

FCC SAR Test Report

APPLICANT : TCL Communication Ltd.
EQUIPMENT : GSM/UMTS/LTE Mobile phone
BRAND NAME : TCL
MODEL NAME : T510D, T510SP
FCC ID : 2ACCJH180
STANDARD : FCC 47 CFR Part 2 (2.1093)

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

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



Approved by: Si Zhang

Sporton International Inc. (Shenzhen)

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People's Republic of China



Table of Contents

1. Statement of Compliance 4

2. Administration Data 5

3. Guidance Applied..... 5

4. Equipment Under Test (EUT) Information..... 6

 4.1 General Information 6

 4.2 General LTE SAR Test and Reporting Considerations 7

5. RF Exposure Limits.....10

 5.1 Uncontrolled Environment.....10

 5.2 Controlled Environment.....10

6. Specific Absorption Rate (SAR).....11

 6.1 Introduction 11

 6.2 SAR Definition..... 11

7. System Description and Setup12

 7.1 E-Field Probe 13

 7.2 Data Acquisition Electronics (DAE) 13

 7.3 Phantom..... 14

 7.4 Device Holder..... 15

8. Measurement Procedures16

 8.1 Spatial Peak SAR Evaluation 16

 8.2 Power Reference Measurement..... 17

 8.3 Area Scan 17

 8.4 Zoom Scan..... 18

 8.5 Volume Scan Procedures 18

 8.6 Power Drift Monitoring..... 18

9. Test Equipment List.....19

10. System Verification20

 10.1 Tissue Simulating Liquids..... 20

 10.2 Tissue Verification 21

 10.3 System Performance Check Results..... 22

11. RF Exposure Positions23

 11.1 Ear and handset reference point 23

 11.2 Definition of the cheek position..... 24

 11.3 Definition of the tilt position..... 25

 11.4 Body Worn Accessory 26

 11.5 Product Specific 10g SAR Exposure 27

 11.6 Wireless Router..... 27

12. Conducted RF Output Power (Unit: dBm).....28

14. Antenna Location32

15. SAR Test Results33

 15.1 Head SAR 35

 15.2 Hotspot SAR 36

 15.3 Body Worn Accessory SAR..... 37

 15.4 Product specific 10g SAR 38

 15.5 Repeated SAR Measurement 39

16. Simultaneous Transmission Analysis40

 16.1 Head Exposure Conditions 41

 16.2 Hotspot Exposure Conditions..... 42

 16.3 Body-Worn Accessory Exposure Conditions 44

 16.4 Product specific 10g SAR Exposure Conditions..... 45

17. Uncertainty Assessment46

18. References47

Appendix A. Plots of System Performance Check

Appendix B. Plots of High SAR Measurement

Appendix C. DASy Calibration Certificate

Appendix D. Test Setup Photos

Appendix E. Conducted RF Output Power Table



Revision History

REPORT NO.	VERSION	DESCRIPTION	ISSUED DATE
FA3O1004-01	Rev. 01	Initial issue of report	Dec. 07, 2023

1. Statement of Compliance

The maximum results of Specific Absorption Rate (SAR) found during testing for **TCL Communication Ltd., GSM/UMTS/LTE Mobile phone, T510D, T510SP**, are as follows.

Highest 1g SAR Summary						
Equipment Class	Frequency Band		Head (Separation 0mm)	Hotspot (Separation 10mm)	Body-worn (Separation 15mm)	Highest Simultaneous Transmission 1g SAR (W/kg)
			1g SAR (W/kg)			
Licensed	GSM	GSM850	0.15	0.18	0.11	1.49
		GSM1900	0.11	0.94	0.45	
	WCDMA	WCDMA II	0.18	0.78	0.65	
		WCDMA IV	0.23	0.73	0.70	
		WCDMA V	0.96	0.53	0.37	
	LTE	LTE Band 25/2	0.20	1.11	0.68	
		LTE Band 66/4	0.21	0.88	0.58	
		LTE Band 26/5	0.93	0.63	0.49	
		LTE Band 7	0.42	1.11	0.38	
		LTE Band 12	1.07	0.73	0.62	
LTE Band 13		1.04	0.77	0.58		
	LTE Band 71	0.78	0.45	0.35		
	LTE Band 41	0.44	0.89	0.38		
DTS	WLAN	WLAN2.4GHz	1.18	0.61	0.60	1.49
NII		WLAN5GHz	1.02	0.61	1.18	1.49
DSS	Bluetooth	Bluetooth	0.13	<0.10	<0.10	1.13

Highest 10g SAR Summary				
Equipment Class	Frequency Band		Product Specific 10g SAR (W/kg) (Separation 0mm)	Highest Simultaneous Transmission 10g SAR (W/kg)
Licensed	GSM	GSM1900	2.68	2.68
	LTE	LTE Band 25/2	2.23	
DTS	WLAN	WLAN2.4GHz	2.86	2.86
NII		WLAN5GHz	2.86	2.86

Date of Testing: 2023/11/21~2023/11/24

Remark:

- This device supports LTE B2 / B4 / B5 and B25 / B66 / B26. Since the supported frequency span for LTE B2 / B4 / B5 falls completely within the supports frequency span for LTE B25 / B66 / B26, 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.
- This is a variant report for T510D, T510SP, for model change note, please refer to the T510D, T510SP_Operational Description of Product Equality Declaration exhibit submitted. Based on the similarity between two models, since reduced conducted power of WCDMA B5 at ant0 for head exposure conditions and WCDMA B4 at ant1 for hotspot exposure conditions, so re-measured WCDMA B5 at ant0 for head exposure conditions and WCDMA B4 at ant1 for hotspot exposure conditions conducted power and performed full SAR retesting. All the other bands spot check the worst cases from original test report (Sporton Report Number FA3O1004) were verified for the differences.
- The WWAN/WLAN max SAR summary was always chosen the highest SAR between the original filing and spot check Verification Data.

Declaration of Conformity:

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

Comments and Explanations:

The declared of product specification for EUT presented in the report are provided by the manufacturer, and the



manufacturer takes all the responsibilities for the accuracy of product specification.

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

2. Administration Data

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

Testing Laboratory			
Test Firm	Sporton International Inc. (Shenzhen)		
Test Site Location	1/F, 2/F, Bldg 5, Shiling Industrial Zone, Xinwei Village, Xili, Nanshan, Shenzhen, 518055 People's Republic of China TEL: +86-755-86379589 FAX: +86-755-86379595		
Test Site No.	Sporton Site No.	FCC Designation No.	FCC Test Firm Registration No.
	SAR05-SZ	CN1256	421272

Applicant	
Company Name	TCL Communication Ltd.
Address	5/F, Building 22E, 22 Science Park East Avenue, Hong Kong Science Park, Shatin, NT, Hong Kong

Manufacturer	
Company Name	TCL Communication Ltd.
Address	5/F, Building 22E, 22 Science Park East Avenue, Hong Kong Science Park, Shatin, NT, Hong Kong

3. Guidance Applied

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

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

4. Equipment Under Test (EUT) Information

4.1 General Information

Product Feature & Specification	
Equipment Name	GSM/UMTS/LTE Mobile phone
Brand Name	TCL
Model Name	T510D, T510SP
FCC ID	2ACCJH180
IMEI Code	016505000000109
Frequency Band	GSM850: 824 MHz ~ 849 MHz GSM1900: 1850 MHz ~ 1910 MHz WCDMA Band II: 1850 MHz ~ 1910 MHz WCDMA Band IV: 1710 MHz ~ 1755 MHz WCDMA Band V: 824 MHz ~ 849 MHz LTE Band 2: 1850 MHz ~ 1910 MHz LTE Band 4: 1710 MHz ~ 1755 MHz LTE Band 5: 824 MHz ~ 849 MHz LTE Band 7: 2500 MHz ~ 2570 MHz LTE Band 12: 699 MHz ~ 716 MHz LTE Band 13: 777 MHz ~ 787 MHz LTE Band 25: 1850 MHz ~ 1915 MHz LTE Band 26: 814 MHz ~ 849 MHz LTE Band 66: 1710 MHz ~ 1780 MHz LTE Band 71: 663 MHz ~ 698 MHz LTE Band 41: 2496 MHz ~ 2690 MHz WLAN 2.4GHz Band: 2412 MHz ~ 2462 MHz WLAN 5.2GHz Band: 5180 MHz ~ 5240 MHz WLAN 5.3GHz Band: 5260 MHz ~ 5320 MHz WLAN 5.5GHz Band: 5500 MHz ~ 5720 MHz WLAN 5.8GHz Band: 5745 MHz ~ 5825 MHz Bluetooth: 2402 MHz ~ 2480 MHz
Mode	GSM/GPRS/EGPRS AMR / RMC 12.2Kbps HSDPA HSUPA DC-HSDPA HSPA+ (16QAM uplink is supported) LTE: QPSK, 16QAM, 64QAM WLAN 2.4GHz : 802.11b/g/n HT20/ HT40 WLAN 5GHz : 802.11a/n/ac HT20/HT40/VHT20/VHT40/VHT80 Bluetooth BR/EDR/LE
HW Version	03
SW Version	9K3J
GSM / (E)GPRS Transfer mode	Class B – EUT cannot support Packet Switched and Circuit Switched Network simultaneously but can automatically switch between Packet and Circuit Switched Network.
EUT Stage	Identical Prototype
Remark:	
<ol style="list-style-type: none"> This device supports VoIP in GPRS, EGPRS, WCDMA and LTE (e.g. for 3rd-party VoIP), LTE supports VoLTE operation. This device 2.4GHz WLAN support hotspot operation and Bluetooth support tethering applications. This device 5.2GHz WLAN/5.8GHz WLAN support hotspot operation, and 5.2GHz WLAN/5.8GHz WLAN supports WiFi Direct (GC/GO), and 5.3GHz / 5.5GHz supports WiFi Direct (GC only). This device does not support DTM operation and supports GPRS/EGPRS mode up to multi-slot class 12. The device implements receiver detection/hotspot mode for SAR compliance at different exposure conditions (head, body-worn, hotspot, extremity). And the device will invoke corresponding work scenarios power level base on frequency bands/antennas, which can refer to power table at appendix E. Power table (DSI 1: receiver on + hotspot off reduced power for head; DSI 0: receiver off + hotspot off power for body worn/extremity; DSI 2: receiver on + hotspot on reduced power for hotspot). For WLAN transmitter, while the device WLAN is transmitting simultaneously with the WWAN/BT antenna, the device 	



- power will be reduced power at head, body-worn, hotspot and extremity exposure conditions.
7. This device supports HPUE for LTE Band 41 with class 2 level, HPUE power has been measured separately. For HPUE power is higher than power class 3 but with lower duty cycle, the maximum average power for class 2 and class 3 is almost the same, so we chose power class 3 full SAR testing and power class 2 verified the worst case of power class 3 SAR.
 8. There are two samples, the difference between them is battery: sample 1 is 1st battery and sample 2 is 2nd source battery. They are only supplier different, so sample 1 was chosen to perform full test only.

4.2 General LTE SAR Test and Reporting Considerations

Summarized necessary items addressed in KDB 941225 D05 v02r05																																																															
FCC ID	2ACCJH180																																																														
Equipment Name	GSM/UMTS/LTE Mobile phone																																																														
Operating Frequency Range of each LTE transmission band	LTE Band 2: 1850 MHz ~ 1910 MHz LTE Band 4: 1710 MHz ~ 1755 MHz LTE Band 5: 824 MHz ~ 849 MHz LTE Band 7: 2500 MHz ~ 2570 MHz LTE Band 12: 699 MHz ~ 716 MHz LTE Band 13: 777 MHz ~ 787 MHz LTE Band 25: 1850 MHz ~ 1915 MHz LTE Band 26: 814 MHz ~ 849 MHz LTE Band 41: 2496 MHz ~ 2690 MHz LTE Band 66: 1710 MHz ~ 1780 MHz LTE Band 71: 663 MHz ~ 698 MHz																																																														
Channel Bandwidth	LTE Band 2: 1.4MHz, 3MHz, 5MHz, 10MHz, 15MHz, 20MHz LTE Band 4: 1.4MHz, 3MHz, 5MHz, 10MHz, 15MHz, 20MHz LTE Band 5: 1.4MHz, 3MHz, 5MHz, 10MHz LTE Band 7: 5MHz, 10MHz, 15MHz, 20MHz LTE Band 12: 1.4MHz, 3MHz, 5MHz, 10MHz LTE Band 13: 5MHz, 10MHz LTE Band 25: 1.4MHz, 3MHz, 5MHz, 10MHz, 15MHz, 20MHz LTE Band 26: 1.4MHz, 3MHz, 5MHz, 10MHz, 15MHz LTE Band 41: 5MHz, 10MHz, 15MHz, 20MHz LTE Band 66: 1.4MHz, 3MHz, 5MHz, 10MHz, 15MHz, 20MHz LTE Band 71: 5MHz, 10MHz, 15MHz, 20MHz																																																														
Uplink Modulations used	QPSK / 16QAM / 64QAM																																																														
LTE Voice / Data requirements	Voice and Data																																																														
LTE Release Version	R11, Cat 5																																																														
CA Support	Supported, Downlink Only																																																														
LTE MPR permanently built-in by design	<p>Table 6.2.3-1: Maximum Power Reduction (MPR) for Power Class 1, 2 and 3</p> <table border="1"> <thead> <tr> <th rowspan="2">Modulation</th> <th colspan="6">Channel bandwidth / Transmission bandwidth (N_{RB})</th> <th rowspan="2">MPR (dB)</th> </tr> <tr> <th>1.4 MHz</th> <th>3.0 MHz</th> <th>5 MHz</th> <th>10 MHz</th> <th>15 MHz</th> <th>20 MHz</th> </tr> </thead> <tbody> <tr> <td>QPSK</td> <td>> 5</td> <td>> 4</td> <td>> 8</td> <td>> 12</td> <td>> 16</td> <td>> 18</td> <td>≤ 1</td> </tr> <tr> <td>16 QAM</td> <td>≤ 5</td> <td>≤ 4</td> <td>≤ 8</td> <td>≤ 12</td> <td>≤ 16</td> <td>≤ 18</td> <td>≤ 1</td> </tr> <tr> <td>16 QAM</td> <td>> 5</td> <td>> 4</td> <td>> 8</td> <td>> 12</td> <td>> 16</td> <td>> 18</td> <td>≤ 2</td> </tr> <tr> <td>64 QAM</td> <td>≤ 5</td> <td>≤ 4</td> <td>≤ 8</td> <td>≤ 12</td> <td>≤ 16</td> <td>≤ 18</td> <td>≤ 2</td> </tr> <tr> <td>64 QAM</td> <td>> 5</td> <td>> 4</td> <td>> 8</td> <td>> 12</td> <td>> 16</td> <td>> 18</td> <td>≤ 3</td> </tr> <tr> <td>256 QAM</td> <td colspan="6">≥ 1</td> <td>≤ 5</td> </tr> </tbody> </table>	Modulation	Channel bandwidth / Transmission bandwidth (N _{RB})						MPR (dB)	1.4 MHz	3.0 MHz	5 MHz	10 MHz	15 MHz	20 MHz	QPSK	> 5	> 4	> 8	> 12	> 16	> 18	≤ 1	16 QAM	≤ 5	≤ 4	≤ 8	≤ 12	≤ 16	≤ 18	≤ 1	16 QAM	> 5	> 4	> 8	> 12	> 16	> 18	≤ 2	64 QAM	≤ 5	≤ 4	≤ 8	≤ 12	≤ 16	≤ 18	≤ 2	64 QAM	> 5	> 4	> 8	> 12	> 16	> 18	≤ 3	256 QAM	≥ 1						≤ 5
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256 QAM	≥ 1						≤ 5																																																								
LTE A-MPR	In the base station simulator configuration, Network Setting value is set to NS_01 to disable A-MPR during SAR testing and the LTE SAR tests was transmitting on all TTI frames (Maximum TTI)																																																														
Spectrum plots for RB configuration	A properly configured base station simulator was used for the SAR and power measurement; therefore, spectrum plots for each RB allocation and offset configuration are not included in the SAR report.																																																														
Power reduction applied to satisfy SAR compliance	Yes, when operating in receiver/hotspot detect mechanism, head/body -worn /hotspot/extremity will trigger reduced power for some bands applied to satisfy SAR compliance, the detail please referred to section 13 and original test report.																																																														
LTE Carrier Aggregation Combinations	Inter-Band and Intra-Band possible combinations and the detail power verification please referred to original test report.																																																														
LTE Carrier Aggregation Additional Information	1. This device supports maximum of 2 carriers in the downlink.																																																														



Transmission (H, M, L) channel numbers and frequencies in each LTE band												
LTE Band 2												
	Bandwidth 1.4 MHz		Bandwidth 3 MHz		Bandwidth 5 MHz		Bandwidth 10 MHz		Bandwidth 15 MHz		Bandwidth 20 MHz	
	Ch. #	Freq. (MHz)	Ch. #	Freq. (MHz)	Ch. #	Freq. (MHz)	Ch. #	Freq. (MHz)	Ch. #	Freq. (MHz)	Ch. #	Freq. (MHz)
L	18607	1850.7	18615	1851.5	18625	1852.5	18650	1855	18675	1857.5	18700	1860
M	18900	1880	18900	1880	18900	1880	18900	1880	18900	1880	18900	1880
H	19193	1909.3	19185	1908.5	19175	1907.5	19150	1905	19125	1902.5	19100	1900
LTE Band 4												
	Bandwidth 1.4 MHz		Bandwidth 3 MHz		Bandwidth 5 MHz		Bandwidth 10 MHz		Bandwidth 15 MHz		Bandwidth 20 MHz	
	Ch. #	Freq. (MHz)	Ch. #	Freq. (MHz)	Ch. #	Freq. (MHz)	Ch. #	Freq. (MHz)	Ch. #	Freq. (MHz)	Ch. #	Freq. (MHz)
L	19957	1710.7	19965	1711.5	19975	1712.5	20000	1715	20025	1717.5	20050	1720
M	20175	1732.5	20175	1732.5	20175	1732.5	20175	1732.5	20175	1732.5	20175	1732.5
H	20393	1754.3	20385	1753.5	20375	1752.5	20350	1750	20325	1747.5	20300	1745
LTE Band 5												
	Bandwidth 1.4 MHz		Bandwidth 3 MHz		Bandwidth 5 MHz		Bandwidth 10 MHz					
	Ch. #	Freq. (MHz)	Ch. #	Freq. (MHz)	Ch. #	Freq. (MHz)	Ch. #	Freq. (MHz)	Ch. #	Freq. (MHz)	Ch. #	Freq. (MHz)
L	20407	824.7	20415	825.5	20425	826.5	20450	829				
M	20525	836.5	20525	836.5	20525	836.5	20525	836.5				
H	20643	848.3	20635	847.5	20625	846.5	20600	844				
LTE Band 7												
	Bandwidth 5 MHz		Bandwidth 10 MHz		Bandwidth 15 MHz		Bandwidth 20 MHz					
	Ch. #	Freq. (MHz)	Ch. #	Freq. (MHz)	Ch. #	Freq. (MHz)	Ch. #	Freq. (MHz)	Ch. #	Freq. (MHz)	Ch. #	Freq. (MHz)
L	20775	2502.5	20800	2505	20825	2507.5	20850	2510				
M	21100	2535	21100	2535	21100	2535	21100	2535				
H	21425	2567.5	21400	2565	21375	2562.5	21350	2560				
LTE Band 12												
	Bandwidth 1.4 MHz		Bandwidth 3 MHz		Bandwidth 5 MHz		Bandwidth 10 MHz					
	Ch. #	Freq. (MHz)	Ch. #	Freq. (MHz)	Ch. #	Freq. (MHz)	Ch. #	Freq. (MHz)	Ch. #	Freq. (MHz)	Ch. #	Freq. (MHz)
L	23017	699.7	23025	700.5	23035	701.5	23060	704				
M	23095	707.5	23095	707.5	23095	707.5	23095	707.5				
H	23173	715.3	23165	714.5	23155	713.5	23130	711				
LTE Band 13												
	Bandwidth 5 MHz				Bandwidth 10 MHz							
	Channel #		Freq.(MHz)		Channel #		Freq.(MHz)					
L	23205		779.5		23230		782					
M	23230		782									
H	23255		784.5									

LTE Band 25												
	Bandwidth 1.4 MHz		Bandwidth 3 MHz		Bandwidth 5 MHz		Bandwidth 10 MHz		Bandwidth 15 MHz		Bandwidth 20 MHz	
	Ch. #	Freq. (MHz)	Ch. #	Freq. (MHz)	Ch. #	Freq. (MHz)	Ch. #	Freq. (MHz)	Ch. #	Freq. (MHz)	Ch. #	Freq. (MHz)
L	26047	1850.7	26055	1851.5	26065	1852.5	26090	1855	26115	1857.5	26140	1860
M	26340	1880	26340	1880	26340	1880	26340	1880	26340	1880	26340	1880
H	26683	1914.3	26675	1913.5	26665	1912.5	26640	1910	26615	1907.5	26590	1905
LTE Band 26												
	Bandwidth 1.4 MHz		Bandwidth 3 MHz		Bandwidth 5 MHz		Bandwidth 10 MHz		Bandwidth 15 MHz			
	Ch. #	Freq. (MHz)	Ch. #	Freq. (MHz)	Ch. #	Freq. (MHz)	Ch. #	Freq. (MHz)	Ch. #	Freq. (MHz)	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	26865	831.5
H	27033	848.3	27025	847.5	27015	846.5	26990	844	26965	841.5		
LTE Band 41												
	Bandwidth 5 MHz		Bandwidth 10 MHz		Bandwidth 15 MHz		Bandwidth 20 MHz					
	Ch. #	Freq. (MHz)	Ch. #	Freq. (MHz)	Ch. #	Freq. (MHz)	Ch. #	Freq. (MHz)	Ch. #	Freq. (MHz)	Ch. #	Freq. (MHz)
L	39675	2498.5	39700	2501	39725	2503.5	39750	2506				
LM	40148	2545.8	40160	2547	40173	2548.3	40185	2549.5				
M	40620	2593	40620	2593	40620	2593	40620	2593				
HM	41093	2640.3	41080	2639	41068	2637.8	41055	2636.5				
H	41565	2687.5	41540	2685	41515	2682.5	41490	2680				
LTE Band 66												
	Bandwidth 1.4 MHz		Bandwidth 3 MHz		Bandwidth 5 MHz		Bandwidth 10 MHz		Bandwidth 15 MHz		Bandwidth 20 MHz	
	Ch. #	Freq. (MHz)	Ch. #	Freq. (MHz)	Ch. #	Freq. (MHz)	Ch. #	Freq. (MHz)	Ch. #	Freq. (MHz)	Ch. #	Freq. (MHz)
L	131979	1710.7	131987	1711.5	131997	1712.5	132022	1715	132047	1717.5	132072	1720
M	132322	1745	132322	1745	132322	1745	132322	1745	132322	1745	132322	1745
H	132665	1779.3	132657	1778.5	132647	1777.5	132622	1775	132597	1772.5	132572	1770
LTE Band 71												
	Bandwidth 5 MHz		Bandwidth 10 MHz		Bandwidth 15 MHz		Bandwidth 20 MHz					
	Ch. #	Freq. (MHz)	Ch. #	Freq. (MHz)	Ch. #	Freq. (MHz)	Ch. #	Freq. (MHz)	Ch. #	Freq. (MHz)	Ch. #	Freq. (MHz)
L	133147	665.5	133172	668	133197	670.5	133222	673				
M	133247	675.5	133272	678	133297	680.5	133322	683				
H	133447	695.5	133422	693	133397	690.5	133372	688				

5. RF Exposure Limits

5.1 Uncontrolled Environment

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

5.2 Controlled Environment

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

Limits for Occupational/Controlled Exposure (W/kg)

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

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

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

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

6. Specific Absorption Rate (SAR)

6.1 Introduction

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

6.2 SAR Definition

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

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

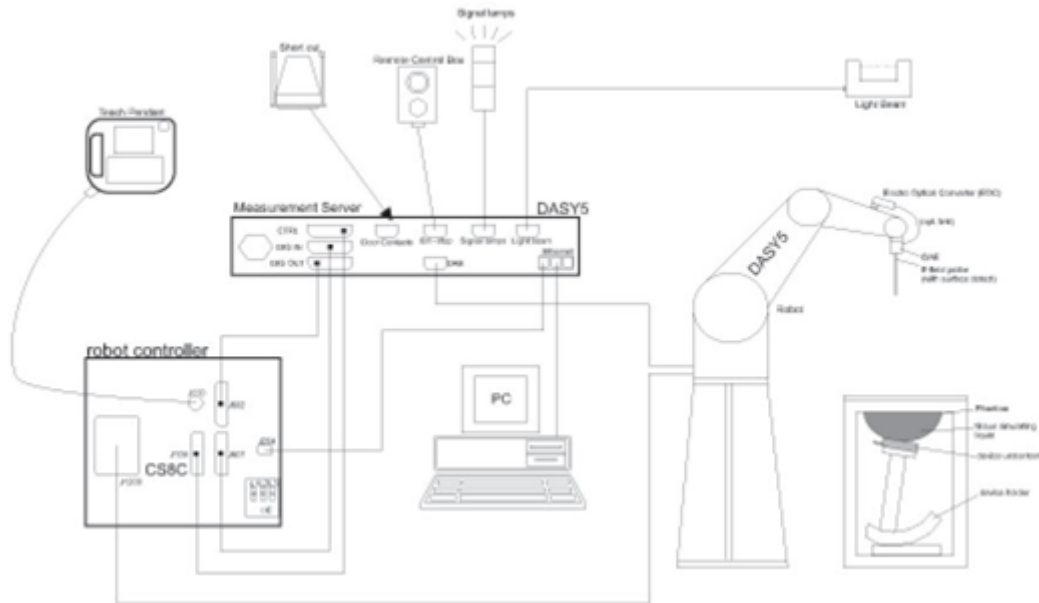
SAR is expressed in units of Watts per kilogram (W/kg)

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

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

7. System Description and Setup

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




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

7.1 E-Field Probe

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

<EX3DV4 Probe>

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

7.2 Data Acquisition Electronics (DAE)

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


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



Photo of DAE


7.3 Phantom

<SAM Twin Phantom>

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

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

<ELI Phantom>

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

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

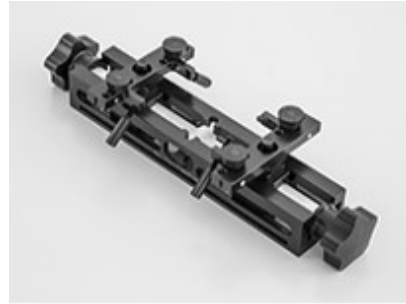
7.4 Device Holder

<Mounting Device for Hand-Held Transmitter>

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



Mounting Device for Hand-Held Transmitters



Mounting Device Adaptor for Wide-Phones

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

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



Mounting Device for Laptops

8. Measurement Procedures

The measurement procedures are as follows:

<Conducted power measurement>

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

<SAR measurement>

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

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

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

8.1 Spatial Peak SAR Evaluation

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

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

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

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

8.2 Power Reference Measurement

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

8.3 Area Scan

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

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

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

8.4 Zoom Scan

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

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

		≤ 3 GHz	> 3 GHz	
Maximum zoom scan spatial resolution: $\Delta x_{Zoom}, \Delta y_{Zoom}$		≤ 2 GHz: ≤ 8 mm 2 – 3 GHz: ≤ 5 mm*	3 – 4 GHz: ≤ 5 mm* 4 – 6 GHz: ≤ 4 mm*	
Maximum zoom scan spatial resolution, normal to phantom surface	uniform grid: $\Delta z_{Zoom}(n)$	≤ 5 mm	3 – 4 GHz: ≤ 4 mm 4 – 5 GHz: ≤ 3 mm 5 – 6 GHz: ≤ 2 mm	
	graded grid	$\Delta z_{Zoom}(1)$: between 1 st two points closest to phantom surface	≤ 4 mm	3 – 4 GHz: ≤ 3 mm 4 – 5 GHz: ≤ 2.5 mm 5 – 6 GHz: ≤ 2 mm
		$\Delta z_{Zoom}(n>1)$: between subsequent points	$\leq 1.5 \cdot \Delta z_{Zoom}(n-1)$	
Minimum zoom scan volume	x, y, z	≥ 30 mm	3 – 4 GHz: ≥ 28 mm 4 – 5 GHz: ≥ 25 mm 5 – 6 GHz: ≥ 22 mm	
Note: δ is the penetration depth of a plane-wave at normal incidence to the tissue medium; see draft standard IEEE P1528-2011 for details. * When zoom scan is required and the <i>reported</i> SAR from the <i>area scan based 1-g SAR estimation</i> procedures of KDB 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.				

8.5 Volume Scan Procedures

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

8.6 Power Drift Monitoring

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



9. Test Equipment List

Manufacturer	Name of Equipment	Type/Model	Serial Number	Calibration	
				Last Cal.	Due Date
SPEAG	750MHz System Validation Kit	D750V3	1099	Dec. 15, 2021	Dec. 14, 2024
SPEAG	835MHz System Validation Kit	D835V2	4d162	Dec. 17, 2021	Dec. 16, 2024
SPEAG	1750MHz System Validation Kit	D1750V2	1090	Feb. 24, 2022	Feb. 23, 2025
SPEAG	1900MHz System Validation Kit	D1900V2	5d182	Dec. 20, 2021	Dec. 19, 2024
SPEAG	2450MHz System Validation Kit	D2450V2	1040	Apr. 25, 2023	Apr. 24, 2024
SPEAG	2600MHz System Validation Kit	D2600V2	1070	Dec. 20, 2021	Dec. 19, 2024
SPEAG	5000MHz System Validation Kit	D5GHzV2	1341	Dec. 13, 2021	Dec. 12, 2024
SPEAG	Data Acquisition Electronics	DAE4	1664	Jun. 06, 2023	Jun. 05, 2024
SPEAG	Dosimetric E-Field Probe	EX3DV4	7641	Apr. 24, 2023	Apr. 23, 2024
SPEAG	SAM Twin Phantom	QD 000 P41 AA	2033	NCR	NCR
SPEAG	Phone Positioner	N/A	N/A	NCR	NCR
Anritsu	Radio communication analyzer	MT8820C	6201300653	Jul. 05, 2023	Jul. 04, 2024
Anritsu	Radio communication analyzer	MT8821C	6262314715	Jul. 05, 2023	Jul. 04, 2024
Agilent	Wireless Communication Test Set	E5515C	MY50267224	Jul. 05, 2023	Jul. 04, 2024
Keysight	Network Analyzer	E5071C	MY46523671	Oct. 16, 2023	Oct. 15, 2024
Speag	Dielectric Assessment KIT	DAK-3.5	1071	Feb. 20, 2023	Feb. 19, 2024
Agilent	Signal Generator	N5181A	MY50145381	Dec. 27, 2022	Dec. 26, 2023
Anritsu	Power Sensor	MA2411B	1306099	Oct. 16, 2023	Oct. 15, 2024
Anritsu	Power Meter	ML2495A	1349001	Oct. 16, 2023	Oct. 15, 2024
Anritsu	Power Sensor	MA2411B	1542004	Dec. 27, 2022	Dec. 26, 2023
Anritsu	Power Meter	ML2495A	1339473	Dec. 27, 2022	Dec. 26, 2023
R&S	CBT BLUETOOTH TESTER	CBT	100963	Dec. 27, 2022	Dec. 26, 2023
R&S	Spectrum Analyzer	FSP7	100818	Jul. 05, 2023	Jul. 04, 2024
TES	Hygrometer	1310	200505600	Jul. 08, 2023	Jul. 07, 2024
Anymetre	Thermo-Hygrometer	JR593	2020062101	Jul. 08, 2023	Jul. 07, 2024
SPEAG	Device Holder	N/A	N/A	N/A	N/A
AR	Amplifier	5S1G4	0333096	Note 1	
Mini-Circuits	Amplifier	ZVE-3W-83+	599201528	Note 1	
ARRA	Power Divider	A3200-2	N/A	Note 1	
ET Industries	Dual Directional Coupler	C-058-10	N/A	Note 1	
Jinkexinhua	Attenuator	10db-8G	N/A	Note 1	

Note:

1. Prior to system verification and validation, the path loss from the signal generator to the system check source and the power meter, which includes the amplifier, cable, attenuator and directional coupler, was measured by the network analyzer. The reading of the power meter was offset by the path loss difference between the path to the power meter and the path to the system check source to monitor the actual power level fed to the system check source.
2. The dipole calibration interval can be extended to 3 years with justification according to KDB 865664 D01. The dipoles are also not physically damaged, or repaired during the interval. The justification data in appendix C can be found which the return loss is < -20dB, within 20% of prior calibration, the impedance is within 5 ohm of prior calibration for each dipole.

10. System Verification

10.1 Tissue Simulating Liquids

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

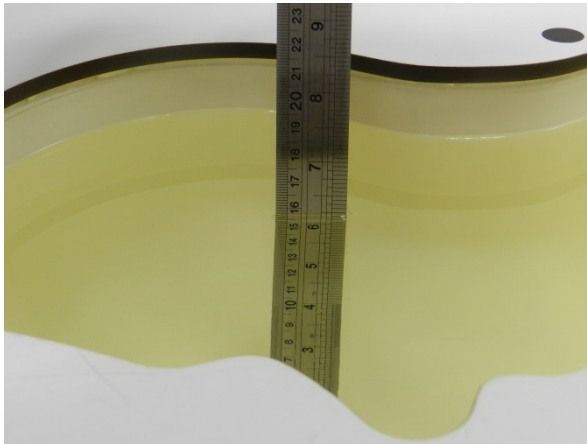


Fig 10.1 Photo of Liquid Height for Head SAR

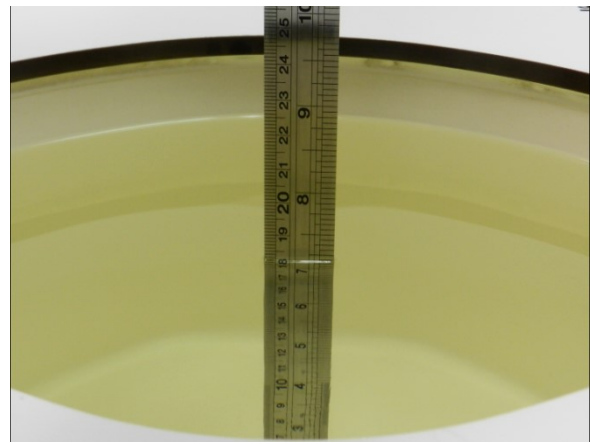


Fig 10.2 Photo of Liquid Height for Body SAR

10.2 Tissue Verification

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

Frequency (MHz)	Water (%)	Sugar (%)	Cellulose (%)	Salt (%)	Preventol (%)	DGBE (%)	Conductivity (σ)	Permittivity (εr)
For Head								
750	41.1	57.0	0.2	1.4	0.2	0	0.89	41.9
835	40.3	57.9	0.2	1.4	0.2	0	0.90	41.5
900	40.3	57.9	0.2	1.4	0.2	0	0.97	41.5
1800, 1900, 2000	55.2	0	0	0.3	0	44.5	1.40	40.0
2450	55.0	0	0	0	0	45.0	1.80	39.2
2600	54.8	0	0	0.1	0	45.1	1.96	39.0
For Body								
750	51.7	47.2	0	0.9	0.1	0	0.96	55.5
835	50.8	48.2	0	0.9	0.1	0	0.97	55.2
1800, 1900, 2000	70.2	0	0	0.4	0	29.4	1.52	53.3
2450	68.6	0	0	0	0	31.4	1.95	52.7
2600	68.1	0	0	0.1	0	31.8	2.16	52.5

Simulating Liquid for 5GHz, Manufactured by SPEAG

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

<Tissue Dielectric Parameter Check Results>

Frequency (MHz)	Tissue Type	Liquid Temp. (°C)	Conductivity (σ)	Permittivity (εr)	Conductivity Target (σ)	Permittivity Target (εr)	Delta (σ) (%)	Delta (εr) (%)	Limit (%)	Date
750	Head	22.4	0.903	41.574	0.89	41.90	1.46	-0.78	±5	2023/11/21
835	Head	22.6	0.936	40.059	0.90	41.50	4.00	-3.47	±5	2023/11/21
1750	Head	22.4	1.354	40.980	1.37	40.10	-1.17	2.19	±5	2023/11/22
1900	Head	22.6	1.434	41.015	1.40	40.00	2.43	2.54	±5	2023/11/22
2450	Head	22.7	1.774	37.977	1.80	39.20	-1.44	-3.12	±5	2023/11/23
2600	Head	22.3	1.944	39.722	1.96	39.00	-0.82	1.85	±5	2023/11/23
5250	Head	22.5	4.732	34.989	4.71	35.95	0.47	-2.67	±5	2023/11/24
5600	Head	22.4	5.111	34.293	5.07	35.50	0.81	-3.40	±5	2023/11/24
5750	Head	22.4	5.275	34.003	5.22	35.35	1.05	-3.81	±5	2023/11/24

10.3 System Performance Check Results

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

<1g SAR>

Date	Frequency (MHz)	Tissue Type	Input Power (mW)	Dipole S/N	Probe S/N	DAE S/N	Measured 1g SAR (W/kg)	Targeted 1g SAR (W/kg)	Normalized 1g SAR (W/kg)	Deviation (%)
2023/11/21	750	Head	250	1099	7641	1664	2.320	8.540	9.28	8.67
2023/11/21	835	Head	250	4d162	7641	1664	2.470	9.640	9.88	2.49
2023/11/22	1750	Head	250	1090	7641	1664	9.130	37.000	36.52	-1.30
2023/11/22	1900	Head	250	5d182	7641	1664	10.400	39.600	41.6	5.05
2023/11/23	2450	Head	250	1040	7641	1664	12.300	52.700	49.2	-6.64
2023/11/23	2600	Head	250	1070	7641	1664	13.000	56.200	52	-7.47
2023/11/24	5250	Head	100	1341	7641	1664	8.030	80.700	80.3	-0.50
2023/11/24	5600	Head	100	1341	7641	1664	8.610	84.500	86.1	1.89
2023/11/24	5750	Head	100	1341	7641	1664	8.080	80.600	80.8	0.25

<10g SAR>

Date	Frequency (MHz)	Tissue Type	Input Power (mW)	Dipole S/N	Probe S/N	DAE S/N	Measured 10g SAR (W/kg)	Targeted 10g SAR (W/kg)	Normalized 10g SAR (W/kg)	Deviation (%)
2023/11/21	750	Head	250	1099	7641	1664	1.540	5.650	6.16	9.03
2023/11/21	835	Head	250	4d162	7641	1664	1.610	6.260	6.44	2.88
2023/11/22	1750	Head	250	1090	7641	1664	4.960	19.500	19.84	1.74
2023/11/22	1900	Head	250	5d182	7641	1664	5.400	20.200	21.6	6.93
2023/11/23	2450	Head	250	1040	7641	1664	5.620	24.600	22.48	-8.62
2023/11/23	2600	Head	250	1070	7641	1664	5.650	24.600	22.6	-8.13
2023/11/24	5250	Head	100	1341	7641	1664	2.210	23.100	22.1	-4.33
2023/11/24	5600	Head	100	1341	7641	1664	2.330	24.000	23.3	-2.92
2023/11/24	5750	Head	100	1341	7641	1664	2.230	22.700	22.3	-1.76

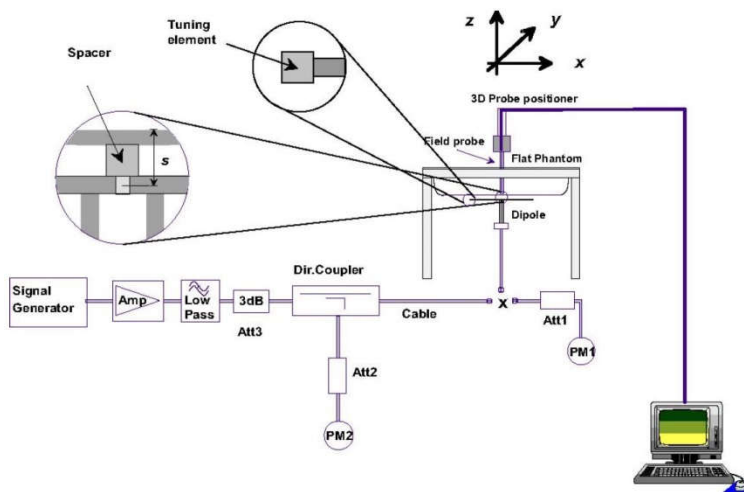


Fig 10.3.1 System Performance Check Setup



Fig 10.3.2 Setup Photo

11. RF Exposure Positions

11.1 Ear and handset reference point

Figure 11.1.1 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 11.1.2 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 11.1.3). 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 11.1.2. The ear truncation is introduced to preclude the ear lobe from interfering with handset tilt, which could lead to unstable positioning at the cheek.

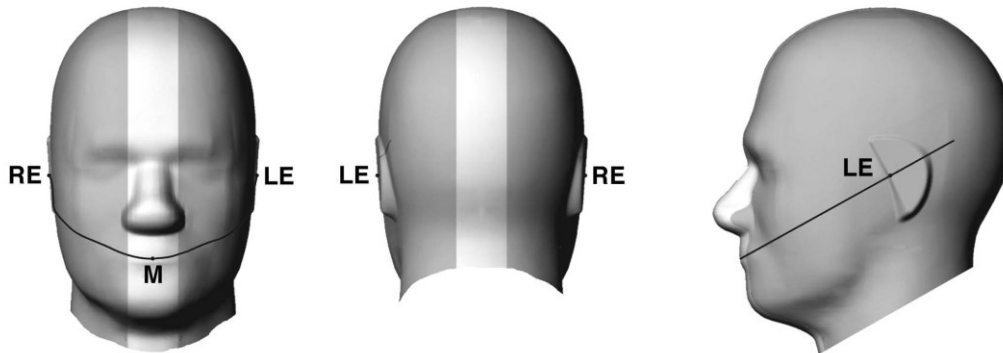


Fig 11.1.1 Front, back, and side views of SAM twin phantom

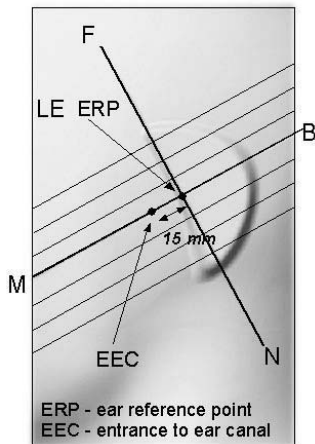


Fig 11.1.2 Close-up side view of phantom showing the ear region.

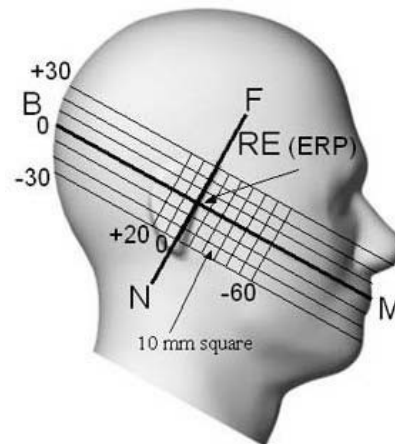


Fig 11.1.3 Side view of the phantom showing relevant markings and seven cross-sectional plane locations

11.2 Definition of the cheek position

1. Ready the handset for talk operation, if necessary. For example, for handsets with a cover piece (flip cover), open the cover. If the handset can transmit with the cover closed, both configurations must be tested.
2. Define two imaginary lines on the handset—the vertical centerline and the horizontal line. The vertical centerline passes through two points on the front side of the handset—the midpoint of the width w_t of the handset at the level of the acoustic output (point A in Figure 11.2.1 and Figure 11.2.2), and the midpoint of the width w_b 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 11.2.1). 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 11.2.2), 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 11.2.3), 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 11.2.3. The actual rotation angles should be documented in the test report.

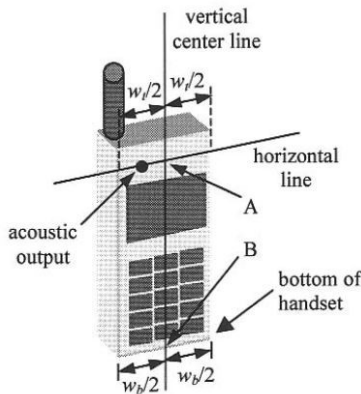


Fig 11.2.1 Handset vertical and horizontal reference lines—“fixed case”

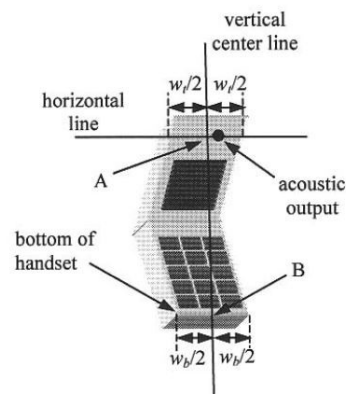


Fig 11.2.2 Handset vertical and horizontal reference lines—“clam-shell case”

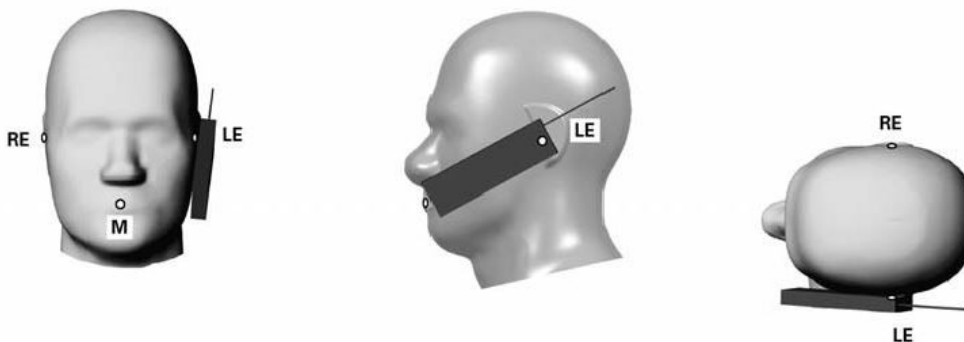


Fig 11.2.3 cheek or touch position. The reference points for the right ear (RE), left ear (LE), and mouth (M), which establish the Reference Plane for handset positioning, are indicated.

11.3 Definition of the tilt position

1. Ready the handset for talk operation, if necessary. For example, for handsets with a cover piece (flip cover), open the cover. If the handset can transmit with the cover closed, both configurations must be tested.
2. While maintaining the orientation of the handset, move the handset away from the pinna along the line passing through RE and LE far enough to allow a rotation of the handset away from the cheek by 15°.
3. Rotate the handset around the horizontal line by 15°.
4. While maintaining the orientation of the handset, move the handset towards the phantom on the line passing through RE and LE until any part of the handset touches the ear. The tilt position is obtained when the contact point is on the pinna. See Figure 11.3.1. 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

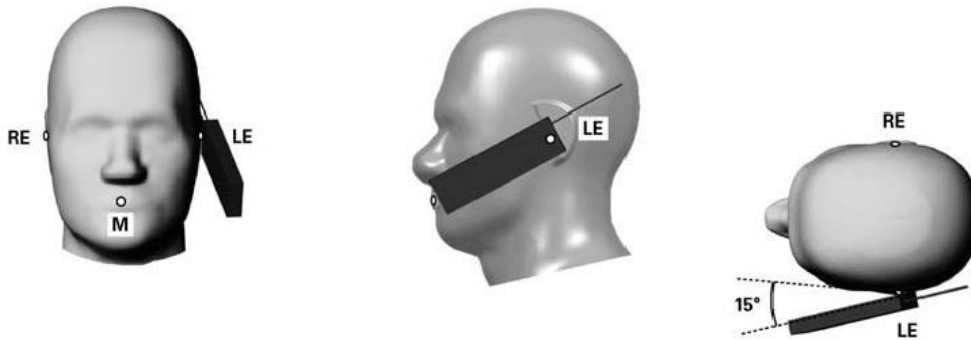


Fig 11.3.1 Tilt position. The reference points for the right ear (RE), left ear (LE), and mouth (M), which define the Reference Plane for handset positioning, are indicated.

11.4 Body Worn Accessory

Body-worn operating configurations are tested with the belt-clips and holsters attached to the device and positioned against a flat phantom in a normal use configuration (see Figure 11.4). Per KDB648474 D04v01r03, body-worn accessory exposure is typically related to voice mode operations when handsets are carried in body-worn accessories. The body-worn accessory procedures in FCC KDB 447498 D01v06 should be used to test for body-worn accessory SAR compliance, without a headset connected to it. This enables the test results for such configuration to be compatible with that required for hotspot mode when the body-worn accessory test separation distance is greater than or equal to that required for hotspot mode, when applicable. When the reported SAR for body-worn accessory, measured without a headset connected to the handset is $> 1.2 \text{ W/kg}$, the highest reported SAR configuration for that wireless mode and frequency band should be repeated for that body-worn accessory with a handset attached to the handset.

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

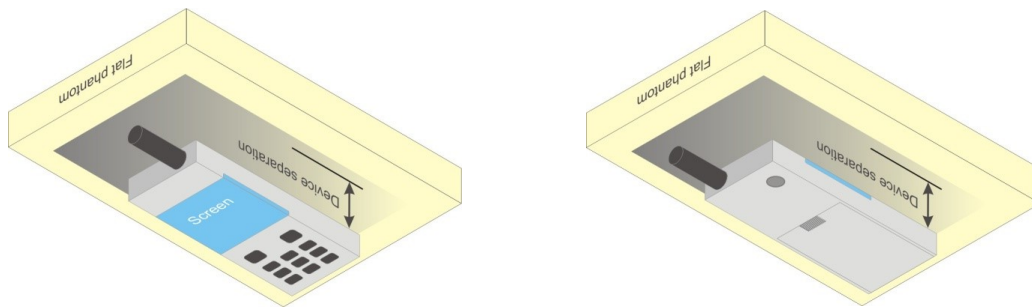


Fig 11.4 Body Worn Position



11.5 Product Specific 10g SAR Exposure

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

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

11.6 Wireless Router

Some battery-operated handsets have the capability to transmit and receive user through simultaneous transmission of WIFI simultaneously with a separate licensed transmitter. The FCC has provided guidance in FCC KDB Publication 941225 D06 v02r01 where SAR test considerations for handsets ($L \times W \geq 9$ 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 from general mixed use conditions for this type of devices. Since the hotspot SAR results may overlap with the body-worn accessory SAR requirements, the more conservative configurations can be considered, thus excluding some body-worn accessory SAR tests.

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

12. Conducted RF Output Power (Unit: dBm)

The detailed conducted power table can refer to Appendix E.

<WCDMA Conducted Power>

1. The following tests were conducted according to the test requirements outlines in 3GPP TS 34.121 specification.
2. The procedures in KDB 941225 D01v03r01 are applied for 3GPP Rel. 6 HSPA to configure the device in the required sub-test mode(s) to determine SAR test exclusion.
3. For HSPA+ devices supporting 16 QAM in the uplink, power measurements procedure is according to the configurations in Table C.11.1.4 of 3GPP TS 34.121-1.
4. 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.

A summary of these settings are illustrated below:

HSDPA Setup Configuration:

- a. The EUT was connected to Base Station Agilent E5515C referred to the Setup Configuration.
- b. The RF path losses were compensated into the measurements.
- c. A call was established between EUT and Base Station with following setting:
 - i. Set Gain Factors (β_c and β_d) and parameters were set according to each
 - ii. Specific sub-test in the following table, C10.1.4, quoted from the TS 34.121
 - iii. Set RMC 12.2Kbps + HSDPA mode.
 - iv. Set Cell Power = -86 dBm
 - v. Set HS-DSCH Configuration Type to FRC (H-set 1, QPSK)
 - vi. Select HSDPA Uplink Parameters
 - vii. Set Delta ACK, Delta NACK and Delta CQI = 8
 - viii. Set Ack-Nack Repetition Factor to 3
 - ix. Set CQI Feedback Cycle (k) to 4 ms
 - x. Set CQI Repetition Factor to 2
 - xi. Power Ctrl Mode = All Up bits
- d. The transmitted maximum output power was recorded.

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} (Note 1, 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: $\Delta_{ACK}, \Delta_{NACK}$ and $\Delta_{CQI} = 30/15$ with $\beta_{HS} = 30/15 * \beta_c$.

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 $\Delta_{NACK} = 30/15$ with $\beta_{HS} = 30/15 * \beta_c$, and $\Delta_{CQI} = 24/15$ with $\beta_{HS} = 24/15 * \beta_c$.

Note 3: CM = 1 for $\beta_c/\beta_d = 12/15, \beta_{HS}/\beta_c = 24/15$. For all other combinations of DPDCCH, 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 $\beta_c = 11/15$ and $\beta_d = 15/15$.

Setup Configuration

HSUPA Setup Configuration:

- a. The EUT was connected to Base Station Agilent E5515C referred to the Setup Configuration.
- b. The RF path losses were compensated into the measurements.
- c. A call was established between EUT and Base Station with following setting * :
 - i. Call Configs = 5.2B, 5.9B, 5.10B, and 5.13.2B with QPSK
 - ii. Set the Gain Factors (β_c and β_d) and parameters (AG Index) were set according to each specific sub-test in the following table, C11.1.3, quoted from the TS 34.121
 - iii. Set Cell Power = -86 dBm
 - iv. Set Channel Type = 12.2k + HSPA
 - v. Set UE Target Power
 - vi. Power Ctrl Mode= Alternating bits
 - vii. Set and observe the E-TFCl
 - viii. Confirm that E-TFCl is equal to the target E-TFCl of 75 for sub-test 1, and other subtest's E-TFCl
- d. The transmitted maximum output power was recorded.

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-TFCl
1	11/15 (Note 3)	15/15 (Note 3)	64	11/15 (Note 3)	22/15	209/25	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	$\beta_{ed1}: 47/15$ $\beta_{ed2}: 47/15$	4	2	2.0	1.0	15	92
4	2/15	15/15	64	2/15	4/15	2/15	56/75	4	1	3.0	2.0	17	71
5	15/15	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 $\Delta_{CQI} = 30/15$ with $\beta_{hs} = 30/15 * \beta_c$. For sub-test 5, Δ_{ACK} , Δ_{NACK} and $\Delta_{CQI} = 5/15$ with $\beta_{hs} = 5/15 * \beta_c$.

Note 2: CM = 1 for $\beta_c/\beta_d = 12/15$, $\beta_{hs}/\beta_c = 24/15$. 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 $\beta_c = 10/15$ and $\beta_d = 15/15$.

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.

Setup Configuration

DC-HSDPA 3GPP release 8 Setup Configuration:

- a. The EUT was connected to Base Station Agilent E5515C referred to the Setup Configuration below
- b. The RF path losses were compensated into the measurements.
- c. A call was established between EUT and Base Station with following setting:
 - i. Set RMC 12.2Kbps + HSDPA mode.
 - ii. Set Cell Power = -25 dBm
 - iii. Set HS-DSCH Configuration Type to FRC (H-set 12, QPSK)
 - iv. Select HSDPA Uplink Parameters
 - v. Set Gain Factors (β_c and β_d) and parameters were set according to each Specific sub-test in the following table, C10.1.4, quoted from the TS 34.121
 - a). Subtest 1: $\beta_c/\beta_d=2/15$
 - b). Subtest 2: $\beta_c/\beta_d=12/15$
 - c). Subtest 3: $\beta_c/\beta_d=15/8$
 - d). Subtest 4: $\beta_c/\beta_d=15/4$
 - vi. Set Delta ACK, Delta NACK and Delta CQI = 8
 - vii. Set Ack-Nack Repetition Factor to 3
 - viii. Set CQI Feedback Cycle (k) to 4 ms
 - ix. Set CQI Repetition Factor to 2
 - x. Power Ctrl Mode = All Up bits
- d. The transmitted maximum output power was recorded.

The following tests were conducted according to the test requirements outlines in 3GPP TS 34.121 specification. A summary of these settings are illustrated below:

C.8.1.12 Fixed Reference Channel Definition H-Set 12

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	Processes	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.		

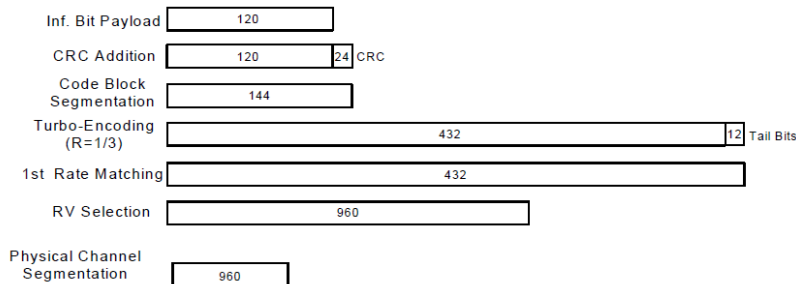


Figure C.8.19: Coding rate for Fixed reference Channel H-Set 12 (QPSK)

Setup Configuration

HSPA+ 3GPP release 7 (uplink category 7) 16QAM, Setup Configuration:

- a. The EUT was connected to Base Station Agilent E5515C referred to the Setup Configuration.
- b. The RF path losses were compensated into the measurements.
- c. A call was established between EUT and Base Station with following setting * :
 - i. Call Configs = 5.2E:HSPA+:UL with 16QAM
 - ii. Set the Gain Factors (β_c and β_d) and parameters (AG Index) were set according to each specific sub-test in the following table, C11.1.4, quoted from the TS 34.121-1 s5.2E
 - iii. Set Channel Parm
 - iv. Set Cell Power = -86 dBm
 - v. Set Channel Type = HSPA
 - vi. Set UE Target Power =21 dBm
 - vii. Power Ctrl Mode= All Up Bits
 - viii. Set Manual Uplink DPCH Bc/Bd = Manual
 - ix. Set Manual Uplink DPCH Bc and Bd=15,15(for 34.121-1 v8.10.0 table C11.1.4 sub-test 1)
 - x. Set HSPA Conn DL Channel Levels
 - xi. Set HS-SCCH Configs
 - xii. Set RB Test Mode Setup
 - xiii. Set Common HSUPA Parameters
 - xiv. Set Serving Grant
 - xv. Confirm that E-TFCI is equal to the target E-TFCI of 105 for sub-test 1, and other subtest's E-TFCI
- d. The transmitted maximum output power was recorded.

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

Sub-test	β_c (Note 3)	β_d	β_{HS} (Note 1)	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_{ed1} : 30/15 β_{ed2} : 30/15	β_{ed3} : 24/15 β_{ed4} : 24/15	3.5	2.5	14	105	105

Note 1: $\Delta_{ACK}, \Delta_{NACK}$ and $\Delta_{CQI} = 30/15$ with $\beta_{HS} = 30/15 * \beta_c$.

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 $\beta_d = 0$ 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 signaled to use the extrapolation algorithm.

Setup Configuration

<WCDMA Conducted Power>

General Note:

1. Per KDB 941225 D01v03r01, for SAR testing is measured using a 12.2 kbps RMC with TPC bits configured to all "1's".
2. Per KDB 941225 D01v03r01, 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 / HSPA+ is $\leq 1/4$ 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 / HSPA+ to RMC12.2Kbps and the adjusted SAR is ≤ 1.2 W/kg, SAR measurement is not required for HSDPA / HSUPA / DC-HSDPA / HSPA+, and according to the following RF output power, the output power results of the secondary modes (HSDPA / HSUPA / DC-HSDPA / HSPA+) are less than $1/4$ dB higher than the primary modes; therefore, SAR measurement is not required for HSDPA / HSUPA / DC-HSDPA / HSPA+.



14. Antenna Location

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



15. SAR Test Results

General Note:

1. Per KDB 447498 D01v06, the reported SAR is the measured SAR value adjusted for maximum tune-up tolerance.
 - a. Tune-up scaling Factor = tune-up limit power (mW) / EUT RF power (mW), where tune-up limit is the maximum rated power among all production units.
 - b. For SAR testing of WLAN/Bluetooth 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 WLAN/Bluetooth: Reported SAR(W/kg)= Measured SAR(W/kg)* Duty Cycle scaling factor * Tune-up scaling factor
 - 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 Reported TDD LTE SAR (W/kg) = measured SAR (W/kg)* Tune-up Scaling Factor* scaling factor for extended cyclic prefix
 - f. 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.
 - g. For TDD LTE SAR measurement of power class 2, the duty cycle 1:2.33 (42.9 %) was used perform testing and considering the theoretical duty cycle of 43.3% for extended cyclic prefix in the uplink, and the theoretical duty cycle of 42.9% for normal cyclic prefix in uplink, a scaling factor of extended cyclic prefix 43.3%/42.9% = 1.009 is applied to scale-up the measured SAR result. The reported TDD LTE SAR (W/kg) = measured SAR (W/kg)* Tune-up Scaling Factor* scaling factor for extended cyclic prefix.
2. Per KDB 447498 D01v06, for each exposure position, testing of other required channels within the operating mode of a frequency band is not required when the *reported* 1-g or 10-g SAR for the mid-band or highest output power channel is:
 - ≤ 0.8 W/kg or 2.0 W/kg, for 1-g or 10-g respectively, when the transmission band is ≤ 100 MHz
 - ≤ 0.6 W/kg or 1.5 W/kg, for 1-g or 10-g respectively, when the transmission band is between 100 MHz and 200 MHz
 - ≤ 0.4 W/kg or 1.0 W/kg, for 1-g or 10-g respectively, when the transmission band is ≥ 200 MHz
3. Per KDB 865664 D01v01r04, for each frequency band, repeated SAR measurement is required only when the measured SAR is ≥0.8W/kg.
4. Per KDB 648474 D04v01r03, when the reported SAR for a body-worn accessory measured without a headset connected to the handset is ≤ 1.2 W/kg, SAR testing with a headset connected to the handset is not required.
5. The device implements receiver detection/hotspot mode for SAR compliance at different exposure conditions (head, body-worn, hotspot, extremity). And the device will invoke corresponding work scenarios power level base on frequency bands/antennas, which can refer to power table at appendix E. Power table (DSI 1: receiver on + hotspot off reduced power for head; DSI 0: receiver off + hotspot off power for body worn/extremity; DSI 2: receiver on + hotspot on reduced power for hotspot).
6. For WLAN transmitter, while the device WLAN is transmitting simultaneously with the WWAN/BT antenna, the device power will be reduced power at head, body-worn, hotspot and extremity exposure conditions.
7. This device supports HPUE for LTE Band 41 with class 2 level, HPUE power has been measured separately. For HPUE power is higher than power class 3 but with lower duty cycle, the maximum average power for class 2 and class 3 is almost the same, so we chose power class 3 full SAR testing and power class 2 verify the worst case of power class 3 SAR.
8. Per KDB648474 D04v01r03, for smart phones with a display diagonal dimension > 15.0 cm or an overall diagonal dimension > 16.0 cm, when hotspot mode applies, 10-g extremity SAR is required only for the surfaces and edges with hotspot mode 1-g reported SAR > 1.2 W/kg, however, when power reduction applies to hotspot mode the measured SAR must be scaled to the maximum output power (for handheld on state, the maximum full power means reduced power), including tolerance, allowed for phablet modes to compare with the 1.2 W/kg SAR test reduction threshold.
 - a. For this device SAR for WWAN/WLAN transmitter scaled to maximum output power mode for product specific 10g SAR is higher than 1.2W/kg of GSM1900, LTE Band 2/25 and WLAN 2.4GHz /WLAN 5.2/5.8GHz therefore product specific 10g SAR is necessary.
 - b. WLAN 5.3/5.5GHz tested the product specific 10g SAR since it has no hotspot mode.
 - c. 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.



9. Although the headset SAR is greater than 0.8 W/kg, the headset SAR verified the worst of the non-headset SAR and less than non-headset SAR, so there is no need to be tested other channels.
10. According to Nov. 2017 TCB workshop, when the reported 1gSAR for UL CA configuration is <1.2 W/kg, UL CA 1gSAR is not required for all required test channels (PCC based).
11. The following table "n/a" in the result means the SAR cube is too small to be detected.

WCDMA Note:

1. Per KDB 941225 D01v03r01, for SAR testing is measured using a 12.2 kbps RMC with TPC bits configured to all "1's".
2. Per KDB 941225 D01v03r01, 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 / HSPA+ is $\leq 1/4$ 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 / HSPA+ to RMC12.2Kbps and the adjusted SAR is ≤ 1.2 W/kg, SAR measurement is not required for HSDPA / HSUPA / DC-HSDPA / HSPA+, and according to the following RF output power, the output power results of the secondary modes (HSDPA / HSUPA / DC-HSDPA / HSPA+) are less than $1/4$ dB higher than the primary modes; therefore, SAR measurement is not required for HSDPA / HSUPA / DC-HSDPA / HSPA+.



15.1 Head SAR

Plot No.	Band	BW (MHz)	Modulation	RB Size	RB offset	Mode	Test Position	Gap (mm)	Antenna	Power State	Ch.	Freq. (MHz)	Average Power (dBm)	Tune-Up Limit (dBm)	Tune-up Scaling Factor	Duty Cycle %	Duty Cycle Scaling Factor	Power Drift (dB)	Measured 1g SAR (W/kg)	Reported 1g SAR (W/kg)
750MHz																				
01	LTE Band 7	20M	QPSK	1	49	-	Right Cheek	0mm	Ant 0	DSI 1	133297	680.5	23.72	24.50	1.197	-	-	-0.18	0.654	0.783
02	LTE Band 12	10M	QPSK	1	25	-	Right Cheek	0mm	Ant 0	DSI 1	23095	707.5	24.12	25.00	1.225	-	-	0.01	0.873	1.069
03	LTE Band 13	10M	QPSK	1	25	-	Right Cheek	0mm	Ant 0	DSI 1	23230	782	22.34	23.00	1.164	-	-	-0.14	0.711	0.828
835MHz																				
04	GSM850	-	-	-	-	GPRS (4 Tx slots)	Left Cheek	0mm	Ant 1	DSI 1	189	836.4	26.91	27.50	1.146	-	-	0.19	0.132	0.151
	WCDMA V	-	-	-	-	RMC 12.2Kbps	Right Cheek	0mm	Ant 0	DSI 1	4182	836.4	21.21	22.50	1.346	-	-	0.02	0.630	0.848
	WCDMA V	-	-	-	-	RMC 12.2Kbps	Right Tilted	0mm	Ant 0	DSI 1	4182	836.4	21.21	22.50	1.346	-	-	-0.04	0.457	0.615
	WCDMA V	-	-	-	-	RMC 12.2Kbps	Left Cheek	0mm	Ant 0	DSI 1	4182	836.4	21.21	22.50	1.346	-	-	0.09	0.538	0.724
	WCDMA V	-	-	-	-	RMC 12.2Kbps	Left Tilted	0mm	Ant 0	DSI 1	4182	836.4	21.21	22.50	1.346	-	-	0.02	0.350	0.471
05	WCDMA V	-	-	-	-	RMC 12.2Kbps	Right Cheek	0mm	Ant 0	DSI 1	4132	826.4	20.98	22.50	1.419	-	-	-0.01	0.676	0.959
	WCDMA V	-	-	-	-	RMC 12.2Kbps	Right Cheek	0mm	Ant 0	DSI 1	4233	846.6	21.15	22.50	1.365	-	-	-0.17	0.649	0.886
06	LTE Band 26	15M	QPSK	1	37	-	Right Cheek	0mm	Ant 0	DSI 1	26865	831.5	21.66	22.50	1.213	-	-	-0.02	0.748	0.908
1750MHz																				
07	WCDMA IV	-	-	-	-	RMC 12.2Kbps	Left Cheek	0mm	Ant 1	DSI 1	1413	1732.6	22.83	24.00	1.309	-	-	-0.11	0.174	0.228
08	LTE Band 66	20M	QPSK	1	49	-	Left Cheek	0mm	Ant 1	DSI 1	132322	1745	23.43	24.50	1.279	-	-	0.07	0.158	0.202
1900MHz																				
09	GSM1900	-	-	-	-	GPRS (4 Tx slots)	Right Cheek	0mm	Ant 1	DSI 1	810	1909.8	24.91	26.00	1.285	-	-	0.06	0.086	0.110
10	WCDMA II	-	-	-	-	RMC 12.2Kbps	Right Cheek	0mm	Ant 1	DSI 1	9400	1880	23.37	24.00	1.156	-	-	-0.03	0.157	0.182
11	LTE Band 25	20M	QPSK	1	49	-	Right Cheek	0mm	Ant 1	DSI 1	26340	1880	24.01	25.00	1.256	-	-	0.01	0.135	0.170
2600MHz																				
12	LTE Band 7	20M	QPSK	1	49	-	Right Cheek	0mm	Ant 1	DSI 1	21100	2535	23.14	24.00	1.219	-	-	-0.12	0.322	0.393
13	LTE Band 41	20M	QPSK	1	49	-	Right Cheek	0mm	Ant 1	DSI 1	40620	2593	25.67	27.00	1.358	42.9	1.009	0.04	0.293	0.402

Plot No.	Band	Mode	Test Position	Gap (mm)	Antenna	Power State	Ch.	Freq. (MHz)	Average Power (dBm)	Tune-Up Limit (dBm)	Tune-up Scaling Factor	Duty Cycle %	Duty Cycle Scaling Factor	Power Drift (dB)	Measured 1g SAR (W/kg)	Reported 1g SAR (W/kg)
WLAN2.4G/BT																
14	Bluetooth	DH5 1Mbps	Left Cheek	0mm	Ant 2	Full	78	2480	7.70	8.50	1.201	76.33	1.310	0.15	0.082	0.129
15	WLAN2.4GHz	802.11b 1Mbps	Left Cheek	0mm	Ant 2	Standalone	6	2437	13.99	15.50	1.416	99.11	1.009	0.05	0.823	1.176
WLAN5G																
16	WLAN5.3GHz	802.11a 6Mbps	Right Tilted	0mm	Ant 2	Standalone	64	5320	18.84	20.00	1.306	96.48	1.036	0.02	0.330	0.447
17	WLAN5.5GHz	802.11a 6Mbps	Right Tilted	0mm	Ant 2	Standalone	144	5720	20.28	21.00	1.182	96.48	1.036	0.04	0.534	0.654
18	WLAN5.8GHz	802.11ac-VHT80 MCS0	Right Tilted	0mm	Ant 2	Standalone	155	5775	18.70	19.50	1.203	87.55	1.142	0.02	0.466	0.640



15.2 Hotspot SAR

Plot No.	Band	BW (MHz)	Modulation	RB Size	RB offset	Mode	Test Position	Gap (mm)	Antenna	Power State	Ch.	Freq. (MHz)	Average Power (dBm)	Tune-Up Limit (dBm)	Tune-up Scaling Factor	Duty Cycle %	Duty Cycle Scaling Factor	Power Drift (dB)	Measured 1g SAR (W/kg)	Reported 1g SAR (W/kg)
750MHz																				
19	LTE Band 7	20M	QPSK	1	49	-	Back	10mm	Ant 0	DSI 2	133297	680.5	23.72	24.50	1.197	-	-	-0.1	0.372	0.445
20	LTE Band 12	10M	QPSK	1	25	-	Back	10mm	Ant 0	DSI 2	23095	707.5	24.12	25.00	1.225	-	-	-0.02	0.598	0.732
21	LTE Band 13	10M	QPSK	1	25	-	Back	10mm	Ant 0	DSI 2	23230	782	24.24	25.00	1.191	-	-	-0.17	0.645	0.768
835MHz																				
22	GSM850	-	-	-	-	GPRS (4 Tx slots)	Back	10mm	Ant 1	DSI 2	189	836.4	26.91	27.50	1.146	-	-	-0.08	0.159	0.182
23	WCDMA V	-	-	-	-	RMC 12.2Kbps	Back	10mm	Ant 0	DSI 2	4182	836.4	22.92	24.00	1.282	-	-	0.01	0.412	0.528
24	LTE Band 26	15M	QPSK	1	37	-	Back	10mm	Ant 0	DSI 2	26865	831.5	23.88	25.00	1.294	-	-	-0.09	0.484	0.626
1750MHz																				
	WCDMA IV	-	-	-	-	RMC 12.2Kbps	Front	10mm	Ant 1	DSI 2	1413	1732.6	17.87	19.00	1.297	-	-	0.02	0.172	0.223
25	WCDMA IV	-	-	-	-	RMC 12.2Kbps	Back	10mm	Ant 1	DSI 2	1413	1732.6	17.87	19.00	1.297	-	-	0.01	0.565	0.733
	WCDMA IV	-	-	-	-	RMC 12.2Kbps	Left Side	10mm	Ant 1	DSI 2	1413	1732.6	17.87	19.00	1.297	-	-	-0.04	0.043	0.056
	WCDMA IV	-	-	-	-	RMC 12.2Kbps	Right Side	10mm	Ant 1	DSI 2	1413	1732.6	17.87	19.00	1.297	-	-	0.09	0.076	0.099
	WCDMA IV	-	-	-	-	RMC 12.2Kbps	Bottom Side	10mm	Ant 1	DSI 2	1413	1732.6	17.87	19.00	1.297	-	-	0.15	0.420	0.545
26	LTE Band 66	20M	QPSK	50	24	-	Back	10mm	Ant 1	DSI 2	132072	1720	18.51	19.50	1.256	-	-	0.02	0.552	0.693
1900MHz																				
27	GSM1900	-	-	-	-	GPRS (4 Tx slots)	Bottom Side	10mm	Ant 1	DSI 2	512	1850.2	22.82	24.00	1.312	-	-	0.13	0.703	0.922
28	WCDMA II	-	-	-	-	RMC 12.2Kbps	Bottom Side	10mm	Ant 1	DSI 2	9400	1880	20.54	21.00	1.112	-	-	-0.09	0.703	0.782
29	LTE Band 25	20M	QPSK	50	24	-	Bottom Side	10mm	Ant 1	DSI 2	26590	1905	20.73	22.00	1.340	-	-	0.11	0.828	1.109
	LTE Band 25	20M	QPSK	50	24	-	Bottom Side	10mm	Ant 1	DSI 2	26140	1860	20.77	22.00	1.327	-	-	0.01	0.780	1.035
	LTE Band 25	20M	QPSK	50	24	-	Bottom Side	10mm	Ant 1	DSI 2	26340	1880	20.94	22.00	1.276	-	-	0.04	0.792	1.011
2600MHz																				
30	LTE Band 7	20M	QPSK	1	49	-	Bottom Side	10mm	Ant 1	DSI 2	21350	2560	23.11	24.00	1.227	-	-	0.05	0.901	1.106
	LTE Band 7	20M	QPSK	1	49	-	Bottom Side	10mm	Ant 1	DSI 2	20850	2510	23.04	24.00	1.247	-	-	0.04	0.790	0.985
	LTE Band 7	20M	QPSK	1	49	-	Bottom Side	10mm	Ant 1	DSI 2	21100	2535	23.14	24.00	1.219	-	-	-0.09	0.803	0.979
31	LTE Band 41	20M	QPSK	1	49	-	Bottom Side	10mm	Ant 1	DSI 2	40620	2593	25.67	27.00	1.358	42.9	1.009	0.04	0.648	0.888

Plot No.	Band	Mode	Test Position	Gap (mm)	Antenna	Power State	Ch.	Freq. (MHz)	Average Power (dBm)	Tune-Up Limit (dBm)	Tune-up Scaling Factor	Duty Cycle %	Duty Cycle Scaling Factor	Power Drift (dB)	Measured 1g SAR (W/kg)	Reported 1g SAR (W/kg)
WLAN2.4G/BT																
32	Bluetooth	DH5 1Mbps	Back	10mm	Ant 2	Full	78	2480	7.70	8.50	1.201	76.33	1.310	0.08	0.033	0.053
33	WLAN2.4GHz	802.11b 1Mbps	Back	10mm	Ant 2	Hotspot	11	2462	15.31	16.50	1.315	99.11	1.009	0.04	0.380	0.504
WLAN5G																
34	WLAN5.2GHz	802.11ac-VHT80 MCS0	Back	10mm	Ant 2	Hotspot	42	5210	14.05	16.00	1.567	87.55	1.142	0.05	0.225	0.403
35	WLAN5.8GHz	802.11ac-VHT80 MCS0	Back	10mm	Ant 2	Hotspot	155	5775	14.11	15.00	1.227	87.55	1.142	-0.09	0.195	0.273

15.3 Body Worn Accessory SAR

Plot No.	Band	BW (MHz)	Modulation	RB Size	RB offset	Mode	Test Position	Gap (mm)	Antenna	Power State	Ch.	Freq. (MHz)	Average Power (dBm)	Tune-Up Limit (dBm)	Tune-up Scaling Factor	Duty Cycle %	Duty Cycle Scaling Factor	Power Drift (dB)	Measured 1g SAR (W/kg)	Reported 1g SAR (W/kg)
750MHz																				
36	LTE Band 71	20M	QPSK	1	49	-	Back	15mm	Ant 0	DSI 0	133297	680.5	23.72	24.50	1.197	-	-	-0.07	0.291	0.348
37	LTE Band 12	10M	QPSK	1	25	-	Back	15mm	Ant 0	DSI 0	23095	707.5	24.12	25.00	1.225	-	-	-0.01	0.508	0.622
38	LTE Band 13	10M	QPSK	1	25	-	Back	15mm	Ant 0	DSI 0	23230	782	24.24	25.00	1.191	-	-	-0.09	0.458	0.546
835MHz																				
39	GSM850	-	-	-	-	GPRS (4 Tx slots)	Back	15mm	Ant 1	DSI 0	189	836.4	26.91	27.50	1.146	-	-	0.02	0.091	0.105
40	WCDMA V	-	-	-	-	RMC 12.2Kbps	Back	15mm	Ant 0	DSI 0	4182	836.4	22.92	24.00	1.282	-	-	-0.05	0.291	0.373
41	LTE Band 26	15M	QPSK	1	37	-	Back	15mm	Ant 0	DSI 0	26865	831.5	23.88	25.00	1.294	-	-	0.06	0.331	0.428
1750MHz																				
	WCDMA IV	-	-	-	-	RMC 12.2Kbps	Front	15mm	Ant 1	DSI 0	1413	1732.6	21.71	22.00	1.069	-	-	0.06	0.218	0.387
42	WCDMA IV	-	-	-	-	RMC 12.2Kbps	Back	15mm	Ant 1	DSI 0	1413	1732.6	21.71	22.00	1.069	-	-	0.13	0.482	0.635
43	LTE Band 66	20M	QPSK	50	24	-	Back	15mm	Ant 1	DSI 0	132322	1745	19.34	20.50	1.306	-	-	-0.06	0.358	0.468
1900MHz																				
44	GSM1900	-	-	-	-	GPRS (4 Tx slots)	Back	15mm	Ant 1	DSI 0	810	1909.8	25.02	26.00	1.253	-	-	-0.12	0.355	0.445
45	WCDMA II	-	-	-	-	RMC 12.2Kbps	Back	15mm	Ant 1	DSI 0	9400	1880	22.30	23.00	1.175	-	-	-0.13	0.557	0.654
46	LTE Band 25	20M	QPSK	50	24	-	Back	15mm	Ant 1	DSI 0	26340	1880	21.98	23.00	1.265	-	-	-0.1	0.541	0.684
2600MHz																				
47	LTE Band 7	20M	QPSK	1	49	-	Front	15mm	Ant 1	DSI 0	21100	2535	23.14	24.00	1.219	-	-	-0.04	0.288	0.351
48	LTE Band 41	20M	QPSK	1	49	-	Front	15mm	Ant 1	DSI 0	40620	2593	25.67	27.00	1.358	42.9	1.009	0.15	0.232	0.318

Plot No.	Band	Mode	Test Position	Gap (mm)	Antenna	Power State	Ch.	Freq. (MHz)	Average Power (dBm)	Tune-Up Limit (dBm)	Tune-up Scaling Factor	Duty Cycle %	Duty Cycle Scaling Factor	Power Drift (dB)	Measured 1g SAR (W/kg)	Reported 1g SAR (W/kg)
WLAN2.4G/BT																
49	Bluetooth	DH5 1Mbps	Back	15mm	Ant 2	Full	78	2480	7.70	8.50	1.201	76.33	1.310	0.09	0.011	0.017
50	WLAN2.4GHz	802.11b 1Mbps	Back	15mm	Ant 2	Standalone	11	2462	19.49	21.00	1.416	99.11	1.009	0.08	0.422	0.603
WLAN5G																
51	WLAN5.3GHz	802.11a 6Mbps	Back	15mm	Ant 2	Standalone	64	5320	18.84	20.00	1.306	96.48	1.036	-0.16	0.575	0.778
52	WLAN5.5GHz	802.11a 6Mbps	Back	15mm	Ant 2	Standalone	132	5660	19.61	20.00	1.095	96.48	1.036	0.11	0.764	0.867
53	WLAN5.8GHz	802.11ac-VHT80 MCS0	Back	15mm	Ant 2	Standalone	155	5775	18.70	19.50	1.203	87.55	1.142	0	0.299	0.411

15.4 Product specific 10g SAR

Plot No.	Band	BW (MHz)	Modulation	RB Size	RB offset	Mode	Test Position	Gap (mm)	Antenna	Power State	Ch.	Freq. (MHz)	Average Power (dBm)	Tune-Up Limit (dBm)	Tune-up Scaling Factor	Duty Cycle %	Duty Cycle Scaling Factor	Power Drift (dB)	Measured 10g SAR (W/kg)	Reported 10g SAR (W/kg)
1900MHz																				
54	GSM1900	-	-	-	-	GPRS (4 Tx slots)	Bottom Side	0mm	Ant 1	DSI 0	512	1850.2	24.57	26.00	1.390	-	-	-0.02	1.900	2.641
	LTE Band 25	20M	QPSK	1	49		Bottom Side	0mm	Ant 1	DSI 0	26340	1880	21.99	23.00	1.262		1.000	0.02	1.730	2.183
	LTE Band 25	20M	QPSK	1	49		Bottom Side	0mm	Ant 1	DSI 0	26590	1905	21.82	23.00	1.312		1.000	0.06	1.620	2.126
	LTE Band 25	20M	QPSK	1	49		Bottom Side	0mm	Ant 1	DSI 0	26140	1860	21.84	23.00	1.306		1.000	-0.01	1.580	2.064
60	LTE Band 25	20M	QPSK	50	24		Bottom Side	0mm	Ant 1	DSI 0	26340	1880	21.98	23.00	1.265		1.000	-0.12	1.760	2.226
	LTE Band 25	20M	QPSK	50	24		Bottom Side	0mm	Ant 1	DSI 0	26590	1905	21.69	23.00	1.352		1.000	0.06	1.640	2.217
	LTE Band 25	20M	QPSK	50	24		Bottom Side	0mm	Ant 1	DSI 0	26140	1860	21.76	23.00	1.330		1.000	-0.02	1.600	2.129
	LTE Band 25	20M	QPSK	100	0		Bottom Side	0mm	Ant 1	DSI 0	26340	1880	21.90	23.00	1.288		1.000	0.18	1.620	2.087

Plot No.	Band	Mode	Test Position	Gap (mm)	Antenna	Power State	Ch.	Freq. (MHz)	Average Power (dBm)	Tune-Up Limit (dBm)	Tune-up Scaling Factor	Duty Cycle %	Duty Cycle Scaling Factor	Power Drift (dB)	Measured 10g SAR (W/kg)	Reported 10g SAR (W/kg)
WLAN2.4G/BT																
55	WLAN2.4GHz	802.11b 1Mbps	Back	0mm	Ant 2	Standalone	6	2437	19.10	21.00	1.549	99.11	1.009	0.02	1.830	2.860
WLAN5G																
56	WLAN5.2GHz	802.11a 6Mbps	Back	0mm	Ant 2	Standalone	48	5240	18.71	20.00	1.347	96.48	1.036	0.04	0.904	1.262
57	WLAN5.3GHz	802.11a 6Mbps	Back	0mm	Ant 2	Standalone	64	5320	18.84	20.00	1.308	96.48	1.036	0.03	1.480	2.005
58	WLAN5.5GHz	802.11a 6Mbps	Back	0mm	Ant 2	Standalone	132	5660	19.61	20.00	1.095	96.48	1.036	0.02	2.080	2.360
59	WLAN5.8GHz	802.11ac-VHT80 MCS0	Back	0mm	Ant 2	Standalone	155	5775	18.70	19.50	1.203	87.55	1.142	0.12	0.945	1.298

15.5 Repeated SAR Measurement

<1g>

Plot No.	Band	BW (MHz)	Modulation	RB Size	RB offset	Mode	Test Position	Gap (mm)	Antenna	Power State	Ch.	Freq. (MHz)	Average Power (dBm)	Tune-Up Limit (dBm)	Tune-up Scaling Factor	Duty Cycle %	Duty Cycle Scaling Factor	Power Drift (dB)	Measured 1g SAR (W/kg)	Ratio	Reported 1g SAR (W/kg)
1st	LTE Band 12	10M	QPSK	1	25	-	Right Cheek	0mm	Ant 0	DSI 1	23095	707.5	24.12	25.00	1.225	-	-	0.01	0.873	1	1.069
2nd	LTE Band 12	10M	QPSK	1	25	-	Right Cheek	0mm	Ant 0	DSI 1	23095	707.5	24.12	25.00	1.225	-	-	0.03	0.868	1.006	1.063
1st	LTE Band 25	20M	QPSK	50	24	-	Bottom Side	10mm	Ant 1	DSI 2	26590	1905	20.73	22.00	1.340	-	-	0.11	0.828	1	1.109
2nd	LTE Band 25	20M	QPSK	50	24	-	Bottom Side	10mm	Ant 1	DSI 2	26590	1905	20.73	22.00	1.340	-	-	-0.02	0.814	1.017	1.090
1st	LTE Band 7	20M	QPSK	1	49	-	Bottom Side	10mm	Ant 1	DSI 2	21350	2560	23.11	24.00	1.227	-	-	0.05	0.901	1	1.106
2nd	LTE Band 7	20M	QPSK	1	49	-	Bottom Side	10mm	Ant 1	DSI 2	21350	2560	23.11	24.00	1.227	-	-	-0.09	0.874	1.03	1.073
1st	WLAN2.4GHz	-	-	-	-	802.11b 1Mbps	Left Cheek	0mm	Ant 2	Standalone	6	2437	13.99	15.50	1.416	99.11	1.009	0.05	0.823	1	1.176
2nd	WLAN2.4GHz	-	-	-	-	802.11b 1Mbps	Left Cheek	0mm	Ant 2	Standalone	6	2437	13.99	15.50	1.416	99.11	1.009	0.09	0.814	1.011	1.163

<10g>

Plot No.	Band	Mode	Test Position	Gap (mm)	Antenna	Power State	Ch.	Freq. (MHz)	Average Power (dBm)	Tune-Up Limit (dBm)	Tune-up Scaling Factor	Duty Cycle %	Duty Cycle Scaling Factor	Power Drift (dB)	Measured 10g SAR (W/kg)	Ratio	Reported 10g SAR (W/kg)
1st	WLAN5GHz	802.11a 6Mbps	Back	0mm	Ant 2	Standalone	132	5660	19.61	20.00	1.095	96.48	1.036	0.02	2.080	1	2.360
2nd	WLAN5GHz	802.11a 6Mbps	Back	0mm	Ant 2	Standalone	132	5660	19.61	20.00	1.095	96.48	1.036	-0.08	2.030	1.025	2.303

General Note:

1. Per KDB 865664 D01v01r04, for each frequency band, repeated SAR measurement is required only when the measured SAR is $\geq 0.8W/kg$.
2. Per KDB 865664 D01v01r04, if the ratio among the repeated measurement is ≤ 1.2 and the measured SAR $< 1.45W/kg$, only one repeated measurement is required.
3. Per KDB 865664 D01v01r04, if the extremity repeated SAR is necessary, the same procedures should be adapted for measurements according to extremity and occupational exposure limits by applying a factor of 2.5 for extremity exposure and a factor of 5 for occupational exposure to the corresponding SAR thresholds.
4. The ratio is the difference in percentage between original and repeated *measured SAR*.
5. All measurement SAR result is scaled-up to account for tune-up tolerance and is compliant.

16. Simultaneous Transmission Analysis

NO.	Simultaneous Transmission Configurations	Mobile Cellular Phone			
		Head	Body	Hotspot	Product specific 10g SAR
1.	WWAN + WLAN2.4GHz	Yes	Yes	Yes	Yes
2.	WWAN + WLAN5GHz	Yes	Yes	Yes	Yes
3.	WWAN + Bluetooth	Yes	Yes	Yes	Yes

General Note:

1. Simultaneous transmission analysis for all bands and all position are based on max SAR results chosen between the original filing and Spot check Verification Data.
2. This device supports VoIP in GPRS, EGPRS, WCDMA and LTE (e.g. for 3rd-party VoIP), and LTE supports VoLTE function.
3. EUT will choose each GSM, WCDMA and LTE according to the network signal condition; therefore, they will not operate simultaneously at any moment.
4. This device WLAN 2.4GHz supports hotspot operation and Bluetooth support tethering applications.
5. This device 2.4GHz WLAN/ 5.2GHz WLAN/5.8GHz WLAN support hotspot operation, and 5.2GHz WLAN/5.8GHz WLAN supports WLAN Direct (GC/GO), and 5.3GHz / 5.5GHz supports WLAN Direct (GC only).
6. According to the EUT characteristic, WLAN 5GHz and Bluetooth cannot transmit simultaneously.
7. According to the EUT characteristic, WLAN 5GHz and WLAN 2.4GHz cannot transmit simultaneously.
8. WLAN 2.4GHz and Bluetooth share the same antenna and they cannot transmit simultaneously.
9. The worst case 5 GHz WLAN SAR for each configuration was used for SAR summation.
10. When stand-alone SAR is not required for a transmitter or antenna, its SAR is considered zero in the SAR summing process to assess Multi-band transmission SAR compliance.
11. The maximum SAR summation is calculated based on the same configuration and test position.
12. Per KDB 447498 D01v06, simultaneous transmission SAR is compliant if,
 - i) 1g Scalar SAR summation < 1.6W/kg and 10g Scalar SAR summation < 4.0W/kg.
 - ii) $SPLSR = (SAR1 + SAR2)^{1.5} / (\min. \text{ separation distance, mm})$, and the peak separation distance is determined from the square root of $[(x1-x2)^2 + (y1-y2)^2 + (z1-z2)^2]$, where (x1, y1, z1) and (x2, y2, z2) are the coordinates of the extrapolated peak SAR locations in the zoom scan.
 - iii) If $SPLSR \leq 0.04$ for 1g SAR and $SPLSR \leq 0.10$ for 10g SAR, simultaneously transmission SAR measurement is not necessary.
 - iv) Simultaneously transmission SAR measurement, and the reported multi-band 1g SAR < 1.6W/kg and 10g SAR < 4.0W/kg.

16.1 Head Exposure Conditions

WWAN Band	Exposure Position	1	5	13	17	1+5	1+13	1+17
		WWAN	WLAN2.4GHz Ant 2	WLAN5GHz Ant 2	Bluetooth Ant 2	Summed	Summed	Summed
		1g SAR (W/kg)	1g SAR (W/kg)	1g SAR (W/kg)	1g SAR (W/kg)	1g SAR (W/kg)	1g SAR (W/kg)	1g SAR (W/kg)
LTE Band 71 Ant 0	Right Cheek	0.783	0.250	0.423	0.056	1.03	1.21	0.84
	Right Tilted	0.450	0.245	0.626	0.059	0.70	1.08	0.51
	Left Cheek	0.374	0.562	0.375	0.129	0.94	0.75	0.50
	Left Tilted	0.279	0.354	0.479	0.084	0.63	0.76	0.36
LTE Band 12 Ant 0	Right Cheek	1.069	0.250	0.423	0.056	1.32	1.49	1.13
	Right Tilted	0.786	0.245	0.626	0.059	1.03	1.41	0.85
	Left Cheek	0.609	0.562	0.375	0.129	1.17	0.98	0.74
	Left Tilted	0.448	0.354	0.479	0.084	0.80	0.93	0.53
LTE Band 13 Ant 0	Right Cheek	1.041	0.250	0.423	0.056	1.29	1.46	1.10
	Right Tilted	0.759	0.245	0.626	0.059	1.00	1.39	0.82
	Left Cheek	0.700	0.562	0.375	0.129	1.26	1.08	0.83
	Left Tilted	0.523	0.354	0.479	0.084	0.88	1.00	0.61
GSM850 Ant 1	Right Cheek	0.089	0.250	0.423	0.056	0.34	0.51	0.15
	Right Tilted	0.015	0.245	0.626	0.059	0.26	0.64	0.07
	Left Cheek	0.151	0.562	0.375	0.129	0.71	0.53	0.28
	Left Tilted	0.011	0.354	0.479	0.084	0.37	0.49	0.10
WCDMA V Ant 0	Right Cheek	0.959	0.250	0.423	0.056	1.21	1.38	1.02
	Right Tilted	0.615	0.245	0.626	0.059	0.86	1.24	0.67
	Left Cheek	0.724	0.562	0.375	0.129	1.29	1.10	0.85
	Left Tilted	0.471	0.354	0.479	0.084	0.83	0.95	0.56
LTE Band 26 Ant 0	Right Cheek	0.933	0.250	0.423	0.056	1.18	1.36	0.99
	Right Tilted	0.650	0.245	0.626	0.059	0.90	1.28	0.71
	Left Cheek	0.679	0.562	0.375	0.129	1.24	1.05	0.81
	Left Tilted	0.497	0.354	0.479	0.084	0.85	0.98	0.58
WCDMA IV Ant 1	Right Cheek	0.140	0.250	0.423	0.056	0.39	0.56	0.20
	Right Tilted	0.124	0.245	0.626	0.059	0.37	0.75	0.18
	Left Cheek	0.228	0.562	0.375	0.129	0.79	0.60	0.36
	Left Tilted	0.149	0.354	0.479	0.084	0.50	0.63	0.23
LTE Band 66 Ant 1	Right Cheek	0.164	0.250	0.423	0.056	0.41	0.59	0.22
	Right Tilted	0.180	0.245	0.626	0.059	0.43	0.81	0.24
	Left Cheek	0.207	0.562	0.375	0.129	0.77	0.58	0.34
	Left Tilted	0.191	0.354	0.479	0.084	0.55	0.67	0.28
GSM1900 Ant 1	Right Cheek	0.110	0.250	0.423	0.056	0.36	0.53	0.17
	Right Tilted	0.084	0.245	0.626	0.059	0.33	0.71	0.14
	Left Cheek	0.098	0.562	0.375	0.129	0.66	0.47	0.23
	Left Tilted	0.078	0.354	0.479	0.084	0.43	0.56	0.16
WCDMA II Ant 1	Right Cheek	0.182	0.250	0.423	0.056	0.43	0.61	0.24
	Right Tilted	0.127	0.245	0.626	0.059	0.37	0.75	0.19
	Left Cheek	0.140	0.562	0.375	0.129	0.70	0.52	0.27
	Left Tilted	0.121	0.354	0.479	0.084	0.48	0.60	0.21
LTE Band 25 Ant 1	Right Cheek	0.203	0.250	0.423	0.056	0.45	0.63	0.26
	Right Tilted	0.185	0.245	0.626	0.059	0.43	0.81	0.24
	Left Cheek	0.201	0.562	0.375	0.129	0.76	0.58	0.33
	Left Tilted	0.181	0.354	0.479	0.084	0.54	0.66	0.27
LTE Band 7 Ant 1	Right Cheek	0.424	0.250	0.423	0.056	0.67	0.85	0.48
	Right Tilted	0.338	0.245	0.626	0.059	0.58	0.96	0.40
	Left Cheek	0.295	0.562	0.375	0.129	0.86	0.67	0.42
	Left Tilted	0.196	0.354	0.479	0.084	0.55	0.68	0.28
LTE Band 41 Ant 1	Right Cheek	0.439	0.250	0.423	0.056	0.69	0.86	0.50
	Right Tilted	0.248	0.245	0.626	0.059	0.49	0.87	0.31
	Left Cheek	0.209	0.562	0.375	0.129	0.77	0.58	0.34
	Left Tilted	0.169	0.354	0.479	0.084	0.52	0.65	0.25



16.2 Hotspot Exposure Conditions

WWAN Band	Exposure Position	1	5	13	17	1+5	1+13	1+17
		WWAN	WLAN2.4GHz Ant 2	WLAN5GHz Ant 2	Bluetooth Ant 2	Summed	Summed	Summed
		1g SAR (W/kg)	1g SAR (W/kg)	1g SAR (W/kg)	1g SAR (W/kg)	1g SAR (W/kg)	1g SAR (W/kg)	1g SAR (W/kg)
LTE Band 71 Ant 0	Front	0.245	0.226	0.178	0.020	0.47	0.42	0.27
	Back	0.445	0.613	0.610	0.053	1.06	1.06	0.50
	Left side	0.385		0.152		0.39	0.54	0.39
	Right side	0.235	0.219	0.228	0.022	0.45	0.46	0.26
	Top side	0.144	0.265	0.449	0.020	0.41	0.59	0.16
	Bottom side					0.00	0.00	0.00
LTE Band 12 Ant 0	Front	0.374	0.226	0.178	0.020	0.60	0.55	0.39
	Back	0.732	0.613	0.610	0.053	1.35	1.34	0.79
	Left side	0.639		0.152		0.64	0.79	0.64
	Right side	0.372	0.219	0.228	0.022	0.59	0.60	0.39
	Top side	0.288	0.265	0.449	0.020	0.55	0.74	0.31
	Bottom side					0.00	0.00	0.00
LTE Band 13 Ant 0	Front	0.394	0.226	0.178	0.020	0.62	0.57	0.41
	Back	0.768	0.613	0.610	0.053	1.38	1.38	0.82
	Left side	0.560		0.152		0.56	0.71	0.56
	Right side	0.322	0.219	0.228	0.022	0.54	0.55	0.34
	Top side	0.266	0.265	0.449	0.020	0.53	0.72	0.29
	Bottom side					0.00	0.00	0.00
GSM850 Ant 1	Front	0.069	0.226	0.178	0.020	0.30	0.25	0.09
	Back	0.182	0.613	0.610	0.053	0.80	0.79	0.24
	Left side	0.076		0.152		0.08	0.23	0.08
	Right side	0.080	0.219	0.228	0.022	0.30	0.31	0.10
	Top side		0.265	0.449	0.020	0.27	0.45	0.02
	Bottom side	0.116				0.12	0.12	0.12
WCDMA V Ant 0	Front	0.236	0.226	0.178	0.020	0.46	0.41	0.26
	Back	0.528	0.613	0.610	0.053	1.14	1.14	0.58
	Left side	0.269		0.152		0.27	0.42	0.27
	Right side	0.180	0.219	0.228	0.022	0.40	0.41	0.20
	Top side	0.201	0.265	0.449	0.020	0.47	0.65	0.22
	Bottom side					0.00	0.00	0.00
LTE Band 26 Ant 0	Front	0.351	0.226	0.178	0.020	0.58	0.53	0.37
	Back	0.626	0.613	0.610	0.053	1.24	1.24	0.68
	Left side	0.454		0.152		0.45	0.61	0.45
	Right side	0.282	0.219	0.228	0.022	0.50	0.51	0.30
	Top side	0.321	0.265	0.449	0.020	0.59	0.77	0.34
	Bottom side					0.00	0.00	0.00
WCDMA IV Ant 1	Front	0.223	0.226	0.178	0.020	0.45	0.40	0.24
	Back	0.733	0.613	0.610	0.053	1.35	1.34	0.79
	Left side	0.056		0.152		0.06	0.21	0.06
	Right side	0.099	0.219	0.228	0.022	0.32	0.33	0.12
	Top side		0.265	0.449	0.020	0.27	0.45	0.02
	Bottom side	0.545				0.55	0.55	0.55
LTE Band 66 Ant 1	Front	0.246	0.226	0.178	0.020	0.47	0.42	0.27
	Back	0.877	0.613	0.610	0.053	1.49	1.49	0.93
	Left side	0.063		0.152		0.06	0.22	0.06
	Right side	0.115	0.219	0.228	0.022	0.33	0.34	0.14
	Top side		0.265	0.449	0.020	0.27	0.45	0.02
	Bottom side	0.673				0.67	0.67	0.67
GSM1900 Ant 1	Front	0.328	0.226	0.178	0.020	0.55	0.51	0.35
	Back	0.661	0.613	0.610	0.053	1.27	1.27	0.71
	Left side	0.090		0.152		0.09	0.24	0.09



	Right side	0.181	0.219	0.228	0.022	0.40	0.41	0.20
	Top side		0.265	0.449	0.020	0.27	0.45	0.02
	Bottom side	0.940				0.94	0.94	0.94
WCDMA II Ant 1	Front	0.243	0.226	0.178	0.020	0.47	0.42	0.26
	Back	0.561	0.613	0.610	0.053	1.17	1.17	0.61
	Left side	0.076		0.152		0.08	0.23	0.08
	Right side	0.147	0.219	0.228	0.022	0.37	0.38	0.17
	Top side		0.265	0.449	0.020	0.27	0.45	0.02
	Bottom side	0.782				0.78	0.78	0.78
LTE Band 25 Ant 1	Front	0.396	0.226	0.178	0.020	0.62	0.57	0.42
	Back	0.860	0.613	0.610	0.053	1.47	1.47	0.91
	Left side	0.107		0.152		0.11	0.26	0.11
	Right side	0.216	0.219	0.228	0.022	0.44	0.44	0.24
	Top side		0.265	0.449	0.020	0.27	0.45	0.02
	Bottom side	1.109				1.11	1.11	1.11
LTE Band 7 Ant 1	Front	0.573	0.226	0.178	0.020	0.80	0.75	0.59
	Back	0.550	0.613	0.610	0.053	1.16	1.16	0.60
	Left side	0.147		0.152		0.15	0.30	0.15
	Right side	0.468	0.219	0.228	0.022	0.69	0.70	0.49
	Top side		0.265	0.449	0.020	0.27	0.45	0.02
	Bottom side	1.106				1.11	1.11	1.11
LTE Band 41 Ant 1	Front	0.459	0.226	0.178	0.020	0.69	0.64	0.48
	Back	0.480	0.613	0.610	0.053	1.09	1.09	0.53
	Left side	0.105		0.152		0.11	0.26	0.11
	Right side	0.405	0.219	0.228	0.022	0.62	0.63	0.43
	Top side		0.265	0.449	0.020	0.27	0.45	0.02
	Bottom side	0.888				0.89	0.89	0.89



16.3 Body-Worn Accessory Exposure Conditions

WWAN Band	Exposure Position	1	5	13	17	1+5	1+13	1+17
		WWAN	WLAN2.4GHz Ant 2	WLAN5GHz Ant 2	Bluetooth Ant 2	Summed	Summed	Summed
		1g SAR (W/kg)	1g SAR (W/kg)	1g SAR (W/kg)	1g SAR (W/kg)	1g SAR (W/kg)	1g SAR (W/kg)	1g SAR (W/kg)
LTE Band 71 Ant 0	Front	0.261	0.303	0.111	0.011	0.56	0.37	0.27
	Back	0.348	0.603	0.796	0.017	0.95	1.14	0.37
LTE Band 12 Ant 0	Front	0.421	0.303	0.111	0.011	0.72	0.53	0.43
	Back	0.622	0.603	0.796	0.017	1.23	1.42	0.64
LTE Band 13 Ant 0	Front	0.405	0.303	0.111	0.011	0.71	0.52	0.42
	Back	0.583	0.603	0.796	0.017	1.19	1.38	0.60
GSM850 Ant 1	Front	0.073	0.303	0.111	0.011	0.38	0.18	0.08
	Back	0.105	0.603	0.796	0.017	0.71	0.90	0.12
WCDMA V Ant 0	Front	0.230	0.303	0.111	0.011	0.53	0.34	0.24
	Back	0.373	0.603	0.796	0.017	0.98	1.17	0.39
LTE Band 26 Ant 0	Front	0.275	0.303	0.111	0.011	0.58	0.39	0.29
	Back	0.491	0.603	0.796	0.017	1.09	1.29	0.51
WCDMA IV Ant 1	Front	0.287	0.303	0.111	0.011	0.59	0.40	0.30
	Back	0.697	0.603	0.796	0.017	1.30	1.49	0.71
LTE Band 66 Ant 1	Front	0.201	0.303	0.111	0.011	0.50	0.31	0.21
	Back	0.580	0.603	0.796	0.017	1.18	1.38	0.60
GSM1900 Ant 1	Front	0.213	0.303	0.111	0.011	0.52	0.32	0.22
	Back	0.445	0.603	0.796	0.017	1.05	1.24	0.46
WCDMA II Ant 1	Front	0.248	0.303	0.111	0.011	0.55	0.36	0.26
	Back	0.654	0.603	0.796	0.017	1.26	1.45	0.67
LTE Band 25 Ant 1	Front	0.343	0.303	0.111	0.011	0.65	0.45	0.35
	Back	0.684	0.603	0.796	0.017	1.29	1.48	0.70
LTE Band 7 Ant 1	Front	0.375	0.303	0.111	0.011	0.68	0.49	0.39
	Back	0.296	0.603	0.796	0.017	0.90	1.09	0.31
LTE Band 41 Ant 1	Front	0.376	0.303	0.111	0.011	0.68	0.49	0.39
	Back	0.234	0.603	0.796	0.017	0.84	1.03	0.25

16.4 Product specific 10g SAR Exposure Conditions

WWAN Band	Exposure Position	1	3	10	1+3	1+10
		WWAN	WLAN2.4GHz Ant 2	WLAN5GHz Ant 2	Summed	Summed
		10g SAR (W/kg)	10g SAR (W/kg)	10g SAR (W/kg)	10g SAR (W/kg)	10g SAR (W/kg)
GSM1900 Ant 1	Front			0.119	0.00	0.12
	Back		1.074	1.199	1.07	1.20
	Left side			0.079	0.00	0.08
	Right side			0.436	0.00	0.44
	Top side			0.998	0.00	1.00
	Bottom side	2.683			2.68	2.68
LTE Band 25 Ant 1	Front			0.119	0.00	0.12
	Back		1.074	1.199	1.07	1.20
	Left side			0.079	0.00	0.08
	Right side			0.436	0.00	0.44
	Top side			0.998	0.00	1.00
	Bottom side	2.226			2.23	2.23

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17. Uncertainty Assessment

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



18. References

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

-----THE END-----