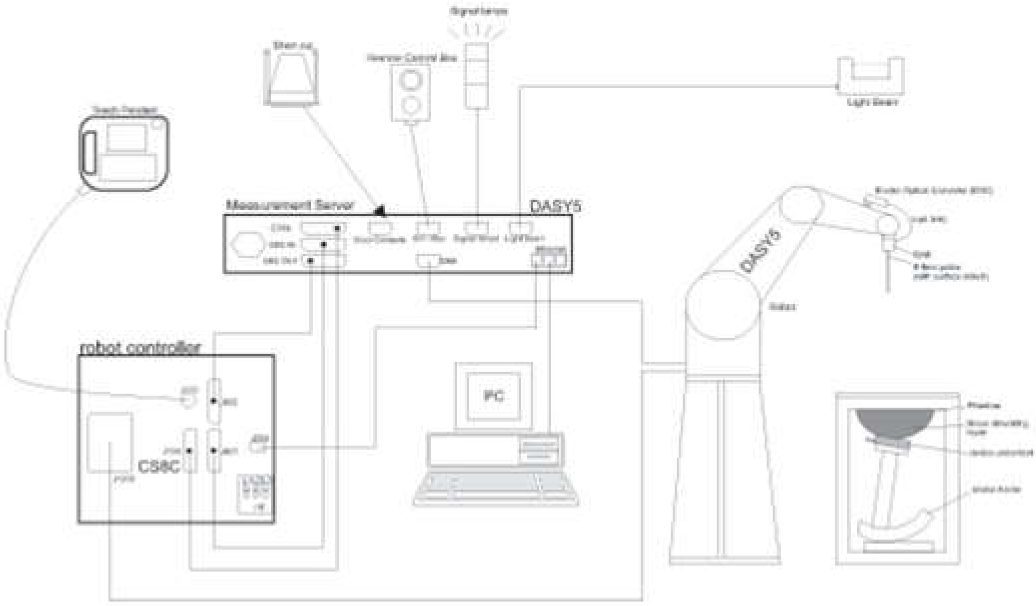
SAR is expressed in units of Watts per kilogram (W/kg)

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

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

9. System Description and Setup

The DASY5 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 Win10 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.

9.1 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.

<ES3DV3 Probe>

Construction	Symmetric design with triangular core Interleaved sensors Built-in shielding against static charges PEEK enclosure material (resistant to organic solvents, e.g., DGBE)	
Frequency	10 MHz – 4 GHz; Linearity: ±0.2 dB (30 MHz – 4 GHz)	
Directivity	±0.2 dB in TSL (rotation around probe axis) ±0.3 dB in TSL (rotation normal to probe axis)	
Dynamic Range	5 μW/g – >100 mW/g; Linearity: ±0.2 dB	
Dimensions	Overall length: 337 mm (tip: 20 mm) Tip diameter: 3.9 mm (body: 12 mm) Distance from probe tip to dipole centers: 3.0 mm	

<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	

9.2 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.

Photo of DAE

9.3 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

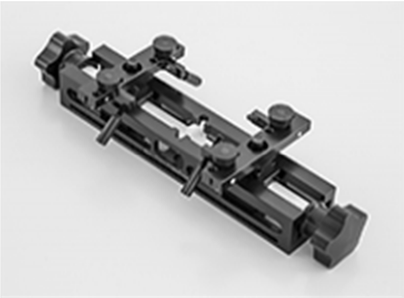
The ELI phantom is intended for compliance testing of handheld and body-mounted wireless devices or for evaluating transmitters operating at low frequencies. ELI is fully compatible with standard and all known tissue simulating liquids.

9.4 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

10. 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

10.1 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

10.2 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.

10.3 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.

<table>
<tr><th></th><th>≤ 3 GHz</th><th>> 3 GHz</th></tr>
<tr><td>Maximum distance from closest measurement point (geometric center of probe sensors) to phantom surface</td><td>5 ± 1 mm</td><td>½·δ·ln(2) ± 0.5 mm</td></tr>
<tr><td>Maximum probe angle from probe axis to phantom surface normal at the measurement location</td><td>30° ± 1°</td><td>20° ± 1°</td></tr>
<tr><td rowspan="2">Maximum area scan spatial resolution: Δx_{Area}, Δy_{Area}</td><td>≤ 2 GHz: ≤ 15 mm
2 – 3 GHz: ≤ 12 mm</td><td>3 – 4 GHz: ≤ 12 mm
4 – 6 GHz: ≤ 10 mm</td></tr>
<tr><td colspan="2">When the x or y dimension of the test device, in the measurement plane orientation, is smaller than the above, the measurement resolution must be ≤ the corresponding x or y dimension of the test device with at least one measurement point on the test device.</td></tr>
</table>

10.4 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.

			$\leq$ 3 GHz	> 3 GHz
Maximum zoom scan spatial resolution: Δx_{Zoom}, Δy_{Zoom}			$\leq$ 2 GHz: $\leq$ 8 mm 2 – 3 GHz: $\leq$ 5 mm*	3 – 4 GHz: $\leq$ 5 mm* 4 – 6 GHz: $\leq$ 4 mm*
Maximum zoom scan spatial resolution, normal to phantom surface	uniform grid: $\Delta z_{Zoom}(n)$		$\leq$ 5 mm	3 – 4 GHz: $\leq$ 4 mm 4 – 5 GHz: $\leq$ 3 mm 5 – 6 GHz: $\leq$ 2 mm
	graded grid	$\Delta z_{Zoom}(1)$: between 1st two points closest to phantom surface	$\leq$ 4 mm	3 – 4 GHz: $\leq$ 3 mm 4 – 5 GHz: $\leq$ 2.5 mm 5 – 6 GHz: $\leq$ 2 mm
		$\Delta z_{Zoom}(n>1)$: between subsequent points	$\leq 1.5 \cdot \Delta z_{Zoom}(n-1)$	
Minimum zoom scan volume	x, y, z		$\geq$ 30 mm	3 – 4 GHz: $\geq$ 28 mm 4 – 5 GHz: $\geq$ 25 mm 5 – 6 GHz: $\geq$ 22 mm
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 *reported* 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.				

10.5 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.

10.6 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.

11. Test Equipment List

Manufacturer	Name of Equipment	Type/Model	Serial Number	Calibration	
				Last Cal.	Due Date
SPEAG	835MHz System Validation Kit	D835V2	4d162	Dec. 17, 2021	Dec. 16, 2024
SPEAG	1900MHz System Validation Kit	D1900V2	5d182	Dec. 20, 2021	Dec. 19, 2024
SPEAG	2450MHz System Validation Kit	D2450V2	924	Sep. 02, 2020	Aug. 31, 2023
SPEAG	2600MHz System Validation Kit	D2600V2	1070	Dec. 20, 2021	Dec. 19, 2024
SPEAG	3500MHz System Validation Kit	D3500V2	1037	Nov. 25, 2020	Nov. 23, 2023
SPEAG	3700MHz System Validation Kit	D3700V2	1008	Nov. 25, 2020	Nov. 23, 2023
SPEAG	3900MHz System Validation Kit	D3900V2	1022	Aug. 18, 2022	Aug. 17, 2023
SPEAG	5000MHz System Validation Kit	D5GHzV2	1341	Dec. 13, 2021	Dec. 12, 2024
SPEAG	Data Acquisition Electronics	DAE4	1437	Nov. 23, 2022	Nov. 22, 2023
SPEAG	Dosimetric E-Field Probe	ES3DV3	3191	Feb. 17, 2023	Feb. 16, 2024
SPEAG	Dosimetric E-Field Probe	EX3DV4	7577	Nov. 23, 2022	Nov. 22, 2023
SPEAG	SAM Twin Phantom	QD 000 P40 CD	1795	NCR	NCR
SPEAG	Phone Positioner	N/A	N/A	NCR	NCR
Anritsu	Radio communication analyzer	MT8821C	6272416837	Apr. 03, 2023	Apr. 02, 2024
Agilent	Wireless Communication Test Set	E5515C	MY50267224	Jul. 07, 2022	Jul. 06, 2023
Agilent	Wireless Communication Test Set	E5515C	MY50267224	Jul. 06, 2023	Jul. 05, 2024
Keysight	Network Analyzer	E5071C	MY46523671	Oct. 17, 2022	Oct. 16, 2023
Speag	Dielectric Assessment KIT	DAK-3.5	1071	Feb. 20, 2023	Feb. 19, 2024
Agilent	Signal Generator	N5181A	MY50145381	Dec. 27, 2022	Dec. 26, 2023
Anritsu	Power Senor	MA2411B	1306099	Oct. 17, 2022	Oct. 16, 2023
Anritsu	Power Meter	ML2495A	1349001	Oct. 17, 2022	Oct. 16, 2023
Anritsu	Power Sensor	MA2411B	1542004	Dec. 27, 2022	Dec. 26, 2023
Anritsu	Power Meter	ML2495A	1339473	Dec. 27, 2022	Dec. 26, 2023
R&S	CBT BLUETOOTH TESTER	CBT	100963	Dec. 27, 2022	Dec. 26, 2023
R&S	Spectrum Analyzer	FSP7	100818	Jul. 05, 2023	Jul. 04, 2024
TES	Hygrometer	1310	200505600	Jul. 12, 2022	Jul. 11, 2023
TES	Hygrometer	1310	200505600	Jul. 08, 2023	Jul. 07, 2024
Anymetre	Thermo-Hygrometer	JR593	2015030903	Dec. 30, 2022	Dec. 29, 2023
AR	Amplifier	5S1G4	0333096	Note 1	
Mini-Circuits	Amplifier	ZVE-3W-83+	599201528	Note 1	
Mini-Circuits	Amplifier	ZVA-183W-S+	726202215	Note 1	
SPEAG	Device Holder	N/A	N/A	Note 1	
ARRA	Power Divider	A3200-2	N/A	Note 1	
ET Industries	Dual Directional Coupler	C-058-10	N/A	Note 1	
Weinschel	Attenuator 1	3M-10	N/A	Note 1	
Weinschel	Attenuator 2	3M-20	N/A	Note 1	

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
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.

12. System Verification

12.1 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. 11.1. 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. 11.2.

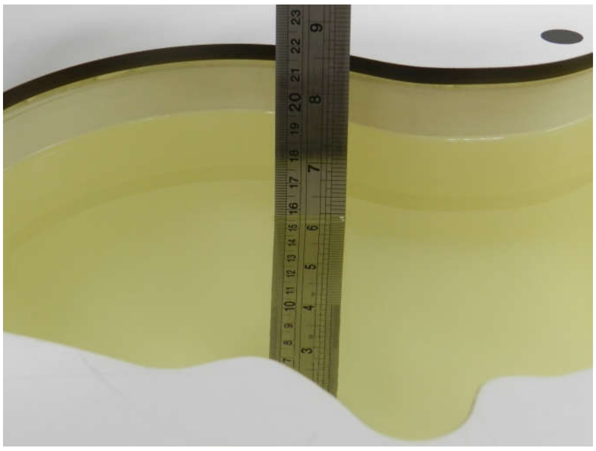


Fig 11.1 Photo of Liquid Height for Head SAR

Fig 11.2 Photo of Liquid Height for Body SAR

12.2 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)
For Head								
750	41.1	57.0	0.2	1.4	0.2	0	0.89	41.9
835	40.3	57.9	0.2	1.4	0.2	0	0.90	41.5
1800, 1900, 2000	55.2	0	0	0.3	0	44.5	1.40	40.0
2450	55.0	0	0	0	0	45.0	1.80	39.2
2600	54.8	0	0	0.1	0	45.1	1.96	39.0

Simulating Liquid for 5GHz, Manufactured by SPEAG

Ingredients	(% by weight)
Water	64~78%
Mineral oil	11~18%
Emulsifiers	9~15%
Additives and Salt	2~3%

<Tissue Dielectric Parameter Check Results>

Frequency (MHz)	Tissue Type	Liquid Temp. (℃)	Conductivity (σ)	Permittivity (ε_r)	Conductivity Target (σ)	Permittivity Target (ε_r)	Delta (σ) (%)	Delta (ε_r) (%)	Limit (%)	Date
835	Head	22.4	0.928	41.847	0.90	41.50	3.11	0.84	±5	2023/7/5
1900	Head	22.5	1.446	39.033	1.40	40.00	3.29	-2.42	±5	2023/7/6
2450	Head	22.6	1.803	38.243	1.80	39.20	0.17	-2.44	±5	2023/7/7
2600	Head	22.2	1.935	37.641	1.96	39.00	-1.28	-3.48	±5	2023/7/8
2600	Head	22.5	1.915	39.563	1.96	39.00	-2.30	1.44	±5	2023/7/17
3500	Head	22.3	2.892	36.650	2.91	37.90	-0.62	-3.30	±5	2023/7/9
3700	Head	22.6	3.140	38.970	3.12	37.70	0.64	3.37	±5	2023/7/13
3700	Head	22.4	3.048	37.958	3.12	37.70	-2.31	0.68	±5	2023/7/19
3900	Head	22.7	3.312	38.764	3.33	37.51	-0.54	3.34	±5	2023/7/14
3900	Head	22.6	3.208	37.743	3.33	37.51	-3.66	0.62	±5	2023/7/21
5250	Head	22.3	4.576	36.019	4.71	35.95	-2.85	0.19	±5	2023/7/10
5600	Head	22.5	4.933	35.510	5.07	35.50	-2.70	0.03	±5	2023/7/11
5750	Head	22.2	5.093	35.309	5.22	35.35	-2.43	-0.12	±5	2023/7/12

12.3 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.

<1g SAR>

Date	Frequency (MHz)	Tissue Type	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 (%)
2023/7/5	835	Head	250	4d162	3191	1437	2.570	9.640	10.28	6.64
2023/7/6	1900	Head	250	5d182	3191	1437	10.500	39.600	42	6.06
2023/7/7	2450	Head	250	924	3191	1437	12.500	51.400	50	-2.72
2023/7/8	2600	Head	250	1070	3191	1437	13.500	56.200	54	-3.91
2023/7/17	2600	Head	250	1070	3191	1437	13.600	56.200	54.4	-3.20
2023/7/9	3500	Head	100	1037	7577	1437	6.430	68.000	64.3	-5.44
2023/7/13	3700	Head	100	1008	7577	1437	7.170	67.600	71.7	6.07
2023/7/19	3700	Head	100	1008	7577	1437	7.110	67.600	71.1	5.18
2023/7/14	3900	Head	100	1022	7577	1437	6.690	66.400	66.9	0.75
2023/7/21	3900	Head	100	1022	7577	1437	6.400	66.400	64	-3.61
2023/7/10	5250	Head	100	1341	7577	1437	7.960	80.700	79.6	-1.36
2023/7/11	5600	Head	100	1341	7577	1437	8.900	84.500	89	5.33
2023/7/12	5750	Head	100	1341	7577	1437	8.420	80.600	84.2	4.47

<10g SAR>

Date	Frequency (MHz)	Tissue Type	Input Power (mW)	Dipole S/N	Probe S/N	DAE S/N	Measured 10g SAR (W/kg)	Targeted 10g SAR (W/kg)	Normalized 10g SAR (W/kg)	Deviation (%)
2023/7/5	835	Head	250	4d162	3191	1437	1.650	6.260	6.6	5.43
2023/7/6	1900	Head	250	5d182	3191	1437	5.440	20.200	21.76	7.72
2023/7/7	2450	Head	250	924	3191	1437	5.810	24.000	23.24	-3.17
2023/7/8	2600	Head	250	1070	3191	1437	6.030	24.600	24.12	-1.95
2023/7/17	2600	Head	250	1070	3191	1437	5.830	24.600	23.32	-5.20
2023/7/9	3500	Head	100	1037	7577	1437	2.470	25.400	24.7	-2.76
2023/7/13	3700	Head	100	1008	7577	1437	2.630	24.400	26.3	7.79
2023/7/19	3700	Head	100	1008	7577	1437	2.620	24.400	26.2	7.38
2023/7/14	3900	Head	100	1022	7577	1437	2.360	23.700	23.6	-0.42
2023/7/21	3900	Head	100	1022	7577	1437	2.230	23.700	22.3	-5.91
2023/7/10	5250	Head	100	1341	7577	1437	2.240	23.100	22.4	-3.03
2023/7/11	5600	Head	100	1341	7577	1437	2.510	24.000	25.1	4.58
2023/7/12	5750	Head	100	1341	7577	1437	2.340	22.700	23.4	3.08

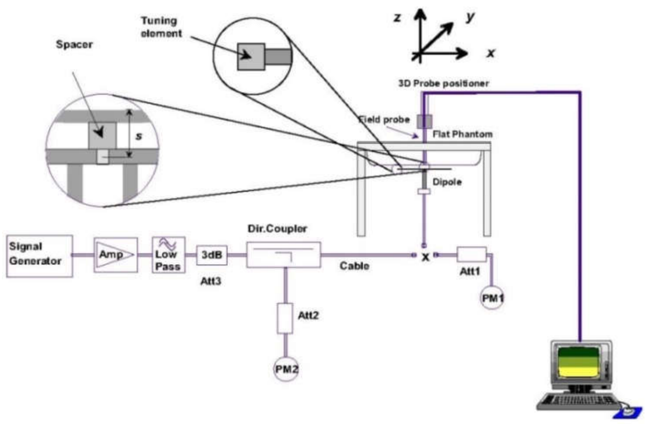


Fig 11.3.1 System Performance Check Setup

Fig 11.3.2 Setup Photo

13. RF Exposure Positions

13.1 Ear and handset reference point

Figure 12.1.1 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 12.1.2 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 12.1.3). 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 12.1.2. The ear truncation is introduced to preclude the ear lobe from interfering with handset tilt, which could lead to unstable positioning at the cheek.

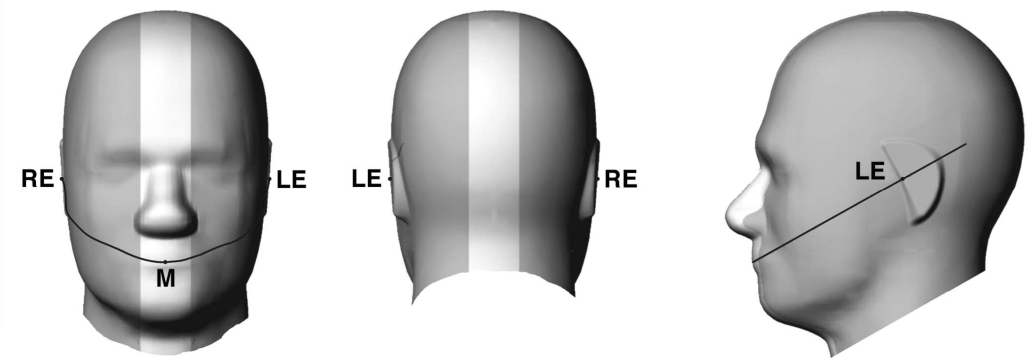


Fig 12.1.1 Front, back, and side views of SAM twin phantom

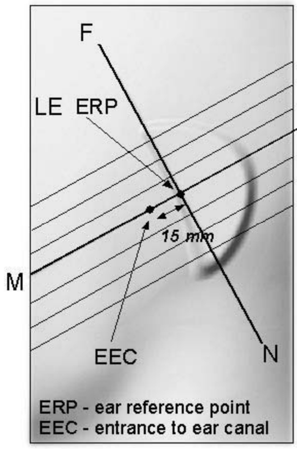


Fig 12.1.2 Close-up side view of phantom showing the ear region.

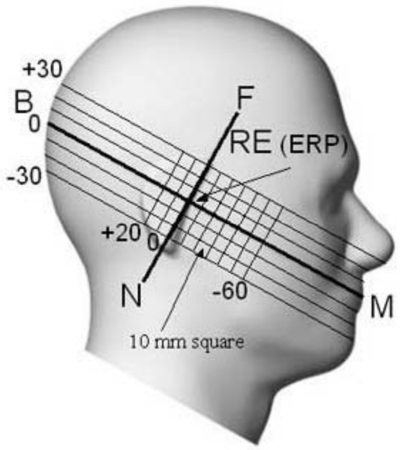


Fig 12.1.3 Side view of the phantom showing relevant markings and seven cross-sectional plane locations

13.2 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 12.2.1 and Figure 12.2.2), 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 12.2.1). 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 12.2.2), 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 12.2.3), 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 12.2.3. The actual rotation angles should be documented in the test report.

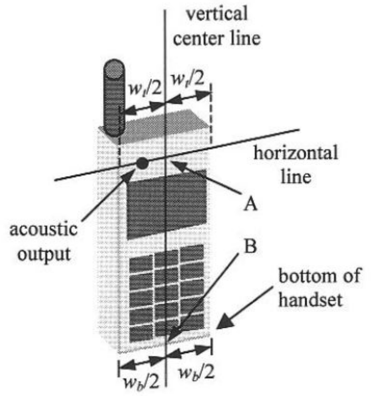


Fig 12.2.1 Handset vertical and horizontal reference lines—"fixed case

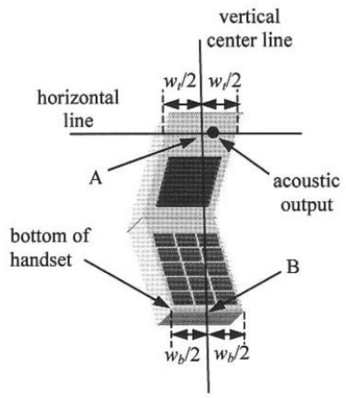


Fig 12.2.2 Handset vertical and horizontal reference lines—"clam-shell case"

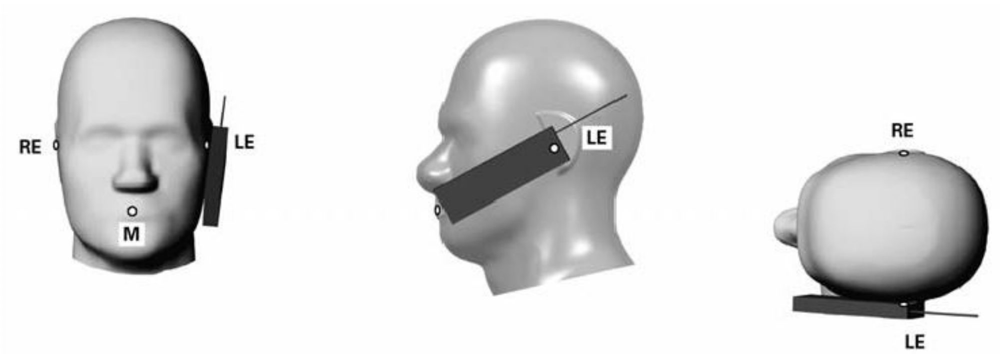


Fig 12.2.3 cheek or touch position. The reference points for the right ear (RE), left ear (LE), and mouth (M), which establish the Reference Plane for handset positioning, are indicated.

13.3 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 12.3.1. 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

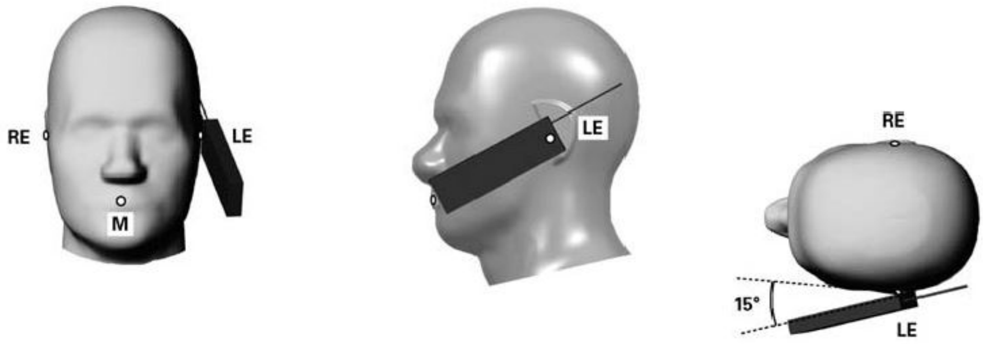


Fig 12.3.1 Tilt position. The reference points for the right ear (RE), left ear (LE), and mouth (M), which define the Reference Plane for handset positioning, are indicated.

13.4 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 11.4). 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. 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.

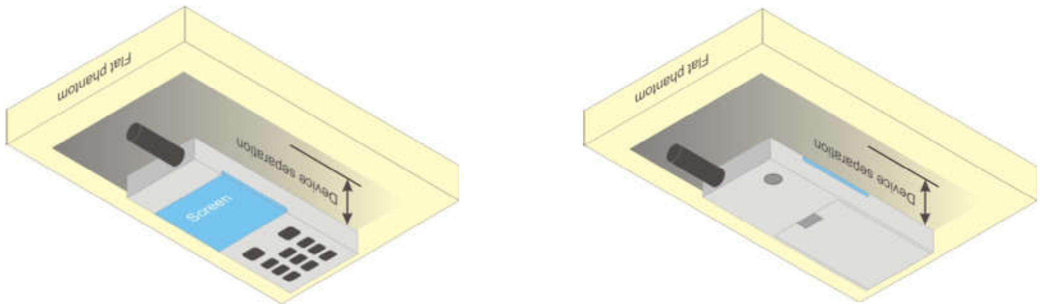


Fig 12.4 Body Worn Position

13.5 Product Specific 10g SAR Exposure

For smart phones with a display diagonal dimension > 15.0 cm or an overall diagonal dimension > 16.0 cm, that can provide similar mobile web access and multimedia support found in mini-tablets or UMPC mini-tablets and 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.

13.6 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.

14. Conducted RF Output Power (Unit: dBm)

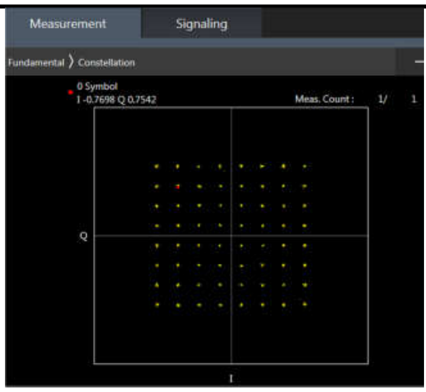
The detailed conducted power table can refer to Appendix E.

<LTE Conducted Power>

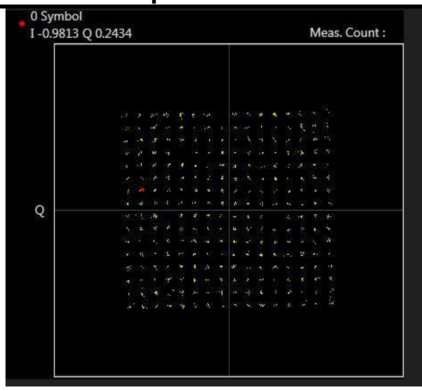
General Note:

1. Anritsu MT8820C base station simulator was used to setup the connection with EUT; the frequency band, channel bandwidth, RB allocation configuration, modulation type are set in the base station simulator to configure EUT transmitting at maximum power and at different configurations which are requested to be reported to FCC, for conducted power measurement and SAR testing.
2. Per KDB 941225 D05v02r05, when a properly configured base station simulator is used for the SAR and power measurements, spectrum plots for each RB allocation and offset configuration is not required.
3. Per KDB 941225 D05v02r05, 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.
4. Per KDB 941225 D05v02r05, 50% RB allocation for QPSK SAR testing follows 1RB QPSK allocation procedure.
5. Per KDB 941225 D05v02r05, for 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.
6. Per KDB 941225 D05v02r05, 16QAM/64QAM/256QAM output power for each RB allocation configuration is > not ½ dB higher than the same configuration in QPSK and the reported SAR for the QPSK configuration is ≤ 1.45 W/kg; Per KDB 941225 D05v02r05, 16QAM/64QAM/256QAM SAR testing is not required.
7. Per KDB 941225 D05v02r05, smaller bandwidth output power for each RB allocation configuration is > 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; Per KDB 941225 D05v02r05, smaller bandwidth SAR testing is not required.
8. For LTE B5 / B26 / B38 the maximum bandwidth does not support three non-overlapping channels, per KDB 941225 D05v02r05, when a device supports overlapping channel assignment in a channel bandwidth configuration, the middle channel of the group of overlapping channels should be selected for testing.
9. LTE B5 / B38 SAR test was covered by B26 / B41; according to April 2015 TCB workshop, SAR test for overlapping LTE bands can be reduced if
   a. the maximum output power, including tolerance, for the smaller band is ≤ the larger band to qualify for the SAR test exclusion
   b. the channel bandwidth and other operating parameters for the smaller band are fully supported by the larger band
10. According to May 2017 TCB workshop, for 16QAM and 64QAM, 256QAM should be verified by checking the signal constellation with a call box to avoid incorrect maximum power levels due to MPR and other requirements associated with signal modulation, and the following figure is taken from the "Fundamental Measurement >> Modulation Analysis >> constellation" mode of the device connect to the MT8821C base station, therefore, the device 256QAM, 64QAM and 16QAM signal modulation are correct.

16QAM



64QAM



256QAM

<TDD LTE SAR Measurement>

TDD LTE configuration setup for SAR measurement

SAR was tested with a fixed periodic duty factor according to the highest transmission duty factor implemented for the device and supported by 3GPP.

a. 3GPP TS 36.211 section 4.2 for Type 2 Frame Structure and Table 4.2-2 for uplink-downlink configurations
b. “special subframe S” contains both uplink and downlink transmissions, it has been taken into consideration to determine the transmission duty factor according to the worst case uplink and downlink cyclic prefix requirements for UpPTS
c. Establishing connections with base station simulators ensure a consistent means for testing SAR and recommended for evaluating SAR. The Anritsu MT8820C (firmware: #22.52#004) was used for LTE output power measurements and SAR testing.

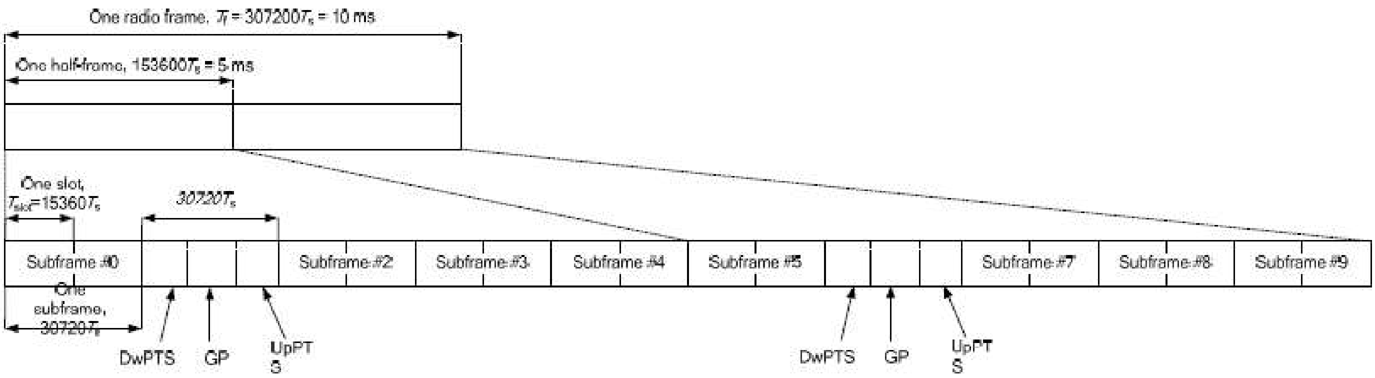


Figure 4.2-1: Frame structure type 2 (for 5 ms switch-point periodicity).

Table 4.2-2: Uplink-downlink configurations.

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

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

Special subframe configuration	Normal cyclic prefix in downlink			Extended cyclic prefix in downlink		
	DwPTS	UpPTS		DwPTS	UpPTS	
		Normal cyclic prefix in uplink	Extended cyclic prefix in uplink		Normal cyclic prefix in uplink	Extended cyclic prefix in uplink
0	$6592 \cdot T_s$	$2192 \cdot T_s$	$2560 \cdot T_s$	$7680 \cdot T_s$	$2192 \cdot T_s$	$2560 \cdot T_s$
1	$19760 \cdot T_s$			$20480 \cdot T_s$		
2	$21952 \cdot T_s$			$23040 \cdot T_s$		
3	$24144 \cdot T_s$			$25600 \cdot T_s$		
4	$26336 \cdot T_s$			$7680 \cdot T_s$	$4384 \cdot T_s$	$5120 \cdot T_s$
5	$6592 \cdot T_s$	$4384 \cdot T_s$	$5120 \cdot T_s$	$20480 \cdot T_s$		
6	$19760 \cdot T_s$			$23040 \cdot T_s$		
7	$21952 \cdot T_s$			$12800 \cdot T_s$		
8	$24144 \cdot T_s$			-	-	-
9	$13168 \cdot T_s$			-	-	-

Special subframe (30720·T_s): Normal cyclic prefix in downlink (UpPTS)			
	Special subframe configuration	Normal cyclic prefix in uplink	Extended cyclic prefix in uplink
Uplink duty factor in one special subframe	0~4	7.13%	8.33%
	5~9	14.3%	16.7%

Special subframe(30720·T_s): Extended cyclic prefix in downlink (UpPTS)			
	Special subframe configuration	Normal cyclic prefix in uplink	Extended cyclic prefix in uplink
Uplink duty factor in one special subframe	0~3	7.13%	8.33%
	4~7	14.3%	16.7%

The highest duty factor is resulted from:

For LTE TDD Power class 2

i. Uplink-downlink configuration: 1. In a half-frame consisted of 5 subfames, uplink operation is in 2 uplink subframes and 1 special subframe.
ii. special subframe configuration: 5-9 for normal cyclic prefix in downlink, 4-7 for extended cyclic prefix in downlink
iii. for special subframe with extended cyclic prefix in uplink, the total uplink duty factor in one half-frame is: (2+0.167)/5 = 43.3%
iv. for special subframe with normal cyclic prefix in uplink, the total uplink duty factor in one half-frame is: (2+0.143)/5 = 42.9%
v. For TDD LTE SAR measurement, the duty cycle 1:2.33 (42.9 %) was used perform testing and considering the theoretical duty cycle of 43.3% for extended cyclic prefix in the uplink, and the theoretical duty cycle of 42.9% for normal cyclic prefix in uplink, a scaling factor of extended cyclic prefix 43.3%/42.9% = 1.009 is applied to scale-up the measured SAR result. The scaled TDD LTE SAR = measured SAR (W/kg)* Tune-up Scaling Factor* scaling factor for extended cyclic prefix.

For LTE TDD Power class 3

i. Uplink-downlink configuration: 0. In a half-frame consisted of 5 subfames, uplink operation is in 3 uplink subframes and 1 special subframe.
ii. special subframe configuration: 5-9 for normal cyclic prefix in downlink, 4-7 for extended cyclic prefix in downlink
iii. for special subframe with extended cyclic prefix in uplink, the total uplink duty factor in one half-frame is: (3+0.167)/5 = 63.3%
iv. for special subframe with normal cyclic prefix in uplink, the total uplink duty factor in one half-frame is: (3+0.143)/5 = 62.9%
v. For TDD LTE SAR measurement, the duty cycle 1:1.59 (62.9 %) was used perform testing and considering the theoretical duty cycle of 63.3% for extended cyclic prefix in the uplink, and the theoretical duty cycle of 62.9% for normal cyclic prefix in uplink, a scaling factor of extended cyclic prefix 63.3%/62.9% = 1.006 is applied to scale-up the measured SAR result. The scaled TDD LTE SAR = measured SAR (W/kg)* Tune-up Scaling Factor* scaling factor for extended cyclic prefix.

The device can adjust uplink/downlink configuration automatically according to the transmitting power class level, as followings:

LTE TDD Band	Power Class level	support uplink/downlink configuration
LTE Band 41	> 23	1,2,3,4,5
	=23	0,1,2,3,4,5,6
	< 23	0,1,2,3,4,5,6

<LTE Carrier Aggregation>

General Note:

1. This device supports Carrier Aggregation on downlink for inter and intra band. For the device supports bands and bandwidths and configurations are provided as follow table was according to 3GPP.
2. In applying the existing power measurement procedures of KDB 941225 D05A for DL CA SAR test exclusion, only the subset with the largest number of combinations of frequency bands and CCs in each row need combination, and for this device that all the configurations were choose to power measurement.
3. The gray color table is covered by other combinations and no need to verify power.

2CC Downlink Carrier Aggregation				3CC Downlink Carrier Aggregation				4CC Downlink Carrier Aggregation			
Number	Combination	4X4 MIMO	Covered by Measurement Superset	Number	Combination	4X4 MIMO	Covered by Measurement Superset	Number	Combination	4X4 MIMO	Covered by Measurement Superset
1	CA_38C	38C, 38A		1	CA_41A-41A-41A	41A		1	CA_41A-41A-41C		
2	CA_41A-41A	41A-41A, 41A	3CC-1	2	CA_41A-41C	41A	4CC-1	2	CA_41A-41D		
3	CA_41C	41C, 41A	3CC-2	3	CA_41D		4CC-2	3	CA_41C-41C		
4	CA_5A-7A	7A		4				4	CA_41E		
5				5				5			
6	CA_7A-7A	7A-7A, 7A		6				6			
7	CA_7B	7B, 7A		7				7			
8	CA_7C	7C, 7A		8				8			

LTE Carrier Aggregation Conducted Power (Downlink)

i. According to KDB941225 D05A v01r02, Uplink maximum output power measurement with downlink carrier aggregation active should be measured, using the highest output channel measured without downlink carrier aggregation, to confirm that uplink maximum output power with downlink carrier aggregation active remains within the specified tune-up tolerance limits and not more than ¼ dB higher than the maximum output measured without downlink carrier aggregation active.

ii. Uplink maximum output power with downlink carrier aggregation active does not show more than ¼ dB higher than the maximum output power without downlink carrier aggregation active, therefore SAR evaluation with downlink carrier aggregation active can be excluded.

iii. The device supports downlink four carrier aggregation. For power measurement were control and acknowledge data is sent on uplink channels that operate identical to specifications when downlink carrier aggregation is inactive.

iv. Selected highest measured power when downlink carrier aggregation is inactive for conducted power comparison with downlink carrier aggregation is active, to confirm that when downlink carrier aggregation is active uplink maximum output power remains within the specified tune-up tolerance limits and not more than ¼ dB higher than the maximum output power measured when downlink carrier aggregation inactive.

v. For inter-band CA, the SCC selected highest bandwidth and near the middle of its transmission band. For SCC DL RB size and offset will base on the PCC corresponding RB allocation.

vi. For non-contiguous intra-band CA, the SCC selected to provide maximum separation from the PCC and must remain fully within the downlink transmission band.

vii. For Intra-band, contiguous CA, the downlink channels selected to perform the uplink power measurement must satisfy 3GPP channel spacing (5.4.1A of 3GPP TS 36.521 or equivalent) and channel bandwidth (5.4.2A) requirements.

$$\text{Nominal channel spacing} = \left\lfloor \frac{BW_{Channel(1)} + BW_{Channel(2)} - 0.1\left|BW_{Channel(1)} - BW_{Channel(2)}\right|}{0.6} \right\rfloor 0.3 \ \ [\text{MHz}]$$

LTE 4x4 MIMO (Downlink)

This device supports downlink 4x4 MIMO operations for LTE Band 7/38/41 only. Uplink transmission is limited to a single output stream. Power measurements were performed with downlink 4x4 MIMO active for the configuration with highest measured maximum conducted power with 4x4 downlink MIMO inactive measured among the channel bandwidth, modulation, and RB combinations in each frequency band.

Per FCC Guidance, SAR for downlink 4x4 MIMO was not needed since the maximum average output power in 4x4 downlink MIMO mode was not > 0.25 dB higher than the maximum output power with downlink 4x4 MIMO inactive. When carrier aggregation is applicable, power measurements were performed with the downlink carrier aggregation and 4x4 DL MIMO active for the configuration with highest measured maximum conducted power with downlink carrier aggregation inactive measured among the channel bandwidth, modulation, and RB combinations in each frequency band.

4X4 MIMO	Band
	LTE Band 7/38/41

LTE Carrier Aggregation Conducted Power (Uplink)

LTE Uplink CA	2CC Uplink Carrier Aggregation
Intra-band	Antenna Tx
CA_7C	Ant 1
CA_38C	Ant 4

<Intra-band>

General Note:

i. The device supports intra-band uplink carrier aggregation for LTE B7/38 with a maximum of two uplink component carriers. For intra band contiguous carrier aggregation scenarios, 3GPP 36.101 table 6.2.2A-1 specifies that the aggregate maximum allowed output power is equivalent to the single carrier scenario. 3GPP 36.101 6.2.3A allows for several dB of MPR to be applied when not-contiguous RB allocation is implemented. The conducted power and MPR setting in this device are permanently implemented pre 3GPP requirement.

ii. The device supports uplink carrier aggregation with a maximum of two uplink component carriers. For intra band contiguous carrier aggregation scenarios, 3GPP 36.101 table 6.2.2A-1 specifies that the aggregate maximum allowed output power is equivalent to the single carrier scenario. 3GPP 36.101 6.2.3A allows for several dB of MPR to be applied when not-contiguous RB allocation is implemented. The conducted power and MPR setting in this device are permanently implemented pre the 3GPP requirement.

iii. According Nov. 2017 TCB workshop, the output power with uplink CA active was measured for the configuration with the highest reported SAR with single carrier for each exposure condition. The power was measured with wideband signal integration over both component carriers.

iv. Additional SAR measurement for LTE UL CA whit other DL CA combinations active were not required since the maximum output power for this configuration was not > 0.25dB higher than the maximum output power for UL CA active.

5G NR Output Power (Unit: dBm)

General Note:

1. 5G NR n5/n7/n26/n38/n41/n77/n78 is SA mode.
2. 5G NR n5/n78 is NSA mode.
3. 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-s QPSK and the reported SAR for the DFT-s 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/64QAM/256QAM and smaller bandwidth output power will spot check largest channel bandwidth worst RB configuration to ensure the 16QAM/64QAM/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 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
    d. 50% RB allocation for QPSK SAR testing follows 1RB QPSK allocation procedure
    e. 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
    f. PI/2 BPSK/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, PI/2 BPSK /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
4. For 5G NR bands test, using FTM (Factory Test Mode) with default 100% duty cycle transmission to perform SAR testing.
5. NSA and SA mode should perform SAR separately. For the maximum power of NSA mode is the same as SA total power level, so SA SAR can represent NSA mode SAR.
6. 5GNR NSA mode, the power level is the same as 5GNR SA mode, so 5GNR NSA mode and SA mode power table only show one time.
7. 5G NR supports CP-OFDM and DFT-s-OFDM modulation, for DFT-s-OFDM power is higher than CP-OFDM, so only show DFT-s-OFDM power table and chose DFT-s-OFDM to perform SAR testing.
8. 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.

<u><3GPP 38.101 MPR for EN-DC></u>

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		

<u><EN-DC combination></u>

ENDC	LTE Band	LTE TX	NR Band	NR TX
DC_38A_n78A	LTE B38	ANT1	n78	ANT5
DC_41A_n78A	LTE B41	ANT1	n78	ANT5
DC_5A_n78A	LTE B5	ANT0	n78	ANT5
DC_7A_n78A	LTE B7	ANT1	n78	ANT5
DC_7A_n5A	LTE B7	ANT4	n5	ANT0

15. Antenna Location

The detailed antenna location information can refer to SAR Test Setup Photos.

16. Spot Check SAR Results

Spot Check General Note:

1. For LTE B7 Ant4，B41/n77/n78 full test.
2. SAR spot check verification on the worst cases from the original model was performed to demonstrate the test data from original model remains representative for the variant model.
3. If the 1-g SAR spot check result "does not exceed 30%, but larger than 1.2 W/kg", more spot check on the next-higher exposure position until the spot check result does not exceed 1.2 W/kg.
4. The Spot check results showed that deviation of the SAR results did not exceed 30%, therefore referring to the guidance in the KDB inquiry, SAR data reuse is justified.
5. 1st as parent model, 2nd as variant model.

Full test 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 BT/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: Reported SAR(W/kg)= Measured SAR(W/kg)*Tune-up Scaling Factor
   d. For BT/WLAN: Reported SAR(W/kg)= Measured SAR(W/kg)* Duty Cycle scaling factor * Tune-up scaling factor
   e. For TDD LTE SAR measurement of power class 3, the duty cycle 1:1.59 (62.9 %) was used perform testing and considering the theoretical duty cycle of 63.3% for extended cyclic prefix in the uplink, and the theoretical duty cycle of 62.9% for normal cyclic prefix in uplink, a scaling factor of extended cyclic prefix 63.3%/62.9% = 1.006 is applied to scale-up the measured SAR result. The reported TDD LTE SAR (W/kg) = Measured SAR (W/kg)* Tune-up Scaling Factor* scaling factor for extended cyclic prefix.
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 when the measured SAR is ≥ 0.8W/kg. Per KDB 865664 D01v01r04, if the extremity repeated SAR is necessary, the same procedures should be adapted for measurements according to extremity and occupational exposure limits by applying a factor of 2.5 for extremity exposure and a factor of 5 for occupational exposure to the corresponding SAR thresholds.
4. The device implements the power management and proximity sensor /receiver detection/hotspot mode for SAR compliance at different exposure conditions (head, body-worn, hotspot, extremity) and the Qualcomm smart transmit will manage to ensure the power level not exceeding the associated power table. Details about the power management decision and sensor detection are provided in the operational description. And the device will invoke corresponding work scenarios power level base on frequency bands/antennas, which can refer to power table at appendix E.
5. This device supports HPUE for LTE Band 41 with class 2 level, HPUE power has been measured separately. For HPUE power is higher than power class 3 but with lower duty cycle, the maximum average power for class 2 and class 3 is almost the same, so we chose power class 3 full SAR testing and power class 2 verify the worst case of power class 3 SAR.
6. 5GNR n77/n78 supports HPUE mode, HPUE power and SAR testing performed separately.
7. For 5GNR n77/n78 HPUE with higher power, so we chose power class 2 full SAR testing and power class 2 SAR can represent power class 3 SAR.
8. For 5G NR bands test, using FTM (Factory Test Mode) with default 100% duty cycle transmission to perform SAR testing.
9. Per KDB648474 D04v01r03, for smart phones with a display diagonal dimension > 15.0 cm or an overall diagonal dimension > 16.0 cm, 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, however, when power reduction applies to hotspot mode the measured SAR must be scaled to the maximum output power, including tolerance, allowed for phablet modes to compare with the 1.2 W/kg SAR test reduction threshold.
   a. For this device SAR for WWAN/WLAN transmitter scaled to maximum output power mode for product specific 10g SAR is higher than 1.2W/kg of LTE Band 7/38/41, 5GNR n77/n78, therefore product specific 10g SAR is necessary.
   b. When 10-g product specific 10g SAR is considered, SAR thresholds is specified in the procedures for SAR test

reduction and exclusion should be multiplied by 2.5.

10. Although the headset SAR is greater than 0.8 W/kg, the headset SAR verified the worst of the non-headset SAR and less than non-headset SAR, so there is no need to be tested other channels.
11. According to Nov. 2017 TCB workshop, when the reported 1gSAR for UL CA configuration is <1.2 W/kg, UL CA 1gSAR is not required for all required test channels (PCC based).

LTE Note:

1. Per KDB 941225 D05v02r05, 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.
2. Per KDB 941225 D05v02r05, 50% RB allocation for QPSK SAR testing follows 1RB QPSK allocation procedure.
3. Per KDB 941225 D05v02r05, for 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.
4. Per KDB 941225 D05v02r05, 16QAM/64QAM/256QAM output power for each RB allocation configuration is > not ½ dB higher than the same configuration in QPSK and the reported SAR for the QPSK configuration is ≤ 1.45 W/kg; Per KDB 941225 D05v02r05, 16QAM/64QAM/256QAM SAR testing is not required.
5. Per KDB 941225 D05v02r05, smaller bandwidth output power for each RB allocation configuration is > 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; Per KDB 941225 D05v02r05, smaller bandwidth SAR testing is not required.
6. For LTE B38 the maximum bandwidth does not support three non-overlapping channels, per KDB 941225 D05v02r05, when a device supports overlapping channel assignment in a channel bandwidth configuration, the middle channel of the group of overlapping channels should be selected for testing.
7. LTE B38 SAR test was covered by B41; according to April 2015 TCB workshop, SAR test for overlapping LTE bands can be reduced if
   a. the maximum output power, including tolerance, for the smaller band is ≤ the larger band to qualify for the SAR test exclusion
   b. the channel bandwidth and other operating parameters for the smaller band are fully supported by the larger band

5G NR Note:

1. For 5G NR test procedure was following step similar FCC KDB 941225 D05:
   a. 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.
   b. 50% RB allocation for QPSK SAR testing follows 1RB QPSK allocation procedure
   c. 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.
   d. PI/2 BPSK/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, PI/2 BPSK /16QAM/64QAM/256QAM SAR testing are not required.
   e. 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
   f. For 5G FR1 n77 the maximum bandwidth does not support three non-overlapping channels, when a device supports overlapping channel assignment in a channel bandwidth configuration, the middle channel of the group of overlapping channels should be selected for testing.

16.1 Head SAR

Plot No.	No.	Band	BW (MHz)	Modulation	RB Size	RB offset	Mode	Test Position	Gap (mm)	Antenna	Power State	Ch.	Freq. (MHz)	Sample	Average Power (dBm)	Tune-Up Limit (dBm)	Tune-up Scaling Factor	Power Drift (dB)	Measured 1g SAR (W/kg)	Reported 1g SAR (W/kg)	Deviation
835MHz																					
	1st	GSM850	-	-	-	-	GPRS 2 Tx slots	Right Cheek	0mm	Ant 0	DSI 2	189	836.4	1	30.22	31.50	1.343	-0.02	0.524	0.704	15%
01	2nd	GSM850	-	-	-	-	GPRS 2 Tx slots	Right Cheek	0mm	Ant 0	DSI 2	189	836.4	1	30.22	31.50	1.343	-0.01	0.617	**0.828**	
	1st	WCDMA V	-	-	-	-	RMC 12.2Kbps	Right Cheek	0mm	Ant 0	DSI 2	4182	836.4	1	22.70	24.00	1.349	-0.14	0.392	0.529	17%
02	2nd	WCDMA V	-	-	-	-	RMC 12.2Kbps	Right Cheek	0mm	Ant 0	DSI 2	4182	836.4	1	22.70	24.00	1.349	0.08	0.472	**0.637**	
	1st	LTE Band 26	15M	QPSK	1	0	-	Right Cheek	0mm	Ant 4	DSI 2	26865	831.5	1	20.75	22.20	1.396	0.06	0.551	0.769	-11%
03	2nd	LTE Band 26	15M	QPSK	1	0	-	Right Cheek	0mm	Ant 4	DSI 2	26865	831.5	1	20.75	22.20	1.396	0.03	0.494	**0.690**	
	1st	LTE Band 26	15M	QPSK	1	0	-	Right Cheek	0mm	Ant 0	DSI 2	26865	831.5	1	22.45	24.00	1.429	-0.13	0.336	0.480	0%
	2nd	LTE Band 26	15M	QPSK	1	0	-	Right Cheek	0mm	Ant 0	DSI 2	26865	831.5	1	22.45	24.00	1.429	0.08	0.335	0.479	
	1st	FR1 n26	20M	QPSK	50	28	DFT-15	Right Cheek	0mm	Ant 4	DSI 2	166300	831.5	1	21.89	23.00	1.291	0.1	0.698	0.901	9%
04	2nd	FR1 n26	20M	QPSK	50	28	DFT-15	Right Cheek	0mm	Ant 4	DSI 2	166300	831.5	1	21.89	23.00	1.291	0.08	0.763	**0.985**	
	1st	FR1 n26	20M	QPSK	50	28	DFT-15	Right Cheek	0mm	Ant 0	DSI 2	166300	831.5	1	22.80	24.00	1.318	0.05	0.283	0.373	-11%
	2nd	FR1 n26	20M	QPSK	50	28	DFT-15	Right Cheek	0mm	Ant 0	DSI 2	166300	831.5	1	22.80	24.00	1.318	0.09	0.256	0.337	
1900MHz																					
	1st	GSM1900	-	-	-	-	GPRS 2 Tx slots	Right Cheek	0mm	Ant 0	DSI 2	661	1880	1	27.10	28.00	1.230	-0.07	0.187	0.230	9%
05	2nd	GSM1900	-	-	-	-	GPRS 2 Tx slots	Right Cheek	0mm	Ant 0	DSI 2	661	1880	1	27.10	28.00	1.230	0.01	0.205	**0.252**	
	1st	WCDMA II	-	-	-	-	RMC 12.2Kbps	Right Cheek	0mm	Ant 0	DSI 2	9400	1880	1	22.58	24.00	1.387	-0.07	0.276	0.383	2%
06	2nd	WCDMA II	-	-	-	-	RMC 12.2Kbps	Right Cheek	0mm	Ant 0	DSI 2	9400	1880	1	22.58	24.00	1.387	0.07	0.282	**0.391**	
	1st	LTE Band 25	20M	QPSK	1	0	-	Right Tilted	0mm	Ant 4	DSI 2	26140	1860	1	16.80	18.00	1.318	-0.15	0.660	0.870	11%
07	2nd	LTE Band 2	20M	QPSK	1	0	-	Right Tilted	0mm	Ant 4	DSI 2	18900	1880	1	16.80	18.00	1.318	0.05	0.740	**0.976**	
	1st	LTE Band 25	20M	QPSK	1	0	-	Right Cheek	0mm	Ant 0	DSI 2	26340	1880	1	22.55	24.00	1.396	0.02	0.193	0.269	23%
	2nd	LTE Band 2	20M	QPSK	1	0	-	Right Cheek	0mm	Ant 0	DSI 2	18900	1880	1	22.55	24.00	1.396	0.01	0.251	0.350	

Plot No.	No.	Band	BW (MHz)	Modulation	RB Size	RB offset	Mode	Test Position	Gap (mm)	Antenna	Power State	Ch.	Freq. (MHz)	Sample	Average Power (dBm)	Tune-Up Limit (dBm)	Tune-up Scaling Factor	Duty Cycle %	Duty Cycle Scaling Factor	Power Drift (dB)	Measured 1g SAR (W/kg)	Reported 1g SAR (W/kg)	Deviation
2600MHz																							
	1st	LTE Band 7	20M	QPSK	1	0	-	Left Cheek	0mm	Ant 1	DSI 2	21350	2560	1	22.64	24.00	1.368	-	-	0.04	0.480	0.657	11%
	2nd	LTE Band 7	20M	QPSK	1	0	-	Left Cheek	0mm	Ant 1	DSI 2	21350	2560	1	22.64	24.00	1.368	-	-	0.1	0.541	0.740	
08	2nd	LTE Band 7	20M	QPSK	1	0	-	Right Cheek	0mm	Ant 4	DSI 2	21100	2535	1	14.46	15.50	1.271	-	-	0.1	0.676	0.859	
	2nd	LTE Band 7	20M	QPSK	1	0	-	Right Cheek	0mm	Ant 4	DSI 2	21100	2535	2	14.46	15.50	1.271	-	-	0.06	0.466	0.592	
	2nd	LTE Band 7	20M	QPSK	1	0	-	Right Tilted	0mm	Ant 4	DSI 2	21100	2535	1	14.46	15.50	1.271	-	-	-0.06	0.570	0.724	
	2nd	LTE Band 7	20M	QPSK	1	0	-	Left Cheek	0mm	Ant 4	DSI 2	21100	2535	1	14.46	15.50	1.271	-	-	0.14	0.217	0.276	
	2nd	LTE Band 7	20M	QPSK	1	0	-	Left Tilted	0mm	Ant 4	DSI 2	21100	2535	1	14.46	15.50	1.271	-	-	0.18	0.238	0.302	
	2nd	LTE Band 7	20M	QPSK	1	0	-	Right Cheek	0mm	Ant 4	DSI 2	20850	2510	1	14.31	15.50	1.315	-	-	-0.07	0.632	0.831	
	2nd	LTE Band 7	20M	QPSK	1	0	-	Right Cheek	0mm	Ant 4	DSI 2	21350	2560	1	14.27	15.50	1.327	-	-	-0.14	0.625	0.830	
	2nd	LTE Band 7	20M	QPSK	50	0	-	Right Cheek	0mm	Ant 4	DSI 2	21100	2535	1	14.45	15.50	1.274	-	-	0	0.653	0.832	
	2nd	LTE Band 7	20M	QPSK	50	0	-	Right Tilted	0mm	Ant 4	DSI 2	21100	2535	1	14.45	15.50	1.274	-	-	0.15	0.560	0.713	
	2nd	LTE Band 7	20M	QPSK	50	0	-	Left Cheek	0mm	Ant 4	DSI 2	21100	2535	1	14.45	15.50	1.274	-	-	-0.02	0.207	0.264	
	2nd	LTE Band 7	20M	QPSK	50	0	-	Left Tilted	0mm	Ant 4	DSI 2	21100	2535	1	14.45	15.50	1.274	-	-	-0.07	0.218	0.278	
	2nd	LTE Band 7	20M	QPSK	50	0	-	Right Cheek	0mm	Ant 4	DSI 2	20850	2510	1	14.24	15.50	1.337	-	-	-0.07	0.612	0.818	
	2nd	LTE Band 7	20M	QPSK	50	0	-	Right Cheek	0mm	Ant 4	DSI 2	21350	2560	1	14.25	15.50	1.334	-	-	0.17	0.605	0.807	
	2nd	LTE Band 7	20M	QPSK	100	0	-	Right Cheek	0mm	Ant 4	DSI 2	21100	2535	1	14.41	15.50	1.285	-	-	0.14	0.643	0.826	
	2nd	LTE Band 41	20M	QPSK	1	0	-	Right Cheek	0mm	Ant 4	DSI 2	40620	2593	1	16.54	17.00	1.112	62.9	1.006	0.19	0.643	0.719	
	2nd	LTE Band 41	20M	QPSK	1	0	-	Right Tilted	0mm	Ant 4	DSI 2	40620	2593	1	16.54	17.00	1.112	62.9	1.006	-0.16	0.640	0.716	
	2nd	LTE Band 41	20M	QPSK	1	0	-	Left Cheek	0mm	Ant 4	DSI 2	40620	2593	1	16.54	17.00	1.112	62.9	1.006	-0.1	0.244	0.273	
	2nd	LTE Band 41	20M	QPSK	1	0	-	Left Tilted	0mm	Ant 4	DSI 2	40620	2593	1	16.54	17.00	1.112	62.9	1.006	0.04	0.267	0.299	
	2nd	LTE Band 41	20M	QPSK	1	0	-	Right Cheek	0mm	Ant 4	DSI 2	39750	2506	1	16.42	17.00	1.143	62.9	1.006	0.08	0.637	0.732	
09	2nd	LTE Band 41	20M	QPSK	1	0	-	Right Cheek	0mm	Ant 4	DSI 2	40185	2549.5	1	16.33	17.00	1.167	62.9	1.006	-0.08	0.727	0.853	
	2nd	LTE Band 38C	20M	QPSK	1	0	-	Right Cheek	0mm	Ant 4	DSI 2	37901+38099	2585.1+2604.9	1	16.33	17.00	1.167	62.9	1.006	0.02	0.711	0.835	
	2nd	LTE Band 41	20M	QPSK	1	0	-	Right Cheek	0mm	Ant 4	DSI 2	41055	2636.5	1	16.48	17.00	1.127	62.9	1.006	0.07	0.611	0.693	
	2nd	LTE Band 41	20M	QPSK	1	0	-	Right Cheek	0mm	Ant 4	DSI 2	41490	2680	1	16.53	17.00	1.114	62.9	1.006	-0.06	0.641	0.719	
	2nd	LTE Band 41	20M	QPSK	1	0	-	Right Tilted	0mm	Ant 4	DSI 2	39750	2506	1	16.42	17.00	1.143	62.9	1.006	-0.1	0.644	0.740	
	2nd	LTE Band 41	20M	QPSK	1	0	-	Right Tilted	0mm	Ant 4	DSI 2	40185	2549.5	1	16.33	17.00	1.167	62.9	1.006	-0.16	0.685	0.804	
	2nd	LTE Band 41	20M	QPSK	1	0	-	Right Tilted	0mm	Ant 4	DSI 2	41055	2636.5	1	16.48	17.00	1.127	62.9	1.006	-0.17	0.589	0.668	
	2nd	LTE Band 41	20M	QPSK	1	0	-	Right Tilted	0mm	Ant 4	DSI 2	41490	2680	1	16.53	17.00	1.114	62.9	1.006	0.17	0.519	0.582	
	2nd	LTE Band 41 PC2	20M	QPSK	1	0	-	Right Cheek	0mm	Ant 4	DSI 2	40185	2549.5	1	17.92	18.60	1.169	42.9	1.009	-0.08	0.661	0.780	
	2nd	LTE Band 41	20M	QPSK	50	0	-	Right Cheek	0mm	Ant 4	DSI 2	40620	2593	1	16.50	17.00	1.122	62.9	1.006	-0.04	0.627	0.708	
	2nd	LTE Band 41	20M	QPSK	50	0	-	Right Tilted	0mm	Ant 4	DSI 2	40620	2593	1	16.50	17.00	1.122	62.9	1.006	0.17	0.624	0.704	
	2nd	LTE Band 41	20M	QPSK	50	0	-	Left Cheek	0mm	Ant 4	DSI 2	40620	2593	1	16.50	17.00	1.122	62.9	1.006	-0.03	0.238	0.269	
	2nd	LTE Band 41	20M	QPSK	50	0	-	Left Tilted	0mm	Ant 4	DSI 2	40620	2593	1	16.50	17.00	1.122	62.9	1.006	0.01	0.260	0.293	
	2nd	LTE Band 41	20M	QPSK	50	0	-	Right Cheek	0mm	Ant 4	DSI 2	39750	2506	1	16.35	17.00	1.161	62.9	1.006	-0.17	0.621	0.726	
	2nd	LTE Band 41	20M	QPSK	50	0	-	Right Cheek	0mm	Ant 4	DSI 2	40185	2549.5	1	16.30	17.00	1.175	62.9	1.006	0.12	0.644	0.761	
	2nd	LTE Band 41	20M	QPSK	50	0	-	Right Cheek	0mm	Ant 4	DSI 2	41055	2636.5	1	16.36	17.00	1.159	62.9	1.006	-0.19	0.596	0.695	
	2nd	LTE Band 41	20M	QPSK	50	0	-	Right Cheek	0mm	Ant 4	DSI 2	41490	2680	1	16.36	17.00	1.159	62.9	1.006	0.03	0.625	0.729	
	2nd	LTE Band 41	20M	QPSK	50	0	-	Right Tilted	0mm	Ant 4	DSI 2	39750	2506	1	16.35	17.00	1.161	62.9	1.006	0.13	0.628	0.734	
	2nd	LTE Band 41	20M	QPSK	50	0	-	Right Tilted	0mm	Ant 4	DSI 2	40185	2549.5	1	16.30	17.00	1.175	62.9	1.006	0	0.639	0.755	
	2nd	LTE Band 41	20M	QPSK	50	0	-	Right Tilted	0mm	Ant 4	DSI 2	41055	2636.5	1	16.36	17.00	1.159	62.9	1.006	-0.09	0.574	0.669	
	2nd	LTE Band 41	20M	QPSK	50	0	-	Right Tilted	0mm	Ant 4	DSI 2	41490	2680	1	16.36	17.00	1.159	62.9	1.006	0.06	0.506	0.590	
	2nd	LTE Band 41	20M	QPSK	100	0	-	Right Cheek	0mm	Ant 4	DSI 2	40620	2593	1	16.46	17.00	1.132	62.9	1.006	0.17	0.644	0.734	
	2nd	LTE Band 41	20M	QPSK	100	0	-	Right Tilted	0mm	Ant 4	DSI 2	40620	2593	1	16.46	17.00	1.132	62.9	1.006	0.17	0.641	0.730	
	2nd	LTE Band 41	20M	QPSK	1	0	-	Right Cheek	0mm	Ant 1	DSI 2	40620	2593	1	22.95	24.00	1.274	62.9	1.006	0.16	0.330	0.423	
	2nd	LTE Band 41	20M	QPSK	1	0	-	Right Tilted	0mm	Ant 1	DSI 2	40620	2593	1	22.95	24.00	1.274	62.9	1.006	-0.12	0.255	0.327	
	2nd	LTE Band 41	20M	QPSK	1	0	-	Left Cheek	0mm	Ant 1	DSI 2	40620	2593	1	22.95	24.00	1.274	62.9	1.006	0.11	0.544	0.697	
	2nd	LTE Band 41	20M	QPSK	1	0	-	Left Tilted	0mm	Ant 1	DSI 2	40620	2593	1	22.95	24.00	1.274	62.9	1.006	0.18	0.171	0.219	
	2nd	LTE Band 41	20M	QPSK	1	0	-	Left Cheek	0mm	Ant 1	DSI 2	39750	2506	1	22.93	24.00	1.279	62.9	1.006	0	0.550	0.708	
	2nd	LTE Band 41	20M	QPSK	1	0	-	Left Cheek	0mm	Ant 1	DSI 2	40185	2549.5	1	22.92	24.00	1.282	62.9	1.006	-0.04	0.525	0.677	
	2nd	LTE Band 41	20M	QPSK	1	0	-	Left Cheek	0mm	Ant 1	DSI 2	41055	2636.5	1	22.75	24.00	1.334	62.9	1.006	-0.12	0.558	0.749	

	2nd	LTE Band 41	20M	QPSK	1	0	-	Left Cheek	0mm	Ant 1	DSI 2	41490	2680	1	22.46	24.00	1.426	62.9	1.006	0.19	0.455	0.653	
	2nd	LTE Band 41	20M	QPSK	50	0	-	Right Cheek	0mm	Ant 1	DSI 2	40620	2593	1	21.89	23.00	1.291	62.9	1.006	-0.13	0.264	0.343	
	2nd	LTE Band 41	20M	QPSK	50	0	-	Right Tilted	0mm	Ant 1	DSI 2	40620	2593	1	21.89	23.00	1.291	62.9	1.006	0.14	0.200	0.260	
	2nd	LTE Band 41	20M	QPSK	50	0	-	Left Cheek	0mm	Ant 1	DSI 2	40620	2593	1	21.89	23.00	1.291	62.9	1.006	-0.17	0.519	0.674	
	2nd	LTE Band 41	20M	QPSK	50	0	-	Left Tilted	0mm	Ant 1	DSI 2	40620	2593	1	21.89	23.00	1.291	62.9	1.006	0	0.139	0.181	
	2nd	LTE Band 41	20M	QPSK	50	0	-	Left Cheek	0mm	Ant 1	DSI 2	39750	2506	1	21.86	23.00	1.300	62.9	1.006	0.04	0.512	0.670	
	2nd	LTE Band 41	20M	QPSK	50	0	-	Left Cheek	0mm	Ant 1	DSI 2	40185	2549.5	1	21.84	23.00	1.306	62.9	1.006	0.06	0.507	0.666	
	2nd	LTE Band 41	20M	QPSK	50	0	-	Left Cheek	0mm	Ant 1	DSI 2	41055	2636.5	1	21.73	23.00	1.340	62.9	1.006	0.07	0.528	0.712	
	2nd	LTE Band 41	20M	QPSK	50	0	-	Left Cheek	0mm	Ant 1	DSI 2	41490	2680	1	21.63	23.00	1.371	62.9	1.006	-0.16	0.500	0.690	
	2nd	LTE Band 41	20M	QPSK	100	0	-	Left Cheek	0mm	Ant 1	DSI 2	40620	2593	1	21.82	23.00	1.312	62.9	1.006	-0.17	0.433	0.572	
	1st	FR1 n7	40M	QPSK	1	1	DFT-15	Right Cheek	0mm	Ant 4	DSI 2	507000	2535	1	14.41	15.50	1.285	-	-	0.05	0.711	0.914	-5%
10	2nd	FR1 n7	40M	QPSK	1	1	DFT-15	Right Cheek	0mm	Ant 4	DSI 2	507000	2535	1	14.41	15.50	1.285	-	-	0.19	0.677	**0.870**	
	1st	FR1 n7	40M	QPSK	108	54	DFT-15	Left Cheek	0mm	Ant 1	DSI 2	507000	2535	1	22.80	24.00	1.318	-	-	0.14	0.455	0.600	20%
	2nd	FR1 n7	40M	QPSK	108	54	DFT-15	Left Cheek	0mm	Ant 1	DSI 2	507000	2535	1	22.80	24.00	1.318	-	-	0.03	0.571	0.753	
	1st	FR1 n41	100M	QPSK	1	1	DFT-30	Right Cheek	0mm	Ant 4	DSI 2	518598	2592.99	1	14.16	15.50	1.361	-	-	0.01	0.626	0.852	11%
11	2nd	FR1 n41	100M	QPSK	1	1	DFT-30	Right Cheek	0mm	Ant 4	DSI 2	518598	2592.99	1	14.16	15.50	1.361	-	-	0.01	0.705	**0.960**	
3000MHz-4000MHz																							
	1st	LTE Band 42	20M	QPSK	1	0	-	Left Cheek	0mm	Ant 5	DSI 2	42590	3500	1	15.01	16.50	1.409	62.9	1.006	0.09	0.607	0.861	2%
12	2nd	LTE Band 42	20M	QPSK	1	0	-	Left Cheek	0mm	Ant 5	DSI 2	42590	3500	1	15.01	16.50	1.409	62.9	1.006	0.15	0.618	**0.876**	
	2nd	FR1 n77	100M	QPSK	1	1	DFT-30	Right Cheek	0mm	Ant 5	DSI 2	656000	3840	1	12.82	14.50	1.472	-	-	0.18	0.469	0.691	
	2nd	FR1 n77	100M	QPSK	1	1	DFT-30	Right Tilted	0mm	Ant 5	DSI 2	656000	3840	1	12.82	14.50	1.472	-	-	-0.03	0.541	0.797	
	2nd	FR1 n77	100M	QPSK	1	1	DFT-30	Left Cheek	0mm	Ant 5	DSI 2	656000	3840	1	12.82	14.50	1.472	-	-	0.09	0.589	0.867	
13	2nd	FR1 n77	100M	QPSK	1	1	DFT-30	Left Tilted	0mm	Ant 5	DSI 2	656000	3840	1	12.82	14.50	1.472	-	-	0.11	0.611	**0.900**	
	2nd	FR1 n77	100M	QPSK	1	1	DFT-30	Left Tilted	0mm	Ant 5	DSI 2	656000	3840	2	12.82	14.50	1.472	-	-	0.03	0.534	0.786	
	2nd	FR1 n77	100M	QPSK	135	69	DFT-30	Right Cheek	0mm	Ant 5	DSI 2	656000	3840	1	12.76	14.50	1.493	-	-	-0.16	0.453	0.676	
	2nd	FR1 n77	100M	QPSK	135	69	DFT-30	Right Tilted	0mm	Ant 5	DSI 2	656000	3840	1	12.76	14.50	1.493	-	-	-0.04	0.515	0.769	
	2nd	FR1 n77	100M	QPSK	135	69	DFT-30	Left Cheek	0mm	Ant 5	DSI 2	656000	3840	1	12.76	14.50	1.493	-	-	-0.01	0.559	0.834	
	2nd	FR1 n77	100M	QPSK	135	69	DFT-30	Left Tilted	0mm	Ant 5	DSI 2	656000	3840	1	12.76	14.50	1.493	-	-	0.11	0.583	0.870	
	2nd	FR1 n77	100M	QPSK	270	0	DFT-30	Right Cheek	0mm	Ant 5	DSI 2	656000	3840	1	12.74	14.50	1.500	-	-	-0.13	0.448	0.672	
	2nd	FR1 n77	100M	QPSK	270	0	DFT-30	Right Tilted	0mm	Ant 5	DSI 2	656000	3840	1	12.74	14.50	1.500	-	-	0.06	0.518	0.777	
	2nd	FR1 n77	100M	QPSK	270	0	DFT-30	Left Cheek	0mm	Ant 5	DSI 2	656000	3840	1	12.74	14.50	1.500	-	-	-0.09	0.549	0.823	
	2nd	FR1 n77	100M	QPSK	270	0	DFT-30	Left Tilted	0mm	Ant 5	DSI 2	656000	3840	1	12.74	14.50	1.500	-	-	0.01	0.575	0.862	
	2nd	FR1 n77	100M	QPSK	1	1	DFT-30	Right Cheek	0mm	Ant 2	DSI 2	656000	3840	1	20.45	21.50	1.274	-	-	-0.02	0.093	0.118	
	2nd	FR1 n77	100M	QPSK	1	1	DFT-30	Right Tilted	0mm	Ant 2	DSI 2	656000	3840	1	20.45	21.50	1.274	-	-	-0.01	0.066	0.084	
	2nd	FR1 n77	100M	QPSK	1	1	DFT-30	Left Cheek	0mm	Ant 2	DSI 2	656000	3840	1	20.45	21.50	1.274	-	-	-0.14	0.051	0.065	
	2nd	FR1 n77	100M	QPSK	1	1	DFT-30	Left Tilted	0mm	Ant 2	DSI 2	656000	3840	1	20.45	21.50	1.274	-	-	0	0.006	0.008	
	2nd	FR1 n77	100M	QPSK	135	69	DFT-30	Right Cheek	0mm	Ant 2	DSI 2	656000	3840	1	20.25	21.50	1.334	-	-	0.14	0.079	0.105	
	2nd	FR1 n77	100M	QPSK	135	69	DFT-30	Right Tilted	0mm	Ant 2	DSI 2	656000	3840	1	20.25	21.50	1.334	-	-	-0.19	0.055	0.073	
	2nd	FR1 n77	100M	QPSK	135	69	DFT-30	Left Cheek	0mm	Ant 2	DSI 2	656000	3840	1	20.25	21.50	1.334	-	-	-0.04	0.042	0.056	
	2nd	FR1 n77	100M	QPSK	135	69	DFT-30	Left Tilted	0mm	Ant 2	DSI 2	656000	3840	1	20.25	21.50	1.334	-	-	-0.16	0.004	0.005	
	2nd	FR1 n77	100M	QPSK	1	1	DFT-30	Right Cheek	0mm	Ant 8	DSI 2	656000	3840	1	24.32	26.00	1.472	-	-	-0.12	0.107	0.158	
	2nd	FR1 n77	100M	QPSK	1	1	DFT-30	Right Tilted	0mm	Ant 8	DSI 2	656000	3840	1	24.32	26.00	1.472	-	-	-0.12	0.112	0.165	
	2nd	FR1 n77	100M	QPSK	1	1	DFT-30	Left Cheek	0mm	Ant 8	DSI 2	656000	3840	1	24.32	26.00	1.472	-	-	-0.1	0.152	0.224	
	2nd	FR1 n77	100M	QPSK	1	1	DFT-30	Left Tilted	0mm	Ant 8	DSI 2	656000	3840	1	24.32	26.00	1.472	-	-	0.02	0.143	0.211	
	2nd	FR1 n77	100M	QPSK	135	69	DFT-30	Right Cheek	0mm	Ant 8	DSI 2	656000	3840	1	24.16	26.00	1.528	-	-	-0.05	0.090	0.137	
	2nd	FR1 n77	100M	QPSK	135	69	DFT-30	Right Tilted	0mm	Ant 8	DSI 2	656000	3840	1	24.16	26.00	1.528	-	-	-0.1	0.097	0.148	
	2nd	FR1 n77	100M	QPSK	135	69	DFT-30	Left Cheek	0mm	Ant 8	DSI 2	656000	3840	1	24.16	26.00	1.528	-	-	0.09	0.129	0.197	
	2nd	FR1 n77	100M	QPSK	135	69	DFT-30	Left Tilted	0mm	Ant 8	DSI 2	656000	3840	1	24.16	26.00	1.528	-	-	-0.17	0.111	0.170	
	2nd	FR1 n77	100M	QPSK	1	1	DFT-30	Right Cheek	0mm	Ant 1	DSI 2	656000	3840	1	20.37	21.50	1.297	-	-	0	0.225	0.292	
	2nd	FR1 n77	100M	QPSK	1	1	DFT-30	Right Tilted	0mm	Ant 1	DSI 2	656000	3840	1	20.37	21.50	1.297	-	-	-0.05	0.228	0.296	
	2nd	FR1 n77	100M	QPSK	1	1	DFT-30	Left Cheek	0mm	Ant 1	DSI 2	656000	3840	1	20.37	21.50	1.297	-	-	-0.15	0.351	0.455	
	2nd	FR1 n77	100M	QPSK	1	1	DFT-30	Left Tilted	0mm	Ant 1	DSI 2	656000	3840	1	20.37	21.50	1.297	-	-	-0.06	0.161	0.209	
	2nd	FR1 n77	100M	QPSK	135	69	DFT-30	Right Cheek	0mm	Ant 1	DSI 2	656000	3840	1	20.35	21.50	1.303	-	-	0.01	0.239	0.311	
	2nd	FR1 n77	100M	QPSK	135	69	DFT-30	Right Tilted	0mm	Ant 1	DSI 2	656000	3840	1	20.35	21.50	1.303	-	-	0.17	0.270	0.352	
	2nd	FR1 n77	100M	QPSK	135	69	DFT-30	Left Cheek	0mm	Ant 1	DSI 2	656000	3840	1	20.35	21.50	1.303	-	-	-0.13	0.393	0.512	
	2nd	FR1 n77	100M	QPSK	135	69	DFT-30	Left Tilted	0mm	Ant 1	DSI 2	656000	3840	1	20.35	21.50	1.303	-	-	-0.17	0.184	0.240	