

# TEST REPORT

ACCORDING TO: FCC CFR 47 PART 15 SUBPART C, section 15.245 and  
RSS-210, Issue 6, Annex 7

FOR:

**CROW Electronic Engineering Ltd.**

**Dual Tech Motion Sensor**

**Models: LC-103-PIMSK (Form A),  
LC-123-PIMSK (Form C)**

This report is in conformity with ISO/IEC 17025. The A2LA logo endorsement applies only to the test methods and the standards 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

**Client name:** CROW Electronic Engineering Ltd.  
**Address:** P.O.Box 293, Ben Gurion Airport, Airport City, 70100, Israel  
**Telephone:** +972 3972 6000  
**Fax:** +972 3972 6001  
**E-mail:** shukis@crow.co.il  
**Contact name:** Mr. Shuki Segal

## 2 Equipment under test attributes

**Product name:** Dual Tech Motion Sensor  
**Product type:** Transceiver  
**Model(s):** LC-123-PIMSK (Form C)  
**Serial number:** 88030095  
**Receipt date:** 11/23/2006

## 3 Manufacturer information

**Manufacturer name:** CROW Electronic Engineering Ltd.  
**Address:** P.O.Box 293, Ben Gurion Airport, Airport City, 70100, Israel  
**Telephone:** +972 3972 6000  
**Fax:** +972 3972 6001  
**E-Mail:** shukis@crow.co.il  
**Contact name:** Mr. Shuki Segal

## 4 Test details




**Project ID:** 17541  
**Location:** Hermon Laboratories Ltd. P.O.Box 23, Binyamina 30550, Israel  
**Test started:** 11/23/2006  
**Test completed:** 11/29/2006  
**Test specification(s):** FCC Part 15, subpart C, §15.245; RSS-210 Issue 6:2005, Annex 7  
**Test suite:** FCC 15.245\_10.5GHz (11/19/2006, modified)

## 5 Tests summary

Test	Status
<b>Transmitter characteristics</b>	
FCC Part 15, Section 15.245(b) / RSS-210, Annex 7, Field strength of emissions	Pass
FCC Part 15, Section 15.245(b)(3)/ RSS-210, Annex 7, Band edge emissions	Pass
FCC Part 15, Section 15.207(a)/ RSS-Gen, Section 7.2.2, Conducted emission	Not required
FCC Part 15, Section 15.203/ RSS-Gen, Section 7.1.4, Antenna requirement	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.

	Name and Title	Date	Signature
<b>Tested by:</b>	Mr. A. Lane, test engineer	November 29, 2006	
<b>Reviewed by:</b>	Mrs. M. Cherniavsky, certification engineer	December 3, 2006	
<b>Approved by:</b>	Mr. M. Nikishin, EMC and radio group leader	December 3, 2006	



## 6 EUT description

### 6.1 General information

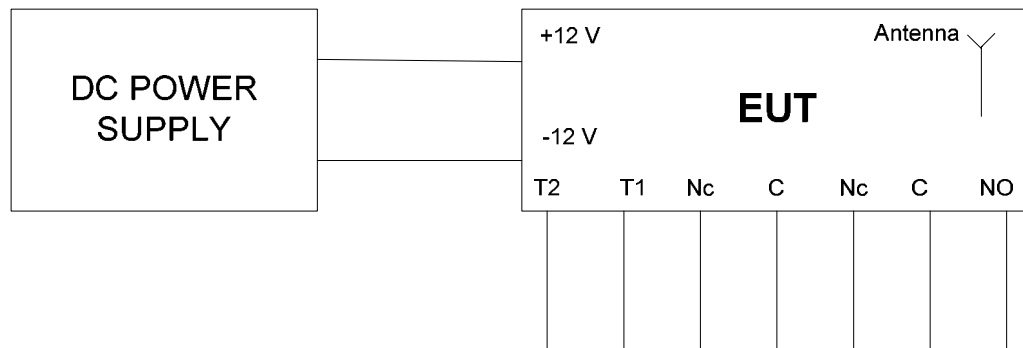
The EUT, model names LC-103-PIMSK (Form A) and LC-123-PIMSK (Form C), is a PIR & MW 10.525 GHz detector (transceiver) operating at 10.525 MHz and used as field disturbance sensor.

According to customer declaration of identity, the radio part of both detectors is identical. The LC-103-PIMSK (Form A) is the less populated version of LC-123-PIMSK (Form C) dual-tech motion sensor which does not support "normally open" option of dry contacts. Upon this only the LC-123-PIMSK (Form C) detector was tested as the most populated model.

### 6.2 Ports and lines

Port type	Port description	Connected		Connector type	Qty.	Cable type	Cable length	Indoor / outdoor
		From	To					
Power In	+ 12VDC	EUT	Power supply	Terminal Block	1	unshielded	2 m	Indoor
Power In	- 12VDC	EUT	Power supply			unshielded	2 m	Indoor
Signal Out	T1 - Tamper switch out	EUT	Open circuit	Terminal Block	1	unshielded	2 m	indoor
Signal Out	T2 - Tamper switch out	EUT	Open circuit			unshielded	2 m	indoor
Signal Out	NC - Alarm relay out	EUT	Open circuit			unshielded	2 m	Indoor
Signal Out	C - Alarm relay out	EUT	Open circuit			unshielded	2 m	Indoor
Signal Out	NC - Alarm relay out	EUT	Open circuit			unshielded	2 m	Indoor
Signal Out	C - Trouble relay out	EUT	Open circuit			unshielded	2 m	indoor
Signal Out	NO - Trouble relay out	EUT	Open circuit			unshielded	2 m	Indoor

### 6.3 Test configuration





## 6.4 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>Intended use</b>		<b>Condition of use</b>		
	fixed	Always at a distance more than 2 m from all people		
X	mobile	Always at a distance more than 20 cm from all people		
	portable	May operate at a distance closer than 20 cm to human body		
<b>Assigned frequency range</b>		10500 - 10550 MHz		
<b>Operating frequency range</b>		10525 MHz		
<b>Maximum rated output power</b>		At transmitter 50 $\Omega$ RF output connector	dBm	
		Effective radiated power (for equipment with no RF connector)	15.9 dBm	
<b>Is transmitter output power variable?</b>	X	No		
		Yes	continuous variable	
			stepped variable with stepsize	dB
			minimum RF power	dBm
		maximum RF power	dBm	
<b>Antenna connection</b>				
unique coupling	standard connector	X	integral	
			with temporary RF connector	
			X without temporary RF connector	
<b>Transmitter duty cycle supplied for test</b>		100%		
<b>Transmitter power source</b>				
DC	<b>Nominal rated voltage</b>	12 VDC		

<b>Test specification:</b>	FCC Part 15, Section 15.245(b) / RSS-210, Annex 7, 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 &amp; Time:</b>	11/27/2006 1:56:34 PM		
<b>Temperature:</b> 22°C	<b>Air Pressure:</b> 1010 hPa	<b>Relative Humidity:</b> 48 %	<b>Power Supply:</b> 12 V DC
<b>Remarks:</b>			

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

### 7.1 Field strength of emissions

#### 7.1.1 General

This test was performed to measure field strength of fundamental and spurious emissions from the EUT. Specification test limits are given in Table 7.1.1 and Table 7.1.2.

Table 7.1.1 Radiated fundamental emission limits

Fundamental frequency, MHz	Field strength at 3 m, dB(μV/m)	
	Peak	Average
10500 – 10550	148.0	128.0

Table 7.1.2 Radiated spurious emissions limits

Frequency, MHz	Field strength at 3 m, dB(μV/m)*				
	Within restricted bands			Harmonics outside restricted bands	
	Peak	Quasi Peak	Average	Peak	Average
0.009 – 0.090	148.5 – 128.5	NA	128.5 – 108.5**	108.0	88.0
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 – 17700		74.0			
Above 17700	108.0 (sensors within building) 97.5 (all other sensors)	NA	88.0 (sensors within building) 77.5 (all other sensors)		

\*- 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.

Note: 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 but not exceeding 40 GHz for intentional radiators operated below 10 GHz and up to the fifth harmonic of the highest fundamental frequency but not exceeding 100 GHz for intentional radiators operated above 10 GHz.

<b>Test specification:</b>	<b>FCC Part 15, Section 15.245(b) / RSS-210, Annex 7, 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 &amp; Time:</b>	11/27/2006 1:56:34 PM		
<b>Temperature:</b> 22°C	<b>Air Pressure:</b> 1010 hPa	<b>Relative Humidity:</b> 48 %	<b>Power Supply:</b> 12 V DC
<b>Remarks:</b>			

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

**7.1.2.1** The EUT was set up as shown in Figure 7.1.1, energized and the performance check was conducted.

**7.1.2.2** 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.

**7.1.2.3** The worst test results (the lowest margins) were recorded in Table 7.1.3, Table 7.1.5 and shown in the associated plots.

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

**7.1.3.1** The EUT was set up as shown in Figure 7.1.2, energized and the performance check was conducted.

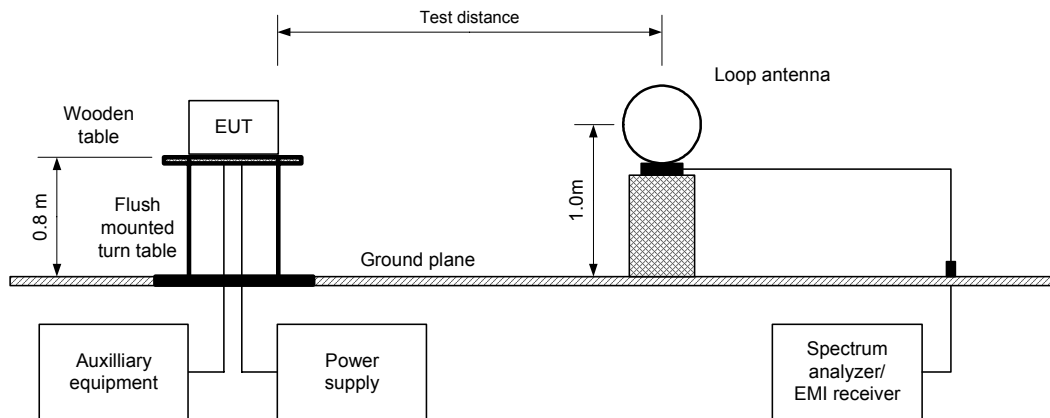
**7.1.3.2** The specified frequency range was investigated with antenna connected to spectrum analyzer/ EMI receiver. To find maximum radiation the turntable was rotated 360°, the measuring antenna height was changed from 1 to 4 m, its polarization was switched from vertical to horizontal.

**7.1.3.3** The worst test results (the lowest margins) were recorded in Table 7.1.3, Table 7.1.5 and shown in the associated plots.



<b>Test specification:</b> FCC Part 15, Section 15.245(b) / RSS-210, Annex 7, 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 &amp; Time:</b> 11/27/2006 1:56:34 PM			
<b>Temperature:</b> 22°C	<b>Air Pressure:</b> 1010 hPa	<b>Relative Humidity:</b> 48 %	<b>Power Supply:</b> 12 V DC
<b>Remarks:</b>			

Figure 7.1.1 Setup for spurious emission field strength measurements below 30 MHz

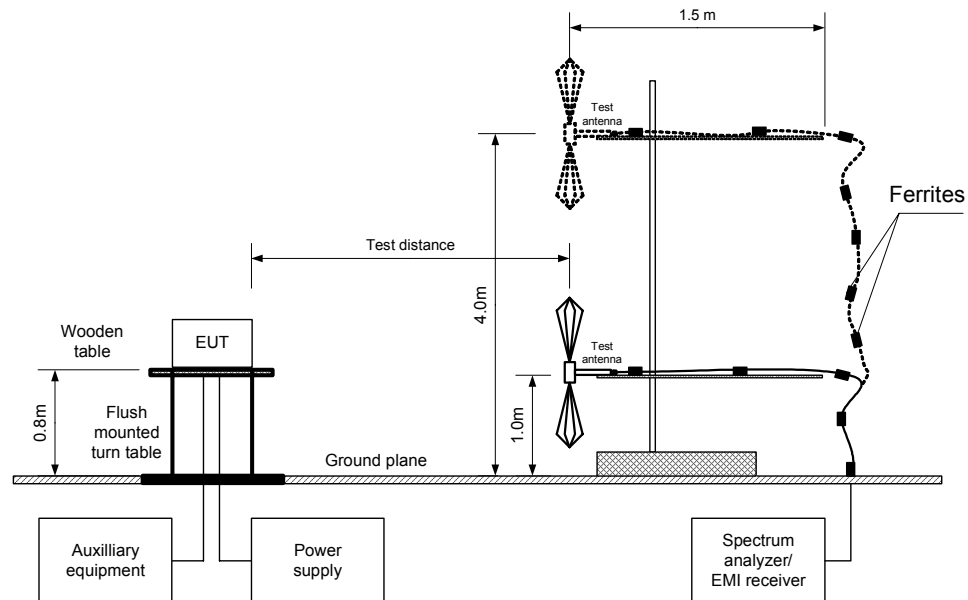


Photograph 7.1.1 Setup for spurious emission field strength measurements below 30 MHz



<b>Test specification:</b> FCC Part 15, Section 15.245(b) / RSS-210, Annex 7, 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 &amp; Time:</b> 11/27/2006 1:56:34 PM			
<b>Temperature:</b> 22°C	<b>Air Pressure:</b> 1010 hPa	<b>Relative Humidity:</b> 48 %	<b>Power Supply:</b> 12 V DC
<b>Remarks:</b>			

Figure 7.1.2 Setup for spurious emission field strength measurements above 30 MHz



Photograph 7.1.2 Setup for spurious emission field strength measurements from 30 to 1000 MHz



<b>Test specification:</b>	<b>FCC Part 15, Section 15.245(b) / RSS-210, Annex 7, 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 &amp; Time:</b>	11/27/2006 1:56:34 PM		
<b>Temperature:</b> 22°C	<b>Air Pressure:</b> 1010 hPa	<b>Relative Humidity:</b> 48 %	<b>Power Supply:</b> 12 V DC
<b>Remarks:</b>			

**Photograph 7.1.3 Setup for spurious emission field strength measurements from 1 to 18 GHz**



**Photograph 7.1.4 Setup for spurious emission field strength measurements from 18 to 26.5 GHz**



<b>Test specification:</b>	<b>FCC Part 15, Section 15.245(b) / RSS-210, Annex 7, 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 &amp; Time:</b>	11/27/2006 1:56:34 PM		
<b>Temperature:</b> 22°C	<b>Air Pressure:</b> 1010 hPa	<b>Relative Humidity:</b> 48 %	<b>Power Supply:</b> 12 V DC
<b>Remarks:</b>			

Photograph 7.1.5 Setup for spurious emission field strength measurements from 26.5 to 40 GHz



Photograph 7.1.6 Setup for spurious emission field strength measurements above 40 GHz



<b>Test specification:</b> FCC Part 15, Section 15.245(b) / RSS-210, Annex 7, 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 &amp; Time:</b> 11/27/2006 1:56:34 PM			
<b>Temperature:</b> 22°C	<b>Air Pressure:</b> 1010 hPa	<b>Relative Humidity:</b> 48 %	<b>Power Supply:</b> 12 V DC
<b>Remarks:</b>			

**Table 7.1.3 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: Typical (Vertical)  
 MODULATION: PM  
 TRANSMITTER OUTPUT POWER SETTINGS: Maximum  
 INVESTIGATED FREQUENCY RANGE: 0.009 - 60000 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			Avr factor, dB	Average field strength			Verdict
	Pol.	Height, m		Measured, dB(μV/m)	Limit, dB(μV/m)	Margin, dB**		Measured, dB(μV/m)	Limit, dB(μV/m)	Margin, dB**	
<b>Fundamental emission</b>											
10524.4	H	1.2	20	111.1	148	-36.9	-13.8	97.3	128	-30.7	Pass
<b>Spurious emissions</b>											
21049.1	H	1.2	60	57.00	108	-51.00	-13.8	43.2	88	-44.8	Pass
31573.5	H	1.2	60	68.83	108	-39.17	-13.8	55.03	88	-32.97	

\*- EUT front panel refers to 0 degrees position of turntable.  
 \*\*- Margin = dB below (negative if above) specification limit.

**Table 7.1.4 Average factor calculation**

Transmission pulse		Average factor, dB*
Duration, ms	Period, ms	
20.4	127.6	-13.8

\*- Average factor was calculated as follows:

$$\text{Average factor} = 20 \times \log_{10} \left( \frac{20.4}{100} \right) = -13.8 \text{ dB}$$

<b>Test specification:</b> FCC Part 15, Section 15.245(b) / RSS-210, Annex 7, 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 &amp; Time:</b> 11/27/2006 1:56:34 PM			
<b>Temperature:</b> 22°C	<b>Air Pressure:</b> 1010 hPa	<b>Relative Humidity:</b> 48 %	<b>Power Supply:</b> 12 V DC
<b>Remarks:</b>			

**Table 7.1.5 Field strength of emissions below 1 GHz within restricted bands**

TEST DISTANCE: 3 m  
EUT POSITION: Typical (Vertical)  
MODULATION: PM  
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 spurious were found								Pass

\*- Margin = Measured emission - specification limit.

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

**Table 7.1.6 Restricted bands**

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 0768	HL 0769	HL 0770	HL 1424	HL 1826	HL 1849
HL 1850	HL 1947	HL 1984	HL 2009	HL 2254	HL 2399	HL 2697	

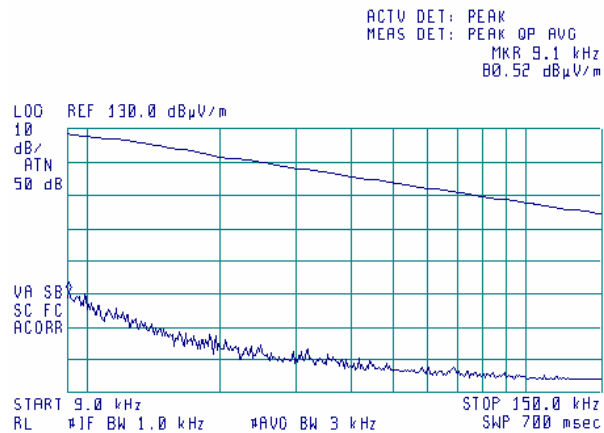
Full description is given in Appendix A.

<b>Test specification:</b>	<b>FCC Part 15, Section 15.245(b) / RSS-210, Annex 7, 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 &amp; Time:</b>	11/27/2006 1:56:34 PM		
<b>Temperature:</b> 22°C	<b>Air Pressure:</b> 1010 hPa	<b>Relative Humidity:</b> 48 %	<b>Power Supply:</b> 12 V DC
<b>Remarks:</b>			

**Plot 7.1.1 Radiated emission measurements from 9 to 150 kHz**

TEST SITE: Anechoic chamber  
TEST DISTANCE: 3 m  
ANTENNA POLARIZATION: Vertical  
EUT POSITION: Typical (Vertical)

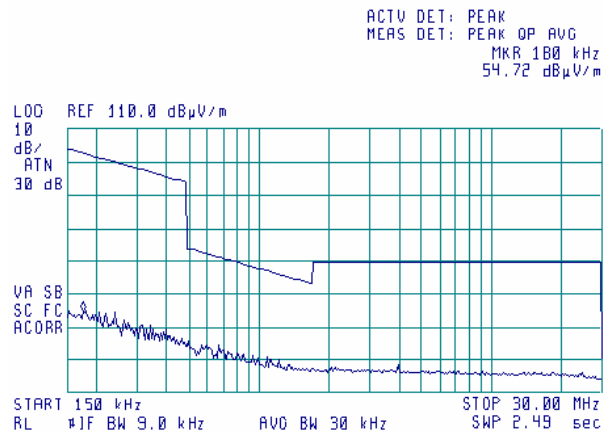
15:34:16 24 NOV 2006



**Plot 7.1.2 Radiated emission measurements from 0.15 to 30 MHz**

TEST SITE: Anechoic chamber  
TEST DISTANCE: 3 m  
ANTENNA POLARIZATION: Vertical  
EUT POSITION: Typical (Vertical)

15:37:57 24 NOV 2006

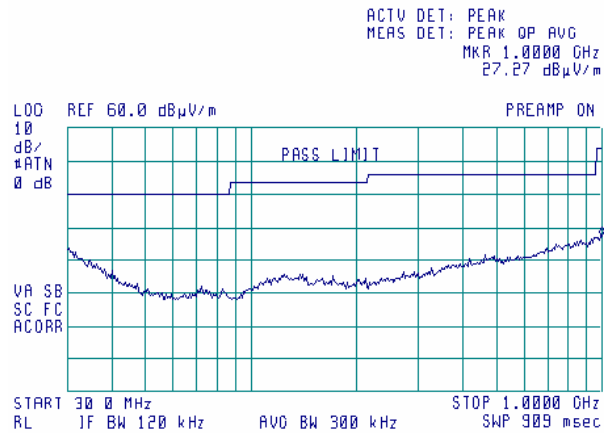


<b>Test specification:</b>	<b>FCC Part 15, Section 15.245(b) / RSS-210, Annex 7, Field strength of emissions</b>		
<b>Test procedure:</b>	ANSI C63.4, Section 13.1.4		
<b>Test mode:</b>	Compliance	<b>Verdict:</b>	<b>PASS</b>
<b>Date &amp; Time:</b>	11/27/2006 1:56:34 PM		
<b>Temperature:</b> 22°C	<b>Air Pressure:</b> 1010 hPa	<b>Relative Humidity:</b> 48 %	<b>Power Supply:</b> 12 V DC
<b>Remarks:</b>			

**Plot 7.1.3 Radiated emission measurements from 30 to 1000 MHz**

TEST SITE: Anechoic chamber  
 TEST DISTANCE: 3 m  
 ANTENNA POLARIZATION: Vertical and Horizontal  
 EUT POSITION: Typical (Vertical)

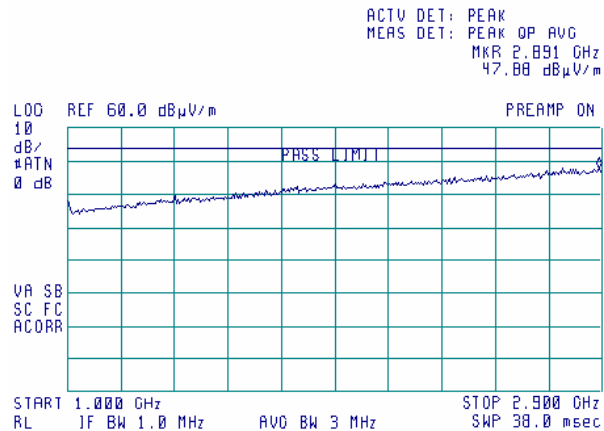
15:17:46 24 NOV 2006



**Plot 7.1.4 Radiated emission measurements from 1.0 to 2.9 MHz**

TEST SITE: Anechoic chamber  
 TEST DISTANCE: 3 m  
 ANTENNA POLARIZATION: Vertical and Horizontal  
 EUT POSITION: Typical (Vertical)

15:14:40 24 NOV 2006



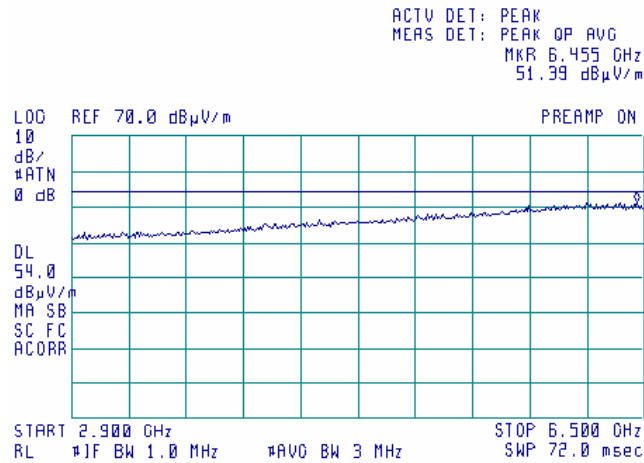


<b>Test specification:</b>		<b>FCC Part 15, Section 15.245(b) / RSS-210, Annex 7, Field strength of emissions</b>	
<b>Test procedure:</b>		ANSI C63.4, Section 13.1.4	
<b>Test mode:</b>	Compliance	<b>Verdict:</b>	PASS
<b>Date &amp; Time:</b>	11/27/2006 1:56:34 PM		
<b>Temperature:</b> 22°C	<b>Air Pressure:</b> 1010 hPa	<b>Relative Humidity:</b> 48 %	<b>Power Supply:</b> 12 V DC
<b>Remarks:</b>			

**Plot 7.1.5 Radiated emission measurements from 2.9 to 6.5 GHz**

TEST SITE: Anechoic chamber  
 TEST DISTANCE: 3 m  
 ANTENNA POLARIZATION: Vertical and Horizontal  
 EUT POSITION: Typical (Vertical)

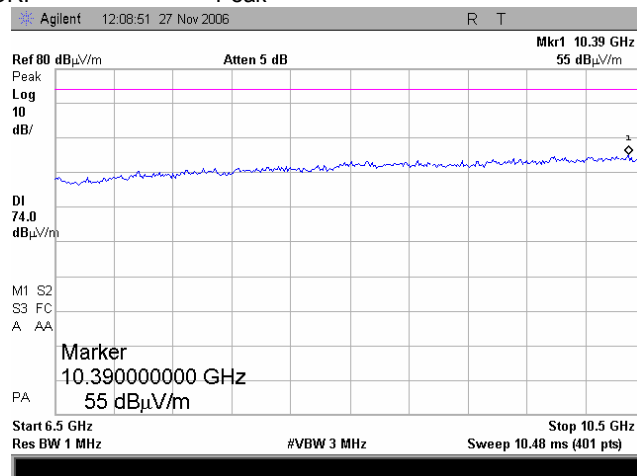
09:18:31 NOV 27, 2006



<b>Test specification:</b> FCC Part 15, Section 15.245(b) / RSS-210, Annex 7, 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 &amp; Time:</b> 11/27/2006 1:56:34 PM			
<b>Temperature:</b> 22°C	<b>Air Pressure:</b> 1010 hPa	<b>Relative Humidity:</b> 48 %	<b>Power Supply:</b> 12 V DC
<b>Remarks:</b>			

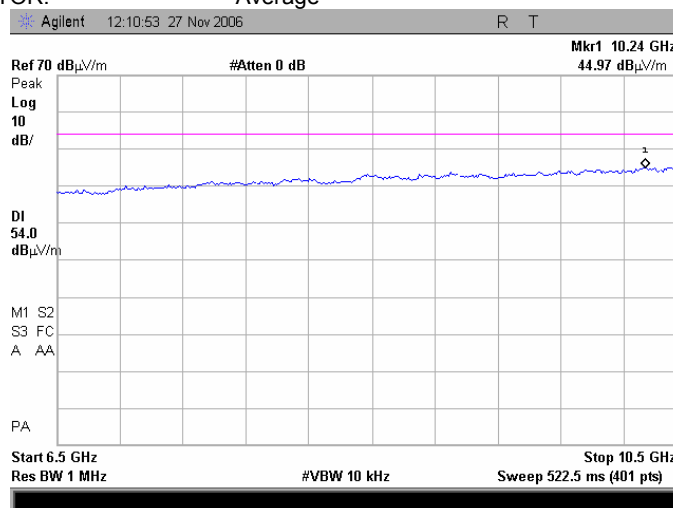
Plot 7.1.6 Radiated emission measurements from 6.5 to 10.5 GHz

TEST SITE: Semi anechoic chamber  
TEST DISTANCE: 3 m  
ANTENNA POLARIZATION: Vertical and Horizontal  
EUT POSITION: Typical (Vertical)  
DETECTOR: Peak



Plot 7.1.7 Radiated emission measurements from 6.5 to 10.5 GHz

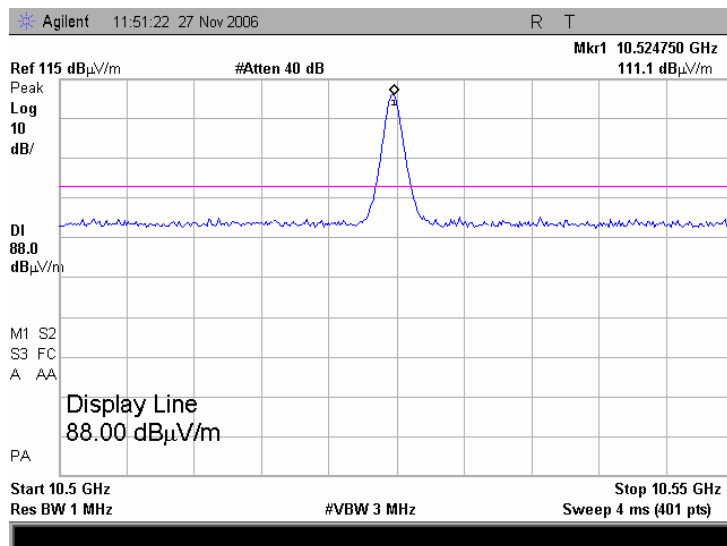
TEST SITE: Semi anechoic chamber  
TEST DISTANCE: 3 m  
ANTENNA POLARIZATION: Vertical and Horizontal  
EUT POSITION: Typical (Vertical)  
DETECTOR: Average



<b>Test specification:</b> FCC Part 15, Section 15.245(b) / RSS-210, Annex 7, 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 &amp; Time:</b> 11/27/2006 1:56:34 PM			
<b>Temperature:</b> 22°C	<b>Air Pressure:</b> 1010 hPa	<b>Relative Humidity:</b> 48 %	<b>Power Supply:</b> 12 V DC
<b>Remarks:</b>			

**Plot 7.1.8 Radiated emission measurements from 10.5 to 10.55 GHz**

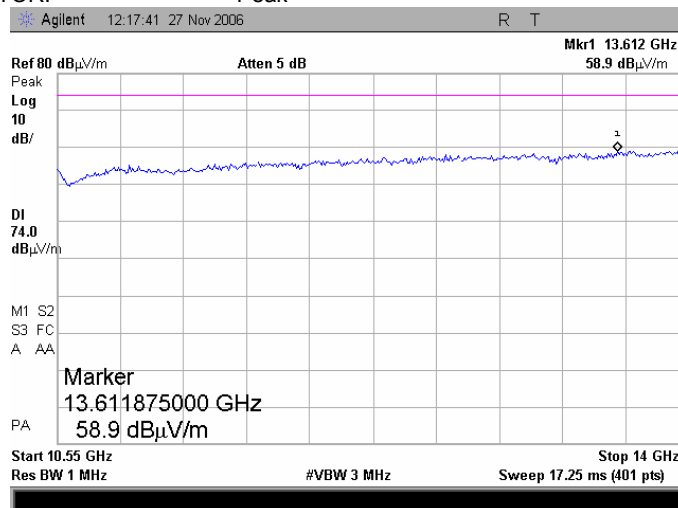
TEST SITE: Semi anechoic chamber  
TEST DISTANCE: 3 m  
ANTENNA POLARIZATION: Vertical and Horizontal  
EUT POSITION: Typical (Vertical)



<b>Test specification:</b> FCC Part 15, Section 15.245(b) / RSS-210, Annex 7, 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 &amp; Time:</b> 11/27/2006 1:56:34 PM			
<b>Temperature:</b> 22°C	<b>Air Pressure:</b> 1010 hPa	<b>Relative Humidity:</b> 48 %	<b>Power Supply:</b> 12 V DC
<b>Remarks:</b>			

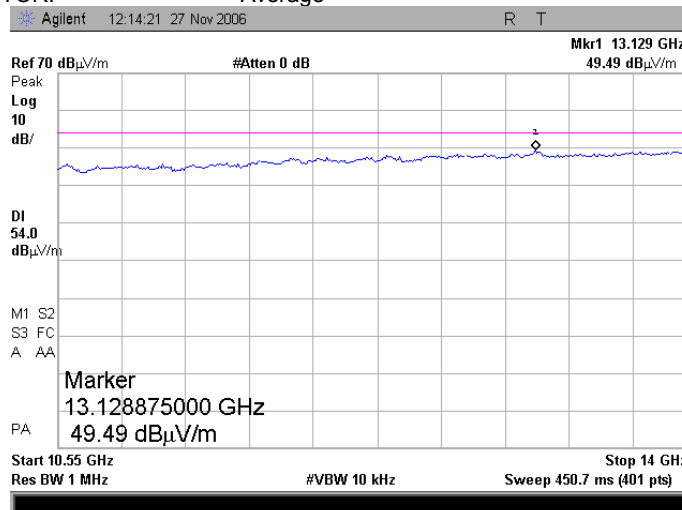
**Plot 7.1.9 Radiated emission measurements from 10.55 to 14.0 GHz**

TEST SITE: Semi anechoic chamber  
TEST DISTANCE: 3 m  
ANTENNA POLARIZATION: Vertical and Horizontal  
EUT POSITION: Typical (Vertical)  
DETECTOR: Peak



**Plot 7.1.10 Radiated emission measurements from 10.55 to 14.0 GHz**

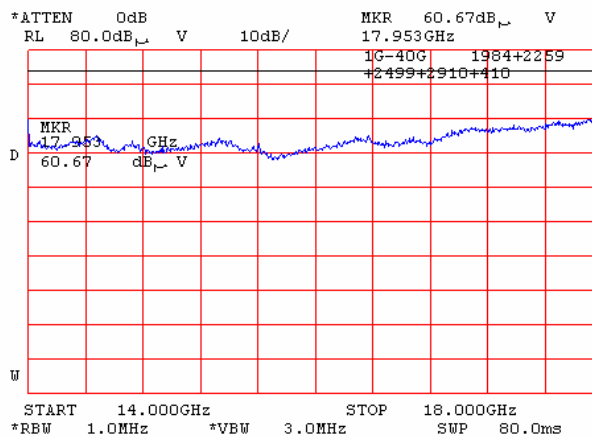
TEST SITE: Semi anechoic chamber  
TEST DISTANCE: 3 m  
ANTENNA POLARIZATION: Vertical and Horizontal  
EUT POSITION: Typical (Vertical)  
DETECTOR: Average



<b>Test specification:</b>	<b>FCC Part 15, Section 15.245(b) / RSS-210, Annex 7, 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 &amp; Time:</b>	11/27/2006 1:56:34 PM		
<b>Temperature:</b> 22°C	<b>Air Pressure:</b> 1010 hPa	<b>Relative Humidity:</b> 48 %	<b>Power Supply:</b> 12 V DC
<b>Remarks:</b>			

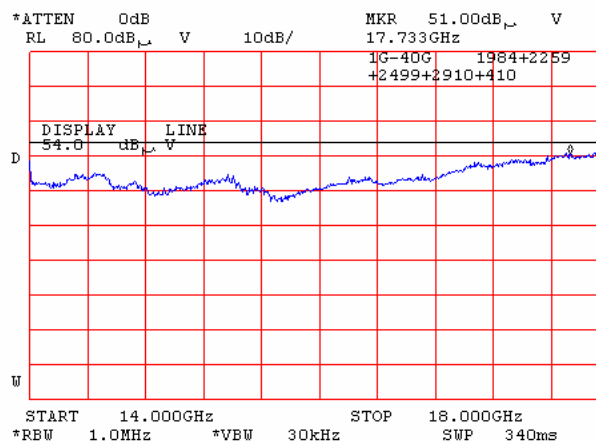
**Plot 7.1.11 Radiated emission measurements from 14.0 to 18.0 GHz**

TEST SITE: OATS  
 TEST DISTANCE: 3 m  
 ANTENNA POLARIZATION: Vertical & horizontal  
 EUT POSITION: Typical (Vertical)  
 DETECTOR: Peak



**Plot 7.1.12 Radiated emission measurements from 14.0 to 18.0 GHz**

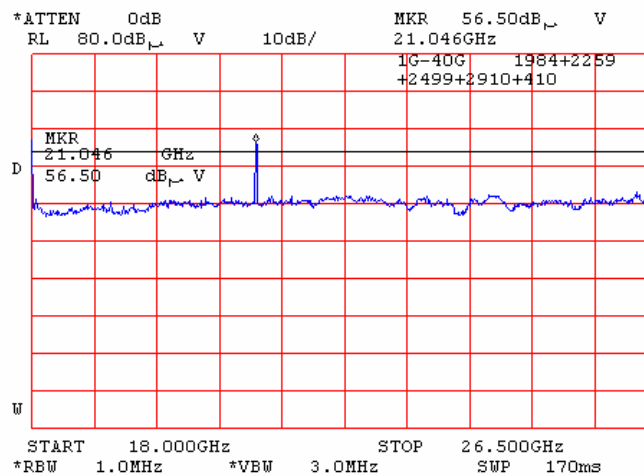
TEST SITE: OATS  
 TEST DISTANCE: 3 m  
 ANTENNA POLARIZATION: Vertical & horizontal  
 EUT POSITION: Typical (Vertical)  
 DETECTOR: Average



<b>Test specification:</b>	<b>FCC Part 15, Section 15.245(b) / RSS-210, Annex 7, 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 &amp; Time:</b>	11/27/2006 1:56:34 PM		
<b>Temperature:</b> 22°C	<b>Air Pressure:</b> 1010 hPa	<b>Relative Humidity:</b> 48 %	<b>Power Supply:</b> 12 V DC
<b>Remarks:</b>			

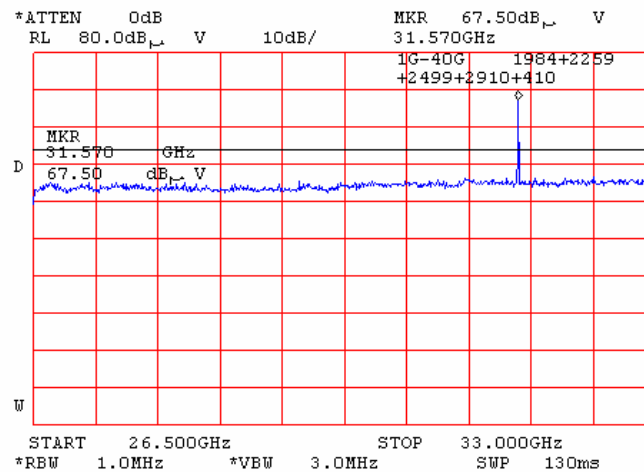
**Plot 7.1.13 Radiated emission measurements from 18.0 to 26.5 GHz**

TEST SITE: OATS  
TEST DISTANCE: 3 m  
ANTENNA POLARIZATION: Vertical & horizontal  
EUT POSITION: Typical (Vertical)



**Plot 7.1.14 Radiated emission measurements from 26.5 to 33.0 GHz**

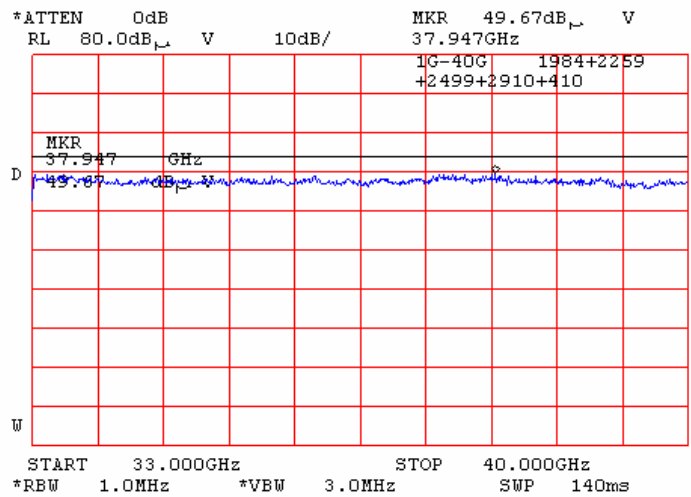
TEST SITE: OATS  
TEST DISTANCE: 3 m  
ANTENNA POLARIZATION: Vertical & horizontal  
EUT POSITION: Typical (Vertical)



<b>Test specification:</b> FCC Part 15, Section 15.245(b) / RSS-210, Annex 7, 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 &amp; Time:</b> 11/27/2006 1:56:34 PM			
<b>Temperature:</b> 22°C	<b>Air Pressure:</b> 1010 hPa	<b>Relative Humidity:</b> 48 %	<b>Power Supply:</b> 12 V DC
<b>Remarks:</b>			

**Plot 7.1.15 Radiated emission measurements from 33.0 to 40.0 GHz**

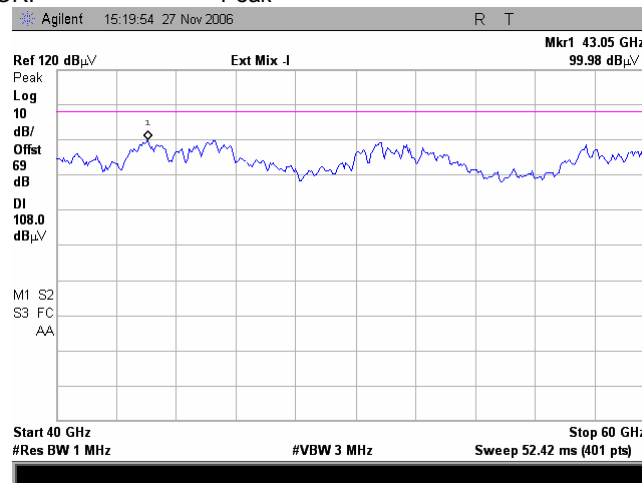
TEST SITE: OATS  
 TEST DISTANCE: 3 m  
 ANTENNA POLARIZATION: Vertical & horizontal  
 EUT POSITION: Typical (Vertical)



<b>Test specification:</b> FCC Part 15, Section 15.245(b) / RSS-210, Annex 7, 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 &amp; Time:</b> 11/27/2006 1:56:34 PM			
<b>Temperature:</b> 22°C	<b>Air Pressure:</b> 1010 hPa	<b>Relative Humidity:</b> 48 %	<b>Power Supply:</b> 12 V DC
<b>Remarks:</b>			

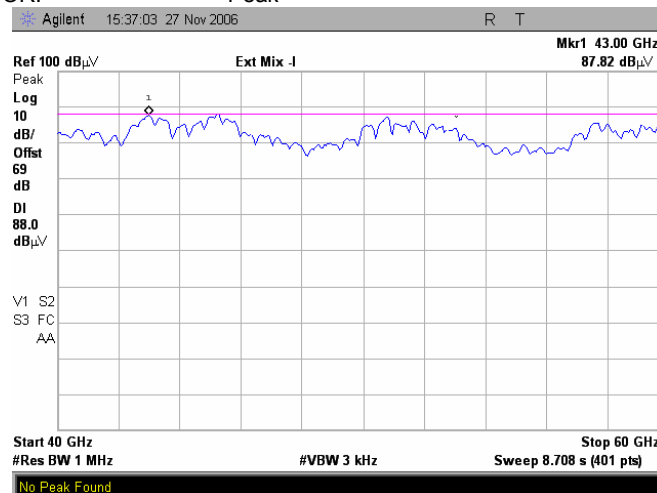
**Plot 7.1.16 Radiated emission measurements above 40.0 GHz**

TEST SITE: OATS  
TEST DISTANCE: 3 m  
ANTENNA POLARIZATION: Vertical & horizontal  
EUT POSITION: Typical (Vertical)  
DETECTOR: Peak



**Plot 7.1.17 Radiated emission measurements above 40.0 GHz**

TEST SITE: OATS  
TEST DISTANCE: 3 m  
ANTENNA POLARIZATION: Vertical & horizontal  
EUT POSITION: Typical (Vertical)  
DETECTOR: Peak

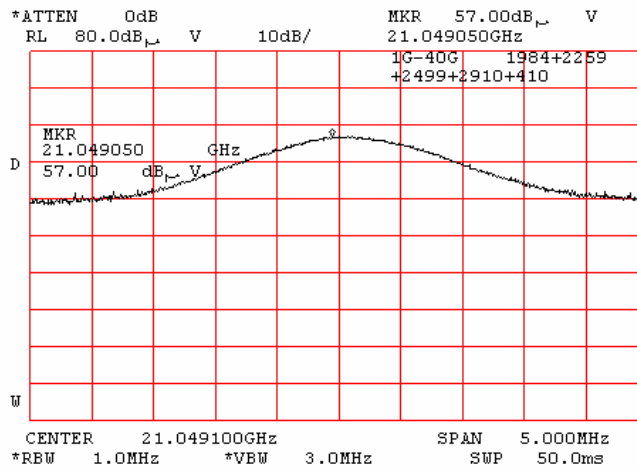




<b>Test specification:</b> FCC Part 15, Section 15.245(b) / RSS-210, Annex 7, Field strength of emissions			
<b>Test procedure:</b> ANSI C63.4, Section 13.1.4			
<b>Test mode:</b> Compliance	<b>Verdict:</b> PASS		
<b>Date &amp; Time:</b> 11/27/2006 1:56:34 PM			
<b>Temperature:</b> 22°C	<b>Air Pressure:</b> 1010 hPa	<b>Relative Humidity:</b> 48 %	<b>Power Supply:</b> 12 V DC
<b>Remarks:</b>			

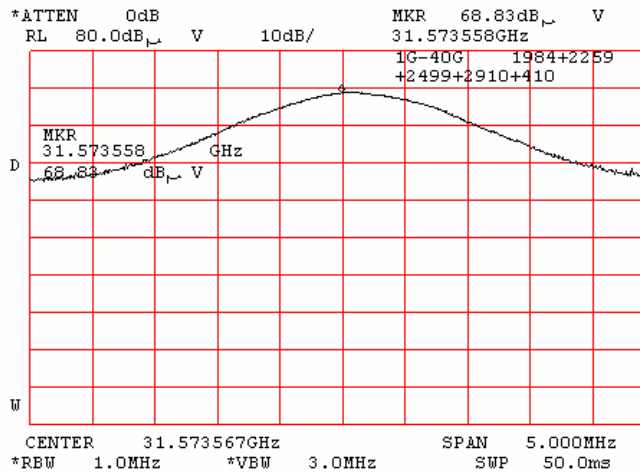
**Plot 7.1.18 Radiated emission measurements at the second harmonic frequency**

TEST SITE: OATS  
TEST DISTANCE: 3 m  
ANTENNA POLARIZATION: Vertical & horizontal  
EUT POSITION: Typical (Vertical)



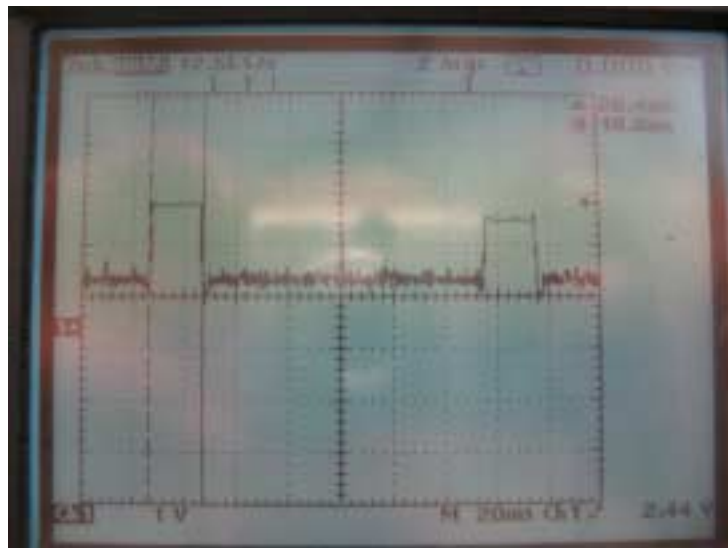
**Plot 7.1.19 Radiated emission measurements at the third harmonic frequency**

TEST SITE: OATS  
TEST DISTANCE: 3 m  
ANTENNA POLARIZATION: Vertical & horizontal  
EUT POSITION: Typical (Vertical)



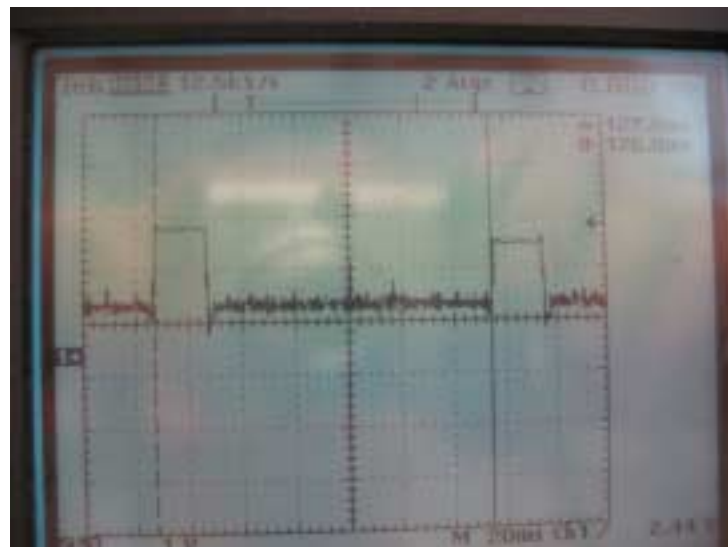
<b>Test specification:</b>	FCC Part 15, Section 15.245(b) / RSS-210, Annex 7, Field strength of emissions		
<b>Test procedure:</b>	ANSI C63.4, Section 13.1.4		
<b>Test mode:</b>	Compliance	<b>Verdict:</b>	PASS
<b>Date &amp; Time:</b>	11/27/2006 1:56:34 PM		
<b>Temperature:</b> 22°C	<b>Air Pressure:</b> 1010 hPa	<b>Relative Humidity:</b> 48 %	<b>Power Supply:</b> 12 V DC
<b>Remarks:</b>			

Plot 7.1.20 Transmission pulse duration



Tx pulse duration=20.4ms

Plot 7.1.21 Transmission pulse period



Tx repetition period= 127.6ms

<b>Test specification:</b>	<b>FCC Part 15, Section 15.203/ 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 &amp; Time:</b>	11/26/2006 4:55:55 PM		
<b>Temperature:</b> 22°C	<b>Air Pressure:</b> 1012 hPa	<b>Relative Humidity:</b> 46%	<b>Power Supply:</b> 12 V DC
<b>Remarks:</b>			

## 7.2 Band edge emission

### 7.2.1 General

This test was performed to verify the EUT band edge emission including all associated side bands and was attenuated at least 50 dB below the unmodulated carrier level or below the general spurious emission limit. Specification test limits are given in Table 7.2.1.

**Table 7.2.1 Band edge emission limits**

Frequency band, MHz	Field strength limit at 3 m, dB $\mu$ V/m		Attenuation below carrier, dBc
	Peak	Average	
10500 - 10550	74.0	54.0	50

### 7.2.2 Test procedure

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

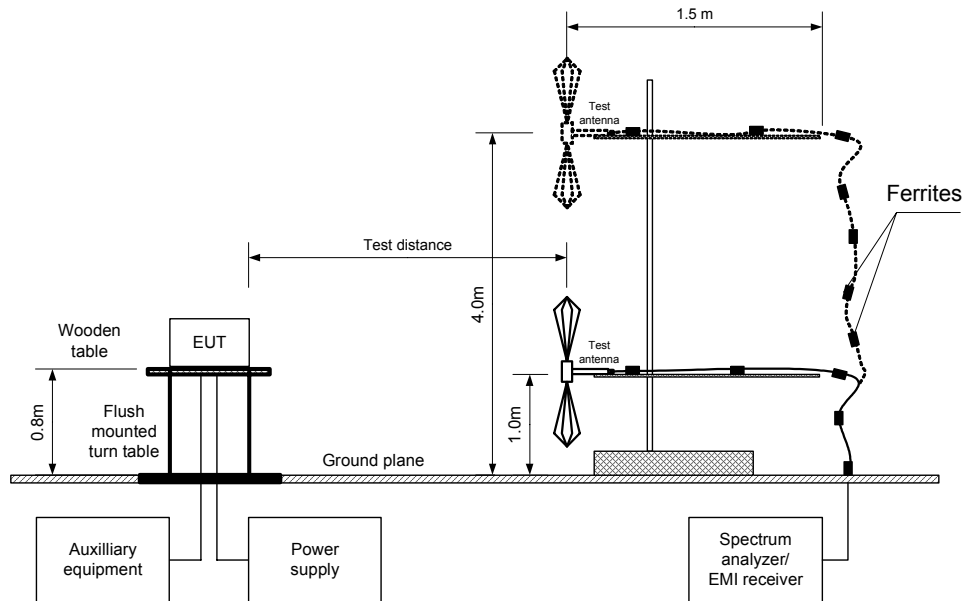
**7.2.2.2** The spectrum analyzer frequency span was set to capture all major modulation sidebands of emission and sweep time was set sufficiently slow to ensure peak measurements. Spectrum analyzer was set in peak hold mode and time sufficient for trace stabilization was allowed.

**7.2.2.3** The frequency of modulation envelope points beyond which power level drops below the band edge emission limit was measured.

**7.2.2.4** The test results were recorded in Table 7.2.2 and shown in the associated plots.

<b>Test specification:</b>	<b>FCC Part 15, Section 15.203/ 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 &amp; Time:</b>	11/26/2006 4:55:55 PM		
<b>Temperature:</b> 22°C	<b>Air Pressure:</b> 1012 hPa	<b>Relative Humidity:</b> 46%	<b>Power Supply:</b> 12 V DC
<b>Remarks:</b>			

Figure 7.2.1 Band edge emission measurement set up



Photograph 7.2.1 Band edge emission measurement set up



<b>Test specification:</b>	<b>FCC Part 15, Section 15.203/ 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 &amp; Time:</b>	11/26/2006 4:55:55 PM		
<b>Temperature:</b> 22°C	<b>Air Pressure:</b> 1012 hPa	<b>Relative Humidity:</b> 46%	<b>Power Supply:</b> 12 V DC
<b>Remarks:</b>			

**Table 7.2.2 Band edge emission test results**

OPERATING FREQUENCY RANGE: 10500 – 10550 MHz  
 DETECTOR USED: Peak hold  
 RESOLUTION BANDWIDTH: 1000 kHz  
 VIDEO BANDWIDTH: 3000 kHz  
 MODULATION: PM  
 TRANSMITTER OUTPUT POWER SETTINGS: Maximum

F, MHz	Antenna		Azimuth, degrees*	Peak field strength			Avr factor, dB	Average field strength			Verdict
	Pol.	Height, m		Measured, dB(μV/m)	Limit, dB(μV/m)	Margin, dB**		Measured, dB(μV/m)	Limit, dB(μV/m)	Margin, dB**	
10500	H	1.2	20	56.00	74.0	-18.0	-13.8	42.2	54.0	-11.8	Pass
10550	H	1.2	20	54.33	74.0	-19.67	-13.8	40.53	54.0	-13.47	Pass

\*- EUT front panel refers to 0 degrees position of turntable.  
 \*\*- Margin = dB below (negative if above) specification limit.

**Table 7.2.3 Average factor calculation**

Transmission pulse		Average factor, dB*
Duration, ms	Period, ms	
20.4	127.6	-13.8

\*- Average factor was calculated as follows:

$$\text{Average factor} = 20 \times \log_{10} \left( \frac{20.4}{100} \right) = -13.8 \text{ dB}$$

**Reference numbers of test equipment used**

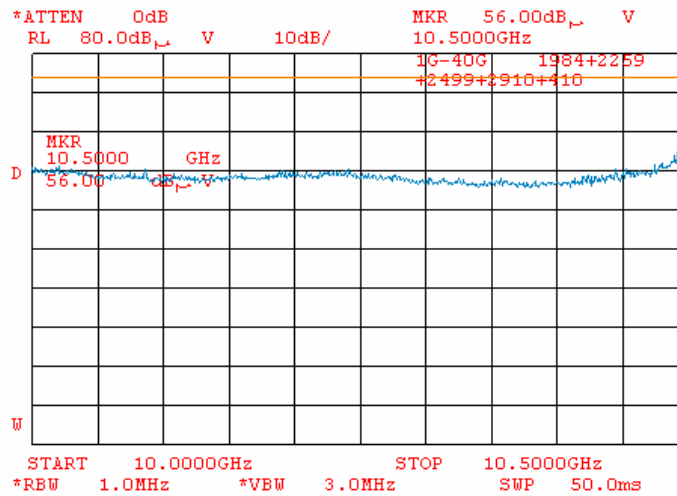
HL 0521	HL 1984	HL 2909				
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Full description is given in Appendix A.

<b>Test specification:</b>	<b>FCC Part 15, Section 15.203/ 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 &amp; Time:</b>	11/26/2006 4:55:55 PM		
<b>Temperature:</b> 22°C	<b>Air Pressure:</b> 1012 hPa	<b>Relative Humidity:</b> 46%	<b>Power Supply:</b> 12 V DC
<b>Remarks:</b>			

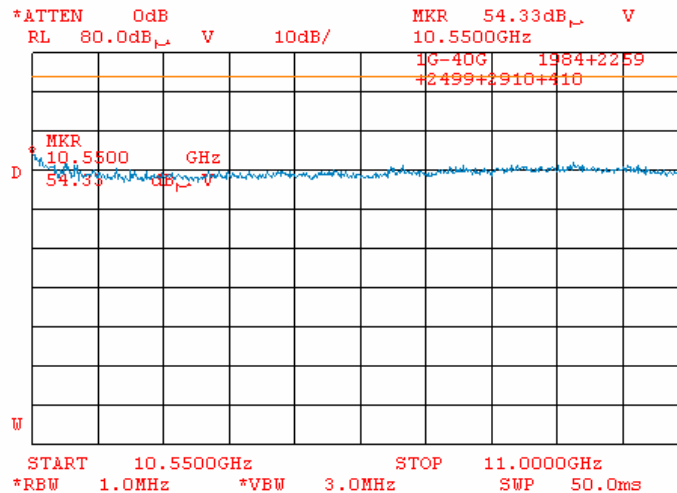
**Plot 7.2.1 Radiated emission measurements from 10.0 to 10.5 GHz**

TEST SITE: OATS  
 TEST DISTANCE: 3 m  
 ANTENNA POLARIZATION: Vertical and Horizontal  
 EUT POSITION: Typical (Vertical)  
 DETECTOR: Peak



**Plot 7.2.2 Radiated emission measurements from 10.55 to 11.0 GHz**

TEST SITE: OATS  
 TEST DISTANCE: 3 m  
 ANTENNA POLARIZATION: Vertical and Horizontal  
 EUT POSITION: Typical (Vertical)  
 DETECTOR: Peak



<b>Test specification:</b>	<b>FCC Part 15, Section 15.203/ 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 &amp; Time:</b>	11/26/2006 4:55:55 PM		
<b>Temperature:</b> 22°C	<b>Air Pressure:</b> 1012 hPa	<b>Relative Humidity:</b> 46%	<b>Power Supply:</b> 12 V DC
<b>Remarks:</b>			

### 7.3 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 7.3.1.

**Table 7.3.1 Antenna requirements**

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

**Photograph 7.3.1 Antenna assembly**



## 8 Transmitter photographs

### 8.1 External

Photograph 8.1.1 Front view



Photograph 8.1.2 Rear view





## 8.2 Internal

Photograph 8.2.1 Internal view



Photograph 8.2.2 Component side of the main PCB with RF PCB



**Photograph 8.2.3 Component side of the main PCB without RF PCB**



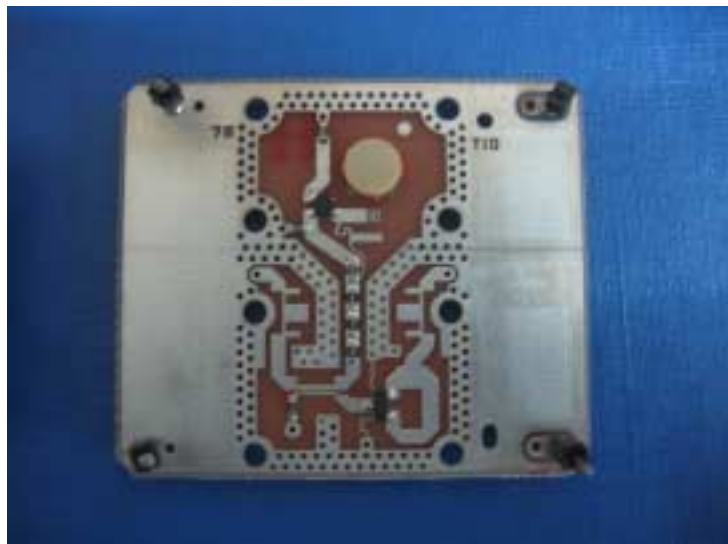
**Photograph 8.2.4 Print side of the main PCB**



Photograph 8.2.5 Component side of the RF PCB



Photograph 8.2.6 Print side of the RF PCB



Photograph 8.2.7 Shielding compartments of the RF PCB



## 9 APPENDIX A Test facility 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) and by Industry Canada for electromagnetic emissions (file numbers IC 2186-1 for OATS and IC 2186-2 for anechoic chamber), certified by VCCI, Japan (the registration numbers are R-808 for OATS, R-1082 for anechoic chamber, C-845 for conducted emissions site), assessed by TNO Certification EP&S (Netherlands) for a number of EMC, telecommunications, environmental, safety standards, and by AMTAC (UK) for safety of medical devices. 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) and approved by Israel Ministry of environmental protection, radiation hazards department (Permit number 1158).

Address: P.O. Box 23, Binyamina 30500, Israel.  
Telephone: +972 4628 8001  
Fax: +972 4628 8277  
e-mail: [mail@hermonlabs.com](mailto:mail@hermonlabs.com)  
website: [www.hermonlabs.com](http://www.hermonlabs.com)

Person for contact: Mr. Alex Usoskin, CEO.

## 10 APPENDIX B Test equipment and ancillaries used for tests

HL No	Description	Manufacturer	Model	Ser. No.	Last Cal.	Due Cal.
0446	Antenna, Loop, Active, 10 kHz - 30 MHz	EMCO	6502	2857	28-Jun-06	28-Jun-07
0521	EMI Receiver (Spectrum Analyzer) with RF filter section 9 kHz-6.5 GHz	Hewlett Packard	8546A	3617A 00319, 3448A002 53	26-Sep-06	26-Sep-07
0768	Antenna Standard Gain Horn, 18-26.5 GHz, WR-42, K-band, Gain - 25 dB	Quinstar Technology	QWH-4200-BA	110	21-Jul-04	21-Jul-07
0769	Antenna Standard Gain Horn, 26.5-40 GHz, WR28, Ka band, Gain 25 dB	Quinstar Technology	QWH-2800-BA	112	21-Jul-04	21-Jul-07
0770	Antenna Standard Gain Horn, 40-60 GHz WR-19, U-band Gain - 25 dB	Quinstar Technology	QWH-1900-AA	118	21-Jul-04	21-Jul-07
1424	Spectrum Analyzer, 30 Hz- 40 GHz	Agilent Technologies	8564EC	3946A002 19	30-Aug-06	30-Aug-07
1826	Antenna mast and Turntable position controller (Small Anechoic chamber)	Sh. I. Machines	CRL-4	1	13-May-06	13-May-07
1849	Antenna mast with polarity control (Small Anechoic chamber)	Sh. I. Machines	AM-F4	1849	18-Jan-06	18-Jan-07
1850	Turntable	Sh. I. Machines	TT-M-3	1850	11-Nov-06	11-Nov-07
1947	Cable 18GHz, 6.5 m, blue	Rhophase Microwave Limited	NPS-1803A-6500-NPS	T4974	17-Oct-06	17-Oct-07
1984	Antenna, Double-Ridged Waveguide Horn, 1-18 GHz, 300 W, N-type	EMC Test Systems	3115	9911-5964	03-Mar-06	03-Mar-07
2009	Cable RF, 8 m	Alpha Wire	RG-214	C-56	02-Dec-05	02-Dec-06
2254	Cable 40GHz, 0.8 m, blue	Rhophase Microwave Limited	KPS-1503A-800-KPS	W4907	20-Jun-06	20-Jun-07
2399	Cable 40GHz, 1.5 m, blue	Rhophase Microwave Limited	KPS-1503A-1500-KPS	X2945	01-Jan-06	01-Jan-07
2697	Antenna, 30 MHz - 3.0 GHz,	Sunol Sciences Corp. Pleasanton, California USA	JB3	A022805	10-Jan-06	10-Jan-07
2909	Spectrum analyzer, ESA-E, 100 Hz to 26.5 GHz	Agilent Technologies	E4407B	MY414447 62	10-Apr-06	10-Apr-07

## 11 APPENDIX C Abbreviations and acronyms

AC	alternating current
AM	amplitude modulation
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
dB $\Omega$	decibel referred to one Ohm
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
Mbps	Mega but per second
MHz	megahertz
min	minute
mm	millimeter
ms	millisecond
$\mu$ s	microsecond
NA	not applicable
OATS	open area test site
$\Omega$	Ohm
PCB	printed circuit board
PM	pulse modulation
PS	power supply
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

## 12 APPENDIX D 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

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 intensity in dB( $\mu$ V/m).



**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).

Antenna calibration  
Sunol Sciences Inc., model JB3, serial number A022805, HL 2697

Frequency, MHz	ACF, dB	Gain, dBi	Num gain	Frequency, MHz	ACF, dB	Gain, dBi	Num gain	Frequency, MHz	ACF, dB	Gain, dBi	Num gain	Frequency, MHz	ACF, dB	Gain, dBi	Num gain	Frequency, MHz	ACF, dB	Gain, dBi	Num gain
30	22.2	-22.5	0.01	620	19.7	6.3	4.27	1215	24.9	7.0	5.05	1810	28.3	7.1	5.08	2405	30.9	6.9	4.93
35	18.5	-17.4	0.02	625	19.7	6.5	4.42	1220	24.9	7.0	4.99	1815	28.5	6.9	4.91	2410	30.9	6.9	4.89
40	14.7	-12.5	0.06	630	19.6	6.6	4.57	1225	25.1	6.9	4.91	1820	28.6	6.8	4.74	2415	31.0	6.9	4.85
45	11.3	-8.1	0.16	635	19.7	6.5	4.48	1230	25.2	6.8	4.92	1825	28.7	6.8	4.76	2420	31.0	6.8	4.82
45	11.3	-8.1	0.16	640	19.9	6.4	4.40	1235	25.1	7.0	4.96	1830	28.7	6.8	4.76	2425	31.1	6.8	4.81
50	8.9	-4.7	0.34	645	19.9	6.5	4.45	1240	25.0	7.1	5.09	1835	28.7	6.7	4.72	2430	31.0	6.9	4.87
60	7.8	-2.1	0.62	655	19.9	6.6	4.60	1250	25.0	7.1	5.15	1845	28.6	6.9	4.90	2440	31.2	6.8	4.74
65	8.5	-2.0	0.63	660	19.9	6.7	4.69	1255	25.0	7.2	5.25	1850	28.4	7.1	5.12	2445	31.1	6.9	4.91
70	11.8	0.0	0.84	665	19.9	6.7	4.70	1260	24.9	7.3	5.38	1855	28.5	7.0	5.07	2450	31.0	7.0	4.96
75	8.8	-1.1	0.78	670	20.0	6.7	4.71	1265	25.0	7.3	5.31	1860	28.6	7.0	5.01	2455	31.0	7.0	5.01
80	8.4	-0.2	0.97	675	20.1	6.7	4.71	1270	25.1	7.2	5.26	1865	28.5	7.1	5.17	2460	30.9	7.2	5.19
90	8.2	1.1	1.29	685	20.1	6.8	4.79	1280	25.5	6.8	4.84	1875	28.4	7.2	5.28	2470	31.3	6.8	4.76
95	9.2	0.5	1.13	690	20.1	6.9	4.88	1285	25.4	7.0	4.97	1880	28.5	7.2	5.22	2475	31.4	6.7	4.69
100	10.6	-0.4	0.92	695	20.2	6.8	4.82	1290	25.3	7.1	5.10	1885	28.5	7.2	5.22	2480	31.3	6.8	4.79
110	12.6	-1.6	0.70	705	20.4	6.8	4.75	1300	25.2	7.3	5.33	1895	28.6	7.2	5.24	2490	31.1	7.0	4.99
115	13.3	-1.9	0.65	710	20.5	6.8	4.75	1305	25.3	7.2	5.21	1900	28.6	7.2	5.24	2495	31.2	7.0	4.99
120	13.9	-2.1	0.62	715	20.5	6.8	4.80	1310	25.5	7.1	5.09	1905	28.5	7.3	5.36	2500	30.9	7.2	5.27
125	14.2	-2.0	0.63	720	20.5	6.9	4.85	1315	25.4	7.2	5.23	1910	28.5	7.4	5.45	2505	31.1	7.1	5.15
130	14.2	-1.7	0.88	725	20.6	6.8	4.81	1320	25.3	7.3	5.38	1915	28.5	7.3	5.38	2510	31.0	7.2	5.22
140	13.4	-0.3	0.94	735	20.9	6.7	4.65	1330	25.6	7.0	5.06	1925	28.6	7.3	5.35	2520	31.2	7.0	5.05
145	13.1	0.3	1.08	740	21.0	6.6	4.53	1335	25.7	7.1	5.07	1930	28.6	7.3	5.39	2525	30.8	7.4	5.54
150	12.9	0.8	1.21	745	21.0	6.6	4.59	1340	25.7	7.1	5.09	1935	28.5	7.4	5.54	2530	31.0	7.3	5.37
155	12.7	1.3	1.34	750	21.0	6.7	4.64	1345	25.7	7.1	5.13	1940	28.4	7.6	5.70	2535	31.2	7.0	5.06
160	12.7	1.6	1.44	755	21.0	6.8	4.74	1350	25.7	7.1	5.17	1945	28.5	7.5	5.67	2540	31.0	7.0	4.97
165	12.5	2.0	1.59	760	21.0	6.8	4.83	1355	25.8	7.0	5.06	1950	28.6	7.4	5.48	2545	31.0	7.3	5.43
170	12.2	2.6	1.83	765	21.1	6.8	4.73	1360	25.9	6.9	4.95	1955	28.6	7.5	5.57	2550	31.0	7.3	5.39
175	11.8	3.3	2.13	770	21.3	6.7	4.64	1365	26.0	6.9	4.95	1960	28.6	7.5	5.65	2555	31.1	7.2	5.30
180	11.6	3.7	2.36	775	21.3	6.7	4.68	1370	26.0	7.0	4.98	1965	28.7	7.4	5.47	2560	31.0	7.4	5.47
185	11.5	4.0	2.54	780	21.3	6.7	4.72	1375	26.0	7.1	5.02	1970	28.7	7.5	5.29	2565	31.0	7.6	5.70
190	11.6	4.2	2.61	785	21.3	6.8	4.77	1380	26.0	7.0	5.06	1975	28.9	7.2	5.22	2570	31.1	7.3	5.37
200	13.1	3.2	2.07	795	21.4	6.8	4.79	1390	26.1	6.9	4.92	1985	29.1	7.1	5.11	2580	31.6	6.9	4.87
205	12.0	4.4	2.76	800	21.5	6.8	4.77	1395	26.2	6.9	4.94	1990	29.1	7.0	5.06	2585	31.6	6.8	4.79
210	11.0	5.6	3.66	805	21.6	6.7	4.71	1400	26.2	7.0	4.98	1995	29.1	7.1	5.09	2590	31.6	6.9	4.88
215	11.3	5.6	3.59	810	21.7	6.7	4.65	1405	26.1	7.0	5.02	2000	29.1	7.1	5.11	2595	31.6	7.0	4.97
220	11.6	5.5	3.52	815	21.7	6.7	4.72	1410	26.1	7.1	5.09	2005	29.1	7.1	5.16	2600	31.6	6.9	4.86
225	11.7	5.5	3.55	820	21.7	6.8	4.80	1415	26.2	7.0	5.02	2010	29.1	7.1	5.15	2605	31.3	7.2	5.30
230	11.9	5.5	3.57	825	21.7	6.8	4.82	1420	26.3	7.0	4.96	2015	29.2	7.1	5.13	2610	31.4	7.1	5.15
235	12.1	5.5	3.56	830	21.7	6.9	4.85	1425	26.2	7.1	5.10	2020	29.2	7.1	5.18	2615	31.7	6.9	4.88
240	12.3	5.5	3.54	835	21.8	6.8	4.82	1430	26.1	7.2	5.25	2025	29.3	7.1	5.08	2620	31.6	7.0	4.97
245	12.3	5.7	3.71	840	21.9	6.8	4.80	1435	26.1	7.2	5.24	2030	29.3	7.0	5.05	2625	31.4	7.1	5.17
250	12.5	5.9	3.88	845	21.9	6.8	4.83	1440	26.2	7.2	5.24	2035	29.3	7.1	5.07	2630	31.6	7.0	5.00
255	12.5	5.9	3.85	850	21.9	6.9	4.86	1445	26.3	7.1	5.11	2040	29.3	7.1	5.13	2635	31.8	6.8	4.82
260	12.7	5.8	3.83	855	22.0	6.8	4.80	1450	26.5	7.0	4.98	2045	29.2	7.2	5.23	2640	31.7	7.0	4.98
265	13.2	5.5	3.54	860	22.1	6.8	4.74	1455	26.4	7.1	5.07	2050	29.2	7.2	5.27	2645	31.7	6.9	4.93
270	13.7	5.2	3.27	865	22.0	6.9	4.92	1460	26.4	7.1	5.17	2055	29.3	7.2	5.21	2650	31.8	6.9	4.85
275	13.7	5.3	3.39	870	21.9	7.1	5.11	1465	26.4	7.2	5.19	2060	29.5	7.0	5.02	2655	31.8	6.9	4.85
280	14.1	5.4	3.50	875	22.0	7.1	5.08	1470	26.5	7.2	5.23	2065	29.4	7.1	5.07	2660	31.7	7.0	5.02
285	13.7	5.6	3.61	880	22.1	7.0	5.05	1475	26.4	7.1	5.17	2070	29.4	7.1	5.10	2665	32.0	6.7	4.71
290	13.7	5.7	3.72	885	22.1	7.0	5.06	1480	26.5	7.1	5.12	2075	29.5	7.0	5.01	2670	32.0	6.7	4.67
295	13.8	5.8	3.77	890	22.1	7.0	5.06	1485	26.5	7.1	5.14	2080	29.6	6.8	4.76	2675	31.9	6.8	4.81
300	13.9	5.8	3.81	895	22.2	7.1	5.09	1490	26.5	7.1	5.17	2085	29.7	6.9	4.89	2680	31.7	7.0	5.04
305	14.0	5.9	3.85	900	22.2	7.1	5.12	1495	26.5	7.2	5.24	2090	29.7	6.9	4.86	2685	31.9	6.8	4.83
310	14.1	5.9	3.88	905	22.3	7.1	5.09	1500	26.5	7.2	5.31	2095	29.8	6.8	4.78	2690	32.1	6.7	4.72
315	14.3	5.9	3.89	910	22.3	7.0	5.05	1505	26.5	7.2	5.27	2100	29.9	6.8	4.75	2695	32.1	6.7	4.71
320	14.4	5.9	3.90	915	22.4	7.0	4.99	1510	26.6	7.2	5.23	2105	29.8	6.8	4.81	2700	32.0	6.8	4.81
325	14.5	5.9	3.92	920	22.6	6.9	4.92	1515	26.6	7.2	5.30	2110	29.9	6.8	4.76	2705	32.0	6.8	4.80
330	14.6	5.9	3.93	925	22.7	6.9	4.85	1520	26.5	7.3	5.38	2115	29.9	6.8	4.78	2710	32.1	6.8	4.79
335	14.7	6.0	4.02	930	22.8	6.8	4.77	1525	26.6	7.3	5.37	2120	29.9	6.8	4.84	2715	32.1	6.7	4.71
340	14.7	6.2	4.12	935	22.8	6.8	4.83	1530	26.8	7.3	5.38	2125	29.9	6.8	4.89	2720	32.4	6.5	4.47
345	14.9	6.1	4.06	940	22.8	6.9	4.89	1535	26.6	7.4	5.44	2130	29.9	6.9	4.90	2725	32.2	6.7	4.63
350	15.1	6.0	3.99	945	22.8	6.9	4.87	1540	26.5	7.4	5.53	2135	29.8	6.9	4.94	2730	31.9	7.0	5.05
355	15.3	5.9	3.88	950	22.9	6.9	4.85	1545	26.5	7.5	5.58	2140	29.8	7.1	5.08	2735	31.6	7.4	5.44
360	15.6	5.8	3.78	955	23.0	6.8	4.81	1550	26.5	7.5	5.63	2145	29.9	6.9	4.92	2740	31.8	7.1	5.46
365	15.5	5.9	3.89	960	23.1	6.8	4.77	1555	26.7	7.3	5.39	2150	29.9	7.0	4.98	2745	31.9	7.0	5.06
370	15.5	6.0	4.01	965	23.1	6.7	4.73	1560	26.9	7.1	5.16	2155	29.8	7.1	5.10	2750	32.0	6.9	4.94
375	15.6	6.1	4.03	970	23.2	6.7	4.69	1565	26.9	7.2	5.23	2160	29.8	7.1	5.09	2755	32.0	7.0	5.08
380	15.7	6.1	4.05	975	23.3	6.6	4.62	1570	26.9	7.2	5.30	2165	29.9	7.0	5.00	2760	32.0	7.0	5.06
385	15.7	6.2	4.15																

**Cable loss**  
**Cable 18 GHz, 6.5 m, blue, model: NPS-1803A-6500-NPS, S/N T4974, HL 1947**

Frequency, GHz	Cable loss, dB
0.03	0.30
0.05	0.38
0.10	0.53
0.20	0.74
0.30	0.91
0.40	1.05
0.50	1.18
0.60	1.29
0.70	1.40
0.80	1.50
0.90	1.59
1.00	1.68
1.10	1.77
1.20	1.86
1.30	1.94
1.40	2.01
1.50	2.08
1.60	2.16
1.70	2.22
1.80	2.29
1.90	2.36
2.00	2.42
2.10	2.48
2.20	2.54
2.30	2.60
2.40	2.66
2.50	2.71
2.60	2.77
2.70	2.83
2.80	2.89
2.90	2.95
3.10	3.06
3.30	3.17
3.50	3.28
3.70	3.39
3.90	3.51
4.10	3.62
4.30	3.76
4.50	3.87
4.70	4.01
4.90	4.10
5.10	4.21
5.30	4.31
5.50	4.43
5.70	4.56
5.90	4.71

Frequency, GHz	Cable loss, dB
6.10	4.87
6.30	4.95
6.50	4.94
6.70	4.88
6.90	4.87
7.10	4.83
7.30	4.85
7.50	4.86
7.70	4.91
7.90	4.96
8.10	5.03
8.30	5.08
8.50	5.13
8.70	5.21
8.90	5.22
9.10	5.34
9.30	5.35
9.50	5.52
9.70	5.51
9.90	5.66
10.10	5.70
10.30	5.78
10.50	5.79
10.70	5.82
10.90	5.86
11.10	5.94
11.30	6.06
11.50	6.21
11.70	6.44
11.90	6.61
12.10	6.76
12.40	6.68
13.00	6.66
13.50	6.81
14.00	6.90
14.50	6.90
15.00	6.97
15.50	7.17
16.00	7.28
16.50	7.27
17.00	7.38
17.50	7.68
18.00	7.92

**Cable loss**  
**RF cable 8 m, model RG-214, HL 2009**

No.	Frequency, MHz	Cable loss, dB	Tolerance (Specification), dB	Measurement uncertainty, dB
1	1	0.10	NA	±0.12
2	10	0.14		
3	30	0.25		
4	50	0.34		
5	100	0.53		
6	300	0.99		
7	500	1.31		
8	800	1.73		
9	1000	1.98		
10	1100	2.11		
11	1200	2.21		
12	1300	2.35		
13	1400	2.46		
14	1500	2.55		
15	1600	2.68		
16	1700	2.78		
17	1800	2.88		
18	1900	2.98		
19	2000	3.09		

**Cable loss**  
**Cable 40 GHz, 0.8 m, blue, model: KPS-1503A-800-KPS, S/N W4907, HL 2254**

Frequency, GHz	Cable loss, dB	Frequency, GHz	Cable loss, dB	Frequency, GHz	Cable loss, dB
0.03	0.04	5.10	0.80	15.00	1.49
0.05	0.07	5.30	0.83	15.50	1.49
0.10	0.09	5.50	0.83	16.00	1.46
0.20	0.15	5.70	0.84	16.50	1.47
0.30	0.19	5.90	0.87	17.00	1.50
0.40	0.25	6.10	0.86	17.50	1.57
0.50	0.29	6.30	0.89	18.00	1.63
0.60	0.33	6.50	0.90	18.50	1.57
0.70	0.37	6.70	0.89	19.00	1.63
0.80	0.41	6.90	0.93	19.50	1.65
0.90	0.44	7.10	0.92	20.00	1.64
1.00	0.45	7.30	0.95	20.50	1.75
1.10	0.48	7.50	0.96	21.00	1.72
1.20	0.51	7.70	0.97	21.50	1.78
1.30	0.53	7.90	1.01	22.00	1.76
1.40	0.54	8.10	1.00	22.50	1.72
1.50	0.57	8.30	1.05	23.00	1.83
1.60	0.59	8.50	1.04	23.50	1.80
1.70	0.04	8.70	1.07	24.00	1.90
1.80	0.07	8.90	1.11	24.50	1.81
1.90	0.09	9.10	1.09	25.00	1.98
2.00	0.15	9.30	1.14	25.50	1.91
2.10	0.19	9.50	1.12	26.00	2.02
2.20	0.25	9.70	1.15	26.50	1.92
2.30	0.29	9.90	1.16	27.00	1.97
2.40	0.33	10.10	1.16	28.00	2.02
2.50	0.37	10.30	1.19	29.00	1.95
2.60	0.41	10.50	1.14	30.00	1.94
2.70	0.44	10.70	1.19	31.00	2.11
2.80	0.45	10.90	1.17	32.00	2.17
2.90	0.48	11.10	1.13	33.00	2.27
3.10	0.61	11.30	1.20	34.00	2.27
3.30	0.64	11.50	1.13	35.00	2.29
3.50	0.65	11.70	1.20	36.00	2.35
3.70	0.68	11.90	1.18	37.00	2.37
3.90	0.69	12.10	1.14	38.00	2.40
4.10	0.71	12.40	1.19	39.00	2.57
4.30	0.73	13.00	1.34	40.00	2.36
4.50	0.75	13.50	1.33		
4.70	0.77	14.00	1.48		
4.90	0.79	14.50	1.45		

**Cable loss**

**Cable coaxial, 40GHz, 1.5 m, Blue, Rhopase Microwave Limited, model: KPS-1503A-1500-KPS, HL 2399**

Frequency, GHz	Cable loss, dB	Frequency, GHz	Cable loss, dB	Frequency, GHz	Cable loss, dB
0.03	0.07	6.5	1.57	15.50	2.50
0.05	0.10	6.7	1.60	16.00	2.51
0.1	0.16	6.9	1.55	16.50	2.58
0.2	0.26	7.1	1.65	17.00	2.65
0.3	0.33	7.3	1.65	17.50	2.73
0.5	0.38	7.5	1.70	18.00	2.74
0.7	0.41	7.7	1.71	18.50	2.67
0.9	0.58	7.9	1.73	19.00	2.67
1.1	0.64	8.1	1.79	19.50	2.74
1.3	0.70	8.3	1.81	20.00	2.69
1.5	0.75	8.5	1.84	20.50	2.80
1.7	0.79	8.7	1.85	21.00	2.82
1.9	0.83	8.9	1.90	21.50	2.87
2.1	0.88	9.1	1.95	22.00	2.87
2.3	0.93	9.3	1.93	22.50	2.92
2.5	0.97	9.5	1.98	23.50	3.04
2.7	1.01	9.7	1.96	24.00	3.05
2.9	1.04	9.9	2.03	24.50	3.03
3.1	1.08	10.1	1.99	25.00	3.11
3.3	1.14	10.30	2.02	25.50	3.10
3.5	1.17	10.50	2.02	26.00	3.17
3.7	1.21	10.70	2.02	26.50	3.11
3.9	1.24	10.90	2.08	27.00	3.16
4.1	1.26	11.10	2.02	28.00	3.19
4.3	1.26	11.30	2.09	29.00	3.19
4.5	1.29	11.50	2.05	30.00	3.30
4.7	1.34	11.70	2.11	31.00	3.31
4.9	1.34	11.90	2.11	32.00	3.35
5.1	1.40	12.10	2.12	33.00	3.46
5.3	1.43	12.40	2.17	34.00	3.45
5.5	1.45	13.00	2.29	35.00	3.49
5.7	1.47	13.50	2.31	36.00	3.54
5.9	1.40	14.00	2.43	37.00	3.62
6.1	1.53	14.50	2.43	39.00	3.69
6.3	1.55	15.00	2.46	40.00	3.75

### 13 APPENDIX E Measurement uncertainties

Expanded uncertainty at 95% confidence in Hermon Labs EMC measurements

Test description	Expanded uncertainty
Radiated emissions at 10 m measuring distance Horizontal polarization	Biconilog antenna: $\pm 5.0$ dB Biconical antenna: $\pm 5.0$ dB Log periodic antenna: $\pm 5.1$ dB Double ridged horn antenna: $\pm 5.3$ dB
Vertical polarization	Biconilog antenna: $\pm 5.5$ dB Biconical antenna: $\pm 5.5$ dB Log periodic antenna: $\pm 5.6$ dB Double ridged horn antenna: $\pm 5.8$ dB
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
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
Duty cycle, timing (Tx ON / OFF) and average factor measurements	$\pm 1.0$ %

The test equipment has been calibrated according to its recommended procedures and is within the manufacturer's published limit of error. The standards and instruments used in the calibration system conform to the present requirements of ISO/IEC 17025 (or alternately ANSI/NCSL Z540-1).

The laboratory calibrates its measurement standards by a third party (traceable to NIST, USA) on a regular basis according to equipment manufacturer requirements. The Hermon Labs EMC measurements uncertainty is given in the table above.

### 14 APPENDIX F Specification references

47CFR part 15: 2006	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 6: 2005	Low Power Licence- Exempt Radiocommunication Devices (All frequency bands), Category I Equipment
RSS-Gen Issue 1:2005	General Requirements and Information for the Certification of Radiocommunication Equipment
RSS-212 Issue 1:1999	Test Facilities and Test Methods for Radio Equipment