



HERMON LABORATORIES



Electrical

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# TEST REPORT

ACCORDING TO: FCC part 90, part 15 subpart C, §15.247 and subpart B

FOR:

**Telematics Wireless Ltd.**

**Electronic seal**

**Model:FP200INT**

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:** Telematics Wireless Ltd.  
**Address:** 26 Hamelaha, POB 1911, Holon, 58117, Israel  
**Telephone:** +972 3557 5767  
**Fax:** +972 3557 5753  
**E-mail:** slavas@tadiran-telematics.com  
**Contact name:** Mr. Slava Snitkovsky

## 2 Equipment under test attributes

**Product name:** Electronic seal  
**Product type:** Transceiver  
**Model(s):** FP200INT  
**Receipt date:** 11/21/2004

## 3 Manufacturer information

**Manufacturer name:** Telematics Wireless Ltd.  
**Address:** 26 Hamelaha, POB 1911, Holon, 58117, Israel  
**Telephone:** +972 3557 5767  
**Fax:** +972 3557 5753  
**E-Mail:** slavas@tadiran-telematics.com  
**Contact name:** Mr. Slava Snitkovsky

## 4 Test details

**Project ID:** 16174  
**Location:** Hermon Laboratories Ltd. P.O.Box 23, Binyamina 30500, Israel  
**Test started:** 11/23/2004  
**Test completed:** 03/23/2005  
**Test specification(s):** FCC part 90, part 15 subpart C §15.247; subpart B §15.109  
**Test suite:** FCC\_15.247\_DTS\_without\_RF\_connector (5/3/2004 5:43:35 PM, modified)



**5 Tests summary**

Test	Status
<b>Transmitter characteristics according to part 15 subpart C</b>	
Section 15.247(a)2, 6 dB bandwidth	Pass
Section 15.247(b)3, Peak output power	Pass
Section 15.247(b)5, RF exposure	Pass
Section 15.247(c), Radiated spurious emissions	Pass
Section 15.247(d), Peak power density	Pass
Section 15.207(a), Conducted emission	Not required
<b>Transmitter characteristics according to part 90</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 90.213, Frequency stability	Pass
Section 90.214, Transient frequency behaviour	Not required
Section 2.1091, RF radiation exposure evaluation	Pass
<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. Results obtained indicate that the product under test complies in full with the requirements tested.  
 The test results relate only to the items tested. Pass/ fail decision was based on nominal values.

**This report replaces the previously issued test report identified by Doc ID: TELRAD\_FCC.16174.**

	Name and Title	Date	Signature
<b>Tested by:</b>	Mr. B. Efros, test engineer	March 23, 2005	
<b>Reviewed by:</b>	Mrs. M. Cherniavsky, certification engineer	March 31, May 16, 2005	
	Mr. M. Nikishin, EMC group leader	April 7, May 16, 2005	
<b>Approved by:</b>	Mr. A. Usoskin, C.E.O.	May 19, 2005	



## 6 EUT description

### 6.1 General information

The EUT is a TDMA electronic container seal, operating at 915 and 2440 MHz, for secure freight management systems. The EUT identifies the cargo, records the sealing event and any subsequently detected tampering events, and communicates its stored data at highway speeds to a CVISN-compatible infrastructure of TDMA readers.

### 6.2 Operating frequencies

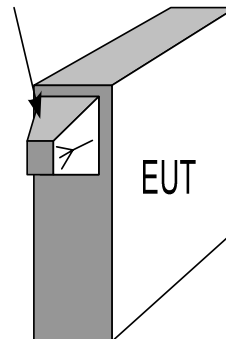
Source	Frequency, MHz		
Digital portion	0.032768	8	NA
Receiver	971.4	915	2450
Transmitter	971.4	915	2450

### 6.3 Changes made in the EUT

No changes were implemented.

### 6.4 Test configuration

Antenna





## 6.5 Transmitter characteristics

### 6.5.1 Operation with readers

<b>Type of equipment</b>						
X	Stand-alone (Equipment with or without its own control provisions)					
	Combined equipment (Equipment where the radio part is fully integrated within another type of equipment)					
	Plug-in card (Equipment intended for a variety of host systems)					
<b>Intended use</b>		<b>Condition of use</b>				
	fixed	Always at a distance more than 2 m from all people				
	mobile	Always at a distance more than 20 cm from all people				
X	portable	May operate at a distance closer than 20 cm to human body				
<b>Assigned frequency range</b>		909.75 – 921.25 MHz				
<b>Operating frequency range</b>		915 MHz				
<b>RF channel spacing</b>		NA				
<b>Maximum rated output power</b>		At transmitter 50 Ω RF output connector			dBm	
		Effective radiated power (for equipment with no RF connector)			11.1 dBm	
<b>Is transmitter output power variable?</b>		X	No			
			continuous variable			
			stepped variable with stepsize			
		Yes	minimum RF power			dBm
			maximum RF power			dBm
<b>Antenna connection</b>						
unique coupling		standard connector		X	integral	
				X	with temporary RF connector without temporary RF connector	
<b>Antenna/s technical characteristics</b>						
Type	Manufacturer	Model number		Gain		
Spring	Telematics	NA		2 dBi		
<b>Transmitter 99% power bandwidth</b>		8 MHz				
<b>Transmitter aggregate data rate/s</b>		0.5 Mbps				
<b>Type of modulation</b>		ASK				
<b>Type of multiplexing</b>		TDMA				
<b>Modulating test signal (baseband)</b>		PRBS				
<b>Maximum transmitter duty cycle in normal use</b>		50 %	<b>Tx ON time</b>	5 msec	<b>Period</b>	
<b>Transmitter duty cycle supplied for test</b>		100 %	<b>Tx ON time</b>	msec	<b>Period</b>	
<b>Transmitter power source</b>						
X	Battery	<b>Nominal rated voltage</b>	3.6 VDC (2.7 – 3.6 VDC )	<b>Battery type</b>	Lithium	
	DC	<b>Nominal rated voltage</b>	VDC			
	AC mains	<b>Nominal rated voltage</b>	VAC	<b>Frequency</b>	Hz	
<b>Common power source for transmitter and receiver</b>				X	yes	
					no	
<b>Emission designator</b>						



**6.5.2 Operation with transponders**

<b>Type of equipment</b>					
X	Stand-alone (Equipment with or without its own control provisions)				
	Combined equipment (Equipment where the radio part is fully integrated within another type of equipment)				
	Plug-in card (Equipment intended for a variety of host systems)				
<b>Intended use</b>		<b>Condition of use</b>			
	fixed	Always at a distance more than 2 m from all people			
	mobile	Always at a distance more than 20 cm from all people			
X	portable	May operate at a distance closer than 20 cm to human body			
<b>Assigned frequency range</b>		2400 – 2483.5 MHz			
<b>Operating frequency range</b>		2440 MHz			
<b>RF channel spacing</b>		NA			
<b>Maximum rated output power</b>		At transmitter 50 Ω RF output connector			dBm
		Effective radiated power (for equipment with no RF connector)			0.2 dBm
<b>Is transmitter output power variable?</b>		X	No		
			Yes	continuous variable	
				stepped variable with stepsize	
				minimum RF power	dBm
		maximum RF power	dBm		
<b>Antenna connection</b>					
	unique coupling	standard connector	X	integral	with temporary RF connector
					X without temporary RF connector
<b>Antenna/s technical characteristics</b>					
Type	Manufacturer	Model number		Gain	
Rhode	Telematics	NA		0 dBi	
<b>Transmitter 99% power bandwidth</b>		8 MHz			
<b>Transmitter aggregate data rate/s</b>		0.5 Mbps			
<b>Type of modulation</b>		ASK			
<b>Type of multiplexing</b>		TDMA			
<b>Modulating test signal (baseband)</b>		PRBS			
<b>Maximum transmitter duty cycle in normal use</b>		50 %	<b>Tx ON time</b>	5 msec	<b>Period</b>
<b>Transmitter duty cycle supplied for test</b>		100 %	<b>Tx ON time</b>	msec	<b>Period</b>
<b>Transmitter power source</b>					
X	Battery	<b>Nominal rated voltage</b>	3.6 VDC (2.7 – 3.6 VDC )	<b>Battery type</b>	Lithium
	DC	<b>Nominal rated voltage</b>	VDC		
	AC mains	<b>Nominal rated voltage</b>	VAC	<b>Frequency</b>	Hz
<b>Common power source for transmitter and receiver</b>				X	yes
					no
<b>Emission designator</b>					



<b>Test specification:</b> Section 15.247(a)2, 6 dB bandwidth			
<b>Test procedure:</b> FR Vol.62, page 26243, Section 15.247(a)2			
<b>Test mode:</b> Compliance	<b>Verdict:</b> PASS		
<b>Date &amp; Time:</b> 1/2/2005 4:15:22 PM			
<b>Temperature:</b> 22 °C	<b>Air Pressure:</b> 1017 hPa	<b>Relative Humidity:</b> 45 %	<b>Power Supply:</b> 3.6 VDC
<b>Remarks:</b>			

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

### 7.1 Minimum 6 dB bandwidth

#### 7.1.1 General

This test was performed to measure 6 dB bandwidth of the EUT carrier frequency. Specification test limits are given in Table 7.1.1.

Table 7.1.1 6 dB bandwidth limits

Assigned frequency, MHz	Modulation envelope reference points*, dBc	Minimum bandwidth, kHz
902.0 – 928.0	6.0	500.0
2400.0 – 2483.5		
5725.0 – 5850.0		

\* - Modulation envelope reference points provided in terms of attenuation below the peak of modulated carrier.

#### 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 set to transmit modulated carrier.

7.1.2.3 The transmitter minimum 6 dB bandwidth was measured with spectrum analyzer as frequency delta between reference points on modulation envelope and provided in Table 7.1.2 and associated plot.

Figure 7.1.1 6 dB bandwidth test setup







<b>Test specification:</b> Section 15.247(a)2, 6 dB bandwidth			
<b>Test procedure:</b> FR Vol.62, page 26243, Section 15.247(a)2			
<b>Test mode:</b> Compliance	<b>Verdict:</b> PASS		
<b>Date &amp; Time:</b> 1/2/2005 4:15:22 PM			
<b>Temperature:</b> 22 °C	<b>Air Pressure:</b> 1017 hPa	<b>Relative Humidity:</b> 45 %	<b>Power Supply:</b> 3.6 VDC
<b>Remarks:</b>			

Table 7.1.2 6 dB bandwidth test results

ASSIGNED FREQUENCY BAND: 2400 – 2483.5 MHz  
DETECTOR USED: Peak  
SWEEP MODE: Single  
SWEEP TIME: Auto  
RESOLUTION BANDWIDTH: 100 kHz  
VIDEO BANDWIDTH: 300 kHz  
MODULATION ENVELOPE REFERENCE POINTS: 6.0 dBc  
MODULATION: ASK  
MODULATING SIGNAL: PRBS  
BIT RATE: 0.5 Mbps

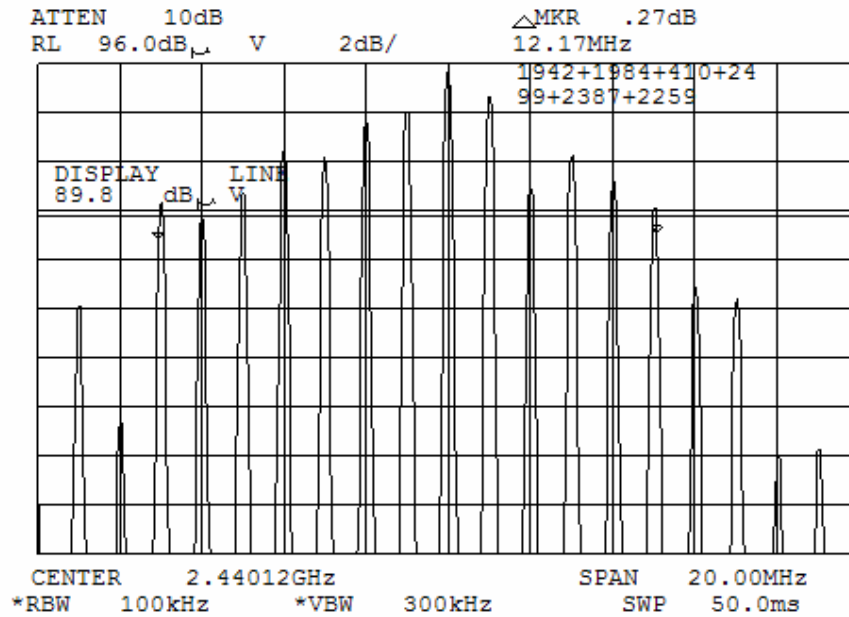
Carrier frequency, MHz	6 dB bandwidth, MHz	Limit, kHz	Margin, MHz	Verdict
2440.0	12.17	500	-11.67	Pass

Reference numbers of test equipment used

HL 1424	HL 1942	HL 2432						
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Full description is given in Appendix A.

Plot 7.1.1 6 dB bandwidth test result at carrier frequency





<b>Test specification:</b>	<b>Section 15.247(b)3, Peak output power</b>		
<b>Test procedure:</b>	FR Vol.62, page 26243, Section 15.247(b)		
<b>Test mode:</b>	Compliance	<b>Verdict:</b>	<b>PASS</b>
<b>Date &amp; Time:</b>	1/2/2005 4:49:22 PM		
<b>Temperature:</b> 24 °C	<b>Air Pressure:</b> 1015 hPa	<b>Relative Humidity:</b> 50 %	<b>Power Supply:</b> 3.6 VDC
<b>Remarks:</b>			

## 7.2 Peak output power

### 7.2.1 General

This test was performed to measure the maximum peak output power radiated by transmitter. Specification test limits are given in Table 7.2.1.

Table 7.2.1 Peak output power limits

Assigned frequency range, MHz	Maximum antenna gain, dBi	Peak output power*		Equivalent field strength limit @ 3m, dB(μV/m)**
		W	dBm	
902.0 – 928.0	6.0	1.0	30.0	131.2
2400.0 – 2483.5				
5725.0 – 5850.0				

\*- The limit is provided in terms of conducted RF power at the antenna connector. If transmitting antennas of directional gain greater than 6 dBi are used, the peak output power limit shall be reduced below the stated value as follows:

- by 1 dB for every 3 dB that the directional gain of antenna exceeds 6 dBi for fixed point-to-point transmitters operate in 2400-2483.5 MHz band;
- without any corresponding reduction for fixed point-to-point transmitters operate in 5725-5850 MHz band;
- by the amount in dB that the directional gain of antenna exceeds 6 dBi for the rest of transmitters.

\*\* - Equivalent field strength limit was calculated from the peak output power as follows:  $E = \sqrt{30 \times P \times G} / r$ , where P is peak output power in Watts, r is antenna to EUT distance in meters and G is transmitter antenna gain in dBi.

### 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 adjusted to produce maximum available to end user RF output power.

7.2.2.3 The resolution bandwidth of spectrum analyzer was set wider than 6 dB bandwidth of the EUT and the field strength of the EUT carrier frequency was measured with antenna connected to spectrum analyzer/ EMI receiver. To find maximum radiation the turntable was rotated 360° and the measuring antenna height was swept in both vertical and horizontal polarizations.

7.2.2.4 The maximum field strength of the EUT carrier frequency was measured as provided in Table 7.2.2 and associated plots.

7.2.2.5 The maximum peak output power was calculated from the field strength of carrier as follows:

$$P = (E \times d)^2 / (30 \times G),$$

where P is the peak output power in W, E is the field strength in V/m, d is the test distance and G is the transmitter numeric antenna gain over an isotropic radiator.

The above equation was converted in logarithmic units for 3 m test distance:

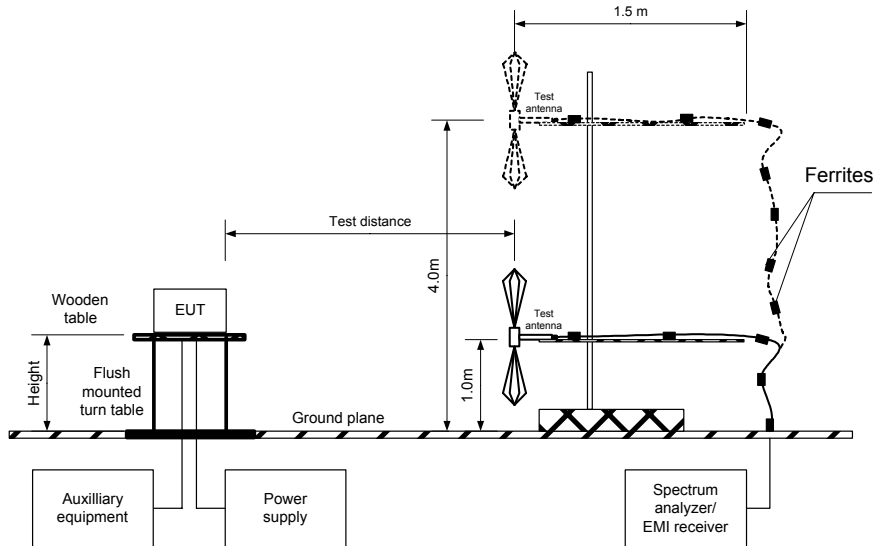
$$\text{Peak output power in dBm} = \text{Field strength in dB}(\mu\text{V/m}) - \text{Transmitter antenna gain in dBi} - 95.2 \text{ dB}$$

7.2.2.6 The worst test results (the lowest margins) were recorded in Table 7.2.2.



<b>Test specification:</b>	<b>Section 15.247(b)3, Peak output power</b>		
<b>Test procedure:</b>	FR Vol.62, page 26243, Section 15.247(b)		
<b>Test mode:</b>	Compliance	<b>Verdict:</b>	<b>PASS</b>
<b>Date &amp; Time:</b>	1/2/2005 4:49:22 PM		
<b>Temperature:</b> 24 °C	<b>Air Pressure:</b> 1015 hPa	<b>Relative Humidity:</b> 50 %	<b>Power Supply:</b> 3.6 VDC
<b>Remarks:</b>			

Figure 7.2.1 Setup for carrier field strength measurements





<b>Test specification:</b>		<b>Section 15.247(b)3, Peak output power</b>	
<b>Test procedure:</b>		FR Vol.62, page 26243, Section 15.247(b)	
<b>Test mode:</b>	Compliance	<b>Verdict:</b>	<b>PASS</b>
<b>Date &amp; Time:</b>	1/2/2005 4:49:22 PM		
<b>Temperature:</b> 24 °C	<b>Air Pressure:</b> 1015 hPa	<b>Relative Humidity:</b> 50 %	<b>Power Supply:</b> 3.6 VDC
<b>Remarks:</b>			

Table 7.2.2 Peak output power test results

ASSIGNED FREQUENCY: 2440 MHz  
TEST DISTANCE: 3 m  
TEST SITE: OATS  
EUT HEIGHT: 0.8 m  
EUT POSITION: 3 orthogonal ( X / Y / Z )  
DETECTOR USED: Peak  
TEST ANTENNA TYPE: Double ridged guide (above 1000 MHz)  
MODULATION: ASK  
MODULATING SIGNAL: PRBS  
BIT RATE: 0.5 Mbps  
TRANSMITTER OUTPUT POWER SETTINGS: Maximum  
DETECTOR USED: Peak  
EUT 6 dB BANDWIDTH: 12.17 MHz  
RESOLUTION BANDWIDTH: 0.1 MHz  
VIDEO BANDWIDTH: 3 MHz

Frequency, MHz	Field strength, dB( $\mu$ V/m)	Antenna polarization	Antenna height, m	Azimuth, degrees*	EUT antenna gain, dBi	Peak output power, dBm**	Limit, dBm	Margin, dB***	Verdict
2440.13	95.4	H	1.0	30	0	0.2	30.0	-29.8	Pass

The recorded result was obtained in the EUT X-axis position

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

\*\* - Peak output power was calculated from the field strength of carrier as follows:  $P = (E \times d)^2 / (30 \times G)$ ,

where P is the peak output power in W, E is the field strength in V/m, d is the test distance in meters and G is the transmitter numeric antenna gain over an isotropic radiator. The above equation was converted in logarithmic units for 3 m test distance: *Peak output power in dBm = Field strength in dB( $\mu$ V/m) - Transmitter antenna gain in dBi - 95.2 dB*

\*\*\* - Margin = Peak output power - specification limit.

#### Reference numbers of test equipment used

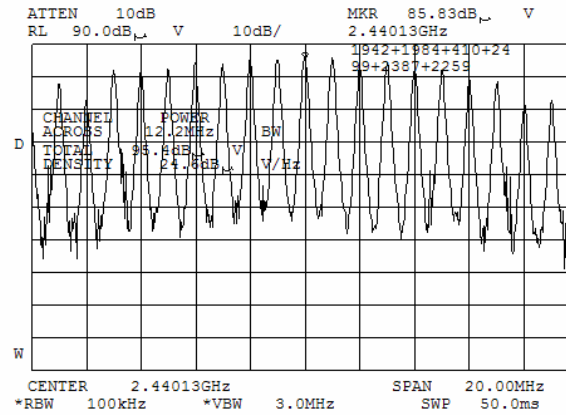
HL 0410	HL 1424	HL 1492	HL 1984	HL 2259		
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Full description is given in Appendix A.



<b>Test specification:</b>	<b>Section 15.247(b)3, Peak output power</b>		
<b>Test procedure:</b>	FR Vol.62, page 26243, Section 15.247(b)		
<b>Test mode:</b>	Compliance	<b>Verdict:</b>	<b>PASS</b>
<b>Date &amp; Time:</b>	1/2/2005 4:49:22 PM		
<b>Temperature:</b> 24 °C	<b>Air Pressure:</b> 1015 hPa	<b>Relative Humidity:</b> 50 %	<b>Power Supply:</b> 3.6 VDC
<b>Remarks:</b>			

Plot 7.2.1 Field strength of carrier at carrier frequency





<b>Test specification:</b>	<b>Section 15.247(c), Radiated spurious emissions</b>		
<b>Test procedure:</b>	FR Vol. 62, page 26243, Section 15.247(c) / ANSI C63.4, Section 13.1.4		
<b>Test mode:</b>	Compliance	<b>Verdict:</b>	<b>PASS</b>
<b>Date &amp; Time:</b>	1/2/2005 6:21:49 PM		
<b>Temperature:</b> 22 °C	<b>Air Pressure:</b> 1017 hPa	<b>Relative Humidity:</b> 45 %	<b>Power Supply:</b> 3.6 VDC
<b>Remarks:</b>			

## 7.3 Field strength of spurious emissions

### 7.3.1 General

This test was performed to measure field strength of spurious emissions from the EUT. Specification test limits are given in Table 7.3.1.

Table 7.3.1 Radiated spurious emissions limits

Frequency, MHz	Field strength at 3 m within restricted bands, dB(μV/m)***			Attenuation of field strength of spurious versus carrier outside restricted bands, dBc***
	Peak	Quasi Peak	Average	
0.009 – 0.490*	NA	128.5 – 93.8**	NA	20.0
0.490 – 1.705*		73.8 – 63.0**		
1.705 – 30.0*		69.5**		
30 – 88		40.0		
88 – 216		43.5		
216 – 960		46.0		
960 - 1000		54.0		
Above 1000		74.0		

\*- The limit for 3 m test distance was calculated using the inverse square distance extrapolation factor as follows:

$$\text{Lims}_2 = \text{Lims}_1 + 40 \log (S_1/S_2),$$

where  $S_1$  and  $S_2$  – standard defined and test distance respectively in meters.

\*\* - The limit decreases linearly with the logarithm of frequency.

\*\*\* - The field strength limits applied from the lowest radio frequency generated in the device, without going below 9 kHz up to the tenth harmonic of the highest fundamental frequency.

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

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

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

7.3.2.3 The worst test results (the lowest margins) found in the EUT X-axis position were shown in the associated plots.

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

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

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

7.3.3.3 The worst test results (the lowest margins) found in the EUT X-axis position were recorded Table 7.3.2, Table 7.3.3 and shown in the associated plots.



<b>Test specification:</b>	<b>Section 15.247(c), Radiated spurious emissions</b>		
<b>Test procedure:</b>	FR Vol. 62, page 26243, Section 15.247(c) / ANSI C63.4, Section 13.1.4		
<b>Test mode:</b>	Compliance	<b>Verdict:</b>	<b>PASS</b>
<b>Date &amp; Time:</b>	1/2/2005 6:21:49 PM		
<b>Temperature:</b> 22 °C	<b>Air Pressure:</b> 1017 hPa	<b>Relative Humidity:</b> 45 %	<b>Power Supply:</b> 3.6 VDC
<b>Remarks:</b>			

Figure 7.3.1 Setup for spurious emission field strength measurements below 30 MHz

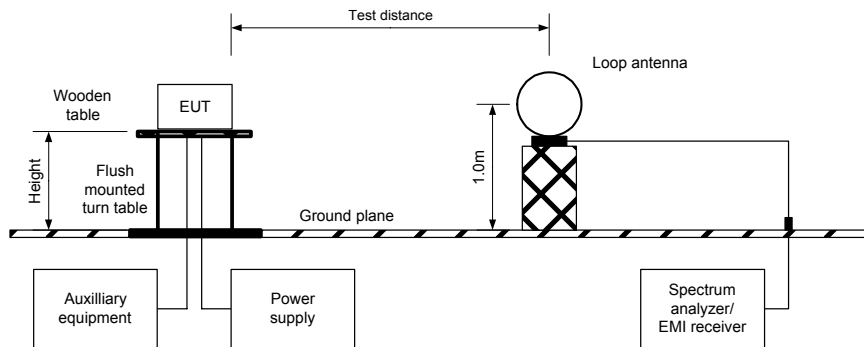
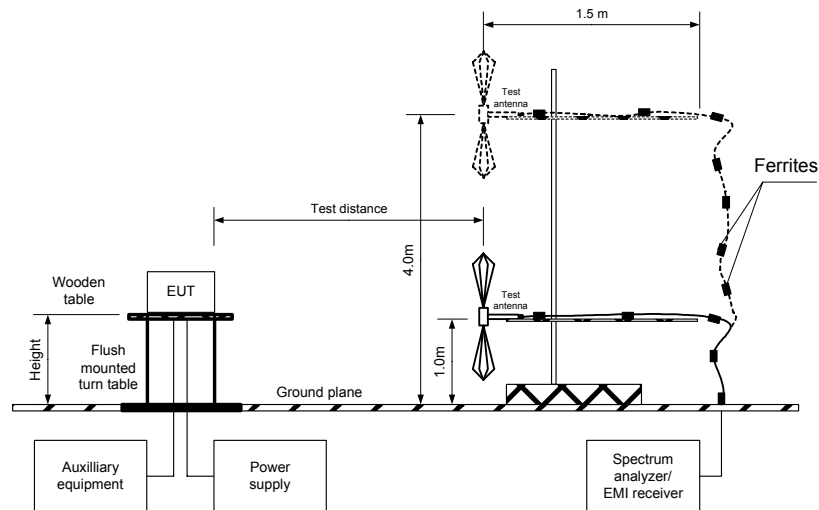


Figure 7.3.2 Setup for spurious emission field strength measurements above 30 MHz





<b>Test specification:</b>		<b>Section 15.247(c), Radiated spurious emissions</b>	
<b>Test procedure:</b>		FR Vol. 62, page 26243, Section 15.247(c) / ANSI C63.4, Section 13.1.4	
<b>Test mode:</b>	Compliance	<b>Verdict:</b>	<b>PASS</b>
<b>Date &amp; Time:</b>	1/2/2005 6:21:49 PM		
<b>Temperature:</b> 22 °C	<b>Air Pressure:</b> 1017 hPa	<b>Relative Humidity:</b> 45 %	<b>Power Supply:</b> 3.6 VDC
<b>Remarks:</b>			

Table 7.3.2 Field strength of emissions outside restricted bands

ASSIGNED FREQUENCY: 2440 MHz  
 INVESTIGATED FREQUENCY RANGE: 0.009 - 25000 MHz  
 TEST DISTANCE: 3 m  
 EUT POSITION: 3 orthogonal ( X / Y / Z )  
 MODULATION: ASK  
 MODULATING SIGNAL: PRBS  
 BIT RATE: 0.5 Mbps  
 DUTY CYCLE: 100 %  
 TRANSMITTER OUTPUT POWER SETTINGS: Maximum  
 DETECTOR USED: Peak  
 RESOLUTION BANDWIDTH: 100 kHz  
 VIDEO BANDWIDTH: 300 kHz  
 TEST ANTENNA TYPE: Active loop (9 kHz – 30 MHz)  
 Biconilog (30 MHz – 1000 MHz)  
 Double ridged guide (above 1000 MHz)

Frequency, MHz	Field strength of spurious, dB(µV/m)	Antenna polarization	Antenna height, m	Azimuth, degrees*	Field strength of carrier, dB(µV/m)	Attenuation below carrier, dBc	Limit, dBc	Margin, dB**	Verdict
1952.055	47.34	H	1.4	354	85.83	38.49	20.00	18.49	Pass
1952.060	45.17	V	1.8	310		40.66		20.66	
2929.084	54.75	H	1.2	30		31.08		11.08	
2929.084	50.03	V	1.1	110		35.80		15.80	
3417.100	53.67	H	1.4	354		32.16		12.16	
3417.100	49.95	V	1.1	183		35.88		15.88	

\*- EUT front panel refers to 0 degrees position of turntable.  
 \*\*- Margin = Attenuation below carrier – specification limit.





<b>Test specification:</b>		<b>Section 15.247(c), Radiated spurious emissions</b>	
<b>Test procedure:</b>		FR Vol. 62, page 26243, Section 15.247(c) / ANSI C63.4, Section 13.1.4	
<b>Test mode:</b>	Compliance	<b>Verdict:</b>	<b>PASS</b>
<b>Date &amp; Time:</b>	1/2/2005 6:21:49 PM		
<b>Temperature:</b> 22 °C	<b>Air Pressure:</b> 1017 hPa	<b>Relative Humidity:</b> 45 %	<b>Power Supply:</b> 3.6 VDC
<b>Remarks:</b>			

**Table 7.3.3 Field strength of spurious emissions above 1 GHz within restricted bands**

ASSIGNED FREQUENCY: 2440 MHz  
 INVESTIGATED FREQUENCY RANGE: 1000 – 25000 MHz  
 TEST DISTANCE: 3 m  
 EUT POSITION: 3 orthogonal ( X / Y / Z )  
 MODULATION: ASK  
 MODULATING SIGNAL: PRBS  
 BIT RATE: 0.5 Mbps  
 DUTY CYCLE: 100 %  
 TRANSMITTER OUTPUT POWER SETTINGS: Maximum  
 DETECTOR USED: Peak  
 RESOLUTION BANDWIDTH: 1000 kHz  
 TEST ANTENNA TYPE: Double ridged guide

Frequency, MHz	Antenna		Azimuth, degrees*	Peak field strength(VBW=3 MHz)			Average field strength(VBW=10 Hz)				Verdict
	Polarization	Height, m		Measured, dB(µV/m)	Limit, dB(µV/m)	Margin, dB**	Measured, dB(µV/m)	Calculated, dB(µV/m)	Limit, dB(µV/m)	Margin, dB***	
2232.50	V	1.2	269	62.49	74.00	-11.51	48.55	42.55	54.00	-11.45	Pass
2218.30	H	1.0	295	49.50	74.00	-24.50	39.94	33.94	54.00	-20.06	
2363.63	V	1.0	0	60.13	74.00	-13.87	45.65	39.65	54.00	-14.35	
2363.63	H	1.0	0	59.30	74.00	-14.70	44.59	38.59	54.00	-15.41	
2696.40	H	1.1	349	54.26	74.00	-19.74	40.25	34.25	54.00	-19.75	
4393.13	H	1.5	157	58.25	74.00	-15.75	53.13	47.13	54.00	-6.87	
4393.13	V	1.1	333	55.40	74.00	-18.60	49.45	43.45	54.00	-10.55	
4881.14	H	1.2	217	62.28	74.00	-11.72	58.62	52.62	54.00	-1.38	
4881.14	V	1.2	167	61.78	74.00	-12.22	57.95	51.95	54.00	-2.05	

\*- EUT front panel refers to 0 degrees position of turntable.  
 \*\*- Margin = Measured field strength - specification limit.  
 \*\*\*- Margin = Calculated field strength - specification limit,  
 where Calculated field strength = Measured field strength + average factor.

**Table 7.3.4 Average factor calculation**

Transmission pulse		Transmission burst		Transmission train duration, ms	Average factor, dB
Duration, ms	Period, ms	Duration, ms	Period, ms		
5	10	NA	NA	NA	6

\*- Average factor was calculated as follows  
 for pulse train shorter than 100 ms:  

$$\text{Average factor} = 20 \times \log_{10} \left( \frac{\text{Pulse duration}}{\text{Pulse period}} \times \frac{\text{Burst duration}}{\text{Train duration}} \times \text{Number of bursts within pulse train} \right)$$



<b>Test specification:</b>		<b>Section 15.247(c), Radiated spurious emissions</b>	
<b>Test procedure:</b>		FR Vol. 62, page 26243, Section 15.247(c) / ANSI C63.4, Section 13.1.4	
<b>Test mode:</b>	Compliance	<b>Verdict:</b>	<b>PASS</b>
<b>Date &amp; Time:</b>	1/2/2005 6:21:49 PM		
<b>Temperature:</b> 22 °C	<b>Air Pressure:</b> 1017 hPa	<b>Relative Humidity:</b> 45 %	<b>Power Supply:</b> 3.6 VDC
<b>Remarks:</b>			

**Table 7.3.5 Field strength of spurious emissions below 1 GHz within restricted bands**

ASSIGNED FREQUENCY: 2440 MHz  
 INVESTIGATED FREQUENCY RANGE: 0.009 – 1000 MHz  
 TEST DISTANCE: 3 m  
 EUT POSITION: 3 orthogonal ( X / Y / Z )  
 MODULATION: ASK  
 MODULATING SIGNAL: PRBS  
 BIT RATE: 0.5 Mbps  
 DUTY CYCLE: 100 %  
 TRANSMITTER OUTPUT POWER SETTINGS: Maximum  
 RESOLUTION BANDWIDTH: 0.2 kHz (9 kHz – 150 kHz)  
 9.0 kHz (150 kHz – 30 MHz)  
 120 kHz (30 MHz – 1000 MHz)  
 VIDEO BANDWIDTH: > Resolution bandwidth  
 TEST ANTENNA TYPE: Active loop (9 kHz – 30 MHz)  
 Biconilog (30 MHz – 1000 MHz)

Frequency, MHz	Peak emission, dB(µV/m)	Quasi-peak			Antenna polarization	Antenna height, m	Turn-table position**, degrees	Verdict
		Measured emission, dB(µV/m)	Limit, dB(µV/m)	Margin, dB*				
No emissions were found								

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

**Table 7.3.6 Restricted bands**

MHz	MHz	MHz	MHz	MHz	GHz
0.09 - 0.11	8.37625 - 8.38675	73 - 74.6	399.9 - 410	2655 - 2900	10.6 - 12.7
0.495 - 0.505	8.41425 - 8.41475	74.8 - 75.2	608 - 614	3260 - 3267	13.25 - 13.4
2.1735 - 2.1905	12.29 - 12.293	108 - 121.94	960 - 1240	3332 - 3339	14.47 - 14.5
4.125 - 4.128	12.51975 - 12.52025	123 - 138	1300 - 1427	3345.8 - 3358	15.35 - 16.2
4.17725 - 4.17775	12.57675 - 12.57725	149.9 - 150.05	1435 - 1626.5	3600 - 4400	17.7 - 21.4
4.20725 - 4.20775	13.36 - 13.41	156.52475 - 156.52525	1645.5 - 1646.5	4500 - 5150	22.01 - 23.12
6.215 - 6.218	16.42 - 16.423	156.7 - 156.9	1660 - 1710	5350 - 5460	23.6 - 24
6.26775 - 6.26825	16.69475 - 16.69525	162.0125 - 167.17	1718.8 - 1722.2	7250 - 7750	31.2 - 31.8
6.31175 - 6.31225	16.80425 - 16.80475	167.72 - 173.2	2200 - 2300	8025 - 8500	36.43 - 36.5
8.291 - 8.294	25.5 - 25.67	240 - 285	2310 - 2390	9000 - 9200	Above 38.6
8.362 - 8.366	37.5 - 38.25	322 - 335.4	2483.5 - 2500	9300 - 9500	

**Reference numbers of test equipment used**

HL 0410	HL 0446	HL 0465	HL 0521	HL 0589	HL 0592	HL 0593	HL 0594
HL 0604	HL 1004	HL 1424	HL 1942	HL 1984	HL 2009	HL 2259	

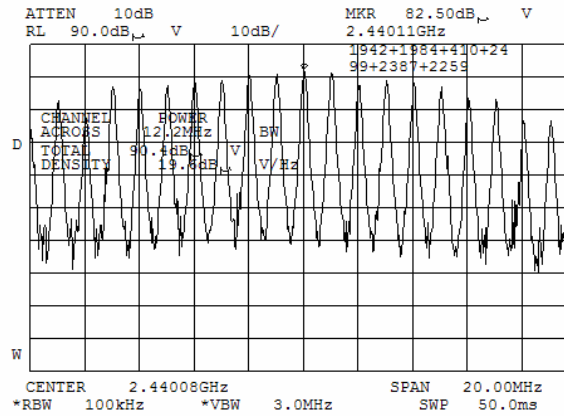
Full description is given in Appendix A.



<b>Test specification:</b>	<b>Section 15.247(c), Radiated spurious emissions</b>		
<b>Test procedure:</b>	FR Vol. 62, page 26243, Section 15.247(c) / ANSI C63.4, Section 13.1.4		
<b>Test mode:</b>	Compliance	<b>Verdict:</b>	<b>PASS</b>
<b>Date &amp; Time:</b>	1/2/2005 6:21:49 PM		
<b>Temperature:</b> 22 °C	<b>Air Pressure:</b> 1017 hPa	<b>Relative Humidity:</b> 45 %	<b>Power Supply:</b> 3.6 VDC
<b>Remarks:</b>			

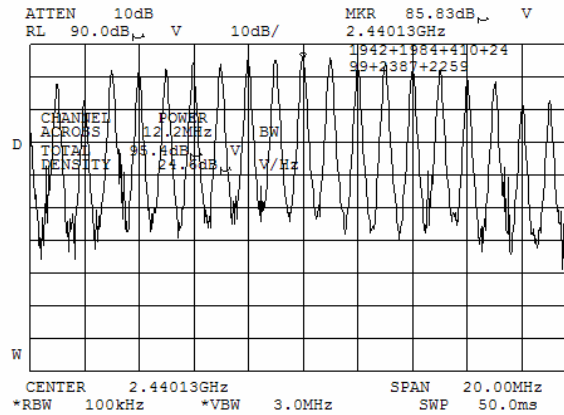
**Plot 7.3.1 Radiated emission measurements at the carrier frequency**

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



**Plot 7.3.2 Radiated emission measurements at the carrier frequency**

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

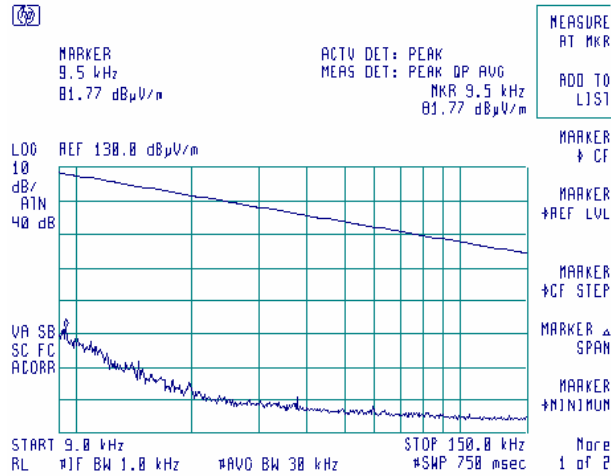




<b>Test specification:</b>	<b>Section 15.247(c), Radiated spurious emissions</b>		
<b>Test procedure:</b>	FR Vol. 62, page 26243, Section 15.247(c) / ANSI C63.4, Section 13.1.4		
<b>Test mode:</b>	Compliance	<b>Verdict:</b>	<b>PASS</b>
<b>Date &amp; Time:</b>	1/2/2005 6:21:49 PM		
<b>Temperature:</b> 22 °C	<b>Air Pressure:</b> 1017 hPa	<b>Relative Humidity:</b> 45 %	<b>Power Supply:</b> 3.6 VDC
<b>Remarks:</b>			

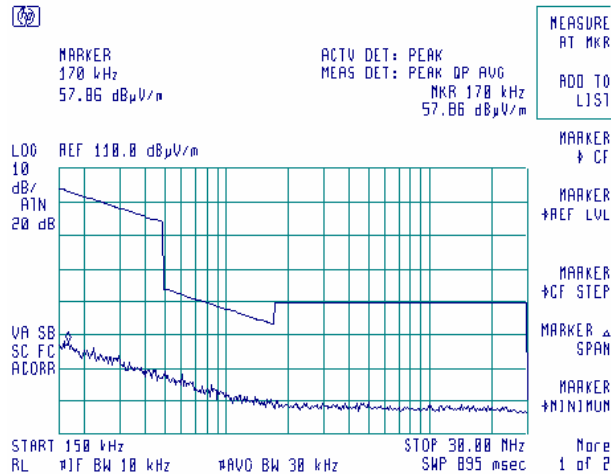
Plot 7.3.3 Radiated emission measurements from 9 to 150 kHz

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



Plot 7.3.4 Radiated emission measurements from 0.15 to 30 MHz

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

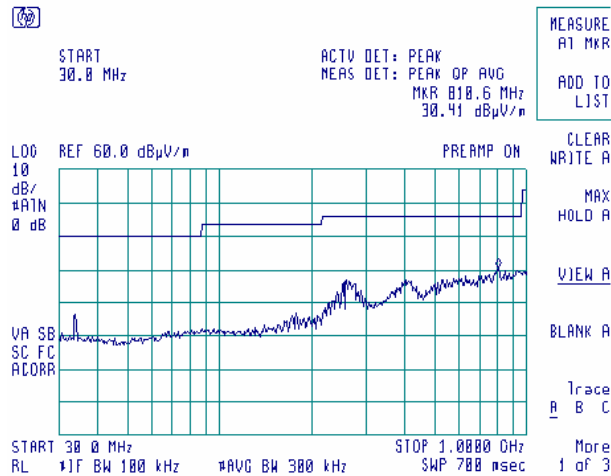




<b>Test specification:</b>	<b>Section 15.247(c), Radiated spurious emissions</b>		
<b>Test procedure:</b>	FR Vol. 62, page 26243, Section 15.247(c) / ANSI C63.4, Section 13.1.4		
<b>Test mode:</b>	Compliance	<b>Verdict:</b>	<b>PASS</b>
<b>Date &amp; Time:</b>	1/2/2005 6:21:49 PM		
<b>Temperature:</b> 22 °C	<b>Air Pressure:</b> 1017 hPa	<b>Relative Humidity:</b> 45 %	<b>Power Supply:</b> 3.6 VDC
<b>Remarks:</b>			

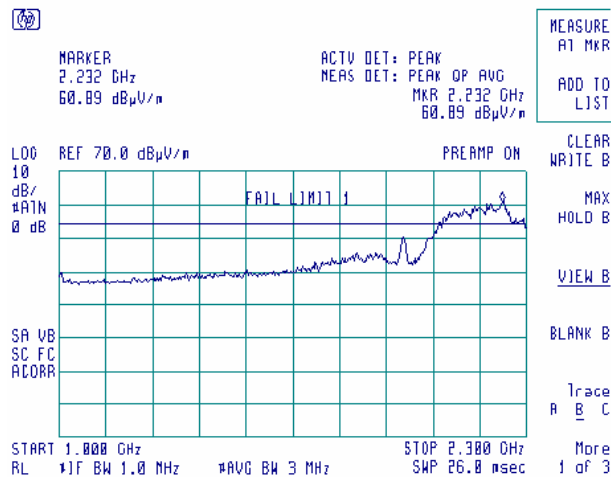
**Plot 7.3.5 Radiated emission measurements from 30 to 1000 MHz**

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



**Plot 7.3.6 Radiated emission measurements from 1000 to 2300 MHz**

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

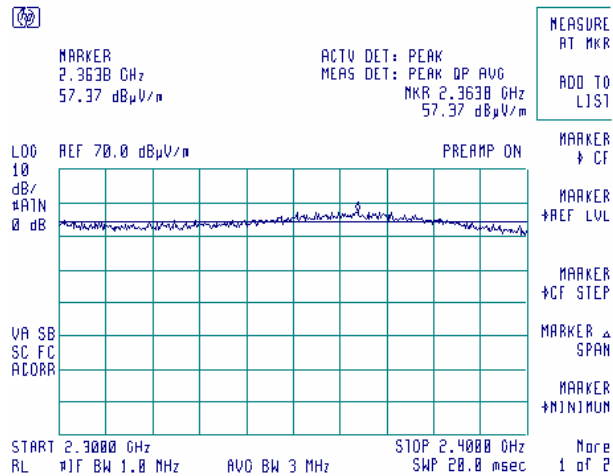




<b>Test specification:</b>	<b>Section 15.247(c), Radiated spurious emissions</b>		
<b>Test procedure:</b>	FR Vol. 62, page 26243, Section 15.247(c) / ANSI C63.4, Section 13.1.4		
<b>Test mode:</b>	Compliance	<b>Verdict:</b>	<b>PASS</b>
<b>Date &amp; Time:</b>	1/2/2005 6:21:49 PM		
<b>Temperature:</b> 22 °C	<b>Air Pressure:</b> 1017 hPa	<b>Relative Humidity:</b> 45 %	<b>Power Supply:</b> 3.6 VDC
<b>Remarks:</b>			

Plot 7.3.7 Radiated emission measurements from 2300 to 2400 MHz at the carrier frequency

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

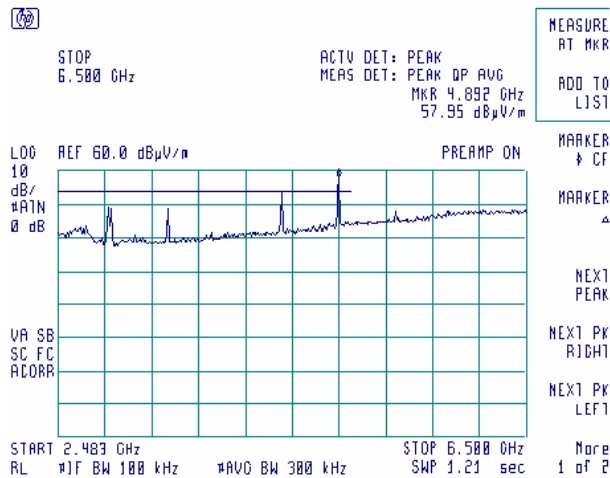




<b>Test specification:</b>	<b>Section 15.247(c), Radiated spurious emissions</b>		
<b>Test procedure:</b>	FR Vol. 62, page 26243, Section 15.247(c) / ANSI C63.4, Section 13.1.4		
<b>Test mode:</b>	Compliance	<b>Verdict:</b>	<b>PASS</b>
<b>Date &amp; Time:</b>	1/2/2005 6:21:49 PM		
<b>Temperature:</b> 22 °C	<b>Air Pressure:</b> 1017 hPa	<b>Relative Humidity:</b> 45 %	<b>Power Supply:</b> 3.6 VDC
<b>Remarks:</b>			

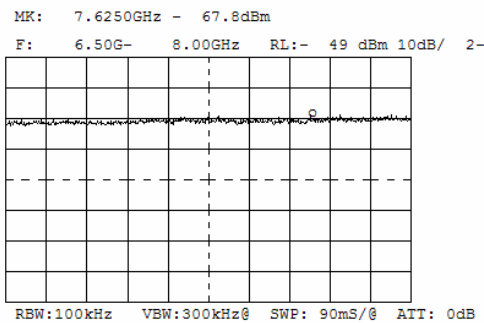
**Plot 7.3.8 Radiated emission measurements from 2483 to 6500 MHz**

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



**Plot 7.3.9 Radiated emission measurements from 6500 to 8000 MHz**

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

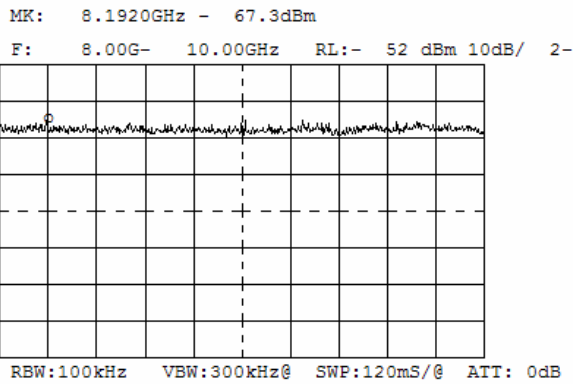




<b>Test specification:</b>		<b>Section 15.247(c), Radiated spurious emissions</b>	
<b>Test procedure:</b>		FR Vol. 62, page 26243, Section 15.247(c) / ANSI C63.4, Section 13.1.4	
<b>Test mode:</b>	Compliance	<b>Verdict:</b>	<b>PASS</b>
<b>Date &amp; Time:</b>	1/2/2005 6:21:49 PM		
<b>Temperature:</b> 22 °C	<b>Air Pressure:</b> 1017 hPa	<b>Relative Humidity:</b> 45 %	<b>Power Supply:</b> 3.6 VDC
<b>Remarks:</b>			

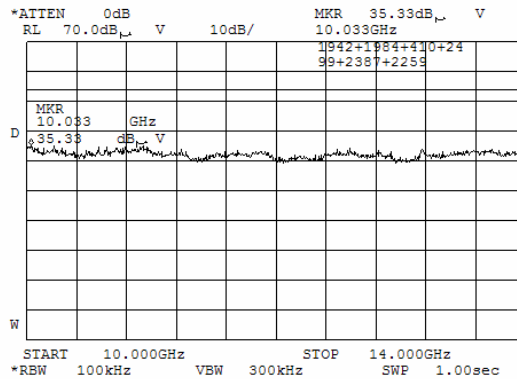
**Plot 7.3.10 Radiated emission measurements from 8000 to 10000 MHz**

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



**Plot 7.3.11 Radiated emission measurements from 10000 to 14000 MHz**

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



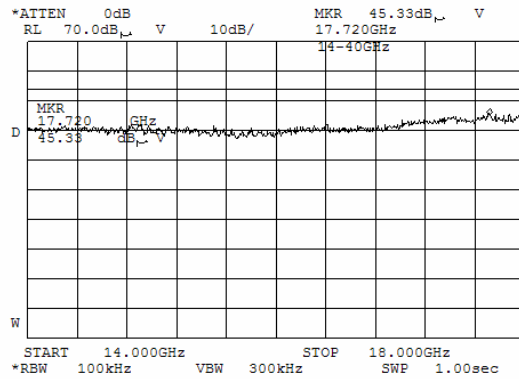




<b>Test specification:</b>	<b>Section 15.247(c), Radiated spurious emissions</b>		
<b>Test procedure:</b>	FR Vol. 62, page 26243, Section 15.247(c) / ANSI C63.4, Section 13.1.4		
<b>Test mode:</b>	Compliance	<b>Verdict:</b>	<b>PASS</b>
<b>Date &amp; Time:</b>	1/2/2005 6:21:49 PM		
<b>Temperature:</b> 22 °C	<b>Air Pressure:</b> 1017 hPa	<b>Relative Humidity:</b> 45 %	<b>Power Supply:</b> 3.6 VDC
<b>Remarks:</b>			

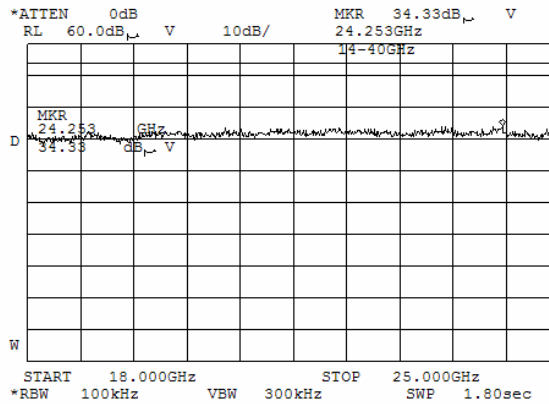
Plot 7.3.12 Radiated emission measurements from 14000 to 18000 MHz

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



Plot 7.3.13 Radiated emission measurements from 18000 to 25000 MHz

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

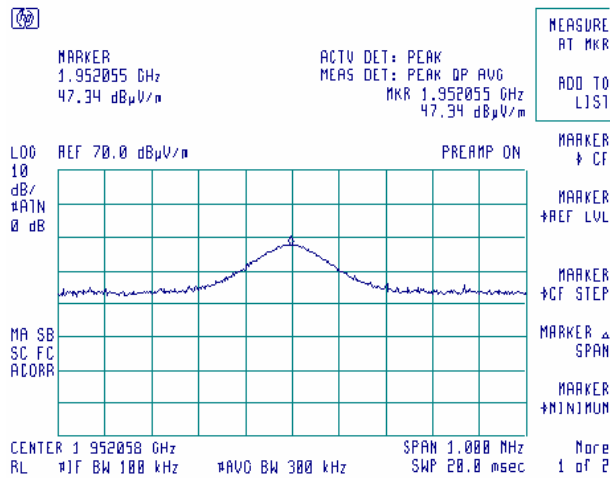




<b>Test specification:</b>	<b>Section 15.247(c), Radiated spurious emissions</b>		
<b>Test procedure:</b>	FR Vol. 62, page 26243, Section 15.247(c) / ANSI C63.4, Section 13.1.4		
<b>Test mode:</b>	Compliance	<b>Verdict:</b>	<b>PASS</b>
<b>Date &amp; Time:</b>	1/2/2005 6:21:49 PM		
<b>Temperature:</b> 22 °C	<b>Air Pressure:</b> 1017 hPa	<b>Relative Humidity:</b> 45 %	<b>Power Supply:</b> 3.6 VDC
<b>Remarks:</b>			

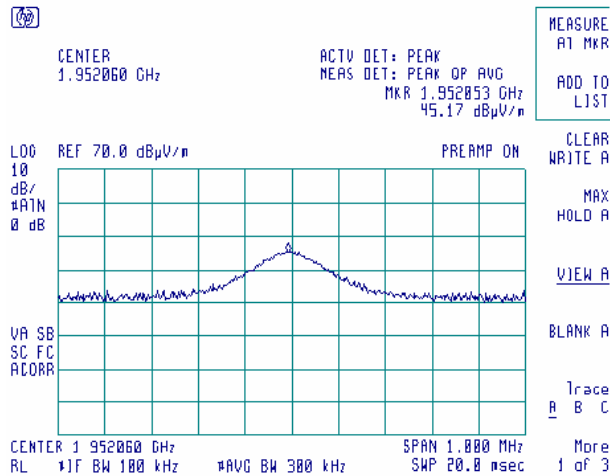
**Plot 7.3.14 Radiated emission measurements at the 1952.1 MHz frequency**

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



**Plot 7.3.15 Radiated emission measurements at the 1952 MHz frequency**

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

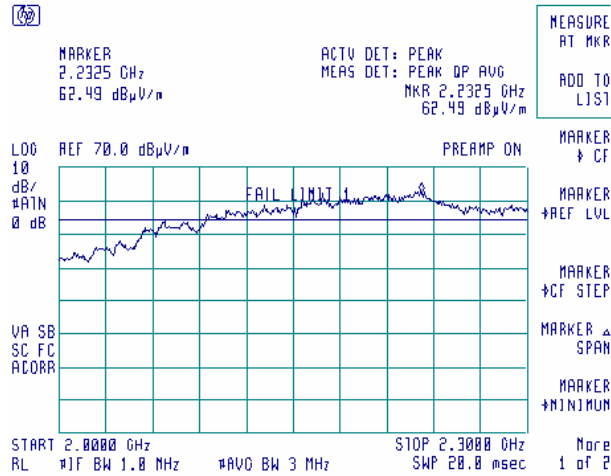




<b>Test specification:</b>	<b>Section 15.247(c), Radiated spurious emissions</b>		
<b>Test procedure:</b>	FR Vol. 62, page 26243, Section 15.247(c) / ANSI C63.4, Section 13.1.4		
<b>Test mode:</b>	Compliance	<b>Verdict:</b>	<b>PASS</b>
<b>Date &amp; Time:</b>	1/2/2005 6:21:49 PM		
<b>Temperature:</b> 22 °C	<b>Air Pressure:</b> 1017 hPa	<b>Relative Humidity:</b> 45 %	<b>Power Supply:</b> 3.6 VDC
<b>Remarks:</b>			

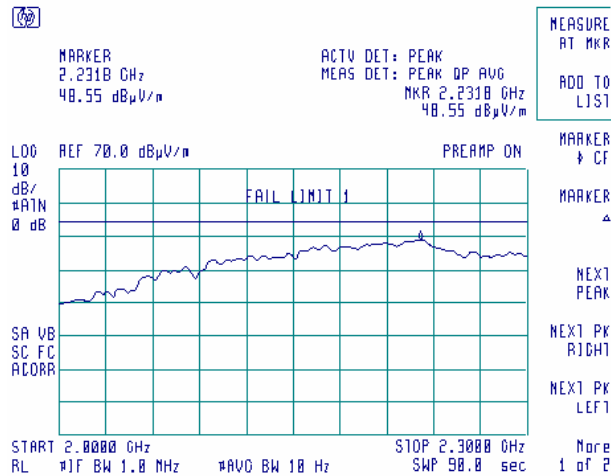
**Plot 7.3.16 Radiated emission measurements at 2236 MHz**

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



**Plot 7.3.17 Radiated emission measurements from at 2236 MHz**

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

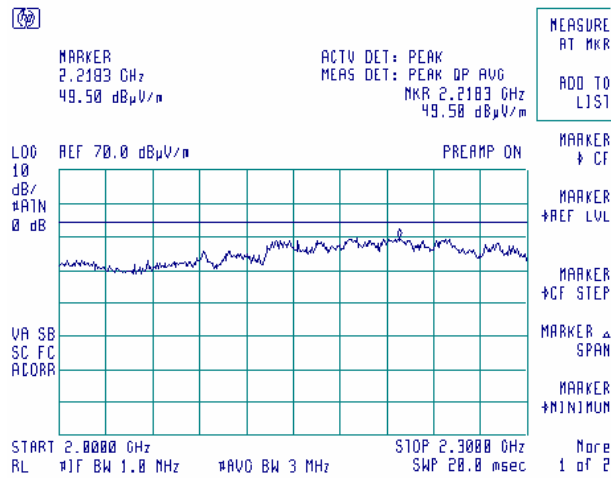




<b>Test specification:</b> Section 15.247(c), Radiated spurious emissions			
<b>Test procedure:</b> FR Vol. 62, page 26243, Section 15.247(c) / ANSI C63.4, Section 13.1.4			
<b>Test mode:</b> Compliance	<b>Verdict:</b> PASS		
<b>Date &amp; Time:</b> 1/2/2005 6:21:49 PM			
<b>Temperature:</b> 22 °C	<b>Air Pressure:</b> 1017 hPa	<b>Relative Humidity:</b> 45 %	<b>Power Supply:</b> 3.6 VDC
<b>Remarks:</b>			

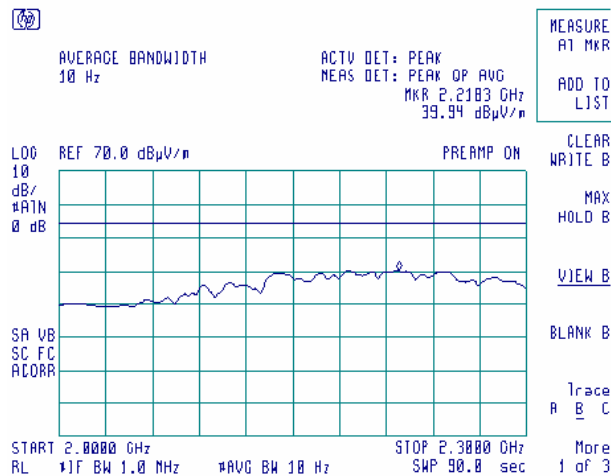
Plot 7.3.18 Radiated emission measurements at 2236 MHz

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



Plot 7.3.19 Radiated emission measurements at 2236 MHz

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

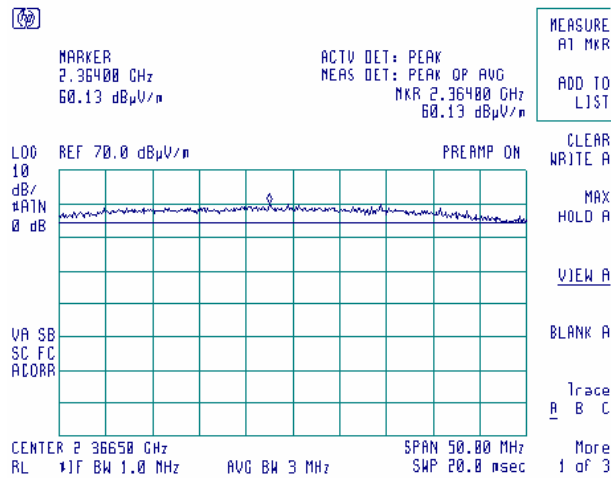




<b>Test specification:</b>	<b>Section 15.247(c), Radiated spurious emissions</b>		
<b>Test procedure:</b>	FR Vol. 62, page 26243, Section 15.247(c) / ANSI C63.4, Section 13.1.4		
<b>Test mode:</b>	Compliance	<b>Verdict:</b>	<b>PASS</b>
<b>Date &amp; Time:</b>	1/2/2005 6:21:49 PM		
<b>Temperature:</b> 22 °C	<b>Air Pressure:</b> 1017 hPa	<b>Relative Humidity:</b> 45 %	<b>Power Supply:</b> 3.6 VDC
<b>Remarks:</b>			

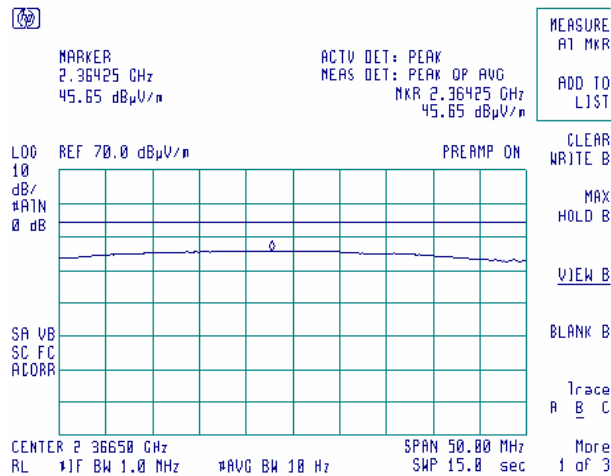
**Plot 7.3.20 Radiated emission measurements at 2364 MHz**

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



**Plot 7.3.21 Radiated emission measurements at 2364 MHz**

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

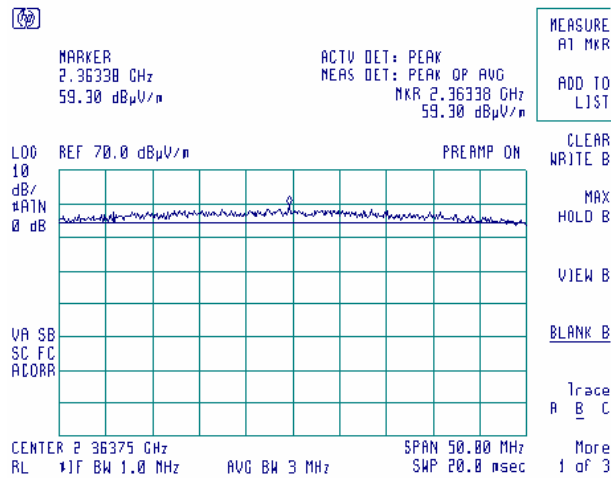




<b>Test specification:</b>	<b>Section 15.247(c), Radiated spurious emissions</b>		
<b>Test procedure:</b>	FR Vol. 62, page 26243, Section 15.247(c) / ANSI C63.4, Section 13.1.4		
<b>Test mode:</b>	Compliance	<b>Verdict:</b>	<b>PASS</b>
<b>Date &amp; Time:</b>	1/2/2005 6:21:49 PM		
<b>Temperature:</b> 22 °C	<b>Air Pressure:</b> 1017 hPa	<b>Relative Humidity:</b> 45 %	<b>Power Supply:</b> 3.6 VDC
<b>Remarks:</b>			

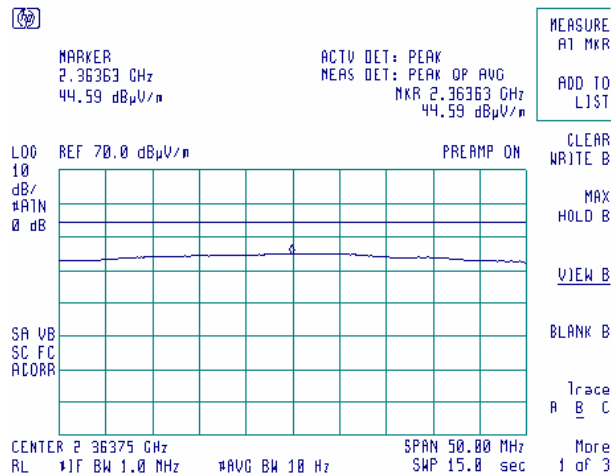
**Plot 7.3.22 Radiated emission measurements at 2364 MHz**

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



**Plot 7.3.23 Radiated emission measurements at 2364 MHz**

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

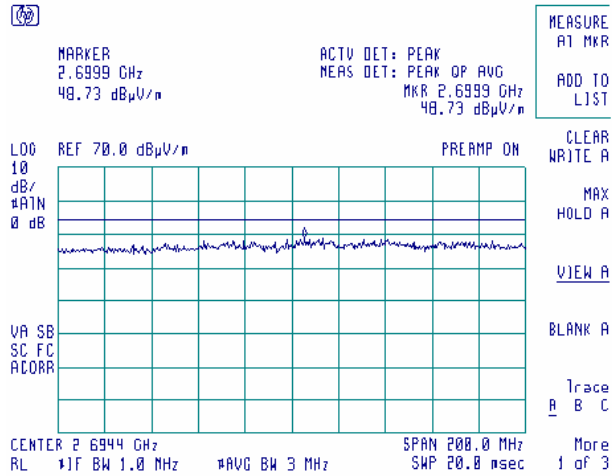




<b>Test specification:</b>	<b>Section 15.247(c), Radiated spurious emissions</b>		
<b>Test procedure:</b>	FR Vol. 62, page 26243, Section 15.247(c) / ANSI C63.4, Section 13.1.4		
<b>Test mode:</b>	Compliance	<b>Verdict:</b>	<b>PASS</b>
<b>Date &amp; Time:</b>	1/2/2005 6:21:49 PM		
<b>Temperature:</b> 22 °C	<b>Air Pressure:</b> 1017 hPa	<b>Relative Humidity:</b> 45 %	<b>Power Supply:</b> 3.6 VDC
<b>Remarks:</b>			

**Plot 7.3.24 Radiated emission measurements at the 2674 MHz frequency**

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

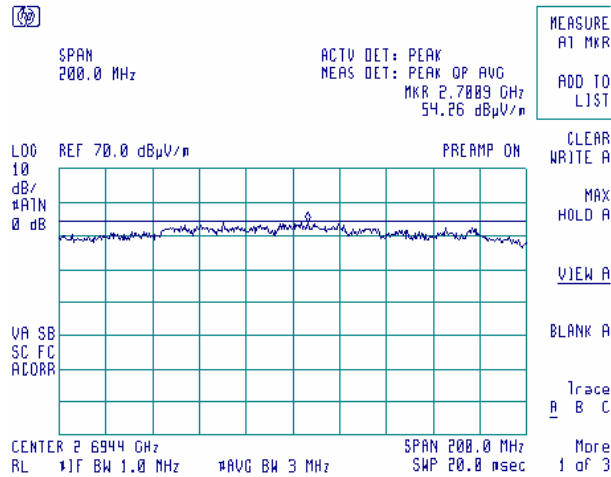




<b>Test specification:</b>	<b>Section 15.247(c), Radiated spurious emissions</b>		
<b>Test procedure:</b>	FR Vol. 62, page 26243, Section 15.247(c) / ANSI C63.4, Section 13.1.4		
<b>Test mode:</b>	Compliance	<b>Verdict:</b>	<b>PASS</b>
<b>Date &amp; Time:</b>	1/2/2005 6:21:49 PM		
<b>Temperature:</b> 22 °C	<b>Air Pressure:</b> 1017 hPa	<b>Relative Humidity:</b> 45 %	<b>Power Supply:</b> 3.6 VDC
<b>Remarks:</b>			

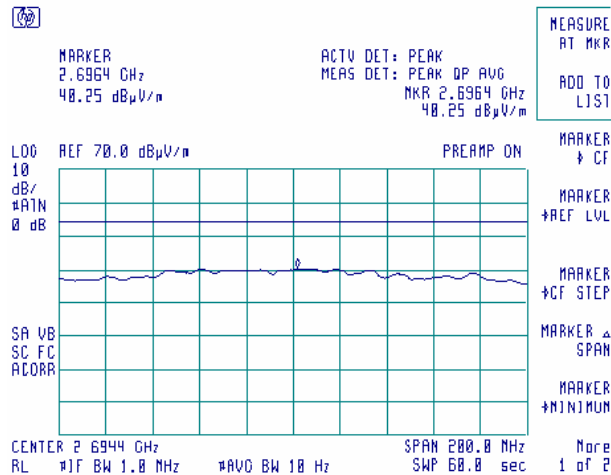
**Plot 7.3.25 Radiated emission measurements at the 2697 MHz frequency**

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



**Plot 7.3.26 Radiated emission measurements at the 2697 MHz frequency**

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



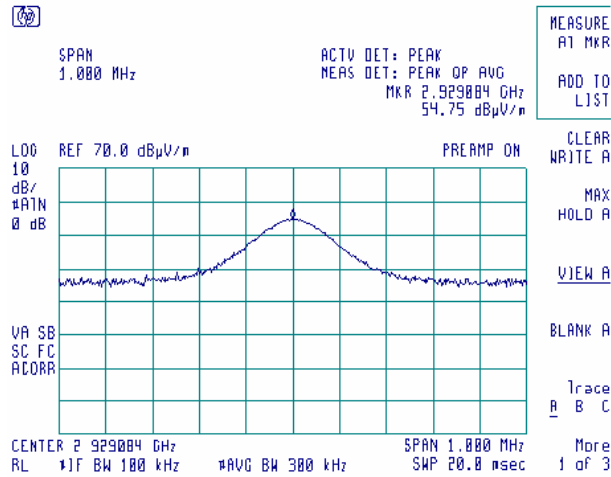




<b>Test specification:</b> Section 15.247(c), Radiated spurious emissions			
<b>Test procedure:</b> FR Vol. 62, page 26243, Section 15.247(c) / ANSI C63.4, Section 13.1.4			
<b>Test mode:</b> Compliance	<b>Verdict:</b> PASS		
<b>Date &amp; Time:</b> 1/2/2005 6:21:49 PM			
<b>Temperature:</b> 22 °C	<b>Air Pressure:</b> 1017 hPa	<b>Relative Humidity:</b> 45 %	<b>Power Supply:</b> 3.6 VDC
<b>Remarks:</b>			

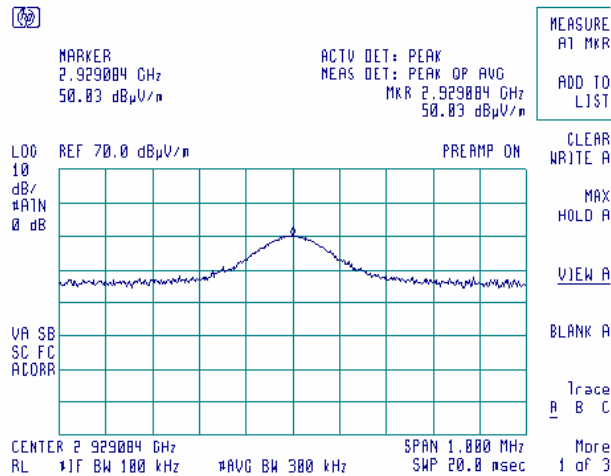
Plot 7.3.27 Radiated emission measurements at the 2929 MHz frequency

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



Plot 7.3.28 Radiated emission measurements at the 2929 MHz frequency

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

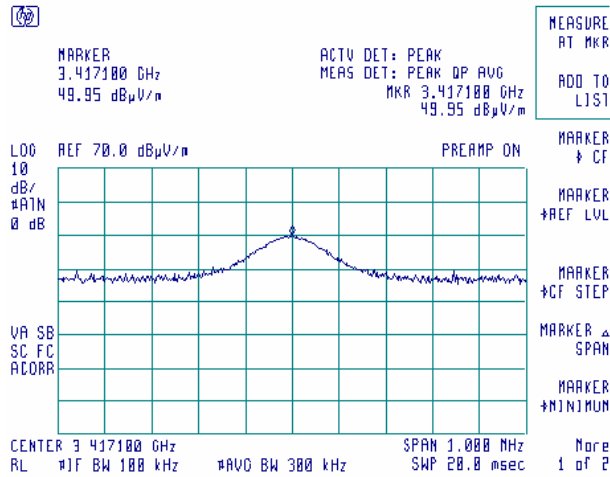




<b>Test specification:</b> Section 15.247(c), Radiated spurious emissions			
<b>Test procedure:</b> FR Vol. 62, page 26243, Section 15.247(c) / ANSI C63.4, Section 13.1.4			
<b>Test mode:</b> Compliance	<b>Verdict:</b> PASS		
<b>Date &amp; Time:</b> 1/2/2005 6:21:49 PM			
<b>Temperature:</b> 22 °C	<b>Air Pressure:</b> 1017 hPa	<b>Relative Humidity:</b> 45 %	<b>Power Supply:</b> 3.6 VDC
<b>Remarks:</b>			

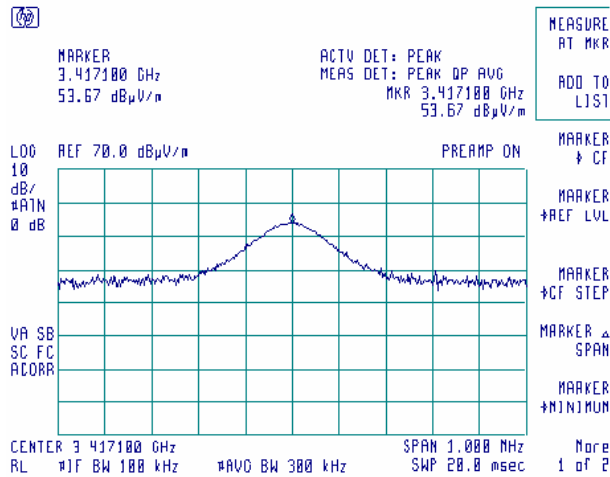
Plot 7.3.29 Radiated emission measurements at the 3417 MHz frequency

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



Plot 7.3.30 Radiated emission measurements at the 3417 MHz frequency

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

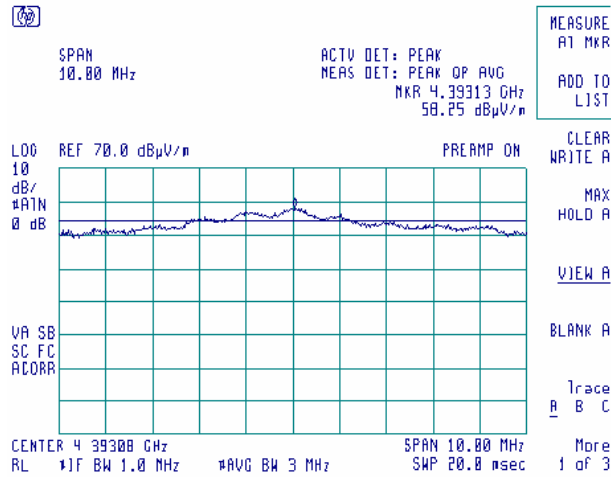




<b>Test specification:</b> Section 15.247(c), Radiated spurious emissions			
<b>Test procedure:</b> FR Vol. 62, page 26243, Section 15.247(c) / ANSI C63.4, Section 13.1.4			
<b>Test mode:</b> Compliance	<b>Verdict:</b> PASS		
<b>Date &amp; Time:</b> 1/2/2005 6:21:49 PM			
<b>Temperature:</b> 22 °C	<b>Air Pressure:</b> 1017 hPa	<b>Relative Humidity:</b> 45 %	<b>Power Supply:</b> 3.6 VDC
<b>Remarks:</b>			

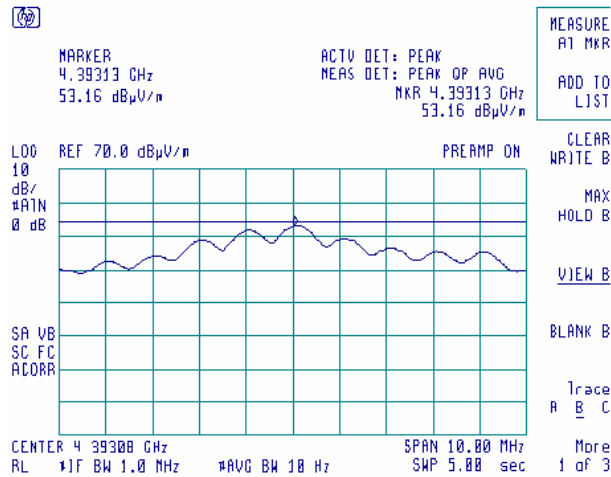
Plot 7.3.31 Radiated emission measurements at the 4399 MHz frequency

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



Plot 7.3.32 Radiated emission measurements at the 4399 MHz frequency

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

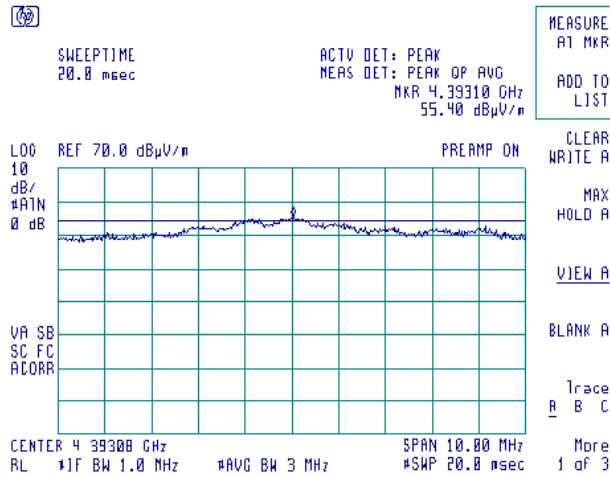




<b>Test specification:</b> Section 15.247(c), Radiated spurious emissions			
<b>Test procedure:</b> FR Vol. 62, page 26243, Section 15.247(c) / ANSI C63.4, Section 13.1.4			
<b>Test mode:</b> Compliance	<b>Verdict:</b> PASS		
<b>Date &amp; Time:</b> 1/2/2005 6:21:49 PM			
<b>Temperature:</b> 22 °C	<b>Air Pressure:</b> 1017 hPa	<b>Relative Humidity:</b> 45 %	<b>Power Supply:</b> 3.6 VDC
<b>Remarks:</b>			

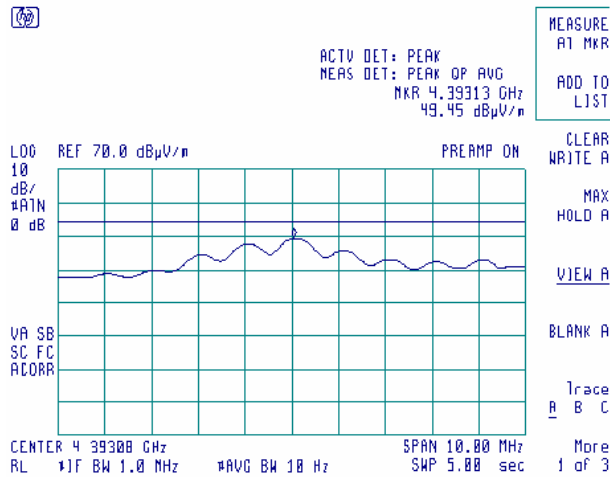
Plot 7.3.33 Radiated emission measurements at the 4399 MHz frequency

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



Plot 7.3.34 Radiated emission measurements at the 4399 MHz frequency

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

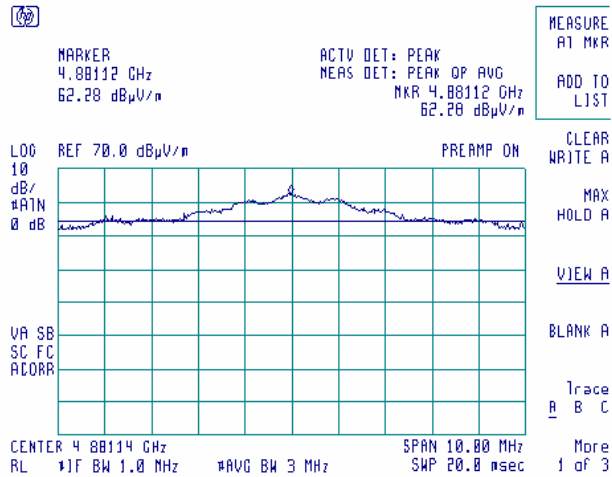




<b>Test specification:</b>	<b>Section 15.247(c), Radiated spurious emissions</b>		
<b>Test procedure:</b>	FR Vol. 62, page 26243, Section 15.247(c) / ANSI C63.4, Section 13.1.4		
<b>Test mode:</b>	Compliance	<b>Verdict:</b>	<b>PASS</b>
<b>Date &amp; Time:</b>	1/2/2005 6:21:49 PM		
<b>Temperature:</b> 22 °C	<b>Air Pressure:</b> 1017 hPa	<b>Relative Humidity:</b> 45 %	<b>Power Supply:</b> 3.6 VDC
<b>Remarks:</b>			

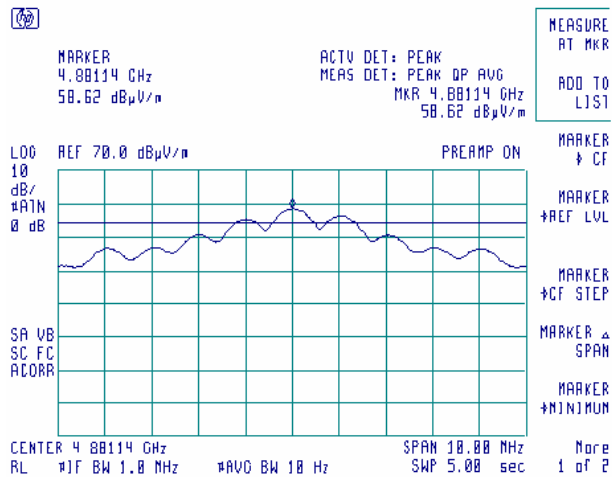
Plot 7.3.35 Radiated emission measurements at the second harmonic of carrier frequency

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



Plot 7.3.36 Radiated emission measurements at the second harmonic of carrier frequency

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

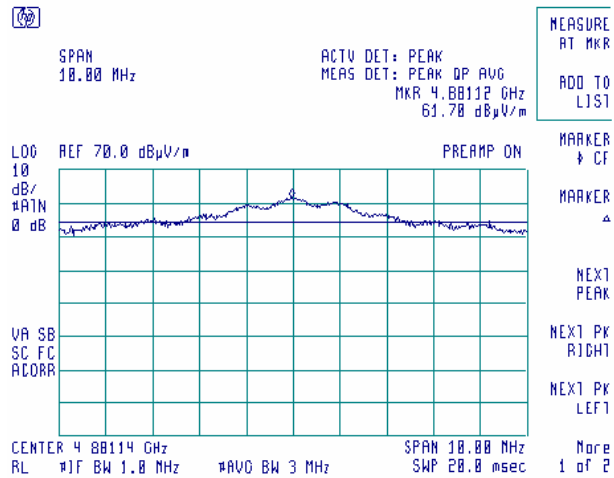




<b>Test specification:</b>	<b>Section 15.247(c), Radiated spurious emissions</b>		
<b>Test procedure:</b>	FR Vol. 62, page 26243, Section 15.247(c) / ANSI C63.4, Section 13.1.4		
<b>Test mode:</b>	Compliance	<b>Verdict:</b>	<b>PASS</b>
<b>Date &amp; Time:</b>	1/2/2005 6:21:49 PM		
<b>Temperature:</b> 22 °C	<b>Air Pressure:</b> 1017 hPa	<b>Relative Humidity:</b> 45 %	<b>Power Supply:</b> 3.6 VDC
<b>Remarks:</b>			

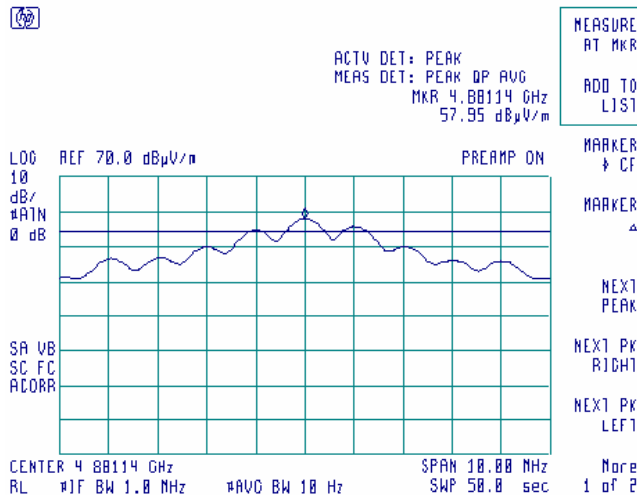
Plot 7.3.37 Radiated emission measurements at the second harmonic of carrier frequency

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



Plot 7.3.38 Radiated emission measurements at the second harmonic of carrier frequency

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

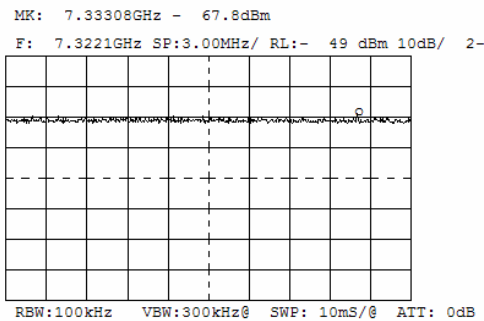




<b>Test specification:</b>	<b>Section 15.247(c), Radiated spurious emissions</b>		
<b>Test procedure:</b>	FR Vol. 62, page 26243, Section 15.247(c) / ANSI C63.4, Section 13.1.4		
<b>Test mode:</b>	Compliance	<b>Verdict:</b>	<b>PASS</b>
<b>Date &amp; Time:</b>	1/2/2005 6:21:49 PM		
<b>Temperature:</b> 22 °C	<b>Air Pressure:</b> 1017 hPa	<b>Relative Humidity:</b> 45 %	<b>Power Supply:</b> 3.6 VDC
<b>Remarks:</b>			

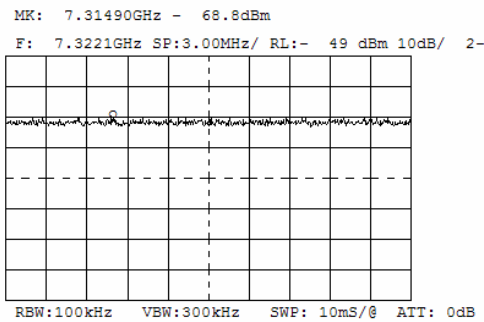
**Plot 7.3.39 Radiated emission measurements at the third harmonic of carrier frequency**

TEST SITE: OATS  
TEST DISTANCE: 3 m  
ANTENNA POLARIZATION: Vertical



**Plot 7.3.40 Radiated emission measurements at the third harmonic of carrier frequency**

TEST SITE: OATS  
TEST DISTANCE: 3 m  
ANTENNA POLARIZATION: Horizontal

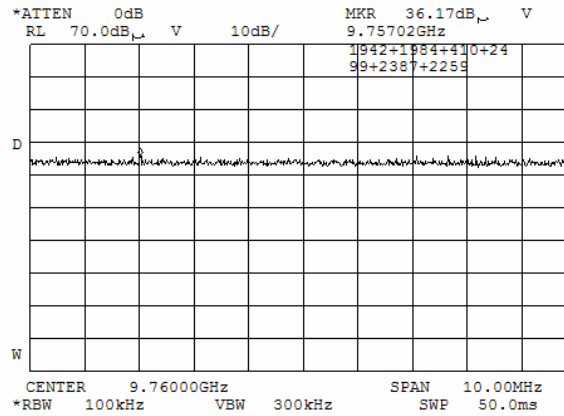




<b>Test specification:</b>	<b>Section 15.247(c), Radiated spurious emissions</b>		
<b>Test procedure:</b>	FR Vol. 62, page 26243, Section 15.247(c) / ANSI C63.4, Section 13.1.4		
<b>Test mode:</b>	Compliance	<b>Verdict:</b>	<b>PASS</b>
<b>Date &amp; Time:</b>	1/2/2005 6:21:49 PM		
<b>Temperature:</b> 22 °C	<b>Air Pressure:</b> 1017 hPa	<b>Relative Humidity:</b> 45 %	<b>Power Supply:</b> 3.6 VDC
<b>Remarks:</b>			

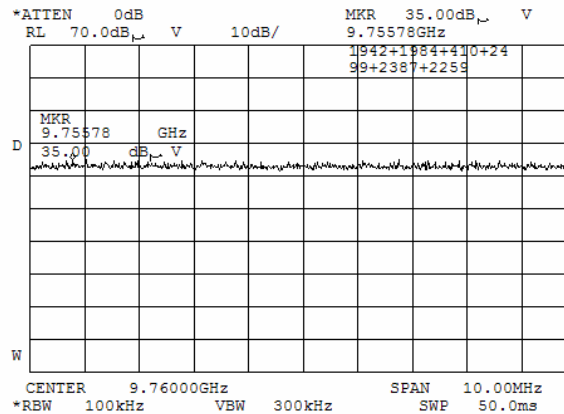
**Plot 7.3.41 Radiated emission measurements at the forth harmonic of carrier frequency**

TEST SITE: OATS  
TEST DISTANCE: 3 m  
ANTENNA POLARIZATION: Vertical



**Plot 7.3.42 Radiated emission measurements at the forth harmonic of carrier frequency**

TEST SITE: OATS  
TEST DISTANCE: 3 m  
ANTENNA POLARIZATION: Horizontal





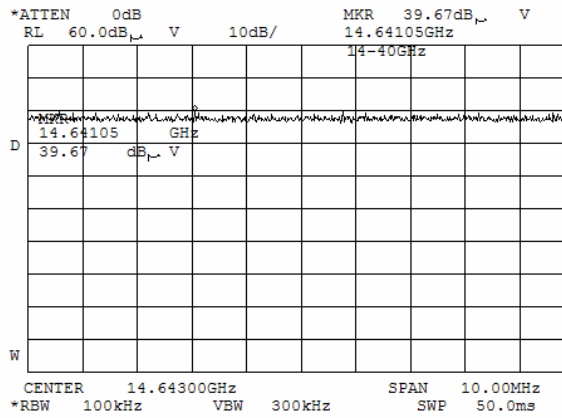




<b>Test specification:</b> Section 15.247(c), Radiated spurious emissions			
<b>Test procedure:</b> FR Vol. 62, page 26243, Section 15.247(c) / ANSI C63.4, Section 13.1.4			
<b>Test mode:</b> Compliance	<b>Verdict:</b> PASS		
<b>Date &amp; Time:</b> 1/2/2005 6:21:49 PM			
<b>Temperature:</b> 22 °C	<b>Air Pressure:</b> 1017 hPa	<b>Relative Humidity:</b> 45 %	<b>Power Supply:</b> 3.6 VDC
<b>Remarks:</b>			

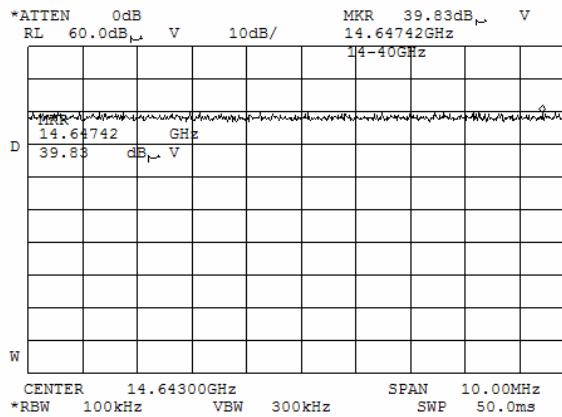
**Plot 7.3.45 Radiated emission measurements at the sixth harmonic of carrier frequency**

TEST SITE: OATS  
TEST DISTANCE: 3 m  
ANTENNA POLARIZATION: Vertical



**Plot 7.3.46 Radiated emission measurements at the sixth harmonic of carrier frequency**

TEST SITE: OATS  
TEST DISTANCE: 3 m  
ANTENNA POLARIZATION: Horizontal

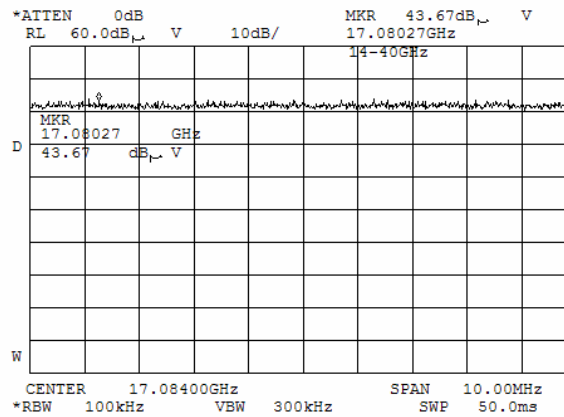




<b>Test specification:</b>	<b>Section 15.247(c), Radiated spurious emissions</b>		
<b>Test procedure:</b>	FR Vol. 62, page 26243, Section 15.247(c) / ANSI C63.4, Section 13.1.4		
<b>Test mode:</b>	Compliance	<b>Verdict:</b>	<b>PASS</b>
<b>Date &amp; Time:</b>	1/2/2005 6:21:49 PM		
<b>Temperature:</b> 22 °C	<b>Air Pressure:</b> 1017 hPa	<b>Relative Humidity:</b> 45 %	<b>Power Supply:</b> 3.6 VDC
<b>Remarks:</b>			

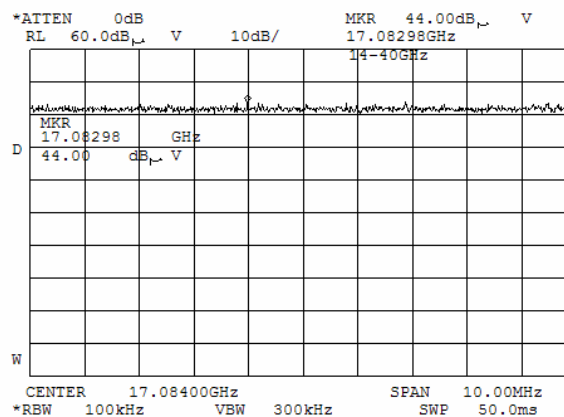
**Plot 7.3.47 Radiated emission measurements at the seventh harmonic of carrier frequency**

TEST SITE: OATS  
TEST DISTANCE: 3 m  
ANTENNA POLARIZATION: Vertical



**Plot 7.3.48 Radiated emission measurements at the seventh harmonic of carrier frequency**

TEST SITE: OATS  
TEST DISTANCE: 3 m  
ANTENNA POLARIZATION: Horizontal

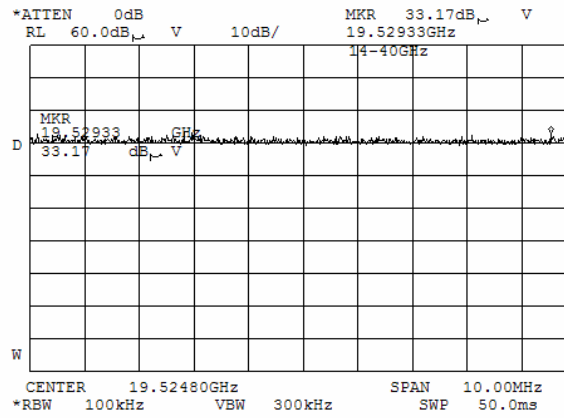




<b>Test specification:</b> Section 15.247(c), Radiated spurious emissions			
<b>Test procedure:</b> FR Vol. 62, page 26243, Section 15.247(c) / ANSI C63.4, Section 13.1.4			
<b>Test mode:</b> Compliance	<b>Verdict:</b> PASS		
<b>Date &amp; Time:</b> 1/2/2005 6:21:49 PM			
<b>Temperature:</b> 22 °C	<b>Air Pressure:</b> 1017 hPa	<b>Relative Humidity:</b> 45 %	<b>Power Supply:</b> 3.6 VDC
<b>Remarks:</b>			

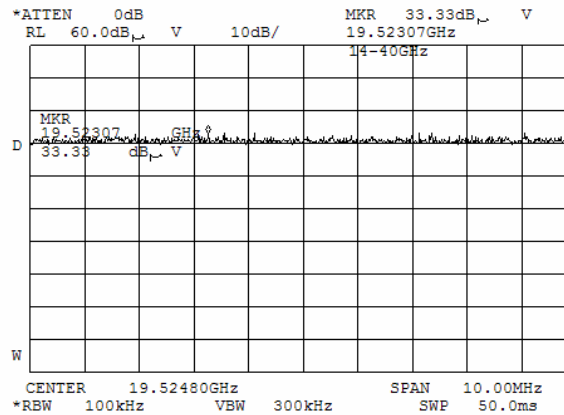
Plot 7.3.49 Radiated emission measurements at the eighth harmonic of carrier frequency

TEST SITE: OATS  
TEST DISTANCE: 3 m  
ANTENNA POLARIZATION: Vertical



Plot 7.3.50 Radiated emission measurements at the eighth harmonic of carrier frequency

TEST SITE: OATS  
TEST DISTANCE: 3 m  
ANTENNA POLARIZATION: Horizontal

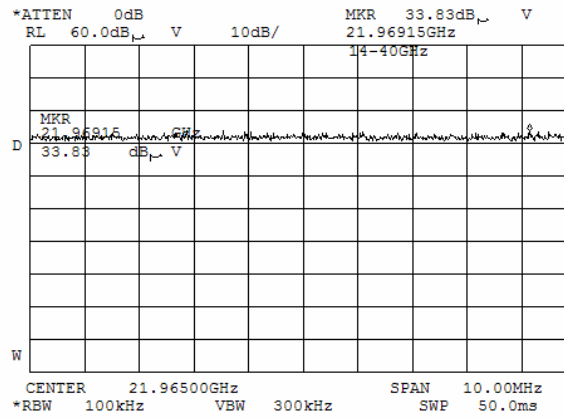




<b>Test specification:</b> Section 15.247(c), Radiated spurious emissions			
<b>Test procedure:</b> FR Vol. 62, page 26243, Section 15.247(c) / ANSI C63.4, Section 13.1.4			
<b>Test mode:</b> Compliance	<b>Verdict:</b> PASS		
<b>Date &amp; Time:</b> 1/2/2005 6:21:49 PM			
<b>Temperature:</b> 22 °C	<b>Air Pressure:</b> 1017 hPa	<b>Relative Humidity:</b> 45 %	<b>Power Supply:</b> 3.6 VDC
<b>Remarks:</b>			

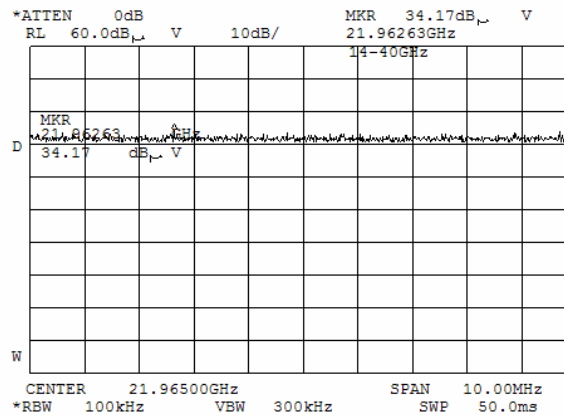
Plot 7.3.51 Radiated emission measurements at the ninth harmonic of carrier frequency

TEST SITE: OATS  
TEST DISTANCE: 3 m  
ANTENNA POLARIZATION: Vertical



Plot 7.3.52 Radiated emission measurements at the ninth harmonic of carrier frequency

TEST SITE: OATS  
TEST DISTANCE: 3 m  
ANTENNA POLARIZATION: Horizontal

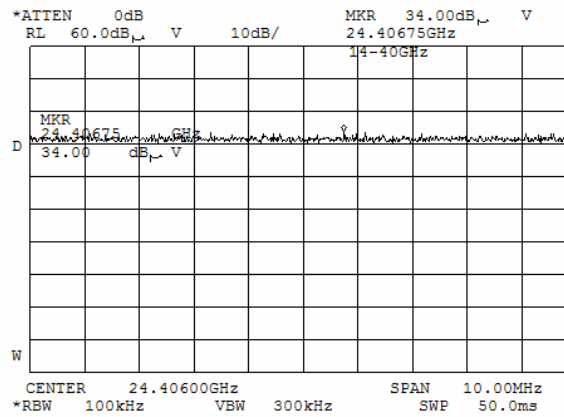




<b>Test specification:</b>	<b>Section 15.247(c), Radiated spurious emissions</b>		
<b>Test procedure:</b>	FR Vol. 62, page 26243, Section 15.247(c) / ANSI C63.4, Section 13.1.4		
<b>Test mode:</b>	Compliance	<b>Verdict:</b>	<b>PASS</b>
<b>Date &amp; Time:</b>	1/2/2005 6:21:49 PM		
<b>Temperature:</b> 22 °C	<b>Air Pressure:</b> 1017 hPa	<b>Relative Humidity:</b> 45 %	<b>Power Supply:</b> 3.6 VDC
<b>Remarks:</b>			

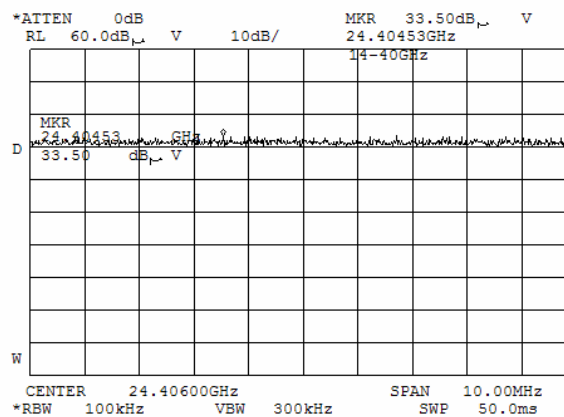
**Plot 7.3.53 Radiated emission measurements at the tenth harmonic of carrier frequency**

TEST SITE: OATS  
TEST DISTANCE: 3 m  
ANTENNA POLARIZATION: Vertical



**Plot 7.3.54 Radiated emission measurements at the tenth harmonic of carrier frequency**

TEST SITE: OATS  
TEST DISTANCE: 3 m  
ANTENNA POLARIZATION: Horizontal





<b>Test specification:</b>	<b>Section 15.247(d), Peak power density</b>		
<b>Test procedure:</b>	FR Vol. 62, page 26243, Section 15.247(d)		
<b>Test mode:</b>	Compliance	<b>Verdict:</b>	<b>PASS</b>
<b>Date &amp; Time:</b>	1/2/2005 5:28:57 PM		
<b>Temperature:</b> 24 °C	<b>Air Pressure:</b> 1015 hPa	<b>Relative Humidity:</b> 50 %	<b>Power Supply:</b> 3.6 VDC
<b>Remarks:</b>			

## 7.4 Peak spectral power density

### 7.4.1 General

This test was performed to measure the peak spectral power density radiated by the transmitter RF antenna. Specification test limits are given in Table 7.4.1.

**Table 7.4.1 Peak spectral power density limits**

Assigned frequency range, MHz	Measurement bandwidth, kHz	Peak spectral power density, dBm	Equivalent field strength limit @ 3m, dB( $\mu$ V/m)*
902.0 – 928.0	3.0	8.0	103.2
2400.0 – 2483.5			
5725.0 – 5850.0			

\* - Equivalent field strength limit was calculated from the peak spectral power density as follows:  $E = \sqrt{30 \times P} / r$ , where P is peak spectral power density and r is antenna to EUT distance in meters.

### 7.4.2 Test procedure for field strength measurements

- 7.4.2.1** The EUT was set up as shown in Figure 7.4.1, energized and its proper operation was checked.
- 7.4.2.2** The EUT was adjusted to produce maximum available to end user RF output power.
- 7.4.2.3** The field strength of the EUT carrier frequency was measured with antenna connected to spectrum analyzer/ EMI receiver. To find maximum radiation the turntable was rotated 360° and the measuring antenna height was swept in both vertical and horizontal polarizations.
- 7.4.2.4** The frequency span of spectrum analyzer was set to capture the entire 6 dB band of the transmitter, in peak hold mode with resolution bandwidth set to 3.0 kHz, video bandwidth wider than resolution bandwidth, auto sweep time and sufficient number of sweeps was allowed for trace stabilization. The spectrum lines spacing was verified to be wider than 3 kHz. Otherwise the resolution bandwidth was reduced until individual spectrum lines were resolved and the power of individual spectrum lines was integrated over 3 kHz band.
- 7.4.2.5** The peak of emission was zoomed with span set just wide enough to capture the emission peak area and sweep time was set equal to span width divided by resolution bandwidth. Spectrum analyzer was set in peak hold mode, sufficient number of sweeps was allowed for trace stabilization and peak spectral power density was measured as provided in Table 7.4.2 and associated plots.

### 7.4.3 Test procedure for substitution power density measurements

- 7.4.3.1** The test equipment was set up as shown in Figure 7.4.2 and energized.
- 7.4.3.2** RF signal generator was set to the EUT carrier frequency and the RF output level was preliminary adjusted to produce the same field strength as it was measured from the EUT.
- 7.4.3.3** The test antenna height was swept to find maximum emission from substitution antenna and RF signal generator output was fine adjusted to produce the same field strength as it was measured from the EUT.
- 7.4.3.4** The peak spectral power density was calculated as a sum of signal generator output power in dBm and substitution antenna gain in dBi reduced by cable loss in dB and the transmitter antenna gain in dBi.
- 7.4.3.5** The above procedure was performed in both horizontal and vertical polarizations of the substitution antenna.
- 7.4.3.6** The worst test results (the lowest margins) were recorded in Table 7.4.3 and shown in the associated plots.



<b>Test specification:</b>	<b>Section 15.247(d), Peak power density</b>		
<b>Test procedure:</b>	FR Vol. 62, page 26243, Section 15.247(d)		
<b>Test mode:</b>	Compliance	<b>Verdict:</b>	<b>PASS</b>
<b>Date &amp; Time:</b>	1/2/2005 5:28:57 PM		
<b>Temperature:</b> 24 °C	<b>Air Pressure:</b> 1015 hPa	<b>Relative Humidity:</b> 50 %	<b>Power Supply:</b> 3.6 VDC
<b>Remarks:</b>			

Figure 7.4.1 Setup for carrier field strength measurements

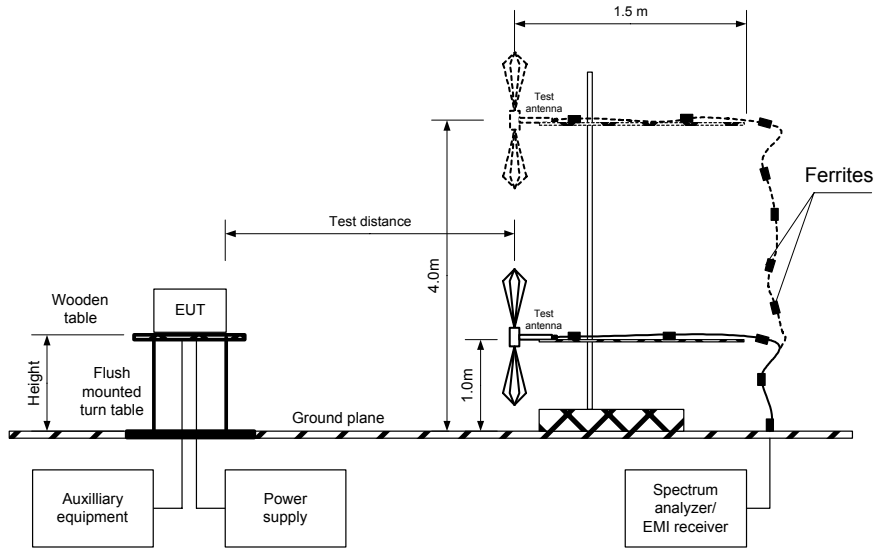
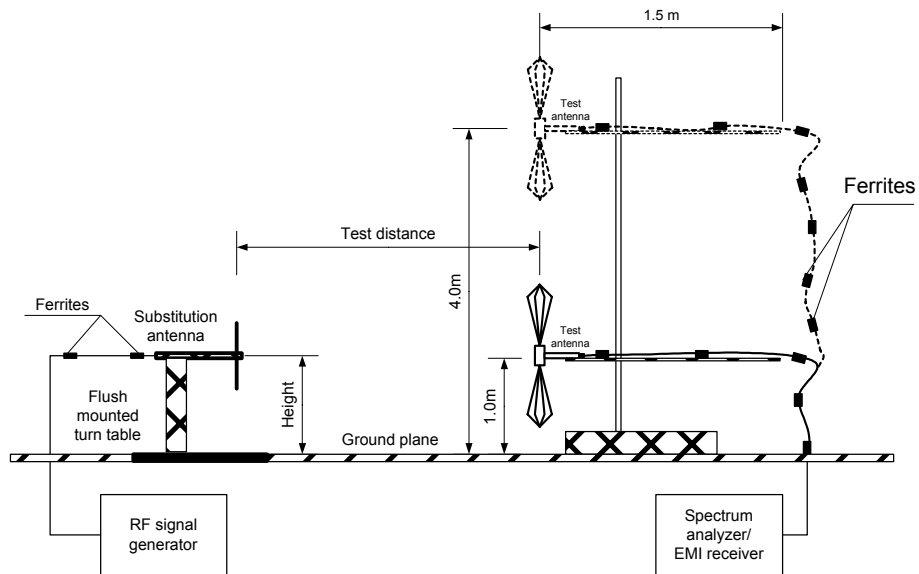


Figure 7.4.2 Setup for substitution power density measurements







<b>Test specification:</b>	<b>Section 15.247(d), Peak power density</b>		
<b>Test procedure:</b>	FR Vol. 62, page 26243, Section 15.247(d)		
<b>Test mode:</b>	Compliance	<b>Verdict:</b>	<b>PASS</b>
<b>Date &amp; Time:</b>	1/2/2005 5:28:57 PM		
<b>Temperature:</b> 24 °C	<b>Air Pressure:</b> 1015 hPa	<b>Relative Humidity:</b> 50 %	<b>Power Supply:</b> 3.6 VDC
<b>Remarks:</b>			

**Table 7.4.2 Field strength measurement of peak spectral power density**

ASSIGNED FREQUENCY: 2440 MHz  
TEST DISTANCE: 3 m  
TEST SITE: OATS  
EUT HEIGHT: 0.8 m  
DETECTOR USED: Peak  
RESOLUTION BANDWIDTH: 3 kHz  
VIDEO BANDWIDTH: 10 kHz  
TEST ANTENNA TYPE: Double ridged guide  
MODULATION: ASK  
MODULATING SIGNAL: PRBS  
BIT RATE: 0.5 Mbps  
TRANSMITTER OUTPUT POWER SETTINGS: Maximum  
TRANSMITTER OUTPUT POWER: 0.2 dBm at carrier frequency

Frequency, MHz	Field strength, dB(μV/m)	EUT antenna gain, dBi	Limit, dB(μV/m)	Margin, dB*	Antenna polarization	Antenna height, m	Turn-table position**, degrees
2440.07	83.17	0	103.20	-20.03	H	1.0	30

\*- Margin = Field strength - EUT antenna gain - calculated field strength limit.

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

**Table 7.4.3 Substitution measurement of peak spectral power density**

ASSIGNED FREQUENCY RANGE: 2440 MHz  
TEST DISTANCE: 3 m  
SUBSTITUTION ANTENNA HEIGHT: 0.8 m  
DETECTOR USED: Peak  
RESOLUTION BANDWIDTH: 3 kHz  
VIDEO BANDWIDTH: 10 kHz  
SUBSTITUTION ANTENNA TYPE: Double ridged guide

Frequency, MHz	Field strength, dB(μV/m)	Antenna polarization	RF generator output, dBm	Antenna gain, dBi	Cable loss, dB	EUT ant. gain, dBi	Peak power density*, dB(mW/3 kHz)	Limit, dBm	Margin, dB**	Verdict
2440.07	83.2	H	-20.6	9.4	4.2	0	-15.4	8.0	-23.4	Pass

\*- Peak power density provided in terms of conducted power density at antenna connector and was calculated as follows:

*Peak power density = RF generator output in dBm – Cable loss in dB + Substitution antenna gain in dBi - Transmitter antenna gain in dBi*

\*\* - Margin = Peak power density - EUT antenna gain - specification limit.

**Reference numbers of test equipment used**

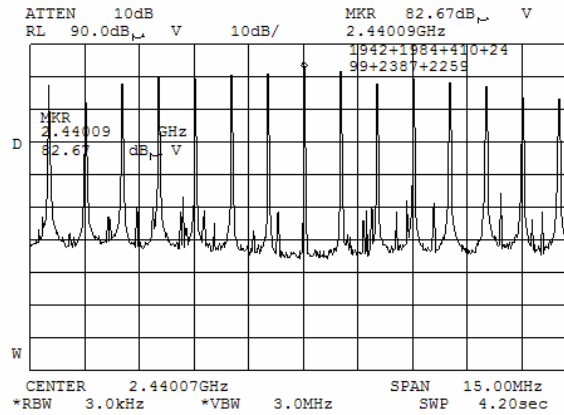
HL 0661	HL 1424	HL 1942	HL 1947	HL 1984	HL 2259	HL 2400	HL 2432
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Full description is given in Appendix A.

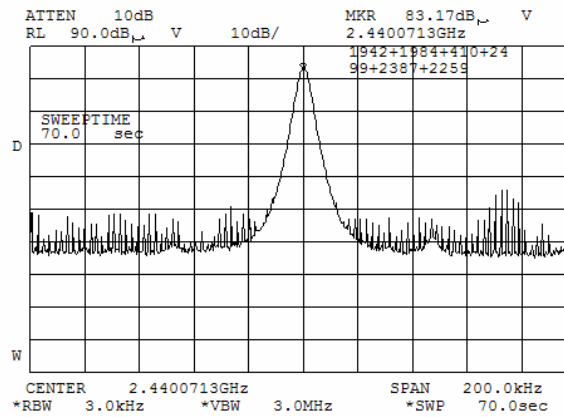


<b>Test specification:</b>	<b>Section 15.247(d), Peak power density</b>		
<b>Test procedure:</b>	FR Vol. 62, page 26243, Section 15.247(d)		
<b>Test mode:</b>	Compliance	<b>Verdict:</b>	<b>PASS</b>
<b>Date &amp; Time:</b>	1/2/2005 5:28:57 PM		
<b>Temperature:</b> 24 °C	<b>Air Pressure:</b> 1015 hPa	<b>Relative Humidity:</b> 50 %	<b>Power Supply:</b> 3.6 VDC
<b>Remarks:</b>			

Plot 7.4.1 Peak spectral power density at low frequency within 6 dB band



Plot 7.4.2 Peak spectral power density at low frequency zoomed at the peak





<b>Test specification:</b>		<b>Section 15.247(b)5, RF exposure</b>	
<b>Test procedure:</b>		47 CFR, Section 1.1307(b)1	
<b>Test mode:</b>	Compliance	<b>Verdict:</b>	PASS
<b>Date &amp; Time:</b>	1/3/2005 5:57:15 PM		
<b>Temperature:</b> NA °C	<b>Air Pressure:</b> NA hPa	<b>Relative Humidity:</b> NA %	<b>Power Supply:</b> NA
<b>Remarks:</b>			

## 7.5 RF exposure

### 7.5.1 General

In accordance with 47CFR 2.1093(c), this portable transmitter is categorically exempted from routine environmental evaluation for RF exposure prior to equipment authorization or use since it does not fall within the scope of 2.1093 (c).

The transmitter output power is 0.2 dBm, antenna gain is 0 dBi, the maximum equivalent isotropically radiated power (e.i.r.p.) is 0.2 dBm = 1.05 mW < 50 mW.

According to section 3 of Supplement C to OET Bulletin 65 this device is exempted from testing for compliance with SAR limits, which are higher than this handheld transmitter would normally be expected to cause.



<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>	3/24/2005 11:28:10 AM		
<b>Temperature:</b> 23 °C	<b>Air Pressure:</b> 1012 hPa	<b>Relative Humidity:</b> 40 %	<b>Power Supply:</b> 4.8 VDC
<b>Remarks:</b>			

## 8 Transmitter tests according to 47CFR part 90 requirements

### 8.1 Effective radiated power of carrier

#### 8.1.1 General

This test was performed to measure effective radiated power emanated by transmitter at carrier frequency. Specification test limits are given in Table 8.1.1.

Table 8.1.1 Effective radiated power limit

Assigned frequency band, MHz	ERP		Equivalent field strength limit @ 3m, dB( $\mu$ V/m)*
	mW	dBm	
902 - 928	30	44.7	142

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

#### 8.1.2 Test procedure for field strength measurements

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

8.1.2.2 The field strength of the EUT carrier frequency was measured with antenna connected to spectrum analyzer/ EMI receiver. To find maximum radiation the turntable was rotated  $360^\circ$ , the measuring antenna height was swept throughout the range, specified in Table 8.1.2, in both vertical and horizontal polarizations.

8.1.2.3 The worst test results (the lowest margins) were recorded in Table 8.1.2 and shown in the associated plots.

#### 8.1.3 Test procedure for substitution ERP measurements

8.1.3.1 The test equipment was set up as shown in Figure 8.1.2 and energized.

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

8.1.3.3 The test antenna height was swept throughout the specified in Table 8.1.2 range to find maximum emission from substitution antenna and RF signal generator output was fine adjusted to produce the same field strength as it was measured from the EUT.

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

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

8.1.3.6 The worst test results (the lowest margins) were recorded in Table 8.1.3 and shown in the associated plots.



<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>PASS</b>
<b>Date &amp; Time:</b>	3/24/2005 11:28:10 AM		
<b>Temperature:</b> 23 °C	<b>Air Pressure:</b> 1012 hPa	<b>Relative Humidity:</b> 40 %	<b>Power Supply:</b> 4.8 VDC
<b>Remarks:</b>			

Figure 8.1.1 Setup for carrier field strength measurements

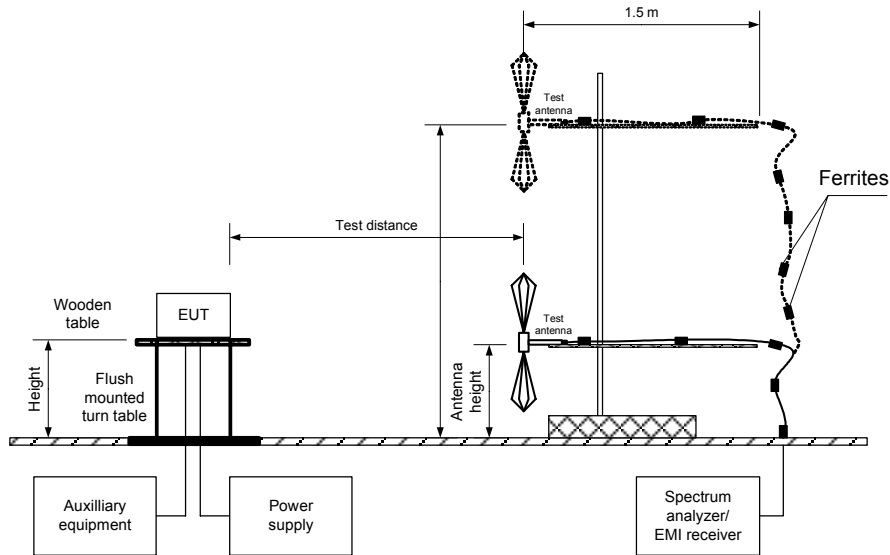
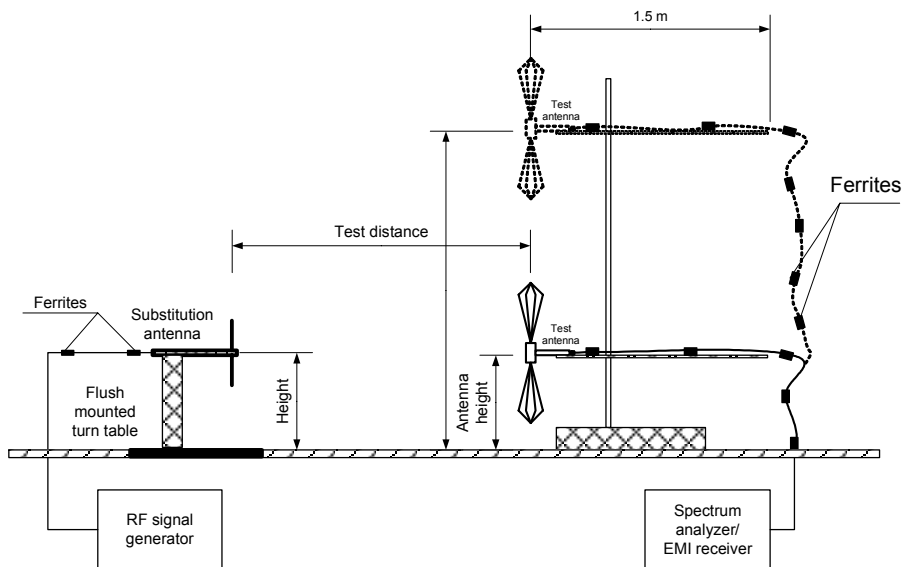


Figure 8.1.2 Setup for substitution ERP measurements





<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>PASS</b>
<b>Date &amp; Time:</b>	3/24/2005 11:28:10 AM		
<b>Temperature:</b> 23 °C	<b>Air Pressure:</b> 1012 hPa	<b>Relative Humidity:</b> 40 %	<b>Power Supply:</b> 4.8 VDC
<b>Remarks:</b>			

**Table 8.1.2 Transmitter carrier field strength**

ASSIGNED FREQUENCY RANGE: 915 MHz  
TEST SITE: OATS  
TEST DISTANCE: 3 m  
EUT HEIGHT: 0.8 m  
EUT POSITION: 3 orthogonal ( X / Y / Z )  
TEST ANTENNA HEIGHTS RANGE: 1.0 – 4.0 m  
DETECTOR USED: Peak  
VIDEO BANDWIDTH: > Resolution bandwidth  
TEST ANTENNA TYPE: Biconical  
MODULATION: ASK  
TRANSMITTER OUTPUT POWER: Maximum  
SETTINGS:

Frequency, MHz	Field strength, dB(μV/m)	Limit, dB(μV/m)	Margin, dB*	RBW, kHz	Antenna polarization	Antenna height, m	Turn-table position**, degrees	EUT position
914.94	104.29	142	-37.71	3000	V	1.2	278	X-axis
914.94	105.21	142	-36.79		H	1.6	35	

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

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

**Table 8.1.3 Transmitter carrier ERP**

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

Frequency, MHz	Field strength, dB(μV/m)	RBW, kHz	Antenna polarization	RF generator output, dBm	Ant gain, dBd	Cable loss, dB	ERP, dBm	Limit, dBm	Margin, dB*	Verdict
914.94	105.21	3000	V	16.5	-0.5	4.9	11.1	44.7	-33.6	Pass
914.94	104.29		H	15.2	-0.5	4.9	9.8	44.7	-34.9	Pass

\*- Margin = ERP – specification limit.

**Reference numbers of test equipment used**

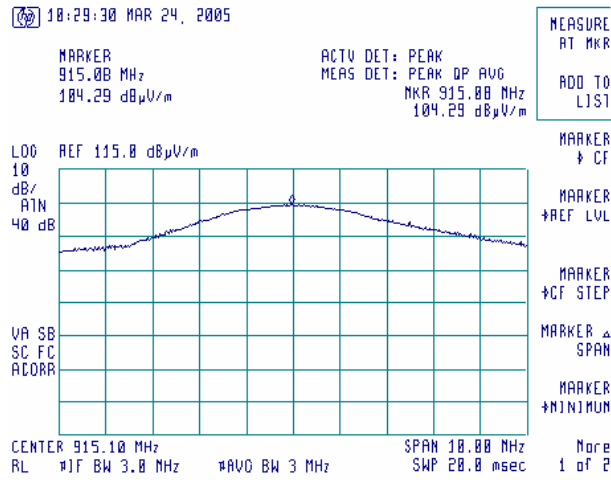
HL 0034	HL 0661	HL 0812	HL 1430	HL 1499	HL 1565		
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Full description is given in Appendix A.

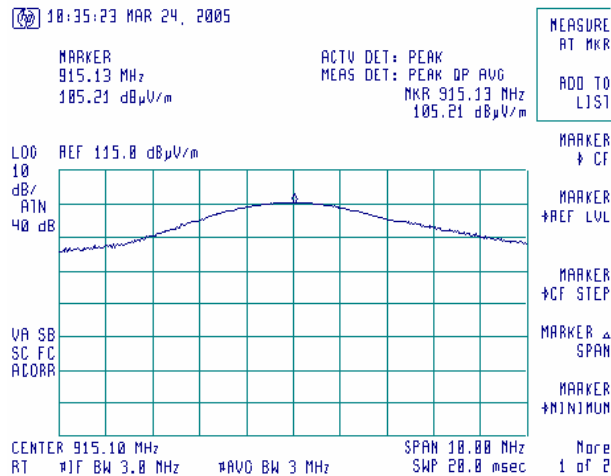


<b>Test specification:</b>	<b>Section 90.205, Maximum output power</b>		
<b>Test procedure:</b>	47 CFR, Section 2.1046; TIA/EIA-603-A, Section 2.2.1		
<b>Test mode:</b>	Compliance	<b>Verdict:</b>	<b>PASS</b>
<b>Date &amp; Time:</b>	3/24/2005 11:28:10 AM		
<b>Temperature:</b> 23 °C	<b>Air Pressure:</b> 1012 hPa	<b>Relative Humidity:</b> 40 %	<b>Power Supply:</b> 4.8 VDC
<b>Remarks:</b>			

Plot 8.1.1 Transmitter carrier field strength at carrier frequency in vertical antenna polarization



Plot 8.1.2 Transmitter carrier field strength at carrier frequency in horizontal antenna polarization





<b>Test specification:</b> Section 90.209, Occupied bandwidth			
<b>Test procedure:</b> 47 CFR, Section 2.1049			
<b>Test mode:</b> Compliance	<b>Verdict:</b> PASS		
<b>Date &amp; Time:</b> 12/28/2004 3:29:50 PM			
<b>Temperature:</b> 22 °C	<b>Air Pressure:</b> 1017 hPa	<b>Relative Humidity:</b> 45 %	<b>Power Supply:</b> 3.6 VDC
<b>Remarks:</b>			

## 8.2 Occupied bandwidth test

### 8.2.1 General

This test was performed to measure transmitter occupied bandwidth. Specification test limits are given in Table 8.2.1. The test results are provided in Table 8.2.2 and the associated plots.

Table 8.2.1 Occupied bandwidth limits

Assigned frequency, MHz	Modulation envelope reference points*, dBc	Maximum allowed bandwidth, kHz
908.75 – 921.75	26	12000

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

### 8.2.2 Test procedure

- 8.2.2.1 The EUT was set up as shown in Figure 8.2.1, energized and its proper operation was checked.
- 8.2.2.2 The EUT was set to transmit the unmodulated carrier and the reference peak power level was measured.
- 8.2.2.3 The EUT was set to transmit the normally modulated carrier.
- 8.2.2.4 The transmitter occupied bandwidth was measured with spectrum analyzer as a frequency delta between the reference points on modulation envelope and provided in Table 8.2.2 and the associated plots.

Figure 8.2.1 Occupied bandwidth test setup







<b>Test specification:</b> Section 90.209, Occupied bandwidth			
<b>Test procedure:</b> 47 CFR, Section 2.1049			
<b>Test mode:</b> Compliance	<b>Verdict:</b> PASS		
<b>Date &amp; Time:</b> 12/28/2004 3:29:50 PM			
<b>Temperature:</b> 22 °C	<b>Air Pressure:</b> 1017 hPa	<b>Relative Humidity:</b> 45 %	<b>Power Supply:</b> 3.6 VDC
<b>Remarks:</b>			

Table 8.2.2 Occupied bandwidth test results

DETECTOR USED: Peak hold  
 RESOLUTION BANDWIDTH: 100 kHz  
 VIDEO BANDWIDTH: 300 kHz  
 MODULATION ENVELOPE REFERENCE POINTS: 26 dBc  
 MODULATION: ASK  
 MODULATING SIGNAL: PRBS  
 BIT RATE: 500 kbps

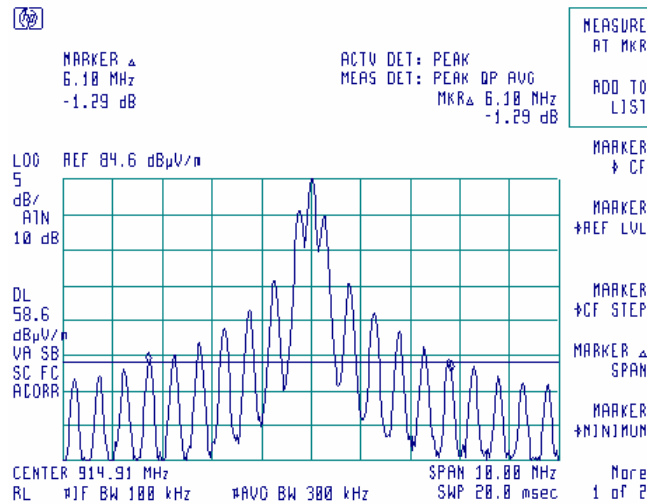
Carrier frequency, MHz	Occupied bandwidth, kHz	Limit, kHz	Margin, kHz	Verdict
914.91	6100	12000	5900	Pass

Reference numbers of test equipment used

HL 0034	HL 0415	HL 0812	HL 1430				
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Full description is given in Appendix A.

Plot 8.2.1 Occupied bandwidth test result at low frequency





<b>Test specification:</b>	<b>Section 90.210, Emission mask</b>		
<b>Test procedure:</b>	47 CFR, Sections 2.1051, 2.1047 and 90.210(m); TIA/EIA-603-A, Section 2.2.13		
<b>Test mode:</b>	Compliance	<b>Verdict:</b>	<b>PASS</b>
<b>Date &amp; Time:</b>	3/24/2005 11:32:08 AM		
<b>Temperature:</b> 24 °C	<b>Air Pressure:</b> 1016 hPa	<b>Relative Humidity:</b> 44 %	<b>Power Supply:</b> 3.6 VDC
<b>Remarks:</b>			

### 8.3 Emission mask test

#### 8.3.1 General

This test was performed to measure emission mask at RF antenna connector. Specification test limits are given in Table 8.3.1. The test results are provided in the associated plots.

Table 8.3.1 Emission mask limits

Frequency displacement from carrier	Attenuation below carrier, dBc
Emission mask K (Transmitters operate in the 902 – 928 MHz band with no audio low pass filter)	
909.75 – 921.75 MHz	0
Outside the sub-band edges	55+10logP(W)

\* - linearly increase with frequency

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

#### 8.3.2 Test procedure

8.3.2.1 The EUT was set up as shown in Figure 8.3.1, energized and its proper operation was checked.

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

Table 8.3.2 Emission mask test results

Carrier frequency, MHz	Limit	Verdict
915.0	Emission mask K	Pass

#### Reference numbers of test equipment used

HL 0034	HL 0415	HL 0812	HL 1430				
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Full description is given in Appendix A.

Figure 8.3.1 Emission mask test setup

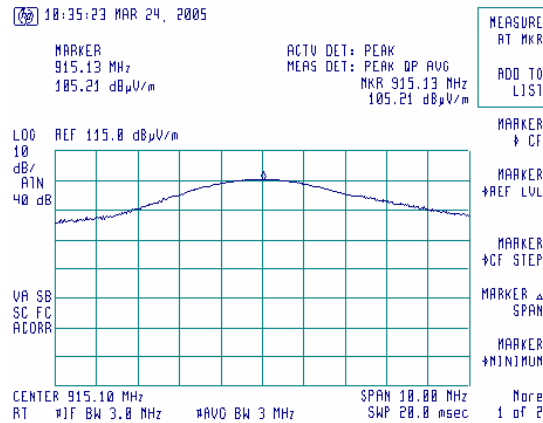




<b>Test specification:</b>	<b>Section 90.210, Emission mask</b>		
<b>Test procedure:</b>	47 CFR, Sections 2.1051, 2.1047 and 90.210(m); TIA/EIA-603-A, Section 2.2.13		
<b>Test mode:</b>	Compliance	<b>Verdict:</b>	<b>PASS</b>
<b>Date &amp; Time:</b>	3/24/2005 11:32:08 AM		
<b>Temperature:</b> 24 °C	<b>Air Pressure:</b> 1016 hPa	<b>Relative Humidity:</b> 44 %	<b>Power Supply:</b> 3.6 VDC
<b>Remarks:</b>			

**Plot 8.3.1 Emission mask test results at carrier frequency**

OPERATING FREQUENCY RANGE: 902 - 928 MHz  
DETECTOR USED: Peak  
MODULATION: ASK  
MODULATING SIGNAL: PRBS  
BIT RATE: 0.5 Mbps  
TRANSMITTER OUTPUT POWER SETTINGS: Maximum

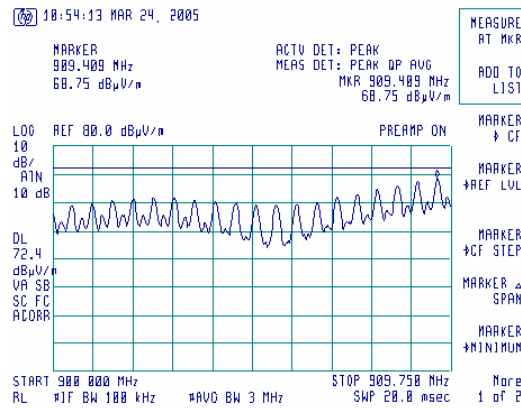




<b>Test specification:</b>	<b>Section 90.210, Emission mask</b>		
<b>Test procedure:</b>	47 CFR, Sections 2.1051, 2.1047 and 90.210(m); TIA/EIA-603-A, Section 2.2.13		
<b>Test mode:</b>	Compliance	<b>Verdict: PASS</b>	
<b>Date &amp; Time:</b>	3/24/2005 11:32:08 AM		
<b>Temperature:</b> 24 °C	<b>Air Pressure:</b> 1016 hPa	<b>Relative Humidity:</b> 44 %	<b>Power Supply:</b> 3.6 VDC
<b>Remarks:</b>			

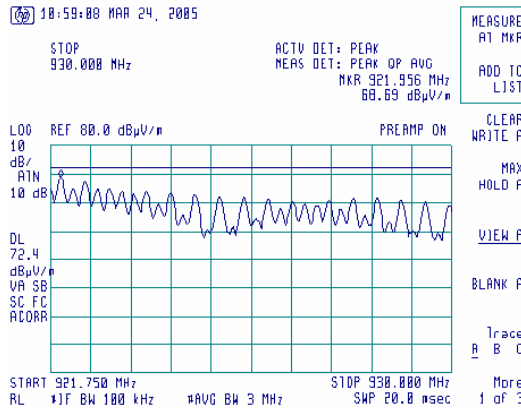
**Plot 8.3.2 Emission mask test results at carrier frequency, left band edge**

OPERATING FREQUENCY RANGE: 902 - 928 MHz  
DETECTOR USED: Peak  
MODULATION: ASK  
MODULATING SIGNAL: PRBS  
BIT RATE: 0.5 Mbps  
TRANSMITTER OUTPUT POWER SETTINGS: Maximum



**Plot 8.3.3 Emission mask test results at carrier frequency, right band edge**

OPERATING FREQUENCY RANGE: 902 - 928 MHz  
DETECTOR USED: Peak  
MODULATION: ASK  
MODULATING SIGNAL: PRBS  
BIT RATE: 0.5 Mbps  
TRANSMITTER OUTPUT POWER SETTINGS: Maximum





<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>	3/24/2005 5:03:27 PM		
<b>Temperature:</b> 24 °C	<b>Air Pressure:</b> 1014 hPa	<b>Relative Humidity:</b> 44 %	<b>Power Supply:</b> 3.6 VDC
<b>Remarks:</b>			

## 8.4 Radiated spurious emission measurements

### 8.4.1 General

This test was performed to measure radiated spurious emissions from the EUT. Specification test limits are given in Table 8.4.1.

**Table 8.4.1 Radiated spurious emission test limits**

Frequency, MHz	Attenuation below carrier, dBc	ERP of spurious, dBm	Equivalent field strength limit @ 3m, dB(μV/m)***
0.009 – 10th harmonic*	55+10logP**	-25	72.4

\* - 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

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

8.4.2.1 The EUT was set up as shown in Figure 8.4.1, energized and the performance check was conducted.

8.4.2.2 The specified frequency range was investigated with antenna connected to spectrum analyzer. To find maximum radiation the turntable was rotated  $360^\circ$  and the measuring antenna was rotated around its vertical axis.

8.4.2.3 The worst test results (the lowest margins) found in X-axis EUT position, were recorded in Table 8.4.2 and shown in the associated plots.

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

8.4.3.1 The EUT was set up as shown in Figure 8.4.2, energized and the performance check was conducted.

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

8.4.3.3 The worst test results (the lowest margins) found in X-axis EUT position were recorded in Table 8.4.2 and shown in the associated plots.

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

8.4.4.1 The test equipment was set up as shown in Figure 8.4.3 and energized.

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

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

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

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

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

8.4.4.7 The worst test results (the lowest margins) were recorded in Table 8.4.3 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>	3/24/2005 5:03:27 PM		
<b>Temperature:</b> 24 °C	<b>Air Pressure:</b> 1014 hPa	<b>Relative Humidity:</b> 44 %	<b>Power Supply:</b> 3.6 VDC
<b>Remarks:</b>			

Figure 8.4.1 Setup for spurious emission field strength measurements in 9 kHz to 30 MHz band

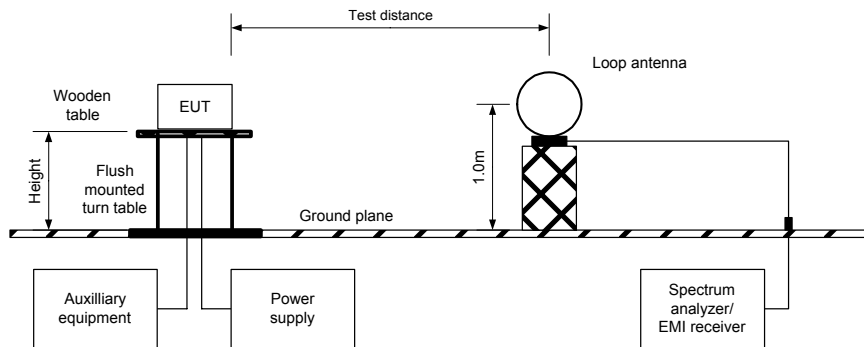
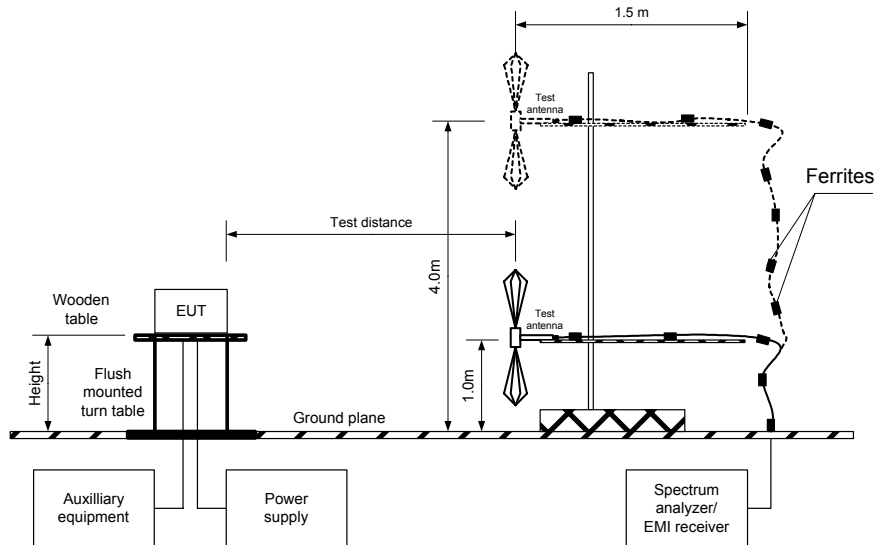


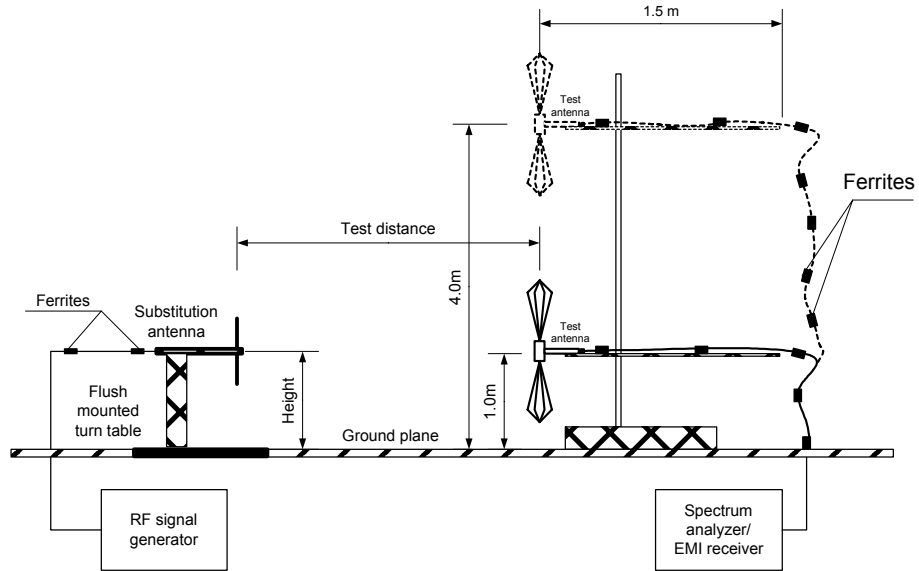
Figure 8.4.2 Setup for spurious emission field strength measurements above 30 MHz





<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>	<b>PASS</b>
<b>Date &amp; Time:</b>	3/24/2005 5:03:27 PM		
<b>Temperature:</b> 24 °C	<b>Air Pressure:</b> 1014 hPa	<b>Relative Humidity:</b> 44 %	<b>Power Supply:</b> 3.6 VDC
<b>Remarks:</b>			

Figure 8.4.3 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: PASS</b>	
<b>Date &amp; Time:</b>	3/24/2005 5:03:27 PM		
<b>Temperature:</b> 24 °C	<b>Air Pressure:</b> 1014 hPa	<b>Relative Humidity:</b> 44 %	<b>Power Supply:</b> 3.6 VDC
<b>Remarks:</b>			

Table 8.4.2 Spurious emission field strength test results

ASSIGNED FREQUENCY RANGE: 909.75 – 921.25 MHz  
 TEST DISTANCE: 3 m  
 TEST SITE: OATS  
 EUT HEIGHT: 0.8 m  
 EUT POSITION: 3 orthogonal ( X / Y / Z )  
 INVESTIGATED FREQUENCY RANGE: 0.009 – 10000 MHz  
 DETECTOR USED: Peak  
 VIDEO BANDWIDTH: > Resolution bandwidth  
 TEST ANTENNA TYPE: Active loop (9 kHz – 30 MHz)  
 Biconilog (30 MHz – 1000 MHz)  
 Double ridged guide (above 1000 MHz)  
 MODULATION: ASK  
 MODULATING SIGNAL: PRBS  
 BIT RATE: 500 kbps  
 TRANSMITTER OUTPUT POWER SETTINGS: Maximum

Frequency, MHz	Field strength, dB(μV/m)	Limit, dB(μV/m)	Margin, dB*	RBW, kHz	Antenna polarization	Antenna height, m	Turn-table position**, degrees
1829.8705	62.43	72.40	-9.97	100	V	1.1	28
1829.8705	57.86	72.40	-14.54	100	H	1.0	34
2444.7972	48.00	72.40	-24.40	100	V	1.2	187
2444.7978	45.00	72.40	-27.40	100	H	1.2	146
3659.7307	55.17	72.4	-17.23	100	V	1.1	354
3659.7307	56.50	72.4	-15.90	100	H	1.4	11
4574.6263	43.67	72.4	-28.73	100	V	1.5	358
4574.6263	44.17	72.4	-28.23	100	H	1.6	254
5489.6125	66.96	72.4	-5.44	100	V	1.4	53
5489.6155	61.61	72.4	-10.79	100	H	1.3	75
6404.4848	47.83	72.4	-24.57	100	V	1.5	360
6404.4852	57.00	72.4	-15.40	100	H	1.7	223
7319.3940	58.83	72.4	-13.57	100	V	1.8	360
7319.4013	61.67	72.4	-10.73	100	H	1.8	360
8234.4197	61.17	72.4	-11.23	100	V	1.2	23
8234.4197	63.67	72.4	-8.73	100	H	1.4	0
9149.3583	53.67	72.4	-18.73	100	V	1.2	233
9149.3593	50.33	72.4	-22.07	100	H	1.1	187

\*- 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: PASS</b>	
<b>Date &amp; Time:</b>	3/24/2005 5:03:27 PM		
<b>Temperature:</b> 24 °C	<b>Air Pressure:</b> 1014 hPa	<b>Relative Humidity:</b> 44 %	<b>Power Supply:</b> 3.6 VDC
<b>Remarks:</b>			

Table 8.4.3 Substitution ERP of spurious test results

ASSIGNED FREQUENCY RANGE: 909.75 – 921.25 MHz  
 TRANSMITTER CARRIER ERP: 11.10 dBm at 915 MHz frequency  
 TEST SITE: OATS  
 TEST DISTANCE: 3 m  
 SUBSTITUTION ANTENNA HEIGHT: 0.8 m  
 DETECTOR USED: Peak  
 VIDEO BANDWIDTH: > Resolution bandwidth  
 SUBSTITUTION ANTENNA TYPE: Double ridged guide (above 1000 MHz)

Frequency, MHz	Field strength, dB( $\mu$ 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
1829.8705	62.43	100	V	-37.90	6.80	2.94	-34.04	45.14	36.10	-9.04	Pass
1829.8705	57.86	100	H	-42.10	6.80	2.94	-38.24	49.34	36.10	-13.24	Pass
3659.7307	55.17	100	V	-43.20	6.30	4.22	-41.12	52.22	36.10	-16.12	Pass
3659.7307	56.50	100	H	-42.30	6.30	4.22	-40.22	51.32	36.10	-15.22	Pass
5489.6125	66.96	100	V	-32.00	7.60	5.77	-30.17	41.27	36.10	-5.17	Pass
5489.6155	61.61	100	H	-37.00	7.60	5.77	-35.17	46.27	36.10	-10.17	Pass
6404.4848	47.83	100	V	-52.10	8.50	6.30	-49.90	61.00	36.10	-24.90	Pass
6404.4852	57.00	100	H	-43.00	8.50	6.30	-40.80	51.90	36.10	-15.80	Pass
7319.3940	58.83	100	V	-40.10	8.30	6.43	-38.23	49.33	36.10	-13.23	Pass
7319.4013	61.67	100	H	-37.50	8.30	6.43	-35.63	46.73	36.10	-10.63	Pass
8234.4197	61.17	100	V	-37.90	8.90	6.71	-35.71	46.81	36.10	-10.71	Pass
8234.4197	63.67	100	H	-36.60	8.90	6.71	-34.41	45.51	36.10	-9.41	Pass
9149.3583	53.67	100	V	-44.90	8.50	7.17	-43.57	54.67	36.10	-18.57	Pass
9149.3593	50.33	100	H	-49.00	8.50	7.17	-47.67	58.77	36.10	-22.67	Pass

\*- Margin = Spurious emission – specification limit.

## Reference numbers of test equipment used

HL 0410	HL 0446	HL 0465	HL 0521	HL 0592	HL 0593	HL 0594	HL 0604
HL 1200	HL 1424	HL 1430	HL 1941	HL 1942	HL 1984	HL 2259	HL 2432

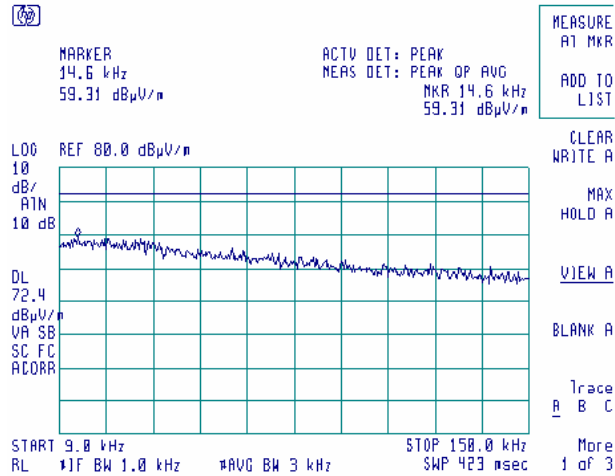
Full description is given in Appendix A.



<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: PASS</b>	
<b>Date &amp; Time:</b>	3/24/2005 5:03:27 PM		
<b>Temperature:</b> 24 °C	<b>Air Pressure:</b> 1014 hPa	<b>Relative Humidity:</b> 44 %	<b>Power Supply:</b> 3.6 VDC
<b>Remarks:</b>			

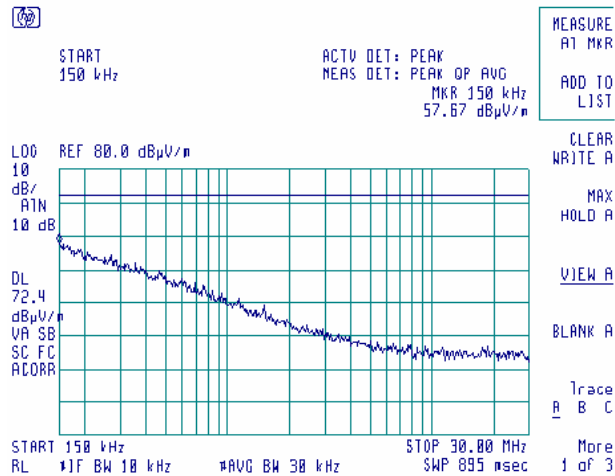
Plot 8.4.1 Radiated emission measurements in 9 - 150 kHz range

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



Plot 8.4.2 Radiated emission measurements in 0.15 - 30 MHz range

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

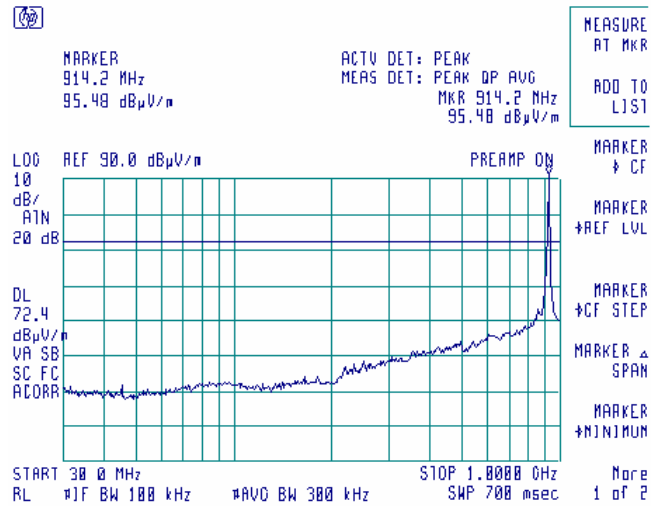




<b>Test specification:</b>	<b>Section 90.210, Radiated spurious emissions</b>		
<b>Test procedure:</b>	47 CFR, Sections 2.1053 and 90.210(m); TIA/EIA-603-A, Section 2.2.12		
<b>Test mode:</b>	Compliance	<b>Verdict:</b>	<b>PASS</b>
<b>Date &amp; Time:</b>	3/24/2005 5:03:27 PM		
<b>Temperature:</b> 24 °C	<b>Air Pressure:</b> 1014 hPa	<b>Relative Humidity:</b> 44 %	<b>Power Supply:</b> 3.6 VDC
<b>Remarks:</b>			

**Plot 8.4.3 Radiated emission measurements in 30 - 1000 MHz range**

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

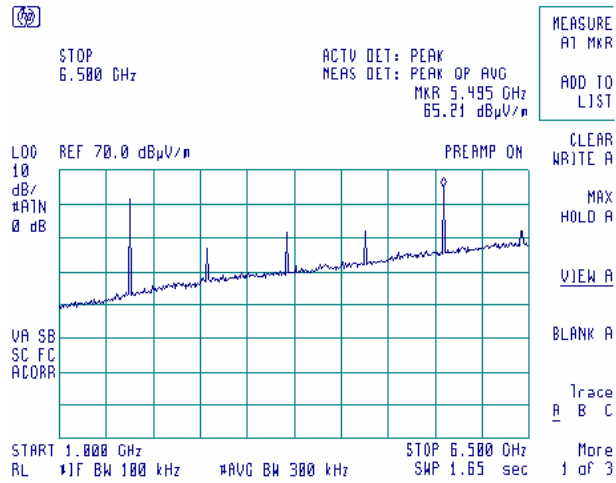




<b>Test specification:</b>	<b>Section 90.210, Radiated spurious emissions</b>		
<b>Test procedure:</b>	47 CFR, Sections 2.1053 and 90.210(m); TIA/EIA-603-A, Section 2.2.12		
<b>Test mode:</b>	Compliance	<b>Verdict: PASS</b>	
<b>Date &amp; Time:</b>	3/24/2005 5:03:27 PM		
<b>Temperature:</b> 24 °C	<b>Air Pressure:</b> 1014 hPa	<b>Relative Humidity:</b> 44 %	<b>Power Supply:</b> 3.6 VDC
<b>Remarks:</b>			

**Plot 8.4.4 Radiated emission measurements in 1000 – 6500 MHz range**

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

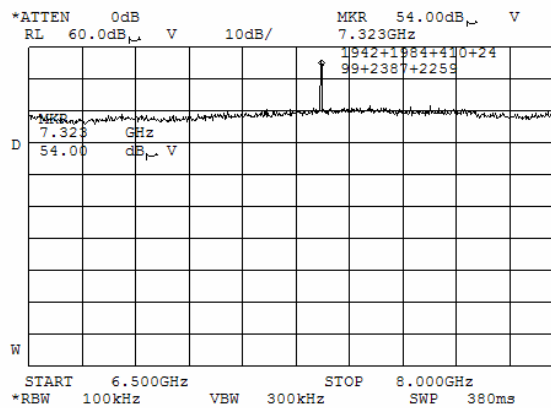




<b>Test specification:</b>	<b>Section 90.210, Radiated spurious emissions</b>		
<b>Test procedure:</b>	47 CFR, Sections 2.1053 and 90.210(m); TIA/EIA-603-A, Section 2.2.12		
<b>Test mode:</b>	Compliance	<b>Verdict:</b>	<b>PASS</b>
<b>Date &amp; Time:</b>	3/24/2005 5:03:27 PM		
<b>Temperature:</b> 24 °C	<b>Air Pressure:</b> 1014 hPa	<b>Relative Humidity:</b> 44 %	<b>Power Supply:</b> 3.6 VDC
<b>Remarks:</b>			

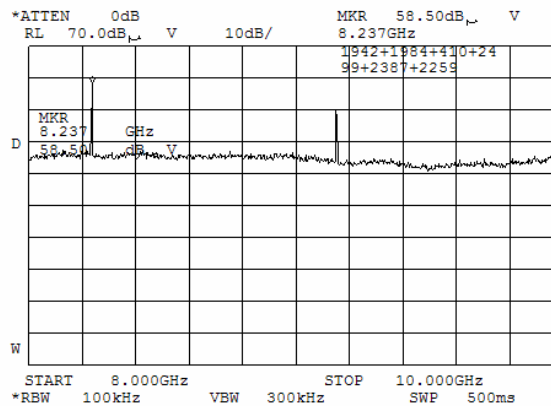
**Plot 8.4.5 Radiated emission measurements in 6500 - 8000 MHz range**

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



**Plot 8.4.6 Radiated emission measurements in 8000 - 10000 MHz range**

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

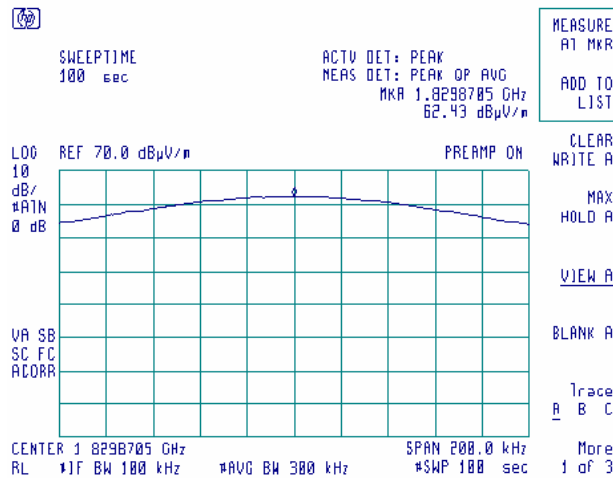




<b>Test specification:</b>	<b>Section 90.210, Radiated spurious emissions</b>		
<b>Test procedure:</b>	47 CFR, Sections 2.1053 and 90.210(m); TIA/EIA-603-A, Section 2.2.12		
<b>Test mode:</b>	Compliance	<b>Verdict:</b>	<b>PASS</b>
<b>Date &amp; Time:</b>	3/24/2005 5:03:27 PM		
<b>Temperature:</b> 24 °C	<b>Air Pressure:</b> 1014 hPa	<b>Relative Humidity:</b> 44 %	<b>Power Supply:</b> 3.6 VDC
<b>Remarks:</b>			

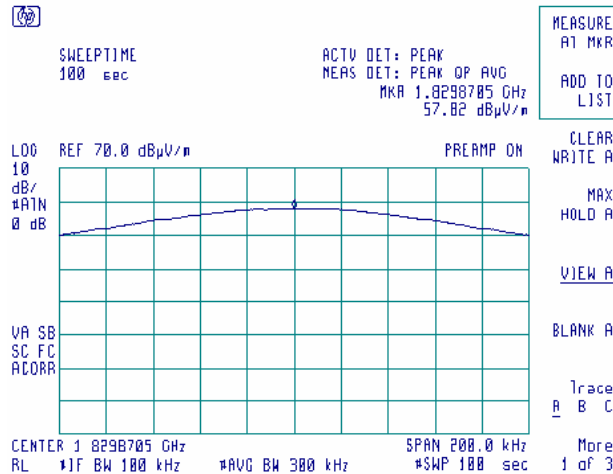
Plot 8.4.7 Radiated emission measurements at the 2<sup>nd</sup> harmonic

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



Plot 8.4.8 Radiated emission measurements at the 2<sup>nd</sup> harmonic

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

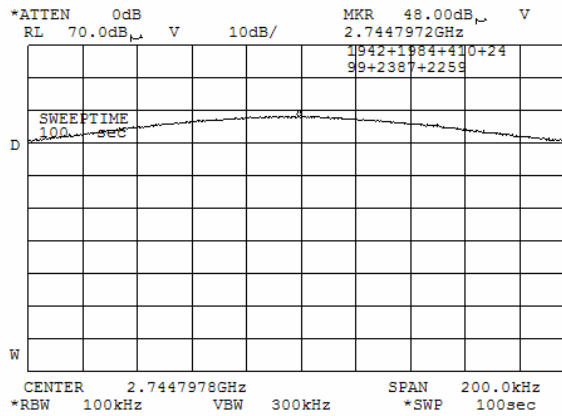




<b>Test specification:</b> Section 90.210, Radiated spurious emissions			
<b>Test procedure:</b> 47 CFR, Sections 2.1053 and 90.210(m); TIA/EIA-603-A, Section 2.2.12			
<b>Test mode:</b> Compliance	<b>Verdict:</b> PASS		
<b>Date &amp; Time:</b> 3/24/2005 5:03:27 PM			
<b>Temperature:</b> 24 °C	<b>Air Pressure:</b> 1014 hPa	<b>Relative Humidity:</b> 44 %	<b>Power Supply:</b> 3.6 VDC
<b>Remarks:</b>			

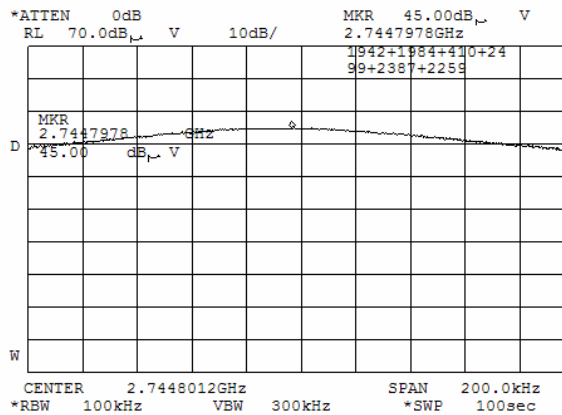
Plot 8.4.9 Radiated emission measurements at the 3<sup>rd</sup> harmonic

TEST SITE: OATS  
 ANTENNA POLARIZATION: Vertical  
 TEST DISTANCE: 3 m



Plot 8.4.10 Radiated emission measurements at the 3<sup>rd</sup> harmonic

TEST SITE: OATS  
 ANTENNA POLARIZATION: Horizontal  
 TEST DISTANCE: 3 m

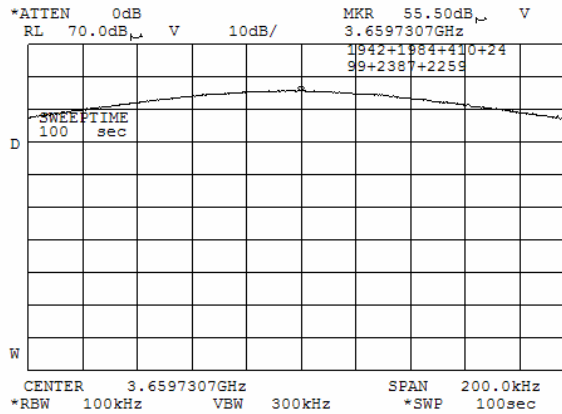




<b>Test specification:</b>	<b>Section 90.210, Radiated spurious emissions</b>		
<b>Test procedure:</b>	47 CFR, Sections 2.1053 and 90.210(m); TIA/EIA-603-A, Section 2.2.12		
<b>Test mode:</b>	Compliance	<b>Verdict: PASS</b>	
<b>Date &amp; Time:</b>	3/24/2005 5:03:27 PM		
<b>Temperature:</b> 24 °C	<b>Air Pressure:</b> 1014 hPa	<b>Relative Humidity:</b> 44 %	<b>Power Supply:</b> 3.6 VDC
<b>Remarks:</b>			

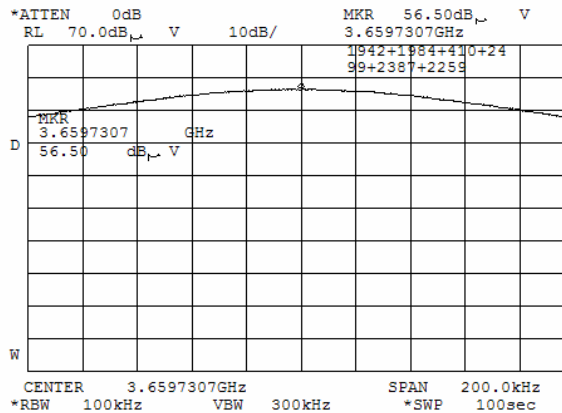
Plot 8.4.11 Radiated emission measurements at the 4<sup>th</sup> harmonic

TEST SITE: OATS  
 ANTENNA POLARIZATION: Vertical  
 TEST DISTANCE: 3 m



Plot 8.4.12 Radiated emission measurements at the 4<sup>th</sup> harmonic

TEST SITE: OATS  
 ANTENNA POLARIZATION: Horizontal  
 TEST DISTANCE: 3 m



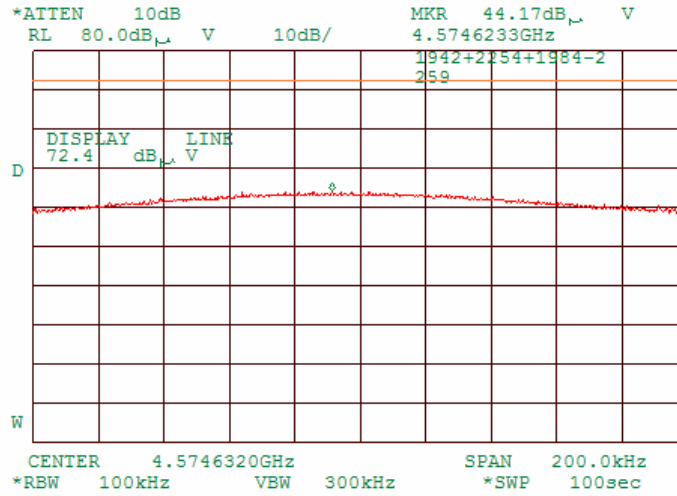




<b>Test specification:</b>	<b>Section 90.210, Radiated spurious emissions</b>		
<b>Test procedure:</b>	47 CFR, Sections 2.1053 and 90.210(m); TIA/EIA-603-A, Section 2.2.12		
<b>Test mode:</b>	Compliance	<b>Verdict: PASS</b>	
<b>Date &amp; Time:</b>	3/24/2005 5:03:27 PM		
<b>Temperature:</b> 24 °C	<b>Air Pressure:</b> 1014 hPa	<b>Relative Humidity:</b> 44 %	<b>Power Supply:</b> 3.6 VDC
<b>Remarks:</b>			

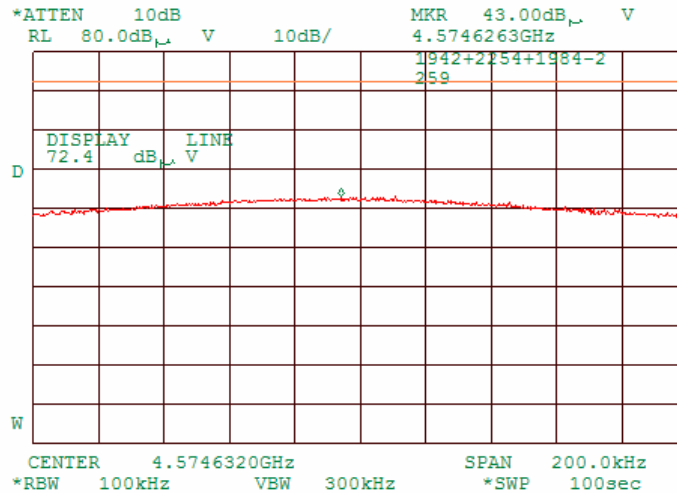
Plot 8.4.13 Radiated emission measurements at the 5<sup>th</sup> harmonic

TEST SITE: OATS  
 ANTENNA POLARIZATION: Vertical  
 TEST DISTANCE: 3 m



Plot 8.4.14 Radiated emission measurements at the 5<sup>th</sup> harmonic

TEST SITE: OATS  
 ANTENNA POLARIZATION: Horizontal  
 TEST DISTANCE: 3 m

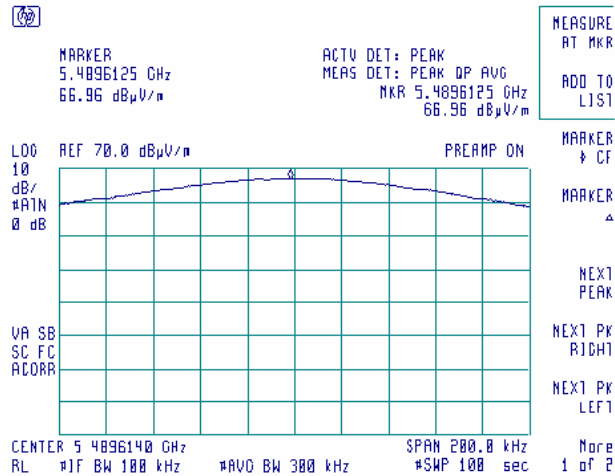




<b>Test specification:</b> Section 90.210, Radiated spurious emissions			
<b>Test procedure:</b> 47 CFR, Sections 2.1053 and 90.210(m); TIA/EIA-603-A, Section 2.2.12			
<b>Test mode:</b> Compliance	<b>Verdict:</b> PASS		
<b>Date &amp; Time:</b> 3/24/2005 5:03:27 PM			
<b>Temperature:</b> 24 °C	<b>Air Pressure:</b> 1014 hPa	<b>Relative Humidity:</b> 44 %	<b>Power Supply:</b> 3.6 VDC
<b>Remarks:</b>			

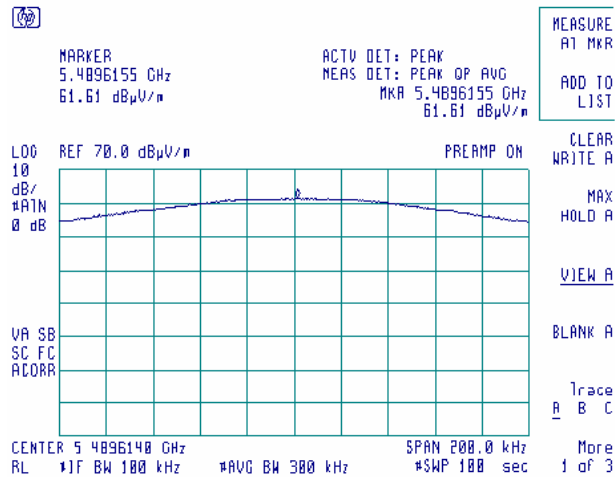
Plot 8.4.15 Radiated emission measurements at the 6<sup>th</sup> harmonic

TEST SITE: OATS  
 ANTENNA POLARIZATION: Vertical  
 TEST DISTANCE: 3 m



Plot 8.4.16 Radiated emission measurements at the 6<sup>th</sup> harmonic

TEST SITE: OATS  
 ANTENNA POLARIZATION: Horizontal  
 TEST DISTANCE: 3 m

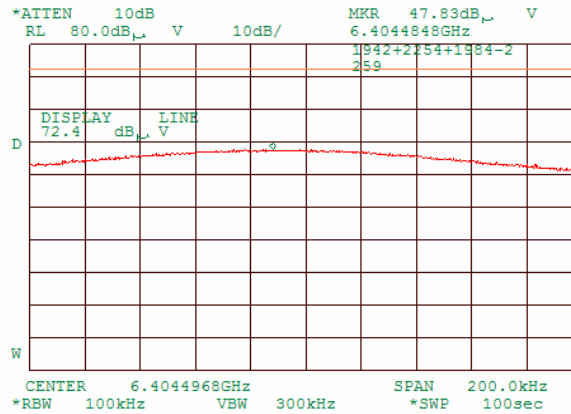




<b>Test specification:</b>	<b>Section 90.210, Radiated spurious emissions</b>		
<b>Test procedure:</b>	47 CFR, Sections 2.1053 and 90.210(m); TIA/EIA-603-A, Section 2.2.12		
<b>Test mode:</b>	Compliance	<b>Verdict: PASS</b>	
<b>Date &amp; Time:</b>	3/24/2005 5:03:27 PM		
<b>Temperature:</b> 24 °C	<b>Air Pressure:</b> 1014 hPa	<b>Relative Humidity:</b> 44 %	<b>Power Supply:</b> 3.6 VDC
<b>Remarks:</b>			

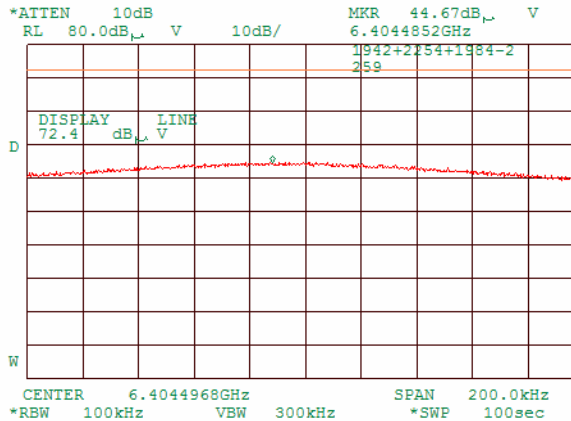
Plot 8.4.17 Radiated emission measurements at the 7<sup>th</sup> harmonic

TEST SITE: OATS  
 ANTENNA POLARIZATION: Vertical  
 TEST DISTANCE: 3 m



Plot 8.4.18 Radiated emission measurements at the 7<sup>th</sup> harmonic

TEST SITE: OATS  
 ANTENNA POLARIZATION: Horizontal  
 TEST DISTANCE: 3 m

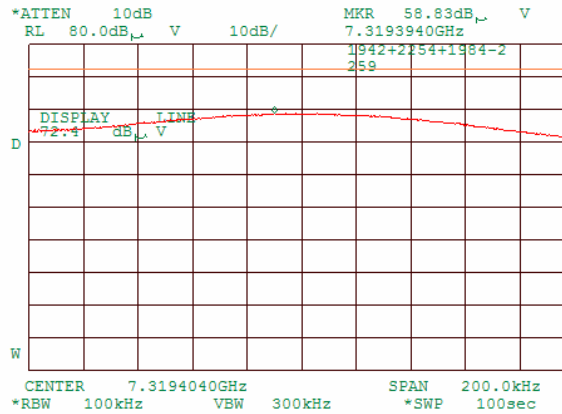




<b>Test specification:</b>	<b>Section 90.210, Radiated spurious emissions</b>		
<b>Test procedure:</b>	47 CFR, Sections 2.1053 and 90.210(m); TIA/EIA-603-A, Section 2.2.12		
<b>Test mode:</b>	Compliance	<b>Verdict: PASS</b>	
<b>Date &amp; Time:</b>	3/24/2005 5:03:27 PM		
<b>Temperature:</b> 24 °C	<b>Air Pressure:</b> 1014 hPa	<b>Relative Humidity:</b> 44 %	<b>Power Supply:</b> 3.6 VDC
<b>Remarks:</b>			

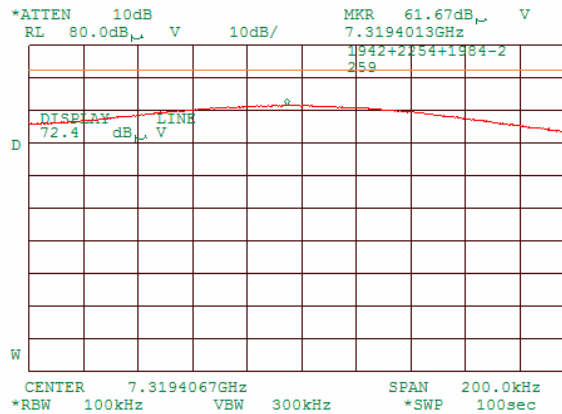
Plot 8.4.19 Radiated emission measurements at the 8<sup>th</sup> harmonic

TEST SITE: OATS  
 ANTENNA POLARIZATION: Vertical  
 TEST DISTANCE: 3 m



Plot 8.4.20 Radiated emission measurements at the 8<sup>th</sup> harmonic

TEST SITE: OATS  
 ANTENNA POLARIZATION: Horizontal  
 TEST DISTANCE: 3 m

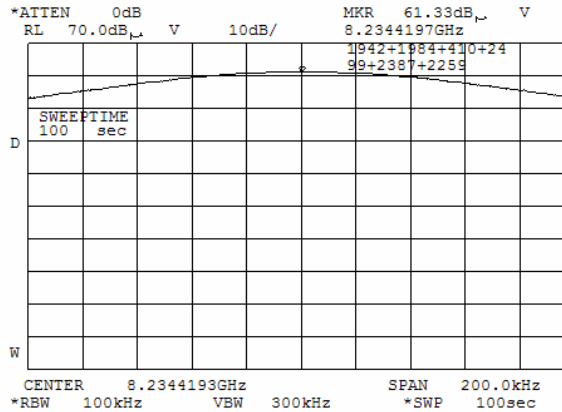




<b>Test specification:</b>	<b>Section 90.210, Radiated spurious emissions</b>		
<b>Test procedure:</b>	47 CFR, Sections 2.1053 and 90.210(m); TIA/EIA-603-A, Section 2.2.12		
<b>Test mode:</b>	Compliance	<b>Verdict:</b>	<b>PASS</b>
<b>Date &amp; Time:</b>	3/24/2005 5:03:27 PM		
<b>Temperature:</b> 24 °C	<b>Air Pressure:</b> 1014 hPa	<b>Relative Humidity:</b> 44 %	<b>Power Supply:</b> 3.6 VDC
<b>Remarks:</b>			

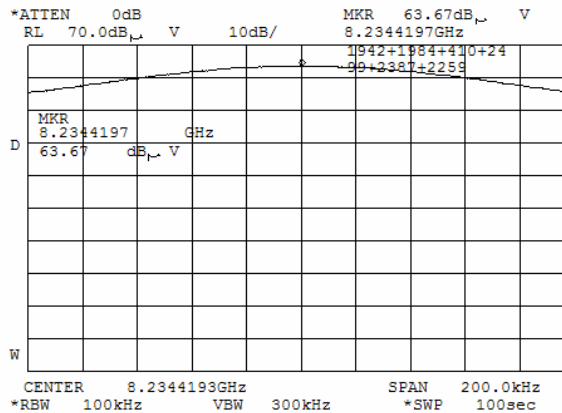
**Plot 8.4.21 Radiated emission measurements at the 9<sup>th</sup> harmonic**

TEST SITE: OATS  
 ANTENNA POLARIZATION: Vertical  
 TEST DISTANCE: 3 m



**Plot 8.4.22 Radiated emission measurements at the 9<sup>th</sup> harmonic**

TEST SITE: OATS  
 ANTENNA POLARIZATION: Horizontal  
 TEST DISTANCE: 3 m

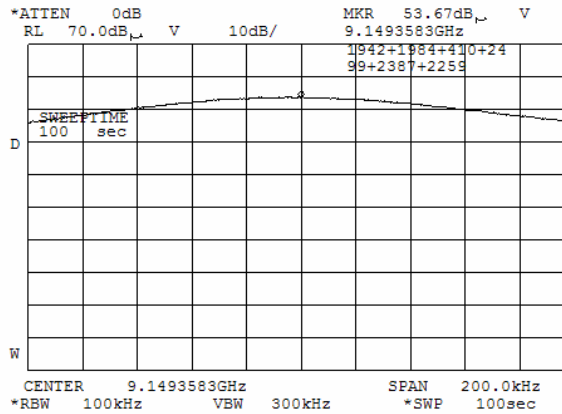




<b>Test specification:</b>	<b>Section 90.210, Radiated spurious emissions</b>		
<b>Test procedure:</b>	47 CFR, Sections 2.1053 and 90.210(m); TIA/EIA-603-A, Section 2.2.12		
<b>Test mode:</b>	Compliance	<b>Verdict: PASS</b>	
<b>Date &amp; Time:</b>	3/24/2005 5:03:27 PM		
<b>Temperature:</b> 24 °C	<b>Air Pressure:</b> 1014 hPa	<b>Relative Humidity:</b> 44 %	<b>Power Supply:</b> 3.6 VDC
<b>Remarks:</b>			

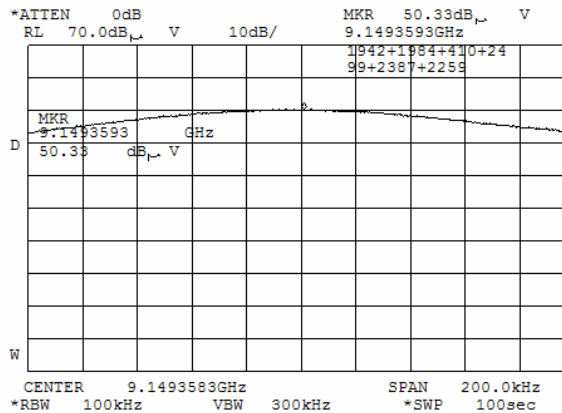
Plot 8.4.23 Radiated emission measurements at the 10<sup>th</sup> harmonic

TEST SITE: OATS  
 ANTENNA POLARIZATION: Vertical  
 TEST DISTANCE: 3 m



Plot 8.4.24 Radiated emission measurements at the 10<sup>th</sup> harmonic

TEST SITE: OATS  
 ANTENNA POLARIZATION: Horizontal  
 TEST DISTANCE: 3 m





<b>Test specification:</b> Section 90.213, Frequency stability			
<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> 3/24/2005 1:06:04 PM			
<b>Temperature:</b> 21 °C	<b>Air Pressure:</b> 1010 hPa	<b>Relative Humidity:</b> 44 %	<b>Power Supply:</b> 3.6 VDC
<b>Remarks:</b> completed, limit NA			

## 8.5 Frequency stability test

### 8.5.1 General

This test was performed to measure frequency stability of transmitter RF carrier. Specification test limits are given in Table 8.5.1. The test results are provided in Table 8.5.2.

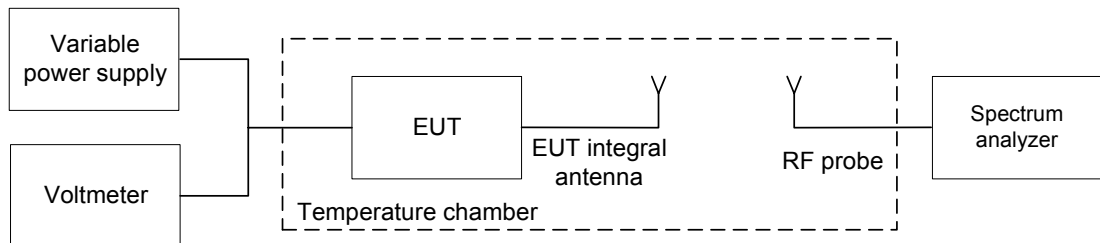
Table 8.5.1 Frequency stability limits

Assigned frequency, MHz	Maximum allowed frequency displacement	
	ppm	Hz
915	2.5	2287.5

### 8.5.2 Test procedure

- 8.5.2.1 The EUT was set up as shown in Figure 8.5.1, energized and its proper operation was checked.
- 8.5.2.2 The EUT power was turned off. Temperature within test chamber was set to +30°C and a period of time sufficient to stabilize all of the oscillator circuit components was allowed.
- 8.5.2.3 The EUT was powered on and carrier frequency was measured at start up moment and then every minute until frequency had been stabilized or 10 minutes elapsed whichever reached the last. The EUT was powered off.
- 8.5.2.4 The above procedure was repeated at 0°C and at the lowest test temperature.
- 8.5.2.5 The EUT was powered on and carrier frequency was measured at start up moment and at the end of stabilization period at the rest of test temperatures and voltages. The EUT was powered off.
- 8.5.2.6 Frequency displacement was calculated and compared with the limit as provided in Table 8.5.2.

Figure 8.5.1 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> PASS	
<b>Date &amp; Time:</b>		3/24/2005 1:06:04 PM			
<b>Temperature:</b> 21 °C		<b>Air Pressure:</b> 1010 hPa		<b>Relative Humidity:</b> 44 %	
<b>Power Supply:</b> 3.6 VDC					
<b>Remarks:</b> completed, limit NA					

Table 8.5.2 Frequency stability test results

OPERATING FREQUENCY: 915 MHz  
 NOMINAL POWER VOLTAGE: 3.6 V  
 TEMPERATURE STABILIZATION PERIOD: 20 min  
 POWER DURING TEMPERATURE TRANSITION: Off  
 SPECTRUM ANALYZER MODE: Counter  
 RESOLUTION BANDWIDTH: 100 Hz  
 VIDEO BANDWIDTH: 100 Hz  
 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			
-30	nominal	914.792618	914.794707	914.795233	914.795702	914.795897	914.795123	914.795062	132573	0	NA	NA	NA
-20	nominal	914.833182	NA	NA	NA	NA	NA	914.837316	92009	0			
-10	nominal	914.8675	NA	NA	NA	NA	NA	914.869276	57691	0			
0	nominal	914.896725	914.897622	914.89804	914.898099	914.898162	914.89815	914.898066	28466	0			
10	nominal	914.916365	NA	NA	NA	NA	NA	914.916371	8826	0			
20	nominal	914.925423	NA	NA	NA	NA	NA	914.925191*	0	-232			
20	2.7**	914.923059	NA	NA	NA	NA	NA	914.922868	2323	0			
30	nominal	914.92488	914.927795	914.924642	914.924663	914.924684	914.924712	914.924741	549	-2604			
40	nominal	914.916912	NA	NA	NA	NA	NA	914.916048	9143	0			
50	nominal	914.935245	NA	NA	NA	NA	NA	914.903714	21477	-10054			

\* - Reference frequency  
 \*\* - Battery operating end point specified by the manufacturer.

Reference numbers of test equipment used

HL 0337	HL 0500	HL 0559	HL 0808			
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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>PASS</b>
<b>Date &amp; Time:</b>	11/21/2004 10:37:44 AM		
<b>Temperature:</b> 24 °C	<b>Air Pressure:</b> 1014 hPa	<b>Relative Humidity:</b> 44 %	<b>Power Supply:</b> 3.6 VDC
<b>Remarks:</b>			

## 9 Emission tests according to 47CFR part 15 subpart B requirements

### 9.1 Radiated emission measurements

#### 9.1.1 General

This test was performed to measure radiated emissions from the EUT enclosure. Specification test limits are given in Table 9.1.1.

Table 9.1.1 Radiated emission test limits

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

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

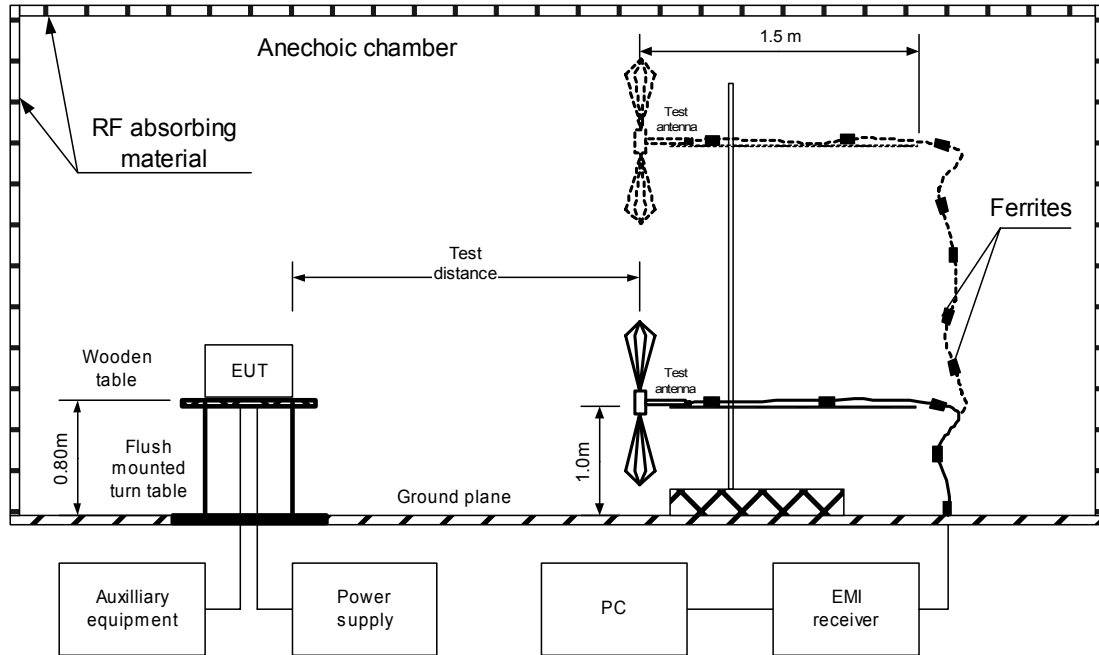
#### 9.1.2 Test procedure for measurements in semi-anechoic chamber

- 9.1.2.1** The EUT was set up as shown in Figure 9.1.1 and associated photograph/s, energized and the performance check was conducted.
- 9.1.2.2** 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.
- 9.1.2.3** The worst test results (the lowest margins) found in 915 MHz receive mode were recorded in Table 9.1.2. Full test results are shown in the associated plots.



<b>Test specification:</b> Section 15.109, Radiated emission			
<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> 11/21/2004 10:37:44 AM			
<b>Temperature:</b> 24 °C	<b>Air Pressure:</b> 1014 hPa	<b>Relative Humidity:</b> 44 %	<b>Power Supply:</b> 3.6 VDC
<b>Remarks:</b>			

Figure 9.1.1 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>PASS</b>
<b>Date &amp; Time:</b>	11/21/2004 10:37:44 AM		
<b>Temperature:</b> 24 °C	<b>Air Pressure:</b> 1014 hPa	<b>Relative Humidity:</b> 44 %	<b>Power Supply:</b> 3.6 VDC
<b>Remarks:</b>			

Table 9.1.2 Radiated emission test results

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

Frequency, MHz	Peak emission, dB(μV/m)	Quasi-peak			Antenna polarization	Antenna height, m	Turn-table position**, degrees	Verdict
		Measured emission, dB(μV/m)	Limit, dB(μV/m)	Margin, dB*				
248.036375	37.78	37.20	46.00	-8.80	H	1.0	237	Pass
264.034500	41.03	40.56	46.00	-5.44	H	1.1	233	Pass
280.037625	40.73	40.20	46.00	-5.80	H	1.1	54	Pass
296.035125	35.58	34.47	46.00	-11.53	H	1.1	237	Pass
368.047325	34.29	33.11	46.00	-12.89	H	1.0	256	Pass
401.510946	35.44	30.57	46.00	-15.43	H	1.0	250	Pass

TEST SITE: SEMI ANECHOIC CHAMBER  
TEST DISTANCE: 3 m  
DETECTORS USED: PEAK  
FREQUENCY RANGE: 1000 MHz - 5000  
RESOLUTION BANDWIDTH: 1000 kHz

Frequency, MHz	Peak emission, dB(μV/m)	Average			Antenna polarization	Antenna height, m	Turn-table position**, degrees	Verdict
		Measured emission, dB(μV/m)	Limit, dB(μV/m)	Margin, dB*				
No emissions were found								Pass

\*- Margin = Measured emission - specification limit.

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

## Reference numbers of test equipment used

HL 0465	HL 0521	HL 0589	HL 0593	HL 0594	HL 0604	HL 1004	HL 1984
HL 2009							

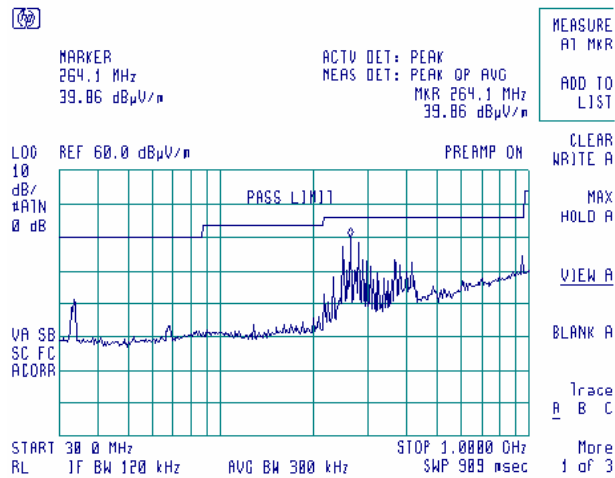
Full description is given in Appendix A.



<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>PASS</b>
<b>Date &amp; Time:</b>	11/21/2004 10:37:44 AM		
<b>Temperature:</b> 24 °C	<b>Air Pressure:</b> 1014 hPa	<b>Relative Humidity:</b> 44 %	<b>Power Supply:</b> 3.6 VDC
<b>Remarks:</b>			

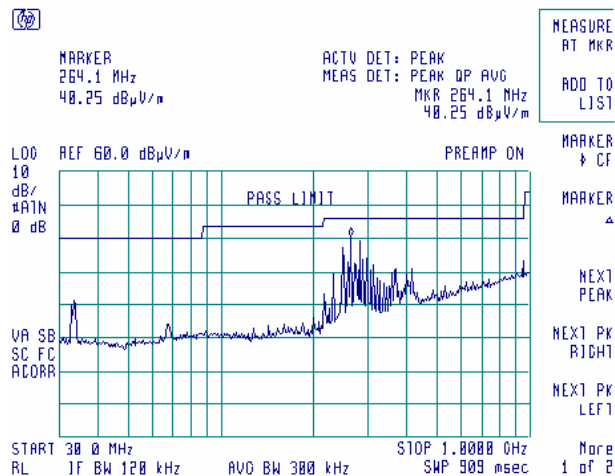
Plot 9.1.1 Radiated emission measurements in 30- 1000 MHz range, vertical and horizontal antenna polarization

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



Plot 9.1.2 Radiated emission measurements in 30- 1000 MHz range, vertical and horizontal antenna polarization

TEST SITE: Semi anechoic chamber  
LIMIT: Class B  
TEST DISTANCE: 3 m  
EUT OPERATING MODE: Receive 915 MHz

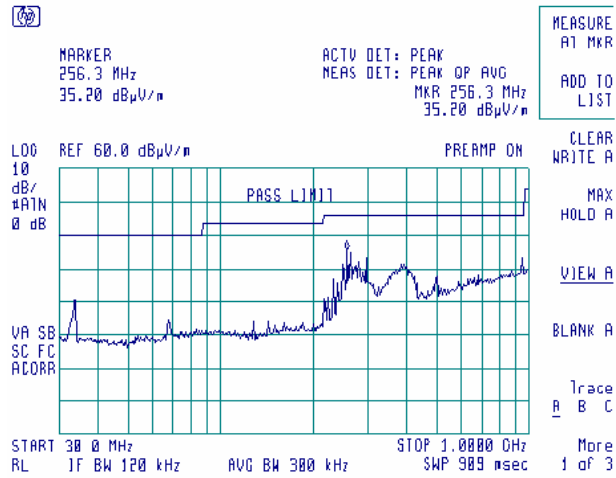




<b>Test specification:</b>	<b>Section 15.109, Radiated emission</b>		
<b>Test procedure:</b>	ANSI C63.4, Sections 11.6 and 12.1.4		
<b>Test mode:</b>	Compliance	<b>Verdict:</b>	<b>PASS</b>
<b>Date &amp; Time:</b>	11/21/2004 10:37:44 AM		
<b>Temperature:</b> 24 °C	<b>Air Pressure:</b> 1014 hPa	<b>Relative Humidity:</b> 44 %	<b>Power Supply:</b> 3.6 VDC
<b>Remarks:</b>			

**Plot 9.1.3 Radiated emission measurements in 30- 1000 MHz range, vertical and horizontal antenna polarization**

TEST SITE: Semi anechoic chamber  
LIMIT: Class B  
TEST DISTANCE: 3 m  
EUT OPERATING MODE: Receive 2450 MHz

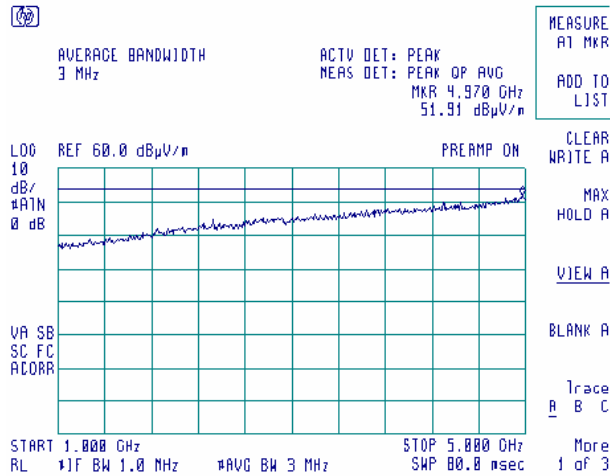




<b>Test specification:</b> Section 15.109, Radiated emission			
<b>Test procedure:</b> ANSI C63.4, Sections 11.6 and 12.1.4			
<b>Test mode:</b> Compliance	<b>Verdict:</b> PASS		
<b>Date &amp; Time:</b> 11/21/2004 10:37:44 AM			
<b>Temperature:</b> 24 °C	<b>Air Pressure:</b> 1014 hPa	<b>Relative Humidity:</b> 44 %	<b>Power Supply:</b> 3.6 VDC
<b>Remarks:</b>			

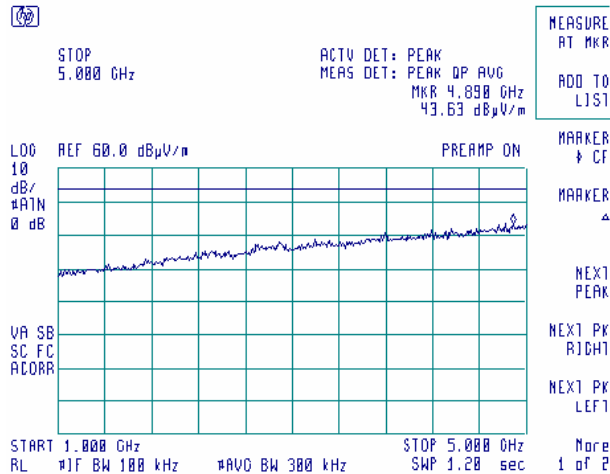
Plot 9.1.4 Radiated emission measurements in 1000- 5000 MHz range, vertical and horizontal antenna polarization

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



Plot 9.1.5 Radiated emission measurements in 1000 – 5000 MHz range, vertical and horizontal antenna polarization

TEST SITE: Semi anechoic chamber  
LIMIT: Class B  
TEST DISTANCE: 3 m  
EUT OPERATING MODE: Receive 915 MHz

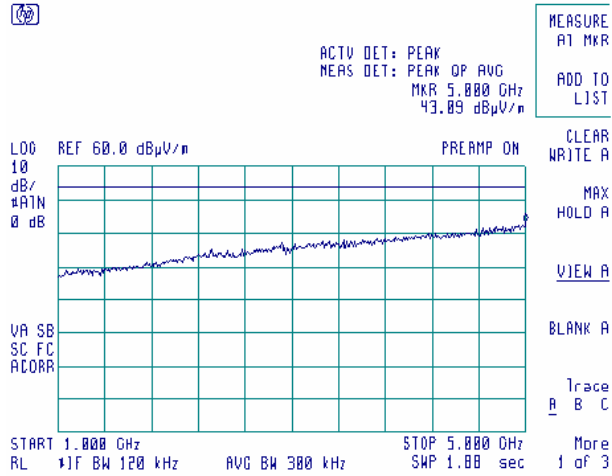




<b>Test specification:</b> Section 15.109, Radiated emission			
<b>Test procedure:</b> ANSI C63.4, Sections 11.6 and 12.1.4			
<b>Test mode:</b> Compliance	<b>Verdict:</b> PASS		
<b>Date &amp; Time:</b> 11/21/2004 10:37:44 AM			
<b>Temperature:</b> 24 °C	<b>Air Pressure:</b> 1014 hPa	<b>Relative Humidity:</b> 44 %	<b>Power Supply:</b> 3.6 VDC
<b>Remarks:</b>			

**Plot 9.1.6 Radiated emission measurements in 1000- 5000 MHz range, vertical and horizontal antenna polarization**

TEST SITE: Semi anechoic chamber  
LIMIT: Class B  
TEST DISTANCE: 3 m  
EUT OPERATING MODE: Receive 2450 MHz



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

HL No	Description	Manufacturer	Model	Ser. No.	Last Cal.	Due Cal.
0034	Antenna, Log Periodic, 200 - 1000 MHz	Electro-Metrics	LPA 25/30	1988	12-Jan-05	12-Jan-06
0337	Probe Set, Hand held, 5 probes	Electro-Metrics	EHFP-30	238	12-Jan-05	12-Jan-06
0410	Cable, Coax, Microwave, DC-18 GHz, N-N, 1 m	Gore	PFP01P0 1039.4	9338767	17-Oct-04	17-Oct-05
0415	Cable, Coax, RF, RG-214	HL	CC-3	056	02-Dec-04	02-Dec-05
0446	Antenna, Loop active, 10 kHz – 30 MHz	EMCO	6502	2857	28-Jun-04	28-Jun-05
0465	Anechoic Chamber 9(L) x 6.5(W) x 5.5(H) m	HL	AC - 1	023	10-Oct-04	10-Oct-05
0500	Oven temperature -42 to +150 deg C	Thermotron	S-16 Mini-Max	25-2893-05	19-Feb-05	19-Feb-06
0521	EMI Receiver (Spectrum Analyzer) with RF filter section 9 kHz-6.5 GHz	Hewlett Packard	8546A	3617A 00319, 3448A002 53	19-Feb-05	19-Feb-06
0559	Multimeter Digital	Fluke	Fluke 76	65360903	19-Feb-05	19-Feb-06
0589	Cable Coaxial, GORE A2P01POL118, 2.3 m	HL	GORE-3	176	19-Feb-05	19-Feb-06
0592	Position Controller	HL	L2-SR3000 (HL CRL-3)	100	02-Dec-04	02-Dec-05
0593	Antenna Mast, 1-4 m Pneumatic	Madgesh	AM-F1	101	03-Feb-05	03-Feb-06
0594	Turn Table FOR ANECHOIC CHAMBER flush mount d=1.2 m Pneumatic	HL	TT-WDC1	102	27-Jan-05	27-Jan-06
0604	Antenna BiconiLog Log-Periodic/T Bow-TIE 26 - 2000 MHz	EMCO	3141	9611-1011	27-Jan-05	27-Jan-06
0661	Generator Swept Signal, 10 MHz to 40 GHz, + 10 dBm	Hewlett Packard	83640B	3614A002 66	27-Jan-05	27-Jan-06
0808	Analyzer Spectrum 100 Hz to 2.2 GHz	Anritsu	MS2601B	M178731	27-Mar-05	27-Mar-06
0812	Cable Coax, RG-214, 11.5 m, N-type connectors	HL	C214-11	148	27-Jan-05	27-Jan-06
1004	Cable Coaxial , ANDREW PSWJ4 , 6m	HL	ANDREW -6	163	27-Jan-05	27-Jan-06
1200	Quadruplexer 1-12 GHz (1-2 GHz; 2-4GHz;4-8 GHz; 8-12GHz)	Elettronica S.p.A. - Roma	UE 84	D/00240	10-Feb-05	10-Feb-06
1424	Spectrum Analyzer, 30 Hz- 40 GHz	Agilent Technologies (HP)	8564EC	3946A002 19	27-Jan-05	27-Jan-06
1430	EMI Receiver, 9 kHz - 2.9 GHz, System: HL1431, HL1432	Agilent Technologies (HP)	8542E	3807A002 62,3705A0 0217	27-Jan-05	27-Jan-06
1492	Antenna, Log Periodic	HL	LPA 200/1000	219	27-Jan-05	27-Jan-06
1499	Cable RF, 20 m	Suhner Switzerland	RG 214/U	1499	23-Sep-04	23-Sep-05
1565	Antenna, Dipole, Tunable 500 - 1000 MHz	Electro-Metrics	TDS-30-2	334	29-Jan-05	29-Jan-06
1941	Cable 18GHz, 4 m, green	Rhophase Microwave Limited	SPS-1803A-4000-NPS	T4657	17-Oct-04	17-Oct-05
1942	Cable 18GHz, 4 m, blue	Rhophase Microwave Limited	SPS-1803A-4000-NPS	T4658	17-Oct-04	17-Oct-05





HL No	Description	Manufacturer	Model	Ser. No.	Last Cal.	Due Cal.
1947	Cable 18GHz, 6.5 m, blue	Rhophase Microwave Limited	NPS-1803A-6500-NPS	T4974	17-Oct-04	17-Oct-05
1984	Antenna, Double-Ridged Waveguide Horn, 1-18 GHz, 300 W, N-type	EMC Test Systems	3115	9911-5964	22-Mar-05	22-Mar-06
2009	Cable RF, 8 m	Alpha Wire	RG-214	C-56	02-Dec-04	02-Dec-05
2259	Amplifier Low Noise 2-20 GHz	Sophia Wireless	LNA0220-C	0223	05-Nov-04	05-Nov-05
2400	Cable 40GHz, 1.5 m, green	Rhophase Microwave Limited	KPS-1503A-1500-KPS	X2946	23-Sep-04	23-Sep-05
2432	Antenna, Double-Ridged Waveguide Horn 1-18 GHz	EMC Test Systems	3115	00027177	22-Mar-05	22-Mar-06



## 11 APPENDIX B Measurement uncertainties

Expanded uncertainty at 95% confidence in Hermon Labs EMC measurements

Test description	Expanded uncertainty
Conducted carrier power at RF antenna connector	Below 12.4 GHz: $\pm 1.7$ dB 12.4 GHz to 40 GHz: $\pm 2.3$ dB
Conducted emissions at RF antenna connector	9 kHz to 2.9 GHz: $\pm 2.6$ dB 2.9 GHz to 6.46 GHz: $\pm 3.5$ dB 6.46 GHz to 13.2 GHz: $\pm 4.3$ dB 13.2 GHz to 22.0 GHz: $\pm 5.0$ dB 22.0 GHz to 26.8 GHz: $\pm 5.5$ dB 26.8 GHz to 40.0 GHz: $\pm 4.8$ dB
Occupied bandwidth	$\pm 8.0$ %
Duty cycle, timing (Tx ON / OFF) and average factor measurements	$\pm 1.0$ %
Radiated emissions at 3 m measuring distance Horizontal polarization  Vertical polarization	Biconilog antenna: $\pm 5.3$ dB Biconical antenna: $\pm 5.0$ dB Log periodic antenna: $\pm 5.3$ dB Double ridged horn antenna: $\pm 5.3$ dB Biconilog antenna: $\pm 6.0$ dB Biconical antenna: $\pm 5.7$ dB Log periodic antenna: $\pm 6.0$ dB Double ridged horn antenna: $\pm 6.0$ dB

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.



## 12 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.

## 13 APPENDIX D Specification references

47CFR part 15: 2004	Radio Frequency Devices.
47CFR part 90: 2004	Private land mobile radio services
47CFR part 1: 2004	Practice and procedure
47CFR part 2: 2004	Frequency allocations and radio treaty matters; general rules and regulations
FR Vol.62	Federal Register, Volume 62, May 13, 1997
ANSI C63.2: 1996	American National Standard for Instrumentation-Electromagnetic Noise and Field Strength, 10 kHz to 40 GHz-Specifications.
ANSI C63.4: 2003	American National Standard for Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz.
ANSI/TIA/EIA-603-A:2001	Land Mobile FM or PM Communications Equipment Measurement and Performance Standards



## 14 APPENDIX E Abbreviations and acronyms

A	ampere
AC	alternating current
A/m	ampere per meter
AM	amplitude modulation
AVRG	average (detector)
cm	centimeter
dB	decibel
dBm	decibel referred to one milliwatt
dB( $\mu$ V)	decibel referred to one microvolt
dB( $\mu$ V/m)	decibel referred to one microvolt per meter
dB( $\mu$ A)	decibel referred to one microampere
dB $\Omega$	decibel referred to one Ohm
DC	direct current
DTS	digital transmission system
EIRP	equivalent isotropically radiated power
ERP	effective radiated power
EUT	equipment under test
F	frequency
FHSS	frequency hopping spread spectrum
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
$\mu$ s	microsecond
NA	not applicable
NT	not tested
OATS	open area test site
$\Omega$	Ohm
PCB	printed circuit board
PM	pulse modulation
PS	power supply
ppm	part per million ( $10^{-6}$ )
QP	quasi-peak
RE	radiated emission
RF	radio frequency
rms	root mean square
Rx	receive
s	second
T	temperature
Tx	transmit
V	volt
VA	volt-ampere

**15 APPENDIX F Test equipment correction factors****Antenna factor  
Active loop antenna  
Model 6502, S/N 2857, HL 0446**

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

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

**Log periodic antenna factor  
Electro-Metrics, model LPA-25/30, serial number 1988, HL 0034**

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

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



**Antenna factor**

**Biconilog antenna EMCO, model 3141, serial number 1011, HL 0604**

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**  
**Model 3115, S/N 9911-5964, HL1984**

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

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



**Antenna factor**  
**Double-ridged guide horn antenna**  
**Model 3115, serial number: 00027177, HL2432**

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

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





**Cable loss**  
**Cable GORE, HL 0410**

No.	Frequency, GHz	Cable loss, dB
1	0.5	0.16
2	1	0.28
3	2	0.38
4	4	0.55
5	6	0.85
6	8	0.90
7	10	1.07
8	12	1.11
9	14	1.29
10	16	1.41
11	18	1.73



**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		±0.17
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 18 GHz, 4 m, green, model: SPS-1803A-4000-NPS, S/N T4657, HL 1941**

Frequency, GHz	Cable loss, dB
0.03	0.39
0.05	0.49
0.1	0.68
0.2	0.95
0.3	1.30
0.5	1.58
0.7	1.84
0.9	2.08
1.1	2.28
1.3	2.56
1.5	2.91
1.7	2.95
1.9	3.17
2.1	3.22
2.3	3.25
2.5	3.39
2.7	3.51
2.9	3.67
3.1	3.81
3.3	3.92
3.5	4.05
3.7	4.14
3.9	4.30
4.1	4.44
4.3	4.55
4.5	4.68
4.7	4.75
4.9	4.84
5.1	4.86
5.3	4.89
5.5	5.00
5.7	5.05
5.9	5.19
6.1	5.28
7.7	5.58

Frequency, GHz	Cable loss, dB
7.9	5.63
8.1	5.67
8.3	5.70
8.5	5.74
8.7	5.78
8.9	5.84
9.1	5.89
9.3	5.94
9.5	6.02
9.7	6.10
9.9	6.12
10.1	6.09
10.3	6.03
10.5	6.01
10.7	6.05
10.9	6.08
11.1	6.10
11.3	6.18
11.5	6.23
11.7	6.20
11.9	6.16
12.1	6.18
12.4	6.33
13.0	6.51
13.5	6.51
14.0	6.75
14.5	6.82
15.0	6.93
15.5	7.16
16.0	7.10
16.5	7.18
17.0	7.67
17.5	7.71
18.0	7.61



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

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

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



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

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



**Cable loss**  
**Cable coaxial, 40GHz, 1.5 m, green, RhoPhase Microwave Limited, model: KPS-1503A-1500-KPS, HL 2400**

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