HERMON LABORATORIES

839.01
Electrical

Hermon Laboratories Ltd.
P.O.Box 23, Binyamina 30500, Israel
Tel. +972 4628 8001
Fax. +972 4628 8277
E-mail: mail@hermonlabs.com

TEST REPORT

ACCORDING TO: FCC part 15 subpart E and subpart B

FOR:

Airspan Networks (Israel) Ltd.

Terminal station

Model: ProST 5.6 GHz TDD Int.

Table of contents

1 Applicant information

Client name:	Airspan Networks (Israel) Ltd.
Address:	1, Harava street, "Unitronics" building, POB 199, Airport City, 70100, Israel
Telephone:	+972 3977 7444
Fax:	+972 3977 7400
E-mail:	zlevi@Airspan.com
Contact name:	Mr. Zion Levi

2 Equipment under test attributes

Product name:	Terminal station
Product type:	Transceiver
Model(s):	ProST 5.6 GHz TDD Int.
Serial number:	893F72C24C98
Software release:	6.0.24.0
Hardware version:	G1
Receipt date	9/4/2007

3 Manufacturer information

Manufacturer name:	Airspan Networks (Israel) Ltd.
Address:	1, Harava street, "Unitronics" building, POB 199, Airport City, 70100, Israel
Telephone:	+972 3977 7444
Fax:	+972 3977 7400
E-Mail:	zlevi@Airspan.com
Contact name:	Mr. Zion Levi

4 Test details

Project ID:	18175
Location:	Hermon Laboratories Ltd. P.O.Box 23, Binyamina 30500, Israel
Test started:	9/4/2007
Test completed:	10/11/2007
Test specification(s):	FCC part 15 subpart E and subpart B

5 Tests summary

Test	Status
Transmitter characteristics	
Section 15.407(a)(3), Occupied 26 dB bandwidth	Pass
Section 15.407(a)(3), Maximum peak output power	Pass
Section 15.407(a)(3), Peak power spectral density	Pass
Section 15.407(a)(6), Ratio of the peak excursion of the modulation envelope to the peak transmit power	Pass
Section 15.407(b), Unwanted radiated emission	Pass
Section 15.407(b)(6), 15.207, Conducted emission	Pass
Section 15.407(f), RF exposure	Provided in documentation for Application
Section 15.407(g), Frequency stability	Pass
Unintentional emissions	
Section 15.107 Class B, AC power lines conducted emissions	Pass
Section 15.109 Class B, Radiated emissions	Pass
Section 15.111, Spurious emissions at RF antenna connector	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.

	Name and Title	Date	Signature
Tested by:	Mr. A. Lane, test engineer	October 11, 2007	
Reviewed by:	Mrs. M. Cherniavsky, certification engineer	October 16, 2007	
Approved by:	Mr. M. Nikishin, EMC and radio group leader	October 17, 2007	

6 EUT description

6.1 General information

The EUT, subscriber premises radio, ProST 5.6GHz TDD Int., is part of a WiMAX broadband fixed cellular wireless access system. The system provides a radio link between an end-user (a subscriber) and a network to give high-speed data access. The ProST's transceiver/receiver (up to 64QAM modulation, data rate up to 37 Mbps) uses OFDM and operating in TDD duplexing mode.

6.2 Ports and lines

Port type	Port description	Connected		Connector type	Qty.	Cable type	Cable length
		From	To				
Signal	48 V DC& Ethernet	EUT	SDA	D-type 15 pin	1	unshielded	10 m
Signal	RS232	EUT	Laptop	D-type 9 pin	1	unshielded	0.2 m
RF	Antenna	EUT	50 Ohm termination	N-type	1	NA	NA

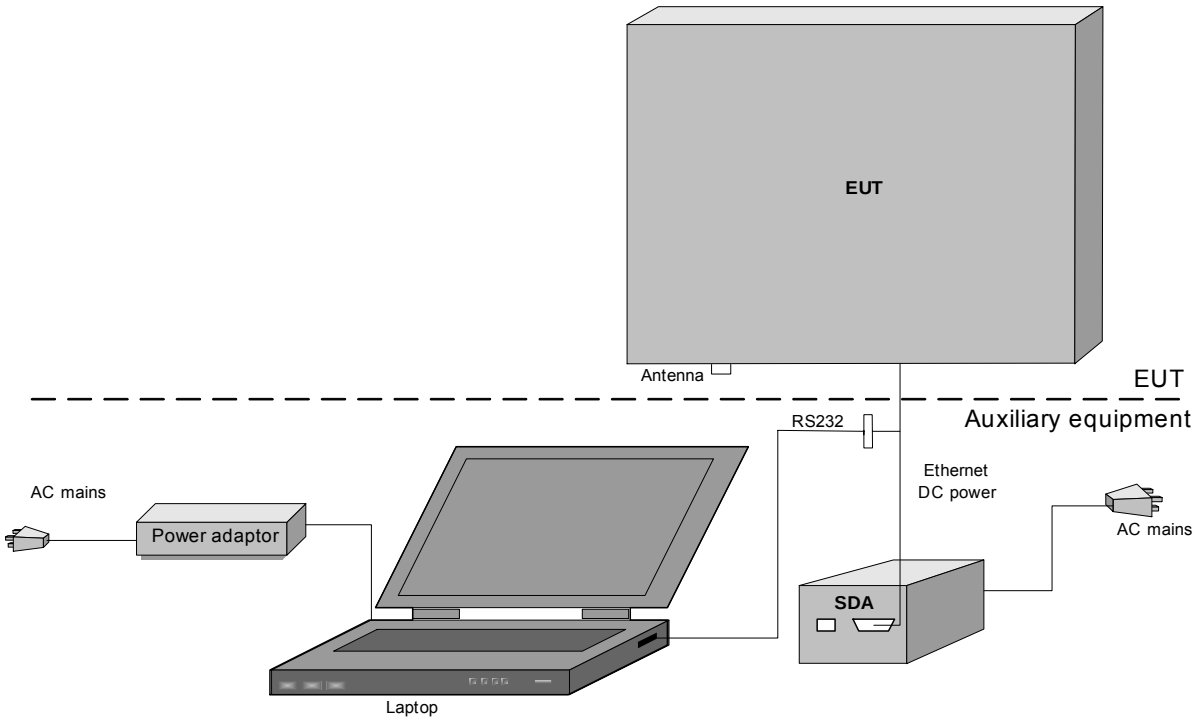
6.3 Support and test equipment

Description	Manufacturer	Model number	Serial number
SDA	Airspan	SDA-1	045D3C0199
Laptop	Dell	Ppx	48985
Adapter to laptop	Dell	AA20031	93640
Mouse	Microsoft	PS/2	X04-72169

6.4 Changes made in the EUT

No changes were implemented.

6.5 Test configuration



6.6 Transmitter characteristics

Type of equipment								
V	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**						
V	fixed	Always at a distance more than 2 m from all people						
	mobile	Always at a distance more than 20 cm from all people						
	portable	May operate at a distance closer than 20 cm to human body						
Assigned frequency range		5470 - 5725 MHz						
Operating frequency range		5485 – 5712.5 MHz						
RF channel spacing		10 MHz						
Rated output power		At transmitter 50 Ω RF output connector					9.1 dBm	
Is transmitter output power variable?			No					
		V	Yes		continuous variable			
				V	stepped variable with stepsize		1 dB	
				minimum RF power			-30 dBm	
				maximum RF power			9.1 dBm	
Antenna connection								
unique coupling		standard connector		**V**	Integral	**V**	with temporary RF connector	
							without temporary RF connector	
Antenna/s technical characteristics								
Type		Manufacturer		Model number		Gain		
Integral		MTI Wireless Edge Ltd.		MT-464008/MV		17.5 dBi		
Transmitter 99% power bandwidth		10 MHz						
Type of modulation		BPSK, 64QAM						
Type of multiplexing		TDMA						
Modulating test signal (baseband)		WiMAX						
Maximum transmitter duty cycle in normal use		100%						
Transmitter power source								
		Nominal rated voltage			Battery type			
V	DC	**Nominal rated voltage**	48 VDC from SDA unit powered by 120 VAC					
	AC mains	**Nominal rated voltage**			Frequency	Hz		
Common power source for transmitter and receiver			**V**	yes		no		

Test specification:	Section 15.407(a)(3), 26 dB bandwidth		
Test procedure:	FCC Public Notice DA 02-2138, Appendix A		
Test mode:	Compliance	Verdict:	PASS
Date:	9/25/2007		
Temperature: 26 ºC	Air Pressure: 1012 hPa	Relative Humidity: 46 %	Power Supply: 120 VAC
Remarks:			

7 Transmitter tests according to 47CFR part 15 subpart E requirements

7.1 Occupied 26 dB bandwidth

7.1.1 General

This test was performed to measure the 26 dB bandwidth of the device.

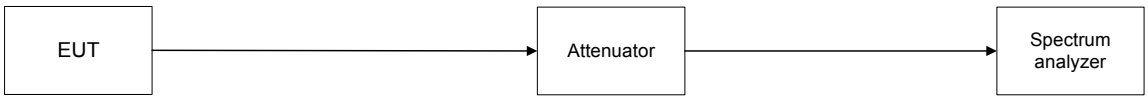
7.1.2 Test procedure

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 at maximum data rate.

7.1.2.3 The measurements were performed in continuous transmission mode of operation for carrier (channel) frequencies at low and high edges and at the middle of the frequency range shown in Table 7.1.1. The transmitter bandwidth was measured with spectrum analyzer as frequency delta between reference points on modulation envelope and provided in Table 7.1.1 and associated plots.

Figure 7.1.1 The 26 dB bandwidth test setup



Test specification:	**Section 15.407(a)(3), 26 dB bandwidth**		
Test procedure:	FCC Public Notice DA 02-2138, Appendix A		
Test mode:	Compliance	**Verdict:**	PASS
Date:	9/25/2007		
Temperature: 26 ºC	**Air Pressure:** 1012 hPa	**Relative Humidity:** 46 %	**Power Supply:** 120 VAC
Remarks:			

Table 7.1.1 The 26 dB bandwidth test results

ASSIGNED FREQUENCY RANGE: 5470- 5725 MHz
DETECTOR USED: Peak
RESOLUTION BANDWIDTH: 100 kHz
VIDEO BANDWIDTH: ≥ RBW
MODULATION SIGNAL: Digital

Carrier Frequency, GHz	26 dB bandwidth, MHz
Modulation: BPSK	
5485.0	9.80
5600.0	9.77
5712.5	9.80
Modulation: 64QAM	
5485.0	9.83
5600.0	9.80
5712.5	9.80

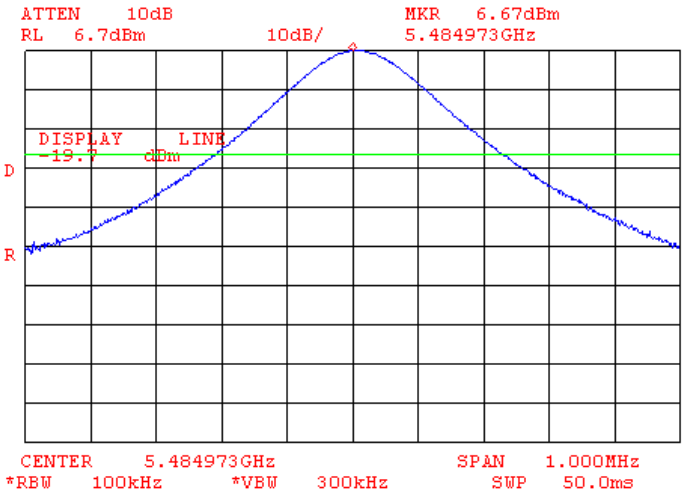
Reference numbers of test equipment used

HL 1424	HL 2524	HL 2952						

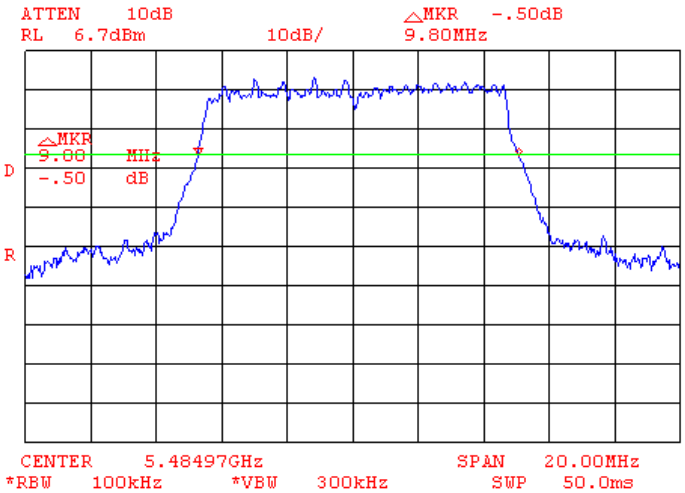
Full description is given in Appendix A.

Test specification:	Section 15.407(a)(3), 26 dB bandwidth		
Test procedure:	FCC Public Notice DA 02-2138, Appendix A		
Test mode:	Compliance	Verdict:	PASS
Date:	9/25/2007		
Temperature: 26 °C	Air Pressure: 1012 hPa	Relative Humidity: 46 %	Power Supply: 120 VAC
Remarks:			

Plot 7.1.1 Reference power level measurement at the low frequency carrier

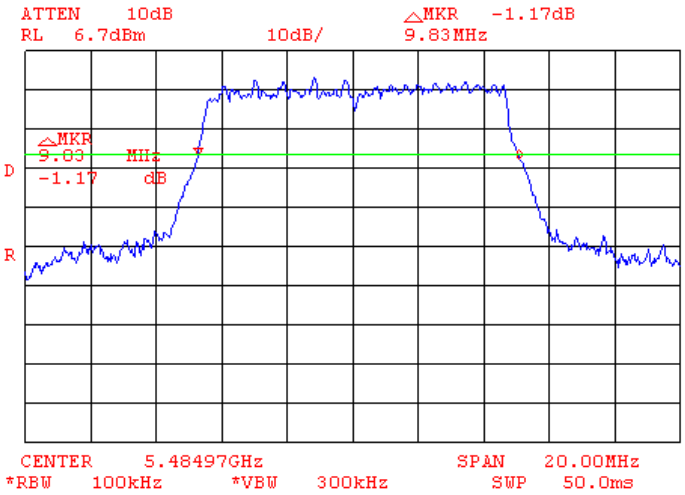


Plot 7.1.2 The 26 dB bandwidth test result at low frequency carrier, BPSK

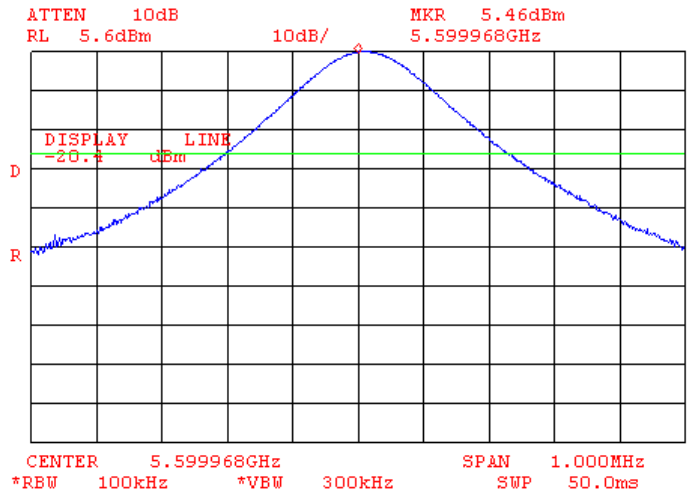


Test specification:	Section 15.407(a)(3), 26 dB bandwidth		
Test procedure:	FCC Public Notice DA 02-2138, Appendix A		
Test mode:	Compliance	Verdict:	PASS
Date:	9/25/2007		
Temperature: 26 °C	Air Pressure: 1012 hPa	Relative Humidity: 46 %	Power Supply: 120 VAC
Remarks:			

Plot 7.1.3 The 26 dB bandwidth test result at low frequency carrier, 64QAM

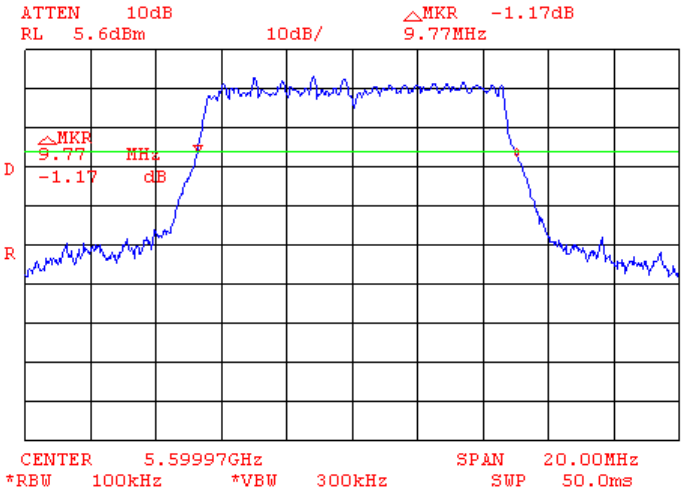


Plot 7.1.4 Reference power level measurement at mid frequency carrier

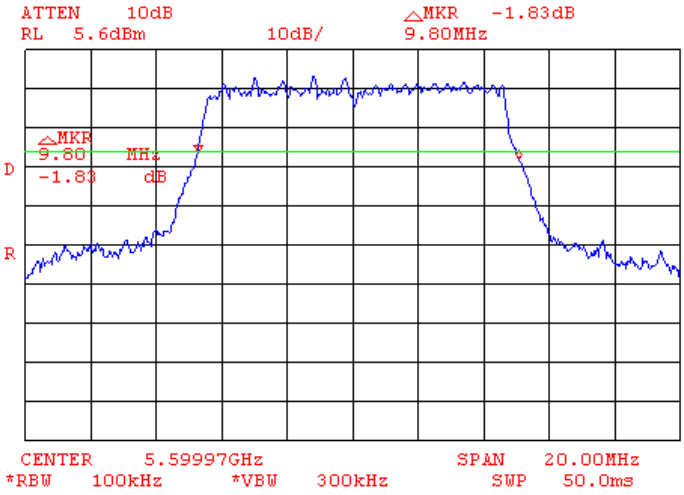


Test specification:	Section 15.407(a)(3), 26 dB bandwidth		
Test procedure:	FCC Public Notice DA 02-2138, Appendix A		
Test mode:	Compliance	Verdict:	PASS
Date:	9/25/2007		
Temperature: 26 °C	Air Pressure: 1012 hPa	Relative Humidity: 46 %	Power Supply: 120 VAC
Remarks:			

Plot 7.1.5 The 26 dB bandwidth test result at mid frequency carrier, BPSK

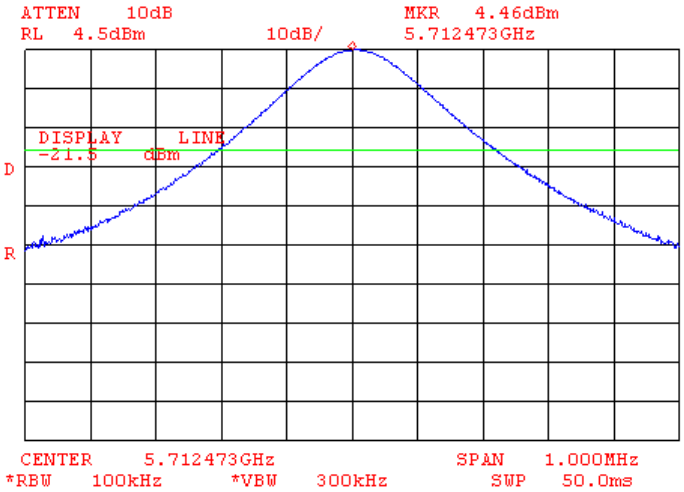


Plot 7.1.6 The 26 dB bandwidth test result at mid frequency carrier, 64QAM

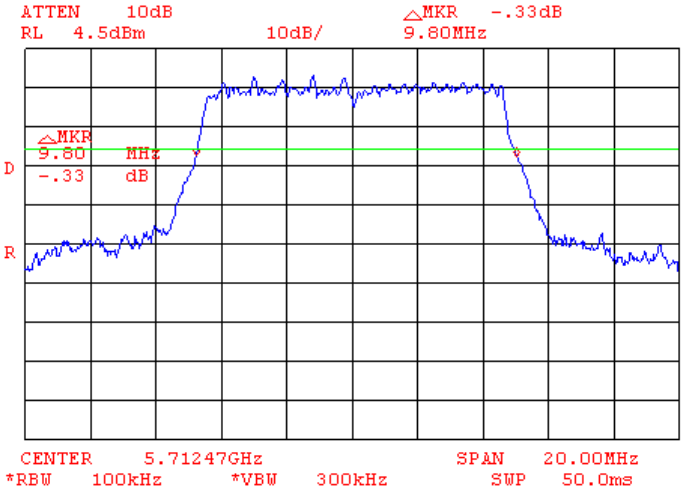


Test specification:	Section 15.407(a)(3), 26 dB bandwidth		
Test procedure:	FCC Public Notice DA 02-2138, Appendix A		
Test mode:	Compliance	Verdict:	PASS
Date:	9/25/2007		
Temperature: 26 °C	Air Pressure: 1012 hPa	Relative Humidity: 46 %	Power Supply: 120 VAC
Remarks:			

Plot 7.1.7 Reference power level measurement at high frequency carrier

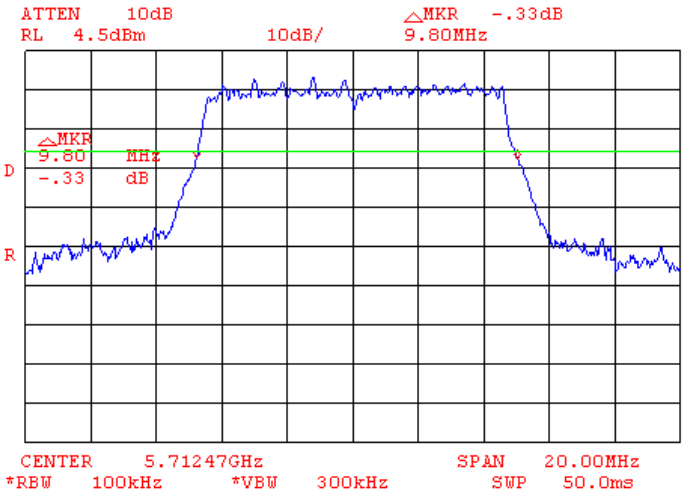


Plot 7.1.8 The 26 dB bandwidth test result at high frequency carrier, BPSK



Test specification:	Section 15.407(a)(3), 26 dB bandwidth		
Test procedure:	FCC Public Notice DA 02-2138, Appendix A		
Test mode:	Compliance	Verdict:	PASS
Date:	9/25/2007		
Temperature: 26 °C	Air Pressure: 1012 hPa	Relative Humidity: 46 %	Power Supply: 120 VAC
Remarks:			

Plot 7.1.9 The 26 dB bandwidth test result at high frequency carrier, 64QAM



Test specification:	Section 15.407(a)(1-3), Peak output power		
Test procedure:	FCC Public Notice DA 02-2138, Appendix A		
Test mode:	Compliance	Verdict:	PASS
Date:	9/25/2007		
Temperature: 26 ºC	Air Pressure: 1012 hPa	Relative Humidity: 46 %	Power Supply: 120 VAC
Remarks:			

7.2 Peak output power

7.2.1 General

This test was performed to measure the maximum peak output power at the transmitter RF antenna connector. Specification test limits are given in Table 7.2.1.

Table 7.2.1 Peak output power limits

Assigned frequency range, MHz	Maximum peak transmit power*	Used limit*, dBm
5470 - 5725	The lesser of 250 mW or 11 dBm +10 log B (B is the 26-dB emission bandwidth in MHz)	20.91 dBm

The maximum 26-dB emission bandwidth is 9.80 MHz, the limit is equal to:
11dBm + 10 log 9.80 = **20.91 dBm** (less than 250 mW = 24 dBm);
* Note 1: due to 17.5 dBi antenna gain the limits of peak output power shall be reduced by 11.5 dB.

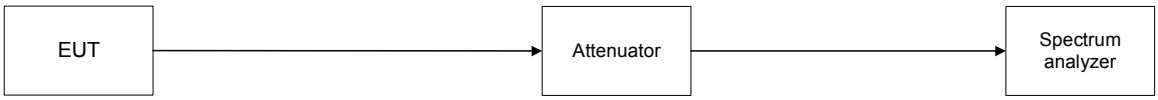
7.2.2 Test procedure

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 for end user RF output power.

7.2.2.3 The measurements were performed in continuous transmission mode of operation for carrier (channel) frequency at low, mid and high edges.

Figure 7.2.1 Peak output power test setup



Test specification:	Section 15.407(a)(1-3), Peak output power		
Test procedure:	FCC Public Notice DA 02-2138, Appendix A		
Test mode:	Compliance	Verdict:	PASS
Date:	9/25/2007		
Temperature: 26 ºC	Air Pressure: 1012 hPa	Relative Humidity: 46 %	Power Supply: 120 VAC
Remarks:			

Table 7.2.2 Peak output power test results

ASSIGNED FREQUENCY RANGE: 5470- 5725 MHz
DETECTOR USED: Sample
POWER WORD: 90
RBW: 1 MHz
VBW: 3 MHz

Frequency, GHz	Total power, dBm	Limit*, dBm	Margin, dB	Verdict
Modulation: BPSK				
5485.0	9.0	9.41	-0.41	Pass
5600.0	8.7	9.41	-0.71	Pass
5712.5	8.7	9.41	-0.71	Pass
Modulation: 64QAM				
5485.0	9.0	9.41	-0.41	Pass
5600.0	9.1	9.41	-0.30	Pass
5712.5	8.8	9.41	-0.61	Pass

* Note: due to 17.5 dBi antenna gain the limits of peak output power were reduced by 11.5 dB.

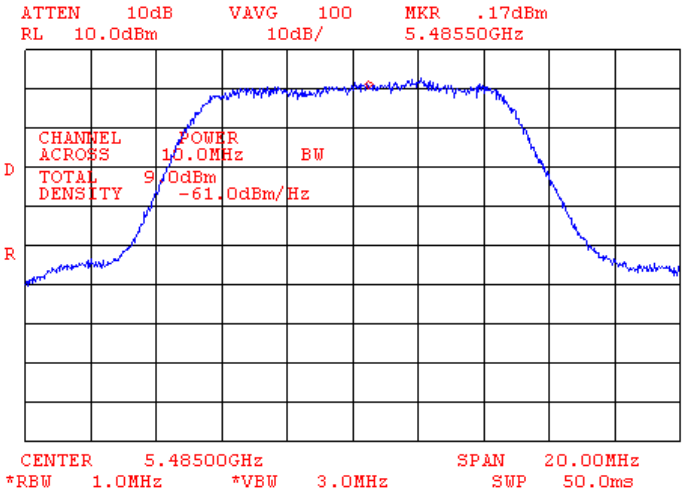
Reference numbers of test equipment used

HL 1424	HL 2524	HL 2925					

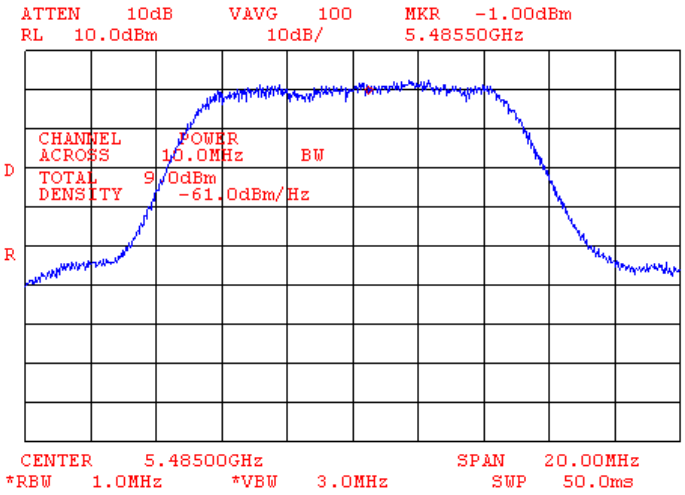
Full description is given in Appendix A.

Test specification:	Section 15.407(a)(1-3), Peak output power		
Test procedure:	FCC Public Notice DA 02-2138, Appendix A		
Test mode:	Compliance	Verdict:	PASS
Date:	9/25/2007		
Temperature: 26 °C	Air Pressure: 1012 hPa	Relative Humidity: 46 %	Power Supply: 120 VAC
Remarks:			

Plot 7.2.1 Peak output power at the low frequency, BPSK

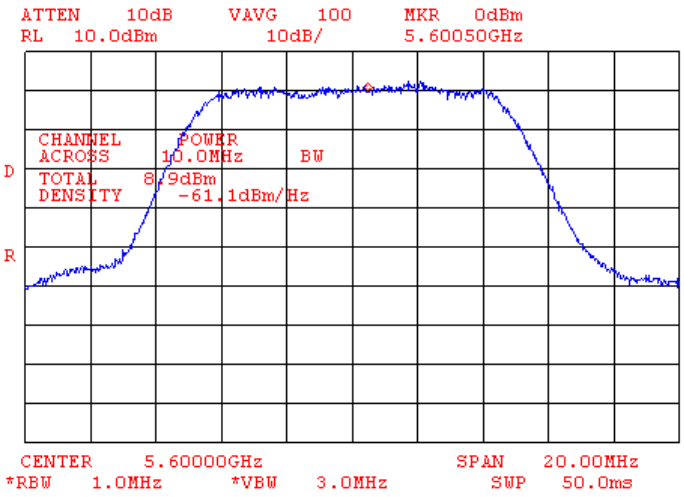


Plot 7.2.2 Peak output power at low frequency, 64QAM

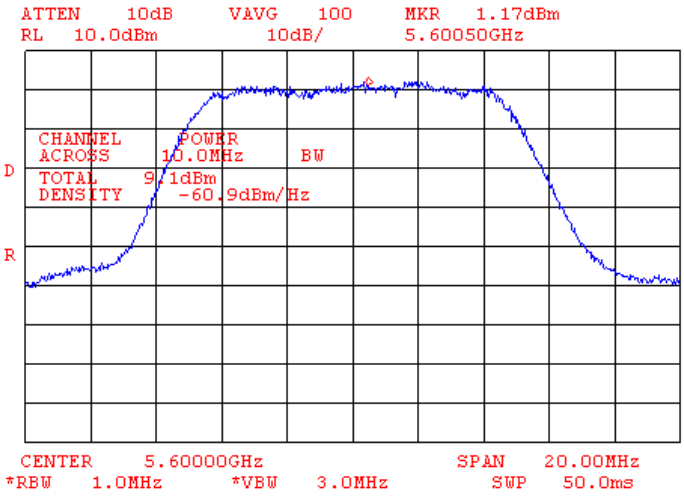


Test specification:	Section 15.407(a)(1-3), Peak output power		
Test procedure:	FCC Public Notice DA 02-2138, Appendix A		
Test mode:	Compliance	Verdict:	PASS
Date:	9/25/2007		
Temperature: 26 °C	Air Pressure: 1012 hPa	Relative Humidity: 46 %	Power Supply: 120 VAC
Remarks:			

Plot 7.2.3 Peak power density at the mid frequency, BPSK

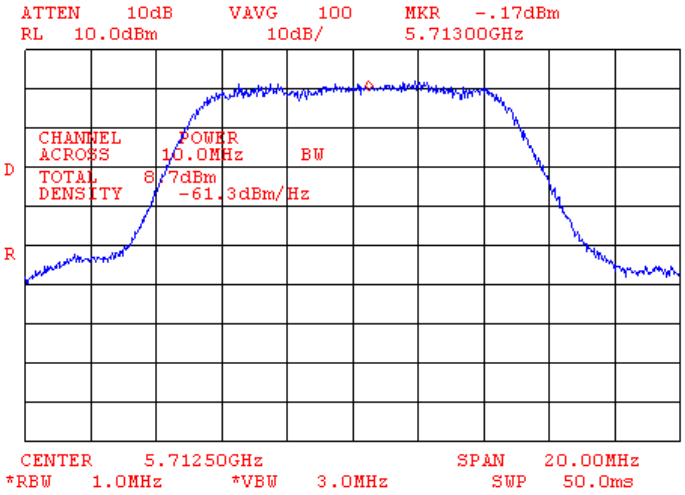


Plot 7.2.4 Peak power density at mid frequency, 64QAM

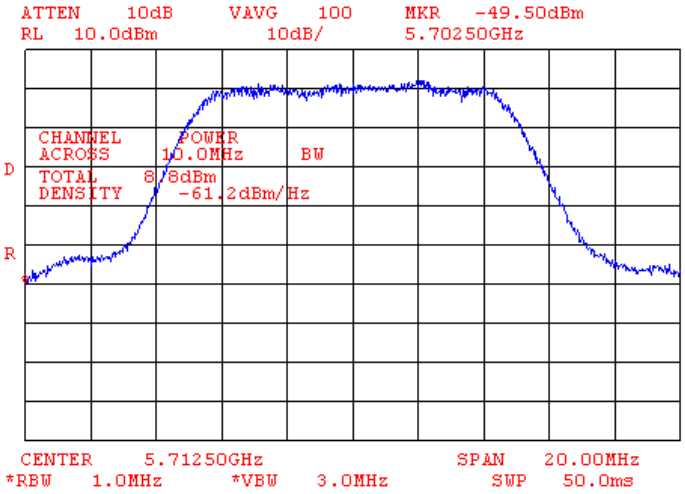


Test specification:	Section 15.407(a)(1-3), Peak output power		
Test procedure:	FCC Public Notice DA 02-2138, Appendix A		
Test mode:	Compliance	Verdict:	PASS
Date:	9/25/2007		
Temperature: 26 °C	Air Pressure: 1012 hPa	Relative Humidity: 46 %	Power Supply: 120 VAC
Remarks:			

Plot 7.2.5 Peak power density at the high frequency, BPSK



Plot 7.2.6 Peak power density at high frequency, 64QAM



Test specification:	Section 15. 407(a)(1-3), Peak power spectral density		
Test procedure:	FCC Public Notice DA 02-2138, Appendix A		
Test mode:	Compliance	Verdict:	PASS
Date:	9/25/2007		
Temperature: 26 ºC	Air Pressure: 1012 hPa	Relative Humidity: 46 %	Power Supply: 120 VAC
Remarks:			

7.3 Peak spectral power density

7.3.1 General

This test was performed to measure the peak spectral power density at the transmitter RF antenna connector. Specification test limits are given in Table 7.3.1.

Table 7.3.1 Peak spectral power density limits

Assigned frequency range, MHz	Measurement bandwidth, MHz	Peak spectral power density*, dBm
5470 - 5725	1.0	11.0

* Note 1: due to 17.5 dBi antenna gain the limits of peak power spectral density shall be reduced by 11.5 dB.

7.3.2 Test procedure

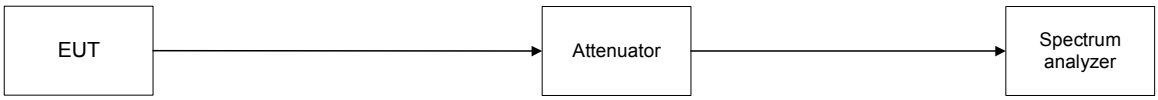
7.3.2.1 The EUT was set up as shown in Figure 7.3.1, energized and its proper operation was checked.

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

7.3.2.3 The measurements were performed in continuous transmission mode of operation for carrier (channel) frequency at low and high edges and at the middle of the frequency range.

7.3.2.4 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 7.3.2 and associated plots.

Figure 7.3.1 Peak spectral power density test setup



Test specification:	Section 15. 407(a)(1-3), Peak power spectral density		
Test procedure:	FCC Public Notice DA 02-2138, Appendix A		
Test mode:	Compliance	Verdict:	PASS
Date:	9/25/2007		
Temperature: 26 ºC	Air Pressure: 1012 hPa	Relative Humidity: 46 %	Power Supply: 120 VAC
Remarks:			

Table 7.3.2 Peak spectral power density test results

ASSIGNED FREQUENCY RANGE: 5470 - 5725 MHz
DETECTOR USED: Sample
RESOLUTION BANDWIDTH: 1 MHz
VIDEO BANDWIDTH: 3 MHz

Carrier frequency, MHz	Measured peak power spectral density, dBm/MHz**	Calculated limit*, dBm/MHz	Margin***, dB	Verdict
Modulation: BPSK				
5485.0	-1.0	-0.5	-0.5	Pass
5600.0	-1.1	-0.5	-0.6	Pass
5712.5	-1.3	-0.5	-0.8	Pass
Modulation: 64QAM				
5485.0	-1.0	-0.5	-0.5	Pass
5600.0	-0.9	-0.5	-0.4	Pass
5712.5	-1.2	-0.5	-0.7	Pass

* due to 17.5dBi antenna gain the limits of peak power spectral density were reduced by 11.5 dB;
** Measurement plots are in dBm/Hz, in order to convert to dBm/MHz a 60dB factor was added.
*** Margin = Peak power density – calculated limit.

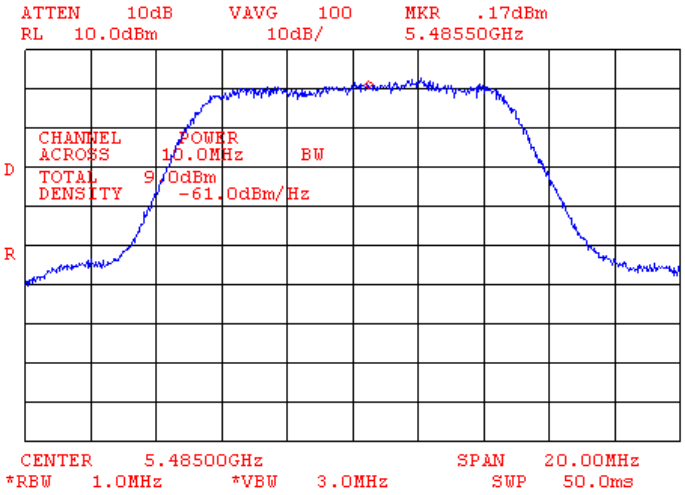
Reference numbers of test equipment used

HL 1424	HL 2524	HL 2952					

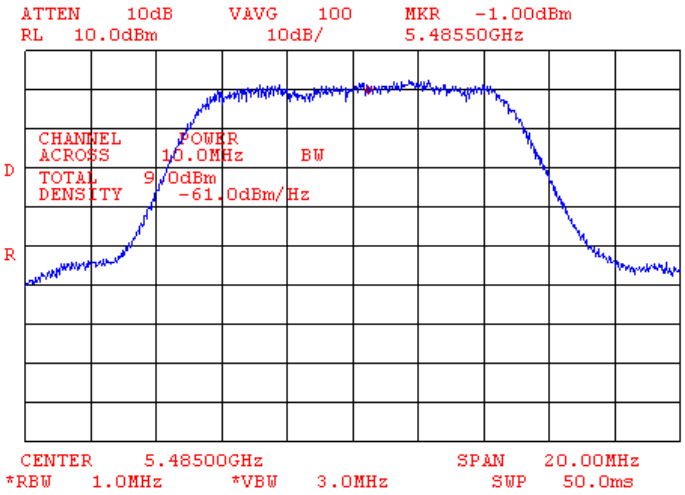
Full description is given in Appendix A.

Test specification:	Section 15. 407(a)(1-3), Peak power spectral density		
Test procedure:	FCC Public Notice DA 02-2138, Appendix A		
Test mode:	Compliance	Verdict:	PASS
Date:	9/25/2007		
Temperature: 26 ºC	Air Pressure: 1012 hPa	Relative Humidity: 46 %	Power Supply: 120 VAC
Remarks:			

Plot 7.3.1 Peak spectral power density at the low frequency, BPSK

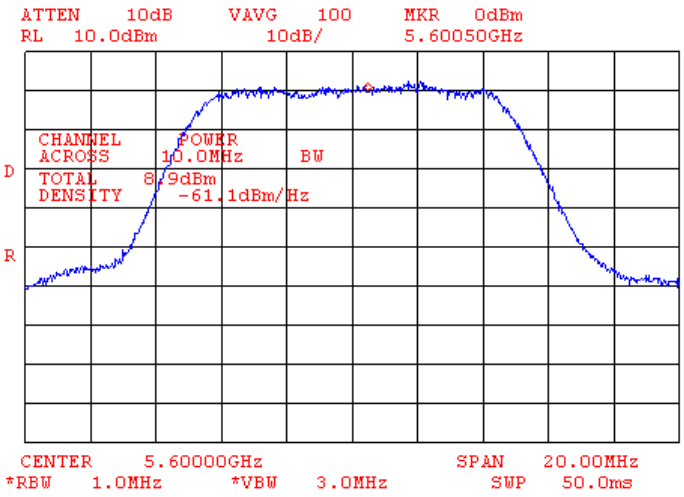


Plot 7.3.2 Peak spectral power density at low frequency, 64QAM

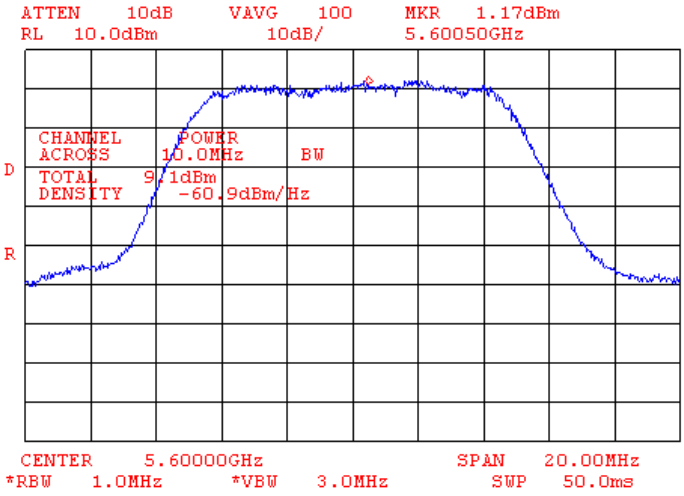


Test specification:	Section 15. 407(a)(1-3), Peak power spectral density		
Test procedure:	FCC Public Notice DA 02-2138, Appendix A		
Test mode:	Compliance	Verdict:	PASS
Date:	9/25/2007		
Temperature: 26 °C	Air Pressure: 1012 hPa	Relative Humidity: 46 %	Power Supply: 120 VAC
Remarks:			

Plot 7.3.3 Peak spectral power density at the mid frequency, BPSK

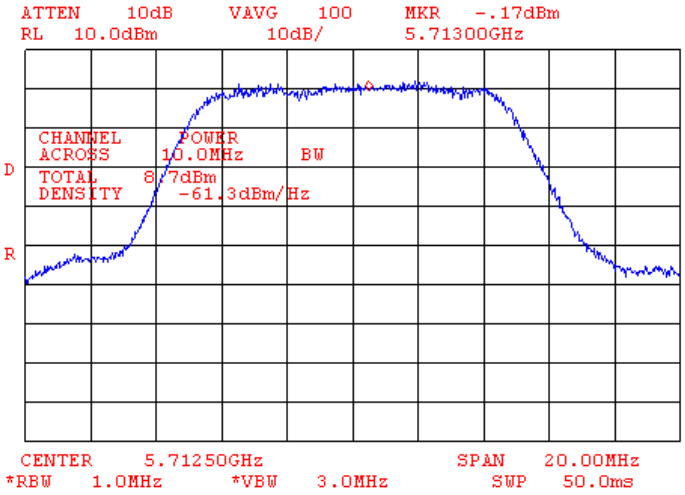


Plot 7.3.4 Peak spectral power density at mid frequency, 64QAM

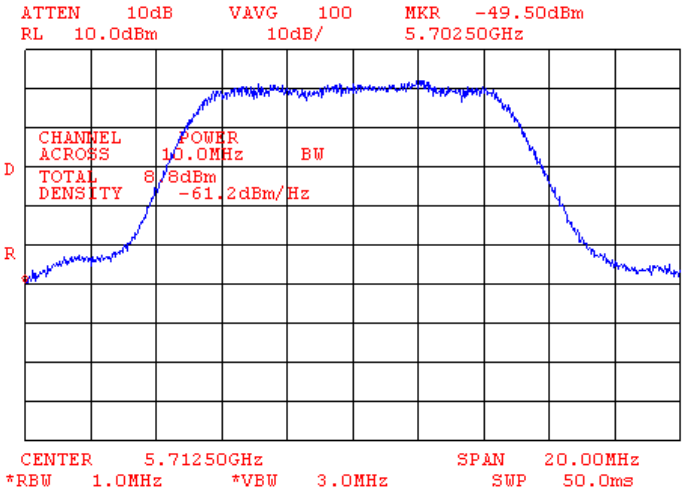


Test specification:	Section 15. 407(a)(1-3), Peak power spectral density		
Test procedure:	FCC Public Notice DA 02-2138, Appendix A		
Test mode:	Compliance	Verdict:	PASS
Date:	9/25/2007		
Temperature: 26 °C	Air Pressure: 1012 hPa	Relative Humidity: 46 %	Power Supply: 120 VAC
Remarks:			

Plot 7.3.5 Peak spectral power density at the high frequency, BPSK



Plot 7.3.6 Peak spectral power density at high frequency, 64QAM



Test specification:	Section 15.407(a)(6), Ratio of the peak excursion of the modulation envelope to the peak transmit power		
Test procedure:	FCC Public Notice DA 02-2138, Appendix A		
Test mode:	Compliance	Verdict:	PASS
Date:	9/25/2007		
Temperature: 26 ºC	Air Pressure: 1012 hPa	Relative Humidity: 46 %	Power Supply: 120 VAC
Remarks:			

7.4 Ratio of the peak excursion of the modulation envelope to the peak transmit power

7.4.1 General

This test was performed to measure the ratio of the peak excursion of the modulation envelope to the peak transmit power at RF antenna connector. Specification test limits are given in Table 7.4.1.

Table 7.4.1 Peak excursion limits

Assigned frequency, MHz	Maximum peak excursion, dB/MHz
5470 - 5750	13.0

7.4.2 Test procedure

7.4.2.1 The EUT was set up as shown in Figure 7.4.1, energized and its proper operation was checked.

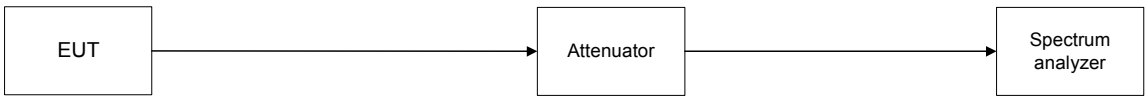
7.4.2.2 The EUT was adjusted to produce maximum available to end user RF output power.

7.4.2.3 The measurements were performed in continuous transmission mode of operation for carrier (channel) frequency at low and high edges and at the middle of the frequency range.

The maximum peak excursion of modulation envelope was measured as a difference between 2 traces.

7.4.2.4 The test results were recorded in Table 7.4.2 and shown in the associated plots.

Figure 7.4.1 Band edge emission test setup



Test specification:	**Section 15.407(a)(6), Ratio of the peak excursion of the modulation envelope to the peak transmit power**		
Test procedure:	FCC Public Notice DA 02-2138, Appendix A		
Test mode:	Compliance	**Verdict:**	PASS
Date:	9/25/2007		
Temperature: 26 ºC	**Air Pressure:** 1012 hPa	**Relative Humidity:** 46 %	**Power Supply:** 120 VAC
Remarks:			

Table 7.4.2 Peak excursion test results

ASSIGNED FREQUENCY RANGE: 5470 – 5725 MHz
DETECTOR USED: Peak hold/Sample
MODULATION TECHNIQUE:: Digital
TRANSMITTER OUTPUT POWER SETTINGS: Maximum
RESOLUTION BANDWIDTH: 1 MHz

Carrier frequency, MHz	Measured maximum peak excursion, dB	Limit, dB/MHz	Margin, dB	Verdict
Modulation: BPSK				
5485.0	11.50	13.0	-1.5	Pass
5600.0	12.50	13.0	-0.5	Pass
5712.5	10.00	13.0	-3.0	Pass
Modulation: 64QAM				
5485.0	11.17	13.0	-1.83	Pass
5600.0	10.34	13.0	-2.66	Pass
5712.5	10.84	13.0	-2.16	Pass

*****- Margin = Attenuation below carrier – specification limit.

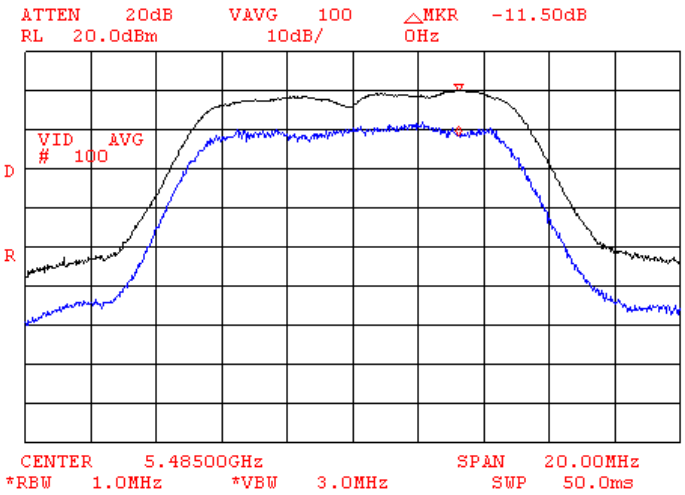
Reference numbers of test equipment used

HL 1424	HL 2524	HL 2925					

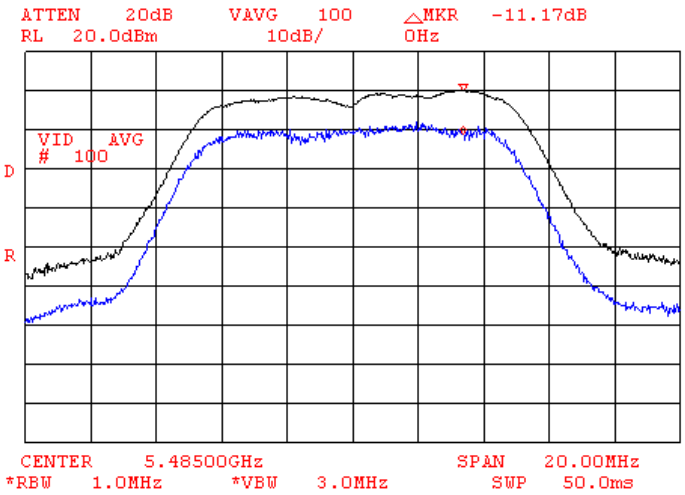
Full description is given in Appendix A.

Test specification:	Section 15.407(a)(6), Ratio of the peak excursion of the modulation envelope to the peak transmit power		
Test procedure:	FCC Public Notice DA 02-2138, Appendix A		
Test mode:	Compliance	Verdict:	PASS
Date:	9/25/2007		
Temperature: 26 ºC	Air Pressure: 1012 hPa	Relative Humidity: 46 %	Power Supply: 120 VAC
Remarks:			

Plot 7.4.1 Peak excursion measurements at low frequency, BPSK

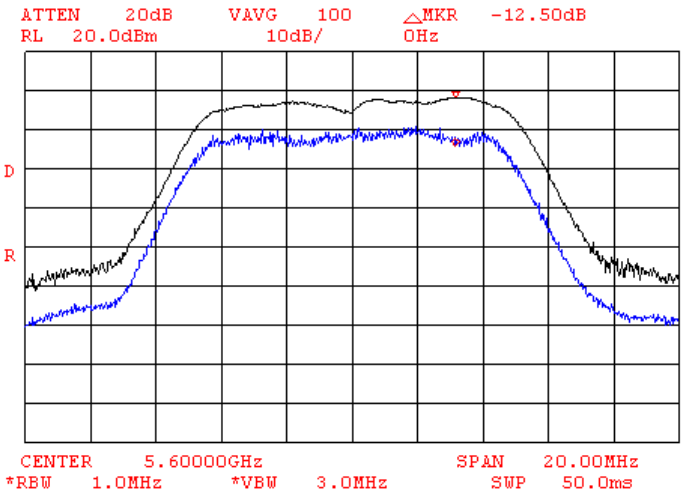


Plot 7.4.2 Peak excursion measurements at low frequency, 64QAM

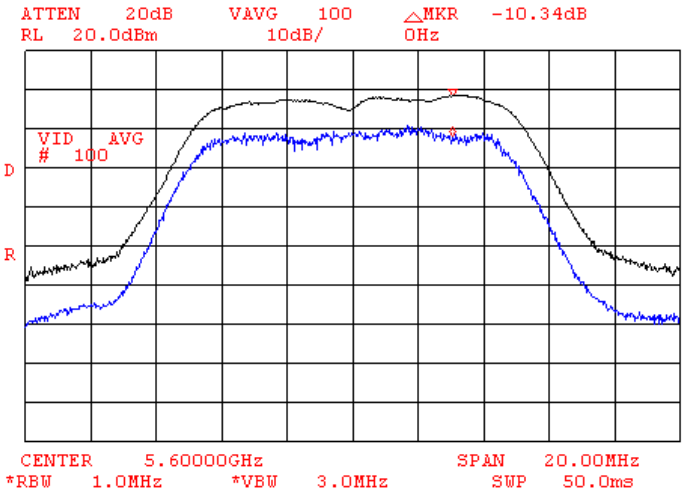


Test specification:	Section 15.407(a)(6), Ratio of the peak excursion of the modulation envelope to the peak transmit power		
Test procedure:	FCC Public Notice DA 02-2138, Appendix A		
Test mode:	Compliance	**Verdict:**	PASS
Date:	9/25/2007		
Temperature: 26 ºC	**Air Pressure:** 1012 hPa	**Relative Humidity:** 46 %	**Power Supply:** 120 VAC
Remarks:			

Plot 7.4.3 Peak excursion measurements at mid frequency, BPSK

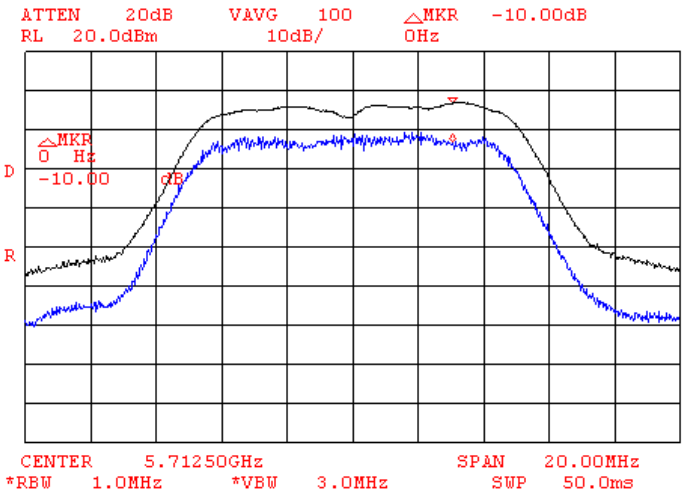


Plot 7.4.4 Peak excursion measurements at mid frequency, 64QAM

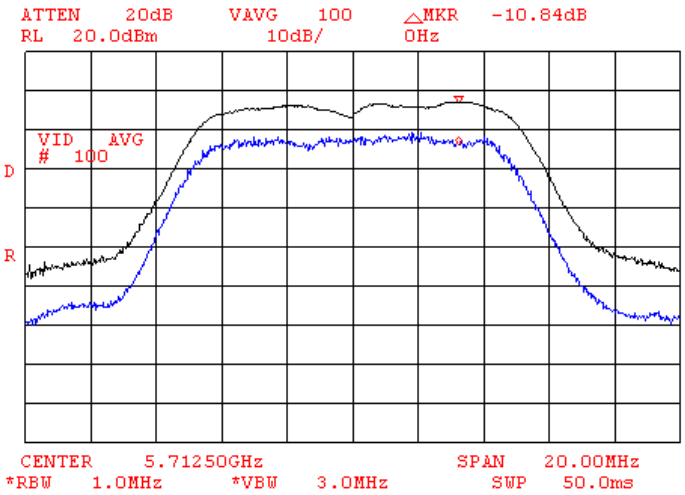


Test specification:	Section 15.407(a)(6), Ratio of the peak excursion of the modulation envelope to the peak transmit power		
Test procedure:	FCC Public Notice DA 02-2138, Appendix A		
Test mode:	Compliance	Verdict:	PASS
Date:	9/25/2007		
Temperature: 26 ºC	Air Pressure: 1012 hPa	Relative Humidity: 46 %	Power Supply: 120 VAC
Remarks:			

Plot 7.4.5 Peak excursion measurements at high frequency, BPSK



Plot 7.4.6 Peak excursion measurements at high frequency, 64QAM



Test specification:	Section 15.407(b), Out of band undesirable emissions		
Test procedure:	Public notice DA02-2138		
Test mode:	Compliance	Verdict:	PASS
Date:	10/01/2007		
Temperature: 25ºC	Air Pressure: 1012 hPa	Relative Humidity: 48 %	Power Supply: 120 VAC
Remarks:			

7.5 Spurious emissions at RF antenna connector test

7.5.1 General

This test was performed to measure spurious emissions at RF antenna connector. Specification test limits are given in Table 7.5.1.

Table 7.5.1 EIRP of undesirable emissions limits outside restricted bands

Frequency band, GHz	Out of band EIRP, dBm/MHz
5.470 – 5.725	-27

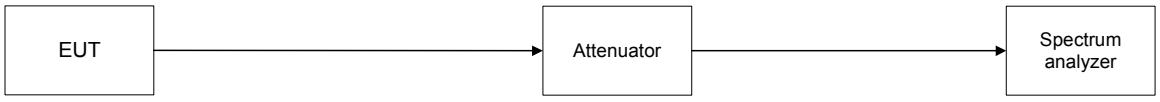
7.5.2 Test procedure for conducted spurious emission

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 for end user RF output power.

7.5.2.3 The spurious emission was measured with spectrum analyzer as provided in Table 7.5.2 and associated plots.

Figure 7.5.1 Setup for conducted spurious emission measurements



Test specification:	**Section 15.407(b), Out of band undesirable emissions**		
Test procedure:	Public notice DA02-2138		
Test mode:	Compliance	**Verdict:**	PASS
Date:	10/01/2007		
Temperature: 25ºC	**Air Pressure:** 1012 hPa	**Relative Humidity:** 48 %	**Power Supply:** 120 VAC
Remarks:			

Table 7.5.2 Conducted spurious emissions test results

ASSIGNED FREQUENCY BAND: 5.470 - 5.725 GHz
INVESTIGATED FREQUENCY RANGE: 0.009 – 40000 MHz
MODULATION: QAM
TRANSMITTER OUTPUT POWER SETTINGS: Maximum
RESOLUTION BANDWIDTH: 1 MHz

Frequency, MHz	Peak emission, dBm	Limit, dBm/MHz**	Margin, dB*	Verdict
Low carrier frequency 5485 MHz				
5725.0	-50.67	-44.5	-6.17	Pass
5470.0	-47.67	-44.5	-3.17	Pass
Mid carrier frequency 5600 MHz				
5732.0	-50.50	-44.5	-6.0	Pass
5470.0	-49.50	-44.5	-5.0	Pass
High carrier frequency 5712.5 MHz				
5725.0	-46.50	-44.5	-2.0	Pass
5470.0	-49.33	-44.5	-4.83	Pass

*****- Margin = Peak emission – limit.
**- The limit was reduced by the gain of antenna (17.5 dBi), because the limit is EIRP limit.

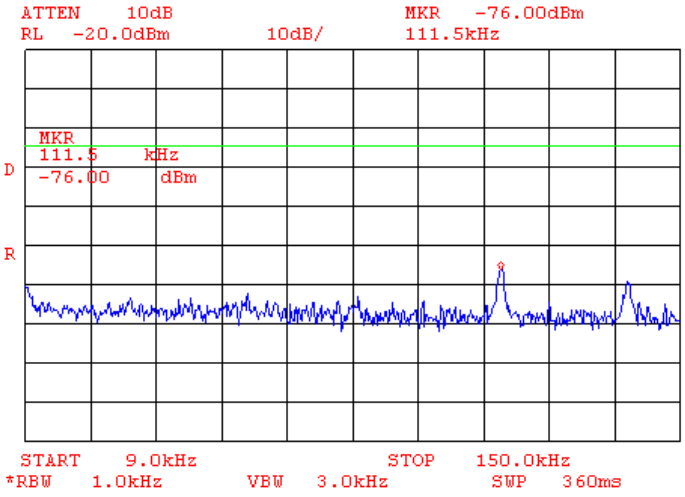
Reference numbers of test equipment used

HL 1424	HL 2524	HL 2925					

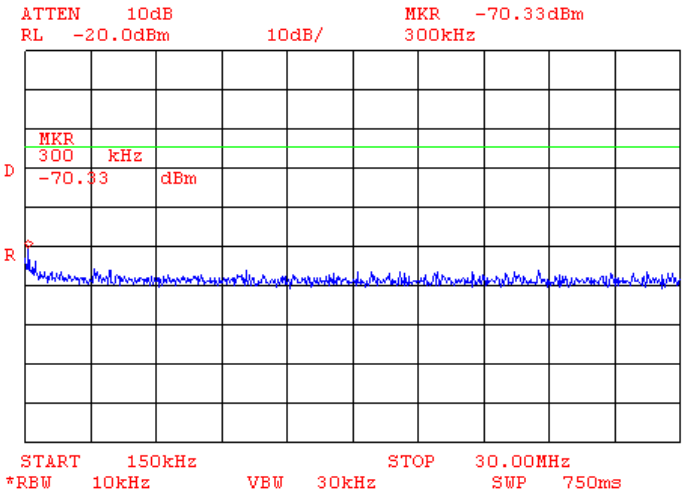
Full description is given in Appendix A.

Test specification:	Section 15.407(b), Out of band undesirable emissions		
Test procedure:	Public notice DA02-2138		
Test mode:	Compliance	Verdict:	PASS
Date:	10/01/2007		
Temperature: 25ºC	Air Pressure: 1012 hPa	Relative Humidity: 48 %	Power Supply: 120 VAC
Remarks:			

Plot 7.5.1 Conducted emission measurements from 9 to 150 kHz at the low carrier frequency

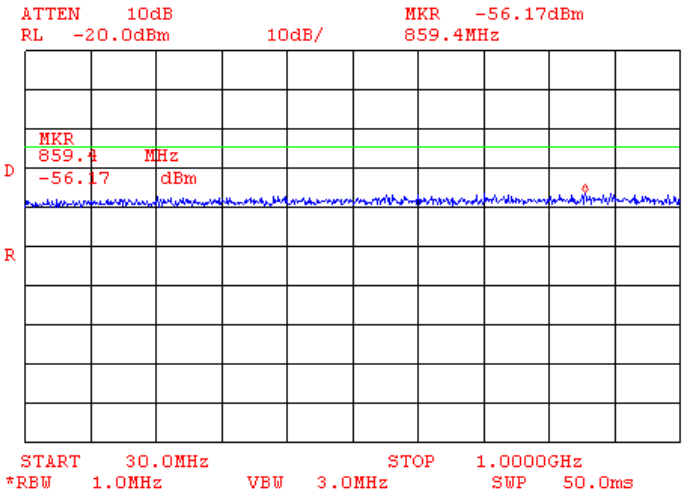


Plot 7.5.2 Conducted emission measurements from 0.15 to 30 MHz at the low carrier frequency

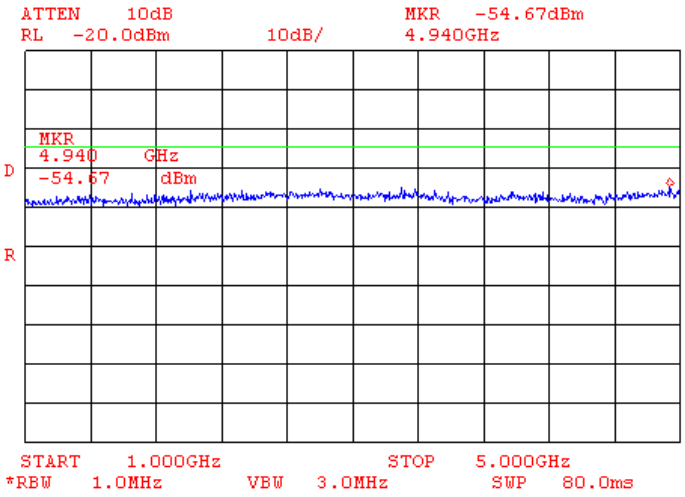


Test specification:	Section 15.407(b), Out of band undesirable emissions		
Test procedure:	Public notice DA02-2138		
Test mode:	Compliance	Verdict:	PASS
Date:	10/01/2007		
Temperature: 25ºC	Air Pressure: 1012 hPa	Relative Humidity: 48 %	Power Supply: 120 VAC
Remarks:			

Plot 7.5.3 Conducted emission measurements from 30 to 1000 MHz at the low carrier frequency

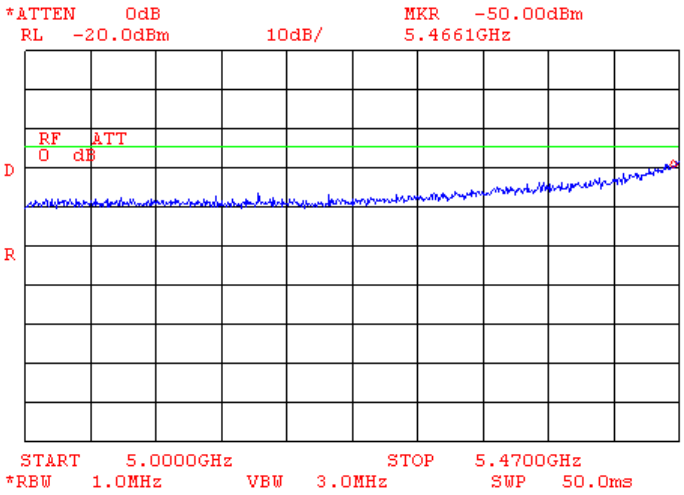


Plot 7.5.4 Conducted emission measurements from 1.0 to 5.0 GHz at the low carrier frequency

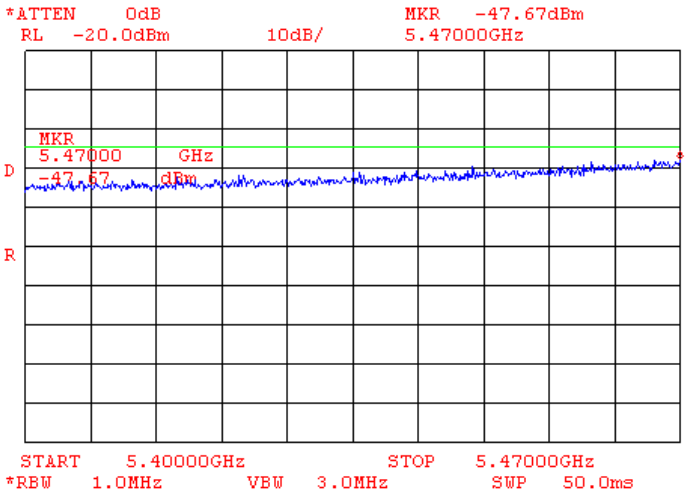


Test specification:	Section 15.407(b), Out of band undesirable emissions		
Test procedure:	Public notice DA02-2138		
Test mode:	Compliance	Verdict:	PASS
Date:	10/01/2007		
Temperature: 25ºC	Air Pressure: 1012 hPa	Relative Humidity: 48 %	Power Supply: 120 VAC
Remarks:			

Plot 7.5.5 Conducted emission measurements from 5.0 to 5.470 GHz at the low carrier frequency

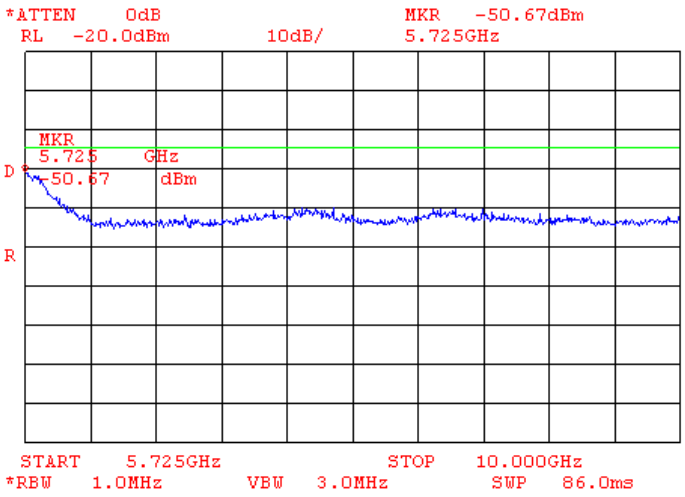


Plot 7.5.6 Conducted emission measurements from 5.4 to 5.470 GHz at the low carrier frequency

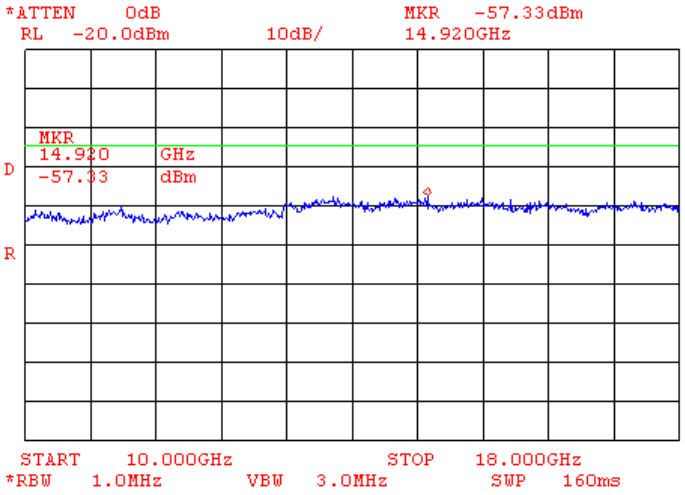


Test specification:	Section 15.407(b), Out of band undesirable emissions		
Test procedure:	Public notice DA02-2138		
Test mode:	Compliance	Verdict:	PASS
Date:	10/01/2007		
Temperature: 25ºC	Air Pressure: 1012 hPa	Relative Humidity: 48 %	Power Supply: 120 VAC
Remarks:			

Plot 7.5.7 Conducted emission measurements from 5.725 to 10 GHz at the low carrier frequency

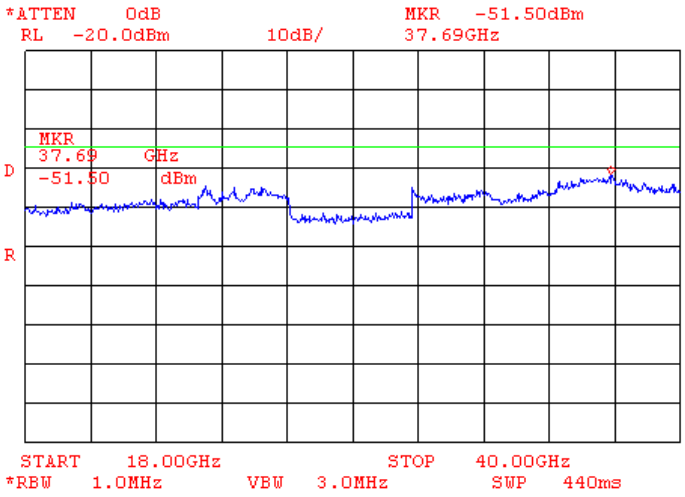


Plot 7.5.8 Conducted emission measurements from 10 to 18 GHz at the low carrier frequency



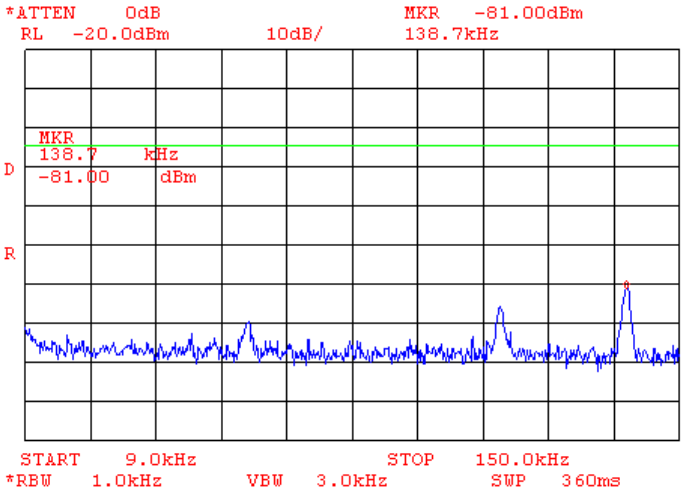
Test specification:	Section 15.407(b), Out of band undesirable emissions		
Test procedure:	Public notice DA02-2138		
Test mode:	Compliance	Verdict:	PASS
Date:	10/01/2007		
Temperature: 25ºC	Air Pressure: 1012 hPa	Relative Humidity: 48 %	Power Supply: 120 VAC
Remarks:			

Plot 7.5.9 Conducted emission measurements from 18 to 40 GHz at the low carrier frequency

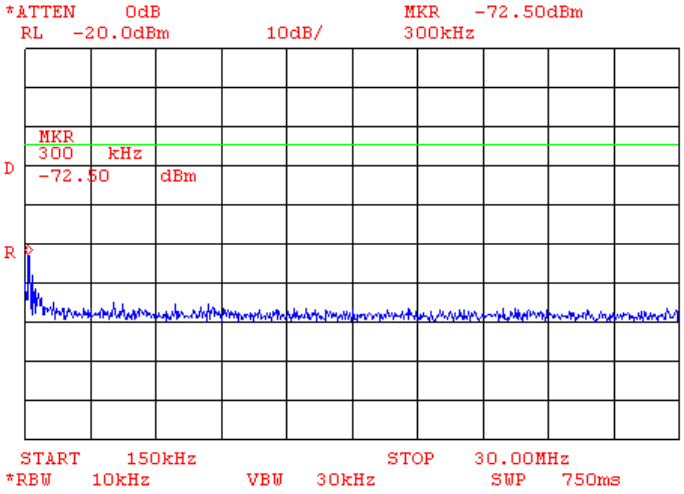


Test specification:	Section 15.407(b), Out of band undesirable emissions		
Test procedure:	Public notice DA02-2138		
Test mode:	Compliance	Verdict:	PASS
Date:	10/01/2007		
Temperature: 25ºC	Air Pressure: 1012 hPa	Relative Humidity: 48 %	Power Supply: 120 VAC
Remarks:			

Plot 7.5.10 Conducted emission measurements from 9 to 150 kHz at the mid carrier frequency

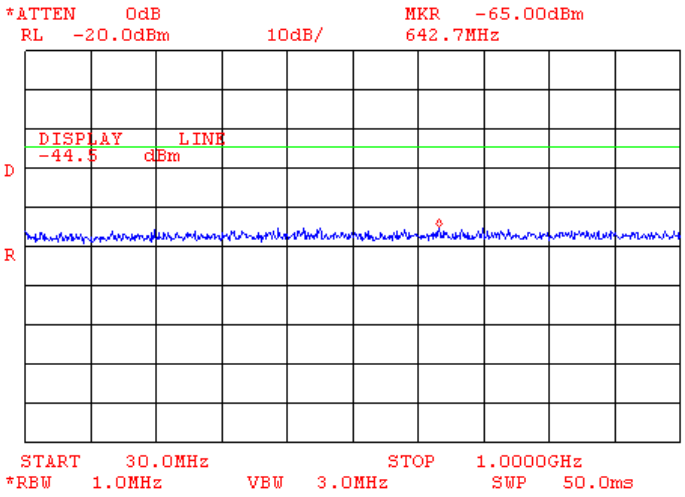


Plot 7.5.11 Conducted emission measurements from 0.15 to 30 MHz at the mid carrier frequency

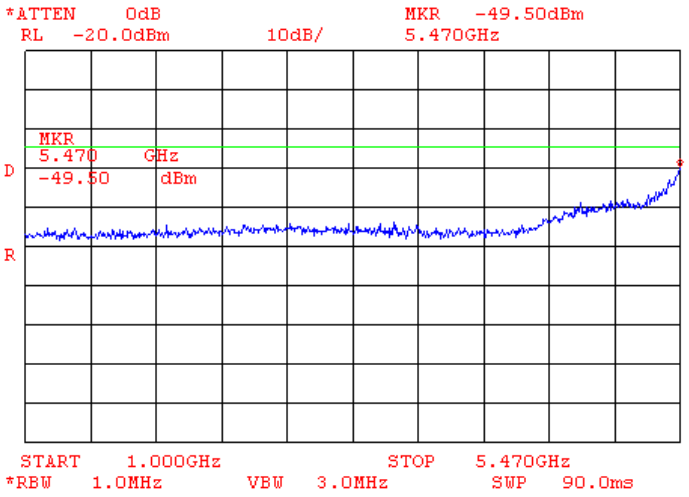


Test specification:	Section 15.407(b), Out of band undesirable emissions		
Test procedure:	Public notice DA02-2138		
Test mode:	Compliance	Verdict:	PASS
Date:	10/01/2007		
Temperature: 25ºC	Air Pressure: 1012 hPa	Relative Humidity: 48 %	Power Supply: 120 VAC
Remarks:			

Plot 7.5.12 Conducted emission measurements from 30 to 1000 MHz at the mid carrier frequency

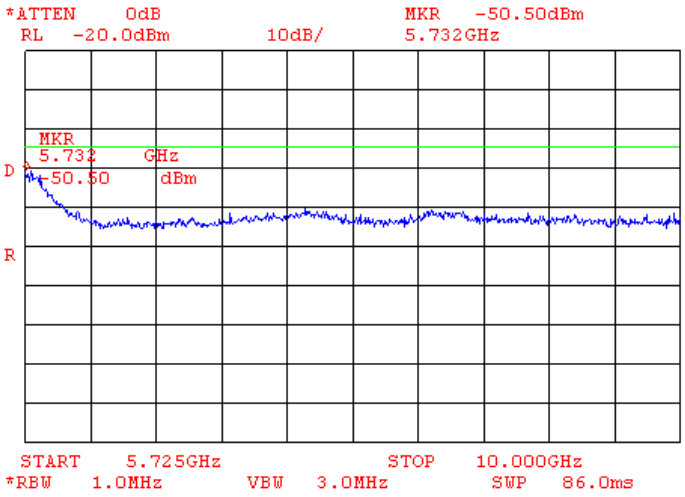


Plot 7.5.13 Conducted emission measurements from 1.0 to 5.47 GHz at the mid carrier frequency

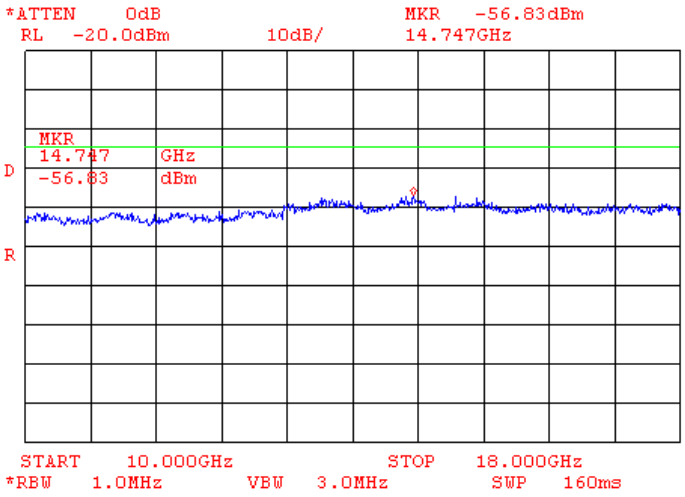


Test specification:	Section 15.407(b), Out of band undesirable emissions		
Test procedure:	Public notice DA02-2138		
Test mode:	Compliance	Verdict:	PASS
Date:	10/01/2007		
Temperature: 25ºC	Air Pressure: 1012 hPa	Relative Humidity: 48 %	Power Supply: 120 VAC
Remarks:			

Plot 7.5.14 Conducted emission measurements from 5.725 to 10 GHz at the mid carrier frequency

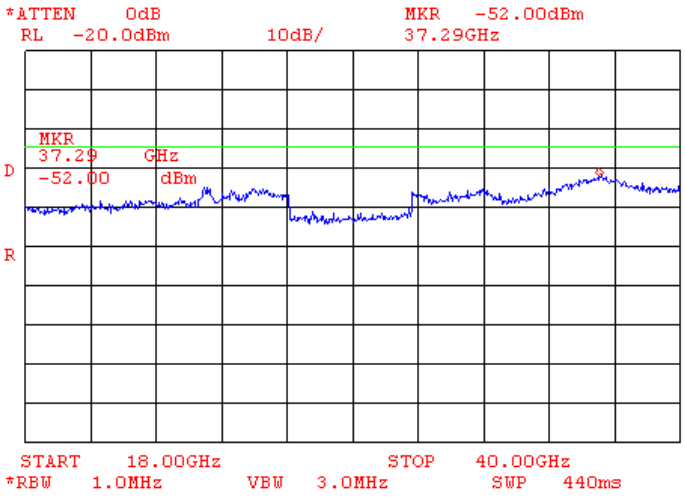


Plot 7.5.15 Conducted emission measurements from 10 to 18 GHz at the mid carrier frequency



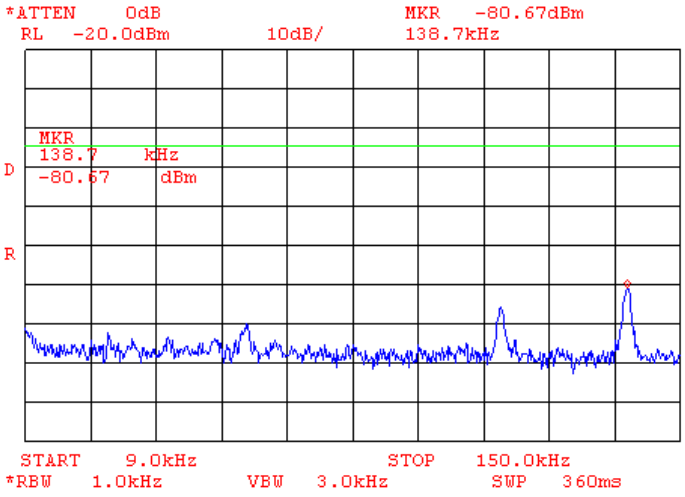
Test specification:	Section 15.407(b), Out of band undesirable emissions		
Test procedure:	Public notice DA02-2138		
Test mode:	Compliance	Verdict:	PASS
Date:	10/01/2007		
Temperature: 25ºC	Air Pressure: 1012 hPa	Relative Humidity: 48 %	Power Supply: 120 VAC
Remarks:			

Plot 7.5.16 Conducted emission measurements from 18 to 40 GHz at the mid carrier frequency

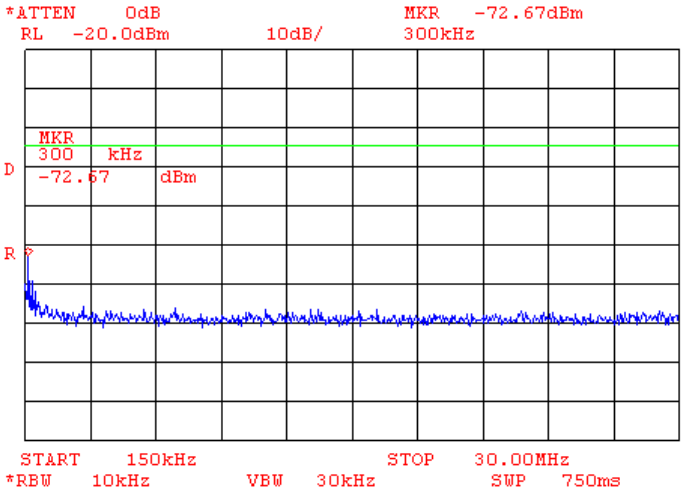


Test specification:	Section 15.407(b), Out of band undesirable emissions		
Test procedure:	Public notice DA02-2138		
Test mode:	Compliance	Verdict:	PASS
Date:	10/01/2007		
Temperature: 25ºC	Air Pressure: 1012 hPa	Relative Humidity: 48 %	Power Supply: 120 VAC
Remarks:			

Plot 7.5.17 Conducted emission measurements from 9 to 150 kHz at the high carrier frequency

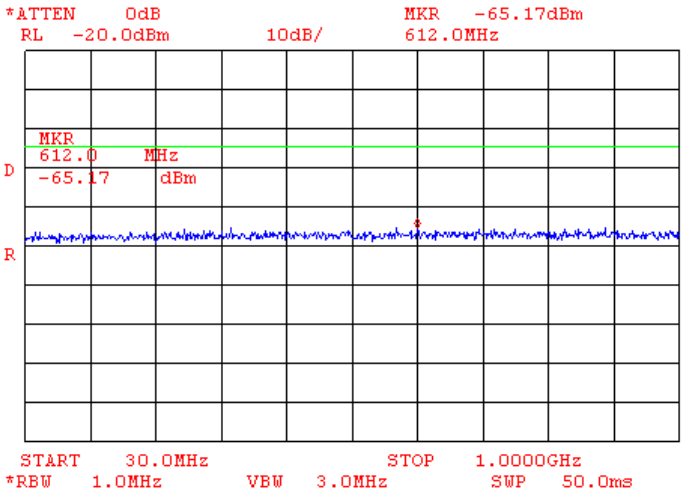


Plot 7.5.18 Conducted emission measurements from 0.15 to 30 MHz at the high carrier frequency

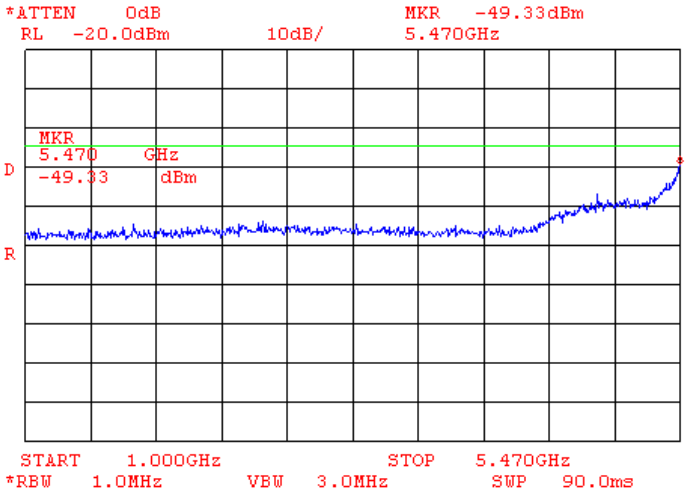


Test specification:	Section 15.407(b), Out of band undesirable emissions		
Test procedure:	Public notice DA02-2138		
Test mode:	Compliance	Verdict:	PASS
Date:	10/01/2007		
Temperature: 25ºC	Air Pressure: 1012 hPa	Relative Humidity: 48 %	Power Supply: 120 VAC
Remarks:			

Plot 7.5.19 Conducted emission measurements from 30 to 1000 MHz at the high carrier frequency

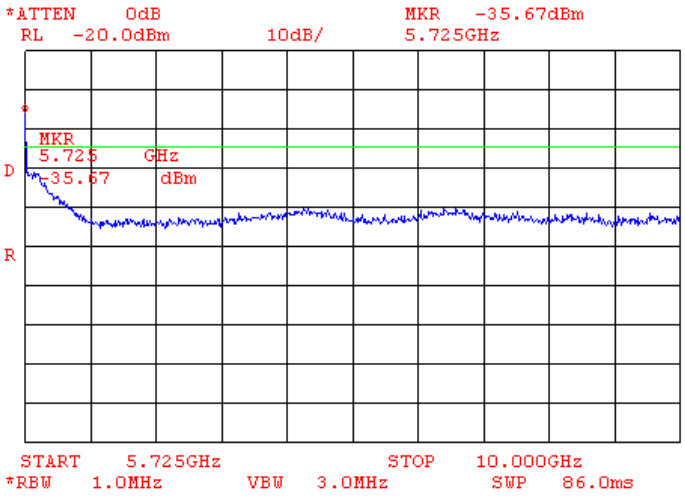


Plot 7.5.20 Conducted emission measurements from 1.0 to 5.47 GHz at the high carrier frequency

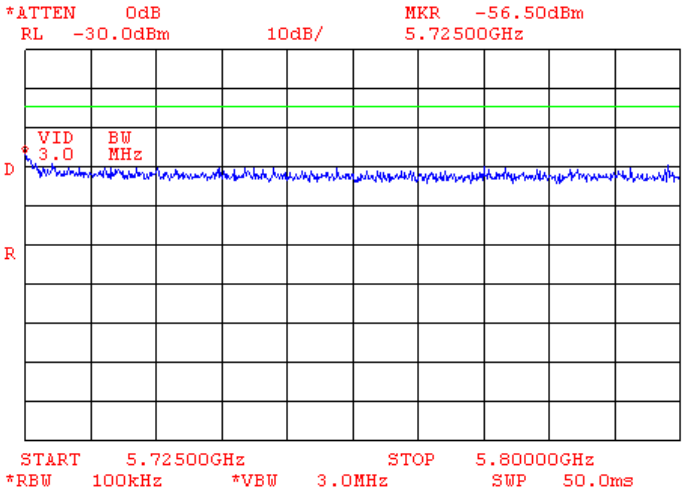


Test specification:	Section 15.407(b), Out of band undesirable emissions		
Test procedure:	Public notice DA02-2138		
Test mode:	Compliance	Verdict:	PASS
Date:	10/01/2007		
Temperature: 25ºC	Air Pressure: 1012 hPa	Relative Humidity: 48 %	Power Supply: 120 VAC
Remarks:			

Plot 7.5.21 Conducted emission measurements from 5.725 to 10 GHz at the high carrier frequency



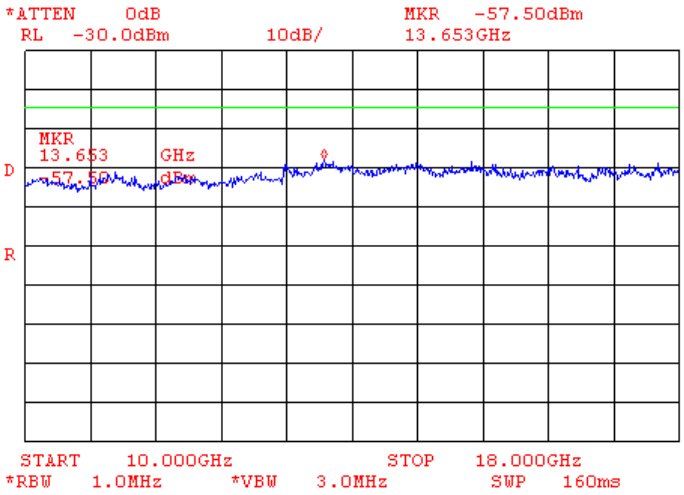
Plot 7.5.22 Conducted emission measurements from 5.725 to 5.8 GHz at the high carrier frequency



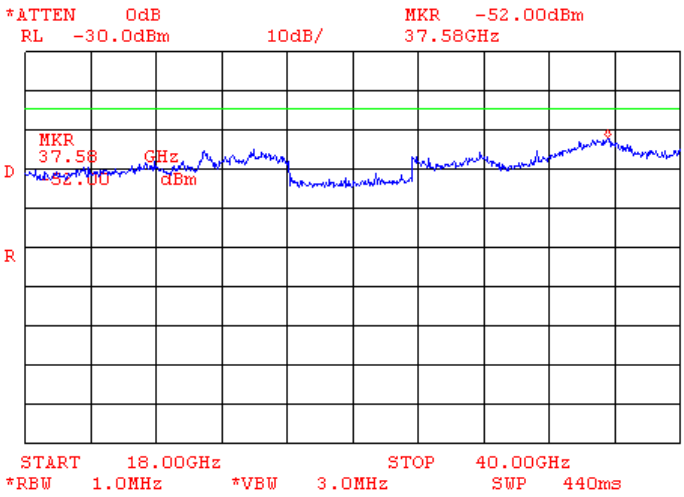
Note: a 10 dB factor should be added to the measurement due to lower RBW.

Test specification:	Section 15.407(b), Out of band undesirable emissions		
Test procedure:	Public notice DA02-2138		
Test mode:	Compliance	Verdict:	PASS
Date:	10/01/2007		
Temperature: 25ºC	Air Pressure: 1012 hPa	Relative Humidity: 48 %	Power Supply: 120 VAC
Remarks:			

Plot 7.5.23 Conducted emission measurements from 10 to 18 GHz at the high carrier frequency



Plot 7.5.24 Conducted emission measurements from 18 to 40 GHz at the high carrier frequency



Test specification:	Section 15.407(b), Unwanted radiated emissions		
Test procedure:	Public notice DA 00-705/ 47 CFR, Section 15.247(c) / ANSI C63.4, Section 13.1.4		
Test mode:	Compliance	Verdict:	PASS
Date:	10/06/2007		
Temperature: 27ºC	Air Pressure: 1009 hPa	Relative Humidity: 48 %	Power Supply: 120 VAC
Remarks:			

7.6 Field strength of spurious emissions

7.6.1 General

This test was performed to measure field strength of spurious emissions from the EUT. Specification test limits are given in Table 7.6.1.

Table 7.6.1 Radiated spurious emissions limits below 1 GHz and within restricted bands above 1 GHz

Frequency, MHz	Field strength at 3 m, dB(μV/m)***		
	Peak	Quasi Peak	Average
0.009 – 0.490*	NA	128.5 – 93.8**	NA
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:

LimS2 = LimS1 + 40 log (S1/S2),

where S1 and S2 – 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.

Table 7.6.2 EIRP of undesirable emissions limits outside restricted bands (above 1 GHz)

Frequency band, GHz	Out of band EIRP, dBm/MHz	Field strength at 3 m, dB(μV/m)
5.47 – 5.725	-27	68.23

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

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

7.6.2.2 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.

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

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

7.6.3.1 The EUT was set up as shown in Figure 7.6.2, energized and the performance check was conducted.

7.6.3.2 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.

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

Test specification:	Section 15.407(b), Unwanted radiated emissions		
Test procedure:	Public notice DA 00-705/ 47 CFR, Section 15.247(c) / ANSI C63.4, Section 13.1.4		
Test mode:	Compliance	Verdict:	PASS
Date:	10/06/2007		
Temperature: 27ºC	Air Pressure: 1009 hPa	Relative Humidity: 48 %	Power Supply: 120 VAC
Remarks:			

Figure 7.6.1 Setup for spurious emission field strength measurements below 30 MHz

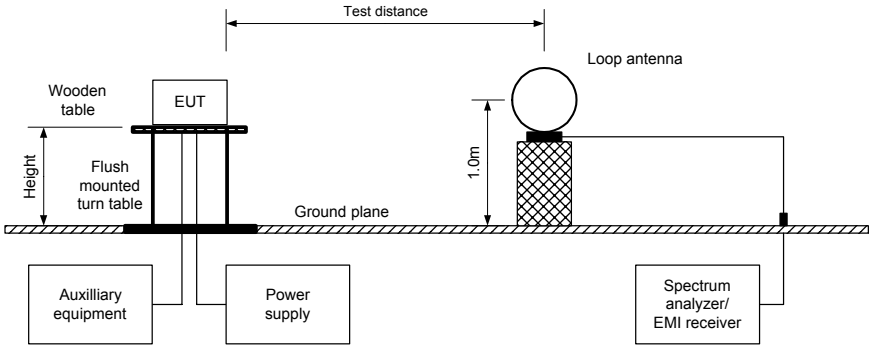
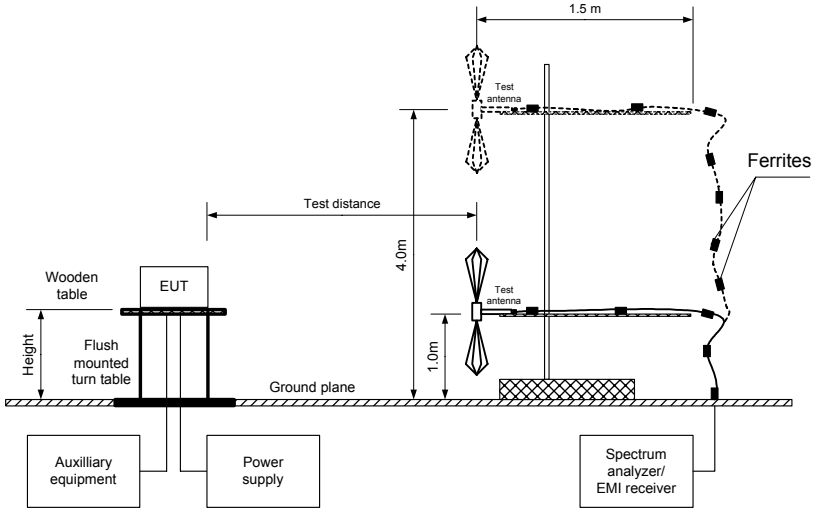


Figure 7.6.2 Setup for spurious emission field strength measurements above 30 MHz



Test specification:	**Section 15.407(b), Unwanted radiated emissions**		
Test procedure:	Public notice DA 00-705/ 47 CFR, Section 15.247(c) / ANSI C63.4, Section 13.1.4		
Test mode:	Compliance	**Verdict:**	PASS
Date:	10/06/2007		
Temperature: 27ºC	**Air Pressure:** 1009 hPa	**Relative Humidity:** 48 %	**Power Supply:** 120 VAC
Remarks:			

Table 7.6.3 Field strength of spurious emissions within restricted bands

ASSIGNED FREQUENCY BAND:	5.470 - 5.725 GHz
INVESTIGATED FREQUENCY RANGE:	1000 - 40000 MHz
TEST DISTANCE:	3 m
MODULATION:	QAM
TRANSMITTER OUTPUT POWER SETTINGS:	Maximum
DETECTOR USED:	Peak
RESOLUTION BANDWIDTH:	1000 kHz
TEST ANTENNA TYPE:	Double ridged guide

Frequency, MHz	Antenna		Azimuth, degrees*	Peak field strength (VBW=3 MHz)			Average field strength (VBW=10Hz)			Verdict
	Polarization	Height, m		Measured, dB(µV/m)	Limit, dB(µV/m)	Margin, dB**	Measured, dB(µV/m)	Limit, dB(µV/m)	Margin, dB***	
Low carrier frequency										
No spurious were found										**Pass**
Mid carrier frequency										
No spurious were found										**Pass**
High carrier frequency										
No spurious were found										**Pass**

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

Table 7.6.4 Restricted bands

MHz	MHz	MHz	MHz	MHz	GHz
0.09 - 0.11	8.37625 - 8.38675	73 - 74.6	399.9 - 410	2690 - 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	

Test specification:	**Section 15.407(b), Unwanted radiated emissions**		
Test procedure:	Public notice DA 00-705/ 47 CFR, Section 15.247(c) / ANSI C63.4, Section 13.1.4		
Test mode:	Compliance	**Verdict:**	PASS
Date:	10/06/2007		
Temperature: 27ºC	**Air Pressure:** 1009 hPa	**Relative Humidity:** 48 %	**Power Supply:** 120 VAC
Remarks:			

Table 7.6.5 Field strength of emissions outside restricted bands

ASSIGNED FREQUENCY BAND:	5.470 - 5.725GHz
INVESTIGATED FREQUENCY RANGE:	0.009 – 40 GHz
TEST DISTANCE:	3 m
MODULATION:	QAM
TRANSMITTER OUTPUT POWER SETTINGS:	Maximum
DETECTOR: USED:	Peak
RESOLUTION BANDWIDTH:	1000 kHz
TEST ANTENNA TYPE:	Active loop (9 kHz – 30 MHz) Biconilog (30 MHz – 1000 MHz) Double ridged guide (above 1000 MHz)

Frequency, MHz	Antenna polarization	Antenna height, m	Azimuth, degrees*	Field strength of spurious, dB(µV/m)	Limit, dBµV/m	Margin, dB**	Verdict
All carrier frequencies							
No spurious were found							Pass

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

Table 7.6.6 Field strength of spurious emissions below 1 GHz within restricted bands

ASSIGNED FREQUENCY BAND:	5.470 - 5.725GHz
INVESTIGATED FREQUENCY RANGE:	0.009 – 1000 MHz
TEST DISTANCE:	3 m
MODULATION:	QAM
TRANSMITTER OUTPUT POWER SETTINGS:	Maximum
RESOLUTION BANDWIDTH:	1 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*				
All carrier frequencies								
45.92500	31.91	28.52	40.00	-11.48	V	1.2	360	Pass
107.0176	33.98	31.75	43.50	-11.75	V	1.3	230	
149.9975	35.33	32.73	43.50	-10.77	V	1.2	220	
175.0000	36.87	34.82	43.50	-8.68	V	1.0	120	
250.0000	44.53	37.70	46.00	-8.30	V	1.0	100	

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

Reference numbers of test equipment used

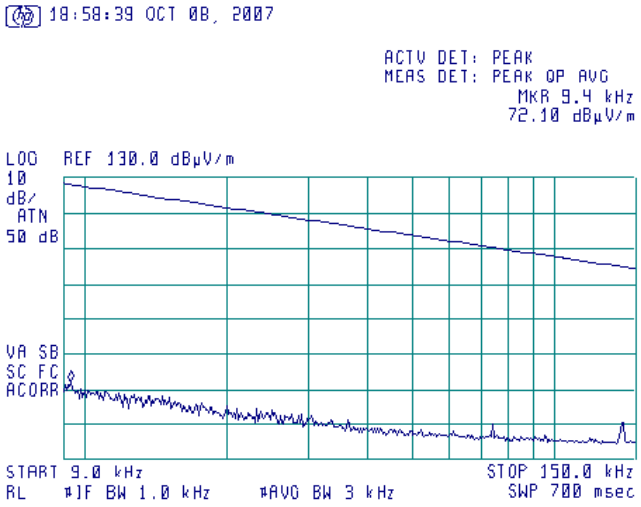
HL 0446	HL 0521	HL 0589	HL 0604	HL 1425	HL 1556	HL 1947	HL 1984
HL 2009	HL 2909						

Full description is given in Appendix A.

Test specification:	Section 15.407(b), Unwanted radiated emissions		
Test procedure:	Public notice DA 00-705/ 47 CFR, Section 15.247(c) / ANSI C63.4, Section 13.1.4		
Test mode:	Compliance	Verdict:	PASS
Date:	10/06/2007		
Temperature: 27ºC	Air Pressure: 1009 hPa	Relative Humidity: 48 %	Power Supply: 120 VAC
Remarks:			

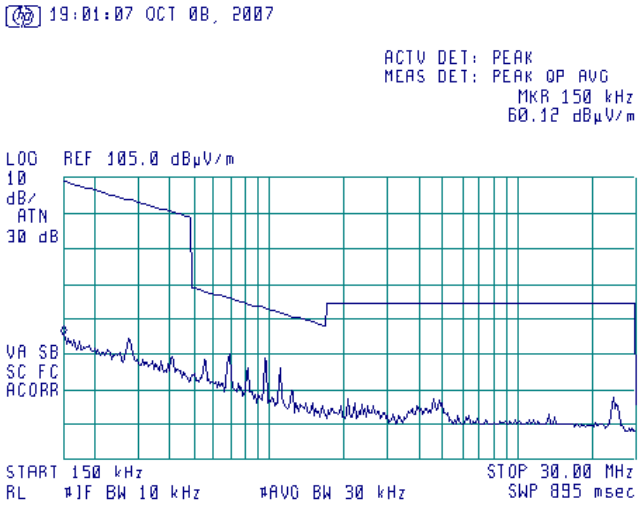
Plot 7.6.1 Radiated emission measurements from 9 to 150 kHz at the mid carrier frequency

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



Plot 7.6.2 Radiated emission measurements from 0.15 to 30 MHz at the mid carrier frequency

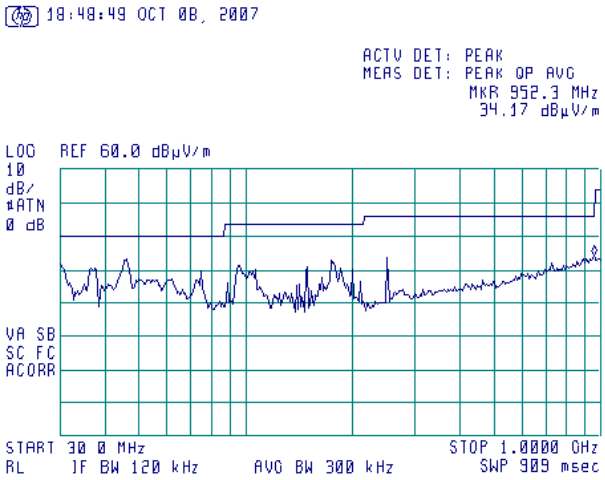
TEST SITE: Anechoic chamber
TEST DISTANCE: 3 m
ANTENNA POLARIZATION: Vertical and Horizontal



Test specification:	Section 15.407(b), Unwanted radiated emissions		
Test procedure:	Public notice DA 00-705/ 47 CFR, Section 15.247(c) / ANSI C63.4, Section 13.1.4		
Test mode:	Compliance	Verdict:	PASS
Date:	10/06/2007		
Temperature: 27ºC	Air Pressure: 1009 hPa	Relative Humidity: 48 %	Power Supply: 120 VAC
Remarks:			

Plot 7.6.3 Radiated emission measurements from 30 to 1000 MHz at the low carrier frequency

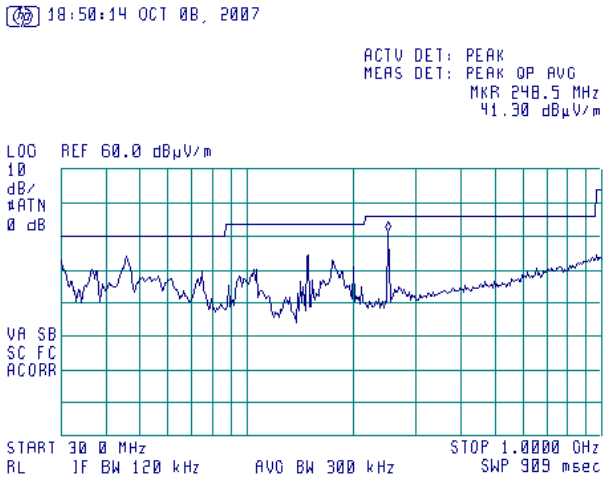
TEST SITE: Anechoic chamber
TEST DISTANCE: 3 m
ANTENNA POLARIZATION: Vertical and Horizontal



Note: all spurious are from digital part of the EUT.

Plot 7.6.4 Radiated emission measurements from 30 to 1000 MHz at the mid carrier frequency

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

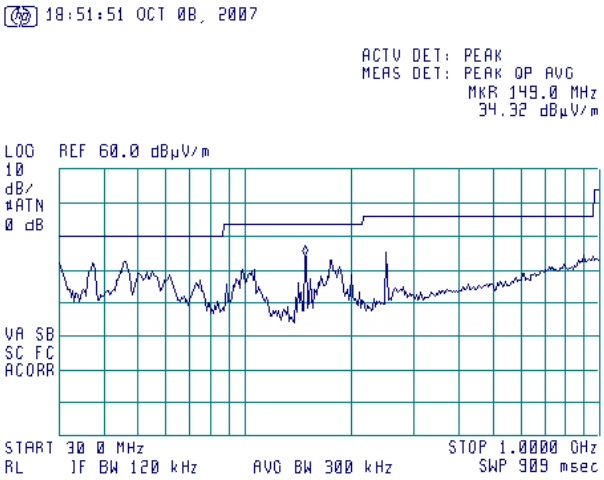


Note: all spurious are from digital part of the EUT.

Test specification:	Section 15.407(b), Unwanted radiated emissions		
Test procedure:	Public notice DA 00-705/ 47 CFR, Section 15.247(c) / ANSI C63.4, Section 13.1.4		
Test mode:	Compliance	Verdict:	PASS
Date:	10/06/2007		
Temperature: 27ºC	Air Pressure: 1009 hPa	Relative Humidity: 48 %	Power Supply: 120 VAC
Remarks:			

Plot 7.6.5 Radiated emission measurements from 30 to 1000 MHz at the high carrier frequency

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

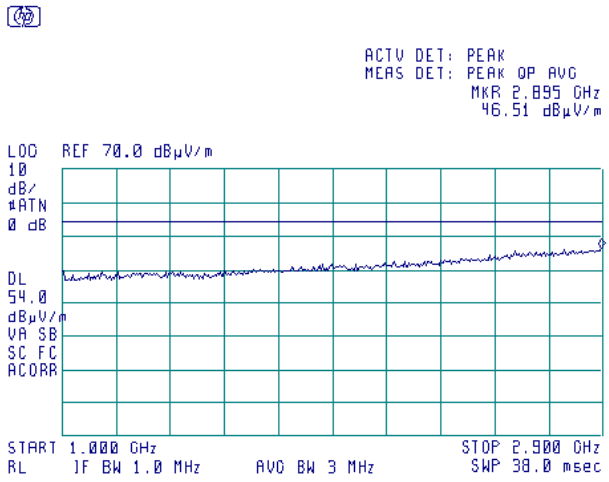


Note: all spurious are from digital part of the EUT.

Test specification:	Section 15.407(b), Unwanted radiated emissions		
Test procedure:	Public notice DA 00-705/ 47 CFR, Section 15.247(c) / ANSI C63.4, Section 13.1.4		
Test mode:	Compliance	Verdict:	PASS
Date:	10/06/2007		
Temperature: 27ºC	Air Pressure: 1009 hPa	Relative Humidity: 48 %	Power Supply: 120 VAC
Remarks:			

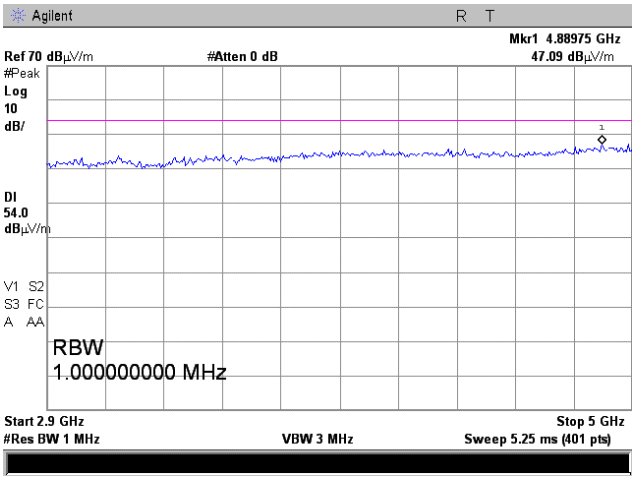
Plot 7.6.6 Radiated emission measurements from 1.0 to 2.9 GHz at the low carrier frequency

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



Plot 7.6.7 Radiated emission measurements from 2.9 to 5.0 GHz at the low carrier frequency

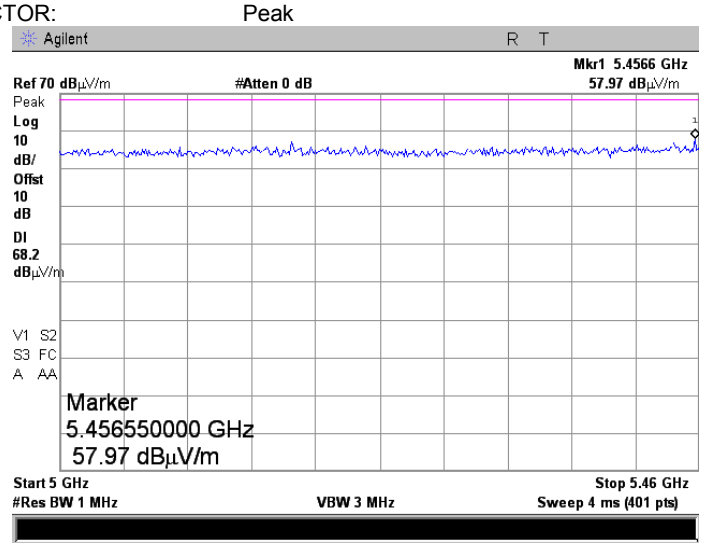
TEST SITE: Anechoic chamber
TEST DISTANCE: 3 m
ANTENNA POLARIZATION: Vertical and Horizontal



Test specification:	Section 15.407(b), Unwanted radiated emissions		
Test procedure:	Public notice DA 00-705/ 47 CFR, Section 15.247(c) / ANSI C63.4, Section 13.1.4		
Test mode:	Compliance	Verdict:	PASS
Date:	10/06/2007		
Temperature: 27ºC	Air Pressure: 1009 hPa	Relative Humidity: 48 %	Power Supply: 120 VAC
Remarks:			

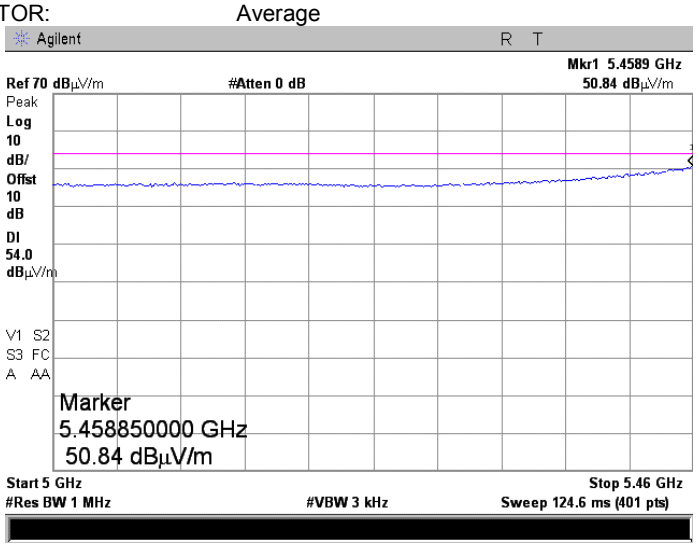
Plot 7.6.8 Radiated emission measurements from 5.0 to 5.46 GHz at the low carrier frequency

TEST SITE: Anechoic chamber
TEST DISTANCE: 3 m
ANTENNA POLARIZATION: Vertical and Horizontal
DETECTOR: Peak



Plot 7.6.9 Radiated emission measurements from 5.0 to 5.46 GHz at the low carrier frequency

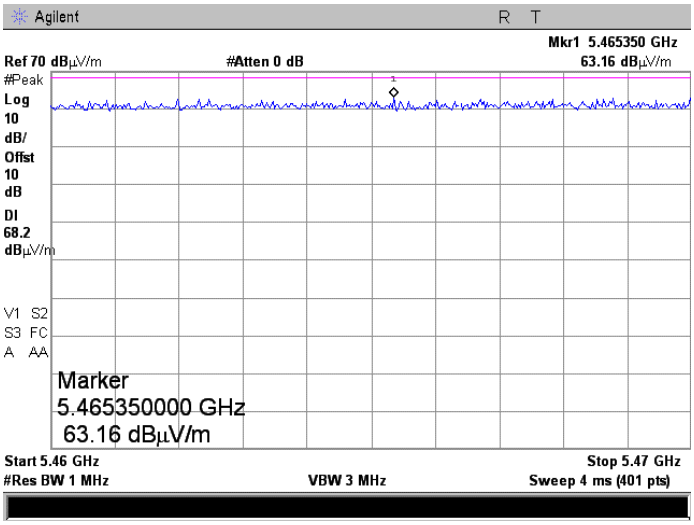
TEST SITE: Anechoic chamber
TEST DISTANCE: 3 m
ANTENNA POLARIZATION: Vertical and Horizontal
DETECTOR: Average



Test specification:	**Section 15.407(b), Unwanted radiated emissions**		
Test procedure:	Public notice DA 00-705/ 47 CFR, Section 15.247(c) / ANSI C63.4, Section 13.1.4		
Test mode:	Compliance	**Verdict:**	PASS
Date:	10/06/2007		
Temperature: 27ºC	**Air Pressure:** 1009 hPa	**Relative Humidity:** 48 %	**Power Supply:** 120 VAC
Remarks:			

Plot 7.6.10 Radiated emission measurements from 5.46 to 5.47GHz at the low carrier frequency

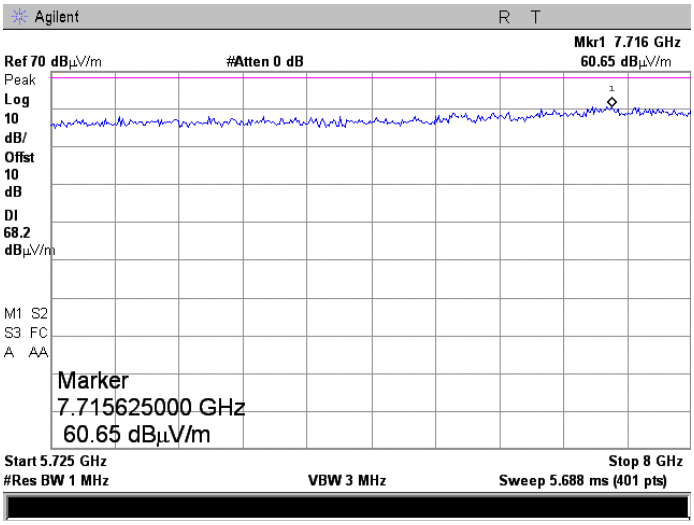
TEST SITE: Anechoic chamber
TEST DISTANCE: 3 m
ANTENNA POLARIZATION: Vertical and Horizontal



Test specification:	Section 15.407(b), Unwanted radiated emissions		
Test procedure:	Public notice DA 00-705/ 47 CFR, Section 15.247(c) / ANSI C63.4, Section 13.1.4		
Test mode:	Compliance	Verdict:	PASS
Date:	10/06/2007		
Temperature: 27ºC	Air Pressure: 1009 hPa	Relative Humidity: 48 %	Power Supply: 120 VAC
Remarks:			

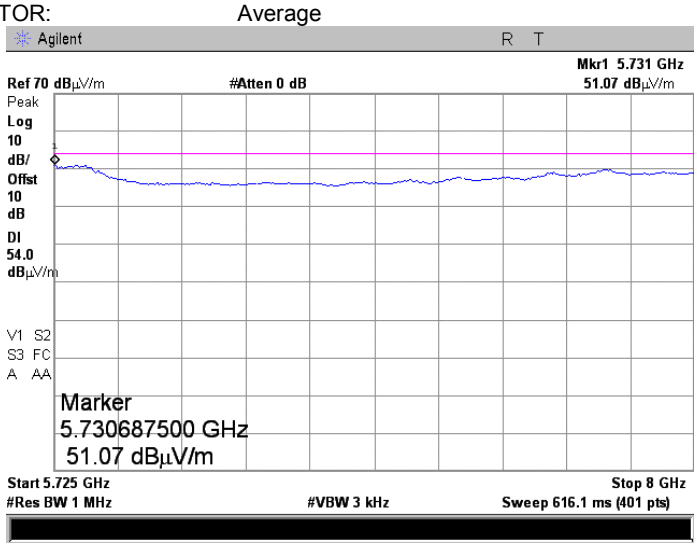
Plot 7.6.11 Radiated emission measurements from 5.725 to 8.0 GHz at the low carrier frequency

TEST SITE: Anechoic chamber
TEST DISTANCE: 3 m
ANTENNA POLARIZATION: Vertical and Horizontal
DETECTOR: Peak



Plot 7.6.12 Radiated emission measurements from 5.725 to 8.0 GHz at the low carrier frequency

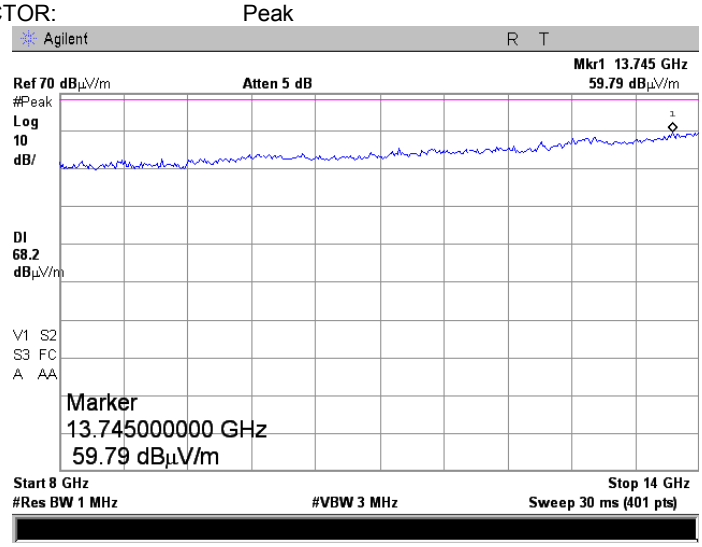
TEST SITE: Anechoic chamber
TEST DISTANCE: 3 m
ANTENNA POLARIZATION: Vertical and Horizontal
DETECTOR: Average



Test specification:	Section 15.407(b), Unwanted radiated emissions		
Test procedure:	Public notice DA 00-705/ 47 CFR, Section 15.247(c) / ANSI C63.4, Section 13.1.4		
Test mode:	Compliance	Verdict:	PASS
Date:	10/06/2007		
Temperature: 27ºC	Air Pressure: 1009 hPa	Relative Humidity: 48 %	Power Supply: 120 VAC
Remarks:			

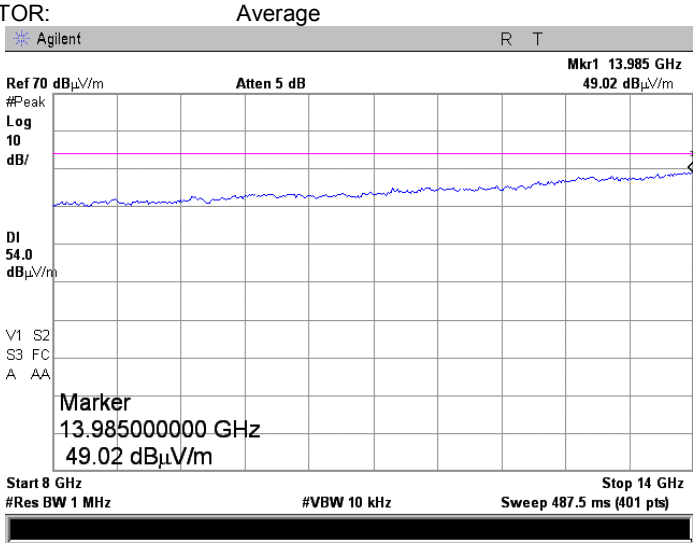
Plot 7.6.13 Radiated emission measurements from 8.0 to 14.0 GHz at the low carrier frequency

TEST SITE: Anechoic chamber
TEST DISTANCE: 3 m
ANTENNA POLARIZATION: Vertical and Horizontal
DETECTOR: Peak



Plot 7.6.14 Radiated emission measurements from 8.0 to 14.0 GHz at the low carrier frequency

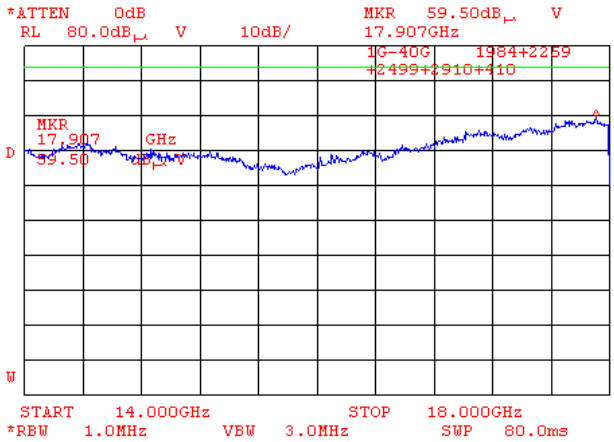
TEST SITE: Anechoic chamber
TEST DISTANCE: 3 m
ANTENNA POLARIZATION: Vertical and Horizontal
DETECTOR: Average



Test specification:	Section 15.407(b), Unwanted radiated emissions		
Test procedure:	Public notice DA 00-705/ 47 CFR, Section 15.247(c) / ANSI C63.4, Section 13.1.4		
Test mode:	Compliance	Verdict:	PASS
Date:	10/06/2007		
Temperature: 27ºC	Air Pressure: 1009 hPa	Relative Humidity: 48 %	Power Supply: 120 VAC
Remarks:			

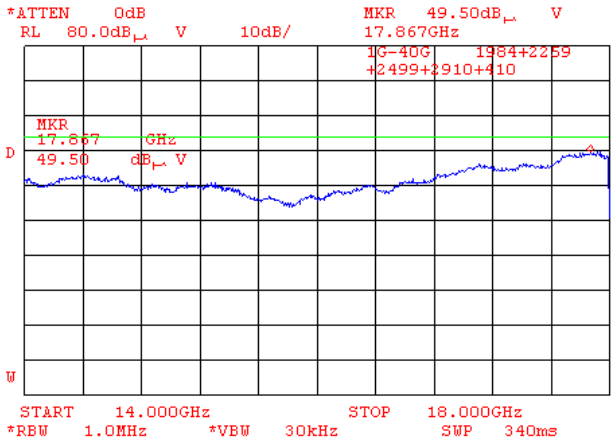
Plot 7.6.15 Radiated emission measurements from 14 to 18 GHz at the low carrier frequency

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



Plot 7.6.16 Radiated emission measurements from 14 to 18 GHz at the low carrier frequency

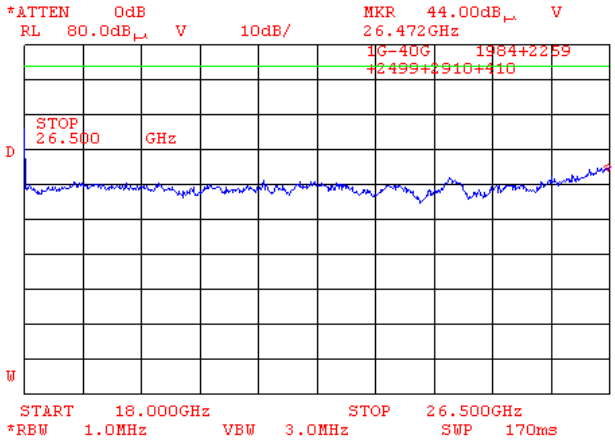
TEST SITE: OATS
TEST DISTANCE: 3 m
ANTENNA POLARIZATION: Vertical and Horizontal
DETECTOR: Average



Test specification:	Section 15.407(b), Unwanted radiated emissions		
Test procedure:	Public notice DA 00-705/ 47 CFR, Section 15.247(c) / ANSI C63.4, Section 13.1.4		
Test mode:	Compliance	Verdict:	PASS
Date:	10/06/2007		
Temperature: 27ºC	Air Pressure: 1009 hPa	Relative Humidity: 48 %	Power Supply: 120 VAC
Remarks:			

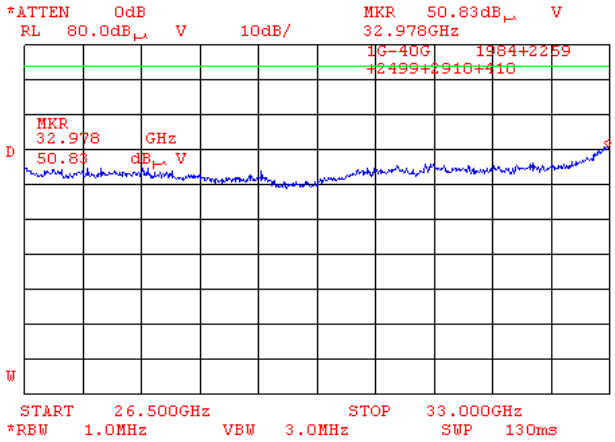
Plot 7.6.17 Radiated emission measurements from 18 to 26.5 GHz at the low carrier frequency

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



Plot 7.6.18 Radiated emission measurements from 26.5 to 33 GHz at the low carrier frequency

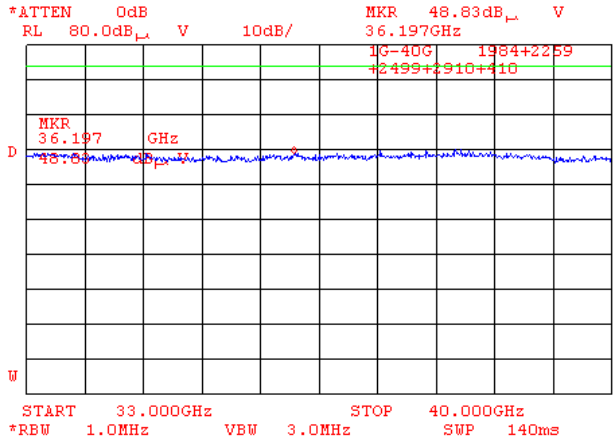
TEST SITE: OATS
TEST DISTANCE: 3 m
ANTENNA POLARIZATION: Vertical and Horizontal



Test specification:	**Section 15.407(b), Unwanted radiated emissions**		
Test procedure:	Public notice DA 00-705/ 47 CFR, Section 15.247(c) / ANSI C63.4, Section 13.1.4		
Test mode:	Compliance	**Verdict:**	PASS
Date:	10/06/2007		
Temperature: 27ºC	**Air Pressure:** 1009 hPa	**Relative Humidity:** 48 %	**Power Supply:** 120 VAC
Remarks:			

Plot 7.6.19 Radiated emission measurements from 33 to 40 GHz at the low carrier frequency

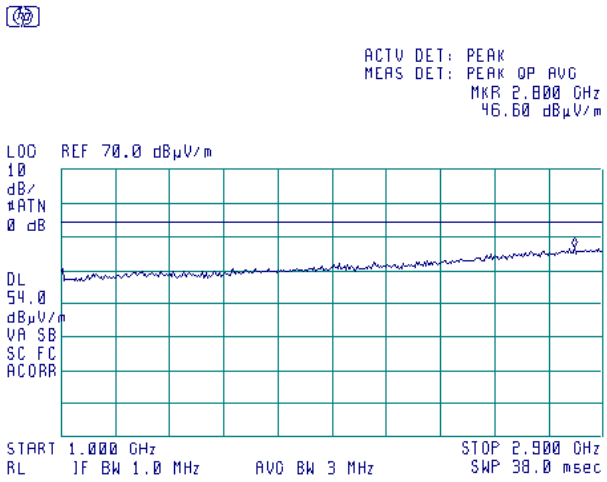
TEST SITE: OATS
TEST DISTANCE: 3 m
ANTENNA POLARIZATION: Vertical and Horizontal



Test specification:	Section 15.407(b), Unwanted radiated emissions		
Test procedure:	Public notice DA 00-705/ 47 CFR, Section 15.247(c) / ANSI C63.4, Section 13.1.4		
Test mode:	Compliance	Verdict:	PASS
Date:	10/06/2007		
Temperature: 27ºC	Air Pressure: 1009 hPa	Relative Humidity: 48 %	Power Supply: 120 VAC
Remarks:			

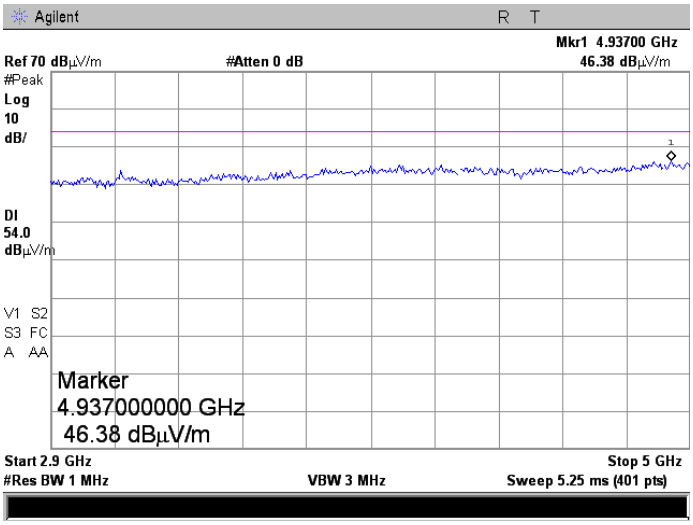
Plot 7.6.20 Radiated emission measurements from 1.0 to 2.9 GHz at the mid carrier frequency

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



Plot 7.6.21 Radiated emission measurements from 2.9 to 5.0 GHz at the mid carrier frequency

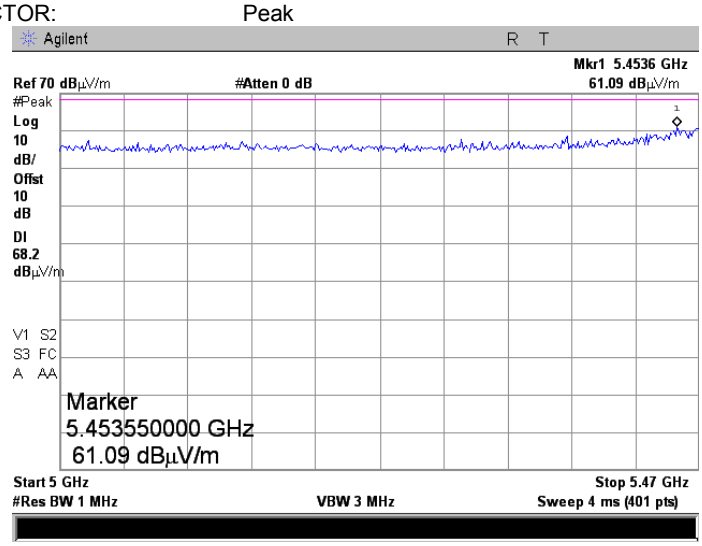
TEST SITE: Anechoic chamber
TEST DISTANCE: 3 m
ANTENNA POLARIZATION: Vertical and Horizontal



Test specification:	**Section 15.407(b), Unwanted radiated emissions**		
Test procedure:	Public notice DA 00-705/ 47 CFR, Section 15.247(c) / ANSI C63.4, Section 13.1.4		
Test mode:	Compliance	**Verdict:**	PASS
Date:	10/06/2007		
Temperature: 27ºC	**Air Pressure:** 1009 hPa	**Relative Humidity:** 48 %	**Power Supply:** 120 VAC
Remarks:			

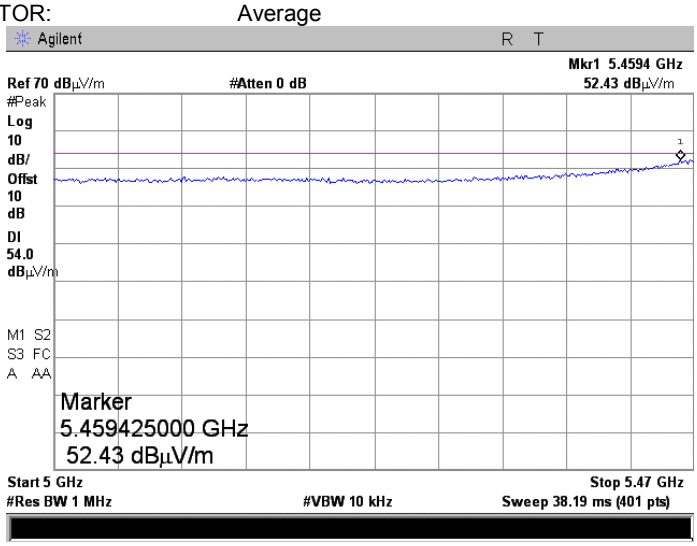
Plot 7.6.22 Radiated emission measurements from 5.00 to 5.47 GHz at the mid carrier frequency

TEST SITE: Anechoic chamber
TEST DISTANCE: 3 m
ANTENNA POLARIZATION: Vertical and Horizontal
DETECTOR: Peak



Plot 7.6.23 Radiated emission measurements from 5.00 to 5.47 GHz at the mid carrier frequency

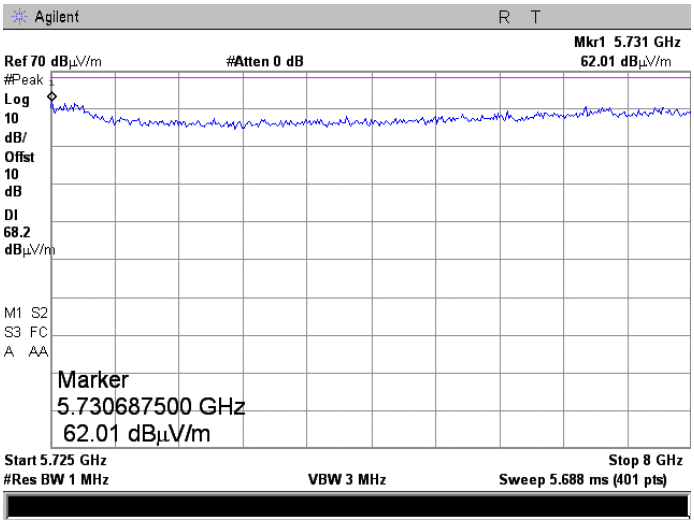
TEST SITE: Anechoic chamber
TEST DISTANCE: 3 m
ANTENNA POLARIZATION: Vertical and Horizontal
DETECTOR: Average



Test specification:	Section 15.407(b), Unwanted radiated emissions		
Test procedure:	Public notice DA 00-705/ 47 CFR, Section 15.247(c) / ANSI C63.4, Section 13.1.4		
Test mode:	Compliance	Verdict:	PASS
Date:	10/06/2007		
Temperature: 27ºC	Air Pressure: 1009 hPa	Relative Humidity: 48 %	Power Supply: 120 VAC
Remarks:			

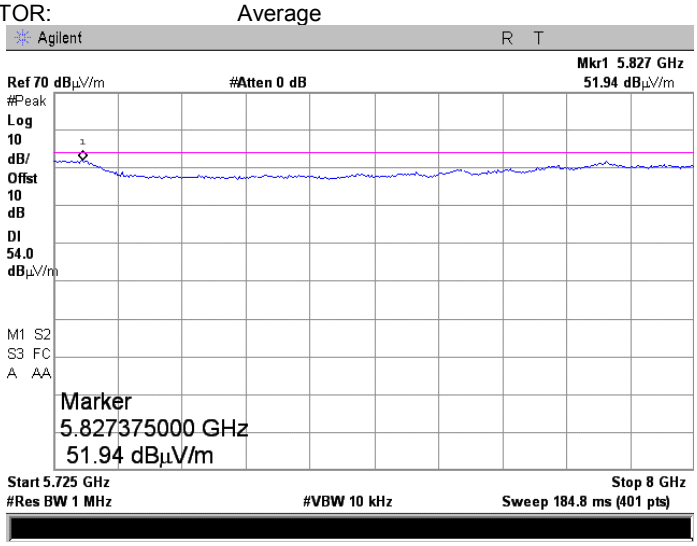
Plot 7.6.24 Radiated emission measurements from 5.725 to 8.0 GHz at the mid carrier frequency

TEST SITE: Anechoic chamber
TEST DISTANCE: 3 m
ANTENNA POLARIZATION: Vertical and Horizontal
DETECTOR: Peak



Plot 7.6.25 Radiated emission measurements from 5.725 to 8.0 GHz at the mid carrier frequency

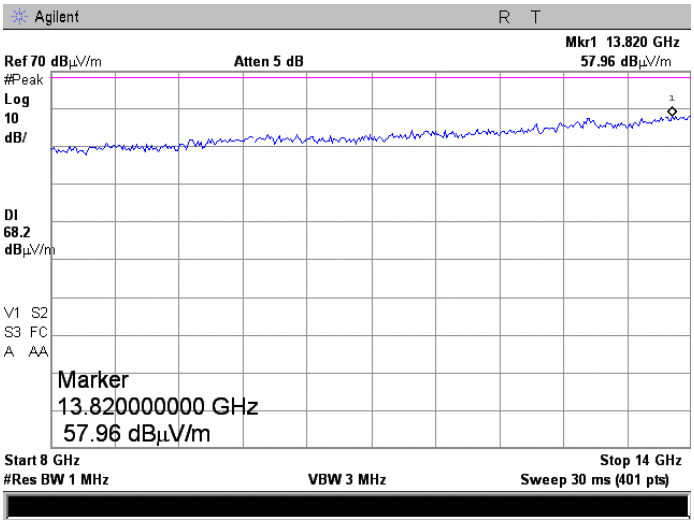
TEST SITE: Anechoic chamber
TEST DISTANCE: 3 m
ANTENNA POLARIZATION: Vertical and Horizontal
DETECTOR: Average



Test specification:	Section 15.407(b), Unwanted radiated emissions		
Test procedure:	Public notice DA 00-705/ 47 CFR, Section 15.247(c) / ANSI C63.4, Section 13.1.4		
Test mode:	Compliance	Verdict:	PASS
Date:	10/06/2007		
Temperature: 27ºC	Air Pressure: 1009 hPa	Relative Humidity: 48 %	Power Supply: 120 VAC
Remarks:			

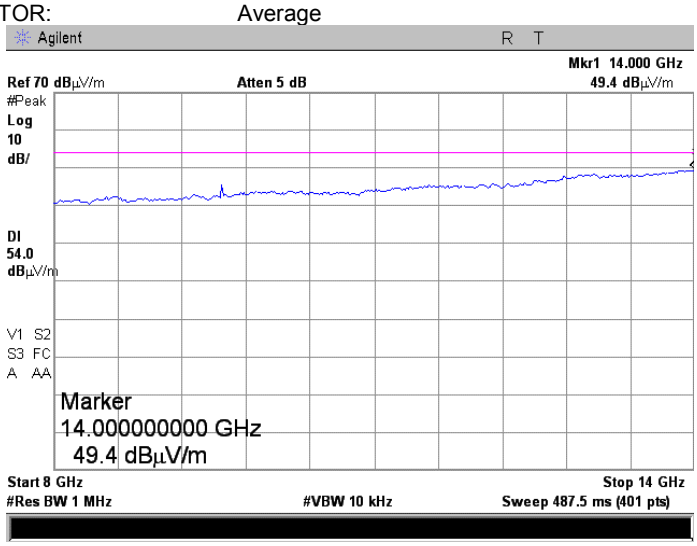
Plot 7.6.26 Radiated emission measurements from 8 to 14 GHz at the mid carrier frequency

TEST SITE: Anechoic chamber
TEST DISTANCE: 3 m
ANTENNA POLARIZATION: Vertical and Horizontal
DETECTOR: Peak



Plot 7.6.27 Radiated emission measurements from 8 to 14 GHz at the mid carrier frequency

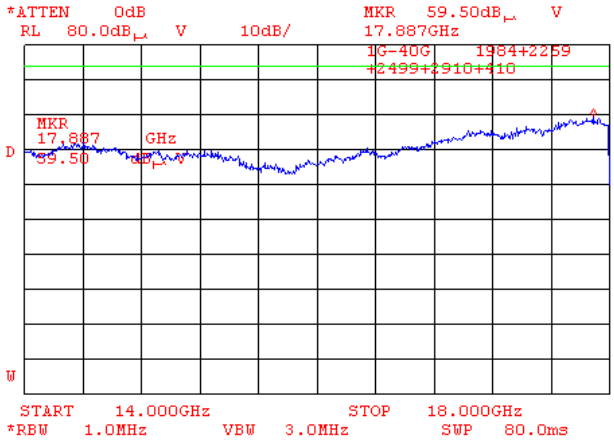
TEST SITE: Anechoic chamber
TEST DISTANCE: 3 m
ANTENNA POLARIZATION: Vertical and Horizontal
DETECTOR: Average



Test specification:	Section 15.407(b), Unwanted radiated emissions		
Test procedure:	Public notice DA 00-705/ 47 CFR, Section 15.247(c) / ANSI C63.4, Section 13.1.4		
Test mode:	Compliance	Verdict:	PASS
Date:	10/06/2007		
Temperature: 27ºC	Air Pressure: 1009 hPa	Relative Humidity: 48 %	Power Supply: 120 VAC
Remarks:			

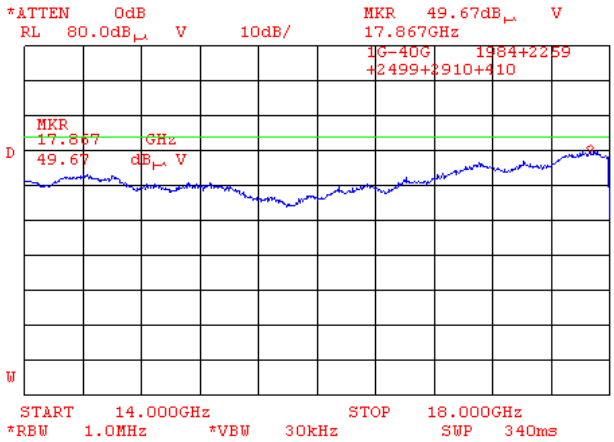
Plot 7.6.28 Radiated emission measurements from 14 to 18 GHz at the mid carrier frequency

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



Plot 7.6.29 Radiated emission measurements from 14 to 18 GHz at the mid carrier frequency

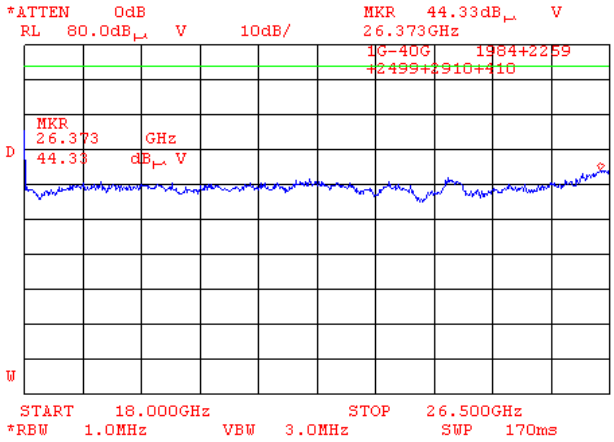
TEST SITE: OATS
TEST DISTANCE: 3 m
ANTENNA POLARIZATION: Vertical and Horizontal
DETECTOR: Average



Test specification:	**Section 15.407(b), Unwanted radiated emissions**		
Test procedure:	Public notice DA 00-705/ 47 CFR, Section 15.247(c) / ANSI C63.4, Section 13.1.4		
Test mode:	Compliance	**Verdict:**	PASS
Date:	10/06/2007		
Temperature: 27ºC	**Air Pressure:** 1009 hPa	**Relative Humidity:** 48 %	**Power Supply:** 120 VAC
Remarks:			

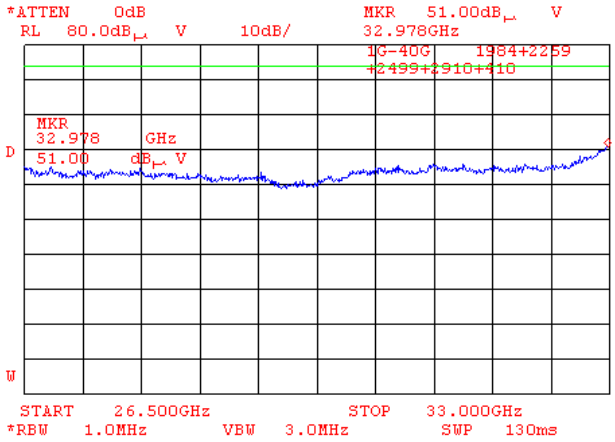
Plot 7.6.30 Radiated emission measurements from 18 to 26.5 GHz at the mid carrier frequency

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



Plot 7.6.31 Radiated emission measurements from 26.5 to 33 GHz at the mid carrier frequency

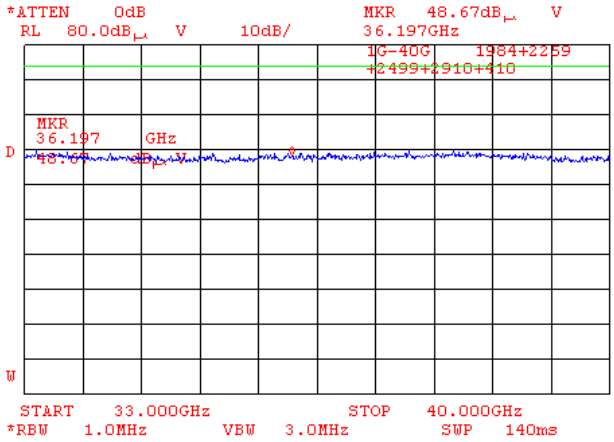
TEST SITE: OATS
TEST DISTANCE: 3 m
ANTENNA POLARIZATION: Vertical and Horizontal



Test specification:	**Section 15.407(b), Unwanted radiated emissions**		
Test procedure:	Public notice DA 00-705/ 47 CFR, Section 15.247(c) / ANSI C63.4, Section 13.1.4		
Test mode:	Compliance	**Verdict:**	PASS
Date:	10/06/2007		
Temperature: 27ºC	**Air Pressure:** 1009 hPa	**Relative Humidity:** 48 %	**Power Supply:** 120 VAC
Remarks:			

Plot 7.6.32 Radiated emission measurements from 33 to 40 GHz at the mid carrier frequency

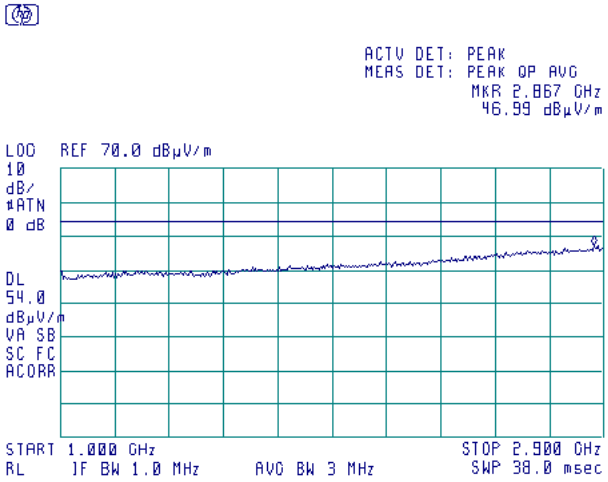
TEST SITE: OATS
TEST DISTANCE: 3 m
ANTENNA POLARIZATION: Vertical and Horizontal



Test specification:	Section 15.407(b), Unwanted radiated emissions		
Test procedure:	Public notice DA 00-705/ 47 CFR, Section 15.247(c) / ANSI C63.4, Section 13.1.4		
Test mode:	Compliance	Verdict:	PASS
Date:	10/06/2007		
Temperature: 27ºC	Air Pressure: 1009 hPa	Relative Humidity: 48 %	Power Supply: 120 VAC
Remarks:			

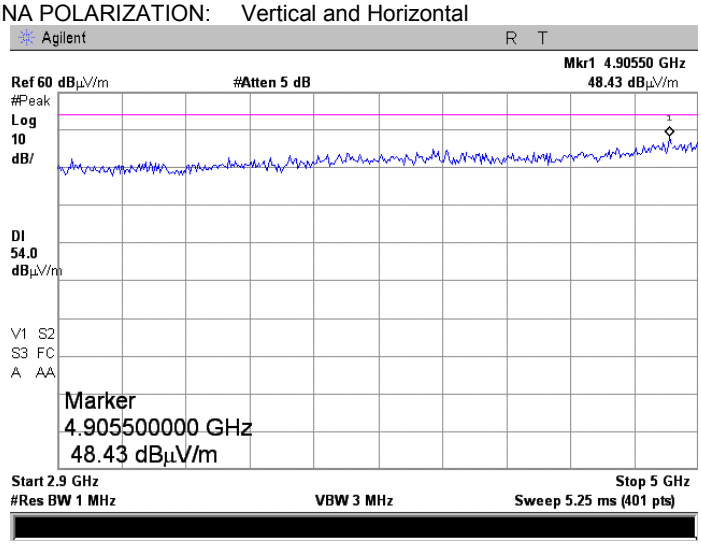
Plot 7.6.33 Radiated emission measurements from 1.0 to 2.9 GHz at the high carrier frequency

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



Plot 7.6.34 Radiated emission measurements from 2.9 to 5.0 GHz at the high carrier frequency

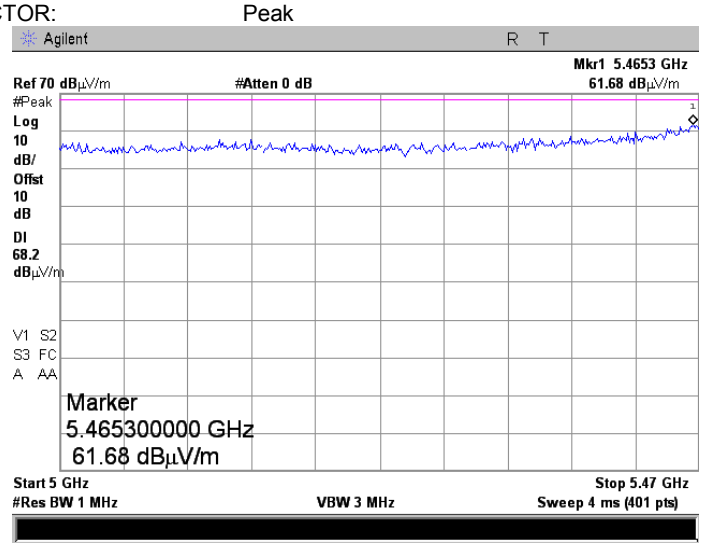
TEST SITE: Anechoic chamber
TEST DISTANCE: 3 m
ANTENNA POLARIZATION: Vertical and Horizontal



Test specification:	**Section 15.407(b), Unwanted radiated emissions**		
Test procedure:	Public notice DA 00-705/ 47 CFR, Section 15.247(c) / ANSI C63.4, Section 13.1.4		
Test mode:	Compliance	**Verdict:**	PASS
Date:	10/06/2007		
Temperature: 27ºC	**Air Pressure:** 1009 hPa	**Relative Humidity:** 48 %	**Power Supply:** 120 VAC
Remarks:			

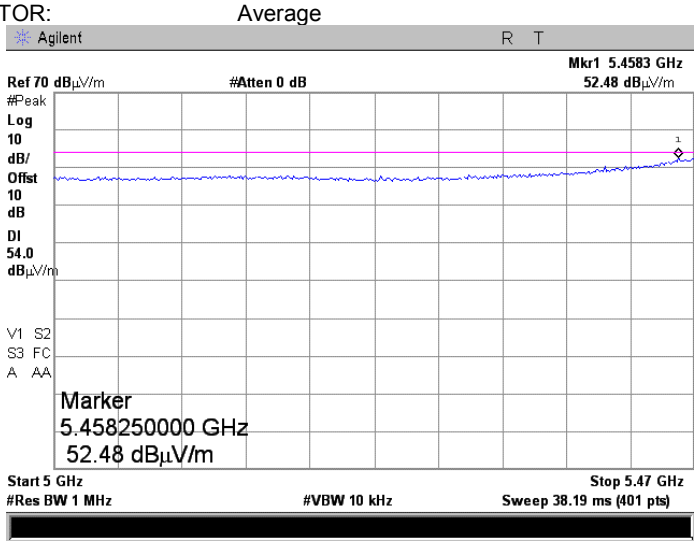
Plot 7.6.35 Radiated emission measurements from 5.0 to 5.47 GHz at the high carrier frequency

TEST SITE: Anechoic chamber
TEST DISTANCE: 3 m
ANTENNA POLARIZATION: Vertical and Horizontal
DETECTOR: Peak



Plot 7.6.36 Radiated emission measurements from 5.0 to 5.47 GHz at the high carrier frequency

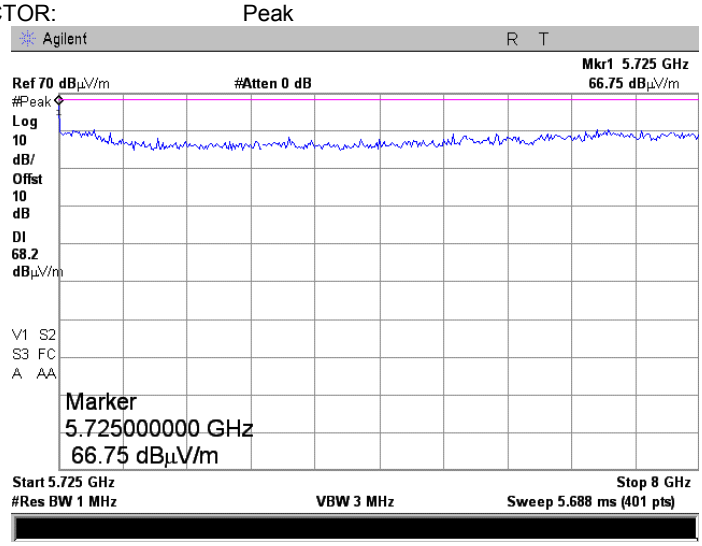
TEST SITE: Anechoic chamber
TEST DISTANCE: 3 m
ANTENNA POLARIZATION: Vertical and Horizontal
DETECTOR: Average



Test specification:	Section 15.407(b), Unwanted radiated emissions		
Test procedure:	Public notice DA 00-705/ 47 CFR, Section 15.247(c) / ANSI C63.4, Section 13.1.4		
Test mode:	Compliance	Verdict:	PASS
Date:	10/06/2007		
Temperature: 27ºC	Air Pressure: 1009 hPa	Relative Humidity: 48 %	Power Supply: 120 VAC
Remarks:			

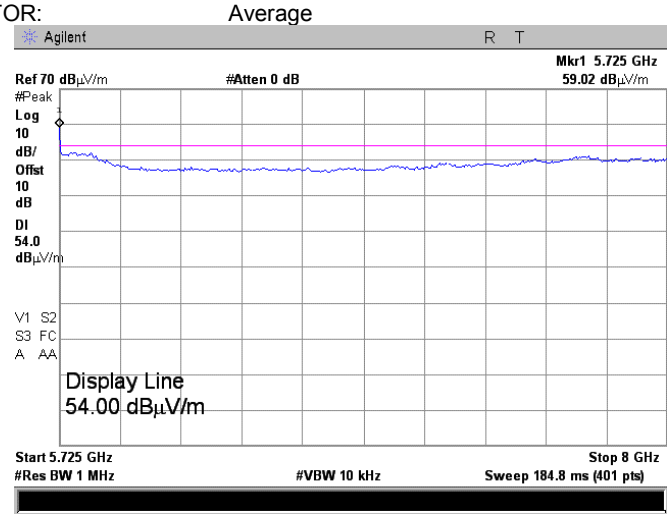
Plot 7.6.37 Radiated emission measurements from 5.725 to 8.0 GHz at the high carrier frequency

TEST SITE: Anechoic chamber
TEST DISTANCE: 3 m
ANTENNA POLARIZATION: Vertical and Horizontal
DETECTOR: Peak



Plot 7.6.38 Radiated emission measurements from 5.725 to 8.0 GHz at the high carrier frequency

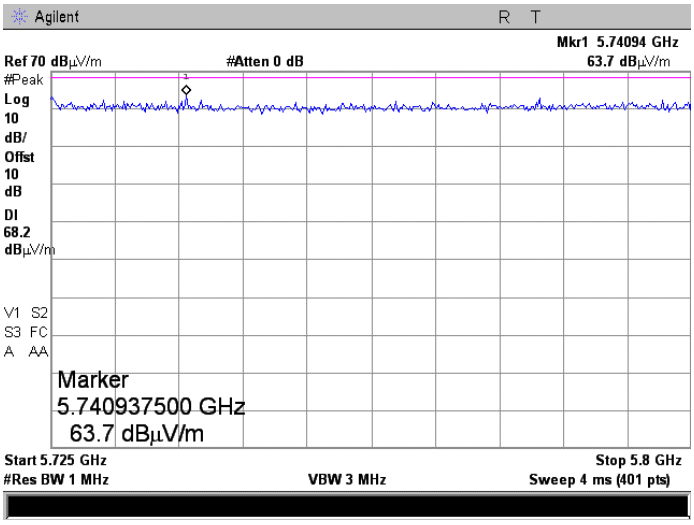
TEST SITE: Anechoic chamber
TEST DISTANCE: 3 m
ANTENNA POLARIZATION: Vertical and Horizontal
DETECTOR: Average



Test specification:	Section 15.407(b), Unwanted radiated emissions		
Test procedure:	Public notice DA 00-705/ 47 CFR, Section 15.247(c) / ANSI C63.4, Section 13.1.4		
Test mode:	Compliance	Verdict:	PASS
Date:	10/06/2007		
Temperature: 27ºC	Air Pressure: 1009 hPa	Relative Humidity: 48 %	Power Supply: 120 VAC
Remarks:			

Plot 7.6.39 Radiated emission measurements from 5.725 to 5.8 GHz at the high carrier frequency

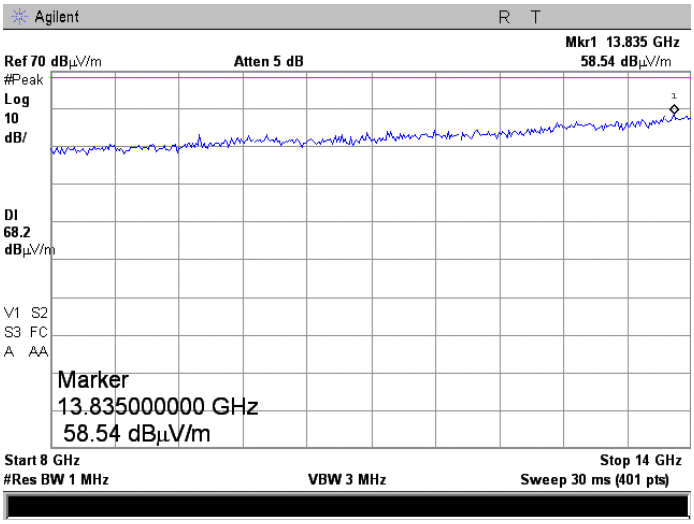
TEST SITE: Anechoic chamber
TEST DISTANCE: 3 m
ANTENNA POLARIZATION: Vertical and Horizontal



Test specification:	Section 15.407(b), Unwanted radiated emissions		
Test procedure:	Public notice DA 00-705/ 47 CFR, Section 15.247(c) / ANSI C63.4, Section 13.1.4		
Test mode:	Compliance	Verdict:	PASS
Date:	10/06/2007		
Temperature: 27ºC	Air Pressure: 1009 hPa	Relative Humidity: 48 %	Power Supply: 120 VAC
Remarks:			

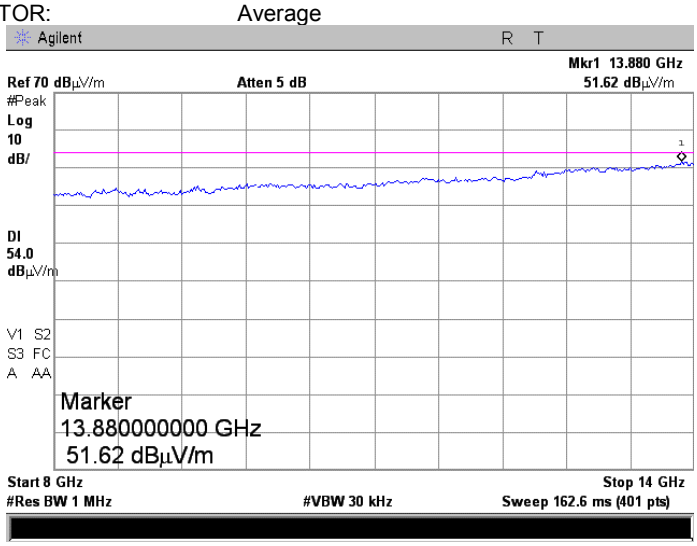
Plot 7.6.40 Radiated emission measurements from 8 to 14 GHz at the high carrier frequency

TEST SITE: Anechoic chamber
TEST DISTANCE: 3 m
ANTENNA POLARIZATION: Vertical and Horizontal
DETECTOR: Peak



Plot 7.6.41 Radiated emission measurements from 8 to 14 GHz at the high carrier frequency

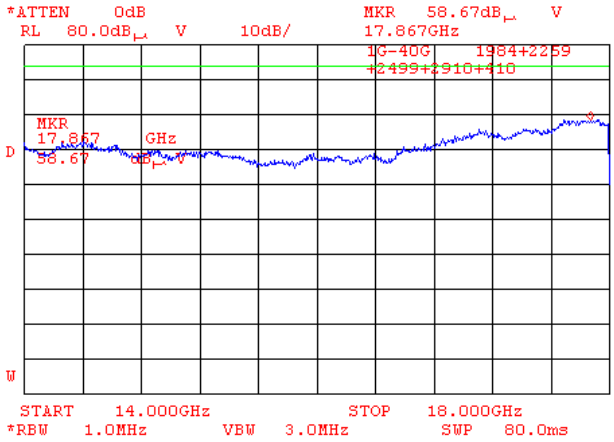
TEST SITE: Anechoic chamber
TEST DISTANCE: 3 m
ANTENNA POLARIZATION: Vertical and Horizontal
DETECTOR: Average



Test specification:	Section 15.407(b), Unwanted radiated emissions		
Test procedure:	Public notice DA 00-705/ 47 CFR, Section 15.247(c) / ANSI C63.4, Section 13.1.4		
Test mode:	Compliance	Verdict:	PASS
Date:	10/06/2007		
Temperature: 27ºC	Air Pressure: 1009 hPa	Relative Humidity: 48 %	Power Supply: 120 VAC
Remarks:			

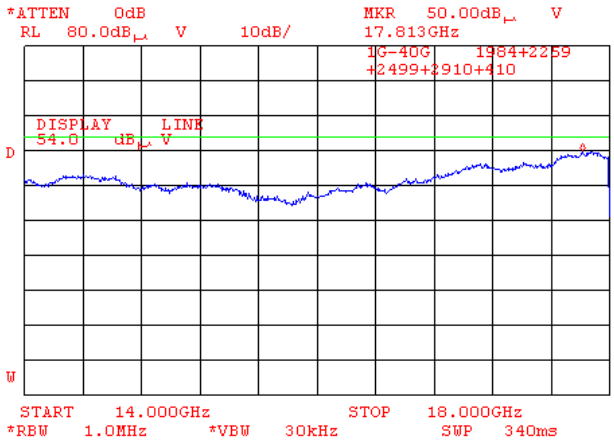
Plot 7.6.42 Radiated emission measurements from 14 to 18 GHz at the high carrier frequency

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



Plot 7.6.43 Radiated emission measurements from 14 to 18 GHz at the high carrier frequency

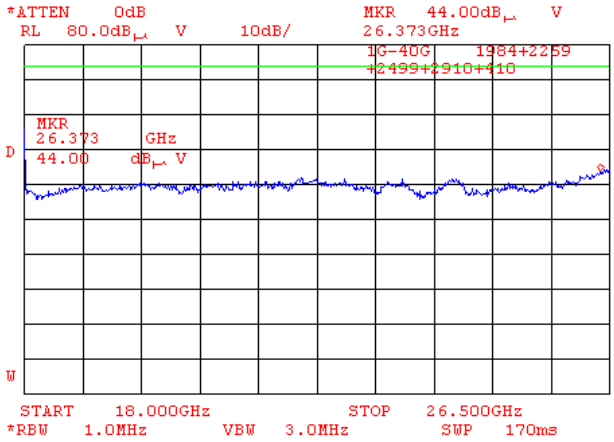
TEST SITE: OATS
TEST DISTANCE: 3 m
ANTENNA POLARIZATION: Vertical and Horizontal
DETECTOR: Average



Test specification:	Section 15.407(b), Unwanted radiated emissions		
Test procedure:	Public notice DA 00-705/ 47 CFR, Section 15.247(c) / ANSI C63.4, Section 13.1.4		
Test mode:	Compliance	Verdict:	PASS
Date:	10/06/2007		
Temperature: 27ºC	Air Pressure: 1009 hPa	Relative Humidity: 48 %	Power Supply: 120 VAC
Remarks:			

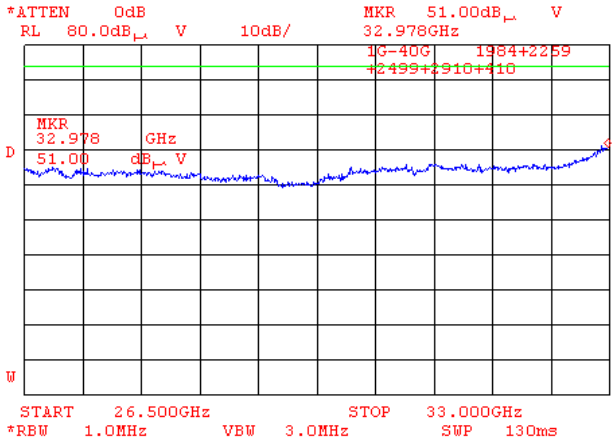
Plot 7.6.44 Radiated emission measurements from 18 to 26.5 GHz at the high carrier frequency

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



Plot 7.6.45 Radiated emission measurements from 26.5 to 33 GHz at the high carrier frequency

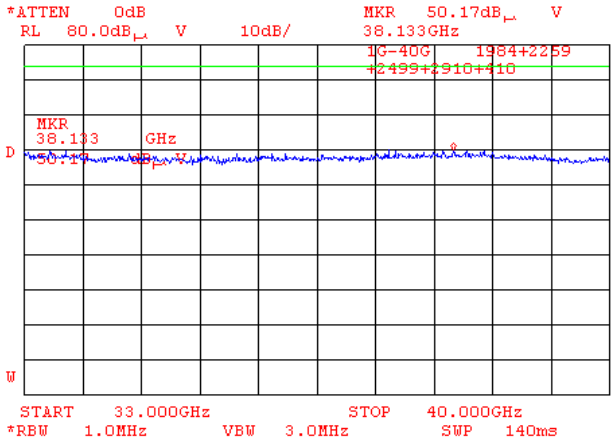
TEST SITE: OATS
TEST DISTANCE: 3 m
ANTENNA POLARIZATION: Vertical and Horizontal



Test specification:	Section 15.407(b), Unwanted radiated emissions		
Test procedure:	Public notice DA 00-705/ 47 CFR, Section 15.247(c) / ANSI C63.4, Section 13.1.4		
Test mode:	Compliance	Verdict:	PASS
Date:	10/06/2007		
Temperature: 27ºC	Air Pressure: 1009 hPa	Relative Humidity: 48 %	Power Supply: 120 VAC
Remarks:			

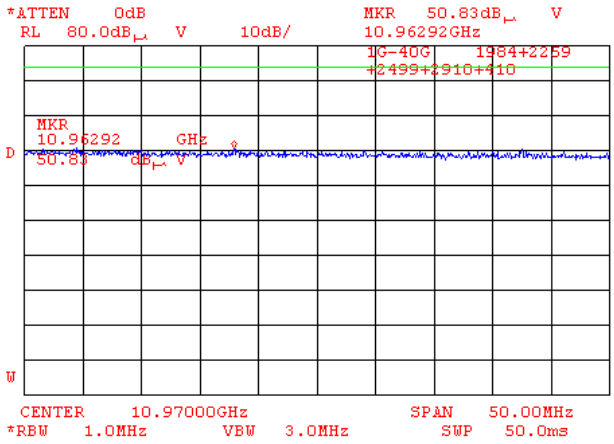
Plot 7.6.46 Radiated emission measurements from 33 to 40 GHz at the high carrier frequency

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



Plot 7.6.47 Radiated emission measurements at the second harmonic of low carrier frequency

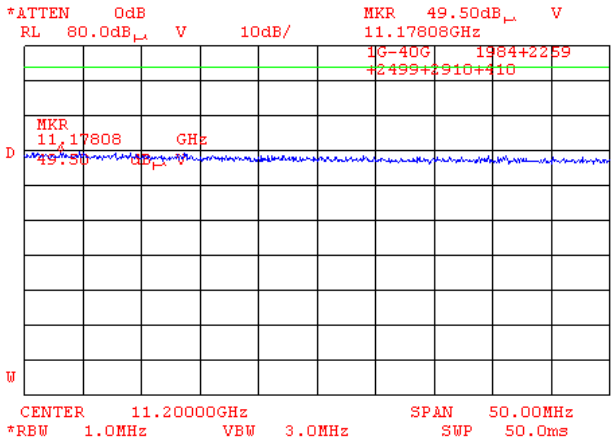
TEST SITE: OATS
TEST DISTANCE: 3 m



Test specification:	**Section 15.407(b), Unwanted radiated emissions**		
Test procedure:	Public notice DA 00-705/ 47 CFR, Section 15.247(c) / ANSI C63.4, Section 13.1.4		
Test mode:	Compliance	**Verdict:**	PASS
Date:	10/06/2007		
Temperature: 27ºC	**Air Pressure:** 1009 hPa	**Relative Humidity:** 48 %	**Power Supply:** 120 VAC
Remarks:			

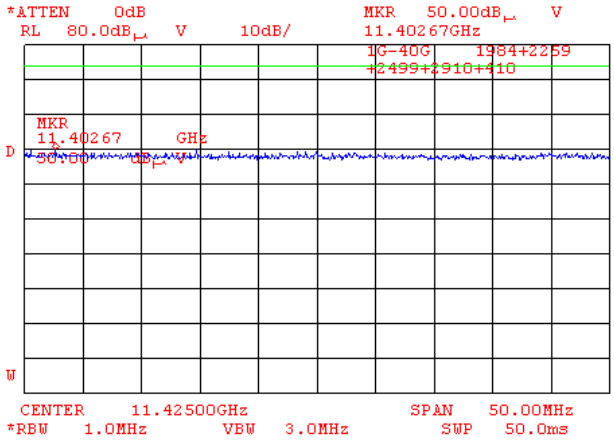
Plot 7.6.48 Radiated emission measurements at the second harmonic of mid carrier frequency

TEST SITE: OATS
TEST DISTANCE: 3 m



Plot 7.6.49 Radiated emission measurements at the second harmonic of high carrier frequency

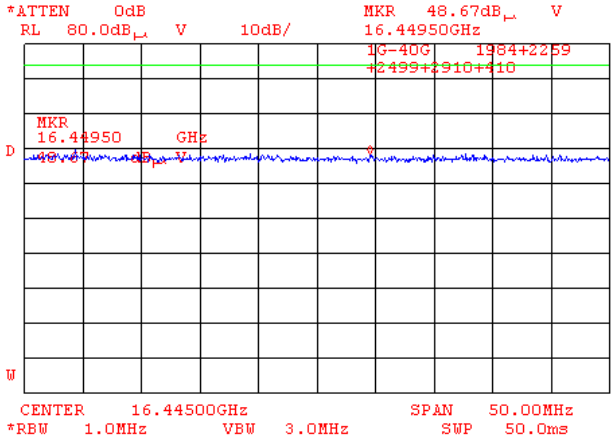
TEST SITE: OATS
TEST DISTANCE: 3 m



Test specification:	Section 15.407(b), Unwanted radiated emissions		
Test procedure:	Public notice DA 00-705/ 47 CFR, Section 15.247(c) / ANSI C63.4, Section 13.1.4		
Test mode:	Compliance	Verdict:	PASS
Date:	10/06/2007		
Temperature: 27ºC	Air Pressure: 1009 hPa	Relative Humidity: 48 %	Power Supply: 120 VAC
Remarks:			

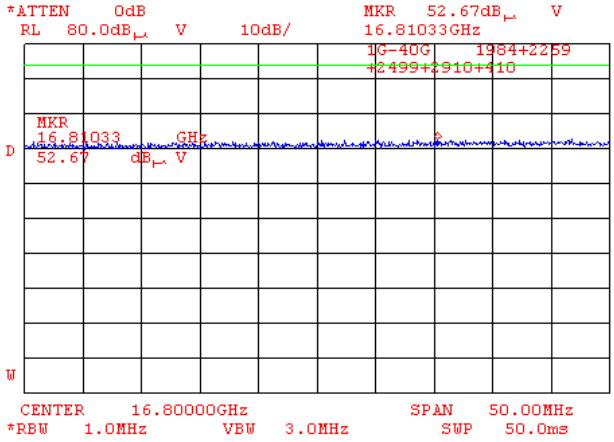
Plot 7.6.50 Radiated emission measurements at the third harmonic of low carrier frequency

TEST SITE: OATS
TEST DISTANCE: 3 m



Plot 7.6.51 Radiated emission measurements at the third harmonic of mid carrier frequency

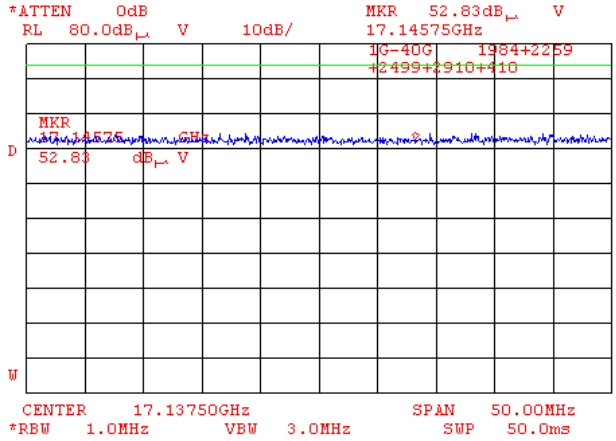
TEST SITE: OATS
TEST DISTANCE: 3 m



Test specification:	Section 15.407(b), Unwanted radiated emissions		
Test procedure:	Public notice DA 00-705/ 47 CFR, Section 15.247(c) / ANSI C63.4, Section 13.1.4		
Test mode:	Compliance	Verdict:	PASS
Date:	10/06/2007		
Temperature: 27ºC	Air Pressure: 1009 hPa	Relative Humidity: 48 %	Power Supply: 120 VAC
Remarks:			

Plot 7.6.52 Radiated emission measurements at the third harmonic of high carrier frequency

TEST SITE: OATS
TEST DISTANCE: 3 m



Test specification:	Section 15.407(g), Frequency stability		
Test procedure:	Section 2.1055		
Test mode:	Compliance	Verdict:	PASS
Date:	10/02/2007		
Temperature: 25ºC	Air Pressure: 1013 hPa	Relative Humidity: 45 %	Power Supply: 120 VAC
Remarks:			

7.7 Frequency stability test

7.7.1 General

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

Table 7.7.1 Frequency stability limits

Assigned frequency band, MHz	Maximum allowed frequency displacement
5470 - 5725	Manufacturers of U-NII devices are responsible for ensuring frequency stability such that an emission is maintained within the band of operation under all conditions of normal operation as specified in the users manual

7.7.2 Test procedure

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

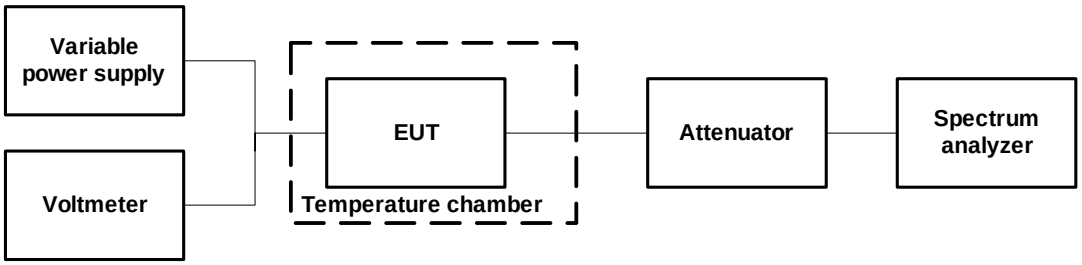
7.7.2.2 The EUT power was turned off. Temperature within test chamber was set to the required one and a period of time sufficient to stabilize all of the oscillator circuit components was allowed.

7.7.2.3 The EUT was powered on and carrier frequency was measured at start up moment and then after 2, 5 and 10 minutes. The EUT was powered off.

7.7.2.4 The above procedure was repeated at the rest of the test temperatures and voltages as provided in Table 7.7.2.

7.7.2.5 Frequency displacement was calculated and compared with the limit as provided in Table 7.7.2.

Figure 7.7.1 Frequency stability test setup



Test specification:	**Section 15.407(g), Frequency stability**		
Test procedure:	Section 2.1055		
Test mode:	Compliance	**Verdict:**	PASS
Date:	10/02/2007		
Temperature: 25ºC	**Air Pressure:** 1013 hPa	**Relative Humidity:** 45 %	**Power Supply:** 120 VAC
Remarks:			

Table 7.7.2 Frequency stability test results

OPERATING FREQUENCY:	5470 - 5725 MHz
NOMINAL POWER VOLTAGE:	120 VAC
TEMPERATURE STABILIZATION PERIOD:	20 min
POWER DURING TEMPERATURE TRANSITION:	Off
SPECTRUM ANALYZER MODE:	Counter
RESOLUTION BANDWIDTH:	10 kHz
VIDEO BANDWIDTH:	30 kHz
MODULATION:	Unmodulated

Temperature, ºC	Voltage, V	Frequency, MHz				Max frequency drift, Hz		Verdict
		Start up	2nd min	5th min	10th min	Positive	Negative	
Low frequency:								
-40	Nominal	5484.963264	5484.963487	5484.962351	5484.969633	0	-21594	Pass
20	Nominal +15%	5484.983222	5484.982354	5484.981903	5484.981255	1995	0	
20	Nominal	5484.983015	5484.982392	5484.981795	5484.981227*	1788	0	
20	Nominal -15%	5484.983254	5484.982340	5484.981988	5484.981540	2027	0	
55	Nominal	5484.979198	5484.979774	5484.980568	5484.981324	97	-2029	
Mid frequency:								
-40	Nominal	5599.967763	5599.967827	5599.967547	5599.966053	0	-13635	Pass
20	Nominal +15%	5599.980370	5599.979784	5599.979842	5599.979657	682	-31	
20	Nominal	5599.980160	5599.979933	5599.979850	5599.979688*	472	0	
20	Nominal -15%	5599.980280	5599.979899	5599.979825	5599.979740	592	0	
55	Nominal	5599.980466	5599.981991	5599.983062	5599.985395	5707	0	
High frequency:								
-40	Nominal	5712.486178	5712.484017	5712.475912	5712.472001	6869	-7308	Pass
20	Nominal +15%	5712.479812	5712.479388	5712.479369	5712.479334	503	0	
20	Nominal	5712.479564	5712.479377	5712.479338	5712.479309*	255	0	
20	Nominal -15%	5712.479587	5712.479387	5712.479359	5712.479329	278	0	
55	Nominal	5712.484186	5712.485983	5712.487297	5712.489254	9945	0	

* - Reference frequency

The maximum frequency drift is 21.5 kHz. The band edge of the channel is at least 7.5 MHz from either side of the band, the 21.5 kHz drift is more than sufficient to guarantee than the intentional emission will remain in the band over the entire operating range of the EUT.

Reference numbers of test equipment used

HL 2882	HL 2909	HL 3286					

Full description is given in Appendix A.

Test specification:	Section 15.207, Conducted emission at AC power port		
Test procedure:	ANSI C63.4, Sections 11.5 and 12.1.3		
Test mode:	Compliance	Verdict:	PASS
Date:	10/11/2007		
Temperature: 25ºC	Air Pressure: 1012 hPa	Relative Humidity: 48 %	Power Supply: 120 VAC
Remarks:			

7.8 Conducted emissions

7.8.1 General

This test was performed to measure common mode conducted emissions at the mains power port. Specification test limits are given in Table 7.8.1.

Table 7.8.1 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.

7.8.2 Test procedure

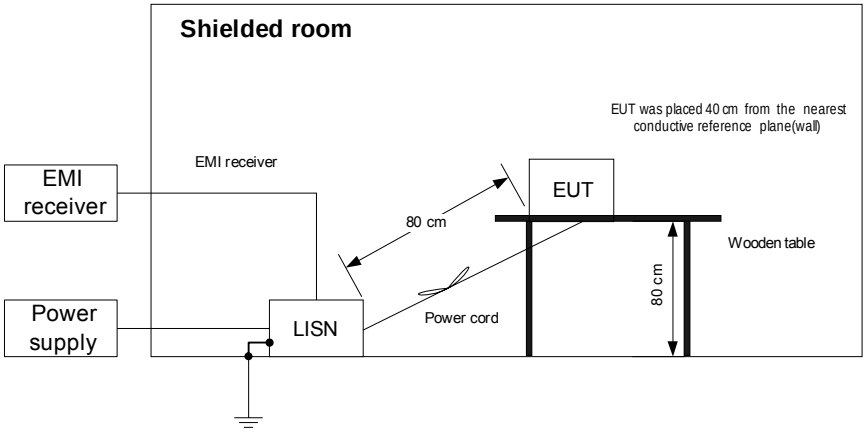
7.8.2.1 The EUT was set up as shown in Figure 7.8.1, energized and the performance check was conducted.

7.8.2.2 The measurements were performed at power terminals with the LISN, connected to a spectrum analyzer in the frequency range referred to in Table 7.8.1. Unused coaxial connector of the LISN was terminated with 50 Ohm. Quasi-peak and average detectors were used throughout the testing.

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

7.8.2.4 The worst test results (the lowest margins) were recorded in Table 7.8.2 and shown in the associated plots.

Figure 7.8.1 Setup for conducted emission measurements, table-top equipment



Test specification:	**Section 15.207, Conducted emission at AC power port**		
Test procedure:	ANSI C63.4, Sections 11.5 and 12.1.3		
Test mode:	Compliance	**Verdict:**	PASS
Date:	10/11/2007		
Temperature: 25ºC	**Air Pressure:** 1012 hPa	**Relative Humidity:** 48 %	**Power Supply:** 120 VAC
Remarks:			

Table 7.8.2 Conducted emission test results

LINE:	AC mains
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 MODE:	Transmit

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*		
0.294745	44.92	44.54	60.43	-15.89	44.51	50.43	-5.92	L1	Pass
0.689380	43.90	41.33	56.00	-14.67	38.24	46.00	-7.76		
0.785942	43.55	43.18	56.00	-12.82	43.13	46.00	-2.87		
0.834413	48.77	47.86	56.00	-8.14	44.38	46.00	-1.62		
1.943491	44.93	44.61	56.00	-11.39	44.58	46.00	-1.42		
2.082196	45.78	45.42	56.00	-10.58	45.39	46.00	-0.61		
2.359568	46.97	46.43	56.00	-9.57	44.64	46.00	-1.36		
0.294636	46.38	46.05	60.44	-14.39	46.05	50.44	-4.39	L2	Pass
0.785897	44.92	44.54	56.00	-11.46	44.44	46.00	-1.56		
0.834503	49.27	48.33	56.00	-7.67	44.73	46.00	-1.27		
1.942644	44.82	44.49	56.00	-11.51	44.46	46.00	-1.54		
2.081432	45.63	45.28	56.00	-10.72	45.25	46.00	-0.75		
2.358928	47.06	46.36	56.00	-9.64	44.47	46.00	-1.53		

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

Reference numbers of test equipment used

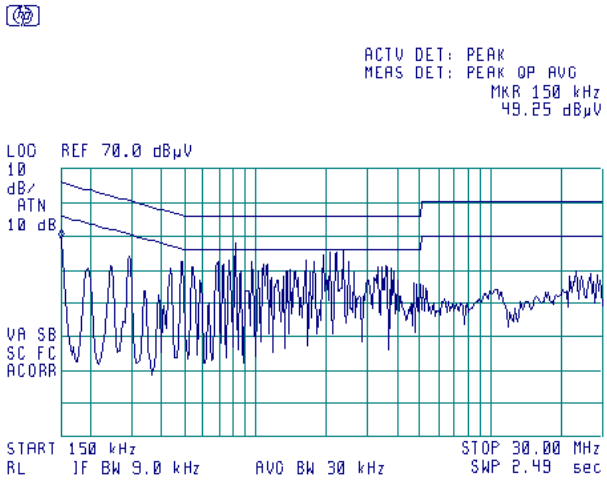
HL 0672	HL 0787	HL 1430	HL 1503	HL 1510	HL 2888		

Full description is given in Appendix A.

Test specification:	Section 15.207, Conducted emission at AC power port		
Test procedure:	ANSI C63.4, Sections 11.5 and 12.1.3		
Test mode:	Compliance	Verdict:	PASS
Date:	10/11/2007		
Temperature: 25ºC	Air Pressure: 1012 hPa	Relative Humidity: 48 %	Power Supply: 120 VAC
Remarks:			

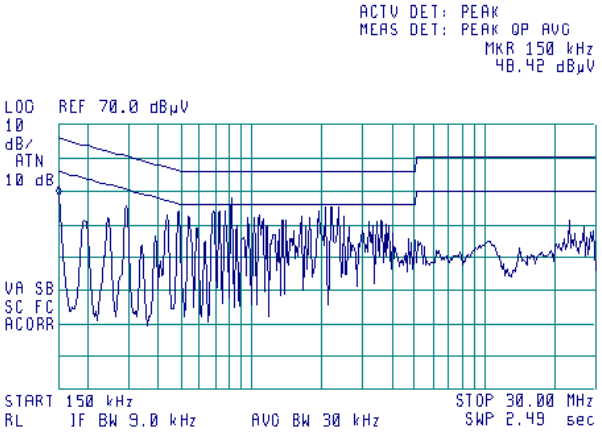
Plot 7.8.1 Conducted emission measurements

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



Plot 7.8.2 Conducted emission measurements

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



Test specification:	**FCC Part 15, Section 203, Antenna requirements**		
Test procedure:	Visual inspection / supplier declaration		
Test mode:	Compliance	**Verdict:**	PASS
Date:	10/08/2007		
Temperature: 24ºC	**Air Pressure:** 1012 hPa	**Relative Humidity:** 44 %	**Power Supply:** 120 VAC
Remarks:			

7.9 Antenna requirements

The EUT was verified for compliance with antenna requirements. A transmitter shall be designed to ensure that no antenna other than that furnished by the responsible party will be used with the device. It may be either permanently attached or employs a unique antenna connector for every antenna proposed for use with the EUT. This requirement does not apply to professionally installed transmitters.
The rationale for compliance with the above requirements was either visual inspection results or supplier declaration. The summary of results is provided in Table 7.9.1.

Table 7.9.1 Antenna requirements

Requirement	Rationale	Verdict
The transmitter antenna is permanently attached	Visual inspection	Comply
The transmitter employs a unique antenna connector	NA	
The transmitter requires professional installation	NA	

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:	10/11/2007		
Temperature: 25ºC	Air Pressure: 1012 hPa	Relative Humidity: 48 %	Power Supply: 120 VAC
Remarks:			

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

8.1 Conducted emissions

8.1.1 General

This test was performed to measure common mode conducted emissions at the mains power port. Specification test limits are given in Table 8.1.1.

Table 8.1.1 Limits for conducted emissions

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

* The limit decreases linearly with the logarithm of frequency.

8.1.2 Test procedure

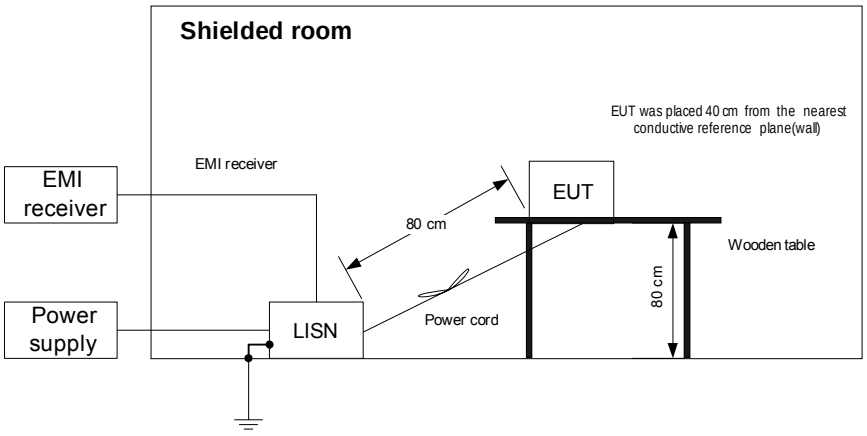
8.1.2.1 The EUT was set up as shown in Figure 8.1.1, energized and the performance check was conducted.

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

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

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

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



Test specification:	**Section 15.107, Conducted emission at AC power port**		
Test procedure:	ANSI C63.4, Sections 11.5 and 12.1.3		
Test mode:	Compliance	**Verdict:**	PASS
Date:	10/11/2007		
Temperature: 25ºC	**Air Pressure:** 1012 hPa	**Relative Humidity:** 48 %	**Power Supply:** 120 VAC
Remarks:			

Table 8.1.2 Conducted emission test results

LINE: AC mains
LIMIT: Class B
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 MODE: Receive

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*		
0.294745	44.92	44.54	60.43	-15.89	44.51	50.43	-5.92	L1	Pass
0.689380	43.90	41.33	56.00	-14.67	38.24	46.00	-7.76		
0.785942	43.55	43.18	56.00	-12.82	43.13	46.00	-2.87		
0.834413	48.77	47.86	56.00	-8.14	44.38	46.00	-1.62		
1.943491	44.93	44.61	56.00	-11.39	44.58	46.00	-1.42		
2.082196	45.78	45.42	56.00	-10.58	45.39	46.00	-0.61		
2.359568	46.97	46.43	56.00	-9.57	44.64	46.00	-1.36		
0.294636	46.38	46.05	60.44	-14.39	46.05	50.44	-4.39	L2	Pass
0.785897	44.92	44.54	56.00	-11.46	44.44	46.00	-1.56		
0.834503	49.27	48.33	56.00	-7.67	44.73	46.00	-1.27		
1.942644	44.82	44.49	56.00	-11.51	44.46	46.00	-1.54		
2.081432	45.63	45.28	56.00	-10.72	45.25	46.00	-0.75		
2.358928	47.06	46.36	56.00	-9.64	44.47	46.00	-1.53		

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

Reference numbers of test equipment used

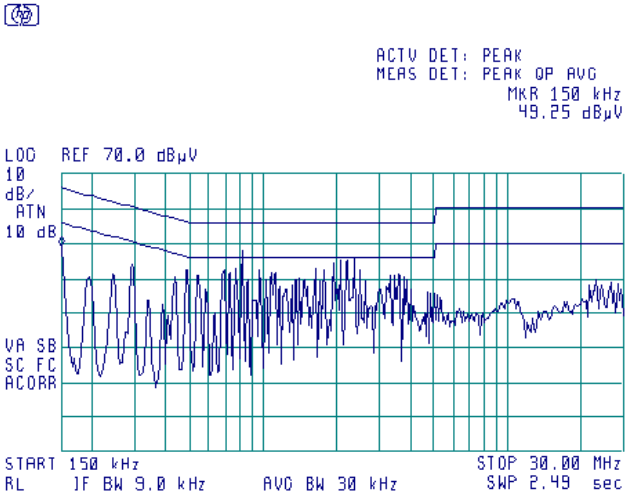
HL 0672	HL 0787	HL 1430	HL 1503	HL 1510	HL 2888		

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:	10/11/2007		
Temperature: 25ºC	**Air Pressure:** 1012 hPa	**Relative Humidity:** 48 %	**Power Supply:** 120 VAC
Remarks:			

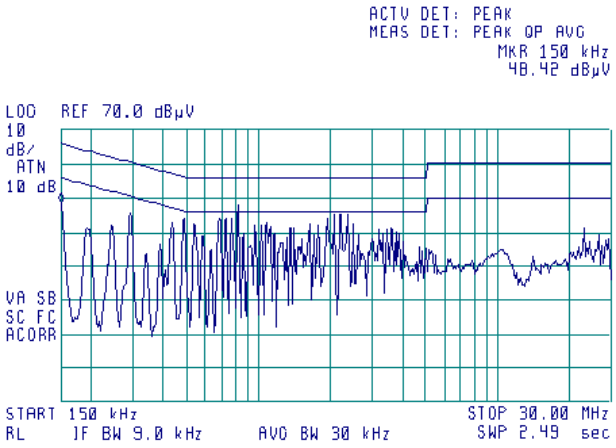
Plot 8.1.1 Conducted emission measurements

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



Plot 8.1.2 Conducted emission measurements

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



Test specification:	Section 15.109 Class B, Radiated emissions		
Test procedure:	ANSI C63.4, Section 11.6		
Test mode:	Compliance	Verdict:	PASS
Date & Time:	10/8/2007		
Temperature: 24ºC	Air Pressure: 1012 hPa	Relative Humidity: 44 %	Power Supply: 120 VAC
Remarks:			

8.2 Radiated emission measurements

8.2.1 General

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

Table 8.2.1 Radiated emission test limits

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

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

8.2.2 Test procedure

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

8.2.2.2 The preliminary measurements were performed in the anechoic chamber at 3 m test distance. The specified frequency range was investigated with the antenna connected to the EMI receiver. To find the highest emission the turntable was rotated 360^0 and the measuring antenna height was swept from 1 to 4 m in both, vertical and horizontal polarizations. The EUT cables position was varied to maximize emission.

8.2.2.3 The EUT was set up as shown in Figure 8.2.2, energized and the EUT performance was checked.

8.2.2.4 The final measurements were performed at the open area test site at 3 m test distance with the antenna connected to the EMI receiver. The EUT wires and cables were arranged to produce the highest emission as it was found during the preliminary measurements. The frequencies, produced the highest emissions with respect to the limits during the preliminary test were investigated. To find the highest emission the turntable was rotated 360^0 and the measuring antenna height was swept from 1 to 4 m in both, vertical and horizontal polarizations.

8.2.2.5 The worst test results with respect to the limits were recorded in Table 8.2.2 and shown in the associated plots.

Test specification:	Section 15.109 Class B, Radiated emissions		
Test procedure:	ANSI C63.4, Section 11.6		
Test mode:	Compliance	Verdict:	PASS
Date & Time:	10/8/2007		
Temperature: 24ºC	Air Pressure: 1012 hPa	Relative Humidity: 44 %	Power Supply: 120 VAC
Remarks:			

Figure 8.2.1 Setup for radiated emission measurements in anechoic chamber, table-top equipment

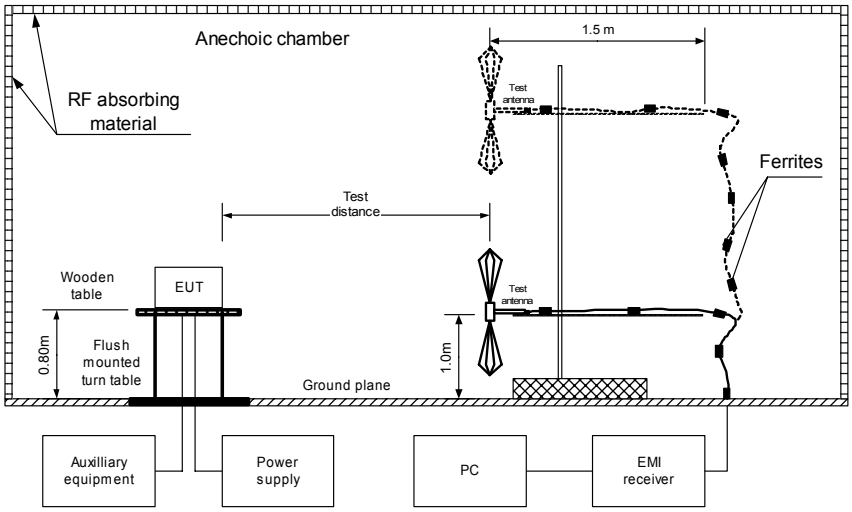
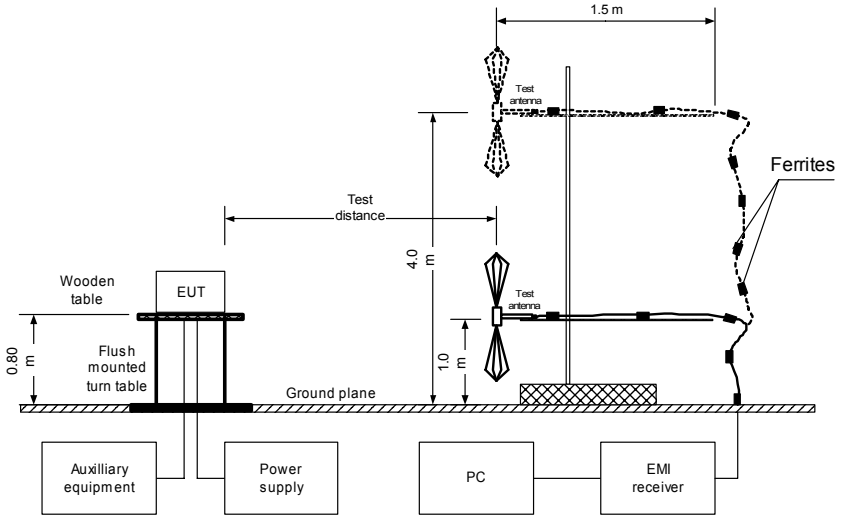


Figure 8.2.2 Setup for radiated emission measurements at OATS, table- top equipment



Test specification:	**Section 15.109 Class B, Radiated emissions**		
Test procedure:	ANSI C63.4, Section 11.6		
Test mode:	Compliance	**Verdict:**	PASS
Date & Time:	10/8/2007		
Temperature: 24ºC	**Air Pressure:** 1012 hPa	**Relative Humidity:** 44 %	**Power Supply:** 120 VAC
Remarks:			

Table 8.2.2 Radiated emission test results

EUT SET UP: TABLE-TOP
TEST SITE: OATS
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*				
45.925000	31.91	28.52	40.00	-11.48	V	1.2	360	Pass
107.017650	33.98	31.75	43.50	-11.75	V	1.3	230	
149.997500	35.33	32.73	43.50	-10.77	V	1.2	220	
175.000025	36.87	34.82	43.50	-8.68	V	1.0	120	
250.000000	44.53	37.70	46.00	-8.30	V	1.0	100	

TEST SITE: OATS
TEST DISTANCE: 3 m
DETECTORS USED: PEAK / AVERAGE
FREQUENCY RANGE: 1000 –33000 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 spurious were found								Pass

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

Reference numbers of test equipment used

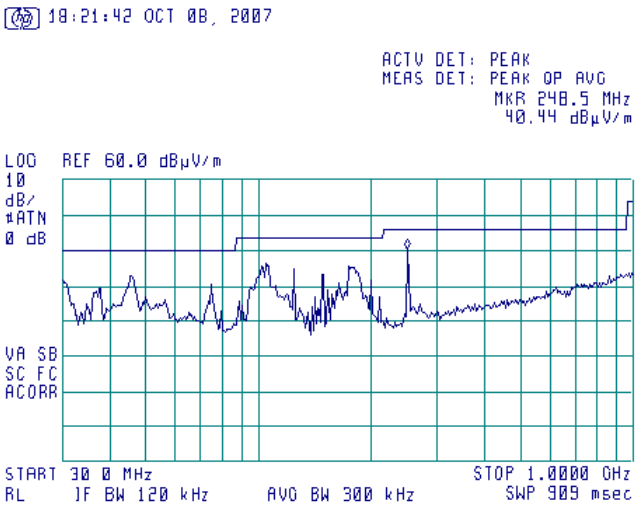
HL 0410	HL 0521	HL 0589	HL 0604	HL 1947	HL 1984	HL 1200	HL 2259
HL 2387	HL 2909	HL 2910					

Full description is given in Appendix A.

Test specification:	Section 15.109 Class B, Radiated emissions		
Test procedure:	ANSI C63.4, Section 11.6		
Test mode:	Compliance	Verdict:	PASS
Date & Time:	10/8/2007		
Temperature: 24ºC	Air Pressure: 1012 hPa	Relative Humidity: 44 %	Power Supply: 120 VAC
Remarks:			

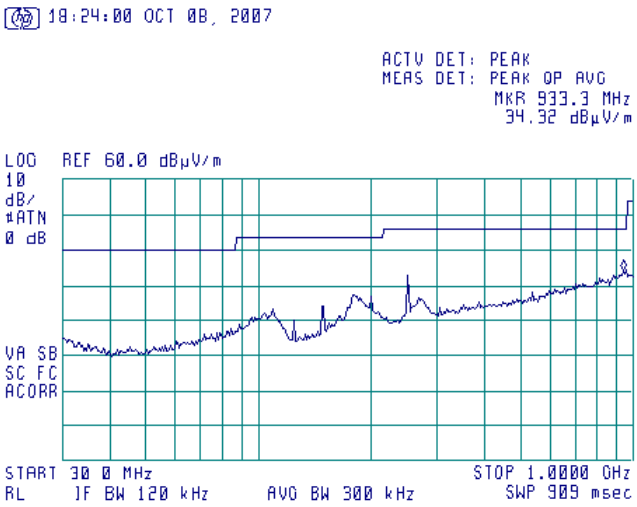
Plot 8.2.1 Radiated emission measurements in 30 - 1000 MHz range, vertical antenna polarization

TEST SITE: Anechoic chamber
TEST DISTANCE: 3 m



Plot 8.2.2 Radiated emission measurements in 30 - 1000 MHz range, horizontal antenna polarization

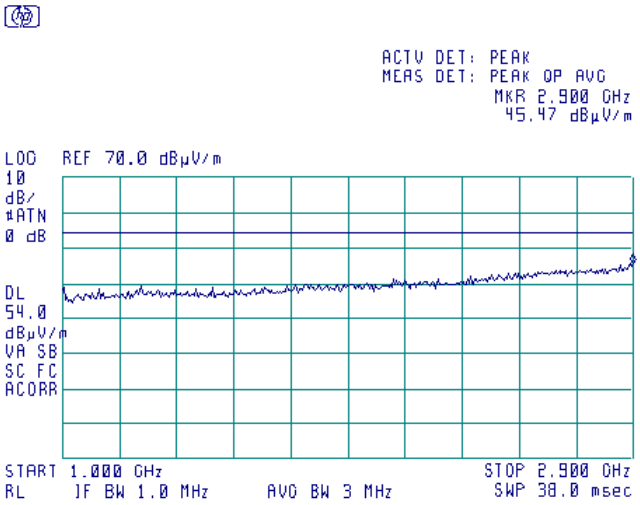
TEST SITE: Anechoic chamber
TEST DISTANCE: 3 m



Test specification:	Section 15.109 Class B, Radiated emissions		
Test procedure:	ANSI C63.4, Section 11.6		
Test mode:	Compliance	Verdict:	PASS
Date & Time:	10/8/2007		
Temperature: 24°C	Air Pressure: 1012 hPa	Relative Humidity: 44 %	Power Supply: 120 VAC
Remarks:			

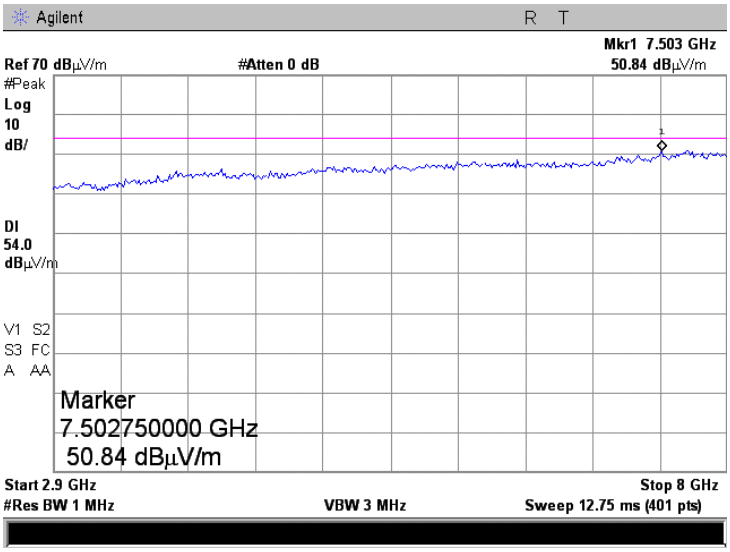
Plot 8.2.3 Radiated emission measurements 1.0 – 2.9 GHz, vertical & horizontal antenna polarization

TEST SITE: Anechoic chamber
TEST DISTANCE: 3 m



Plot 8.2.4 Radiated emission measurements 2.9 – 8.0 GHz, vertical & horizontal antenna polarization

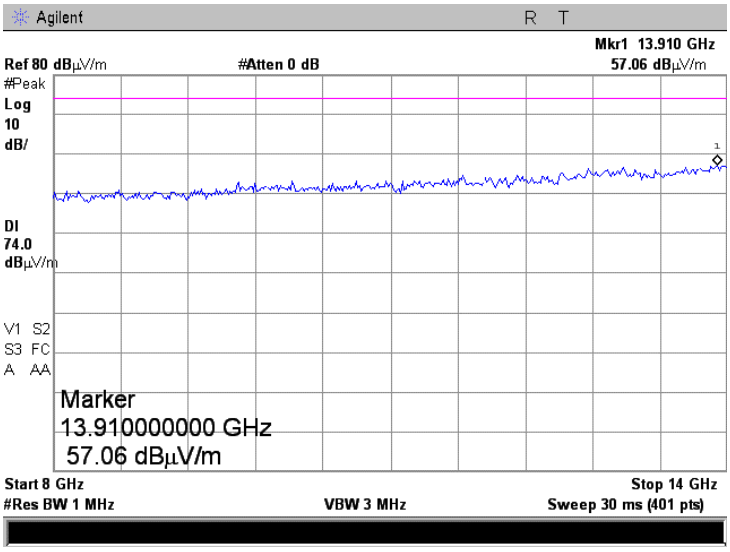
TEST SITE: Anechoic chamber
TEST DISTANCE: 3 m



Test specification:	Section 15.109 Class B, Radiated emissions		
Test procedure:	ANSI C63.4, Section 11.6		
Test mode:	Compliance	Verdict:	PASS
Date & Time:	10/8/2007		
Temperature: 24°C	Air Pressure: 1012 hPa	Relative Humidity: 44 %	Power Supply: 120 VAC
Remarks:			

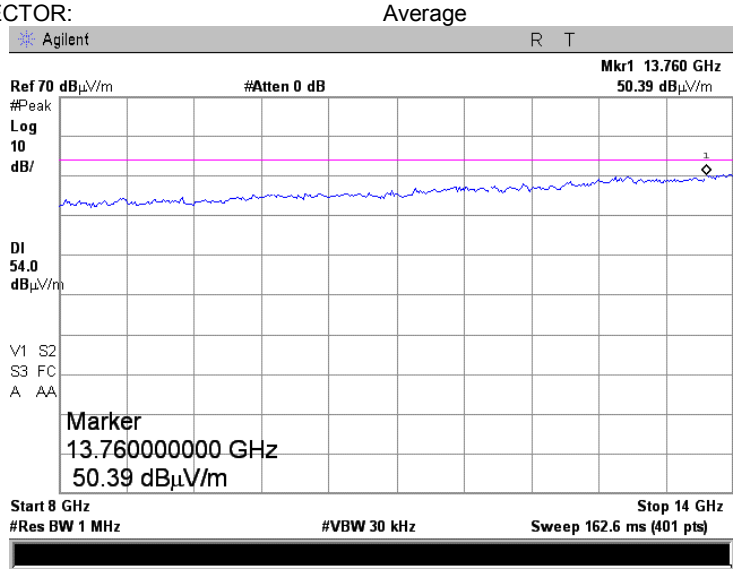
Plot 8.2.5 Radiated emission measurements 8.0 – 14.0 GHz, vertical & horizontal antenna polarization

TEST SITE: Anechoic chamber
TEST DISTANCE: 3 m
DETECTOR: Peak



Plot 8.2.6 Radiated emission measurements 8.0 – 14.0GHz, vertical & horizontal antenna polarization

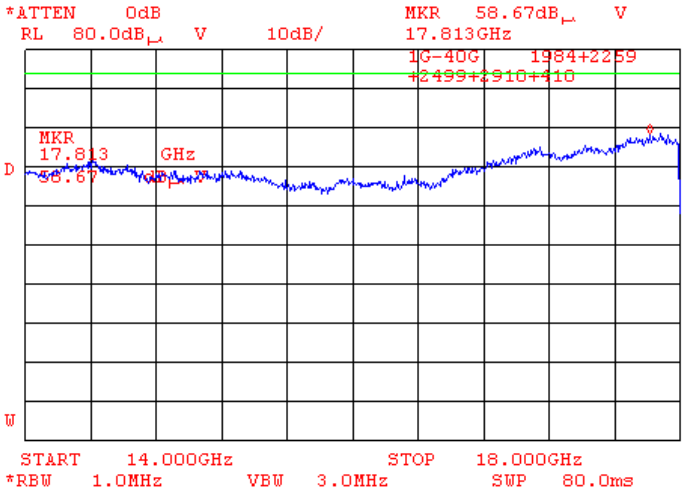
TEST SITE: Anechoic chamber
TEST DISTANCE: 3 m
DETECTOR: Average



Test specification:	Section 15.109 Class B, Radiated emissions		
Test procedure:	ANSI C63.4, Section 11.6		
Test mode:	Compliance	Verdict:	PASS
Date & Time:	10/8/2007		
Temperature: 24°C	Air Pressure: 1012 hPa	Relative Humidity: 44 %	Power Supply: 120 VAC
Remarks:			

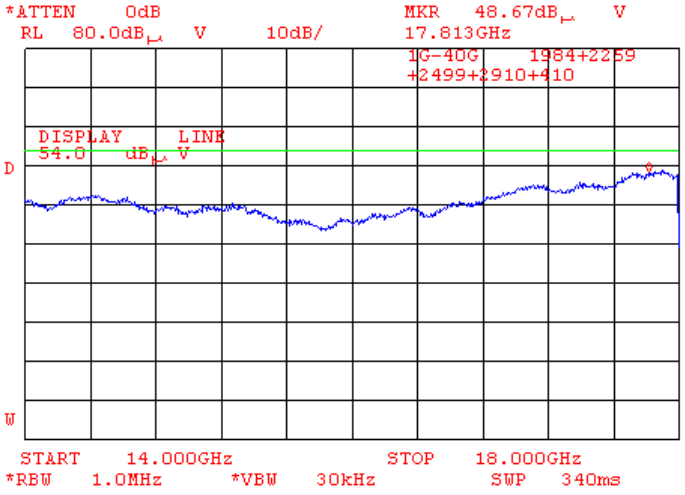
Plot 8.2.7 Radiated emission measurements from 14.0 to 18 GHz, vertical & horizontal antenna polarization

TEST SITE: OATS
TEST DISTANCE: 3 m
DETECTOR: Peak



Plot 8.2.8 Radiated emission measurements from 14.0 to 18 GHz, vertical & horizontal antenna polarization

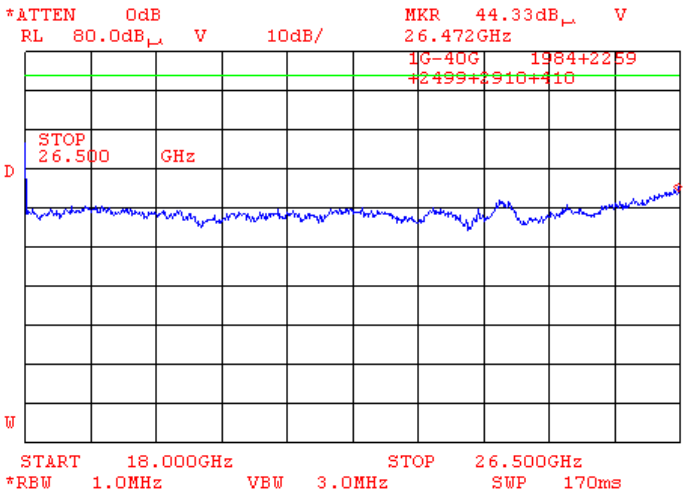
TEST SITE: OATS
TEST DISTANCE: 3 m
DETECTOR: Average



Test specification:	Section 15.109 Class B, Radiated emissions		
Test procedure:	ANSI C63.4, Section 11.6		
Test mode:	Compliance	Verdict:	PASS
Date & Time:	10/8/2007		
Temperature: 24°C	Air Pressure: 1012 hPa	Relative Humidity: 44 %	Power Supply: 120 VAC
Remarks:			

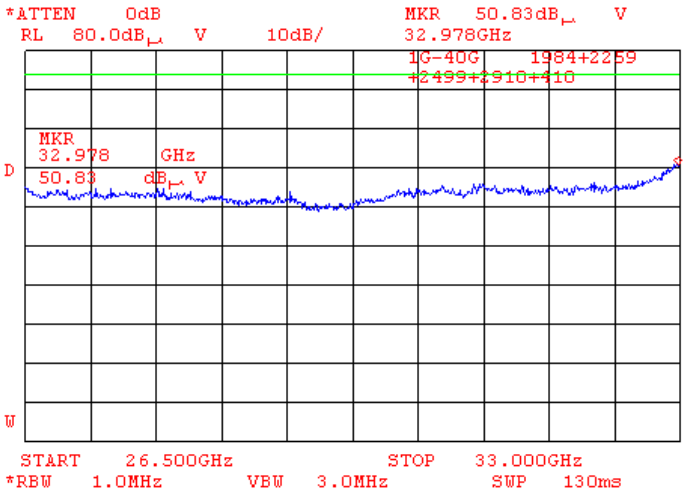
Plot 8.2.9 Radiated emission measurements from 18 to 26.5 GHz, vertical & horizontal antenna polarization

TEST SITE: OATS
TEST DISTANCE: 3 m



Plot 8.2.10 Radiated emission measurements from 26.5 to 33 GHz, vertical & horizontal antenna polarization

TEST SITE: OATS
TEST DISTANCE: 3 m



9 APPENDIX A Test equipment and ancillaries used for tests

HL No	Description	Manufacturer	Model	Ser. No.	Last Cal.	Due Cal.
0410	Cable, Coax, Microwave, DC-18 GHz, N-N, 1 m	Gore	PFP01P0 1039.4	9338767	05-Oct-07	05-Oct-08
0446	Antenna, Loop, Active, 10 kHz - 30 MHz	EMCO	6502	2857	28-Jun-07	28-Jun-08
0521	EMI Receiver (Spectrum Analyzer) with RF filter section 9 kHz-6.5 GHz	Hewlett Packard Co	8546A	3617A 00319, 3448A002 53	28-Aug-07	28-Aug-08
0589	Cable Coaxial, GORE A2P01POL118, 2.3 m	HL	GORE-3	176	02-Dec-06	02-Dec-07
0604	Antenna BiconiLog Log-Periodic/T Bow-TIE, 26 - 2000 MHz	EMCO	3141	9611-1011	10-Jan-07	10-Jan-08
0672	Shielded Room 4.6(L) x 4.2(W) x 2.4(H) m	HL	SR - 3	027	11-Nov-06	11-Nov-07
0787	Transient Limiter 9 kHz-200 MHz	Hewlett Packard Co	11947A	3107A018 77	21-Nov-06	21-Nov-07
1200	Quadruplexer 1-12 GHz (1-2 GHz; 2-4GHz;4-8 GHz; 8-12GHz)	Elettronica S.p.A. - Roma	UE 84	D/00240	08-Feb-07	08-Feb-09
1424	Spectrum Analyzer, 30 Hz- 40 GHz	Agilent Technologies	8564EC	3946A002 19	28-Aug-07	28-Aug-08
1425	EMI Receiver, 9 kHz - 2.9 GHz, System: HL1426, HL1427	Agilent Technologies	8542E	3710A002 22, 3705A002 04	31-Aug-07	31-Aug-08
1430	EMI Receiver, 9 kHz - 2.9 GHz, System: HL1431, HL1432	Agilent Technologies	8542E	3807A002 62,3705A0 0217	31-Aug-07	31-Aug-08
1503	Cable RF, 6 m, BNC/BNC	Belden	M17/167 MIL-C-17	1503	11-Sep-07	11-Sep-08
1510	Cable RF, 8 m, BNC/BNC	Belden	M17/167 MIL-C-17	1510	01-Jan-07	01-Jan-08
1553	Cable RF, 3.5 m	Alpha Wire	RG-214	1553	22-May-07	22-May-08
1556	Cable RF, 0.5 m	Telequis	MIL-C-17F-RG 058 CU	1556	12-Sep-07	12-Sep-08
1566	Cable RF, 2 m	Huber-Suhner	Sucoflex 104PE	13094/4PE	02-Dec-06	02-Dec-07
1947	Cable 18GHz, 6.5 m, blue	Rhophase Microwave Limited	NPS-1803A-6500-NPS	T4974	05-Oct-07	05-Oct-08
1984	Antenna, Double-Ridged Waveguide Horn, 1-18 GHz, 300 W	EMC Test Systems	3115	9911-5964	03-Mar-07	03-Mar-08
2009	Cable RF, 8 m	Alpha Wire	RG-214	C-56	20-May-07	20-May-08
2254	Cable 40GHz, 0.8 m, blue	Rhophase Microwave Limited	KPS-1503A-800-KPS	W4907	17-Jun-07	17-Jun-08
2259	Amplifier Low Noise 2-20 GHz	Sophia Wireless	LNA0220-C	0223	05-Nov-06	05-Nov-07
2260	Amplifier Low Noise 14-33 GHz	Sophia Wireless	LNA28-B	0233	05-Nov-06	05-Nov-07
2387	Filter Bandpass, 8-14 GHz	HL	FBP8-14	2387	05-Jun-07	05-Jun-09
2399	Cable 40 GHz, 1.5 m, blue	Rhophase Microwave Limited	KPS-1503A-1500-KPS	X2945	01-Jan-07	01-Jan-08
2524	Attenuator, 10 dB, DC-18 GHz	Midwest Microwave	263-10	2524	03-Jan-07	03-Jan-08

HL No	Description	Manufacturer	Model	Ser. No.	Last Cal.	Due Cal.
2882	Cable, 18 GHz N-type, M-F, 3 m	Bird	TC-MNFN-3.0	211539 001	11-Feb-07	11-Feb-08
2888	LISN Two-line V-Network 50 Ohm / 50 uH + 5 Ohm, 16A, MIL STD 461E, CISPR 16-1	Rolf Heine	NNB-2/16Z	02/10018	29-Mar-07	29-Mar-08
2909	Spectrum analyzer, ESA-E, 100 Hz to 26.5 GHz	Agilent Technologies	E4407B	MY41444762	07-May-07	07-May-08
2910	Cable 18 GHz, 3 m, SMA-SMA	Gore	NA	989370	05-Oct-07	05-Oct-08
2925	Directional coupler 80 MHz to 2400 MHz, 50 dB	RLC Electronics	M-3341	9648	25-May-06	25-May-07
2952	Cable, RF, 1.2 m, SMA-SMA	Gore	10020014	NA	05-Oct-07	05-Oct-08
3286	Temperature chamber, (-40 to +170) °C	Thermotron	EL-8-CH-1-1-CO2	21-9048	16-Aug-07	16-Aug-08

10 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

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

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

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

11 APPENDIX C Test laboratory description

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

Address: P.O. Box 23, Binyamina 30500, Israel.
Telephone: +972 4628 8001
Fax: +972 4628 8277
e-mail: mail@hermonlabs.com
website: www.hermonlabs.com

Person for contact: Mr. Alex Usoskin, CEO.

12 APPENDIX D Specification references

47CFR part 15: 2006	Radio Frequency Devices.
FCC Public Notice DA 02-2138 August 30, 2002	Measurement procedure updated for peak transmit power in U-NII bands
ANSI C63.2: 1996	American National Standard for Instrumentation-Electromagnetic Noise and Field Strength, 10 kHz to 40 GHz-Specifications.
ANSI C63.4: 2003	American National Standard for Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz.

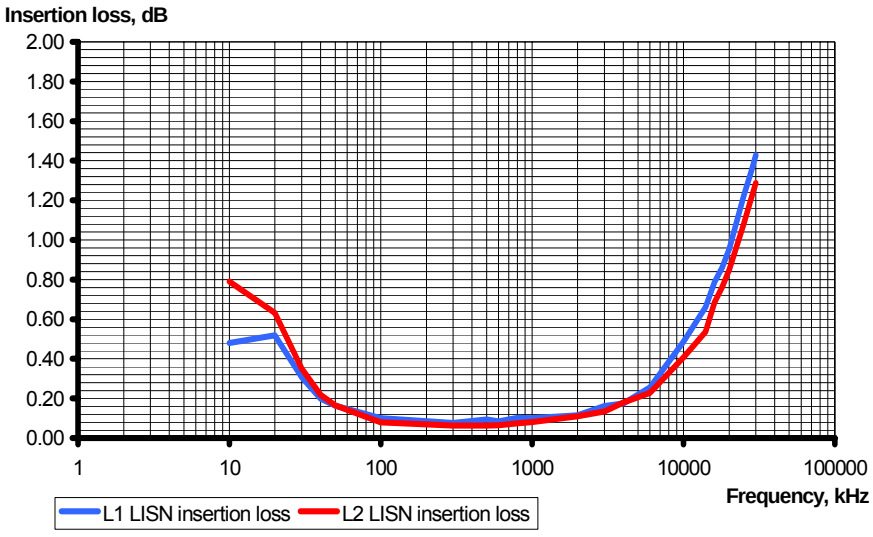
13 APPENDIX E Abbreviations and acronyms

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

14 APPENDIX F Test equipment correction factors

Correction factor
Line impedance stabilization network
Model NNB-2/16Z, Rolf Heine, HL 2888

Frequency, kHz	Insertion loss,dB		Measurement Uncertainty, dB
	L1	N	
10	0.48	0.79	±0.6
20	0.52	0.63	
30	0.31	0.35	
40	0.20	0.22	
50	0.16	0.17	
100	0.10	0.08	
300	0.08	0.06	
500	0.10	0.06	
600	0.09	0.07	
800	0.10	0.07	
1000	0.10	0.08	
2000	0.12	0.11	
3000	0.16	0.14	
4000	0.17	0.18	
6000	0.26	0.23	
10000	0.49	0.41	
14000	0.66	0.54	
16000	0.79	0.69	
18000	0.86	0.76	
20000	0.96	0.85	
25000	1.22	1.08	
28000	1.35	1.21	
30000	1.43	1.29	



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, HL 0604

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

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

Antenna factor
Double-ridged wave guide horn antenna
EMC Test Systems, model 3115, serial no: 9911-5964, HL 1984

Frequency, MHz	Antenna gain, dBi	Antenna factor. dB(1/m)
1000.0	5.8	24.5
1500.0	9.0	24.8
2000.0	8.6	27.7
2500.0	9.5	28.7
3000.0	8.9	30.8
3500.0	8.2	32.9
4000.0	9.6	32.7
4500.0	11.2	32.1
5000.0	10.6	33.6
5500.0	9.8	35.3
6000.0	10.1	35.7
6500.0	10.7	35.8
7000.0	10.9	36.2
7500.0	10.5	37.2
8000.0	11.1	37.2
8500.0	10.8	38.1
9000.0	10.7	38.6
9500.0	11.5	38.3
10000.0	11.8	38.4
10500.0	12.3	38.3
11000.0	12.3	38.8
11500.0	11.5	39.9
12000.0	12.2	39.6
12500.0	12.6	39.5
13000.0	12.0	40.5
13500.0	11.7	41.1
14000.0	11.7	41.5
14500.0	12.7	40.8
15000.0	14.2	39.5
15500.0	16.0	38.1
16000.0	16.2	38.1
16500.0	14.5	40.1
17000.0	12.2	42.6
17500.0	9.7	45.4
18000.0	6.6	48.7

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

Antenna Factor
Active Loop Antenna
EMC Test Systems, model 6502, serial number 2857, HL 0446

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).

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, 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 RG-214, HL 0813

No.	Frequency, MHz	Cable loss, dB
1	10	0.15
2	20	0.40
3	30	0.51
4	40	0.61
5	50	0.68
6	60	0.76
7	70	0.80
8	80	0.92
9	90	0.96
10	100	0.99
11	200	1.60
12	300	1.85
13	400	2.25
14	500	2.43
15	600	2.80
16	700	3.14
17	800	3.34
18	900	3.75
19	1000	4.05
20	1200	4.41
21	1400	4.81
22	1600	5.18
23	1800	5.58
24	2000	6.09
25	2500	7.27
26	2900	8.01

Cable loss
Cable coaxial, 6 m, model: M17/167 MIL-C-17, HL 1503

Frequency, MHz	Cable loss, dB
0.15	0.043
1	0.077
3	0.139
5	0.169
10	0.248
30	0.430
50	0.561
75	0.697
100	0.822
300	1.446
500	1.901
800	2.663
1000	2.829
1500	3.569
2000	4.179

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
RF cable 3.5 m, Alpha Wire, model RG-214, S/N 149, HL 1553

No.	Frequency, MHz	Cable loss, dB	Measurement uncertainty, dB
1	1	0.01	±0.05
2	10	0.07	
3	30	0.12	
4	50	0.22	
5	100	0.26	
6	200	0.40	
7	300	0.52	
8	400	0.60	
9	500	0.70	
10	600	0.77	
11	700	0.84	
12	800	1.00	
13	900	1.00	
14	1000	1.05	
15	2000	1.70	

Cable loss
Cable RF, 2m, model: Sucoflex 104PE, S/N 13094/4PE, HL 1566

No.	Frequency, MHz	Cable loss, dB	Tolerance, dB	Measurement uncertainty, dB
1	30	0.10	≤ 5.0	±0.12
2	50	0.13		
3	100	0.20		
4	300	0.33		
5	500	0.45		
6	800	0.60		
7	1000	0.65		
8	1500	0.91		
9	2000	1.08		
10	2500	1.19		
11	3000	1.28		
12	3500	1.49		
13	4000	1.63		
14	4500	1.63	≤ 5.0	±0.17
15	5000	1.66		
16	5500	1.88		
17	6000	1.96		
18	6500	1.93		
19	7000	2.07		
20	7500	2.37		
21	8000	2.34		
22	8500	2.64		
23	9000	2.68		
24	9500	2.64		
25	10000	2.70		
26	10500	2.84		
27	11000	2.88		
28	11500	3.19		
29	12000	3.15		
30	12500	3.20	≤ 5.0	±0.26
31	13000	3.22		
32	13500	3.47		
33	14000	3.41		
34	14500	3.59		
35	15000	3.79		
36	15500	4.24		
37	16000	4.12		
38	16500	4.46		
39	17000	4.50		
40	17500	4.49		
41	18000	4.45		

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 40 GHz, 0.8 m, blue, model: KPS-1503A-800-KPS, S/N W4907, HL 2254

Frequency, GHz	Cable loss, dB	Frequency, GHz	Cable loss, dB	Frequency, GHz	Cable loss, dB
0.03	0.04	5.10	0.80	15.00	1.49
0.05	0.07	5.30	0.83	15.50	1.49
0.10	0.09	5.50	0.83	16.00	1.46
0.20	0.15	5.70	0.84	16.50	1.47
0.30	0.19	5.90	0.87	17.00	1.50
0.40	0.25	6.10	0.86	17.50	1.57
0.50	0.29	6.30	0.89	18.00	1.63
0.60	0.33	6.50	0.90	18.50	1.57
0.70	0.37	6.70	0.89	19.00	1.63
0.80	0.41	6.90	0.93	19.50	1.65
0.90	0.44	7.10	0.92	20.00	1.64
1.00	0.45	7.30	0.95	20.50	1.75
1.10	0.48	7.50	0.96	21.00	1.72
1.20	0.51	7.70	0.97	21.50	1.78
1.30	0.53	7.90	1.01	22.00	1.76
1.40	0.54	8.10	1.00	22.50	1.72
1.50	0.57	8.30	1.05	23.00	1.83
1.60	0.59	8.50	1.04	23.50	1.80
1.70	0.04	8.70	1.07	24.00	1.90
1.80	0.07	8.90	1.11	24.50	1.81
1.90	0.09	9.10	1.09	25.00	1.98
2.00	0.15	9.30	1.14	25.50	1.91
2.10	0.19	9.50	1.12	26.00	2.02
2.20	0.25	9.70	1.15	26.50	1.92
2.30	0.29	9.90	1.16	27.00	1.97
2.40	0.33	10.10	1.16	28.00	2.02
2.50	0.37	10.30	1.19	29.00	1.95
2.60	0.41	10.50	1.14	30.00	1.94
2.70	0.44	10.70	1.19	31.00	2.11
2.80	0.45	10.90	1.17	32.00	2.17
2.90	0.48	11.10	1.13	33.00	2.27
3.10	0.61	11.30	1.20	34.00	2.27
3.30	0.64	11.50	1.13	35.00	2.29
3.50	0.65	11.70	1.20	36.00	2.35
3.70	0.68	11.90	1.18	37.00	2.37
3.90	0.69	12.10	1.14	38.00	2.40
4.10	0.71	12.40	1.19	39.00	2.57
4.30	0.73	13.00	1.34	40.00	2.36
4.50	0.75	13.50	1.33		
4.70	0.77	14.00	1.48		
4.90	0.79	14.50	1.45		

Cable loss
Cable coaxial, 40GHz, 1.5 m, Blue, Rhophase Microwave Limited, model: KPS-1503A-1500-KPS, HL 2399

Frequency, GHz	Cable loss, dB	Frequency, GHz	Cable loss, dB	Frequency, GHz	Cable loss, dB
0.03	0.07	6.5	1.57	15.50	2.50
0.05	0.10	6.7	1.60	16.00	2.51
0.1	0.16	6.9	1.55	16.50	2.58
0.2	0.26	7.1	1.65	17.00	2.65
0.3	0.33	7.3	1.65	17.50	2.73
0.5	0.38	7.5	1.70	18.00	2.74
0.7	0.41	7.7	1.71	18.50	2.67
0.9	0.58	7.9	1.73	19.00	2.67
1.1	0.64	8.1	1.79	19.50	2.74
1.3	0.70	8.3	1.81	20.00	2.69
1.5	0.75	8.5	1.84	20.50	2.80
1.7	0.79	8.7	1.85	21.00	2.82
1.9	0.83	8.9	1.90	21.50	2.87
2.1	0.88	9.1	1.95	22.00	2.87
2.3	0.93	9.3	1.93	22.50	2.92
2.5	0.97	9.5	1.98	23.50	3.04
2.7	1.01	9.7	1.96	24.00	3.05
2.9	1.04	9.9	2.03	24.50	3.03
3.1	1.08	10.1	1.99	25.00	3.11
3.3	1.14	10.30	2.02	25.50	3.10
3.5	1.17	10.50	2.02	26.00	3.17
3.7	1.21	10.70	2.02	26.50	3.11
3.9	1.24	10.90	2.08	27.00	3.16
4.1	1.26	11.10	2.02	28.00	3.19
4.3	1.26	11.30	2.09	29.00	3.19
4.5	1.29	11.50	2.05	30.00	3.30
4.7	1.34	11.70	2.11	31.00	3.31
4.9	1.34	11.90	2.11	32.00	3.35
5.1	1.40	12.10	2.12	33.00	3.46
5.3	1.43	12.40	2.17	34.00	3.45
5.5	1.45	13.00	2.29	35.00	3.49
5.7	1.47	13.50	2.31	36.00	3.54
5.9	1.40	14.00	2.43	37.00	3.62
6.1	1.53	14.50	2.43	39.00	3.69
6.3	1.55	15.00	2.46	40.00	3.75

Cable loss
Cable coaxial, Bird, 18 GHz, N-type, M-F, model TC-MNFN-3.0, S/N 211539 001
HL 2882

Frequency, GHz	Cable loss, dB	Frequency, GHz	Cable loss, dB	Frequency, GHz	Cable loss, dB
10	0.08	5750	1.78	12000	2.57
30	0.12	6000	1.84	12250	2.62
100	0.22	6250	1.87	12500	2.66
250	0.35	6500	1.92	12750	2.68
500	0.49	6750	1.96	13000	2.67
750	0.60	7000	2.01	13250	2.75
1000	0.68	7250	2.08	13500	2.77
1250	0.78	7500	2.12	13750	2.90
1500	0.85	7750	2.19	14000	3.00
1750	0.92	8000	2.22	14250	3.12
2000	0.98	8250	2.28	14500	2.98
2250	1.06	8500	2.29	14750	3.03
2500	1.11	8750	2.27	15000	2.99
2750	1.19	9000	2.28	15250	2.99
3000	1.25	9250	2.26	15500	2.98
3250	1.30	9500	2.29	15750	2.98
3500	1.34	9750	2.33	16000	2.99
3750	1.40	10000	2.34	16250	3.05
4000	1.45	10250	2.41	16500	3.11
4250	1.51	10500	2.46	16750	3.18
4500	1.54	10750	2.48	17000	3.23
4750	1.59	11000	2.48	17250	3.21
5000	1.63	11250	2.52	17500	3.22
5250	1.68	11500	2.53	17750	3.22
5500	1.72	11750	2.56	18000	3.25

Cable loss
Cable coaxial, Gore, 18 GHz, 3m, SMA-SMA, S/N 989370
HL 2910

Frequency, GHz	Cable loss, dB	Frequency, GHz	Cable loss, dB	Frequency, GHz	Cable loss, dB
10	0.07	5750	2.97	12000	5.05
30	0.19	6000	2.91	12250	4.44
100	0.36	6250	3.23	12500	4.82
250	0.53	6500	3.42	12750	5.22
500	0.77	6750	3.17	13000	5.02
750	0.94	7000	3.56	13250	5.00
1000	1.10	7250	3.77	13500	5.09
1250	1.19	7500	3.48	13750	4.70
1500	1.35	7750	3.81	14000	5.03
1750	1.51	8000	3.82	14250	5.17
2000	1.57	8250	3.62	14500	4.92
2250	1.69	8500	3.95	14750	4.91
2500	1.76	8750	4.00	15000	5.03
2750	1.83	9000	3.80	15250	4.93
3000	2.02	9250	4.09	15500	5.28
3250	2.17	9500	4.12	15750	5.60
3500	2.13	9750	4.11	16000	5.16
3750	2.23	10000	4.36	16250	5.45
4000	2.40	10250	4.75	16500	5.78
4250	2.31	10500	4.61	16750	5.47
4500	2.52	10750	4.26	17000	5.21
4750	2.77	11000	4.62	17250	5.53
5000	2.82	11250	4.55	17500	5.53
5250	2.77	11500	4.59	17750	5.71
5500	3.04	11750	5.20	18000	5.77

Cable loss
Cable coaxial, Gore, 18 GHz, 1.2 m, SMA-SMA, S/N 10020014
HL 2952

Frequency, GHz	Cable loss, dB	Frequency, GHz	Cable loss, dB	Frequency, GHz	Cable loss, dB
10	0.03	5750	0.97	12000	1.50
30	0.05	6000	1.01	12250	1.45
100	0.11	6250	1.03	12500	1.48
250	0.19	6500	1.06	12750	1.57
500	0.26	6750	1.08	13000	1.51
750	0.32	7000	1.10	13250	1.64
1000	0.38	7250	1.13	13500	1.60
1250	0.43	7500	1.13	13750	1.63
1500	0.47	7750	1.21	14000	1.59
1750	0.53	8000	1.20	14250	1.66
2000	0.55	8250	1.24	14500	1.60
2250	0.59	8500	1.29	14750	1.65
2500	0.63	8750	1.23	15000	1.72
2750	0.66	9000	1.27	15250	1.68
3000	0.69	9250	1.27	15500	1.73
3250	0.72	9500	1.29	15750	1.70
3500	0.75	9750	1.30	16000	1.82
3750	0.78	10000	1.38	16250	1.79
4000	0.82	10250	1.44	16500	1.81
4250	0.84	10500	1.47	16750	1.91
4500	0.86	10750	1.45	17000	1.92
4750	0.90	11000	1.50	17250	1.98
5000	0.91	11250	1.46	17500	2.05
5250	0.94	11500	1.47	17750	2.04
5500	0.96	11750	1.44	18000	2.05