

## JUSTIFICATION TEST REPORT

**ACCORDING TO: FCC CFR 47 part 15 subpart C, §15.247 and subpart B;  
RSS-210 issue 8 Annex 8, ICES-003 Issue 4:2004**

FOR:

**LogiTag Systems Ltd.**

**UHF RFID reader**

**Part number: LogiRead-UX1-NA**

**Contains: FCC ID:PI403B,  
IC:1931B-EUSB**

**Contains: FCC ID:QV5MERCURY5E,  
IC:5407A-MERCURY5E**

This report is in conformity with ISO/ IEC 17025. The "A2LA Accredited" symbol endorsement applies only to the tests and calibrations that are listed in the scope of Hermon Laboratories accreditation. The test results relate only to the items tested. This test report shall not be reproduced in any form except in full with the written approval of Hermon Laboratories Ltd.



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## 1 Applicant information

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**Fax:** +972 9865 6262  
**E-mail:** golank@Logi-tag.com  
**Contact name:** Mr. Golan Kormian

## 2 Equipment under test attributes

**Product name:** UHF RFID reader  
**Part number:** LogiRead-UX1-NA  
**Serial number:** UX1NA00001  
**Hardware version:** B02  
**Software release:** V1.05  
**Receipt date** 3/25/2012

## 3 Manufacturer information

**Manufacturer name:** LogiTag Systems Ltd.  
**Address:** 2 Hamelacha street, Poleg Industrial Zone, Netanya 42504, Israel  
**Telephone:** +972 9835 4848  
**Fax:** +972 9865 6262  
**E-Mail:** golank@Logi-tag.com  
**Contact name:** Mr. Golan Kormian

## 4 Test details

**Project ID:** 23127  
**Location:** Hermon Laboratories Ltd. Harakevet Industrial Zone, Binyamina 30500, Israel  
**Test started:** 3/25/2012  
**Test completed:** 4/24/2012  
**Test specification(s):** FCC CFR47 part 15 subp.C §15.247, subp.B §15.109;  
RSS-210 issue 8 Annex 8, ICES-003:2004

## 5 Tests summary

Test	Status
<b>Transmitter characteristics</b>	
Section 15.247(b), RSS-210 section A8.4, Peak output power	Pass
Section 15.247(c), RSS-210 section A8.5, Radiated spurious emissions	Pass
<b>Unintentional emissions</b>	
Section 15.109 class B, ICES-003, Section 5.5, Radiated emission	Pass

The device contains two modular approved transmitters:

- 1) FCC ID:PI403B, IC:1931B-EUSB and
- 2) FCC ID:QV5MERCURY5E, IC:5407A-MERCURY5E.

Only relevant tests for Application for certification of Class II permissive change were conducted. The peak output test was performed for FCC ID:QV5MERCURY5E, IC:5407A-MERCURY5E module to check the higher output power of 2 approved modules.

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

	Name and Title	Date	Signature
Tested by:	Mrs. E. Pitt, test engineer	April 24, 2012	
Reviewed by:	Mrs. M. Cherniavsky, certification engineer	April 29, 2012	
Approved by:	Mr. M. Nikishin, EMC and Radio group manager	April 30, 2012	



## 6 EUT description

### 6.1 General information

The EUT, UHF RFID Reader, is a system for read and write operations for UHF RFID transponders. The device contains two modular approved transmitters FCC ID:PI403B, IC:1931B-EUSB (2402-2480 MHz) and FCC ID:QV5MERCURY5E, IC:5407A-MERCURY5E (902.75 – 927.25 MHz). It can be operated by host computer with Bluetooth link support. The device is powered by rechargeable LI-PO battery, can be charged by 5V/3A adaptor or USB connection to host.

### 6.2 Changes made in EUT

No changes were performed in the EUT.



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<b>Test specification:</b>	<b>Section 15.247(b), RSS-210 section A8.4(1), Peak output power</b>		
<b>Test procedure:</b>	Public notice DA 00-705		
<b>Test mode:</b>	Compliance	<b>Verdict:</b> PASS	
<b>Date(s):</b>	4/24/2012		
<b>Temperature:</b> 23 °C	<b>Air Pressure:</b> 1012 hPa	<b>Relative Humidity:</b> 47 %	<b>Power Supply:</b> 5 VDC
<b>Remarks:</b>			

## 7 Transmitter tests according to 47CFR part 15 subpart C and RSS-210 Annex 8 requirements

### 7.1 Peak output power

#### 7.1.1 General

This test was performed to measure the maximum peak output power radiated by transmitter. Specification test limits are given in Table 7.1.1.

Table 7.1.1 Peak output power limits

Assigned frequency range, MHz	Peak output power*		Equivalent field strength limit @ 3m, dB(µV/m)*	Maximum antenna gain, dBi
	W	dBm		
902.0 – 928.0	0.25 (<50 hopping channels) 1.0 (≥50 hopping channels)	24.0 (<50 hopping channels) 30.0 (≥50 hopping channels)	125.2 (<50 hopping channels) <b>131.2 (≥50 hopping channels)</b>	6.0*
2400.0 – 2483.5	0.125 (<75 hopping channels) 1.0 (≥75 hopping channels)	21.0 (<75 hopping channels) 30.0 (≥75 hopping channels)	122.2 (<75 hopping channels) 131.2 (≥75 hopping channels)	
5725.0 – 5850.0	1.0	30.0	131.2	

\*- 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.

\*\*- 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.

#### 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 adjusted to produce maximum available to end user RF output power.

7.1.2.3 The frequency span of spectrum analyzer was set approximately 5 times wider than 20 dB bandwidth of the EUT and the resolution bandwidth was set wider than 20 dB bandwidth of the EUT. To find maximum radiation the turntable was rotated 360° and the measuring antenna height was swept in both vertical and horizontal polarizations.

7.1.2.4 The maximum field strength of the EUT carrier frequency was measured as provided in Table 7.1.2 and associated plots.

7.1.2.5 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:

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

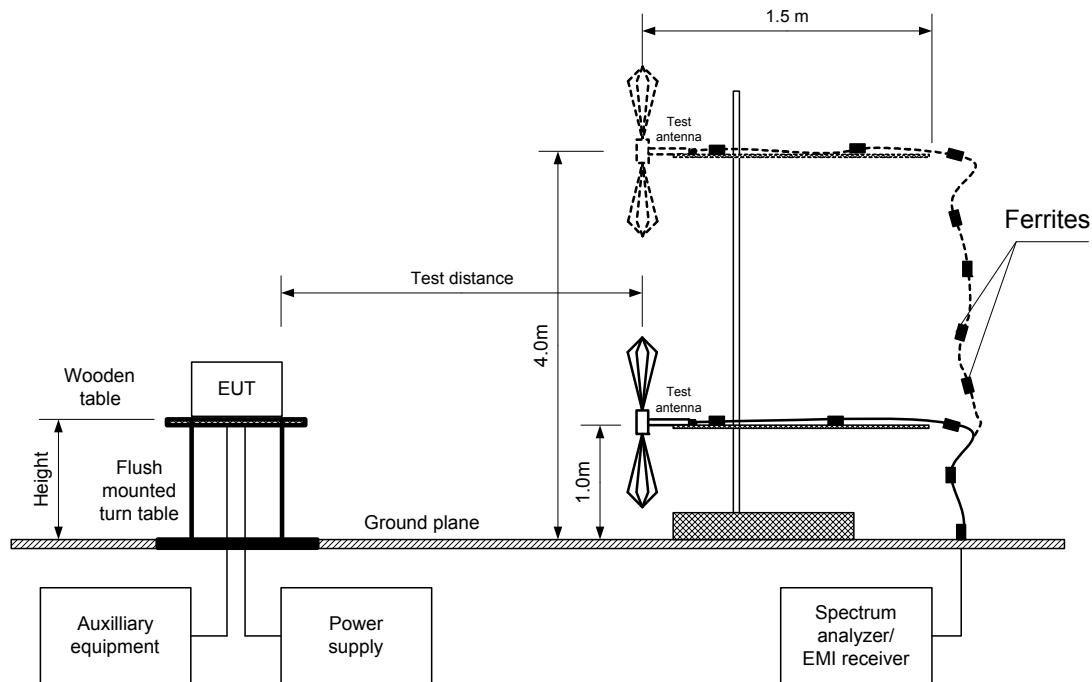
7.1.2.6 The worst test results (the lowest margins) were recorded in Table 7.1.2.



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<b>Test specification:</b>	<b>Section 15.247(b), RSS-210 section A8.4(1), Peak output power</b>		
<b>Test procedure:</b>	Public notice DA 00-705		
<b>Test mode:</b>	Compliance	<b>Verdict:</b>	PASS
<b>Date(s):</b>	4/24/2012		
<b>Temperature:</b> 23 °C	<b>Air Pressure:</b> 1012 hPa	<b>Relative Humidity:</b> 47 %	<b>Power Supply:</b> 5 VDC
<b>Remarks:</b>			

Figure 7.1.1 Setup for carrier field strength measurements





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<b>Test specification:</b>	<b>Section 15.247(b), RSS-210 section A8.4(1), Peak output power</b>		
<b>Test procedure:</b>	Public notice DA 00-705		
<b>Test mode:</b>	Compliance	<b>Verdict:</b> PASS	
<b>Date(s):</b>	4/24/2012		
<b>Temperature:</b> 23 °C	<b>Air Pressure:</b> 1012 hPa	<b>Relative Humidity:</b> 47 %	<b>Power Supply:</b> 5 VDC
<b>Remarks:</b>			

**Table 7.1.2 Peak output power test results**

ASSIGNED FREQUENCY BAND: 902-928MHz  
 TEST DISTANCE: 3 m  
 TEST SITE: Semi anechoic chamber  
 EUT HEIGHT: 0.8 m  
 DETECTOR USED: Peak  
 TEST ANTENNA TYPE: Biconilog (30 MHz – 1000 MHz)  
 Double ridged guide (above 1000 MHz)  
 TRANSMITTER OUTPUT POWER SETTINGS:  
 DETECTOR USED: Peak  
 RESOLUTION BANDWIDTH: 1 MHz  
 VIDEO BANDWIDTH: 3 MHz  
 FREQUENCY HOPPING: Disabled

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
908.76	122.9	V	1.2	0	4	23.7	30	-6.3	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 0604	HL 2871	HL 3617				
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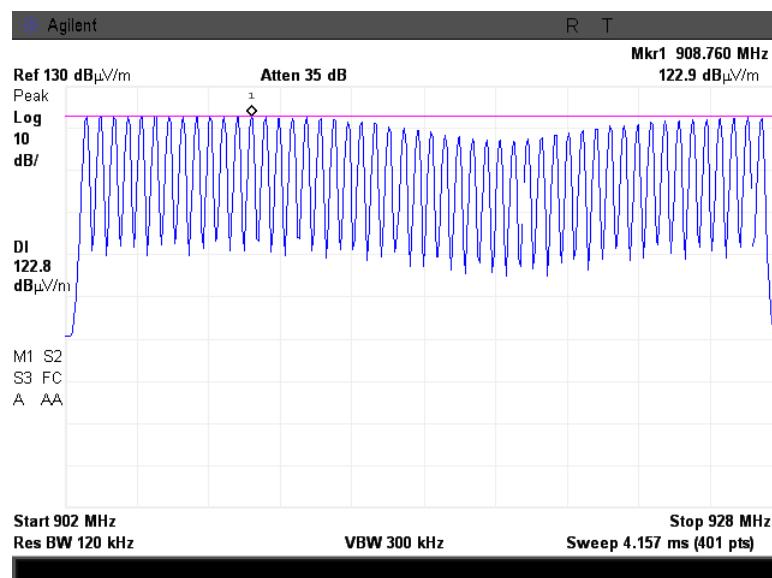
Full description is given in Appendix A.



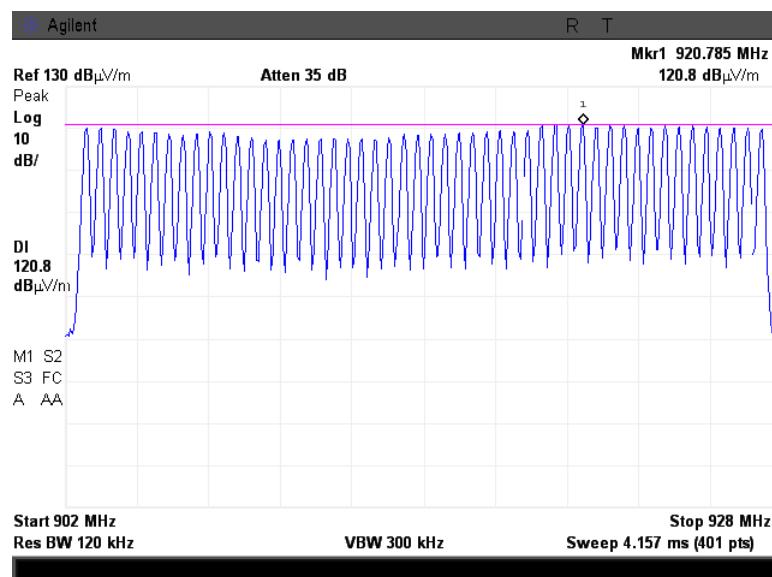
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<b>Test specification:</b>	<b>Section 15.247(b), RSS-210 section A8.4(1), Peak output power</b>		
<b>Test procedure:</b>	Public notice DA 00-705		
<b>Test mode:</b>	Compliance	<b>Verdict:</b>	PASS
<b>Date(s):</b>	4/24/2012		
<b>Temperature:</b> 23 °C	<b>Air Pressure:</b> 1012 hPa	<b>Relative Humidity:</b> 47 %	<b>Power Supply:</b> 5 VDC
<b>Remarks:</b>			

Plot 7.1.1 Field strength of carrier at vertical antenna polarization



Plot 7.1.2 Field strength of carrier at horizontal antenna polarization





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<b>Test specification:</b>	<b>Section 15.247(c), RSS-210 section A8.5, Radiated spurious emissions</b>		
<b>Test procedure:</b>	Public notice DA 00-705/ 47 CFR, Section 15.247(c) / ANSI C63.4, Section 13.1.4		
<b>Test mode:</b>	Compliance	<b>Verdict:</b>	PASS
<b>Date(s):</b>	3/25/2012 - 4/24/2012		
<b>Temperature:</b> 22 °C	<b>Air Pressure:</b> 1017 hPa	<b>Relative Humidity:</b> 50 %	<b>Power Supply:</b> 5 VDC
<b>Remarks:</b>			

## 7.2 Field strength of spurious emissions

### 7.2.1 General

This test was performed to measure field strength of spurious emissions from the EUT. Specification test limits are given in Table 7.2.1.

Table 7.2.1 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 <sup>th</sup> 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.

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

7.2.2.1 The EUT was set up as shown in Figure 7.2.1, energized and the performance check was conducted.

7.2.2.2 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.

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

### 7.2.3 Test procedure for spurious emission field strength measurements above 30 MHz

7.2.3.1 The EUT was set up as shown in Figure 7.2.2, energized and the performance check was conducted.

7.2.3.2 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.

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



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<b>Test specification:</b>	<b>Section 15.247(c), RSS-210 section A8.5, Radiated spurious emissions</b>		
<b>Test procedure:</b>	Public notice DA 00-705/ 47 CFR, Section 15.247(c) / ANSI C63.4, Section 13.1.4		
<b>Test mode:</b>	Compliance	<b>Verdict:</b>	PASS
<b>Date(s):</b>	3/25/2012 - 4/24/2012		
<b>Temperature:</b> 22 °C	<b>Air Pressure:</b> 1017 hPa	<b>Relative Humidity:</b> 50 %	<b>Power Supply:</b> 5 VDC
<b>Remarks:</b>			

Figure 7.2.1 Setup for spurious emission field strength measurements below 30 MHz

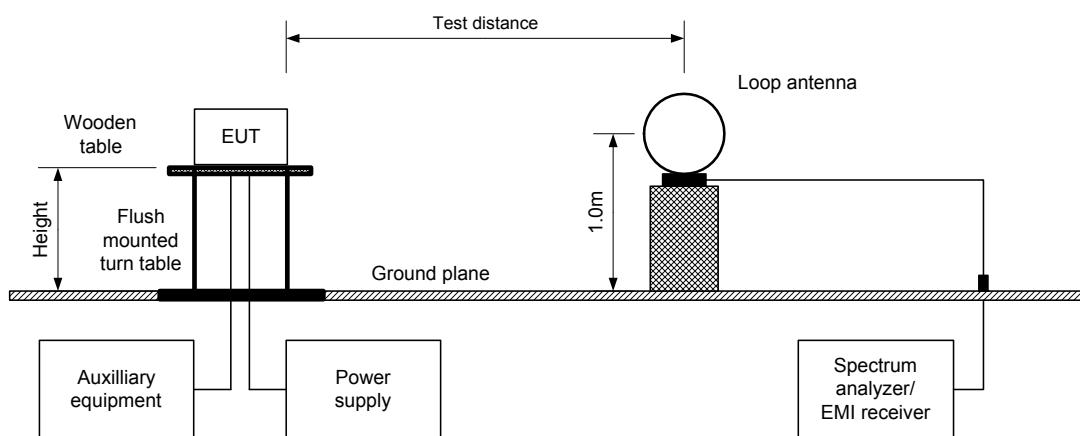
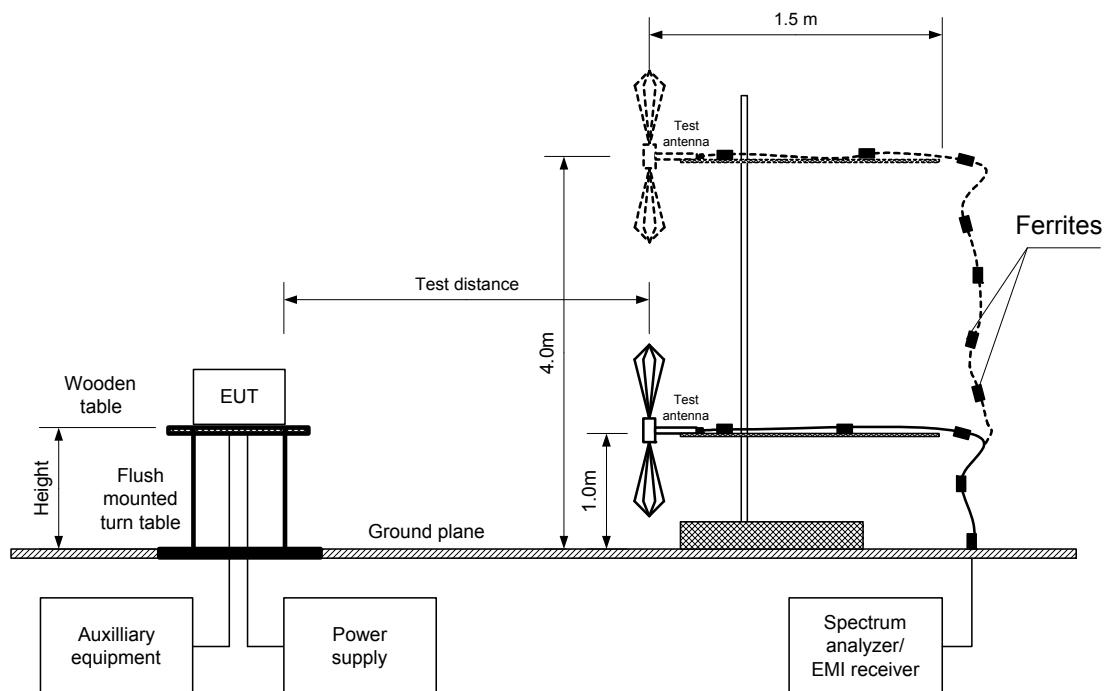


Figure 7.2.2 Setup for spurious emission field strength measurements above 30 MHz





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<b>Test specification:</b>	<b>Section 15.247(c), RSS-210 section A8.5, Radiated spurious emissions</b>		
<b>Test procedure:</b>	Public notice DA 00-705/ 47 CFR, Section 15.247(c) / ANSI C63.4, Section 13.1.4		
<b>Test mode:</b>	Compliance	<b>Verdict:</b> <b>PASS</b>	
<b>Date(s):</b>	3/25/2012 - 4/24/2012		
<b>Temperature:</b> 22 °C	<b>Air Pressure:</b> 1017 hPa	<b>Relative Humidity:</b> 50 %	<b>Power Supply:</b> 5 VDC
<b>Remarks:</b>			

**Table 7.2.2 Field strength of emissions outside restricted bands**

ASSIGNED FREQUENCY BANDS:	902-928 MHz
INVESTIGATED FREQUENCY RANGE:	2400-2483.5 MHz
TEST DISTANCE:	0.009 - 25000 MHz
TRANSMITTER OUTPUT POWER SETTINGS:	3 m
DETECTOR USED:	Maximum
RESOLUTION BANDWIDTH:	Peak
VIDEO BANDWIDTH:	100 kHz
TEST ANTENNA TYPE:	300 kHz
	Active loop (9 kHz – 30 MHz)
	Biconilog (30 MHz – 1000 MHz)
	Double ridged guide (above 1000 MHz)

Frequency, MHz	Field strength of spurious, dB(µV/m)	Antenna polarization	Antenna height, m	Azimuth, degrees*	Field strength of carrier, dB(µV/m)	Attenuation below carrier, dBc	Limit, dBc	Margin, dB**	Verdict
1810	58.43	V	1.1	63	122.9	64.47	20.0	44.47	Pass

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

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

**Table 7.2.3 Field strength of spurious emissions above 1 GHz within restricted bands**

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)	
<b>902-928 MHz band</b>										
3659.08	V	1.1	75	45.28	74	-28.72	45.28	36.35	54	-17.65
<b>2400-2483.5 MHz band</b>										
4863.90	V	1.1	90	53.27	74	-20.73	53.27	13.86	54	-40.14

\*- 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 7.2.4 Average factor calculation**

Transmission pulse (915.2 MHz)		Transmission pulse (2.4 GHz)		Average factor(915 MHz) dB	Average factor(2.4 GHz) dB
Duration, ms	Period, ms	Duration, ms	Period, ms		
35.75	115.5	0.1125	10.5	-8.93	-39.41

\*- Average factor was calculated as follows

for pulse train shorter than 100 ms:

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

for pulse train longer than 100 ms:

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



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<b>Test specification:</b>	<b>Section 15.247(c), RSS-210 section A8.5, Radiated spurious emissions</b>		
<b>Test procedure:</b>	Public notice DA 00-705/ 47 CFR, Section 15.247(c) / ANSI C63.4, Section 13.1.4		
<b>Test mode:</b>	Compliance	<b>Verdict:</b> <b>PASS</b>	
<b>Date(s):</b>	3/25/2012 - 4/24/2012		
<b>Temperature:</b> 22 °C	<b>Air Pressure:</b> 1017 hPa	<b>Relative Humidity:</b> 50 %	<b>Power Supply:</b> 5 VDC
<b>Remarks:</b>			

**Table 7.2.5 Field strength of spurious emissions below 1 GHz within restricted bands**

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*				
38.1	36.1	30.1	40	-3.9	V	1.1	30	Pass
249.5	38.4	34.3	46	-11.7	V	1.1	75	

\*- Margin = Measured emission - specification limit.

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

**Table 7.2.6 Restricted bands**

MHz	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	Above 38.6	
8.362 - 8.366	37.5 - 38.25	322 - 335.4	2483.5 - 2500	9300 - 9500		

**Reference numbers of test equipment used**

HL 0446	HL 0521	HL 0604	HL 0768	HL 1984	HL 2387	HL 2871	HL 2909
HL 3533	HL 3535	HL 3617	HL 3901				

Full description is given in Appendix A.

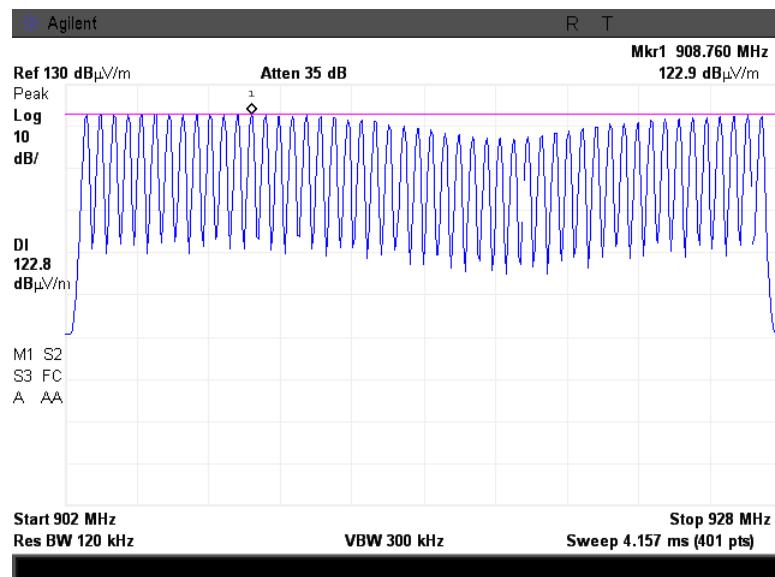


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<b>Test specification:</b>	<b>Section 15.247(c), RSS-210 section A8.5, Radiated spurious emissions</b>		
<b>Test procedure:</b>	Public notice DA 00-705/ 47 CFR, Section 15.247(c) / ANSI C63.4, Section 13.1.4		
<b>Test mode:</b>	Compliance	<b>Verdict:</b>	PASS
<b>Date(s):</b>	3/25/2012 - 4/24/2012		
<b>Temperature:</b> 22 °C	<b>Air Pressure:</b> 1017 hPa	<b>Relative Humidity:</b> 50 %	<b>Power Supply:</b> 5 VDC
<b>Remarks:</b>			

**Plot 7.2.1 Radiated emission measurements at carrier frequencies, 902-928 MHz band**

TEST SITE: Semi anechoic chamber  
TEST DISTANCE: 3 m  
ANTENNA POLARIZATION: Vertical& horizontal





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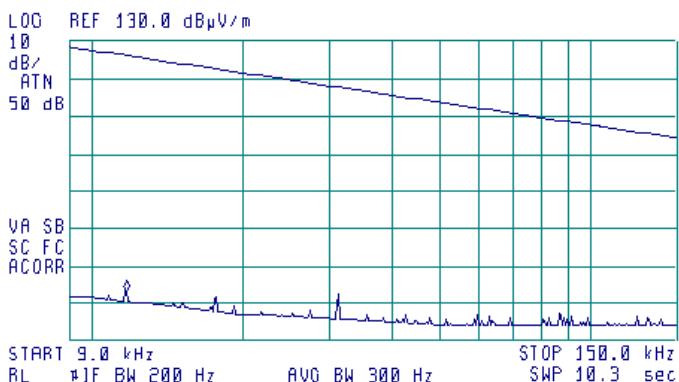
<b>Test specification:</b>	<b>Section 15.247(c), RSS-210 section A8.5, Radiated spurious emissions</b>		
<b>Test procedure:</b>	Public notice DA 00-705/ 47 CFR, Section 15.247(c) / ANSI C63.4, Section 13.1.4		
<b>Test mode:</b>	Compliance	<b>Verdict:</b>	PASS
<b>Date(s):</b>	3/25/2012 - 4/24/2012		
<b>Temperature:</b> 22 °C	<b>Air Pressure:</b> 1017 hPa	<b>Relative Humidity:</b> 50 %	<b>Power Supply:</b> 5 VDC
<b>Remarks:</b>			

**Plot 7.2.2 Radiated emission measurements from 9 to 150 kHz**

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



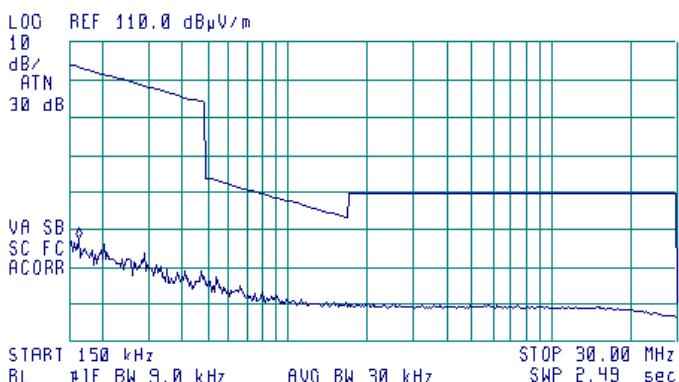
ACTV DET: PEAK  
 MEAS DET: PEAK OP AVG  
 MKR 11.7 kHz  
 63.21 dB $\mu$ V/m

**Plot 7.2.3 Radiated emission measurements from 0.15 to 30 MHz**

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



ACTV DET: PEAK  
 MEAS DET: PEAK OP AVG  
 MKR 160 kHz  
 57.37 dB $\mu$ V/m



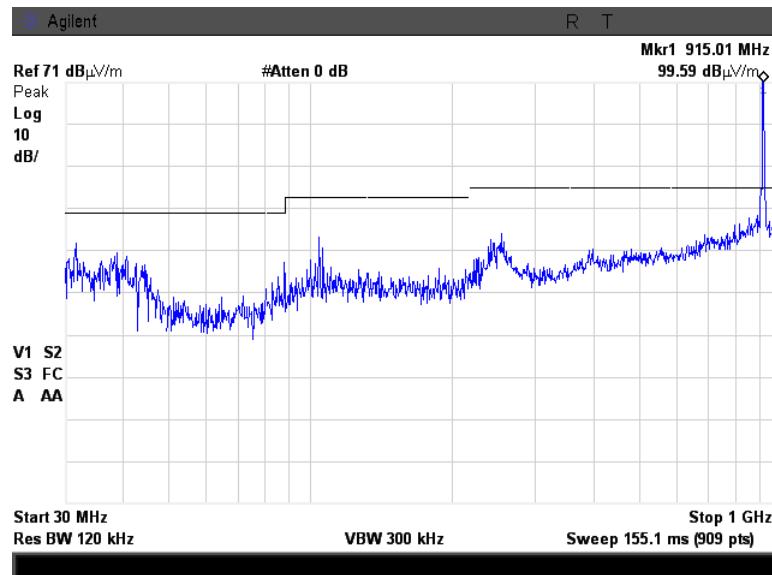
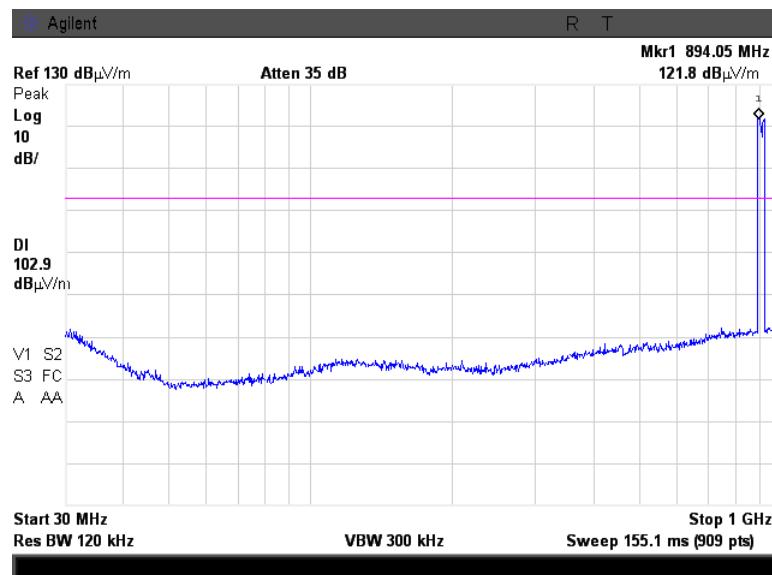


HERMON LABORATORIES

<b>Test specification:</b>	<b>Section 15.247(c), RSS-210 section A8.5, Radiated spurious emissions</b>		
<b>Test procedure:</b>	Public notice DA 00-705/ 47 CFR, Section 15.247(c) / ANSI C63.4, Section 13.1.4		
<b>Test mode:</b>	Compliance	<b>Verdict:</b>	PASS
<b>Date(s):</b>	3/25/2012 - 4/24/2012		
<b>Temperature:</b> 22 °C	<b>Air Pressure:</b> 1017 hPa	<b>Relative Humidity:</b> 50 %	<b>Power Supply:</b> 5 VDC
<b>Remarks:</b>			

**Plot 7.2.4 Radiated emission measurements from 30 to 1000 MHz**

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



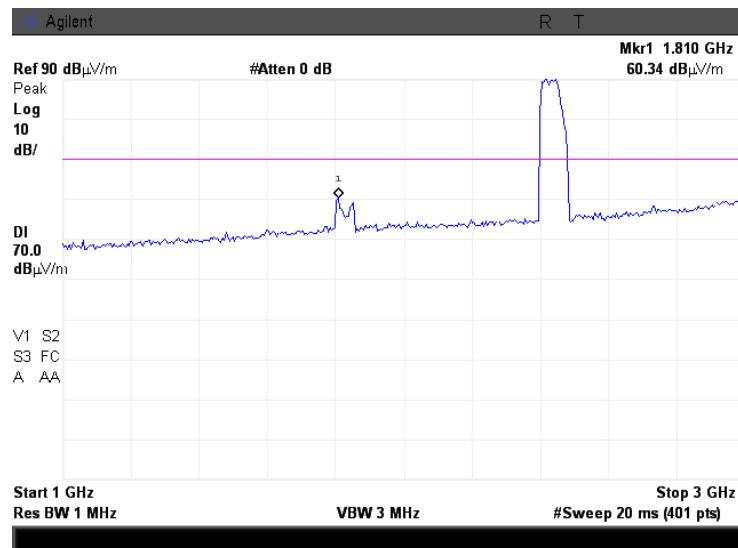


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<b>Test specification:</b>	<b>Section 15.247(c), RSS-210 section A8.5, Radiated spurious emissions</b>		
<b>Test procedure:</b>	Public notice DA 00-705/ 47 CFR, Section 15.247(c) / ANSI C63.4, Section 13.1.4		
<b>Test mode:</b>	Compliance	<b>Verdict:</b>	PASS
<b>Date(s):</b>	3/25/2012 - 4/24/2012		
<b>Temperature:</b> 22 °C	<b>Air Pressure:</b> 1017 hPa	<b>Relative Humidity:</b> 50 %	<b>Power Supply:</b> 5 VDC
<b>Remarks:</b>			

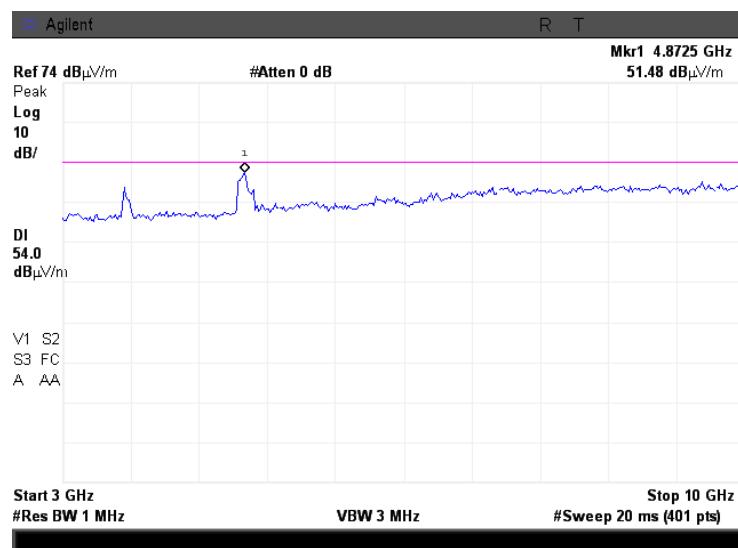
**Plot 7.2.5 Radiated emission measurements from 1000 to 3000 MHz**

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



**Plot 7.2.6 Radiated emission measurements from 3000 to 10000 MHz**

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



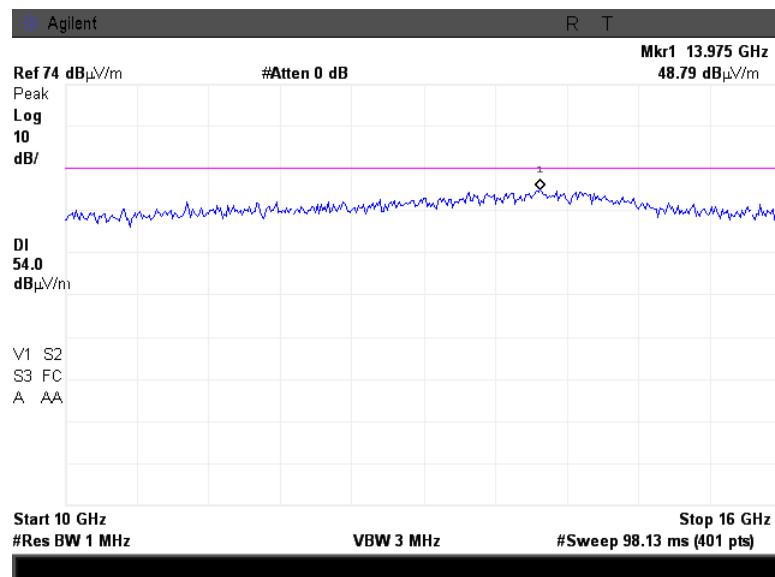


HERMON LABORATORIES

<b>Test specification:</b>	<b>Section 15.247(c), RSS-210 section A8.5, Radiated spurious emissions</b>		
<b>Test procedure:</b>	Public notice DA 00-705/ 47 CFR, Section 15.247(c) / ANSI C63.4, Section 13.1.4		
<b>Test mode:</b>	Compliance	<b>Verdict:</b>	PASS
<b>Date(s):</b>	3/25/2012 - 4/24/2012		
<b>Temperature:</b> 22 °C	<b>Air Pressure:</b> 1017 hPa	<b>Relative Humidity:</b> 50 %	<b>Power Supply:</b> 5 VDC
<b>Remarks:</b>			

**Plot 7.2.7 Radiated emission measurements from 10000 to 16000 MHz**

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



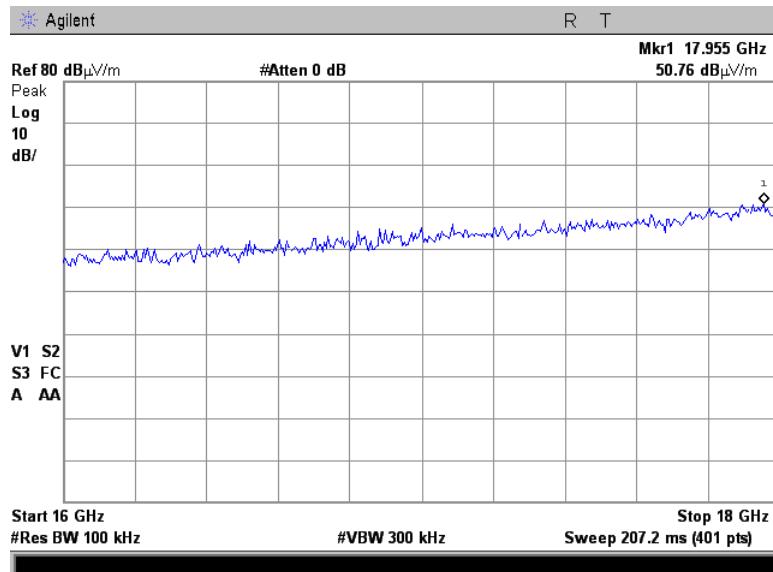
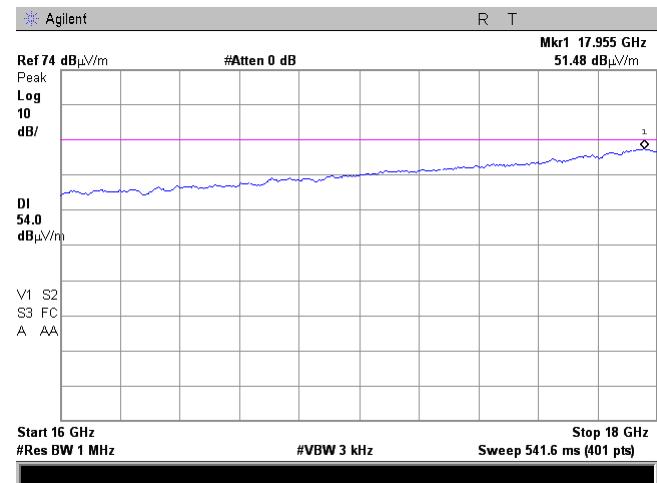
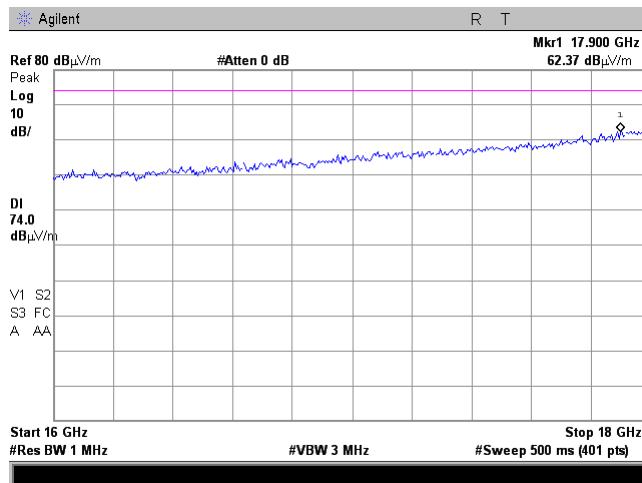


HERMON LABORATORIES

<b>Test specification:</b>	<b>Section 15.247(c), RSS-210 section A8.5, Radiated spurious emissions</b>		
<b>Test procedure:</b>	Public notice DA 00-705/ 47 CFR, Section 15.247(c) / ANSI C63.4, Section 13.1.4		
<b>Test mode:</b>	Compliance	<b>Verdict:</b>	PASS
<b>Date(s):</b>	3/25/2012 - 4/24/2012		
<b>Temperature:</b> 22 °C	<b>Air Pressure:</b> 1017 hPa	<b>Relative Humidity:</b> 50 %	<b>Power Supply:</b> 5 VDC
<b>Remarks:</b>			

**Plot 7.2.8 Radiated emission measurements from 16000 to 18000 MHz**

TEST SITE: OATS  
 TEST DISTANCE: 3 m  
 ANTENNA POLARIZATION: Vertical and Horizontal



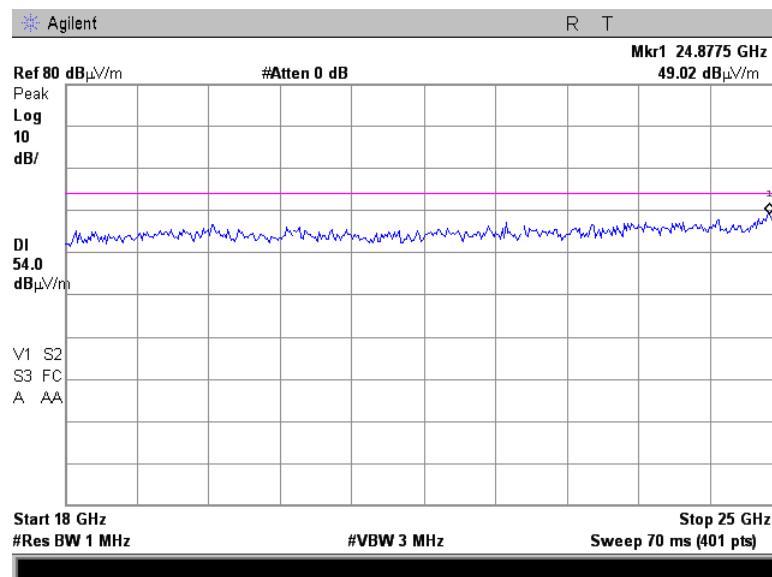


HERMON LABORATORIES

<b>Test specification:</b>	<b>Section 15.247(c), RSS-210 section A8.5, Radiated spurious emissions</b>		
<b>Test procedure:</b>	Public notice DA 00-705/ 47 CFR, Section 15.247(c) / ANSI C63.4, Section 13.1.4		
<b>Test mode:</b>	Compliance	<b>Verdict:</b>	PASS
<b>Date(s):</b>	3/25/2012 - 4/24/2012		
<b>Temperature:</b> 22 °C	<b>Air Pressure:</b> 1017 hPa	<b>Relative Humidity:</b> 50 %	<b>Power Supply:</b> 5 VDC
<b>Remarks:</b>			

**Plot 7.2.9 Radiated emission measurements from 18000 to 25000 MHz**

TEST SITE: OATS  
TEST DISTANCE: 3 m  
ANTENNA POLARIZATION: Vertical and Horizontal



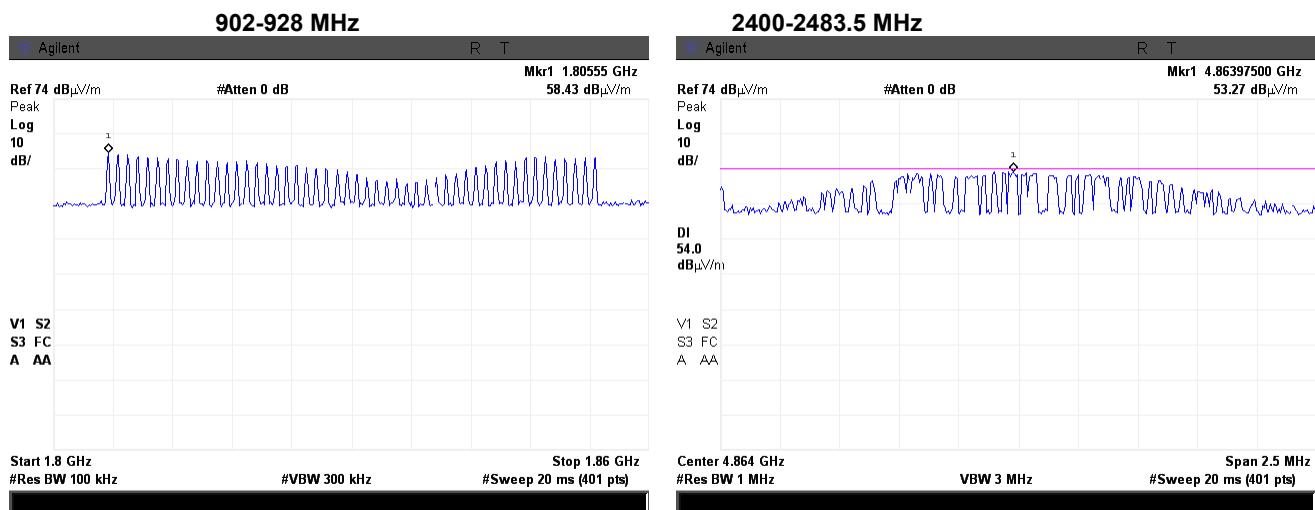


HERMON LABORATORIES

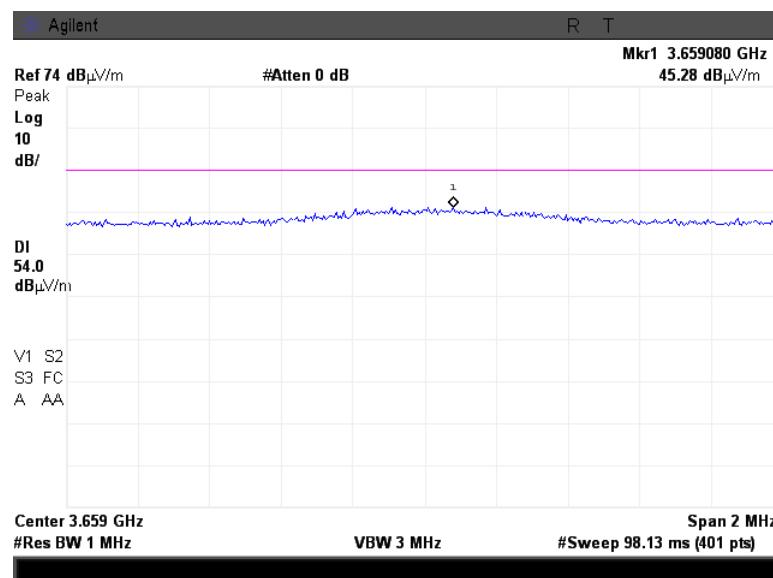
<b>Test specification:</b>	<b>Section 15.247(c), RSS-210 section A8.5, Radiated spurious emissions</b>		
<b>Test procedure:</b>	Public notice DA 00-705/ 47 CFR, Section 15.247(c) / ANSI C63.4, Section 13.1.4		
<b>Test mode:</b>	Compliance	<b>Verdict:</b>	PASS
<b>Date(s):</b>	3/25/2012 - 4/24/2012		
<b>Temperature:</b> 22 °C	<b>Air Pressure:</b> 1017 hPa	<b>Relative Humidity:</b> 50 %	<b>Power Supply:</b> 5 VDC
<b>Remarks:</b>			

**Plot 7.2.10 Radiated emission measurements at the second harmonic**

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

**Plot 7.2.11 Radiated emission measurements at the fourth harmonic**

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

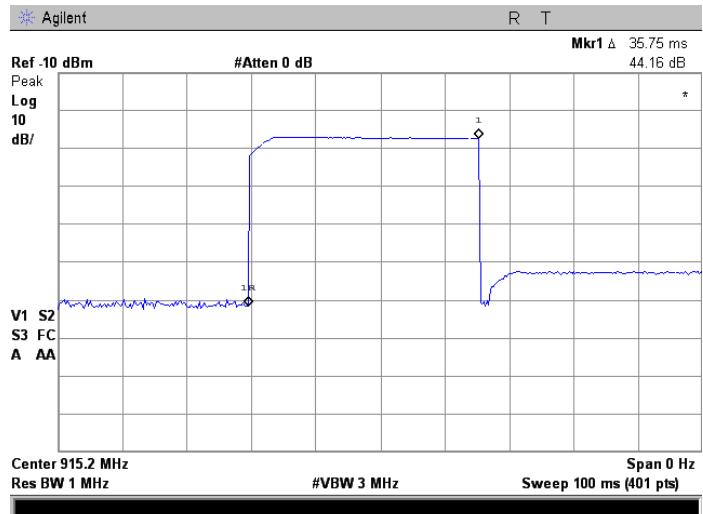




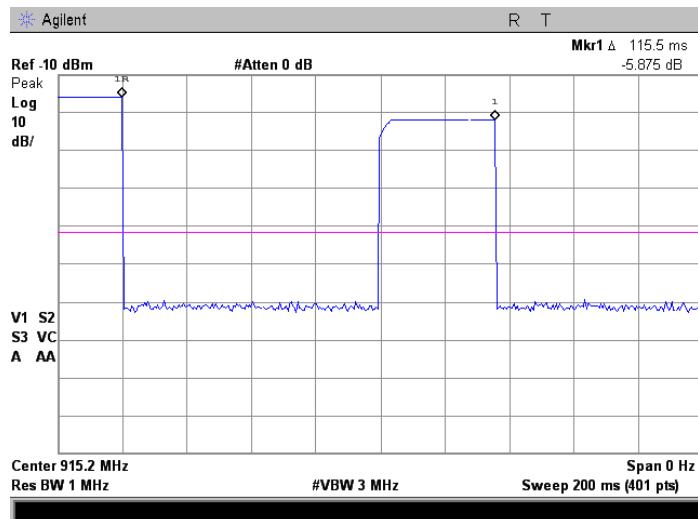
HERMON LABORATORIES

<b>Test specification:</b>	<b>Section 15.247(c), RSS-210 section A8.5, Radiated spurious emissions</b>		
<b>Test procedure:</b>	Public notice DA 00-705/ 47 CFR, Section 15.247(c) / ANSI C63.4, Section 13.1.4		
<b>Test mode:</b>	Compliance	<b>Verdict:</b>	PASS
<b>Date(s):</b>	3/25/2012 - 4/24/2012		
<b>Temperature:</b> 22 °C	<b>Air Pressure:</b> 1017 hPa	<b>Relative Humidity:</b> 50 %	<b>Power Supply:</b> 5 VDC
<b>Remarks:</b>			

Plot 7.2.12 Transmission pulse duration, 902-928 MHz



Plot 7.2.13 Transmission pulse period, 902-928 MHz

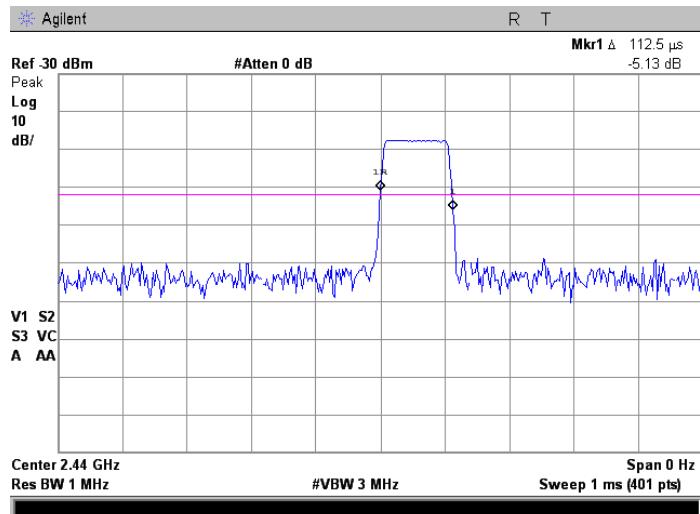




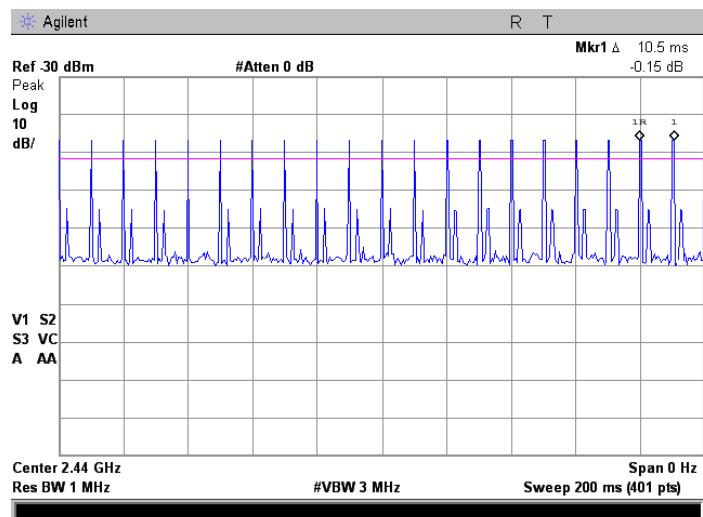
HERMON LABORATORIES

<b>Test specification:</b>	<b>Section 15.247(c), RSS-210 section A8.5, Radiated spurious emissions</b>		
<b>Test procedure:</b>	Public notice DA 00-705/ 47 CFR, Section 15.247(c) / ANSI C63.4, Section 13.1.4		
<b>Test mode:</b>	Compliance	<b>Verdict:</b>	PASS
<b>Date(s):</b>	3/25/2012 - 4/24/2012		
<b>Temperature:</b> 22 °C	<b>Air Pressure:</b> 1017 hPa	<b>Relative Humidity:</b> 50 %	<b>Power Supply:</b> 5 VDC
<b>Remarks:</b>			

Plot 7.2.14 Transmission pulse duration, 2400-2483.5 MHz



Plot 7.2.15 Transmission pulse period, 2400-2483.5 MHz





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<b>Test specification:</b>	<b>Section 15.109, ICES-003 section 5.5, Radiated emission</b>		
<b>Test procedure:</b>	ANSI C63.4, Sections 11.6 and 12.1.4		
<b>Test mode:</b>	Compliance	<b>Verdict:</b>	PASS
<b>Date(s):</b>	3/27/2012 - 3/28/2012		
<b>Temperature:</b> 22 °C	<b>Air Pressure:</b> 1015 hPa	<b>Relative Humidity:</b> 62 %	<b>Power Supply:</b> 5 VDC
<b>Remarks:</b>			

## 7.3 Unintentional radiated emission measurements

### 7.3.1 General

This test was performed to measure radiated emissions from the EUT enclosure. Specification test limits are given in Table 7.3.1.

**Table 7.3.1 Radiated emission test limits according to FCC Part 15 Section 15.109**

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*
Above 960	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 7.3.2 Radiated emissions limits according to ICES-003 Section 5.5, Class B**

Frequency, MHz	Limit, dB(µV/m)	
	10 m distance	3 m distance
30 - 230	30.0	40.0*
230 - 1000	37.0	47.0*

\* The limit for 3-m test distance shall be increased by 10 dB.

### 7.3.2 Test procedure for measurements in semi-anechoic chamber

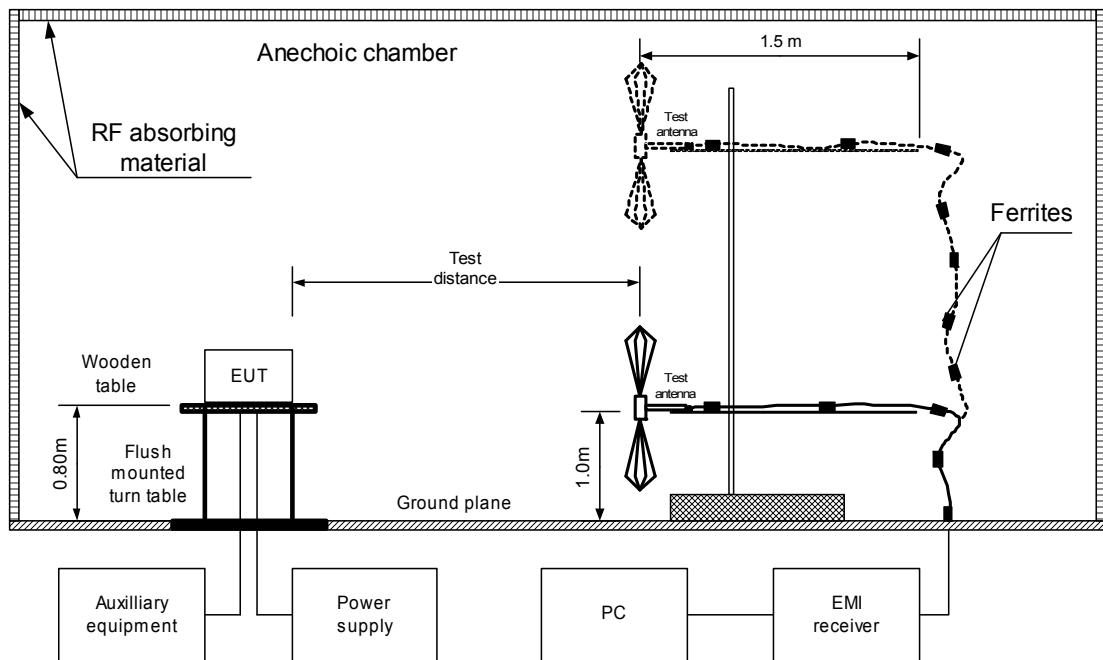
- 7.3.2.1 The EUT was set up as shown in Figure 7.3.1 and associated photograph/s, energized and the performance check was conducted.
- 7.3.2.2 The specified frequency range was investigated with biconilog antenna connected to EMI receiver. To find maximum radiation the turntable was rotated 360°, the 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.
- 7.3.2.3 The worst test results (the lowest margins) were recorded in Table 7.3.3 and shown in the associated plots.



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<b>Test specification:</b>	<b>Section 15.109, ICES-003 section 5.5, Radiated emission</b>		
<b>Test procedure:</b>	ANSI C63.4, Sections 11.6 and 12.1.4		
<b>Test mode:</b>	Compliance	<b>Verdict:</b>	PASS
<b>Date(s):</b>	3/27/2012 - 3/28/2012		
<b>Temperature:</b> 22 °C	<b>Air Pressure:</b> 1015 hPa	<b>Relative Humidity:</b> 62 %	<b>Power Supply:</b> 5 VDC
<b>Remarks:</b>			

Figure 7.3.1 Setup for radiated emission measurements in anechoic chamber, table-top equipment





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<b>Test specification:</b>	<b>Section 15.109, ICES-003 section 5.5, Radiated emission</b>		
<b>Test procedure:</b>	ANSI C63.4, Sections 11.6 and 12.1.4		
<b>Test mode:</b>	Compliance	<b>Verdict:</b> <b>PASS</b>	
<b>Date(s):</b>	3/27/2012 - 3/28/2012		
<b>Temperature:</b> 22 °C	<b>Air Pressure:</b> 1015 hPa	<b>Relative Humidity:</b> 62 %	<b>Power Supply:</b> 5 VDC
<b>Remarks:</b>			

**Table 7.3.3 Radiated emission test results**

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

**FCC part 15**

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*				
55.4	30.0	24.8	40.0	-15.2	Vertical	1.0	256	Pass
68.8	29.7	24.3	40.0	-15.7	Vertical	1.0	270	
108.3	34.9	30.1	43.5	-13.4	Vertical	1.0	210	
112.5	36.7	31.4	43.5	-12.1	Vertical	1.0	230	
256.3	35.2	30.8	46.0	-15.2	Vertical	1.0	210	

**ICES-003**

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*				
55.4	30.0	24.8	40.0	-15.2	Vertical	1.0	256	Pass
68.8	29.7	24.3	40.0	-15.7	Vertical	1.0	270	
108.3	34.9	30.1	40.0	-8.9	Vertical	1.0	210	
112.5	36.7	31.4	40.0	-7.6	Vertical	1.0	230	
256.3	35.2	30.8	47.0	-16.2	Vertical	1.0	210	

TEST SITE:	SEMI ANECHOIC CHAMBER
TEST DISTANCE:	3 m
DETECTORS USED:	PEAK / AVERAGE
FREQUENCY RANGE:	1000 MHz – 12500 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 2871	HL 2909	HL 3533	HL 3617	HL 4160
HL 4280							

Full description is given in Appendix A.



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<b>Test specification:</b>	<b>Section 15.109, ICES-003 section 5.5, Radiated emission</b>		
<b>Test procedure:</b>	ANSI C63.4, Sections 11.6 and 12.1.4		
<b>Test mode:</b>	Compliance	<b>Verdict:</b>	PASS
<b>Date(s):</b>	3/27/2012 - 3/28/2012		
<b>Temperature:</b> 22 °C	<b>Air Pressure:</b> 1015 hPa	<b>Relative Humidity:</b> 62 %	<b>Power Supply:</b> 5 VDC
<b>Remarks:</b>			

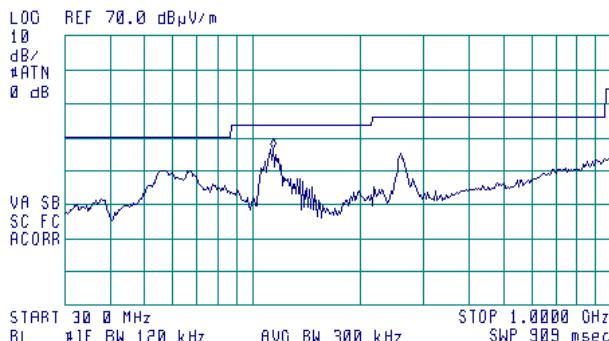
**Plot 7.3.1 Radiated emission measurements in 30 - 1000 MHz range, vertical antenna polarization**

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



ACTV DET: PEAK  
 MEAS DET: PEAK OP AVG  
 MKR 113.8 MHz  
 36.43 dB $\mu$ V/m

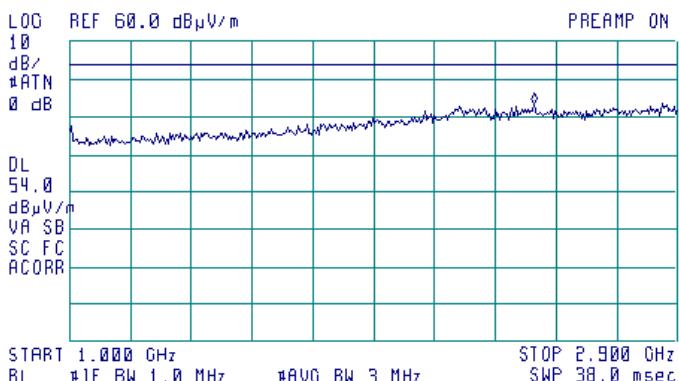
ACTV DET: PEAK  
 MEAS DET: PEAK OP AVG  
 MKR 113.8 MHz  
 36.43 dB $\mu$ V/m

**Plot 7.3.2 Radiated emission measurements in 1.0-2.9 GHz range**

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



ACTV DET: PEAK  
 MEAS DET: PEAK OP AVG  
 MKR 2.449 GHz  
 43.38 dB $\mu$ V/m





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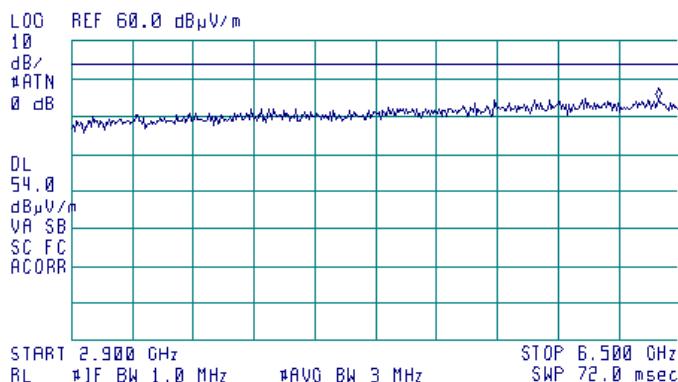
<b>Test specification:</b>	<b>Section 15.109, ICES-003 section 5.5, Radiated emission</b>		
<b>Test procedure:</b>	ANSI C63.4, Sections 11.6 and 12.1.4		
<b>Test mode:</b>	Compliance	<b>Verdict:</b>	PASS
<b>Date(s):</b>	3/27/2012 - 3/28/2012		
<b>Temperature:</b> 22 °C	<b>Air Pressure:</b> 1015 hPa	<b>Relative Humidity:</b> 62 %	<b>Power Supply:</b> 5 VDC
<b>Remarks:</b>			

**Plot 7.3.3 Radiated emission measurements in 2.9-6.5 GHz range**

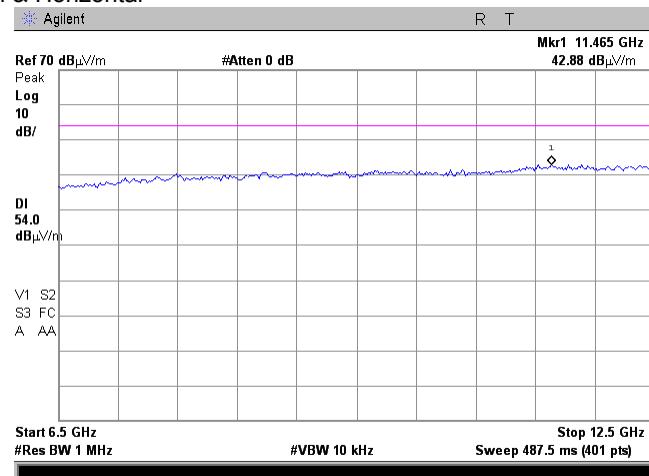
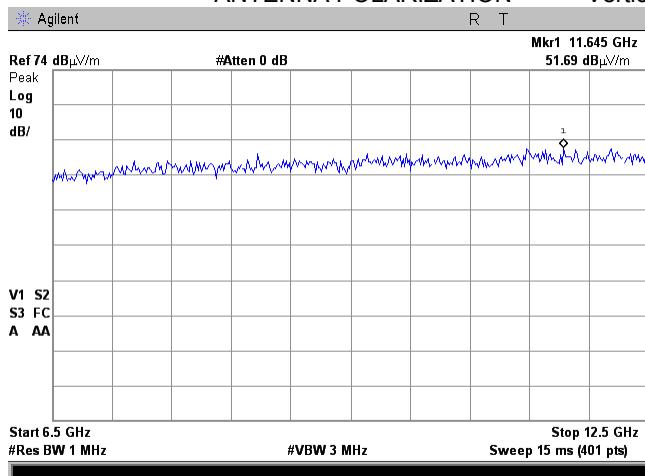
TEST SITE: Semi anechoic chamber  
 LIMIT: Class B  
 TEST DISTANCE: 3 m  
 EUT OPERATING MODE: Receive / Stand-by  
 ANTENNA POLARIZATION: Vertical & Horizontal



ACTV DET: PEAK  
 MEAS DET: PEAK OP AVG  
 MKR 6.374 GHz  
 44.60 dB $\mu$ V/m

**Plot 7.3.4 Radiated emission measurements in 6.5-12.5 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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## 8 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	03-Jul-11	03-Jul-12
0521	EMI Receiver (Spectrum Analyzer) with RF filter section 9 kHz-6.5 GHz	Hewlett Packard	8546A	3617A 00319, 3448A002 53	29-Aug-11	29-Sep-12
0604	Antenna BiconiLog Log-Periodic/T Bow-TIE, 26 - 2000 MHz	EMCO	3141	9611-1011	11-Jan-11	11-Jan-13
0768	Antenna Standard Gain Horn, 18-26.5 GHz, WR-42, 25 dB gain	Quinstar Technology	QWH-4200-BA	110	03-Feb-12	03-Feb-15
1984	Antenna, Double-Ridged Waveguide Horn, 1-18 GHz, 300 W	EMC Test Systems	3115	9911-5964	25-Nov-11	25-Nov-12
2387	Filter Bandpass, 8-14 GHz	Hermon Laboratories	FBP8-14	2387	02-Oct-11	02-Oct-13
2871	Microwave Cable Assembly, 18 GHz, 6.4 m, SMA - SMA	Huber-Suhner	198-8155-00	2871	15-Jan-12	15-Jan-13
2909	Spectrum analyzer, ESA-E, 100 Hz to 26.5 GHz	Agilent Technologies	E4407B	MY414447 62	08-May-11	08-May-12
3533	Amplifier, low noise, 6 to 18 GHz	Quinstar Technology	QLJ-06184040-J0	111590010 01	25-Dec-11	25-Dec-12
3535	Amplifier, low noise, 18 to 40 GHz	Quinstar Technology	QLJ-18404537-J0	111590030 01	11-Jul-11	11-Jul-12
3617	Cable RF, 6.5 m, N type-N type, DC-6.5 GHz	Suhner Switzerland	RG 214/U	NA	19-May-11	19-May-12
3901	Microwave Cable Assembly, 40.0 GHz, 3.5 m, SMA/SMA	Huber-Suhner	SUCOFLEX 102A	1225/2A	08-Feb-12	08-Feb-13
4160	Preamplifier, 0.1 to 18 GHz, Gain 25 dB, N-type(f) in, N-type(m) out.	Agilent Technologies	87405C	MY470105 94	29-Jun-11	29-Jun-12
4280	Test Cable, DC-18 GHz, 4.6 m, N/M - N/M	Mini-Circuits	APC-15FT-NMNM+	0763A	23-Nov-11	23-Nov-12



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## 9 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: $\pm 1.7$ dB 12.4 GHz to 40 GHz: $\pm 2.3$ dB
Conducted emissions at RF antenna connector	9 kHz to 2.9 GHz: $\pm 2.6$ dB 2.9 GHz to 6.46 GHz: $\pm 3.5$ dB 6.46 GHz to 13.2 GHz: $\pm 4.3$ dB 13.2 GHz to 22.0 GHz: $\pm 5.0$ dB 22.0 GHz to 26.8 GHz: $\pm 5.5$ dB 26.8 GHz to 40.0 GHz: $\pm 4.8$ dB
Occupied bandwidth	$\pm 8.0$ %
Duty cycle, timing (Tx ON / OFF) and average factor measurements	$\pm 1.0$ %
Radiated emissions at 3 m measuring distance Horizontal polarization	Biconilog antenna: $\pm 5.3$ dB Biconical antenna: $\pm 5.0$ dB Log periodic antenna: $\pm 5.3$ dB Double ridged horn antenna: $\pm 5.3$ dB
Vertical polarization	Biconilog antenna: $\pm 6.0$ dB Biconical antenna: $\pm 5.7$ dB Log periodic antenna: $\pm 6.0$ dB Double ridged horn antenna: $\pm 6.0$ dB

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.



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## 10 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 listed by the Federal Communications Commission (USA) for all parts of Code of Federal Regulations 47 (CFR 47), Registration Numbers 90624 for OATS and 90623 for the anechoic chamber; by Industry Canada for electromagnetic emissions (file numbers IC 2186A-1 for OATS, IC 2186A-2 for anechoic chamber, IC 2186A-3 for full-anechoic chamber for RE measurements above 1 GHz), certified by VCCI, Japan (the registration numbers are R-808 for OATS, R-1082 for anechoic chamber, G-27 for full-anechoic chamber for RE measurements above 1 GHz, C-845 for conducted emissions site, T-1606 for conducted emissions at telecommunication ports), has a status of a Telefication - Listed Testing Laboratory, Certificate No. L138/00. 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). The FCC Designation Number is US1003.

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## 11 APPENDIX D Specification references

47CFR part 15: 2011	Radio Frequency Devices.
ANSI C63.2: 1996	American National Standard for Instrumentation-Electromagnetic Noise and Field Strength, 10 kHz to 40 GHz-Specifications.
ANSI C63.4: 2003	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-210 Issue 8: 2010	Low Power Licence- Exempt Radiocommunication Devices
RSS-Gen Issue 3, September 2010	General Requirements and Information for the certification of Radiocommunication Equipment
ICES-003 Issue 4: 2004	Digital Apparatus
CAN/CSA-CEI/IEC CISPR 22: 2002	Information Technology Equipment- Radio Disturbance Characteristics- Limits and Methods of measurement



HERMON LABORATORIES

**12 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( $\mu$ V) to convert it into field intensity in dB( $\mu$ 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( $\mu$ V) to convert it into field strength in dB( $\mu$ V/m).



HERMON LABORATORIES

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

Antenna factor in dB(1/m) is to be added to receiver meter reading in dB( $\mu$ V) to convert it into field intensity in dB( $\mu$ V/m).



HERMON LABORATORIES

**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( $\mu$ V) to convert it into field intensity in dB( $\mu$ V/m).



HERMON LABORATORIES

**Cable loss**  
**Cable coaxial, Huber-Suhner, 18 GHz, 6.4 m, SMA - SMA, model 198-8155-00,  
HL 2871**

Frequency, MHz	Cable loss, dB	Frequency, MHz	Cable loss, dB	Frequency, MHz	Cable loss, dB
10	0.12	5750	2.34	12000	3.55
30	0.14	6000	2.39	12250	3.61
100	0.27	6250	2.46	12500	3.67
250	0.45	6500	2.52	12750	3.74
500	0.63	6750	2.58	13000	3.79
750	0.76	7000	2.64	13250	3.82
1000	0.89	7250	2.68	13500	3.83
1250	1.01	7500	2.73	13750	3.83
1500	1.12	7750	2.78	14000	3.88
1750	1.23	8000	2.83	14250	3.93
2000	1.32	8250	2.88	14500	3.96
2250	1.41	8500	2.94	14750	4.01
2500	1.49	8750	2.97	15000	4.00
2750	1.58	9000	3.02	15250	4.01
3000	1.66	9250	3.07	15500	4.00
3250	1.73	9500	3.13	15750	4.13
3500	1.80	9750	3.18	16000	4.22
3750	1.87	10000	3.21	16250	4.29
4000	1.93	10250	3.26	16500	4.29
4250	2.01	10500	3.30	16750	4.32
4500	2.06	10750	3.36	17000	4.37
4750	2.12	11000	3.39	17250	4.45
5000	2.17	11250	3.44	17500	4.49
5250	2.24	11500	3.48	17750	4.53
5500	2.29	11750	3.52	18000	4.55



HERMON LABORATORIES

**Cable loss**  
**Cable coaxial, RG-214/U, N type-N type, 6.5 m**  
**Suhner Switzerland, HL 3617**

Frequency, MHz	Cable loss, dB	Frequency, MHz	Cable loss, dB	Frequency, MHz	Cable loss, dB
10	0.13	2200	2.97	4500	5.10
50	0.33	2300	3.06	4600	5.20
100	0.48	2400	3.16	4700	5.34
200	0.71	2500	3.23	4800	5.36
300	0.89	2600	3.34	4900	5.48
400	1.04	2700	3.42	5000	5.52
500	1.19	2800	3.52	5100	5.61
600	1.32	2900	3.61	5200	5.72
700	1.44	3000	3.69	5300	5.81
800	1.56	3100	3.80	5400	5.93
900	1.68	3200	3.86	5500	6.08
1000	1.80	3300	3.98	5600	6.12
1100	1.90	3400	4.07	5700	6.25
1200	2.00	3500	4.14	5800	6.31
1300	2.11	3600	4.27	5900	6.41
1400	2.21	3700	4.36	6000	6.51
1500	2.30	3800	4.47	6100	6.62
1600	2.40	3900	4.62	6200	6.73
1700	2.49	4000	4.63	6300	6.86
1800	2.61	4100	4.76	6400	6.94
1900	2.69	4200	4.83	6500	7.06
2000	2.79	4300	4.89		
2100	2.88	4400	5.04		



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

## 13 APPENDIX F Abbreviations and acronyms

A	ampere
AC	alternating current
A/m	ampere per meter
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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