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## TEST REPORT

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

FOR:

**Miltel Communications Ltd**  
**Irriwise Transmitter**

This report is in conformity with ISO/ IEC 17025. The A2LA logo endorsement applies only to the test methods and the standards that are listed in the scope of Hermon Laboratories accreditation. The test results relate only to the items tested. This test report shall not be reproduced in any form except in full with the written approval of Hermon Laboratories Ltd.

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## 1 Applicant information

**Client name:** Miltel Communications Ltd.  
**Address:** 7 Leshem street, P.O.Box 7374, Petach Tikva, 49170, Israel  
**Telephone:** +972 3926 9550  
**Fax:** +972 3924 6550  
**E-mail:** erez1@miltelcom.com  
**Contact name:** Mr. Erez Sharabi

## 2 Equipment under test attributes

**Product name:** Transmitter  
**Brand name:** Irriwise  
**Model(s):**  
1) IRRIWISE-TRANS. & ANT WEATHER STATION 151, S/N 10681, P/N 74300-002110  
2) IRRIWISE-TRANS. & ANT FOR GROPOINT 151, S/N 10698, P/N 74300-001425  
3) IRRIWISE-TRANS. & ANT FOR TENSIO 151, S/N 10688, P/N 74300-001525  
4) IRRIWISE-TRANS. & ANT ONE WTR METER 151, S/N 10692, P/N 74300-001625  
**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  
**Fax:** +972 3924 6550  
**E-Mail:** erez1@miltelcom.com  
**Contact name:** Mr. Erez Sharabi

## 4 Test details

**Project ID:** 15978  
**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 §15.109  
**Test suite:** FCC\_90\_150-170MHz\_BS\_with\_RF\_connector (7/11/2004 10:28:06 AM, modified)

## 5 Tests summary

Test	Status
<b>Transmitter characteristics</b>	
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 2.1091, RF radiation exposure evaluation	Not required
<b>Unintentional emissions</b>	
Section 15.107, Conducted emission at AC power port	Not required
Section 15.109, Radiated emission	Pass
Section 15.111, Conducted emission at receiver antenna port	Not required

Testing was completed against all relevant requirements of the test standard. 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	October 19, 2004	
	Mr. M. Nikishin, EMC group leader	October 19, 2004	
Approved by:	Mr. A. Usoskin, C.E.O.	October 20, 2004	

## 6 EUT description

### 6.1 General information

### 6.2 General information

The EUT, transmitter, 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 IrriWise™ transmitter is a data collection device that connects to various analog and/or digital sensors. All of the IrriWise™ transmitter models transmit the information using the same protocol and at the same radio frequency.

The transmitter carrier EIRP was measured for 4 EUT models, the rest of the tests were performed for the model with S/N 10688 as it yields the highest output power.

### 6.3 Transmitter characteristics

Type of equipment				
X	Stand-alone (Equipment with or without its own control provisions)			
	Combined equipment (Equipment where the radio part is fully integrated within another type of equipment)			
	Plug-in card (Equipment intended for a variety of host systems)			
Intended use				
	fixed	Always at a distance more than 2 m from all people		
X	mobile	Always at a distance more than 20 cm from all people		
	portable	May operate at a distance closer than 20 cm to human body		
Assigned frequency range				
		150 – 170 MHz		
Operating frequencies				
		150 – 170 MHz		
Channel spacing				
		25 kHz		
Is transmitter output power variable?		X	No	
			continuous variable	
			stepped variable with stepsize	dB
			minimum RF power	dBm
			maximum RF power	dBm
Antenna connection				
unique coupling	X	standard connector	integral	with temporary RF connector
				without temporary RF connector
Antenna/technical characteristics				
Type	Manufacturer	Model number	Gain	
Monopole	Miltel Communications	MA-153-2D		-1 dBi
Transmitter aggregate data rate/s				
		600 bps		
Transmitter aggregate symbol (baud) rate/s				
		600 bps		
Type of modulation				
		FSK		
Type of multiplexing				
		NA		
Modulating test signal (baseband)				
		Data		
Maximum transmitter duty cycle in normal use	0.0005 %	Tx ON time	2000 msec	Period
Transmitter duty cycle supplied for test	100%	Tx ON time	NA	Period
Transmitter power source				
X	Battery	Nominal rated voltage	3.6 VDC	Battery type
	DC	Nominal rated voltage		Lithium
	AC mains	Nominal rated voltage		Frequency
Emission designator 12K5F1D				

<b>Test specification:</b>	<b>Section 90.205, Maximum output power</b>		
<b>Test procedure:</b>	47 CFR, Section 2.1046; TIA/EIA-603-A, Section 2.2.1		
<b>Test mode:</b>	Compliance	<b>Verdict:</b>	PASS
<b>Date &amp; Time:</b>	7/12/2004 9:12:08 PM	<b>Relative Humidity:</b>	42 %
<b>Temperature:</b> 25 °C	<b>Air Pressure:</b> 1001 hPa	<b>Power Supply:</b>	3.6VDC
<b>Remarks:</b>			

## 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
150.0 – 170.0	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**



<b>Test specification:</b>	<b>Section 90.205, Maximum output power</b>		
<b>Test procedure:</b>	47 CFR, Section 2.1046; TIA/EIA-603-A, Section 2.2.1		
<b>Test mode:</b>	Compliance	<b>Verdict:</b>	
<b>Date &amp; Time:</b>	7/12/2004 9:12:08 PM		PASS
<b>Temperature:</b> 25 °C	<b>Air Pressure:</b> 1001 hPa	<b>Relative Humidity:</b> 42 %	<b>Power Supply:</b> 3.6VDC
<b>Remarks:</b>			

**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  
 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
EUT S/N 10692							
150.2	-14.31	30.0	0.1	15.79	20.8	-5.0	Pass
160.0	-14.28	30.0	0.1	15.82	20.8	-5.0	Pass
169.8	-14.06	30.0	0.1	16.04	20.8	-4.8	Pass
EUT S/N 10681							
150.2	-14.91	30.0	0.1	15.19	20.8	-5.6	Pass
160.0	-14.93	30.0	0.1	15.17	20.8	-5.6	Pass
169.8	-14.58	30.0	0.1	15.52	20.8	-5.3	Pass
EUT S/N 10698							
150.2	-15.01	30.0	0.1	15.09	20.8	-5.7	Pass
160.0	-14.53	30.0	0.1	15.57	20.8	-5.2	Pass
169.8	-14.16	30.0	0.1	15.94	20.8	-4.9	Pass
EUT S/N 10688							
150.2	-14.06	30.0	0.1	16.04	20.8	-4.8	Pass
160.0	-14.06	30.0	0.1	16.04	20.8	-4.8	Pass
169.8	-13.85	30.0	0.1	16.25	20.8	-4.5	Pass

\*- Margin = RF output power– specification limit.

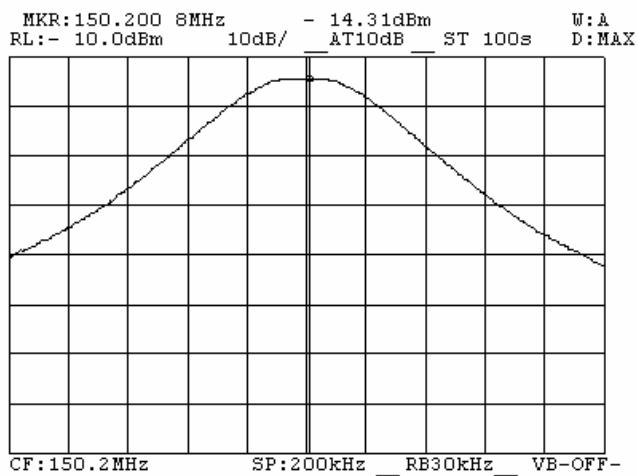
**Reference numbers of test equipment used**

HL1652	HL0026	HL2107	HL0810			
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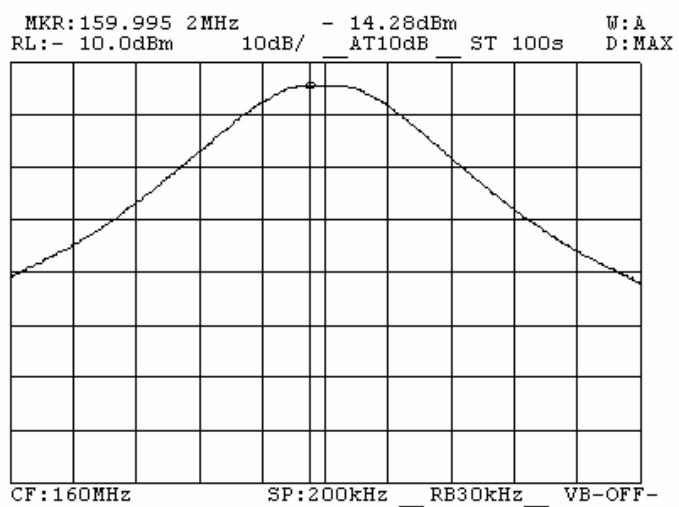
Full description is given in Appendix A.

<b>Test specification:</b>	<b>Section 90.205, Maximum output power</b>		
<b>Test procedure:</b>	47 CFR, Section 2.1046; TIA/EIA-603-A, Section 2.2.1		
<b>Test mode:</b>	Compliance	<b>Verdict:</b>	PASS
<b>Date &amp; Time:</b>	7/12/2004 9:12:08 PM	<b>Relative Humidity:</b>	42 %
<b>Temperature:</b> 25 °C	<b>Air Pressure:</b> 1001 hPa	<b>Power Supply:</b> 3.6VDC	
<b>Remarks:</b>			

Plot 7.1.1 Peak output power test results at 150.2 MHz, EUT No. 10692

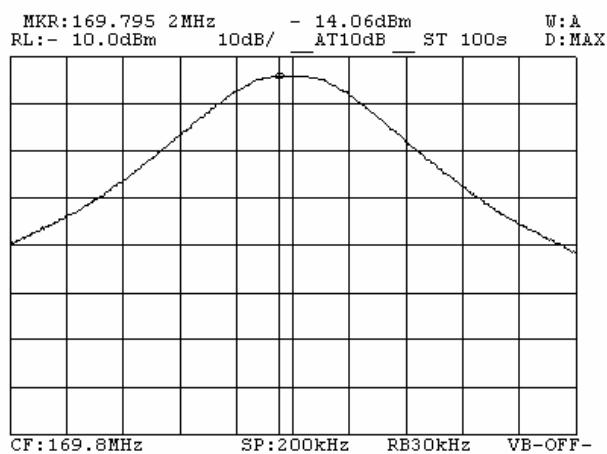


Plot 7.1.2 Peak output power test results at 160.0 MHz, EUT No. 10692

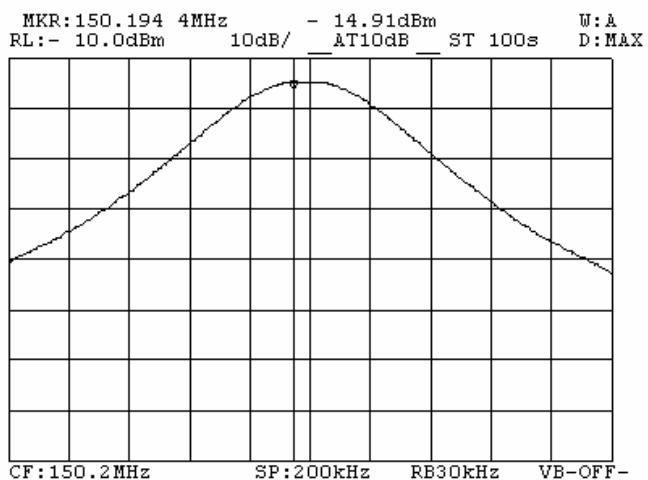


<b>Test specification:</b>	<b>Section 90.205, Maximum output power</b>		
<b>Test procedure:</b>	47 CFR, Section 2.1046; TIA/EIA-603-A, Section 2.2.1		
<b>Test mode:</b>	Compliance	<b>Verdict:</b>	PASS
<b>Date &amp; Time:</b>	7/12/2004 9:12:08 PM	<b>Relative Humidity:</b>	42 %
<b>Temperature:</b> 25 °C	<b>Air Pressure:</b> 1001 hPa	<b>Power Supply:</b> 3.6VDC	
<b>Remarks:</b>			

**Plot 7.1.3 Peak output power test results at 169.8 MHz, EUT No. 10692**

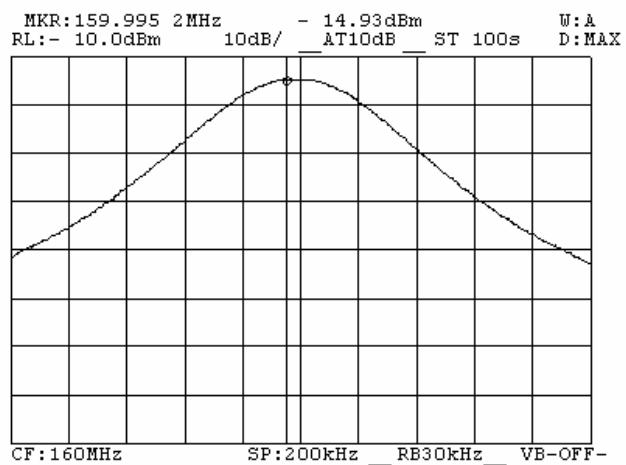


**Plot 7.1.4 Peak output power test results at 150.2 MHz, EUT No. 10681**

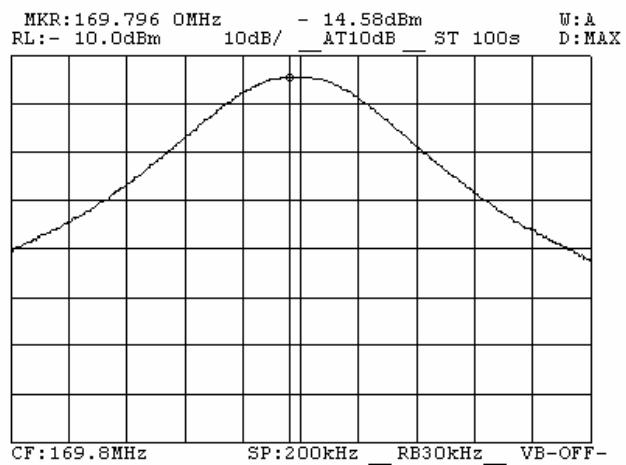


<b>Test specification:</b>	<b>Section 90.205, Maximum output power</b>		
<b>Test procedure:</b>	47 CFR, Section 2.1046; TIA/EIA-603-A, Section 2.2.1		
<b>Test mode:</b>	Compliance	<b>Verdict:</b>	PASS
<b>Date &amp; Time:</b>	7/12/2004 9:12:08 PM	<b>Relative Humidity:</b>	42 %
<b>Temperature:</b> 25 °C	<b>Air Pressure:</b> 1001 hPa	<b>Power Supply:</b> 3.6VDC	
<b>Remarks:</b>			

Plot 7.1.5 Peak output power test results at 160.0 MHz, EUT No. 10681

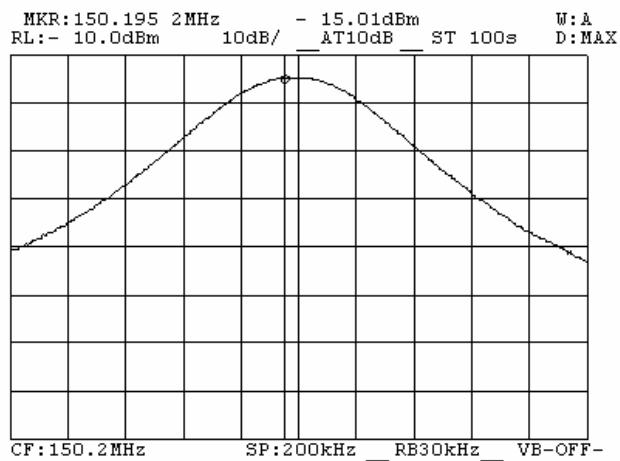


Plot 7.1.6 Peak output power test results at 169.8 MHz, EUT No. 10681

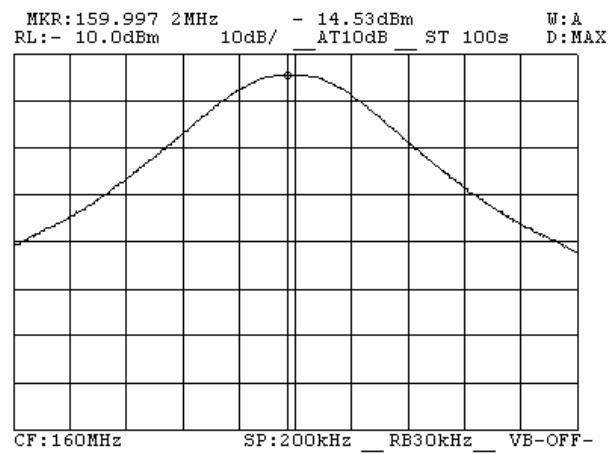


<b>Test specification:</b>	<b>Section 90.205, Maximum output power</b>		
<b>Test procedure:</b>	47 CFR, Section 2.1046; TIA/EIA-603-A, Section 2.2.1		
<b>Test mode:</b>	Compliance	<b>Verdict:</b>	PASS
<b>Date &amp; Time:</b>	7/12/2004 9:12:08 PM	<b>Relative Humidity:</b>	42 %
<b>Temperature:</b> 25 °C	<b>Air Pressure:</b> 1001 hPa	<b>Power Supply:</b> 3.6VDC	
<b>Remarks:</b>			

Plot 7.1.7 Peak output power test results at 150.2 MHz, EUT No. 10698

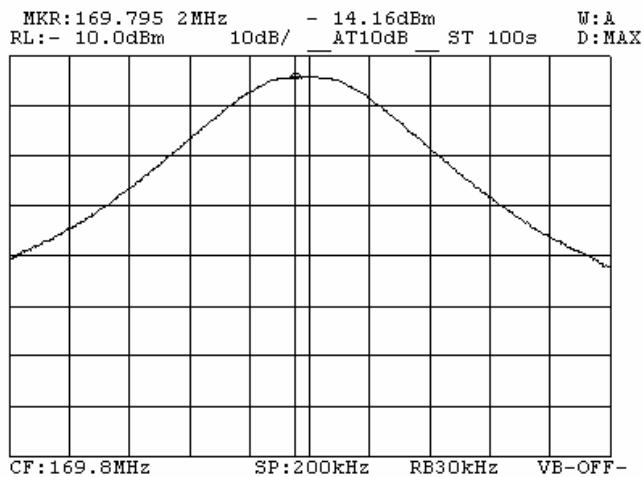


Plot 7.1.8 Peak output power test results at 160.0 MHz, EUT No. 10698

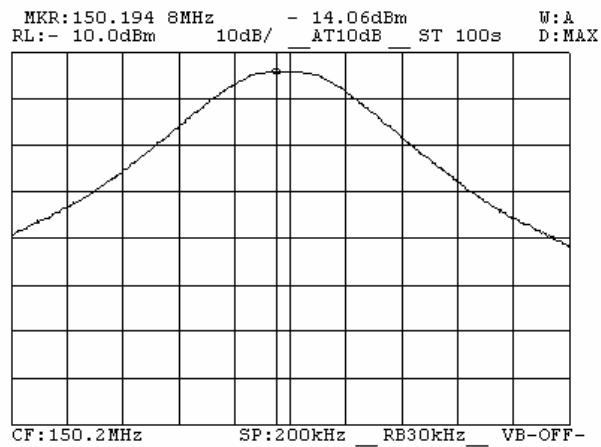


<b>Test specification:</b>	<b>Section 90.205, Maximum output power</b>		
<b>Test procedure:</b>	47 CFR, Section 2.1046; TIA/EIA-603-A, Section 2.2.1		
<b>Test mode:</b>	Compliance	<b>Verdict:</b>	PASS
<b>Date &amp; Time:</b>	7/12/2004 9:12:08 PM	<b>Relative Humidity:</b>	42 %
<b>Temperature:</b> 25 °C	<b>Air Pressure:</b> 1001 hPa	<b>Power Supply:</b> 3.6VDC	
<b>Remarks:</b>			

**Plot 7.1.9 Peak output power test results at 169.8 MHz, EUT No. 10698**

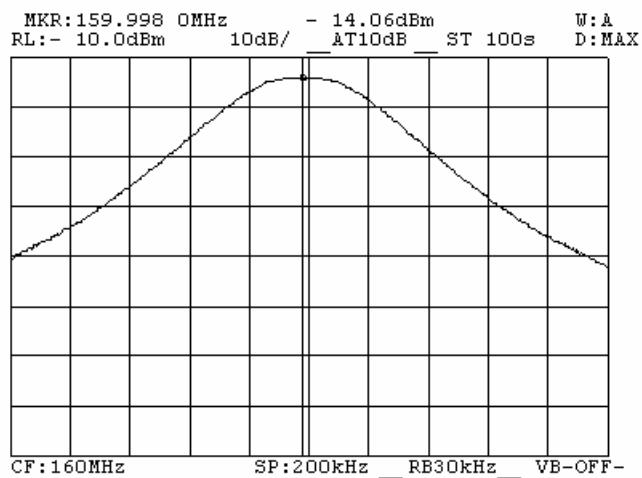


**Plot 7.1.10 Peak output power test results at 150.2 MHz, EUT No. 10688**

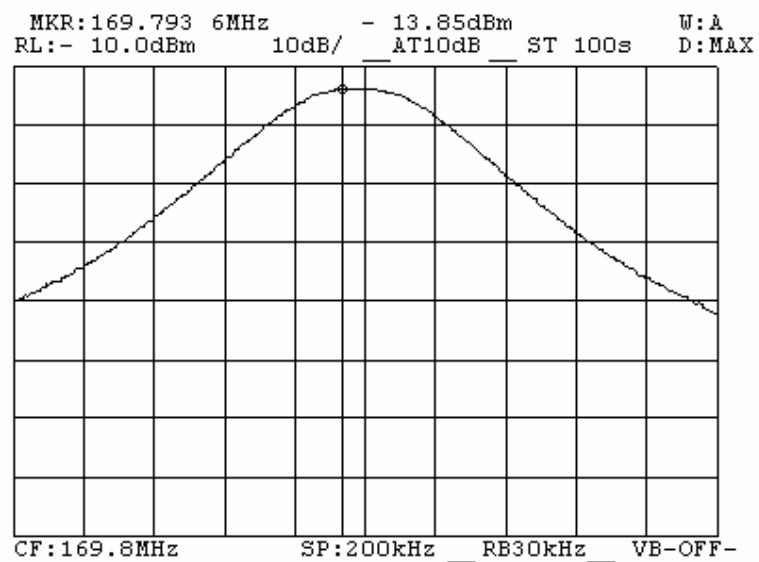


<b>Test specification:</b>	<b>Section 90.205, Maximum output power</b>		
<b>Test procedure:</b>	47 CFR, Section 2.1046; TIA/EIA-603-A, Section 2.2.1		
<b>Test mode:</b>	Compliance	<b>Verdict:</b>	PASS
<b>Date &amp; Time:</b>	7/12/2004 9:12:08 PM	<b>Relative Humidity:</b>	42 %
<b>Temperature:</b> 25 °C	<b>Air Pressure:</b> 1001 hPa	<b>Power Supply:</b> 3.6VDC	
<b>Remarks:</b>			

**Plot 7.1.11 Peak output power test results at 160.0 MHz, EUT No. 10688**



**Plot 7.1.12 Peak output power test results at 169.8 MHz, EUT No. 10688**



<b>Test specification:</b>	<b>Section 90.209, Occupied bandwidth</b>		
<b>Test procedure:</b>	47 CFR, Section 2.1049		
<b>Test mode:</b>	Compliance	<b>Verdict:</b>	
<b>Date &amp; Time:</b>	7/12/2004 9:13:39 PM	<b>PASS</b>	
<b>Temperature:</b> 25 °C	<b>Air Pressure:</b> 1001 hPa	<b>Relative Humidity:</b> 42 %	<b>Power Supply:</b> 3.6VDC
<b>Remarks:</b>			

## 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
150.2-170.0	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



<b>Test specification:</b>	<b>Section 90.209, Occupied bandwidth</b>		
<b>Test procedure:</b>	47 CFR, Section 2.1049		
<b>Test mode:</b>	Compliance	<b>Verdict:</b>	
<b>Date &amp; Time:</b>	7/12/2004 9:13:39 PM	<b>PASS</b>	
<b>Temperature:</b> 25 °C	<b>Air Pressure:</b> 1001 hPa	<b>Relative Humidity:</b> 42 %	<b>Power Supply:</b> 3.6VDC
<b>Remarks:</b>			

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  
 EUT: S/N 10688

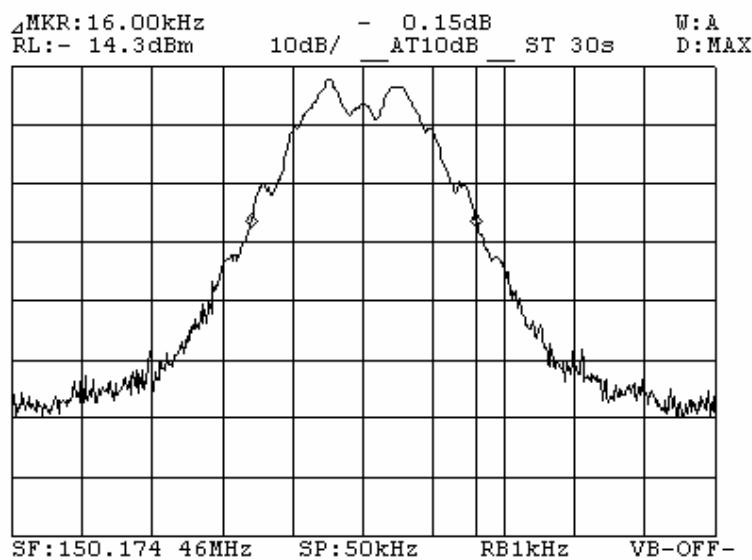
Carrier frequency, MHz	Occupied bandwidth, kHz	Limit, kHz	Margin, kHz	Verdict
150.2	16.0	20	4.0	pass
160.0	15.8	20	4.2	pass
169.8	15.7	20	4.3	pass

## Reference numbers of test equipment used

HL 0026	HL 0810	HL 1652	HL 2107			
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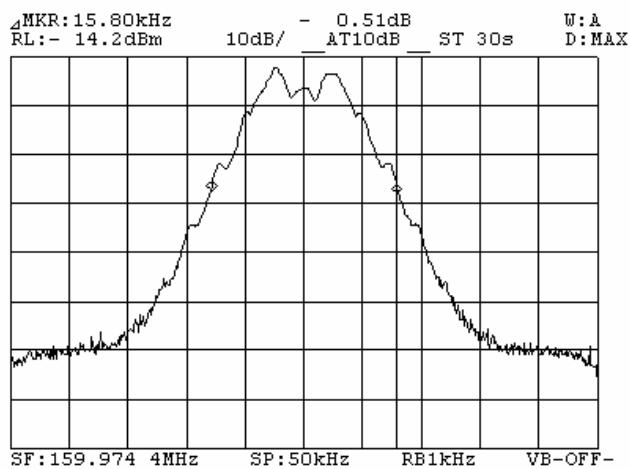
Full description is given in Appendix A.

Plot 7.2.1 Occupied bandwidth test result at 150.2 MHz

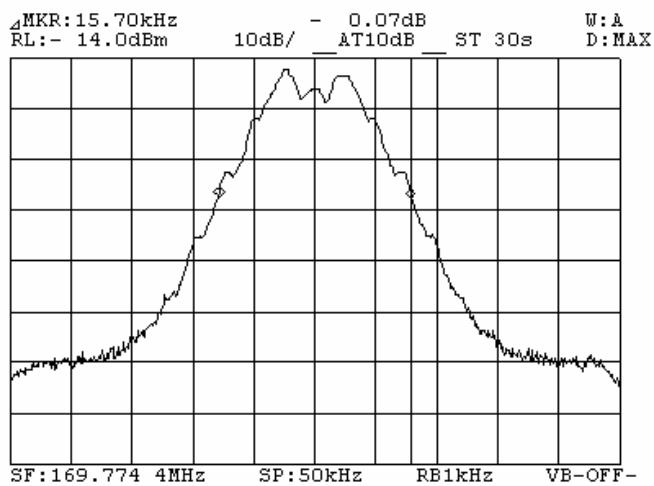


<b>Test specification:</b>	<b>Section 90.209, Occupied bandwidth</b>		
<b>Test procedure:</b>	47 CFR, Section 2.1049		
<b>Test mode:</b>	Compliance	<b>Verdict:</b>	PASS
<b>Date &amp; Time:</b>	7/12/2004 9:13:39 PM	<b>Relative Humidity:</b>	42 %
<b>Temperature:</b> 25 °C	<b>Air Pressure:</b> 1001 hPa	<b>Power Supply:</b> 3.6VDC	
<b>Remarks:</b>			

**Plot 7.2.2 Occupied bandwidth test result at 160.0 MHz**



**Plot 7.2.3 Occupied bandwidth test result at 169.8 MHz**



<b>Test specification:</b>	<b>Section 90.210, Emission mask</b>		
<b>Test procedure:</b>	47 CFR, Sections 2.1051, 2.1047 and 90.217(a); TIA/EIA-603-A, Section 2.2.13		
<b>Test mode:</b>	Compliance	<b>Verdict:</b>	
<b>Date &amp; Time:</b>	7/20/2004 12:18:35 PM	<b>PASS</b>	
<b>Temperature:</b> 25 °C	<b>Air Pressure:</b> 1001 hPa	<b>Relative Humidity:</b> 44 %	<b>Power Supply:</b> 3.6 VDC
<b>Remarks:</b>			

### 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 90.217	
0 – 40 kHz	0
More than 40 kHz	30

\* - linearly increase with frequency

\*\* - emission mask includes carrier modulation envelope within  $\pm 250$  % of the authorized bandwidth; the frequency range removed beyond  $\pm 250$  % 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.

Table 7.3.2 Emission mask test results

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

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

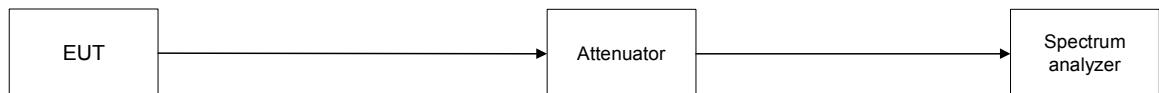
#### Reference numbers of test equipment used

HL 1652	HL 1653	HL 2107					
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Full description is given in Appendix A.

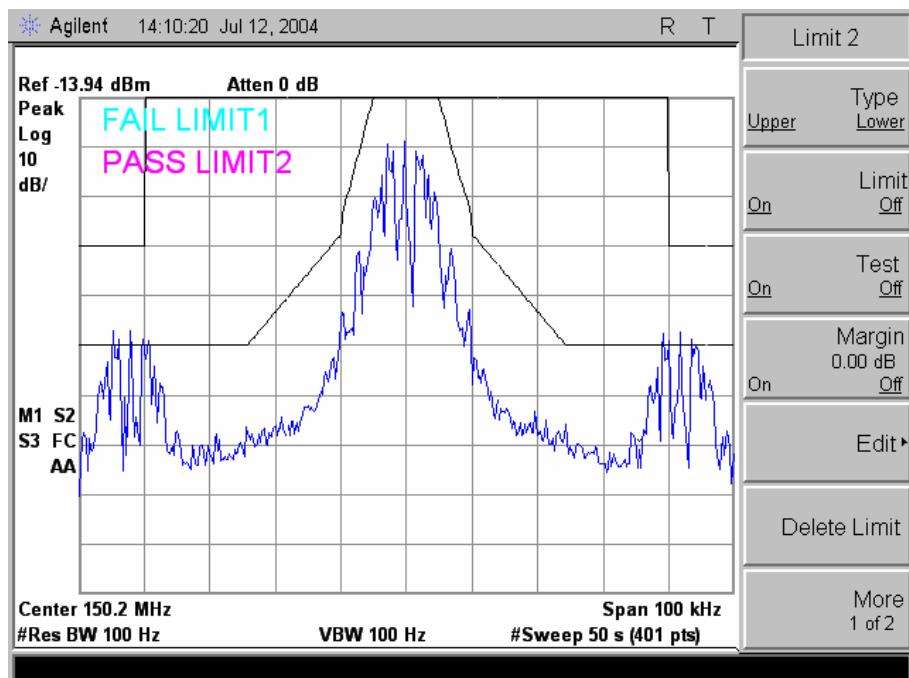
<b>Test specification:</b>	<b>Section 90.210, Emission mask</b>		
<b>Test procedure:</b>	47 CFR, Sections 2.1051, 2.1047 and 90.217(a); TIA/EIA-603-A, Section 2.2.13		
<b>Test mode:</b>	Compliance	<b>Verdict:</b>	
<b>Date &amp; Time:</b>	7/20/2004 12:18:35 PM	<b>PASS</b>	
<b>Temperature:</b> 25 °C	<b>Air Pressure:</b> 1001 hPa	<b>Relative Humidity:</b> 44 %	<b>Power Supply:</b> 3.6 VDC
<b>Remarks:</b>			

Figure 7.3.1 Emission mask test setup



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  
 BIT RATE: 600 bps  
 TRANSMITTER OUTPUT POWER SETTINGS: Maximum



<b>Test specification:</b>	<b>Section 90.210, Emission mask</b>		
<b>Test procedure:</b>	47 CFR, Sections 2.1051, 2.1047 and 90.217(a); TIA/EIA-603-A, Section 2.2.13		
<b>Test mode:</b>	Compliance	<b>Verdict:</b> <b>PASS</b>	
<b>Date &amp; Time:</b>	7/20/2004 12:18:35 PM		
<b>Temperature:</b> 25 °C	<b>Air Pressure:</b> 1001 hPa	<b>Relative Humidity:</b> 44 %	<b>Power Supply:</b> 3.6 VDC
<b>Remarks:</b>			

## Plot 7.3.2 Emission mask test results at 160 MHz

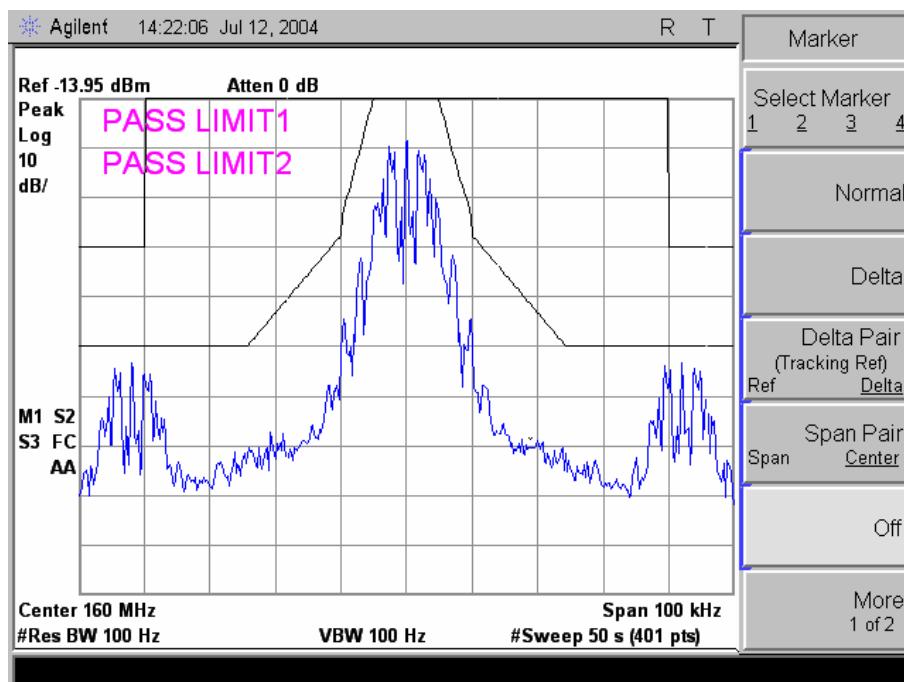
OPERATING FREQUENCY RANGE: 150.2 – 169.8 MHz

DETECTOR USED: Peak

MODULATION: FSK

BIT RATE: 600 bps

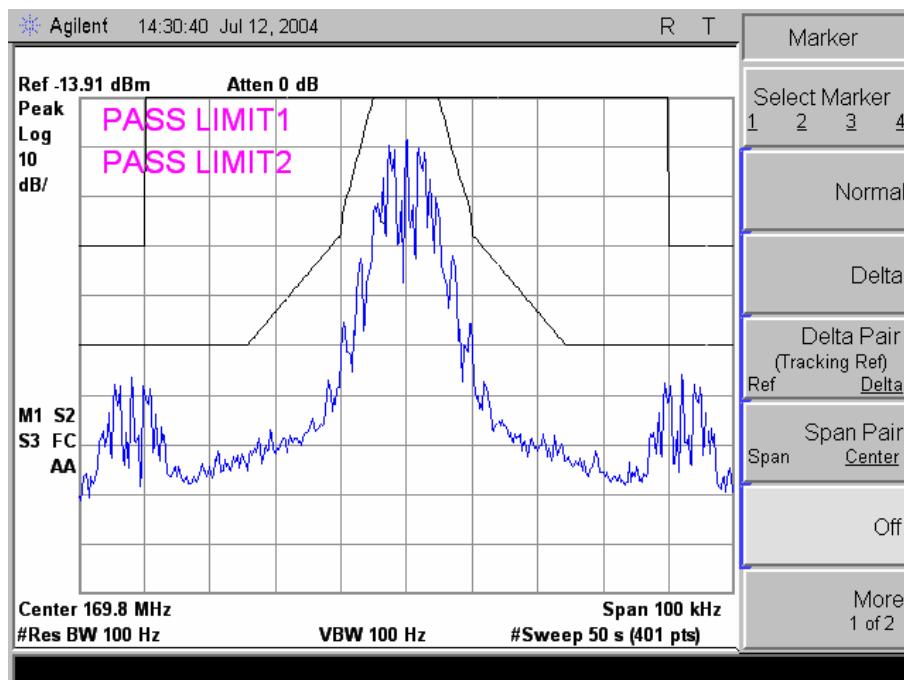
TRANSMITTER OUTPUT POWER SETTINGS: Maximum



<b>Test specification:</b>	<b>Section 90.210, Emission mask</b>		
<b>Test procedure:</b>	47 CFR, Sections 2.1051, 2.1047 and 90.217(a); TIA/EIA-603-A, Section 2.2.13		
<b>Test mode:</b>	Compliance	<b>Verdict:</b> PASS	
<b>Date &amp; Time:</b>	7/20/2004 12:18:35 PM		
<b>Temperature:</b> 25 °C	<b>Air Pressure:</b> 1001 hPa	<b>Relative Humidity:</b> 44 %	<b>Power Supply:</b> 3.6 VDC
<b>Remarks:</b>			

**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  
 BIT RATE: 600 bps  
 TRANSMITTER OUTPUT POWER SETTINGS: Maximum



<b>Test specification:</b>	<b>Section 90.217, Band edge emission</b>		
<b>Test procedure:</b>	47 CFR, Sections 2.1051, 2.1047 and 90.217; TIA/EIA-603-A, Section 2.2.13		
<b>Test mode:</b>	Compliance	<b>Verdict:</b>	
<b>Date &amp; Time:</b>	7/25/2004 8:18:07 PM	<b>PASS</b>	
<b>Temperature:</b> 25 °C	<b>Air Pressure:</b> 1006 hPa	<b>Relative Humidity:</b> 40 %	<b>Power Supply:</b> 3.6 VDC
<b>Remarks:</b>			

## 7.4 Band edge emission

### 7.4.1 General

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

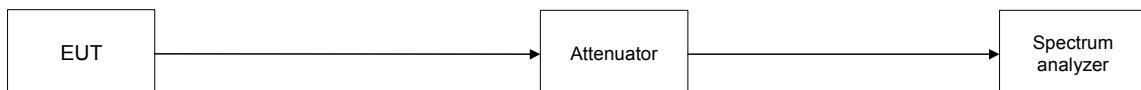
Table 7.4.1 Band edge emission limits

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

### 7.4.2 Test procedure

- 7.4.2.1 The EUT was set up as shown in Figure 7.4.1, energized and the performance check was conducted.
- 7.4.2.2 The spectrum analyzer sweep time and bandwidth were set to capture all major modulation sidebands of emission and sweep time was set sufficiently slow to ensure peak measurements. Spectrum analyzer was set in peak hold mode and time sufficient for trace stabilization was allowed.
- 7.4.2.3 The frequency of modulation envelope points beyond which power level drops below the band edge emission limit was measured.
- 7.4.2.4 The total bandwidth was calculated by adding of the negative frequency drift to the lower measured frequency and the positive frequency drift to the higher measured frequency. The obtained bandwidth was verified to be within the allowed frequency range.
- 7.4.2.5 The test results were recorded in Table 7.4.2 and shown in the associated plots.

Figure 7.4.1 Band edge emission measurement set up



Photograph 7.4.1 Band edge emission measurement set up



<b>Test specification:</b>	<b>Section 90.217, Band edge emission</b>		
<b>Test procedure:</b>	47 CFR, Sections 2.1051, 2.1047 and 90.217; TIA/EIA-603-A, Section 2.2.13		
<b>Test mode:</b>	Compliance	<b>Verdict:</b>	
<b>Date &amp; Time:</b>	7/25/2004 8:18:07 PM		<b>PASS</b>
<b>Temperature:</b> 25 °C	<b>Air Pressure:</b> 1006 hPa	<b>Relative Humidity:</b> 40 %	<b>Power Supply:</b> 3.6 VDC
<b>Remarks:</b>			

**Table 7.4.2 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  
 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				
<b>Low carrier frequency</b>							
Low	150.192000	-0.881	NA	150.191109	150.160000	-31.11	Pass
High	150.208130	NA	0.512	150.208640	150.240000	31.36	Pass
<b>Mid carrier frequency</b>							
Low	159.991970	-1.253	NA	159.990717	159.960000	-30.72	Pass
High	160.007900	NA	0.455	160.008360	160.040000	31.64	Pass
<b>High carrier frequency</b>							
Low	169.791970	-1.038	NA	169.790932	169.760000	-30.93	Pass
High	169.807900	NA	0.514	169.808410	169.840000	31.59	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

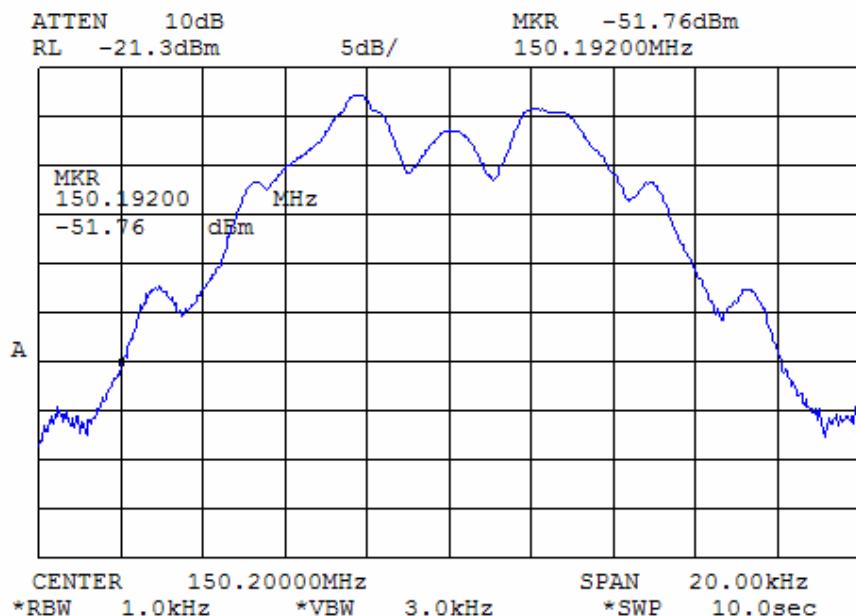
**Reference numbers of test equipment used**

HL 1134	HL 1424	HL 1519	HL 1652			
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Full description is given in Appendix A.

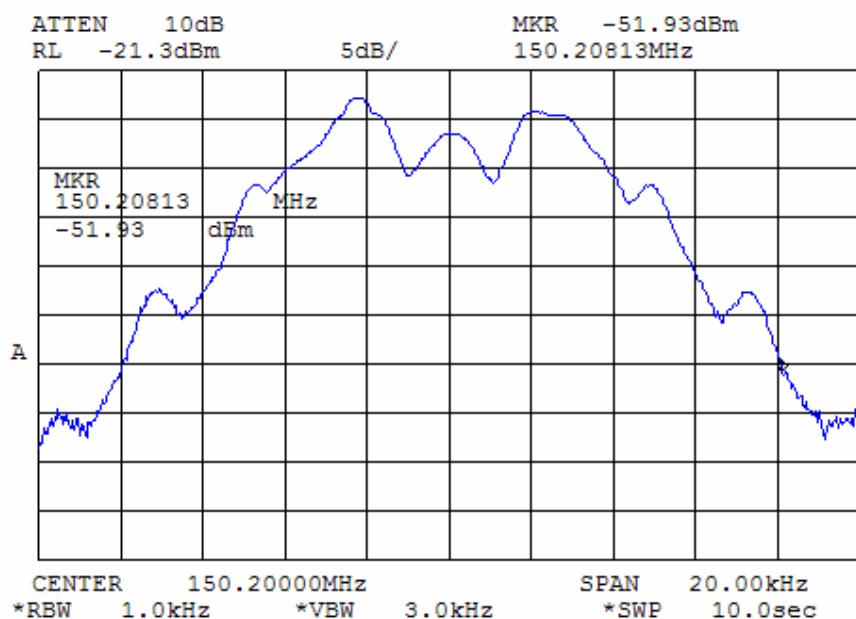
<b>Test specification:</b>	<b>Section 90.217, Band edge emission</b>		
<b>Test procedure:</b>	47 CFR, Sections 2.1051, 2.1047 and 90.217; TIA/EIA-603-A, Section 2.2.13		
<b>Test mode:</b>	Compliance	<b>Verdict:</b> PASS	
<b>Date &amp; Time:</b>	7/25/2004 8:18:07 PM		
<b>Temperature:</b> 25 °C	<b>Air Pressure:</b> 1006 hPa	<b>Relative Humidity:</b> 40 %	<b>Power Supply:</b> 3.6 VDC
<b>Remarks:</b>			

Plot 7.4.1 Low band edge emission test results at 150.2 MHz



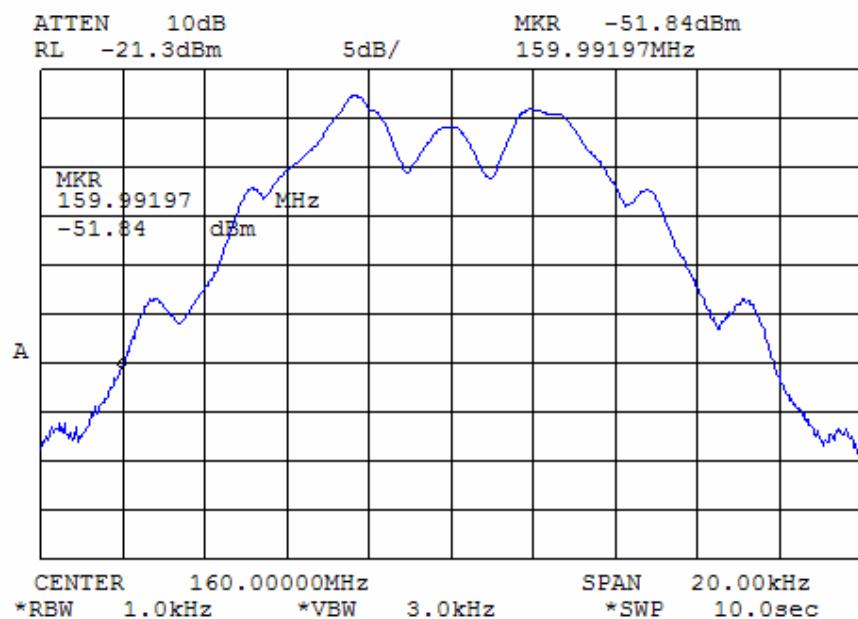
<b>Test specification:</b>	<b>Section 90.217, Band edge emission</b>		
<b>Test procedure:</b>	47 CFR, Sections 2.1051, 2.1047 and 90.217; TIA/EIA-603-A, Section 2.2.13		
<b>Test mode:</b>	Compliance	<b>Verdict:</b>	
<b>Date &amp; Time:</b>	7/25/2004 8:18:07 PM	<b>PASS</b>	
<b>Temperature:</b> 25 °C	<b>Air Pressure:</b> 1006 hPa	<b>Relative Humidity:</b> 40 %	<b>Power Supply:</b> 3.6 VDC
<b>Remarks:</b>			

Plot 7.4.2 High band edge emission test results at 150.2 MHz



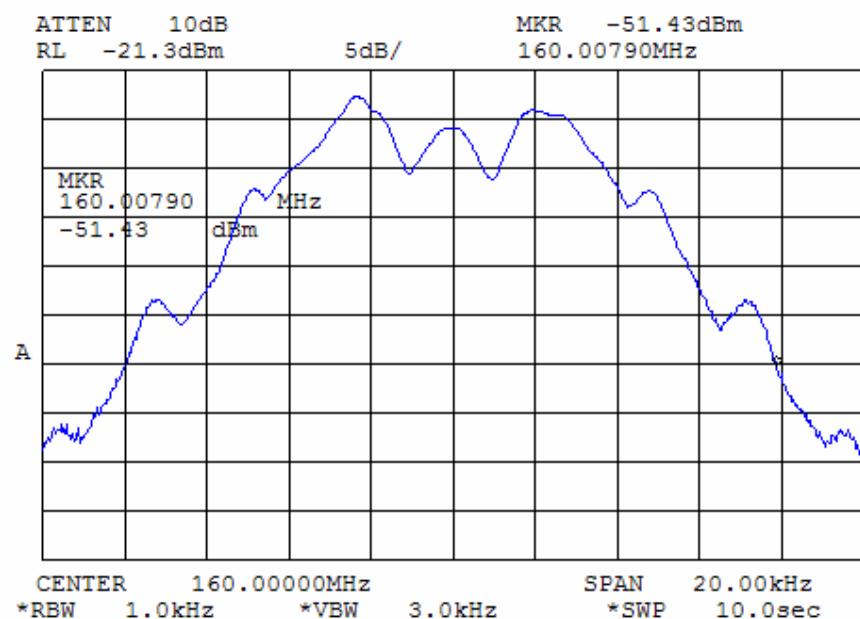
<b>Test specification:</b>	<b>Section 90.217, Band edge emission</b>		
<b>Test procedure:</b>	47 CFR, Sections 2.1051, 2.1047 and 90.217; TIA/EIA-603-A, Section 2.2.13		
<b>Test mode:</b>	Compliance	<b>Verdict:</b> <b>PASS</b>	
<b>Date &amp; Time:</b>	7/25/2004 8:18:07 PM		
<b>Temperature:</b> 25 °C	<b>Air Pressure:</b> 1006 hPa	<b>Relative Humidity:</b> 40 %	<b>Power Supply:</b> 3.6 VDC
<b>Remarks:</b>			

Plot 7.4.3 Low band edge emission test results at 160.0 MHz



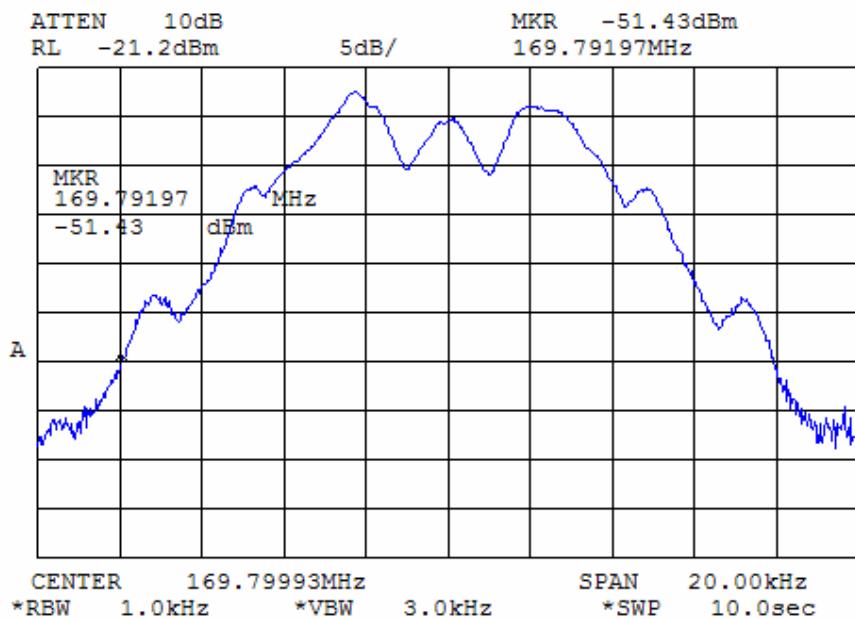
<b>Test specification:</b>	<b>Section 90.217, Band edge emission</b>		
<b>Test procedure:</b>	47 CFR, Sections 2.1051, 2.1047 and 90.217; TIA/EIA-603-A, Section 2.2.13		
<b>Test mode:</b>	Compliance	<b>Verdict:</b>	
<b>Date &amp; Time:</b>	7/25/2004 8:18:07 PM	<b>PASS</b>	
<b>Temperature:</b> 25 °C	<b>Air Pressure:</b> 1006 hPa	<b>Relative Humidity:</b> 40 %	<b>Power Supply:</b> 3.6 VDC
<b>Remarks:</b>			

Plot 7.4.4 High band edge emission test results at 160.0 MHz



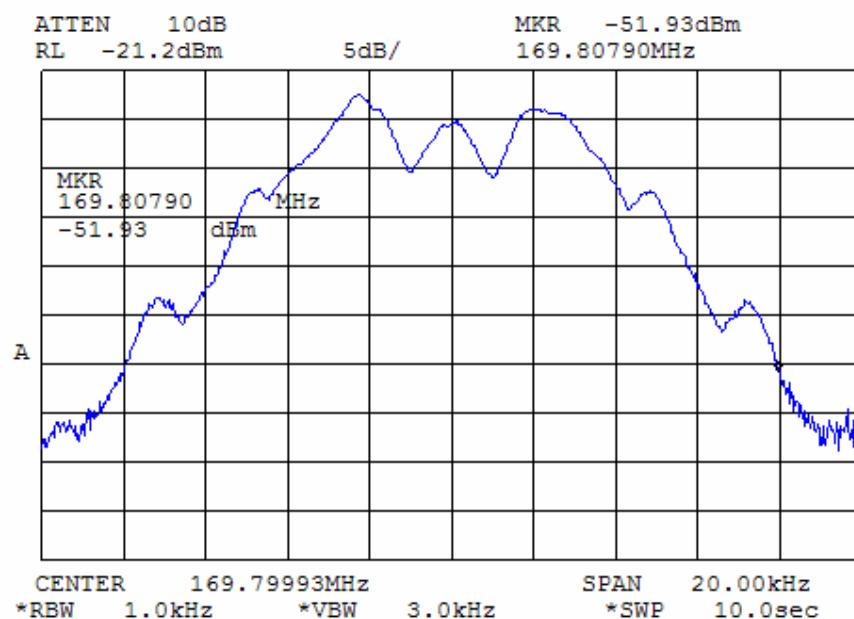
<b>Test specification:</b>	<b>Section 90.217, Band edge emission</b>		
<b>Test procedure:</b>	47 CFR, Sections 2.1051, 2.1047 and 90.217; TIA/EIA-603-A, Section 2.2.13		
<b>Test mode:</b>	Compliance	<b>Verdict:</b> PASS	
<b>Date &amp; Time:</b>	7/25/2004 8:18:07 PM		
<b>Temperature:</b> 25 °C	<b>Air Pressure:</b> 1006 hPa	<b>Relative Humidity:</b> 40 %	<b>Power Supply:</b> 3.6 VDC
<b>Remarks:</b>			

Plot 7.4.5 Low band edge emission test results at 169.8 MHz



<b>Test specification:</b>	<b>Section 90.217, Band edge emission</b>		
<b>Test procedure:</b>	47 CFR, Sections 2.1051, 2.1047 and 90.217; TIA/EIA-603-A, Section 2.2.13		
<b>Test mode:</b>	Compliance	<b>Verdict:</b> <b>PASS</b>	
<b>Date &amp; Time:</b>	7/25/2004 8:18:07 PM		
<b>Temperature:</b> 25 °C	<b>Air Pressure:</b> 1006 hPa	<b>Relative Humidity:</b> 40 %	<b>Power Supply:</b> 3.6 VDC
<b>Remarks:</b>			

Plot 7.4.6 High band edge emission test results at 169.8 MHz



<b>Test specification:</b>	<b>Section 90.210, Radiated spurious emissions</b>		
<b>Test procedure:</b>	47 CFR, Sections 2.1053 and 90.210(m); TIA/EIA-603-A, Section 2.2.12		
<b>Test mode:</b>	Compliance	<b>Verdict:</b>	
<b>Date &amp; Time:</b>	8/31/2004 3:04:26 PM	<b>PASS</b>	
<b>Temperature:</b> 25 °C	<b>Air Pressure:</b> 1001 hPa	<b>Relative Humidity:</b> 44 %	<b>Power Supply:</b> 3.6 VDC
<b>Remarks:</b>			

## 7.5 Radiated spurious emission measurements

### 7.5.1 General

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

**Table 7.5.1 Radiated spurious emission test limits**

Frequency, MHz	Attenuation below carrier, dBc	ERP of spurious, dBm	Equivalent field strength limit @ 3m, dB(µV/m)***
0.009 – 10 <sup>th</sup> harmonic*	43+10logP**	-13	84.4

\* - Excluding the in band emission within  $\pm 250$  % 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:  $E = \sqrt{30 \times P \times 1.64} / r$ , where P is ERP in Watts, 1.64 is numeric gain of ideal dipole and r is antenna to EUT distance in meters

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

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

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

7.5.2.3 The worst test results (the lowest margins) were recorded in Table 7.5.2 and shown in the associated plots.

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

7.5.3.1 The EUT was set up as shown in Figure 7.5.2, energized and the performance check was conducted.

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

7.5.3.3 The worst test results (the lowest margins) were recorded in Table 7.5.2 and shown in the associated plots.

### 7.5.4 Test procedure for substitution ERP measurements of spurious

7.5.4.1 The test equipment was set up as shown in Figure 7.5.3 and energized.

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

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

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

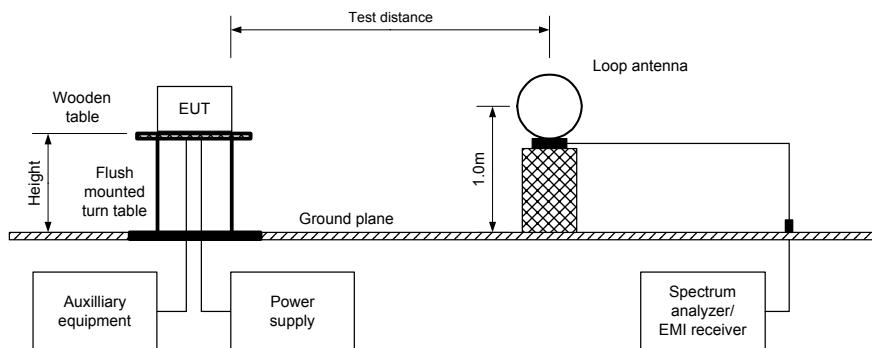
7.5.4.5 The ERP of spurious emissions was calculated as a sum of signal generator output power in dBm and antenna gain in dBd reduced by cable loss in dB.

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

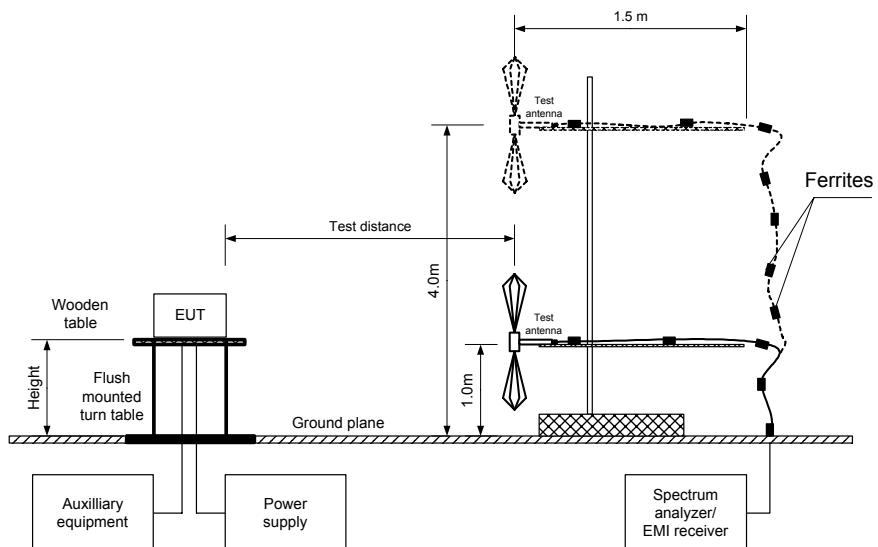
7.5.4.7 The worst test results (the lowest margins) were recorded in Table 7.5.3 and shown in the associated plots.

<b>Test specification:</b>	<b>Section 90.210, Radiated spurious emissions</b>		
<b>Test procedure:</b>	47 CFR, Sections 2.1053 and 90.210(m); TIA/EIA-603-A, Section 2.2.12		
<b>Test mode:</b>	Compliance	<b>Verdict:</b> <b>PASS</b>	
<b>Date &amp; Time:</b>	8/31/2004 3:04:26 PM		
<b>Temperature:</b> 25 °C	<b>Air Pressure:</b> 1001 hPa	<b>Relative Humidity:</b> 44 %	<b>Power Supply:</b> 3.6 VDC
<b>Remarks:</b>			

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

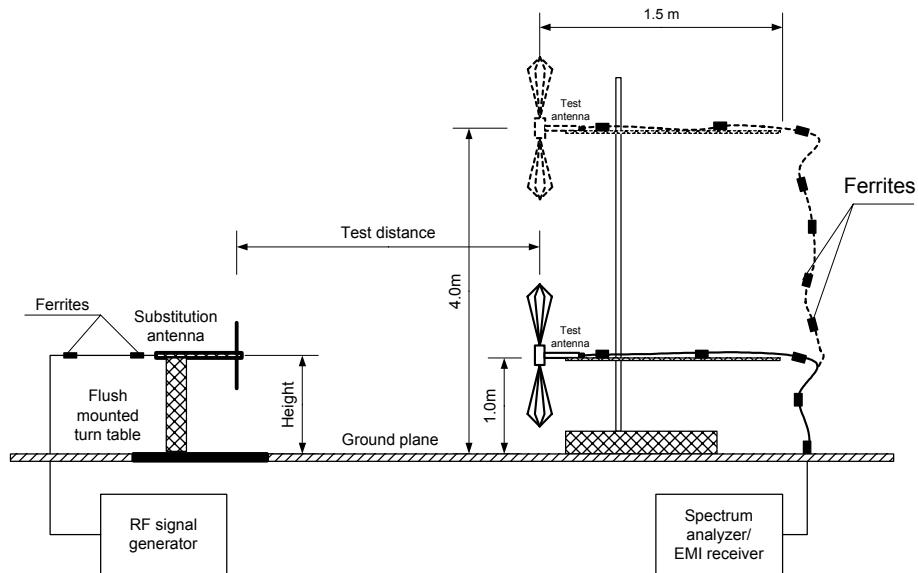


**Figure 7.5.2 Setup for spurious emission field strength measurements above 30 MHz**



<b>Test specification:</b>	<b>Section 90.210, Radiated spurious emissions</b>		
<b>Test procedure:</b>	47 CFR, Sections 2.1053 and 90.210(m); TIA/EIA-603-A, Section 2.2.12		
<b>Test mode:</b>	Compliance	<b>Verdict:</b> PASS	
<b>Date &amp; Time:</b>	8/31/2004 3:04:26 PM		
<b>Temperature:</b> 25 °C	<b>Air Pressure:</b> 1001 hPa	<b>Relative Humidity:</b> 44 %	<b>Power Supply:</b> 3.6 VDC
<b>Remarks:</b>			

Figure 7.5.3 Setup for substitution ERP measurements of spurious



<b>Test specification:</b>	<b>Section 90.210, Radiated spurious emissions</b>		
<b>Test procedure:</b>	47 CFR, Sections 2.1053 and 90.210(m); TIA/EIA-603-A, Section 2.2.12		
<b>Test mode:</b>	Compliance	<b>Verdict:</b>	
<b>Date &amp; Time:</b>	8/31/2004 3:04:26 PM	<b>PASS</b>	
<b>Temperature:</b> 25 °C	<b>Air Pressure:</b> 1001 hPa	<b>Relative Humidity:</b> 44 %	<b>Power Supply:</b> 3.6 VDC
<b>Remarks:</b>			

Table 7.5.2 Spurious emission field strength test results

ASSIGNED FREQUENCY RANGE: 150 - 170 MHz  
 TEST DISTANCE: 3 m  
 TEST SITE: 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: FSK  
 TRANSMITTER OUTPUT POWER SETTINGS: Maximum  
 EUT: S/N 10688

Frequency, MHz	Field strength, dB(µV/m)	Limit, dB(µV/m)	Margin, dB*	RBW, kHz	Antenna polarization	Antenna height, m	Turn-table position**, degrees
<b>150.2 MHz carrier frequency</b>							
300.4	46.1	84.4	38.3	120	Horizontal	1.1	0
450.6	40.1	84.4	44.3	120	Vertical	1.1	3
600.8	41.3	84.4	43.1	120	Vertical	1.1	4
751	54.7	84.4	29.7	120	Vertical	1.2	1
901.2	54.8	84.4	29.6	120	Vertical	1.2	-3
1051.4	49.6	84.4	34.8	1000	Vertical	1.2	0
1201.6	40.8	84.4	43.6	1000	Vertical	1.2	3
1351.8	42.5	84.4	41.9	1000	Vertical	1.2	-3
1502	41.2	84.4	43.2	1000	Vertical	1.2	-2
<b>160 MHz carrier frequency</b>							
320	40.5	84.4	43.9	120	Horizontal	1.1	1
480	41.4	84.4	43.0	120	Vertical	1.1	3
640	49.9	84.4	34.5	120	Vertical	1.1	-4
800	56.8	84.4	27.6	120	Vertical	1.2	-1
960	54.5	84.4	29.9	120	Vertical	1.2	3
1120	47.3	84.4	37.1	1000	Vertical	1.2	-2
1280	40.0	84.4	44.4	1000	Horizontal	1.1	2
1440	41.6	84.4	42.8	1000	Vertical	1.2	1
1600	45.4	84.4	39.0	1000	Horizontal	1.2	-4
<b>169.8 MHz carrier frequency</b>							
339.6	31.9	84.4	52.5	120	Horizontal	1.1	1
509.4	37.9	84.4	46.5	120	Vertical	1.1	5
679.2	51.9	84.4	32.5	120	Vertical	1.1	-3
849	55.0	84.4	29.4	120	Vertical	1.1	-2
1018.8	55.2	84.4	29.2	120	Vertical	1.1	2
1188.6	46.2	84.4	38.2	1000	Vertical	1.1	3
1358.4	41.7	84.4	42.7	1000	Vertical	1.1	1
1528.2	43.9	84.4	40.5	1000	Horizontal	1.1	-1
1698.0	45.0	84.4	39.4	1000	Horizontal	1.1	-2

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

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

<b>Test specification:</b>	<b>Section 90.210, Radiated spurious emissions</b>						
<b>Test procedure:</b>	47 CFR, Sections 2.1053 and 90.210(m); TIA/EIA-603-A, Section 2.2.12						
<b>Test mode:</b>	Compliance			<b>Verdict:</b> <b>PASS</b>			
<b>Date &amp; Time:</b>	8/31/2004 3:04:26 PM			<b>Relative Humidity:</b>	44 %	<b>Power Supply:</b>	3.6 VDC
<b>Temperature:</b> 25 °C	<b>Air Pressure:</b> 1001 hPa						
<b>Remarks:</b>							

Table 7.5.3 Substitution ERP of spurious test results

ASSIGNED FREQUENCY RANGE: 150 -170 MHz  
 TRANSMITTER CARRIER ERP: 16.04 dBm at low frequency  
 16.04 dBm at mid frequency  
 16.25 dBm at high frequency  
 TEST SITE: 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 <sub>μ</sub> V/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
<b>150.2 MHz carrier frequency</b>											
300.4	46.1	120	Horizontal	-49.05	-0.5	2.2	-51.7	67.7	29.0	38.7	pass
450.6	40.1	120	Vertical	-53.63	-1.2	2.8	-57.5	73.6	29.0	44.5	pass
600.8	41.3	120	Vertical	-51.06	-0.4	3.3	-54.7	70.7	29.0	41.7	pass
751	54.7	120	Vertical	-35.43	-0.3	3.7	-39.4	55.4	29.0	26.4	pass
901.2	54.8	120	Vertical	-38.59	-0.5	4.4	-43.4	59.4	29.0	30.4	pass
1051.4	49.6	1000	Vertical	-48.78	3.6	4.6	-49.8	65.8	29.0	36.8	pass
1201.6	40.8	1000	Vertical	-57.36	4.4	4.9	-57.9	74.0	29.0	44.9	pass
1351.8	42.5	1000	Vertical	-55.55	5.2	5.3	-55.7	71.7	29.0	42.7	pass
1502	41.2	1000	Vertical	-56.24	5.9	5.5	-55.9	72.0	29.0	42.9	pass
<b>160 MHz carrier frequency</b>											
320	40.5	120	Horizontal	-57.05	-0.5	2.2	-59.7	75.7	29.0	46.7	pass
480	41.4	120	Vertical	-50.64	-1.4	2.8	-54.7	70.8	29.0	41.7	pass
640	49.9	120	Vertical	-41.6	0.0	3.3	-44.9	61.0	29.0	31.9	pass
800	56.8	120	Vertical	-32.98	-0.9	3.7	-37.5	53.6	29.0	24.5	pass
960	54.5	120	Vertical	-38.97	-0.3	4.4	-43.6	59.6	29.0	30.6	pass
1120	47.3	1000	Vertical	-51.07	4.0	4.6	-51.7	67.7	29.0	38.7	pass
1280	40.0	1000	Horizontal	-58.16	4.8	4.9	-58.3	74.4	29.0	45.3	pass
1440	41.6	1000	Vertical	-56.15	5.6	5.4	-56.0	72.0	29.0	43.0	pass
1600	45.4	1000	Horizontal	-51.59	6.0	5.6	-51.2	67.3	29.0	38.2	pass
<b>169.8 MHz carrier frequency</b>											
339.6	31.9	120	Horizontal	-65.12	-0.6	2.2	-67.9	84.1	29.3	54.9	pass
509.4	37.9	120	Vertical	-52.18	-1.7	2.8	-56.6	72.8	29.3	43.6	pass
679.2	51.9	120	Vertical	-39.08	0.4	3.3	-42.0	58.3	29.3	29.0	pass
849	55.0	120	Vertical	-37.01	-0.7	3.7	-41.4	57.6	29.3	28.4	pass
1018.8	55.2	120	Vertical	-43.2	3.5	4.4	-44.1	60.4	29.3	31.1	pass
1188.6	46.2	1000	Vertical	-51.77	4.4	4.6	-52.0	68.2	29.3	39.0	pass
1358.4	41.7	1000	Vertical	-56.31	5.2	4.9	-56.1	72.3	29.3	43.1	pass
1528.2	43.9	1000	Horizontal	-53.33	5.9	5.4	-52.9	69.1	29.3	39.9	pass
1698.0	45.0	1000	Horizontal	-50.53	6.1	5.7	-50.2	66.4	29.3	37.2	pass

\*- Margin = Spurious emission – specification limit.

#### Reference numbers of test equipment used

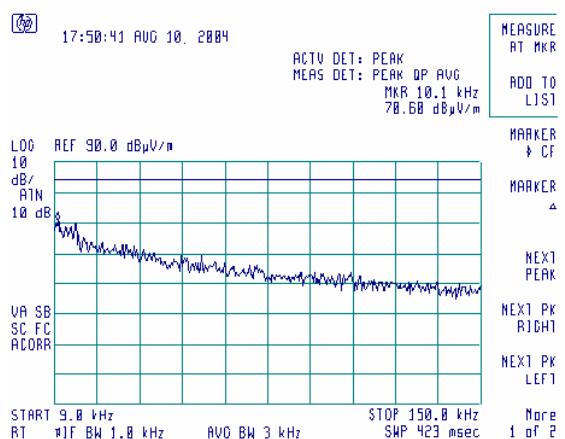
HL 0030	HL 0415	HL 0465	HL 0521	HL 0566	HL 0569	HL 0589	HL 0592
HL 0593	HL 0594	HL 0604	HL 0661	HL 0812	HL1004	HL 1425	HL 1430
HL 1500	HL 1942	HL 2009	HL 2432				

Full description is given in Appendix A.

<b>Test specification:</b>	<b>Section 90.210, Radiated spurious emissions</b>		
<b>Test procedure:</b>	47 CFR, Sections 2.1053 and 90.210(m); TIA/EIA-603-A, Section 2.2.12		
<b>Test mode:</b>	Compliance	<b>Verdict:</b> <b>PASS</b>	
<b>Date &amp; Time:</b>	8/31/2004 3:04:26 PM		
<b>Temperature:</b> 25 °C	<b>Air Pressure:</b> 1001 hPa	<b>Relative Humidity:</b> 44 %	<b>Power Supply:</b> 3.6 VDC
<b>Remarks:</b>			

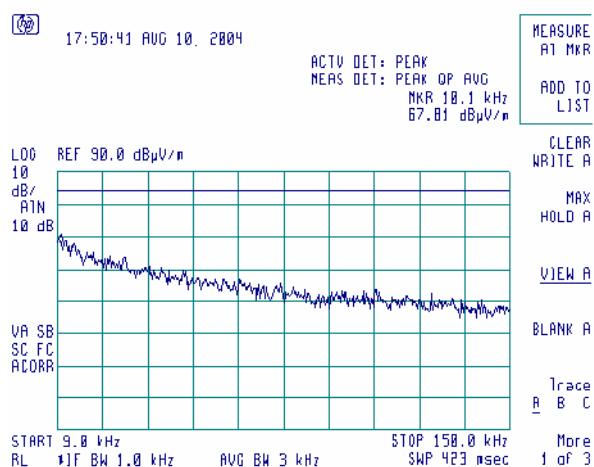
**Plot 7.5.1 Radiated emission measurements in 9 - 150 kHz range**

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



**Plot 7.5.2 Radiated emission measurements in 9 - 150 kHz range**

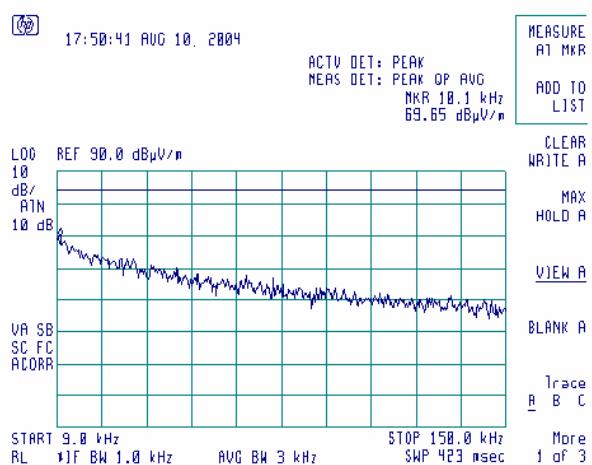
TEST SITE: Anechoic chamber  
 CARRIER FREQUENCY: 160 MHz  
 ANTENNA POLARIZATION: Vertical and Horizontal  
 TEST DISTANCE: 3 m



<b>Test specification:</b>	<b>Section 90.210, Radiated spurious emissions</b>		
<b>Test procedure:</b>	47 CFR, Sections 2.1053 and 90.210(m); TIA/EIA-603-A, Section 2.2.12		
<b>Test mode:</b>	Compliance	<b>Verdict:</b> PASS	
<b>Date &amp; Time:</b>	8/31/2004 3:04:26 PM		
<b>Temperature:</b> 25 °C	<b>Air Pressure:</b> 1001 hPa	<b>Relative Humidity:</b> 44 %	<b>Power Supply:</b> 3.6 VDC
<b>Remarks:</b>			

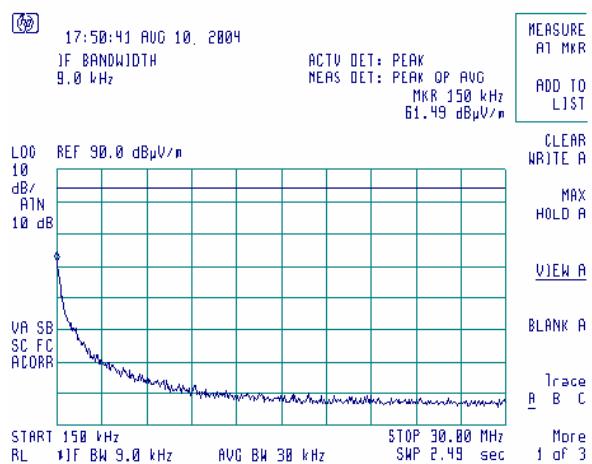
**Plot 7.5.3 Radiated emission measurements in 9 - 150 kHz range**

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



**Plot 7.5.4 Radiated emission measurements in 0.15 - 30 MHz range**

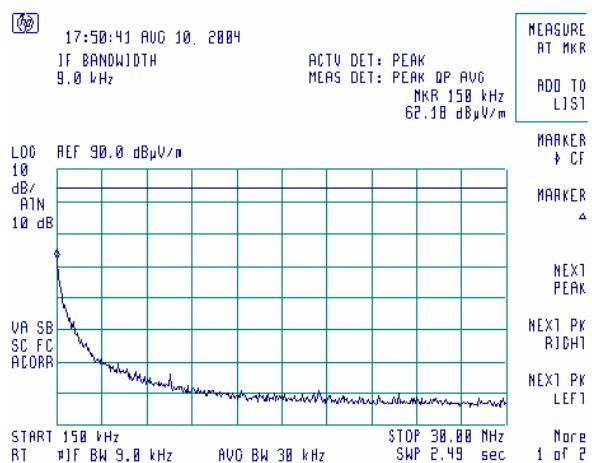
TEST SITE: Anechoic chamber  
CARRIER FREQUENCY: 150.2 MHz  
ANTENNA POLARIZATION: Vertical and Horizontal  
TEST DISTANCE: 3 m



<b>Test specification:</b>	<b>Section 90.210, Radiated spurious emissions</b>		
<b>Test procedure:</b>	47 CFR, Sections 2.1053 and 90.210(m); TIA/EIA-603-A, Section 2.2.12		
<b>Test mode:</b>	Compliance	<b>Verdict:</b> <b>PASS</b>	
<b>Date &amp; Time:</b>	8/31/2004 3:04:26 PM		
<b>Temperature:</b> 25 °C	<b>Air Pressure:</b> 1001 hPa	<b>Relative Humidity:</b> 44 %	<b>Power Supply:</b> 3.6 VDC
<b>Remarks:</b>			

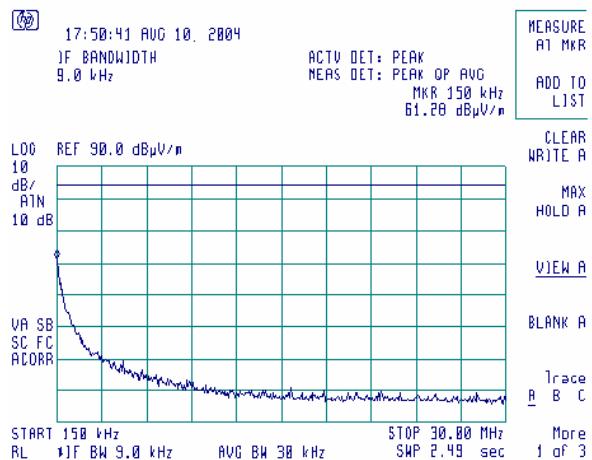
**Plot 7.5.5 Radiated emission measurements in 0.15 - 30 MHz range**

TEST SITE: Anechoic chamber  
CARRIER FREQUENCY: 160 MHz  
ANTENNA POLARIZATION: Vertical and Horizontal  
TEST DISTANCE: 3 m



**Plot 7.5.6 Radiated emission measurements in 0.15 - 30 MHz range**

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

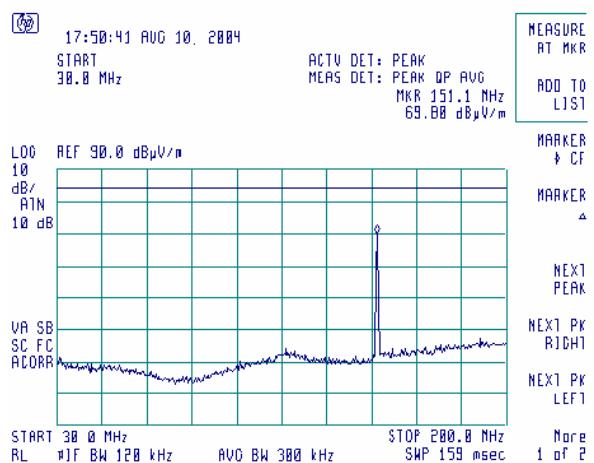




<b>Test specification:</b>	<b>Section 90.210, Radiated spurious emissions</b>		
<b>Test procedure:</b>	47 CFR, Sections 2.1053 and 90.210(m); TIA/EIA-603-A, Section 2.2.12		
<b>Test mode:</b>	Compliance	<b>Verdict:</b>	PASS
<b>Date &amp; Time:</b>	8/31/2004 3:04:26 PM		
<b>Temperature:</b> 25 °C	<b>Air Pressure:</b> 1001 hPa	<b>Relative Humidity:</b> 44 %	<b>Power Supply:</b> 3.6 VDC
<b>Remarks:</b>			

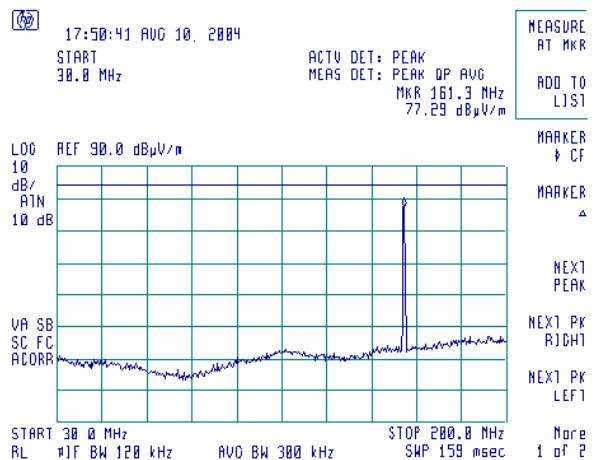
### Plot 7.5.7 Radiated emission measurements in 30 - 200 MHz range

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



### Plot 7.5.8 Radiated emission measurements in 30 - 200 MHz range

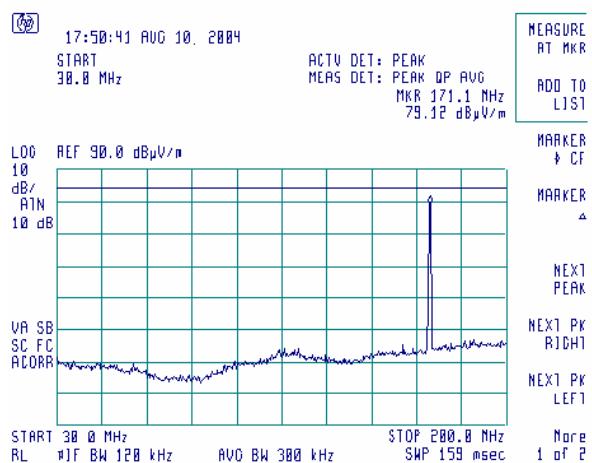
TEST SITE: Anechoic chamber  
CARRIER FREQUENCY: 160 MHz  
ANTENNA POLARIZATION: Vertical and Horizontal  
TEST DISTANCE: 3 m



<b>Test specification:</b>	<b>Section 90.210, Radiated spurious emissions</b>		
<b>Test procedure:</b>	47 CFR, Sections 2.1053 and 90.210(m); TIA/EIA-603-A, Section 2.2.12		
<b>Test mode:</b>	Compliance	<b>Verdict:</b> PASS	
<b>Date &amp; Time:</b>	8/31/2004 3:04:26 PM		
<b>Temperature:</b> 25 °C	<b>Air Pressure:</b> 1001 hPa	<b>Relative Humidity:</b> 44 %	<b>Power Supply:</b> 3.6 VDC
<b>Remarks:</b>			

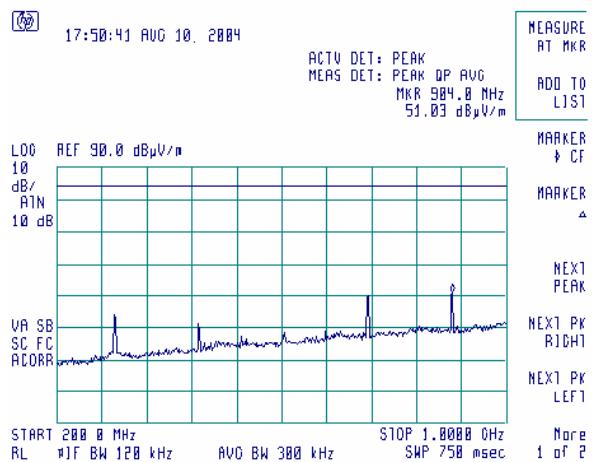
**Plot 7.5.9 Radiated emission measurements in 30 - 200 MHz range**

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



**Plot 7.5.10 Radiated emission measurements in 200 – 1000 MHz range**

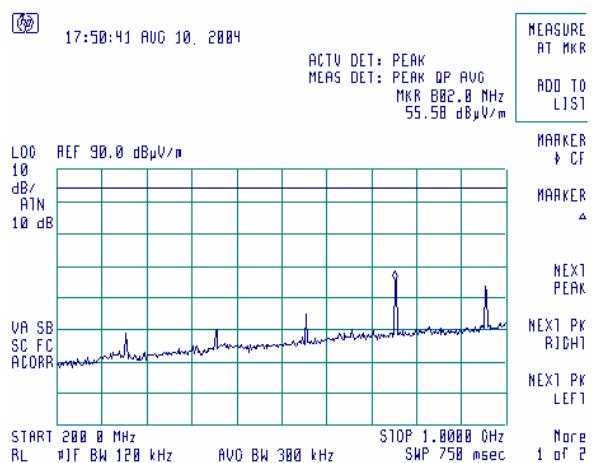
TEST SITE: Anechoic chamber  
 CARRIER FREQUENCY: 150.2 MHz  
 ANTENNA POLARIZATION: Vertical and Horizontal  
 TEST DISTANCE: 3 m



<b>Test specification:</b>	<b>Section 90.210, Radiated spurious emissions</b>		
<b>Test procedure:</b>	47 CFR, Sections 2.1053 and 90.210(m); TIA/EIA-603-A, Section 2.2.12		
<b>Test mode:</b>	Compliance	<b>Verdict:</b> <b>PASS</b>	
<b>Date &amp; Time:</b>	8/31/2004 3:04:26 PM		
<b>Temperature:</b> 25 °C	<b>Air Pressure:</b> 1001 hPa	<b>Relative Humidity:</b> 44 %	<b>Power Supply:</b> 3.6 VDC
<b>Remarks:</b>			

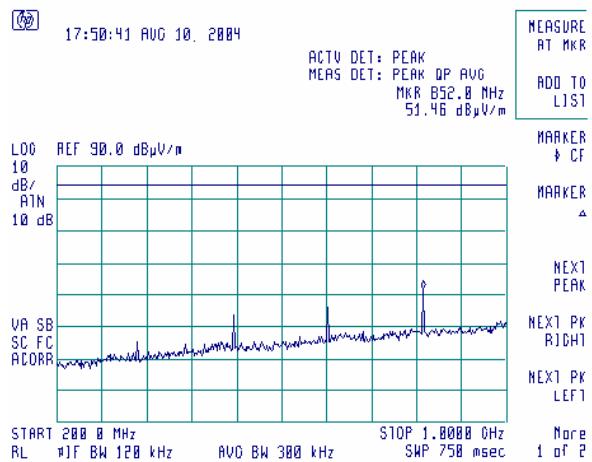
**Plot 7.5.11 Radiated emission measurements in 200 – 1000 MHz range**

TEST SITE: Anechoic chamber  
CARRIER FREQUENCY: 160 MHz  
ANTENNA POLARIZATION: Vertical and Horizontal  
TEST DISTANCE: 3 m



**Plot 7.5.12 Radiated emission measurements in 200 – 1000 MHz range**

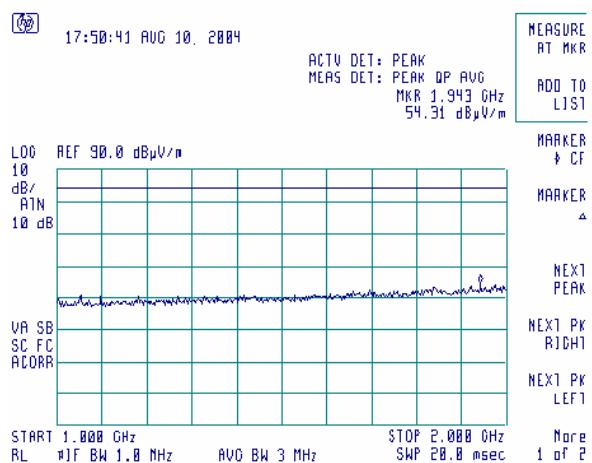
TEST SITE: Anechoic chamber  
CARRIER FREQUENCY: 169.8 MHz  
ANTENNA POLARIZATION: Vertical and Horizontal  
TEST DISTANCE: 3 m



<b>Test specification:</b>	<b>Section 90.210, Radiated spurious emissions</b>		
<b>Test procedure:</b>	47 CFR, Sections 2.1053 and 90.210(m); TIA/EIA-603-A, Section 2.2.12		
<b>Test mode:</b>	Compliance	<b>Verdict:</b>	
<b>Date &amp; Time:</b>	8/31/2004 3:04:26 PM	<b>PASS</b>	
<b>Temperature:</b> 25 °C	<b>Air Pressure:</b> 1001 hPa	<b>Relative Humidity:</b> 44 %	<b>Power Supply:</b> 3.6 VDC
<b>Remarks:</b>			

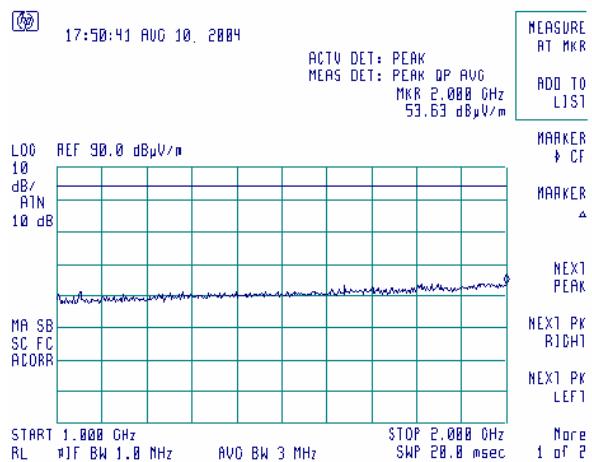
Plot 7.5.13 Radiated emission measurements in 1000 – 2000 MHz range

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



Plot 7.5.14 Radiated emission measurements in 1000 – 2000 MHz range

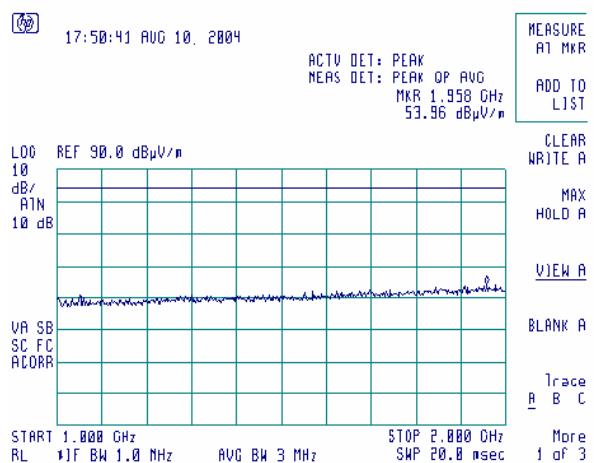
TEST SITE: Anechoic chamber  
 CARRIER FREQUENCY: 160 MHz  
 ANTENNA POLARIZATION: Vertical and Horizontal  
 TEST DISTANCE: 3 m



<b>Test specification:</b>	<b>Section 90.210, Radiated spurious emissions</b>		
<b>Test procedure:</b>	47 CFR, Sections 2.1053 and 90.210(m); TIA/EIA-603-A, Section 2.2.12		
<b>Test mode:</b>	Compliance	<b>Verdict:</b> <b>PASS</b>	
<b>Date &amp; Time:</b>	8/31/2004 3:04:26 PM		
<b>Temperature:</b> 25 °C	<b>Air Pressure:</b> 1001 hPa	<b>Relative Humidity:</b> 44 %	<b>Power Supply:</b> 3.6 VDC
<b>Remarks:</b>			

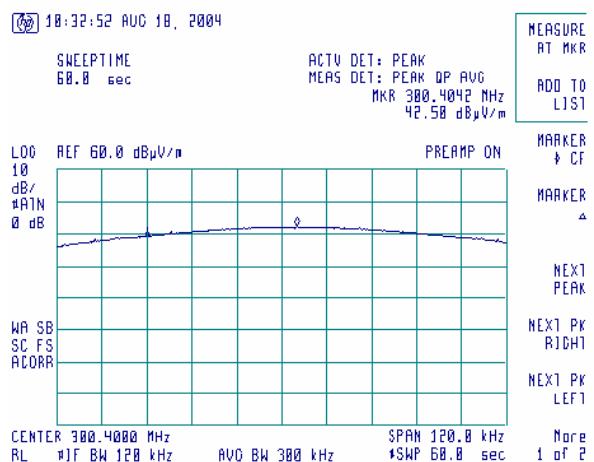
**Plot 7.5.15 Radiated emission measurements in 1000 – 2000 MHz range**

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



**Plot 7.5.16 Radiated emission measurements at the 2<sup>nd</sup> harmonic**

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



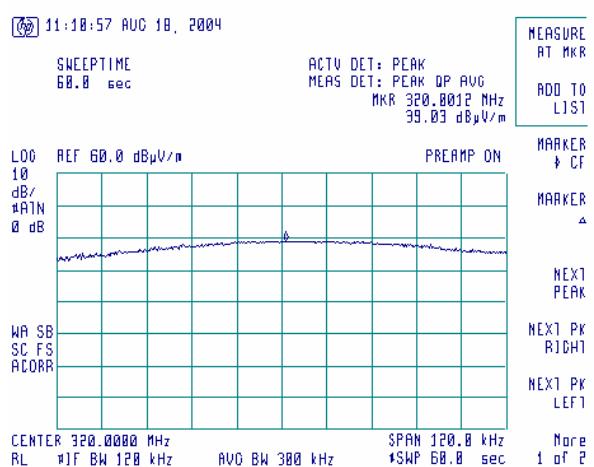
<b>Test specification:</b>	<b>Section 90.210, Radiated spurious emissions</b>		
<b>Test procedure:</b>	47 CFR, Sections 2.1053 and 90.210(m); TIA/EIA-603-A, Section 2.2.12		
<b>Test mode:</b>	Compliance	<b>Verdict:</b>	
<b>Date &amp; Time:</b>	8/31/2004 3:04:26 PM	<b>PASS</b>	
<b>Temperature:</b> 25 °C	<b>Air Pressure:</b> 1001 hPa	<b>Relative Humidity:</b> 44 %	<b>Power Supply:</b> 3.6 VDC
<b>Remarks:</b>			

**Plot 7.5.17 Radiated emission measurements at the 2<sup>nd</sup> harmonic**

TEST SITE:  
CARRIER FREQUENCY:  
ANTENNA POLARIZATION:  
TEST DISTANCE:

OATS

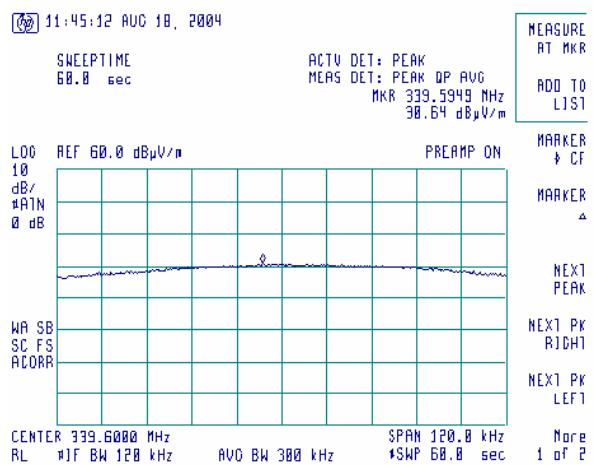
160 MHz  
Vertical  
3 m



**Plot 7.5.18 Radiated emission measurements at the 2<sup>nd</sup> harmonic**

TEST SITE:  
CARRIER FREQUENCY:  
ANTENNA POLARIZATION:  
TEST DISTANCE:

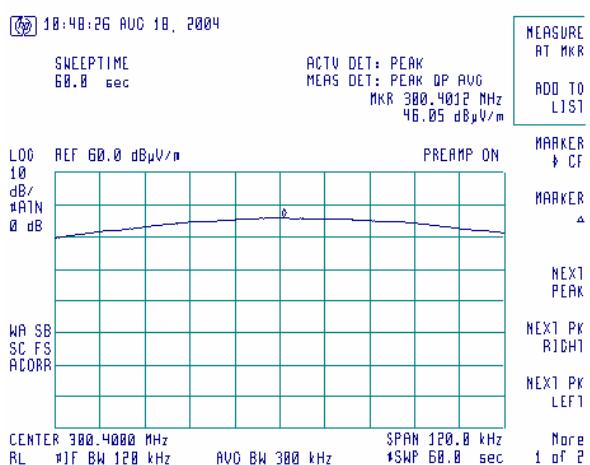
OATS  
169.8 MHz  
Vertical  
3 m



<b>Test specification:</b>	<b>Section 90.210, Radiated spurious emissions</b>		
<b>Test procedure:</b>	47 CFR, Sections 2.1053 and 90.210(m); TIA/EIA-603-A, Section 2.2.12		
<b>Test mode:</b>	Compliance	<b>Verdict:</b>	
<b>Date &amp; Time:</b>	8/31/2004 3:04:26 PM	<b>PASS</b>	
<b>Temperature:</b> 25 °C	<b>Air Pressure:</b> 1001 hPa	<b>Relative Humidity:</b> 44 %	<b>Power Supply:</b> 3.6 VDC
<b>Remarks:</b>			

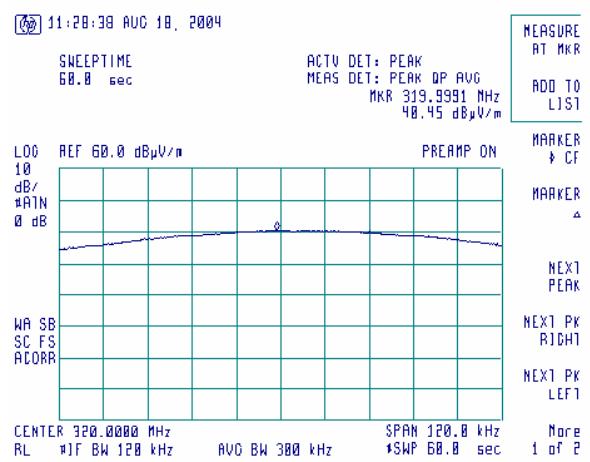
**Plot 7.5.19 Radiated emission measurements at the 2<sup>nd</sup> harmonic**

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



**Plot 7.5.20 Radiated emission measurements at the 2<sup>nd</sup> harmonic**

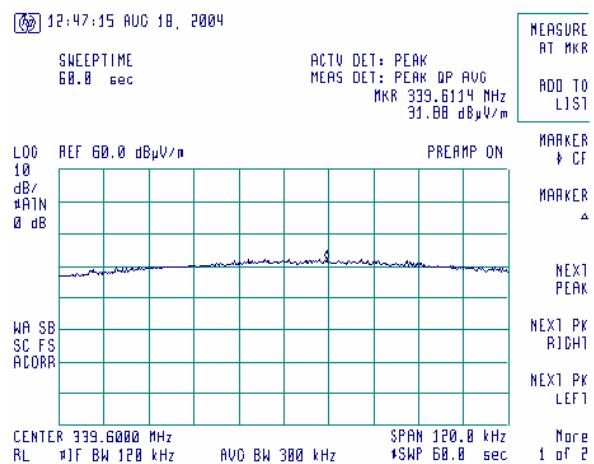
TEST SITE: OATS  
CARRIER FREQUENCY: 160 MHz  
ANTENNA POLARIZATION: Horizontal  
TEST DISTANCE: 3 m



<b>Test specification:</b>	<b>Section 90.210, Radiated spurious emissions</b>		
<b>Test procedure:</b>	47 CFR, Sections 2.1053 and 90.210(m); TIA/EIA-603-A, Section 2.2.12		
<b>Test mode:</b>	Compliance	<b>Verdict:</b> PASS	
<b>Date &amp; Time:</b>	8/31/2004 3:04:26 PM		
<b>Temperature:</b> 25 °C	<b>Air Pressure:</b> 1001 hPa	<b>Relative Humidity:</b> 44 %	<b>Power Supply:</b> 3.6 VDC
<b>Remarks:</b>			

**Plot 7.5.21 Radiated emission measurements at the 2<sup>nd</sup> harmonic**

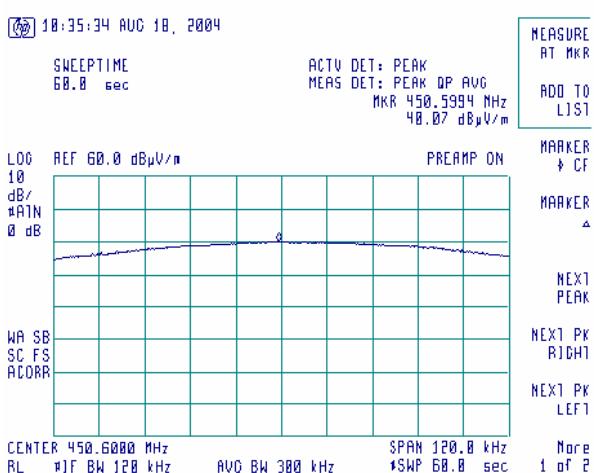
TEST SITE: OATS  
 CARRIER FREQUENCY: 169.8 MHz  
 ANTENNA POLARIZATION: Horizontal  
 TEST DISTANCE: 3 m



<b>Test specification:</b>	<b>Section 90.210, Radiated spurious emissions</b>		
<b>Test procedure:</b>	47 CFR, Sections 2.1053 and 90.210(m); TIA/EIA-603-A, Section 2.2.12		
<b>Test mode:</b>	Compliance	<b>Verdict:</b>	
<b>Date &amp; Time:</b>	8/31/2004 3:04:26 PM	<b>PASS</b>	
<b>Temperature:</b> 25 °C	<b>Air Pressure:</b> 1001 hPa	<b>Relative Humidity:</b> 44 %	<b>Power Supply:</b> 3.6 VDC
<b>Remarks:</b>			

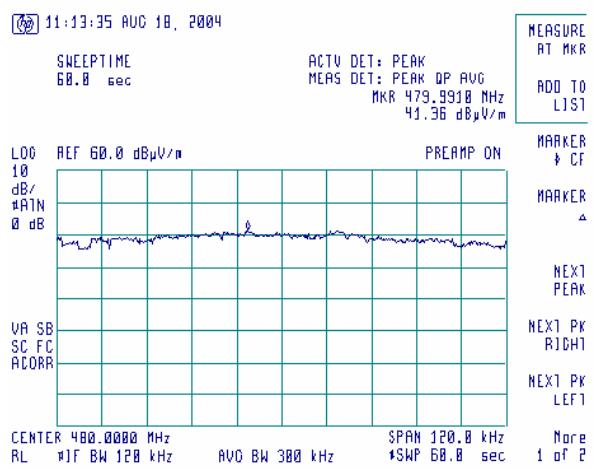
**Plot 7.5.22 Radiated emission measurements at the 3<sup>rd</sup> harmonic**

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



**Plot 7.5.23 Radiated emission measurements at the 3<sup>rd</sup> harmonic**

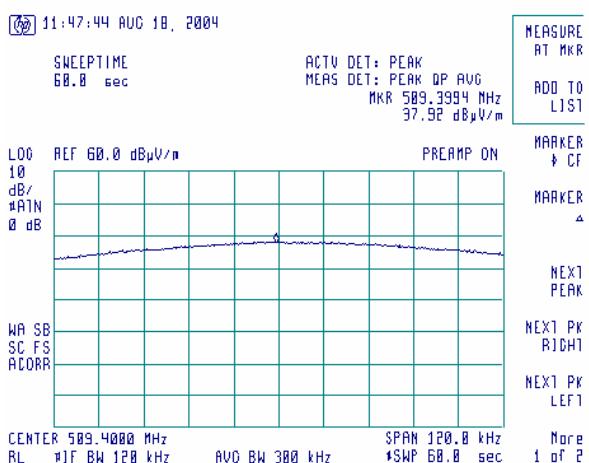
TEST SITE: OATS  
CARRIER FREQUENCY: 160 MHz  
ANTENNA POLARIZATION: Vertical  
TEST DISTANCE: 3 m



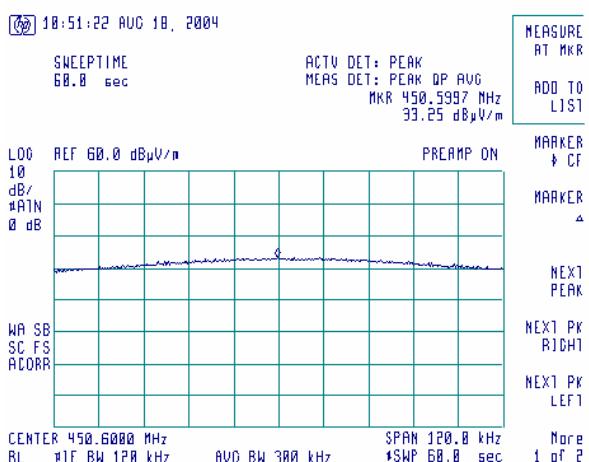
<b>Test specification:</b>	<b>Section 90.210, Radiated spurious emissions</b>		
<b>Test procedure:</b>	47 CFR, Sections 2.1053 and 90.210(m); TIA/EIA-603-A, Section 2.2.12		
<b>Test mode:</b>	Compliance	<b>Verdict:</b>	
<b>Date &amp; Time:</b>	8/31/2004 3:04:26 PM	<b>PASS</b>	
<b>Temperature:</b> 25 °C	<b>Air Pressure:</b> 1001 hPa	<b>Relative Humidity:</b> 44 %	<b>Power Supply:</b> 3.6 VDC
<b>Remarks:</b>			

 Plot 7.5.24 Radiated emission measurements at the 3<sup>rd</sup> harmonic

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


 Plot 7.5.25 Radiated emission measurements at the 3<sup>rd</sup> harmonic

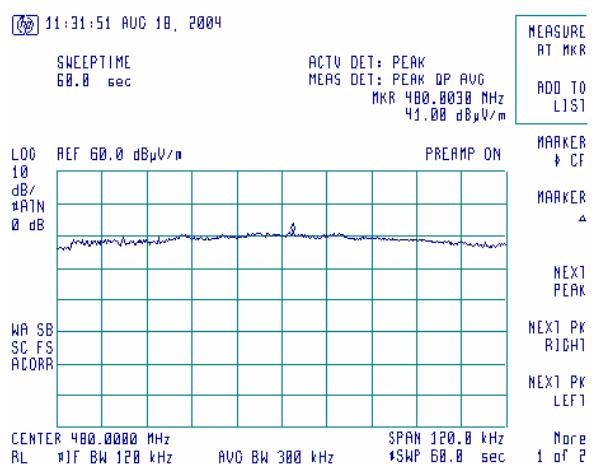
TEST SITE: OATS  
 CARRIER FREQUENCY: 150.2 MHz  
 ANTENNA POLARIZATION: Horizontal  
 TEST DISTANCE: 3 m



<b>Test specification:</b>	<b>Section 90.210, Radiated spurious emissions</b>		
<b>Test procedure:</b>	47 CFR, Sections 2.1053 and 90.210(m); TIA/EIA-603-A, Section 2.2.12		
<b>Test mode:</b>	Compliance	<b>Verdict:</b>	
<b>Date &amp; Time:</b>	8/31/2004 3:04:26 PM	<b>PASS</b>	
<b>Temperature:</b> 25 °C	<b>Air Pressure:</b> 1001 hPa	<b>Relative Humidity:</b> 44 %	<b>Power Supply:</b> 3.6 VDC
<b>Remarks:</b>			

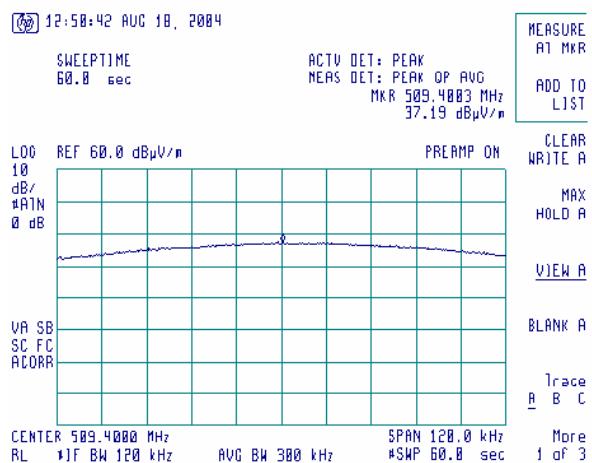
**Plot 7.5.26 Radiated emission measurements at the 3<sup>rd</sup> harmonic**

TEST SITE: OATS  
CARRIER FREQUENCY: 160 MHz  
ANTENNA POLARIZATION: Horizontal  
TEST DISTANCE: 3 m



**Plot 7.5.27 Radiated emission measurements at the 3<sup>rd</sup> harmonic**

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

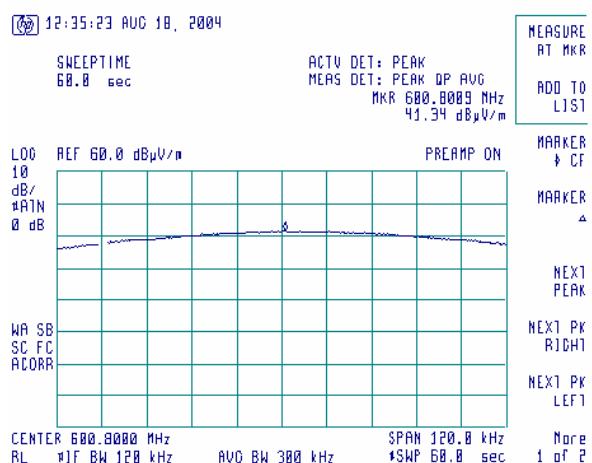




<b>Test specification:</b>	<b>Section 90.210, Radiated spurious emissions</b>		
<b>Test procedure:</b>	47 CFR, Sections 2.1053 and 90.210(m); TIA/EIA-603-A, Section 2.2.12		
<b>Test mode:</b>	Compliance	<b>Verdict:</b>	PASS
<b>Date &amp; Time:</b>	8/31/2004 3:04:26 PM		
<b>Temperature:</b> 25 °C	<b>Air Pressure:</b> 1001 hPa	<b>Relative Humidity:</b> 44 %	<b>Power Supply:</b> 3.6 VDC
<b>Remarks:</b>			

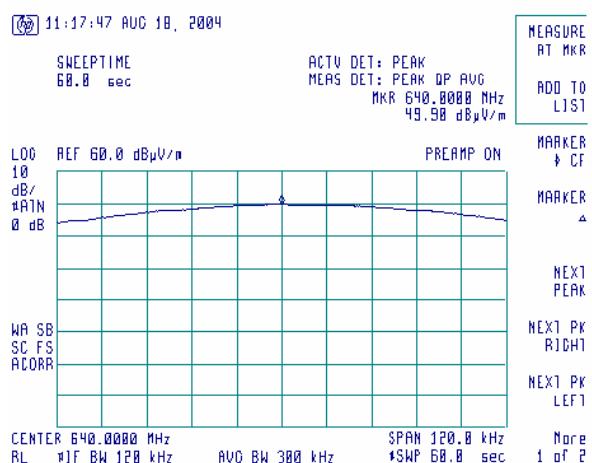
### Plot 7.5.28 Radiated emission measurements at the 4<sup>th</sup> harmonic

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



Plot 7.5.29 Radiated emission measurements at the 4<sup>th</sup> harmonic

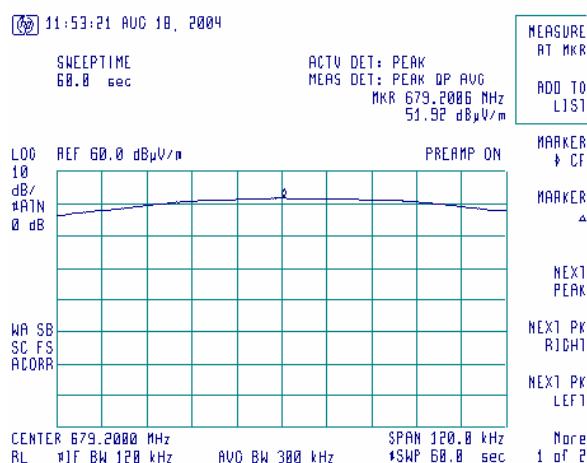
TEST SITE: OATS  
CARRIER FREQUENCY: 160 MHz  
ANTENNA POLARIZATION: Vertical  
TEST DISTANCE: 3 m



<b>Test specification:</b>	<b>Section 90.210, Radiated spurious emissions</b>		
<b>Test procedure:</b>	47 CFR, Sections 2.1053 and 90.210(m); TIA/EIA-603-A, Section 2.2.12		
<b>Test mode:</b>	Compliance	<b>Verdict:</b>	
<b>Date &amp; Time:</b>	8/31/2004 3:04:26 PM	<b>PASS</b>	
<b>Temperature:</b> 25 °C	<b>Air Pressure:</b> 1001 hPa	<b>Relative Humidity:</b> 44 %	<b>Power Supply:</b> 3.6 VDC
<b>Remarks:</b>			

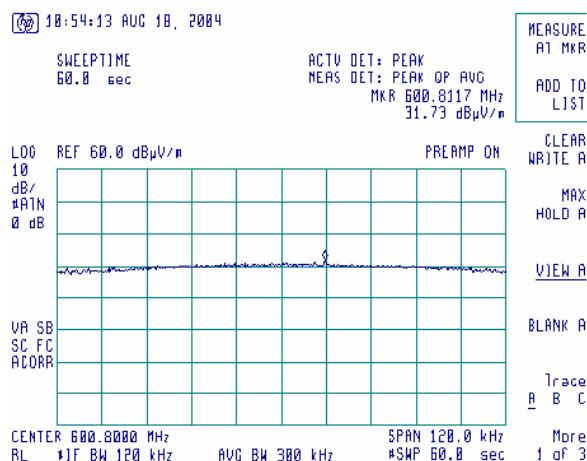
**Plot 7.5.30 Radiated emission measurements at the 4<sup>th</sup> harmonic**

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



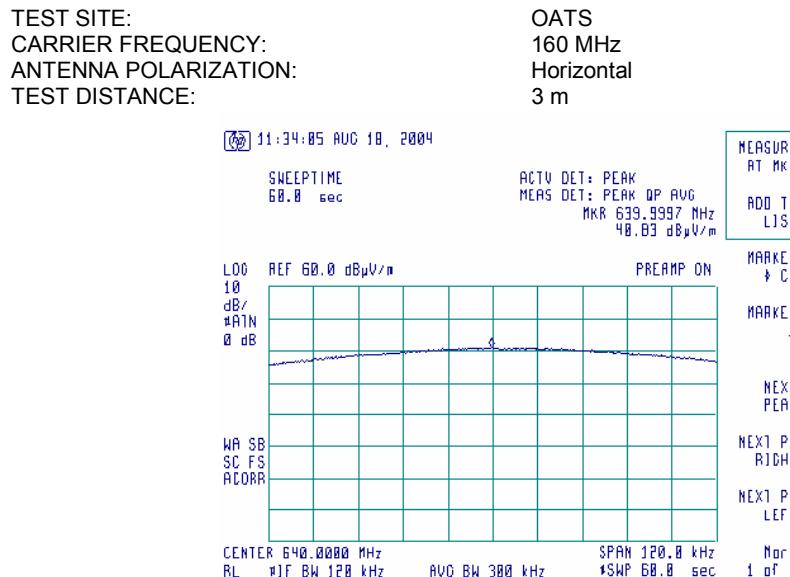
**Plot 7.5.31 Radiated emission measurements at the 4<sup>th</sup> harmonic**

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



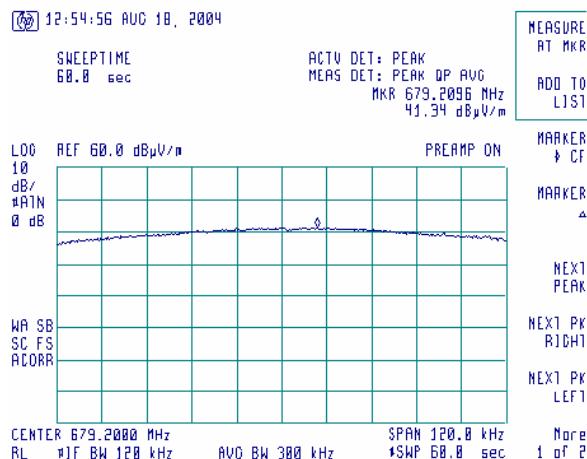
<b>Test specification:</b>	<b>Section 90.210, Radiated spurious emissions</b>		
<b>Test procedure:</b>	47 CFR, Sections 2.1053 and 90.210(m); TIA/EIA-603-A, Section 2.2.12		
<b>Test mode:</b>	Compliance	<b>Verdict:</b>	
<b>Date &amp; Time:</b>	8/31/2004 3:04:26 PM	<b>PASS</b>	
<b>Temperature:</b> 25 °C	<b>Air Pressure:</b> 1001 hPa	<b>Relative Humidity:</b> 44 %	<b>Power Supply:</b> 3.6 VDC
<b>Remarks:</b>			

**Plot 7.5.32 Radiated emission measurements at the 4<sup>th</sup> harmonic**



**Plot 7.5.33 Radiated emission measurements at the 4<sup>th</sup> harmonic**

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

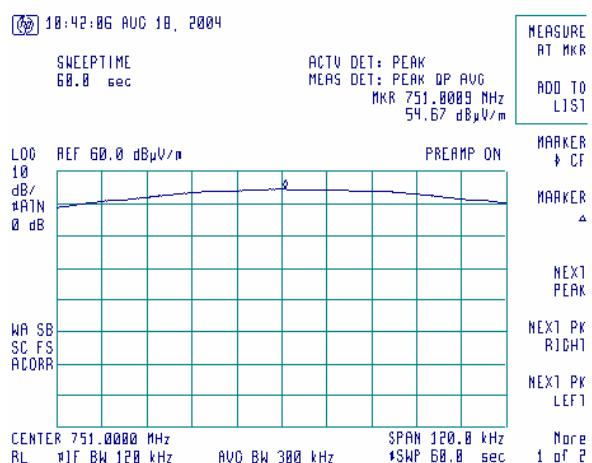




<b>Test specification:</b>	<b>Section 90.210, Radiated spurious emissions</b>		
<b>Test procedure:</b>	47 CFR, Sections 2.1053 and 90.210(m); TIA/EIA-603-A, Section 2.2.12		
<b>Test mode:</b>	Compliance	<b>Verdict:</b>	PASS
<b>Date &amp; Time:</b>	8/31/2004 3:04:26 PM		
<b>Temperature:</b> 25 °C	<b>Air Pressure:</b> 1001 hPa	<b>Relative Humidity:</b> 44 %	<b>Power Supply:</b> 3.6 VDC
<b>Remarks:</b>			

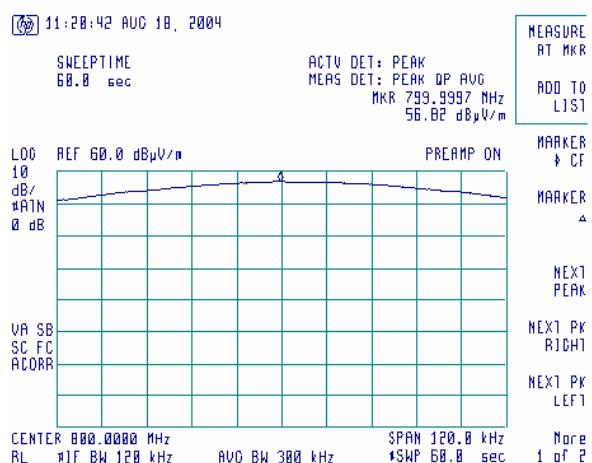
Plot 7.5.34 Radiated emission measurements at the 5<sup>th</sup> harmonic

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



#### Plot 7.5.35 Radiated emission measurements at the 5<sup>th</sup> harmonic

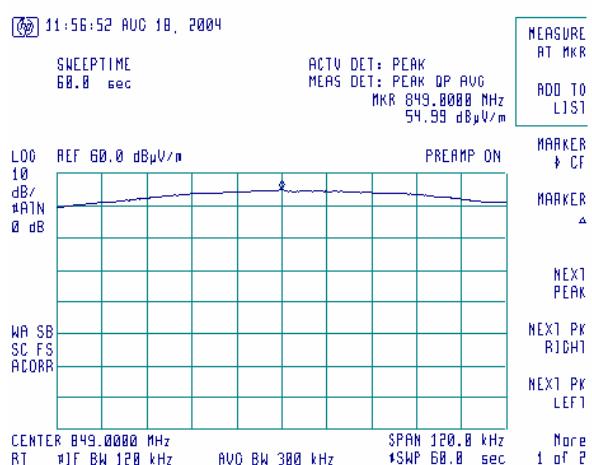
TEST SITE: OATS  
CARRIER FREQUENCY: 160 MHz  
ANTENNA POLARIZATION: Vertical  
TEST DISTANCE: 3 m



<b>Test specification:</b>	<b>Section 90.210, Radiated spurious emissions</b>		
<b>Test procedure:</b>	47 CFR, Sections 2.1053 and 90.210(m); TIA/EIA-603-A, Section 2.2.12		
<b>Test mode:</b>	Compliance	<b>Verdict:</b>	
<b>Date &amp; Time:</b>	8/31/2004 3:04:26 PM	<b>PASS</b>	
<b>Temperature:</b> 25 °C	<b>Air Pressure:</b> 1001 hPa	<b>Relative Humidity:</b> 44 %	<b>Power Supply:</b> 3.6 VDC
<b>Remarks:</b>			

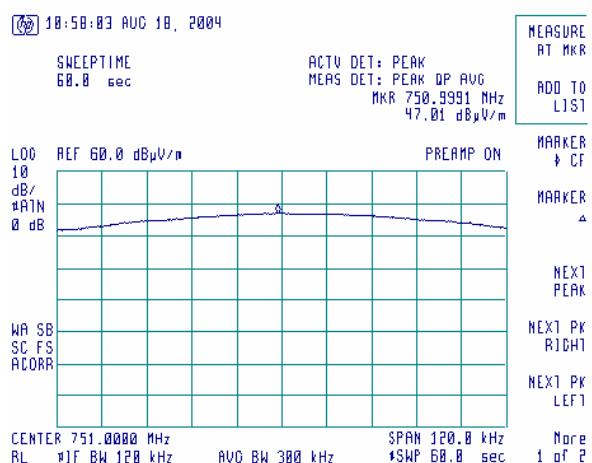
**Plot 7.5.36 Radiated emission measurements at the 5<sup>th</sup> harmonic**

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



**Plot 7.5.37 Radiated emission measurements at the 5<sup>th</sup> harmonic**

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

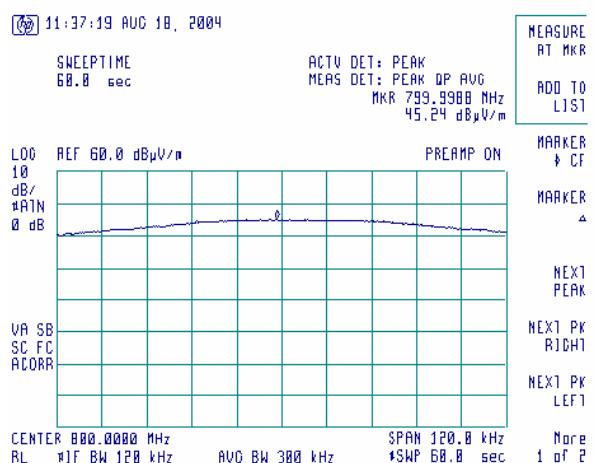




<b>Test specification:</b>	<b>Section 90.210, Radiated spurious emissions</b>		
<b>Test procedure:</b>	47 CFR, Sections 2.1053 and 90.210(m); TIA/EIA-603-A, Section 2.2.12		
<b>Test mode:</b>	Compliance	<b>Verdict:</b>	PASS
<b>Date &amp; Time:</b>	8/31/2004 3:04:26 PM		
<b>Temperature:</b> 25 °C	<b>Air Pressure:</b> 1001 hPa	<b>Relative Humidity:</b> 44 %	<b>Power Supply:</b> 3.6 VDC
<b>Remarks:</b>			

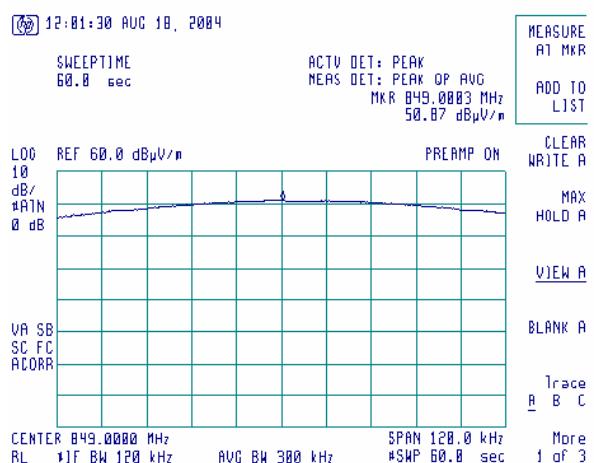
#### Plot 7.5.38 Radiated emission measurements at the 5<sup>th</sup> harmonic

TEST SITE: OATS  
CARRIER FREQUENCY: 160 MHz  
ANTENNA POLARIZATION: Horizontal  
TEST DISTANCE: 3 m



#### Plot 7.5.39 Radiated emission measurements at the 5<sup>th</sup> harmonic

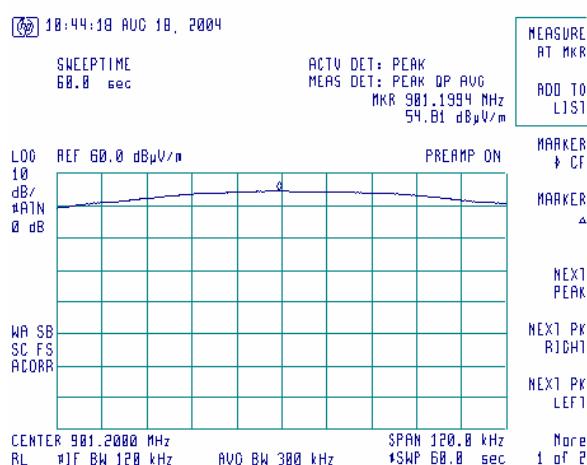
TEST SITE: OATS  
CARRIER FREQUENCY: 169.8 MHz  
ANTENNA POLARIZATION: Horizontal  
TEST DISTANCE: 3 m



<b>Test specification:</b>	<b>Section 90.210, Radiated spurious emissions</b>		
<b>Test procedure:</b>	47 CFR, Sections 2.1053 and 90.210(m); TIA/EIA-603-A, Section 2.2.12		
<b>Test mode:</b>	Compliance	<b>Verdict:</b>	
<b>Date &amp; Time:</b>	8/31/2004 3:04:26 PM	<b>PASS</b>	
<b>Temperature:</b> 25 °C	<b>Air Pressure:</b> 1001 hPa	<b>Relative Humidity:</b> 44 %	<b>Power Supply:</b> 3.6 VDC
<b>Remarks:</b>			

**Plot 7.5.40 Radiated emission measurements at the 6<sup>th</sup> harmonic**

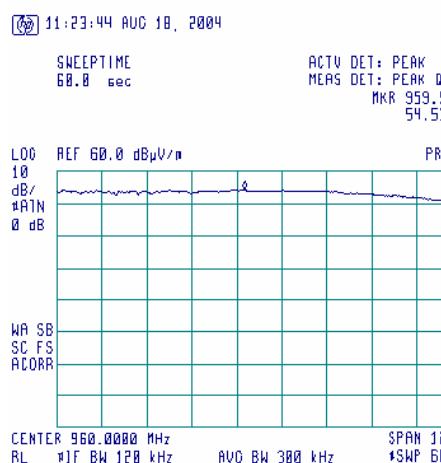
TEST SITE: OATS  
CARRIER FREQUENCY: 150.2 MHz  
ANTENNA POLARIZATION: Vertical  
TEST DISTANCE: 3 m



MEASURE AT MKR  
ADD TO LIST  
MARKER ▲ CF  
MARKER ▲  
NEXT PEAK  
NEXT PK RIGHT  
NEXT PK LEFT  
More  
1 of 2

**Plot 7.5.41 Radiated emission measurements at the 6<sup>th</sup> harmonic**

TEST SITE: OATS  
CARRIER FREQUENCY: 160 MHz  
ANTENNA POLARIZATION: Vertical  
TEST DISTANCE: 3 m

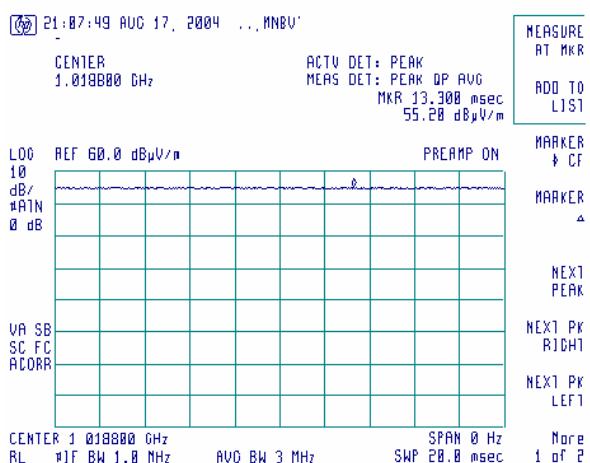


MEASURE AT MKR  
ADD TO LIST  
MARKER ▲ CF  
MARKER ▲  
NEXT PEAK  
NEXT PK RIGHT  
NEXT PK LEFT  
More  
1 of 2

<b>Test specification:</b>	<b>Section 90.210, Radiated spurious emissions</b>		
<b>Test procedure:</b>	47 CFR, Sections 2.1053 and 90.210(m); TIA/EIA-603-A, Section 2.2.12		
<b>Test mode:</b>	Compliance	<b>Verdict:</b>	
<b>Date &amp; Time:</b>	8/31/2004 3:04:26 PM	<b>PASS</b>	
<b>Temperature:</b> 25 °C	<b>Air Pressure:</b> 1001 hPa	<b>Relative Humidity:</b> 44 %	<b>Power Supply:</b> 3.6 VDC
<b>Remarks:</b>			

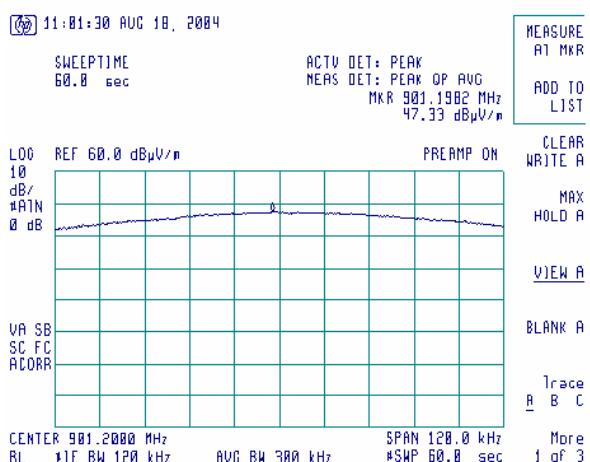
**Plot 7.5.42 Radiated emission measurements at the 6<sup>th</sup> harmonic**

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

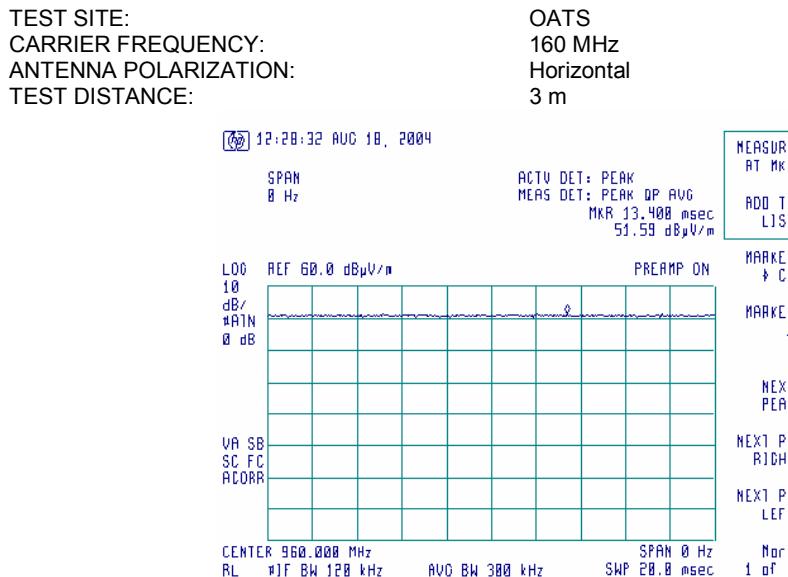


**Plot 7.5.43 Radiated emission measurements at the 6<sup>th</sup> harmonic**

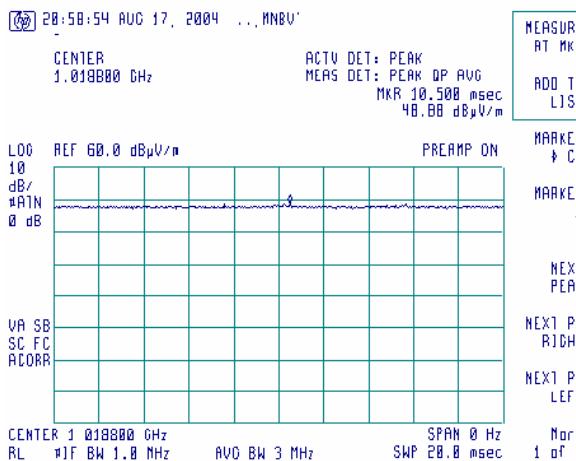
TEST SITE: OATS  
CARRIER FREQUENCY: 150.2 MHz  
ANTENNA POLARIZATION: Horizontal  
TEST DISTANCE: 3 m



<b>Test specification:</b>	<b>Section 90.210, Radiated spurious emissions</b>		
<b>Test procedure:</b>	47 CFR, Sections 2.1053 and 90.210(m); TIA/EIA-603-A, Section 2.2.12		
<b>Test mode:</b>	Compliance	<b>Verdict:</b>	
<b>Date &amp; Time:</b>	8/31/2004 3:04:26 PM	<b>PASS</b>	
<b>Temperature:</b> 25 °C	<b>Air Pressure:</b> 1001 hPa	<b>Relative Humidity:</b> 44 %	<b>Power Supply:</b> 3.6 VDC
<b>Remarks:</b>			

 Plot 7.5.44 Radiated emission measurements at the 6<sup>th</sup> harmonic

 Plot 7.5.45 Radiated emission measurements at the 6<sup>th</sup> harmonic

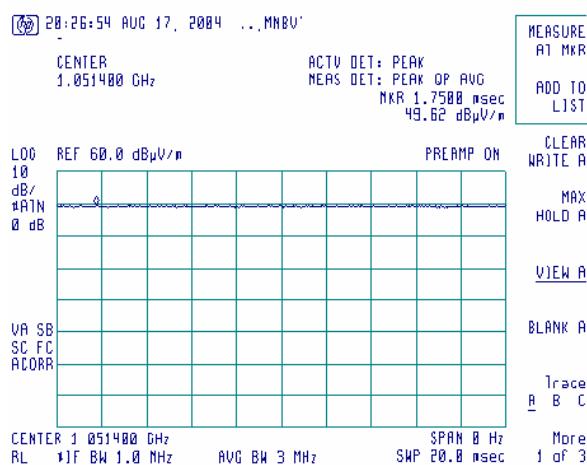
TEST SITE: OATS  
 CARRIER FREQUENCY: 169.8 MHz  
 ANTENNA POLARIZATION: Horizontal  
 TEST DISTANCE: 3 m



<b>Test specification:</b>	<b>Section 90.210, Radiated spurious emissions</b>		
<b>Test procedure:</b>	47 CFR, Sections 2.1053 and 90.210(m); TIA/EIA-603-A, Section 2.2.12		
<b>Test mode:</b>	Compliance	<b>Verdict:</b>	
<b>Date &amp; Time:</b>	8/31/2004 3:04:26 PM	<b>PASS</b>	
<b>Temperature:</b> 25 °C	<b>Air Pressure:</b> 1001 hPa	<b>Relative Humidity:</b> 44 %	<b>Power Supply:</b> 3.6 VDC
<b>Remarks:</b>			

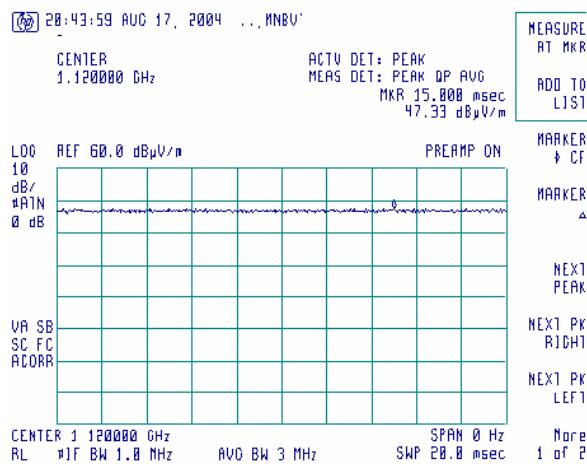
**Plot 7.5.46 Radiated emission measurements at the 7<sup>th</sup> harmonic**

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



**Plot 7.5.47 Radiated emission measurements at the 7<sup>th</sup> harmonic**

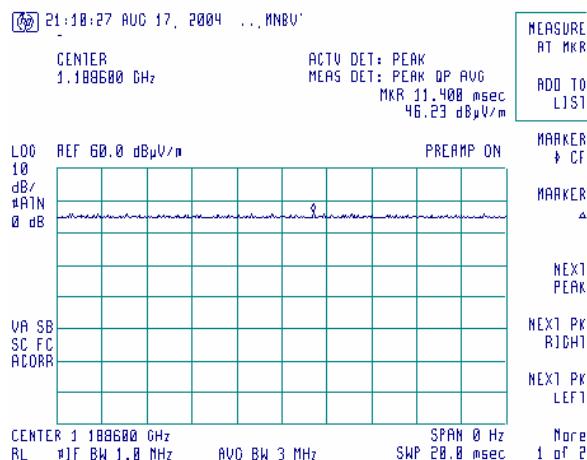
TEST SITE: OATS  
CARRIER FREQUENCY: 160 MHz  
ANTENNA POLARIZATION: Vertical  
TEST DISTANCE: 3 m



<b>Test specification:</b>	<b>Section 90.210, Radiated spurious emissions</b>		
<b>Test procedure:</b>	47 CFR, Sections 2.1053 and 90.210(m); TIA/EIA-603-A, Section 2.2.12		
<b>Test mode:</b>	Compliance	<b>Verdict:</b> <b>PASS</b>	
<b>Date &amp; Time:</b>	8/31/2004 3:04:26 PM		
<b>Temperature:</b> 25 °C	<b>Air Pressure:</b> 1001 hPa	<b>Relative Humidity:</b> 44 %	<b>Power Supply:</b> 3.6 VDC
<b>Remarks:</b>			

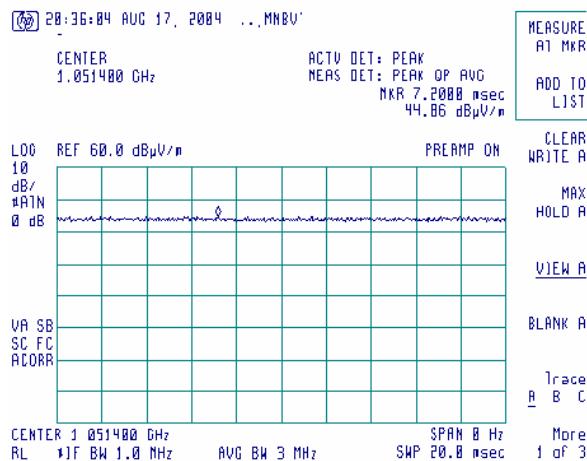
**Plot 7.5.48 Radiated emission measurements at the 7<sup>th</sup> harmonic**

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



**Plot 7.5.49 Radiated emission measurements at the 7<sup>th</sup> harmonic**

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

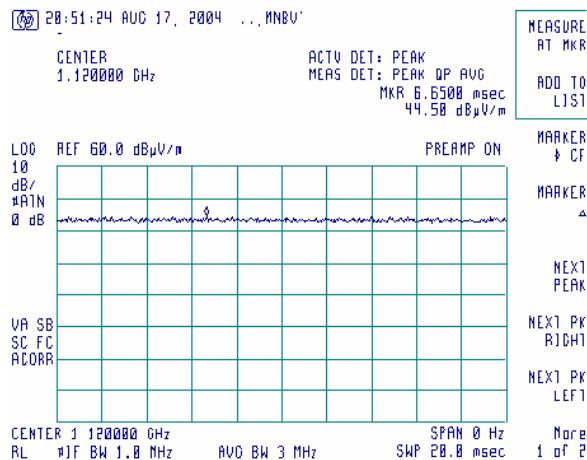




<b>Test specification:</b>	<b>Section 90.210, Radiated spurious emissions</b>		
<b>Test procedure:</b>	47 CFR, Sections 2.1053 and 90.210(m); TIA/EIA-603-A, Section 2.2.12		
<b>Test mode:</b>	Compliance	<b>Verdict:</b>	PASS
<b>Date &amp; Time:</b>	8/31/2004 3:04:26 PM		
<b>Temperature:</b> 25 °C	<b>Air Pressure:</b> 1001 hPa	<b>Relative Humidity:</b> 44 %	<b>Power Supply:</b> 3.6 VDC
<b>Remarks:</b>			

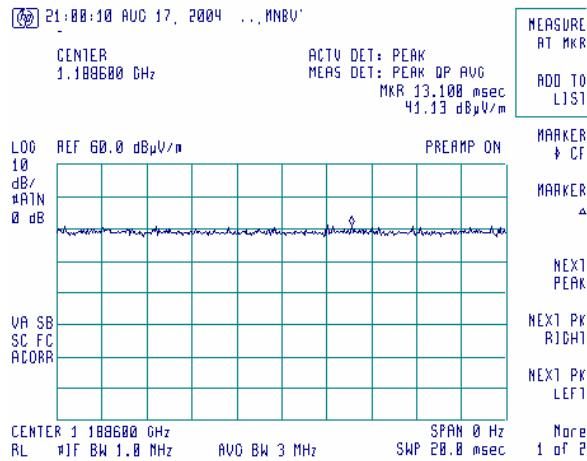
### Plot 7.5.50 Radiated emission measurements at the 7<sup>th</sup> harmonic

TEST SITE: OATS  
CARRIER FREQUENCY: 160 MHz  
ANTENNA POLARIZATION: Horizontal  
TEST DISTANCE: 3 m



### Plot 7.5.51 Radiated emission measurements at the 7<sup>th</sup> harmonic

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

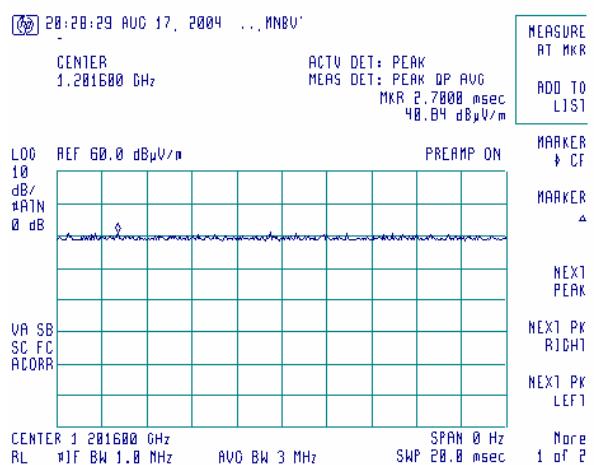




<b>Test specification:</b>	<b>Section 90.210, Radiated spurious emissions</b>		
<b>Test procedure:</b>	47 CFR, Sections 2.1053 and 90.210(m); TIA/EIA-603-A, Section 2.2.12		
<b>Test mode:</b>	Compliance	<b>Verdict:</b>	<b>PASS</b>
<b>Date &amp; Time:</b>	8/31/2004 3:04:26 PM		
<b>Temperature:</b> 25 °C	<b>Air Pressure:</b> 1001 hPa	<b>Relative Humidity:</b> 44 %	<b>Power Supply:</b> 3.6 VDC
<b>Remarks:</b>			

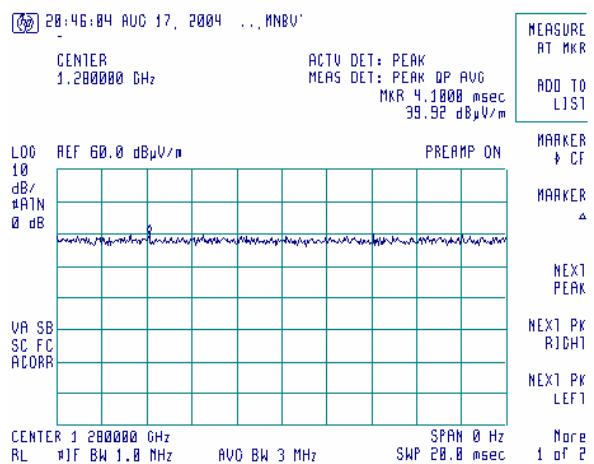
Plot 7.5.52 Radiated emission measurements at the 8<sup>th</sup> harmonic

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



Plot 7.5.53 Radiated emission measurements at the 8<sup>th</sup> harmonic

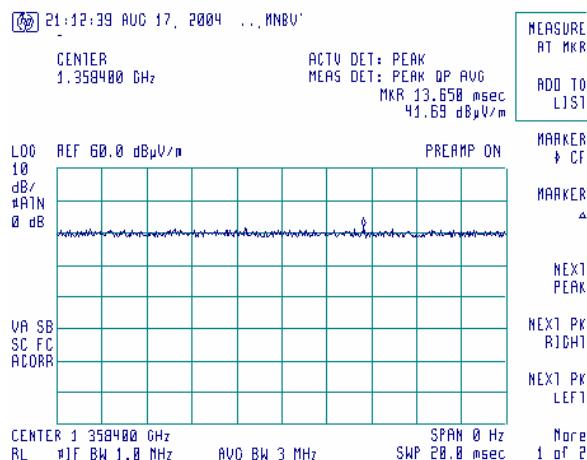
TEST SITE: OATS  
CARRIER FREQUENCY: 160 MHz  
ANTENNA POLARIZATION: Vertical  
TEST DISTANCE: 3 m



<b>Test specification:</b>	<b>Section 90.210, Radiated spurious emissions</b>		
<b>Test procedure:</b>	47 CFR, Sections 2.1053 and 90.210(m); TIA/EIA-603-A, Section 2.2.12		
<b>Test mode:</b>	Compliance	<b>Verdict:</b> <b>PASS</b>	
<b>Date &amp; Time:</b>	8/31/2004 3:04:26 PM		
<b>Temperature:</b> 25 °C	<b>Air Pressure:</b> 1001 hPa	<b>Relative Humidity:</b> 44 %	<b>Power Supply:</b> 3.6 VDC
<b>Remarks:</b>			

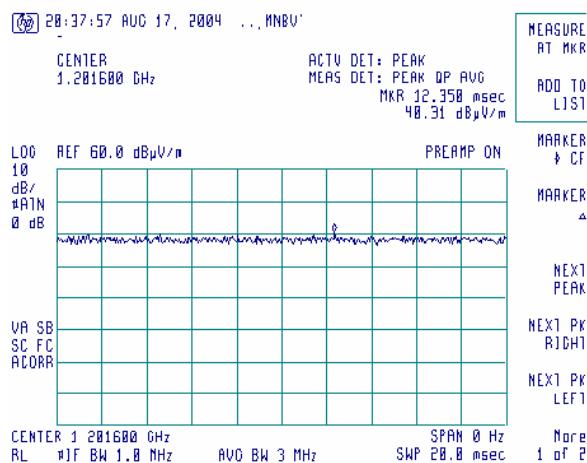
**Plot 7.5.54 Radiated emission measurements at the 8<sup>th</sup> harmonic**

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



**Plot 7.5.55 Radiated emission measurements at the 8<sup>th</sup> harmonic**

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

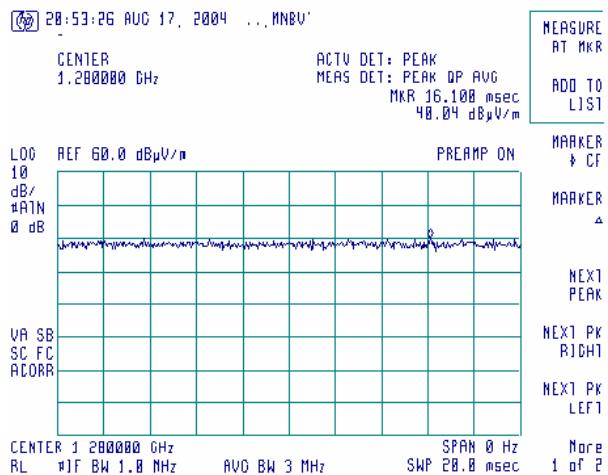




<b>Test specification:</b>	<b>Section 90.210, Radiated spurious emissions</b>		
<b>Test procedure:</b>	47 CFR, Sections 2.1053 and 90.210(m); TIA/EIA-603-A, Section 2.2.12		
<b>Test mode:</b>	Compliance	<b>Verdict:</b>	PASS
<b>Date &amp; Time:</b>	8/31/2004 3:04:26 PM		
<b>Temperature:</b> 25 °C	<b>Air Pressure:</b> 1001 hPa	<b>Relative Humidity:</b> 44 %	<b>Power Supply:</b> 3.6 VDC
<b>Remarks:</b>			

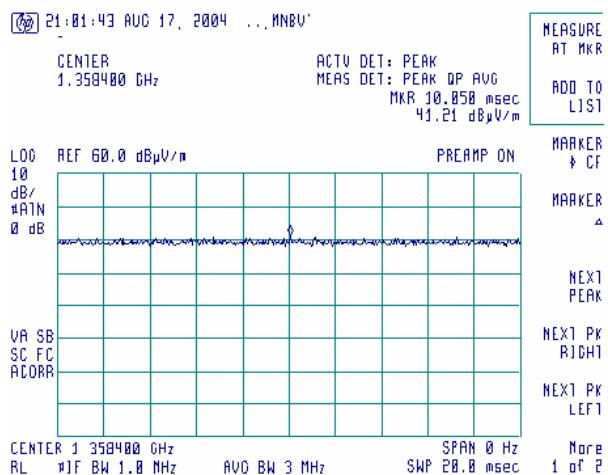
#### Plot 7.5.56 Radiated emission measurements at the 8<sup>th</sup> harmonic

TEST SITE: OATS  
CARRIER FREQUENCY: 160 MHz  
ANTENNA POLARIZATION: Horizontal  
TEST DISTANCE: 3 m



#### Plot 7.5.57 Radiated emission measurements at the 8<sup>th</sup> harmonic

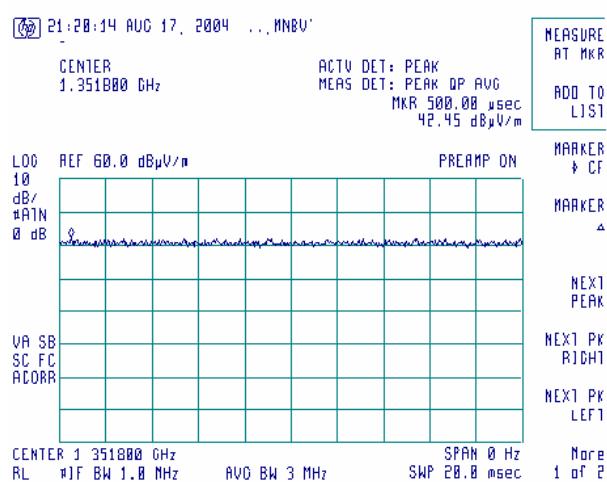
TEST SITE: OATS  
CARRIER FREQUENCY: 169.8 MHz  
ANTENNA POLARIZATION: Horizontal  
TEST DISTANCE: 3 m



<b>Test specification:</b>	<b>Section 90.210, Radiated spurious emissions</b>		
<b>Test procedure:</b>	47 CFR, Sections 2.1053 and 90.210(m); TIA/EIA-603-A, Section 2.2.12		
<b>Test mode:</b>	Compliance	<b>Verdict:</b>	
<b>Date &amp; Time:</b>	8/31/2004 3:04:26 PM	<b>PASS</b>	
<b>Temperature:</b> 25 °C	<b>Air Pressure:</b> 1001 hPa	<b>Relative Humidity:</b> 44 %	<b>Power Supply:</b> 3.6 VDC
<b>Remarks:</b>			

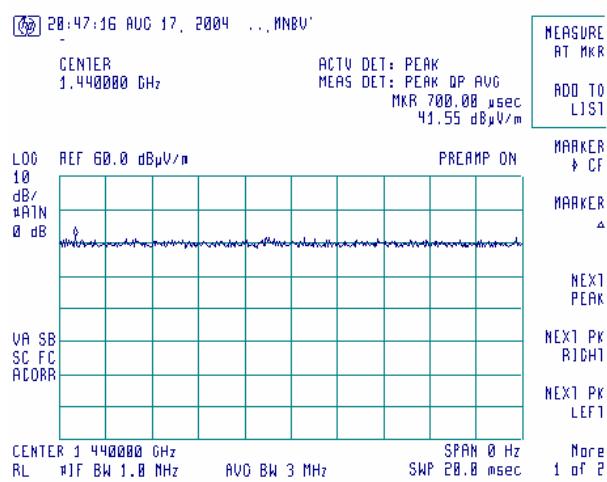
**Plot 7.5.58 Radiated emission measurements at the 9<sup>th</sup> harmonic**

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



**Plot 7.5.59 Radiated emission measurements at the 9<sup>th</sup> harmonic**

TEST SITE: OATS  
CARRIER FREQUENCY: 160 MHz  
ANTENNA POLARIZATION: Vertical  
TEST DISTANCE: 3 m

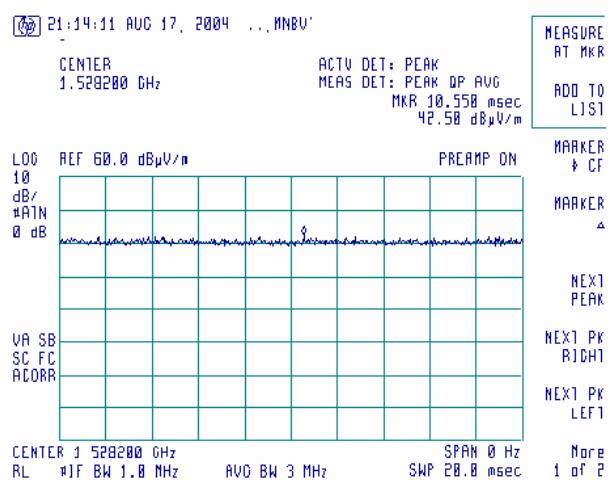




<b>Test specification:</b>	<b>Section 90.210, Radiated spurious emissions</b>		
<b>Test procedure:</b>	47 CFR, Sections 2.1053 and 90.210(m); TIA/EIA-603-A, Section 2.2.12		
<b>Test mode:</b>	Compliance	<b>Verdict:</b>	PASS
<b>Date &amp; Time:</b>	8/31/2004 3:04:26 PM		
<b>Temperature:</b> 25 °C	<b>Air Pressure:</b> 1001 hPa	<b>Relative Humidity:</b> 44 %	<b>Power Supply:</b> 3.6 VDC
<b>Remarks:</b>			

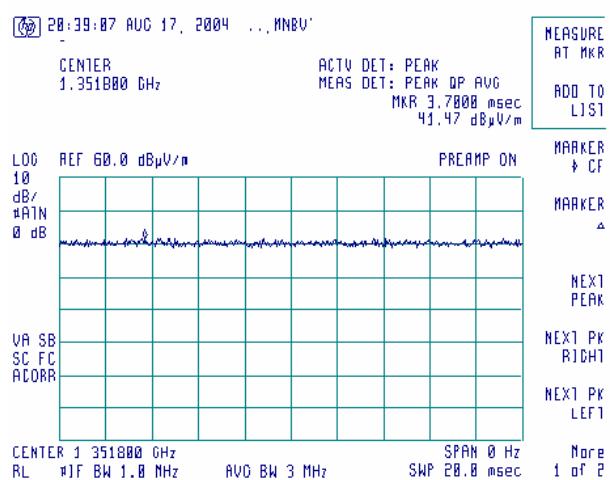
#### Plot 7.5.60 Radiated emission measurements at the 9<sup>th</sup> harmonic

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



Plot 7.5.61 Radiated emission measurements at the 9<sup>th</sup> harmonic

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

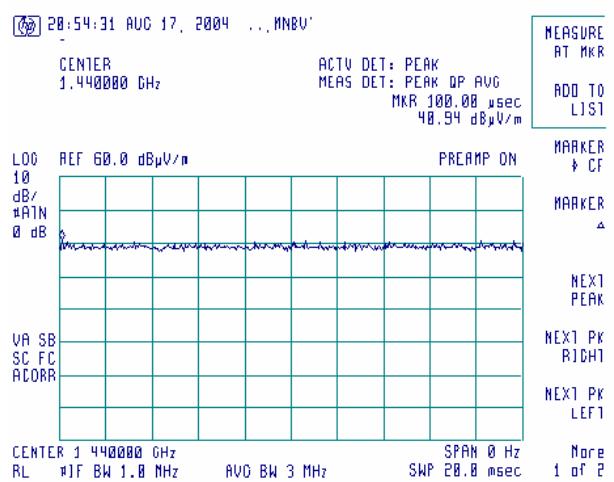




<b>Test specification:</b>	<b>Section 90.210, Radiated spurious emissions</b>		
<b>Test procedure:</b>	47 CFR, Sections 2.1053 and 90.210(m); TIA/EIA-603-A, Section 2.2.12		
<b>Test mode:</b>	Compliance	<b>Verdict:</b>	PASS
<b>Date &amp; Time:</b>	8/31/2004 3:04:26 PM		
<b>Temperature:</b> 25 °C	<b>Air Pressure:</b> 1001 hPa	<b>Relative Humidity:</b> 44 %	<b>Power Supply:</b> 3.6 VDC
<b>Remarks:</b>			

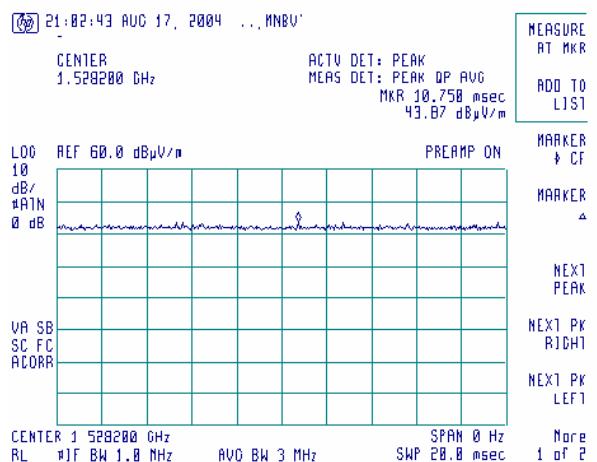
#### Plot 7.5.62 Radiated emission measurements at the 9<sup>th</sup> harmonic

TEST SITE: OATS  
CARRIER FREQUENCY: 160 MHz  
ANTENNA POLARIZATION: Horizontal  
TEST DISTANCE: 3 m



#### Plot 7.5.63 Radiated emission measurements at the 9<sup>th</sup> harmonic

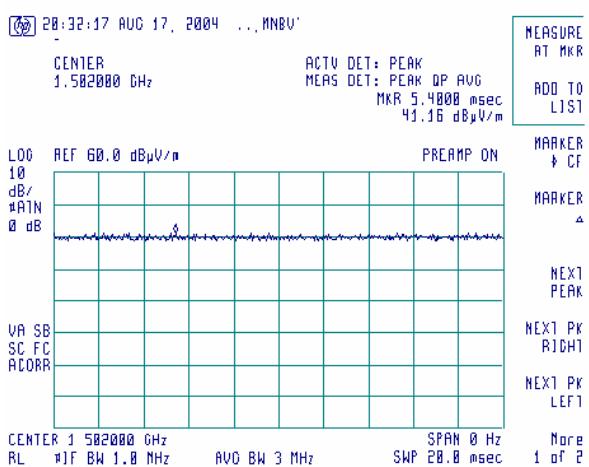
TEST SITE: OATS  
CARRIER FREQUENCY: 169.8 MHz  
ANTENNA POLARIZATION: Horizontal  
TEST DISTANCE: 3 m



<b>Test specification:</b>	<b>Section 90.210, Radiated spurious emissions</b>		
<b>Test procedure:</b>	47 CFR, Sections 2.1053 and 90.210(m); TIA/EIA-603-A, Section 2.2.12		
<b>Test mode:</b>	Compliance	<b>Verdict:</b>	
<b>Date &amp; Time:</b>	8/31/2004 3:04:26 PM	<b>PASS</b>	
<b>Temperature:</b> 25 °C	<b>Air Pressure:</b> 1001 hPa	<b>Relative Humidity:</b> 44 %	<b>Power Supply:</b> 3.6 VDC
<b>Remarks:</b>			

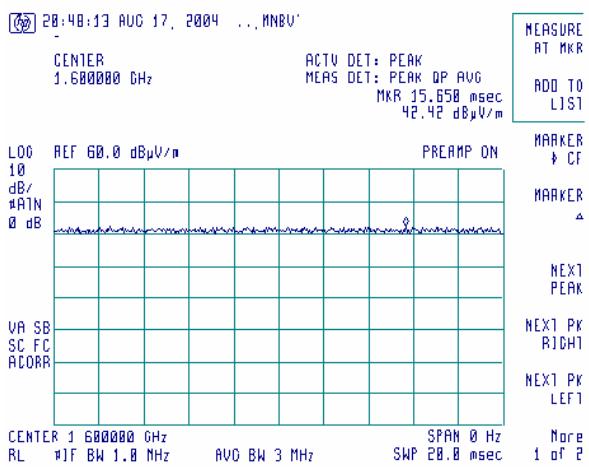
**Plot 7.5.64 Radiated emission measurements at the 10<sup>th</sup> harmonic**

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



**Plot 7.5.65 Radiated emission measurements at the 10<sup>th</sup> harmonic**

TEST SITE: OATS  
CARRIER FREQUENCY: 160 MHz  
ANTENNA POLARIZATION: Vertical  
TEST DISTANCE: 3 m

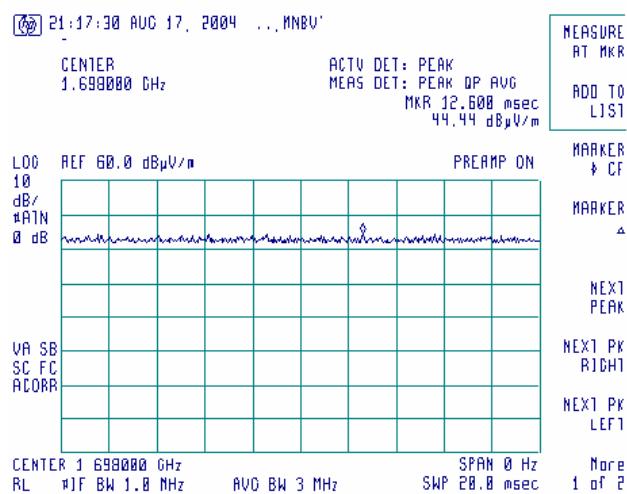


<b>Test specification:</b>	<b>Section 90.210, Radiated spurious emissions</b>		
<b>Test procedure:</b>	47 CFR, Sections 2.1053 and 90.210(m); TIA/EIA-603-A, Section 2.2.12		
<b>Test mode:</b>	Compliance	<b>Verdict:</b>	
<b>Date &amp; Time:</b>	8/31/2004 3:04:26 PM	<b>PASS</b>	
<b>Temperature:</b> 25 °C	<b>Air Pressure:</b> 1001 hPa	<b>Relative Humidity:</b> 44 %	<b>Power Supply:</b> 3.6 VDC
<b>Remarks:</b>			

**Plot 7.5.66 Radiated emission measurements at the 10<sup>th</sup> harmonic**

TEST SITE:  
CARRIER FREQUENCY:  
ANTENNA POLARIZATION:  
TEST DISTANCE:

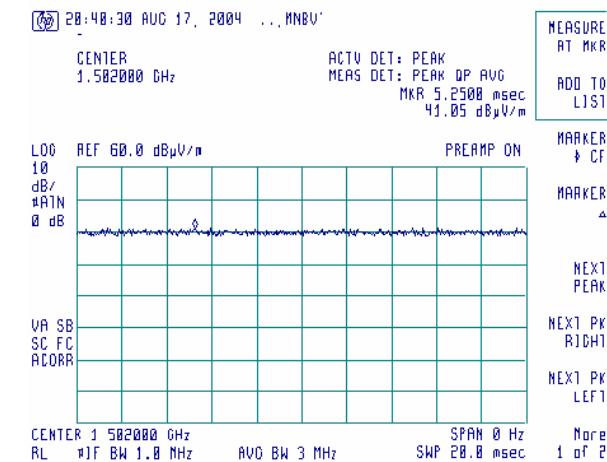
OATS  
169.8 MHz  
Vertical  
3 m



**Plot 7.5.67 Radiated emission measurements at the 10<sup>th</sup> harmonic**

TEST SITE:  
CARRIER FREQUENCY:  
ANTENNA POLARIZATION:  
TEST DISTANCE:

OATS  
150.2 MHz  
Horizontal  
3 m

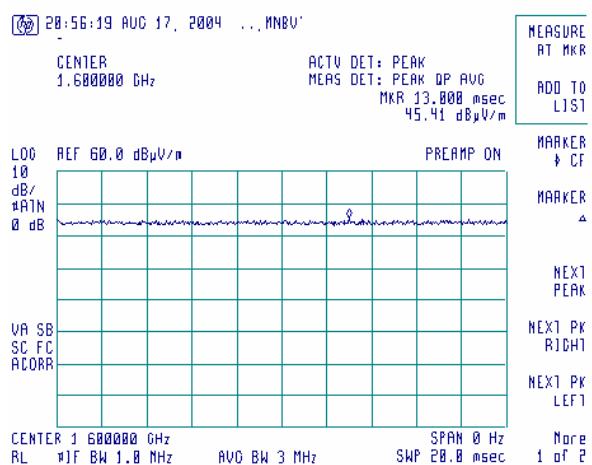




<b>Test specification:</b>	<b>Section 90.210, Radiated spurious emissions</b>		
<b>Test procedure:</b>	47 CFR, Sections 2.1053 and 90.210(m); TIA/EIA-603-A, Section 2.2.12		
<b>Test mode:</b>	Compliance	<b>Verdict:</b>	PASS
<b>Date &amp; Time:</b>	8/31/2004 3:04:26 PM		
<b>Temperature:</b> 25 °C	<b>Air Pressure:</b> 1001 hPa	<b>Relative Humidity:</b> 44 %	<b>Power Supply:</b> 3.6 VDC
<b>Remarks:</b>			

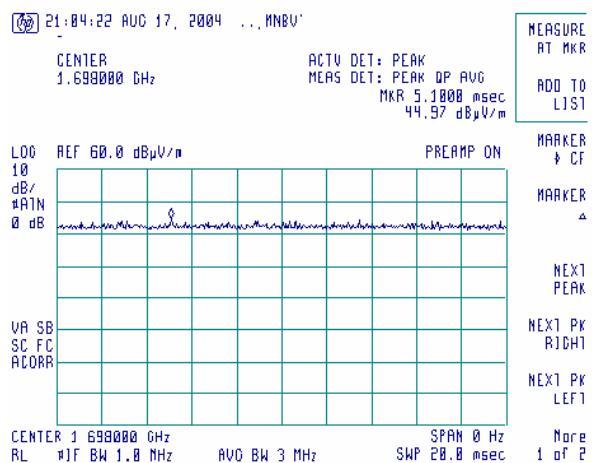
Plot 7.5.68 Radiated emission measurements at the 10<sup>th</sup> harmonic

TEST SITE: OATS  
CARRIER FREQUENCY: 160 MHz  
ANTENNA POLARIZATION: Horizontal  
TEST DISTANCE: 3 m



### Plot 7.5.69 Radiated emission measurements at the 10<sup>th</sup> harmonic

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



<b>Test specification:</b>	<b>Section 90.210, Conducted spurious emissions</b>		
<b>Test procedure:</b>	47 CFR, Sections 2.1051 and 90.210(m); TIA/EIA-603-A, Section 2.2.13		
<b>Test mode:</b>	Compliance	<b>Verdict:</b>	
<b>Date &amp; Time:</b>	7/23/2004 1:21:10 PM	<b>PASS</b>	
<b>Temperature:</b> 26 °C	<b>Air Pressure:</b> 1006 hPa	<b>Relative Humidity:</b> 39 %	<b>Power Supply:</b>
<b>Remarks:</b>			

## 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 – 10 <sup>th</sup> harmonic*	43+10logP**	-13.0
FCC 90.217		
0.009 – 10 <sup>th</sup> harmonic*	30	-11.0

\* - spurious emission limits do not apply to the in band emission within  $\pm 250$  % 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**



<b>Test specification:</b>	<b>Section 90.210, Conducted spurious emissions</b>		
<b>Test procedure:</b>	47 CFR, Sections 2.1051 and 90.210(m); TIA/EIA-603-A, Section 2.2.13		
<b>Test mode:</b>	Compliance	<b>Verdict:</b>	
<b>Date &amp; Time:</b>	7/23/2004 1:21:10 PM	<b>PASS</b>	
<b>Temperature:</b> 26 °C	<b>Air Pressure:</b> 1006 hPa	<b>Relative Humidity:</b> 39 %	<b>Power Supply:</b>
<b>Remarks:</b>			

**Table 7.6.2 Spurious emission test results**

ASSIGNED FREQUENCY RANGE: 150 – 170 MHz  
 INVESTIGATED FREQUENCY RANGE: 0.009 – 2000 MHz  
 DETECTOR USED: Peak  
 VIDEO BANDWIDTH: Off  
 MODULATION: FSK  
 BIT RATE: 600 bps  
 TRANSMITTER OUTPUT POWER SETTINGS: Maximum  
 TRANSMITTER OUTPUT POWER: 16.04 dBm at 150.2 MHz  
 16.04 dBm at 160.0 MHz  
 16.25 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
<b>150.2 MHz carrier frequency</b>									
300.4	-65.64	30	0.2	10	-35.4	51.4	30	21.4	Pass
450.6	-68.15	30.1	0.2	10	-37.9	53.9	30	23.9	Pass
<b>160.0 MHz carrier frequency</b>									
320	-76.59	30	0.2	10	-46.4	62.4	30	32.4	Pass
480	-67.38	30.1	0.2	10	-37.1	53.1	30	23.1	Pass
<b>169.8 MHz carrier frequency</b>									
339.6	-71.48	30	0.2	10	-41.3	57.3	30	27.3	Pass
509.4	-67.94	30.1	0.2	10	-37.6	53.6	30	23.6	Pass

\*- Margin = Spurious emission – specification limit.

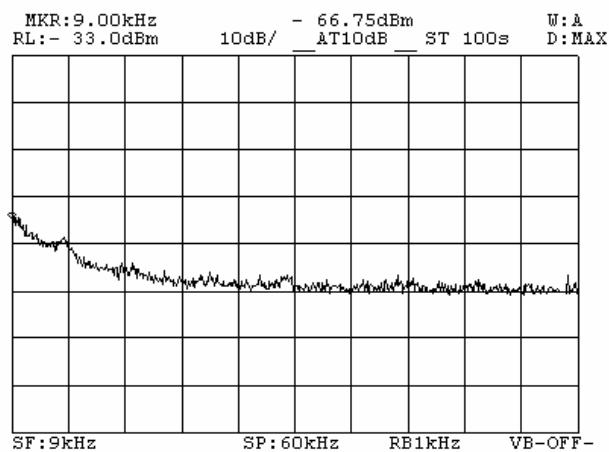
**Reference numbers of test equipment used**

HL 0026	HL 0810	HL 1652	HL 2107				
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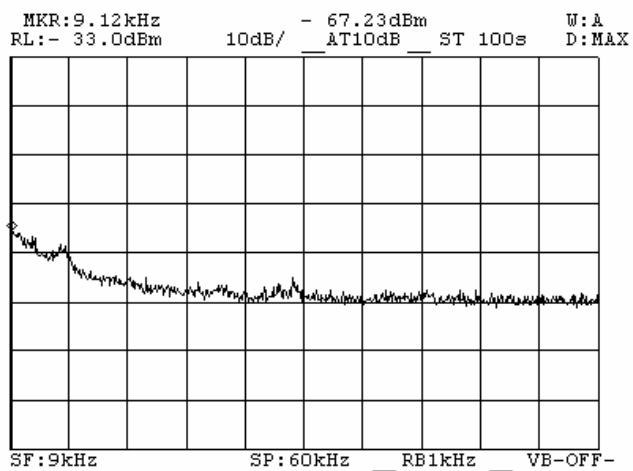
Full description is given in Appendix A.

<b>Test specification:</b>	<b>Section 90.210, Conducted spurious emissions</b>		
<b>Test procedure:</b>	47 CFR, Sections 2.1051 and 90.210(m); TIA/EIA-603-A, Section 2.2.13		
<b>Test mode:</b>	Compliance	<b>Verdict:</b>	PASS
<b>Date &amp; Time:</b>	7/23/2004 1:21:10 PM	<b>Relative Humidity:</b>	39 %
<b>Temperature:</b> 26 °C	<b>Air Pressure:</b> 1006 hPa	<b>Power Supply:</b>	
<b>Remarks:</b>			

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

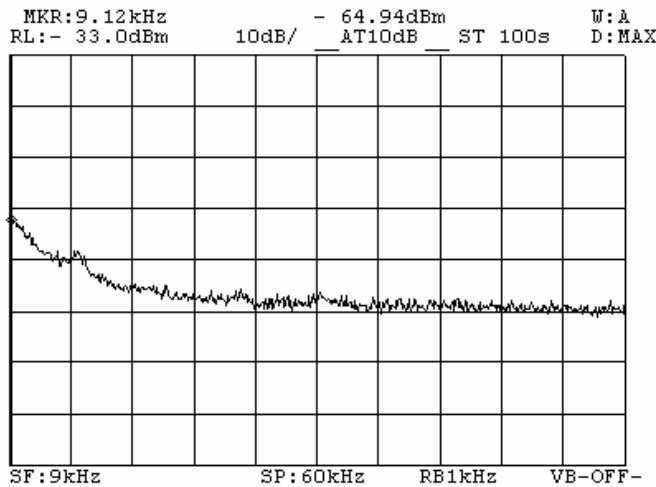


**Plot 7.6.2 Spurious emission measurements in 9 - 60 kHz range at 160.0 MHz carrier frequency**

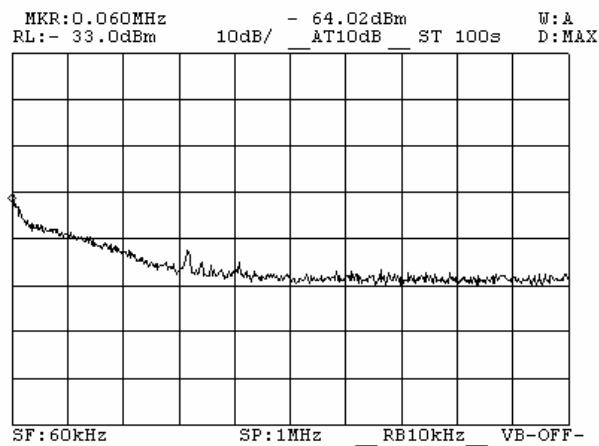


<b>Test specification:</b>	<b>Section 90.210, Conducted spurious emissions</b>		
<b>Test procedure:</b>	47 CFR, Sections 2.1051 and 90.210(m); TIA/EIA-603-A, Section 2.2.13		
<b>Test mode:</b>	Compliance	<b>Verdict:</b>	PASS
<b>Date &amp; Time:</b>	7/23/2004 1:21:10 PM	<b>Relative Humidity:</b>	39 %
<b>Temperature:</b> 26 °C	<b>Air Pressure:</b> 1006 hPa	<b>Power Supply:</b>	
<b>Remarks:</b>			

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

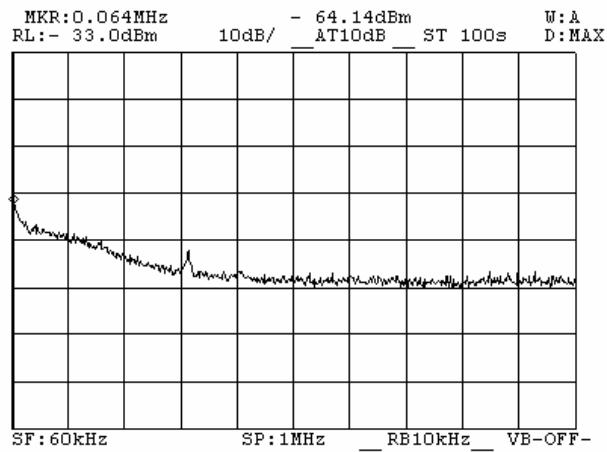


**Plot 7.6.4 Spurious emission measurements in 0.06 - 1.0 MHz range at 150.2 MHz carrier frequency**

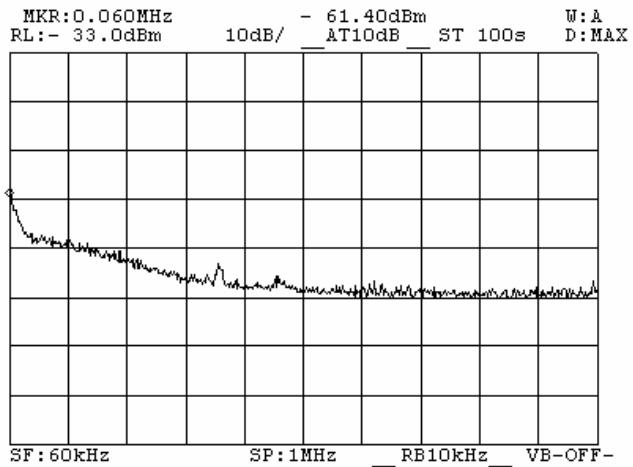


<b>Test specification:</b>	<b>Section 90.210, Conducted spurious emissions</b>		
<b>Test procedure:</b>	47 CFR, Sections 2.1051 and 90.210(m); TIA/EIA-603-A, Section 2.2.13		
<b>Test mode:</b>	Compliance	<b>Verdict:</b>	PASS
<b>Date &amp; Time:</b>	7/23/2004 1:21:10 PM	<b>Relative Humidity:</b>	39 %
<b>Temperature:</b> 26 °C	<b>Air Pressure:</b> 1006 hPa	<b>Power Supply:</b>	
<b>Remarks:</b>			

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

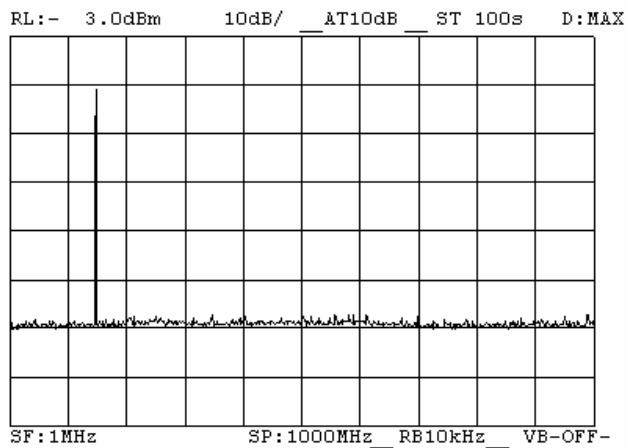


**Plot 7.6.6 Spurious emission measurements in 0.06 – 1.0 MHz range at 169.8 MHz carrier frequency**

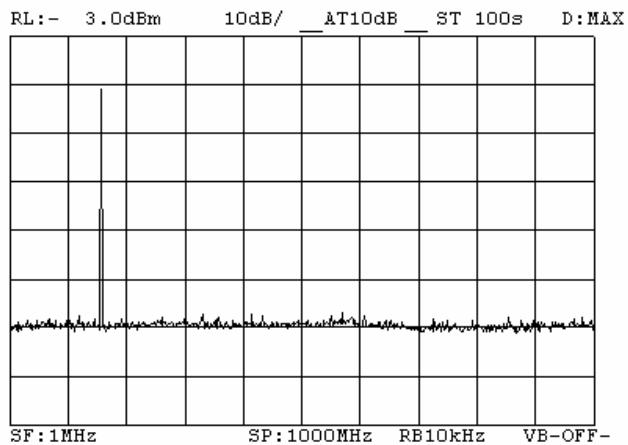


<b>Test specification:</b>	<b>Section 90.210, Conducted spurious emissions</b>		
<b>Test procedure:</b>	47 CFR, Sections 2.1051 and 90.210(m); TIA/EIA-603-A, Section 2.2.13		
<b>Test mode:</b>	Compliance	<b>Verdict:</b>	
<b>Date &amp; Time:</b>	7/23/2004 1:21:10 PM	<b>PASS</b>	
<b>Temperature:</b> 26 °C	<b>Air Pressure:</b> 1006 hPa	<b>Relative Humidity:</b> 39 %	<b>Power Supply:</b>
<b>Remarks:</b>			

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

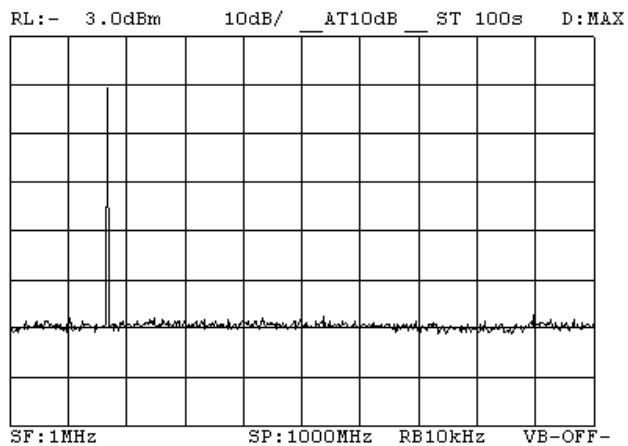


**Plot 7.6.8 Spurious emission measurements in 1.0 - 1000 MHz range at 160.0 MHz carrier frequency**

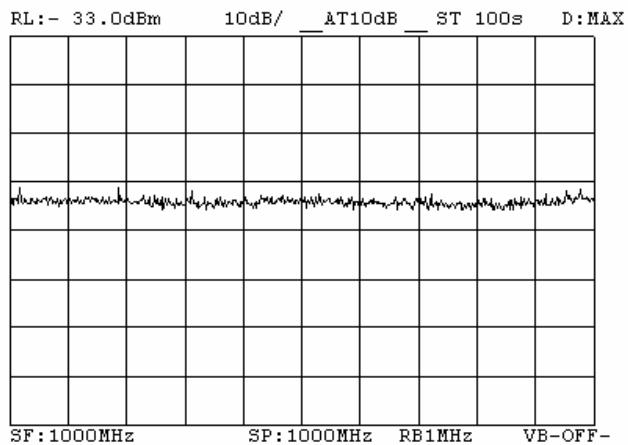


<b>Test specification:</b>	<b>Section 90.210, Conducted spurious emissions</b>		
<b>Test procedure:</b>	47 CFR, Sections 2.1051 and 90.210(m); TIA/EIA-603-A, Section 2.2.13		
<b>Test mode:</b>	Compliance	<b>Verdict:</b>	PASS
<b>Date &amp; Time:</b>	7/23/2004 1:21:10 PM	<b>Relative Humidity:</b>	39 %
<b>Temperature:</b> 26 °C	<b>Air Pressure:</b> 1006 hPa	<b>Power Supply:</b>	
<b>Remarks:</b>			

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

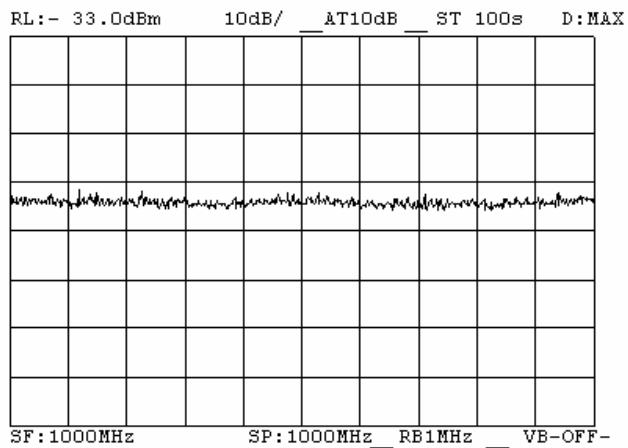


**Plot 7.6.10 Spurious emission measurements in 1000 - 2000 MHz range at 150.2 MHz carrier frequency**

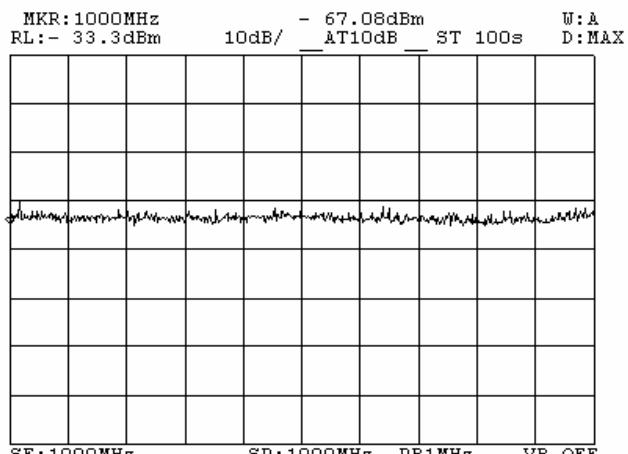


<b>Test specification:</b>	<b>Section 90.210, Conducted spurious emissions</b>		
<b>Test procedure:</b>	47 CFR, Sections 2.1051 and 90.210(m); TIA/EIA-603-A, Section 2.2.13		
<b>Test mode:</b>	Compliance	<b>Verdict:</b>	
<b>Date &amp; Time:</b>	7/23/2004 1:21:10 PM	<b>PASS</b>	
<b>Temperature:</b> 26 °C	<b>Air Pressure:</b> 1006 hPa	<b>Relative Humidity:</b> 39 %	<b>Power Supply:</b>
<b>Remarks:</b>			

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

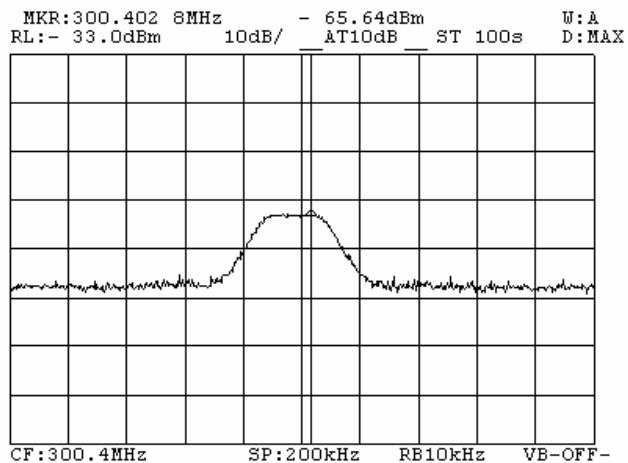


**Plot 7.6.12 Spurious emission measurements in 1000 - 2000 MHz at 169.8 MHz carrier frequency**

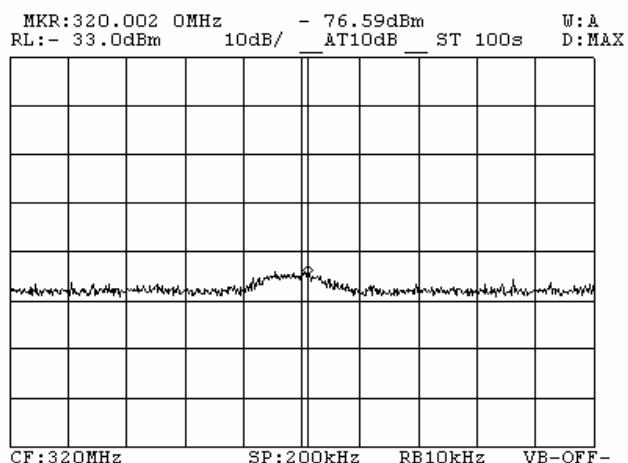


<b>Test specification:</b>	<b>Section 90.210, Conducted spurious emissions</b>		
<b>Test procedure:</b>	47 CFR, Sections 2.1051 and 90.210(m); TIA/EIA-603-A, Section 2.2.13		
<b>Test mode:</b>	Compliance	<b>Verdict:</b>	
<b>Date &amp; Time:</b>	7/23/2004 1:21:10 PM	<b>PASS</b>	
<b>Temperature:</b> 26 °C	<b>Air Pressure:</b> 1006 hPa	<b>Relative Humidity:</b> 39 %	<b>Power Supply:</b>
<b>Remarks:</b>			

**Plot 7.6.13 Conducted spurious emission measurements at the 2<sup>nd</sup> harmonic of 150.2 MHz carrier frequency**

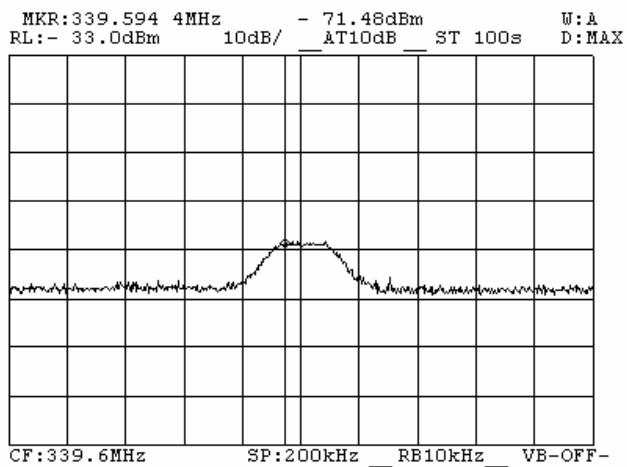


**Plot 7.6.14 Conducted spurious emission measurements at the 2<sup>nd</sup> harmonic of 160.0 MHz carrier frequency**

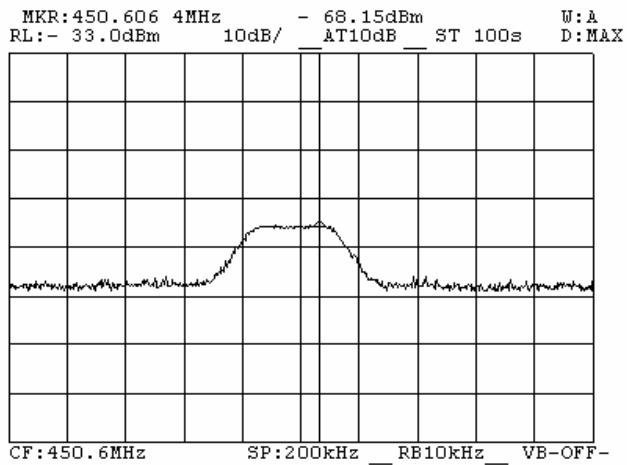


<b>Test specification:</b>	<b>Section 90.210, Conducted spurious emissions</b>		
<b>Test procedure:</b>	47 CFR, Sections 2.1051 and 90.210(m); TIA/EIA-603-A, Section 2.2.13		
<b>Test mode:</b>	Compliance	<b>Verdict:</b>	
<b>Date &amp; Time:</b>	7/23/2004 1:21:10 PM	<b>PASS</b>	
<b>Temperature:</b> 26 °C	<b>Air Pressure:</b> 1006 hPa	<b>Relative Humidity:</b> 39 %	<b>Power Supply:</b>
<b>Remarks:</b>			

**Plot 7.6.15 Conducted spurious emission measurements at the 2<sup>nd</sup> harmonic of 169.8 MHz carrier frequency**

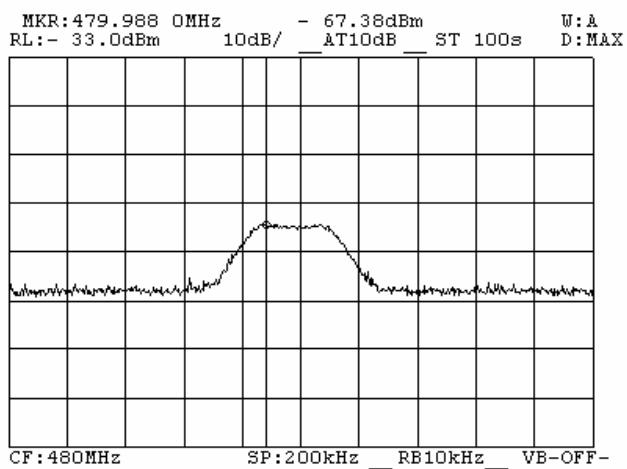


**Plot 7.6.16 Conducted spurious emission measurements at the 3<sup>rd</sup> harmonic of 150.2 MHz carrier frequency**

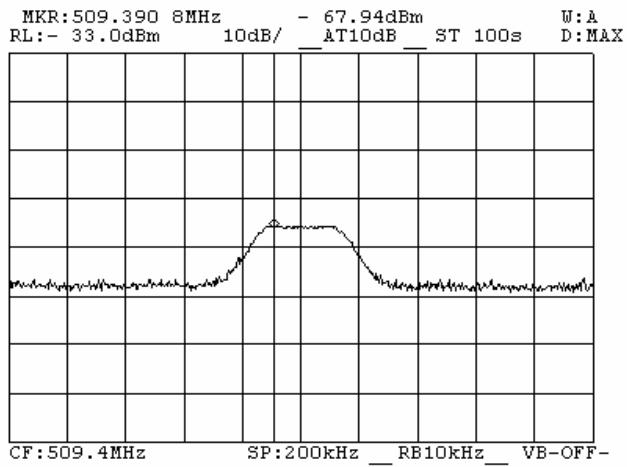


<b>Test specification:</b>	<b>Section 90.210, Conducted spurious emissions</b>		
<b>Test procedure:</b>	47 CFR, Sections 2.1051 and 90.210(m); TIA/EIA-603-A, Section 2.2.13		
<b>Test mode:</b>	Compliance	<b>Verdict:</b>	
<b>Date &amp; Time:</b>	7/23/2004 1:21:10 PM	<b>PASS</b>	
<b>Temperature:</b> 26 °C	<b>Air Pressure:</b> 1006 hPa	<b>Relative Humidity:</b> 39 %	<b>Power Supply:</b>
<b>Remarks:</b>			

**Plot 7.6.17 Conducted spurious emission measurements at the 3<sup>rd</sup> harmonic of 160.0 MHz carrier frequency**



**Plot 7.6.18 Conducted spurious emission measurements at the 3<sup>rd</sup> harmonic of 169.8 MHz carrier frequency**



<b>Test specification:</b>	<b>Section 90.213, Frequency stability</b>		
<b>Test procedure:</b>	47 CFR, Section 2.1055; TIA/EIA-603-A Section 2.2.2		
<b>Test mode:</b>	Compliance	<b>Verdict:</b>	PASS
<b>Date &amp; Time:</b>	7/25/2004 6:33:13 PM	<b>Relative Humidity:</b>	40 %
<b>Temperature:</b> 25 °C	<b>Air Pressure:</b> 1006 hPa	<b>Power Supply:</b>	
<b>Remarks:</b>			

## 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.

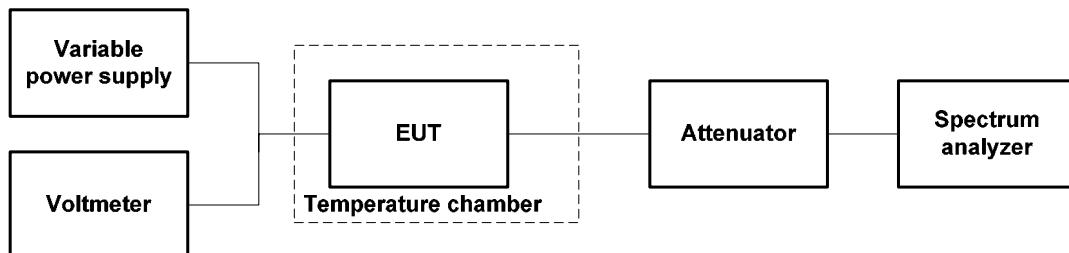
Table 7.7.1 Frequency stability limits

Assigned frequency, MHz	Maximum allowed frequency displacement	
	ppm	Hz
150 – 170	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



<b>Test specification:</b>	<b>Section 90.213, Frequency stability</b>		
<b>Test procedure:</b>	47 CFR, Section 2.1055; TIA/EIA-603-A Section 2.2.2		
<b>Test mode:</b>	Compliance	<b>Verdict:</b>	
<b>Date &amp; Time:</b>	7/25/2004 6:33:13 PM	<b>PASS</b>	
<b>Temperature:</b> 25 °C	<b>Air Pressure:</b> 1006 hPa	<b>Relative Humidity:</b> 40 %	<b>Power Supply:</b>
<b>Remarks:</b>			

Table 7.7.2 Frequency stability test results

ASSIGNED FREQUENCY BAND: 150 – 170 MHz  
 NOMINAL POWER VOLTAGE: 3.6 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, °C	Voltage, V	Frequency, MHz							Max frequency drift, Hz		Limit, Hz	Margin, Hz	Verdict
		Start up	1 <sup>st</sup> min	2 <sup>nd</sup> min	3 <sup>rd</sup> min	4 <sup>th</sup> min	5 <sup>th</sup> min	10 <sup>th</sup> min	Positive	Negative			
<b>Low frequency</b>													
-30	3.6	150.199414	150.199520	150.199581	150.199613	150.199620	150.199639	150.199649	-507	-742	NA	NA	Pass
-20	3.6	150.200179	NA	NA	NA	NA	NA	150.200330	174	23		NA	Pass
-10	3.6	150.200550	NA	NA	NA	NA	NA	150.200614	458	394		NA	Pass
0	3.6	150.200654	150.200665	150.200666	150.200667	150.200668	150.200667	150.200668	512	498		NA	Pass
10	3.6	150.200569	NA	NA	NA	NA	NA	150.200500	413	344		NA	Pass
20	3.6	150.200313	NA	NA	NA	NA	NA	150.200156*	0	0		NA	Pass
20	3.06	150.200315	NA	NA	NA	NA	NA	150.200156	159	0		NA	Pass
30	3.6	150.200000	150.199980	150.199951	150.199920	150.199918	150.199918	150.199914	-156	-242		NA	Pass
40	3.6	150.199640	NA	NA	NA	NA	NA	150.199545	-516	-611		NA	Pass
50	3.6	150.199353	NA	NA	NA	NA	NA	150.199275	-803	-881		NA	Pass
<b>Mid frequency</b>													
-30	3.6	159.999232	159.999335	159.999435	159.999487	159.999516	159.999536	159.999615	-638	-1021	NA	NA	Pass
-20	3.6	160.000202	NA	NA	NA	NA	NA	160.000350	97	-51		NA	Pass
-10	3.6	160.000586	NA	NA	NA	NA	NA	160.000653	400	333		NA	Pass
0	3.6	160.000698	160.000703	160.000706	160.000708	160.000705	160.000705	160.000706	455	445		NA	Pass
10	3.6	160.000593	NA	NA	NA	NA	NA	160.000535	340	282		NA	Pass
20	3.6	160.00033	NA	NA	NA	NA	NA	160.000253	0	0		NA	Pass
20	3.06	160.000333	NA	NA	NA	NA	NA	160.000245	80	-8		NA	Pass
30	3.6	160.000014	159.999971	159.999945	159.999936	159.999928	159.999900	159.999898	-239	-1253		NA	Pass
40	3.6	159.99958	NA	NA	NA	NA	NA	159.999495	-673	-758		NA	Pass
50	3.6	159.999293	NA	NA	NA	NA	NA	159.999225	-960	-1028		NA	Pass
<b>High frequency</b>													
-30	3.6	169.79923	169.799369	169.799439	169.799485	169.79951	169.799526	169.799594	-651	-1015	NA	NA	Pass
-20	3.6	169.800222	NA	NA	NA	NA	NA	169.800378	133	-23		NA	Pass
-10	3.6	169.80064	NA	NA	NA	NA	NA	169.8007	455	395		NA	Pass
0	3.6	169.800749	169.800756	169.800754	169.800758	169.800759	169.800754	169.800754	514	504		NA	Pass
10	3.6	169.800655	NA	NA	NA	NA	NA	169.800574	410	329		NA	Pass
20	3.6	169.800351	NA	NA	NA	NA	NA	169.800245*	0	0		NA	Pass
20	3.06	169.800355	NA	NA	NA	NA	NA	169.800244	110	-1		NA	Pass
30	3.6	169.800016	169.79999	169.799973	169.799942	169.799933	169.799918	169.799902	-229	-343		NA	Pass
40	3.6	169.799514	NA	NA	NA	NA	NA	169.79946	-731	-785		NA	Pass
50	3.6	169.799266	NA	NA	NA	NA	NA	169.799207	-979	-1038		NA	Pass

\* - Reference frequency

## Reference numbers of test equipment used

HL 0026	HL 0810	HL 0892	HL 1523	HL 1652	HL 2265		
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Full description is given in Appendix A.

<b>Test specification:</b>	<b>Section 90.214, Transient frequency behaviour</b>		
<b>Test procedure:</b>	TIA/EIA-603-A, Section 2.2.19		
<b>Test mode:</b>	Compliance	<b>Verdict:</b>	
<b>Date &amp; Time:</b>	7/23/2004 10:13:39 AM	<b>PASS</b>	
<b>Temperature:</b> 25 °C	<b>Air Pressure:</b> 1005 hPa	<b>Relative Humidity:</b> 41 %	<b>Power Supply:</b>
<b>Remarks:</b>			

## 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

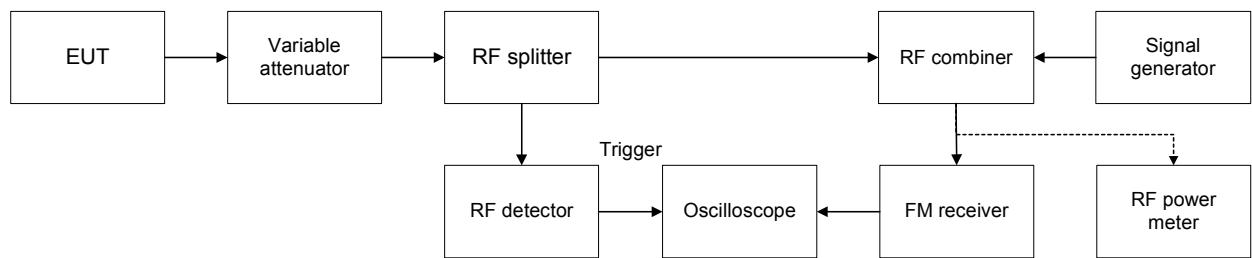
7.8.2.1 The EUT was set up as shown in Figure 7.8.1, energized and its proper operation was checked. Variable attenuator was adjusted to provide signal level approximately 40 dB below the FM receiver maximum allowed level as measured with RF power meter. The EUT was turned off.

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  $\pm 4$  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



<b>Test specification:</b>	<b>Section 90.214, Transient frequency behaviour</b>		
<b>Test procedure:</b>	TIA/EIA-603-A, Section 2.2.19		
<b>Test mode:</b>	Compliance	<b>Verdict:</b>	PASS
<b>Date &amp; Time:</b>	7/23/2004 10:13:39 AM	<b>Relative Humidity:</b>	41 %
<b>Temperature:</b> 25 °C	<b>Air Pressure:</b> 1005 hPa	<b>Power Supply:</b>	
<b>Remarks:</b>			

**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*	$\pm 12.5$	>10.9	Pass
	$t_3$	5.0	16.5	$\pm 25.0$	8.8	
160.0	$t_2$	20.0	< 1.6*	$\pm 12.5$	>10.9	Pass
	$t_3$	5.0	12.8	$\pm 25.0$	12.2	
169.8	$t_2$	20.0	< 1.6*	$\pm 12.5$	>10.9	Pass
	$t_3$	5.0	-17.4	$\pm 25.0$	7.6	

\* - 1/4 division

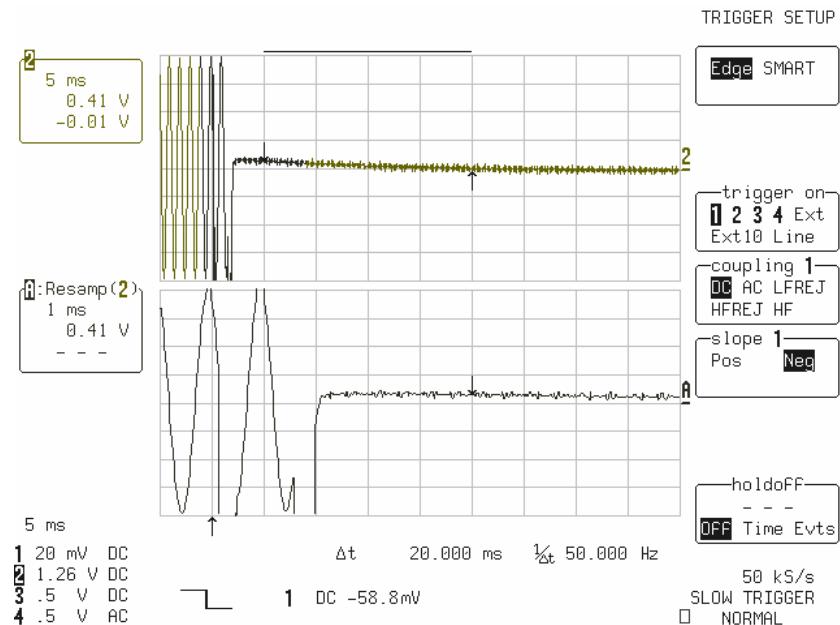
**Reference numbers of test equipment used**

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

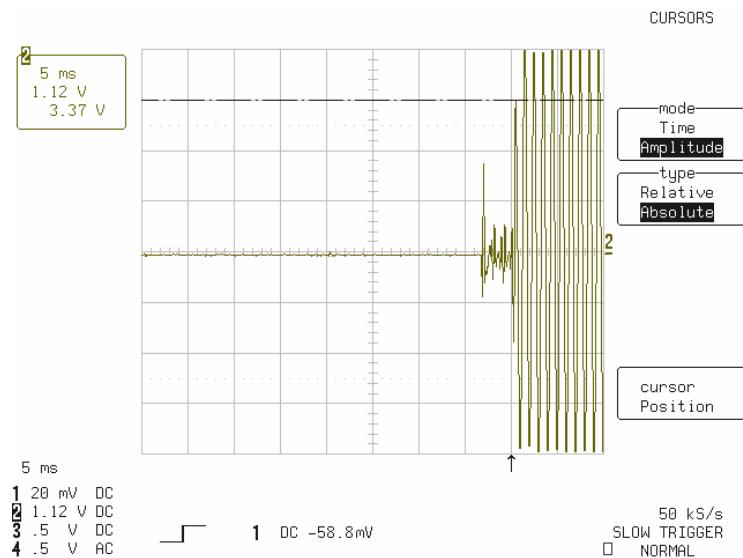
Full description is given in Appendix A.

<b>Test specification:</b>	<b>Section 90.214, Transient frequency behaviour</b>		
<b>Test procedure:</b>	TIA/EIA-603-A, Section 2.2.19		
<b>Test mode:</b>	Compliance	<b>Verdict:</b> <b>PASS</b>	
<b>Date &amp; Time:</b>	7/23/2004 10:13:39 AM		
<b>Temperature:</b> 25 °C	<b>Air Pressure:</b> 1005 hPa	<b>Relative Humidity:</b> 41 %	<b>Power Supply:</b>
<b>Remarks:</b>			

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

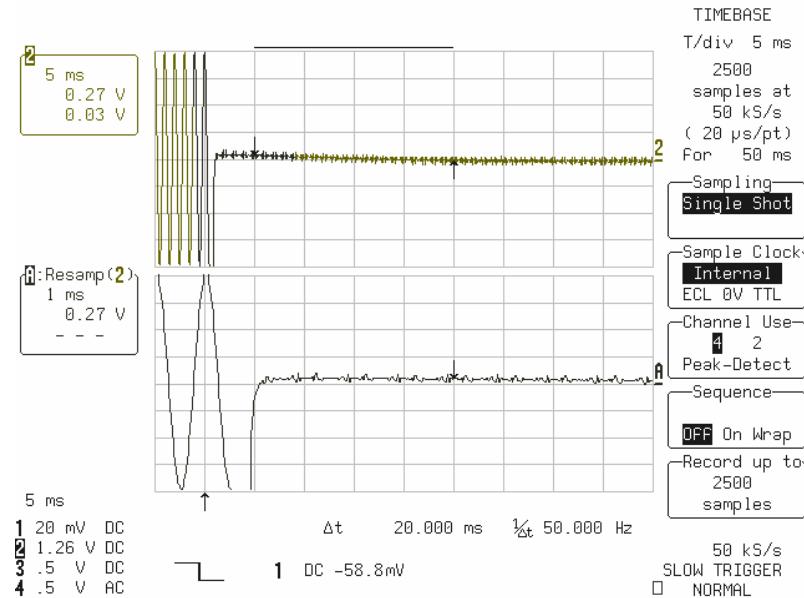


Plot 7.8.2 Transient frequency during power OFF test results at 150.2 MHz carrier frequency

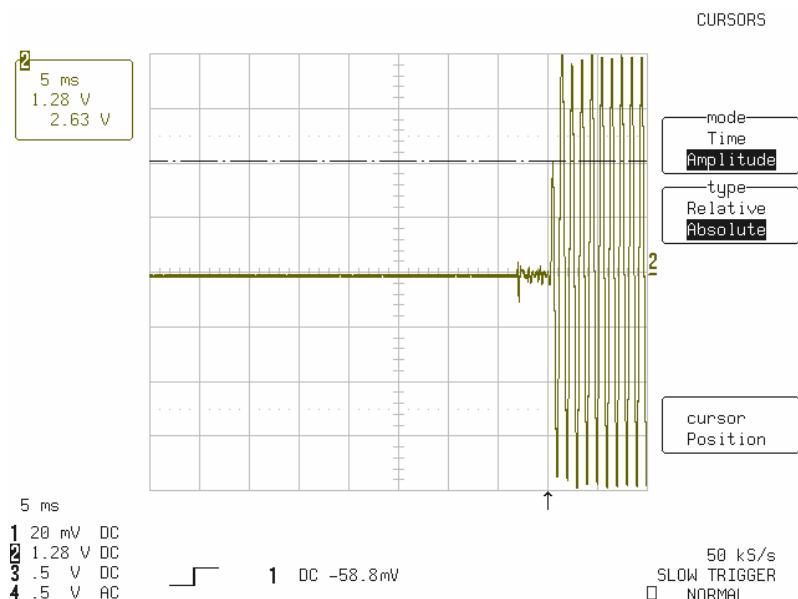


<b>Test specification:</b>	<b>Section 90.214, Transient frequency behaviour</b>		
<b>Test procedure:</b>	TIA/EIA-603-A, Section 2.2.19		
<b>Test mode:</b>	Compliance	<b>Verdict:</b> <b>PASS</b>	
<b>Date &amp; Time:</b>	7/23/2004 10:13:39 AM		
<b>Temperature:</b> 25 °C	<b>Air Pressure:</b> 1005 hPa	<b>Relative Humidity:</b> 41 %	<b>Power Supply:</b>
<b>Remarks:</b>			

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

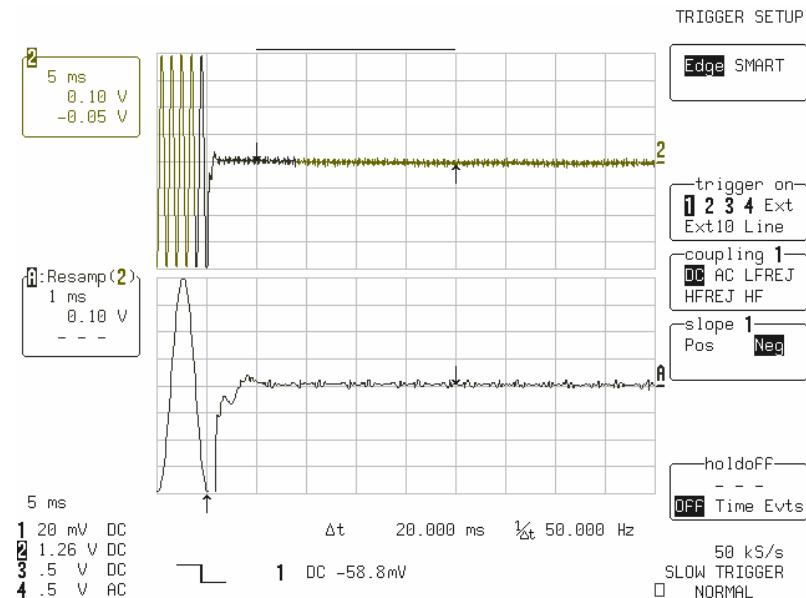


**Plot 7.8.4 Transient frequency during power OFF test results at 160.0 MHz carrier frequency**

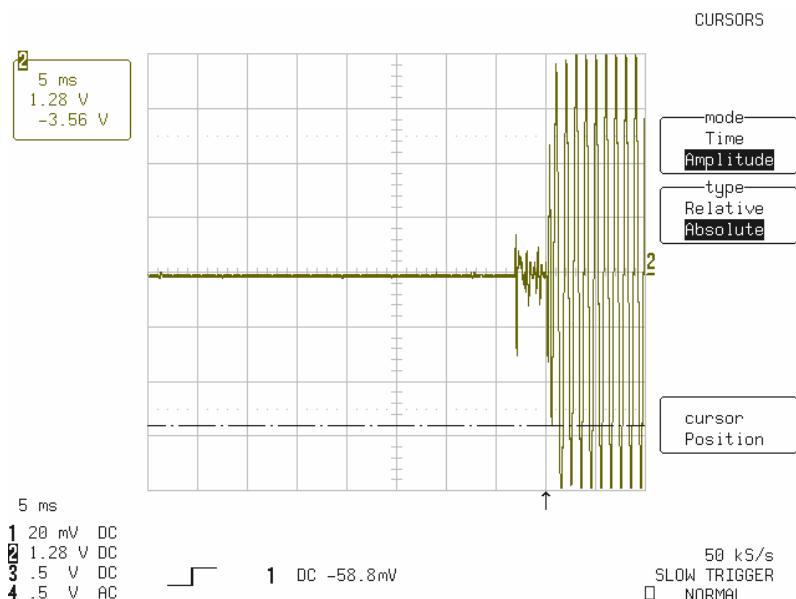


<b>Test specification:</b>	<b>Section 90.214, Transient frequency behaviour</b>		
<b>Test procedure:</b>	TIA/EIA-603-A, Section 2.2.19		
<b>Test mode:</b>	Compliance	<b>Verdict:</b> <b>PASS</b>	
<b>Date &amp; Time:</b>	7/23/2004 10:13:39 AM		
<b>Temperature:</b> 25 °C	<b>Air Pressure:</b> 1005 hPa	<b>Relative Humidity:</b> 41 %	<b>Power Supply:</b>
<b>Remarks:</b>			

**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**



<b>Test specification:</b>	<b>Section 15.109, Radiated emission</b>		
<b>Test procedure:</b>	ANSI C63.4, Sections 11.6 and 12.1.4		
<b>Test mode:</b>	Compliance	<b>Verdict:</b>	
<b>Date &amp; Time:</b>	8/31/2004 4:40:48 PM	<b>PASS</b>	
<b>Temperature:</b> 25 °C	<b>Air Pressure:</b> 1001 hPa	<b>Relative Humidity:</b> 44 %	<b>Power Supply:</b> 3.6 VDC
<b>Remarks:</b>			

## 7.9 Radiated emission measurements

### 7.9.1 General

This test was performed to measure radiated emissions from the EUT enclosure. Specification test limits are given in Table 7.9.1.

Table 7.9.1 Radiated emission test limits

Frequency, MHz	Class B limit, dB( $\mu$ V/m)	
	10 m distance	3 m distance
30 - 88	29.5*	40.0
88 - 216	33.0*	43.5
216 - 960	35.5*	46.0
Above 960	43.5*	54.0

\* The limit for test distance other than specified was calculated using the inverse linear distance extrapolation factor as follows:  $\text{Lim}_{S2} = \text{Lim}_{S1} + 20 \log (S_1/S_2)$ , where  $S_1$  and  $S_2$  – standard defined and test distance respectively in meters.

### 7.9.2 Test procedure for measurements in semi-anechoic chamber

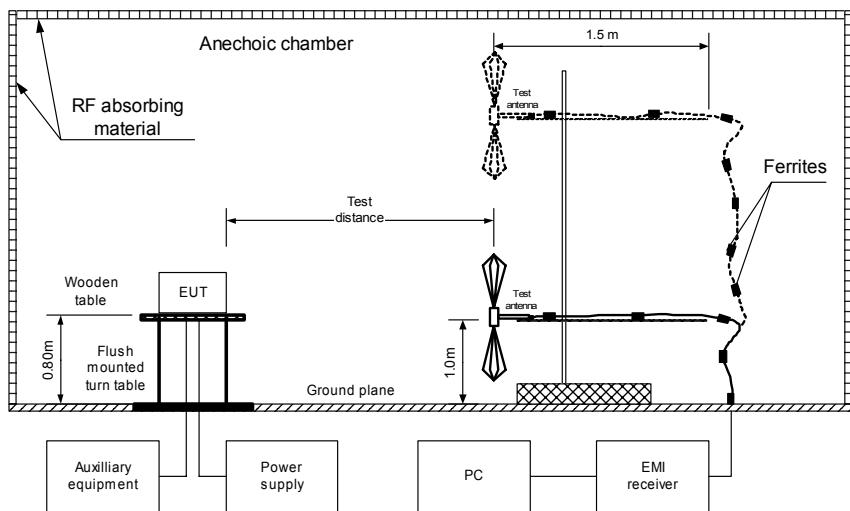
7.9.2.1 The EUT was set up as shown in Figure 7.9.1 and associated photograph/s, energized and the performance check was conducted.

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

7.9.2.3 The worst test results (the lowest margins) were recorded in Table 7.9.2 and shown in the associated plots.

<b>Test specification:</b>	<b>Section 15.109, Radiated emission</b>		
<b>Test procedure:</b>	ANSI C63.4, Sections 11.6 and 12.1.4		
<b>Test mode:</b>	Compliance	<b>Verdict:</b>	
<b>Date &amp; Time:</b>	8/31/2004 4:40:48 PM	<b>PASS</b>	
<b>Temperature:</b> 25 °C	<b>Air Pressure:</b> 1001 hPa	<b>Relative Humidity:</b> 44 %	<b>Power Supply:</b> 3.6 VDC
<b>Remarks:</b>			

**Figure 7.9.1 Setup for radiated emission measurements in anechoic chamber, table-top equipment**



<b>Test specification:</b>	<b>Section 15.109, Radiated emission</b>		
<b>Test procedure:</b>	ANSI C63.4, Sections 11.6 and 12.1.4		
<b>Test mode:</b>	Compliance	<b>Verdict:</b>	
<b>Date &amp; Time:</b>	8/31/2004 4:40:48 PM	<b>PASS</b>	
<b>Temperature:</b> 25 °C	<b>Air Pressure:</b> 1001 hPa	<b>Relative Humidity:</b> 44 %	<b>Power Supply:</b> 3.6 VDC
<b>Remarks:</b>			

**Table 7.9.2 Radiated emission test results**

EUT SET UP:

TABLE-TOP

LIMIT:

Class B

EUT OPERATING MODE:

Stand-by

TEST SITE:

ANECHOIC CHAMBER

TEST DISTANCE:

3 m

DETECTORS USED:

PEAK / QUASI-PEAK

FREQUENCY RANGE:

30 MHz – 1000 MHz

RESOLUTION BANDWIDTH:

120 kHz

Frequency, MHz	Peak emission, dB(µV/m)	Quasi-peak			Antenna polarization	Antenna height, m	Turn-table position**, degrees	Verdict
		Measured emission, dB(µV/m)	Limit, dB(µV/m)	Margin, dB*				
All emissions were found at least 20 dB below limit								Pass

\*- Margin = Measured emission - specification limit.

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

**Reference numbers of test equipment used**

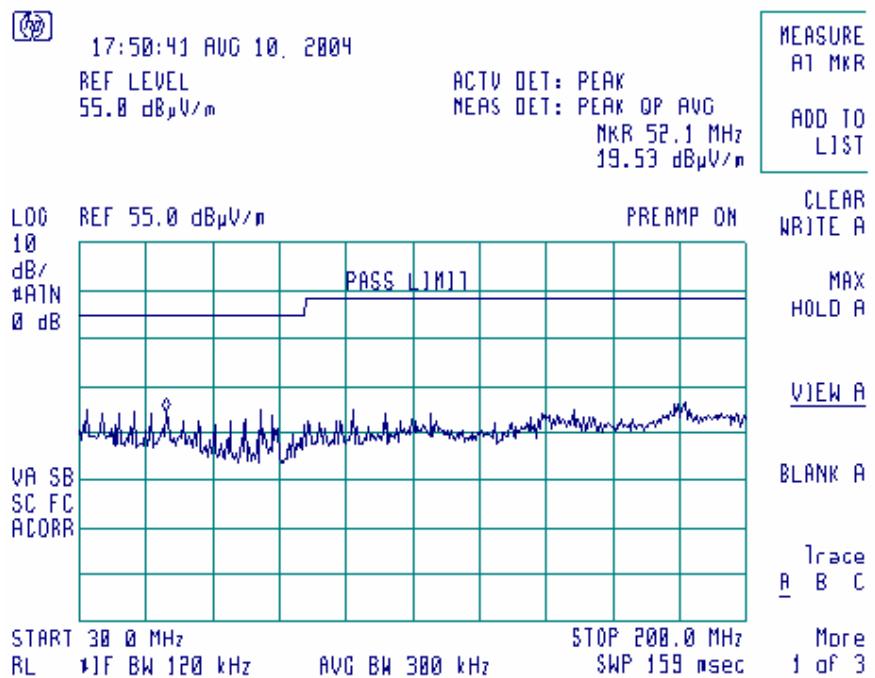
HL 0465	HL 0521	HL 0589	HL 0592	HL 0593	HL 0594	HL 0604	HL 1004
HL 1530	HL 1567	HL 1942	HL 2009				

Full description is given in Appendix A.

<b>Test specification:</b>	<b>Section 15.109, Radiated emission</b>		
<b>Test procedure:</b>	ANSI C63.4, Sections 11.6 and 12.1.4		
<b>Test mode:</b>	Compliance	<b>Verdict:</b>	
<b>Date &amp; Time:</b>	8/31/2004 4:40:48 PM	<b>PASS</b>	
<b>Temperature:</b> 25 °C	<b>Air Pressure:</b> 1001 hPa	<b>Relative Humidity:</b> 44 %	<b>Power Supply:</b> 3.6 VDC
<b>Remarks:</b>			

**Plot 7.9.1 Radiated emission measurements in 30- 200 MHz range, vertical antenna polarization**

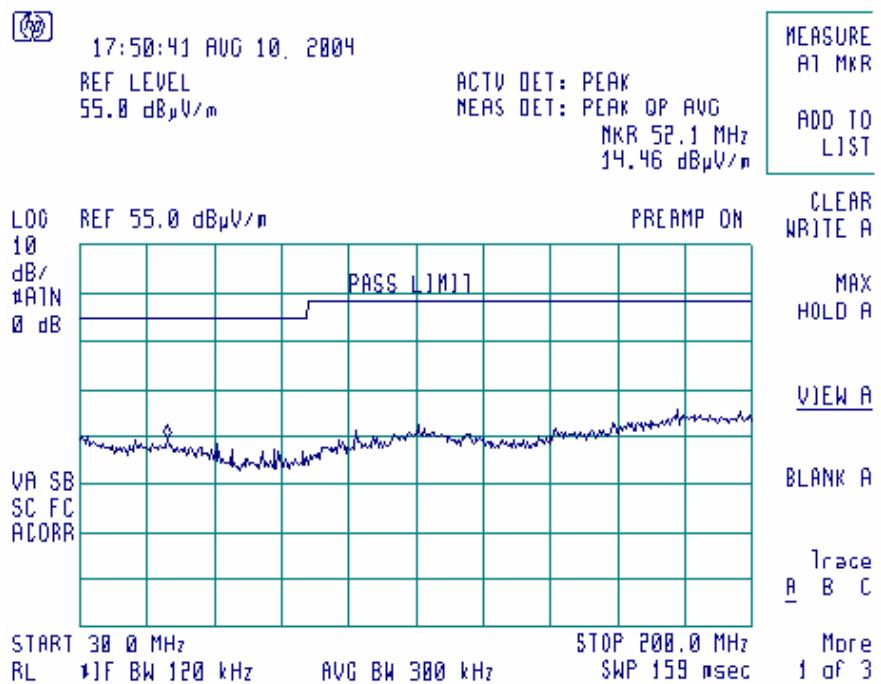
TEST SITE: Anechoic chamber  
 LIMIT: Class B  
 TEST DISTANCE: 3 m  
 EUT OPERATING MODE: Stand-by



<b>Test specification:</b>	<b>Section 15.109, Radiated emission</b>		
<b>Test procedure:</b>	ANSI C63.4, Sections 11.6 and 12.1.4		
<b>Test mode:</b>	Compliance	<b>Verdict:</b>	
<b>Date &amp; Time:</b>	8/31/2004 4:40:48 PM	<b>PASS</b>	
<b>Temperature:</b> 25 °C	<b>Air Pressure:</b> 1001 hPa	<b>Relative Humidity:</b> 44 %	<b>Power Supply:</b> 3.6 VDC
<b>Remarks:</b>			

**Plot 7.9.2 Radiated emission measurements in 30- 200 MHz range, horizontal antenna polarization**

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

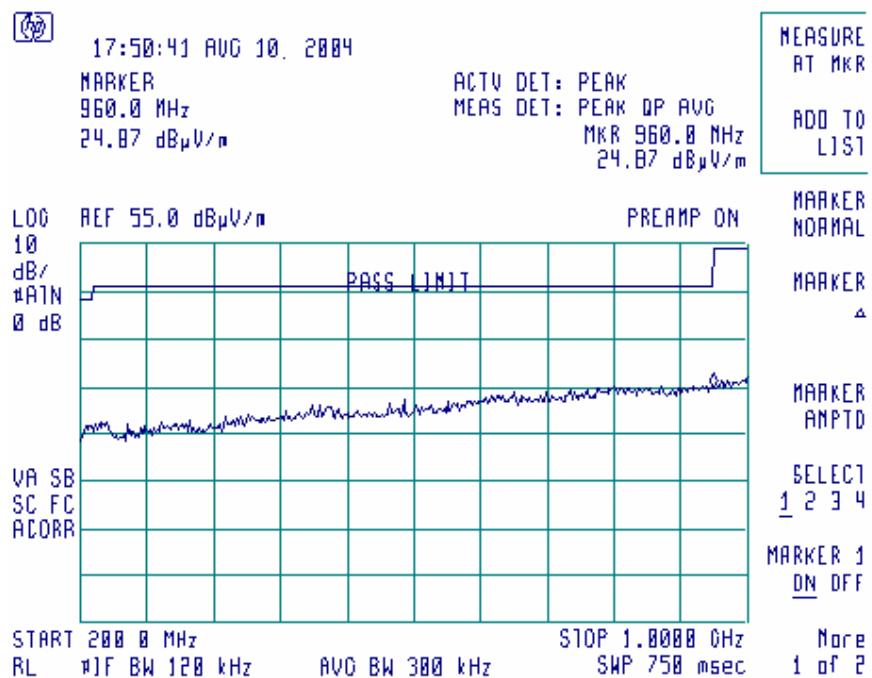




<b>Test specification:</b>	<b>Section 15.109, Radiated emission</b>		
<b>Test procedure:</b>	ANSI C63.4, Sections 11.6 and 12.1.4		
<b>Test mode:</b>	Compliance	<b>Verdict:</b>	PASS
<b>Date &amp; Time:</b>	8/31/2004 4:40:48 PM		
<b>Temperature:</b> 25 °C	<b>Air Pressure:</b> 1001 hPa	<b>Relative Humidity:</b> 44 %	<b>Power Supply:</b> 3.6 VDC
<b>Remarks:</b>			

### Plot 7.9.3 Radiated emission measurements 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



<b>Test specification:</b>	<b>Section 15.109, Radiated emission</b>		
<b>Test procedure:</b>	ANSI C63.4, Sections 11.6 and 12.1.4		
<b>Test mode:</b>	Compliance	<b>Verdict:</b>	
<b>Date &amp; Time:</b>	8/31/2004 4:40:48 PM	<b>PASS</b>	
<b>Temperature:</b> 25 °C	<b>Air Pressure:</b> 1001 hPa	<b>Relative Humidity:</b> 44 %	<b>Power Supply:</b> 3.6 VDC
<b>Remarks:</b>			

Plot 7.9.4 Radiated emission measurements in 200- 1000 MHz range, horizontal antenna polarization

TEST SITE:

Anechoic chamber

LIMIT:

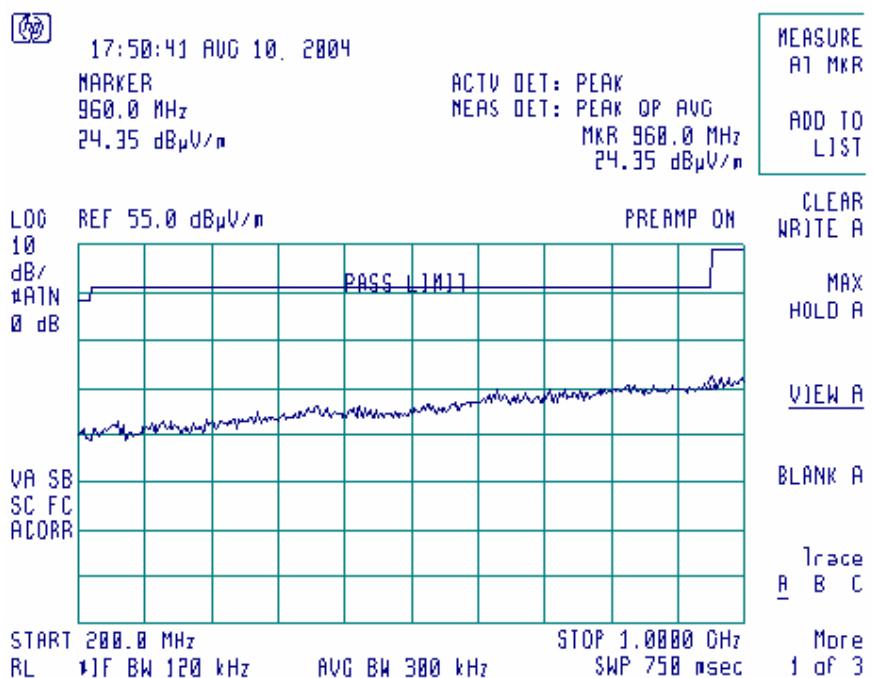
Class B

TEST DISTANCE:

3 m

EUT OPERATING MODE:

Stand-by



## 8 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

HL No.	Description	Manufacturer information			Due Calibr. Month/Year
		Name	Model No.	Serial No.	
1519	Cable RF, 0.5 m	Telequus	MIL-C-17F- RG 058	1519	12/04
1523	Cable RF, 2.3 m	Telequus	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	Agilent Technologies	E7401	US394402 81	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	Telequus	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

## 9 APPENDIX B Measurement uncertainties

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

Test description	Expanded uncertainty
<b>Transmitter tests</b>	
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 %
<b>Unintentional radiator tests</b>	
Radiated emissions at 3 m measuring distance	
Horizontal polarization	Biconilog antenna: ± 5.3 dB Biconical antenna: ± 5.0 dB Log periodic antenna: ± 5.3 dB Double ridged horn antenna: ± 5.3 dB
Vertical polarization	Biconilog antenna: ± 6.0 dB Biconical antenna: ± 5.7 dB Log periodic antenna: ± 6.0 dB Double ridged horn antenna: ± 6.0 dB

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

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

## 10 APPENDIX C Test facility description

Tests were performed at Hermon Laboratories Ltd., which is a fully independent, private, EMC, safety, environmental and telecommunication testing facility. Hermon Laboratories is listed by the Federal Communications Commission (USA) for all parts of Code of Federal Regulations 47 (CFR 47) and by Industry Canada for electromagnetic emissions (file numbers IC 2186-1 for OATS and IC 2186-2 for anechoic chamber), certified by VCCI, Japan (the registration numbers are R-808 for OATS, R-1082 for anechoic chamber, C-845 for conducted emissions site), assessed by TNO Certification EP&S (Netherlands) for a number of EMC, telecommunications, environmental, safety standards, and by AMTAC (UK) for safety of medical devices. The laboratory is accredited by American Association for Laboratory Accreditation (USA) according to ISO/IEC 17025 for electromagnetic compatibility, product safety, telecommunications testing and environmental simulation (for exact scope please refer to Certificate No. 839.01).

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Person for contact: Mr. Alex Usoskin, CEO.

## 11 APPENDIX D Specification references

47CFR part 90: 2002	Private land mobile radio services
47CFR part 1: 2003	Practice and procedure
47CFR part 2: 2002	Frequency allocations and radio treaty matters; general rules and regulations
ANSI C63.2: 1996	American National Standard for Instrumentation-Electromagnetic Noise and Field Strength, 10 kHz to 40 GHz-Specifications.
ANSI C63.4: 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

## 12 APPENDIX E Abbreviations and acronyms

A	ampere
AC	alternating current
A/m	ampere per meter
AM	amplitude modulation
AVRG	average (detector)
BB	broad band
cm	centimeter
dB	decibel
dBm	decibel referred to one milliwatt
dB(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

## 13 APPENDIX F Test equipment correction factors

### 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( $\mu$ V) to convert it into field intensity in dB( $\mu$ V/m).

### Log periodic antenna factor

Electro-Metrics, model LPA-25/30, serial number 1953

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

600	24.7	
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Antenna factor in dB(1/m) is to be added to receiver meter reading in dB( $\mu$ V) to convert it into field intensity in dB( $\mu$ V/m).

**Antenna factor**  
**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( $\mu$ V) to convert it into field intensity in dB( $\mu$ V/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( $\mu$ V) to convert it into field intensity in dB( $\mu$ V/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( $\mu$ V) to convert it into field intensity in dB( $\mu$ A/m).  
Antenna factor in dB(1/m) is to be added to receiver meter reading in dB( $\mu$ V) to convert it into field intensity in dB( $\mu$ V/m).

**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		
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	3000	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	$\pm 0.12$
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		