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# Wireless CCTV, LTD. SAR TEST REPORT

## SCOPE OF WORK

Specific Absorption Rate – Bodyworn Connect 1.6

## REPORT NUMBER

104286003LEX-002

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## SPECIFIC ABSORPTION RATE TEST REPORT

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**Report Issue Date:** 11/1/2021

**Product Name:** Bodyworn Connect 1.6

**Standards:** FCC Part 2.1093

RSS-102 Issue 5

**Tested by:**

Intertek Testing Services NA, Inc.  
731 Enterprise Drive  
Lexington, KY 40510  
USA

**Client:**

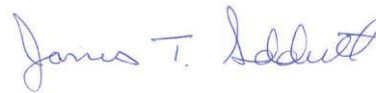
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## 1 INTRODUCTION

At the request of Wireless CCTV, LTD. the Bodyworn Connect 1.6 was evaluated for SAR in accordance with the requirements for FCC Part 2.1093 and RSS-102 Issue 5. Testing was performed in accordance with IEEE Std 1528:2013, IEC62209-2:2010, and the Office of Engineering and Technology KDB 447498. Testing was performed at the Intertek facility in Lexington, Kentucky.

For the evaluation, the dosimetric assessment system DASY52 was used. The total uncertainty for the evaluation of the spatial peak SAR values averaged over a cube of 1g tissue mass had been assessed for this system to be  $\pm 22.2\%$  from 300MHz – 3GHz and 24.6% from 3GHz – 6GHz.

The Bodyworn Connect 1.6 was tested at the maximum output power measured by Intertek. Maximum output power measurements are tabulated under Section 8 Test Results. The maximum spatial peak SAR value for the sample device averaged over 1g (for body worn mode) and 10g (for hand-held mode) is shown below.

Based on the worst-case data presented below, the Bodyworn Connect 1.6 was found to be **compliant** with the 1.6 W/kg requirements for general population / uncontrolled exposure.

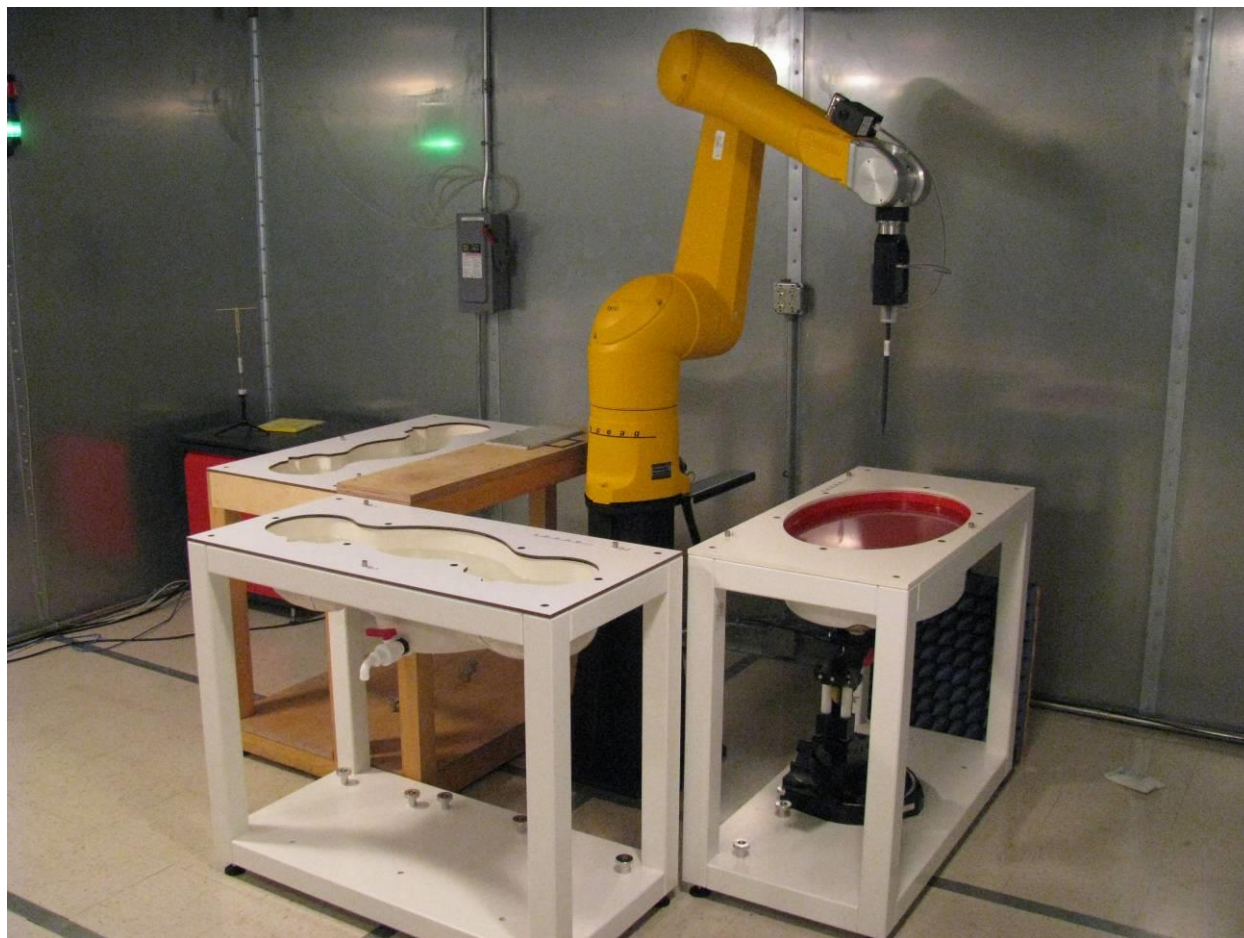
*Table 1: Worst Case Reported SAR per Exposure Condition*

Device Position	Transmit Mode	Separation Distance	Band	Maximum Conducted Output Power (dBm)	Reported SAR (W/kg)	Limit (W/kg)
Back Side, Flat	LTE	0mm	2	24.00	0.1885	1.6W/kg
Back Side, Flat	LTE	0mm	4	24.3	0.2398	1.6W/kg
Back Side, Tilt Down	LTE	0mm	5	24.5	0.1649	1.6W/kg
Back Side, Flat	LTE	0mm	13	24.00	0.2634	1.6W/kg
Back Side, Tilt Up	LTE	0mm	17	24.00	0.1898	1.6W/kg
Back Side, Flat	UMTS	0mm	2	24.5	0.1263	1.6W/kg
Back Side, Tilt Down	UMTS	0mm	5	24.5	0.1554	1.6W/kg



## 2 TEST SITE DESCRIPTION

The SAR test site located at 731 Enterprise Drive, Lexington KY 40510 is comprised of the SPEAG model DASY 5.2 automated near-field scanning system, which is a package, optimized for dosimetric evaluation of mobile radios [3]. This system is installed in an ambient-free shielded chamber. The ambient temperature is controlled to  $22.0 \pm 2^\circ\text{C}$ . During the SAR evaluations, the RF ambient conditions are monitored continuously for signals that might interfere with the test results. The tissue simulating liquid is also stored in this area in order to keep it at the same constant ambient temperature as the room.



*Figure 1: Intertek SAR Test Site*



## SAR Test Report

## 2.1 Measurement Equipment

The following major equipment/components were used for the SAR evaluation:

*Table 2: Test Equipment Used for SAR Evaluation*

Description	Serial Number	Manufacturer	Model	Cal. Date	Cal. Due
SAR Probe	3516	Speag	EXDV3	11/19/2020	11/19/2021
750MHz Dipole	1042	Speag	D750V3	11/11/2020	11/11/2021
835MHz Dipole	3605	Speag	D835V2	11/11/2020	11/11/2021
1800MHz Dipole	3015	Speag	D1800V2	11/9/2020	11/9/2021
DAE	358	Speag	DAE4	11/17/2020	11/17/2021
Vector Signal Generator	257708	Rohde & Schwarz	SMBV100A	9/22/2020	9/22/2021
Network Analyzer	US39173983	Agilent	8753ES	2/21/2021	2/21/2022
USB Power Sensor	100155	Rohde & Schwarz	NRP-Z81	9/22/2020	9/22/2021
Dielectric Probe Kit	1111	Speag	DAK-3.5	11/12/2020	11/12/2021
Spectrum Analyzer	3099	Rohde & Schwarz	FSP7	9/22/2020	9/22/2021
SAM Twin Phantom	1663	Speag	QD 000 P40 C	NCR	NCR
6-axis robot	F11/5H1YA/A/01	Staubli	RX-90	NCR	NCR
Base Station Simulator	8021	Rohde & Schwarz	CMW 500	9/23/2020	9/23/2021

*\*NCR – No Calibration Required*



## SAR Test Report

## 2.2 Measurement Uncertainty

The Tables below includes the uncertainty budget suggested by the IEEE Std 1528-2013 and IEC62209-2: 2010 as determined by SPEAG for the DASY5 measurement System.

Error Description	Uncertainty Value	Prob. Dist.	Div.	$c_1$ (1g)	$c_1$ (10g)	Std.Unc. (1g)	Std.Unc. (10g)	$(v_1)$ $v_{eff}$
Measurement System								
Probe Calibration	±6.0%	N	1	1	1	±6.0%	±6.0%	∞
Axial Isotropy	±4.7%	R	√3	0.7	0.7	±1.9%	±1.9%	∞
Hemispherical Isotropy	±9.6%	R	√3	0.7	0.7	±3.9%	±3.9%	∞
Boundary Effect	±1.0%	R	√3	1	1	±0.6%	±0.6%	∞
Linearity	±4.7%	R	√3	1	1	±2.7%	±2.7%	∞
System Detection Limits	±1.0%	R	√3	1	1	±0.6%	±0.6%	∞
Modulation Response	±2.4%	R	√3	1	1	±1.4%	±1.4%	∞
Readout Electronics	±0.3%	N	1	1	1	±0.3%	±0.3%	∞
Response Time	±0.8%	R	√3	1	1	±0.5%	±0.5%	∞
Integration Time	±2.6%	R	√3	1	1	±1.5%	±1.5%	∞
RF Ambient Noise	±3.0%	R	√3	1	1	±1.7%	±1.7%	∞
RF Ambient Reflections	±3.0%	R	√3	1	1	±1.7%	±1.7%	∞
Probe Positioner	±0.4%	R	√3	1	1	±0.2%	±0.2%	∞
Probe Positioning	±2.9%	R	√3	1	1	±1.7%	±1.7%	∞
Max. SAR Eval.	±2.0%	R	√3	1	1	±1.2%	±1.2%	∞
Test sample Related								
Device Positioning	±2.9%	N	1	1	1	±2.9%	±2.9%	145
Device Holder	±3.6%	N	1	1	1	±3.6%	±3.6%	5
Power Drift	±5.0%	R	√3	1	1	±2.9%	±2.9%	∞
Power Scaling	±0.0%	R	√3	1	1	±0%	±0%	∞
Phantom and Setup								
Phantom Uncertainty	±6.1%	R	√3	1	1	±3.5%	±3.5%	∞
SAR Correction	±1.9%	R	√3	1	0.84	±1.1%	±0.9%	∞
Liquid Conductivity (mea.)	±2.5%	R	√3	0.78	0.71	±1.1%	±1.0%	∞
Liquid Permittivity(meas.)	±2.5%	R	√3	0.26	0.26	±0.3%	±0.4%	∞
Temp unc. - Conductivity	±3.4%	R	√3	0.78	0.71	±1.5%	±1.4%	∞
Temp unc. - Permittivity	±0.4%	R	√3	0.23	0.26	±0.1%	±0.1%	∞
Combined Standard Uncertainty						±11.2%	±11.1%	361
Expanded STD Uncertainty						±22.3%	±22.2%	

**Notes:**

Worst Case uncertainty budget for DASY5 assessed according to IEEE 1528-2013. The budget is valid for the frequency range 300 MHz – 3 GHz and represents a worst-case analysis. For specific tests and configurations, the uncertainty could be considerably smaller.



## SAR Test Report

Error Description	Uncertainty Value	Prob. Dist.	Div.	$c_i$ (1g)	$c_i$ (10g)	Std.Unc. (1g)	Std.Unc. (10g)	( $v_i$ ) $v_{eff}$
Measurement System								
Probe Calibration	±6.55%	N	1	1	1	±6.55%	±6.55%	∞
Axial Isotropy	±4.7%	R	√3	0.7	0.7	±1.9%	±1.9%	∞
Hemispherical Isotropy	±9.6%	R	√3	0.7	0.7	±3.9%	±3.9%	∞
Boundary Effect	±2.0%	R	√3	1	1	±1.2%	±1.2%	∞
Linearity	±4.7%	R	√3	1	1	±2.7%	±2.7%	∞
System Detection Limits	±1.0%	R	√3	1	1	±0.6%	±0.6%	∞
Modulation Response	±2.4%	R	√3	1	1	±1.4%	±1.4%	∞
Readout Electronics	±0.3%	N	1	1	1	±0.3%	±0.3%	∞
Response Time	±0.8%	R	√3	1	1	±0.5%	±0.5%	∞
Integration Time	±2.6%	R	√3	1	1	±1.5%	±1.5%	∞
RF Ambient Noise	±3.0%	R	√3	1	1	±1.7%	±1.7%	∞
RF Ambient Reflections	±3.0%	R	√3	1	1	±1.7%	±1.7%	∞
Probe Positioner	±0.8%	R	√3	1	1	±0.5%	±0.5%	∞
Probe Positioning	±6.7%	R	√3	1	1	±3.9%	±3.9%	∞
Max. SAR Eval.	±4.0%	R	√3	1	1	±2.3%	±2.3%	∞
Test sample Related								
Device Positioning	±2.9%	N	1	1	1	±2.9%	±2.9%	145
Device Holder	±3.6%	N	1	1	1	±3.6%	±3.6%	5
Power Drift	±5.0%	R	√3	1	1	±2.9%	±2.9%	∞
Power Scaling	±0.0%	R	√3	1	1	±0%	±0%	∞
Phantom and Setup								
Phantom Uncertainty	±6.6%	R	√3	1	1	±3.8%	±3.8%	∞
SAR Correction	±1.9%	R	√3	1	0.84	±1.1%	±0.9%	∞
Liquid Conductivity (mea.)	±2.5%	R	√3	0.78	0.71	±1.1%	±1.0%	∞
Liquid Permittivity(meas.)	±2.5%	R	√3	0.26	0.26	±0.3%	±0.4%	∞
Temp unc. - Conductivity	±3.4%	R	√3	0.78	0.71	±1.5%	±1.4%	∞
Temp unc. - Permittivity	±0.4%	R	√3	0.23	0.26	±0.1%	±0.1%	∞
Combined Standard Uncertainty						±12.3%	±12.2%	748
Expanded STD Uncertainty						±24.6%	±24.5%	

## Notes.

Worst Case uncertainty budget for DASY5 assessed according to IEEE 1528-2013. The budget is valid for the frequency range 3 GHz – 6 GHz and represents a worst-case analysis. Probe calibration error reflects uncertainty of the EX3D probe. For specific tests and configurations, the uncertainty could be considerably smaller.





## SAR Test Report

Error Description	Uncertainty Value	Prob. Dist.	Div.	$c_i$ (1g)	$c_i$ (10g)	Std.Unc. (1g)	Std.Unc. (10g)	( $v_i$ ) $v_{eff}$
Measurement System								
Probe Calibration	±6.55%	N	1	1	1	±6.55%	±6.55%	∞
Axial Isotropy	±4.7%	R	√3	0.7	0.7	±1.9%	±1.9%	∞
Hemispherical Isotropy	±9.6%	R	√3	0.7	0.7	±3.9%	±3.9%	∞
Boundary Effect	±2.0%	R	√3	1	1	±1.2%	±1.2%	∞
Linearity	±4.7%	R	√3	1	1	±2.7%	±2.7%	∞
System Detection Limits	±1.0%	R	√3	1	1	±0.6%	±0.6%	∞
Modulation Response	±2.4%	R	√3	1	1	±1.4%	±1.4%	∞
Readout Electronics	±0.3%	N	1	1	1	±0.3%	±0.3%	∞
Response Time	±0.8%	R	√3	1	1	±0.5%	±0.5%	∞
Integration Time	±2.6%	R	√3	1	1	±1.5%	±1.5%	∞
RF Ambient Noise	±3.0%	R	√3	1	1	±1.7%	±1.7%	∞
RF Ambient Reflections	±3.0%	R	√3	1	1	±1.7%	±1.7%	∞
Probe Positioner	±0.8%	R	√3	1	1	±0.5%	±0.5%	∞
Probe Positioning	±6.7%	R	√3	1	1	±3.9%	±3.9%	∞
Post-Processing	±4.0%	R	√3	1	1	±2.3%	±2.3%	∞
Test sample Related								
Device Positioning	±2.9%	N	1	1	1	±2.9%	±2.9%	145
Device Holder	±3.6%	N	1	1	1	±3.6%	±3.6%	5
Power Drift	±5.0%	R	√3	1	1	±2.9%	±2.9%	∞
Power Scaling	±0.0%	R	√3	1	1	±0%	±0%	∞
Phantom and Setup								
Phantom Uncertainty	±7.9%	R	√3	1	1	±4.6%	±4.6%	∞
SAR Correction	±1.9%	R	√3	1	0.84	±1.1%	±0.9%	∞
Liquid Conductivity (mea.)	±2.5%	R	√3	0.78	0.71	±1.1%	±1.0%	∞
Liquid Permittivity(me.)	±2.5%	R	√3	0.26	0.26	±0.3%	±0.4%	∞
Temp unc. - Conductivity	±3.4%	R	√3	0.78	0.71	±1.5%	±1.4%	∞
Temp unc. - Permittivity	±0.4%	R	√3	0.23	0.26	±0.1%	±0.1%	∞
Combined Standard Uncertainty						±12.5%	±12.5%	748
Expanded STD Uncertainty						±25.1%	±25.0%	

## Notes.

Worst Case uncertainty budget for DASY5 assessed according to IEC62209-2: 2010. The budget is valid for the frequency range 30MHz – 6 GHz and represents a worst-case analysis. Probe calibration error reflects uncertainty of the EX3D probe. For specific tests and configurations, the uncertainty could be considerably smaller.

**3 DESCRIPTION OF EQUIPMENT UNDER TEST**

Equipment Under Test	
Product Name	Bodyworn Connect 1.6
Model Number	Bodyworn Connect 1.6
Serial Number	35850206473249
Hardware Version	Rev 1.9us
Software Version	V1.5.6.106
Supported Transmit Bands	LTE Bands: 2, 4, 5, 13, 17 WCDMA Bands: 2, 5
Embedded Module	Ublox Toby L201
Embedded Module hardware Version	TOBY-L201-02S-01 (218B01)
Embedded Module Software Version	20.06,A01.00
Embedded Module FCCID	XPYTOBYL201
Receive Date	5/7/2021
Test Start Date	6/15/2021
Test End Date	6/25/2021
Device Received Condition	Good
Test Sample Type	Production
Rated Voltage	3.7VDC
Antenna Gains	Taoglas PA.711.A (maximum gain 4.1dBi)
Description of Equipment Under Test (provided by client)	
The Bodyworn Connect 1.6 is a CCTV camera which has the ability to stream live video via a cellular link to a cloud environment.	

Operating Band	Technology	Modulation	Frequency Range (MHz)	Maximum Output Power (dBm)	LTE Channel Bandwidth (MHz)	Duty Cycle
2	LTE	QPSK, 16QAM	1850 – 1910	24.0	1.4, 3, 5, 10, 15, 20	1:1
4	LTE	QPSK, 16QAM	1710 – 1755	24.3	1.4, 3, 5, 10, 15, 20	1:1
5	LTE	QPSK, 16QAM	824 – 849	24.5	1.4, 3, 5, 10	1:1
13	LTE	QPSK, 16QAM	777 – 787	24.0	5, 10	1:1
17	LTE	QPSK, 16QAM	704 - 716	24.0	5, 10	1:1
2	UMTS	QPSK	1850 – 1910	24.5	NA	1:1
5	UMTS	QPSK	824 – 849	24.5	NA	1:1

## 4 SYSTEM VERIFICATION

### System Validation

Prior to the assessment, the system was verified to be within  $\pm 10\%$  of the specifications by using the system validation kit. The system validation procedure tests the system against reference SAR values and the performance of probe, readout electronics and software. The test setup utilizes a phantom and reference dipole.



Figure 2: System Verification Setup



Table 3: Dipole Validations

Reference Dipole Validation									
Ambient Temp (°C)	Fluid Temp (°C)	Frequency (MHz)	Dipole	Fluid Type	Dipole Power Input	Cal. Lab SAR (1g)	Measured SAR (1g)	% Error SAR (1g)	Date
23.2	23.1	750	D750V3	MSL750	1W	8.77	8.45	3.65	6/18/2021
23.1	23.2	835	D835V2	MSL835	1W	9.87	9.36	5.17	6/21/2021
22.8	23	1800	D1800V2	MSL1800	1W	38.60	38.00	1.55	6/23/2021
Reference Dipole Validation									
Ambient Temp (°C)	Fluid Temp (°C)	Frequency (MHz)	Dipole	Fluid Type	Dipole Power Input	Cal. Lab SAR (10g)	Measured SAR (10g)	% Error SAR (10g)	Date
23.2	23.1	750	D750V3	MSL750	1W	5.81	5.68	2.24	6/18/2021
23.1	23.2	835	D835V2	MSL835	1W	6.49	6.16	5.08	6/21/2021
23.2	23.1	1800	D1800V2	MSL1800	1W	20.30	21.20	4.43	6/23/2021



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### Measurement Uncertainty for System Validation

Source of Uncertainty	Value(dB)	Probability Distribution	Divisor	$c_i$	$u_i(y)$	$(u_i(y))^2$
Measurement System						
Probe Calibration	5.50	n1	1	1	5.50	30.250
Axial Isotropy	4.70	r	1.732	0.7	2.71	7.364
Hemispherical Isotropy	9.60	r	1.732	0.7	5.54	30.722
Boundary Effect	1.00	r	1.732	1	0.58	0.333
Linearity	4.70	r	1.732	1	2.71	7.364
System Detection Limits	1.00	r	1.732	1	0.58	0.333
Readout Electronics	0.30	n1	1	1	0.30	0.090
Response Time	0.80	r	1.732	1	0.46	0.213
Integration Time	2.60	r	1.732	1	1.50	2.253
RF Ambient Noise	3.00	r	1.732	1	1.73	3.000
RF Ambient Reflections	3.00	r	1.732	1	1.73	3.000
Probe Positioner	0.40	r	1.732	1	0.23	0.053
Probe Positioning	2.90	r	1.732	1	1.67	2.803
Max. SAR Eval.	1.00	r	1.732	1	0.58	0.333
Dipole / Generator / Power Meter Related						
Dipole positioning	2.90	n1	1	1	2.90	8.410
Dipole Calibration Uncertainty	0.68	r	1.732	1	0.39	0.154
Power Meter 1 Uncertainty (+20C to +25C)	0.13	n1	1	2	0.13	0.017
Power Meter 2 Uncertainty (+20C to +25C)	0.04	n1	1	3	0.04	0.002
Sig Gen VSWR Mismatch Error	1.80	n1	1	5	1.80	3.240
Sig Gen Resolution Error	0.01	n1	1	6	0.01	0.000
Sig Gen Level Error	0.90	n1	1	1	0.90	0.810
Phantom and Setup						
Phantom Uncertainty	4.00	r	1.732	1	2.31	5.334
Liquid Conductivity (target)	5.00	r	1.732	0.43	2.89	8.334
Liquid Conductivity (meas.)	2.50	n1	1	0.43	2.50	6.250
Liquid Permittivity (target)	5.00	r	1.732	0.49	2.89	8.334
Liquid Permittivity (meas.)	2.50	n1	1	0.49	2.50	6.250
Combined Standard Uncertainty		N1	1	1	11.63	135.247
Expanded Uncertainty		Normal k=	2		23.26	
Expanded Uncertainty	is	23.3	for	Normal	k=	2

**Tissue Simulating Liquid Description and Validation**

The dielectric parameters were verified to be within 5% of the target values prior to assessment. The dielectric parameters ( $\epsilon_r, \sigma$ ) are shown in Table 4. A recipe for the tissue simulating fluid used is shown in Table 5.

*Table 4: Dielectric Parameter Validations*

Measured Tissue Properties									
Tissue Type	Frequency Measure (MHz)	Dielectric Constant Target	Conductivity Target	Dielectric Constant Measure	Imaginary Part	Conductivity Measure	Dielectric % Deviation	Conductivity % Deviation	Date
835MSL	824	55.2	0.969	54.2	20.6	0.94	1.81	2.61	6/21/2021
	835	55.15	0.97	54.6	20.8	0.9656	1.00	0.46	6/21/2021
	850	55.28	0.988	54.9	21.2	1.0018	0.69	1.40	6/21/2021
Measured Tissue Properties									
Tissue Type	Frequency Measure (MHz)	Dielectric Constant Target	Conductivity Target	Dielectric Constant Measure	Imaginary Part	Conductivity Measure	Dielectric % Deviation	Conductivity % Deviation	Date
750MSL	699	55.72	0.96	55.34	24.89	0.97	0.68	0.76	6/18/2021
	710	55.68	0.96	55.21	25.08	0.9900	0.84	3.12	6/18/2021
	720	55.65	0.96	55.12	25.12	1.0055	0.95	4.74	6/18/2021
Measured Tissue Properties									
Tissue Type	Frequency Measure (MHz)	Dielectric Constant Target	Conductivity Target	Dielectric Constant Measure	Imaginary Part	Conductivity Measure	Dielectric % Deviation	Conductivity % Deviation	Date
1800 MSL	1800	53.3	1.52	52.81	15.6	1.56	0.92	2.71	6/23/2021
	1850	53.3	1.52	52.97	15.48	1.5921	0.62	4.75	6/23/2021
	1910	53.3	1.52	53.1	14.89	1.5811	0.38	4.02	6/23/2021



Table 5: Tissue Simulating Fluid Recipe

Composition of Ingredients for Liquid Tissue Phantoms (450MHz to 2450 MHz data only)												
Ingredient (% by weight)	f (MHz)											
	450		835		915		1900		2450		5500	
Tissue Type	Head	Body	Head	Body	Head	Body	Head	Body	Head	Body	Head	Body
Water	38.56	51.16	41.45	52.4	41.05	56	54.9	70.45	62.7	68.64	65.53	78.67
Salt (NaCl)	3.95	1.49	1.45	1.4	1.35	0.76	0.18	0.36	0.5	0	0	0
Sugar	56.32	46.78	56	45	56.5	41.76	0	0	0	0	0	0
HEC	0.98	0.52	1	1	1	1.21	0	0	0	0	0	0
Bactericide	0.19	0.05	0.1	0.1	0.1	0.27	0	0	0	0	0	0
Triton X-100	0	0	0	0	0	0	0	0	36.8	0	17.235	10.665
DGBE	0	0	0	0	0	0	44.92	29.18	0	31.37	0	0
DGHE	0	0	0	0	0	0	0	0	0	0	17.235	10.665
Dielectric Constant	43.42	58	42.54	56.1	42	56.8	39.9	53.3	39.8	52.7		
Conductivity (S/m)	0.85	0.83	0.91	0.95	1	1.07	1.42	1.52	1.88	1.95		

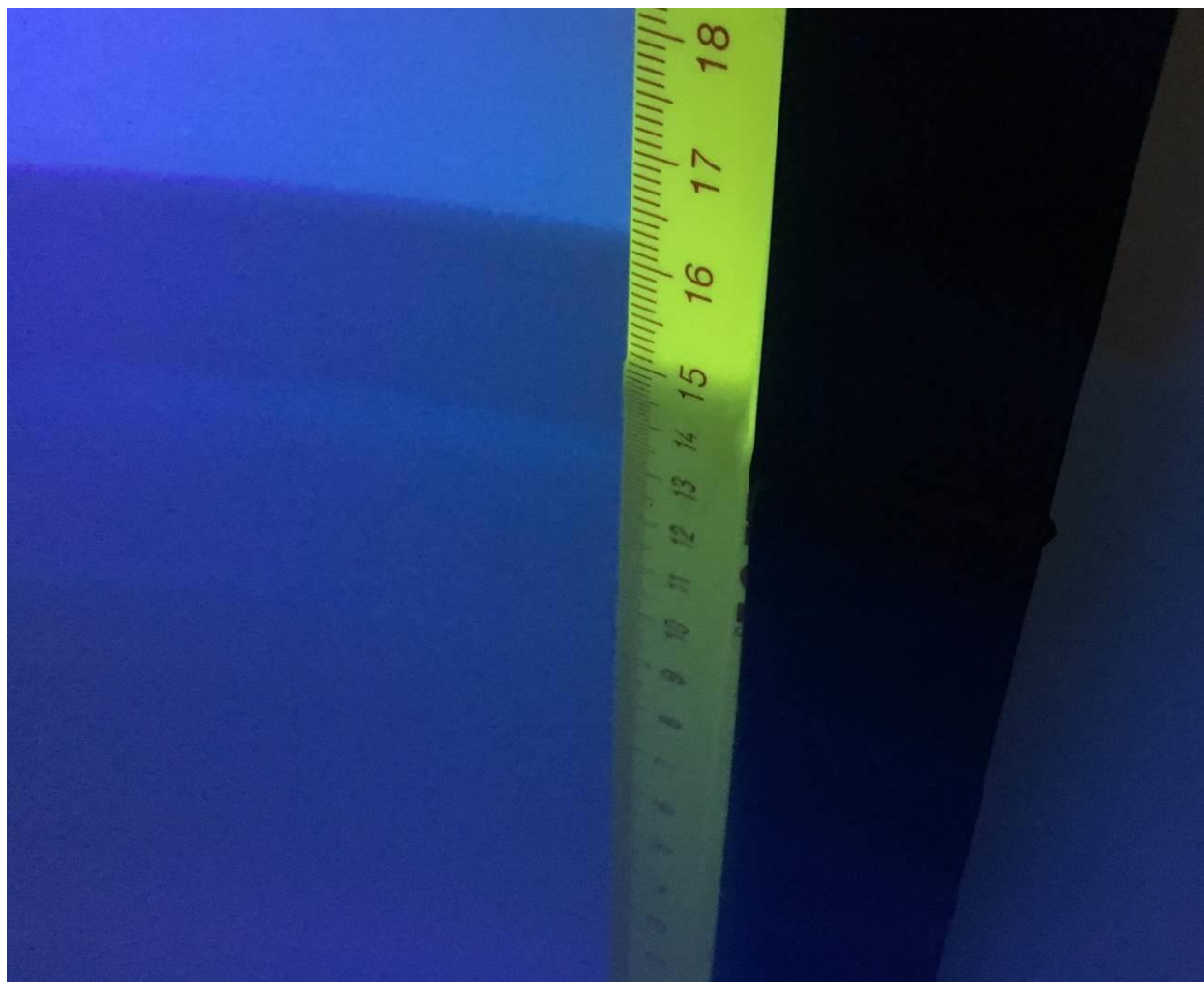
Tissue Simulating Liquid for 5GHz, MBBL3500-5800V5 Manufactured by SPEAG (proprietary mixture)

Ingredients	(% by weight)
Water	78
Mineral oil	11
Emulsifiers	9
Additives and Salt	2



## 5 EVALUATION PROCEDURES

Prior to any testing, the appropriate fluid was used to fill the phantom to a depth of 15 cm  $\pm 0.2$ cm. The fluid parameters were verified and the dipole validation was performed as described in the previous sections.



*Figure 3: Fluid Depth 15cm*



**Test Positions:**

The Device was positioned against the SAM and flat phantom using the exact procedure described in IEEE Std 1528:2013, IEC62209-2:2010, and the Office of Engineering and Technology KDB 447498.

**Reference Power Measurement:**

The measurement probe was positioned at a fixed location above the reference point. A power measurement was made with the probe above this reference position so it could be used for assessing the power drift later in the test procedure.

**Area Scan:**

A coarse area scan was performed in order to find the approximate location of the peak SAR value. This scan was performed with the measurement probe at a constant height in the simulating fluid. A two dimensional spline interpolation algorithm was then used to determine the peaks and gradients within the scanned area. The area scan resolution conformed to the requirements of KDB 865664 as shown in Table 6.

**Zoom Scan:**

A zoom scan was performed around the approximate location of the peak SAR as determined from the area scan. On the basis of this data set, the spatial peak SAR value was evaluated with the following procedure. The zoom scan resolution conformed to the requirements of KDB 865664 as shown in Table 6.



Table 6: SAR Area and Zoom Scan Resolutions

			$\leq 3$ GHz	$> 3$ GHz
Maximum distance from closest measurement point (geometric center of probe sensors) to phantom surface			$5 \pm 1$ mm	$\frac{1}{2} \cdot \delta \cdot \ln(2) \pm 0.5$ mm
Maximum probe angle from probe axis to phantom surface normal at the measurement location			$30^{\circ} \pm 1^{\circ}$	$20^{\circ} \pm 1^{\circ}$
Maximum area scan spatial resolution: $\Delta x_{Area}$ , $\Delta y_{Area}$			$\leq 2$ GHz: $\leq 15$ mm 2 – 3 GHz: $\leq 12$ mm	3 – 4 GHz: $\leq 12$ mm 4 – 6 GHz: $\leq 10$ mm
			When the x or y dimension of the test device, in the measurement plane orientation, is smaller than the above, the measurement resolution must be $\leq$ the corresponding x or y dimension of the test device with at least one measurement point on the test device.	
Maximum zoom scan spatial resolution: $\Delta x_{Zoom}$ , $\Delta y_{Zoom}$			$\leq 2$ GHz: $\leq 8$ mm 2 – 3 GHz: $\leq 5$ mm*	3 – 4 GHz: $\leq 5$ mm* 4 – 6 GHz: $\leq 4$ mm*
Maximum zoom scan spatial resolution, normal to phantom surface	uniform grid: $\Delta z_{Zoom}(n)$		$\leq 5$ mm	3 – 4 GHz: $\leq 4$ mm 4 – 5 GHz: $\leq 3$ mm 5 – 6 GHz: $\leq 2$ mm
	graded grid	$\Delta z_{Zoom}(1)$ : between 1 <sup>st</sup> two points closest to phantom surface	$\leq 4$ mm	3 – 4 GHz: $\leq 3$ mm 4 – 5 GHz: $\leq 2.5$ mm 5 – 6 GHz: $\leq 2$ mm
		$\Delta z_{Zoom}(n>1)$ : between subsequent points	$\leq 1.5 \cdot \Delta z_{Zoom}(n-1)$	
Minimum zoom scan volume	x, y, z		$\geq 30$ mm	3 – 4 GHz: $\geq 28$ mm 4 – 5 GHz: $\geq 25$ mm 5 – 6 GHz: $\geq 22$ mm
Note: $\delta$ is the penetration depth of a plane-wave at normal incidence to the tissue medium; see draft standard IEEE P1528-2011 for details.				
* When zoom scan is required and the <u>reported</u> SAR from the <u>area scan based 1-g SAR estimation</u> procedures of KDB 447498 is $\leq 1.4$ W/kg, $\leq 8$ mm, $\leq 7$ mm and $\leq 5$ mm zoom scan resolution may be applied, respectively, for 2 GHz to 3 GHz, 3 GHz to 4 GHz and 4 GHz to 6 GHz.				

**Interpolation, Extrapolation and Detection of Maxima:**

The probe is calibrated at the center of the dipole sensors which is located 1 to 2.7 mm away from the probe tip. During measurements, the probe stops shortly above the phantom surface, depending on the probe and the surface detecting system. Both distances are included as parameters in the probe configuration file. The software always knows exactly how far away the measured point is from the surface. As the probe cannot directly measure at the surface, the values between the deepest measured point and the surface must be extrapolated.

In DASYS, the choice of the coordinate system defining the location of the measurement points has no influence on the uncertainty of the interpolation, Maxima Search and extrapolation routines. The interpolation, extrapolation and maximum search routines are all based on the modified Quadratic Shepard's method.

Thereby, the interpolation scheme combines a least-square fitted function method and a weighted average method which are the two basic types of computational interpolation and approximation. The DASYS routines construct a once-continuously differentiable function that interpolates the measurement values as follows:

- For each measurement point a trivariate (3-D) / bivariate (2-D) quadratic is computed. It interpolates the measurement values at the data point and forms a least-square fit to neighboring measurement values.
- The spatial location of the quadratic with respect to the measurement values is attenuated by an inverse distance weighting. This is performed since the calculated quadratic will fit measurement values at nearby points more accurate than at points located further away.
- After the quadratics are calculated for at all measurement points, the interpolating function is calculated as a weighted average of the quadratics.

There are two control parameters that govern the behavior of the interpolation method. One specifies the number of measurement points to be used in computing the least-square fits for the local quadratics. These measurement points are the ones nearest the input point for which the quadratic is being computed. The second parameter specifies the number of measurement points that will be used in calculating the weights for the quadratics to produce the final function. The input data points used there are the ones nearest the point at which the interpolation is desired. Appropriate defaults are chosen for each of the control parameters.

The trivariate quadratics that have been previously computed for the 3-D interpolation and whose input data are at the closest distance from the phantom surface, are used in order to extrapolate the fields to the surface of the phantom.

In order to determine all the field maxima in 2-D (Area Scan) and 3-D (Zoom Scan), the measurement grid is refined by a default factor of 10 and the interpolation function is used to evaluate all field values between corresponding measurement points. Subsequently, a linear search is applied to find all the candidate maxima. In a last step, non-physical maxima are removed and only those maxima which are within 2 dB of the global maximum value are retained.



## Averaging and Determination of Spatial Peak SAR

The interpolated data is used to average the SAR over the 1g and 10g cubes by spatially discretizing the entire measured volume. The resolution of this spatial grid used to calculate the averaged SAR is 1mm or about 42875 interpolated points. The resulting volumes are defined as cubical volumes containing the appropriate tissue parameters that are centered at the location. The location is defined as the center of the incremental volume.

The spatial-peak SAR must be evaluated in cubical volumes containing a mass that is within 5% of the required mass. The cubical volume centered at each location, as defined above, should be expanded in all directions until the desired value for the mass is reached, with no surface boundaries of the averaging volume extending beyond the outermost surface of the considered region. In addition, the cubical volume should not consist of more than 10% of air. If these conditions are not satisfied then the center of the averaging volume is moved to the next location. Otherwise, the exact size of the final sampling cube is found using an inverse polynomial approximation algorithm, leading to results with improved accuracy. If one boundary of the averaging volume reaches the boundary of the measured volume during its expansion, it will not be evaluated at all. Reference is kept of all locations used and those not used for averaging the SAR. All average SAR values are finally assigned to the centered location in each valid averaging volume.

All locations included in an averaging volume are marked to indicate that they have been used at least once. If a location has been marked as used, but has never been assigned to the center of a cube, the highest averaged SAR value of all other cubical volumes which have used this location for averaging is assigned to this location. Only those locations that are not part of any valid averaging volume should be marked as unused. For the case of an unused location, a new averaging volume must be constructed which will have the unused location centered at one surface of the cube. The remaining five surfaces are expanded evenly in all directions until the required mass is enclosed, regardless of the amount of included air. Of the six possible cubes with one surface centered on the unused location, the smallest cube is used, which still contains the required mass.

If the final cube containing the highest averaged SAR touches the surface of the measured volume, an appropriate warning is issued within the post processing engine.

### Power Drift Measurement:

The probe was positioned at precisely the same reference point and the reference power measurement was repeated. The difference between the initial reference power and the final one is referred to as the power drift. This value should not exceed 5%. The power drift measurement was used to assess the output power stability of the test sample throughout the SAR scan.

### RF Ambient Activity:

During the entire SAR evaluation, the RF ambient activity was monitored using a spectrum analyzer with an antenna connected to it. The spectrum analyzer was tuned to the frequency of measurement and with one trace set to max hold mode. In this way, it was possible to determine if at any point during the SAR measurement there was an interfering ambient signal. If an ambient signal was detected, then the SAR measurement was repeated.



## 6 CRITERIA

The following ANSI/IEEE C95.1 – 1992 limits for SAR apply to portable devices operating in the General Population/Uncontrolled Exposure environment. Uncontrolled environments are defined as locations where there is the exposure of individuals who have no knowledge or control of their exposure.

Exposure Type (General Population/Uncontrolled Exposure environment)	SAR Limit (W/kg or mW/g)
Average over the whole body	0.08
Spatial Peak (1g)	1.60
Spatial Peak for hands, wrists, feet and ankles (10g)	4.00

## 7 TEST CONFIGURATION

The Bodyworn Connect 1.6 was designed to be used against the body with the integral attachment to a vest. Therefore, it was evaluated while attached to the vest which was in direct contact with the SAM phantom. Due to the nature of the design, the Bodyworn Connect 1.6 could tilt up or down. It was evaluated for body SAR with it tilted up, tilted down, and again with it flat (parallel) to the SAM torso phantom. The separate test photo exhibit shows the device positions during the measurements.

The device was evaluated according to the specific requirements found in the following KDBs and Standards:

- FCC KDB 447498D01 v06, General RF Exposure Guidance
- FCC KDB 865664D01 v01r04, SAR Measurement Requirements for 100MHz to 6GHz
- FCC KDB 941225 D05, SAR for LTE Devices v02r05
- RSS-102 Issue 5, Radio Frequency (RF) Exposure Compliance of Radiocommunication Apparatus (All Frequency Bands)



## 8 TEST RESULTS

The worst case 1g SAR value for body exposure was less than the 1.6W/kg limit.

## 9 SAR DATA:

The results on the following page(s) were obtained when the device was transmitting at maximum output power. The worst case plots, which reveal information about the location of the maximum SAR with respect to the device, are referenced are shown in APPENDIX B – Worst Case SAR Plot. The measured conducted output power was compared to the power declared by the manufacturer and used for scaling the measured SAR values.



## SAR Test Report

Table 7: Body Mode SAR Results, (LTE Band 2)

Body SAR Results								
TX Mode	Spacing	RB	Position	Power Drift (dB)	Measured SAR 1g (W/kg)	Reported SAR 1g (W/kg)	Measured Conducted Output Power (dBm)	Maximum Conducted Output Power (dBm)
LTE, Band 2, QPSK	0mm	1	Flat	0.10	0.1310	0.1885	22.42	24.00
			Tilt Down	0.04	0.1010	0.1453	22.42	24.00
			Tilt Up	-0.05	0.1030	0.1482	22.42	24.00
LTE, Band 2, QPSK	0mm	50%	Flat	0.11	0.0947	0.1363	22.42	24.00
			Tilt Down	0.08	0.0989	0.1423	22.42	24.00
			Tilt Up	-0.12	0.0967	0.1391	22.42	24.00
LTE, Band 2, QPSK	0mm	100%	Flat	-0.02	0.0876	0.1260	22.42	24.00
			Tilt Down	0.06	0.0887	0.1276	22.42	24.00
			Tilt Up	-0.14	0.0859	0.1236	22.42	24.00
1g SAR Limit = 1.6W/kg								

Test Personnel: Bryan Taylor  
 Supervising/Reviewing Engineer: NA  
 Signal Setup: Base Station Simulator  
 Power Method: Fully Charged Battery  
 Pretest Dipole Verification: Yes

Test Date: 6/23/2021 – 6/25/2021  
 Tissue Depth: 15cm  
 Ambient Temperature: 22.3C  
 Relative Humidity: 46.5%  
 Atmospheric Pressure: 991mbar

Deviations, Additions, or Exclusions: None



## SAR Test Report

Table 8: Body Mode SAR Results, (LTE Band 4)

Body SAR Results								
TX Mode	Spacing	RB	Position	Power Drift (dB)	Measured SAR 1g (W/kg)	Reported SAR 1g (W/kg)	Measured Conducted Output Power (dBm)	Maximum Conducted Output Power (dBm)
LTE, Band 4, QPSK	0mm	1	Flat	0.02	0.1870	0.2398	23.22	24.30
			Tilt Down	0.03	0.1034	0.1326	23.22	24.30
			Tilt Up	-0.02	0.0954	0.1223	23.22	24.30
LTE, Band 4, QPSK	0mm	50%	Flat	-0.13	0.1540	0.1975	23.22	24.30
			Tilt Down	-0.11	0.1022	0.1311	23.22	24.30
			Tilt Up	-0.13	0.0979	0.1255	23.22	24.30
LTE, Band 4, QPSK	0mm	100%	Flat	0.12	0.1460	0.1872	23.22	24.30
			Tilt Down	-0.20	0.0969	0.1243	23.22	24.30
			Tilt Up	-0.14	0.0835	0.1071	23.22	24.30
1g SAR Limit = 1.6W/kg								

Test Personnel: Bryan Taylor  
Supervising/Reviewing Engineer: NA  
Signal Setup: Base Station Simulator  
Power Method: Fully Charged Battery

Test Date: 6/23/2021 – 6/25/2021  
Tissue Depth: 15cm  
Ambient Temperature: 22.3C  
Relative Humidity: 46.5%

Pretest Dipole Verification: Yes

Atmospheric Pressure: 991mbar

Deviations, Additions, or Exclusions: None





## SAR Test Report

Table 9: Body Mode SAR Results, (LTE Band 5)

Body SAR Results								
TX Mode	Spacing	RB	Position	Power Drift (dB)	Measured SAR 1g (W/kg)	Reported SAR 1g (W/kg)	Measured Conducted Output Power (dBm)	Maximum Conducted Output Power (dBm)
LTE, Band 5, QPSK	0mm	1	Flat	-0.04	0.0776	0.1094	23.01	24.50
			Tilt Down	-0.02	0.1170	0.1649	23.01	24.50
			Tilt Up	-0.03	0.0822	0.1158	23.01	24.50
LTE, Band 5, QPSK	0mm	50%	Flat	-0.12	0.0763	0.1075	23.01	24.50
			Tilt Down	-0.14	0.1082	0.1525	23.01	24.50
			Tilt Up	0.12	0.0843	0.1188	23.01	24.50
LTE, Band 5, QPSK	0mm	100%	Flat	-0.10	0.0762	0.1074	23.01	24.50
			Tilt Down	-0.02	0.0686	0.0967	23.01	24.50
			Tilt Up	0.10	0.0794	0.1119	23.01	24.50
1g SAR Limit = 1.6W/kg								

Test Personnel: Bryan Taylor  
 Supervising/Reviewing Engineer: NA  
 Signal Setup: Base Station Simulator  
 Power Method: Fully Charged Battery

Test Date: 6/21/2021  
 Tissue Depth: 15cm  
 Ambient Temperature: 22.3C  
 Relative Humidity: 46.5%

Pretest Dipole Verification: Yes

Atmospheric Pressure: 991mbar

Deviations, Additions, or Exclusions: None



## SAR Test Report

Table 10: Body Mode SAR Results, (LTE Band 13)

Body SAR Results								
TX Mode	Spacing	RB	Position	Power Drift (dB)	Measured SAR 1g (W/kg)	Reported SAR 1g (W/kg)	Measured Conducted Output Power (dBm)	Maximum Conducted Output Power (dBm)
LTE, Band 13, QPSK	0mm	1	Flat	0.00	0.1740	0.2634	22.20	24.00
			Tilt Down	-0.06	0.1170	0.1771	22.20	24.00
			Tilt Up	-0.10	0.1040	0.1574	22.20	24.00
LTE, Band 13, QPSK	0mm	50%	Flat	0.30	0.0602	0.0911	22.20	24.00
			Tilt Down	-0.10	0.1020	0.1544	22.20	24.00
			Tilt Up	-0.05	0.0982	0.1486	22.20	24.00
LTE, Band 13, QPSK	0mm	100%	Flat	0.02	0.0701	0.1061	22.20	24.00
			Tilt Down	-0.20	0.0850	0.1287	22.20	24.00
			Tilt Up	0.10	0.0895	0.1355	22.20	24.00
1g SAR Limit = 1.6W/kg								

Test Personnel: Bryan Taylor  
 Supervising/Reviewing Engineer: NA  
 Signal Setup: Base Station Simulator  
 Power Method: Fully Charged Battery

Test Date: 6/18/2021 – 6/21/2021  
 Tissue Depth: 15cm  
 Ambient Temperature: 22.3C  
 Relative Humidity: 46.5%

Pretest Dipole Verification: Yes

Atmospheric Pressure: 991mbar

Deviations, Additions, or Exclusions: None



## SAR Test Report

Table 11: Body Mode SAR Results, (LTE Band 17)

Body SAR Results								
TX Mode	Spacing	RB	Position	Power Drift (dB)	Measured SAR 1g (W/kg)	Reported SAR 1g (W/kg)	Measured Conducted Output Power (dBm)	Maximum Conducted Output Power (dBm)
LTE, Band 17, QPSK	0mm	1	Flat	-0.14	0.0675	0.0827	23.12	24.00
			Tilt Down	0.00	0.1520	0.1861	23.12	24.00
			Tilt Up	-0.06	0.1550	0.1898	23.12	24.00
LTE, Band 17, QPSK	0mm	50%	Flat	-0.12	0.0402	0.0492	23.12	24.00
			Tilt Down	-0.14	0.1214	0.1487	23.12	24.00
			Tilt Up	0.20	0.1132	0.1386	23.12	24.00
LTE, Band 17, QPSK	0mm	100%	Flat	-0.12	0.0459	0.0562	23.12	24.00
			Tilt Down	0.02	0.0531	0.0650	23.12	24.00
			Tilt Up	-0.04	0.0613	0.0751	23.12	24.00
1g SAR Limit = 1.6W/kg								

Test Personnel: Bryan Taylor  
 Supervising/Reviewing Engineer: NA  
 Signal Setup: Base Station Simulator  
 Power Method: Fully Charged Battery

Test Date: 6/18/2021 – 6/21/2021  
 Tissue Depth: 15cm  
 Ambient Temperature: 22.3C  
 Relative Humidity: 46.5%

Pretest Dipole Verification: Yes

Atmospheric Pressure: 991mbar

Deviations, Additions, or Exclusions: None



## SAR Test Report

Table 12: Body Mode SAR Results, (UMTS Band 2)

Body SAR Results								
TX Mode	Spacing	Channel	Position	Power Drift (dB)	Measured SAR 1g (W/kg)	Reported SAR 1g (W/kg)	Measured Conducted Output Power (dBm)	Maximum Conducted Output Power (dBm)
WCDMA Band 2	0mm	Low	Flat	-0.07	0.0919	0.1263	23.12	24.50
			Tilt Down	-0.13	0.0843	0.1158	23.12	24.50
			Tilt Up	-0.06	0.0903	0.1241	23.12	24.50
WCDMA Band 2	0mm	Mid	Flat	-0.03	0.0843	0.1158	23.12	24.50
			Tilt Down	-0.05	0.0847	0.1164	23.12	24.50
			Tilt Up	0.13	0.0862	0.1184	23.12	24.50
WCDMA Band 2	0mm	High	Flat	-0.01	0.0901	0.1238	23.12	24.50
			Tilt Down	0.00	0.0910	0.1250	23.12	24.50
			Tilt Up	-0.02	0.0863	0.1186	23.12	24.50
1g SAR Limit = 1.6W/kg								

Test Personnel: Bryan Taylor  
 Supervising/Reviewing Engineer: NA  
 Signal Setup: Base Station Simulator  
 Power Method: Fully Charged Battery

Test Date: 6/23/2021 – 6/25/2021  
 Tissue Depth: 15cm  
 Ambient Temperature: 22.3C  
 Relative Humidity: 46.5%

Pretest Dipole Verification: Yes

Atmospheric Pressure: 991mbar

Deviations, Additions, or Exclusions: None



## SAR Test Report

Table 13: Body Mode SAR Results, (UMTS Band 5)

Body SAR Results								
TX Mode	Spacing	Channel	Position	Power Drift (dB)	Measured SAR 1g (W/kg)	Reported SAR 1g (W/kg)	Measured Conducted Output Power (dBm)	Maximum Conducted Output Power (dBm)
WCDMA Band 5	0mm	Low	Flat	0.12	0.0970	0.1358	23.04	24.50
			Tilt Down	0.03	0.1110	0.1554	23.04	24.50
			Tilt Up	-0.20	0.0871	0.1219	23.04	24.50
WCDMA Band 5	0mm	Mid	Flat	-0.12	0.0902	0.1262	23.04	24.50
			Tilt Down	0.03	0.0994	0.1391	23.04	24.50
			Tilt Up	-0.13	0.0867	0.1213	23.04	24.50
WCDMA Band 5	0mm	High	Flat	-0.02	0.0823	0.1152	23.04	24.50
			Tilt Down	0.04	0.0901	0.1261	23.04	24.50
			Tilt Up	0.15	0.0924	0.1293	23.04	24.50
1g SAR Limit = 1.6W/kg								

Test Personnel: Bryan Taylor  
 Supervising/Reviewing Engineer: NA  
 Signal Setup: Base Station Simulator  
 Power Method: Fully Charged Battery

Test Date: 6/21/2021  
 Tissue Depth: 15cm  
 Ambient Temperature: 22.3C  
 Relative Humidity: 46.5%

Pretest Dipole Verification: Yes

Atmospheric Pressure: 991mbar

Deviations, Additions, or Exclusions: None



## 1.0 REFERENCES

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- [12] Federal Communications Commission, KDB 865664 – "SAR Measurement Requirements for 3-6GHz".
- [13] Federal Communications Commission, KDB 941225 – "SAR Measurement Procedures for 3G Devices".
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**APPENDIX A – SYSTEM VALIDATION SUMMARY**

Per FCC KDB 865664, a tabulated summary of the system validation status including the validation date(s), measurement frequencies, SAR probes and tissue dielectric parameters have been included in the summary table below. The validation was performed with reference dipoles using the required tissue equivalent media for system validation according to KDB 865664. Each probe calibration point was validated at a frequency within the valid frequency range of the probe calibration point. All measurements were performed using probes calibrated for CW signals. Modulations in the table above represent test configurations for which the SAR system has been validated. The SAR system was also validated with modulated signals per KDB 865664.

*Table 14: SAR System Validation Summary*

Frequency (MHz)	Date	Probe (SN#)	Probe (Model #)	Probe Calibration Point		Dielectric Properties		CW Validation			Modulation Validation		
				Frequency (MHz)	Fluid Type	$\sigma$	$\epsilon_r$	Sensitivity	Probe Linearity	Probe Isotropy	Mod. Type	Duty Factor	PAR
2450	1/10/2021	3516	EX3DV3	2450	Body	50.65	2.02	Pass	Pass	Pass	OFDM	N/A	Pass
5200	1/10/2021	3516	EX3DV3	5200	Body	48.71	5.54	Pass	Pass	Pass	OFDM	N/A	Pass
5500	1/10/2021	3516	EX3DV3	5500	Body	47.68	6.29	Pass	Pass	Pass	OFDM	N/A	Pass
5800	1/10/2021	3516	EX3DV3	5800	Body	48.71	5.54	Pass	Pass	Pass	OFDM	N/A	Pass
Frequency (MHz)	Date	Probe (SN#)	Probe (Model #)	Probe Calibration Point		Dielectric Properties		CW Validation			Modulation Validation		
				Frequency (MHz)	Fluid Type	$\sigma$	$\epsilon_r$	Sensitivity	Probe Linearity	Probe Isotropy	Mod. Type	Duty Factor	PAR
835	1/10/2021	3516	EX3DV3	835	Body	54.2	0.98	Pass	Pass	Pass	GMSK	Pass	N/A
900	1/10/2021	3516	EX3DV3	900	Body	54	1.02	Pass	Pass	Pass	GMSK	Pass	N/A
1750	1/10/2021	3516	EX3DV3	1800	Body	52.9	1.41	Pass	Pass	Pass	GMSK	Pass	N/A
1900	1/10/2021	3516	EX3DV3	1900	Body	52.7	1.48	Pass	Pass	Pass	GMSK	Pass	N/A



## APPENDIX B – WORST CASE SAR PLOT

Date/Time: 6/18/2021 10:48:41 AM

Test Laboratory: Intertek

File Name: [SAR\\_LTE Band 13.da52:4](#)

### SAR\_LTE Band 13

Procedure Notes:

#### DUT: WCCTV;

Communication System: UID 0, Generic LTE 10 MHz Bandwidth (0); Communication System Band: Band 13;  
Frequency: 782 MHz; Duty Cycle: 1:1

Medium parameters used (interpolated):  $f = 782 \text{ MHz}$ ;  $\sigma = 0.96 \text{ S/m}$ ;  $\epsilon_r = 55.9$ ;  $\rho = 1000 \text{ kg/m}^3$

Phantom section: Flat Section

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

DASYS Configuration:

- Probe: EX3DV3 - SN3516; ConvF(10.89, 10.89, 10.89); Calibrated: 11/19/2020;
- Sensor-Surface: 1.4mm (Mechanical Surface Detection), Sensor-Surface: 0mm (Fix Surface)
- Electronics: DAE4 Sn358; Calibrated: 11/17/2020
- Phantom: SAM 2 with CRP v5.0; Type: QD000P40CD; Serial: TP:1663
- DASYS2 52.8.7(1137); SEMCAD X 14.6.10(7164)

**LTE Flat Section Band 13/LTE Band 13, 1RB/Area Scan 2 (51x71x1):** Interpolated grid:  $dx=1.500 \text{ mm}$ ,  $dy=1.500 \text{ mm}$

Maximum value of SAR (interpolated) =  $0.210 \text{ W/kg}$

**LTE Flat Section Band 13/LTE Band 13, 1RB/mid zoom scan 1RB 2 (9x8x7)/Cube 0:** Measurement grid:  $dx=5\text{mm}$ ,  $dy=5\text{mm}$ ,  $dz=5\text{mm}$

Reference Value =  $14.720 \text{ V/m}$ ; Power Drift =  $-0.00 \text{ dB}$

Peak SAR (extrapolated) =  $0.228 \text{ W/kg}$

**SAR(1 g) =  $0.174 \text{ W/kg}$ ; SAR(10 g) =  $0.131 \text{ W/kg}$**

Maximum value of SAR (measured) =  $0.211 \text{ W/kg}$

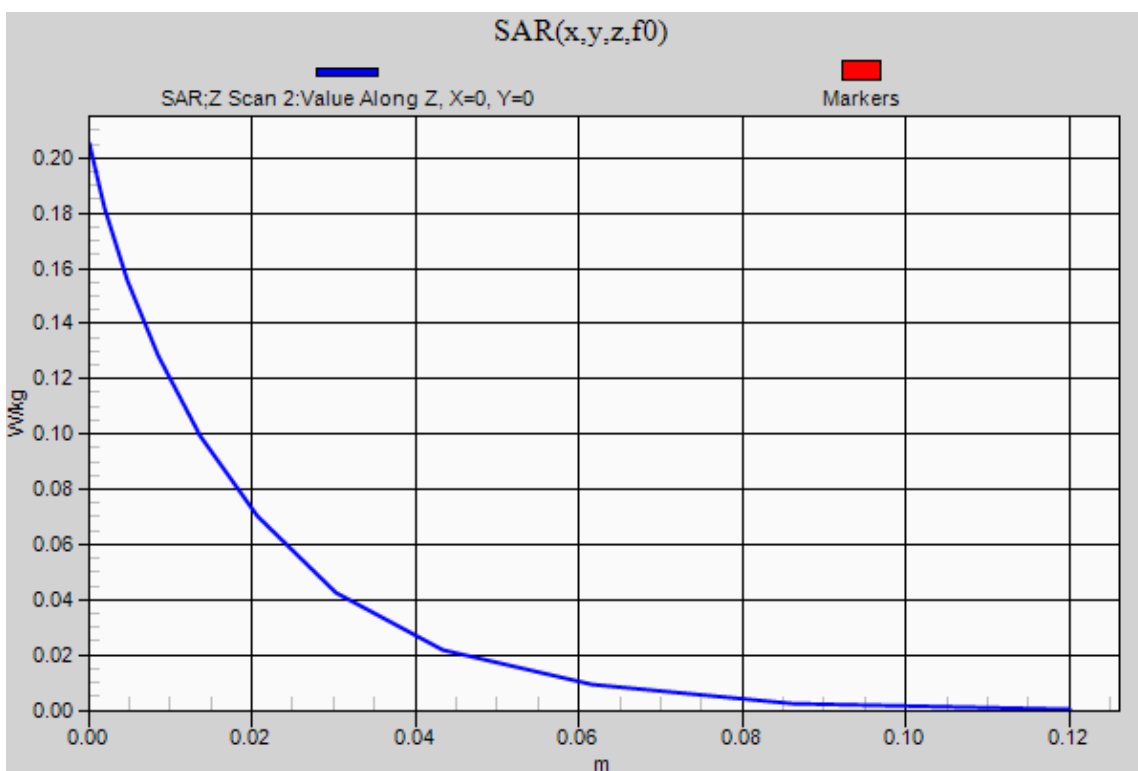
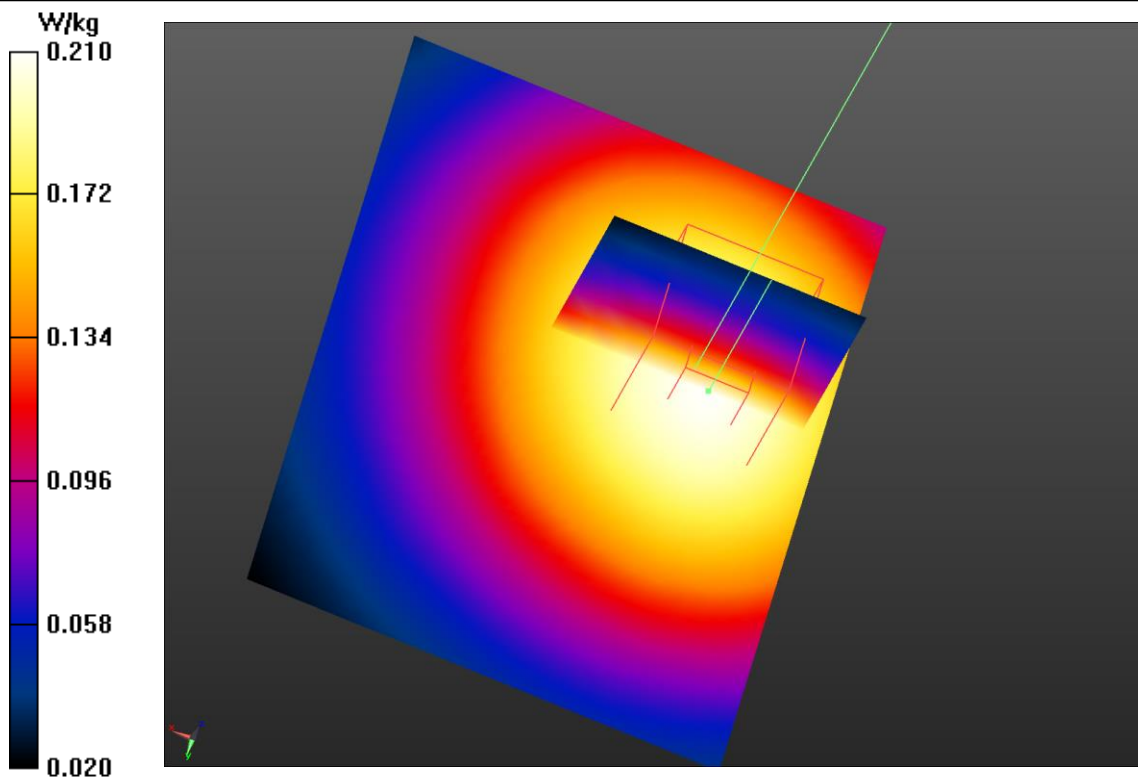
**LTE Flat Section Band 13/LTE Band 13, 1RB/Z Scan 2 (1x1x11):** Measurement grid:  $dx=20\text{mm}$ ,  $dy=20\text{mm}$ ,  $dz=2\text{mm}$

Maximum value of SAR (measured) =  $0.205 \text{ W/kg}$





SAR Test Report



**APPENDIX C – DIPOLE VALIDATION PLOTS**

Date/Time: 6/18/2021 4:39:50 PM

Test Laboratory: Intertek

File Name: [Dipole 750.da52:4](#)**Dipole 750**

Procedure Notes:

**DUT: Dipole 750 MHz D750V3; Serial: D750V3 - SN:xxx**

Communication System: UID 0, CW (0); Communication System Band: D750 (750.0 MHz); Frequency: 750 MHz; Duty Cycle: 1:1

Medium parameters used:  $f = 750 \text{ MHz}$ ;  $\sigma = 0.96 \text{ S/m}$ ;  $\epsilon_r = 55.9$ ;  $\rho = 1000 \text{ kg/m}^3$ 

Phantom section: Flat Section

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

DASYS Configuration:

- Probe: EX3DV3 - SN3516; ConvF(10.89, 10.89, 10.89); Calibrated: 11/19/2020;
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn358; Calibrated: 11/17/2020
- Phantom: SAM 2 with CRP v5.0; Type: QD000P40CD; Serial: TP:1663
- DASYS2 52.8.7(1137); SEMCAD X 14.6.10(7164)

**WWAN Flat-Section MSL Testing/750MHz Dipole/Area Scan 2 (5x8x1):** Measurement grid: dx=15mm, dy=15mm  
Maximum value of SAR (measured) = 0.107 W/kg**WWAN Flat-Section MSL Testing/750MHz Dipole/Zoom Scan (9x9x7)/Cube 0:** Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 10.605 V/m; Power Drift = 0.02 dB

Peak SAR (extrapolated) = 12.3 W/kg

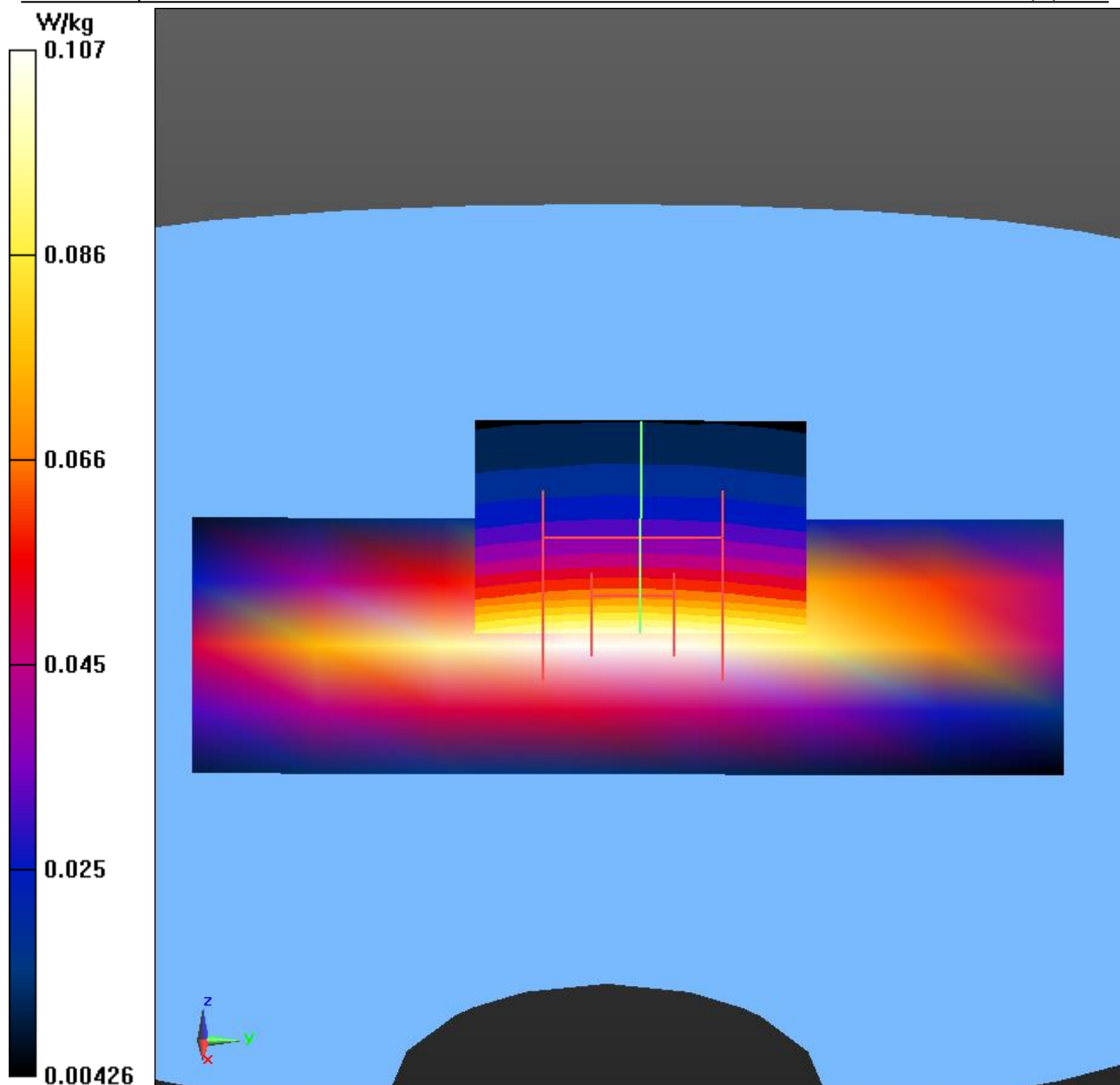
**SAR(1 g) = 8.45 W/kg; SAR(10 g) = 5.68 W/kg**

Normalized to target power = 1 W and actual power = 0.01 W

Maximum value of SAR (measured) = 11.1 W/kg



SAR Test Report





Date/Time: 6/21/2021 5:01:36 PM

Test Laboratory: Intertek

File Name: [Dipole 835.da52:4](#)

### 9.1.1 Dipole 835

Procedure Notes:

**DUT: Dipole 835 MHz D835V2; Serial: D835V2 - SN:4d122**

Communication System: UID 0, CW (0); Communication System Band: D835 (835.0 MHz); Frequency: 835 MHz; Duty Cycle: 1:1

Medium parameters used (interpolated):  $f = 835 \text{ MHz}$ ;  $\sigma = 1.008 \text{ S/m}$ ;  $\epsilon_r = 52.614$ ;  $\rho = 1000 \text{ kg/m}^3$

Phantom section: Flat Section

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

DASY5 Configuration:

- Probe: EX3DV3 - SN3516; ConvF(10.68, 10.68, 10.68); Calibrated: 11/19/2020;
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn358; Calibrated: 11/17/2020
- Phantom: SAM 2 with CRP v5.0; Type: QD000P40CD; Serial: TP:1663
- DASY52 52.8.7(1137); SEMCAD X 14.6.10(7164)

**WWAN Flat-Section MSL Testing/835MHz Dipole/Area Scan 2 (41x71x1):** Interpolated grid:  $dx=1.500 \text{ mm}$ ,  $dy=1.500 \text{ mm}$

Maximum value of SAR (interpolated) =  $0.124 \text{ W/kg}$

**WWAN Flat-Section MSL Testing/835MHz Dipole/Zoom Scan (9x9x7)/Cube 0:** Measurement grid:  $dx=5\text{mm}$ ,  $dy=5\text{mm}$ ,  $dz=5\text{mm}$

Reference Value =  $11.036 \text{ V/m}$ ; Power Drift =  $-0.01 \text{ dB}$

Peak SAR (extrapolated) =  $14.0 \text{ W/kg}$

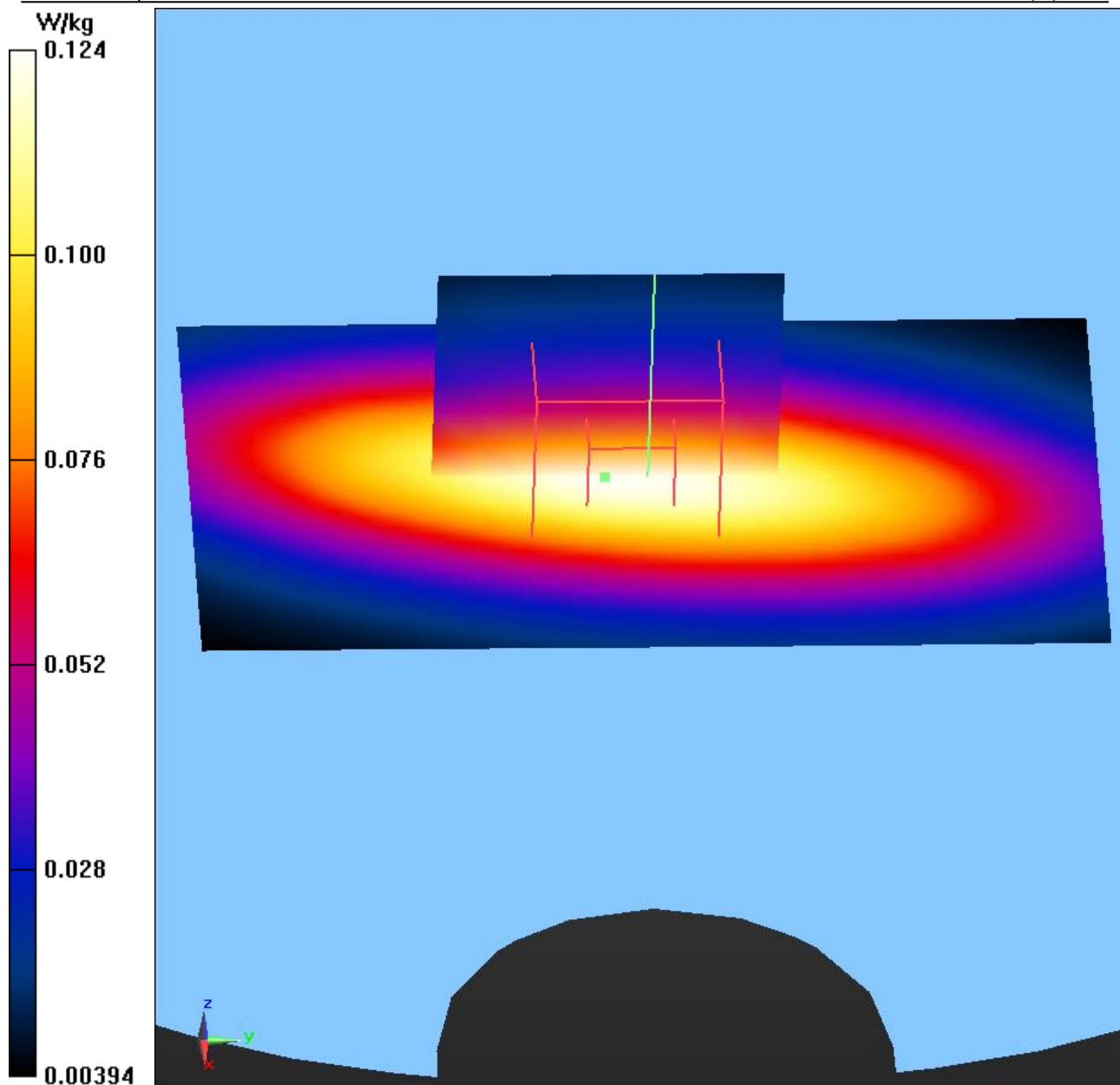
**SAR(1 g) = 9.36 W/kg; SAR(10 g) = 6.16 W/kg**

Normalized to target power = 1 W and actual power = 0.01 W

Maximum value of SAR (measured) =  $12.4 \text{ W/kg}$



SAR Test Report





Date/Time: 6/23/2021 11:03:43 AM

Test Laboratory: Intertek

File Name: [Dipole 1800.da52:4](#)

### 9.1.2 Dipole 1800

Procedure Notes:

**DUT: Dipole 1800 MHz D1800V2; Serial: D1800V2 - SN:224**

Communication System: UID 0, CW (0); Communication System Band: D1800 (1800.0 MHz); Frequency: 1800 MHz; Duty Cycle: 1:1

Medium parameters used:  $f = 1800$  MHz;  $\sigma = 1.48$  S/m;  $\epsilon_r = 51.39$ ;  $\rho = 1000$  kg/m<sup>3</sup>

Phantom section: Flat Section

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

DASY5 Configuration:

- Probe: EX3DV3 - SN3516; ConvF(9.21, 9.21, 9.21); Calibrated: 11/19/2020;
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn358; Calibrated: 11/17/2020
- Phantom: SAM 2 with CRP v5.0; Type: QD000P40CD; Serial: TP:1663
- DASY52 52.8.7(1137); SEMCAD X 14.6.10(7164)

**WWAN Flat-Section MSL Testing/1800MHz Dipole/Area Scan 2 (41x71x1):** Interpolated grid: dx=1.500 mm, dy=1.500 mm

Maximum value of SAR (interpolated) = 0.321 W/kg

**WWAN Flat-Section MSL Testing/1800MHz Dipole/Zoom Scan (9x9x7)/Cube 0:** Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 13.838 V/m; Power Drift = 0.05 dB

Peak SAR (extrapolated) = 66.3 W/kg

**SAR(1 g) = 38 W/kg; SAR(10 g) = 21.2 W/kg**

Normalized to target power = 1 W and actual power = 0.0055 W

Maximum value of SAR (measured) = 56.0 W/kg



SAR Test Report

