

SAR TEST REPORT

Project No. : JB-Z0743
 Client : Murata Manufacturing Co., Ltd.
 Address : 10-1 Higashikotari 1-chome, Nagaokakyo-shi, Kyoto 617-8555 Japan
 Type of Equipment : Communication Module
 Model No. : Type1VY (* installed in Digital Camera 1VY002)
 FCC ID : VPYLB1VY
 Regulation Applied : FCC 47 CFR 2.1093

SAR Limits :

Exposure Characteristics	Spatial Peak SAR (Head and Trunk) averaged over any 1 g of tissue
General Public Exposure	1.6 W/kg

The Highest Reported SAR:

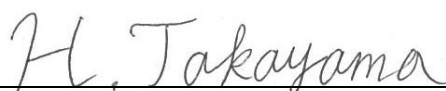
RF Exposure Conditions	Equipment Class			Note(s)
	DTS	DTS	U-NII	
	Wi-Fi 2.4 GHz	Bluetooth Low Energy	Wi-Fi 5 GHz	
Body-Worn	0.465 W/kg	0.305 W/kg	0.741 W/kg	
Simultaneous Tx	1.046 W/kg			

Test Result : Complied

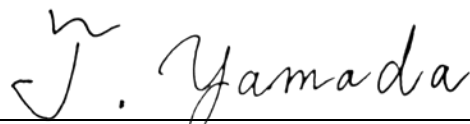
Sample Receipt : October 21, 2019
 Testing : February 04, 2020 - March 05, 2020 (for conducted power measurements)
 November 04, 2020 - November 11, 2020 (for SAR measurements)
 Reported : November 27, 2020

Reported by :

Approved Signatory :



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Sony Global Manufacturing & Operations Corporation EMC/RF Test Laboratory, Main Lab.

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REVISION HISTORY

Project No.	Revision	Page	Description	Issued date
JB-Z0743	Original	-	-	November 27, 2020

DISCLAIMER

This report includes the information provided by the customer as below;

- Cover page : Client and product related information
- Clause 1.1 : Description of Device Under Test (DUT)
- Clause 1.2 : Antenna Placement
- Clause 1.3 : Simultaneous Transmission Conditions
- Clause 1.4 : Nominal and Maximum Possible Power (Maximum Tune-up Tolerance Limit)

* The laboratory is not responsible for results affected by the above information.

TABLE OF CONTENTS

1. General Information.....	4
1.1. Description of Device Under Test (DUT).....	4
1.2. Antenna Placement.....	5
1.3. Simultaneous Transmission Conditions.....	5
1.4. Nominal and Maximum Possible Power (Maximum Tune-up Tolerance Limit)	5
1.5. RF Exposure Conditions	8
1.6. RF Exposure Limits.....	8
1.7. SAR Test Exclusion	9
1.8. Test Specification, Methods and Procedures.....	11
1.9. Test Facilities and Accreditation	12
2. Test Set-up.....	13
2.1. Test Equipment and Measurement Software Lists.....	13
2.2. Measurement System Description	15
2.3. Measurement System Main Components.....	16
2.4. Tissue Simulating Liquids.....	19
2.5. SAR Measurement	20
2.6. Measurement Uncertainty	21
2.7. Dielectric Parameter Measurement of Tissue Simulating Liquids	24
2.8. System Check Measurement	26
3. Conducted Power Measurements	28
3.1. Conducted Power Measurement Results	29
4. SAR Measurements.....	33
4.1. SAR Measurement Results	35
5. Simultaneous Transmission SAR evaluation.....	40
Appendix A. Plots of SAR Measurement	41
Appendix B. Plots of System Check.....	51
Appendix C. Calibration Certificate	57
Appendix D. Photographs	94

1. General Information

1.1. Description of Device Under Test (DUT)

DUT Description

	DUT
Type of Equipment	Communication Module
Model No.	Type1VY
FCC-ID	VPYLB1VY
Test Sample Condition	☐ Prototype ☐ Pre-production ☒ Mass-production * Not for sale: The sample is equivalent to mass-production items. * No modification by the test lab.
Serial No.	19
Rating	DC 3.3 V (VDD_3P3, VDD_FEM, SWREG_IN, VDDIO_GPIO, VDDIO_AO) * Supplied from the host.
Head/Body-Worn Accessories (supplied with the device)	n/a
Device Dimension (W x H x D)	10.25 mm x 7.5 mm x 1.15 mm
Device Category	Portable
Exposure Category	General population/ Uncontrolled environment
Note(s):	
* Please refer to Appendix D for Host Platform Descriptions.	

Wireless Technologies

Wireless Technologies	Frequency Bands	Operating Mode	Power Setting Mode
Wi-Fi	2.4 GHz	802.11b 802.11g 802.11n (HT20)	Low Power Mode
	5 GHz	802.11a 802.11n (HT20/HT40) 802.11ac (VHT20/VHT40/VHT80)	High Power Mode
Bluetooth	2.4 GHz	Version 5 (LE)	n/a
Note(s): * The DUT installed in this host does not support the Wi-Fi 2.4 GHz High Power Mode, Wi-Fi 5 GHz Low power Mode, and Bluetooth Classic (BR/EDR) operations.			

Radio Specification

		Chain0	Chain1
Wireless Technologies		Wi-Fi 2.4 / 5 GHz, Bluetooth	Wi-Fi 2.4 / 5 GHz
Antenna Type		Dual Monopole antenna	Dual Monopole antenna
Antenna Gain	Original Approval	+0.93 dBi (2.4 GHz) +1.04 dBi (5 GHz)	+1.98 dBi (2.4 GHz) +1.98 dBi (5 GHz)
	Class II Permissive Change (*The DUT is installed in this host.)	-4.95 dBi (2.4 GHz) -2.77 dBi (5 GHz)	-6.54 dBi (2.4 GHz) -0.02 dBi (5 GHz)

* The antenna is of the same type and lower gain than in the original approval.

1.2. Antenna Placement

Antenna	Minimum Distance from Edges or Sides of Host Platform (mm)						
	Front	Front-Right	Back	Left	Right	Top	Bottom
Chain0	*1	*1	*1	*1	*1	*1	*1
Chain1	*1	*1	*1	*1	*1	*1	*1

*1 Please refer to Appendix D.

1.3. Simultaneous Transmission Conditions

RF Exposure Conditions	No.	Capable Transmit Configurations				
		Wi-Fi 2.4 GHz		Wi-Fi 5 GHz		Bluetooth
		Chain 0	Chain 1	Chain 0	Chain 1	
Body-Worn	1	Yes	Yes			
	2			Yes	Yes	
	3			Yes	Yes	Yes

1.4. Nominal and Maximum Possible Power (Maximum Tune-up Tolerance Limit)

Chain 0

Wireless Technologies	Mode	Band	Frequency Band (MHz)		Channel	Data Rate /MCS	Full Power (Burst Averaged)	Ant. Gain (dBi)	Equivalent Isotopically Radiated Power (dBm)
			Lower	Higher			Max. Tune-up Limit (dBm)		
Wi-Fi	802.11b	2.4 GHz	2412	2462	All	All	9.5	-4.95	4.55
	802.11g		2412	2462	All	All	9.5	-4.95	4.55
	802.11n (HT20)		2412	2462	All	All	9.5	-4.95	4.55
	802.11a	W52	5180	5240	All	All	11.5	-2.77	8.73
		W53	5260	5320	All	All	11.5	-2.77	8.73
		W56	5500	5580	All	All	11.5	-2.77	8.73
			5660	5700	All	All	11.5	-2.77	8.73
		W58	5745	5825	All	All	11.5	-2.77	8.73
	802.11n (HT20)	W52	5180	5240	All	All	11.5	-2.77	8.73
		W53	5260	5320	All	All	11.5	-2.77	8.73
		W56	5500	5580	All	All	11.5	-2.77	8.73
			5660	5700	All	All	11.5	-2.77	8.73
		W58	5745	5825	All	All	11.5	-2.77	8.73
	802.11n (HT40)	W52	5190	5230	All	All	11.5	-2.77	8.73
		W53	5270	5310	All	All	11.5	-2.77	8.73
		W56	5510	5550	All	All	11.5	-2.77	8.73
			5670		All	All	11.5	-2.77	8.73
		W58	5755	5795	All	All	11.5	-2.77	8.73
	802.11ac (VHT20)	W52	5180	5240	All	MCS 0-8	11.5	-2.77	8.73
		W53	5260	5320	All	MCS 0-8	11.5	-2.77	8.73
		W56	5500	5580	All	MCS 0-8	11.5	-2.77	8.73
			5660	5700	All	MCS 0-8	11.5	-2.77	8.73
		W58	5745	5825	All	MCS 0-8	11.5	-2.77	8.73

Chain 0 (Continued)

Wireless Technologies	Mode	Band	Frequency Band (MHz)		Channel	Data Rate /MCS	Full Power (Burst Averaged)	Ant. Gain (dBi)	Equivalent Isotopically Radiated Power (dBm)	
			Lower	Higher			Max. Tune-up Limit (dBm)			
Wi-Fi	802.11ac (VHT40)	W52	5190	5230	All	MCS 0-8	11.5	-2.77	8.73	
						MCS 9	10.5	-2.77	7.73	
		W53	5270	5310	All	MCS 0-8	11.5	-2.77	8.73	
						MCS 9	10.5	-2.77	7.73	
		W56	5510	5550	All	MCS 0-8	11.5	-2.77	8.73	
						MCS 9	10.5	-2.77	7.73	
			5670		All	MCS 0-8	11.5	-2.77	8.73	
						MCS 9	10.5	-2.77	7.73	
		W58	5755	5795	All	MCS 0-8	11.5	-2.77	8.73	
						MCS 9	10.5	-2.77	7.73	
		802.11ac (VHT80)	W52	5210		-	MCS 0-8	11.5	-2.77	8.73
							MCS 9	10.5	-2.77	7.73
	W53		5290		-	MCS 0-8	11.5	-2.77	8.73	
						MCS 9	10.5	-2.77	7.73	
	W56		5530		-	MCS 0-8	11.5	-2.77	8.73	
						MCS 9	10.5	-2.77	7.73	
	W58		5775		-	MCS 0-8	11.5	-2.77	8.73	
						MCS 9	10.5	-2.77	7.73	
Bluetooth	LE	2.4 GHz	2402	2480	All	-	10.1	-4.95	5.15	

Chain 1

Wireless Technologies	Mode	Band	Frequency Band (MHz)		Channel	Data Rate /MCS	Full Power (Burst Averaged)	Ant. Gain (dBi)	Equivalent Isotopically Radiated Power (dBm)
			Lower	Higher			Max. Tune-up Limit (dBm)		
Wi-Fi	802.11b	2.4 GHz	2412	2462	All	All	9.5	-6.54	2.96
	802.11g		2412	2462	All	All	9.5	-6.54	2.96
	802.11n (HT20)		2412	2462	All	All	9.5	-6.54	2.96
	802.11a	W52	5180	5240	All	All	11.5	-0.02	11.48
		W53	5260	5320	All	All	11.5	-0.02	11.48
		W56	5500	5580	All	All	11.5	-0.02	11.48
			5660	5700	All	All	11.5	-0.02	11.48
		W58	5745	5825	All	All	11.5	-0.02	11.48
	802.11n (HT20)	W52	5180	5240	All	All	11.5	-0.02	11.48
		W53	5260	5320	All	All	11.5	-0.02	11.48
		W56	5500	5580	All	All	11.5	-0.02	11.48
			5660	5700	All	All	11.5	-0.02	11.48
		W58	5745	5825	All	All	11.5	-0.02	11.48
	802.11n (HT40)	W52	5190	5230	All	All	11.5	-0.02	11.48
		W53	5270	5310	All	All	11.5	-0.02	11.48
		W56	5510	5550	All	All	11.5	-0.02	11.48
			5670		All	All	11.5	-0.02	11.48
		W58	5755	5795	All	All	11.5	-0.02	11.48
	802.11ac (VHT20)	W52	5180	5240	All	MCS 0-8	11.5	-0.02	11.48
		W53	5260	5320	All	MCS 0-8	11.5	-0.02	11.48
		W56	5500	5580	All	MCS 0-8	11.5	-0.02	11.48
			5660	5700	All	MCS 0-8	11.5	-0.02	11.48
		W58	5745	5825	All	MCS 0-8	11.5	-0.02	11.48
	802.11ac (VHT40)	W52	5190	5230	All	MCS 0-8	11.5	-0.02	11.48
						MCS 9	10.5	-0.02	10.48
		W53	5270	5310	All	MCS 0-8	11.5	-0.02	11.48
						MCS 9	10.5	-0.02	10.48
		W56	5510	5550	All	MCS 0-8	11.5	-0.02	11.48
						MCS 9	10.5	-0.02	10.48
						MCS 0-8	11.5	-0.02	11.48
						MCS 9	10.5	-0.02	10.48
		W58	5755	5795	All	MCS 0-8	11.5	-0.02	11.48
						MCS 9	10.5	-0.02	10.48
	802.11ac (VHT80)	W52	5210		All	MCS 0-8	11.5	-0.02	11.48
						MCS 9	10.5	-0.02	10.48
		W53	5290		All	MCS 0-8	11.5	-0.02	11.48
						MCS 9	10.5	-0.02	10.48
		W56	5530		All	MCS 0-8	11.5	-0.02	11.48
						MCS 9	10.5	-0.02	10.48
		W58	5775		All	MCS 0-8	11.5	-0.02	11.48
						MCS 9	10.5	-0.02	10.48

1.5. RF Exposure Conditions

Wireless Technologies	RF Exposure Conditions	User-to-Host Distance (mm)	Test Position	Host-to-Ant. Distance (mm)		SAR Required	Note(s)
				Chain 0	Chain 1		
Wi-Fi/ Bluetooth	Body-Worn	0	Front	*1	*1	Yes	
			Front-Right	*1	*1	Yes	
			Back	*1	*1	Yes	
			Left	*1	*1	Yes	
			Right	*1	*1	Yes	
			Top	*1	*1	Yes	
			Bottom	*1	*1	Yes	
Note(s): *1 Please refer to Appendix D.							

1.6. RF Exposure Limits

Human Exposure	General Population/ Uncontrolled Exposure	Occupational/ Controlled Exposure
Spatial Peak SAR (Head and Trunk) averaged over any 1 g of tissue	1.6 W/kg*	8 W/kg
Spatial Average SAR (Whole Body) averaged over the whole body	0.08 W/kg	0.4 W/kg
Spatial Peak SAR (Extremities: Hands/Wrists/Feet/Ankles) averaged over any 10 g of tissue	4 W/kg	20 W/kg

* The limit(s) applied in this report.

1.7. SAR Test Exclusion

SAR test exclusion is applied according to KDB 447498 D01.

The 1-g SAR test exclusion thresholds for 100 MHz to 6 GHz at test separation distances ≤ 50 mm are determined by:

$$[(\text{max. power of channel, including tune-up tolerance, mW})/(\text{min. test separation distance, mm})] \cdot$$

$$[\sqrt{f(\text{GHz})}] \leq 3.0 \text{ for 1-g SAR and } \leq 7.5 \text{ for 10-g extremity SAR, where:}$$

- * $f(\text{GHz})$ is the RF channel transmit frequency in GHz
- * Power and distance are rounded to the nearest mW and mm before calculation
- * The result is rounded to one decimal place for comparison
- * When the minimum test separation distance is < 5 mm, a distance of 5 mm is applied to determine SAR test exclusion

Body-Worn SAR (1-g SAR) Test Exclusion as per KDB 447498 D01 - Chain0

Freq. Band	Freq. (MHz)	Test Position	Host-to-Ant Distance (mm)	User-to-Ant Distance (mm)	Min. Test Sep. Distance (mm)	Max. Possible Power				Exclusion Threshold	SAR Required (> 3.0)
						Chain0 (dBm)	Chain1 (dBm)	Total (mW)	rounded (mW)		
Wi-Fi 2.4 GHz (Chain0)	2450	Front	*1	*1	*1	9.5	9.5	17.8	18	*1	No
	2450	Front-Right	*1	*1	*1	9.5	9.5	17.8	18	*1	Yes
	2450	Back	*1	*1	*1	9.5	9.5	17.8	18	*1	No
	2450	Left	*1	*1	*1	9.5	9.5	17.8	18	*1	No
	2450	Right	*1	*1	*1	9.5	9.5	17.8	18	*1	Yes
	2450	Top	*1	*1	*1	9.5	9.5	17.8	18	*1	No
	2450	Bottom	*1	*1	*1	9.5	9.5	17.8	18	*1	Yes
Wi-Fi 5 GHz (Chain0)	5800	Front	*1	*1	*1	11.5	11.5	28.3	28	*1	No
	5800	Front-Right	*1	*1	*1	11.5	11.5	28.3	28	*1	Yes
	5800	Back	*1	*1	*1	11.5	11.5	28.3	28	*1	No
	5800	Left	*1	*1	*1	11.5	11.5	28.3	28	*1	No
	5800	Right	*1	*1	*1	11.5	11.5	28.3	28	*1	Yes
	5800	Top	*1	*1	*1	11.5	11.5	28.3	28	*1	No
	5800	Bottom	*1	*1	*1	11.5	11.5	28.3	28	*1	Yes
Bluetooth	2450	Front	*1	*1	*1	10.1	-	10.2	10	*1	No
	2450	Front-Right	*1	*1	*1	10.1	-	10.2	10	*1	No
	2450	Back	*1	*1	*1	10.1	-	10.2	10	*1	No
	2450	Left	*1	*1	*1	10.1	-	10.2	10	*1	No
	2450	Right	*1	*1	*1	10.1	-	10.2	10	*1	Yes
	2450	Top	*1	*1	*1	10.1	-	10.2	10	*1	No
	2450	Bottom	*1	*1	*1	10.1	-	10.2	10	*1	Yes

*1 Please refer to Appendix D.

Body-Worn SAR (1-g SAR) Test Exclusion as per KDB 447498 D01 - Chain1

Freq. Band	Freq. (MHz)	Test Position	Host-to-Ant Distance (mm)	User-to-Ant Distance (mm)	Min. Test Sep. Distance (mm)	Max. Possible Power				Exclusion Threshold	SAR Required (> 3.0)
						Chain0 (dBm)	Chain1 (dBm)	Total (mW)	rounded (mW)		
Wi-Fi 2.4 GHz (Chain1)	2450	Front	*1	*1	*1	9.5	9.5	17.8	18	*1	Yes
	2450	Front-Right	*1	*1	*1	9.5	9.5	17.8	18	*1	Yes
	2450	Back	*1	*1	*1	9.5	9.5	17.8	18	*1	No
	2450	Left	*1	*1	*1	9.5	9.5	17.8	18	*1	No
	2450	Right	*1	*1	*1	9.5	9.5	17.8	18	*1	No
	2450	Top	*1	*1	*1	9.5	9.5	17.8	18	*1	No
	2450	Bottom	*1	*1	*1	9.5	9.5	17.8	18	*1	No
Wi-Fi 5 GHz (Chain1)	5800	Front	*1	*1	*1	11.5	11.5	28.3	28	*1	Yes
	5800	Front-Right	*1	*1	*1	11.5	11.5	28.3	28	*1	Yes
	5800	Back	*1	*1	*1	11.5	11.5	28.3	28	*1	No
	5800	Left	*1	*1	*1	11.5	11.5	28.3	28	*1	Yes
	5800	Right	*1	*1	*1	11.5	11.5	28.3	28	*1	No
	5800	Top-Left	*1	*1	*1	11.5	11.5	28.3	28	*1	No
	5800	Top	*1	*1	*1	11.5	11.5	28.3	28	*1	No
	5800	Bottom	*1	*1	*1	11.5	11.5	28.3	28	*1	Yes

*1 Please refer to Appendix D.

1.8. Test Specification, Methods and Procedures

Test Specification

☒ FCC 47 CFR 2.1093 Radiofrequency radiation exposure evaluation: portable devices

Test Methods

☒ 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

☒ KDB 248227 D01 v02r02 SAR Guidance for IEEE 802.11 (Wi-Fi) Transmitters

☒ KDB 447498 D01 v06 Mobile and Portable Devices RF Exposure Procedures and Equipment Authorization Policies

☐ KDB 447498 D02 v02r01 SAR Measurement Procedures for USB Dongle Transmitters

☐ KDB 615223 D01 v01r01 802.16e/WiMax SAR Measurement Guidance

☐ KDB 616217 D04 v01r02 SAR Evaluation Considerations for Laptop, Notebook, Netbook and Tablet Computers

☐ KDB 643646 D01 v01r03 SAR Test Reduction Considerations for Occupational PTT Radios

☐ KDB 648474 D03 v01r04 Evaluation and Approval Considerations for Handsets with Specific Wireless Charging Battery Covers

☐ KDB 648474 D04 v01r03 SAR Evaluation Considerations for Wireless Handsets

☒ KDB 865664 D01 v01r04 SAR Measurement Requirements for 100 MHz to 6 GHz

☐ KDB 941225 D01 v03r01 3G SAR Measurement Procedures

☐ KDB 941225 D05 v02r05 SAR Evaluation Considerations for LTE Devices

☐ KDB 941225 D06 v02r01 SAR Evaluation Procedures for Portable Devices with Wireless Router Capabilities

☐ KDB 941225 D07 v01r02 SAR Evaluation Procedures for UMPC Mini-Tablet Devices

Test Procedures

The SAR tests were performed according to the procedures of Sony Global Manufacturing & Operations Corporation EMC/RF Test Laboratory, the Document No. NV3-2 and NV3-16, available upon request.

☒ No deviation from the procedures

☐ Deviation from the procedures

☐ _____

References

- [1] ICNIRP. Guidelines for limiting exposure to time-varying electric, magnetic, and electromagnetic fields (up to 300 GHz). Health Physics 74(4): 494-522, 1998.
- [2] American National Standards Institute (ANSI), "Safety Levels with Respect to Human Exposure to Radio Frequency Electromagnetic Fields, 3 kHz to 300 GHz," ANSI/IEEE C95.1-1992.
- [3] Health Canada, "Limits of Human Exposure to Radiofrequency Electromagnetic Energy in the Frequency Range from 3 kHz to 300 GHz," Safety Code 6 (2009).
- [4] European Council Recommendation 1999/519/EC of 12 July 1999 on the limitation of exposure of the general public to electromagnetic fields (0 Hz to 300 GHz) (Official Journal L 199 of 30 July 1999).
- [5] REDCA Technical Guidance Note 20 (TGN 20), SAR Testing and Assessment Guidance, Version 5.0, July 2017.
- [6] Australian Communications and Media Authority (ACMA), Radiocommunications (Electromagnetic Radiation - Human Exposure) Standard 2014.
- [7] TCB Workshop April 2019; RF Exposure Procedures (Tissue Simulating Liquids)
- [8] Schmid & Partner Engineering AG (SPEAG), DASY52 System Handbook, April 2014.
- [9] Schmid & Partner Engineering AG (SPEAG), Safety Data Sheet, Doc No 772-SLAAx0yy-J, June 14, 2013.
- [10] Schmid & Partner Engineering AG (SPEAG), Safety Data Sheet, Doc No 772-SLAAx1yy-I, October 18, 2013.
- [11] Schmid & Partner Engineering AG (SPEAG), Safety Data Sheet, Doc No 772-SLAAx6yy-H, September 26, 2013.
- [12] Schmid & Partner Engineering AG (SPEAG), Material Safety Data Sheet, Doc No 772-SLAAH502A-D, August 9, 2013.
- [13] Schmid & Partner Engineering AG (SPEAG), Material Safety Data Sheet, Doc No 772-SLAAx4yy-J, August 9, 2013.
- [14] Schmid & Partner Engineering AG (SPEAG), Material Safety Data Sheet, Doc No 772-SLAAHxU16B-C, June 9, 2015.

1.9. Test Facilities and Accreditation

Test Facilities

Test Facility Name	: Sony Global Manufacturing & Operations Corporation EMC/RF Test Laboratory, Main Lab.
Address	: 8-4 Shiomi Kisarazu-shi Chiba-ken, 292-0834, Japan
Shielded Room Used	: ☒ 4 th Site Shielded Room 2 ☐ 4 th Site Shielded Room 3

A2LA Accreditation

Certificate No.	: 3203.01
Expiration	: October 31, 2021

2. Test Set-up

2.1. Test Equipment and Measurement Software Lists

Table 2-1 Test Equipment List

Used	Control No.	Equipment Description	Model No.	Serial No.	Manufacturer	Cal. Int.	Last Cal.	Note(s)
☒	W0128	Robot	TX60 L	F14/5VR2B1/A/01	Staubli	N/A	N/A *1	
☐	W0124	Robot	RX60B L	F04/5Z71A1/A/03	Staubli	N/A	N/A *1	
☒	WA0002	E-Field Probe	EX3DV4	3921	SPEAG	1Y	20.10.21	
☐	WA0052	E-Field Probe	EX3DV4	7452	SPEAG	1Y	20.03.13	
☐	WA0031	E-Field Probe	EX3DV4	3745	SPEAG	1Y	20.06.22	
☐	W0095	Data Acquisition Electronics	DAE4	482	SPEAG	1Y	20.09.10	
☒	W0096	Data Acquisition Electronics	DAE4	610	SPEAG	1Y	20.01.10	
☐	W0081	Twin SAM Phantom	Twin SAM	TP-1441	SPEAG	N/A	N/A *1	
☐	W0082	Twin SAM Phantom	Twin SAM	TP-1325	SPEAG	N/A	N/A *1	
☐	W0126	Twin SAM Phantom	Twin SAM	TP-1851	SPEAG	N/A	N/A *1	
☒	W0127	Twin SAM Phantom	Twin SAM	TP-1852	SPEAG	N/A	N/A *1	
☐	W0119	ELI Phantom	ELI V5.0	1259	SPEAG	N/A	N/A *1	
☒	WA0026	System Validation Dipole	D2450V2	936	SPEAG	1Y	20.06.12	
☒	WA0028	System Validation Dipole	D5GHzV2	1183	SPEAG	1Y	20.06.17	
☒	W0121	Vector Reflectometer	DAKS_VN AR140	0111013	Copper Mountain Technologies	1Y	20.06.20	
☒	WA0029	Dielectric Probe	DAKS-3.5	1034	SPEAG	1Y	20.07.15	
☒	M0913	Signal Generator	SMR40	100360	Rohde & Schwarz	1Y	20.10.03	
☒	W0122	Power Amp	CGA020M 602-2633R	B40550	R&K	N/A	N/A *1	
☒	W0104	Power Sensor	U2021XA	MY54040006	Agilent	1Y	20.10.03	
☒	W0105	Power Sensor	U2021XA	MY54080005	Agilent	1Y	20.10.03	
☒	W0120	Directional Coupler	4226-20	-	narda	1Y	20.10.03	
☒	W0117	Attenuator	8493B 3 dB	MY39260857	Agilent	1Y	20.10.03	
☒	W0118	Attenuator	AT-110 10 dB	932968	Hirose	1Y	20.10.03	
☒	W0148	Attenuator	AT-103 3 dB	980711	Hirose	1Y	20.10.03	
☐	WC0022	RF Cable	SUCOFLE X 106	503094/6	HUBER+SUHNER	1Y	20.10.03	
☒	WC0017	RF Cable	SUCOFLE X 104	253269/4	HUBER+SUHNER	1Y	20.10.03	
☒	WC0024	RF Cable	SUCOFLE X 126E	MY1150/26E	HUBER+SUHNER	1Y	20.10.03	
☒	WC0025	RF Cable	SUCOFLE X 104	MY37246/4	HUBER+SUHNER	1Y	20.10.03	
☒	WC0021	RF Cable	SUCOFLE X 106	503095/6	HUBER+SUHNER	1Y	20.10.03	
☐	M5061	Thermometer	0560 6220	39515471/801	testo	1Y	20.04.17	
☐	M5276	Thermometer	608-H2	39520032/904	testo	1Y	20.07.15	
☐	M5152	Thermometer	608-H2	41475965	testo	1Y	20.11.05	
☒	M5292	Thermometer	608-H2	41476142	testo	1Y	20.10.02	
☐	W0112	Water Thermometer	735-1	02736130	testo	1Y	20.09.08	
☒	W0113	Water Thermometer	735-1	02788580	testo	1Y	20.07.13	
☐	W0116	Water Thermometer	735-1	02788596	testo	1Y	20.08.06	

Note(s):

* The calibration is valid until the end of the expiration month.

*1 In-house verification is conducted periodically.

Table 2-2 Measurement Software List

Used	Control No.	Software Description	Model No.	Ver.	Manufacturer
☐	SW-0401	SAR measurement software	DASY52	52.10.4.1527	SPEAG
☐	SW-0402	SAR post-processing software	SEMCAD X	14.6.14.7483	SPEAG
☒	SW-0403	Dielectric measurement software	DAK	2.6.0.5	SPEAG
☒	SW-0404	SAR measurement software	DASY52	52.10.4.1527	SPEAG
☒	SW-0405	SAR post-processing software	SEMCAD X	14.6.14.7483	SPEAG
☐	SW-0406	SAR measurement spreadsheet	-	1.00	Main Lab.
☒	SW-0314	Power measurement software	N1918A	R03.09.00	Agilent

2.2. Measurement System Description

The DASY5 system for performing compliance tests consists of the following items:

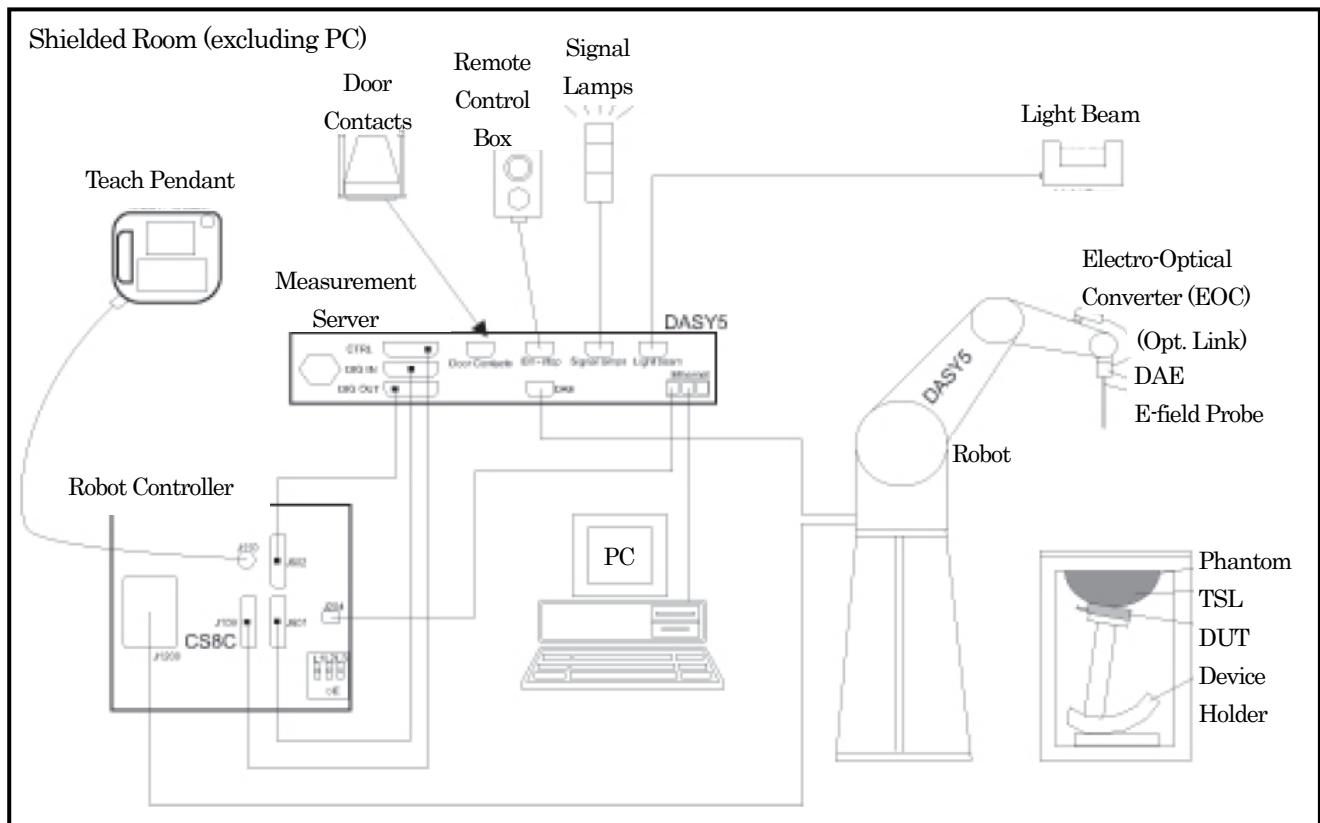


Figure 2-1 Measurement System Description

- A standard high precision 6-axis robot (Staubli TX/RX family) 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. 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 Win7 professional operating system and the DASY5 software.
- Remote control and teach pendant as well as additional circuitry for robot safety such as warning lamps, etc.
- The phantoms (the Twin SAM and/or ELI phantoms) enabling the testing of handheld (left-hand and right-hand) and/or body-mounted usage.
- The device holders for handheld mobile phones and/or larger devices (e.g., laptops, cameras, etc.).
- Tissue simulating liquid (TSL) mixed according to the given recipes.
- System Validation Dipole Kits allowing to validate the proper functioning of the system.

2.3. Measurement System Main Components

Robot (Positioner)

	Shielded Room 2	Shielded Room 3
Manufacturer	Staubli SA	
Model No.	TX60L	RX60BL
Number of Axis	6	
Reach at Wrist	920 mm	865 mm
Repeatability	+/- 0.03 mm	+/- 0.033 mm
Nominal Load Capacity	2 kg	1.5 kg
Maximum Load Capacity	5 kg	2.5 kg
Control Unit	CS8c	CS7m
Weight	52.2 kg	45 kg

E-Field Probe

Manufacturer	Schmid & Partner Engineering AG (SPEAG)
Model No.	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 (30 MHz to 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 μ W/g to > 100 mW/g Linearity: ± 0.2 dB (noise: typically < 1 μ W/g)
Dimensions	Overall length: 337 mm (Tip length: 20 mm) Tip diameter: 2.5 mm (Body diameter: 12 mm) Typical distance from probe tip to dipole centers: 1 mm

Data Acquisition Electronics (DAE)

Manufacturer	Schmid & Partner Engineering AG (SPEAG)
Model No.	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: 4 mV, 400 mV)
Input Offset Voltage	< 5 μ V (with auto zero)
Input Resistance	200 M Ω
Input Bias Current	< 50 fA
Battery Power	> 10 hours of operation (with two 9.6 V NiMH accus)
Dimensions (L x W x H)	60 x 60 x 68 mm

DASY5 Measurement Server

Manufacturer	Schmid & Partner Engineering AG (SPEAG)
Model No.	DASY5 Measurement Server
CPU	Intel ULV Celeron 400 MHz
Chip-Disk	128 MB
RAM	128 MB
Construction	16 Bit A/D converter for surface detection system Vacuum Fluorescent Display
I/O Interface	Robot Interface / Serial link to DAE (with watchdog supervision) / Door contact port / Emergency stop port (to connect the remote control) / Signal lamps port / Light beam port / Three Ethernet connection ports (for PC, Control Unit, and future applications) / Two USB 2.0 ports (for installation and advanced troubleshooting by SPEAG) / Two serial links (for future applications) / Expansion port (for future applications)
Dimensions (L x W x H)	440 x 241 x 89 mm

Phantoms (Twin SAM Phantom)

Manufacturer	Schmid & Partner Engineering AG (SPEAG)
Model No.	Twin SAM
Description	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. Twin SAM V5.0 has the same shell geometry and is manufactured from the same material as Twin SAM V4.0, but has reinforced top structure.
Material	Vinylester, glass fiber reinforced (VE-GF)
Liquid Compatibility	Compatible with all SPEAG tissue simulating liquids (incl. DGBE type)
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
Wooden Support	SPEAG standard phantom table

Phantoms (ELI Phantom)

Manufacturer	Schmid & Partner Engineering AG (SPEAG)
Model No.	ELI V5.0
Description	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. ELI V5.0 has the same shell geometry and is manufactured from the same material as ELI4, but has reinforced top structure.
Material	Vinylester, glass fiber reinforced (VE-GF)
Liquid Compatibility	Compatible with all SPEAG tissue simulating liquids (incl. DGBE type)
Shell Thickness	2.0 ± 0.2 mm (bottom plate)
Dimensions	Major axis: 600 mm Minor axis: 400 mm
Filling Volume	Approx. 30 liters
Wooden Support	SPEAG standard phantom table

Device Holder (Mounting Device for Hand-Held Transmitters)

Manufacturer	Schmid & Partner Engineering AG (SPEAG)
Model No.	MD4HHTV5
Description	In combination with the Twin SAM 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).
Material	Polyoxymethylene (POM)

Device Holder (Mounting Device Adaptor for Ultra Wide Transmitters)

Manufacturer	Schmid & Partner Engineering AG (SPEAG)
Model No.	MDA4WTV5
Description	An 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 140mm.
Material	Polyoxymethylene (POM)

Device Holder (Mounting Device Adaptor for Laptops)

Manufacturer	Schmid & Partner Engineering AG (SPEAG)
Model No.	MDA4LAP
Description	A simple but effective and easy-to-use extension for the Mounting Device; facilitates testing of larger devices according to IEC 62209-2 (e.g., laptops, cameras, etc.); lightweight and fits easily on the upper part of the Mounting Device in place of the phone positioner. The extension is fully compatible with the Twin SAM, ELI Phantoms.
Material	Polyoxymethylene (POM), PET-G, Foam

System Validation Dipole Kits

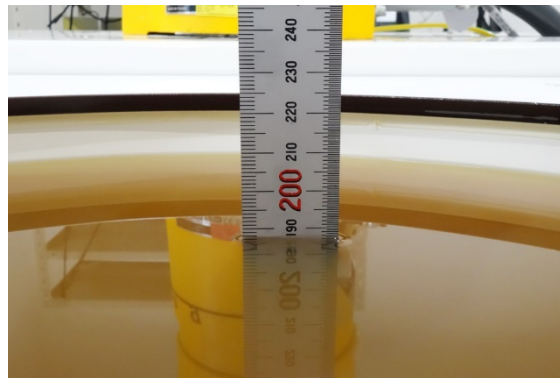
Manufacturer	Schmid & Partner Engineering AG (SPEAG)		
Model No.	D-Series		
Construction	Symmetrical dipole with 1/4 balun Enables measurement of feedpoint impedance with NWA Matched for use near flat phantoms filled with tissue simulating solutions		
Frequency	2450, 5100 to 5800 MHz		
Return Loss	> 20 dB at specified validation position		
Power Capability	> 100 W ($f < 1$ GHz); > 40 W ($f > 1$ GHz)		
Accessories	Distance holder, tripod adaptor, tripod		
Dimensions	Product	Dipole length	Overall height
	D2450V2	52.0 mm	290.0 mm
	D5GHzV2	20.6 mm	300.0 mm

2.4. Tissue Simulating Liquids

Recipes for tissue simulating liquids manufactured by SPEAG

Ingredients (% by weight)	Frequency (MHz)					
	1900 to 3800		3500 to 5800		600 to 6000	
Used	☐	☐	☐	☐	☒	☐
Tissue Simulating Liquids	HBBL 1900- 3800 V3	MBBL 1900- 3800 V3	HBBL 3500- 5800 V5	MBBL 3500- 5800 V5	HBBL 600- 6000 V6	MBBL 600- 6000 V6
Tissue Type	Head	Body	Head	Body	Head	Body
H ₂ O	50 – 73 %		50 – 65 %		60 – 80 %	
Non-ionic detergents	25 – 50 %		–		–	
NaCl	0 – 2 %		0 – 1.5 %		–	
Preventol-D7	0.05 – 0.1 %		–		–	
Ethanediol	–		–		1.0 – 4.9 %	
Sodium Petroleum Sulfonate	–		–		< 2.9 %	
Hexylene Glycol	–		–		< 2.9 %	
Alkoxylated Alcohol	–		–		< 2.0 %	
Mineral Oil	–		10 – 30 %		< 20 %	
Emulsifiers	–		8 – 25 %		20 – 40 %	

For the SAR measurement, the phantom must be filled with tissue simulating liquid to a depth of at least 15 cm.



HBBL600-6000 V6

Figure 2-2

Photos: Liquid Depth (at the center of the flat phantom)

2.5. SAR Measurement

Step 1: Power Reference Measurement

Before an area scan and after the zoom scan, single point SAR measurements are performed at defined locations to estimate the SAR measurement drift due to device output power variations.

Step 2: Area Scan

An area scan is performed according to the requirements in Table 2-3.

Step 3: Zoom Scan

A zoom scan is performed according to the requirements in Table 2-3.

Step 4: Power Drift Measurement

Before an area scan and after the zoom scan, single point SAR measurements are performed at defined locations to estimate the SAR measurement drift due to device output power variations.

Table 2-3 Area Scan and Zoom Scan Parameters

			DUT Transmit Frequency being Tested	
			≤ 3 GHz	> 3 GHz
Maximum distance from closest measurement point (geometric center of probe sensors) to phantom surface			5 ± 1 mm	$\frac{1}{2} \delta \ln(2) \pm 0.5$ mm
Maximum probe angle from probe axis to phantom surface normal at the measurement location			$30^\circ \pm 1^\circ$	$20^\circ \pm 1^\circ$
Maximum area scan spatial resolution: $\Delta x_{\text{Area}}, \Delta y_{\text{Area}}$			≤ 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 $\leq$ the corresponding x or y dimension of the test device with at least one measurement point on the test device.	
Maximum zoom scan spatial resolution: $\Delta x_{\text{Zoom}}, \Delta y_{\text{Zoom}}$			≤ 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: $\Delta z_{\text{Zoom}}(n)$		≤ 5 mm	3 – 4 GHz: ≤ 4 mm 4 – 5 GHz: ≤ 3 mm 5 – 6 GHz: ≤ 2 mm
	graded grid	$\Delta z_{\text{Zoom}}(1)$: between 1st two points closest to phantom surface	≤ 4 mm	3 – 4 GHz: ≤ 3 mm 4 – 5 GHz: ≤ 2.5 mm 5 – 6 GHz: ≤ 2 mm
		$\Delta z_{\text{Zoom}}(n>1)$: between subsequent points	$\leq 1.5 \Delta z_{\text{Zoom}}(n-1)$	
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.

2.6. Measurement Uncertainty

☒ Table 2-4 DASY5 Uncertainty Budget for SAR Tests

According to IEEE Std 1528-2013 (0.3GHz to 3GHz range)								
Input quantity	Uncertainty of Xi			Ci		Ciu(Xi)		Vi Veff
	Xi	Prob. Dist.	Div.	1g [-]	10g [-]	1g	10g	
Measurement System								
Probe Calibration (k=1)	±6.0%	N	1.00	1.00	1.00	±6.0%	±6.0%	∞
Axial Isotropy	±4.7%	R	1.73	0.70	0.70	±1.9%	±1.9%	∞
Hemispherical Isotropy	±9.7%	R	1.73	0.70	0.70	±3.9%	±3.9%	∞
Boundary Effects	±1.0%	R	1.73	1.00	1.00	±0.6%	±0.6%	∞
Linearity	±4.7%	R	1.73	1.00	1.00	±2.7%	±2.7%	∞
System Detection Limits	±0.3%	R	1.73	1.00	1.00	±0.1%	±0.1%	∞
Modulation Response	±2.4%	R	1.73	1.00	1.00	±1.4%	±1.4%	∞
Readout Electronics	±0.3%	N	1.00	1.00	1.00	±0.3%	±0.3%	∞
Response Time	±0.8%	R	1.73	1.00	1.00	±0.5%	±0.5%	∞
Integration Time	±2.6%	R	1.73	1.00	1.00	±1.5%	±1.5%	∞
RF Ambient Noise	±0.2%	R	1.73	1.00	1.00	±0.1%	±0.1%	∞
RF Ambient Reflections	±0.0%	R	1.73	1.00	1.00	±0.0%	±0.0%	∞
Probe Positioner	±0.4%	R	1.73	1.00	1.00	±0.2%	±0.2%	∞
Probe Positioning	±2.9%	R	1.73	1.00	1.00	±1.7%	±1.7%	∞
Max. SAR Eval.	±2.0%	R	1.73	1.00	1.00	±1.2%	±1.2%	∞
Test Sample Related								
Device Positioning	±1.8%	N	1.00	1.00	1.00	±1.8%	±1.8%	14
Device Holder	±3.6%	N	1.00	1.00	1.00	±3.6%	±3.6%	5
Power Drift	±5.0%	R	1.73	1.00	1.00	±2.9%	±2.9%	∞
Power Scaling	±0.0%	R	1.73	1.00	1.00	±0.0%	±0.0%	∞
Phantom and Setup								
Phantom Uncertainty	±7.2%	R	1.73	1.00	1.00	±4.2%	±4.2%	∞
SAR Correction	±1.9%	R	1.73	1.00	0.84	±1.1%	±0.9%	∞
Liquid Conductivity (mea.)	±2.5%	R	1.73	0.78	0.71	±1.1%	±1.0%	∞
Liquid Permittivity (mea.)	±2.5%	R	1.73	0.23	0.26	±0.3%	±0.4%	∞
Temp. Unc. - Conductivity	±3.4%	R	1.73	0.78	0.71	±1.5%	±1.4%	∞
Temp. Unc. - Permittivity	±0.4%	R	1.73	0.23	0.26	±0.1%	±0.1%	∞
Combined Standard Uncertainty						±10.9%	±10.8%	405
Expanded Uncertainty (95% conf. interval)			k=2			±21.7%	±21.6%	

☒ Table 2-5 DASY5 Uncertainty Budget for SAR Tests

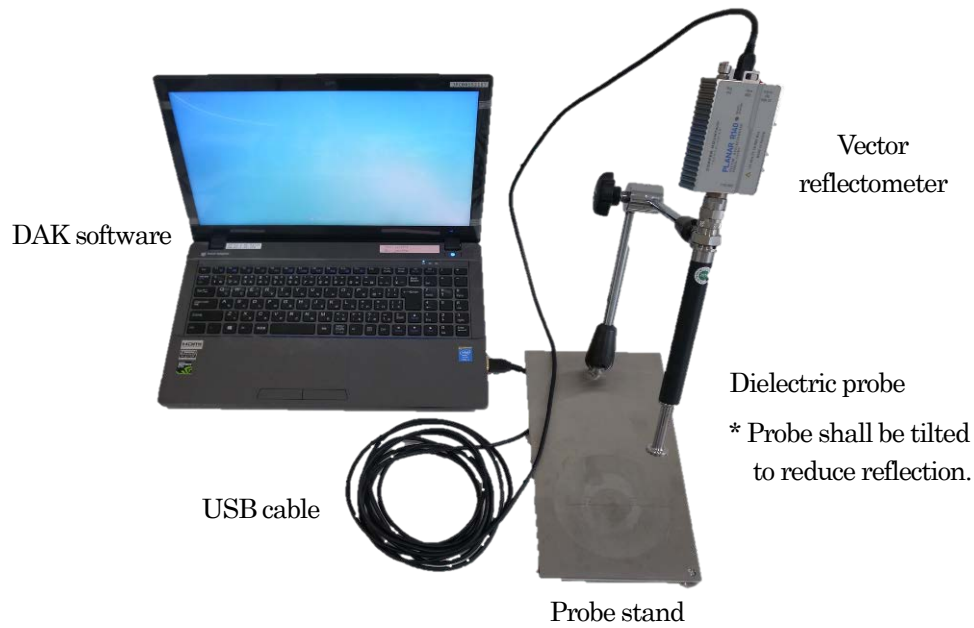
According to IEEE Std 1528-2013 (3GHz to 6GHz range)								
Input quantity	Uncertainty of Xi			Ci		Ciu(Xi)		Vi Veff
	Xi	Prob. Dist.	Div.	1g [-]	10g [-]	1g	10g	
Measurement System								
Probe Calibration (k=1)	±6.55%	N	1.00	1.00	1.00	±6.6%	±6.6%	∞
Axial Isotropy	±4.7%	R	1.73	0.70	0.70	±1.9%	±1.9%	∞
Hemispherical Isotropy	±9.7%	R	1.73	0.70	0.70	±3.9%	±3.9%	∞
Boundary Effects	±2.0%	R	1.73	1.00	1.00	±1.2%	±1.2%	∞
Linearity	±4.7%	R	1.73	1.00	1.00	±2.7%	±2.7%	∞
System Detection Limits	±0.3%	R	1.73	1.00	1.00	±0.1%	±0.1%	∞
Modulation Response	±2.4%	R	1.73	1.00	1.00	±1.4%	±1.4%	∞
Readout Electronics	±0.3%	N	1.00	1.00	1.00	±0.3%	±0.3%	∞
Response Time	±0.8%	R	1.73	1.00	1.00	±0.5%	±0.5%	∞
Integration Time	±2.6%	R	1.73	1.00	1.00	±1.5%	±1.5%	∞
RF Ambient Noise	±0.2%	R	1.73	1.00	1.00	±0.1%	±0.1%	∞
RF Ambient Reflections	±0.0%	R	1.73	1.00	1.00	±0.0%	±0.0%	∞
Probe Positioner	±0.8%	R	1.73	1.00	1.00	±0.5%	±0.5%	∞
Probe Positioning	±6.7%	R	1.73	1.00	1.00	±3.9%	±3.9%	∞
Max. SAR Eval.	±4.0%	R	1.73	1.00	1.00	±2.3%	±2.3%	∞
Test Sample Related								
Device Positioning	±1.8%	N	1.00	1.00	1.00	±1.8%	±1.8%	14
Device Holder	±3.6%	N	1.00	1.00	1.00	±3.6%	±3.6%	5
Power Drift	±5.0%	R	1.73	1.00	1.00	±2.9%	±2.9%	∞
Power Scaling	±0.0%	R	1.73	1.00	1.00	±0.0%	±0.0%	∞
Phantom and Setup								
Phantom Uncertainty	±7.6%	R	1.73	1.00	1.00	±4.4%	±4.4%	∞
SAR Correction	±1.9%	R	1.73	1.00	0.84	±1.1%	±0.9%	∞
Liquid Conductivity (mea.)	±2.5%	R	1.73	0.78	0.71	±1.1%	±1.0%	∞
Liquid Permittivity (mea.)	±2.5%	R	1.73	0.23	0.26	±0.3%	±0.4%	∞
Temp. Unc. - Conductivity	±3.4%	R	1.73	0.78	0.71	±1.5%	±1.4%	∞
Temp. Unc. - Permittivity	±0.4%	R	1.73	0.23	0.26	±0.1%	±0.1%	∞
Combined Standard Uncertainty						±12.0%	±12.0%	605
Expanded Uncertainty (95% conf. interval)			k=2			±24.0%	±23.9%	

☒ Table 2-6 DASY5 Uncertainty Budget for SAR System Check

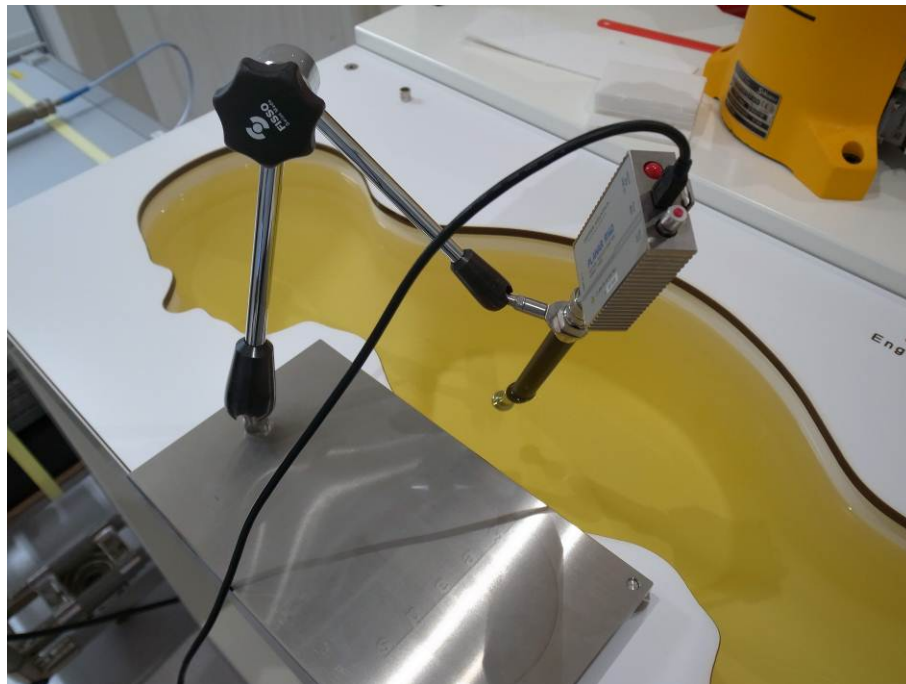
According to IEEE Std 1528-2013 (0.3GHz to 6GHz range)								
Input quantity	Uncertainty of Xi			Ci		Ciu(Xi)		Vi Veff
	Xi	Prob. Dist.	Div.	1g [-]	10g [-]	1g	10g	
Measurement System								
Probe Calibration (k=1)	±6.55%	N	1.00	1.00	1.00	±6.6%	±6.6%	∞
Axial Isotropy	±4.7%	R	1.73	0.70	0.70	±1.9%	±1.9%	∞
Hemispherical Isotropy	±9.7%	R	1.73	0.70	0.70	±3.9%	±3.9%	∞
Boundary Effects	±2.0%	R	1.73	1.00	1.00	±1.2%	±1.2%	∞
Linearity	±4.7%	R	1.73	1.00	1.00	±2.7%	±2.7%	∞
System Detection Limits	±0.3%	R	1.73	1.00	1.00	±0.1%	±0.1%	∞
Modulation Response	±0.0%	R	1.73	1.00	1.00	±0.0%	±0.0%	∞
Readout Electronics	±0.3%	N	1.00	1.00	1.00	±0.3%	±0.3%	∞
Response Time	±0.0%	R	1.73	1.00	1.00	±0.0%	±0.0%	∞
Integration Time	±0.0%	R	1.73	1.00	1.00	±0.0%	±0.0%	∞
RF Ambient Noise	±1.0%	R	1.73	1.00	1.00	±0.6%	±0.6%	∞
RF Ambient Reflections	±1.0%	R	1.73	1.00	1.00	±0.6%	±0.6%	∞
Probe Positioner	±0.8%	R	1.73	1.00	1.00	±0.5%	±0.5%	∞
Probe Positioning	±6.7%	R	1.73	1.00	1.00	±3.9%	±3.9%	∞
Max. SAR Eval.	±4.0%	R	1.73	1.00	1.00	±2.3%	±2.3%	∞
Dipole Related								
Deviation of exp. Dipole	±5.5%	R	1.73	1.00	1.00	±3.2%	±3.2%	∞
Dipole Axis to Liquid Dist.	±2.0%	R	1.73	1.00	1.00	±1.2%	±1.2%	∞
Inoput Power & SAR Drift	±3.4%	R	1.73	1.00	1.00	±2.0%	±2.0%	∞
Phantom and Setup								
Phantom Uncertainty	±7.6%	R	1.73	1.00	1.00	±4.4%	±4.4%	∞
SAR Correction	±1.9%	R	1.73	1.00	0.84	±1.1%	±0.9%	∞
Liquid Conductivity (mea.)	±2.5%	N	1.00	0.78	0.71	±2.0%	±1.8%	∞
Liquid Permittivity (mea.)	±2.5%	N	1.00	0.23	0.26	±0.6%	±0.7%	∞
Temp. Unc. - Conductivity	±3.4%	R	1.73	0.78	0.71	±1.5%	±1.4%	∞
Temp. Unc. - Permittivity	±0.4%	R	1.73	0.23	0.26	±0.1%	±0.1%	∞
Combined Standard Uncertainty						±11.6%	±11.5%	
Expanded Uncertainty (95% conf. interval)			k=2			±23.1%	±23.0%	

2.7. Dielectric Parameter Measurement of Tissue Simulating Liquids

The dielectric properties of the tissue simulating liquids used were verified within 24 hours before the SAR measurement.



(a) Dielectric Parameter Measurement System



(b) Example Photo: Dielectric Parameter Measurement

Figure 2-3

Dielectric Parameter Measurement Set-up

*1 Target values are linearly interpolated between the values defined in KDB 865664 D01, when necessary.

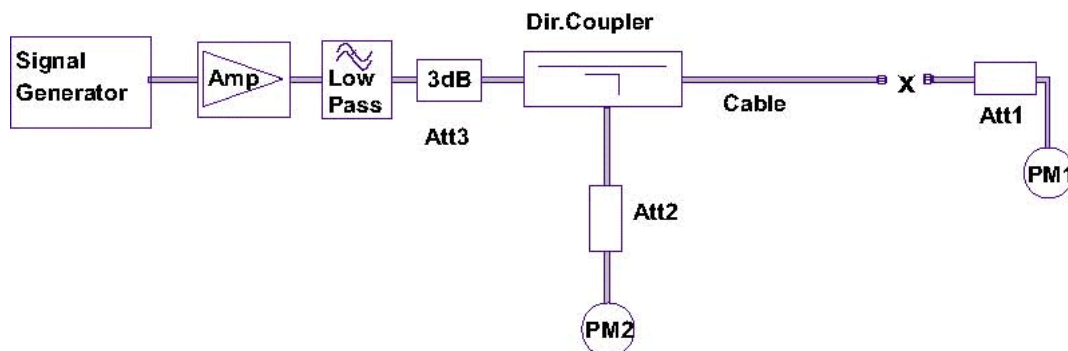
*2 The deviation of measured values from target values must be within +/-5 %.

4th Site Shielded Room 2

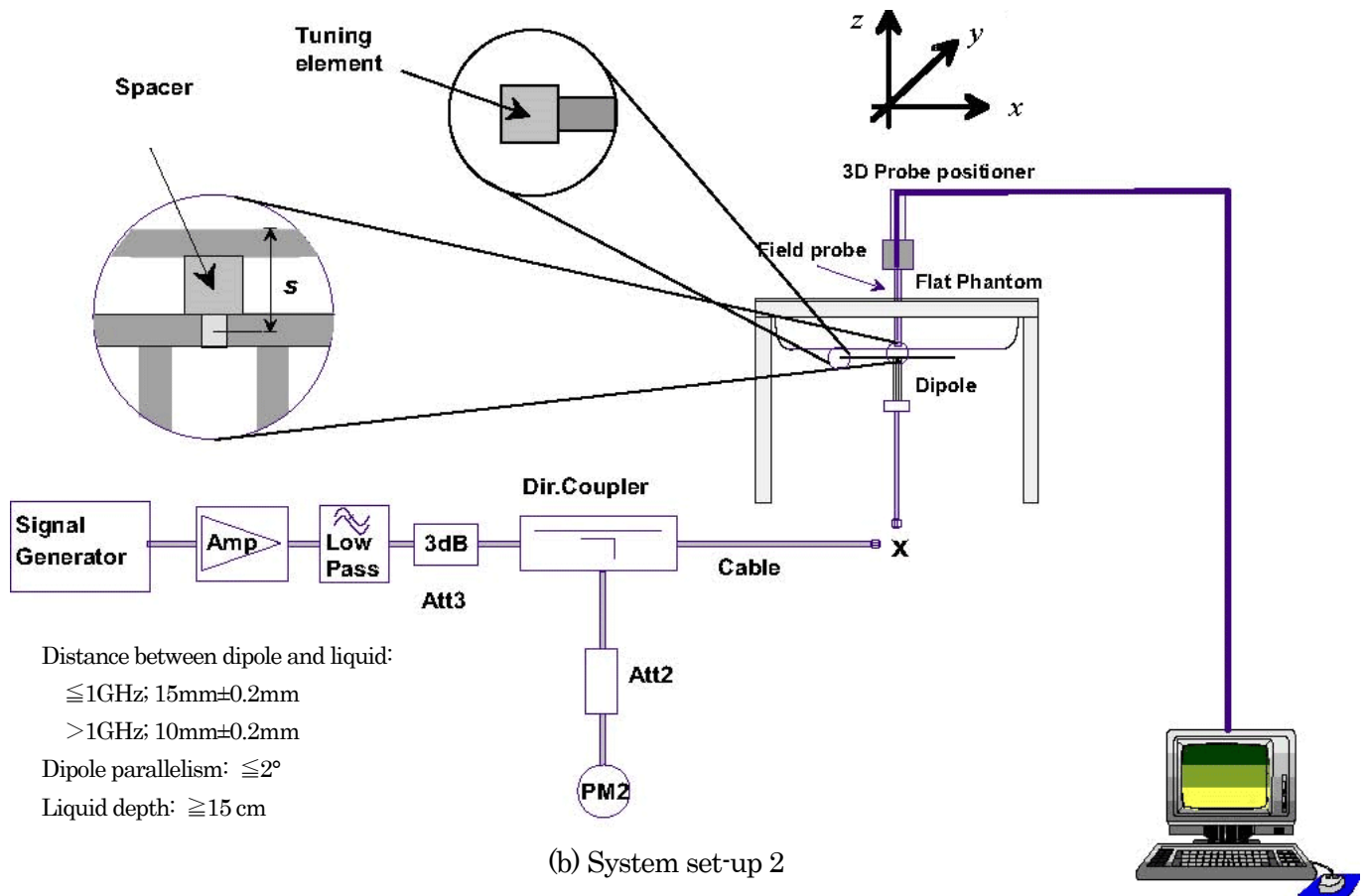
TSL	Freq. (MHz)	Param.	Target *1	Meas.	Dev. (%) *2	Date	Amb. Temp. (deg. C)	Rel. Hum. (%RH)	Liquid Temp. (deg. C)	Note(s)
HBBL 600-6000V6	2402	ϵ_r	39.29	40.26	2.47	2020/11/09	21.8	44.3	21.1	
		σ (S/m)	1.76	1.80	2.27					
	2412	ϵ_r	39.27	40.12	2.16	2020/11/10	21.9	46.9	20.6	
		σ (S/m)	1.77	1.79	1.13					
	2437	ϵ_r	39.22	40.08	2.19	2020/11/10	21.9	46.9	20.6	
		σ (S/m)	1.79	1.81	1.12					
	2440	ϵ_r	39.22	40.21	2.52	2020/11/09	21.8	44.3	21.1	
		σ (S/m)	1.79	1.83	2.23					
	2462	ϵ_r	39.18	40.04	2.19	2020/11/10	21.9	46.9	20.6	
		σ (S/m)	1.81	1.83	1.10					
	2480	ϵ_r	39.16	40.13	2.48	2020/11/09	21.8	44.3	21.1	
		σ (S/m)	1.83	1.87	2.19					
	5290	ϵ_r	35.88	35.15	-2.03	2020/11/04	20.4	44.7	20.3	
		σ (S/m)	4.75	4.77	0.42					
	5530	ϵ_r	35.61	34.95	-1.85	2020/11/11	22.3	43.7	20.6	
		σ (S/m)	4.99	4.97	-0.40					
	5775	ϵ_r	35.33	34.29	-2.94	2020/11/06	22.4	54.3	20.6	
		σ (S/m)	5.24	5.32	1.53					

2.8. System Check Measurement

The system check was performed before each series of SAR measurements using the same probe calibration point and tissue-equivalent medium.



(a) System set-up 1



(b) System set-up 2

Figure 2-4

System Check Measurement Set-up



D2450V2



D5GHzV2

Figure 2-4

System Check Measurement Set-up (continued)

*1 The normalized values (1 W) were calculated by normalizing the measured values to 1-W forward input power.

*2 The target values (1 W) are defined in IEEE Std 1528 and/or the calibration certificate of system validation dipoles used.

*3 The deviation of normalized values from target values must be within +/-10 %.

4th Site Shielded Room 2

System Validation Dipole	Freq. (MHz)	Param.	250 mW-Meas. (W/kg)	1 W-Norm. (W/kg) *1	1 W-Target (W/kg) *2	Dev. (%) *3	Date	Amb. Temp. (deg. C)	Rel. Hum. (%RH)	Liquid Temp. (deg. C)	Note(s)
D2450V2	2450	1-g SAR	14.00	56.00	52.10	7.49	2020/11/09	22.2	44.0	21.0	
		10-g SAR	6.51	26.04	24.00	8.50					
D2450V2	2450	1-g SAR	13.60	54.40	52.10	4.41	2020/11/10	21.7	43.2	20.5	
		10-g SAR	6.31	25.24	24.00	5.17					
System Validation Dipole	Freq. (MHz)	Param.	100 mW-Meas. (W/kg)	1 W-Norm. (W/kg) *1	1 W-Target (W/kg) *2	Dev. (%) *3	Date	Amb. Temp. (deg. C)	Rel. Hum. (%RH)	Liquid Temp. (deg. C)	Note(s)
D5GHzV2	5300	1-g SAR	8.48	84.80	81.80	3.67	2020/11/04	20.8	44.1	20.3	
		10-g SAR	2.41	24.10	23.20	3.88					
D5GHzV2	5600	1-g SAR	8.69	86.90	85.30	1.88	2020/11/11	22.3	38.6	20.6	
		10-g SAR	2.46	24.60	24.00	2.50					
D5GHzV2	5800	1-g SAR	8.40	84.00	81.60	2.94	2020/11/06	22.5	53.5	20.7	
		10-g SAR	2.37	23.70	22.80	3.95					

3. Conducted Power Measurements

☒ <The Initial Test Configuration Procedures for Wi-Fi>

According to KDB 248227 D01,

the initial test configuration is determined by the 802.11 configuration with the highest maximum output power specified for production units, including tune-up tolerance, in each standalone and aggregated frequency band.

When multiple channel bandwidth configurations in a frequency band have the same specified maximum output power, the initial test configuration is determined by applying the following steps sequentially.

- 1) The largest channel bandwidth configuration is selected among the multiple configurations in a frequency band with the same specified maximum output power.
- 2) If multiple configurations have the same specified maximum output power and largest channel bandwidth, the lowest order modulation among the largest channel bandwidth configurations is selected.
- 3) If multiple configurations have the same specified maximum output power, largest channel bandwidth and lowest order modulation, the lowest data rate configuration among these configurations is selected.
- 4) When multiple transmission modes (802.11a/g/n/ac) have the same specified maximum output power, largest channel bandwidth, lowest order modulation and lowest data rate, the lowest order 802.11 mode is selected; i.e., 802.11a is chosen over 802.11n then 802.11ac or 802.11g is chosen over 802.11n.

3.1. Conducted Power Measurement Results

Wi-Fi 2.4 GHz

Date : 2020/02/25
 Amb. Temp. : 22.2 deg. C

Measured by : Y. Kawano and S. Onotora
 Rel. hum. : 42.1 %RH

IEEE 802.11b

Ch.	Freq. (MHz)	Power Setting	Data Rate (Mbps)	Meas. Frame Averaged Power (dBm)		Meas. Burst Averaged Power (dBm) *1		Max. Poss. Power (dBm)		Within 2 dB of Max. Poss. Power	SAR Tested	Note(s)
				Chain0	Chain1	Chain0	Chain1	Chain0	Chain1			
1	2412	Tune-up	1.0	8.95	8.26	8.95	8.27	9.5	9.5	Yes	Yes	Chain0 Worst Ch
6	2437		1.0	8.68	8.40	8.68	8.40	9.5	9.5	Yes	Yes	
11	2462		1.0	8.83	8.61	8.83	8.61	9.5	9.5	Yes	Yes	Chain1 Worst Ch

IEEE 802.11g (*2)

Ch.	Freq. (MHz)	Power Setting	Data Rate (Mbps)	Meas. Frame Averaged Power (dBm)		Meas. Burst Averaged Power (dBm) *1		Max. Poss. Power (dBm)		Within 2 dB of Max. Poss. Power	SAR Tested	Note(s)
				Chain0	Chain1	Chain0	Chain1	Chain0	Chain1			
1	2412	Tune-up	6.0	8.83	8.15	8.86	8.18	9.5	9.5	Yes	-	Chain0 Worst Ch
6	2437		6.0	8.51	8.25	8.54	8.27	9.5	9.5	Yes	-	
11	2462		6.0	8.65	8.46	8.68	8.49	9.5	9.5	Yes	-	Chain1 Worst Ch

IEEE 802.11n (*2)

Ch.	Freq. (MHz)	Power Setting	Data Rate (MCS)	Meas. Frame Averaged Power (dBm)		Meas. Burst Averaged Power (dBm) *1		Max. Poss. Power (dBm)		Within 2 dB of Max. Poss. Power	SAR Tested	Note(s)
				Chain0	Chain1	Chain0	Chain1	Chain0	Chain1			
1	2412	Tune-up	0	8.56	8.00	8.59	8.04	9.5	9.5	Yes	-	Chain0 Worst Ch
6	2437		0	8.23	8.18	8.26	8.22	9.5	9.5	Yes	-	
11	2462		0	8.44	8.33	8.48	8.36	9.5	9.5	Yes	-	Chain1 Worst Ch

*1 Used for confirmation that the DUT's output power is within +0/-2 dB of the maximum tune-up tolerance limits (max. poss. power), since the maximum tune-up tolerance limits are defined as burst averaged values.

*2 SAR is not required for 802.11g/n channels when the highest reported SAR for DSSS (802.11b) is adjusted by the ratio of OFDM to DSSS specified maximum output power and the adjusted SAR is ≤ 1.2 W/kg or 3 W/kg (1-g or 10-g respectively), according to KDB 248227 D01.

Wi-Fi 5 GHz (W52: U-NII-1 and W53: U-NII-2A Bands)

Date : 2020/02/26 Measured by : S. Onotora and Y. Kawano
 Amb. Temp. : 22.5 deg. C Rel. hum. : 46.4 %RH
 Date : 2020/03/05 Measured by : Y. Kawano
 Amb. Temp. : 22.3 deg. C Rel. hum. : 49.8 %RH

The Initial Test Configuration (ITC) : IEEE 802.11ac (VHT80) in W53 (*2)(*3)

Mode	Freq. Band	Ch.	Freq. (MHz)	Data Rate /MCS	Meas.Frame Averaged Power (dBm)		Meas.Burst Averaged Power (dBm) *1		Max.Poss.Power (dBm)		Within 2 dB of Max. Poss. Power	SAR Tested	Note(s)
					Chain0	Chain1	Chain0	Chain1	Chain0	Chain1			
802.11a	W52	36	5180	6.0 Mbps	11.05	9.98	11.07	10.01	11.5	11.5	Yes	-	
		40	5200	6.0 Mbps	11.06	9.87	11.08	9.89	11.5	11.5	Yes	-	
		44	5220	6.0 Mbps	10.74	9.90	10.76	9.93	11.5	11.5	Yes	-	
		48	5240	6.0 Mbps	10.78	9.80	10.81	9.83	11.5	11.5	Yes	-	
	W53	52	5260	6.0 Mbps	10.80	9.75	10.83	9.77	11.5	11.5	Yes	-	
		56	5280	6.0 Mbps	10.59	9.90	10.61	9.92	11.5	11.5	Yes	-	
		60	5300	6.0 Mbps	10.68	9.89	10.70	9.91	11.5	11.5	Yes	-	
		64	5320	6.0 Mbps	10.69	9.83	10.72	9.86	11.5	11.5	Yes	-	
802.11n (HT20)	W52	36	5180	MCS-0	10.59	10.51	10.62	10.53	11.5	11.5	Yes	-	
		40	5200	MCS-0	10.65	10.43	10.67	10.45	11.5	11.5	Yes	-	
		44	5220	MCS-0	10.23	10.37	10.26	10.39	11.5	11.5	Yes	-	
		48	5240	MCS-0	10.32	10.33	10.35	10.35	11.5	11.5	Yes	-	
	W53	52	5260	MCS-0	10.36	10.30	10.39	10.33	11.5	11.5	Yes	-	
		56	5280	MCS-0	10.17	10.46	10.20	10.49	11.5	11.5	Yes	-	
		60	5300	MCS-0	10.24	10.40	10.26	10.43	11.5	11.5	Yes	-	
		64	5320	MCS-0	10.25	10.35	10.28	10.38	11.5	11.5	Yes	-	
802.11n (HT40)	W52	38	5190	MCS-0	11.10	10.05	11.15	10.09	11.5	11.5	Yes	-	
		46	5230	MCS-0	10.79	10.07	10.84	10.11	11.5	11.5	Yes	-	
	W53	54	5270	MCS-0	10.95	9.92	11.00	9.96	11.5	11.5	Yes	-	
		62	5310	MCS-0	10.81	9.95	10.86	10.00	11.5	11.5	Yes	-	
802.11ac (VHT20)	W52	36	5180	MCS-0	10.61	10.49	10.64	10.52	11.5	11.5	Yes	-	
		40	5200	MCS-0	10.64	10.45	10.66	10.47	11.5	11.5	Yes	-	
		44	5220	MCS-0	10.17	10.46	10.20	10.48	11.5	11.5	Yes	-	
		48	5240	MCS-0	10.22	10.39	10.25	10.42	11.5	11.5	Yes	-	
	W53	52	5260	MCS-0	10.24	10.34	10.26	10.36	11.5	11.5	Yes	-	
		56	5280	MCS-0	10.10	10.48	10.13	10.51	11.5	11.5	Yes	-	
		60	5300	MCS-0	10.14	10.45	10.16	10.47	11.5	11.5	Yes	-	
		64	5320	MCS-0	10.21	10.37	10.23	10.39	11.5	11.5	Yes	-	
802.11ac (VHT40)	W52	38	5190	MCS-0	11.12	9.96	11.17	10.01	11.5	11.5	Yes	-	
		46	5230	MCS-0	10.88	10.10	10.93	10.15	11.5	11.5	Yes	-	
	W53	54	5270	MCS-0	10.83	9.86	10.88	9.91	11.5	11.5	Yes	-	
		62	5310	MCS-0	10.68	10.08	10.73	10.13	11.5	11.5	Yes	-	
802.11ac (VHT80)	W52	42	5210	MCS-0	10.45	9.84	10.55	9.95	11.5	11.5	Yes	-	
	W53	58	5290	MCS-0	10.27	9.77	10.37	9.87	11.5	11.5	Yes	Yes	ITC

*1 Used for confirmation that the DUT's output power is within +0/-2 dB of the maximum tune-up tolerance limits (max. poss. power), since the maximum tune-up tolerance limits are defined as burst averaged values.

*2 When the same maximum output power is specified for U-NII-1 and U-NII-2A bands, begin SAR measurement in U-NII-2A band by applying the OFDM SAR requirements. If the highest reported SAR for a test configuration is ≤ 1.2 W/kg or 3 W/kg (1-g or 10-g respectively), SAR is not required for U-NII-1 band for that configuration.

*3 SAR is not required for the remaining 802.11 transmission configurations (802.11a/n-HT20/n-HT40/ac-VHT20/ac-VHT40) when the highest reported SAR for the initial test configuration (802.11 ac-VHT80) 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 or 3 W/kg (1-g or 10-g respectively), according to KDB 248227 D01.

Wi-Fi 5 GHz (W56: U-NII-2C Band)

Date : 2020/03/02 Measured by : Y. Kawano
 Amb. Temp. : 24.2 deg. C Rel. hum. : 43.1 %RH
 Date : 2020/03/03 Measured by : Y. Kawano
 Amb. Temp. : 22.2 deg. C Rel. hum. : 41.0 %RH

The Initial Test Configuration (ITC) : IEEE 802.11ac (VHT80) (*3)

Mode	Freq. Band	Ch.	Freq. (MHz)	Data Rate /MCS	Meas. Frame Averaged Power (dBm)		Meas. Burst Averaged Power (dBm) *1		Max. Poss. Power (dBm)		Within 2 dB of Max. Poss. Power	SAR Tested	Note(s)
					Chain0	Chain1	Chain0	Chain1	Chain0	Chain1			
802.11a	W56	100	5500	6.0 Mbps	10.50	10.04	10.52	10.06	11.5	11.5	Yes	-	
		116	5580	6.0 Mbps	10.86	10.11	10.89	10.13	11.5	11.5	Yes	-	
		140	5700	6.0 Mbps	11.45	10.19	11.47	10.21	11.5	11.5	Yes	-	
802.11n (HT20)	W56	100	5500	MCS-0	10.04	9.72	10.06	9.75	11.5	11.5	Yes	-	
		116	5580	MCS-0	10.34	9.81	10.37	9.84	11.5	11.5	Yes	-	
		140	5700	MCS-0	10.97	9.77	10.99	9.79	11.5	11.5	Yes	-	
802.11n (HT40)	W56	102	5510	MCS-0	10.45	10.16	10.50	10.21	11.5	11.5	Yes	-	
		110	5550	MCS-0	10.64	10.28	10.69	10.33	11.5	11.5	Yes	-	
		134	5670	MCS-0	11.20	10.23	11.24	10.28	11.5	11.5	Yes	-	
802.11ac (VHT20)	W56	100	5500	MCS-0	9.99	9.72	10.01	9.74	11.5	11.5	Yes	-	
		116	5580	MCS-0	10.40	9.82	10.43	9.84	11.5	11.5	Yes	-	
		140	5700	MCS-0	11.01	9.77	11.04	9.80	11.5	11.5	Yes	-	
802.11ac (VHT40)	W56	102	5510	MCS-0	10.64	10.08	10.69	10.13	11.5	11.5	Yes	-	
		110	5550	MCS-0	10.70	10.205	10.75	10.25	11.5	11.5	Yes	-	
		134	5670	MCS-0	11.28	10.214	11.33	10.26	11.5	11.5	Yes	-	
802.11ac (VHT80)	W56	106	5530	MCS-0	10.34	9.79	10.44	9.90	11.5	11.5	Yes	Yes	ITC

*1 Used for confirmation that the DUT's output power is within +0/-2 dB of the maximum tune-up tolerance limits (max. poss. power), since the maximum tune-up tolerance limits are defined as burst averaged values.

*3 SAR is not required for the remaining 802.11 transmission configurations (802.11 a/n-HT20/ n-HT40/ac-VHT20/ac-VHT40) when the highest reported SAR for the initial test configuration (802.11 ac-VHT80) 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 or 3 W/kg (1-g or 10-g respectively), according to KDB 248227 D01.

Wi-Fi 5 GHz (W58: U-NII-3 Band)

Date : 2020/03/04 Measured by : Y. Kawano
 Amb. Temp. : 22.0 deg. C Rel. hum. : 47.6 %RH

The Initial Test Configuration (ITC) : IEEE 802.11ac (VHT80) (*3)

Mode	Freq. Band	Ch.	Freq. (MHz)	Data Rate /MCS	Meas. Frame Averaged Power (dBm)		Meas. Burst Averaged Power (dBm) *1		Max. Poss. Power (dBm)		Within 2 dB of Max. Poss. Power	SAR Tested	Note(s)
					Chain0	Chain1	Chain0	Chain1	Chain0	Chain1			
802.11a	W58	149	5745	6.0 Mbps	10.55	10.35	10.58	10.37	11.5	11.5	Yes	-	
		157	5785	6.0 Mbps	10.04	10.51	10.07	10.54	11.5	11.5	Yes	-	
		165	5825	6.0 Mbps	10.28	10.42	10.30	10.45	11.5	11.5	Yes	-	
802.11n (HT20)	W58	149	5745	MCS-0	11.07	9.93	11.10	9.95	11.5	11.5	Yes	-	
		157	5785	MCS-0	10.71	10.13	10.74	10.16	11.5	11.5	Yes	-	
		165	5825	MCS-0	10.95	9.95	10.98	9.97	11.5	11.5	Yes	-	
802.11n (HT40)	W58	151	5755	MCS-0	10.81	10.42	10.86	10.47	11.5	11.5	Yes	-	
		159	5795	MCS-0	10.32	10.64	10.37	10.69	11.5	11.5	Yes	-	
802.11ac (VHT20)	W58	149	5745	MCS-0	11.13	10.01	11.15	10.03	11.5	11.5	Yes	-	
		157	5785	MCS-0	10.65	10.13	10.67	10.16	11.5	11.5	Yes	-	
		165	5825	MCS-0	10.93	10.05	10.96	10.08	11.5	11.5	Yes	-	
802.11ac (VHT40)	W58	151	5755	MCS-0	10.76	10.44	10.81	10.49	11.5	11.5	Yes	-	
		159	5795	MCS-0	10.30	10.63	10.35	10.68	11.5	11.5	Yes	-	
802.11ac (VHT80)	W58	155	5775	MCS-0	10.54	10.15	10.65	10.25	11.5	11.5	Yes	Yes	ITC

*1 Used for confirmation that the DUT's output power is within +0/-2 dB of the maximum tune-up tolerance limits (max. poss. power), since the maximum tune-up tolerance limits are defined as burst averaged values.

*3 SAR is not required for the remaining 802.11 transmission configurations (802.11 a/n-HT20/n-HT40/ac-VHT20/ac-VHT40) when the highest reported SAR for the initial test configuration (802.11 ac-VHT80) 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 or 3 W/kg (1-g or 10-g respectively), according to KDB 248227 D01.

Bluetooth

Date : 2020/02/04 Measured by : Y. Kawano
 Amb. Temp. : 21.4 deg. C Rel. hum. : 31.6 %RH

Bluetooth LE

Ch.	Freq. (MHz)	Packet Type	Meas. Frame Averaged Power (dBm)	Meas. Burst Averaged Power (dBm) *1	Max. Poss. Power (dBm)	Within 2 dB of Max. Poss. Power	SAR Tested	Note(s)
0	2402	-	8.19	10.08	10.1	Yes	Yes	
19	2440	-	8.12	10.01	10.1	Yes	Yes	
39	2480	-	8.06	9.96	10.1	Yes	Yes	

*1 Used for confirmation that the DUT's output power is within +0/-2 dB of the maximum tune-up tolerance limits (max. poss. power), since the maximum tune-up tolerance limits are defined as burst averaged values.

4. SAR Measurements

☒ <SAR Correction/Scaling>

According to KDB 447498 D01, KDB 248227 D01, and/or KDB 865664 D01, the maximum SAR values are determined by taking account of the following correction or scaling factors.

The maximum 1-g SAR and/or 10-g SAR values (reported SAR) are calculated by applying the Δ SAR positive correction for deviations of the tissue-equivalent liquid and the power scaling for the maximum duty factor and maximum possible power levels (maximum tune-up tolerance limit) to each measured 1-g SAR and/or 10-g SAR value:

$$\begin{aligned} \text{Reported SAR (W/kg)} &= \text{Measured SAR (W/kg)} * \Delta\text{SAR positive correction factor} \\ &\quad * \text{Duty cycle scaling factor} * \text{Tune-up scaling factor} \end{aligned}$$

where;

$$\Delta\text{SAR positive correction factor} = (100 - \Delta\text{SAR}^{*1}) / 100$$

$$\text{Duty cycle scaling factor} = \text{Max. possible duty cycle} / \text{Measured duty cycle used for the SAR measurement}$$

$$\text{Tune-up scaling factor} = \text{Max. possible power (mW)} / \text{Measured power used for the SAR measurement (mW)}$$

$$*1 \quad \Delta\text{SAR} (\%) = c_e * \Delta\epsilon_r + c_o * \Delta\sigma$$

<For 1-g SAR>

$$c_e = -7.854 * 10^{-4} f^3 + 9.402 * 10^{-3} f^2 - 2.742 * 10^{-2} f - 0.2026$$

$$c_o = 9.804 * 10^{-3} f^3 - 8.661 * 10^{-2} f^2 + 2.981 * 10^{-2} f + 0.7829$$

<For 10-g SAR>

$$c_e = 3.456 * 10^{-3} f^3 - 3.531 * 10^{-2} f^2 + 7.675 * 10^{-2} f - 0.1860$$

$$c_o = 4.479 * 10^{-3} f^3 - 1.586 * 10^{-2} f^2 - 0.1972 f + 0.7717$$

where;

c_e coefficient representing the sensitivity of SAR to permittivity

$\Delta\epsilon_r$ percent change in permittivity

c_o coefficient representing the sensitivity of SAR to conductivity

$\Delta\sigma$ percent change in conductivity

f frequency in GHz

A negative Δ SAR would translate to a lower measured SAR value than what would be measured if using dielectric properties equal to the target values.

A positive Δ SAR would translate to a higher measured SAR value than what would be measured if using dielectric properties equal to the target values.

SAR correction shall not be made when the Δ SAR has a positive sign to provide a conservative SAR value.

The SAR is only corrected when Δ SAR has a negative sign.

☒ <SAR Test Reduction for Wi-Fi>

SAR test reduction for Wi-Fi is applied according to KDB 248227 D01.

For 2.4 GHz 802.11g/n OFDM configurations

SAR is not required for the following 2.4 GHz OFDM conditions.

- 1) When KDB Publication 447498 SAR test exclusion applies to the OFDM configuration.
- 2) When the highest reported SAR for DSSS is adjusted by the ratio of OFDM to DSSS specified maximum output power and the adjusted SAR is ≤ 1.2 W/kg or 3 W/kg (1-g or 10-g respectively).

For U-NII-1 (W52) and U-NII-2A (W53) Bands

When the same transmitter and antenna(s) are used for U-NII-1 and U-NII-2A bands, additional SAR test reduction applies.

- 1) When the same maximum output power is specified for both bands, begin SAR measurement in U-NII-2A band by applying the OFDM SAR requirements. If the highest reported SAR for a test configuration is ≤ 1.2 W/kg or 3 W/kg (1-g or 10-g respectively), SAR is not required for U-NII-1 band for that configuration (802.11 mode and exposure condition); otherwise, each band is tested independently for SAR.
- 2) 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 or 3 W/kg (1-g or 10-g respectively), SAR is not required for the band with lower maximum output power in that test configuration; otherwise, each band is tested independently for SAR.

4.1. SAR Measurement Results

<Body-Worn SAR>

Wi-Fi 2.4 GHz

(Chain 0)

Date : 2020/11/10

Measured by : Y. Kawano and S. Fukushima

Amb. Temp. : 21.8 deg. C

Rel. hum. : 40.6 %RH

Mode	Ch.	Freq. (MHz)	Position	Dis. (mm)	Max. Poss. Power (dBm)	Meas. Power (dBm)	Max. Duty Cycle (%)	Meas. Duty Cycle (%)	Meas. 1-g SAR (W/kg)	Reported 1-g SAR (W/kg)	Liquid Temp. (deg. C)	Plot No.
Step 1: Worst Position Check												
802.11b	1	2412	Front	0	9.50	8.95	100.00	99.91	N/D	N/D	20.7	
			Front-Right		9.50	8.95	100.00	99.91	0.013	0.015	20.7	
			Right		9.50	8.95	100.00	99.91	0.409	0.465	20.5	1
			Bottom		9.50	8.95	100.00	99.91	0.041	0.047	20.7	
Step 2: Worst Channel Check (for Step 1)												
802.11b	6	2437	Right	0	9.50	8.68	100.00	99.91	0.367	0.444	20.5	
	11	2462			9.50	8.83	100.00	99.91	0.353	0.412	20.6	

N/D: Not Detected

*1 The burst averaged power values are used for power scaling since the maximum tune-up tolerance limits are defined as burst averaged values.

*2 Reported SAR (W/kg) = Measured SAR (W/kg) * Duty cycle scaling factor * Tune-up scaling factor

where:

Duty cycle scaling factor = Max. possible duty cycle (%) / Measured duty cycle used for the SAR measurement (%)

Tune-up scaling factor = Max. possible power (mW) (* equal to 100% duty cycle) / Measured power used for the SAR measurement (mW)

(Chain 1)

Date : 2020/11/10

Measured by : Y. Kawano and S. Fukushima

Amb. Temp. : 22.8 deg. C

Rel. hum. : 43.8 %RH

Mode	Ch.	Freq. (MHz)	Position	Dis. (mm)	Max. Poss. Power (dBm)	Meas. Power (dBm)	Max. Duty Cycle (%)	Meas. Duty Cycle (%)	Meas. 1-g SAR (W/kg)	Reported 1-g SAR (W/kg)	Liquid Temp. (deg. C)	Plot No.
Step 1: Worst Position Check												
802.11b	11	2462	Front	0	9.50	8.61	100.00	99.91	0.015	0.018	20.8	
			Front-Right		9.50	8.61	100.00	99.91	0.016	0.020	20.8	
			Right		9.50	8.61	100.00	99.91	N/D	N/D	20.5	
			Bottom		9.50	8.61	100.00	99.91	N/D	N/D	20.7	
Step 2: Worst Channel Check (for Step 1)												
802.11b	1	2412	Front-Right	0	9.50	8.27	100.00	99.91	0.016	0.0213	20.8	2
	6	2437			9.50	8.40	100.00	99.91	0.016	0.0206	20.7	

N/D: Not Detected

*1 The burst averaged power values are used for power scaling since the maximum tune-up tolerance limits are defined as burst averaged values.

*2 Reported SAR (W/kg) = Measured SAR (W/kg) * Duty cycle scaling factor * Tune-up scaling factor

where:

Duty cycle scaling factor = Max. possible duty cycle (%) / Measured duty cycle used for the SAR measurement (%)

Tune-up scaling factor = Max. possible power (mW) (* equal to 100% duty cycle) / Measured power used for the SAR measurement (mW)

Wi-Fi 5 GHz (W53: U-NII-2A Band)

(Chain 0)

Date : 2020/11/04

Measured by : Y. Kawano

Amb. Temp. : 21.3 deg. C

Rel. hum. : 45.5 %RH

Mode	Ch.	Freq. (MHz)	Position	Dis. (mm)	Max. Poss. Power (dBm)	Meas. Power (dBm)	Max. Duty Cycle (%)	Meas. Duty Cycle (%)	Meas. 1-g SAR (W/kg)	Reported 1-g SAR (W/kg)	Liquid Temp. (deg. C)	Plot No.
802.11ac (VHT80)	58	5290	Front	0	11.50	10.37	100.00	97.64	N/D	N/D	20.7	
			Front-Right		11.50	10.37	100.00	97.64	0.017	0.023	20.8	
			Left		11.50	10.37	100.00	97.64	N/D	N/D	20.5	
			Right		11.50	10.37	100.00	97.64	0.558	0.741	20.3	3
			Bottom		11.50	10.37	100.00	97.64	0.012	0.016	20.7	

N/D: Not Detected

*1 The burst averaged power values are used for power scaling since the maximum tune-up tolerance limits are defined as burst averaged values.

*2 Reported SAR (W/kg) = Measured SAR (W/kg) * Duty cycle scaling factor * Tune-up scaling factor

where;

Duty cycle scaling factor = Max. possible duty cycle (%) / Measured duty cycle used for the SAR measurement (%)

Tune-up scaling factor = Max. possible power (mW) (* equal to 100% duty cycle) / Measured power used for the SAR measurement (mW)

(Chain 1)

Date : 2020/11/04

Measured by : S. Fukushima

Amb. Temp. : 22.1 deg. C

Rel. hum. : 53.4 %RH

Mode	Ch.	Freq. (MHz)	Position	Dis. (mm)	Max. Poss. Power (dBm)	Meas. Power (dBm)	Max. Duty Cycle (%)	Meas. Duty Cycle (%)	Meas. 1-g SAR (W/kg)	Reported 1-g SAR (W/kg)	Liquid Temp. (deg. C)	Plot No.
802.11ac (VHT80)	58	5290	Front	0	11.50	9.87	100.00	97.64	0.180	0.268	21.0	
			Front-Right		11.50	9.87	100.00	97.64	0.191	0.285	21.0	4
			Left		11.50	9.87	100.00	97.64	0.016	0.024	20.9	
			Right		11.50	9.87	100.00	97.64	N/D	N/D	20.9	
			Bottom		11.50	9.87	100.00	97.64	0.017	0.025	20.9	

N/D: Not Detected

*1 The burst averaged power values are used for power scaling since the maximum tune-up tolerance limits are defined as burst averaged values.

*2 Reported SAR (W/kg) = Measured SAR (W/kg) * Duty cycle scaling factor * Tune-up scaling factor

where;

Duty cycle scaling factor = Max. possible duty cycle (%) / Measured duty cycle used for the SAR measurement (%)

Tune-up scaling factor = Max. possible power (mW) (* equal to 100% duty cycle) / Measured power used for the SAR measurement (mW)

Wi-Fi 5 GHz (W56: U-NII-2C Band)

(Chain 0)

Date : 2020/11/05 Measured by : Y. Kawano
 Amb. Temp. : 22.2 deg. C Rel. hum. : 39.9 %RH

Mode	Ch.	Freq. (MHz)	Position	Dis. (mm)	Max. Poss. Power (dBm)	Meas. Power (dBm)	Max. Duty Cycle (%)	Meas. Duty Cycle (%)	Meas. 1-g SAR (W/kg)	Reported 1-g SAR (W/kg)	Liquid Temp. (deg. C)	Plot No.
802.11ac (VHT80)	106	5530	Front	0	11.50	10.44	100.00	97.64	N/D	N/D	20.2	
			Front-Right		11.50	10.44	100.00	97.64	0.022	0.029	20.1	
			Left		11.50	10.44	100.00	97.64	N/D	N/D	20.2	
			Right		11.50	10.44	100.00	97.64	0.475	0.621	20.2	5
			Bottom		11.50	10.44	100.00	97.64	0.021	0.027	20.1	

N/D: Not Detected

*1 The burst averaged power values are used for power scaling since the maximum tune-up tolerance limits are defined as burst averaged values.

*2 Reported SAR (W/kg) = Measured SAR (W/kg) * Duty cycle scaling factor * Tune-up scaling factor

where:

Duty cycle scaling factor = Max. possible duty cycle (%) / Measured duty cycle used for the SAR measurement (%)

Tune-up scaling factor = Max. possible power (mW) (* equal to 100% duty cycle) / Measured power used for the SAR measurement (mW)

(Chain 1)

Date : 2020/11/05 Measured by : S. Fukushima
 Amb. Temp. : 21.8 deg. C Rel. hum. : 50.2 %RH

Mode	Ch.	Freq. (MHz)	Position	Dis. (mm)	Max. Poss. Power (dBm)	Meas. Power (dBm)	Max. Duty Cycle (%)	Meas. Duty Cycle (%)	Meas. 1-g SAR (W/kg)	Reported 1-g SAR (W/kg)	Liquid Temp. (deg. C)	Plot No.
802.11ac (VHT80)	106	5530	Front	0	11.50	9.90	100.00	97.64	0.206	0.305	20.2	
			Front-Right		11.50	9.90	100.00	97.64	0.232	0.343	20.2	6
			Left		11.50	9.90	100.00	97.64	0.013	0.019	20.2	
			Right		11.50	9.90	100.00	97.64	N/D	N/D	20.2	
			Bottom		11.50	9.90	100.00	97.64	0.013	0.019	20.2	

N/D: Not Detected

*1 The burst averaged power values are used for power scaling since the maximum tune-up tolerance limits are defined as burst averaged values.

*2 Reported SAR (W/kg) = Measured SAR (W/kg) * Duty cycle scaling factor * Tune-up scaling factor

where:

Duty cycle scaling factor = Max. possible duty cycle (%) / Measured duty cycle used for the SAR measurement (%)

Tune-up scaling factor = Max. possible power (mW) (* equal to 100% duty cycle) / Measured power used for the SAR measurement (mW)

Wi-Fi 5 GHz (W58: U-NII-3 Band)

(Chain 0)

Date : 2020/11/06 Measured by : Y. Kawano
 Amb. Temp. : 22.5 deg. C Rel. hum. : 52.9 %RH

Mode	Ch.	Freq. (MHz)	Position	Dis. (mm)	Max. Poss. Power (dBm)	Meas. Power (dBm)	Max. Duty Cycle (%)	Meas. Duty Cycle (%)	Meas. 1-g SAR (W/kg)	Reported 1-g SAR (W/kg)	Liquid Temp. (deg. C)	Plot No.
802.11ac (VHT80)	155	5775	Front	0	11.50	10.65	100.00	97.64	N/D	N/D	21.2	
			Front-Right		11.50	10.65	100.00	97.64	0.035	0.044	20.9	
			Left		11.50	10.65	100.00	97.64	N/D	N/D	21.1	
			Right		11.50	10.65	100.00	97.64	0.513	0.639	20.7	7
			Bottom		11.50	10.65	100.00	97.64	0.025	0.031	20.9	

N/D: Not Detected

*1 The burst averaged power values are used for power scaling since the maximum tune-up tolerance limits are defined as burst averaged values.

*2 Reported SAR (W/kg) = Measured SAR (W/kg) * Duty cycle scaling factor * Tune-up scaling factor

where;

Duty cycle scaling factor = Max. possible duty cycle (%) / Measured duty cycle used for the SAR measurement (%)

Tune-up scaling factor = Max. possible power (mW) (* equal to 100% duty cycle) / Measured power used for the SAR measurement (mW)

(Chain 1)

Date : 2020/11/06 Measured by : S. Fukushima
 Amb. Temp. : 21.5 deg. C Rel. hum. : 54.8 %RH

Mode	Ch.	Freq. (MHz)	Position	Dis. (mm)	Max. Poss. Power (dBm)	Meas. Power (dBm)	Max. Duty Cycle (%)	Meas. Duty Cycle (%)	Meas. 1-g SAR (W/kg)	Reported 1-g SAR (W/kg)	Liquid Temp. (deg. C)	Plot No.
802.11ac (VHT80)	155	5775	Front	0	11.50	10.25	100.00	97.64	0.368	0.503	20.6	
			Front-Right		11.50	10.25	100.00	97.64	0.374	0.511	20.7	8
			Left		11.50	10.25	100.00	97.64	0.014	0.019	20.9	
			Right		11.50	10.25	100.00	97.64	N/D	N/D	20.8	
			Bottom		11.50	10.25	100.00	97.64	0.021	0.029	20.9	

N/D: Not Detected

*1 The burst averaged power values are used for power scaling since the maximum tune-up tolerance limits are defined as burst averaged values.

*2 Reported SAR (W/kg) = Measured SAR (W/kg) * Duty cycle scaling factor * Tune-up scaling factor

where;

Duty cycle scaling factor = Max. possible duty cycle (%) / Measured duty cycle used for the SAR measurement (%)

Tune-up scaling factor = Max. possible power (mW) (* equal to 100% duty cycle) / Measured power used for the SAR measurement (mW)

Bluetooth

Date : 2020/11/09

Measured by : Y. Kawano

Amb. Temp. : 22.7 deg. C

Rel. hum. : 42.8 %RH

Mode	Ch.	Freq. (MHz)	Position	Dis. (mm)	Max. Poss. Power (dBm)	Meas. Power (dBm)	Max. Duty Cycle (%)	Meas. Duty Cycle (%)	Meas. 1-g SAR (W/kg)	Reported 1-g SAR (W/kg)	Liquid Temp. (deg. C)	Plot No.
Step 1: Worst Position Check												
LE	0	2402	Front	0	10.10	10.08	100.00	64.63	N/D	N/D	21.2	
			Front- Right		10.10	10.08	100.00	64.63	0.003	0.005	21.2	
			Left		10.10	10.08	100.00	64.63	N/D	N/D	21.1	
			Right		10.10	10.08	100.00	64.63	0.183	0.284	21.0	
			Bottom		10.10	10.08	100.00	64.63	0.012	0.019	21.3	
Step 2: Worst Channel Check (for Step 1)												
LE	19	2440	Right	0	10.10	10.01	100.00	64.63	0.193	0.305	21.1	9
	39	2480			10.10	9.96	100.00	64.63	0.172	0.275	21.1	

N/D: Not Detected

*1 The burst averaged power values are used for power scaling since the maximum tune-up tolerance limits are defined as burst averaged values.

*2 Reported SAR (W/kg) = Measured SAR (W/kg) * Duty cycle scaling factor * Tune-up scaling factor

where:

Duty cycle scaling factor = Max. possible duty cycle (%) / Measured duty cycle used for the SAR measurement (%)

Tune-up scaling factor = Max. possible power (mW) (* equal to 100% duty cycle) / Measured power used for the SAR measurement (mW)

5. Simultaneous Transmission SAR evaluation

Simultaneous transmission SAR evaluation is determined according to KDB 447498 D01, Evaluation by summation of Reported SAR values, as the reference method.

- 1) If Reported SAR summation $> 1.6\text{W/kg}$, SAR test exclusion is determined by the SPLSR.
- 2) $\text{SPLSR} = (\text{SAR}_1 + \text{SAR}_2)^{1.5} / (\text{minimum separation distance})$, and the peak separation distance is determined from the square root of $[(x_1 - x_2)^2 + (y_1 - y_2)^2 + (z_1 - z_2)^2]$ where (x_1, y_1, z_1) and (x_2, y_2, z_2) are the coordinates of the extrapolated peak SAR location in the zoom scan.
- 3) If $\text{SPLSR} \leq 0.04$, simultaneously transmission SAR measurement is not necessary.

RF Exposure Conditions	Test Position	Highest Reported 1g-SAR (W/kg)					Σ 1-g SAR (W/kg)		
		(1) Wi-Fi 2.4 GHz Chain 0 (Measured)	(2) Wi-Fi 2.4 GHz Chain 1 (Measured)	(3) Wi-Fi 5 GHz Chain 0 (Measured)	(4) Wi-Fi 5 GHz Chain 1 (Measured)	(5) Bluetooth (Measured)	(1) + (2)	(3) + (4)	(3) + (4) + (5)
Body-Worn	Front	N/D	0.018	N/D	0.503	N/D	0.018	0.503	0.503
	Front-Right	0.015	0.0213	0.044	0.511	0.005	0.036	0.555	0.560
	Left	-	-	N/D	0.024	N/D	-	0.024	0.024
	Right	0.465	N/D	0.741	N/D	0.305	0.465	0.741	1.046
	Bottom	0.047	N/D	0.031	0.029	0.019	0.047	0.060	0.079

Appendix A. Plots of SAR Measurement

Please see the following page(s).

Plot No. 1

Date: 2020/11/10

Test Laboratory: Sony Global Manufacturing & Operations Corporation EMC/RF Test Laboratory Main Lab. 4th Site Shielded Room 2

Wi-Fi 2.4GHz (Chain0_1ch)_Body-Worn_Right_0mm

DUT: Type1VY (installed in Digital Camera 1VY002)

Communication System: UID 0, Wi-Fi_802.11b_1Mbps (0);

Communication System Band: 2.4GHz; Frequency: 2412 MHz;

Medium parameters used: $f = 2412$ MHz; $\sigma = 1.788$ S/m; $\epsilon_r = 40.116$; $\rho = 1000$ kg/m³

Phantom section: Flat Section

DASY Configuration:

- Probe: EX3DV4 - SN3921; ConvF(7.82, 7.82, 7.82) @ 2412 MHz; Calibrated: 2020/10/21
- Sensor-Surface: 1.4mm (Mechanical Surface Detection), $z = 1.0, 31.0$
- Electronics: DAE4 Sn610; Calibrated: 2020/01/10
- Phantom: SAM (20deg probe tilt) with CRP v5.0 FRONT; Type: QD000P40CD; Serial: TP:1852
- DASY52 52.10.4(1527); SEMCAD X 14.6.14(7483)

Configuration/Wi-Fi 2.4GHz (Chain0_1ch)_Body-Worn_Right_0mm/

Area Scan (11x11x1): Measurement grid: $dx=12$ mm, $dy=12$ mm

Maximum value of SAR (measured) = 0.617 W/kg

Configuration/Wi-Fi 2.4GHz (Chain0_1ch)_Body-Worn_Right_0mm/

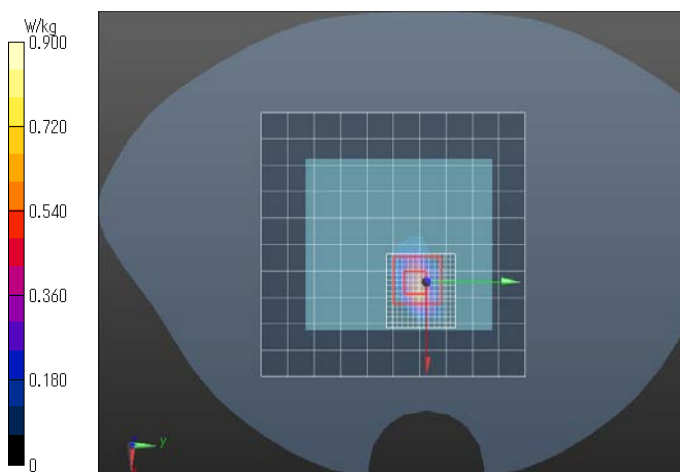
Zoom Scan 2 (15x14x8)/Cube 0: Measurement grid: $dx=2.4$ mm, $dy=2.4$ mm, $dz=1.4$ mm

Reference Value = 18.39 V/m; Power Drift = 0.19 dB

Peak SAR (extrapolated) = 1.41 W/kg

SAR(1 g) = 0.409 W/kg; SAR(10 g) = 0.124 W/kg (SAR corrected for target medium)

Maximum value of SAR (measured) = 0.900 W/kg



Plot No. 2

Date: 2020/11/10

Test Laboratory: Sony Global Manufacturing & Operations Corporation EMC/RF Test Laboratory Main Lab. 4th Site Shielded Room 2

Wi-Fi 2.4GHz (Chain1_1ch)_Body-Worn_Front-Right_0mm

DUT: Type1VY (installed in Digital Camera 1VY002)

Communication System: UID 0, Wi-Fi_802.11b_1Mbps (0);

Communication System Band: 2.4GHz; Frequency: 2412 MHz;

Medium parameters used: $f = 2412$ MHz; $\sigma = 1.788$ S/m; $\epsilon_r = 40.116$; $\rho = 1000$ kg/m³

Phantom section: Flat Section

DASY Configuration:

- Probe: EX3DV4 - SN3921; ConvF(7.82, 7.82, 7.82) @ 2412 MHz; Calibrated: 2020/10/21
- Sensor-Surface: 1.4mm (Mechanical Surface Detection), $z = 1.0, 31.0$
- Electronics: DAE4 Sn610; Calibrated: 2020/01/10
- Phantom: SAM (20deg probe tilt) with CRP v5.0 FRONT; Type: QD000P40CD; Serial: TP:1852
- DASY52 52.10.4(1527); SEMCAD X 14.6.14(7483)

Configuration/Wi-Fi 2.4GHz (Chain1_1ch)_Body-Worn_Front-Right_0mm/

Area Scan (10x16x1): Measurement grid: $dx=12$ mm, $dy=12$ mm

Maximum value of SAR (measured) = 0.0232 W/kg

Configuration/Wi-Fi 2.4GHz (Chain1_1ch)_Body-Worn_Front-Right_0mm/

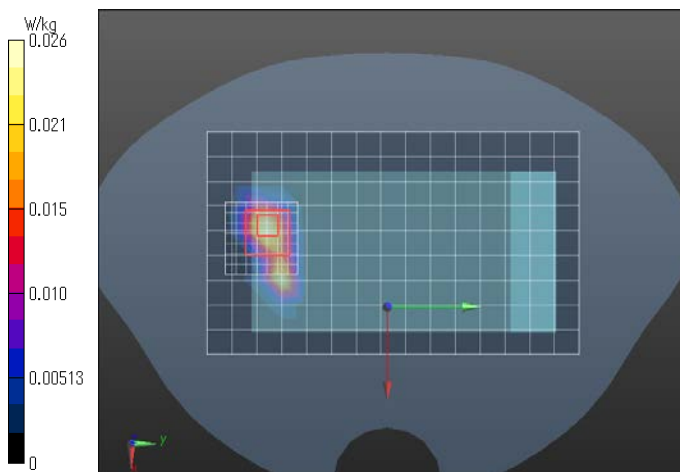
Zoom Scan (8x8x5)/Cube 0: Measurement grid: $dx=5$ mm, $dy=5$ mm, $dz=5$ mm

Reference Value = 3.629 V/m; Power Drift = 0.01 dB

Peak SAR (extrapolated) = 0.0710 W/kg

SAR(1 g) = 0.016 W/kg; SAR(10 g) = 0.00641 W/kg (SAR corrected for target medium)

Maximum value of SAR (measured) = 0.0256 W/kg



Plot No. 3

Date: 2020/11/04

Test Laboratory: Sony Global Manufacturing & Operations Corporation EMC/RF Test Laboratory Main Lab. 4th Site Shielded Room 2

Wi-Fi 5GHz (Chain0_58ch)_Body-Worn_Right_0mm

DUT: Type1VY (installed in Digital Camera 1VY002)

Communication System: UID 0, Wi-Fi_802.11ac_VHT80_MCS0 (0);

Communication System Band: 5GHz; Frequency: 5290 MHz;

Medium parameters used: $f = 5290 \text{ MHz}$; $\sigma = 4.774 \text{ S/m}$; $\epsilon_r = 35.15$; $\rho = 1000 \text{ kg/m}^3$

Phantom section: Flat Section

DASY Configuration:

- Probe: EX3DV4 - SN3745; ConvF(4.63, 4.63, 4.63) @ 5290 MHz; Calibrated: 2020/06/22
- Sensor-Surface: 1.4mm (Mechanical Surface Detection), $z = 1.0, 25.0$
- Electronics: DAE4 Sn610; Calibrated: 2020/01/10
- Phantom: SAM (20deg probe tilt) with CRP v5.0 FRONT; Type: QD000P40CD; Serial: TP:1852
- DASY52 52.10.4(1527); SEMCAD X 14.6.14(7483)

Configuration/Wi-Fi 5GHz (Chain0_58ch)_Body-Worn_Right_0mm/

Area Scan (11x11x1): Measurement grid: $dx=10\text{mm}$, $dy=10\text{mm}$

Maximum value of SAR (measured) = 1.23 W/kg

Configuration/Wi-Fi 5GHz (Chain0_58ch)_Body-Worn_Right_0mm/

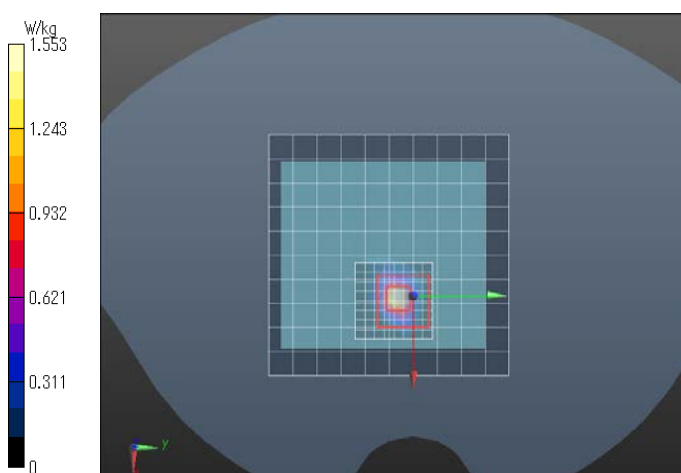
Zoom Scan (9x9x6)/Cube 0: Measurement grid: $dx=4\text{mm}$, $dy=4\text{mm}$, $dz=2\text{mm}$

Reference Value = 15.80 V/m; Power Drift = 0.03 dB

Peak SAR (extrapolated) = 3.07 W/kg

SAR(1 g) = 0.558 W/kg; SAR(10 g) = 0.107 W/kg (SAR corrected for target medium)

Maximum value of SAR (measured) = 1.55 W/kg



Plot No. 4

Date: 2020/11/04

Test Laboratory: Sony Global Manufacturing & Operations Corporation EMC/RF Test Laboratory Main Lab. 4th Site Shielded Room 2

Wi-Fi 5GHz (Chain1_58ch)_Body-Worn_Front-Right_0mm

DUT: Type1VY (installed in Digital Camera 1VY002)

Communication System: UID 0, Wi-Fi_802.11ac_VHT80_MCS0 (0);

Communication System Band: 5GHz; Frequency: 5290 MHz;

Medium parameters used: $f = 5290 \text{ MHz}$; $\sigma = 4.774 \text{ S/m}$; $\epsilon_r = 35.15$; $\rho = 1000 \text{ kg/m}^3$

Phantom section: Flat Section

DASY Configuration:

- Probe: EX3DV4 - SN3745; ConvF(4.63, 4.63, 4.63) @ 5290 MHz; Calibrated: 2020/06/22
- Sensor-Surface: 1.4mm (Mechanical Surface Detection), $z = 1.0, 25.0$
- Electronics: DAE4 Sn610; Calibrated: 2020/01/10
- Phantom: SAM (20deg probe tilt) with CRP v5.0 FRONT; Type: QD000P40CD; Serial: TP:1852
- DASY52 52.10.4(1527); SEMCAD X 14.6.14(7483)

Configuration/Wi-Fi 5GHz (Chain1_58ch)_Body-Worn_Front-Right_0mm/

Area Scan (11x18x1): Measurement grid: $dx=10\text{mm}$, $dy=10\text{mm}$

Maximum value of SAR (measured) = 0.362 W/kg

Configuration/Wi-Fi 5GHz (Chain1_58ch)_Body-Worn_Front-Right_0mm/

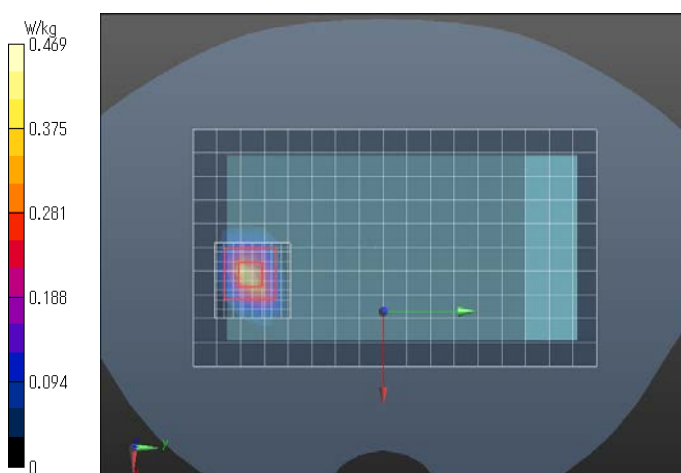
Zoom Scan (9x9x6)/Cube 0: Measurement grid: $dx=4\text{mm}$, $dy=4\text{mm}$, $dz=2\text{mm}$

Reference Value = 9.495 V/m; Power Drift = -0.07 dB

Peak SAR (extrapolated) = 0.755 W/kg

SAR(1 g) = 0.191 W/kg; SAR(10 g) = 0.053 W/kg (SAR corrected for target medium)

Maximum value of SAR (measured) = 0.469 W/kg



Plot No. 5

Date: 2020/11/05

Test Laboratory: Sony Global Manufacturing & Operations Corporation EMC/RF Test Laboratory Main Lab. 4th Site Shielded Room 2

Wi-Fi 5GHz (Chain0_106ch)_Body-Worn_Right_0mm**DUT: Type1VY (installed in Digital Camera 1VY002)**

Communication System: UID 0, Wi-Fi_802.11ac_VHT80_MCS0 (0);

Communication System Band: 5GHz; Frequency: 5530 MHz;

Medium parameters used: $f = 5530$ MHz; $\sigma = 4.976$ S/m; $\epsilon_r = 34.467$; $\rho = 1000$ kg/m³

Phantom section: Flat Section

DASY Configuration:

- Probe: EX3DV4 - SN3745; ConvF(4.37, 4.37, 4.37) @ 5530 MHz; Calibrated: 2020/06/22
- Sensor-Surface: 1.4mm (Mechanical Surface Detection), $z = 1.0, 25.0$
- Electronics: DAE4 Sn610; Calibrated: 2020/01/10
- Phantom: SAM (20deg probe tilt) with CRP v5.0 FRONT; Type: QD000P40CD; Serial: TP:1852
- DASY52 52.10.4(1527); SEMCAD X 14.6.14(7483)

Configuration/Wi-Fi 5GHz (Chain0_106ch)_Body-Worn_Right_0mm/**Area Scan (11x11x1): Measurement grid: $dx=10$ mm, $dy=10$ mm**

Maximum value of SAR (measured) = 1.10 W/kg

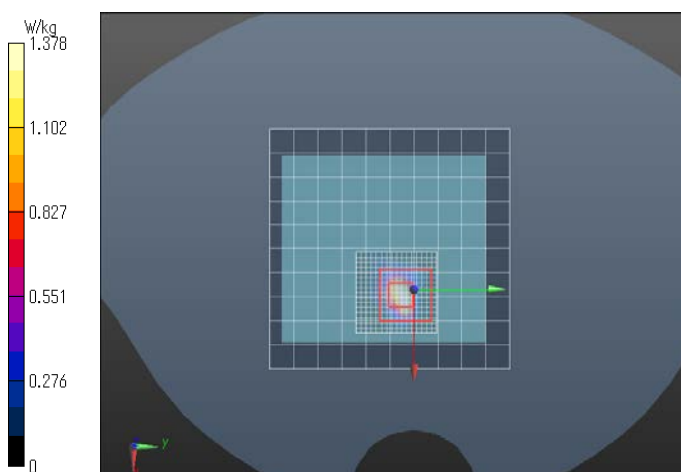
Configuration/Wi-Fi 5GHz (Chain0_106ch)_Body-Worn_Right_0mm/**Zoom Scan 2 (17x17x7)/Cube 0: Measurement grid: $dx=2.1$ mm, $dy=2.1$ mm, $dz=1.4$ mm**

Reference Value = 13.52 V/m; Power Drift = -0.08 dB

Peak SAR (extrapolated) = 2.29 W/kg

SAR(1 g) = 0.475 W/kg; SAR(10 g) = 0.096 W/kg (SAR corrected for target medium)

Smallest distance from peaks to all points 3 dB below = 3.8 mm



Plot No. 6

Date: 2020/11/05

Test Laboratory: Sony Global Manufacturing & Operations Corporation EMC/RF Test Laboratory Main Lab. 4th Site Shielded Room 2

Wi-Fi 5GHz (Chain1_106ch)_Body-Worn_Front-Right_0mm

DUT: Type1VY (installed in Digital Camera 1VY002)

Communication System: UID 0, Wi-Fi_802.11ac_VHT80_MCS0 (0);

Communication System Band: 5GHz; Frequency: 5530 MHz;

Medium parameters used: $f = 5530$ MHz; $\sigma = 4.976$ S/m; $\epsilon_r = 34.467$; $\rho = 1000$ kg/m³

Phantom section: Flat Section

DASY Configuration:

- Probe: EX3DV4 - SN3745; ConvF(4.37, 4.37, 4.37) @ 5530 MHz; Calibrated: 2020/06/22
- Sensor-Surface: 1.4mm (Mechanical Surface Detection), $z = 1.0, 25.0$
- Electronics: DAE4 Sn610; Calibrated: 2020/01/10
- Phantom: SAM (20deg probe tilt) with CRP v5.0 FRONT; Type: QD000P40CD; Serial: TP:1852
- DASY52 52.10.4(1527); SEMCAD X 14.6.14(7483)

Configuration/Wi-Fi 5GHz (Chain1_106ch)_Body-Worn_Front-Right_0mm/

Area Scan (11x18x1): Measurement grid: $dx=10$ mm, $dy=10$ mm

Maximum value of SAR (measured) = 0.406 W/kg

Configuration/Wi-Fi 5GHz(Chain1_106ch)_Body-Worn_Front-Right_0mm/

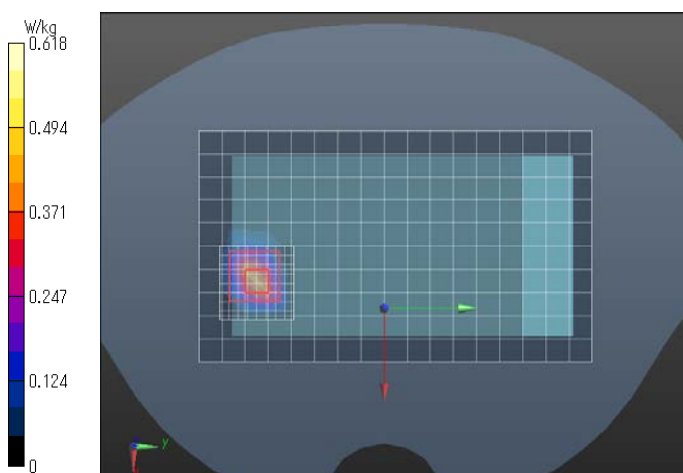
Zoom Scan (9x9x6)/Cube 0: Measurement grid: $dx=4$ mm, $dy=4$ mm, $dz=2$ mm

Reference Value = 10.03 V/m; Power Drift = -0.10 dB

Peak SAR (extrapolated) = 0.942 W/kg

SAR(1 g) = 0.232 W/kg; SAR(10 g) = 0.062 W/kg (SAR corrected for target medium)

Smallest distance from peaks to all points 3 dB below = 5.7 mm



Plot No. 7

Date: 2020/11/06

Test Laboratory: Sony Global Manufacturing & Operations Corporation EMC/RF Test Laboratory Main Lab. 4th Site Shielded Room 2

Wi-Fi 5GHz (Chain0_155ch)_Body-Worn_Right_0mm

DUT: Type1VY (installed in Digital Camera 1VY002)

Communication System: UID 0, Wi-Fi_802.11ac_VHT80_MCS0 (0);

Communication System Band: 5GHz; Frequency: 5775 MHz;

Medium parameters used: $f = 5775 \text{ MHz}$; $\sigma = 5.317 \text{ S/m}$; $\epsilon_r = 34.287$; $\rho = 1000 \text{ kg/m}^3$

Phantom section: Flat Section

DASY Configuration:

- Probe: EX3DV4 - SN3745; ConvF(4.31, 4.31, 4.31) @ 5775 MHz; Calibrated: 2020/06/22
- Sensor-Surface: 1.4mm (Mechanical Surface Detection), $z = 1.0, 25.0$
- Electronics: DAE4 Sn610; Calibrated: 2020/01/10
- Phantom: SAM (20deg probe tilt) with CRP v5.0 FRONT; Type: QD000P40CD; Serial: TP:1852
- DASY52 52.10.4(1527); SEMCAD X 14.6.14(7483)

Configuration/Wi-Fi 5GHz (Chain0_155ch)_Body-Worn_Right_0mm/

Area Scan (11x11x1): Measurement grid: $dx=10\text{mm}$, $dy=10\text{mm}$

Maximum value of SAR (measured) = 0.869 W/kg

Configuration/Wi-Fi 5GHz (Chain0_155ch)_Body-Worn_Right_0mm/

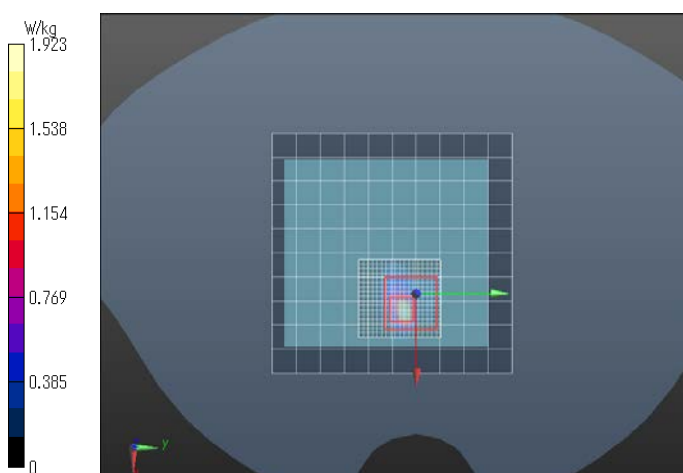
Zoom Scan 2 (18x19x7)/Cube 0: Measurement grid: $dx=1.9\text{mm}$, $dy=1.9\text{mm}$, $dz=1.4\text{mm}$

Reference Value = 12.31 V/m; Power Drift = 0.15 dB

Peak SAR (extrapolated) = 3.36 W/kg

SAR(1 g) = 0.513 W/kg; SAR(10 g) = 0.097 W/kg (SAR corrected for target medium)

Maximum value of SAR (measured) = 1.92 W/kg



Plot No. 8

Date: 2020/11/06

Test Laboratory: Sony Global Manufacturing & Operations Corporation EMC/RF Test Laboratory Main Lab. 4th Site Shielded Room 2

Wi-Fi 5GHz (Chain1_155ch)_Body-Worn_Front-Right_0mm

DUT: Type1VY (installed in Digital Camera 1VY002)

Communication System: UID 0, Wi-Fi_802.11ac_VHT80_MCS0 (0);

Communication System Band: 5GHz; Frequency: 5775 MHz;

Medium parameters used: $f = 5775$ MHz; $\sigma = 5.317$ S/m; $\epsilon_r = 34.287$; $\rho = 1000$ kg/m³

Phantom section: Flat Section

DASY Configuration:

- Probe: EX3DV4 - SN3745; ConvF(4.31, 4.31, 4.31) @ 5775 MHz; Calibrated: 2020/06/22
- Sensor-Surface: 1.4mm (Mechanical Surface Detection), $z = 1.0, 25.0$
- Electronics: DAE4 Sn610; Calibrated: 2020/01/10
- Phantom: SAM (20deg probe tilt) with CRP v5.0 FRONT; Type: QD000P40CD; Serial: TP:1852
- DASY52 52.10.4(1527); SEMCAD X 14.6.14(7483)

Configuration/Wi-Fi 5GHz (Chain1_155ch)_Body-Worn_Front-Right_0mm/

Area Scan (11x18x1): Measurement grid: $dx=10$ mm, $dy=10$ mm

Maximum value of SAR (measured) = 0.685 W/kg

Configuration/Wi-Fi 5GHz (Chain1_155ch)_Body-Worn_Front-Right_0mm/

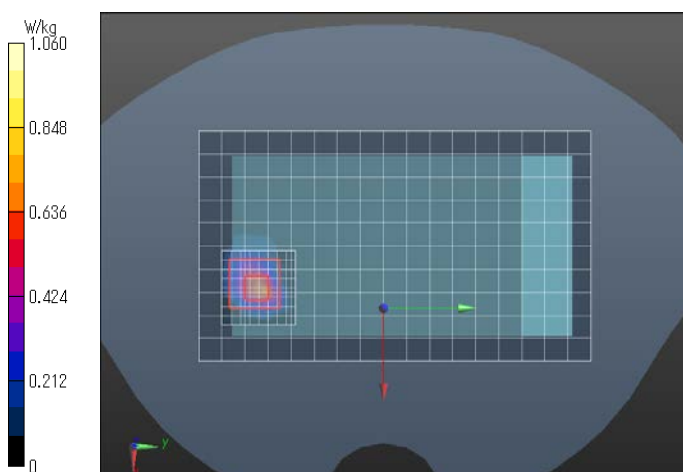
Zoom Scan (9x9x6)/Cube 0: Measurement grid: $dx=4$ mm, $dy=4$ mm, $dz=2$ mm

Reference Value = 12.66 V/m; Power Drift = -0.04 dB

Peak SAR (extrapolated) = 1.79 W/kg

SAR(1 g) = 0.374 W/kg; SAR(10 g) = 0.092 W/kg (SAR corrected for target medium)

Maximum value of SAR (measured) = 1.06 W/kg



Plot No. 9

Date: 2020/11/09

Test Laboratory: Sony Global Manufacturing & Operations Corporation EMC/RF Test Laboratory Main Lab. 4th Site Shielded Room 2

Bluetooth (19ch)_Body-Worn_Right_0mm**DUT: Type1VY (installed in Digital Camera 1VY002)**

Communication System: UID 0, Bluetooth LE (0);

Communication System Band: Bluetooth; Frequency: 2440 MHz;

Medium parameters used: $f = 2440 \text{ MHz}$; $\sigma = 1.833 \text{ S/m}$; $\epsilon_r = 40.205$; $\rho = 1000 \text{ kg/m}^3$

Phantom section: Flat Section

DASY Configuration:

- Probe: EX3DV4 - SN3921; ConvF(7.82, 7.82, 7.82) @ 2440 MHz; Calibrated: 2020/10/21
- Sensor-Surface: 1.4mm (Mechanical Surface Detection), $z = 1.0, 31.0$
- Electronics: DAE4 Sn610; Calibrated: 2020/01/10
- Phantom: SAM (20deg probe tilt) with CRP v5.0 FRONT; Type: QD000P40CD; Serial: TP:1852
- DASY52 52.10.4(1527); SEMCAD X 14.6.14(7483)

Configuration/Bluetooth (19ch)_Body-Worn_Right_0mm/**Area Scan (11x11x1): Measurement grid: $dx=12\text{mm}$, $dy=12\text{mm}$**

Maximum value of SAR (measured) = 0.287 W/kg

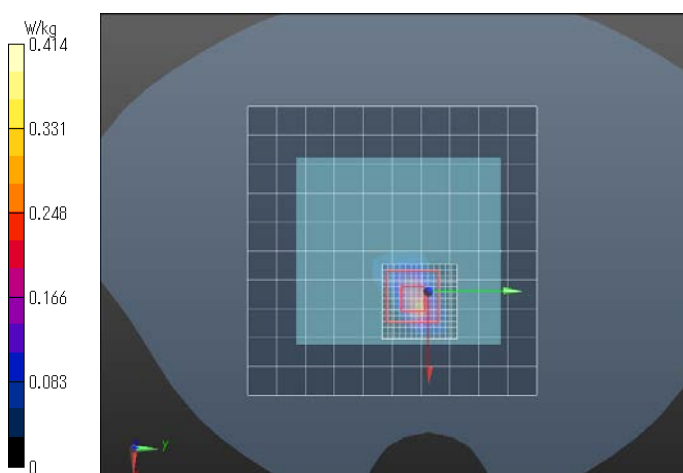
Configuration/Bluetooth (19ch)_Body-Worn_Right_0mm/**Zoom Scan 2 (14x14x8)/Cube 0: Measurement grid: $dx=2.4\text{mm}$, $dy=2.4\text{mm}$, $dz=1.4\text{mm}$**

Reference Value = 13.16 V/m; Power Drift = 0.02 dB

Peak SAR (extrapolated) = 0.601 W/kg

SAR(1 g) = 0.193 W/kg; SAR(10 g) = 0.057 W/kg (SAR corrected for target medium)

Maximum value of SAR (measured) = 0.414 W/kg



Appendix B. Plots of System Check

Please see the following page(s).

Date: 2020/11/09

Test Laboratory: Sony Global Manufacturing & Operations Corporation EMC/RF Test Laboratory Main Lab. 4th Site Shielded Room 2

Validation_D2450_HSL (1)

DUT: Dipole 2450 MHz; Type: D2450V2; Serial: 936

Communication System: UID 0, CW (0); Frequency: 2450 MHz

Medium parameters used: $f = 2450$ MHz; $\sigma = 1.84$ S/m; $\epsilon_r = 40.181$; $\rho = 1000$ kg/m³

Phantom section: Flat Section

DASY Configuration:

- Probe: EX3DV4 - SN3921; ConvF(7.82, 7.82, 7.82) @ 2450 MHz; Calibrated: 2020/10/21
- Sensor-Surface: 1.4mm (Mechanical Surface Detection), $z = 1.0, 31.0$
- Electronics: DAE4 Sn610; Calibrated: 2020/01/10
- Phantom: SAM (20deg probe tilt) with CRP v5.0 FRONT; Type: QD000P40CD; Serial: TP:1852
- DASY52 52.10.4(1527); SEMCAD X 14.6.14(7483)

System Performance Check at Frequencies above 2 GHz/Validation D2450 HSL/

Area Scan (8x8x1): Measurement grid: $dx=12$ mm, $dy=12$ mm

Maximum value of SAR (measured) = 17.3 W/kg

System Performance Check at Frequencies above 2 GHz/Validation D2450 HSL/

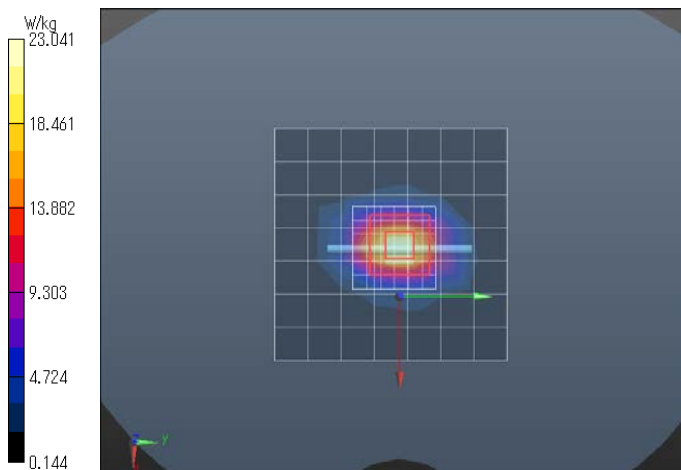
Zoom Scan (7x7x7)/Cube 0: Measurement grid: $dx=5$ mm, $dy=5$ mm, $dz=5$ mm

Reference Value = 116.2 V/m; Power Drift = 0.10 dB

Peak SAR (extrapolated) = 28.7 W/kg

SAR(1 g) = 14 W/kg; SAR(10 g) = 6.51 W/kg (SAR corrected for target medium)

Maximum value of SAR (measured) = 23.0 W/kg



Date: 2020/11/10

Test Laboratory: Sony Global Manufacturing & Operations Corporation EMC/RF Test Laboratory Main Lab. 4th Site Shielded Room 2

Validation_D2450_HSL (2)

DUT: Dipole 2450 MHz; Type: D2450V2; Serial: 936

Communication System: UID 0, CW (0); Frequency: 2450 MHz

Medium parameters used: $f = 2450$ MHz; $\sigma = 1.818$ S/m; $\epsilon_r = 40.059$; $\rho = 1000$ kg/m³

Phantom section: Flat Section

DASY Configuration:

- Probe: EX3DV4 - SN3921; ConvF(7.82, 7.82, 7.82) @ 2450 MHz; Calibrated: 2020/10/21
- Sensor-Surface: 1.4mm (Mechanical Surface Detection), $z = 1.0, 31.0$
- Electronics: DAE4 Sn610; Calibrated: 2020/01/10
- Phantom: SAM (20deg probe tilt) with CRP v5.0 FRONT; Type: QD000P40CD; Serial: TP:1852
- DASY52 52.10.4(1527); SEMCAD X 14.6.14(7483)

System Performance Check at Frequencies above 2 GHz/Validation D2450 HSL/

Area Scan (8x8x1): Measurement grid: $dx=12$ mm, $dy=12$ mm

Maximum value of SAR (measured) = 17.4 W/kg

System Performance Check at Frequencies above 2 GHz/Validation D2450 HSL/

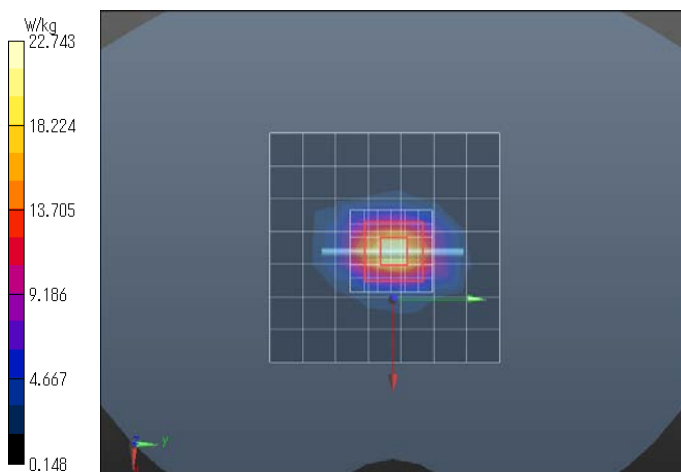
Zoom Scan (7x7x7)/Cube 0: Measurement grid: $dx=5$ mm, $dy=5$ mm, $dz=5$ mm

Reference Value = 115.5 V/m; Power Drift = 0.12 dB

Peak SAR (extrapolated) = 28.2 W/kg

SAR(1 g) = 13.6 W/kg; SAR(10 g) = 6.31 W/kg (SAR corrected for target medium)

Maximum value of SAR (measured) = 22.7 W/kg



Date: 2020/11/04

Test Laboratory: Sony Global Manufacturing & Operations Corporation EMC/RF Test Laboratory Main Lab. 4th Site Shielded Room 2

Validation_D5300_HSL

DUT: Dipole 5GHz; Type: D5GHzV2; Serial: 1183

Communication System: UID 0, CW (0); Frequency: 5300 MHz

Medium parameters used: $f = 5300$ MHz; $\sigma = 4.747$ S/m; $\epsilon_r = 35.148$; $\rho = 1000$ kg/m³

Phantom section: Flat Section

DASY Configuration:

- Probe: EX3DV4 - SN3745; ConvF(4.63, 4.63, 4.63) @ 5300 MHz; Calibrated: 2020/06/22
- Sensor-Surface: 1.4mm (Mechanical Surface Detection), $z = 1.0, 25.0$
- Electronics: DAE4 Sn610; Calibrated: 2020/01/10
- Phantom: SAM (20deg probe tilt) with CRP v5.0 FRONT; Type: QD000P40CD; Serial: TP:1852
- DASY52 52.10.4(1527); SEMCAD X 14.6.14(7483)

System Performance Check at Frequencies above 5 GHz/Validation D5300 HSL/

Area Scan (6x7x1): Measurement grid: $dx=10$ mm, $dy=10$ mm

Maximum value of SAR (measured) = 17.1 W/kg

System Performance Check at Frequencies above 5 GHz/Validation D5300 HSL/

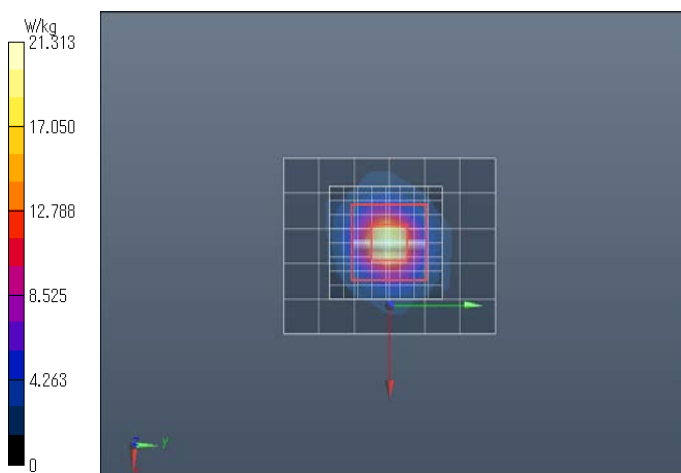
Zoom Scan (9x9x6)/Cube 0: Measurement grid: $dx=4$ mm, $dy=4$ mm, $dz=2$ mm

Reference Value = 73.21 V/m; Power Drift = 0.14 dB

Peak SAR (extrapolated) = 33.8 W/kg

SAR(1 g) = 8.48 W/kg; SAR(10 g) = 2.41 W/kg (SAR corrected for target medium)

Maximum value of SAR (measured) = 21.3 W/kg



Date: 2020/11/11

Test Laboratory: Sony Global Manufacturing & Operations Corporation EMC/RF Test Laboratory Main Lab. 4th Site Shielded Room 2

Validation_D5600_HSL

DUT: Dipole 5GHz; Type: D5GHzV2; Serial: 1183

Communication System: UID 0, CW (0); Frequency: 5600 MHz

Medium parameters used: $f = 5600$ MHz; $\sigma = 5.063$ S/m; $\epsilon_r = 34.707$; $\rho = 1000$ kg/m³

Phantom section: Flat Section

DASY Configuration:

- Probe: EX3DV4 - SN3921; ConvF(4.84, 4.84, 4.84) @ 5600 MHz; Calibrated: 2020/10/21
- Sensor-Surface: 1.4mm (Mechanical Surface Detection), $z = 1.0, 25.0$
- Electronics: DAE4 Sn610; Calibrated: 2020/01/10
- Phantom: SAM (20deg probe tilt) with CRP v5.0 FRONT; Type: QD000P40CD; Serial: TP:1852
- DASY52 52.10.4(1527); SEMCAD X 14.6.14(7483)

System Performance Check at Frequencies above 5 GHz/Validation D5600 HSL/**Area Scan (6x7x1): Measurement grid: $dx=10$ mm, $dy=10$ mm**

Maximum value of SAR (measured) = 18.5 W/kg

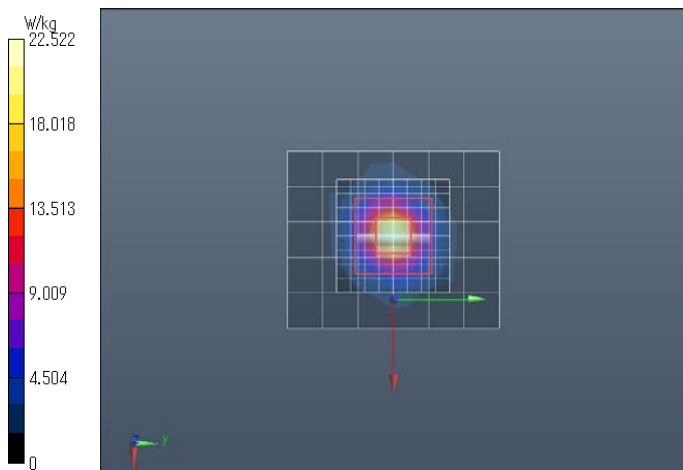
System Performance Check at Frequencies above 5 GHz/Validation D5600 HSL/**Zoom Scan (9x9x6)/Cube 0: Measurement grid: $dx=4$ mm, $dy=4$ mm, $dz=2$ mm**

Reference Value = 73.56 V/m; Power Drift = 0.02 dB

Peak SAR (extrapolated) = 37.9 W/kg

SAR(1 g) = 8.69 W/kg; SAR(10 g) = 2.46 W/kg (SAR corrected for target medium)

Maximum value of SAR (measured) = 22.5 W/kg



Date: 2020/11/06

Test Laboratory: Sony Global Manufacturing & Operations Corporation EMC/RF Test Laboratory Main Lab. 4th Site Shielded Room 2

Validation_D5800_HSL

DUT: Dipole 5GHz; Type: D5GHzV2; Serial: 1183

Communication System: UID 0, CW (0); Frequency: 5800 MHz

Medium parameters used: $f = 5800$ MHz; $\sigma = 5.326$ S/m; $\epsilon_r = 34.334$; $\rho = 1000$ kg/m³

Phantom section: Flat Section

DASY Configuration:

- Probe: EX3DV4 - SN3745; ConvF(4.31, 4.31, 4.31) @ 5800 MHz; Calibrated: 2020/06/22
- Sensor-Surface: 1.4mm (Mechanical Surface Detection), $z = 1.0, 25.0$
- Electronics: DAE4 Sn610; Calibrated: 2020/01/10
- Phantom: SAM (20deg probe tilt) with CRP v5.0 FRONT; Type: QD000P40CD; Serial: TP:1852
- DASY52 52.10.4(1527); SEMCAD X 14.6.14(7483)

System Performance Check at Frequencies above 5 GHz/Validation D5800 HSL/**Area Scan (6x7x1): Measurement grid: $dx=10$ mm, $dy=10$ mm**

Maximum value of SAR (measured) = 18.0 W/kg

System Performance Check at Frequencies above 5 GHz/Validation D5800 HSL/**Zoom Scan (9x9x6)/Cube 0: Measurement grid: $dx=4$ mm, $dy=4$ mm, $dz=2$ mm**

Reference Value = 70.49 V/m; Power Drift = 0.11 dB

Peak SAR (extrapolated) = 38.0 W/kg

SAR(1 g) = 8.4 W/kg; SAR(10 g) = 2.37 W/kg (SAR corrected for target medium)

Maximum value of SAR (measured) = 22.1 W/kg

