HERMON LABORATORIES

839.01
Electrical

Hermon Laboratories Ltd.
Harakevet Industrial Zone, Binyamina 30500,
Israel
Tel. +972-4-6288001
Fax. +972-4-6288277
E-mail: mail@hermonlabs.com

TEST REPORT

ACCORDING TO: FCC CFR 47 PART 90 §90.217(b)

FOR:

Miltel Communications Ltd

Wireless transmitter for data collection

Model:Galaxy PIT

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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:	yarum@miltelcom.com
Contact name:	Mr. Yarum Locker

2 Equipment under test attributes

Product name:	Wireless transmitter for data collection
Model(s):	Galaxy PIT
Receipt date	5/20/2008

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:	yarum@miltelcom.com
Contact name:	Mr. Yarum Locker

4 Test details

Project ID:	18809
Location:	Hermon Laboratories Ltd. Harakevet Industrial Zone, Binyamina 30500, Israel
Test started:	5/20/2008
Test completed:	9/08/2008
Test specification(s):	47CFR part 90, §§90.217(b)

5 Tests summary

Test	Status
Transmitter characteristics	
Section 90.205, Maximum output power	Pass
Section 90.209, Occupied bandwidth	Pass
Section 90.213, Frequency stability	Tested with no limit
Section 90.214, Transient frequency behaviour	Not required
Section 90.217, Band edge emission	Pass
Section 90.217, Radiated spurious emissions	Pass

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

	Name and Title	Date	Signature
Tested by:	Mr. L. Markel, test engineer	September 8, 2008	
Reviewed by:	Mrs. M. Cherniavsky, certification engineer	September 11, 2008	
Approved by:	Mr. M. Nikishin, EMC and radio group leader	September 12, 2008	

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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. The EUT is intended for installation in a metal meter pit with a composite lid such as a cast Ford Meter Box (Ford Yokebox model YUC-x or within an equivalent meter pit). The EUT was tested within the pit with a composite lid cover.

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

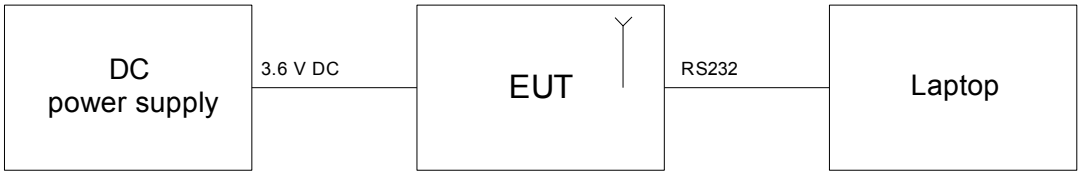
6.4 Operating frequencies

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



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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)	15.58 dBm

Is transmitter output power variable?	X	No		
			continuous variable	
			stepped variable with stepsize	dB
			minimum RF power	dBm
			maximum RF power	dBm

Antenna connection			
unique coupling	standard connector	X integral	with temporary RF connector
			X 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					
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:	9/9/2008 7:21:29 PM		
Temperature: 25ºC	Air Pressure: 1006 hPa	Relative Humidity: 60%	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(μV/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×P×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 360^0, 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:	9/9/2008 7:21:29 PM		
Temperature: 25ºC	Air Pressure: 1006 hPa	Relative Humidity: 60%	Power Supply: 3.6 VDC
Remarks:			

Figure 7.1.1 Setup for carrier field strength measurements

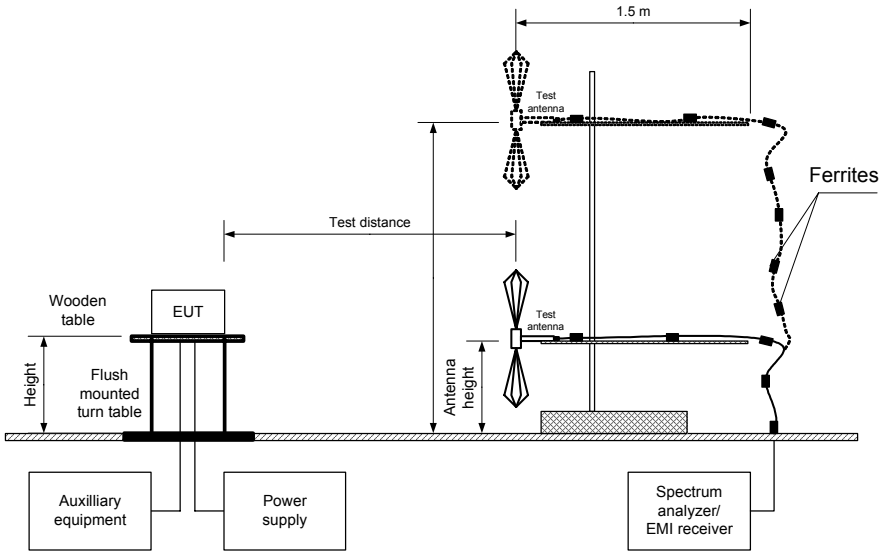
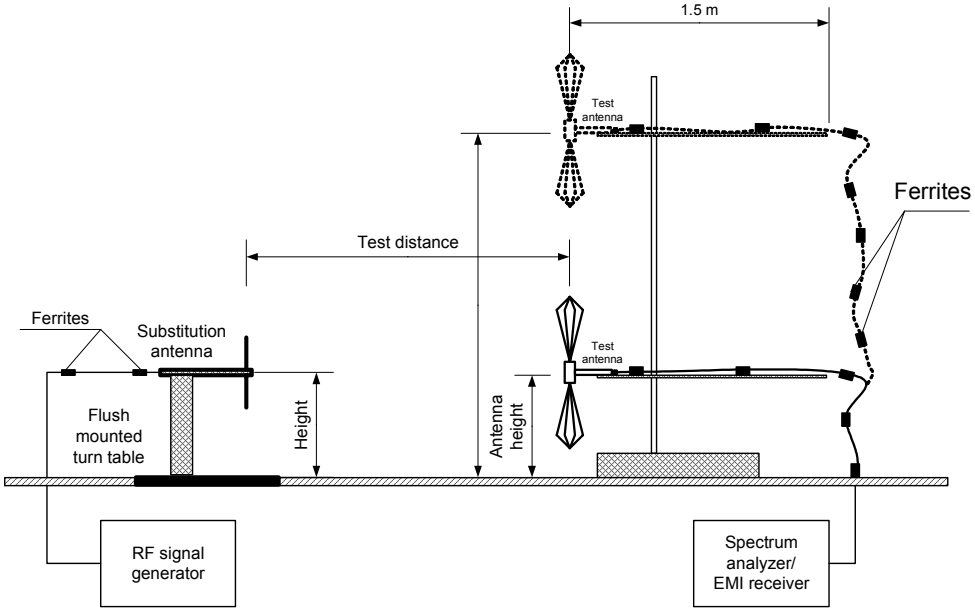


Figure 7.1.2 Setup for substitution ERP measurements



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:	9/9/2008 7:21:29 PM		
Temperature: 25ºC	**Air Pressure:** 1006 hPa	**Relative Humidity:** 60%	**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
450.00625	109.94	118.2	-8.26	120	Vertical	1.0	0
450.00625	103.91		-13.52		Horizontal	2.5	30
460.00000	112.19		-6.01		Vertical	1.0	0
460.00000	106.66		-11.54		Horizontal	2.0	30
469.99375	114.36		-3.84		Vertical	1.0	0
469.99375	108.85		-9.35		Horizontal	2.2	30

*****- 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
450.00625	109.94	120	Vertical	13.64	-2.1	2.40	9.16	20.8	-11.64	Pass
450.00625	103.91		Horizontal	7.37	-2.1	2.40	2.89	20.8	-17.91	Pass
460.00000	112.19		Vertical	17.49	-2.3	2.45	12.72	20.8	-8.08	Pass
460.00000	106.66		Horizontal	9.86	-2.3	2.45	5.09	20.8	-15.71	Pass
469.99375	114.36		Vertical	18.51	-2.6	2.50	13.43	20.8	-7.37	Pass
469.99375	108.85		Horizontal	12.62	-2.6	2.50	7.54	20.8	-13.26	Pass

*****- Margin = ERP – specification limit.

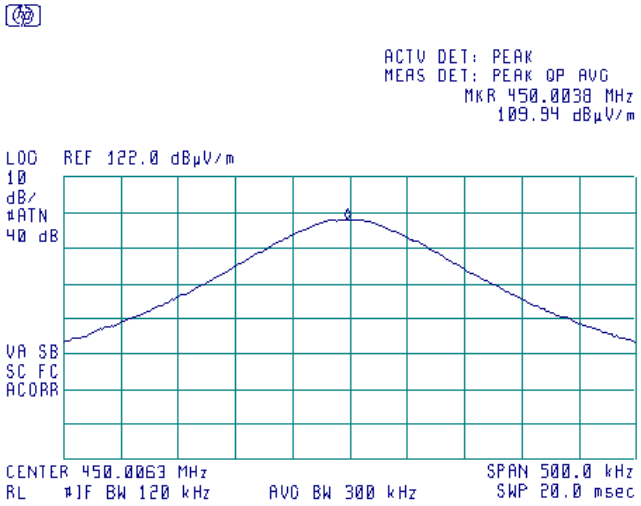
Reference numbers of test equipment used

HL 0415	HL 0539	HL 0569	HL 0614	HL 0812	HL 1430	HL 1500	

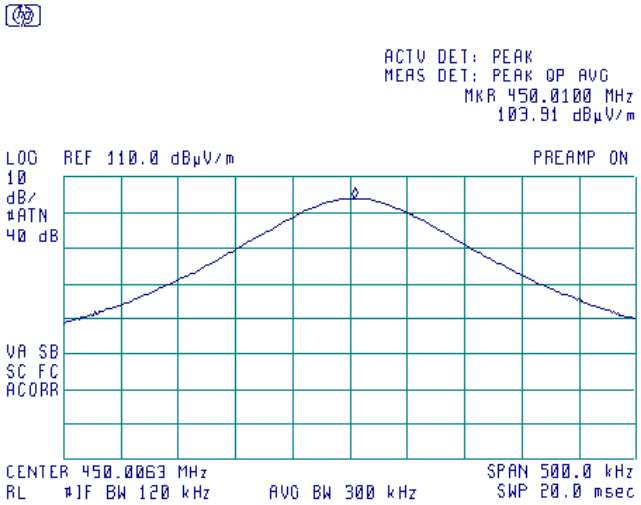
Full description is given in Appendix A.

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:	9/9/2008 7:21:29 PM		
Temperature: 25ºC	Air Pressure: 1006 hPa	Relative Humidity: 60%	Power Supply: 3.6 VDC
Remarks:			

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

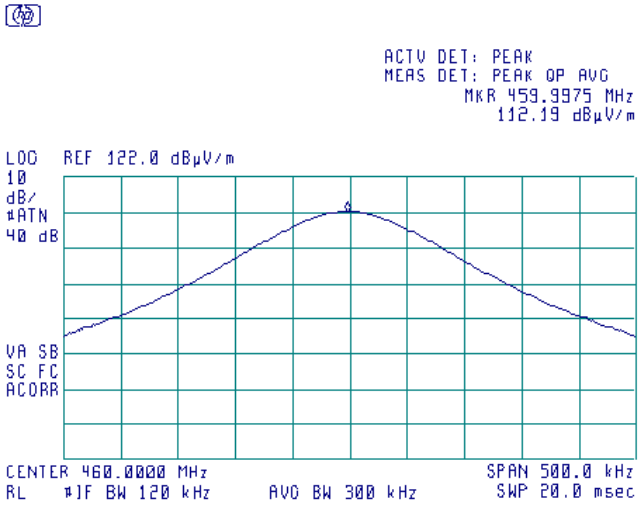


Plot 7.1.2 Transmitter carrier field strength at low frequency in horizontal antenna polarization

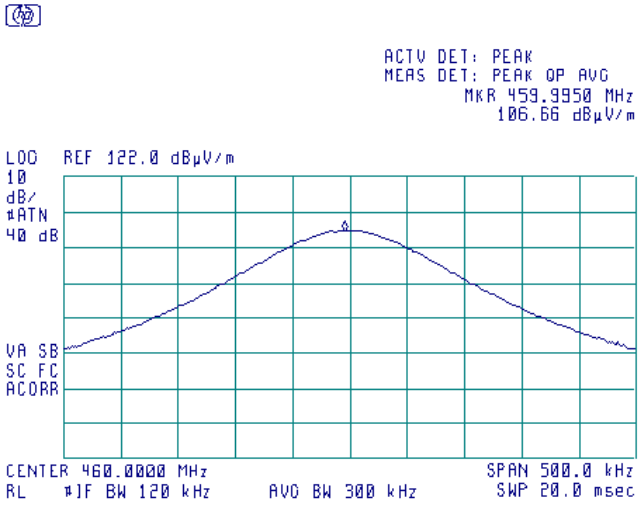


Test specification:	Section 90.205, Maximum output power		
Test procedure:	47 CFR, Section 2.1046; TIA/EIA-603-A, Section 2.2.1		
Test mode:	Compliance	Verdict:	PASS
Date & Time:	9/9/2008 7:21:29 PM		
Temperature: 25ºC	Air Pressure: 1006 hPa	Relative Humidity: 60%	Power Supply: 3.6 VDC
Remarks:			

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

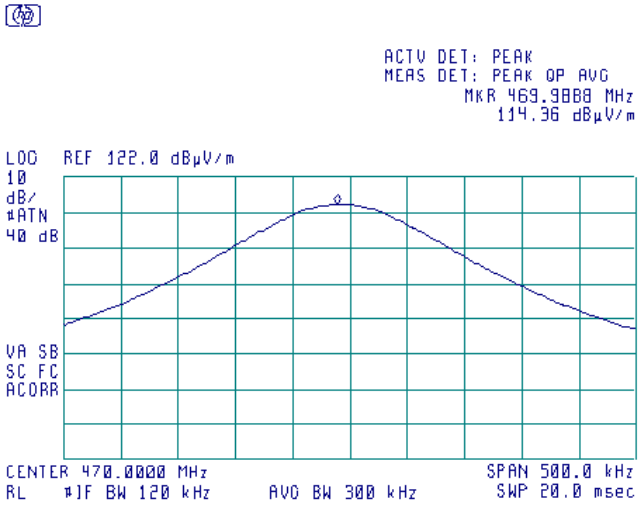


Plot 7.1.4 Transmitter carrier field strength at mid frequency in horizontal antenna polarization

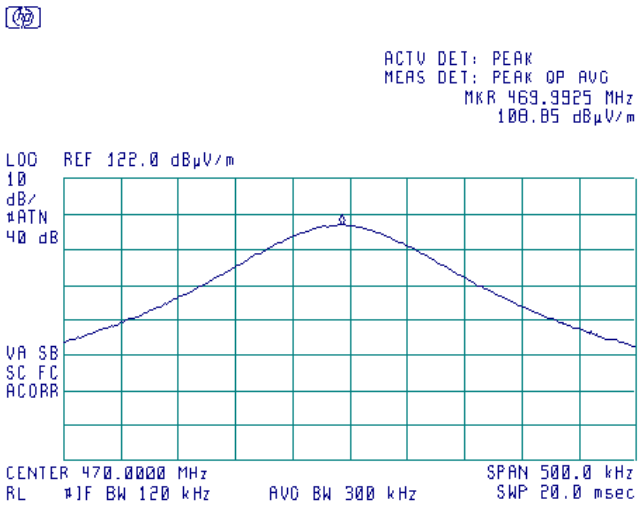


Test specification:	Section 90.205, Maximum output power		
Test procedure:	47 CFR, Section 2.1046; TIA/EIA-603-A, Section 2.2.1		
Test mode:	Compliance	Verdict:	PASS
Date & Time:	9/9/2008 7:21:29 PM		
Temperature: 25ºC	Air Pressure: 1006 hPa	Relative Humidity: 60%	Power Supply: 3.6 VDC
Remarks:			

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:	8/31/2008 8:00:55 PM		
Temperature: 25ºC	Air Pressure: 1010 hPa	Relative Humidity: 62%	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.

Table 7.2.1 Occupied bandwidth limits

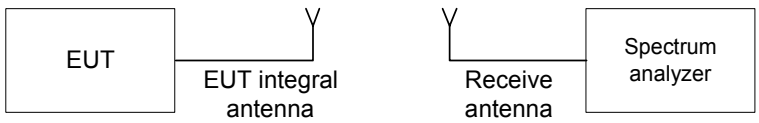
Assigned frequency, MHz	Modulation envelope reference points*, dBc	Maximum allowed bandwidth, kHz
450 - 470	26	11.25

* - 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:	8/31/2008 8:00:55 PM		
Temperature: 25ºC	Air Pressure: 1010 hPa	Relative Humidity: 62%	Power Supply: 3.6 VDC
Remarks:			

Table 7.2.2 Occupied bandwidth test results

DETECTOR USED:	Peak hold
RESOLUTION BANDWIDTH:	100 Hz
VIDEO BANDWIDTH:	300 Hz
MODULATION ENVELOPE REFERENCE POINTS:	26 dBc
MODULATION:	FSK

Carrier frequency, MHz	Occupied bandwidth, kHz	Limit, kHz	Margin, kHz	Verdict
450.00625	10.25	11.25	1.00	Pass
460.00000	10.50	11.25	0.75	Pass
469.99375	10.88	11.25	0.37	Pass

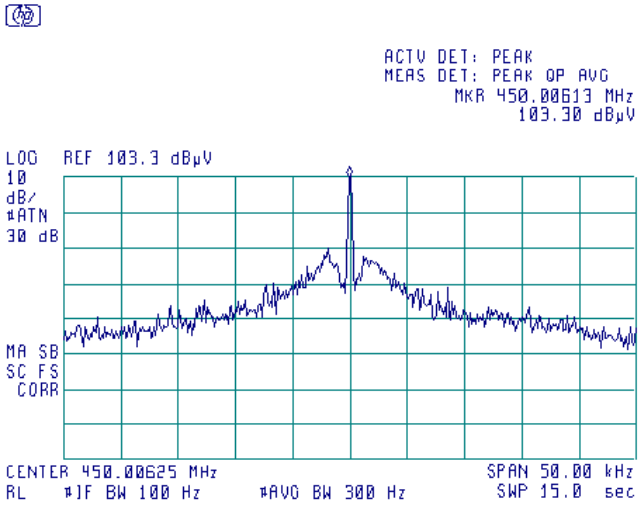
Reference numbers of test equipment used

HL 0521							

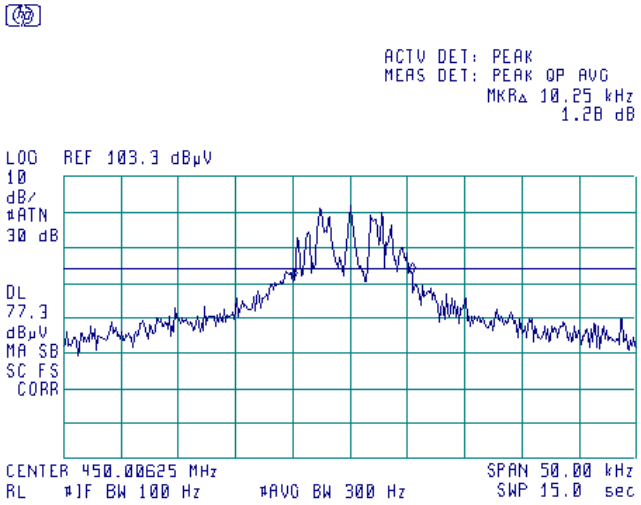
Full description is given in Appendix A.

Test specification:	Section 90.209, Occupied bandwidth		
Test procedure:	47 CFR, Section 2.1049		
Test mode:	Compliance	Verdict:	PASS
Date & Time:	8/31/2008 8:00:55 PM		
Temperature: 25ºC	Air Pressure: 1010 hPa	Relative Humidity: 62%	Power Supply: 3.6 VDC
Remarks:			

Plot 7.2.1 Reference unmodulated carrier at low frequency

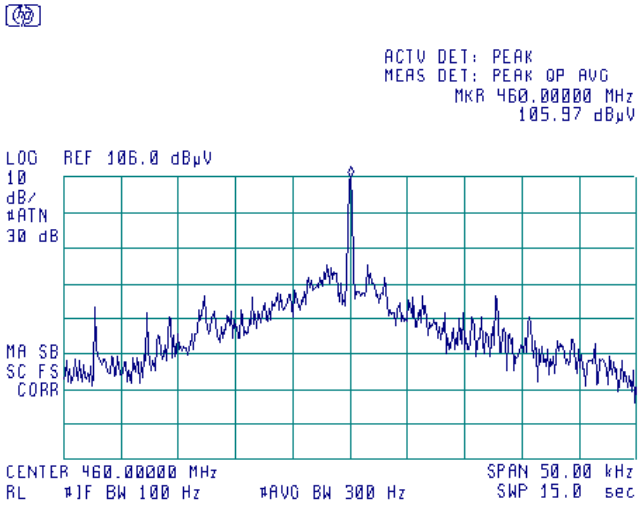


Plot 7.2.2 Occupied bandwidth test result at low frequency

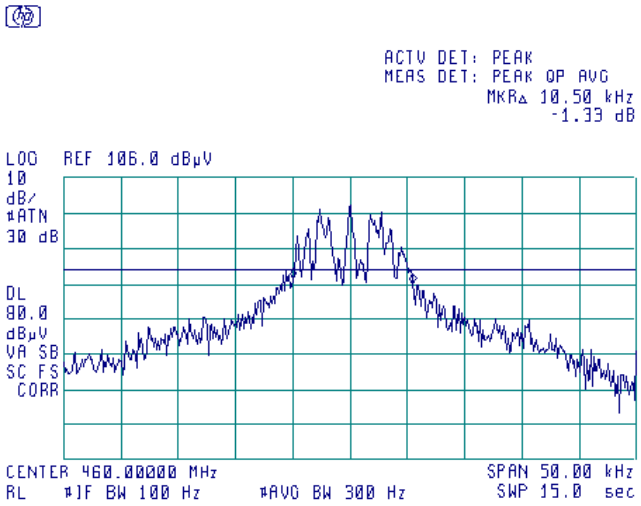


Test specification:	Section 90.209, Occupied bandwidth		
Test procedure:	47 CFR, Section 2.1049		
Test mode:	Compliance	Verdict:	PASS
Date & Time:	8/31/2008 8:00:55 PM		
Temperature: 25ºC	Air Pressure: 1010 hPa	Relative Humidity: 62%	Power Supply: 3.6 VDC
Remarks:			

Plot 7.2.3 Reference unmodulated carrier at mid frequency

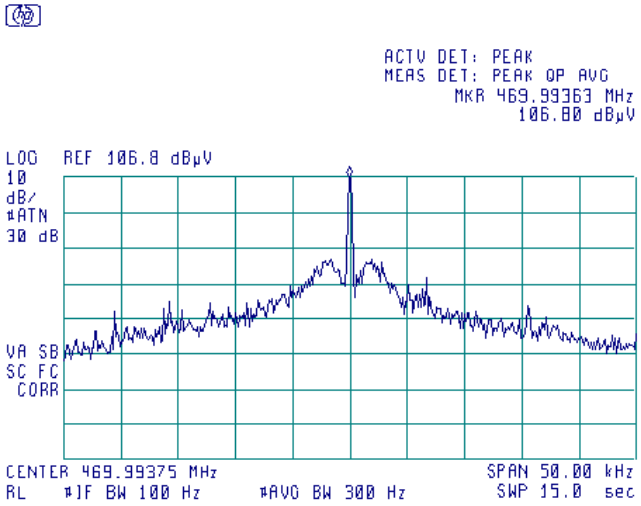


Plot 7.2.4 Occupied bandwidth test result at mid frequency

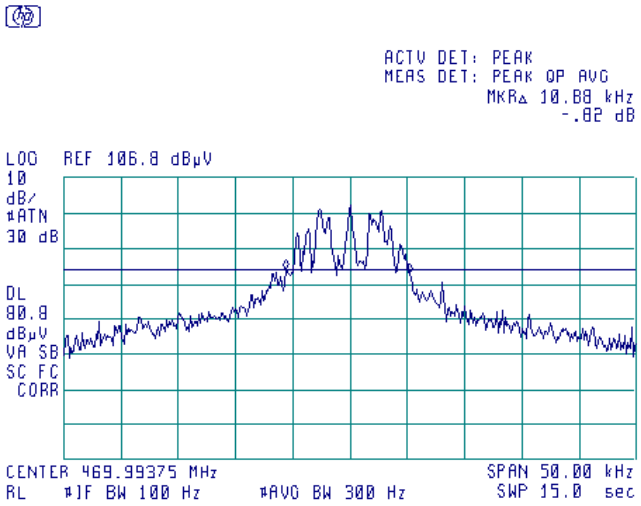


Test specification:	Section 90.209, Occupied bandwidth		
Test procedure:	47 CFR, Section 2.1049		
Test mode:	Compliance	Verdict:	PASS
Date & Time:	8/31/2008 8:00:55 PM		
Temperature: 25ºC	Air Pressure: 1010 hPa	Relative Humidity: 62%	Power Supply: 3.6 VDC
Remarks:			

Plot 7.2.5 Reference unmodulated carrier at high frequency



Plot 7.2.6 Occupied bandwidth test result at high frequency



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:	8/31/2008 6:34:16 PM		
Temperature: 25ºC	Air Pressure: 1010 hPa	Relative Humidity: 62%	Power Supply: 3.6 VDC
Remarks:			

7.3 Frequency stability test

7.3.1 General

This test was performed to measure frequency stability of transmitter RF carrier. Specification test limits are given in Table 7.3.1.

Table 7.3.1 Frequency stability limits

Assigned frequency, MHz	Maximum allowed frequency displacement	
	ppm	Hz
450.00625	1.5	675
460.00000		690
469.99375		705

7.3.2 Test procedure

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

7.3.2.2 The EUT 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.

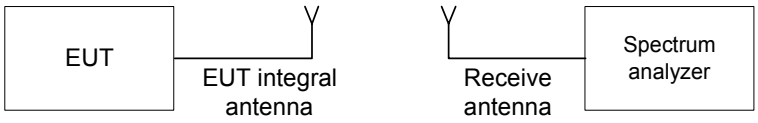
7.3.2.3 The EUT was powered on and carrier frequency was measured at start up moment and then every minute until frequency had been stabilized or 10 minutes elapsed whichever reached the last. The EUT was powered off.

7.3.2.4 The above procedure was repeated at 0˚C and at the lowest test temperature.

7.3.2.5 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.

7.3.2.6 Frequency displacement was calculated and compared with the limit as provided in Table 7.3.2.

Figure 7.3.1 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:	8/31/2008 6:34:16 PM		
Temperature: 25ºC	**Air Pressure:** 1010 hPa	**Relative Humidity:** 62%	**Power Supply:** 3.6 VDC
Remarks:			

Table 7.3.2 Frequency stability test results

ASSIGNED FREQUENCY RANGE: 450.00 – 470.00 MHz
NOMINAL POWER VOLTAGE: 3.6 V
TEMPERATURE STABILIZATION PERIOD: 20 min
POWER DURING TEMPERATURE TRANSITION: Off
SPECTRUM ANALYZER MODE: Max Hold
RESOLUTION BANDWIDTH: 10 Hz
VIDEO BANDWIDTH: 30 Hz
MODULATION: Unmodulated

', °C	Voltage, V	Frequency, MHz							Max frequency drift, Hz		Limit, Hz	Margin, Hz	Verdict
		Start up	1st min	2nd min	3rd min	4th min	5th min	10th min	Positive	Negative			
Low frequency 450.00625 MHz													
-30	nominal	450.005476	450.005483	450.005490	450.005495	450.005499	450.005503	450.005520	0.00	-204.00		NA	Tested
-20	nominal	450.005769	NA	NA	NA	NA	NA	450.005754	89.00	0.00		NA	Tested
-10	nominal	450.005686	NA	NA	NA	NA	NA	450.005684	6.00	0.00		NA	Tested
0	nominal	450.005710	450.005722	450.005726	450.005728	450.005727	450.005728	450.005729	49.00	0.00		NA	Tested
10	nominal	450.005689	NA	NA	NA	NA	NA	450.005722	42.00	0.00	NA	NA	Tested
20	nominal	450.005680	NA	NA	NA	NA	NA	450.005680	0.00	0.00		NA	Tested
20	min**	450.005685	NA	NA	NA	NA	NA	450.005676	5.00	-4.00		NA	Tested
30	nominal	450.005715	450.005714	450.005713	450.005714	450.005713	450.005712	450.005711	35.00	0.00		NA	Tested
40	nominal	450.005709	NA	NA	NA	NA	NA	450.005686	29.00	0.00		NA	Tested
50	nominal	450.005679	450.005671	450.005663	450.005655	450.005650	450.005644	450.005589	0.00	-91.00		NA	Tested
Mid frequency 460.00000 MHz													
-30	nominal	459.999218	459.999217	459.999215	459.999214	459.999214	459.999213	459.999211	0.00	-199.00		NA	Tested
-20	nominal	459.999488	NA	NA	NA	NA	NA	459.999504	94.00	0.00		NA	Tested
-10	nominal	459.999417	NA	NA	NA	NA	NA	459.999418	8.00	0.00		NA	Tested
0	nominal	459.999460	459.999460	459.999459	459.999459	459.999457	459.999454	459.999450	50.00	0.00		NA	Tested
10	nominal	459.999454	NA	NA	NA	NA	NA	459.999471	61.00	0.00	NA	NA	Tested
20	nominal	459.999410	NA	NA	NA	NA	NA	459.999410	0.00	0.00		NA	Tested
20	min**	459.999420	NA	NA	NA	NA	NA	459.999417	10.00	0.00		NA	Tested
30	nominal	459.999446	459.999446	459.999446	459.999446	459.999446	459.999444	459.999444	36.00	0.00		NA	Tested
40	nominal	459.999442	NA	NA	NA	NA	NA	459.999417	32.00	0.00		NA	Tested
50	nominal	459.999304	459.999298	459.999291	459.999286	459.999282	459.999277	459.999263	0.00	-147.00		NA	Tested
High frequency 469.99375 MHz													
-30	nominal	469.992946	469.992965	469.992980	469.992989	469.992993	469.992996	469.992953	0.00	-209.00		NA	Tested
-20	nominal	469.993238	NA	NA	NA	NA	NA	469.993239	84.00	0.00		NA	Tested
-10	nominal	469.993161	NA	NA	NA	NA	NA	469.993149	6.00	-6.00		NA	Tested
0	nominal	469.993179	469.993176	469.993174	469.993171	469.993170	469.993167	469.993166	24.00	0.00		NA	Tested
10	nominal	469.993204	NA	NA	NA	NA	NA	469.993212	57.00	0.00	NA	NA	Tested
20	nominal	469.993155	NA	NA	NA	NA	NA	469.993155	0.00	0.00		NA	Tested
20	min**	469.993155	NA	NA	NA	NA	NA	469.993151	0.00	-4.00		NA	Tested
30	nominal	469.993178	469.993179	469.993179	469.993179	469.993178	469.993176	469.993176	24.00	0.00		NA	Tested
40	nominal	469.993172	NA	NA	NA	NA	NA	469.993149	17.00	-6.00		NA	Tested
50	nominal	469.992994	469.992989	469.992987	469.992981	469.992978	469.992970	469.992962	0.00	-193.00		NA	Tested

* - Reference frequency
** - Battery operating end point specified by the manufacturer (3.2 VDC).

Reference numbers of test equipment used

HL 0493	HL 2634	HL 3001	HL 3309				

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:	8/31/2008 6:34:24 PM		
Temperature: 25ºC	Air Pressure: 1010 hPa	Relative Humidity: 62%	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.

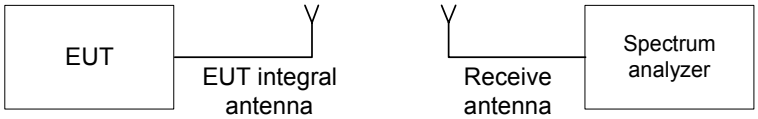
7.4.2.2 The spectrum analyzer sweep time and bandwidth were set to capture all major modulation sidebands of emission and sweep time was set sufficiently slow to ensure the peak measurements. The spectrum analyzer was set in peak hold mode and time sufficient for trace stabilization was allowed.

7.4.2.3 The frequency of modulation envelope points beyond which the modulation envelope power 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:	8/31/2008 6:34:24 PM		
Temperature: 25ºC	**Air Pressure:** 1010 hPa	**Relative Humidity:** 62%	**Power Supply:** 3.6 VDC
Remarks:			

Table 7.4.2 Band edge emission test results

ASSIGNED FREQUENCY RANGE: 450 – 470 MHz
DETECTOR USED: Peak hold
RESOLUTION BANDWIDTH: 100 Hz
VIDEO BANDWIDTH: 300 Hz
MODULATION: FSK
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	450.00000	204	NA	449.999796	449.98125	-18.546	Pass
High	450.01125	NA	89	450.011339	450.03125	19.911	Pass
Mid carrier frequency							
Low	459.99363	199.00	NA	459.993431	459.97500	-18.431	Pass
High	460.00500	NA	94.00	460.005094	460.02500	19.906	Pass
High carrier frequency							
Low	469.98744	209	NA	469.987231	469.96875	-18.481	Pass
High	469.99875	NA	84	469.998834	470.01875	19.916	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

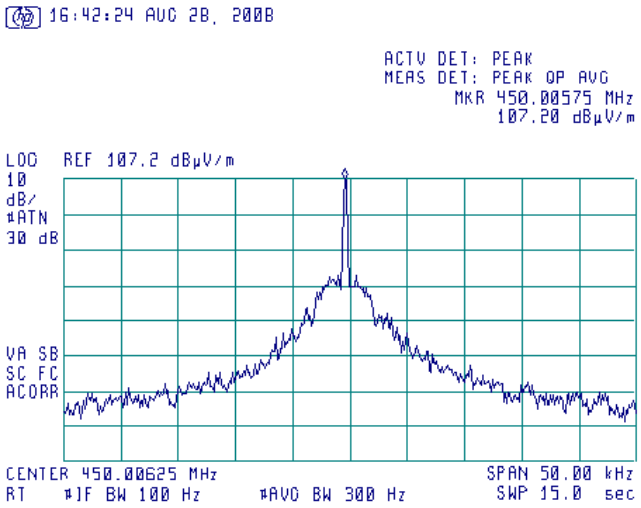
Reference numbers of test equipment used

HL 0521	HL 0604	HL 1947	HL 3123				

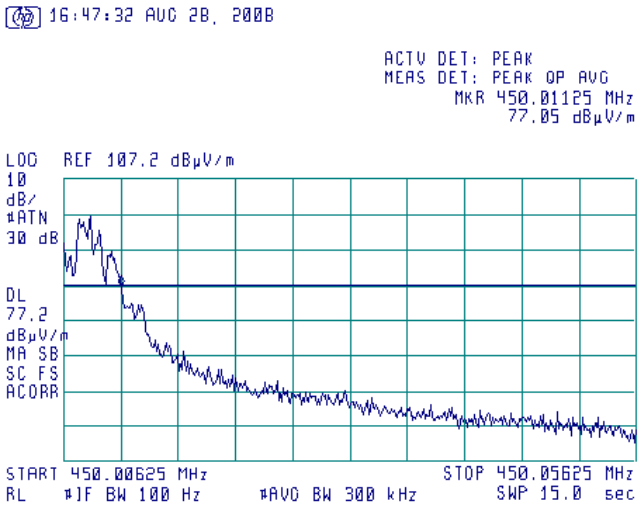
Full description is given in Appendix A.

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:	8/31/2008 6:34:24 PM		
Temperature: 25ºC	Air Pressure: 1010 hPa	Relative Humidity: 62%	Power Supply: 3.6 VDC
Remarks:			

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

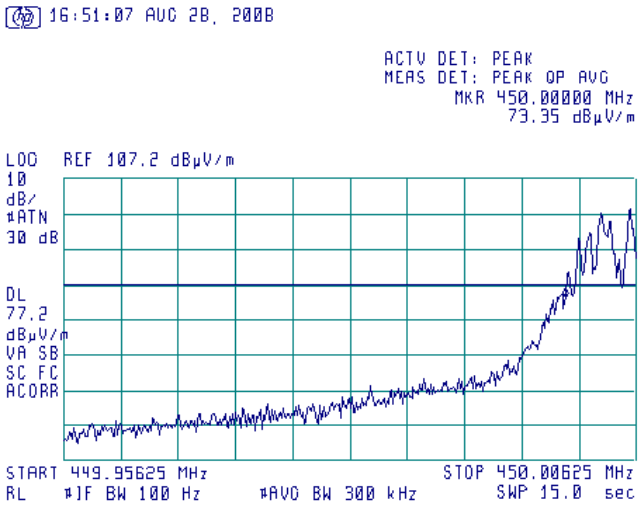


Plot 7.4.2 Band edge emission test results at low carrier frequency, right side



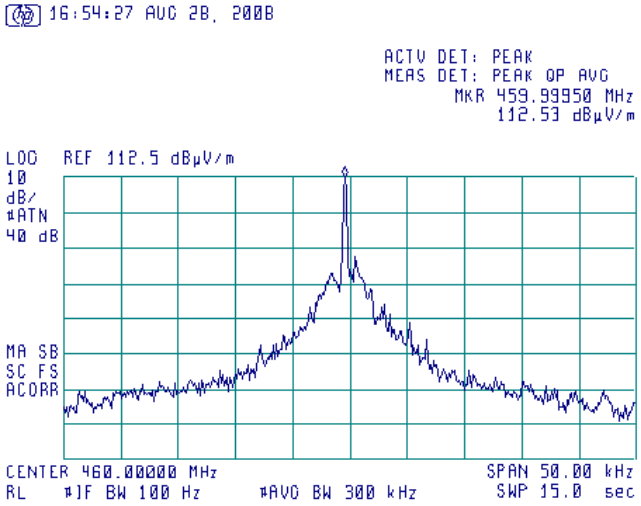
Test specification:	Section 90.217, Band edge emission		
Test procedure:	47 CFR, Sections 2.1051, 2.1047 and 90.217; TIA/EIA-603-A, Section 2.2.13		
Test mode:	Compliance	Verdict:	PASS
Date & Time:	8/31/2008 6:34:24 PM		
Temperature: 25ºC	Air Pressure: 1010 hPa	Relative Humidity: 62%	Power Supply: 3.6 VDC
Remarks:			

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

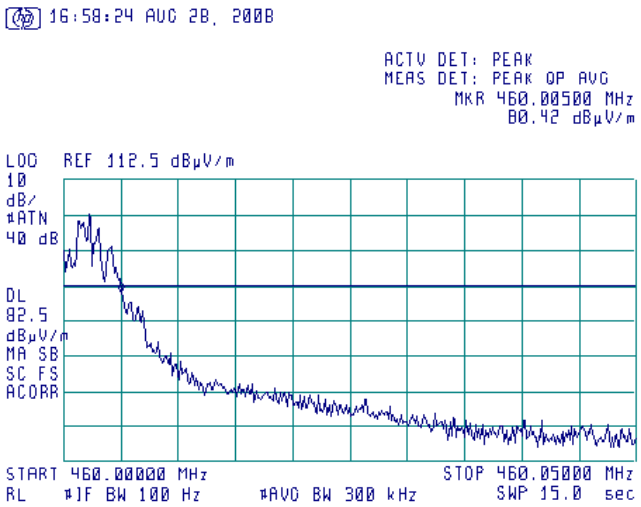


Test specification:	Section 90.217, Band edge emission		
Test procedure:	47 CFR, Sections 2.1051, 2.1047 and 90.217; TIA/EIA-603-A, Section 2.2.13		
Test mode:	Compliance	Verdict:	PASS
Date & Time:	8/31/2008 6:34:24 PM		
Temperature: 25ºC	Air Pressure: 1010 hPa	Relative Humidity: 62%	Power Supply: 3.6 VDC
Remarks:			

Plot 7.4.4 Band edge emission test results at mid carrier frequency, unmodulated carrier reference level

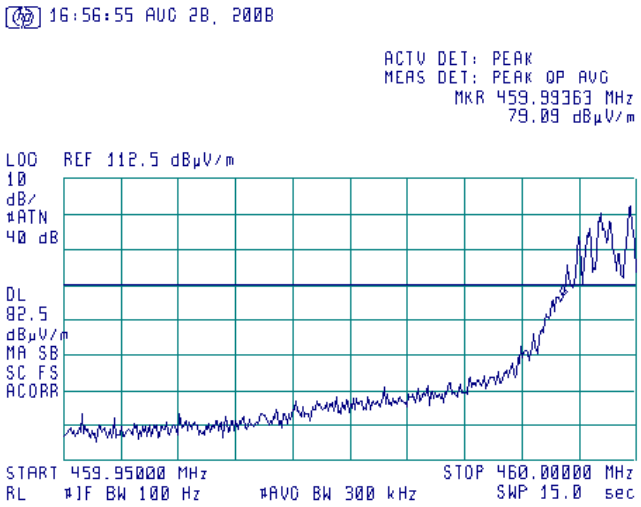


Plot 7.4.5 Band edge emission test results at mid carrier frequency, right side



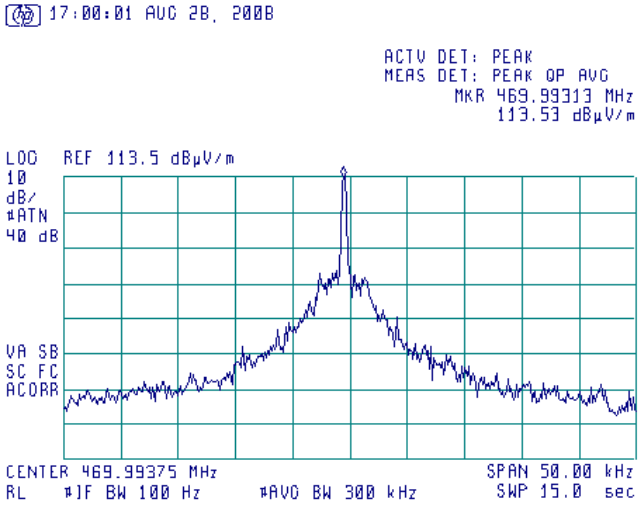
Test specification:	Section 90.217, Band edge emission		
Test procedure:	47 CFR, Sections 2.1051, 2.1047 and 90.217; TIA/EIA-603-A, Section 2.2.13		
Test mode:	Compliance	Verdict:	PASS
Date & Time:	8/31/2008 6:34:24 PM		
Temperature: 25ºC	Air Pressure: 1010 hPa	Relative Humidity: 62%	Power Supply: 3.6 VDC
Remarks:			

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

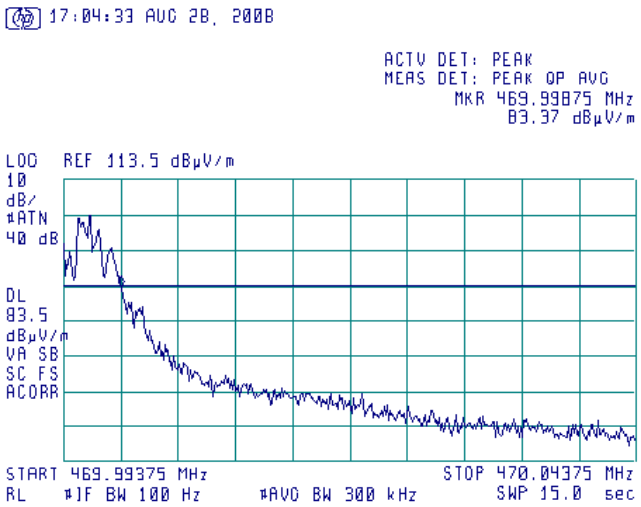


Test specification:	Section 90.217, Band edge emission		
Test procedure:	47 CFR, Sections 2.1051, 2.1047 and 90.217; TIA/EIA-603-A, Section 2.2.13		
Test mode:	Compliance	Verdict:	PASS
Date & Time:	8/31/2008 6:34:24 PM		
Temperature: 25ºC	Air Pressure: 1010 hPa	Relative Humidity: 62%	Power Supply: 3.6 VDC
Remarks:			

Plot 7.4.7 Band edge emission test results at high carrier frequency, unmodulated carrier reference level

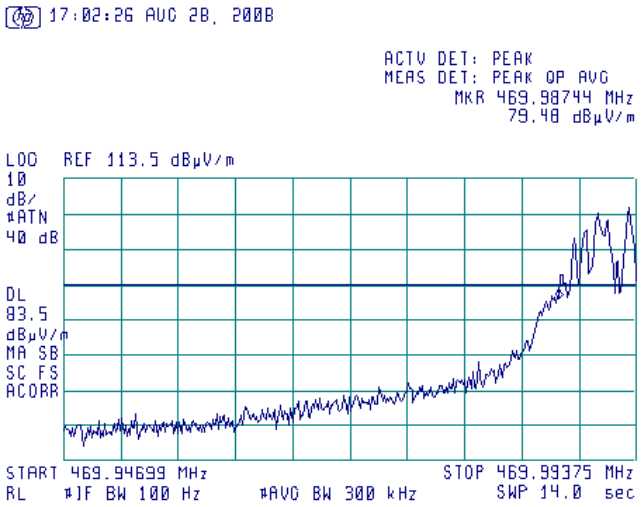


Plot 7.4.8 Band edge emission test results at high carrier frequency, right side



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:	8/31/2008 6:34:24 PM		
Temperature: 25ºC	Air Pressure: 1010 hPa	Relative Humidity: 62%	Power Supply: 3.6 VDC
Remarks:			

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



Test specification:	Section 90.217, Radiated spurious emissions		
Test procedure:	47 CFR, Sections 2.1053 and 90.217; TIA/EIA-603-A, Section 2.2.12		
Test mode:	Compliance	Verdict:	PASS
Date & Time:	8/31/2008 7:57:35 PM		
Temperature: 25ºC	Air Pressure: 1010 hPa	Relative Humidity: 62%	Power Supply: 3.6 VDC
Remarks:			

7.5 Radiated spurious emission measurements

7.5.1 General

This test was performed to measure radiated spurious emissions from the EUT. Specification test limits are given in Table 7.5.1.

Table 7.5.1 Radiated spurious emission test limits

Frequency, MHz	Attenuation below carrier dBc	ERP of spurious, dBm	Equivalent field strength limit @ 3m, dB(µV/m)**
0.009 – 10th harmonic*	30	13.43	110.78

* - spurious emission limits do not apply to the in band emission within:
± 40 kHz from the carrier for equipment designed to operate with 25 kHz channel bandwidth
± 25 kHz from the carrier for equipment designed to operate with 12.5 kHz channel bandwidth
± 12.5 kHz from the carrier for equipment designed to operate with 6.25 kHz channel bandwidth

** - Equivalent field strength limit was calculated from maximum allowed ERP of spurious as follows: E=sqrt(30×P×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

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

7.5.2.1 The EUT was set up as shown in Figure 7.5.1, energized and the performance check was conducted.
7.5.2.2 The specified frequency range was investigated with antenna connected to spectrum analyzer. To find maximum radiation the turntable was rotated 360^0 and the measuring antenna was rotated around its vertical axis.
7.5.2.3 The worst test results (the lowest margins) were recorded in Table 7.5.2 and shown in the associated plots.

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

7.5.3.1 The EUT was set up as shown in Figure 7.5.2, energized and the performance check was conducted.
7.5.3.2 The specified frequency range was investigated with antenna connected to spectrum analyzer. To find maximum radiation the turntable was rotated 360^0 and the measuring antenna height was swept from 1 to 4 m in both, vertical and horizontal, polarizations.
7.5.3.3 The worst test results (the lowest margins) were recorded in Table 7.5.2 and shown in the associated plots.

7.5.4 Test procedure for substitution ERP measurements of spurious

7.5.4.1 The test equipment was set up as shown in Figure 7.5.3 and energized.
7.5.4.2 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.
7.5.4.3 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.
7.5.4.4 The above procedure was performed in both, horizontal and vertical, polarizations of the test and substitution antennas.
7.5.4.5 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.
7.5.4.6 The above procedure was repeated at the rest of investigated frequencies.
7.5.4.7 The worst test results (the lowest margins) were recorded in Table 7.5.3 and shown in the associated plots.

Test specification:	Section 90.217, Radiated spurious emissions		
Test procedure:	47 CFR, Sections 2.1053 and 90.217; TIA/EIA-603-A, Section 2.2.12		
Test mode:	Compliance	Verdict:	PASS
Date & Time:	8/31/2008 7:57:35 PM		
Temperature: 25ºC	Air Pressure: 1010 hPa	Relative Humidity: 62%	Power Supply: 3.6 VDC
Remarks:			

Figure 7.5.1 Setup for spurious emission field strength measurements in 9 kHz to 30 MHz band

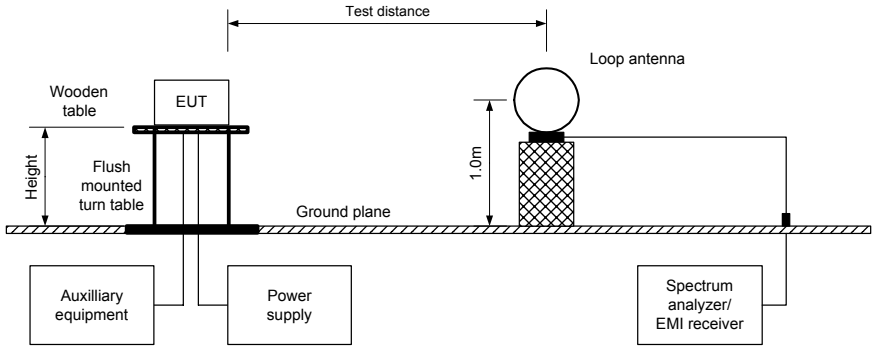
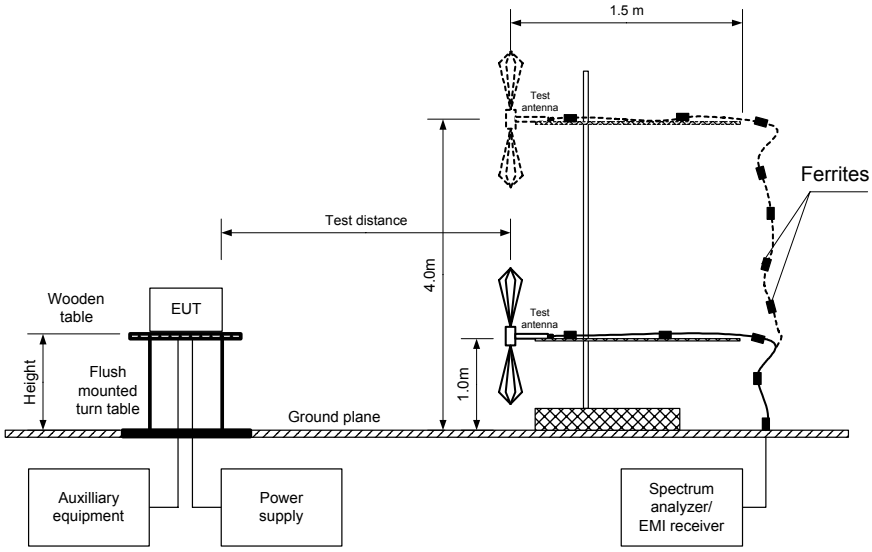
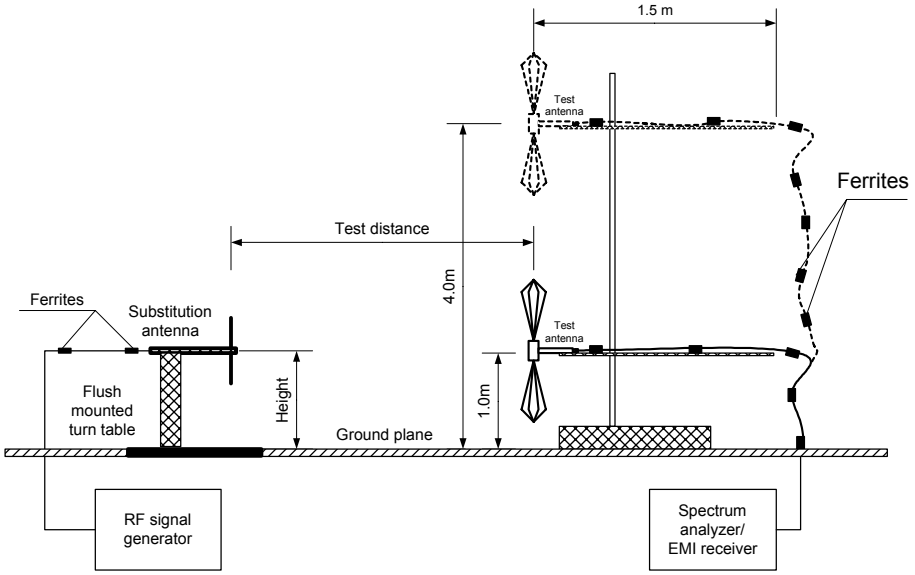


Figure 7.5.2 Setup for spurious emission field strength measurements above 30 MHz



Test specification:	Section 90.217, Radiated spurious emissions		
Test procedure:	47 CFR, Sections 2.1053 and 90.217; TIA/EIA-603-A, Section 2.2.12		
Test mode:	Compliance	Verdict:	PASS
Date & Time:	8/31/2008 7:57:35 PM		
Temperature: 25ºC	Air Pressure: 1010 hPa	Relative Humidity: 62%	Power Supply: 3.6 VDC
Remarks:			

Figure 7.5.3 Setup for substitution ERP measurements of spurious



Test specification:	**Section 90.217, Radiated spurious emissions**		
Test procedure:	47 CFR, Sections 2.1053 and 90.217; TIA/EIA-603-A, Section 2.2.12		
Test mode:	Compliance	**Verdict:**	PASS
Date & Time:	8/31/2008 7:57:35 PM		
Temperature: 25ºC	**Air Pressure:** 1010 hPa	**Relative Humidity:** 62%	**Power Supply:** 3.6 VDC
Remarks:			

Table 7.5.2 Spurious emission field strength test results

ASSIGNED FREQUENCY RANGE: 450 - 470 MHz
TEST DISTANCE: 3 m
TEST SITE: Semi anechoic chamber / OATS
EUT HEIGHT: 0.8 m
INVESTIGATED FREQUENCY RANGE: 0.009 – 5000 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
MODULATING SIGNAL: PRBS
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							
900.0063	63.50	79.94	-16.44	120	Vertical	1.0	0
1350.069	58.34	79.94	-21.6	1000	Vertical	1.1	270
1800.00	48.48	79.94	-31.46	1000	Vertical	1.0	260
2249.994	50.87	79.94	-29.07	1000	Vertical	1.3	130
2700.137	59.38	79.94	-20.56	1000	Vertical	1.0	270
Mid carrier frequency 460.00000 MHz							
920.0013	67.82	82.19	-14.37	120	Horizontal	1.4	240
1380.000	59.00	82.19	-23.19	1000	Vertical	1.1	240
1839.988	55.64	82.19	-26.55	1000	Horizontal	1.4	220
2299.988	54.21	82.19	-27.98	1000	Vertical	1.2	200
2760.038	56.34	82.19	-25.85	1000	Horizontal	1.0	280
High carrier frequency 469.99375 MHz							
939.9763	68.93	84.36	-15.43	120	Horizontal	1.0	240
1410.006	62.94	84.36	-21.42	1000	Vertical	1.1	030
1880.00	59.72	84.36	-24.64	1000	Vertical	1.1	180
2349.994	57.37	84.36	-26.99	1000	Vertical	1.2	320
2819.969	59.64	84.36	-24.72	1000	Vertical	1.1	250

*****- Margin = Field strength of spurious – calculated field strength limit.
******- EUT front panel refers to 0 degrees position of turntable.

Test specification:	**Section 90.217, Radiated spurious emissions**		
Test procedure:	47 CFR, Sections 2.1053 and 90.217; TIA/EIA-603-A, Section 2.2.12		
Test mode:	Compliance	**Verdict:**	PASS
Date & Time:	8/31/2008 7:57:35 PM		
Temperature: 25ºC	**Air Pressure:** 1010 hPa	**Relative Humidity:** 62%	**Power Supply:** 3.6 VDC
Remarks:			

Table 7.5.3 Substitution ERP of spurious test results

ASSIGNED FREQUENCY RANGE: 450 -470 MHz
TRANSMITTER CARRIER ERP: 9.16 dBm at low frequency
(Substitution method) 12.72 dBm at mid frequency
13.43 dBm at high frequency
TEST SITE: Semi 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)
Biconilog (30 MHz – 1000 MHz)
Double ridged guide (above 1000 MHz)

Frequency MHz	Field strength dB(µV/m	RBW, kHz	Antenna polarizatio	RF generato output, dBm	Ant gain dBd	Cable oss, dE	ERP, dBm	Attenuation below carrier dBc	Limit, dBc	Margin dB*	Verdict
Low carrier frequency											
900.0063	63.50	120	Vertical	-38.14	1.88	2.94	-39.20	-48.36	30	-18.36	Pass
1350.069	58.34	1000	Vertical	-43.77	5.7	1.26	-39.33	-48.49	30	-18.49	Pass
1800.00	48.48	1000	Vertical	-55.19	6.49	1.47	-50.17	-59.33	30	-29.33	Pass
2249.994	50.87	1000	Vertical	-51.77	6.88	1.66	-46.55	-55.71	30	-25.71	Pass
2700.137	59.38	1000	Vertical	-42.61	7.1	1.86	-37.37	-46.53	30	-16.53	Pass
Mid carrier frequency											
920.0013	67.82	120	Horizontal	-36.17	1.98	3.00	-37.19	-49.91	30	-19.91	Pass
1380.000	59.00	1000	Vertical	-43.11	5.7	1.26	-38.67	-51.39	30	-21.39	Pass
1839.988	55.64	1000	Horizontal	-48.03	6.49	1.47	-43.01	-55.73	30	-25.73	Pass
2299.988	54.21	1000	Vertical	-48.43	6.88	1.66	-43.21	-55.93	30	-25.93	Pass
2760.038	56.34	1000	Horizontal	-45.65	7.1	1.86	-40.41	-53.13	30	-23.13	Pass
High carrier frequency											
939.9763	68.93	120	Horizontal	-32.41	1.98	3.10	-33.53	-46.96	30	-16.96	Pass
1410.006	62.94	1000	Vertical	-39.17	5.7	1.29	-34.76	-48.19	30	-18.19	Pass
1880.00	59.72	1000	Vertical	-43.95	6.49	1.47	-38.93	-52.36	30	-22.36	Pass
2349.994	57.37	1000	Vertical	-40.08	6.88	1.66	-34.86	-48.29	30	-18.29	Pass
2819.969	59.64	1000	Vertical	-42.35	7.1	1.86	-37.11	-50.54	30	-20.54	Pass

*****- Margin = Spurious emission – specification limit.

Reference numbers of test equipment used

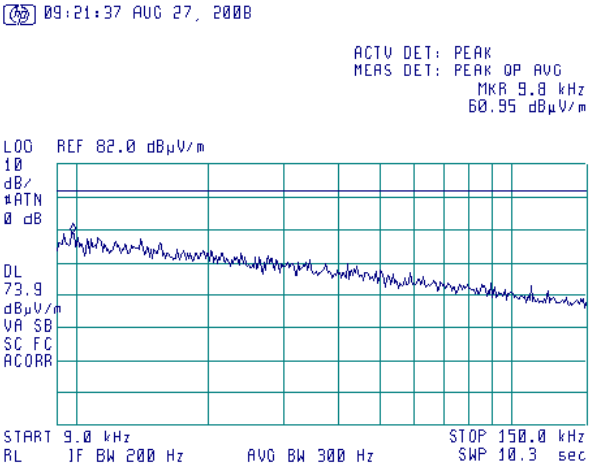
HL 0034	HL 0415	HL 0446	HL 0521	HL 0569	HL 0812	HL 1003	HL 1430
HL 1984	HL 2432	HL 2667	HL 3120	HL 3123	HL 3234		

Full description is given in Appendix A.

Test specification:	Section 90.217, Radiated spurious emissions		
Test procedure:	47 CFR, Sections 2.1053 and 90.217; TIA/EIA-603-A, Section 2.2.12		
Test mode:	Compliance	Verdict:	PASS
Date & Time:	8/31/2008 7:57:35 PM		
Temperature: 25ºC	Air Pressure: 1010 hPa	Relative Humidity: 62%	Power Supply: 3.6 VDC
Remarks:			

Plot 7.5.1 Radiated emission measurements in 9 - 150 kHz range

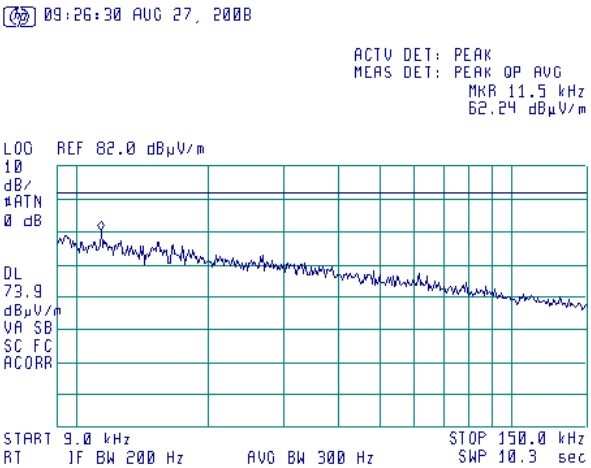
TEST SITE:	Fully anechoic chamber
CARRIER FREQUENCY:	Low
ANTENNA POLARIZATION:	Vertical and Horizontal
TEST DISTANCE:	3 m



Note: The displayed limit 73.9 dB(µV/m) was chosen according to the lowest field strength of the carrier 103.9 dB(µV/m)

Plot 7.5.2 Radiated emission measurements in 9 - 150 kHz range

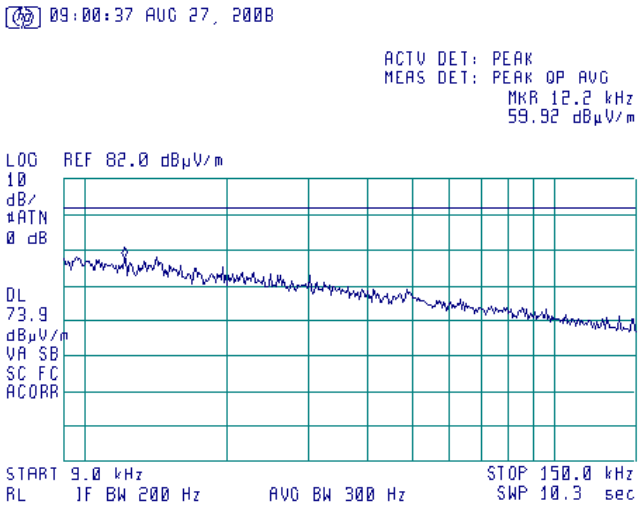
TEST SITE:	Fully anechoic chamber
CARRIER FREQUENCY:	Mid
ANTENNA POLARIZATION:	Vertical and Horizontal
TEST DISTANCE:	3 m



Test specification:	**Section 90.217, Radiated spurious emissions**		
Test procedure:	47 CFR, Sections 2.1053 and 90.217; TIA/EIA-603-A, Section 2.2.12		
Test mode:	Compliance	**Verdict:**	PASS
Date & Time:	8/31/2008 7:57:35 PM		
Temperature: 25ºC	**Air Pressure:** 1010 hPa	**Relative Humidity:** 62%	**Power Supply:** 3.6 VDC
Remarks:			

Plot 7.5.3 Radiated emission measurements in 9 - 150 kHz range

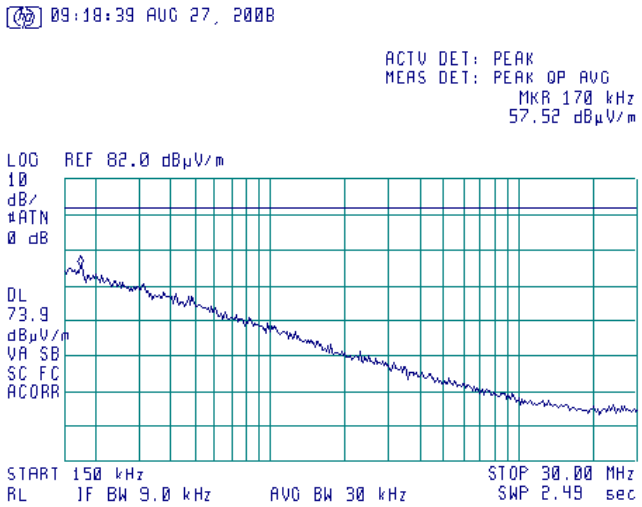
TEST SITE:	Fully anechoic chamber
CARRIER FREQUENCY:	High
ANTENNA POLARIZATION:	Vertical and Horizontal
TEST DISTANCE:	3 m



Test specification:	Section 90.217, Radiated spurious emissions		
Test procedure:	47 CFR, Sections 2.1053 and 90.217; TIA/EIA-603-A, Section 2.2.12		
Test mode:	Compliance	Verdict:	PASS
Date & Time:	8/31/2008 7:57:35 PM		
Temperature: 25ºC	Air Pressure: 1010 hPa	Relative Humidity: 62%	Power Supply: 3.6 VDC
Remarks:			

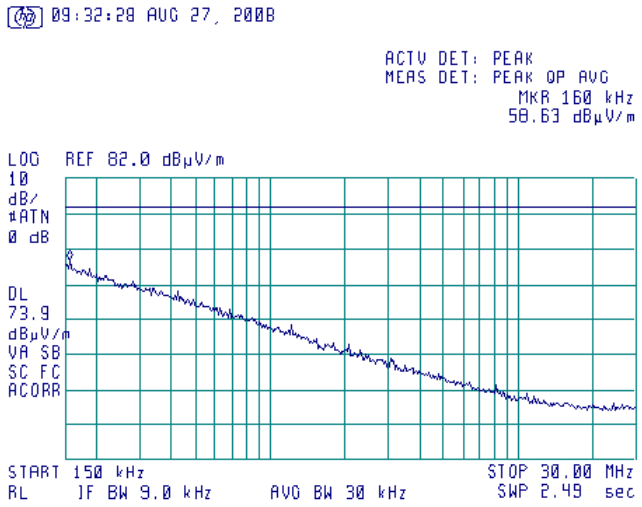
Plot 7.5.4 Radiated emission measurements in 0.15 - 30 MHz range

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



Plot 7.5.5 Radiated emission measurements in 0.15 - 30 MHz range

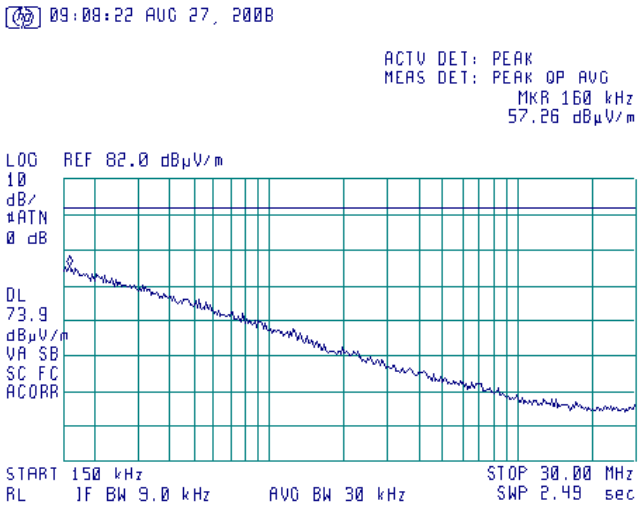
TEST SITE:	Fully anechoic chamber
CARRIER FREQUENCY:	Mid
ANTENNA POLARIZATION:	Vertical and Horizontal
TEST DISTANCE:	3 m



Test specification:	**Section 90.217, Radiated spurious emissions**		
Test procedure:	47 CFR, Sections 2.1053 and 90.217; TIA/EIA-603-A, Section 2.2.12		
Test mode:	Compliance	**Verdict:**	PASS
Date & Time:	8/31/2008 7:57:35 PM		
Temperature: 25ºC	**Air Pressure:** 1010 hPa	**Relative Humidity:** 62%	**Power Supply:** 3.6 VDC
Remarks:			

Plot 7.5.6 Radiated emission measurements in 0.15 - 30 MHz range

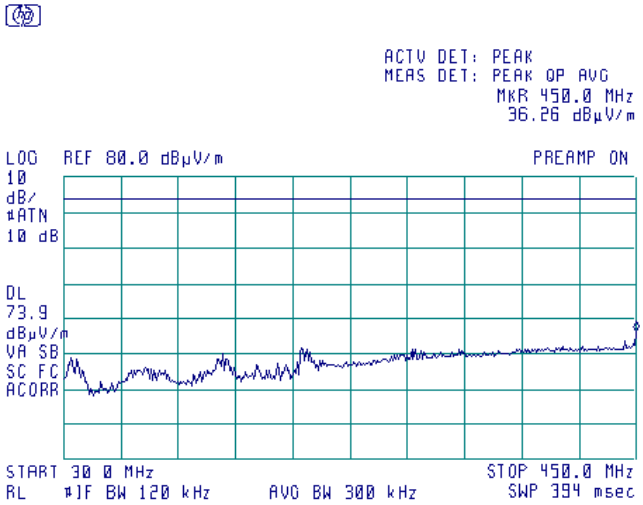
TEST SITE:	Fully anechoic chamber
CARRIER FREQUENCY:	High
ANTENNA POLARIZATION:	Vertical and Horizontal
TEST DISTANCE:	3 m



Test specification:	Section 90.217, Radiated spurious emissions		
Test procedure:	47 CFR, Sections 2.1053 and 90.217; TIA/EIA-603-A, Section 2.2.12		
Test mode:	Compliance	Verdict:	PASS
Date & Time:	8/31/2008 7:57:35 PM		
Temperature: 25ºC	Air Pressure: 1010 hPa	Relative Humidity: 62%	Power Supply: 3.6 VDC
Remarks:			

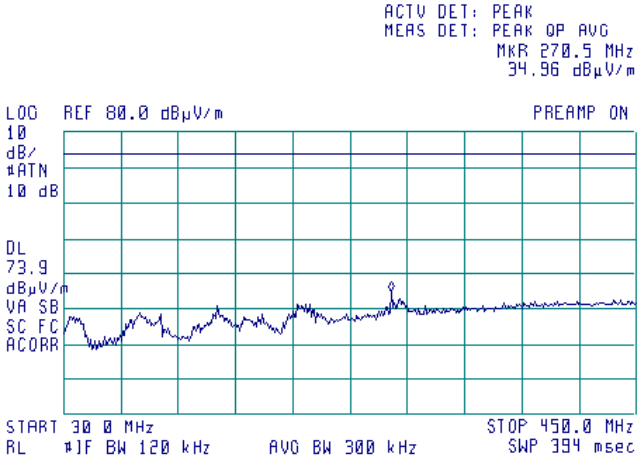
Plot 7.5.7 Radiated emission measurements in 30 - 450 MHz range

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



Plot 7.5.8 Radiated emission measurements in 30 - 450 MHz range

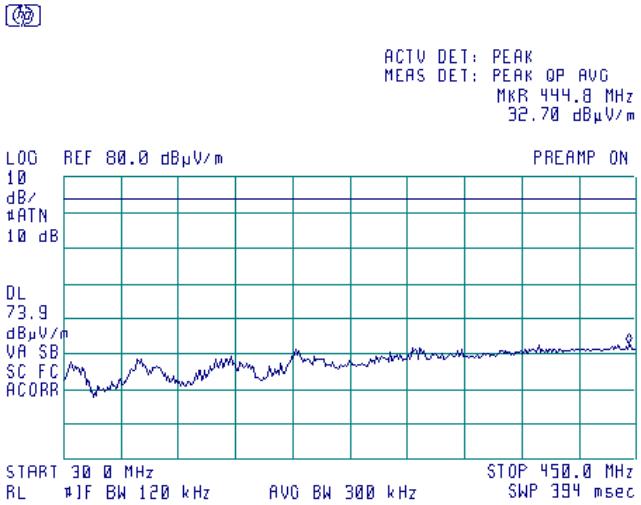
TEST SITE:	Semi anechoic chamber
CARRIER FREQUENCY:	Mid
ANTENNA POLARIZATION:	Vertical and Horizontal
TEST DISTANCE:	3 m



Test specification:	Section 90.217, Radiated spurious emissions		
Test procedure:	47 CFR, Sections 2.1053 and 90.217; TIA/EIA-603-A, Section 2.2.12		
Test mode:	Compliance	Verdict:	PASS
Date & Time:	8/31/2008 7:57:35 PM		
Temperature: 25ºC	Air Pressure: 1010 hPa	Relative Humidity: 62%	Power Supply: 3.6 VDC
Remarks:			

Plot 7.5.9 Radiated emission measurements in 30 - 450 MHz range

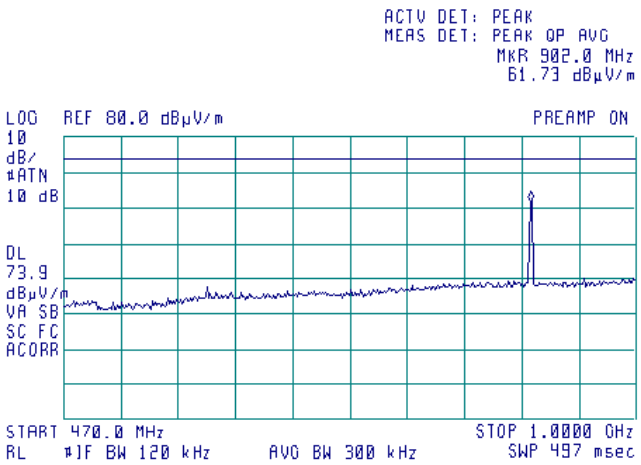
TEST SITE:	Semi anechoic chamber
CARRIER FREQUENCY:	High
ANTENNA POLARIZATION:	Vertical and Horizontal
TEST DISTANCE:	3 m



Test specification:	Section 90.217, Radiated spurious emissions		
Test procedure:	47 CFR, Sections 2.1053 and 90.217; TIA/EIA-603-A, Section 2.2.12		
Test mode:	Compliance	Verdict:	PASS
Date & Time:	8/31/2008 7:57:35 PM		
Temperature: 25ºC	Air Pressure: 1010 hPa	Relative Humidity: 62%	Power Supply: 3.6 VDC
Remarks:			

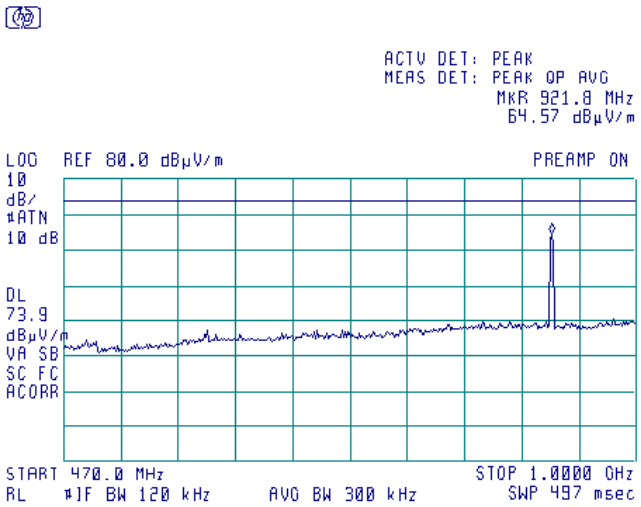
Plot 7.5.10 Radiated emission measurements in 470 - 1000 MHz range

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



Plot 7.5.11 Radiated emission measurements in 470 - 1000 MHz range

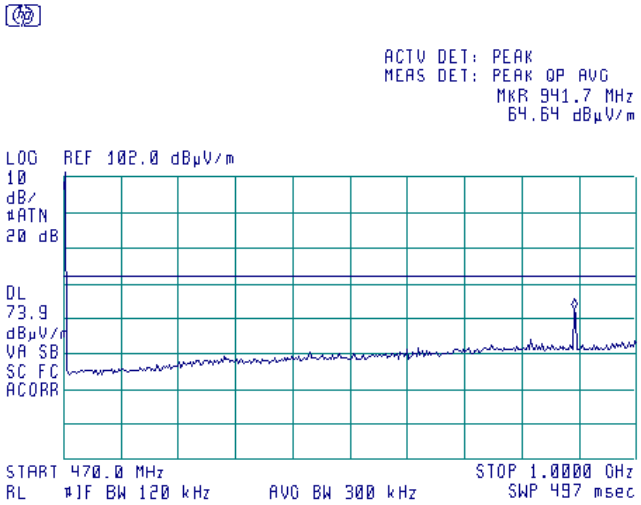
TEST SITE:	Semi anechoic chamber
CARRIER FREQUENCY:	Mid
ANTENNA POLARIZATION:	Vertical and Horizontal
TEST DISTANCE:	3 m



Test specification:	Section 90.217, Radiated spurious emissions		
Test procedure:	47 CFR, Sections 2.1053 and 90.217; TIA/EIA-603-A, Section 2.2.12		
Test mode:	Compliance	Verdict:	PASS
Date & Time:	8/31/2008 7:57:35 PM		
Temperature: 25ºC	Air Pressure: 1010 hPa	Relative Humidity: 62%	Power Supply: 3.6 VDC
Remarks:			

Plot 7.5.12 Radiated emission measurements in 470 - 1000 MHz range

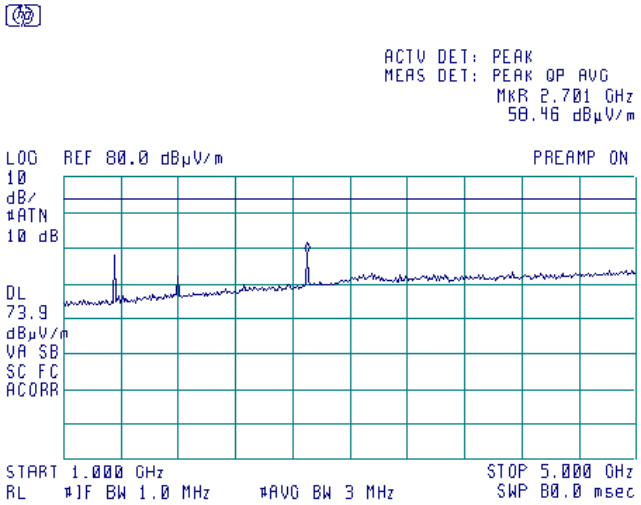
TEST SITE:	Semi anechoic chamber
CARRIER FREQUENCY:	High
ANTENNA POLARIZATION:	Vertical and Horizontal
TEST DISTANCE:	3 m



Test specification:	Section 90.217, Radiated spurious emissions		
Test procedure:	47 CFR, Sections 2.1053 and 90.217; TIA/EIA-603-A, Section 2.2.12		
Test mode:	Compliance	Verdict:	PASS
Date & Time:	8/31/2008 7:57:35 PM		
Temperature: 25ºC	Air Pressure: 1010 hPa	Relative Humidity: 62%	Power Supply: 3.6 VDC
Remarks:			

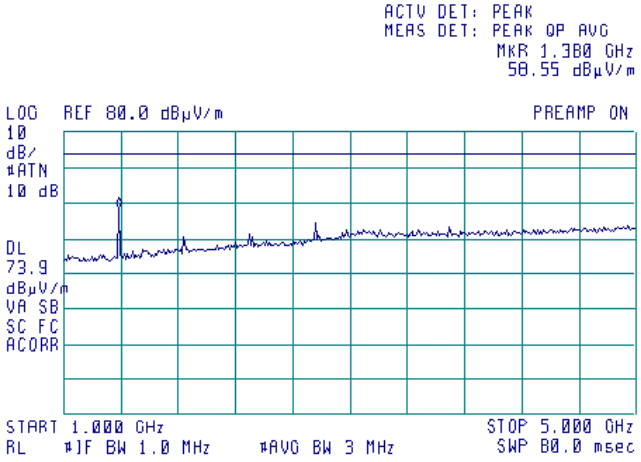
Plot 7.5.13 Radiated emission measurements in 1000 – 5000 MHz range

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



Plot 7.5.14 Radiated emission measurements in 1000 – 5000 MHz range

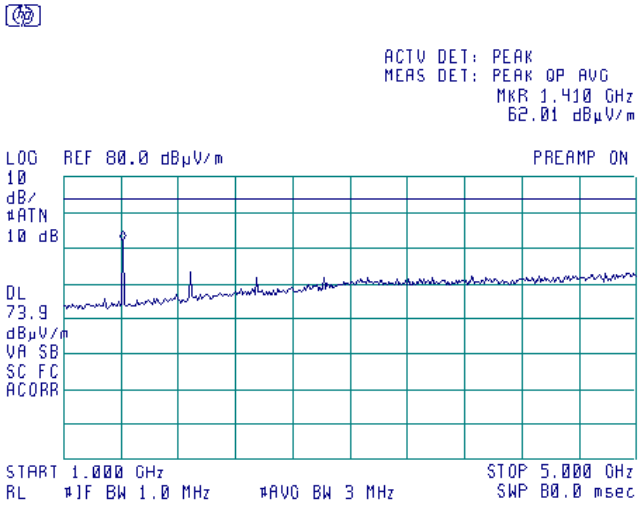
TEST SITE:	Semi anechoic chamber
CARRIER FREQUENCY:	Mid
ANTENNA POLARIZATION:	Vertical and Horizontal
TEST DISTANCE:	3 m



Test specification:	Section 90.217, Radiated spurious emissions		
Test procedure:	47 CFR, Sections 2.1053 and 90.217; TIA/EIA-603-A, Section 2.2.12		
Test mode:	Compliance	Verdict:	PASS
Date & Time:	8/31/2008 7:57:35 PM		
Temperature: 25ºC	Air Pressure: 1010 hPa	Relative Humidity: 62%	Power Supply: 3.6 VDC
Remarks:			

Plot 7.5.15 Radiated emission measurements in 1000 – 5000 MHz range

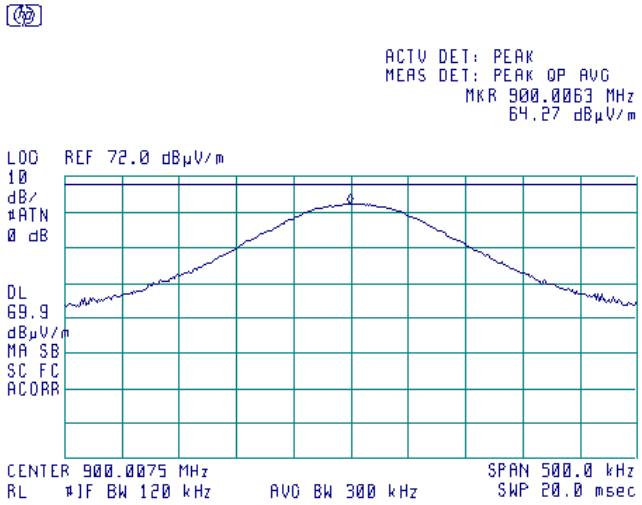
TEST SITE:	Semi anechoic chamber
CARRIER FREQUENCY:	High
ANTENNA POLARIZATION:	Vertical and Horizontal
TEST DISTANCE:	3 m



Test specification:	Section 90.217, Radiated spurious emissions		
Test procedure:	47 CFR, Sections 2.1053 and 90.217; TIA/EIA-603-A, Section 2.2.12		
Test mode:	Compliance	Verdict:	PASS
Date & Time:	8/31/2008 7:57:35 PM		
Temperature: 25ºC	Air Pressure: 1010 hPa	Relative Humidity: 62%	Power Supply: 3.6 VDC
Remarks:			

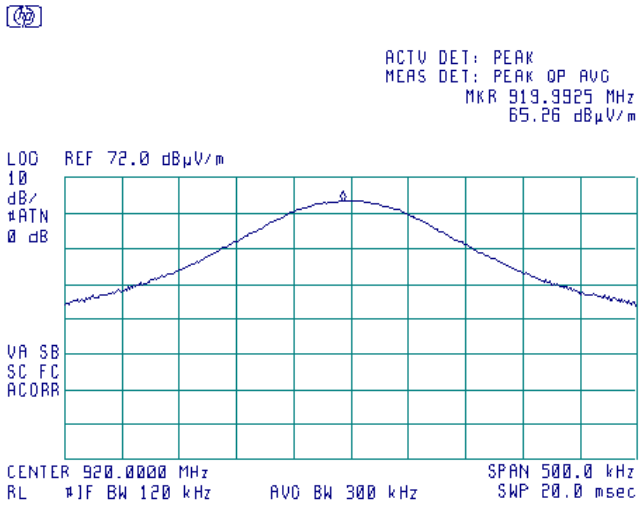
Plot 7.5.16 Radiated emission measurements at the 2nd harmonic

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



Plot 7.5.17 Radiated emission measurements at the 2nd harmonic

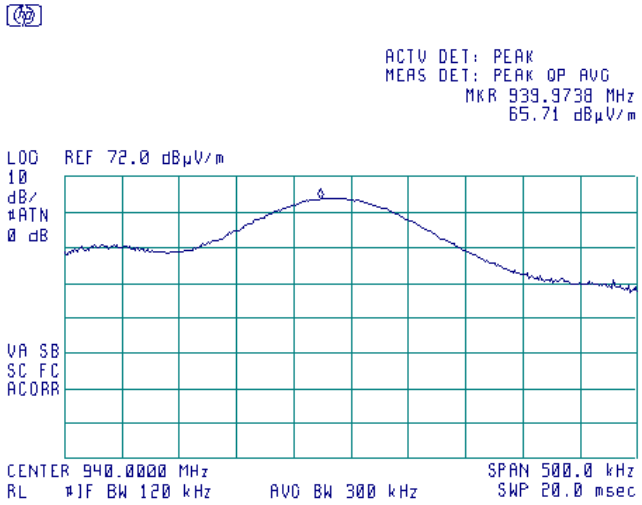
TEST SITE:	OATS
CARRIER FREQUENCY:	Mid
ANTENNA POLARIZATION:	Vertical
TEST DISTANCE:	3 m



Test specification:	Section 90.217, Radiated spurious emissions		
Test procedure:	47 CFR, Sections 2.1053 and 90.217; TIA/EIA-603-A, Section 2.2.12		
Test mode:	Compliance	Verdict:	PASS
Date & Time:	8/31/2008 7:57:35 PM		
Temperature: 25ºC	Air Pressure: 1010 hPa	Relative Humidity: 62%	Power Supply: 3.6 VDC
Remarks:			

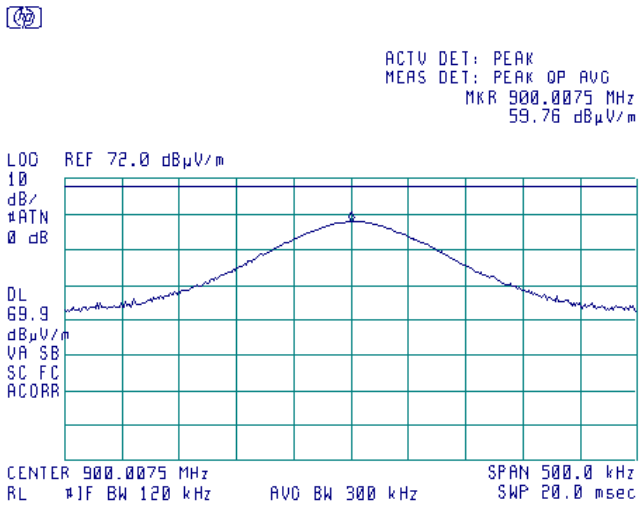
Plot 7.5.18 Radiated emission measurements at the 2nd harmonic

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



Plot 7.5.19 Radiated emission measurements at the 2nd harmonic

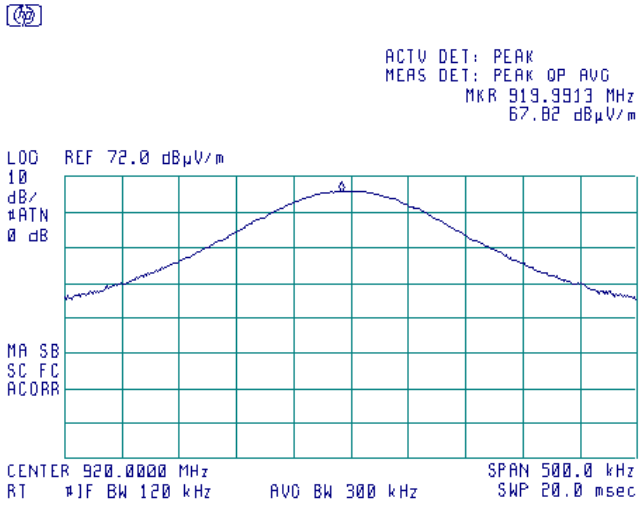
TEST SITE:	OATS
CARRIER FREQUENCY:	Low
ANTENNA POLARIZATION:	Horizontal
TEST DISTANCE:	3 m



Test specification:	Section 90.217, Radiated spurious emissions		
Test procedure:	47 CFR, Sections 2.1053 and 90.217; TIA/EIA-603-A, Section 2.2.12		
Test mode:	Compliance	Verdict:	PASS
Date & Time:	8/31/2008 7:57:35 PM		
Temperature: 25ºC	Air Pressure: 1010 hPa	Relative Humidity: 62%	Power Supply: 3.6 VDC
Remarks:			

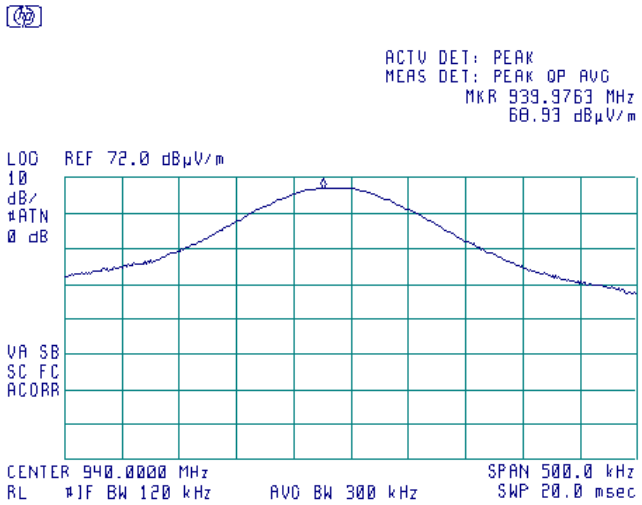
Plot 7.5.20 Radiated emission measurements at the 2nd harmonic

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



Plot 7.5.21 Radiated emission measurements at the 2nd harmonic

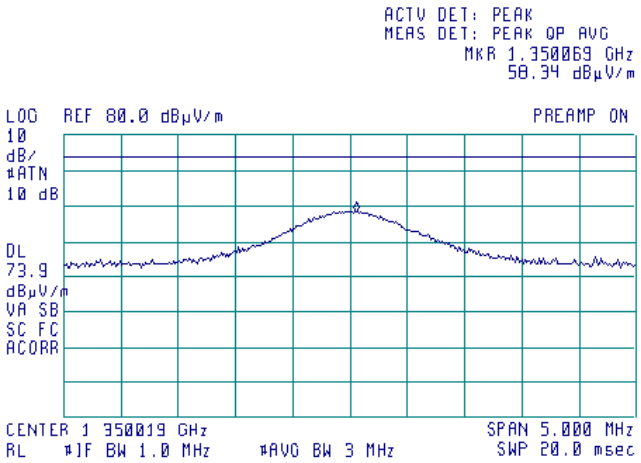
TEST SITE:	OATS
CARRIER FREQUENCY:	High
ANTENNA POLARIZATION:	Horizontal
TEST DISTANCE:	3 m



Test specification:	Section 90.217, Radiated spurious emissions		
Test procedure:	47 CFR, Sections 2.1053 and 90.217; TIA/EIA-603-A, Section 2.2.12		
Test mode:	Compliance	Verdict:	PASS
Date & Time:	8/31/2008 7:57:35 PM		
Temperature: 25ºC	Air Pressure: 1010 hPa	Relative Humidity: 62%	Power Supply: 3.6 VDC
Remarks:			

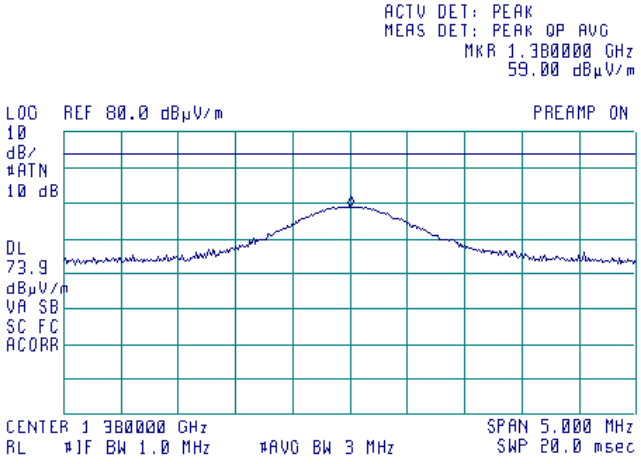
Plot 7.5.22 Radiated emission measurements at the 3rd harmonic

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



Plot 7.5.23 Radiated emission measurements at the 3rd harmonic

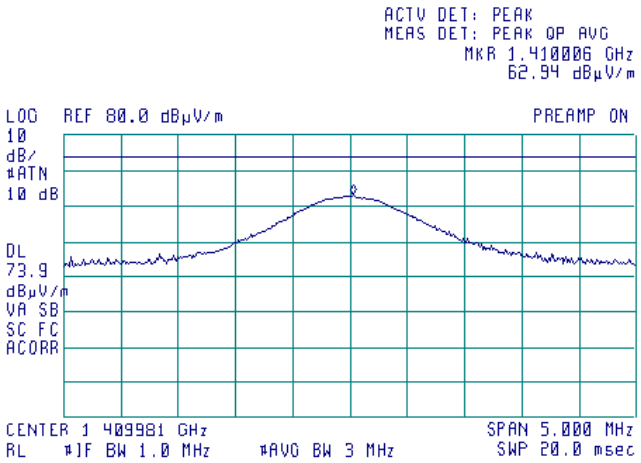
TEST SITE:	Semi anechoic chamber
CARRIER FREQUENCY:	Mid
ANTENNA POLARIZATION:	Vertical
TEST DISTANCE:	3 m



Test specification:	Section 90.217, Radiated spurious emissions		
Test procedure:	47 CFR, Sections 2.1053 and 90.217; TIA/EIA-603-A, Section 2.2.12		
Test mode:	Compliance	Verdict:	PASS
Date & Time:	8/31/2008 7:57:35 PM		
Temperature: 25ºC	Air Pressure: 1010 hPa	Relative Humidity: 62%	Power Supply: 3.6 VDC
Remarks:			

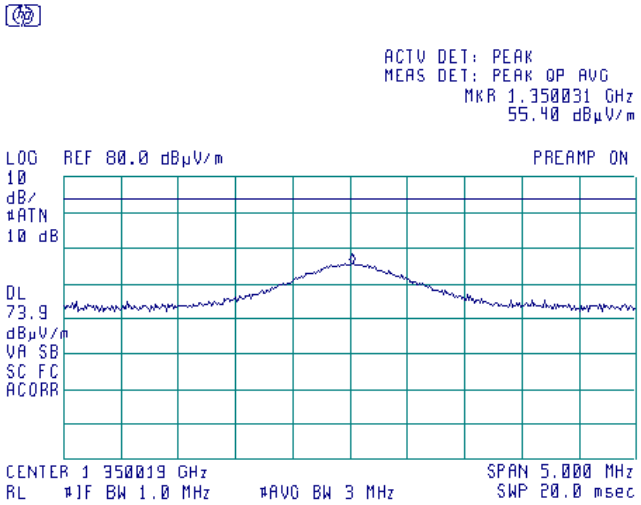
Plot 7.5.24 Radiated emission measurements at the 3rd harmonic

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



Plot 7.5.25 Radiated emission measurements at the 3rd harmonic

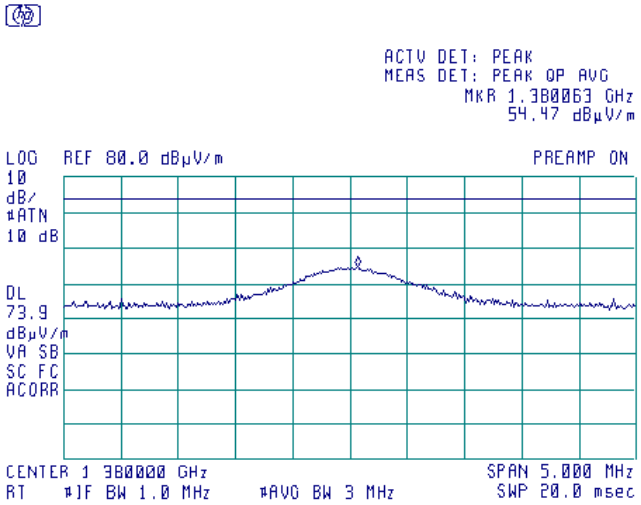
TEST SITE:	Semi anechoic chamber
CARRIER FREQUENCY:	Low
ANTENNA POLARIZATION:	Horizontal
TEST DISTANCE:	3 m



Test specification:	Section 90.217, Radiated spurious emissions		
Test procedure:	47 CFR, Sections 2.1053 and 90.217; TIA/EIA-603-A, Section 2.2.12		
Test mode:	Compliance	Verdict:	PASS
Date & Time:	8/31/2008 7:57:35 PM		
Temperature: 25ºC	Air Pressure: 1010 hPa	Relative Humidity: 62%	Power Supply: 3.6 VDC
Remarks:			

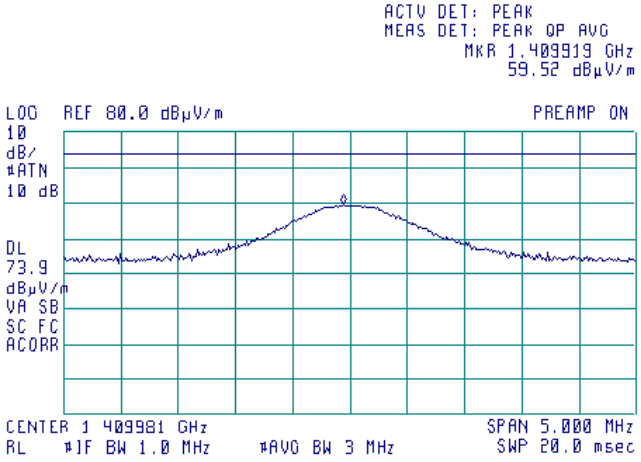
Plot 7.5.26 Radiated emission measurements at the 3rd harmonic

TEST SITE:	Semi anechoic chamber
CARRIER FREQUENCY:	Mid
ANTENNA POLARIZATION:	Horizontal
TEST DISTANCE:	3 m



Plot 7.5.27 Radiated emission measurements at the 3rd harmonic

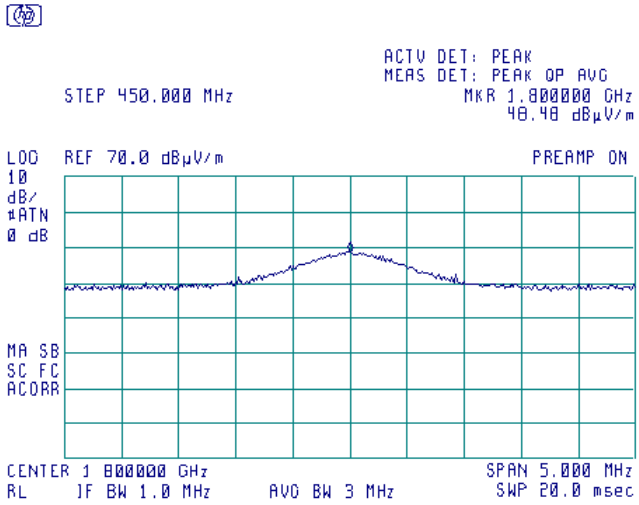
TEST SITE:	Semi anechoic chamber
CARRIER FREQUENCY:	High
ANTENNA POLARIZATION:	Horizontal
TEST DISTANCE:	3 m



Test specification:	Section 90.217, Radiated spurious emissions		
Test procedure:	47 CFR, Sections 2.1053 and 90.217; TIA/EIA-603-A, Section 2.2.12		
Test mode:	Compliance	Verdict:	PASS
Date & Time:	8/31/2008 7:57:35 PM		
Temperature: 25ºC	Air Pressure: 1010 hPa	Relative Humidity: 62%	Power Supply: 3.6 VDC
Remarks:			

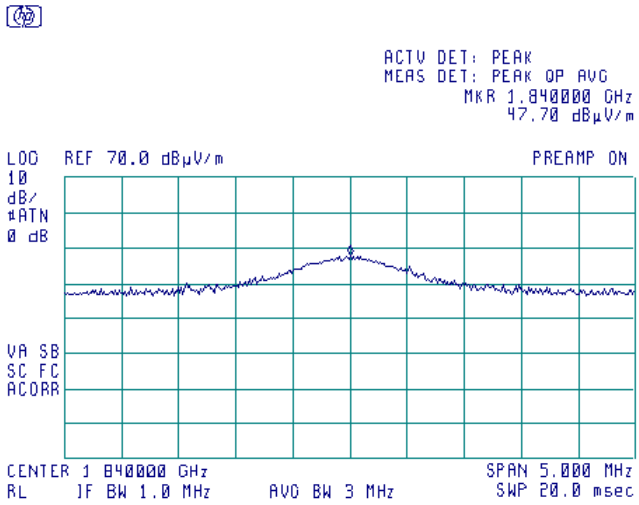
Plot 7.5.28 Radiated emission measurements at the 4th harmonic

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



Plot 7.5.29 Radiated emission measurements at the 4th harmonic

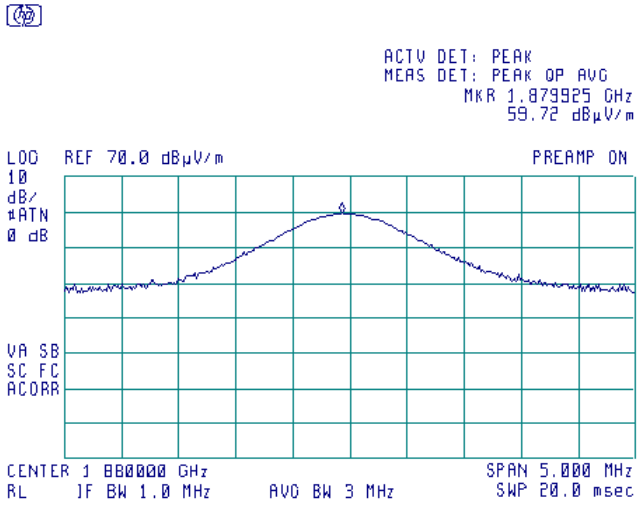
TEST SITE:	Semi anechoic chamber
CARRIER FREQUENCY:	Mid
ANTENNA POLARIZATION:	Vertical
TEST DISTANCE:	3 m



Test specification:	Section 90.217, Radiated spurious emissions		
Test procedure:	47 CFR, Sections 2.1053 and 90.217; TIA/EIA-603-A, Section 2.2.12		
Test mode:	Compliance	Verdict:	PASS
Date & Time:	8/31/2008 7:57:35 PM		
Temperature: 25ºC	Air Pressure: 1010 hPa	Relative Humidity: 62%	Power Supply: 3.6 VDC
Remarks:			

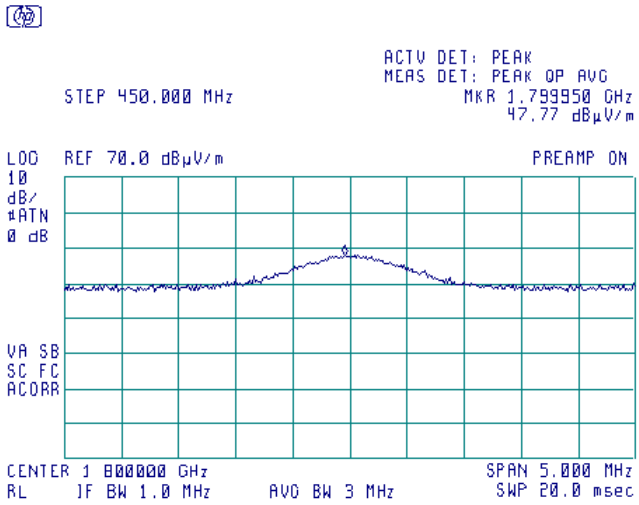
Plot 7.5.30 Radiated emission measurements at the 4th harmonic

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



Plot 7.5.31 Radiated emission measurements at the 4th harmonic

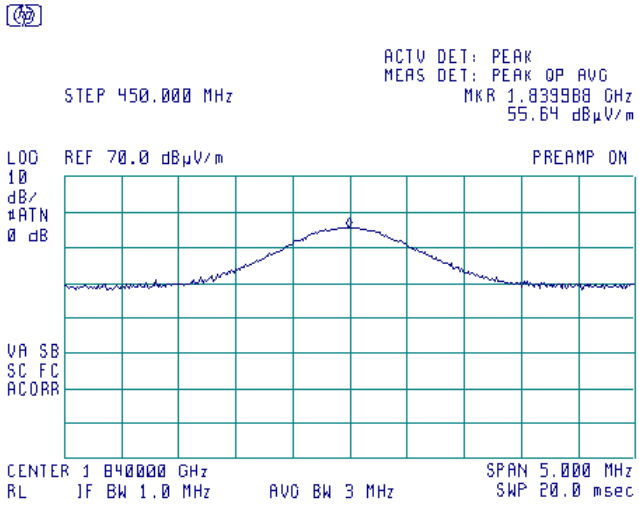
TEST SITE:	Semi anechoic chamber
CARRIER FREQUENCY:	Low
ANTENNA POLARIZATION:	Horizontal
TEST DISTANCE:	3 m



Test specification:	Section 90.217, Radiated spurious emissions		
Test procedure:	47 CFR, Sections 2.1053 and 90.217; TIA/EIA-603-A, Section 2.2.12		
Test mode:	Compliance	Verdict:	PASS
Date & Time:	8/31/2008 7:57:35 PM		
Temperature: 25ºC	Air Pressure: 1010 hPa	Relative Humidity: 62%	Power Supply: 3.6 VDC
Remarks:			

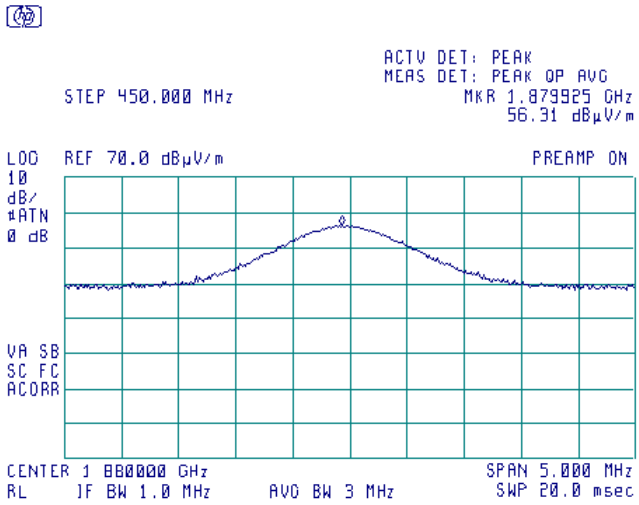
Plot 7.5.32 Radiated emission measurements at the 4th harmonic

TEST SITE:	Semi anechoic chamber
CARRIER FREQUENCY:	Mid
ANTENNA POLARIZATION:	Horizontal
TEST DISTANCE:	3 m



Plot 7.5.33 Radiated emission measurements at the 4th harmonic

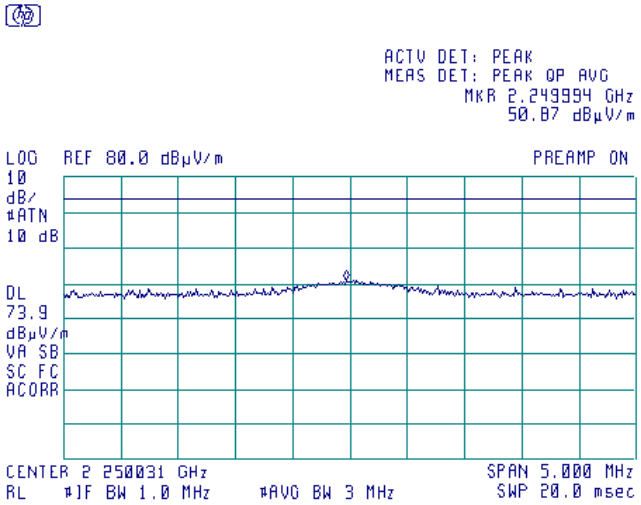
TEST SITE:	Semi anechoic chamber
CARRIER FREQUENCY:	High
ANTENNA POLARIZATION:	Horizontal
TEST DISTANCE:	3 m



Test specification:	Section 90.217, Radiated spurious emissions		
Test procedure:	47 CFR, Sections 2.1053 and 90.217; TIA/EIA-603-A, Section 2.2.12		
Test mode:	Compliance	Verdict:	PASS
Date & Time:	8/31/2008 7:57:35 PM		
Temperature: 25ºC	Air Pressure: 1010 hPa	Relative Humidity: 62%	Power Supply: 3.6 VDC
Remarks:			

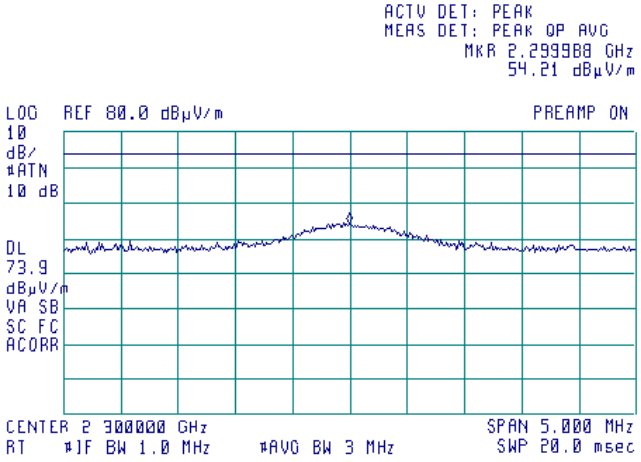
Plot 7.5.34 Radiated emission measurements at the 5th harmonic

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



Plot 7.5.35 Radiated emission measurements at the 5th harmonic

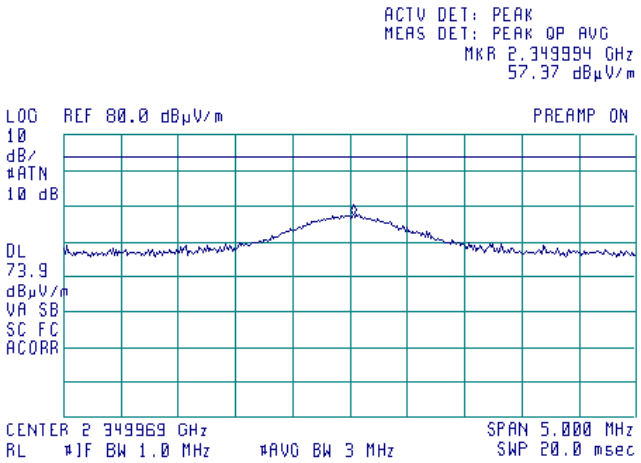
TEST SITE:	Semi anechoic chamber
CARRIER FREQUENCY:	Mid
ANTENNA POLARIZATION:	Vertical
TEST DISTANCE:	3 m



Test specification:	Section 90.217, Radiated spurious emissions		
Test procedure:	47 CFR, Sections 2.1053 and 90.217; TIA/EIA-603-A, Section 2.2.12		
Test mode:	Compliance	Verdict:	PASS
Date & Time:	8/31/2008 7:57:35 PM		
Temperature: 25ºC	Air Pressure: 1010 hPa	Relative Humidity: 62%	Power Supply: 3.6 VDC
Remarks:			

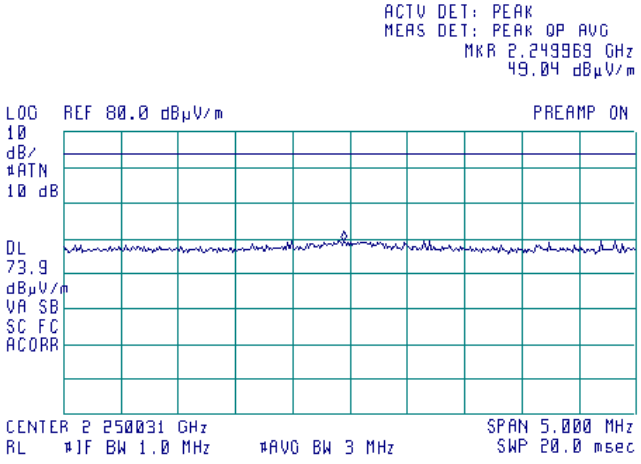
Plot 7.5.36 Radiated emission measurements at the 5th harmonic

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



Plot 7.5.37 Radiated emission measurements at the 5th harmonic

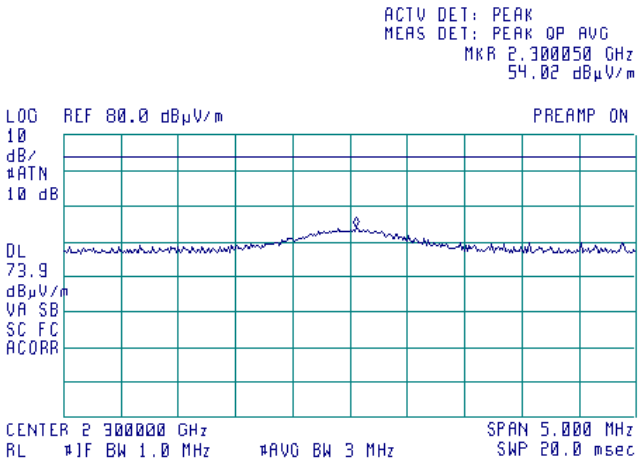
TEST SITE:	Semi anechoic chamber
CARRIER FREQUENCY:	Low
ANTENNA POLARIZATION:	Horizontal
TEST DISTANCE:	3 m



Test specification:	Section 90.217, Radiated spurious emissions		
Test procedure:	47 CFR, Sections 2.1053 and 90.217; TIA/EIA-603-A, Section 2.2.12		
Test mode:	Compliance	Verdict:	PASS
Date & Time:	8/31/2008 7:57:35 PM		
Temperature: 25ºC	Air Pressure: 1010 hPa	Relative Humidity: 62%	Power Supply: 3.6 VDC
Remarks:			

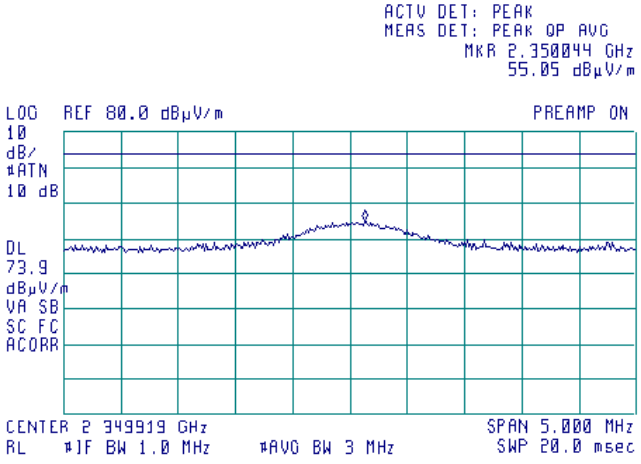
Plot 7.5.38 Radiated emission measurements at the 5th harmonic

TEST SITE:	Semi anechoic chamber
CARRIER FREQUENCY:	Mid
ANTENNA POLARIZATION:	Horizontal
TEST DISTANCE:	3 m



Plot 7.5.39 Radiated emission measurements at the 5th harmonic

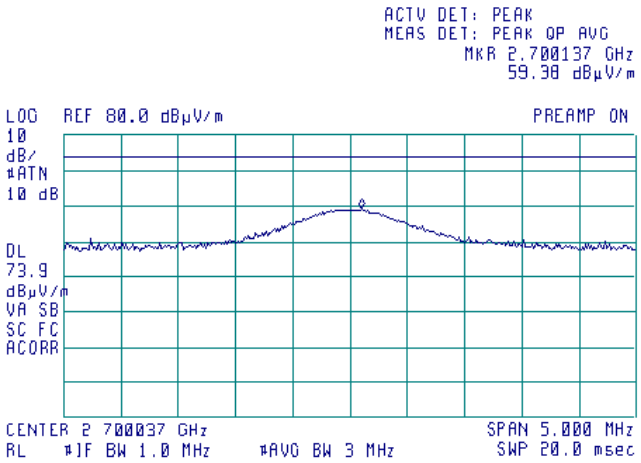
TEST SITE:	Semi anechoic chamber
CARRIER FREQUENCY:	High
ANTENNA POLARIZATION:	Horizontal
TEST DISTANCE:	3 m



Test specification:	Section 90.217, Radiated spurious emissions		
Test procedure:	47 CFR, Sections 2.1053 and 90.217; TIA/EIA-603-A, Section 2.2.12		
Test mode:	Compliance	Verdict:	PASS
Date & Time:	8/31/2008 7:57:35 PM		
Temperature: 25ºC	Air Pressure: 1010 hPa	Relative Humidity: 62%	Power Supply: 3.6 VDC
Remarks:			

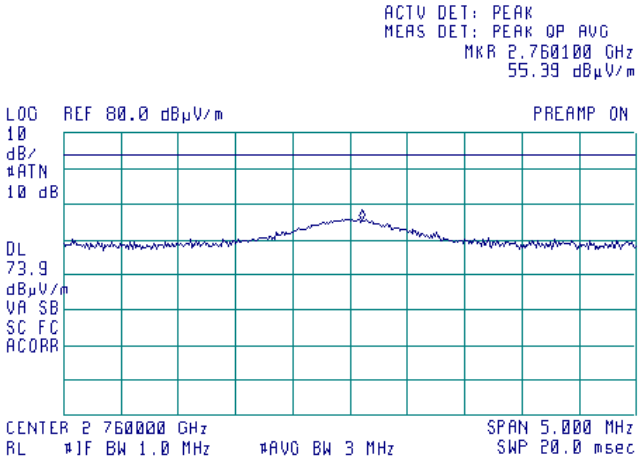
Plot 7.5.40 Radiated emission measurements at the 6th harmonic

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



Plot 7.5.41 Radiated emission measurements at the 6th harmonic

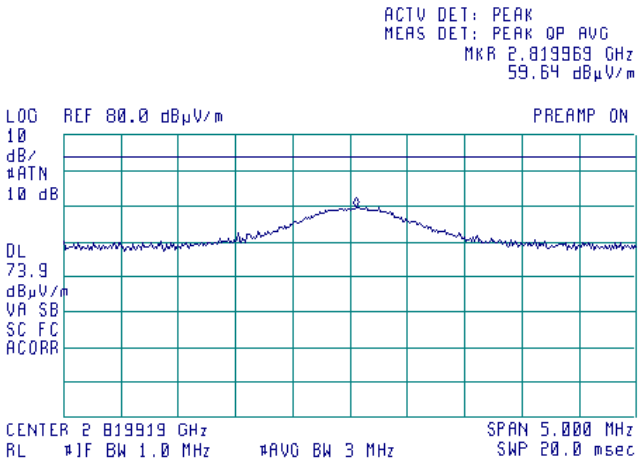
TEST SITE:	Semi anechoic chamber
CARRIER FREQUENCY:	Mid
ANTENNA POLARIZATION:	Vertical
TEST DISTANCE:	3 m



Test specification:	Section 90.217, Radiated spurious emissions		
Test procedure:	47 CFR, Sections 2.1053 and 90.217; TIA/EIA-603-A, Section 2.2.12		
Test mode:	Compliance	Verdict:	PASS
Date & Time:	8/31/2008 7:57:35 PM		
Temperature: 25ºC	Air Pressure: 1010 hPa	Relative Humidity: 62%	Power Supply: 3.6 VDC
Remarks:			

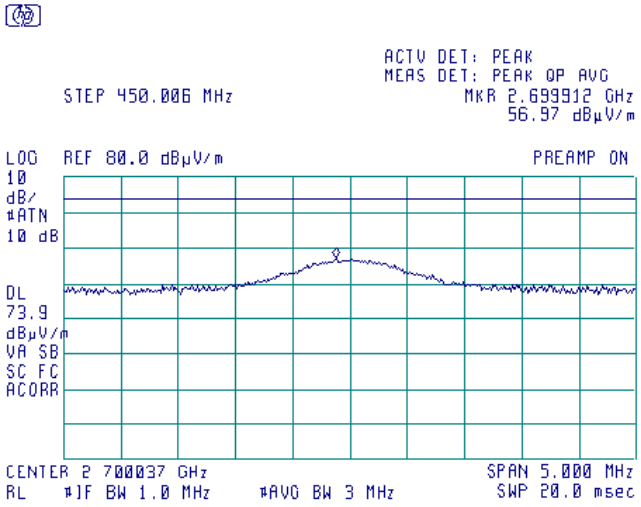
Plot 7.5.42 Radiated emission measurements at the 6th harmonic

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



Plot 7.5.43 Radiated emission measurements at the 6th harmonic

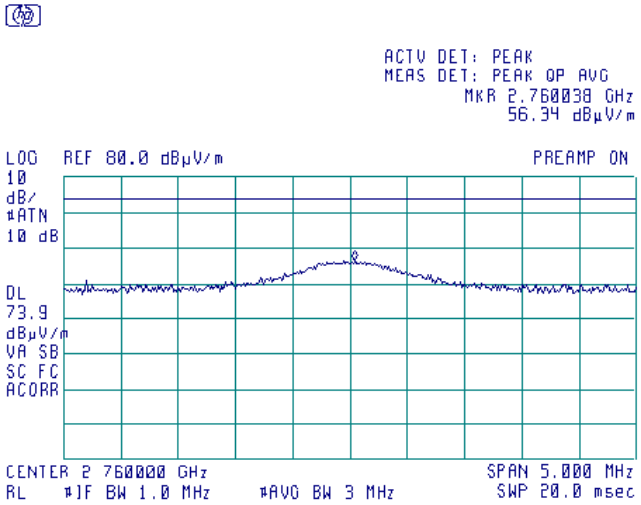
TEST SITE:	Semi anechoic chamber
CARRIER FREQUENCY:	Low
ANTENNA POLARIZATION:	Horizontal
TEST DISTANCE:	3 m



Test specification:	Section 90.217, Radiated spurious emissions		
Test procedure:	47 CFR, Sections 2.1053 and 90.217; TIA/EIA-603-A, Section 2.2.12		
Test mode:	Compliance	Verdict:	PASS
Date & Time:	8/31/2008 7:57:35 PM		
Temperature: 25ºC	Air Pressure: 1010 hPa	Relative Humidity: 62%	Power Supply: 3.6 VDC
Remarks:			

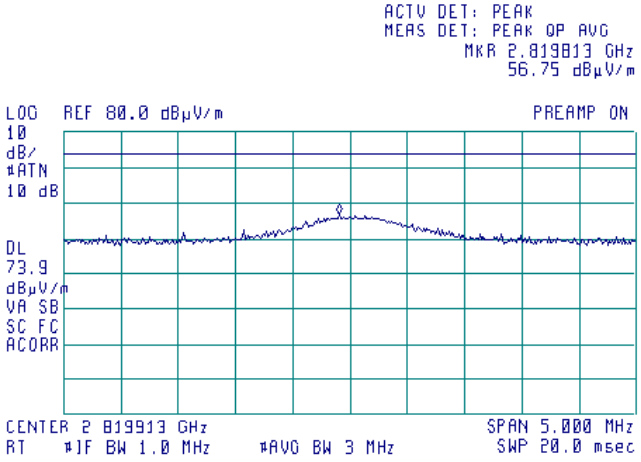
Plot 7.5.44 Radiated emission measurements at the 6th harmonic

TEST SITE:	Semi anechoic chamber
CARRIER FREQUENCY:	Mid
ANTENNA POLARIZATION:	Horizontal
TEST DISTANCE:	3 m



Plot 7.5.45 Radiated emission measurements at the 6th harmonic

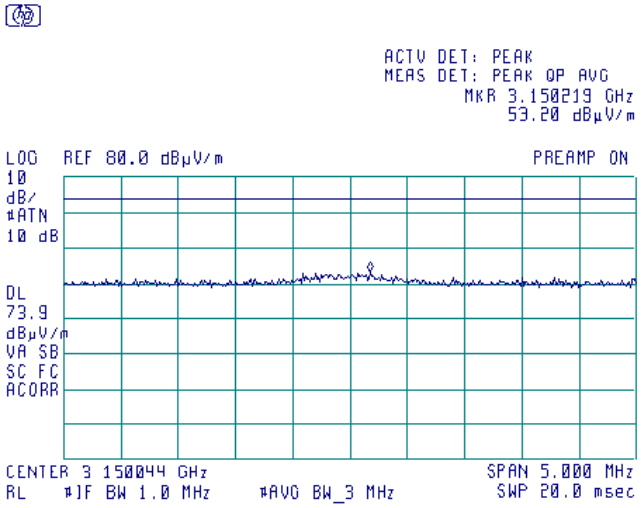
TEST SITE:	Semi anechoic chamber
CARRIER FREQUENCY:	High
ANTENNA POLARIZATION:	Horizontal
TEST DISTANCE:	3 m



Test specification:	Section 90.217, Radiated spurious emissions		
Test procedure:	47 CFR, Sections 2.1053 and 90.217; TIA/EIA-603-A, Section 2.2.12		
Test mode:	Compliance	Verdict:	PASS
Date & Time:	8/31/2008 7:57:35 PM		
Temperature: 25ºC	Air Pressure: 1010 hPa	Relative Humidity: 62%	Power Supply: 3.6 VDC
Remarks:			

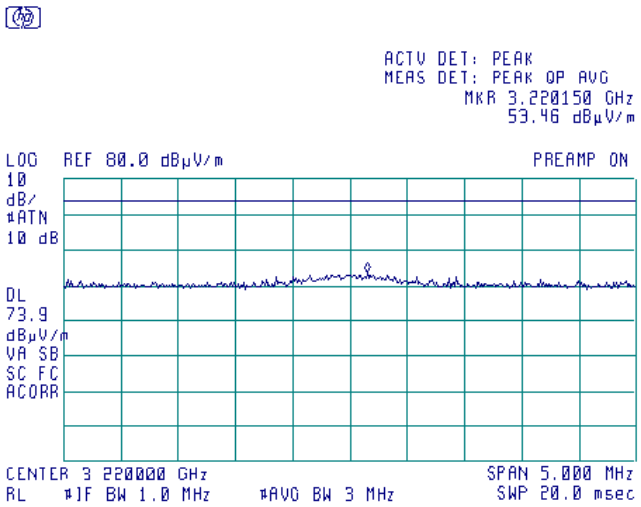
Plot 7.5.46 Radiated emission measurements at the 7th harmonic

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



Plot 7.5.47 Radiated emission measurements at the 7th harmonic

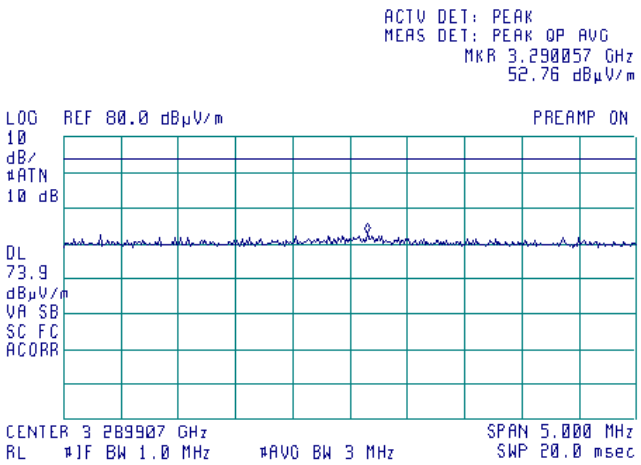
TEST SITE: Semi anechoic chamber
CARRIER FREQUENCY: Mid
ANTENNA POLARIZATION: Vertical
TEST DISTANCE: 3 m



Test specification:	Section 90.217, Radiated spurious emissions		
Test procedure:	47 CFR, Sections 2.1053 and 90.217; TIA/EIA-603-A, Section 2.2.12		
Test mode:	Compliance	Verdict:	PASS
Date & Time:	8/31/2008 7:57:35 PM		
Temperature: 25ºC	Air Pressure: 1010 hPa	Relative Humidity: 62%	Power Supply: 3.6 VDC
Remarks:			

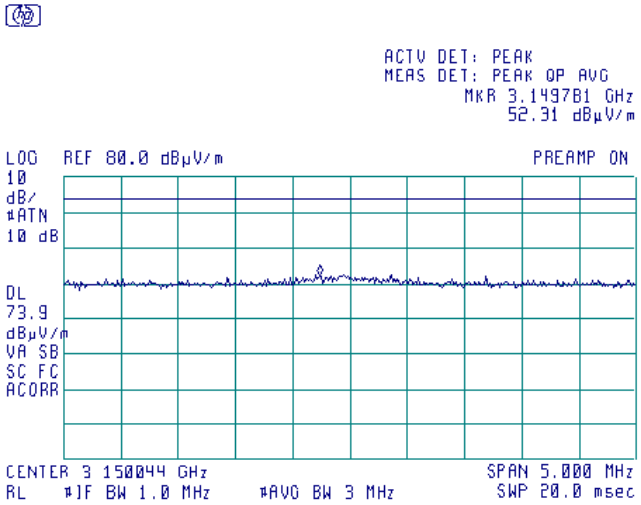
Plot 7.5.48 Radiated emission measurements at the 7th harmonic

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



Plot 7.5.49 Radiated emission measurements at the 7th harmonic

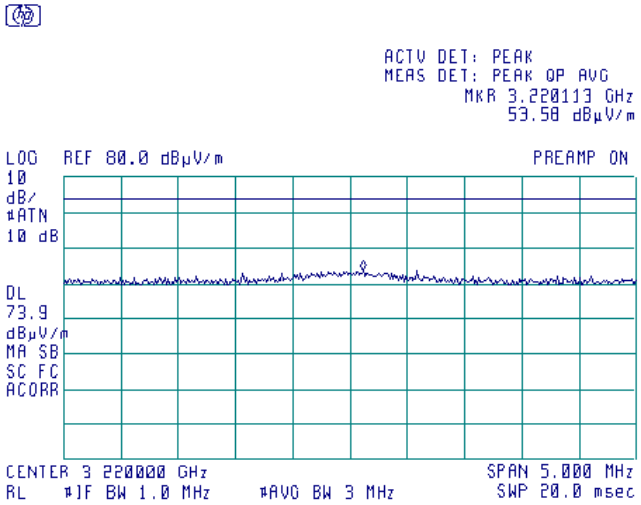
TEST SITE:	Semi anechoic chamber
CARRIER FREQUENCY:	Low
ANTENNA POLARIZATION:	Horizontal
TEST DISTANCE:	3 m



Test specification:	Section 90.217, Radiated spurious emissions		
Test procedure:	47 CFR, Sections 2.1053 and 90.217; TIA/EIA-603-A, Section 2.2.12		
Test mode:	Compliance	Verdict:	PASS
Date & Time:	8/31/2008 7:57:35 PM		
Temperature: 25ºC	Air Pressure: 1010 hPa	Relative Humidity: 62%	Power Supply: 3.6 VDC
Remarks:			

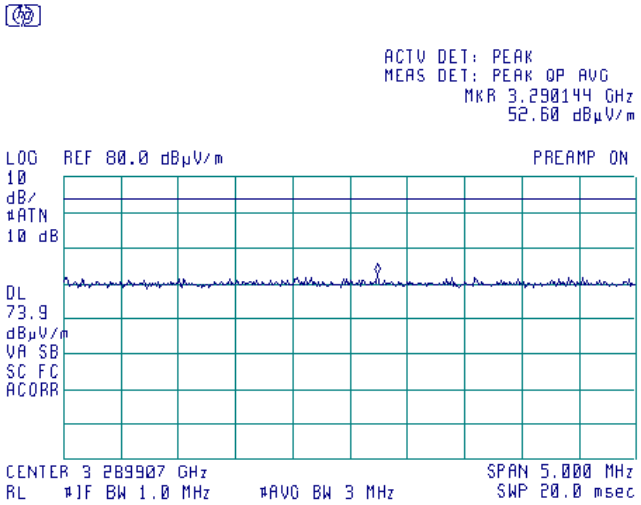
Plot 7.5.50 Radiated emission measurements at the 7th harmonic

TEST SITE:	Semi anechoic chamber
CARRIER FREQUENCY:	Mid
ANTENNA POLARIZATION:	Horizontal
TEST DISTANCE:	3 m



Plot 7.5.51 Radiated emission measurements at the 7th harmonic

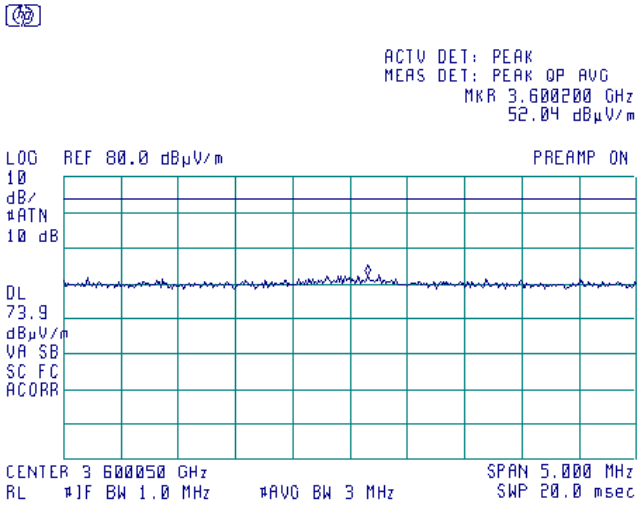
TEST SITE:	Semi anechoic chamber
CARRIER FREQUENCY:	High
ANTENNA POLARIZATION:	Horizontal
TEST DISTANCE:	3 m



Test specification:	Section 90.217, Radiated spurious emissions		
Test procedure:	47 CFR, Sections 2.1053 and 90.217; TIA/EIA-603-A, Section 2.2.12		
Test mode:	Compliance	Verdict:	PASS
Date & Time:	8/31/2008 7:57:35 PM		
Temperature: 25ºC	Air Pressure: 1010 hPa	Relative Humidity: 62%	Power Supply: 3.6 VDC
Remarks:			

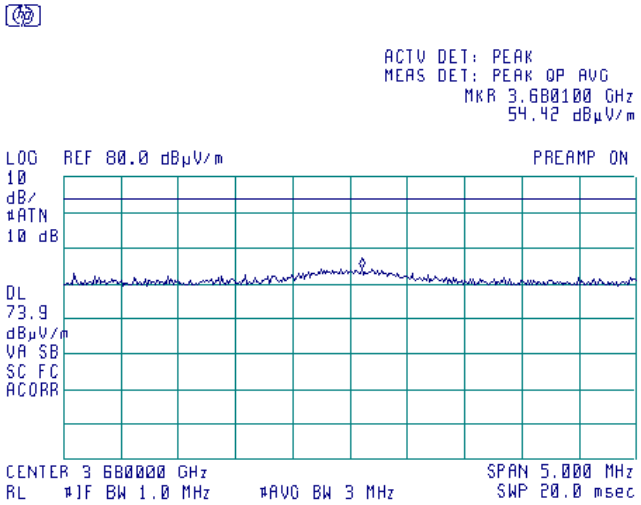
Plot 7.5.52 Radiated emission measurements at the 8th harmonic

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



Plot 7.5.53 Radiated emission measurements at the 8th harmonic

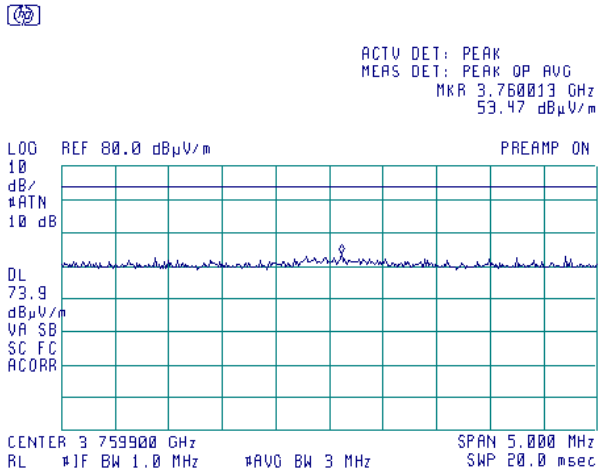
TEST SITE:	Semi anechoic chamber / OATS
CARRIER FREQUENCY:	Mid
ANTENNA POLARIZATION:	Vertical
TEST DISTANCE:	3 m



Test specification:	Section 90.217, Radiated spurious emissions		
Test procedure:	47 CFR, Sections 2.1053 and 90.217; TIA/EIA-603-A, Section 2.2.12		
Test mode:	Compliance	Verdict:	PASS
Date & Time:	8/31/2008 7:57:35 PM		
Temperature: 25ºC	Air Pressure: 1010 hPa	Relative Humidity: 62%	Power Supply: 3.6 VDC
Remarks:			

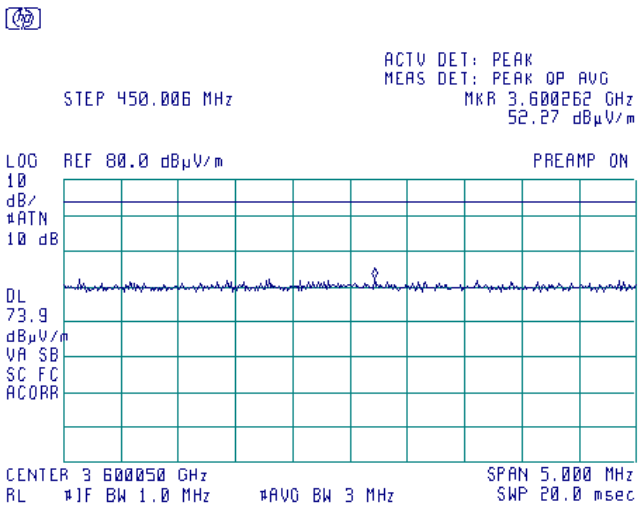
Plot 7.5.54 Radiated emission measurements at the 8th harmonic

TEST SITE:	Semi anechoic chamber / OATS
CARRIER FREQUENCY:	High
ANTENNA POLARIZATION:	Vertical
TEST DISTANCE:	3 m



Plot 7.5.55 Radiated emission measurements at the 8th harmonic

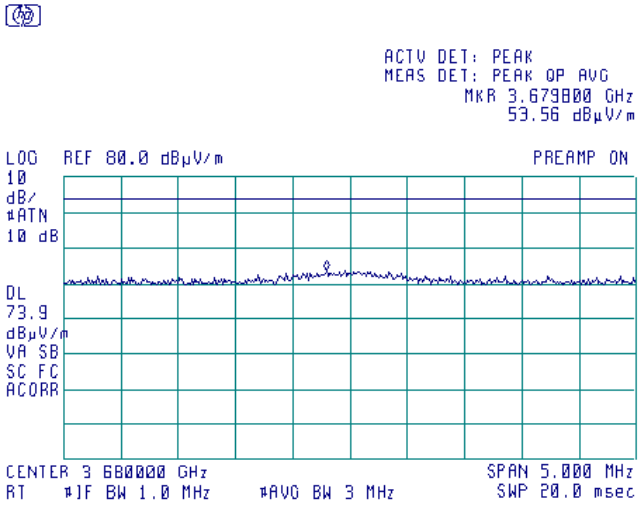
TEST SITE:	Semi anechoic chamber / OATS
CARRIER FREQUENCY:	Low
ANTENNA POLARIZATION:	Horizontal
TEST DISTANCE:	3 m



Test specification:	Section 90.217, Radiated spurious emissions		
Test procedure:	47 CFR, Sections 2.1053 and 90.217; TIA/EIA-603-A, Section 2.2.12		
Test mode:	Compliance	Verdict:	PASS
Date & Time:	8/31/2008 7:57:35 PM		
Temperature: 25ºC	Air Pressure: 1010 hPa	Relative Humidity: 62%	Power Supply: 3.6 VDC
Remarks:			

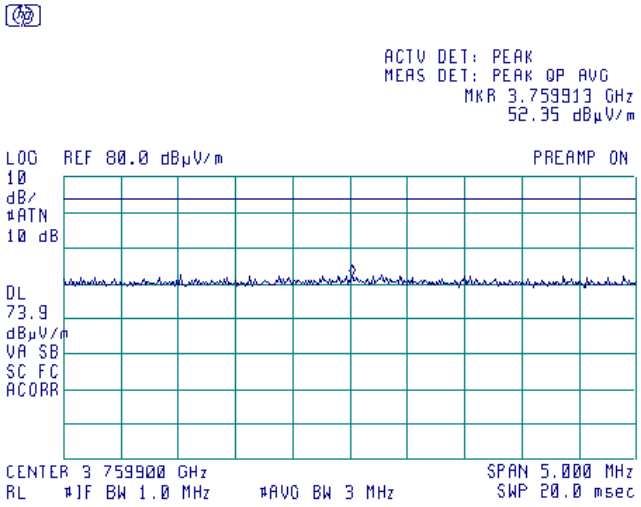
Plot 7.5.56 Radiated emission measurements at the 8th harmonic

TEST SITE: Semi anechoic chamber / OATS
CARRIER FREQUENCY: Mid
ANTENNA POLARIZATION: Horizontal
TEST DISTANCE: 3 m



Plot 7.5.57 Radiated emission measurements at the 8th harmonic

TEST SITE: Semi anechoic chamber / OATS
CARRIER FREQUENCY: High
ANTENNA POLARIZATION: Horizontal
TEST DISTANCE: 3 m



8 APPENDIX A Test equipment and ancillaries used for tests

HL No	Description	Manufacturer	Model	Ser. No.	Last Cal.	Due Cal.
0034	Antenna, Log Periodic, 200 - 1000 MHz	Electro-Metrics	LPA 25/30	1988	25-Sep-07	25-Sep-08
0415	Cable, Coax, RF, RG-214	Hermon Laboratories	CC-3	056	02-Dec-07	02-Dec-08
0446	Antenna, Loop active, 10 kHz-30 MHz	EMCO	6502	2857	29-Jun-08	29-Jun-09
0493	Temperature Chamber -45…175 deg C	Thermotron	S-1.2 Mini-Max	14016	19-May-08	19-May-09
0521	EMI Receiver (Spectrum Analyzer) with RF filter section 9 kHz-6.5 GHz	Hewlett Packard Co	8546A	3617A 00319, 3448A002 53	29-Aug-08	29-Aug-09
0569	Antenna, Log Periodic, 200 - 1000 MHz	Electro-Metrics	LPA 25/30	1953	25-Sep-07	25-Sep-08
0604	Antenna BiconiLog Log-Periodic/T Bow-TIE, 26 - 2000 MHz	EMCO	3141	9611-1011	10-Jan-08	10-Jan-09
0614	Antenna, Dipole, Tunable, 200 - 500 MHz	Electro-Metrics	TDS-30-1	334	29-Jan-08	29-Jan-09
0812	Cable Coax, RG-214, 11.5 m, N-type connectors	Hermon Laboratories	C214-11	148	02-Dec-07	02-Dec-08
1003	Cable Coaxial, M17/164, 10 m	Hermon Laboratories	C17164-10	161	04-Sep-08	04-Sep-09
1430	EMI Receiver, 9 kHz - 2.9 GHz, System: HL1431, HL1432	Agilent Technologies	8542E	3807A002 62,3705A0 0217	31-Aug-08	31-Aug-09
1448	Cable, 10 m	Harbour Industries	MIL 17/60-RG142	1448	02-Sep-08	02-Sep-09
1500	Cable RF, 15 m, N/N-type	Suhner Switzerland	RG 214/U	1500	08-Sep-08	08-Sep-09
1947	Cable 18GHz, 6.5 m, blue	Rhophase Microwave Limited	NPS-1803A-6500-NPS	T4974	05-Oct-07	05-Oct-08
1984	Antenna, Double-Ridged Waveguide Horn, 1-18 GHz, 300 W	EMC Test Systems	3115	9911-5964	03-Mar-08	03-Mar-09
2432	Antenna, Double-Ridged Waveguide Horn 1-18 GHz	EMC Test Systems	3115	00027177	03-Mar-08	03-Mar-09
2634	Power Supply, 0-36.0 VDC, 0-12.0 A	NEMIC-LAMBDA	UP36-12	2634	25-Aug-08	25-Aug-09
2667	Signal generator, 9 kHz - 3.3 GHz	Rohde & Schwarz	SML03	101909	25-Sep-06	25-Sep-08
3001	EMC Analyzer, 9 kHz to 3 GHz	Agilent Technologies	E7402A	US394401 80	22-Nov-07	22-Nov-08
3120	Microwave Cable Assembly, 18 GHz, 6.4 m, SMA - SMA	Huber-Suhner	198-9155-00	3120	13-Dec-07	13-Dec-08
3123	Microwave Cable Assembly, 18 GHz, 6.4 m, SMA - SMA	Huber-Suhner	198-9155-00	3123	13-Dec-07	13-Dec-08
3234	Signal generator, 9 kHz - 3.3 GHz	Rohde & Schwarz	SML03	103387	13-Jul-08	13-Jul-09
3309	Multimeter	Fluke	115C	94321809	28-Jul-08	28-Jul-09

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	±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 ± 13.9 %
Duty cycle, timing (Tx ON / OFF) and average factor measurements	± 1.0 %

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

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

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

10 APPENDIX C Test laboratory description

Tests were performed at Hermon Laboratories Ltd., which is a fully independent, private, EMC, safety, environmental and telecommunication testing facility. Hermon Laboratories is listed by the Federal Communications Commission (USA) for all parts of Code of Federal Regulations 47 (CFR 47) and by Industry Canada for electromagnetic emissions (file numbers IC 2186A-1 for OATS and IC 2186A-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

FCC 47CFR part 90: 2007	Private land mobile radio services
FCC 47CFR part 1: 2007	Practice and procedure
FCC 47CFR part 2: 2007	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: 2005	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-C:2004	Land Mobile FM or PM Communications Equipment Measurement and Performance Standards

12 APPENDIX E Test equipment correction factors

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

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

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

Antenna factor
Log periodic antenna
Electro-Metrics, model LPA-25/30
Ser.No.1988, HL 0034

Frequency MHz	Antenna Factor dB(1/m)	Frequency MHz	Antenna Factor dB(1/m)
200	12.6	625	20.4
225	12.2	650	20.9
250	13.4	675	22.0
275	14.3	700	22.2
300	15.2	725	22.7
325	15.7	750	22.5
350	15.9	775	22.7
375	16.4	800	22.8
400	17.0	825	23.2
425	17.4	850	23.5
450	17.9	875	23.9
475	18.6	900	24.0
500	19.1	925	24.0
525	19.3	950	24.2
550	19.6	975	24.7
575	19.8	1000	25.1
600	20.0		

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

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

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

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

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

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

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

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

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

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

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

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

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

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, M17/164, model: C17164-10, s/n 161, HL 1003

No.	Frequency, MHz	Cable loss, dB	Tolerance, dB	Measurement uncertainty, dB
1	30	0.41	≤ 12.5	±0.12
2	50	0.52		
3	100	0.75		
4	300	1.45		
5	500	2.01		
6	800	2.71		
7	1000	3.14		
8	1200	3.56		
9	1400	3.93		
10	1600	4.31		
11	1800	4.63		
12	2000	4.97		
13	2200	5.32		
14	2400	5.65		
15	2600	6.01		
16	2800	6.42	≤ 12.5	±0.12
17	3000	6.76		
18	3300	7.12		
19	3600	7.53		
20	3900	7.95		
21	4200	8.32		±0.17
22	4500	8.72		
23	4800	9.14		
24	5100	9.59		
25	5400	10.00		
26	5700	10.49		
27	6000	11.07		
28	6500	11.80		

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
Microwave Cable Assembly, 18 GHz, 6.4 m, SMA – SMA, Huber-Suhner, model 198-9155-00
HL 3123

Frequency, MHz	Cable loss, dB	Frequency, MHz	Cable loss, dB	Frequency, MHz	Cable loss, dB	Frequency, MHz	Cable loss, dB	Frequency, MHz	Cable loss, dB
10.0	0.11	3600	1.97	7400	3.12	11200	3.90	15100	4.74
30	0.17	3700	1.97	7500	3.13	11300	3.93	15200	4.70
50	0.25	3800	2.03	7600	3.16	11400	3.88	15300	4.73
100	0.32	3900	2.04	7700	3.18	11500	3.87	15400	4.78
200	0.46	4000	2.10	7800	3.20	11600	3.90	15500	4.75
300	0.58	4100	1.97	7900	3.23	11700	3.86	15600	4.76
400	0.65	4200	1.97	8000	3.25	11800	3.88	15700	4.75
500	0.74	4300	2.03	8100	3.26	11900	3.86	15800	4.78
600	0.82	4400	2.04	8200	3.28	12000	3.89	15900	4.79
700	0.89	4500	2.10	8300	3.31	12100	3.94	16000	4.73
800	0.95	4600	1.97	8400	3.31	12200	3.92	16100	4.78
900	1.01	4700	1.97	8500	3.32	12300	3.96	16200	4.84
1000	1.07	4800	2.03	8600	3.34	12400	4.01	16300	4.90
1100	1.11	4900	2.04	8700	3.35	12500	4.07	16400	4.87
1200	1.17	5000	2.10	8800	3.37	12600	4.08	16500	4.90
1300	1.22	5100	2.53	8900	3.39	12700	4.17	16600	4.98
1400	1.27	5200	2.55	9000	3.42	12800	4.26	16700	5.05
1500	1.29	5300	2.60	9100	3.43	12900	4.16	16800	5.04
1600	1.35	5400	2.61	9200	3.51	13000	4.21	16900	5.02
1700	1.40	5500	2.64	9300	3.52	13100	4.24	17000	5.09
1800	1.44	5600	2.70	9400	3.54	13200	4.27	17100	5.07
1900	1.51	5700	2.67	9500	3.63	13300	4.31	17200	5.10
2000	1.49	5800	2.71	9600	3.61	13400	4.33	17300	5.13
2100	1.55	5900	2.74	9700	3.71	13500	4.25	17400	5.23
2200	1.58	6000	2.80	9800	3.66	13600	4.27	17500	5.21
2300	1.62	6100	2.79	9900	3.77	13700	4.33	17600	5.22
2400	1.72	6200	2.81	10000	3.75	13800	4.33	17700	5.36
2500	1.76	6300	2.83	10100	3.77	13900	4.31	17800	5.35
2600	1.78	6400	2.86	10200	3.80	14000	4.30	17900	5.45
2700	1.80	6500	2.88	10300	3.79	14100	4.30	18000	5.43
2800	1.86	6600	2.90	10400	3.87	14200	4.31		
2900	1.90	6700	2.92	10500	3.83	14300	4.37		
3000	1.90	6800	2.98	10600	3.88	14400	4.35		
3100	1.97	6900	2.98	10700	3.86	14600	4.53		
3200	1.97	7000	3.00	10800	3.87	14700	4.50		
3300	2.03	7100	3.02	10900	3.90	14800	4.62		
3400	2.04	7200	3.04	11000	3.84	14900	4.65		
3500	2.10	7300	3.06	11100	3.88	15000	4.79		

13 APPENDIX F 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(μV)	decibel referred to one microvolt
dB(μV/m)	decibel referred to one microvolt per meter
dB(μA)	decibel referred to one microampere
dBΩ	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
μs	microsecond
NA	not applicable
NB	narrow band
NT	not tested
OATS	open area test site
Ω	Ohm
QP	quasi-peak
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

END OF DOCUMENT