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Electrical

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TEST REPORT

ACCORDING TO: FCC CFR 47 PART 90 §90.217 and PART 15 SUBPART B

FOR:

Miltel Communications Ltd.

Transceiver

Models: Irriwise-repeater 153, Irriwise-receiver 153

Table of contents

1 Applicant information

Client name:	Miltel Communications Ltd
Address:	7 Leshem street, P.O.Box 7374, Petach Tikva, 49170, Israel
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E-mail:	erez1@miltelcom.com
Contact name:	Mr. Erez Sharabi

2 Equipment under test attributes

Product name:	Transceiver
Model(s):	1) Irriwise-repeater 153, P/N 74300-001050 2) Irriwise-receiver 153, P/N 74300-001210
Receipt date	7/11/2004

3 Manufacturer information

Manufacturer name:	Miltel Communications Ltd
Address:	7 Leshem street, P.O.Box 7374, Petach Tikva, 49170, Israel
Telephone:	+972 3926 9550
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E-Mail:	erez1@miltelcom.com
Contact name:	Mr. Erez Sharabi

4 Test details

Project ID:	15979
Location:	Hermon Laboratories Ltd. P.O.Box 23, Binyamina 30500, Israel
Test started:	7/11/2004
Test completed:	8/31/2004
Test specification(s):	47CFR part 90, §§90.217(a), part 15 §15.107, §15.109
Test suite:	FCC_90_BS_with_RF_connector_below_120mW (7/15/2004 12:12:42 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	Pass
Section 90.210, Radiated spurious emissions	Pass
Section 90.210, Conducted spurious emissions	Pass
Section 90.213, Frequency stability	Pass
Section 90.214, Transient frequency behaviour	Pass
Section 90.217, Band edge emission	Pass
Unintentional emissions	
Section 15.107, Conducted emission at AC power port	Pass
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. 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. A. Kruglov, test engineer	August 31, 2004	
Reviewed by:	Mrs. M. Cherniavsky, certification engineer	September 1, 2004	
	Mr. M. Nikishin, EMC group leader	September 2, 2004	
Approved by:	Mr. A. Usoskin, C.E.O.	September 5, 2004	

6 EUT description

6.1 General information

The EUT, transceiver, is a part of IrriWise™ system intended to provide the farmer/grower with better control over crop irrigation and farm resources by means of remote data collection and analysis. The transceiver may be used as a Receiver and/or as a Repeater. The Receiver is installed (with an antenna) at the base station and is connected to a PC that saves the information and displays it for further analysis. The Receiver is responsible for the reception of data sent by the transmitters and for its transfer to the PC via a standard RS232 serial connection.
The Repeater is a device which is identical to the Receiver (the same transceiver except that the Receiver has an external cable for connection to the PC). The Repeater picks up the signals transmitted by the IrriWise™ transmitters and relays them to the Receiver. The Repeater should be located at a strategic point between the transmitters and the Receiver (base station). This unit operates in 150-170 MHz range with 25 kHz RF channel spacing, 600 bps data rate, requires 12 V DC power or a battery charged by a solar panel.

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:	7/12/2004 9:08:31 PM		
Temperature: 25 ºC	Air Pressure: 1001 hPa	Relative Humidity: 42 %	Power Supply: 12VDC
Remarks:			

7 Transmitter tests according to 47CFR part 90 requirements

7.1 Peak output power test

7.1.1 General

This test was performed to measure the peak output power at RF antenna connector. Specification test limits are given in Table 7.1.1. The test results are provided in Table 7.1.2 and associated plots.

Table 7.1.1 Peak output power limits

Operating frequency range, MHz	Maximum peak output power	
	mW	dBm
150.2 – 169.8	120	20.8

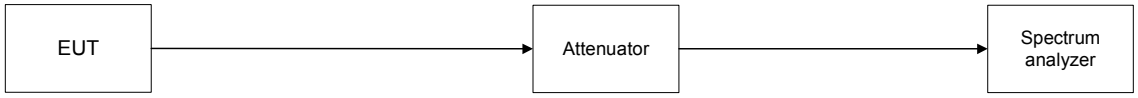
7.1.2 Test procedure

7.1.2.1 The EUT was set up as shown in Figure 7.1.1, energized and its proper operation was checked.

7.1.2.2 The EUT was adjusted to produce maximum available for end user RF output power.

7.1.2.3 The peak output power was measured with spectrum analyzer as provided in Table 7.1.2 and associated plots.

Figure 7.1.1 Peak output power test setup



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:	7/12/2004 9:08:31 PM		
Temperature: 25 ºC	**Air Pressure:** 1001 hPa	**Relative Humidity:** 42 %	**Power Supply:** 12VDC
Remarks:			

Table 7.1.2 Peak output power test results

OPERATING FREQUENCY RANGE:	150 – 170 MHz
DETECTOR USED:	Peak
RESOLUTION BANDWIDTH:	30 kHz
VIDEO BANDWIDTH:	Off
MODULATION:	FSK
MODULATING SIGNAL:	Alternative signal
BIT RATE:	600 bps
TRANSMITTER OUTPUT POWER SETTINGS:	Maximum

Carrier frequency, MHz	Spectrum analyzer reading, dBm	External attenuation, dB	Cable loss, dB	RF output power, dBm	Limit, dBm	Margin, dB	Verdict
150.2	-10.64	30.0	0.1	19.46	20.8	1.34	pass
160.0	-10.77	30.0	0.1	19.33	20.8	1.47	pass
169.8	-11.09	30.0	0.1	19.01	20.8	1.79	pass

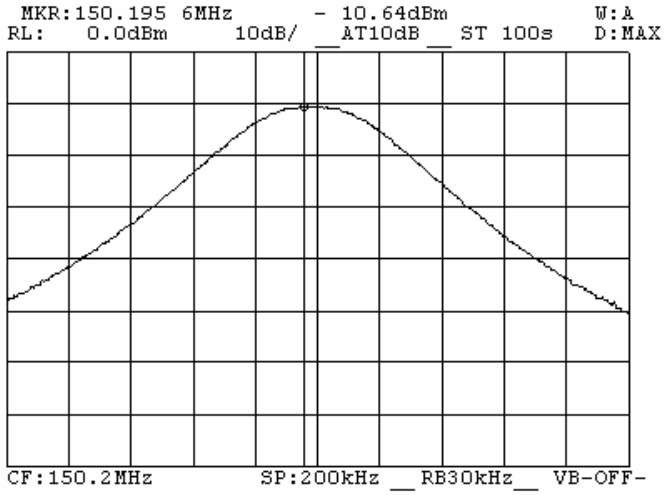
Reference numbers of test equipment used

HL 0026	HL 1652	HL 2107					

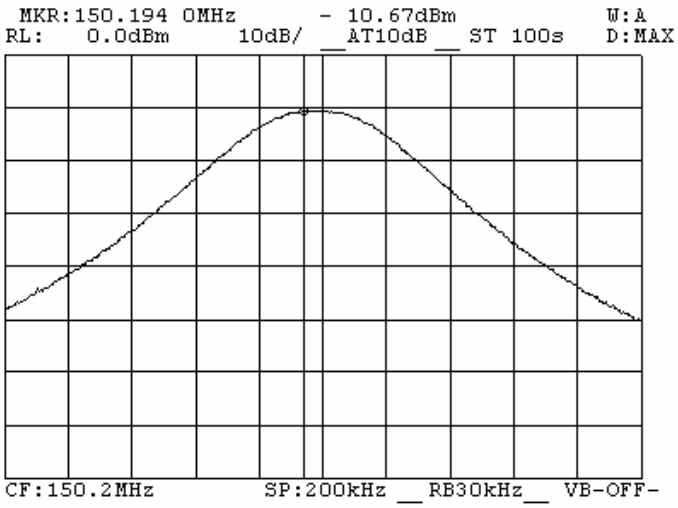
Full description is given in Appendix A.

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:	7/12/2004 9:08:31 PM		
Temperature: 25 ºC	Air Pressure: 1001 hPa	Relative Humidity: 42 %	Power Supply: 12VDC
Remarks:			

Plot 7.1.1. Antenna 1. Peak output power test results at 150.2 MHz

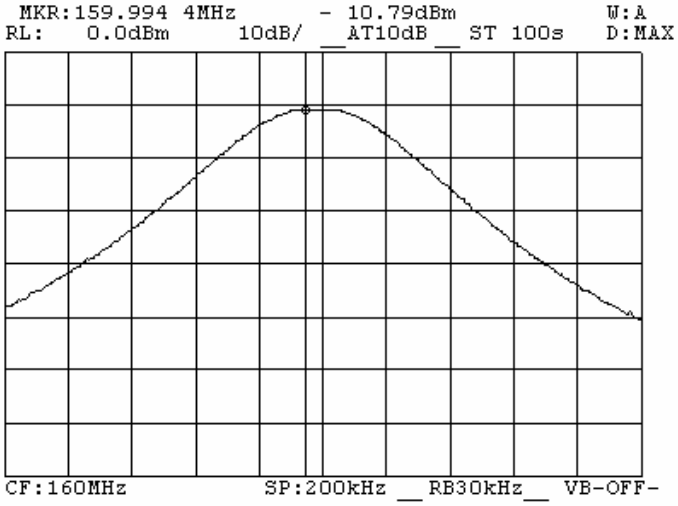


Plot 7.1.2. Antenna 2. Peak output power test results at 150.2 MHz

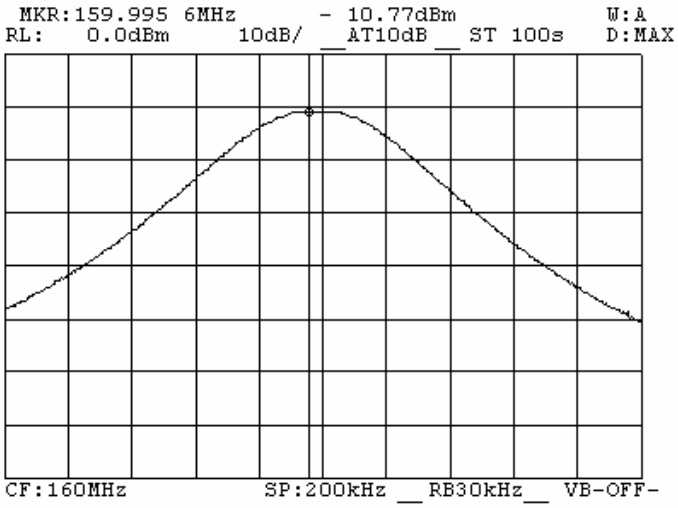


Test specification:	Section 90.205, Maximum output power		
Test procedure:	47 CFR, Section 2.1046; TIA/EIA-603-A, Section 2.2.1		
Test mode:	Compliance	Verdict:	PASS
Date & Time:	7/12/2004 9:08:31 PM		
Temperature: 25 ºC	Air Pressure: 1001 hPa	Relative Humidity: 42 %	Power Supply: 12VDC
Remarks:			

Plot 7.1.3. Antenna 1. Peak output power test results at 160.0 MHz

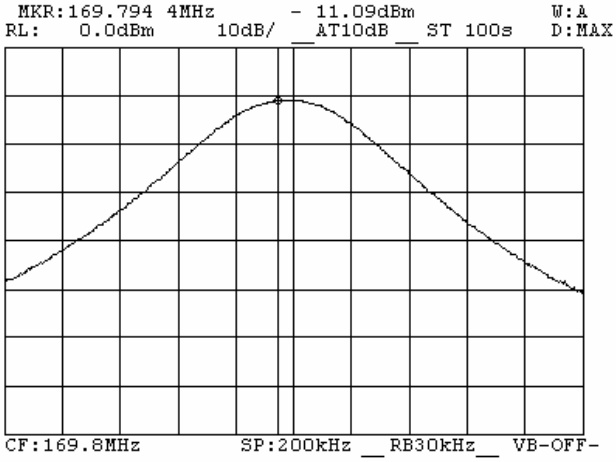


Plot 7.1.4. Antenna 2. Peak output power test results at 160.0 MHz

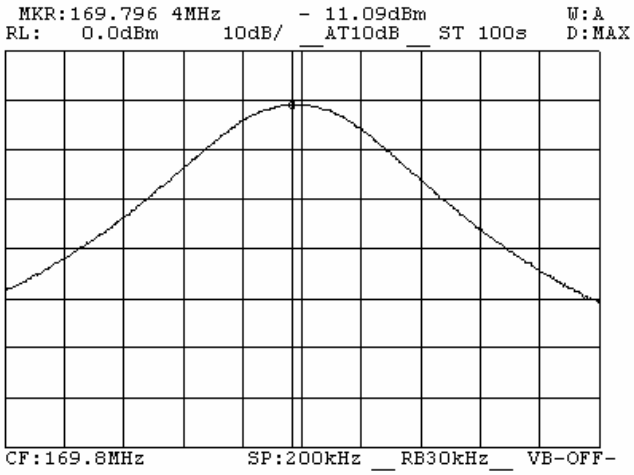


Test specification:	Section 90.205, Maximum output power		
Test procedure:	47 CFR, Section 2.1046; TIA/EIA-603-A, Section 2.2.1		
Test mode:	Compliance	Verdict:	PASS
Date & Time:	7/12/2004 9:08:31 PM		
Temperature: 25 ºC	Air Pressure: 1001 hPa	Relative Humidity: 42 %	Power Supply: 12VDC
Remarks:			

Plot 7.1.5. Antenna 1. Peak output power test results at 169.8 MHz



Plot 7.1.6. Antenna 2. Peak output power test results at 169.8 MHz



Test specification:	Section 90.209, Occupied bandwidth		
Test procedure:	47 CFR, Section 2.1049		
Test mode:	Compliance	Verdict:	PASS
Date & Time:	7/12/2004 9:10:47 PM		
Temperature: 25 ºC	Air Pressure: 1001 hPa	Relative Humidity: 42 %	Power Supply: 12VDC
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 associated plots.

Table 7.2.1 Occupied bandwidth limits

Operating frequency range, MHz	Modulation envelope reference points*, dBc	Maximum allowed bandwidth, kHz
150.0-170.0	26	20

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

7.2.2 Test procedure

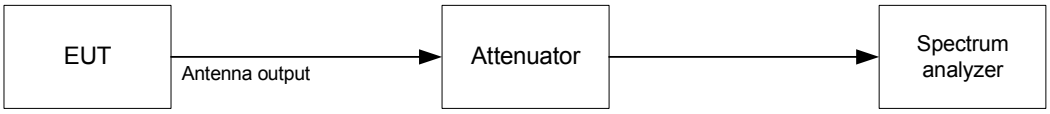
7.2.2.1 The EUT was set up as shown in Figure 7.2.1, energized and its proper operation was checked.

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

7.2.2.3 The EUT was set to transmit modulated carrier.

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

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:	7/12/2004 9:10:47 PM		
Temperature: 25 ºC	Air Pressure: 1001 hPa	Relative Humidity: 42 %	Power Supply: 12VDC
Remarks:			

Table 7.2.2 Occupied bandwidth test results

DETECTOR USED:	Peak hold
RESOLUTION BANDWIDTH:	1 kHz
VIDEO BANDWIDTH:	Off
MODULATION ENVELOPE REFERENCE POINTS:	26 dBc
MODULATION:	FSK
MODULATING SIGNAL:	Alternative signal
BIT RATE:	600 bps
ANTENNA OUTPUT:	1

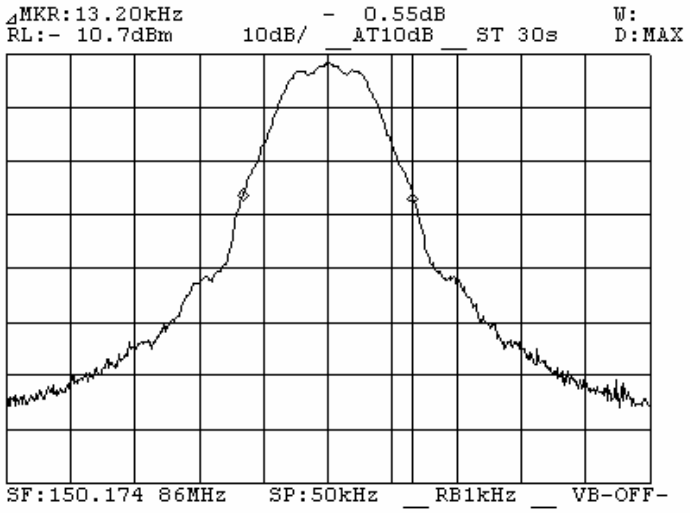
Carrier frequency, MHz	Occupied bandwidth, kHz	Limit, kHz	Margin, kHz	Verdict
150.2	13.2	20	6.8	pass
160.0	12.9	20	7.1	pass
169.8	13.0	20	7.0	pass

Reference numbers of test equipment used

HL 0026	HL 1652	HL 2107					

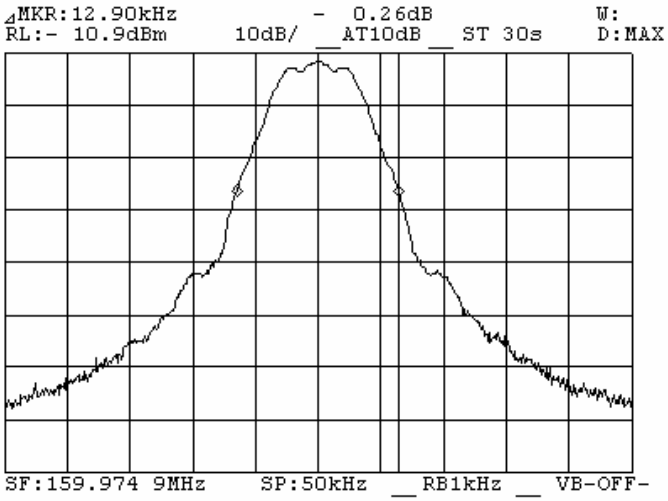
Full description is given in Appendix A.

Plot 7.2.1 Occupied bandwidth test result at 150.2 MHz

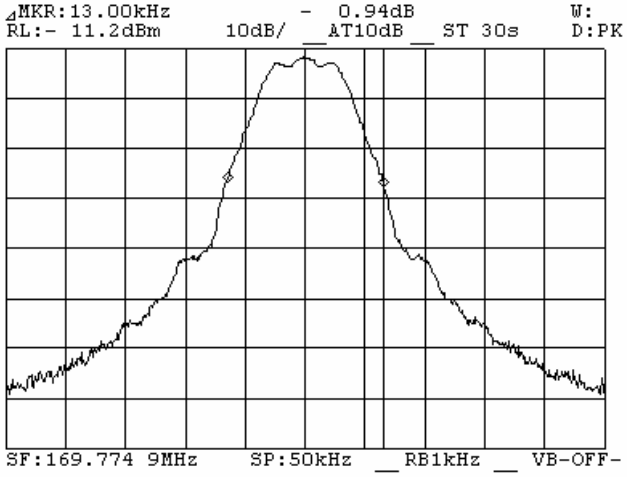


Test specification:	Section 90.209, Occupied bandwidth		
Test procedure:	47 CFR, Section 2.1049		
Test mode:	Compliance	Verdict:	PASS
Date & Time:	7/12/2004 9:10:47 PM		
Temperature: 25 ºC	Air Pressure: 1001 hPa	Relative Humidity: 42 %	Power Supply: 12VDC
Remarks:			

Plot 7.2.2 Occupied bandwidth test result at 160 MHz



Plot 7.2.3 Occupied bandwidth test result at 169.8 MHz



Test specification:	Section 90.210, Emission mask		
Test procedure:	47 CFR, Sections 2.1051, 2.1047 and 90.210(m); TIA/EIA-603-A, Section 2.2.13		
Test mode:	Compliance	Verdict:	PASS
Date & Time:	7/20/2004 12:07:59 PM		
Temperature: 25 ºC	Air Pressure: 1001 hPa	Relative Humidity: 44 %	Power Supply: 12 VDC
Remarks:			

7.3 Emission mask test

7.3.1 General

This test was performed to measure emission mask at RF antenna connector. Specification test limits are given in Table 7.3.1. The test results are provided in the associated plots.

Table 7.3.1 Emission mask limits

Frequency displacement from carrier	Attenuation below carrier, dBc
Emission mask according to section 90.210C (Channel bandwidth 25.0 kHz, authorized bandwidth 20.0 kHz)	
0 – 5.0 kHz	0
5.0 – 10.0 kHz	0 – 25.0*
10.0 – 24.2 kHz	27.8 – 50.0*
24.2 – 50.0 kHz	50.0
More than 50.0 kHz	43+10logP(W)
Emission mask according to section 90.217	
0 – 40 kHz	0
More than 40 kHz	30

* - linearly increase with frequency
** - emission mask includes carrier modulation envelope within ± 250 % of the authorized bandwidth; the frequency range removed beyond ± 250 % of the authorized bandwidth from carrier was investigated as spurious emission

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 emission mask was measured with spectrum analyzer as provided in the associated plots.

Figure 7.3.1 Emission mask test setup

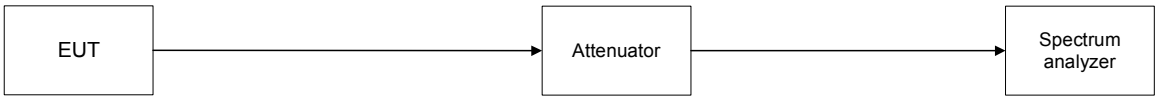


Table 7.3.2 Emission mask test results

Carrier frequency, MHz	Limit	Verdict
150.2	Emission mask 90.217*	Pass
160.0		
169.8		

* Emission mask according to FCC 90.210C provided for information only.

Reference numbers of test equipment used

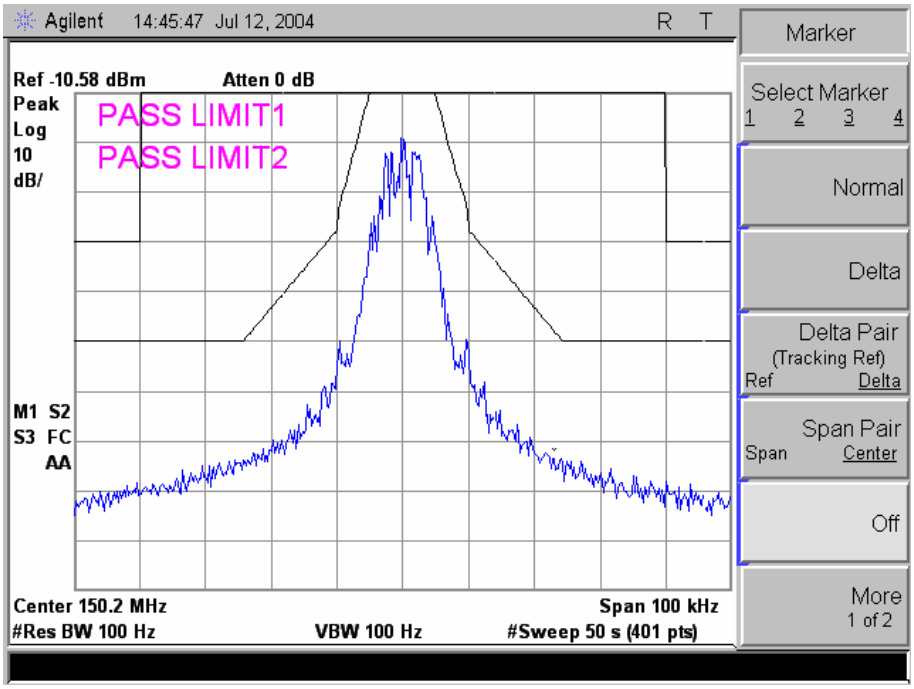
HL 1652	HL 1653	HL 2107					

Full description is given in Appendix A.

Test specification:	Section 90.210, Emission mask		
Test procedure:	47 CFR, Sections 2.1051, 2.1047 and 90.210(m); TIA/EIA-603-A, Section 2.2.13		
Test mode:	Compliance	Verdict:	PASS
Date & Time:	7/20/2004 12:07:59 PM		
Temperature: 25 ºC	Air Pressure: 1001 hPa	Relative Humidity: 44 %	Power Supply: 12 VDC
Remarks:			

Plot 7.3.1 Emission mask test results at 150.2 MHz

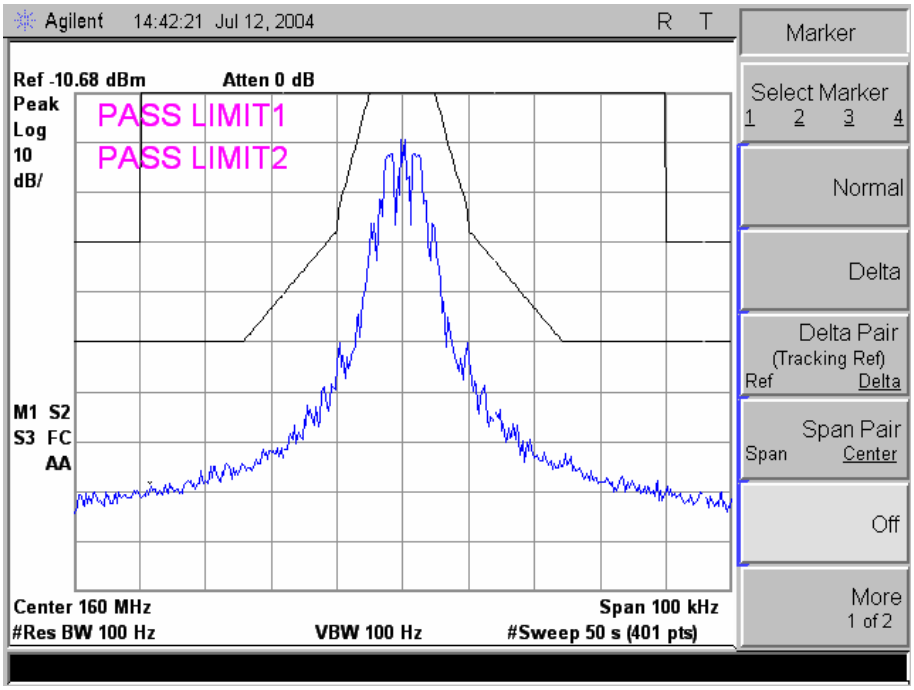
OPERATING FREQUENCY RANGE:	150.2-169.8 MHz
DETECTOR USED:	Peak
MODULATION:	FSK
MODULATING SIGNAL:	Alternating signal
BIT RATE:	600 bps
TRANSMITTER OUTPUT POWER SETTINGS:	Maximum



Test specification:	Section 90.210, Emission mask		
Test procedure:	47 CFR, Sections 2.1051, 2.1047 and 90.210(m); TIA/EIA-603-A, Section 2.2.13		
Test mode:	Compliance	Verdict:	PASS
Date & Time:	7/20/2004 12:07:59 PM		
Temperature: 25 °C	Air Pressure: 1001 hPa	Relative Humidity: 44 %	Power Supply: 12 VDC
Remarks:			

Plot 7.3.2 Emission mask test results at 160 MHz

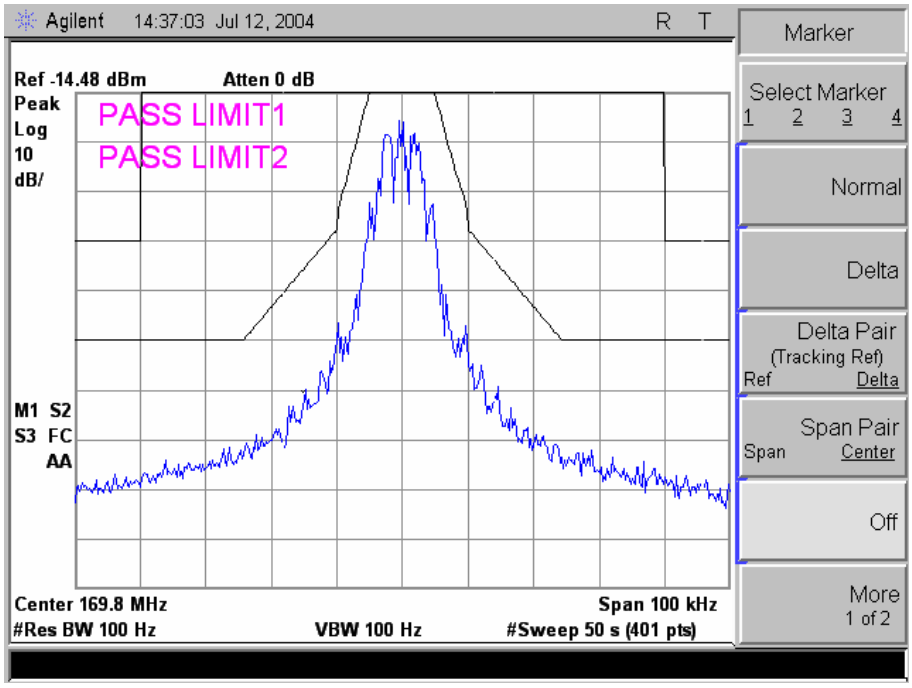
OPERATING FREQUENCY RANGE:	150.2 – 169.8 MHz
DETECTOR USED:	Peak
MODULATION:	FSK
MODULATING SIGNAL:	Alternating signal
BIT RATE:	600 bps
TRANSMITTER OUTPUT POWER SETTINGS:	Maximum



Test specification:	Section 90.210, Emission mask		
Test procedure:	47 CFR, Sections 2.1051, 2.1047 and 90.210(m); TIA/EIA-603-A, Section 2.2.13		
Test mode:	Compliance	Verdict:	PASS
Date & Time:	7/20/2004 12:07:59 PM		
Temperature: 25 °C	Air Pressure: 1001 hPa	Relative Humidity: 44 %	Power Supply: 12 VDC
Remarks:			

Plot 7.3.3 Emission mask test results at 169.8 MHz

OPERATING FREQUENCY RANGE:	150.2 – 169.8 MHz
DETECTOR USED:	Peak
MODULATION:	FSK
MODULATING SIGNAL:	Alternating signal
BIT RATE:	600 bps
TRANSMITTER OUTPUT POWER SETTINGS:	Maximum



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:	8/31/2004 2:26:20 PM		
Temperature: 26 ºC	Air Pressure: 1006 hPa	Relative Humidity: 39 %	Power Supply: 12 VDC
Remarks:			

7.4 Radiated spurious emission measurements

7.4.1 General

This test was performed to measure radiated spurious emissions from the EUT. Specification test limits are given in Table 7.4.1.

Table 7.4.1 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*	43+10logP**	-13	84.4

* - Excluding the in band emission within ± 250 % of the authorized bandwidth from the carrier
** - P is transmitter output power in Watts
*** - 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

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

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 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.

7.4.2.3 The worst test results (the lowest margins) were recorded in Table 7.4.2 and shown in the associated plots.

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

7.4.3.1 The EUT was set up as shown in Figure 7.4.2, energized and the performance check was conducted.

7.4.3.2 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.

7.4.3.3 The worst test results (the lowest margins) were recorded in Table 7.4.2 and shown in the associated plots.

7.4.4 Test procedure for substitution ERP measurements of spurious

7.4.4.1 The test equipment was set up as shown in Figure 7.4.3 and energized.

7.4.4.2 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.

7.4.4.3 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.

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

7.4.4.5 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.

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

7.4.4.7 The worst test results (the lowest margins) were recorded in Table 7.4.3 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:	8/31/2004 2:26:20 PM		
Temperature: 26 ºC	Air Pressure: 1006 hPa	Relative Humidity: 39 %	Power Supply: 12 VDC
Remarks:			

Figure 7.4.1 Setup for spurious emission field strength measurements in 9 kHz to 30 MHz band

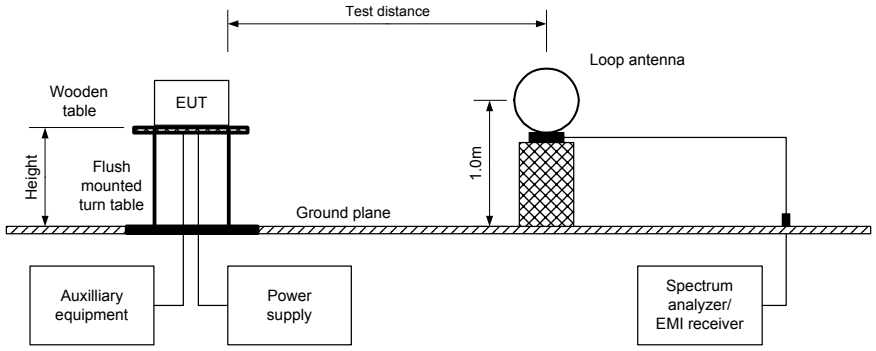
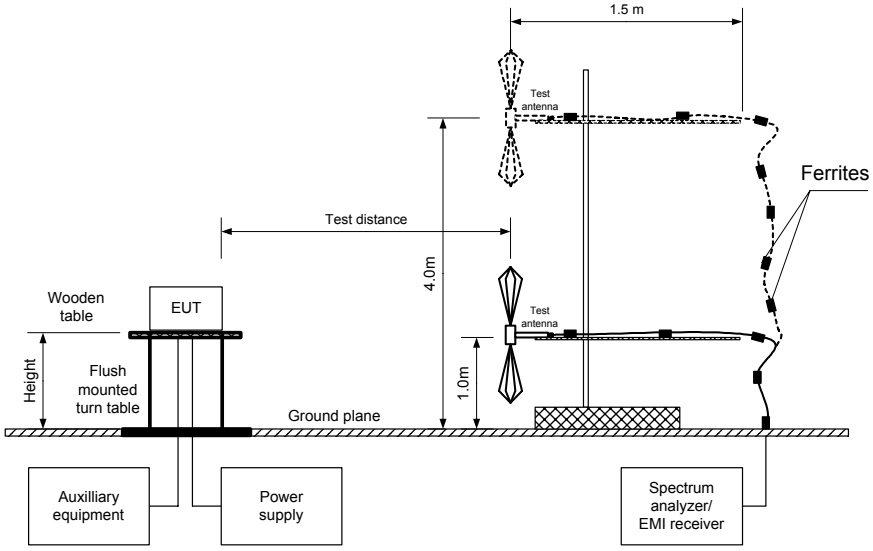
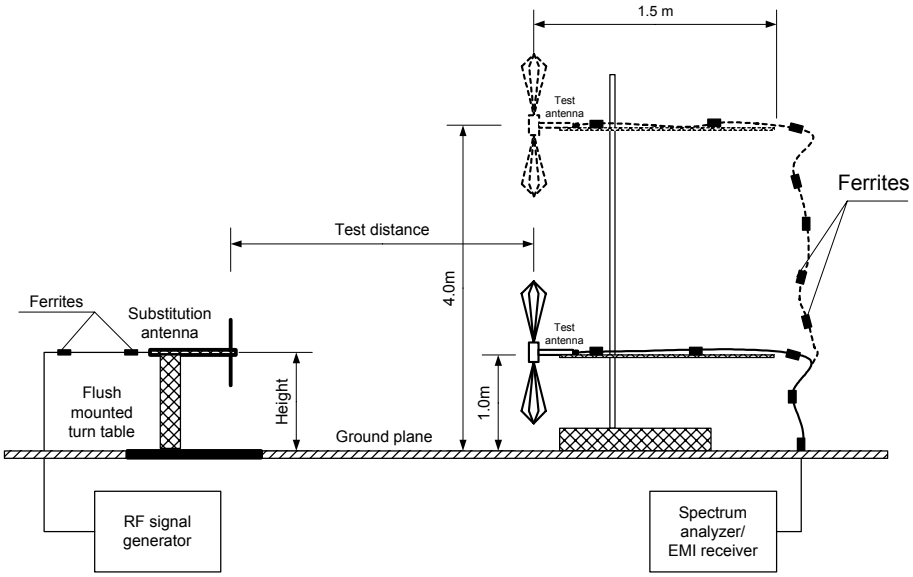


Figure 7.4.2 Setup for spurious emission field strength measurements above 30 MHz



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:	8/31/2004 2:26:20 PM		
Temperature: 26 ºC	Air Pressure: 1006 hPa	Relative Humidity: 39 %	Power Supply: 12 VDC
Remarks:			

Figure 7.4.3 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:	8/31/2004 2:26:20 PM		
Temperature: 26 ºC	Air Pressure: 1006 hPa	Relative Humidity: 39 %	Power Supply: 12 VDC
Remarks:			

Table 7.4.2 Spurious emission field strength test results

ASSIGNED FREQUENCY RANGE: 150 - 170 MHz
TEST DISTANCE: 3 m
TEST SITE: Semi 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)
Biconical (30 MHz – 200 MHz)
Log periodic (200 MHz – 1000 MHz)
Biconilog (30 MHz – 1000 MHz)
Double ridged guide (above 1000 MHz)
MODULATION: CW
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
150.2 MHz carrier frequency							
300.4	24.8	84.4	59.6	120	Vertical	1.1	3
450.6	25.5	84.4	58.9	120	Vertical	1.1	5
600.8	22.1	84.4	62.3	120	Horizontal	1.1	1
751	25.5	84.4	58.9	120	Vertical	1.1	0
901.2	27.8	84.4	56.6	120	Vertical	1.1	3
1051.4	39.5	84.4	44.9	1000	Vertical	1.2	4
1201.6	42.4	84.4	42.0	1000	Horizontal	1.2	0
1351.8	41.4	84.4	43.0	1000	Vertical	1.2	1
1502	45.6	84.4	38.8	1000	Horizontal	1.2	0
160 MHz carrier frequency							
320	26.3	84.4	58.1	120	Vertical	1.1	2
480	37.6	84.4	46.8	120	Horizontal	1.1	2
640	23.1	84.4	61.3	120	Vertical	1.1	0
800	26.3	84.4	58.1	120	Vertical	1.1	5
960	36.5	84.4	47.9	120	Vertical	1.1	4
1120	46.6	84.4	37.8	1000	Horizontal	1.2	4
1280	45.2	84.4	39.2	1000	Vertical	1.2	1
1440	42.0	84.4	42.4	1000	Horizontal	1.2	3
1600	44.4	84.4	40.0	1000	Horizontal	1.2	2
169.8 MHz carrier frequency							
339.6	20.4	84.4	64.0	120	Vertical	1.1	0
509.4	29.0	84.4	55.4	120	Vertical	1.1	5
679.2	26.3	84.4	58.1	120	Horizontal	1.1	4
849	26.5	84.4	57.9	120	Horizontal	1.1	1
1018.8	43.0	84.4	41.4	120	Vertical	1.1	0
1188.6	43.2	84.4	41.2	1000	Horizontal	1.2	1
1358.4	41.9	84.4	42.5	1000	Vertical	1.2	2
1528.2	43.2	84.4	41.2	1000	Horizontal	1.2	3
1698	44.5	84.4	39.9	1000	Horizontal	1.2	6

*****- 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:	8/31/2004 2:26:20 PM		
Temperature: 26 ºC	**Air Pressure:** 1006 hPa	**Relative Humidity:** 39 %	**Power Supply:** 12 VDC
Remarks:			

Table 7.4.3 Substitution ERP of spurious test results

ASSIGNED FREQUENCY RANGE: 150 -170 MHz
TRANSMITTER CARRIER ERP: dBm at low frequency
dBm at mid frequency
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)
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, dBc	Margin, dB*	Verdict
Low carrier frequency											
300.4	24.8	120	Vertical	-70.35	-0.5	2.2	-73.0	92.5	32.5	60.0	pass
450.6	25.5	120	Vertical	-68.22	-1.2	2.8	-72.1	91.6	32.5	59.1	pass
600.8	22.1	120	Horizontal	-70.28	-0.4	3.3	-73.9	93.4	32.5	60.9	pass
751	25.5	120	Vertical	-64.61	-0.3	3.7	-68.6	88.1	32.5	55.6	pass
901.2	27.8	120	Vertical	-65.57	-0.5	4.4	-70.4	89.9	32.5	57.4	pass
1051.4	39.5	1000	Vertical	-58.89	3.6	4.6	-59.9	79.4	32.5	46.9	pass
1201.6	42.4	1000	Horizontal	-55.82	4.4	4.9	-56.4	75.9	32.5	43.4	pass
1351.8	41.4	1000	Vertical	-56.64	5.2	5.3	-56.8	76.3	32.5	43.8	pass
1502	45.6	1000	Horizontal	-51.82	5.9	5.5	-51.5	71.0	32.5	38.5	pass
Mid carrier frequency											
320	26.3	120	Vertical	-71.23	-0.5	2.2	-73.9	93.2	32.3	60.9	pass
480	37.6	120	Horizontal	-54.43	-1.4	2.8	-58.5	77.8	32.3	45.5	pass
640	23.1	120	Vertical	-68.39	0.0	3.3	-71.7	91.0	32.3	58.7	pass
800	26.3	120	Vertical	-63.52	-0.9	3.7	-68.1	87.4	32.3	55.1	pass
960	36.5	120	Vertical	-56.98	-0.3	4.4	-61.6	80.9	32.3	48.6	pass
1120	46.6	1000	Horizontal	-51.81	4.0	4.6	-52.4	71.7	32.3	39.4	pass
1280	45.2	1000	Vertical	-52.98	4.8	4.9	-53.1	72.4	32.3	40.1	pass
1440	42.0	1000	Horizontal	-55.68	5.6	5.4	-55.5	74.8	32.3	42.5	pass
1600	44.4	1000	Horizontal	-52.61	6.0	5.6	-52.3	71.6	32.3	39.3	pass
High carrier frequency											
339.6	20.4	120	Vertical	-76.64	-0.6	2.2	-79.4	98.4	32	66.4	pass
509.4	29.0	120	Vertical	-61.11	-1.7	2.8	-65.5	84.5	32	52.5	pass
679.2	26.3	120	Horizontal	-64.72	0.4	3.3	-67.7	86.7	32	54.7	pass
849	26.5	120	Horizontal	-65.47	-0.7	3.7	-69.8	88.8	32	56.8	pass
1018.8	43.0	120	Vertical	-55.45	3.5	4.4	-56.4	75.4	32	43.4	pass
1188.6	43.2	1000	Horizontal	-54.76	4.4	4.6	-55.0	74.0	32	42.0	pass
1358.4	41.9	1000	Vertical	-56.12	5.2	4.9	-55.9	74.9	32	42.9	pass
1528.2	43.2	1000	Horizontal	-53.96	5.9	5.4	-53.5	72.5	32	40.5	pass
1698	44.5	1000	Horizontal	-50.97	6.1	5.7	-50.6	69.6	32	37.6	pass

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

Reference numbers of test equipment used

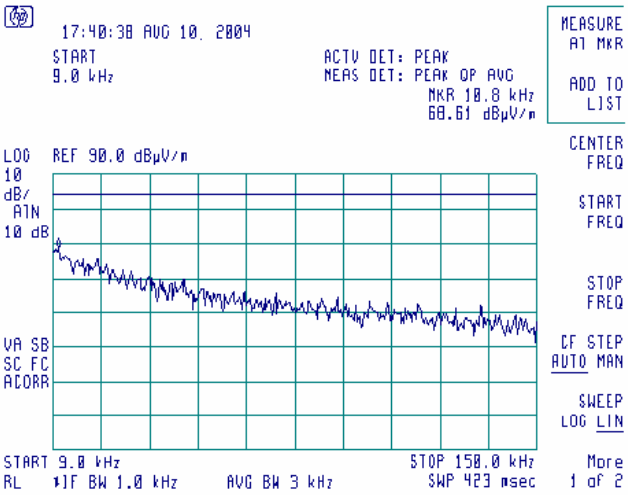
HL 0030	HL 0415	HL 0465	HL 0521	HL 0566	HL 0569	HL 0589	HL 0592
HL 0593	HL 0594	HL 0604	HL 0661	HL 0812	HL1004	HL 1425	HL 1430
HL 1500	HL 1942	HL 2009	HL 2432				

Full description is given in Appendix A.

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:	8/31/2004 2:26:20 PM		
Temperature: 26 ºC	Air Pressure: 1006 hPa	Relative Humidity: 39 %	Power Supply: 12 VDC
Remarks:			

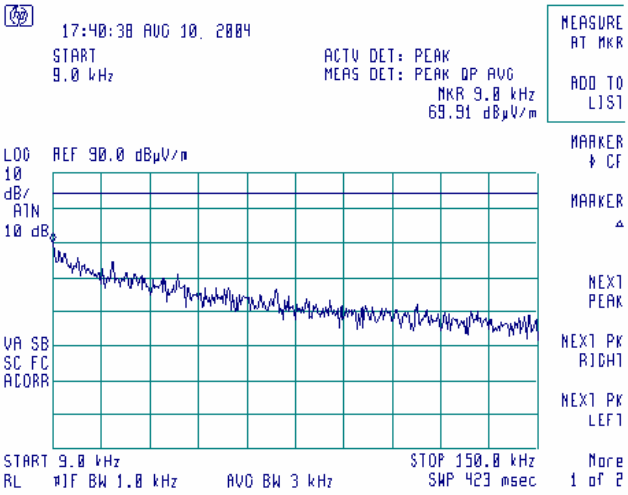
Plot 7.4.1 Radiated emission measurements in 9 - 150 kHz range

TEST SITE:	Fully anechoic chamber
CARRIER FREQUENCY:	150.2 MHz
ANTENNA POLARIZATION:	Vertical and Horizontal
TEST DISTANCE:	3 m



Plot 7.4.2 Radiated emission measurements in 9 - 150 kHz range

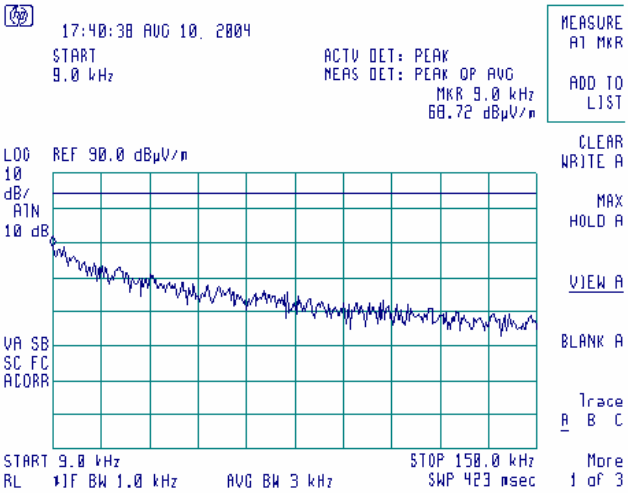
TEST SITE:	Fully anechoic chamber
CARRIER FREQUENCY:	160.0 MHz
ANTENNA POLARIZATION:	Vertical and Horizontal
TEST DISTANCE:	3 m



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:	8/31/2004 2:26:20 PM		
Temperature: 26 ºC	Air Pressure: 1006 hPa	Relative Humidity: 39 %	Power Supply: 12 VDC
Remarks:			

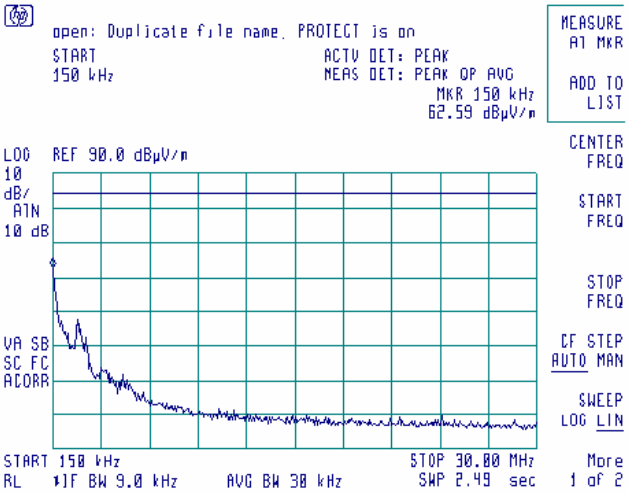
Plot 7.4.3 Radiated emission measurements in 9 - 150 kHz range

TEST SITE:	Fully anechoic chamber
CARRIER FREQUENCY:	169.8 MHz
ANTENNA POLARIZATION:	Vertical and Horizontal
TEST DISTANCE:	3 m



Plot 7.4.4 Radiated emission measurements in 0.15 - 30 MHz range

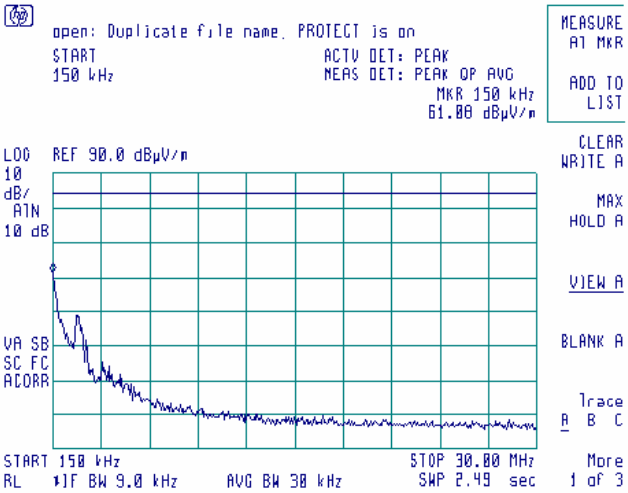
TEST SITE:	Fully anechoic chamber
CARRIER FREQUENCY:	150.2 MHz
ANTENNA POLARIZATION:	Vertical and Horizontal
TEST DISTANCE:	3 m



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:	8/31/2004 2:26:20 PM		
Temperature: 26 ºC	Air Pressure: 1006 hPa	Relative Humidity: 39 %	Power Supply: 12 VDC
Remarks:			

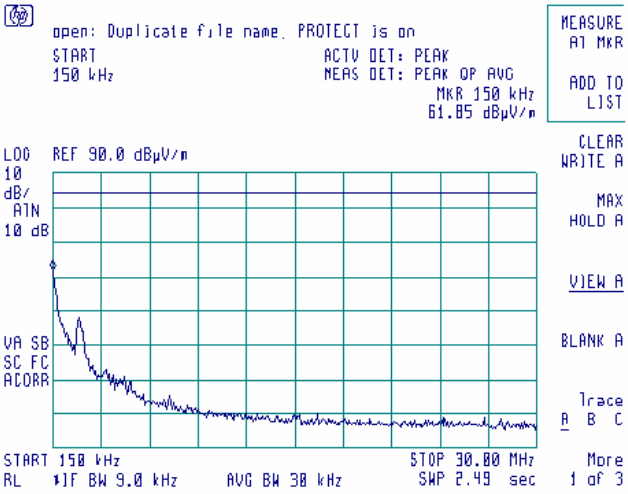
Plot 7.4.5 Radiated emission measurements in 0.15 - 30 MHz range

TEST SITE:	Fully anechoic chamber
CARRIER FREQUENCY:	160.0 MHz
ANTENNA POLARIZATION:	Vertical and Horizontal
TEST DISTANCE:	3 m



Plot 7.4.6 Radiated emission measurements in 0.15 - 30 MHz range

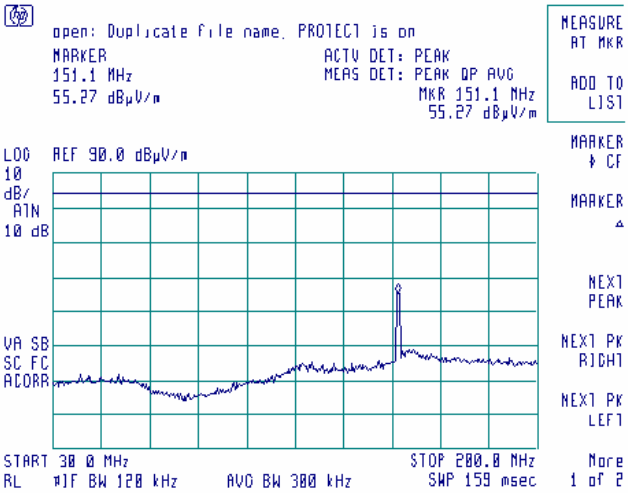
TEST SITE:	Fully anechoic chamber
CARRIER FREQUENCY:	169.8 MHz
ANTENNA POLARIZATION:	Vertical and Horizontal
TEST DISTANCE:	3 m



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:	8/31/2004 2:26:20 PM		
Temperature: 26 ºC	Air Pressure: 1006 hPa	Relative Humidity: 39 %	Power Supply: 12 VDC
Remarks:			

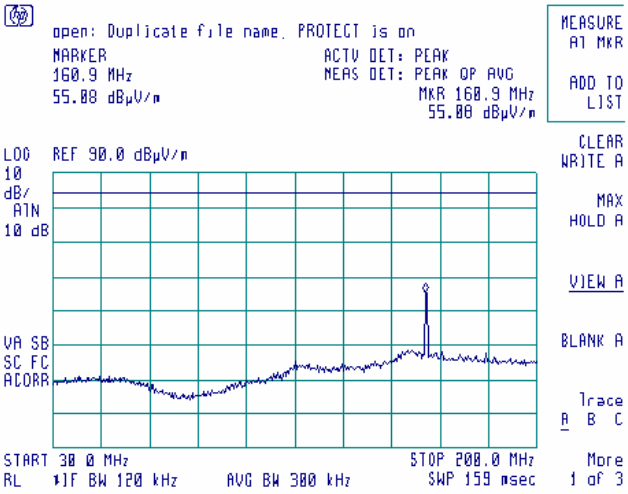
Plot 7.4.7 Radiated emission measurements in 30 - 200 MHz range

TEST SITE:	Fully anechoic chamber
CARRIER FREQUENCY:	150.2 MHz
ANTENNA POLARIZATION:	Vertical and Horizontal
TEST DISTANCE:	3 m



Plot 7.4.8 Radiated emission measurements in 30 - 200 MHz range

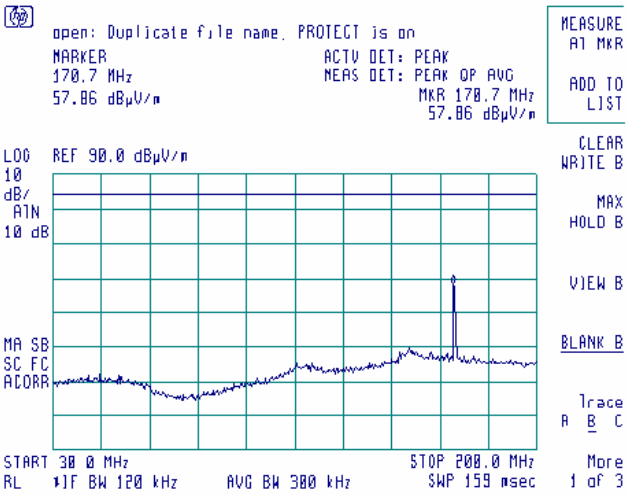
TEST SITE:	Fully anechoic chamber
CARRIER FREQUENCY:	160.0 MHz
ANTENNA POLARIZATION:	Vertical and Horizontal
TEST DISTANCE:	3 m



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:	8/31/2004 2:26:20 PM		
Temperature: 26 ºC	Air Pressure: 1006 hPa	Relative Humidity: 39 %	Power Supply: 12 VDC
Remarks:			

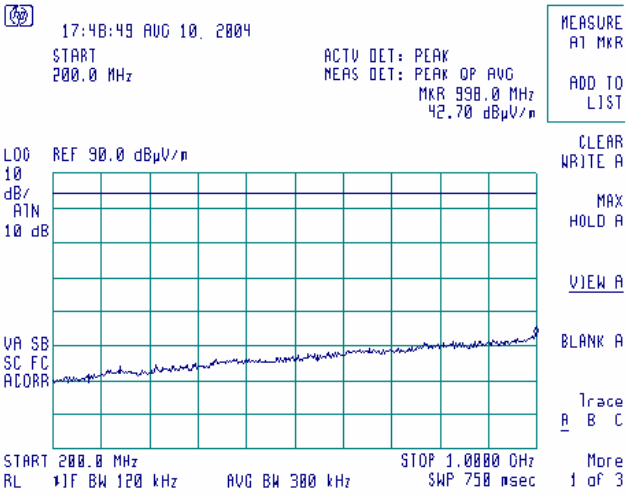
Plot 7.4.9 Radiated emission measurements in 30 - 200 MHz range

TEST SITE:	Fully anechoic chamber
CARRIER FREQUENCY:	169.8 MHz
ANTENNA POLARIZATION:	Vertical and Horizontal
TEST DISTANCE:	3 m



Plot 7.4.10 Radiated emission measurements in 200 – 1000 MHz range

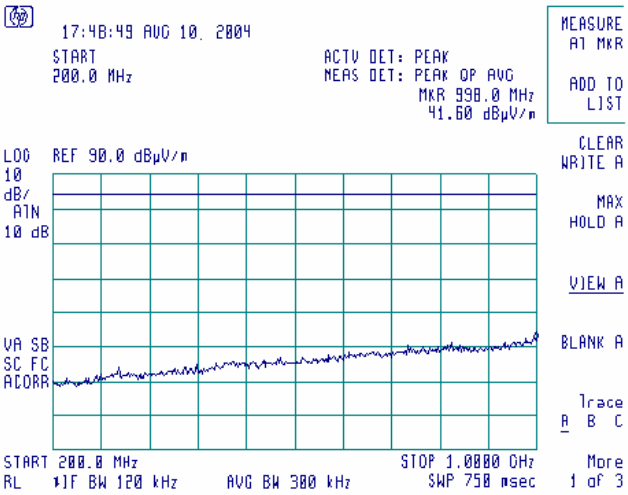
TEST SITE:	Fully anechoic chamber
CARRIER FREQUENCY:	150.2 MHz
ANTENNA POLARIZATION:	Vertical and Horizontal
TEST DISTANCE:	3 m



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:	8/31/2004 2:26:20 PM		
Temperature: 26 ºC	Air Pressure: 1006 hPa	Relative Humidity: 39 %	Power Supply: 12 VDC
Remarks:			

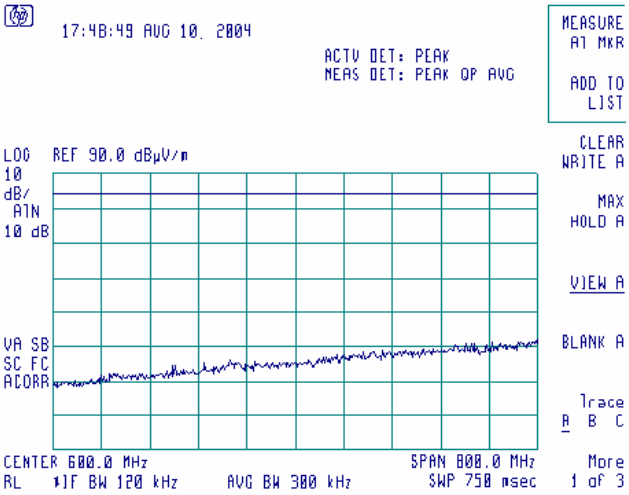
Plot 7.4.11 Radiated emission measurements in 200 – 1000 MHz range

TEST SITE:	Fully anechoic chamber
CARRIER FREQUENCY:	160.0 MHz
ANTENNA POLARIZATION:	Vertical and Horizontal
TEST DISTANCE:	3 m



Plot 7.4.12 Radiated emission measurements in 200 – 1000 MHz range

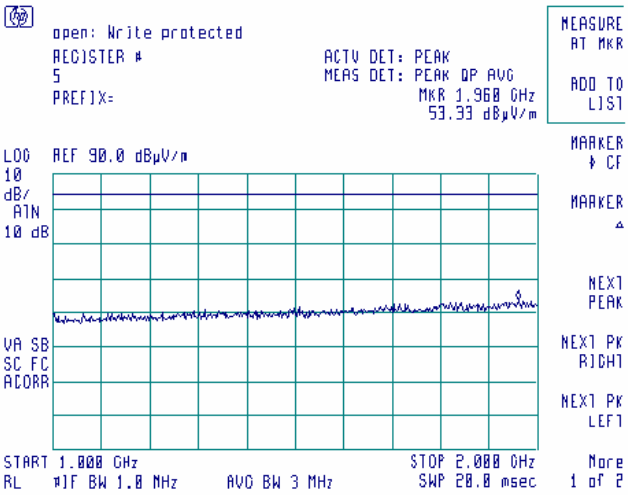
TEST SITE:	Fully anechoic chamber
CARRIER FREQUENCY:	169.8 MHz
ANTENNA POLARIZATION:	Vertical and Horizontal
TEST DISTANCE:	3 m



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:	8/31/2004 2:26:20 PM		
Temperature: 26 ºC	Air Pressure: 1006 hPa	Relative Humidity: 39 %	Power Supply: 12 VDC
Remarks:			

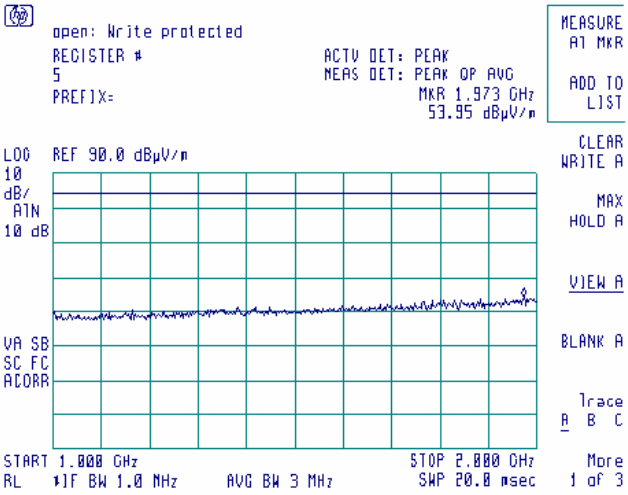
Plot 7.4.13 Radiated emission measurements in 1000 – 2000 MHz range

TEST SITE:	Fully anechoic chamber
CARRIER FREQUENCY:	150.2 MHz
ANTENNA POLARIZATION:	Vertical and Horizontal
TEST DISTANCE:	3 m



Plot 7.4.14 Radiated emission measurements in 1000 – 2000 MHz range

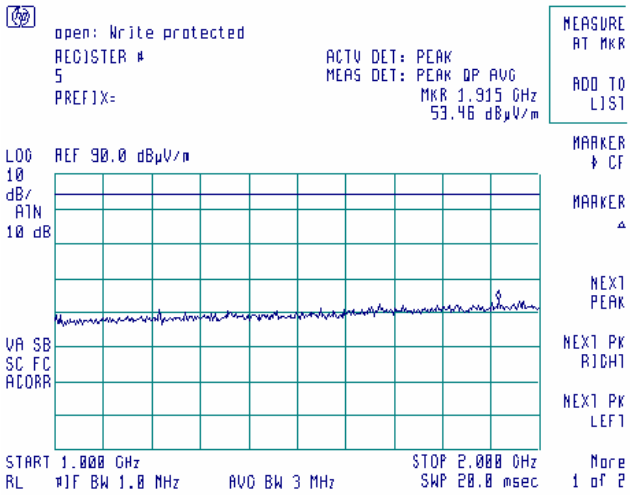
TEST SITE:	Fully anechoic chamber
CARRIER FREQUENCY:	160.0 MHz
ANTENNA POLARIZATION:	Vertical and Horizontal
TEST DISTANCE:	3 m



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:	8/31/2004 2:26:20 PM		
Temperature: 26 ºC	**Air Pressure:** 1006 hPa	**Relative Humidity:** 39 %	**Power Supply:** 12 VDC
Remarks:			

Plot 7.4.15 Radiated emission measurements in 1000 – 2000 MHz range

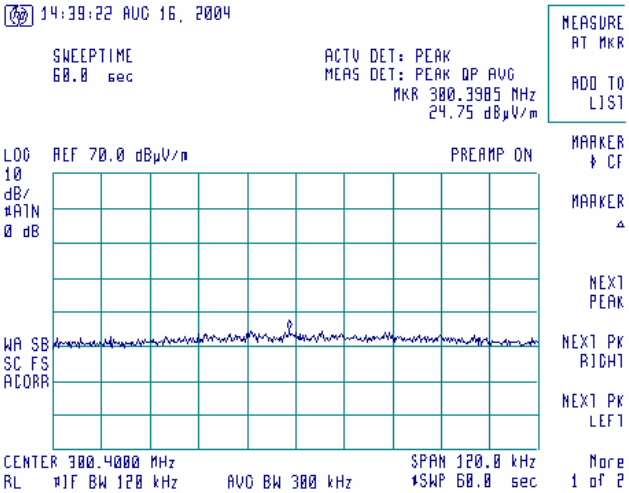
TEST SITE:	Fully anechoic chamber
CARRIER FREQUENCY:	169.8 MHz
ANTENNA POLARIZATION:	Vertical and Horizontal
TEST DISTANCE:	3 m



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:	8/31/2004 2:26:20 PM		
Temperature: 26 ºC	Air Pressure: 1006 hPa	Relative Humidity: 39 %	Power Supply: 12 VDC
Remarks:			

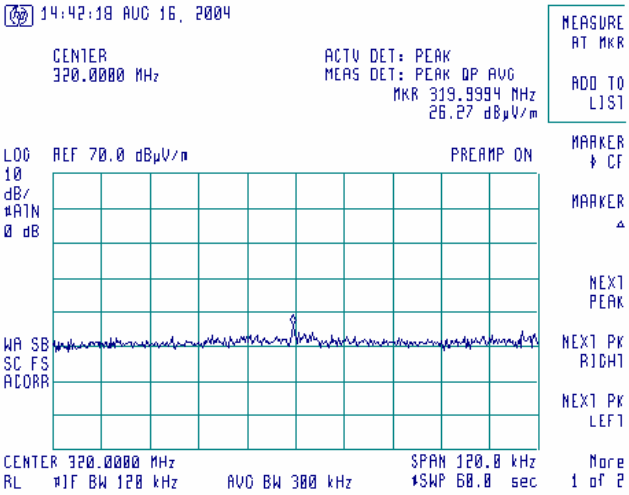
Plot 7.4.16 Radiated emission measurements at the 2nd harmonic

TEST SITE: OATS
CARRIER FREQUENCY: 150.2 MHz
ANTENNA POLARIZATION: Vertical
TEST DISTANCE: 3 m



Plot 7.4.17 Radiated emission measurements at the 2nd harmonic

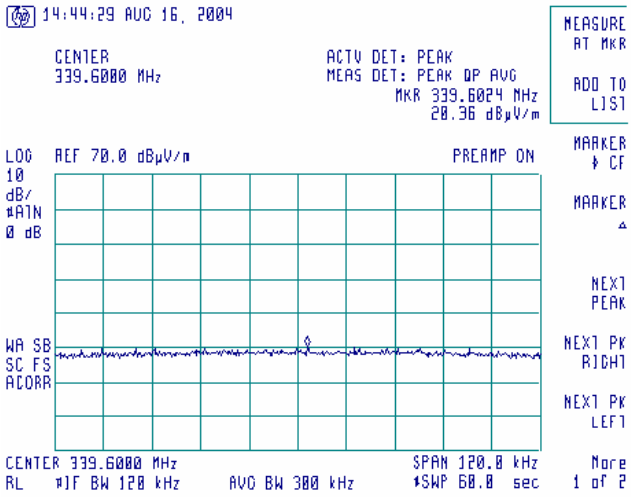
TEST SITE: OATS
CARRIER FREQUENCY: 160.0 MHz
ANTENNA POLARIZATION: Vertical
TEST DISTANCE: 3 m



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:	8/31/2004 2:26:20 PM		
Temperature: 26 ºC	Air Pressure: 1006 hPa	Relative Humidity: 39 %	Power Supply: 12 VDC
Remarks:			

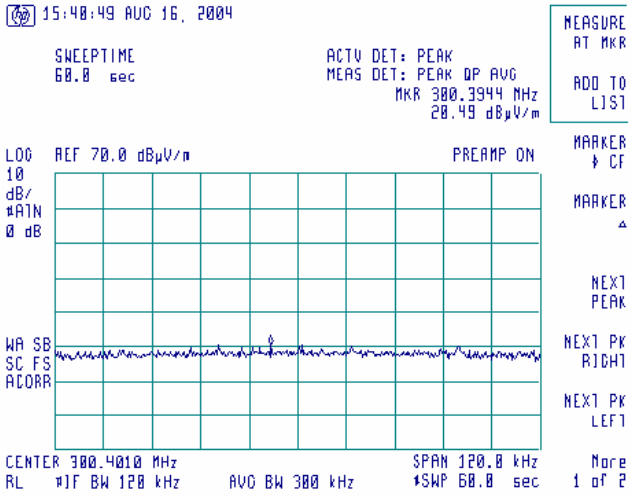
Plot 7.4.18 Radiated emission measurements at the 2nd harmonic

TEST SITE: OATS
CARRIER FREQUENCY: 169.8 MHz
ANTENNA POLARIZATION: Vertical
TEST DISTANCE: 3 m



Plot 7.4.19 Radiated emission measurements at the 2nd harmonic

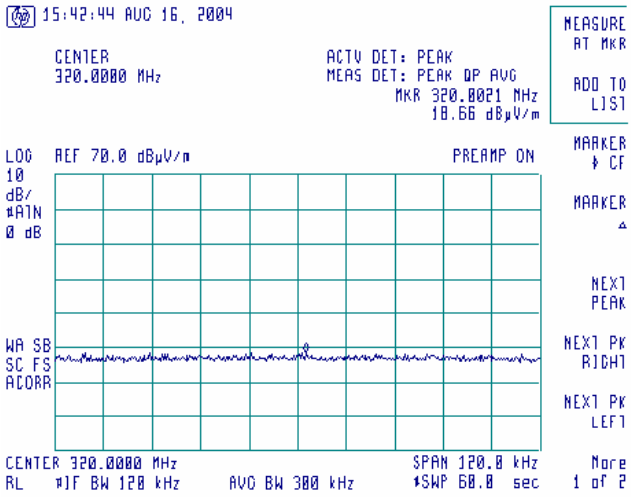
TEST SITE: OATS
CARRIER FREQUENCY: 150.2 MHz
ANTENNA POLARIZATION: Horizontal
TEST DISTANCE: 3 m



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:	8/31/2004 2:26:20 PM		
Temperature: 26 ºC	Air Pressure: 1006 hPa	Relative Humidity: 39 %	Power Supply: 12 VDC
Remarks:			

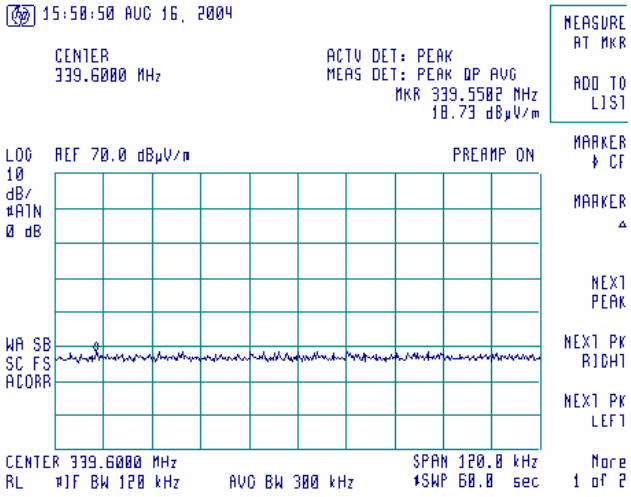
Plot 7.4.20 Radiated emission measurements at the 2nd harmonic

TEST SITE:	OATS
CARRIER FREQUENCY:	160.0 MHz
ANTENNA POLARIZATION:	Horizontal
TEST DISTANCE:	3 m



Plot 7.4.21 Radiated emission measurements at the 2nd harmonic

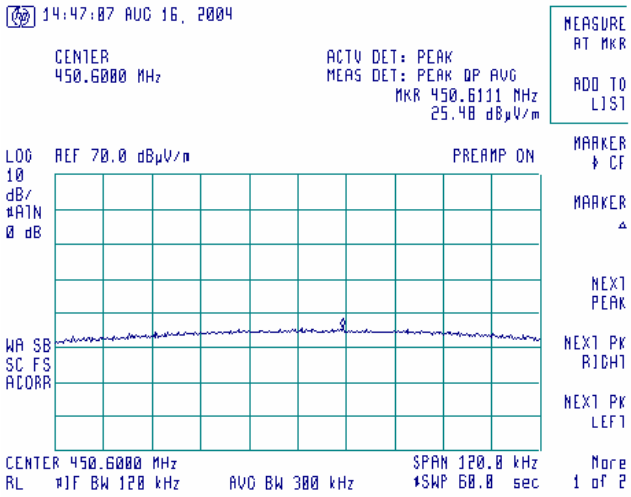
TEST SITE:	OATS
CARRIER FREQUENCY:	169.8 MHz
ANTENNA POLARIZATION:	Horizontal
TEST DISTANCE:	3 m



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:	8/31/2004 2:26:20 PM		
Temperature: 26 ºC	Air Pressure: 1006 hPa	Relative Humidity: 39 %	Power Supply: 12 VDC
Remarks:			

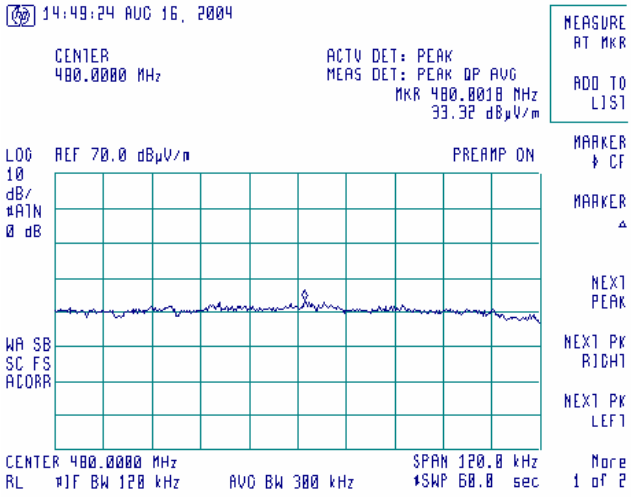
Plot 7.4.22 Radiated emission measurements at the 3rd harmonic

TEST SITE:	OATS
CARRIER FREQUENCY:	150.2 MHz
ANTENNA POLARIZATION:	Vertical
TEST DISTANCE:	3 m



Plot 7.4.23 Radiated emission measurements at the 3rd harmonic

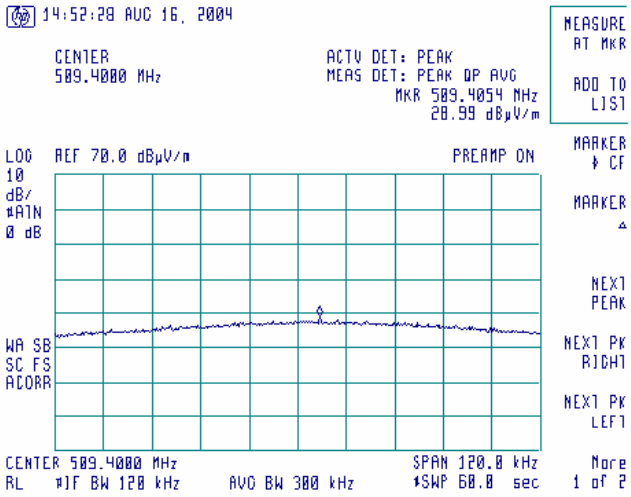
TEST SITE:	OATS
CARRIER FREQUENCY:	160.0 MHz
ANTENNA POLARIZATION:	Vertical
TEST DISTANCE:	3 m



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:	8/31/2004 2:26:20 PM		
Temperature: 26 ºC	Air Pressure: 1006 hPa	Relative Humidity: 39 %	Power Supply: 12 VDC
Remarks:			

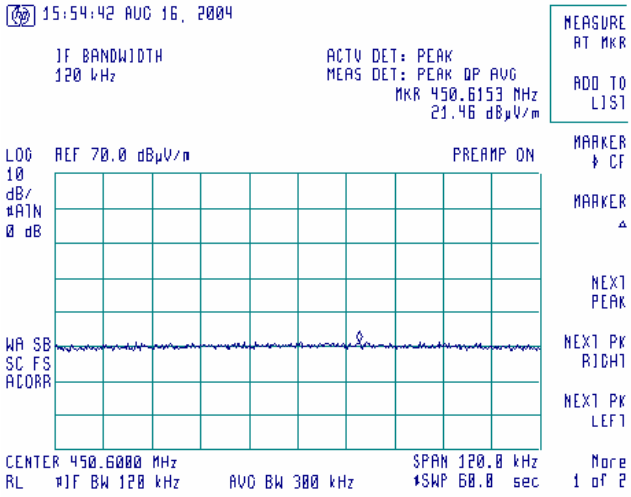
Plot 7.4.24 Radiated emission measurements at the 3rd harmonic

TEST SITE: OATS
CARRIER FREQUENCY: 169.8 MHz
ANTENNA POLARIZATION: Vertical
TEST DISTANCE: 3 m



Plot 7.4.25 Radiated emission measurements at the 3rd harmonic

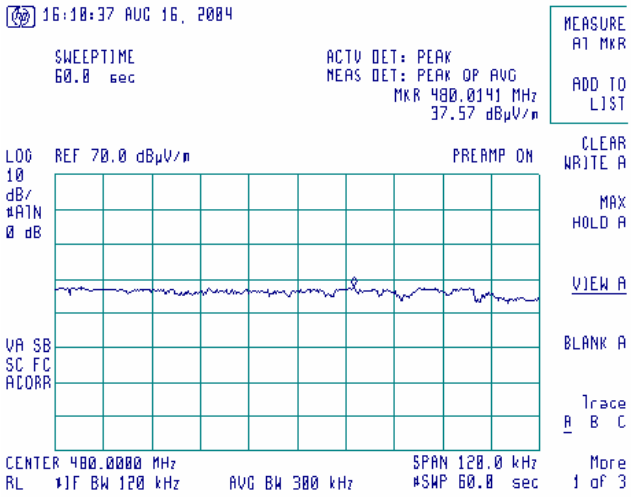
TEST SITE: OATS
CARRIER FREQUENCY: 150.2 MHz
ANTENNA POLARIZATION: Horizontal
TEST DISTANCE: 3 m



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:	8/31/2004 2:26:20 PM		
Temperature: 26 ºC	Air Pressure: 1006 hPa	Relative Humidity: 39 %	Power Supply: 12 VDC
Remarks:			

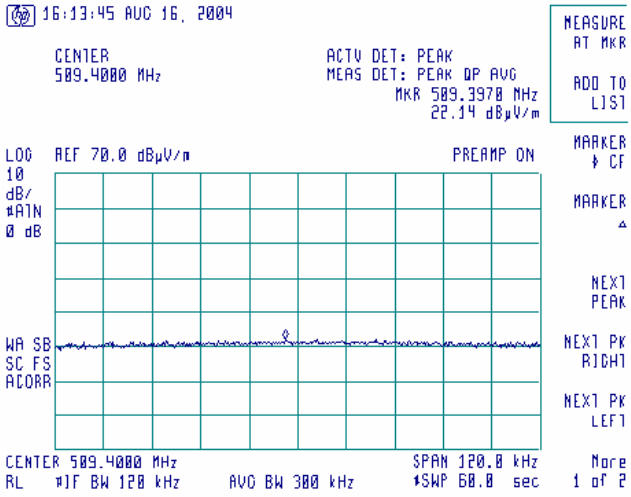
Plot 7.4.26 Radiated emission measurements at the 3rd harmonic

TEST SITE: OATS
CARRIER FREQUENCY: 160.0 MHz
ANTENNA POLARIZATION: Horizontal
TEST DISTANCE: 3 m



Plot 7.4.27 Radiated emission measurements at the 3rd harmonic

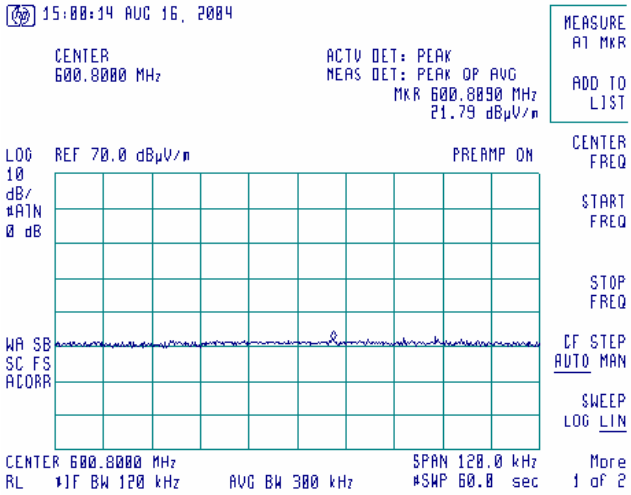
TEST SITE: OATS
CARRIER FREQUENCY: 169.8 MHz
ANTENNA POLARIZATION: Horizontal
TEST DISTANCE: 3 m



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:	8/31/2004 2:26:20 PM		
Temperature: 26 ºC	Air Pressure: 1006 hPa	Relative Humidity: 39 %	Power Supply: 12 VDC
Remarks:			

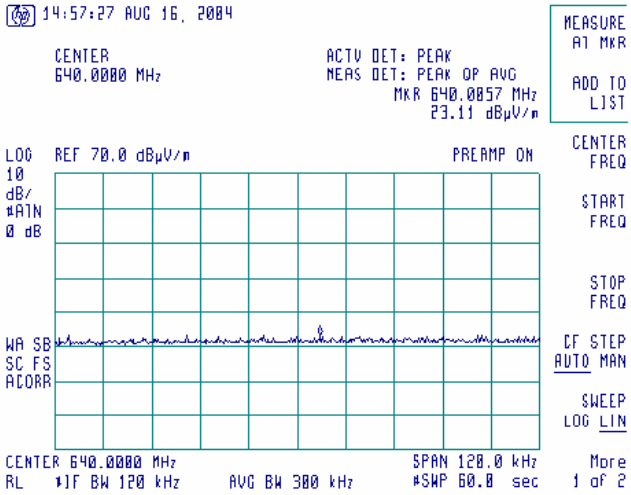
Plot 7.4.28 Radiated emission measurements at the 4th harmonic

TEST SITE:	OATS
CARRIER FREQUENCY:	150.2 MHz
ANTENNA POLARIZATION:	Vertical
TEST DISTANCE:	3 m



Plot 7.4.29 Radiated emission measurements at the 4th harmonic

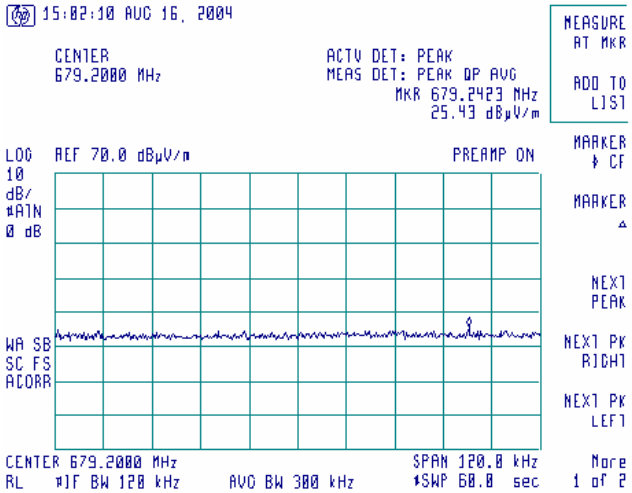
TEST SITE:	OATS
CARRIER FREQUENCY:	160.0 MHz
ANTENNA POLARIZATION:	Vertical
TEST DISTANCE:	3 m



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:	8/31/2004 2:26:20 PM		
Temperature: 26 ºC	Air Pressure: 1006 hPa	Relative Humidity: 39 %	Power Supply: 12 VDC
Remarks:			

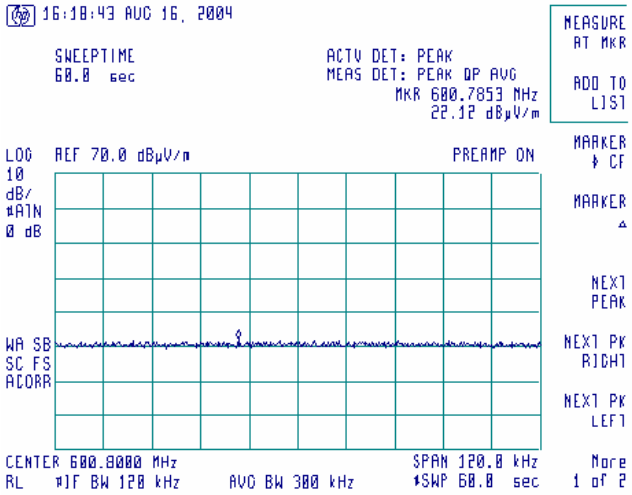
Plot 7.4.30 Radiated emission measurements at the 4th harmonic

TEST SITE:	OATS
CARRIER FREQUENCY:	169.8 MHz
ANTENNA POLARIZATION:	Vertical
TEST DISTANCE:	3 m



Plot 7.4.31 Radiated emission measurements at the 4th harmonic

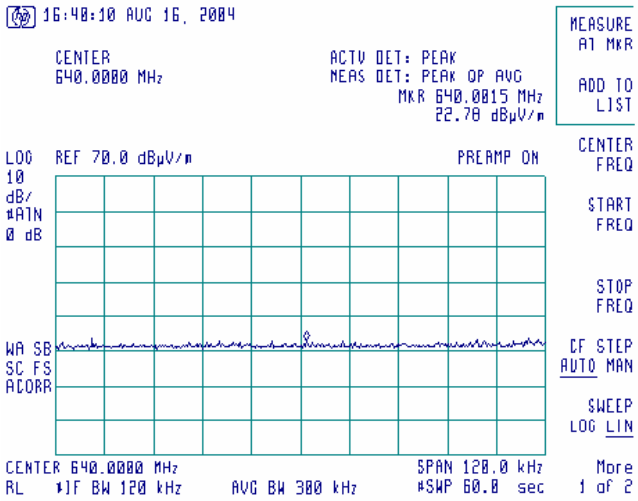
TEST SITE:	OATS
CARRIER FREQUENCY:	150.2 MHz
ANTENNA POLARIZATION:	Horizontal
TEST DISTANCE:	3 m



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:	8/31/2004 2:26:20 PM		
Temperature: 26 ºC	Air Pressure: 1006 hPa	Relative Humidity: 39 %	Power Supply: 12 VDC
Remarks:			

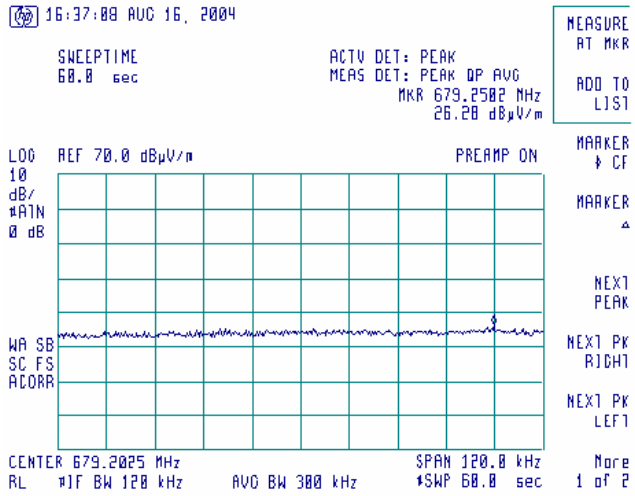
Plot 7.4.32 Radiated emission measurements at the 4th harmonic

TEST SITE:	OATS
CARRIER FREQUENCY:	160.0 MHz
ANTENNA POLARIZATION:	Horizontal
TEST DISTANCE:	3 m



Plot 7.4.33 Radiated emission measurements at the 4th harmonic

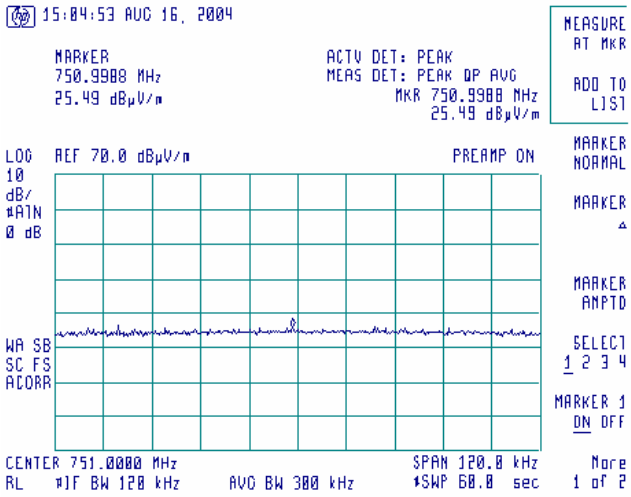
TEST SITE:	OATS
CARRIER FREQUENCY:	169.8 MHz
ANTENNA POLARIZATION:	Horizontal
TEST DISTANCE:	3 m



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:	8/31/2004 2:26:20 PM		
Temperature: 26 ºC	Air Pressure: 1006 hPa	Relative Humidity: 39 %	Power Supply: 12 VDC
Remarks:			

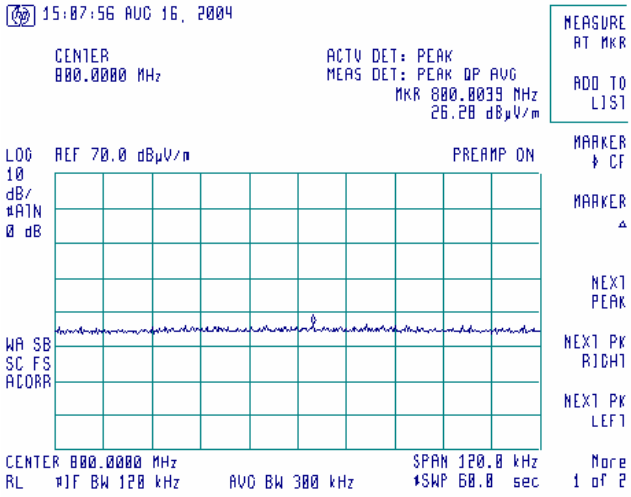
Plot 7.4.34 Radiated emission measurements at the 5th harmonic

TEST SITE:	OATS
CARRIER FREQUENCY:	150.2 MHz
ANTENNA POLARIZATION:	Vertical
TEST DISTANCE:	3 m



Plot 7.4.35 Radiated emission measurements at the 5th harmonic

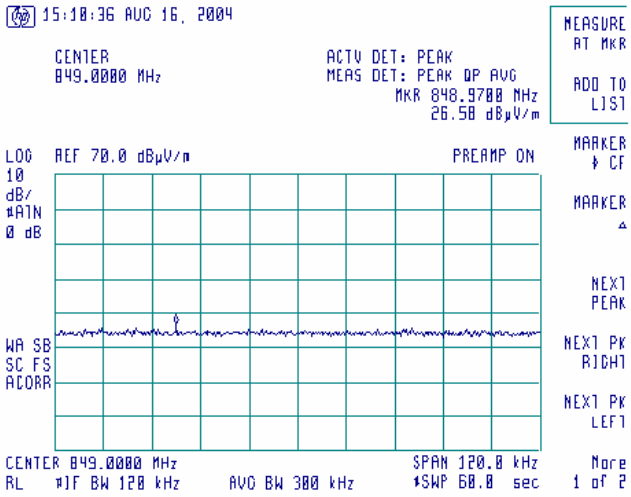
TEST SITE:	OATS
CARRIER FREQUENCY:	160.0 MHz
ANTENNA POLARIZATION:	Vertical
TEST DISTANCE:	3 m



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:	8/31/2004 2:26:20 PM		
Temperature: 26 ºC	Air Pressure: 1006 hPa	Relative Humidity: 39 %	Power Supply: 12 VDC
Remarks:			

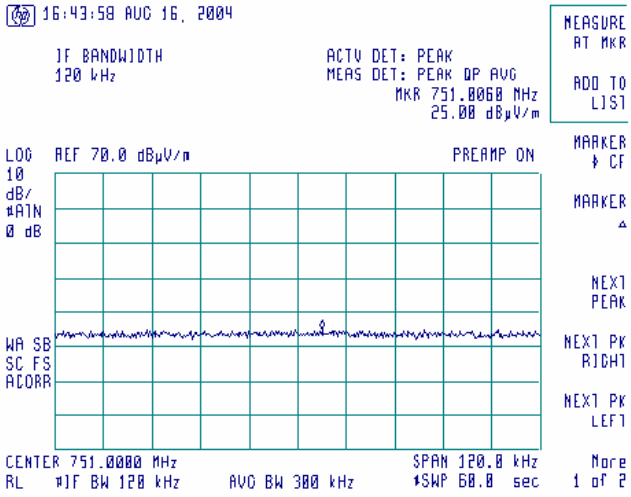
Plot 7.4.36 Radiated emission measurements at the 5th harmonic

TEST SITE: OATS
CARRIER FREQUENCY: 169.8 MHz
ANTENNA POLARIZATION: Vertical
TEST DISTANCE: 3 m



Plot 7.4.37 Radiated emission measurements at the 5th harmonic

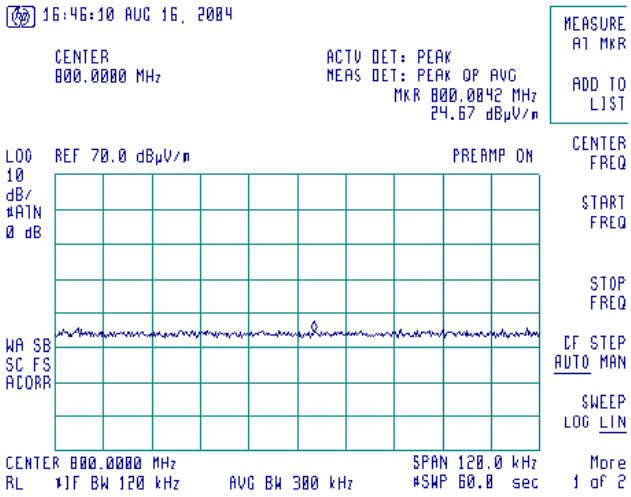
TEST SITE: OATS
CARRIER FREQUENCY: 150.2 MHz
ANTENNA POLARIZATION: Horizontal
TEST DISTANCE: 3 m



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:	8/31/2004 2:26:20 PM		
Temperature: 26 ºC	Air Pressure: 1006 hPa	Relative Humidity: 39 %	Power Supply: 12 VDC
Remarks:			

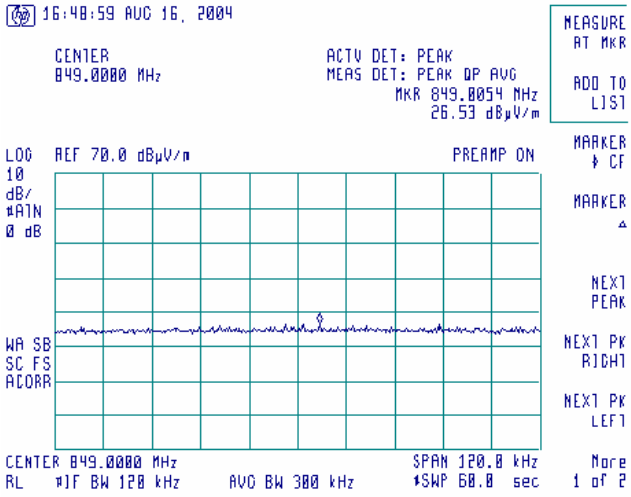
Plot 7.4.38 Radiated emission measurements at the 5th harmonic

TEST SITE:	OATS
CARRIER FREQUENCY:	160.0 MHz
ANTENNA POLARIZATION:	Horizontal
TEST DISTANCE:	3 m



Plot 7.4.39 Radiated emission measurements at the 5th harmonic

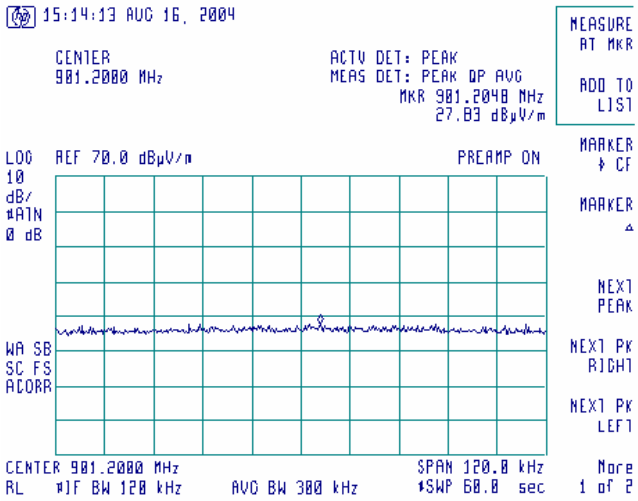
TEST SITE:	OATS
CARRIER FREQUENCY:	169.8 MHz
ANTENNA POLARIZATION:	Horizontal
TEST DISTANCE:	3 m



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:	8/31/2004 2:26:20 PM		
Temperature: 26 ºC	Air Pressure: 1006 hPa	Relative Humidity: 39 %	Power Supply: 12 VDC
Remarks:			

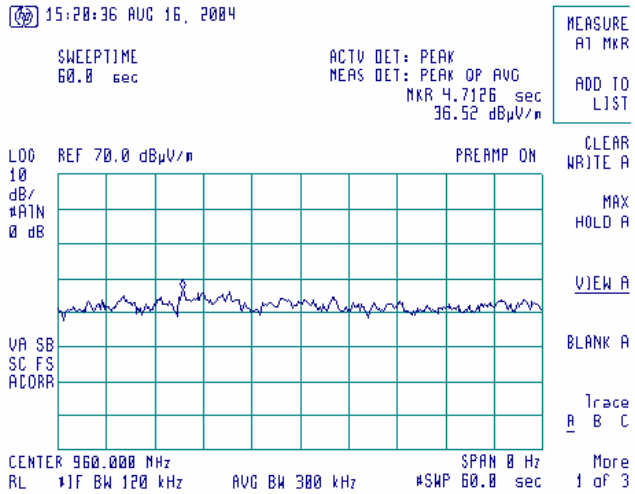
Plot 7.4.40 Radiated emission measurements at the 6th harmonic

TEST SITE:	OATS
CARRIER FREQUENCY:	150.2 MHz
ANTENNA POLARIZATION:	Vertical
TEST DISTANCE:	3 m



Plot 7.4.41 Radiated emission measurements at the 6th harmonic

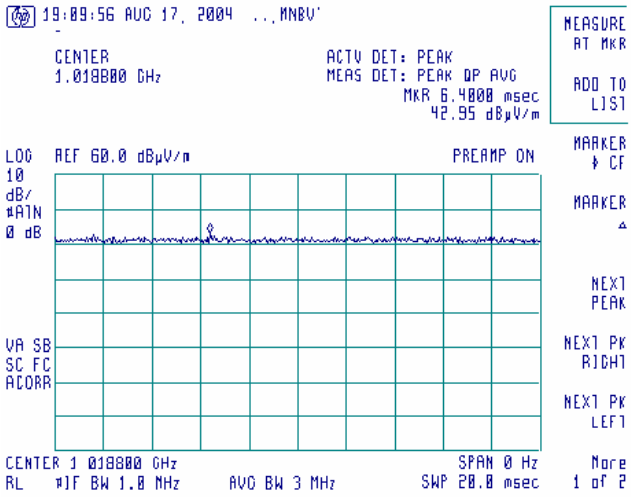
TEST SITE:	OATS
CARRIER FREQUENCY:	160.0 MHz
ANTENNA POLARIZATION:	Vertical
TEST DISTANCE:	3 m



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:	8/31/2004 2:26:20 PM		
Temperature: 26 ºC	Air Pressure: 1006 hPa	Relative Humidity: 39 %	Power Supply: 12 VDC
Remarks:			

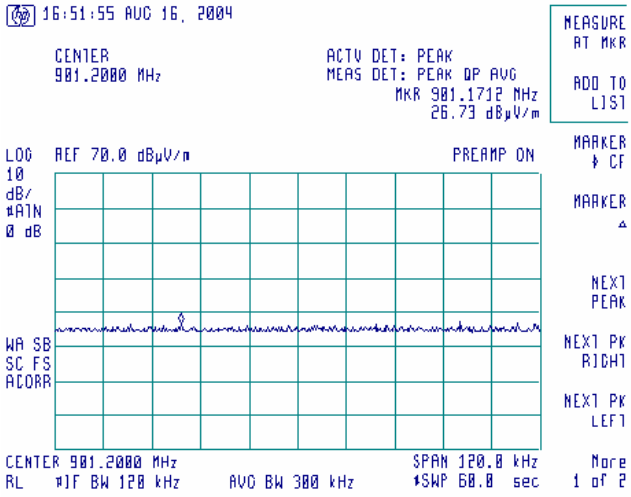
Plot 7.4.42 Radiated emission measurements at the 6th harmonic

TEST SITE:	OATS
CARRIER FREQUENCY:	169.8 MHz
ANTENNA POLARIZATION:	Vertical
TEST DISTANCE:	3 m



Plot 7.4.43 Radiated emission measurements at the 6th harmonic

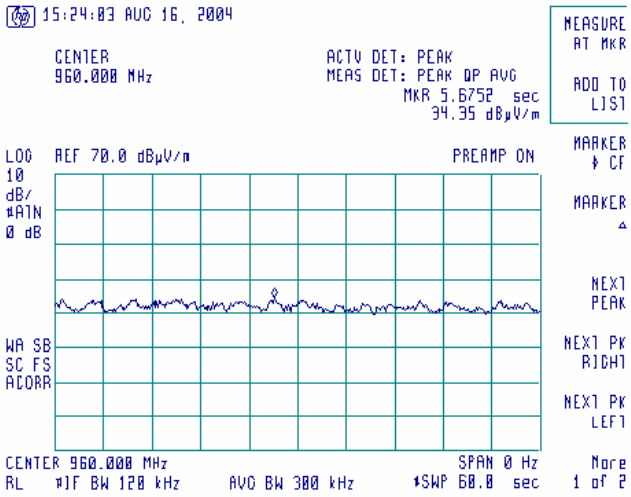
TEST SITE:	OATS
CARRIER FREQUENCY:	150.2 MHz
ANTENNA POLARIZATION:	Horizontal
TEST DISTANCE:	3 m



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:	8/31/2004 2:26:20 PM		
Temperature: 26 ºC	Air Pressure: 1006 hPa	Relative Humidity: 39 %	Power Supply: 12 VDC
Remarks:			

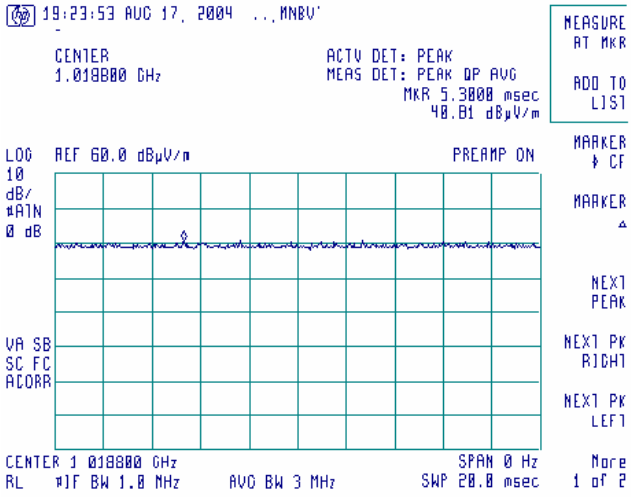
Plot 7.4.44 Radiated emission measurements at the 6th harmonic

TEST SITE:	OATS
CARRIER FREQUENCY:	160.0 MHz
ANTENNA POLARIZATION:	Horizontal
TEST DISTANCE:	3 m



Plot 7.4.45 Radiated emission measurements at the 6th harmonic

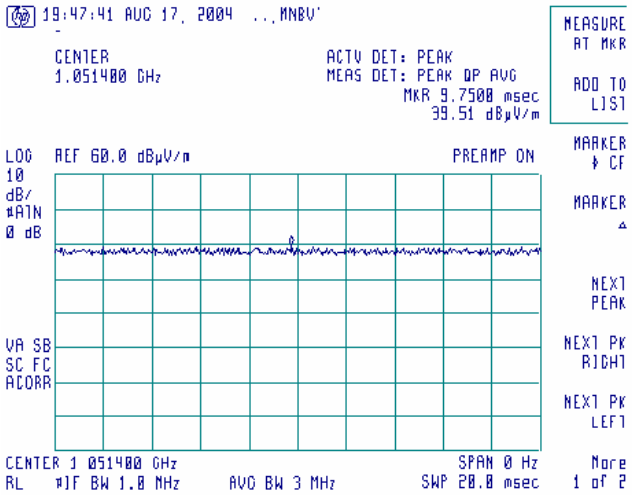
TEST SITE:	OATS
CARRIER FREQUENCY:	169.8 MHz
ANTENNA POLARIZATION:	Horizontal
TEST DISTANCE:	3 m



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:	8/31/2004 2:26:20 PM		
Temperature: 26 ºC	Air Pressure: 1006 hPa	Relative Humidity: 39 %	Power Supply: 12 VDC
Remarks:			

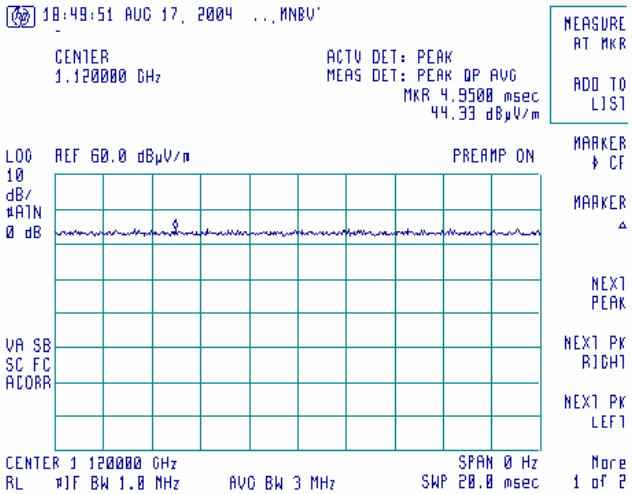
Plot 7.4.46 Radiated emission measurements at the 7th harmonic

TEST SITE:	OATS
CARRIER FREQUENCY:	150.2 MHz
ANTENNA POLARIZATION:	Vertical
TEST DISTANCE:	3 m



Plot 7.4.47 Radiated emission measurements at the 7th harmonic

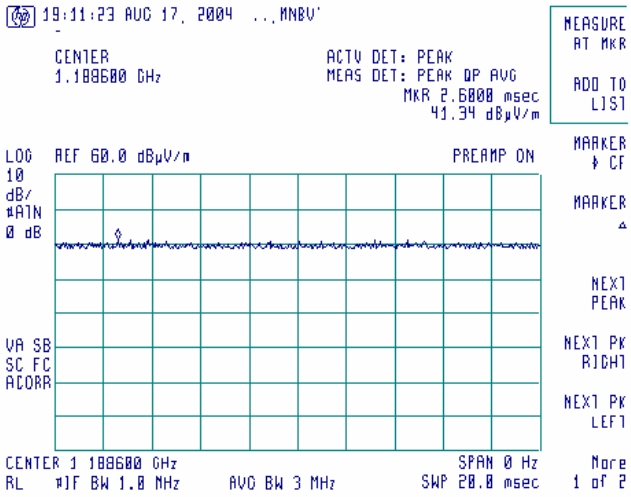
TEST SITE:	OATS
CARRIER FREQUENCY:	160.0 MHz
ANTENNA POLARIZATION:	Vertical
TEST DISTANCE:	3 m



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:	8/31/2004 2:26:20 PM		
Temperature: 26 ºC	Air Pressure: 1006 hPa	Relative Humidity: 39 %	Power Supply: 12 VDC
Remarks:			

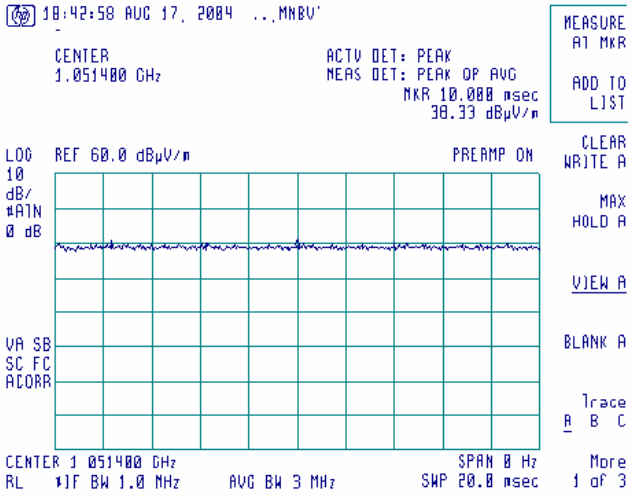
Plot 7.4.48 Radiated emission measurements at the 7th harmonic

TEST SITE:	OATS
CARRIER FREQUENCY:	169.8 MHz
ANTENNA POLARIZATION:	Vertical
TEST DISTANCE:	3 m



Plot 7.4.49 Radiated emission measurements at the 7th harmonic

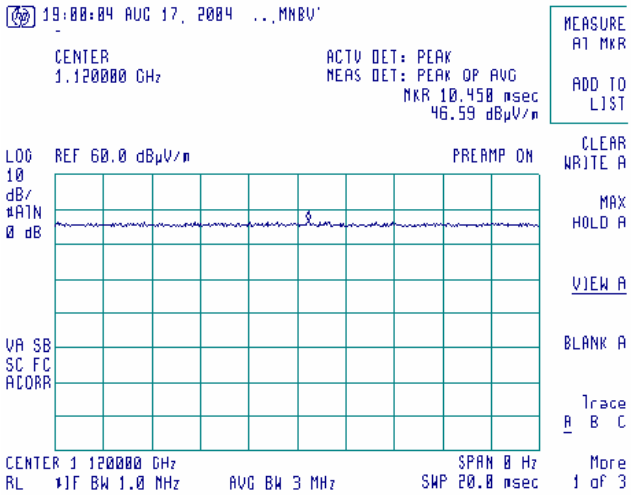
TEST SITE:	OATS
CARRIER FREQUENCY:	150.2 MHz
ANTENNA POLARIZATION:	Horizontal
TEST DISTANCE:	3 m



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:	8/31/2004 2:26:20 PM		
Temperature: 26 ºC	Air Pressure: 1006 hPa	Relative Humidity: 39 %	Power Supply: 12 VDC
Remarks:			

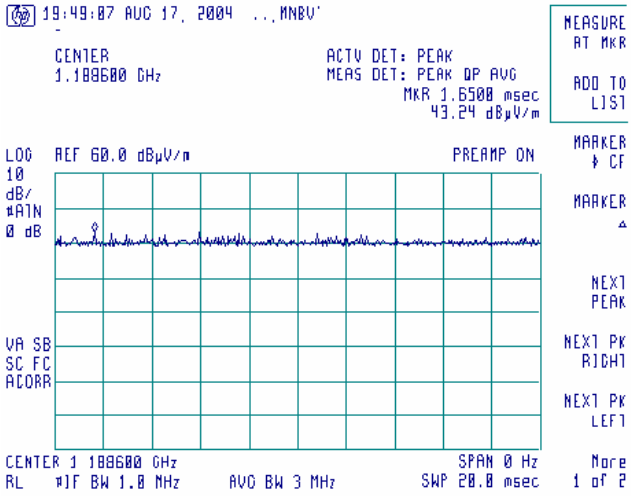
Plot 7.4.50 Radiated emission measurements at the 7th harmonic

TEST SITE:	OATS
CARRIER FREQUENCY:	160.0 MHz
ANTENNA POLARIZATION:	Horizontal
TEST DISTANCE:	3 m



Plot 7.4.51 Radiated emission measurements at the 7th harmonic

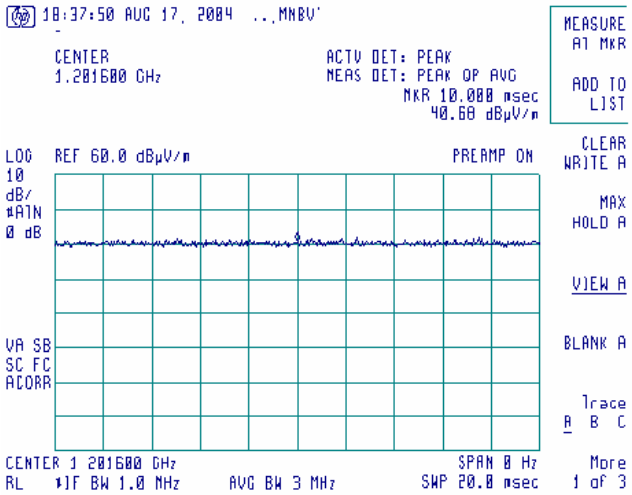
TEST SITE:	OATS
CARRIER FREQUENCY:	169.8 MHz
ANTENNA POLARIZATION:	Horizontal
TEST DISTANCE:	3 m



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:	8/31/2004 2:26:20 PM		
Temperature: 26 ºC	Air Pressure: 1006 hPa	Relative Humidity: 39 %	Power Supply: 12 VDC
Remarks:			

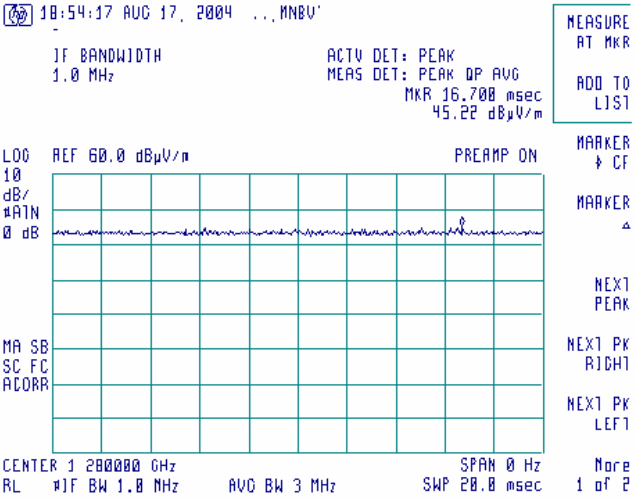
Plot 7.4.52 Radiated emission measurements at the 8th harmonic

TEST SITE:	OATS
CARRIER FREQUENCY:	150.2 MHz
ANTENNA POLARIZATION:	Vertical
TEST DISTANCE:	3 m



Plot 7.4.53 Radiated emission measurements at the 8th harmonic

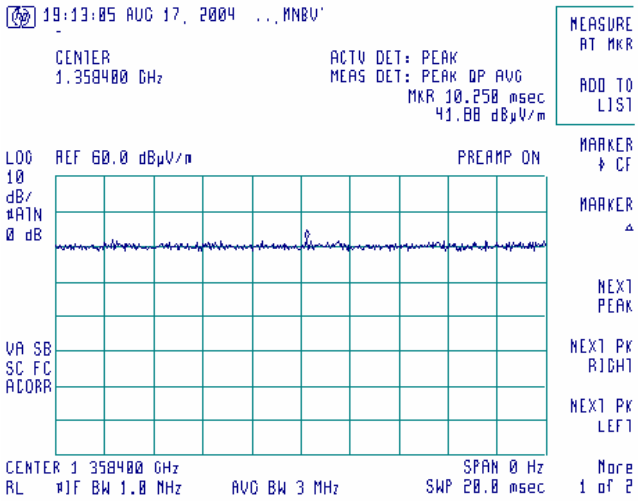
TEST SITE:	OATS
CARRIER FREQUENCY:	160.0 MHz
ANTENNA POLARIZATION:	Vertical
TEST DISTANCE:	3 m



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:	8/31/2004 2:26:20 PM		
Temperature: 26 ºC	Air Pressure: 1006 hPa	Relative Humidity: 39 %	Power Supply: 12 VDC
Remarks:			

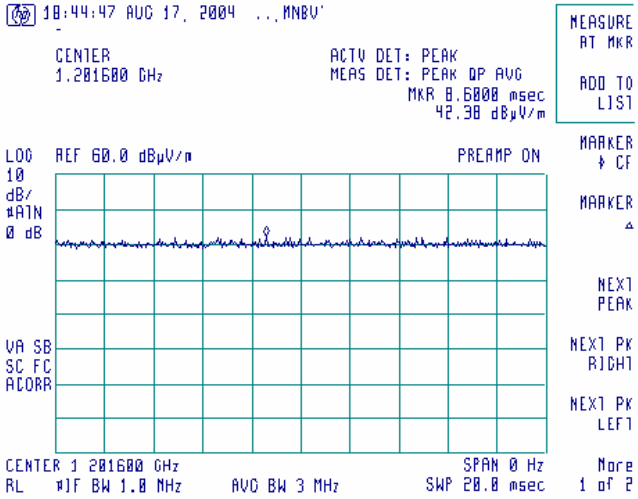
Plot 7.4.54 Radiated emission measurements at the 8th harmonic

TEST SITE:	OATS
CARRIER FREQUENCY:	169.8 MHz
ANTENNA POLARIZATION:	Vertical
TEST DISTANCE:	3 m



Plot 7.4.55 Radiated emission measurements at the 8th harmonic

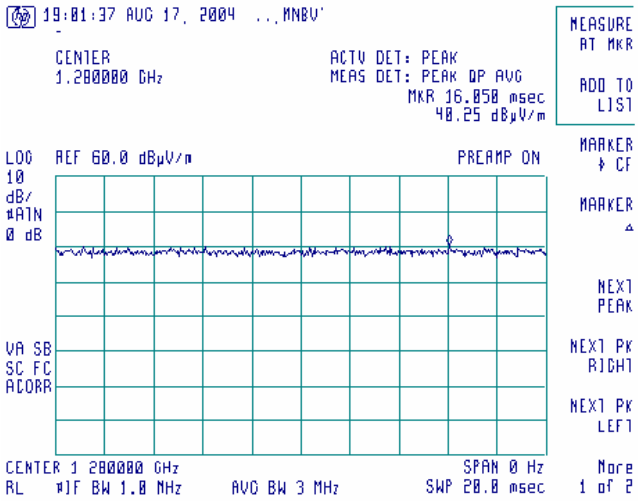
TEST SITE:	OATS
CARRIER FREQUENCY:	150.2 MHz
ANTENNA POLARIZATION:	Horizontal
TEST DISTANCE:	3 m



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:	8/31/2004 2:26:20 PM		
Temperature: 26 ºC	Air Pressure: 1006 hPa	Relative Humidity: 39 %	Power Supply: 12 VDC
Remarks:			

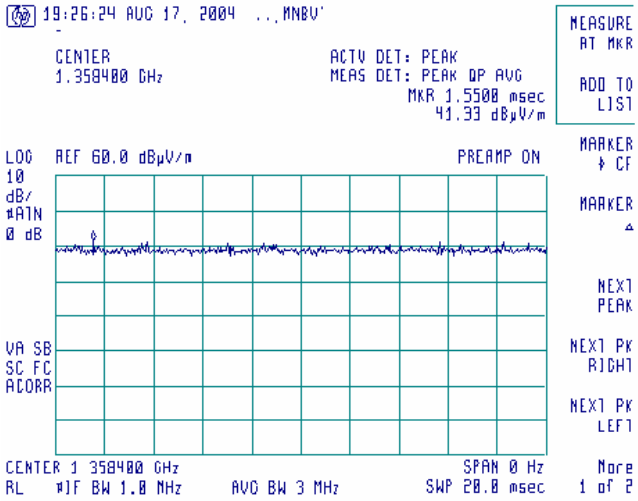
Plot 7.4.56 Radiated emission measurements at the 8th harmonic

TEST SITE:	OATS
CARRIER FREQUENCY:	160.0 MHz
ANTENNA POLARIZATION:	Horizontal
TEST DISTANCE:	3 m



Plot 7.4.57 Radiated emission measurements at the 8th harmonic

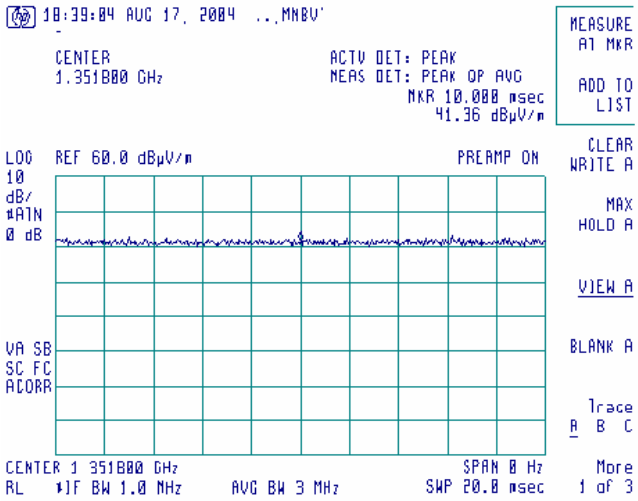
TEST SITE:	OATS
CARRIER FREQUENCY:	169.8 MHz
ANTENNA POLARIZATION:	Horizontal
TEST DISTANCE:	3 m



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:	8/31/2004 2:26:20 PM		
Temperature: 26 ºC	Air Pressure: 1006 hPa	Relative Humidity: 39 %	Power Supply: 12 VDC
Remarks:			

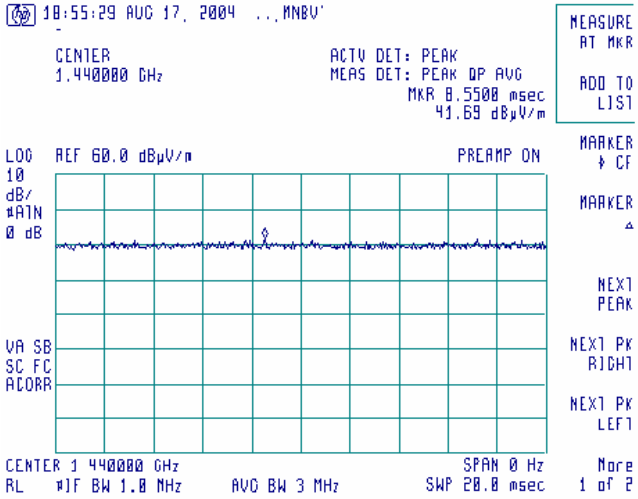
Plot 7.4.58 Radiated emission measurements at the 9th harmonic

TEST SITE:	OATS
CARRIER FREQUENCY:	150.2 MHz
ANTENNA POLARIZATION:	Vertical
TEST DISTANCE:	3 m



Plot 7.4.59 Radiated emission measurements at the 9th harmonic

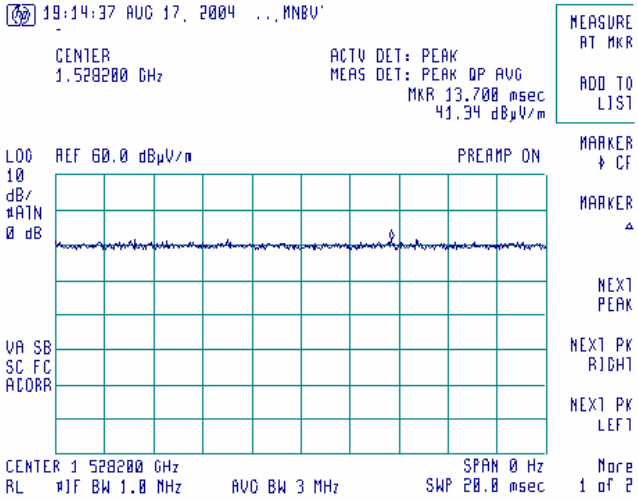
TEST SITE:	OATS
CARRIER FREQUENCY:	160.0 MHz
ANTENNA POLARIZATION:	Vertical
TEST DISTANCE:	3 m



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:	8/31/2004 2:26:20 PM		
Temperature: 26 ºC	Air Pressure: 1006 hPa	Relative Humidity: 39 %	Power Supply: 12 VDC
Remarks:			

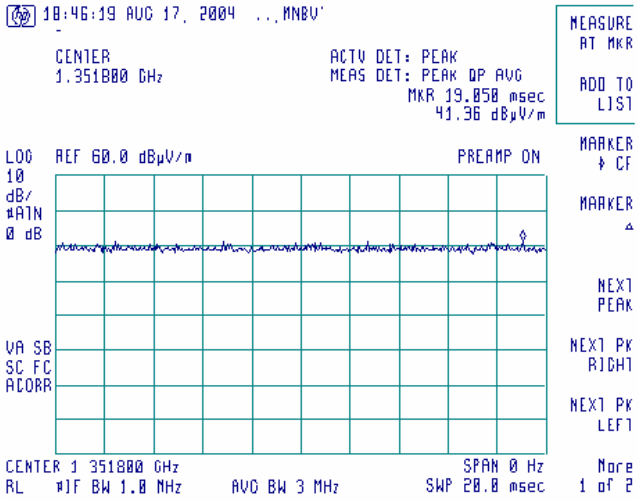
Plot 7.4.60 Radiated emission measurements at the 9th harmonic

TEST SITE: OATS
CARRIER FREQUENCY: 169.8 MHz
ANTENNA POLARIZATION: Vertical
TEST DISTANCE: 3 m



Plot 7.4.61 Radiated emission measurements at the 9th harmonic

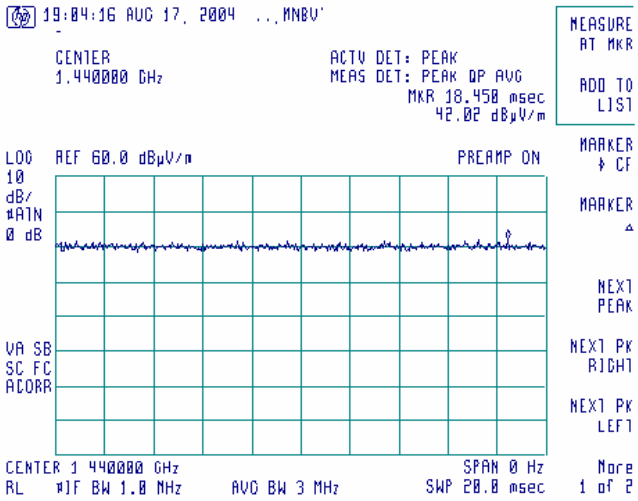
TEST SITE: OATS
CARRIER FREQUENCY: 150.2 MHz
ANTENNA POLARIZATION: Horizontal
TEST DISTANCE: 3 m



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:	8/31/2004 2:26:20 PM		
Temperature: 26 ºC	Air Pressure: 1006 hPa	Relative Humidity: 39 %	Power Supply: 12 VDC
Remarks:			

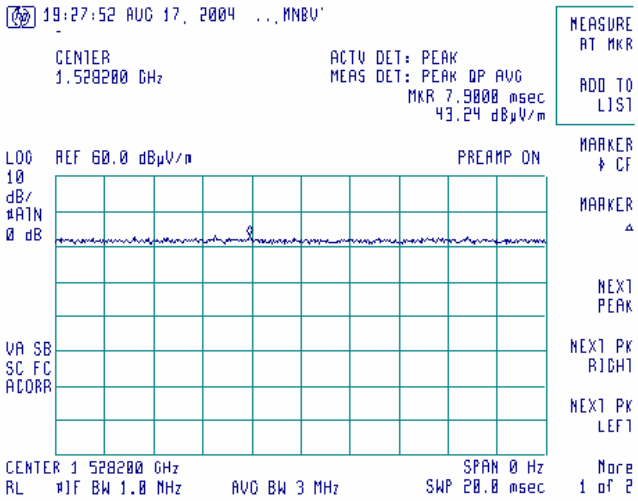
Plot 7.4.62 Radiated emission measurements at the 9th harmonic

TEST SITE:	OATS
CARRIER FREQUENCY:	160.0 MHz
ANTENNA POLARIZATION:	Horizontal
TEST DISTANCE:	3 m



Plot 7.4.63 Radiated emission measurements at the 9th harmonic

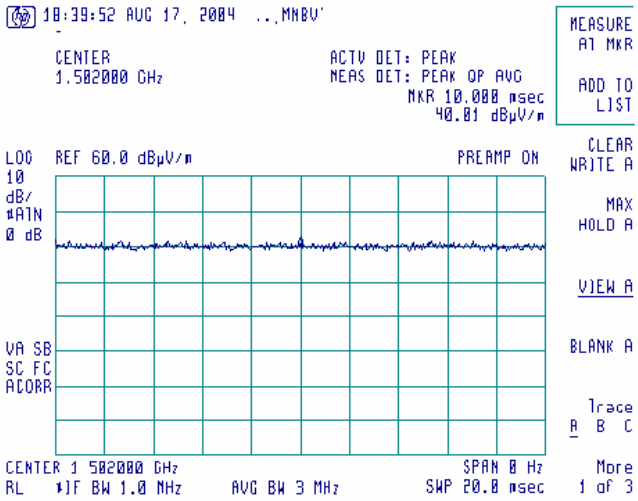
TEST SITE:	OATS
CARRIER FREQUENCY:	169.8 MHz
ANTENNA POLARIZATION:	Horizontal
TEST DISTANCE:	3 m



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:	8/31/2004 2:26:20 PM		
Temperature: 26 ºC	Air Pressure: 1006 hPa	Relative Humidity: 39 %	Power Supply: 12 VDC
Remarks:			

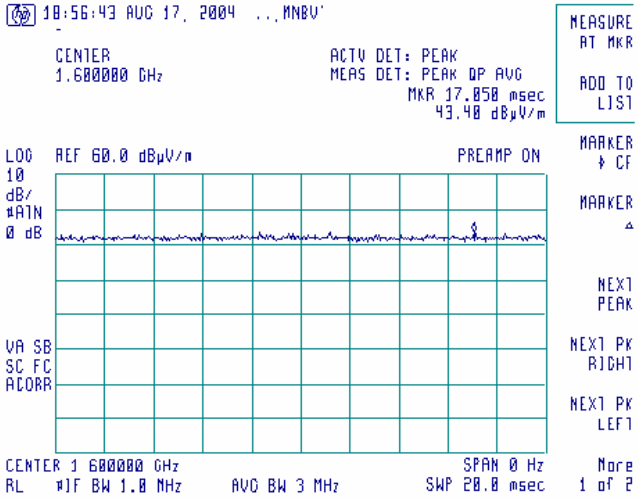
Plot 7.4.64 Radiated emission measurements at the 10th harmonic

TEST SITE:	OATS
CARRIER FREQUENCY:	150.2 MHz
ANTENNA POLARIZATION:	Vertical
TEST DISTANCE:	3 m



Plot 7.4.65 Radiated emission measurements at the 10th harmonic

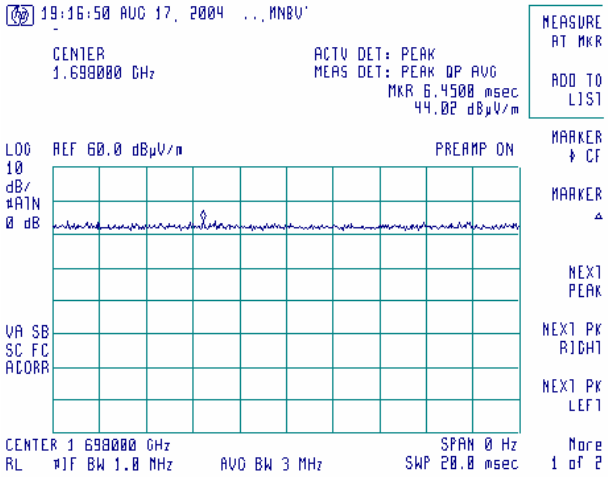
TEST SITE:	OATS
CARRIER FREQUENCY:	160.0 MHz
ANTENNA POLARIZATION:	Vertical
TEST DISTANCE:	3 m



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:	8/31/2004 2:26:20 PM		
Temperature: 26 ºC	Air Pressure: 1006 hPa	Relative Humidity: 39 %	Power Supply: 12 VDC
Remarks:			

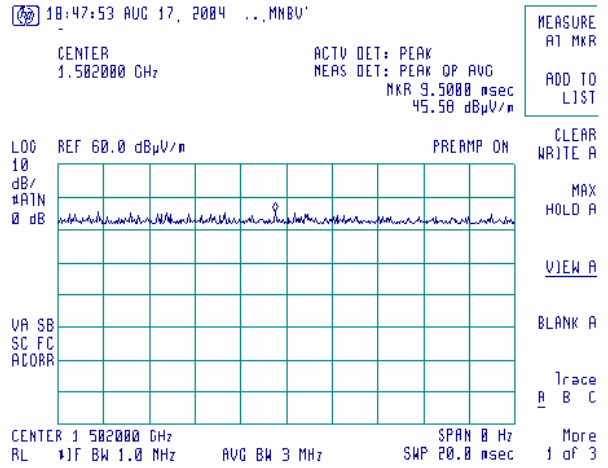
Plot 7.4.66 Radiated emission measurements at the 10th harmonic

TEST SITE:	OATS
CARRIER FREQUENCY:	169.8 MHz
ANTENNA POLARIZATION:	Vertical
TEST DISTANCE:	3 m



Plot 7.4.67 Radiated emission measurements at the 10th harmonic

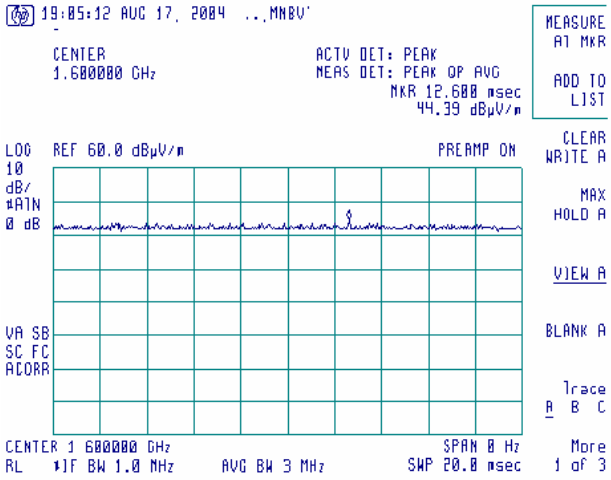
TEST SITE:	OATS
CARRIER FREQUENCY:	150.2 MHz
ANTENNA POLARIZATION:	Horizontal
TEST DISTANCE:	3 m



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:	8/31/2004 2:26:20 PM		
Temperature: 26 ºC	Air Pressure: 1006 hPa	Relative Humidity: 39 %	Power Supply: 12 VDC
Remarks:			

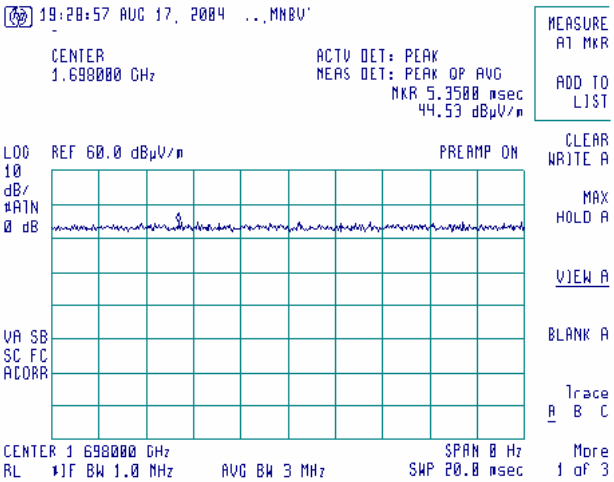
Plot 7.4.68 Radiated emission measurements at the 10th harmonic

TEST SITE:	OATS
CARRIER FREQUENCY:	160.0 MHz
ANTENNA POLARIZATION:	Horizontal
TEST DISTANCE:	3 m



Plot 7.4.69 Radiated emission measurements at the 10th harmonic

TEST SITE:	OATS
CARRIER FREQUENCY:	169.8 MHz
ANTENNA POLARIZATION:	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:	7/25/2004 8:24:13 PM		
Temperature: 1006 ºC	Air Pressure: 25 hPa	Relative Humidity: 40 %	Power Supply: 12 VDC
Remarks:			

7.5 Band edge emission

7.5.1 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 7.5.1.

Table 7.5.1 Band edge emission limits

Band edge frequency shift from carrier, kHz	Channel bandwidth, kHz	Attenuation below carrier, dBc
± 40.0	25.0	30

7.5.2 Test procedure

7.5.2.1 The EUT was set up as shown in Figure 7.5.1, energized and the performance check was conducted.

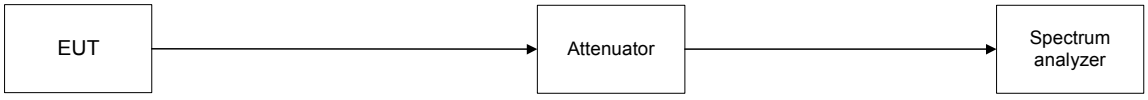
7.5.2.2 The spectrum analyzer sweep time and bandwidth were set to capture all major modulation sidebands of emission and sweep time was set sufficiently slow to ensure peak measurements. Spectrum analyzer was set in peak hold mode and time sufficient for trace stabilization was allowed.

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

7.5.2.4 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.

7.5.2.5 The test results were recorded in Table 7.5.2 and shown in the associated plots.

Figure 7.5.1 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:	7/25/2004 8:24:13 PM		
Temperature: 1006 ºC	**Air Pressure:** 25 hPa	**Relative Humidity:** 40 %	**Power Supply:** 12 VDC
Remarks:			

Table 7.5.2 Band edge emission test results

OPERATING FREQUENCY RANGE:	150.2 – 169.8 MHz
DETECTOR USED:	Peak hold
SWEEP RATE:	2 kHz/s
RESOLUTION BANDWIDTH:	1 kHz
VIDEO BANDWIDTH:	3 kHz
MODULATION:	FSK
MODULATING SIGNAL:	Alternative signal
BIT RATE:	600 bps
TRANSMITTER OUTPUT POWER SETTINGS:	Maximum
ATTENUATION BELOW CARRIER:	30 dBc

Band edge	Measured frequency, MHz*	Frequency drift, kHz		Band edge frequency, MHz**	Band edge limit, MHz	Margin, kHz***	Verdict
		Negative	Positive				
150.2 MHz							
Low	150.19373	1.673	NA	150.19206	150.16000	32.06	Pass
High	150.20700	NA	0.08	150.20708	150.24000	32.92	Pass
160.0 MHz							
Low	159.99380	1.639	NA	159.99216	159.96000	32.16	Pass
High	160.00697	NA	0.085	160.00706	160.04000	32.94	Pass
169.8 NHz							
Low	169.79377	1.875	NA	169.79189	169.76000	31.89	Pass
High	169.80707	NA	0.11	169.80718	169.84000	32.82	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

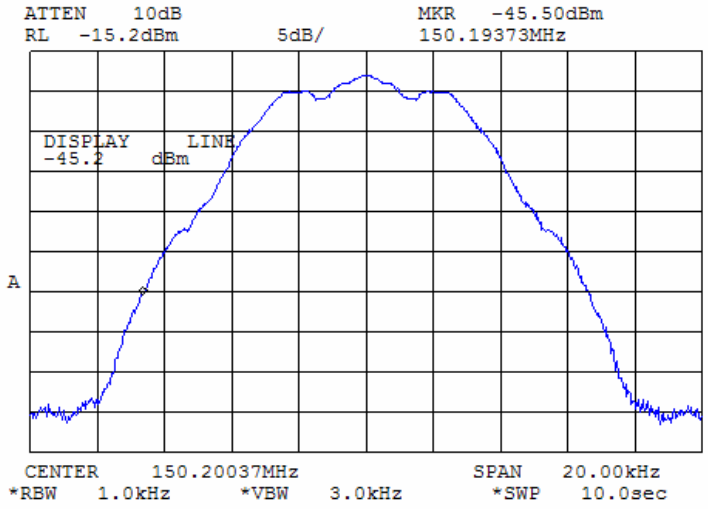
Reference numbers of test equipment used

HL 0810	HL 1424	HL 1519	HL 1652				

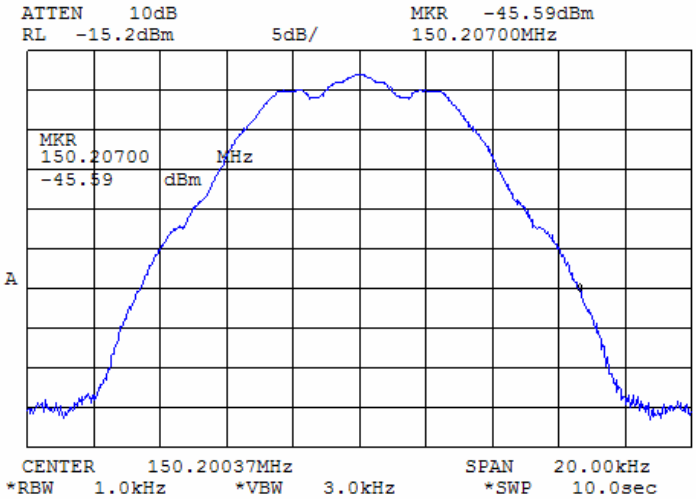
Full description is given in Appendix A.

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:	7/25/2004 8:24:13 PM		
Temperature: 1006 ºC	Air Pressure: 25 hPa	Relative Humidity: 40 %	Power Supply: 12 VDC
Remarks:			

Plot 7.5.1 Low band edge emission test results at 150.2 MHz

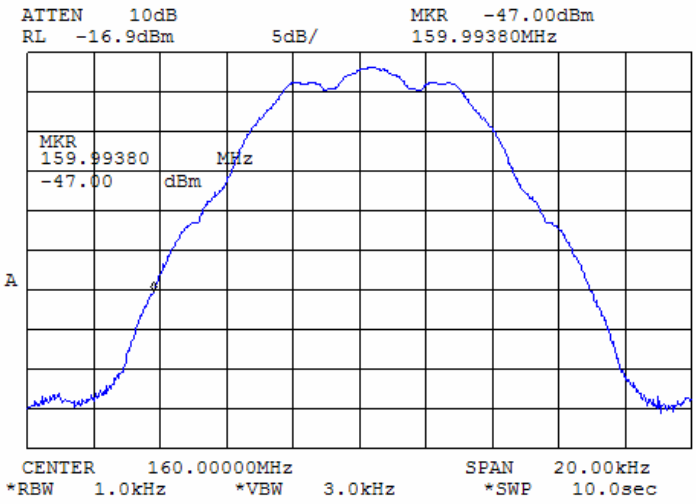


Plot 7.5.2 High band edge emission test results at 150.2 MHz

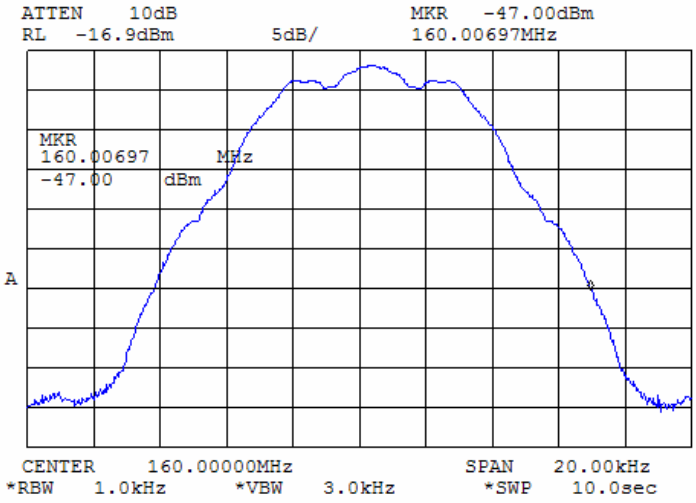


Test specification:	Section 90.217, Band edge emission		
Test procedure:	47 CFR, Sections 2.1051, 2.1047 and 90.217; TIA/EIA-603-A, Section 2.2.13		
Test mode:	Compliance	Verdict:	PASS
Date & Time:	7/25/2004 8:24:13 PM		
Temperature: 1006 ºC	Air Pressure: 25 hPa	Relative Humidity: 40 %	Power Supply: 12 VDC
Remarks:			

Plot 7.5.3 Low band edge emission test results at 160.0 MHz

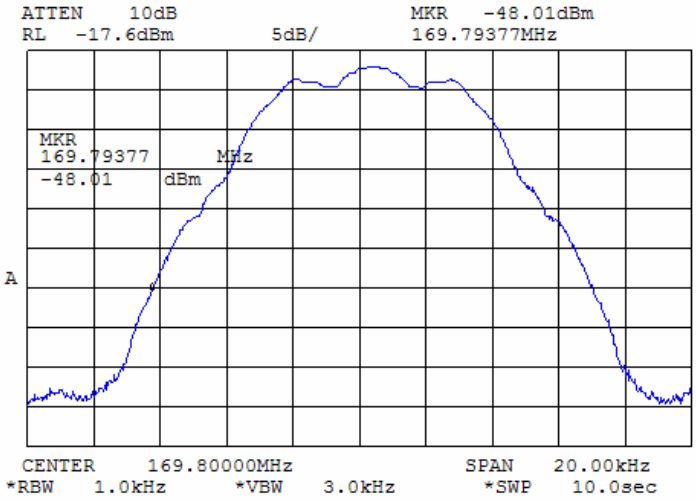


Plot 7.5.4 High band edge emission test results at 160.0 MHz

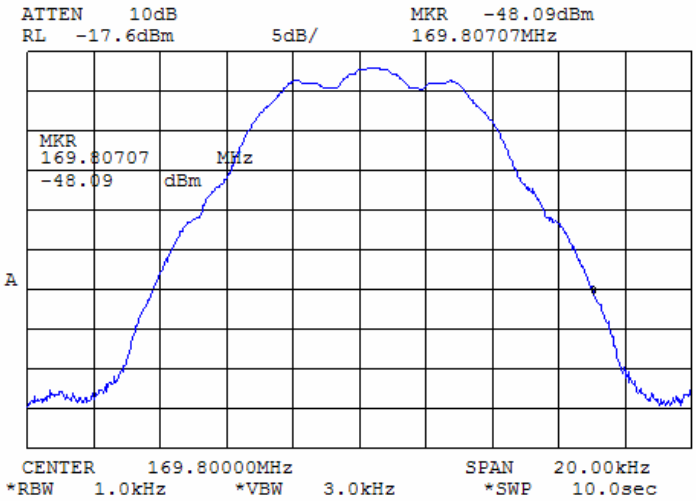


Test specification:	Section 90.217, Band edge emission		
Test procedure:	47 CFR, Sections 2.1051, 2.1047 and 90.217; TIA/EIA-603-A, Section 2.2.13		
Test mode:	Compliance	Verdict:	PASS
Date & Time:	7/25/2004 8:24:13 PM		
Temperature: 1006 ºC	Air Pressure: 25 hPa	Relative Humidity: 40 %	Power Supply: 12 VDC
Remarks:			

Plot 7.5.5 Low band edge emission test results at 169.8 MHz



Plot 7.5.6 High band edge emission test results at 169.8 MHz



Test specification:	Section 90.210, Conducted spurious emissions		
Test procedure:	47 CFR, Sections 2.1051 and 90.210(m); TIA/EIA-603-A, Section 2.2.13		
Test mode:	Compliance	Verdict:	PASS
Date & Time:	7/23/2004 1:23:34 PM		
Temperature: 26 ºC	Air Pressure: 1006 hPa	Relative Humidity: 39 %	Power Supply:
Remarks:			

7.6 Spurious emissions at RF antenna connector test

7.6.1 General

This test was performed to measure spurious emissions at RF antenna connector. Specification test limits are given in Table 7.6.1. The test results are provided in Table 7.6.2 and associated plots.

Table 7.6.1 Spurious emission limits

Frequency, MHz	Attenuation below carrier, dBc	ERP of spurious, dBm
FCC 90.210		
0.009 – 10th harmonic*	43+10logP**	-13.0
FCC 90.217		
0.009 – 10th harmonic*	30	-11.0

* - spurious emission limits do not apply to the in band emission within ± 250 % of the authorized bandwidth from the carrier; investigated in course of emission mask testing
** - P is transmitter output power in Watts

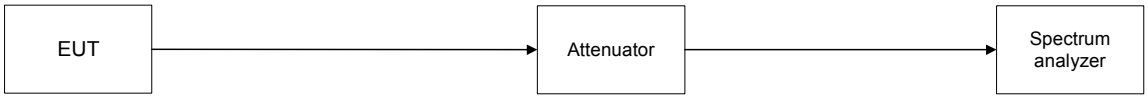
7.6.2 Test procedure

7.6.2.1 The EUT was set up as shown in Figure 7.6.1, energized and its proper operation was checked.

7.6.2.2 The EUT was adjusted to produce maximum available for end user RF output power.

7.6.2.3 The spurious emission was measured with spectrum analyzer as provided in Table 7.6.2 and associated plots.

Figure 7.6.1 Spurious emission test setup



Test specification:	**Section 90.210, Conducted spurious emissions**		
Test procedure:	47 CFR, Sections 2.1051 and 90.210(m); TIA/EIA-603-A, Section 2.2.13		
Test mode:	Compliance	**Verdict:**	PASS
Date & Time:	7/23/2004 1:23:34 PM		
Temperature: 26 ºC	**Air Pressure:** 1006 hPa	**Relative Humidity:** 39 %	**Power Supply:**
Remarks:			

Table 7.6.2 Spurious emission test results

OPERATING FREQUENCY RANGE: 150.2 – 169.8 MHz
INVESTIGATED FREQUENCY RANGE: 0.009 – 2000 MHz
DETECTOR USED: Peak
VIDEO BANDWIDTH: Off
MODULATION: FSK
MODULATING SIGNAL: Alternative
BIT RATE: 600 bps
TRANSMITTER OUTPUT POWER SETTINGS: Maximum
TRANSMITTER OUTPUT POWER: 19.46 dBm at 150.2 MHz
19.31 dBm at 160.0 MHz
19.01 dBm at 169.8 MHz

Frequency, MHz	SA reading, dBm	Attenuator, dB	Cable loss, dB	RBW, kHz	Spurious emission, dBm	Attenuation below carrier, dBc	Limit, dBc	Margin, dB*	Verdict
150.2 MHz carrier frequency									
300.4	-60.26	30.0	0.2	10	-30.1	49.1	30	19.1	Pass
450.6	-69.80	30.1	0.2	10	-39.5	58.5	30	28.5	Pass
160.0 MHz carrier frequency									
320	-59.81	30.0	0.2	10	-29.6	48.6	30	18.6	Pass
480	-69.30	30.1	0.2	10	-39.0	58.0	30	28.0	Pass
169.8 MHz carrier frequency									
339.6	-65.30	30.0	0.2	10	-35.1	54.1	30	24.1	Pass
509.4	-71.12	30.1	0.2	10	-40.82	59.82	30	29.82	Pass

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

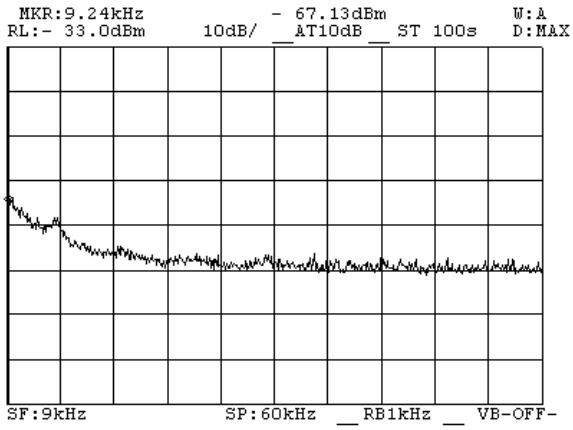
Reference numbers of test equipment used

HL 0026	HL 0810	HL 1652	HL 2107				

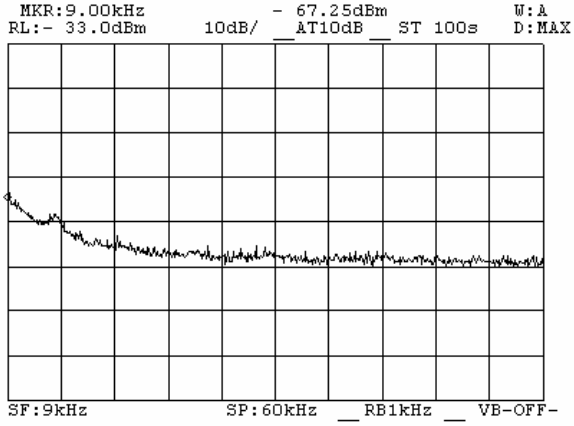
Full description is given in Appendix A.

Test specification:	Section 90.210, Conducted spurious emissions		
Test procedure:	47 CFR, Sections 2.1051 and 90.210(m); TIA/EIA-603-A, Section 2.2.13		
Test mode:	Compliance	Verdict:	PASS
Date & Time:	7/23/2004 1:23:34 PM		
Temperature: 26 ºC	Air Pressure: 1006 hPa	Relative Humidity: 39 %	Power Supply:
Remarks:			

Plot 7.6.1 Spurious emission measurements in 9 - 60 kHz range at 150.2 MHz carrier frequency

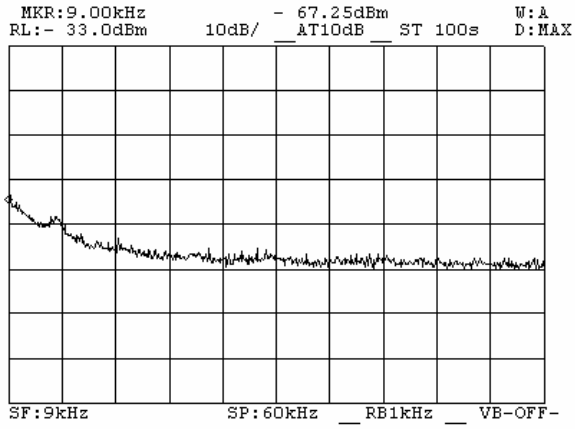


Plot 7.6.2 Spurious emission measurements in 9 - 60 kHz range at 160.0 MHz carrier frequency

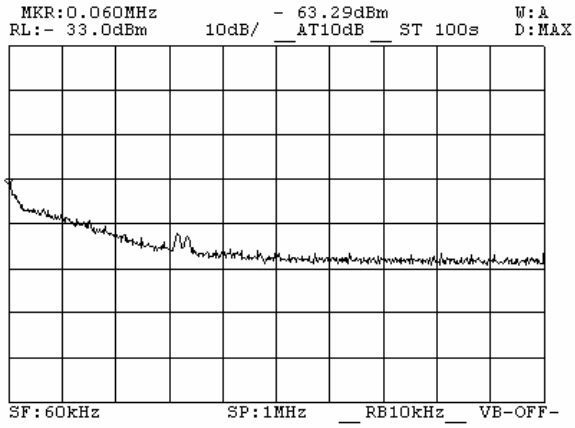


Test specification:	Section 90.210, Conducted spurious emissions		
Test procedure:	47 CFR, Sections 2.1051 and 90.210(m); TIA/EIA-603-A, Section 2.2.13		
Test mode:	Compliance	Verdict:	PASS
Date & Time:	7/23/2004 1:23:34 PM		
Temperature: 26 ºC	Air Pressure: 1006 hPa	Relative Humidity: 39 %	Power Supply:
Remarks:			

Plot 7.6.3 Spurious emission measurements in 9 - 60 kHz range at 169.8 MHz carrier frequency

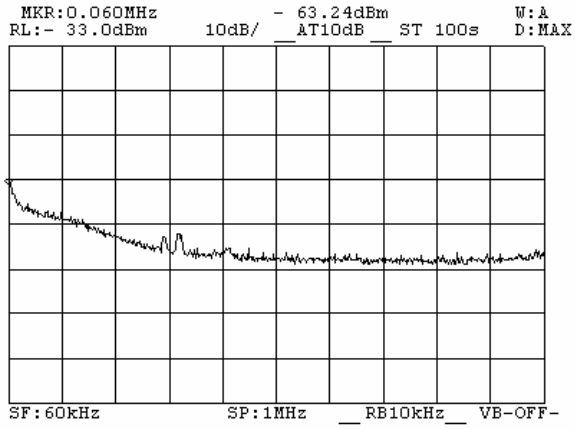


Plot 7.6.4 Spurious emission measurements in 0.06 - 1.0 MHz range at 150.2 MHz carrier frequency

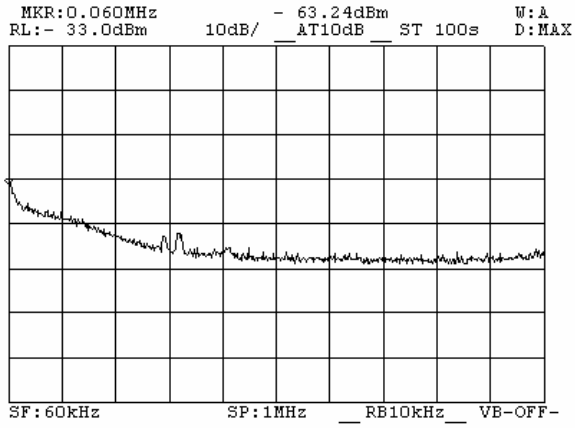


Test specification:	Section 90.210, Conducted spurious emissions		
Test procedure:	47 CFR, Sections 2.1051 and 90.210(m); TIA/EIA-603-A, Section 2.2.13		
Test mode:	Compliance	Verdict:	PASS
Date & Time:	7/23/2004 1:23:34 PM		
Temperature: 26 ºC	Air Pressure: 1006 hPa	Relative Humidity: 39 %	Power Supply:
Remarks:			

Plot 7.6.5 Spurious emission measurements in 0.06 - 1.0 MHz range at 160.0 MHz carrier frequency

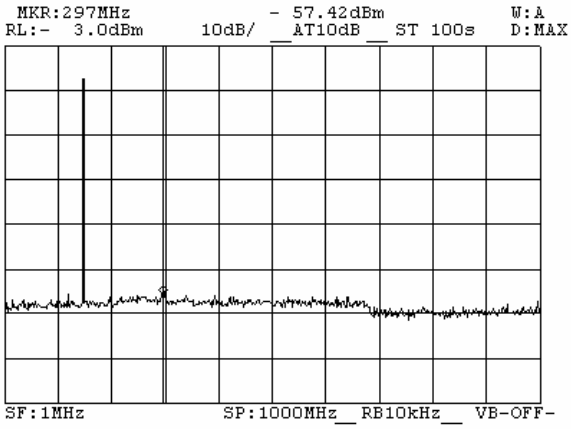


Plot 7.6.6 Spurious emission measurements in 0.06 – 1.0 MHz range at 169.8 MHz carrier frequency

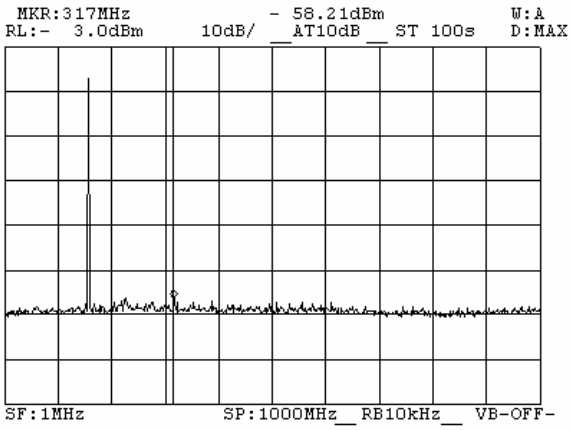


Plot 7.6.7 Spurious emission measurements in 1.0 - 1000 MHz range at 150.2 MHz carrier frequency

Test specification:	Section 90.210, Conducted spurious emissions		
Test procedure:	47 CFR, Sections 2.1051 and 90.210(m); TIA/EIA-603-A, Section 2.2.13		
Test mode:	Compliance	Verdict:	PASS
Date & Time:	7/23/2004 1:23:34 PM		
Temperature: 26 ºC	Air Pressure: 1006 hPa	Relative Humidity: 39 %	Power Supply:
Remarks:			

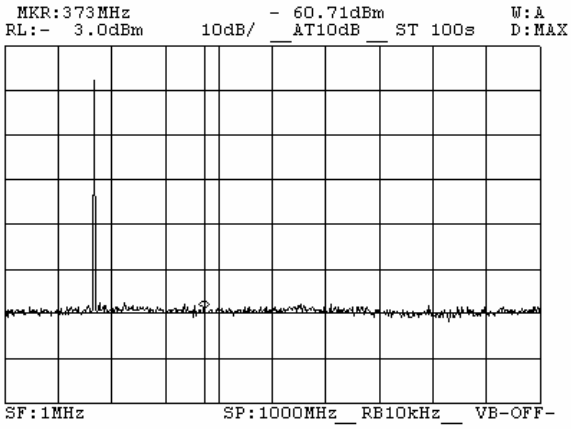


Plot 7.6.8 Spurious emission measurements in 1.0 - 1000 MHz range at 160.0 MHz carrier frequency

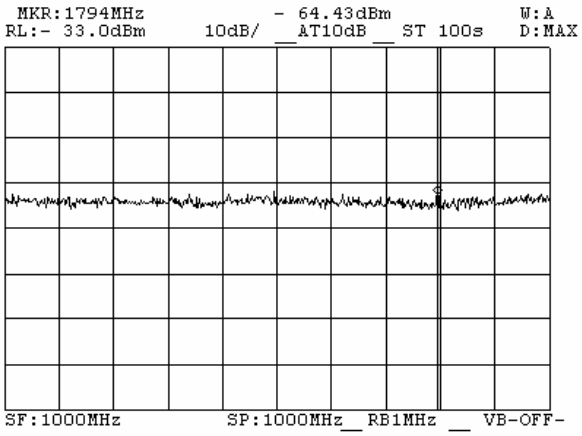


Test specification:	Section 90.210, Conducted spurious emissions		
Test procedure:	47 CFR, Sections 2.1051 and 90.210(m); TIA/EIA-603-A, Section 2.2.13		
Test mode:	Compliance	Verdict:	PASS
Date & Time:	7/23/2004 1:23:34 PM		
Temperature: 26 ºC	Air Pressure: 1006 hPa	Relative Humidity: 39 %	Power Supply:
Remarks:			

Plot 7.6.9 Spurious emission measurements in 1.0 - 1000 MHz range at 169.8 MHz carrier frequency

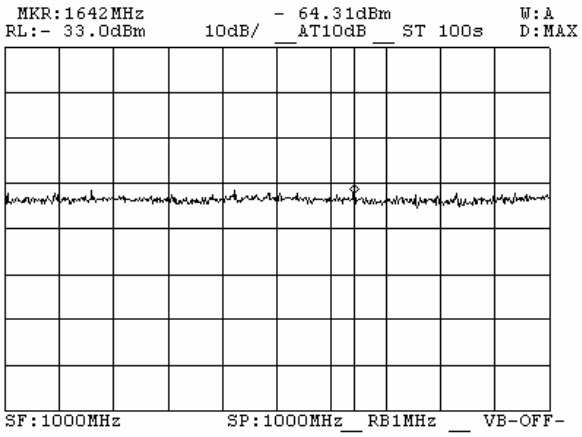


Plot 7.6.10 Spurious emission measurements in 1000 - 2000 MHz range at 150.2 MHz carrier frequency

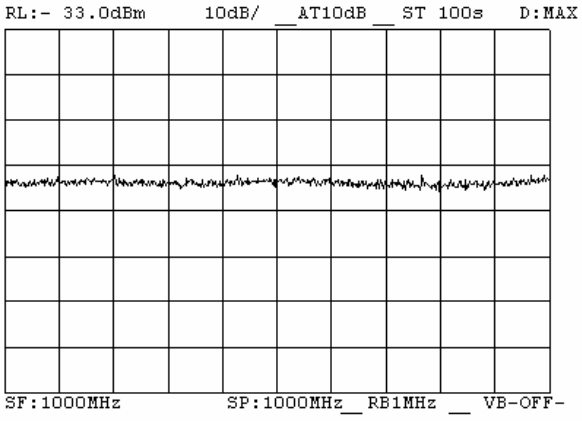


Test specification:	Section 90.210, Conducted spurious emissions		
Test procedure:	47 CFR, Sections 2.1051 and 90.210(m); TIA/EIA-603-A, Section 2.2.13		
Test mode:	Compliance	Verdict:	PASS
Date & Time:	7/23/2004 1:23:34 PM		
Temperature: 26 ºC	Air Pressure: 1006 hPa	Relative Humidity: 39 %	Power Supply:
Remarks:			

Plot 7.6.11 Spurious emission measurements in 1000 - 2000 MHz at 160.0 MHz carrier frequency

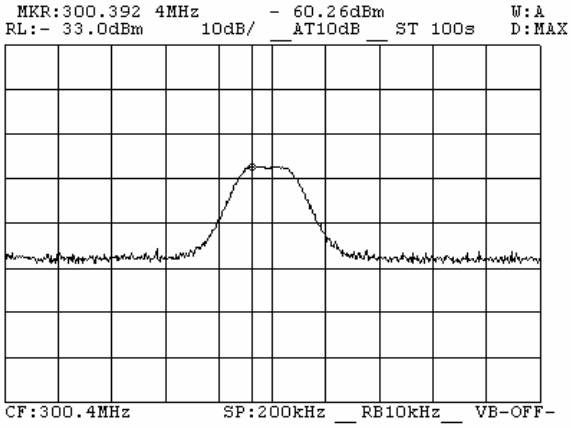


Plot 7.6.12 Spurious emission measurements in 1000 - 2000 MHz at 169.8 MHz carrier frequency

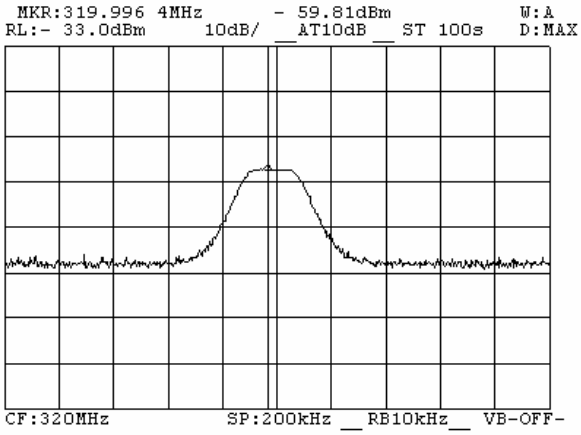


Test specification:	Section 90.210, Conducted spurious emissions		
Test procedure:	47 CFR, Sections 2.1051 and 90.210(m); TIA/EIA-603-A, Section 2.2.13		
Test mode:	Compliance	Verdict:	PASS
Date & Time:	7/23/2004 1:23:34 PM		
Temperature: 26 ºC	Air Pressure: 1006 hPa	Relative Humidity: 39 %	Power Supply:
Remarks:			

Plot 7.6.13 Conducted spurious emission measurements at the 2nd harmonic of 150.2 MHz carrier frequency

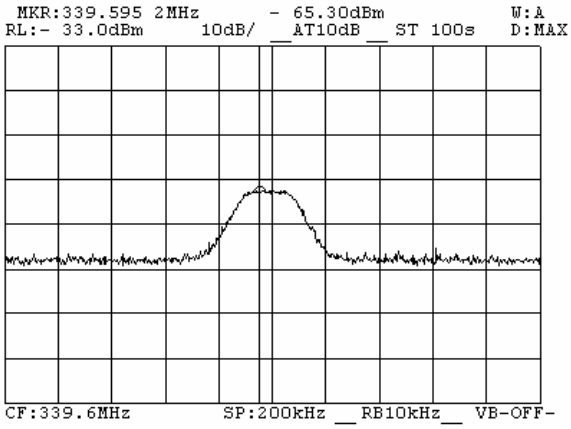


Plot 7.6.14 Conducted spurious emission measurements at the 2nd harmonic of 160.0 MHz carrier frequency

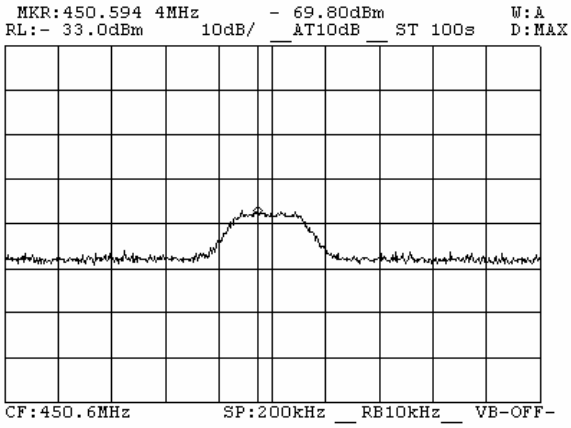


Test specification:	Section 90.210, Conducted spurious emissions		
Test procedure:	47 CFR, Sections 2.1051 and 90.210(m); TIA/EIA-603-A, Section 2.2.13		
Test mode:	Compliance	Verdict:	PASS
Date & Time:	7/23/2004 1:23:34 PM		
Temperature: 26 ºC	Air Pressure: 1006 hPa	Relative Humidity: 39 %	Power Supply:
Remarks:			

Plot 7.6.15 Conducted spurious emission measurements at the 2nd harmonic of 169.8 MHz carrier frequency

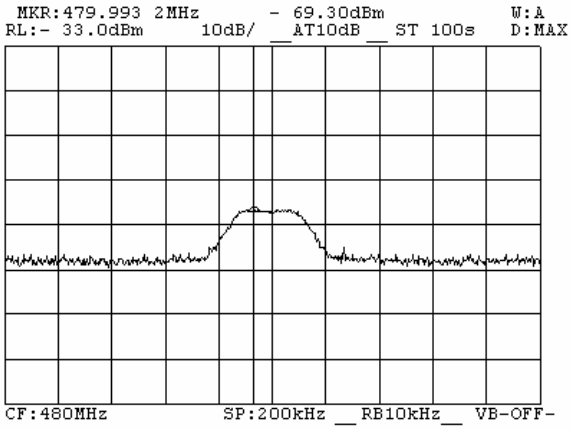


Plot 7.6.16 Conducted spurious emission measurements at the 3rd harmonic of 150.2 MHz carrier frequency

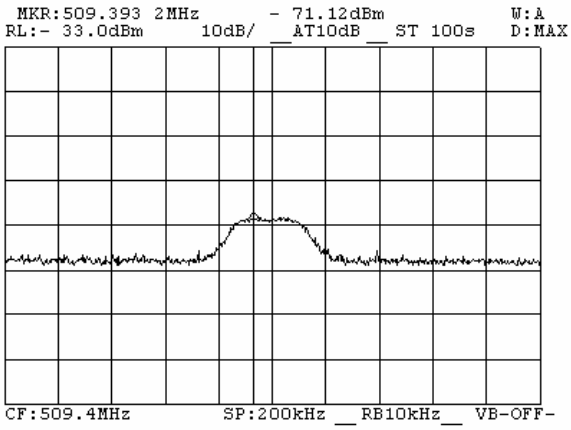


Test specification:	Section 90.210, Conducted spurious emissions		
Test procedure:	47 CFR, Sections 2.1051 and 90.210(m); TIA/EIA-603-A, Section 2.2.13		
Test mode:	Compliance	Verdict:	PASS
Date & Time:	7/23/2004 1:23:34 PM		
Temperature: 26 ºC	Air Pressure: 1006 hPa	Relative Humidity: 39 %	Power Supply:
Remarks:			

Plot 7.6.17 Conducted spurious emission measurements at the 3rd harmonic of 160.0 MHz carrier frequency



Plot 7.6.18 Conducted spurious emission measurements at the 3rd harmonic of 169.8 MHz carrier 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:	7/25/2004 3:08:36 PM		
Temperature: 1006 ºC	Air Pressure: 25 hPa	Relative Humidity: 40 %	Power Supply: 12 VDC
Remarks:			

7.7 Frequency stability test

7.7.1 General

This test was performed to measure frequency stability of transmitter RF carrier. Specification test limits are given in Table 7.7.1. The test results are provided in Table 7.7.2.

Table 7.7.1 Frequency stability limits

Assigned frequency, MHz	Maximum allowed frequency displacement	
	ppm	Hz
150.2 – 169.8	NA	NA

7.7.2 Test procedure

7.7.2.1 The EUT was set up as shown in Figure 7.7.1, energized and its proper operation was checked.

7.7.2.2 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.

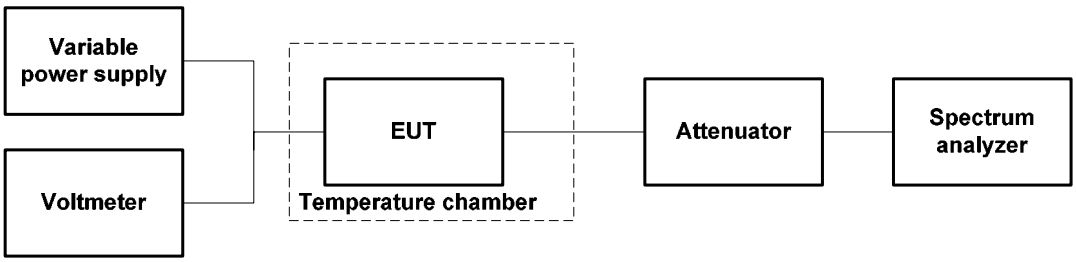
7.7.2.3 The EUT was powered on and carrier frequency was measured at start up moment and then every minute until frequency had been stabilized or 10 minutes elapsed whichever reached the last. The EUT was powered off.

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

7.7.2.5 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.

7.7.2.6 Frequency displacement was calculated as provided in Table 7.7.2.

Figure 7.7.1 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:	7/25/2004 3:08:36 PM		
Temperature: 1006 ºC	**Air Pressure:** 25 hPa	**Relative Humidity:** 40 %	**Power Supply:** 12 VDC
Remarks:			

Table 7.7.2 Frequency stability test results

OPERATING FREQUENCY: 150.2 – 169.8 MHz
NOMINAL POWER VOLTAGE: 12 VDC
TEMPERATURE STABILIZATION PERIOD: 20 min
POWER DURING TEMPERATURE TRANSITION: Off
SPECTRUM ANALYZER MODE: Counter
RESOLUTION BANDWIDTH: 1 kHz
VIDEO BANDWIDTH: 1 kHz
MODULATION: Unmodulated

T, ºC	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			
150.2 MHz													
-30	nominal	150.198815	150.198991	150.199129	150.199230	150.199298	150.199345	150.199463	-1025	-1673		NA	Pass
-20	nominal	150.199582	NA	NA	NA	NA	NA	150.200085	-403	-906		NA	Pass
-10	nominal	150.200448	NA	NA	NA	NA	NA	150.200448	-40	-40		NA	Pass
0	nominal	150.200494	150.200521	150.200536	150.200545	150.200555	150.200561	150.200568	80	6		NA	Pass
10	nominal	150.200544	NA	NA	NA	NA	NA	150.200565	77	56		NA	Pass
20	+15%	150.200520	NA	NA	NA	NA	NA	150.200487	32	-1	NA	NA	Pass
20	nominal	150.200521	NA	NA	NA	NA	NA	150.200488*	0	0		NA	Pass
20	-15%	150.200530	NA	NA	NA	NA	NA	150.200485	42	-3		NA	Pass
30	nominal	150.200448	150.200438	150.200435	150.200434	150.200434	150.200434	150.200434	-40	-54		NA	Pass
40	nominal	150.200415	NA	NA	NA	NA	NA	150.200444	-44	-73		NA	Pass
50	nominal	150.200460	NA	NA	NA	NA	NA	150.200466	-22	-28		NA	Pass
160.0 MHz													
-30	nominal	159.998881	159.999001	159.999055	159.999162	159.999243	159.999302	159.999434	-1086	-1639		NA	Pass
-20	nominal	159.999660	NA	NA	NA	NA	NA	160.000155	-365	-860		NA	Pass
-10	nominal	160.000277	NA	NA	NA	NA	NA	160.000506	-14	-243		NA	Pass
0	nominal	160.000515	160.000549	160.000573	160.000585	160.000591	160.000598	160.000605	85	-5		NA	Pass
10	nominal	160.000511	NA	NA	NA	NA	NA	160.000587	67	-9		NA	Pass
20	+15%	160.000565	NA	NA	NA	NA	NA	160.000522	45	2	NA	NA	Pass
20	nominal	160.000576	NA	NA	NA	NA	NA	160.000520*	0	0		NA	Pass
20	-15%	160.000569	NA	NA	NA	NA	NA	160.000523	49	3		NA	Pass
30	nominal	160.000491	160.000474	160.000469	160.000467	160.000465	160.000464	160.000464	-29	-56		NA	Pass
40	nominal	160.000446	NA	NA	NA	NA	NA	160.000500	-20	-74		NA	Pass
50	nominal	160.000601	NA	NA	NA	NA	NA	160.000630	110	81		NA	Pass
169.8 MHz													
-30	nominal	169.798657	169.798852	169.799030	169.799140	169.799207	169.799265	169.799450	-1082	-1875		NA	Pass
-20	nominal	169.799665	NA	NA	NA	NA	NA	169.800160	-372	-867		NA	Pass
-10	nominal	169.800180	NA	NA	NA	NA	NA	169.800508	-24	-352		NA	Pass
0	nominal	169.800534	169.800585	169.800604	169.800621	169.800626	169.800632	169.800642	110	2		NA	Pass
10	nominal	169.800615	NA	NA	NA	NA	NA	169.800615	83	83		NA	Pass
20	+15%	169.800550	NA	NA	NA	NA	NA	169.800530	18	-2	NA	NA	Pass
20	nominal	169.800560	NA	NA	NA	NA	NA	169.800532*	0	0		NA	Pass
20	-15%	169.800557	NA	NA	NA	NA	NA	169.800537	5	5		NA	Pass
30	nominal	169.800498	169.800491	169.800490	169.800491	169.800492	169.800492	169.800494	-34	-42		NA	Pass
40	nominal	169.800489	NA	NA	NA	NA	NA	169.800558	26	-43		NA	Pass
50	nominal	169.800455	NA	NA	NA	NA	NA	169.800255	-77	-277		NA	Pass

* - Reference frequency

Reference numbers of test equipment used

HL 0026	HL 0810	HL 0892	HL 1523	HL 1652	HL 2265		

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:	7/22/2004 3:30:39 PM		
Temperature: 25 ºC	Air Pressure: 1005 hPa	Relative Humidity: 42 %	Power Supply: 12 VDC
Remarks:			

7.8 Transient frequency behaviour test

7.8.1 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 7.8.1. The test results are provided in the associated plots.

Table 7.8.1 Transient frequency limits

Channel bandwidth, kHz	Carrier frequency tolerance, kHz	Duration, ms	Time interval*
25.0	± 12.5	20.0	t_2
	± 25.0	5.0	t_3

* - t_{on} is the instant when a 1 kHz test signal is completely suppressed;
t_1 is the time period immediately following t_{on};
t_2 is the time period immediately following t_1;
t_3 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.

7.8.2 Test procedure

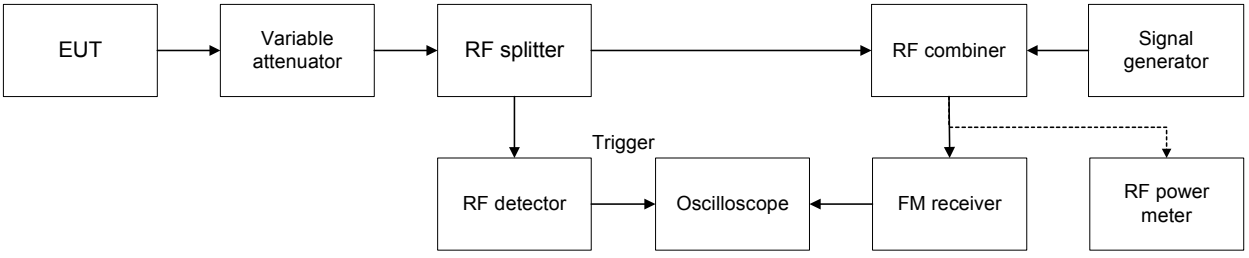
7.8.2.1 The EUT was set up as shown in Figure 7.8.1, energized and its proper operation was checked. Variable attenuator was adjusted to provide signal level approximately 40 dB below the FM receiver maximum allowed level as measured with RF power meter. The EUT was turned off.

7.8.2.2 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.

7.8.2.3 The storage oscilloscope was set to provide horizontal sweep rate 5 milliseconds per division. Amplitude control of the storage oscilloscope was adjusted to obtain 1 kHz sinusoidal signal vertically centered with ± 4 divisions amplitude.

7.8.2.4 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 7.8.1 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:	7/22/2004 3:30:39 PM		
Temperature: 25 ºC	Air Pressure: 1005 hPa	Relative Humidity: 42 %	Power Supply: 12 VDC
Remarks:			

Table 7.8.2 Transient frequency behaviour test results

Carrier frequency, MHz	Time interval	Duration, ms	Frequency deviation, kHz	Limit, kHz	Margin, kHz	Verdict
150.2	t_2	20.0	< 1.6*	± 12.5	>10.9	Pass
	t_3	5.0	-16.9	± 25.0	8.1	
160.0	t_2	20.0	< 1.6*	± 12.5	>10.9	Pass
	t_3	5.0	13.5	± 25.0	11.5	
169.8	t_2	20.0	< 1.6*	± 12.5	>10.9	Pass
	t_3	5.0	-16.5	± 25.0	8.5	

* ¼ division.

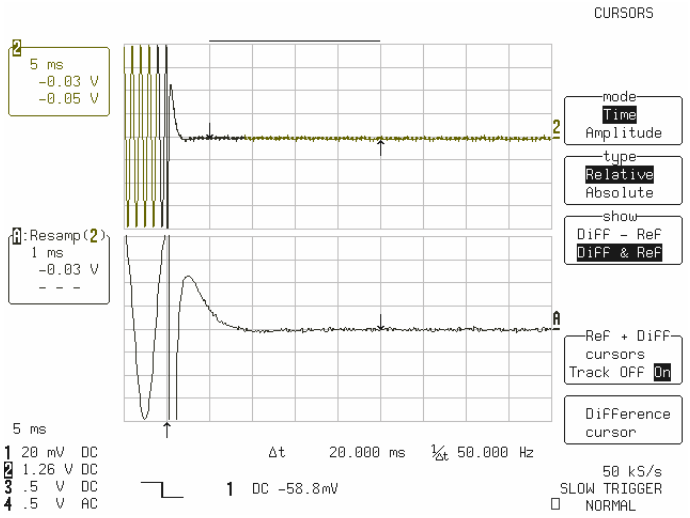
Reference numbers of test equipment used

HL 0557	HL 0670	HL 0788	HL 0793	HL 0810	HL 1519	HL 1523	HL 1907
HL 1956	HL 2012	HL 2227	HL 2265				

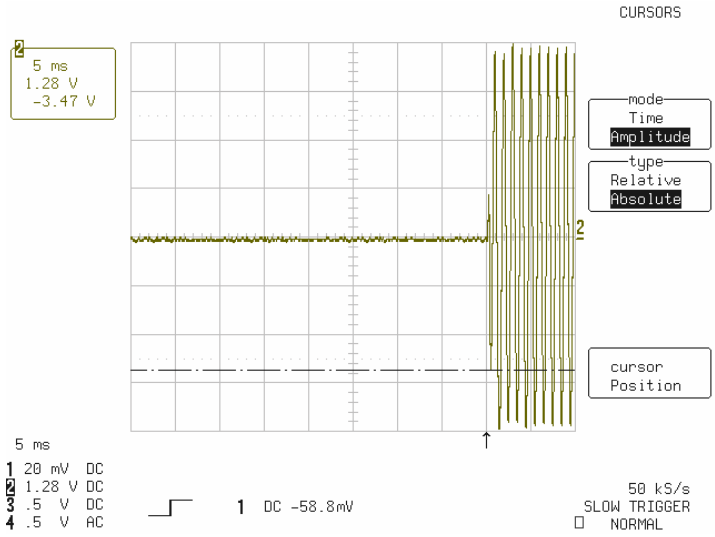
Full description is given in Appendix A.

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:	7/22/2004 3:30:39 PM		
Temperature: 25 ºC	Air Pressure: 1005 hPa	Relative Humidity: 42 %	Power Supply: 12 VDC
Remarks:			

Plot 7.8.1 Transient frequency during power ON test results at 150.2 MHz carrier frequency

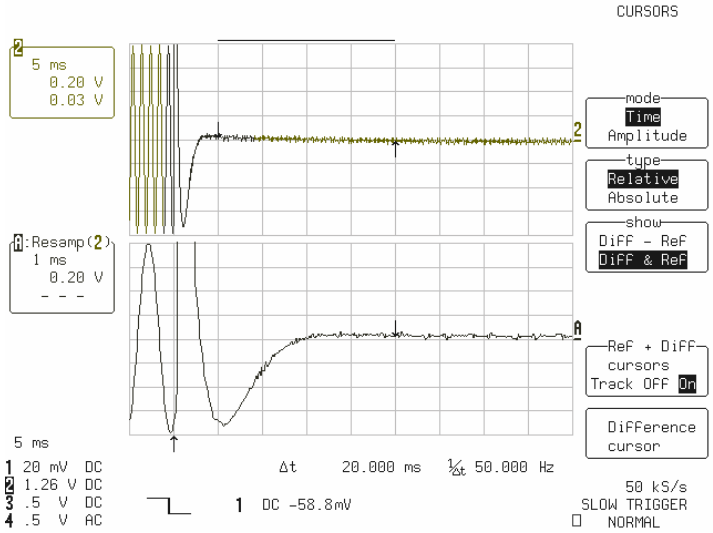


Plot 7.8.2 Transient frequency during power OFF test results at 150.2 MHz carrier frequency

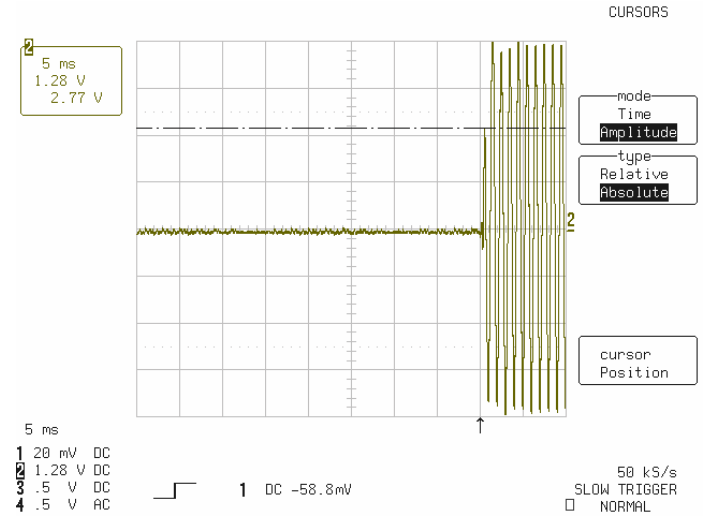


Test specification:	Section 90.214, Transient frequency behaviour		
Test procedure:	TIA/EIA-603-A, Section 2.2.19		
Test mode:	Compliance	Verdict:	PASS
Date & Time:	7/22/2004 3:30:39 PM		
Temperature: 25 ºC	Air Pressure: 1005 hPa	Relative Humidity: 42 %	Power Supply: 12 VDC
Remarks:			

Plot 7.8.3 Transient frequency during power ON test results at 160.0 MHz carrier frequency

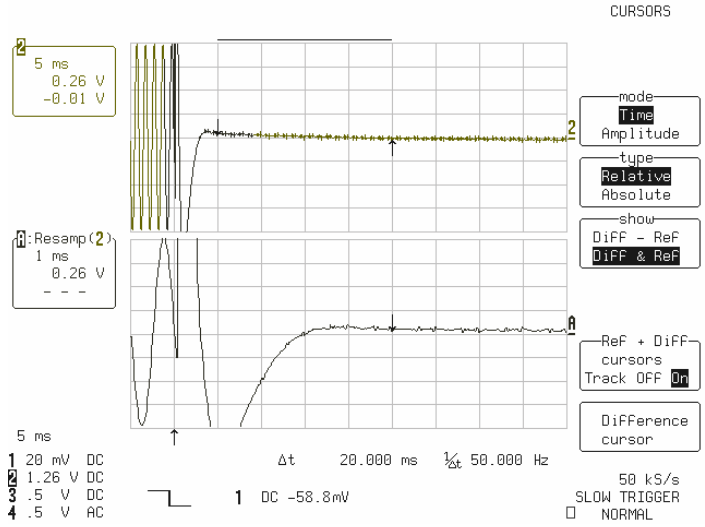


Plot 7.8.4 Transient frequency during power OFF test results at 160.0 MHz carrier frequency

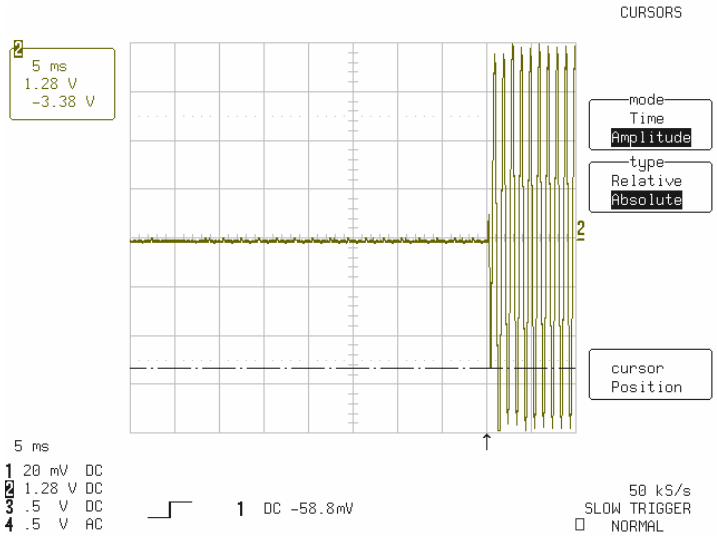


Test specification:	Section 90.214, Transient frequency behaviour		
Test procedure:	TIA/EIA-603-A, Section 2.2.19		
Test mode:	Compliance	Verdict:	PASS
Date & Time:	7/22/2004 3:30:39 PM		
Temperature: 25 ºC	Air Pressure: 1005 hPa	Relative Humidity: 42 %	Power Supply: 12 VDC
Remarks:			

Plot 7.8.5 Transient frequency during power ON test results at 169.8 MHz carrier frequency



Plot 7.8.6 Transient frequency during power OFF test results at 169.8 MHz carrier frequency



Test specification:	Section 15.107, Conducted emission at AC power port		
Test procedure:	ANSI C63.4, Sections 11.5 and 12.1.3		
Test mode:	Compliance	Verdict:	PASS
Date & Time:	8/30/2004 7:43:13 PM		
Temperature: 25.2 ºC	Air Pressure: 1009 hPa	Relative Humidity: 38 %	Power Supply: 120 VAC
Remarks:			

8 Emissions tests according to 47CFR part 15 subpart B requirements

8.1 Conducted emissions

8.1.1 General

This test was performed to measure common mode conducted emissions at the mains power port.
Specification test limits are given in Table 8.1.1. The worst test results (the lowest margins) were recorded in Table 8.1.2 and shown in the associated plots.

Table 8.1.1 Limits for conducted emissions

Frequency, MHz	Class B limit, dB(µV)		Class A limit, dB(µV)	
	QP	AVRG	QP	AVRG
0.15 - 0.5	66 - 56*	56 - 46*	79	66
0.5 - 5.0	56	46	73	60
5.0 - 30	60	50	73	60

* The limit decreases linearly with the logarithm of frequency.

8.1.2 Test procedure

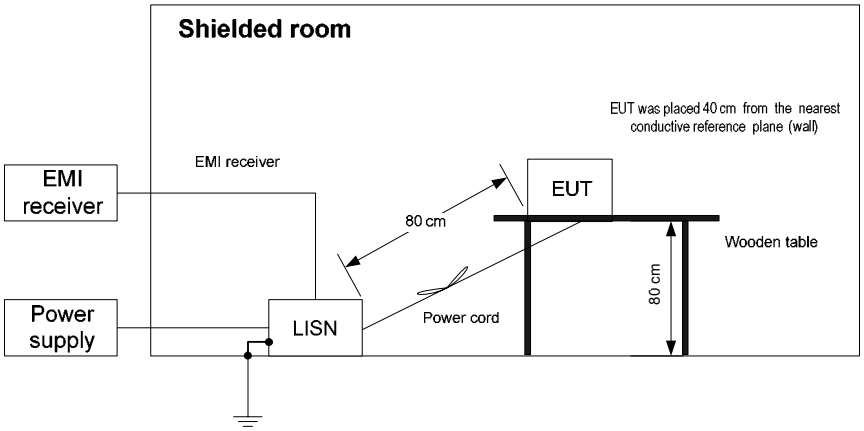
8.1.2.1 The EUT was set up as shown in Figure 8.1.1, energized and the performance check was conducted.

8.1.2.2 The measurements were performed at power terminals with the LISN, connected to a spectrum analyzer in the frequency range referred to in Table 8.1.2. Unused coaxial connector of the LISN was terminated with 50 Ohm. Quasi-peak and average detectors were used throughout the testing.

8.1.2.3 The position of the device cables was varied to determine maximum emission level.

Test specification:	Section 15.107, Conducted emission at AC power port		
Test procedure:	ANSI C63.4, Sections 11.5 and 12.1.3		
Test mode:	Compliance	Verdict:	PASS
Date & Time:	8/30/2004 7:43:13 PM		
Temperature: 25.2 ºC	Air Pressure: 1009 hPa	Relative Humidity: 38 %	Power Supply: 120 VAC
Remarks:			

Figure 8.1.1 Setup for conducted emission measurements, table-top equipment



Test specification:	**Section 15.107, Conducted emission at AC power port**		
Test procedure:	ANSI C63.4, Sections 11.5 and 12.1.3		
Test mode:	Compliance	**Verdict:**	PASS
Date & Time:	8/30/2004 7:43:13 PM		
Temperature: 25.2 ºC	**Air Pressure:** 1009 hPa	**Relative Humidity:** 38 %	**Power Supply:** 120 VAC
Remarks:			

Table 8.1.2 Conducted emission test results

LINE:	AC mains
LIMIT:	Class B
EUT OPERATING MODE:	Receive (Stand-by)
EUT SET UP:	TABLE-TOP
TEST SITE:	SHIELDED ROOM
DETECTORS USED:	PEAK / QUASI-PEAK / AVERAGE
FREQUENCY RANGE:	150 kHz - 30 MHz
RESOLUTION BANDWIDTH:	9 kHz

Frequency, MHz	Peak emission, dB(µV)	Quasi-peak			Average			Line ID	Verdict
		Measured emission, dB(µV)	Limit, dB(µV)	Margin, dB*	Measured emission, dB(µV)	Limit, dB(µV)	Margin, dB*		
Receive mode									
0.174805	51.35	47.18	64.79	-17.61	41.36	54.79	-7.61	L1	Pass
0.211520	46.19	41.77	63.21	-21.44	37.02	53.21	-11.44		
0.246515	43.22	40.86	61.89	-21.03	38.33	51.89	-11.03		
0.279080	43.88	42.71	60.91	-18.20	41.31	50.91	-8.20		
1.817325	40.51	37.52	56.00	-18.48	33.08	46.00	-8.48		
2.047098	39.21	37.10	56.00	-18.90	35.28	46.00	-8.90		
0.175415	52.07	48.22	64.76	-16.54	41.74	54.76	-6.54	L2	Pass
0.211600	46.28	41.79	63.21	-21.42	37.37	53.21	-11.42		
0.245880	43.54	41.61	61.91	-20.30	39.06	51.91	-10.30		
0.279460	43.91	43.13	60.90	-17.77	41.63	50.90	-7.77		
0.313740	43.08	42.16	59.89	-17.73	41.01	49.89	-7.73		
1.887200	40.60	37.97	56.00	-18.03	33.28	46.00	-8.03		

*****- Margin = Measured emission - specification limit.

Reference numbers of test equipment used

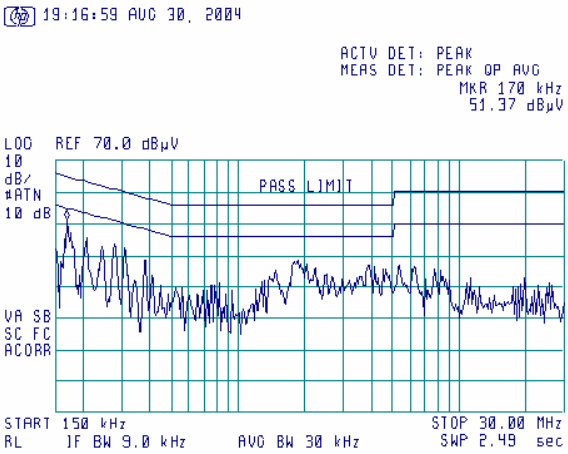
HL 0163	HL 0447	HL 0787	HL 1430	HL 1502			

Full description is given in Appendix A.

Test specification:	Section 15.107, Conducted emission at AC power port		
Test procedure:	ANSI C63.4, Sections 11.5 and 12.1.3		
Test mode:	Compliance	Verdict:	PASS
Date & Time:	8/30/2004 7:43:13 PM		
Temperature: 25.2 ºC	Air Pressure: 1009 hPa	Relative Humidity: 38 %	Power Supply: 120 VAC
Remarks:			

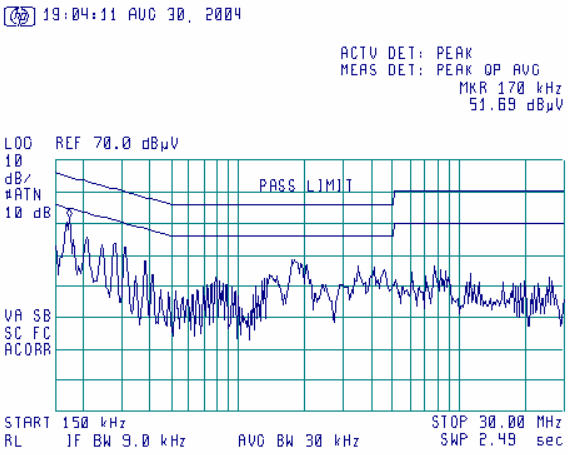
Plot 8.1.1 Conducted emission measurements

LINE:	L1
LIMIT:	Class B
EUT OPERATING MODE:	Receive / Stand by
LIMIT:	QUASI-PEAK, AVERAGE
DETECTOR:	PEAK



Plot 8.1.2 Conducted emission measurements

LINE:	L2
LIMIT:	Class B
EUT OPERATING MODE:	Receive / Stand by
LIMIT:	QUASI-PEAK, AVERAGE
DETECTOR:	PEAK



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:	8/31/2004 11:59:33 AM		
Temperature: 26 ºC	Air Pressure: 1006 hPa	Relative Humidity: 37 %	Power Supply: 12 VDC
Remarks:			

8.2 Radiated emission measurements

8.2.1 General

This test was performed to measure radiated emissions from the EUT enclosure (Repeater or Receiver). Specification test limits are given in Table 8.2.1.

Table 8.2.1 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: $Lim_{S2} = Lim_{S1} + 20 \log (S_1/S_2)$,
where S_1 and S_2 – standard defined and test distance respectively in meters.

8.2.2 Test procedure for measurements in semi-anechoic chamber

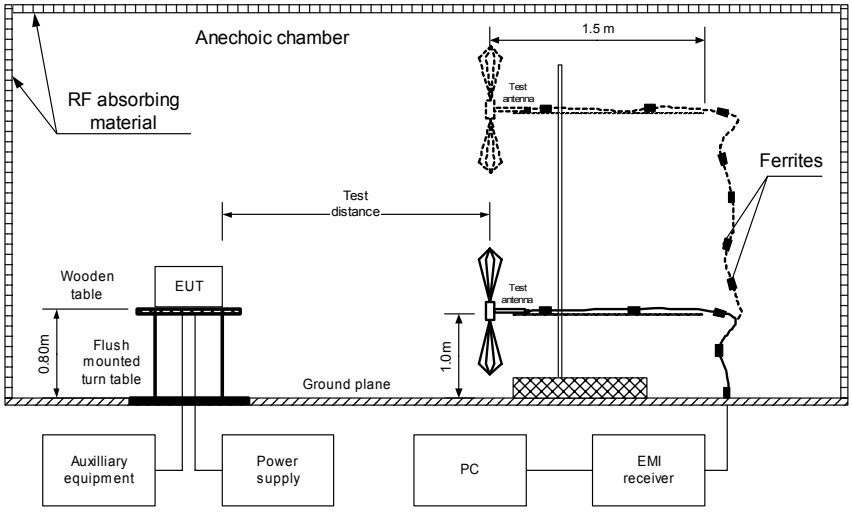
8.2.2.1 The EUT was set up as shown in Figure 8.2.1, energized and the performance check was conducted.

8.2.2.2 The specified frequency range was investigated with biconilog antenna connected to EMI receiver. To find maximum radiation the turntable was rotated 360^0, 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.

8.2.2.3 The worst test results (the lowest margins) were recorded in Table 8.2.2 and shown in the associated plots.

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:	8/31/2004 11:59:33 AM		
Temperature: 26 ºC	Air Pressure: 1006 hPa	Relative Humidity: 37 %	Power Supply: 12 VDC
Remarks:			

Figure 8.2.1 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:	8/31/2004 11:59:33 AM		
Temperature: 26 ºC	**Air Pressure:** 1006 hPa	**Relative Humidity:** 37 %	**Power Supply:** 12 VDC
Remarks:			

Table 8.2.2 Radiated emission test results for Repeater

EUT SET UP:	TABLE-TOP
LIMIT:	Class B
EUT OPERATING MODE:	Receive / Stand-by
TEST SITE:	ANECHOIC CHAMBER / SEMI 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*				
160.0	28.2	26.4	43.5	17.1	Vertical	1.15	3	Pass

*****- Margin = Measured emission - specification limit.
******- EUT front panel refer to 0 degrees position of turntable.

Reference numbers of test equipment used

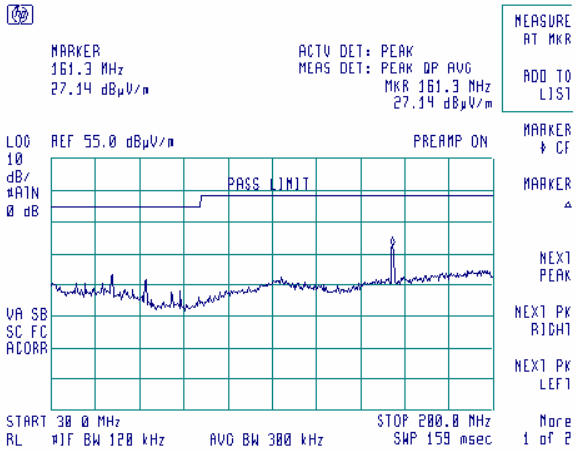
HL 0465	HL 0521	HL 0566	HL 0569	HL 0589	HL 0592	HL 0593	HL 0594
HL 0604	HL 1004	HL 1530	HL 1567	HL 1942	HL 2009		

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:	8/31/2004 11:59:33 AM		
Temperature: 26 ºC	Air Pressure: 1006 hPa	Relative Humidity: 37 %	Power Supply: 12 VDC
Remarks:			

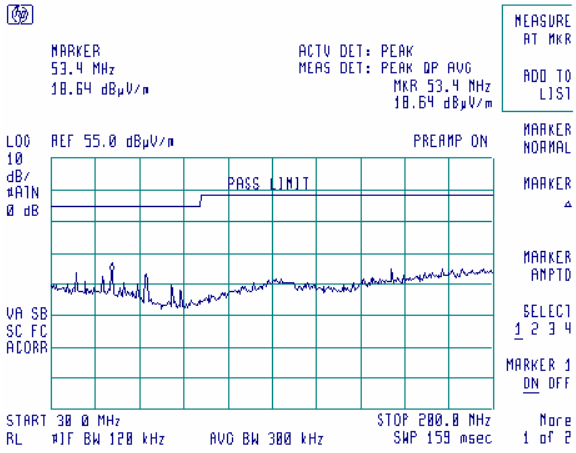
Plot 8.2.1 Radiated emission measurements of Repeater in 30- 200 MHz range, vertical antenna polarization

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



Plot 8.2.2 Radiated emission measurements of Repeater in 30- 200 MHz range, horizontal antenna polarization

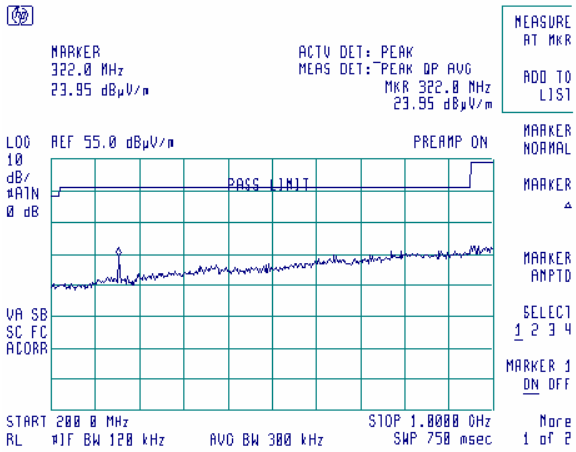
TEST SITE: Anechoic chamber
LIMIT: Class B
TEST DISTANCE: 3 m
EUT OPERATING MODE: Receive / Stand-by



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:	8/31/2004 11:59:33 AM		
Temperature: 26 ºC	Air Pressure: 1006 hPa	Relative Humidity: 37 %	Power Supply: 12 VDC
Remarks:			

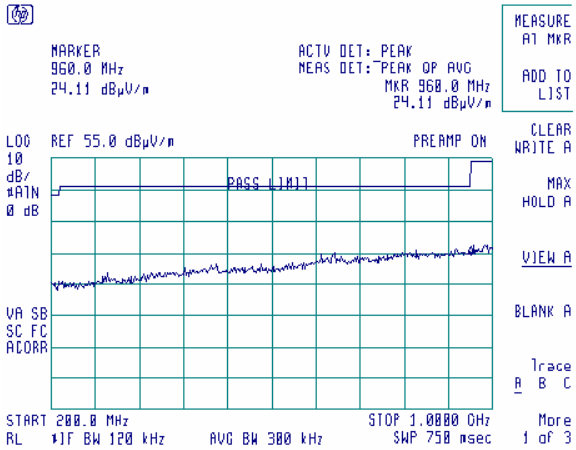
Plot 8.2.3 Radiated emission measurements of Repeater in 200- 1000 MHz range, vertical antenna polarization

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



Plot 8.2.4 Radiated emission measurements of Repeater in 200- 1000 MHz range, horizontal antenna polarization

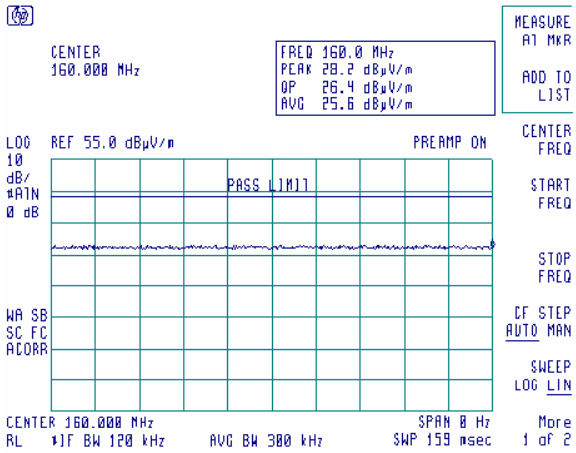
TEST SITE:	Anechoic chamber
LIMIT:	Class B
TEST DISTANCE:	3 m
EUT OPERATING MODE:	Receive / Stand-by



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:	8/31/2004 11:59:33 AM		
Temperature: 26 ºC	Air Pressure: 1006 hPa	Relative Humidity: 37 %	Power Supply: 12 VDC
Remarks:			

Plot 8.2.5 Radiated emission measurements of Repeater at 160 MHz, vertical antenna polarization

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



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:	8/31/2004 11:59:33 AM		
Temperature: 26 ºC	Air Pressure: 1006 hPa	Relative Humidity: 37 %	Power Supply: 12 VDC
Remarks:			

Table 8.2.3 Radiated emission test results for Receiver

EUT SET UP: TABLE-TOP
LIMIT: Class B
EUT OPERATING MODE: Receive/ Stand-by
TEST SITE: OATS / SEMI 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*				
55.835000	11.07	23.87	40.00	-16.13	Vertical	1.0	132	Pass
120.022500	38.16	37.56	43.50	-5.94	Horizontal	3.0	345	
160.008750	33.91	33.01	43.50	-10.49	Vertical	1.0	182	
300.705000	39.55	37.29	46.00	-8.71	Horizontal	1.0	298	
334.000000	43.35	40.18	46.00	-5.82	Horizontal	1.7	229	
467.950000	42.26	38.87	46.00	-7.13	Horizontal	1.6	290	
698.590000	45.97	43.94	46.00	-2.06	Horizontal	1.0	219	

TEST SITE: SEMI ANECHOIC CHAMBER
TEST DISTANCE: 3 m
DETECTORS USED: PEAK / AVERAGE
FREQUENCY RANGE: 1000 MHz -
RESOLUTION BANDWIDTH: 1000 kHz

Frequency, MHz	Peak emission, dB(µV/m)	Average			Antenna polarization	Antenna height, m	Turn-table position**, degrees	Verdict
		Measured emission, dB(µV/m)	Limit, dB(µV/m)	Margin, dB*				
1003.000000	52.52	37.54	54.00	-16.46	Vertical	1.5	136	Pass
1402.500000	50.45	33.95	54.00	-20.05	Horizontal	1.0	286	

*****- Margin = Measured emission - specification limit.
******- EUT front panel refer to 0 degrees position of turntable.

Reference numbers of test equipment used

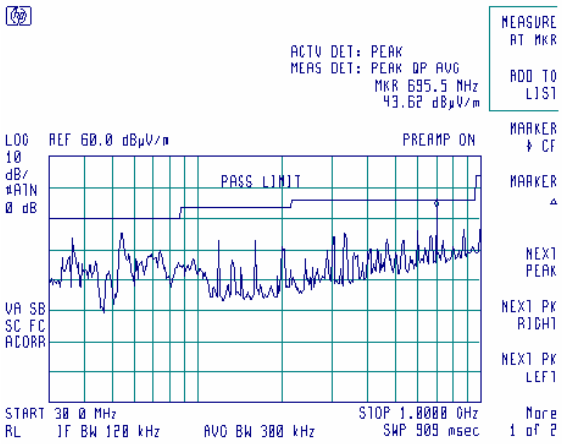
HL 0465	HL 0521	HL 0566	HL 0569	HL 0589	HL 0592	HL 0593	HL 0594
HL 0604	HL 1004	HL 1530	HL 1567	HL 1942	HL 2009		

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:	8/31/2004 11:59:33 AM		
Temperature: 26 ºC	Air Pressure: 1006 hPa	Relative Humidity: 37 %	Power Supply: 12 VDC
Remarks:			

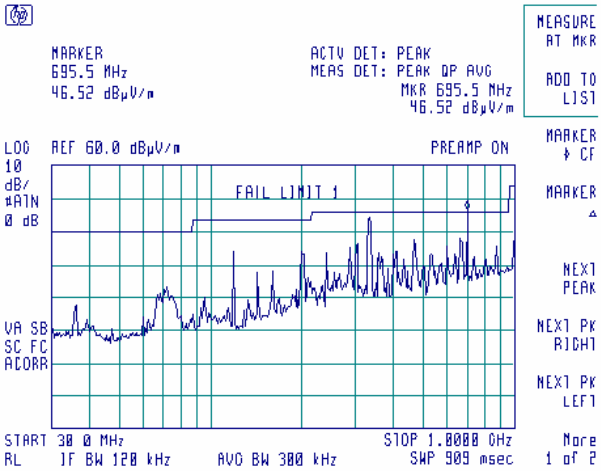
Plot 8.2.6 Radiated emission measurements of Receiver in 30- 1000 MHz range, vertical antenna polarization

TEST SITE: Semi anechoic chamber
LIMIT: Class B
TEST DISTANCE: 3 m
EUT OPERATING MODE: Receive



Plot 8.2.7 Radiated emission measurements of Receiver in 30- 1000 MHz range, horizontal antenna polarization

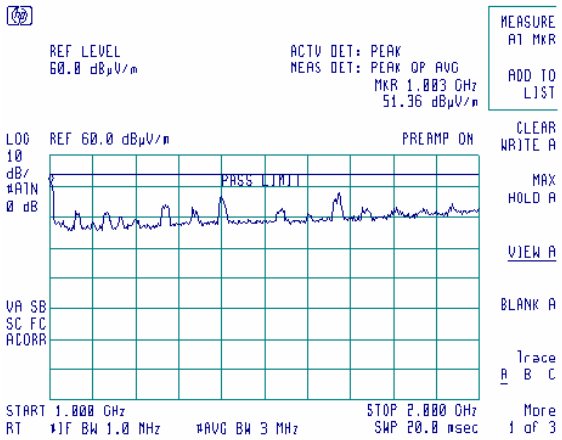
TEST SITE: Semi anechoic chamber
LIMIT: Class B
TEST DISTANCE: 3 m
EUT OPERATING MODE: Receive



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:	8/31/2004 11:59:33 AM		
Temperature: 26 ºC	Air Pressure: 1006 hPa	Relative Humidity: 37 %	Power Supply: 12 VDC
Remarks:			

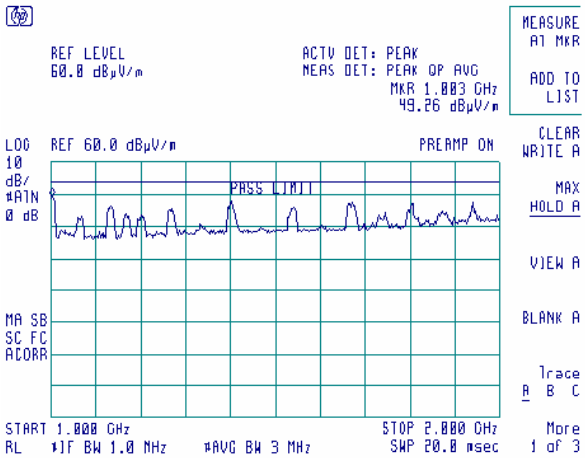
Plot 8.2.8 Radiated emission measurements of Receiver above 1000 MHz, vertical antenna polarization

TEST SITE: Semi anechoic chamber
LIMIT: Class B
TEST DISTANCE: 3 m
EUT OPERATING MODE: Receive



Plot 8.2.9 Radiated emission measurements of Receiver above 1000 MHz, horizontal antenna polarization

TEST SITE: Semi anechoic chamber
LIMIT: Class B
TEST DISTANCE: 3 m
EUT OPERATING MODE: Receive



9 APPENDIX A Test equipment and ancillaries used for tests

HL No.	Description	Manufacturer information			Due Calibr. Month/Year
		Name	Model No.	Serial No.	
0026	Spectrum analyzer, 100 Hz-2.2 GHz	Anritsu	MS 2601A	3460	9/05
0030	Antenna, dipole, tunable 30-200 MHz	Electro-Metrics	TDA 25/30	261	1/05
0163	LISN FCC/VDE/MIL -STD	Electro-Metrics	ANS-25/2	1314	10/04
0415	Cable coax RF, RG-58,	Hermon Labs	CC-3	056	12/04
0447	LISN, 16/2, 300 V RMS	Hermon Labs	LISN 16-1	447	11/04
0465	Anechoic Chamber 9 (L) x 6.5 (W) x 5.5 (H) m	Hermon Labs	AC-1	023	10/05 check
0521	Spectrum analyzer with RF filter section (EMI receiver 9 kHz - 6.5 GHz)	Hewlett Packard	8546A	0319	9/05
0557	Signal generator	Marconi Instruments	52023-002E	080	1/05
0566	Antenna, Biconical, 20-200 MHz	Electro-Metrics	BIA 25/30	3566	4/05
0569	Antenna, Log Periodic, 200-1000MHz	Electro-Metrics	LPA 25/30	1953	1/05
0589	Cable coaxial, GORE A2POL118.2, 3 m	Hermon Labs	GORE-3	589	11/04
0592	Position controller	Hermon Labs	L2-SR3000	100	5/05 check
0593	Antenna mast, 1-4 m/ 1-6 m Pneumatic	Hermon Labs	AM-F1	101	2/05 check
0594	Turntable for Anechoic Chamber, flush mounted, d=1.2 m, pneumatic	Hermon Labs	WDC1	102	1/05 check
0604	Antenna biconilog log-periodic/T Bow-Tie, 26 - 2000 MHz	EMCO	3141	9611-1011	1/05
0661	Generator Swept Signal, 10MHz to 40GHz+ 10dBm	Hewlett Packard	83640B	0266	9/05
0670	Oscilloscope, Digital storage 500 MHz, 2 Gs/s, 4 ch with Telecom Mask Tester	LeCroy Corporation	LC 334A	2387	8/05
0787	Transient limiter	Hewlett Packard	11947A-8ZE	3107A01877	11/04
0788	Power splitter/combiner	Mini-Circuits	ZFSC-2-1	923705	9/05
0793	Radio communication test set	Marconi Instruments	2955	9507/179	2/05
0810	Power supply DC, programmable, dual, 0-10 V DC, with GPIB	American Reliance, Inc.	AMREL	20140028	1/05
0812	Cable, coax, RG-214, 11.5 m, N-type connectors	Hermon Labs	C214-11	148	12/04
0892	Multimeter digital	Tabor Electronics	DM 4021	232757	7/05
1004	Cable coaxial, ANDREW PSWJ4, 6 m	Hermon Labs	ANDREW-6	163	12/04
1424	Spectrum analyzer, 30 Hz - 40 GHz	Agilent Technologies	8564EC	3946A00219	8/05
1425	EMI Receiver System, 9 kHz - 2.9 GHz	Agilent Technologies	8542E	3710A00222	9/05
1430	EMI Receiver System, 9 kHz - 2.9 GHz	Agilent Technologies	8542E	3807A00262	9/05
1500	Cable RF, 15 m	Suhner Switzerland	RG 214/U	1500	12/04
1502	Cable RF, 6 m	Belden	M17/167 MIL-C-17	1502	12/04 check
1519	Cable RF, 0.5 m	Telequis	MIL-C-17F- RG 058	1519	12/04

HL No.	Description	Manufacturer information			Due Calibr. Month/Year
		Name	Model No.	Serial No.	
1523	Cable RF, 2.3 m	Telequis	MIL-C-17F-RG 058 CU	1523	12/04
1530	Cable RF, 1.0 m	Alpha wire	RG-213/U	1530	9/05
1567	Cable RF, 2 m	Huber-Suhner	Sucoflex 104PE	13094/4PE	12/04
1652	Attenuators set (1 - 30 dB), DC – 18 GHz	M/A –COM	2082	1652	3/05
1653	Analyzer EMC, 9 KHz – 1.5 GHz	Aglient Technologies	E7401	US39440281	2/05
1907	Power splitter/combiner, 5-500 MHz	Mini-Circuits	ZFSCC-2-1	NA	7/05
1942	Cable 18 GHz, 4 m, blue	Rhophase Microwave Ltd	SPS-1803A-4000-NPS	T4658	10/04
1956	Cable 0.5 m, BNC/BNC	Telequis	RG-58	1956	12/04
2009	Cable RF, 8 m	Alpha Wire	RG-214	C-56	12/04
2012	Attenuator, Manual Step, 0-99/1 dB, 0-4 GHz, 2 W	Weinschel	AC9004-99-11	2012	12/04
2107	Cable, 18 GHz	Huber-Suhner	SF 104 PE	23000/4PE	4/05
2227	Crystal Detector 0.01-18 GHz	Hewlett Packard	8472A	NA	10/04
2265	Cable, 1 m, BNC/BNC	Hermon Labs	MIL-C-17F-RG058	2265	12/04
2432	Antenna, double-ridged waveguide horn, 1-18 GHz	EMC Test Systems	3115	000271777	7/05

10 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 %
Unintentional radiator tests	
Conducted emissions with LISN	9 kHz to 150 kHz: ± 3.9 dB 150 kHz to 30 MHz: ± 3.8 dB
Radiated emissions at 3 m measuring distance Horizontal polarization Vertical polarization	 Biconilog antenna: ± 5.3 dB Biconical antenna: ± 5.0 dB Log periodic antenna: ± 5.3 dB 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.

11 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).

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12 APPENDIX D Specification references

47CFR part 90:2003	Private land mobile radio services
47CFR part 1: 2003	Practice and procedure
47CFR part 2: 2003	Frequency allocations and radio treaty matters; general rules and regulations
47CFR part 15: 2004	Radio frequency devices
ANSI C63.2: 1996	American National Standard for Instrumentation-Electromagnetic Noise and Field Strength, 10 kHz to 40 GHz-Specifications.
ANSI C63.4: 2001	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

13 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(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
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

14 APPENDIX F Test equipment correction factors

Correction factor
Line impedance stabilization network
Model LISN 16 - 1
Hermon Laboratories

Frequency, kHz	Correction factor, dB
10	4.9
15	2.86
20	1.83
25	1.25
30	0.91
35	0.69
40	0.53
50	0.35
60	0.25
70	0.18
80	0.14
90	0.11
100	0.09
125	0.06
150	0.04

The correction factor in dB is to be added to meter readings of an interference analyzer or a spectrum analyzer.

Correction factor
Line impedance stabilization network
Model ANS-25/2
Electro-Metrics

Frequency, kHz	Correction factor, dB
10	4.9
15	2.86
20	1.83
25	1.25
30	0.91
35	0.69
40	0.53
50	0.35
60	0.25
70	0.18
80	0.14
90	0.11
100	0.09
125	0.06
150	0.04

The correction factor in dB is to be added to meter readings of an interference analyzer or a spectrum analyzer.

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

Antenna factor
Double-ridged wave guide horn antenna
EMC Test Systems, model 3115, serial no: 00027177

Frequency, MHz	Antenna gain, dBi	Antenna factor. dB(1/m)
1000.0	5.5	24.7
1500.0	8.0	25.7
2000.0	8.4	27.8
2500.0	9.3	28.9
3000.0	9.0	30.7
3500.0	9.3	31.8
4000.0	9.3	33.0
4500.0	10.4	32.8
5000.0	10.0	34.2
5500.0	10.1	34.9
6000.0	10.6	35.2
6500.0	11.0	35.4
7000.0	10.8	36.3
7500.0	10.4	37.3
8000.0	10.8	37.5
8500.0	10.8	38.0
9000.0	11.0	38.3
9500.0	11.5	38.3
10000.0	11.5	38.7
10500.0	11.9	38.7
11000.0	12.2	38.9
11500.0	11.9	39.5
12000.0	12.3	39.5
12500.0	12.7	39.4
13000.0	12.0	40.5
13500.0	12.0	40.8
14000.0	11.6	41.5
14500.0	12.2	41.3
15000.0	13.6	40.2
15500.0	15.3	38.7
16000.0	15.8	38.5
16500.0	14.8	39.8
17000.0	12.9	41.9
17500.0	9.2	45.8
18000.0	6.2	49.1

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

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(μV) to convert it into field intensity in dB(μA/m).
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, 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		
19	3600	3.62		
20	3900	3.84		
21	4200	3.92		±0.17
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
Cable coaxial, 6 m, model: M17/167 MIL-C-17, HL 1502

Frequency, MHz	Cable loss, dB
0.1	0.02
1	0.07
3	0.15
5	0.17
10	0.26
30	0.43
50	0.57
80	0.72
100	0.81
300	1.48
500	2.00
800	2.70
1000	3.09

Cable loss
Cable RF, 2 m, model: Sucoflex 104PE, s/n 13095/4PE, HL 1567

No.	Frequency, MHz	Cable loss, dB
1	30	0.09
2	50	0.15
3	100	0.23
4	300	0.31
5	500	0.46
6	800	0.63
7	1000	0.67
8	1500	0.89
9	2000	1.05
10	2500	1.18
11	300	1.26
12	5300	1.51
13	4000	1.66
14	4500	1.61
15	5000	1.67
16	5500	1.91
17	6000	1.98
18	6500	1.91
19	7000	2.04
20	7500	2.36
21	8000	2.36
22	8500	2.61
23	9000	2.69
24	9500	2.62
25	10000	2.73
26	10500	2.83
27	11000	2.84
28	11500	3.22
29	12000	3.17
30	12500	3.17
31	13000	3.18
32	13500	3.49
33	14000	3.43
34	14500	3.57
35	15000	3.76
36	15500	4.20
37	16000	4.10
38	16500	4.49
39	17000	4.53
40	17500	4.46
41	18000	4.47

Cable loss
Cable 18 GHz, 4 m, blue, model: SPS-1803A-4000-NPS, S/N T4658, HL 1942

Frequency, GHz	Cable loss, dB
0.03	0.21
0.05	0.26
0.10	0.36
0.20	0.50
0.30	0.61
0.40	0.70
0.50	0.78
0.60	0.85
0.70	0.93
0.80	0.99
0.90	1.04
1.00	1.10
1.10	1.16
1.20	1.22
1.30	1.26
1.40	1.31
1.50	1.35
1.60	1.41
1.70	1.45
1.80	1.49
1.90	1.53
2.00	1.57
2.10	1.61
2.20	1.65
2.30	1.69
2.40	1.72
2.50	1.76
2.60	1.79
2.70	1.83
2.80	1.87
2.90	1.90
3.10	1.97
3.30	2.04
3.50	2.11
3.70	2.18
3.90	2.24
4.10	2.31
4.30	2.38
4.50	2.43
4.70	2.53
4.90	2.53
5.10	2.63
5.30	2.65
5.50	2.72
5.70	2.76
5.90	2.79

Frequency, GHz	Cable loss, dB
6.10	2.88
6.30	2.90
6.50	2.97
6.70	3.02
6.90	3.04
7.10	3.07
7.30	3.12
7.50	3.13
7.70	3.19
7.90	3.24
8.10	3.30
8.30	3.36
8.50	3.45
8.70	3.41
8.90	3.45
9.10	3.42
9.30	3.55
9.50	3.48
9.70	3.58
9.90	3.61
10.10	3.66
10.30	3.68
10.50	3.70
10.70	3.70
10.90	3.75
11.10	3.78
11.30	3.86
11.50	3.98
11.70	4.10
11.90	4.12
12.10	4.09
12.40	4.13
13.00	4.23
13.50	4.35
14.00	4.40
14.50	4.44
15.00	4.57
15.50	4.66
16.00	4.64
16.50	4.66
17.00	4.75
17.50	4.85
18.00	4.93

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		