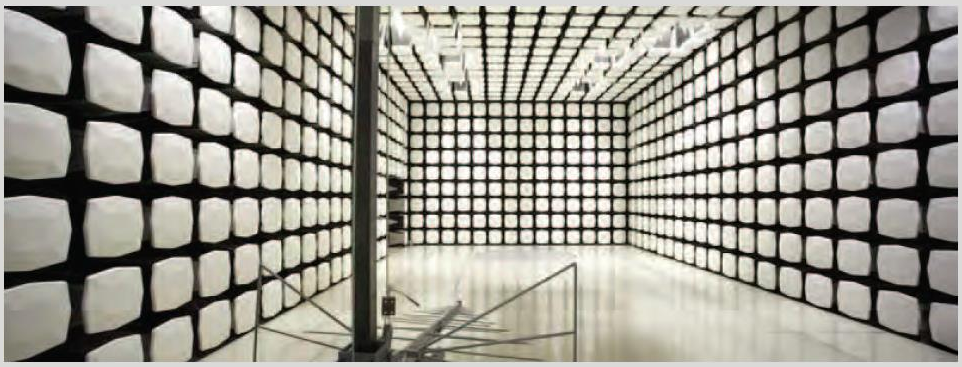
Motorola Solutions

VB400V3

SAR Evaluation Report: ELEM0125 Rev. 1, Issue Date: September 1, 2021

Evaluated to the following SAR specification:

FCC 2.1093:2021



CERT #3310.05

CERTIFICATE OF TEST

Last Date of Test: August 3, 2021
Motorola Solutions
EUT: VB400V3

Applicable Standard:

Test Description	Specification	Test Method	Pass/Fail
SAR Evaluation	FCC 2.1093:2021	IEEE Std 1528:2013 FCC KDB 865664 D01 v01r04 FCC KDB 865664 D02 v01r02 FCC KDB 447498 D01 v06 KDB 248227 D01 v02r02	Pass

Highest Measured SAR Values:

Radio	Equipment Class	Frequency Band (MHz)	Body (W/kg)	Limit (W/kg)	Exposure Environment
			1g	1g	
Bluetooth	DSS	2402-2480	**0.03**	1.6	General Population
Wi-Fi 802.11b/g/n	DTS	2412-2462	**0.34**	1.6	
Wi-Fi 802.11a/n	NII	5180-5240	Reduced	1.6	
		5260-5320	**0.09**	1.6	

Highest Simultaneous SAR Values:

Radios	Combined Body (W/kg)	Limit (W/kg)	Exposure Environment
	1g	1g	
Bluetooth Low Energy*, Wi-Fi 802.11b/g/n	0.38	1.6	General Population

*The SAR value for Bluetooth Low Energy is an estimated SAR value.

Deviations From Test Standards

None

Approved By:

Don Facteau, Systems Architect

REVISION HISTORY

Revision Number	Description	Date (yyyy-mm-dd)	Page Number
01	Updated lab accreditation from NVLAP to A2LA	2021-09-01	1, 4, 5

ACCREDITATIONS AND AUTHORIZATIONS

element
2021.09.01

United States

FCC - Designated by the FCC as a Telecommunications Certification Body (TCB). Certification chambers, Open Area Test Sites, and conducted measurement facilities are listed with the FCC.

A2LA - Each laboratory is accredited by A2LA to ISO / IEC 17025, and as a product certifier to ISO / IEC 17065 which allows Element to certify transmitters to FCC and IC specifications.

Canada

ISED - Recognized by Innovation, Science and Economic Development Canada as a Certification Body (CB) and as a CAB for the acceptance of test data.

European Union

European Commission – Recognized as an EU Notified Body validated for the EMCD and RED Directives.

United Kingdom

BEIS – Recognized by the UK as an Approved Body under the UK Radio Equipment and UK EMC Regulations.

Australia/New Zealand

ACMA - Recognized by ACMA as a CAB for the acceptance of test data.

Korea

MSIT / RRA - Recognized by KCC's RRA as a CAB for the acceptance of test data.

Japan

VCCI - Associate Member of the VCCI. Conducted and radiated measurement facilities are registered.

Taiwan

BSMI – Recognized by BSMI as a CAB for the acceptance of test data.

NCC - Recognized by NCC as a CAB for the acceptance of test data.

Singapore

IDA – Recognized by IDA as a CAB for the acceptance of test data.

Israel

MOC – Recognized by MOC as a CAB for the acceptance of test data.

Hong Kong

OFCA – Recognized by OFCA as a CAB for the acceptance of test data.

Vietnam

MIC – Recognized by MIC as a CAB for the acceptance of test data.

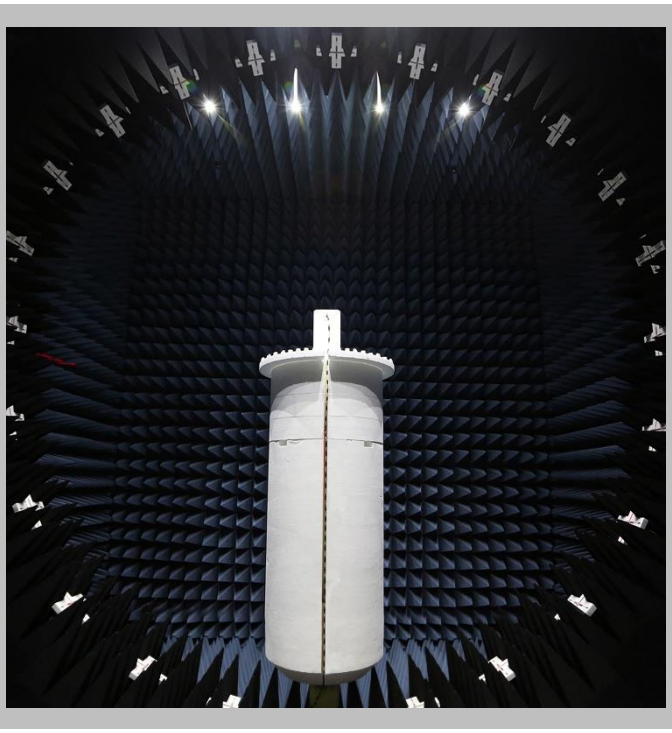
SCOPE

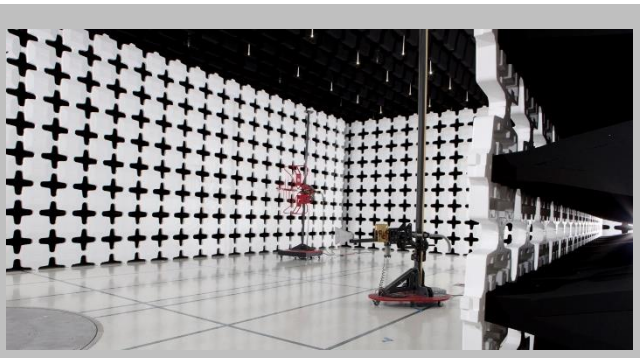
For details on the Scopes of our Accreditations, please visit:

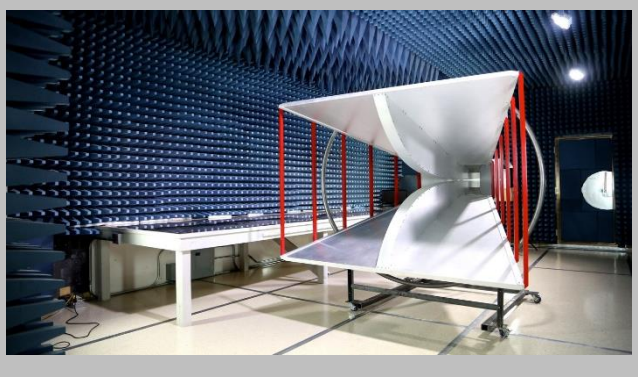
California Minnesota Oregon Texas Washington

FACILITIES

California	Minnesota	Oregon	Texas	Washington
Labs OC01-17 41 Tesla Irvine, CA 92618 (949) 861-8918	Labs MN01-11 9349 W Broadway Ave. Brooklyn Park, MN 55445 (612)-638-5136	Labs EV01-12 6775 NE Evergreen Pkwy #400 Hillsboro, OR 97124 (503) 844-4066	Labs TX01-09 3801 E Plano Pkwy Plano, TX 75074 (469) 304-5255	Labs NC01-05 19201 120th Ave NE Bothell, WA 98011 (425)984-6600
A2LA				
Lab Code: 3310.04	Lab Code: 3310.05	Lab Code: 3310.02	Lab Code: 3310.03	Lab Code: 3310.06
Innovation, Science and Economic Development Canada				
2834B-1, 2834B-3	2834E-1, 2834E-3	2834D-1	2834G-1	2834F-1
BSMI				
SL2-IN-E-1154R	SL2-IN-E-1152R	SL2-IN-E-1017	SL2-IN-E-1158R	SL2-IN-E-1153R
VCCI				
A-0029	A-0109	A-0108	A-0201	A-0110
Recognized Phase I CAB for ISED, ACMA, BSMI, IDA, KCC/RRA, MIC, MOC, NCC, OFCA				
US0158	US0175	US0017	US0191	US0157







PRODUCT DESCRIPTION

2014-12-10

Client and Equipment Under Test (EUT) Information

Company Name:	Motorola Solutions
Address:	Motorola Solutions, Caledonian Exchange, 19A Canning Street
City, State, Zip:	Edinburgh, EH3 8EG, UK
Test Requested By:	Anne Ambler
Model:	VB400V3
First Date of Test:	April 20, 2021
Last Date of Test:	August 3, 2021
Receipt Date of Samples:	February 23, 2021
Equipment Design Stage:	Preproduction
Equipment Condition:	No Damage
Purchase Authorization:	Verified

Information Provided by the Party Requesting the Test

Functional Description of the EUT:

The VB400V3 is a body-worn camera containing a combination 802.11a/b/g/n and Bluetooth radio. It also contains a standalone BLE radio. The VB400V3 can attach to clothing or harnesses via various accessories.

Contains FCC IDs: VPYLBEE5HY1MW, AZ489FT7148

The device contains the following radios:
802.11b/g/n: 2412-2462 MHz
802.11a/n: 5180-5320 MHz
Bluetooth: 2402-2480 MHz
Bluetooth Low Energy: 2402-2480 MHz

Location of transmit antenna(s):

PRODUCT DESCRIPTION

2014-12-10

Testing Locations and Separation Distances:

Accessory	Technology	EUT Orientation					
		Front	Back	Left	Right	Top	Bottom
None	Bluetooth BDR/EDR	Reduced[4]	0 mm	Reduced[4]	Reduced[4]	Reduced[4]	Reduced[4]
	Bluetooth LE	Reduced[3]	Reduced[3]	Reduced[3]	Reduced[3]	Reduced[3]	Reduced[3]
	802.11b/g/n DSSS	Reduced[4]	0 mm	Reduced[4]	Reduced[4]	Reduced[4]	Reduced[4]
	802.11b/g/n OFDM	Reduced[1]	Reduced[1]	Reduced[1]	Reduced[1]	Reduced[1]	Reduced[1]
	802.11a/n U-NII-1	Reduced[2]	Reduced[2]	Reduced[2]	Reduced[2]	Reduced[2]	Reduced[2]
	802.11a/n U-NII-2A	Reduced[4]	0 mm	Reduced[4]	Reduced[4]	Reduced[4]	Reduced[4]
MagMount[5]	Bluetooth BDR/EDR	Reduced[4]	0 mm	Reduced[4]	Reduced[4]	Reduced[4]	Reduced[4]
	Bluetooth LE	Reduced[3]	Reduced[3]	Reduced[3]	Reduced[3]	Reduced[3]	Reduced[3]
	802.11b/g/n DSSS	Reduced[4]	0 mm	Reduced[4]	Reduced[4]	Reduced[4]	Reduced[4]
	802.11b/g/n OFDM	Reduced[1]	Reduced[1]	Reduced[1]	Reduced[1]	Reduced[1]	Reduced[1]
	802.11a/n U-NII-1	Reduced[2]	Reduced[2]	Reduced[2]	Reduced[2]	Reduced[2]	Reduced[2]
	802.11a/n U-NII-2A	Reduced[4]	0 mm	Reduced[4]	Reduced[4]	Reduced[4]	Reduced[4]

1: Per KDB 248227 D01 5.2.2, when the highest reported SAR for DSSS is adjusted by the ratio of OFDM to DSSS maximum output power and if the SAR ≤ 1.2 W/kg over 1g, SAR is not required for 2.4 GHz OFDM conditions.

2: Per KDB 248227 D01 5.3.1, SAR is initially measured on the band with the highest rated power between U-NII-1 and U-NII-2A, when they are the same U-NII-2A is meausred. The SAR value for the non-measured band is then estimated by taking the SAR value for the measured band and adjusting it by the ratio of the rated power values between the non-measured band and the measured band. If the estimated SAR ≤ 1.2 W/kg over 1g, SAR is not required for the non-measured band.

3: Applies for standalone SAR Test Exclusion

4: Not requested

5: The MagMount accessory includes a <1 mm thick plastic sheet used to represent clothing.

Rated Power and Software Power Settings:

Radio and Band	Channel	Frequency (MHz)	Protocol	Data Rate	Modulation	Software Power Setting	Max Rated Power (dBm)
Wi-Fi 2.4 GHz	1	2412	802.11b	**1 Mbps**	**DSSS**	**17**	**19.5**
				11 Mbps	DSSS	17	19.5
			802.11g	6 Mbps	OFDM	12	18.5
				54 Mbps	OFDM	12	15.5
			802.11n	MCS0 20 MHz	OFDM	12	16.5
				MCS7 20 MHz	OFDM	12	14.5
	6	2437	802.11b	**1 Mbps**	**DSSS**	**17**	**19.5**
				11 Mbps	DSSS	17	19.5
			802.11g	6 Mbps	OFDM	16	18.5
				54 Mbps	OFDM	13	15.5
			802.11n	MCS0 20 MHz	OFDM	14	16.5
				MCS7 20 MHz	OFDM	12	14.5
	11	2462	802.11b	**1 Mbps**	**DSSS**	**17**	**19.5**
				11 Mbps	DSSS	17	19.5
			802.11g	6 Mbps	OFDM	12	18.5
				54 Mbps	OFDM	12	15.5
			802.11n	MCS0 20 MHz	OFDM	14	16.5
				MCS7 20 MHz	OFDM	12	14.5

Radio and Band	Channel	Frequency (MHz)	Protocol	Data Rate	Modulation	Software Power Setting	Max Rated Power (dBm)
Wi-Fi U-NII-1	36	5180	802.11a	6 Mbps	OFDM	12	17
				54 Mbps	OFDM	12	15
			802.11n	MCS0 20 MHz	OFDM	12	17
				MCS7 20 MHz	OFDM	12	15
	38F	5190		**MCS0 40 MHz**	**OFDM**	**10**	**17**
				MCS7 40 MHz	OFDM	10	15
	40	5200	802.11a	6 Mbps	OFDM	12	17
				54 Mbps	OFDM	12	15
			802.11n	MCS0 20 MHz	OFDM	12	17
				MCS7 20 MHz	OFDM	12	15
	44	5220	802.11a	**6 Mbps**	**OFDM**	**15**	**17**
				54 Mbps	OFDM	13	15
			802.11n	MCS0 20 MHz	OFDM	15	17
				MCS7 20 MHz	OFDM	13	15
	48	5240	802.11a	6 Mbps	OFDM	15	17
				54 Mbps	OFDM	13	15
			802.11n	MCS0 20 MHz	OFDM	15	17
				MCS7 20 MHz	OFDM	13	15
	46F	5230		**MCS0 40 MHz**	**OFDM**	**15**	**17**
				MCS7 40 MHz	OFDM	13	15
Wi-Fi U-NII-2A	52	5260	802.11a	6 Mbps	OFDM	15	17
				54 Mbps	OFDM	13	15
			802.11n	MCS0 20 MHz	OFDM	15	17
				MCS7 20 MHz	OFDM	13	15
	54F	5270		**MCS0 40 MHz**	**OFDM**	**15**	**17**
				MCS7 40 MHz	OFDM	13	15
	56	5280	802.11a	**6 Mbps**	**OFDM**	**15**	**17**
				54 Mbps	OFDM	13	15
			802.11n	MCS0 20 MHz	OFDM	15	17
				MCS7 20 MHz	OFDM	13	15
	60	5300	802.11a	6 Mbps	OFDM	12	17
				54 Mbps	OFDM	12	15
			802.11n	MCS0 20 MHz	OFDM	12	17
				MCS7 20 MHz	OFDM	12	15
	64	5320	802.11a	6 Mbps	OFDM	12	17
				54 Mbps	OFDM	12	15
			802.11n	MCS0 20 MHz	OFDM	12	17
				MCS7 20 MHz	OFDM	12	15
	62F	5310		**MCS0 40 MHz**	**OFDM**	**10**	**17**
				MCS7 40 MHz	OFDM	10	15

Radio and Band	Channel	Frequency (MHz)	Data Rate	Modulation	Software Power Setting	Max Rated Power (dBm)
BT Classic	0	2402	**1 Mbps**	**DH5**	**0x09**	**10.5**
			2 Mbps	2DH5	0x09	6.5
			3 Mbps	3DH5	0x09	6.5
	38	2440	**1 Mbps**	**DH5**	**0x09**	**10.5**
			2 Mbps	2DH5	0x09	6.5
			3 Mbps	3DH5	0x09	6.5
	78	2480	**1 Mbps**	**DH5**	**0x09**	**10.5**
			2 Mbps	2DH5	0x09	6.5
			3 Mbps	3DH5	0x09	6.5

Radio and Band	Channel	Frequency (MHz)	Data Rate	Modulation	Software Power Setting	Max Rated Power (dBm)
BT Low Energy	37	2402	**1 Mbps**	**GFSK**	**-4**	**-4**
			2 Mbps	GFSK	-4	-4
	17	2440	**1 Mbps**	**GFSK**	**-4**	**-4**
			2 Mbps	GFSK	-4	-4
	39	2480	**1 Mbps**	**GFSK**	**-4**	**-4**
			2 Mbps	GFSK	-4	-4

Simultaneous Transmission:

The EUT is capable of simultaneous transmission capability between the Bluetooth Low Energy radio and either the 802.11a/b/g/n or the Bluetooth radio. The equipment qualifies for simultaneous transmission SAR test exclusion based on summing the reported SAR values and estimated SAR values for all simultaneously transmitting radios and comparing these to the SAR limit.

Radio Set 1	Highest Reported SAR Value (W/kg over 1 g)
802.11b/g/n	0.34
802.11a/n	0.09
Bluetooth	0.03
Highest	**0.34**

Radio Set 2	Highest Reported SAR Value (W/kg over 1 g)
Bluetooth Low Energy	0.04
Highest	**0.04**

The sum of the highest reported SAR and estimated SAR values for each radio set is then compared against the limit to determine if the equipment qualifies for simultaneous transmission SAR test exclusion.

0.34 W/kg over 1 g + 0.04 W/kg over 1 g = 0.38 W/kg over 1g
0.38 W/kg over 1 g ≤ 1.6 W/kg over 1 g

Therefore, the equipment qualifies for simultaneous SAR test exclusion.

Testing Objective:

To demonstrate compliance of the 802.11a/b/g/n, Bluetooth, and Bluetooth Low Energy radios with the SAR requirements of FCC 2.1093:2020.

CONFIGURATIONS

Configuration ELEM0125- 1

EUT			
Description	**Manufacturer**	**Model/Part Number**	**Serial Number**
VB400V3	Motorola Solutions	VB400V3	229318

Peripherals in test setup boundary			
Description	**Manufacturer**	**Model/Part Number**	**Serial Number**
Magmount	Motorola Solutions	VB-400-VF-MAG	None
Debug Board	Motorola Solutions	Unknown	Unknown
USB to UART Bridge Board	FTDI Chip	LC231X	None

Cables					
Cable Type	**Shield**	**Length (m)**	**Ferrite**	**Connection 1**	**Connection 2**
Ribbon Cable	No	0.05 m	No	VB400V3	Dev Board

Software/Firmware Running during test	
Description	**Version**
VB400V3 Firmware	V15.0_e07x_rftest8

Configuration ELEM0125- 2

EUT			
Description	**Manufacturer**	**Model/Part Number**	**Serial Number**
VB400V3	Motorola Solutions	VB400V3	229324

Peripherals in test setup boundary			
Description	**Manufacturer**	**Model/Part Number**	**Serial Number**
Debug Board	Motorola Solutions	Unknown	Unknown
USB to UART Bridge Board	FTDI Chip	LC231X	None

Cables					
Cable Type	**Shield**	**Length (m)**	**Ferrite**	**Connection 1**	**Connection 2**
Ribbon Cable	No	0.05 m	No	VB400V3	Dev Board

Software/Firmware Running during test	
Description	**Version**
VB400V3 Firmware	V15.0_e07x_rftest8

CONFIGURATIONS

Configuration ELEM0125- 3

EUT			
Description	**Manufacturer**	**Model/Part Number**	**Serial Number**
VB400V3	Motorola Solutions	VB400V3	229308

Peripherals in test setup boundary			
Description	**Manufacturer**	**Model/Part Number**	**Serial Number**
Debug Board	Motorola Solutions	Unknown	Unknown
USB to UART Bridge Board	FTDI Chip	LC231X	None

Cables					
Cable Type	**Shield**	**Length (m)**	**Ferrite**	**Connection 1**	**Connection 2**
Ribbon Cable	No	0.05 m	No	VB400V3	Dev Board

Software/Firmware Running during test	
Description	**Version**
VB400V3 Firmware	V15.0_e07x_rftest8

MODIFICATIONS

Equipment Modifications

Item	Date	Test	Modification	Note	Disposition of EUT
1	2021-04-20	Output Power	Tested as delivered to Test Station.	No EMI suppression devices were added or modified during this test.	EUT remained at Element following the test.
2	2021-08-02	SAR Evaluation	Tested as delivered to Test Station.	No EMI suppression devices were added or modified during this test.	EUT remained at Element following the test.
3	2021-08-03	SAR Evaluation	Tested as delivered to Test Station.	No EMI suppression devices were added or modified during this test.	Scheduled testing was completed.

TISSUE – EQUIVALENT LIQUID DESCRIPTION

Characterization of tissue-equivalent liquid dielectric properties

The measured values must be within ±10% of the target values provided SAR error compensation algorithms documented in IEEE Std 1528-2013 section E.3.2.2 are implemented for upward correction purposes only. The temperature variation in the liquid during SAR measurements must be within ± 2 °C of that recorded when the dielectric properties were measured.

The dielectric parameters of the tissue-equivalent liquids were measured using the SPEAG DAKS:200 dielectric assessment kit. The dielectric measurements were made across the frequency range of the liquid. The attached data sheets show that the dielectric parameters of the liquid were within the required tolerances.

Target values of dielectric parameters

Per KDB 865664 D01 v01r04, Appendix A:

The head tissue dielectric parameters recommended by IEEE Std 1528-2013 have been incorporated in the following table. These head parameters are derived from planar layer models simulating the highest expected SAR for the dielectric properties and tissue thickness variations in a human head. Other head and body tissue parameters that have not been specified in IEEE Std 1528 are derived from tissue dielectric parameters computed from the 4-Cole-Cole equations described above and extrapolated according to the head parameters specified in IEEE Std 1528."

Linear interpolation is used for determining target dielectric parameters for values between those listed.

Target Frequency	Head		Body	
(MHz)	ε_r	σ (S/m)	ε_r	σ (S/m)
150	52.3	0.76	61.9	0.80
300	45.3	0.87	58.2	0.92
450	43.5	0.87	56.7	0.94
835	41.5	0.90	55.2	0.97
900	41.5	0.97	55.0	1.05
915	41.5	0.98	55.0	1.06
1450	40.5	1.20	54.0	1.30
1610	40.3	1.29	53.8	1.40
1800 – 2000	40.0	1.40	53.3	1.52
2450	39.2	1.80	52.7	1.95
3000	38.5	2.40	52.0	2.73
5800	35.3	5.27	48.2	6.00

(ε_r = relative permittivity, σ = conductivity and ρ = 1000 kg/m^3)

TISSUE – EQUIVALENT LIQUID DESCRIPTION

Composition of Ingredients for Liquid Tissue Phantoms

Element uses broadband tissue equivalent liquids prepared by SPEAG and confirmed by Element to be within +/- 10% of target values. SAR error compensation algorithms documented in IEEE Std 1528-2013 are implemented for upward correction purposes only.

By percent weight, the approximate compositions of the broadband tissue are listed below. The composition of ingredients may be modified accordingly to achieve the desired target tissue parameters required for routine SAR evaluation:

Material	Percent Weight
Ethanediol	1.0 - 4.9%
Sodium Petroleum Sulfonate	<2.9%
Hexylene Glycol	<2.9%
Alkoxylated Alcohol	<2.0%
Mineral Oils	<20%
Deionized Water	Fill to volume

The exact liquid recipes are proprietary to the tissue equivalent liquid manufacturer.

SAR Correction Formula for Deviation from Target Dielectric Values

A correction formula is automatically applied by the measurement software to SAR data to account for the deviation from the target dielectric values. The correction formula only scales measured values upward. The SAR system manufacturer has been contacted and has verified Element's implementation and understanding of the SAR correction formula. The correction is calculated following IEEE Std 1528-2013 Annex E.3. The equation is as follows:

$$\Delta SAR = c_\varepsilon \Delta\varepsilon_r + c_\sigma \Delta\sigma$$

Where the values for, $\Delta\varepsilon_r$ and $\Delta\sigma$ and are the percent the permittivity and conductivity respectively are away from ideal values and where ΔSAR is the percent the measured SAR value is corrected.

When 1 g peak spatial-average SAR measurements are taken:

$$c_\varepsilon = -7.854 \times 10^{-4} f^3 + 9.402 \times 10^{-3} f^2 - 2.742 \times 10^{-2} f - 0.2026$$
$$c_\sigma = 9.804 \times 10^{-3} f^3 - 8.661 \times 10^{-2} f^2 + 2.981 \times 10^{-2} f + 0.7829$$

Where *f* is the frequency in GHz.

When 10 g peak spatial-average SAR measurements are taken:

$$c_\varepsilon = 3.456 \times 10^{-3} f^3 - 3.531 \times 10^{-2} f^2 + 7.675 \times 10^{-2} f - 0.1860$$
$$c_\sigma = 4.479 \times 10^{-3} f^3 - 1.586 \times 10^{-2} f^2 - 0.1972 f + 0.7717$$

Where *f* is the frequency in GHz.

TISSUE – EQUIVALENT LIQUID

EUT:	VB400V3	Work Order:	ELEM0125
Customer:	Motorola Solutions	Job Site:	MN11
Attendees:	None	Customer Project:	None

TEST SPECIFICATIONS

Specification	Test Method
FCC 2.1093:2021	IEEE Std 1528:2013 FCC KDB 865664 D01 v01r04 FCC KDB 865664 D02 v01r02 FCC KDB 447498 D01 v06

HBBL600-10000V6

Date	Tissue Temp (°C)	Ambient Temp (°C)	Freq. (MHz)	Measured Values		Target Values		Deviation	
				Relative Permittivity	Cond. (S/m)	Relative Permittivity	Cond. (S/m)	Permittivity Deviation	Cond. Deviation
8/2/2021	21.0	20.9	2400	42.0	1.83	39.3	1.76	6.8%	4.3%
			2450	41.9	1.88	39.2	1.80	6.8%	4.2%
			2500	41.8	1.92	39.1	1.85	6.9%	3.6%
			5150	37.1	4.63	36.0	4.60	3.1%	0.7%
			5200	37.0	4.70	36.0	4.66	2.8%	0.9%
			5250	36.9	4.78	35.9	4.71	2.8%	1.4%
			5300	36.8	4.85	35.9	4.76	2.6%	1.9%
			5350	36.7	4.92	35.8	4.81	2.6%	2.3%
8/3/2021	20.6	21.7	5150	34.8	4.55	36.0	4.60	-3.4%	-1.2%
			5200	34.7	4.62	36.0	4.66	-3.6%	-0.8%
			5250	34.7	4.69	35.9	4.71	-3.5%	-0.3%
			5300	34.6	4.76	35.9	4.76	-3.6%	0.0%
			5350	34.5	4.82	35.8	4.81	-3.6%	0.2%
8/3/2021 (End of Test)	20.6	21.7	2400	40.5	1.79	39.3	1.76	3.0%	1.8%
			2450	40.4	1.83	39.2	1.80	3.1%	1.8%
			2500	40.3	1.88	39.1	1.85	3.2%	1.4%
			5150	35.7	4.48	36.0	4.60	-0.7%	-2.6%
			5200	35.7	4.55	36.0	4.66	-0.9%	-2.3%
			5250	35.6	4.62	35.9	4.71	-0.8%	-1.9%
			5300	35.5	4.68	35.9	4.76	-1.0%	-1.6%
			5350	35.5	4.74	35.8	4.81	-0.9%	-1.4%

SAR SYSTEM VERIFICATION DESCRIPTION

element
WSSV.2017.1.31

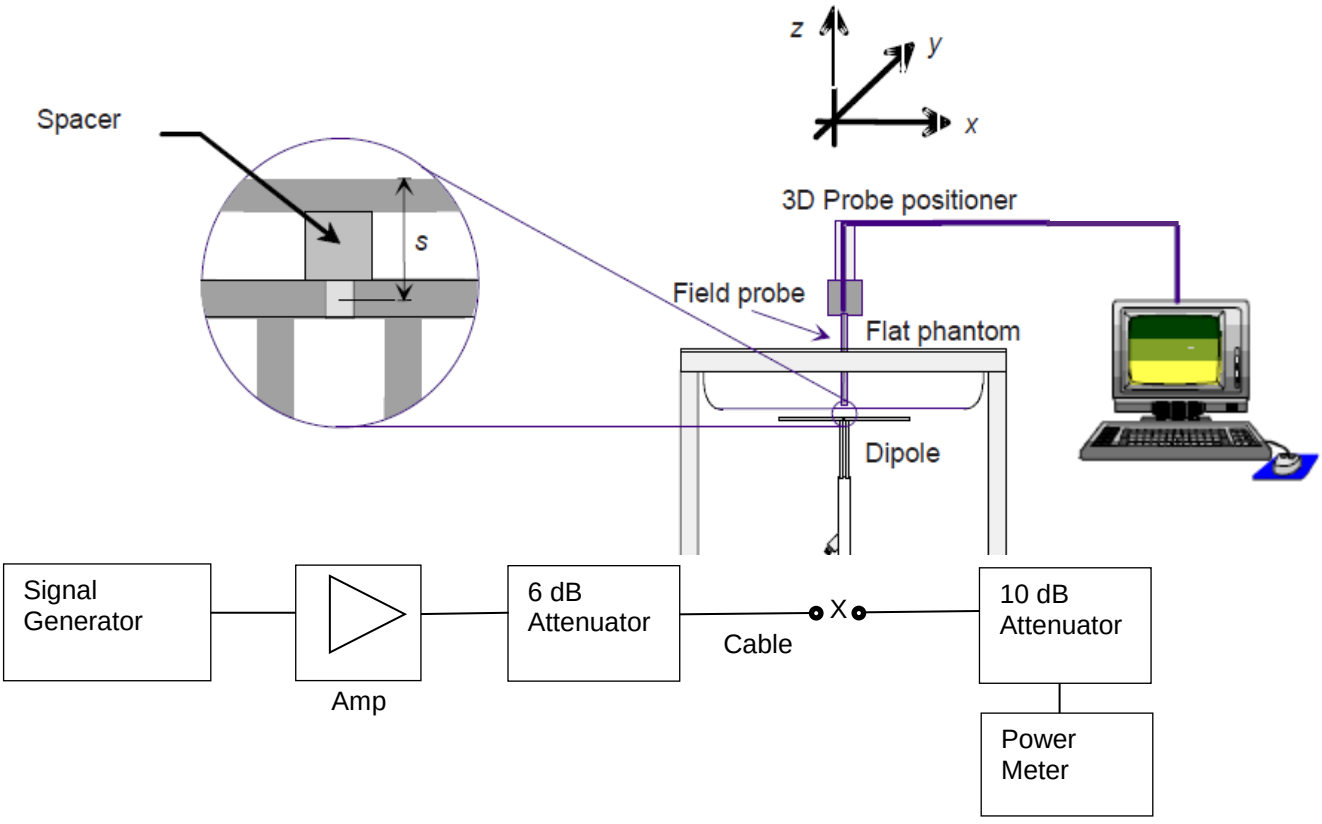
REQUIREMENT
Per IEEE 1528, Section 8.2.1, “System checks are performed prior to compliance tests and the results must always be within ± 10% of the target value corresponding to the test frequency, liquid, and the source used. The target values are 1 g or 10 g averaged SAR values measured on systems having current system validation and calibration status, and using the system check setup as shown in Figure 14. These target values should be determined using a standard source.”

TEST DESCRIPTION
Within 24 hours of a measurement, then every 24 hours thereafter, Element used the system validation kit (calibrated reference dipole) to test whether the system was operating within its specifications. The validation was performed in the indicated bands by making SAR measurements of the reference dipole with the phantom filled with the tissue-equivalent liquid. First, a signal generator and power amplifier were used to produce a 100mW level as measured with a power meter at the antenna terminals of the dipole (X). Then, the reference dipole was positioned below the bottom of the phantom and centered with its axis parallel to the longest side of the phantom. A low loss and low relative permittivity spacer was used to establish the correct distance between the center axis of the reference dipole and the liquid.

For the reference dipoles, the spacing distance s is given by:

s = 15mm, +/- 0.2mm for 300MHz ≤ f ≤ 1000 MHz
s = 10mm, +/- 0.2mm for 1000MHz ≤ f ≤ 6000MHz

The measured 1 g and 10 g spatial average SAR values were normalized to a 1W dipole input power for comparison to the calibration data. The results are summarized in the attached table. The deviation is less than 10% in all cases, indicating that the system performance check was within tolerance.



SAR SYSTEM VERIFICATION

element
WSSV.2016.12.19

TEST SPECIFICATIONS

Specification:	Method:
FCC 2.1093:2021	IEEE Std 1528:2013 FCC KDB 865664 D01 v01r04 FCC KDB 865664 D02 v01r02 FCC KDB 447498 D01 v06

RESULTS

Date	Tissue Temp (°C)	Ambient Temp (°C)	Freq. (MHz)	Conducted Power into Dipole (dBm)	1W Adj. Factor (dB)	Measured Values		Normalized Values		Target Values		Deviation	
						1g	10g	1g	10g	1g	10g	1g	10g
8/2/2021	21.0	20.9	2450	20.0	10.0	5.66	2.66	56.6	26.6	52.3	24.5	8.2%	8.6%
8/2/2021	21.0	20.9	5200	20.0	10.0	8.45	2.45	84.5	24.5	80.4	22.7	5.1%	7.9%

SAR SYSTEM VERIFICATION

element
WSSV.2016.12.19

Tested By:	Kyle McMullan	Room Temperature (°C):	20.9
Date:	2021-08-02, 12:32	Liquid Temperature (°C):	21
		Humidity (%RH):	51.2
		Bar. Pressure (mb):	1024

2450MHz System Check Rev3 4-20-21

Summary

Dipole	Frequency [MHz]	TSL	Power [dBm]	Dev. 1g [%]	Dev. 10g [%]	Dev. Peak [%]	Iso. Error [%]
D2450V2 - SN855	2450.0	HSL	20.0	8.2	8.6	22.2	2.3

Exposure Conditions

Phantom Section, TSL	Test Distance [mm]	Band	Group, UID	Frequency [MHz], Channel Number	Conversion Factor	TSL Conductivity [S/m]	TSL Permittivity
Flat, HSL	10		, 0--	2450.0, 0	7.22	1.88	41.9

Hardware Setup

Phantom	TSL, Measured Date	Probe, Calibration Date	DAE, Calibration Date
ELI V6.0 (20deg probe tilt) - 2044	HBBL-600-10000 Charge: 190820-2, 2021-Aug-02	EX3DV4 - SN3746, 2020-11-18	DAE4 Sn1237, 2020-11-04

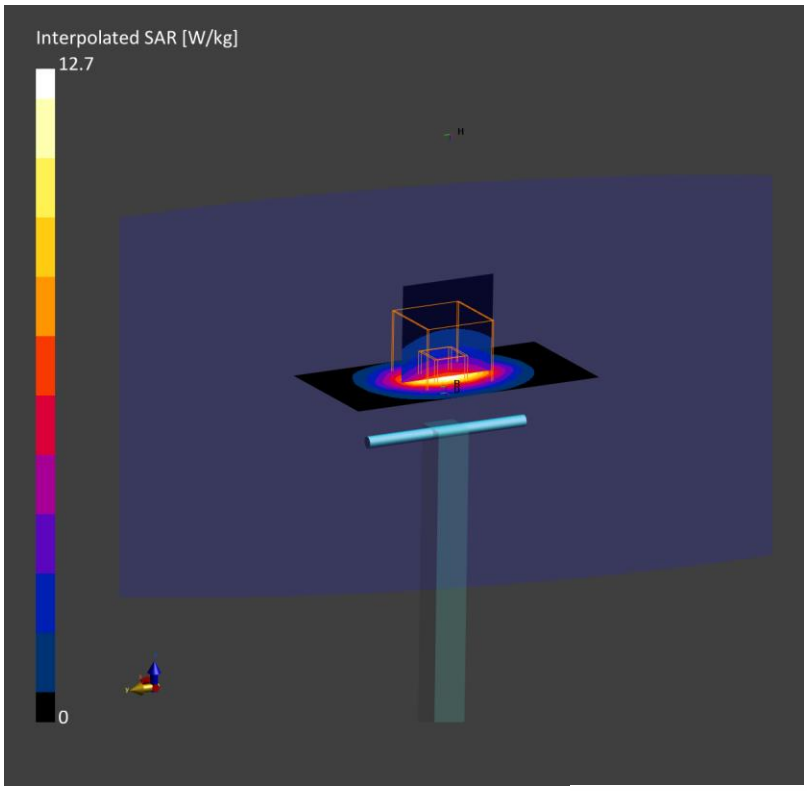
Scans Setup

	Area Scan	Zoom Scan
Grid Extents [mm]	40.0 x 80.0	30.0 x 30.0 x 30.0
Grid Steps [mm]	10.0 x 10.0	5.0 x 5.0 x 1.5
Sensor Surface [mm]	3.0	1.4
Graded Grid	Yes	Yes
Grading Ratio	1.5	1.5
MAIA	N/A	N/A
Surface Detection	VMS + 6p	VMS + 6p
Scan Method	Measured	Measured

Measurement Results

	Area Scan	Zoom Scan
Date	2021-08-02, 12:25	2021-08-02, 12:32
psSAR1g [W/Kg]	5.65	5.66
psSAR10g [W/Kg]	2.65	2.66
Power Drift [dB]	0.01	-0.00
Power Scaling	Disabled	Disabled
Scaling Factor [dB]		
TSL Correction	Positive only	Positive only

SAR SYSTEM VERIFICATION



Approved By

SAR SYSTEM VERIFICATION

element
WSSV.2016.12.19

Tested By:	Kyle McMullan	Room Temperature (°C):	20.9
Date:	2021-08-02, 12:32	Liquid Temperature (°C):	21
		Humidity (%RH):	51.2
		Bar. Pressure (mb):	1024

5200MHz System Check 4-21-21 Rev3

Summary

Dipole	Frequency [MHz]	TSL	Power [dBm]	Dev. 1g [%]	Dev. 10g [%]	Dev. Peak [%]	Iso. Error [%]
D5GHzV2 - SN1066	5200.0	HSL	20.0	5.1	7.9	4.0	3.0

Exposure Conditions

Phantom Section, TSL	Test Distance [mm]	Band	Group, UID	Frequency [MHz], Channel Number	Conversion Factor	TSL Conductivity [S/m]	TSL Permittivity
Flat, HSL	10		, 0--	5200.0, 0	5.13	4.70	37.0

Hardware Setup

Phantom	TSL, Measured Date	Probe, Calibration Date	DAE, Calibration Date
ELI V6.0 (20deg probe tilt) - 2044	HBBL-600-10000 Charge: 190820-2, 2021-Aug-02	EX3DV4 - SN3746, 2020-11-18	DAE4 Sn1237, 2020-11-04

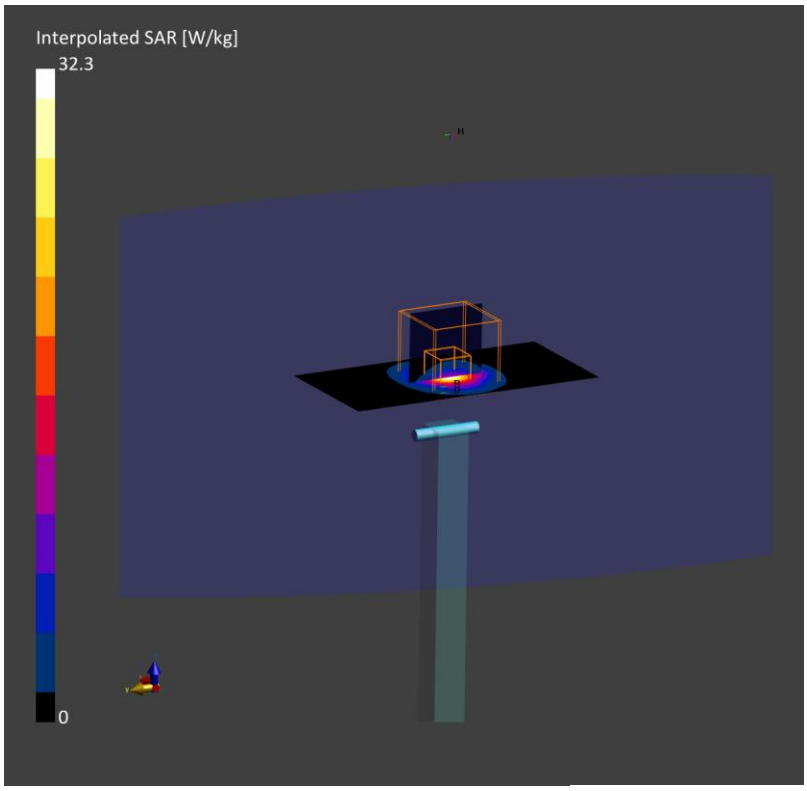
Scans Setup

	Area Scan	Zoom Scan
Grid Extents [mm]	40.0 x 80.0	22.0 x 22.0 x 22.0
Grid Steps [mm]	10.0 x 10.0	4.0 x 4.0 x 1.4
Sensor Surface [mm]	3.0	1.4
Graded Grid	Yes	Yes
Grading Ratio	1.5	1.4
MAIA	N/A	N/A
Surface Detection	VMS + 6p	VMS + 6p
Scan Method	Measured	Measured

Measurement Results

	Area Scan	Zoom Scan
Date	2021-08-02, 13:41	2021-08-02, 13:48
psSAR1g [W/Kg]	7.87	8.45
psSAR10g [W/Kg]	2.26	2.45
Power Drift [dB]	-0.01	-0.03
Power Scaling	Disabled	Disabled
Scaling Factor [dB]		
TSL Correction	Positive only	Positive only

SAR SYSTEM VERIFICATION



Approved By

OUTPUT POWER

element
WPM.12.06.24

EUT:	VB400V3	Work Order:	ELEM0125
Serial Number:	229308	Date:	20-Apr-21
Customer:	Motorola Solutions	Room Temperature (°C):	21
Attendees:	None	Humidity (%RH):	24.4
Customer Project:	None	Bar. Pressure (mb):	989.2
Tested By:	Marcelo Aguayo	Job Site:	MN11
Power:	Battery	Configuration:	ELEM0125-3

TEST SPECIFICATIONS

Specification	Test Method
FCC 2.1093:2021	IEEE Std 1528:2013 FCC KDB 865664 D01 v01r04 FCC KDB 865664 D02 v01r02 FCC KDB 447498 D01 v06 KDB 248227 D01 v02r02

COMMENTS

None

RESULTS – 2.4 GHz Wi-Fi

Radio and Band	Channel	Frequency (MHz)	Protocol	Data Rate	Modulation	Software Power Setting	Max Rated Power (dBm)	Output Power (dBm)	Output Power (mW)
Wi-Fi 2.4 GHz	1	2412	802.11b	**1 Mbps**	**DSSS**	**17**	**19.5**	**17.3**	**53.7**
				11 Mbps	DSSS	17	19.5	18.1	64.6
			802.11g	6 Mbps	OFDM	12	18.5	13.3	21.5
				54 Mbps	OFDM	12	15.5	13.4	22.0
			802.11n	MCS0 20 MHz	OFDM	12	16.5	12.9	19.6
				MCS7 20 MHz	OFDM	12	14.5	12.9	19.5
	6	2437	802.11b	**1 Mbps**	**DSSS**	**17**	**19.5**	**16.5**	**44.7**
				11 Mbps	DSSS	17	19.5	17.4	55.5
			802.11g	6 Mbps	OFDM	16	18.5	17.2	52.4
				54 Mbps	OFDM	13	15.5	14.3	26.6
			802.11n	MCS0 20 MHz	OFDM	14	16.5	15.4	35.0
				MCS7 20 MHz	OFDM	12	14.5	13.2	20.7
	11	2462	802.11b	**1 Mbps**	**DSSS**	**17**	**19.5**	**17.3**	**53.1**
				11 Mbps	DSSS	17	19.5	18.0	63.1
			802.11g	6 Mbps	OFDM	12	18.5	13.2	20.7
				54 Mbps	OFDM	12	15.5	13.1	20.2
			802.11n	MCS0 20 MHz	OFDM	14	16.5	14.6	28.9
				MCS7 20 MHz	OFDM	12	14.5	12.6	18.2

TEST RESULTS - BLUETOOTH

Radio and Band	Channel	Frequency (MHz)	Data Rate	Modulation	Software Power Setting	Max Rated Power (dBm)	Output Power (dBm)	Output Power (mW)
BT Classic	0	2402	**1 Mbps**	**DH5**	**0x09**	**10.5**	**6.0**	**4.0**
			2 Mbps	2DH5	0x09	6.5	2.1	1.6
			3 Mbps	3DH5	0x09	6.5	2.2	1.6
	38	2440	**1 Mbps**	**DH5**	**0x09**	**10.5**	**5.9**	**3.9**
			2 Mbps	2DH5	0x09	6.5	2.2	1.7
			3 Mbps	3DH5	0x09	6.5	2.4	1.7
	78	2480	**1 Mbps**	**DH5**	**0x09**	**10.5**	**5.8**	**3.8**
			2 Mbps	2DH5	0x09	6.5	2.2	1.6
			3 Mbps	3DH5	0x09	6.5	2.2	1.6

OUTPUT POWER

element
WPM.12.06.24

Radio and Band	Channel	Frequency (MHz)	Data Rate	Modulation	Software Power Setting	Max Rated Power (dBm)	Output Power (dBm)	Output Power (mW)
BLE	37	2402	1 Mbps	GFSK	-4	-4	-5.8	0.3
			2 Mbps	GFSK	-4	-4	-6.0	0.3
	17	2440	1 Mbps	GFSK	-4	-4	-6.4	0.2
			2 Mbps	GFSK	-4	-4	-6.5	0.2
	39	2480	1 Mbps	GFSK	-4	-4	-7.0	0.2
			2 Mbps	GFSK	-4	-4	-6.6	0.2

RESULTS - 5 GHz U-NII

Radio and Band	Channel	Frequency (MHz)	Protocol	Data Rate	Modulation	Software Power Setting	Max Rated Power (dBm)	Output Power (dBm)	Output Power (mW)
Wi-Fi U-NII-1	36	5180	802.11a	6 Mbps	OFDM	12	17	11.2	13.2
				54 Mbps	OFDM	12	15	11.4	13.7
			802.11n	MCS0 20 MHz	OFDM	12	17	11.1	12.9
				MCS7 20 MHz	OFDM	12	15	11.7	14.8
	38F	5190		**MCS0 40 MHz**	**OFDM**	**10**	**17**	**10.3**	**10.6**
				MCS7 40 MHz	OFDM	10	15	10.0	10.0
	40	5200	802.11a	6 Mbps	OFDM	12	17	12.2	16.5
				54 Mbps	OFDM	12	15	12.2	16.4
			802.11n	MCS0 20 MHz	OFDM	12	17	11.8	15.0
				MCS7 20 MHz	OFDM	12	15	12.0	15.7
	44	5220	802.11a	**6 Mbps**	**OFDM**	**15**	**17**	**14.9**	**30.9**
				54 Mbps	OFDM	13	15	12.9	19.6
			802.11n	MCS0 20 MHz	OFDM	15	17	14.4	27.7
				MCS7 20 MHz	OFDM	13	15	13.1	20.4
	48	5240	802.11a	6 Mbps	OFDM	15	17	14.7	29.4
				54 Mbps	OFDM	13	15	13.0	19.9
			802.11n	MCS0 20 MHz	OFDM	15	17	14.3	27.0
				MCS7 20 MHz	OFDM	13	15	13.0	20.1
	46F	5230		**MCS0 40 MHz**	**OFDM**	**15**	**17**	**15.1**	**32.3**
				MCS7 40 MHz	OFDM	13	15	13.2	20.9
Wi-Fi U-NII-2A	52	5260	802.11a	6 Mbps	OFDM	15	17	15.0	31.3
				54 Mbps	OFDM	13	15	13.2	20.7
			802.11n	MCS0 20 MHz	OFDM	15	17	14.5	28.4
				MCS7 20 MHz	OFDM	13	15	13.2	20.7
	54F	5270		**MCS0 40 MHz**	**OFDM**	**15**	**17**	**14.5**	**28.2**
				MCS7 40 MHz	OFDM	13	15	13.0	19.8
	56	5280	802.11a	**6 Mbps**	**OFDM**	**15**	**17**	**15.3**	**34.1**
				54 Mbps	OFDM	13	15	13.2	21.1
			802.11n	MCS0 20 MHz	OFDM	15	17	14.6	28.5
				MCS7 20 MHz	OFDM	13	15	12.9	19.5
	60	5300	802.11a	6 Mbps	OFDM	12	17	12.6	18.0
				54 Mbps	OFDM	12	15	12.5	17.9
			802.11n	MCS0 20 MHz	OFDM	12	17	12.1	16.3
				MCS7 20 MHz	OFDM	12	15	12.2	16.7
	64	5320	802.11a	6 Mbps	OFDM	12	17	12.5	17.9
				54 Mbps	OFDM	12	15	12.2	16.7
			802.11n	MCS0 20 MHz	OFDM	12	17	11.9	15.6
				MCS7 20 MHz	OFDM	12	15	12.1	16.3
	62F	5310		**MCS0 40 MHz**	**OFDM**	**10**	**17**	**10.1**	**10.3**
				MCS7 40 MHz	OFDM	10	15	10.2	10.5

SAR TEST EXCLUSION

element
EXRPT.2020.10.21.0

OVERVIEW

Human exposure to RF emissions from portable devices (47 CFR §2.1093) used with the radiating antenna closer than 20 cm to the user requires Specific Absorption Rate (SAR) to evaluate the environmental impact of human exposure to radiofrequency (RF) radiation.

COMPLIANCE WITH FCC 2.1093

"Portable devices that operate in the Cellular Radiotelephone Service pursuant to part 22 of this chapter; the Personal Communications Service (PCS) pursuant to part 24 of this chapter; the Satellite Communications Services pursuant to part 25 of this chapter; the Miscellaneous Wireless Communications Services pursuant to part 27 of this chapter; the Maritime Services (ship earth station devices only) pursuant to part 80 of this chapter; the Specialized Mobile Radio Service, the 4.9 GHz Band Service, and the 3650 MHz Wireless Broadband Service pursuant to part 90 of this chapter; the Wireless Medical Telemetry Service (WMTS) and the Medical Device Radiocommunication Service (MedRadio), pursuant to subparts H and I of part 95 of this chapter, respectively, unlicensed personal communication service, unlicensed NII devices and millimeter wave devices authorized under §§15.253(f), 15.255(g), 15.257(g), 15.319(i), and 15.407(f) of this chapter; and the Citizens Broadband Radio Service pursuant to part 96 of this chapter are subject to routine environmental evaluation for RF exposure prior to equipment authorization or use. All other portable transmitting devices are categorically excluded from routine environmental evaluation for RF exposure prior to equipment authorization or use, except as specified in §§1.1307(c) and 1.1307(d) of this chapter. Applications for equipment authorization of portable transmitting devices subject to routine environmental evaluation must contain a statement confirming compliance with the limits specified in paragraph (d) of this section. Technical information showing the basis for this statement must be submitted to the Commission upon request."

The EUT will be used with a separation distance of less than 20 centimeters between the radiating antenna and the body of the user or nearby persons and must therefore be considered a portable transmitter per 47 CFR 2.1093(b).

COMPLIANCE WITH FCC KDB 447498 D01 General RF Exposure Guidance v06

"KDB 447498 D01 General RF Exposure Guidance v06" provides the procedures, requirements, and authorization policies for mobile and portable devices.

Standalone radio SAR test exclusion is covered under section 4.3.1. Unless specifically required by the published RF exposure KDB procedures, standalone 1-g head or body and 10-g extremity SAR evaluation for general population exposure conditions, by measurement or numerical simulation, is not required when the corresponding SAR Test Exclusion Thresholds are met as shown in the Limits section below.

Simultaneous transmission SAR test exclusion is covered under section 4.3.2. SAR test exclusion is determined for each operating configuration and exposure condition according to the reported standalone SAR of each applicable simultaneously transmitting antenna. When the sum of 1-g or 10-g SAR of all simultaneously transmitting antennas in an operating mode and exposure condition combination is within the SAR limit, SAR test exclusion applies to that simultaneous transmission configuration.

SAR TEST EXCLUSION

element
EXRPT.2020.10.21.0

LIMITS

Limits for General Population /Uncontrolled Exposure: 47 CFR 1.1310 (c)

The SAR limits for general population/uncontrolled exposure are 0.08 W/kg, as averaged over the whole body, and a peak spatial-average SAR of 1.6 W/kg, averaged over any 1 gram of tissue (defined as a tissue volume in the shape of a cube). Exceptions are the parts of the human body treated as extremities, such as hands, wrists, feet, ankles, and pinnae, where the peak spatial-average SAR limit is 4 W/kg, averaged over any 10 grams of tissue (defined as a tissue volume in the shape of a cube). Exposure may be averaged over a time period not to exceed 30 minutes to determine compliance with general population/uncontrolled SAR limits.

For 100 MHz to 6 GHz and test separation distances ≤ 50 mm, the SAR test exclusion thresholds are 1-g for head and body SAR and 10-g SAR for extremity SAR.

ASSESSMENT

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:

$$\left[\frac{(\text{max. power of channel, including tune-up tolerance, mW})}{(\text{min. test separation distance, mm})}\right] \cdot \left[\sqrt{f(GHz)}\right] = \begin{matrix}\text{3.0 for 1-g SAR} \\ \text{7.5 for 10-g extremity SAR}\end{matrix}$$

Where:

- *f(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
- 3.0 and 7.5 are referred to as the numeric thresholds

The test exclusions are applicable only when the minimum test separation distance is ≤ 50 mm and for transmission frequencies between 100 MHz and 6 GHz. When the minimum test separation distance is < 5 mm, a distance of 5 mm according to 4.1f) is applied to determine SAR test exclusion.

The SAR Test Exclusion Threshold is summarized in the following table(s):

Radio	Transmit Frequency (MHz)	Rated Conducted Output Power	Rated Conducted Output Power plus Tolerance	Units	Duty Cycle	Minimum Separation Distance (mm)	Exclusion Threshold	Limit	Compliant
BTLE	2402	0.398	1	mW	100.0%	5	0.3	3.0	Yes

The information in the table above was obtained from:

nRF52840 product specification and client provided information. There is 4 dB of rated power tolerance from the product specification.

ESTIMATED SAR

element
EXRPT.2020.10.21.0

METHOD OF EVALUATION – SIMULTANEOUS TRANSMISSION CONFIGURATION

KDB 447498 D01 General RF Exposure Guidance v06, Section 4.3.2(b)

"When an antenna qualifies for the standalone SAR test exclusion of 4.3.1 and also transmits simultaneously with other antennas, the standalone SAR value must be estimated according to the following to determine the simultaneous transmission SAR test exclusion criteria:

1) *[(max. power of channel, including tune-up tolerance, mW)/(min. test separation distance, mm)] · [$\sqrt{f(GHz)}/x$], for test separation distances ≤ 50mm;*

   where x = 7.5 for 1-g SAR and x = 18.75 for 10-g SAR.

2) *0.4 W/kg for 1-g SAR and 1.0 W/kg for 10-g SAR, when the test separation distance is > 50 mm.*

This SAR estimation formula has been considered in conjunction with the SAR Test Exclusion Thresholds to result in substantially conservative SAR values of = 0.4 W/kg. When SAR is estimated, the peak SAR location is assumed to be at the feed-point or geometric center of the antenna, whichever provides a smaller antenna separation distance, and this location must be clearly identified in test reports. The estimated SAR is used only to determine simultaneous transmission SAR test exclusion; it should not be reported as the standalone SAR. When SAR is estimated, it must be applied to determine the sum of 1-g SAR test exclusion. When SAR to peak location separation ratio test exclusion is applied, the highest reported SAR for simultaneous transmission can be an estimated standalone SAR if the estimated SAR is the highest among the simultaneously transmitting antennas (see also KDB Publication 690783 D01). For situations where the estimated SAR is overly conservative for certain conditions, the test lab may choose to perform standalone SAR measurements, then use the measured SAR to determine simultaneous transmission SAR test exclusion. Estimated SAR values at selected frequencies, distances, and power levels are illustrated in Appendix D.

In the table below, the estimated stand-alone SAR for the radio(s) capable of simultaneous transmission is listed. The estimated values have been summed and compared to the SAR limit. The result of the calculation is well below the limit therefore the unit is excluded from simultaneous SAR evaluation and deemed compliant with FCC RF exposure requirements.

Radio	Transmit Frequency (GHz)	Test Separation (mm)	Rated Power (mW)	Rated Power plus Tolerance (mW)	Duty Cycle	Estimated SAR (W/kg)	Specification (W/kg)
BTLE	2.48	5	0.398	1	1	0.04	1.6
					Estimated Summed SAR	0.04	1.6

The information in the table above was obtained from:
nRF52840 product specification and client provided information. There is 4 dB of rated power tolerance from the product specification.

SAR TEST DATA

element
WSTD.2016.12.19

EUT:	VB400V3	Work Order:	ELEM0125
Customer:	Motorola Solutions	Job Site:	MN11
Attendees:	None	Customer Project:	None

TEST SPECIFICATIONS

Specification:	Method:
FCC 2.1093:2021	FCC KDB 248227 D01 V02r02 FCC KDB 447498 D01 v06 FCC KDB 865664 D01 v01r04 FCC KDB 865664 D02 v01r02 IEEE Std 1528:2013

COMMENTS

Highest scaled value for each radio and band combination in bold.

DEVIATIONS FROM TEST STANDARD

None

SCALING FACTORS

Radio	Modulation	Test Mode Duty Cycle (%)	Max. Field Duty Cycle (%)[2]	Channel	Frequency (MHz)	EUT Power (dBm)	Max Power (dBm)	Max Power Scaling Factor[1]	Scaling Factor[3]
802.11a/b/g/n	802.11b 1Mbps	98.8	100	1	2412	17.3	19.5	1.66	1.66
				6	2437	16.5	19.5	2.00	2.00
				11	2462	17.3	19.5	1.66	1.66
	802.11a 6Mbps	98.5	100	44	5520	14.9	17.0	1.62	1.62
				56	5280	15.3	17.0	1.48	1.48
	802.11n MCS0 VHT40	98.1	100	54F	5270	14.5	17.0	1.78	1.78
				62F	5310	10.1	17.0	4.90	4.90
Bluetooth	DH5	76.9	100	0	2402	6.0	10.5	2.82	2.82
				38	2440	5.9	10.5	2.88	2.88
				79	2480	5.8	10.5	2.95	2.95

1: Max power scaling factor = 10^((Max Power (dBm) - Measured Power (dBm)) / 10)
2: Duty cycle scaling factor = Max Field Duty Cycle / 100%
3: Scaling factor = Max power scaling factor * Duty cycle scaling factor

RESULTS – BODY CONFIGURATION

Radio and Band	Transmit Freq. (MHz)	EUT Accessory	EUT Channel	Modulation	SAR Drift (%)	Measured Values (mW/g)		Scaling Factor	Scaled (mW/g) Values		Test Run Name
						1g	10g		1g	10g	
Bluetooth DSS/DTS	**2402**	**No Accessory**	**1**	**DH5**	**N/A[2]**	**0.01**	**0.00**	**2.82**	**0.03**	**0.01**	**BT 2402 No Accessory 1**
	2402	MagMount	1	DH5	N/A[2]	N/A[1]	N/A[1]	2.82	N/A[1]	N/A[1]	BT 2402 MagMount 1
	2440	No Accessory	38	DH5	N/A[2]	0.01	0.00	2.88	0.03	0.01	BT 2440 No Accessory 1
	2480	No Accessory	78	DH5	N/A[2]	0.00	0.00	2.95	0.01	0.00	BT 2480 No Accessory 1
Wi-Fi 2.4 GHz DTS	**2412**	**No Accessory**	**1**	**802.11b 1Mbps**	**-2.04**	**0.20**	**0.11**	**1.66**	**0.34**	**0.18**	**Wi-Fi 2412 No Accessory 1**
	2412	MagMount	1	802.11b 1Mbps	N/A[2]	0.01	0.00	1.66	0.01	0.00	Wi-Fi 2412 MagMount 1
	2437	No Accessory	6	802.11b 1Mbps	-2.01	0.16	0.08	2.00	0.31	0.17	Wi-Fi 2437 No Accessory 1
	2462	No Accessory	11	802.11b 1Mbps	-1.57	0.11	0.06	1.66	0.18	0.11	Wi-Fi 2462 No Accessory 1
Wi-Fi U-NII-2A NII	5280	No Accessory	56	802.11a 6Mbps	N/A[2]	0.05	0.02	1.48	0.08	0.03	U-NII-2A 5280 No Accessory 1
	5280	MagMount	56	802.11a 6Mbps	N/A[2]	0.01	N/A[1]	1.48	0.01	N/A[1]	U-NII-2A 5280 MagMount 1
	5270	**No Accessory**	**54F**	**802.11n MCS0 VHT40**	**N/A[2]**	**0.05**	**0.01**	**1.78**	**0.09**	**0.02**	**U-NII-2A 5270 No Accessory 1**
	5310	No Accessory	62F	802.11n MCS0 VHT40	N/A[2]	N/A[1]	N/A[1]	4.90	N/A[1]	N/A[1]	U-NII-2A 5310 No Accessory 1

1: The signal is lower than the probe could measure. The SAR probe is capable of measurements down to 0.010 mW/g.
2: Measured SAR value is low enough where a SAR drift measurement was not practical.

SAR TEST DATA

element
WSTD.2016.12.19

Tested By:	Kyle McMullan	Room Temperature (°C):	20.9
Date:	2021-08-02, 14:39	Liquid Temperature (°C):	21
Serial Number:	229318	Humidity (%RH):	51.2
Configuration:	ELEM0125-1	Bar. Pressure (mb):	1024

BT 2402 No Accessory 1

Device Under Test Properties

Model, Manufacturer	Dimensions [mm]	IMEI	DUT Type
VB400V3, Motorola Solutions	88.0 x 68.0 x 20.0	Unknown	Phone

Exposure Conditions

Phantom Section, TSL	Position, Test Distance [mm]	Band	Group, UID	Frequency [MHz], Channel Number	Conversion Factor	TSL Conductivity [S/m]	TSL Permittivity
Flat, HSL	BACK, 0.00	D2450	CW, 0--	2402.0, 2	7.22	1.84	42.0

Hardware Setup

Phantom	TSL, Measured Date	Probe, Calibration Date	DAE, Calibration Date
ELI V6.0 (20deg probe tilt) - 2044	HBBL-600-10000 Charge: 190820-2, 2021-Aug-02	EX3DV4 - SN3746, 2020-11-18	DAE4 Sn1237, 2020-11-04

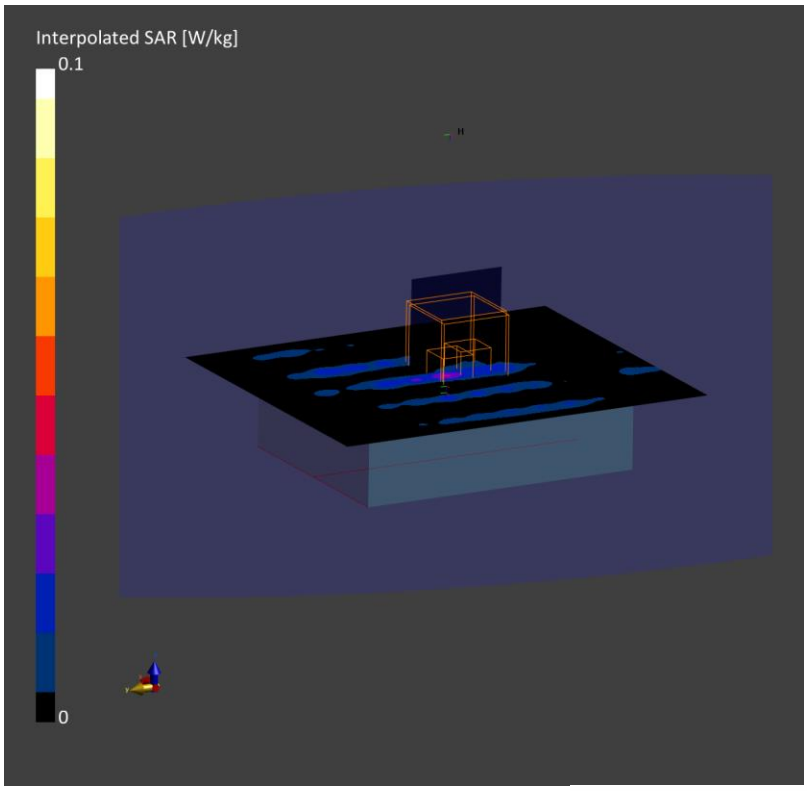
Scans Setup

	Area Scan	Zoom Scan
Grid Extents [mm]	100.0 x 120.0	30.0 x 30.0 x 30.0
Grid Steps [mm]	10.0 x 10.0	5.0 x 5.0 x 1.5
Sensor Surface [mm]	3.0	1.4
Graded Grid	Yes	Yes
Grading Ratio	1.5	1.5
MAIA	N/A	N/A
Surface Detection	VMS + 6p	VMS + 6p
Scan Method	Measured	Measured

Measurement Results

	Area Scan	Zoom Scan
Date	2021-08-02, 14:31	2021-08-02, 14:39
psSAR1g [W/Kg]	0.020	0.009
psSAR10g [W/Kg]	0.008	0.003
Power Drift [dB]	0.07	-0.42
Power Scaling	Disabled	Disabled
Scaling Factor [dB]		
TSL Correction	Positive only	Positive only
M2/M1 [%]		92.2
Dist 3dB Peak [mm]		> 15.0

SAR TEST DATA



Approved By

SAR TEST DATA

element
WSTD.2016.12.19

Tested By:	Kyle McMullan	Room Temperature (°C):	20.9
Date:	2021-08-02, 16:07	Liquid Temperature (°C):	21
Serial Number:	229324	Humidity (%RH):	51.2
Configuration:	ELEM0125-2	Bar. Pressure (mb):	1024

Wi-Fi 2412 No Accessory 1

Device Under Test Properties

Model, Manufacturer	Dimensions [mm]	IMEI	DUT Type
VB400V3, Motorola Solutions	88.0 x 68.0 x 20.0	Unknown	Phone

Exposure Conditions

Phantom Section, TSL	Position, Test Distance [mm]	Band	Group, UID	Frequency [MHz], Channel Number	Conversion Factor	TSL Conductivity [S/m]	TSL Permittivity
Flat, HSL	BACK, 0.00	D2450	CW, 0--	2412.0, 12	7.22	1.84	41.9

Hardware Setup

Phantom	TSL, Measured Date	Probe, Calibration Date	DAE, Calibration Date
ELI V6.0 (20deg probe tilt) - 2044	HBBL-600-10000 Charge: 190820-2, 2021-Aug-02	EX3DV4 - SN3746, 2020-11-18	DAE4 Sn1237, 2020-11-04

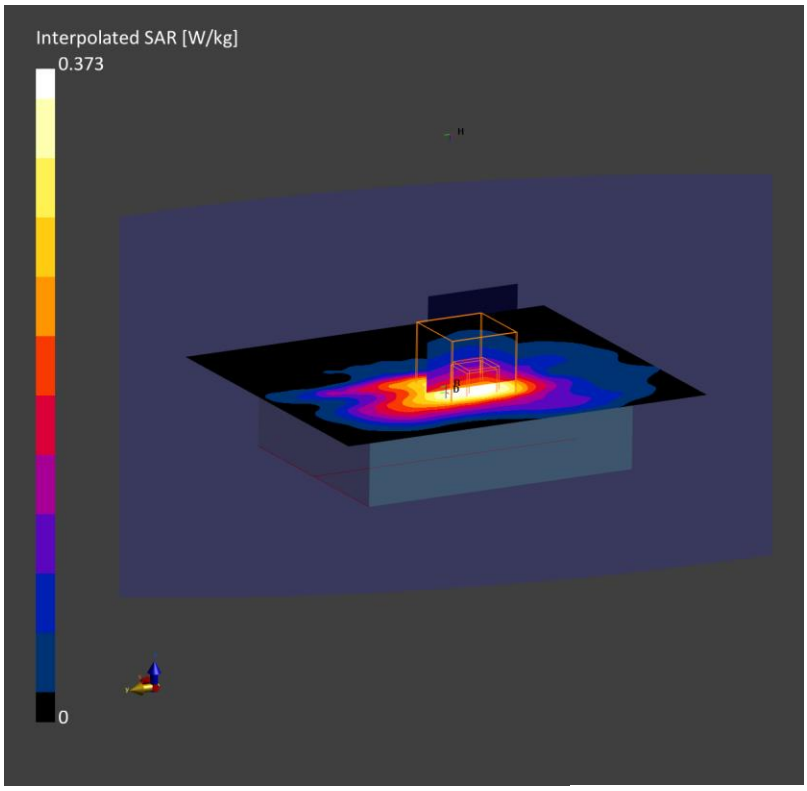
Scans Setup

	Area Scan	Zoom Scan
Grid Extents [mm]	100.0 x 120.0	30.0 x 30.0 x 30.0
Grid Steps [mm]	10.0 x 10.0	5.0 x 5.0 x 1.5
Sensor Surface [mm]	3.0	1.4
Graded Grid	Yes	Yes
Grading Ratio	1.5	1.5
MAIA	N/A	N/A
Surface Detection	VMS + 6p	VMS + 6p
Scan Method	Measured	Measured

Measurement Results

	Area Scan	Zoom Scan
Date	2021-08-02, 15:59	2021-08-02, 16:07
psSAR1g [W/Kg]	0.192	0.203
psSAR10g [W/Kg]	0.106	0.111
Power Drift [dB]	0.01	-0.09
Power Scaling	Disabled	Disabled
Scaling Factor [dB]		
TSL Correction	Positive only	Positive only
M2/M1 [%]		80.3
Dist 3dB Peak [mm]		15.1

SAR TEST DATA



Approved By

SAR TEST DATA

element
WSTD.2016.12.19

Tested By:	Kyle McMullan	Room Temperature (°C):	21.7
Date:	2021-08-03, 09:52	Liquid Temperature (°C):	20.6
Serial Number:	229324	Humidity (%RH):	52.2
Configuration:	ELEM0125-2	Bar. Pressure (mb):	1017.1

U-NII-2A 5270 No Accessory 1

Device Under Test Properties

Model, Manufacturer	Dimensions [mm]	IMEI	DUT Type
VB400V3, Motorola Solutions	88.0 x 68.0 x 20.0	Unknown	Phone

Exposure Conditions

Phantom Section, TSL	Position, Test Distance [mm]	Band	Group, UID	Frequency [MHz], Channel Number	Conversion Factor	TSL Conductivity [S/m]	TSL Permittivity
Flat, HSL	BACK, 0.00	D5GHz	CW, 0--	5270.0, 27	4.99	4.72	34.6

Hardware Setup

Phantom	TSL, Measured Date	Probe, Calibration Date	DAE, Calibration Date
ELI V6.0 (20deg probe tilt) - 2044	HBBL-600-10000 Charge: 190820-2, 2021-Aug-03	EX3DV4 - SN3746, 2020-11-18	DAE4 Sn1237, 2020-11-04

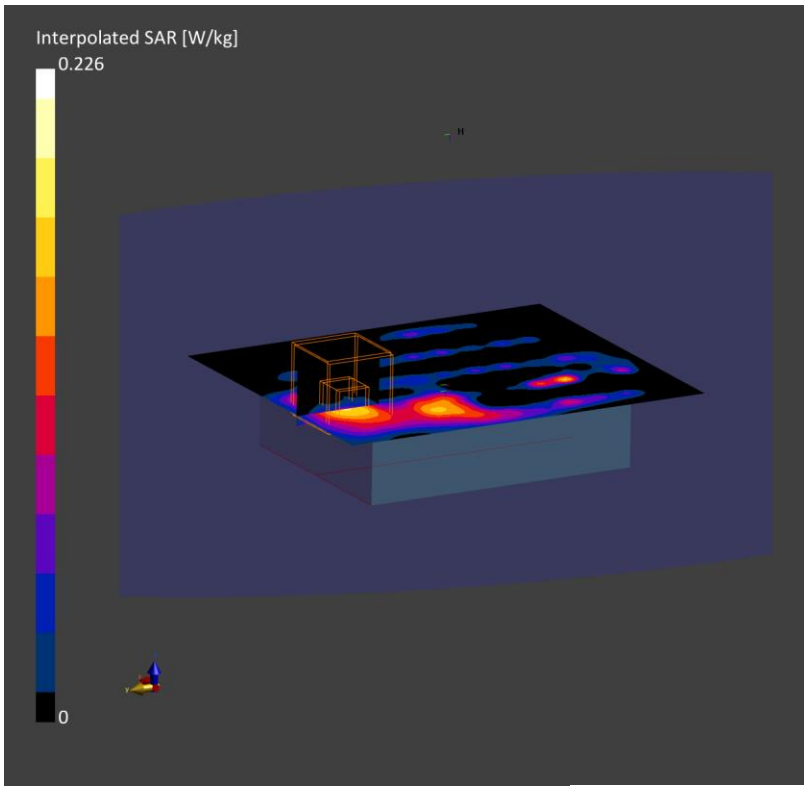
Scans Setup

	Area Scan	Zoom Scan
Grid Extents [mm]	100.0 x 120.0	22.0 x 22.0 x 22.0
Grid Steps [mm]	10.0 x 10.0	4.0 x 4.0 x 1.4
Sensor Surface [mm]	3.0	1.4
Graded Grid	Yes	Yes
Grading Ratio	1.5	1.4
MAIA	N/A	N/A
Surface Detection	VMS + 6p	VMS + 6p
Scan Method	Measured	Measured

Measurement Results

	Area Scan	Zoom Scan
Date	2021-08-03, 09:40	2021-08-03, 09:52
psSAR1g [W/Kg]	0.059	0.053
psSAR10g [W/Kg]	0.023	0.012
Power Drift [dB]	0.86	-1.29
Power Scaling	Disabled	Disabled
Scaling Factor [dB]		
TSL Correction	Positive only	Positive only
M2/M1 [%]		56.8
Dist 3dB Peak [mm]		8.8

SAR TEST DATA



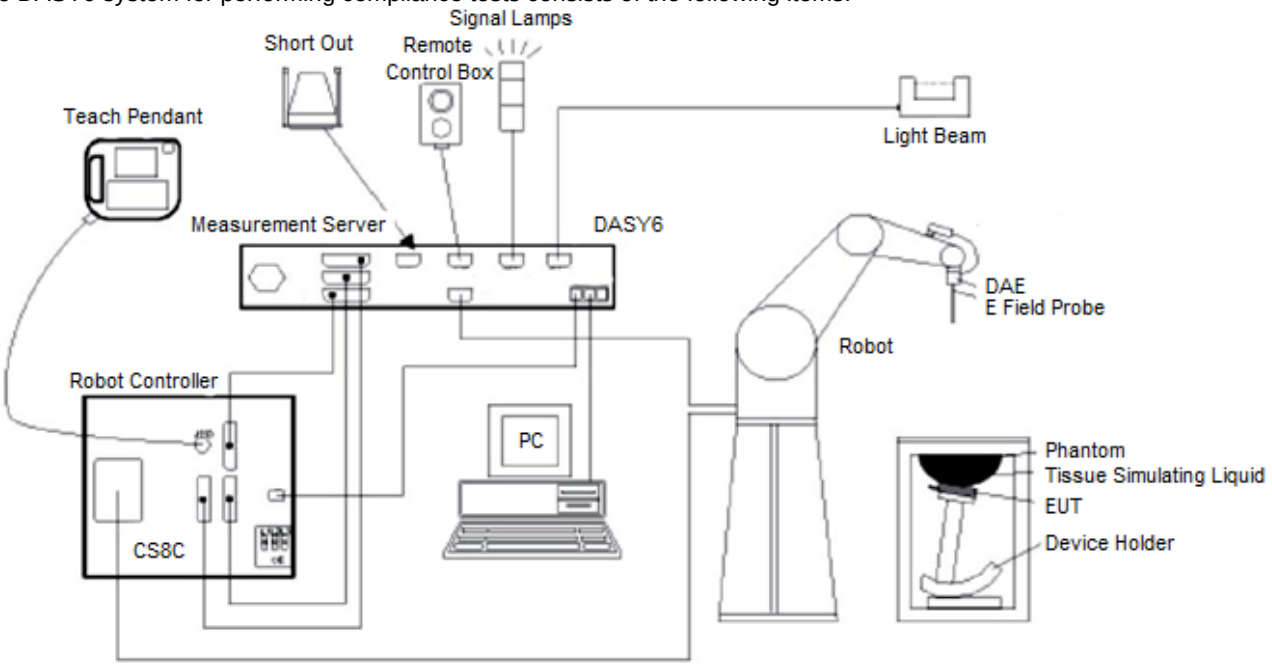
Approved By

SAR MEASUREMENT SYSTEM

Schmid & Partner Engineering AG, DASY6

Element selected the leader in SAR evaluation systems to provide the measurement tools for this evaluation. SPEAG's DASY6 is the fastest and most accurate scanner on the market. It is fully compatible with all world-wide standards for transmitters operating at the ear or within 20cm of the body. It provides full compatibility with IEC/IEEE 62209-1528:2020, IEC 62209-1, IEC 62209-2, IEEE 1528 as well as national adaptations such as FCC OET-65c and Korean Std. MIC #2000-93

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



- A standard high precision 6-axis robot (Stäubli 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. To use optical surface detection, a special version of the EOC is required. The EOC signal is transmitted to the measurement server.
- The function of the measurement server is to perform the time critical tasks such as signal filtering, control of the robot operation and fast movement interrupts.
- The Light Beam used is for probe alignment. This improves the (absolute) accuracy of the probe positioning.
- A computer running Windows 10 and the DASY6 software.
- Remote control and teach pendant as well as additional circuitry for robot safety such as warning lamps, etc.
- The SAM twin phantom, oval flat phantom, device holder, tissue simulating liquids, and validation dipole kits.

SYSTEM AND TEST SITE DESCRIPTION

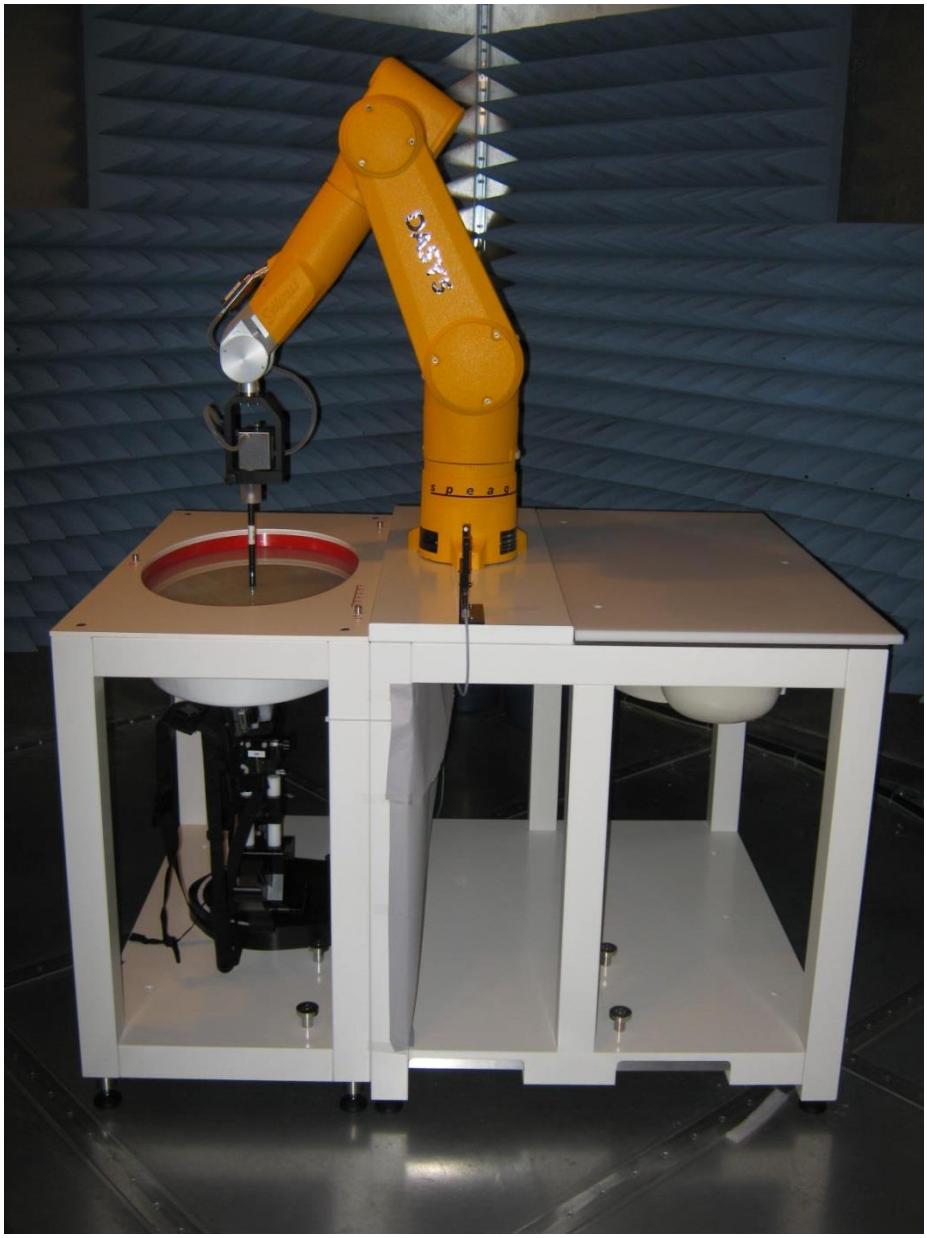
element
WSTD.2017.1.31

TEST SITE

Element

The SAR measurement system is located in a semi-anechoic chamber. This provides an ambient free environment that also eliminates reflections.

The chamber is 12 ft wide by 16 ft long x 8 ft high. A dedicated HVAC unit provides +/- 1 degree C temperature control.



TEST EQUIPMENT

element
WSEQ.2016.12.19

TEST EQUIPMENT

Description	Manufacturer	Model	ID	Last Cal.	Interval
Amplifier	Mini Circuits	ZVE-3W-83+	TTA	NCR [1]	0 mo
Antenna - Dipole	SPEAG	D2450V2	ADL	11/9/2020	12 mo
Antenna - Dipole	SPEAG	D5GHzV2	ADM	11/9/2020	12 mo
DAE	SPEAG	SD 000 D04 EJ	SAH	11/4/2020	12 mo
Device Holder	SPEAG	N/A	SAW	NCR	0 mo
Dielectric Assessment Kit	SPEAG	DAKS:200	IPR	4/25/2019	36 mo
Generator - Signal	Agilent	V2920A	TIH	NCR	0 mo
Meter - Power	Agilent	N1913A	SQL	7/12/2021	12 mo
Meter - Power	ETS Lindgren	7002-006	SRA	3/21/2021	12 mo
Power Sensor	Agilent	N8481A	SQN	7/12/2021	12 mo
Probe - Dielectric	SPEAG	DAKS-3.5	IPRA	11/12/2019	36 mo
Probe - SAR	SPEAG	EX3DV4	SAG	11/18/2020	12 mo
SAR - Tissue Test Solution	SPEAG	HBBL600-10000V6	SALN	At start of testing	
SAR Test System	Stäubli	DASY6	SAK	NCR	0 mo
SAR Test System	SPEAG	QD 000 P40 CC	SAB	NCR	0 mo
Thermometer	Omega Engineering, Inc.	HH311	DUI	2/2/2021	36 mo

Note 1: The output of the signal generator / amplifier is verified with the calibrated power meter listed above.

SAR SYSTEM VALIDATION SUMMARY

Dipole	Date	Freq.	Tissue Perm.	Tissue Cond.	CW				OFDM		
					Sensitivity	Linearity	Isotropy	Reduced DC	802.11n	LTE	LTE TDD
ADL	5/5/2021	2450	40.2	1.85	Pass	Pass	Pass	Pass[1]	Pass	N/A	N/A
ADM	5/5/2021	5200	35.2	4.59	Pass	Pass	Pass	Pass[1]	Pass	N/A	N/A
ADL[4]	7/28/2021	2450	41.0	1.82	Pass	Pass	Pass	Pass[1,2,3]	Pass	Pass	Pass

1: Reduced to a duty factor of 0.1 with a 10 Hz pulse repetition rate.
2: Reduced duty cycle to match a single GSM time slot.
3: Reduced duty cycle to match a single DECT time slot.
4: ADL measurement on 7/28/2021 used to confirm system validation after software upgrade.

MEASUREMENT UNCERTAINTY

MEASUREMENT UNCERTAINTY BUDGETS PER IEEE 1528:2013

300-3000 MHz Range

Uncertainty Component	Tolerance (+/- %)	Probability Distribution	Divisor	c_i (1g)	c_i (10g)	u_i (1g) (+/-%)	u_i (10g) (+/-%)	v_i
Measurement System								
Probe calibration (k=1)	6.0	normal	1	1	1	6.0	6.0	∞
Axial isotropy	4.7	rectangular	1.732	0.707	0.707	1.9	1.9	∞
Hemispherical isotropy	9.6	rectangular	1.732	0.707	0.707	3.9	3.9	∞
Boundary effect	1.0	rectangular	1.732	1	1	0.6	0.6	∞
Linearity	4.7	rectangular	1.732	1	1	2.7	2.7	∞
System detection limits	1.0	rectangular	1.732	1	1	0.6	0.6	∞
Modulation Response	2.4	rectangular	1.732	1	1	1.4	1.4	∞
Readout electronics	0.3	normal	1	1	1	0.3	0.3	∞
Response time	0.8	rectangular	1.732	1	1	0.5	0.5	∞
Integration time	2.6	rectangular	1.732	1	1	1.5	1.5	∞
RF ambient conditions - noise	3.0	rectangular	1.732	1	1	1.7	1.7	∞
RF Ambient Reflections	3.0	rectangular	1.732	1	1	1.7	1.7	∞
Probe positioner mechanical tolerance	0.4	rectangular	1.732	1	1	0.2	0.2	∞
Probe positioner with respect to phantom shell	2.9	rectangular	1.732	1	1	1.7	1.7	∞
Extrapolation, interpolation, and integration algorithms for max. SAR evaluation	2.0	rectangular	1.732	1	1	1.2	1.2	∞
Test Sample Related								
Device Positioning	2.9	normal	1	1	1	2.9	2.9	145
Device Holder	3.6	normal	1	1	1	3.6	3.6	5
Power Drift	5.0	rectangular	1.732	1	1	2.9	2.9	∞
Power scaling	1.0	rectangular	1.732	1	1	0.6	0.6	∞
Phantom and tissue parameters								
Phantom Uncertainty - shell thickness tolerances	6.1	rectangular	1.732	1	1	3.5	3.5	∞
Uncertainty in SAR correction for deviations in permittivity and conductivity	1.9	normal	1	1.00	0.84	1.9	1.6	∞
Liquid conductivity - measurement uncertainty	2.5	normal	1	0.78	0.71	2.0	1.8	∞
Liquid permittivity - measurement uncertainty	2.5	normal	1	0.26	0.26	0.7	0.7	∞
Temp Uncertainty - Conductivity	3.4	rectangular	1.732	0.8	0.71	1.5	1.4	∞
Temp Uncertainty - Permittivity	0.4	rectangular	1.732	0.2	0.26	0.1	0.1	∞
Combined Standard Uncertainty		RSS				11.4	11.3	361
Expanded Measurement Uncertainty (95% Confidence/		normal (k=2)				22.8	22.7	

Full measurement uncertainty included for ISO 17025 accreditation purposes.

MEASUREMENT UNCERTAINTY

MEASUREMENT UNCERTAINTY BUDGETS PER IEEE 1528:2013

3000-6000 MHz Range

Uncertainty Component	Tolerance (+/- %)	Probability Distribution	Divisor	c_i (1g)	c_i (10g)	u_i (1g) (+/-%)	u_i (10g) (+/-%)	v_i
Measurement System								
Probe calibration (k=1)	6.6	normal	1	1	1	6.6	6.6	∞
Axial isotropy	4.7	rectangular	1.732	0.707	0.707	1.9	1.9	∞
Hemispherical isotropy	9.6	rectangular	1.732	0.707	0.707	3.9	3.9	∞
Boundary effect	2.0	rectangular	1.732	1	1	1.2	1.2	∞
Linearity	4.7	rectangular	1.732	1	1	2.7	2.7	∞
System detection limits	1.0	rectangular	1.732	1	1	0.6	0.6	∞
Modulation Response	2.4	rectangular	1.732	1	1	1.4	1.4	∞
Readout electronics	0.3	normal	1	1	1	0.3	0.3	∞
Response time	0.8	rectangular	1.732	1	1	0.5	0.5	∞
Integration time	2.6	rectangular	1.732	1	1	1.5	1.5	∞
RF ambient conditions - noise	3.0	rectangular	1.732	1	1	1.7	1.7	∞
RF Ambient Reflections	3.0	rectangular	1.732	1	1	1.7	1.7	∞
Probe positioner mechanical tolerance	0.8	rectangular	1.732	1	1	0.5	0.5	∞
Probe positioner with respect to phantom shell	6.7	rectangular	1.732	1	1	3.9	3.9	∞
Extrapolation, interpolation, and integration algorithms for max. SAR evaluation	4.0	rectangular	1.732	1	1	2.3	2.3	∞
Test Sample Related								
Device Positioning	2.9	normal	1	1	1	2.9	2.9	145
Device Holder	3.6	normal	1	1	1	3.6	3.6	5
Power Drift	5.0	rectangular	1.732	1	1	2.9	2.9	∞
Power scaling	1.0	rectangular	1.732	1	1	0.6	0.6	∞
Phantom and tissue parameters								
Phantom Uncertainty - shell thickness tolerances	6.6	rectangular	1.732	1	1	3.8	3.8	∞
Uncertainty in SAR correction for deviations in permittivity and conductivity	1.9	normal	1	1.00	0.84	1.9	1.6	∞
Liquid conductivity - measurement uncertainty	2.5	normal	1	0.78	0.71	2.0	1.8	∞
Liquid permittivity - measurement uncertainty	2.5	normal	1	0.26	0.26	0.7	0.7	∞
Temp Uncertainty - Conductivity	3.4	rectangular	1.732	0.8	0.71	1.5	1.4	∞
Temp Uncertainty - Permittivity	0.4	rectangular	1.732	0.2	0.26	0.1	0.1	∞
Combined Standard Uncertainty		RSS				12.5	12.4	748
Expanded Measurement Uncertainty (95% Confidence/		normal (k=2)				25.0	24.9	

Full measurement uncertainty included for ISO 17025 accreditation purposes.