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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.

Hand held reader

FP200HH

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.

Report ID: TELRAD_16172_rev2.doc
Date of Issue: 3/1/2005

Table of contents

1 Applicant information

Client name:	Telematics Wireless Ltd.
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E-mail:	slavas@tadiran-telematics.com
Contact name:	Mr. Slava Snitkovsky

2 Equipment under test attributes

Product name:	Hand held reader
Model(s):	FP200HH
Serial number:	000024
Receipt date	11/21/2004 9:45:00 AM

3 Manufacturer information

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

4 Test details

Project ID:	16172
Location:	Hermon Laboratories Ltd. P.O.Box 23, Binyamina 30500, Israel
Test started:	11/21/2004
Test completed:	2/7/2005
Test specification(s):	FCC part 90, part 15 subpart C, §15.247; §15.207; subpart B, §§15.107, 15.109
Test suite:	FCC_15.247_DTS_without_RF_connector (5/3/2004 5:43:35 PM, modified)

5 Tests summary

Test	Status
Transmitter characteristics according to part 15 subpart C	
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	Pass
Transmitter characteristics according to part 90	
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
Unintentional emissions	
Section 15.107, Conducted emission at AC power port	Pass
Section 15.109, Radiated emission	Pass
Section 15.111, Conducted emission at receiver antenna port	Not required

Testing was completed against all relevant requirements of the test standard. 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_16172_rev1.

	Name and Title	Date	Signature
Tested by:	Mr. B. Efros, test engineer	February 7, 2005	
Reviewed by:	Mrs. M. Cherniavsky, certification engineer	May 9, 2005	
	Mr. M. Nikishin, EMC group leader	May 10, 2005	
Approved by:	Mr. A. Usoskin, C.E.O.	May 11, 2005	

6 EUT description

6.1 General information

The EUT is a hand-held reader (HHR) for component or vehicle identification system implementing two operating frequencies. The HHR provides information access and setting for Telematics Wireless transponders at 2.44 GHz operating frequency and electronic seals (at 915 MHz). The EUT is powered from 4.8 V DC rechargeable battery or via AC/DC adapter.

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6.2 Ports and lines

Port type	Port description	Connected		Connector type	Qty.	Cable type	Cable length	Indoor / outdoor
		From	To					
Signal	USB	EUT	OC	USB F	1	Shielded	1.5 m	Indoor
Power	DC	EUT	PS	DC jack	1	Unshielded	1.5 m	Indoor
Power	AC Mains	PS	AC Mains	Two pole	1	NA	NA	NA

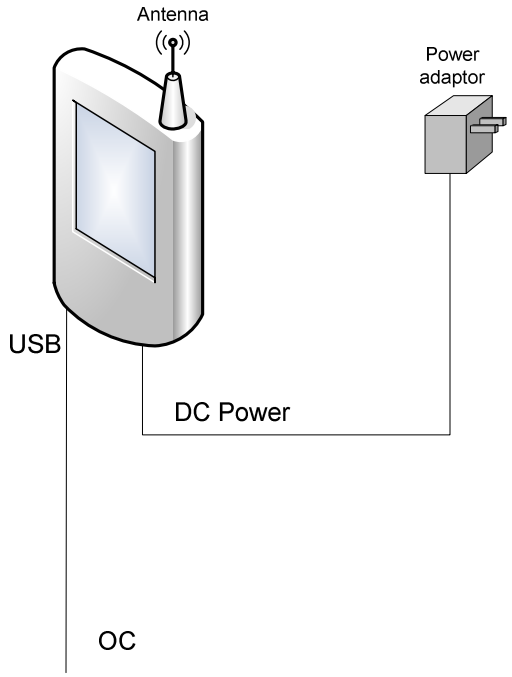
6.3 Operating frequencies

Source	Frequency, MHz		
Digital portion	0.032768	8	NA
Receiver	915.44	2440	971.4
Transmitter	915.44	2440	971.4

6.4 Changes made in the EUT

No changes were implemented.

6.5 Test configuration



6.6 Transmitter characteristics

6.6.1 Operation with transponders

Type of equipment	
X	Stand-alone (Equipment with or without its own control provisions)
	Combined equipment (Equipment where the radio part is fully integrated within another type of equipment)
	Plug-in card (Equipment intended for a variety of host systems)

Intended use		**Condition of use**
	fixed	Always at a distance more than 2 m from all people
	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

Assigned frequency range	2400.0 – 2483.5 MHz
Operating frequency range	2440 MHz
RF channel spacing	NA

Maximum rated output power	At transmitter 50 Ω RF output connector	dBm
	Effective radiated power (for equipment with no RF connector)	2.3 dBm

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

Antenna connection					
unique coupling	standard connector	X	integral		with temporary RF connector
				X	without temporary RF connector

Antenna/s technical characteristics			
Type	Manufacturer	Model number	Gain
Spring	Telematics	NA	2 dB

Transmitter 99% power bandwidth	14.1 MHz				
Transmitter aggregate data rate/s	0.5 Mbps				
Transmitter aggregate symbol (baud) rate/s	0.5 Msymbols (MBaud) per second				
Type of modulation	ASK				
Type of multiplexing	TDMA				
Modulating test signal (baseband)	PRBS				
Maximum transmitter duty cycle in normal use	50 %	**Tx ON time**	5 msec	**Period**	10 msec
Transmitter duty cycle supplied for test	100 %	**Tx ON time**	msec	**Period**	msec

Transmitter power source						
X	Battery	**Nominal rated voltage**	4.8 VDC (4.3 – 5)VDC	Battery type	Lithium	
	DC	**Nominal rated voltage**	VDC			
	AC mains	**Nominal rated voltage**	VAC	Frequency	Hz	

Common power source for transmitter and receiver	X	yes	no

6.6.2 Operation with electronic seals

Type of equipment	
X	Stand-alone (Equipment with or without its own control provisions)
	Combined equipment (Equipment where the radio part is fully integrated within another type of equipment)
	Plug-in card (Equipment intended for a variety of host systems)

Intended use		**Condition of use**
	fixed	Always at a distance more than 2 m from all people
	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

Assigned frequency range	909.75 – 921.75 MHz
Operating frequency range	915 MHz
RF channel spacing	NA

Maximum rated output power	At transmitter 50 Ω RF output connector	dBm
	Effective radiated power (for equipment with no RF connector)	14.4 dBm

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

Antenna connection			
unique coupling	standard connector	X integral	with temporary RF connector
			X without temporary RF connector

Antenna/s technical characteristics			
Type	Manufacturer	Model number	Gain
Printed	Telematics	NA	2 dB

Transmitter 99% power bandwidth	8 MHz				
Transmitter aggregate data rate/s	0.5 Mbps				
Transmitter aggregate symbol (baud) rate/s	0.5 Msymbols (MBaud) per second				
Type of modulation	ASK				
Type of multiplexing	TDMA				
Modulating test signal (baseband)	PRBS				
Maximum transmitter duty cycle in normal use	50 %	**Tx ON time**	5 msec	**Period**	10 msec
Transmitter duty cycle supplied for test	100 %	**Tx ON time**	msec	**Period**	msec

Transmitter power source					
X	Battery	**Nominal rated voltage**	4.8 VDC (4.3 – 5)VDC	Battery type	Lithium
	DC	**Nominal rated voltage**	VDC		
	AC mains	**Nominal rated voltage**	VAC	Frequency	Hz

Common power source for transmitter and receiver	X	yes	no

Test specification:	**Section 15.247(a)2, 6 dB bandwidth**		
Test procedure:	FR Vol.62, page 26243, Section 15.247(a)2		
Test mode:	Compliance	**Verdict:**	PASS
Date & Time:	12/30/2004 11:45:59 AM		
Temperature: 23 ºC	**Air Pressure:** 1012 hPa	**Relative Humidity:** 40 %	**Power Supply:** 4.8 VDC
Remarks:			

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.

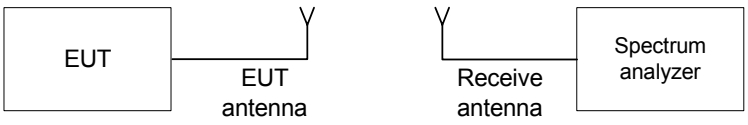
7.1.2 Test procedure

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



Test specification:	**Section 15.247(a)2, 6 dB bandwidth**		
Test procedure:	FR Vol.62, page 26243, Section 15.247(a)2		
Test mode:	Compliance	**Verdict:**	PASS
Date & Time:	12/30/2004 11:45:59 AM		
Temperature: 23 ºC	**Air Pressure:** 1012 hPa	**Relative Humidity:** 40 %	**Power Supply:** 4.8 VDC
Remarks:			

Table 7.1.2 6 dB bandwidth test results

ASSIGNED FREQUENCY BAND:	2400.0 – 2483.5 MHz
DETECTOR USED:	Peak
SWEEP MODE:	Single
SWEEP TIME:	Auto
RESOLUTION BANDWIDTH:	100 kHz
VIDEO BANDWIDTH:	3000 kHz
MODULATION ENVELOPE REFERENCE POINTS:	6.0 dBc
MODULATION:	ASK
MODULATING SIGNAL:	PRBS
BIT RATE:	0.5 Mbps

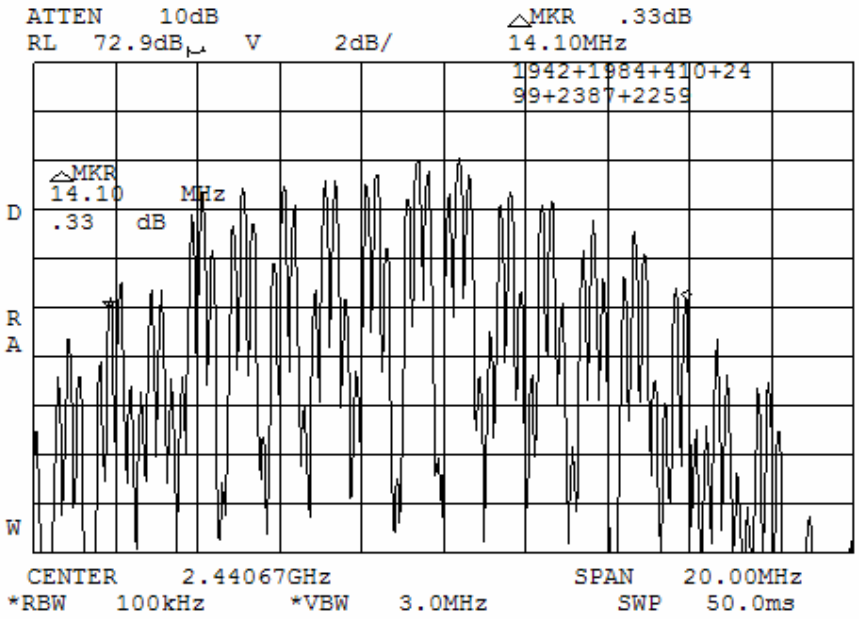
Carrier frequency, MHz	6 dB bandwidth, kHz	Limit, kHz	Margin, kHz	Verdict
2440.0	14100.0	500.0	13600.0	Pass

Reference numbers of test equipment used

HL 1424	HL 1942	HL 1984						

Full description is given in Appendix A.

Plot 7.1.1 6 dB bandwidth test result at carrier frequency



Test specification:	Section 15.247(b)3, Peak output power		
Test procedure:	FR Vol.62, page 26243, Section 15.247(b)		
Test mode:	Compliance	Verdict:	PASS
Date & Time:	1/2/2005 10:19:33 AM		
Temperature: 23 ºC	Air Pressure: 1012 hPa	Relative Humidity: 40 %	Power Supply: 4.8 VDC
Remarks:			

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×P×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 360^0 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 plot.

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.

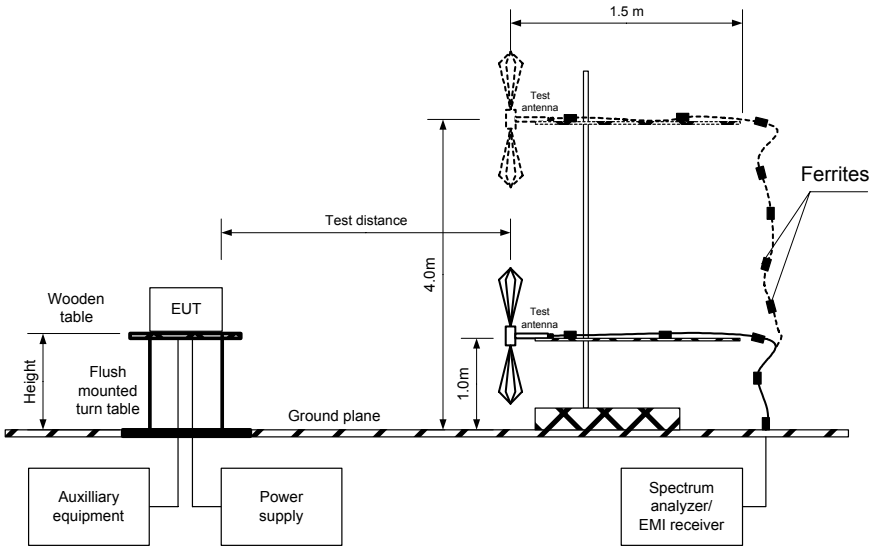
The above equation was converted in logarithmic units for 3 m test distance:

Peak output power in dBm = Field strength in dB(μV/m) - Transmitter antenna gain in dBi – 95.2 dB

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

Test specification:	**Section 15.247(b)3, Peak output power**		
Test procedure:	FR Vol.62, page 26243, Section 15.247(b)		
Test mode:	Compliance	**Verdict:**	PASS
Date & Time:	1/2/2005 10:19:33 AM		
Temperature: 23 ºC	**Air Pressure:** 1012 hPa	**Relative Humidity:** 40 %	**Power Supply:** 4.8 VDC
Remarks:			

Figure 7.2.1 Setup for carrier field strength measurements



Test specification:	**Section 15.247(b)3, Peak output power**		
Test procedure:	FR Vol.62, page 26243, Section 15.247(b)		
Test mode:	Compliance	**Verdict:**	PASS
Date & Time:	1/2/2005 10:19:33 AM		
Temperature: 23 ºC	**Air Pressure:** 1012 hPa	**Relative Humidity:** 40 %	**Power Supply:** 4.8 VDC
Remarks:			

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:	1410 MHz
RESOLUTION BANDWIDTH:	1 MHz
VIDEO BANDWIDTH:	3 MHz

Frequency, MHz	Field strength, dB(µV/m)	Antenna polarization	Antenna height, m	Azimuth, degrees*	EUT antenna gain, dBi	Peak output power, dBm**	Limit, dBm	Margin, dB***	Verdict
2440.75	99.5	H	1.5	167	2.0	2.3	30.0	-27.7	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(µV/m) - Transmitter antenna gain in dBi – 95.2 dB*
***- Margin = Peak output power – specification limit.

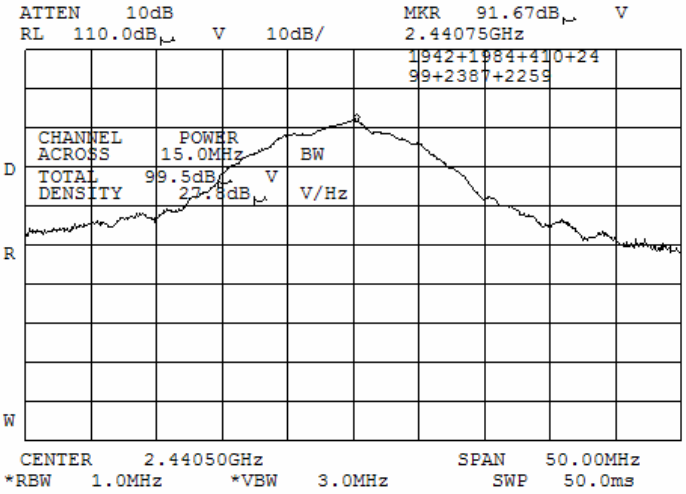
Reference numbers of test equipment used

HL 0410	HL 1424	HL 1942	HL 1984	HL 2259	HL 2384		

Full description is given in Appendix A.

Test specification:	**Section 15.247(b)3, Peak output power**		
Test procedure:	FR Vol.62, page 26243, Section 15.247(b)		
Test mode:	Compliance	**Verdict:**	PASS
Date & Time:	1/2/2005 10:19:33 AM		
Temperature: 23 ºC	**Air Pressure:** 1012 hPa	**Relative Humidity:** 40 %	**Power Supply:** 4.8 VDC
Remarks:			

Plot 7.2.1 Field strength of carrier frequency



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

7.3 RF exposure

7.3.1 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 2.3 dBm, antenna gain is 2 dBi, the maximum equivalent isotropically radiated power (e.i.r.p.) is 4.3 dBm = 2.7 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.

Test specification:	Section 15.247(c), Radiated spurious emissions		
Test procedure:	FR Vol. 62, page 26243, Section 15.247(c) / ANSI C63.4, Section 13.1.4		
Test mode:	Compliance	Verdict:	PASS
Date & Time:	2/7/2005 6:29:54 PM		
Temperature: 21 ºC	Air Pressure: 1015 hPa	Relative Humidity: 38 %	Power Supply: 4.8
Remarks: Final layout			

7.4 Field strength of spurious emissions

7.4.1 General

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

Table 7.4.1 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	NA	54.0	

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

$$Lim_{S2} = Lim_{S1} + 40 \log (S_1/S_2),$$

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.

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

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

7.4.2.2 The specified frequency range was investigated with antenna connected to spectrum analyzer/ EMI receiver. To find maximum radiation the turntable was rotated 360^0 and the measuring antenna was rotated around its vertical axis.

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

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

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

7.4.3.2 The specified frequency range was investigated with antenna connected to spectrum analyzer/ EMI receiver. To find maximum radiation the turntable was rotated 360^0, the measuring antenna height was changed from 1 to 4 m, its polarization was switched from vertical to horizontal.

7.4.3.3 The worst test results (the lowest margins) found in the EUT X-axis position were recorded in Tables 7.4.2, 7.4.3, 7.4.5 and shown in the associated plots.

Test specification:	**Section 15.247(c), Radiated spurious emissions**		
Test procedure:	FR Vol. 62, page 26243, Section 15.247(c) / ANSI C63.4, Section 13.1.4		
Test mode:	Compliance	**Verdict:**	PASS
Date & Time:	2/7/2005 6:29:54 PM		
Temperature: 21 ºC	**Air Pressure:** 1015 hPa	**Relative Humidity:** 38 %	**Power Supply:** 4.8
Remarks: Final layout			

Figure 7.4.1 Setup for spurious emission field strength measurements below 30 MHz

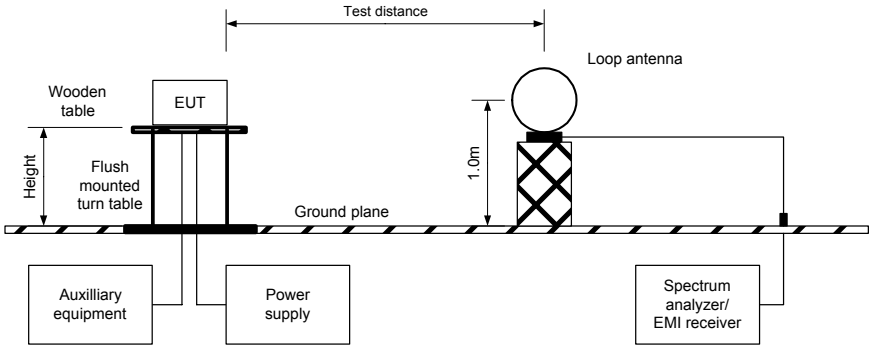
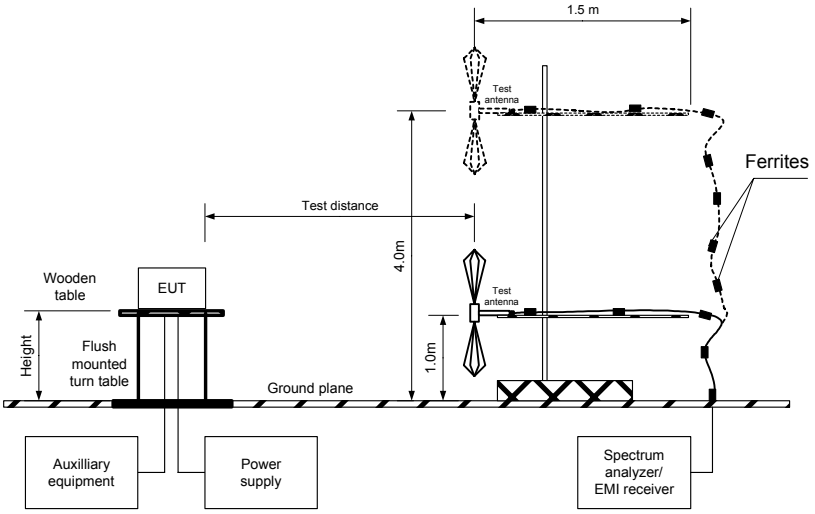


Figure 7.4.2 Setup for spurious emission field strength measurements above 30 MHz



Test specification:	**Section 15.247(c), Radiated spurious emissions**		
Test procedure:	FR Vol. 62, page 26243, Section 15.247(c) / ANSI C63.4, Section 13.1.4		
Test mode:	Compliance	**Verdict:**	PASS
Date & Time:	2/7/2005 6:29:54 PM		
Temperature: 21 ºC	**Air Pressure:** 1015 hPa	**Relative Humidity:** 38 %	**Power Supply:** 4.8
Remarks: Final layout			

Table 7.4.2 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
1954.05	44.19	H	1.2	199	84.22	40.03	20.00	20.03	Pass
1954.05	46.19	V	1.5	311		38.03		18.03	
2926.07	47.98	H	2.0	103		36.24		16.24	
2926.07	46.13	V	1.0	345		38.09		18.09	
3417.09	42.55	V	1.0	179		41.67		21.67	
3417.09	47.94	H	1.4	96		36.28		16.28	

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

Test specification:	**Section 15.247(c), Radiated spurious emissions**		
Test procedure:	FR Vol. 62, page 26243, Section 15.247(c) / ANSI C63.4, Section 13.1.4		
Test mode:	Compliance	**Verdict:**	PASS
Date & Time:	2/7/2005 6:29:54 PM		
Temperature: 21 ºC	**Air Pressure:** 1015 hPa	**Relative Humidity:** 38 %	**Power Supply:** 4.8
Remarks: Final layout			

Table 7.4.3 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
TRANSMITTER OUTPUT POWER:	2.3 dBm at high carrier frequency
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***	
1160.80	V	1.9	176	51.10	74.00	-22.90	31.30	25.30	54	-28.70	Pass
1160.80	H	1.2	299	54.58	74.00	-19.42	34.84	28.84	54	-25.16	
2202.75	V	1.6	12	48.12	74.00	-25.88	31.82	25.82	54	-28.18	
2202.75	H	1.0	233	45.77	74.00	-28.23	31.08	25.08	54	-28.92	
2353.34	H	1.6	94	57.40	74.00	-16.60	40.33	34.33	54	-19.67	
2727.57	H	1.8	257	55.00	74.00	-19.00	36.61	30.61	54	-23.39	
2727.57	V	1.0	94	47.69	74.00	-26.31	33.26	27.26	54	-26.74	
4881.21	V	1.5	98	56.33	74.00	-17.67	45.29	39.29	54	-14.71	
4881.21	H	1.2	196	59.96	74.00	-14.04	47.11	41.11	54	-12.89	
7322.17	H	1.2	34	58.50	74.00	-15.50	44.83	38.83	54	-15.17	
7322.17	V	1.1	48	56.83	74.00	-17.17	43.33	37.33	54	-16.67	

*- 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 7.4.4 Average factor calculation

Transmission pulse		Transmission burst		Transmission train duration, ms	Average factor, dB
Duration, ms	Period, ms	Duration, ms	Period, ms		
5.0	10.0	NA	NA	NA	6

*- Average factor was calculated as follows

for pulse train shorter than 100 ms: $$Average\ factor = 20 \times \log_{10}\left(\frac{Pulse\ duration}{Pulse\ period} \times \frac{Burst\ duration}{Train\ duration} \times Number\ of\ bursts\ within\ pulse\ train\right)$$

for pulse train longer than 100 ms: $$Average\ factor = 20 \times \log_{10}\left(\frac{Pulse\ duration}{Pulse\ period} \times \frac{Burst\ duration}{100\,ms} \times Number\ of\ bursts\ within\ 100\,ms\right)$$

Test specification:	**Section 15.247(c), Radiated spurious emissions**		
Test procedure:	FR Vol. 62, page 26243, Section 15.247(c) / ANSI C63.4, Section 13.1.4		
Test mode:	Compliance	**Verdict:**	PASS
Date & Time:	2/7/2005 6:29:54 PM		
Temperature: 21 ºC	**Air Pressure:** 1015 hPa	**Relative Humidity:** 38 %	**Power Supply:** 4.8
Remarks: Final layout			

Table 7.4.5 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
TRANSMITTER OUTPUT POWER:	2.3 dBm at carrier frequency
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*				
40.27494	31.33	28.72	40.00	-11.28	V	1.0	168	Pass
109.35615	30.78	21.39	43.50	-22.11	V	1.0	194	
129.02627	33.83	30.89	43.50	-12.61	V	1.0	178	
149.34402	35.43	28.26	43.50	-15.24	V	1.0	134	
447.90000	35.53	33.97	46.00	-12.03	H	1.0	87	
497.66125	35.15	28.33	46.00	-17.67	H	1.4	90	
547.43460	34.25	32.34	46.00	-13.66	H	1.2	356	
597.20515	36.16	34.19	46.00	-11.81	V	1.6	10	

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

Table 7.4.6 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

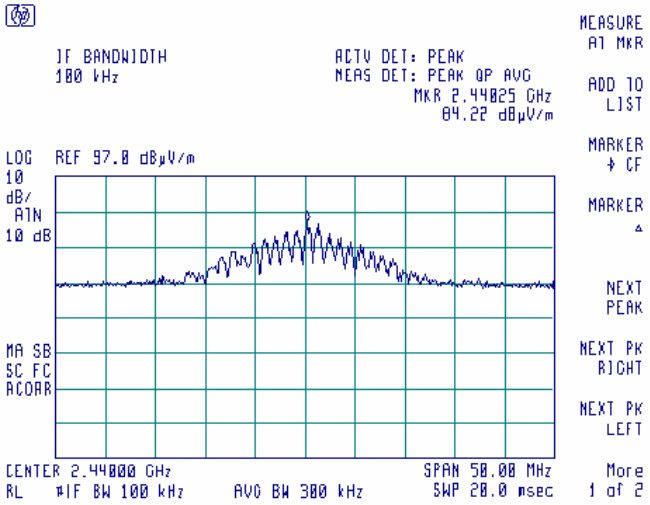
HL 0410	HL 0446	HL 0521	HL 0589	HL 0592	HL 0593	HL 0594	HL 0604
HL 1004	HL 1424	HL 1942	HL 1984	HL 2009	HL 2259		

Full description is given in Appendix A.

Test specification:	Section 15.247(c), Radiated spurious emissions		
Test procedure:	FR Vol. 62, page 26243, Section 15.247(c) / ANSI C63.4, Section 13.1.4		
Test mode:	Compliance	Verdict:	PASS
Date & Time:	2/7/2005 6:29:54 PM		
Temperature: 21 ºC	Air Pressure: 1015 hPa	Relative Humidity: 38 %	Power Supply: 4.8
Remarks: Final layout			

Plot 7.4.1 Radiated emission measurements at the carrier frequency

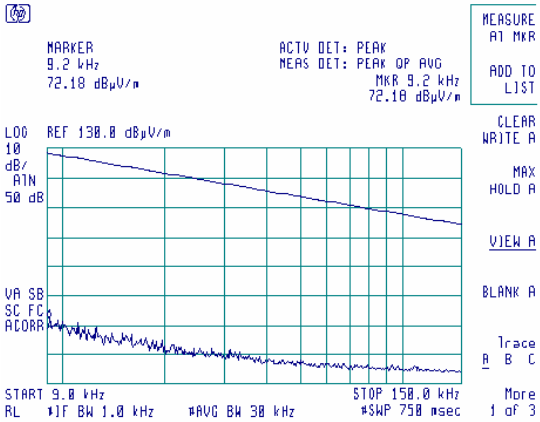
TEST SITE: OATS
TEST DISTANCE: 3 m
ANTENNA POLARIZATION: Vertical and Horizontal



Test specification:	**Section 15.247(c), Radiated spurious emissions**		
Test procedure:	FR Vol. 62, page 26243, Section 15.247(c) / ANSI C63.4, Section 13.1.4		
Test mode:	Compliance	**Verdict:**	PASS
Date & Time:	2/7/2005 6:29:54 PM		
Temperature: 21 ºC	**Air Pressure:** 1015 hPa	**Relative Humidity:** 38 %	**Power Supply:** 4.8
Remarks: Final layout			

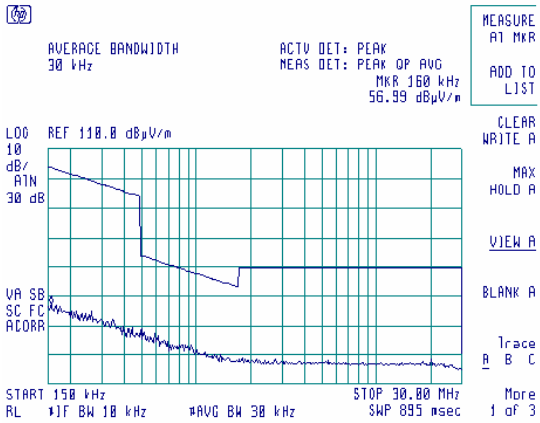
Plot 7.4.2 Radiated emission measurements from 9 to 150 kHz

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



Plot 7.4.3 Radiated emission measurements from 0.15 to 30 MHz

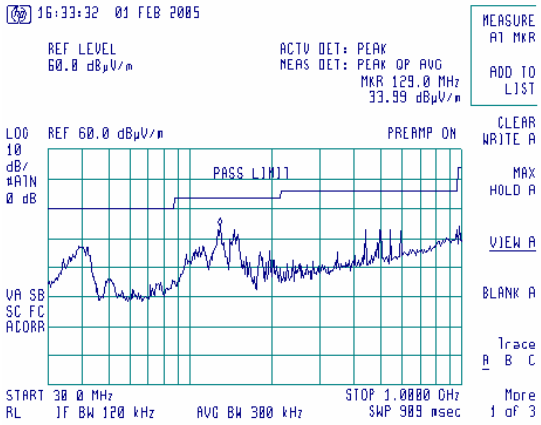
TEST SITE: Semi anechoic chamber
TEST DISTANCE: 3 m
ANTENNA POLARIZATION: Vertical



Test specification:	Section 15.247(c), Radiated spurious emissions		
Test procedure:	FR Vol. 62, page 26243, Section 15.247(c) / ANSI C63.4, Section 13.1.4		
Test mode:	Compliance	Verdict:	PASS
Date & Time:	2/7/2005 6:29:54 PM		
Temperature: 21 ºC	Air Pressure: 1015 hPa	Relative Humidity: 38 %	Power Supply: 4.8
Remarks: Final layout			

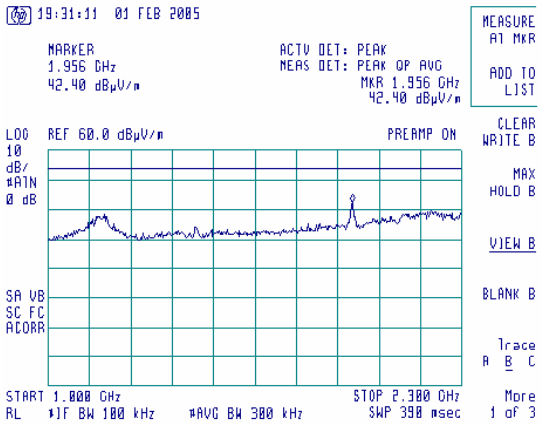
Plot 7.4.4 Radiated emission measurements from 30 to 1000 MHz

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



Plot 7.4.5 Radiated emission measurements from 1000 to 2300 MHz

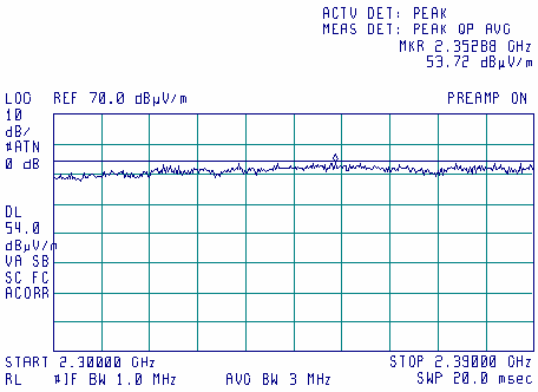
TEST SITE: Semi anechoic chamber
TEST DISTANCE: 3 m
ANTENNA POLARIZATION: Vertical and Horizontal



Test specification:	Section 15.247(c), Radiated spurious emissions		
Test procedure:	FR Vol. 62, page 26243, Section 15.247(c) / ANSI C63.4, Section 13.1.4		
Test mode:	Compliance	Verdict:	PASS
Date & Time:	2/7/2005 6:29:54 PM		
Temperature: 21 ºC	Air Pressure: 1015 hPa	Relative Humidity: 38 %	Power Supply: 4.8
Remarks: Final layout			

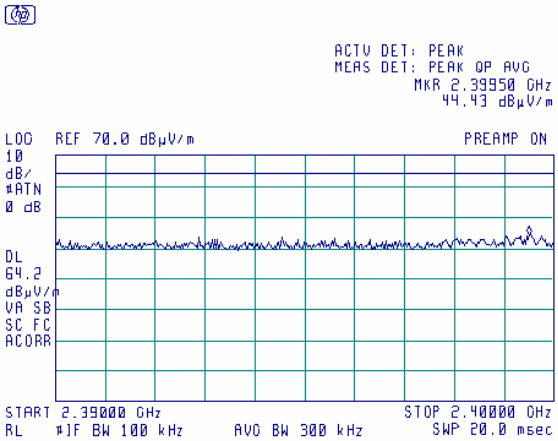
Plot 7.4.6 Radiated emission measurements from 2300 to 2390 MHz at the carrier frequency

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



Plot 7.4.7 Radiated emission measurements from 2390 to 2400 MHz at the carrier frequency

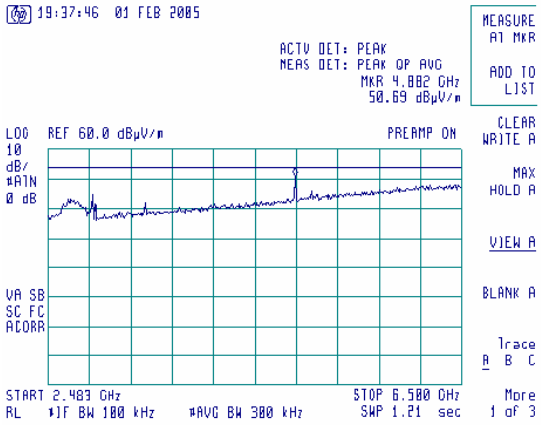
TEST SITE: Semi anechoic chamber
TEST DISTANCE: 3 m
ANTENNA POLARIZATION: Vertical and Horizontal



Test specification:	Section 15.247(c), Radiated spurious emissions		
Test procedure:	FR Vol. 62, page 26243, Section 15.247(c) / ANSI C63.4, Section 13.1.4		
Test mode:	Compliance	Verdict:	PASS
Date & Time:	2/7/2005 6:29:54 PM		
Temperature: 21 ºC	Air Pressure: 1015 hPa	Relative Humidity: 38 %	Power Supply: 4.8
Remarks: Final layout			

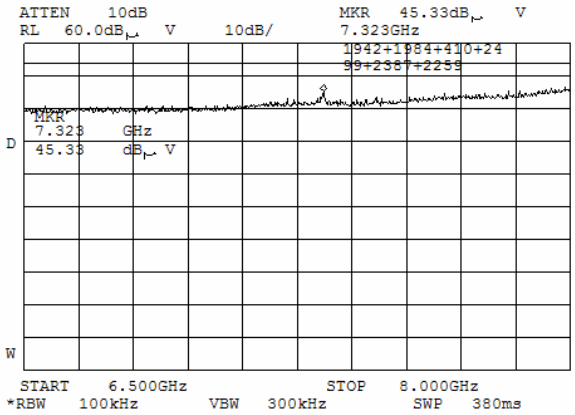
Plot 7.4.8 Radiated emission measurements from 2483 to 6500 MHz at the carrier frequency

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



Plot 7.4.9 Radiated emission measurements from 6500 to 8000 MHz at the carrier frequency

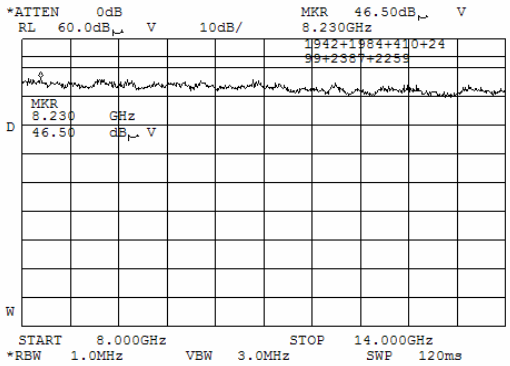
TEST SITE: OATS
TEST DISTANCE: 3 m
ANTENNA POLARIZATION: Vertical and Horizontal



Test specification:	**Section 15.247(c), Radiated spurious emissions**		
Test procedure:	FR Vol. 62, page 26243, Section 15.247(c) / ANSI C63.4, Section 13.1.4		
Test mode:	Compliance	**Verdict:**	PASS
Date & Time:	2/7/2005 6:29:54 PM		
Temperature: 21 ºC	**Air Pressure:** 1015 hPa	**Relative Humidity:** 38 %	**Power Supply:** 4.8
Remarks: Final layout			

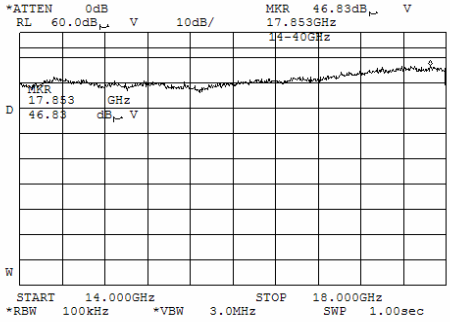
Plot 7.4.10 Radiated emission measurements from 8000 to 14000 MHz at the carrier frequency

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



Plot 7.4.11 Radiated emission measurements from 14000 to 18000 MHz at the carrier frequency

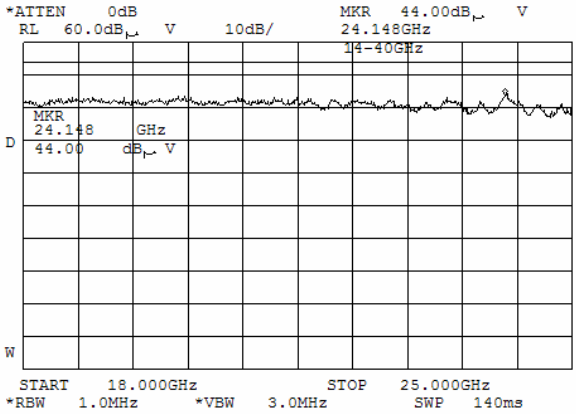
TEST SITE: OATS
TEST DISTANCE: 3 m
ANTENNA POLARIZATION: Vertical and Horizontal



Test specification:	**Section 15.247(c), Radiated spurious emissions**		
Test procedure:	FR Vol. 62, page 26243, Section 15.247(c) / ANSI C63.4, Section 13.1.4		
Test mode:	Compliance	**Verdict:**	PASS
Date & Time:	2/7/2005 6:29:54 PM		
Temperature: 21 ºC	**Air Pressure:** 1015 hPa	**Relative Humidity:** 38 %	**Power Supply:** 4.8
Remarks: Final layout			

Plot 7.4.12 Radiated emission measurements from 18000 to 25000 MHz at the carrier frequency

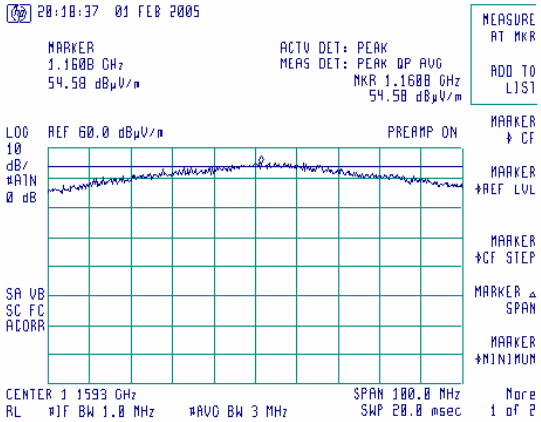
TEST SITE: OATS
TEST DISTANCE: 3 m
ANTENNA POLARIZATION: Vertical and Horizontal



Test specification:	Section 15.247(c), Radiated spurious emissions		
Test procedure:	FR Vol. 62, page 26243, Section 15.247(c) / ANSI C63.4, Section 13.1.4		
Test mode:	Compliance	Verdict:	PASS
Date & Time:	2/7/2005 6:29:54 PM		
Temperature: 21 ºC	Air Pressure: 1015 hPa	Relative Humidity: 38 %	Power Supply: 4.8
Remarks: Final layout			

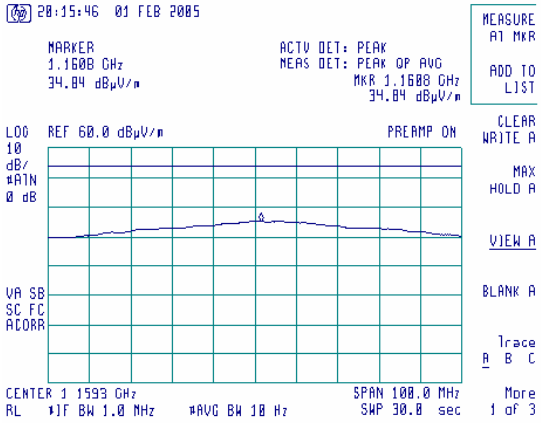
Plot 7.4.13 Radiated emission measurements in 1153.9 MHz frequency

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



Plot 7.4.14 Radiated emission measurements in 1153.9 MHz frequency

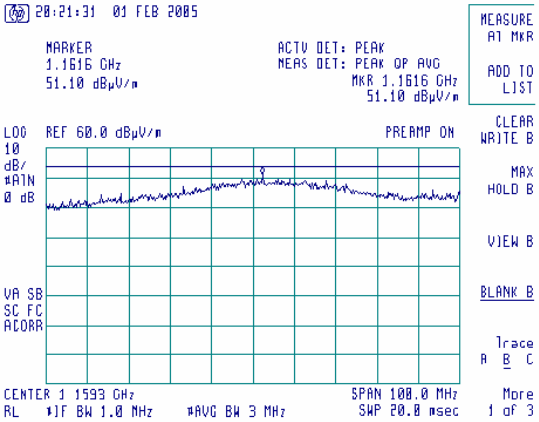
TEST SITE: Semi anechoic chamber
TEST DISTANCE: 3 m
ANTENNA POLARIZATION: Vertical



Test specification:	Section 15.247(c), Radiated spurious emissions		
Test procedure:	FR Vol. 62, page 26243, Section 15.247(c) / ANSI C63.4, Section 13.1.4		
Test mode:	Compliance	Verdict:	PASS
Date & Time:	2/7/2005 6:29:54 PM		
Temperature: 21 ºC	Air Pressure: 1015 hPa	Relative Humidity: 38 %	Power Supply: 4.8
Remarks: Final layout			

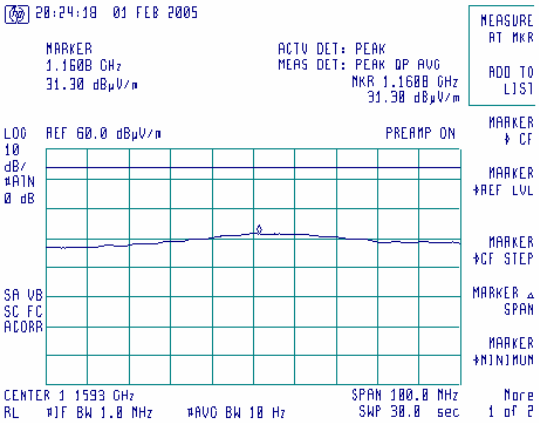
Plot 7.4.15 Radiated emission measurements in 1153.9 MHz frequency

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



Plot 7.4.16 Radiated emission measurements in 1153.9 MHz frequency

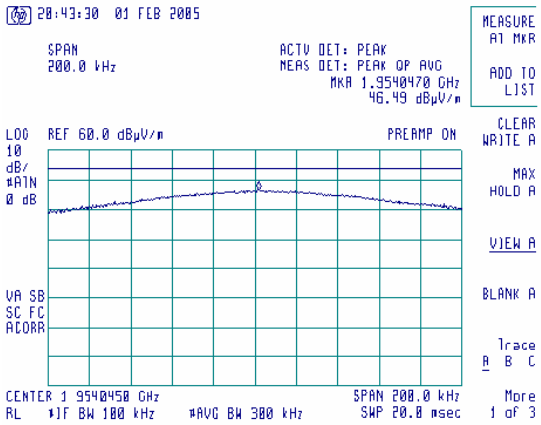
TEST SITE: Semi anechoic chamber
TEST DISTANCE: 3 m
ANTENNA POLARIZATION: Horizontal



Test specification:	Section 15.247(c), Radiated spurious emissions		
Test procedure:	FR Vol. 62, page 26243, Section 15.247(c) / ANSI C63.4, Section 13.1.4		
Test mode:	Compliance	Verdict:	PASS
Date & Time:	2/7/2005 6:29:54 PM		
Temperature: 21 ºC	Air Pressure: 1015 hPa	Relative Humidity: 38 %	Power Supply: 4.8
Remarks: Final layout			

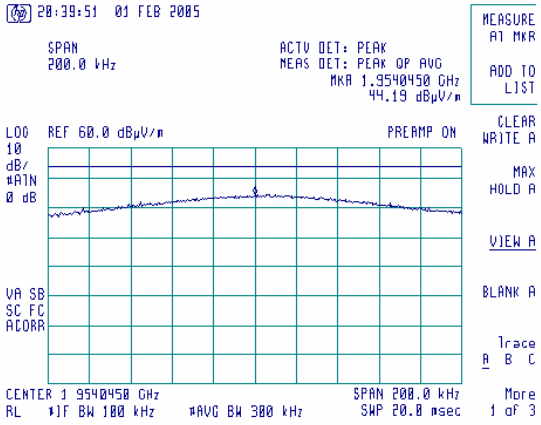
Plot 7.4.17 Radiated emission measurements in 1954.0 MHz frequency

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



Plot 7.4.18 Radiated emission measurements in 1954.0 MHz frequency

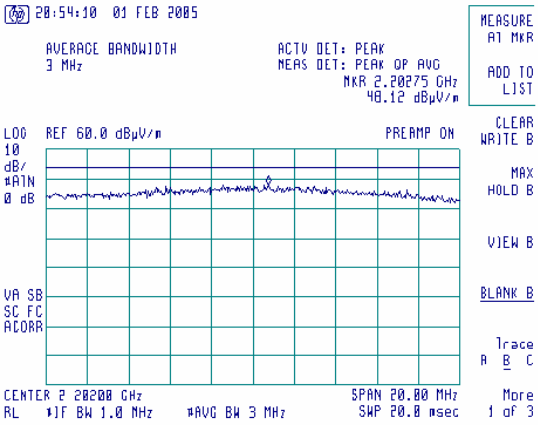
TEST SITE: Semi anechoic chamber
TEST DISTANCE: 3 m
ANTENNA POLARIZATION: Horizontal



Test specification:	Section 15.247(c), Radiated spurious emissions		
Test procedure:	FR Vol. 62, page 26243, Section 15.247(c) / ANSI C63.4, Section 13.1.4		
Test mode:	Compliance	Verdict:	PASS
Date & Time:	2/7/2005 6:29:54 PM		
Temperature: 21 ºC	Air Pressure: 1015 hPa	Relative Humidity: 38 %	Power Supply: 4.8
Remarks: Final layout			

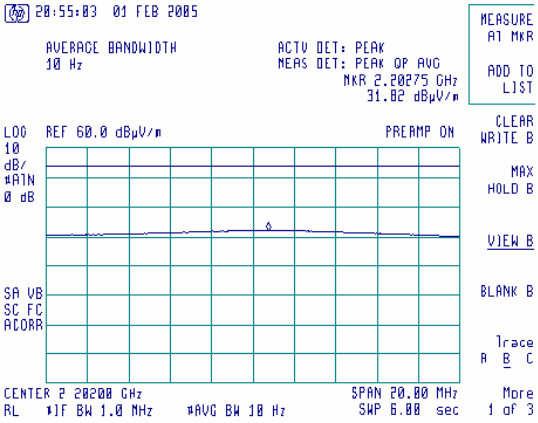
Plot 7.4.19 Radiated emission measurements in 2202.75 MHz frequency

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



Plot 7.4.20 Radiated emission measurements in 2202.75 MHz frequency

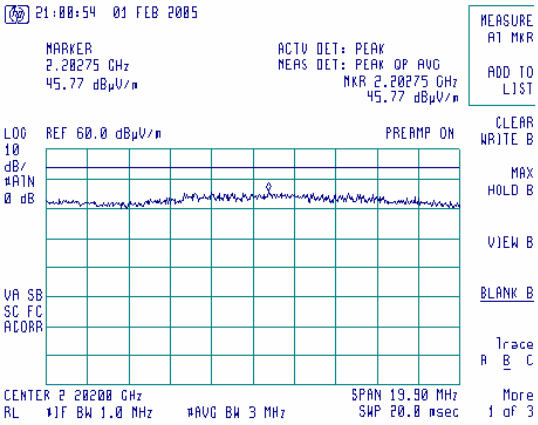
TEST SITE: Semi anechoic chamber
TEST DISTANCE: 3 m
ANTENNA POLARIZATION: Vertical



Test specification:	Section 15.247(c), Radiated spurious emissions		
Test procedure:	FR Vol. 62, page 26243, Section 15.247(c) / ANSI C63.4, Section 13.1.4		
Test mode:	Compliance	Verdict:	PASS
Date & Time:	2/7/2005 6:29:54 PM		
Temperature: 21 ºC	Air Pressure: 1015 hPa	Relative Humidity: 38 %	Power Supply: 4.8
Remarks: Final layout			

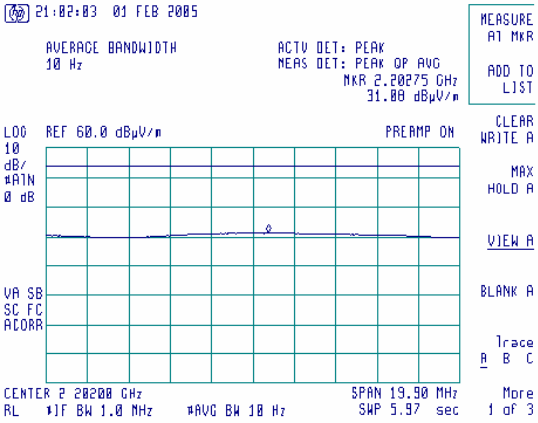
Plot 7.4.21 Radiated emission measurements in 2202.75 MHz frequency

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



Plot 7.4.22 Radiated emission measurements in 2202.75 MHz frequency

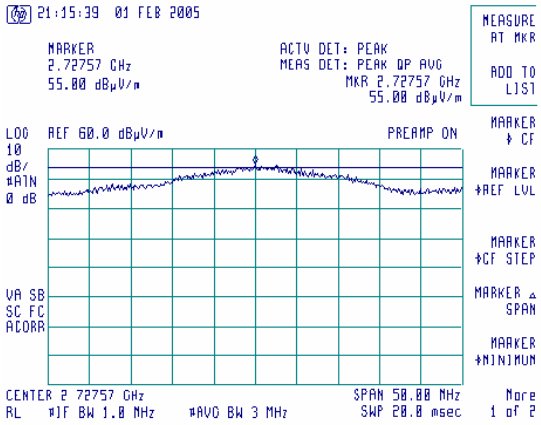
TEST SITE: Semi anechoic chamber
TEST DISTANCE: 3 m
ANTENNA POLARIZATION: Horizontal



Test specification:	Section 15.247(c), Radiated spurious emissions		
Test procedure:	FR Vol. 62, page 26243, Section 15.247(c) / ANSI C63.4, Section 13.1.4		
Test mode:	Compliance	Verdict:	PASS
Date & Time:	2/7/2005 6:29:54 PM		
Temperature: 21 ºC	Air Pressure: 1015 hPa	Relative Humidity: 38 %	Power Supply: 4.8
Remarks: Final layout			

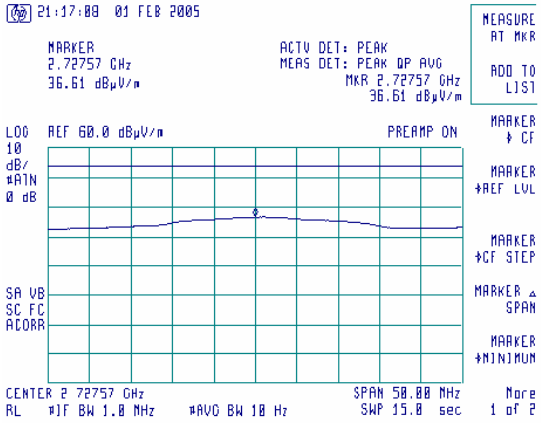
Plot 7.4.23 Radiated emission measurements in 2727.6 MHz frequency

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



Plot 7.4.24 Radiated emission measurements in 2727.6 MHz frequency

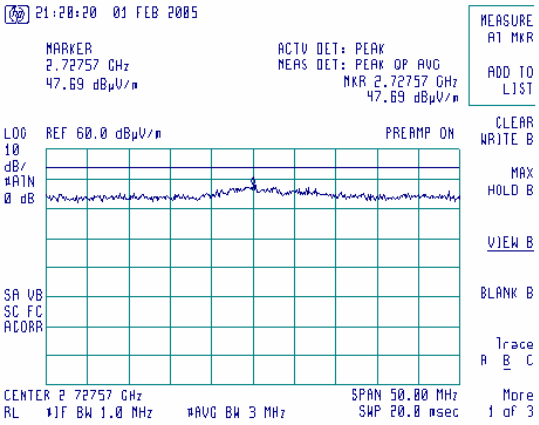
TEST SITE: Semi anechoic chamber
TEST DISTANCE: 3 m
ANTENNA POLARIZATION: Vertical



Test specification:	**Section 15.247(c), Radiated spurious emissions**		
Test procedure:	FR Vol. 62, page 26243, Section 15.247(c) / ANSI C63.4, Section 13.1.4		
Test mode:	Compliance	**Verdict:**	PASS
Date & Time:	2/7/2005 6:29:54 PM		
Temperature: 21 ºC	**Air Pressure:** 1015 hPa	**Relative Humidity:** 38 %	**Power Supply:** 4.8
Remarks: Final layout			

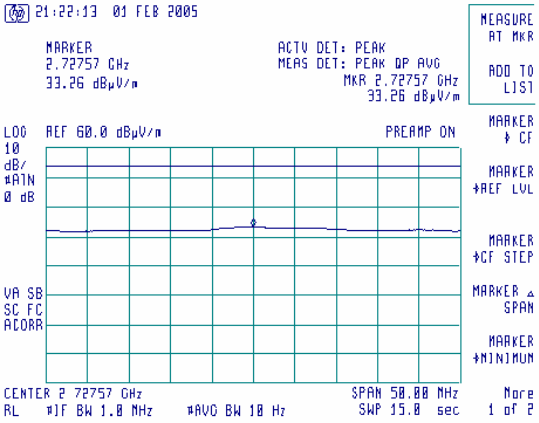
Plot 7.4.25 Radiated emission measurements in 2727.6 MHz frequency

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



Plot 7.4.26 Radiated emission measurements in 2727.6 MHz frequency

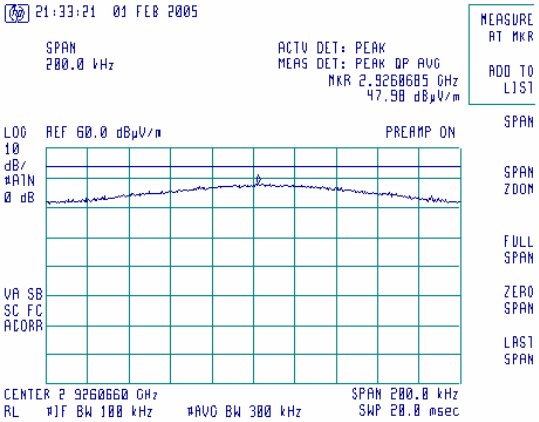
TEST SITE: Semi anechoic chamber
TEST DISTANCE: 3 m
ANTENNA POLARIZATION: Horizontal



Test specification:	Section 15.247(c), Radiated spurious emissions		
Test procedure:	FR Vol. 62, page 26243, Section 15.247(c) / ANSI C63.4, Section 13.1.4		
Test mode:	Compliance	Verdict:	PASS
Date & Time:	2/7/2005 6:29:54 PM		
Temperature: 21 ºC	Air Pressure: 1015 hPa	Relative Humidity: 38 %	Power Supply: 4.8
Remarks: Final layout			

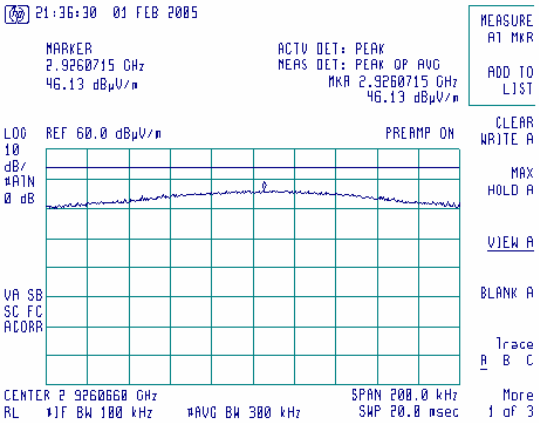
Plot 7.4.27 Radiated emission measurements in 2926.1 MHz frequency

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



Plot 7.4.28 Radiated emission measurements in 2926.1 MHz frequency

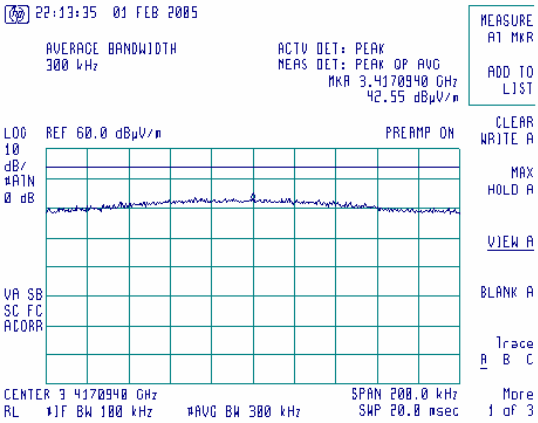
TEST SITE: OATS
TEST DISTANCE: 3 m
ANTENNA POLARIZATION: Horizontal



Test specification:	Section 15.247(c), Radiated spurious emissions		
Test procedure:	FR Vol. 62, page 26243, Section 15.247(c) / ANSI C63.4, Section 13.1.4		
Test mode:	Compliance	Verdict:	PASS
Date & Time:	2/7/2005 6:29:54 PM		
Temperature: 21 ºC	Air Pressure: 1015 hPa	Relative Humidity: 38 %	Power Supply: 4.8
Remarks: Final layout			

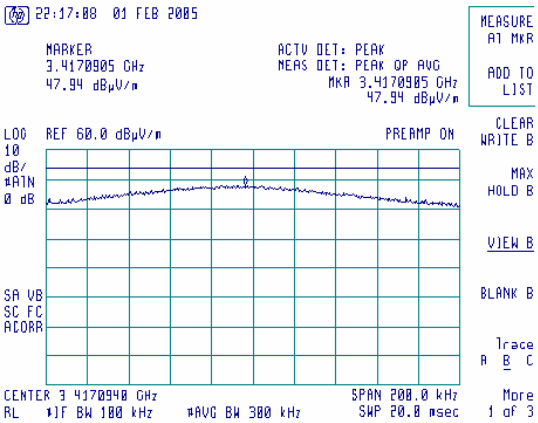
Plot 7.4.29 Radiated emission measurements in 3417.1 MHz frequency

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



Plot 7.4.30 Radiated emission measurements in 3417.1 MHz frequency

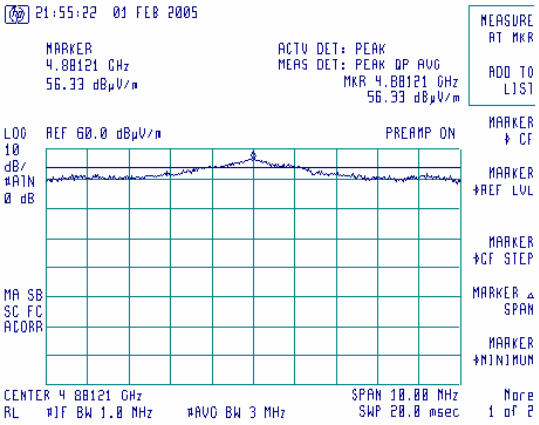
TEST SITE: OATS
TEST DISTANCE: 3 m
ANTENNA POLARIZATION: Horizontal



Test specification:	Section 15.247(c), Radiated spurious emissions		
Test procedure:	FR Vol. 62, page 26243, Section 15.247(c) / ANSI C63.4, Section 13.1.4		
Test mode:	Compliance	Verdict:	PASS
Date & Time:	2/7/2005 6:29:54 PM		
Temperature: 21 ºC	Air Pressure: 1015 hPa	Relative Humidity: 38 %	Power Supply: 4.8
Remarks: Final layout			

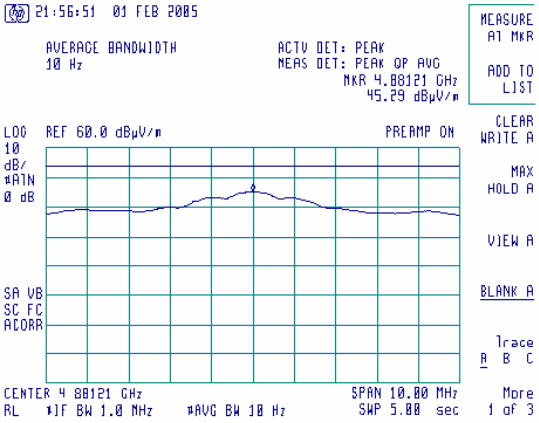
Plot 7.4.31 Radiated emission measurements at the second harmonic of carrier frequency

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



Plot 7.4.32 Radiated emission measurements at the second harmonic of carrier frequency

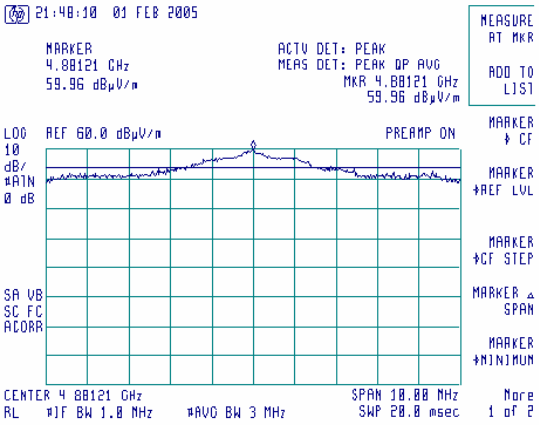
TEST SITE: OATS
TEST DISTANCE: 3 m
ANTENNA POLARIZATION: Vertical



Test specification:	Section 15.247(c), Radiated spurious emissions		
Test procedure:	FR Vol. 62, page 26243, Section 15.247(c) / ANSI C63.4, Section 13.1.4		
Test mode:	Compliance	Verdict:	PASS
Date & Time:	2/7/2005 6:29:54 PM		
Temperature: 21 ºC	Air Pressure: 1015 hPa	Relative Humidity: 38 %	Power Supply: 4.8
Remarks: Final layout			

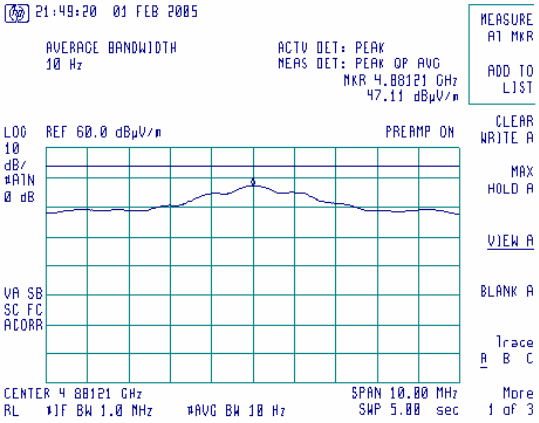
Plot 7.4.33 Radiated emission measurements at the second harmonic of carrier frequency

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



Plot 7.4.34 Radiated emission measurements at the second harmonic of carrier frequency

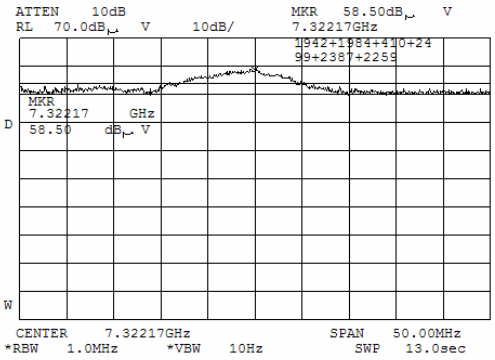
TEST SITE: OATS
TEST DISTANCE: 3 m
ANTENNA POLARIZATION: Horizontal



Test specification:	Section 15.247(c), Radiated spurious emissions		
Test procedure:	FR Vol. 62, page 26243, Section 15.247(c) / ANSI C63.4, Section 13.1.4		
Test mode:	Compliance	Verdict:	PASS
Date & Time:	2/7/2005 6:29:54 PM		
Temperature: 21 ºC	Air Pressure: 1015 hPa	Relative Humidity: 38 %	Power Supply: 4.8
Remarks: Final layout			

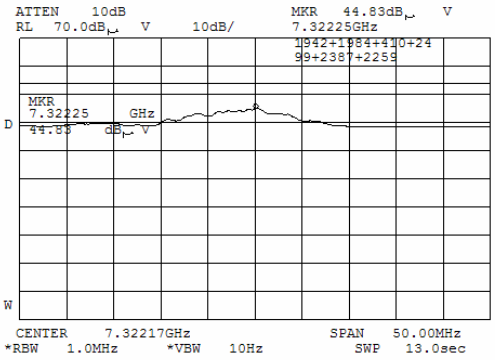
Plot 7.4.35 Radiated emission measurements at the third harmonic of carrier frequency

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



Plot 7.4.36 Radiated emission measurements at the third harmonic of carrier frequency

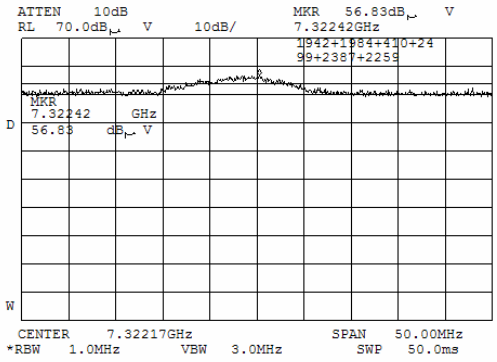
TEST SITE: OATS
TEST DISTANCE: 3 m
ANTENNA POLARIZATION: Horizontal



Test specification:	Section 15.247(c), Radiated spurious emissions		
Test procedure:	FR Vol. 62, page 26243, Section 15.247(c) / ANSI C63.4, Section 13.1.4		
Test mode:	Compliance	Verdict:	PASS
Date & Time:	2/7/2005 6:29:54 PM		
Temperature: 21 ºC	Air Pressure: 1015 hPa	Relative Humidity: 38 %	Power Supply: 4.8
Remarks: Final layout			

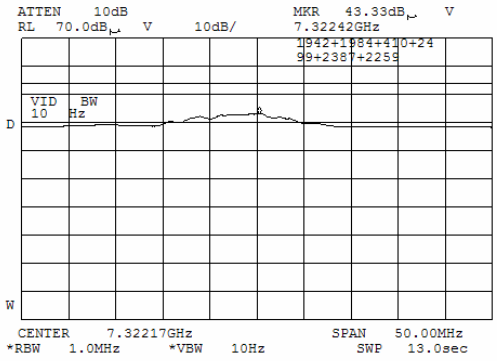
Plot 7.4.37 Radiated emission measurements at the third harmonic of carrier frequency

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



Plot 7.4.38 Radiated emission measurements at the third harmonic of carrier frequency

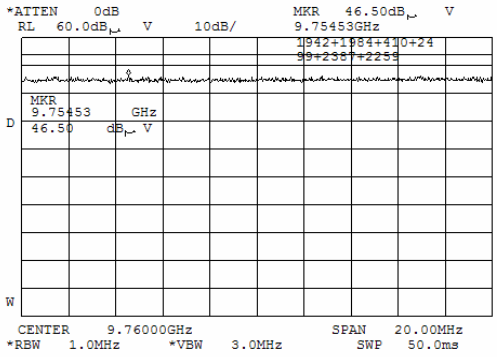
TEST SITE: OATS
TEST DISTANCE: 3 m
ANTENNA POLARIZATION: Vertical



Test specification:	Section 15.247(c), Radiated spurious emissions		
Test procedure:	FR Vol. 62, page 26243, Section 15.247(c) / ANSI C63.4, Section 13.1.4		
Test mode:	Compliance	Verdict:	PASS
Date & Time:	2/7/2005 6:29:54 PM		
Temperature: 21 ºC	Air Pressure: 1015 hPa	Relative Humidity: 38 %	Power Supply: 4.8
Remarks: Final layout			

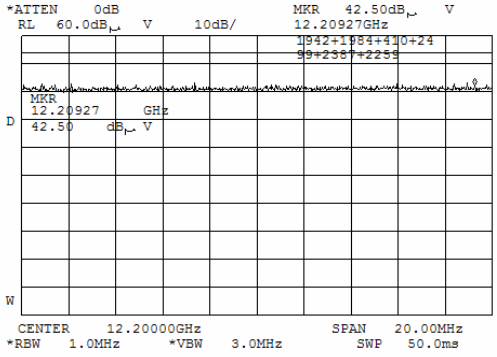
Plot 7.4.39 Radiated emission measurements at the forth harmonic of carrier frequency

TEST SITE: OATS
TEST DISTANCE: 3 m



Plot 7.4.40 Radiated emission measurements at the fifth harmonic of carrier frequency

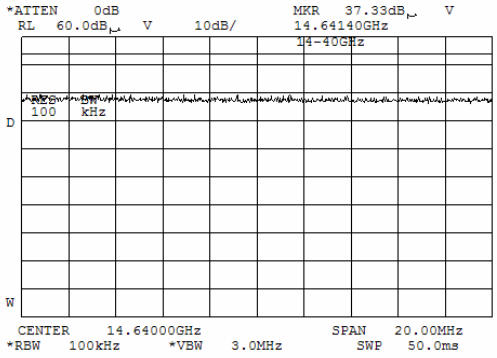
TEST SITE: OATS
TEST DISTANCE: 3 m



Test specification:	Section 15.247(c), Radiated spurious emissions		
Test procedure:	FR Vol. 62, page 26243, Section 15.247(c) / ANSI C63.4, Section 13.1.4		
Test mode:	Compliance	Verdict:	PASS
Date & Time:	2/7/2005 6:29:54 PM		
Temperature: 21 ºC	Air Pressure: 1015 hPa	Relative Humidity: 38 %	Power Supply: 4.8
Remarks: Final layout			

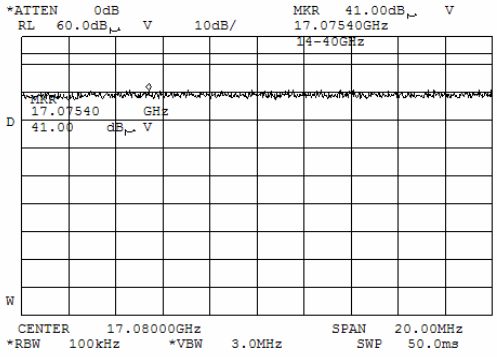
Plot 7.4.41 Radiated emission measurements at the sixth harmonic of carrier frequency

TEST SITE: OATS
TEST DISTANCE: 3 m



Plot 7.4.42 Radiated emission measurements at the seventh harmonic of carrier frequency

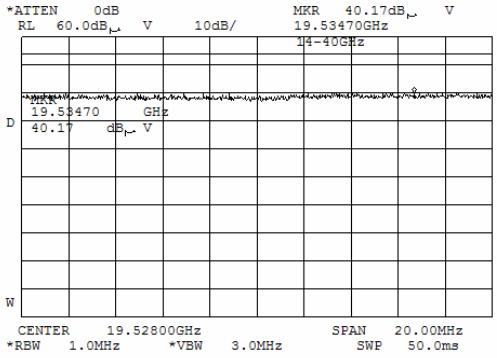
TEST SITE: OATS
TEST DISTANCE: 3 m



Test specification:	Section 15.247(c), Radiated spurious emissions		
Test procedure:	FR Vol. 62, page 26243, Section 15.247(c) / ANSI C63.4, Section 13.1.4		
Test mode:	Compliance	Verdict:	PASS
Date & Time:	2/7/2005 6:29:54 PM		
Temperature: 21 ºC	Air Pressure: 1015 hPa	Relative Humidity: 38 %	Power Supply: 4.8
Remarks: Final layout			

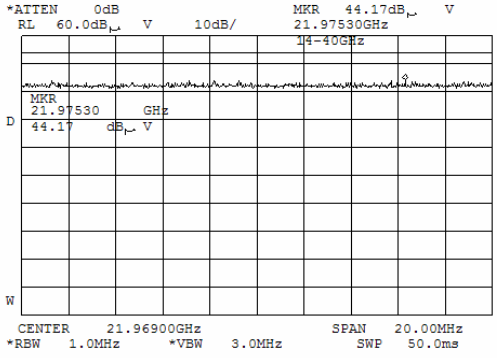
Plot 7.4.43 Radiated emission measurements at the eighth harmonic of carrier frequency

TEST SITE: OATS
TEST DISTANCE: 3 m



Plot 7.4.44 Radiated emission measurements at the ninth harmonic of carrier frequency

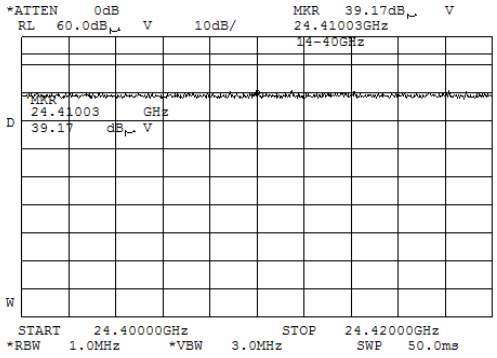
TEST SITE: OATS
TEST DISTANCE: 3 m



Test specification:	Section 15.247(c), Radiated spurious emissions		
Test procedure:	FR Vol. 62, page 26243, Section 15.247(c) / ANSI C63.4, Section 13.1.4		
Test mode:	Compliance	Verdict:	PASS
Date & Time:	2/7/2005 6:29:54 PM		
Temperature: 21 ºC	Air Pressure: 1015 hPa	Relative Humidity: 38 %	Power Supply: 4.8
Remarks: Final layout			

Plot 7.4.45 Radiated emission measurements at the tenth harmonic of carrier frequency

TEST SITE: OATS
TEST DISTANCE: 3 m



Test specification:	Section 15.247(d), Peak power density		
Test procedure:	FR Vol. 62, page 26243, Section 15.247(d)		
Test mode:	Compliance	Verdict:	PASS
Date & Time:	12/23/2004 1:27:32 PM		
Temperature: 22 ºC	Air Pressure: 1010 hPa	Relative Humidity: 31 %	Power Supply: 4.8
Remarks:			

7.5 Peak spectral power density

7.5.1 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 7.5.1.

Table 7.5.1 Peak spectral power density limits

Assigned frequency range, MHz	Measurement bandwidth, kHz	Peak spectral power density, dBm	Equivalent field strength limit @ 3m, dB(µV/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×P)/r, where P is peak spectral power density and r is antenna to EUT distance in meters.

7.5.2 Test procedure for field strength measurements

7.5.2.1 The EUT was set up as shown in Figure 7.5.1, energized and its proper operation was checked.

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

7.5.2.3 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 360^0 and the measuring antenna height was swept in both vertical and horizontal polarizations.

7.5.2.4 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.

7.5.2.5 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 7.5.2 and associated plots.

7.5.3 Test procedure for substitution power density measurements

7.5.3.1 The test equipment was set up as shown in Figure 7.5.2 and energized.

7.5.3.2 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.

7.5.3.3 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.

7.5.3.4 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.

7.5.3.5 The above procedure was performed in both horizontal and vertical polarizations of the substitution antenna.

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

Test specification:	Section 15.247(d), Peak power density		
Test procedure:	FR Vol. 62, page 26243, Section 15.247(d)		
Test mode:	Compliance	Verdict:	PASS
Date & Time:	12/23/2004 1:27:32 PM		
Temperature: 22 ºC	Air Pressure: 1010 hPa	Relative Humidity: 31 %	Power Supply: 4.8
Remarks:			

Figure 7.5.1 Setup for carrier field strength measurements

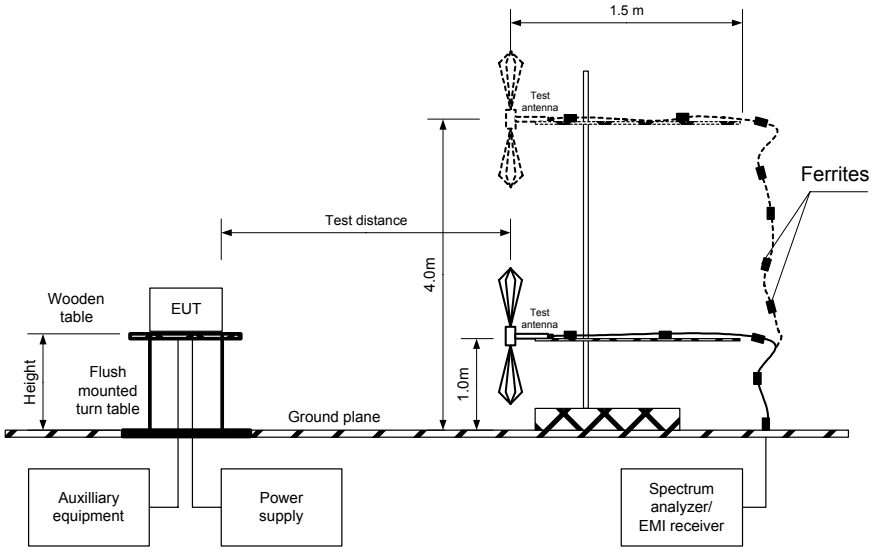
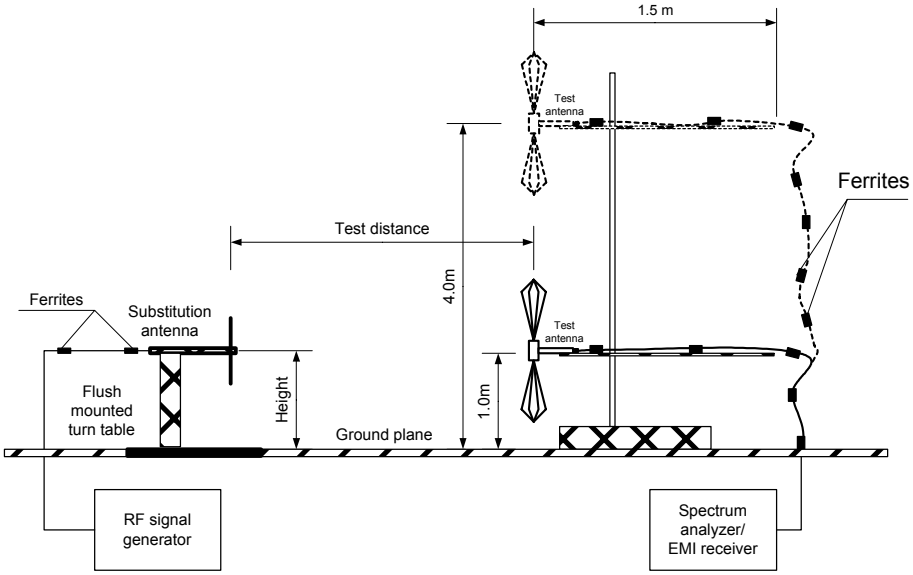


Figure 7.5.2 Setup for substitution power density measurements



Test specification:	**Section 15.247(d), Peak power density**		
Test procedure:	FR Vol. 62, page 26243, Section 15.247(d)		
Test mode:	Compliance	**Verdict:**	PASS
Date & Time:	12/23/2004 1:27:32 PM		
Temperature: 22 ºC	**Air Pressure:** 1010 hPa	**Relative Humidity:** 31 %	**Power Supply:** 4.8
Remarks:			

Table 7.5.2 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 (above 1000 MHz)
MODULATION:	ASK
MODULATING SIGNAL:	PRBS
BIT RATE:	0.5 Mbps
TRANSMITTER OUTPUT POWER SETTINGS:	Maximum
TRANSMITTER OUTPUT POWER:	2.3 dBm at high 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
2440.00	81.7	2.0	103.2	-21.5	H	1.5	167

*- Margin = Field strength - EUT antenna gain - calculated field strength limit.
**- EUT front panel refer to 0 degrees position of turntable.

Table 7.5.3 Substitution measurement of peak spectral power density

ASSIGNED FREQUENCY:	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 (above 1000 MHz)

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
2440.00	81.7	H	-22.3	9.4	4.5	2.0	-19.4	8.0	-27.4	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.

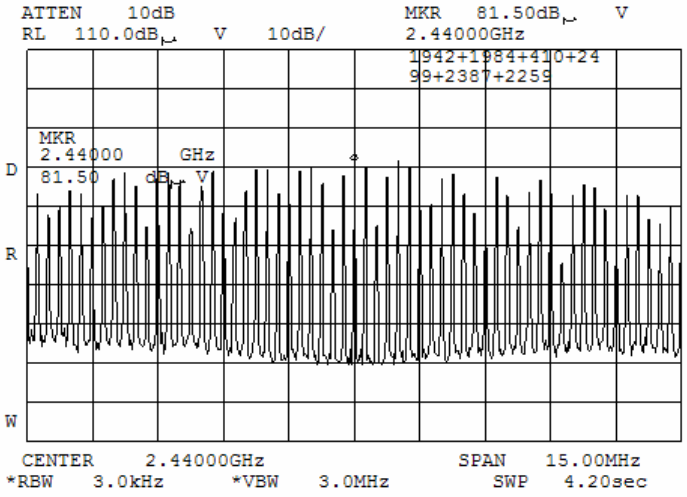
Reference numbers of test equipment used

HL 0410	HL 0661	HL 1424	HL 1941	HL 1942	HL 1984	HL 2259	

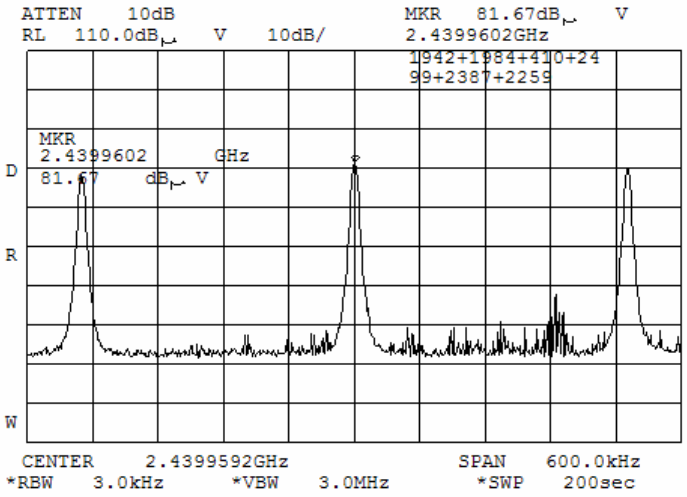
Full description is given in Appendix A.

Test specification:	Section 15.247(d), Peak power density		
Test procedure:	FR Vol. 62, page 26243, Section 15.247(d)		
Test mode:	Compliance	Verdict:	PASS
Date & Time:	12/23/2004 1:27:32 PM		
Temperature: 22 ºC	Air Pressure: 1010 hPa	Relative Humidity: 31 %	Power Supply: 4.8
Remarks:			

Plot 7.5.1 Peak spectral power density at low frequency within 6 dB band



Plot 7.5.2 Peak spectral power density at low frequency zoomed at the peak



Test specification:	**Section 15.207(a), Conducted emission**		
Test procedure:	ANSI C63.4, Section 13.1.3		
Test mode:	Compliance	**Verdict:**	PASS
Date & Time:	2/3/2005 5:57:44 PM		
Temperature: 22 ºC	**Air Pressure:** 1017 hPa	**Relative Humidity:** 36 %	**Power Supply:** 120 VAC
Remarks: after changes no photo			

7.6 Conducted emissions

7.6.1 General

This test was performed to measure common mode conducted emissions at the power port. Specification test limits are given in Table 7.6.1. The worst test results (the lowest margins) were recorded in Table 7.6.2 and shown in the associated plots.

Table 7.6.1 Limits for conducted emissions

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

* The limit decreases linearly with the logarithm of frequency.

7.6.2 Test procedure

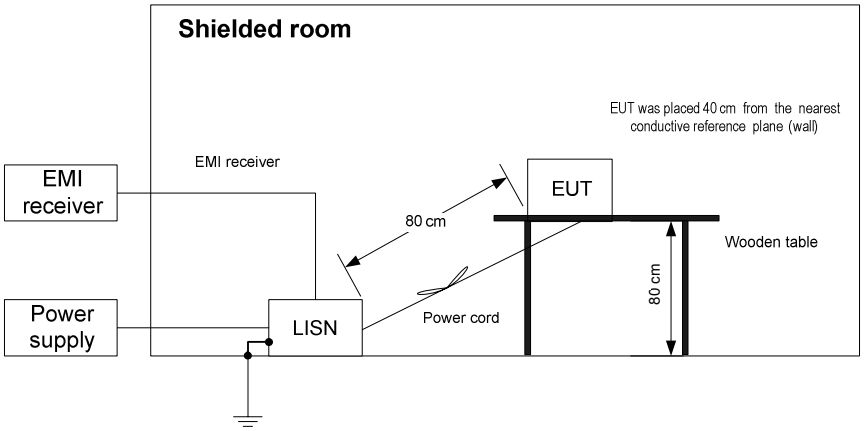
7.6.2.1 The EUT was set up as shown in Figure 7.6.1 and associated photographs, energized and the performance check was conducted.

7.6.2.2 The measurements were performed at power terminals with the LISN, connected to a spectrum analyzer in the frequency range referred to in Table 7.6.2. Unused coaxial connector of the LISN was terminated with 50 Ohm. Quasi-peak and average detectors were used throughout the testing.

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

Test specification:	**Section 15.207(a), Conducted emission**		
Test procedure:	ANSI C63.4, Section 13.1.3		
Test mode:	Compliance	**Verdict:**	PASS
Date & Time:	2/3/2005 5:57:44 PM		
Temperature: 22 ºC	**Air Pressure:** 1017 hPa	**Relative Humidity:** 36 %	**Power Supply:** 120 VAC
Remarks: after changes no photo			

Figure 7.6.1 Setup for conducted emission measurements, table-top equipment



Test specification:	**Section 15.207(a), Conducted emission**		
Test procedure:	ANSI C63.4, Section 13.1.3		
Test mode:	Compliance	**Verdict:**	PASS
Date & Time:	2/3/2005 5:57:44 PM		
Temperature: 22 ºC	**Air Pressure:** 1017 hPa	**Relative Humidity:** 36 %	**Power Supply:** 120 VAC
Remarks: after changes no photo			

Table 7.6.2 Conducted emission test results

LINE:	AC mains
EUT OPERATING MODE:	Transmit
EUT SET UP:	TABLE-TOP
TEST SITE:	SHIELDED ROOM
DETECTORS USED:	PEAK / QUASI-PEAK / AVERAGE
FREQUENCY RANGE:	150 kHz - 30 MHz
RESOLUTION BANDWIDTH:	9 kHz

Frequency, MHz	Peak emission, dB(µV)	Quasi-peak			Average			Line ID	Verdict
		Measured emission, dB(µV)	Limit, dB(µV)	Margin, dB*	Measured emission, dB(µV)	Limit, dB(µV)	Margin, dB*		
0.246527	44.22	43.08	61.89	-18.81	38.39	51.89	-13.50	L1	Pass
0.616700	42.54	41.59	56.00	-14.41	33.40	46.00	-12.60		
0.743213	41.80	40.54	56.00	-15.46	31.68	46.00	-14.32		
1.107333	41.98	41.35	56.00	-14.65	29.72	46.00	-16.28		
1.234138	41.71	40.76	56.00	-15.24	27.14	46.00	-18.86		
1.602406	39.74	38.48	56.00	-17.52	23.92	46.00	-22.08		
0.156251	46.74	38.42	65.70	-27.28	8.92	55.70	-46.78	L2	Pass
0.242500	45.49	42.65	62.02	-19.37	33.83	52.02	-18.19		
0.600501	40.31	39.19	56.00	-16.81	28.72	46.00	-17.28		
0.950065	38.59	35.91	56.00	-20.09	22.85	46.00	-23.15		
1.073347	40.50	39.17	56.00	-16.83	24.67	46.00	-21.33		
1.561194	37.89	36.01	56.00	-19.99	20.66	46.00	-25.34		

*- Margin = Measured emission - specification limit.

Reference numbers of test equipment used

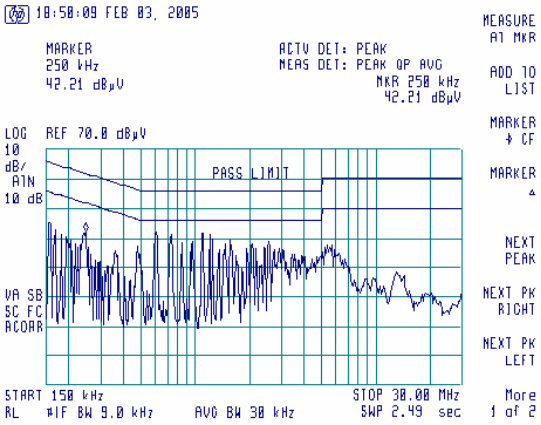
HL 0163	HL 0787	HL 1425	HL 1512				

Full description is given in Appendix A.

Test specification:	Section 15.207(a), Conducted emission		
Test procedure:	ANSI C63.4, Section 13.1.3		
Test mode:	Compliance	Verdict:	PASS
Date & Time:	2/3/2005 5:57:44 PM		
Temperature: 22 ºC	Air Pressure: 1017 hPa	Relative Humidity: 36 %	Power Supply: 120 VAC
Remarks: after changes no photo			

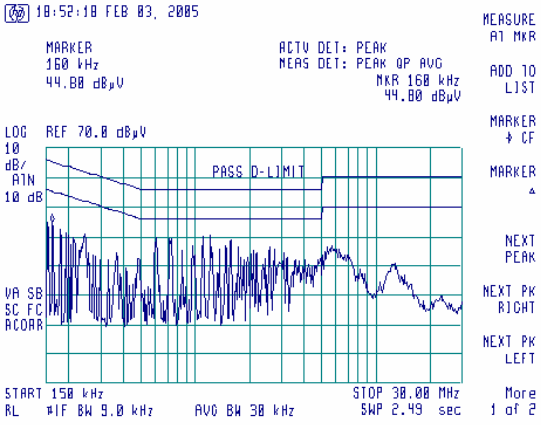
Plot 7.6.1 Conducted emission measurements

LINE: L1
EUT OPERATING MODE: Transmit
LIMIT: QUASI-PEAK, AVERAGE
DETECTOR: PEAK



Plot 7.6.2 Conducted emission measurements

LINE: L2
EUT OPERATING MODE: Transmit
LIMIT: QUASI-PEAK, AVERAGE
DETECTOR: PEAK



Test specification:	Section 90.205, Maximum output power		
Test procedure:	47 CFR, Section 2.1046; TIA/EIA-603-A, Section 2.2.1		
Test mode:	Compliance	Verdict:	PASS
Date & Time:	11/29/2004 6:47:28 PM		
Temperature: 23 ºC	Air Pressure: 1012 hPa	Relative Humidity: 40 %	Power Supply: 4.8 VDC
Remarks:			

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(µV/m)*
	W	dBm	
902-928	30	44.7	142

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

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 360^0, 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.

Test specification:	Section 90.205, Maximum output power		
Test procedure:	47 CFR, Section 2.1046; TIA/EIA-603-A, Section 2.2.1		
Test mode:	Compliance	Verdict:	PASS
Date & Time:	11/29/2004 6:47:28 PM		
Temperature: 23 ºC	Air Pressure: 1012 hPa	Relative Humidity: 40 %	Power Supply: 4.8 VDC
Remarks:			

Figure 8.1.1 Setup for carrier field strength measurements

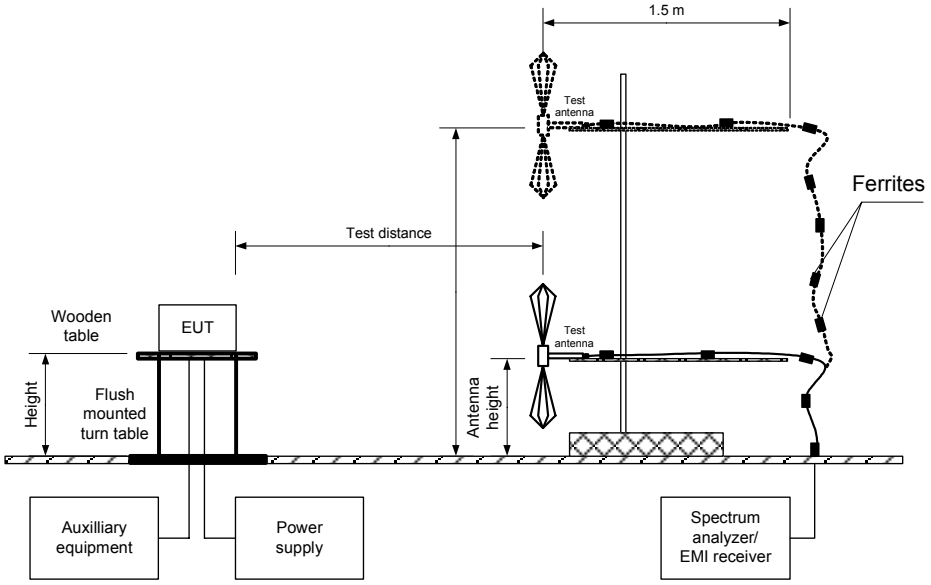
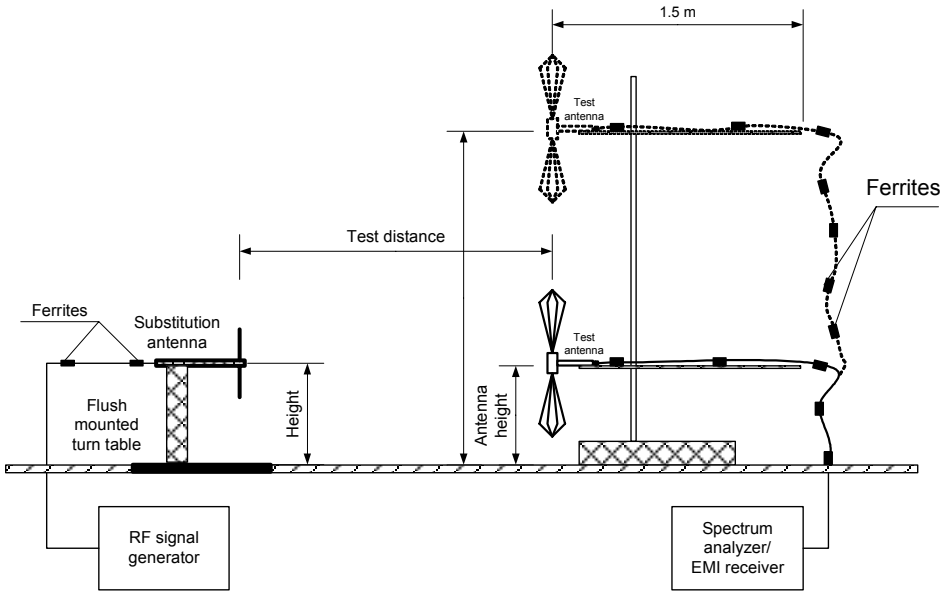


Figure 8.1.2 Setup for substitution ERP measurements



Test specification:	**Section 90.205, Maximum output power**		
Test procedure:	47 CFR, Section 2.1046; TIA/EIA-603-A, Section 2.2.1		
Test mode:	Compliance	**Verdict:**	PASS
Date & Time:	11/29/2004 6:47:28 PM		
Temperature: 23 ºC	**Air Pressure:** 1012 hPa	**Relative Humidity:** 40 %	**Power Supply:** 4.8 VDC
Remarks:			

Table 8.1.2 Transmitter carrier field strength

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

Frequency, MHz	Field strength, dB(μV/m)	Limit, dB(μV/m)	Margin, dB*	RBW, MHz	Antenna polarization	Antenna height, m	Turn-table position**, degrees
915.0	109.46	142	-32.54	3.0	V	1.1	98

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

*- 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:	3000 kHz
SUBSTITUTION ANTENNA TYPE:	Tunable dipole

Frequency, MHz	RBW, kHz	Antenna polariz.	RF generator output, dBm	Ant gain, dBd	Cable loss, dB	ERP, dBm	Correction factor**, dB	Calculated ERP, dBm	Limit, dBm	Margin, dB*
915.0	1000	V	16.3	-0.47	5.67	10.16	4.23	14.4	44.7	-30.3

*- Margin = ERP – specification limit.
** Correction factor = 10 log (Tx BW/Measured bandwidth) = 10 log (3 MHz/7.95 MHz) = -4.23 dB
Calculated ERP:10.16 dBm – (-4.23 dB) = 14.4 dBm

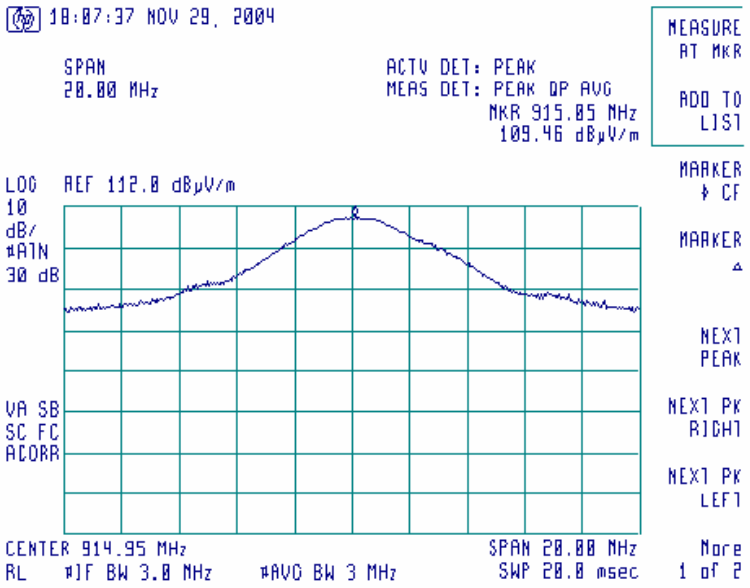
Reference numbers of test equipment used

HL 0034	HL 0661	HL 1430	HL 1499	HL 1545	HL 2400		

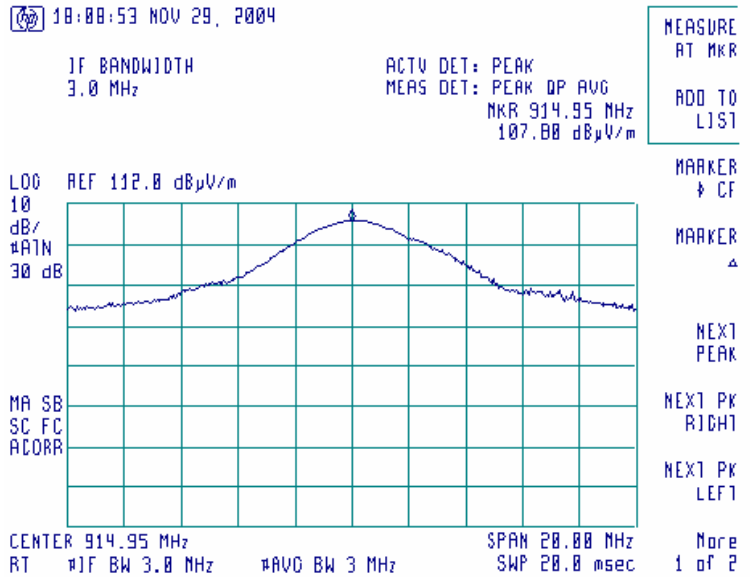
Full description is given in Appendix A.

Test specification:	Section 90.205, Maximum output power		
Test procedure:	47 CFR, Section 2.1046; TIA/EIA-603-A, Section 2.2.1		
Test mode:	Compliance	Verdict:	PASS
Date & Time:	11/29/2004 6:47:28 PM		
Temperature: 23 ºC	Air Pressure: 1012 hPa	Relative Humidity: 40 %	Power Supply: 4.8 VDC
Remarks:			

Plot 8.1.1 Transmitter carrier field strength in vertical antenna polarization



Plot 8.1.2 Transmitter carrier field strength in horizontal antenna polarization



Test specification:	**Section 90.209, Occupied bandwidth**		
Test procedure:	47 CFR, Section 2.1049		
Test mode:	Compliance	**Verdict:**	PASS
Date & Time:	1/2/2005 9:36:15 AM		
Temperature: 23 ºC	**Air Pressure:** 1012 hPa	**Relative Humidity:** 40 %	**Power Supply:** 4.8 VDC
Remarks:			

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
909.75 - 921.75	26	12000

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

8.2.2 Test procedure

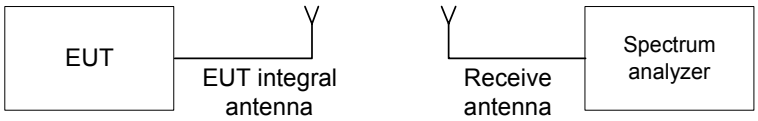
8.2.2.1 The EUT was set up as shown in Figure 8.2.1, energized and its proper operation was checked.

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



Test specification:	**Section 90.209, Occupied bandwidth**		
Test procedure:	47 CFR, Section 2.1049		
Test mode:	Compliance	**Verdict:**	PASS
Date & Time:	1/2/2005 9:36:15 AM		
Temperature: 23 ºC	**Air Pressure:** 1012 hPa	**Relative Humidity:** 40 %	**Power Supply:** 4.8 VDC
Remarks:			

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

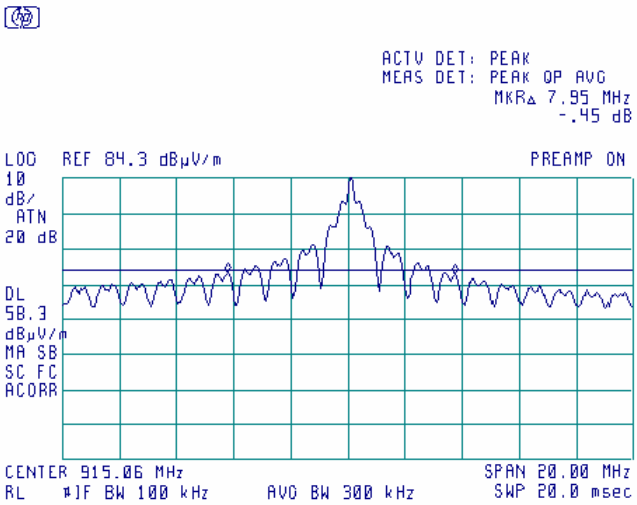
Carrier frequency, MHz	Occupied bandwidth, MHz	Limit, MHz	Margin, MHz	Verdict
915.06	7.95	12	4.05	Pass

Reference numbers of test equipment used

HL 0467	HL 0521	HL 0589	HL 0604	HL 2009			

Full description is given in Appendix A.

Plot 8.2.1 Occupied bandwidth test result



Test specification:	**Section 90.210, Emission mask**		
Test procedure:	47 CFR, Sections 2.1051, 2.1047 and 90.210(m); TIA/EIA-603-A, Section 2.2.13		
Test mode:	Compliance	**Verdict:**	PASS
Date & Time:	1/2/2005 9:17:05 AM		
Temperature: 22 ºC	**Air Pressure:** 1015 hPa	**Relative Humidity:** 45 %	**Power Supply:** 4.8 VDC
Remarks:			

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

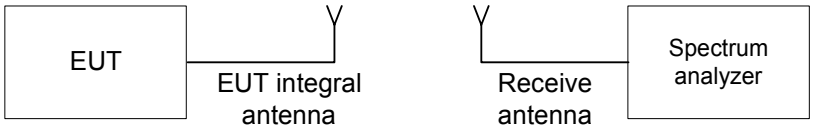
Carrier frequency, MHz	Limit	Verdict
915.0	Emission mask K	Pass

Reference numbers of test equipment used

HL 0337	HL 1097	HL 1430					

Full description is given in Appendix A.

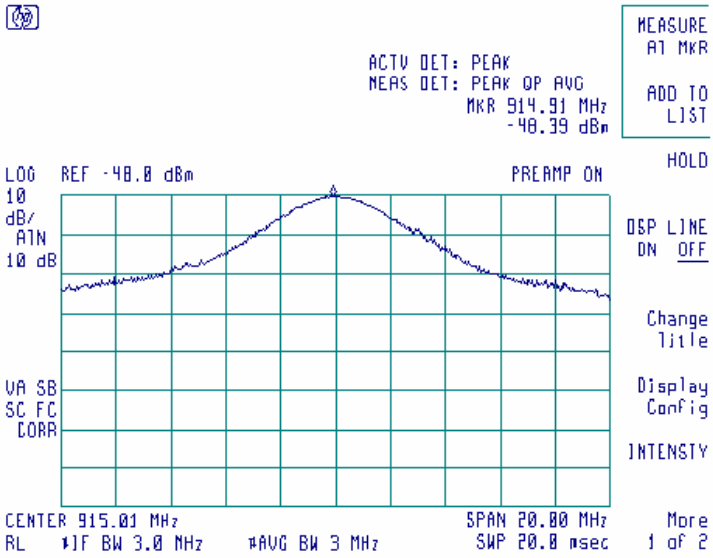
Figure 8.3.1 Emission mask test setup



Test specification:	**Section 90.210, Emission mask**		
Test procedure:	47 CFR, Sections 2.1051, 2.1047 and 90.210(m); TIA/EIA-603-A, Section 2.2.13		
Test mode:	Compliance	**Verdict:**	PASS
Date & Time:	1/2/2005 9:17:05 AM		
Temperature: 22 ºC	**Air Pressure:** 1015 hPa	**Relative Humidity:** 45 %	**Power Supply:** 4.8 VDC
Remarks:			

Plot 8.3.1 Emission mask test results at carrier frequency

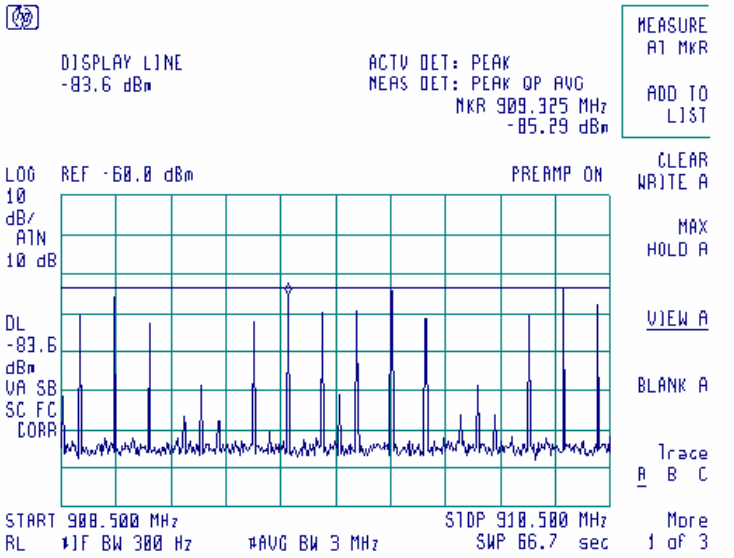
OPERATING FREQUENCY RANGE:	902 - 928 MHz
DETECTOR USED:	Peak
MODULATION:	ASK
MODULATING SIGNAL:	PRBS
BIT RATE:	0.5 Mbps
TRANSMITTER OUTPUT POWER SETTINGS:	Maximum



Test specification:	**Section 90.210, Emission mask**		
Test procedure:	47 CFR, Sections 2.1051, 2.1047 and 90.210(m); TIA/EIA-603-A, Section 2.2.13		
Test mode:	Compliance	**Verdict:**	PASS
Date & Time:	1/2/2005 9:17:05 AM		
Temperature: 22 ºC	**Air Pressure:** 1015 hPa	**Relative Humidity:** 45 %	**Power Supply:** 4.8 VDC
Remarks:			

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

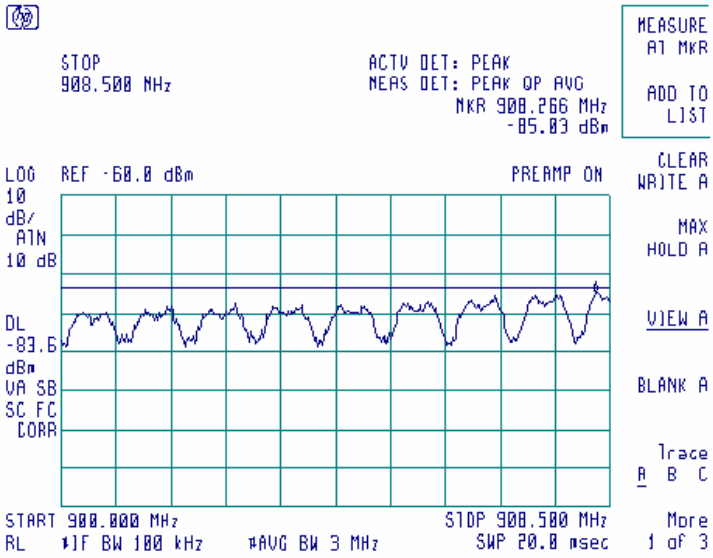


Attenuation below carrier (dB): 55 + 10 log P(W) = 35.16 (dB)
Limit for spurious emission: -48.39 (dBm) -35.16 (dB) = -83.55 (dBm)

Test specification:	**Section 90.210, Emission mask**		
Test procedure:	47 CFR, Sections 2.1051, 2.1047 and 90.210(m); TIA/EIA-603-A, Section 2.2.13		
Test mode:	Compliance	**Verdict:**	PASS
Date & Time:	1/2/2005 9:17:05 AM		
Temperature: 22 ºC	**Air Pressure:** 1015 hPa	**Relative Humidity:** 45 %	**Power Supply:** 4.8 VDC
Remarks:			

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

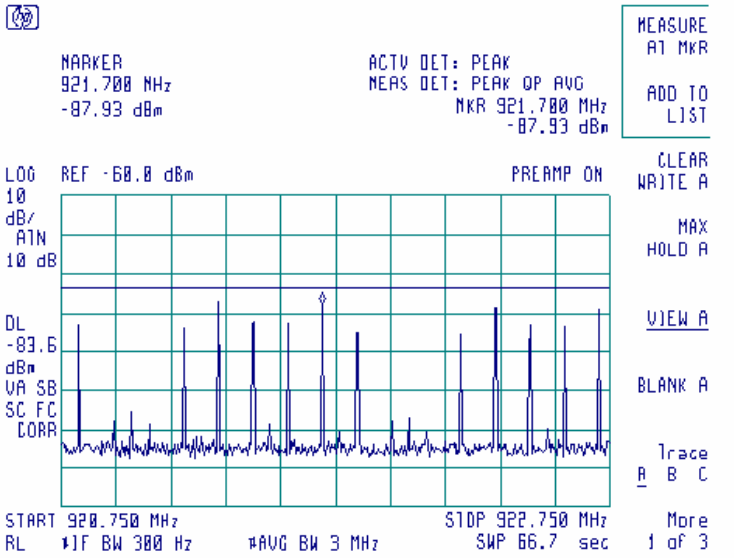
OPERATING FREQUENCY RANGE:	902 - 928 MHz
DETECTOR USED:	Peak
MODULATION:	ASK
MODULATING SIGNAL:	PRBS
BIT RATE:	0.5 Mbps
TRANSMITTER OUTPUT POWER SETTINGS:	Maximum



Test specification:	**Section 90.210, Emission mask**		
Test procedure:	47 CFR, Sections 2.1051, 2.1047 and 90.210(m); TIA/EIA-603-A, Section 2.2.13		
Test mode:	Compliance	**Verdict:**	PASS
Date & Time:	1/2/2005 9:17:05 AM		
Temperature: 22 ºC	**Air Pressure:** 1015 hPa	**Relative Humidity:** 45 %	**Power Supply:** 4.8 VDC
Remarks:			

Plot 8.3.4 Emission mask test results at carrier frequency, right band edge

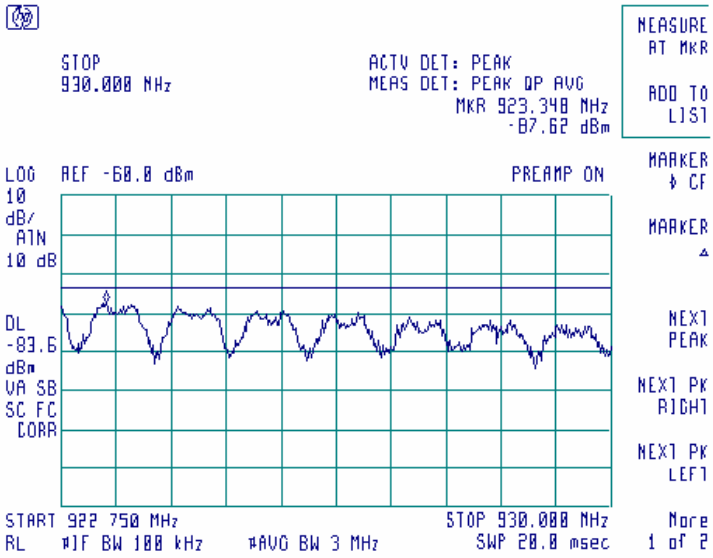
OPERATING FREQUENCY RANGE:	902 - 928 MHz
DETECTOR USED:	Peak
MODULATION:	ASK
MODULATING SIGNAL:	PRBS
BIT RATE:	0.5 Mbps
TRANSMITTER OUTPUT POWER SETTINGS:	Maximum



Test specification:	**Section 90.210, Emission mask**		
Test procedure:	47 CFR, Sections 2.1051, 2.1047 and 90.210(m); TIA/EIA-603-A, Section 2.2.13		
Test mode:	Compliance	**Verdict:**	PASS
Date & Time:	1/2/2005 9:17:05 AM		
Temperature: 22 ºC	**Air Pressure:** 1015 hPa	**Relative Humidity:** 45 %	**Power Supply:** 4.8 VDC
Remarks:			

Plot 8.3.5 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



Test specification:	**Section 90.210, Radiated spurious emissions**		
Test procedure:	47 CFR, Sections 2.1053 and 90.210(m); TIA/EIA-603-A, Section 2.2.12		
Test mode:	Compliance	**Verdict:**	PASS
Date & Time:	3/1/2005 12:06:31 PM		
Temperature: 23 ºC	**Air Pressure:** 1012 hPa	**Relative Humidity:** 40 %	**Power Supply:** 4.8 VDC
Remarks: new layout template			

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 ± 250 % of the authorized bandwidth from the carrier

** - P is transmitter output power in Watts

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

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 360^0 and the measuring antenna was rotated around its vertical axis.

8.4.2.3 The worst test results (the lowest margins) found in the EUT X-axis position were 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 360^0 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 the EUT X-axis 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 8.1.2 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.

Test specification:	**Section 90.210, Radiated spurious emissions**		
Test procedure:	47 CFR, Sections 2.1053 and 90.210(m); TIA/EIA-603-A, Section 2.2.12		
Test mode:	Compliance	**Verdict:**	PASS
Date & Time:	3/1/2005 12:06:31 PM		
Temperature: 23 ºC	**Air Pressure:** 1012 hPa	**Relative Humidity:** 40 %	**Power Supply:** 4.8 VDC
Remarks: new layout template			

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

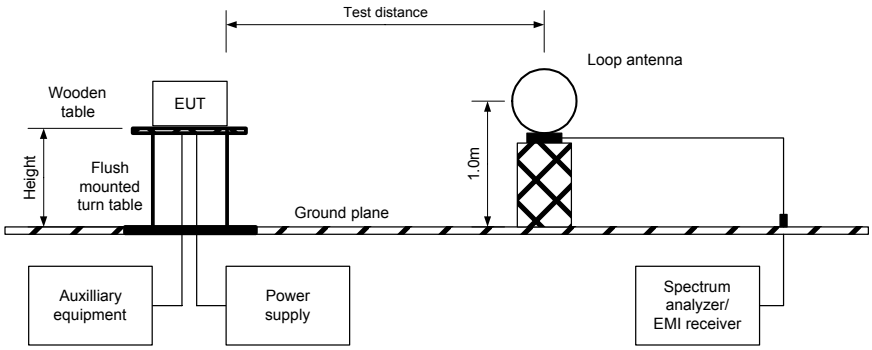
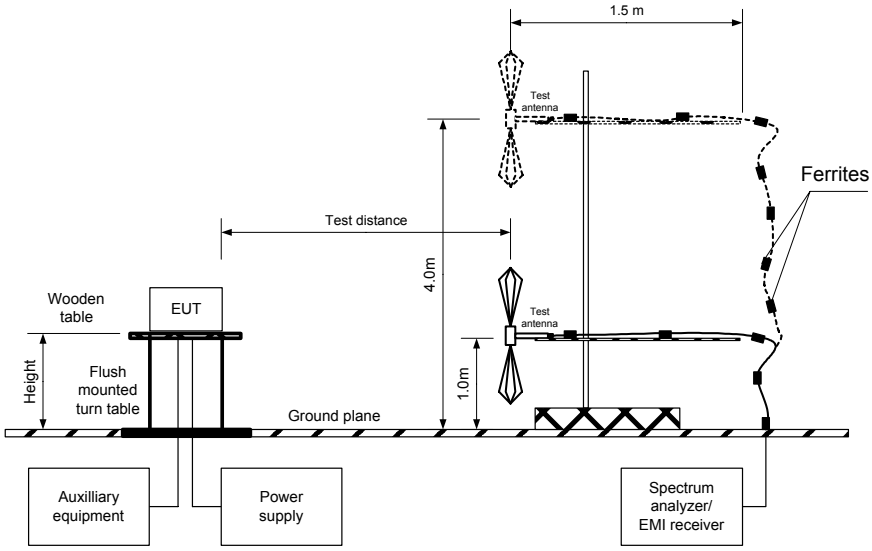
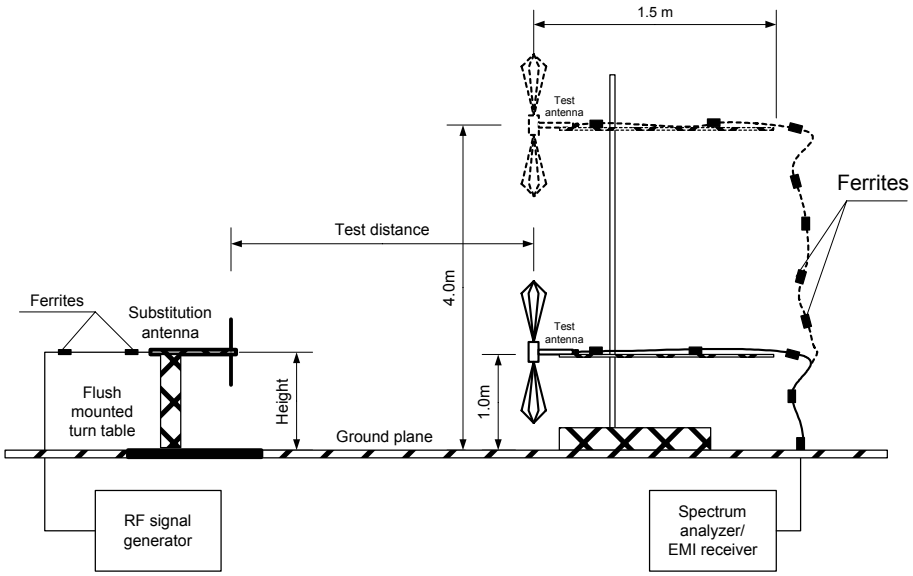


Figure 8.4.2 Setup for spurious emission field strength measurements above 30 MHz



Test specification:	**Section 90.210, Radiated spurious emissions**		
Test procedure:	47 CFR, Sections 2.1053 and 90.210(m); TIA/EIA-603-A, Section 2.2.12		
Test mode:	Compliance	**Verdict:**	PASS
Date & Time:	3/1/2005 12:06:31 PM		
Temperature: 23 ºC	**Air Pressure:** 1012 hPa	**Relative Humidity:** 40 %	**Power Supply:** 4.8 VDC
Remarks: new layout template			

Figure 8.4.3 Setup for substitution ERP measurements of spurious



Test specification:	**Section 90.210, Radiated spurious emissions**		
Test procedure:	47 CFR, Sections 2.1053 and 90.210(m); TIA/EIA-603-A, Section 2.2.12		
Test mode:	Compliance	**Verdict:**	PASS
Date & Time:	3/1/2005 12:06:31 PM		
Temperature: 23 ºC	**Air Pressure:** 1012 hPa	**Relative Humidity:** 40 %	**Power Supply:** 4.8 VDC
Remarks: new layout template			

Table 8.4.2 Spurious emission field strength test results

OPERATING FREQUENCY:	915 MHz
TEST DISTANCE:	3 m
EUT HEIGHT:	0.8 m
EUT POSITION:	3 orthogonal (X / Y / Z)
INVESTIGATED FREQUENCY RANGE:	0.009 – 9200 MHz
DETECTOR USED:	Peak
VIDEO BANDWIDTH:	> Resolution bandwidth
TEST ANTENNA TYPE:	Active loop (9 kHz – 30 MHz) Biconical (30 MHz – 200 MHz) Log periodic (200 MHz – 1000 MHz) Biconilog (30 MHz – 1000 MHz) Double ridged guide (above 1000 MHz)
MODULATION:	ASK
MODULATING SIGNAL:	PRBS
BIT RATE:	0.5 Mbps
TRANSMITTER OUTPUT POWER SETTINGS:	Maximum

TEST SITE: **Semi anechoic chamber**

Frequency, MHz	Field strength, dB(μV/m)	Limit, dB(μV/m)	Margin, dB*	RBW, kHz	Antenna polarization	Antenna height, m	Turn-table position**, degrees
1830.00	55.47	72.40	-16.93	100	V	1.0	205
1830.00	52.99	72.40	-19.41	100	H	1.4	178

TEST SITE: **OATS**

Frequency, MHz	Field strength, dB(μV/m)	Limit, dB(μV/m)	Margin, dB*	RBW, kHz	Antenna polarization	Antenna height, m	Turn-table position**, degrees
2745.01	46.50	72.40	-25.9	100	V	1.1	167
2745.01	46.17	72.40	-26.23	100	H	1.4	180
3660.03	45.67	72.40	-26.73	100	V	1.2	145
3660.03	45.83	72.40	-26.57	100	H	1.2	240
4575.03	46.67	72.40	-25.73	100	V	1.5	65
4575.03	48.50	72.40	-23.9	100	H	1.4	265
5490.04	47.83	72.40	-24.57	100	V	1.0	83
5490.04	47.33	72.40	-25.07	100	H	1.2	90
6405.06	48.67	72.40	-23.73	100	V	1.0	233
6405.06	54.33	72.40	-18.07	100	H	1.1	180
7320.07	60.67	72.40	-11.73	100	V	1.4	143
7320.07	54.83	72.40	-17.57	100	H	1.2	160

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

Test specification:	**Section 90.210, Radiated spurious emissions**		
Test procedure:	47 CFR, Sections 2.1053 and 90.210(m); TIA/EIA-603-A, Section 2.2.12		
Test mode:	Compliance	**Verdict:**	PASS
Date & Time:	3/1/2005 12:06:31 PM		
Temperature: 23 ºC	**Air Pressure:** 1012 hPa	**Relative Humidity:** 40 %	**Power Supply:** 4.8 VDC
Remarks: new layout template			

Table 8.4.3 Substitution ERP of spurious test results

OPERATING FREQUENCY: 915 MHz
TRANSMITTER CARRIER ERP: 10.16 dBm at high frequency

TEST DISTANCE: 3 m
SUBSTITUTION ANTENNA HEIGHT: 0.8 m
DETECTOR USED: Peak
VIDEO BANDWIDTH: > Resolution bandwidth
SUBSTITUTION ANTENNA TYPE: Tunable dipole (30 MHz – 1000 MHz)
Double ridged guide (above 1000 MHz)

TEST SITE: Semi anechoic chamber

Frequency, MHz	Field strength, dB(μV/m)	RBW, kHz	Antenna polarization	RF generator output, dBm	Ant gain, dBd	Cable loss, dB	ERP, dBm	Attenuation below carrier, dBc	Limit, dBc	Margin, dB*	Verdict
1830.00	55.47	100	V	-45.51	7.80	3.79	-36.50	46.66	35.16	11.50	PASS
1830.00	52.99	100	H	-47.99	7.80	3.79	-38.98	49.14	35.16	13.98	PASS

TEST SITE: OATS

Frequency, MHz	Field strength, dB(μV/m)	RBW, kHz	Antenna polarization	RF generator output, dBm	Ant gain, dBd	Cable loss, dB	ERP, dBm	Attenuation below carrier, dBc	Limit, dBc	Margin, dB*	Verdict
6405.06	54.33	100	H	-48.07	11.70	6.51	-42.88	53.04	35.16	17.88	PASS
7320.07	60.67	100	V	-42.63	11.18	7.11	-38.56	48.72	35.16	13.56	PASS
7320.07	54.83	100	H	-48.07	11.18	7.11	-44.00	54.16	35.16	19.00	PASS

*- Margin = Spurious emission – specification limit.

Reference numbers of test equipment used

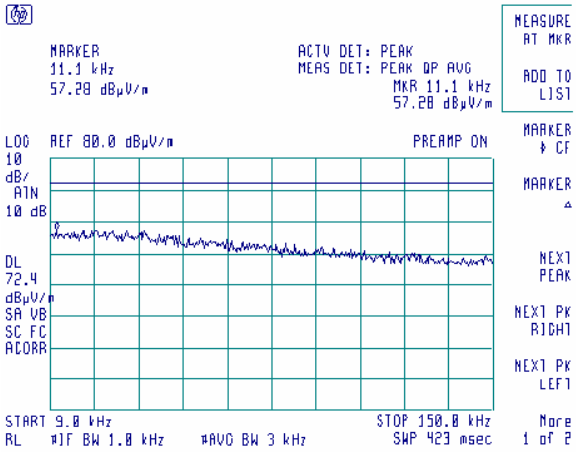
HL 0410	HL 0521	HL 0604	HL 0661	HL 0644	HL 1424	HL 1430	HL 1942
HL 1947	HL 1545	HL 2259	HL 2400				

Full description is given in Appendix A.

Test specification:	**Section 90.210, Radiated spurious emissions**		
Test procedure:	47 CFR, Sections 2.1053 and 90.210(m); TIA/EIA-603-A, Section 2.2.12		
Test mode:	Compliance	**Verdict:**	PASS
Date & Time:	3/1/2005 12:06:31 PM		
Temperature: 23 ºC	**Air Pressure:** 1012 hPa	**Relative Humidity:** 40 %	**Power Supply:** 4.8 VDC
Remarks: new layout template			

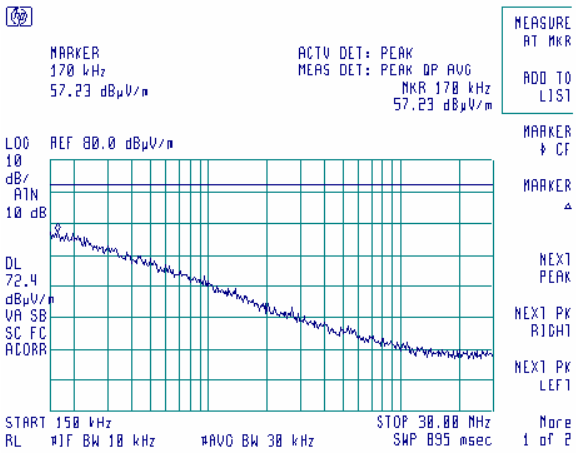
Plot 8.4.1 Radiated emission measurements in 9 - 150 kHz range

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



Plot 8.4.2 Radiated emission measurements in 0.15 - 30 MHz range

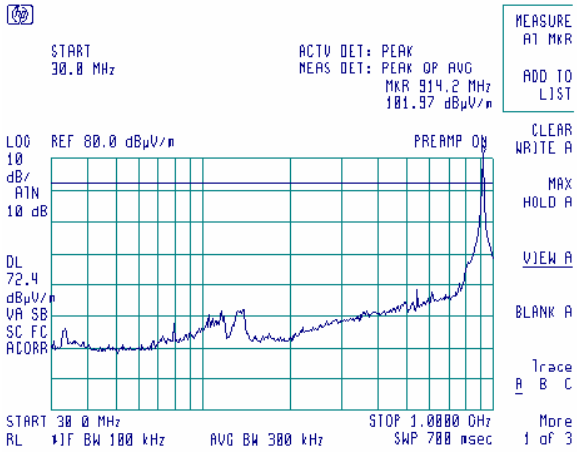
TEST SITE: Semi anechoic chamber
ANTENNA POLARIZATION: Vertical and Horizontal
TEST DISTANCE: 3 m



Test specification:	**Section 90.210, Radiated spurious emissions**		
Test procedure:	47 CFR, Sections 2.1053 and 90.210(m); TIA/EIA-603-A, Section 2.2.12		
Test mode:	Compliance	**Verdict:**	PASS
Date & Time:	3/1/2005 12:06:31 PM		
Temperature: 23 ºC	**Air Pressure:** 1012 hPa	**Relative Humidity:** 40 %	**Power Supply:** 4.8 VDC
Remarks: new layout template			

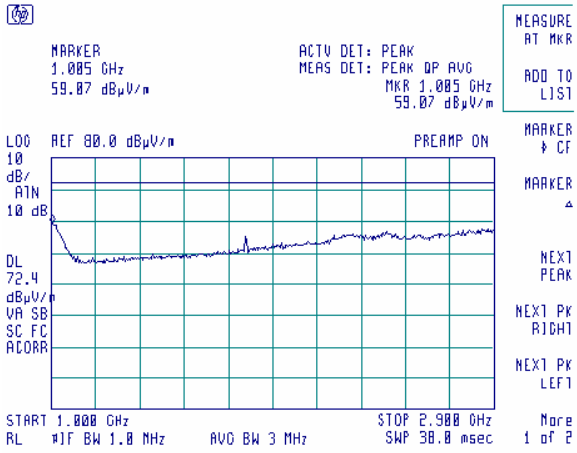
Plot 8.4.3 Radiated emission measurements in 30 – 1000 MHz range

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



Plot 8.4.4 Radiated emission measurements in 1000 – 2900 MHz range

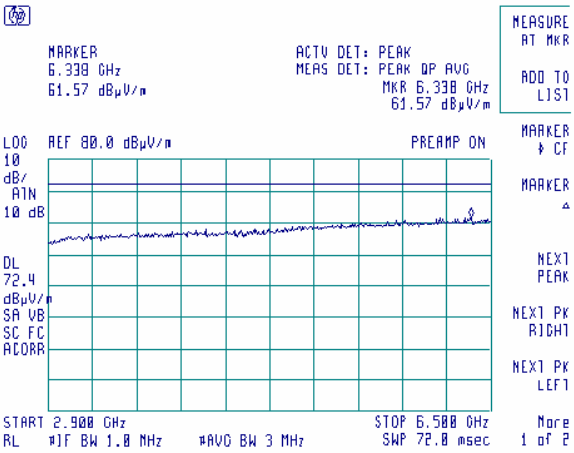
TEST SITE: Semi anechoic chamber
ANTENNA POLARIZATION: Vertical and Horizontal
TEST DISTANCE: 3 m



Test specification:	**Section 90.210, Radiated spurious emissions**		
Test procedure:	47 CFR, Sections 2.1053 and 90.210(m); TIA/EIA-603-A, Section 2.2.12		
Test mode:	Compliance	**Verdict:**	PASS
Date & Time:	3/1/2005 12:06:31 PM		
Temperature: 23 ºC	**Air Pressure:** 1012 hPa	**Relative Humidity:** 40 %	**Power Supply:** 4.8 VDC
Remarks: new layout template			

Plot 8.4.5 Radiated emission measurements in 2900 – 6500 MHz range

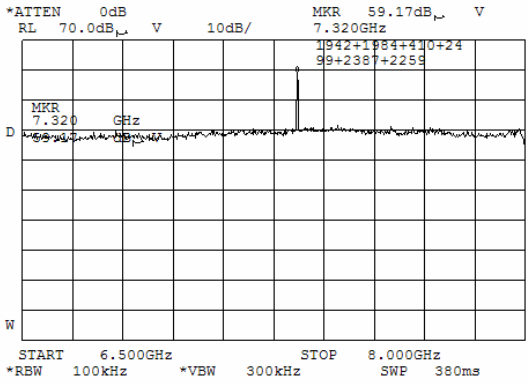
TEST SITE:	OATS
ANTENNA POLARIZATION:	Vertical and Horizontal
TEST DISTANCE:	3 m



Test specification:	**Section 90.210, Radiated spurious emissions**		
Test procedure:	47 CFR, Sections 2.1053 and 90.210(m); TIA/EIA-603-A, Section 2.2.12		
Test mode:	Compliance	**Verdict:**	PASS
Date & Time:	3/1/2005 12:06:31 PM		
Temperature: 23 ºC	**Air Pressure:** 1012 hPa	**Relative Humidity:** 40 %	**Power Supply:** 4.8 VDC
Remarks: new layout template			

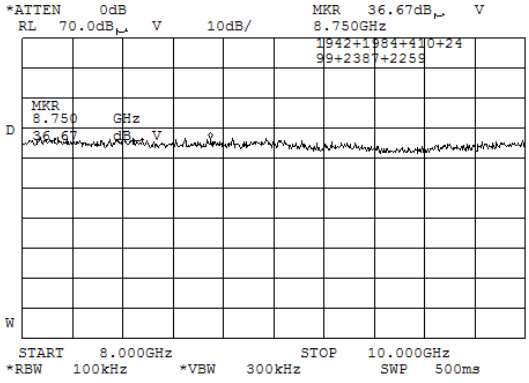
Plot 8.4.6 Radiated emission measurements in 6500 – 8000 MHz range

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



Plot 8.4.7 Radiated emission measurements in 8000 – 10000 MHz range

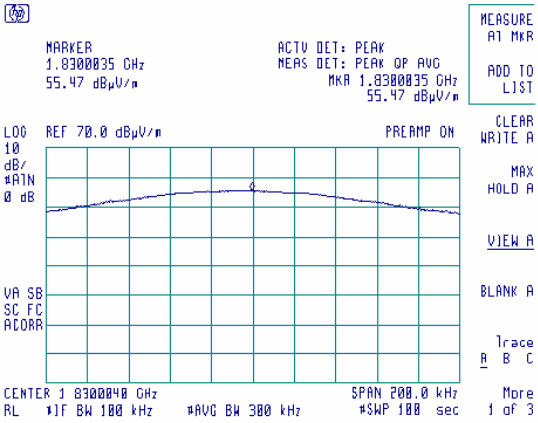
TEST SITE: OATS
ANTENNA POLARIZATION: Vertical and Horizontal
TEST DISTANCE: 3 m



Test specification:	**Section 90.210, Radiated spurious emissions**		
Test procedure:	47 CFR, Sections 2.1053 and 90.210(m); TIA/EIA-603-A, Section 2.2.12		
Test mode:	Compliance	**Verdict:**	PASS
Date & Time:	3/1/2005 12:06:31 PM		
Temperature: 23 ºC	**Air Pressure:** 1012 hPa	**Relative Humidity:** 40 %	**Power Supply:** 4.8 VDC
Remarks: new layout template			

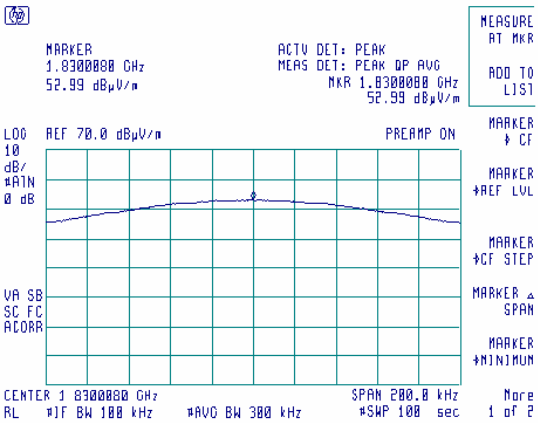
Plot 8.4.8 Radiated emission measurements at the 2nd harmonic

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



Plot 8.4.9 Radiated emission measurements at the 2nd harmonic

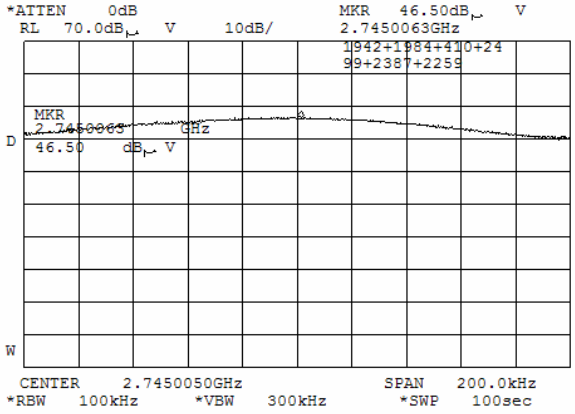
TEST SITE: Semi anechoic chamber
ANTENNA POLARIZATION: Horizontal
TEST DISTANCE: 3 m



Test specification:	**Section 90.210, Radiated spurious emissions**		
Test procedure:	47 CFR, Sections 2.1053 and 90.210(m); TIA/EIA-603-A, Section 2.2.12		
Test mode:	Compliance	**Verdict:**	PASS
Date & Time:	3/1/2005 12:06:31 PM		
Temperature: 23 ºC	**Air Pressure:** 1012 hPa	**Relative Humidity:** 40 %	**Power Supply:** 4.8 VDC
Remarks: new layout template			

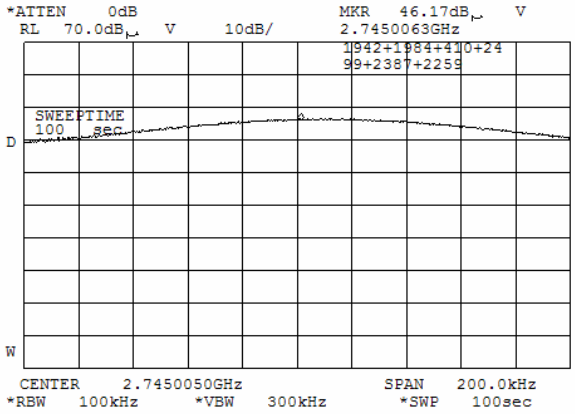
Plot 8.4.10 Radiated emission measurements at the 3rd harmonic

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



Plot 8.4.11 Radiated emission measurements at the 3rd harmonic

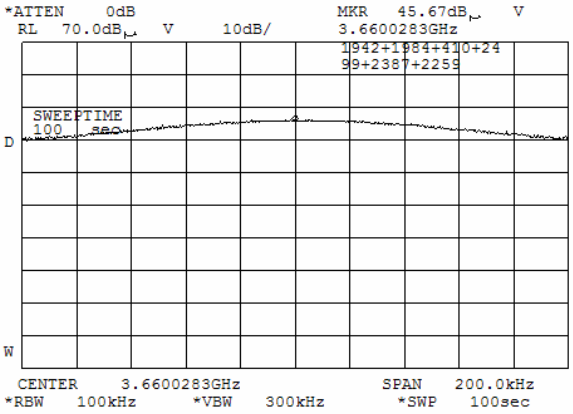
TEST SITE: OATS
ANTENNA POLARIZATION: Horizontal
TEST DISTANCE: 3 m



Test specification:	**Section 90.210, Radiated spurious emissions**		
Test procedure:	47 CFR, Sections 2.1053 and 90.210(m); TIA/EIA-603-A, Section 2.2.12		
Test mode:	Compliance	**Verdict:**	PASS
Date & Time:	3/1/2005 12:06:31 PM		
Temperature: 23 ºC	**Air Pressure:** 1012 hPa	**Relative Humidity:** 40 %	**Power Supply:** 4.8 VDC
Remarks: new layout template			

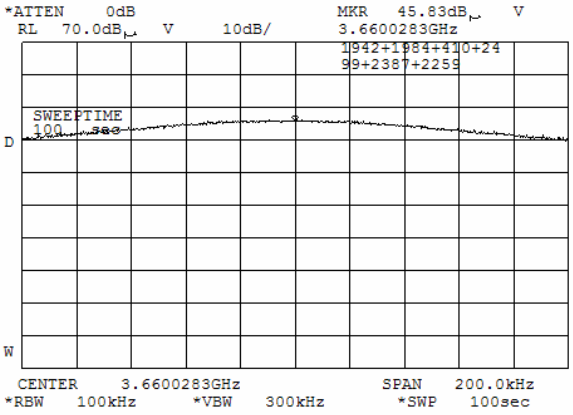
Plot 8.4.12 Radiated emission measurements at the 4th harmonic

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



Plot 8.4.13 Radiated emission measurements at the 4th harmonic

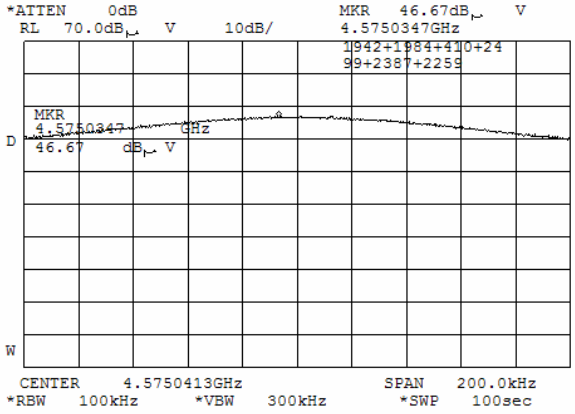
TEST SITE: OATS
ANTENNA POLARIZATION: Horizontal
TEST DISTANCE: 3 m



Test specification:	**Section 90.210, Radiated spurious emissions**		
Test procedure:	47 CFR, Sections 2.1053 and 90.210(m); TIA/EIA-603-A, Section 2.2.12		
Test mode:	Compliance	**Verdict:**	PASS
Date & Time:	3/1/2005 12:06:31 PM		
Temperature: 23 ºC	**Air Pressure:** 1012 hPa	**Relative Humidity:** 40 %	**Power Supply:** 4.8 VDC
Remarks: new layout template			

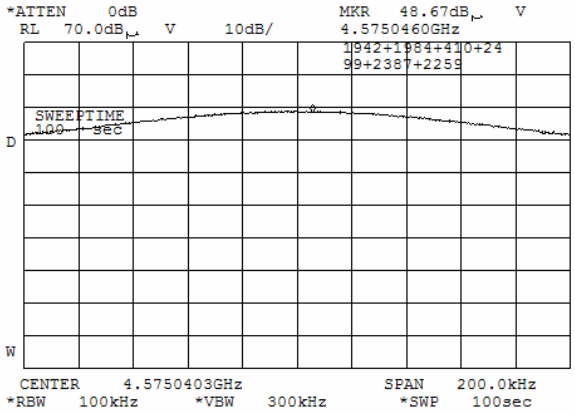
Plot 8.4.14 Radiated emission measurements at the 5th harmonic

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



Plot 8.4.15 Radiated emission measurements at the 5th harmonic

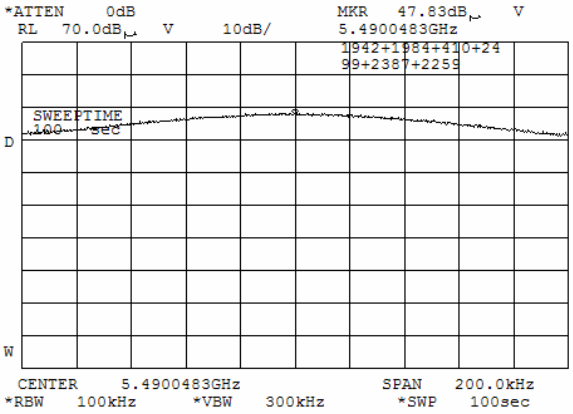
TEST SITE: OATS
ANTENNA POLARIZATION: Horizontal
TEST DISTANCE: 3 m



Test specification:	**Section 90.210, Radiated spurious emissions**		
Test procedure:	47 CFR, Sections 2.1053 and 90.210(m); TIA/EIA-603-A, Section 2.2.12		
Test mode:	Compliance	**Verdict:**	PASS
Date & Time:	3/1/2005 12:06:31 PM		
Temperature: 23 ºC	**Air Pressure:** 1012 hPa	**Relative Humidity:** 40 %	**Power Supply:** 4.8 VDC
Remarks: new layout template			

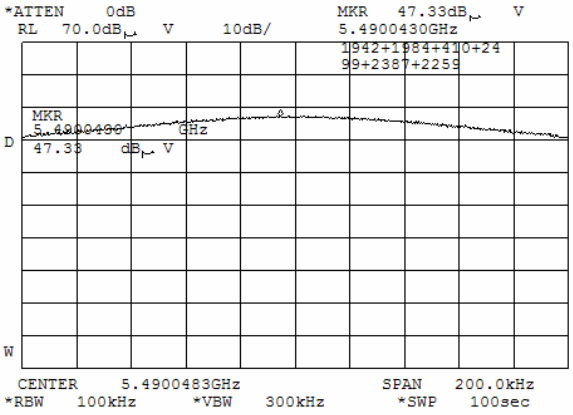
Plot 8.4.16 Radiated emission measurements at the 6th harmonic

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



Plot 8.4.17 Radiated emission measurements at the 6th harmonic

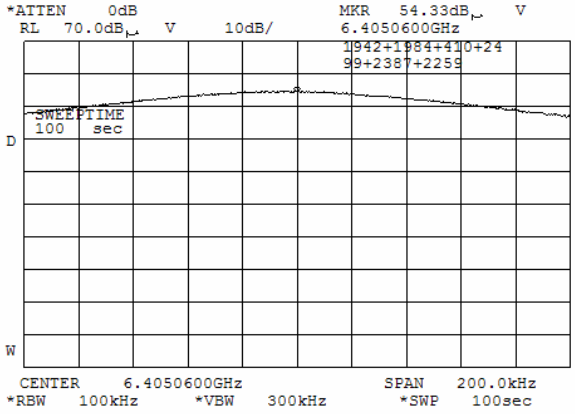
TEST SITE: OATS
ANTENNA POLARIZATION: Horizontal
TEST DISTANCE: 3 m



Test specification:	**Section 90.210, Radiated spurious emissions**		
Test procedure:	47 CFR, Sections 2.1053 and 90.210(m); TIA/EIA-603-A, Section 2.2.12		
Test mode:	Compliance	**Verdict:**	PASS
Date & Time:	3/1/2005 12:06:31 PM		
Temperature: 23 ºC	**Air Pressure:** 1012 hPa	**Relative Humidity:** 40 %	**Power Supply:** 4.8 VDC
Remarks: new layout template			

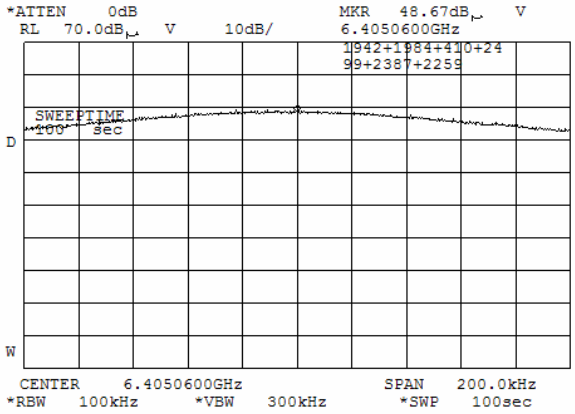
Plot 8.4.18 Radiated emission measurements at the 7th harmonic

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



Plot 8.4.19 Radiated emission measurements at the 7th harmonic

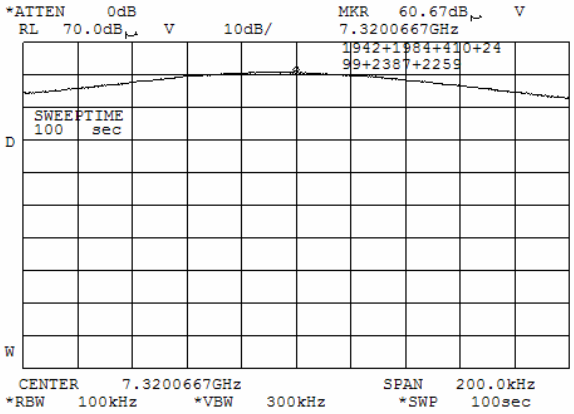
TEST SITE: OATS
ANTENNA POLARIZATION: Vertical
TEST DISTANCE: 3 m



Test specification:	**Section 90.210, Radiated spurious emissions**		
Test procedure:	47 CFR, Sections 2.1053 and 90.210(m); TIA/EIA-603-A, Section 2.2.12		
Test mode:	Compliance	**Verdict:**	PASS
Date & Time:	3/1/2005 12:06:31 PM		
Temperature: 23 ºC	**Air Pressure:** 1012 hPa	**Relative Humidity:** 40 %	**Power Supply:** 4.8 VDC
Remarks: new layout template			

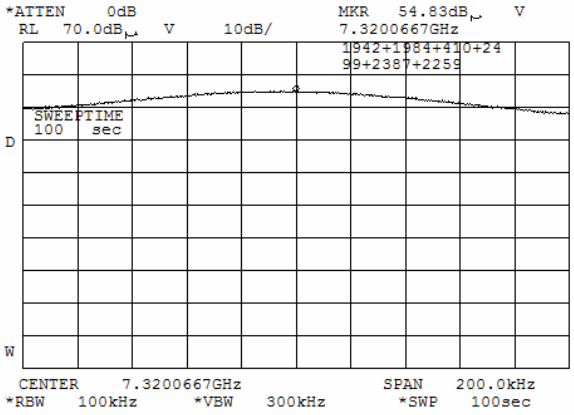
Plot 8.4.20 Radiated emission measurements at the 8th harmonic

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



Plot 8.4.21 Radiated emission measurements at the 8th harmonic

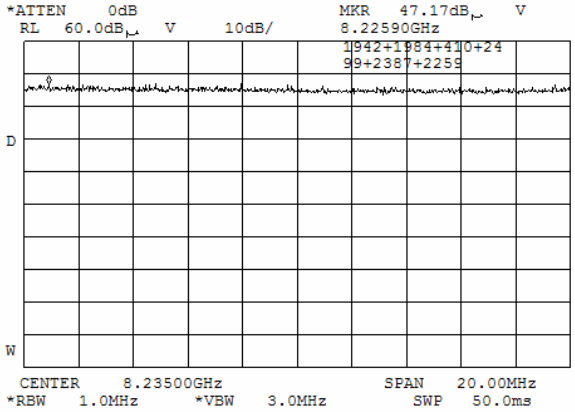
TEST SITE: OATS
ANTENNA POLARIZATION: Horizontal
TEST DISTANCE: 3 m



Test specification:	**Section 90.210, Radiated spurious emissions**		
Test procedure:	47 CFR, Sections 2.1053 and 90.210(m); TIA/EIA-603-A, Section 2.2.12		
Test mode:	Compliance	**Verdict:**	PASS
Date & Time:	3/1/2005 12:06:31 PM		
Temperature: 23 ºC	**Air Pressure:** 1012 hPa	**Relative Humidity:** 40 %	**Power Supply:** 4.8 VDC
Remarks: new layout template			

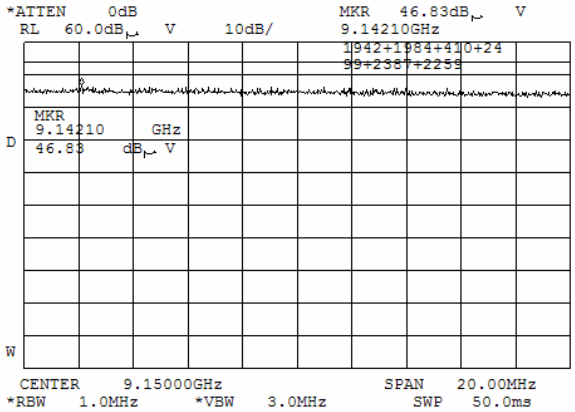
Plot 8.4.22 Radiated emission measurements at the 9th harmonic

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



Plot 8.4.23 Radiated emission measurements at the 10th harmonic

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



Test specification:	Section 90.213, Frequency stability		
Test procedure:	47 CFR, Section 2.1055; TIA/EIA-603-A Section 2.2.2		
Test mode:	Compliance	Verdict:	PASS
Date & Time:	1/2/2005 10:16:03 AM		
Temperature: 24 ºC	Air Pressure: 1017 hPa	Relative Humidity: 35 %	Power Supply: 4.8 VDC
Remarks:			

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.

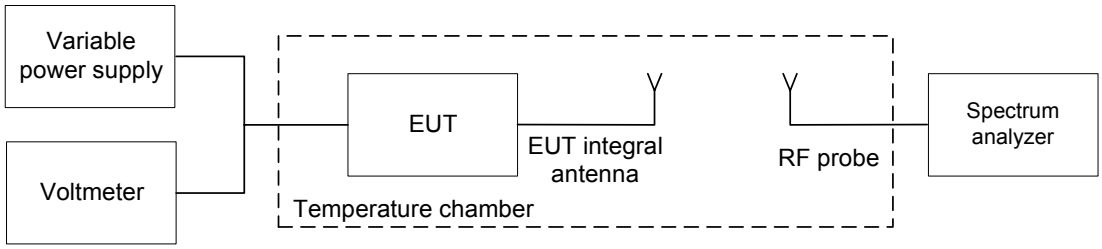
8.5.2.3 The EUT was powered on and carrier frequency was measured at start up moment and then every minute until frequency had been stabilized or 10 minutes elapsed whichever reached the last. The EUT was powered off.

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



Test specification:	**Section 90.213, Frequency stability**		
Test procedure:	47 CFR, Section 2.1055; TIA/EIA-603-A Section 2.2.2		
Test mode:	Compliance	**Verdict:**	PASS
Date & Time:	1/2/2005 10:16:03 AM		
Temperature: 24 ºC	**Air Pressure:** 1017 hPa	**Relative Humidity:** 35 %	**Power Supply:** 4.8 VDC
Remarks:			

Table 8.5.2 Frequency stability test results

OPERATING FREQUENCY:	915 MHz
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, ºC	Voltage, V	Frequency, MHz							Max frequency drift, Hz		Limit, Hz	Margin, Hz	Verdict
		Start up	1st min	2nd min	3rd min	4th min	5th min	10th min	Positive	Negative			
Frequency													
-30	nominal	914.936447	914.936414	914.934412	914.934365	914.933096	914.931441	914.924688	0	91000	NA	NA	NA
-20	nominal	914.868940	NA	NA	NA	NA	NA	914.951388	0	146748			
-10	nominal	914.993392	NA	NA	NA	NA	NA	914.983026	0	32662			
0	nominal	915.014800	915.015711	915.015277	915.014674	915.014733	915.014090	915.008888	23	1598			
10	nominal	915.015760	NA	NA	NA	NA	NA	915.018835	3147	0			
20	nominal	915.016179	NA	NA	NA	NA	NA	*915.015688	491	0			
20	V**	915.011981	NA	NA	NA	NA	NA	915.013356	0	3707			
30	nominal	915.014775	915.014952	915.015073	915.015208	915.015302	915.015353	915.015410	0	913			
40	nominal	915.011554	NA	NA	NA	NA	NA	915.008734	0	6954			
50	nominal	914.899431	NA	NA	NA	NA	NA	914.989349	0	116257			

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

Reference numbers of test equipment used

HL 0278	HL 0493	HL 0808	HL 2004				

Full description is given in Appendix A.

Test specification:	Section 15.107, Conducted emission at AC power port		
Test procedure:	ANSI C63.4, Sections 11.5 and 12.1.3		
Test mode:	Compliance	Verdict:	PASS
Date & Time:	2/7/2005 5:54:54 PM		
Temperature: 22 ºC	Air Pressure: 1017 hPa	Relative Humidity: 36 %	Power Supply: 120 VAC
Remarks: final layout			

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

9.1 Conducted emissions

9.1.1 General

This test was performed to measure common mode conducted emissions at the mains power port.
Specification test limits are given in Table 9.1.1. The worst test results (the lowest margins) were recorded in Table 9.1.2 and shown in the associated plots.

Table 9.1.1 Limits for conducted emissions

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

* The limit decreases linearly with the logarithm of frequency.

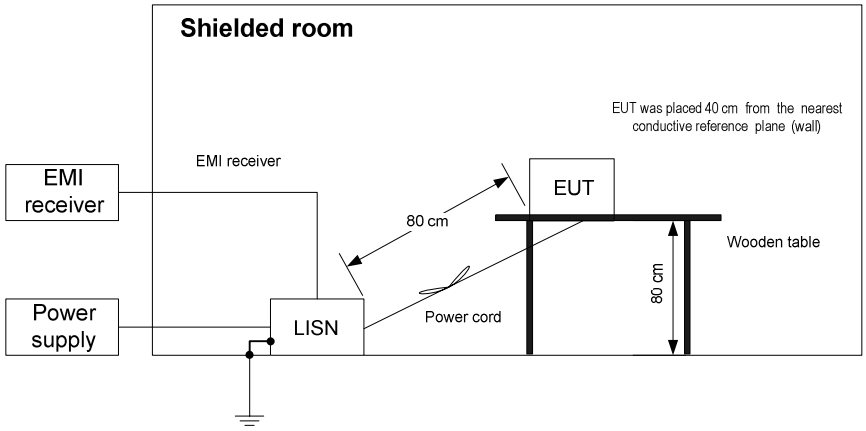
9.1.2 Test procedure

9.1.2.1 The EUT was set up as shown in Figure 9.1.1 and associated photographs, energized and the performance check was conducted.

9.1.2.2 The measurements were performed at power terminals with the LISN, connected to a spectrum analyzer in the frequency range referred to in Table 9.1.1. Unused coaxial connector of the LISN was terminated with 50 Ohm. Quasi-peak and average detectors were used throughout the testing.

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

Figure 9.1.1 Setup for conducted emission measurements, table-top equipment



Test specification:	**Section 15.107, Conducted emission at AC power port**		
Test procedure:	ANSI C63.4, Sections 11.5 and 12.1.3		
Test mode:	Compliance	**Verdict:**	PASS
Date & Time:	2/7/2005 5:54:54 PM		
Temperature: 22 ºC	**Air Pressure:** 1017 hPa	**Relative Humidity:** 36 %	**Power Supply:** 120 VAC
Remarks: final layout			

Table 9.1.2 Conducted emission test results

LINE: AC mains
LIMIT: Class A
EUT SET UP: TABLE-TOP
TEST SITE: SHIELDED ROOM
DETECTORS USED: PEAK / QUASI-PEAK / AVERAGE
FREQUENCY RANGE: 150 kHz - 30 MHz
RESOLUTION BANDWIDTH: 9 kHz

EUT OPERATING MODE: Stand-by

Frequency, MHz	Peak emission, dB(µV)	Quasi-peak			Average			Line ID	Verdict
		Measured emission, dB(µV)	Limit, dB(µV)	Margin, dB*	Measured emission, dB(µV)	Limit, dB(µV)	Margin, dB		
0.15 -30	All measured emissions were found at least 20 dB below class A limit							L1	Pass
0.15 -30	All measured emissions were found at least 20 dB below class A limit							L2	Pass

EUT OPERATING MODE: Receive (2.44 GHz)

Frequency, MHz	Peak emission, dB(µV)	Quasi-peak			Average			Line ID	Verdict
		Measured emission, dB(µV)	Limit, dB(µV)	Margin, dB*	Measured emission, dB(µV)	Limit, dB(µV)	Margin, dB		
0.15 -30	All measured emissions were found at least 20 dB below class A limit							L1	Pass
0.15 -30	All measured emissions were found at least 20 dB below class A limit							L2	Pass

EUT OPERATING MODE: Receive (915 MHz)

Frequency, MHz	Peak emission, dB(µV)	Quasi-peak			Average			Line ID	Verdict
		Measured emission, dB(µV)	Limit, dB(µV)	Margin, dB*	Measured emission, dB(µV)	Limit, dB(µV)	Margin, dB		
0.15 -30	All measured emissions were found at least 20 dB below class A limit							L1	Pass
0.15 -30	All measured emissions were found at least 20 dB below class A limit							L2	Pass

Reference numbers of test equipment used

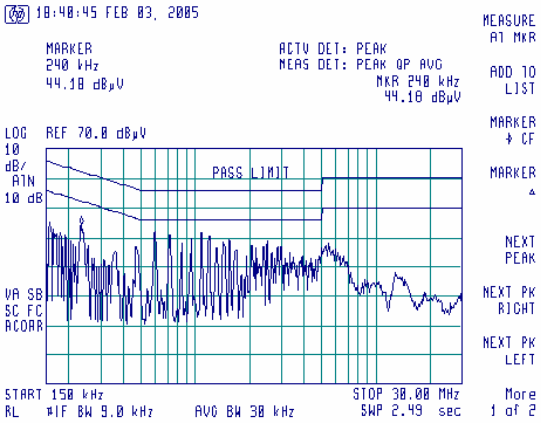
HL 0163	HL 0787	HL 1430	HL 1502	HL 1510			

Full description is given in Appendix A.

Test specification:	Section 15.107, Conducted emission at AC power port		
Test procedure:	ANSI C63.4, Sections 11.5 and 12.1.3		
Test mode:	Compliance	Verdict:	PASS
Date & Time:	2/7/2005 5:54:54 PM		
Temperature: 22 ºC	Air Pressure: 1017 hPa	Relative Humidity: 36 %	Power Supply: 120 VAC
Remarks: final layout			

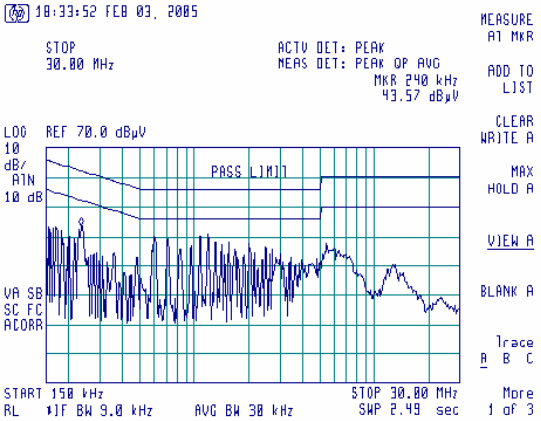
Plot 9.1.1 Conducted emission measurements

LINE:	L1
LIMIT:	Class B
EUT OPERATING MODE:	Receive (2.44 GHz)
LIMIT:	QUASI-PEAK, AVERAGE
DETECTOR:	PEAK



Plot 9.1.2 Conducted emission measurements

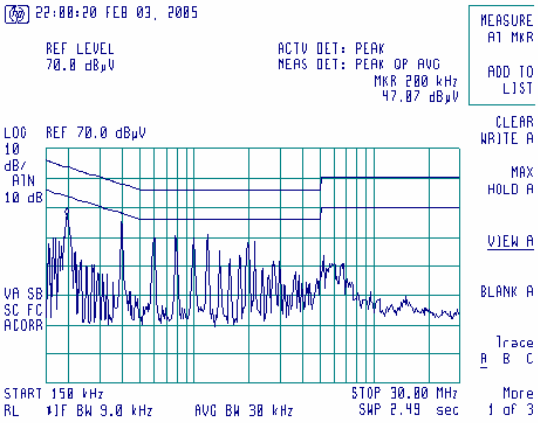
LINE:	L2
LIMIT:	Class B
EUT OPERATING MODE:	Receive (2.44 GHz)
LIMIT:	QUASI-PEAK, AVERAGE
DETECTOR:	PEAK



Test specification:	Section 15.107, Conducted emission at AC power port		
Test procedure:	ANSI C63.4, Sections 11.5 and 12.1.3		
Test mode:	Compliance	Verdict:	PASS
Date & Time:	2/7/2005 5:54:54 PM		
Temperature: 22 ºC	Air Pressure: 1017 hPa	Relative Humidity: 36 %	Power Supply: 120 VAC
Remarks: final layout			

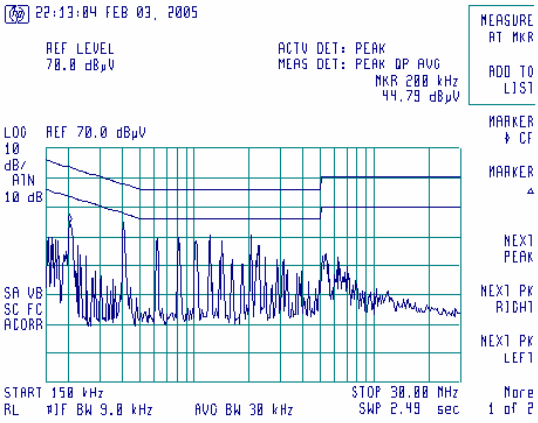
Plot 9.1.3 Conducted emission measurements

LINE:	L1
LIMIT:	Class B
EUT OPERATING MODE:	Receive (915 MHz)
LIMIT:	QUASI-PEAK, AVERAGE
DETECTOR:	PEAK



Plot 9.1.4 Conducted emission measurements

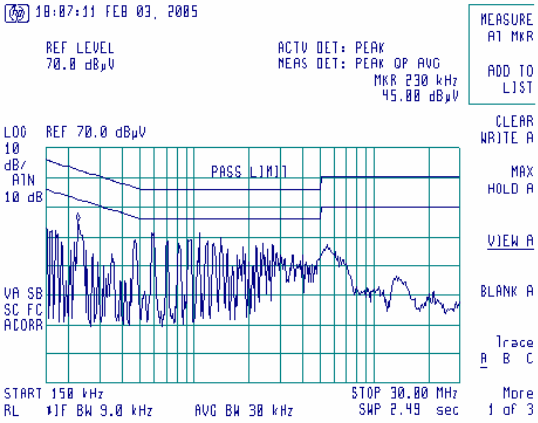
LINE:	L2
LIMIT:	Class B
EUT OPERATING MODE:	Receive (915 MHz)
LIMIT:	QUASI-PEAK, AVERAGE
DETECTOR:	PEAK



Test specification:	**Section 15.107, Conducted emission at AC power port**		
Test procedure:	ANSI C63.4, Sections 11.5 and 12.1.3		
Test mode:	Compliance	**Verdict:**	PASS
Date & Time:	2/7/2005 5:54:54 PM		
Temperature: 22 ºC	**Air Pressure:** 1017 hPa	**Relative Humidity:** 36 %	**Power Supply:** 120 VAC
Remarks: final layout			

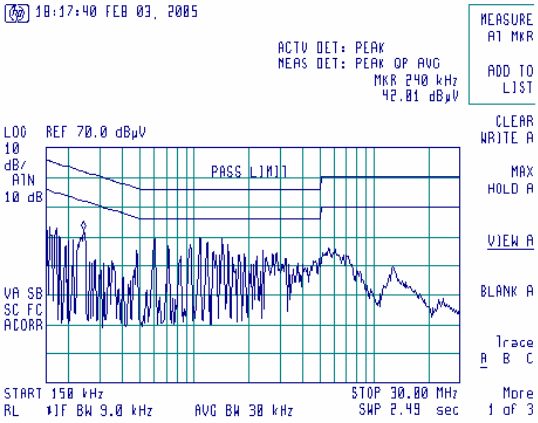
Plot 9.1.5 Conducted emission measurements

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



Plot 9.1.6 Conducted emission measurements

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



Test specification:	**Section 15.109, Radiated emission**		
Test procedure:	ANSI C63.4, Sections 11.6 and 12.1.4		
Test mode:	Compliance	**Verdict:**	PASS
Date & Time:	2/7/2005 9:03:32 AM		
Temperature: 23 ºC	**Air Pressure:** 1012 hPa	**Relative Humidity:** 40 %	**Power Supply:** 230 VAC
Remarks: new layout			

9.2 Radiated emission measurements

9.2.1 General

This test was performed to measure radiated emissions from the EUT enclosure. Specification test limits are given in Table 9.2.1.

Table 9.2.1 Radiated emission test limits

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

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

9.2.2 Test procedure for measurements in semi-anechoic chamber

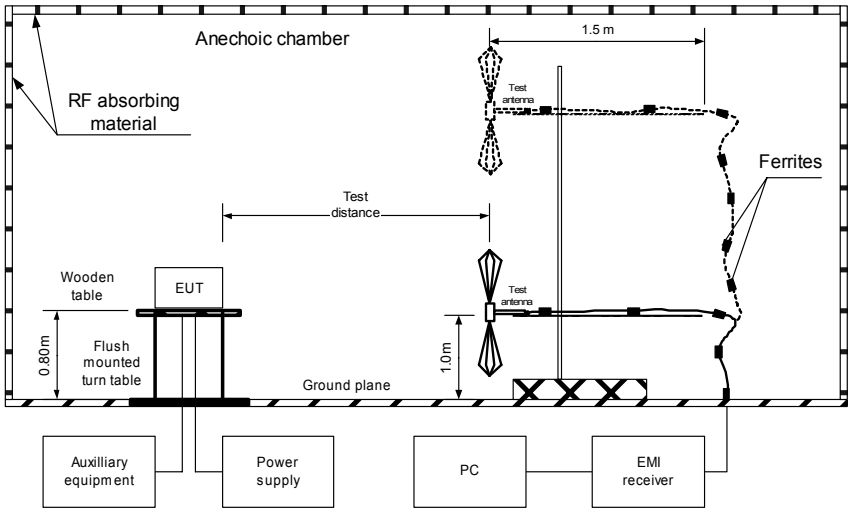
9.2.2.1 The EUT was set up as shown in Figure 9.2.1 and associated photograph/s, energized and the performance check was conducted.

9.2.2.2 The specified frequency range was investigated with biconilog antenna connected to EMI receiver. To find maximum radiation the turntable was rotated 360^0, the measuring antenna height was changed from 1 to 4 m, its polarization was switched from vertical to horizontal and the EUT cables position was varied.

9.2.2.3 The worst test results (the lowest margins) were recorded in Table 9.2.2 and shown in the associated plots.

Test specification:	**Section 15.109, Radiated emission**		
Test procedure:	ANSI C63.4, Sections 11.6 and 12.1.4		
Test mode:	Compliance	**Verdict:**	PASS
Date & Time:	2/7/2005 9:03:32 AM		
Temperature: 23 ºC	**Air Pressure:** 1012 hPa	**Relative Humidity:** 40 %	**Power Supply:** 230 VAC
Remarks: new layout			

Figure 9.2.1 Setup for radiated emission measurements in anechoic chamber, table-top equipment



Test specification:	**Section 15.109, Radiated emission**		
Test procedure:	ANSI C63.4, Sections 11.6 and 12.1.4		
Test mode:	Compliance	**Verdict:**	PASS
Date & Time:	2/7/2005 9:03:32 AM		
Temperature: 23 ºC	**Air Pressure:** 1012 hPa	**Relative Humidity:** 40 %	**Power Supply:** 230 VAC
Remarks: new layout			

Table 9.2.2 Radiated emission test results

EUT SET UP: TABLE-TOP
LIMIT: Class A
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*				
40.274940	31.33	28.72	49.50	-20.78	V	1.0	168	Pass
129.026275	33.83	30.89	54.00	-23.11	V	1.0	178	
597.205150	36.16	34.19	56.90	-22.71	V	1.6	10	

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

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

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

Reference numbers of test equipment used

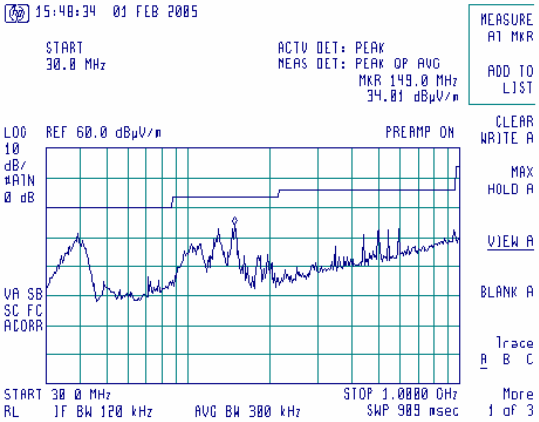
HL 0521	HL 0589	HL 0592	HL 0593	HL 0594	HL 0604	HL 1004	HL 1947
HL 1984	HL 2009						

Full description is given in Appendix A.

Test specification:	**Section 15.109, Radiated emission**		
Test procedure:	ANSI C63.4, Sections 11.6 and 12.1.4		
Test mode:	Compliance	**Verdict:**	PASS
Date & Time:	2/7/2005 9:03:32 AM		
Temperature: 23 ºC	**Air Pressure:** 1012 hPa	**Relative Humidity:** 40 %	**Power Supply:** 230 VAC
Remarks: new layout			

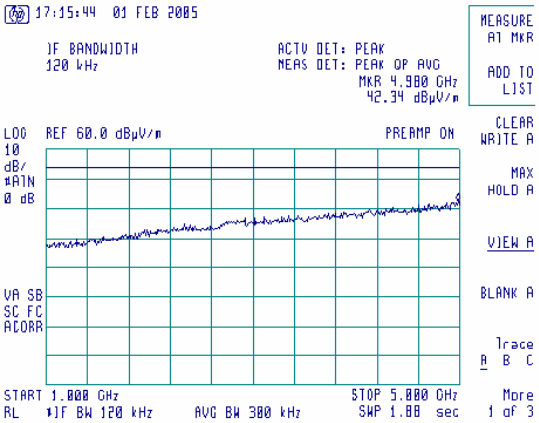
Plot 9.2.1 Radiated emission measurements in 30- 1000 MHz range, vertical and horizontal antenna polarization

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



Plot 9.2.2 Radiated emission measurements above 1000 MHz, vertical and horizontal antenna polarization

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



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	10-Jan-05	10-Jan-06
0163	LISN FCC/VDE/MIL-STD	Electro-Metrics	ANS 25/2	1314	01-Oct-04	01-Oct-05
0278	Thermometer, -200 - +760C	Fluke	51K/J	5045468	28-Apr-04	28-Apr-05
0337	Probe Set, Hand held, 5 probes	Electro-Metrics	EHFP-30	238	12-Jun-04	12-Jun-05
0410	Cable, Coax, Microwave, DC-18 GHz, N-N, 1 m	Gore	PFP01P0 1039.4	9338767	17-Oct-04	17-Oct-05
0446	Antenna, Loop active, 10kHz-30MHz	EMCO	6502	2857	28-Jun-04	28-Jun-05
0466	Shielded Room 3(L) x 3(W) x 2,4(H) m	HL	SR - 1	024	11-Nov-04	11-Nov-05
0493	Oven temperature -45…175 deg C	Thermotron	S-1.2 Mini-Max	14016	11-Nov-04	11-Nov-05
0521	EMI Receiver (Spectrum Analyzer) with RF filter section 9 kHz-6.5 GHz	Hewlett Packard	8546A	3617A 00319, 3448A002 53	11-Nov-04	11-Nov-05
0589	Cable Coaxial, GORE A2P01POL118, 2.3 m	HL	GORE-3	176	02-Dec-04	02-Dec-05
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
0644	Probe current, 20 Hz - 100 MHz	Solar Electronics	6741-1	874916	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
0787	Transient Limiter	Hewlett Packard	11947A	3107A018 77	27-Jan-05	27-Jan-06
0808	Analyzer Spectrum 100 Hz to 2.2 GHz	Anritsu	MS2601B	M178731	27-Jan-05	27-Jan-06
1004	Cable Coaxial , ANDREW PSWJ4 , 6m	HL	ANDREW -6	163	27-Jan-05	27-Jan-06
1097	Attenuator, 50 Ohm, 5 W, DC to 8 GHz, 20 dB	Midwest Microwave	0793-20-NN-07	1097	27-Jan-05	27-Jan-06
1424	Spectrum Analyzer, 30 Hz- 40 GHz	Agilent Technologies (HP)	8564EC	3946A002 19	27-Jan-05	27-Jan-06
1425	EMI Receiver, 9 kHz - 2.9 GHz, System: HL1426, HL1427	Agilent Technologies (HP)	8542E	3710A002 22, 3705A002 04	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
1499	Cable RF, 20 m	Suhner Switzerland	RG 214/U	1499	23-Sep-04	23-Sep-05
1502	Cable RF, 6 m	Belden	M17/167 MIL-C-17	1502	12-Feb-05	12-Feb-06
1510	Cable RF, 8 m	Belden	M17/167 MIL-C-17	1510	02-Dec-04	02-Dec-05

HL No	Description	Manufacturer	Model	Ser. No.	Last Cal.	Due Cal.
1512	Cable RF, 8 m	Belden	M17/167 MIL-C-17	1512	02-Dec-04	02-Dec-05
1545	Cable RF	Alpha Wire	RG-214/U		02-Dec-04	02-Dec-05
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
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	23-Sep-04	23-Sep-05
2004	Cable RF, 3 m	Alpha Wire	RG 58	2004	23-Sep-04	23-Sep-05
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
2384	Oven, +25…+90 degC, 10…98% RH	Weiss Umwelttechnik	T130	222/16713	05-Nov-04	05-Nov-05
2400	Cable 40GHz, 1.5 m, green	Rhophase Microwave Limited	KPS-1503A-1500-KPS	X2946	24-Jun-04	24-Jun-05

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: ± 1.7 dB 12.4 GHz to 40 GHz: ± 2.3 dB
Conducted emissions at RF antenna connector	9 kHz to 2.9 GHz: ± 2.6 dB 2.9 GHz to 6.46 GHz: ± 3.5 dB 6.46 GHz to 13.2 GHz: ± 4.3 dB 13.2 GHz to 22.0 GHz: ± 5.0 dB 22.0 GHz to 26.8 GHz: ± 5.5 dB 26.8 GHz to 40.0 GHz: ± 4.8 dB
Occupied bandwidth	± 8.0 %
Duty cycle, timing (Tx ON / OFF) and average factor measurements	± 1.0 %
Conducted emissions with LISN	9 kHz to 150 kHz: ± 3.9 dB 150 kHz to 30 MHz: ± 3.8 dB
Radiated emissions at 3 m measuring distance Horizontal polarization Vertical polarization	 Biconilog antenna: ± 5.3 dB Biconical antenna: ± 5.0 dB Log periodic antenna: ± 5.3 dB Double ridged horn antenna: ± 5.3 dB Biconilog antenna: ± 6.0 dB Biconical antenna: ± 5.7 dB Log periodic antenna: ± 6.0 dB Double ridged horn antenna: ± 6.0 dB

The test equipment has been calibrated according to its recommended procedures and is within the manufacturer's published limit of error. The standards and instruments used in the calibration system conform to the present requirements of ISO/IEC 17025 (or alternately ANSI/NCSL Z540-1).
The laboratory calibrates its measurement standards by a third party (traceable to NIST, USA) on a regular basis according to equipment manufacturer requirements. The Hermon Labs EMC measurements uncertainty is given in the table above.

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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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: 2001	American National Standard for Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz.
ANSI/TIA/EIA-603-A:2001	Land Mobile FM or PM Communications Equipment Measurement and Performance Standards

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(μV)	decibel referred to one microvolt
dB(μV/m)	decibel referred to one microvolt per meter
dB(μA)	decibel referred to one microampere
dBΩ	decibel referred to one Ohm
DC	direct current
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
μs	microsecond
NA	not applicable
NT	not tested
OATS	open area test site
Ω	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

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

Frequency, MHz	Correction factor, dB	Frequency, MHz	Correction factor, dB
0.01	4.7	3.0	0.1
0.02	2.1	4.0	0.1
0.03	1.1	5.0	0.1
0.04	0.7	6.0	0.1
0.05	0.5	10.0	0.1
0.1	0.2	12.0	0.1
0.2	0.1	16.0	0.1
0.4	0.1	18.0	0.1
0.6	0.1	20.0	0.1
0.8	0.1	25.0	0.1
1.0	0.1	28.0	0.1
2.0	0.1	30.0	0.1

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

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

Frequency, MHz	Magnetic Antenna Factor, dB(S/m)	Electric Antenna Factor, dB(1/m)
0.009	-32.8	18.7
0.010	-33.8	17.7
0.020	-38.3	13.2
0.050	-41.1	10.4
0.075	-41.3	10.2
0.100	-41.6	9.9
0.150	-41.7	9.8
0.250	-41.6	9.9
0.500	-41.8	9.7
0.750	-41.9	9.6
1.000	-41.4	10.1
2.000	-41.5	10.0
3.000	-41.4	10.1
4.000	-41.4	10.1
5.000	-41.5	10.0
10.000	-41.9	9.6
15.000	-41.9	9.6
20.000	-42.2	9.3
25.000	-42.8	8.7
30.000	-44.0	7.5

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

Antenna factor

Biconilog antenna EMCO, model 3141, serial number 1011

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

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

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

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

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

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, 6 m, model: M17/167 MIL-C-17, HL 1502

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

Cable loss
Cable M17/167 MIL-C-17, HL 1510

No.	Frequency, MHz	Cable loss, dB
1	0.1	0.05
2	1	0.09
3	3	0.16
4	5	0.18
5	10	0.27
6	30	0.44
7	50	0.58
8	80	0.69
9	100	0.82
10	300	1.48
11	500	2.01
12	800	2.65
13	1000	3.12

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

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

Cable loss
Cable 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