FCC SAR TEST REPORT

Name of Sample: Mobile Cellular Phone

Model of Sample: XT2429-1

Applicant: Motorola Mobility LLC

Issued Date: Mar. 21, 2024

ADR TEST AND CERTIFICATION CENTER

Motorola Mobility LLC, a Lenovo Company

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Name of Client	**Motorola Mobility LLC**		
Address of Client	**222 W, Merchandise Mart Plaza, Chicago IL 60654 USA**		
Trademark	**Motorola**	**FCC ID**	**IHDT56AR4**
Applicant No.	**RF173570**	**Sample No.**	**NGCL2N0310 NGCL2N0245 NGCL2N0125 NGCL2N0590 NGCL2N0440 NGCLC30127**
Delivering Date	**Jan. 28, 2024**	**Test Date(s)**	**Jan. 30, 2024 ~ Mar. 13, 2024**
Sample Illustration	**None**		
Standard	**FCC 47 CFR Part 2(2.1093)**		
Remarks	**None**		

Editor: Gavin Gao **Auditor: Xingwei Zhang** **Approver: Huangsheng Lin**

Gavin Gao Xingwei Zhang Huangsheng Lin

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Revision History

Report No.	Version	Description	Issued Date
24ADRTCC6003	Rev.01	Initial issue of report	Mar. 21, 2024
24ADRTCC6003	Rev.02	Add Chapter 1 Second Source Information remarks	Apr. 07, 2024
24ADRTCC6003	Rev.03	Add Appendix G Power reduction mechanism verification	Apr. 15, 2024

Catalogue

1. Statement of Compliance

The maximum results of Specific Absorption Rate (SAR) found during testing for Motorola Mobility LLC, Mobile Cellular Phone, XT2429-1, are as follows.

Test Summary					
Frequency Band		Highest Reported SAR(W/kg)			
		1g SAR			10g SAR
		Head (Gap: 0mm)	Body-worn (Gap: 5mm)	Hotspot (Gap: 5mm)	Product Specific 10g SAR (Gap: 0mm)
GSM	GSM850	0.13	0.93	0.93	/
	GSM1900	0.19	0.86	1.24	2.05
WCDMA	WCDMA Band II	0.39	1.12	1.04	2.74
	WCDMA Band IV	0.20	1.27	0.97	2.79
	WCDMA Band V	0.22	1.14	1.13	/
LTE	LTE Band 7	0.76	0.99	1.24	2.88
	LTE Band 12(B17)	0.98	0.78	1.05	/
	LTE Band 13	0.76	0.66	0.66	/
	LTE Band 25(B2)	0.73	1.11	1.30	2.33
	LTE Band 26(B5)	0.75	1.10	1.15	/
	LTE Band 66(B4)	0.75	1.27	1.15	2.60
	LTE Band 41(B38)	0.70	0.74	1.23	2.41
	LTE Band 42	0.68	0.94	0.61	2.40
5G NR	FR1 n2	0.74	1.23	1.13	2.55
	FR1 n5	0.79	1.12	1.22	/
	FR1 n7	0.77	0.97	1.23	2.83
	FR1 n26	0.71	0.84	0.69	/
	FR1 n41(n38)	0.25	1.05	1.19	2.86
	FR1 n66	0.90	1.17	1.14	2.73
	FR1 n78	0.85	1.07	1.16	2.97
WLAN	WLAN 2.4GHz	1.22	0.98	0.82	/
	WLAN 5GHz	1.14	1.15	0.93	3.01
Bluetooth	Bluetooth	0.27	0.18	0.18	/
Highest Simultaneous Transmission SAR(W/kg)		1.59	1.58	1.57	3.99
SAR Limit(W/kg)		1.6			4.0

Remark:

1) There are two samples (1st source and 2nd source), the different between them refer to the XT2429-1_Operational Description of Product Equality Declaration which is exhibit separately. According to the differences, 1st source was chosen to perform full SAR testing and 2nd source verified the worst case of 1st source.
2) This device supports LTE B2 / B4 / B5 / B17 / B38 and B25 / B66 / B26 / B12 / B41. Since the supported frequency span for LTE B2 / B4 / B5 / B17 / B38 falls completely within the support frequency span for LTE B25 / B66 / B26 /B12 / 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 B25, B66, B26, B12, B41.

3) This device supports 5G NR n38 and n41. Since the supported frequency span for 5G NR n38 falls completely within the support frequency span for n41, both 5G NR bands have the same target power, and both 5G NR bands share the same transmission path; therefore, SAR was only assessed for n41.

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. General Information

2.1. Details of Client

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

2.2. Testing Laboratory

Testing LAB	ADR TEST AND CERTIFICATION CENTER
Test Site Location	No. 19, Gao Xin 4th Road Wuhan, People's Republic of China (430205)
TEL	027-81806505
FAX	027-81806512
E-mail	lucz1@motorola.com

2.3. Laboratory Qualification

·A2LA (Certificate No. 3680.01)
ADR TEST AND CERTIFICATION CENTER is accredited to ISO/IEC 17025:2017 by American Association for Laboratory Accreditation with Certificate Number 3680.01.

3. Test Specification Guidance

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

Specification number	Document title
FCC 47 CFR Part 2 (2.1093)	Radiofrequency Radiation Exposure Evaluation: Portable Devices
ANSI/IEEE C95.1-1992	IEEE Standard for Safety Levels with Respect to Human Exposure to Radio Frequency Electromagnetic Fields, 3 kHz to 300 GHz
IEEE Std 1528-2013	IEEE Recommended Practice for Determining the Peak Spatial-Average Specific Absorption Rate (SAR) in the Human Head from Wireless Communications Devices: Measurement Techniques
FCC KDB 865664 D01	SAR Measurement 100 MHz to 6 GHz v01r04
FCC KDB 865664 D02	RF Exposure Reporting v01r02
FCC KDB 447498 D01	General RF Exposure Guidance v06
FCC KDB 941225 D01	3G SAR Procedures v03r01
FCC KDB 941225 D05	SAR for LTE Devices v02r05
FCC KDB 941225 D05A	LTE Rel.10 KDB Inquiry Sheet v01r02
FCC KDB 941225 D06	Hot Spot SAR v02r01
FCC KDB 648474 D04	Handset SAR v01r03
FCC KDB 248227 D01	802.11 Wi-Fi SAR v02r02
FCC KDB 616217 D04	SAR for laptop and tablets v01r02

4. Equipment Under Test (EUT) Information

4.1. General Description

Product Name:	Mobile Cellular Phone	
Model Name:	XT2429-1	
Brand Name:	Motorola	
FCC ID:	IHDT56AR4	
Device Type:	Portable Device	
Exposure Category:	Uncontrolled Environment / General Population	
EUT Phase:	Identical Prototype	
Sample IMEI:	NGCL2N0310: IMEI1: 366305710028435 IMEI2: 356305710028443 NGCL2N0245: IMEI1: 356305710028294 IMEI2: 356305710028302 NGCL2N0125: IMEI1: 356305710027734 IMEI2: 356305710027742 NGCL2N0590: IMEI1: 356305710028559 IMEI2: 356305710028567 NGCL2N0440: IMEI1: 356305710028096 IMEI2: 356305710028104 NGCLC30127: IMEI1: 356305710045579 IMEI2: 356305710045587	
HW Version:	DVT2	
SW Version:	U2UU34.7	
Device Operating Configurations:		
Modulation Mode:	GSM: GMSK, 8PSK; WCDMA: RMC/AMR 12.2Kbps, HSDPA, HSUPA, DC-HSDPA, HSPA+; LTE: QPSK,16QAM,64QAM,256QAM; 5G NR: CP-OFDM / DFT-s-OFDM, P1/2 BPSK, QPSK,16QAM,64QAM,256QAM; Wi-Fi: DSSS, OFDM; BT: GFSK, π/4DQPSK,8DPSK NFC: ASK	
Device Class:	GSM/EDGE Transfer Mode: Class B	
	GPRS Multi-slots Class: 12; EGPRS Multi-slots Class: 12	
	HSDPA UE Category: 24; HSUPA UE Category: 7	
Power Class:	4, tested with power level 5(GSM850) 1, tested with power level 0(GSM1900) 3, tested with power control "all 1"(WCDMA Band) 3, tested with power control "Max Power"(LTE Band)	

	Band: Tx (MHz)
Frequency Range:	GSM850: 824~849 GSM1900: 1850~1910 WCDMA Band II: 1850~1910 WCDMA Band IV: 1710~1755 WCDMA Band V: 824~849 LTE Band 2: 1850~1910 LTE Band 4: 1710~1755 LTE Band 5: 824~849 LTE Band 7: 2500~2570 LTE Band 12: 699~716 LTE Band 13: 777~787 LTE Band 17: 704~716 LTE Band 25: 1850~1915 LTE Band 26: 814~849 LTE Band 38: 2570~2620 LTE Band 41: 2496~2690 LTE Band 42: 3450~3550 LTE Band 66: 1710~1780 5G NR n2: 1850~1910 5G NR n5: 824~849 5G NR n7: 2500~2570 5G NR n26: 814~849 5G NR n38: 2570~2620 5G NR n41: 2496~2690 5G NR n66: 1710~1780 5G NR n78: 3450~3550 Wi-Fi 2.4GHz: 2412~2462 Wi-Fi 5.2GHz: 5180~5240 Wi-Fi 5.3GHz: 5260~5320 Wi-Fi 5.5GHz: 5500~5720 Wi-Fi 5.8GHz: 5745~5825 Bluetooth: 2402~2480 NFC: 13.56

EUT 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 Wi-Fi Direct (GC/GO), and 5.3GHz / 5.5GHz supports Wi-Fi Direct (GC only).
4) This device does not support DTM operation and supports GPRS/EGPRS mode up to multi-slot class12.
5) For dual SIM card mobile has two SIM slots and supports dual SIM dual standby. The WWAN radio transmission will be enabled by either one SIM at a time (single active). After pre-scan two

SIM cards power, we found test result of the SIM1 was the worse, so we chose SIM1 slot to perform all tests.

6) 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.
7) For WLAN when transmit simultaneous with WWAN, power reduction will be activated to head. For WLAN when transmit simultaneous with WWAN and Proximity sensors trigger, power reduction will be activated to body-worn and Handheld.
8) For some WWAN bands, sensor on reduced power level is higher than hotspot reduced power level, so front/back sensor on SAR can represent hotspot conservatively.
9) This device implements antenna tuning techniques for several WWAN (cellular) operating modes and frequencies for the purpose of improving antenna efficiency over a broad range of frequencies. Specifically, these techniques are employed in the LTE and 5G NR modes. In this report SAR was measured according to the normally required SAR configurations with the tuner active and worst tune state (auto tune) was used for SAR testing. The detail descriptions of the antenna tuner and supplemental data for additional information can be referred to section5 and appendix F.
10) For 5G NR test, using FTM (Factory Test Mode) to perform SAR with default 100% transmission.
11) 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.
12) 5G NR NSA mode, the power level is the same as 5G NR SA mode, so 5G NR NSA mode and SA mode power table only show one time.
13) 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.
14) 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.
15) This device supports 5G NR FR1 bands as following table, including NSA mode and SA mode. NSA and SA mode performed SAR separately.

5G NR n26 only supports SA mode, n2/n5/n7/n38/n41/n66/n78 support both SA and NSA mode, as follows.

Mode	Band	Duplex	SCS (kHz)	Bandwidths (BW)
NSA	n2	FDD	15	5, 10, 15, 20
	n5	FDD	15	5, 10, 15, 20, 25
	n7	FDD	15	5, 10, 15, 20, 25, 30, 40
	n38	TDD	30	10, 15, 20, 30, 40
	n41	TDD	30	10, 15, 20, 30, 40, 50, 60, 70, 80, 90, 100
	n66	FDD	15	5, 10, 15, 20, 25, 30, 35, 40
	n78	TDD	30	10, 15, 20, 30, 40, 50, 60, 70, 80, 90, 100
SA	n2	FDD	15	5, 10, 15, 20
	n5	FDD	15	5, 10, 15, 20, 25
	n7	FDD	15	5, 10, 15, 20, 25, 30, 40
	n26	FDD	15	5, 10, 15, 20
	n38	TDD	30	10, 15, 20, 30, 40
	n41	TDD	30	10, 15, 20, 30, 40, 50, 60, 70, 80, 90, 100
	n66	FDD	15	5, 10, 15, 20, 25, 30, 35, 40
	n78	TDD	30	10, 15, 20, 30, 40, 50, 60, 70, 80, 90, 100

4.2. Special Considerations

<Transmission(L,M,H) channel numbers and frequencies in each LTE Band>

LTE Band 2	BW	1.4MHz		3MHz		5MHz		10MHz		15MHz		20MHz	
		Ch.	Freq.(MHz)	Ch.	Freq.(MHz)	Ch.	Freq.(MHz)	Ch.	Freq.(MHz)	Ch.	Freq.(MHz)	Ch.	Freq.(MHz)
	L	18607	1850.7	18615	1851.5	18625	1852.5	18650	1855	18675	1857.5	18700	1860
	M	18900	1880	18900	1880	18900	1880	18900	1880	18900	1880	18900	1880
	H	19193	1909.3	19185	1908.5	19175	1907.5	19150	1905	19125	1902.5	19100	1900

LTE Band 4	BW	1.4MHz		3MHz		5MHz		10MHz		15MHz		20MHz	
		Ch.	Freq.(MHz)	Ch.	Freq.(MHz)	Ch.	Freq.(MHz)	Ch.	Freq.(MHz)	Ch.	Freq.(MHz)	Ch.	Freq.(MHz)
	L	19957	1710.7	19965	1711.5	19975	1712.5	20000	1715	20025	1717.5	20050	1720
	M	20175	1732.5	20175	1732.5	20175	1732.5	20175	1732.5	20175	1732.5	20175	1732.5
	H	20393	1754.5	20385	1753.5	20375	1752.5	20350	1750	20325	1747.5	20300	1745

LTE Band 5	BW	1.4MHz		3MHz		5MHz		10MHz	
		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	BW	5MHz		10MHz		15MHz		20MHz	
		Ch.	Freq.(MHz)	Ch.	Freq.(MHz)	Ch.	Freq.(MHz)	Ch.	Freq.(MHz)
	L	20775	2502.5	20800	2505	20825	2507.5	20850	2510
	M	21100	2535	21100	2535	21100	2535	21100	2535
	H	21425	2567.5	21400	2565	21375	2562.5	21350	2560

LTE Band 12	BW	1.4MHz		3MHz		5MHz		10MHz	
		Ch.	Freq.(MHz)	Ch.	Freq.(MHz)	Ch.	Freq.(MHz)	Ch.	Freq.(MHz)
	L	23017	699.7	23025	700.5	23035	701.5	23060	704
	M	23095	707.5	23095	707.5	23095	707.5	23095	707.5
	H	23173	715.3	23165	714.5	23155	713.5	23130	711

LTE Band 13	BW	5MHz		10MHz	
		Ch.	Freq.(MHz)	Ch.	Freq.(MHz)
	L	23205	779.5		
	M	23230	782	23230	782
	H	23255	784.5		

LTE Band 17	BW	5MHz		10MHz	
		Ch.	Freq.(MHz)	Ch.	Freq.(MHz)
	L	23755	706.5	23780	709
	M	23790	710	23790	710
	H	23825	713.5	23800	711

LTE Band 25	BW	1.4MHz		3MHz		5MHz		10MHz		15MHz		20MHz	
		Ch.	Freq.(MHz)	Ch.	Freq.(MHz)	Ch.	Freq.(MHz)	Ch.	Freq.(MHz)	Ch.	Freq.(MHz)	Ch.	Freq.(MHz)
	L	26047	1850.7	26055	1851.5	26065	1852.5	26090	1855	26115	1857.5	26140	1860
	M	26340	1880	26340	1880	26340	1880	26340	1880	26340	1880	26340	1880
	H	26683	1914.3	26675	1913.5	26665	1912.5	26640	1910	26615	1907.5	26590	1905

LTE Band 26	BW	1.4MHz		3MHz		5MHz		10MHz		15MHz	
		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	BW	5MHz		10MHz		15MHz		20MHz	
		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	BW	5MHz		10MHz		15MHz		20MHz	
		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	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	BW	5MHz		10MHz		15MHz		20MHz	
		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

LTE Band 66	BW	1.4MHz		3MHz		5MHz		10MHz		15MHz		20MHz	
		Ch.	Freq.(MHz)	Ch.	Freq.(MHz)	Ch.	Freq.(MHz)	Ch.	Freq.(MHz)	Ch.	Freq.(MHz)	Ch.	Freq.(MHz)
	L	131979	1710.7	131987	1711.5	131997	1712.5	132022	1715	132047	1717.5	132072	1720
	M	132322	1745	132322	1745	132322	1745	132322	1745	132322	1745	132322	1745
	H	132665	1779.5	132657	1778.5	132647	1777.5	132622	1775	132597	1772.5	132572	1770

(1) 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 2	Yes	Yes	Yes	Yes	Yes	Yes
LTE Band 25	Yes	Yes	Yes	Yes	Yes	Yes
LTE Band 4	Yes	Yes	Yes	Yes	Yes	Yes
LTE Band 66	Yes	Yes	Yes	Yes	Yes	Yes
LTE Band 12	Yes	Yes	Yes	Yes	/	/
LTE Band 17	/	/	Yes	Yes	/	/
LTE Band 5	Yes	Yes	Yes	Yes	/	/
LTE Band 26	Yes	Yes	Yes	Yes	Yes	/
LTE Band 38	/	/	Yes	Yes	Yes	Yes
LTE Band 41	/	/	Yes	Yes	Yes	Yes

2) LTE Bands Tune-up Limit

Band	**Antenna**	**Head DSI 2 Tune-up**	**Body-worn DSI 3 Tune-up**	**Hotspot DSI 7 Tune-up**	**Extremity DSI 6 Tune-up**	**Sensor off DSI 4 Tune-up**
LTE Band 12	ANT0	24.00	24.00	24.00	24.00	24.00
LTE Band 17	ANT0	24.00	24.00	24.00	24.00	24.00
LTE Band 12	ANT4	23.00	23.00	23.00	23.00	23.00
LTE Band 17	ANT4	23.00	23.00	23.00	23.00	23.00
LTE Band 26	ANT0	24.00	24.00	24.00	24.00	24.00
LTE Band 5	ANT0	24.00	24.00	24.00	24.00	24.00
LTE Band 26	ANT4	21.50	21.50	21.50	21.50	21.50
LTE Band 5	ANT4	21.50	21.50	21.50	21.50	21.50
LTE Band 66	ANT1	24.00	21.50	21.00	23.50	24.00
LTE Band 4	ANT1	24.00	21.50	21.00	23.50	24.00
LTE Band 66	ANT4	19.00	18.00	17.00	21.50	21.50
LTE Band 4	ANT4	19.00	18.00	17.00	21.50	21.50
LTE Band 25	ANT1	23.50	21.50	23.50	23.50	23.50
LTE Band 2	ANT1	23.50	21.50	23.50	23.50	23.50
LTE Band 25	ANT4	19.00	19.00	14.00	18.00	22.50
LTE Band 2	ANT4	19.00	19.00	14.00	18.00	22.50
LTE Band 41	ANT1	24.00	24.00	24.00	24.00	24.00
LTE Band 38	ANT1	24.00	24.00	24.00	24.00	24.00
LTE Band 41	ANT4	17.50	19.00	17.00	21.00	23.00
LTE Band 38	ANT4	17.50	19.00	17.00	21.00	23.00

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

5G NR n2 BW	5MHz		10MHz		15MHz		20MHz	
	Ch.	Freq.(MHz)	Ch.	Freq.(MHz)	Ch.	Freq.(MHz)	Ch.	Freq.(MHz)
L	370500	1852.2	371000	1855	371500	1857.5	372000	1860
M	376000	1880	376000	1880	376000	1880	376000	1880
H	381500	1907.5	381000	1905	380500	1902.5	380000	1900

5G NR n5 BW	5MHz		10MHz		15MHz		20MHz		25MHz	
	Ch.	Freq.(MHz)	Ch.	Freq.(MHz)	Ch.	Freq.(MHz)	Ch.	Freq.(MHz)	Ch.	Freq.(MHz)
L	164800	824	165300	826.5	165800	829	166300	831.5	166800	834
M	167300	836.5	167300	836.5	167300	836.5	167300	836.5	167300	836.5
H	169800	849	169300	846.5	168800	844	168300	841.5	167800	839

5G NR n7 BW	5MHz		10MHz		15MHz		20MHz		25MHz		30MHz		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

5G NR n26 BW	5MHz		10MHz		15MHz		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

5G NR n66 BW	5MHz		10MHz		15MHz		20MHz		25MHz		30MHz		35MHz		40MHz	
	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	342500	1712.5	343000	1715	343500	1717.5	344000	1720	344500	1722.5	345000	1725	345500	1727.5	346000	1730
M	349000	1745	349000	1745	349000	1745	349000	1745	349000	1745	349000	1745	349000	1745	349000	1745
H	355500	1777.5	355000	1775	354500	1772.5	354000	1770	353500	1767.5	353000	1765	352500	1762.5	352000	1760

5G NR n38 BW	10MHz		15MHz		20MHz		30MHz		40MHz	
	Ch.	Freq.(MHz)	Ch.	Freq.(MHz)	Ch.	Freq.(MHz)	Ch.	Freq.(MHz)	Ch.	Freq.(MHz)
L	515004	2575.02	515502	2577.51	516000	2580	517002	2585.01	518004	2590.02
M	519000	2595	519000	2595	519000	2595	519000	2595	519000	2595
H	522996	2614.98	522498	2612.49	522000	2610	520998	2604.99	519996	2599.98

5G NR n41 BW	10MHz		15MHz		20MHz		30MHz		40MHz		50MHz		60MHz		70MHz		80MHz		90MHz		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)	Ch.	Freq.(MHz)	Ch.	Freq.(MHz)
L	500205	2501.02	500703	2503.52	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	518598	2592.99	518598	2592.99
H	536997	2684.99	536499	2682.49	535998	2679.99	534996	2674.98	534000	2670	532998	2664.99	531996	2659.98	531000	2655	529998	2649.99	528996	2644.98	528000	2640

5G NR n78 BW	10MHz		15MHz		20MHz		30MHz		40MHz		50MHz		60MHz		70MHz		80MHz		90MHz		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)	Ch.	Freq.(MHz)	Ch.	Freq.(MHz)
L	630335	3455.02	630501	3457.52	630668	3460.02	631000	3465	631334	3470.01	631668	3475.02	632000	3480	632334	3485.01	632668	3490.02	633000	3495		
M	633332	3499.98	633332	3499.98	633332	3499.98	633332	3499.98	633332	3499.98	633332	3499.98	633332	3499.98	633332	3499.98	633332	3499.98	633332	3499.98	633332	3499.98
H	638333	3545	636167	3542.5	636000	3540	635666	3534.99	635332	3529.98	635000	3525	634666	3519.99	634332	3514.98	634000	3510	633666	3504.99		

(2) For 5G NR Overlap Bands Description

1) 5G NR Bands BW

Mode	Band	Duplex	SCS (kHz)	Bandwidths (BW)
NSA	n38	TDD	30	10, 15, 20, 30, 40
	n41	TDD	30	10, 15, 20, 30, 40, 50, 60, 70, 80, 90, 100
SA	n38	TDD	30	10, 15, 20, 30, 40
	n41	TDD	30	10, 15, 20, 30, 40, 50, 60, 70, 80, 90, 100

2) 5G NR Bands Tune-up Limit

Band	**Antenna**	**Head DSI 2 Tune-up**	**Body-worn DSI 3 Tune-up**	**Hotspot DSI 7 Tune-up**	**Extremity DSI 6 Tune-up**	**Sensor off DSI 4 Tune-up**
FR1 n41	ANT1	24.00	22.50	20.00	23.50	24.00
FR1 n38	ANT1	24.00	22.50	20.00	23.50	24.00

5. Smart Transmit technology for 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.

For EN-DC mode, Qualcomm Smart Transmit algorithm in WWAN adds directly the time-averaged RF exposure from 4G(LTE) and time-averaged RF exposure from 5G NR. Smart Transmit algorithm controls the total RF exposure from both 4G and 5G NR to not exceed FCC limit.

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.

<1>P_{limit}: The time-averaged RF power which corresponds to SAR_design_target.
<2>P_{max}: Maximum target power level
<3>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 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:
Uncertainty dB (k=2): 1.5

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 P_{limit}. Below table shows P_{limit} EFS settings and maximum tune up output power Pmax configured for this EUT for various transmit conditions (Device State Index DSI).

<Plimit for supported technologies and bands (Plimit in EFS file)>

Band	Antenna	Head DSI 2	Body-Worn DSI 3	Extremity DSI 6	Hotspot DSI 7	Sensor off DSI 4	Pmax
GSM 850(GPRS 1Tx slot)	ANT0	26.50	26.50	26.50	26.50	23.00	23.00
GSM 1900(GPRS 2Tx slot)	ANT1	25.00	21.50	25.00	21.50	21.00	21.00
WCDMA II	ANT1	44.50	21.00	22.50	20.00	23.00	23.00
WCDMA IV	ANT1	44.50	21.00	23.50	19.50	23.00	23.00
WCDMA V	ANT0	44.70	44.70	44.70	44.70	23.00	23.00
LTE Band 12(B17)	ANT0	44.70	44.70	44.70	44.70	23.00	23.00
LTE Band 12(B17)	ANT4	23.70	44.70	44.70	24.20	22.00	22.00
LTE Band 13	ANT0	44.70	44.70	44.70	44.70	23.00	23.00
LTE Band 13	ANT4	23.70	44.70	44.70	23.20	21.00	21.00
LTE Band 28	ANT0	44.70	44.70	44.70	44.70	23.00	23.00
LTE Band 28	ANT4	23.70	44.70	44.70	44.70	21.50	21.50
LTE Band 26(B5)	ANT0	44.70	44.70	44.70	44.70	23.00	23.00
LTE Band 26(B5)	ANT4	23.70	44.70	44.70	44.70	20.50	20.50
LTE Band 66(B4)	ANT1	44.50	20.50	22.50	20.50	23.00	23.00
LTE Band 66(B4)	ANT4	19.00	20.00	23.00	17.50	20.50	20.50
LTE Band 25(B2)	ANT1	44.50	20.50	22.50	20.50	22.50	22.50
LTE Band 25(B2)	ANT4	19.00	17.50	19.00	16.00	21.50	21.50
LTE Band 7	ANT1	44.00	21.00	22.00	19.50	23.00	23.00
LTE Band 7	ANT4	18.00	19.00	20.00	16.00	23.00	23.00
LTE Band41(B38)	ANT1	42.00	21.50	42.00	20.00	21.00	21.00
LTE Band41(B38)	ANT4	17.50	19.00	20.00	16.50	20.00	20.00
LTE Band42	ANT2	16.00	15.50	19.00	12.50	21.00	21.00
FR1 N2	ANT1	44.50	19.50	22.50	20.00	23.00	23.00
FR1 N2	ANT4	18.00	19.00	19.00	17.00	23.00	23.00
FR1 N7	ANT1	44.00	20.50	21.00	19.50	22.00	22.00
FR1 N7	ANT4	18.50	18.50	19.50	15.50	23.00	23.00
FR1 N26	ANT0	44.70	44.70	44.70	44.70	22.00	22.00
FR1 N26	ANT4	23.70	44.70	44.70	44.70	21.50	21.50
FR1 N5	ANT0	44.70	22.00	44.70	44.70	23.00	23.00
FR1 N5	ANT4	23.50	24.70	24.70	24.70	23.00	23.00
FR1 N41(N38)	ANT1	44.00	21.50	22.50	20.00	23.00	23.00
FR1 N66	ANT1	44.50	21.00	23.00	19.50	23.00	23.00
FR1 N66	ANT4	20.00	18.50	21.00	16.00	23.00	23.00
FR1 N78 Part27Q	ANT2	17.00	17.00	19.00	12.50	22.50	22.50
FR1 N78 Part27Q	ANT5	44.00	44.00	44.00	44.00	15.50	15.50
FR1 N78 Part27Q	ANT7	44.00	44.00	44.00	44.00	16.00	16.00
FR1 N78 Part27Q	ANT11	44.00	22.50	44.00	19.00	22.00	22.00

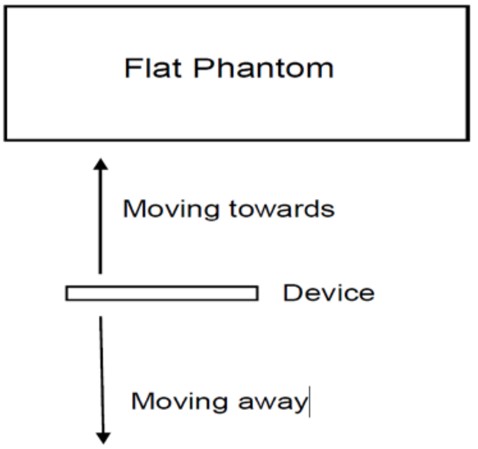
Note:
1) Pmax is used for RF tune up procedure. The maximum allowed output power is equal to Pmax + 1.0 dB device uncertainty.
2) All Plimit power levels entered in the Table correspond to average power levels after accounting for duty

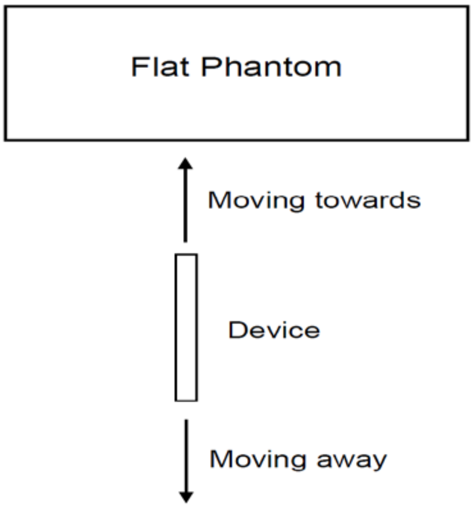
cycle in the case TDD modulation schemes (for e.g., GSM & LTE TDD).
3) The max allowed output power is the P_{limit} + 1.0 dB device uncertainty, and if P_{limit} is higher than Pmax, the device output power will be Pmax instead.

6. Proximity Sensor Triggering Test

Proximity Sensor Triggering Distance:

1) Proximity sensor triggering distance testing was performed according to the procedures outlined in KDB 616217 D04 section 6.2, and EUT moving further away from the flat phantom and EUT moving toward the flat phantom were both assessed and the tissue-equivalent medium for highest frequency (5850MHz) and lowest (1750MHz) frequency was used for proximity sensor triggering testing.
2) Capacitive proximity sensors placed coincident with antenna elements at the top and bottom ends of the phone are utilized to determine when the device comes in proximity of the user’s body at the front or back of the device.
3) The output power will reduce to body worn power level when top and bottom sensor pad be detected.
4) The sensors used to detect the proximity of the user’s body at the front or back surface of the device use a detection threshold distance. The data shown in the sections below shows the distance(s). When front or back body worn condition is detected reduced power will be active.
5) The device employs proximity sensors also can detect the presence of the user’s a finger or hand when handheld state at the front/back/left/right/top/bottom sides of the device. When six sides of handheld condition is detected reduced power will be active.
6) For verification of compliance of power reduction scheme, additional SAR testing with EUT transmitting at full RF power at a conservative trigger distance -1mm was performed:





Front side, Back side	Left side, Right side, Top side, Bottom side

For Main supply:

For ANT 0				
Proximity Sensor Triggering Distance (mm)				
Position	Front		Back	
	Moving towards	Moving away	Moving towards	Moving away
Minimum	17	22	24	29

For ANT 5&6				
Proximity Sensor Triggering Distance (mm)				
Position	Front		Back	
	Moving towards	Moving away	Moving towards	Moving away
Minimum	14	20	18	23

For ANT 0								
Proximity Sensor Triggering Distance (mm)								
Position	Front		Back		Left side		Bottom side	
	Moving towards	Moving away	Moving towards	Moving away	Moving towards	Moving away	Moving towards	Moving away
Minimum	9	15	13	19	12	18	12	17

For ANT 7&8						
Proximity Sensor Triggering Distance (mm)						
Position	Front		Back		Right side	
	Moving towards	Moving away	Moving towards	Moving away	Moving towards	Moving away
Minimum	4	8	8	13	13	18

For ANT 5&6								
Proximity Sensor Triggering Distance (mm)								
Position	Front		Back		Right side		Top side	
	Moving towards	Moving away	Moving towards	Moving away	Moving towards	Moving away	Moving towards	Moving away
Minimum	7	13	13	17	6	11	13	18

For ANT 2&4								
Proximity Sensor Triggering Distance (mm)								
Position	Front		Back		Left side		Top side	
	Moving towards	Moving away	Moving towards	Moving away	Moving towards	Moving away	Moving towards	Moving away
Minimum	10	15	16	21	12	17	14	19

For ANT 1						
Proximity Sensor Triggering Distance (mm)						
Position	Front		Back		Bottom side	
	Moving towards	Moving away	Moving towards	Moving away	Moving towards	Moving away
Minimum	7	13	8	14	11	16

For Second supply:

For ANT 0				
Proximity Sensor Triggering Distance (mm)				
Position	Front		Back	
	Moving towards	Moving away	Moving towards	Moving away
Minimum	15	19	17	23

For ANT 5&6				
Proximity Sensor Triggering Distance (mm)				
Position	Front		Back	
	Moving towards	Moving away	Moving towards	Moving away
Minimum	15	20	20	25

For ANT 0								
Proximity Sensor Triggering Distance (mm)								
Position	Front		Back		Left side		Bottom side	
	Moving towards	Moving away	Moving towards	Moving away	Moving towards	Moving away	Moving towards	Moving away
Minimum	7	13	11	17	10	16	10	16

For ANT 7&8						
Proximity Sensor Triggering Distance (mm)						
Position	Front		Back		Right side	
	Moving towards	Moving away	Moving towards	Moving away	Moving towards	Moving away
Minimum	5	9	9	13	13	15

For ANT 5&6								
Proximity Sensor Triggering Distance (mm)								
Position	Front		Back		Right side		Top side	
	Moving towards	Moving away	Moving towards	Moving away	Moving towards	Moving away	Moving towards	Moving away
Minimum	9	15	14	19	7	13	15	21

For ANT 2&4								
Proximity Sensor Triggering Distance (mm)								
Position	Front		Back		Left side		Top side	
	Moving towards	Moving away	Moving towards	Moving away	Moving towards	Moving away	Moving towards	Moving away
Minimum	10	16	17	22	14	19	14	19

For ANT 1						
Proximity Sensor Triggering Distance (mm)						
Position	Front		Back		Bottom side	
	Moving towards	Moving away	Moving towards	Moving away	Moving towards	Moving away
Minimum	5	9	9	13	13	17

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. In 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 exposure. In general, occupational/controlled exposure limits are applicable to situations in which persons are exposed because 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 1 gram 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. Definition

Specific Absorption Rate (SAR): the time derivative of the incremental energy *(dW)* absorbed by an incremental mass *(dm)* contained in a volume element *(dV)* of given mass density (ρ)

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

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

SAR is usually calculated by:

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

where

E : rms value of the electric field strength in the tissue in V/m

σ : conductivity of body tissue in S/m

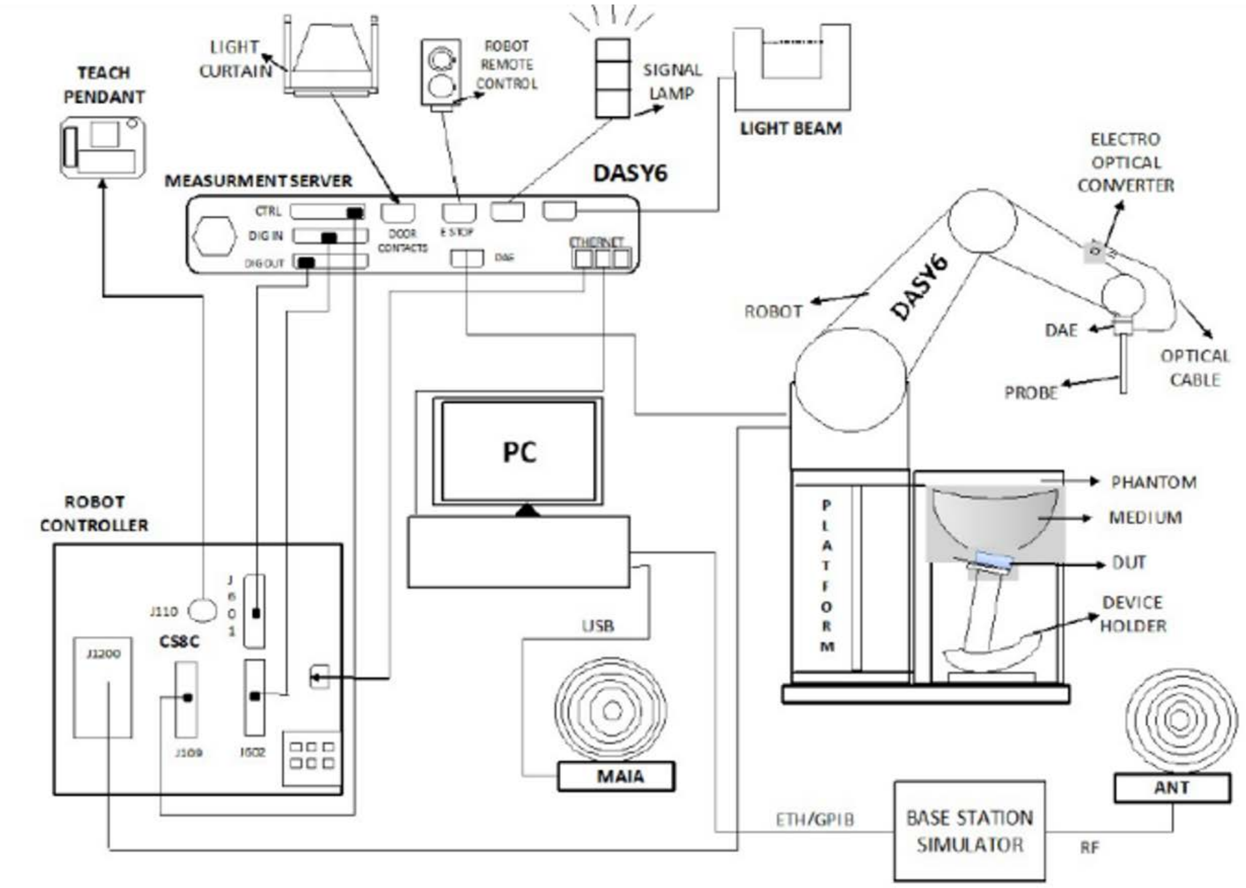
ρ :density of body tissue in kg/m^3

9. Laboratory Environment

Temperature:	Min. = 18°C, Max. = 25°C
Relative humidity:	Min. = 30%, Max. = 70%
Ambient noise is checked and found very low in compliance with requirement of standards.	
Reflection of surrounding objects is minimized in compliance with requirement of standards.	

10. SAR Test System Configuration

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



1) A standard high precision 6-axis robot with controller, teach pendant and software. An arm extension for accommodating the data acquisition electronics (DAE).
2) An isotropic Field probe optimized and calibrated for the targeted measurement.
3) 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.
4) 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.
5) 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.
6) The Light Beam used is for probe alignment. This improves the accuracy of the probe positioning.
7) A computer running WinXP or Win10 and the cDASY6 software.
8) Remote control and teach pendant as well as additional circuitry for robot safety such as warning lamps, etc.
9) The phantom, the device holder and other accessories according to the targeted measurement.

10.1. E-Field Probe

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

EX3DV4 Probe		
Construction	Symmetric design with triangular core Built-in shielding against static charges PEEK enclosure material (resistant to organic solvents, e.g., DGBE)	
Frequency	10 MHz – >6 GHz Linearity: ±0.2 dB (30 MHz – 6 GHz)	
Directivity	±0.3 dB in TSL (rotation around probe axis) ±0.5 dB in TSL (rotation normal to probe axis)	
Dynamic Range	10 µW/g – >100 mW/g Linearity: ±0.2 dB (noise: typically <1 µW/g)	
Dimensions	Overall length: 337 mm (tip: 20 mm) Tip diameter: 2.5 mm (body: 12 mm) Typical distance from probe tip to dipole centers: 1 mm	

10.2. 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.

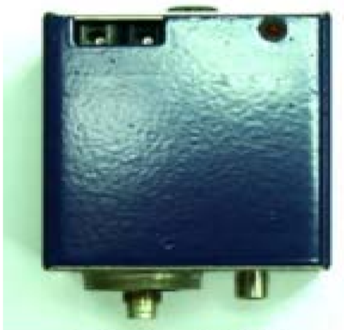


Photo of DAE

10.3. Phantom

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

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

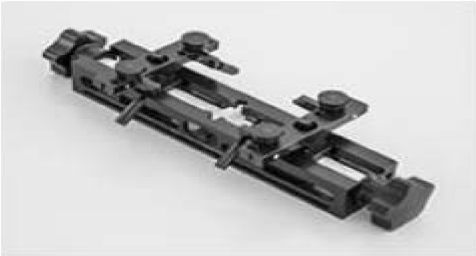
ELI Phantom		
Shell Thickness	2 ± 0.2 mm (sagging: <1%)	
Filling Volume	Approx. 30 liters	
Dimensions	Major ellipse axis: 600 mm Minor axis: 400 mm	

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

10.4. 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 be 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

11. Measurement Procedures

The measurement procedures are as follows:

(1) 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.

(2) 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

11.1. 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

11.2. 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.

11.3. 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 D01 SAR measurement 100 MHz to 6 GHz.

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

11.4. Zoom Scan

Zoom scans are used assess the peak spatial SAR values within a cubic averaging volume containing 1 gram and 10 grams 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 D01 SAR measurement 100 MHz to 6 GHz.

<table>
<tr><td colspan="3"></td><td>≤ 3 GHz</td><td>> 3 GHz</td></tr>
<tr><td colspan="3">Maximum zoom scan spatial resolution: Δx_{Zoom}, Δy_{Zoom}</td><td>≤ 2 GHz: ≤ 8 mm
2 – 3 GHz: ≤ 5 mm*</td><td>3 – 4 GHz: ≤ 5 mm*
4 – 6 GHz: ≤ 4 mm*</td></tr>
<tr><td rowspan="3">Maximum zoom scan spatial resolution, normal to phantom surface</td><td colspan="2">uniform grid: $\Delta z_{Zoom}(n)$</td><td>≤ 5 mm</td><td>3 – 4 GHz: ≤ 4 mm
4 – 5 GHz: ≤ 3 mm
5 – 6 GHz: ≤ 2 mm</td></tr>
<tr><td rowspan="2">graded grid</td><td>$\Delta z_{Zoom}(1)$: between 1st two points closest to phantom surface</td><td>≤ 4 mm</td><td>3 – 4 GHz: ≤ 3 mm
4 – 5 GHz: ≤ 2.5 mm
5 – 6 GHz: ≤ 2 mm</td></tr>
<tr><td>$\Delta z_{Zoom}(n>1)$: between subsequent points</td><td colspan="2">$\leq 1.5 \cdot \Delta z_{Zoom}(n-1)$ mm</td></tr>
<tr><td>Minimum zoom scan volume</td><td colspan="2">x, y, z</td><td>≥ 30 mm</td><td>3 – 4 GHz: ≥ 28 mm
4 – 5 GHz: ≥ 25 mm
5 – 6 GHz: ≥ 22 mm</td></tr>
<tr><td colspan="5">Note: δ is the penetration depth of a plane-wave at normal incidence to the tissue medium; see IEEE Std 1528-2013 for details.
* When zoom scan is required and the <u>reported</u> SAR from the area scan based 1-g SAR estimation procedures of KDB Publication 447498 is ≤ 1.4 W/kg, ≤ 8 mm, ≤ 7 mm and ≤ 5 mm zoom scan resolution may be applied, respectively, for 2 GHz to 3 GHz, 3 GHz to 4 GHz and 4 GHz to 6 GHz.</td></tr>
</table>

11.5. Volume Scan

The volume scan is used for assessing 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.

11.6. Power Drift

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.

12. Test Equipment List

Test Platform	SPEAG DASY6 Professional				
Description	SAR Test System (Frequency Range 600MHz~6GHz)				
Software Reference	cDASY6 Module SAR V16.0.0.116; SEMCAD X V14.6.14(7483)				
Hardware Reference					
Name of Equipment	Manufacturer	Model/Type	Serial Number	Calibration Date	Due Date of Calibration
SAM Twin Phantom	SPEAG	SAM	1860	NCR	NCR
ELI Phantom	SPEAG	ELI	2007	NCR	NCR
Mounting Device	SPEAG	N/A	141408-5	NCR	NCR
Data Acquisition Electronics	SPEAG	DAE4	1806	2023-10-06	2024-10-05
Data Acquisition Electronics	SPEAG	DAE4	719	2023-04-10	2024-04-09
Data Acquisition Electronics	SPEAG	DAE4	1738	2023-08-07	2024-08-06
E-Field Probe	SPEAG	EX3DV4	7846	2023-10-03	2024-10-02
E-Field Probe	SPEAG	EX3DV4	7746	2023-08-22	2024-08-21
E-Field Probe	SPEAG	EX3DV4	7745	2023-08-22	2024-08-21
System Validation Kit	SPEAG	D750V3	1126	2021-08-31	2024-08-30
System Validation Kit	SPEAG	D835V2	4d178	2021-08-31	2024-08-30
System Validation Kit	SPEAG	D1750V2	1128	2021-09-02	2024-09-01
System Validation Kit	SPEAG	D1900V2	5d192	2021-09-01	2024-08-31
System Validation Kit	SPEAG	D2450V2	943	2021-09-03	2024-09-02
System Validation Kit	SPEAG	D2600V2	1093	2021-09-03	2024-09-02
System Validation Kit	SPEAG	D3500V2	1143	2022-07-05	2025-07-04
System Validation Kit	SPEAG	D5GHzV2	1188	2021-09-06	2024-09-05
Radio Communication Analyzer	Anritsu	MT8821C	6272374630	2023-12-06	2024-12-05
Radio Communication Test Station	Anritsu	MT8000A	6272427164	2023-12-07	2024-12-06
Dielectric Probe Kit	SPEAG	DAKS-3.5	1140	2023-12-05	2024-12-04
RF Cable	SPEAG	SF404	3028	NCR	NCR
Power Amplifier	Mini-Circuits	ZHL-42W+	15542	NCR	NCR
Power Amplifier	Mini-Circuits	ZVE-8G+	945501433	NCR	NCR
Coupler	Agilent	778D	MY52180451	NCR	NCR
Coupler	Agilent	772D	MY52180200	NCR	NCR
Attenuator	Keysight	8491A	MY52461278	NCR	NCR
Signal Generator	Keysight	N5173B	MY62220848	2023-08-06	2024-08-05
Power Sensor	R&S	NRP18S	102984	2023-12-09	2024-12-08
Power Sensor	R&S	NRP18S	102985	2023-12-09	2024-12-08
Thermometer	SPEAG	DTM3000	3915	2023-03-20	2024-03-19
Temperature and Humidity Meter	testo	608-H1	1845168354	2023-12-15	2024-12-14

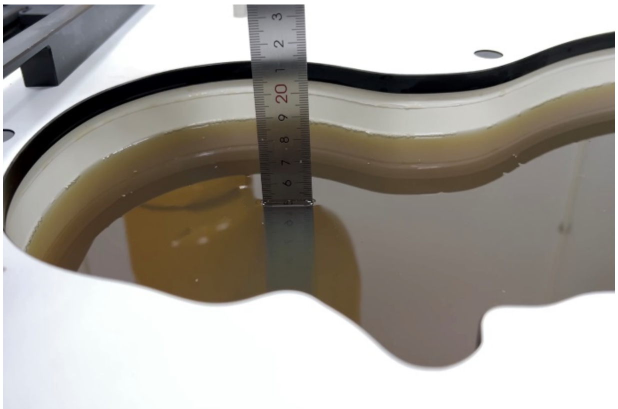
Note:
1) Prior to system verification and validation, the path loss from the signal generator to the system check source and the power meter, which includes the amplifier, cable, attenuator and directional coupler, was measured by the network analyzer. The reading of the power meter was offset by the 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) Justification for Extended Dipole Calibrations
Referring to KDB865664 D01 requirements for dipole calibration, instead of the typical annual calibration recommended by measurement standards, longer calibration intervals of up to three years may be

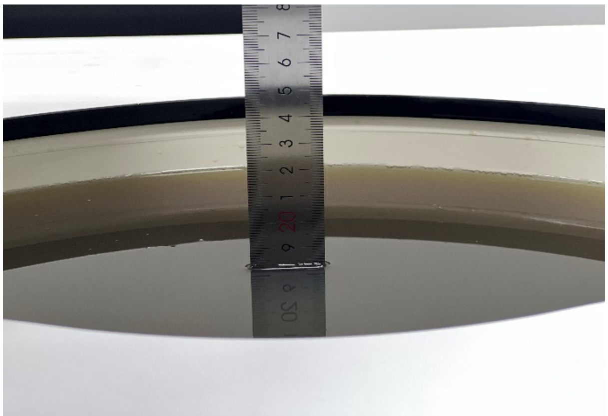
considered when it is demonstrated that the SAR target, impedance and return loss of a dipole have remain stable according to the following requirements. Each measured dipole is expected to evaluate with the following criteria at least on annual interval in Appendix C.
a) There is no physical damage on the dipole.
b) System check with specific dipole is within 10% of calibrated value.
c) Return-loss is within 20% of calibrated measurement.
d) Impedance is within 5Ω from the previous measurement.
Network analyzer probe calibration against air, distilled water and a shorting block performed before measuring liquid parameters.

13. System Verification

13.1. 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. According to KDB 865664 D01, the depth of tissue-equivalent liquid in a phantom must be ≥ 15.0 cm with ≤ ± 0.5 cm variation for SAR measurements ≤ 3 GHz and ≥ 10.0 cm with ≤ ± 0.5 cm variation for measurements > 3 GHz. These depths should ensure the SAR probe is immersed sufficiently in the tissue medium while scanning along the curved surfaces of the SAM phantom at various probe angles, with an acceptable separation between the top of the zoom scan volume and the liquid-air boundary above.





13.2. 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.
(For Head)

Frequency (MHz)	Water (%)	Sugar (%)	Cellulose (%)	Salt (%)	Preventol (%)	DGBE (%)	Conductivity (σ)	Permittivity (εr)
750	41.10	57.00	0.20	1.40	0.20	0.00	0.89	41.90
835	40.30	57.90	0.20	1.40	0.20	0.00	0.90	41.50
1750~2000	55.20	0.00	0.00	0.30	0.00	44.50	1.40	40.00
2300~2450	55.00	0.00	0.00	0.20	0.00	45.00	1.80	39.20
2600	54.80	0.00	0.00	0.10	0.00	45.10	1.96	39.00

For 5GHz Head, Manufactured by SPEAG:

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

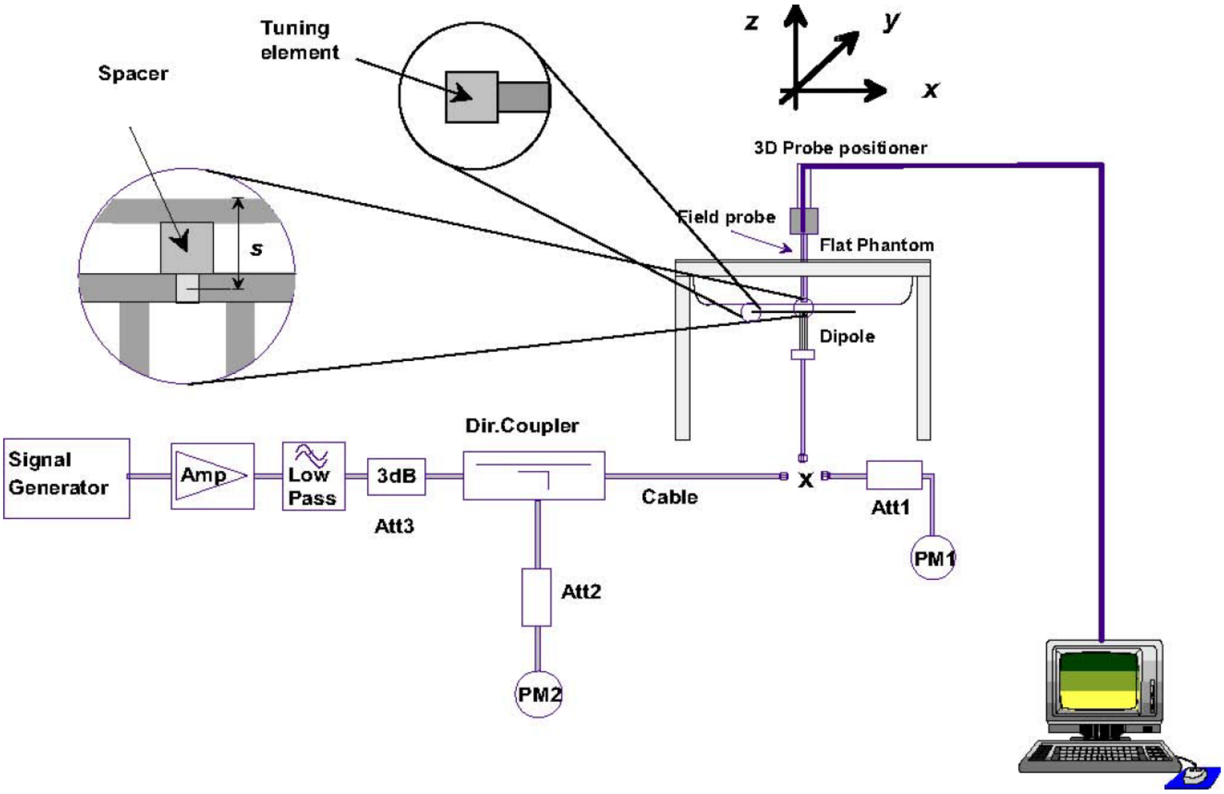
The temperature of the tissue-equivalent medium used during measurement must also be within 18°C to 25°C and within ± 2°C of the temperature when the tissue parameters are characterized.
The dielectric parameters must be measured before the tissue-equivalent medium is used in a series of SAR measurements. The parameters should be re-measured after each 3~4 days of use; or earlier if the dielectric parameters can become out of tolerance; for example, when the parameters are marginal at the beginning of the measurement series.
Tissue dielectric parameters were measured at the low, middle and high frequency of each operating frequency range of the test device.
The dielectric constant (εr) and conductivity (σ) of typical tissue-equivalent media recipes are expected to be within ± 5% of the required target values; but for SAR measurement systems that have implemented the SAR error compensation algorithms documented in IEEE Std 1528-2013, to automatically compensate the measured SAR results for deviations between the measured and required tissue dielectric parameters, the tolerance for εr and σ may be relaxed to ± 10%. This is limited to frequencies ≤ 3 GHz.

<Measurement Results of Tissue electric parameters>

Date	Tissue Type	Frequency (MHz)	Liquid Temp. (℃)	Measured Conductivity (σ)	Measured Permittivity (εr)	Targeted Conductivity (σ)	Targeted Permittivity (εr)	Deviation Conductivity (%)	Deviation Permittivity (%)
2024-2-18	Head	750	22.20	0.908	41.89	0.89	41.90	2.02	-0.03
2024-2-19	Head	750	22.00	0.895	41.95	0.89	41.90	0.56	0.12
2024-2-20	Head	750	22.20	0.880	41.47	0.89	41.90	-1.14	-1.03
2024-2-21	Head	835	22.10	0.930	42.23	0.90	41.50	3.68	1.75
2024-2-22	Head	835	22.20	0.900	41.60	0.90	41.50	0.33	0.24
2024-2-23	Head	835	22.10	0.934	42.58	0.90	41.50	4.11	2.60
2024-3-2	Head	1750	22.10	1.373	38.34	1.37	40.10	0.18	-4.40
2024-3-3	Head	1750	22.30	1.390	38.48	1.37	40.10	1.46	-4.05
2024-3-4	Head	1750	22.30	1.360	38.37	1.37	40.10	-0.73	-4.31
2024-3-5	Head	1750	22.30	1.330	41.01	1.37	40.10	-2.92	2.26
2024-3-6	Head	1900	22.10	1.434	40.21	1.40	40.00	2.43	0.53
2024-3-7	Head	1900	22.20	1.450	40.51	1.40	40.00	3.57	1.27
2024-3-8	Head	1900	22.10	1.460	40.19	1.40	40.00	4.29	0.48
2024-3-9	Head	1900	22.10	1.454	40.79	1.40	40.00	3.86	1.98
2024-2-24	Head	2600	22.20	1.890	37.95	1.96	39.00	-3.57	-2.69
2024-2-26	Head	2600	22.10	1.930	38.00	1.96	39.00	-1.53	-2.56
2024-2-27	Head	2600	22.20	1.900	37.98	1.96	39.00	-3.06	-2.60
2024-2-28	Head	2600	22.30	1.920	39.86	1.96	39.00	-2.04	2.21
2024-2-29	Head	2600	22.10	1.887	40.21	1.96	39.00	-3.72	3.10
2024-3-2	Head	2600	22.30	1.920	39.21	1.96	39.00	-2.04	0.53
2024-3-6	Head	3500	22.30	2.850	38.50	2.91	37.90	-2.06	1.59
2024-3-7	Head	3500	22.10	2.800	38.50	2.91	37.90	-3.78	1.59
2024-3-8	Head	3500	22.20	2.830	38.69	2.91	37.90	-2.75	2.08
2024-3-9	Head	3500	22.10	2.810	39.40	2.91	37.90	-3.44	3.96
2024-3-10	Head	2450	22.40	1.730	38.22	1.80	39.20	-3.89	-2.50
2024-3-10	Head	5250	22.40	4.556	34.65	4.71	35.90	-3.27	-3.48
2024-3-11	Head	5600	22.40	4.919	33.99	5.07	35.50	-2.98	-4.25
2024-3-12	Head	5750	22.20	5.100	33.86	5.27	35.30	-3.23	-4.08

13.3. System Performance Check

The microwave circuit arrangement for system Check is sketched as follows. The daily system accuracy verification occurs within the flat section of the SAM phantom. A SAR measurement was performed to see if the measured SAR was within +/- 10% from the target SAR values. The tests were conducted on the same days as the measurement of the EUT. The obtained results from the system accuracy verification are displayed in the following table (a power level of 250mW (below 3GHz) or 100mW (3-6GHz) was input to the dipole antenna). During the tests, the ambient temperature of the laboratory was in the range 22±2°C, the relative humidity was in the range 60% and the liquid depth above the ear reference points was above 15±0.5 cm in all the cases. It is seen that the system is operating within its specification, as the results are within acceptable tolerance of the reference values.



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.

<System Performance Check Results>

1g:

Date	Tissue Type	Frequency (MHz)	Dipole S/N	Probe S/N	DAE S/N	Input Power (mW)	Targeted 1g SAR (W/kg)	Measured 1g SAR (W/kg)	Normalized 1g SAR (W/kg)	Deviation (%)
2024-2-18	Head	750	1126	7846	1806	250	8.52	2.09	8.36	-1.88
2024-2-19	Head	750	1126	7846	1806	250	8.52	2.13	8.52	0.00
2024-2-20	Head	750	1126	7846	1806	250	8.52	2.21	8.84	3.76
2024-2-21	Head	835	4d178	7846	1806	250	9.62	2.40	9.60	-0.21
2024-2-22	Head	835	4d178	7846	1806	250	9.62	2.50	10.00	3.95
2024-2-23	Head	835	4d178	7846	1806	250	9.62	2.51	10.04	4.37
2024-3-2	Head	1750	1128	7846	1806	250	35.70	8.98	35.92	0.62
2024-3-3	Head	1750	1128	7846	1806	250	35.70	8.46	33.84	-5.21
2024-3-4	Head	1750	1128	7846	1806	250	35.70	8.49	33.96	-4.87
2024-3-5	Head	1750	1128	7846	1806	250	35.70	8.31	33.24	-6.89
2024-3-6	Head	1900	5d192	7846	1806	250	39.50	10.40	41.60	5.32
2024-3-7	Head	1900	5d192	7846	1806	250	39.50	9.68	38.72	-1.97
2024-3-8	Head	1900	5d192	7846	1806	250	39.50	9.81	39.24	-0.66
2024-3-9	Head	1900	5d192	7846	1806	250	39.50	9.91	39.64	0.35
2024-2-24	Head	2600	1093	7746	719	250	56.90	13.20	52.80	-7.21
2024-2-26	Head	2600	1093	7746	719	250	56.90	13.10	52.40	-7.91
2024-2-27	Head	2600	1093	7746	719	250	56.90	13.50	54.00	-5.10
2024-2-28	Head	2600	1093	7746	719	250	56.90	13.80	55.20	-2.99
2024-2-29	Head	2600	1093	7746	719	250	56.90	13.80	55.20	-2.99
2024-3-2	Head	2600	1093	7746	719	250	56.90	13.90	55.60	-2.28
2024-3-6	Head	3500	1143	7746	719	100	64.80	6.13	61.30	-5.40
2024-3-7	Head	3500	1143	7746	719	100	64.80	6.25	62.50	-3.55
2024-3-8	Head	3500	1143	7746	719	100	64.80	6.34	63.40	-2.16
2024-3-9	Head	3500	1143	7746	719	100	64.80	6.44	64.40	-0.62
2024-3-10	Head	2450	943	7745	1738	250	52.30	12.20	48.80	-6.69
2024-3-10	Head	5250	1188	7745	1738	100	78.00	7.87	78.70	0.90
2024-3-11	Head	5600	1188	7745	1738	100	81.40	8.62	86.20	5.90
2024-3-12	Head	5750	1188	7745	1738	100	77.70	7.35	73.50	-5.41

10g:

Date	Tissue Type	Frequency (MHz)	Dipole S/N	Probe S/N	DAE S/N	Input Power (mW)	Targeted 10g SAR (W/kg)	Measured 10g SAR (W/kg)	Normalized 10g SAR (W/kg)	Deviation (%)
2024-2-18	Head	750	1126	7846	1806	250	5.58	1.38	5.52	-1.08
2024-2-19	Head	750	1126	7846	1806	250	5.58	1.40	5.60	0.36
2024-2-20	Head	750	1126	7846	1806	250	5.58	1.45	5.80	3.94
2024-2-21	Head	835	4d178	7846	1806	250	6.23	1.56	6.24	0.16
2024-2-22	Head	835	4d178	7846	1806	250	6.23	1.64	6.56	5.30
2024-2-23	Head	835	4d178	7846	1806	250	6.23	1.64	6.56	5.30
2024-3-2	Head	1750	1128	7846	1806	250	18.60	4.82	19.28	3.66
2024-3-3	Head	1750	1128	7846	1806	250	18.60	4.56	18.24	-1.94
2024-3-4	Head	1750	1128	7846	1806	250	18.60	4.52	18.08	-2.80
2024-3-5	Head	1750	1128	7846	1806	250	18.60	4.42	17.68	-4.95
2024-3-6	Head	1900	5d192	7846	1806	250	20.10	5.41	21.64	7.66
2024-3-7	Head	1900	5d192	7846	1806	250	20.10	5.00	20.00	-0.50
2024-3-8	Head	1900	5d192	7846	1806	250	20.10	5.07	20.28	0.90
2024-3-9	Head	1900	5d192	7846	1806	250	20.10	5.15	20.60	2.49
2024-2-24	Head	2600	1093	7746	719	250	25.20	5.91	23.64	-6.19
2024-2-26	Head	2600	1093	7746	719	250	25.20	5.97	23.88	-5.24
2024-2-27	Head	2600	1093	7746	719	250	25.20	6.15	24.60	-2.38
2024-2-28	Head	2600	1093	7746	719	250	25.20	6.25	25.00	-0.79
2024-2-29	Head	2600	1093	7746	719	250	25.20	6.24	24.96	-0.95
2024-3-2	Head	2600	1093	7746	719	250	25.20	6.31	25.24	0.16
2024-3-6	Head	3500	1143	7746	719	100	24.30	2.36	23.60	-2.88
2024-3-7	Head	3500	1143	7746	719	100	24.30	2.40	24.00	-1.23
2024-3-8	Head	3500	1143	7746	719	100	24.30	2.43	24.30	0.00
2024-3-9	Head	3500	1143	7746	719	100	24.30	2.47	24.70	1.65
2024-3-10	Head	2450	943	7745	1738	250	23.90	5.65	22.60	-5.44
2024-3-10	Head	5250	1188	7745	1738	100	22.30	2.27	22.70	1.79
2024-3-11	Head	5600	1188	7745	1738	100	23.30	2.46	24.60	5.58
2024-3-12	Head	5750	1188	7745	1738	100	22.20	2.20	22.00	-0.90

14. RF Exposure Positions

14.1. 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.

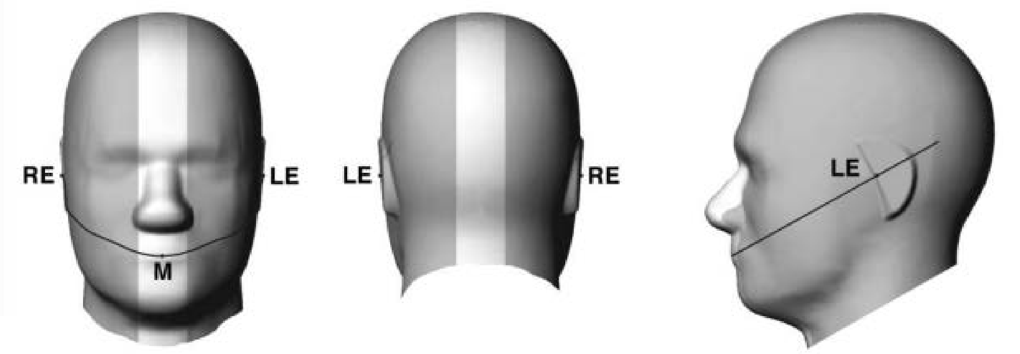


Fig 12.1.1 Front, back, and side views of SAM twin phantom

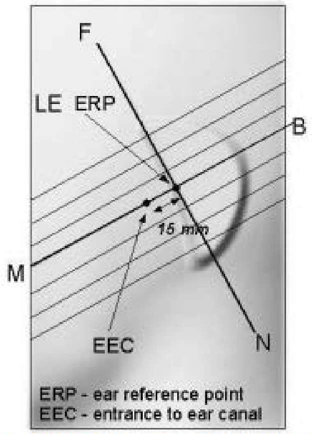


Fig 12.1.2 Close-up side view of phantom showing the ear region.

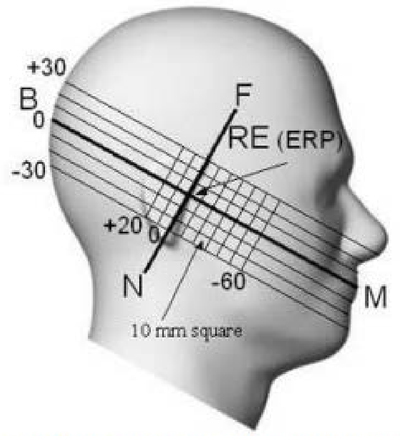


Fig 12.1.3 Side view of the phantom showing relevant markings and seven cross-sectional plane locations

14.2. 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.

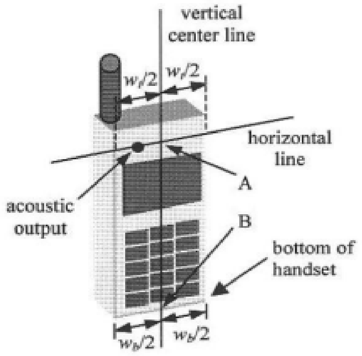


Fig 12.2.1 Handset vertical and horizontal reference lines—"fixed case

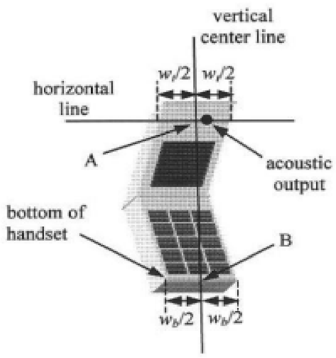


Fig 12.2.2 Handset vertical and horizontal reference lines—"clam-shell case"

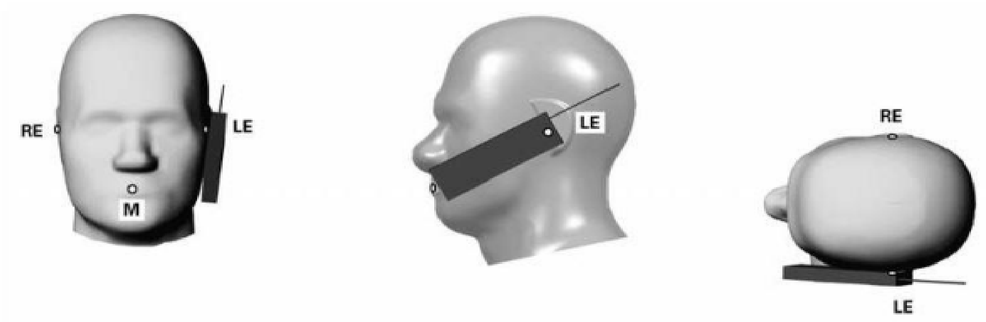


Fig 12.2.3 cheek or touch position. The reference points for the right ear (RE), left ear (LE), and mouth (M), which establish the Reference Plane for handset positioning, are indicated.

14.3. 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.

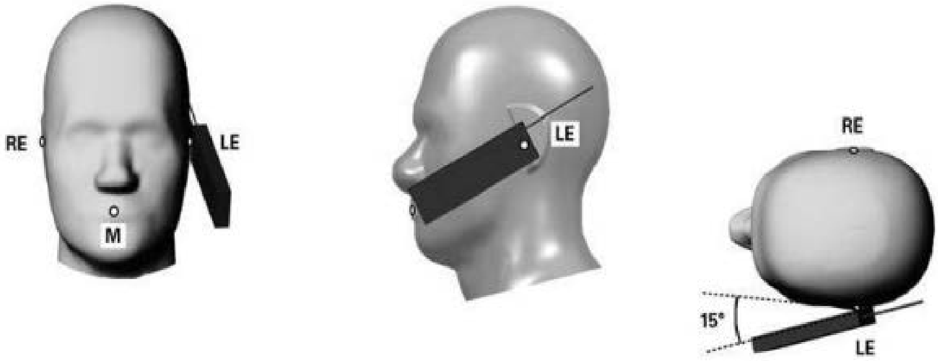


Fig 12.3.1 Tilt position. The reference points for the right ear (RE), left ear (LE), and mouth (M), which define the Reference Plane for handset positioning, are indicated.

14.4. 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 12.4). Per KDB648474 D04, 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 D01 should be used to test for body-worn accessory SAR compliance, without a headset connected to it. This enables the test results for such configuration to be compatible with that required for hotspot mode when the body-worn accessory test separation distance is greater than or equal to that required for hotspot mode, when applicable. When the reported SAR for body-worn accessory, measured without a headset connected to the handset is > 1.2 W/kg, the highest reported SAR configuration for that wireless mode and frequency band should be repeated for that body-worn accessory with a handset attached to the handset. Accessories for body-worn operation configurations are divided into two categories: those that do not contain metallic components and those that do contain metallic components and those that do contain metallic components. When multiple accessories that do not contain metallic components are supplied with the device, the device is tested with only the accessory that dictates the closest spacing to the body. Then multiple accessories that contain metallic components are test with the device with each accessory. If multiple accessories share an identical metallic component (i.e., the same metallic belt-chip used with different holsters with no other metallic components) only the accessory that dictates the closest spacing to the body is tested.

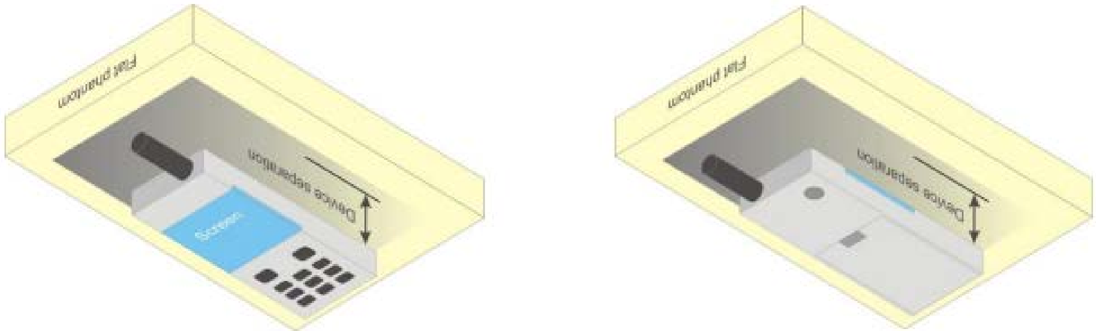


Fig 12.4 Body Worn Position

14.5. Hotspot Mode

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 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 somebody-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 D01 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.

14.6. 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 D04, the following phablet procedures should be applied to evaluate SAR compliance for each applicable wireless mode 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 D01 to address interactive hand use exposure conditions. The 1-g SAR at 5 mm for UMPC mini-tablets 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; 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.

15. Test Results of Conducted Power

- The detailed conducted output power table can refer to Appendix E.

(1) GSM Test Configuration

1) CMW500 measures GSM peak and average output power for active timeslots. For SAR time based average power is relevant. The difference in between depends on the duty cycle of the TDMA signal.

Number of Timeslots	1	2	3	4
Duty Cycle	1:8.3	1:4.15	1:2.77	1:2.075
Time based avg. power VS slotted avg. power	-9.19	-6.18	-4.42	-3.17

2) The frame-averaged power is linearly proportion to the slot number configured and it is linearly scaled the maximum burst-averaged power based on time slots. The calculated method is shown as below:

Frame-averaged power = 10 x log (Burst-averaged power mW x Slot used) / 8

3) When the maximum output power variation across the required test channels is > ½ dB, instead of the middle channel, the highest output power channel must be used.

4) Per KDB 941225 D01, for SAR test reduction for GSM/GPRS/EDGE modes is determined by the source-based time-averaged output power including tune-up tolerance. The mode with highest specified time-averaged output power should be tested for SAR compliance in the applicable exposure conditions. For modes with the same specified maximum output power and tolerance, the higher number time-slot configuration should be tested.

(2) WCDMA Test Configuration

1) Maximum output power is verified on the H/M/L channels according to procedures described in section 5.2 of 3GPP TS 34.121, using the appropriate RMC or AMR with TPC (transmit power control) set to all "1's" for WCDMA/HSDPA or by applying the required inner loop power control procedures to maintain maximum output power while HSUPA is active. Results for all applicable physical channel configurations (DPCCH, DPDCHn and spreading codes, HSDPA, HSPA) are required in the SAR report. All configurations that are not supported by the handset or cannot be measured due to technical or equipment limitations must be clearly identified.

2) The procedures in KDB 941225 D01 are applied for 3GPP Rel. 6 HSPA to configure the device in the required sub-test mode to determine SAR test exclusion.

3) For DC-HSDPA, the device was configured according to the H-Set 12, Fixed Reference Channel (FRC) configuration in Table C.8.1.12 of 3GPP TS 34.121-1, with the primary and the secondary serving HS-DSCH Cell enabled during the power measurement.

HSDPA Setup Configuration:

HSDPA is configured according to the applicable UE category of a test device. The number of HS-DSCH/HS-PDSCHs, HARQ processes, minimum inter-TTI interval, transport block sizes and RV coding sequence are defined by the H-set. To maintain a consistent test configuration and stable transmission conditions, QPSK is used in the H-set for SAR testing. HS-DPCCH should be configured with a CQI feedback cycle of 4 ms and a CQI repetition factor of 2 to maintain a constant rate of active CQI slots. DPCCH and DPDCH gain factors(βc, βd), and HS-DPCCH power offset parameters (ΔACK, ΔNACK, ΔCQI) are set according to values indicated in the following table. The CQI value is determined by the UE category, transport block size, number of HS-PDSCHs and modulation used in the H-set.

Table C.10.1.4: β values for transmitter characteristics tests with HS-DPCCH

Sub-test	β_c	β_d	β_d *(SF)*	β_c/β_d	β_{HS} *(Note1, Note 2)*	CM (dB) *(Note 3)*	MPR (dB) *(Note 3)*
1	2/15	15/15	64	2/15	4/15	0.0	0.0
2	12/15 *(Note 4)*	15/15 *(Note 4)*	64	12/15 *(Note 4)*	24/15	1.0	0.0
3	15/15	8/15	64	15/8	30/15	1.5	0.5
4	15/15	4/15	64	15/4	30/15	1.5	0.5

Note 1: Δ_{ACK}, Δ_{NACK} and Δ_{CQI} = 30/15 with β_{hs} = 30/15 * β_c .

Note 2: For the HS-DPCCH power mask requirement test in clause 5.2C, 5.7A, and the Error Vector Magnitude (EVM) with HS-DPCCH test in clause 5.13.1A, and HSDPA EVM with phase discontinuity in clause 5.13.1AA, Δ_{ACK} and Δ_{NACK} = 30/15 with β_{hs} = 30/15 * β_c , and Δ_{CQI} = 24/15 with β_{hs} = 24/15 * β_c .

Note 3: CM = 1 for β_c/β_d =12/15, β_{hs}/β_c=24/15. For all other combinations of DPDCH, DPCCH and HS-DPCCH the MPR is based on the relative CM difference. This is applicable for only UEs that support HSDPA in release 6 and later releases.

Note 4: For subtest 2 the β_c/β_d ratio of 12/15 for the TFC during the measurement period (TF1, TF0) is achieved by setting the signalled gain factors for the reference TFC (TF1, TF1) to β_c = 11/15 and β_d = 15/15.

HSUPA Setup Configuration:

Due to inner loop power control requirements in HSUPA, a commercial communication test set should be used for the output power and SAR tests. The 12.2 kbps RMC, FRC H-set 1 and E-DCH configurations for HSUPA should be configured according to the values indicated below as well as other applicable procedures described in the “WCDMA Handset” and “Release 5 HSUPA Data Device” sections of 3G device.

Table C.11.1.3: β values for transmitter characteristics tests with HS-DPCCH and E-DCH

Sub-test	β_c	β_d	β_d *(SF)*	β_c/β_d	β_{HS} *(Note1)*	β_{ec}	β_{ed} *(Note 4) (Note 5)*	β_{ed} *(SF)*	β_{ed} *(Codes)*	CM (dB) *(Note 2)*	MPR (dB) *(Note 2) (Note 6)*	AG Index *(Note 5)*	E-TFCI
1	11/15 *(Note 3)*	15/15 *(Note 3)*	64	11/15 *(Note 3)*	22/15	209/225	1309/225	4	1	1.0	0.0	20	75
2	6/15	15/15	64	6/15	12/15	12/15	94/75	4	1	3.0	2.0	12	67
3	15/15	9/15	64	15/9	30/15	30/15	β_{ed}1: 47/15 β_{ed}2: 47/15	4 4	2	2.0	1.0	15	92
4	2/15	15/15	64	2/15	4/15	2/15	56/75	4	1	3.0	2.0	17	71
5	15/15	0	-	-	5/15	5/15	47/15	4	1	1.0	0.0	12	67

Note 1: For sub-test 1 to 4, Δ_{ACK}, Δ_{NACK} and Δ_{CQI} = 30/15 with β_{hs} = 30/15 * β_c . For sub-test 5, Δ_{ACK}, Δ_{NACK} and Δ_{CQI} = 5/15 with β_{hs} = 5/15 * β_c .

Note 2: CM = 1 for β_c/β_d =12/15, β_{hs}/β_c=24/15. For all other combinations of DPDCH, DPCCH, HS- DPCCH, E-DPDCH and E-DPCCH the MPR is based on the relative CM difference.

Note 3: For subtest 1 the β_c/β_d ratio of 11/15 for the TFC during the measurement period (TF1, TF0) is achieved by setting the signalled gain factors for the reference TFC (TF1, TF1) to β_c = 10/15 and β_d = 15/15.

Note 4: In case of testing by UE using E-DPDCH Physical Layer category 1, Sub-test 3 is omitted according to TS25.306 Table 5.1g.

Note 5: β_{ed} can not be set directly; it is set by Absolute Grant Value.

Note 6: For subtests 2, 3 and 4, UE may perform E-DPDCH power scaling at max power which could results in slightly smaller MPR values.

DC-HSDPA Setup Configuration:

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

The following tests were completed according to procedures in section 7.3.13 of 3GPP TS 34.108 v9.5.0. A summary of these settings is illustrated below:

Downlink Physical Channels are set as per 3GPP TS34.121-1 v9.0.0 E.5.0

Table E.5.0: Levels for HSDPA connection setup

Parameter During Connection setup	Unit	Value
P-CPICH_Ec/Ior	dB	-10
P-CCPCH and SCH_Ec/Ior	dB	-12
PICH _Ec/Ior	dB	-15
HS-PDSCH	dB	off
HS-SCCH_1	dB	off
DPCH_Ec/Ior	dB	-5
OCNS_Ec/Ior	dB	-3.1

Call is set up as per 3GPP TS34.108 v9.5.0 sub clause 7.3.13.

The configurations of the fixed reference channels for HSDPA RF tests are described in 3GPP TS 34.121, annex C for FDD and 3GPP TS 34.122.

The measurements were performed with a Fixed Reference Channel (FRC) H-Set 12 with QPSK.

Table C.8.1.12: Fixed Reference Channel H-Set 12

Parameter	Unit	Value
Nominal Avg. Inf. Bit Rate	kbps	60
Inter-TTI Distance	TTI's	1
Number of HARQ Processes	Proces ses	6
Information Bit Payload (N_{INF})	Bits	120
Number Code Blocks	Blocks	1
Binary Channel Bits Per TTI	Bits	960
Total Available SML's in UE	SML's	19200
Number of SML's per HARQ Proc.	SML's	3200
Coding Rate		0.15
Number of Physical Channel Codes	Codes	1
Modulation		QPSK
Note 1: The RMC is intended to be used for DC-HSDPA mode and both cells shall transmit with identical parameters as listed in the table. Note 2: Maximum number of transmission is limited to 1, i.e., retransmission is not allowed. The redundancy and constellation version 0 shall be used.		

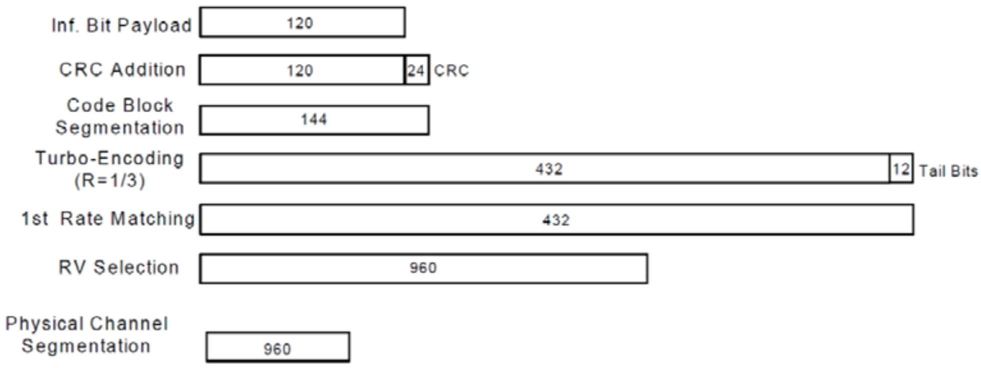


Figure C.8.19: Coding rate for Fixed reference Channel H-Set 12 (QPSK)

HSPA+ Setup Configuration:

Per KDB 941225 D01, SAR is required for Rel. 7 HSPA+ when SAR is required for Rel. 6 HSPA, otherwise, the 3G SAR test reduction procedure is applied to (uplink) HSPA+ with 12.2 kbps RMC as the primary mode. Power is measured for HSPA+ that supports uplink 16QAM according to configurations in Table C.11.1.4 of 3GPP TS 34.121-1 to determine SAR test reduction.

Table C.11.1.4: β values for transmitter characteristics tests with HS-DPCCH and E-DCH with 16QAM

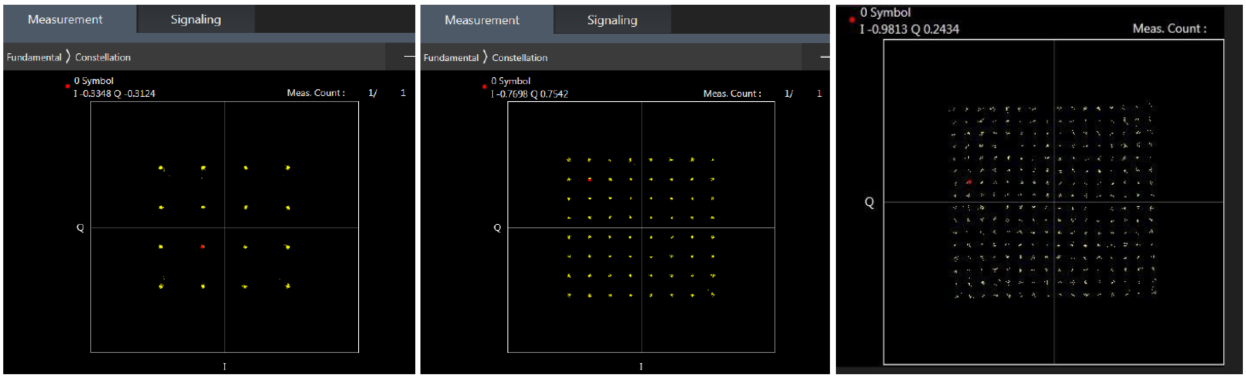
Sub-test	β_c *(Note3)*	β_d	β_{HS} *(Note1)*	β_{ec}	β_{ed} ***(2xSF2)*** *(Note 4)*	β_{ed} ***(2xSF4)*** *(Note 4)*	**CM (dB)** *(Note 2)*	**MPR (dB)** *(Note 2)*	***AG Index*** *(Note 4)*	***E-TFCI*** *(Note 5)*	***E-TFCI*** *(boost)*
1	1	0	30/15	30/15	β_{ed}1: 30/15 β_{ed}2: 30/15	β_{ed}3: 24/15 β_{ed}4: 24/15	3.5	2.5	14	105	105

Note 1: Δ_{ACK}, Δ_{NACK} and Δ_{CQI} = 30/15 with β_{hs} = 30/15 * β_c .
Note 2: CM = 3.5 and the MPR is based on the relative CM difference, MPR = MAX(CM-1,0).
Note 3: DPDCH is not configured, therefore the β_c is set to 1 and β_d = 0 by default.
Note 4: β_{ed} can not be set directly; it is set by Absolute Grant Value.
Note 5: All the sub-tests require the UE to transmit 2SF2+2SF4 16QAM EDCH and they apply for UE using E-DPDCH category 7. E-DCH TTI is set to 2ms TTI and E-DCH table index = 2. To support these E-DCH configurations DPDCH is not allocated. The UE is signalled to use the extrapolation algorithm.

(3) LTE Test Configuration

1) Anritsu MT8821C base station simulator was used to setup the connection with EUT; the frequency band, channel bandwidth, RB allocation configuration, modulation type is 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) According to 2017 TCB workshop, for 16QAM, 64QAM and 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 16QAM, 64QAM and 256QAM signal modulation are correct.



16QAM 64QAM 256QAM

3) TDD LTE configuration setup for SAR measurements: 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. Anritsu MT8821C was used for LTE output power measurements and SAR testing.

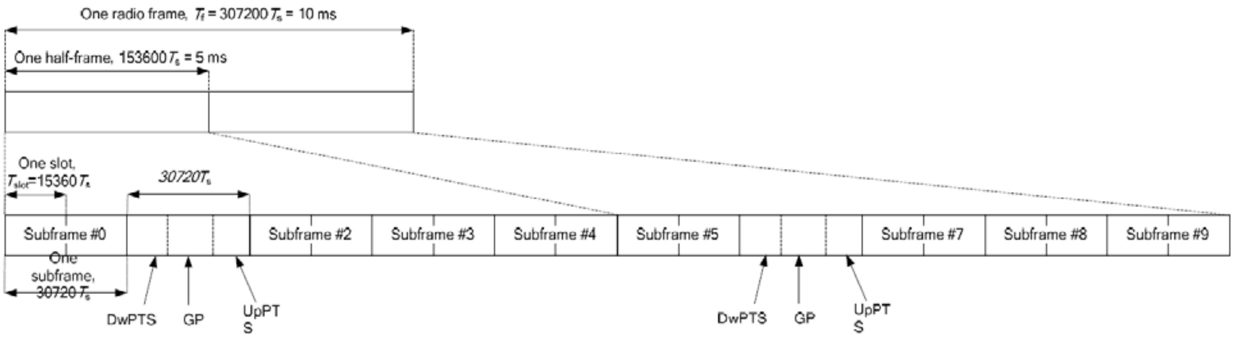


Figure 4.2-1: Frame structure type 2 (for 5 ms switch-point periodicity)

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

<table>
<tr><th rowspan="3">Special subframe configuration</th><th colspan="3">Normal cyclic prefix in downlink</th><th colspan="3">Extended cyclic prefix in downlink</th></tr>
<tr><th rowspan="2">DwPTS</th><th colspan="2">UpPTS</th><th rowspan="2">DwPTS</th><th colspan="2">UpPTS</th></tr>
<tr><th>Normal cyclic prefix in uplink</th><th>Extended cyclic prefix in uplink</th><th>Normal cyclic prefix in uplink</th><th>Extended cyclic prefix in uplink</th></tr>
<tr><td>0</td><td>$6592 \cdot T_s$</td><td rowspan="5">$(1+X) \cdot 2192 \cdot T_s$</td><td rowspan="5">$(1+X) \cdot 2560 \cdot T_s$</td><td>$7680 \cdot T_s$</td><td rowspan="4">$(1+X) \cdot 2192 \cdot T_s$</td><td rowspan="4">$(1+X) \cdot 2560 \cdot T_s$</td></tr>
<tr><td>1</td><td>$19760 \cdot T_s$</td><td>$20480 \cdot T_s$</td></tr>
<tr><td>2</td><td>$21952 \cdot T_s$</td><td>$23040 \cdot T_s$</td></tr>
<tr><td>3</td><td>$24144 \cdot T_s$</td><td>$25600 \cdot T_s$</td></tr>
<tr><td>4</td><td>$26336 \cdot T_s$</td><td>$7680 \cdot T_s$</td><td rowspan="4">$(2+X) \cdot 2192 \cdot T_s$</td><td rowspan="4">$(2+X) \cdot 2560 \cdot T_s$</td></tr>
<tr><td>5</td><td>$6592 \cdot T_s$</td><td rowspan="5">$(2+X) \cdot 2192 \cdot T_s$</td><td rowspan="5">$(2+X) \cdot 2560 \cdot T_s$</td><td>$20480 \cdot T_s$</td></tr>
<tr><td>6</td><td>$19760 \cdot T_s$</td><td>$23040 \cdot T_s$</td></tr>
<tr><td>7</td><td>$21952 \cdot T_s$</td><td>$12800 \cdot T_s$</td></tr>
<tr><td>8</td><td>$24144 \cdot T_s$</td><td>-</td><td>-</td><td>-</td></tr>
<tr><td>9</td><td>$13168 \cdot T_s$</td><td>-</td><td>-</td><td>-</td></tr>
<tr><td>10</td><td>$13168 \cdot T_s$</td><td>$13152 \cdot T_s$</td><td>$12800 \cdot T_s$</td><td>-</td><td>-</td><td>-</td></tr>
</table>

Table 4.2-2: Uplink-downlink configurations

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

Special subframe(30720·Ts): Normal cyclic prefix in downlink(UpPTS)			
Uplink duty factor in one special subframe	Special subframe configuration	Normal cyclic prefix in uplink	Extended cyclic prefix in uplink
	0~4	7.13%	8.33%
	5~9	14.30%	16.70%
Special subframe(30720·Ts): Extended cyclic prefix in downlink(UpPTS)			
Uplink duty factor in one special subframe	Special subframe configuration	Normal cyclic prefix in uplink	Extended cyclic prefix in uplink
	0~3	7.13%	8.33%
	4~7	14.30%	16.70%

The highest duty factor is resulted from:
For LTE Band 38/41 Power Class 3:
a) Uplink-downlink configuration: 0. In a half-frame consisted of 5 subframes, uplink operation is in 3 uplink subframes and 1 special subframe.
b) special subframe configuration: 5-9 for normal cyclic prefix in downlink, 4-7 for extended cyclic prefix in downlink
c) 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%
d) 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%
e) 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 B38/41	> 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 Conducted Power:

1) This device supports Carrier Aggregation on downlink for inter and intra band. For the device supports bands, 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 DL CA		3CC DL CA		4CC DL CA	
Number	**Combination**	**Number**	**Combination**	**Number**	**Combination**
1	CA_26A-41A	1	CA_2A-2A-4A	1	CA_2A-4A-7C
2	CA_2A-2A	2	CA_2A-2A-5A	2	CA_2A-7A-66A-66A
3	CA_2A-38A	3	CA_2A-2A-66A		
4	CA_2A-4A	4	CA_2A-2A-7A		
5	CA_2A-5A	5	CA_2A-4A-4A		
6	CA_2A-66A	6	CA_2A-4A-5A		
7	CA_2A-7A	7	CA_2A-4A-7A		
8	CA_2C	8	CA_2A-5A-66A		
9	CA_38C	9	CA_2A-5A-7A		
10	CA_41A-42A	10	CA_2A-66A-66A		
11	CA_41C	11	CA_2A-7A-66A		
12	CA_42A-42A	12	CA_2A-7A-7A		
13	CA_42C	13	CA_2A-7C		
14	CA_4A-4A	14	CA_4A-4A-5A		
15	CA_4A-5A	15	CA_4A-7A-7A		
16	CA_4A-7A	16	CA_4A-7C		
17	CA_5A-66A	17	CA_5A-5A-66A		
18	CA_5A-7A	18	CA_5A-66A-66A		
19	CA_66A-66A	19	CA_5A-66C		
20	CA_66B	20	CA_5A-7A-66A		
21	CA_66C	21	CA_5A-7C		
22	CA_7A-26A	22	CA_7A-26A-66A		
23	CA_7A-42A	23	CA_7A-66A-66A		
24	CA_7A-66A	24	CA_7C-66A		
25	CA_7A-7A				
26	CA_7B				
27	CA_7C				

Downlink LTE CA Conducted Power:

1) According to KDB 941225 D05A, uplink maximum output power measurement with downlink CA active should be measured, using the highest output channel measured without downlink CA, to confirm that uplink maximum output power with downlink CA active remains within the specified tune-up tolerance limits and not more than ¼ dB higher than the maximum output measured without downlink CA active.
2) Uplink maximum output power with downlink CA active does not show more than ¼ dB higher than the maximum output power without downlink CA active, therefore SAR evaluation with downlink CA active can be excluded.
3) The device supports downlink five CA. For power measurement were control and acknowledge data is sent on uplink channels that operate identical to specifications when downlink CA is inactive.
4) Selected highest measured power when downlink CA is inactive for conducted power comparison with downlink CA is active, to confirm that when downlink CA 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 CA inactive.
5) 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.
6) 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.
7) 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.

LTE 4x4 MIMO (Downlink):

1) This device supports downlink 4x4 MIMO operations for LTE Band 2/4/7/38/41/42/66 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.
2) 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 CA is applicable, power measurements were performed with the downlink CA and 4x4 DL MIMO active for the configuration with highest measured maximum conducted power with downlink CA inactive measured among the channel bandwidth, modulation, and RB combinations in each frequency band.

Uplink LTE CA Conducted Power:

2CC Uplink CA	
Combination	Antenna No.
CA_7C	ANT 1
CA_38C	ANT 1
CA_41C	ANT 1

Intra-band:

1) The device supports intra-band uplink CA for LTE B7/38/41 with a maximum of two uplink component carriers. For intra band contiguous CA 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.

2) The device supports uplink CA with a maximum of two uplink component carriers. For intra band contiguous CA 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.

3) According 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.

4) 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.

Inter-band uplink CA:

LTE Uplink CA	Main Antenna Tx	DIV Antenna Tx
CA_4A-5A	ANT 1/4	/
CA_4A-7A	ANT 1/4	/
CA_5A-7A	ANT 4/1	/
CA_2A-66A	ANT 1/4	/
CA_2A-4A	ANT 1/4	/
CA_2A-7A	ANT 1/4	/

1) The single carrier of inter-band CA uplink power level is the same as Non-CA standalone LTE power level.

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

3) For LTE inter-band CA mode, Qualcomm Smart Transmit algorithm in WWAN directly adds the time-averaged RF exposure between two LTE bands. Smart Transmit algorithm controls the total RF exposure base on LTE inter CA bands to not exceed FCC limit.

(4) 5G NR Test Configuration

1) For 5G NR test procedure was following step similar FCC KDB 941225 D05:
For DFT-OFDM and CP-OFDM output power measurement reduction, according to 38.101 maximum power reduction for power class2/3, the CP-OFDM mode will not higher than DFT-OFDM mode, therefore, similar FCC KDB 941225 D05 procedure for other modulation output power for each RB allocation configuration is > not ½ dB higher than the same configuration in DFT-QPSK and the reported SAR for the DFT-QPSK configuration is ≤ 1.45 W/kg. CP-OFDM testing is not required.
For DFT-OFDM output power measurement reduction, according to 38.101 maximum power reduction for power class2/3, for 16QAM/64QAM/256QAM and smaller bandwidth output power will spot check largest channel bandwidth worst RB configuration to ensure 16QAM/64QAM/256QAM and smaller bandwidth output power will not ½ dB higher than the same configuration in the largest supported bandwidth.

2) Due to test setup limitations, SAR testing for 5G NR was performed using FTM (Factory Test Mode) software to establish the connection and perform SAR with default 100% transmission.

3) 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. For 5G NR NSA mode, the power level is the same as 5G NR SA mode, so 5G NR NSA mode and SA mode power table only show one time.

4) 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. 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.

5) For this device, 5G NR n26 only supports SA mode, 5G NR n2/n5/n7/n38/n41/n66/n78 support both SA and NSA mode.

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]
	Pi/2 BPSK w Pi/2 BPSK DMRS	≤ 0.5[2]	0[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		

ENDC	Main Antenna Tx	
	LTE Tx	NR Tx
LTE B2+5G NR n5	Ant 1	Ant 4
LTE B2+5G NR n7	Ant 1	Ant 4
LTE B4+5G NR n7	Ant 1	Ant 4
LTE B5+5G NR n7	Ant 4	Ant 1
LTE B66+5G NR n7	Ant 1	Ant 4
LTE B2+5G NR n66	Ant 1	Ant 4
LTE B5+5G NR n66	Ant 4	Ant 1
LTE B7+5G NR n66	Ant 1	Ant 4
LTE B2+5G NR n41	Ant 4	Ant 1
LTE B66+5G NR n41	Ant 4	Ant 1
LTE B2+5G NR n78	Ant 1	Ant 2
LTE B4+5G NR n78	Ant 1	Ant 2
LTE B5+5G NR n78	Ant 0	Ant 2
LTE B7+5G NR n78	Ant 4	Ant 2
LTE B38+5G NR n78	Ant 4	Ant 2
LTE B41+5G NR n78	Ant 4	Ant 2
LTE B66+5G NR n78	Ant 1	Ant 2

LTE B5+5G NR n2	Ant 4	Ant 1
LTE B7+5G NR n2	Ant 1	Ant 4
LTE B66+5G NR n2	Ant 1	Ant 4
DC_26A_n41A	Ant 4	Ant 1
DC_26A_n78A	Ant 0	Ant 2
DC_2A_n38A	Ant 4	Ant 1
DC_4A_n2A	Ant 4	Ant 1
DC_4A_n38A	Ant 4	Ant 1
DC_4A_n41A	Ant 4	Ant 1
DC_4A_n78A	Ant 1	Ant 2
DC_66A_n38A	Ant 4	Ant 1

(5) WLAN Test Configuration

1) Per KDB 248227 D01, SAR test reduction is determined according to 802.11 transmission mode configurations and certain exposure conditions with multiple test positions. In the 2.4GHz band, separate SAR procedures are applied to DSSS and OFDM configurations to simplify DSSS test requirements. For OFDM, in both 2.4 and 5GHz bands, an initial test configuration must be determined for each standalone and aggregated frequency band, according to the transmission mode configuration with the highest maximum output power specified for production units to perform SAR measurements. If the same highest maximum output power applies to different combinations of channel bandwidths, modulations and data rates, additional procedures are applied to determine which test configurations require SAR measurement. When applicable, an initial test position may be applied to reduce the number of SAR measurements required for next to the ear, UMPC mini-tablet or hotspot mode configurations with multiple test positions.

2) For 2.4GHz 802.11b DSSS, either the initial test position procedure for multiple exposure test positions or the DSSS procedure for fixed exposure position is applied; these are mutually exclusive. For 2.4GHz and 5GHz OFDM configurations, the initial test configuration is applied to measure SAR using either the initial test position procedure for multiple exposure test position configurations or the initial test configuration procedures for fixed exposure test conditions. Based on the reported SAR of the measured configurations and maximum output power of the transmission mode configurations that are not included in the initial test configuration, the subsequent test configuration and initial test position procedures are applied to determine if SAR measurements are required for the remaining OFDM transmission configurations. In general, the number of test channels that require SAR measurement is minimized based on maximum output power measured for test samples.

3) For OFDM transmission configurations in the 2.4GHz and 5GHz bands, When the same maximum power is specified for multiple transmission modes in a frequency band, the largest channel bandwidth, lowest order modulation, lowest data rate and lowest order 802.11a/g/n/ac mode is used for SAR measurement, on the highest measured output power channel for each frequency band.

4) Power must be measured at each transmit antenna port according to the DSSS and OFDM transmission configurations in each standalone and aggregated frequency band.
a) Power measurement is required for the transmission mode configuration with the highest maximum output power specified for production units.
b) When the same highest maximum output power specification applies to multiple transmission modes, the largest channel bandwidth configuration with the lowest order modulation and lowest data rate is measured.
c) When the same highest maximum output power is specified for multiple largest channel bandwidth configurations with the same lowest order modulation or lowest order modulation and lowest data rate, power measurement is required for all equivalent 802.11 configurations with the same maximum output power.
d) For each transmission mode configuration, power must be measured for the highest and lowest channels; and at the mid-band channel(s) when there are at least 3 channels. For configurations with multiple mid-band channels, due to an even number of channels, both channels should be measured.

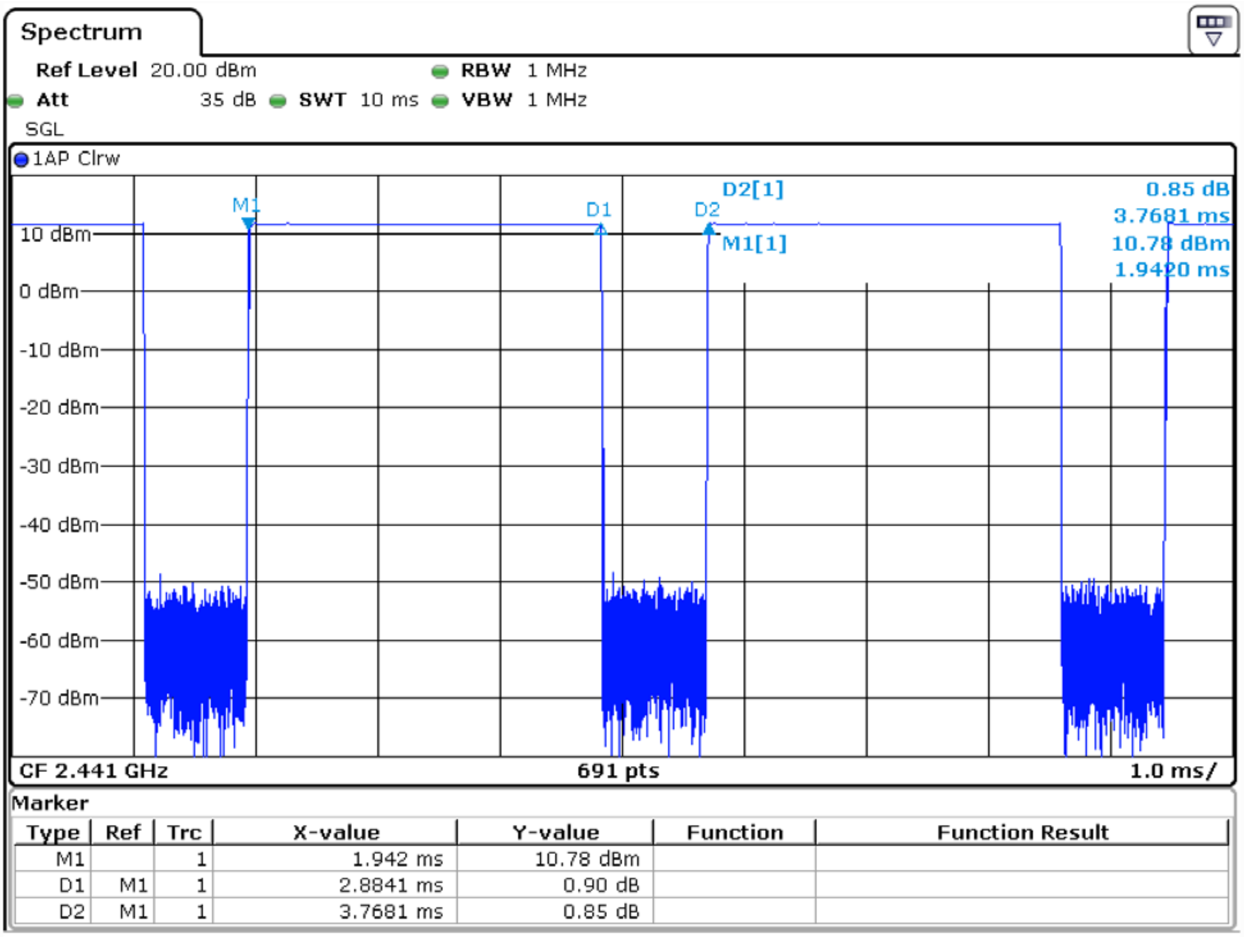
5) 802.11ax supports full tone size and partial tone size, after verification for the partial tone size mode power level will not higher than full tone size power level, so chose full tone power to be measured in this report.

6) The 2.4GHz/5GHz/6GHz WLAN can transmit in MIMO antenna mode only and it has no SISO antenna mode.

(6) Bluetooth Test Configuration

1) For 2.4GHz Bluetooth SAR testing was selected 1Mbps, due to its highest average power.

2) The Bluetooth duty cycle is 76.54% for ANT6 as following figure, Bluetooth SAR scaling need further consideration and the theoretical maximum duty cycle is 83.3%, therefore the actual duty cycle will be scaled up to 83.3% for Bluetooth reported SAR calculation.



16. EUT Antenna Location

●The detailed antenna location information can refer to Appendix D Test Setup Photographs.

17. Test Results of SAR

General Note:

1) Per KDB 447498 D01, the reported SAR is the measured SAR value adjusted for maximum tune-up tolerance.
(a) Tune-up scaling Factor = tune-up limit power / average power, where tune-up limit is the maximum rated power among all production units.
(b) For SAR testing of Wi-Fi/BT 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 Wi-Fi/BT: 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 D01, 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:
(a) ≤ 0.8 W/kg or 2.0 W/kg, for 1-g or 10-g respectively, when the transmission band is ≤ 100 MHz
(b) ≤ 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
(c) ≤ 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 D01, for each frequency band, repeated SAR measurement is required when the measured SAR is ≥ 0.8W/kg. 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) This device implements antenna tuning techniques for several WWAN operating modes and frequencies for the purpose of improving antenna efficiency over a broad range of frequencies. Specifically, these techniques are employed in the WCDMA/LTE/5G NR modes. In this report SAR was measured according to the normally required SAR configurations with the tuner active and worst tune state (auto tune) was used for SAR testing. The detail descriptions of the antenna tuner and supplemental data for additional information can be referred to section19 and appendix F.

5) For 5G NR test, using FTM (Factory Test Mode) to perform SAR with default 100% transmission. 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.

6) Per KDB 648474 D04, 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.

7) 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 Qualcomm smart transmit will manage to ensure the power level not exceeding the associated power table.

For this device, the frequency bands of SAR scaled to maximum output power mode for product specific 10g SAR is higher than 1.2W/kg as follows: GSM1900, WCDMA B2/4, LTE B2/4/7/25/66/38/41/42, 5G NR n2/n7/n66/n38/n41/n78, WLAN5.2GHz/5.3GHz/5.5GHz/5.8GHz, therefore product specific 10g SAR is necessary. WLAN 5.3/5.5GHz does not test the product specific 10g SAR since it has no hotspot mode. 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.

(1) GSM Note:

Per KDB 941225 D01, for SAR test reduction for GSM/GPRS/EDGE modes is determined by the source-based time-averaged output power including tune-up tolerance. The mode with highest specified time-averaged output power should be tested for SAR compliance in the applicable exposure conditions. For modes with the same specified maximum output power and tolerance, the higher number time-slot configuration should be tested.

Other configurations of GSM/GPRS/EDGE are considered as secondary modes. The 3G SAR test reduction procedure is applied, when the maximum output power and tune-up tolerance specified for production units in a secondary mode is ≤ ¼ dB higher than the primary mode, SAR measurement is not required for the secondary mode.

(2) WCDMA Note:

Per KDB 941225 D01, for SAR testing is measured using a 12.2 kbps RMC with TPC bits configured to all “1’s”. RMC 12.2kbps setting is used to evaluate SAR. The maximum output power and tune-up tolerance specified for production units in HSDPA/HSUPA/DC-HSDPA is ≤ ¼ dB higher than RMC 12.2Kbps or when the highest reported SAR of the RMC12.2Kbps is scaled by the ratio of specified maximum output power and tune-up tolerance of HSDPA/HSUPA/DC-HSDPA to RMC12.2Kbps and the adjusted SAR is ≤1.2 W/kg, SAR measurement is not required for HSDPA/HSUPA/DC-HSDPA, and according to the following RF output power, the output power results of the secondary modes (HSDPA/HSUPA/DC-HSDPA) are less than ¼ dB higher than the primary modes; therefore, SAR measurement is not required for HSDPA/HSUPA/DC-HSDPA.

(3) LTE Note:
Per KDB 941225 D05, Largest channel bandwidth standalone SAR test requirements:
(a) QPSK with 1 RB allocation
Start with the largest channel bandwidth then measure SAR for QPSK with 1 RB allocation, using the RB offset and required test channel combination with the highest maximum output power among RB offsets at the upper edge, middle, and lower edge of each required test channel. When the reported SAR is ≤ 0.8 W/kg, testing of the remaining RB offset configurations and required test channels is not required for 1 RB allocation; otherwise, SAR is required for the remaining required test channels and only for the RB offset configuration with the highest output power for that channel. When the reported SAR of a required test channel is > 1.45 W/kg, SAR is required for all three RB offset configurations for that required test channel.

(b) QPSK with 50% RB allocation
The procedures required for 1 RB allocation in (a) are applied to measure the SAR for QPSK with 50% RB allocation.

(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 ≤ 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) Higher order modulations
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, SAR testing of 16QAM/64QAM/256QAM is not required.

(e) Other channel bandwidth standalone SAR test requirements
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, SAR testing of smaller bandwidth is not required.

(4) 5G NR Note:
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.

(5) Wi-Fi and BT Note:
Per KDB 248227 D01, for 2.4GHz 802.11g/n SAR testing is not required when the highest reported SAR for DSSS is adjusted by the ratio of OFDM to DSSS specified maximum output power and the adjusted SAR is ≤ 1.2 W/kg. U-NII-1 SAR testing is not required when the U-NII-2A band highest reported SAR for a test configuration is ≤ 1.2 W/kg, SAR is not required for U-NII-1 band.
When the reported SAR of the test position is > 0.4 W/kg, SAR is repeated for the 802.11 transmission mode configuration tested in the initial test position to measure the subsequent next closet/smallest test separation distance and maximum coupling test position on the highest maximum output power channel, until the report SAR is ≤ 0.8 W/kg or all required test position are tested.
For all positions and configurations, when the reported SAR is > 0.8 W/kg, SAR is measured for these test positions and configurations on the subsequent next highest measured output power channels until the reported SAR is ≤ 1.2 W/kg or all required channels are tested.
During SAR testing the WLAN transmission was verified using a spectrum analyzer.
802.11ax supports full tone size and partial tone size, after verification for the partial tone size mode power level will not higher than full tone size power level, so chose full tone power to be measured in this report.

DSSS and OFDM configurations are considered separately according to the required SAR procedures. SAR is measured in the initial test position using the 802.11 transmission mode configuration required by the DSSS procedure or initial test configuration and subsequent test configurations according to the OFDM procedures.18 The initial test position procedure is described in the following:
(a) When the reported SAR of the initial test position is ≤ 0.4 W/kg, further SAR measurement is not required for the other test positions in that exposure configuration and 802.11 transmission mode combinations within the frequency band or aggregated band.
(b) When the reported SAR of the test position is > 0.4 W/kg, SAR is repeated for the 802.11 transmission mode configuration tested in the initial test position to measure the subsequent next closet/smallest test separation distance and maximum coupling test position on the highest maximum output power channel, until the report SAR is ≤ 0.8 W/kg or all required test position are tested.
(c) For all positions/configurations, when the reported SAR is > 0.8 W/kg, SAR is measured for these test positions/configurations on the subsequent next highest measured output power channel(s) until the reported SAR is ≤ 1.2 W/kg or all required channels are tested.

17.1. Head SAR

- The detailed “Table of Head SAR Test Record” can refer to Appendix B-1.

17.2. Hotspot SAR

- The detailed “Table of Hotspot SAR Test Record” can refer to Appendix B-1.

17.3. Body-Worn SAR

- The detailed “Table of Body-Worn SAR Test Record” can refer to Appendix B-1.

17.4. Product Specific 10g SAR

- The detailed “Table of Product Specific 10g SAR Test Record” can refer to Appendix B-1.

17.5. Repeated SAR

- The detailed “Table of Repeated SAR Test Record” can refer to Appendix B-1.

Note:
Per KDB 865664 D01 SAR measurement 100 MHz to 6 GHz v01r04, SAR measurement variability must be assessed for each frequency band, which is determined by the SAR probe calibration point and tissue-equivalent medium used for the device measurements. The additional measurements are repeated after the completion of all measurements requiring the same head or body tissue-equivalent medium in a frequency band. The test device should be returned to ambient conditions (normal room temperature) with the battery fully charged before it is re-mounted on the device holder for the repeated measurement(s) to minimize any unexpected variations in the repeated results.
1) Repeated measurement is not required when the original highest measured SAR is < 0.80 W/kg, steps 2) through 4) do not apply.
2) When the original highest measured SAR is ≥ 0.80 W/kg, repeat that measurement once.
3) Perform a second repeated measurement only if the ratio of largest to smallest SAR for the original and first repeated measurements is > 1.20 or when the original or repeated measurement is ≥ 1.45 W/kg (~ 10% from the 1-g SAR limit).
4) Perform a third repeated measurement only if the original, first or second repeated measurement is ≥1.5 W/kg and the ratio of largest to smallest SAR for the original, first and second repeated measurements is > 1.20.

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.

All measurement SAR results is scaled-up to account for tune-up tolerance and is compliant.

18. Simultaneous Transmission Analysis

18.1. Simultaneous Transmission Possibilities

No.	Simultaneous Transmission Scene	Head	Body-worn	Hotspot	Product specific 10g SAR
1	WWAN + WLAN2.4G MIMO	Yes	Yes	Yes	Yes
2	WWAN + WLAN5G MIMO	Yes	Yes	Yes	Yes
3	WWAN + BT	Yes	Yes	Yes	Yes
4	WWAN + WLAN2.4G MIMO + NFC				Yes
5	WWAN + WLAN5G MIMO + NFC				Yes
6	WWAN + BT + NFC				Yes

Note:
Per KDB 447498 D01, simultaneous transmission SAR is compliant if:
1) 1g Scalar SAR summation < 1.6W/kg and 10g Scalar SAR summation < 4.0W/kg.
2) If SPLSR ≤ 0.04 for 1g SAR and SPLSR ≤ 0.10 for 10g SAR, simultaneously transmission SAR measurement is not necessary. SPLSR = (SAR1 + SAR2) ^1.5 / (min. separation distance, mm), and the peak separation distance is determined from the square root of [(x1-x2)2 + (y1-y2)2 + (z1-z2)2], where (x1, y1, z1) and (x2, y2, z2) are the coordinates of the extrapolated peak SAR locations in the zoom scan.
3) Simultaneously transmission SAR measurement, and the reported multi-band 1g SAR < 1.6W/kg and 10g SAR < 4.0W/kg.

18.2. Sub6 Antenna Groups

The 2nd generation of Smart Transmit (GEN2) operates based on pre-defined sub6 antenna groups (AG). Sub6 Tx antennas in the device are grouped based on spatial variation of RF exposure distributions, where the RF exposure of one AG is mutually exclusive from other AG. This is accomplished by demonstrating below conditions for all exposure positions under each DSI for a given exposure category.

1) Case1: Sum of SAR of one antenna from each of the sub6 AGs and the RF exposure from radios outside Smart Transmit is less than regulatory limits for each supported DSI. This condition must be demonstrated for all antenna combinations of sub6 AGs.
   i. For a given DSI, obtain the highest reported SAR for each antenna out of all supported technologies and frequency bands. Obtain the maximum reported SAR for each AG by taking the maximum out of reported SAR for all antennas belonging to each AG.
   ii. Demonstrate that the sum of maximum reported SAR (normalized to regulatory limit) from each of the sub6 AGs and the sum of reported SAR (normalized to regulatory limit) from all supported radios outside of Smart Transmit should be less than 1.0
2) Case2: If the Case1 is not met, then for a given antenna grouping scheme plus external radios/antennas (ERs) (referred to as 'configuration'), demonstrate all AG pairs, all ER pairs and all (AG, ER) pairs in the configuration meet SPLSR criteria (Section 4.3.2 (c) in FCC KDB447498 D01v06) for each exposure position under each supported DSI. For a given exposure position under a given DSI, prove all AG pairs, all ER pairs and all (AG, ER) pairs (if there are external radios outside Smart Transmit) in the configuration meet SPLSR.

This device supports two Sub6 AG: AG0 and AG1, the detailed please refer to the below table:

Antenna Group 0 (AG0)	ANT0 & ANT1 & ANT11
Antenna Group 1 (AG1)	ANT2 & ANT4 & ANT5 & ANT7

The conditions are verified through the following criteria:

i) (SAR1+ SAR2 criteria): If SPLSR criteria is not used, then the highest reported SAR at Plimit for each antenna should be obtained out of all supported technologies and frequency bands for each DSI. Demonstrate that the sum of reported SAR of one antenna from each of the sub6 AGs and the sum of RF exposure from all supported radios outside of Smart Transmit should be less than the regulatory limit as given below for each DSI.1. Obtain the worst-case reported SAR for each antenna group (i.e., maximum reported SAR at Plimit out of all supported technologies, frequency bands and antennas in AG0 and AG1), denoted as max.SAR. AG0 and max.SAR.AG1, and obtain the worst-case RF exposure for each external radio, and demonstrate that the sum of these RF exposures meets: ([max.SAR.AG0+max.SAR.AG1] + WIFI/BT worst-case reported SAR) ≤ 1.6 for 1g, or 4.0 for 10g. (WIFI/BT worst-case reported SAR is the worst SAR in all combinations of WIFI and BT simultaneous transmission)
ii) (SPLSR criteria): For each antenna, obtain the highest reported SAR value at Plimit out of all supported technologies for each frequency band. Using these values, demonstrate for a given DSi that every antenna from one sub6 AG meets SPLSR criteria with every antenna in another sub6 AG for all frequency bands. This criteria must be demonstrated for al antenna pair combinations irrespective of supported simultaneous transmission scenarios as given below for each DSI:
   a. SPLSR criteria should be met for all antenna pair combinations of AG0 and AG1. As it can be seen, these include all combinations of antenna groups, antennas, and frequency bands.
   b. Obtain combined SAR per AG: Obtain the worst-case conservative combined SAR and its peak location for each AG.
   c. Use the 'closest peak location out of all antennas of AGj to evaluate SPLSR with other AGs in the configuration. Note, by 'closest, select the peak location out of all antennas (AGj) that is closest to the peak location of other AG where SPLSR is evaluated.
iii) (combination of SPLSR & SAR1+SAR2 criteria): If SPLSR criteria for all the combinations of sub6 antenna groups in(i) is demonstrated to show that each AG is mutually exclusive from other AGs, and if the WIFI/BT antennas supported outside of Smart Transmit do not meet SPLSR criteria, then the condition in (ii) reduces to: (max.SAR.AG0+ worst-case reported SAR) s1.6 and (max.SAR.AG1+ worst-case reported SAR) ≤1.6 for compliance demonstration (for 1g, or 4.0 for 10g).

All of the combinations of sub6 antenna groups are sufficient to show that AG0 is mutually exclusive from AG1 and that simultaneous transmission cases will not exceed the SAR limit and therefore no measured volumetric simultaneous SAR summation is required per FCC KDB Publication 447498 D01v06 and IEEE 1528-2013 Section6.3.4.1. For summed SAR results and SPLSR detailed analysis, please refer to the following.

<1>Head Exposure Conditions:

General Note: The unit of SAR evaluation is W/kg.

Simultaneous Transmission Evaluation of WWAN+WLAN/BT

AG0 Highest Reported SAR：

Test Position	Ant0	Ant1	Ant11	MAX
Right Cheek 0mm	0.222	0.393	0.138	**0.393**
Right Tilted 0mm	0.159	0.204	0.053	**0.204**
Left Cheek 0mm	0.377	0.224	0.097	**0.377**
Left Tilted 0mm	0.216	0.143	0.109	**0.216**

AG1 Highest Reported SAR：

Test Position	Ant2	Ant4	Ant5	Ant7	MAX
Right Cheek 0mm	0.846	0.981	0.283	0.324	**0.981**
Right Tilted 0mm	0.405	0.787	0.251	0.063	**0.787**
Left Cheek 0mm	0.263	0.661	0.377	0.141	**0.661**
Left Tilted 0mm	0.213	0.769	0.436	0.117	**0.769**

WIFI&BT Worse-case SAR:

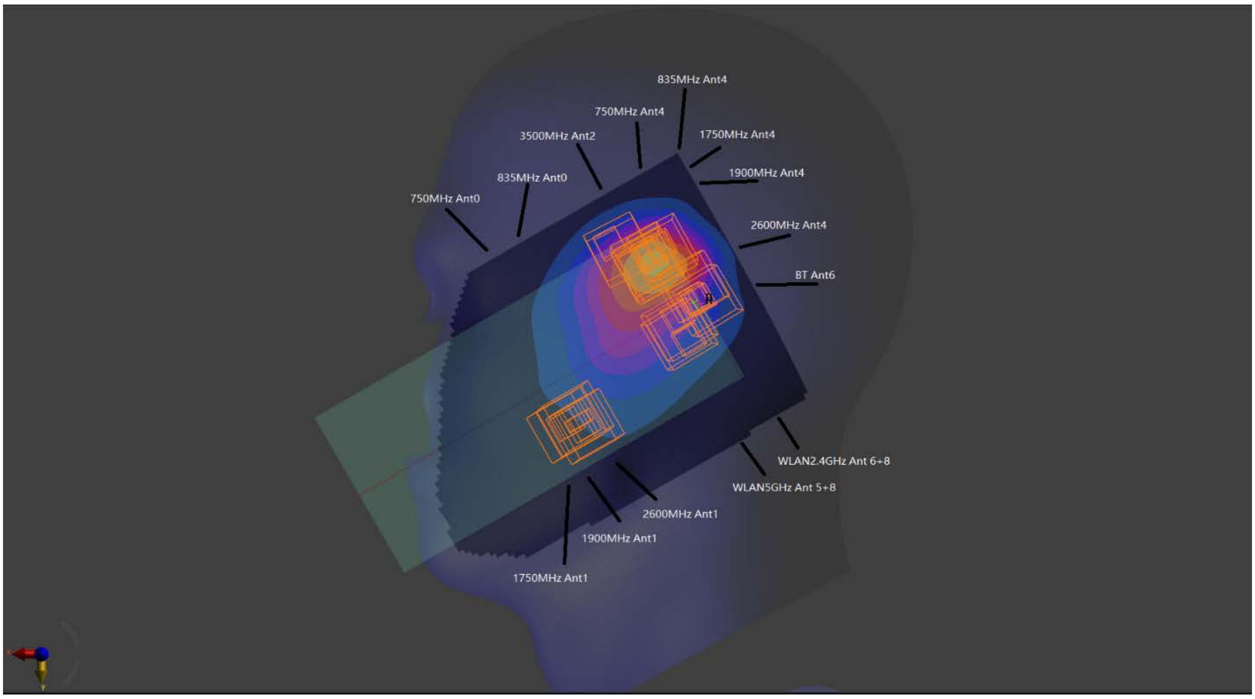
NO	1	2	3	WLAN/BT worse case
Test	WLAN2.4GHz	WLAN5GHz	Bluetooth	
Position	Ant 6+8	Ant 5+8	Ant 6	
Right Cheek 0mm	0.22	0.464	0.105	**0.464**
Right Tilted 0mm	0.261	0.53	0.103	**0.53**
Left Cheek 0mm	0.486	0.548	0.266	**0.548**
Left Tilted 0mm	0.406	0.568	0.167	**0.568**

Simultaneous Transmission analysis of AG0 + AG1 + WLAN/BT Worse-case:

Test Position	AG0	AG1	WLAN/BT worst case	AG0+AG1+WLAN/BT worse case
Right Cheek 0mm	0.393	0.981	0.464	1.84
Right Tilted 0mm	0.204	0.787	0.53	1.52
Left Cheek 0mm	0.377	0.661	0.548	1.59
Left Tilted 0mm	0.216	0.769	0.568	1.55

Note: The results marked yellow in above table refers to the detailed analysis corresponding to each position below tables.

Right Cheek					
Ant combination	AG0	AG1	WLAN/BT worst case	AG0+AG1+WLAN/BT worst case	Note
	1g SAR (W/kg)	1g SAR (W/kg)	1g SAR (W/kg)	1g SAR (W/kg)	
Ant0-Ant2	0.222	0.846	0.464	1.53	-
Ant0-Ant4	0.222	0.981	0.464	1.67	Case 1
Ant0-Ant5	0.222	0.283	0.464	0.97	-
Ant0-Ant7	0.222	0.324	0.464	1.01	-
Ant1-Ant2	0.393	0.846	0.464	1.7	Case 2
Ant1-Ant4	0.393	0.981	0.464	1.84	Case 3
Ant1-Ant5	0.393	0.283	0.464	1.14	-
Ant1-Ant7	0.393	0.324	0.464	1.18	-
Ant11-Ant2	0.138	0.846	0.464	1.45	-
Ant11-Ant4	0.138	0.981	0.464	1.58	-
Ant11-Ant5	0.138	0.283	0.464	0.89	-
Ant11-Ant7	0.138	0.324	0.464	0.93	-



WWAN+WLAN/BT Right Cheek

No.1 Band	Position	SAR 1g SAR (W/kg)	Summed	Gap	SAR peak location (mm)			3D distance (mm)	Summed SAR (W/kg)	SPLSR Results	Simultaneous SAR
					X	Y	Z				
Ant0	Right Cheek	0.222	0.222	0mm	57.3	-275	-171.6	59.3	1.67	0.04	Not required
Ant4		0.981	0.981	0mm							
WLAN		0.464	0.464	0mm	16.1	-317.6	-170.2				
No.2 Band	**Position**	**SAR 1g SAR (W/kg)**	**Summed**	**Gap**	**SAR peak location (mm)**			**3D distance (mm)**	**Summed SAR (W/kg)**	**SPLSR Results**	**Simultaneous SAR**
					X	**Y**	**Z**				
Ant1	Right Cheek	0.393	0.393	0mm	55.4	-263.1	-171.2	67.2	1.7	0.03	Not required
Ant2		0.846	0.846	0mm							
WLAN		0.464	0.464	0mm	16.1	-317.6	-169.9				
No.3 Band	**Position**	**SAR 1g SAR (W/kg)**	**Summed**	**Gap**	**SAR peak location (mm)**			**3D distance (mm)**	**Summed SAR (W/kg)**	**SPLSR Results**	**Simultaneous SAR**
					X	**Y**	**Z**				
Ant1	Right Cheek	0.393	0.393	0mm	55.4	-263.1	-171.2	67.2	1.84	0.04	Not required
Ant4		0.981	0.981	0mm							
WLAN		0.464	0.464	0mm	16.1	-317.6	-169.9				

<2>Hotspot Exposure Conditions:

General Note: The unit of SAR evaluation is W/kg.

Simultaneous Transmission Evaluation of WWAN+WLAN/BT

AG0 Highest Reported SAR:

Test Position	Ant0	Ant1	Ant11	MAX
Front 5mm	0.644	1.047	0.303	**1.047**
Back 5mm	1.22	1.126	0.65	**1.22**
Left Side 5mm	0.658			**0.658**
Right Side 5mm		0.468	1.157	**1.157**
Top Side 5mm				**0**
Bottom Side 5mm	0.836	1.298	0.274	**1.298**

AG1 Highest Reported SAR:

Test Position	Ant2	Ant4	Ant5	Ant7	MAX
Front 5mm	0.162	0.301	0.185	0.07	**0.301**
Back 5mm	0.317	0.524	0.31	0.149	**0.524**
Left Side 5mm	0.609	0.403			**0.609**
Right Side 5mm			0.119	0.275	**0.275**
Top Side 5mm	0.103	0.587	0.399	0.081	**0.587**
Bottom Side 5mm					**0**

WIFI&BT Worse-case SAR:

NO	1	2	3	WLAN/BT worse case
Test	WLAN2.4GHz	WLAN5GHz	Bluetooth	
Position	Ant 6+8	Ant 5+8	Ant 6	
Front 5mm	0.482	0.396	0.073	**0.482**
Back 5mm	0.762	0.578	0.181	**0.762**
Left Side 5mm				**0**
Right Side 5mm	0.749	0.349	0.041	**0.749**
Top Side 5mm	0.823	0.926	0.166	**0.926**
Bottom Side 5mm				**0**

Simultaneous Transmission analysis of AG0 + AG1 + WLAN/BT Worse-case:

Test Position	AG0	AG1	WLAN/BT worst case	AG0+AG1+WLAN/BT worse case
Front 5mm	1.047	0.301	0.482	1.83
Back 5mm	1.22	0.524	0.762	2.51
Left Side 5mm	0.658	0.609		1.27
Right Side 5mm	1.157	0.275	0.749	2.18
Top Side 5mm		0.587	0.926	1.51
Bottom Side 5mm	1.298			1.3

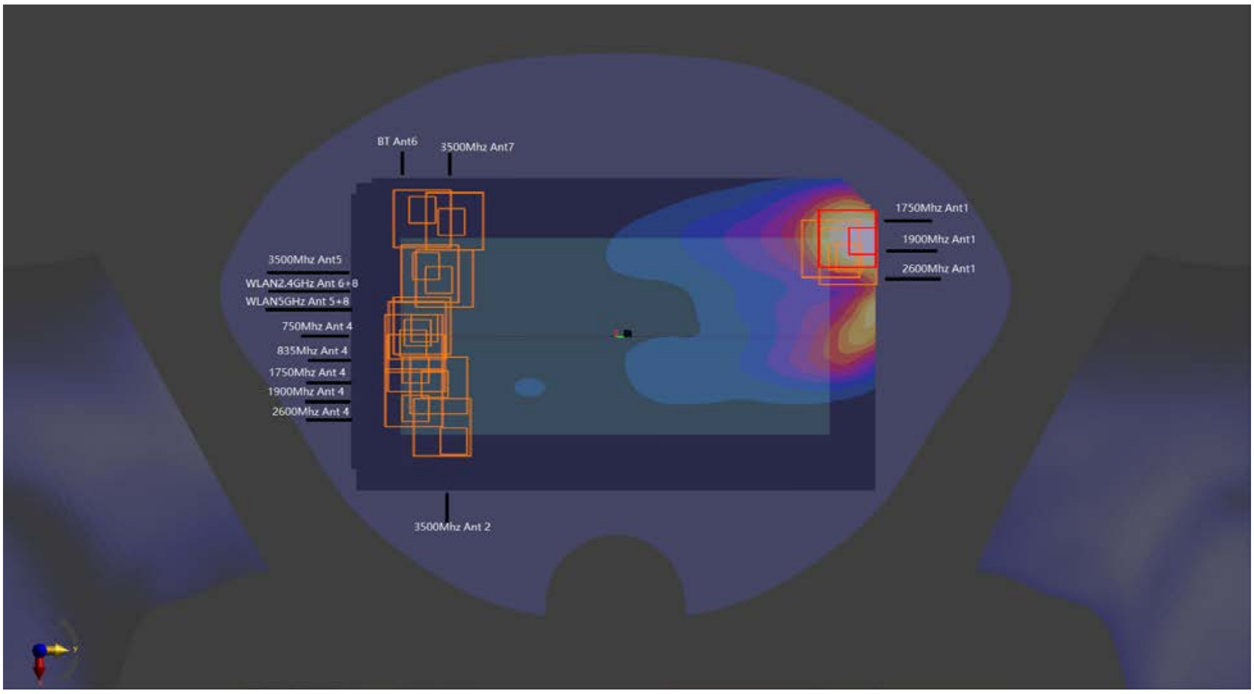
Note: The results marked yellow in above table refers to the detailed analysis corresponding to each position below tables.

Front					
Ant combination	AG0	AG1	Wlan/BT worst case	AG0+AG1+Wlan/BT worst case	Note
	1g SAR (W/kg)	1g SAR (W/kg)	1g SAR (W/kg)	1g SAR (W/kg)	
Ant0-Ant2	0.644	0.162	0.482	1.29	-
Ant0-Ant4	0.644	0.301	0.482	1.43	-
Ant0-Ant5	0.644	0.185	0.482	1.31	-
Ant0-Ant7	0.644	0.07	0.482	1.2	-
Ant1-Ant2	1.047	0.162	0.482	1.69	Case 11
Ant1-Ant4	1.047	0.301	0.482	1.83	Case 12
Ant1-Ant5	1.047	0.185	0.482	1.71	Case 13
Ant1-Ant7	1.047	0.07	0.482	1.6	Case 14
Ant11-Ant2	0.303	0.162	0.482	0.95	-
Ant11-Ant4	0.303	0.301	0.482	1.09	-
Ant11-Ant5	0.303	0.185	0.482	0.97	-
Ant11-Ant7	0.303	0.07	0.482	0.86	-

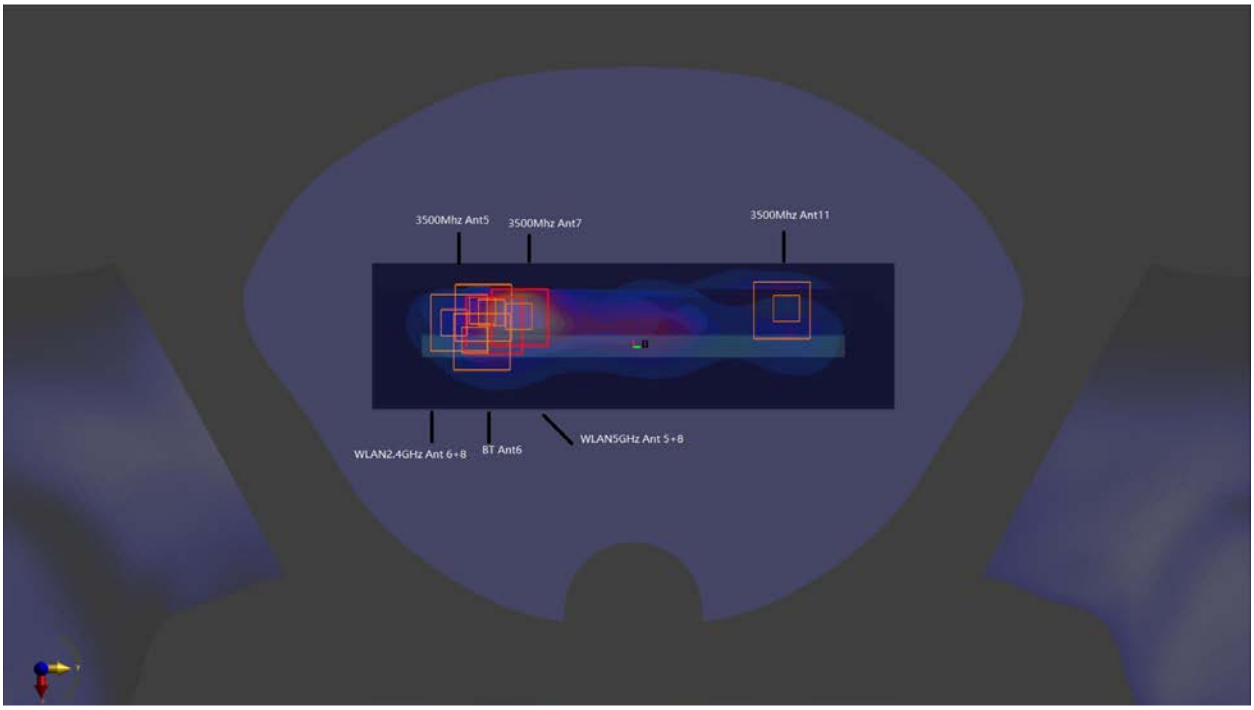
Back					
Ant combination	AG0	AG1	Wlan/BT worst case	AG0+AG1+Wlan/BT worst case	Note
	1g SAR (W/kg)	1g SAR (W/kg)	1g SAR (W/kg)	1g SAR (W/kg)	
Ant0-Ant2	1.22	0.317	0.762	2.3	Case 15
Ant0-Ant4	1.22	0.524	0.762	2.51	Case 16
Ant0-Ant5	1.22	0.31	0.762	2.29	Case 17
Ant0-Ant7	1.22	0.149	0.762	2.13	Case 18
Ant1-Ant2	1.126	0.317	0.762	2.21	Case 19
Ant1-Ant4	1.126	0.524	0.762	2.41	Case 20
Ant1-Ant5	1.126	0.31	0.762	2.2	Case 21
Ant1-Ant7	1.126	0.149	0.762	2.04	Case 22
Ant11-Ant2	0.65	0.317	0.762	1.73	Case 23
Ant11-Ant4	0.65	0.524	0.762	1.94	Case 24
Ant11-Ant5	0.65	0.31	0.762	1.72	Case 25

Ant11-Ant7	0.65	0.149	0.762	1.56	-

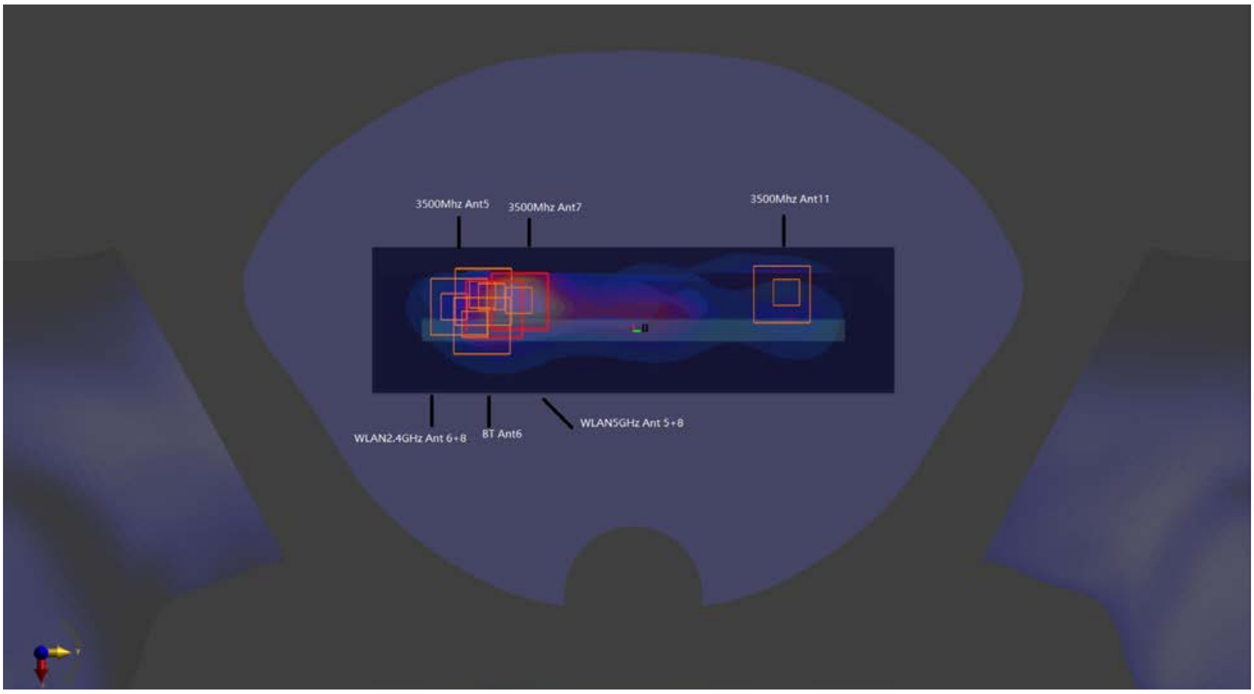
Right Side					
Ant combination	AG0	AG1	Wlan/BT worst case	AG0+AG1+Wlan/BT worst case	Note
	1g SAR (W/kg)	1g SAR (W/kg)	1g SAR (W/kg)	1g SAR (W/kg)	
Ant0-Ant2			0.749	0.75	-
Ant0-Ant4			0.749	0.75	-
Ant0-Ant5		0.119	0.749	0.87	-
Ant0-Ant7		0.275	0.749	1.02	-
Ant1-Ant2	0.468		0.749	1.22	-
Ant1-Ant4	0.468		0.749	1.22	-
Ant1-Ant5	0.468	0.119	0.749	1.34	-
Ant1-Ant7	0.468	0.275	0.749	1.49	-
Ant11-Ant2	1.157		0.749	1.91	Case 26
Ant11-Ant4	1.157		0.749	1.91	Case 27
Ant11-Ant5	1.157	0.119	0.749	2.03	Case 28
Ant11-Ant7	1.157	0.275	0.749	2.18	Case 29



WWAN+WLAN/BT Front side 5mm



WWAN+WLAN/BT Back side 5mm



WWAN+WLAN/BT Right side 5mm

No.11 Band	Position	SAR 1g SAR (W/kg)	Summed	Gap	SAR peak location (mm)			3D distance (mm)	Summed SAR (W/kg)	SPLSR Results	Simultaneous SAR
					X	Y	Z				
Ant1	Front	1.047	1.047	0mm	-55	54.5	-203.4	117.9	1.69	0.02	Not required
Ant2		0.162	0.162	0mm							
WLAN		0.482	0.482	0mm	-65	-63	-202.8				

No.12 Band	Position	SAR 1g SAR (W/kg)	Summed	Gap	SAR peak location (mm)			3D distance (mm)	Summed SAR (W/kg)	SPLSR Results	Simultaneous SAR
					X	Y	Z				
Ant1	Front	1.047	1.047	0mm	-55	54.5	-203.4	117.9	1.83	0.02	Not required
Ant4		0.301	0.301	0mm							
WLAN		0.482	0.482	0mm	-65	-63	-202.8				

No.13 Band	Position	SAR 1g SAR (W/kg)	Summed	Gap	SAR peak location (mm)			3D distance (mm)	Summed SAR (W/kg)	SPLSR Results	Simultaneous SAR
					X	Y	Z				
Ant1	Front	1.047	1.047	0mm	-55	54.5	-203.4	117.9	1.71	0.02	Not required
Ant5		0.185	0.185	0mm							
WLAN		0.482	0.482	0mm	-65	-63	-202.8				

No.14 Band	Position	SAR 1g SAR (W/kg)	Summed	Gap	SAR peak location (mm)			3D distance (mm)	Summed SAR (W/kg)	SPLSR Results	Simultaneous SAR
					X	Y	Z				
Ant1	Front	1.047	1.047	0mm	-55	54.5	-203.4	117.9	1.6	0.02	Not required
Ant7		0.07	0.07	0mm							
WLAN		0.482	0.482	0mm	-65	-63	-202.8				

No.15 Band	Position	SAR 1g SAR (W/kg)	Summed	Gap	SAR peak location (mm)			3D distance (mm)	Summed SAR (W/kg)	SPLSR Results	Simultaneous SAR
					X	Y	Z				
Ant0	Back	1.22	1.22	0mm	-55	65.3	-201.6	121.5	2.3	0.03	Not required
Ant2		0.317	0.317	0mm							
WLAN		0.762	0.762	0mm	5	-40.4	-202.6				

No.16 Band	Position	SAR 1g SAR (W/kg)	Summed	Gap	SAR peak location (mm)			3D distance (mm)	Summed SAR (W/kg)	SPLSR Results	Simultaneous SAR
					X	Y	Z				
Ant0	Back	1.22	1.22	0mm	-55	65.3	-201.6	121.5	2.51	0.03	Not required
Ant4		0.524	0.524	0mm							
WLAN		0.762	0.762	0mm	5	-40.4	-202.6				

No.17 Band	Position	SAR 1g SAR (W/kg)	Summed	Gap	SAR peak location (mm)			3D distance (mm)	Summed SAR (W/kg)	SPLSR Results	Simultaneous SAR
					X	Y	Z				
Ant0	Back	1.22	1.22	0mm	-55	65.3	-201.6	121.5	2.29	0.03	Not required
Ant5		0.31	0.31	0mm							
WLAN		0.762	0.762	0mm	5	-40.4	-202.6				

No.18 Band	Position	SAR 1g SAR (W/kg)	Summed	Gap	SAR peak location (mm)			3D distance (mm)	Summed SAR (W/kg)	SPLSR Results	Simultaneous SAR
					X	Y	Z				
Ant0	Back	1.22	1.22	0mm	-55	65.3	-201.6	121.5	2.13	0.03	Not required
Ant7		0.149	0.149	0mm							
WLAN		0.762	0.762	0mm	5	-40.4	-202.6				

No.19 Band	Position	SAR 1g SAR (W/kg)	Summed	Gap	SAR peak location (mm)			3D distance (mm)	Summed SAR (W/kg)	SPLSR Results	Simultaneous SAR
					X	Y	Z				
Ant1	Back	1.126	1.126	0mm	-8.5	60.5	-207	101.9	2.21	0.03	Not required
Ant2		0.317	0.317	0mm							
WLAN		0.762	0.762	0mm	5	-40.4	-202.6				

No.20 Band	Position	SAR 1g SAR (W/kg)	Summed	Gap	SAR peak location (mm)			3D distance (mm)	Summed SAR (W/kg)	SPLSR Results	Simultaneous SAR
					X	Y	Z				
Ant1	Back	1.126	1.126	0mm	-8.5	60.5	-207	101.9	2.41	0.04	Not required
Ant4		0.524	0.524	0mm							
WLAN		0.762	0.762	0mm	5	-40.4	-202.6				

No.21 Band	Position	SAR 1g SAR (W/kg)	Summed	Gap	SAR peak location (mm)			3D distance (mm)	Summed SAR (W/kg)	SPLSR Results	Simultaneous SAR
					X	Y	Z				
Ant1	Back	1.126	1.126	0mm	-8.5	60.5	-207	101.9	2.2	0.03	Not required
Ant5		0.31	0.31	0mm							
WLAN		0.762	0.762	0mm	5	-40.4	-202.6				

No.22 Band	Position	SAR 1g SAR (W/kg)	Summed	Gap	SAR peak location (mm)			3D distance (mm)	Summed SAR (W/kg)	SPLSR Results	Simultaneous SAR
					X	Y	Z				
Ant1		1.126	1.126	0mm	-8.5	60.5	-207				
Ant7	Back	0.149	0.149	0mm				101.9	2.04	0.03	Not required
WLAN		0.762	0.762	0mm	5	-40.4	-202.6				

No.23 Band	Position	SAR 1g SAR (W/kg)	Summed	Gap	SAR peak location (mm)			3D distance (mm)	Summed SAR (W/kg)	SPLSR Results	Simultaneous SAR
					X	Y	Z				
Ant11		0.65	0.65	0mm	-15	81.2	-201.8				
Ant4	Back	0.317	0.317	0mm				123.2	1.73	0.02	Not required
WLAN		0.762	0.762	0mm	5	-40.4	-202.6				

No.24 Band	Position	SAR 1g SAR (W/kg)	Summed	Gap	SAR peak location (mm)			3D distance (mm)	Summed SAR (W/kg)	SPLSR Results	Simultaneous SAR
					X	Y	Z				
Ant11		0.65	0.65	0mm	-15	81.2	-201.8				
Ant5	Back	0.524	0.524	0mm				123.2	1.94	0.02	Not required
WLAN		0.762	0.762	0mm	5	-40.4	-202.6				

No.25 Band	Position	SAR 1g SAR (W/kg)	Summed	Gap	SAR peak location (mm)			3D distance (mm)	Summed SAR (W/kg)	SPLSR Results	Simultaneous SAR
					X	Y	Z				
Ant11		0.65	0.65	0mm	-15	81.2	-201.8				
Ant5	Back	0.31	0.31	0mm				123.2	1.72	0.02	Not required
WLAN		0.762	0.762	0mm	5	-40.4	-202.6				

No.26 Band	Position	SAR 1g SAR (W/kg)	Summed	Gap	SAR peak location (mm)			3D distance (mm)	Summed SAR (W/kg)	SPLSR Results	Simultaneous SAR
					X	Y	Z				
Ant11		1.157	1.157	0mm	-25	71.2	-202.8				
Ant2	Right side		0	0mm				106.4	1.91	0.02	Not required
WLAN		0.749	0.749	0mm	-33	-34.9	-202.9				

No.27 Band	Position	SAR 1g SAR (W/kg)	Summed	Gap	SAR peak location (mm)			3D distance (mm)	Summed SAR (W/kg)	SPLSR Results	Simultaneous SAR
					X	Y	Z				
Ant11		1.157	1.157	0mm	-25	71.2	-202.8				
Ant4	Right side		0	0mm				106.4	1.91	0.02	Not required
WLAN		0.749	0.749	0mm	-33	-34.9	-202.9				

No.28 Band	Position	SAR 1g SAR (W/kg)	Summed	Gap	SAR peak location (mm)			3D distance (mm)	Summed SAR (W/kg)	SPLSR Results	Simultaneous SAR
					X	Y	Z				
Ant11		1.157	1.157	0mm	-25	71.2	-202.8				
Ant5	Right side	0.119	0.119	0mm				106.4	2.03	0.03	Not required
WLAN		0.749	0.749	0mm	-33	-34.9	-202.9				

No.29 Band	Position	SAR 1g SAR (W/kg)	Summed	Gap	SAR peak location (mm)			3D distance (mm)	Summed SAR (W/kg)	SPLSR Results	Simultaneous SAR
					X	Y	Z				
Ant11		1.157	1.157	0mm	-25	71.2	-202.8				
Ant7	Right side	0.275	0.275	0mm				106.4	2.18	0.03	Not required
WLAN		0.749	0.749	0mm	-33	-34.9	-202.9				

<3>Body-Worn Exposure Conditions:
General Note: The unit of SAR evaluation is W/kg.
Simultaneous Transmission Evaluation of WWAN+WLAN/BT

AG0 Highest Reported SAR：

Test Position	Ant0	Ant1	Ant11	MAX
Front 5mm	0.644·	0.922	0.599	**0.922**
Back 5mm	1.143	1.274	1.067	**1.274**

AG1 Highest Reported SAR：

Test Position	Ant2	Ant4	Ant5	Ant7	MAX
Front 5mm	0.474	0.585	0.152	0.07	**0.585**
Back 5mm	0.935	0.844	0.314	0.154	**0.935**

WIFI&BT Worse-case SAR:

NO	1	2	3	Wlan/BT worse case
Test	WLAN2.4GHz	WLAN5GHz	Bluetooth	
Position	Ant 6+8	Ant 5+8	Ant 6	
Front 5mm	0.376	0.278	0.073	**0.376**
Back 5mm	0.651	0.598	0.181	**0.651**

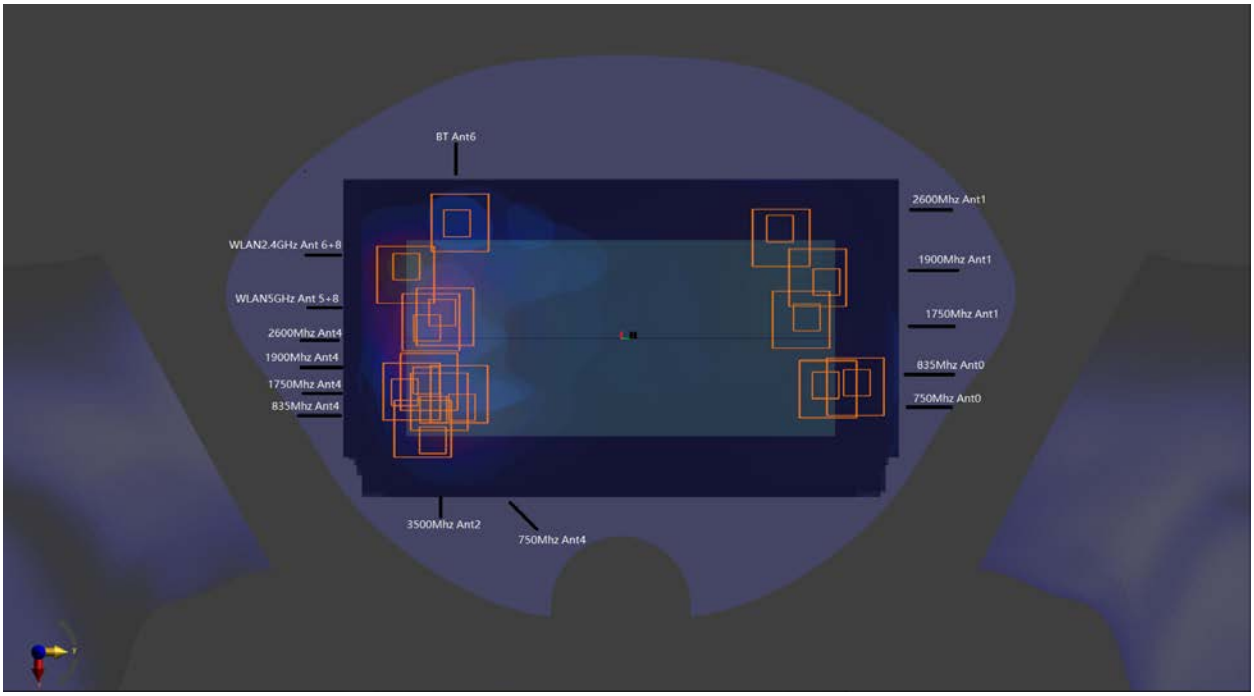
Simultaneous Transmission analysis of AG0 + AG1 + WLAN/BT Worse-case:

Test Position	AG0	AG1	Wlan/BT worst case	AG0+AG1+wlan /BT worse cas
Front 5mm	0.922	0.585	0.376	1.88
Back 5mm	1.274	0.935	0.651	2.86

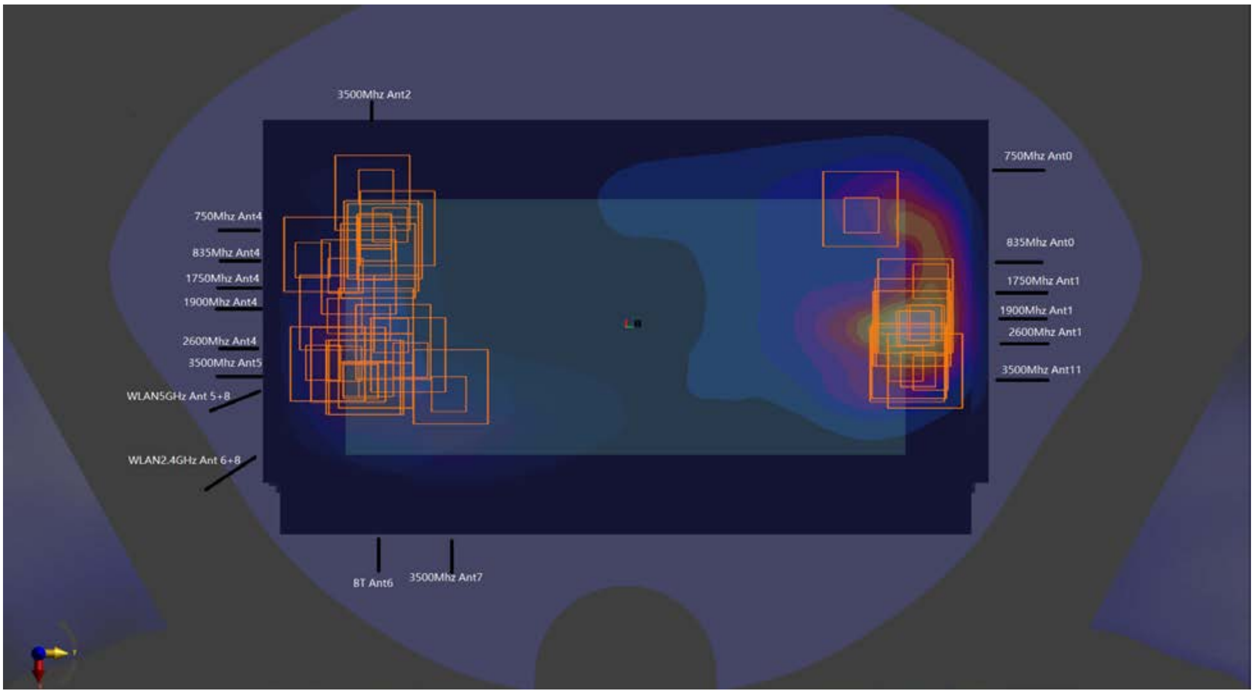
Note: The results marked yellow in above table refers to the detailed analysis corresponding to each position below tables.

Front					
Ant combination	AG0	AG1	Wlan/BT worst case	AG0+AG1+Wlan/BT worst case	Note
	1g SAR (W/kg)	1g SAR (W/kg)	1g SAR (W/kg)	1g SAR (W/kg)	
Ant0-Ant2	0.644	0.474	0.376	1.49	-
Ant0-Ant4	0.644	0.585	0.376	1.61	Case 30
Ant0-Ant5	0.644	0.152	0.376	1.17	-
Ant0-Ant7	0.644	0.07	0.376	1.09	-
Ant1-Ant2	0.922	0.474	0.376	1.77	Case 31
Ant1-Ant4	0.922	0.585	0.376	1.88	Case 32
Ant1-Ant5	0.922	0.152	0.376	1.45	-
Ant1-Ant7	0.922	0.07	0.376	1.37	-
Ant11-Ant2	0.599	0.474	0.376	1.45	-
Ant11-Ant4	0.599	0.585	0.376	1.56	-

Back					
Ant combination	AG0	AG1	Wlan/BT worst case	AG0+AG1+Wlan/BT worst case	Note
	1g SAR (W/kg)	1g SAR (W/kg)	1g SAR (W/kg)	1g SAR (W/kg)	
Ant0-Ant2	1.143	0.935	0.651	2.73	Case 33
Ant0-Ant4	1.143	0.844	0.651	2.64	Case 34
Ant0-Ant5	1.143	0.314	0.651	2.11	Case 35
Ant0-Ant7	1.143	0.154	0.651	1.95	Case 36
Ant1-Ant2	1.274	0.935	0.651	2.86	Case 37
Ant1-Ant4	1.274	0.844	0.651	2.77	Case 38
Ant1-Ant5	1.274	0.314	0.651	2.24	Case 39
Ant1-Ant7	1.274	0.154	0.651	2.08	Case 40
Ant11-Ant2	1.067	0.935	0.651	2.65	Case 41
Ant11-Ant4	1.067	0.844	0.651	2.56	Case 42
Ant11-Ant5	1.067	0.314	0.651	2.03	Case 43
Ant11-Ant7	1.067	0.154	0.651	1.87	Case 44



WWAN+WLAN/BT Front side 5mm



WWAN+WLAN/BT Back side 5mm

No.30 Band	Position	SAR 1g SAR (W/kg)	Summed	Gap	SAR peak location (mm)			3D distance (mm)	Summed SAR (W/kg)	SPLSR Results	Simultaneous SAR
					X	Y	Z				
Ant0	Front	0.644	0.644	0mm	9.5	65.2	-207	118.6	1.61	0.02	Not required
Ant4		0.585	0.585	0mm	5	-53.3	-203.7				
WLAN		0.376	0.376	0mm							
No.31 Band	**Position**	**SAR 1g SAR (W/kg)**	**Summed**	**Gap**	**SAR peak location (mm)**			**3D distance (mm)**	**Summed SAR (W/kg)**	**SPLSR Results**	**Simultaneous SAR**
					X	**Y**	**Z**				
Ant1	Front	0.922	0.922	0mm	-55	54.5	-203.4	117.9	1.77	0.02	Not required
Ant2		0.474	0.474	0mm							
WLAN		0.376	0.376	0mm	-65	-63	-202.8				

No.32 Band	Position	SAR 1g SAR (W/kg)	Summed	Gap	SAR peak location (mm)			3D distance (mm)	Summed SAR (W/kg)	SPLSR Results	Simultaneous SAR
					X	Y	Z				
Ant1	Front	0.922	0.922	0mm	-55	54.5	-203.4	117.9	1.88	0.02	Not required
Ant4		0.585	0.585	0mm							
WLAN		0.376	0.376	0mm	-65	-63	-202.8				

No.33 Band	Position	SAR 1g SAR (W/kg)	Summed	Gap	SAR peak location (mm)			3D distance (mm)	Summed SAR (W/kg)	SPLSR Results	Simultaneous SAR
					X	Y	Z				
Ant0	Back	1.143	1.143	0mm	-55	65.3	-201.6	132.1	2.73	0.03	Not required
Ant2		0.935	0.935	0mm							
WLAN		0.651	0.651	0mm	5	-52.4	-202.6				

No.34 Band	Position	SAR 1g SAR (W/kg)	Summed	Gap	SAR peak location (mm)			3D distance (mm)	Summed SAR (W/kg)	SPLSR Results	Simultaneous SAR
					X	Y	Z				
Ant0	Back	1.143	1.143	0mm	-55	65.3	-201.6	114	2.64	0.04	Not required
Ant4		0.844	0.844	0mm	-54.4	-48.6	-207				
WLAN		0.651	0.651	0mm							

No.35 Band	Position	SAR 1g SAR (W/kg)	Summed	Gap	SAR peak location (mm)			3D distance (mm)	Summed SAR (W/kg)	SPLSR Results	Simultaneous SAR
					X	Y	Z				
Ant0	Back	1.143	1.143	0mm	-55	65.3	-201.6	132.1	2.11	0.02	Not required
Ant5		0.314	0.314	0mm							
WLAN		0.651	0.651	0mm	5	-52.4	-202.6				

No.36 Band	Position	SAR 1g SAR (W/kg)	Summed	Gap	SAR peak location (mm)			3D distance (mm)	Summed SAR (W/kg)	SPLSR Results	Simultaneous SAR
					X	Y	Z				
Ant0	Back	1.143	1.143	0mm	-55	65.3	-201.6	122.8	1.95	0.02	Not required
Ant7		0.154	0.154	0mm	-21	-52.5	-208.3				
WLAN		0.651	0.651	0mm							

No.37 Band	Position	SAR 1g SAR (W/kg)	Summed	Gap	SAR peak location (mm)			3D distance (mm)	Summed SAR (W/kg)	SPLSR Results	Simultaneous SAR
					X	Y	Z				
Ant1	Back	1.274	1.274	0mm	-10	71.1	-201.7	124.4	2.86	0.04	Not required
Ant2		0.935	0.935	0mm							
WLAN		0.651	0.651	0mm	5	-52.4	-202.6				

No.38 Band	Position	SAR 1g SAR (W/kg)	Summed	Gap	SAR peak location (mm)			3D distance (mm)	Summed SAR (W/kg)	SPLSR Results	Simultaneous SAR
					X	Y	Z				
Ant1	Back	1.274	1.274	0mm	-10	71.1	-201.7	124.4	2.77	0.04	Not required
Ant4		0.844	0.844	0mm							
WLAN		0.651	0.651	0mm	5	-52.4	-202.6				

No.39 Band	Position	SAR 1g SAR (W/kg)	Summed	Gap	SAR peak location (mm)			3D distance (mm)	Summed SAR (W/kg)	SPLSR Results	Simultaneous SAR
					X	Y	Z				
Ant1	Back	1.274	1.274	0mm	-10	71.1	-201.7	124.4	2.24	0.03	Not required
Ant5		0.314	0.314	0mm							
WLAN		0.651	0.651	0mm	5	-52.4	-202.6				

No.40 Band	Position	SAR 1g SAR (W/kg)	Summed	Gap	SAR peak location (mm)			3D distance (mm)	Summed SAR (W/kg)	SPLSR Results	Simultaneous SAR
					X	Y	Z				
Ant1	Back	1.274	1.274	0mm	-15	70.7	-201.6	123.5	2.08	0.02	Not required
Ant7		0.154	0.154	0mm							
WLAN		0.651	0.651	0mm	-21	-52.5	-208.3				

No.41 Band	Position	SAR 1g SAR (W/kg)	Summed	Gap	SAR peak location (mm)			3D distance (mm)	Summed SAR (W/kg)	SPLSR Results	Simultaneous SAR
					X	Y	Z				
Ant11	Back	1.067	1.067	0mm	-15	81.2	-201.8	135.1	2.65	0.03	Not required
Ant2		0.935	0.935	0mm							
WLAN		0.651	0.651	0mm	5	-52.4	-202.6				
No.42 Band	**Position**	**SAR 1g SAR (W/kg)**	**Summed**	**Gap**	**SAR peak location (mm)**			**3D distance (mm)**	**Summed SAR (W/kg)**	**SPLSR Results**	**Simultaneous SAR**
					X	**Y**	**Z**				
Ant11	Back	1.067	1.067	0mm	-15	81.2	-201.8	135.1	2.56	0.03	Not required
Ant4		0.844	0.844	0mm							
WLAN		0.651	0.651	0mm	5	-52.4	-202.6				
No.43 Band	**Position**	**SAR 1g SAR (W/kg)**	**Summed**	**Gap**	**SAR peak location (mm)**			**3D distance (mm)**	**Summed SAR (W/kg)**	**SPLSR Results**	**Simultaneous SAR**
					X	**Y**	**Z**				
Ant11	Back	1.067	1.067	0mm	-15	81.2	-201.8	135.1	2.03	0.02	Not required
Ant5		0.314	0.314	0mm							
WLAN		0.651	0.651	0mm	5	-52.4	-202.6				
No.44 Band	**Position**	**SAR 1g SAR (W/kg)**	**Summed**	**Gap**	**SAR peak location (mm)**			**3D distance (mm)**	**Summed SAR (W/kg)**	**SPLSR Results**	**Simultaneous SAR**
					X	**Y**	**Z**				
Ant11	Back	1.067	1.067	0mm	-15	81.2	-201.8	134	1.87	0.02	Not required
Ant7		0.154	0.154	0mm	-21	-52.5	-208.3				
WLAN		0.651	0.651	0mm							

Sensor Off:
General Note: The unit of SAR evaluation is W/kg.
Simultaneous Transmission Evaluation of WWAN+WLAN/BT

AG0 Highest Reported SAR:

Test Position	Ant0	Ant1	Ant11	MAX
Front 13mm		0.739	0.315	0.739
Back 17mm		0.661	0.22	**0.661**

AG1 Highest Reported SAR:

Test Position	Ant2	Ant4	Ant5	Ant7	MAX
Front 13mm	0.474	0.625			0.625
Back 17mm	0.346	0.464			**0.464**

WIFI&BT Worse-case SAR:

NO	1	2	3	WLAN/BT worse case
Test Position	WLAN2.4GHz Ant 6+8	WLAN5GHz Ant 5+8	Bluetooth Ant 6	
Front 13mm	0.158	0.323		**0.323**
Back 17mm	0.129	0.625		0.625

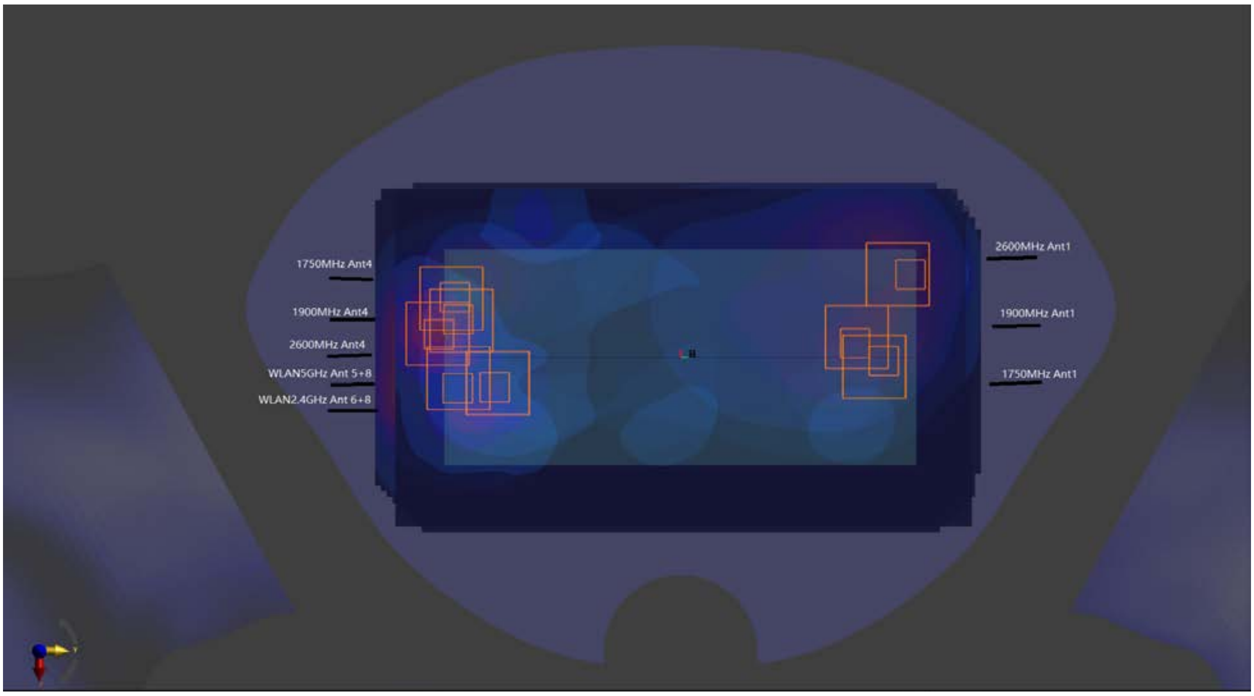
Simultaneous Transmission analysis of AG0 + AG1 + WLAN/BT Worse-case:

Test Position	AG0	AG1	Wlan/BT worst case	AG0+AG1+wlan /BT worse cas
Front 13mm	0.739	0.625	0.323	1.69
Back 17mm	0.661	0.464	0.625	1.75

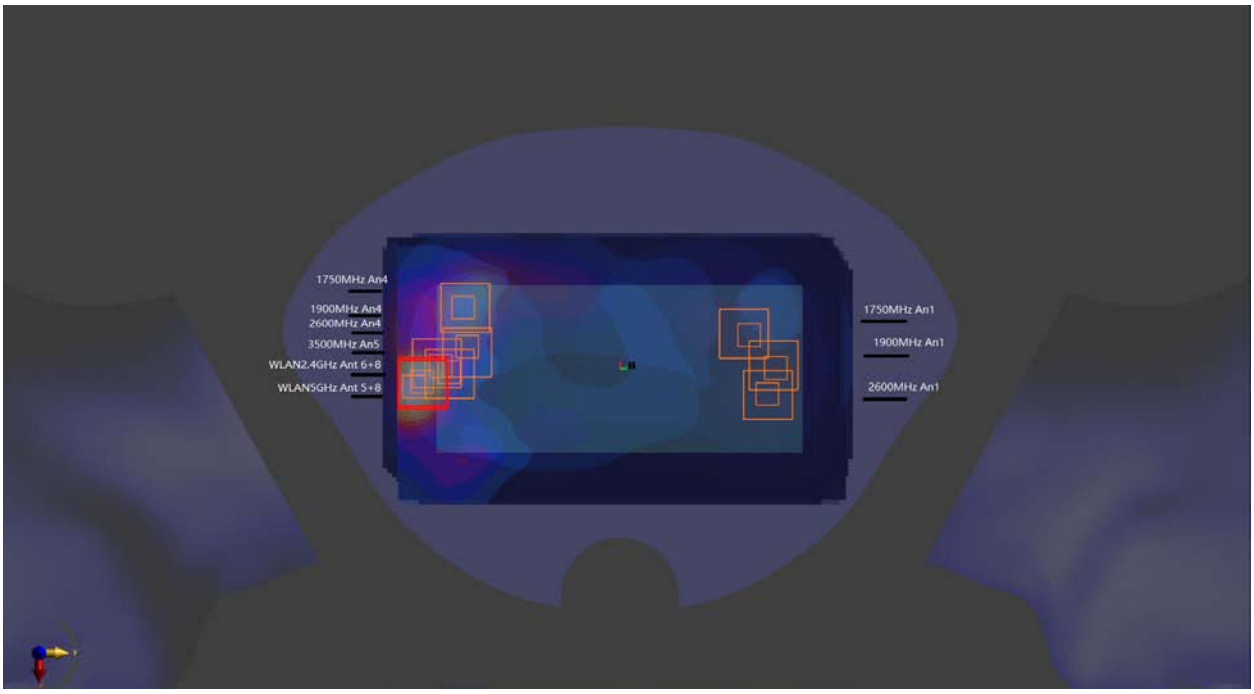
Note: The results marked yellow in above table refers to the detailed analysis corresponding to each position below tables.

Front					
Ant combination	AG0	AG1	Wlan/BT worst case	AG0+AG1+Wlan/BT worst case	Note
	1g SAR (W/kg)	1g SAR (W/kg)	1g SAR (W/kg)	1g SAR (W/kg)	
Ant0-Ant2		0.474	0.323	0.8	-
Ant0-Ant4		0.625	0.323	0.95	-
Ant0-Ant5			0.323	0.32	-
Ant0-Ant7			0.323	0.32	-
Ant1-Ant2	0.739	0.474	0.323	1.54	-
Ant1-Ant4	0.739	0.625	0.323	1.69	Case 50
Ant1-Ant5	0.739		0.323	1.06	-
Ant1-Ant7	0.739		0.323	1.06	-
Ant11-Ant2	0.315	0.474	0.323	1.11	-
Ant11-Ant4	0.315	0.625	0.323	1.26	-
Ant11-Ant5	0.315		0.323	0.64	-
Ant11-Ant7	0.315		0.323	0.64	-

Back					
Ant combination	AG0	AG1	Wlan/BT worst case	AG0+AG1+Wlan/BT worst case	Note
	1g SAR (W/kg)	1g SAR (W/kg)	1g SAR (W/kg)	1g SAR (W/kg)	
Ant0-Ant2		0.346	0.625	0.97	-
Ant0-Ant4		0.464	0.625	1.09	-
Ant0-Ant5			0.625	0.63	-
Ant0-Ant7			0.625	0.63	-
Ant1-Ant2	0.661	0.346	0.625	1.63	Case 51
Ant1-Ant4	0.661	0.464	0.625	1.75	Case 52
Ant1-Ant5	0.661		0.625	1.29	-
Ant1-Ant7	0.661		0.625	1.29	-
Ant11-Ant2	0.22	0.346	0.625	1.19	-
Ant11-Ant4	0.22	0.464	0.625	1.31	-
Ant11-Ant5	0.22		0.625	0.85	-
Ant11-Ant7	0.22		0.625	0.85	-



WWAN+WLAN/BT Front side 13mm



WWAN+WLAN/BT Back side 17mm

No.50	Position	SAR 1g SAR	Summed	Gap	SAR peak location (mm)			3D distance	Summed SAR	SPLSR	Simultaneous
Band		(W/kg)			X	Y	Z	(mm)	(W/kg)	Results	SAR
Ant1		0.739	0.739	13mm	-25	63.6	-203.8				
Ant4	Front	0.625	0.625	13mm				126.6	1.69	0.02	Not required
WLAN		0.323	0.323	13mm	-15	-62.6	-202.8				

No.51	Position	SAR 1g SAR	Summed	Gap	SAR peak location (mm)			3D distance	Summed SAR	SPLSR	Simultaneous
Band		(W/kg)			X	Y	Z	(mm)	(W/kg)	Results	SAR
Ant1		0.661	0.661	17mm	-40	57.1	-203.7				
Ant2	Back	0.346	0.346	17mm				125.5	1.63	0.02	Not required
WLAN		0.625	0.625	17mm	-35	-68.3	-202.8				

No.52	Position	SAR 1g SAR	Summed	Gap	SAR peak location (mm)			3D distance	Summed SAR	SPLSR	Simultaneous
Band		(W/kg)			X	Y	Z	(mm)	(W/kg)	Results	SAR
Ant1		0.661	0.661	17mm	-40	57.1	-203.7				
Ant4	Back	0.464	0.464	17mm				125.5	1.75	0.02	Not required
WLAN		0.625	0.625	17mm	-35	-68.3	-202.8				

<4> Product specific 10g SAR Exposure Conditions:

General Note: The unit of SAR evaluation is W/kg.

Simultaneous Transmission Evaluation of WWAN+WLAN/BT

AG0 Highest Reported SAR：

Test Position	Ant0	Ant1	Ant11	MAX
Front 0mm		2.786	0.928	**2.786**
Back 0mm		2.727	1.997	**2.727**
Left Side 0mm				**0**
Right Side 0mm		1.35	2.974	**2.974**
Top Side 0mm				**0**
Bottom Side 0mm		2.882	0.497	**2.882**

AG1 Highest Reported SAR：

Test Position	Ant2	Ant4	Ant5	Ant7	MAX
Front 0mm	0.971	1.008			**1.008**
Back 0mm	1.186	1.225			**1.225**
Left Side 0mm	2.399	1.625			**2.399**
Right Side 0mm					**0**
Top Side 0mm	0.217	2.41			**2.41**
Bottom Side 0mm					**0**

WIFI&BT Worse-case SAR:

NO	1	2	3	WLAN/BT worse case
Test	WLAN2.4GHz	WLAN5GHz	Bluetooth	
Position	Ant 6+8	Ant 5+8	Ant 6	
Front 0mm		0.476		**0.476**
Back 0mm		0.762		**0.762**
Left Side 0mm				**0**
Right Side 0mm		0.68		**0.68**
Top Side 0mm		0.904		**0.904**
Bottom Side 0mm				**0**

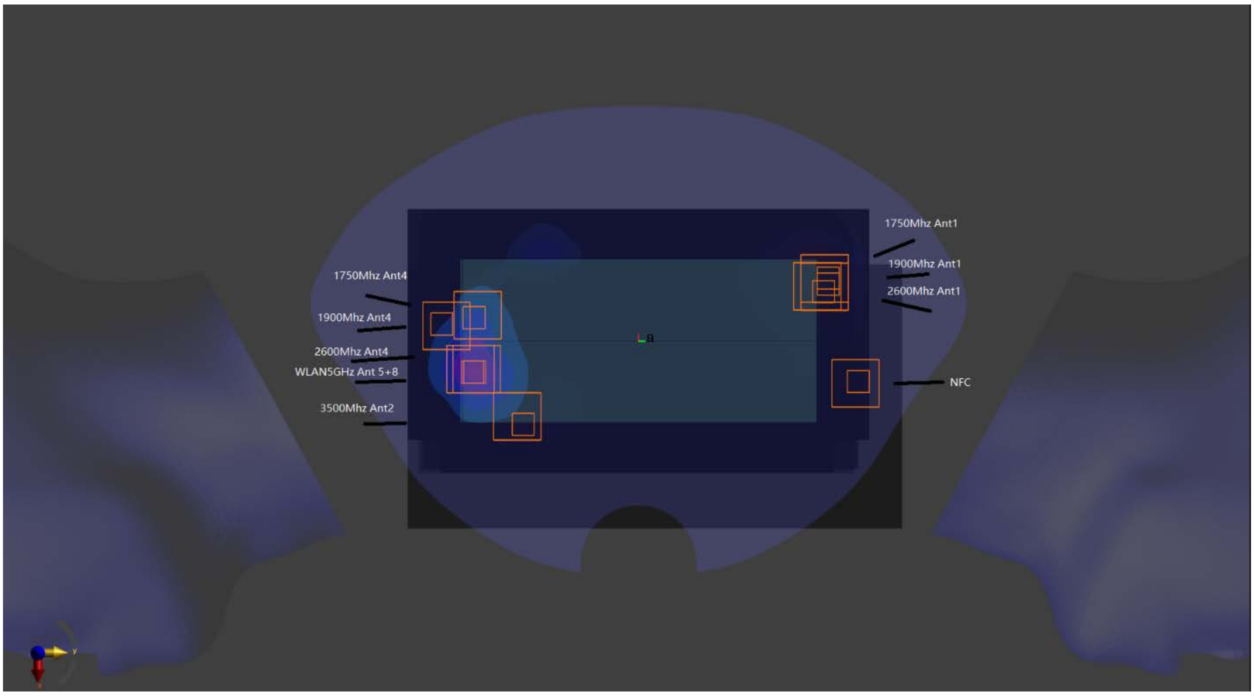
Simultaneous Transmission analysis of AG0 + AG1 + WLAN/BT Worse-case:

	1	2	3	4	1+2+3+4
Test / Position	AG0	AG1	Wlan/BT worst case	NFC	AG0+AG1+wlan/BT+NFC worse cas
Front 0mm	2.786	1.008	0.476	0.001	4.27
Back 0mm	2.727	1.225	0.762	0.045	4.76
Left Side 0mm		2.399		0.002	2.4
Right Side 0mm	2.974		0.68	0.001	3.66
Top Side 0mm		2.41	0.904	0.001	3.32
Bottom Side 0mm	2.882			0.001	2.88

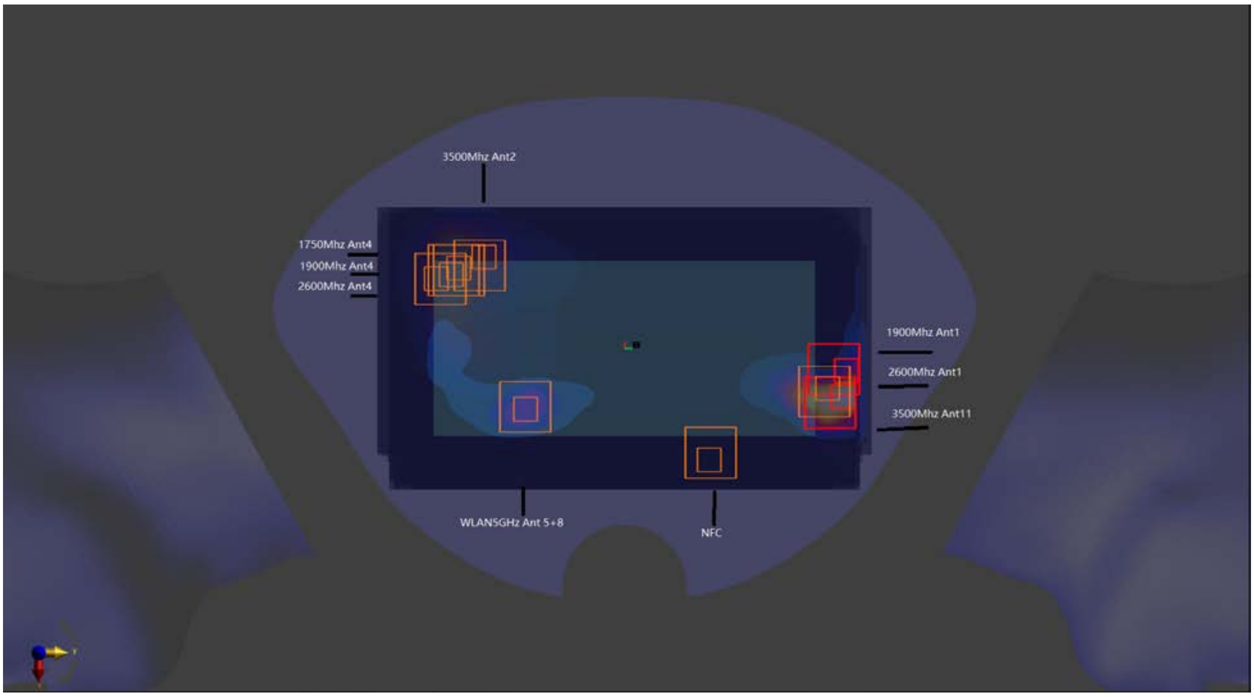
Note: The results marked yellow in above table refers to the detailed analysis corresponding to each position below tables.

Front						
Ant combination	AG0	AG1	Wlan/BT worst case	NFC	AG0+AG1+wlan/BT+NFC worse cas	Note
	10g SAR (W/kg)	10g SAR (W/kg)	10g SAR (W/kg)	10g SAR (W/kg)	10g SAR (W/kg)	
Ant0-Ant2		0.971	0.476	0.001	1.45	-
Ant0-Ant4		1.008	0.476	0.001	1.49	-
Ant0-Ant5			0.476	0.001	0.48	-
Ant0-Ant7			0.476	0.001	0.48	-
Ant1-Ant2	2.786	0.971	0.476	0.001	4.23	Case 45
Ant1-Ant4	2.786	1.008	0.476	0.001	4.27	Case 46
Ant1-Ant5	2.786		0.476	0.001	3.26	-
Ant1-Ant7	2.786		0.476	0.001	3.26	-
Ant11-Ant2	0.928	0.971	0.476	0.001	2.38	-
Ant11-Ant4	0.928	1.008	0.476	0.001	2.41	-
Ant11-Ant5	0.928		0.476	0.001	1.41	-
Ant11-Ant7	0.928		0.476	0.001	1.41	-

Back						
Ant combination	AG0	AG1	Wlan/BT worst case	NFC	AG0+AG1+Wlan/BT worst case	Note
	10g SAR (W/kg)	10g SAR (W/kg)	10g SAR (W/kg)	10g SAR (W/kg)	10g SAR (W/kg)	
Ant0-Ant2		1.186	0.762	0.045	1.99	-
Ant0-Ant4		1.225	0.762	0.045	2.03	-
Ant0-Ant5			0.762	0.045	0.81	-
Ant0-Ant7			0.762	0.045	0.81	-
Ant1-Ant2	2.727	1.186	0.762	0.045	4.72	Case 47
Ant1-Ant4	2.727	1.225	0.762	0.045	4.76	Case 48
Ant1-Ant5	2.727		0.762	0.045	3.53	-
Ant1-Ant7	2.727		0.762	0.045	3.53	-
Ant11-Ant2	1.997	1.186	0.762	0.045	3.99	-
Ant11-Ant4	1.997	1.225	0.762	0.045	4.03	Case 49
Ant11-Ant5	1.997		0.762	0.045	2.8	-
Ant11-Ant7	1.997		0.762	0.045	2.8	-



WWAN+WLAN+NFC Front side 0mm



WWAN+WLAN+NFC Back side 0mm

No.45 Band	Position	SAR 10g SAR (W/kg)	Summed	Gap	SAR peak location (mm)			3D distance (mm)	Summed SAR (W/kg)	SPLSR Results	Simultaneous SAR
					X	Y	Z				
Ant1	Front	2.786	2.786	0mm	-40	75.2	-201.6	138.1	4.23	0.06	Not required
Ant2		0.971	0.971	0mm	15	-51.5	-203.6				
WLAN		0.476	0.476	0mm							
NFC		0.001	0.001	0mm							
No.46 Band	Position	SAR 10g SAR (W/kg)	Summed	Gap	SAR peak location (mm)			3D distance (mm)	Summed SAR (W/kg)	SPLSR Results	Simultaneous SAR
					X	Y	Z				
Ant1	Front	2.786	2.786	0mm	-40	75.2	-201.6	132.1	4.27	0.07	Not required

Ant4		1.008	1.008	0mm	-10	-53.4	-201.9				
WLAN		0.476	0.476	0mm							
NFC		0.001	0.001	0mm							

No.47 Band	Position	SAR 10g SAR (W/kg)	Summed	Gap	SAR peak location (mm)			3D distance (mm)	Summed SAR (W/kg)	SPLSR Results	Simultaneous SAR
					X	Y	Z				
Ant1	Back	2.727	2.727	0mm	-14.1	79.7	-208.9	141.9	4.72	0.07	Not required
Ant2		1.186	1.186	0mm	-65	-52.6	-203.4				
WLAN		0.762	0.762	0mm							
NFC		0.045	0.045	0mm							

No.48 Band	Position	SAR 10g SAR (W/kg)	Summed	Gap	SAR peak location (mm)			3D distance (mm)	Summed SAR (W/kg)	SPLSR Results	Simultaneous SAR
					X	Y	Z				
Ant1	Back	2.727	2.727	0mm	-14.1	79.7	-208.9	148.7	4.76	0.07	Not required
Ant4		1.225	1.225	0mm	-55	-63.1	-201.8				
WLAN		0.762	0.762	0mm							
NFC		0.045	0.045	0mm							

No.49 Band	Position	SAR 10g SAR (W/kg)	Summed	Gap	SAR peak location (mm)			3D distance (mm)	Summed SAR (W/kg)	SPLSR Results	Simultaneous SAR
					X	Y	Z				
Ant11	Back	1.997	1.997	0mm	1.9	66.6	-207	141.7	4.03	0.06	Not required
Ant4		1.225	1.225	0mm	-55	-63.1	-201.8				
WLAN		0.762	0.762	0mm							
NFC		0.045	0.045	0mm							

<5>Maximum Report SAR and SAR Peak Locations

General Note:

1) The maximum report SAR and SAR Peak Locations corresponding to each position of each frequency band of each antenna in the below tables are as follows.
2) The unit of SAR evaluation is W/kg. The unit of x, y, z with Axis evaluation is mm.

Head:

Right Cheek													
Band		Ant0			Ant1			Ant2			Ant4		
GSM850	SAR (W/kg)	0.112											
	Axis	57.4	-273.9	-175.7									
GSM1900	SAR (W/kg)				0.194								
	Axis				56.2	-262.6	-170.9						
WCDMA II	SAR (W/kg)				0.393								
	Axis				55.4	-263.1	-171.2						
WCDMA IV	SAR (W/kg)				0.182								
	Axis				60.2	-252.8	-173.6						
WCDMA V	SAR (W/kg)	0.222											
	Axis	54.1	-267.6	-178.1									
LTE Band 12	SAR (W/kg)	0.128									0.981		
	Axis	57.1	-273	-177.5							17.2	-329.4	-174.2
LTE Band 13	SAR (W/kg)	0.103									0.764		
	Axis	55.5	-268.5	-175.7							2.8	-328.3	-168.8
LTE Band 25	SAR (W/kg)				0.281						0.728		
	Axis				54.6	-255.7	-174.9				17.5	-327.3	-174.3
LTE Band 26	SAR (W/kg)	0.174									0.746		
	Axis	54.5	-268.5	-177.9							18.2	-330.9	-174.2
LTE Band 66	SAR (W/kg)				0.251						0.724		
	Axis				61.7	-252.8	-173.3				19.7	-335.3	-170
LTE Band 7	SAR (W/kg)				0.257						0.58		
	Axis				56.9	-254.7	-176				6.8	310.6	-173.1
LTE Band 41	SAR (W/kg)				0.12						0.598		
	Axis				56.6	-256.7	-171.2				10.1	-317	-170.1
LTE Band 42	SAR (W/kg)							0.678					
	Axis							44.2	-333.2	-174.1			
FR1 n2	SAR (W/kg)				0.252						0.744		
	Axis				55.7	-252.7	-176				29.4	-329.6	-170.6
FR1 n5	SAR (W/kg)	0.118									0.643		
	Axis	57.3	-275	-171.6							17.8	-331.2	-177.7
FR1 n7	SAR (W/kg)				0.277						0.579		
	Axis				53.2	-254.9	-175.1				5.7	-321	-169.3
FR1 n26	SAR (W/kg)	0.096									0.71		
	Axis	55.6	-272.8	-177.6							16.7	-334.7	-175.9
FR1 n66	SAR (W/kg)				0.251						0.902		
	Axis				56.8	-245.9	-175				17.7	-336.6	-170.6
FR1 n41	SAR (W/kg)				0.246								
	Axis				51.4	-249.7	-174.7						
FR1 n78	SAR (W/kg)							0.846					
	Axis							39.1	-333.1	-174.4			

Right Cheek																
BT Ant6	SAR	0.105				WLAN2.4GHz	SAR	0.22				WLAN5GHz	SAR	0.464		
	Axis	16.1	-317.6	-170.2		Ant 6+8	Axis	16.1	-317.6	-169.9		Ant 5+8	Axis	6.6	-319.1	-169.8

Hotspot:

Front																
Band		Ant1			Ant2			Ant4			Ant5			Ant7		
GSM1900	SAR (W/kg)	1.047														
	Axis	-41.1	59.6	-208.3												
WCDMA II	SAR (W/kg)	0.757														
	Axis	-48.4	71.6	-208.4												
WCDMA IV	SAR (W/kg)	0.554														
	Axis	-55	86	-201.9												
LTE Band 12	SAR (W/kg)							0.274								
	Axis							-10	-88.8	-203.7						
LTE Band 13	SAR (W/kg)							0.223								
	Axis							-10	-67.6	-203.3						
LTE Band 25	SAR (W/kg)	0.816						0.216								
	Axis	-57.3	77.1	-208.5				5	-53.3	-203.7						
LTE Band 26	SAR (W/kg)							0.301								
	Axis							-10	-67.3	-203.3						
LTE Band 66	SAR (W/kg)	0.643						0.186								
	Axis	-51.4	65.4	-207				5	-69.6	-203.4						
LTE Band 7	SAR (W/kg)	0.584						0.232								
	Axis	-45	76.6	-203.1				-25	-71.1	-203.3						
LTE Band 41	SAR (W/kg)	0.535						0.293								
	Axis	-55	78.5	-203.4				-25	-66.6	-203.4						
LTE Band 42	SAR (W/kg)				0.139											
	Axis				15	-70.5	-203.6									
FR1 n2	SAR (W/kg)	0.838						0.112								
	Axis	-40	87.8	-203.5				-25	-64.7	-202.8						
FR1 n5	SAR (W/kg)							0.228								
	Axis							-7.1	-85.1	-208.4						
FR1 n7	SAR (W/kg)	0.501						0.226								
	Axis	-55	94	-203.5				-39.9	-100	-203.3						
FR1 n26	SAR (W/kg)							0.216								
	Axis							3.8	-78.3	-208.4						
FR1 n66	SAR (W/kg)	0.679						0.152								
	Axis	-55	54.5	-203.4				5	-86.9	-202.7						
FR1 n41	SAR (W/kg)	0.51														
	Axis	-65	71	-203.4												
FR1 n78	SAR (W/kg)				0.162						0.185			0.07		
	Axis				15	-45.9	-203.4				-39.5	-69	-208.6	-75	-73.5	-203.4
Front																
BT Ant6	SAR	0.073				WLAN2.4 GHz Ant 6+8	SAR	0.482				WLAN5G Hz Ant 5+8	SAR	0.396		
	Axis	-65	-63	-202.8			Axis	-55	-69.3	-202.8			Axis	-35	-85.5	-203.1

Right Side																
Band		Ant5			Ant7			Ant11								
FR1 n78	SAR (W/kg)	0.119			0.275			1.157								
	Axis	-17	-70.4	-203.7	-38.6	-57	-207	-25	71.2	-202.8						
Right Side																
BT Ant6	SAR	0.041				WLAN2.4 GHz Ant 6+8	SAR	0.749				WLAN5G Hz Ant 5+8	SAR	0.349		
	Axis	-25	-57.2	-203			Axis	-33	-34.9	-202.9			Axis	-33	-38.1	-203

Body-Worn:

Front

Band		Ant0			Ant1			Ant2			Ant4		
GSM850	SAR (W/kg)	0.394											
	Axis	-12.7	89.6	-207									
GSM1900	SAR (W/kg)				0.635								
	Axis				-41.1	59.6	-208.3						
WCDMA II	SAR (W/kg)				0.807								
	Axis				-48.4	71.6	-208.4						
WCDMA IV	SAR (W/kg)				0.922								
	Axis				-55	86	-201.9						
WCDMA V	SAR (W/kg)	0.644											
	Axis	9.5	65.2	-207									
LTE Band 12	SAR (W/kg)	0.532									0.323		
	Axis	2	91.7	-207							-10	-88.8	-203.7
LTE Band 13	SAR (W/kg)	0.407									0.339		
	Axis	5	93	-203.4							-10	-67.6	-203.3
LTE Band 25	SAR (W/kg)				0.696						0.292		
	Axis				-57.3	77.1	-208.5				5	-53.3	-203.7
LTE Band 26	SAR (W/kg)	0.541									0.387		
	Axis	-6	75.6	-207							-10	-67.3	-203.3
LTE Band 66	SAR (W/kg)				0.792						0.268		
	Axis				-51.4	65.4	-207				5	-69.6	-203.4
LTE Band 7	SAR (W/kg)				0.654						0.48		
	Axis				-45	76.6	-203.1				-25	-71.1	-203.3
LTE Band 41	SAR (W/kg)				0.489						0.522		
	Axis				-55	78.5	-203.4				-25	-66.6	-203.4
LTE Band 42	SAR (W/kg)							0.327					
	Axis							15	-70.5	-203.6			
FR1 n2	SAR (W/kg)				0.699						0.319		
	Axis				-40	87.8	-203.5				-25	-64.7	-202.8
FR1 n5	SAR (W/kg)	0.29									0.25		
	Axis	-10	97.7	-201.6							-7.1	-85.1	-208.4
FR1 n7	SAR (W/kg)				0.613						0.585		
	Axis				-55	94	-203.5				-35	-94	-203.3
FR1 n26	SAR (W/kg)	0.299									0.204		
	Axis	-9.2	80.3	-207							3.8	-78.3	-208.4
FR1 n66	SAR (W/kg)				0.877						0.245		
	Axis				-55	54.5	-203.4				5	-86.9	-202.7
FR1 n41	SAR (W/kg)				0.664								
	Axis				-65	71	-203.4						
FR1 n78	SAR (W/kg)							0.382					
	Axis							15	-45.9	-203.4			

Front

BT Ant6	SAR	0.073				WLAN2.4 GHz Ant 6+8	SAR	0.376				WLAN5G Hz Ant 5+8	SAR	0.278		
	Axis	-65	-63	-202.8			Axis	-55	-69.3	-202.8			Axis	-35	-85.5	-203.1

Back

Band		Ant0			Ant1			Ant2			Ant4			Ant5			Ant7			Ant11		
GSM850	SAR (W/kg)	0.925																				
	Axis	-40	84.8	-201.7																		
GSM1900	SAR (W/kg)				0.86																	
	Axis				-18.6	72.4	-208.6															
WCDMA II	SAR (W/kg)				1.118																	
	Axis				-10	71.1	-201.7															
WCDMA IV	SAR (W/kg)				1.274																	
	Axis				-10	84.3	-201.6															
WCDMA V	SAR (W/kg)	1.143																				
	Axis	-40	82.1	-201.7																		
LTE Band 12	SAR (W/kg)	0.769									0.778											
	Axis	-37.1	83.5	-208.5							-56.7	-80.8	-207									
LTE Band 13	SAR (W/kg)	0.657									0.489											
	Axis	-36.1	81.6	-208.7							-55	-58.6	-203									
LTE Band 25	SAR (W/kg)				1.111						0.736											
	Axis				5.2	79.4	-207				-50.1	-75.3	-207									
LTE Band 26	SAR (W/kg)	1.102									0.56											
	Axis	-55	65.3	-201.6							-49.9	-72.8	-207									
LTE Band 66	SAR (W/kg)				1.269						0.754											
	Axis				-10	77.1	-201.9				-45.1	-74.1	-207									
LTE Band 7	SAR (W/kg)				0.988						0.785											
	Axis				-3	75.5	-208.3				-41	-79	-207									
LTE Band 41	SAR (W/kg)				0.551						0.735											
	Axis				-1	77	-208.4				-15	-77.4	-203.9									
LTE Band 42	SAR (W/kg)							0.935														
	Axis							-65	-69.6	-202.8												
FR1 n2	SAR (W/kg)				1.228						0.81											
	Axis				-12.6	76.6	-207				-43.9	-80.4	-207									
FR1 n5	SAR (W/kg)	1.119									0.465											
	Axis	-42.2	79.4	-208.6							-50.5	-79.8	-208.5									
FR1 n7	SAR (W/kg)				0.966						0.844											
	Axis				-15	70.7	-201.6				-34.5	-75.5	-207									
FR1 n26	SAR (W/kg)	0.835									0.329											
	Axis	-38.5	85.8	-208.6							-54.4	-48.6	-207									
FR1 n66	SAR (W/kg)				1.174						0.801											
	Axis				5	75.3	-201.6				-65.4	-81.1	-207									
FR1 n41	SAR (W/kg)				1.045																	
	Axis				-17	86	-207															
FR1 n78	SAR (W/kg)							0.927						0.314			0.154			1.067		
	Axis							-71.5	-66.5	-208.5				-17	-74.5	-208.4	-21	-52.5	-208.3	-15	81.2	-201.8
Back																						
BT Ant6	SAR	0.181				WLAN2.4 GHz Ant 6+8	SAR	0.651				WLAN5G Hz Ant 5+8	SAR	0.691								
	Axis	-28	-74	-207			Axis	5	-52.4	-202.6			Axis	-25	-73.4	-203						