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# **TEST REPORT**

# Report Number: 103030302LEX-002 Project Number: G103030302

# Evaluation of the: GoTenna MESH (Model: Gotenna MESH)

# Tested to the SAR Criteria in FCC Part 2.1093 and RSS-102 Issue 5 per KDB447498 D01 v06

For

GoTenna

Test Performed by: Intertek 731 Enterprise Drive Lexington, KY 40510 Test Authorized by:

GoTenna 81 Willoughby Street, Suite 302 Brooklyn, NY 11201

7/5/2017

Date:\_

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Evalu	ation For: GoTenna	Product Name: GoTenna MESH Gotenna MESH
	TARLE	Report Number: 103030302LEX-002
10	INTRODUCTION	
1.0		τ
2.0	TEST SITE DESCRIPTION	
М	EASUREMENT EQUIPMENT	
М	EASUREMENT UNCERTAINTY	7
3.0	JOB DESCRIPTION	9
4.0	SYSTEM VERIFICATION	9
SY	STEM VALIDATION	
Μ	EASUREMENT UNCERTAINTY FOR SYSTEM	VALIDATION12
TI	SSUE SIMULATING LIQUID DESCRIPTION AN	D VALIDATION
5.0	EVALUATION PROCEDURES	
TI	EST POSITIONS:	
Ri	EFERENCE POWER MEASUREMENT:	
A	REA SCAN:	
Zo	DOM SCAN:	
In	TERPOLATION, EXTRAPOLATION AND DETE	CTION OF MAXIMA:17
Po	WER DRIFT MEASUREMENT:	
RI	F AMBIENT ACTIVITY:	
6.0	CRITERIA	
7.0	TEST CONFIGURATION	
8.0	TEST RESULTS	
SI	MULTANEOUS TRANSMISSION CALCULATIO	NS:25
9.0	REFERENCES	
APP	ENDIX B – SYSTEM VALIDATION SU	MMARY27
APP	ENDIX B – WORST CASE SAR PLOTS	
АРР	ENDIX C – DIPOLE SAR PLOTS	32



# **DOCUMENT HISTORY**

Product Name: GoTenna MESH Gotenna MESH Report Number: 103030302LEX-002

Revision/	Revision/ Writer		Change
Project Number	Initials	Dute	Chunge
1.0 /G103030302	.0 /G103030302 BCT		Original document



### **1.0 INTRODUCTION**

Product Name: GoTenna MESH Gotenna MESH Report Number: 103030302LEX-002

At the request of GoTenna, the GoTenna MESH 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  $\pm 22.3\%$ .

The Gotenna MESH was tested at the maximum output power measured by Intertek. Maximum output power measurements are tabulated under Section 8.0 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) was found to be:

Plot Number	Transmit Band (MHz)	Device Position	Frequency (MHz)	Conducted Output Power (dBm)	Reported SAR <sub>1g</sub> – Body Mode (W/kg)	Limit (W/kg)
1	902.5 – 927.5MHz	Extremity Mode; Direct Contact with Phantom; LED Side	927.5MHz	29.44dBm	1.05W/kg	4.0W/kg
2	902.5 – 927.5MHz	Body Mode; 5mm Spacing to Phantom; LED Side	927.5MHz	29.44dBm	1.285W/kg	1.6W/kg

Table 1: Maximum Measured SAR

Based on the worst-case data presented above, the GoTenna MESH was found to be **compliant** with the 1.6 W/kg and 4W/kg requirements for general population / uncontrolled exposure.



Product Name: GoTenna MESH Gotenna MESH Report Number: 103030302LEX-002

## 2.0 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  $22.0 \pm 2^{\circ}$ 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



Product Name: GoTenna MESH Gotenna MESH Report Number: 103030302LEX-002

# **Measurement Equipment**

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

Description	Serial Number	Manufacturer	Model	Cal. Date	Cal. Due
SAR Probe	3516	Speag	EXDV3	10/26/2016	10/26/2017
System Verification Dipole	013	Speag	D900V2	10/24/2016	10/24/2017
DAE	358	Speag	DAE4	10/24/2016	10/24/2017
Vector Signal Generator	257708	Rohde & Schwarz	SMBV100A	9/21/2016	9/21/2017
Network Analyzer	US39173983	Agilent	8753ES	3/14/2017	3/14/2018
USB Power Sensor	100155	Rohde & Schwarz	NRP-Z81	9/22/2016	9/22/2017
USB Power Sensor	100705	Rohde & Schwarz	NRP-Z51	9/22/2016	9/22/2017
Dielectric Probe Kit	1111	Speag	DAK-3.5	NCR	NCR
Spectrum Analyzer	3099	Rohde & Schwarz	FSP7	9/20/2016	9/20/2017
Base Station Simulator	119981	Rohde & Schwarz	CMU200	9/25/2016	9/25/2017
SAM Twin Phantom	1663	Speag	QD 000 P40 C	NCR	NCR
Oval Flat Phantom ELI 5.0	1108	Speag	QD OVA 002 A	NCR	NCR
6-axis robot	F11/5H1YA/A/01	Staubli	RX-90	NCR	NCR
Tape Measure	3629	Tajima	10m Tape	10/4/2016	10/4/2017
Thermometer	3181	Fluke 53II		3/6/2017	3/6/2018

NCR - No Calibration Required

Table 2: Test Equipment Used for SAR Evaluation

Product Name: GoTenna MESH Gotenna MESH Report Number: 103030302LEX-002

# **Measurement Uncertainty**

The Table below includes the uncertainty budget suggested by the IEEE Std 1528-2013 and determined by SPEAG for the DASY5 measurement System.

		Prob.				Std.Unc.	Std.Unc.	
Error Description	Uncertainty Value	Dist.	Div.	<i>c</i> <sub>i</sub> (1g)	c <sub>i</sub> (10g)	(1g)	(10g)	(V <sub>i</sub> ) V <sub>eff</sub>
Measurement System								
Probe Calibration	±6.0%	N	1	1	1	±6.0%	±6.0%	00
Axial Isotropy	±4.7%	R	√3	0.7	0.7	±1.9%	±1.9%	œ
Hemispherical Isotropy	±9.6%	R	√3	0.7	0.7	±3.9%	±3.9%	x
Boundary Effect	±1.0%	R	√3	1	1	±0.6%	±0.6%	x
Linearity	±4.7%	R	√3	1	1	±2.7%	±2.7%	x
System Detection Limits	±1.0%	R	√3	1	1	±0.6%	±0.6%	x
Modulation Response	±2.4%	R	√3	1	1	±1.4%	±1.4%	x
Readout Electronics	±0.3%	Ν	1	1	1	±0.3%	±0.3%	00
Response Time	±0.8%	R	√3	1	1	±0.5%	±0.5%	00
Integration Time	±2.6%	R	√3	1	1	±1.5%	±1.5%	œ
RF Ambient Noise	±3.0%	R	√3	1	1	±1.7%	±1.7%	x
RF Ambient Reflections	±3.0%	R	√3	1	1	±1.7%	±1.7%	x
Probe Positioner	±0.4%	R	√3	1	1	±0.2%	±0.2%	x
Probe Positioning	±2.9%	R	√3	1	1	±1.7%	±1.7%	x
Max. SAR Eval.	±2.0%	R	√3	1	1	±1.2%	±1.2%	œ
Test sample Related								
Device Positioning	±2.9%	Ν	1	1	1	±2.9%	±2.9%	145
Device Holder	±3.6%	Ν	1	1	1	±3.6%	±3.6%	5
Power Drift	±5.0%	R	√3	1	1	±2.9%	±2.9%	œ
Power Scaling	±0.0%	R	√3	1	1	±0%	±0%	œ
Phantom and Setup								
Phantom Uncertainty	±6.1%	R	√3	1	1	±3.5%	±3.5%	œ
SAR Correction	±1.9%	R	√3	1	0.84	±1.1%	±0.9%	00
Liquid Conductivity (mea.)	±2.5%	R	√3	0.78	0.71	±1.1%	±1.0%	x
Liquid Permittivity(mea.)	±2.5%	R	√3	0.26	0.26	±0.3%	±0.4%	œ
Temp unc Conductivity	±3.4%	R	√3	0.78	0.71	±1.5%	±1.4%	x
Temp unc Permittivity	±0.4%	R	√3	0.23	0.26	±0.1%	±0.1%	x
Combined Standard Uncertainty						±11.2%	±11.1%	361
Expanded STD Uncertainty						±22.3%	±22.2%	

Notes.

1. 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.



#### Product Name: GoTenna MESH Gotenna MESH Report Number: 103030302LEX-002

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



Product Name: GoTenna MESH Gotenna MESH Report Number: 103030302LEX-002

### 3.0 JOB DESCRIPTION

At the request of GoTenna, SAR testing was performed on the Gotenna MESH. This is a portable device that can pair with a smart phone and use the GoTenna app to communicate off-grid using a proprietary mesh network.

Test sample						
Manufacturer	GoTenna					
Product Name	GoTenna MESH (Model:Gotenna MESH)					
Serial Number	Test Sample 1					
Receive Date	5/17/2017					
Device Received Condition	Good					
Test Dates	5/19/2017 to 6/20/2017					
Device Category	Portable					
<b>RF Exposure Category</b>	General Population/Uncontrolled Environment					
Antenna Type	Internal					
Test sample Accessories						
Accessory	None					

Table 3: Product Information

Operating Bands	Frequency Range (MHz)	Maximum Output Power (declared by Manufacturer)	Duty Cycle
Mesh network (FHSS)	902.5 – 927.5MHz	30dBm	1:1
Bluetooth (FHSS)	2402 - 2480MHz	7.73dBm	1:1

Table 4: Operating Bands

# 4.0 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. The results from the system verifications with a dipole are shown in

**Reference Dipole Validation** 



731 Enterprise Drive, Lexington KY 40510

Evaluation For: GoTenna

#### Product Name: GoTenna MESH Gotenna MESH Report Number: 103030302LEX-002

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
23.1	22.1	900	D900V2	MSL900	1W	11	11	0.00	6/6/2017
23.1	22.1	900	D900V2	MSL900	1W	11	10.3	6.36	6/8/2017
23.1	22.1	900	D900V2	MSL900	1W	11	11.7	6.36	6/13/2017

Table 5.



Figure 2: System Verification Setup



Product Name: GoTenna MESH Gotenna MESH Report Number: 103030302LEX-002

	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			
23.1	22.1	900	D900V2	MSL900	1W	11	11	0.00	6/6/2017			
23.1	22.1	900	D900V2	MSL900	1W	11	10.3	6.36	6/8/2017			
23.1	22.1	900	D900V2	MSL900	1W	11	11.7	6.36	6/13/2017			

Table 5: Dipole Validations (1g)

	Reference Dipole Validation											
Ambient Temp (°C)	Fluid Temp (°C)	Frequency (MHz)	Dipole	Fluid Type	Dipole Power Input	Cal. Lab SAR (1g)	Measured SAR (10g)	% Error SAR (10g)	Date			
23.1	22.1	900	D900V2	MSL900	1W	7.12	7.2	1.12	6/6/2017			
23.1	22.1	900	D900V2	MSL900	1W	7.12	6.69	6.04	6/8/2017			
23.1	22.1	900	D900V2	MSL900	1W	7.12	7.66	7.58	6/13/2017			

Table 6: Dipole Validations (10g)



Product Name: GoTenna MESH Gotenna MESH Report Number: 103030302LEX-002

# Measurement Uncertainty for System Validation

Source of Uncertainty	Value(dB)	Probability Distribution	Divisor	Ci	u <sub>i</sub> (y)	(u <sub>i</sub> (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
<b>RF</b> 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	
				Nor		
Expanded Uncertainty	is	23.3	for	mal	k=	2



Product Name: GoTenna MESH Gotenna MESH Report Number: 103030302LEX-002

# 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 7. A recipe for the tissue simulating fluid used is shown in Table 8.

	Measured Tissue Properties										
Tissue Type	Frequency Measure (MHz)	Permittivity Target	Conductivity Target	Permittivity Measure	Complex Permittivity	Conductivity Measure	Dielectric % Deviation	Conductivity % Deviation	Date		
	900	55	1.05	54.13	20.33	1.02	1.58	3.12			
	915	55	1.06	54.32	20.45	1.04	1.24	1.86	6/6/2017		
MSL900	930	55	1.07	54.51	20.62	1.07	0.89	0.36			
Measured Tissue Properties											
	Measure	Permittivity	Conductivity	Permittivity	Complex	Conductivity	Dielectric	Conductivity			
Tissue Type	(MHz)	Target	Target	Measure	Permittivity	Measure	% Deviation	% Deviation	Date		
	900	55	1.05	54.21	20.31	1.02	1.44	3.22	6/8/2017		
	915	55	1.06	54.41	20.42	1.04	1.07	2.00			
MSL900	930	55	1.07	54.76	20.53	1.06	0.44	0.80			

	Measured Tissue Properties												
	Frequency	equency											
	Measure	Permittivity	Conductivity	Permittivity	Complex	Conductivity	Dielectric	Conductivity					
Tissue Type	(MHz)	Target	Target	Measure	Permittivity	Measure	% Deviation	% Deviation	Date				
	900	55	1.05	54.32	20.42	1.02	1.24	2.69					
	915	55	1.06	54.46	20.51	1.04	0.98	1.57	6/13/2017				
MSL900	930	55	1.07	54.58	20.63	1.07	0.76	0.31					

Table 7: Dielectric Parameter Validations



Product Name: GoTenna MESH Gotenna MESH Report Number: 103030302LEX-002

TYPICAL COMPOSITION OF INGREDIENTS FOR LIQUID TISSUE PHANTOMS. (450MHz to 2450 MHz data only)												
Ingredient (% by		f (MHz)										
weight)	45	50	83	35	9	15	19	00	24	50	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		

Table 8: Tissue Simulating Fluid Recipe

# 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



Product Name: GoTenna MESH Gotenna MESH Report Number: 103030302LEX-002

### 5.0 EVALUATION PROCEDURES

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

#### **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 used for the 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 9.

### 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 9.



Product Name: GoTenna MESH Gotenna MESH Report Number: 103030302LEX-002

			$\leq$ 3 GHz	> 3 GHz
Maximum distance fro (geometric center of pr	m <mark>clo</mark> sest i obe sensor	measurement point rs) to phantom surface	5 ± 1 mm	$\frac{1}{2} \cdot \delta \cdot \ln(2) \pm 0.5 \text{ mm}$
Maximum probe angle surface normal at the n	from prob neasureme	e axis to phantom nt location	30° ± 1°	20° ± 1°
			≤ 2 GHz: ≤ 15 mm 2 – 3 GHz: ≤ 12 mm	3 – 4 GHz: ≤ 12 mm 4 – 6 GHz: ≤ 10 mm
Maximum area scan sp	oatial resol	ution: $\Delta x_{Area}$ , $\Delta y_{Area}$	When the x or y dimension of measurement plane orientation the measurement resolution x or y dimension of the test of measurement point on the test	of the test device, in the on, is smaller than the above must be $\leq$ the corresponding device with at least one st device.
Maximum zoom scan s	spatial reso	blution: $\Delta x_{Zoom}$ , $\Delta y_{Zoom}$	≤ 2 GHz: ≤ 8 mm 2 - 3 GHz: ≤ 5 mm*	3 – 4 GHz: ≤ 5 mm <sup>*</sup> 4 – 6 GHz: ≤ 4 mm <sup>*</sup>
	uniform	grid: ∆z <sub>Zoom</sub> (n)	≤ 5 mm	$3 - 4 \text{ GHz} \le 4 \text{ mm}$ $4 - 5 \text{ GHz} \le 3 \text{ mm}$ $5 - 6 \text{ GHz} \le 2 \text{ mm}$
Maximum zoom scan spatial resolution, normal to phantom surface	graded	$\Delta z_{Zoom}(1)$ : between 1 <sup>st</sup> two points closest to phantom surface	≤4 mm	3 – 4 GHz: ≤ 3 mm 4 – 5 GHz: ≤ 2.5 mm 5 – 6 GHz: ≤ 2 mm
	grid	∆z <sub>Zoom</sub> (n>1): between subsequent points	≤ 1.5·Δ:	z <sub>Zoom</sub> (n-1)
Minimum zoom scan volume	x, y, z		≥ 30 mm	3 – 4 GHz: ≥ 28 mm 4 – 5 GHz: ≥ 25 mm 5 – 6 GHz: ≥ 22 mm

When zoom scan is required and the <u>reported</u> SAR from the <u>area scan based 1-g</u> SAR estimation 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.

Table 9: SAR Area and Zoom Scan Resolutions



Product Name: GoTenna MESH Gotenna MESH Report Number: 103030302LEX-002

### 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 DASY5, 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 DASY5 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.



Product Name: GoTenna MESH Gotenna MESH Report Number: 103030302LEX-002

### 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.



Product Name: GoTenna MESH Gotenna MESH Report Number: 103030302LEX-002

## 6.0 CRITERIA

The following FCC limits for SAR apply to portable devices operating in the General Population/Uncontrolled Exposure environment:

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

### 7.0 TEST CONFIGURATION

The GoTenna MESH could be mounted via a lanyard to a backpack, belt loop, or other attachment point. Therefore it was tested for body mode exposure with a 5mm spacing to the SAR phantom. It could also be used whilst being held in the users hand. Therefore SAR scans were also performed with it in direct contact with the phantom for extremity exposure conditions.

According to the manufacturer, the actual feature code's Tx duty cycle is limited to 45% when measured across entire 902 to 928 MHz spectrum. Therefore the measured SAR values were adjusted by a factor of 0.45 to account for the low transmission duty cycle.



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Evaluation For: GoTenna

Product Name: GoTenna MESH Gotenna MESH Report Number: 103030302LEX-002



Test Setup (5mm spacing)



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Evaluation For: GoTenna

Product Name: GoTenna MESH Gotenna MESH Report Number: 103030302LEX-002



Test Setup (Direct Contact)



### 8.0 TEST RESULTS

Product Name: GoTenna MESH Gotenna MESH Report Number: 103030302LEX-002

The results on the following page(s) were obtained when the device was transmitting at maximum output power. Detailed measurement data and plots, which reveal information about the location of the maximum SAR with respect to the device, are referenced are shown in separate exhibits presented with this application. The measured conducted output power was compared to the power declared by the manufacturer and used for scaling the measured SAR values.

The device was evaluated according to the specific requirements found in FCC KDB 447498[9]. The worst case 1-g SAR value was less than the 1.6W/kg limit.

#### Standalone SAR Measurements

		US / Canada Body SAR Results Using 900MHz MSL.										
Date 6/6/2017 6/6/2017 6/6/2017	<b>TX Mode</b> 915MHz, Mesh 915MHz, Mesh 915MHz, Mesh	Spacing Direct Direct Direct	Position Label Side LED Side Blank Edge	Power Drift (dB) 0.04 0.03 -0.16	Measured SAR 10g (W/kg) 1.4600 1.8100 1.4700	Reported SAR 10g (W/kg) 0.7881 0.9770 0.7935	Duty Cycle Adjustment 0.4500 0.4500 0.4500	Measured Conducted Output Power (dBm) 29.21 29.21 29.21	Maximum Conducted Output Power (dBm) 30.00 30.00 30.00			
6/6/2017	915MHz, Mesh	Direct	USB Edge	-0.14	1.4500	0.7827	0.4500	29.21	30.00			
			10g SAR	Limit (Extrem	ity) = 4W/kg	5						
			US / Cana	do Pody SAD I	Doculto Usino	- 000MH2 MS						
-		[		ua bouy SAK I	cesuits Using	g 900MHZ M31	L.	Measured				
Date	TX Mode	Spacing	Position	Power Drift	Measured SAR 10g (W/kg)	Reported SAR 10g (W/kg)	Duty Cycle	Conducted Output Power (dBm)	Maximum Conducted Output Power (dBm)			
6/6/2017	902 5MHz Mesh	Direct	Label Side	-0.14	1 2800	0.7699	0.4500	28.74	30.00			
6/6/2017	902.5MHz, Mesh	Direct	LED Side	-0.08	1.5700	0.9443	0.4500	28.74	30.00			
6/6/2017	902.5MHz, Mesh	Direct	Blank Edge	0.04	1.5000	0.9022	0.4500	28.74	30.00			
6/6/2017	902.5MHz, Mesh	Direct	USB Edge	-0.02	1.3100	0.7879	0.4500	28.74	30.00			
	· · · · · ·	L	10g SAR	Limit (Extrem	ity) = 4W/kg							
			US / Cana	da Body SAR I	Results Using	g 900MHz MS	L.					
Data	TV Mode	Specing	Position	Power Drift	Measured SAR 10g	Reported SAR 10g	Duty Cycle	Measured Conducted Output Power (dBm)	Maximum Conducted Output Bowon (dRm)			
6/8/2017	027 5MHz Mash	Direct	Label Side	(uB) 0.10	(W/Kg)	(W/Kg)	0 4500	20.44	20.00			
6/8/2017	927 5MHz Mesh	Direct	Label Side	-0.10	2.0600	1.0546	0.4500	29.44	30.00			
6/8/2017	927 5MHz Mech	Direct	Blank Edge	-0.02	1.6300	0.8344	0.4500	29.44	30.00			
6/8/2017	927 5MHz Mesh	Direct	USB Edge	-0.03	1.5900	0.8140	0.4500	29.44	30.00			
5/0/2017	27.5 mill, mesh	Ditter		Limit (Extrom	$(it_{\rm W}) = 4W/k_{\rm C}$		0.4500	27.77	50.00			

Table 10: Extremity SAR Results



Product Name: GoTenna MESH Gotenna MESH Report Number: 103030302LEX-002

			US / Cana	da Body SAR I	Results Using	g 900MHz MS	L.			
Date	TX Mode	Spacing	Position	Power Drift (dB)	Measured SAR 1g (W/kg)	Reported SAR 1g (W/kg)	Duty Cycle Adjustment	Measured Conducted Output Power (dBm)	Maximum Conducted Output Power (dBm)	
6/13/2017	915MHz, Mesh	5mm		-0.15	1.4200	0.7005	0.4500	29.21	30.00	
6/13/2017	915MHz, Mesh	5mm	LED Side	-0.18	1.9400	1.0472	0.4500	29.21	30.00	
6/13/2017	915MHz, Mesh	5mm	Blank Edge	0.13	1.5100	0.8151	0.4500	29.21	30.00	
6/13/2017	915MHz, Mesh	5mm	USB Edge	0.02	1.7000	0.9170	0.4500	29.21	30.00	
	1g SAR Limit (Head & Body) = 1.6W/kg									
	US / Canada Body SAR Results Using 900MHz MSL.									
Date	TX Mode	Spacing	Position	Power Drift (dB)	Measured SAR 1g (W/kg)	Reported SAR 1g (W/kg)	Duty Cycle	Measured Conducted Output Power (dBm)	Maximum Conducted Output Power (dBm)	
6/13/2017	002 5MHz Mesh	5 pacing	Label Side	0.26	1 4000	0 8421	0.4500	(ubiii) 28.74	30.00	
6/13/2017	902.5MHz, Mesh	5mm	LED Side	-0.20	1,4000	1 1608	0.4500	28.74	30.00	
6/13/2017	902.5MHz, Mesh	5mm	Blank Edge	-0.33	1.5500	0.9383	0.4500	28.74	30.00	
6/13/2017	902.5MHz, Mesh	5mm	USB Edge	-0.11	1.5300	0.9202	0.4500	28.74	30.00	
0/15/2017	902.5 MILL, Mesh	511111	1g SAR Li	mit (Head & B	(1.5500)	ko	0.4500	20.74	50.00	
					(uj) = 110 (())					
			US / Cana	da Body SAR I	Results Using	g 900MHz MS	L.	-		
Date	TX Mode	Spacing	Position	Power Drift (dB)	Measured SAR 1g (W/kg)	Reported SAR 1g (W/kg)	Duty Cycle Adjustment	Measured Conducted Output Power (dBm)	Maximum Conducted Output Power (dBm)	
6/13/2017	927.5MHz, Mesh	5mm	Label Side	-0.13	1.8600	0.9522	0.4500	29.44	30.00	
6/13/2017	927.5MHz, Mesh	5mm	LED Side	-0.08	2.5100	1.2850	0.4500	29.44	30.00	
6/13/2017	927.5MHz, Mesh	5mm	Blank Edge	-0.05	1.7700	0.9061	0.4500	29.44	30.00	
6/13/2017	927.5MHz, Mesh	5mm	USB Edge	-0.12	1.8300	0.9368	0.4500	29.44	30.00	
				Repeated W	Vorst Case Sca	n				
6/13/2017	927.5MHz, Mesh	5mm	LED Side	-0.14	2.4900	1.2747	0.4500	29.44	30.00	
				Second Repea	t Wost Case S	Scan				
6/13/2017	927.5MHz, Mesh	5mm	LED Side	0.15	2.1000	1.0751	0.4500	29.44	30.00	
		-	1a SAD L	mit (Hood & P	(dv) = 1.6W/	ka	-	-		

Table 11: Body Worn SAR Results



Product Name: GoTenna MESH Gotenna MESH Report Number: 103030302LEX-002

# **Conducted Output Power Measurements:**

Mode	Frequency (MHz)	Power (dBm)	Power (W)
Mesh	902.5	28.74	0.748W
Mesh	915.0	29.21	0.834W
Mesh	927.5	29.44	0.879W

 Table 12: Conducted Power Measurements

Mode	Frequency (MHz)	Power (dBm)	Power (mW)
Bluetooth	2402	-1.99	0.633mW
Bluetooth	2440	-2.06	0.623mW
Bluetooth	2480	-1.57	0.697mW

\*Note that the Bluetooth radio is exempt from SAR testing due to the low output power

 Table 13: Conducted Power Measurements (Bluetooth)



Product Name: GoTenna MESH Gotenna MESH Report Number: 103030302LEX-002

#### Simultaneous Transmission Calculations:

The Bluetooth and mesh network radio can transmit simultaneously. The FCC exemption threshold for 2.45GHz radios with less than 5mm separation distance to the user is 10mW. The RSS-102 exemption threshold for 2.45GHz is 4mW. The maximum output power measured for Bluetooth was 0.697mW, well under both exclusion thresholds.

In order to consider the simultaneous transmission for Bluetooth and Mesh together, the Bluetooth SAR must be estimated per 4.3.2b (KDB447498) using the following formula:

[(max. power of channel, including tune-up tolerance, mW) / (min. test separation distance, mm)]·[ $\sqrt{f(GHz)/x}$ ] W/kg, for test separation distances  $\leq$  50 mm; where x = 7.5 for 1-g SAR and x = 18.75 for 10-g SAR

- Max power: 0.7mW
- Min separation distance: 0mm (5mm used in calculation)
- f(GHz): 2.402

The maximum estimated Bluetooth SAR for this device is 0.03W/kg using the values above.

Per 4.3.2 of KDB447498, when the sum of all the simultaneous transmitting SAR values is less than the stand alone SAR limit then simultaneous transmission SAR exclusion applies. For this product, the worst case mesh network SAR (1.285W/kg) summed with the worst case estimated Bluetooth SAR (0.03W/kg) is less than the standalone SAR limit. Therefore simultaneous SAR is excluded.

(1.285 + 0.03)W/kg) = 1.315W/kg



Product Name: GoTenna MESH Gotenna MESH Report Number: 103030302LEX-002

### 9.0 REFERENCES

- [1] ANSI, ANSI/IEEE C95.1-1991: IEEE Standard for Safety Levels with Respect to Human Exposure to Radio Frequency Electromagnetic Fields, 3kHz to 300 GHz, The Institute of electrical and Electronics Engineers, Inc., New York, NY 10017, 1992
- [2] Federal Communications Commission, "Evaluating Compliance with FCC Guidelines for Human Exposure to Radiofrequency Electromagnetic Fields", Supplement C (Edition 01-01) to OET Bulletin 65 (Edition 97-01), FCC, Washington, D.C. 20554, 1997
- [3] Thomas Schmid, Oliver Egger, and Niels Kuster, "Automated E-field scanning system for dosimetric assessments", *IEEE Transaction on Microwave Theory and Techniques*, vol. 44, pp. 105-113, Jan. 1996.
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- [7] Federal Communications Commission, KDG 248227 "SAR Measurement Procedures for 802.11 a/b/g Transmitters"
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- [11] Federal Communications Commission, KDB 450824 "SAR Probe Calibration and System Verification Considerations for Measurements at 150MHz 3GHz".
- [12] Federal Communications Commission, KDB 865664 "SAR Measurement Requirements for 3-6GHz".
- [13] Federal Communications Commission, KDB 941225 "SAR Measurement Procedures for 3G Devices".

[14] ANSI, ANSI/IEEE C63.10-2009: American National Standard for Testing Unlicensed Wireless Devices.



Product Name: GoTenna MESH Gotenna MESH Report Number: 103030302LEX-002

# **APPENDIX B – 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.

				Probe Calib	Probe Calibration Point		Dielectric Properties		W Validation	ı	Modulation Validation		
Frequency	_	Probe	Probe	Frequency	Eluid Tons	_		Constitution	Probe	Probe	Mad Tons	Duty	
(MHz)	Date	(SN#)	(Model #)	(IVIHZ)	Fiuld Type	σ	ε <sub>r</sub>	Sensitivity	Linearity	isotropy	woa. Type	Factor	PAR
2450	1/13/2017	3516	EX3DV3	2450	Body	50.65	2.02	Pass	Pass	Pass	OFDM	N/A	Pass
5200	1/13/2017	3516	EX3DV3	5200	Body	48.71	5.54	Pass	Pass	Pass	OFDM	N/A	Pass
5500	1/13/2017	3516	EX3DV3	5500	Body	47.68	6.29	Pass	Pass	Pass	OFDM	N/A	Pass
5800	1/13/2017	3516	EX3DV3	5800	Body	48.71	5.54	Pass	Pass	Pass	OFDM	N/A	Pass

				Probe Calib	Probe Calibration Point Dielectric Properties		C	W Validation	1	Modulation Validation			
Frequency		Probe	Probe	Frequency					Probe	Probe		Duty	
(MHz)	Date	(SN#)	(Model #)	(MHz)	Fluid Type	σ	ε <sub>r</sub>	Sensitivity	Linearity	Isotropy	Mod. Type	Factor	PAR
835	1/14/2017	3516	EX3DV3	835	Body	54.2	0.98	Pass	Pass	Pass	GMSK	Pass	N/A
900	1/14/2017	3516	EX3DV3	900	Body	54	1.02	Pass	Pass	Pass	GMSK	Pass	N/A
1750	1/14/2017	3516	EX3DV3	1800	Body	52.9	1.41	Pass	Pass	Pass	GMSK	Pass	N/A
1900	1/14/2017	3516	EX3DV3	1900	Body	52.7	1.48	Pass	Pass	Pass	GMSK	Pass	N/A

Table 14: SAR System Validation Summary



Product Name: GoTenna MESH Gotenna MESH Report Number: 103030302LEX-002

# **APPENDIX B – WORST CASE SAR PLOTS**

### PLOT 1: Worst Case Extremity Exposure SAR

Date/Time: 6/8/2017 9:39:52 AM

Test Laboratory: Intertek File Name: <u>SAR\_NA\_New Duty Cycle\_High Channel.da52:4</u>

### SAR\_NA\_New Duty Cycle\_High Channel

Procedure Notes:

#### DUT: Gotenna;

Communication System: UID 0, CW (0); Communication System Band: D900 (900.0 MHz); Frequency: 900 MHz;Duty Cycle: 1:1

Medium parameters used: f = 900 MHz;  $\sigma$  = 1.02 S/m;  $\epsilon_r$  = 57.98;  $\rho$  = 1000 kg/m<sup>3</sup>

Phantom section: Flat Section Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2007)

DASY5 Configuration:

- Probe: EX3DV3 SN3516; ConvF(10.87, 10.87, 10.87); Calibrated: 10/26/2016;
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn358; Calibrated: 10/19/2016
- 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/High Channel LED Side\_Direct Contact/Area Scan 2 (6x8x1): Measurement grid: dx=15mm, dy=15mm Maximum value of SAR (measured) = 4.43 W/kg

WWAN Flat-Section MSL Testing/High Channel LED Side\_Direct Contact/Zoom Scan (9x8x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm Reference Value = 57.079 V/m; Power Drift = -0.02 dB Peak SAR (extrapolated) = 5.51 W/kg SAR(1 g) = 3.22 W/kg; SAR(10 g) = 2.06 W/kg Maximum value of SAR (measured) = 5.14 W/kg



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Evaluation For: GoTenna

Product Name: GoTenna MESH Gotenna MESH Report Number: 103030302LEX-002





731 Enterprise Drive, Lexington KY 40510

Product Name: GoTenna MESH Gotenna MESH Report Number: 103030302LEX-002

### PLOT 2: Worst Case Body Exposure SAR

Date/Time: 6/13/2017 8:04:47 AM

Test Laboratory: Intertek File Name: <u>5mm spacing\_SAR\_NA\_New Duty Cycle\_High Channel.da52:4</u>

### 5mm spacing\_SAR\_NA\_New Duty Cycle\_High Channel

Procedure Notes:

#### DUT: Gotenna;

Communication System: UID 0, CW (0); Communication System Band: D900 (900.0 MHz); Frequency: 900 MHz;Duty Cycle: 1:1

Medium parameters used: f = 900 MHz;  $\sigma$  = 1.02 S/m;  $\varepsilon_r$  = 57.98;  $\rho$  = 1000 kg/m<sup>3</sup>

Phantom section: Flat Section Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2007)

DASY5 Configuration:

- Probe: EX3DV3 SN3516; ConvF(10.87, 10.87, 10.87); Calibrated: 10/26/2016;
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn358; Calibrated: 10/19/2016
- 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/High Channel LED Side\_5mm spacing/Area Scan 2 (6x8x1): Measurement grid: dx=15mm, dy=15mm Maximum value of SAR (measured) = 3.67 W/kg

WWAN Flat-Section MSL Testing/High Channel LED Side\_5mm spacing/Zoom Scan (9x8x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm Reference Value = 61.352 V/m; Power Drift = -0.09 dB Peak SAR (extrapolated) = 5.08 W/kg SAR(1 g) = 2.51 W/kg; SAR(10 g) = 1.68 W/kg Maximum value of SAR (measured) = 3.96 W/kg







### **APPENDIX C – DIPOLE SAR PLOTS**

Product Name: GoTenna MESH Gotenna MESH Report Number: 103030302LEX-002

Date/Time: 6/6/2017 10:46:59 AM

Test Laboratory: Intertek File Name: <u>dipole\_900mhz.da52:0</u>

### dipole\_900mhz

Procedure Notes: Ambient Temp: 22.8C, Fluid Temp: 22.2C

#### DUT: Dipole 900 MHz D900V2; Serial: D900V2 - SN:xxx

Communication System: UID 0, CW (0); Communication System Band: D900 (900.0 MHz); Frequency: 900 MHz;Duty Cycle: 1:1

Medium parameters used: f = 900 MHz;  $\sigma$  = 1.02 S/m;  $\epsilon_r$  = 57.98;  $\rho$  = 1000 kg/m<sup>3</sup>

Phantom section: Flat Section Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2007)

DASY5 Configuration:

- Probe: EX3DV3 SN3516; ConvF(10.87, 10.87, 10.87); Calibrated: 10/26/2016;
- Sensor-Surface: 2mm (Mechanical Surface Detection), Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn358; Calibrated: 10/19/2016
- Phantom: SAM 2 with CRP v5.0; Type: QD000P40CD; Serial: TP:1663
- DASY52 52.8.7(1137); SEMCAD X 14.6.10(7164)

System Performance Check at Frequencies below 1 GHz/d=15mm, Pin=100 mW, dist=2.0mm (EX-Probe)/Area Scan (31x121x1): Interpolated grid: dx=1.500 mm, dy=1.500 mm Maximum value of SAR (interpolated) = 0.136 W/kg

System Performance Check at Frequencies below 1 GHz/d=15mm, Pin=100 mW, dist=2.0mm (EX-Probe)/Zoom Scan (7x7x7) (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm Reference Value = 11.822 V/m; Power Drift = -0.00 dB Peak SAR (extrapolated) = 16.4 W/kg SAR(1 g) = 11 W/kg; SAR(10 g) = 7.2 W/kg Normalized to target power = 1 W and actual power = 0.01 W Maximum value of SAR (measured) = 11.8 W/kg







Product Name: GoTenna MESH Gotenna MESH Report Number: 103030302LEX-002

Date/Time: 6/8/2017 9:52:53 AM

Test Laboratory: Intertek File Name: <u>dipole\_900mhz.da52:0</u>

## dipole\_900mhz

Procedure Notes: Ambient Temp: 22.8C, Fluid Temp: 22.2C

#### DUT: Dipole 900 MHz D900V2; Serial: D900V2 - SN:xxx

Communication System: UID 0, CW (0); Communication System Band: D900 (900.0 MHz); Frequency: 900 MHz;Duty Cycle: 1:1

Medium parameters used: f = 900 MHz;  $\sigma$  = 1.02 S/m;  $\epsilon_r$  = 57.98;  $\rho$  = 1000 kg/m<sup>3</sup>

Phantom section: Flat Section Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2007)

DASY5 Configuration:

- Probe: EX3DV3 SN3516; ConvF(10.87, 10.87, 10.87); Calibrated: 10/26/2016;
- Sensor-Surface: 2mm (Mechanical Surface Detection), Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn358; Calibrated: 10/19/2016
- Phantom: SAM 2 with CRP v5.0; Type: QD000P40CD; Serial: TP:1663
- DASY52 52.8.7(1137); SEMCAD X 14.6.10(7164)

System Performance Check at Frequencies below 1 GHz/d=15mm, Pin=100 mW, dist=2.0mm (EX-Probe) 2/Area Scan (4x13x1): Measurement grid: dx=15mm, dy=15mm Maximum value of SAR (measured) = 0.122 W/kg

System Performance Check at Frequencies below 1 GHz/d=15mm, Pin=100 mW, dist=2.0mm (EX-Probe) 2/Zoom Scan (7x7x7) (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm Reference Value = 11.205 V/m; Power Drift = 0.06 dB Peak SAR (extrapolated) = 15.4 W/kg SAR(1 g) = 10.3 W/kg; SAR(10 g) = 6.69 W/kg Normalized to target power = 1 W and actual power = 0.01 W Maximum value of SAR (measured) = 11.1 W/kg







Product Name: GoTenna MESH Gotenna MESH Report Number: 103030302LEX-002

Date/Time: 6/13/2017 10:46:59 AM

Test Laboratory: Intertek File Name: <u>dipole\_900mhz.da52:0</u>

## dipole\_900mhz

Procedure Notes: Ambient Temp: 22.8C, Fluid Temp: 22.2C

#### DUT: Dipole 900 MHz D900V2; Serial: D900V2 - SN:xxx

Communication System: UID 0, CW (0); Communication System Band: D900 (900.0 MHz); Frequency: 900 MHz;Duty Cycle: 1:1

Medium parameters used: f = 900 MHz;  $\sigma$  = 1.02 S/m;  $\epsilon_r$  = 57.98;  $\rho$  = 1000 kg/m<sup>3</sup>

Phantom section: Flat Section Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2007)

DASY5 Configuration:

- Probe: EX3DV3 SN3516; ConvF(10.87, 10.87, 10.87); Calibrated: 10/26/2016;
- Sensor-Surface: 2mm (Mechanical Surface Detection), Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn358; Calibrated: 10/19/2016
- Phantom: SAM 2 with CRP v5.0; Type: QD000P40CD; Serial: TP:1663
- DASY52 52.8.7(1137); SEMCAD X 14.6.10(7164)

System Performance Check at Frequencies below 1 GHz/d=15mm, Pin=100 mW, dist=2.0mm (EX-Probe) 2 2/Area Scan (31x121x1): Interpolated grid: dx=1.500 mm, dy=1.500 mm Maximum value of SAR (interpolated) = 0.145 W/kg

System Performance Check at Frequencies below 1 GHz/d=15mm, Pin=100 mW, dist=2.0mm (EX-Probe) 2 2/Zoom Scan (7x7x7) (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm Reference Value = 12.261 V/m; Power Drift = -0.07 dB Peak SAR (extrapolated) = 17.5 W/kg SAR(1 g) = 11.7 W/kg; SAR(10 g) = 7.66 W/kg Normalized to target power = 1 W and actual power = 0.01 W Maximum value of SAR (measured) = 12.6 W/kg



