



Element Materials Technology

Smart Connected Hub

SAR Evaluation Report # ELEM0093.3

Evaluated to the following SAR specification:

FCC 2.1093:2020



NVLAP Lab Code: 200881-0



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CERTIFICATE OF TEST



Last Date of Test: January 25, 2020
Element Materials Technology
EUT: Smart Connected Hub

Applicable Standard

Test Description	Specification	Test Method	Pass/Fail
SAR Evaluation	FCC 15.247:2020 FCC 2.1093:2020	FCC KDB 865664 D01 v01r04 FCC KDB 865664 D02 v01r02 FCC KDB 248227 D01 V02r02 FCC KDB 447498 D01 v06 FCC KDB 941225 D05 v02r05 FCC KDB 941225 D01 v03r01 IEEE Std 1528:2013	Pass

Highest SAR Values:

Radio	Frequency Band	Body (W/kg) 1g	Limit (W/kg) 1g	Exposure Environment
Cellular	850 (GSM)	0.98	1.6	General Population
Cellular	1900 (PCS)	0.29	1.6	
Cellular	LTE Band 2	0.06	1.6	
Cellular	LTE Band 4	0.21	1.6	
Cellular	LTE Band 5	0.12	1.6	
Cellular	LTE Band 12	0.12	1.6	
802.11bgn	2.4 GHz ISM	0.02	1.6	

Highest Simultaneous Transmission Values:

Radios	Combined Body (W/kg) 1g	Limit (W/kg) 1g	Exposure Environment
Cellular, Bluetooth, NFC	1.04	1.6	General Population
Cellular, Bluetooth Low Energy, NFC	1.04	1.6	
Cellular, 802.11bgn, NFC	1.00	1.6	

Deviations From Test Standards

None

Approved By:

Don Facteau, Systems Architect

REVISION HISTORY



Revision Number	Description	Date (yyyy-mm-dd)	Page Number
00	None		

ACCREDITATIONS AND AUTHORIZATIONS



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 - Accredited by A2LA to ISO / IEC 17065 as a product certifier. This allows Element to certify transmitters to FCC and IC specifications.

NVLAP - Each laboratory is accredited by NVLAP to ISO 17025

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 – Within Element, we have a EU Notified Body validated for the EMCD and RED Directives.

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.

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Vietnam

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

SCOPE

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FACILITIES



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NVLAP				
NVLAP Lab Code: 200676-0	NVLAP Lab Code: 200881-0	NVLAP Lab Code: 200630-0	NVLAP Lab Code:201049-0	NVLAP Lab Code: 200629-0
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/RRR, MIC, MOC, NCC, OFCA				
US0158	US0175	US0017	US0191	US0157





PRODUCT DESCRIPTION

Client and Equipment Under Test (EUT) Information

Company Name:	Wearable Technologies Ltd
Address:	Unit 12 Warren Park Way
City, State, Zip:	Enderby, Leicester, LE19 4SA
Test Requested By:	Alex Toohie of Element Materials Technology, Hull
Model:	Smart Connected Hub
First Date of Test:	September 27, 2019
Last Date of Test:	January 25, 2020
Receipt Date of Samples:	August 11, 2019
Equipment Design Stage:	Production
Equipment Condition:	No Damage
Purchase Authorization:	P038958

Information Provided by the Party Requesting the Test

Functional Description of the EUT:

The Eleksen™ Smart Connected Hub, acts as both transmitter and receiver for several technologies, that transmits data at a configurable interval period over a work shift, working in correlation with the Eleksen™ Connected Worker Platform real-time module. This ensures that both the worker and the control center are alerted to any imminent danger. If at any point the Hub loses cellular connection, it will continue to gather data and deliver alerts to the “worker”, and it will upload the missed data to the control center once it comes back into range or alternatively when the HUB is plugged into the Hub Station. The stored data will be transmitted via WiFi to the dashboard.”

The device contains the following radios:

4G LTE: Cat M1/NB-IoT

EGPRS Quad-Band

Wi-Fi 802.11 bgn

Bluetooth v4 with BLE (Bluetooth low energy)

GNSS: GPS / A-GPS / GLONASS / BeiDou / Galileo – Receive only

NFC

ISM – Receive only

The device transmits Wi-Fi 802.11bgn and Bluetooth from the same combination radio module. The device transmits 4G LTE and EGPRS from the same combination radio module.

FCC IDs: 2AU6IWTLMO28, 8595A-UBX18ZO01, 2AC7Z-ESPWROOM32

Frequency Ranges:

- a) Bluetooth: 2402-2480 MHz
- b) 802.11bgn: 2412-2462 MHz (SISO, 20 MHz and 40 MHz channel bandwidth)
- c) NFC: 13.56 MHz
- d) Cellular LTE Band 2 for Cat M1 and NB-IoT: 1850-1910 MHz
- e) Cellular LTE Band 4 for Cat M1 and NB-IoT: 1710-1755 MHz
- f) Cellular LTE Band 5 for Cat M1 and NB-IoT: 824-849 MHz
- g) Cellular LTE Band 12 for Cat M1 and NB-IoT: 699-716 MHz
- h) Cellular GSM-850 for GPRS and EDGE: 824.2-848.8 MHz
- i) Cellular PCS-1900 for GPRS and EDGE: 1850.2-1909.8

PRODUCT DESCRIPTION

Location of transmit antenna(s):



Testing Locations:

Testing was performed on the front, back, and both sides of the EUT. For clarity, the sides of the EUT are referred to as the connector side and the SIM card side. When near the human body for non-transient amounts of time, the EUT will either be in a belt holster or in the pocket on a reflective vest. Neither of these accessories contains metal nor conductive material. Of these two options, the pocket on the reflective vest will always result in the EUT being closer to the human body. Testing was done with the EUT in the reflective vest pocket.

Testing Objective:

To demonstrate compliance of the 802.11bgn radio and the cellular radio with the SAR requirements of FCC 2.1093:2020.

The RF exposure compliance of the Bluetooth radio is documented in a separate report, Element Report # ELEM0093.

Scaling:

Maximum Power:

Per FCC KDB 447498, the measured SAR values were scaled to the maximum tune-up tolerance limit. The results are referred to as the "Reported SAR" values. The following formula was used to calculate the linear SAR scaling factor:

$$\text{SAR scaling factor} = 10^{((\text{Maximum Rated Power (dBm)} - \text{Measured Power (dBm)}) / 10)}$$



PRODUCT DESCRIPTION

SAR Scaling Factors

Radio	Maximum Rated Power (dBm)	Measured Power (dBm)	SAR scaling factor
802.11bgn	5.0	5.0	1
Cellular LTE Category M1 Band 2	17.0	17.0	1
Cellular LTE Category M1 Band 4	16.6	16.6	1
Cellular LTE Category M1 Band 5	10.2	10.2	1
Cellular LTE Category M1 Band 12	10.1	10.1	1
Cellular LTE NB-IoT Band 2	18.4	18.4	1
Cellular LTE NB-IoT Band 4	17.8	17.8	1
Cellular LTE NB-IoT Band 5	13.7	13.7	1
Cellular LTE NB-IoT Band 12	11.3	11.1	1.05
Cellular GSM-850*	12.5	12.5	1
Cellular PCS-1900*	20.8	20.8	1

*Per KDB 941225 the maximum average values across all time slot combinations are considered the maximum power.

802.11bgn Test Reduction

Per KDB 248227 D01 section 5.2.2, 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, test exclusion applies.

$(\text{DSSS Value}) * (\text{OFDM specified maximum output power}) / (\text{DSSS specified maximum output power}) \leq 1.2 \text{ W/kg}$

$0.02 \text{ W/kg} * 2.40 \text{ mW} / 3.13 \text{ mW} = 0.02 \text{ W/kg}$

$0.02 \text{ W/kg} \leq 1.2 \text{ W/kg}$ is true, therefore OFDM test exclusion applies.

Duty Cycle

The operational duty cycle can be up to 100% for Wi-Fi.

Per the customer, the operational duty cycle can be up to 30% for LTE Category M1.

Per the customer, the operational duty cycle can be up to 80% for LTE NB-IoT.

All SAR measurements were performed with the maximum possible duty cycle.

Simultaneous Transmission:

There are three different operational modes that support simultaneous transmission:

- (1) Cellular, Bluetooth, and 13.56 MHz NFC
- (2) Cellular, Bluetooth Low Energy, and 13.56 MHz NFC
- (3) Cellular, 802.11bgn, and 13.56 MHz NFC

The 13.56 MHz NFC radio is exempt from RF exposure evaluation. The applicable estimated standalone SAR values and the measured standalone SAR values are added together and compared against the limit to determine compliance. For each of the 3 scenarios, this is done below:

Cellular + Bluetooth + NFC = $0.98 + 0.06 + 0$ (exempt) = 1.04

Cellular + Bluetooth Low Energy + NFC = $0.98 + 0.06 + 0$ (exempt) = 1.04

Cellular + 802.11bgn + NFC = $0.98 + 0.02 + 0$ (exempt) = 1.00

Where all values given have the units W/kg averaged over 1g.



PRODUCT DESCRIPTION

The limit for all of these cases is the head/torso general population exposure limit of 1.60 W/kg. All cases comply with this limit.

CONFIGURATIONS

Configuration ELEM0093- 1

Software/Firmware Running during test	
Description	Version
m-center	V02.01.00

EUT			
Description	Manufacturer	Model/Part Number	Serial Number
Eleksen Smart Connected Hub	Wearable Technology	M.28.R1.B1	SAR C3

Remote Equipment Outside of Test Setup Boundary			
Description	Manufacturer	Model/Part Number	Serial Number
Test Computer	Rohde & Schwarz	1201.0002K50	167070

Cables					
Cable Type	Shield	Length (m)	Ferrite	Connection 1	Connection 2
Eleksen Connector	No	0.3 m	No	Eleksen Smart Connected Hub	Unterminated
DC Leads	No	0.2 m	No	Eleksen Smart Connected Hub	TQL
USB Cable	Yes	>3.0 m	No	Eleksen Smart Connected Hub	Test Computer

Configuration ELEM0093- 2

Software/Firmware Running during test	
Description	Version
m-center	V02.01.00

EUT			
Description	Manufacturer	Model/Part Number	Serial Number
Eleksen Smart Connected Hub	Wearable Technology	M.28.R1.B1	SAR C1

Remote Equipment Outside of Test Setup Boundary			
Description	Manufacturer	Model/Part Number	Serial Number
Test Computer	Rohde & Schwarz	1201.0002K50	167070

Cables					
Cable Type	Shield	Length (m)	Ferrite	Connection 1	Connection 2
Eleksen Connector	No	0.3 m	No	Eleksen Smart Connected Hub	Unterminated
DC Leads	No	0.2 m	No	Eleksen Smart Connected Hub	TQL
USB Cable	Yes	>3.0 m	No	Eleksen Smart Connected Hub	Test Computer

CONFIGURATIONS



Configuration ELEM0093- 3

Software/Firmware Running during test	
Description	Version
m-center	V02.01.00

EUT			
Description	Manufacturer	Model/Part Number	Serial Number
Eleksen Smart Connected Hub	Wearable Technology	M.28.R1.B1	Conducted Cellular 1

Remote Equipment Outside of Test Setup Boundary			
Description	Manufacturer	Model/Part Number	Serial Number
Test Computer	Rohde & Schwarz	1201.0002K50	167070

Cables					
Cable Type	Shield	Length (m)	Ferrite	Connection 1	Connection 2
Eleksen Connector	No	0.3 m	No	Eleksen Smart Connected Hub	Unterminated
DC Leads	No	0.2 m	No	Eleksen Smart Connected Hub	TQL
USB Cable	Yes	>3.0 m	No	Eleksen Smart Connected Hub	Test Computer

Configuration ELEM0093- 4

Software/Firmware Running during test	
Description	Version
ESP RF Test Tool	V1.1.0

EUT			
Description	Manufacturer	Model/Part Number	Serial Number
Eleksen Smart Connected Hub	Wearable Technology	M.28.R1.B1	Conducted Wi-Fi 1

Remote Equipment Outside of Test Setup Boundary			
Description	Manufacturer	Model/Part Number	Serial Number
Test Computer	Rohde & Schwarz	1201.0002K50	167070

Cables					
Cable Type	Shield	Length (m)	Ferrite	Connection 1	Connection 2
DC Leads	No	0.2 m	No	Eleksen Smart Connected Hub	TQL
Eleksen Connector	No	0.3 m	No	Eleksen Smart Connected Hub	USB Cable
USB Cable	Yes	>3.0 m	No	Eleksen Connector	Test Computer

CONFIGURATIONS

Configuration ELEM0093- 5

Software/Firmware Running during test	
Description	Version
ESP RF Test Tool	V1.1.0

EUT			
Description	Manufacturer	Model/Part Number	Serial Number
Eleksen Smart Connected Hub	Wearable Technology	M.28.R1.B1	SAR C4

Remote Equipment Outside of Test Setup Boundary			
Description	Manufacturer	Model/Part Number	Serial Number
Test Computer	Rohde & Schwarz	1201.0002K50	167070

Cables					
Cable Type	Shield	Length (m)	Ferrite	Connection 1	Connection 2
DC Leads	No	0.2 m	No	Eleksen Smart Connected Hub	TQL
Eleksen Connector	No	0.3 m	No	Eleksen Smart Connected Hub	USB Cable
USB Cable	Yes	>3.0 m	No	Eleksen Connector	Test Computer

MODIFICATIONS



Equipment Modifications

Item	Date	Test	Modification	Note	Disposition of EUT
1	2019-09-27	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	2020-01-16	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	2020-01-20	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

Per IEEE 1528: 2003, Section 5.2.2, the permittivity and conductivity of the tissue material should be measured at least within 24 hours of any full-compliance test. The measured values must be within +/- 5% of the target values or +/- 10% as long as SAR error compensation algorithms documented in IEEE Std 1528-2013 are implemented for upward correction purposes only. The temperature variation in the liquid during SAR measurements must be within +/- 2 degrees C of that recorded when the dielectric properties were measured.

The dielectric parameters of the tissue-equivalent liquids were measured within 24 hours of the start of testing 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 10% 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.”

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 $\rho = 1000 \text{ kg/m}^3$)

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. If the liquids prepared are between +/- 5% and +/- 10% of their target values, SAR error compensation algorithms documented in IEEE Std 1528-2013 are implemented for upward correction purposes only. Their recipes are based upon the following formulations as found in IEEE 1528:2013 Annex C (head) and IEC 62209-2:2010 Annex E (body):

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

HEAD

**Table C.1—Suggested recipes for achieving target dielectric parameters:
300 MHz to 900 MHz**

Frequency (MHz)	300	450	450	450	835	835	900	900	900	900
Reference	[B118]	[B118]	[B172]	[B74]	[B118]	[B74]	[B118]	[B196]	[B172]	[B74]
Ingredients (% by weight)										
1,2-Propanediol	—	—	—	—	—	—	—	64.81	—	—
Bactericide	0.19	0.19	0.50	—	0.10	—	0.10	—	0.50	—
Diacetin	—	—	48.90	—	—	—	—	—	49.20	—
DGBE	—	—	—	—	—	—	—	—	—	—
HEC	0.98	0.98	—	—	1.00	—	1.00	—	—	—
NaCl	5.95	3.95	1.70	1.96	1.45	1.25	1.48	0.79	1.10	1.35
Sucrose	55.32	56.32	—	—	57.00	—	56.50	—	—	—
Triton X-100	—	—	—	—	—	—	—	—	—	—
Tween 20	—	—	—	49.51	—	48.39	—	—	—	48.34
Water	37.56	38.56	48.90	48.53	40.45	50.36	40.92	34.40	49.20	50.31

**Table C.2—Suggested recipes for achieving target dielectric parameters:
1450 MHz to 2000 MHz**

Frequency (MHz)	1450	1800	1800	1800	1800	1800	1900	1900	1950	2000
Reference	[B118]	[B118]	[B196]	[B196]	[B172]	[B74]	[B118]	[B196]	[B74]	[B118]
Ingredients (% by weight)										
1,2-Propanediol	—	—	—	—	—	—	—	—	—	—
Bactericide	—	—	—	—	0.50	—	—	—	—	—
Diacetin	—	—	—	—	49.43	—	—	—	—	—
DGBE	45.51	47.00	13.84	44.92	—	—	44.92	13.84	45.00	50.00
HEC	—	—	—	—	—	—	—	—	—	—
NaCl	0.67	0.36	0.35	0.18	0.64	0.50	0.18	0.35	—	—
Sucrose	—	—	—	—	—	—	—	—	—	—
Triton X-100	—	—	30.45	—	—	—	—	30.45	—	—
Tween 20	—	—	—	—	—	45.27	—	—	—	—
Water	53.82	52.64	55.36	54.90	49.43	54.23	54.90	55.36	55.00	50.00

TISSUE – EQUIVALENT LIQUID DESCRIPTION

**Table C.3—Suggested recipes for achieving target dielectric parameters:
2100 MHz to 5800 MHz**

Frequency (MHz)	2100	2100	2450	2450	3000	5200	5800
Reference	[B118]	[B196]	[B196]	[B172]	[B196]		
Ingredients (% by weight)							
1,2-Propanediol	—	—	—		—	—	—
Bactericide	—	—	—	0.50	—	—	—
Diacetin	—	—	—	49.75	—	—	—
DGBE	50.00	7.99	7.99	—	7.99	—	—
HEC	—	—	—	—	—	—	—
NaCl	—	0.16	0.16	—	0.16	—	—
Sucrose	—	—	—	—	—	—	—
Triton X-100	—	19.97	19.97	—	19.97	17.24	17.24
Diethylenglycol monohexylether	—	—	—	—	—	17.24	17.24
Water	50.00	71.88	71.88	49.75	71.88	65.52	65.52

BODY

Frequency (MHz)	30	50		144		450		835	900	
Recipe source number	3	3	2	2	3	2	4	2	2	4
Ingredients (% by weight)										
Deionised water	48,30	48,30	53,53	55,12	48,30	48,53	56	50,36	50,31	56
Tween			44,70	43,31		49,51		48,39	48,34	
Oxidised mineral oil							44			44
Diethylenglycol monohexylether										
Triton X-100										
Diacetin	50,00	50,00			50,00					
DGBE										
NaCl	1,60	1,60	1,77	1,57	1,60	1,96		1,25	1,35	
Additives and salt	0,10	0,10			0,10					

Frequency (MHz)	1 800		2 450	4 000	5 000	5 200	5 800	6 000
Recipe source number	2	4	4	4	4	1	1	4
Ingredients (% by weight)								
Deionised water	54,23	56	56	56	56	65,53	65,53	56
Tween	45,27							
Oxidised mineral oil		44	44	44	44			44
Diethylenglycol monohexylether						17,24	17,24	
Triton X-100						17,24	17,24	
Diacetin								
DGBE								
NaCl	0,50							
Additives and salt								

TISSUE – EQUIVALENT LIQUID



Date:	2020-01-14	Temperature:	22.7°C
Tissue:	MBBL600-6000V6	Liquid Temperature:	21.3°C
Tested By:	Kyle McMullan	Relative Humidity:	24.6%
Job Site:	MN11	Bar. Pressure:	1015.4 mb

TEST SPECIFICATIONS

Specification:	Method:
FCC 15.247:2020 FCC 2.1093:2020	FCC KDB 865664 D01 v01r04 FCC KDB 865664 D02 v01r02 IEEE Std 1528:2013

RESULTS

Frequency (MHz)	Actual Values		Target Values		Deviation (%)	
	Relative Permittivity	Conductivity	Relative Permittivity	Conductivity	Relative Permittivity	Conductivity
750	52.5	0.97	55.5	0.96	-5.41	1.04
835	52.2	1.00	55.2	0.97	-5.43	3.09
1750	50.5	1.49	53.4	1.37	-5.43	8.76
1900	50.3	1.59	53.3	1.52	-5.63	4.61
2450	49.4	2.03	52.7	1.95	-6.26	4.10

Freq (MHz)	Relative Perm.	Cond. (S/m)
600	52.91	0.92
650	52.78	0.94
700	52.62	0.95
750	52.48	0.97
800	52.33	0.99
850	52.20	1.01
900	52.05	1.03
950	52.00	1.05
1000	51.85	1.08
1050	51.73	1.10
1100	51.61	1.12
1150	51.51	1.15
1200	51.40	1.17
1250	51.25	1.20
1300	51.21	1.22
1350	51.16	1.25
1400	51.08	1.28
1450	51.00	1.31
1500	50.90	1.33
1550	50.81	1.36
1600	50.67	1.39
1650	50.61	1.42
1700	50.53	1.46
1750	50.50	1.49
1800	50.44	1.52
1850	50.36	1.56
1900	50.29	1.59
1950	50.17	1.62
2000	50.08	1.66
2050	49.96	1.70
2100	49.92	1.74
2150	49.84	1.78
2200	49.82	1.82
2250	49.74	1.86
2300	49.68	1.90
2350	49.60	1.94
2400	49.50	1.98

Freq (MHz)	Relative Perm.	Cond. (S/m)
2450	49.42	2.03
2500	49.32	2.08
2550	49.25	2.12
2600	49.13	2.17
2650	49.02	2.22
2700	49.01	2.27
2750	48.88	2.31
2800	48.80	2.36
2850	48.68	2.41
2900	48.63	2.46
2950	48.54	2.51
3000	48.41	2.55
3050	48.29	2.61
3100	48.20	2.67
3150	48.08	2.72
3200	47.97	2.77
3250	47.96	2.81
3300	47.88	2.86
3350	47.76	2.91
3400	47.66	2.97
3450	47.58	3.02
3500	47.44	3.07
3550	47.39	3.13
3600	47.35	3.17
3650	47.24	3.23
3700	47.18	3.29
3750	47.08	3.35
3800	47.02	3.41
3850	46.94	3.46
3900	46.89	3.52
3950	46.78	3.58
4000	46.69	3.64
4050	46.63	3.71
4100	46.57	3.75
4150	46.47	3.81
4200	46.35	3.88
4250	46.27	3.94

Freq (MHz)	Relative Perm.	Cond. (S/m)
4300	46.17	4.03
4350	46.10	4.10
4400	46.06	4.17
4450	45.90	4.22
4500	45.84	4.28
4550	45.74	4.34
4600	45.62	4.41
4650	45.50	4.49
4700	45.41	4.55
4750	45.26	4.62
4800	45.19	4.69
4850	45.05	4.65
4900	44.80	4.75
4950	44.76	4.71
5000	44.41	4.88
5050	44.69	4.98
5100	44.48	5.07
5150	44.48	5.09
5200	44.05	5.19
5250	43.88	5.35
5300	43.46	5.30
5350	43.93	5.55
5400	43.82	5.56
5450	43.83	5.58
5500	43.80	5.62
5550	43.74	5.67
5600	43.42	5.70
5650	43.12	5.75
5700	42.95	6.01
5750	43.16	6.01
5800	42.70	6.06
5850	42.82	5.95
5900	42.68	6.05
5950	42.54	6.13
6000	42.39	6.20

SAR SYSTEM VERIFICATION DESCRIPTION

REQUIREMENT

Per IEEE 1528, Section 8.2.1, "System checks are performed prior to compliance tests and the results must always be within $\pm 10\%$ 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

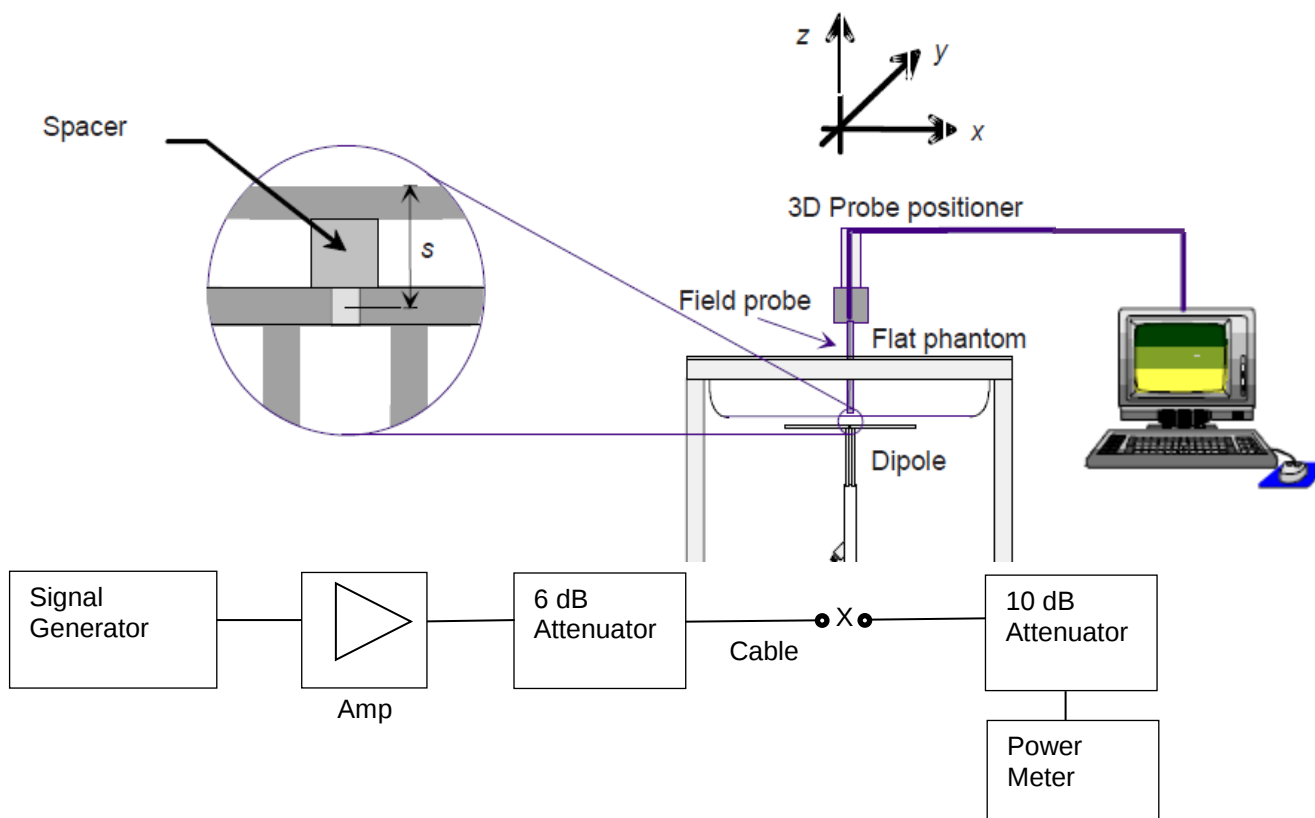
Element used the system validation kit (calibrated reference dipole) to test whether the system was operating within its specifications. The validation was performed in the indicated bands by making SAR measurements of the reference dipole with the phantom filled with the tissue-equivalent liquid. First, 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:

$s = 15\text{mm}$, $\pm 0.2\text{mm}$ for $300\text{MHz} \leq f \leq 1000\text{ MHz}$:

$s = 10\text{mm}$, $\pm 0.2\text{mm}$ for $1000\text{MHz} \leq f \leq 6000\text{MHz}$

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



TEST SPECIFICATIONS

Specification:	Method:
FCC 15.247:2020 FCC 2.1093:2020	FCC KDB 865664 D01 v01r04 FCC KDB 865664 D02 v01r02 IEEE Std 1528:2013

RESULTS

Date	Liquid part number and frequency	Conducted Power into the Dipole (dBm)	Correction Factor	Measured		Normalized to 1W		Target (Normalized to 1W) Get from Dipole Calibration Certificate		% Difference	
				1g	10g	1g	10g	1g	10g	1g	10g
2020-01-14	MBBL600-6000V6 (750 MHz)	20.00	10.00	0.86	0.57	8.62	5.73	8.55	5.64	0.70	1.60
2020-01-14	MBBL600-6000V6 (835 MHz)	20.00	10.00	1.00	0.66	9.99	6.59	9.73	6.40	4.28	5.44
2020-01-14	MBBL600-6000V6 (1750 MHz)	20.00	10.00	3.72	1.98	37.20	19.80	37.8	20.0	-0.53	0.00
2020-01-14	MBBL600-6000V6 (1900 MHz)	20.00	10.00	4.19	2.18	41.90	21.80	40.4	21.2	3.46	2.83
2020-01-25	MBBL600-6000V6 (2450 MHz)	20.00	10.00	4.65	2.15	46.50	21.50	50.80	23.80	-8.46	-9.66

SAR SYSTEM VERIFICATION



Tested By:	Marcelo Aguayo, Kyle McMullan	Room Temperature (°C):	22.1°C
Date:	2020-01-14	Liquid Temperature (°C):	21.3°C
		Humidity (%RH):	24.3%
		Bar. Pressure (mb):	998 mb

MBBL600-6000V6 System Check

DUT: Dipole 750 MHz D750V3; Type: D750V3; Serial: D750V3 - SN: 1094

Communication System: UID 0, CW (0); Communication System Band: D750 (750.0 MHz); Frequency: 750 MHz; Communication System PAR: 0 dB; PMF: 1

Medium parameters used: $f = 750 \text{ MHz}$; $\sigma = 0.972 \text{ S/m}$; $\epsilon_r = 52.477$; $\rho = 1000 \text{ kg/m}^3$

Phantom section: Flat Section

Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2007)

DASY Configuration:

- Probe: EX3DV4 - SN3746; ConvF(9.3, 9.3, 9.3) @ 750 MHz; Calibrated: 11/19/2019
 - Modulation Compensation:
- Sensor-Surface: 5mm (Mechanical Surface Detection), Sensor-Surface: 0mm (Fix Surface), $z = 1.0, 101.0, 31.0$
- Electronics: DAE4 Sn909; Calibrated: 12/6/2019
- Phantom: ELI V6.0 (SAC); Type: QD OVA 003 AA; Serial: 2044
- DASY52 52.10.2(1504); SEMCAD X 14.6.12(7470)

System Check/System Check/Area Scan (51x61x1): Interpolated grid: $dx=1.000 \text{ mm}$, $dy=1.000 \text{ mm}$

Maximum value of SAR (interpolated) = 0.857 W/kg

System Check/System Check/Z Scan (1x1x21): Measurement grid: $dx=20\text{mm}$, $dy=20\text{mm}$, $dz=5\text{mm}$

Maximum value of Total (measured) = 35.59 V/m

System Check/System Check/Zoom Scan (7x7x7) (7x7x7)/Cube 0: Measurement grid: $dx=5\text{mm}$, $dy=5\text{mm}$, $dz=5\text{mm}$

Reference Value = 28.91 V/m ; Power Drift = 0.07 dB

Peak SAR (extrapolated) = 1.27 W/kg

SAR(1 g) = 0.862 W/kg ; SAR(10 g) = 0.573 W/kg (SAR corrected for target medium)

Maximum value of SAR (measured) = 0.861 W/kg

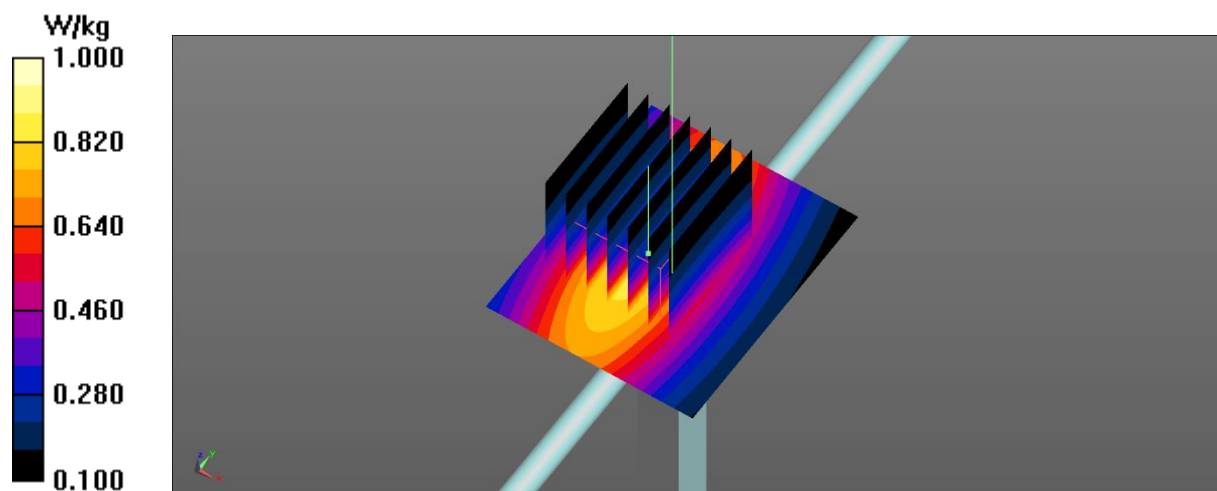
System Check/System Check/Z Scan (1x1x21): Measurement grid: $dx=20\text{mm}$, $dy=20\text{mm}$, $dz=5\text{mm}$

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

Approved By

SAR SYSTEM VERIFICATION

MSL750 System Check



SAR SYSTEM VERIFICATION



Tested By:	Marcelo Aguayo, Kyle McMullan	Room Temperature (°C):	22.1°C
Date:	2020-01-14	Liquid Temperature (°C):	21.3°C
		Humidity (%RH):	24.3%
		Bar. Pressure (mb):	998 mb

MBBL600-6000V6 System Check

DUT: Dipole 835 MHz D835V2; Type: D835V2 Serial: 4d108

Communication System: UID 10000, CW; Communication System Band: D835 (835.0 MHz); Frequency: 835 MHz; Communication System PAR: 0 dB; PMF: 1

Medium parameters used (interpolated): $f = 835$ MHz; $\sigma = 1.005$ S/m; $\epsilon_r = 52.237$; $\rho = 1000$ kg/m³

Phantom section: Flat Section

Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2007)

DASY Configuration:

- Probe: EX3DV4 - SN3746; ConvF(9.06, 9.06, 9.06) @ 835 MHz; Calibrated: 11/19/2019
 - Modulation Compensation:
- Sensor-Surface: 0mm (Fix Surface), Sensor-Surface: 5mm (Mechanical Surface Detection), $z = 101.0, 31.0$
- Electronics: DAE4 Sn909; Calibrated: 12/6/2019
- Phantom: ELI V6.0 (SAC); Type: QD OVA 003 AA; Serial: 2044
- DASY52 52.10.2(1504); SEMCAD X 14.6.12(7470)

System Check/System Check/Z Scan (1x1x21): Measurement grid: $dx=20$ mm, $dy=20$ mm, $dz=5$ mm

[Info: Interpolated medium parameters used for SAR evaluation.](#)

Maximum value of Total (measured) = 37.69 V/m

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

Reference Value = 31.10 V/m; Power Drift = 0.05 dB

Peak SAR (extrapolated) = 1.48 W/kg

SAR(1 g) = 0.999 W/kg; SAR(10 g) = 0.659 W/kg (SAR corrected for target medium)

[Info: Interpolated medium parameters used for SAR evaluation.](#)

Maximum value of SAR (measured) = 0.999 W/kg

System Check/System Check/Area Scan (71x101x1): Interpolated grid: $dx=1.000$ mm, $dy=1.000$ mm

[Info: Interpolated medium parameters used for SAR evaluation.](#)

Maximum value of SAR (interpolated) = 0.995 W/kg

System Check/System Check/Z Scan (1x1x21): Measurement grid: $dx=20$ mm, $dy=20$ mm, $dz=5$ mm

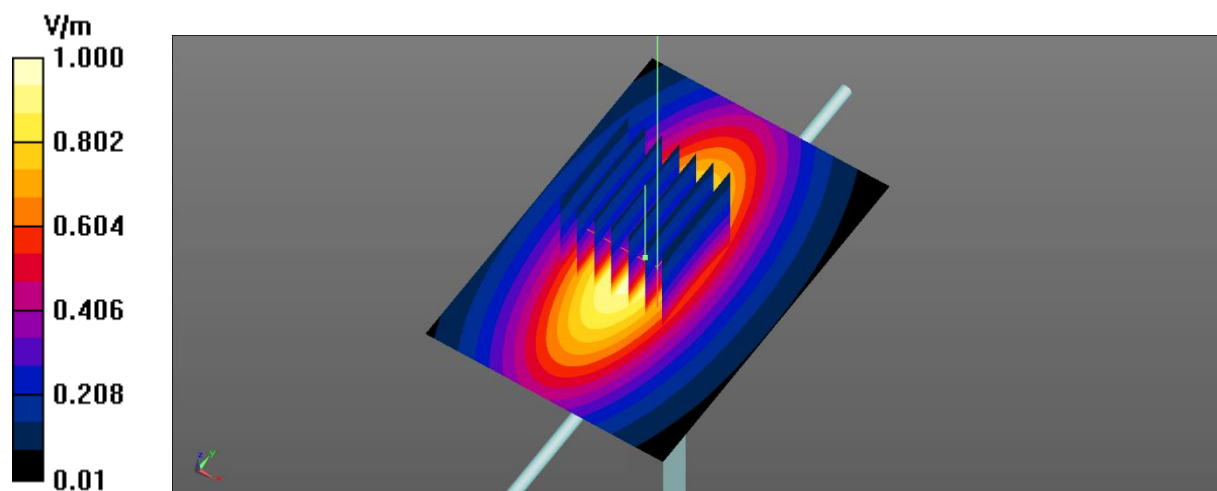
[Info: Interpolated medium parameters used for SAR evaluation.](#)

Maximum value of SAR (measured) = 1.43 W/kg

Approved By

SAR SYSTEM VERIFICATION

MSL835 System CheckMHz



SAR SYSTEM VERIFICATION



Tested By:	Marcelo Aguayo, Kyle McMullan	Room Temperature (°C):	22.1°C
Date:	2020-01-14	Liquid Temperature (°C):	21.3°C
		Humidity (%RH):	24.3%
		Bar. Pressure (mb):	998 mb

MBBL600-6000V6 System Check

DUT: Dipole 1750 MHz D1750V2; Type: D1750V2; Serial: D1750V2 - SN: 1040

Communication System: UID 0, CW (0); Communication System Band: D1750 (1750.0 MHz); Frequency: 1750 MHz; Communication System PAR: 0 dB; PMF: 1

Medium parameters used: $f = 1750$ MHz; $\sigma = 1.49$ S/m; $\epsilon_r = 50.504$; $\rho = 1000$ kg/m³

Phantom section: Flat Section

Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2007)

DASY Configuration:

- Probe: EX3DV4 - SN3746; ConvF(7.67, 7.67, 7.67) @ 1750 MHz; Calibrated: 11/19/2019
 - Modulation Compensation:
- Sensor-Surface: 0mm (Fix Surface), Sensor-Surface: 5mm (Mechanical Surface Detection), $z = 101.0, 31.0$
- Electronics: DAE4 Sn909; Calibrated: 12/6/2019
- Phantom: ELI V6.0 (SAC); Type: QD OVA 003 AA; Serial: 2044
- DASY52 52.10.2(1504); SEMCAD X 14.6.12(7470)

System Check/System Check/Z Scan (1x1x21): Measurement grid: $dx=20$ mm, $dy=20$ mm, $dz=5$ mm

Maximum value of Total (measured) = 61.42 V/m

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

Reference Value = 48.96 V/m; Power Drift = -0.05 dB

Peak SAR (extrapolated) = 6.71 W/kg

SAR(1 g) = 3.72 W/kg; SAR(10 g) = 1.98 W/kg (SAR corrected for target medium)

Maximum value of SAR (measured) = 3.74 W/kg

System Check/System Check/Area Scan (51x61x1): Interpolated grid: $dx=1.000$ mm, $dy=1.000$ mm

Maximum value of SAR (interpolated) = 3.78 W/kg

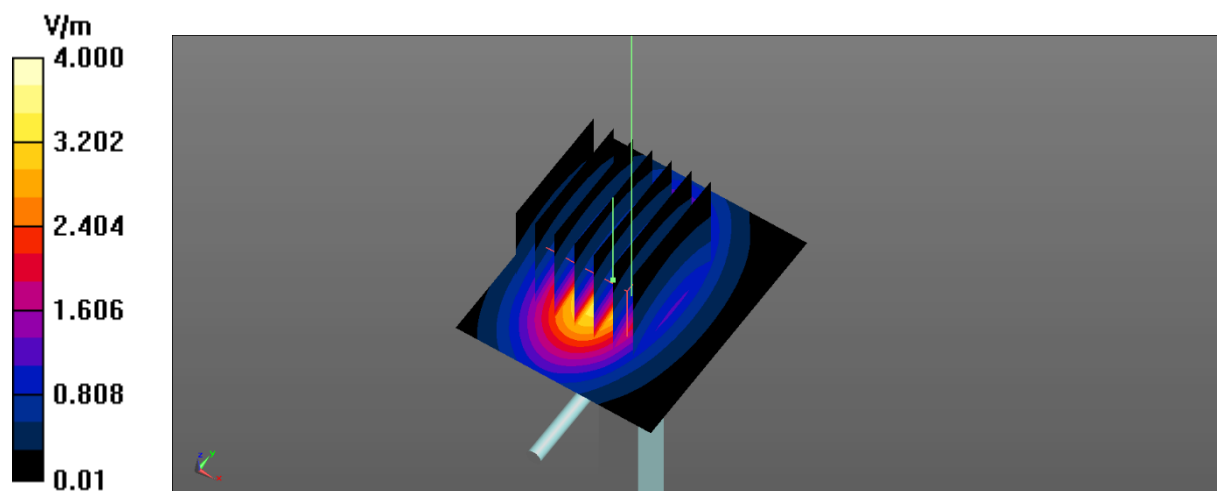
System Check/System Check/Z Scan (1x1x21): Measurement grid: $dx=20$ mm, $dy=20$ mm, $dz=5$ mm

Maximum value of SAR (measured) = 5.62 W/kg

Approved By

SAR SYSTEM VERIFICATION

MSL1750 System Check



SAR SYSTEM VERIFICATION



Tested By:	Marcelo Aguayo, Kyle McMullan	Room Temperature (°C):	22.1°C
Date:	2020-01-14	Liquid Temperature (°C):	21.3°C
		Humidity (%RH):	24.3%
		Bar. Pressure (mb):	998 mb

MBBL600-6000V6 System Check

DUT: Dipole 1900 MHz D1900V2; Type: D1900V2; Serial: D1900V2 - SN: 5d131

Communication System: UID 10000, CW; Communication System Band: D1900 (1900.0 MHz); Frequency: 1900 MHz; Communication System PAR: 0 dB; PMF: 1

Medium parameters used: $f = 1900$ MHz; $\sigma = 1.589$ S/m; $\epsilon_r = 50.292$; $\rho = 1000$ kg/m³

Phantom section: Flat Section

Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2007)

DASY Configuration:

- Probe: EX3DV4 - SN3746; ConvF(7.44, 7.44, 7.44) @ 1900 MHz; Calibrated: 11/19/2019
 - Modulation Compensation:
- Sensor-Surface: 5mm (Mechanical Surface Detection), Sensor-Surface: 0mm (Fix Surface), $z = 1.0, 31.0, 101.0$
- Electronics: DAE4 Sn909; Calibrated: 12/6/2019
- Phantom: ELI V6.0 (SAC); Type: QD OVA 003 AA; Serial: 2044
- DASY52 52.10.2(1504); SEMCAD X 14.6.12(7470)

System Check/System Check/Area Scan (51x61x1): Interpolated grid: $dx=1.000$ mm, $dy=1.000$ mm

Maximum value of SAR (interpolated) = 4.37 W/kg

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

Reference Value = 51.60 V/m; Power Drift = -0.11 dB

Peak SAR (extrapolated) = 7.78 W/kg

SAR(1 g) = 4.19 W/kg; SAR(10 g) = 2.18 W/kg (SAR corrected for target medium)

Maximum value of SAR (measured) = 4.20 W/kg

System Check/System Check/Z Scan (1x1x21): Measurement grid: $dx=20$ mm, $dy=20$ mm, $dz=5$ mm

Maximum value of Total (measured) = 65.80 V/m

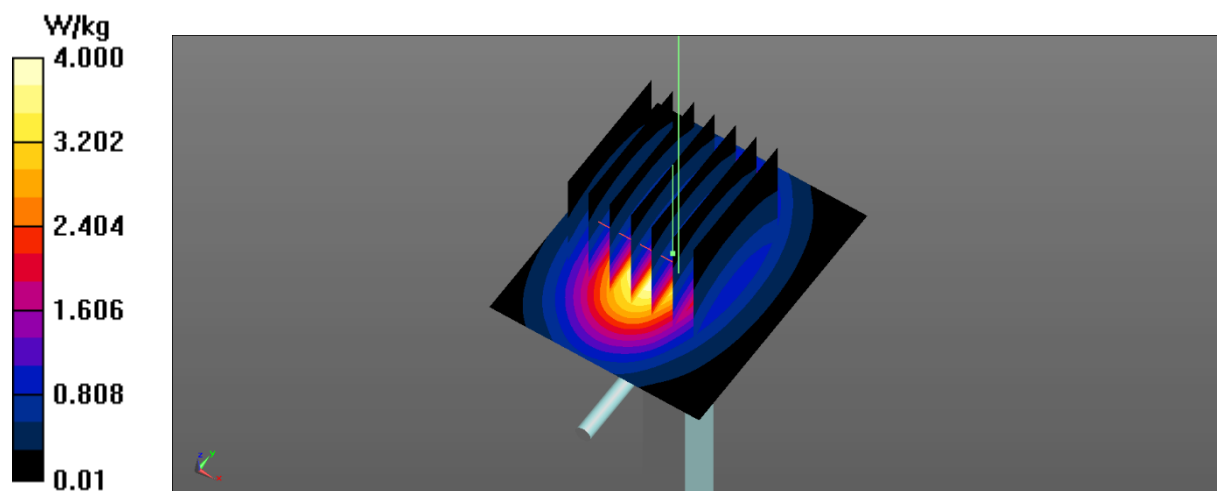
System Check/System Check/Z Scan (1x1x21): Measurement grid: $dx=20$ mm, $dy=20$ mm, $dz=5$ mm

Maximum value of SAR (measured) = 6.88 W/kg

Approved By

SAR SYSTEM VERIFICATION

MSL1900 System Check



SAR SYSTEM VERIFICATION



Tested By:	Marcelo Aguayo, Kyle McMullan	Room Temperature (°C):	22.1°C
Date:	2020-01-25	Liquid Temperature (°C):	21.3°C
		Humidity (%RH):	24.3%
		Bar. Pressure (mb):	998 mb

MBBL600-6000V6 System Check

DUT: Dipole 2450 MHz D2450V2; Type: D2450V2; Serial: D2450V2 - SN: 855

Communication System: UID 10000, CW; Communication System Band: D2450 (2450.0 MHz); Frequency: 2450 MHz; Communication System PAR: 0 dB; PMF: 1

Medium parameters used: $f = 2450$ MHz; $\sigma = 2.028$ S/m; $\epsilon_r = 49.416$; $\rho = 1000$ kg/m³

Phantom section: Flat Section

Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2007)

DASY Configuration:

- Probe: EX3DV4 - SN3746; ConvF(7.33, 7.33, 7.33) @ 2450 MHz; Calibrated: 11/19/2019
 - Modulation Compensation:
- Sensor-Surface: 5mm (Mechanical Surface Detection), Sensor-Surface: 0mm (Fix Surface), $z = 1.0, 101.0, 31.0$
- Electronics: DAE4 Sn909; Calibrated: 12/6/2019
- Phantom: ELI V6.0 (SAC); Type: QD OVA 003 AA; Serial: 2044
- DASY52 52.10.2(1504); SEMCAD X 14.6.12(7470)

System Check/System Check/Area Scan (51x61x1): Interpolated grid: $dx=1.000$ mm, $dy=1.000$ mm

Maximum value of SAR (interpolated) = 5.05 W/kg

System Check/System Check/Z Scan (1x1x21): Measurement grid: $dx=20$ mm, $dy=20$ mm, $dz=5$ mm

Maximum value of Total (measured) = 60.73 V/m

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

Reference Value = 46.33 V/m; Power Drift = -0.14 dB

Peak SAR (extrapolated) = 9.50 W/kg

SAR(1 g) = 4.65 W/kg; SAR(10 g) = 2.15 W/kg (SAR corrected for target medium)

Maximum value of SAR (measured) = 4.62 W/kg

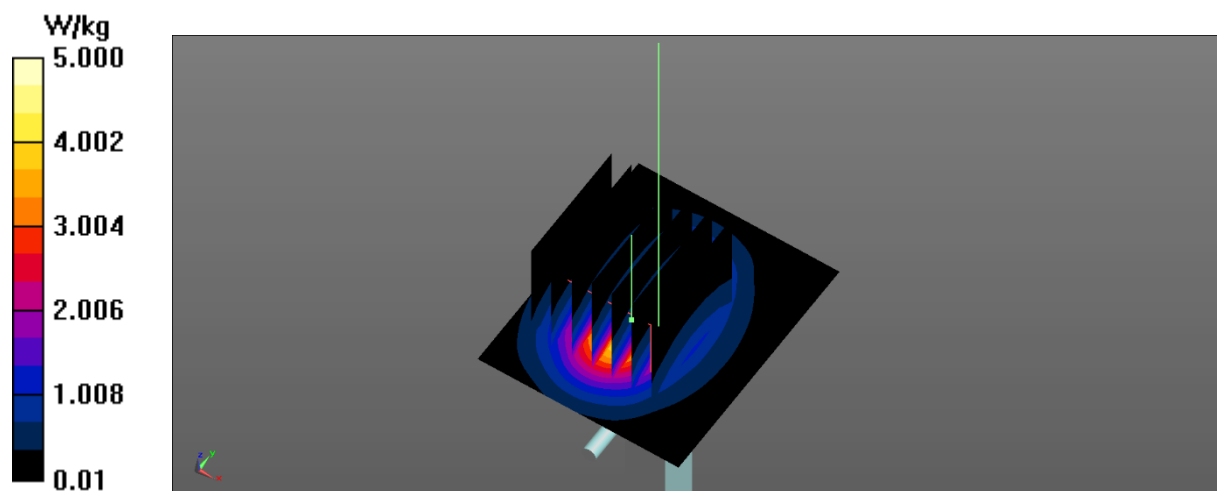
System Check/System Check/Z Scan (1x1x21): Measurement grid: $dx=20$ mm, $dy=20$ mm, $dz=5$ mm

Maximum value of SAR (measured) = 7.48 W/kg

Approved By

SAR SYSTEM VERIFICATION

MSL2450 System Check 1-25-20



OUTPUT POWER

EUT:	Smart Connected Hub	Work Order:	ELEM0093
Serial Number:	Conducted Cellular 1 and Conducted WiFi 1	Date:	2019-12-05
Customer:	Element Materials Technology	Temperature:	23 °C
Attendees:	None	Relative Humidity:	34.5% RH
Customer Project:	None	Bar. Pressure:	1018 mbar
Tested By:	Kyle McMullan	Job Site:	MN11
Power:	4.1VDC	Configuration:	ELEM0093-3 ELEM0093-4

TEST SPECIFICATIONS

Specification:	Method:
FCC 15.247:2019 FCC 2.1093:2019	FCC KDB 248227 D01 V02r02 FCC KDB 447498 D01 V06 FCC KDB 865664 D01 v01r04 FCC KDB 865664 D02 v01r02 FCC KDB 941225 D01 v03r01 FCC KDB 941225 D05 v02r05 IEEE Std 1528:2013

COMMENTS

See the data tables below for the transmitter power setting used for each channel/data rate/band.

The EUT is not capable of voice calling and therefore GSM is not tested.

After testing all combinations of LTE Category M1, it was determined that the worst-case mode is maximum bandwidth and minimal resource blocks. This worst-case mode was used for the rest of LTE Category M1 and NB-IoT testing.

Serial number Conducted Cellular 1 and configuration ELEM0093-3 used for conducted cellular testing. Serial number Conducted WiFi 1 and configuration ELEM0093-4 used for Wi-Fi testing.

DEVIATIONS FROM TEST STANDARD

None

OUTPUT POWER

802.11bgn Results

20 MHz Bandwidth

Channel	Frequency (MHz)	Radio Mode	Data Rate (Mbps)	Modulation	Software Atten. Setting dBm	Meter Reading dBm	mW
1	2412	802.11b	1	BPSK	0	4.96	3.13
			11	CCK	0	4.92	3.10
		802.11g	6	OFDM	0	3.81	2.40
			54	OFDM	0	-0.63	0.86
		802.11n	MCS0	OFDM	0	3.81	2.40
			MCS7	OFDM	0	-1.54	0.70
6	2437	802.11b	1	BPSK	0	4.45	2.79
			11	CCK	0	4.34	2.72
		802.11g	6	OFDM	0	3.24	2.11
			54	OFDM	0	-1.12	0.77
		802.11n	MCS0	OFDM	0	3.14	2.06
			MCS7	OFDM	0	-2.33	0.58
11	2462	802.11b	1	BPSK	0	1.77	1.50
			11	CCK	0	1.63	1.46
		802.11g	6	OFDM	0	0.78	1.20
			54	OFDM	0	-3.51	0.45
		802.11n	MCS0	OFDM	0	0.69	1.17
			MCS7	OFDM	0	-4.53	0.35

40 MHz Bandwidth

Channel	Frequency (MHz)	Radio Mode	Data Rate (Mbps)	Modulation	Software Power Setting	Meter Reading dBm	mW
3F	2422	802.11n	MCS0	BPSK	0	3.86	2.43
			MCS7	64-QAM	0	-2.00	0.63
7F	2442	802.11n	MCS0	OFDM	0	3.23	2.10
			MCS7	OFDM	0	-2.33	0.58
11F	2462	802.11n	MCS0	OFDM	0	1.11	1.29
			MCS7	OFDM	0	-4.25	0.38

OUTPUT POWER

GPRS and EDGE Results

GSM/GPRS/EDGE Maximum Output Power (in dBm)											
Band	Ch	Freq (MHz)	Voice 1 UL	Data 1 UL		Data 2 UL		Data 3 UL		Data 4 UL	
			GSM GSMK	GPRS/ EDGE GMSK	EDGE 8-PSK	GPRS/ EDGE GMSK	EDGE 8-PSK	GPRS/ EDGE GMSK	EDGE 8-PSK	GPRS/ EDGE GMSK	EDGE 8-PSK
GSM-850	128	824.2	N/A	19.4	14.6	17.8	13.2	16.4	11.5	15.5	10.6
	190	836.6	N/A	20.1	14.6	18.3	13.0	16.7	12.0	15.5	10.6
	251	848.8	N/A	20.8	15.0	18.4	13.5	17.2	12.0	15.7	11.0
PCS-1900	512	1850.2	N/A	24.7	21.1	24.7	20.7	24.5	20.4	24.2	20.3
	661	1880	N/A	24.7	20.8	24.4	20.5	24.2	20.3	24.0	20.0
	810	1909.8	N/A	24.6	20.3	24.3	20.4	24.1	20.1	23.8	19.9

GPRS/EDGE Data Average Output Power (in dBm)											
Band	Ch	Freq (MHz)	Voice 1 UL	Data 1 UL		Data 2 UL		Data 3 UL		Data 4 UL	
			GSM GSMK	GPRS/ EDGE GMSK	EDGE 8-PSK	GPRS/ EDGE GMSK	EDGE 8-PSK	GPRS/ EDGE GMSK	EDGE 8-PSK	GPRS/ EDGE GMSK	EDGE 8-PSK
GSM-850	128	824.2	N/A	10.2	5.4	11.4	6.8	11.7	6.8	12.1	7.2
	190	836.6	N/A	10.9	5.4	11.9	6.6	12.0	7.3	12.1	7.2
	251	848.8	N/A	11.6	5.8	12.0	7.1	12.5	7.3	12.3	7.6
PCS-1900	512	1850.2	N/A	15.5	11.9	18.3	14.3	19.8	15.7	20.8	16.9
	661	1880	N/A	15.5	11.6	18.0	14.1	19.5	15.6	20.6	16.6
	810	1909.8	N/A	15.4	11.1	17.9	14.0	19.4	15.4	20.4	16.5

OUTPUT POWER

LTE Category M1 Results Band 2

Bandwidth (MHz)	Channel	Channel Frequency (MHz)	Modulation	RB Allocation	NB Value and RB start	Power (dBm)	Modulation	RB Allocation	NB Value and RB start	Power (dBm)
20	18700	1860.0	QPSK	1	0,0	16.35	16-QAM	1	0,0	16.06
				1	8,0	16.99		1	8,0	16.08
				1	15,5	16.59		1	15,5	16.51
				3	0,0	16.48		3	0,0	16.37
				3	8,0	16.57		3	8,0	16.20
				3	15,5	16.29		3	15,5	16.15
				6	0,0	16.41		6	0,0	16.24
				6	8,0	16.54		6	8,0	16.28
				6	15,5	16.54		6	15,5	16.26
	18900	1880.0	QPSK	1	0,0	16.39	16-QAM	1	0,0	16.16
				1	8,0	16.66		1	8,0	16.35
				1	15,5	16.88		1	15,5	16.61
				3	0,0	16.50		3	0,0	16.22
				3	8,0	16.57		3	8,0	16.63
				3	15,5	16.56		3	15,5	16.51
				6	0,0	16.63		6	0,0	16.13
				6	8,0	16.78		6	8,0	16.72
				6	15,5	16.63		6	15,5	16.60
	19100	1900.0	QPSK	1	0,0	16.72	16-QAM	1	0,0	16.39
				1	8,0	16.60		1	8,0	16.55
				1	15,5	16.68		1	15,5	16.61
				3	0,0	16.59		3	0,0	16.48
				3	8,0	16.54		3	8,0	16.16
				3	15,5	16.31		3	15,5	16.34
				6	0,0	16.76		6	0,0	16.72
				6	8,0	16.70		6	8,0	16.59
				6	15,5	16.57		6	15,5	16.44
15	18675	1857.5	QPSK	1	0,0	16.73	16-QAM	1	0,0	16.60
				1	6,0	16.53		1	6,0	15.70
				1	11,5	16.44		1	11,5	16.61
				3	0,0	16.76		3	0,0	16.78
				3	6,0	16.78		3	6,0	16.66
				3	11,5	16.55		3	11,5	16.45
				6	0,0	16.61		6	0,0	16.79
				6	6,0	16.72		6	6,0	16.64
				6	11,5	16.81		6	11,5	17.03
	18900	1880.0	QPSK	1	0,0	16.39	16-QAM	1	0,0	16.35
				1	6,0	16.41		1	6,0	16.38
				1	11,5	16.27		1	11,5	16.33
				3	0,0	16.37		3	0,0	16.44
				3	6,0	16.79		3	6,0	16.63
				3	11,5	16.60		3	11,5	16.59

OUTPUT POWER

	19125	1902.5	QPSK	6	0,0	16.55	16-QAM	6	0,0	16.51
				6	6,0	16.83		6	6,0	16.73
				6	11,5	16.65		6	11,5	16.56
				1	0,0	16.83		1	0,0	16.76
				1	6,0	16.61		1	6,0	16.59
				1	11,5	16.87		1	11,5	16.76
				3	0,0	16.64		3	0,0	16.24
				3	6,0	16.48		3	6,0	16.20
				3	11,5	16.42		3	11,5	16.50
				6	0,0	16.71		6	0,0	16.73
				6	6,0	16.76		6	6,0	16.63
				6	11,5	16.77		6	11,5	16.60
10	18650	1855.0	QPSK	1	0,0	15.66	16-QAM	1	0,0	14.58
				1	4,0	16.49		1	4,0	16.48
				1	9,5	16.43		1	9,5	16.41
				3	0,0	16.64		3	0,0	16.55
				3	4,0	16.66		3	4,0	16.64
				3	9,5	16.78		3	9,5	16.66
				6	0,0	15.59		6	0,0	14.99
				6	4,0	15.76		6	4,0	14.55
				6	9,5	15.77		6	9,5	14.58
	18900	1880.0	QPSK	1	0,0	16.33	16-QAM	1	0,0	16.26
				1	4,0	16.64		1	4,0	16.63
				1	9,5	16.46		1	9,5	15.64
				3	0,0	16.61		3	0,0	16.62
				3	4,0	16.77		3	4,0	16.12
				3	9,5	16.80		3	9,5	16.66
				6	0,0	15.65		6	0,0	14.50
				6	4,0	15.79		6	4,0	15.70
				6	9,5	15.72		6	9,5	15.66
	19150	1905.0	QPSK	1	0,0	16.39	16-QAM	1	0,0	15.62
				1	4,0	16.34		1	4,0	15.47
				1	9,5	16.55		1	9,5	16.60
				3	0,0	16.74		3	0,0	16.46
				3	4,0	16.71		3	4,0	16.52
				3	9,5	16.64		3	9,5	16.63
				6	0,0	15.51		6	0,0	14.43
				6	4,0	15.72		6	4,0	15.07
				6	9,5	15.84		6	9,5	15.11
5	18625	1852.5	QPSK	1	0,0	16.46	16-QAM	0,0	low/0	15.48
				1	2,0	16.65		2,0	2/0	15.88
				1	4,5	16.36		4,5	high/5	15.57
				3	0,0	15.81		0,0	low/0	15.43
				3	2,0	15.94		2,0	2/0	15.58
				3	4,5	15.66		4,5	high/3	15.65
				6	0,0	15.47		0,0	low/0	14.49

OUTPUT POWER

				6	2,0	15.80		2,0	2/0	14.84
				6	4,5	15.79		4,5	high/0	15.77
	18900	1880.0	QPSK	1	0,0	16.59	16-QAM	0,0	low/0	16.33
				1	2,0	16.65		2,0	2/0	16.32
				1	4,5	16.27		4,5	high/5	16.30
				3	0,0	15.75		0,0	low/0	15.31
				3	2,0	15.91		2,0	2/0	15.45
				3	4,5	16.69		4,5	high/3	15.45
				6	0,0	15.64		0,0	low/0	14.60
				6	2,0	15.77		2,0	2/0	15.74
				6	4,5	15.71		4,5	high/0	14.59
	19175	1907.5	QPSK	1	0,0	16.46	16-QAM	0,0	low/0	16.16
				1	2,0	16.51		2,0	2/0	16.43
				1	4,5	16.40		4,5	high/5	16.16
				3	0,0	15.49		0,0	low/0	15.42
				3	2,0	15.51		2,0	2/0	15.26
				3	4,5	15.48		4,5	high/3	15.41
				6	0,0	15.57		0,0	low/0	14.39
				6	2,0	15.73		2,0	2/0	15.69
				6	4,5	15.67		4,5	high/0	14.57
3	18615	1851.5	QPSK	1	0,0	14.84	16-QAM	1	0,0	14.66
				1	1,0	16.66		1	1,0	16.16
				1	1,5	16.66		1	1,5	15.26
				3	0,0	15.73		3	0,0	14.40
				3	1,0	15.75		3	1,0	14.36
				3	1,5	15.77		3	1,5	14.23
				6	0,0	14.35		6	0,0	14.58
				6	N/A	N/A		6	N/A	N/A
				6	1,5	14.78		6	1,5	14.90
	18900	1880.0	QPSK	1	0,0	16.67	16-QAM	1	0,0	15.99
				1	1,0	16.70		1	1,0	15.37
				1	1,5	16.74		1	1,5	15.36
				3	0,0	15.73		3	0,0	14.21
				3	1,0	15.75		3	1,0	14.19
				3	1,5	15.80		3	1,5	14.20
				6	0,0	14.55		6	0,0	14.48
				6	N/A	N/A		6	N/A	N/A
				6	1,5	15.16		6	1,5	14.76
	19185	1908.5	QPSK	1	0,0	16.42	16-QAM	1	0,0	15.19
				1	1,0	16.57		1	1,0	15.06
				1	1,5	16.52		1	1,5	15.13
				3	0,0	15.77		3	0,0	14.27
				3	1,0	15.90		3	1,0	14.28
				3	1,5	15.73		3	1,5	14.23
				6	0,0	14.54		6	0,0	14.27
				6	N/A	N/A		6	N/A	N/A

OUTPUT POWER

				6	1,5	14.64		6	1,5	15.02
1.4	18607	1850.7	QPSK	1	0,0	16.70	16-QAM	1	0,0	15.29
				1	0,3	16.84		1	0,3	15.35
				1	0,5	16.66		1	0,5	15.32
				3	0,0	15.67		3	0,0	14.38
				3	0,3	15.84		3	0,3	14.35
				3	0,5	15.88		3	0,5	14.38
				6	N/A	N/A		6	N/A	N/A
				6	0,6	14.77		6	0,6	14.66
				6	N/A	N/A		6	N/A	N/A
	18900	1880.0	QPSK	1	0,0	16.58	16-QAM	1	0,0	15.30
				1	0,3	16.71		1	0,3	15.33
				1	0,5	16.64		1	0,5	15.38
				3	0,0	15.73		3	0,0	14.28
				3	0,3	15.98		3	0,3	14.55
				3	0,5	16.88		3	0,5	15.23
				6	N/A	N/A		6	N/A	N/A
				6	0,6	14.59		6	0,6	14.90
				6	N/A	N/A		6	N/A	N/A
	19193	1909.3	QPSK	1	0,0	16.34	16-QAM	1	0,0	15.06
				1	0,3	16.80		1	0,3	16.72
				1	0,5	16.29		1	0,5	14.75
				3	0,0	15.73		3	0,0	14.38
				3	0,3	15.60		3	0,3	14.31
				3	0,5	15.58		3	0,5	14.40
				6	N/A	N/A		6	N/A	N/A
				6	0,6	14.75		6	0,6	14.80
				6	N/A	N/A		6	N/A	N/A

OUTPUT POWER

LTE Category M1 Results Band 4, 5, 12

Band	Bandwidth (MHz)	Channel	Channel Frequency (MHz)	Modulation	RB Allocation	NB Value and RB start	Power (dBm)	Modulation	RB Allocation	NB Value and RB start	Power (dBm)
4	20	20050	1720.0	QPSK	1	0,0	16.06	16-QAM	1	0,0	15.16
					1	8,0	16.3		1	8,0	15.28
					1	15,5	16.16		1	15,5	15.36
		20175	1732.5	QPSK	1	0,0	16.11	16-QAM	1	0,0	15.58
					1	8,0	16.37		1	8,0	15.44
					1	15,5	16.48		1	15,5	15.52
		20300	1745.0	QPSK	1	0,0	16.15	16-QAM	1	0,0	16.4
					1	8,0	16.56		1	8,0	16.62
					1	15,5	16.57		1	15,5	16.68
5	10	20450	829.0	QPSK	1	0,0	10.05	16-QAM	1	0,0	9.21
					1	6,0	10.23		1	6,0	9.22
					1	11,5	10.12		1	11,5	9.36
		20525	836.5	QPSK	1	0,0	10.13	16-QAM	1	0,0	9.24
					1	6,0	9.82		1	6,0	9.15
					1	11,5	9.87		1	11,5	9.01
		20600	844.0	QPSK	1	0,0	9.91	16-QAM	1	0,0	9.03
					1	6,0	9.73		1	6,0	8.88
					1	11,5	9.92		1	11,5	8.99
12	10	23060	704.0	QPSK	1	0,0	9.23	16-QAM	1	0,0	9.03
					1	6,0	9.33		1	6,0	9.05
					1	11,5	9.60		1	11,5	9.29
		23095	707.5	QPSK	1	0,0	9.47	16-QAM	1	0,0	8.43
					1	6,0	9.86		1	6,0	8.75
					1	11,5	10.07		1	11,5	8.88
		23130	711.0	QPSK	1	0,0	9.53	16-QAM	1	0,0	9.44
					1	6,0	9.55		1	6,0	9.58
					1	11,5	9.75		1	11,5	9.73

OUTPUT POWER

LTE NB-IoT Results Bands 2, 4, 5, 12

Band	Channel	Channel Frequency	UL SCS	RB Allocation	RB start	Power (dBm)	UL SCS	RB Allocation	RB start	Power (dBm)
2	18600	1850.0	15	1	0	18.16	3.75	1	0	17.87
				1	5	18.41		1	23	18.08
				1	11	18.11		1	47	17.73
	18900	1880.0	15	1	0	17.90	3.75	1	0	17.64
				1	5	18.09		1	23	17.93
				1	11	17.91		1	47	17.71
	19199	1910.0	15	1	0	17.66	3.75	1	0	17.58
				1	5	17.78		1	23	17.81
				1	11	17.54		1	47	17.75
4	19950	1710.0	15	1	0	17.23	3.75	1	0	17.28
				1	5	17.50		1	23	17.97
				1	11	17.17		1	47	17.13
	20175	1732.5	15	1	0	17.24	3.75	1	0	17.19
				1	5	17.53		1	23	18.15
				1	11	17.26		1	47	17.24
	20399	1755.0	15	1	0	17.22	3.75	1	0	17.23
				1	5	17.76		1	23	18.16
				1	11	17.51		1	47	17.44
5	20400	824.0	15	1	0	13.31	3.75	1	0	13.04
				1	5	13.65		1	23	13.44
				1	11	13.35		1	47	13.24
	20525	836.5	15	1	0	12.54	3.75	1	0	12.20
				1	5	12.72		1	23	12.50
				1	11	12.42		1	47	12.33
	20649	849.0	15	1	0	11.70	3.75	1	0	11.47
				1	5	11.81		1	23	11.63
				1	11	11.79		1	47	11.50
12	23010	699.0	15	1	0	10.71	3.75	1	0	11.10
				1	5	11.14		1	23	11.25
				1	11	10.64		1	47	9.99
	23095	707.5	15	1	0	9.59	3.75	1	0	9.40
				1	5	9.61		1	23	10.10
				1	11	9.58		1	47	9.56
	23179	716.0	15	1	0	9.45	3.75	1	0	9.62
				1	5	9.66		1	23	9.99
				1	11	9.04		1	47	8.78

SAR TEST DATA – 2G GPRS AND EDGE



EUT:	Smart Connected Hub	Work Order:	ELEM0093
Customer:	Element Materials Technology	Job Site:	MN11
Attendees:	None	Customer Project:	None

TEST SPECIFICATIONS

Specification:	Method:
FCC 15.247:2020 FCC 2.1093:2020	FCC KDB 865664 D01 v01r04 FCC KDB 865664 D02 v01r02 FCC KDB 447498 D01 v06 FCC KDB 941225 D01 v03r01 IEEE Std 1528:2013

COMMENTS

All tests run with the reflective vest body-worn accessory. Per the manufacturer, this represents the worst-case scenario for EUT proximity to the human body.

DEVIATIONS FROM TEST STANDARD

None

RESULTS

Test Config.	Transmit Band	Transmit Freq. (MHz)	Transmit Channel	Transmit Mod.	Time Slots	EUT Position	SAR Drift During Test (dB)	Measured 1g SAR Level (mW/g)	Measured 10g SAR Level (mW/g)	SAR Scaling Factor	Scaled 1g SAR Level (mW/g)	Scaled 10g SAR Level (mW/g)	Test#
Body	GSM-850	848.6	251	GMSK	3	Front	-0.18	0.98	0.64	1	0.98	0.64	GPRS 3A
Body	GSM-850	848.6	251	GMSK	3	Connector side	-0.26	0.24	0.16	1	0.24	0.16	GPRS 3B
Body	GSM-850	848.6	251	GMSK	3	SIM card side	0.07	0.03	0.03	1	0.03	0.03	GPRS 3C
Body	GSM-850	848.6	251	GMSK	3	Back	-0.00	0.22	0.15	1	0.22	0.15	GPRS 3D
Body	PCS-1900	1850.2	512	GMSK	4	Front	0.00	0.29	0.16	1	0.29	0.16	GPRS 4A
Body	PCS-1900	1850.2	512	GMSK	4	Connector side	0.02	0.13	0.07	1	0.13	0.07	GPRS 4B
Body	PCS-1900	1850.2	512	GMSK	4	SIM card side	-0.04	0.03	0.02	1	0.03	0.02	GPRS 4C
Body	PCS-1900	1850.2	512	GMSK	4	Back	0.00	0.29	0.16	1	0.29	0.16	GPRS 4D

SAR TEST DATA – 2G GPRS AND EDGE



Tested By:	Marcelo Aguayo, Kyle McMullan	Room Temperature (°C):	22.7°C
Date:	2020-01-20	Liquid Temperature (°C):	21.3°C
Serial Number:	C3	Humidity (%RH):	24.6%
Configuration:	ELEM0093-1	Bar. Pressure (mb):	1015.4 mb
Comments:	None		

GPRS 3A

DUT: Eleksen Smart Connected Hub; Type: M.28.R1.B1; Serial: SAR C3

Communication System: UID 0, Generic GSM (0); Communication System Band: GSM 850 (824.0 - 849.0 MHz); Frequency: 848.6 MHz; Communication System PAR: 9.191 dB; PMF: 2.88104

Medium parameters used (interpolated): $f = 848.6$ MHz; $\sigma = 1.011$ S/m; $\epsilon_r = 52.201$; $\rho = 1000$ kg/m³, Medium parameters used: $\sigma = 0$ S/m, $\epsilon_r = 1$; $\rho = 1000$ kg/m³

Phantom section: Flat Section

Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2007)

DASY Configuration:

- Probe: EX3DV4 - SN3746; ConvF(9.06, 9.06, 9.06) @ 848.6 MHz; Calibrated: 11/19/2019
 - Modulation Compensation:
- Sensor-Surface: 3mm (Mechanical Surface Detection), Sensor-Surface: 0mm (Fix Surface), $z = 31.0, 106.0$
- Electronics: DAE4 Sn909; Calibrated: 12/6/2019
- Phantom: ELI V6.0 (SAC); Type: QD OVA 003 AA; Serial: 2044
- DASY52 52.10.2(1504); SEMCAD X 14.6.12(7470)

Body/Body/Zoom Scan (6x6x7)/Cube 0: Measurement grid: $dx=8$ mm, $dy=8$ mm, $dz=5$ mm

Reference Value = 28.38 V/m; Power Drift = -0.18 dB

Peak SAR (extrapolated) = 1.52 W/kg

SAR(1 g) = 0.977 W/kg; SAR(10 g) = 0.643 W/kg (SAR corrected for target medium)

[Info: Interpolated medium parameters used for SAR evaluation.](#)

Maximum value of SAR (measured) = 1.11 W/kg

Body/Body/Area scan (41x41x1): Interpolated grid: $dx=1.500$ mm, $dy=1.500$ mm

[Info: Interpolated medium parameters used for SAR evaluation.](#)

Maximum value of SAR (interpolated) = 1.25 W/kg

Body/Body/Z Scan (1x1x21): Measurement grid: $dx=20$ mm, $dy=20$ mm, $dz=5$ mm

[Info: Interpolated medium parameters used for SAR evaluation.](#)

Maximum value of Total (measured) = 24.20 V/m

Body/Body/Reference scan (41x51x1): Interpolated grid: $dx=3.000$ mm, $dy=3.000$ mm

[Info: Interpolated medium parameters used for SAR evaluation.](#)

Maximum value of SAR (interpolated) = 1.13 W/kg

Body/Body/Z Scan (1x1x21): Measurement grid: $dx=20$ mm, $dy=20$ mm, $dz=5$ mm

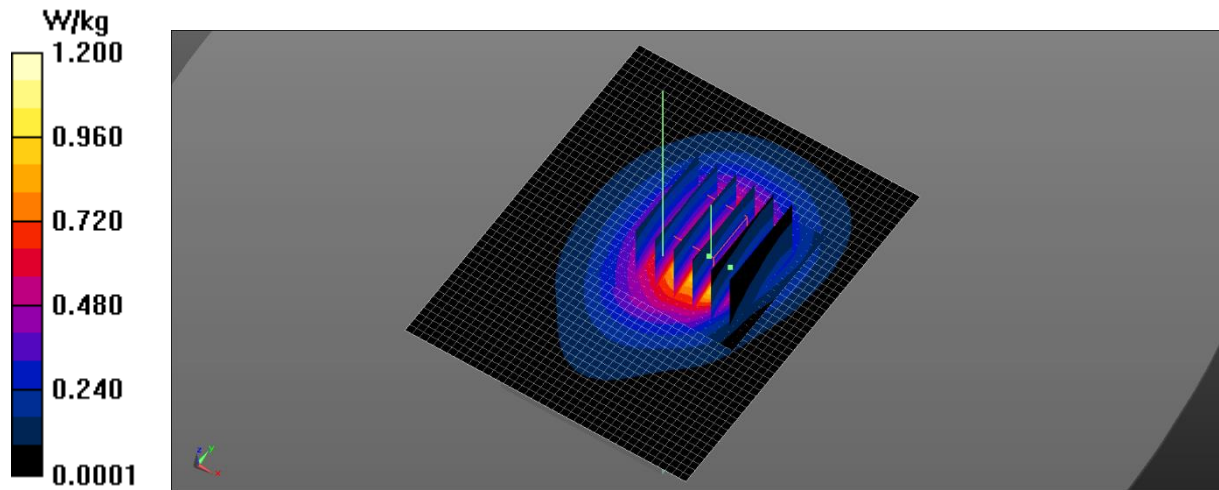
[Info: Interpolated medium parameters used for SAR evaluation.](#)

Maximum value of SAR (measured) = 0.592 W/kg

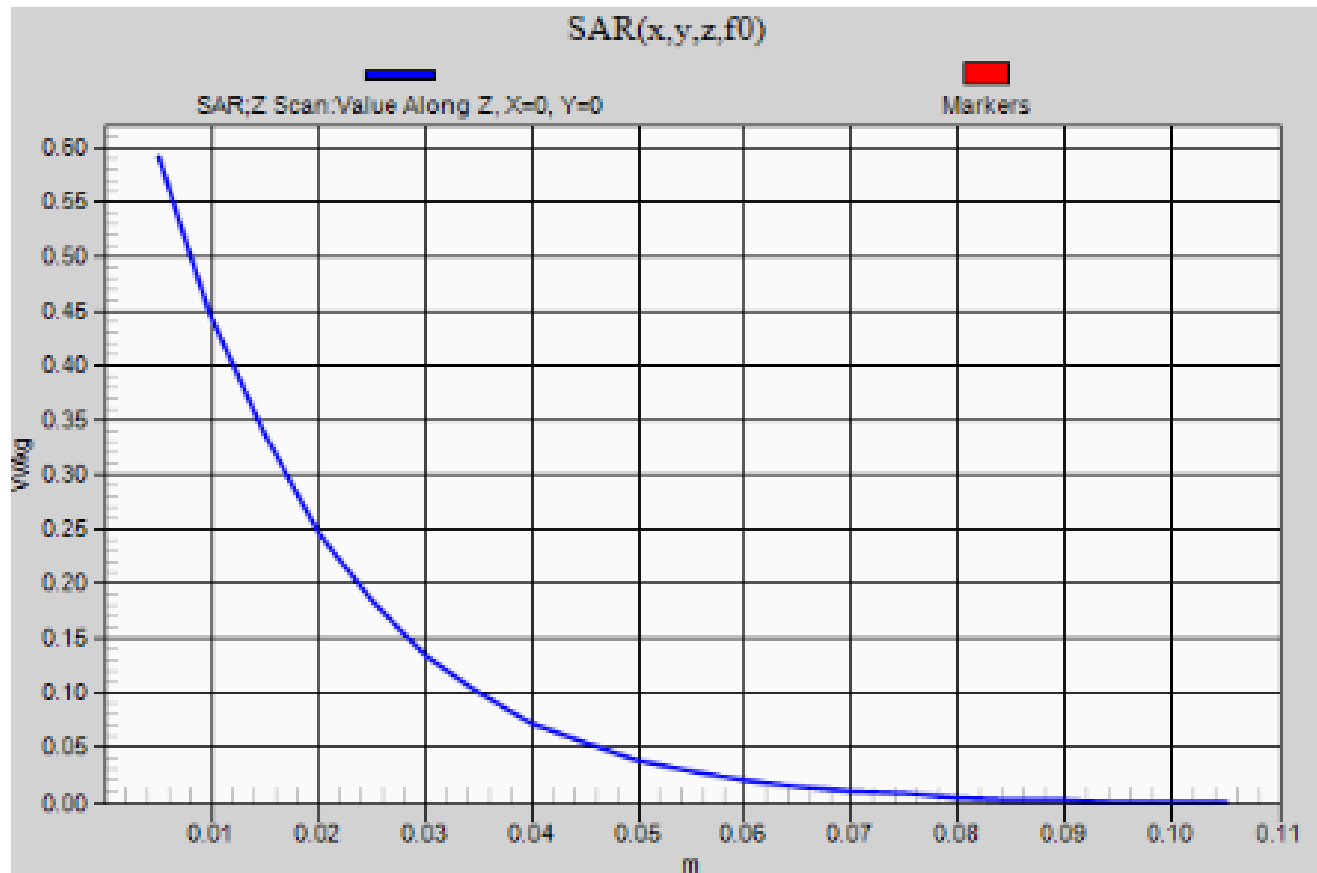
Approved By

SAR TEST DATA – 2G GPRS AND EDGE

GPRS 3A



SAR TEST DATA – 2G GPRS AND EDGE



SAR TEST DATA – 2G GPRS AND EDGE



Tested By:	Marcelo Aguayo, Kyle McMullan	Room Temperature (°C):	22.7°C
Date:	2020-01-20	Liquid Temperature (°C):	21.3°C
Serial Number:	C3	Humidity (%RH):	24.6%
Configuration:	ELEM0093-1	Bar. Pressure (mb):	1015.4 mb
Comments:	None		

GPRS 4A

DUT: Eleksen Smart Connected Hub; Type: M.28.R1.B1; Serial: SAR C3

Communication System: UID 0, GPRS and Edge (0); Communication System Band: PCS 1900; Frequency: 1850.2 MHz; Communication System PAR: 9.2 dB; PMF: 2.88403

Medium parameters used (interpolated): $f = 1850.2$ MHz; $\sigma = 1.555$ S/m; $\epsilon_r = 50.356$; $\rho = 1000$ kg/m³, Medium parameters used: $\sigma = 0$ S/m, $\epsilon_r = 1$; $\rho = 1000$ kg/m³

Phantom section: Flat Section

Measurement Standard: DASYS (IEEE/IEC/ANSI C63.19-2007)

DASY Configuration:

- Probe: EX3DV4 - SN3746; ConvF(7.44, 7.44, 7.44) @ 1850.2 MHz; Calibrated: 11/19/2019
 - Modulation Compensation:
- Sensor-Surface: 3mm (Mechanical Surface Detection), Sensor-Surface: 0mm (Fix Surface), $z = 31.0, 106.0$
- Electronics: DAE4 Sn909; Calibrated: 12/6/2019
- Phantom: ELI V6.0 (SAC); Type: QD OVA 003 AA; Serial: 2044
- DASY52 52.10.2(1504); SEMCAD X 14.6.12(7470)

Body/Body/Zoom Scan (5x5x7)/Cube 0: Measurement grid: $dx=8$ mm, $dy=8$ mm, $dz=5$ mm

Reference Value = 15.08 V/m; Power Drift = 0.00 dB

Peak SAR (extrapolated) = 0.484 W/kg

SAR(1 g) = 0.289 W/kg; SAR(10 g) = 0.156 W/kg (SAR corrected for target medium)

[Info: Interpolated medium parameters used for SAR evaluation.](#)

Maximum value of SAR (measured) = 0.357 W/kg

Body/Body/Area scan (41x41x1): Interpolated grid: $dx=1.500$ mm, $dy=1.500$ mm

[Info: Interpolated medium parameters used for SAR evaluation.](#)

Maximum value of SAR (interpolated) = 0.350 W/kg

Body/Body/Z Scan (1x1x21): Measurement grid: $dx=20$ mm, $dy=20$ mm, $dz=5$ mm

[Info: Interpolated medium parameters used for SAR evaluation.](#)

Maximum value of Total (measured) = 12.15 V/m

Body/Body/Reference scan (41x51x1): Interpolated grid: $dx=3.000$ mm, $dy=3.000$ mm

[Info: Interpolated medium parameters used for SAR evaluation.](#)

Maximum value of SAR (interpolated) = 0.332 W/kg

Body/Body/Z Scan (1x1x21): Measurement grid: $dx=20$ mm, $dy=20$ mm, $dz=5$ mm

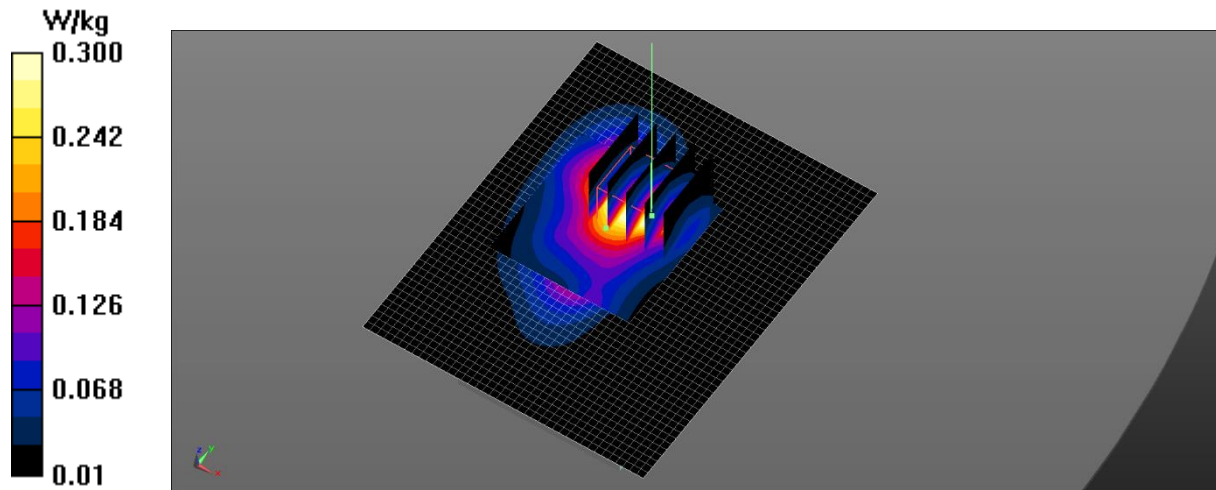
[Info: Interpolated medium parameters used for SAR evaluation.](#)

Maximum value of SAR (measured) = 0.229 W/kg

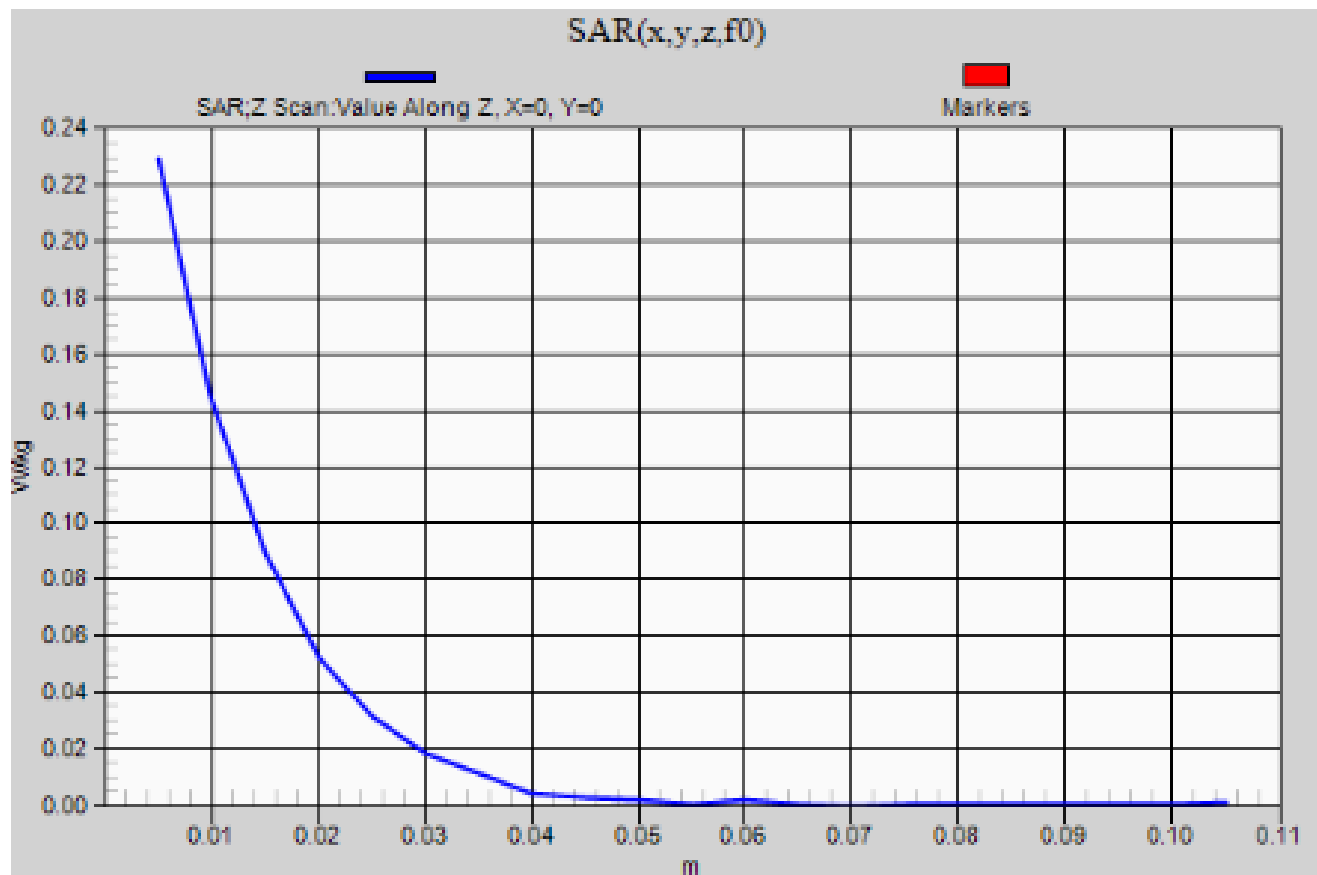
Approved By

SAR TEST DATA – 2G GPRS AND EDGE

GPRS 4A



SAR TEST DATA – 2G GPRS AND EDGE



SAR TEST DATA – LTE CATEGORY M1



EUT:	Smart Connected Hub	Work Order:	ELEM0093
Customer:	Element Materials Technology	Job Site:	MN11
Attendees:	None	Customer Project:	None

TEST SPECIFICATIONS

Specification:	Method:
FCC 15.247:2020 FCC 2.1093:2020	FCC KDB 865664 D01 v01r04 FCC KDB 865664 D02 v01r02 FCC KDB 941225 D05 v02r05 FCC KDB 447498 D01 v06 IEEE Std 1528:2013

COMMENTS

All tests run with the reflective vest body-worn accessory. Per the manufacturer, this represents the worst-case scenario for EUT proximity to the human body.

N/A on a SAR drift measurement indicates the signal seen by the probe was at noise floor levels, therefore a SAR drift measurement was not possible.

DEVIATIONS FROM TEST STANDARD

None

RESULTS

Test Config.	Freq. Band	Transmit Freq. (MHz)	Transmit Channel	Transmit Mod.	Bandwidth, NB Index, and Start RB	RBs	EUT Position	SAR Drift During Test (dB)	Measured 1g SAR Level (mW/g)	Measured 10g SAR Level (mW/g)	SAR Scaling Factor	Scaled 1g SAR Level (mW/g)	Scaled 10g SAR Level (mW/g)	Test#
Body	LTE Band 2	1860	18700	QPSK	20 MHz, NB 0, RB 0	1	Front	0.34	0.04	0.02	1	0.04	0.02	Cat M1 1A
Body	LTE Band 2	1860	18700	QPSK	20 MHz, NB 0, RB 0	1	Connector Side	0.04	0.06	0.03	1	0.06	0.03	Cat M1 1B
Body	LTE Band 2	1860	18700	QPSK	20 MHz, NB 0, RB 0	1	SIM Card Side	0.24	0.01	<0.01	1	0.01	<0.01	Cat M1 1C
Body	LTE Band 2	1860	18700	QPSK	20 MHz, NB 0, RB 0	1	Back	0.17	0.03	0.02	1	0.03	0.02	Cat M1 1D
Body	LTE Band 4	1745	20300	QPSK	20 MHz, NB 15, RB 0	1	Front	0.14	0.08	0.05	1	0.08	0.05	Cat M1 3A
Body	LTE Band 4	1745	20300	QPSK	20 MHz, NB 15, RB 0	1	Connector Side	0.03	0.07	0.04	1	0.07	0.04	Cat M1 3B
Body	LTE Band 4	1745	20300	QPSK	20 MHz, NB 15, RB 0	1	SIM Card Side	<0.01	<0.01	-0.35	1	<0.01	-0.35	Cat M1 3C
Body	LTE Band 4	1745	20300	QPSK	20 MHz, NB 15, RB 0	1	Back	0.14	0.08	0.5	1	0.08	0.5	Cat M1 3D
Body	LTE Band 5	829	20450	QPSK	10 MHz, NB 4, RB 0	1	Front	0.13	0.12	0.08	1	0.12	0.08	Cat M1 4A
Body	LTE Band 5	829	20450	QPSK	10 MHz, NB 4, RB 0	1	Connector Side	0.05	0.09	0.05	1	0.09	0.05	Cat M1 4B
Body	LTE Band 5	829	20450	QPSK	10 MHz, NB 4, RB 0	1	SIM Card Side	-0.14	<0.01	<0.01	1	<0.01	<0.01	Cat M1 4C
Body	LTE Band 5	829	20450	QPSK	10 MHz, NB 4, RB 0	1	Back	0.11	0.07	0.05	1	0.07	0.05	Cat M1 4D
Body	LTE Band 12	707.5	23095	QPSK	10 MHz, NB 7, RB 5	1	Front	-0.08	0.12	0.08	1	0.12	0.08	Cat M1 6A
Body	LTE Band 12	707.5	23095	QPSK	10 MHz, NB 7, RB 5	1	Connector Side	-0.08	0.08	0.04	1	0.08	0.04	Cat M1 6B
Body	LTE Band 12	707.5	23095	QPSK	10 MHz, NB 7, RB 5	1	SIM Card Side	0.11	<0.01	<0.01	1	<0.01	<0.01	Cat M1 6C
Body	LTE Band 12	707.5	23095	QPSK	10 MHz, NB 7, RB 5	1	Back	0.23	0.02	0.01	1	0.02	0.01	Cat M1 6D

SAR TEST DATA – LTE CATEGORY M1



Tested By:	Marcelo Aguayo, Kyle McMullan	Room Temperature (°C):	22.7°C
Date:	2020-01-16	Liquid Temperature (°C):	21.3°C
Serial Number:	C3	Humidity (%RH):	24.6%
Configuration:	ELEM0093-1	Bar. Pressure (mb):	1015.4 mb
Comments:	None		

Cat M1 1B

DUT: Eleksen Smart Connected Hub; Type: M.28.R1.B1; Serial: SAR C3

Communication System: UID 0, LTE-FDD (0); Communication System Band: Band 2; Frequency: 1860 MHz; Communication System PAR: 0 dB; PMF: 1.12202e-005

Medium parameters used (interpolated): $f = 1860$ MHz; $\sigma = 1.562$ S/m; $\epsilon_r = 50.344$; $\rho = 1000$ kg/m³, Medium parameters used: $\sigma = 0$ S/m, $\epsilon_r = 1$; $\rho = 1000$ kg/m³

Phantom section: Flat Section

Measurement Standard: DASYS (IEEE/IEC/ANSI C63.19-2007)

DASY Configuration:

- Probe: EX3DV4 - SN3746; ConvF(7.44, 7.44, 7.44) @ 1860 MHz; Calibrated: 11/19/2019
 - Modulation Compensation:
- Sensor-Surface: 3mm (Mechanical Surface Detection), Sensor-Surface: 0mm (Fix Surface), $z = 31.0, 106.0$
- Electronics: DAE4 Sn909; Calibrated: 12/6/2019
- Phantom: ELI V6.0 (SAC); Type: QD OVA 003 AA; Serial: 2044
- DASY52 52.10.2(1504); SEMCAD X 14.6.12(7470)

Body/Body/Zoom Scan (5x5x7)/Cube 0: Measurement grid: $dx=8$ mm, $dy=8$ mm, $dz=5$ mm

Reference Value = 6.968 V/m; Power Drift = 0.04 dB

Peak SAR (extrapolated) = 0.0980 W/kg

SAR(1 g) = 0.059 W/kg; SAR(10 g) = 0.032 W/kg (SAR corrected for target medium)

[Info: Interpolated medium parameters used for SAR evaluation.](#)

Maximum value of SAR (measured) = 0.0713 W/kg

Body/Body/Area scan (41x41x1): Interpolated grid: $dx=1.500$ mm, $dy=1.500$ mm

[Info: Interpolated medium parameters used for SAR evaluation.](#)

Maximum value of SAR (interpolated) = 0.0666 W/kg

Body/Body/Z Scan (1x1x21): Measurement grid: $dx=20$ mm, $dy=20$ mm, $dz=5$ mm

[Info: Interpolated medium parameters used for SAR evaluation.](#)

Maximum value of Total (measured) = 5.474 V/m

Body/Body/Reference scan (51x31x1): Interpolated grid: $dx=3.000$ mm, $dy=3.000$ mm

[Info: Interpolated medium parameters used for SAR evaluation.](#)

Maximum value of SAR (interpolated) = 0.0600 W/kg

Body/Body/Z Scan (1x1x21): Measurement grid: $dx=20$ mm, $dy=20$ mm, $dz=5$ mm

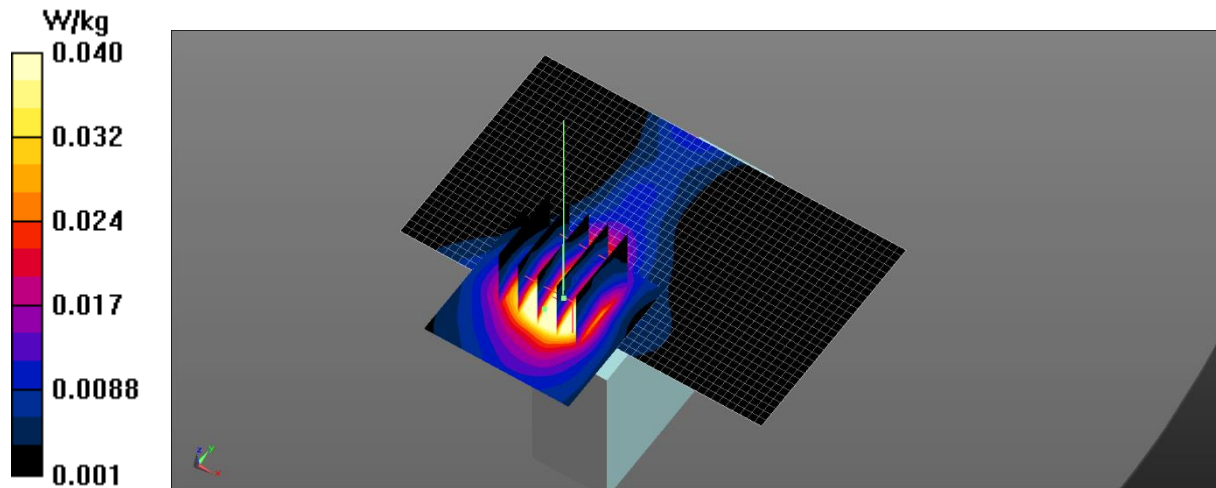
[Info: Interpolated medium parameters used for SAR evaluation.](#)

Maximum value of SAR (measured) = 0.0468 W/kg

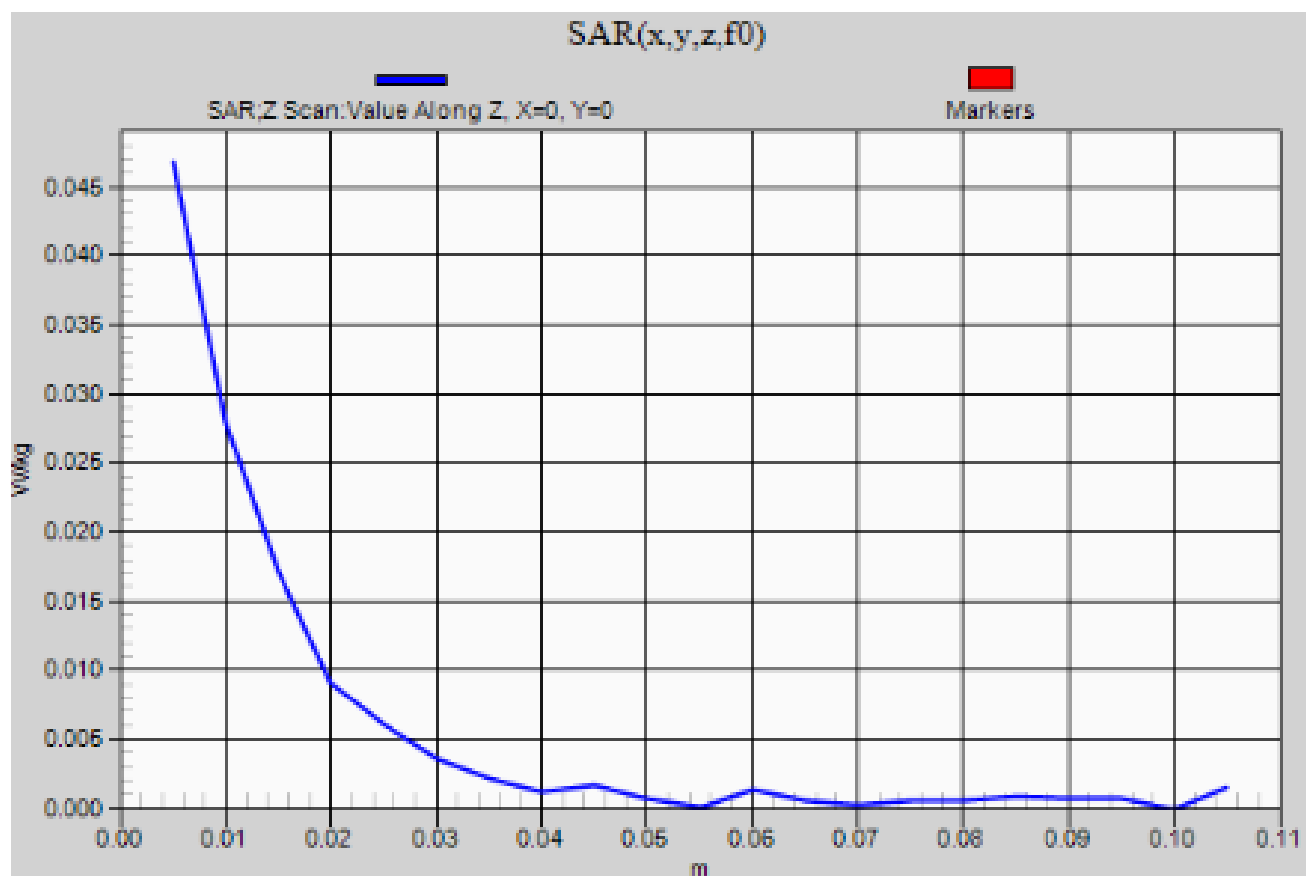
Approved By

SAR TEST DATA – LTE CATEGORY M1

Cat M1 1B



SAR TEST DATA – LTE CATEGORY M1



SAR TEST DATA – LTE CATEGORY M1



Tested By:	Marcelo Aguayo, Kyle McMullan	Room Temperature (°C):	22.7°C
Date:	2020-01-16	Liquid Temperature (°C):	21.3°C
Serial Number:	C3	Humidity (%RH):	24.6%
Configuration:	ELEM0093-1	Bar. Pressure (mb):	1015.4 mb
Comments:	None		

Cat M1 3A

DUT: Eleksen Smart Connected Hub; Type: M.28.R1.B1; Serial: SAR C3

Communication System: UID 0, LTE-FDD (0); Communication System Band: Band 4; Frequency: 1745 MHz; Communication System PAR: 0 dB; PMF: 1.12202e-005

Medium parameters used (interpolated): $f = 1745$ MHz; $\sigma = 1.487$ S/m; $\epsilon_r = 50.506$; $\rho = 1000$ kg/m³, Medium parameters used: $\sigma = 0$ S/m, $\epsilon_r = 1$; $\rho = 1000$ kg/m³

Phantom section: Flat Section

Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2007)

DASY Configuration:

- Probe: EX3DV4 - SN3746; ConvF(7.67, 7.67, 7.67) @ 1745 MHz; Calibrated: 11/19/2019
 - Modulation Compensation:
- Sensor-Surface: 3mm (Mechanical Surface Detection), Sensor-Surface: 0mm (Fix Surface), $z = 31.0, 106.0$
- Electronics: DAE4 Sn909; Calibrated: 12/6/2019
- Phantom: ELI V6.0 (SAC); Type: QD OVA 003 AA; Serial: 2044
- DASY52 52.10.2(1504); SEMCAD X 14.6.12(7470)

Body/Body/Zoom Scan (5x5x7)/Cube 0: Measurement grid: $dx=8$ mm, $dy=8$ mm, $dz=5$ mm

Reference Value = 7.901 V/m; Power Drift = 0.14 dB

Peak SAR (extrapolated) = 0.128 W/kg

SAR(1 g) = 0.080 W/kg; SAR(10 g) = 0.046 W/kg (SAR corrected for target medium)

[Info: Interpolated medium parameters used for SAR evaluation.](#)

Maximum value of SAR (measured) = 0.0923 W/kg

Body/Body/Area scan (41x41x1): Interpolated grid: $dx=1.500$ mm, $dy=1.500$ mm

[Info: Interpolated medium parameters used for SAR evaluation.](#)

Maximum value of SAR (interpolated) = 0.106 W/kg

Body/Body/Z Scan (1x1x21): Measurement grid: $dx=20$ mm, $dy=20$ mm, $dz=5$ mm

[Info: Interpolated medium parameters used for SAR evaluation.](#)

Maximum value of Total (measured) = 6.377 V/m

Body/Body/Reference scan (41x51x1): Interpolated grid: $dx=3.000$ mm, $dy=3.000$ mm

[Info: Interpolated medium parameters used for SAR evaluation.](#)

Maximum value of SAR (interpolated) = 0.0772 W/kg

Body/Body/Z Scan (1x1x21): Measurement grid: $dx=20$ mm, $dy=20$ mm, $dz=5$ mm

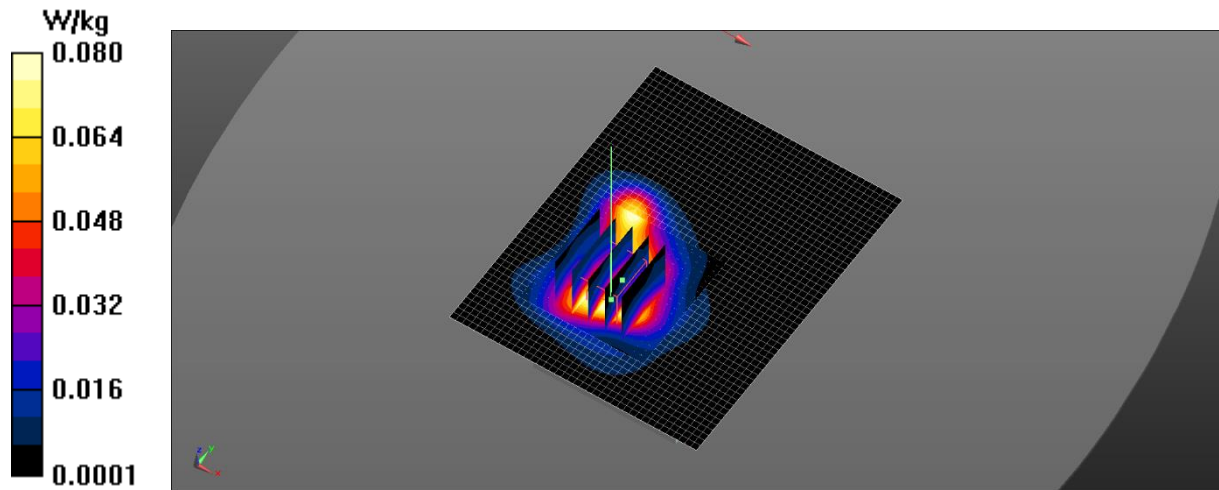
[Info: Interpolated medium parameters used for SAR evaluation.](#)

Maximum value of SAR (measured) = 0.0604 W/kg

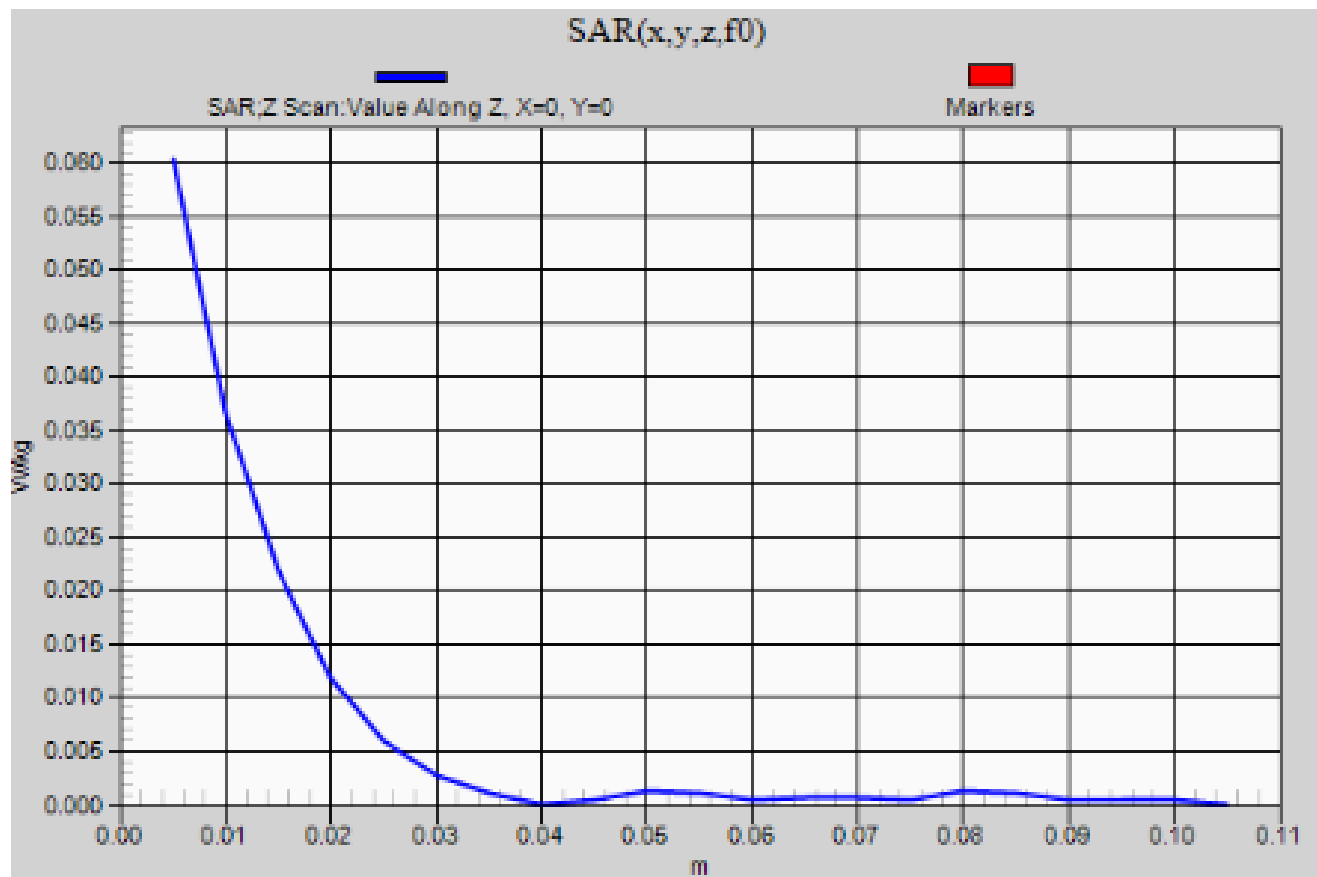
Approved By

SAR TEST DATA – LTE CATEGORY M1

Cat M1 3A



SAR TEST DATA – LTE CATEGORY M1



SAR TEST DATA – LTE CATEGORY M1



Tested By:	Marcelo Aguayo, Kyle McMullan	Room Temperature (°C):	22.7°C
Date:	2020-01-16	Liquid Temperature (°C):	21.3°C
Serial Number:	C3	Humidity (%RH):	24.6%
Configuration:	ELEM0093-1	Bar. Pressure (mb):	1015.4 mb
Comments:	None		

Cat M1 4A

DUT: Eleksen Smart Connected Hub; Type: M.28.R1.B1; Serial: SAR C3

Communication System: UID 0, LTE-FDD (0); Communication System Band: Band 5; Frequency: 829 MHz; Communication System PAR: 0 dB; PMF: 1.12202e-005

Medium parameters used (interpolated): $f = 829$ MHz; $\sigma = 1.002$ S/m; $\epsilon_r = 52.253$; $\rho = 1000$ kg/m³, Medium parameters used: $\sigma = 0$ S/m, $\epsilon_r = 1$; $\rho = 1000$ kg/m³

Phantom section: Flat Section

Measurement Standard: DASYS (IEEE/IEC/ANSI C63.19-2007)

DASY Configuration:

- Probe: EX3DV4 - SN3746; ConvF(9.06, 9.06, 9.06) @ 829 MHz; Calibrated: 11/19/2019
 - Modulation Compensation:
- Sensor-Surface: 3mm (Mechanical Surface Detection), Sensor-Surface: 0mm (Fix Surface), $z = 31.0, 106.0$
- Electronics: DAE4 Sn909; Calibrated: 12/6/2019
- Phantom: ELI V6.0 (SAC); Type: QD OVA 003 AA; Serial: 2044
- DASY52 52.10.2(1504); SEMCAD X 14.6.12(7470)

Body/Body/Zoom Scan (6x5x7)/Cube 0: Measurement grid: $dx=8$ mm, $dy=8$ mm, $dz=5$ mm

Reference Value = 11.77 V/m; Power Drift = 0.13 dB

Peak SAR (extrapolated) = 0.174 W/kg

SAR(1 g) = 0.123 W/kg; SAR(10 g) = 0.084 W/kg (SAR corrected for target medium)

[Info: Interpolated medium parameters used for SAR evaluation.](#)

Maximum value of SAR (measured) = 0.138 W/kg

Body/Body/Area scan (41x41x1): Interpolated grid: $dx=1.500$ mm, $dy=1.500$ mm

[Info: Interpolated medium parameters used for SAR evaluation.](#)

Maximum value of SAR (interpolated) = 0.151 W/kg

Body/Body/Z Scan (1x1x21): Measurement grid: $dx=20$ mm, $dy=20$ mm, $dz=5$ mm

[Info: Interpolated medium parameters used for SAR evaluation.](#)

Maximum value of Total (measured) = 9.890 V/m

Body/Body/Reference scan (41x51x1): Interpolated grid: $dx=3.000$ mm, $dy=3.000$ mm

[Info: Interpolated medium parameters used for SAR evaluation.](#)

Maximum value of SAR (interpolated) = 0.136 W/kg

Body/Body/Z Scan (1x1x21): Measurement grid: $dx=20$ mm, $dy=20$ mm, $dz=5$ mm

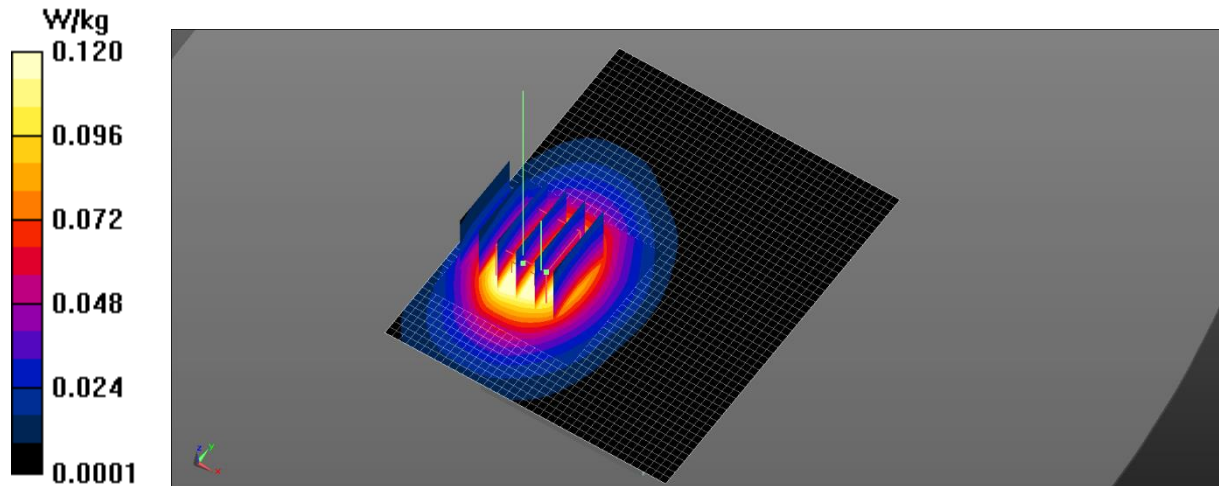
[Info: Interpolated medium parameters used for SAR evaluation.](#)

Maximum value of SAR (measured) = 0.0980 W/kg

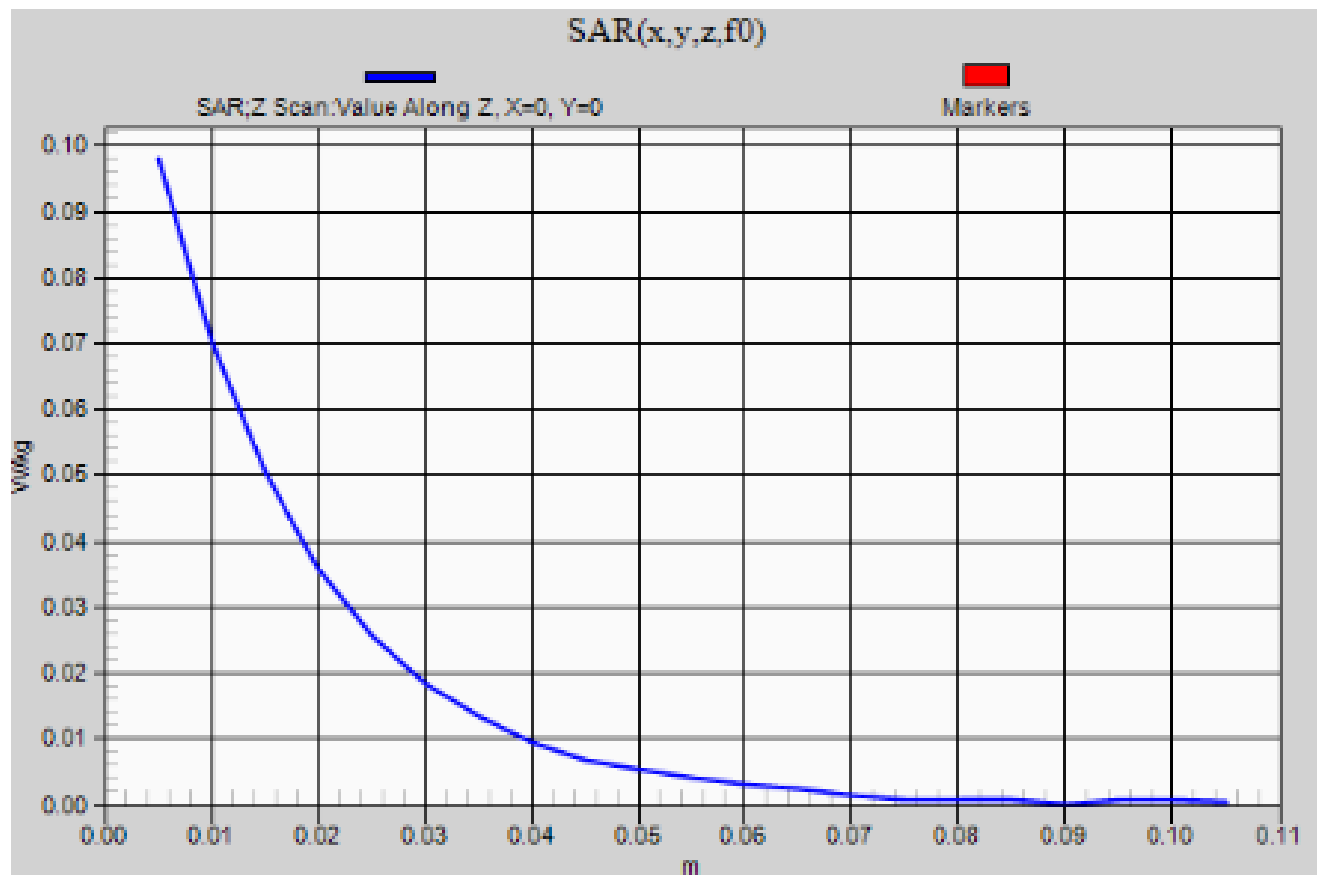
Approved By

SAR TEST DATA – LTE CATEGORY M1

Cat M1 4A



SAR TEST DATA – LTE CATEGORY M1



SAR TEST DATA – LTE CATEGORY M1



Tested By:	Marcelo Aguayo, Kyle McMullan	Room Temperature (°C):	22.7°C
Date:	2020-01-16	Liquid Temperature (°C):	21.3°C
Serial Number:	C3	Humidity (%RH):	24.6%
Configuration:	ELEM0093-1	Bar. Pressure (mb):	1015.4 mb
Comments:	None		

Cat M1 6A

DUT: Eleksen Smart Connected Hub; Type: M.28.R1.B1; Serial: SAR C3

Communication System: UID 0, LTE-FDD (0); Communication System Band: Band 12; Frequency: 707.5 MHz; Communication System PAR: 0 dB; PMF: 1.12202e-005

Medium parameters used (interpolated): $f = 707.5$ MHz; $\sigma = 0.956$ S/m; $\epsilon_r = 52.6$; $\rho = 1000$ kg/m³, Medium parameters used: $\sigma = 0$ S/m, $\epsilon_r = 1$; $\rho = 1000$ kg/m³

Phantom section: Flat Section

Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2007)

DASY Configuration:

- Probe: EX3DV4 - SN3746; ConvF(9.3, 9.3, 9.3) @ 707.5 MHz; Calibrated: 11/19/2019
 - Modulation Compensation:
- Sensor-Surface: 3mm (Mechanical Surface Detection), Sensor-Surface: 0mm (Fix Surface), $z = 31.0, 106.0$
- Electronics: DAE4 Sn909; Calibrated: 12/6/2019
- Phantom: ELI V6.0 (SAC); Type: QD OVA 003 AA; Serial: 2044
- DASY52 52.10.2(1504); SEMCAD X 14.6.12(7470)

Body/Body/Zoom Scan (5x5x7)/Cube 0: Measurement grid: $dx=8$ mm, $dy=8$ mm, $dz=5$ mm

Reference Value = 11.42 V/m; Power Drift = -0.08 dB

Peak SAR (extrapolated) = 0.199 W/kg

SAR(1 g) = 0.116 W/kg; SAR(10 g) = 0.073 W/kg (SAR corrected for target medium)

[Info: Interpolated medium parameters used for SAR evaluation.](#)

Maximum value of SAR (measured) = 0.142 W/kg

Body/Body/Area scan (41x41x1): Interpolated grid: $dx=1.500$ mm, $dy=1.500$ mm

[Info: Interpolated medium parameters used for SAR evaluation.](#)

Maximum value of SAR (interpolated) = 0.143 W/kg

Body/Body/Z Scan (1x1x21): Measurement grid: $dx=20$ mm, $dy=20$ mm, $dz=5$ mm

[Info: Interpolated medium parameters used for SAR evaluation.](#)

Maximum value of Total (measured) = 9.540 V/m

Body/Body/Reference scan (41x51x1): Interpolated grid: $dx=3.000$ mm, $dy=3.000$ mm

[Info: Interpolated medium parameters used for SAR evaluation.](#)

Maximum value of SAR (interpolated) = 0.168 W/kg

Body/Body/Z Scan (1x1x21): Measurement grid: $dx=20$ mm, $dy=20$ mm, $dz=5$ mm

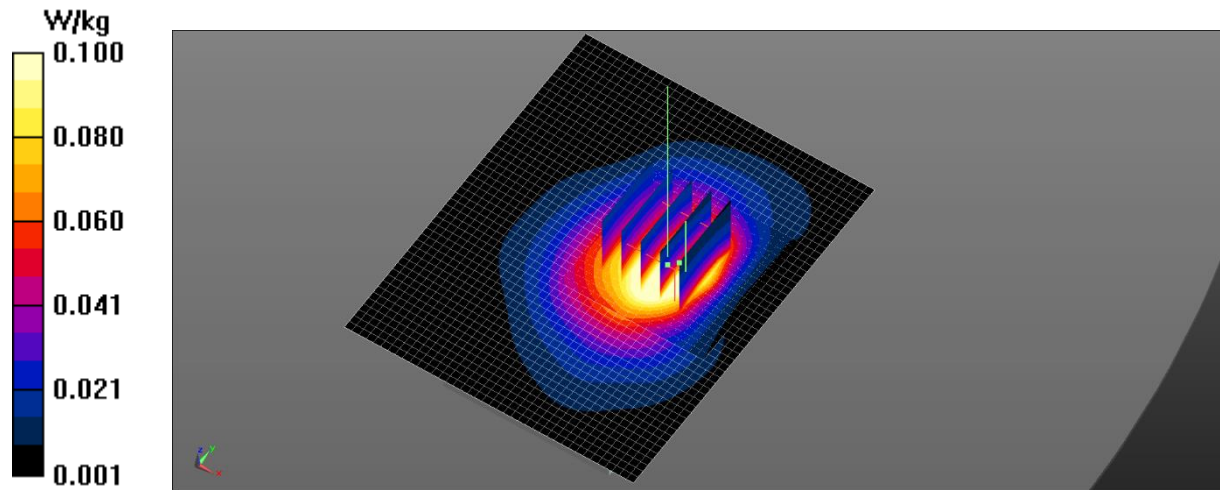
[Info: Interpolated medium parameters used for SAR evaluation.](#)

Maximum value of SAR (measured) = 0.0870 W/kg

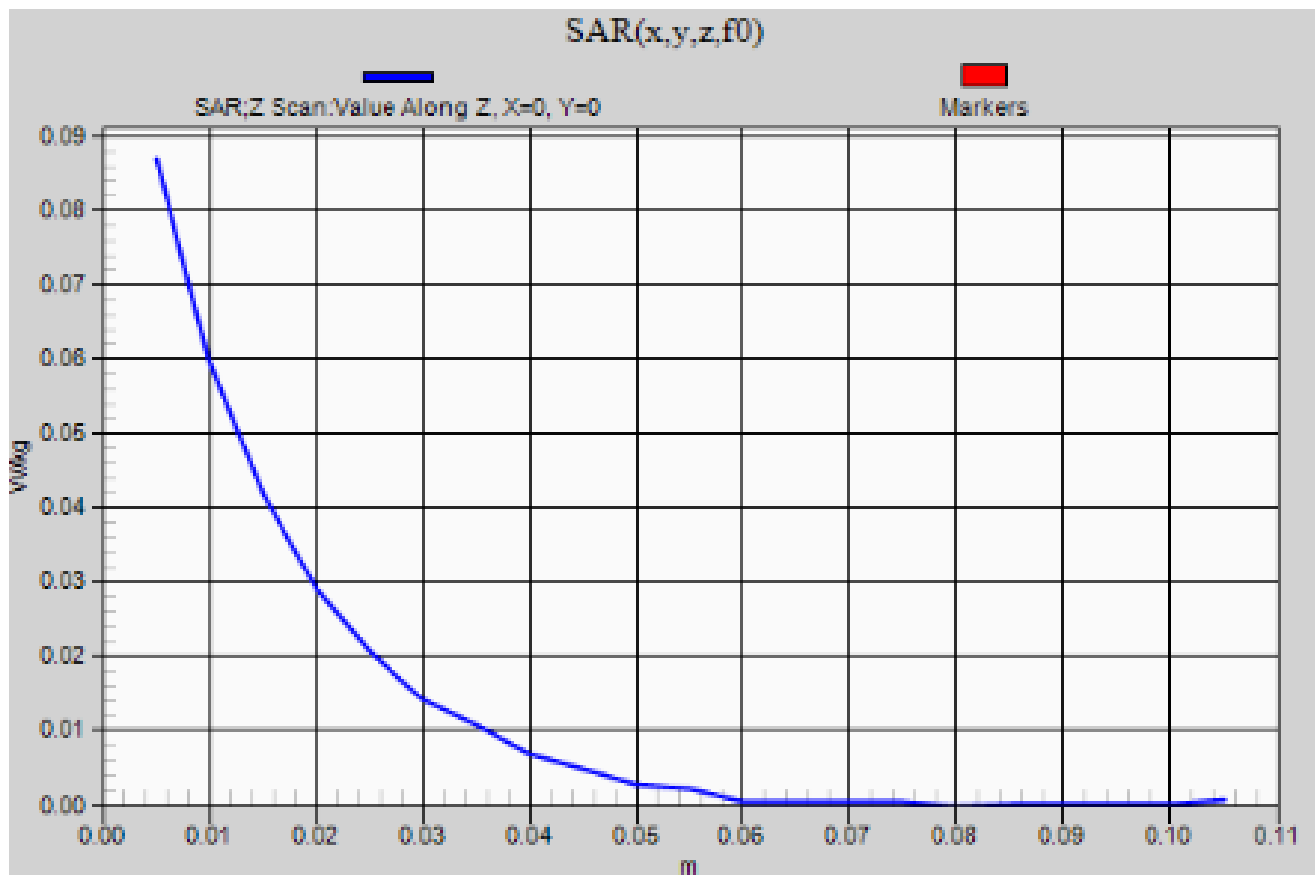
Approved By

SAR TEST DATA – LTE CATEGORY M1

Cat M1 6A



SAR TEST DATA – LTE CATEGORY M1



SAR TEST DATA – NB-IOT



EUT:	Smart Connected Hub	Work Order:	ELEM0093
Customer:	Element Materials Technology	Job Site:	MN11
Attendees:	None	Customer Project:	None

TEST SPECIFICATIONS

Specification:	Method:
FCC 15.247:2020 FCC 2.1093:2020	FCC KDB 865664 D01 v01r04 FCC KDB 865664 D02 v01r02 FCC KDB 941225 D05 v02r05 FCC KDB 447498 D01 v06 IEEE Std 1528:2013

COMMENTS

All tests run with the reflective vest body-worn accessory. Per the manufacturer, this represents the worst-case scenario for EUT proximity to the human body.

N/A on a SAR drift measurement indicates the signal seen by the probe was at noise floor levels, therefore a SAR drift measurement was not possible.

DEVIATIONS FROM TEST STANDARD

None

RESULTS

Test Config.	Freq. Band	Transmit Freq. (MHz)	Transmit Channel	Transmit Mod.	Subcarrier Spacing and RBs	EUT Position	SAR Drift During Test (dB)	Measured 1g SAR Level (mW/g)	Measured 10g SAR Level (mW/g)	SAR Scaling Factor	Scaled 1g SAR Level (mW/g)	Scaled 10g SAR Level (mW/g)	Test#
Body	LTE Band 2	1850	18600	QPSK	15 kHz, 1 RB	Front	-0.12	0.06	0.04	1	0.06	0.04	NB IoT 1A
Body	LTE Band 2	1850	18600	QPSK	15 kHz, 1 RB	Connector Side	0.20	0.05	0.03	1	0.05	0.03	NB IoT 1B
Body	LTE Band 2	1850	18600	QPSK	15 kHz, 1 RB	SIM Card Side	0.38	<0.01	<0.01	1	<0.01	<0.01	NB IoT 1C
Body	LTE Band 2	1850	18600	QPSK	15 kHz, 1 RB	Back	-0.10	<0.01	<0.01	1	<0.01	<0.01	NB IoT 1D
Body	LTE Band 4	1755	20399	QPSK	15 kHz, 1 RB	Front	0.03	0.20	0.11	1	0.20	0.11	NB IoT 3A
Body	LTE Band 4	1755	20399	QPSK	15 kHz, 1 RB	Connector Side	0.07	0.07	0.04	1	0.07	0.04	NB IoT 3B
Body	LTE Band 4	1755	20399	QPSK	15 kHz, 1 RB	SIM Card Side	0.50	0.01	0.01	1	0.01	0.01	NB IoT 3C
Body	LTE Band 4	1755	20399	QPSK	15 kHz, 1 RB	Back	-0.12	0.21	0.12	1	0.21	0.12	NB IoT 3D
Body	LTE Band 5	824	20400	QPSK	15 kHz, 1 RB	Front	-0.04	0.03	0.02	1	0.03	0.02	NB IoT 4A
Body	LTE Band 5	824	20400	QPSK	15 kHz, 1 RB	Connector Side	-0.30	0.01	<0.01	1	0.01	<0.01	NB IoT 4B
Body	LTE Band 5	824	20400	QPSK	15 kHz, 1 RB	SIM Card Side	N/A*	<0.01	<0.01	1	<0.01	<0.01	NB IoT 4C
Body	LTE Band 5	824	20400	QPSK	15 kHz, 1 RB	Back	0.35	0.01	0.01	1	0.01	0.01	NB IoT 4D
Body	LTE Band 12	699	23010	QPSK	15 kHz, 1 RB	Front	-0.41	0.01	0.01	1.05	0.01	0.01	NB IoT 6A
Body	LTE Band 12	699	23010	QPSK	15 kHz, 1 RB	Connector Side	0.41	<0.01	<0.01	1.05	0.01	0.01	NB IoT 6B
Body	LTE Band 12	699	23010	QPSK	15 kHz, 1 RB	SIM Card Side	N/A*	<0.01	<0.01	1.05	0.01	0.01	NB IoT 6C
Body	LTE Band 12	699	23010	QPSK	15 kHz, 1 RB	Back	0.19	0.02	0.02	1.05	0.02	0.02	NB IoT 6D

SAR TEST DATA – NB-IOT



Tested By:	Marcelo Aguayo, Kyle McMullan	Room Temperature (°C):	22.7°C
Date:	2020-01-16	Liquid Temperature (°C):	21.3°C
Serial Number:	C1	Humidity (%RH):	24.6%
Configuration:	ELEM0093-2	Bar. Pressure (mb):	1015.4 mb
Comments:	None		

NBIOT 1A

DUT: Eleksen Smart Connected Hub; Type: M.28.R1.B1; Serial: SAR C1

Communication System: UID 0, LTE-FDD (0); Communication System Band: Band 2; Frequency: 1850 MHz; Communication System PAR: 0 dB; PMF: 1.12202e-005

Medium parameters used: $f = 1850$ MHz; $\sigma = 1.555$ S/m; $\epsilon_r = 50.356$; $\rho = 1000$ kg/m³, Medium parameters used: $\sigma = 0$ S/m, $\epsilon_r = 1$; $\rho = 1000$ kg/m³

Phantom section: Flat Section

Measurement Standard: DASYS (IEEE/IEC/ANSI C63.19-2007)

DASY Configuration:

- Probe: EX3DV4 - SN3746; ConvF(7.44, 7.44, 7.44) @ 1850 MHz; Calibrated: 11/19/2019
 - Modulation Compensation:
- Sensor-Surface: 3mm (Mechanical Surface Detection), Sensor-Surface: 0mm (Fix Surface), $z = 31.0, 106.0$
- Electronics: DAE4 Sn909; Calibrated: 12/6/2019
- Phantom: ELI V6.0 (SAC); Type: QD OVA 003 AA; Serial: 2044
- DASY52 52.10.2(1504); SEMCAD X 14.6.12(7470)

Body/Body/Zoom Scan (5x5x7)/Cube 0: Measurement grid: $dx=8$ mm, $dy=8$ mm, $dz=5$ mm

Reference Value = 6.972 V/m; Power Drift = -0.12 dB

Peak SAR (extrapolated) = 0.119 W/kg

SAR(1 g) = 0.062 W/kg; SAR(10 g) = 0.037 W/kg (SAR corrected for target medium)

Maximum value of SAR (measured) = 0.0758 W/kg

Body/Body/Area scan (41x41x1): Interpolated grid: $dx=1.500$ mm, $dy=1.500$ mm

Maximum value of SAR (interpolated) = 0.0750 W/kg

Body/Body/Z Scan (1x1x21): Measurement grid: $dx=20$ mm, $dy=20$ mm, $dz=5$ mm

Maximum value of Total (measured) = 5.514 V/m

Body/Body/Reference scan (41x51x1): Interpolated grid: $dx=3.000$ mm, $dy=3.000$ mm

Maximum value of SAR (interpolated) = 0.0777 W/kg

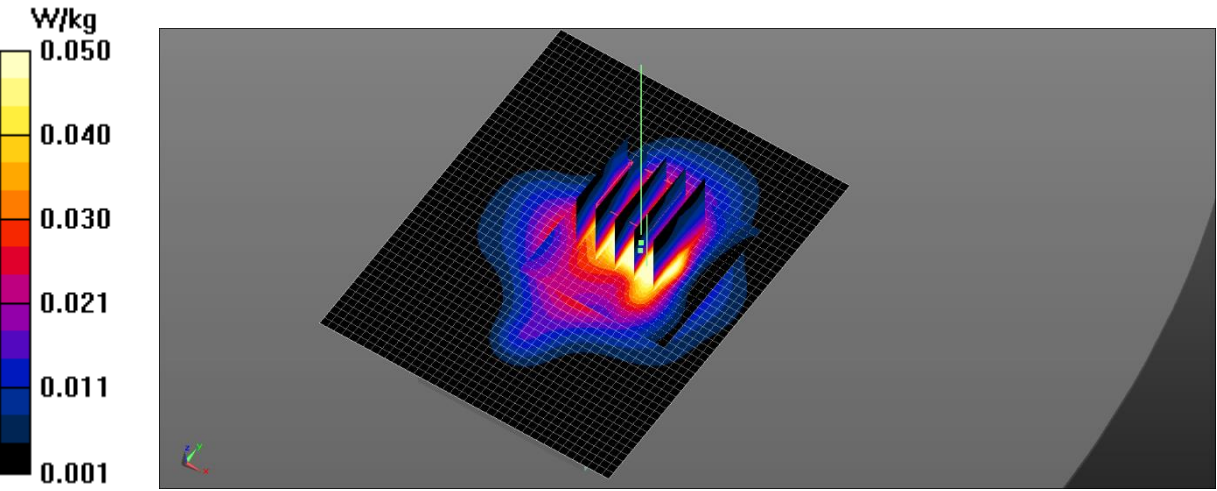
Body/Body/Z Scan (1x1x21): Measurement grid: $dx=20$ mm, $dy=20$ mm, $dz=5$ mm

Maximum value of SAR (measured) = 0.0473 W/kg

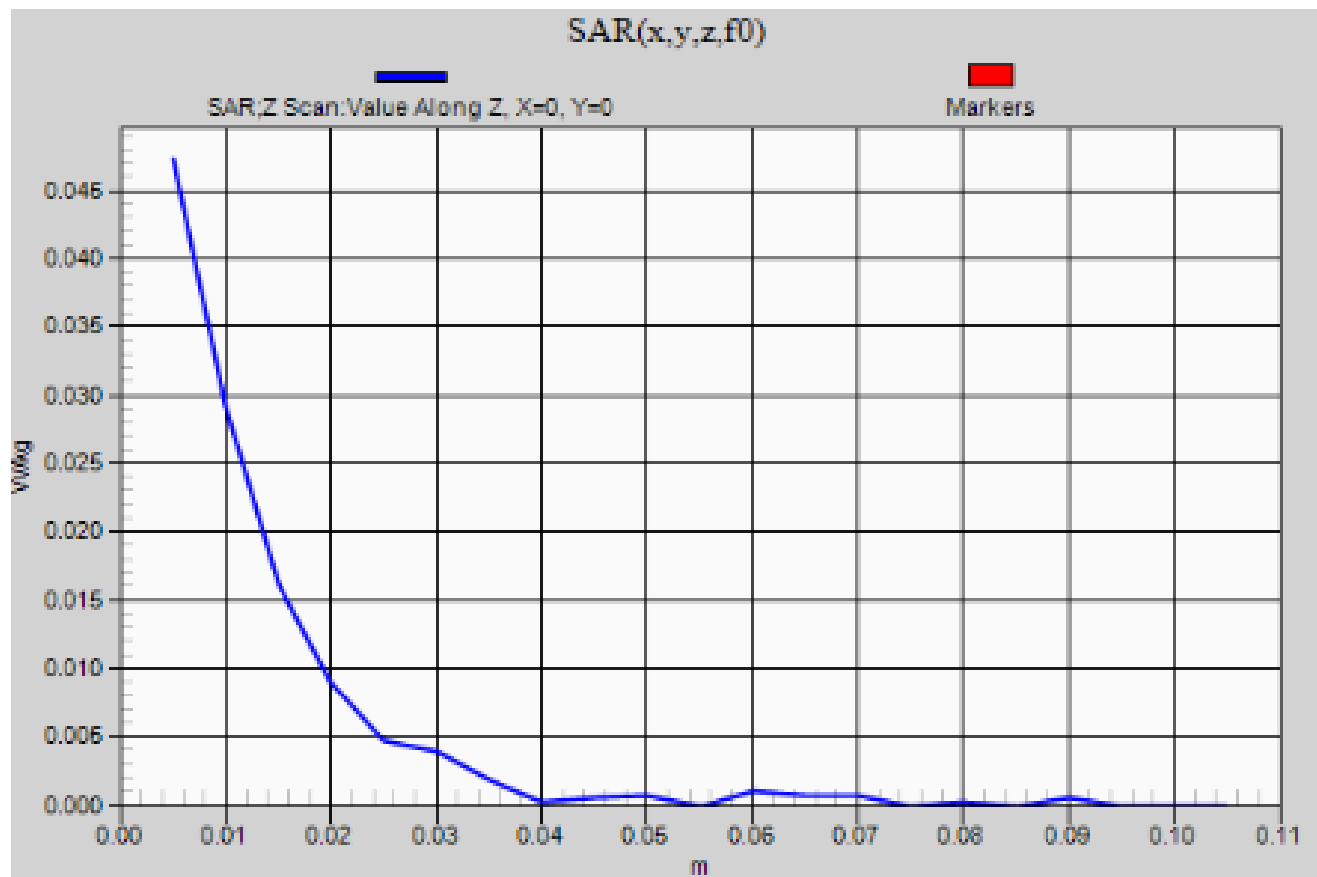
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SAR TEST DATA – NB-IOT

NBIoT 1A



SAR TEST DATA – NB-IOT



SAR TEST DATA – NB-IOT



Tested By:	Marcelo Aguayo, Kyle McMullan	Room Temperature (°C):	22.7°C
Date:	2020-01-16	Liquid Temperature (°C):	21.3°C
Serial Number:	C1	Humidity (%RH):	24.6%
Configuration:	ELEM0093-2	Bar. Pressure (mb):	1015.4 mb
Comments:	None		

NB-IOT 3D

DUT: Eleksen Smart Connected Hub; Type: M.28.R1.B1; Serial: SAR C1

Communication System: UID 0, LTE-FDD (0); Communication System Band: Band 4; Frequency: 1754.9 MHz; Communication System PAR: 0 dB; PMF: 1.12202e-005

Medium parameters used (interpolated): $f = 1754.9$ MHz; $\sigma = 1.493$ S/m; $\epsilon_r = 50.497$; $\rho = 1000$ kg/m³, Medium parameters used: $\sigma = 0$ S/m, $\epsilon_r = 1$; $\rho = 1000$ kg/m³

Phantom section: Flat Section

Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2007)

DASY Configuration:

- Probe: EX3DV4 - SN3746; ConvF(7.67, 7.67, 7.67) @ 1754.9 MHz; Calibrated: 11/19/2019
 - Modulation Compensation:
- Sensor-Surface: 3mm (Mechanical Surface Detection), Sensor-Surface: 0mm (Fix Surface), $z = 31.0, 106.0$
- Electronics: DAE4 Sn909; Calibrated: 12/6/2019
- Phantom: ELI V6.0 (SAC); Type: QD OVA 003 AA; Serial: 2044
- DASY52 52.10.2(1504); SEMCAD X 14.6.12(7470)

Body/Body/Zoom Scan (6x6x7)/Cube 0: Measurement grid: $dx=8$ mm, $dy=8$ mm, $dz=5$ mm

Reference Value = 13.32 V/m; Power Drift = -0.12 dB

Peak SAR (extrapolated) = 0.339 W/kg

SAR(1 g) = 0.214 W/kg; SAR(10 g) = 0.119 W/kg (SAR corrected for target medium)

[Info: Interpolated medium parameters used for SAR evaluation.](#)

Maximum value of SAR (measured) = 0.243 W/kg

Body/Body/Area scan (41x41x1): Interpolated grid: $dx=1.500$ mm, $dy=1.500$ mm

[Info: Interpolated medium parameters used for SAR evaluation.](#)

Maximum value of SAR (interpolated) = 0.275 W/kg

Body/Body/Z Scan (1x1x21): Measurement grid: $dx=20$ mm, $dy=20$ mm, $dz=5$ mm

[Info: Interpolated medium parameters used for SAR evaluation.](#)

Maximum value of Total (measured) = 10.33 V/m

Body/Body/Reference scan (41x51x1): Interpolated grid: $dx=3.000$ mm, $dy=3.000$ mm

[Info: Interpolated medium parameters used for SAR evaluation.](#)

Maximum value of SAR (interpolated) = 0.200 W/kg

Body/Body/Z Scan (1x1x21): Measurement grid: $dx=20$ mm, $dy=20$ mm, $dz=5$ mm

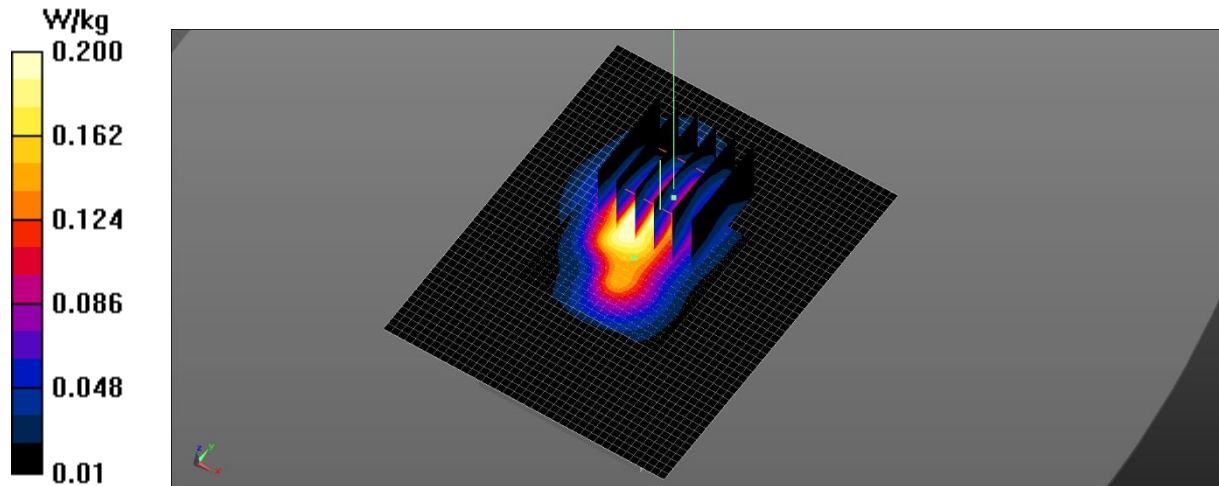
[Info: Interpolated medium parameters used for SAR evaluation.](#)

Maximum value of SAR (measured) = 0.159 W/kg

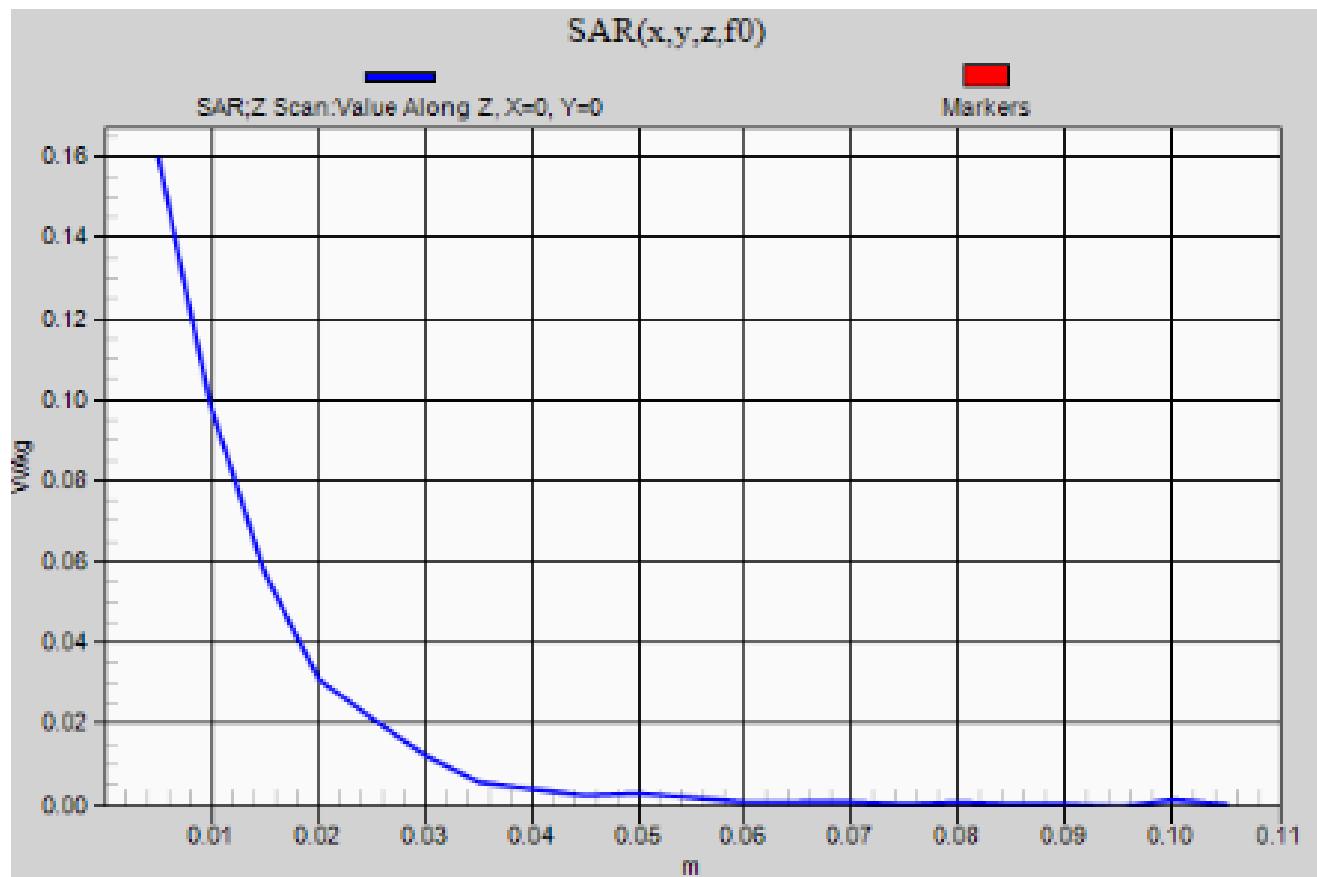
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SAR TEST DATA – NB-IOT

NBIoT 3D



SAR TEST DATA – NB-IOT



SAR TEST DATA – NB-IOT



Tested By:	Marcelo Aguayo, Kyle McMullan	Room Temperature (°C):	22.7°C
Date:	2020-01-16	Liquid Temperature (°C):	21.3°C
Serial Number:	C1	Humidity (%RH):	24.6%
Configuration:	ELEM0093-2	Bar. Pressure (mb):	1015.4 mb
Comments:	None		

NBIOT 4A

DUT: Eleksen Smart Connected Hub; Type: M.28.R1.B1; Serial: SAR C1

Communication System: UID 0, LTE-FDD (0); Communication System Band: Band 5; Frequency: 824

MHz; Communication System PAR: 0 dB; PMF: 1.12202e-005

Medium parameters used (interpolated): $f = 824$ MHz; $\sigma = 1$ S/m; $\epsilon_r = 52.267$; $\rho = 1000$ kg/m³, Medium parameters used: $\sigma = 0$ S/m, $\epsilon_r = 1$; $\rho = 1000$ kg/m³

Phantom section: Flat Section

Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2007)

DASY Configuration:

- Probe: EX3DV4 - SN3746; ConvF(9.06, 9.06, 9.06) @ 824 MHz; Calibrated: 11/19/2019
 - Modulation Compensation:
- Sensor-Surface: 3mm (Mechanical Surface Detection), Sensor-Surface: 0mm (Fix Surface), $z = 31.0, 106.0$
- Electronics: DAE4 Sn909; Calibrated: 12/6/2019
- Phantom: ELI V6.0 (SAC); Type: QD OVA 003 AA; Serial: 2044
- DASY52 52.10.2(1504); SEMCAD X 14.6.12(7470)

Body/Body/Zoom Scan (5x5x7)/Cube 0: Measurement grid: $dx=8$ mm, $dy=8$ mm, $dz=5$ mm

Reference Value = 6.222 V/m; Power Drift = -0.04 dB

Peak SAR (extrapolated) = 0.0480 W/kg

SAR(1 g) = 0.030 W/kg; SAR(10 g) = 0.020 W/kg (SAR corrected for target medium)

[Info: Interpolated medium parameters used for SAR evaluation.](#)

Maximum value of SAR (measured) = 0.0357 W/kg

Body/Body/Area scan (41x41x1): Interpolated grid: $dx=1.500$ mm, $dy=1.500$ mm

[Info: Interpolated medium parameters used for SAR evaluation.](#)

Maximum value of SAR (interpolated) = 0.0402 W/kg

Body/Body/Z Scan (1x1x21): Measurement grid: $dx=20$ mm, $dy=20$ mm, $dz=5$ mm

[Info: Interpolated medium parameters used for SAR evaluation.](#)

Maximum value of Total (measured) = 4.832 V/m

Body/Body/Reference scan (41x51x1): Interpolated grid: $dx=3.000$ mm, $dy=3.000$ mm

[Info: Interpolated medium parameters used for SAR evaluation.](#)

Maximum value of SAR (interpolated) = 0.0346 W/kg

Body/Body/Z Scan (1x1x21): Measurement grid: $dx=20$ mm, $dy=20$ mm, $dz=5$ mm

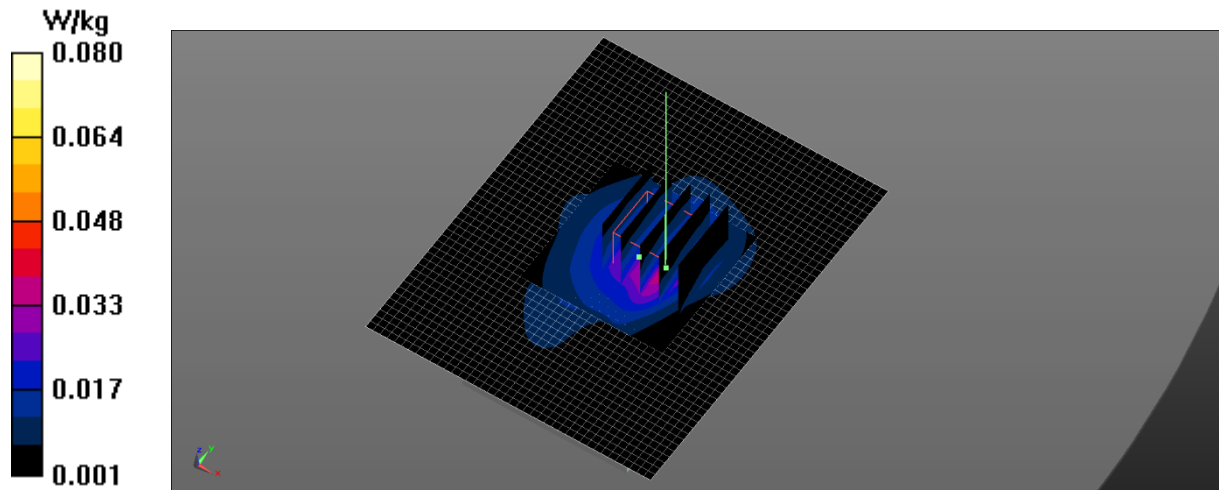
[Info: Interpolated medium parameters used for SAR evaluation.](#)

Maximum value of SAR (measured) = 0.0233 W/kg

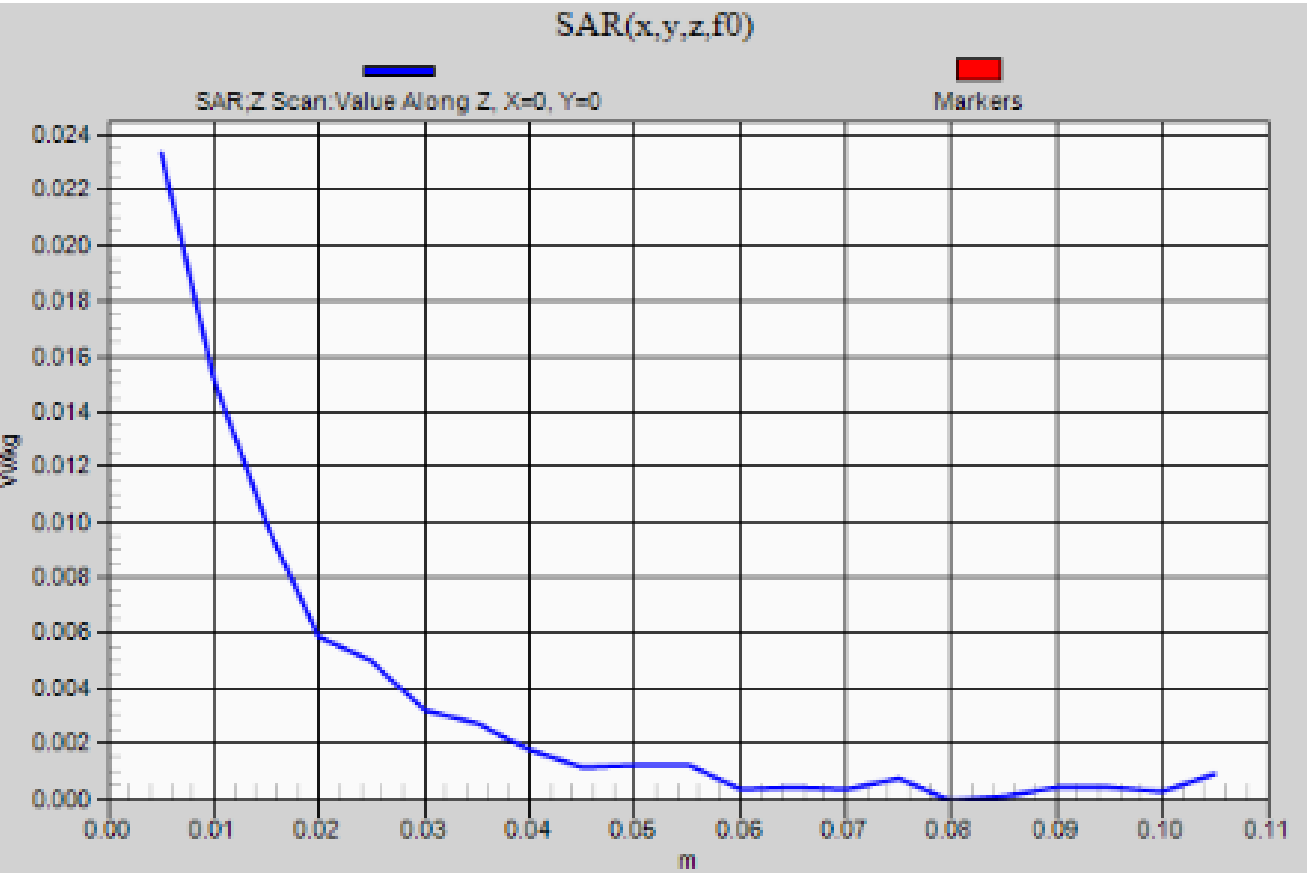
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NBIOT 4A



SAR TEST DATA – NB-IOT



SAR TEST DATA – NB-IOT



Tested By:	Marcelo Aguayo, Kyle McMullan	Room Temperature (°C):	22.7°C
Date:	2020-01-16	Liquid Temperature (°C):	21.3°C
Serial Number:	C1	Humidity (%RH):	24.6%
Configuration:	ELEM0093-2	Bar. Pressure (mb):	1015.4 mb
Comments:	None		

NBIOT 6D

DUT: Eleksen Smart Connected Hub; Type: M.28.R1.B1; Serial: SAR C1

Communication System: UID 0, LTE-FDD (0); Communication System Band: Band 12; Frequency: 699 MHz; Communication System PAR: 0 dB; PMF: 1.12202e-005

Medium parameters used (interpolated): $f = 699$ MHz; $\sigma = 0.953$ S/m; $\epsilon_r = 52.625$; $\rho = 1000$ kg/m³, Medium parameters used: $\sigma = 0$ S/m, $\epsilon_r = 1$; $\rho = 1000$ kg/m³

Phantom section: Flat Section

Measurement Standard: DASYS (IEEE/IEC/ANSI C63.19-2007)

DASY Configuration:

- Probe: EX3DV4 - SN3746; ConvF(9.3, 9.3, 9.3) @ 699 MHz; Calibrated: 11/19/2019
 - Modulation Compensation:
- Sensor-Surface: 3mm (Mechanical Surface Detection), Sensor-Surface: 0mm (Fix Surface), $z = 31.0, 106.0$
- Electronics: DAE4 Sn909; Calibrated: 12/6/2019
- Phantom: ELI V6.0 (SAC); Type: QD OVA 003 AA; Serial: 2044
- DASY52 52.10.2(1504); SEMCAD X 14.6.12(7470)

Body/Body/Zoom Scan (6x6x7)/Cube 0: Measurement grid: $dx=8$ mm, $dy=8$ mm, $dz=5$ mm

Reference Value = 5.374 V/m; Power Drift = 0.19 dB

Peak SAR (extrapolated) = 0.0340 W/kg

SAR(1 g) = 0.024 W/kg; SAR(10 g) = 0.016 W/kg (SAR corrected for target medium)

[Info: Interpolated medium parameters used for SAR evaluation.](#)

Maximum value of SAR (measured) = 0.0281 W/kg

Body/Body/Area scan (41x41x1): Interpolated grid: $dx=1.500$ mm, $dy=1.500$ mm

[Info: Interpolated medium parameters used for SAR evaluation.](#)

Maximum value of SAR (interpolated) = 0.0285 W/kg

Body/Body/Z Scan (1x1x21): Measurement grid: $dx=20$ mm, $dy=20$ mm, $dz=5$ mm

[Info: Interpolated medium parameters used for SAR evaluation.](#)

Maximum value of Total (measured) = 4.638 V/m

Body/Body/Reference scan (41x51x1): Interpolated grid: $dx=3.000$ mm, $dy=3.000$ mm

[Info: Interpolated medium parameters used for SAR evaluation.](#)

Maximum value of SAR (interpolated) = 0.0291 W/kg

Body/Body/Z Scan (1x1x21): Measurement grid: $dx=20$ mm, $dy=20$ mm, $dz=5$ mm

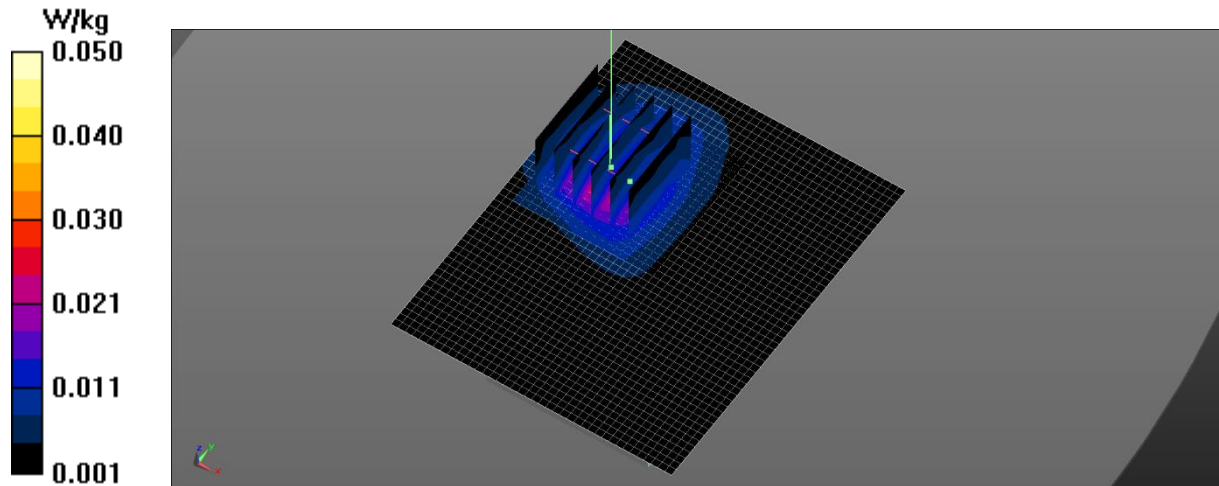
[Info: Interpolated medium parameters used for SAR evaluation.](#)

Maximum value of SAR (measured) = 0.0205 W/kg

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NBIoT 6D



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