Audix Technology Corp.
No. 491, Zhongfu Rd., Linkou Dist.,
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FCC 2.1093
SAR Test Report

for

LG Electronics Inc.

222, LG-ro, Jinwi-myeon Pyeongtaek-Si, Gyeonggi-Do, 17709 Republic of Korea

Product Name	**:**	**Notebook PC**
Model Name	**:**	**(1)15Z90Q (2)15ZB90Q (3)15ZD90Q (4)15ZG90Q**
Brand		**LG**
FCC ID	**:**	**BEJNT-15Z90Q**

Prepared by:	**:**	**AUDIX Technology Corporation, EMC Department**

Testing Laboratory
1724

The test report is based on a single evaluation of one sample of the above-mentioned products. It does not imply an assessment of the whole production and does not permit the use of the test lab logo.

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TEST REPORT

Applicant	:	LG Electronics Inc.
Manufacturer	:	LG Electronics Inc.
Factory	:	LG Electronics Nanjing New Technology Co., Ltd.
EUT Description		
(1) Product	:	Notebook PC
(2) Model	:	(1)15Z90Q (2)15ZB90Q (3)15ZD90Q (4)15ZG90Q
(3) Brand	:	LG
(4) Power Supply	:	DC 20V, 3.25A

Applicable Standards:

47 CFR FCC Part 2(§2.1093)

Audix Technology Corp. tested the equipment mentioned in accordance with the requirements set forth in the above standards. Test results indicate that the equipment tested is capable of demonstrating compliance with the requirements as documented within this report.
Audix Technology Corp. does not assume responsibility for any conclusions and generalizations drawn from the test results with regard to other specimens and samples.

Date of Report: 2022. 03. 07

Reviewed by: Annie Yu (Annie Yu/Administrator)

Approved by: Johnny Hsueh (Johnny Hsueh/Section Manager)

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1. REVISION RECORD OF TEST REPORT

Edition No	Issued Date	Revision Summary	Report Number
0	2022. 03. 07	Original Report	EM-SR220016

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2. SUMMARY OF TEST RESULTS

Test SKU: SKU #1 (with INPAQ Antenna)

Highest Simultaneous Transmission SAR	Reported Body SAR_{1g}
WLAN 2.4G ANT Main+ WLAN 2.4G ANT AUX	0.764 (W/kg)
WLAN 2.4G ANT AUX+ BT ANT AUX	0.446 (W/kg)
WLAN 5G ANT AUX+ BT ANT AUX	0.685 (W/kg)
WLAN 5G ANT Main+ WLAN 5 ANT AUX	1.127 (W/kg)
WLAN 5G ANT Main+ WLAN 5 ANT AUX + BT ANT AUX	1.143 (W/kg)

Note: 1. The SAR limit (SAR1g 1.6 W/kg) for general population / uncontrolled exposure is specified in FCC 47 CFR part 2 (2.1093).
2. It is calculated from scale SAR.
3. It is larger than the limit 1.6(W/kg), SAR test exclusion is determined by the SAR to peak location separation ratio.

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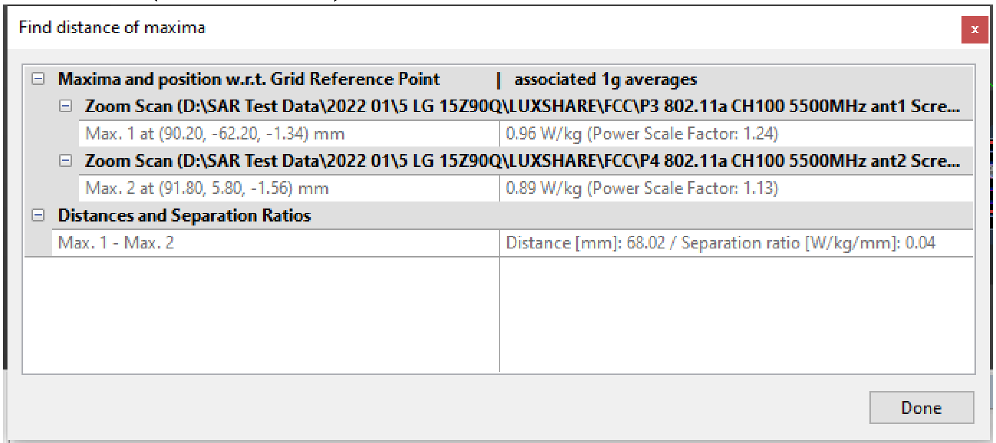
Test SKU: SKU #2 (with LUXSHARE-ICT Antenna)

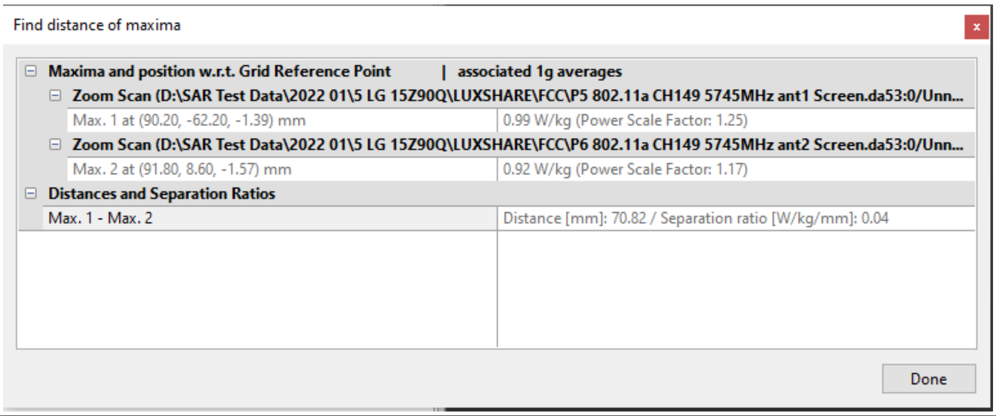
Highest Simultaneous Transmission SAR	Reported Body SAR_{1g}
WLAN 2.4G ANT Main+ WLAN 2.4G ANT AUX	0.717 (W/kg)
WLAN 2.4G ANT AUX+ BT ANT AUX	0.385 (W/kg)
WLAN 5G ANT AUX+ BT ANT AUX	1.056 (W/kg)
WLAN 5G ANT Main+ WLAN 5 ANT AUX	1.911 (W/kg) NOTE 3
WLAN 5G ANT Main+ WLAN 5 ANT AUX + BT ANT AUX	1.972 (W/kg) NOTE 3

Note: 1. The SAR limit (SAR1g 1.6 W/kg) for general population / uncontrolled exposure is specified in FCC 47 CFR part 2 (2.1093).
2. It is calculated from scale SAR.
3. It is larger than the limit 1.6(W/kg), SAR test exclusion is determined by the SAR to peak location separation ratio.

Simultaneous Transmission SAR	Frequency	Measured Body SAR_{1g} (SAR1+SAR2) Note2	Ri (mm) Note2	SPLSR Note2
WLAN 5G ANT Main+ WLAN 5 ANT AUX	5500MHz	1.85 (W/kg) Note 2	68.02	0.04
	5745MHz	1.91 (W/kg) Note 2	70.82	0.04

Note: 1. The SAR limit (SAR1g 1.6 W/kg) for general population / uncontrolled exposure is specified in FCC 47 CFR part 2 (2.1093).
2. SPLSR=$(SAR1+SAR2)^{1.5}/Ri$ must ≤ 0.04





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3. GENERAL INFORMATION

3.1. Description of Application

Applicant	LG Electronics Inc. 222, LG-ro, Jinwi-myeon Pyeongtaek-Si, Gyeonggi-Do, 17709 Republic of Korea
Manufacturer	LG Electronics Inc. 222, LG-ro, Jinwi-myeon Pyeongtaek-Si, Gyeonggi-Do, 17709 Republic of Korea
Factory	LG Electronics Nanjing New Technology Co., Ltd. No.346,Yaoxin Road, Economic & Technical Development Zone, Nanjing, China.
Product	Notebook PC
Model	(1)15Z90Q (2)15ZB90Q (3)15ZD90Q (4)15ZG90Q The difference between all models is different in the sales customers.
Brand	LG

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3.2. Description of EUT

<table>
<tr><td>Test Model</td><td>15Z90Q</td></tr>
<tr><td>Serial Number</td><td>N/A</td></tr>
<tr><td>Power Rating</td><td>DC 20V, 3.25A</td></tr>
<tr><td>Software Version</td><td>XY (X, Y can be 0 to 9 for different SW version not influence RF parameter)</td></tr>
<tr><td>RF Features</td><td>WLAN:802.11 a/b/g/n/ac/ax
Bluetooth: BT and BLE (BT 5.1)</td></tr>
<tr><td>Transmit Type</td><td>
<table>
<tr><th colspan="2">2.4 GHz</th></tr>
<tr><td>802.11b</td><td>1T1R</td></tr>
<tr><td>802.11g</td><td>1T1R</td></tr>
<tr><td>802.11n-HT20</td><td>2T2R</td></tr>
<tr><td>802.11n-HT40</td><td>2T2R</td></tr>
<tr><td>802.11ax-HE20</td><td>2T2R</td></tr>
<tr><td>802.11ax-HE40</td><td>2T2R</td></tr>
<tr><td>BT/BLE</td><td>1T1R</td></tr>
</table>
<table>
<tr><th colspan="2">U-NII Bands</th></tr>
<tr><td>802.11a</td><td>1T1R</td></tr>
<tr><td>802.11n-HT20/802.11ac-VHT20/802.11ax-HE20</td><td>2T2R</td></tr>
<tr><td>802.11n-HT40/802.11ac-VHT40/802.11ax-HE40</td><td>2T2R</td></tr>
<tr><td>802.11ac-VHT80/802.11ax-HE80</td><td>2T2R</td></tr>
<tr><td>802.11ac-VHT160/802.11ax-HE160</td><td>2T2R</td></tr>
</table>
The MIMO is uncorrelated and supported SDM mode only.
</td></tr>
<tr><td>Software Version</td><td>N/A</td></tr>
<tr><td>Sample Status</td><td>Mass production</td></tr>
<tr><td>Test Sample</td><td>
<table>
<tr><th>Sample No.</th><th>Test Item</th><th>Firmware</th></tr>
<tr><td>03</td><td>SAR</td><td>N/A</td></tr>
<tr><td>04</td><td>SAR</td><td>N/A</td></tr>
</table>
</td></tr>
<tr><td>Date of Receipt</td><td>2022. 01. 14</td></tr>
<tr><td>Date of Test</td><td>2022. 02. 07 ~ 10</td></tr>
<tr><td>Interface Ports of EUT</td><td>• One Micro SD Card Slot
• Three USB 3.0 Ports
• One HDMI Port
• One USB Type C Port
• One Earphone Port
• One DC Input Port</td></tr>
<tr><td>Accessories Supplied</td><td>• AC Adapter
• LAN Gender</td></tr>
</table>

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3.3. Reference Test Guidance

IEEE 1528-2013
IEC/IEEE 62209-1528:2020
KDB 447498 D01 General RF Exposure Guidance v06
KDB 865664 D01 SAR Measurement 100MHz to 6GHz v01r04
KDB 616217 D04 SAR for laptop and tablets v01r02
KDB 248227 D01 802 11 Wi-Fi SAR v02r02

3.4. Antenna Information

No.	Antenna Part Number	Manufacture	Antenna Type	Frequency (MHz)	Max Gain(dBi) Main	Max Gain(dBi) AUX
1.	WA-P-LELE-04-009	INPAQ	Mono-Pole	2400	2.3	2.0
				2450	2.4	**2.6**
				2500	**3.2**	2.4
				5150	4.2	3.5
				5400	4.2	**3.6**
				5850	**4.4**	3.5
				5925	4.1	**3.4**
				6525	4.1	3.2
				7125	**4.2**	2.3

Note 1. 2.4G: Directional gain = 10 log[($10^{3.2/10}$ +$10^{2.6/10}$)/2]= 2.91dBi
Note 2. UNII Band: (I/2A/2C/III) Directional gain = 10 log[($10^{4.4/10}$ +$10^{3.6/10}$)/2]= 4.02dBi
Note 3. UNII Band (5-8): Directional gain = 10 log[($10^{4.2/10}$ +$10^{3.4/10}$)/2]= 3.82dBi

No.	Antenna Part Number	Manufacture	Antenna Type	Frequency (MHz)	Max Gain(dBi) Main	Max Gain(dBi) AUX
2.	L1LRF008-CS-H	LUXSHARE-ICT	Mono-Pole	2400	**6.3**	0.9
				2450	5.7	1.6
				2500	2.7	**3.5**
				5150	-1.5	2.3
				5400	3.4	4.5
				5850	**3.3**	**5.8**
				5925	2.9	**4.7**
				6525	**3.4**	1.3
				7125	-4.9	-1.6

Note 1. 2.4G: Directional gain = 10 log[($10^{6.3/10}$ +$10^{3.5/10}$)/2]= 5.12dBi
Note 2. UNII Band: (I/2A/2C/III) Directional gain = 10 log[($10^{3.3/10}$ +$10^{5.8/10}$)/2]= 4.73dBi
Note 3. UNII Band (5-8): Directional gain = 10 log[($10^{3.4/10}$ +$10^{4.7/10}$)/2]= 4.10dBi

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3.5. EUT Specifications Assessed in Current Report

2.4GHz		
Mode	Fundamental Range (MHz)	Channel Number
802.11b	2412-2472	13
802.11g		13
802.11n-HT20		13
802.11n-HT40	2422-2462	9
Bluetooth	2402-2480	79
BLE	2402-2480	40

5GHz			
Mode	U-NII Band	Fundamental Range (MHz)	Channel Number
802.11a	I	5180-5240	4
	2A	5260-5320	4
	2C	5500-5720	12
	III	5745-5825	5
802.11n-HT20/ 802.11ac-VHT20 802.11ax-HE20	I	5180-5240	4
	2A	5260-5320	4
	2C	5500-5720	12
	III	5745-5825	5
802.11n-HT40/ 802.11ac-VHT40 802.11ax-HE40	I	5190-5230	2
	2A	5270-5310	2
	2C	5510-5710	6
	III	5755-5795	2
802.11ac-VHT80 802.11ax-HE80	I	5210	1
	2A	5290	1
	2C	5530-5690	3
	III	5775	1
802.11ac-VHT160 /802.11ax-HE160	I	5250	1
	2A		
	2C	5570	1
Remark: U-NII Band 2A and 2C (DFS Function, Slave/no In service monitor, no Ad-Hoc mode)			

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Mode	Modulation	Data Rate (Mbps)
802.11b	DSSS (DBPSK/DQPSK/CCK)	Up to 11
802.11g	OFDM (BPSK/QPSK/16QAM/64QAM)	Up to 54
802.11a	OFDM (BPSK/QPSK/16QAM/64QAM)	Up to 54
802.11n-HT20	OFDM (BPSK/QPSK/16QAM/64QAM)	Up to 144.4
802.11n-HT40		Up to 300
802.11ac-VHT20	OFDM (BPSK/QPSK/16QAM/64QAM/256QAM)	Up to 173.3
802.11ac-VHT40		Up to 400
802.11ac-VHT80		Up to 866.7
802.11ac-VHT160		Up to 1733.3
802.11ax-HE20	OFDMA (BPSK/ QPSK/ 16QAM/ 64QAM/ 256QAM/1024QAM)	Up to 287
802.11ax-HE40		Up to 574
802.11ax-HE80		Up to 1201
802.11ax-HE160		Up to 2402
Bluetooth	FHSS (GFSK, π/4 DQPSK, 8-DPSK)	1/2/3
BLE	GFSK (1M, 2M, PHY Coded S8, PHY Coded S2)	2

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3.6. Description of Key Components

3.6.1. For the All Component Lists

Item	Supplier	Model / Type	Character
System	Microsoft	Win11 Home	---
Main Board	LG	Queen MAIN B/D PCB	Main Board (GM) Manufacturer: #1 HannstarBoardTech(Jiang Yin)Corp.,Ltd. #2 Elec&Eltek Company (MCO) Limited.
WLAN SUB Board	LG	15Z90Q SUB B/D	Manufacturer: #1 HannstarBoardTech(Jiang Yin)Corp.,Ltd. #2 Elec&Eltek Company (MCO) Limited. #3 JiangSuHuaShen Electronic co.,ltd (HXF)
CPU (Socket: BGA1744)	Intel	i7-1260P	2.5GHz
	Intel	i5-1240P	2.1GHz
15" LCD Panel	LG Display	LP156WFD(SP)(Z1)	Resolution: 2560 x 1600, 60Hz WQXGAIPS (Touch)
	LG Display	LP156WFC(SP)(Z2)	Resolution: 2560 x 1600, 60Hz WQXGAIPS (Non Touch)
Storage (SSD)	SK hynix	HFM001TD3JX013N	1TB
		HFM512GD3JX013N	512GB
		HFM256GD3JX013N	256GB
	Samsung	MZ-VL21T00	1TB
		MZ-VL25120	512GB
		MZ-VL22560	256GB
Memory (RAM)	Samsung	---	16GB LPDDR5x(On Board)
		---	8GB LPDDR5x(On Board)
	SK Hynix	---	16GB LPDDR5x(On Board)
		---	8GB LPDDR5x(On Board)
Battery Pack	LG	LBV7227E	80Wh, DC7.74V, 80Wh Typ 10336mAh
WLAN Combo Card	Intel	AX211D2W	WLAN and BT, 2x2 PCle M.2 1216 SD adapter card FCC ID: PD9AX211D2 IC: 1000M-AX211D2
WLAN Combo Antenna	LG (INPAQ)	WA-P-LELE-04-009	PCB, Mono-pole Type Main: Black, Aux: Gray
	LG (LUXSHARE-ICT)	L1LRF008-CS-H	PCB, Mono-pole Type Main: Black, Aux: Gray
Keyboard	TIC	KT0120B8E	---
	LITE ON	SN8101	---
Web Camera	Chicony	CKFLF26	---
	Luxvisions	1BF225N3	---

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Item	Supplier	Model / Type	Character
LAN Gender (Type C to LAN)	SUZHOU MEC ELECTRONICS	80-5946-111	(White) 10/100Megabit Ethernet
		80-5946-101	(Black) 10/100 Megabit Ethernet
		80-5946-230	(White) 10/100/1000 Megabit Ethernet
		80-5946-240	(Black) 10/100/1000 Megabit Ethernet
	Type C to LAN: Shielded, Undetached, 0.12m		
	ARIN TECH CO. LTD	GD-08MF-36-WH-LP10	(White) 10/100Megabit Ethernet
		GD-08MF-36-BK-LP11	(Black) 10/100 Megabit Ethernet
		GD-08MF-50-WH-LP12	(White) 10/100/1000 Megabit Ethernet
		GD-08MF-50-BK-LP13	(Black) 10/100/1000 Megabit Ethernet
	Type C to LAN: Shielded, Undetached, 0.12m		
AC Adapter (65W)	LG (HONOR)	ADT-65DSU-D03-2	I/P: AC 100-240V, 1.6A, 50-60Hz O/P: DC 20V, 3.25A
	DC Power Cord: Non-Shielded, Undetached, 1.5m AC Power Cord: Non-Shielded, Detached, 1.0m (2C) (For Other Countries) AC Power Cord: Non-Shielded, Detached, 1.55m (2C) (For US, Canada, Mexico)		

Remark: For more detailed features description, please refer to the manufacturer's specifications or the user manual.

3.6.2. The EUT collocates with following worst components, which are used to establish a basic configuration of system during test:

SKU (Mode)			1	2
Main Board		LG, Queen MAIN B/D PCB	V	V
SUB Board		LG, 15Z90Q SUB B/D	V	V
CPU		Intel, i7-1260P	V	
		Intel, i5-1240P		V
15" LCD Panel		LG Display, LP156WFD(SP)(Z1)	V	
		LG Display, LP156WFC(SP)(Z2)		V
Storage (SSD)		Samsung, 1TB	V	
		SK hynix, 1TB	V	
		Samsung, 256GB		V
		SK hynix, 256GB		V
Memory (RAM)		16GB	V	V
Battery Pack		LG, 80Wh	V	V
Keyboard		LITE ON, SN8101	V	V
Web Camera		Luxvisions, 1BF225N3	V	V
WLAN Combo Card		Intel, AX211D2W	V	V
WLAN Combo Antenna		LG (INPAQ), WA-P-LELE-04-009	V	
		LG (LUXSHARE-ICT), L1LRF008-CS-H		V
Type C #1	AC Adapter	LG (HONOR), ADT-65DSU-D03-2	V	V
Type C #2	Link to LAN Gender	ARIN (Black)	V	V

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3.7. Test Environment

Ambient conditions in the laboratory:

Item	Require	Actual
Temperature (℃)	18-25	22 ±2
Humidity (%RH)	30-70	48 ± 2

3.8. Description of Test Facility

Name of Test Firm	Audix Technology Corporation / EMC Department No. 491, Zhongfu Rd., Linkou Dist., New Taipei City 244, Taiwan Tel: +886-2-26092133 Fax: +886-2-26099303 Website : www.audixtech.com Contact e-mail: attemc_report@audixtech.com
Accreditations	The laboratory is accredited by following organizations under ISO/IEC 17025:2017 (1) NVLAP(USA) NVLAP Lab Code 200077-0 (2) TAF(Taiwan) No. 1724
Test Facilities	FCC OET Designation Number under APEC MRA by NCC is : TW1724 (1) SAR Room

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3.9. Measurement Uncertainty

DASY5 Uncertainty
According to IEEE 1528-2013 and IEC 62209-1/2016 (0.3 - 6 GHz range)

Error Description	Uncert. value	Prob. Dist.	Div.	(c_i) 1g	(c_i) 10g	Std. Unc. (1g)	Std. Unc. (10g)	(v_i) v_{eff}
Measurement System								
Probe Calibration	±6.0%	N	1	1	1	±6.0%	±6.0%	∞
Axial Isotropy	±4.7%	R	$\sqrt{3}$	0.7	0.7	±1.9%	±1.9%	∞
Hemispherical Isotropy	±9.6%	R	$\sqrt{3}$	0.7	0.7	±3.9%	±3.9%	∞
Boundary Effects	±1.0%	R	$\sqrt{3}$	1	1	±0.6%	±0.6%	∞
Linearity	±4.7%	R	$\sqrt{3}$	1	1	±2.7%	±2.7%	∞
System Detection Limits	±1.0%	R	$\sqrt{3}$	1	1	±0.6%	±0.6%	∞
Readout Electronics	±0.3%	N	1	1	1	±0.3%	±0.3%	∞
Response Time	±0.8%	R	$\sqrt{3}$	1	1	±0.5%	±0.5%	∞
Integration Time	±2.6%	R	$\sqrt{3}$	1	1	±1.5%	±1.5%	∞
RF Ambient Noise	±3.0%	R	$\sqrt{3}$	1	1	±1.7%	±1.7%	∞
RF Ambient Reflections	±3.0%	R	$\sqrt{3}$	1	1	±1.7%	±1.7%	∞
Probe Positioner	±0.4%	R	$\sqrt{3}$	1	1	±0.2%	±0.2%	∞
Probe Positioning	±2.9%	R	$\sqrt{3}$	1	1	±1.7%	±1.7%	∞
Max. SAR Eval.	±1.0%	R	$\sqrt{3}$	1	1	±0.6%	±0.6%	∞
Test Sample Related								
Device Positioning	±2.9%	N	1	1	1	±2.9%	±2.9%	145
Device Holder	±3.6%	N	1	1	1	±3.6%	±3.6%	5
Power Drift	±5.0%	R	$\sqrt{3}$	1	1	±2.9%	±2.9%	∞
Phantom and Setup								
Phantom Uncertainty	±4.0%	R	$\sqrt{3}$	1	1	±2.3%	±2.3%	∞
Liquid Conductivity (target)	±5.0%	R	$\sqrt{3}$	0.64	0.43	±1.8%	±1.2%	∞
Liquid Conductivity (meas.)	±2.5%	N	1	0.64	0.43	±1.6%	±1.1%	∞
Liquid Permittivity (target)	±5.0%	R	$\sqrt{3}$	0.6	0.49	±1.7%	±1.4%	∞
Liquid Permittivity (meas.)	±2.5%	N	1	0.6	0.49	±1.5%	±1.2%	∞
Combined Std. Uncertainty						±11%	±10.8%	387
Expanded STD Uncertainty						±22%	±21.5%	

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DASY5 Uncertainty

According to IEC 62209-2/2010 (30 MHz - 6 GHz range)

Error Description	Uncert. value	Prob. Dist.	Div.	(ci) 1g	(ci) 10g	Std. Unc. (1g)	Std. Unc. (10g)	(vi) Veff
Measurement System								
Probe Calibration	±6.0%	N	1	1	1	±6.0%	±6.0%	∞
Axial Isotropy	±4.7%	R	√3	0.7	0.7	±1.9%	±1.9%	∞
Hemispherical Isotropy	±9.6%	R	√3	0.7	0.7	±3.9%	±3.9%	∞
Boundary Effects	±1.0%	R	√3	1	1	±0.6%	±0.6%	∞
Linearity	±4.7%	R	√3	1	1	±2.7%	±2.7%	∞
System Detection Limits	±1.0%	R	√3	1	1	±0.6%	±0.6%	∞
Readout Electronic	±0.3%	N	1	1	1	±0.3%	±0.3%	∞
Response Time	±0.8%	R	√3	1	1	±0.5%	±0.5%	∞
Integration Time	±2.6%	R	√3	1	1	±1.5%	±1.5%	∞
RF Ambient Noise	±3.0%	R	√3	1	1	±1.7%	±1.7%	∞
RF Ambient Reflections	±3.0%	R	√3	1	1	±1.7%	±1.7%	∞
Probe Positioner	±0.4%	R	√3	1	1	±0.2%	±0.2%	∞
Probe Positioning	±2.9%	R	√3	1	1	±1.7%	±1.7%	∞
Modulation Response	±2.5%	R	√3	1	1	±1.45 %	±1.45 %	∞
Post-processing	±3.8%	R	√3	1	1	±2.2%	±2.2%	∞
Test Sample Related								
Test Sample Positioning	±2.9%	N	1	1	1	±2.9%	±2.9%	145
Device Holder	±3.6%	N	1	1	1	±3.6%	±3.6%	5
Power Drift	±5.0%	R	√3	1	1	±2.9%	±2.9%	∞
Power Scaling	±0.0%	R	√3	1	1	±0.0%	±0.0%	∞
Phantom and Setup								
Phantom Uncertainty	±4.5%	R	√3	1	1	±2.4%	±2.4%	∞
SAR correction	±1.9%	R	√3	1	0.84	±1.9%	±1.9%	∞
Liquid Conductivity (target)	±5.0%	R	√3	0.64	0.43	±1.8%	±1.2%	∞
Liquid Conductivity (mea.)DAK	±2.5%	R	√3	0.64	0.43	±0.9%	±0.6%	∞
Liquid Permittivity (target)	±5.0%	R	√3	0.6	0.49	±1.7%	±1.4%	∞
Liquid Permittivity(mea.)DAK	±2.5%	R	√3	0.6	0.49	±0.9%	±0.7%	∞
Combined Std. Uncertainty						±11.0%	±10.9%	387
Expanded STD Uncertainty						±22.1%	±21.8%	

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4. MEASUREMENT EQUIPMENTLIST

Item	Type	Manufacturer	Model No.	Serial No.	Cal. Date	Cal. Interval
1.	Stäubli Robot TX90 XL	Stäubli	TX90	F12/5K9SA1/A101	N/A	N/A
2.	Controller	SPEAG	CS8c	N/A	N/A	N/A
3.	SAM Twin Phantom	SPEAG	N/A	1706	N/A	N/A
4.	ELI5 Phantom	SPEAG	N/A	1170	N/A	N/A
5.	Device Holder	SPEAG	N/A	N/A	N/A	N/A
6.	Data Acquisition Electronic	SPEAG	DAE4	1337	2021. 09. 20	1 Year
7.	E-Field Probe	SPEAG	EX3DV4	3855	2021. 09. 24	1 Year
8.	SAR Software	SPEAG	DASY52	V.52.8.8.1222	N/A	N/A
9.	ENA Network Analyzer	Agilent	E5071C-285	MY46215502	2021. 04. 08	1 Year
10.	Signal Generator	Aglient	N5181A	MY50143917	2021. 09. 15	1 Year
11.	Power Meter	Aglient	ML2487A	MY52180007	2021. 09. 15	1 Year
12.	Power Sensor	Aglient	N8481	MY52080006	2021. 09. 15	1 Year
13.	Dipole Antenna	SPEAG	D2450V2	888	2021. 09. 13	3 Years
14.	Dipole Antenna	SPEAG	D5GHzV2	1124	2021. 09. 27	3 Years

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5. SAR MEASUREMENT SYSTEM

5.1. Definition of Specific Absorption Rate (SAR)

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.

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:

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

SAR is expressed in units of Watts per kilogram (W/kg)
SAR measurement can be related to the electrical field in the tissue by

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

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

5.2. SPEAG DASY System

DASY system consists of high precision robot, probe alignment sensor, phantom, robot controller, controlled measurement server and near-field probe. The robot includes six axes that can move to the precision position of the DASY5 software defined. The DASY software can define the area that is detected by the probe. The robot is connected to controlled box. Controlled measurement server is connected to the controlled robot box. The DAE includes amplifier, signal multiplexing, AD converter, offset measurement and surface detection. It is connected to the Electro-optical coupler (ECO). The ECO performs the conversion form the optical into digital electric signal of the DAE and transfers data to the PC.

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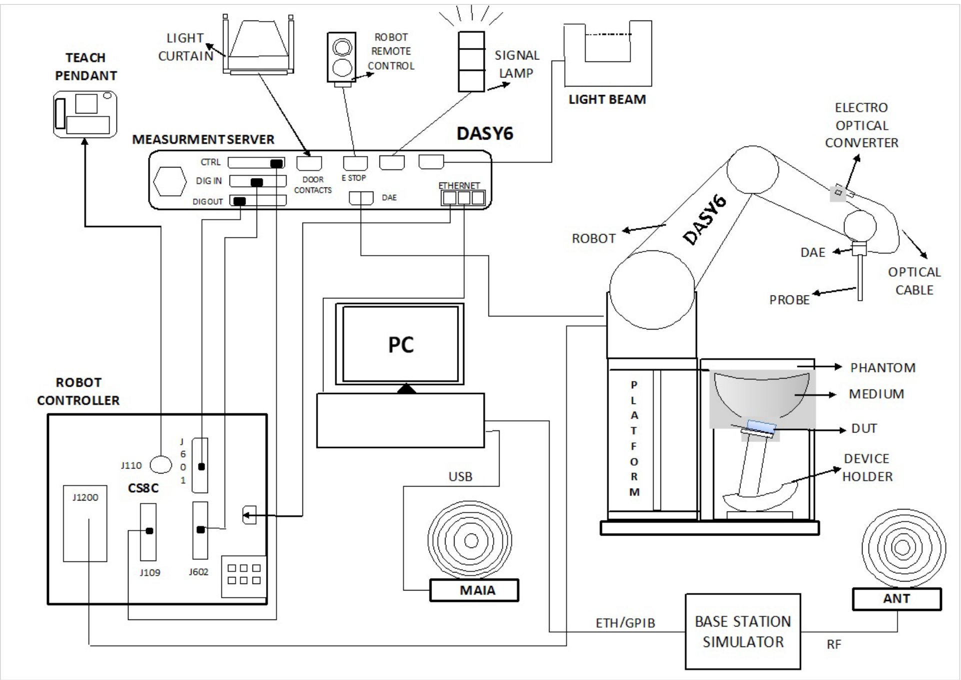

Fig-3.1 DASY6 System Setup

5.2.1. Robot

The DASY6 system uses the high precision robots from Stäubli SA (France). For the 6-axis controller system, the robot controller version (DASY5: CS8c) from Stäubli is used. The Stäubli robot series have many features that are important for our application:

- High precision (repeatability ±0.035 mm)
- High reliability (industrial design)
- Jerk-free straight movements
- Low ELF interference (the closed metallic construction shields against motor control fields)

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5.2.2. Probes

Model	Ex3DV4	
Construction	Symmetrical design with triangular core Built-in shielding against static charges PEEK enclosure material (resistant to organic solvents, e.g., DGBE)	
Frequency	10 MHz to 6 GHz Linearity: ± 0.2 dB	
Directivity	± 0.3 dB in HSL (rotation around probe axis) ± 0.5 dB in tissue material (rotation normal to probe axis)	
Dynamic Range	10 µW/g to 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	

5.2.3. Data Acquisition Electronics (DAE)

Model	DAE4	
Construction	Signal amplifier, multiplexer, A/D converter and control logic. Serial optical link for communication with DASY4/5 embedded system (fully remote controlled). Two step probe touch detector for mechanical surface detection and emergency robot stop.	
Measurement Range	-100 to +300 mV (16 bit resolution and two range settings: 4mV, 400mV)	
Input Offset Voltage	< 5µV (with auto zero)	
Input Bias Current	< 50 fA	
Dimensions	60 x 60 x 68 mm	

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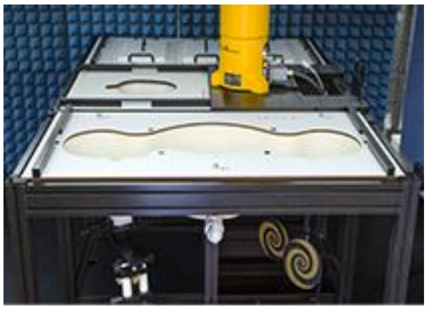
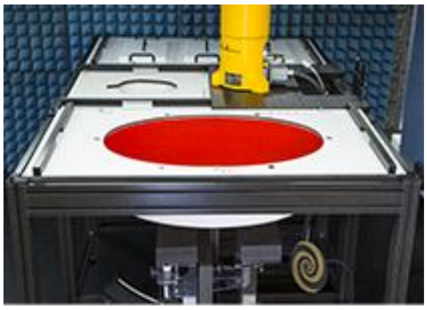
5.2.4. Phantom

Model	Twin SAM	 
Construction	The shell corresponds to the specifications of the Specific Anthropomorphic Mannequin (SAM) phantom defined in IEEE 1528 and IEC 62209-1. It enables the dosimetric evaluation of left and right hand phone usage as well as body mounted usage at the flat phantom region. A cover prevents evaporation of the liquid. Reference markings on the phantom allow the complete setup of all predefined phantom positions and measurement grids by teaching three points with the robot.	
Material	Vinylester, glass fiber reinforced (VE-GF)	
Shell Thickness	2 ± 0.2 mm (6 ± 0.2 mm at ear point)	
Dimensions	Length: 1000 mm Width: 500 mm Height: adjustable feet	
Filling Volume	approx. 25 liters	

Model	ELI	 
Construction	Phantom for compliance testing of handheld and body-mounted wireless devices in the frequency range of 30 MHz to 6 GHz. ELI is fully compatible with the IEC 62209-2 standard and all known tissue simulating liquids. ELI has been optimized regarding its performance and can be integrated into our standard phantom tables. A cover prevents evaporation of the liquid. Reference markings on the phantom allow installation of the complete setup, including all predefined phantom positions and measurement grids, by teaching three points. The phantom is compatible with all SPEAG dosimetric probes and dipoles.	
Material	Vinylester, glass fiber reinforced (VE-GF)	
Shell Thickness	2.0 ± 0.2 mm (bottom plate)	
Dimensions	Major axis: 600 mm Minor axis: 400 mm	
Filling Volume	approx. 30 liters	

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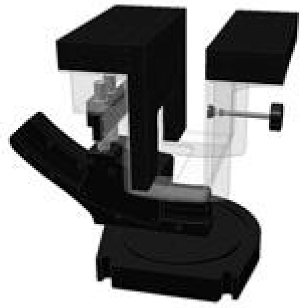
5.2.5. Device Holder

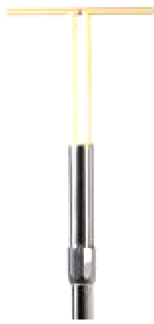
Model	Mounting Device
Construction	In combination with the Twin SAM Phantom or ELI4, the Mounting Device enables the rotation of the mounted transmitter device in spherical coordinates. Rotation point is the ear opening point. Transmitter devices can be easily and accurately positioned according to IEC, IEEE, FCC or other specifications. The device holder can be locked for positioning at different phantom sections (left head, right head, flat).
Material	POM

Model	Laptop Extensions Kit
Construction	Simple but effective and easy-to-use extension for Mounting Device that facilitates the testing of larger devices according to IEC 62209-2 (e.g., laptops, cameras, etc.). It is lightweight and fits easily on the upper part of the Mounting Device in place of the phone positioner.
Material	POM, Acrylic glass, Foam



5.2.6. Reference Dipole

Model	System Validation Dipoles
Construction	Symmetrical dipole with l/4 balun. Enables measurement of feed point impedance with NWA. Matched for use near flat phantoms filled with tissue simulating solutions.
Frequency	750 MHz to 5800 MHz
Return Loss	> 20 dB
Power Capability	> 100 W (f < 1GHz), > 40 W (f > 1GHz)



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5.2.7. Tissue Simulating Liquids

For SAR measurement of the field distribution inside the phantom, the phantom must be filled with homogeneous tissue simulating liquid to a depth of at least 15 cm. 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. For body SAR testing, the liquid height from the center of the flat phantom to the liquid top surface is larger than 15 cm. The nominal dielectric values of the tissue simulating liquids in the phantom and the tolerance of 5% are listed in Table-5.1.

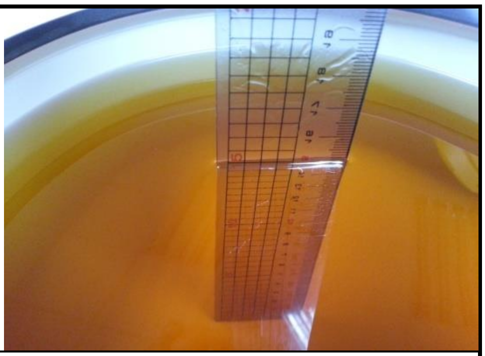

Photo of Liquid Height

The dielectric properties of the head tissue simulating liquids are defined in IEEE 1528 and FCC OET 65 Supplement C Appendix C. For the body tissue simulating liquids, the dielectric properties are defined in FCC OET 65 Supplement C Appendix C. The dielectric properties of the tissue simulating liquids were verified prior to the SAR evaluation using an Agilent 85070D Dielectric Probe Kit and an Agilent Network Analyzer.

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Table-5.1 Targets of Tissue Simulating Liquid

Target Frequency [MHz]	Target Permittivity (εr)	Range of ± 5%	Target Conductivity σ[s/m]	Range of ± 5%
750	41.9	39.805 ~ 43.995	0.89	0.846 ~ 0.935
835	41.5	39.425 ~ 43.575	0.90	0.855 ~ 0.945
900	41.5	39.425 ~ 43.575	0.97	0.922 ~ 1.019
1450	40.5	38.475 ~ 42.525	1.20	1.140 ~ 1.260
1640	40.3	38.285 ~ 42.315	1.29	1.226 ~ 1.355
1750	40.1	38.095 ~ 42.105	1.37	1.302 ~ 1.439
1800	40.0	38.000 ~ 42.000	1.40	1.330 ~ 1.470
1900	40.0	38.000 ~ 42.000	1.40	1.330 ~ 1.470
2000	40.0	38.000 ~ 42.000	1.40	1.330 ~ 1.470
2300	39.5	37.525 ~ 41.475	1.67	1.587 ~ 1.754
2450	39.2	37.240 ~ 41.160	1.80	1.710 ~ 1.890
2600	39.0	37.050 ~ 40.950	1.96	1.862 ~ 2.058
3500	37.9	36.005 ~ 39.795	2.91	2.765 ~ 3.056
5200	36.0	34.2.00 ~ 37.800	4.66	4.427 ~ 4.893
5300	35.9	34.105 ~ 37.695	4.76	4.522 ~ 4.998
5500	35.6	33.820 ~ 37.380	4.96	4.712 ~ 5.208
5600	35.5	33.725 ~ 37.275	5.07	4.817 ~ 5.324
5800	35.3	33.535 ~ 37.065	5.27	5.007 ~ 5.534
6000	35.1	33.345~ 36.855	5.48	5.206 ~ 5.754
6500	34.5	32.775 ~ 36.225	6.07	5.767 ~ 6.374
7000	33.9	32.205 ~ 35.595	6.65	6.318 ~ 6.983

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Table-5.2-1 Recipes of Tissue Simulating Liquid, 30MHz to 900MHz

Frequency (MHz)	30	50		144		450		835	900	
Recipe source number	3	3	2	2	3	2	4	2	2	4
Ingredients (% by weight)										
De-ionized water	48,30	48,30	53,53	55,12	48,30	48,53	56	50,36	50,31	56
Tween 20			44,70	43,31		49,51		48,39	48,34	
Oxidized mineral oil							44			44
Diethylenglycol monohexylether										
Triton X-100										
Diacetin	50,00	50,00			50,00					
DGBE										
NaCl	1,60	1,60	1,77	1,57	1,60	1,96		1,25	1,35	
Additives and salt	0,10	0,10			0,10					
Measured temperature dependence										
Temp. (°C)			21	21		21	20	21	21	20
$\varepsilon_{\text{liquid temp. unc.}}$ (%)	0,8	0,1			0,1	0,1		0,04	0,04	
$\sigma_{\text{liquid temp. unc.}}$ (%)	2,8	2,8			2,6	4,2		1,6	1,6	

Table-5.2-2 Recipes of Tissue Simulating Liquid, 1800MHz to 10000MHz

Frequency (MHz)	1 800		2 450	4 000	5 000	5 200	5 800	6 000	8 000	10 000
Recipe source number	2	4	4	4	4	1	1	4	5	5
Ingredients (% by weight)										
De-ionized water	54,23	56	56	56	56	65,53	65,53	56	67,8	66,0
Tween	45,27								31,1	33,0
Oxidized mineral oil		44	44	44	44			44		
Diethylenglycol monohexylether						17,24	17,24			
Triton X-100						17,24	17,24			
Diacetin										
DGBE										
NaCl	0,50									
Additives and salt										
Measured temperature dependence										
Temp. (°C)	21	20	20	20	20	22	22	20	20	20
$\varepsilon_{\text{liquid temp. unc.}}$ (%)	0,4					1,7	1,8			
$\sigma_{\text{liquid temp. unc.}}$ (%)	2,3					2,7	2,6			

NOTE 1 Multiple columns under a single frequency indicate optional recipes.

NOTE 2 Recipe source numbers: 1 verified by different labs, 2 Reference [59], 3 developed by IT'IS Foundation, 4 developed by IT'IS Foundation, 5 Reference [60].

NOTE 3 The values of $\varepsilon_{\text{liquid temp. unc.}}$ and $\sigma_{\text{liquid temp. unc.}}$ are liquid temperature uncertainties described in O.9.6, based on measurements of the applicable liquid recipes given above. These are not part of the original publications but have been subsequently developed by the project team.

NOTE 4 The recipes at 8 000 MHz and 10 000 MHz are sufficiently broadband that they cover the frequency range of 6 000 MHz to 10 000 MHz within a tolerance of ±10 % for permittivity and conductivity.

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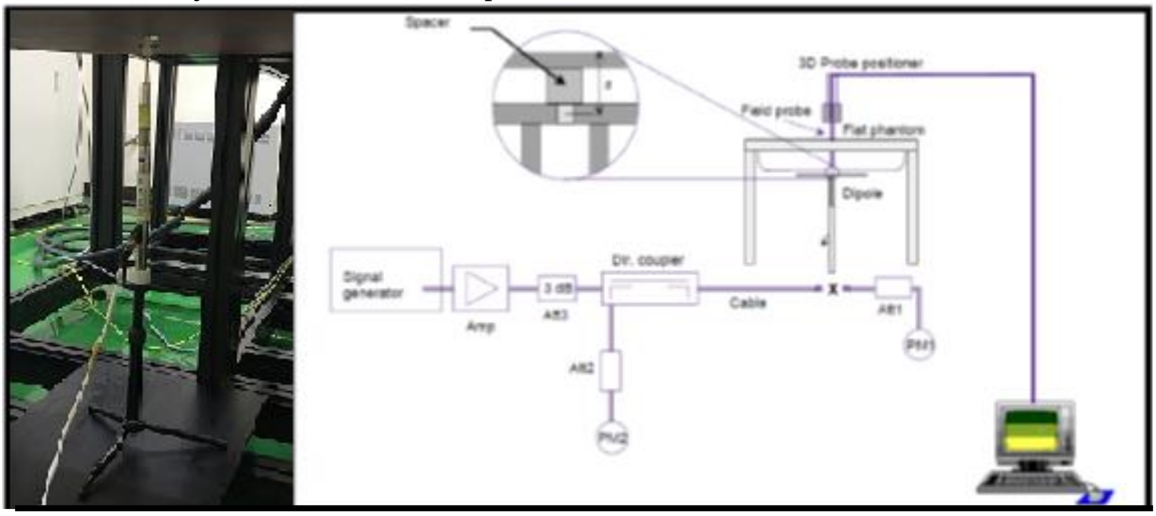
5.3. SAR System Verification

The system check verifies that the system operates within its specifications. It is performed daily or before every SAR measurement. The system check uses normal SAR measurements in the flat section of the phantom with a matched dipole at a specified distance. The system verification setup is shown as below.



The validation dipole is placed beneath the flat phantom with the specific spacer in place. The distance spacer is touch the phantom surface with a light pressure at the reference marking and be oriented parallel to the long side of the phantom. The power meter PM1 measures the forward power at the loation of the system check dipole connector. The signal generator is adjusted for the desired forward power (250 mW is used for 700 MHz to 3 GHz, 100 mW is used for 3.5 GHz to 6 GHz) at the dipole connector and the power meter PM2 is read at that level. After connecting the cable to the dipole, the signal generator is readjusted for the same reading at power meter PM2.

After system check testing, the SAR result will be normalized to 1W forward input power and compared with the reference SAR value derived from validation dipole certificate report. The deviation of system check should be within 10 %.

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5.3.1. SAR System Verification Result

<table>
<tr><td colspan="11">Dipole Kit: D2450V2

Test Date: 2022. 02. 10   Liquid Temp. [℃]: 21.0</td></tr>
<tr><td>Frequency [MHz]</td><td colspan="5">1g SAR</td><td colspan="5">10g SAR</td></tr>
<tr><td rowspan="3">2450MHz</td><td rowspan="2">Zoom Scan to 250mW</td><td rowspan="2">Normalize to 1W</td><td colspan="3">Target Value Reference result ± 10% window</td><td rowspan="2">Zoom Scan to 250mW</td><td rowspan="2">Normalize to 1W</td><td colspan="3">Target Value Reference result ± 10% window</td></tr>
<tr><td colspan="3">52.9</td><td colspan="3">24.8</td></tr>
<tr><td>13.5</td><td>54.0</td><td>47.61</td><td>to</td><td>58.19</td><td>6.31</td><td>25.24</td><td>22.32</td><td>to</td><td>27.28</td></tr>
</table>

<table>
<tr><td colspan="11">Dipole Kit: D5GHzV2

Test Date: 2022. 02. 07   Liquid Temp. [℃]: 21.0</td></tr>
<tr><td>Frequency [MHz]</td><td colspan="5">1g SAR</td><td colspan="5">10g SAR</td></tr>
<tr><td rowspan="3">5200MHz</td><td rowspan="2">Zoom Scan to 100mW</td><td rowspan="2">Normalize to 1W</td><td colspan="3">Target Value Reference result ± 10% window</td><td rowspan="2">Zoom Scan to 100mW</td><td rowspan="2">Normalize to 1W</td><td colspan="3">Target Value Reference result ± 10% window</td></tr>
<tr><td colspan="3">81.1</td><td colspan="3">23.1</td></tr>
<tr><td>8.42</td><td>84.2</td><td>72.99</td><td>to</td><td>89.21</td><td>2.37</td><td>23.7</td><td>20.79</td><td>to</td><td>25.41</td></tr>
</table>

<table>
<tr><td colspan="11">Dipole Kit: D5GHzV2

Test Date: 2022. 02. 08   Liquid Temp. [℃]: 20.0</td></tr>
<tr><td>Frequency [MHz]</td><td colspan="5">1g SAR</td><td colspan="5">10g SAR</td></tr>
<tr><td rowspan="3">5600MHz</td><td rowspan="2">Zoom Scan to 100mW</td><td rowspan="2">Normalize to 1W</td><td colspan="3">Target Value Reference result ± 10% window</td><td rowspan="2">Zoom Scan to 100mW</td><td rowspan="2">Normalize to 1W</td><td colspan="3">Target Value Reference result ± 10% window</td></tr>
<tr><td colspan="3">83.9</td><td colspan="3">23.8</td></tr>
<tr><td>8.23</td><td>82.3</td><td>75.51</td><td>to</td><td>92.29</td><td>2.27</td><td>22.7</td><td>21.42</td><td>to</td><td>26.18</td></tr>
</table>

<table>
<tr><td colspan="11">Dipole Kit: D5GHzV2

Test Date: 2022. 02. 09   Liquid Temp. [℃]: 21.0</td></tr>
<tr><td>Frequency [MHz]</td><td colspan="5">1g SAR</td><td colspan="5">10g SAR</td></tr>
<tr><td rowspan="3">5800MHz</td><td rowspan="2">Zoom Scan to 100mW</td><td rowspan="2">Normalize to 1W</td><td colspan="3">Target Value Reference result ± 10% window</td><td rowspan="2">Zoom Scan to 100mW</td><td rowspan="2">Normalize to 1W</td><td colspan="3">Target Value Reference result ± 10% window</td></tr>
<tr><td colspan="3">81.8</td><td colspan="3">22.9</td></tr>
<tr><td>8.61</td><td>86.1</td><td>73.62</td><td>to</td><td>89.98</td><td>2.41</td><td>24.1</td><td>20.61</td><td>to</td><td>25.19</td></tr>
</table>

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5.3.2. SAR System Check Data

Date: 2/10/2022

Test Laboratory: Audix_SAR Lab

System Check_H2450

DUT: D2450V2 - SN888

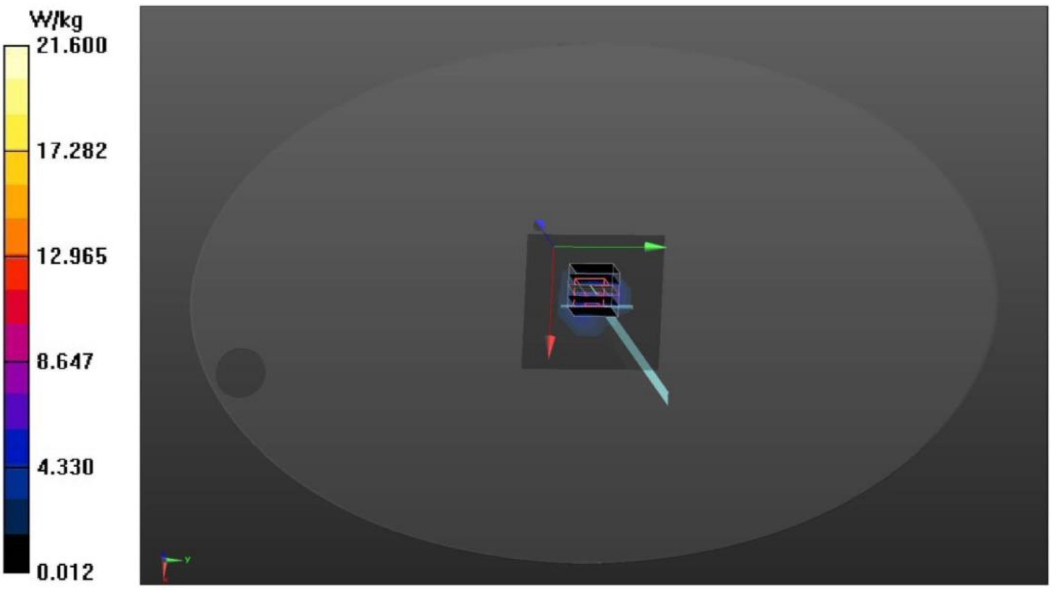
Communication System: UID 0, CW (0); Frequency: 2450 MHz;Duty Cycle:1:1
Medium parameters used: f = 2450 MHz; σ = 1.865 S/m; ε_r = 39.16; ρ = 1000 kg/m^3
Phantom section: Flat Section

DASY Configuration:

- Probe: EX3DV4 - SN3855; ConvF(7.7, 7.7, 7.7) @ 2450 MHz; Calibrated: 9/24/2021
- Sensor-Surface: 2mm (Mechanical Surface Detection), z = 1.0, 31.0
- Electronics: DAE4 Sn1337; Calibrated: 9/20/2021
- Phantom: ELI V5.0 (20deg probe tilt); Type: QD OVA 002 AA; Serial: 1170
- DASY52 52.10.4(1527); SEMCAD X 14.6.14(7483)

P=250mW/Area Scan (6x6x1): Measurement grid: dx=20mm, dy=20mm
Maximum value of SAR (measured) = 13.7 W/kg

P=250mW/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 110.8 V/m; Power Drift = 0.31 dB
Peak SAR (extrapolated) = 29.3 W/kg
SAR(1 g) = 13.5 W/kg; SAR(10 g) = 6.31 W/kg
Smallest distance from peaks to all points 3 dB below = 9.4 mm
Ratio of SAR at M2 to SAR at M1 = 41.4%
Maximum value of SAR (measured) = 21.6 W/kg



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Date: 2/7/2022

Test Laboratory: Audix_SAR Lab

System Check_H5200

DUT: D5GHzV2 - SN1124

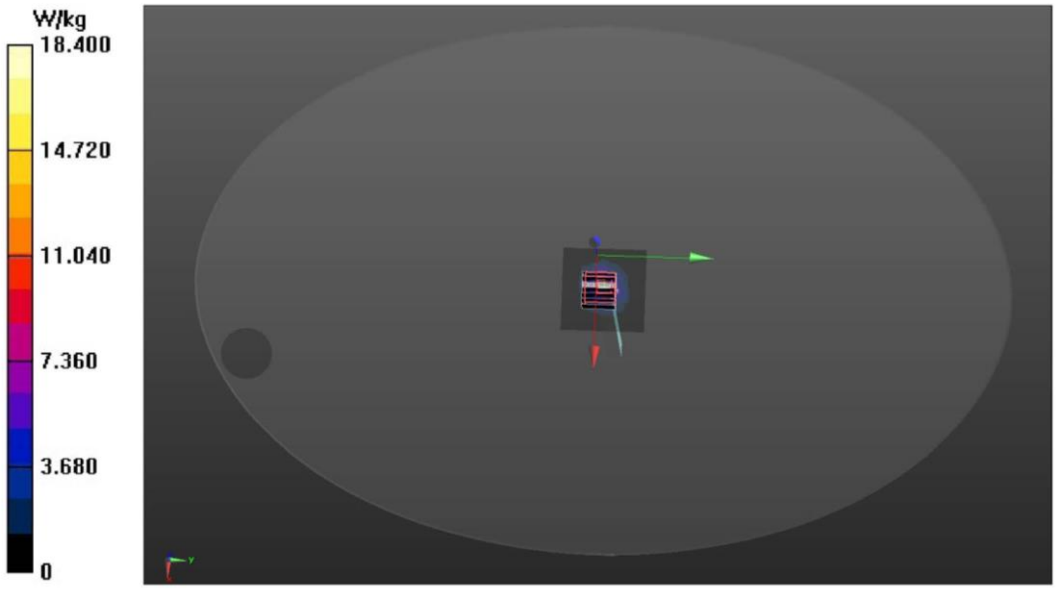
Communication System: UID 0, CW (0); Frequency: 5200 MHz;Duty Cycle:1:1
Medium parameters used: f = 5200 MHz; σ = 4.854 S/m; ε_r = 36.274; ρ = 1000 kg/m^3
Phantom section: Flat Section

DASY Configuration:

- Probe: EX3DV4 - SN3855; ConvF(5.35, 5.35, 5.35) @ 5200 MHz; Calibrated: 9/24/2021
- Sensor-Surface: 2mm (Mechanical Surface Detection), z = 1.0, 31.0
- Electronics: DAE4 Sn1337; Calibrated: 9/20/2021
- Phantom: ELI V5.0 (20deg probe tilt); Type: QD OVA 002 AA; Serial: 1170
- DASY52 52.10.4(1527); SEMCAD X 14.6.14(7483)

P=100mW/Area Scan (7x7x1): Measurement grid: dx=10mm, dy=10mm
Maximum value of SAR (measured) = 17.2 W/kg

P=100mW/Zoom Scan (7x7x12)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=2mm
Reference Value = 42.89 V/m; Power Drift = -0.04 dB
Peak SAR (extrapolated) = 35.9 W/kg
SAR(1 g) = 8.42 W/kg; SAR(10 g) = 2.37 W/kg
Smallest distance from peaks to all points 3 dB below = 8.2 mm
Ratio of SAR at M2 to SAR at M1 = 59.7%
Maximum value of SAR (measured) = 18.4 W/kg



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Test Laboratory: Audix_SAR Lab

System Check_H5600

DUT: D5GHzV2 - SN1124

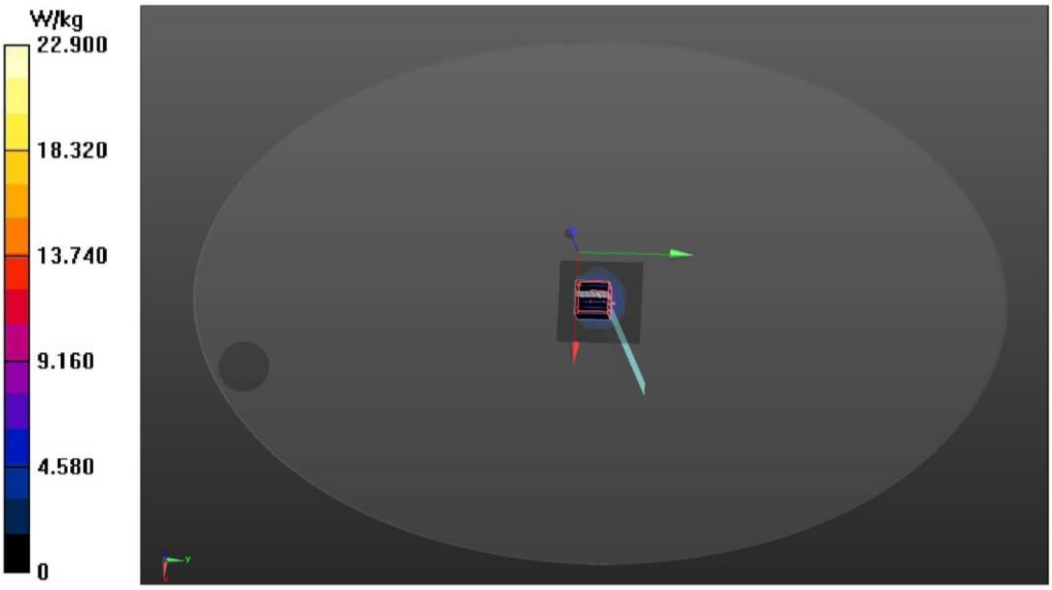
Communication System: UID 0, CW (0); Frequency: 5600 MHz;Duty Cycle:1:1
Medium parameters used: f = 5600 MHz; σ = 5.299 S/m; ε_r = 35.565; ρ = 1000 kg/m^3
Phantom section: Flat Section

DASY Configuration:

- Probe: EX3DV4 - SN3855; ConvF(4.7, 4.7, 4.7) @ 5600 MHz; Calibrated: 9/24/2021
- Sensor-Surface: 2mm (Mechanical Surface Detection), z = 1.0, 31.0
- Electronics: DAE4 Sn1337; Calibrated: 9/20/2021
- Phantom: ELI V5.0 (20deg probe tilt); Type: QD OVA 002 AA; Serial: 1170
- DASY52 52.10.4(1527); SEMCAD X 14.6.14(7483)

P=100mW/Area Scan (7x7x1): Measurement grid: dx=10mm, dy=10mm
Maximum value of SAR (measured) = 30.1 W/kg

P=100mW/Zoom Scan (7x7x12)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=2mm
Reference Value = 52.14 V/m; Power Drift = -0.19 dB
Peak SAR (extrapolated) = 61.1 W/kg
SAR(1 g) = 8.23 W/kg; SAR(10 g) = 2.27 W/kg
Smallest distance from peaks to all points 3 dB below = 9.4 mm
Ratio of SAR at M2 to SAR at M1 = 47.2%
Maximum value of SAR (measured) = 22.9 W/kg



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Test Laboratory: Audix_SAR Lab

System Check_H5800

DUT: D5GHzV2 - SN1124

Communication System: UID 0, CW (0); Frequency: 5800 MHz;Duty Cycle:1:1
Medium parameters used: f = 5800 MHz; σ = 5.518 S/m; ε_r = 35.205; ρ = 1000 kg/m^3

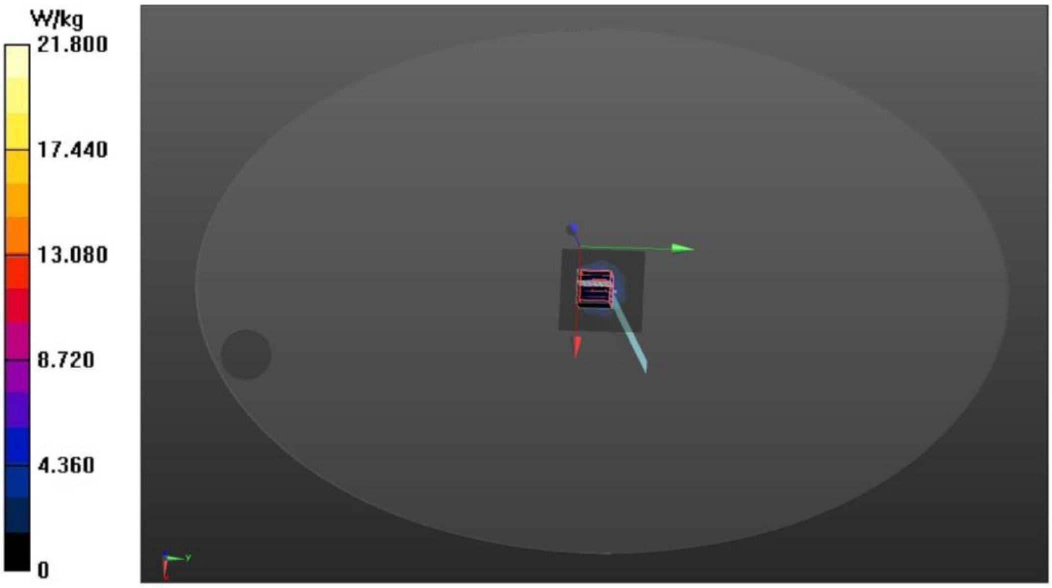
Phantom section: Flat Section

DASY Configuration:

- Probe: EX3DV4 - SN3855; ConvF(4.8, 4.8, 4.8) @ 5800 MHz; Calibrated: 9/24/2021
- Sensor-Surface: 2mm (Mechanical Surface Detection), z = 1.0, 31.0
- Electronics: DAE4 Sn1337; Calibrated: 9/20/2021
- Phantom: ELI V5.0 (20deg probe tilt); Type: QD OVA 002 AA; Serial: 1170
- DASY52 52.10.4(1527); SEMCAD X 14.6.14(7483)

P=100mW/Area Scan (7x7x1): Measurement grid: dx=10mm, dy=10mm
Maximum value of SAR (measured) = 22.2 W/kg

P=100mW/Zoom Scan (7x7x12)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=2mm
Reference Value = 39.25 V/m; Power Drift = 0.09 dB
Peak SAR (extrapolated) = 32.3 W/kg
SAR(1 g) = 8.61 W/kg; SAR(10 g) = 2.41 W/kg
Smallest distance from peaks to all points 3 dB below = 8.8 mm
Ratio of SAR at M2 to SAR at M1 = 54.9%
Maximum value of SAR (measured) = 21.8 W/kg



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5.4. SAR Measurement Procedure

According to the SAR 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

The SAR measurement procedures for each of test conditions are as follows:

(a) Make EUT to transmit maximum output power
(b) Measure conducted output power through RF cable
(c) Place the EUT in the specific position of phantom
(d) Perform SAR testing steps on the DASY system
(e) Record the SAR value

5.4.1. Area &Zoom Scan Procedure

According to IEC/IEEE 62209-1528, the resolution for Area and Zoom scan is specified in the table below.

Items	≤ 2 GHz	2-3 GHz	3-4 GHz	4-5 GHz	5-6 GHz
Area Scan (Δx, Δy)	≤ 15mm	≤ 12mm	≤ 12mm	≤ 10mm	≤ 10mm
Zoom Scan (Δx, Δy)	≤ 8mm	≤ 5mm	≤ 5mm	≤ 4mm	≤ 4mm
Zoom Scan (Δz)	≤ 5mm	≤ 5mm	≤ 4mm	≤ 3mm	≤ 2mm
Zoom Scan Volume	≥30mm	≥30mm	≥28mm	≥25mm	≥22mm

Note:
When zoom scan is required and report SAR is <= 1.4 W/kg, the zoom scan resolution of Δx / Δy (2-3GHz: ≤ 8 mm, 3-4GHz: ≤ 7 mm, 4-6GHz: ≤ 5 mm) may be applied.

According to IEC/IEEE 62209-1528, if the zoom scan measured as specified in the preceding paragraphs complies with both of the following items, or if the peak spatial-average SAR is below 0.1 W/kg, no additional measurements are needed:

(1) The smallest horizontal distance from the local SAR peaks to all points 3 dB below the SAR peak shall be larger than the horizontal gird steps in both x and y directions (Δx, Δy). This shall be checked for the measured zoom scan plane conformal to the phantom at the distance z_{M1}.
(2) The ratio of the SAR at the second measured point (M2) to the SAR at the closest measured point (M1) at the x, y location of the measured mazimum SAR value shall be at least 30%.

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5.4.2. Volume Scan Procedure

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.

5.4.3. Power Drift Monitoring

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

5.4.4. Spatial Peak SAR Evaluation

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

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

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

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

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5.4.5. SAR Averaged Methods

In DASY, the interpolation and extrapolation are both based on the modified Quadratic Shepard's method. The interpolation scheme combines a least-square fitted function method and a weighted average method which are the two basic types of computational interpolation and approximation.

Extrapolation routines are used to obtain SAR values between the lowest measurement points and the inner phantom surface. The extrapolation distance is determined by the surface detection distance and the probe sensor offset. The uncertainty increases with the extrapolation distance. To keep the uncertainty within 1% for the 1 g and 10 g cubes, the extrapolation distance should not be larger than 5 mm.

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6. SAR MEASUREMENT EVALUATION

6.1. EUT Configuration and Setting

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 KDB 447498 D01 are 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 the reported SAR for a body-worn accessory, measured without a headset connected to the handset, is > 1.2 W/kg, the highest reported SAR configuration for that wireless mode and frequency band should be repeated for that body-worn accessory with a headset attached to the handset.

Body-worn accessories that do not contain metallic or conductive components may be tested according to worst-case exposure configurations, typically according to the smallest test separation distance required for the group of body-worn accessories with similar operating and exposure characteristics. All body-worn accessories containing metallic components are tested in conjunction with the host device.

Body-worn accessory SAR compliance is based on a single minimum test separation distance for all wireless and operating modes applicable to each body-worn accessory used by the host, and according to the relevant voice and/or data mode transmissions and operations. If a body-worn accessory supports voice only operations in its normal and expected use conditions, testing of data mode for body-worn compliance is not required.

A conservative minimum test separation distance for supporting off-the-shelf body-worn accessories that may be acquired by users of consumer handsets is used to test for body-worn accessory SAR compliance. This distance is determined by the handset manufacturer, according to the requirements of Supplement C 01-01. Devices that are designed to operate on the body of users using lanyards and straps, or without requiring additional body-worn accessories, will be tested using a conservative minimum test separation distance ≤ 5 mm to support compliance.

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6.2. EUT Testing Position

The SAR testing required mode is listed as below.

Antenna	Front Face	Rear Face	Top Side	Bottom Side	Left Side	Right Side	Screen Side
WLAN				√			√

Note: Per KDB 447498 D01

a) For 100 MHz to 6 GHz and test separation distances ≤ 50 mm, the 1-g and 10-g SAR test exclusion thresholds are determined by the following:
[(max. power of channel, including tune-up tolerance, mW) / (min. test separation distance, mm)] · [√f(GHz)] ≤ 3.0 for 1-g SAR, and ≤ 7.5 for 10-g extremity SAR, where

- f(GHz) is the RF channel transmit frequency in GHz

b) For 100 MHz to 6 GHz and test separation distances > 50 mm, the 1-g and 10-g SAR test exclusion thresholds are determined by the following (also illustrated in Appendix B):[32]

1) {[Power allowed at numeric threshold for 50 mm in step a)] + [(test separation distance – 50 mm)·(f(MHz)/150)]} mW, for 100 MHz to 1500 MHz
2) {[Power allowed at numeric threshold for 50 mm in step a)] + [(test separation distance – 50 mm)·10]} mW, for > 1500 MHz and ≤ 6 GHz

c) Per KDB 248227 D01, the SAR test reset on the rear face is evaluated by the worst configuration on the screen side.

SAR test exclusion table distance is > 50mm @ Right Side (Main to edge)

Frequency (GHz)	In Step 1 threshold Power (mW)	Distance between antenna and user(mm)	SAR Exclusion Threshold Power (mW)@ >50 mm	EUT tune-up maximum power (mW)	SAR test
2.442	95.9883	104.26	638.5883	281.838	No
5.260	65.4031	104.26	608.0031	56.234	No
5.580	63.5001	104.26	606.1001	63.096	No
5.745	62.5815	104.26	605.1815	63.096	No
5.785	62.3648	104.26	604.9648	63.096	No
5.825	62.1503	104.26	604.7503	63.096	No

SAR test exclusion table distance is > 50mm @ Left Side (AUX to edge)

Frequency (GHz)	In Step 1 threshold Power (mW)	Distance between antenna and user(mm)	SAR Exclusion Threshold Power (mW)@ >50 mm	EUT tune-up maximum power (mW)	SAR test
2.442	95.9883	143.34	1029.3883	281.838	No
5.260	65.4031	143.34	998.8031	56.234	No
5.580	63.5001	143.34	996.9001	63.096	No
5.745	62.5815	143.34	995.9815	63.096	No
5.785	62.3648	143.34	995.7648	63.096	No
5.825	62.1503	143.34	995.5503	63.096	No

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6.3. Tissue Calibration Result

The dielectric parameters of the liquids were verified prior to the SAR evaluation using Agilent Dielectric Probe Kit and Agilent E5071C Vector Network Analyzer.

Body Tissue Simulate Measurement								
Frequency [MHz]	Description	Dielectric Parameters						Liquid Temp. [℃]
		ε_r			σ[s/m]			
2450MHz	Reference result	39.2			1.8			N/A
	± 5% window	37.240	to	41.160	1.710	to	1.890	
	2022. 02. 10	39.16			1.865			21.0

Body Tissue Simulate Measurement								
Frequency [MHz]	Description	Dielectric Parameters						Liquid Temp. [℃]
		ε_r			σ[s/m]			
5200MHz	Reference result	36.0			4.66			N/A
	± 5% window	34.200	to	37.800	4.427	to	4.893	
	2022. 02. 07	36.017			4.88			21.0

Body Tissue Simulate Measurement								
Frequency [MHz]	Description	Dielectric Parameters						Liquid Temp. [℃]
		ε_r			σ[s/m]			
5600MHz	Reference result	35.50			5.07			N/A
	± 5% window	33.725	to	37.275	4.817	to	5.324	
	2022. 02. 08	35.207			5.166			20.0

Body Tissue Simulate Measurement								
Frequency [MHz]	Description	Dielectric Parameters						Liquid Temp. [℃]
		ε_r			σ[s/m]			
5800MHz	Reference result	35.3			5.27			N/A
	± 5% window	33.535	to	37.065	5.007	to	5.534	
	2022. 02. 09	35.205			5. 518			21.0

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6.4. SAR Exposure Limits

SAR assessments have been made in line with the requirements of IEEE-1528, FCC Supplement C, and comply with ANSI/IEEE C95.1-1992 "Uncontrolled Environments" limits. These limits apply to a location which is deemed as "Uncontrolled Environment" which can be described as a situation where the general public may be exposed to an RF source with no prior knowledge or control over their exposure.

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

Type Exposure	Uncontrolled Environment Limit
Spatial Peak SAR (1g cube tissue for brain or body)	1.60 W/kg
Spatial Average SAR (whole body)	0.08 W/kg
Spatial Peak SAR (10g for hands, feet, ankles and wrist)	4.00 W/kg

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6.5. Conducted Power Measurement

Note:

1. Per KDB 447498 D01, the reported SAR is the measured SAR value adjusted for maximum tune-up tolerance.
   Scale Factor = tune-up limit power (mW)/EUT Conducted power (mW), where tune-up limit is the maximum rated power among all production units.
   Scale SAR(W/kg)= Measured SAR(W/kg)* Scaling Factor
2. Per KDB 447498 D01, for each exposure position, if the highest output channel reported SAR ≤0.8W/kg, other channels SAR testing is not necessary.
3. Per KDB 248227 D01, for OFDM transmission configuration in the 2.4G and 5G bands. An initial test configuration is determined by the highest maximum output power including tune-up tolerance. When multiple transmission modes(802.11a/g/n/ac/ax) have same maximum power, largest channel bandwidth , lowest order modulation and lowest data rate, lowest order 802.11 mode is selected.(i.e. a, g, n, ac then ax)
4. Per KDB 248227 D01, when the highest reported SAR for the initial test configuration (when applicable, include subsequent highest output channels), according to the initial test position or fixed exposure position requirements, is adjusted by the ratio of the subsequent test configuration to initial test configuration specified maximum output power and the adjusted SAR is ≤ 1.2 W/kg, SAR is not required for that subsequent test configuration.
5. Per KDB 248227 D01,U-NII-1 and U-NII-2A bands have the same specified maximum output and tolerance; SAR is measured for U-NII-2A band first. Adjusted SAR of U-NII-2A band is ≤ 1.2 W/kg, SAR is not required for U-NII-1 band. When different maximum output power is specified for the bands, begin SAR measurement in the band with higher specified maximum output power. The highest reported SAR for the tested configuration is adjusted by the ratio of lower to higher specified maximum output power for the two bands. When the adjusted SAR is ≤ 1.2 W/kg, SAR is not required for the band with lower maximum output power in that test configuration; otherwise, each band is tested independently for SAR.
6. Per KDB 248227 D01, When different maximum output power is specified for the bands, begin SAR measurement in the band with higher specified maximum output power. The highest reported SAR for the tested.
7. Pursuant section 2.8.1(2) KDB 865664 D01, when the original highest measured SAR is ≥ 0.80 W/kg, repeat that measurement once.
8. Pursuant section 2.8.1(3) KDB 865664 D01, perform a second repeated measurement only if the ratio of largest to smallest SAR for the original and first repeated measurements is > 1.20 or when the original or repeated measurement is ≥ 1.45 W/kg (~ 10% from the 1-g SAR limit)

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6.5.1. For WLAN Function

Type of Network	Channel	Frequency (MHz)	Output Power (dBm)						SAR Test
			Chain 0 (AUX)			Chain 1 (Main)			
			Average Power	Tune-Up Limit	Scale Factor	Average Power	Tune-Up Limit	Scale Factor	
802.11b	CH 1	2412	19.70	20.00	---	19.79	20.00	---	No[NOTE2]
	CH 7	2442	19.78	20.00	1.05	19.79	20.00	1.05	Yes
	CH 11	2462	19.76	20.00	---	19.69	20.00	---	No[NOTE2]
	CH 12	2467	18.78	19.00	---	18.65	19.00	---	
	CH 13	2472	16.39	17.00	---	15.37	16.00	---	
802.11g	CH 1	2412	16.48	17.00	---	17.02	17.50	---	No[NOTE6]
	CH 2	2417	18.34	19.00	---	18.58	19.00	---	
	CH 7	2442	19.37	19.50	---	19.32	19.50	---	
	CH 10	2457	18.15	18.50	---	18.37	19.00	---	
	CH 11	2462	16.25	16.50	---	16.39	17.00	---	
	CH 12	2467	14.06	14.50	---	13.97	14.50	---	
	CH 13	2472	11.09	11.50	---	10.87	11.50	---	

Type of Network	Channel	Frequency (MHz)	Output Power (dBm)						SAR Test
			Chain 0 (AUX)			Chain 1 (Main)			
			Average Power	Tune-Up Limit	Scale Factor	Average Power	Tune-Up Limit	Scale Factor	
802.11n-HT20	CH 1	2412	14.86	15.50	---	14.89	15.50	---	No[NOTE4、3]
	CH 2	2417	16.35	17.50	---	16.37	17.00	---	
	CH 3	2422	17.59	18.00	---	17.57	17.50	---	
	CH 7	2442	19.26	19.50	---	19.24	19.50	---	
	CH 10	2457	17.87	18.00	---	17.78	18.50	---	
	CH 11	2462	14.40	15.00	---	14.35	15.00	---	
	CH 12	2467	10.41	11.00	---	10.15	11.00	---	
	CH 13	2472	7.41	8.00	---	7.18	8.00	---	
802.11n-HT40	CH 3	2422	13.87	14.50	---	14.10	14.50	---	
	CH 7	2442	14.64	15.00	---	14.81	15.00	---	
	CH 9	2452	13.55	14.00	---	13.71	14.00	---	
	CH 10	2457	10.85	11.00	---	10.75	11.00	---	
	CH 11	2462	6.55	7.00	---	6.77	7.00	---	

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Type of Network	Channel	Frequency (MHz)	Output Power (dBm)						SAR Test
			Chain 0 (AUX)			Chain 1 (Main)			
			Average Power	Tune-Up Limit	Scale Factor	Average Power	Tune-Up Limit	Scale Factor	
802.11ax-HE20	CH 1	2412	16.52	17.00	---	16.40	17.00	---	No[NOTE4、3]
	CH 2	2417	17.48	18.00	---	17.53	18.00	---	
	CH 3	2422	17.77	18.50	---	18.82	18.50	---	
	CH 7	2442	19.47	20.00	---	19.42	20.00	---	
	CH 10	2457	18.00	18.50	---	17.93	18.50	---	
	CH 11	2462	14.53	15.00	---	14.50	15.00	---	
	CH 12	2467	10.49	11.00	---	10.34	11.00	---	
	CH 13	2472	7.23	8.00	---	7.46	8.00	---	
802.11ax-HE40	CH 3	2422	13.72	14.50	---	13.95	14.50	---	
	CH 7	2442	14.46	15.00	---	14.60	15.00	---	
	CH 9	2452	13.40	14.00	---	13.55	14.00	---	
	CH 10	2457	10.35	10.50	---	10.28	10.50	---	
	CH 11	2462	6.65	7.00	---	6.59	7.00	---	

Type of Network	RU Config	Frequency (MHz)	Output Power (dBm)						SAR Test
			Chain 0 (AUX)			Chain 1 (Main)			
			Average Power	Tune-Up Limit	Scale Factor	Average Power	Tune-Up Limit	Scale Factor	
802.11ax-HE20	26/0	2412	18.28	18.50	---	18.79	18.50	---	No[NOTE4、3]
	52/37		18.41	18.50	---	18.93	18.50	---	
	106/53		17.92	19.00	---	18.41	19.00	---	
	26/8	2472	5.37	6.00	---	5.62	5.50	---	
	52/40		5.85	6.50	---	6.11	6.50	---	
	106/54		6.07	6.50	---	6.23	6.50	---	
802.11ax-HE40	242/61	2422	15.32	16.00	---	15.84	16.00	---	
	242/62	2462	8.38	8.50	---	8.18	8.00	---	

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Type of Network	U-NII Band	Channel	Frequency (MHz)	Output Power (dBm)						SAR Test
				Chain 0 (AUX)			Chain 1 (Main)			
				Average Power	Tune-Up Limit	Scale Factor	Average Power	Tune-Up Limit	Scale Factor	
802.11a	I	CH 36	5180	16.48	17.50	---	16.86	17.50	---	No[NOTE5、3]
		CH 40	5200	16.56	17.50	---	16.82	17.50	---	
		CH 48	5240	16.60	17.50	---	16.73	17.50	---	
	2A	CH 52	5260	16.66	17.50	1.21	16.86	17.50	1.16	Yes
		CH 60	5300	16.64	17.50	---	16.87	17.50	---	No[NOTE2]
		CH 64	5320	16.58	17.50	---	16.85	17.50	---	
	2C	CH 100	5500	16.55	17.50	1.24	16.97	17.50	1.13	Yes
		CH 116	5580	16.57	17.50	---	16.83	17.50	---	No[NOTE2、3]
		CH 140	5700	16.63	17.50	---	16.72	17.50	---	
		CH 144	5720	16.65	17.50	---	16.62	17.50	---	
	III	CH 149	5745	16.52	17.50	1.25	16.82	17.50	1.17	Yes
		CH 157	5785	16.50	17.50	---	14.58	14.50	---	No[NOTE2、3]
		CH 165	5825	16.51	17.50	---	16.72	17.50	---	

Type of Network	U-NII Band	Channel	Frequency (MHz)	Output Power (dBm)						SAR Test
				Chain 0 (AUX)			Chain 1 (Main)			
				Average Power	Tune-Up Limit	Scale Factor	Average Power	Tune-Up Limit	Scale Factor	
802.11n-HT20	I	CH 36	5180	16.47	17.00	---	16.88	17.00	---	No[NOTE4、3]
		CH 40	5200	16.25	17.00	---	16.90	17.00	---	
		CH 48	5240	16.30	17.00	---	16.64	17.00	---	
	2A	CH 52	5260	16.31	17.00	---	16.50	17.00	---	
		CH 60	5300	16.36	17.00	---	16.61	17.00	---	
		CH 64	5320	16.18	17.00	---	16.65	17.00	---	
	2C	CH 100	5500	16.57	17.00	---	16.65	17.00	---	
		CH 116	5580	16.29	17.00	---	16.39	17.00	---	
		CH 140	5700	12.66	13.00	---	12.34	12.50	---	
		CH 144	5720	16.41	17.00	---	16.59	17.50	---	
	III	CH 149	5745	16.30	17.00	---	16.74	17.50	---	
		CH 157	5785	16.33	17.00	---	16.89	17.50	---	
		CH 165	5825	16.37	17.00	---	16.71	17.00	---	

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Type of Network	U-NII Band	Channel	Frequency (MHz)	Output Power (dBm) Chain 0 (AUX) Average Power	Chain 0 (AUX) Tune-Up Limit	Chain 0 (AUX) Scale Factor	Chain 1 (Main) Average Power	Chain 1 (Main) Tune-Up Limit	Chain 1 (Main) Scale Factor	SAR Test
802.11n-HT40	I	CH 38	5190	15.02	16.00	---	15.12	16.00	---	No[NOTE4、3]
		CH 46	5230	16.78	17.50	---	16.86	17.50	---	
	2A	CH 54	5270	16.81	17.50	---	17.60	17.50	---	
		CH 62	5310	14.86	15.50	---	15.58	15.50	---	
	2C	CH 102	5510	14.95	15.50	---	15.02	15.50	---	
		CH 110	5550	16.91	17.50	---	16.93	17.50	---	
		CH 134	5670	17.13	17.50	---	16.79	17.50	---	
		CH 142	5710	16.97	17.50	---	16.82	17.50	---	
	III	CH 151	5755	17.15	17.50	---	17.40	17.50	---	
		CH 159	5795	16.14	17.50	---	17.23	17.50	---	
802.11ac-VHT80	I	CH 52	5210	13.80	14.00	---	14.25	14.00	---	No[NOTE4、3]
	2A	CH 58	5290	14.48	14.50	---	14.50	14.50	---	
	2C	CH 106	5530	13.96	14.00	---	13.36	14.00	---	
		CH 133	5610	16.23	16.50	---	15.83	16.50	---	
		CH 138	5690	16.09	16.50	---	15.83	16.50	---	
	III	CH 155	5775	16.09	17.00	---	16.35	17.00	---	
802.11ac-VHT160	I/2A	CH 50	5250	10.82	11.00	---	10.91	10.50	---	No[NOTE4、3]
	2C	CH 114	5570	13.20	13.50	---	13.12	13.50	---	

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Type of Network	U-NII Band	Channel	Frequency (MHz)	Output Power (dBm)						SAR Test
				Chain 0 (AUX)			Chain 1 (Main)			
				Average Power	Tune-Up Limit	Scale Factor	Average Power	Tune-Up Limit	Scale Factor	
802.11ax -HE20	I	CH 36	5180	16.41	17.00	---	17.07	17.50	---	No NOTE4、3
		CH 40	5200	16.51	17.00	---	16.56	17.00	---	
		CH 48	5240	16.53	17.00	---	16.42	17.00	---	
	2A	CH 52	5260	16.44	17.00	---	16.50	17.00	---	
		CH 60	5300	16.48	17.00	---	16.62	17.50	---	
		CH 64	5320	16.47	17.00	---	16.63	17.00	---	
	2C	CH 100	5500	16.64	17.50	---	16.66	17.00	---	
		CH 116	5580	16.43	17.00	---	16.71	17.00	---	
		CH 140	5700	15.59	16.00	---	15.51	15.50	---	
		CH 144	5720	16.56	17.00	---	16.72	17.50	---	
	III	CH 149	5745	16.49	17.00	---	16.65	17.50	---	
		CH 157	5785	16.47	17.00	---	16.68	17.50	---	
		CH 165	5825	16.40	17.00	---	16.63	17.50	---	
802.11ax -HE40	I	CH 38	5190	14.81	15.50	---	14.87	15.50	---	No NOTE4、3
		CH 46	5230	16.51	17.50	---	16.49	17.00	---	
	2A	CH 54	5270	16.62	17.50	---	16.66	17.50	---	
		CH 62	5310	14.64	15.50	---	14.64	15.00	---	
	2C	CH 102	5510	14.84	15.00	---	15.03	15.50	---	
		CH 110	5550	16.56	17.50	---	16.83	17.50	---	
		CH 134	5670	16.85	17.50	---	16.55	17.50	---	
		CH 142	5710	16.69	17.50	---	16.67	17.50	---	
	III	CH 151	5755	16.60	17.00	---	16.70	17.50	---	
		CH 159	5795	16.53	17.50	---	16.75	17.50	---	
802.11ax -HE80	I	CH 52	5210	13.32	13.50	---	13.01	13.50	---	No NOTE4、3
	2A	CH 58	5290	13.75	14.50	---	14.17	14.50	---	
	2C	CH 106	5530	14.01	14.50	---	14.09	14.50	---	
		CH 133	5610	15.53	16.50	---	15.51	16.50	---	
		CH 138	5690	15.65	16.50	---	15.79	16.50	---	
	III	CH 155	5775	15.60	16.50	---	16.02	16.50	---	
802.11ax -HE160	I/2A	CH 50	5250	10.20	10.50	---	10.68	10.50	---	No NOTE4、3
	2C	CH 114	5570	13.44	13.50	---	12.95	13.50	---	

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Type of Network	U-NII Band	Channel	Frequency (MHz)	RU Config	Output Power (dBm)						SAR Test
					Chain 0 (AUX)			Chain 1 (Main)			
					Average Power	Tune-Up Limit	Scale Factor	Average Power	Tune-Up Limit	Scale Factor	
802.11ax -HE20	I	CH 36	5180	26/0	9.49	10.00	---	9.87	10.00	---	No NOTE 4、3
				52/37	12.97	13.00	---	13.25	13.50	---	
				106/53	15.45	16.00	---	15.60	16.00	---	
	2A	CH 64	5320	26/8	10.11	10.50	---	9.92	10.00	---	
				52/40	13.13	13.50	---	12.89	13.50	---	
				106/54	15.52	15.50	---	15.32	16.00	---	
	2C	CH 100	5500	26/0	9.78	10.00	---	9.56	10.00	---	
				52/37	13.02	13.00	---	13.08	13.00	---	
				106/53	14.91	15.00	---	15.13	15.50	---	
		CH 140	5700	26/8	9.98	10.00	---	9.41	10.00	---	
				52/40	13.14	13.50	---	12.98	13.50	---	
				106/54	15.57	16.00	---	15.63	16.00	---	
	III	CH 149	5745	26/0	15.39	15.50	---	15.58	16.00	---	
				52/37	12.98	13.00	---	12.77	13.50	---	
				106/53	17.11	17.50	---	14.05	15.00	---	
		CH 165	5825	26/8	15.42	16.00	---	15.65	16.00	---	
				52/40	13.16	13.50	---	12.97	13.50	---	
				106/54	17.03	17.50	---	17.15	17.50	---	
802.11ax -HE40	I	CH 38	5190	242/61	16.81	17.00	---	17.12	17.00	---	No NOTE 4、3
	2A	CH 62	5310	242/62	16.10	16.00	---	15.97	16.50	---	
	2C	CH 102	5510	242/61	16.56	17.00	---	16.68	17.00	---	
		CH 142	5710	242/62	16.84	17.50	---	16.92	17.50	---	
	III	CH 151	5755	242/61	16.25	17.00	---	16.91	17.50	---	
		CH 159	5795	242/62	16.69	17.00	---	16.72	17.50	---	
802.11ax -HE80	I	CH 52	5210	484/65	15.32	15.50	---	15.64	15.50	---	No NOTE 4、3
	2A	CH 58	5290	484/66	11.46	12.50	---	11.80	12.50	---	
	2C	CH 106	5530	484/65	13.69	14.50	---	13.91	14.50	---	
		CH 133	5610	484/66	16.62	17.50	---	16.92	17.00	---	
	III	CH 155	5775	484/65	16.25	17.00	---	16.75	17.50	---	
				484/66	16.56	17.00	---	16.72	17.50	---	
802.11ax -HE160	2A	CH 50	5250	996/67	13.04	13.50	---	13.76	14.00	---	No NOTE 4、3
				996/S67	11.45	12.00	---	11.44	12.00	---	
	2C	CH 114	5570	996/67	13.15	13.50	---	13.59	13.50	---	
				996/S67	15.42	16.00	---	15.35	16.00	---	

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6.5.2. For BT Function

Type of Network	Channel	Frequency (MHz)	Max Output Power (dBm)	Tune-Up Limit	Scale Factor	SAR Test
Bluetooth-GFSK	CH 0	2402	8.65	9.5	---	No
	CH 39	2441	9.36	9.5	1.03	Yes
	CH 78	2480	9.83	10.0	---	No
Bluetooth-8-DPSK	CH 0	2402	6.82	7.5	---	No
	CH 39	2441	7.63	8.0	---	No
	CH 78	2480	7.57	8.0	---	No
BLE (1M)	CH 37	2402	5.04	5.5	---	No
	CH 17	2440	5.42	6.0	---	No
	CH 39	2480	5.25	6.0	---	No
BLE (2M)	CH 37	2402	5.02	6.0	---	No
	CH 17	2440	5.26	6.0	---	No
	CH 39	2480	5.27	6.0	---	No
BLE (PHY Coded S2)	CH 37	2402	5.12	5.5	---	No
	CH 17	2440	5.26	6.0	---	No
	CH 39	2480	5.27	6.0	---	No
BLE (PHY Coded S8)	CH 37	2402	4.92	5.5	---	No
	CH 17	2440	5.08	6.0	---	No
	CH 39	2480	5.28	6.0	---	No

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6.6. SAR Test Result

Test Date	2022. 02. 10	Temp./Hum.	22℃/42%
Test Voltage	AC 120V, 60Hz (with AC Adapter)	Tested by	Brian Hsieh
Test SKU	SKU #1 (with INPAQ Antenna)		

Liquid Temperature : 21.0℃							Depth of Liquid: ＞15cm			
Test Mode: 2.4GHz										
Plot No.	Test Position: Body	Antenna Position	Separation Distance (cm)	Frequency	Conducted Power (dBm)	Maximum Tune-up (dBm)	SAR 1g (W/kg)	Scale Factor	Scale SAR	Limit (W/kg)
802.11b										
Antenna: Chain 0 (ANT 1-AUX)										
13	Bottom	Fixed	0	2442	19.78	20.00	0.136	1.05	0.143	1.60
7	Screen	Fixed	0.5	2442	19.78	20.00	0.409	1.05	**0.429**	1.60
Antenna: Chain 1 (ANT 2-Main)										
14	Bottom	Fixed	0	2442	19.79	20.00	0.186	1.05	0.195	1.60
8	Screen	Fixed	0.5	2442	19.79	20.00	0.319	1.05	**0.335**	1.60

Liquid Temperature : 21.0℃							Depth of Liquid: ＞15cm			
Test Mode: BT-GFSK										
Plot No.	Test Position: Body	Antenna Position	Separation Distance (cm)	Frequency	Conducted Power (dBm)	Maximum Tune-up (dBm)	SAR 1g (W/kg)	Scale Factor	Scale SAR	Limit (W/kg)
Antenna: Chain 0 (ANT 1-AUX)										
15	Bottom	Fixed	0	2441	9.36	9.5	0.00894	1.03	0.009	1.60
9	Screen	Fixed	0.5	2441	9.36	9.5	0.016	1.03	**0.016**	1.60

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Test Date	2022. 02. 07 ~ 09	Temp./Hum.	21 ~ 22℃/44 ~ 46%
Test Voltage	AC 120V, 60Hz (with AC Adapter)	Tested by	Brian Hsieh
Test SKU	SKU #1 (with INPAQ Antenna)		

Liquid Temperature : 20.0/21.0℃										Depth of Liquid: ＞15c
Test Mode: 5GHz										
Plot No.	Test Position: Body	Antenna Position	Separation Distance (cm)	Frequency	Conducted Power (dBm)	Maximum Tune-up (dBm)	SAR 1g (W/kg)	Scale Factor	Scale SAR	Limit (W/kg)
802.11a (Band NII-2A)										
Antenna: Chain 0 (ANT 1-AUX)										
11	Bottom	Fixed	0.5	5260	16.66	17.50	0.204	1.21	0.247	1.60
1	Screen	Fixed	0.5	5260	16.66	17.50	0.553	1.21	**0.669**	1.60
Antenna: Chain 1 (ANT 2-Main)										
12	Bottom	Fixed	0.5	5260	16.86	17.50	0.248	1.16	0.288	1.60
2	Screen	Fixed	0.5	5260	16.86	17.50	0.395	1.16	**0.458**	1.60
802.11a (Band NII-2C)										
Antenna: Chain 0 (ANT 1-AUX)										
3	Screen	Fixed	0.5	5500	16.55	17.50	0.354	1.24	0.439	1.60
Antenna: Chain 1 (ANT 2-Main)										
4	Screen	Fixed	0.5	5500	16.97	17.50	0.318	1.13	0.359	1.60
802.11a (Band NII-III)										
Antenna: Chain 0 (ANT 1-AUX)										
5	Screen	Fixed	0.5	5745	16.52	17.50	0.407	1.25	0.509	1.60
Antenna: Chain 1 (ANT 2-Main)										
6	Screen	Fixed	0.5	5745	16.82	17.50	0.310	1.17	0.363	1.60

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Test Date	2022. 02. 10	Temp./Hum.	22℃/42%
Test Voltage	AC 120V, 60Hz (with AC Adapter)	Tested by	Brian Hsieh
Test SKU	SKU #2 (with LUXSHARE-ICT Antenna)		

Liquid Temperature : 21.0℃ Depth of Liquid: >15cm

Test Mode: 2.4GHz

Plot No.	Test Position: Body	Antenna Position	Separation Distance (cm)	Frequency	Conducted Power (dBm)	Maximum Tune-up (dBm)	SAR 1g (W/kg)	Scale Factor	Scale SAR	Limit (W/kg)
802.11b										
Antenna: Chain 0 (ANT 1-AUX)										
11	Bottom	Fixed	0	2442	19.78	20.00	0.033	1.05	0.035	1.60
7	Screen	Fixed	0.5	2442	19.78	20.00	0.309	1.05	**0.324**	1.60
Antenna: Chain 1 (ANT 2-Main)										
12	Bottom	Fixed	0	2442	19.79	20.00	0.062	1.05	0.065	1.60
8	Screen	Fixed	0.5	2442	19.79	20.00	0.374	1.05	**0.393**	1.60

Liquid Temperature : 21.0℃ Depth of Liquid: >15cm

Test Mode: BT-GFSK

Plot No.	Test Position: Body	Antenna Position	Separation Distance (cm)	Frequency	Conducted Power (dBm)	Maximum Tune-up (dBm)	SAR 1g (W/kg)	Scale Factor	Scale SAR	Limit (W/kg)
Antenna: Chain 0 (ANT 1-AUX)										
15	Bottom	Fixed	0	2441	9.36	9.5	0.019	1.03	0.020	1.60
9	Screen	Fixed	0.5	2441	9.36	9.5	0.059	1.03	**0.061**	1.60

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Test Date	2022. 02. 07 ~ 09	Temp./Hum.	21 ~ 22℃/44 ~ 46%
Test Voltage	AC 120V, 60Hz (with AC Adapter)	Tested by	Brian Hsieh
Test SKU	SKU #2 (with LUXSHARE-ICT Antenna)		

Liquid Temperature : 20.0/21.0℃										Depth of Liquid:＞15cm
Test Mode: 5GHz										
Plot No.	Test Position: Body	Antenna Position	Separation Distance (cm)	Frequency	Conducted Power (dBm)	Maximum Tune-up (dBm)	SAR 1g (W/kg)	Scale Factor	Scale SAR	Limit (W/kg)
802.11a (Band NII-2A)										
Antenna: Chain 0 (ANT 1-AUX)										
1	Screen	Fixed	0.5	5260	16.66	17.50	0.459	1.21	0.555	1.60
Antenna: Chain 1 (ANT 2-Main)										
2	Screen	Fixed	0.5	5260	16.86	17.50	0.722	1.16	0.838	1.60
802.11a (Band NII-2C)										
Antenna: Chain 0 (ANT 1-AUX)										
3	Screen	Fixed	0.5	5500	16.55	17.50	0.775	1.24	0.961	1.60
Antenna: Chain 1 (ANT 2-Main)										
4	Screen	Fixed	0.5	5500	16.97	17.50	0.788	1.13	0.890	1.60
802.11a (Band NII-III)										
Antenna: Chain 0 (ANT 1-AUX)										
13	Bottom	Fixed	0	5745	16.52	17.50	0.427	1.25	0.534	1.60
5	Screen	Fixed	0.5	5745	16.52	17.50	0.796	1.25	**0.995**	1.60
Antenna: Chain 1 (ANT 2-Main)										
14	Bottom	Fixed	0	5745	16.82	17.50	0.218	1.17	0.255	1.60
6	Screen	Fixed	0.5	5745	16.82	17.50	0.783	1.17	**0.916**	1.60

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APPENDIX A

GRAPH RESULT

(Model: 15Z90Q)

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APPENDIX B

TEST PHOTOGRAPHS

(Model: 15Z90Q)

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APPENDIX C

Test Equipment Calibration Data