

# TEST REPORT

ACCORDING TO: FCC CFR 47 Part 15 subpart C, section 15.231 (e),  
RSS-210 issue 8 Annex 1

FOR:

**Elpas Solutions Ltd.**

**Tempature Sensor**

**Models: 5-STC00433-1**

**5-STE00433-1**

**FCC ID:O4X5-STC00433**

**IC:1467G-5STC00433**

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.  
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## 1 Applicant information

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**Address:** 23 Habarzel street, Tel Aviv 69710, Israel  
**Telephone:** +972 3768 1421  
**Fax:** +972 3768 1415  
**E-mail:** MErenkrantz@tycoint.com  
**Contact name:** Mr. Meir Erenkrantz

## 2 Equipment under test attributes

**Product name:** Temperature sensor  
**Product type:** Transceiver operating at 433.92 MHz  
**Model(s):** 5-STC00433-1  
**Serial number:** Prototype  
**Hardware version:** A0  
**Software release:** B2  
**Receipt date** 1/09/2012

## 3 Manufacturer information

**Manufacturer name:** Elpas Solutions Ltd.  
**Address:** 23 Habarzel street, Tel Aviv 69710, Israel  
**Telephone:** +972 3768 1421  
**Fax:** +972 3768 1415  
**E-Mail:** MErenkrantz@tycoint.com  
**Contact name:** Mr. Meir Erenkrantz

## 4 Test details

**Project ID:** 22850  
**Location:** Hermon Laboratories Ltd. Harakevet Industrial Zone, Binyamina 30500, Israel  
**Test started:** 1/09/2012  
**Test completed:** 5/02/2013  
**Test specification(s):** FCC 47CFR part 15, subpart C, §15.231(e);  
RSS-210 issue 8 Annex 1, RSS-Gen issue 3







## 5 Tests summary

Test	Status
<b>Transmitter characteristics</b>	
FCC Part 15, Section 231(e) / RSS-210, Section A1.1.5, Periodic operation requirements	Pass
FCC Part 15, Section 231(e) / RSS-210, Section A1.1.5, Field strength of emissions	Pass
FCC Part 15, Section 231(c) / RSS-210, Section A1.1.3, Occupied bandwidth	Pass
FCC Part 15, Section 207 / RSS-Gen, Section 7.2.4, Conducted emission	Not required
FCC Part 15, Section 203 / RSS-Gen, Section 7.1.2, Antenna requirements	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 report is assigned for Application for Certification to FCC. This test report supersedes the previously issued test report identified by Doc ID:ELPRAD\_FCC.22850\_rev2.

	Name and Title	Date	Signature
<b>Tested by:</b>	Mrs. E. Pitt, test engineer Mr. Alex Chaplik, test engineer	June 23, 2013	 
<b>Reviewed by:</b>	Mrs. M. Cherniavsky, certification engineer	June 26, 2013	
<b>Approved by:</b>	Mr. M. Nikishin, EMC and Radio group manager	June 26, 2013	



## 6 EUT description

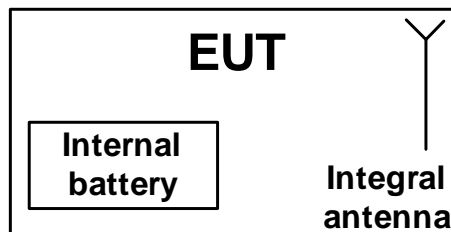
### 6.1 General information

The EUT, Temperature Sensor, model numbers 5-STC00433-1, 5-STE00433-1 are supervised Active RFID Tags that provide wireless remote monitoring of environmental sensitive assets or environments that require strict temperature range compliance. The EUT is powered by 3 V internal battery.

Two EUT models, 5-STC00433-1 and 5-STE00433-1, are electrically/electronically identical. The differences between models are given in the table below. The EUT model 5-STC00433-1 with external temperature sensor was tested.

Part Number	Detailed Description	Comparison
5-STE00433-1	Temperature Sensor Tag, RF, 433MHz	Same Electrical circuit, Same schematics, Same transmit and receive , with internal Temperature sensor
5-STC00433-1	Temperature Sensor Tag, External Probe, RF, 433MHz	Same Electrical circuit, Same schematics , Same transmit and receive, with external Temperature sensor

### 6.2 Test configuration



### 6.3 Changes made in EUT

No changes were implemented in the EUT during the testing.

## 6.4 EUT test positions

Photograph 6.4.1 EUT in X-axis orthogonal position



Photograph 6.4.2 EUT in Y-axis orthogonal position



Photograph 6.4.3 EUT in Z-axis orthogonal position





### 6.5 Transmitter characteristics

<b>Type of equipment</b>						
X	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)					
<b>Operating frequency</b>		433.92 MHz				
<b>Maximum rated output power</b>		At transmitter 50 Ω RF output connector			dBm	
		Field strength at 3 m distance			87.09 dB(μV/m) – peak 59.09 dB(μV/m) - average	
<b>Is transmitter output power variable?</b>		X	No			
			continuous variable			
			stepped variable with stepsize			dB
		Yes	minimum RF power			dBm
		maximum RF power			dBm	
<b>Antenna connection</b>						
unique coupling	standard connector	X	integral	X	with temporary RF connector without temporary RF connector	
<b>Antenna/s technical characteristics</b>						
Type	Manufacturer		Model number			
Internal	Elpas		Printed antenna			
<b>Transmitter aggregate data rate/s</b>		175 kbps				
<b>Type of modulation</b>		ASK				
<b>Transmitter power source</b>						
X	Battery	<b>Nominal rated voltage</b>	3.0 VDC	Battery type	Lithium	
	DC	<b>Nominal rated voltage</b>	VDC			
	AC mains	<b>Nominal rated voltage</b>	VAC	Frequency		
<b>Common power source for transmitter and receiver</b>		X	yes	no		



<b>Test specification:</b>	<b>FCC Part 15, Section 231(e) / RSS-210, Section A1.1.5, Periodic operation requirements</b>		
<b>Test procedure:</b>	Supplier declaration		
<b>Test mode:</b>	Compliance	<b>Verdict:</b>	<b>PASS</b>
<b>Date(s):</b>	5/2/2013		
<b>Temperature:</b> 22 °C	<b>Air Pressure:</b> 1010 hPa	<b>Relative Humidity:</b> 48 %	<b>Power Supply:</b> Battery
<b>Remarks:</b>			

## 7 Transmitter tests according to 47CFR part 15 subpart C requirements

### 7.1 Periodic operation requirements

#### 7.1.1 General

The EUT was verified for compliance with periodic operation requirements listed below:

- Continuous transmissions such as voice, video and the radio control of toys are not permitted;
- Duration of each transmission shall not be greater than 1 second;
- Silent period between transmissions shall be at least 30 times the duration of the transmission;
- Silent period between transmissions shall be in no case less than 10 seconds.

The rationale for compliance with the above requirements was either test results or supplier declaration. The summary of results is provided in Table 7.1.1.

#### 7.1.2 Test procedure for transmitter shut down test

7.1.2.1 The EUT was set up as shown in Figure 7.1.1.

7.1.2.2 The spectrum analyzer center frequency was adjusted to the EUT carrier, span set to zero and video triggered for transmission.

7.1.2.3 The transmitter was activated either manually or automatically. Once manually operated transmitter was activated, the switch was immediately released.

7.1.2.4 The transmission time was captured and shown in the associated plots.

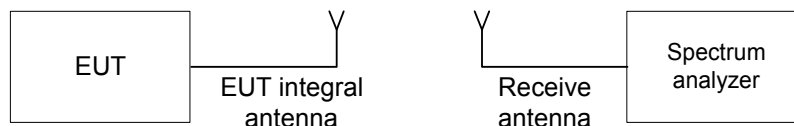
#### 7.1.3 Test procedure for measurements of polling / supervision transmission duration

7.1.3.1 The EUT was set up as shown in Figure 7.1.1.

7.1.3.2 The spectrum analyzer center frequency was adjusted to the EUT carrier, span set to zero and video triggered for transmission.

7.1.3.3 The transmission time was captured and shown in the associated plots. The test results were recorded in Table 7.1.2.

Figure 7.1.1 Setup for transmitter shut down test





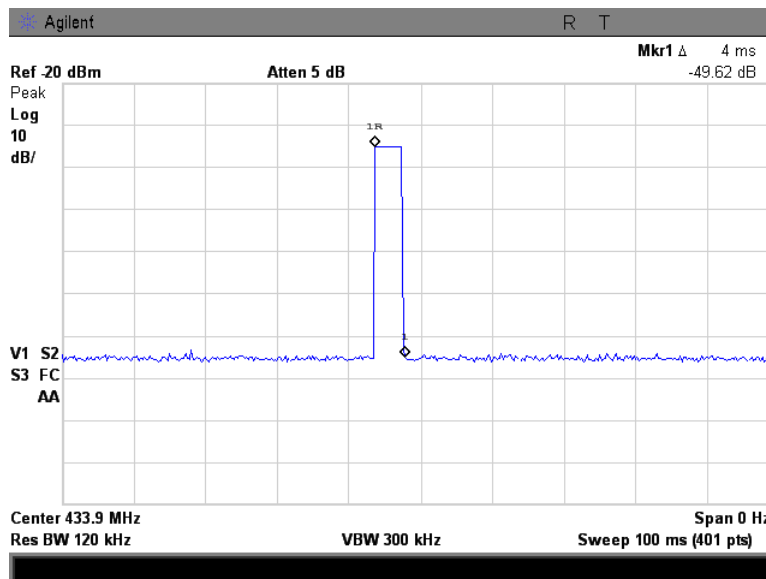


<b>Test specification:</b>	<b>FCC Part 15, Section 231(e) / RSS-210, Section A1.1.5, Periodic operation requirements</b>		
<b>Test procedure:</b>	Supplier declaration		
<b>Test mode:</b>	Compliance	<b>Verdict: PASS</b>	
<b>Date(s):</b>	5/2/2013		
<b>Temperature:</b> 22 °C	<b>Air Pressure:</b> 1010 hPa	<b>Relative Humidity:</b> 48 %	<b>Power Supply:</b> Battery
<b>Remarks:</b>			

Table 7.1.1 Periodic operation requirements

Requirement	Rationale	Verdict
Continuous transmissions are not permitted	Supplier declaration	Comply
Duration of each transmission shall not be greater than 1 second	Plot 7.1.1	Comply
Silent period between transmissions shall be at least 30 times the duration of the transmission	Plot 7.1.2	Comply
Silent period between transmissions shall be in no case less than 10 seconds	Plot 7.1.2	Comply

Plot 7.1.1 Transmission pulse duration

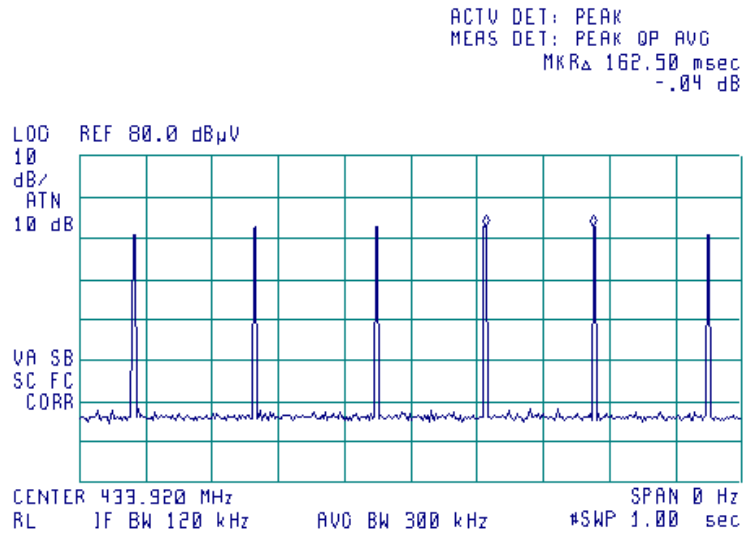




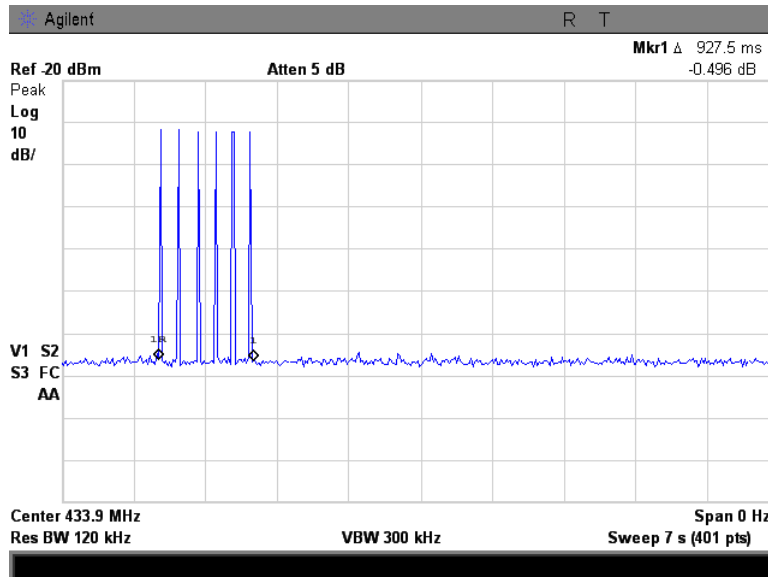
HERMON LABORATORIES

<b>Test specification:</b>		<b>FCC Part 15, Section 231(e) / RSS-210, Section A1.1.5, Periodic operation requirements</b>	
<b>Test procedure:</b>		Supplier declaration	
<b>Test mode:</b>		Compliance	
<b>Date(s):</b>		5/2/2013	
<b>Temperature: 22 °C</b>		<b>Air Pressure: 1010 hPa</b>	
<b>Relative Humidity: 48 %</b>		<b>Power Supply: Battery</b>	
<b>Remarks:</b>			
		<b>Verdict: PASS</b>	

Plot 7.1.2 Transmission pulse period



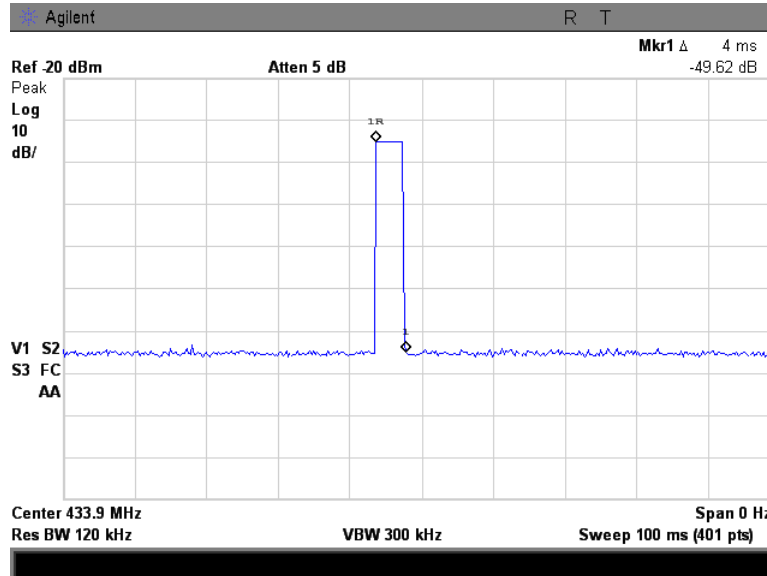
Plot 7.1.3 Transmitter shut down test result



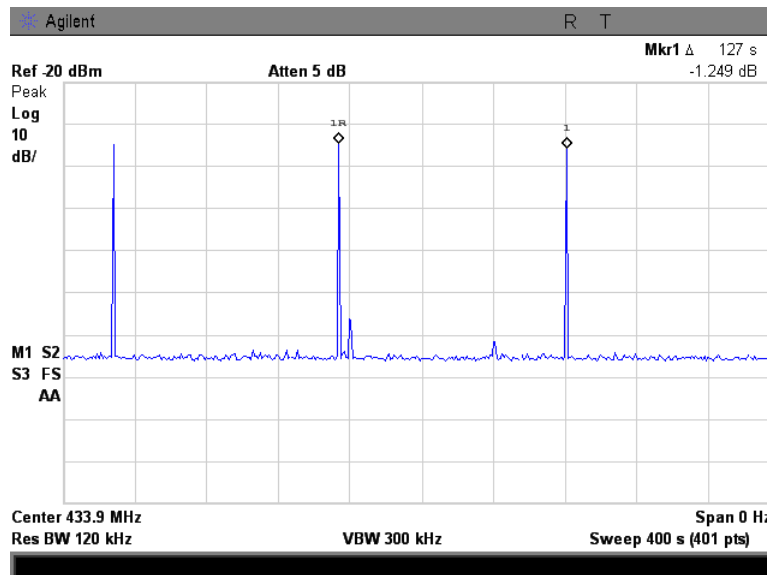


<b>Test specification:</b>		<b>FCC Part 15, Section 231(e) / RSS-210, Section A1.1.5, Periodic operation requirements</b>	
<b>Test procedure:</b>		Supplier declaration	
<b>Test mode:</b>		Compliance	
<b>Date(s):</b>		5/2/2013	
<b>Temperature: 22 °C</b>		<b>Air Pressure: 1010 hPa</b>	
<b>Relative Humidity: 48 %</b>		<b>Power Supply: Battery</b>	
<b>Remarks:</b>			
		<b>Verdict: PASS</b>	

Plot 7.1.4 Polling / supervision transmission duration



Plot 7.1.5 Polling / supervision transmission period





<b>Test specification:</b>	<b>FCC Part 15, Section 231(e) / RSS-210, Section A1.1.5, Periodic operation requirements</b>		
<b>Test procedure:</b>	Supplier declaration		
<b>Test mode:</b>	Compliance	<b>Verdict:</b>	<b>PASS</b>
<b>Date(s):</b>	5/2/2013		
<b>Temperature:</b> 22 °C	<b>Air Pressure:</b> 1010 hPa	<b>Relative Humidity:</b> 48 %	<b>Power Supply:</b> Battery
<b>Remarks:</b>			

Table 7.1.2 Total duration of polling / supervision transmissions

Duration, ms	Repetition period, s	Maximum number of transmissions within 1 hour	Total duration within 1 hour, ms
4	127	28.6	114.4

Reference numbers of test equipment used

HL 2780							
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Full description is given in Appendix A.



<b>Test specification:</b>	FCC Part 15, Section 231(e) / RSS-210, Section A1.1.5, Field strength of emissions		
<b>Test procedure:</b>	ANSI C63.4, Section 13.1.4		
<b>Test mode:</b>	Compliance	<b>Verdict:</b>	PASS
<b>Date(s):</b>	1/9/2012; 6/23/2013		
<b>Temperature:</b> 29.1 °C	<b>Air Pressure:</b> 1007 hPa	<b>Relative Humidity:</b> 65 %	<b>Power Supply:</b> Battery
<b>Remarks:</b>			

## 7.2 Field strength of emissions

### 7.2.1 General

This test was performed to measure field strength of fundamental and spurious emissions from the EUT. Specification test limits are given in Table 7.2.1 and Table 7.2.2.

Table 7.2.1 Radiated fundamental emission limits

Fundamental frequency, MHz	Field strength at 3 m, dB(µV/m)	
	Peak	Average
433.9	92.9	72.9

Table 7.2.2 Radiated spurious emissions limits

Frequency, MHz	Field strength at 3 m, dB(µV/m)				
	Within restricted bands			Outside restricted bands	
	Peak	Quasi Peak	Average	Peak	Average
0.009 – 0.090	148.5 – 128.5	NA	128.5 – 108.5**	72.9	52.9
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			
Above 1000	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 limit for spurious emissions was 20 dB lower than fundamental emission limit.

The above limits provided in terms of average values, peak limit was 20 dB above the average limit.

**Note 2:** The above 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.



<b>Test specification:</b>	<b>FCC Part 15, Section 231(e) / RSS-210, Section A1.1.5, Field strength of emissions</b>		
<b>Test procedure:</b>	ANSI C63.4, Section 13.1.4		
<b>Test mode:</b>	Compliance	<b>Verdict:</b>	<b>PASS</b>
<b>Date(s):</b>	1/9/2012; 6/23/2013		
<b>Temperature:</b> 29.1 °C	<b>Air Pressure:</b> 1007 hPa	<b>Relative Humidity:</b> 65 %	<b>Power Supply:</b> Battery
<b>Remarks:</b>			

**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 measurements were performed in three EUT orthogonal positions.

7.2.2.3 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.

7.2.2.4 The worst test results (the lowest margins) were recorded in Table 7.2.3, Table 7.2.5 and shown in the associated plots.

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

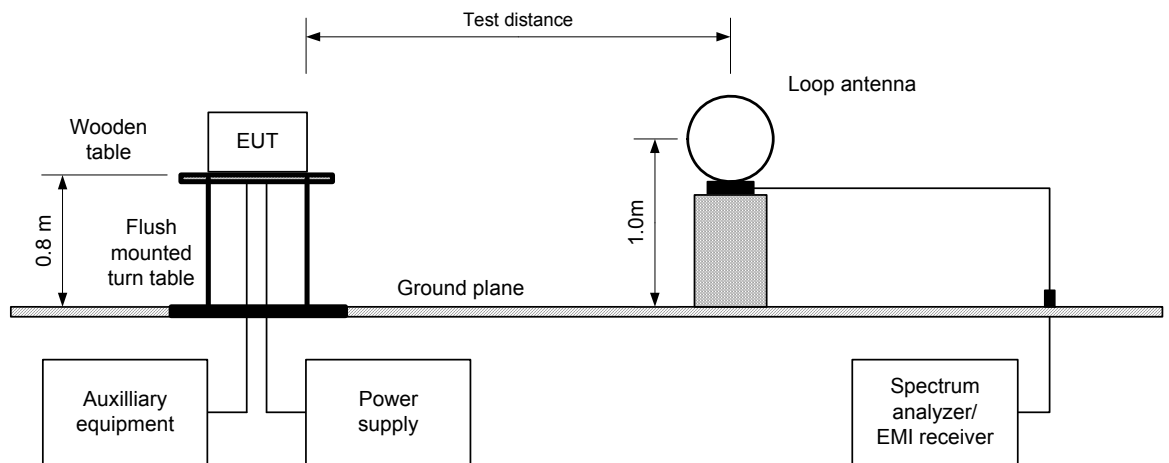
7.2.3.1 The EUT was set up as shown in Figure 7.2.2, energized and the performance check was conducted.

7.2.3.2 The measurements were performed in three EUT orthogonal positions.

7.2.3.3 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.

7.2.3.4 The worst test results (the lowest margins) were recorded in Table 7.2.3, Table 7.2.5 and shown in the associated plots.

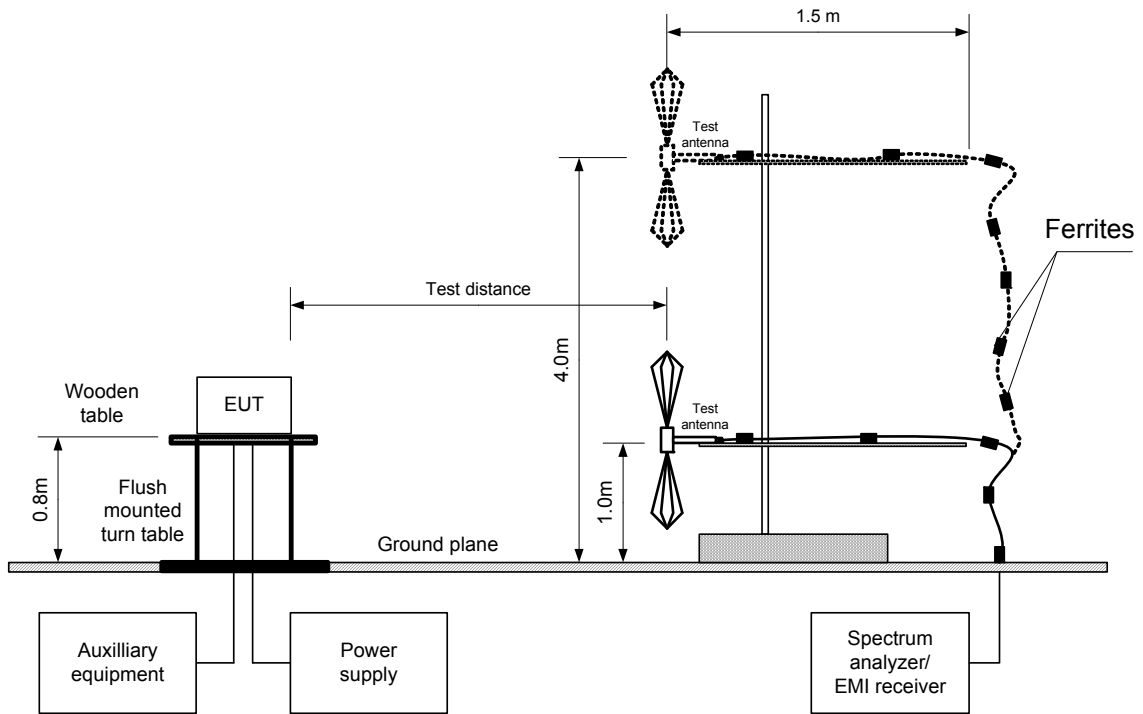
**Figure 7.2.1 Setup for spurious emission field strength measurements below 30 MHz**





<b>Test specification:</b>	<b>FCC Part 15, Section 231(e) / RSS-210, Section A1.1.5, Field strength of emissions</b>		
<b>Test procedure:</b>	ANSI C63.4, Section 13.1.4		
<b>Test mode:</b>	Compliance	<b>Verdict:</b>	<b>PASS</b>
<b>Date(s):</b>	1/9/2012; 6/23/2013		
<b>Temperature:</b> 29.1 °C	<b>Air Pressure:</b> 1007 hPa	<b>Relative Humidity:</b> 65 %	<b>Power Supply:</b> Battery
<b>Remarks:</b>			

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





<b>Test specification:</b>	FCC Part 15, Section 231(e) / RSS-210, Section A1.1.5, Field strength of emissions		
<b>Test procedure:</b>	ANSI C63.4, Section 13.1.4		
<b>Test mode:</b>	Compliance	<b>Verdict:</b>	PASS
<b>Date(s):</b>	1/9/2012; 6/23/2013		
<b>Temperature:</b> 29.1 °C	<b>Air Pressure:</b> 1007 hPa	<b>Relative Humidity:</b> 65 %	<b>Power Supply:</b> Battery
<b>Remarks:</b>			

**Table 7.2.3 Field strength of fundamental emission, spurious emissions outside restricted bands and within restricted bands at frequencies above 1 GHz**

TEST DISTANCE: 3 m  
 EUT POSITION: 3 orthogonal ( X / Y / Z )  
 MODULATION: ASK  
 BIT RATE: 175 kbps  
 TRANSMITTER OUTPUT POWER SETTINGS: Maximum  
 INVESTIGATED FREQUENCY RANGE: 0.009 – 4500 MHz  
 DETECTOR USED: Peak  
 RESOLUTION BANDWIDTH: 0.2 kHz (9 kHz – 150 kHz)  
 9.0 kHz (150 kHz – 30 MHz)  
 120 kHz (30 MHz – 1000 MHz)  
 1.0 MHz (above 1000 MHz)  
 VIDEO BANDWIDTH: ≥ Resolution bandwidth  
 TEST ANTENNA TYPE: Active loop (9 kHz – 30 MHz)  
 Biconilog (30 MHz – 1000 MHz)  
 Double ridged guide (above 1000 MHz)

F, MHz	Antenna		Azimuth, degrees*	Peak field strength			Average field strength				Verdict
	Pol.	Height, m		Measured, dB(µV/m)	Limit, dB(µV/m)	Margin, dB**	Measured, dB(µV/m)	Calculated, dB(µV/m)	Limit, dB(µV/m)	Margin, dB**	
<b>Fundamental emission***</b>											
433.920	V	1.2	230	87.09	92.9	-5.81	NA	59.09	72.9	-13.81	Pass
<b>Spurious emissions</b>											
867.8338	V	1.3	115	55.16	92.9	-37.74	NA	27.16	72.9	-45.74	Pass
1301.793	V	1.1	120	55.56	74.0	-18.44	49.25	21.25	54.0	-32.75	
1735.895	V	1.2	360	53.91	92.9	-38.99	40.90	12.90	72.9	-60.00	
2169.555	V	1.1	110	60.22	92.9	-32.68	53.23	25.23	72.9	-47.67	
2603.103	H	1.1	360	58.58	92.9	-34.32	45.17	17.17	72.9	-55.73	
3037.395	V	1.3	320	65.60	92.9	-27.3	56.59	28.59	72.9	-44.31	
3470.885	H	1.1	360	65.93	92.9	-26.97	42.64	14.64	72.9	-58.26	
3905.303	V	1.4	170	58.40	74.0	-15.6	49.60	21.60	54.0	-32.40	
4338.753	H	1.1	360	56.99	74.0	-17.01	44.03	16.03	54.0	-37.97	

\*- EUT front panel refers to 0 degrees position of turntable.  
 \*\*- Margin, dB = Limit, dB(µV/m) – measured (calculated) value, dB(µV/m).  
 \*\*\* Max value was obtained in Z-axis orthogonal position.

**Table 7.2.4 Average factor calculation**

Transmission pulse		Transmission burst		Transmission train duration, ms	Average factor, dB
Duration, ms	Period, ms	Duration, ms	Period, ms		
4	162	NA	NA	NA	-28

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

**Reference numbers of test equipment used**

HL 0415	HL 0521	HL 0569	HL 0604	HL 0812	HL 1425	HL 2432	HL 2871
HL 3617							

Full description is given in Appendix A.





<b>Test specification:</b>	<b>FCC Part 15, Section 231(e) / RSS-210, Section A1.1.5, Field strength of emissions</b>		
<b>Test procedure:</b>	ANSI C63.4, Section 13.1.4		
<b>Test mode:</b>	Compliance	<b>Verdict: PASS</b>	
<b>Date(s):</b>	1/9/2012; 6/23/2013		
<b>Temperature:</b> 29.1 °C	<b>Air Pressure:</b> 1007 hPa	<b>Relative Humidity:</b> 65 %	<b>Power Supply:</b> Battery
<b>Remarks:</b>			

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

TEST DISTANCE: 3 m  
EUT POSITION: 3 orthogonal ( X / Y / Z )  
MODULATION: ASK  
BIT RATE: 175 kbps  
TRANSMITTER OUTPUT POWER SETTINGS: Maximum  
INVESTIGATED FREQUENCY RANGE: 0.009 – 1000 MHz  
DETECTOR USED: Peak  
RESOLUTION BANDWIDTH: 0.2 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)  
Biconilog (30 MHz – 1000 MHz)

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 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 0521	HL 0604	HL 0446	HL2781	HL 3617			
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Full description is given in Appendix A.



<b>Test specification:</b>	FCC Part 15, Section 231(e) / RSS-210, Section A1.1.5, Field strength of emissions		
<b>Test procedure:</b>	ANSI C63.4, Section 13.1.4		
<b>Test mode:</b>	Compliance	<b>Verdict:</b>	<b>PASS</b>
<b>Date(s):</b>	1/9/2012; 6/23/2013		
<b>Temperature:</b> 29.1 °C	<b>Air Pressure:</b> 1007 hPa	<b>Relative Humidity:</b> 65 %	<b>Power Supply:</b> Battery
<b>Remarks:</b>			

Table 7.2.6 Restricted bands according to FCC 15, Section 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	12.290 - 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	16.420 - 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	

Table 7.2.7 Restricted bands according to RSS-210, Section 2.7

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 - 2.190	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	12.290 - 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 - 24.0
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

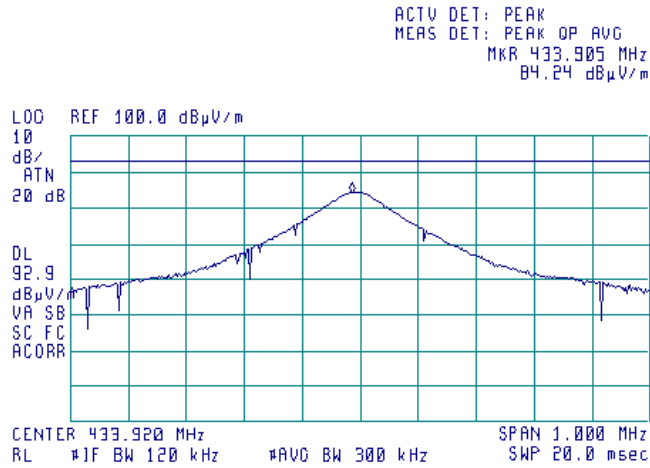


HERMON LABORATORIES

<b>Test specification:</b>	<b>FCC Part 15, Section 231(e) / RSS-210, Section A1.1.5, Field strength of emissions</b>		
<b>Test procedure:</b>	ANSI C63.4, Section 13.1.4		
<b>Test mode:</b>	Compliance	<b>Verdict:</b>	<b>PASS</b>
<b>Date(s):</b>	1/9/2012; 6/23/2013		
<b>Temperature:</b> 29.1 °C	<b>Air Pressure:</b> 1007 hPa	<b>Relative Humidity:</b> 65 %	<b>Power Supply:</b> Battery
<b>Remarks:</b>			

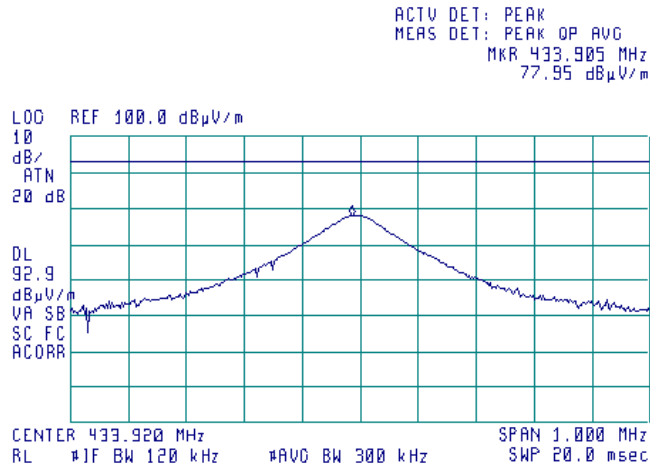
**Plot 7.2.1 Radiated emission measurements at the fundamental frequency**

TEST SITE: OATS  
 TEST DISTANCE: 3 m  
 ANTENNA POLARIZATION: Vertical  
 EUT POSITION: X-axis  
 INPUT VOLTAGE: Unom



**Plot 7.2.2 Radiated emission measurements at the fundamental frequency**

TEST SITE: OATS  
 TEST DISTANCE: 3 m  
 ANTENNA POLARIZATION: Horizontal  
 EUT POSITION: X-axis  
 INPUT VOLTAGE: Unom



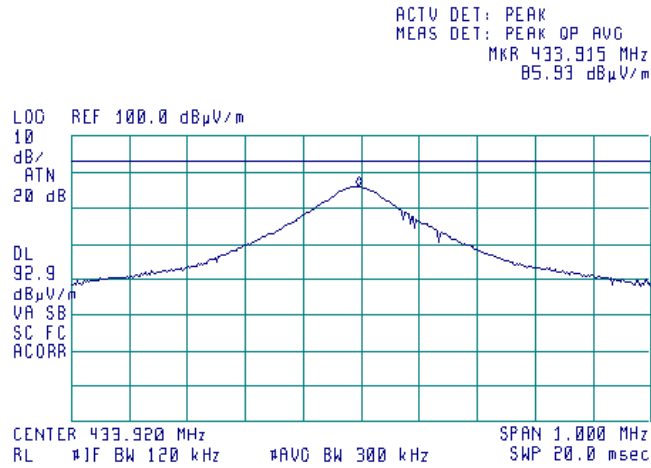


HERMON LABORATORIES

<b>Test specification:</b>	<b>FCC Part 15, Section 231(e) / RSS-210, Section A1.1.5, Field strength of emissions</b>		
<b>Test procedure:</b>	ANSI C63.4, Section 13.1.4		
<b>Test mode:</b>	Compliance	<b>Verdict:</b>	<b>PASS</b>
<b>Date(s):</b>	1/9/2012; 6/23/2013		
<b>Temperature:</b> 29.1 °C	<b>Air Pressure:</b> 1007 hPa	<b>Relative Humidity:</b> 65 %	<b>Power Supply:</b> Battery
<b>Remarks:</b>			

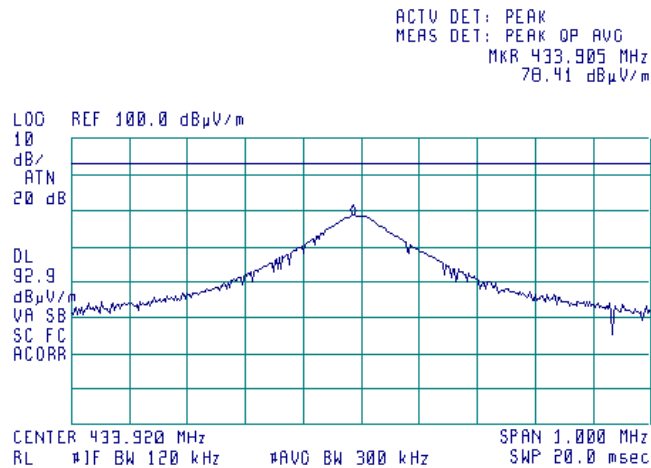
**Plot 7.2.3 Radiated emission measurements at the fundamental frequency**

TEST SITE: OATS  
 TEST DISTANCE: 3 m  
 ANTENNA POLARIZATION: Vertical  
 EUT POSITION: Y-axis  
 INPUT VOLTAGE: Unom



**Plot 7.2.4 Radiated emission measurements at the fundamental frequency**

TEST SITE: OATS  
 TEST DISTANCE: 3 m  
 ANTENNA POLARIZATION: Horizontal  
 EUT POSITION: Y-axis  
 INPUT VOLTAGE: Unom



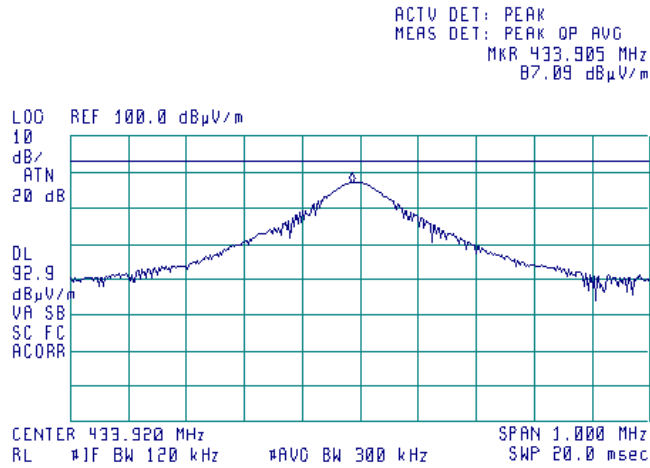


HERMON LABORATORIES

<b>Test specification:</b>	<b>FCC Part 15, Section 231(e) / RSS-210, Section A1.1.5, Field strength of emissions</b>		
<b>Test procedure:</b>	ANSI C63.4, Section 13.1.4		
<b>Test mode:</b>	Compliance	<b>Verdict:</b>	<b>PASS</b>
<b>Date(s):</b>	1/9/2012; 6/23/2013		
<b>Temperature:</b> 29.1 °C	<b>Air Pressure:</b> 1007 hPa	<b>Relative Humidity:</b> 65 %	<b>Power Supply:</b> Battery
<b>Remarks:</b>			

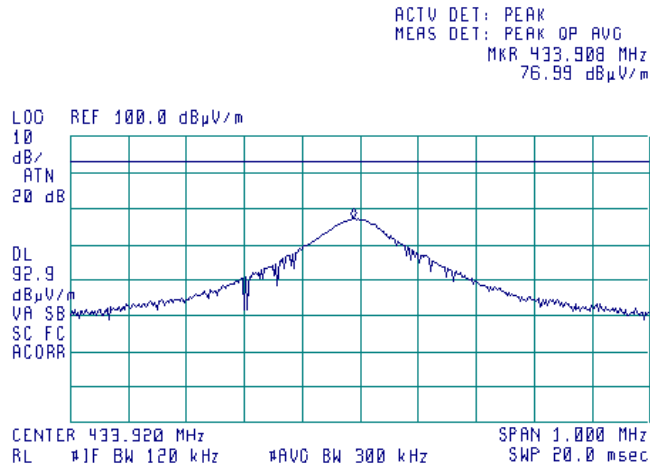
**Plot 7.2.5 Radiated emission measurements at the fundamental frequency**

TEST SITE: OATS  
 TEST DISTANCE: 3 m  
 ANTENNA POLARIZATION: Vertical  
 EUT POSITION: Z-axis  
 INPUT VOLTAGE: Unom



**Plot 7.2.6 Radiated emission measurements at the fundamental frequency**

TEST SITE: OATS  
 TEST DISTANCE: 3 m  
 ANTENNA POLARIZATION: Horizontal  
 EUT POSITION: Z-axis  
 INPUT VOLTAGE: Unom

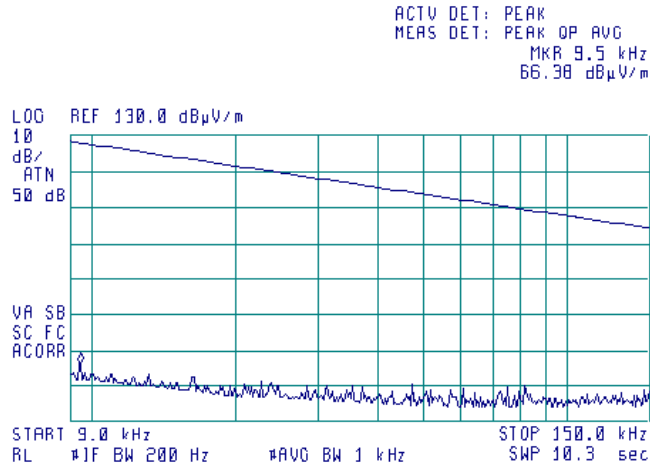




<b>Test specification:</b>	<b>FCC Part 15, Section 231(e) / RSS-210, Section A1.1.5, Field strength of emissions</b>		
<b>Test procedure:</b>	ANSI C63.4, Section 13.1.4		
<b>Test mode:</b>	Compliance	<b>Verdict:</b>	<b>PASS</b>
<b>Date(s):</b>	1/9/2012; 6/23/2013		
<b>Temperature:</b> 29.1 °C	<b>Air Pressure:</b> 1007 hPa	<b>Relative Humidity:</b> 65 %	<b>Power Supply:</b> Battery
<b>Remarks:</b>			

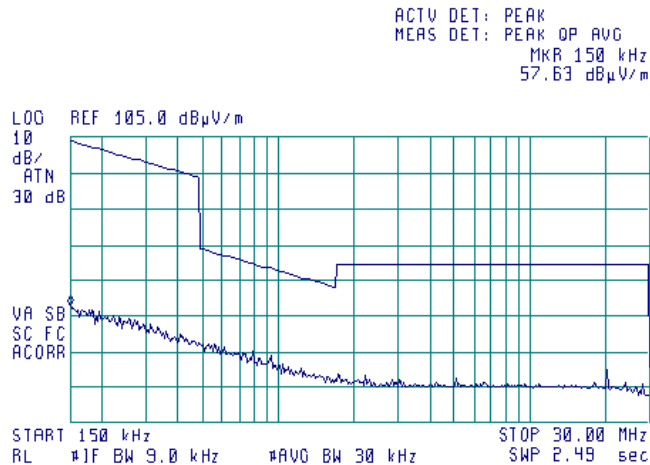
**Plot 7.2.7 Radiated emission measurements from 9 to 150 kHz**

TEST SITE: Semi anechoic chamber  
 TEST DISTANCE: 3 m  
 ANTENNA POLARIZATION: Vertical  
 EUT POSITION: Z-axis



**Plot 7.2.8 Radiated emission measurements from 0.15 to 30 MHz**

TEST SITE: Semi anechoic chamber  
 TEST DISTANCE: 3 m  
 ANTENNA POLARIZATION: Vertical  
 EUT POSITION: Z-axis



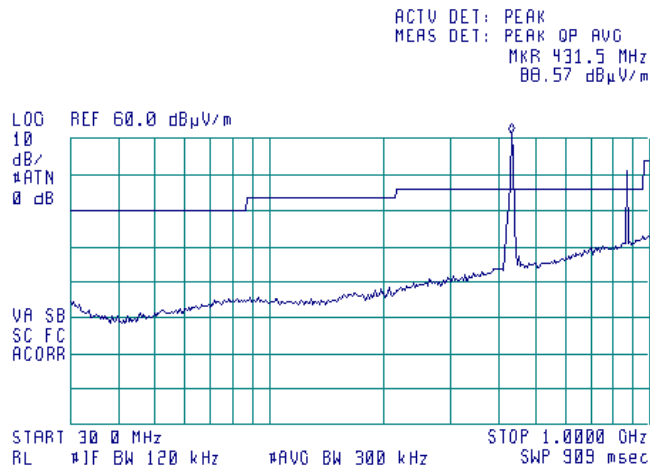


HERMON LABORATORIES

<b>Test specification:</b>	<b>FCC Part 15, Section 231(e) / RSS-210, Section A1.1.5, Field strength of emissions</b>		
<b>Test procedure:</b>	ANSI C63.4, Section 13.1.4		
<b>Test mode:</b>	Compliance	<b>Verdict:</b>	<b>PASS</b>
<b>Date(s):</b>	1/9/2012; 6/23/2013		
<b>Temperature:</b> 29.1 °C	<b>Air Pressure:</b> 1007 hPa	<b>Relative Humidity:</b> 65 %	<b>Power Supply:</b> Battery
<b>Remarks:</b>			

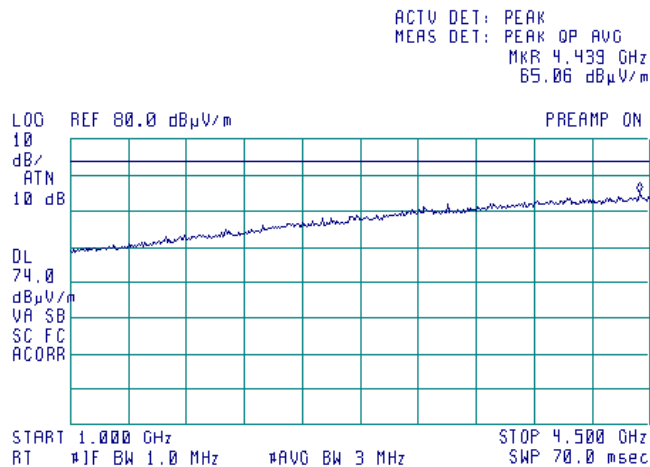
**Plot 7.2.9 Radiated emission measurements from 30 to 1000 MHz**

TEST SITE: Semi anechoic chamber  
 TEST DISTANCE: 3 m  
 ANTENNA POLARIZATION: Vertical and Horizontal  
 EUT POSITION: Z-axis



**Plot 7.2.10 Radiated emission measurements from 1000 to 4500 MHz**

TEST SITE: Semi anechoic chamber  
 TEST DISTANCE: 3 m  
 ANTENNA POLARIZATION: Vertical and Horizontal  
 EUT POSITION: Z-axis

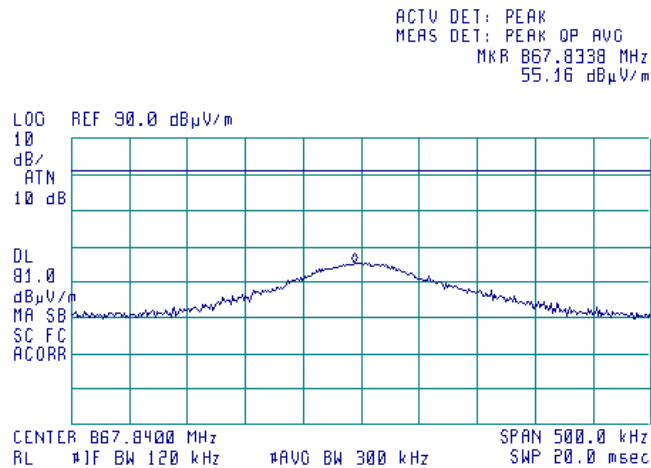




<b>Test specification:</b>	<b>FCC Part 15, Section 231(e) / RSS-210, Section A1.1.5, Field strength of emissions</b>		
<b>Test procedure:</b>	ANSI C63.4, Section 13.1.4		
<b>Test mode:</b>	Compliance	<b>Verdict: PASS</b>	
<b>Date(s):</b>	1/9/2012; 6/23/2013		
<b>Temperature:</b> 29.1 °C	<b>Air Pressure:</b> 1007 hPa	<b>Relative Humidity:</b> 65 %	<b>Power Supply:</b> Battery
<b>Remarks:</b>			

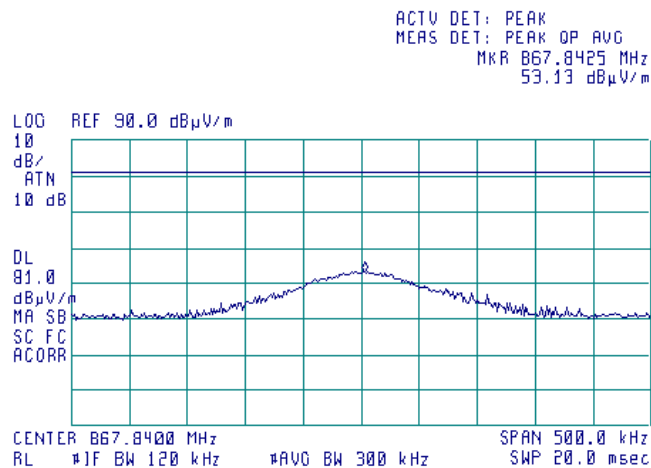
**Plot 7.2.11 Radiated emission measurements at the second harmonic frequency**

TEST SITE: Semi anechoic chamber  
 TEST DISTANCE: 3 m  
 ANTENNA POLARIZATION: Vertical  
 EUT POSITION: Z-axis



**Plot 7.2.12 Radiated emission measurements at the second harmonic frequency**

TEST SITE: Semi anechoic chamber  
 TEST DISTANCE: 3 m  
 ANTENNA POLARIZATION: Horizontal  
 EUT POSITION: Z-axis





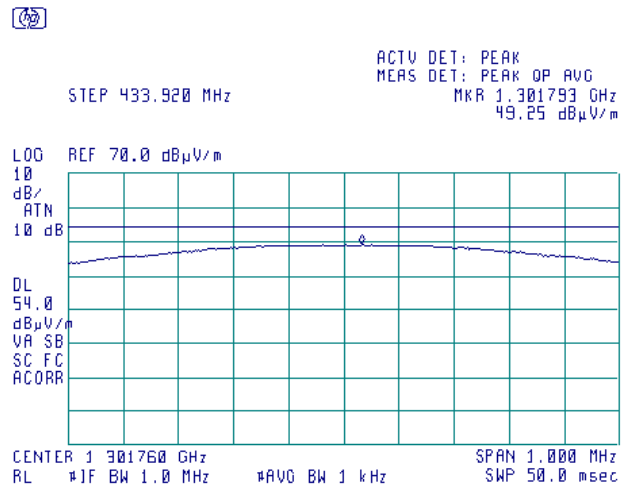
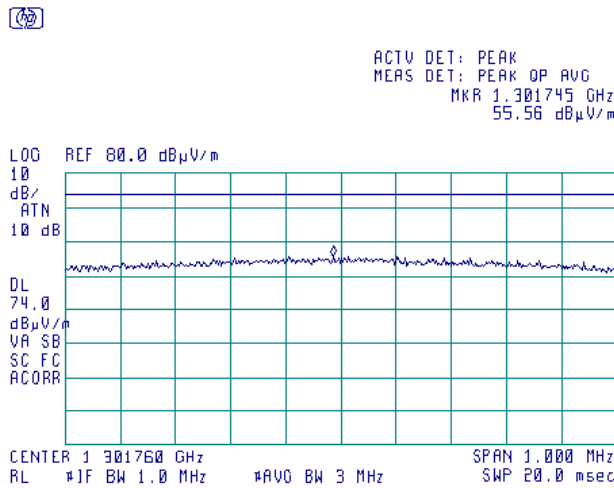


HERMON LABORATORIES

<b>Test specification:</b>		<b>FCC Part 15, Section 231(e) / RSS-210, Section A1.1.5, Field strength of emissions</b>	
<b>Test procedure:</b>		ANSI C63.4, Section 13.1.4	
<b>Test mode:</b>		Compliance	
<b>Date(s):</b>		1/9/2012; 6/23/2013	
<b>Temperature:</b> 29.1 °C		<b>Air Pressure:</b> 1007 hPa	
<b>Remarks:</b>		<b>Verdict:</b> PASS	
		<b>Relative Humidity:</b> 65 %	
		<b>Power Supply:</b> Battery	

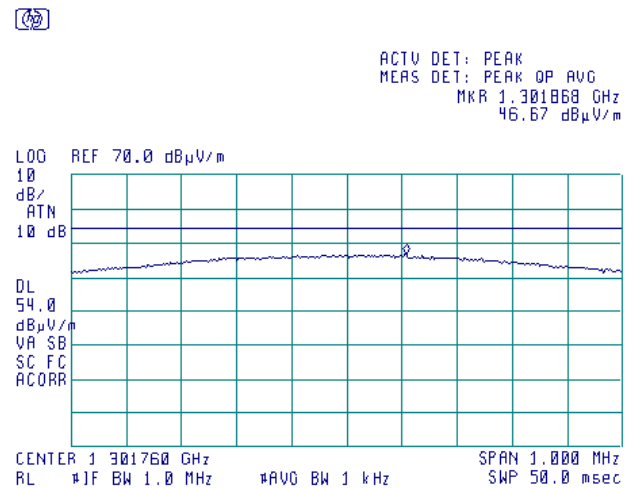
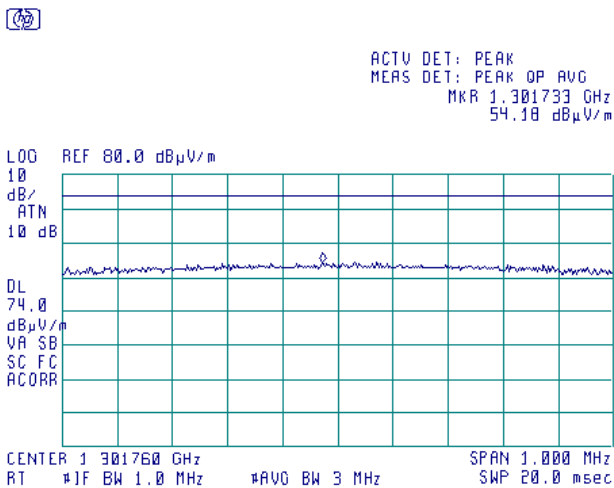
**Plot 7.2.13 Radiated emission measurements at the third harmonic frequency**

TEST SITE: Semi anechoic chamber  
TEST DISTANCE: 3 m  
ANTENNA POLARIZATION: Vertical  
EUT POSITION: Z-axis



**Plot 7.2.14 Radiated emission measurements at the third harmonic frequency**

TEST SITE: Semi anechoic chamber  
TEST DISTANCE: 3 m  
ANTENNA POLARIZATION: Horizontal  
EUT POSITION: Z-axis



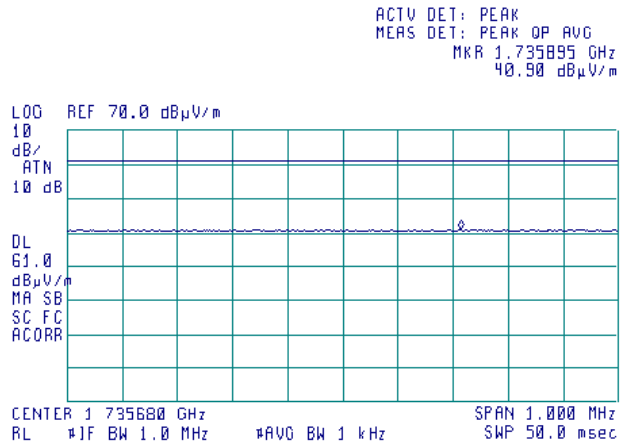
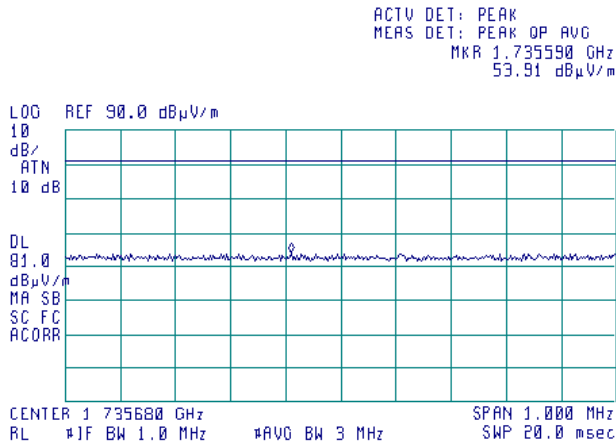


HERMON LABORATORIES

<b>Test specification:</b> FCC Part 15, Section 231(e) / RSS-210, Section A1.1.5, Field strength of emissions			
<b>Test procedure:</b> ANSI C63.4, Section 13.1.4			
<b>Test mode:</b> Compliance	<b>Verdict:</b> PASS		
<b>Date(s):</b> 1/9/2012; 6/23/2013			
<b>Temperature:</b> 29.1 °C	<b>Air Pressure:</b> 1007 hPa	<b>Relative Humidity:</b> 65 %	<b>Power Supply:</b> Battery
<b>Remarks:</b>			

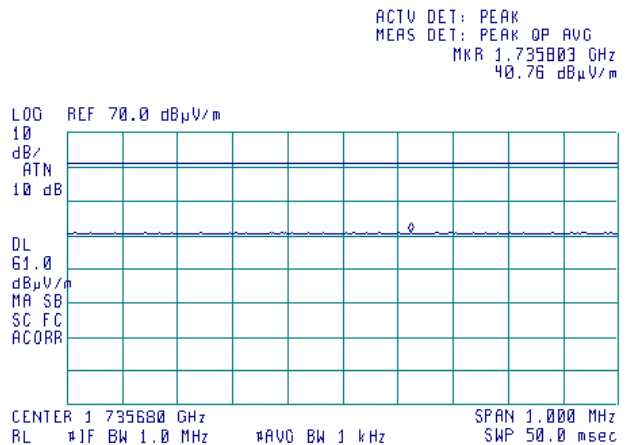
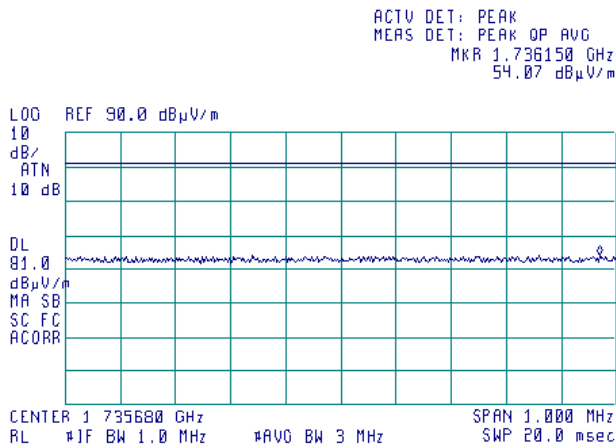
**Plot 7.2.15 Radiated emission measurements at the fourth harmonic frequency**

TEST SITE: Semi anechoic chamber  
TEST DISTANCE: 3 m  
ANTENNA POLARIZATION: Vertical  
EUT POSITION: Z-axis



**Plot 7.2.16 Radiated emission measurements at the fourth harmonic frequency**

TEST SITE: Semi anechoic chamber  
TEST DISTANCE: 3 m  
ANTENNA POLARIZATION: Horizontal  
EUT POSITION: Z-axis



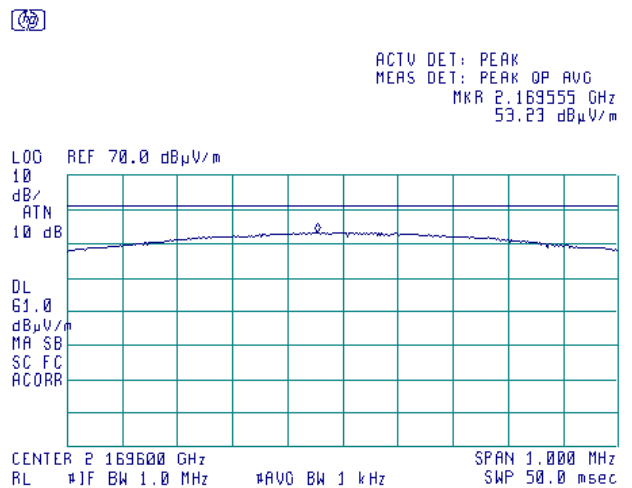
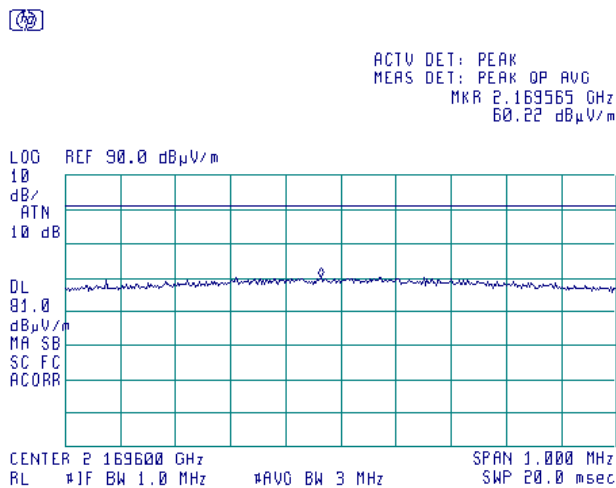


HERMON LABORATORIES

<b>Test specification:</b>		<b>FCC Part 15, Section 231(e) / RSS-210, Section A1.1.5, Field strength of emissions</b>	
<b>Test procedure:</b>		ANSI C63.4, Section 13.1.4	
<b>Test mode:</b>		Compliance	
<b>Date(s):</b>		1/9/2012; 6/23/2013	
<b>Temperature:</b> 29.1 °C		<b>Air Pressure:</b> 1007 hPa	
<b>Remarks:</b>		<b>Verdict:</b> PASS	
		<b>Relative Humidity:</b> 65 %	
		<b>Power Supply:</b> Battery	

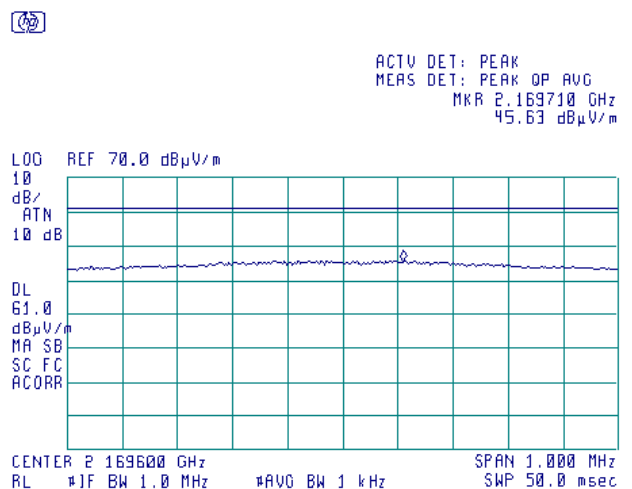
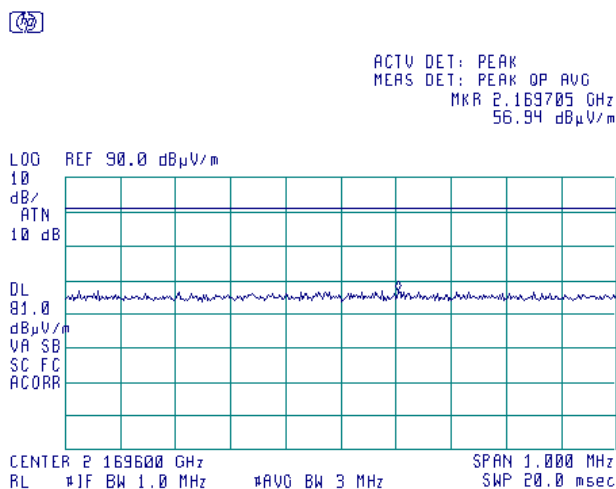
**Plot 7.2.17 Radiated emission measurements at the fifth harmonic frequency**

TEST SITE: Semi anechoic chamber  
 TEST DISTANCE: 3 m  
 ANTENNA POLARIZATION: Vertical  
 EUT POSITION: Z-axis



**Plot 7.2.18 Radiated emission measurements at the fifth harmonic frequency**

TEST SITE: Semi anechoic chamber  
 TEST DISTANCE: 3 m  
 ANTENNA POLARIZATION: Horizontal  
 EUT POSITION: Z-axis



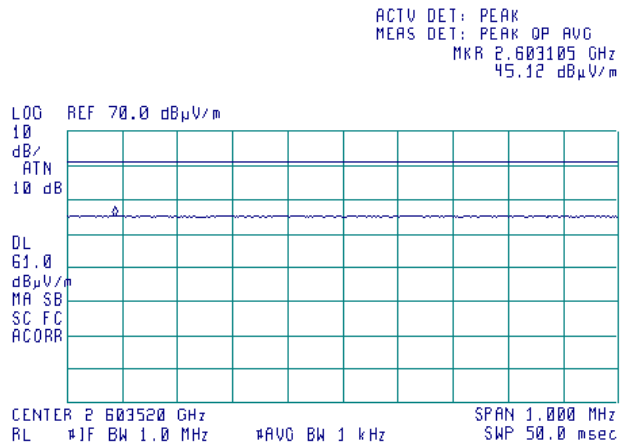
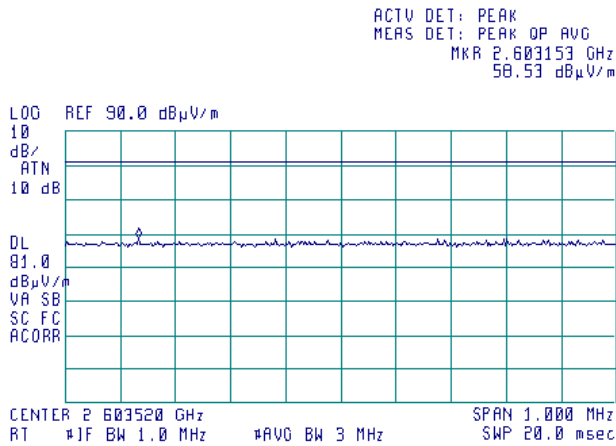


HERMON LABORATORIES

<b>Test specification:</b> FCC Part 15, Section 231(e) / RSS-210, Section A1.1.5, Field strength of emissions	
<b>Test procedure:</b> ANSI C63.4, Section 13.1.4	
<b>Test mode:</b> Compliance	<b>Verdict:</b> PASS
<b>Date(s):</b> 1/9/2012; 6/23/2013	
<b>Temperature:</b> 29.1 °C	<b>Air Pressure:</b> 1007 hPa
<b>Remarks:</b>	

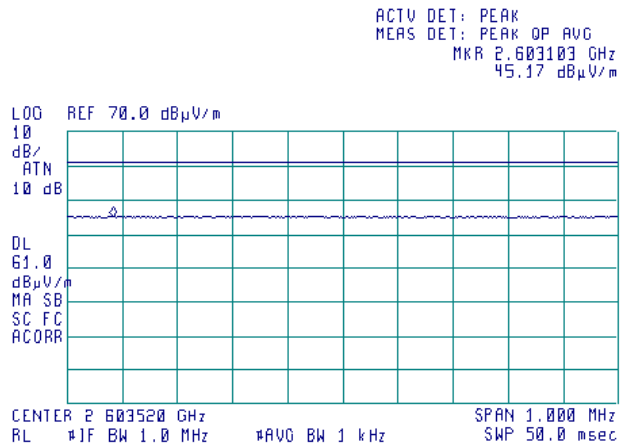
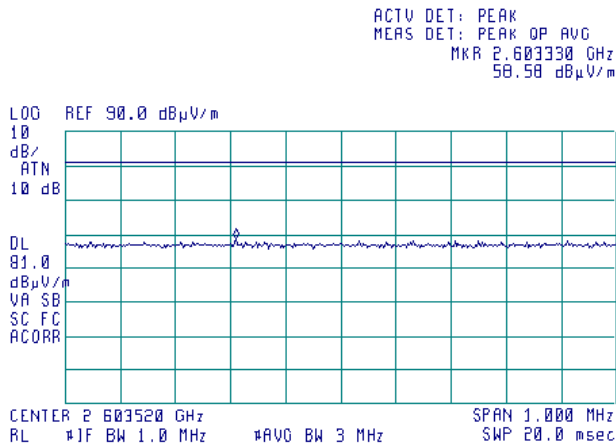
**Plot 7.2.19 Radiated emission measurements at the sixth harmonic frequency**

TEST SITE: Semi anechoic chamber  
TEST DISTANCE: 3 m  
ANTENNA POLARIZATION: Vertical  
EUT POSITION: Z-axis



**Plot 7.2.20 Radiated emission measurements at the sixth harmonic frequency**

TEST SITE: Semi anechoic chamber  
TEST DISTANCE: 3 m  
ANTENNA POLARIZATION: Horizontal  
EUT POSITION: Z-axis



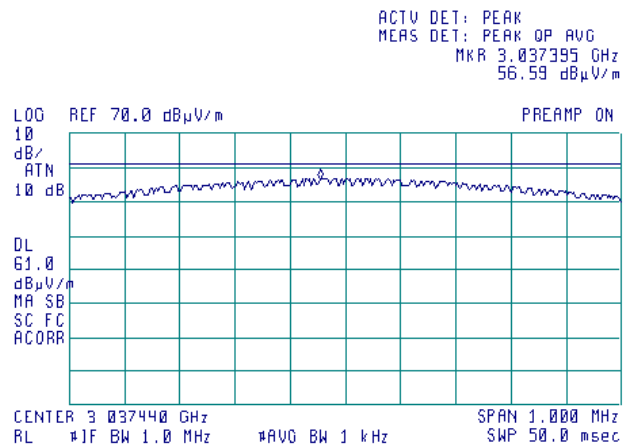
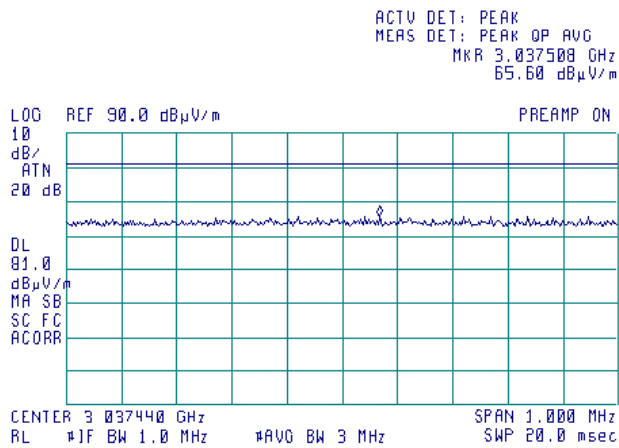


HERMON LABORATORIES

<b>Test specification:</b>		<b>FCC Part 15, Section 231(e) / RSS-210, Section A1.1.5, Field strength of emissions</b>	
<b>Test procedure:</b>		ANSI C63.4, Section 13.1.4	
<b>Test mode:</b>		Compliance	
<b>Date(s):</b>		1/9/2012; 6/23/2013	
<b>Temperature:</b> 29.1 °C		<b>Air Pressure:</b> 1007 hPa	
		<b>Relative Humidity:</b> 65 %	<b>Power Supply:</b> Battery
<b>Remarks:</b>			

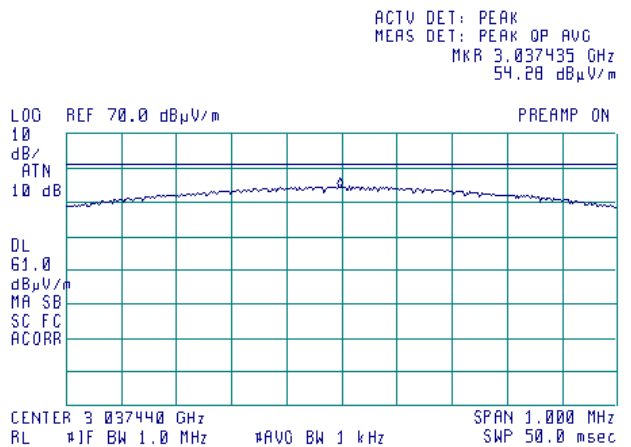
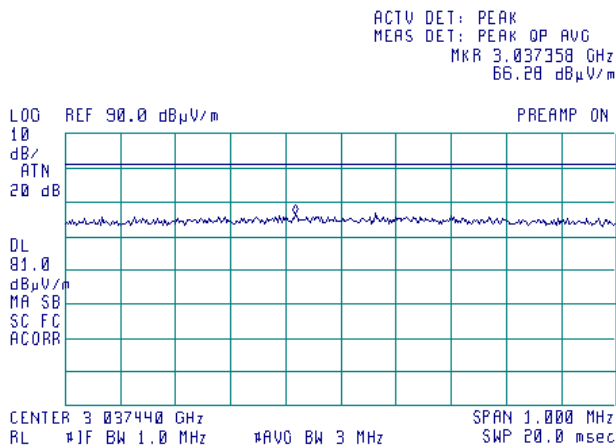
**Plot 7.2.21 Radiated emission measurements at the seventh harmonic frequency**

TEST SITE: Semi anechoic chamber  
TEST DISTANCE: 3 m  
ANTENNA POLARIZATION: Vertical  
EUT POSITION: Z-axis



**Plot 7.2.22 Radiated emission measurements at the seventh harmonic frequency**

TEST SITE: Semi anechoic chamber  
TEST DISTANCE: 3 m  
ANTENNA POLARIZATION: Horizontal  
EUT POSITION: Z-axis



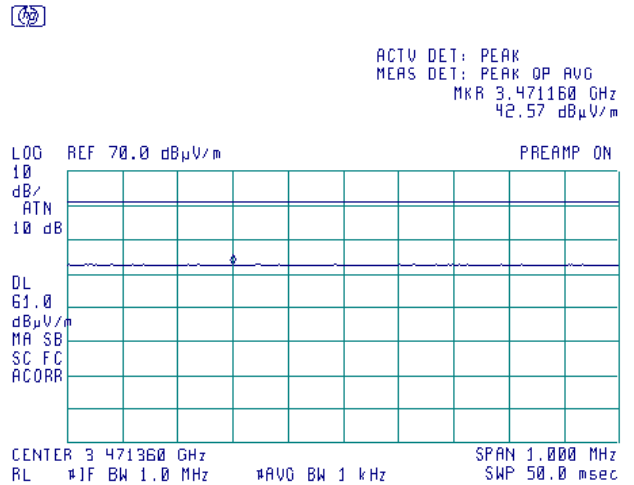
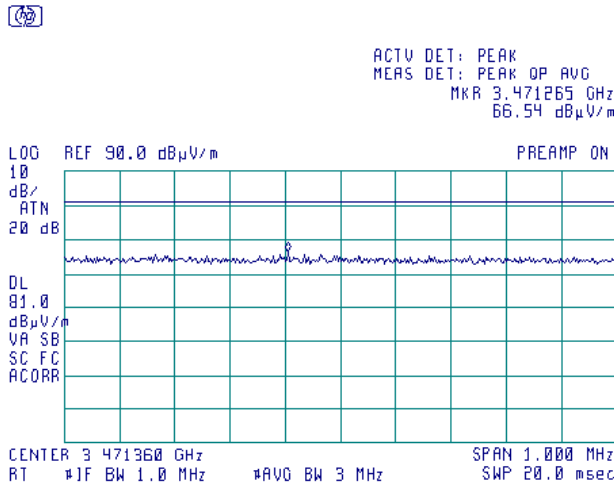


HERMON LABORATORIES

<b>Test specification:</b>		<b>FCC Part 15, Section 231(e) / RSS-210, Section A1.1.5, Field strength of emissions</b>	
<b>Test procedure:</b>		ANSI C63.4, Section 13.1.4	
<b>Test mode:</b>		Compliance	
<b>Date(s):</b>		1/9/2012; 6/23/2013	
<b>Temperature:</b> 29.1 °C		<b>Air Pressure:</b> 1007 hPa	
<b>Remarks:</b>		<b>Verdict:</b> PASS	
		<b>Relative Humidity:</b> 65 %	
		<b>Power Supply:</b> Battery	

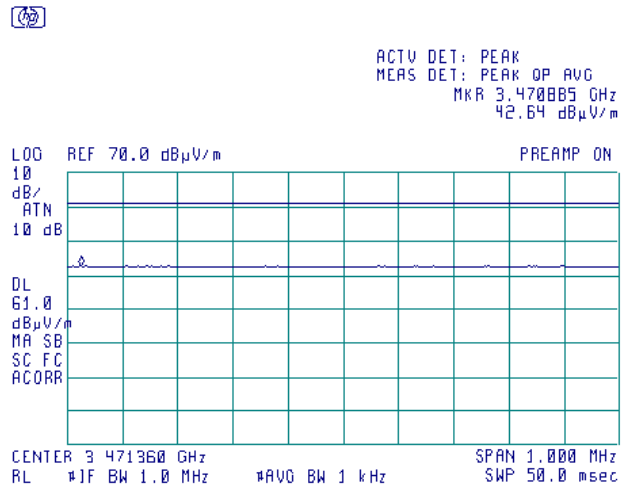
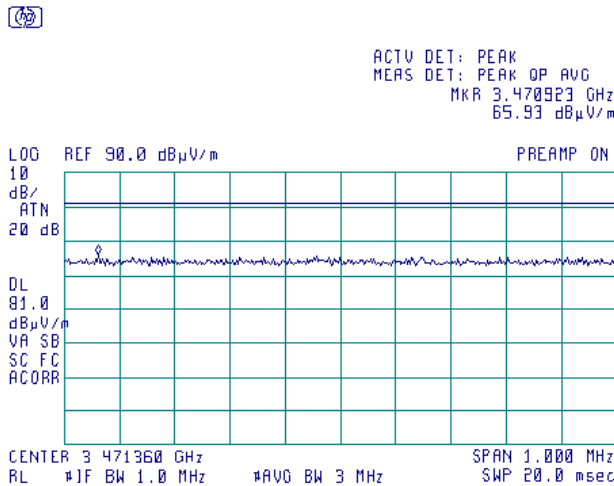
**Plot 7.2.23 Radiated emission measurements at the eighth harmonic frequency**

TEST SITE: Semi anechoic chamber  
TEST DISTANCE: 3 m  
ANTENNA POLARIZATION: Vertical  
EUT POSITION: Z-axis



**Plot 7.2.24 Radiated emission measurements at the eighth harmonic frequency**

TEST SITE: Semi anechoic chamber  
TEST DISTANCE: 3 m  
ANTENNA POLARIZATION: Horizontal  
EUT POSITION: Z-axis



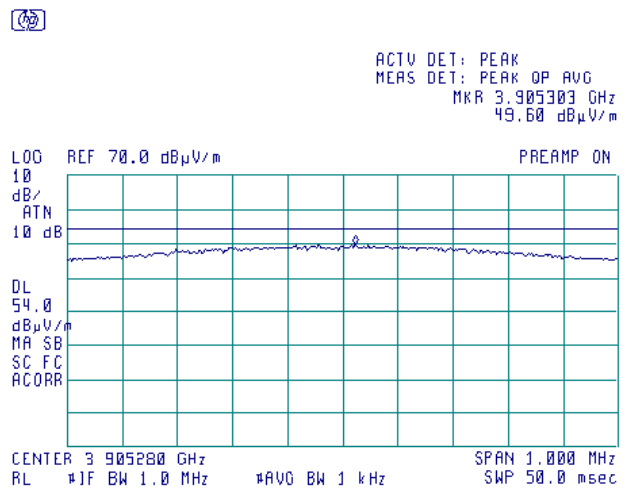
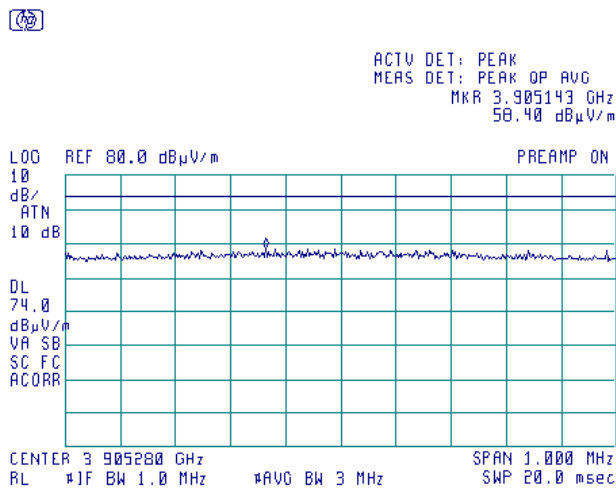


HERMON LABORATORIES

<b>Test specification:</b>		<b>FCC Part 15, Section 231(e) / RSS-210, Section A1.1.5, Field strength of emissions</b>	
<b>Test procedure:</b>		ANSI C63.4, Section 13.1.4	
<b>Test mode:</b>		Compliance	
<b>Date(s):</b>		1/9/2012; 6/23/2013	
<b>Temperature:</b> 29.1 °C		<b>Air Pressure:</b> 1007 hPa	
		<b>Relative Humidity:</b> 65 %	
		<b>Power Supply:</b> Battery	
<b>Remarks:</b>			
		<b>Verdict:</b> PASS	

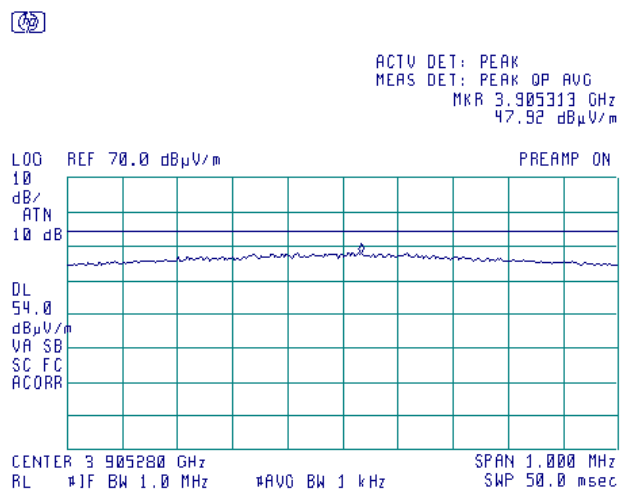
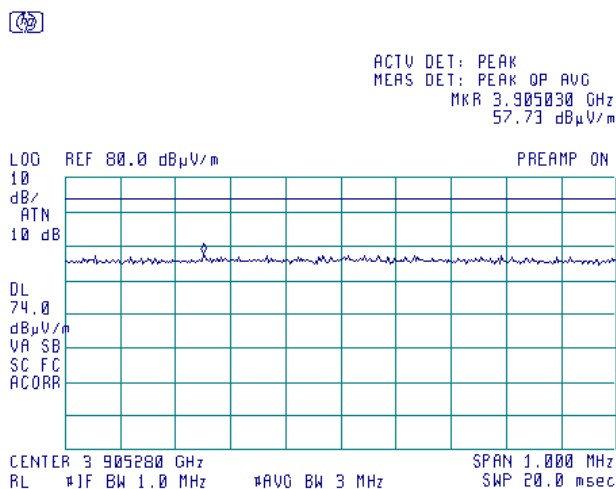
### Plot 7.2.25 Radiated emission measurements at the ninth harmonic frequency

TEST SITE: Semi anechoic chamber  
 TEST DISTANCE: 3 m  
 ANTENNA POLARIZATION: Vertical  
 EUT POSITION: Z-axis



### Plot 7.2.26 Radiated emission measurements at the ninth harmonic frequency

TEST SITE: Semi anechoic chamber  
 TEST DISTANCE: 3 m  
 ANTENNA POLARIZATION: Horizontal  
 EUT POSITION: Z-axis



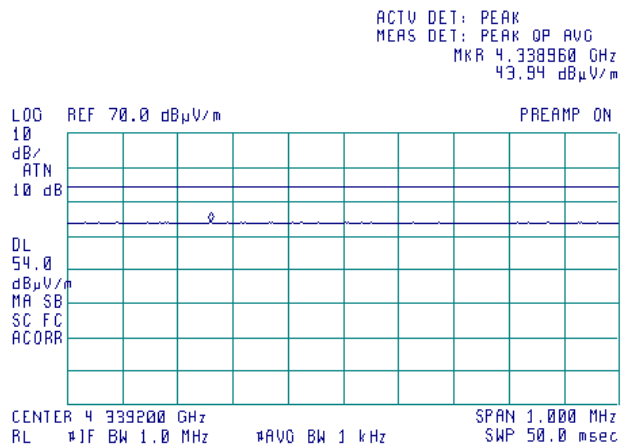
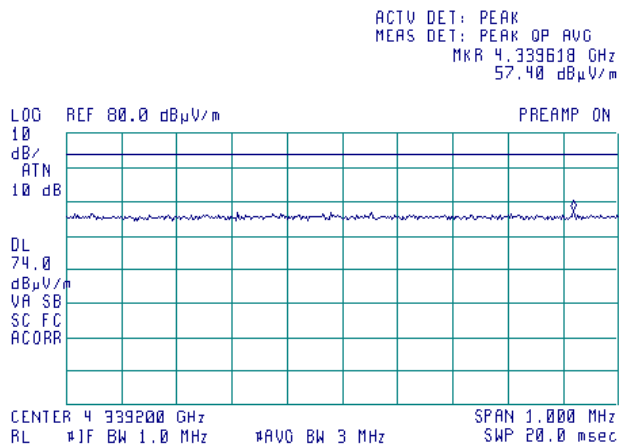


HERMON LABORATORIES

<b>Test specification:</b> FCC Part 15, Section 231(e) / RSS-210, Section A1.1.5, Field strength of emissions	
<b>Test procedure:</b> ANSI C63.4, Section 13.1.4	
<b>Test mode:</b> Compliance	<b>Verdict:</b> PASS
<b>Date(s):</b> 1/9/2012; 6/23/2013	
<b>Temperature:</b> 29.1 °C	<b>Air Pressure:</b> 1007 hPa
<b>Relative Humidity:</b> 65 %	
<b>Power Supply:</b> Battery	
<b>Remarks:</b>	

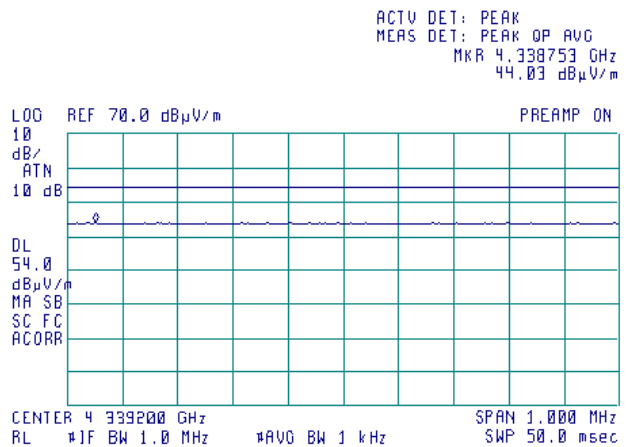
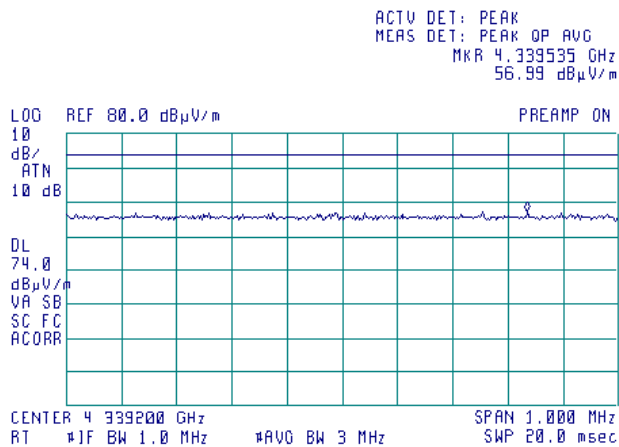
Plot 7.2.27 Radiated emission measurements at the tenth harmonic frequency

TEST SITE: Semi anechoic chamber  
 TEST DISTANCE: 3 m  
 ANTENNA POLARIZATION: Vertical  
 EUT POSITION: Z-axis



Plot 7.2.28 Radiated emission measurements at the tenth harmonic frequency

TEST SITE: Semi anechoic chamber  
 TEST DISTANCE: 3 m  
 ANTENNA POLARIZATION: Horizontal  
 EUT POSITION: Z-axis



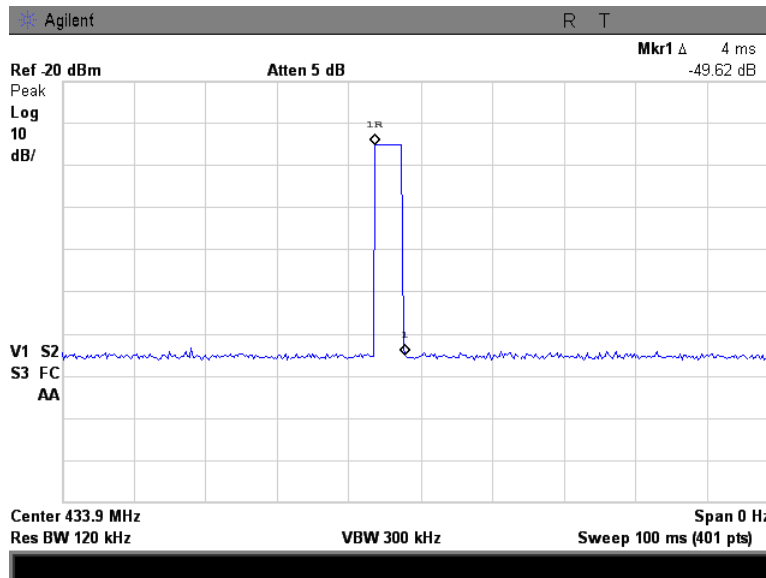




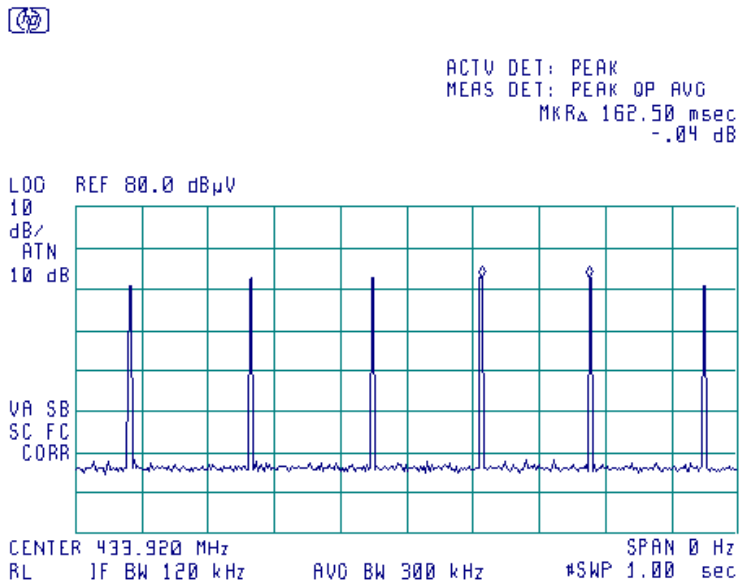
HERMON LABORATORIES

<b>Test specification:</b>	<b>FCC Part 15, Section 231(e) / RSS-210, Section A1.1.5, Field strength of emissions</b>		
<b>Test procedure:</b>	ANSI C63.4, Section 13.1.4		
<b>Test mode:</b>	Compliance	<b>Verdict:</b>	<b>PASS</b>
<b>Date(s):</b>	1/9/2012; 6/23/2013		
<b>Temperature:</b> 29.1 °C	<b>Air Pressure:</b> 1007 hPa	<b>Relative Humidity:</b> 65 %	<b>Power Supply:</b> Battery
<b>Remarks:</b>			

Plot 7.2.29 Transmission pulse duration



Plot 7.2.30 Transmission pulse period





<b>Test specification:</b>		<b>FCC Part 15, Section 231(c) / RSS-210, Section A1.1.3, Occupied bandwidth</b>	
<b>Test procedure:</b>		ANSI C63.4, Section 13.1.7	
<b>Test mode:</b>		Compliance	
<b>Date(s):</b>		1/9/2012	
<b>Temperature:</b> 20.8 °C		<b>Air Pressure:</b> 1019 hPa	
<b>Relative Humidity:</b> 54 %		<b>Power Supply:</b> Battery	
<b>Remarks:</b>			

### 7.3 Occupied bandwidth test

#### 7.3.1 General

This test was performed to measure transmitter occupied bandwidth. Specification test limits are given in Table 7.3.1.

Table 7.3.1 Occupied bandwidth limits

Assigned frequency, MHz	Modulation envelope reference points*, dBc	Maximum allowed bandwidth, % of the carrier frequency
70 - 900	20.0	0.25
Above 900		0.50

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

#### 7.3.2 Test procedure

7.3.2.1 The EUT was set up as shown in Figure 7.3.1, energized and its proper operation was checked.

7.3.2.2 The EUT was set to transmit modulated carrier.

7.3.2.3 The transmitter occupied bandwidth was measured with spectrum analyzer as frequency delta between reference points on modulation envelope and provided in Table 7.3.2 and the associated plots.

Figure 7.3.1 Occupied bandwidth test setup





<b>Test specification:</b>	<b>FCC Part 15, Section 231(c) / RSS-210, Section A1.1.3, Occupied bandwidth</b>		
<b>Test procedure:</b>	ANSI C63.4, Section 13.1.7		
<b>Test mode:</b>	Compliance	<b>Verdict:</b>	<b>PASS</b>
<b>Date(s):</b>	1/9/2012		
<b>Temperature:</b> 20.8 °C	<b>Air Pressure:</b> 1019 hPa	<b>Relative Humidity:</b> 54 %	<b>Power Supply:</b> Battery
<b>Remarks:</b>			

Table 7.3.2 Occupied bandwidth test results

DETECTOR USED: Peak hold  
 RESOLUTION BANDWIDTH: 120 kHz  
 VIDEO BANDWIDTH: 300 kHz  
 MODULATION ENVELOPE REFERENCE POINTS: 20 dBc  
 MODULATION: ASK  
 BIT RATE: 175 kbps

Carrier frequency, MHz	Occupied bandwidth, kHz	Limit		Margin, kHz	Verdict
		% of the carrier frequency	kHz		
433.92	488	0.25	1084.8	-560.8	Pass

Reference numbers of test equipment used

HL 0521	HL 0604	HL 2871	HL 3617				
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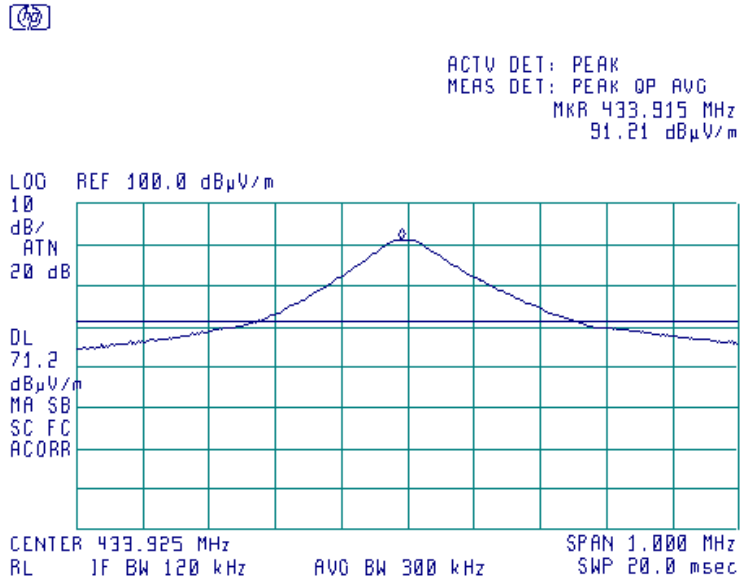
Full description is given in Appendix A.



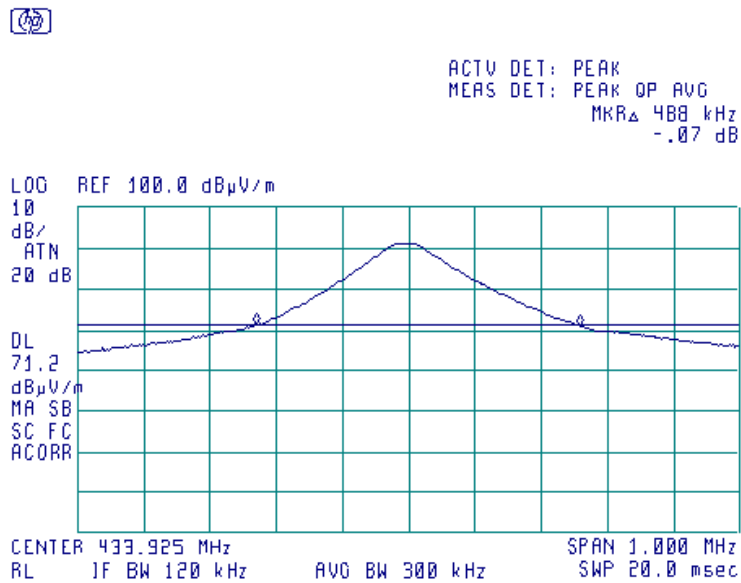
HERMON LABORATORIES

<b>Test specification:</b>		<b>FCC Part 15, Section 231(c) / RSS-210, Section A1.1.3, Occupied bandwidth</b>	
<b>Test procedure:</b>		ANSI C63.4, Section 13.1.7	
<b>Test mode:</b>		Compliance	
<b>Date(s):</b>		1/9/2012	
<b>Temperature:</b> 20.8 °C		<b>Air Pressure:</b> 1019 hPa	
<b>Relative Humidity:</b> 54 %		<b>Power Supply:</b> Battery	
<b>Remarks:</b>			
		<b>Verdict: PASS</b>	

Plot 7.3.1 Occupied bandwidth test result



Plot 7.3.2 Occupied bandwidth test result





<b>Test specification:</b>	<b>FCC Part 15, Section 203 / RSS-Gen, Section 7.1.4, Antenna requirements</b>		
<b>Test procedure:</b>	Visual inspection / supplier declaration		
<b>Test mode:</b>	Compliance	<b>Verdict:</b>	<b>PASS</b>
<b>Date(s):</b>	1/17/2012		
<b>Temperature:</b> 17.5 °C	<b>Air Pressure:</b> 1021 hPa	<b>Relative Humidity:</b> 55 %	<b>Power Supply:</b> Battery
<b>Remarks:</b>			

### 7.4 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 7.4.1.

Table 7.4.1 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	

**8 APPENDIX A Test equipment and ancillaries used for tests**

HL No	Description	Manufacturer	Model	Ser. No.	Last Cal./ Check	Due Cal./ Check
0415	Cable, Coax, RF, RG-214, 12.3 m	Hermon Laboratories	CC-3	056	02-Dec-12	02-Dec-13
0446	Antenna, Loop, Active, 10 kHz - 30 MHz	EMCO	6502	2857	03-Jul-12	03-Jul-13
0521	EMI Receiver (Spectrum Analyzer) with RF filter section 9 kHz-6.5 GHz	Hewlett Packard	8546A	3617A 00319, 3448A002 53	22-Apr-13	22-Apr-14
0569	Antenna, Log Periodic, 200 - 1000 MHz	Electro-Metrics	LPA 25/30	1953	26-Apr-13	26-Apr-14
0604	Antenna BiconiLog Log-Periodic/T Bow-TIE, 26 - 2000 MHz	EMCO	3141	9611-1011	20-May-12	20-May-14
0812	Cable Coax, RG-214, 11.5 m, N-type connectors	Hermon Laboratories	C214-11	148	02-Dec-12	02-Dec-13
1425	EMI Receiver, 9 kHz - 2.9 GHz	Agilent Technologies	8542E	3710A002 22, 3705A002 04	26-Aug-12	26-Aug-13
2432	Antenna, Double-Ridged Waveguide Horn 1-18 GHz	EMC Test Systems	3115	00027177	07-Dec-12	07-Dec-13
2780	EMC analyzer, 100 Hz to 26.5 GHz	Agilent Technologies	E7405A	MY451024 62	09-Jul-12	09-Jul-13
2781	EMC analyzer measurement software	Agilent Technologies	E7415A	NA	01-Jan-13	01-Jan-14
2871	Microwave Cable Assembly, 18 GHz, 6.4 m, SMA - SMA	Huber-Suhner	198-8155-00	2871	04-Dec-12	04-Dec-13
3617	Cable RF, 6.5 m, N type-N type, DC-6.5 GHz	Suhner Switzerland	RG 214/U	NA	01-Jan-13	01-Jan-14



## 9 APPENDIX B Measurement uncertainties

### Expanded uncertainty at 95% confidence in Hermon Labs EMC measurements

Test description	Expanded uncertainty
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
Vertical polarization	Double ridged horn antenna: $\pm 5.3$ dB 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
Duty cycle, timing (Tx ON / OFF) and average factor measurements	$\pm 1.0$ %
Occupied bandwidth	$\pm 8.0$ %

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.

## 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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Telephone: +972 4628 8001  
Fax: +972 4628 8277  
e-mail: mail@hermonlabs.com  
website: www.hermonlabs.com

Person for contact: Mr. Alex Usoskin, CEO.

## 11 APPENDIX D Specification references

FCC 47CFR part 15: 2012	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: 2010	General Requirements and Information for the Certification of Radiocommunication Equipment
ICES-003 issue 5:2012	Information Technology Equipment (ITE) – Limits and methods of measurement





**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(μV) to convert it into field intensity in dB(μV/m).

**Antenna factor  
Log periodic antenna  
Electro-Metrics, model LPA-25/30  
Ser.No.1953, HL 0569**

Frequency MHz	Antenna Factor dB(1/m)	Frequency MHz	Antenna Factor dB(1/m)
200	15.2	625	25.2
225	15.1	650	25.8
250	16.3	675	27.2
275	17.2	700	27.6
300	19.6	725	27.6
325	18.4	750	27.6
350	19.0	775	28.0
375	20.0	800	28.2
400	20.9	825	29.4
425	21.3	850	29.9
450	22.1	875	30.0
475	22.7	900	30.4
500	23.2	925	30.6
525	23.9	950	30.8
550	24.2	975	31.6
575	24.6	1000	32.1
600	24.7		

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



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(μV) to convert it into field strength in dB(μV/m).



**Antenna factor**  
**Double-ridged guide horn antenna**  
**Model 3115, serial number: 00027177, HL 2432**

<b>Frequency, MHz</b>	<b>Antenna factor. dB(1/m)</b>
1000.0	24.7
1500.0	25.7
2000.0	27.8
2500.0	28.9
3000.0	30.7
3500.0	31.8
4000.0	33.0
4500.0	32.8
5000.0	34.2
5500.0	34.9
6000.0	35.2
6500.0	35.4
7000.0	36.3
7500.0	37.3
8000.0	37.5
8500.0	38.0
9000.0	38.3
9500.0	38.3
10000.0	38.7
10500.0	38.7
11000.0	38.9
11500.0	39.5
12000.0	39.5
12500.0	39.4
13000.0	40.5
13500.0	40.8
14000.0	41.5
14500.0	41.3
15000.0	40.2
15500.0	38.7
16000.0	38.5
16500.0	39.8
17000.0	41.9
17500.0	45.8
18000.0	49.1

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).



**Cable loss**  
**Cable coax, RG-214, 12.3 m, s/n 056, HL 0415**

No.	Frequency, MHz	Cable loss, dB	Measured uncertainty, dB
1	10	0.23	±0.12
2	30	0.44	±0.12
3	50	0.60	±0.12
4	100	0.89	±0.12
5	150	1.11	±0.13
6	200	1.30	±0.13
7	250	1.45	±0.13
8	300	1.61	±0.13
9	400	1.94	±0.13
10	500	2.18	±0.13
11	600	2.45	±0.14
12	700	2.67	±0.14
13	800	2.94	±0.14
14	900	3.16	±0.14
15	1000	3.38	±0.14



**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



**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		



### 13 APPENDIX F Abbreviations and acronyms

A	ampere
AC	alternating current
A/m	ampere per meter
AVRG	average (detector)
cm	centimeter
dB	decibel
dBm	decibel referred to one milliwatt
dB( $\mu$ V)	decibel referred to one microvolt
dB( $\mu$ V/m)	decibel referred to one microvolt per meter
dB( $\mu$ A)	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
$\mu$ s	microsecond
NA	not applicable
OATS	open area test site
$\Omega$	Ohm
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

END OF DOCUMENT