

TEST REPORT

**ACCORDING TO: FCC 47CFR part 15 subpart C § 15.247(DTS) and subpart B;
RSS-247 issue 1, RSS-Gen issue 4 section 7**

FOR:
Pixie Technology Ltd.
Thin Point
Model:P1100
FCC ID:2ADBO-P1100

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1 Applicant information

Client name: Pixie Technology Ltd.
Address: 8 Hamada street, Bld. B, 3rd floor, Herzliya 46733, Israel
Telephone: +972 77 921 5815
Fax: +972 77 921 5833
E-mail: tsachs@getpixie.com
Contact name: Mr. Tsach Shwartz

2 Equipment under test attributes

Product name: Thin Point
Product type: Transceiver
Model(s): P1100
Serial number: Prototype
Hardware version: 1
Software release: 001
Receipt date 31-Jul-16

3 Manufacturer information

Manufacturer name: Pixie Technology Ltd.
Address: 8 Hamada street, Bld. B, 3rd floor, Herzliya 46733, Israel
Telephone: +972 77 921 5815
Fax: +972 77 921 5833
E-Mail: tsachs@getpixie.com
Contact name: Mr. Tsach Shwartz

4 Test details

Project ID: 28663
Location: Hermon Laboratories Ltd. Harakevet Industrial Zone, Binyamina 30500, Israel
Test started: 31-Jul-16
Test completed: 28-Aug-16
Test specification(s): FCC Part 15 subpart C §15.247 (DTS), subpart B §15.109;
RSS-247 issue 1, RSS-Gen issue 4 section 7, ICES-003 issue 6:2016



5 Tests summary

Test	Status
Transmitter characteristics	
FCC Section 15.247(a)2 / RSS-247 section 5.2(1), 6 dB bandwidth	Pass
FCC Section 15.247(b)3/ RSS-247 section 5.4(4), Peak output power	Pass
FCC section 15.247(i) / RSS-102 section 2.5.1, RF exposure	Pass, the exhibit to the application of certification is provided
FCC Section 15.247(d) / RSS-247 section 5.5, Radiated spurious emissions	Pass
FCC Section 15.247(d)/ RSS-247 section 5.5, Emissions at band edges	Pass
FCC Section 15.247(e) / RSS-247 section 5.2(2), Peak power density	Pass
FCC section 15.203 / RSS-Gen section 8.3, Antenna requirement	Pass
FCC section 15.207(a) / RSS-Gen section 8.8, Conducted emission	Not required
Unintentional emissions	
FCC section 15.107/ RSS-Gen section 8.8, Conducted emission at AC power port	Not required
FCC section 15.109, RSS-Gen section 7, Radiated emission	Pass

Testing was completed against all relevant requirements of the test standard. The results obtained indicate that the product under test complies in full with the requirements tested.

The test results relate only to the items tested. Pass/ fail decision was based on nominal values.

This test report supersedes the previously issued test report identified by Doc ID:PIXRAD_FCC.28663_BLE.

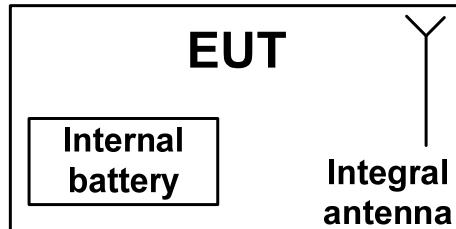
	Name and Title	Date	Signature
Tested by:	Mrs. E. Pitt, test engineer	August 28, 2016	
Reviewed by:	Mrs. M. Cherniavsky, certification engineer	September 1, 2016	
Approved by:	Mr. M. Nikishin, EMC and Radio group manager	April 2, 2017	

6 EUT description

6.1 General information

The EUT, ThinPoint tag, is a very low power wireless device utilizing 2 wireless technologies: BLE (Bluetooth) to communicate with smartphones and UWB to measure distance between the tags. The tag is working in very low duty cycle. Most of the time the tag is advertising (sends BLE standard "existing" message). Advertise is done every 2 sec for 3 msec. The UWB radio is set to deep sleep. Once the smartphone responses the tag can communicate with the smartphone and via smartphone can communicate with other similar tags and measure Tag to Tag range using the UWB radio. The UWB radio is active for minimal time that is needed for range measurement – about 2 -3 msec. After the measurement sequence, the UWB is set to deep sleep again. The BLE (Bluetooth) and UWB radio do not work at the same time. There is one built-in antenna for UWB and BLE.

6.2 Test configuration



6.3 Changes made in EUT

No changes were performed in the EUT during testing.



6.4 Transmitter characteristics

Type of equipment							
<input checked="" type="checkbox"/> V	Stand-alone (Equipment with or without its own control provisions)						
	Combined equipment (Equipment where the radio part is fully integrated within another type of equipment)						
	Plug-in card (Equipment intended for a variety of host systems)						
Assigned frequency range		2400 -2483.5 MHz					
Operating frequencies		2402-2478 MHz					
Maximum rated output power		Peak output power 8.9 dBm					
Is transmitter output power variable?		<input checked="" type="checkbox"/> V	No	continuous variable			
			<input checked="" type="checkbox"/> Yes	stepped variable with stepsize	dB		
				minimum RF power	dBm		
				maximum RF power	dBm		
Antenna connection							
unique coupling	standard connector	<input checked="" type="checkbox"/> V	Integral	with temporary RF connector			
		<input checked="" type="checkbox"/> V		without temporary RF connector			
Antenna/s technical characteristics							
Type	Manufacturer	Model number		Gain			
Internal Printed Omni	Pixie	P1100		0 dBi			
Transmitter aggregate data rate/s		1 Mbps					
Type of modulation		GFSK					
Modulating test signal (baseband)		PRBS					
Transmitter power source							
<input checked="" type="checkbox"/> V	Battery	Nominal rated voltage	3.0 V	Battery type	Lithium Manganese Dioxide		
	DC	Nominal rated voltage					
	AC mains	Nominal rated voltage		Frequency	Hz		



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Test specification: Section 15.247(a)2 / RSS-247 section 5.2(1), 6 dB bandwidth		
Test procedure: ANSI C63.10 section 11.8.1		
Test mode: Compliance		Verdict: PASS
Date(s): 31-Jul-16 - 14-Aug-16		
Temperature: 23 °C	Relative Humidity: 55 %	Air Pressure: 1005 hPa
Remarks:		

7 Transmitter tests according to 47CFR part 15 subpart C and RSS-247 requirements

7.1 Minimum 6 dB bandwidth

7.1.1 General

This test was performed to measure 6 dB bandwidth of the EUT carrier frequency. Specification test limits are given in Table 7.1.1.

Table 7.1.1 The 6 dB bandwidth limits

Assigned frequency, MHz	Modulation envelope reference points*, dBc	Minimum bandwidth, kHz
2400.0 – 2483.5	6.0	500.0

* - Modulation envelope reference points provided in terms of attenuation below the peak of modulated carrier.

7.1.2 Test procedure

- 7.1.2.1 The EUT was set up as shown in Figure 7.1.1, energized and its proper operation was checked.
- 7.1.2.2 The EUT was set to transmit modulated carrier.
- 7.1.2.3 The transmitter minimum 6 dB bandwidth was measured with spectrum analyzer as frequency delta between reference points on modulation envelope and provided in Table 7.1.2 and associated plot.

Figure 7.1.1 The 6 dB bandwidth test setup





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Test specification: Section 15.247(a)2 / RSS-247 section 5.2(1), 6 dB bandwidth				
Test procedure:	ANSI C63.10 section 11.8.1			
Test mode:	Compliance			
Date(s):	31-Jul-16 - 14-Aug-16		Verdict:	PASS
Temperature: 23 °C	Relative Humidity: 55 %	Air Pressure: 1005 hPa		Power: Battery
Remarks:				

Table 7.1.2 The 6 dB bandwidth test results

ASSIGNED FREQUENCY BAND: 2400-2483.5 MHz
DETECTOR USED: Peak
RESOLUTION BANDWIDTH: 100 kHz
VIDEO BANDWIDTH: 300 kHz
MODULATION: GFSK
BIT RATE: 1 Mbps

Carrier frequency, MHz	6 dB bandwidth, kHz	Limit, kHz	Margin, kHz	Verdict
2402	708.241	500	208.241	Pass
2440	712.659	500	212.659	Pass
2478	714.835	500	214.835	Pass

Carrier frequency, MHz	99% bandwidth, kHz	Limit, kHz	Margin, kHz	Verdict
2402	1067.2	500	567.2	Pass
2440	1074.4	500	574.4	Pass
2478	1073.2	500	573.2	Pass

- Margin, kHz = Occupied bandwidth, kHz - Limit, kHz

Reference numbers of test equipment used

HL 2909	HL 3818	HL 3903					
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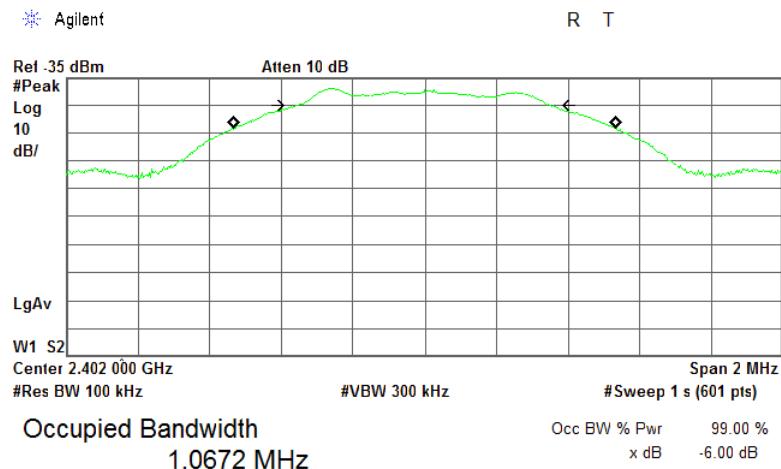
Full description is given in Appendix A.



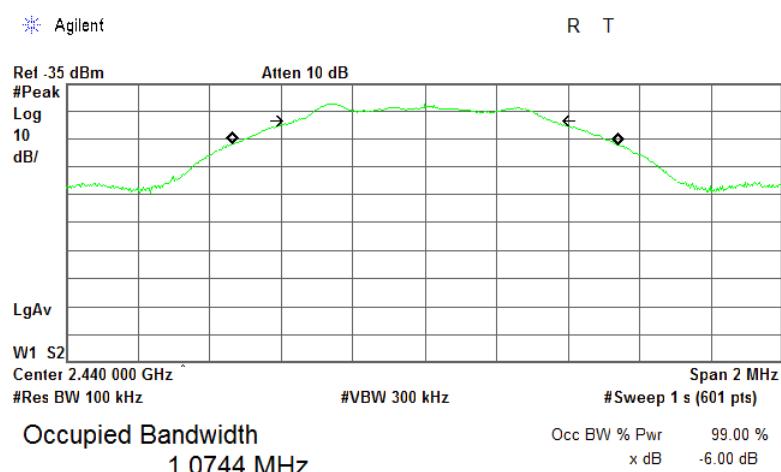
HERMON LABORATORIES

Test specification: Section 15.247(a)2 / RSS-247 section 5.2(1), 6 dB bandwidth		
Test procedure: ANSI C63.10 section 11.8.1		
Test mode: Compliance		Verdict: PASS
Date(s): 31-Jul-16 - 14-Aug-16		
Temperature: 23 °C	Relative Humidity: 55 %	Air Pressure: 1005 hPa
Remarks:		Power: Battery

Plot 7.1.1 The 6 dB bandwidth test result at low frequency



Plot 7.1.2 The 6 dB bandwidth test result at mid frequency

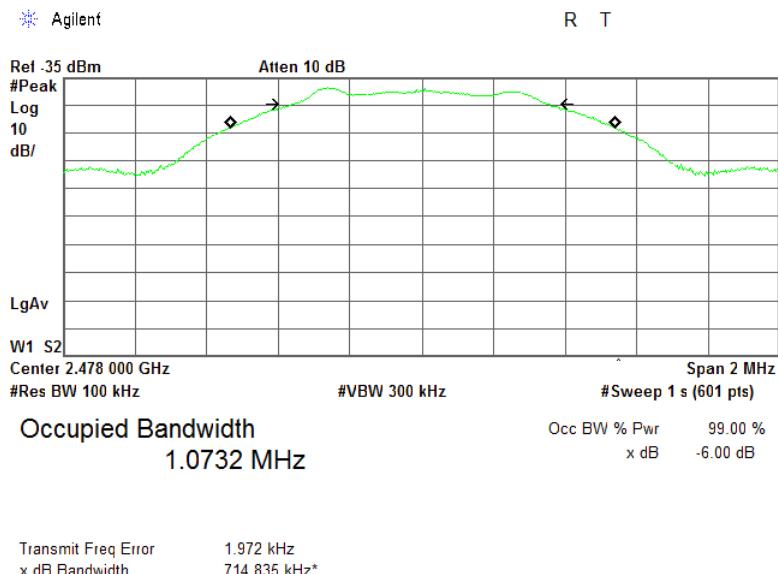




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Test specification: Section 15.247(a)2 / RSS-247 section 5.2(1), 6 dB bandwidth		
Test procedure: ANSI C63.10 section 11.8.1		
Test mode: Compliance		Verdict: PASS
Date(s): 31-Jul-16 - 14-Aug-16		
Temperature: 23 °C	Relative Humidity: 55 %	Air Pressure: 1005 hPa
Power: Battery		
Remarks:		

Plot 7.1.3 The 6 dB bandwidth test result at high frequency





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Test specification: Section 15.247(b)3 / RSS-247 section 5.4(4), Maximum output power		
Test procedure: ANSI C63.10 sections 11.9.2.2.4		
Test mode: Compliance		Verdict: PASS
Date(s): 31-Jul-16 - 14-Aug-16		
Temperature: 23 °C	Relative Humidity: 55 %	Air Pressure: 1005 hPa
Remarks:		

7.2 Peak output power

7.2.1 General

This test was performed to measure the maximum peak output power radiated by transmitter. Specification test limits are given in Table 7.2.1.

Table 7.2.1 Peak output power limits

Assigned frequency range, MHz	Maximum antenna gain, dBi	Peak output power*		Equivalent field strength limit @ 3m, dB(µV/m)**
		W	dBm	
2400.0 – 2483.5	6.0	1.0	30.0	131.2

*- The limit is provided in terms of conducted RF power at the antenna connector. If transmitting antennas of directional gain greater than 6 dBi are used, the peak output power limit shall be reduced below the stated value as follows:

by 1 dB for every 3 dB that the directional gain of antenna exceeds 6 dBi for fixed point-to-point transmitters operate in 2400-2483.5 MHz band;
without any corresponding reduction for fixed point-to-point transmitters operate in 5725-5850 MHz band;
by the amount in dB that the directional gain of antenna exceeds 6 dBi for the rest of transmitters.

**- Equivalent field strength limit was calculated from the peak output power as follows: $E = \sqrt{30 \times P \times G} / r$, where P is peak output power in Watts, r is antenna to EUT distance in meters and G is transmitter antenna gain in dBi.

7.2.2 Test procedure

- 7.2.2.1 The EUT was set up as shown in Figure 7.2.1, energized and its proper operation was checked.
- 7.2.2.2 The EUT was adjusted to produce maximum available to end user RF output power.
- 7.2.2.3 The resolution bandwidth of spectrum analyzer was set wider than 6 dB bandwidth of the EUT and the field strength of the EUT carrier frequency was measured with antenna connected to spectrum analyzer/ EMI receiver. To find maximum radiation the turntable was rotated 360° and the measuring antenna height was swept in both vertical and horizontal polarizations.
- 7.2.2.4 The maximum field strength of the EUT carrier frequency was measured as provided in Table 7.2.2 and associated plots.
- 7.2.2.5 The maximum peak output power was calculated from the field strength of carrier as follows:

$$P = (E \times d)^2 / (30 \times G),$$

where P is the peak output power in W, E is the field strength in V/m, d is the test distance and G is the transmitter numeric antenna gain over an isotropic radiator.

The above equation was converted in logarithmic units for 3 m test distance:

$$\text{Peak output power in dBm} = \text{Field strength in dB}(\mu\text{V}/\text{m}) - \text{Transmitter antenna gain in dBi} - 95.2 \text{ dB}$$

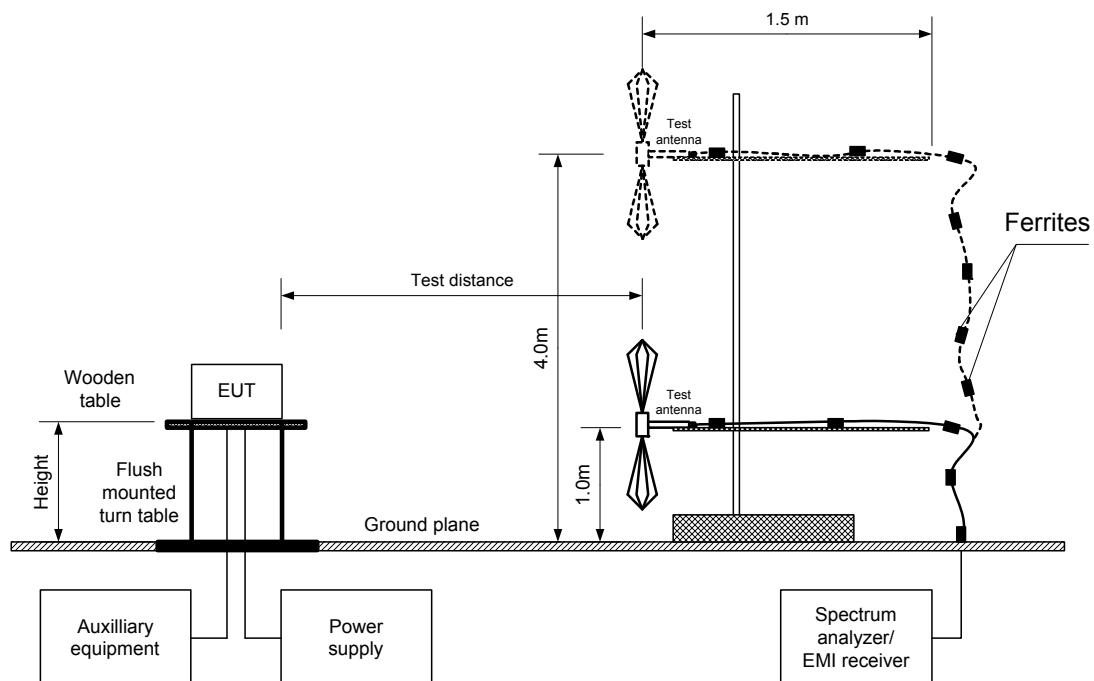
- 7.2.2.6 The worst test results (the lowest margins) were recorded in Table 7.2.2.



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Test specification: Section 15.247(b)3 / RSS-247 section 5.4(4), Maximum output power		
Test procedure: ANSI C63.10 sections 11.9.2.2.4		
Test mode: Compliance		Verdict: PASS
Date(s): 31-Jul-16 - 14-Aug-16		
Temperature: 23 °C	Relative Humidity: 55 %	Air Pressure: 1005 hPa
Power: Battery		
Remarks:		

Figure 7.2.1 Setup for carrier field strength measurements





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Test specification: Section 15.247(b)3 / RSS-247 section 5.4(4), Maximum output power		
Test procedure: ANSI C63.10 sections 11.9.2.2.4		
Test mode: Compliance		Verdict: PASS
Date(s):	31-Jul-16 - 14-Aug-16	
Temperature: 23 °C	Relative Humidity: 55 %	Air Pressure: 1005 hPa
Remarks:		

Table 7.2.2 Peak output power test results

ASSIGNED FREQUENCY: 2400-2483.5 MHz
 TEST DISTANCE: 3 m
 TEST SITE: OATS
 EUT HEIGHT: 1.5 m
 DETECTOR USED: Peak
 TEST ANTENNA TYPE: Double ridged guide
 MODULATION: GFSK
 BIT RATE: 1 Mbps
 DETECTOR USED: Peak
 EUT 6 dB BANDWIDTH: 714.8 kHz
 RESOLUTION BANDWIDTH: 1 MHz
 VIDEO BANDWIDTH: 3 MHz

Frequency, MHz	Field strength, dB(µV/m)	Antenna polarization	Antenna height, m	Azimuth, degrees*	EUT antenna gain, dBi	Peak output power, dBm**	Limit, dBm	Margin, dB***	Verdict
2402	102.90	Horizontal	1.7	30	0	7.70	30.00	-22.30	Pass
2440	103.21	Horizontal	1.9	60	0	8.01	30.00	-21.99	Pass
2478	104.08	Horizontal	1.8	60	0	8.88	30.00	-21.12	Pass

*- EUT front panel refer to 0 degrees position of turntable.

**- Peak output power was calculated from the field strength of carrier as follows: $P = (E \times d)^2 / (30 \times G)$, where P is the peak output power in W, E is the field strength in V/m, d is the test distance in meters and G is the transmitter numeric antenna gain over an isotropic radiator. The above equation was converted in logarithmic units for 3 m test distance: *Peak output power in dBm = Field strength in dB(µV/m) - Transmitter antenna gain in dBi - 95.2 dB*

***- Margin = Peak output power – specification limit.

Reference numbers of test equipment used

HL 0521	HL 1984	HL 4278	HL 4353				
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Full description is given in Appendix A.



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Test specification: Section 15.247(b)3 / RSS-247 section 5.4(4), Maximum output power		
Test procedure: ANSI C63.10 sections 11.9.2.2.4		
Test mode: Compliance		Verdict: PASS
Date(s): 31-Jul-16 - 14-Aug-16		
Temperature: 23 °C	Relative Humidity: 55 %	Air Pressure: 1005 hPa
Remarks:		

Plot 7.2.1 Field strength of carrier at low frequency

TEST SITE:

OATS

TEST DISTANCE:

3 m

ANTENNA POLARIZATION:

Horizontal

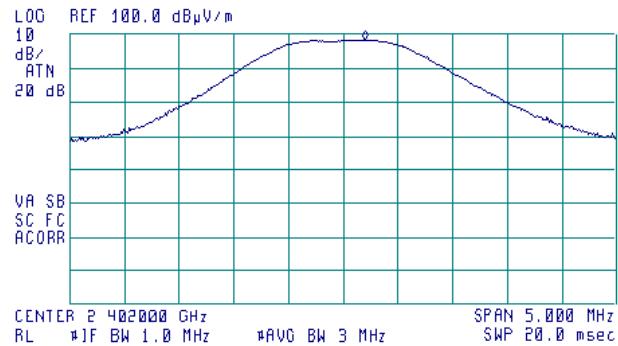
Vertical

X-axis

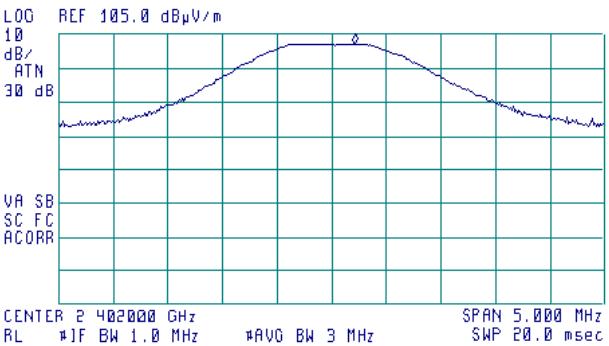
EUT PLANE



ACTV DET: PEAK
MEAS DET: PEAK OP AVG
MKR 2.402200 GHz
98.35 dB μ V/m



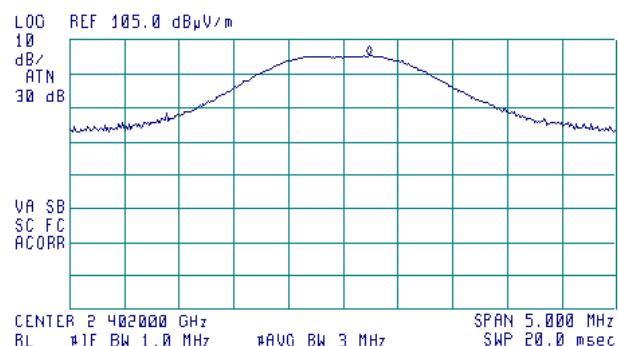
ACTV DET: PEAK
MEAS DET: PEAK OP AVG
MKR 2.402213 GHz
102.00 dB μ V/m



EUT PLANE



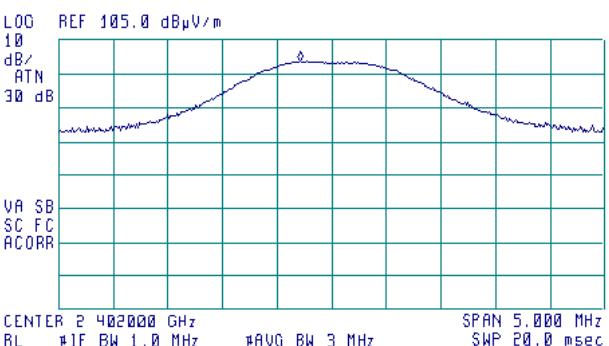
ACTV DET: PEAK
MEAS DET: PEAK OP AVG
MKR 2.402238 GHz
100.36 dB μ V/m



Y-axis



ACTV DET: PEAK
MEAS DET: PEAK OP AVG
MKR 2.401713 GHz
98.56 dB μ V/m





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Test specification: Section 15.247(b)3 / RSS-247 section 5.4(4), Maximum output power		
Test procedure: ANSI C63.10 sections 11.9.2.2.4		
Test mode: Compliance		Verdict: PASS
Date(s): 31-Jul-16 - 14-Aug-16		
Temperature: 23 °C	Relative Humidity: 55 %	Air Pressure: 1005 hPa
Remarks:		

Plot 7.2.2 Field strength of carrier at low frequency

TEST SITE:

OATS

TEST DISTANCE:

3 m

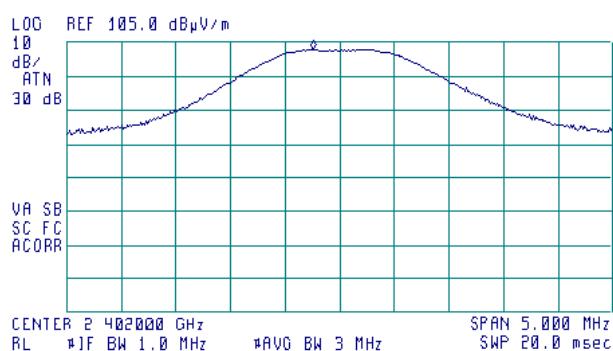
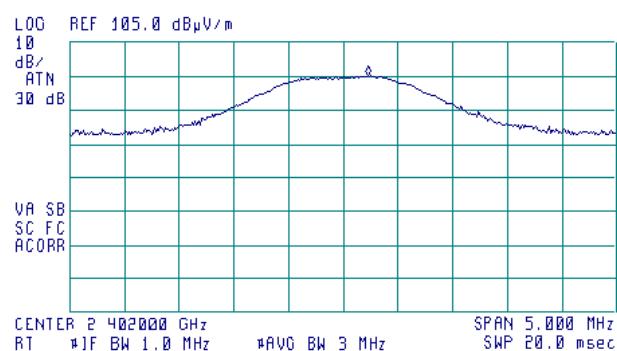
ANTENNA POLARIZATION:

Horizontal

Vertical

EUT PLANE

Z-axis

**Plot 7.2.3 Field strength of carrier at mid frequency**

TEST SITE:

OATS

TEST DISTANCE:

3 m

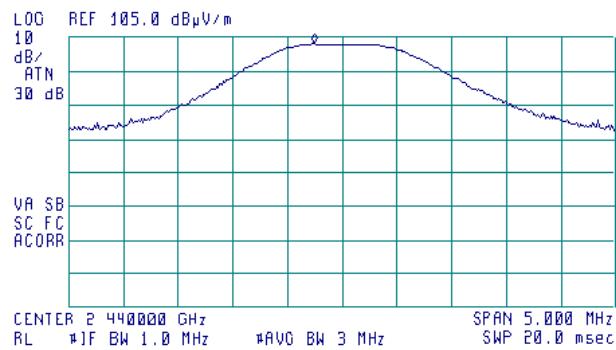
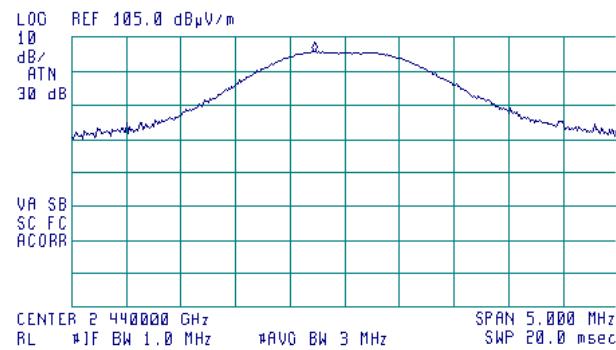
EUT PLANE

X,Y,Z-axes

ANTENNA POLARIZATION:

Horizontal

Vertical





HERMON LABORATORIES

Test specification:	Section 15.247(b)3 / RSS-247 section 5.4(4), Maximum output power		
Test procedure:	ANSI C63.10 sections 11.9.2.2.4		
Test mode:	Compliance	Verdict:	PASS
Date(s):	31-Jul-16 - 14-Aug-16		
Temperature: 23 °C	Relative Humidity: 55 %	Air Pressure: 1005 hPa	Power: Battery
Remarks:			

Plot 7.2.4 Field strength of carrier at high frequency

TEST SITE:

TEST DISTANCE:

EUT PLANE

ANTENNA POLARIZATION:

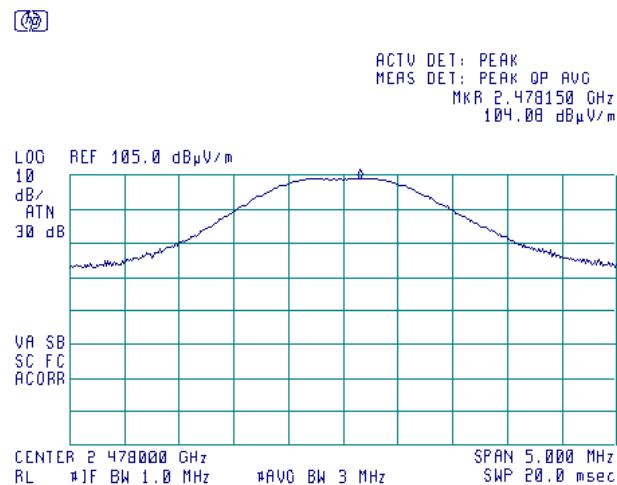
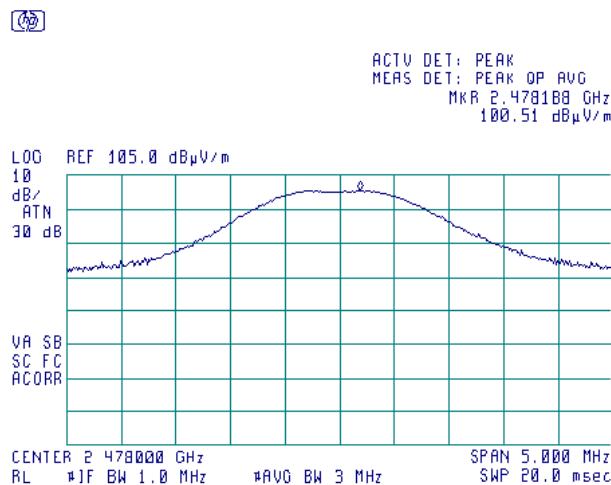
Vertical

OATS

3 m

X,Y,Z-axes

Horizontal





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Test specification: Section 15.247(d) / RSS-247 section 5.5, Radiated spurious emissions		
Test procedure: ANSI C63.10 section 11.12.1		
Test mode: Compliance		Verdict: PASS
Date(s): 01-Aug-16 - 14-Aug-16		
Temperature: 23 °C	Relative Humidity: 56 %	Air Pressure: 1005 hPa
Remarks:		

7.3 Field strength of spurious emissions

7.3.1 General

This test was performed to measure field strength of spurious emissions from the EUT. Specification test limits are given in Table 7.3.1.

Table 7.3.1 Radiated spurious emissions limits

Frequency, MHz	Field strength at 3 m within restricted bands, dB(µV/m)*			Attenuation of field strength of spurious versus carrier outside restricted bands, dBc***	
	Peak	Quasi Peak	Average		
0.009 – 0.090	148.5 – 128.5	NA	128.5 – 108.5**	20.0	
0.090 – 0.110	NA	108.5 – 106.8**	NA		
0.110 – 0.490	126.8 – 113.8	NA	106.8 – 93.8**		
0.490 – 1.705	NA	73.8 – 63.0**	NA		
1.705 – 30.0*		69.5			
30 – 88		40.0			
88 – 216		43.5			
216 – 960		46.0			
960 – 1000		54.0			
1000 – 10 th harmonic		74.0	NA		
			54.0		

*- The limit for 3 m test distance was calculated using the inverse square distance extrapolation factor as follows:

$$\text{Lim}_{S_2} = \text{Lim}_{S_1} + 40 \log (S_1/S_2)$$

where S_1 and S_2 – standard defined and test distance respectively in meters.

**- The limit decreases linearly with the logarithm of frequency.

*** - The field strength limits applied from the lowest radio frequency generated in the device, without going below 9 kHz up to the tenth harmonic of the highest fundamental frequency.

7.3.2 Test procedure for spurious emission field strength measurements in 9 kHz to 30 MHz band

7.3.2.1 The EUT was set up as shown in Figure 7.3.1, energized and the performance check was conducted.

7.3.2.2 The specified frequency range was investigated with antenna connected to spectrum analyzer/ EMI receiver. To find maximum radiation the turntable was rotated 360° and the measuring antenna was rotated around its vertical axis.

7.3.2.3 The worst test results (the lowest margins) were recorded and shown in the associated plots.

7.3.3 Test procedure for spurious emission field strength measurements above 30 MHz

7.3.3.1 The EUT was set up as shown in Figure 7.3.2, Figure 7.3.3, energized and the performance check was conducted.

7.3.3.2 The specified frequency range was investigated with antenna connected to spectrum analyzer/ EMI receiver. To find maximum radiation the turntable was rotated 360°, the measuring antenna height was changed from 1 to 4 m, its polarization was switched from vertical to horizontal.

7.3.3.3 The worst test results (the lowest margins) were recorded and shown in the associated plots.



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Test specification: Section 15.247(d) / RSS-247 section 5.5, Radiated spurious emissions		
Test procedure: ANSI C63.10 section 11.12.1		
Test mode: Compliance		Verdict: PASS
Date(s): 01-Aug-16 - 14-Aug-16		
Temperature: 23 °C	Relative Humidity: 56 %	Air Pressure: 1005 hPa
Power: Battery		
Remarks:		

Figure 7.3.1 Setup for spurious emission field strength measurements below 30 MHz

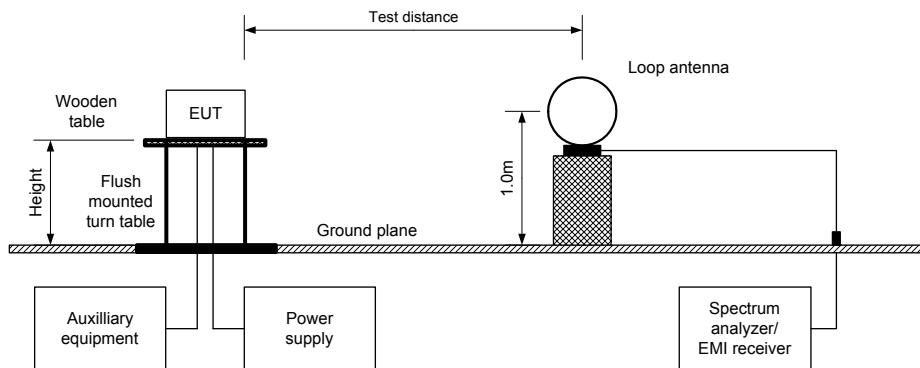
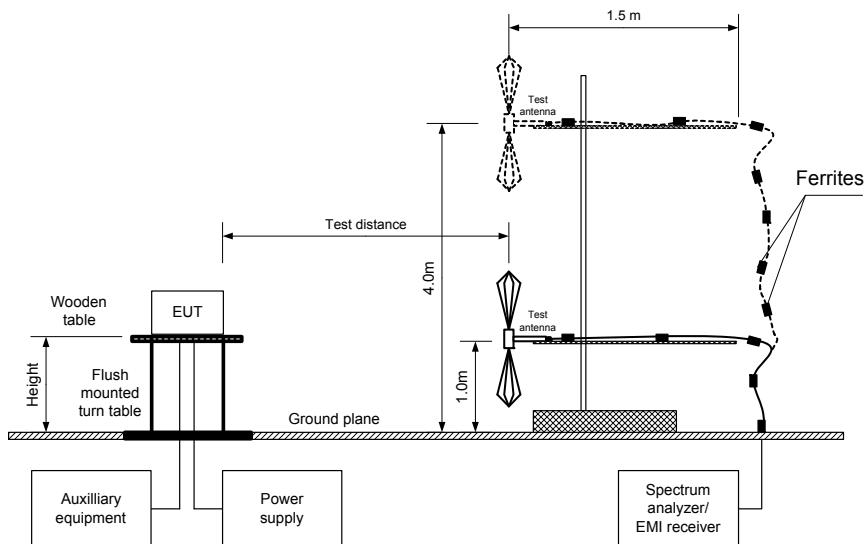


Figure 7.3.2 Setup for spurious emission field strength measurements above 30 MHz

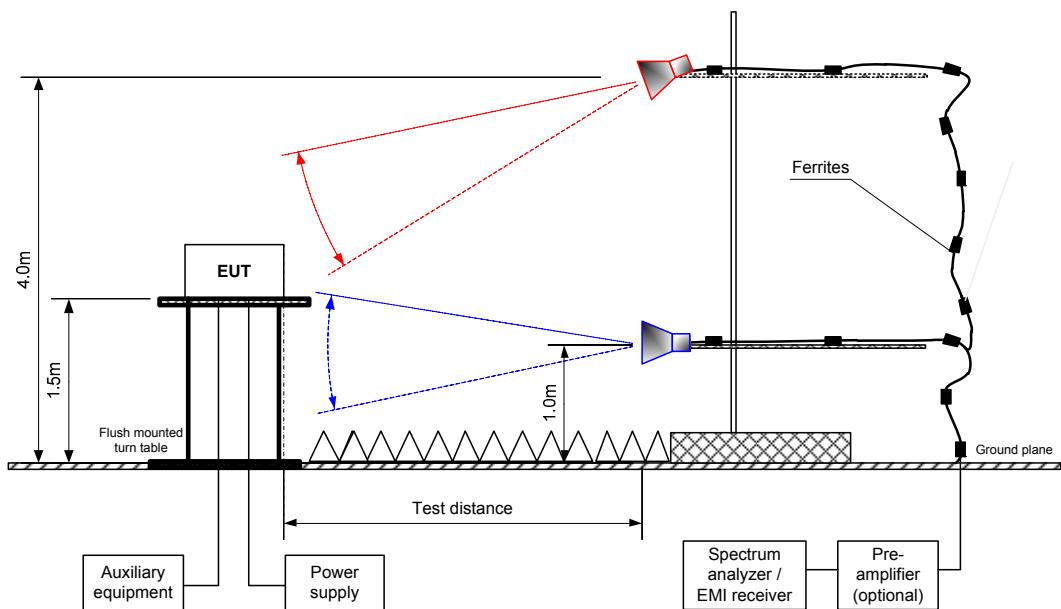




HERMON LABORATORIES

Test specification: Section 15.247(d) / RSS-247 section 5.5, Radiated spurious emissions		
Test procedure: ANSI C63.10 section 11.12.1		
Test mode: Compliance		Verdict: PASS
Date(s): 01-Aug-16 - 14-Aug-16		
Temperature: 23 °C	Relative Humidity: 56 %	Air Pressure: 1005 hPa
Power: Battery		
Remarks:		

Figure 7.3.3 Setup for spurious emission field strength measurements above 1000 MHz





Test specification:	Section 15.247(d) / RSS-247 section 5.5, Radiated spurious emissions		
Test procedure:	ANSI C63.10 section 11.12.1		
Test mode:	Compliance	Verdict:	PASS
Date(s):	01-Aug-16 - 14-Aug-16		
Temperature: 23 °C	Relative Humidity: 56 %	Air Pressure: 1005 hPa	Power: Battery
Remarks:			

Table 7.3.2 Field strength of emissions outside restricted bands

ASSIGNED FREQUENCY:	2400-2483.5 MHz
INVESTIGATED FREQUENCY RANGE:	0.009 – 25000 MHz
TEST DISTANCE:	3 m
MODULATION:	GFSK
BIT RATE:	1Mbps
DUTY CYCLE:	99.1 %
DETECTOR USED:	Peak
RESOLUTION BANDWIDTH:	100 kHz
VIDEO BANDWIDTH:	300 kHz
TEST ANTENNA TYPE:	Active loop (9 kHz – 30 MHz) Biconilog (30 MHz – 1000 MHz) Double ridged quide (above 1000 MHz)

*- EUT front panel refers to 0 degrees position of turntable.

**- Margin = Attenuation below carrier – specification limit.



HERMON LABORATORIES

Test specification: Section 15.247(d) / RSS-247 section 5.5, Radiated spurious emissions		
Test procedure: ANSI C63.10 section 11.12.1		
Test mode: Compliance		Verdict: PASS
Date(s):	01-Aug-16 - 14-Aug-16	
Temperature: 23 °C	Relative Humidity: 56 %	Air Pressure: 1005 hPa
Remarks:		Power: Battery

Table 7.3.3 Field strength of spurious emissions above 1 GHz within restricted bands

ASSIGNED FREQUENCY: 2400-2483.5 MHz
 INVESTIGATED FREQUENCY RANGE: 1000 – 25000 MHz
 TEST DISTANCE: 3 m
 MODULATION: GFSK
 MODULATING SIGNAL: PRBS
 BIT RATE: 1 Mbps
 DUTY CYCLE: 99.1 %
 DETECTOR USED: Peak
 RESOLUTION BANDWIDTH: 1000 kHz
 TEST ANTENNA TYPE: Double ridged guide

Frequency, MHz	Antenna		Azimuth, degrees*	Peak field strength(VBW=3 MHz)			Average field strength(VBW=10 Hz)			Verdict	
	Polarization	Height, m		Measured, dB(µV/m)	Limit, dB(µV/m)	Margin, dB**	Measured, dB(µV/m)	Calculated, dB(µV/m)	Limit, dB(µV/m)		
Low carrier frequency										Pass	
No emissions were found											
Mid carrier frequency										Pass	
No emissions were found											
High carrier frequency										Pass	
No emissions were found											

*- EUT front panel refers to 0 degrees position of turntable.

**- Margin = Measured field strength - specification limit.

***- Margin = Calculated field strength - specification limit,

where Calculated field strength = Measured field strength + average factor.

Table 7.3.4 Average factor calculation

Transmission pulse		Transmission burst		Transmission train duration, ms	Average factor, dB
Duration, ms	Period, ms	Duration, ms	Period, ms		
NA					

*- Average factor was calculated as follows

$$\text{for pulse train shorter than 100 ms: } \text{Average factor} = 20 \times \log_{10} \left(\frac{\text{Pulse duration}}{\text{Pulse period}} \times \frac{\text{Burst duration}}{\text{Train duration}} \times \text{Number of bursts within pulse train} \right)$$

$$\text{for pulse train longer than 100 ms: } \text{Average factor} = 20 \times \log_{10} \left(\frac{\text{Pulse duration}}{\text{Pulse period}} \times \frac{\text{Burst duration}}{100 \text{ ms}} \times \text{Number of bursts within 100 ms} \right)$$



HERMON LABORATORIES

Test specification: Section 15.247(d) / RSS-247 section 5.5, Radiated spurious emissions		
Test procedure: ANSI C63.10 section 11.12.1		
Test mode: Compliance		Verdict: PASS
Date(s):	01-Aug-16 - 14-Aug-16	
Temperature: 23 °C	Relative Humidity: 56 %	Air Pressure: 1005 hPa
Remarks:		

Table 7.3.5 Field strength of spurious emissions below 1 GHz within restricted bands

ASSIGNED FREQUENCY:	2400-2483.5 MHz
INVESTIGATED FREQUENCY RANGE:	0.009 – 1000 MHz
TEST DISTANCE:	3 m
MODULATION:	GFSK
BIT RATE:	1 Mbps
DUTY CYCLE:	99.1 %
RESOLUTION BANDWIDTH:	1.0 kHz (9 kHz – 150 kHz) 9.0 kHz (150 kHz – 30 MHz) 120 kHz (30 MHz – 1000 MHz)
VIDEO BANDWIDTH:	> Resolution bandwidth
TEST ANTENNA TYPE:	Active loop (9 kHz – 30 MHz) Biconical (30 MHz – 200 MHz) Log periodic (200 MHz – 1000 MHz) Biconilog (30 MHz – 1000 MHz)

Frequency, MHz	Peak emission, dB(µV/m)	Quasi-peak		Margin, dB*	Antenna polarization	Antenna height, m	Turn-table position**, degrees	Verdict
Low carrier frequency								
		No emissions were found						Pass
Mid carrier frequency								
		No emissions were found						Pass
High carrier frequency								
		No emissions were found						Pass

*- Margin = Measured emission - specification limit.

**- EUT front panel refer to 0 degrees position of turntable.

Reference numbers of test equipment used

HL 0446	HL 1984	HL 2780	HL 3818	HL 3901	HL 4114	HL 4224	HL 4353
HL 4575	HL 4722	HL 4932	HL 4933	HL 4965			

Full description is given in Appendix A.



HERMON LABORATORIES

Test specification: Section 15.247(d) / RSS-247 section 5.5, Radiated spurious emissions					
Test procedure: ANSI C63.10 section 11.12.1					
Test mode: Compliance			Verdict: PASS		
Date(s): 01-Aug-16 - 14-Aug-16					
Temperature: 23 °C	Relative Humidity: 56 %	Air Pressure: 1005 hPa	Power: Battery		
Remarks:					

Table 7.3.6 Restricted bands according to FCC section 15.205

MHz	MHz	MHz	MHz	MHz	GHz
0.09 - 0.11	8.37625 - 8.38675	73 - 74.6	399.9 - 410	2690 - 2900	10.6 - 12.7
0.495 - 0.505	8.41425 - 8.41475	74.8 - 75.2	608 - 614	3260 - 3267	13.25 - 13.4
2.1735 - 2.1905	12.29 - 12.293	108 - 121.94	960 - 1240	3332 - 3339	14.47 - 14.5
4.125 - 4.128	12.51975 - 12.52025	123 - 138	1300 - 1427	3345.8 - 3358	15.35 - 16.2
4.17725 - 4.17775	12.57675 - 12.57725	149.9 - 150.05	1435 - 1626.5	3600 - 4400	17.7 - 21.4
4.20725 - 4.20775	13.36 - 13.41	156.52475 - 156.52525	1645.5 - 1646.5	4500 - 5150	22.01 - 23.12
6.215 - 6.218	16.42 - 16.423	156.7 - 156.9	1660 - 1710	5350 - 5460	23.6 - 24
6.26775 - 6.26825	16.69475 - 16.69525	162.0125 - 167.17	1718.8 - 1722.2	7250 - 7750	31.2 - 31.8
6.31175 - 6.31225	16.80425 - 16.80475	167.72 - 173.2	2200 - 2300	8025 - 8500	36.43 - 36.5
8.291 - 8.294	25.5 - 25.67	240 - 285	2310 - 2390	9000 - 9200	
8.362 - 8.366	37.5 - 38.25	322 - 335.4	2483.5 - 2500	9300 - 9500	Above 38.6

Table 7.3.7 Restricted bands according to RSS-Gen

MHz	MHz	MHz	MHz	MHz	GHz
0.09 - 0.11	8.291 - 8.294	16.80425 - 16.80475	399.9 - 410	3260 - 3267	10.6 - 12.7
2.1735 - 2.1905	8.362 - 8.366	25.5 - 25.67	608 - 614	3332 - 3339	13.25 - 13.4
3.020 - 3.026	8.37625 - 8.38675	37.5 - 38.25	960 - 1427	3345.8 - 3358	14.47 - 14.5
4.125 - 4.128	8.41425 - 8.41475	73 - 74.6	1435 - 1626.5	3500 - 4400	15.35 - 16.2
4.17725 - 4.17775	12.29 - 12.293	74.8 - 75.2	1645.5 - 1646.5	4500 - 5150	17.7 - 21.4
4.20725 - 4.20775	12.51975 - 12.52025	108 - 138	1660 - 1710	5350 - 5460	22.01 - 23.12
5.677 - 5.683	12.57675 - 12.57725	156.52475 - 156.52525	1718.8 - 1722.2	7250 - 7750	23.6 - 24
6.215 - 6.218	13.36 - 13.41	156.7 - 156.9	2200 - 2300	8025 - 8500	31.2 - 31.8
6.26775 - 6.26825	16.42 - 16.423	240 - 285	2310 - 2390	9000 - 9200	36.43 - 36.5
6.31175 - 6.31225	16.69475 - 16.69525	322 - 335.4	2655 - 2900	9300 - 9500	Above 38.6

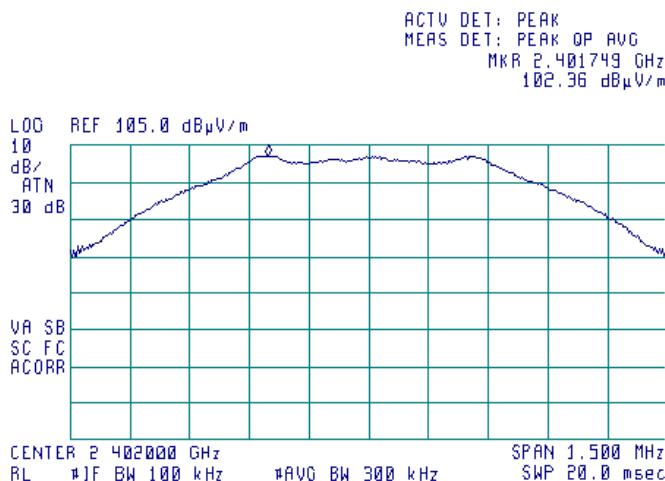


HERMON LABORATORIES

Test specification: Section 15.247(d) / RSS-247 section 5.5, Radiated spurious emissions		
Test procedure: ANSI C63.10 section 11.12.1		
Test mode: Compliance		Verdict: PASS
Date(s): 01-Aug-16 - 14-Aug-16		
Temperature: 23 °C	Relative Humidity: 56 %	Air Pressure: 1005 hPa
Remarks:		

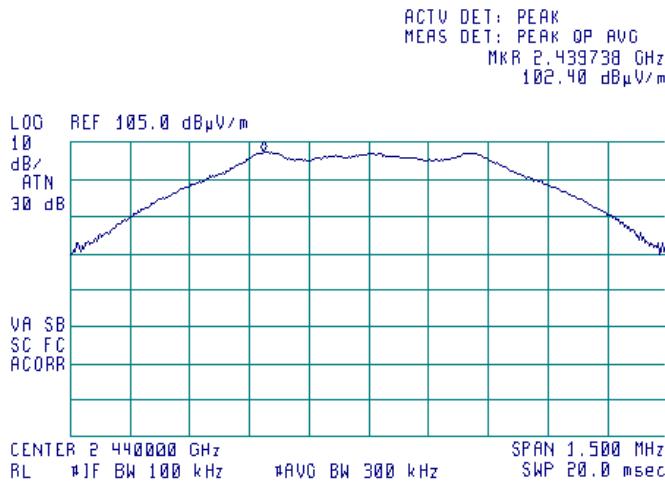
Plot 7.3.1 Radiated emission measurements at the low carrier frequency

TEST SITE: Semi anechoic chamber
TEST DISTANCE: 3 m
ANTENNA POLARIZATION: Vertical and Horizontal



Plot 7.3.2 Radiated emission measurements at the mid carrier frequency

TEST SITE: Semi anechoic chamber
TEST DISTANCE: 3 m
ANTENNA POLARIZATION: Vertical and Horizontal



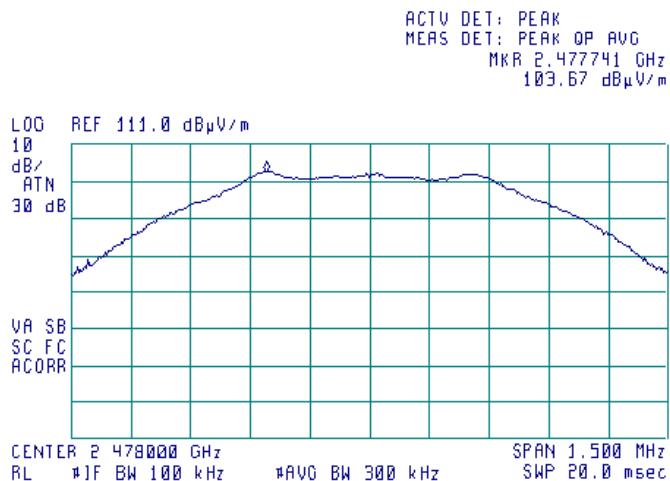


HERMON LABORATORIES

Test specification: Section 15.247(d) / RSS-247 section 5.5, Radiated spurious emissions		
Test procedure: ANSI C63.10 section 11.12.1		
Test mode: Compliance		Verdict: PASS
Date(s): 01-Aug-16 - 14-Aug-16		
Temperature: 23 °C	Relative Humidity: 56 %	Air Pressure: 1005 hPa
Remarks:		

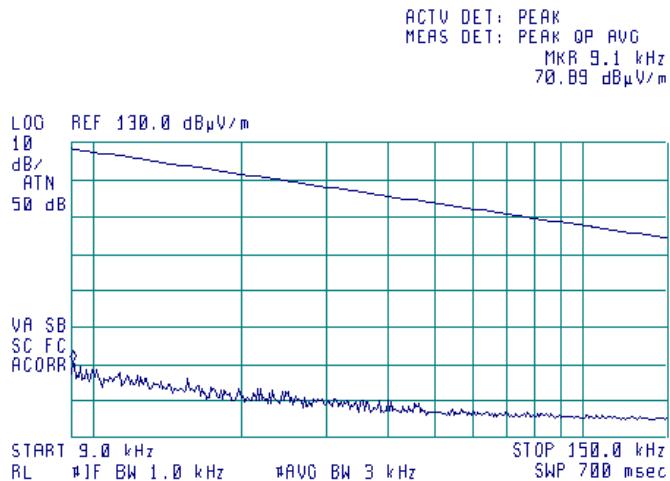
Plot 7.3.3 Radiated emission measurements at the high carrier frequency

TEST SITE: Semi anechoic chamber
TEST DISTANCE: 3 m
ANTENNA POLARIZATION: Vertical and Horizontal



Plot 7.3.4 Radiated emission measurements from 9 to 150 kHz

TEST SITE: Semi anechoic chamber
TEST DISTANCE: 3 m
ANTENNA POLARIZATION: Vertical
CARRIER FREQUENCY: Low, Mid, High



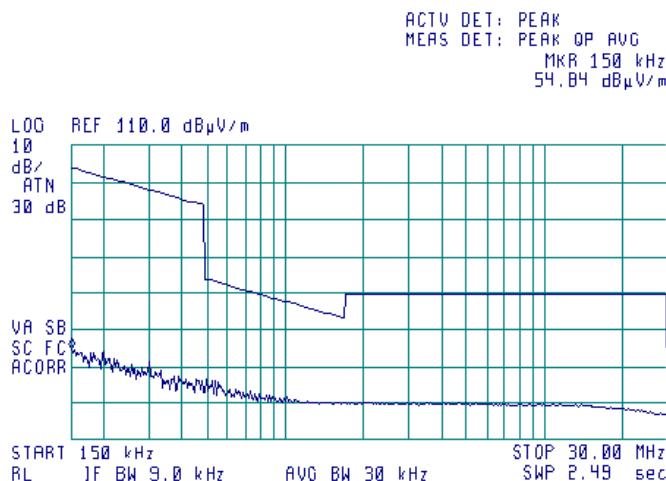


HERMON LABORATORIES

Test specification: Section 15.247(d) / RSS-247 section 5.5, Radiated spurious emissions		
Test procedure:	ANSI C63.10 section 11.12.1	
Test mode:	Compliance	
Date(s):	01-Aug-16 - 14-Aug-16	
Temperature: 23 °C	Relative Humidity: 56 %	Air Pressure: 1005 hPa
Remarks:		

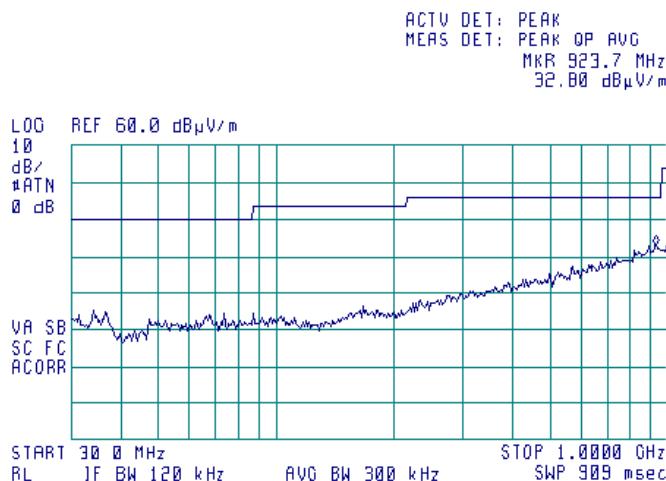
Plot 7.3.5 Radiated emission measurements from 0.15 to 30 MHz

TEST SITE: Semi anechoic chamber
TEST DISTANCE: 3 m
ANTENNA POLARIZATION: Vertical
CARRIER FREQUENCY: Low, Mid, High



Plot 7.3.6 Radiated emission measurements from 30 to 1000 MHz

TEST SITE: Semi anechoic chamber
TEST DISTANCE: 3 m
ANTENNA POLARIZATION: Vertical and Horizontal
Carrier Frequency: Low, Mid, High



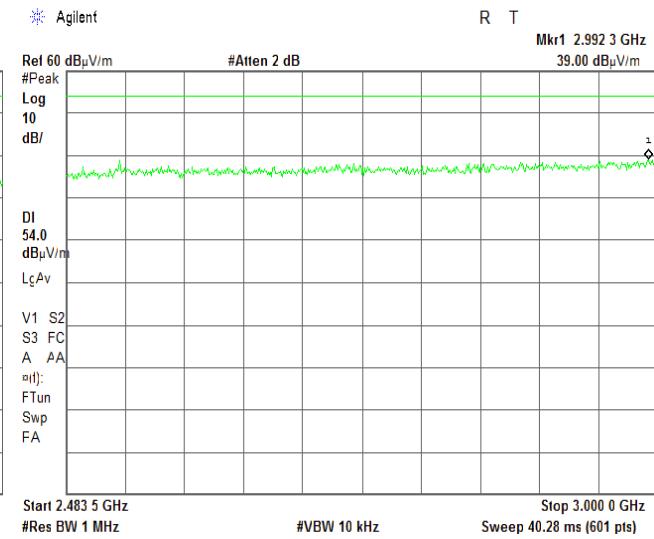
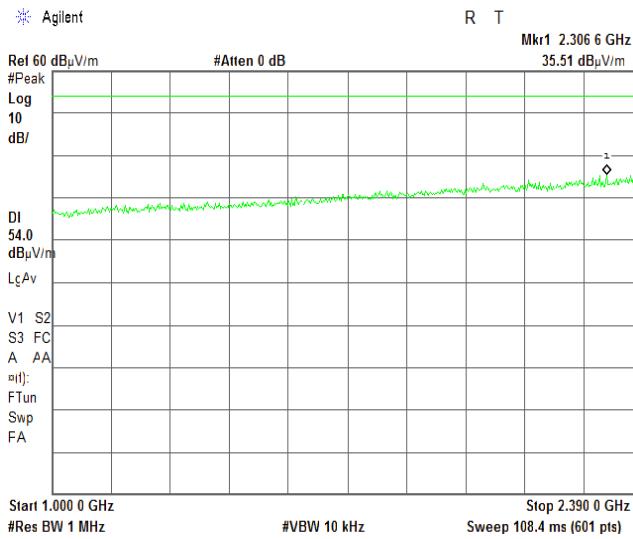
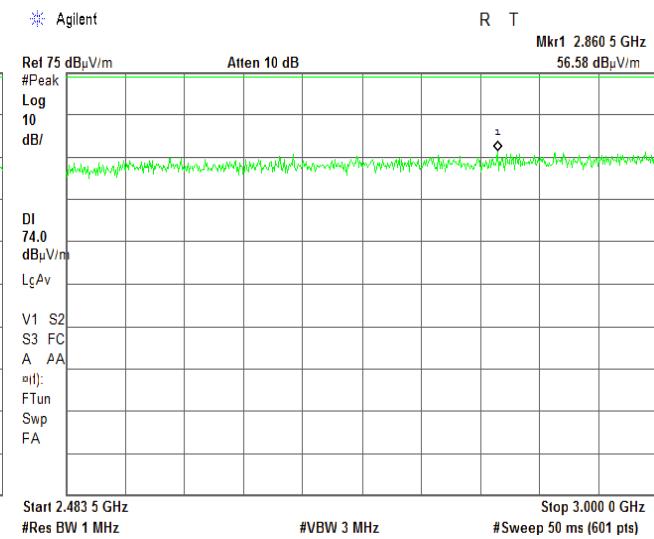
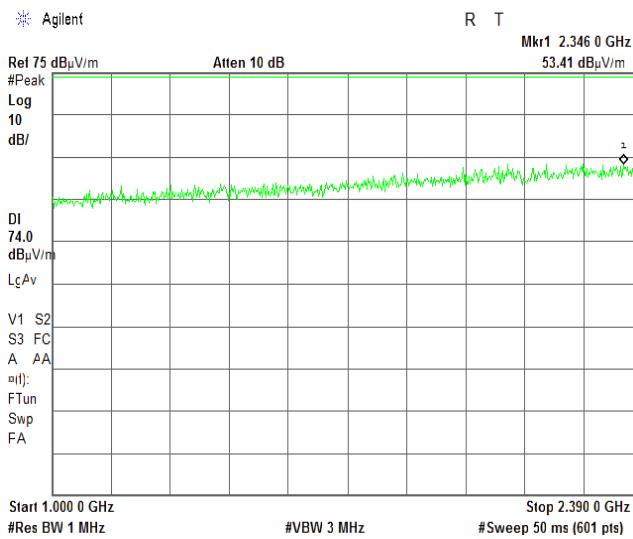


HERMON LABORATORIES

Test specification: Section 15.247(d) / RSS-247 section 5.5, Radiated spurious emissions		
Test procedure: ANSI C63.10 section 11.12.1		
Test mode: Compliance	Verdict: PASS	
Date(s): 01-Aug-16 - 14-Aug-16		
Temperature: 23 °C	Relative Humidity: 56 %	Air Pressure: 1005 hPa
Power: Battery		
Remarks:		

Plot 7.3.7 Radiated emission measurements from 1000 to 3000 MHz at the low carrier frequency

TEST SITE: Semi anechoic chamber
 TEST DISTANCE: 3 m
 ANTENNA POLARIZATION: Vertical and Horizontal

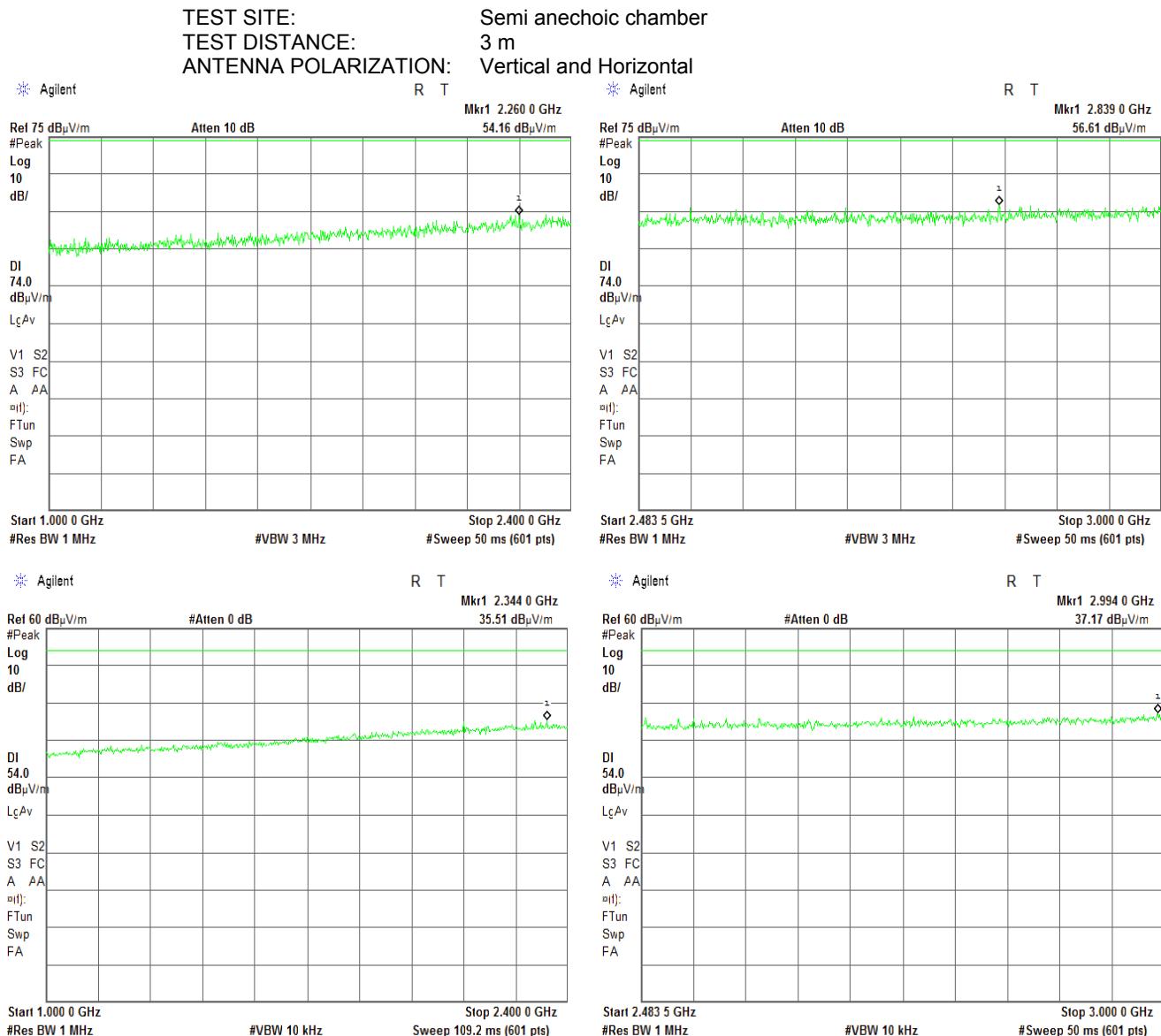




HERMON LABORATORIES

Test specification: Section 15.247(d) / RSS-247 section 5.5, Radiated spurious emissions		
Test procedure: ANSI C63.10 section 11.12.1		
Test mode: Compliance	Verdict: PASS	
Date(s): 01-Aug-16 - 14-Aug-16		
Temperature: 23 °C	Relative Humidity: 56 %	Air Pressure: 1005 hPa
Remarks:		

Plot 7.3.8 Radiated emission measurements from 1000 to 3000 MHz at the mid carrier frequency

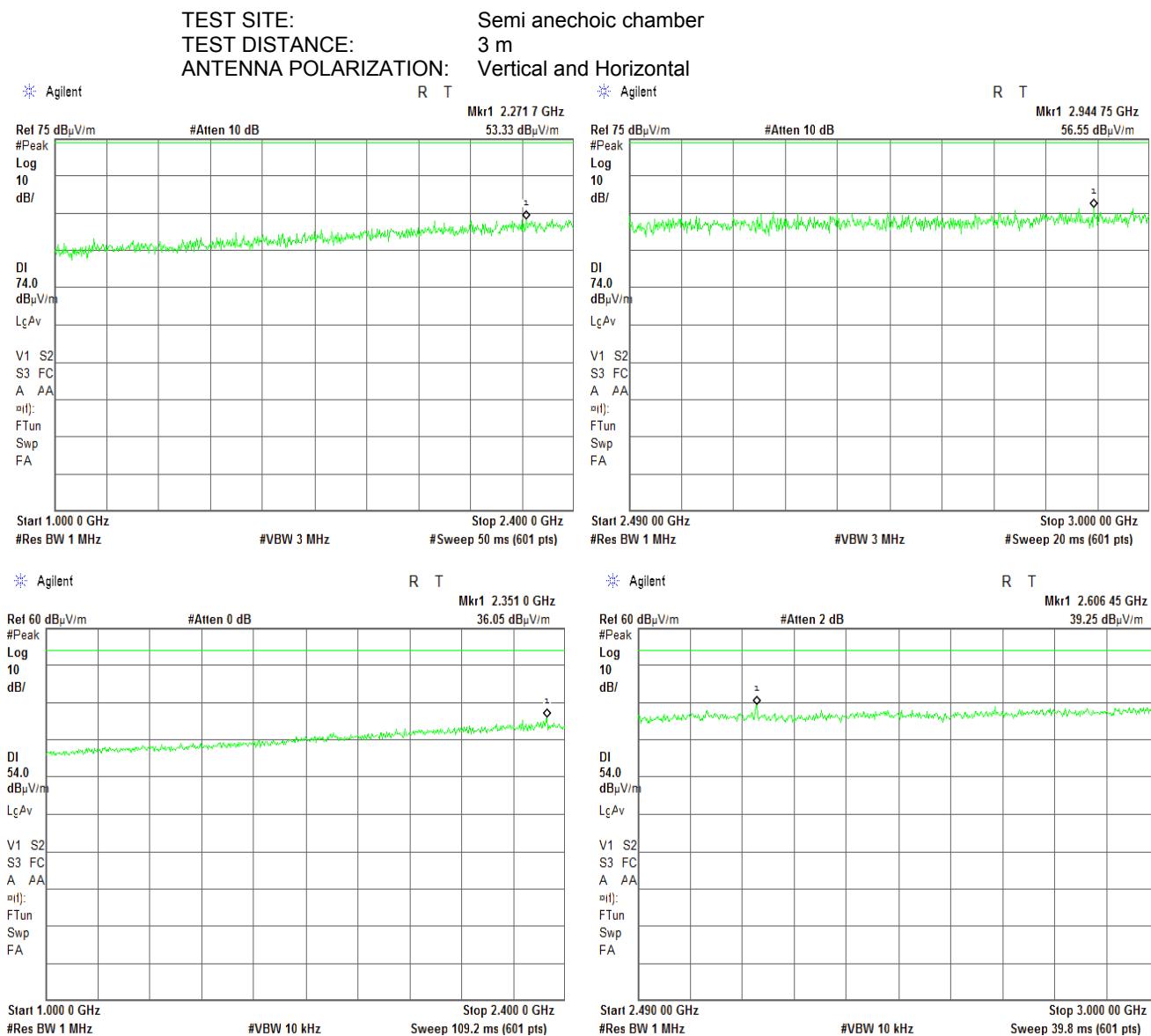




HERMON LABORATORIES

Test specification: Section 15.247(d) / RSS-247 section 5.5, Radiated spurious emissions		
Test procedure:	ANSI C63.10 section 11.12.1	
Test mode:	Compliance	Verdict: PASS
Date(s):	01-Aug-16 - 14-Aug-16	
Temperature: 23 °C	Relative Humidity: 56 %	Air Pressure: 1005 hPa
Remarks:		Power: Battery

Plot 7.3.9 Radiated emission measurements from 1000 to 3000 MHz at the high carrier frequency

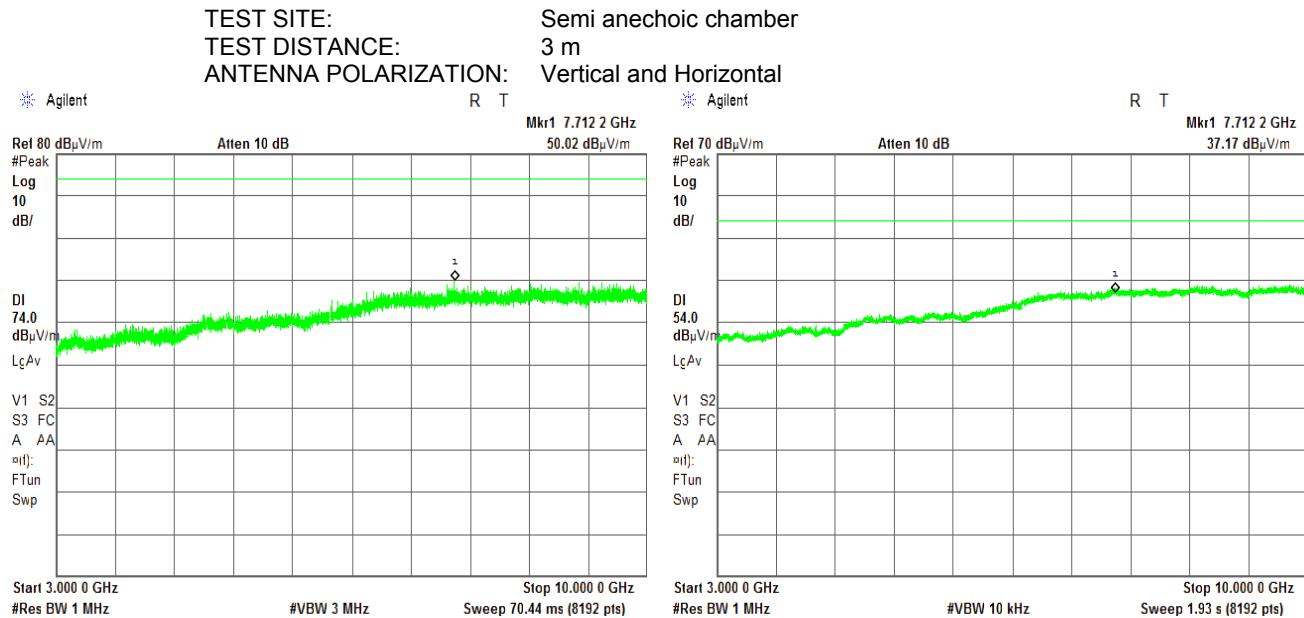




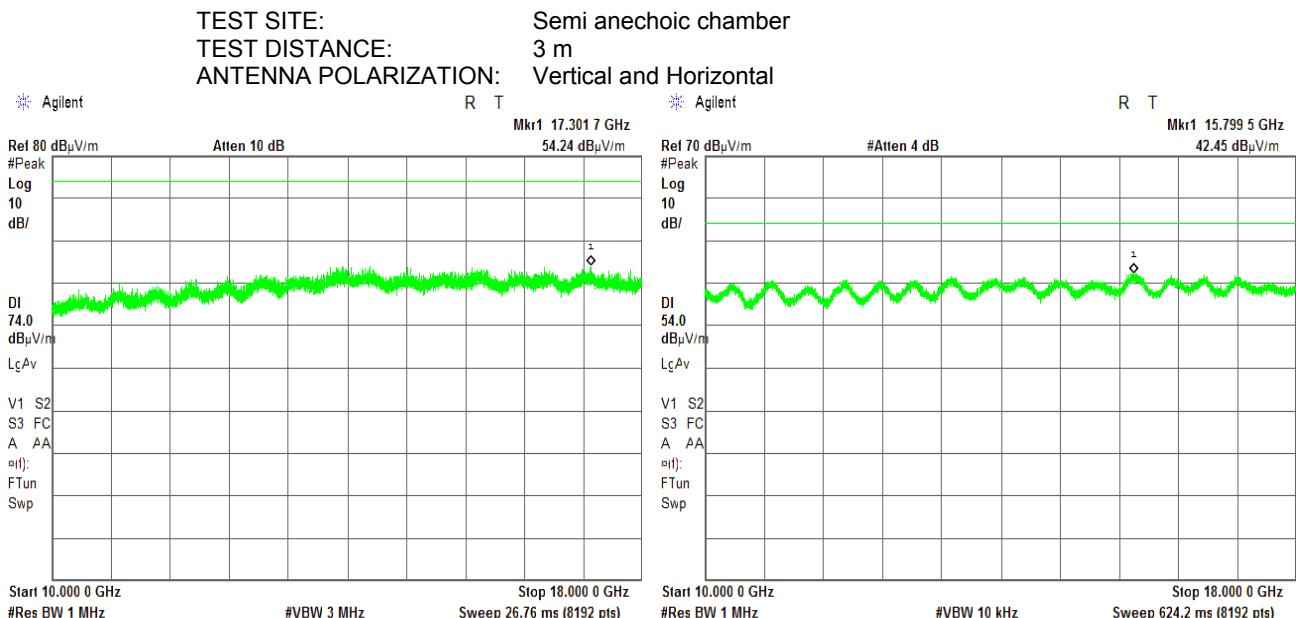
HERMON LABORATORIES

Test specification: Section 15.247(d) / RSS-247 section 5.5, Radiated spurious emissions		
Test procedure:	ANSI C63.10 section 11.12.1	
Test mode:	Compliance	Verdict: PASS
Date(s):	01-Aug-16 - 14-Aug-16	
Temperature: 23 °C	Relative Humidity: 56 %	Air Pressure: 1005 hPa
Remarks:		Power: Battery

Plot 7.3.10 Radiated emission measurements from 3000 to 10000 MHz at the low, mid, high carrier frequency



Plot 7.3.11 Radiated emission measurements from 10000 to 18000 MHz at the low, mid, high carrier frequency



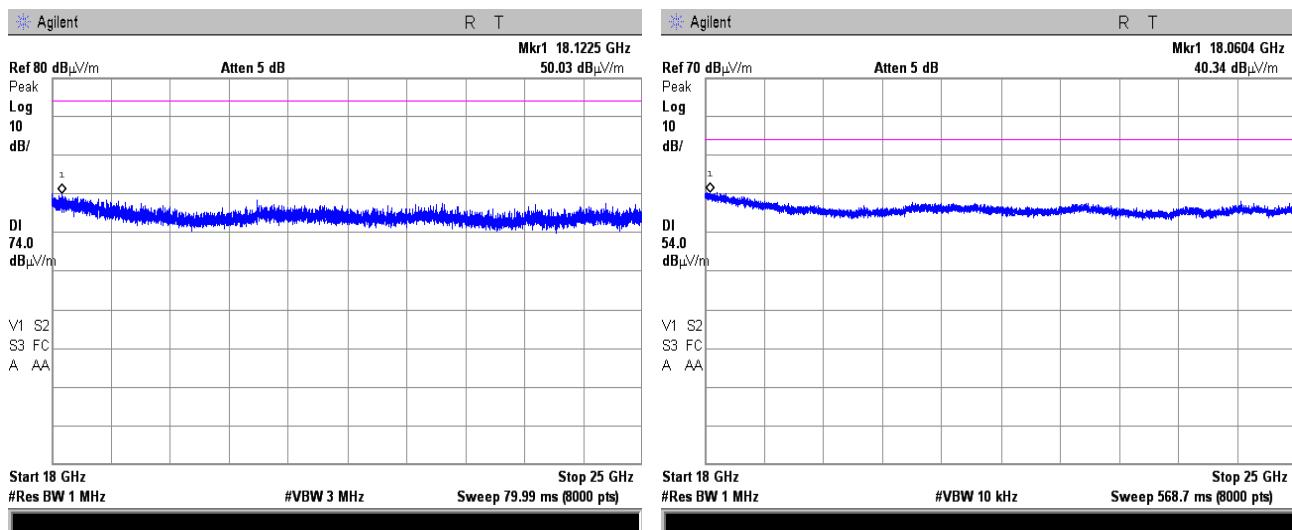


HERMON LABORATORIES

Test specification: Section 15.247(d) / RSS-247 section 5.5, Radiated spurious emissions		
Test procedure: ANSI C63.10 section 11.12.1		
Test mode: Compliance	Verdict: PASS	
Date(s): 01-Aug-16 - 14-Aug-16		
Temperature: 23 °C	Relative Humidity: 56 %	Air Pressure: 1005 hPa
Remarks:		

Plot 7.3.12 Radiated emission measurements from 18000 to 25000 MHz at the low, mid, high carrier frequency

TEST SITE: Semi anechoic chamber
TEST DISTANCE: 3 m
ANTENNA POLARIZATION: Vertical and Horizontal

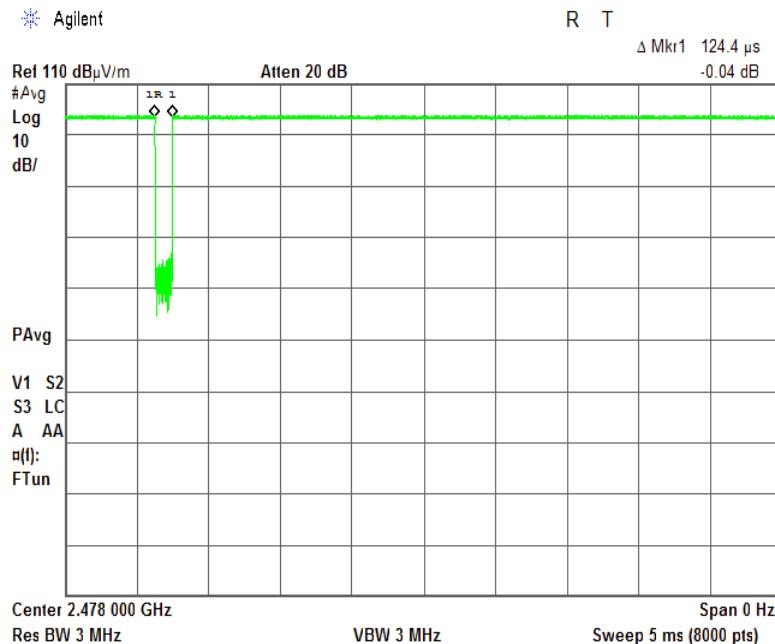




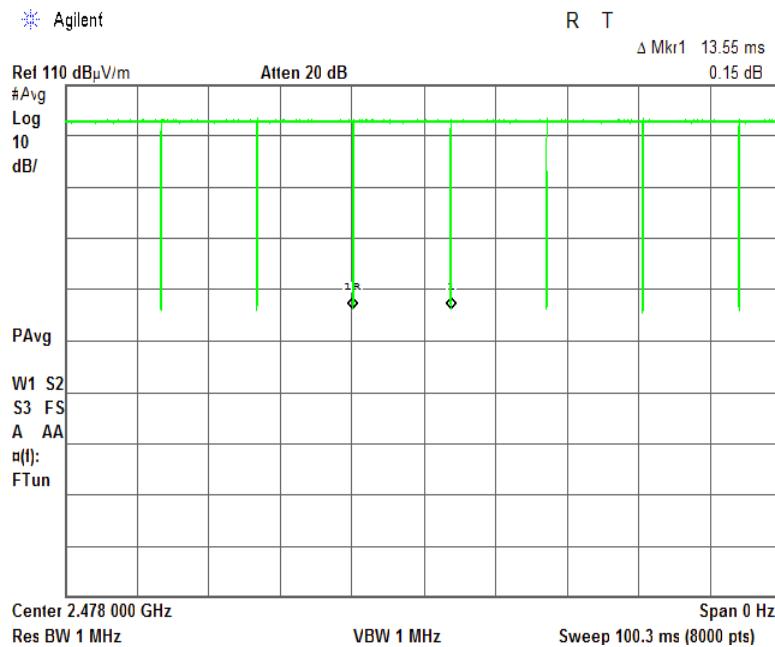
HERMON LABORATORIES

Test specification: Section 15.247(d) / RSS-247 section 5.5, Radiated spurious emissions		
Test procedure: ANSI C63.10 section 11.12.1		
Test mode: Compliance		Verdict: PASS
Date(s): 01-Aug-16 - 14-Aug-16		
Temperature: 23 °C	Relative Humidity: 56 %	Air Pressure: 1005 hPa
Remarks:		

Plot 7.3.13 Transmission pulse duration



Plot 7.3.14 Transmission pulse period





HERMON LABORATORIES

Test specification: Section 15.247(d) / RSS-247 section 5.5, Band edge emissions		
Test procedure: ANSI C63.10 section 11.12.1		
Test mode: Compliance		Verdict: PASS
Date(s): 31-Jul-16 - 14-Aug-16		
Temperature: 23 °C	Relative Humidity: 55 %	Air Pressure: 1005 hPa
Remarks:		

7.4 Band edge radiated emissions

7.4.1 General

This test was performed to measure emissions, radiated from the EUT at the assigned frequency band edges. Specification test limits are given in Table 7.4.1.

Table 7.4.1 Band edge emission limits

Output power	Assigned frequency, MHz	Attenuation below carrier*, dBc	Field strength at 3 m within restricted bands, dB(µV/m)	
			Peak	Average
Peak	2400.0 – 2483.5	20.0	74.0	54.0

* - Band edge emission limit is provided in terms of attenuation below the peak of modulated carrier measured with the same resolution bandwidth.

7.4.2 Test procedure

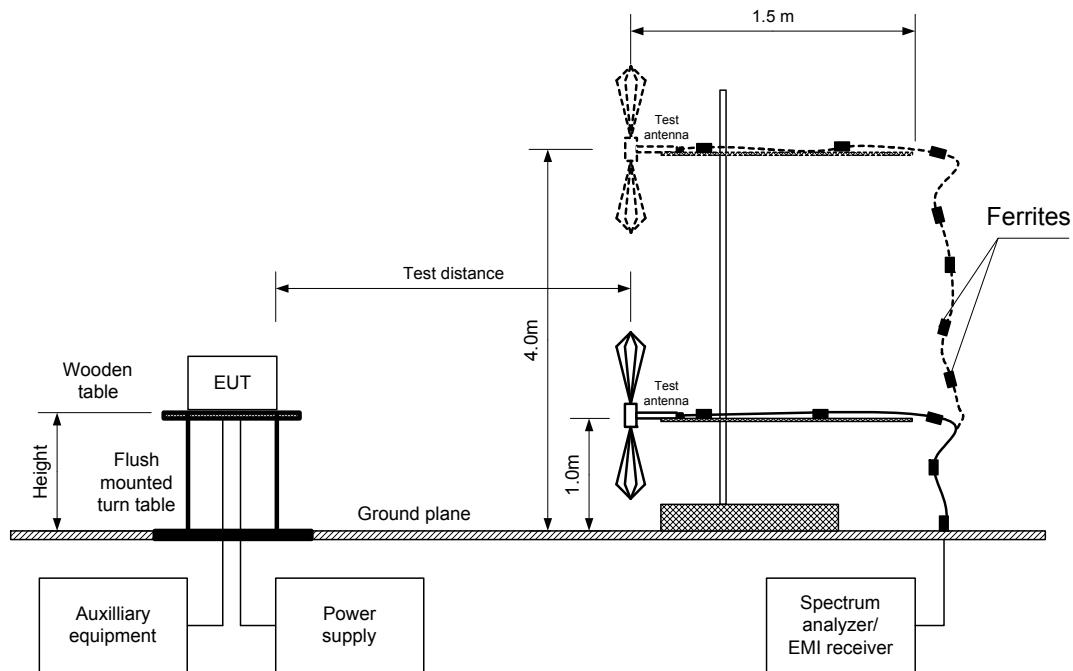
- 7.4.2.1 The EUT was set up as shown in Figure 7.4.1, energized normally modulated at the maximum data rate and its proper operation was checked.
- 7.4.2.2 The EUT was adjusted to produce maximum available to end user RF output power at the lowest carrier frequency.
- 7.4.2.3 The spectrum analyzer span was set to capture the carrier frequency and associated modulation products. The resolution bandwidth was set wider than 1 % of the frequency span.
- 7.4.2.4 The spectrum analyzer was set in max hold mode and allowed trace to stabilize. The highest emission level within the authorized band was measured.
- 7.4.2.5 The maximum band edge emission and modulation product outside of the band were measured as provided in Table 7.4.2 and associated plots and referenced to the highest emission level measured within the authorized band.
- 7.4.2.6 The above procedure was repeated with the EUT adjusted to produce maximum RF output power at the highest carrier frequency.
- 7.4.2.7 The above procedure was repeated with the frequency hopping function enabled.



HERMON LABORATORIES

Test specification: Section 15.247(d) / RSS-247 section 5.5, Band edge emissions		
Test procedure: ANSI C63.10 section 11.12.1		
Test mode: Compliance		Verdict: PASS
Date(s): 31-Jul-16 - 14-Aug-16		
Temperature: 23 °C	Relative Humidity: 55 %	Air Pressure: 1005 hPa
Power: Battery		
Remarks:		

Figure 7.4.1 Band edge emission test setup





HERMON LABORATORIES

Test specification: Section 15.247(d) / RSS-247 section 5.5, Band edge emissions		
Test procedure: ANSI C63.10 section 11.12.1		
Test mode: Compliance		Verdict: PASS
Date(s):	31-Jul-16 - 14-Aug-16	
Temperature: 23 °C	Relative Humidity: 55 %	Air Pressure: 1005 hPa
Remarks:		

Table 7.4.2 Band edge emission test results

ASSIGNED FREQUENCY RANGE: 2400-2483.5MHz
 DETECTOR USED: Peak
 MODULATION: GFSK
 MODULATING SIGNAL: PRBS
 BIT RATE: 1 Mbps
 RESOLUTION BANDWIDTH: $\geq 1\%$ of the span
 VIDEO BANDWIDTH: \geq RBW

Frequency, MHz	Band edge emission, dB _{uV/m}	Emission at carrier, dB _{uV/m}	Attenuation below carrier, dBc	Limit, dBc	Margin, dB*	Verdict
2390.2	50.75	102.36	51.61	20.0	31.61	Pass

*- Margin = Attenuation below carrier – specification limit.

Frequency, MHz	Peak field strength(VBW=3 MHz)			Average field strength(VBW>1/Ton=100 Hz)				Verdict
	Measured, dB(μ V/m)	Limit, dB(μ V/m)	Margin, dB**	Measured, dB(μ V/m)	Calculated, dB(μ V/m)	Limit, dB(μ V/m)	Margin, dB***	
2490	57.39	74.0	-16.61	39.90	39.90	54.0	-14.10	Pass

*- Margin = Measured emission – specification limit.

Reference numbers of test equipment used

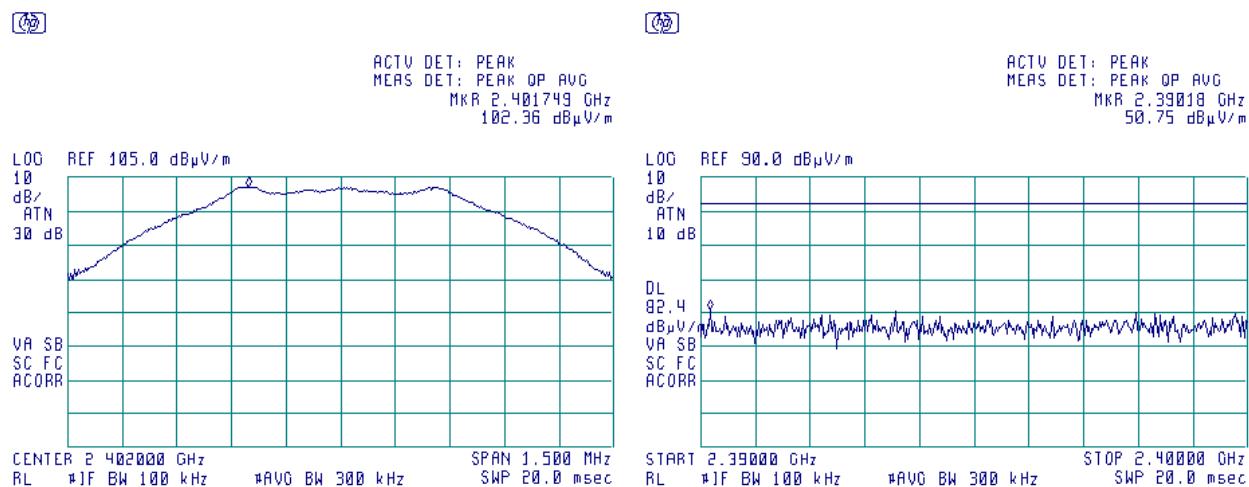
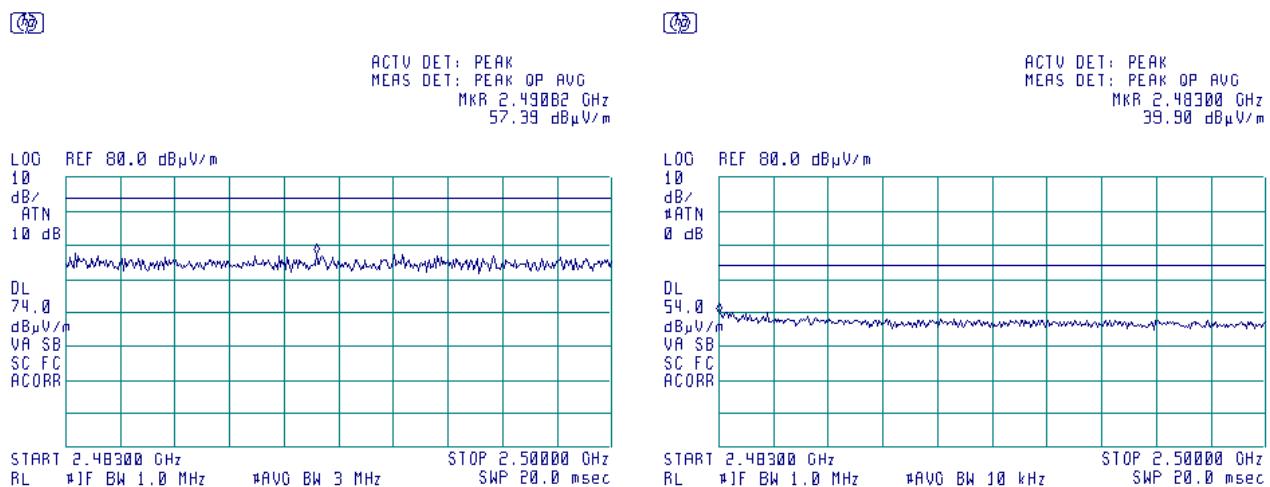
HL 0521	HL 1984	HL 4278	HL 4353				
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Full description is given in Appendix A.



HERMON LABORATORIES

Test specification: Section 15.247(d) / RSS-247 section 5.5, Band edge emissions		
Test procedure: ANSI C63.10 section 11.12.1		
Test mode: Compliance	Verdict: PASS	
Date(s): 31-Jul-16 - 14-Aug-16		
Temperature: 23 °C	Relative Humidity: 55 %	Air Pressure: 1005 hPa
Power: Battery		
Remarks:		

Plot 7.4.1 The band edge emission level at low carrier frequency**Plot 7.4.2 The band edge emission level at high carrier frequency**



HERMON LABORATORIES

Test specification: Section 15.247(e) / RSS-247 section 5.2(2), Maximum power spectral density			
Test procedure:	ANSI C63.10 section 11.10.2		
Test mode:	Compliance		
Date(s):	31-Jul-16 - 14-Aug-16		
Temperature: 23 °C	Relative Humidity: 55 %	Air Pressure: 1005 hPa	Power: Battery
Remarks:			

7.5 Peak spectral power density

7.5.1 General

This test was performed to measure the peak spectral power density radiated by the transmitter RF antenna. Specification test limits are given in Table 7.5.1.

Table 7.5.1 Peak spectral power density limits

Assigned frequency range, MHz	Measurement bandwidth, kHz	Peak spectral power density, dBm	Equivalent field strength limit @ 3m, dB(μ V/m)*
2400.0 – 2483.5	3.0	8.0	103.2

* - Equivalent field strength limit was calculated from the peak spectral power density as follows: $E = \sqrt{30 \times P} / r$, where P is peak spectral power density and r is antenna to EUT distance in meters.

7.5.2 Test procedure for field strength measurements

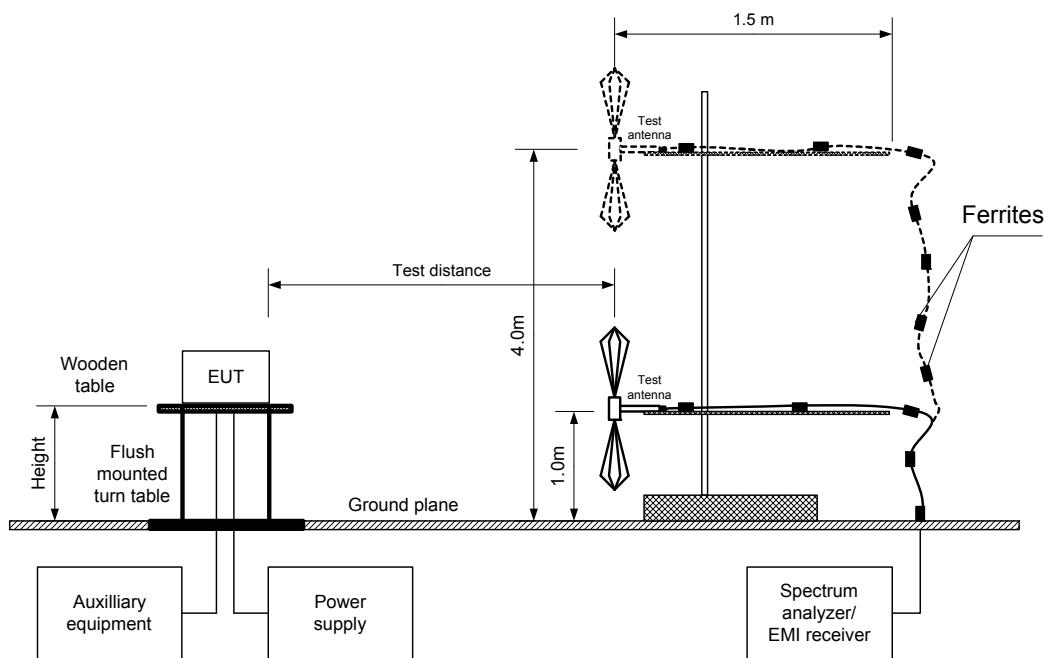
- 7.5.2.1 The EUT was set up as shown in Figure 7.5.1, energized and its proper operation was checked.
- 7.5.2.2 The EUT was adjusted to produce maximum available to end user RF output power.
- 7.5.2.3 The field strength of the EUT carrier frequency was measured with antenna connected to spectrum analyzer/ EMI receiver. To find maximum radiation the turntable was rotated 360° and the measuring antenna height was swept in both vertical and horizontal polarizations.
- 7.5.2.4 The maximum power spectral density was measured using a peak detector with resolution bandwidth set to 100 kHz, $VBW \geq 300$ kHz, sweep time = auto couple, trace mode=max hold.
- 7.5.2.5 The maximum power level was determined in any 100 kHz band within the fundamental EBW. The measured value exceeded the limit, the measurements were repeated with resolution bandwidth set to 30 kHz, $VBW = 100$ kHz.
- 7.5.2.6 The test results provided in Table 7.5.2 and the associated plots.



HERMON LABORATORIES

Test specification: Section 15.247(e) / RSS-247 section 5.2(2), Maximum power spectral density			
Test procedure:	ANSI C63.10 section 11.10.2		
Test mode:	Compliance		
Date(s):	31-Jul-16 - 14-Aug-16		
Temperature: 23 °C	Relative Humidity: 55 %	Air Pressure: 1005 hPa	Power: Battery
Remarks:			

Figure 7.5.1 Setup for carrier field strength measurements





HERMON LABORATORIES

Test specification: Section 15.247(e) / RSS-247 section 5.2(2), Maximum power spectral density							
Test procedure: ANSI C63.10 section 11.10.2							
Test mode:	Compliance				Verdict:		PASS
Date(s):	31-Jul-16 - 14-Aug-16						
Temperature: 23 °C	Relative Humidity: 55 %		Air Pressure: 1005 hPa		Power: Battery		
Remarks:							

Table 7.5.2 Field strength measurement of peak spectral power density

ASSIGNED FREQUENCY: 2440-2483.5 MHz
 TEST DISTANCE: 3 m
 TEST SITE: OATS
 EUT HEIGHT: 1.5 m
 DETECTOR USED: Peak
 RESOLUTION BANDWIDTH: 30 kHz
 VIDEO BANDWIDTH: 100 kHz
 TEST ANTENNA TYPE: Double ridged guide
 MODULATION: GFSK
 BIT RATE: 1 Mbps

Frequency, MHz	Field strength, dB(µV/m)	EUT antenna gain, dBi	Limit, dB(µV/m)	Margin, dB*	Antenna polarization	Antenna height, m	Turn-table position**, degrees
2402	100.37	0	103.2	-2.83	Horizontal	1.7	30
2440	100.46	0	103.2	-2.74	Horizontal	1.9	60
2478	101.74	0	103.2	-1.46	Horizontal	1.8	60

Verdict: Pass

*- Margin = Field strength - EUT antenna gain - calculated field strength limit.

**- EUT front panel refer to 0 degrees position of turntable.

Reference numbers of test equipment used

HL 0521	HL 1984	HL 4278	HL 4353				
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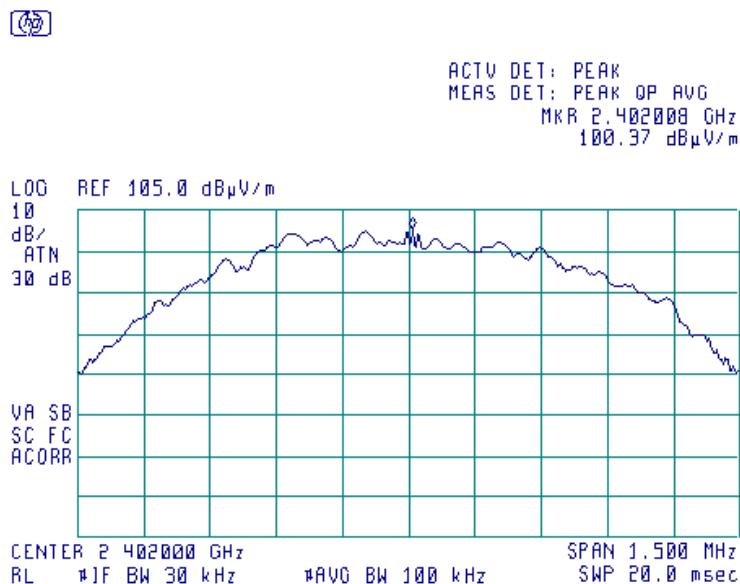
Full description is given in Appendix A.



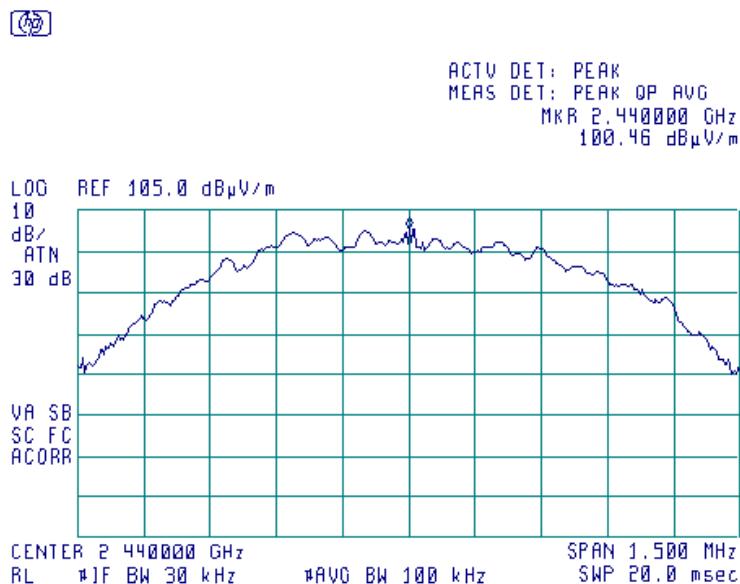
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Test specification: Section 15.247(e) / RSS-247 section 5.2(2), Maximum power spectral density			
Test procedure:	ANSI C63.10 section 11.10.2		
Test mode:	Compliance		
Date(s):	31-Jul-16 - 14-Aug-16		
Temperature: 23 °C	Relative Humidity: 55 %	Air Pressure: 1005 hPa	Power: Battery
Remarks:			

Plot 7.5.1 Peak spectral power density at low frequency, RBW=30 kHz, VBW=100 kHz



Plot 7.5.2 Peak spectral power density at mid frequency, RBW=30 kHz, VBW=100 kHz

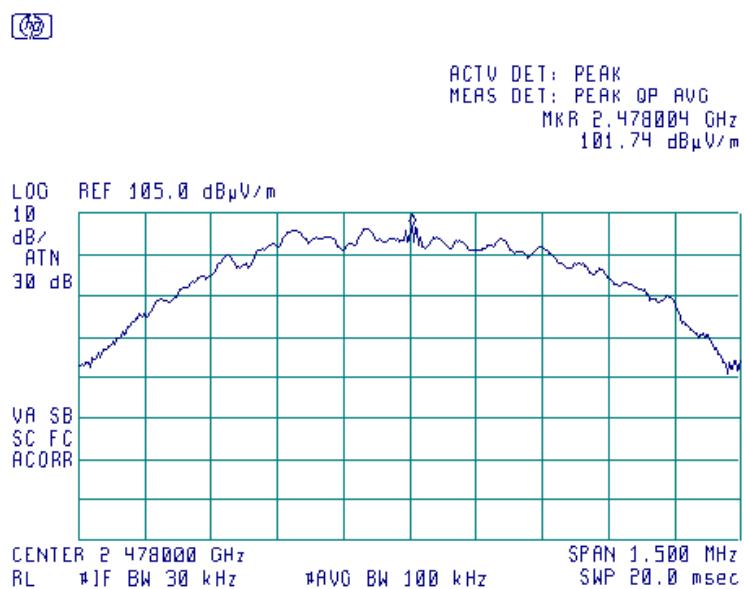




HERMON LABORATORIES

Test specification: Section 15.247(e) / RSS-247 section 5.2(2), Maximum power spectral density			
Test procedure:	ANSI C63.10 section 11.10.2		
Test mode:	Compliance		
Date(s):	31-Jul-16 - 14-Aug-16		
Temperature: 23 °C	Relative Humidity: 55 %	Air Pressure: 1005 hPa	Power: Battery
Remarks:			

Plot 7.5.3 Peak spectral power density at high frequency, RBW=30 kHz, VBW=100 kHz





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Test specification:	Section 15.203 / RSS-Gen section 7.1.4, Antenna requirements		
Test procedure:	Visual inspection		
Test mode:	Compliance	Verdict:	PASS
Date(s):	14-Aug-16		
Temperature: 23 °C	Relative Humidity: 56 %	Air Pressure: 1008 hPa	Power Supply: Battery
Remarks:			

7.6 Antenna requirements

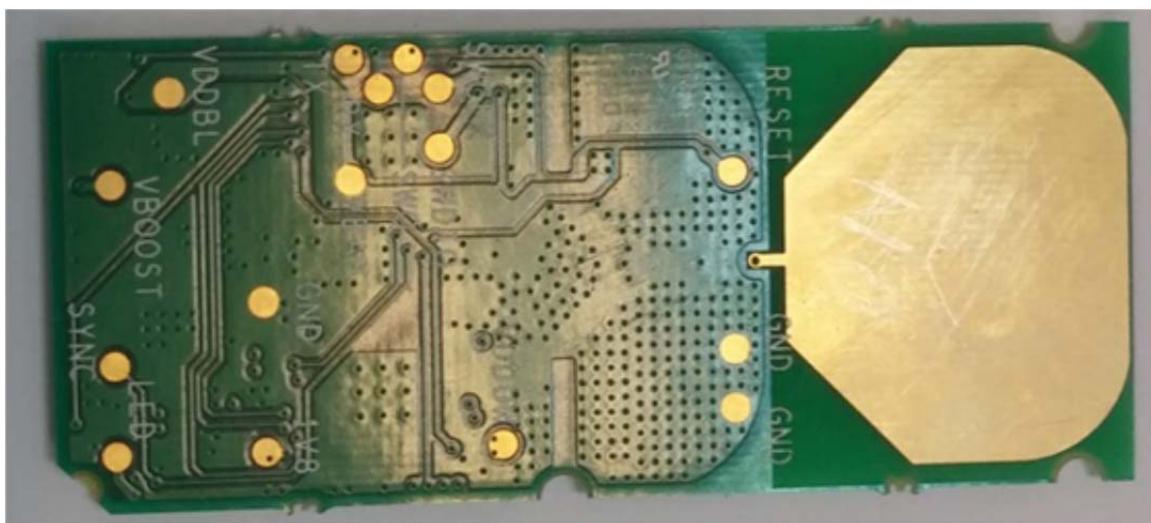
The EUT was verified for compliance with antenna requirements. A transmitter shall be designed to ensure that no antenna other than that furnished by the responsible party will be used with the device. It may be either permanently attached or employs a unique antenna connector for every antenna proposed for use with the EUT. This requirement does not apply to professionally installed transmitters.

The rationale for compliance with the above requirements was either visual inspection results or supplier declaration. The summary of results is provided in Table 7.6.1.

Table 7.6.1 Antenna requirements

Requirement	Rationale	Verdict
The transmitter antenna is permanently attached	Visual inspection	Comply
The transmitter employs a unique antenna connector	NA	
The transmitter requires professional installation	NA	

Photograph 7.6.1 Antenna view





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Test specification:	FCC section 15.109, ICES-003, RSS-Gen section 7.2.3/ ICES-003, Radiated emission		
Test procedure:	ANSI C63.4, Sections 8.3 and 12.2.5		
Test mode:	Compliance		
Date(s):	22-Aug-16 - 23-Aug-16	Verdict:	PASS
Temperature: 23 °C	Relative Humidity: 56 %	Air Pressure: 1008 hPa	Power: Battery
Remarks:			

8 Unintentional emissions

8.1 Radiated emission measurements

8.1.1 General

This test was performed to measure radiated emissions from the EUT enclosure. Specification test limits are given in Table 8.1.1, in Table 8.1.2.

Table 8.1.1 Radiated emission limits according to FCC Part 15, Section 109 and ICES-003, Section 6.2

Frequency, MHz	Class B limit, dB(µV/m)		Class A limit, dB(µV/m)	
	10 m distance	3 m distance	10 m distance	3 m distance
30 - 88	29.5*	40.0	39.0	49.5*
88 - 216	33.0*	43.5	43.5	54.0*
216 - 960	35.5*	46.0	46.4	56.9*
960 - 5 th harmonic**	43.5*	54.0	49.5	60.0*

* - The limit for test distance other than specified was calculated using the inverse linear distance extrapolation factor as follows: $\text{Lim}_{S2} = \text{Lim}_{S1} + 20 \log (S_1/S_2)$, where S_1 and S_2 – standard defined and test distance respectively in meters.

Table 8.1.2 Radiated emission limits according to RSS-Gen, Section 7.1.2

Frequency, MHz	Field strength limit at 3 m test distance, dB(µV/m)
30 - 88	40.0
88 - 216	43.5
216 - 960	46.0
960 - 5 th harmonic**	54.0

** - harmonic of the highest frequency the EUT generates, uses, operates or tunes to.

8.1.2 Test procedure

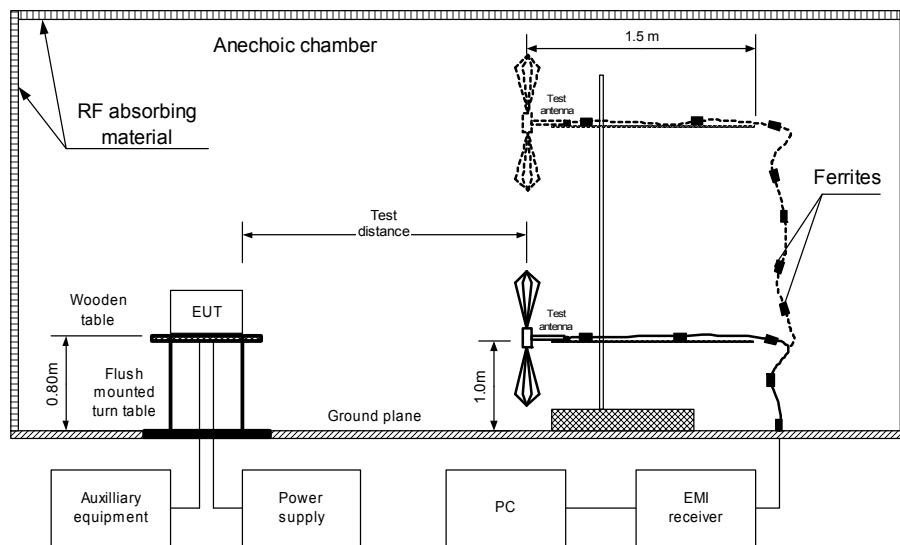
- 8.1.2.1 The EUT was set up as shown in Figure 8.1.1 and associated photograph/s, energized and the performance check was conducted.
- 8.1.2.2 The specified frequency range was investigated with biconilog antenna connected to EMI receiver. To find maximum radiation the turntable was rotated 360°, the measuring antenna height was changed from 1 to 4 m, its polarization was switched from vertical to horizontal and the EUT cables position was varied.
- 8.1.2.3 The worst test results (the lowest margins) were provided in the associated tables and plots.



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Test specification:	FCC section 15.109, ICES-003, RSS-Gen section 7.2.3/ ICES-003, Radiated emission		
Test procedure:	ANSI C63.4, Sections 8.3 and 12.2.5		
Test mode:	Compliance	Verdict:	PASS
Date(s):	22-Aug-16 - 23-Aug-16		
Temperature: 23 °C	Relative Humidity: 56 %	Air Pressure: 1008 hPa	Power: Battery
Remarks:			

Figure 8.1.1 Setup for radiated emission measurements in anechoic chamber, table-top equipment



Photograph 8.1.1 Setup for radiated emission measurements





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Test specification:	FCC section 15.109, ICES-003, RSS-Gen section 7.2.3/ ICES-003, Radiated emission		
Test procedure:	ANSI C63.4, Sections 8.3 and 12.2.5		
Test mode:	Compliance	Verdict:	PASS
Date(s):	22-Aug-16 - 23-Aug-16		
Temperature: 23 °C	Relative Humidity: 56 %	Air Pressure: 1008 hPa	Power: Battery
Remarks:			

Photograph 8.1.2 Setup for radiated emission measurements





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Test specification: FCC section 15.109, ICES-003, RSS-Gen section 7.2.3/ ICES-003, Radiated emission	
Test procedure: ANSI C63.4, Sections 8.3 and 12.2.5	
Test mode: Compliance	Verdict: PASS
Date(s): 22-Aug-16 - 23-Aug-16	
Temperature: 23 °C	Relative Humidity: 56 %
Remarks:	

Table 8.1.3 Radiated emission test results

EUT SET UP: TABLE-TOP
 LIMIT: Class B
 EUT OPERATING MODE: Stand-by and Receive
 TEST SITE: SEMI ANECHOIC CHAMBER
 TEST DISTANCE: 3 m
 FREQUENCY RANGE: 30 MHz – 1000 MHz
 RESOLUTION BANDWIDTH: 120 kHz

Frequency, MHz	Peak emission, dB(µV/m)	Quasi-peak			Antenna polarization	Antenna height, m	Turn-table position**, degrees	Verdict
		Measured emission, dB(µV/m)	Limit, dB(µV/m)	Margin, dB*				
No signals were found								Pass

TEST SITE: SEMI ANECHOIC CHAMBER
 TEST DISTANCE: 3 m
 DETECTORS USED: PEAK / AVERAGE
 FREQUENCY RANGE: 1000 MHz – 13000 MHz
 RESOLUTION BANDWIDTH: 1000 kHz

Frequency, MHz	Peak			Average			Antenna polarization	Antenna height, m	Turn-table position**, degrees	Verdict
	Measured emission, dB(µV/m)	Limit, dB(µV/m)	Margin, dB*	Measured emission, dB(µV/m)	Limit, dB(µV/m)	Margin, dB*				
No signals were found										Pass

*- Margin = Measured emission - specification limit.

**- EUT front panel refer to 0 degrees position of turntable.

Reference numbers of test equipment used

HL 0521	HL 0604	HL 1984	HL 3818	HL 4278	HL 4353	HL 4933	HL 5101
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Full description is given in Appendix A.

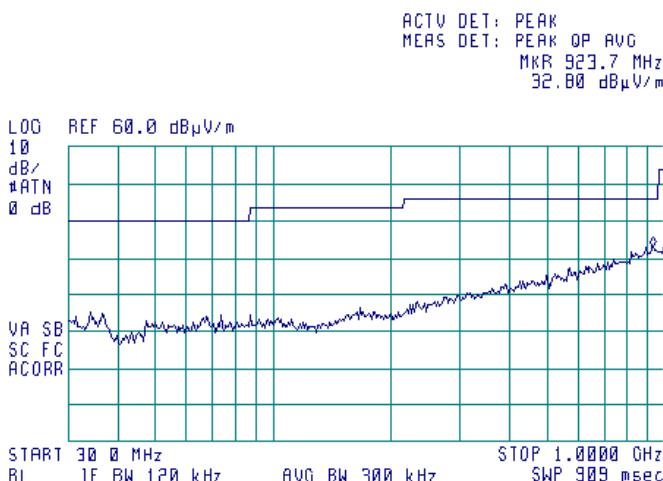


HERMON LABORATORIES

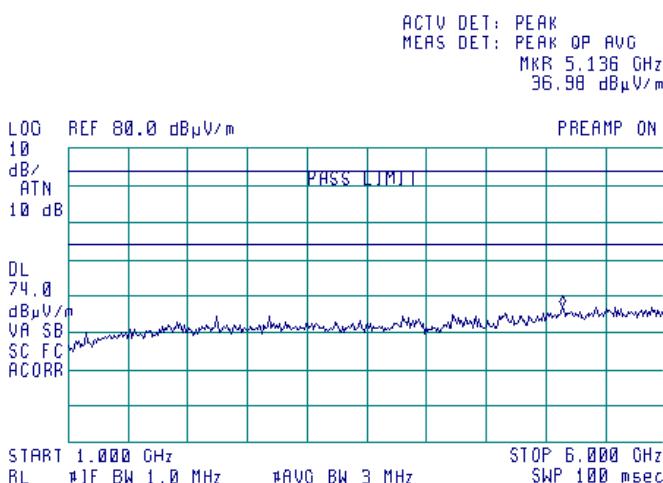
Test specification:	FCC section 15.109, ICES-003, RSS-Gen section 7.2.3/ ICES-003, Radiated emission		
Test procedure:	ANSI C63.4, Sections 8.3 and 12.2.5		
Test mode:	Compliance	Verdict:	PASS
Date(s):	22-Aug-16 - 23-Aug-16		
Temperature: 23 °C	Relative Humidity: 56 %	Air Pressure: 1008 hPa	Power: Battery
Remarks:			

Plot 8.1.1 Radiated emission measurements in 30 - 1000 MHz range

TEST SITE: Semi anechoic chamber
 TEST DISTANCE: 3 m
 EUT OPERATING MODE: Receive / Stand-by
 ANTENNA POLARIZATION: Vertical & Horizontal

**Plot 8.1.2 Radiated emission measurements in 1- 6 GHz range**

TEST SITE: Semi anechoic chamber
 TEST DISTANCE: 3 m
 EUT OPERATING MODE: Receive / Stand-by
 ANTENNA POLARIZATION: Vertical & Horizontal



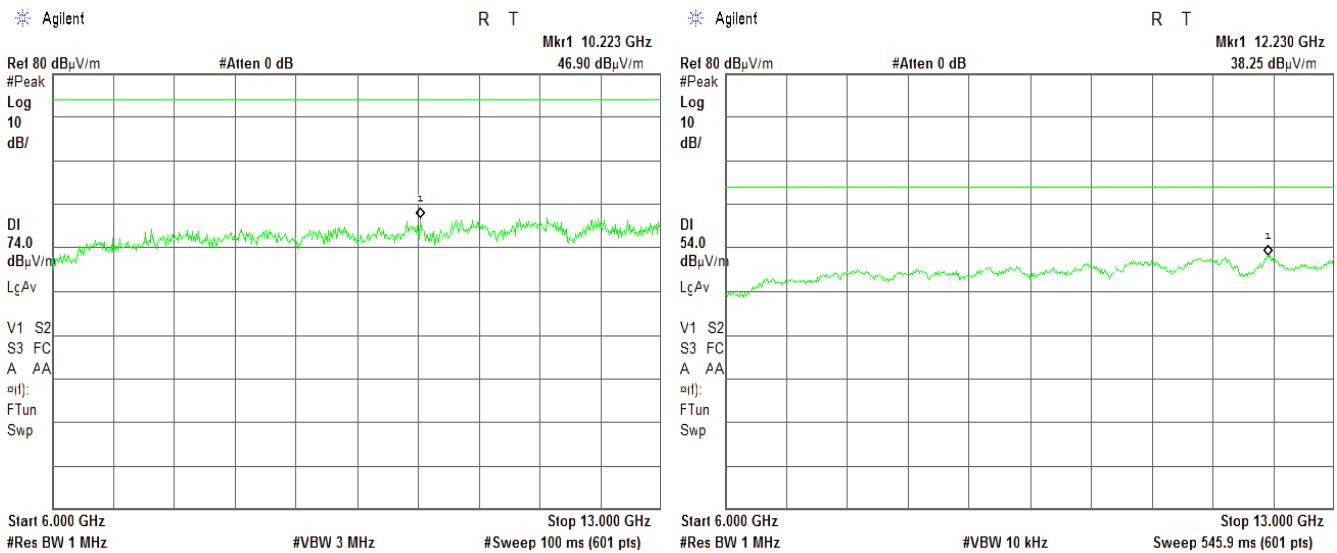


HERMON LABORATORIES

Test specification:	FCC section 15.109, ICES-003, RSS-Gen section 7.2.3/ ICES-003, Radiated emission		
Test procedure:	ANSI C63.4, Sections 8.3 and 12.2.5		
Test mode:	Compliance	Verdict:	PASS
Date(s):	22-Aug-16 - 23-Aug-16		
Temperature: 23 °C	Relative Humidity: 56 %	Air Pressure: 1008 hPa	Power: Battery
Remarks:			

Plot 8.1.3 Radiated emission measurements in 6-13 GHz range

TEST SITE: Semi anechoic chamber
LIMIT: Class B
TEST DISTANCE: 3 m
EUT OPERATING MODE: Receive / Stand-by
ANTENNA POLARIZATION: Vertical & Horizontal





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9 APPENDIX A Test equipment and ancillaries used for tests

HL No	Description	Manufacturer	Model	Ser. No.	Last Cal./Check*	Due Cal./Check*
0446	Antenna, Loop, Active, 10 kHz - 30 MHz	EMCO	6502	2857	18-Jan-16	18-Jan-17
0521	EMI Receiver (Spectrum Analyzer) with RF filter section 9 kHz-6.5 GHz	Hewlett Packard	8546A	3617A 00319, 3448A002 53	27-Oct-16	27-Oct-17
0604	Antenna BiconiLog Log-Periodic/T Bow-TIE, 26 - 2000 MHz	EMCO	3141	9611-1011	10-May-16	10-May-17
1984	Antenna, Double-Ridged Waveguide Horn, 1 to 18 GHz, 300 W	EMC Test Systems	3115	9911-5964	28-Mar-16	28-Mar-17
2780	EMC analyzer, 100 Hz to 26.5 GHz	Agilent Technologies	E7405A	MY451024 62	08-Sep-16	08-Sep-17
2909	Spectrum analyzer, ESA-E, 100 Hz to 26.5 GHz	Agilent Technologies	E4407B	MY414447 62	21-Feb-16	21-Feb-17
3818	PSA Series Spectrum Analyzer, 3 Hz- 44 GHz	Agilent Technologies	E4446A	MY482502 88	03-May-16	03-May-17
3901	Microwave Cable Assembly, 40.0 GHz, 3.5 m, SMA/SMA	Huber-Suhner	SUCOFLE X 102A	1225/2A	15-Feb-16	15-Feb-17
3903	Microwave Cable Assembly, 40.0 GHz, 1.5 m, SMA/SMA	Huber-Suhner	SUCOFLE X 102A	1226/2A	15-Feb-16	15-Feb-17
4114	Antenna, Double-Ridged Waveguide Horn, 1 to 18 GHz	ETS Lindgren	3117	00123515	24-Dec-15	24-Dec-16
4224	Precision Fixed Attenuator, 50 Ohm, 5W, 10dB, DC to 18000 MHz	Mini-Circuits	BW-N10W5+	NA	09-Mar-16	09-Mar-17
4278	Test Cable , DC-18 GHz, 4.6 m, N/M - N/M	Mini-Circuits	APC-15FT-NMNM+	0755A	22-Nov-15	22-Nov-16
4353	Low Loss Armored Test Cable, DC - 18 GHz, 6.2 m, N type-M/N type-M	MegaPhase	NC29-N1N1-244	12025101 003	15-Mar-16	15-Mar-17
4575	EXA Signal Analyzer, 9 kHz - 26.5 GHz	Agilent Technologies	N9010A	MY480301 10	17-Feb-16	17-Mar-17
4722	Low Loss Armored Test Cable, DC - 18 GHz, 6.2 m, N type-M/N type-M	MegaPhase	NC29-N1N1-244	51228701 001	30-Dec-15	30-Dec-16
4917	High Pass Filter, 50 Ohm, 3150 to 6500 MHz, SMA-FM / SMA-M	Mini-Circuits	VHF-2700+	NA	01-Oct-15	01-Oct-17
4932	Microwave preamplifier, 500 MHz to 18 GHz, 40 dB Gain	Com-Power Corporation	PAM-118A	551029	19-Nov-15	19-Nov-16
4933	Active Horn Antenna, 1 GHz to 18 GHz	Com-Power Corporation	AHA-118	701046	04-Sep-16	04-Sep-17
4956	Active horn antenna, 18 to 40 GHz	Com-Power Corporation	AHA-840	105004	09-Nov-15	09-Nov-16
4965	Cable, 1 m, BNC-N	HL	C1BN	001	18-Feb-16	18-Feb-17
5101	RF cable, 18 GHz, 6 m, N-type	Huber-Suhner	SF106A/1 1N/11N/6 000MM	500847/6A	26-Jul-16	26-Jul-17

*the calibration was valid at the testing time



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10 APPENDIX B Measurement uncertainties

Expanded uncertainty at 95% confidence in Hermon Labs EMC measurements

Test description	Expanded uncertainty
Conducted carrier power at RF antenna connector	Below 12.4 GHz: ± 1.7 dB 12.4 GHz to 40 GHz: ± 2.3 dB
Conducted emissions at RF antenna connector	9 kHz to 2.9 GHz: ± 2.6 dB 2.9 GHz to 6.46 GHz: ± 3.5 dB 6.46 GHz to 13.2 GHz: ± 4.3 dB 13.2 GHz to 22.0 GHz: ± 5.0 dB 22.0 GHz to 26.8 GHz: ± 5.5 dB 26.8 GHz to 40.0 GHz: ± 4.8 dB
Occupied bandwidth	± 8.0 %
Duty cycle, timing (Tx ON / OFF) and average factor measurements	± 1.0 %
Conducted emissions with LISN	9 kHz to 150 kHz: ± 3.9 dB 150 kHz to 30 MHz: ± 3.8 dB
Radiated emissions at 3 m measuring distance Horizontal polarization	Biconilog antenna: ± 5.3 dB Biconical antenna: ± 5.0 dB Log periodic antenna: ± 5.3 dB Double ridged horn antenna: ± 5.3 dB Biconilog antenna: ± 6.0 dB Biconical antenna: ± 5.7 dB Log periodic antenna: ± 6.0 dB Double ridged horn antenna: ± 6.0 dB
Vertical polarization	

Hermon Laboratories is accredited by A2LA for calibration according to present requirements of ISO/IEC 17025 and NCSL Z540-1. The accreditation is granted to perform calibration of parameters that are listed in the Scope of Hermon Laboratories Accreditation.

Hermon Laboratories calibrates its reference and transfer standards by calibration laboratories accredited to ISO/IEC 17025 by a mutually recognized Accreditation Body or by a recognized national metrology institute. All reference and transfer standards used in the calibration system are traceable to national or international standards.

In-house calibration of all test and measurement equipment is performed on a regular basis according to Hermon Laboratories calibration procedures, manufacturer calibration/verification procedures or procedures defined in the relevant standards. The Hermon Laboratories test and measurement equipment is calibrated within the tolerances specified by the manufacturers and/or by the relevant standards.



HERMON LABORATORIES

11 APPENDIX C Test laboratory description

Tests were performed at Hermon Laboratories Ltd., which is a fully independent, private, EMC, safety, environmental and telecommunication testing facility.

Hermon Laboratories is recognized and accredited by the Federal Communications Commission (USA) for 1, 2, 15, 18 parts of Code of Federal Regulations 47 (CFR 47), Test Firm Registration Number is 927748, Designation Number is IL1001; registered by Industry Canada for electromagnetic emissions, file number IC 2186A-1 for OATS, certified by VCCI, Japan (the registration numbers are R-808 for OATS, R-1082 for anechoic chamber, G-869 for RE measurements above 1 GHz, C-845 for conducted emissions site, T-1606 for conducted emissions at telecommunication ports). The laboratory is accredited by American Association for Laboratory Accreditation (USA) according to ISO/IEC 17025 for electromagnetic compatibility, product safety, telecommunications testing and environmental simulation (for exact scope please refer to Certificate No. 839.01).

Address: P.O. Box 23, Binyamina 30500, Israel.
Telephone: +972 4628 8001
Fax: +972 4628 8277
e-mail: mail@hermonlabs.com
website: www.hermonlabs.com

Person for contact: Mr. Alex Usoskin, CEO.

12 APPENDIX D Specification references

FCC 47CFR part 15: 2015	Radio Frequency Devices
ANSI C63.10: 2013	American National Standard of Procedures for Compliance Testing of Unlicensed Wireless Devices
ANSI C63.2: 1996	American National Standard for Instrumentation-Electromagnetic Noise and Field Strength, 10 kHz to 40 GHz-Specifications
ANSI C63.4: 2014	American National Standard for Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz
RSS-247 Issue 1: 2015	Digital Transmission Systems (DTSs), Frequency Hopping Systems (FHSs) and Licence- Exempt Local Area Network (LE-LAN) Devices
RSS-Gen Issue 4: 2014	General Requirements and Information for the Certification of Radiocommunication Equipment
ICES-003: 2016, Issue 6	Information Technology Equipment (Including Digital Apparatus) – Limits and methods of measurement



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13 APPENDIX E Test equipment correction factors

Antenna factor
Active loop antenna
Model 6502, S/N 2857, HL 0446

Frequency, MHz	Magnetic antenna factor, dB	Electric antenna factor, dB
0.009	-32.8	18.7
0.010	-33.8	17.7
0.020	-38.3	13.2
0.050	-41.1	10.4
0.075	-41.3	10.2
0.100	-41.6	9.9
0.150	-41.7	9.8
0.250	-41.6	9.9
0.500	-41.8	9.8
0.750	-41.9	9.7
1.000	-41.4	10.1
2.000	-41.5	10.0
3.000	-41.4	10.2
4.000	-41.4	10.1
5.000	-41.5	10.1
10.000	-41.9	9.6
15.000	-41.9	9.6
20.000	-42.2	9.3
25.000	-42.8	8.7
30.000	-44.0	7.5

Antenna factor in dB(1/m) is to be added to receiver meter reading in dB(μ V) to convert it into field strength in dB(μ V/m).

Antenna factor
Standard gain horn antenna
Quinstar Technology
Model QWH
Ser.No.112, HL 0768, 0769, 0770, 0771, 0772

Frequency min, GHz	Frequency max, GHz	Antenna factor, dB(1/m)
18.000	26.500	32.01
26.500	40.000	35.48
40.000	60.000	39.03
60.000	90.000	42.55
90.000	140.000	46.23
140.000	220.000	50.11

Antenna factor in dB(1/m) is to be added to receiver meter reading in dB(μ V) to convert it into field strength in dB(μ V/m).



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Antenna factor
Biconilog antenna EMCO Model 3141
Ser.No.1011, HL 0604

Frequency, MHz	Antenna factor, dB(1/m)	Frequency, MHz	Antenna factor, dB(1/m)	Frequency, MHz	Antenna factor, dB(1/m)
26	7.8	580	20.6	1320	27.8
28	7.8	600	21.3	1340	28.3
30	7.8	620	21.5	1360	28.2
40	7.2	640	21.2	1380	27.9
60	7.1	660	21.4	1400	27.9
70	8.5	680	21.9	1420	27.9
80	9.4	700	22.2	1440	27.8
90	9.8	720	22.2	1460	27.8
100	9.7	740	22.1	1480	28.0
110	9.3	760	22.3	1500	28.5
120	8.8	780	22.6	1520	28.9
130	8.7	800	22.7	1540	29.6
140	9.2	820	22.9	1560	29.8
150	9.8	840	23.1	1580	29.6
160	10.2	860	23.4	1600	29.5
170	10.4	880	23.8	1620	29.3
180	10.4	900	24.1	1640	29.2
190	10.3	920	24.1	1660	29.4
200	10.6	940	24.0	1680	29.6
220	11.6	960	24.1	1700	29.8
240	12.4	980	24.5	1720	30.3
260	12.8	1000	24.9	1740	30.8
280	13.7	1020	25.0	1760	31.1
300	14.7	1040	25.2	1780	31.0
320	15.2	1060	25.4	1800	30.9
340	15.4	1080	25.6	1820	30.7
360	16.1	1100	25.7	1840	30.6
380	16.4	1120	26.0	1860	30.6
400	16.6	1140	26.4	1880	30.6
420	16.7	1160	27.0	1900	30.6
440	17.0	1180	27.0	1920	30.7
460	17.7	1200	26.7	1940	30.9
480	18.1	1220	26.5	1960	31.2
500	18.5	1240	26.5	1980	31.6
520	19.1	1260	26.5	2000	32.0
540	19.5	1280	26.6		
560	19.8	1300	27.0		

Antenna factor in dB(1/m) is to be added to receiver meter reading in dB(μ V) to convert it into field strength in dB(μ V/m).



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Antenna factor
Double-ridged wave guide horn antenna
Model 3115, S/N 9911-5964, HL1984

Frequency, MHz	Antenna factor, dB(1/m)
1000.0	24.7
1500.0	25.7
2000.0	27.6
2500.0	28.9
3000.0	31.2
3500.0	32.0
4000.0	32.5
4500.0	32.7
5000.0	33.6
5500.0	35.1
6000.0	35.4
6500.0	34.9
7000.0	36.1
7500.0	37.8
8000.0	38.0
8500.0	38.1
9000.0	39.1
9500.0	38.3
10000.0	38.6
10500.0	38.2
11000.0	38.7
11500.0	39.5
12000.0	40.0
12500.0	40.4
13000.0	40.5
13500.0	41.1
14000.0	41.6
14500.0	41.7
15000.0	38.7
15500.0	38.2
16000.0	38.8
16500.0	40.5
17000.0	42.5
17500.0	45.9
18000.0	49.4

Antenna factor in dB(1/m) is to be added to receiver meter reading in dB(μ V) to convert it into field strength in dB(μ V/m).



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Antenna factor
Double-ridged waveguide horn antenna
ETS Lindgren, Model 3117, serial number: 00123515, HL 4114

Frequency, MHz	Antenna factor, dB/m		
	Measured	Manufacturer	Deviation
1000	28.0	28.4	-0.4
1500	28.0	27.4	0.6
2000	31.2	30.9	0.3
2500	32.5	33.4	-0.9
3000	32.9	32.6	0.3
3500	32.7	32.8	-0.1
4000	33.1	33.4	-0.3
4500	33.8	33.9	-0.1
5000	33.8	34.1	-0.3
5500	34.4	34.5	-0.1
6000	35.0	35.2	-0.2
6500	35.4	35.5	-0.1
7000	35.7	35.7	0.0
7500	35.9	35.7	0.2
8000	35.8	35.8	0.0
8500	35.9	35.8	0.1
9000	36.3	36.2	0.1
9500	36.6	36.6	0.0
10000	37.1	37.1	0.0
10500	37.6	37.5	0.1
11000	37.9	37.7	0.2
11500	38.5	38.1	0.4
12000	39.2	38.7	0.5
12500	39.0	38.9	0.1
13000	39.1	39.1	0.0
13500	38.9	38.8	0.1
14000	39.0	38.8	0.2
14500	39.6	39.9	-0.3
15000	39.9	39.7	0.2
15500	39.9	40.1	-0.2
16000	40.7	40.8	-0.1
16500	41.3	41.8	-0.5
17000	42.5	42.1	0.4
17500	41.3	41.2	0.1
18000	41.4	40.9	0.5

Antenna factor is to be added to receiver meter reading in dB(μ V) to convert to field strength in dB(μ V/meter)



HERMON LABORATORIES

Antenna factor, HL 4933

**Active Horn Antenna Factor Calibration**

1 GHz to 18 GHz

Equipment:	ACTIVE HORN ANTENNA				
Model:	AHA-118				
Serial Number:	701046				
Calibration Distance:	3 Meter				
Polarization:	Horizontal				
Calibration Date:	11/12/2014				
Frequency (GHz)	Preamplifier Gain (dB)	Antenna Factor with pre-amp (dB/m)	Frequency (GHz)	Preamplifier Gain (dB)	Antenna Factor with pre-amp (dB/m)
1	40.96	-16.47	10	40.94	-1.97
1.5	41.21	-14.53	10.5	40.63	-1.06
2	41.44	-13.30	11	40.74	-1.50
2.5	41.71	-12.87	11.5	40.65	-0.52
3	41.96	-12.26	12	40.76	-0.15
3.5	42.14	-11.77	12.5	41.03	-0.85
4	42.13	-10.91	13	41.37	-0.81
4.5	41.79	-9.41	13.5	41.18	0.05
5	41.44	-7.54	14	40.98	0.36
5.5	40.91	-6.47	14.5	40.81	1.26
6	40.69	-5.48	15	40.65	0.25
6.5	40.64	-5.53	15.5	40.93	-1.05
7	40.76	-4.12	16	41.31	-1.44
7.5	40.94	-3.12	16.5	40.96	-0.80
8	40.68	-1.69	17	40.64	-0.02
8.5	40.08	-1.71	17.5	40.57	1.81
9	40.41	-1.86	18	40.08	3.63
9.5	41.21	-2.73			
Calibration according to ARP 958					
Antenna Factor to be added to receiver reading:					
Meter Reading (dBuV) + Antenna Factor (dB/m) = Corrected Reading (dBuV/m)					



HERMON LABORATORIES

Antenna factor, HL 4956



Active Horn Antenna Factor Calibration

18 GHz to 40 GHz

Equipment:			ACTIVE HORN ANTENNA		
Model:			AHA-840		
Serial Number:			105004		
Calibration Distance:			3 meter		
Polarization:			Horizontal		
Calibration Date:			1/26/2015		
Frequency (GHz)	Preamplifier Gain (dB)	Antenna Factor with pre-amp (dB/m)	Frequency (GHz)	Preamplifier Gain (dB)	Antenna Factor with pre-amp (dB/m)
18	38.83	-1.06	29.5	42.47	-5.33
18.5	39.34	-2.65	30	41.91	-4.86
19	39.71	-3.88	30.5	41.60	-4.64
19.5	39.87	-4.35	31	41.52	-4.60
20	39.98	-3.97	31.5	41.56	-4.79
20.5	40.42	-3.68	32	41.80	-5.21
21	41.12	-4.06	32.5	42.29	-5.54
21.5	41.74	-5.46	33	42.79	-5.63
22	42.14	-6.22	33.5	42.88	-5.38
22.5	42.35	-6.42	34	42.62	-4.76
23	42.50	-6.59	34.5	42.63	-4.84
23.5	42.65	-6.82	35	43.15	-5.13
24	42.81	-7.01	35.5	43.91	-5.83
24.5	42.86	-7.37	36	44.59	-6.39
25	42.73	-7.53	36.5	45.04	-6.64
25.5	42.77	-7.45	37	45.08	-6.40
26	42.85	-7.21	37.5	44.82	-5.75
26.5	42.98	-7.17	38	44.16	-4.58
27	43.14	-7.22	38.5	42.90	-2.66
27.5	43.18	-7.32	39	42.39	-1.71
28	43.04	-7.10	39.5	43.76	-2.49
28.5	43.01	-6.73	40	45.98	-5.21
Calibration per ANSI C63.5: 2006 Standard Site Method, Equations 1-6 (3-antenna)					
Corrected Reading (dB μ V/m) = Meter Reading (dB μ V) + AFE(dB/m)					



HERMON LABORATORIES

Cable loss
Microwave Cable Assembly, Huber-Suhner, 40 GHz, 3.5 m, SMA-SMA, S/N 1225/2A
HL 3901

Frequency, MHz	Cable loss, dB	Frequency, MHz	Cable loss, dB	Frequency, MHz	Cable loss, dB
10	0.09	9500	4.29	21000	6.67
100	0.41	10000	4.40	22000	6.92
500	0.93	10500	4.52	23000	7.00
1000	1.33	11000	4.64	24000	7.18
1500	1.63	11500	4.76	25000	7.29
2000	1.90	12000	4.87	26000	7.55
2500	2.12	12500	4.99	27000	7.70
3000	2.33	13000	5.11	28000	7.88
3500	2.50	13500	5.20	29000	8.02
4000	2.67	14000	5.31	30000	8.15
4500	2.82	14500	5.42	31000	8.35
5000	2.99	15000	5.51	32000	8.40
5500	3.16	15500	5.58	33000	8.62
6000	3.32	16000	5.68	34000	8.73
6500	3.51	16500	5.78	35000	8.78
7000	3.65	17000	5.91	36000	8.94
7500	3.79	17500	5.99	37000	9.21
8000	3.92	18000	6.07	38000	9.37
8500	4.04	19000	6.36	39000	9.45
9000	4.18	20000	6.49	40000	9.52



HERMON LABORATORIES

Cable loss
Microwave Cable Assembly, Huber-Suhner, 40 GHz, 1.5 m, SMA-SMA, S/N 1226/2A
HL 3903

Frequency, MHz	Cable loss, dB	Frequency, MHz	Cable loss, dB	Frequency, MHz	Cable loss, dB
10	-0.02	9500	1.84	21000	2.98
100	0.15	10000	1.86	22000	3.07
500	0.38	10500	1.93	23000	3.13
1000	0.56	11000	1.99	24000	3.21
1500	0.69	11500	2.04	25000	3.26
2000	0.82	12000	2.10	26000	3.48
2500	0.90	12500	2.15	27000	3.44
3000	0.98	13000	2.21	28000	3.53
3500	1.06	13500	2.25	29000	3.59
4000	1.11	14000	2.29	30000	3.66
4500	1.17	14500	2.34	31000	3.70
5000	1.24	15000	2.36	32000	3.79
5500	1.32	15500	2.40	33000	3.88
6000	1.40	16000	2.45	34000	3.94
6500	1.50	16500	2.48	35000	3.91
7000	1.56	17000	2.56	36000	4.05
7500	1.62	17500	2.58	37000	4.22
8000	1.68	18000	2.60	38000	4.25
8500	1.74	19000	2.84	39000	4.27
9000	1.78	20000	2.88	40000	4.33



HERMON LABORATORIES

Cable loss
Test cable, Mini-Circuits, S/N 0755A, 18 GHz, 4.6 m, N/M - N/M
APC-15FT-NMNM+, HL 4278

Frequency, MHz	Cable loss, dB						
10	0.24	4900	4.19	10000	6.47	15100	8.33
30	0.26	5000	4.25	10100	6.50	15200	8.35
50	0.34	5100	4.29	10200	6.52	15300	8.37
100	0.50	5200	4.32	10300	6.57	15400	8.40
200	0.72	5300	4.38	10400	6.59	15500	8.42
300	0.90	5400	4.41	10500	6.61	15600	8.46
400	1.06	5500	4.46	10600	6.64	15700	8.50
500	1.20	5600	4.51	10700	6.64	15800	8.52
600	1.32	5700	4.56	10800	6.65	15900	8.56
700	1.44	5800	4.59	10900	6.68	16000	8.61
800	1.54	5900	4.64	11000	6.68	16100	8.64
900	1.64	6000	4.69	11100	6.69	16200	8.66
1000	1.74	6100	4.72	11200	6.70	16300	8.70
1100	1.83	6200	4.77	11300	6.74	16400	8.73
1200	1.92	6300	4.80	11400	6.78	16500	8.74
1300	2.01	6400	4.83	11500	6.81	16600	8.75
1400	2.09	6500	4.89	11600	6.84	16700	8.78
1500	2.18	6600	4.90	11700	6.87	16800	8.79
1600	2.25	6700	4.95	11800	6.92	16900	8.81
1700	2.33	6800	5.01	11900	6.98	17000	8.85
1800	2.39	6900	4.99	12000	7.02	17100	8.90
1900	2.47	7000	5.04	12100	7.08	17200	8.95
2000	2.53	7100	5.11	12200	7.15	17300	8.99
2100	2.60	7200	5.14	12300	7.20	17400	9.03
2200	2.67	7300	5.21	12400	7.26	17500	9.07
2300	2.73	7400	5.29	12500	7.31	17600	9.11
2400	2.80	7500	5.33	12600	7.36	17700	9.15
2500	2.87	7600	5.38	12700	7.41	17800	9.19
2600	2.93	7700	5.46	12800	7.46	17900	9.24
2700	3.00	7800	5.52	12900	7.51	18000	9.28
2800	3.06	7900	5.58	13000	7.55		
2900	3.12	8000	5.64	13100	7.59		
3000	3.18	8100	5.69	13200	7.65		
3100	3.24	8200	5.75	13300	7.69		
3200	3.30	8300	5.80	13400	7.72		
3300	3.35	8400	5.84	13500	7.78		
3400	3.42	8500	5.90	13600	7.82		
3500	3.46	8600	5.97	13700	7.86		
3600	3.52	8700	5.99	13800	7.91		
3700	3.57	8800	6.04	13900	7.96		
3800	3.61	8900	6.10	14000	8.01		
3900	3.67	9000	6.13	14100	8.06		
4000	3.71	9100	6.17	14200	8.10		
4100	3.77	9200	6.23	14300	8.13		
4200	3.83	9300	6.27	14400	8.16		
4300	3.89	9400	6.30	14500	8.19		
4400	3.94	9500	6.35	14600	8.21		
4500	4.00	9600	6.37	14700	8.23		
4600	4.05	9700	6.40	14800	8.26		
4700	4.10	9800	6.44	14900	8.28		
4800	4.16	9900	6.45	15000	8.30		



HERMON LABORATORIES

Cable loss
Low Loss Armored Test Cable, MegaPhase, 18 GHz, 6.2 m, N type-M/N type-M,
NC29-N1N1-244S/N 12025101 003,
HL 4353

Frequency, MHz	Cable loss, dB	Frequency, MHz	Cable loss, dB
50	0.20	9000	2.71
100	0.27	9500	2.81
300	0.47	10000	2.90
500	0.61	10500	2.97
1000	0.87	11000	3.06
1500	1.07	11500	3.13
2000	1.24	12000	3.20
2500	1.39	12500	3.26
3000	1.53	13000	3.34
3500	1.65	13500	3.39
4000	1.77	14000	3.47
4500	1.89	14500	3.54
5000	1.99	15000	3.62
5500	2.07	15500	3.69
6000	2.20	16000	3.76
6500	2.30	16500	3.83
7000	2.39	17000	3.86
7500	2.51	17500	3.94
8000	2.58	18000	4.02
8500	2.65		



HERMON LABORATORIES

Cable loss
Low Loss Armored Test Cable, MegaPhase, 18 GHz, 6.2 m, N type-M/N type-M,
NC29-N1N1-244, S/N 51228701001
HL 4722

Frequency, MHz	Cable loss, dB	Frequency, MHz	Cable loss, dB
50	0.22	9000	2.93
100	0.30	9500	3.06
300	0.52	10000	3.16
500	0.66	10500	3.20
1000	0.93	11000	3.34
1500	1.15	11500	3.39
2000	1.33	12000	3.48
2500	1.49	12500	3.55
3000	1.64	13000	3.66
3500	1.77	13500	3.75
4000	1.90	14000	3.76
4500	2.03	14500	3.87
5000	2.17	15000	3.98
5500	2.30	15500	4.01
6000	2.39	16000	4.14
6500	2.51	16500	4.15
7000	2.59	17000	4.32
7500	2.67	17500	4.36
8000	2.76	18000	4.38
8500	2.84		



HERMON LABORATORIES

Cable loss
RF Cable, Huber-Suhner, 18 GHz, 6 m, N- type,
SF106A/11N/11N/6000MM, S/N 500847/6A
HL 5101

Frequency, MHz	Cable loss, dB	Frequency, MHz	Cable loss, dB
0.1	0.01	5500	2.42
50	0.22	6000	2.53
100	0.31	6500	2.65
200	0.43	7000	2.76
300	0.53	7500	2.86
400	0.62	8000	2.96
500	0.69	8500	3.06
600	0.76	9000	3.16
700	0.82	9500	3.26
800	0.87	10000	3.35
900	0.93	10500	3.44
1000	0.98	11000	3.54
1100	1.03	11500	3.62
1200	1.08	12000	3.70
1300	1.12	12500	3.80
1400	1.17	13000	3.88
1500	1.21	13500	3.97
1600	1.25	14000	4.04
1700	1.29	14500	4.13
1800	1.33	15000	4.22
1900	1.37	15500	4.31
2000	1.41	16000	4.39
2500	1.59	16500	4.47
3000	1.75	17000	4.54
3500	1.90	17500	4.61
4000	2.04	18000	4.68
4500	2.17		
5000	2.30		



HERMON LABORATORIES

14 APPENDIX F Abbreviations and acronyms

A	ampere
AC	alternating current
AM	amplitude modulation
AVRG	average (detector)
cm	centimeter
dB	decibel
dBm	decibel referred to one milliwatt
dB(µV)	decibel referred to one microvolt
dB(µV/m)	decibel referred to one microvolt per meter
dB(µA)	decibel referred to one microampere
DC	direct current
EIRP	equivalent isotropically radiated power
ERP	effective radiated power
EUT	equipment under test
F	frequency
GHz	gigahertz
GND	ground
H	height
HL	Hermon laboratories
Hz	hertz
k	kilo
kHz	kilohertz
LO	local oscillator
m	meter
MHz	megahertz
min	minute
mm	millimeter
ms	millisecond
µs	microsecond
NA	not applicable
NB	narrow band
OATS	open area test site
Ω	Ohm
PM	pulse modulation
PS	power supply
ppm	part per million (10^{-6})
QP	quasi-peak
RE	radiated emission
RF	radio frequency
rms	root mean square
Rx	receive
s	second
T	temperature
Tx	transmit
V	volt
WB	wideband

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