HERMON LABORATORIES

839.01
Electrical

Hermon Laboratories Ltd.
Harakevet Industrial Zone, Binyamina 30500,
Israel
Tel. +972-4-6288001
Fax. +972-4-6288277
E-mail: mail@hermonlabs.com

TEST REPORT

ACCORDING TO: FCC CFR 47 Part 90 subpart Y, Part 15 subpart B

FOR:

Alvarion Ltd.

WiMAX base station

Model:BreezeMAX Extreme 4.9GHz

Table of contents

1 Applicant information

Client name:	Alvarion Ltd.
Address:	21A Habarzel street, Ramat Hachayal, Tel Aviv 69710, Israel
Telephone:	972 3645 7859
Fax:	972 3645 6222
E-mail:	avner.ruta@alvarion.com
Contact name:	Mr. Avner Ruta

2 Equipment under test attributes

Product name:	WiMAX base station
Product type:	Transciever
Model(s):	BreezeMAX Extreme 4.9GHz
Serial number:	90047967, 90047969 for RF heads
Hardware version:	AD9370-02 rev2 - digital card, BA0024-01 rev5 - RF head
Receipt date	8/24/2009

3 Manufacturer information

Manufacturer name:	Alvarion Ltd.
Address:	21A Habarzel street, Ramat Hachayal, Tel Aviv 69710, Israel
Telephone:	972 3645 7859
Fax:	972 3645 6222
E-Mail:	avner.ruta@alvarion.com
Contact name:	Mr. Avner Ruta

4 Test details

Project ID:	19945
Location:	Hermon Laboratories Ltd. Harakevet Industrial Zone, Binyamina 30500, Israel
Test started:	8/13/2009
Test completed:	9/21/2009
Test specification(s):	47CFR Part 90 subpart Y, Part 15 subpart B class B

5 Tests summary

Test	Status
Transmitter characteristics	
Section 90.205, 90.1215, Maximum output power and peak power spectral density	Pass
Section 90.209, Occupied bandwidth	Pass
Section 90.210(m), Emission mask	Pass
Section 90.210, Radiated spurious emissions	Pass
Section 90.210, Conducted spurious emissions	Pass
Section 90.213, Frequency stability	Tested without limit
Section 90.214, Transient frequency behaviour	Not required
Section 2.1091, RF radiation exposure evaluation	Pass
Unintentional emissions	
Section 15.107, Class B, Conducted emission at AC power port	Pass
Section 15.109, Class B, Radiated emission	Pass
Section 15.111, Conducted emission at receiver antenna port	Not required

The results obtained indicate that the product under test complies in full with the requirements tested.
The test results relate only to the items tested. Pass/ fail decision was based on nominal values.

	Name and Title	Date	Signature
Tested by:	Mr. L. Markel, test engineer	September 21, 2009	
Reviewed by:	Mrs. M. Cherniavsky, certification engineer	September 23, 2009	
Approved by:	Mr. M. Nikishin, EMC and Radio group leader	September 29, 2009	

HERMON LABORATORIES

6 EUT description

6.1 General information

The EUT, base station, is a part of BreezeMAX Extreme 4.9 high capacity, IP services oriented Broadband Wireless Access system. The BreezeMAX Extreme 4.9 is digital modulated TDD system covering 4942.5 MHz up to 4982.5 MHz range. The system contains a base station unit and a subscriber unit.
The basic base station system configuration is all outdoor-box configurations that contain a power supply, a MODEM and the radio part.

6.2 EUT modules and sub-assemblies

Description	Manufacturer	Model or P/N	Hardware rev.	Serial number
AC power adaptor	PS1126-01	0525B5570	A	A30906120564

6.3 EUT options/configurations

Number	Operating mode description
Transmit	MIMO transmitting mode via both Tx chains/SISO transmit mode via each chain
Option 1	EUT powered via AC power adaptor 120 VAC to 55VDC
Option 2	EUT powered via external 48VDC PS

6.4 Ports and lines

Port type	Port description	Conn. from	Conn. to	Qty.	Cable type	Cable length	Indoor / outdoor
RF	Antenna	Base station	Termination	2	Coax	NA	Outdoor
RF GPS	Antenna GPS	Base station	Antenna external	1	Coax	15 m	Outdoor
Signal	GPS In/Out	Base station (GPS Out)	Base station (GPS In)	1	Shielded	2 m	Outdoor
Option 1							
Power	AC power	AC mains	Power adaptor	1	Unshielded	1.5 m	Indoor
Signal	DATA/DC	Power adaptor	Base station	1	Shielded	3 m	Outdoor
Power	DC power	Base station (DC in)	Open circuit	1	Shielded	20 m	Outdoor
Signal	Ethernet	Power adaptor	Laptop	1	Unshielded	10 m	Indoor
Option 2							
Power	DC power	48 VDC supply	Base station (DC in)	1	Shielded	20 m	Outdoor
Signal	Ethernet	Base station	Laptop	1	Shielded	10 m	Outdoor

6.5 Support and test equipment

Description	Manufacturer	Model number	Serial number
Laptop	IBM (lenovo)	T60	L3-DZK37 07/01

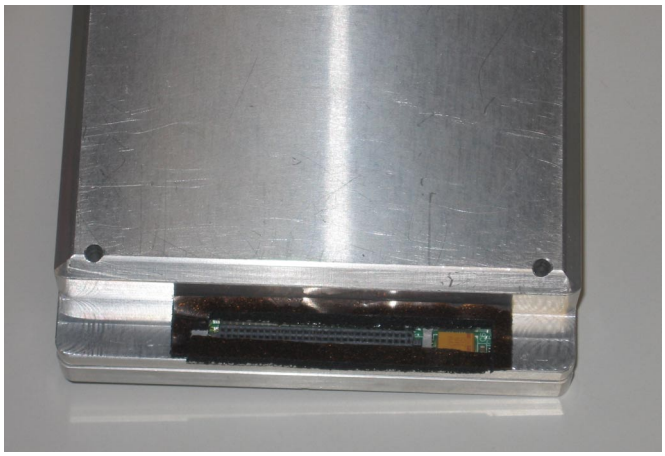
6.6 Operating frequencies

Source	Frequency, MHz
Tx/Rx	4942.5 – 4987.5
LO	4130 - 4180

6.7 Changes made in the EUT

To withstand the standard requirements the following changes were implemented in the EUT:
1) An absorber material was installed around the RF head connector as shown in Photograph 6.7.1;
2) The 10 MHz clock of GPS synchronization was disabled.
It is manufacturer responsibility to implement the change in the production version of the EUT. In any case the test report applies to the tested item only.

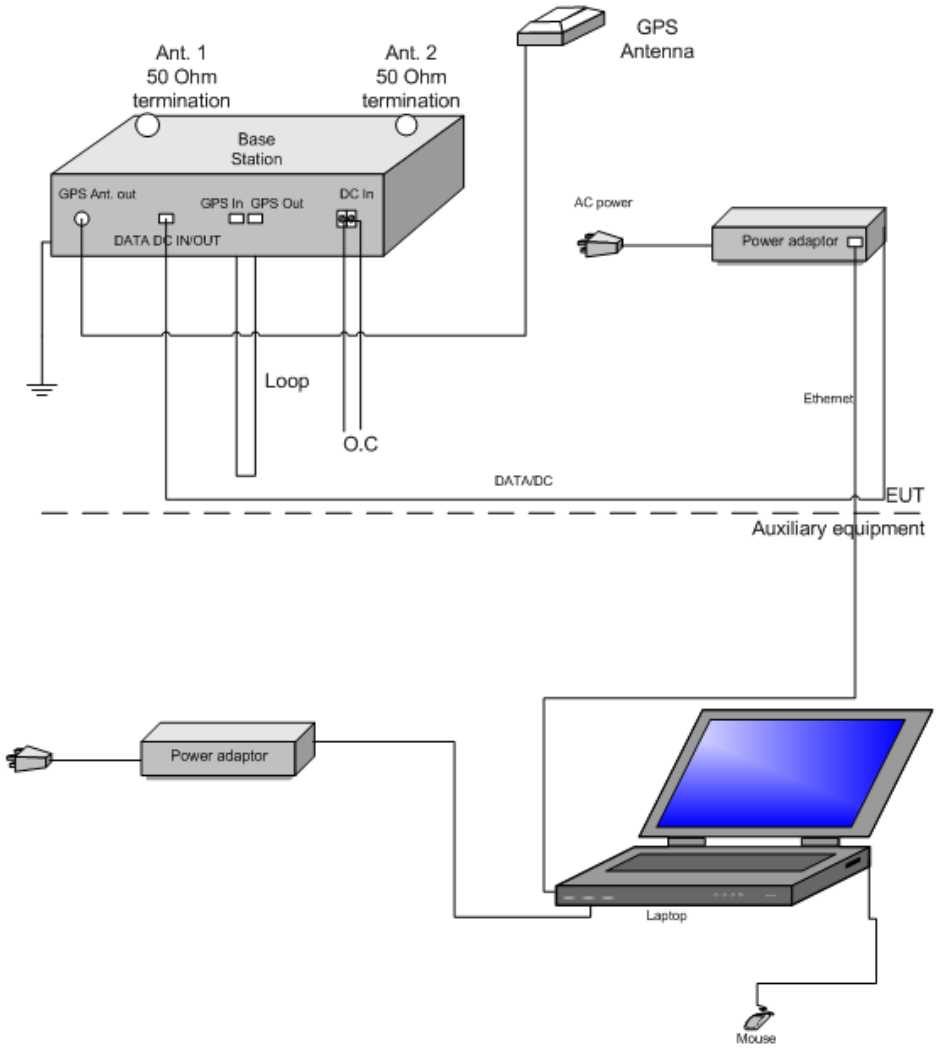
Photograph 6.7.1 RF head connector



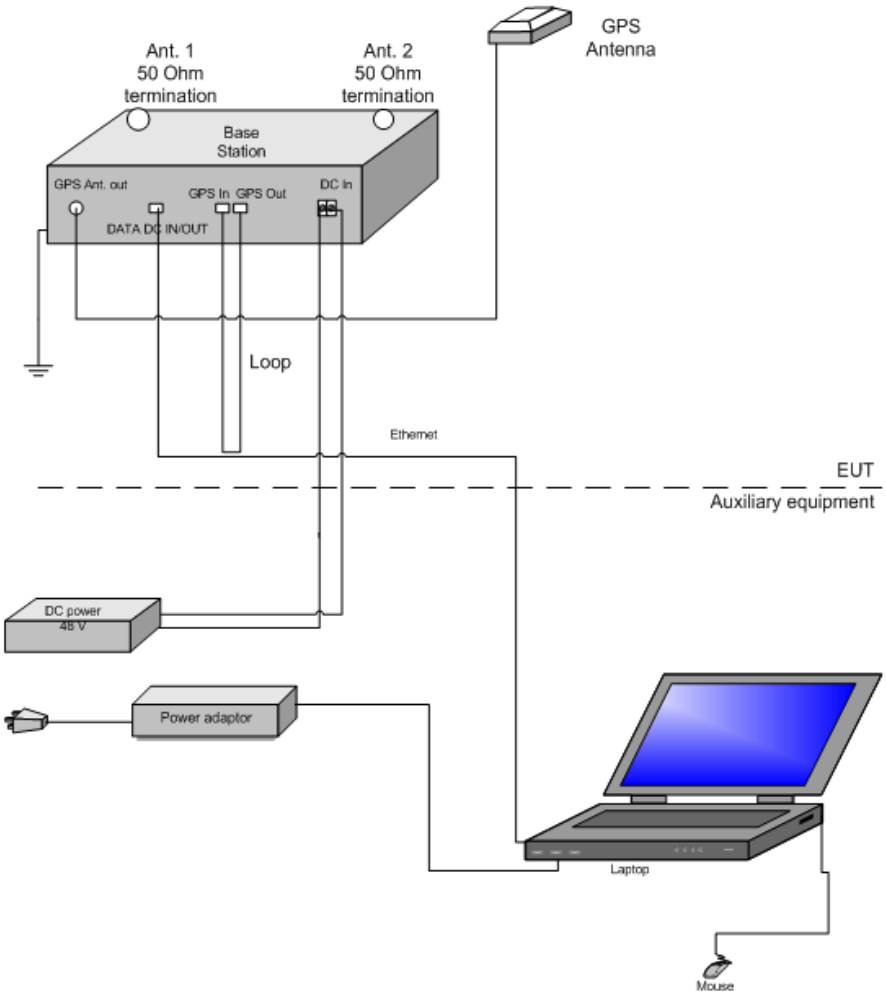
HERMON LABORATORIES

6.8 Test configuration

Option 1



Option 2


GPS
Antenna
Ant. 1
50 Ohm
termination
Ant. 2
50 Ohm
termination
Base
Station
GPS Ant. out
GPS In
GPS Out
DC In
DATA DC IN/OUT
Loop
Ethernet
EUT
Auxiliary equipment
DC power
48 V
Power adaptor
Laptop
Mouse

HERMON LABORATORIES

6.9 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	4940 – 4990 MHz
Operating frequency range	4942.5 – 4987.5 MHz
RF channel spacing	2.5 MHz for 5MHz BW, 5MHz for 10MHz BW
Maximum rated output power	At transmitter 50 Ω RF output connectors — Total 22.4 dBm for 5 MHz CBW Total 21.8 dBm for 10 MHz CBW

Is transmitter output power variable?				
	No			
V	Yes		continuous variable	
		V	stepped variable with stepsize	1 dB
		minimum RF power		0 dBm
		maximum RF power		22.4 dBm

Antenna connection							
unique coupling	**V**	standard connector	**V**	Integral	**V**	with temporary RF connector	
						without temporary RF connector	

Antenna/s technical characteristics			
Type	Manufacturer	Model number	Gain
Integral dual slant	PCTEL	P/N AN1428-02	14.5 dBi
External omni-directional	Alvarion	P/N 300709 Rev.A	9.5 dBi
External sector	Alvarion	P/N 858170 Rev.D	16.5 dBi

Transmitter 99% power bandwidth	5 MHz, 10 MHz				
Transmitter aggregate data rate/s	9.36 Mbps @ 64QAM5/6 for 5MHz BW; 18.72 Mbps @ 64QAM5/6 for 10MHz BW				
Transmitter aggregate symbol (baud) rate/s	1.56 Msps @ 64QAM5/6 for 5MHz BW; 3.12 Msps @ 64QAM5/6 for 10MHz BW				
Type of modulation	QPSK, 16QAM, 64QAM				
Type of multiplexing	OFDMA				
Modulating test signal (baseband)	PRBS				
Maximum transmitter duty cycle in normal use	60%	**Tx ON time**	3 msec	**Period**	5 msec
Transmitter duty cycle supplied for test	100%				

Transmitter power source					
		Nominal rated voltage		Battery type	
V	DC	**Nominal rated voltage**	48 V (option 2)		
V	AC mains	**Nominal rated voltage**	120 V (option 1)	Frequency	60 Hz

Common power source for transmitter and receiver	**V**	yes	no

Test specification:	FCC section 90.1215, Maximum output power		
Test procedure:	47 CFR, Section 2.1046; TIA/EIA-603-C, Section 2.2.1		
Test mode:	Compliance	Verdict:	PASS
Date & Time:	9/6/2009 5:29:37 PM		
Temperature: 25ºC	Air Pressure: 1008 hPa	Relative Humidity: 43 %	Power Supply: 120 VAC
Remarks:			

7 Transmitter tests according to 47CFR part 90 requirements

7.1 Peak output power test

7.1.1 General

This test was performed to measure the peak output power and peak power spectral density at RF antenna connector. Specification test limits are given in Table 7.1.1.

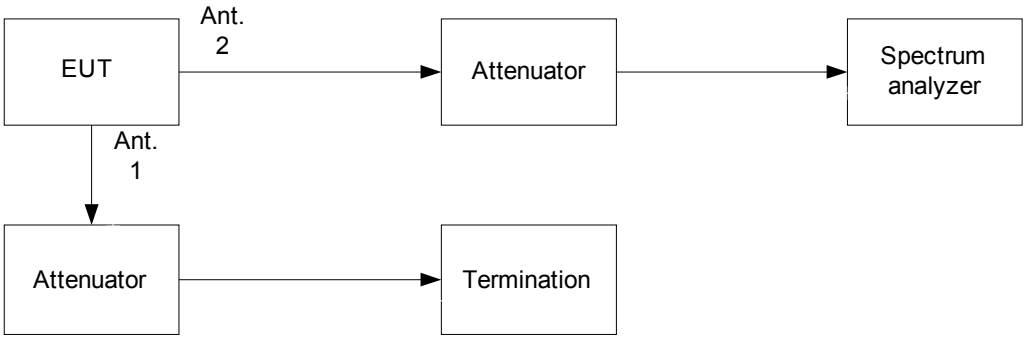
Table 7.1.1 Peak output power limits

Assigned frequency range, MHz	Channel bandwidth, MHz	Maximum peak output power		Power spectral density, dBm/MHz
		mW	dBm	
4940.0 – 4990.0	5	500	27.0	21
	10	1000	30.0	

7.1.2 Test procedure

7.1.2.1 The EUT was set up as shown in Figure 7.1.1, energized and its proper operation was checked.
7.1.2.2 The EUT was adjusted to produce maximum available to the end user RF output power.
7.1.2.3 The peak output power was measured with power meter as provided in Table 7.1.2 and Table 7.1.4.
7.1.2.4 The peak output power spectral density was measured with spectrum analyzer as provided in Table 7.1.3, Table 7.1.5 and the associated plots.

Figure 7.1.1 Peak output power test setup



Test specification:	FCC section 90.1215, Maximum output power		
Test procedure:	47 CFR, Section 2.1046; TIA/EIA-603-C, Section 2.2.1		
Test mode:	Compliance	Verdict:	PASS
Date & Time:	9/6/2009 5:29:37 PM		
Temperature: 25ºC	Air Pressure: 1008 hPa	Relative Humidity: 43 %	Power Supply: 120 VAC
Remarks:			

Table 7.1.2 Peak output power test results

ASSIGNED FREQUENCY RANGE: 4940.0 – 4990.0 MHz
DETECTOR USED: Average (Power meter)
RESOLUTION BANDWIDTH: NA
VIDEO BANDWIDTH: NA
MODULATING SIGNAL: PRBS
TRANSMITTER OUTPUT POWER SETTINGS: Maximum
CHANNEL BANDWIDTH: 5 MHz

Carrier frequency, MHz	Power Meter reading, dBm Ant 1	Power Meter reading, dBm Ant 2	Total RF output Power* , dBm	Limit, dBm	Margin, dB	Verdict
64QAM						
4942.50	18.93	18.93	21.94	27.00	-5.06	Pass
4962.50	19.09	19.22	22.17	27.00	-4.83	Pass
4987.50	19.21	19.58	22.41	27.00	-4.59	Pass

* - RF output power calculated, dBm = 10 log(10^((P(dBm,Ant1)/10)+ 10^((P(dBm,Ant2))/10))

Table 7.1.3 Peak output power spectral density test results

ASSIGNED FREQUENCY RANGE: 4940.0 – 4990.0 MHz
DETECTOR USED: Average
RESOLUTION BANDWIDTH: 1 MHz
VIDEO BANDWIDTH: 3 MHz
MODULATING SIGNAL: PRBS
TRANSMITTER OUTPUT POWER SETTINGS: Maximum
CHANNEL BANDWIDTH: 5 MHz

Carrier frequency, MHz	Spectrum Analyzer reading dBm/MHz Ant 1	Spectrum Analyzer reading dBm/MHz Ant 2	RF output power spectral density*, dBm/MHZ	Limit*, dBm/MHz	Margin, dB	Verdict
64QAM						
4942.50	10.83	11.33	14.10	21.00	-6.90	Pass
4962.50	11.50	11.83	14.68	21.00	-6.32	Pass
4987.50	12.00	12.00	15.01	21.00	-5.99	Pass

* - RF output power calculated, dBm/MHz = 10 log(10^((P(dBm/MHz,Ant1)/10)+ 10^((P(dBm/MHz,Ant2)/10))

Test specification:	FCC section 90.1215, Maximum output power		
Test procedure:	47 CFR, Section 2.1046; TIA/EIA-603-C, Section 2.2.1		
Test mode:	Compliance	Verdict:	PASS
Date & Time:	9/6/2009 5:29:37 PM		
Temperature: 25ºC	Air Pressure: 1008 hPa	Relative Humidity: 43 %	Power Supply: 120 VAC
Remarks:			

Table 7.1.4 Peak output power test results

ASSIGNED FREQUENCY RANGE: 4940.0 – 4990.0 MHz
DETECTOR USED: Average (Power meter)
RESOLUTION BANDWIDTH: NA
VIDEO BANDWIDTH: NA
MODULATING SIGNAL: PRBS
TRANSMITTER OUTPUT POWER SETTINGS: Maximum
CHANNEL BANDWIDTH: 10 MHz

Carrier frequency, MHz	Power Meter reading, dBm Ant 1	Power Meter reading, dBm Ant 2	Total RF output Power* , dBm	Limit, dBm	Margin, dB	Verdict
64QAM						
4947.50	18.67	18.75	21.72	30.00	-8.28	Pass
4962.50	18.63	18.77	21.71	30.00	-8.29	Pass
4982.50	18.85	18.76	21.82	30.00	-8.18	Pass

* - RF output power calculated, dBm = 10 log(10^((P(dBm,Ant1)/10)+ 10^((P(dBm,Ant2))/10))

Table 7.1.5 Peak output power spectral density test results

ASSIGNED FREQUENCY RANGE: 4940.0 – 4990.0 MHz
DETECTOR USED: Average
RESOLUTION BANDWIDTH: 1 MHz
VIDEO BANDWIDTH: 3 MHz
MODULATING SIGNAL: PRBS
TRANSMITTER OUTPUT POWER SETTINGS: Maximum
CHANNEL BANDWIDTH: 10 MHz

Carrier frequency, MHz	Spectrum Analyzer reading dBm/MHz Ant 1	Spectrum Analyzer reading dBm/MHz Ant 2	RF output power spectral density*, dBm/MHZ	Limit, dBm/MHz	Margin, dB	Verdict
64QAM						
4947.50	8.00	8.50	11.27	21.00	-9.73	Pass
4962.50	8.33	8.50	11.43	21.00	-9.57	Pass
4982.50	8.33	9.00	11.69	21.00	-9.31	Pass

* - RF output power calculated, dBm/MHz = 10 log(10^((P(dBm/MHz,Ant1)/10)+ 10^((P(dBm/MHz,Ant2)/10))

Reference numbers of test equipment used

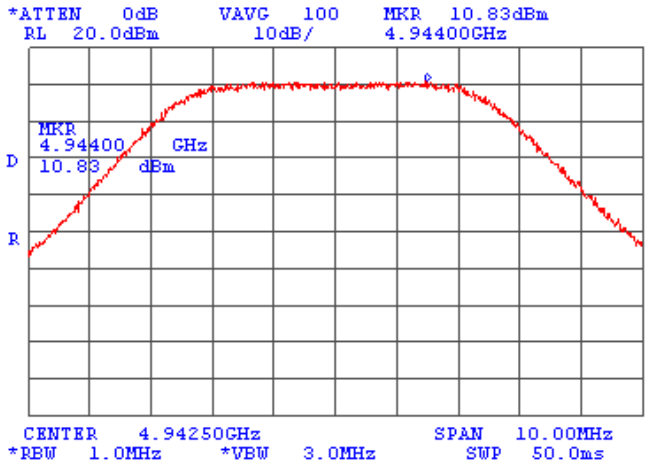
HL 1906	HL 2951	HL 3179	HL 3301	HL 3302	HL 3442	HL 3472	HL 3473

Full description is given in Appendix A.

Test specification:	FCC section 90.1215, Maximum output power		
Test procedure:	47 CFR, Section 2.1046; TIA/EIA-603-C, Section 2.2.1		
Test mode:	Compliance	Verdict:	PASS
Date & Time:	9/6/2009 5:29:37 PM		
Temperature: 25ºC	Air Pressure: 1008 hPa	Relative Humidity: 43 %	Power Supply: 120 VAC
Remarks:			

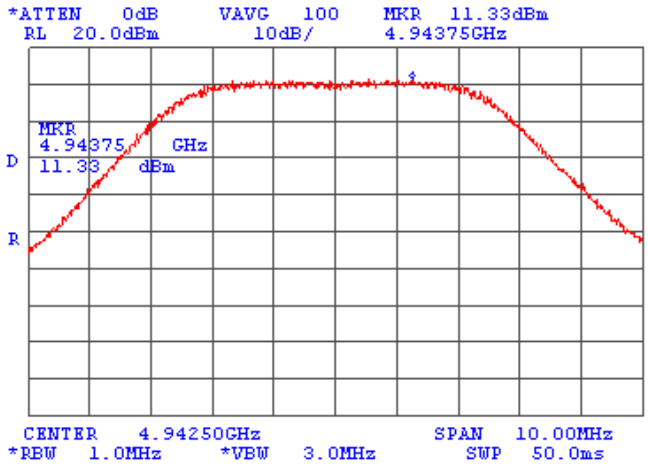
Plot 7.1.1 Peak output power spectral density test results at low frequency

EUT OUTPUT CONNECTOR: Ant 1
CHANNEL BANDWIDTH: 5 MHz
MODULATION: 64QAM



Plot 7.1.2 Peak output power spectral density test results at low frequency

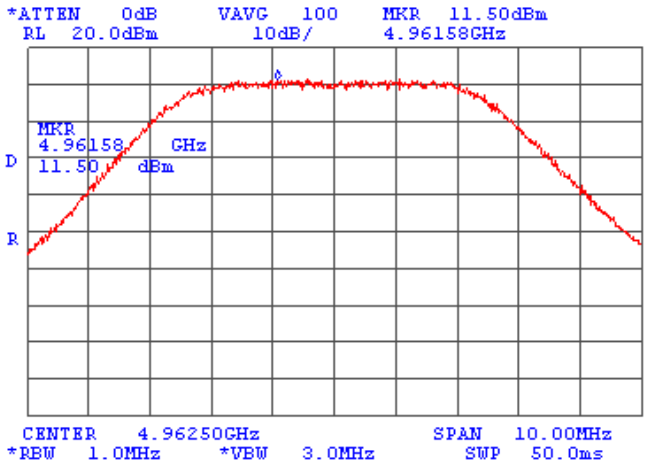
EUT OUTPUT CONNECTOR: Ant 2
CHANNEL BANDWIDTH: 5 MHz
MODULATION: 64QAM



Test specification:	FCC section 90.1215, Maximum output power		
Test procedure:	47 CFR, Section 2.1046; TIA/EIA-603-C, Section 2.2.1		
Test mode:	Compliance	Verdict:	PASS
Date & Time:	9/6/2009 5:29:37 PM		
Temperature: 25ºC	Air Pressure: 1008 hPa	Relative Humidity: 43 %	Power Supply: 120 VAC
Remarks:			

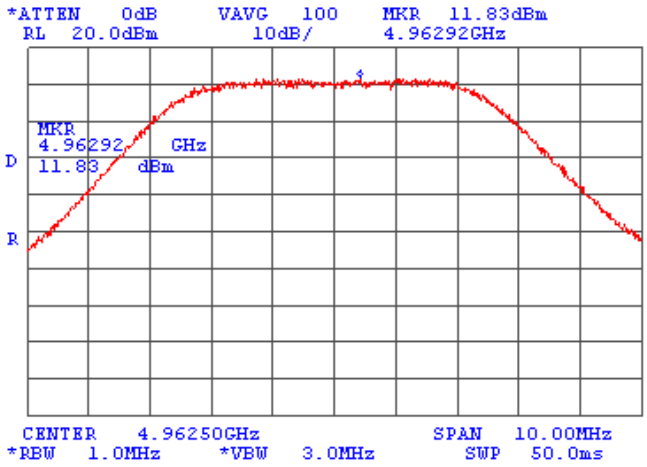
Plot 7.1.3 Peak output power spectral density test results at mid frequency

EUT OUTPUT CONNECTOR: Ant 1
CHANNEL BANDWIDTH: 5 MHz
MODULATION: 64QAM



Plot 7.1.4 Peak output power spectral density test results at mid frequency

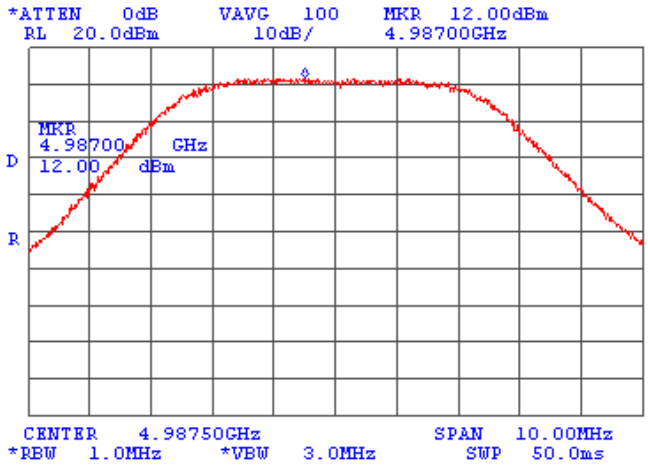
EUT OUTPUT CONNECTOR: Ant 2
CHANNEL BANDWIDTH: 5 MHz
MODULATION: 64QAM



Test specification:	FCC section 90.1215, Maximum output power		
Test procedure:	47 CFR, Section 2.1046; TIA/EIA-603-C, Section 2.2.1		
Test mode:	Compliance	Verdict:	PASS
Date & Time:	9/6/2009 5:29:37 PM		
Temperature: 25ºC	Air Pressure: 1008 hPa	Relative Humidity: 43 %	Power Supply: 120 VAC
Remarks:			

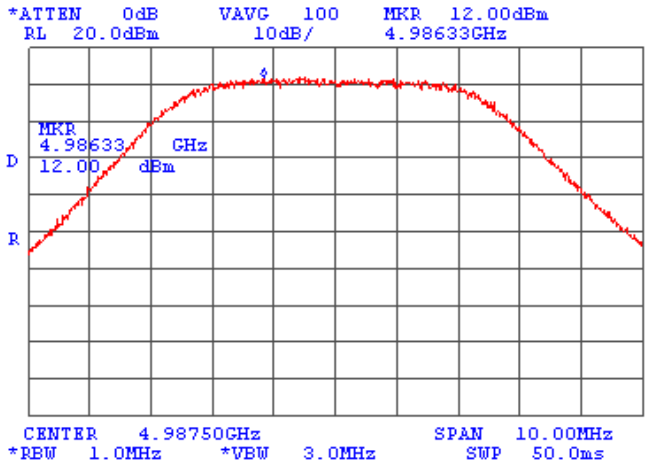
Plot 7.1.5 Peak output power spectral density test results at high frequency

EUT OUTPUT CONNECTOR: Ant 1
CHANNEL BANDWIDTH: 5 MHz
MODULATION: 64QAM



Plot 7.1.6 Peak output power spectral density test results at high frequency

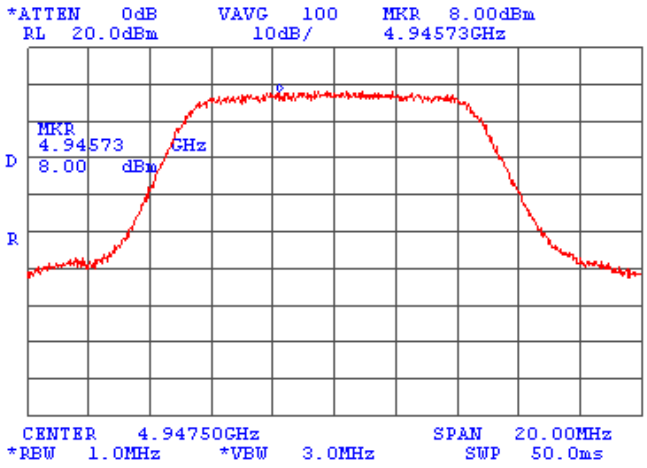
EUT OUTPUT CONNECTOR: Ant 2
CHANNEL BANDWIDTH: 5 MHz
MODULATION: 64QAM



Test specification:	FCC section 90.1215, Maximum output power		
Test procedure:	47 CFR, Section 2.1046; TIA/EIA-603-C, Section 2.2.1		
Test mode:	Compliance	Verdict:	PASS
Date & Time:	9/6/2009 5:29:37 PM		
Temperature: 25ºC	Air Pressure: 1008 hPa	Relative Humidity: 43 %	Power Supply: 120 VAC
Remarks:			

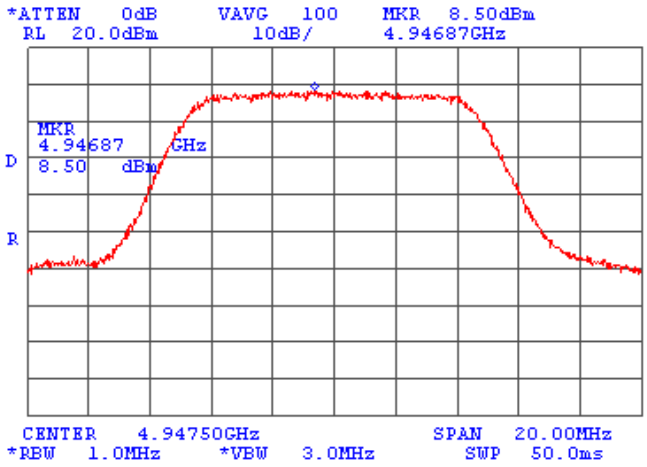
Plot 7.1.7 Peak output power spectral density test results at low frequency

EUT OUTPUT CONNECTOR:	Ant 1
CHANNEL BANDWIDTH:	10 MHz
MODULATION:	64QAM



Plot 7.1.8 Peak output power spectral density test results at low frequency

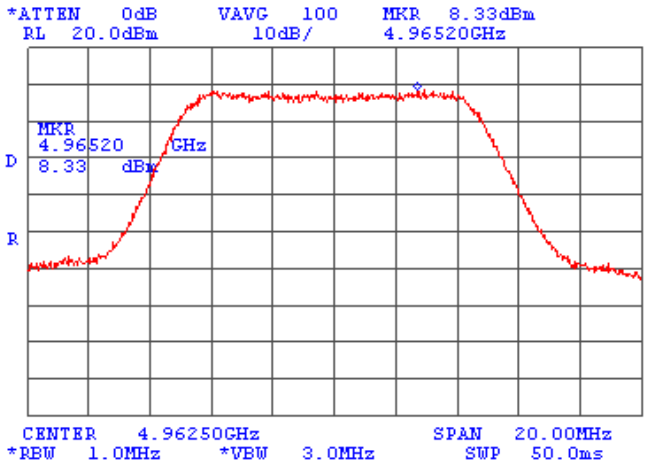
EUT OUTPUT CONNECTOR:	Ant 2
CHANNEL BANDWIDTH:	10 MHz
MODULATION:	64QAM



Test specification:	FCC section 90.1215, Maximum output power		
Test procedure:	47 CFR, Section 2.1046; TIA/EIA-603-C, Section 2.2.1		
Test mode:	Compliance	Verdict:	PASS
Date & Time:	9/6/2009 5:29:37 PM		
Temperature: 25ºC	Air Pressure: 1008 hPa	Relative Humidity: 43 %	Power Supply: 120 VAC
Remarks:			

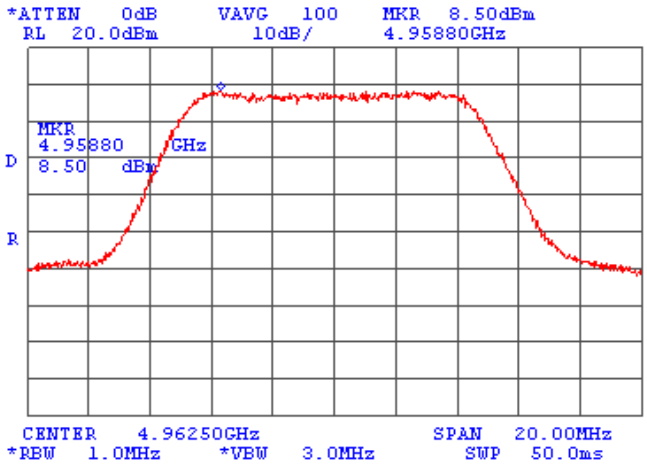
Plot 7.1.9 Peak output power spectral density test results at mid frequency

EUT OUTPUT CONNECTOR: Ant 1
CHANNEL BANDWIDTH: 10 MHz
MODULATION: 64QAM



Plot 7.1.10 Peak output power spectral density test results at mid frequency

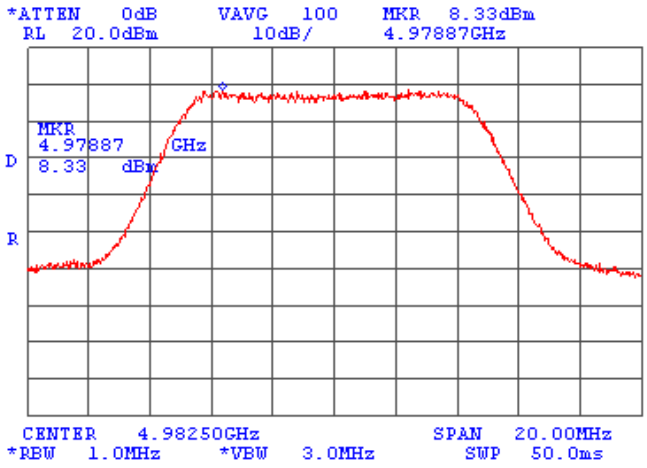
EUT OUTPUT CONNECTOR: Ant 2
CHANNEL BANDWIDTH: 10 MHz
MODULATION: 64QAM



Test specification:	FCC section 90.1215, Maximum output power		
Test procedure:	47 CFR, Section 2.1046; TIA/EIA-603-C, Section 2.2.1		
Test mode:	Compliance	Verdict:	PASS
Date & Time:	9/6/2009 5:29:37 PM		
Temperature: 25ºC	Air Pressure: 1008 hPa	Relative Humidity: 43 %	Power Supply: 120 VAC
Remarks:			

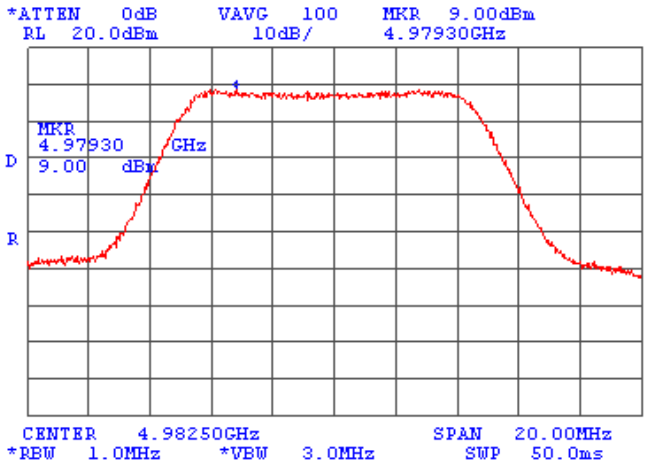
Plot 7.1.11 Peak output power spectral density test results at high frequency

EUT OUTPUT CONNECTOR: Ant 1
CHANNEL BANDWIDTH: 10 MHz
MODULATION: 64QAM



Plot 7.1.12 Peak output power spectral density test results at high frequency

EUT OUTPUT CONNECTOR: Ant 2
CHANNEL BANDWIDTH: 10 MHz
MODULATION: 64QAM



Test specification:	Section 90.209, Occupied bandwidth		
Test procedure:	47 CFR, Section 2.1049		
Test mode:	Compliance	Verdict:	PASS
Date & Time:	9/6/2009 5:30:12 PM		
Temperature: 25ºC	Air Pressure: 1008 hPa	Relative Humidity: 43 %	Power Supply: 120 VAC
Remarks:			

7.2 Occupied bandwidth test

7.2.1 General

This test was performed to measure transmitter occupied bandwidth. Specification test limits are given in Table 7.2.1. The test results are provided in Table 7.2.2 and the associated plots.

Table 7.2.1 Occupied bandwidth limits

Assigned frequency, MHz	Modulation envelope reference points*, dBc	Maximum allowed bandwidth, kHz
4940.00 – 4990.00	26	NA

* - Modulation envelope reference points are provided in terms of attenuation below the average transmitted power.

7.2.2 Test procedure

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

7.2.2.2 The EUT was set to transmit the normally modulated carrier.

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

Figure 7.2.1 Occupied bandwidth test setup

Test specification:	Section 90.209, Occupied bandwidth		
Test procedure:	47 CFR, Section 2.1049		
Test mode:	Compliance	Verdict:	PASS
Date & Time:	9/6/2009 5:30:12 PM		
Temperature: 25ºC	Air Pressure: 1008 hPa	Relative Humidity: 43 %	Power Supply: 120 VAC
Remarks:			

Table 7.2.2 Occupied bandwidth test results

DETECTOR USED: Average
RESOLUTION BANDWIDTH: 100 kHz
VIDEO BANDWIDTH: 1000 kHz
MODULATION ENVELOPE REFERENCE POINTS: 26 dBc
MODULATION: 64QAM
MODULATING SIGNAL: PRBS
CHANNEL BANDWIDTH: 5 MHz

Carrier frequency, MHz	Occupied bandwidth, kHz	Limit, kHz	Margin, kHz	Verdict
4942.50	4658.00	NA	NA	Pass
4962.50	4642.00	NA	NA	Pass
4987.50	4608.00	NA	NA	Pass

DETECTOR USED: Average
RESOLUTION BANDWIDTH: 100 kHz
VIDEO BANDWIDTH: 1000 kHz
MODULATION ENVELOPE REFERENCE POINTS: 26 dBc
MODULATION: 64QAM
MODULATING SIGNAL: PRBS
CHANNEL BANDWIDTH: 10 MHz

Carrier frequency, MHz	Occupied bandwidth, kHz	Limit, kHz	Margin, kHz	Verdict
4947.50	9100.00	NA	NA	Pass
4962.50	9080.00	NA	NA	Pass
4982.50	9080.00	NA	NA	Pass

* - RBW ≥ 1% of OBW; 1 % of 5 MHz is 50 kHz, hence, RBW=100 kHz was chosen for the measurements.

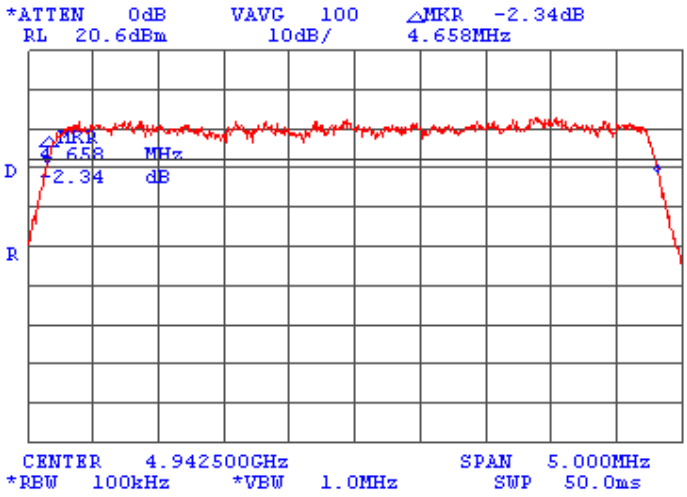
Reference numbers of test equipment used

HL 1424	HL 2951	HL 3179	HL 3435				

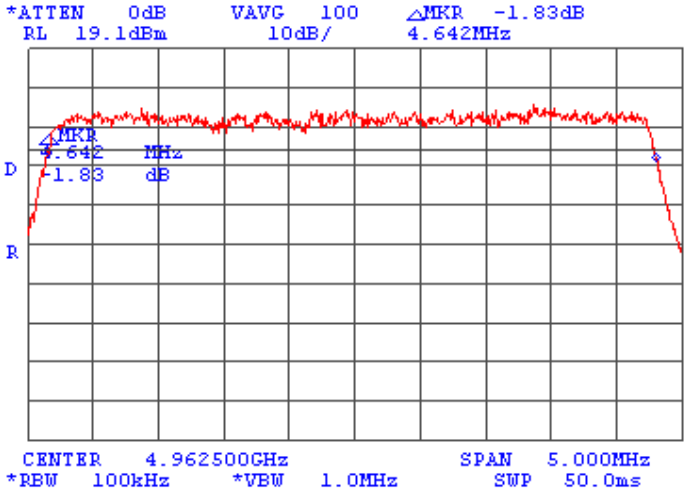
Full description is given in Appendix A.

Test specification:	Section 90.209, Occupied bandwidth		
Test procedure:	47 CFR, Section 2.1049		
Test mode:	Compliance	Verdict:	PASS
Date & Time:	9/6/2009 5:30:12 PM		
Temperature: 25ºC	Air Pressure: 1008 hPa	Relative Humidity: 43 %	Power Supply: 120 VAC
Remarks:			

Plot 7.2.1 Occupied bandwidth test result at low frequency, 5 MHz channel bandwidth

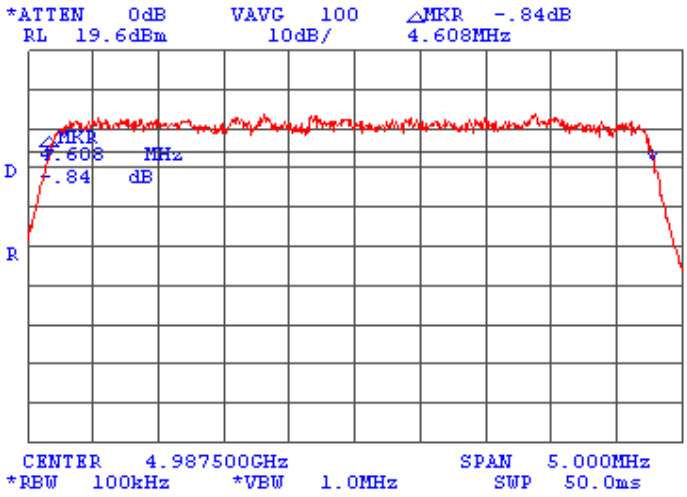


Plot 7.2.2 Occupied bandwidth test result at mid frequency, 5 MHz channel bandwidth



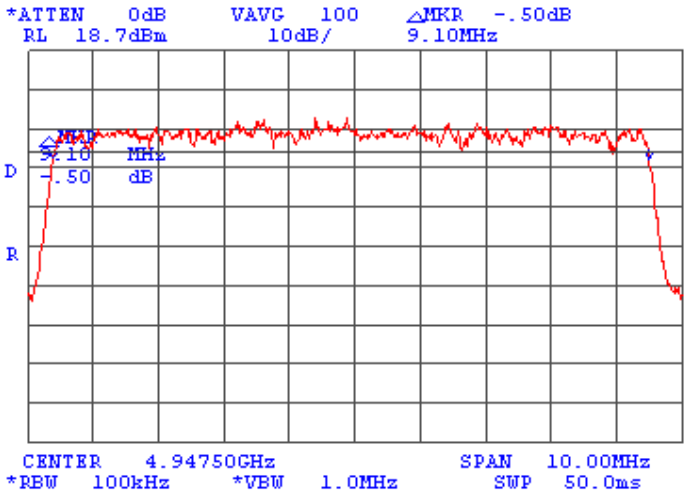
Test specification:	Section 90.209, Occupied bandwidth		
Test procedure:	47 CFR, Section 2.1049		
Test mode:	Compliance	Verdict:	PASS
Date & Time:	9/6/2009 5:30:12 PM		
Temperature: 25ºC	Air Pressure: 1008 hPa	Relative Humidity: 43 %	Power Supply: 120 VAC
Remarks:			

Plot 7.2.3 Occupied bandwidth test result at high frequency, 5 MHz channel bandwidth

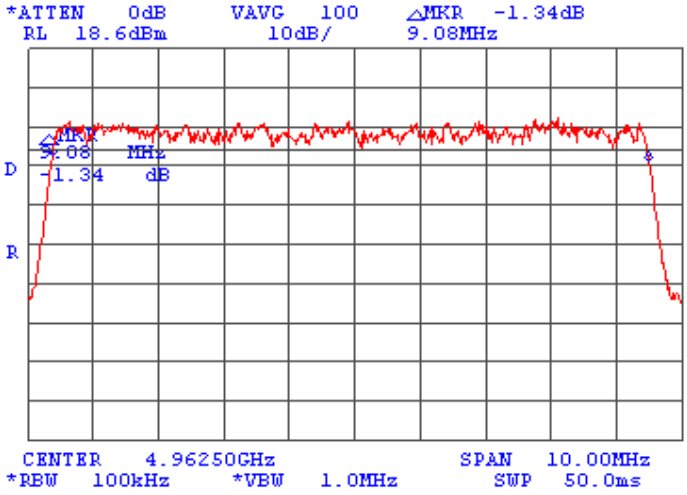


Test specification:	Section 90.209, Occupied bandwidth		
Test procedure:	47 CFR, Section 2.1049		
Test mode:	Compliance	Verdict:	PASS
Date & Time:	9/6/2009 5:30:12 PM		
Temperature: 25ºC	Air Pressure: 1008 hPa	Relative Humidity: 43 %	Power Supply: 120 VAC
Remarks:			

Plot 7.2.4 Occupied bandwidth test result at low frequency, 10 MHz channel bandwidth

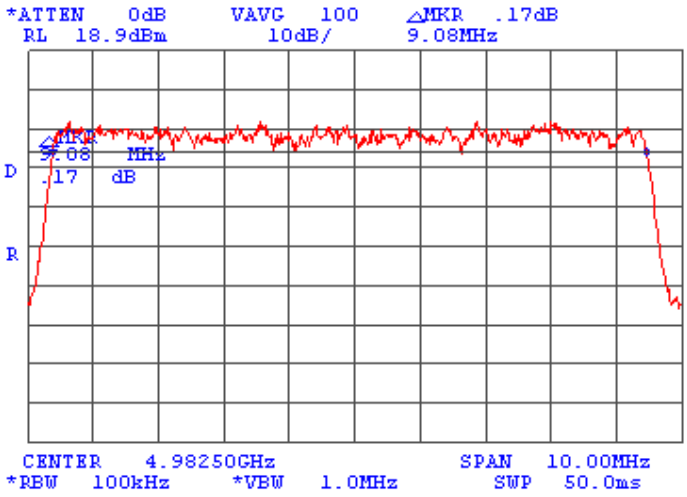


Plot 7.2.5 Occupied bandwidth test result at mid frequency, 10 MHz channel bandwidth



Test specification:	Section 90.209, Occupied bandwidth		
Test procedure:	47 CFR, Section 2.1049		
Test mode:	Compliance	Verdict:	PASS
Date & Time:	9/6/2009 5:30:12 PM		
Temperature: 25ºC	Air Pressure: 1008 hPa	Relative Humidity: 43 %	Power Supply: 120 VAC
Remarks:			

Plot 7.2.6 Occupied bandwidth test result at high frequency, 10 MHz channel bandwidth



Test specification:	Section 90.210, Emission mask		
Test procedure:	47 CFR, Sections 2.1051, 2.1047 and 90.210(m); TIA/EIA-603-C, Section 2.2.13		
Test mode:	Compliance	Verdict:	PASS
Date & Time:	9/17/2009 10:31:37 AM		
Temperature: 26ºC	Air Pressure: 1011 hPa	Relative Humidity: 46 %	Power Supply: 120 VAC
Remarks:			

7.3 Emission mask test

7.3.1 General

This test was performed to measure emission mask at RF antenna connector. Specification test limits are given in Table 7.3.1 and Table 7.3.2.

Table 7.3.1 Emission mask limits for 5 MHz channel bandwidth

Frequency displacement from carrier	Attenuation below carrier, dBc
Emission mask M (Channel bandwidth 5 MHz)	
0 – 2.25 MHz	0
2.25 – 2.5 MHz	568log(F*/2.25)
2.5 – 2.75 MHz	26+145log(F*/2.5)
2.75 – 5.0 MHz	32+31log(F*/2.75)
5.0 – 7.5 MHz	40+57log(F*/5.0)
More than** 7.5 MHz	50 or 55+10logP(W) (whichever is the lesser attenuation)

* - F – frequency in MHz removed from center
** - emission mask includes carrier modulation envelope within ± 150 % of the authorized bandwidth; the frequency range removed beyond ± 150 % of the authorized bandwidth from carrier was investigated as spurious emission

Table 7.3.2 Emission mask limits for 10 MHz channel bandwidth

Frequency displacement from carrier	Attenuation below carrier, dBc
Emission mask M (Channel bandwidth 10 MHz)	
0 – 4.5 MHz	0***
4.5 – 5.0 MHz	568log(F*/4.5)
5.0 – 5.5 MHz	26+145log(F*/5.0)
5.5 – 10.0 MHz	32+31log(F*/5.5)
10.0 – 15.0 MHz	40+57log(F*/10.0)
More than** 15.0 MHz	50 or 55+10logP(W) (whichever is the lesser attenuation)

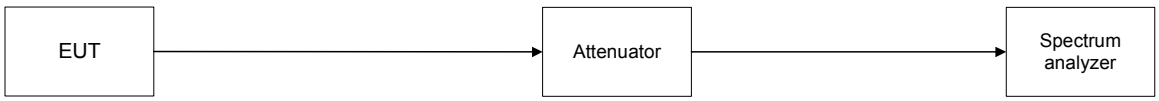
* - F – frequency in MHz removed from center
** - emission mask includes carrier modulation envelope within ± 150 % of the authorized bandwidth; the frequency range removed beyond ± 150 % of the authorized bandwidth from carrier was investigated as spurious emission
*** - Zero dB reference measured relative to the highest average power of the fundamental emission measured across designated channel bandwidth

7.3.2 Test procedure

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

7.3.2.2 The emission mask was measured with spectrum analyzer with RBW set to 1% of emission bandwidth and VBW = 30 kHz as provided in the associated plots. The test results are provided in Table 7.3.3 and Table 7.3.4.

Figure 7.3.1 Emission mask test setup



Test specification:	**Section 90.210, Emission mask**		
Test procedure:	47 CFR, Sections 2.1051, 2.1047 and 90.210(m); TIA/EIA-603-C, Section 2.2.13		
Test mode:	Compliance	**Verdict:**	PASS
Date & Time:	9/17/2009 10:31:37 AM		
Temperature: 26ºC	**Air Pressure:** 1011 hPa	**Relative Humidity:** 46 %	**Power Supply:** 120 VAC
Remarks:			

Table 7.3.3 Emission mask test results 5 MHz channel bandwidth

Carrier frequency, MHz	Limit	Verdict
4942.5	Emission mask M	Pass
4962.5		
4987.5		

Table 7.3.4 Emission mask test results 10 MHz channel bandwidth

Carrier frequency, MHz	Limit	Verdict
4947.5	Emission mask M	Pass
4962.5		
4982.5		

NOTE: Due to the limitations of the spectrum analyzer in some cases the emission mask test was performed using two steps measurement: once using narrower span and then 150 % of the emission bandwidth.

Reference numbers of test equipment used

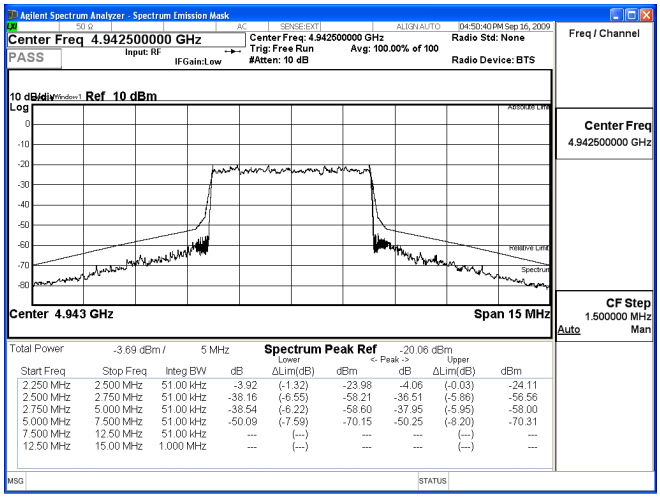
HL 2780	HL 2951	HL 3435	HL 3440					

Full description is given in Appendix A.

Test specification:	Section 90.210, Emission mask		
Test procedure:	47 CFR, Sections 2.1051, 2.1047 and 90.210(m); TIA/EIA-603-C, Section 2.2.13		
Test mode:	Compliance	Verdict:	PASS
Date & Time:	9/17/2009 10:31:37 AM		
Temperature: 26ºC	Air Pressure: 1011 hPa	Relative Humidity: 46 %	Power Supply: 120 VAC
Remarks:			

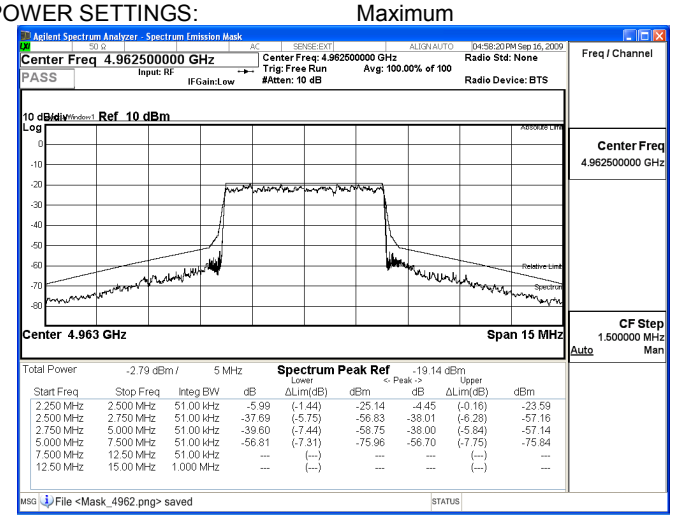
Plot 7.3.1 Emission mask test results at low carrier frequency

ASSIGNED FREQUENCY RANGE:	4940.00 – 4990.00 MHz
DETECTOR USED:	Peak
MODULATION:	64QAM
MODULATING SIGNAL:	PRBS
BIT RATE:	Maximum
TRANSMITTER OUTPUT POWER SETTINGS:	Maximum



Plot 7.3.2 Emission mask test results at mid carrier frequency

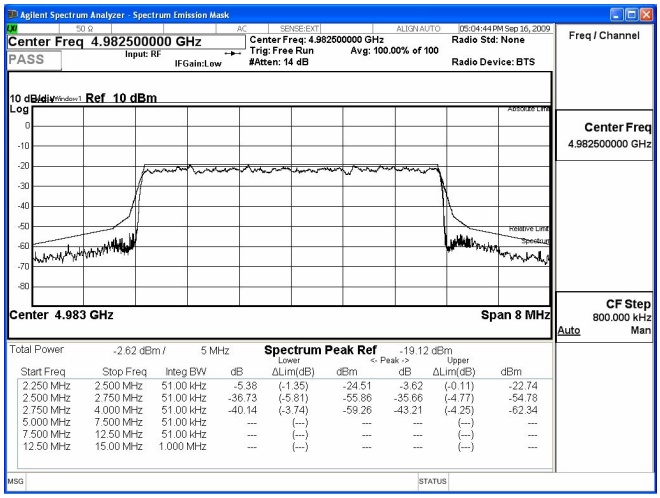
ASSIGNED FREQUENCY RANGE:	4940.0 – 4990.0 MHz
DETECTOR USED:	Average
MODULATION:	64QAM
MODULATING SIGNAL:	PRBS
BIT RATE:	Maximum
TRANSMITTER OUTPUT POWER SETTINGS:	Maximum



Test specification:	Section 90.210, Emission mask		
Test procedure:	47 CFR, Sections 2.1051, 2.1047 and 90.210(m); TIA/EIA-603-C, Section 2.2.13		
Test mode:	Compliance	Verdict:	PASS
Date & Time:	9/17/2009 10:31:37 AM		
Temperature: 26ºC	Air Pressure: 1011 hPa	Relative Humidity: 46 %	Power Supply: 120 VAC
Remarks:			

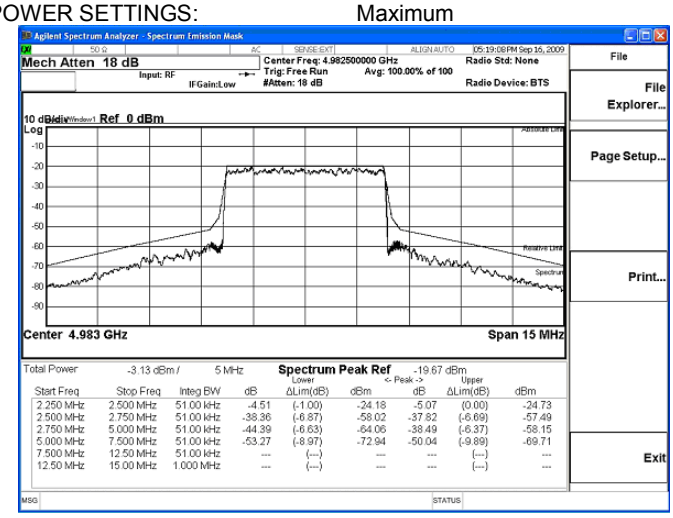
Plot 7.3.3 Emission mask test results at high carrier frequency close view

ASSIGNED FREQUENCY RANGE:	4940.0 – 4990.0 MHz
DETECTOR USED:	Average
MODULATION:	64QAM
MODULATING SIGNAL:	PRBS
BIT RATE:	Maximum
TRANSMITTER OUTPUT POWER SETTINGS:	Maximum



Plot 7.3.4 Emission mask test results at high carrier frequency

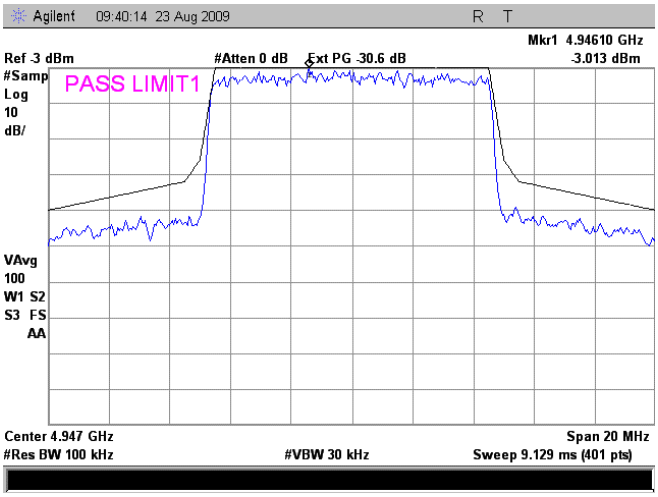
ASSIGNED FREQUENCY RANGE:	4940.0 – 4990.0 MHz
DETECTOR USED:	Average
MODULATION:	64QAM
MODULATING SIGNAL:	PRBS
BIT RATE:	Maximum
TRANSMITTER OUTPUT POWER SETTINGS:	Maximum



Test specification:	Section 90.210, Emission mask		
Test procedure:	47 CFR, Sections 2.1051, 2.1047 and 90.210(m); TIA/EIA-603-C, Section 2.2.13		
Test mode:	Compliance	Verdict:	PASS
Date & Time:	9/17/2009 10:31:37 AM		
Temperature: 26ºC	Air Pressure: 1011 hPa	Relative Humidity: 46 %	Power Supply: 120 VAC
Remarks:			

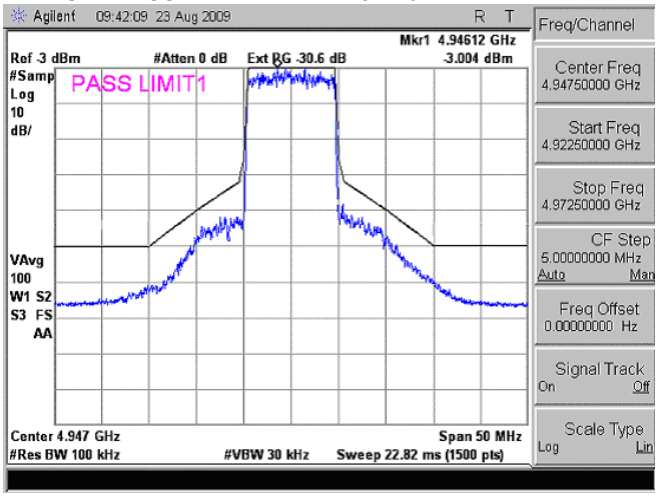
Plot 7.3.5 Emission mask test results at low carrier frequency close view

ASSIGNED FREQUENCY RANGE:	4940.00 – 4990.00 MHz
DETECTOR USED:	Peak
MODULATION:	64QAM
MODULATING SIGNAL:	PRBS
BIT RATE:	Maximum
TRANSMITTER OUTPUT POWER SETTINGS:	Maximum



Plot 7.3.6 Emission mask test results at low carrier frequency close view

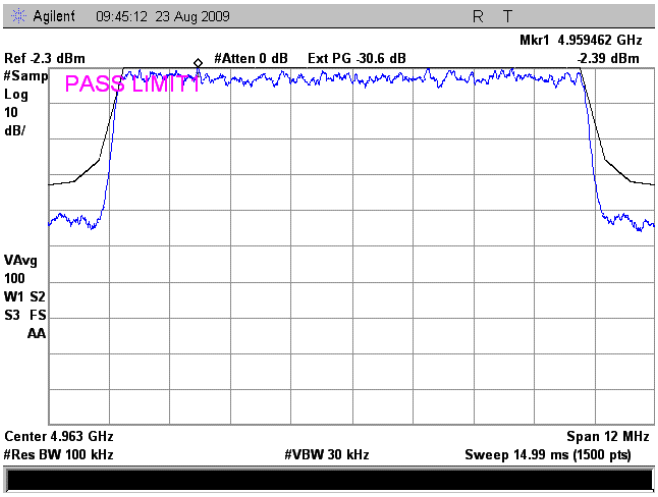
ASSIGNED FREQUENCY RANGE:	4940.00 – 4990.00 MHz
DETECTOR USED:	Peak
MODULATION:	64QAM
MODULATING SIGNAL:	PRBS
BIT RATE:	Maximum
TRANSMITTER OUTPUT POWER SETTINGS:	Maximum



Test specification:	Section 90.210, Emission mask		
Test procedure:	47 CFR, Sections 2.1051, 2.1047 and 90.210(m); TIA/EIA-603-C, Section 2.2.13		
Test mode:	Compliance	Verdict:	PASS
Date & Time:	9/17/2009 10:31:37 AM		
Temperature: 26ºC	Air Pressure: 1011 hPa	Relative Humidity: 46 %	Power Supply: 120 VAC
Remarks:			

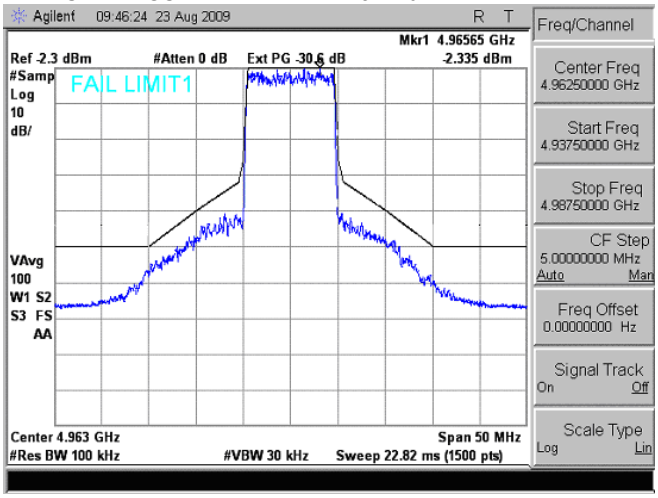
Plot 7.3.7 Emission mask test results at mid carrier frequency close view

ASSIGNED FREQUENCY RANGE:	4940.0 – 4990.0 MHz
DETECTOR USED:	Average
MODULATION:	64QAM
MODULATING SIGNAL:	PRBS
BIT RATE:	Maximum
TRANSMITTER OUTPUT POWER SETTINGS:	Maximum



Plot 7.3.8 Emission mask test results at mid carrier frequency

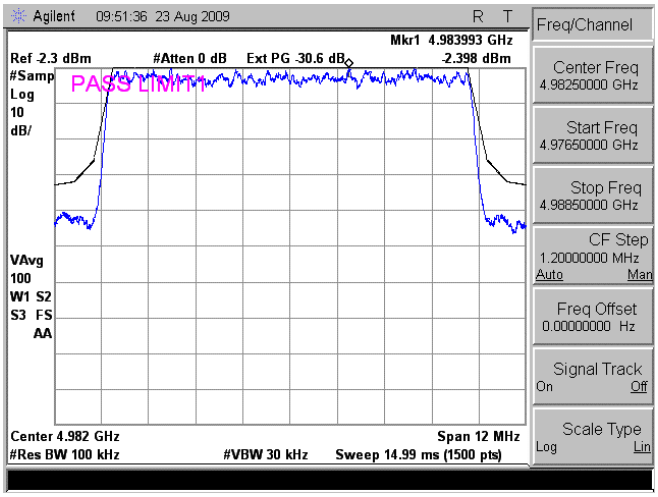
ASSIGNED FREQUENCY RANGE:	4940.0 – 4990.0 MHz
DETECTOR USED:	Average
MODULATION:	64QAM
MODULATING SIGNAL:	PRBS
BIT RATE:	Maximum
TRANSMITTER OUTPUT POWER SETTINGS:	Maximum



Test specification:	Section 90.210, Emission mask		
Test procedure:	47 CFR, Sections 2.1051, 2.1047 and 90.210(m); TIA/EIA-603-C, Section 2.2.13		
Test mode:	Compliance	Verdict:	PASS
Date & Time:	9/17/2009 10:31:37 AM		
Temperature: 26ºC	Air Pressure: 1011 hPa	Relative Humidity: 46 %	Power Supply: 120 VAC
Remarks:			

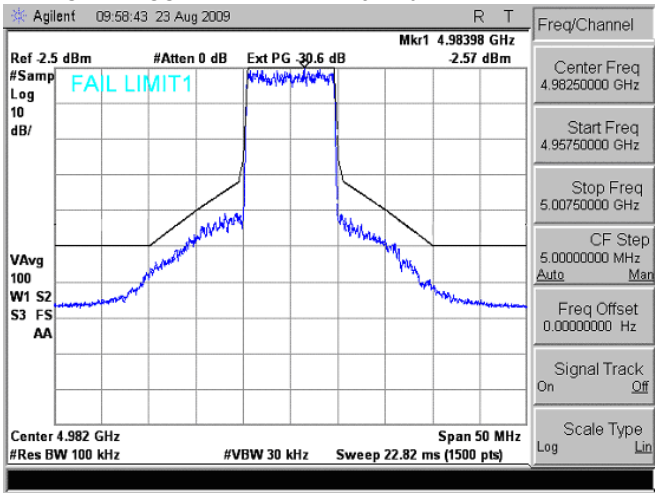
Plot 7.3.9 Emission mask test results at high carrier frequency close view

ASSIGNED FREQUENCY RANGE:	4940.0 – 4990.0 MHz
DETECTOR USED:	Average
MODULATION:	64QAM
MODULATING SIGNAL:	PRBS
BIT RATE:	Maximum
TRANSMITTER OUTPUT POWER SETTINGS:	Maximum



Plot 7.3.10 Emission mask test results at high carrier frequency

ASSIGNED FREQUENCY RANGE:	4940.0 – 4990.0 MHz
DETECTOR USED:	Average
MODULATION:	64QAM
MODULATING SIGNAL:	PRBS
BIT RATE:	Maximum
TRANSMITTER OUTPUT POWER SETTINGS:	Maximum



Test specification:	Section 90.210, Radiated spurious emissions		
Test procedure:	47 CFR, Sections 2.1053 and 90.210(m); TIA/EIA-603-C, Section 2.2.12		
Test mode:	Compliance	Verdict:	PASS
Date & Time:	9/6/2009 5:48:37 PM		
Temperature: 25.4 ºC	Air Pressure: 1008 hPa	Relative Humidity: 41 %	Power Supply: 120 VAC
Remarks:			

7.4 Radiated spurious emission measurements

7.4.1 General

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

Table 7.4.1 Radiated spurious emission test limits

Frequency, MHz	Attenuation below carrier dBc	ERP of spurious, dBm	Equivalent field strength limit @ 3m, dB(µV/m)***
0.009 – 10th harmonic*	55+10logP**	-25	72.40

* - Excluding the in band emission within ± 150 % of the authorized bandwidth from the carrier
** - P is transmitter output power in Watts
*** - Equivalent field strength limit was calculated from maximum allowed ERP of spurious as follows: E=sqrt(30×P×1.64)/r, where P is ERP in Watts, 1.64 is numeric gain of ideal dipole and r is antenna to EUT distance in meters

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

7.4.2.1 The EUT was set up as shown in Figure 7.4.1, energized and the performance check was conducted.
7.4.2.2 The specified frequency range was investigated with antenna connected to spectrum analyzer. To find maximum radiation the turntable was rotated 360^0 and the measuring antenna was rotated around its vertical axis.
7.4.2.3 The worst test results (the lowest margins) were recorded in Table 7.4.2 and shown in the associated plots.

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

7.4.3.1 The EUT was set up as shown in Figure 7.4.2, energized and the performance check was conducted.
7.4.3.2 The specified frequency range was investigated with antenna connected to spectrum analyzer. To find maximum radiation the turntable was rotated 360^0 and the measuring antenna height was swept from 1 to 4 m in both, vertical and horizontal, polarizations.
7.4.3.3 The worst test results (the lowest margins) were recorded in Table 7.4.2 and shown in the associated plots.

Test specification:	Section 90.210, Radiated spurious emissions		
Test procedure:	47 CFR, Sections 2.1053 and 90.210(m); TIA/EIA-603-C, Section 2.2.12		
Test mode:	Compliance	Verdict:	PASS
Date & Time:	9/6/2009 5:48:37 PM		
Temperature: 25.4 ºC	Air Pressure: 1008 hPa	Relative Humidity: 41 %	Power Supply: 120 VAC
Remarks:			

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

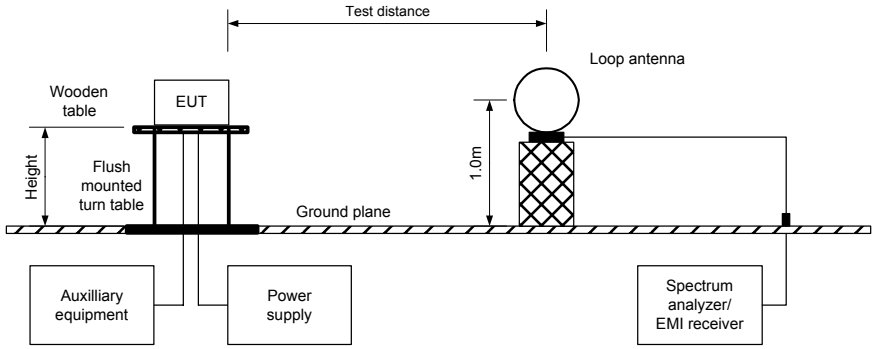
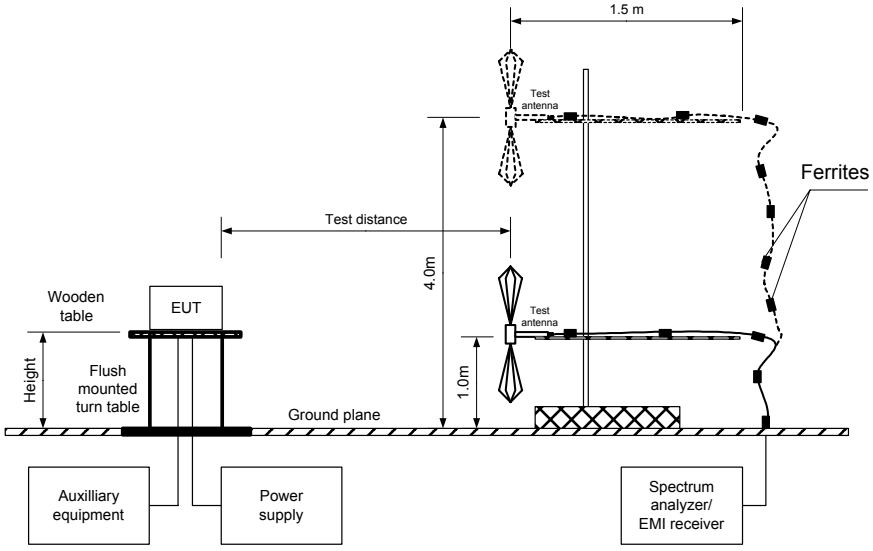


Figure 7.4.2 Setup for spurious emission field strength measurements above 30 MHz



Test specification:	**Section 90.210, Radiated spurious emissions**		
Test procedure:	47 CFR, Sections 2.1053 and 90.210(m); TIA/EIA-603-C, Section 2.2.12		
Test mode:	Compliance	**Verdict:**	PASS
Date & Time:	9/6/2009 5:48:37 PM		
Temperature: 25.4 ºC	**Air Pressure:** 1008 hPa	**Relative Humidity:** 41 %	**Power Supply:** 120 VAC
Remarks:			

Table 7.4.2 Spurious emission field strength test results

ASSIGNED FREQUENCY RANGE:	4940.0 – 4990.0 MHz
TEST DISTANCE:	3 m
TEST SITE:	Anechoic chamber / OATS
EUT HEIGHT:	0.8 m
INVESTIGATED FREQUENCY RANGE:	0.009 – 40000 MHz
DETECTOR USED:	Peak
VIDEO BANDWIDTH:	> Resolution bandwidth
TEST ANTENNA TYPE:	Active loop (9 kHz – 30 MHz) Biconilog (30 MHz – 1000 MHz) Double ridged guide (above 1000 MHz)
MODULATION:	64QAM
MODULATING SIGNAL:	PRBS
TRANSMITTER OUTPUT POWER SETTINGS:	Maximum (MIMO operation; both antennas terminated with 50 Ohm and transmitting with maximum rated output power)
CHANNEL BANDWIDTH:	5 MHz (as maximum aggregate output power is the same for both CBW, the 5 MHz channel bandwidth produces higher power spectral density)

Frequency, MHz	Field strength, dB(μV/m)	Limit, dB(μV/m)	Margin, dB*	RBW, kHz	Antenna polarization	Antenna height, m	Turn-table position**, degrees
All found emissions were from digital part of the EUT, refer to section 8.2 of this test report							

Verdict: Pass

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

Reference numbers of test equipment used

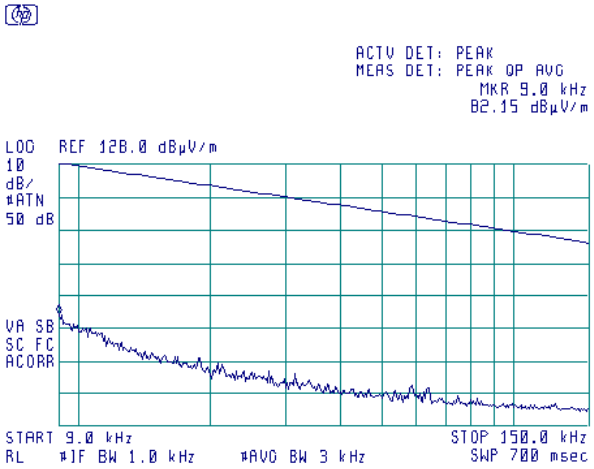
HL 0446	HL 0768	HL 0769	HL 1425	HL 2697	HL 2780	HL 2882	HL 2883
HL 3533	HL 3534	HL 3624					

Full description is given in Appendix A.

Test specification:	Section 90.210, Radiated spurious emissions		
Test procedure:	47 CFR, Sections 2.1053 and 90.210(m); TIA/EIA-603-C, Section 2.2.12		
Test mode:	Compliance	Verdict:	PASS
Date & Time:	9/6/2009 5:48:37 PM		
Temperature: 25.4 ºC	Air Pressure: 1008 hPa	Relative Humidity: 41 %	Power Supply: 120 VAC
Remarks:			

Plot 7.4.1 Radiated emission measurements in 9 - 150 kHz range

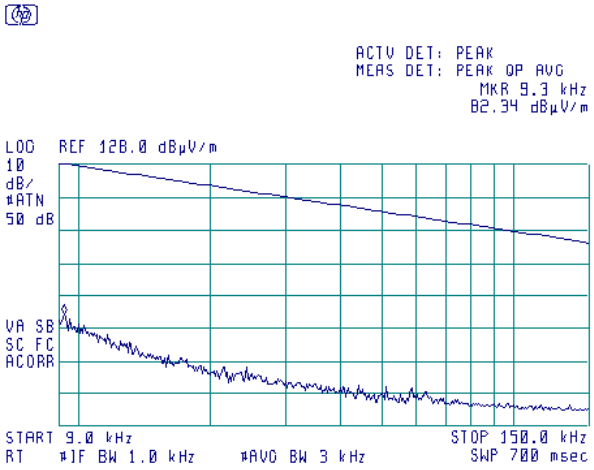
TEST SITE:	Fully anechoic chamber
CARRIER FREQUENCY:	Low
ANTENNA POLARIZATION:	Vertical and Horizontal
TEST DISTANCE:	3 m



FCC §15.209 limit

Plot 7.4.2 Radiated emission measurements in 9 - 150 kHz range

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

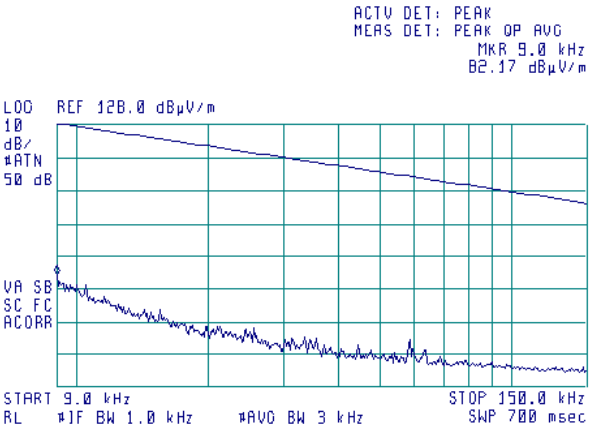


FCC §15.209 limit

Test specification:	Section 90.210, Radiated spurious emissions		
Test procedure:	47 CFR, Sections 2.1053 and 90.210(m); TIA/EIA-603-C, Section 2.2.12		
Test mode:	Compliance	Verdict:	PASS
Date & Time:	9/6/2009 5:48:37 PM		
Temperature: 25.4 ºC	Air Pressure: 1008 hPa	Relative Humidity: 41 %	Power Supply: 120 VAC
Remarks:			

Plot 7.4.3 Radiated emission measurements in 9 - 150 kHz range

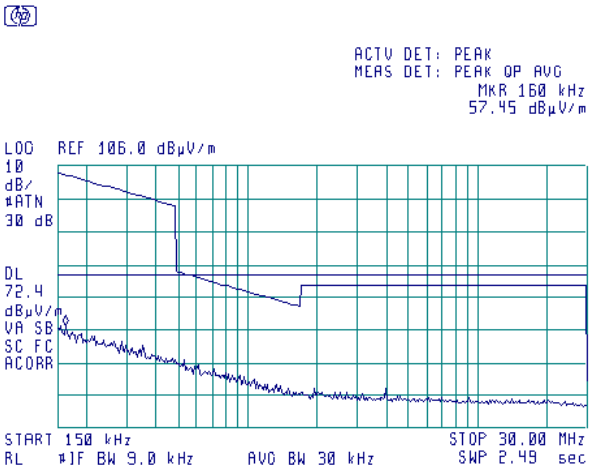
TEST SITE:	Fully anechoic chamber
CARRIER FREQUENCY:	High
ANTENNA POLARIZATION:	Vertical and Horizontal
TEST DISTANCE:	3 m



FCC §15.209 limit

Plot 7.4.4 Radiated emission measurements in 0.15 - 30 MHz range

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

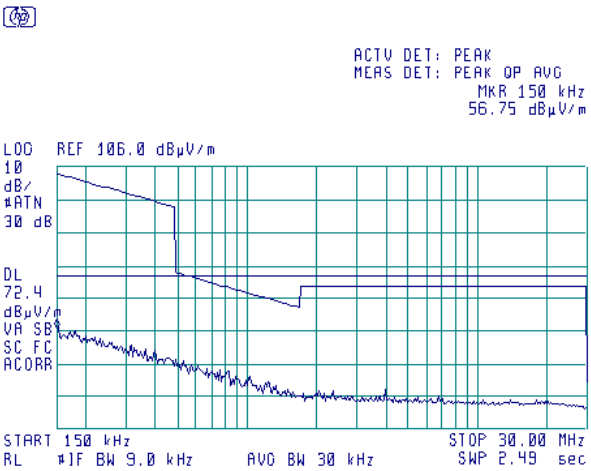


FCC §15.209&FCC §90.210 (m) limits

Test specification:	Section 90.210, Radiated spurious emissions		
Test procedure:	47 CFR, Sections 2.1053 and 90.210(m); TIA/EIA-603-C, Section 2.2.12		
Test mode:	Compliance	Verdict:	PASS
Date & Time:	9/6/2009 5:48:37 PM		
Temperature: 25.4 ºC	Air Pressure: 1008 hPa	Relative Humidity: 41 %	Power Supply: 120 VAC
Remarks:			

Plot 7.4.5 Radiated emission measurements in 0.15 - 30 MHz range

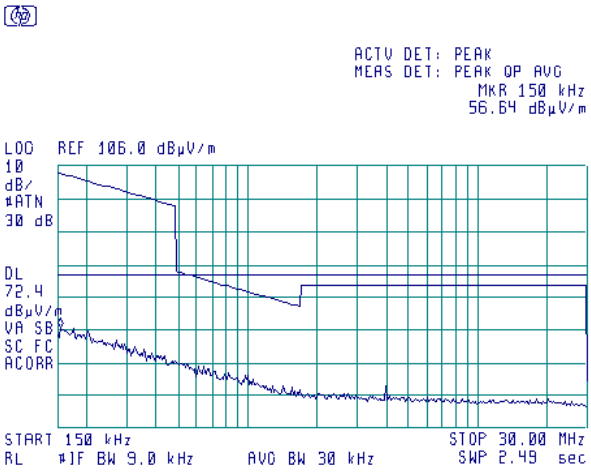
TEST SITE:	Fully anechoic chamber
CARRIER FREQUENCY:	Mid
ANTENNA POLARIZATION:	Vertical and Horizontal
TEST DISTANCE:	3 m



FCC §15.209&FCC §90.210 (m) limits

Plot 7.4.6 Radiated emission measurements in 0.15 - 30 MHz range

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

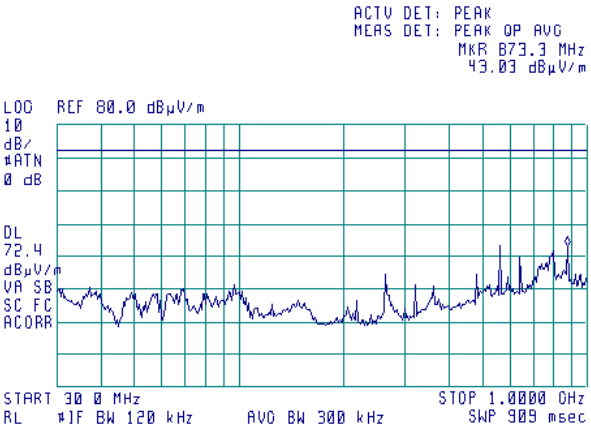


FCC §15.209&FCC §90.210 (m) limits

Test specification:	Section 90.210, Radiated spurious emissions		
Test procedure:	47 CFR, Sections 2.1053 and 90.210(m); TIA/EIA-603-C, Section 2.2.12		
Test mode:	Compliance	Verdict:	PASS
Date & Time:	9/6/2009 5:48:37 PM		
Temperature: 25.4 ºC	Air Pressure: 1008 hPa	Relative Humidity: 41 %	Power Supply: 120 VAC
Remarks:			

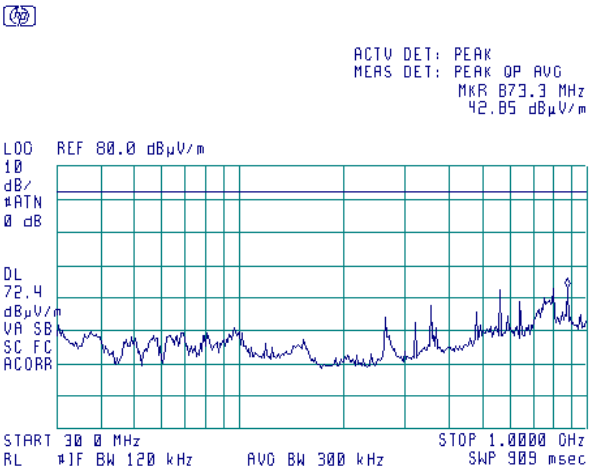
Plot 7.4.7 Radiated emission measurements in 30 - 1000 MHz range

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



Plot 7.4.8 Radiated emission measurements in 30 - 1000 MHz range

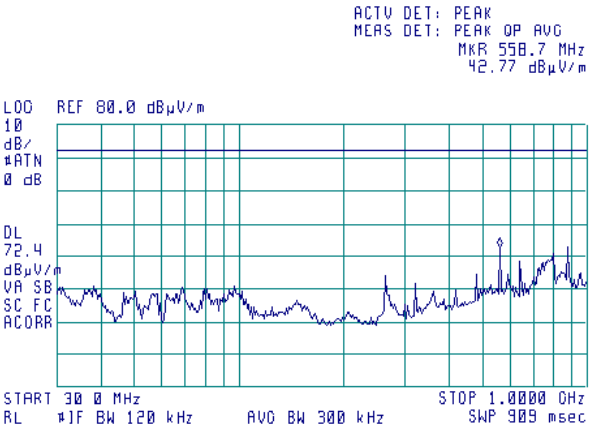
TEST SITE:	Fully anechoic chamber
CARRIER FREQUENCY:	Mid
ANTENNA POLARIZATION:	Vertical and Horizontal
TEST DISTANCE:	3 m



Test specification:	Section 90.210, Radiated spurious emissions		
Test procedure:	47 CFR, Sections 2.1053 and 90.210(m); TIA/EIA-603-C, Section 2.2.12		
Test mode:	Compliance	Verdict:	PASS
Date & Time:	9/6/2009 5:48:37 PM		
Temperature: 25.4 ºC	Air Pressure: 1008 hPa	Relative Humidity: 41 %	Power Supply: 120 VAC
Remarks:			

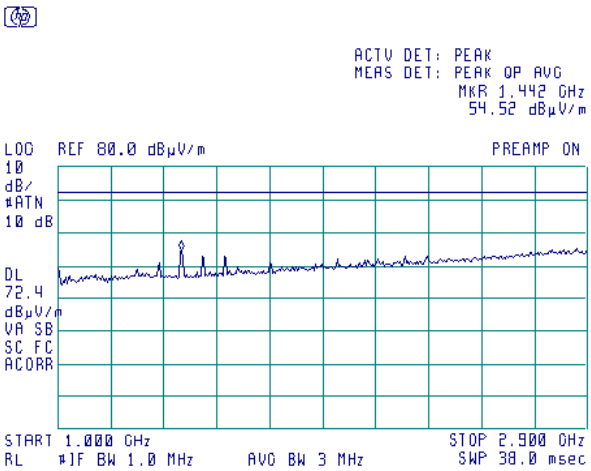
Plot 7.4.9 Radiated emission measurements in 30 - 1000 MHz range

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



Plot 7.4.10 Radiated emission measurements in 1000 – 2900 MHz range

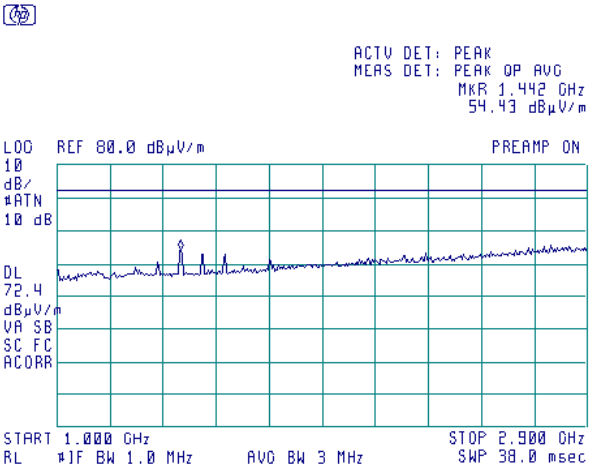
TEST SITE:	Fully anechoic chamber
CARRIER FREQUENCY:	Low
ANTENNA POLARIZATION:	Vertical and Horizontal
TEST DISTANCE:	3 m



Test specification:	Section 90.210, Radiated spurious emissions		
Test procedure:	47 CFR, Sections 2.1053 and 90.210(m); TIA/EIA-603-C, Section 2.2.12		
Test mode:	Compliance	Verdict:	PASS
Date & Time:	9/6/2009 5:48:37 PM		
Temperature: 25.4 ºC	Air Pressure: 1008 hPa	Relative Humidity: 41 %	Power Supply: 120 VAC
Remarks:			

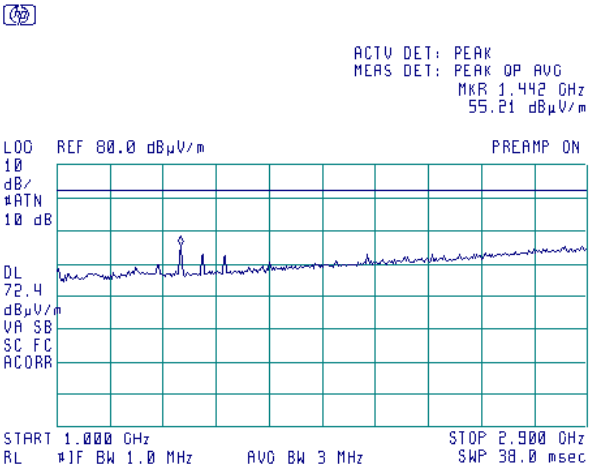
Plot 7.4.11 Radiated emission measurements in 1000 – 2900 MHz range

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



Plot 7.4.12 Radiated emission measurements in 1000 – 2900 MHz range

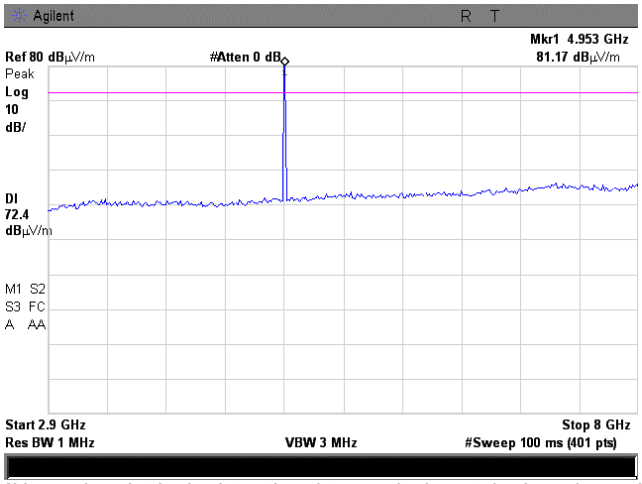
TEST SITE:	Fully anechoic chamber
CARRIER FREQUENCY:	High
ANTENNA POLARIZATION:	Vertical and Horizontal
TEST DISTANCE:	3 m



Test specification:	Section 90.210, Radiated spurious emissions		
Test procedure:	47 CFR, Sections 2.1053 and 90.210(m); TIA/EIA-603-C, Section 2.2.12		
Test mode:	Compliance	Verdict:	PASS
Date & Time:	9/6/2009 5:48:37 PM		
Temperature: 25.4 ºC	Air Pressure: 1008 hPa	Relative Humidity: 41 %	Power Supply: 120 VAC
Remarks:			

Plot 7.4.13 Radiated emission measurements in 2900 – 8000 MHz range

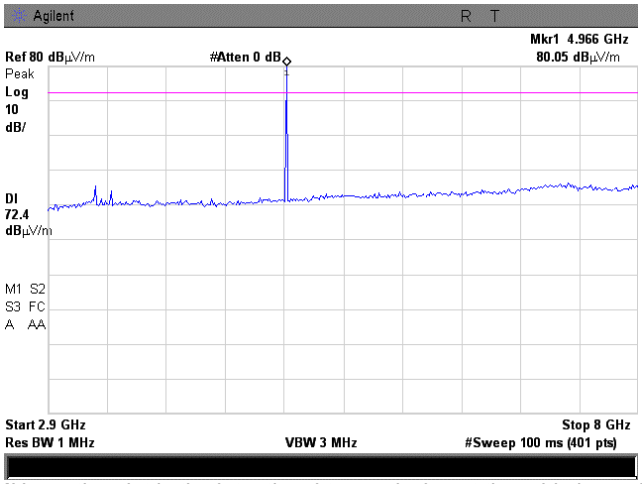
TEST SITE: Fully anechoic chamber
CARRIER FREQUENCY: Low
ANTENNA POLARIZATION: Vertical and Horizontal
TEST DISTANCE: 3 m



NOTE: 4953 MHz on the plot is the intentional transmission at the low channel (4942.5MHz)

Plot 7.4.14 Radiated emission measurements in 2900 – 8000 MHz range

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

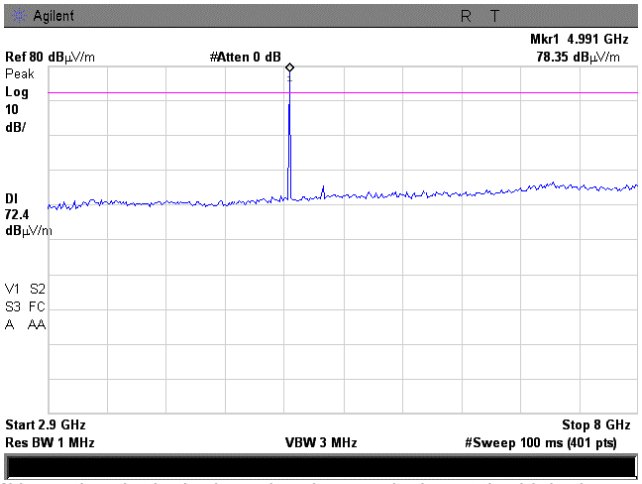


NOTE: 4966 MHz on the plot is the intentional transmission at the mid channel (4962.5MHz)

Test specification:	Section 90.210, Radiated spurious emissions		
Test procedure:	47 CFR, Sections 2.1053 and 90.210(m); TIA/EIA-603-C, Section 2.2.12		
Test mode:	Compliance	Verdict:	PASS
Date & Time:	9/6/2009 5:48:37 PM		
Temperature: 25.4 ºC	Air Pressure: 1008 hPa	Relative Humidity: 41 %	Power Supply: 120 VAC
Remarks:			

Plot 7.4.15 Radiated emission measurements in 2900 – 8000 MHz range

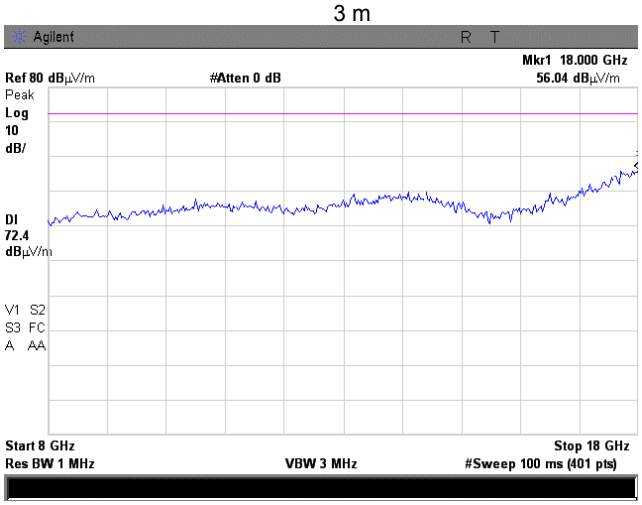
TEST SITE: Fully anechoic chamber
CARRIER FREQUENCY: High
ANTENNA POLARIZATION: Vertical and Horizontal
TEST DISTANCE: 3 m



NOTE: 4991 MHz on the plot is the intentional transmission at the high channel (4987.5MHz)

Plot 7.4.16 Radiated emission measurements in 8000 – 18000 MHz range

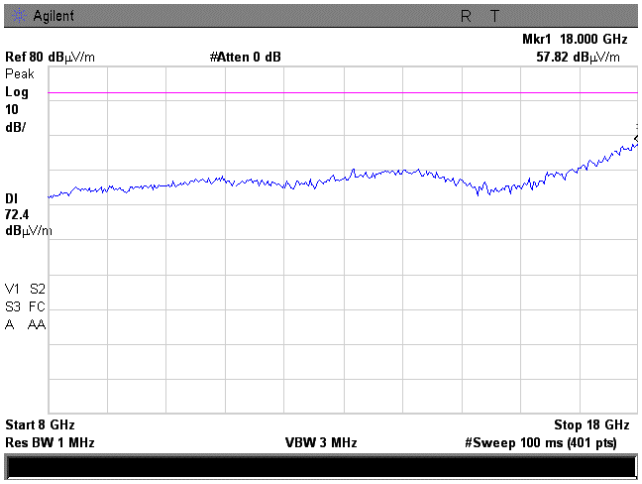
TEST SITE: Fully anechoic chamber
CARRIER FREQUENCY: Low
ANTENNA POLARIZATION: Vertical and Horizontal
TEST DISTANCE: 3 m



Test specification:	Section 90.210, Radiated spurious emissions		
Test procedure:	47 CFR, Sections 2.1053 and 90.210(m); TIA/EIA-603-C, Section 2.2.12		
Test mode:	Compliance	Verdict:	PASS
Date & Time:	9/6/2009 5:48:37 PM		
Temperature: 25.4 ºC	Air Pressure: 1008 hPa	Relative Humidity: 41 %	Power Supply: 120 VAC
Remarks:			

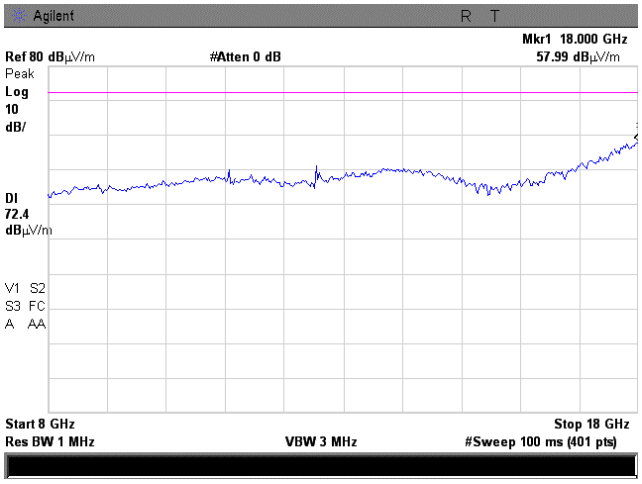
Plot 7.4.17 Radiated emission measurements in 8000 – 18000 MHz range

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



Plot 7.4.18 Radiated emission measurements in 8000 – 18000 MHz range

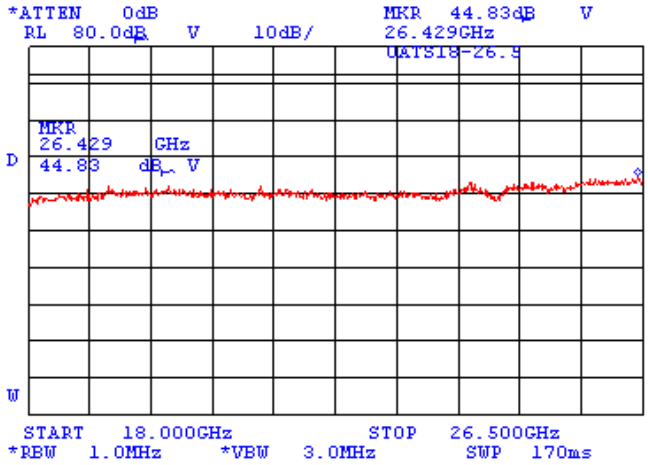
TEST SITE: Fully anechoic chamber
CARRIER FREQUENCY: High
ANTENNA POLARIZATION: Vertical and Horizontal
TEST DISTANCE: 3 m



Test specification:	Section 90.210, Radiated spurious emissions		
Test procedure:	47 CFR, Sections 2.1053 and 90.210(m); TIA/EIA-603-C, Section 2.2.12		
Test mode:	Compliance	Verdict:	PASS
Date & Time:	9/6/2009 5:48:37 PM		
Temperature: 25.4 ºC	Air Pressure: 1008 hPa	Relative Humidity: 41 %	Power Supply: 120 VAC
Remarks:			

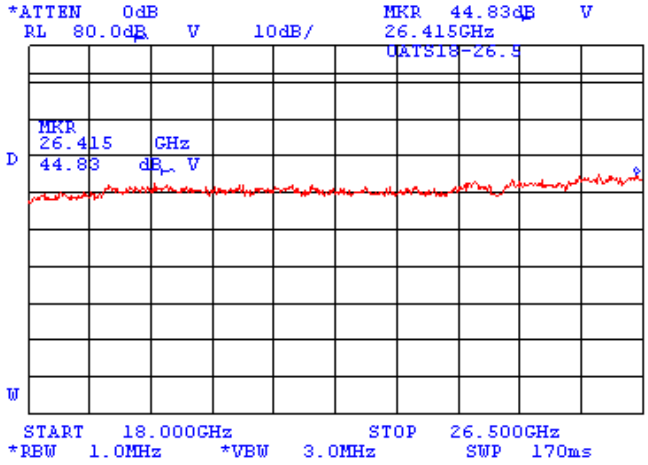
Plot 7.4.19 Radiated emission measurements in 18000 – 26500 MHz range

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



Plot 7.4.20 Radiated emission measurements in 18000 – 26500 MHz range

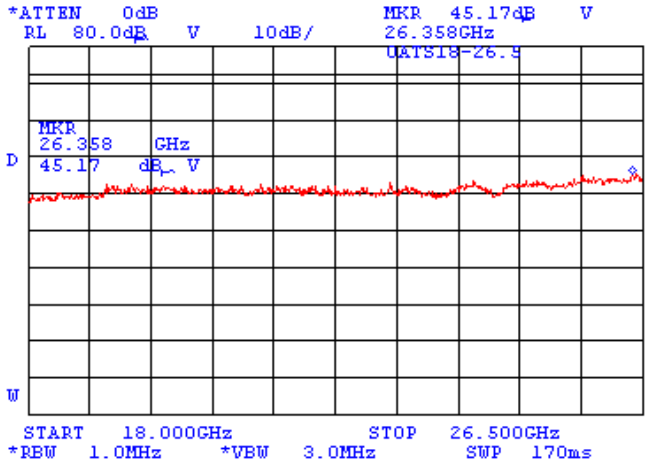
TEST SITE:	OATS
CARRIER FREQUENCY:	Mid
ANTENNA POLARIZATION:	Vertical and Horizontal
TEST DISTANCE:	3 m



Test specification:	Section 90.210, Radiated spurious emissions		
Test procedure:	47 CFR, Sections 2.1053 and 90.210(m); TIA/EIA-603-C, Section 2.2.12		
Test mode:	Compliance	Verdict:	PASS
Date & Time:	9/6/2009 5:48:37 PM		
Temperature: 25.4 ºC	Air Pressure: 1008 hPa	Relative Humidity: 41 %	Power Supply: 120 VAC
Remarks:			

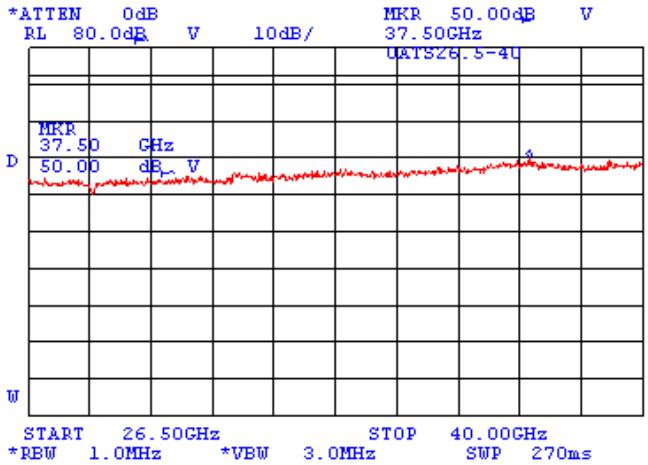
Plot 7.4.21 Radiated emission measurements in 18000 – 26500 MHz range

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



Plot 7.4.22 Radiated emission measurements in 26500 – 40000 MHz range

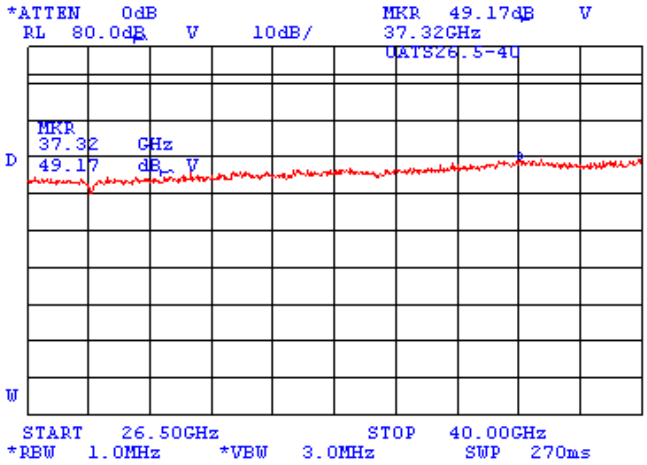
TEST SITE:	OATS
CARRIER FREQUENCY:	Low
ANTENNA POLARIZATION:	Vertical and Horizontal
TEST DISTANCE:	3 m



Test specification:	Section 90.210, Radiated spurious emissions		
Test procedure:	47 CFR, Sections 2.1053 and 90.210(m); TIA/EIA-603-C, Section 2.2.12		
Test mode:	Compliance	Verdict:	PASS
Date & Time:	9/6/2009 5:48:37 PM		
Temperature: 25.4 ºC	Air Pressure: 1008 hPa	Relative Humidity: 41 %	Power Supply: 120 VAC
Remarks:			

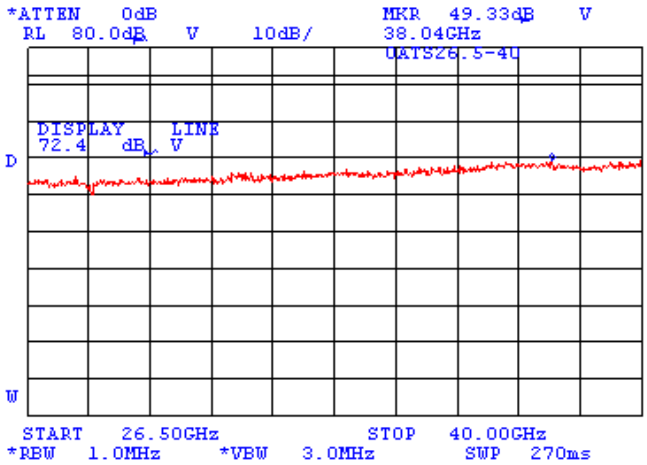
Plot 7.4.23 Radiated emission measurements in 26500 – 40000 MHz range

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



Plot 7.4.24 Radiated emission measurements in 26500 – 40000 MHz range

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



Test specification:	Section 90.210, Conducted spurious emissions		
Test procedure:	47 CFR, Sections 2.1051 and 90.210(m); TIA/EIA-603-C, Section 2.2.13		
Test mode:	Compliance	Verdict:	PASS
Date & Time:	9/6/2009 5:44:32 PM		
Temperature: 25ºC	Air Pressure: 1008 hPa	Relative Humidity: 43 %	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. The test results are provided in Table 7.5.2 and associated plots.

Table 7.5.1 Spurious emission limits

Frequency, MHz	Attenuation below carrier, dBc	ERP of spurious, dBm
0.009 – 10th harmonic*	55+10logP** (mask M, lesser attenuation)	-25.0

* - spurious emission limits do not apply to the in band emission within ± 150 % of the authorized bandwidth from the carrier; investigated in course of emission mask testing
** - P is transmitter output power in Watts

7.5.2 Test procedure

7.5.2.1 The EUT was set up as shown in Figure 7.5.1, Figure 7.5.2energized 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 the associated plots.

Figure 7.5.1 Spurious emission test setup - individual Tx chain

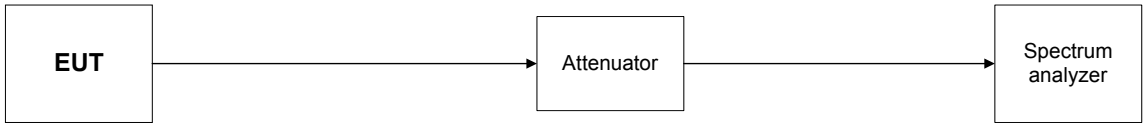
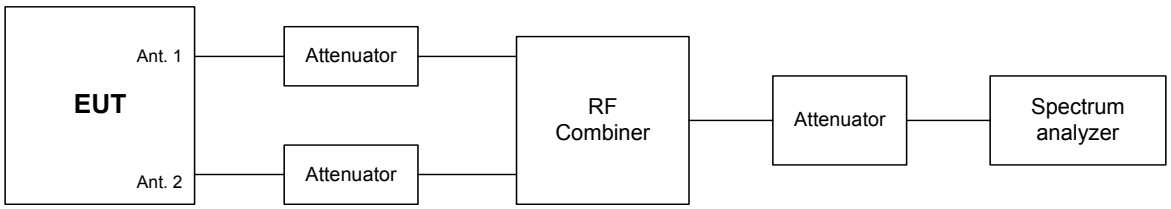


Figure 7.5.2 Spurious emission test setup– combined Tx chains



Test specification:	Section 90.210, Conducted spurious emissions		
Test procedure:	47 CFR, Sections 2.1051 and 90.210(m); TIA/EIA-603-C, Section 2.2.13		
Test mode:	Compliance	Verdict:	PASS
Date & Time:	9/6/2009 5:44:32 PM		
Temperature: 25ºC	Air Pressure: 1008 hPa	Relative Humidity: 43 %	Power Supply: 120 VAC
Remarks:			

Table 7.5.2 Spurious emission test results

ASSIGNED FREQUENCY RANGE:	4940.00 – 4990.00 MHz
INVESTIGATED FREQUENCY RANGE:	0.009 – 40000 MHz
DETECTOR USED:	Peak
VIDEO BANDWIDTH:	≥ Resolution bandwidth
MODULATION:	64QAM
MODULATING SIGNAL:	PRBS
BIT RATE:	9.36 Mbps
TRANSMITTER OUTPUT POWER SETTINGS:	Maximum
CHANNEL BANDWIDTH:	5 MHz (Maximum output power spectral density)
TRANSMITTER OUTPUT POWER:	18.93(Ant1) / 18.93(Ant2) dBm at low frequency 19.09(Ant1) / 19.22(Ant2) dBm at mid frequency 19.58(Ant1) / 19.21(Ant2) dBm at high frequency

Individual Tx chain

Frequency, MHz	SA reading, dBm	Attenuator, dB	Cable loss, dB	RBW, kHz	Spurious emission, dBm	Limit, dBm	Margin, dB*	Verdict
Low carrier frequency								
4934.986	-41.26	Included	Included	1000	-41.26	-25.00	-16.26	Pass
4950.007	-41.05	Included	Included	1000	-41.05	-25.00	-16.05	Pass
Mid carrier frequency								
4955.000	-41.28	Included	Included	1000	-41.28	-25.00	-16.28	Pass
4970.007	-40.49	Included	Included	1000	-40.49	-25.00	-15.49	Pass
High carrier frequency								
4979.887	-42.65	Included	Included	1000	-42.65	-25.00	-17.65	Pass
4995.028	-41.52	Included	Included	1000	-41.52	-25.00	-16.52	Pass

Combined Tx chains

Frequency, MHz	SA reading, dBm	Attenuator, dB	Cable loss, dB	RBW, kHz	Spurious emission, dBm	Limit, dBm	Margin, dB*	Verdict
Low carrier frequency								
4934.979	-39.13	Included	Included	1000	-39.13	-25.00	-14.13	Pass
4950.035	-37.50	Included	Included	1000	-37.50	-25.00	-12.5	Pass
5009.200	-40.22	Included	Included	1000	-40.22	-25.00	-15.22	Pass
5012.000	-49.55	Included	Included	1000	-49.55	-25.00	-24.55	Pass
Mid carrier frequency								
5050.33	-49.18	Included	Included	1000	-49.18	-25.00	-24.18	Pass
4954.979	-40.75	Included	Included	1000	-40.75	-25.00	-15.75	Pass
4970.021	-39.81	Included	Included	1000	-39.81	-25.00	-14.81	Pass
High carrier frequency								
4979.979	-42.54	Included	Included	1000	-42.54	-25.00	-17.54	Pass
4995.007	-41.66	Included	Included	1000	-41.66	-25.00	-16.66	Pass
5127.000	-46.60	Included	Included	1000	-46.60	-25.00	-21.6	Pass

*- Margin = Spurious emission – specification limit.

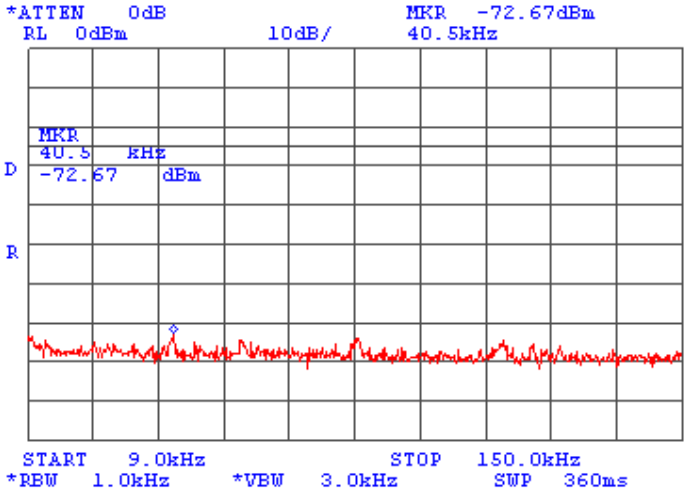
Reference numbers of test equipment used

HL 1424	HL 2013	HL 2909	HL 2951	HL 3435	HL 3440	HL 3455	HL 3472
HL 3473	HL 3559						

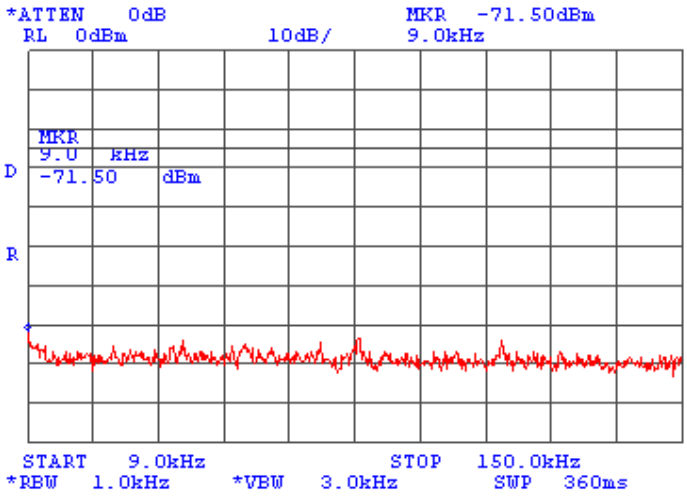
Full description is given in Appendix A.

Test specification:	Section 90.210, Conducted spurious emissions		
Test procedure:	47 CFR, Sections 2.1051 and 90.210(m); TIA/EIA-603-C, Section 2.2.13		
Test mode:	Compliance	Verdict:	PASS
Date & Time:	9/6/2009 5:44:32 PM		
Temperature: 25ºC	Air Pressure: 1008 hPa	Relative Humidity: 43 %	Power Supply: 120 VAC
Remarks:			

Plot 7.5.1 Spurious emission measurements in 9 - 150 kHz range at low carrier frequency (Ant 2)

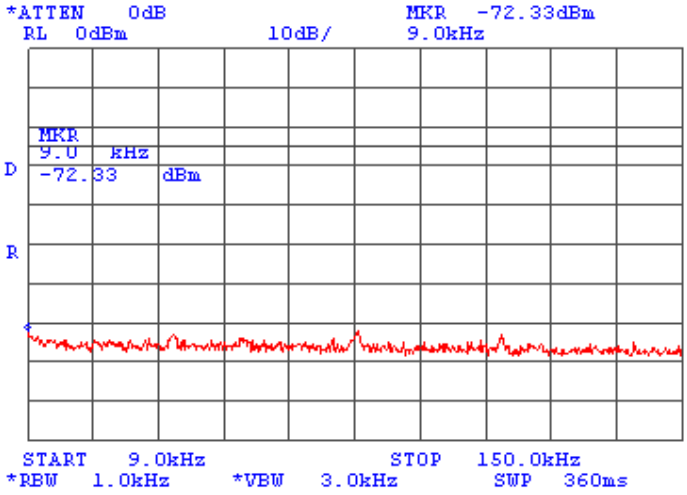


Plot 7.5.2 Spurious emission measurements in 9 - 150 kHz range at mid carrier frequency (Ant 2)

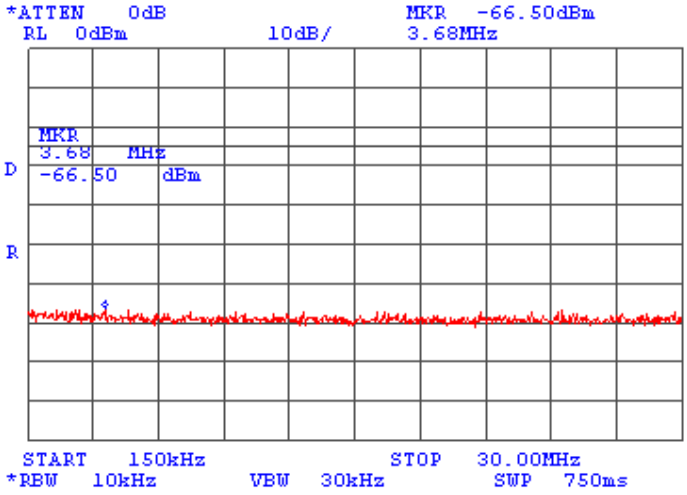


Test specification:	Section 90.210, Conducted spurious emissions		
Test procedure:	47 CFR, Sections 2.1051 and 90.210(m); TIA/EIA-603-C, Section 2.2.13		
Test mode:	Compliance	Verdict:	PASS
Date & Time:	9/6/2009 5:44:32 PM		
Temperature: 25ºC	Air Pressure: 1008 hPa	Relative Humidity: 43 %	Power Supply: 120 VAC
Remarks:			

Plot 7.5.3 Spurious emission measurements in 9 - 150 kHz range at high carrier frequency (Ant 2)

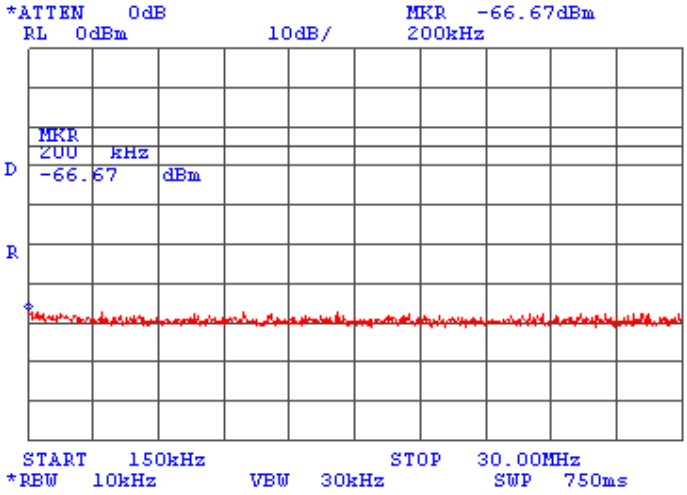


Plot 7.5.4 Spurious emission measurements in 0.15 - 30.0 MHz range at low carrier frequency (Ant 2)

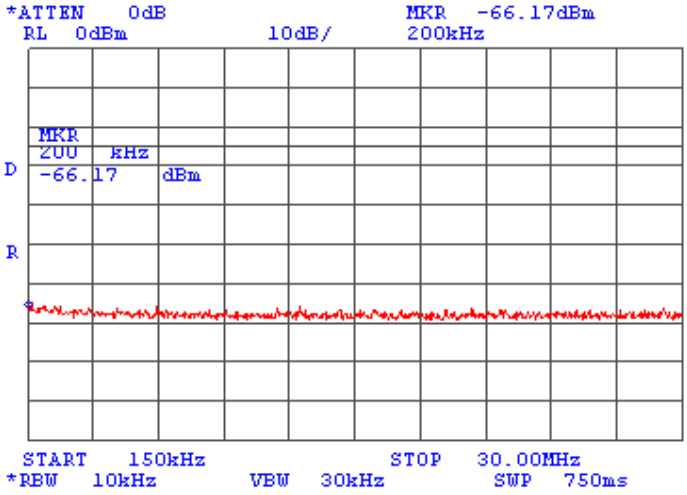


Test specification:	Section 90.210, Conducted spurious emissions		
Test procedure:	47 CFR, Sections 2.1051 and 90.210(m); TIA/EIA-603-C, Section 2.2.13		
Test mode:	Compliance	Verdict:	PASS
Date & Time:	9/6/2009 5:44:32 PM		
Temperature: 25ºC	Air Pressure: 1008 hPa	Relative Humidity: 43 %	Power Supply: 120 VAC
Remarks:			

Plot 7.5.5 Spurious emission measurements in 0.15 - 30.0 MHz range at mid carrier frequency (Ant 2)

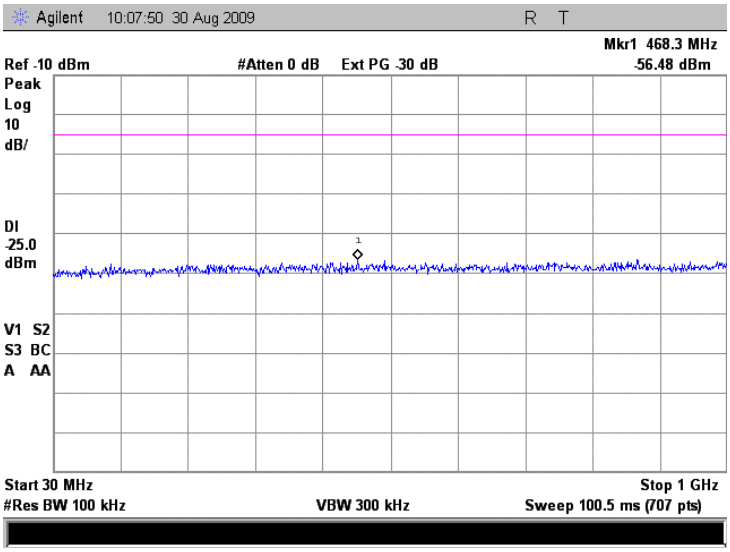


Plot 7.5.6 Spurious emission measurements in 0.15 – 30.0 MHz range at high carrier frequency (Ant 2)

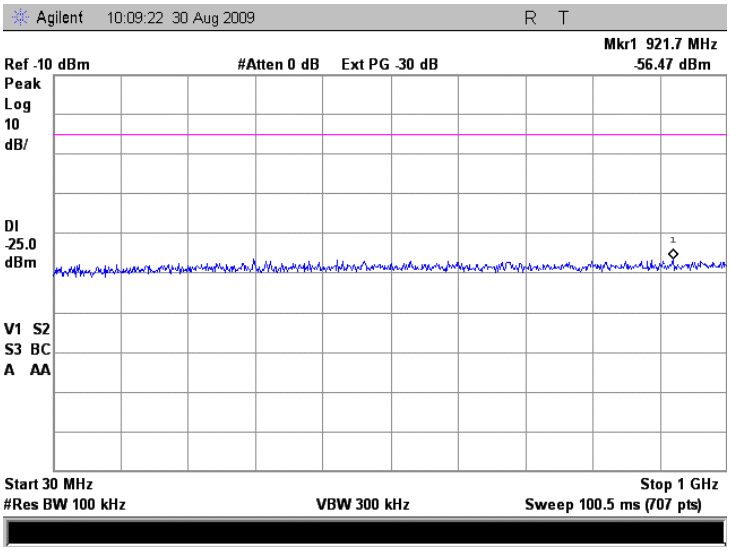


Test specification:	Section 90.210, Conducted spurious emissions		
Test procedure:	47 CFR, Sections 2.1051 and 90.210(m); TIA/EIA-603-C, Section 2.2.13		
Test mode:	Compliance	Verdict:	PASS
Date & Time:	9/6/2009 5:44:32 PM		
Temperature: 25ºC	Air Pressure: 1008 hPa	Relative Humidity: 43 %	Power Supply: 120 VAC
Remarks:			

Plot 7.5.7 Spurious emission measurements in 30.0 - 1000 MHz range at low carrier frequency (Ant 2)

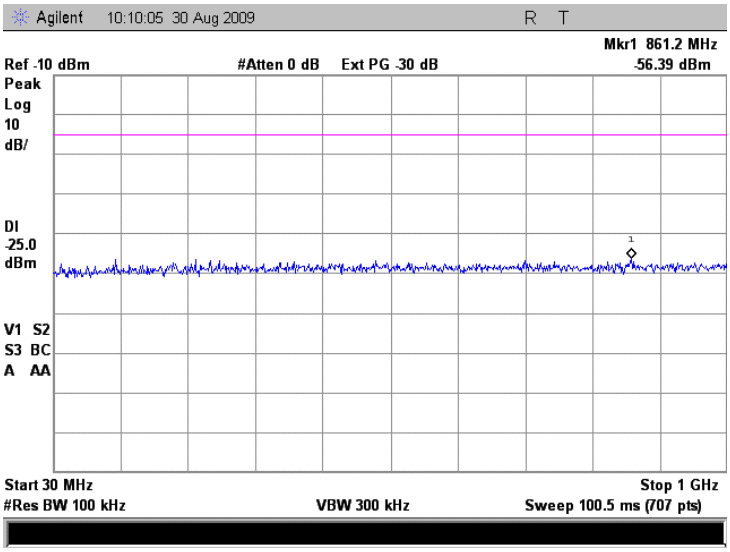


Plot 7.5.8 Spurious emission measurements in 30.0 - 1000 MHz range at mid carrier frequency (Ant 2)



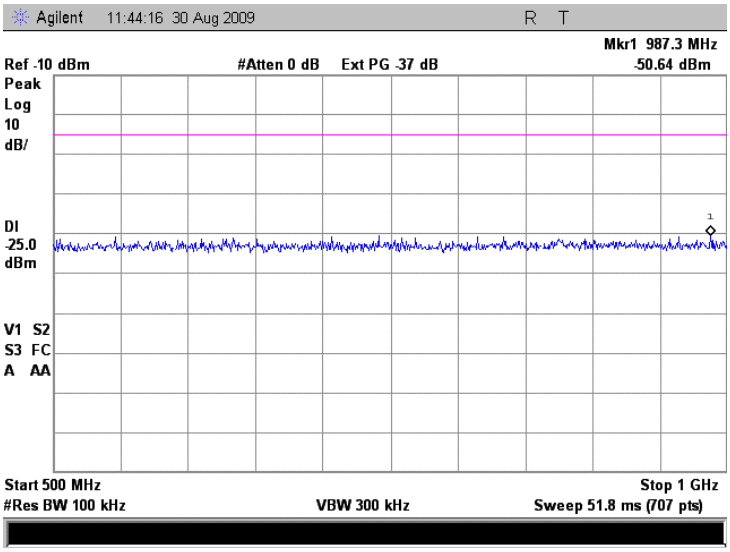
Test specification:	Section 90.210, Conducted spurious emissions		
Test procedure:	47 CFR, Sections 2.1051 and 90.210(m); TIA/EIA-603-C, Section 2.2.13		
Test mode:	Compliance	Verdict:	PASS
Date & Time:	9/6/2009 5:44:32 PM		
Temperature: 25ºC	Air Pressure: 1008 hPa	Relative Humidity: 43 %	Power Supply: 120 VAC
Remarks:			

Plot 7.5.9 Spurious emission measurements in 30.0 - 1000 MHz range at high carrier frequency (Ant 2)

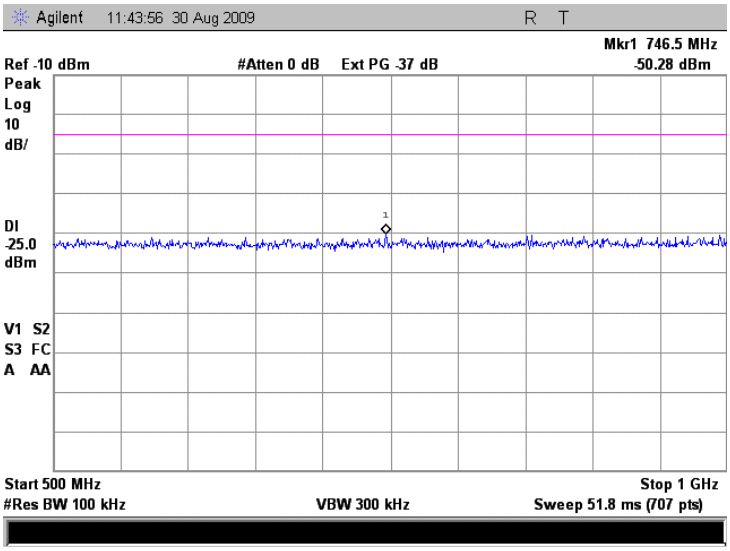


Test specification:	Section 90.210, Conducted spurious emissions		
Test procedure:	47 CFR, Sections 2.1051 and 90.210(m); TIA/EIA-603-C, Section 2.2.13		
Test mode:	Compliance	Verdict:	PASS
Date & Time:	9/6/2009 5:44:32 PM		
Temperature: 25ºC	Air Pressure: 1008 hPa	Relative Humidity: 43 %	Power Supply: 120 VAC
Remarks:			

Plot 7.5.10 Spurious emission measurements in 500 - 1000 MHz range at low carrier frequency (combined)

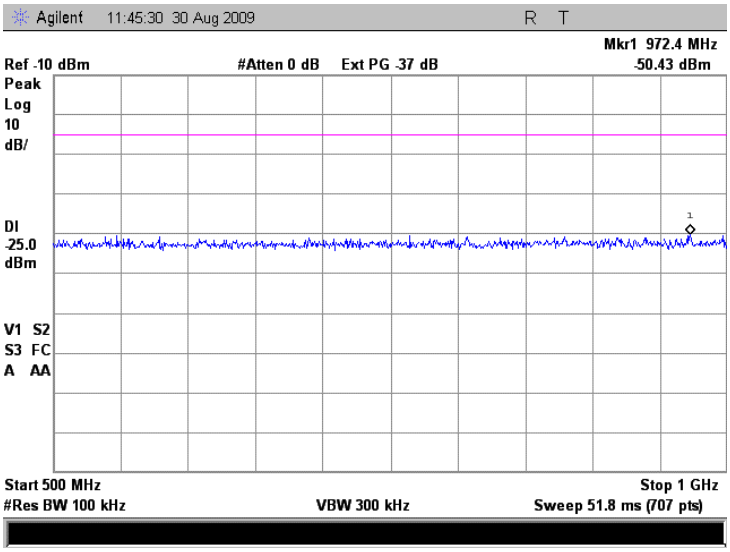


Plot 7.5.11 Spurious emission measurements in 500 - 1000 MHz at mid carrier frequency (combined)



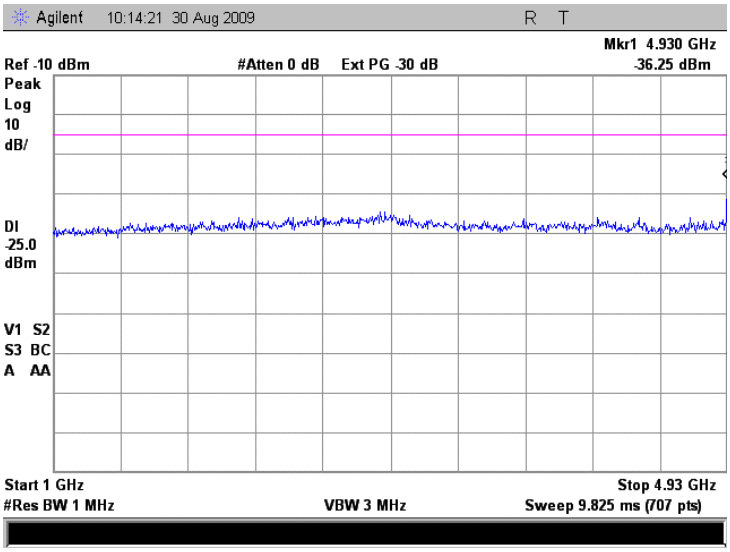
Test specification:	Section 90.210, Conducted spurious emissions		
Test procedure:	47 CFR, Sections 2.1051 and 90.210(m); TIA/EIA-603-C, Section 2.2.13		
Test mode:	Compliance	Verdict:	PASS
Date & Time:	9/6/2009 5:44:32 PM		
Temperature: 25ºC	Air Pressure: 1008 hPa	Relative Humidity: 43 %	Power Supply: 120 VAC
Remarks:			

Plot 7.5.12 Spurious emission measurements in 500 - 1000 MHz at high carrier frequency (combined)

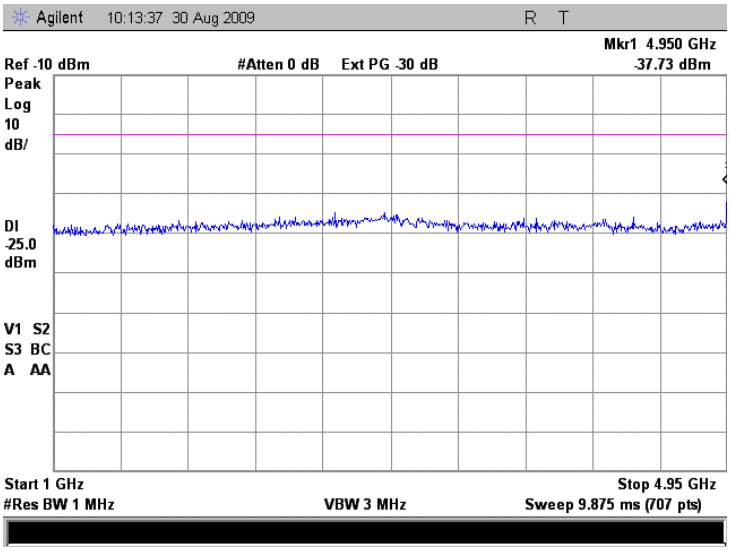


Test specification:	Section 90.210, Conducted spurious emissions		
Test procedure:	47 CFR, Sections 2.1051 and 90.210(m); TIA/EIA-603-C, Section 2.2.13		
Test mode:	Compliance	Verdict:	PASS
Date & Time:	9/6/2009 5:44:32 PM		
Temperature: 25ºC	Air Pressure: 1008 hPa	Relative Humidity: 43 %	Power Supply: 120 VAC
Remarks:			

Plot 7.5.13 Spurious emission measurements in 1000 – 4930.0 MHz range at low carrier frequency (Ant 2)

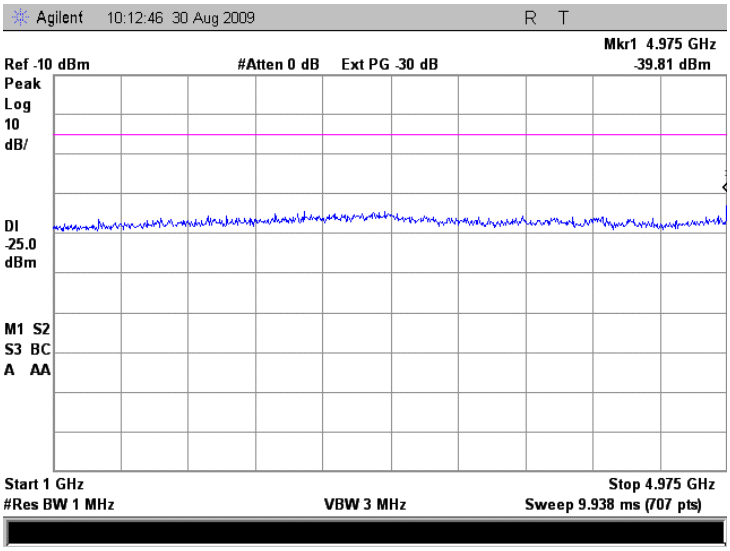


Plot 7.5.14 Spurious emission measurements in 1000 – 4950.0 MHz at mid carrier frequency (Ant 2)



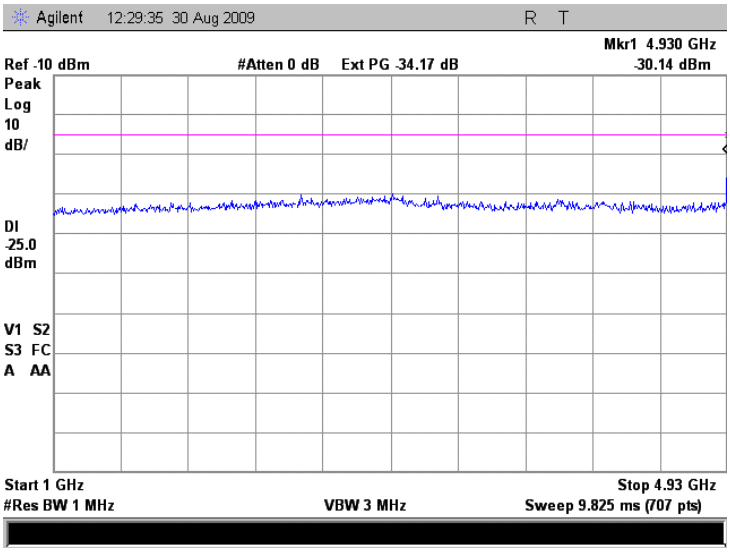
Test specification:	Section 90.210, Conducted spurious emissions		
Test procedure:	47 CFR, Sections 2.1051 and 90.210(m); TIA/EIA-603-C, Section 2.2.13		
Test mode:	Compliance	Verdict:	PASS
Date & Time:	9/6/2009 5:44:32 PM		
Temperature: 25ºC	Air Pressure: 1008 hPa	Relative Humidity: 43 %	Power Supply: 120 VAC
Remarks:			

Plot 7.5.15 Spurious emission measurements in 1000 – 4975.0 MHz at high carrier frequency (Ant 2)

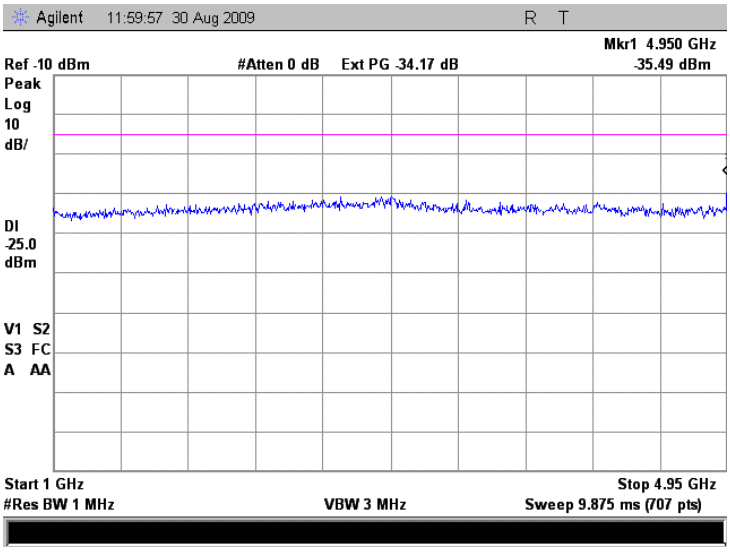


Test specification:	Section 90.210, Conducted spurious emissions		
Test procedure:	47 CFR, Sections 2.1051 and 90.210(m); TIA/EIA-603-C, Section 2.2.13		
Test mode:	Compliance	Verdict:	PASS
Date & Time:	9/6/2009 5:44:32 PM		
Temperature: 25ºC	Air Pressure: 1008 hPa	Relative Humidity: 43 %	Power Supply: 120 VAC
Remarks:			

Plot 7.5.16 Spurious emission measurements in 1000 – 4930.0 MHz range at low carrier frequency (combined)

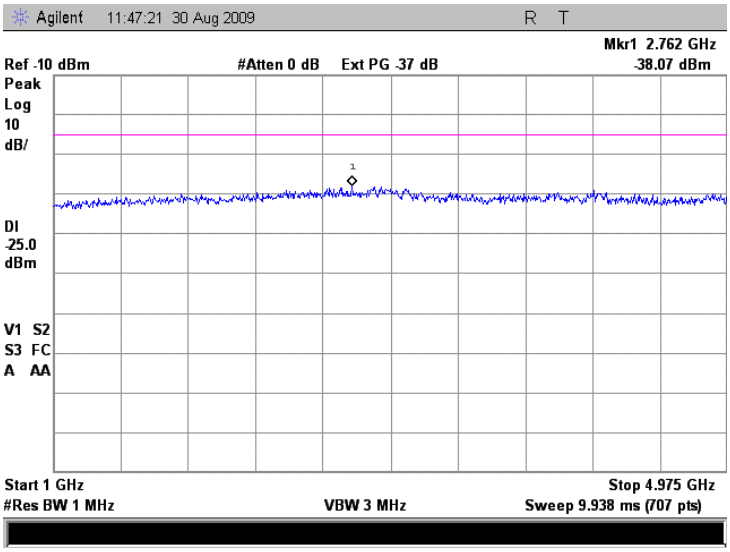


Plot 7.5.17 Spurious emission measurements in 1000 – 4950.0 MHz at mid carrier frequency (combined)



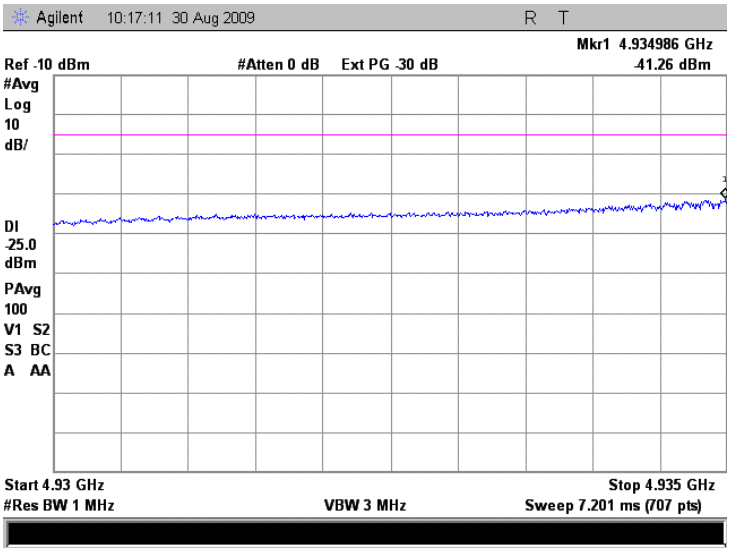
Test specification:	Section 90.210, Conducted spurious emissions		
Test procedure:	47 CFR, Sections 2.1051 and 90.210(m); TIA/EIA-603-C, Section 2.2.13		
Test mode:	Compliance	Verdict:	PASS
Date & Time:	9/6/2009 5:44:32 PM		
Temperature: 25ºC	Air Pressure: 1008 hPa	Relative Humidity: 43 %	Power Supply: 120 VAC
Remarks:			

Plot 7.5.18 Spurious emission measurements in 1000 – 4975.0 MHz at high carrier frequency (combined)

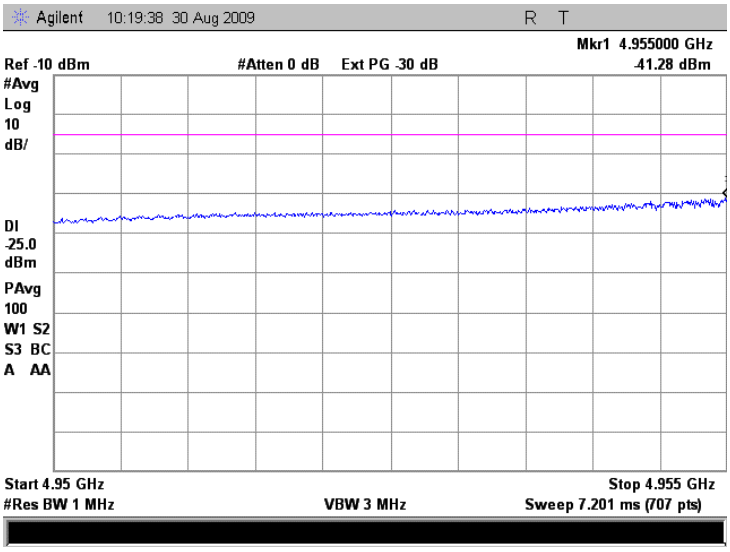


Test specification:	Section 90.210, Conducted spurious emissions		
Test procedure:	47 CFR, Sections 2.1051 and 90.210(m); TIA/EIA-603-C, Section 2.2.13		
Test mode:	Compliance	Verdict:	PASS
Date & Time:	9/6/2009 5:44:32 PM		
Temperature: 25ºC	Air Pressure: 1008 hPa	Relative Humidity: 43 %	Power Supply: 120 VAC
Remarks:			

Plot 7.5.19 Spurious emission measurements in 4930.0 – 4935.0 MHz range at low carrier frequency (Ant 2)

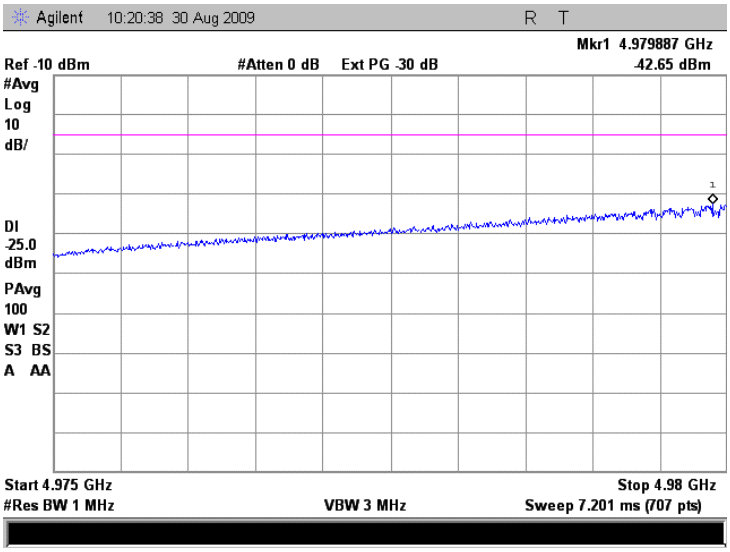


Plot 7.5.20 Spurious emission measurements in 4950.0 – 4955.0 MHz at mid carrier frequency (Ant 2)



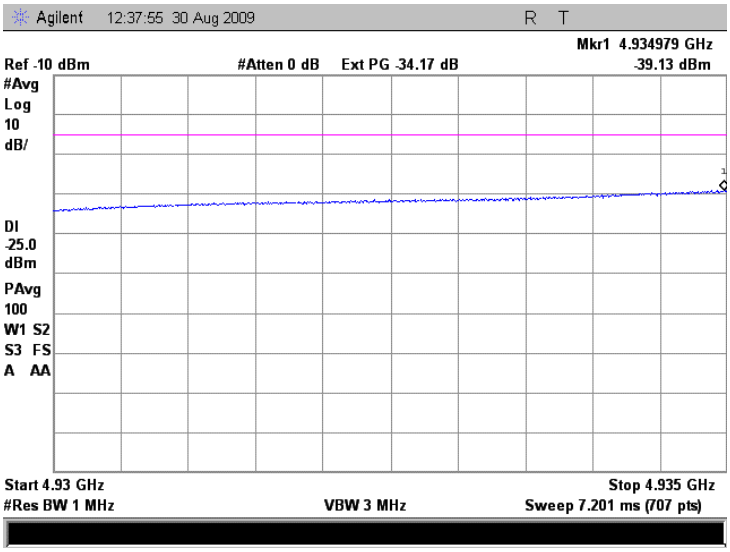
Test specification:	Section 90.210, Conducted spurious emissions		
Test procedure:	47 CFR, Sections 2.1051 and 90.210(m); TIA/EIA-603-C, Section 2.2.13		
Test mode:	Compliance	Verdict:	PASS
Date & Time:	9/6/2009 5:44:32 PM		
Temperature: 25ºC	Air Pressure: 1008 hPa	Relative Humidity: 43 %	Power Supply: 120 VAC
Remarks:			

Plot 7.5.21 Spurious emission measurements in 4975.0 – 4980.0 MHz at high carrier frequency (Ant 2)

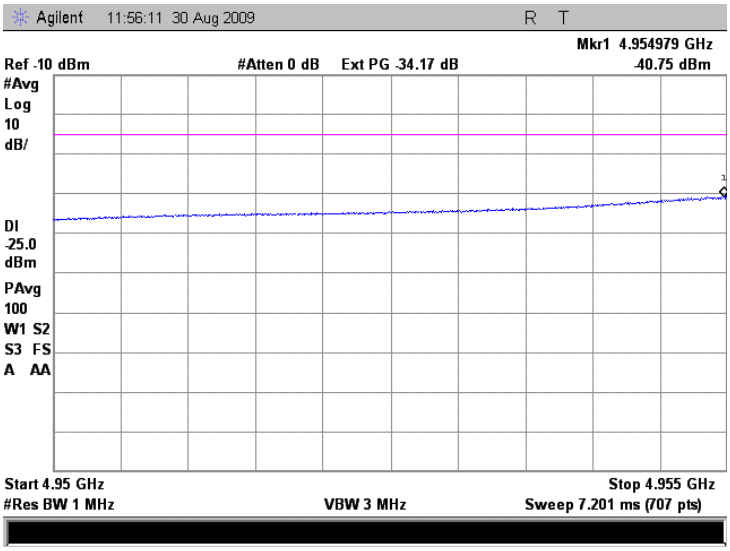


Test specification:	Section 90.210, Conducted spurious emissions		
Test procedure:	47 CFR, Sections 2.1051 and 90.210(m); TIA/EIA-603-C, Section 2.2.13		
Test mode:	Compliance	Verdict:	PASS
Date & Time:	9/6/2009 5:44:32 PM		
Temperature: 25ºC	Air Pressure: 1008 hPa	Relative Humidity: 43 %	Power Supply: 120 VAC
Remarks:			

Plot 7.5.22 Spurious emission measurements in 4930.0 – 4935.0 MHz range at low carrier frequency (combined)

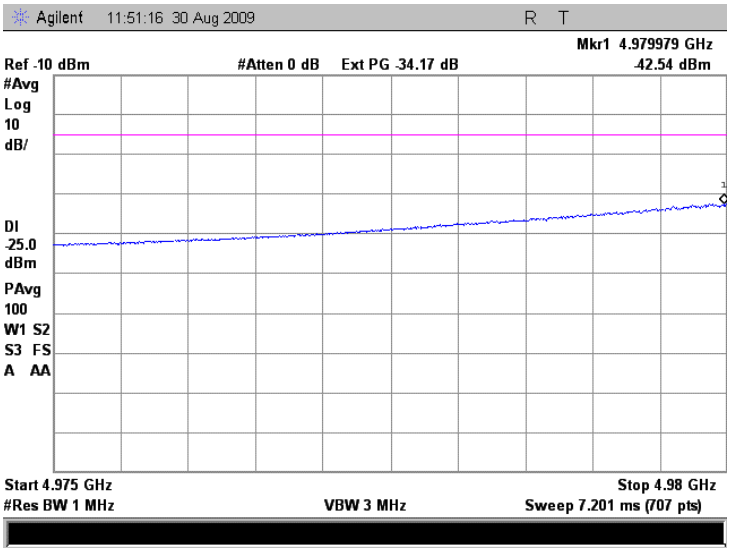


Plot 7.5.23 Spurious emission measurements in 4950.0 – 4955.0 MHz at mid carrier frequency (combined)



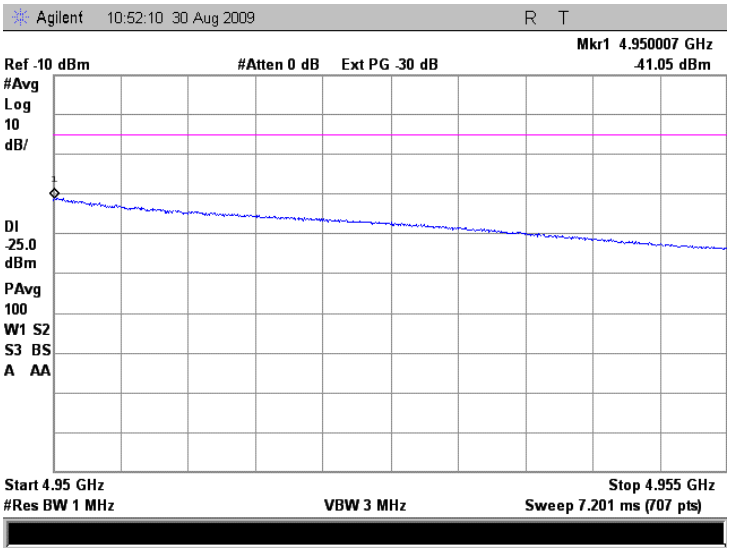
Test specification:	Section 90.210, Conducted spurious emissions		
Test procedure:	47 CFR, Sections 2.1051 and 90.210(m); TIA/EIA-603-C, Section 2.2.13		
Test mode:	Compliance	Verdict:	PASS
Date & Time:	9/6/2009 5:44:32 PM		
Temperature: 25ºC	Air Pressure: 1008 hPa	Relative Humidity: 43 %	Power Supply: 120 VAC
Remarks:			

Plot 7.5.24 Spurious emission measurements in 4975.0 – 4980.0 MHz at high carrier frequency (combined)

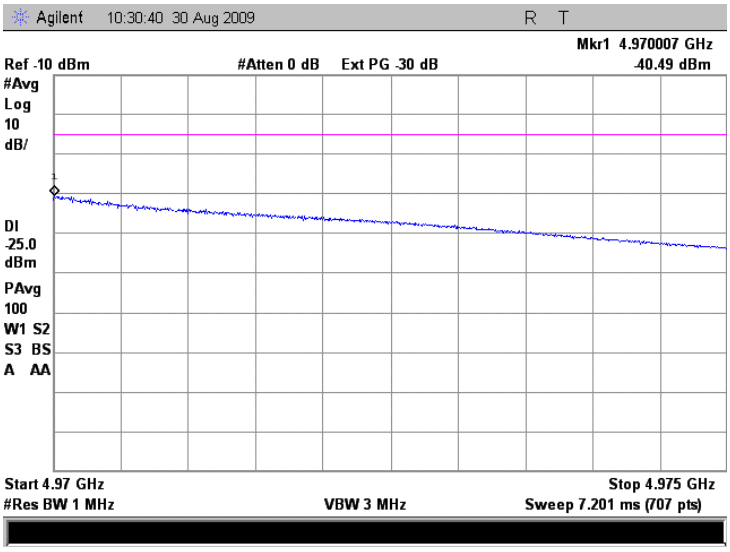


Test specification:	Section 90.210, Conducted spurious emissions		
Test procedure:	47 CFR, Sections 2.1051 and 90.210(m); TIA/EIA-603-C, Section 2.2.13		
Test mode:	Compliance	Verdict:	PASS
Date & Time:	9/6/2009 5:44:32 PM		
Temperature: 25ºC	Air Pressure: 1008 hPa	Relative Humidity: 43 %	Power Supply: 120 VAC
Remarks:			

Plot 7.5.25 Spurious emission measurements in 4950.0 – 4955.0 MHz range at low carrier frequency (Ant 2)

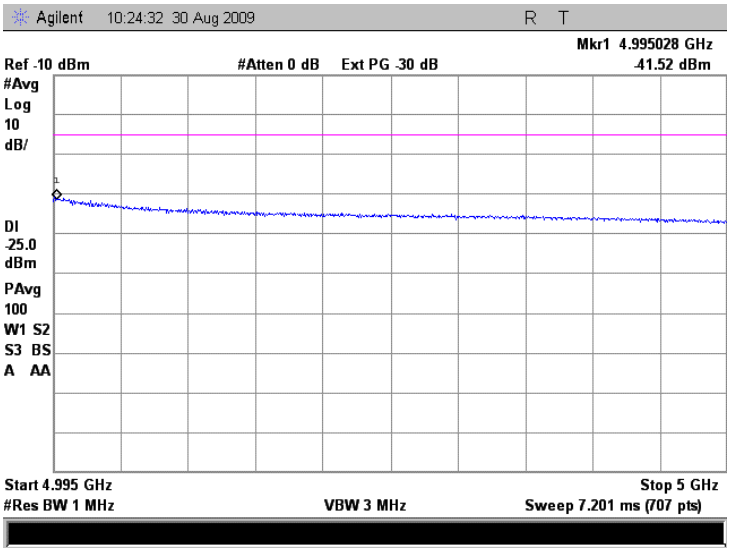


Plot 7.5.26 Spurious emission measurements in 4970.0 – 4975.0 MHz at mid carrier frequency (Ant 2)



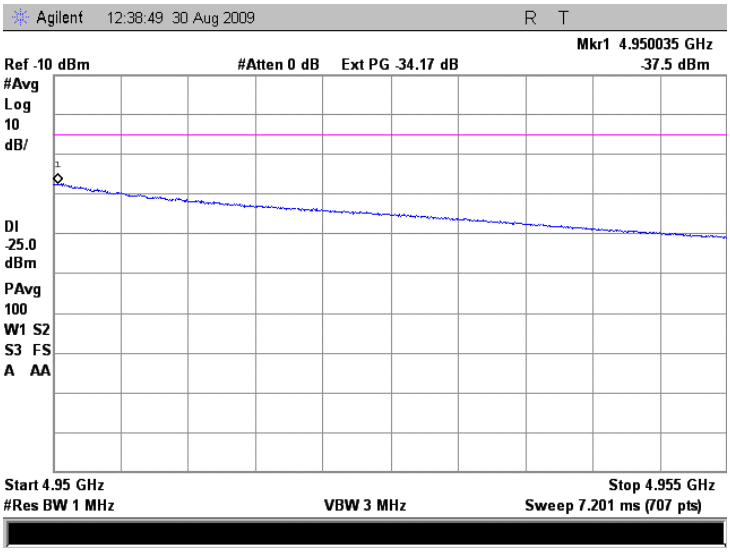
Test specification:	Section 90.210, Conducted spurious emissions		
Test procedure:	47 CFR, Sections 2.1051 and 90.210(m); TIA/EIA-603-C, Section 2.2.13		
Test mode:	Compliance	Verdict:	PASS
Date & Time:	9/6/2009 5:44:32 PM		
Temperature: 25ºC	Air Pressure: 1008 hPa	Relative Humidity: 43 %	Power Supply: 120 VAC
Remarks:			

Plot 7.5.27 Spurious emission measurements in 4995.0 – 5000.0 MHz at high carrier frequency (Ant 2)

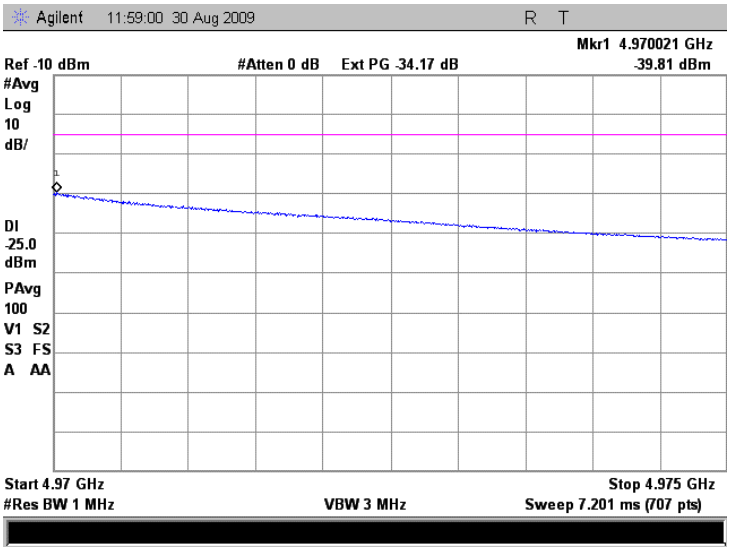


Test specification:	Section 90.210, Conducted spurious emissions		
Test procedure:	47 CFR, Sections 2.1051 and 90.210(m); TIA/EIA-603-C, Section 2.2.13		
Test mode:	Compliance	Verdict:	PASS
Date & Time:	9/6/2009 5:44:32 PM		
Temperature: 25ºC	Air Pressure: 1008 hPa	Relative Humidity: 43 %	Power Supply: 120 VAC
Remarks:			

Plot 7.5.28 Spurious emission measurements in 4950.0 – 4955.0 MHz range at low carrier frequency (combined)

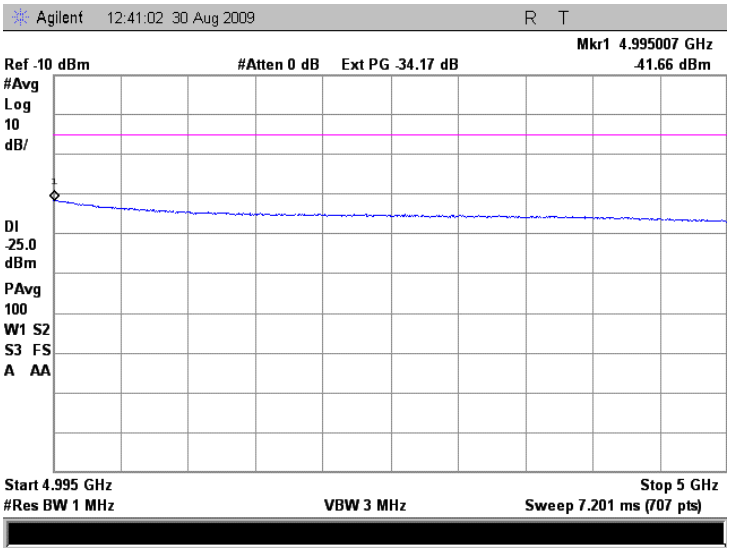


Plot 7.5.29 Spurious emission measurements in 4970.0 – 4975.0 MHz at mid carrier frequency (combined)



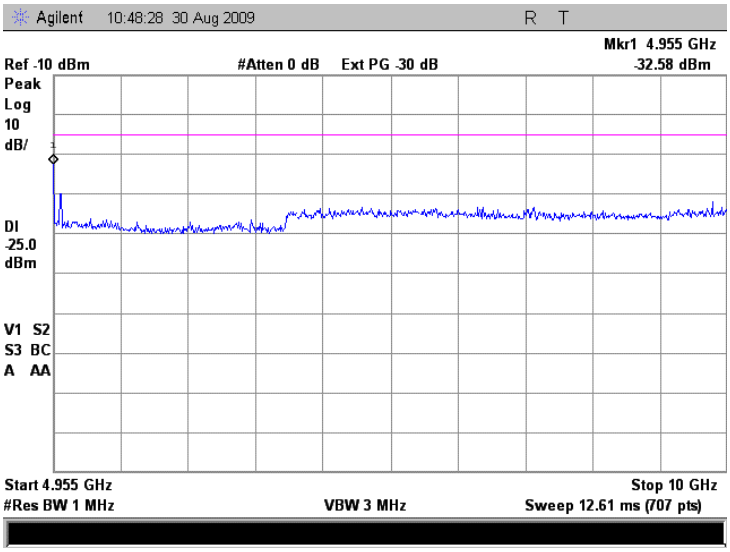
Test specification:	Section 90.210, Conducted spurious emissions		
Test procedure:	47 CFR, Sections 2.1051 and 90.210(m); TIA/EIA-603-C, Section 2.2.13		
Test mode:	Compliance	Verdict:	PASS
Date & Time:	9/6/2009 5:44:32 PM		
Temperature: 25ºC	Air Pressure: 1008 hPa	Relative Humidity: 43 %	Power Supply: 120 VAC
Remarks:			

Plot 7.5.30 Spurious emission measurements in 4995.0 – 5000.0 MHz at high carrier frequency (combined)

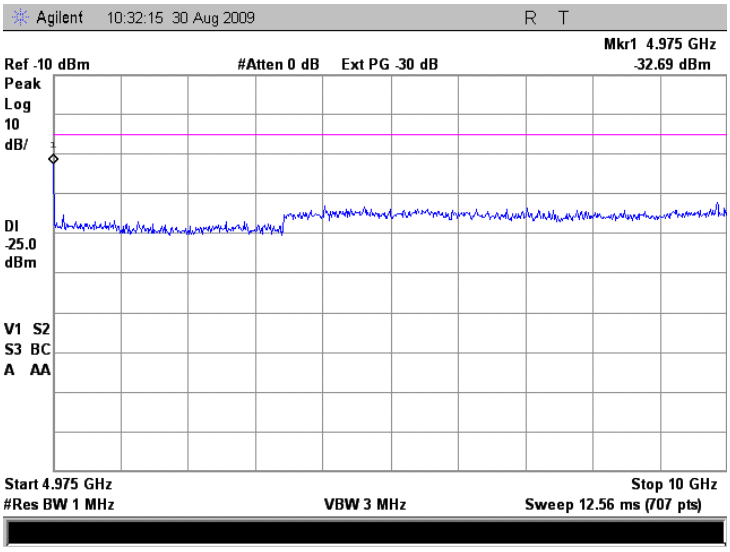


Test specification:	Section 90.210, Conducted spurious emissions		
Test procedure:	47 CFR, Sections 2.1051 and 90.210(m); TIA/EIA-603-C, Section 2.2.13		
Test mode:	Compliance	Verdict:	PASS
Date & Time:	9/6/2009 5:44:32 PM		
Temperature: 25ºC	Air Pressure: 1008 hPa	Relative Humidity: 43 %	Power Supply: 120 VAC
Remarks:			

Plot 7.5.31 Spurious emission measurements in 4955.0 – 10000.0 MHz range at low carrier frequency (Ant 2)

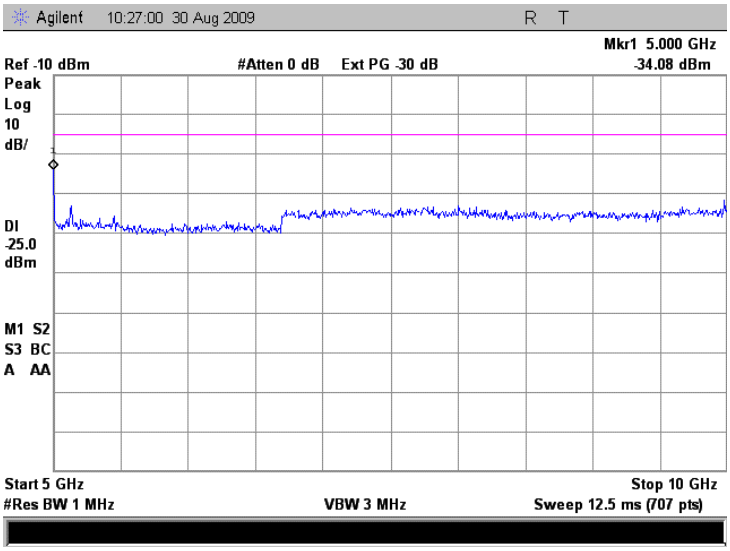


Plot 7.5.32 Spurious emission measurements in 4975.0 – 10000.0 MHz at mid carrier frequency (Ant 2)



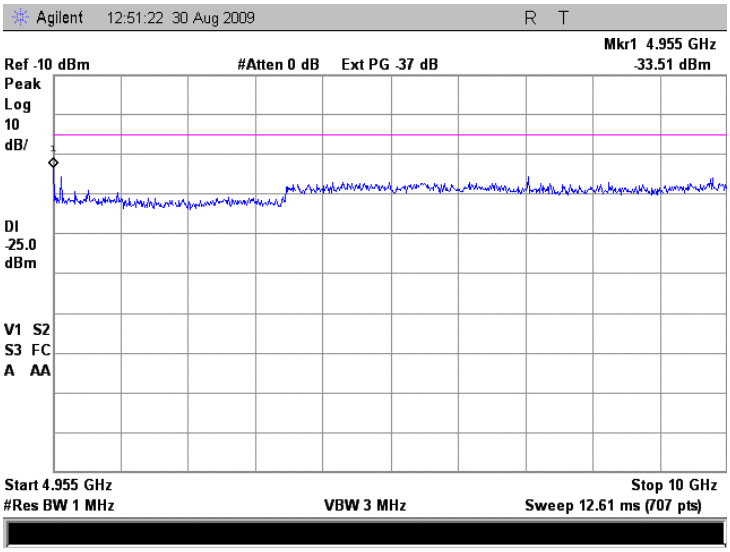
Test specification:	Section 90.210, Conducted spurious emissions		
Test procedure:	47 CFR, Sections 2.1051 and 90.210(m); TIA/EIA-603-C, Section 2.2.13		
Test mode:	Compliance	Verdict:	PASS
Date & Time:	9/6/2009 5:44:32 PM		
Temperature: 25ºC	Air Pressure: 1008 hPa	Relative Humidity: 43 %	Power Supply: 120 VAC
Remarks:			

Plot 7.5.33 Spurious emission measurements in 5000.0 – 10000.0 MHz at high carrier frequency (Ant 2)

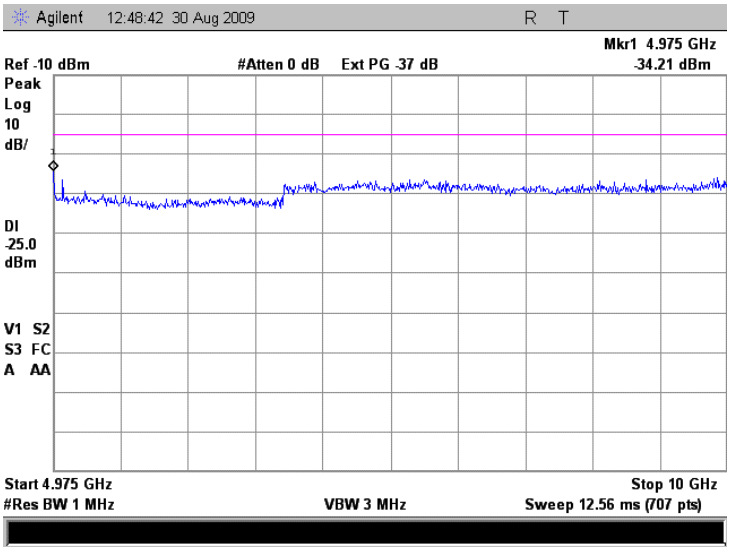


Test specification:	Section 90.210, Conducted spurious emissions		
Test procedure:	47 CFR, Sections 2.1051 and 90.210(m); TIA/EIA-603-C, Section 2.2.13		
Test mode:	Compliance	Verdict:	PASS
Date & Time:	9/6/2009 5:44:32 PM		
Temperature: 25ºC	Air Pressure: 1008 hPa	Relative Humidity: 43 %	Power Supply: 120 VAC
Remarks:			

Plot 7.5.34 Spurious emission measurements in 4950.0 – 10000.0 MHz range at low carrier frequency (combined)

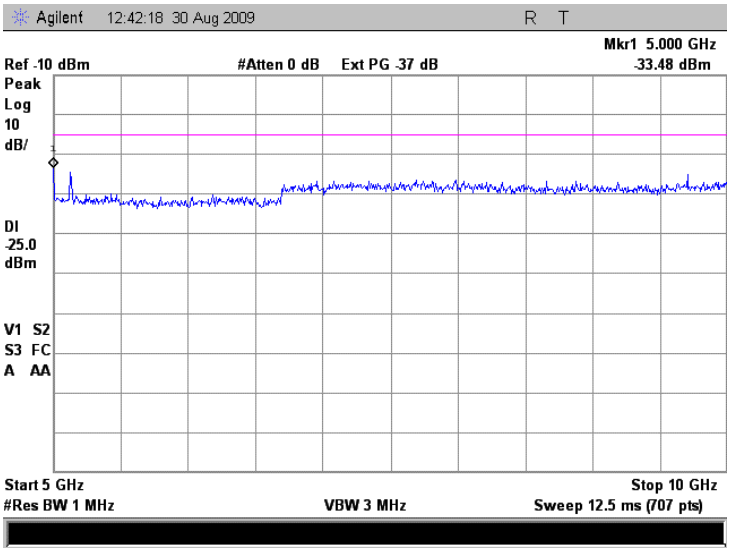


Plot 7.5.35 Spurious emission measurements in 4975.0 – 10000.0 MHz at mid carrier frequency (combined)



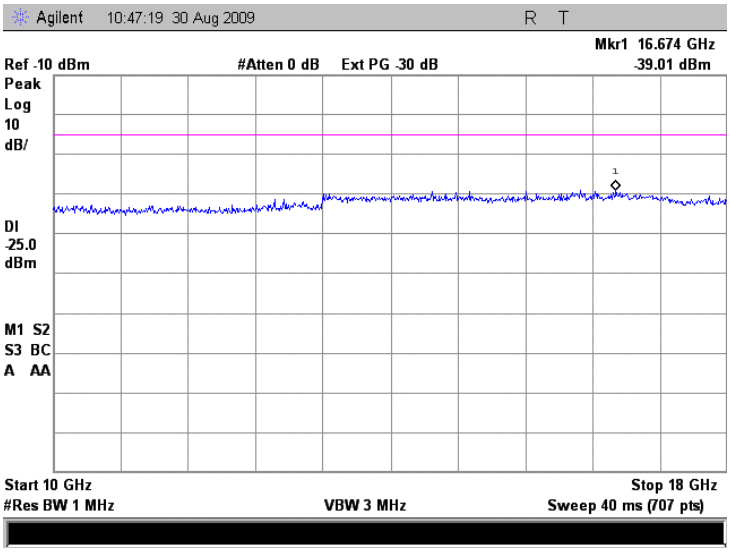
Test specification:	Section 90.210, Conducted spurious emissions		
Test procedure:	47 CFR, Sections 2.1051 and 90.210(m); TIA/EIA-603-C, Section 2.2.13		
Test mode:	Compliance	Verdict:	PASS
Date & Time:	9/6/2009 5:44:32 PM		
Temperature: 25ºC	Air Pressure: 1008 hPa	Relative Humidity: 43 %	Power Supply: 120 VAC
Remarks:			

Plot 7.5.36 Spurious emission measurements in 5000.0 – 10000.0 MHz at high carrier frequency (combined)

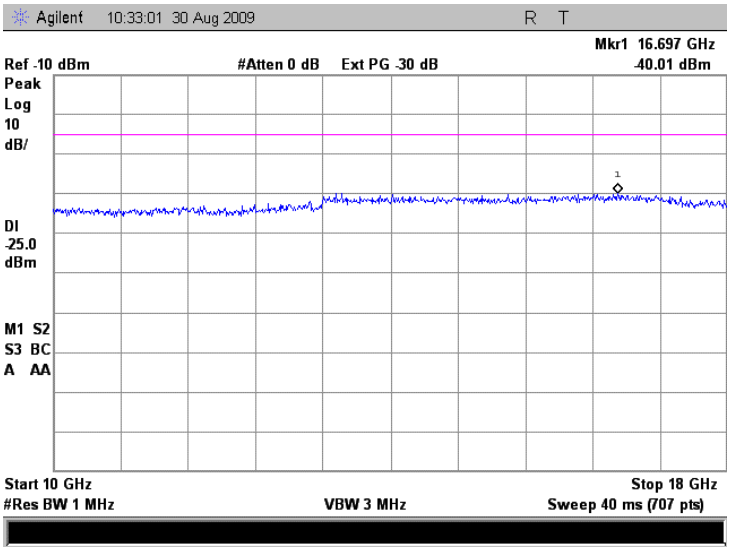


Test specification:	Section 90.210, Conducted spurious emissions		
Test procedure:	47 CFR, Sections 2.1051 and 90.210(m); TIA/EIA-603-C, Section 2.2.13		
Test mode:	Compliance	Verdict:	PASS
Date & Time:	9/6/2009 5:44:32 PM		
Temperature: 25ºC	Air Pressure: 1008 hPa	Relative Humidity: 43 %	Power Supply: 120 VAC
Remarks:			

Plot 7.5.37 Spurious emission measurements in 10000 - 18000 MHz range at low carrier frequency (Ant 2)

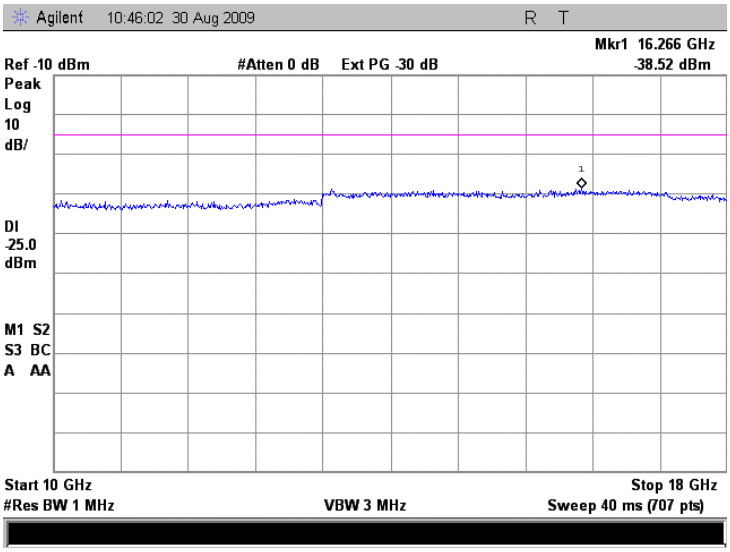


Plot 7.5.38 Spurious emission measurements in 10000 - 18000 MHz at mid carrier frequency (Ant 2)



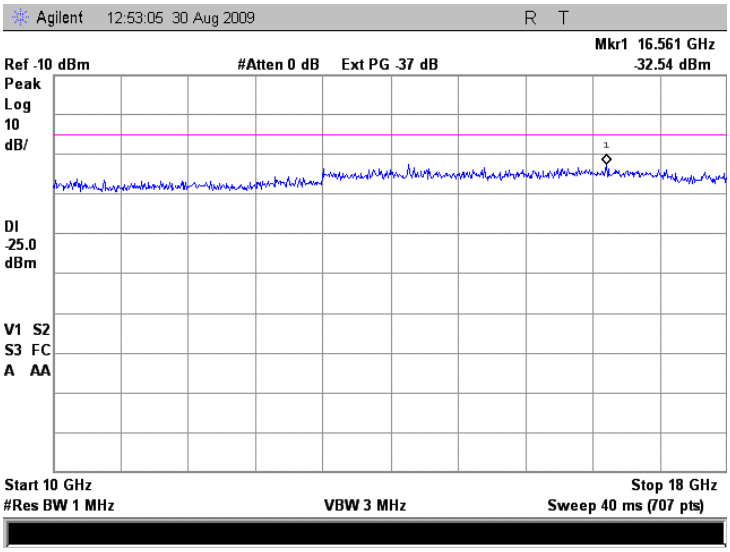
Test specification:	Section 90.210, Conducted spurious emissions		
Test procedure:	47 CFR, Sections 2.1051 and 90.210(m); TIA/EIA-603-C, Section 2.2.13		
Test mode:	Compliance	Verdict:	PASS
Date & Time:	9/6/2009 5:44:32 PM		
Temperature: 25ºC	Air Pressure: 1008 hPa	Relative Humidity: 43 %	Power Supply: 120 VAC
Remarks:			

Plot 7.5.39 Spurious emission measurements in 10000 - 18000 MHz at high carrier frequency (Ant 2)

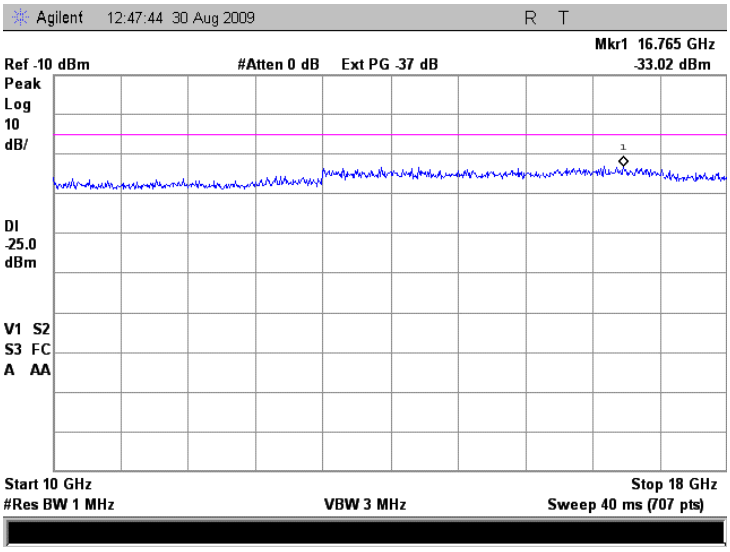


Test specification:	Section 90.210, Conducted spurious emissions		
Test procedure:	47 CFR, Sections 2.1051 and 90.210(m); TIA/EIA-603-C, Section 2.2.13		
Test mode:	Compliance	Verdict:	PASS
Date & Time:	9/6/2009 5:44:32 PM		
Temperature: 25ºC	Air Pressure: 1008 hPa	Relative Humidity: 43 %	Power Supply: 120 VAC
Remarks:			

Plot 7.5.40 Spurious emission measurements in 10000 - 18000 MHz range at low carrier frequency (combined)

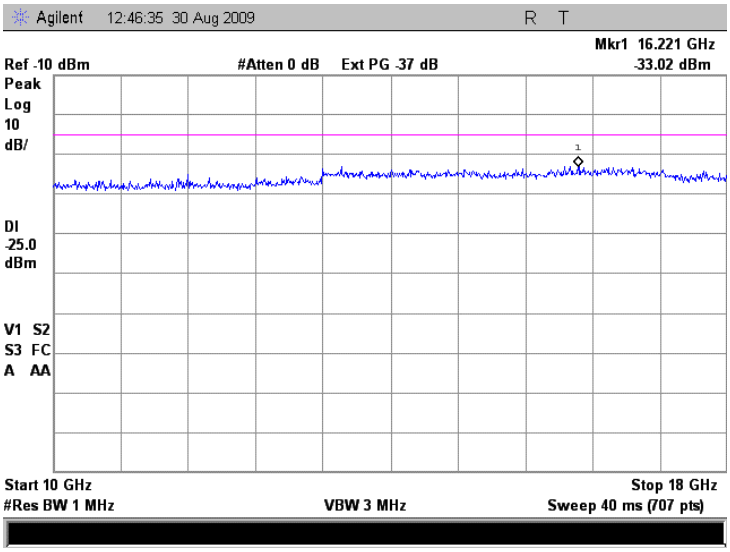


Plot 7.5.41 Spurious emission measurements in 10000 - 18000 MHz at mid carrier frequency (combined)



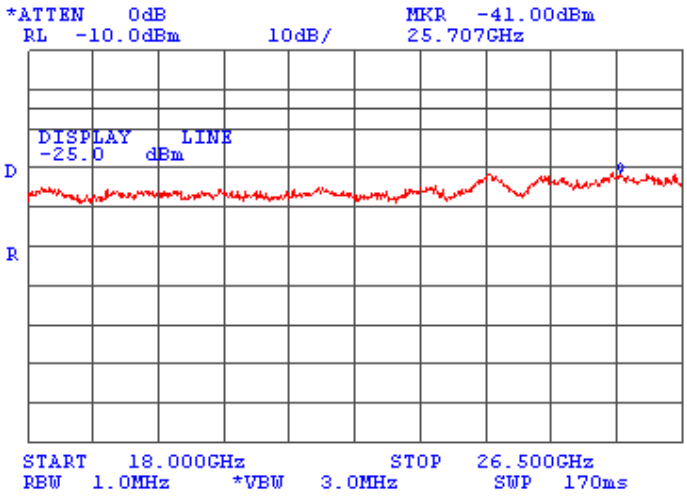
Test specification:	Section 90.210, Conducted spurious emissions		
Test procedure:	47 CFR, Sections 2.1051 and 90.210(m); TIA/EIA-603-C, Section 2.2.13		
Test mode:	Compliance	Verdict:	PASS
Date & Time:	9/6/2009 5:44:32 PM		
Temperature: 25ºC	Air Pressure: 1008 hPa	Relative Humidity: 43 %	Power Supply: 120 VAC
Remarks:			

Plot 7.5.42 Spurious emission measurements in 10000 - 18000 MHz at high carrier frequency (combined)

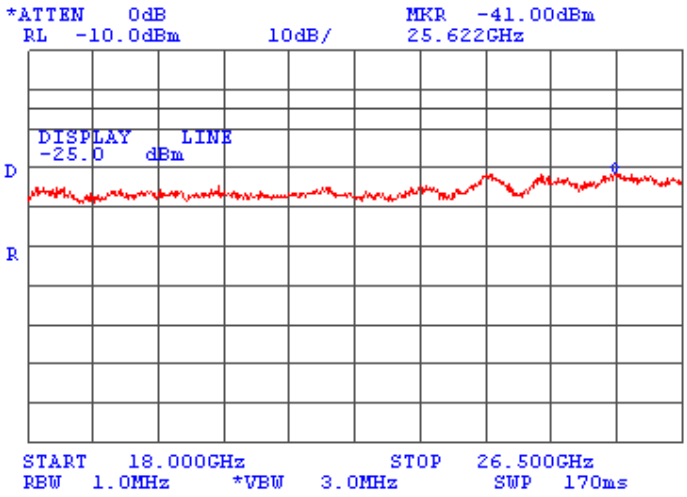


Test specification:	Section 90.210, Conducted spurious emissions		
Test procedure:	47 CFR, Sections 2.1051 and 90.210(m); TIA/EIA-603-C, Section 2.2.13		
Test mode:	Compliance	Verdict:	PASS
Date & Time:	9/6/2009 5:44:32 PM		
Temperature: 25ºC	Air Pressure: 1008 hPa	Relative Humidity: 43 %	Power Supply: 120 VAC
Remarks:			

Plot 7.5.43 Spurious emission measurements in 18000 - 26500 MHz range at low carrier frequency (Ant 2)

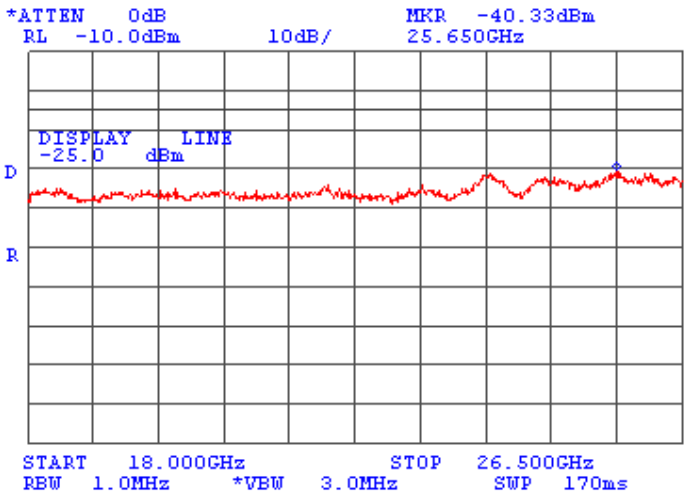


Plot 7.5.44 Spurious emission measurements in 18000 - 26500 MHz at mid carrier frequency (Ant 2)



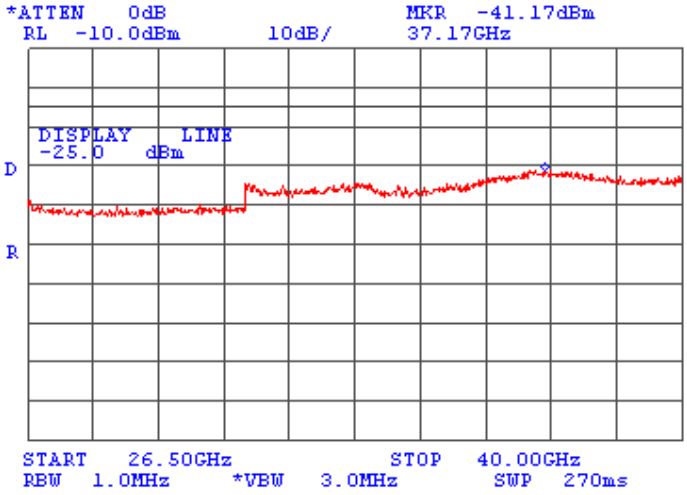
Test specification:	Section 90.210, Conducted spurious emissions		
Test procedure:	47 CFR, Sections 2.1051 and 90.210(m); TIA/EIA-603-C, Section 2.2.13		
Test mode:	Compliance	Verdict:	PASS
Date & Time:	9/6/2009 5:44:32 PM		
Temperature: 25ºC	Air Pressure: 1008 hPa	Relative Humidity: 43 %	Power Supply: 120 VAC
Remarks:			

Plot 7.5.45 Spurious emission measurements in 18000 - 26500 MHz at high carrier frequency (Ant 2)

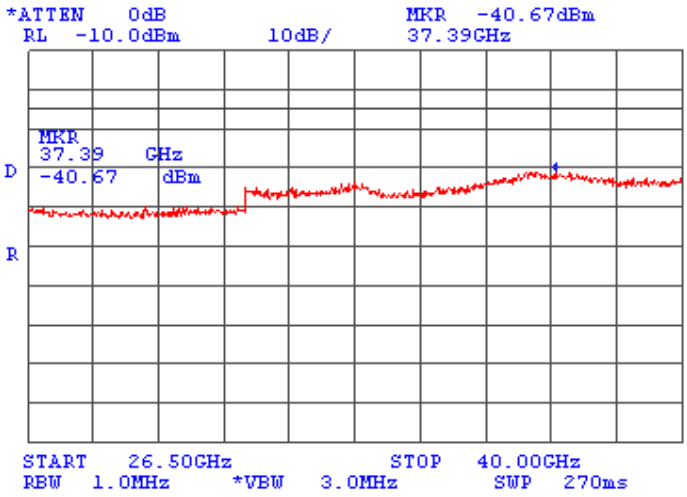


Test specification:	Section 90.210, Conducted spurious emissions		
Test procedure:	47 CFR, Sections 2.1051 and 90.210(m); TIA/EIA-603-C, Section 2.2.13		
Test mode:	Compliance	Verdict:	PASS
Date & Time:	9/6/2009 5:44:32 PM		
Temperature: 25ºC	Air Pressure: 1008 hPa	Relative Humidity: 43 %	Power Supply: 120 VAC
Remarks:			

Plot 7.5.46 Spurious emission measurements in 26500 - 40000 MHz range at low carrier frequency (Ant 2)

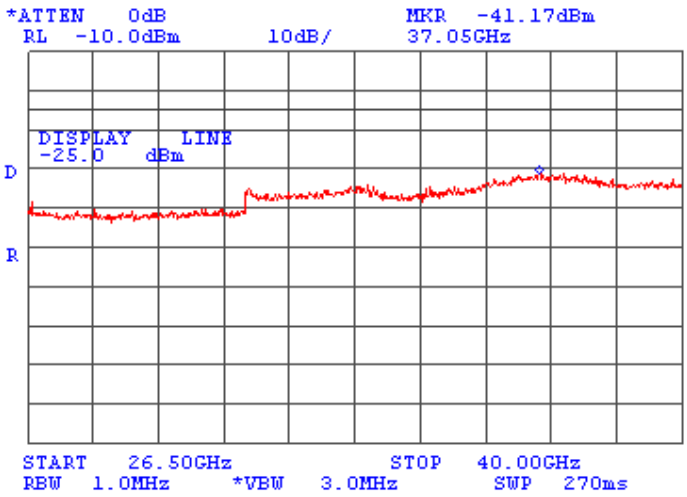


Plot 7.5.47 Spurious emission measurements in 26500 - 40000 MHz at mid carrier frequency (Ant 2)



Test specification:	Section 90.210, Conducted spurious emissions		
Test procedure:	47 CFR, Sections 2.1051 and 90.210(m); TIA/EIA-603-C, Section 2.2.13		
Test mode:	Compliance	Verdict:	PASS
Date & Time:	9/6/2009 5:44:32 PM		
Temperature: 25ºC	Air Pressure: 1008 hPa	Relative Humidity: 43 %	Power Supply: 120 VAC
Remarks:			

Plot 7.5.48 Spurious emission measurements in 26500 - 40000 MHz at high carrier frequency (Ant 2)



Test specification:	Section 90.213, Frequency stability		
Test procedure:	47 CFR, Section 2.1055; TIA/EIA-603-C Section 2.2.2		
Test mode:	Compliance	Verdict:	PASS
Date & Time:	9/16/2009 5:54:11 PM		
Temperature: 25.4 ºC	Air Pressure: 1008 hPa	Relative Humidity: 41 %	Power Supply: 120 VAC
Remarks:			

7.6 Frequency stability test

7.6.1 General

This test was performed to measure frequency stability of transmitter RF carrier. Specification test limits are given in Table 7.6.1.

Table 7.6.1 Frequency stability limits

Assigned frequency, MHz	Maximum allowed frequency displacement	
	ppm	Hz
4940.0 – 4990.0	The frequency stability shall be sufficient to ensure that the fundamental emissions stay within the authorized bands of operation	

7.6.2 Test procedure

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

7.6.2.2 The EUT power was turned off. Temperature within test chamber was set to +30˚C and a period of time sufficient to stabilize all of the oscillator circuit components was allowed.

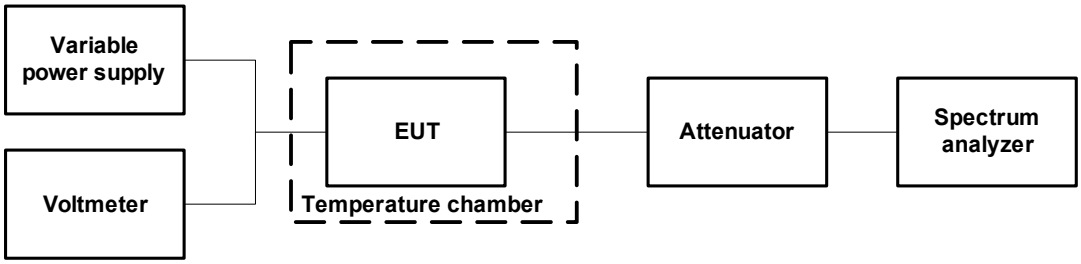
7.6.2.3 The EUT was powered on and carrier frequency was measured at start up moment and then every minute until frequency had been stabilized or 10 minutes elapsed whichever reached the last. The EUT was powered off.

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

7.6.2.5 The EUT was powered on and carrier frequency was measured at start up moment and at the end of stabilization period at the rest of test temperatures and voltages. The EUT was powered off.

7.6.2.6 Frequency displacement was calculated and compared with the limit as provided in Table 7.6.2.

Figure 7.6.1 Frequency stability test setup



Test specification:	**Section 90.213, Frequency stability**		
Test procedure:	47 CFR, Section 2.1055; TIA/EIA-603-C Section 2.2.2		
Test mode:	Compliance	**Verdict:**	PASS
Date & Time:	9/16/2009 5:54:11 PM		
Temperature: 25.4 ºC	**Air Pressure:** 1008 hPa	**Relative Humidity:** 41 %	**Power Supply:** 120 VAC
Remarks:			

Table 7.6.2 Frequency stability test results

ASSIGNED FREQUENCY RANGE: 4940.0 – 4990.0 MHz
NOMINAL POWER VOLTAGE: 120VAC
TEMPERATURE STABILIZATION PERIOD: 20 min
POWER DURING TEMPERATURE TRANSITION: Off
SPECTRUM ANALYZER MODE: Counter
RESOLUTION BANDWIDTH: 1000 Hz
VIDEO BANDWIDTH: 3000 Hz
MODULATION: Unmodulated

T, ºC	Voltage, V	Frequency, MHz							Max frequency drift, Hz		Max frequency drift, ppm	
		Start up	1st min	2nd min	3rd min	4th min	5th min	10th min	Positive	Negative	Positive	Negative
Low frequency 4942.500 MHz												
-30	nominal	4942.501188	4942.501170	4942.501166	4942.501157	4942.501135	4942.501130	4942.501055	1668.000	0.000	0.337	0.000
-20	nominal	4942.497759	NA	NA	NA	NA	NA	4942.497382	0.000	-2138.000	0.000	-0.433
-10	nominal	4942.497377	NA	NA	NA	NA	NA	4942.497440	0.000	-2143.000	0.000	-0.434
0	nominal	4942.498774	4942.498854	4942.498856	4942.498859	4942.498861	4942.498863	4942.498884	0.000	-746.000	0.000	-0.151
10	nominal	4942.500145	NA	NA	NA	NA	NA	4942.500174	654.000	0.000	0.132	0.000
20	+15%	4942.500039	NA	NA	NA	NA	NA	4942.499878	519.000	0.000	0.105	0.000
20	nominal	4942.499520	NA	NA	NA	NA	NA	4942.499520*	0.000	0.000	0.000	0.000
20	-15%	4942.499740	NA	NA	NA	NA	NA	4942.499742	222.000	0.000	0.045	0.000
30	nominal	4942.499522	4942.499516	4942.499508	4942.499502	4942.499490	4942.499485	4942.499427	2.000	-93.000	0.000	-0.019
40	nominal	4942.498447	NA	NA	NA	NA	NA	4942.498230	0.000	-1290.000	0.000	-0.261
50	nominal	4942.496727	4942.496657	4942.496624	4942.496577	4942.496536	4942.496502	4942.496150	0.000	-3370.000	0.000	-0.682
Mid frequency 4962.500												
-30	nominal	4962.501227	4962.501208	4962.501198	4962.501113	4962.501208	4962.501198	4962.501113	1775.000	0.000	0.358	0.000
-20	nominal	NA	NA	NA	4962.497367	NA	NA	4962.497367	0.000	-2166.000	0.000	-0.436
-10	nominal	NA	NA	NA	4962.497416	NA	NA	4962.497416	0.000	-2170.000	0.000	-0.437
0	nominal	4962.498784	4962.498795	4962.498808	4962.498940	4962.498795	4962.498808	4962.498940	0.000	-821.000	0.000	-0.165
10	nominal	NA	NA	NA	4962.500166	NA	NA	4962.500166	633.000	0.000	0.128	0.000
20	+15%	NA	NA	NA	4962.499797	NA	NA	4962.499797	323.000	0.000	0.065	0.000
20	nominal	NA	NA	NA	4962.499533	NA	NA	4962.499533*	47.000	0.000	0.009	0.000
20	-15%	NA	NA	NA	4962.499742	NA	NA	4962.499742	210.000	0.000	0.042	0.000
30	nominal	4962.499610	4962.499592	4962.499580	4962.499458	4962.499592	4962.499580	4962.499458	134.000	-75.000	0.027	-0.015
40	nominal	NA	NA	NA	4962.498208	NA	NA	4962.498208	0.000	-1325.000	0.000	-0.267
50	nominal	4962.496493	4962.496465	4962.496430	4962.496087	4962.496465	4962.496430	4962.496087	0.000	-3446.000	0.000	-0.694
High frequency 4987.500												
-30	nominal	4987.501375	4987.501360	4987.501332	4987.501200	4987.501360	4987.501332	4987.501200	1865.000	0.000	0.374	0.000
-20	nominal	NA	NA	NA	4987.497342	NA	NA	4987.497342	0.000	-2199.000	0.000	-0.441
-10	nominal	NA	NA	NA	4987.497365	NA	NA	4987.497365	0.000	-2215.000	0.000	-0.444
0	nominal	4987.498479	4987.498525	4987.498560	4987.498866	4987.498525	4987.498560	4987.498866	0.000	-1196.000	0.000	-0.240
10	nominal	NA	NA	NA	4987.500163	NA	NA	4987.500163	622.000	0.000	0.125	0.000
20	+15%	NA	NA	NA	4987.499747	NA	NA	4987.499747	243.000	0.000	0.049	0.000
20	nominal	NA	NA	NA	4987.499541	NA	NA	4987.499541*	0.000	-10.000	0.000	-0.002
20	-15%	NA	NA	NA	4987.499741	NA	NA	4987.499741	240.000	0.000	0.048	0.000
30	nominal	4987.499589	4987.499573	4987.499564	4987.499485	4987.499573	4987.499564	4987.499485	143.000	-56.000	0.029	-0.011
40	nominal	NA	NA	NA	4987.498195	NA	NA	4987.498195	0.000	-1346.000	0.000	-0.270
50	nominal	4987.496259	4987.496241	4987.496218	4987.496017	4987.496241	4987.496218	4987.496017	0.000	-3524.000	0.000	-0.707

* - Reference frequency

Test specification:	**Section 90.213, Frequency stability**		
Test procedure:	47 CFR, Section 2.1055; TIA/EIA-603-C Section 2.2.2		
Test mode:	Compliance	**Verdict:**	PASS
Date & Time:	9/16/2009 5:54:11 PM		
Temperature: 25.4 ºC	**Air Pressure:** 1008 hPa	**Relative Humidity:** 41 %	**Power Supply:** 48 VDC
Remarks:			

Table 7.6.2 Frequency stability test results (continued)

ASSIGNED FREQUENCY RANGE: 4940.0 – 4990.0 MHz
NOMINAL POWER VOLTAGE: 48 VDC
TEMPERATURE STABILIZATION PERIOD: 20 min
POWER DURING TEMPERATURE TRANSITION: Off
SPECTRUM ANALYZER MODE: Counter
RESOLUTION BANDWIDTH: 1000 Hz
VIDEO BANDWIDTH: 3000 Hz
MODULATION: Unmodulated

T, ºC	Voltage, V	Frequency, MHz							Max frequency drift, Hz		Max frequency drift, ppm	
		Start up	1st min	2nd min	3rd min	4th min	5th min	10th min	Positive	Negative	Positive	Negative
Low frequency 4942.500 MHz												
20	+15%	4942.499265	NA	NA	NA	NA	NA	4942.499228	0.000	-209.000	0.000	-0.042
20	nominal	4942.499711	NA	NA	NA	NA	NA	4942.499437	274.000	0.000	0.055	0.000
20	-15%	4942.499375	NA	NA	NA	NA	NA	4942.499273	0.000	-164.000	0.000	-0.033
Mid frequency 4962.500												
20	+15%	4962.499270	NA	NA	NA	NA	NA	4962.499229	0.000	-236.000	0.000	-0.048
20	nominal	4962.499563	NA	NA	NA	NA	NA	4962.499465	98.000	0.000	0.020	0.000
20	-15%	4987.499381	NA	NA	NA	NA	NA	4962.499274	0.000	-191.000	0.000	-0.038
High frequency 4987.500												
20	+15%	4987.499267	NA	NA	NA	NA	NA	4987.499232	0.000	-166.000	0.000	-0.033
20	nominal	4987.499453	NA	NA	NA	NA	NA	4987.499398	55.000	0.000	0.011	0.000
20	-15%	4987.499376	NA	NA	NA	NA	NA	4987.499276	0.000	-122.000	0.000	-0.024

Reference numbers of test equipment used

HL 1424	HL 2909	HL 3286					

Full description is given in Appendix A.

Test specification:	Section 2.1091, RF radiation exposure evaluation		
Test procedure:	47 CFR, Section 1.1307(b)1		
Test mode:	Compliance	Verdict:	PASS
Date & Time:	9/16/2009 3:53:55 PM		
Temperature: 25.4 ºC	Air Pressure: 1008 hPa	Relative Humidity: 41 %	Power Supply: 120 VAC
Remarks:			

7.7 RF exposure

7.7.1 General

This test was performed to determine the minimum safe distance between the transmitter antenna and human to avoid public exposure in excess of limits for general population (uncontrolled exposure). Specification test limits are given in Table 7.7.1.

Table 7.7.1 RF exposure limits

Frequency range, MHz	Power density	
	mW/cm^2	W/m^2
4940.0 – 4990.0	1.00	10.0

*- Power density limit within 300 - 1500 MHz was calculated according to the following equation: S = F / 1500, where S is power density in mW/cm^2 and F is frequency in MHz.

7.7.2 Safe distance calculation for fixed transmitter

The minimum safe distance was calculated from the following equation as provided in Table 7.7.2:

$$r = sqrt[P \times G / (4 \times \pi \times S)],$$

where S is power density in W/m^2 , P is the transmitter output power in W, G is the transmitter antenna numeric gain and r is distance to transmit antenna in m.
With power density equal to the RF exposure limit the minimum safe distance was calculated according to the following equation: $r = sqrt[P \times G / (4 \times \pi \times S])$

Table 7.7.2 Safe distance calculation

ASSIGNED FREQUENCY: 4940.0 – 4990.0 MHz
EQUIPMENT INTENDED USE: Fixed*
MODE: 5 MHz EBW MIMO

Carrier frequency MHz	Peak output power, dBm	Antenna gain, dBi	EIRP		Power density limit, W/m^2	Safe distance, m**	Intended separation, r	Verdict
			dBm	W				
4942.5	21.94	17	38.94	21.94	0.15586	0.25	2.0	Pass
4962.5	22.17	17	39.17	22.17	0.16434	0.26	2.0	Pass
4987.5	22.41	17	39.41	22.41	0.17367	0.26	2.0	Pass

- - The equipment deemed fixed as intended for use at a distance of more than 2.0 m from humans.

Test specification:	Section 15.107, Conducted emission at AC power port		
Test procedure:	ANSI C63.4, Sections 11.5 and 12.1.3		
Test mode:	Compliance	Verdict:	PASS
Date & Time:	9/21/2009 2:23:44 PM		
Temperature: 24.5 ºC	Air Pressure: 1008 hPa	Relative Humidity: 38 %	Power Supply: 120VAC
Remarks:			

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

8.1 Conducted emissions

8.1.1 General

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

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 and associated photographs, energized and the performance check was conducted.

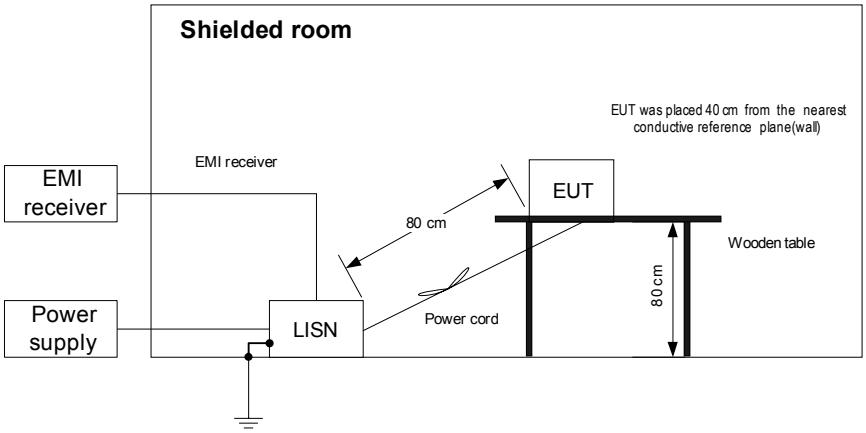
8.1.2.2 The measurements were performed at power terminals with the LISN, connected to a spectrum analyzer in the frequency range referred to in Table 8.1.2. Unused coaxial connector of the LISN was terminated with 50 Ohm. Quasi-peak and average detectors were used throughout the testing.

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

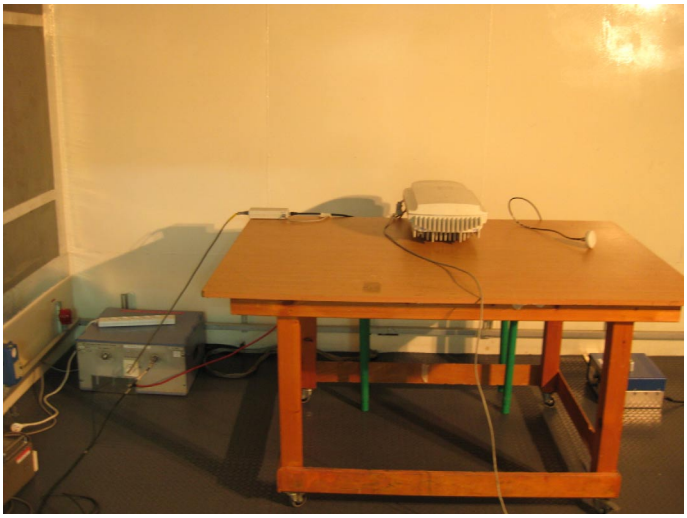
8.1.2.4 The worst test results (the lowest margins) were recorded in Table 8.1.2 and shown in the associated plots.

Test specification:	Section 15.107, Conducted emission at AC power port		
Test procedure:	ANSI C63.4, Sections 11.5 and 12.1.3		
Test mode:	Compliance	Verdict:	PASS
Date & Time:	9/21/2009 2:23:44 PM		
Temperature: 24.5 ºC	Air Pressure: 1008 hPa	Relative Humidity: 38 %	Power Supply: 120VAC
Remarks:			

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



Photograph 8.1.1 Setup for conducted emission measurements



Test specification:	**Section 15.107, Conducted emission at AC power port**		
Test procedure:	ANSI C63.4, Sections 11.5 and 12.1.3		
Test mode:	Compliance	**Verdict:**	PASS
Date & Time:	9/21/2009 2:23:44 PM		
Temperature: 24.5 ºC	**Air Pressure:** 1008 hPa	**Relative Humidity:** 38 %	**Power Supply:** 120VAC
Remarks:			

Table 8.1.2 Conducted emission test results

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

Frequency, MHz	Peak emission, dB(µV)	Quasi-peak			Average			Line ID	Verdict
		Measured emission, dB(µV)	Limit, dB(µV)	Margin, dB*	Measured emission, dB(µV)	Limit, dB(µV)	Margin, dB*		
0.172855	59.26	58.24	64.89	-6.65	48.17	54.89	-6.72	L1	Pass
0.232620	51.74	50.67	62.40	-11.73	42.44	52.40	-9.96		
0.293305	47.68	45.27	60.48	-15.21	36.66	50.48	-13.82		
0.345760	47.46	45.41	59.12	-13.71	38.40	49.12	-10.72		
20.260060	42.77	41.14	60.00	-18.86	38.17	50.00	-11.83		
28.443940	40.72	38.70	60.00	-21.30	37.11	50.00	-12.89		
0.172910	57.94	57.00	64.88	-7.88	45.82	54.88	-9.06	L2	Pass
0.232825	50.59	49.36	62.39	-13.03	40.36	52.39	-12.03		
0.290748	45.84	44.41	60.55	-16.14	36.58	50.55	-13.97		
8.087838	44.15	39.42	60.00	-20.58	28.73	50.00	-21.27		
20.257500	43.33	40.87	60.00	-19.13	37.07	50.00	-12.93		
28.687760	45.33	44.14	60.00	-15.86	43.19	50.00	-6.81		

*- Margin = Measured emission - specification limit.

Reference numbers of test equipment used

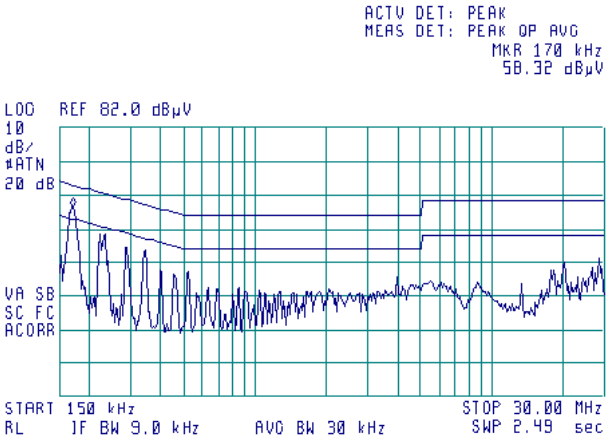
HL 0447	HL 0787	HL 1513	HL 3612				

Full description is given in Appendix A.

Test specification:	Section 15.107, Conducted emission at AC power port		
Test procedure:	ANSI C63.4, Sections 11.5 and 12.1.3		
Test mode:	Compliance	Verdict:	PASS
Date & Time:	9/21/2009 2:23:44 PM		
Temperature: 24.5 ºC	Air Pressure: 1008 hPa	Relative Humidity: 38 %	Power Supply: 120VAC
Remarks:			

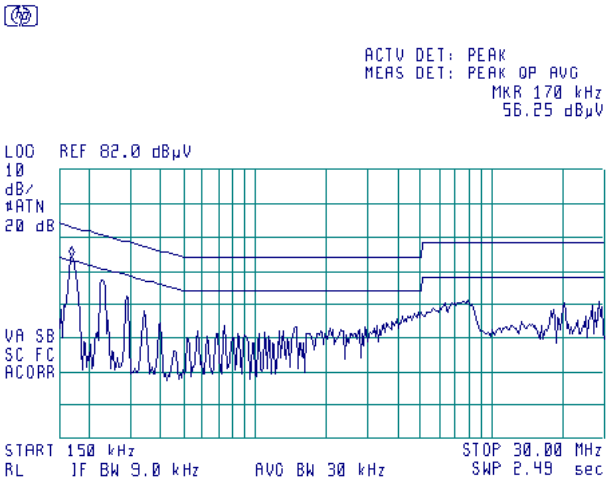
Plot 8.1.1 Conducted emission measurements

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



Plot 8.1.2 Conducted emission measurements

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



Test specification:	Section 15.109, Radiated emission		
Test procedure:	ANSI C63.4, Sections 11.6 and 12.1.4		
Test mode:	Compliance	Verdict:	PASS
Date & Time:	9/16/2009 5:37:48 PM		
Temperature: 25.4 ºC	Air Pressure: 1008 hPa	Relative Humidity: 41 %	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 and associated photographs, energized and the performance check was conducted.

8.2.2.2 Preliminary measurements were performed in the anechoic chamber at 3 m test distance. The specified frequency range was investigated with biconical and log periodic antennas connected to EMI receiver. To find maximum radiation the turntable was rotated 360^0, the measuring antenna height was changed, its polarization was switched from vertical to horizontal and the EUT cables position was varied.

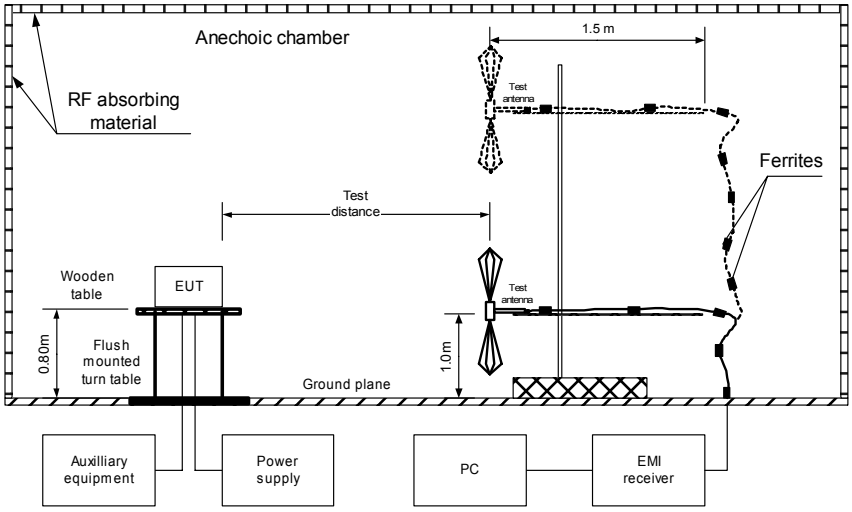
8.2.2.3 The EUT was set up as shown in Figure 8.2.2, energized and the performance check was conducted.

8.2.2.4 Final measurements were performed at the open area test site at 3 m test distance. The EUT wires and cables were arranged to produce maximum emission as it was found during preliminary measurements. The frequencies yield the worst test results (the lowest margins) during preliminary testing were investigated with biconilog antenna connected to EMI receiver. To find maximum radiation the turntable was rotated 360^0, the measuring antenna height was changed from 1 to 4 m and its polarization was changed from vertical to horizontal.

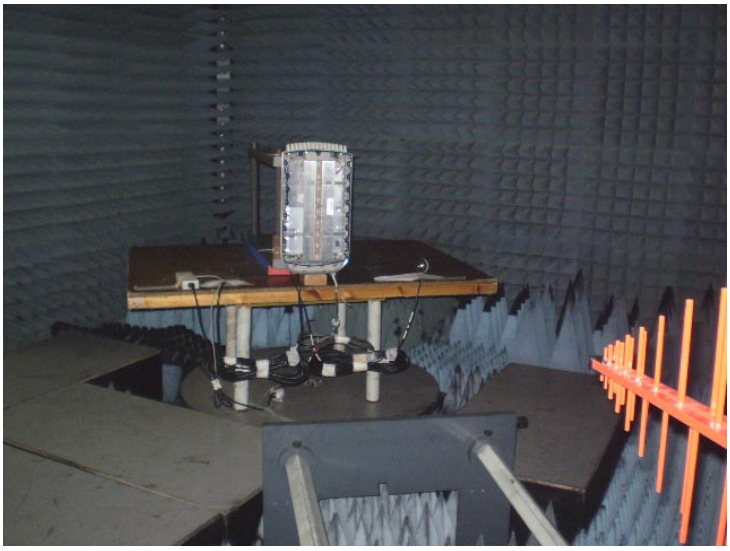
8.2.2.5 The worst test results (the lowest margins) were recorded in Table 8.2.2 and shown in the associated plots.

Test specification:	Section 15.109, Radiated emission		
Test procedure:	ANSI C63.4, Sections 11.6 and 12.1.4		
Test mode:	Compliance	Verdict:	PASS
Date & Time:	9/16/2009 5:37:48 PM		
Temperature: 25.4 ºC	Air Pressure: 1008 hPa	Relative Humidity: 41 %	Power Supply: 120 VAC
Remarks:			

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

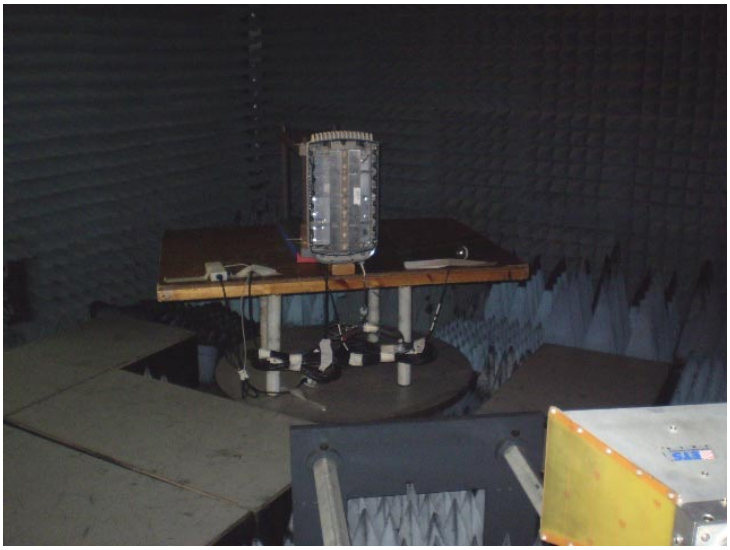


Photograph 8.2.1 Setup for preliminary radiated emission measurements



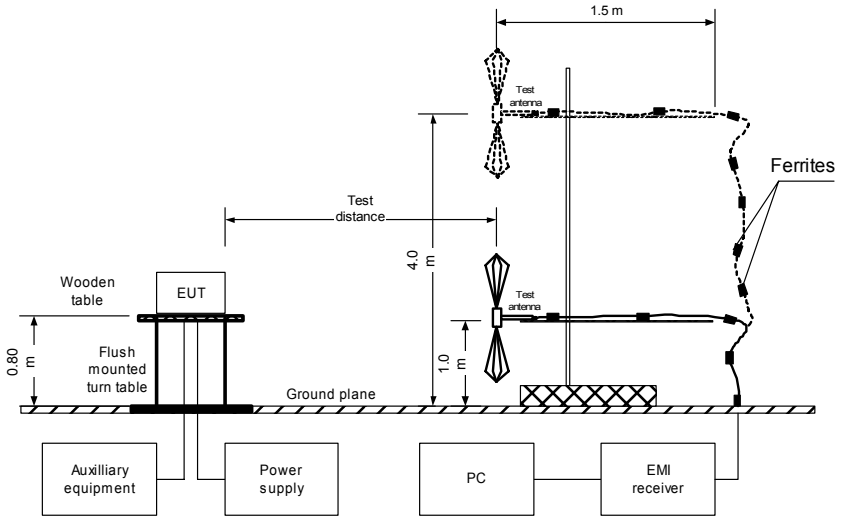
Test specification:	Section 15.109, Radiated emission		
Test procedure:	ANSI C63.4, Sections 11.6 and 12.1.4		
Test mode:	Compliance	Verdict:	PASS
Date & Time:	9/16/2009 5:37:48 PM		
Temperature: 25.4 ºC	Air Pressure: 1008 hPa	Relative Humidity: 41 %	Power Supply: 120 VAC
Remarks:			

Photograph 8.2.2 Setup for preliminary radiated emission measurements



Test specification:	Section 15.109, Radiated emission		
Test procedure:	ANSI C63.4, Sections 11.6 and 12.1.4		
Test mode:	Compliance	Verdict:	PASS
Date & Time:	9/16/2009 5:37:48 PM		
Temperature: 25.4 ºC	Air Pressure: 1008 hPa	Relative Humidity: 41 %	Power Supply: 120 VAC
Remarks:			

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



Photograph 8.2.3 Setup for final radiated emission measurements, general view

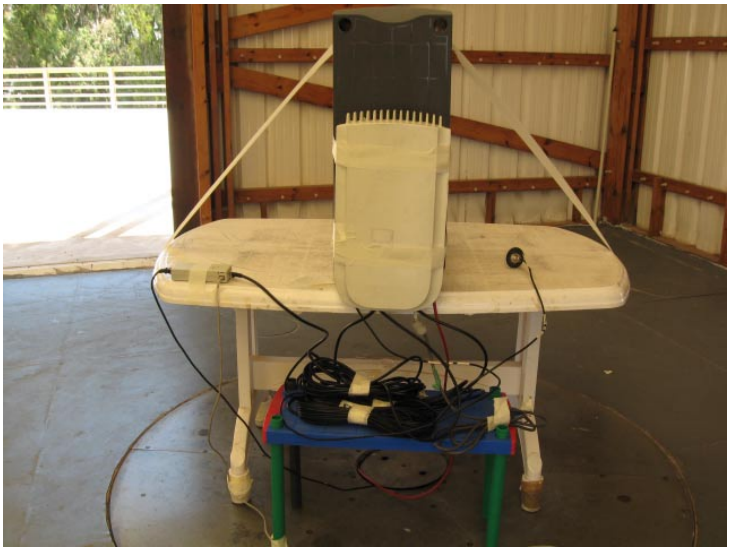
Test specification:	Section 15.109, Radiated emission		
Test procedure:	ANSI C63.4, Sections 11.6 and 12.1.4		
Test mode:	Compliance	Verdict:	PASS
Date & Time:	9/16/2009 5:37:48 PM		
Temperature: 25.4 ºC	Air Pressure: 1008 hPa	Relative Humidity: 41 %	Power Supply: 120 VAC
Remarks:			

Photograph 8.2.4 Setup for final radiated emission measurements, general view

Photograph 8.2.5 Setup for final radiated emission measurements, general view

Test specification:	Section 15.109, Radiated emission		
Test procedure:	ANSI C63.4, Sections 11.6 and 12.1.4		
Test mode:	Compliance	Verdict:	PASS
Date & Time:	9/16/2009 5:37:48 PM		
Temperature: 25.4 ºC	Air Pressure: 1008 hPa	Relative Humidity: 41 %	Power Supply: 120 VAC
Remarks:			

Photograph 8.2.6 Setup for final radiated emission measurements, EUT cabling



Test specification:	**Section 15.109, Radiated emission**		
Test procedure:	ANSI C63.4, Sections 11.6 and 12.1.4		
Test mode:	Compliance	**Verdict:**	PASS
Date & Time:	9/16/2009 5:37:48 PM		
Temperature: 25.4 ºC	**Air Pressure:** 1008 hPa	**Relative Humidity:** 41 %	**Power Supply:** 120 VAC
Remarks:			

Table 8.2.2 Radiated emission test results

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

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*				
640.000	34.90	31.90	46.00	-14.1	H	1.2	020	Pass
720.000	46.40	43.60	46.00	-2.40	H	1.1	000	
800.000	38.50	35.90	46.00	-10.1	H	1.1	300	
880.000	44.90	39.90	46.00	-6.10	V	1.0	000	

TEST SITE: OATS
TEST DISTANCE: 3 m
DETECTORS USED: PEAK / AVERAGE
FREQUENCY RANGE: 1000 MHz – 9000 MHz
RESOLUTION BANDWIDTH: 1000 kHz
POWER SUPPLY: 120 VAC

Frequency, MHz	Peak			Average			Antenna polarization	Antenna height, m	Turn-table position**, degrees	Verdict
	Measured emission, dB(µV/m)	Limit, dB(µV/m)	Margin, dB*	Measured emission, dB(µV/m)	Limit, dB(µV/m)	Margin, dB*				
1200.000	46.70	74.00	-27.3	40.10	54.00	-13.90	H	1.7	020	Pass
1439.944	50.20	74.00	-23.8	45.00	54.00	-9.00	H	1.0	350	
1120.004	50.50	74.00	-23.5	40.40	54.00	-13.60	H	1.4	000	
1280.007	47.60	74.00	-26.4	42.10	54.00	-11.90	H	1.0	000	
1360.000	48.60	74.00	-25.4	42.20	54.00	-11.80	H	1.0	020	
1520.000	47.30	74.00	-26.7	39.00	54.00	-15.00	H	1.0	340	
2320.000	52.50	74.00	-21.5	41.80	54.00	-12.20	H	1.1	340	
2400.000	53.10	74.00	-20.9	43.10	54.00	-10.90	H	1.0	000	
2480.000	53.70	74.00	-20.3	44.40	54.00	-9.60	V	1.2	340	
3359.000	46.61	74.00	-27.39	42.16	54.00	-11.84	V	1.1	010	
4179.963	43.61	74.00	-30.39	36.01	54.00	-17.99	V	1.1	020	
8360.025	48.96	74.00	-25.04	44.67	54.00	-9.33	V	1.1	000	

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

Test specification:	**Section 15.109, Radiated emission**		
Test procedure:	ANSI C63.4, Sections 11.6 and 12.1.4		
Test mode:	Compliance	**Verdict:**	PASS
Date & Time:	9/16/2009 5:37:48 PM		
Temperature: 25.4 ºC	**Air Pressure:** 1008 hPa	**Relative Humidity:** 41 %	**Power Supply:** 48 VDC
Remarks:			

Table 8.2.3 Radiated emission test results

EUT SET UP: TABLE-TOP
LIMIT: Class B
EUT OPERATING MODE: Receive / Stand-by
TEST SITE: OATS
TEST DISTANCE: 3 m
DETECTORS USED: PEAK / QUASI-PEAK
FREQUENCY RANGE: 30 MHz – 1000 MHz
RESOLUTION BANDWIDTH: 120 kHz
POWER SUPPLY: 48 VDC

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*				
640.000	34.90	30.40	46.00	-15.60	V	1.2	040	Pass
720.000	43.20	41.40	46.00	-4.60	H	1.1	000	
800.000	37.90	34.20	46.00	-11.80	H	1.1	300	
880.000	45.80	40.90	46.00	-5.10	H	1.0	000	

TEST SITE: OATS
TEST DISTANCE: 3 m
DETECTORS USED: PEAK / AVERAGE
FREQUENCY RANGE: 1000 MHz – 9000 MHz
RESOLUTION BANDWIDTH: 1000 kHz
POWER SUPPLY: 48 VDC

Frequency, MHz	Peak			Average			Antenna polarization	Antenna height, m	Turn-table position**, degrees	Verdict
	Measured emission, dB(µV/m)	Limit, dB(µV/m)	Margin, dB*	Measured emission, dB(µV/m)	Limit, dB(µV/m)	Margin, dB*				
1200.000	46.90	74.00	-27.10	39.60	54.00	-14.40	H	1.7	020	Pass
1439.944	50.40	74.00	-23.60	46.10	54.00	-7.90	H	1.0	350	
1120.004	43.70	74.00	-30.30	35.00	54.00	-19.00	H	1.4	000	
1280.007	48.40	74.00	-25.60	42.90	54.00	-11.10	H	1.0	000	
1360.000	48.50	74.00	-25.50	42.70	54.00	-11.30	H	1.0	020	
1600.000	51.20	74.00	-22.80	39.40	54.00	-14.60	H	1.1	330	
1520.000	47.00	74.00	-27.00	38.60	54.00	-15.40	H	1.0	340	
2320.000	51.80	74.00	-22.20	40.70	54.00	-13.30	H	1.1	340	
2400.000	53.20	74.00	-20.80	42.30	54.00	-11.70	H	1.0	000	
2480.000	54.10	74.00	-19.90	44.30	54.00	-9.70	V	1.2	340	

Reference numbers of test equipment used

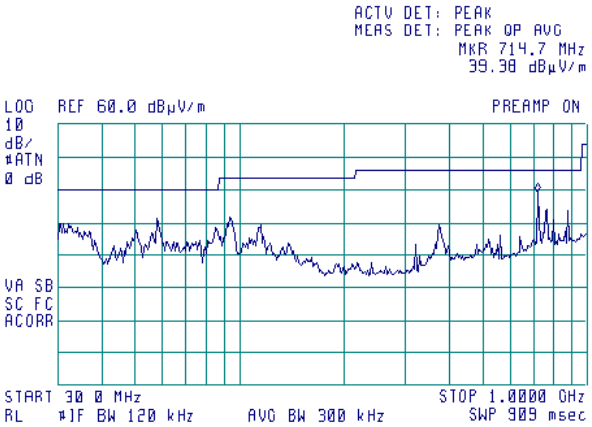
HL 0034	HL 0415	HL 0812	HL 1424	HL 1425	HL 1430	HL 2432	HL 2697
HL 2882	HL 2883	HL 3531	HL 3533				

Full description is given in Appendix A.

Test specification:	Section 15.109, Radiated emission		
Test procedure:	ANSI C63.4, Sections 11.6 and 12.1.4		
Test mode:	Compliance	Verdict:	PASS
Date & Time:	9/16/2009 5:37:48 PM		
Temperature: 25.4 ºC	Air Pressure: 1008 hPa	Relative Humidity: 41 %	Power Supply: 120 VAC
Remarks:			

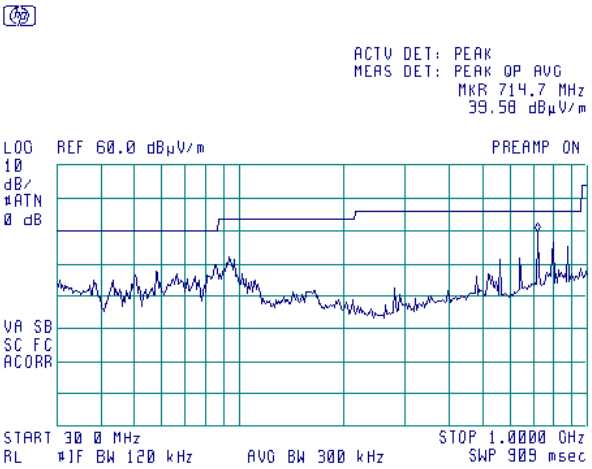
Plot 8.2.1 Radiated emission measurements in 30 - 1000 MHz range, vertical antenna polarization

TEST SITE:	Full Anechoic chamber
LIMIT:	Class B
TEST DISTANCE:	3 m
EUT OPERATING MODE:	Receive / Stand-by
POWER SUPPLY	120 VAC



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

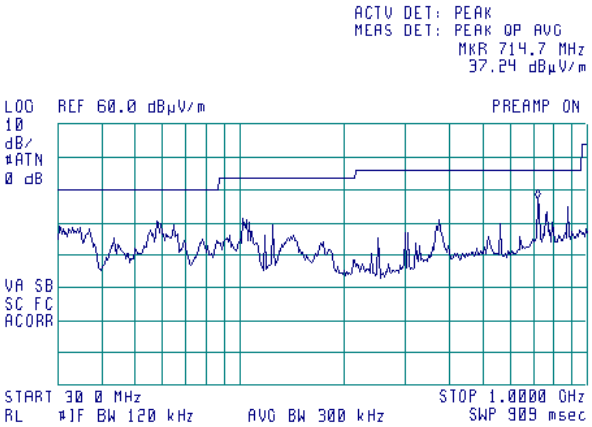
TEST SITE:	Full Anechoic chamber
LIMIT:	Class B
TEST DISTANCE:	3 m
EUT OPERATING MODE:	Receive / Stand-by
POWER SUPPLY	120 VAC



Test specification:	Section 15.109, Radiated emission		
Test procedure:	ANSI C63.4, Sections 11.6 and 12.1.4		
Test mode:	Compliance	Verdict:	PASS
Date & Time:	9/16/2009 5:37:48 PM		
Temperature: 25.4 ºC	Air Pressure: 1008 hPa	Relative Humidity: 41 %	Power Supply: 48 VDC
Remarks:			

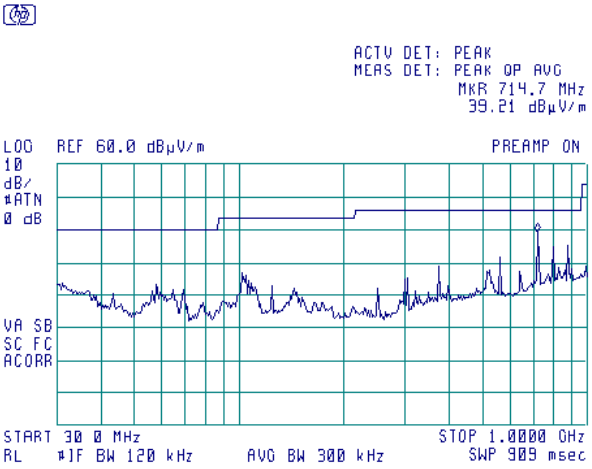
Plot 8.2.3 Radiated emission measurements in 30 - 1000 MHz range, vertical antenna polarization

TEST SITE:	Full Anechoic chamber
LIMIT:	Class B
TEST DISTANCE:	3 m
EUT OPERATING MODE:	Receive / Stand-by
POWER SUPPLY	48 VDC



Plot 8.2.4 Radiated emission measurements in 30 - 1000 MHz range, horizontal antenna polarization

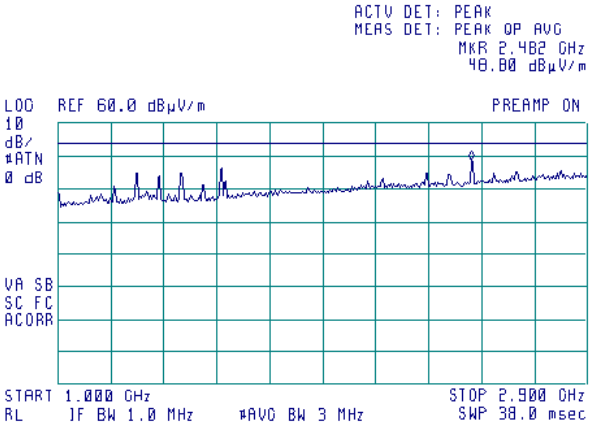
TEST SITE:	Full Anechoic chamber
LIMIT:	Class B
TEST DISTANCE:	3 m
EUT OPERATING MODE:	Receive / Stand-by
POWER SUPPLY	48 VDC



Test specification:	Section 15.109, Radiated emission		
Test procedure:	ANSI C63.4, Sections 11.6 and 12.1.4		
Test mode:	Compliance	Verdict:	PASS
Date & Time:	9/16/2009 5:37:48 PM		
Temperature: 25.4 ºC	Air Pressure: 1008 hPa	Relative Humidity: 41 %	Power Supply: 120 VAC
Remarks:			

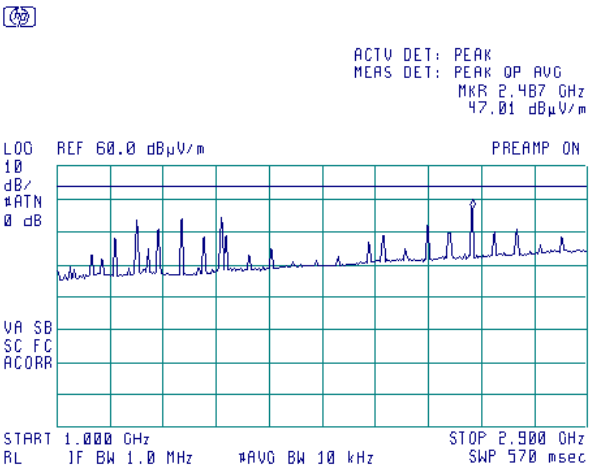
Plot 8.2.5 Radiated emission measurements in 1000 – 2900 range, vertical antenna polarization

TEST SITE:	Full Anechoic chamber
LIMIT:	Class B
TEST DISTANCE:	3 m
EUT OPERATING MODE:	Receive / Stand-by
POWER SUPPLY	120 VAC
DETECTOR:	Peak



Plot 8.2.6 Radiated emission measurements in 1000 – 2900 range, vertical antenna polarization

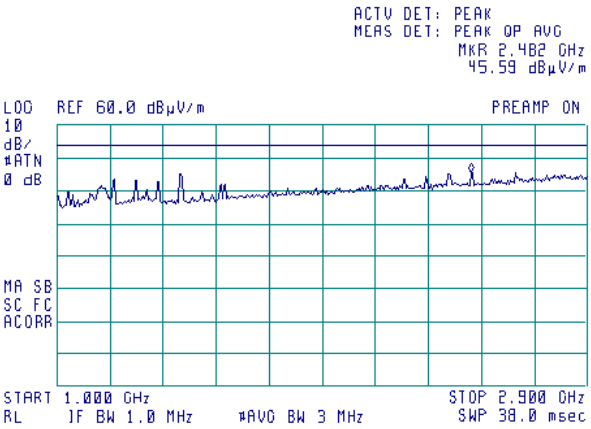
TEST SITE:	Full Anechoic chamber
LIMIT:	Class B
TEST DISTANCE:	3 m
EUT OPERATING MODE:	Receive / Stand-by
POWER SUPPLY	120 VAC
DETECTOR:	VBW = 10 kHz



Test specification:	Section 15.109, Radiated emission		
Test procedure:	ANSI C63.4, Sections 11.6 and 12.1.4		
Test mode:	Compliance	Verdict:	PASS
Date & Time:	9/16/2009 5:37:48 PM		
Temperature: 25.4 ºC	Air Pressure: 1008 hPa	Relative Humidity: 41 %	Power Supply: 120 VAC
Remarks:			

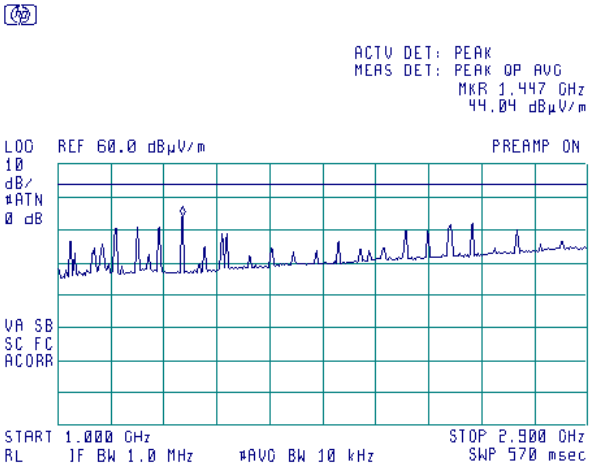
Plot 8.2.7 Radiated emission measurements 1000 – 2900 range, horizontal antenna polarization

TEST SITE:	Full Anechoic chamber
LIMIT:	Class B
TEST DISTANCE:	3 m
EUT OPERATING MODE:	Receive / Stand-by
POWER SUPPLY	120 VAC
DETECTOR:	Peak



Plot 8.2.8 Radiated emission measurements 1000 – 2900 range, horizontal antenna polarization

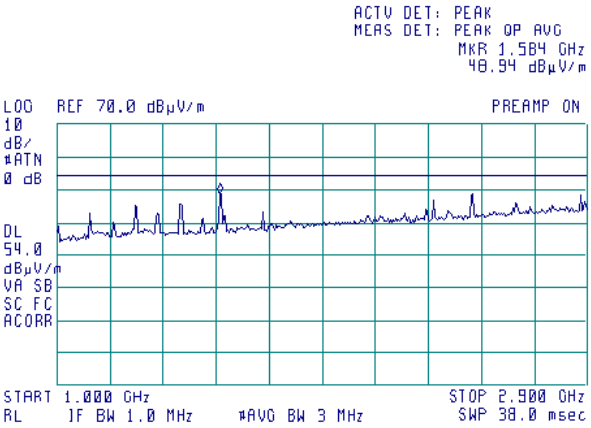
TEST SITE:	Full Anechoic chamber
LIMIT:	Class B
TEST DISTANCE:	3 m
EUT OPERATING MODE:	Receive / Stand-by
POWER SUPPLY	120 VAC
DETECTOR:	VBW = 10 kHz



Test specification:	Section 15.109, Radiated emission		
Test procedure:	ANSI C63.4, Sections 11.6 and 12.1.4		
Test mode:	Compliance	Verdict:	PASS
Date & Time:	9/16/2009 5:37:48 PM		
Temperature: 25.4 ºC	Air Pressure: 1008 hPa	Relative Humidity: 41 %	Power Supply: 48 VDC
Remarks:			

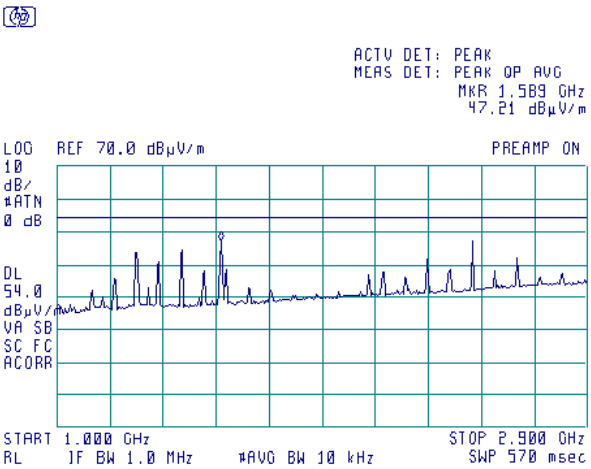
Plot 8.2.9 Radiated emission measurements in 1000 – 2900 range, vertical antenna polarization

TEST SITE:	Full Anechoic chamber
LIMIT:	Class B
TEST DISTANCE:	3 m
EUT OPERATING MODE:	Receive / Stand-by
POWER SUPPLY	48 VDC
DETECTOR:	Peak



Plot 8.2.10 Radiated emission measurements in 1000 – 2900 range, vertical antenna polarization

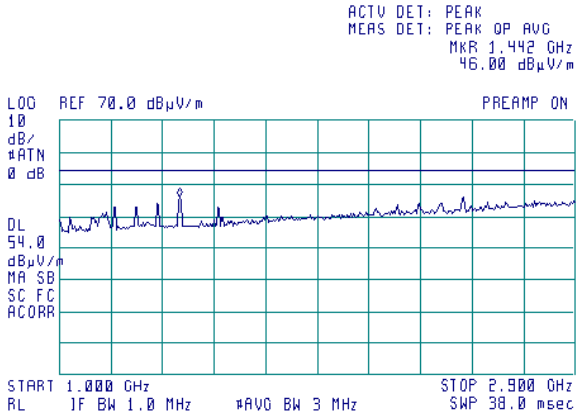
TEST SITE:	Full Anechoic chamber
LIMIT:	Class B
TEST DISTANCE:	3 m
EUT OPERATING MODE:	Receive / Stand-by
POWER SUPPLY	48 VDC
DETECTOR:	VBW = 10 kHz



Test specification:	Section 15.109, Radiated emission		
Test procedure:	ANSI C63.4, Sections 11.6 and 12.1.4		
Test mode:	Compliance	Verdict:	PASS
Date & Time:	9/16/2009 5:37:48 PM		
Temperature: 25.4 ºC	Air Pressure: 1008 hPa	Relative Humidity: 41 %	Power Supply: 48 VDC
Remarks:			

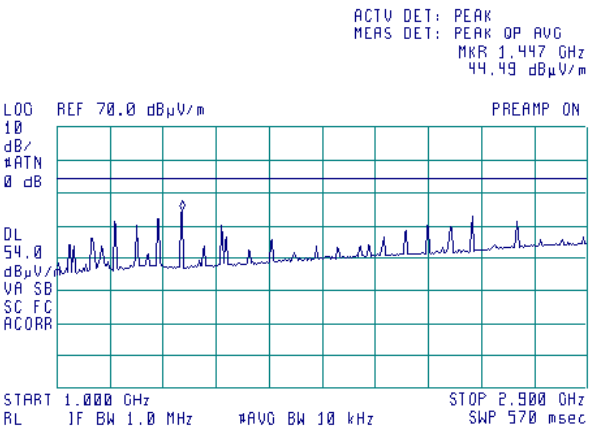
Plot 8.2.11 Radiated emission measurements 1000 – 2900 range, horizontal antenna polarization

TEST SITE:	Full Anechoic chamber
LIMIT:	Class B
TEST DISTANCE:	3 m
EUT OPERATING MODE:	Receive / Stand-by
POWER SUPPLY	48 VDC
DETECTOR:	Peak



Plot 8.2.12 Radiated emission measurements 1000 – 2900 range, horizontal antenna polarization

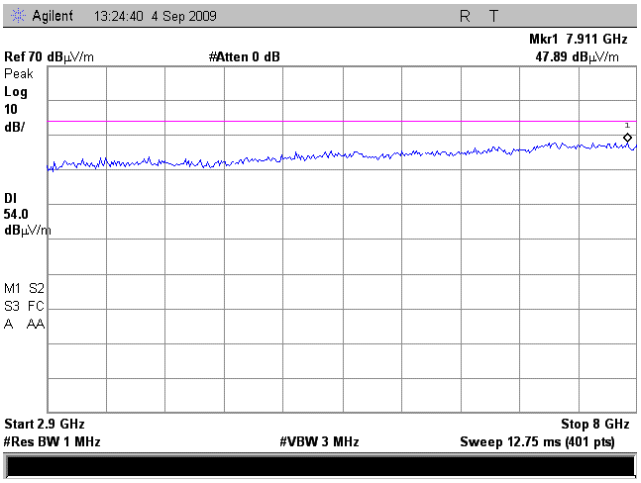
TEST SITE:	Full Anechoic chamber
LIMIT:	Class B
TEST DISTANCE:	3 m
EUT OPERATING MODE:	Receive / Stand-by
POWER SUPPLY	48 VDC
DETECTOR:	VBW = 10 kHz



Test specification:	Section 15.109, Radiated emission		
Test procedure:	ANSI C63.4, Sections 11.6 and 12.1.4		
Test mode:	Compliance	Verdict:	PASS
Date & Time:	9/16/2009 5:37:48 PM		
Temperature: 25.4 ºC	Air Pressure: 1008 hPa	Relative Humidity: 41 %	Power Supply: 120 VAC
Remarks:			

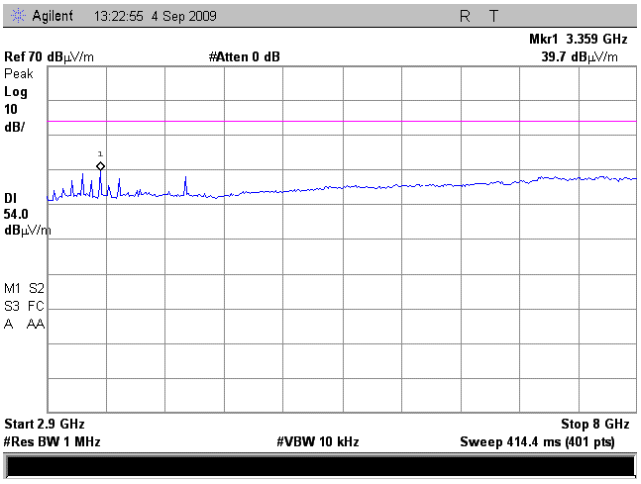
Plot 8.2.13 Radiated emission measurements in 2900 – 8000 range, vertical antenna polarization

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



Plot 8.2.14 Radiated emission measurements in 2900 – 8000 range, vertical antenna polarization

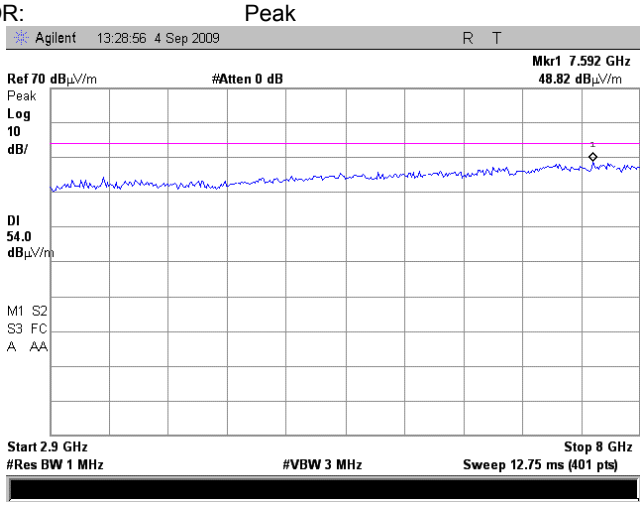
TEST SITE:	Full Anechoic chamber
LIMIT:	Class B
TEST DISTANCE:	3 m
EUT OPERATING MODE:	Receive / Stand-by
DETECTOR:	VBW = 10 kHz



Test specification:	Section 15.109, Radiated emission		
Test procedure:	ANSI C63.4, Sections 11.6 and 12.1.4		
Test mode:	Compliance	Verdict:	PASS
Date & Time:	9/16/2009 5:37:48 PM		
Temperature: 25.4 ºC	Air Pressure: 1008 hPa	Relative Humidity: 41 %	Power Supply: 120 VAC
Remarks:			

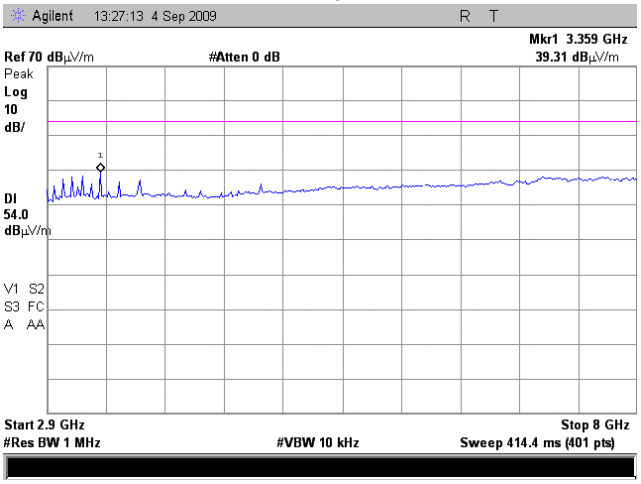
Plot 8.2.15 Radiated emission measurements 2900 – 8000 range, horizontal antenna polarization

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



Plot 8.2.16 Radiated emission measurements 2900 – 8000 range, horizontal antenna polarization

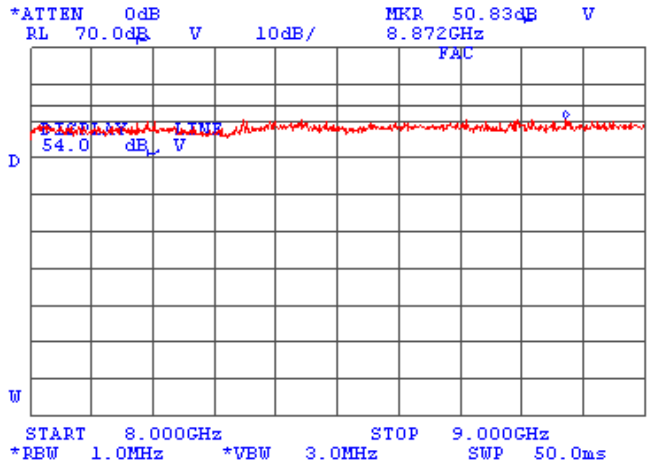
TEST SITE:	Full Anechoic chamber
LIMIT:	Class B
TEST DISTANCE:	3 m
EUT OPERATING MODE:	Receive / Stand-by
DETECTOR:	VBW = 10 kHz



Test specification:	Section 15.109, Radiated emission		
Test procedure:	ANSI C63.4, Sections 11.6 and 12.1.4		
Test mode:	Compliance	Verdict:	PASS
Date & Time:	9/16/2009 5:37:48 PM		
Temperature: 25.4 ºC	Air Pressure: 1008 hPa	Relative Humidity: 41 %	Power Supply: 120 VAC
Remarks:			

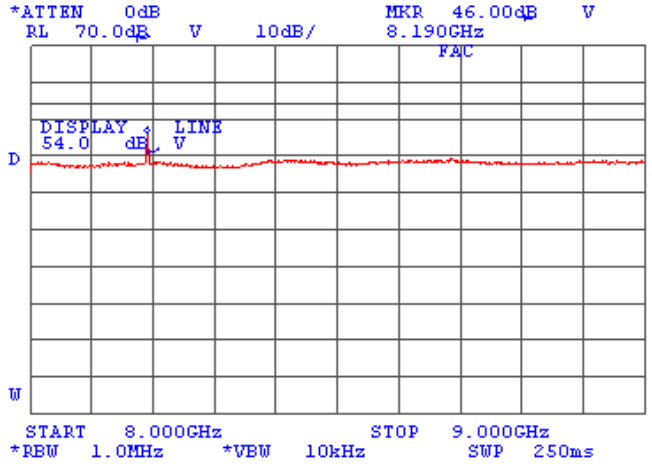
Plot 8.2.17 Radiated emission measurements in 8000 – 9000 range, vertical antenna polarization

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



Plot 8.2.18 Radiated emission measurements in 8000 – 9000 range, vertical antenna polarization

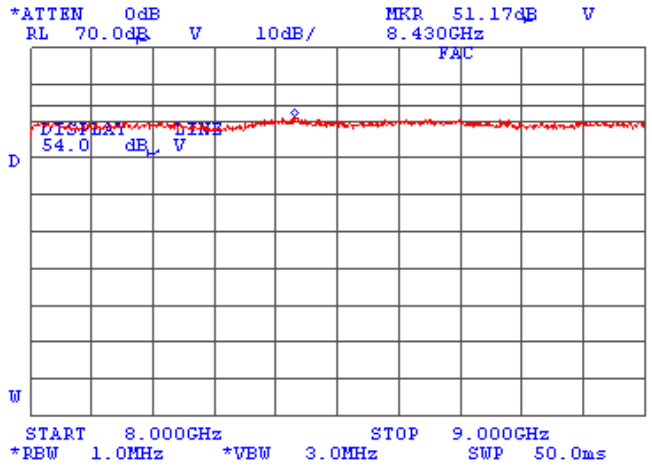
TEST SITE:	Full Anechoic chamber
LIMIT:	Class B
TEST DISTANCE:	3 m
EUT OPERATING MODE:	Receive / Stand-by
DETECTOR:	VBW = 10 kHz



Test specification:	Section 15.109, Radiated emission		
Test procedure:	ANSI C63.4, Sections 11.6 and 12.1.4		
Test mode:	Compliance	Verdict:	PASS
Date & Time:	9/16/2009 5:37:48 PM		
Temperature: 25.4 ºC	Air Pressure: 1008 hPa	Relative Humidity: 41 %	Power Supply: 120 VAC
Remarks:			

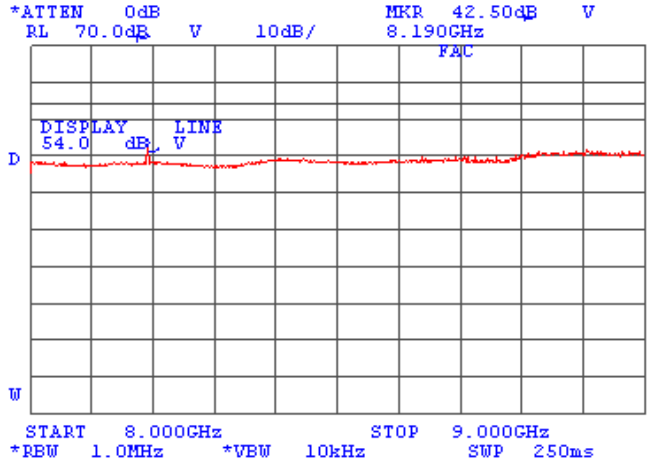
Plot 8.2.19 Radiated emission measurements 8000 – 9000 range, horizontal antenna polarization

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



Plot 8.2.20 Radiated emission measurements 8000 – 9000 range, horizontal antenna polarization

TEST SITE:	Full Anechoic chamber
LIMIT:	Class B
TEST DISTANCE:	3 m
EUT OPERATING MODE:	Receive / Stand-by
DETECTOR:	VBW = 10 kHz



9 APPENDIX A Test equipment and ancillaries used for tests

HL No	Description	Manufacturer	Model	Ser. No.	Last Cal.	Due Cal.
0034	Antenna, Log Periodic, 200 - 1000 MHz	Electro-Metrics	LPA 25/30	1988	25-Sep-08	25-Sep-09
0415	Cable, Coax, RF, RG-214	Hermon Laboratories	CC-3	056	02-Dec-08	02-Dec-09
0446	Antenna, Loop, Active, 10 kHz - 30 MHz	EMCO	6502	2857	29-Jun-09	29-Jun-10
0447	LISN, 16/2, 300V RMS, 50 Ohm/50 uH + 5 Ohm, STD CISPR 16-1	Hermon Laboratories	LISN 16 - 1	066	04-Nov-08	04-Nov-09
0768	Antenna Standard Gain Horn, 18-26.5 GHz, WR-42, 25 dB gain	Quinstar Technology	QWH-4200-BA	110	23-Dec-08	23-Dec-11
0769	Antenna Standard Gain Horn, 26.5-40 GHz, WR28, 25 dB gain	Quinstar Technology	QWH-2800-BA	112	23-Dec-08	23-Dec-11
0787	Transient Limiter 9 kHz-200 MHz	Hewlett Packard Co	11947A	3107A01877	16-Oct-08	16-Oct-09
0812	Cable Coax, RG-214, 11.5 m, N-type connectors	Hermon Laboratories	C214-11	148	02-Dec-08	02-Dec-09
1424	Spectrum Analyzer, 30 Hz- 40 GHz	Agilent Technologies	8564EC	3946A00219	28-Aug-08	28-Sep-09
1425	EMI Receiver, 9 kHz - 2.9 GHz, System: HL1426, HL1427	Agilent Technologies	8542E	3710A00222, 3705A00204	28-Aug-09	28-Aug-10
1430	EMI Receiver, 9 kHz - 2.9 GHz, System: HL1431, HL1432	Agilent Technologies	8542E	3807A00262,3705A00217	31-Aug-09	31-Aug-10
1513	Cable RF, 8 m, BNC/BNC	Belden	M17/167 MIL-C-17	1513	01-Sep-09	01-Sep-10
1906	Power Divider, 0.5-18.0 GHz, 80 W	Omni Spectra	2090-6204-00	1906	01-Dec-08	01-Dec-09
2013	Power Divider, 0.5-18.0 GHz, 80 W	Omni Spectra	2090-6204-00	2013	01-Dec-08	01-Dec-09
2432	Antenna, Double-Ridged Waveguide Horn 1-18 GHz	EMC Test Systems	3115	00027177	23-Jan-09	23-Jan-10
2697	Antenna, 30 MHz - 3.0 GHz	Sunol Sciences. Corp. Pleasanton, California USA	JB3	A022805	11-Jan-09	11-Jan-10
2780	EMC analyzer, 100 Hz to 26.5 GHz	Agilent Technologies	E7405A	MY45102406	05-Jul-09	05-Jul-10
2882	Cable, 18 GHz N-type, M-F, 3 m	Bird	TC-MNFN-3.0	211539001	04-Feb-09	04-Feb-10
2883	Cable, 18 GHz N-type, M-F, 3 m	Bird	TC-MNFN-3.0	211539003	07-Dec-08	07-Dec-09
2909	Spectrum analyzer, ESA-E, 100 Hz to 26.5 GHz	Agilent Technologies	E4407B	MY41444762	07-May-09	07-May-10
2951	Cable, RF, 18 GHz, 0.9 m, SMA-SMA	Gore	10020014	NA	05-Oct-08	05-Oct-09
3179	Attenuator, N-type, 20 dB, DC to 18 GHz, 5 W	Mini-Circuits	BW-N20W5+	NA	07-May-09	07-May-10
3286	Temperature Chamber, (-40 to +170) °C	Thermotron	EL-8-CH-1-1-CO2	21-9048	09-Sep-09	09-Sep-10
3301	Power Meter, P-series, 50 MHz to 40 GHz	Agilent Technologies	N1911A	MY45101057	03-Dec-08	03-Dec-09
3302	Power sensor, P-Series, 50 MHz to 40 GHz, -35/30 to 20 dBm	Agilent Technologies	N1922A	MY45240586	05-Dec-08	05-Dec-09

HL No	Description	Manufacturer	Model	Ser. No.	Last Cal.	Due Cal.
3435	Precision Fixed Attenuator, 50 Ohm, 5 W, 10 dB, DC to 18 GHz	Mini-Circuits	BW-S10W5+	NA	08-Mar-09	08-Mar-10
3440	Precision Fixed Attenuator, 50 Ohm, 5 W, 20 dB, DC to 18 GHz	Mini-Circuits	BW-S20W5+	NA	08-Mar-09	08-Mar-10
3442	Precision Fixed Attenuator, 50 Ohm, 5 W, 20 dB, DC to 18 GHz	Mini-Circuits	BW-S20W5+	NA	08-Mar-09	08-Mar-10
3455	Medium Power Fixed Coaxial Attenuator DC to 40 GHz, 20 dB, 5 W	Aeroflex / Weinschel	75A-20-12	1182	17-Mar-09	17-Mar-10
3472	Cable, Coax, Microwave, DC-18 GHz, SMA-SMA, 1.0 m	Gore	GORE 65474	1003478	10-May-09	10-May-10
3473	Cable, Coax, Microwave, DC-18 GHz, SMA-SMA, 0.6 m	Gore	GORE 65474	1003478	10-May-09	10-May-10
3531	Amplifier, low noise, 2 to 8 GHz	Quinstar Technology	QLJ-02084040-J0	11159002002	07-Dec-08	07-Dec-09
3533	Amplifier, low noise, 6 to 18 GHz	Quinstar Technology	QLJ-06184040-J0	11159001001	07-Dec-08	07-Dec-09
3534	Amplifier, low noise, 6 to 18 GHz	Quinstar Technology	QLJ-06184040-J0	11159001002	07-Dec-08	07-Dec-09
3559	Cable 40 GHz, SMA-SMA, 0.95 m, Blue	Gore	PHASEFLEX	03771245	10-Aug-09	10-Aug-10
3612	Cable RF, 17.5 m, N type-N type	Teldor	RG-214/U	NA	17-Nov-08	17-Nov-09
3624	Cable RF, 3.5 m, N type-N type, DC-6.5 GHz	Belden	MIL C-17	NA	17-Dec-08	17-Dec-09

10 APPENDIX B Measurement uncertainties

Expanded uncertainty at 95% confidence in Hermon Labs EMC measurements

Test description	Expanded uncertainty
Transmitter tests	
Carrier power conducted at antenna connector	± 1.7 dB
Carrier power radiated (substitution method)	± 4.5 dB
Occupied bandwidth	±8%
Conducted emissions at RF antenna connector	9 kHz to 2.9 GHz: ± 2.6 dB 2.9 GHz to 6.46 GHz: ± 3.5 dB 6.46 GHz to 13.2 GHz: ± 4.3 dB 13.2 GHz to 22.0 GHz: ± 5.0 dB 22.0 GHz to 26.8 GHz: ± 5.5 dB 26.8 GHz to 40.0 GHz: ± 4.8 dB
Spurious emissions radiated 30 MHz – 40 GHz (substitution method)	± 4.5 dB
Frequency error	30 – 300 MHz: ± 50.5 Hz (1.68 ppm) 300 – 1000 MHz: ± 168 Hz (0.56 ppm)
Transient frequency behaviour	187 Hz ± 13.9 %
Duty cycle, timing (Tx ON / OFF) and average factor measurements	± 1.0 %
Unintentional radiator tests	
Conducted emissions with LISN	9 kHz to 150 kHz: ± 3.9 dB 150 kHz to 30 MHz: ± 3.8 dB
Radiated emissions at 3 m measuring distance Horizontal polarization Vertical polarization	 Biconilog antenna: ± 5.3 dB Biconical antenna: ± 5.0 dB Log periodic antenna: ± 5.3 dB Double ridged horn antenna: ± 5.3 dB Biconilog antenna: ± 6.0 dB Biconical antenna: ± 5.7 dB Log periodic antenna: ± 6.0 dB Double ridged horn antenna: ± 6.0 dB

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), Registration Numbers 90624 for OATS and 90623 for the anechoic chamber; by Industry Canada for electromagnetic emissions (file numbers IC 2186A-1 for OATS and IC 2186A-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), has a status of a Telefication - Listed Testing Laboratory, Certificate No. L138/00. 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

FCC 47CFR part 90: 2008	Private land mobile radio services
FCC 47CFR part 1: 2008	Practice and procedure
FCC 47CFR part 2: 2008	Frequency allocations and radio treaty matters; general rules and regulations
FCC 47CFR part 15: 2008	Radio Frequency Devices.
ANSI C63.2: 1996	American National Standard for Instrumentation-Electromagnetic Noise and Field Strength, 10 kHz to 40 GHz-Specifications.
ANSI C63.4: 2003	American National Standard for Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz.
ANSI/TIA/EIA-603-C:2004	Land Mobile FM or PM Communications Equipment Measurement and Performance Standards

13 APPENDIX E Test equipment correction factors

Correction factor
Line impedance stabilization network
Model LISN 16 - 1
Hermon Laboratories, HL 0447

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

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

Antenna factor
Log periodic antenna
Electro-Metrics, model LPA-25/30
Ser.No.1988, HL 0034

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

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

Antenna Factor
Active Loop Antenna
EMC Test Systems, model 6502, S/N 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).
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
Standard gain horn antenna
Quinstar Technology
Model QWH, Ser.No.112, HL 0768, 0769

Frequency min, GHz	Frequency max, GHz	Antenna factor, dB(1/m)
18.000	26.500	32.01
26.500	40.000	35.48
40.000	60.000	39.03
60.000	90.000	42.55
90.000	140.000	46.23
140.000	220.000	50.11

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 guide horn antenna
Model 3115, serial number: 00027177, HL 2432

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

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

Antenna calibration
Sunol Sciences Inc., model JB3, serial number A022805, HL 2697

Frequency, MHz	ACF, dB	Gain, dBi	Num gain	Frequency, MHz	ACF, dB	Gain, dBi	Num gain	Frequency, MHz	ACF, dB	Gain, dBi	Num gain	Frequency, MHz	ACF, dB	Gain, dBi	Num gain	Frequency, MHz	ACF, dB	Gain, dBi	Num gain
30	22.2	-22.5	0.01	620	19.7	6.3	4.27	1215	24.9	7.0	5.05	1810	28.3	7.1	5.08	2405	30.9	6.9	4.93
35	18.5	-17.4	0.02	625	19.7	6.5	4.42	1220	24.9	7.0	4.99	1815	28.5	6.9	4.91	2410	30.9	6.9	4.89
40	14.7	-12.5	0.06	630	19.6	6.6	4.57	1225	25.1	6.9	4.91	1820	28.6	6.8	4.74	2415	31.0	6.9	4.85
45	11.3	-8.1	0.16	635	19.7	6.5	4.48	1230	25.2	6.8	4.82	1825	28.7	6.8	4.75	2420	31.0	6.8	4.82
45	11.3	-8.1	0.16	640	19.9	6.4	4.40	1235	25.1	7.0	4.96	1830	28.7	6.8	4.76	2425	31.1	6.8	4.81
50	8.9	-4.7	0.34	645	19.9	6.5	4.45	1240	25.0	7.1	5.09	1835	28.7	6.7	4.72	2430	31.0	6.9	4.87
55	7.9	-2.8	0.52	650	19.9	6.5	4.51	1245	25.0	7.1	5.12	1840	28.8	6.7	4.69	2435	31.0	6.9	4.88
60	7.8	-2.1	0.62	655	19.9	6.6	4.60	1250	25.0	7.1	5.15	1845	28.6	6.9	4.90	2440	31.2	6.8	4.74
65	8.5	-2.0	0.63	660	19.9	6.7	4.69	1255	25.0	7.2	5.25	1850	28.4	7.1	5.12	2445	31.1	6.9	4.91
70	9.0	-1.9	0.64	665	19.9	6.7	4.70	1260	24.9	7.3	5.36	1855	28.5	7.0	5.07	2450	31.0	7.0	4.96
75	8.8	-1.1	0.78	670	20.0	6.7	4.71	1265	25.0	7.3	5.31	1860	28.6	7.0	5.01	2455	31.0	7.0	5.01
80	8.4	-0.2	0.97	675	20.1	6.7	4.71	1270	25.1	7.2	5.26	1865	28.5	7.1	5.17	2460	30.9	7.2	5.19
85	8.0	0.8	1.20	680	20.1	6.7	4.71	1275	25.3	7.0	5.05	1870	28.4	7.3	5.33	2465	31.1	6.9	4.95
90	8.2	1.1	1.29	685	20.1	6.8	4.79	1280	25.5	6.8	4.84	1875	28.4	7.2	5.28	2470	31.3	6.8	4.76
95	9.2	0.5	1.13	690	20.1	6.9	4.88	1285	25.4	7.0	4.97	1880	28.5	7.2	5.22	2475	31.4	6.7	4.69
100	10.6	-0.4	0.92	695	20.2	6.8	4.82	1290	25.3	7.1	5.10	1885	28.5	7.2	5.22	2480	31.3	6.8	4.79
110	12.6	-1.6	0.70	705	20.4	6.8	4.75	1300	25.2	7.3	5.33	1895	28.6	7.2	5.24	2490	31.1	7.0	4.99
120	13.9	-2.1	0.62	715	20.5	6.8	4.80	1310	25.5	7.1	5.09	1905	28.5	7.3	5.36	2500	30.9	7.2	5.27
125	14.2	-2.0	0.63	720	20.5	6.9	4.85	1315	25.4	7.2	5.23	1910	28.5	7.4	5.45	2505	31.1	7.1	5.15
130	14.2	-1.7	0.68	725	20.6	6.8	4.81	1320	25.3	7.3	5.36	1915	28.5	7.3	5.38	2510	31.0	7.2	5.22
140	13.4	-0.3	0.94	735	20.9	6.7	4.65	1330	25.6	7.0	5.06	1925	28.6	7.3	5.35	2520	31.2	7.0	5.05
150	12.9	0.8	1.21	745	21.0	6.6	4.59	1340	25.7	7.1	5.09	1935	28.5	7.4	5.54	2530	31.0	7.3	5.37
160	12.7	1.6	1.44	755	21.0	6.8	4.74	1350	25.7	7.1	5.17	1945	28.5	7.5	5.59	2540	31.2	7.1	5.09
165	12.5	2.0	1.59	760	21.0	6.8	4.83	1355	25.8	7.0	5.06	1950	28.6	7.4	5.48	2545	31.0	7.3	5.43
170	12.2	2.6	1.83	765	21.1	6.8	4.73	1360	25.9	6.9	4.95	1955	28.6	7.5	5.57	2550	31.0	7.3	5.39
175	11.8	3.3	2.13	770	21.3	6.7	4.64	1365	26.0	6.9	4.95	1960	28.6	7.5	5.65	2555	31.1	7.2	5.30
180	11.6	3.7	2.36	775	21.3	6.7	4.68	1370	26.0	7.0	4.96	1965	28.7	7.4	5.47	2560	31.0	7.4	5.47
185	11.5	4.0	2.54	780	21.3	6.7	4.72	1375	26.0	7.0	5.01	1970	28.9	7.2	5.29	2565	30.8	7.6	5.70
190	11.6	4.2	2.61	785	21.3	6.8	4.77	1380	26.0	7.0	5.06	1975	28.9	7.2	5.22	2570	31.1	7.3	5.37
200	13.1	3.2	2.07	795	21.4	6.8	4.79	1390	26.1	6.9	4.92	1985	29.1	7.1	5.11	2580	31.6	6.9	4.87
205	12.0	4.4	2.76	800	21.5	6.8	4.77	1395	26.2	6.9	4.94	1990	29.1	7.0	5.06	2585	31.6	6.8	4.79
210	11.0	5.6	3.66	805	21.6	6.7	4.71	1400	26.2	7.0	4.96	1995	29.1	7.1	5.09	2590	31.6	6.9	4.88
215	11.3	5.6	3.59	810	21.7	6.7	4.65	1405	26.1	7.0	5.02	2000	29.1	7.1	5.11	2595	31.5	7.0	4.97
220	11.6	5.5	3.52	815	21.7	6.7	4.72	1410	26.1	7.1	5.09	2005	29.1	7.1	5.16	2600	31.6	6.9	4.86
225	11.7	5.5	3.55	820	21.7	6.8	4.80	1415	26.2	7.0	5.02	2010	29.1	7.1	5.15	2605	31.3	7.2	5.30
230	11.9	5.5	3.57	825	21.7	6.8	4.82	1420	26.3	7.0	4.96	2015	29.2	7.1	5.13	2610	31.4	7.1	5.15
235	12.1	5.5	3.56	830	21.7	6.9	4.85	1425	26.2	7.1	5.10	2020	29.2	7.1	5.18	2615	31.7	6.9	4.88
240	12.3	5.5	3.54	835	21.8	6.8	4.82	1430	26.1	7.2	5.25	2025	29.3	7.1	5.08	2620	31.6	7.0	4.97
245	12.3	5.7	3.71	840	21.9	6.8	4.80	1435	26.1	7.2	5.24	2030	29.3	7.0	5.05	2625	31.4	7.1	5.17
250	12.3	5.9	3.88	845	21.9	6.8	4.83	1440	26.2	7.2	5.24	2035	29.3	7.1	5.07	2630	31.6	7.0	5.00
255	12.5	5.9	3.85	850	21.9	6.9	4.86	1445	26.3	1	5.11	2040	29.3	7.1	5.13	2635	31.8	6.8	4.82
260	12.7	5.8	3.83	855	22.0	6.8	4.80	1450	26.5	7.0	4.98	2045	29.2	7.2	5.23	2640	31.7	7.0	4.98
265	13.2	5.5	3.54	860	22.1	6.8	4.74	1455	26.4	7.1	5.07	2050	29.2	7.2	5.27	2645	31.7	6.9	4.93
270	13.7	5.2	3.27	865	22.0	6.9	4.92	1460	26.4	7.1	5.17	2055	29.3	7.2	5.21	2650	31.8	6.9	4.85
275	13.7	5.3	3.39	870	21.9	7.1	5.11	1465	26.4	7.2	5.19	2060	29.5	7.0	5.02	2655	31.8	6.9	4.85
280	13.7	5.4	3.50	875	22.0	7.1	5.08	1470	26.4	7.2	5.22	2065	29.4	7.1	5.08	2660	31.7	7.0	5.02
285	13.7	5.6	3.61	880	22.1	7.0	5.05	1475	26.4	7.1	5.17	2070	29.4	7.1	5.10	2665	32.0	6.7	4.71
290	13.7	5.7	3.72	885	22.1	7.0	5.06	1480	26.5	7.1	5.12	2075	29.5	7.0	5.01	2670	32.0	6.7	4.67
295	13.8	5.8	3.77	890	22.1	7.0	5.06	1485	26.5	7.1	5.14	2080	29.8	6.8	4.76	2675	31.9	6.8	4.81
300	13.9	5.8	3.81	895	22.2	7.1	5.09	1490	26.5	7.1	5.17	2085	29.7	6.9	4.89	2680	31.7	7.0	5.04
305	14.0	5.9	3.85	900	22.2	7.1	5.12	1495	26.5	7.2	5.24	2090	29.7	6.9	4.86	2685	31.9	6.8	4.83
310	14.1	5.9	3.88	905	22.3	7.1	5.09	1500	26.5	7.2	5.31	2095	29.8	6.8	4.78	2690	32.1	6.7	4.72
315	14.3	5.9	3.89	910	22.3	7.0	5.05	1505	26.5	7.2	5.27	2100	29.9	6.8	4.75	2695	32.1	6.7	4.71
320	14.4	5.9	3.90	915	22.4	7.0	4.99	1510	26.6	7.2	5.23	2105	29.8	6.8	4.81	2700	32.0	6.8	4.81
325	14.5	5.9	3.92	920	22.6	6.9	4.92	1515	26.6	7.2	5.30	2110	29.9	6.8	4.78	2705	32.0	6.8	4.80
330	14.6	5.9	3.93	925	22.7	6.9	4.85	1520	26.5	7.3	5.38	2115	29.9	6.8	4.76	2710	32.1	6.8	4.79
335	14.7	6.0	4.02	930	22.8	6.8	4.77	1525	26.6	7.3	5.37	2120	29.9	6.8	4.84	2715	32.1	6.7	4.71
340	14.7	6.2	4.12	935	22.8	6.8	4.83	1530	26.6	7.3	5.36	2125	29.9	6.9	4.89	2720	32.4	6.5	4.47
345	14.9	6.1	4.06	940	22.8	6.9	4.89	1535	26.6	7.4	5.44	2130	29.9	6.9	4.90	2725	32.2	6.7	4.63
350	15.1	6.0	3.99	945	22.8	6.9	4.87	1540	26.5	7.4	5.53	2135	29.8	6.9	4.94	2730	31.9	7.0	5.05
355	15.3	5.9	3.88	950	22.9	6.9	4.85	1545	26.5	7.5	5.58	2140	29.8	7.1	5.08	2735	31.6	7.4	5.44
360	15.6	5.8	3.78	955	23.0	6.8	4.81	1550	26.5	7.5	5.63	2145	29.9	6.9	4.92	2740	31.6	7.1	5.46
365	15.5	5.9	3.89	960	23.1	6.8	4.77	1555	26.7	7.3	5.39	2150	29.9	7.0	4.98	2745	31.9	7.0	5.06
370	15.5	6.0	4.01	965	23.1	6.7	4.73	1560	26.9	7.1	5.16	2155	29.8	7.1	5.10	2750	32.0	6.9	4.94
375	15.6	6.1	4.03	970	23.2	6.7	4.69	1565	26.9	7.2	5.23	2160	29.8	7.1	5.09	2755	32.0	7.0	4.98
380	15.7	6.1	4.05	975	23.3	6.6	4.62	1570	26.9	7.2	5.30	2165	29.9	7.0	5.00	2760	32.0	7.0	5.06
385	15.7	6.2	4.15	980	23.5	6.6	4.54	1575	27.0	7.2	5.23	2170	29.9	7.1	5.07	2765	32.2	6.8	4.80
390	15.7	6.3	4.25	985	23.5	6.6	4.52	1580	27.0	7.1	5.17	2175	29.8	7.2	5.20	2770	32.3	6.8	4.73
395	15.9	6.3	4.22	990	23.6	6.5	4.50	1585	27.0	7.2	5.20	2180	29.8	7.2	5.27	2775	32.3	6.8	4.77
400	16.0	6.2	4.18	995	23.6	6.5	4.48	1590	27.0	7.2	5.22	2185	29.8	7.2	5.27	2780	32.3	6.8	4.82
405	16.3	6.1	4.07	1000	23.7	6.5	4.46	1595	27.0	7.2	5.29	2190	29.8	7.2	5.28	2785	32.7	6.4	4.41
410	16.5	6.0	3.96	1005	23.7	6.5	4.51	1600	27.0	7.3	5.36	2195	29.8	7.2	5.30	2790	32.8	6.3	4.25
415	16.5	6.0	4.00	1010	23.7	6.6	4.57	1605	27.0	7.3	5.38	2200	29.7	7.3	5.38	2795	32.8	6.4	4.33
420	16.6	6.1	4.03	1015	23.7	6.6	4.55	1610	27.0	7.3	5.41	2205	29.7	7.3	5.41	2800	32.5	6.7	4.66
425	16.6	6.1	4.10	1020	23.8	6.6	4.54	1615	27.1	7.3	5.33	2210	29.7	7.4	5.47	2805	32.5	6.6	4.62
430	16.7	6.2	4.16	1025	23.8	6.6	4.62	1620	27.2	7.2	5.27	2215	29.7	7.4	5.54	2810	32.5	6.7	4.70
435	16.9	6.1	4.05	1030	23.7	6.7	4.70	1625	27.2	7.2	5.30	2220	29.7	7.5	5.57	2815	32.3	6.9	4.85
440	17.1	5.9	3.93	1035	23.7	6.8	4.81	1630	27.2	7.3	5.33	2225	29.8	7.3	5.43	2820	32.2	7.0	5.01
445	17.2	6.0	3.97	1040	23.6	6.9	4.92	1635	27.2	7.3	5.35	2230	29.8	7.4	5.45	2825	32.3	7.0	4.96
450	17.2	6.0	4.00	1045	23.7	6.9	4.91	1640	27.2	7.3	5.36	2235	29.7	7.5	5.61	2830	32.4	6.8	4.80
455	17.3	6.1	4.04	1050	23.7	6.9	4.91	1645	27.3	7.2	5.22	2240	29.5	7.7	5.86	2835	32.5	6.7	4.68
460	17.4	6.1	4.07	1055	23.7	7.0	5.01	1650	27.5	7.1	5.09	2245	29.8	7.4	5.53	2840	32.5	6.8	4.78
465	17.5	6.1	4.05	1060	23.6	7.1	5.11	1655	27.5	7.1	5.11	2250	30.0	7.3	5.35	2845	32.6	6.6	4.62
470	17.6	6.1	4.04	1065	23.7	7.0	5.06	1660	27.5	7.1	5.13	2255	30.0	7.2	5.28	2850	32.6	6.7	4.70
475	17.7	6.0	3.99	1070	23.8	7.0	5.01	1665	27.6	7.0	5.06	2260	30.1	7.2	5.24	2855	32.4	6.9	4.88
480	17.9	5.9	3.93	1075	23.8	7.0	5.01	1670	27.7	7.0	4.99	2265	30.1	7.2	5.20	2860	32.4	7.0	4.98
485	18.0	5.9	3.88	1080	23.9	7.0	5.01	1675	27.7	7.0	5.02	2270	30.2	7.1	5.12	2865	32.8	6.5	4.52
490	18.2	5.8	3.82	1085	24.0	7.0	4.96	1680	27.7	7.0	5.05	2275	30.3	7.0	5.05	2870	33.0	6.3	4.30
495	18.0	6.0	4.02	1090	24.0	6.9	4.91	1685	27.7	7.0	5.01	2280	30.0	7.0	5.06	2875	33.0	6.4	4.38
500	17.9	6.3	4.23	1095	24.1	6.9	4.86	1690	27.8	7.0	4.98	2285	30.3	7.0	5.05	2880	32.5	6.9	4.87
505	17.9	6.3	4.29	1100	24.2	6.8	4.82	1695	27.8	7.0	5.01	2290	30.3	7.1	5.07	2885	33.0	6.4	4.40
510	18.0	6.4	4.36	1105	24.3	6.8	4.80	1700	27.8	7.0	5.03	2295	30.3	7.1	5.13	2890	33.1	6.3	4.28
515	18.1	6.4	4.34	1110	24.3	6.8	4.78	1705	27.8	7.1	5.09	2300	30.2	7.2	5.23	2895	33.1	6.4	4.34
520	18.2	6.4	4.32	1115	24.3	6.8	4.79	1710	27.7	7.1	5.16	2305	30.3	7.2	5.20	2900	33.0	6.4	4.41
525	18.2	6.4	4.36	1120	24.4	6.8	4.80	1715	27.8	7.1	5.08	2310	30.2	7.3	5.35	2905	32.9	6.6	4.58
530	18.3	6.4	4.39	1125	24.3	6.9	4.90	1720	27.9	7.0	5.00	2315	30.1	7.4	5.45	2910	32.9	6.5	4.51
535	18.3	6.4	4.41	1130	24.3	7.0	5.00	1725	28.0	7.0	4.99	2320	30.3	7.2	5.27	2915	33.1	6.4	4.33
540	18.4	6.4	4.41	1135	24.4	6.9	4.90	1730	28.0	7.0	4.98	2325	304	7.2	5.22	2920	33.3	6.2	4.16
545	18.4	6.5	4.47	1140	24.5	6.8	4.81	1735	28.0	7.0	5.02	2330	30.4	7.1	5.13	2925	33.0	6.5	4.45
550	18.4	6.6	4.53	1145	24.6	6.8	4.76	1740	28.0	7.1	5.07	2335	30.5	7.0	5.07	2930	33.0	6.5	4.51
555	18.6	6.5	4.45	1150	24.7	6.7	4.71	1745	28.0	7.0	5.04	2340	30.5	7.1	5.11	2935	33.0	6.5	4.48
560	18.8	6.4	4.37	1155	24.7	6.8	4.76	1750	28.1	7.0	5.01	2345	30.6	7.0	5.07	2940	33.0	6.5	4.52
565	18.9	6.4	4.33	1160	24.7	6.8	4.80	1755	27.9	7.1	5.17	2350	30.5	7.1	5.12	2945	33.1	6.5	4.42
570	19.0	6.3	4.28	1165	24.7	6.8	4.81	1760	27.8	7.3	5.34	2355	30.6	7.1	5.08	2950	33.2	6.4	4.32
575	19.1	6.3	4.31	1170	24.7	6.8	4.81	1765	27.9	7.3	5.31	2360	30.9	6.8	4.79	2955	33.3	6.3	4.27
580	19.1	6.4	4.33	1175	24.8	6.8	4.84	1770	27.9	7.2	5.28	2365	31.0	6.7	4.66	2960	33.3	6.3	4.30
590	19.1	6.6	4.52	1185	24.8	6.9	4.92	1780	27.9	7.3	5.35	2375	31.1	6.6	4.60	2970	33.3	6.4	4.36
595	19.0	6.6	4.62	1190	24.7	7.0	4.99	1785	28.1	7.2	5.21	2380	31.1	6.6	4.61	2975	33.0	6.6	4.60
600	19.0	6.7	4.72	1195	24.7	7.0	5.02	1790	28.2	7.0	5.07	2385	31.1	6.7	4.62	2980	32.9	6.8	4.74
610	19.1	6.8	4.76	1205	24.08	7.1	5.08	1800	28.3	7.0	5.06	2395	31.2	6.6	4.60	2990	32.9	6.8	4.82
615	19.4	6.5	4.51	1210	24.8	7.1	5.11	1805	28.3	7.1	5.07	2400	30.9	6.9	4.93	3000	33.4	6.4	4.33

Cable loss
Cable Coaxial, RG-58/RG-214, s/n 056, HL 0415
+ Cable Coaxial, RG-214, 11.5m, s/n 148, HL 0812

No.	Frequency, MHz	Cable loss, dB	Measured uncertainty, dB
1	20	0.73	±0.12
2	30	0.91	
3	50	1.2	
4	80	1.56	
5	100	1.76	
6	200	2.59	
7	300	3.26	
8	400	3.93	
9	500	4.42	
10	600	4.92	
11	700	5.36	
12	800	5.88	
13	900	6.41	
14	1000	6.71	
15	1500	8.63	
16	2000	10.39	

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

Frequency, MHz	Cable loss, dB	Frequency, MHz	Cable loss, dB	Frequency, MHz	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, Bird, 18 GHz, N-type, M-F, model TC-MNFN-3.0, S/N 211539 003
HL 2883

Frequency, MHz	Cable loss, dB	Frequency, MHz	Cable loss, dB	Frequency, MHz	Cable loss, dB
10	0.06	5750	1.70	12000	2.46
30	0.12	6000	1.75	12250	2.48
100	0.21	6250	1.80	12500	2.52
250	0.34	6500	1.81	12750	2.50
500	0.47	6750	1.86	13000	2.54
750	0.59	7000	1.86	13250	2.48
1000	0.67	7250	1.92	13500	2.63
1250	0.76	7500	1.96	13750	2.65
1500	0.84	7750	1.98	14000	2.72
1750	0.92	8000	2.02	14250	2.67
2000	0.98	8250	2.03	14500	2.70
2250	1.05	8500	2.05	14750	2.72
2500	1.12	8750	2.11	15000	2.79
2750	1.17	9000	2.17	15250	2.80
3000	1.22	9250	2.17	15500	2.83
3250	1.27	9500	2.20	15750	2.75
3500	1.33	9750	2.19	16000	2.82
3750	1.38	10000	2.22	16250	2.85
4000	1.42	10250	2.25	16500	2.90
4250	1.46	10500	2.30	16750	2.89
4500	1.51	10750	2.28	17000	2.88
4750	1.54	11000	2.32	17250	2.85
5000	1.59	11250	2.34	17500	2.96
5250	1.62	11500	2.39	17750	3.04
5500	1.65	11750	2.42	18000	3.04

Cable loss
Cable coaxial, Gore, 18 GHz, 0.9 m, SMA-SMA, S/N 10020014
HL 2951

Frequency, MHz	Cable loss, dB	Frequency, MHz	Cable loss, dB	Frequency, MHz	Cable loss, dB
10	0.07	5750	0.77	12000	1.23
30	0.06	6000	0.78	12250	1.25
100	0.09	6250	0.81	12500	1.26
250	0.15	6500	0.83	12750	1.26
500	0.21	6750	0.84	13000	1.30
750	0.27	7000	0.85	13250	1.30
1000	0.31	7250	0.88	13500	1.30
1250	0.36	7500	0.88	13750	1.29
1500	0.38	7750	0.93	14000	1.23
1750	0.42	8000	0.92	14250	1.32
2000	0.44	8250	0.94	14500	1.27
2250	0.47	8500	0.99	14750	1.27
2500	0.50	8750	0.97	15000	1.34
2750	0.52	9000	1.01	15250	1.36
3000	0.54	9250	1.05	15500	1.35
3250	0.57	9500	1.08	15750	1.36
3500	0.58	9750	1.10	16000	1.43
3750	0.61	10000	1.09	16250	1.38
4000	0.63	10250	1.09	16500	1.42
4250	0.66	10500	1.07	16750	1.49
4500	0.68	10750	1.10	17000	1.53
4750	0.70	11000	1.09	17250	1.59
5000	0.71	11250	1.09	17500	1.65
5250	0.74	11500	1.13	17750	1.82
5500	0.77	11750	1.12	18000	2.09

Cable loss
Cable coaxial, Microwave, SMA-SMA, 18 GHz, 1.0 m
Gore, HL 3472

Frequency, MHz	Cable loss, dB	Frequency, MHz	Cable loss, dB	Frequency, MHz	Cable loss, dB	Frequency, MHz	Cable loss, dB
10	0.01	5000	0.47	10200	0.72	15500	0.75
30	0.03	5100	0.47	10300	0.67	15600	0.89
50	0.04	5200	0.47	10400	0.77	15700	0.82
100	0.04	5300	0.47	10500	0.67	15800	0.89
200	0.08	5400	0.49	10600	0.74	15900	0.89
300	0.11	5500	0.48	10700	0.81	16000	0.93
400	0.11	5600	0.49	10800	0.77	16100	0.90
500	0.12	5700	0.49	10900	0.82	16200	0.92
600	0.14	5800	0.51	11000	0.86	16300	0.90
700	0.15	5900	0.50	11100	0.78	16400	0.94
800	0.16	6000	0.51	11200	0.82	16500	0.93
900	0.18	6100	0.53	11300	0.77	16600	0.95
1000	0.17	6200	0.52	11400	0.84	16700	0.98
1100	0.19	6300	0.53	11500	0.74	16800	1.00
1200	0.22	6400	0.54	11600	0.81	16900	0.94
1300	0.21	6500	0.55	11700	0.73	17000	1.00
1400	0.22	6600	0.54	11800	0.75	17100	0.93
1500	0.23	6700	0.57	11900	0.73	17200	1.00
1600	0.24	6800	0.54	12000	0.75	17300	0.93
1700	0.24	6900	0.58	12100	0.66	17400	0.93
1800	0.25	7000	0.58	12200	0.66	17500	0.96
1900	0.26	7100	0.58	12300	0.72	17600	0.94
2000	0.28	7200	0.61	12400	0.64	17700	0.99
2100	0.27	7300	0.59	12500	0.75	17800	0.97
2200	0.29	7400	0.55	12600	0.67	17900	0.90
2300	0.29	7500	0.63	12700	0.75	18000	0.78
2400	0.30	7600	0.60	12800	0.66		
2500	0.30	7700	0.61	12900	0.81		
2600	0.32	7800	0.64	13000	0.75		
2700	0.32	7900	0.60	13100	0.80		
2800	0.33	8000	0.58	13200	0.80		
2900	0.34	8100	0.61	13300	0.81		
3000	0.34	8200	0.62	13400	0.88		
3100	0.35	8300	0.62	13500	0.82		
3200	0.35	8400	0.68	13600	1.00		
3300	0.36	8500	0.63	13700	0.93		
3400	0.37	8600	0.61	13800	0.86		
3500	0.38	8700	0.63	13900	0.84		
3600	0.38	8800	0.62	14000	1.00		
3700	0.40	8900	0.64	14100	0.86		
3800	0.40	9000	0.62	14200	0.98		
3900	0.40	9100	0.64	14300	0.99		
4000	0.40	9200	0.62	14400	0.82		
4100	0.43	9300	0.62	14600	0.89		
4200	0.43	9400	0.62	14700	0.84		
4300	0.43	9500	0.63	14800	0.90		
4400	0.44	9600	0.64	14900	0.89		
4500	0.45	9700	0.60	15000	0.89		
4600	0.45	9800	0.65	15100	0.86		
4700	0.46	9900	0.60	15200	0.87		
4800	0.46	10000	0.67	15300	0.86		
4900	0.46	10100	0.69	15400	0.87		

Cable loss
Cable coaxial, Microwave, SMA-SMA, 18 GHz, 0.6 m
Gore, HL 3473

Frequency, MHz	Cable loss, dB	Frequency, MHz	Cable loss, dB	Frequency, MHz	Cable loss, dB	Frequency, MHz	Cable loss, dB
10	0.01	5000	0.48	10200	0.72	15500	0.85
30	0.03	5100	0.48	10300	0.70	15600	0.93
50	0.04	5200	0.48	10400	0.75	15700	0.87
100	0.04	5300	0.48	10500	0.68	15800	0.88
200	0.08	5400	0.50	10600	0.77	15900	0.94
300	0.11	5500	0.48	10700	0.80	16000	0.94
400	0.12	5600	0.50	10800	0.77	16100	0.99
500	0.13	5700	0.50	10900	0.85	16200	0.96
600	0.15	5800	0.52	11000	0.83	16300	0.96
700	0.15	5900	0.51	11100	0.79	16400	0.94
800	0.17	6000	0.52	11200	0.82	16500	0.94
900	0.19	6100	0.54	11300	0.79	16600	1.03
1000	0.18	6200	0.53	11400	0.81	16700	1.04
1100	0.20	6300	0.54	11500	0.76	16800	1.07
1200	0.22	6400	0.55	11600	0.78	16900	0.94
1300	0.22	6500	0.56	11700	0.74	17000	1.05
1400	0.23	6600	0.56	11800	0.76	17100	0.96
1500	0.24	6700	0.60	11900	0.79	17200	1.07
1600	0.25	6800	0.55	12000	0.74	17300	0.98
1700	0.25	6900	0.60	12100	0.69	17400	1.16
1800	0.26	7000	0.59	12200	0.69	17500	1.05
1900	0.27	7100	0.60	12300	0.75	17600	1.13
2000	0.29	7200	0.61	12400	0.66	17700	1.05
2100	0.28	7300	0.60	12500	0.76	17800	1.22
2200	0.30	7400	0.57	12600	0.70	17900	1.02
2300	0.30	7500	0.63	12700	0.77	18000	1.04
2400	0.31	7600	0.60	12800	0.69		
2500	0.31	7700	0.63	12900	0.79		
2600	0.33	7800	0.66	13000	0.81		
2700	0.33	7900	0.61	13100	0.83		
2800	0.35	8000	0.58	13200	0.80		
2900	0.35	8100	0.62	13300	0.82		
3000	0.35	8200	0.62	13400	0.90		
3100	0.35	8300	0.63	13500	0.85		
3200	0.36	8400	0.67	13600	1.04		
3300	0.38	8500	0.63	13700	0.93		
3400	0.38	8600	0.61	13800	0.91		
3500	0.40	8700	0.64	13900	0.89		
3600	0.40	8800	0.62	14000	0.96		
3700	0.40	8900	0.64	14100	0.88		
3800	0.41	9000	0.64	14200	1.01		
3900	0.41	9100	0.64	14300	0.99		
4000	0.41	9200	0.63	14400	0.83		
4100	0.45	9300	0.63	14600	0.88		
4200	0.43	9400	0.63	14700	0.91		
4300	0.46	9500	0.64	14800	0.91		
4400	0.44	9600	0.65	14900	0.88		
4500	0.47	9700	0.62	15000	0.89		
4600	0.46	9800	0.66	15100	0.91		
4700	0.47	9900	0.61	15200	0.88		
4800	0.47	10000	0.70	15300	0.94		
4900	0.48	10100	0.70	15400	0.91		

Cable loss
Cable coaxial, GORE, PHASEFLEX, 40 GHz, 0.95 m, SMA-SMA, S/N 03771245
HL 3559

Frequency, MHz	Cable loss, dB	Frequency, MHz	Cable loss, dB	Frequency, MHz	Cable loss, dB	Frequency, MHz	Cable loss,dB
30	0.08	10000	0.96	20500	1.59	31000	2.24
100	0.10	10500	0.99	21000	1.63	31500	2.71
500	0.22	11000	1.02	21500	1.70	32000	2.47
1000	0.32	11500	1.07	22000	1.71	32500	2.37
1500	0.40	12000	1.13	22500	1.60	33000	2.35
2000	0.41	12500	1.16	23000	1.58	33500	2.34
2500	0.44	13000	1.26	23500	1.64	34000	2.31
3000	0.53	13500	1.26	24000	1.68	34500	2.43
3500	0.54	14000	1.22	24500	1.79	35000	2.45
4000	0.62	14500	1.26	25000	1.86	35500	2.48
4500	0.62	15000	1.27	25500	1.77	36000	3.60
5000	0.67	15500	1.29	26000	1.78	36500	2.62
5500	0.70	16000	1.39	26500	1.83	37000	2.45
6000	0.72	16500	1.50	27000	1.87	37500	2.47
6500	0.76	17000	1.49	27500	1.97	38000	2.38
7000	0.83	17500	1.37	28000	2.69	38500	2.41
7500	0.85	18000	1.40	28500	1.94	39000	2.56
8000	0.89	18500	1.41	29000	2.02	39500	2.71
8500	0.91	19000	1.48	29500	2.05	40000	2.69
9000	0.95	19500	1.61	30000	2.11		
9500	0.96	20000	1.59	30500	2.11		

Cable loss
Cable coaxial, RG-214/U, N type-N type, 17 m
Teldor, HL 3612

Frequency, GHz	Cable loss, dB
0.1	0.05
0.5	0.07
1	0.10
3	0.22
5	0.29
10	0.39
30	0.68
50	0.90
100	1.27
150	1.58
200	1.80
250	2.12
300	2.36
350	2.60
400	2.82
450	2.99
500	3.23
550	3.40
600	3.56
650	3.71
700	3.90
750	4.04
800	4.23
850	4.39
900	4.55
950	4.65
1000	4.79

Cable loss
Cable coaxial, MIL C-17, N type-N type, 2.7 m
Belden, HL 3624

Frequency, MHz	Cable loss, dB	Frequency, MHz	Cable loss, dB	Frequency, MHz	Cable loss, dB	Frequency, MHz	Cable loss, dB
10	0.08	1750	1.79	3550	3.02	5350	4.19
30	0.13	1800	1.83	3600	3.10	5400	4.13
50	0.18	1850	1.88	3650	3.12	5450	4.22
100	0.27	1900	1.90	3700	3.10	5500	4.32
150	0.35	1950	1.94	3750	3.18	5550	4.32
200	0.42	2000	1.96	3800	3.24	5600	4.27
250	0.47	2050	2.02	3850	3.26	5650	4.40
300	0.54	2100	2.04	3900	3.24	5700	4.42
350	0.60	2150	2.08	3950	3.35	5750	4.42
400	0.66	2200	2.10	4000	3.39	5800	4.45
450	0.71	2250	2.15	4050	3.40	5850	4.54
500	0.75	2300	2.19	4100	3.36	5900	4.61
550	0.81	2350	2.22	4150	3.49	5950	4.62
600	0.86	2400	2.24	4200	3.54	6000	4.53
650	0.90	2450	2.28	4250	3.46	6050	4.63
700	0.94	2500	2.32	4300	3.53	6100	4.71
750	1.01	2550	2.34	4350	3.70	6150	4.68
800	1.06	2600	2.39	4400	3.67	6200	4.65
850	1.10	2650	2.42	4450	3.58	6250	4.77
900	1.13	2700	2.44	4500	3.66	6300	4.76
950	1.20	2750	2.47	4550	3.78	6350	4.77
1000	1.23	2800	2.50	4600	3.75	6400	4.77
1050	1.26	2850	2.54	4650	3.70	6450	4.89
1100	1.31	2900	2.59	4700	3.80	6500	4.91
1150	1.38	2950	2.61	4750	3.86		
1200	1.51	3000	2.63	4800	3.89		
1250	1.45	3050	2.71	4850	3.80		
1300	1.47	3100	2.72	4900	3.92		
1350	1.49	3150	2.73	4950	3.97		
1400	1.55	3200	2.80	5000	3.98		
1450	1.59	3250	2.84	5050	3.94		
1500	1.62	3300	2.85	5100	4.08		
1550	1.64	3350	2.87	5150	4.12		
1600	1.70	3400	2.94	5200	4.04		
1650	1.74	3450	2.98	5250	4.05		
1700	1.75	3500	2.98	5300	4.26		

14 APPENDIX F Abbreviations and acronyms

A	ampere
AC	alternating current
A/m	ampere per meter
AM	amplitude modulation
AVRG	average (detector)
BB	broad band
cm	centimeter
dB	decibel
dBm	decibel referred to one milliwatt
dB(μV)	decibel referred to one microvolt
dB(μV/m)	decibel referred to one microvolt per meter
dB(μA)	decibel referred to one microampere
dBΩ	decibel referred to one Ohm
DC	direct current
EIRP	equivalent isotropically radiated power
ERP	effective radiated power
EUT	equipment under test
F	frequency
GHz	gigahertz
GND	ground
H	height
HL	Hermon laboratories
Hz	hertz
ITE	information technology equipment
k	kilo
kHz	kilohertz
LO	local oscillator
m	meter
MHz	megahertz
min	minute
mm	millimeter
ms	millisecond
μs	microsecond
NA	not applicable
NB	narrow band
NT	not tested
OATS	open area test site
Ω	Ohm
QP	quasi-peak
PCB	printed circuit board
PM	pulse modulation
PS	power supply
RE	radiated emission
RF	radio frequency
rms	root mean square
Rx	receive
s	second
T	temperature
Tx	transmit
V	volt
VA	volt-ampere

END OF DOCUMENT