

TEST REPORT

ACCORDING TO: FCC CFR 47 PART 90 §90.217(b) AND PART 15 SUBPART B

FOR:

Mitel Communications Ltd.
**Wireless transmitter for data
collection**
Model: Galaxy Pit2
FCC ID: MLLGLXPT2

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.

Table of contents

1	Applicant information	3
2	Equipment under test attributes	3
3	Manufacturer information	3
4	Test details	3
5	Tests summary	4
6	EUT description	5
6.1	General information	5
6.2	Ports and lines	5
6.3	Support and test equipment	5
6.4	Operating frequencies	5
6.5	Changes made in the EUT	5
6.6	Test configuration	5
6.7	Transmitter characteristics	6
7	Transmitter tests according to 47CFR part 90 requirements	7
7.1	Effective radiated power of carrier	7
7.2	Occupied bandwidth test	13
7.3	Radiated spurious emission measurements	18
7.4	Band edge emission	57
7.5	Frequency stability test	65
7.6	Transient frequency behaviour test	67
7.7	Radiated emission measurements	72
8	APPENDIX A Test equipment and ancillaries used for tests	75
9	APPENDIX B Measurement uncertainties	77
10	APPENDIX C Test facility description	78
11	APPENDIX D Specification references	78
12	APPENDIX E Abbreviations and acronyms	79
13	APPENDIX F Test equipment correction factors	80

1 Applicant information

Client name: Miltel Communications Ltd
Address: 7 Gush-Etzion, 4th floor, Givat-Shmuel 54030, Israel
Telephone: +972 3737 1333
Fax: +972 3737 1331
E-mail: erez1@miltelcom.com
Contact name: Mr. Erez Sharabi

2 Equipment under test attributes

Product name: Wireless transmitter for data collection
Model(s): Galaxy Pit2
Software release: 1.09
Receipt date 6/29/2005

3 Manufacturer information

Manufacturer name: Miltel Communications Ltd
Address: 7 Gush-Etzion, 4th floor, Givat-Shmuel 54030, Israel
Telephone: +972 3737 1333
Fax: +972 3737 1331
E-Mail: erez1@miltelcom.com
Contact name: Mr. Erez Sharabi

4 Test details

Project ID: 16356
Location: Hermon Laboratories Ltd. P.O.Box 23, Binyamina 30500, Israel
Test started: 6/29/2005
Test completed: 8/14/2005
Test specification(s): 47CFR part 90, §§90.217(b), part 15 , subpart B
Test suite: FCC_90_HH_without_RF_connector (4/25/2005 10:09:25 AM, modified)

5 Tests summary

Test	Status
Transmitter characteristics	
Section 90.205, Maximum output power	Pass
Section 90.209, Occupied bandwidth	Pass
Section 90.210, Emission mask	Not required
Section 90.210, Radiated spurious emissions	Pass
Section 90.217, Band edge emission	Pass
Section 90.213, Frequency stability	Tested with no limit
Section 90.214, Transient frequency behaviour	Pass
Section 2.1091, RF radiation exposure evaluation	Not required
Unintentional emissions	
Section 15.107, Conducted emission at AC power port	Not required
Section 15.109, Radiated emission	Pass
Section 15.111, Conducted emission at receiver antenna port	Not required

Testing was completed against all relevant requirements of the test standard. Results obtained indicate that the product under test complies in full with the requirements tested.
The test results relate only to the items tested. Pass/ fail decision was based on nominal values.

This test report replaces the previously issued test report identified by Doc. ID: MILRAD_FCC.16356.

	Name and Title	Date	Signature
Tested by:	Mr. A. Adelberg, test engineer	August 14, 2005	
Reviewed by:	Mrs. M. Cherniavsky, certification engineer	August 18, September 12, 2005	
Approved by:	Mr. M. Nikishin, EMC group leader	September 13, 2005	

6 EUT description

6.1 General information

The EUT is a data link transmitter operating in 450 -470 MHz range that is used for data acquisition in Miltel's telemetric data collection system.

6.2 Ports and lines

Port type	Port description	Connected		Connector type	Qty.	Cable type	Cable length
		From	To				
Power	DC	EUT	DC power supply	Terminal block	1	unshielded	2 m
Signal	RS232	EUT	PC	D-type 9	1	unshielded	3 m

6.3 Support and test equipment

Description	Manufacturer	Model number	Serial number
Laptop	Compaq	Pressario-2500	CNF4021NBF
DC power supply	Horizon Electronics	SR 60-26	72-7137

6.4 Operating frequencies

Source	Frequency, MHz	
Digital portion	4	20
Transmitter	450 - 470	NA

6.5 Changes made in the EUT

No changes were implemented.

6.6 Test configuration





6.7 Transmitter characteristics

Type of equipment					
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)				
Intended use		Condition of use			
	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			
Assigned frequency range		450-470 MHz			
Operating frequency range		450.00625 – 469.99375 MHz			
RF channel spacing		12.5 kHz			
Maximum rated output power (EIRP)		At transmitter 50 Ω RF output connector			dBm
		Equivalent isotropically radiated power (for equipment with no RF connector)			16.67dBm
Is transmitter output power variable?		X	No		
			continuous variable		
			stepped variable with stepsize		
			minimum RF power		
			dBm		
			maximum RF power		
			dBm		
Antenna connection					
unique coupling		standard connector		X	integral
				X	with temporary RF connector
					without temporary RF connector
Antenna/s technical characteristics					
Type	Manufacturer		Model number		Gain
PCB	Miltel		NA		-12 dBi
Transmitter 99% power bandwidth		10.5 kHz			
Transmitter aggregate data rate/s		600 baud			
Transmitter aggregate symbol (baud) rate/s		600 baud			
Type of modulation		FSK			
Type of multiplexing		NA			
Modulating test signal (baseband)		PRBS			
Transmitter duty cycle supplied for test		100%	Tx ON time	msec	Period
					msec
Transmitter power source					
	Battery	Nominal rated voltage	3.6 VDC	Battery type	Lithium
	DC	Nominal rated voltage	VDC		
	AC mains	Nominal rated voltage	VAC	Frequency	Hz



Test specification:		Section 90.205, Maximum output power	
Test procedure:		47 CFR, Section 2.1046; TIA/EIA-603-A, Section 2.2.1	
Test mode:	Compliance	Verdict:	PASS
Date & Time:	6/29/2005 4:57:12 PM		
Temperature: 24 °C	Air Pressure: 1006 hPa	Relative Humidity: 37 %	Power Supply: 3.6 Vdc
Remarks:			

7 Transmitter tests according to 47CFR part 90 requirements

7.1 Effective radiated power of carrier

7.1.1 General

This test was performed to measure effective radiated power emanated by transmitter at carrier frequency. Specification test limits are given in Table 7.1.1.

Table 7.1.1 Effective radiated power limit

Assigned frequency band, MHz	ERP		Equivalent field strength limit @ 3m, dB(μ V/m)*
	mW	dBm	
450-470	120	20.8	118.2

* - Equivalent field strength limit was calculated from maximum allowed ERP as follows: $E = \sqrt{30 \times P \times 1.64} / r$, where P is ERP in Watts, 1.64 is numeric gain of ideal dipole and r is antenna to EUT distance in meters.

7.1.2 Test procedure for field strength measurements

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 field strength of the EUT carrier frequency was measured with antenna connected to spectrum analyzer/ EMI receiver. To find maximum radiation the turntable was rotated 360° , the measuring antenna height was swept throughout the range, specified in Table 7.1.2, in both vertical and horizontal polarizations.

7.1.2.3 The worst test results (the lowest margins) were recorded in Table 7.1.2 and shown in the associated plots.

7.1.3 Test procedure for substitution ERP measurements

7.1.3.1 The test equipment was set up as shown in Figure 7.1.2 and energized.

7.1.3.2 RF signal generator was set to the EUT carrier frequency and the RF output level was preliminary adjusted to produce the same field strength as it was measured from the EUT.

7.1.3.3 The test antenna height was swept throughout the specified in Table 7.1.2 range to find maximum emission from substitution antenna and RF signal generator output was fine adjusted to produce the same field strength as it was measured from the EUT.

7.1.3.4 The ERP was calculated as a sum of signal generator output power in dBm and antenna gain in dBd reduced by cable loss in dB.

7.1.3.5 The above procedure was performed in both horizontal and vertical polarizations of the test antenna.

7.1.3.6 The worst test results (the lowest margins) were recorded in Table 7.1.3 and shown in the associated plots.



Test specification: Section 90.205, Maximum output power			
Test procedure: 47 CFR, Section 2.1046; TIA/EIA-603-A, Section 2.2.1			
Test mode: Compliance			Verdict: PASS
Date & Time: 6/29/2005 4:57:12 PM			
Temperature: 24 °C	Air Pressure: 1006 hPa	Relative Humidity: 37 %	Power Supply: 3.6 Vdc
Remarks:			

Figure 7.1.1 Setup for carrier field strength measurements

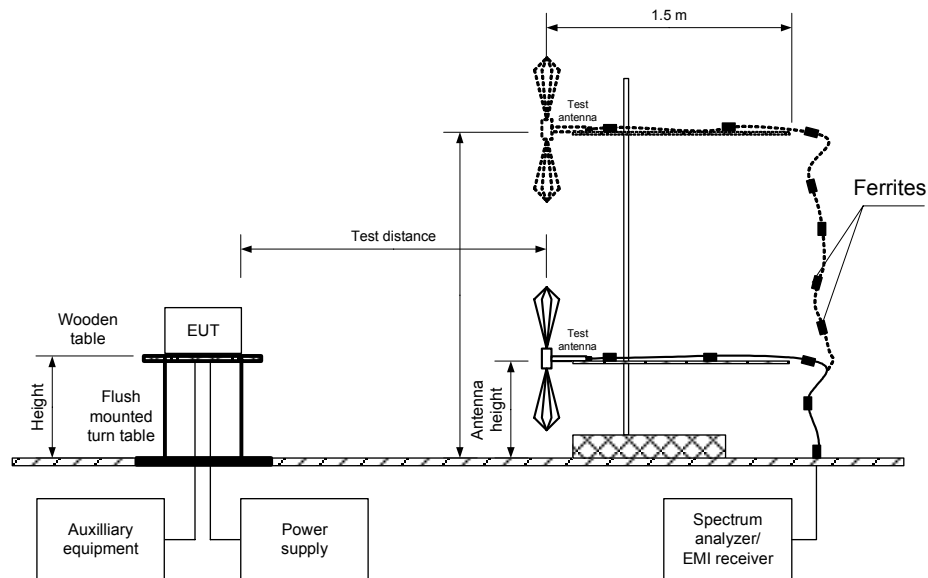
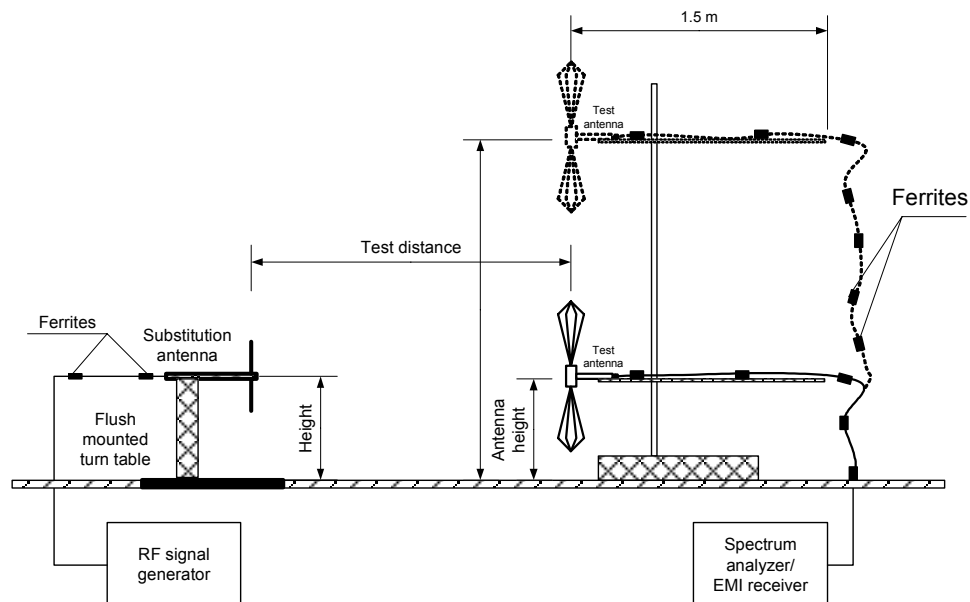


Figure 7.1.2 Setup for substitution ERP measurements





Test specification:		Section 90.205, Maximum output power	
Test procedure:		47 CFR, Section 2.1046; TIA/EIA-603-A, Section 2.2.1	
Test mode:	Compliance	Verdict:	PASS
Date & Time:	6/29/2005 4:57:12 PM		
Temperature: 24 °C	Air Pressure: 1006 hPa	Relative Humidity: 37 %	Power Supply: 3.6 Vdc
Remarks:			

Table 7.1.2 Transmitter carrier field strength

ASSIGNED FREQUENCY RANGE: 450 - 470 MHz
 TEST SITE: OATS
 TEST DISTANCE: 3 m
 EUT HEIGHT: 0.8 m
 TEST ANTENNA HEIGHTS RANGE: 1.0 – 4.0 m
 DETECTOR USED: Peak
 VIDEO BANDWIDTH: > Resolution bandwidth
 TEST ANTENNA TYPE: Biconical
 MODULATION: FSK
 TRANSMITTER OUTPUT POWER SETTINGS: Maximum

Frequency, MHz	Field strength, dB(μV/m)	Limit, dB(μV/m)	Margin, dB*	RBW, kHz	Antenna polarization	Antenna height, m	Turn-table position**, degrees
450.006	118.87	118.2	0.67	120	Vertical	1.0	336
459.998	117.17	118.2	-1.03		Vertical	1.1	305
469.994	114.78	118.2	-3.42		Vertical	1.0	321

*- Margin = Field strength – calculated field strength limit.

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

Table 7.1.3 Transmitter carrier ERP

TEST DISTANCE: 3 m
 SUBSTITUTION ANTENNA HEIGHT: 0.8 m
 TEST ANTENNA HEIGHTS RANGE: 1.0 – 4.0 m
 DETECTOR USED: Peak
 VIDEO BANDWIDTH: 300 kHz
 SUBSTITUTION ANTENNA TYPE: Tunable dipole

Frequency, MHz	Field strength, dB(μV/m)	RBW, kHz	Antenna polarization	RF generator output, dBm	Ant gain, dBd	Cable loss, dB	ERP, dBm	Limit, dBm	Margin, dB*	Verdict
450.006	118.87	120	Vertical	18.67	-1.15	3.00	14.52	20.80	-6.28	Pass
459.998	117.17		Vertical	18.07	-0.97	3.00	14.10	20.80	-6.70	Pass
469.994	114.78		Vertical	16.48	-0.79	2.44	13.25	20.80	-7.55	Pass

*- Margin = ERP – specification limit.

Reference numbers of test equipment used

HL 0415	HL 0569	HL 0812	HL 1430				
---------	---------	---------	---------	--	--	--	--

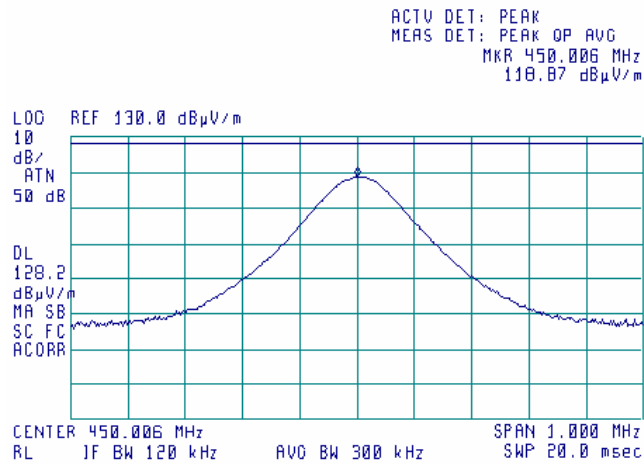
Full description is given in Appendix A.



Test specification:		Section 90.205, Maximum output power	
Test procedure:		47 CFR, Section 2.1046; TIA/EIA-603-A, Section 2.2.1	
Test mode:		Compliance	Verdict: PASS
Date & Time:		6/29/2005 4:57:12 PM	
Temperature: 24 °C		Air Pressure: 1006 hPa	Relative Humidity: 37 %
Remarks:		Power Supply: 3.6 Vdc	

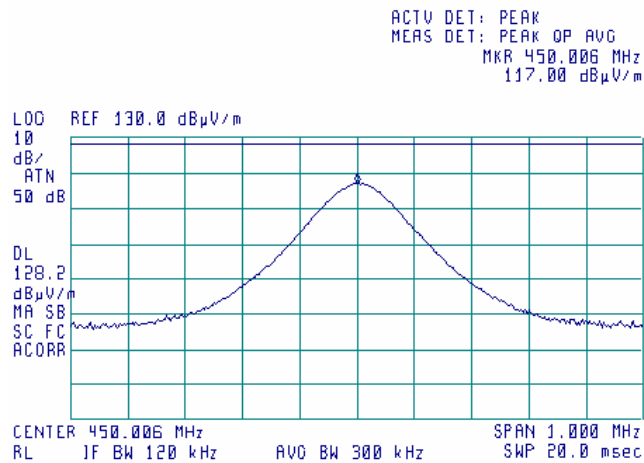
Plot 7.1.1 Transmitter carrier field strength at low frequency in vertical antenna polarization

15:20:02 JUN 29, 2005



Plot 7.1.2 Transmitter carrier field strength at low frequency in horizontal antenna polarization

15:00:46 JUN 29, 2005

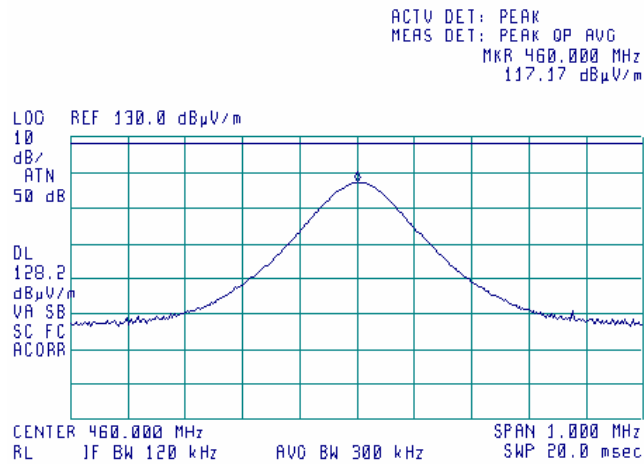




Test specification:	Section 90.205, Maximum output power		
Test procedure:	47 CFR, Section 2.1046; TIA/EIA-603-A, Section 2.2.1		
Test mode:	Compliance	Verdict:	PASS
Date & Time:	6/29/2005 4:57:12 PM		
Temperature: 24 °C	Air Pressure: 1006 hPa	Relative Humidity: 37 %	Power Supply: 3.6 Vdc
Remarks:			

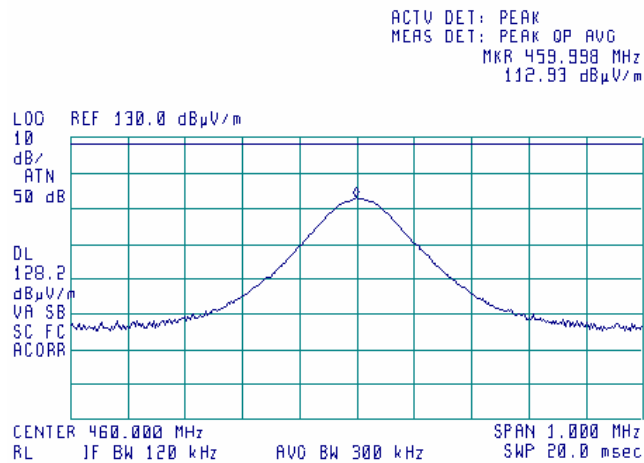
Plot 7.1.3 Transmitter carrier field strength at mid frequency in vertical antenna polarization

15:16:47 JUN 29, 2005



Plot 7.1.4 Transmitter carrier field strength at mid frequency in horizontal antenna polarization

14:49:11 JUN 29, 2005





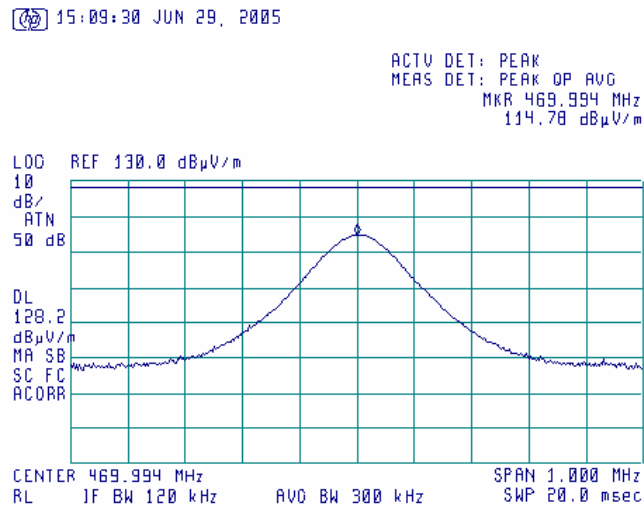
HERMON LABORATORIES

Report ID: MILRAD_FCC.16356_rev1.doc

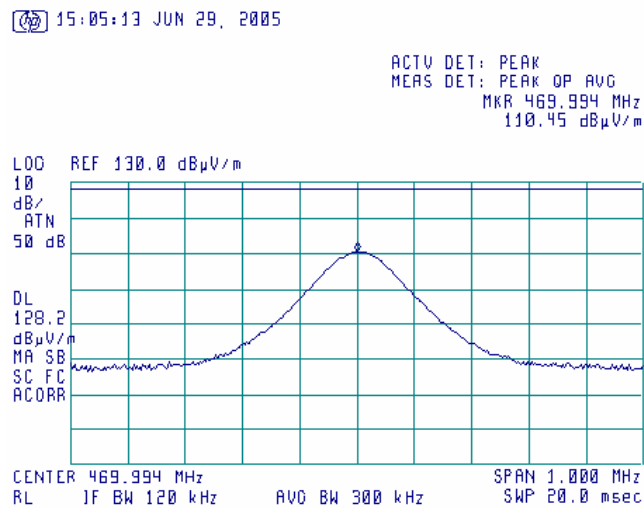
Date of Issue: 8/16/2005

Test specification:	Section 90.205, Maximum output power		
Test procedure:	47 CFR, Section 2.1046; TIA/EIA-603-A, Section 2.2.1		
Test mode:	Compliance	Verdict:	PASS
Date & Time:	6/29/2005 4:57:12 PM		
Temperature: 24 °C	Air Pressure: 1006 hPa	Relative Humidity: 37 %	Power Supply: 3.6 Vdc
Remarks:			

Plot 7.1.5 Transmitter carrier field strength at high frequency in vertical antenna polarization



Plot 7.1.6 Transmitter carrier field strength at high frequency in horizontal antenna polarization





Test specification:		Section 90.209, Occupied bandwidth	
Test procedure:		47 CFR, Section 2.1049	
Test mode:	Compliance	Verdict:	PASS
Date & Time:	6/29/2005 4:42:19 PM		
Temperature: 24 °C	Air Pressure: 1006 hPa	Relative Humidity: 37 %	Power Supply: 3.6 Vdc
Remarks:			

7.2 Occupied bandwidth test

7.2.1 General

This test was performed to measure transmitter occupied bandwidth. Specification test limits are given in Table 7.2.1. The test results are provided in Table 7.2.2 and the associated plots.

Table 7.2.1 Occupied bandwidth limits

Assigned frequency, MHz	Modulation envelope reference points*, dBc	Maximum allowed bandwidth, kHz
450 - 470	26	11.25

* - Modulation envelope reference points are provided in terms of attenuation below the unmodulated carrier.

7.2.2 Test procedure

7.2.2.1 The EUT was set up as shown in Figure 7.2.1, energized and its proper operation was checked.

7.2.2.2 The EUT was set to transmit the unmodulated carrier and the reference peak power level was measured.

7.2.2.3 The EUT was set to transmit the normally modulated carrier.

7.2.2.4 The transmitter occupied bandwidth was measured with spectrum analyzer as a frequency delta between the reference points on modulation envelope and provided in Table 7.2.2 and the associated plots.

Figure 7.2.1 Occupied bandwidth test setup





Test specification:		Section 90.209, Occupied bandwidth	
Test procedure:		47 CFR, Section 2.1049	
Test mode:	Compliance	Verdict:	PASS
Date & Time:	6/29/2005 4:42:19 PM		
Temperature: 24 °C	Air Pressure: 1006 hPa	Relative Humidity: 37 %	Power Supply: 3.6 Vdc
Remarks:			

Table 7.2.2 Occupied bandwidth test results

DETECTOR USED: Peak hold
RESOLUTION BANDWIDTH: 0.1 kHz
VIDEO BANDWIDTH: 0.3 kHz
MODULATION ENVELOPE REFERENCE POINTS: 26 dBc
MODULATION: FSK
MODULATING SIGNAL: PRBS

Carrier frequency, MHz	Occupied bandwidth, kHz	Limit, kHz	Margin, kHz	Verdict
450.00625	10.50	11.25	-0.75	Pass
460.00000	10.38	11.25	-0.87	Pass
469.99375	10.38	11.25	-0.87	Pass

Reference numbers of test equipment used

HL 0415	HL 0569	HL 0812	HL 1430				
---------	---------	---------	---------	--	--	--	--

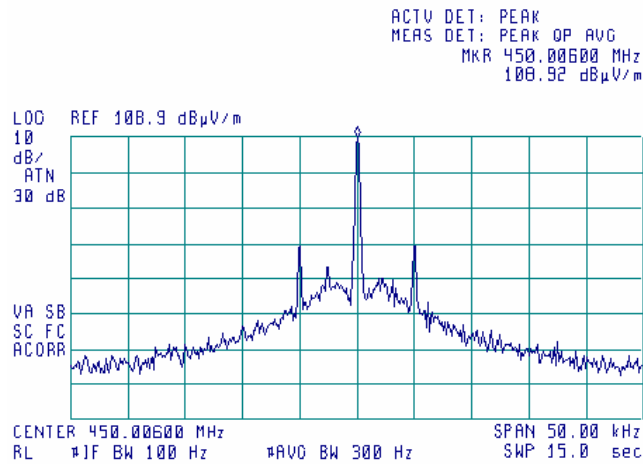
Full description is given in Appendix A.



Test specification:	Section 90.209, Occupied bandwidth		
Test procedure:	47 CFR, Section 2.1049		
Test mode:	Compliance	Verdict:	PASS
Date & Time:	6/29/2005 4:42:19 PM		
Temperature: 24 °C	Air Pressure: 1006 hPa	Relative Humidity: 37 %	Power Supply: 3.6 Vdc
Remarks:			

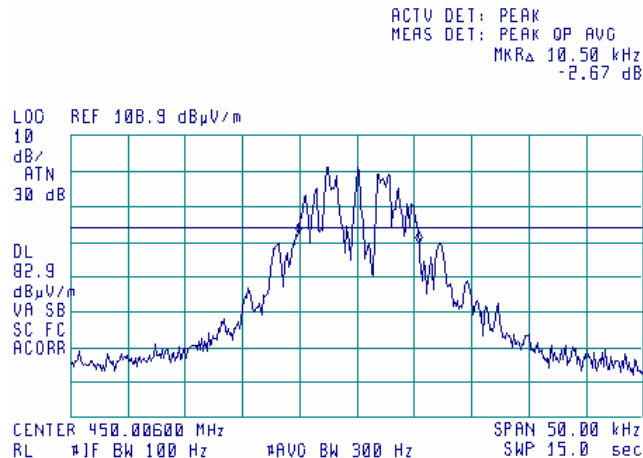
Plot 7.2.1 Reference unmodulated carrier at low frequency

16:32:50 JUN 29, 2005



Plot 7.2.2 Occupied bandwidth test result at low frequency

16:34:12 JUN 29, 2005

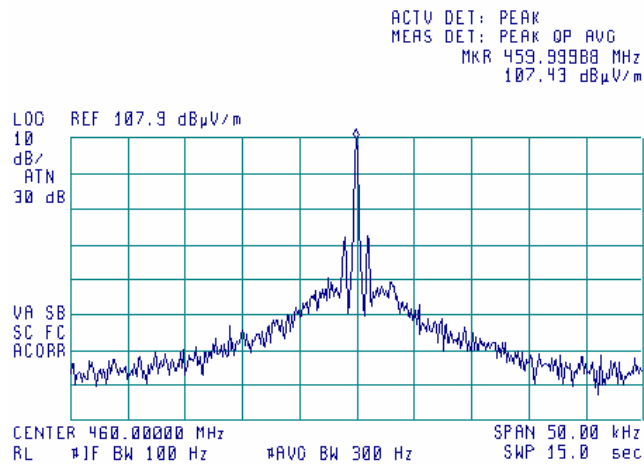




Test specification:	Section 90.209, Occupied bandwidth		
Test procedure:	47 CFR, Section 2.1049		
Test mode:	Compliance	Verdict:	PASS
Date & Time:	6/29/2005 4:42:19 PM		
Temperature: 24 °C	Air Pressure: 1006 hPa	Relative Humidity: 37 %	Power Supply: 3.6 Vdc
Remarks:			

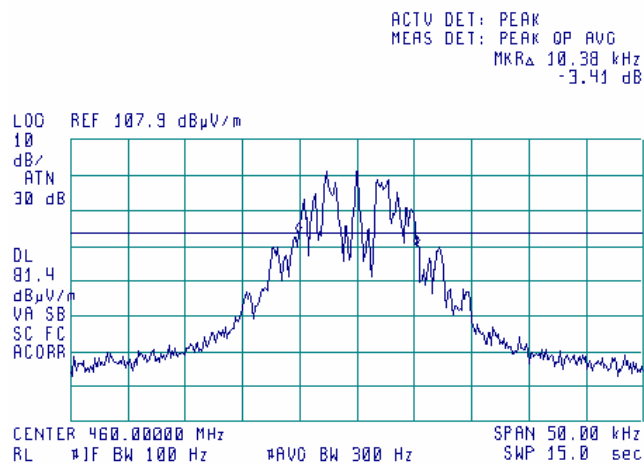
Plot 7.2.3 Reference unmodulated carrier at mid frequency

16:19:59 JUN 29, 2005



Plot 7.2.4 Occupied bandwidth test result at mid frequency

16:21:44 JUN 29, 2005

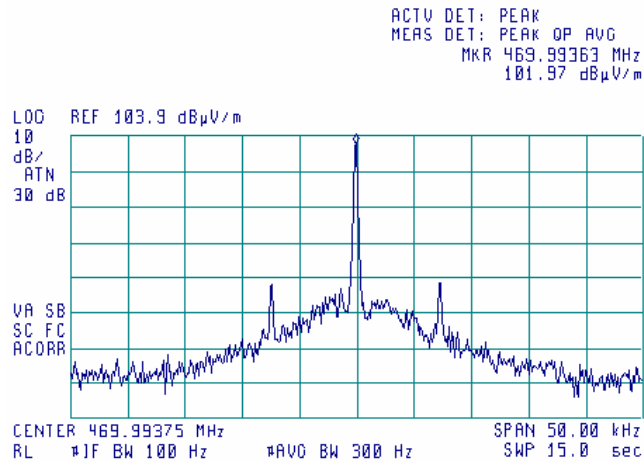




Test specification:	Section 90.209, Occupied bandwidth		
Test procedure:	47 CFR, Section 2.1049		
Test mode:	Compliance	Verdict:	PASS
Date & Time:	6/29/2005 4:42:19 PM		
Temperature: 24 °C	Air Pressure: 1006 hPa	Relative Humidity: 37 %	Power Supply: 3.6 Vdc
Remarks:			

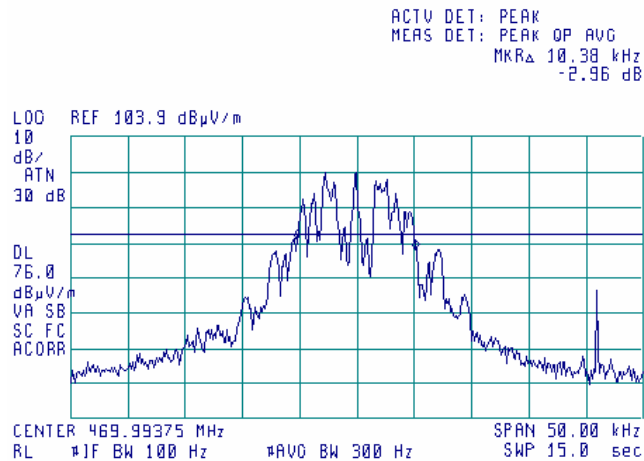
Plot 7.2.5 Reference unmodulated carrier at high frequency

16:36:00 JUN 29, 2005



Plot 7.2.6 Occupied bandwidth test result at high frequency

16:41:27 JUN 29, 2005





Test specification:	Section 90.210, Radiated spurious emissions		
Test procedure:	47 CFR, Sections 2.1053 and 90.210(m); TIA/EIA-603-A, Section 2.2.12		
Test mode:	Compliance	Verdict:	PASS
Date & Time:	8/14/2005 5:17:50 PM		
Temperature: 24 °C	Air Pressure: 1006 hPa	Relative Humidity: 37 %	Power Supply: 3.6 Vdc
Remarks:			

7.3 Radiated spurious emission measurements

7.3.1 General

This test was performed to measure radiated spurious emissions from the EUT. Specification test limits are given in Table 7.1.1.

Table 7.3.1 Radiated spurious emission test limits

Frequency, MHz	Attenuation below carrier, dBc
0.009 – 10 th harmonic*	30

* - spurious emission limits do not apply to the in band emission within:

± 25 kHz from the carrier for equipment designed to operate with 12.5 kHz channel bandwidth

** - Equivalent field strength limit was calculated from maximum allowed ERP of spurious as follows:
 $E = \sqrt{30 \times P \times 1.64} / r$, where P is ERP in Watts, 1.64 is numeric gain of ideal dipole and r is antenna to EUT distance in meters

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

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

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

7.3.2.3 The worst test results (the lowest margins) were recorded in Table 7.1.2 and shown in the associated plots.

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

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

7.3.3.2 The specified frequency range was investigated with antenna connected to spectrum analyzer. To find maximum radiation the turntable was rotated 360° and the measuring antenna height was swept from 1 to 4 m in both, vertical and horizontal, polarizations.

7.3.3.3 The worst test results (the lowest margins) were recorded in Table 7.1.2 and shown in the associated plots.

7.3.4 Test procedure for substitution ERP measurements of spurious

7.3.4.1 The test equipment was set up as shown in Figure 7.3.3 and energized.

7.3.4.2 RF signal generator was set to the frequency of investigated spurious emission and the RF output level was preliminary adjusted to produce the same field strength as it was measured from the EUT.

7.3.4.3 The test antenna height was swept from 1 to 4 m to find maximum emission from substitution antenna and RF signal generator output was fine adjusted to produce the same field strength as it was measured from the EUT.

7.3.4.4 The above procedure was performed in both, horizontal and vertical, polarizations of the test and substitution antennas.

7.3.4.5 The ERP of spurious emissions was calculated as a sum of signal generator output power in dBm and antenna gain in dBd reduced by cable loss in dB.

7.3.4.6 The above procedure was repeated at the rest of investigated frequencies.

7.3.4.7 The worst test results (the lowest margins) were recorded in Table 7.1.3 and shown in the associated plots.



Test specification:		Section 90.210, Radiated spurious emissions	
Test procedure:		47 CFR, Sections 2.1053 and 90.210(m); TIA/EIA-603-A, Section 2.2.12	
Test mode:	Compliance	Verdict: PASS	
Date & Time:	8/14/2005 5:17:50 PM		
Temperature: 24 °C	Air Pressure: 1006 hPa	Relative Humidity: 37 %	Power Supply: 3.6 Vdc
Remarks:			

Figure 7.3.1 Setup for spurious emission field strength measurements in 9 kHz to 30 MHz band

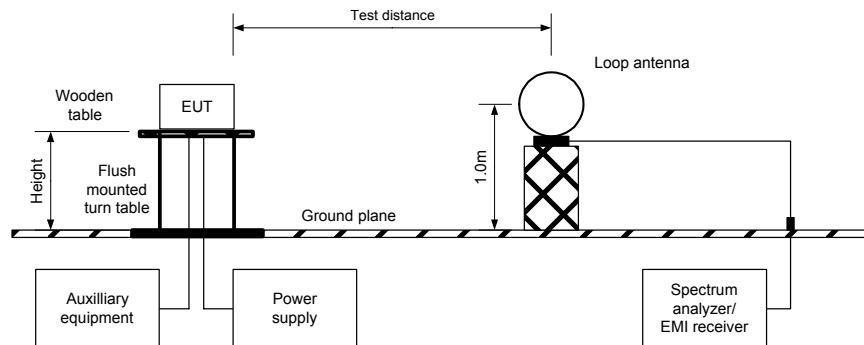
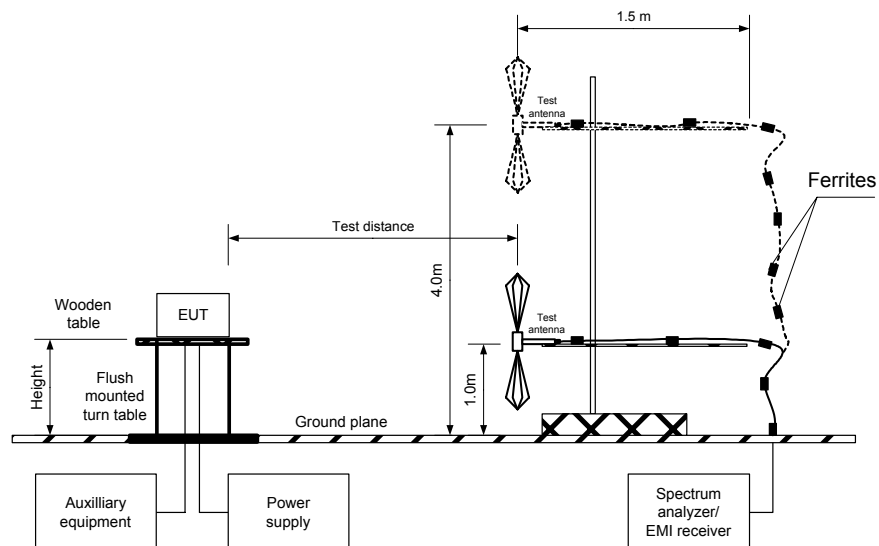


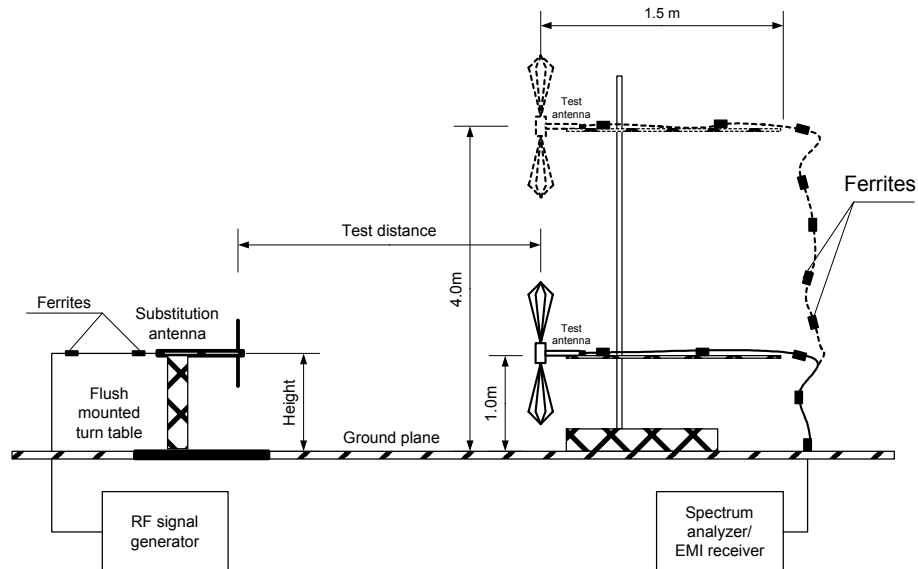
Figure 7.3.2 Setup for spurious emission field strength measurements above 30 MHz





Test specification:		Section 90.210, Radiated spurious emissions	
Test procedure:		47 CFR, Sections 2.1053 and 90.210(m); TIA/EIA-603-A, Section 2.2.12	
Test mode:	Compliance	Verdict:	PASS
Date & Time:	8/14/2005 5:17:50 PM		
Temperature: 24 °C	Air Pressure: 1006 hPa	Relative Humidity: 37 %	Power Supply: 3.6 Vdc
Remarks:			

Figure 7.3.3 Setup for substitution ERP measurements of spurious





Test specification:	Section 90.210, Radiated spurious emissions		
Test procedure:	47 CFR, Sections 2.1053 and 90.210(m); TIA/EIA-603-A, Section 2.2.12		
Test mode:	Compliance	Verdict:	PASS
Date & Time:	8/14/2005 5:17:50 PM		
Temperature: 24 °C	Air Pressure: 1006 hPa	Relative Humidity: 37 %	Power Supply: 3.6 Vdc
Remarks:			

Table 7.3.2 Spurious emission field strength test results

ASSIGNED FREQUENCY RANGE: 450 - 470 MHz
 TEST DISTANCE: 3 m
 TEST SITE: Fully anechoic chamber / OATS
 EUT HEIGHT: 0.8 m
 INVESTIGATED FREQUENCY RANGE: 0.009 – 2000 MHz
 DETECTOR USED: Peak
 VIDEO BANDWIDTH: > Resolution bandwidth
 TEST ANTENNA TYPE: Active loop (9 kHz – 30 MHz)
 Biconilog (30 MHz – 1000 MHz)
 Double ridged guide (above 1000 MHz)
 MODULATION: FSK
 TRANSMITTER OUTPUT POWER SETTINGS: Maximum

Frequency, MHz	Field strength, dB(μV/m)	Limit, dB(μV/m)	Margin, dB*	RBW, kHz	Antenna polarization	Antenna height, m	Turn-table position**, degrees
Low carrier frequency 450.00625 MHz							
900.020	58.75	88.87	-30.12	120	Vertical	1.4	185
1350.050	71.98	88.87	-16.89	1000	Vertical	1.4	296
1800.025	70.94	88.87	-17.93	1000	Vertical	1.4	186
2250.000	60.24	88.87	-28.63	1000	Vertical	1.5	27
2700.903	77.23	88.87	-17.64	1000	Vertical	1.2	63
3149.985	55.33	88.87	-33.54	1000	Vertical	1.0	133
3599.967	56.67	88.87	-32.2	1000	Vertical	1.0	213
4049.906	60.00	88.87	-28.87	1000	Vertical	1.2	142
4499.871	55.00	88.87	-33.87	1000	Vertical	1.1	271
Mid carrier frequency 460 MHz							
920.008	61.34	87.17	-25.83	120	Vertical	1.4	260
1379.975	71.45	87.17	-15.72	1000	Vertical	1.4	204
1840.000	65.52	87.17	-21.65	1000	Vertical	1.5	187
2300.013	61.20	87.17	-25.97	1000	Vertical	1.5	194
2760.000	76.38	87.17	-10.79	1000	Vertical	1.2	51
3219.892	47.00	87.17	-40.17	1000	Vertical	1.0	89
3679.967	56.33	87.17	-30.84	1000	Vertical	1.0	291
4140.017	52.83	87.17	-34.34	1000	Vertical	1.0	159
High carrier frequency 469.99375 MHz							
939.996	60.90	84.78	-23.88	120	Vertical	1.5	263
1410.000	61.79	84.78	-22.99	1000	Vertical	1.6	253
1879.938	58.26	84.78	-26.52	1000	Vertical	1.3	228
2349.913	61.00	84.78	-23.78	1000	Vertical	1.5	176
2820.013	56.35	84.78	-28.43	1000	Vertical	1.2	72
3290.023	50.00	84.78	-34.78	1000	Vertical	1.1	101
3759.917	54.17	84.78	-30.61	1000	Vertical	1.0	290
4229.977	54.00	84.78	-30.78	1000	Vertical	1.0	188

*- Margin = Field strength of spurious – calculated field strength limit.

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



Test specification:		Section 90.210, Radiated spurious emissions	
Test procedure:		47 CFR, Sections 2.1053 and 90.210(m); TIA/EIA-603-A, Section 2.2.12	
Test mode:	Compliance	Verdict:	PASS
Date & Time:	8/14/2005 5:17:50 PM		
Temperature: 24 °C	Air Pressure: 1006 hPa	Relative Humidity: 37 %	Power Supply: 3.6 Vdc
Remarks:			

Table 7.3.3 Substitution ERP of spurious test results

ASSIGNED FREQUENCY RANGE: 450 -470 MHz
 TRANSMITTER CARRIER ERP: 14.52 dBm at low frequency
 14.10 dBm at mid frequency
 13.25 dBm at high frequency
 TEST SITE: Fully anechoic chamber / OATS
 TEST DISTANCE: 3 m
 SUBSTITUTION ANTENNA HEIGHT: 0.8 m
 DETECTOR USED: Peak
 VIDEO BANDWIDTH: > Resolution bandwidth
 SUBSTITUTION ANTENNA TYPE: Tunable dipole (30 MHz – 1000 MHz)
 Double ridged guide (above 1000 MHz)

Frequency, MHz	Field strength, dB(μV/m)	RBW, kHz	Antenna polarization	RF generator output, dBm	Ant gain, dBd	Cable loss, dB	ERP, dBm	Attenuation below carrier, dBc	Limit, dBm	Margin, dB*	Verdict
Low carrier frequency											
900.020	58.75	120	Vertical	-35.12	1.68	2.98	-36.54	51.06	30.0	21.06	Pass
1350.050	71.98	1000	Vertical	-29.62	6.79	3.25	-20.91	35.43	30.0	5.43	Pass
1800.025	70.94	1000	Vertical	-30.04	6.20	3.88	-20.86	35.38	30.0	5.38	Pass
2250.000	60.24	1000	Vertical	-39.46	6.80	2.95	-34.22	48.74	30.0	18.74	Pass
2700.903	77.23	1000	Vertical	-22.79	7.54	3.22	-18.36	32.88	30.0	2.88	Pass
3149.985	55.33	1000	Vertical	-50.19	10.22	1.20	-41.17	55.69	30.0	25.69	Pass
3599.967	56.67	1000	Vertical	-49.44	10.68	1.24	-40.00	54.52	30.0	24.52	Pass
4049.906	60.00	1000	Vertical	-45.08	9.70	1.35	-36.73	51.25	30.0	21.25	Pass
4499.871	55.00	1000	Vertical	-49.49	8.51	1.41	-42.39	56.91	30.0	26.91	Pass
Mid carrier frequency											
920.008	61.34	120	Vertical	-32.53	2.46	2.93	-33.24	47.34	30.0	17.34	Pass
1379.975	71.45	1000	Vertical	-30.15	6.89	3.30	-21.54	35.64	30.0	5.64	Pass
1840.000	65.52	1000	Vertical	-35.46	6.25	3.76	-26.51	40.61	30.0	10.61	Pass
2300.013	61.2	1000	Vertical	-38.50	6.86	2.71	-33.52	47.62	30.0	17.62	Pass
2760.000	76.38	1000	Vertical	-23.64	7.67	3.65	-19.16	33.26	30.0	3.26	Pass
3219.892	47.00	1000	Vertical	-60.87	10.41	1.21	-51.67	65.77	30.0	35.77	Pass
3679.967	56.33	1000	Vertical	-51.26	10.67	1.26	-41.85	55.95	30.0	25.95	Pass
4140.017	52.83	1000	Vertical	-52.07	9.59	1.35	-43.83	57.93	30.0	27.93	Pass
4599.808	52.83	1000	Vertical	-49.89	7.60	1.42	-43.71	57.81	30.0	27.81	Pass
High carrier frequency											
939.996	60.90	120	Vertical	-32.97	3.25	2.88	-32.97	46.22	30.0	16.22	Pass
1410.000	61.79	1000	Vertical	-39.81	6.99	3.34	-31.29	44.54	30.0	14.54	Pass
1879.938	58.26	1000	Vertical	-42.72	6.30	3.64	-33.99	47.24	30.0	17.24	Pass
2349.913	61.00	1000	Vertical	-38.70	6.92	2.48	-33.98	47.23	30.0	17.23	Pass
2820.013	56.35	1000	Vertical	-43.67	7.80	4.09	-39.14	52.39	30.0	22.39	Pass
3290.023	50.00	1000	Vertical	-56.50	10.59	1.20	-47.11	60.36	30.0	30.36	Pass
3759.917	54.17	1000	Vertical	-51.01	10.35	1.28	-41.94	55.19	30.0	25.19	Pass
4229.977	54.00	1000	Vertical	-49.52	9.08	1.36	-41.80	55.05	30.0	25.05	Pass

*- Margin = Spurious emission – specification limit.

Reference numbers of test equipment used

HL 0029	HL 0415	HL 0446	HL 0521	HL 0589	HL 0604	HL 0661	HL 1424
HL 1947	HL 1984	HL 2009	HL 2259	HL 2400			

Full description is given in Appendix A.



HERMON LABORATORIES

Report ID: MILRAD_FCC.16356_rev1.doc

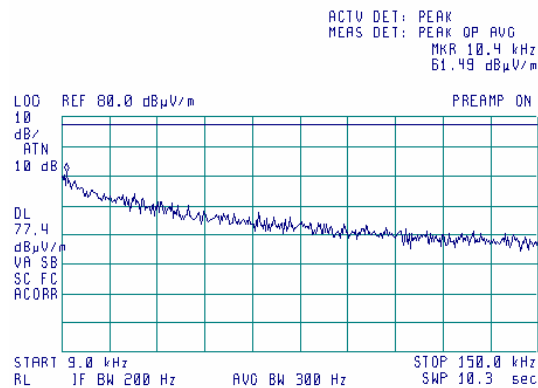
Date of Issue: 8/16/2005

Test specification:		Section 90.210, Radiated spurious emissions	
Test procedure:		47 CFR, Sections 2.1053 and 90.210(m); TIA/EIA-603-A, Section 2.2.12	
Test mode:		Compliance	Verdict: PASS
Date & Time:		8/14/2005 5:17:50 PM	
Temperature: 24 °C		Air Pressure: 1006 hPa	Relative Humidity: 37 %
Remarks:		Power Supply: 3.6 Vdc	

Plot 7.3.1 Radiated emission measurements in 9 - 150 kHz range

TEST SITE: Fully anechoic chamber
CARRIER FREQUENCY: Low
ANTENNA POLARIZATION: Vertical and Horizontal
TEST DISTANCE: 3 m

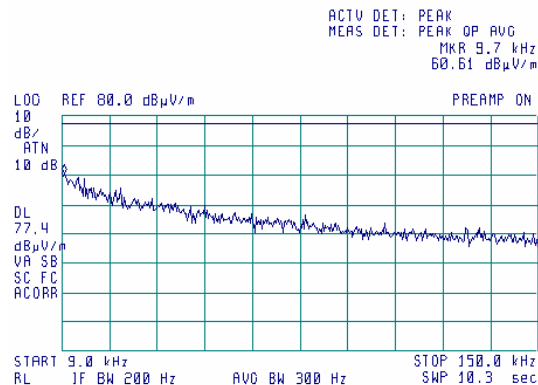
16:22:01 JUN 16, 2005



Plot 7.3.2 Radiated emission measurements in 9 - 150 kHz range

TEST SITE: Fully anechoic chamber
CARRIER FREQUENCY: Mid
ANTENNA POLARIZATION: Vertical and Horizontal
TEST DISTANCE: 3 m

16:23:22 JUN 16, 2005



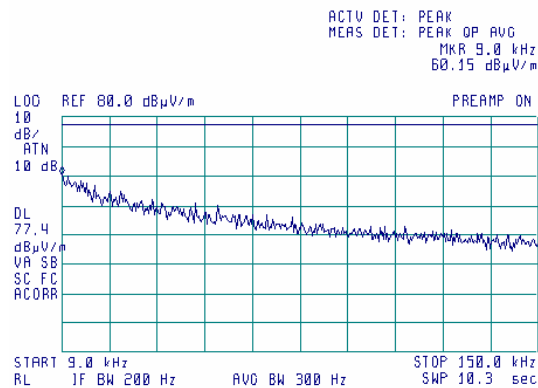


Test specification:	Section 90.210, Radiated spurious emissions		
Test procedure:	47 CFR, Sections 2.1053 and 90.210(m); TIA/EIA-603-A, Section 2.2.12		
Test mode:	Compliance	Verdict:	PASS
Date & Time:	8/14/2005 5:17:50 PM		
Temperature: 24 °C	Air Pressure: 1006 hPa	Relative Humidity: 37 %	Power Supply: 3.6 Vdc
Remarks:			

Plot 7.3.3 Radiated emission measurements in 9 - 150 kHz range

TEST SITE: Fully anechoic chamber
CARRIER FREQUENCY: High
ANTENNA POLARIZATION: Vertical and Horizontal
TEST DISTANCE: 3 m

(6) 16:24:23 JUN 16, 2005





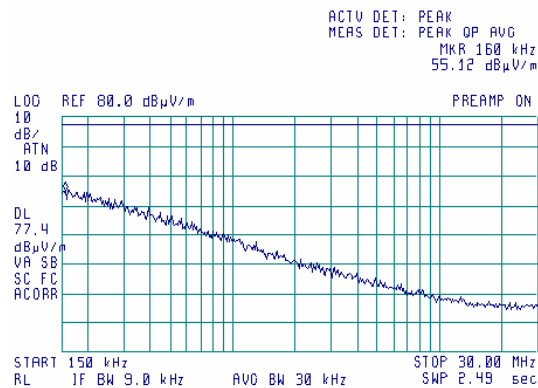
HERMON LABORATORIES

Test specification:		Section 90.210, Radiated spurious emissions	
Test procedure:		47 CFR, Sections 2.1053 and 90.210(m); TIA/EIA-603-A, Section 2.2.12	
Test mode:	Compliance	Verdict:	PASS
Date & Time:	8/14/2005 5:17:50 PM		
Temperature: 24 °C	Air Pressure: 1006 hPa	Relative Humidity: 37 %	Power Supply: 3.6 Vdc
Remarks:			

Plot 7.3.4 Radiated emission measurements in 0.15 - 30 MHz range

TEST SITE: Fully anechoic chamber
CARRIER FREQUENCY: Low
ANTENNA POLARIZATION: Vertical and Horizontal
TEST DISTANCE: 3 m

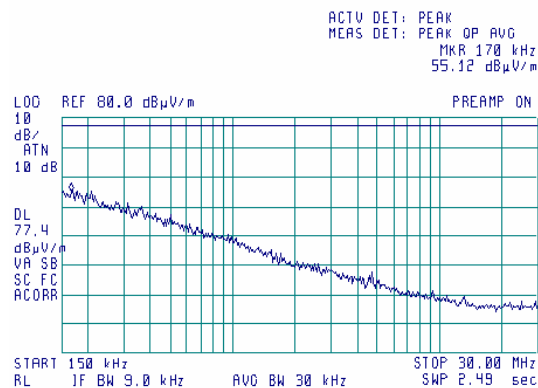
16:25:50 JUN 16, 2005



Plot 7.3.5 Radiated emission measurements in 0.15 - 30 MHz range

TEST SITE: Fully anechoic chamber
CARRIER FREQUENCY: Mid
ANTENNA POLARIZATION: Vertical and Horizontal
TEST DISTANCE: 3 m

16:26:42 JUN 16, 2005



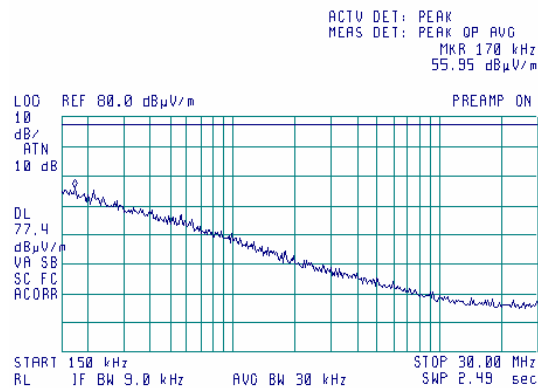


Test specification:		Section 90.210, Radiated spurious emissions	
Test procedure:		47 CFR, Sections 2.1053 and 90.210(m); TIA/EIA-603-A, Section 2.2.12	
Test mode:		Compliance	Verdict: PASS
Date & Time:		8/14/2005 5:17:50 PM	
Temperature: 24 °C		Air Pressure: 1006 hPa	Relative Humidity: 37 %
Remarks:		Power Supply: 3.6 Vdc	

Plot 7.3.6 Radiated emission measurements in 0.15 - 30 MHz range

TEST SITE: Fully anechoic chamber
CARRIER FREQUENCY: High
ANTENNA POLARIZATION: Vertical and Horizontal
TEST DISTANCE: 3 m

(6) 16:27:38 JUN 16, 2005





HERMON LABORATORIES

Report ID: MILRAD_FCC.16356_rev1.doc

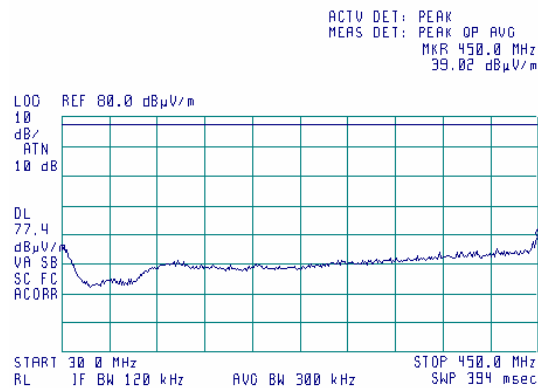
Date of Issue: 8/16/2005

Test specification:	Section 90.210, Radiated spurious emissions		
Test procedure:	47 CFR, Sections 2.1053 and 90.210(m); TIA/EIA-603-A, Section 2.2.12		
Test mode:	Compliance	Verdict:	PASS
Date & Time:	8/14/2005 5:17:50 PM		
Temperature: 24 °C	Air Pressure: 1006 hPa	Relative Humidity: 37 %	Power Supply: 3.6 Vdc
Remarks:			

Plot 7.3.7 Radiated emission measurements in 30 - 450 MHz range

TEST SITE: Fully anechoic chamber
CARRIER FREQUENCY: Low
ANTENNA POLARIZATION: Vertical and Horizontal
TEST DISTANCE: 3 m

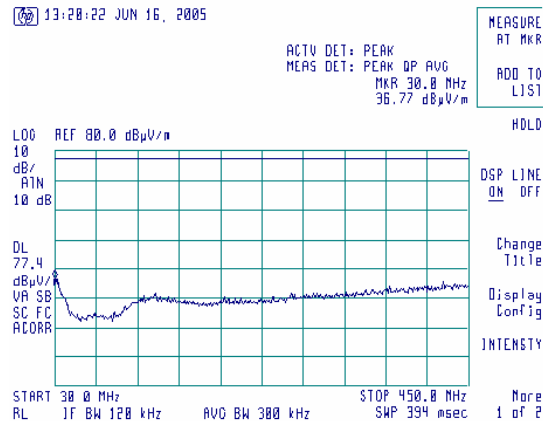
13:34:21 JUN 16, 2005



Plot 7.3.8 Radiated emission measurements in 30 - 450 MHz range

TEST SITE: Fully anechoic chamber
CARRIER FREQUENCY: Mid
ANTENNA POLARIZATION: Vertical and Horizontal
TEST DISTANCE: 3 m

13:28:22 JUN 16, 2005





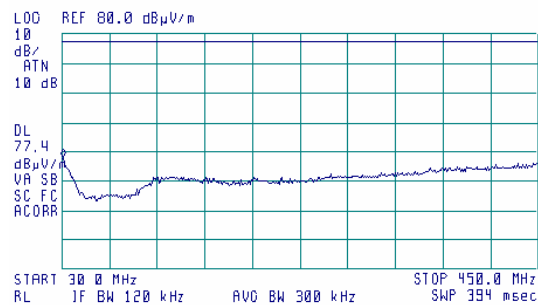
Test specification:		Section 90.210, Radiated spurious emissions	
Test procedure:		47 CFR, Sections 2.1053 and 90.210(m); TIA/EIA-603-A, Section 2.2.12	
Test mode:		Compliance	Verdict: PASS
Date & Time:		8/14/2005 5:17:50 PM	
Temperature: 24 °C		Air Pressure: 1006 hPa	Relative Humidity: 37 %
Remarks:		Power Supply: 3.6 Vdc	

Plot 7.3.9 Radiated emission measurements in 30 - 450 MHz range

TEST SITE: Fully anechoic chamber
CARRIER FREQUENCY: High
ANTENNA POLARIZATION: Vertical and Horizontal
TEST DISTANCE: 3 m

13:19:31 JUN 16, 2005

ACTV DET: PEAK
MEAS DET: PEAK OP AVG
MKR 31.1 MHz
30.12 dBμV/m



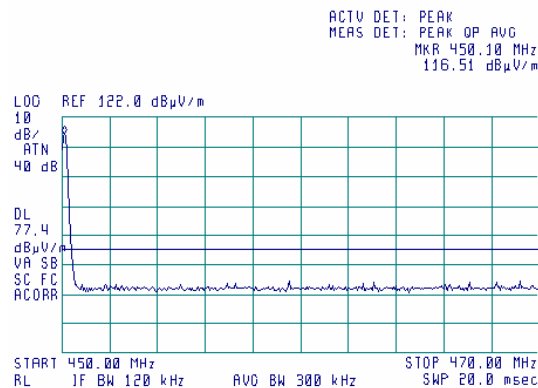


Test specification:		Section 90.210, Radiated spurious emissions	
Test procedure:		47 CFR, Sections 2.1053 and 90.210(m); TIA/EIA-603-A, Section 2.2.12	
Test mode:	Compliance	Verdict:	PASS
Date & Time:	8/14/2005 5:17:50 PM		
Temperature: 24 °C	Air Pressure: 1006 hPa	Relative Humidity: 37 %	Power Supply: 3.6 Vdc
Remarks:			

Plot 7.3.10 Radiated emission measurements in 450 – 470 MHz range

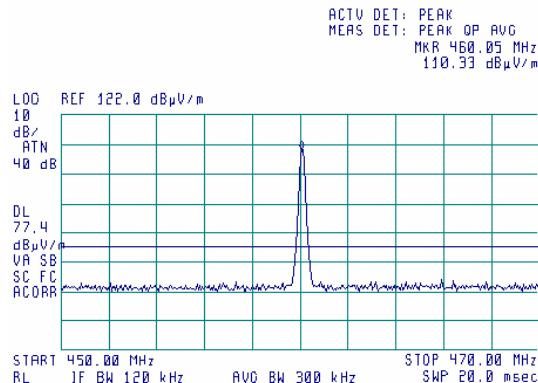
TEST SITE: Fully anechoic chamber
CARRIER FREQUENCY: Low
ANTENNA POLARIZATION: Vertical and Horizontal
TEST DISTANCE: 3 m

(62) 18:32:22 AUG 10, 2005

**Plot 7.3.11 Radiated emission measurements in 450 – 470 MHz range**

TEST SITE: Fully anechoic chamber
CARRIER FREQUENCY: Mid
ANTENNA POLARIZATION: Vertical and Horizontal
TEST DISTANCE: 3 m

(62) 18:34:21 AUG 10, 2005





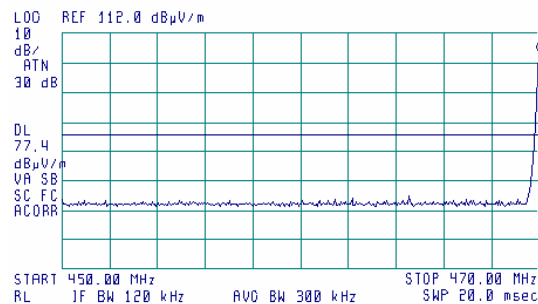
Test specification:		Section 90.210, Radiated spurious emissions	
Test procedure:		47 CFR, Sections 2.1053 and 90.210(m); TIA/EIA-603-A, Section 2.2.12	
Test mode:	Compliance	Verdict:	PASS
Date & Time:	8/14/2005 5:17:50 PM		
Temperature: 24 °C	Air Pressure: 1006 hPa	Relative Humidity: 37 %	Power Supply: 3.6 Vdc
Remarks:			

Plot 7.3.12 Radiated emission measurements in 450 – 470 MHz range

TEST SITE: Fully anechoic chamber
CARRIER FREQUENCY: High
ANTENNA POLARIZATION: Vertical and Horizontal
TEST DISTANCE: 3 m

(G) 18:22:02 AUG 10, 2005

ACTV DET: PEAK
MEAS DET: PEAK OP AVG
MKR 470.00 MHz
105.99 dBµV/m



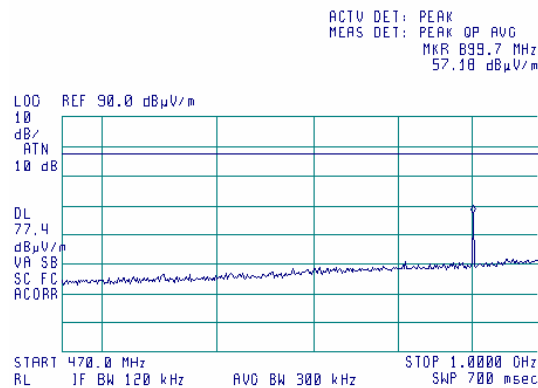


Test specification:		Section 90.210, Radiated spurious emissions	
Test procedure:		47 CFR, Sections 2.1053 and 90.210(m); TIA/EIA-603-A, Section 2.2.12	
Test mode:		Compliance	Verdict: PASS
Date & Time:		8/14/2005 5:17:50 PM	
Temperature: 24 °C		Air Pressure: 1006 hPa	Relative Humidity: 37 %
Remarks:		Power Supply: 3.6 Vdc	

Plot 7.3.13 Radiated emission measurements in 470 – 1000 MHz range

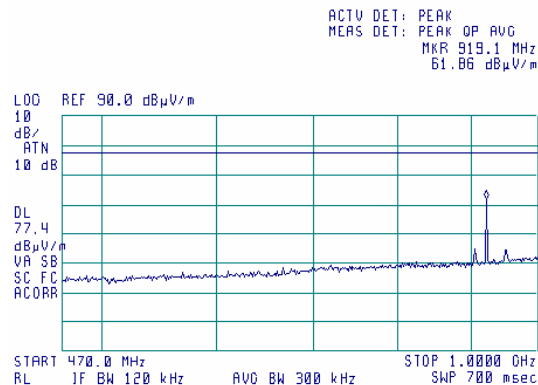
TEST SITE: Fully anechoic chamber
CARRIER FREQUENCY: Low
ANTENNA POLARIZATION: Vertical and Horizontal
TEST DISTANCE: 3 m

13:32:00 JUN 16, 2005

**Plot 7.3.14 Radiated emission measurements in 470 – 1000 MHz range**

TEST SITE: Fully anechoic chamber
CARRIER FREQUENCY: Mid
ANTENNA POLARIZATION: Vertical and Horizontal
TEST DISTANCE: 3 m

13:30:02 JUN 16, 2005





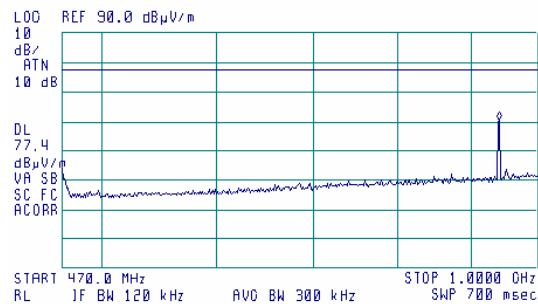
Test specification:		Section 90.210, Radiated spurious emissions	
Test procedure:		47 CFR, Sections 2.1053 and 90.210(m); TIA/EIA-603-A, Section 2.2.12	
Test mode:	Compliance	Verdict:	PASS
Date & Time:	8/14/2005 5:17:50 PM		
Temperature: 24 °C	Air Pressure: 1006 hPa	Relative Humidity: 37 %	Power Supply: 3.6 Vdc
Remarks:			

Plot 7.3.15 Radiated emission measurements in 470 – 1000 MHz range

TEST SITE: Fully anechoic chamber
CARRIER FREQUENCY: High
ANTENNA POLARIZATION: Vertical and Horizontal
TEST DISTANCE: 3 m

(6) 13:45:01 JUN 16, 2005

ACTV DET: PEAK
MEAS DET: PEAK OP AVG
MKR 937.3 MHz
60.32 dB μ V/m



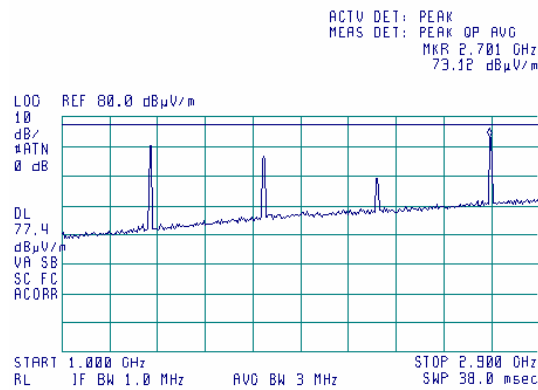


Test specification:	Section 90.210, Radiated spurious emissions		
Test procedure:	47 CFR, Sections 2.1053 and 90.210(m); TIA/EIA-603-A, Section 2.2.12		
Test mode:	Compliance	Verdict:	PASS
Date & Time:	8/14/2005 5:17:50 PM		
Temperature: 24 °C	Air Pressure: 1006 hPa	Relative Humidity: 37 %	Power Supply: 3.6 Vdc
Remarks:			

Plot 7.3.16 Radiated emission measurements in 1000 – 2900 MHz range

TEST SITE: Fully anechoic chamber
CARRIER FREQUENCY: Low
ANTENNA POLARIZATION: Vertical and Horizontal
TEST DISTANCE: 3 m

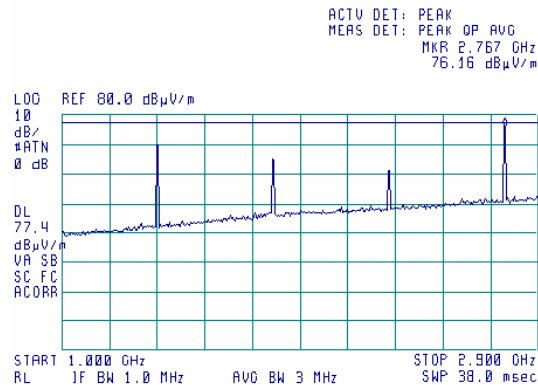
15:50:16 JUN 16, 2005



Plot 7.3.17 Radiated emission measurements in 1000 – 2900 MHz range

TEST SITE: Fully anechoic chamber
CARRIER FREQUENCY: Mid
ANTENNA POLARIZATION: Vertical and Horizontal
TEST DISTANCE: 3 m

15:57:02 JUN 16, 2005





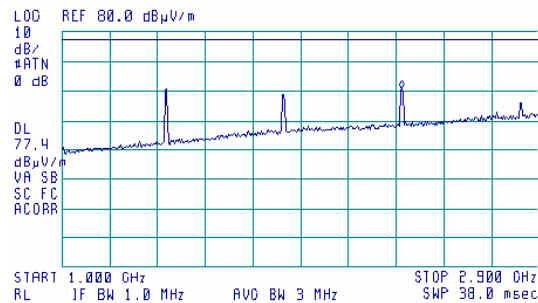
Test specification:		Section 90.210, Radiated spurious emissions	
Test procedure:		47 CFR, Sections 2.1053 and 90.210(m); TIA/EIA-603-A, Section 2.2.12	
Test mode:	Compliance	Verdict:	PASS
Date & Time:	8/14/2005 5:17:50 PM		
Temperature: 24 °C	Air Pressure: 1006 hPa	Relative Humidity: 37 %	Power Supply: 3.6 Vdc
Remarks:			

Plot 7.3.18 Radiated emission measurements in 1000 – 2900 MHz range

TEST SITE: Fully anechoic chamber
CARRIER FREQUENCY: High
ANTENNA POLARIZATION: Vertical and Horizontal
TEST DISTANCE: 3 m

16:11:17 JUN 16, 2005

ACTV DET: PEAK
MEAS DET: PEAK OP AVG
MKR 2.354 GHz
60.72 dBμV/m

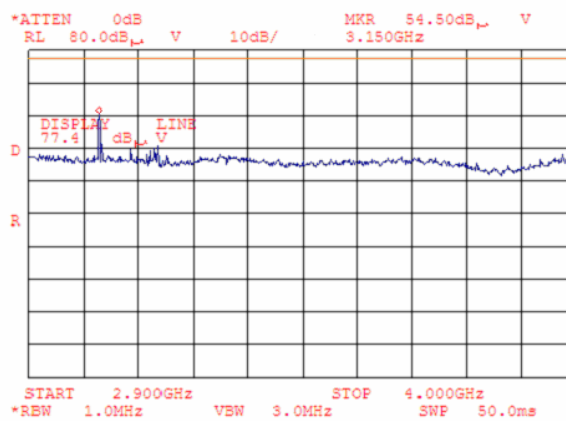




Test specification:	Section 90.210, Radiated spurious emissions		
Test procedure:	47 CFR, Sections 2.1053 and 90.210(m); TIA/EIA-603-A, Section 2.2.12		
Test mode:	Compliance	Verdict:	PASS
Date & Time:	8/14/2005 5:17:50 PM		
Temperature: 24 °C	Air Pressure: 1006 hPa	Relative Humidity: 37 %	Power Supply: 3.6 Vdc
Remarks:			

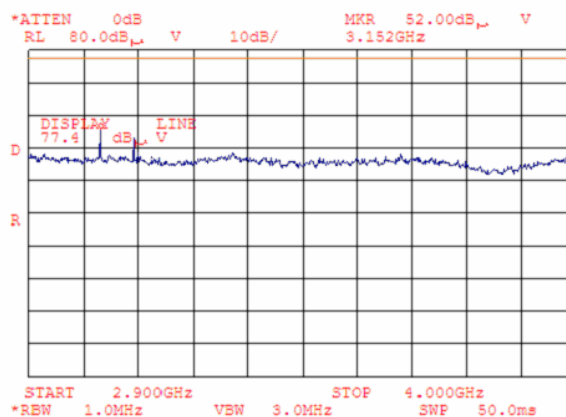
Plot 7.3.19 Radiated emission measurements in 2.9 – 4.0 GHz range

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



Plot 7.3.20 Radiated emission measurements in 2.9 – 4.0 GHz range

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

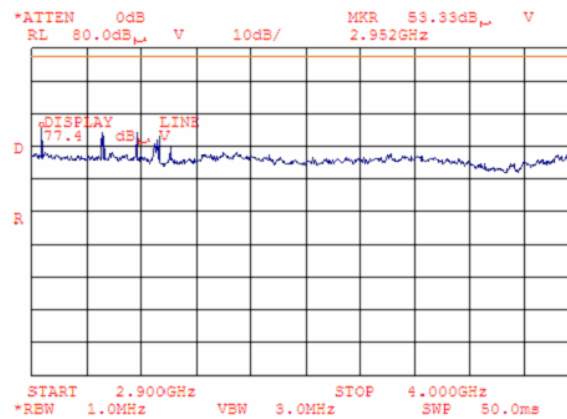




Test specification:		Section 90.210, Radiated spurious emissions	
Test procedure:		47 CFR, Sections 2.1053 and 90.210(m); TIA/EIA-603-A, Section 2.2.12	
Test mode:		Compliance	Verdict: PASS
Date & Time:		8/14/2005 5:17:50 PM	
Temperature: 24 °C		Air Pressure: 1006 hPa	Relative Humidity: 37 %
Remarks:		Power Supply: 3.6 Vdc	

Plot 7.3.21 Radiated emission measurements in 2.9 – 4.0 GHz range

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

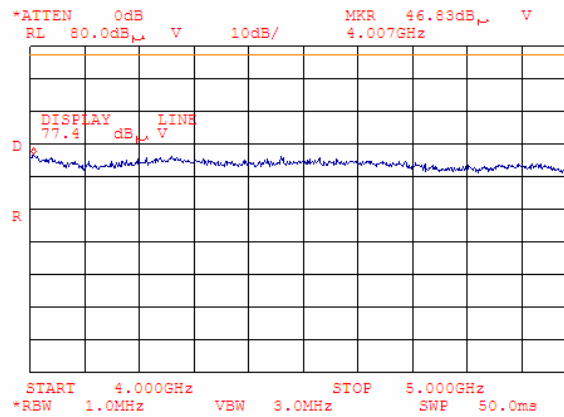




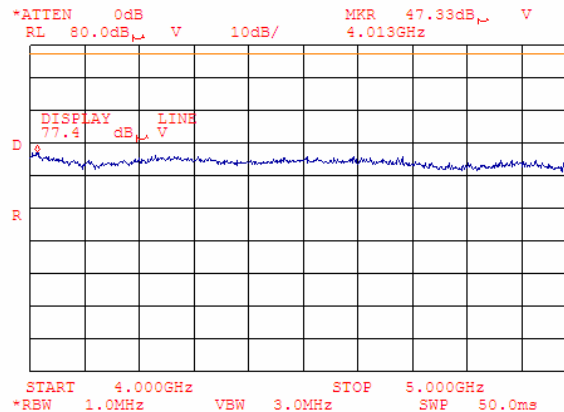
Test specification:	Section 90.210, Radiated spurious emissions		
Test procedure:	47 CFR, Sections 2.1053 and 90.210(m); TIA/EIA-603-A, Section 2.2.12		
Test mode:	Compliance	Verdict:	PASS
Date & Time:	8/14/2005 5:17:50 PM		
Temperature: 24 °C	Air Pressure: 1006 hPa	Relative Humidity: 37 %	Power Supply: 3.6 Vdc
Remarks:			

Plot 7.3.22 Radiated emission measurements in 4.0 – 5.0 GHz range

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

**Plot 7.3.23 Radiated emission measurements in 4.0 – 5.0 GHz range**

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

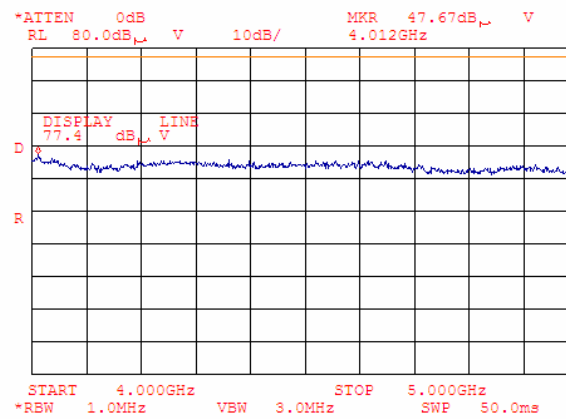




Test specification:		Section 90.210, Radiated spurious emissions	
Test procedure:		47 CFR, Sections 2.1053 and 90.210(m); TIA/EIA-603-A, Section 2.2.12	
Test mode:	Compliance	Verdict:	PASS
Date & Time:	8/14/2005 5:17:50 PM		
Temperature: 24 °C	Air Pressure: 1006 hPa	Relative Humidity: 37 %	Power Supply: 3.6 Vdc
Remarks:			

Plot 7.3.24 Radiated emission measurements in 4.0 – 5.0 GHz range

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





HERMON LABORATORIES

Report ID: MILRAD_FCC.16356_rev1.doc

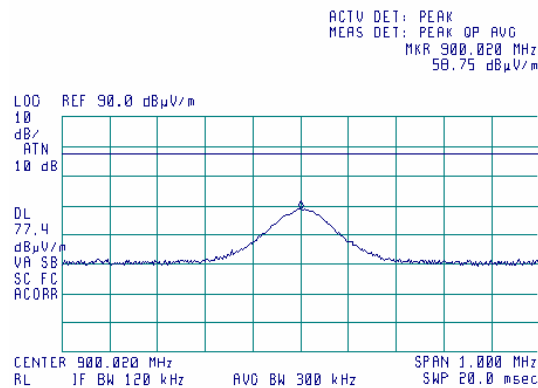
Date of Issue: 8/16/2005

Test specification:		Section 90.210, Radiated spurious emissions	
Test procedure:		47 CFR, Sections 2.1053 and 90.210(m); TIA/EIA-603-A, Section 2.2.12	
Test mode:		Compliance	Verdict: PASS
Date & Time:		8/14/2005 5:17:50 PM	
Temperature: 24 °C		Air Pressure: 1006 hPa	Relative Humidity: 37 %
Remarks:		Power Supply: 3.6 Vdc	

Plot 7.3.25 Radiated emission measurements at the 2nd harmonic

TEST SITE: Fully anechoic chamber
CARRIER FREQUENCY: Low
ANTENNA POLARIZATION: Vertical and Horizontal
TEST DISTANCE: 3 m

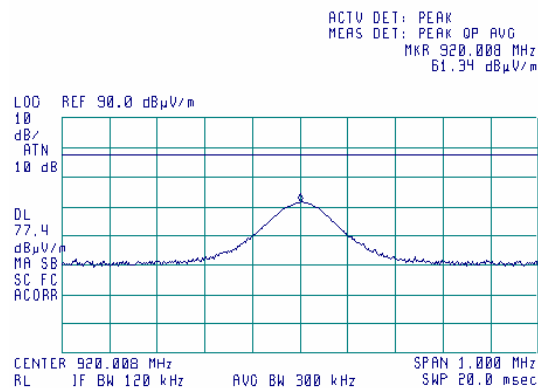
14:06:56 JUN 16, 2005



Plot 7.3.26 Radiated emission measurements at the 2nd harmonic

TEST SITE: Fully anechoic chamber
CARRIER FREQUENCY: Mid
ANTENNA POLARIZATION: Vertical and Horizontal
TEST DISTANCE: 3 m

14:08:04 JUN 16, 2005





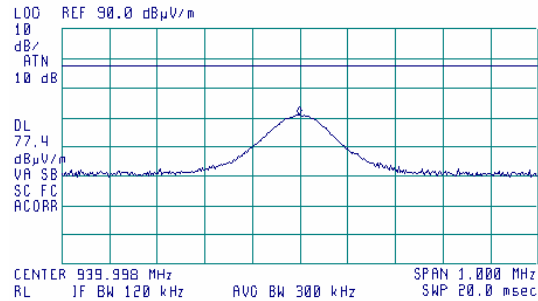
Test specification:		Section 90.210, Radiated spurious emissions	
Test procedure:		47 CFR, Sections 2.1053 and 90.210(m); TIA/EIA-603-A, Section 2.2.12	
Test mode:	Compliance	Verdict:	PASS
Date & Time:	8/14/2005 5:17:50 PM		
Temperature: 24 °C	Air Pressure: 1006 hPa	Relative Humidity: 37 %	Power Supply: 3.6 Vdc
Remarks:			

Plot 7.3.27 Radiated emission measurements at the 2nd harmonic

TEST SITE: Fully anechoic chamber
CARRIER FREQUENCY: High
ANTENNA POLARIZATION: Vertical and Horizontal
TEST DISTANCE: 3 m

13:53:28 JUN 16, 2005

ACTV DET: PEAK
MEAS DET: PEAK OP AVG
MKR 939.996 MHz
60.90 dBμV/m



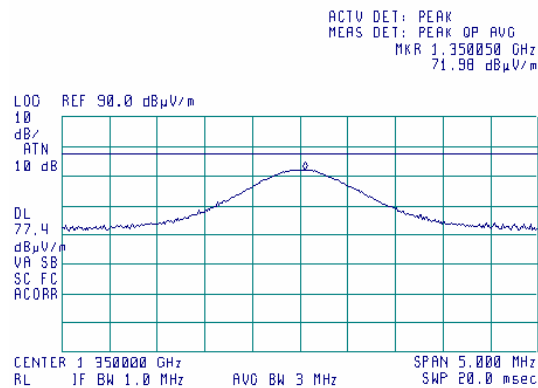


Test specification:		Section 90.210, Radiated spurious emissions	
Test procedure:		47 CFR, Sections 2.1053 and 90.210(m); TIA/EIA-603-A, Section 2.2.12	
Test mode:	Compliance	Verdict:	PASS
Date & Time:	8/14/2005 5:17:50 PM		
Temperature: 24 °C	Air Pressure: 1006 hPa	Relative Humidity: 37 %	Power Supply: 3.6 Vdc
Remarks:			

Plot 7.3.28 Radiated emission measurements at the 3rd harmonic

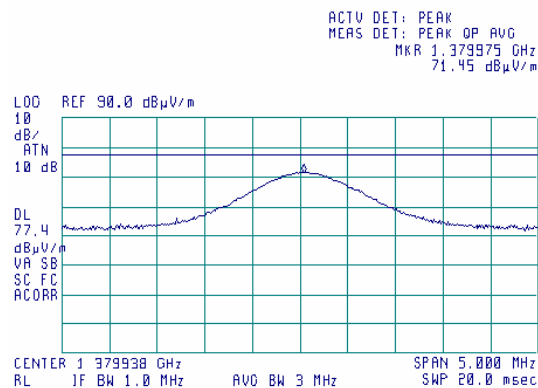
TEST SITE: Fully anechoic chamber
CARRIER FREQUENCY: Low
ANTENNA POLARIZATION: Vertical and Horizontal
TEST DISTANCE: 3 m

14:11:12 JUN 16, 2005

**Plot 7.3.29 Radiated emission measurements at the 3rd harmonic**

TEST SITE: Fully anechoic chamber
CARRIER FREQUENCY: Mid
ANTENNA POLARIZATION: Vertical and Horizontal
TEST DISTANCE: 3 m

14:16:36 JUN 16, 2005





HERMON LABORATORIES

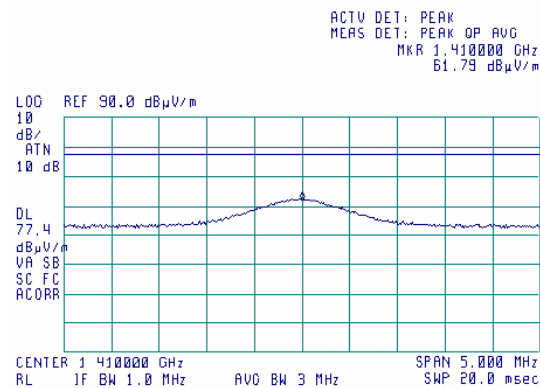
Report ID: MILRAD_FCC.16356_rev1.doc
Date of Issue: 8/16/2005

Test specification:		Section 90.210, Radiated spurious emissions	
Test procedure:		47 CFR, Sections 2.1053 and 90.210(m); TIA/EIA-603-A, Section 2.2.12	
Test mode:	Compliance	Verdict:	PASS
Date & Time:	8/14/2005 5:17:50 PM		
Temperature: 24 °C	Air Pressure: 1006 hPa	Relative Humidity: 37 %	Power Supply: 3.6 Vdc
Remarks:			

Plot 7.3.30 Radiated emission measurements at the 3rd harmonic

TEST SITE: Fully anechoic chamber
CARRIER FREQUENCY: High
ANTENNA POLARIZATION: Vertical and Horizontal
TEST DISTANCE: 3 m

14:20:17 JUN 16, 2005





HERMON LABORATORIES

Report ID: MILRAD_FCC.16356_rev1.doc

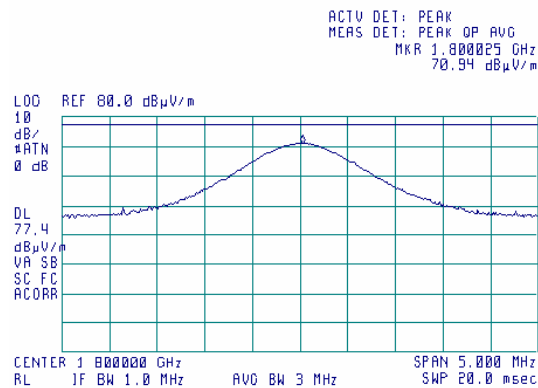
Date of Issue: 8/16/2005

Test specification:		Section 90.210, Radiated spurious emissions	
Test procedure:		47 CFR, Sections 2.1053 and 90.210(m); TIA/EIA-603-A, Section 2.2.12	
Test mode:	Compliance	Verdict:	PASS
Date & Time:	8/14/2005 5:17:50 PM		
Temperature: 24 °C	Air Pressure: 1006 hPa	Relative Humidity: 37 %	Power Supply: 3.6 Vdc
Remarks:			

Plot 7.3.31 Radiated emission measurements at the 4th harmonic

TEST SITE: Fully anechoic chamber
CARRIER FREQUENCY: Low
ANTENNA POLARIZATION: Vertical and Horizontal
TEST DISTANCE: 3 m

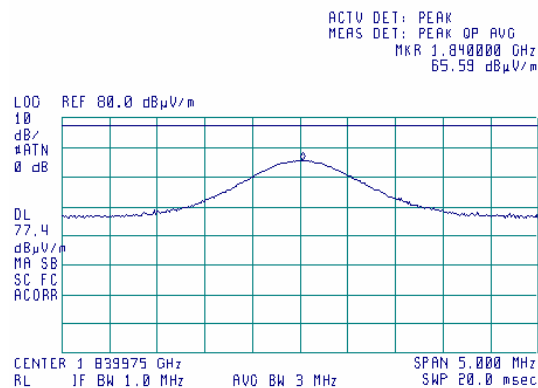
14:40:57 JUN 16, 2005



Plot 7.3.32 Radiated emission measurements at the 4th harmonic

TEST SITE: Fully anechoic chamber
CARRIER FREQUENCY: Mid
ANTENNA POLARIZATION: Vertical and Horizontal
TEST DISTANCE: 3 m

14:43:12 JUN 16, 2005



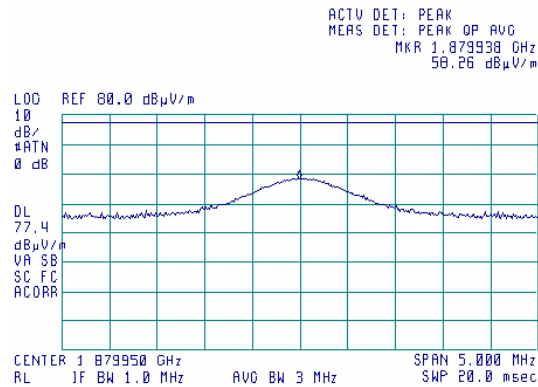


Test specification:		Section 90.210, Radiated spurious emissions	
Test procedure:		47 CFR, Sections 2.1053 and 90.210(m); TIA/EIA-603-A, Section 2.2.12	
Test mode:	Compliance	Verdict:	PASS
Date & Time:	8/14/2005 5:17:50 PM		
Temperature: 24 °C	Air Pressure: 1006 hPa	Relative Humidity: 37 %	Power Supply: 3.6 Vdc
Remarks:			

Plot 7.3.33 Radiated emission measurements at the 4th harmonic

TEST SITE: Fully anechoic chamber
CARRIER FREQUENCY: High
ANTENNA POLARIZATION: Vertical and Horizontal
TEST DISTANCE: 3 m

14:36:25 JUN 16, 2005





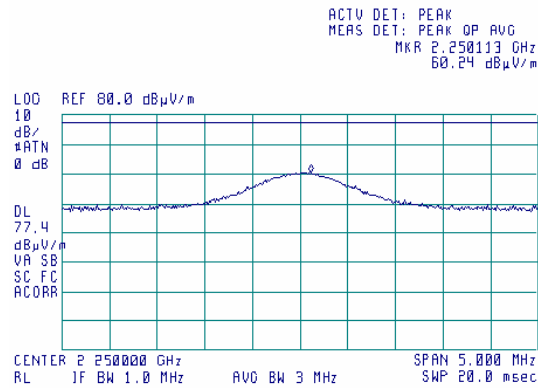
HERMON LABORATORIES

Test specification:		Section 90.210, Radiated spurious emissions	
Test procedure:		47 CFR, Sections 2.1053 and 90.210(m); TIA/EIA-603-A, Section 2.2.12	
Test mode:	Compliance	Verdict:	PASS
Date & Time:	8/14/2005 5:17:50 PM		
Temperature: 24 °C	Air Pressure: 1006 hPa	Relative Humidity: 37 %	Power Supply: 3.6 Vdc
Remarks:			

Plot 7.3.34 Radiated emission measurements at the 5th harmonic

TEST SITE: Fully anechoic chamber
CARRIER FREQUENCY: Low
ANTENNA POLARIZATION: Vertical and Horizontal
TEST DISTANCE: 3 m

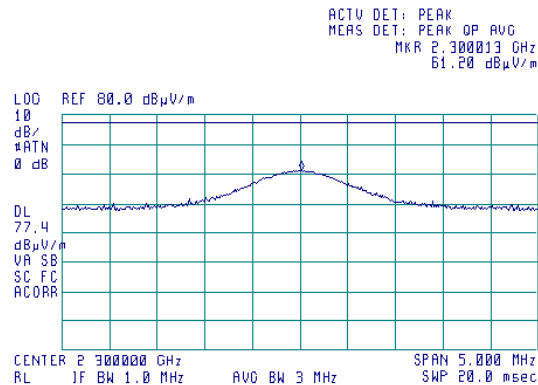
14:56:05 JUN 16, 2005



Plot 7.3.35 Radiated emission measurements at the 5th harmonic

TEST SITE: Fully anechoic chamber
CARRIER FREQUENCY: Mid
ANTENNA POLARIZATION: Vertical and Horizontal
TEST DISTANCE: 3 m

15:01:19 JUN 16, 2005





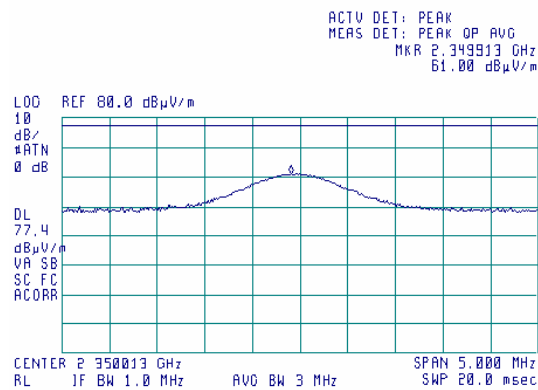
HERMON LABORATORIES

Test specification:		Section 90.210, Radiated spurious emissions	
Test procedure:		47 CFR, Sections 2.1053 and 90.210(m); TIA/EIA-603-A, Section 2.2.12	
Test mode:	Compliance	Verdict:	PASS
Date & Time:	8/14/2005 5:17:50 PM		
Temperature: 24 °C	Air Pressure: 1006 hPa	Relative Humidity: 37 %	Power Supply: 3.6 Vdc
Remarks:			

Plot 7.3.36 Radiated emission measurements at the 5th harmonic

TEST SITE:	Fully anechoic chamber
CARRIER FREQUENCY:	High
ANTENNA POLARIZATION:	Vertical and Horizontal
TEST DISTANCE:	3 m

15:07:17 JUN 16, 2005





HERMON LABORATORIES

Report ID: MILRAD_FCC.16356_rev1.doc

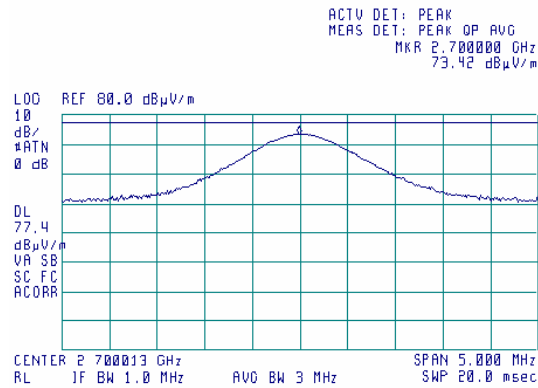
Date of Issue: 8/16/2005

Test specification:		Section 90.210, Radiated spurious emissions	
Test procedure:		47 CFR, Sections 2.1053 and 90.210(m); TIA/EIA-603-A, Section 2.2.12	
Test mode:	Compliance	Verdict:	PASS
Date & Time:	8/14/2005 5:17:50 PM		
Temperature: 24 °C	Air Pressure: 1006 hPa	Relative Humidity: 37 %	Power Supply: 3.6 Vdc
Remarks:			

Plot 7.3.37 Radiated emission measurements at the 6th harmonic

TEST SITE: Fully anechoic chamber
CARRIER FREQUENCY: Low
ANTENNA POLARIZATION: Vertical and Horizontal
TEST DISTANCE: 3 m

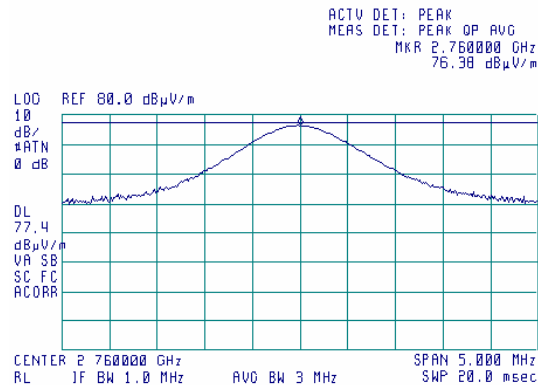
16:00:26 JUN 16, 2005



Plot 7.3.38 Radiated emission measurements at the 6th harmonic

TEST SITE: Fully anechoic chamber
CARRIER FREQUENCY: Mid
ANTENNA POLARIZATION: Vertical and Horizontal
TEST DISTANCE: 3 m

15:59:56 JUN 16, 2005



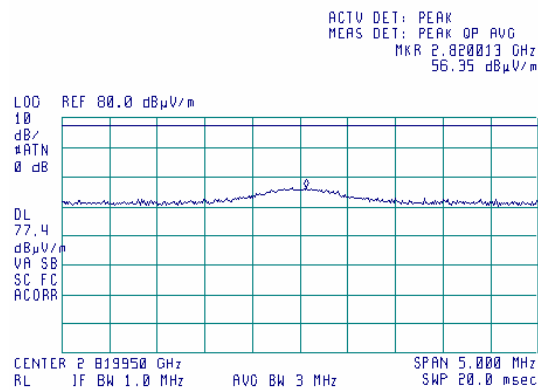


Test specification:		Section 90.210, Radiated spurious emissions	
Test procedure:		47 CFR, Sections 2.1053 and 90.210(m); TIA/EIA-603-A, Section 2.2.12	
Test mode:	Compliance	Verdict:	PASS
Date & Time:	8/14/2005 5:17:50 PM		
Temperature: 24 °C	Air Pressure: 1006 hPa	Relative Humidity: 37 %	Power Supply: 3.6 Vdc
Remarks:			

Plot 7.3.39 Radiated emission measurements at the 6th harmonic

TEST SITE: Fully anechoic chamber
CARRIER FREQUENCY: High
ANTENNA POLARIZATION: Vertical and Horizontal
TEST DISTANCE: 3 m

15:27:30 JUN 16, 2005

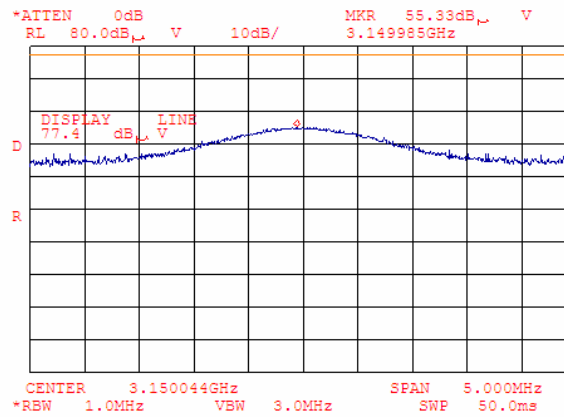




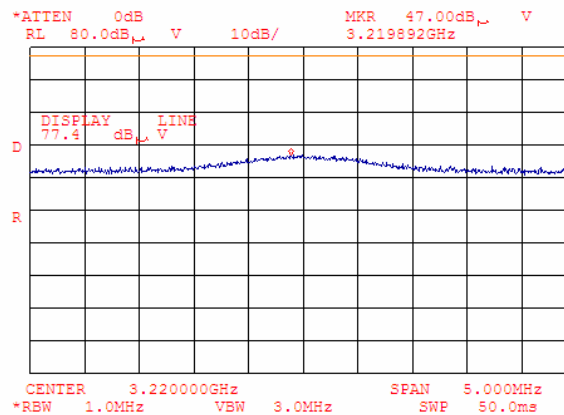
Test specification:	Section 90.210, Radiated spurious emissions		
Test procedure:	47 CFR, Sections 2.1053 and 90.210(m); TIA/EIA-603-A, Section 2.2.12		
Test mode:	Compliance	Verdict:	PASS
Date & Time:	8/14/2005 5:17:50 PM		
Temperature: 24 °C	Air Pressure: 1006 hPa	Relative Humidity: 37 %	Power Supply: 3.6 Vdc
Remarks:			

Plot 7.3.40 Radiated emission measurements at the 7th harmonic

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

**Plot 7.3.41 Radiated emission measurements at the 7th harmonic**

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

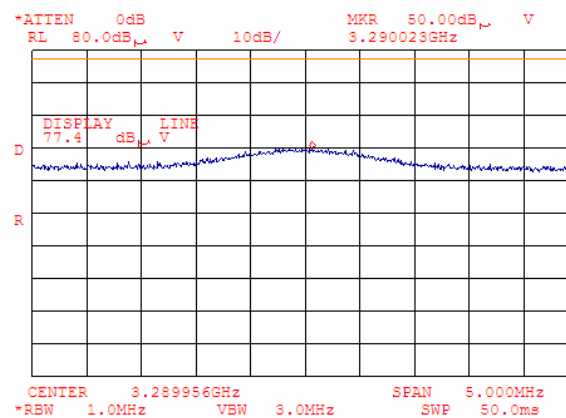




Test specification:		Section 90.210, Radiated spurious emissions	
Test procedure:		47 CFR, Sections 2.1053 and 90.210(m); TIA/EIA-603-A, Section 2.2.12	
Test mode:		Compliance	Verdict: PASS
Date & Time:		8/14/2005 5:17:50 PM	
Temperature: 24 °C		Air Pressure: 1006 hPa	Relative Humidity: 37 %
Remarks:		Power Supply: 3.6 Vdc	

Plot 7.3.42 Radiated emission measurements at the 7th harmonic

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



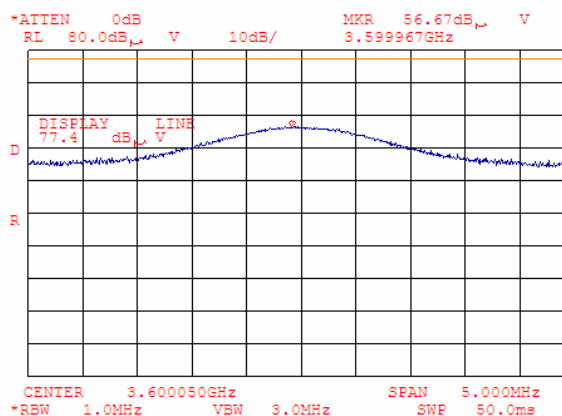


HERMON LABORATORIES

Test specification:		Section 90.210, Radiated spurious emissions	
Test procedure:		47 CFR, Sections 2.1053 and 90.210(m); TIA/EIA-603-A, Section 2.2.12	
Test mode:		Compliance	Verdict: PASS
Date & Time:		8/14/2005 5:17:50 PM	
Temperature: 24 °C	Air Pressure: 1006 hPa	Relative Humidity: 37 %	Power Supply: 3.6 Vdc
Remarks:			

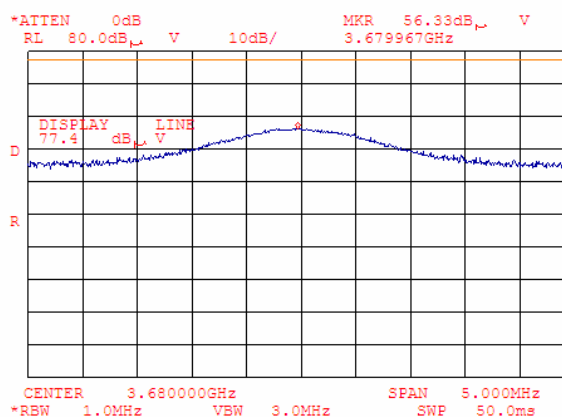
Plot 7.3.43 Radiated emission measurements at the 8th harmonic

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



Plot 7.3.44 Radiated emission measurements at the 8th harmonic

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

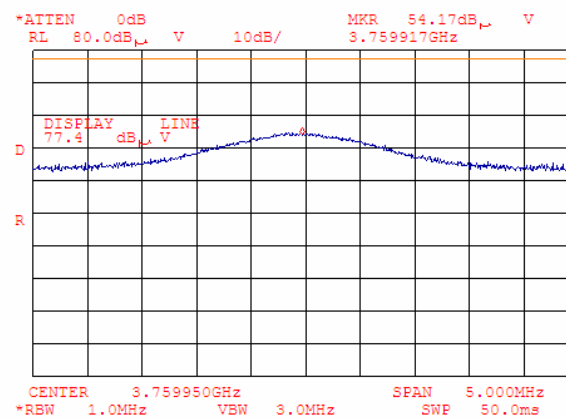




Test specification:		Section 90.210, Radiated spurious emissions	
Test procedure:		47 CFR, Sections 2.1053 and 90.210(m); TIA/EIA-603-A, Section 2.2.12	
Test mode:	Compliance	Verdict:	PASS
Date & Time:	8/14/2005 5:17:50 PM		
Temperature: 24 °C	Air Pressure: 1006 hPa	Relative Humidity: 37 %	Power Supply: 3.6 Vdc
Remarks:			

Plot 7.3.45 Radiated emission measurements at the 8th harmonic

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

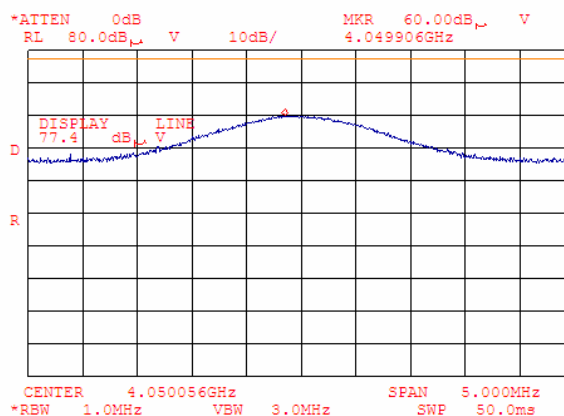




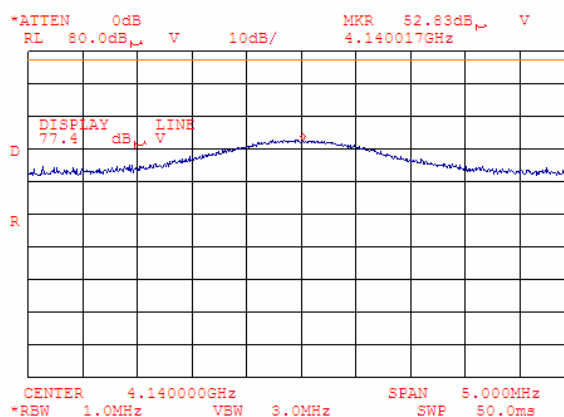
Test specification:	Section 90.210, Radiated spurious emissions		
Test procedure:	47 CFR, Sections 2.1053 and 90.210(m); TIA/EIA-603-A, Section 2.2.12		
Test mode:	Compliance	Verdict:	PASS
Date & Time:	8/14/2005 5:17:50 PM		
Temperature: 24 °C	Air Pressure: 1006 hPa	Relative Humidity: 37 %	Power Supply: 3.6 Vdc
Remarks:			

Plot 7.3.46 Radiated emission measurements at the 9th harmonic

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

Plot 7.3.47 Radiated emission measurements at the 9th harmonic

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

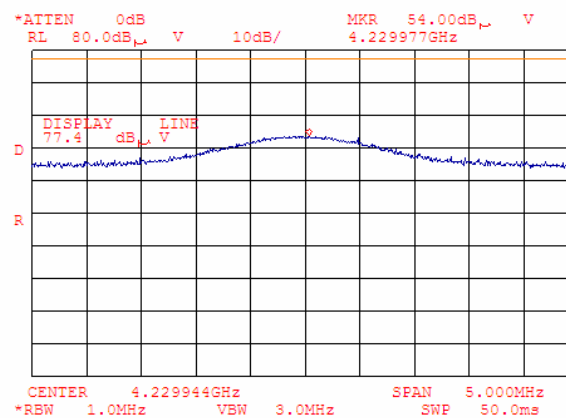




Test specification:		Section 90.210, Radiated spurious emissions	
Test procedure:		47 CFR, Sections 2.1053 and 90.210(m); TIA/EIA-603-A, Section 2.2.12	
Test mode:	Compliance	Verdict:	PASS
Date & Time:	8/14/2005 5:17:50 PM		
Temperature: 24 °C	Air Pressure: 1006 hPa	Relative Humidity: 37 %	Power Supply: 3.6 Vdc
Remarks:			

Plot 7.3.48 Radiated emission measurements at the 9th harmonic

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

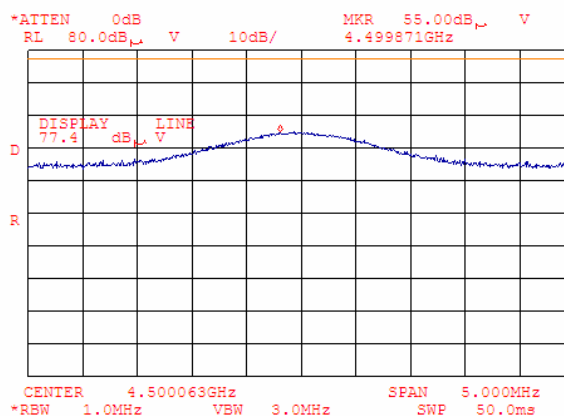




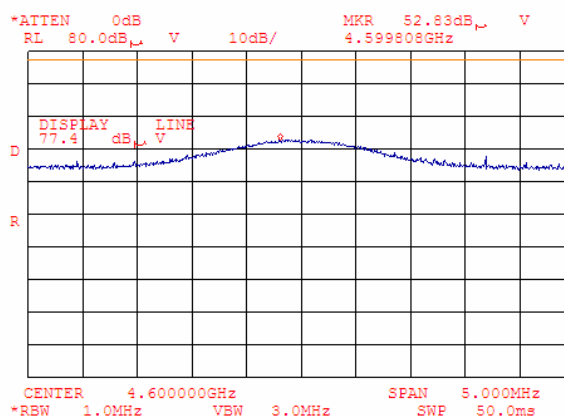
Test specification:	Section 90.210, Radiated spurious emissions		
Test procedure:	47 CFR, Sections 2.1053 and 90.210(m); TIA/EIA-603-A, Section 2.2.12		
Test mode:	Compliance	Verdict:	PASS
Date & Time:	8/14/2005 5:17:50 PM		
Temperature: 24 °C	Air Pressure: 1006 hPa	Relative Humidity: 37 %	Power Supply: 3.6 Vdc
Remarks:			

Plot 7.3.49 Radiated emission measurements at the 10th harmonic

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

**Plot 7.3.50 Radiated emission measurements at the 10th harmonic**

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

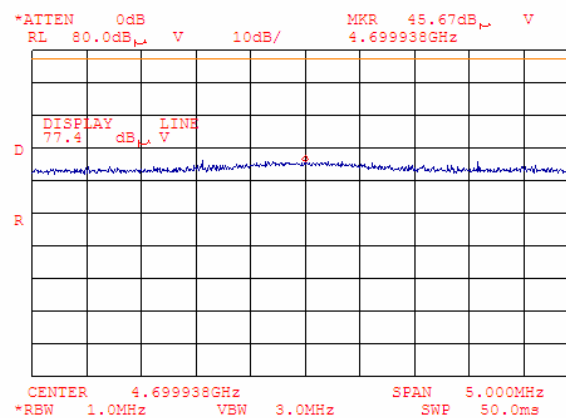




Test specification:	Section 90.210, Radiated spurious emissions		
Test procedure:	47 CFR, Sections 2.1053 and 90.210(m); TIA/EIA-603-A, Section 2.2.12		
Test mode:	Compliance	Verdict:	PASS
Date & Time:	8/14/2005 5:17:50 PM		
Temperature: 24 °C	Air Pressure: 1006 hPa	Relative Humidity: 37 %	Power Supply: 3.6 Vdc
Remarks:			

Plot 7.3.51 Radiated emission measurements at the 10th harmonic

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





Test specification:		Section 90.217, Band edge emission	
Test procedure:		47 CFR, Sections 2.1051, 2.1047 and 90.217; TIA/EIA-603-A, Section 2.2.13	
Test mode:		Compliance	Verdict: PASS
Date & Time:		8/12/2005 8:24:13 PM	
Temperature: 24 °C	Air Pressure: 1006 hPa	Relative Humidity: 37 %	Power Supply: 3.6 Vdc
Remarks:			

7.4 Band edge emission

7.4.1 General

This test was performed to verify the EUT band edge emission including all associated side bands and frequency drift under extreme test conditions was attenuated at least 30 dB below the unmodulated carrier level. Specification test limits are given in Table 7.4.1.

Table 7.4.1 Band edge emission limits

Band edge frequency shift from carrier, kHz	Channel bandwidth, kHz	Attenuation below carrier, dBc
± 25.0	12.5	30

7.4.2 Test procedure

7.4.2.1 The EUT was set up as shown in Figure 7.4.1, energized and the performance check was conducted.

7.4.2.2 The spectrum analyzer sweep time and bandwidth were 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.

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

7.4.2.4 The total bandwidth was calculated by adding of the negative frequency drift to the lower measured frequency and the positive frequency drift to the higher measured frequency. The obtained bandwidth was verified to be within the allowed frequency range.

7.4.2.5 The test results were recorded in Table 7.4.2 and shown in the associated plots.

Figure 7.4.1 Band edge emission measurement set up





Test specification:	Section 90.217, Band edge emission		
Test procedure:	47 CFR, Sections 2.1051, 2.1047 and 90.217; TIA/EIA-603-A, Section 2.2.13		
Test mode:	Compliance	Verdict:	PASS
Date & Time:	8/12/2005 8:24:13 PM		
Temperature: 24 °C	Air Pressure: 1006 hPa	Relative Humidity: 37 %	Power Supply: 3.6 Vdc
Remarks:			

Table 7.4.2 Band edge emission test results

OPERATING FREQUENCY RANGE: 450.00625 – 469.99375 MHz
 DETECTOR USED: Peak hold
 SWEEP RATE: 3.33 kHz/s
 RESOLUTION BANDWIDTH: 100 Hz
 VIDEO BANDWIDTH: 300 Hz
 MODULATION: FSK
 MODULATING SIGNAL: Alternating symbols
 BIT RATE: 600 bps
 TRANSMITTER OUTPUT POWER SETTINGS: Maximum
 ATTENUATION BELOW CARRIER: 30 dBc

Band edge	Measured frequency, MHz*	Frequency drift, Hz		Band edge frequency, MHz**	Band edge limit, MHz	Margin, kHz***	Verdict
		Negative	Positive				
Low carrier frequency							
Low	449.999130	356	NA	449.998774	449.975000	23.774	Pass
High	450.013380	NA	900	450.014280	450.025000	-10.720	Pass
Mid carrier frequency							
Low	459.993130	408	NA	459.992722	459.975000	17.722	Pass
High	460.007500	NA	758	460.008258	460.025000	-16.742	Pass
High carrier frequency							
Low	469.986740	460	NA	469.986280	469.975000	11.280	Pass
High	470.001250	NA	564	470.001814	470.025000	-23.186	Pass

* - Measured frequency beyond which the emission level is attenuated at least 30 dB below the unmodulated carrier

** - Band edge frequency = Measured frequency ± Frequency drift under extreme conditions

*** - Margin = Band edge limit – Band edge frequency

Reference numbers of test equipment used

HL 1425	HL 1553	HL 1566	HL 1849	HL 1850	HL 2109	HL 2697		
---------	---------	---------	---------	---------	---------	---------	--	--

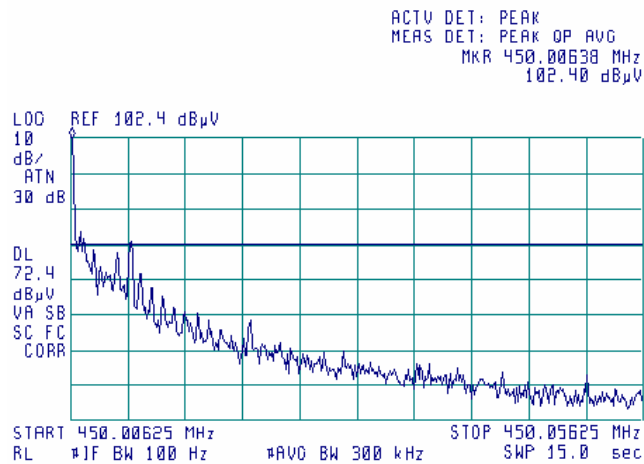
Full description is given in Appendix A.



Test specification:	Section 90.217, Band edge emission		
Test procedure:	47 CFR, Sections 2.1051, 2.1047 and 90.217; TIA/EIA-603-A, Section 2.2.13		
Test mode:	Compliance	Verdict:	PASS
Date & Time:	8/12/2005 8:24:13 PM		
Temperature: 24 °C	Air Pressure: 1006 hPa	Relative Humidity: 37 %	Power Supply: 3.6 Vdc
Remarks:			

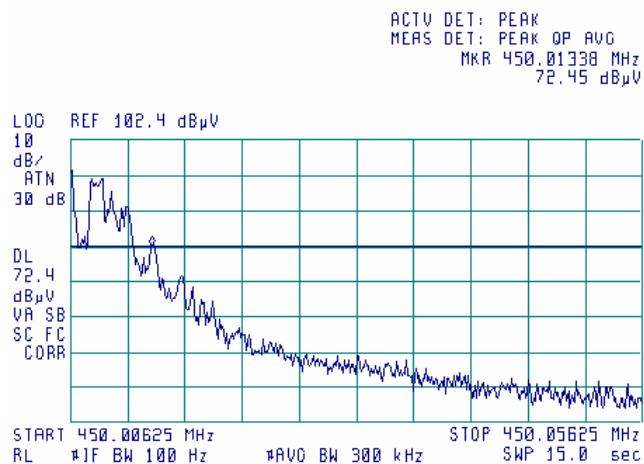
Plot 7.4.1 Band edge emission test results at low carrier frequency, right side, unmodulated reference

12:20:02 AUG 12, 2005



Plot 7.4.2 Band edge emission test results at low carrier frequency, right side

12:21:12 AUG 12, 2005

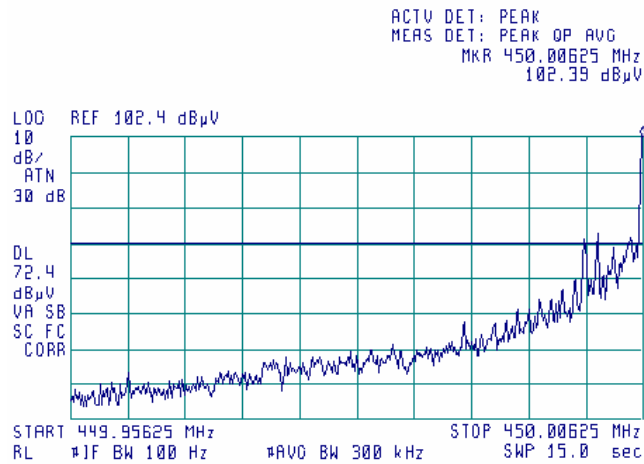




Test specification:	Section 90.217, Band edge emission		
Test procedure:	47 CFR, Sections 2.1051, 2.1047 and 90.217; TIA/EIA-603-A, Section 2.2.13		
Test mode:	Compliance	Verdict:	PASS
Date & Time:	8/12/2005 8:24:13 PM		
Temperature: 24 °C	Air Pressure: 1006 hPa	Relative Humidity: 37 %	Power Supply: 3.6 Vdc
Remarks:			

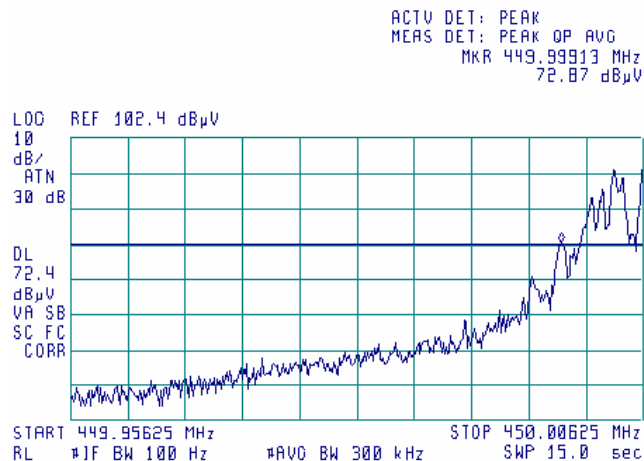
Plot 7.4.3 Band edge emission test results at low carrier frequency, left side, unmodulated reference

12:24:17 AUG 12, 2005



Plot 7.4.4 Band edge emission test results at low carrier frequency, left side

12:23:15 AUG 12, 2005

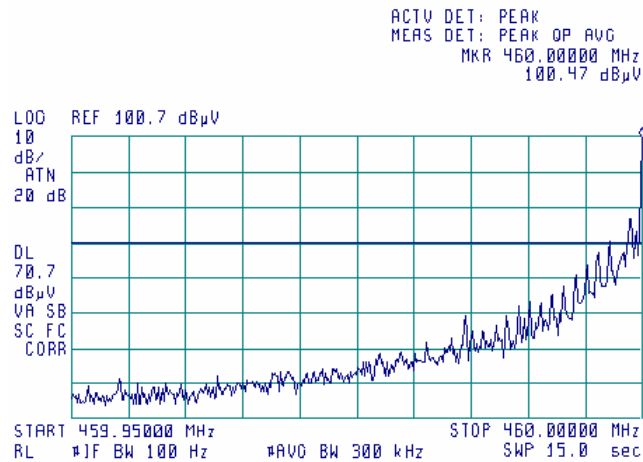




Test specification:	Section 90.217, Band edge emission		
Test procedure:	47 CFR, Sections 2.1051, 2.1047 and 90.217; TIA/EIA-603-A, Section 2.2.13		
Test mode:	Compliance	Verdict:	PASS
Date & Time:	8/12/2005 8:24:13 PM		
Temperature: 24 °C	Air Pressure: 1006 hPa	Relative Humidity: 37 %	Power Supply: 3.6 Vdc
Remarks:			

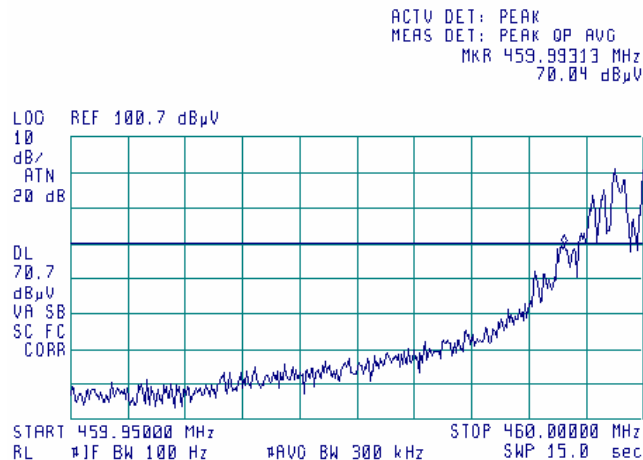
Plot 7.4.5 Band edge emission test results at mid carrier frequency, left side, reference

11:57:14 AUG 12, 2005



Plot 7.4.6 Band edge emission test results at mid carrier frequency, left side

11:59:09 AUG 12, 2005

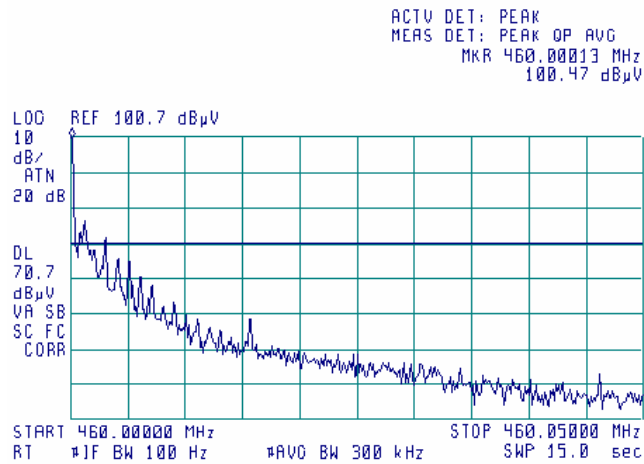




Test specification:	Section 90.217, Band edge emission		
Test procedure:	47 CFR, Sections 2.1051, 2.1047 and 90.217; TIA/EIA-603-A, Section 2.2.13		
Test mode:	Compliance	Verdict:	PASS
Date & Time:	8/12/2005 8:24:13 PM		
Temperature: 24 °C	Air Pressure: 1006 hPa	Relative Humidity: 37 %	Power Supply: 3.6 Vdc
Remarks:			

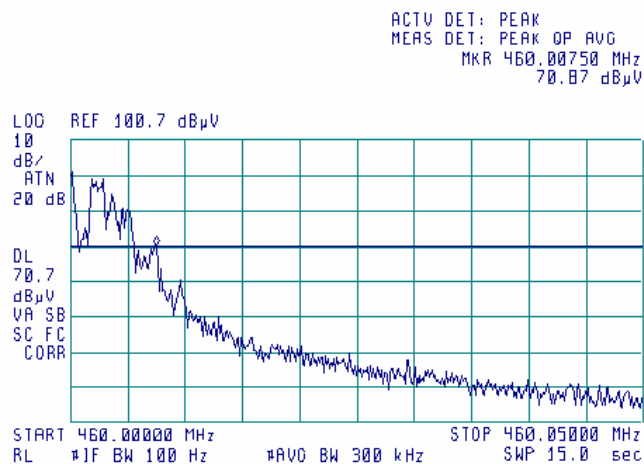
Plot 7.4.7 Band edge emission test results at mid carrier frequency, right side, unmodulated reference

12:02:19 AUG 12, 2005



Plot 7.4.8 Band edge emission test results at mid carrier frequency, right side

12:00:43 AUG 12, 2005

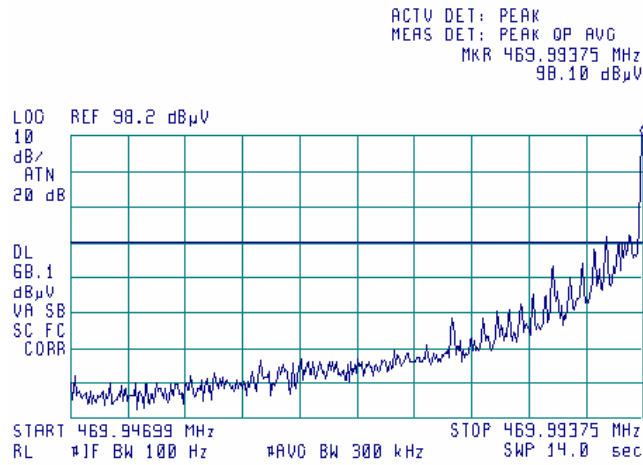




Test specification:	Section 90.217, Band edge emission		
Test procedure:	47 CFR, Sections 2.1051, 2.1047 and 90.217; TIA/EIA-603-A, Section 2.2.13		
Test mode:	Compliance	Verdict:	PASS
Date & Time:	8/12/2005 8:24:13 PM		
Temperature: 24 °C	Air Pressure: 1006 hPa	Relative Humidity: 37 %	Power Supply: 3.6 Vdc
Remarks:			

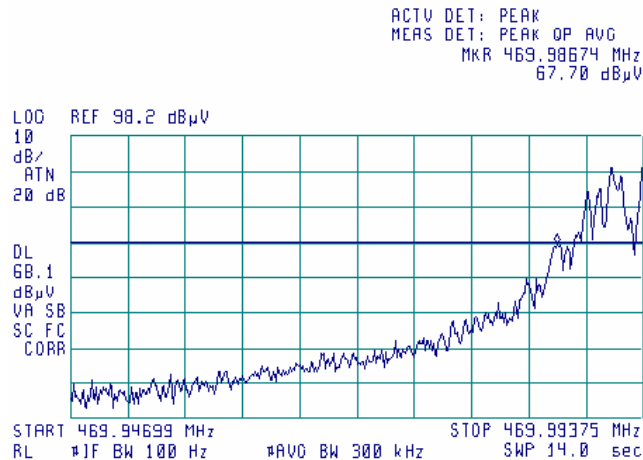
Plot 7.4.9 Band edge emission test results at high carrier frequency, left side, unmodulated reference

12:08:27 AUG 12, 2005



Plot 7.4.10 Band edge emission test results at high carrier frequency, left side

12:10:11 AUG 12, 2005

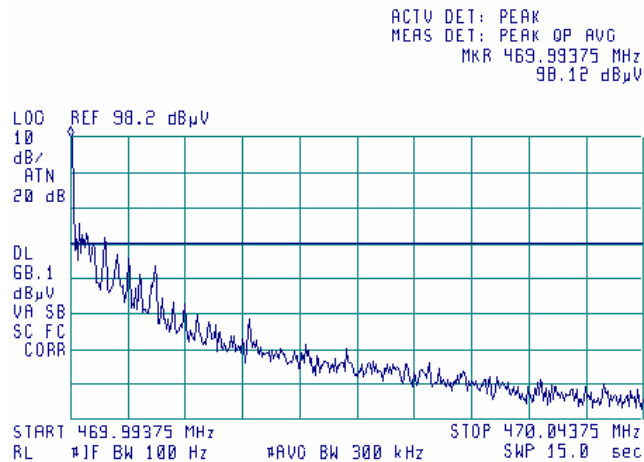




Test specification:	Section 90.217, Band edge emission		
Test procedure:	47 CFR, Sections 2.1051, 2.1047 and 90.217; TIA/EIA-603-A, Section 2.2.13		
Test mode:	Compliance	Verdict:	PASS
Date & Time:	8/12/2005 8:24:13 PM		
Temperature: 24 °C	Air Pressure: 1006 hPa	Relative Humidity: 37 %	Power Supply: 3.6 Vdc
Remarks:			

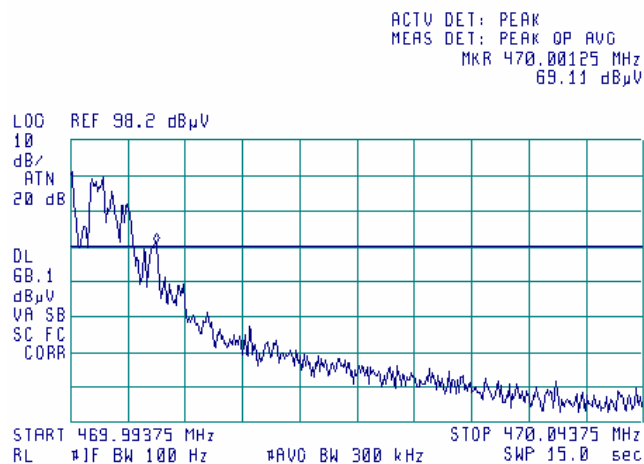
Plot 7.4.11 Band edge emission test results at high carrier frequency, right side, unmodulated reference

12:13:36 AUG 12, 2005



Plot 7.4.12 Band edge emission test results at high carrier frequency, right side

12:11:57 AUG 12, 2005





Test specification:		Section 90.213, Frequency stability	
Test procedure:		47 CFR, Section 2.1055; TIA/EIA-603-A Section 2.2.2	
Test mode:	Compliance	Verdict:	PASS
Date & Time:	8/9/2005 8:24:41 AM		
Temperature: 24 °C	Air Pressure: 1006 hPa	Relative Humidity: 41 %	Power Supply: 3.6V DC
Remarks:			

7.5 Frequency stability test

7.5.1 General

This test was performed to measure frequency stability of transmitter RF carrier. Specification test limits are given in Table 7.5.1. The test results are provided in Table 7.5.2.

Table 7.5.1 Frequency stability limits

Assigned frequency, MHz	Maximum allowed frequency displacement	
	ppm	Hz
450.006250	2.5	1125
460.000000		1150
469.993750		1174

7.5.2 Test procedure

- 7.5.2.1 The EUT was set up as shown in Figure 7.5.1, energized and its proper operation was checked.
- 7.5.2.2 The EUT power was turned off. Temperature within test chamber was set to +30°C and a period of time sufficient to stabilize all of the oscillator circuit components was allowed.
- 7.5.2.3 The EUT was powered on and carrier frequency was measured at start up moment and then every minute until frequency had been stabilized or 10 minutes elapsed whichever reached the last. The EUT was powered off.
- 7.5.2.4 The above procedure was repeated at 0°C and at the lowest test temperature.
- 7.5.2.5 The EUT was powered on and carrier frequency was measured at start up moment and at the end of stabilization period at the rest of test temperatures and voltages. The EUT was powered off.
- 7.5.2.6 Frequency displacement was calculated and compared with the limit as provided in Table 7.5.2.

Figure 7.5.1 Frequency stability test setup





Test specification:	Section 90.213, Frequency stability		
Test procedure:	47 CFR, Section 2.1055; TIA/EIA-603-A Section 2.2.2		
Test mode:	Compliance	Verdict: PASS	
Date & Time:	8/9/2005 8:24:41 AM		
Temperature: 24 °C	Air Pressure: 1006 hPa	Relative Humidity: 41 %	Power Supply: 3.6V DC
Remarks:			

Table 7.5.2 Frequency stability test results

OPERATING FREQUENCY: 450.0-470.0 MHz
 NOMINAL POWER VOLTAGE: 3.6 V
 TEMPERATURE STABILIZATION PERIOD: 20 min
 POWER DURING TEMPERATURE TRANSITION: Off
 SPECTRUM ANALYZER MODE: Counter
 RESOLUTION BANDWIDTH: 30 Hz
 VIDEO BANDWIDTH: 10 Hz
 MODULATION: Unmodulated

T, °C	Voltage, V	Frequency, MHz							Max frequency drift, Hz		Limit**, Hz	Margin, Hz	Verdict
		Start up	1 st min	2 nd min	3 rd min	4 th min	5 th min	10 th min	Positive	Negative			
Low frequency													
-30	nominal	450.005614	450.005168	450.005204	450.005248	450.005284	450.005314	450.005412	146	-300	NA	NA	Pass
-20	nominal	450.005112	NA	NA	NA	NA	NA	450.005362	0	-356		NA	Pass
-10	nominal	450.005366	NA	NA	NA	NA	NA	450.005360	0	-108		NA	Pass
0	nominal	450.005546	450.005534	450.005514	450.005492	450.005476	450.005538	450.005482	78	0		NA	Pass
10	nominal	450.005404	NA	NA	NA	NA	NA	450.005432	0	-64		NA	Pass
20	15%	450.005508	NA	NA	NA	NA	NA	450.005434	40	-34		NA	Pass
20	nominal	450.005462	NA	NA	NA	NA	NA	450.005468	0	-6		NA	Pass
20	-15%	450.005426	NA	NA	NA	NA	NA	450.005348	0	-120		NA	Pass
30	nominal	450.006368	450.006326	450.006296	450.006270	450.006244	450.006220	450.006152	900	0		NA	Pass
40	nominal	450.005640	NA	NA	NA	NA	NA	450.005548	172	0		NA	Pass
50	nominal	450.005542	NA	NA	NA	NA	NA	450.005518	74	0	NA	Pass	
Mid frequency													
-30	nominal	459.998948	459.999042	459.999122	459.999182	459.998734	459.999274	459.998888	132	-408	NA	NA	Pass
-20	nominal	459.999064	NA	NA	NA	NA	NA	459.999156	14	-78		NA	Pass
-10	nominal	459.999126	NA	NA	NA	NA	NA	459.999126	0	-16		NA	Pass
0	nominal	459.999268	459.999262	459.999256	459.999250	459.999246	459.999168	459.999122	126	-20		NA	Pass
10	nominal	459.999202	NA	NA	NA	NA	NA	459.999120	60	-22		NA	Pass
20	15%	459.999194	NA	NA	NA	NA	NA	459.999028	52	-114		NA	Pass
20	nominal	459.999140	NA	NA	NA	NA	NA	459.999142	0	-2		NA	Pass
20	-15%	459.999092	NA	NA	NA	NA	NA	459.999132	0	-50		NA	Pass
30	nominal	459.999900	459.999870	459.999836	459.999810	459.999782	459.999760	459.999706	758	0		NA	Pass
40	nominal	459.999440	NA	NA	NA	NA	NA	459.999338	298	0		NA	Pass
50	nominal	459.999260	NA	NA	NA	NA	NA	459.999374	232	0	NA	Pass	
High frequency													
-30	nominal	469.992526	469.992752	469.992894	469.993016	469.992624	469.992696	469.992404	152	-460	NA	NA	Pass
-20	nominal	469.992838	NA	NA	NA	NA	NA	469.992946	82	-26		NA	Pass
-10	nominal	469.993020	NA	NA	NA	NA	NA	469.992886	156	0		NA	Pass
0	nominal	469.992980	469.992938	469.992918	469.992898	469.992956	469.992942	469.992884	116	0		NA	Pass
10	nominal	469.992924	NA	NA	NA	NA	NA	469.992758	60	-106		NA	Pass
20	15%	469.992810	NA	NA	NA	NA	NA	469.992648	0	-216		NA	Pass
20	nominal	469.993040	NA	NA	NA	NA	NA	469.992864	176	0		NA	Pass
20	-15%	469.992770	NA	NA	NA	NA	NA	469.992806	0	-94		NA	Pass
30	nominal	469.993428	469.993390	469.993396	469.993374	469.993352	469.993350	469.993282	564	0		NA	Pass
40	nominal	469.993270	NA	NA	NA	NA	NA	469.993126	406	0		NA	Pass
50	nominal	469.993088	NA	NA	NA	NA	NA	469.993378	514	0		NA	Pass

* - Reference frequency

** - Tested without limit

Reference numbers of test equipment used

HL 0808	HL 1870	HL 2263	HL 2468	HL 2634			
---------	---------	---------	---------	---------	--	--	--

Full description is given in Appendix A.

Test specification:	Section 90.214, Transient frequency behaviour		
Test procedure:	TIA/EIA-603-A, Section 2.2.19		
Test mode:	Compliance	Verdict:	PASS
Date & Time:	8/5/2005 2:57:33 PM		
Temperature: 24 °C	Air Pressure: 1005 hPa	Relative Humidity: 43 %	Power Supply: 3.6 Vdc
Remarks:			

7.6 Transient frequency behaviour test

7.6.1 General

This test was performed to measure carrier frequency drift as function of time during transmitter start up and shut down. Specification test limits are given in Table 7.6.1. The test results are provided in the associated plots.

Table 7.6.1 Transient frequency limits

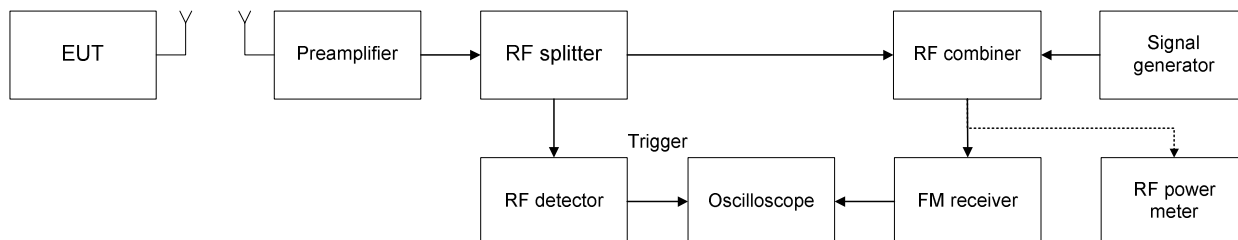
Channel bandwidth, kHz	Carrier frequency tolerance, kHz	Duration, ms	Time interval*
421.0 – 512.0 MHz band			
12.5	± 12.5	10.0	t ₁
	± 6.25	25.0	t ₂
	± 12.5	10.0	t ₃

* - t_{on} is the instant when a 1 kHz test signal is completely suppressed;
t₁ is the time period immediately following t_{on};
t₂ is the time period immediately following t₁;
t₃ is the time period from the instant when the transmitter is turned off until t_{off};
t_{off} is the instant when the 1 kHz test signal starts to rise.

7.6.2 Test procedure

- 7.6.2.1** The EUT was set up as shown in Figure 7.6.1, energized and its proper operation was checked. Variable attenuator was adjusted to provide signal level approximately 40 dB below the FM receiver maximum allowed level as measured with RF power meter. The EUT was turned off.
- 7.6.2.2** The signal generator was set to the assigned transmitter frequency modulated with 1 kHz tone at 25 kHz deviation and the output power was adjusted to provide the same as the EUT signal level at the FM receiver input as measured with power meter.
- 7.6.2.3** The storage oscilloscope was set to provide horizontal sweep rate 10 milliseconds per division. Amplitude control of the storage oscilloscope was adjusted to obtain 1 kHz sinusoidal signal vertically centered with ± 4 divisions amplitude.
- 7.6.2.4** The variable attenuator was adjusted to increase RF level supplied to splitter by 30 dB and the EUT was consequently turned on and off. Transient frequency during power switching was captured and shown in the associated plots.

Figure 7.6.1 Transient frequency test setup





Test specification:	Section 90.214, Transient frequency behaviour			
Test procedure:	TIA/EIA-603-A, Section 2.2.19			
Test mode:	Compliance	Verdict:		PASS
Date & Time:	8/5/2005 2:57:33 PM			
Temperature: 24 °C	Air Pressure: 1005 hPa	Relative Humidity: 43 %	Power Supply: 3.6 Vdc	
Remarks:				

Table 7.6.2 Transient frequency behaviour test results

Carrier frequency, MHz	Time interval	Duration, ms	Frequency tolerance, kHz	Limit, kHz	Margin, kHz	Verdict
450.00625	t ₁	10.0	>25*	± 12.5	NA*	Pass
	t ₂	25.0	0	± 6.25	6.25	
	t ₃	10.0	-9.375	± 12.5	-3.125	
460.00000	t ₁	10.0	>25*	± 12.5	NA*	Pass
	t ₂	25.0	0	± 6.25	6.25	
	t ₃	10.0	11.250	± 12.5	-1.250	
469.99375	t ₁	10.0	>25*	± 12.5	NA*	Pass
	t ₂	25.0	0	± 6.25	6.25	
	t ₃	10.0	-7.8125	± 12.5	-4.687	

*NOTE: If the transmitter carrier output power rating is 6 watts or less, the frequency difference during this time period may exceed the maximum frequency difference for this time period.

Reference numbers of test equipment used

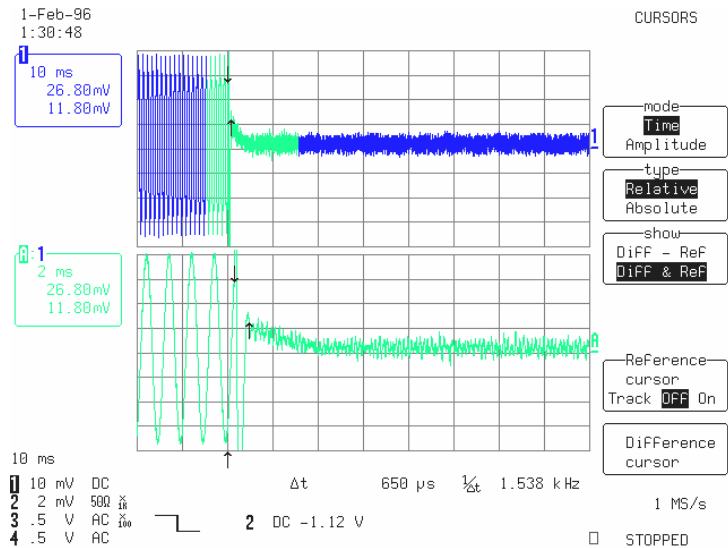
HL 0661	HL 0670	HL 0788	HL 1653	HL 1907	HL 1956	HL 2014	HL 2254
HL 2400	HL 2634						

Full description is given in Appendix A.

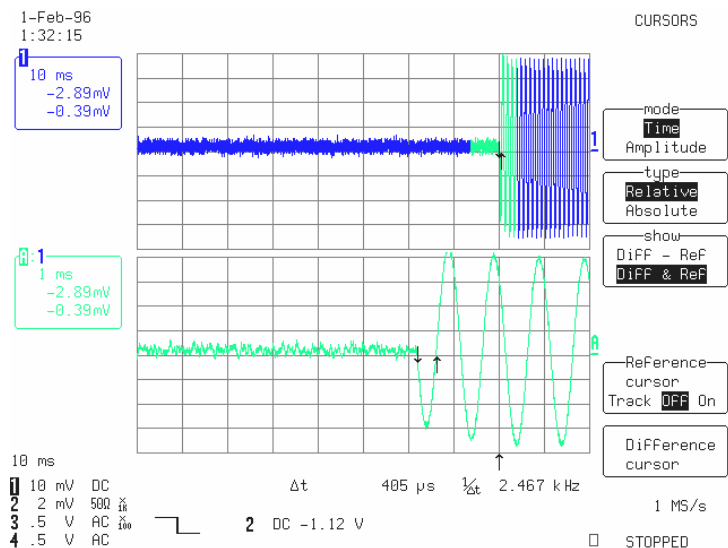


Test specification:		Section 90.214, Transient frequency behaviour	
Test procedure:		TIA/EIA-603-A, Section 2.2.19	
Test mode:		Compliance	Verdict: PASS
Date & Time:		8/5/2005 2:57:33 PM	
Temperature: 24 °C		Air Pressure: 1005 hPa	Relative Humidity: 43 %
Remarks:		Power Supply: 3.6 Vdc	

Plot 7.6.1 Transient frequency during power ON test results at low carrier frequency



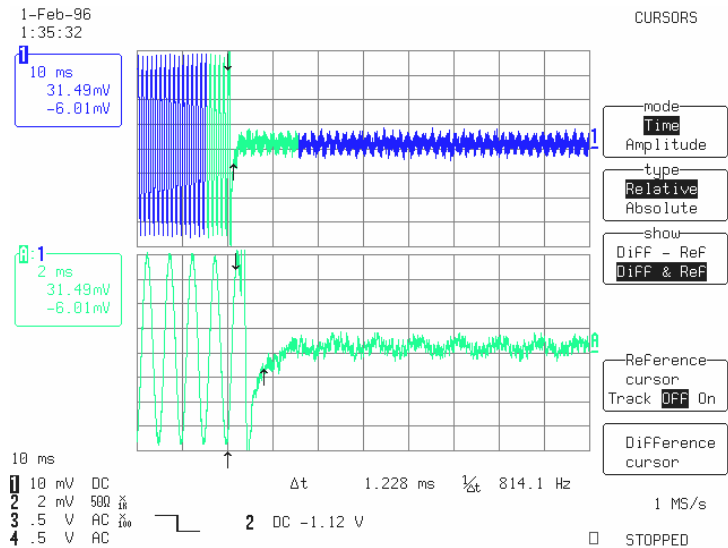
Plot 7.6.2 Transient frequency during power OFF test results at low carrier frequency



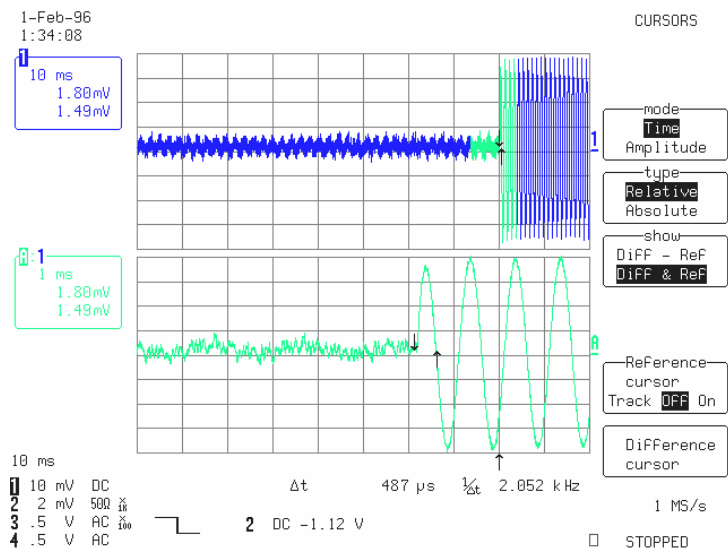


Test specification:		Section 90.214, Transient frequency behaviour	
Test procedure:		TIA/EIA-603-A, Section 2.2.19	
Test mode:		Compliance	Verdict: PASS
Date & Time:		8/5/2005 2:57:33 PM	
Temperature: 24 °C		Air Pressure: 1005 hPa	Relative Humidity: 43 %
Remarks:		Power Supply: 3.6 Vdc	

Plot 7.6.3 Transient frequency during power ON test results at mid carrier frequency



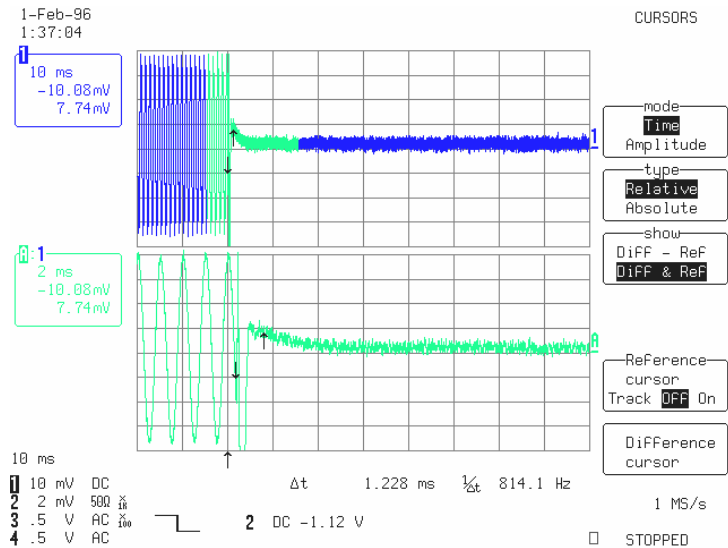
Plot 7.6.4 Transient frequency during power OFF test results at mid carrier frequency



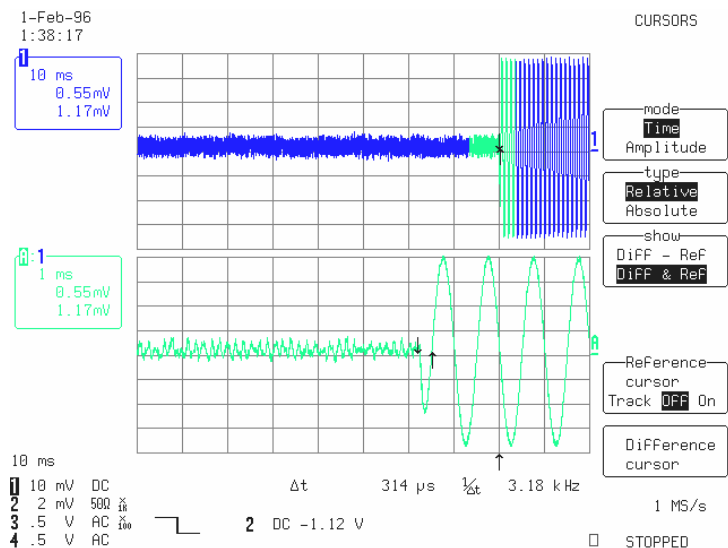


Test specification:		Section 90.214, Transient frequency behaviour	
Test procedure:		TIA/EIA-603-A, Section 2.2.19	
Test mode:		Compliance	Verdict: PASS
Date & Time:		8/5/2005 2:57:33 PM	
Temperature: 24 °C		Air Pressure: 1005 hPa	Relative Humidity: 43 %
Remarks:		Power Supply: 3.6 Vdc	

Plot 7.6.5 Transient frequency during power ON test results at high carrier frequency



Plot 7.6.6 Transient frequency during power OFF test results at high carrier frequency





Test specification:		Section 15.109, Radiated emission	
Test procedure:		ANSI C63.4, Sections 11.6 and 12.1.4	
Test mode:	Compliance	Verdict:	PASS
Date & Time:	8/8/2005 9:18:12 AM		
Temperature: 25 °C	Air Pressure: 1007 hPa	Relative Humidity: 39 %	Power Supply: 3.6 Vdc
Remarks:			

7.7 Radiated emission measurements

7.7.1 General

This test was performed to measure radiated emissions from the EUT enclosure. Specification test limits are given in Table 7.7.1.

Table 7.7.1 Radiated emission test limits

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

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

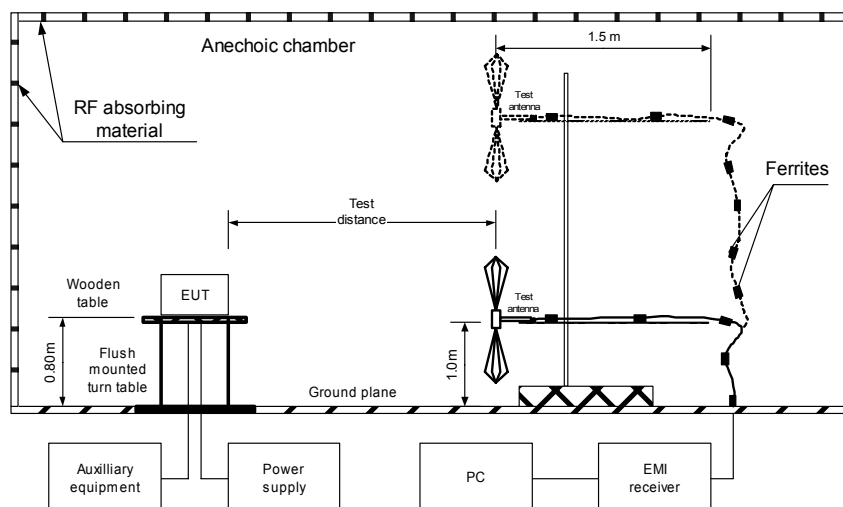
7.7.2 Test procedure for measurements in semi-anechoic chamber

7.7.2.1 The EUT was set up as shown in Figure 7.7.1 and associated photograph/s, energized and the performance check was conducted.

7.7.2.2 The specified frequency range was investigated with biconilog antenna connected to EMI receiver. To find maximum radiation the turntable was rotated 360°, the measuring antenna height was changed from 1 to 4 m, its polarization was switched from vertical to horizontal and the EUT cables position was varied.

7.7.2.3 The worst test results (the lowest margins) were recorded in Table 7.7.2 and shown in the associated plots.

Figure 7.7.1 Setup for radiated emission measurements in anechoic chamber, table-top equipment





Test specification:	Section 15.109, Radiated emission		
Test procedure:	ANSI C63.4, Sections 11.6 and 12.1.4		
Test mode:	Compliance	Verdict:	PASS
Date & Time:	8/8/2005 9:18:12 AM		
Temperature: 25 °C	Air Pressure: 1007 hPa	Relative Humidity: 39 %	Power Supply: 3.6 Vdc
Remarks:			

Table 7.7.2 Radiated emission test results

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

Frequency, MHz	Peak emission, dB(μV/m)	Quasi-peak			Antenna polarization	Antenna height, m	Turn-table position**, degrees	Verdict
		Measured emission, dB(μV/m)	Limit, dB(μV/m)	Margin, dB*				
No 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 1425	HL 1553	HL 1566	HL 1826	HL 1849	HL 1850	HL 2109	HL 2697
---------	---------	---------	---------	---------	---------	---------	---------

Full description is given in Appendix A.

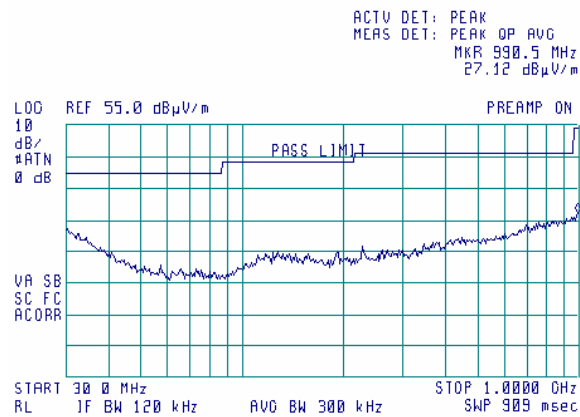


Test specification:		Section 15.109, Radiated emission	
Test procedure:		ANSI C63.4, Sections 11.6 and 12.1.4	
Test mode:	Compliance	Verdict:	PASS
Date & Time:	8/8/2005 9:18:12 AM		
Temperature: 25 °C	Air Pressure: 1007 hPa	Relative Humidity: 39 %	Power Supply: 3.6 Vdc
Remarks:			

Plot 7.7.1 Radiated emission measurements in 30- 1000 MHz range, vertical antenna polarization

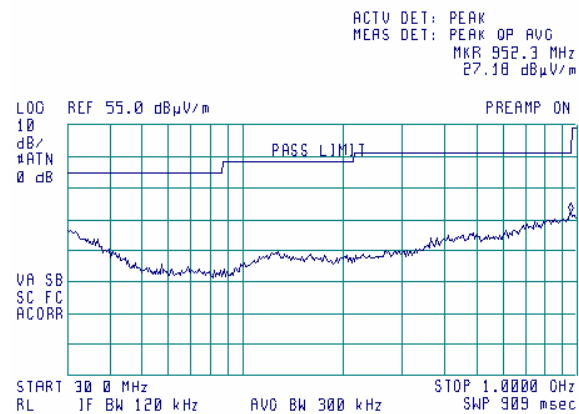
TEST SITE: Anechoic chamber
LIMIT: Class B
TEST DISTANCE: 3 m
EUT OPERATING MODE: Receive / Stand-by

08:46:39 AVG 08, 2005

**Plot 7.7.2 Radiated emission measurements in 30- 1000 MHz range, horizontal antenna polarization**

TEST SITE: Anechoic chamber
LIMIT: Class B
TEST DISTANCE: 3 m
EUT OPERATING MODE: Receive / Stand-by

08:47:50 AVG 08, 2005



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

HL No	Description	Manufacturer	Model	Ser. No.	Last Cal.	Due Cal.
0029	Antenna, Dipole, Tunable 200 -500 MHz	Electro-Metrics	TDS-25/30-1	297	29-Jan-05	29-Jan-06
0415	Cable, Coax, RF, RG-214	HL	CC-3	056	02-Dec-04	02-Dec-05
0446	Antenna, Loop active, 10kHz-30MHz	EMCO	6502	2857	28-Jun-05	28-Jun-06
0521	EMI Receiver (Spectrum Analyzer) with RF filter section 9 kHz-6.5 GHz	Hewlett Packard	8546A	3617A 00319, 3448A002 53	26-Sep-04	26-Sep-05
0569	Antenna, Log Periodic, 200 - 1000 MHz	Electro-Metrics	LPA 25/30	1953	12-Jan-05	12-Jan-06
0589	Cable Coaxial, GORE A2P01POL118, 2.3 m	HL	GORE-3	176	02-Dec-04	02-Dec-05
0604	Antenna BiconiLog Log-Periodic/T Bow-TIE 26 - 2000 MHz	EMCO	3141	9611-1011	10-Jan-05	10-Jan-06
0661	Generator Swept Signal, 10 MHz to 40 GHz, + 10 dBm	Hewlett Packard	83640B	3614A002 66	14-Sep-04	14-Sep-05
0670	Oscilloscope, Digital storage 500 MHz, 2 Gs/s, 4 ch with Telecom Mask Tester	LeCroy Corporation	LC 334A	lc3340238 7	16-Aug-05	16-Aug-06
0788	Power splitter/combiner 5-500 MHz	Mini-Circuits	ZFSC-2-1	923705	01-Jul-05	01-Jul-06
0808	Analyzer Spectrum 100 Hz to 2.2 GHz	Anritsu	MS2601B	M178731	27-Mar-05	27-Mar-06
0812	Cable Coax, RG-214, 11.5 m, N-type connectors	HL	C214-11	148	02-Dec-04	02-Dec-05
1424	Spectrum Analyzer, 30 Hz- 40 GHz	Agilent Technologies (HP)	8564EC	3946A002 19	30-Aug-04	30-Aug-05
1425	EMI Receiver, 9 kHz - 2.9 GHz, System: HL1426, HL1427	Agilent Technologies (HP)	8542E	3710A002 22, 3705A002 04	01-Sep-04	01-Sep-05
1430	EMI Receiver, 9 kHz - 2.9 GHz, System: HL1431, HL1432	Agilent Technologies (HP)	8542E	3807A002 62,3705A0 0217	01-Sep-04	01-Sep-05
1553	Cable RF, 3.5 m	Alpha Wire	RG-214	1553	02-Dec-04	02-Dec-05
1566	Cable RF, 2 m	Huber-Suhner	Sucoflex 104PE	13094/4PE	02-Dec-04	02-Dec-05
1653	Analyzer EMC 9 kHz - 1.5 GHz	Agilent Technologies (HP)	E7401A	US394402 81	06-Feb-05	06-Feb-06
1826	Antenna mast and Turntable position controller (Small Anechoic chamber)	Sh. I. Machines	CRL-4	1	13-May-05	13-May-06
1849	Antenna mast with polarity control (Small Anechoic chamber)	Sh. I. Machines	AM-F4	1849	06-Feb-05	06-Feb-06
1850	Turntable	Sh. I. Machines	TT-M-3	1850	06-Feb-05	06-Feb-06
1870	Oven Temperature, 220 VAC	Tenney Engineering		1870	28-Apr-05	28-Apr-06
1907	Power Splitter / Combiner, 5-500 MHz	Mini-Circuits	ZFSC-2-1	1907	28-Apr-05	28-Apr-06
1947	Cable 18GHz, 6.5 m, blue	Rhophase Microwave Limited	NPS-1803A-6500-NPS	T4974	28-Apr-05	28-Apr-06
1956	Cable, 0.5m BNC/BNC	Telequis	RG-58		17-Oct-04	17-Oct-05
1984	Antenna, Double-Ridged Waveguide Horn, 1-18 GHz, 300 W, N-type	EMC Test Systems	3115	9911-5964	22-Mar-05	22-Mar-06
2009	Cable RF, 8 m	Alpha Wire	RG-214	C-56	02-Dec-04	02-Dec-05
2014	Attenuator, Manual Step, 0-99/1 dB, 0-4 GHz, 2 W	Weinschel	AC9004-99-11	16924	08-Dec-04	08-Dec-05
2109	Anechoic Chamber 6(L) x 5.5(W) x	HL	AC-2	2109	12-Dec-04	12-Dec-05



HERMON LABORATORIES

Report ID: MILRAD_FCC.16356_rev1.doc
Date of Issue: 8/16/2005

HL No	Description	Manufacturer	Model	Ser. No.	Last Cal.	Due Cal.
	2.95(H) m					
2254	Cable 40GHz, 0.8 m, blue	Rhophase Microwave Limited	KPS-1503A-800-KPS	W4907	24-Jun-05	24-Jun-06
2259	Amplifier Low Noise 2-20 GHz	Sophia Wireless	LNA0220-C	0223	12-Dec-04	12-Dec-05
2263	Humidity and Temperature Controller	HL	HTCL-6	2263	21-Apr-05	21-Apr-06
2400	Cable 40GHz, 1.5 m, green	Rhophase Microwave Limited	KPS-1503A-1500-KPS	X2946	24-Jun-05	24-Jun-06
2468	Cable RF, 3.4 m	Coleman	M17/84-RG223	2468	24-Jun-05	24-Jun-06
2634	Power Supply, 0-36.0 VDC, 0-12.0 A	Nemic-Lambda	UP36-12	2634	24-Jun-05	24-Jun-06
2697	Antenna, 30 MHz - 3.0 GHz,	Sunol Sciences. Corp. Pleasanton, California USA	JB3	A022805	10-Mar-05	10-Mar-06

**9 APPENDIX B Measurement uncertainties****Expanded uncertainty at 95% confidence in Hermon Labs EMC measurements**

Test description	Expanded uncertainty
Transmitter tests	
Carrier power conducted at antenna connector	± 1.7 dB
Carrier power radiated (substitution method)	± 4.5 dB
Occupied bandwidth	$\pm 8\%$
Conducted emissions at RF antenna connector	9 kHz to 2.9 GHz: ± 2.6 dB 2.9 GHz to 6.46 GHz: ± 3.5 dB 6.46 GHz to 13.2 GHz: ± 4.3 dB 13.2 GHz to 22.0 GHz: ± 5.0 dB 22.0 GHz to 26.8 GHz: ± 5.5 dB 26.8 GHz to 40.0 GHz: ± 4.8 dB
Spurious emissions radiated 30 MHz – 40 GHz (substitution method)	± 4.5 dB
Frequency error	30 – 300 MHz: ± 50.5 Hz (1.68 ppm) 300 – 1000 MHz: ± 168 Hz (0.56 ppm)
Transient frequency behaviour	187 Hz $\pm 13.9\%$
Duty cycle, timing (Tx ON / OFF) and average factor measurements	$\pm 1.0\%$
Unintentional radiator tests	
Radiated emissions at 3 m measuring distance	
Horizontal polarization	Biconilog antenna: ± 5.3 dB Biconical antenna: ± 5.0 dB Log periodic antenna: ± 5.3 dB
Vertical polarization	Double ridged horn antenna: ± 5.3 dB Biconilog antenna: ± 6.0 dB Biconical antenna: ± 5.7 dB Log periodic antenna: ± 6.0 dB Double ridged horn antenna: ± 6.0 dB

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.



10 APPENDIX C 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).

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

Person for contact: Mr. Alex Usoskin, CEO.

11 APPENDIX D Specification references

47CFR part 90: 2004	Private land mobile radio services
47CFR part 1: 2004	Practice and procedure
47CFR part 2: 2004	Frequency allocations and radio treaty matters; general rules and regulations
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.
ANSI/TIA/EIA-603-A:2001	Land Mobile FM or PM Communications Equipment Measurement and Performance Standards

**12 APPENDIX E Abbreviations and acronyms**

A	ampere
AC	alternating current
A/m	ampere per meter
AM	amplitude modulation
AVRG	average (detector)
BB	broad band
cm	centimeter
dB	decibel
dBm	decibel referred to one milliwatt
dB(μ V)	decibel referred to one microvolt
dB(μ V/m)	decibel referred to one microvolt per meter
dB(μ A)	decibel referred to one microampere
dB Ω	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
ITE	information technology equipment
k	kilo
kHz	kilohertz
LISN	line impedance stabilization network
LO	local oscillator
m	meter
MHz	megahertz
min	minute
mm	millimeter
ms	millisecond
μ s	microsecond
NA	not applicable
NB	narrow band
NT	not tested
OATS	open area test site
Ω	Ohm
QP	quasi-peak
PCB	printed circuit board
PM	pulse modulation
PS	power supply
RE	radiated emission
RF	radio frequency
rms	root mean square
Rx	receive
s	second
T	temperature
Tx	transmit
V	volt
VA	volt-ampere

**13 APPENDIX F Test equipment correction factors**

Antenna Factor
Active Loop Antenna
EMC Test Systems, model 6502, serial number 2857

Frequency, MHz	Magnetic Antenna Factor, dB(S/m)	Electric Antenna Factor, dB(1/m)
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	9.7
0.750	-41.9	9.6
1.000	-41.4	10.1
2.000	-41.5	10.0
3.000	-41.4	10.1
4.000	-41.4	10.1
5.000	-41.5	10.0
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(S/m) is to be added to receiver meter reading in dB(μ V) to convert it into field intensity in dB(μ A/m).
Antenna factor in dB(1/m) is to be added to receiver meter reading in dB(μ V) to convert it into field intensity in dB(μ V/m).



Biconical antenna factor
Electro-Metrics, model BIA-25/30, serial number 3566

Frequency, MHz	Antenna factor, dB(1/m)	Frequency, MHz	Antenna factor, dB(1/m)
20	14.1	115	15.2
25	14.5	120	14.9
30	13.8	125	13.5
35	11.9	130	13.5
40	11.5	135	13.0
45	11.7	140	12.7
50	11.4	145	12.9
55	10.6	150	14.7
60	10.4	155	15.0
65	9.0	160	15.0
70	7.8	165	15.5
75	7.6	170	15.9
80	7.5	175	16.6
85	7.9	180	17.1
90	9.5	185	17.5
95	10.9	190	17.9
100	11.9	195	18.0
105	12.4	200	18.1
110	13.5		

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

Log periodic antenna factor
Electro-Metrics, model LPA-25/30, serial number 1953

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(μ V) to convert it into field intensity in dB(μ V/m).



Antenna factor

Biconilog antenna EMCO, model 3141, serial number 1011

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

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



Antenna factor
Double-ridged wave guide horn antenna
EMC Test Systems, model 3115, serial no: 9911-5964

Frequency, MHz	Antenna gain, dBi	Antenna factor. dB(1/m)
1000.0	5.8	24.5
1500.0	9.0	24.8
2000.0	8.6	27.7
2500.0	9.5	28.7
3000.0	8.9	30.8
3500.0	8.2	32.9
4000.0	9.6	32.7
4500.0	11.2	32.1
5000.0	10.6	33.6
5500.0	9.8	35.3
6000.0	10.1	35.7
6500.0	10.7	35.8
7000.0	10.9	36.2
7500.0	10.5	37.2
8000.0	11.1	37.2
8500.0	10.8	38.1
9000.0	10.7	38.6
9500.0	11.5	38.3
10000.0	11.8	38.4
10500.0	12.3	38.3
11000.0	12.3	38.8
11500.0	11.5	39.9
12000.0	12.2	39.6
12500.0	12.6	39.5
13000.0	12.0	40.5
13500.0	11.7	41.1
14000.0	11.7	41.5
14500.0	12.7	40.8
15000.0	14.2	39.5
15500.0	16.0	38.1
16000.0	16.2	38.1
16500.0	14.5	40.1
17000.0	12.2	42.6
17500.0	9.7	45.4
18000.0	6.6	48.7

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

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

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	-8.3	0.01	625	19.7	6.3	4.27	1215	24.9	7.0	5.05	1810	28.3	7.1	5.08
35	-19.5	-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
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
45	-11.3	-8.1	0.16	635	19.7	6.5	4.48	1230	25.2	6.8	4.82	1825	28.7	6.8	4.75
45	-11.3	-8.1	0.16	640	19.9	6.4	4.40	1235	25.1	7.0	4.86	1830	28.7	6.8	4.76
50	-8.9	-4.7	0.34	645	19.6	6.5	4.45	1240	25.0	7.1	5.09	1835	28.7	6.7	4.72
55	-7.9	-2.9	0.82	650	19.9	6.5	4.51	1245	25.0	7.1	5.12	1840	28.8	6.7	4.66
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
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
70	-9.0	-1.9	0.64	665	19.9	6.7	4.70	1260	24.9	7.3	5.36	1855	28.5	7.0	5.07
75	-11.1	-1.0	0.78	670	20.0	6.7	4.71	1265	25.0	7.3	5.31	1860	28.6	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
85	-8.0	0.8	1.20	680	20.1	6.7	4.71	1275	25.3	7.0	5.05	1870	28.4	7.3	5.33
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
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
100	-10.0	0.4	0.92	695	20.2	6.9	4.82	1290	25.3	7.1	5.10	1885	28.5	7.2	5.22
105	-11.7	-1.1	0.78	700	20.3	6.8	4.76	1295	25.3	7.2	5.22	1890	28.6	7.2	5.21
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
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	5.27
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
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
130	-14.2	-1.7	0.68	725	20.6	6.8	4.81	1320	25.3	7.3	5.36	1915	28.5	7.3	5.38
135	-13.8	-1.0	0.79	730	20.7	6.8	4.77	1325	25.5	7.2	5.21	1920	28.6	7.3	5.31
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
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
150	-12.9	0.8	1.21	745	21.0	6.8	4.59	1340	25.6	7.2	5.23	1935	28.6	7.4	5.54
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
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	5.59
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
170	-12.2	2.6	1.83	765	21.1	6.8	4.73	1360	25.9	6.9	4.85	1955	28.6	7.5	5.57
175	-11.8	3.3	2.13	770	21.3	6.8	4.84	1365	26.0	6.8	4.85	1960	28.6	7.6	5.65
180	-11.6	3.7	2.36	775	21.3	6.7	4.65	1370	26.0	7.0	4.96	1965	28.7	7.4	5.47
185	-11.5	4.0	2.54	780	21.3	6.7	4.72	1375	26.0	7.0	5.01	1970	28.9	7.2	5.29
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
195	-12.1	3.9	2.47	790	21.3	6.8	4.82	1385	26.0	7.0	5.09	1980	29.0	7.1	5.16
200	-13.1	3.2	2.07	795	21.3	6.8	4.79	1390	26.1	6.9	4.79	1985	29.1	7.1	5.11
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
210	-11.0	5.6	3.66	805	21.6	6.7	4.71	1400	26.2	7.0	4.96	1995	29.1	7.1	5.09
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
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
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
230	-11.9	5.5	3.57	825	21.8	6.8	4.85	1420	26.3	7.0	4.98	2015	29.2	7.1	5.13
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
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
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
250	-12.3	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
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
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
265	-12.5	5.6	3.54	860	22.1	6.8	4.74	1455	26.4	7.1	5.07	2050	29.2	7.2	5.27
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
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
280	-13.7	5.4	3.50	875	22.0	7.1	5.08	1470	26.4	7.2	5.22	2065	29.4	7.1	5.08
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
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	5.07
295	-13.8	5.8	3.77	890	22.2	7.0	5.06	1485	26.5	7.1	5.14	2080	29.6	6.8	4.76
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	4.88
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
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
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
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
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	4.78
330	-14.6	5.9	3.93	925	22.7	6.9	4.85	1520	26.5	7.3	5.36	2115	29.9	6.8	4.76
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
340	-14.7	6.2	4.12	935	22.8	6.8	4.83	1530	26.6	7.3	5.36	2125	29.9	6.9	4.89
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
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
355	-15.9	5.9	3.88	950	22.8	6.9	4.85	1545	26.6	7.5	5.58	2140	29.8	7.1	5.08
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
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
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
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
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
385	-15.7	6.2	4.15	980	23.4	6.6	4.54	1575	27.0	7.1	5.25	2170	29.9	7.1	5.07
390	-15.7	6.3	4.25	985	23.5	6.6	4.52	1580	27.0	7.1	5.17	2175	29.8	7.2	5.20
395	-15.9	6.3	4.22	990	23.6	6.5	4.50	1585	27.0	7.2	5.20	2180	29.8	7.2	5.27
400	-16.0	6.2	4.18	995	23.6	6.5	4.48	1590	27.0	7.2	5.22	2185	29.8	7.2	5.27
405	-16.3	6.1	4.07	1000	23.7	6.5	4.46	1595	27.0	7.2	5.29	2190	29.8	7.2	5.28
410	-16.5	6.0	3.96	1005	23.7	6.5	4.51	1600	27.0	7.3	5.36	2195	29.8	7.2	5.30
415	-16.5	6.0	4.00	1010	23.7	6.6	4.57	1605	27.0	7.3	5.38	2200	29.7	7.3	5.38
420	-16.1	6.1	4.03	1015	23.7	6.7	4.65	1610	27.0	7.3	5.41	2205	29.7	7.4	5.41
425	-16.6	6.1	4.10	1020	23.8	6.6	4.54	1615	27.1	7.3	5.33	2210	29.7	7.4	5.47
430	-16.7	6.2	4.16	1025	23.8	6.6	4.62	1620	27.2	7.2	5.27	2215	29.7	7.4	5.54
435	-16.9	6.1	4.05	1030	23.7	6.7	4.70	1625	27.2	7.2	5.30	2220	29.7	7.5	5.57
440	-17.1	5.9	3.93	1035	23.7	6.8	4.81	1630	27.2	7.3	5.33	2225	29.8	7.3	5.43
445	-17.2	6.0	3.97	1040	23.6	6.9	4.92	1635	27.2	7.3	5.35	2230			



Cable loss
Cable Coaxial, RG-58/RG-214, s/n 056, HL 0415
+ Cable Coaxial, RG-214, 11.5m, s/n 148, HL 0812

No.	Frequency, MHz	Cable loss, dB	Measured uncertainty, dB
1	20	0.73	±0.12
2	30	0.91	
3	50	1.2	
4	80	1.56	
5	100	1.76	
6	200	2.59	
7	300	3.26	
8	400	3.93	
9	500	4.42	
10	600	4.92	
11	700	5.36	
12	800	5.88	
13	900	6.41	
14	1000	6.71	
15	1500	8.63	
16	2000	10.39	



Cable loss
Cable Coaxial, GORE A2P01POL118, 2.3 m, model:GORE-3, HL 0589
+ Cable Coaxial, ANDREW PSWJ4, 6m, model: ANDREW-6, HL 1004

No.	Frequency, MHz	Cable loss, dB	Tolerance (Specification), dB	Measurement uncertainty, dB
1	30	0.33	≤ 6.5	± 0.12
2	50	0.40		
3	100	0.57		
4	300	0.97		
5	500	1.25		
6	800	1.59		
7	1000	1.81		
8	1200	1.97		
9	1400	2.15		
10	1600	2.28		
11	1800	2.43		
12	2000	2.61		
13	2200	2.75		
14	2400	2.89		
15	2600	2.97		
16	2800	3.21	≤ 6.5	± 0.12
17	3000	3.32		
18	3300	3.47		± 0.17
19	3600	3.62		
20	3900	3.84		
21	4200	3.92		
22	4500	4.07		
23	4800	4.36		
24	5100	4.62		
25	5400	4.78		
26	5700	5.16		
27	6000	5.67		
28	6500	5.99		



Cable loss
RF cable 3.5 m, Alpha Wire, model RG-214, S/N 149, HL 1553

No.	Frequency, MHz	Cable loss, dB	Measurement uncertainty, dB
1	1	0.01	±0.05
2	10	0.07	
3	30	0.12	
4	50	0.22	
5	100	0.26	
6	200	0.40	
7	300	0.52	
8	400	0.60	
9	500	0.70	
10	600	0.77	
11	700	0.84	
12	800	1.00	
13	900	1.00	
14	1000	1.05	
15	2000	1.70	



Cable loss
Cable RF, 2m, model: Sucoflex 104PE, S/N 13094/4PE, HL 1566

No.	Frequency, MHz	Cable loss, dB	Tolerance, dB	Measurement uncertainty, dB
1	30	0.10	≤ 5.0	± 0.12
2	50	0.13		
3	100	0.20		
4	300	0.33		
5	500	0.45		
6	800	0.60		
7	1000	0.65		
8	1500	0.91		
9	2000	1.08		
10	2500	1.19		
11	3000	1.28		
12	3500	1.49		
13	4000	1.63		
14	4500	1.63	≤ 5.0	± 0.17
15	5000	1.66		
16	5500	1.88		
17	6000	1.96		
18	6500	1.93		
19	7000	2.07		
20	7500	2.37		
21	8000	2.34		
22	8500	2.64		
23	9000	2.68		
24	9500	2.64		
25	10000	2.70		
26	10500	2.84		
27	11000	2.88		
28	11500	3.19		
29	12000	3.15		
30	12500	3.20	≤ 5.0	± 0.26
31	13000	3.22		
32	13500	3.47		
33	14000	3.41		
34	14500	3.59		
35	15000	3.79		
36	15500	4.24		
37	16000	4.12		
38	16500	4.46		
39	17000	4.50		
40	17500	4.49		
41	18000	4.45		



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	0.64	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, green, Rhophase Microwave Limited, model: KPS-1503A-1500-KPS, HL 2400

Frequency, GHz	Cable loss, dB	Frequency, GHz	Cable loss, dB	Frequency, GHz	Cable loss, dB
0.03	0.06	6.5	1.46	15.50	2.34
0.05	0.08	6.7	1.49	16.00	2.34
0.1	0.15	6.9	1.50	16.50	2.40
0.2	0.23	7.1	1.51	17.00	2.46
0.3	0.29	7.3	1.55	17.50	2.54
0.5	0.37	7.5	1.56	18.00	2.61
0.7	0.46	7.7	1.58	18.50	2.59
0.9	0.53	7.9	1.60	19.00	2.59
1.1	0.58	8.1	1.61	19.50	2.67
1.3	0.65	8.3	1.68	20.00	2.62
1.5	0.66	8.5	1.68	20.50	2.73
1.7	0.72	8.7	1.75	21.00	2.71
1.9	0.76	8.9	1.74	21.50	2.78
2.1	0.79	9.1	1.81	22.00	2.83
2.3	0.85	9.3	1.79	22.50	2.81
2.5	0.90	9.5	1.86	23.50	2.91
2.7	0.91	9.7	1.85	24.00	2.97
2.9	0.97	9.9	1.87	24.50	2.98
3.1	0.97	10.1	1.88	25.00	2.97
3.3	1.03	10.30	1.82	25.50	3.03
3.5	1.06	10.50	1.92	26.00	3.04
3.7	1.10	10.70	1.86	26.50	3.11
3.9	1.13	10.90	1.96	27.00	2.97
4.1	1.16	11.10	1.90	28.00	3.15
4.3	1.18	11.30	1.99	29.00	3.07
4.5	1.21	11.50	1.95	30.00	3.13
4.7	1.23	11.70	2.00	31.00	3.13
4.9	1.26	11.90	2.01	32.00	3.18
5.1	1.28	12.10	1.99	33.00	3.31
5.3	1.31	12.40	2.06	34.00	3.32
5.5	1.32	13.00	2.11	35.00	3.37
5.7	1.36	13.50	2.17	36.00	3.36
5.9	1.37	14.00	2.36	37.00	3.46
6.1	1.38	14.50	2.32	39.00	3.49
6.3	1.44	15.00	2.30	40.00	3.52