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839.01
Electrical

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TEST REPORT

ACCORDING TO: FCC CFR 47 Part 90

FOR:

Elta Systems Ltd.

Radar

Model:ELM-2107

Table of contents

1 Applicant information

Client name:	Elta Systems Ltd.
Address:	100 Yitzhack Hanassi Blvd., P.O.B. 330, Ashdod, 77102, Israel
Telephone:	+972 8857 2891
Fax:	+972 8857 2798
E-mail:	motif@elta.co.il
Contact name:	Mr. Moti Faivelovitz

2 Equipment under test attributes

Product name:	Radar
Model(s):	ELM-2107
Serial number:	236
Hardware version:	PN 1021E500-001
Software release:	3_0_541
Receipt date	10/22/2009

3 Manufacturer information

Manufacturer name:	Elta Systems Ltd.
Address:	100 Yitzhack Hanassi Blvd., P.O.B. 330, Ashdod, 77102, Israel
Telephone:	+972 8857 2891
Fax:	+972 8857 2798
E-Mail:	motif@elta.co.il
Contact name:	Mr. Moti Faivelovitz

4 Test details

Project ID:	20144
Location:	Hermon Laboratories Ltd. Harakevet Industrial Zone, Binyamina 30500, Israel
Test started:	10/22/2009
Test completed:	11/11/2009
Test specification(s):	47CFR Part 90

5 Tests summary

Test	Status
Transmitter characteristics	
Section 90.205, Maximum output power	Pass
Section 90.209, Occupied bandwidth	Pass
Section 90.210, Emission mask	Pass
Section 90.210, Radiated spurious emissions	Pass
Section 90.210, Conducted spurious emissions	Pass
Section 90.213, Frequency stability	Pass
Section 90.214, Transient frequency behaviour	Not required
Section 2.1091, RF radiation exposure evaluation	Pass

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	November 5, 2009	
Reviewed by:	Mrs. M. Cherniavsky, certification engineer	November 15, 2009	
Approved by:	Mr. M. Nikishin, EMC and Radio group leader	November 16, 2009	

6 EUT description

6.1 General information

The EUT, human detection system (HDS) is a sensor that detects and automatically alerts entering and outgoing moving persons and vehicles within defined preset boundaries. The radar is comprised of a transceiver LRU (Large Replaceable Unit) connected to an antennae array module that were designed to be mounted on top of a mast, buildings or any other static component of infrastructure.

6.2 Ports and lines

Port type	Port description	Conn. from	Conn. to	Qty.	Cable type	Cable length	Indoor / outdoor
Power + Data	DC Power + Control	EUT	Laptop and DC Power supply	1	Shielded	10	Outdoor
RF (Rx)	Antenna	EUT	Antenna	2	Coax	0.25	Outdoor
RF (Tx)	Antenna	EUT	Termination	1	Coax	NA	Outdoor

6.3 Support and test equipment

Description	Manufacturer	Model number	Serial number
Power supply	Horizon	DHR 36-1	5361231
Laptop	IBM	T22	55Y8X6F 110

6.4 Changes made in the EUT

No changes were implemented in the EUT.

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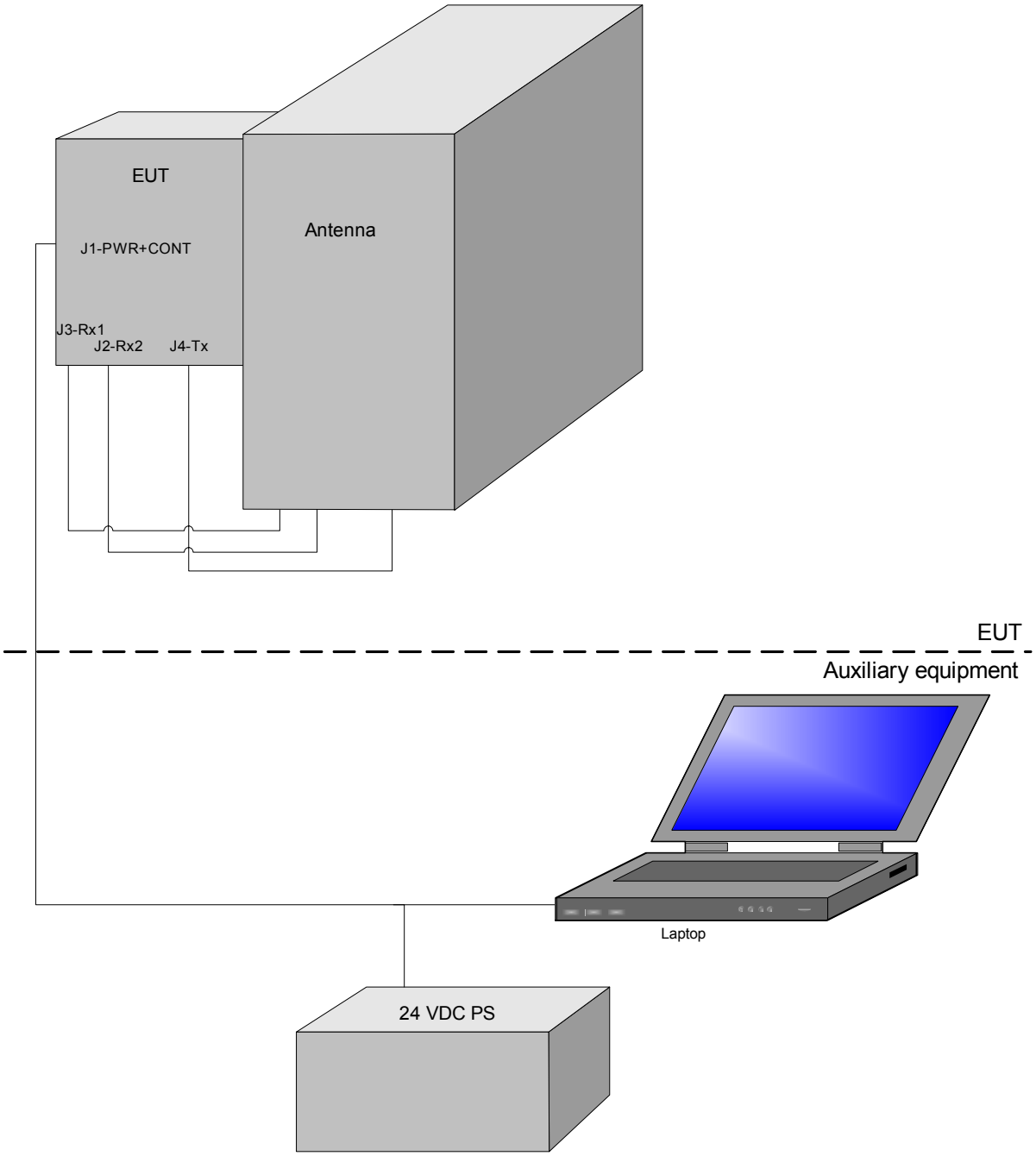
6.5 Test configuration



6.6 Transmitter characteristics

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

Intended use		**Condition of use**
V	fixed	Always at a distance more than 2 m from all people
	mobile	Always at a distance more than 20 cm from all people
	portable	May operate at a distance closer than 20 cm to human body

Assigned frequency range	5250 –5500 MHz
Operating frequency range	5394.375 – 5406.250 MHz

Maximum rated output power	At transmitter 50 Ω RF output connectors	20.1 dBm

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

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

Antenna/s technical characteristics			
Type	Manufacturer	Model number	Gain
Printed Patch	Elta Systems Ltd.	1021E530-001	13 dBi

Type of modulation	FM				
Maximum transmitter duty cycle in normal use	100%	**Tx ON time**		**Period**	
Transmitter duty cycle supplied for test	100%				

Transmitter power source					
		Nominal rated voltage		Battery type	
V	DC	**Nominal rated voltage**	Via 24 V DC power supply powered from the mains		
	AC mains	**Nominal rated voltage**		Frequency	

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

Test specification:	Section 90.205, 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:	11/11/2009 9:34:46 AM		
Temperature: 26.3 ºC	Air Pressure: 1012 hPa	Relative Humidity: 36 %	Power Supply: 24 VDC
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 at RF antenna connector. Specification test limits are given in Table 7.1.1.

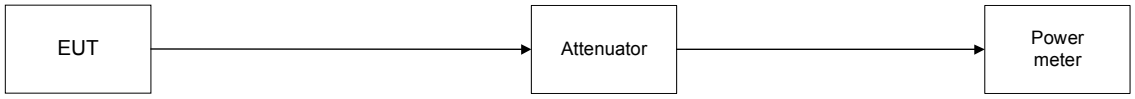
Table 7.1.1 Peak output power limits

Assigned frequency range, MHz	Maximum peak output power	
	W	dBm
5250.00 – 5500.00	NA	NA

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.

Figure 7.1.1 Peak output power test setup



Test specification:	Section 90.205, 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:	11/11/2009 9:34:46 AM		
Temperature: 26.3 ºC	Air Pressure: 1012 hPa	Relative Humidity: 36 %	Power Supply: 24 VDC
Remarks:			

Table 7.1.2 Peak output power test results

OPERATING FREQUENCY RANGE:	5250 – 5500 MHz
DETECTOR USED:	Peak / Average
RESOLUTION BANDWIDTH:	NA
VIDEO BANDWIDTH:	NA
MODULATION:	FM
TRANSMITTER OUTPUT POWER SETTINGS:	Maximum

Carrier frequency, MHz	Power Meter reading, Peak Value dBm	Power Meter reading, Average Value dBm	External attenuation, dB	RF output power Peak, dBm	Limit, dBm	Margin, dB	Verdict
5394.375	20.10	19.68	Included	20.10	NA	NA	Pass
5406.250	20.07	19.67	Included	20.07	NA	NA	Pass

Reference numbers of test equipment used

HL 3301	HL 3302	HL 3437	HL 3440				

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:	11/3/2009 10:27:26 AM		
Temperature: 25.8 ºC	Air Pressure: 1012 hPa	Relative Humidity: 36 %	Power Supply: 24 VDC
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.

Table 7.2.1 Occupied bandwidth limits

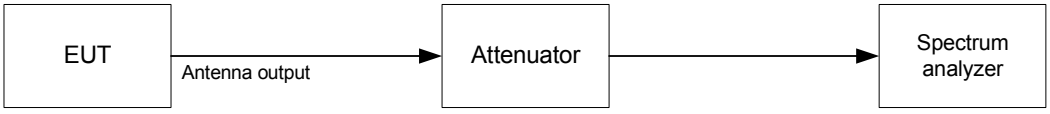
Assigned frequency, MHz	Modulation envelope reference points*, dBc	Maximum allowed bandwidth, kHz
5250 – 5500	26	NA

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

7.2.2 Test procedure

7.2.2.1 The EUT was set up as shown in Figure 7.2.1, energized and its proper operation was checked.
7.2.2.2 The EUT was set to transmit the unmodulated carrier and the reference peak power level was measured.
7.2.2.3 The EUT was set to transmit the normally modulated carrier.
7.2.2.4 The transmitter occupied bandwidth was measured with spectrum analyzer as a frequency delta between the reference points on modulation envelope and provided in Table 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:	11/3/2009 10:27:26 AM		
Temperature: 25.8 ºC	Air Pressure: 1012 hPa	Relative Humidity: 36 %	Power Supply: 24 VDC
Remarks:			

Table 7.2.2 Occupied bandwidth test results

DETECTOR USED:	Peak hold
RESOLUTION BANDWIDTH:	3000 kHz
VIDEO BANDWIDTH:	3000 kHz
MODULATION ENVELOPE REFERENCE POINTS:	26 dBc
MODULATION:	FM
MODULATING SIGNAL:	Linear FM

Carrier frequency*, MHz	Occupied bandwidth, MHz	Limit, MHz	Margin, MHz	Verdict
5394.375	208.75	NA	NA	Pass
5406.250	185.00	NA	NA	Pass

* - Carrier frequency was calculated as the middle point between two 26 dBc points

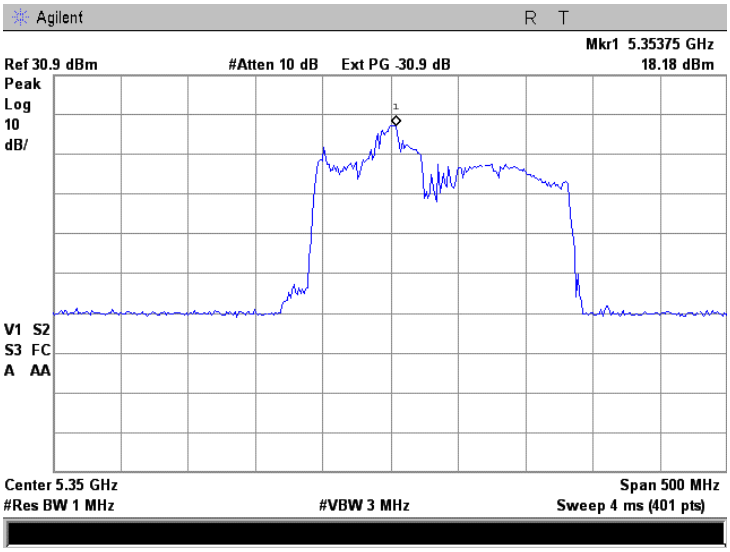
Reference numbers of test equipment used

HL 2909	HL 3437	HL 3440	HL 3559				

Full description is given in Appendix A.

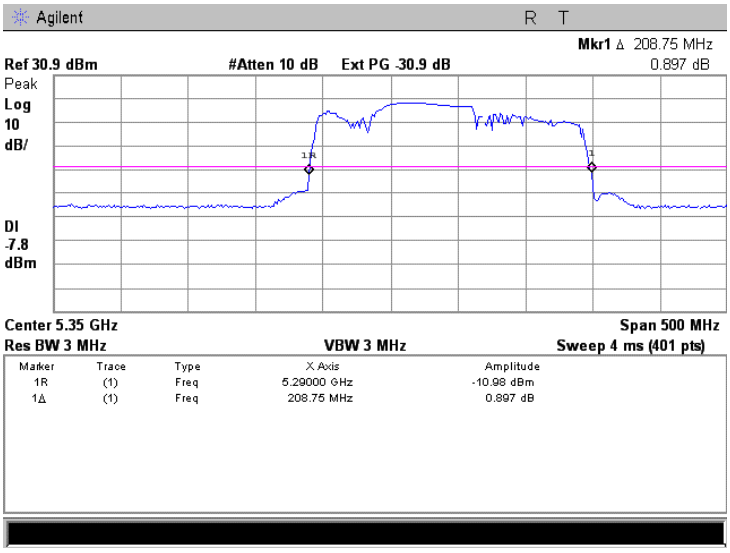
Test specification:	Section 90.209, Occupied bandwidth		
Test procedure:	47 CFR, Section 2.1049		
Test mode:	Compliance	Verdict:	PASS
Date & Time:	11/3/2009 10:27:26 AM		
Temperature: 25.8 ºC	Air Pressure: 1012 hPa	Relative Humidity: 36 %	Power Supply: 24 VDC
Remarks:			

Plot 7.2.1 Unmodulated carrier reference level

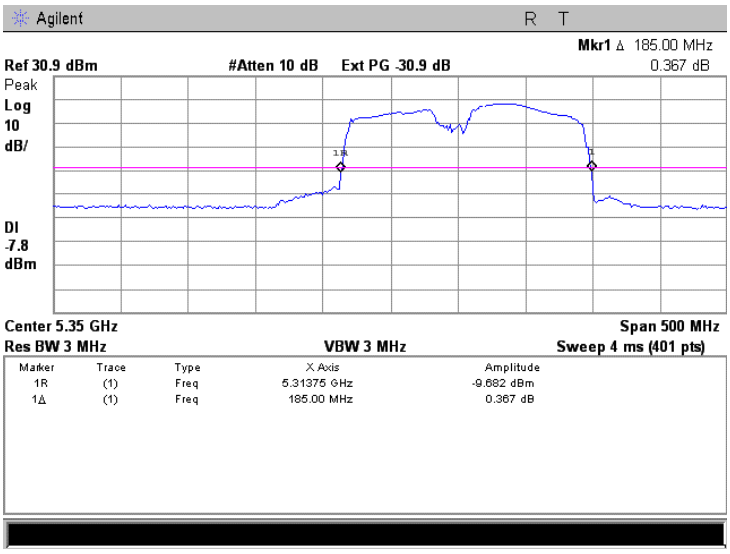


Test specification:	Section 90.209, Occupied bandwidth		
Test procedure:	47 CFR, Section 2.1049		
Test mode:	Compliance	Verdict:	PASS
Date & Time:	11/3/2009 10:27:26 AM		
Temperature: 25.8 ºC	Air Pressure: 1012 hPa	Relative Humidity: 36 %	Power Supply: 24 VDC
Remarks:			

Plot 7.2.2 Occupied bandwidth test result at low frequency



Plot 7.2.3 Occupied bandwidth test result at high frequency



Test specification:	Section 90.210, Emission mask		
Test procedure:	47 CFR, Sections 2.1051, 2.1047 and 90.210(b); TIA/EIA-603-C, Section 2.2.13		
Test mode:	Compliance	Verdict:	PASS
Date & Time:	11/3/2009 10:28:01 AM		
Temperature: 25.9 ºC	Air Pressure: 1015 hPa	Relative Humidity: 41 %	Power Supply: 24 VDC
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.

Table 7.3.1 Emission mask limits

Frequency displacement from carrier	Attenuation below carrier, dBc
Emission mask B	
0 – 50 %	0
50 – 100 %	25.0
100 - 250 %	35.0
More than 250 %	43+10logP(W)

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

7.3.2 Test procedure

7.3.2.1 The EUT was set up as shown in Figure 7.3.1, energized and its proper operation was checked.
7.3.2.2 The emission mask was measured with spectrum analyzer as provided in Table 7.3.2 and the associated plots.

Table 7.3.2 Emission mask test results

Carrier frequency*, MHz	Limit	Verdict
5394.375	Emission mask B	Pass
5406.250		

* - Carrier frequency was calculated as the middle point between two 26 dBc points

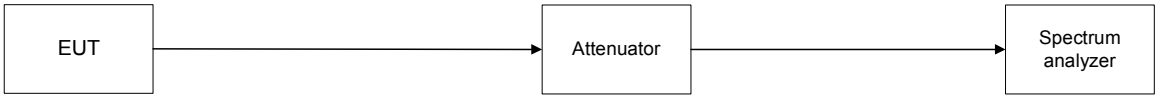
Reference numbers of test equipment used

HL 3442	HL 3559	HL 3818					

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(b); TIA/EIA-603-C, Section 2.2.13		
Test mode:	Compliance	Verdict:	PASS
Date & Time:	11/3/2009 10:28:01 AM		
Temperature: 25.9 ºC	Air Pressure: 1015 hPa	Relative Humidity: 41 %	Power Supply: 24 VDC
Remarks:			

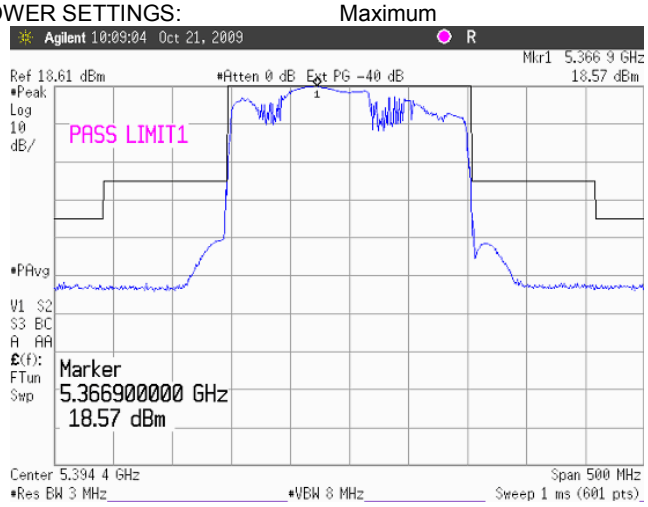
Figure 7.3.1 Emission mask test setup



Test specification:	Section 90.210, Emission mask		
Test procedure:	47 CFR, Sections 2.1051, 2.1047 and 90.210(b); TIA/EIA-603-C, Section 2.2.13		
Test mode:	Compliance	Verdict:	PASS
Date & Time:	11/3/2009 10:28:01 AM		
Temperature: 25.9 ºC	Air Pressure: 1015 hPa	Relative Humidity: 41 %	Power Supply: 24 VDC
Remarks:			

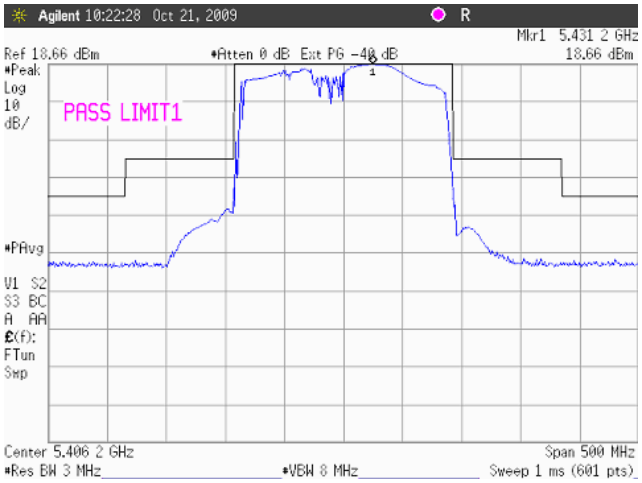
Plot 7.3.1 Emission mask test results at low carrier frequency

OPERATING FREQUENCY RANGE:	5250.00 – 5550.00 MHz
DETECTOR USED:	Peak
MODULATION:	Linear FM
26 dBc OCCUPIED BANDWIDTH:	208.75 MHz
TRANSMITTER OUTPUT POWER SETTINGS:	Maximum



Plot 7.3.2 Emission mask test results at high carrier frequency

OPERATING FREQUENCY RANGE:	5250.00 – 5550.00 MHz
DETECTOR USED:	Peak
MODULATION:	Linear FM
26 dBc OCCUPIED BANDWIDTH:	185.0 MHz
TRANSMITTER OUTPUT POWER SETTINGS:	Maximum



Test specification:	Section 90.210, Radiated spurious emissions		
Test procedure:	47 CFR, Sections 2.1053 and 90.210(b); TIA/EIA-603-C, Section 2.2.12		
Test mode:	Compliance	Verdict:	PASS
Date & Time:	11/1/2009 5:37:53 PM		
Temperature: 23.7 ºC	Air Pressure: 1010 hPa	Relative Humidity: 37 %	Power Supply: 24 VDC
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*	43+10logP**	-13	84.4

* - Excluding the in band emission within ± 250 % of the authorized bandwidth from the carrier
** - P is transmitter output power in Watts
*** - Equivalent field strength limit was calculated from maximum allowed ERP of spurious as follows: E=sqrt(30×P×1.64)/r, where P is ERP in Watts, 1.64 is numeric gain of ideal dipole and r is antenna to EUT distance in meters

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(b); TIA/EIA-603-C, Section 2.2.12		
Test mode:	Compliance	Verdict:	PASS
Date & Time:	11/1/2009 5:37:53 PM		
Temperature: 23.7 ºC	Air Pressure: 1010 hPa	Relative Humidity: 37 %	Power Supply: 24 VDC
Remarks:			

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

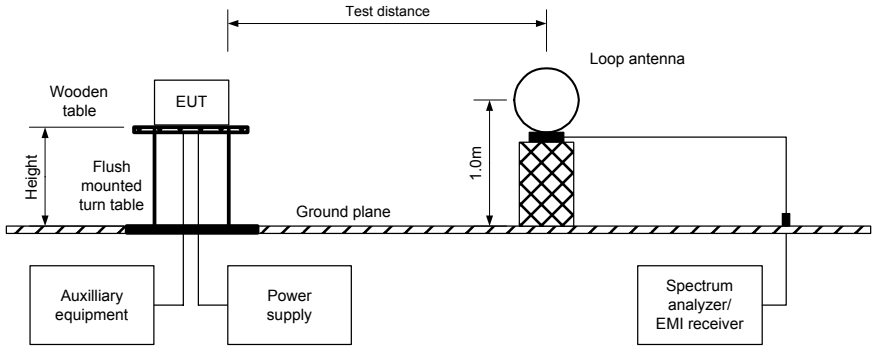
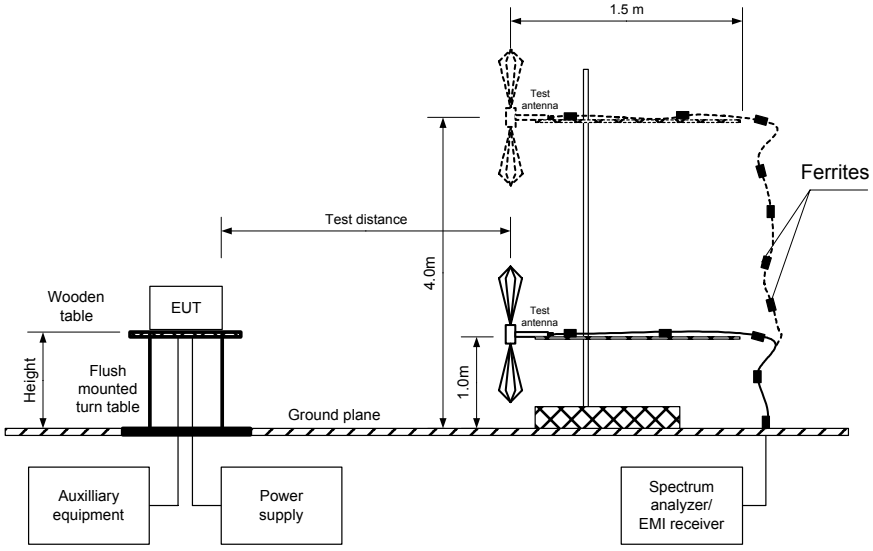


Figure 7.4.2 Setup for spurious emission field strength measurements above 30 MHz



Test specification:	**Section 90.210, Radiated spurious emissions**		
Test procedure:	47 CFR, Sections 2.1053 and 90.210(b); TIA/EIA-603-C, Section 2.2.12		
Test mode:	Compliance	**Verdict:**	PASS
Date & Time:	11/1/2009 5:37:53 PM		
Temperature: 23.7 ºC	**Air Pressure:** 1010 hPa	**Relative Humidity:** 37 %	**Power Supply:** 24 VDC
Remarks:			

Table 7.4.2 Spurious emission field strength test results

ASSIGNED FREQUENCY RANGE:	5250.00 – 5500.00 MHz
TEST DISTANCE:	3 m
TEST SITE:	Semi 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:	FM
TRANSMITTER OUTPUT POWER SETTINGS:	Maximum

Frequency, MHz	Field strength, dB(μV/m)	Limit, dB(μV/m)	Margin, dB*	RBW, kHz	Antenna polarization	Antenna height, m	Turn-table position**, degrees
No emissions were found							

*- 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

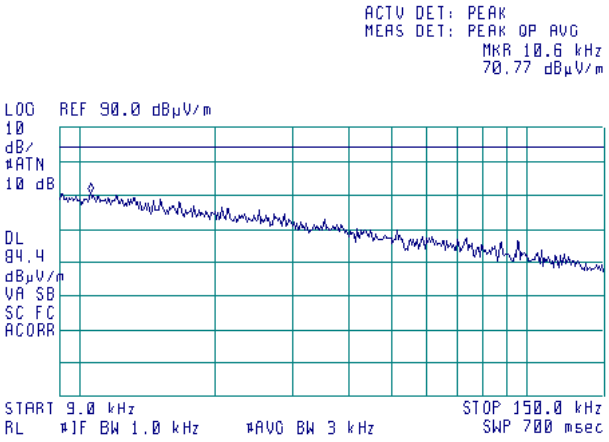
HL 0446	HL 0521	HL 0604	HL 0768	HL 0769	HL 1430	HL 2254	HL 2432
HL 2882	HL 2883	HL 3121	HL 3533	HL 3535	HL 3559	HL 3616	HL 3818

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(b); TIA/EIA-603-C, Section 2.2.12		
Test mode:	Compliance	Verdict:	PASS
Date & Time:	11/1/2009 5:37:53 PM		
Temperature: 23.7 ºC	Air Pressure: 1010 hPa	Relative Humidity: 37 %	Power Supply: 24 VDC
Remarks:			

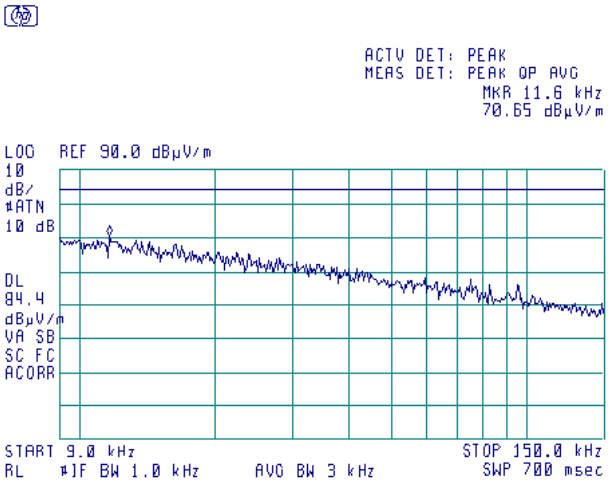
Plot 7.4.1 Radiated emission measurements in 9 - 150 kHz range

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



Plot 7.4.2 Radiated emission measurements in 9 - 150 kHz range

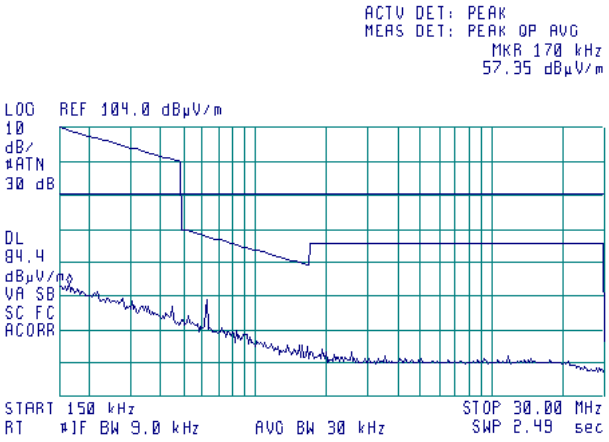
TEST SITE:	Semi anechoic chamber
CARRIER FREQUENCY:	High
ANTENNA POLARIZATION:	Vertical and Horizontal
TEST DISTANCE:	3 m



Test specification:	Section 90.210, Radiated spurious emissions		
Test procedure:	47 CFR, Sections 2.1053 and 90.210(b); TIA/EIA-603-C, Section 2.2.12		
Test mode:	Compliance	Verdict:	PASS
Date & Time:	11/1/2009 5:37:53 PM		
Temperature: 23.7 ºC	Air Pressure: 1010 hPa	Relative Humidity: 37 %	Power Supply: 24 VDC
Remarks:			

Plot 7.4.3 Radiated emission measurements in 0.15 - 30 MHz range

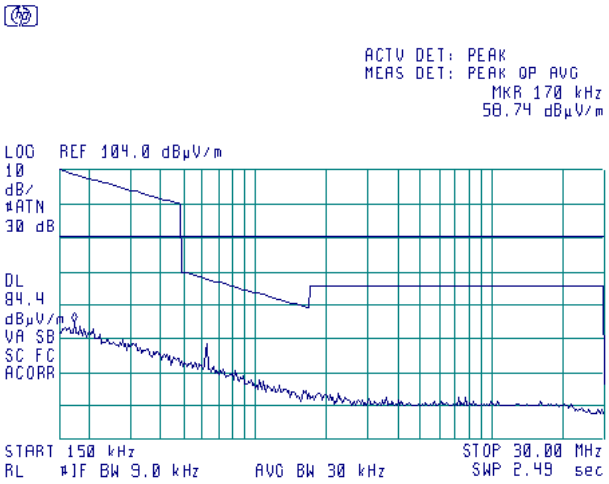
TEST SITE:	Semi anechoic chamber
CARRIER FREQUENCY:	Low
ANTENNA POLARIZATION:	Vertical and Horizontal
TEST DISTANCE:	3 m



limit lines: section 15.209 and 84.4 dBuV/m

Plot 7.4.4 Radiated emission measurements in 0.15 - 30 MHz range

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

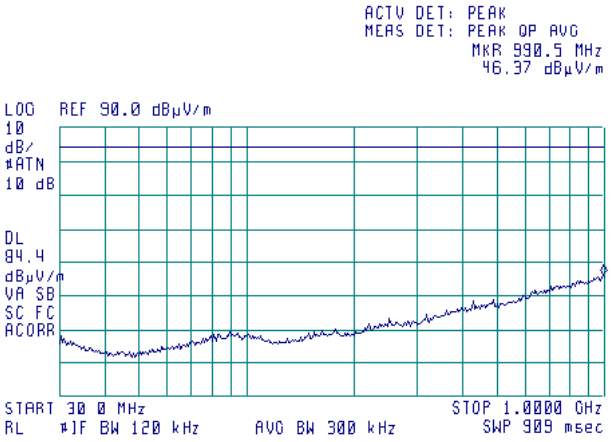


limit lines: section 15.209 and 84.4 dBuV/m

Test specification:	Section 90.210, Radiated spurious emissions		
Test procedure:	47 CFR, Sections 2.1053 and 90.210(b); TIA/EIA-603-C, Section 2.2.12		
Test mode:	Compliance	Verdict:	PASS
Date & Time:	11/1/2009 5:37:53 PM		
Temperature: 23.7 ºC	Air Pressure: 1010 hPa	Relative Humidity: 37 %	Power Supply: 24 VDC
Remarks:			

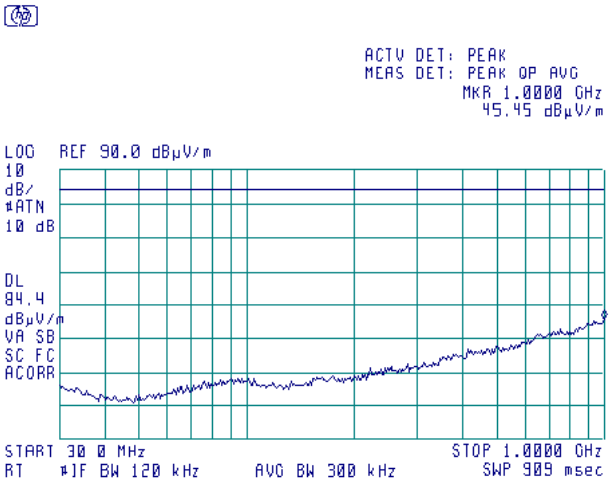
Plot 7.4.5 Radiated emission measurements in 30 - 1000 MHz range

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



Plot 7.4.6 Radiated emission measurements in 30 - 1000 MHz range

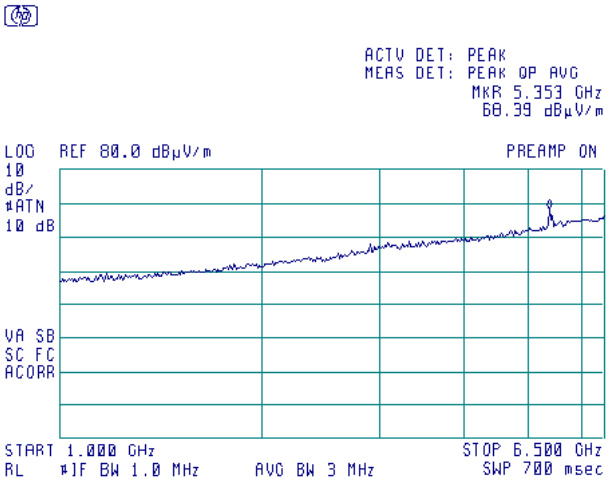
TEST SITE:	Semi anechoic chamber
CARRIER FREQUENCY:	High
ANTENNA POLARIZATION:	Vertical and Horizontal
TEST DISTANCE:	3 m



Test specification:	Section 90.210, Radiated spurious emissions		
Test procedure:	47 CFR, Sections 2.1053 and 90.210(b); TIA/EIA-603-C, Section 2.2.12		
Test mode:	Compliance	Verdict:	PASS
Date & Time:	11/1/2009 5:37:53 PM		
Temperature: 23.7 ºC	Air Pressure: 1010 hPa	Relative Humidity: 37 %	Power Supply: 24 VDC
Remarks:			

Plot 7.4.7 Radiated emission measurements in 1000 – 6500 MHz range

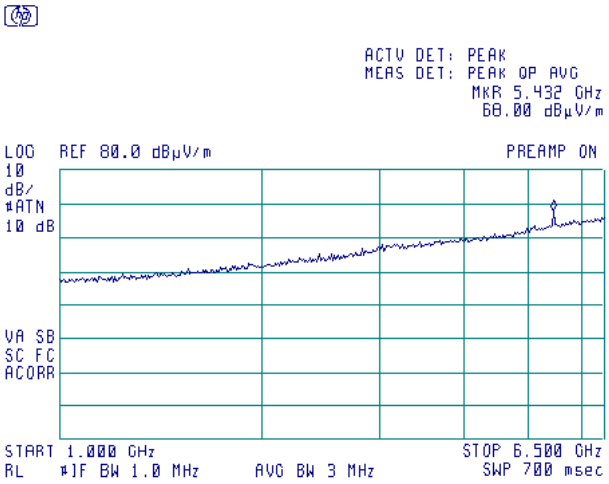
TEST SITE:	Semi anechoic chamber
CARRIER FREQUENCY:	Low
ANTENNA POLARIZATION:	Vertical and Horizontal
TEST DISTANCE:	3 m



limit: 84.4 dBuV/m; 5.353 GHz – EUT carrier

Plot 7.4.8 Radiated emission measurements in 1000 – 6500 MHz range

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

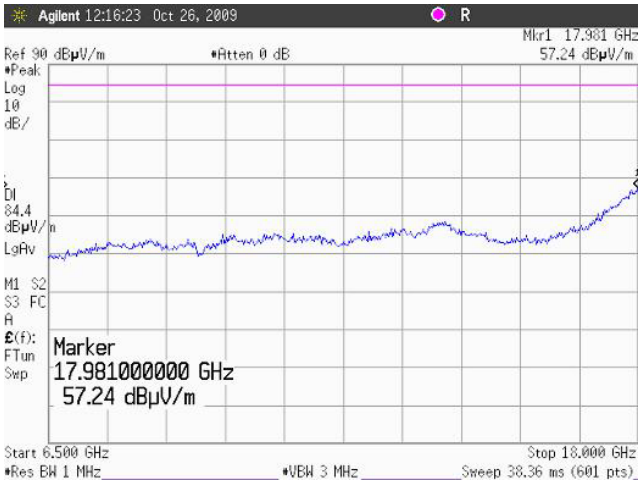


limit: 84.4 dBuV/m; 5.432 GHz – EUT carrier

Test specification:	Section 90.210, Radiated spurious emissions		
Test procedure:	47 CFR, Sections 2.1053 and 90.210(b); TIA/EIA-603-C, Section 2.2.12		
Test mode:	Compliance	Verdict:	PASS
Date & Time:	11/1/2009 5:37:53 PM		
Temperature: 23.7 ºC	Air Pressure: 1010 hPa	Relative Humidity: 37 %	Power Supply: 24 VDC
Remarks:			

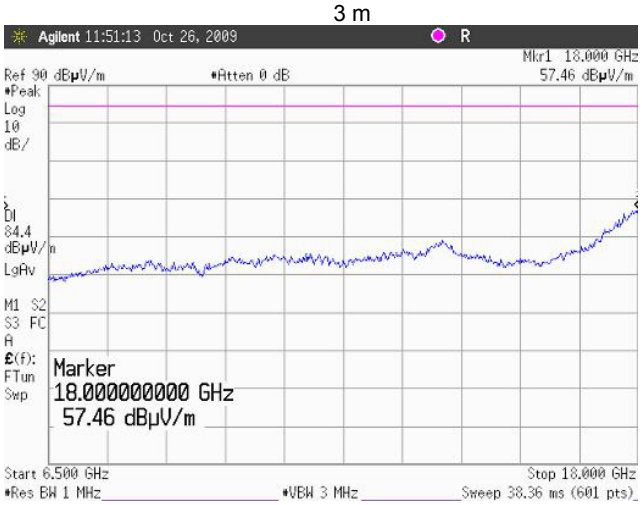
Plot 7.4.9 Radiated emission measurements in 6500 – 18000 MHz range

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



Plot 7.4.10 Radiated emission measurements in 6500 – 18000 MHz range

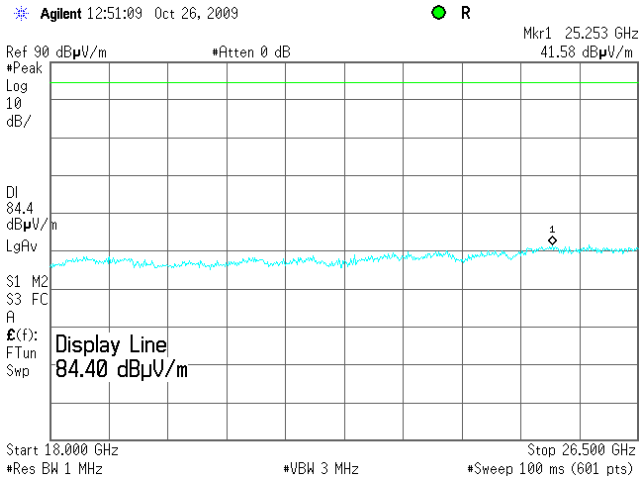
TEST SITE: Fully anechoic chamber
CARRIER FREQUENCY: High
ANTENNA POLARIZATION: Vertical and Horizontal
TEST DISTANCE: 3 m



Test specification:	Section 90.210, Radiated spurious emissions		
Test procedure:	47 CFR, Sections 2.1053 and 90.210(b); TIA/EIA-603-C, Section 2.2.12		
Test mode:	Compliance	Verdict:	PASS
Date & Time:	11/1/2009 5:37:53 PM		
Temperature: 23.7 ºC	Air Pressure: 1010 hPa	Relative Humidity: 37 %	Power Supply: 24 VDC
Remarks:			

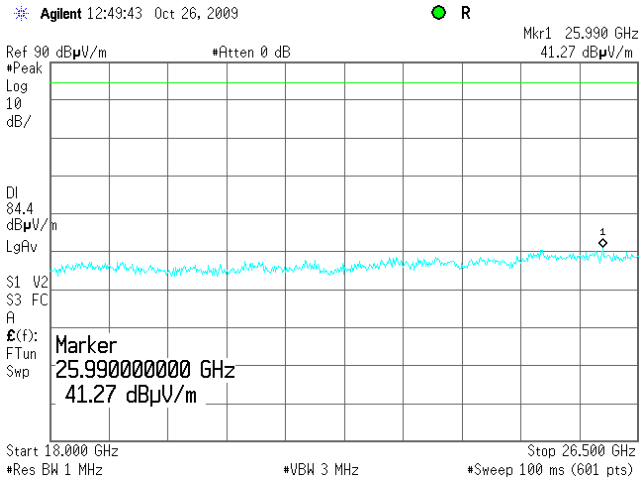
Plot 7.4.11 Radiated emission measurements in 18000 – 26500 MHz range

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



Plot 7.4.12 Radiated emission measurements in 18000 – 26500 MHz range

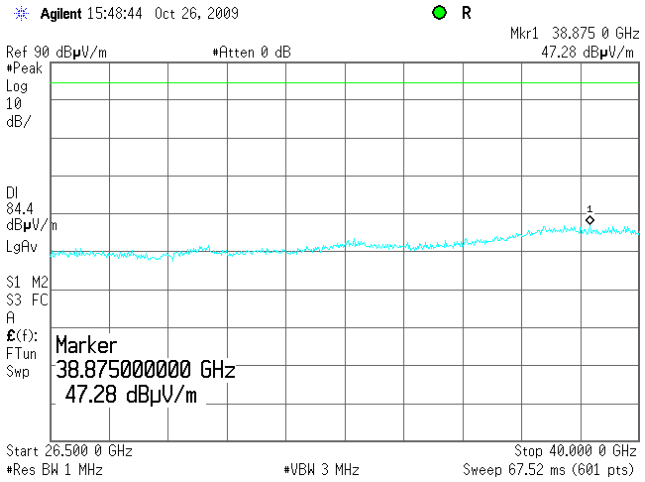
TEST SITE: Fully anechoic chamber
CARRIER FREQUENCY: High
ANTENNA POLARIZATION: Vertical and Horizontal
TEST DISTANCE: 3 m



Test specification:	Section 90.210, Radiated spurious emissions		
Test procedure:	47 CFR, Sections 2.1053 and 90.210(b); TIA/EIA-603-C, Section 2.2.12		
Test mode:	Compliance	Verdict:	PASS
Date & Time:	11/1/2009 5:37:53 PM		
Temperature: 23.7 ºC	Air Pressure: 1010 hPa	Relative Humidity: 37 %	Power Supply: 24 VDC
Remarks:			

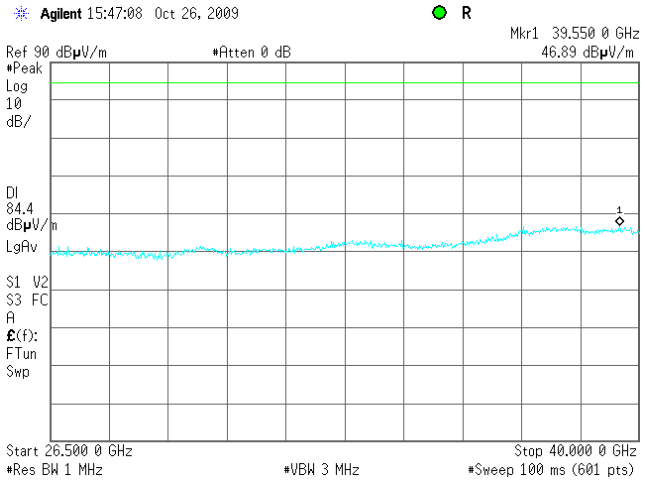
Plot 7.4.13 Radiated emission measurements in 26500 – 40000 MHz range

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



Plot 7.4.14 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(b); TIA/EIA-603-C, Section 2.2.13		
Test mode:	Compliance	Verdict:	PASS
Date & Time:	11/1/2009 5:39:03 PM		
Temperature: 25.8 ºC	Air Pressure: 1012 hPa	Relative Humidity: 36 %	Power Supply: 24 VDC
Remarks:			

7.5 Spurious emissions at RF antenna connector test

7.5.1 General

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

Table 7.5.1 Spurious emission limits

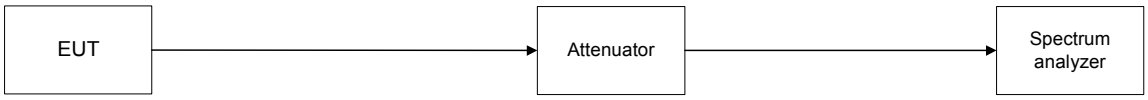
Frequency, MHz	Attenuation below carrier, dBc	ERP of spurious, dBm
0.009 – 10th harmonic*	43+10logP** (mask B)	-13.0

* - spurious emission limits do not apply to the in band emission within ± 250 % 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, energized and its proper operation was checked.
7.5.2.2 The EUT was adjusted to produce maximum available for end user RF output power.
7.5.2.3 The spurious emission was measured with spectrum analyzer as provided in Table 7.5.2 and the associated plots.

Figure 7.5.1 Spurious emission test setup



Test specification:	Section 90.210, Conducted spurious emissions		
Test procedure:	47 CFR, Sections 2.1051 and 90.210(b); TIA/EIA-603-C, Section 2.2.13		
Test mode:	Compliance	Verdict:	PASS
Date & Time:	11/1/2009 5:39:03 PM		
Temperature: 25.8 ºC	Air Pressure: 1012 hPa	Relative Humidity: 36 %	Power Supply: 24 VDC
Remarks:			

Table 7.5.2 Spurious emission test results

ASSIGNED FREQUENCY RANGE: 5250.0 – 5500.0 MHz
INVESTIGATED FREQUENCY RANGE: 0.009 – 40000 MHz
DETECTOR USED: Peak
VIDEO BANDWIDTH: ≥ Resolution bandwidth
MODULATION: FM
TRANSMITTER OUTPUT POWER SETTINGS: Maximum
TRANSMITTER OUTPUT POWER: 20.10 dBm at low band
20.07 dBm at high high

Frequency, MHz	SA reading, dBm	Attenuator, dB	Cable loss, dB	RBW, kHz	Spurious emission, dBm	Limit, dBm	Margin, dB*	Verdict
Low carrier frequency								
4597.000	-26.67	Included	Included	1000	-26.67	-13.00	-13.67	Pass
10000.00	-24.48	Included	Included	1000	-24.48	-13.00	-11.48	Pass
21554.20	-32.67	Included	Included	1000	-32.67	-13.00	-19.67	Pass
21554.20	-34.97	Included	Included	1000	-34.97	-13.00	-21.97	Pass
High carrier frequency								
4547.00	-25.00	Included	Included	1000	-25.00	-13.00	-12.00	Pass
10000.01	-26.53	Included	Included	1000	-25.00	-13.00	-13.53	Pass

*- Margin = Spurious emission – specification limit.

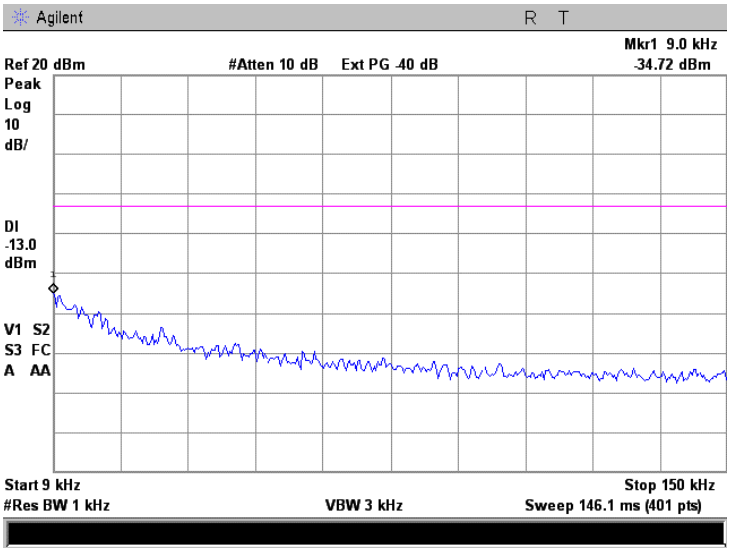
Reference numbers of test equipment used

HL 2909	HL 2953	HL 3440	HL 3447	HL 3455	HL 3818		

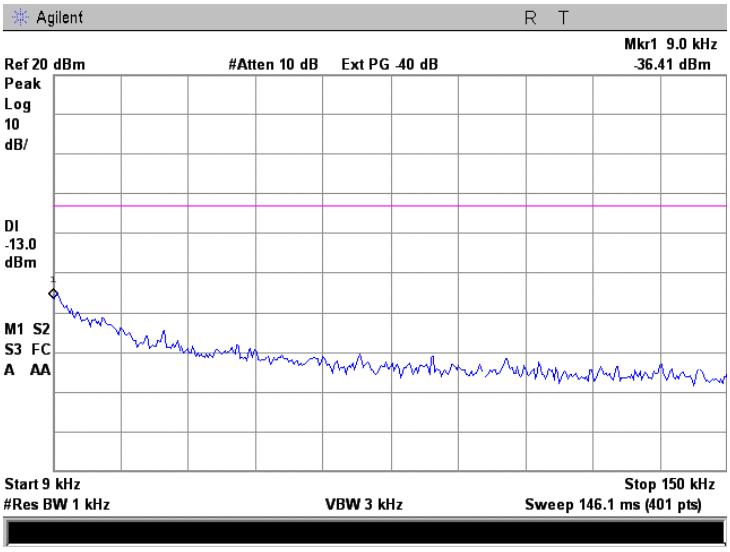
Full description is given in Appendix A.

Test specification:	Section 90.210, Conducted spurious emissions		
Test procedure:	47 CFR, Sections 2.1051 and 90.210(b); TIA/EIA-603-C, Section 2.2.13		
Test mode:	Compliance	Verdict:	PASS
Date & Time:	11/1/2009 5:39:03 PM		
Temperature: 25.8 ºC	Air Pressure: 1012 hPa	Relative Humidity: 36 %	Power Supply: 24 VDC
Remarks:			

Plot 7.5.1 Spurious emission measurements in 9 - 150 kHz range at low carrier frequency

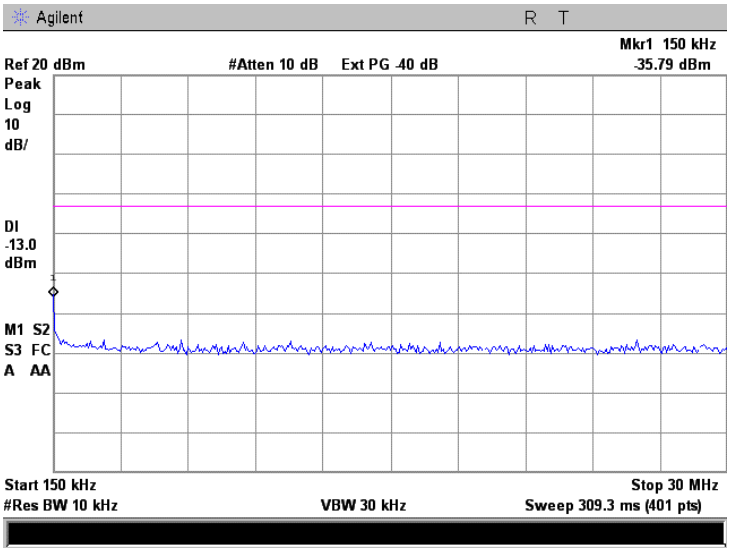


Plot 7.5.2 Spurious emission measurements in 9 - 150 kHz range at high carrier frequency

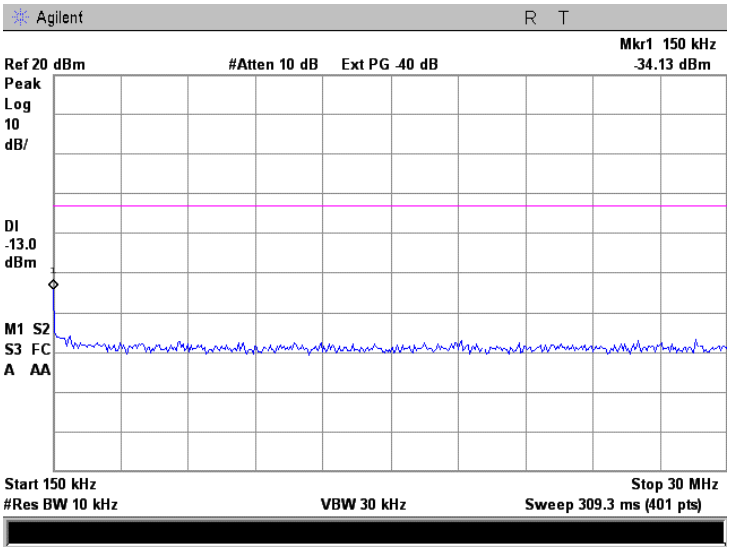


Test specification:	Section 90.210, Conducted spurious emissions		
Test procedure:	47 CFR, Sections 2.1051 and 90.210(b); TIA/EIA-603-C, Section 2.2.13		
Test mode:	Compliance	Verdict:	PASS
Date & Time:	11/1/2009 5:39:03 PM		
Temperature: 25.8 ºC	Air Pressure: 1012 hPa	Relative Humidity: 36 %	Power Supply: 24 VDC
Remarks:			

Plot 7.5.3 Spurious emission measurements in 0.15 - 30.0 MHz range at low carrier frequency

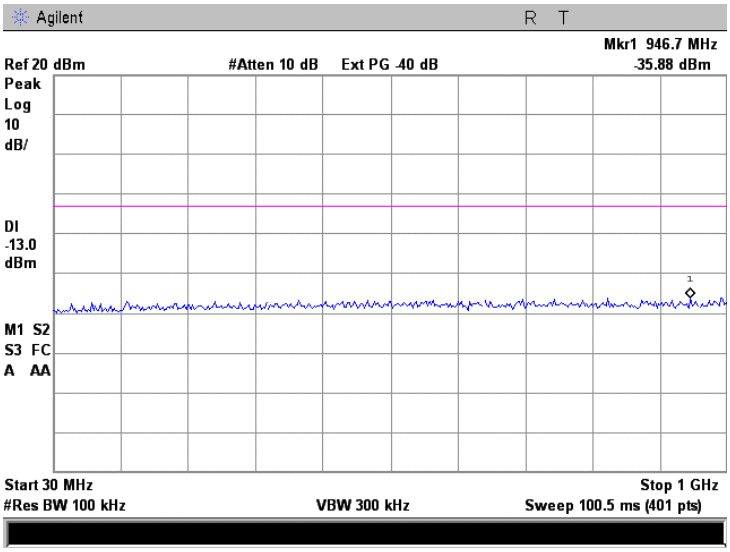


Plot 7.5.4 Spurious emission measurements in 0.15 – 30.0 MHz range at high carrier frequency

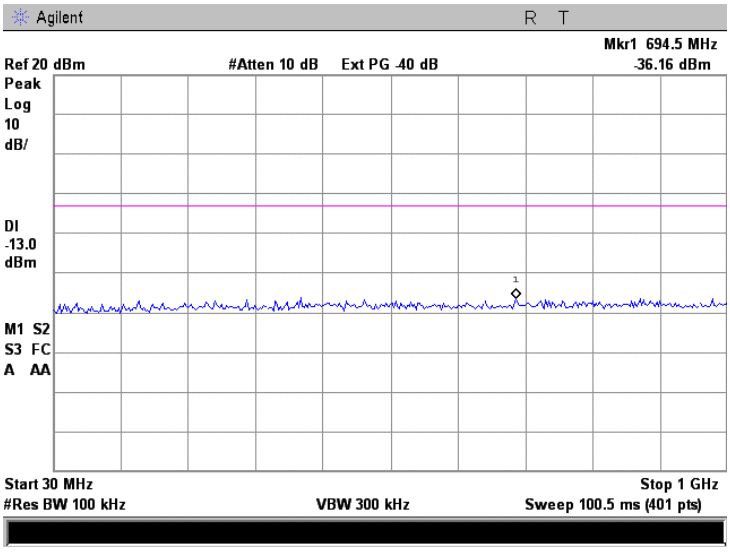


Test specification:	Section 90.210, Conducted spurious emissions		
Test procedure:	47 CFR, Sections 2.1051 and 90.210(b); TIA/EIA-603-C, Section 2.2.13		
Test mode:	Compliance	Verdict:	PASS
Date & Time:	11/1/2009 5:39:03 PM		
Temperature: 25.8 ºC	Air Pressure: 1012 hPa	Relative Humidity: 36 %	Power Supply: 24 VDC
Remarks:			

Plot 7.5.5 Spurious emission measurements in 30.0 - 1000 MHz range at low carrier frequency

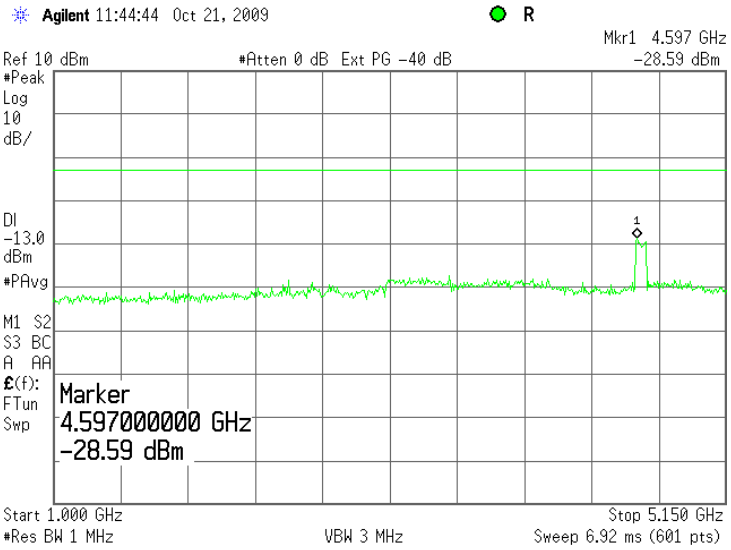


Plot 7.5.6 Spurious emission measurements in 30.0 - 1000 MHz range at high carrier frequency

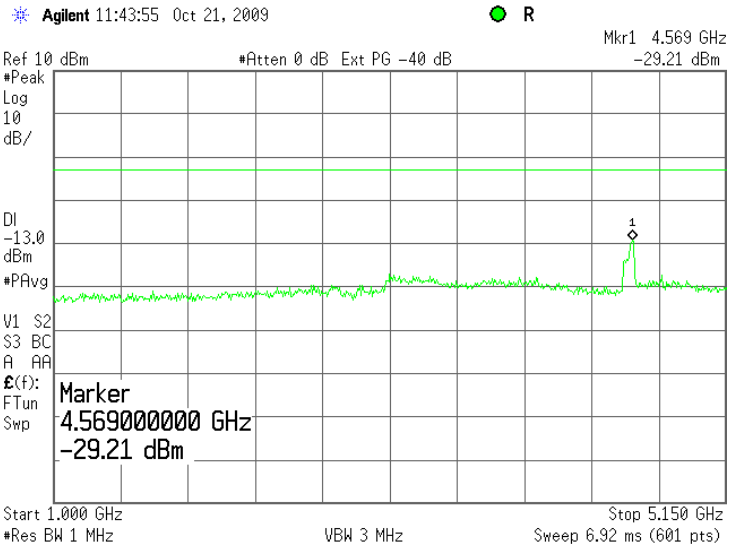


Test specification:	Section 90.210, Conducted spurious emissions		
Test procedure:	47 CFR, Sections 2.1051 and 90.210(b); TIA/EIA-603-C, Section 2.2.13		
Test mode:	Compliance	Verdict:	PASS
Date & Time:	11/1/2009 5:39:03 PM		
Temperature: 25.8 ºC	Air Pressure: 1012 hPa	Relative Humidity: 36 %	Power Supply: 24 VDC
Remarks:			

Plot 7.5.7 Spurious emission measurements in 1000 - 5150 MHz range at low carrier frequency

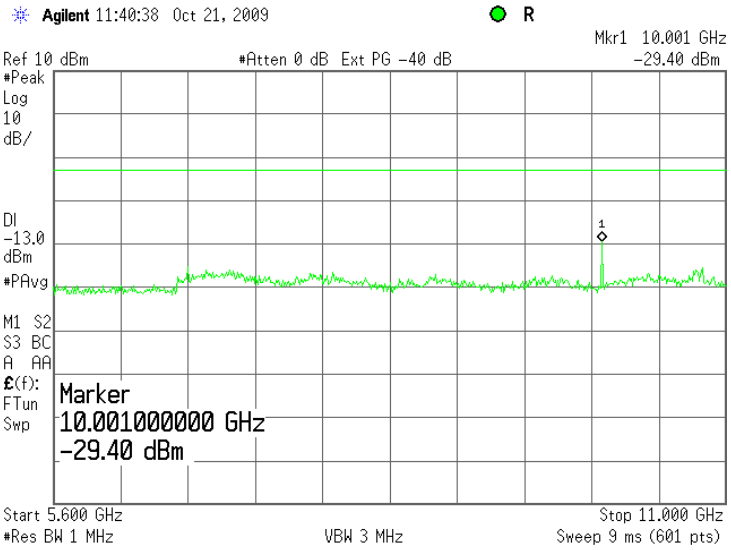


Plot 7.5.8 Spurious emission measurements in 1000 - 5150 MHz at high carrier frequency

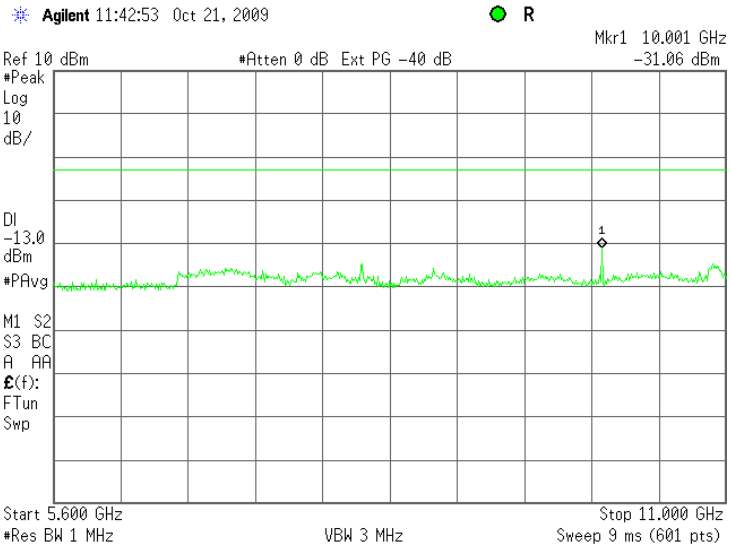


Test specification:	Section 90.210, Conducted spurious emissions		
Test procedure:	47 CFR, Sections 2.1051 and 90.210(b); TIA/EIA-603-C, Section 2.2.13		
Test mode:	Compliance	Verdict:	PASS
Date & Time:	11/1/2009 5:39:03 PM		
Temperature: 25.8 ºC	Air Pressure: 1012 hPa	Relative Humidity: 36 %	Power Supply: 24 VDC
Remarks:			

Plot 7.5.9 Spurious emission measurements in 5600 - 11000 MHz range at low carrier frequency

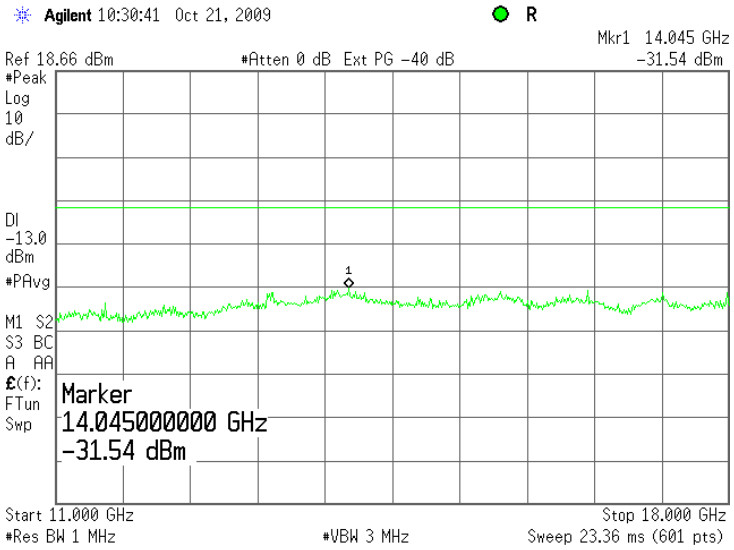


Plot 7.5.10 Spurious emission measurements in 5600 - 11000 MHz at high carrier frequency

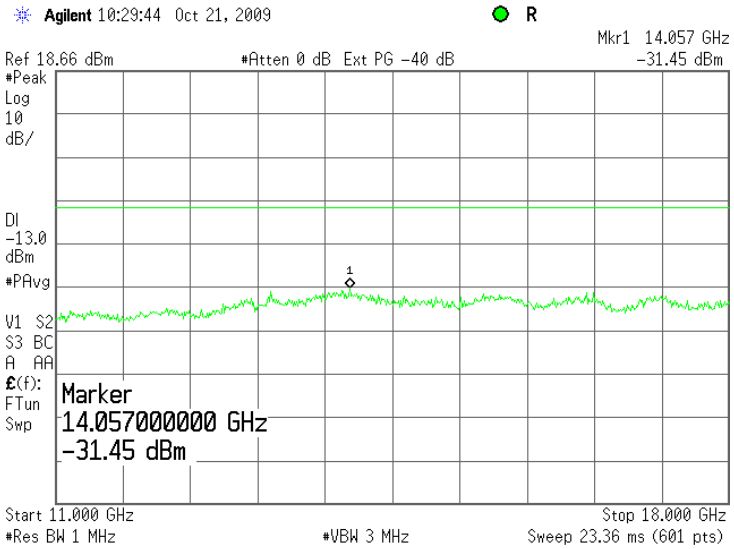


Test specification:	Section 90.210, Conducted spurious emissions		
Test procedure:	47 CFR, Sections 2.1051 and 90.210(b); TIA/EIA-603-C, Section 2.2.13		
Test mode:	Compliance	Verdict:	PASS
Date & Time:	11/1/2009 5:39:03 PM		
Temperature: 25.8 ºC	Air Pressure: 1012 hPa	Relative Humidity: 36 %	Power Supply: 24 VDC
Remarks:			

Plot 7.5.11 Spurious emission measurements in 11000 - 18000 MHz range at low carrier frequency

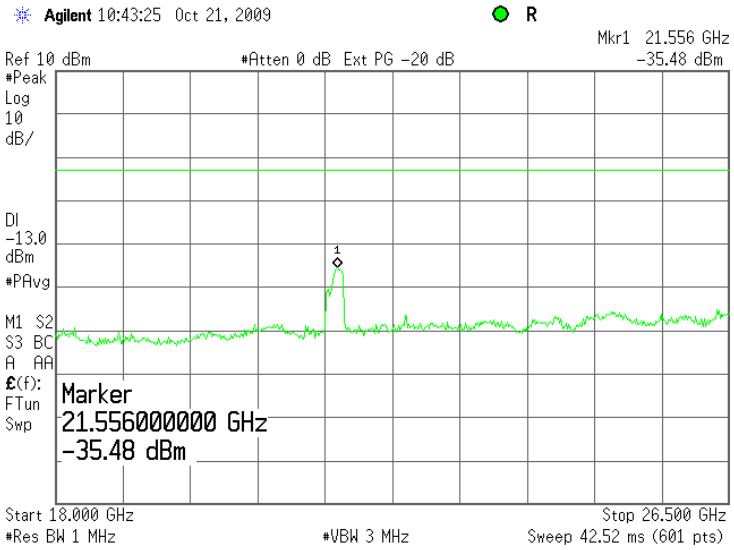


Plot 7.5.12 Spurious emission measurements in 11000 - 18000 MHz at high carrier frequency

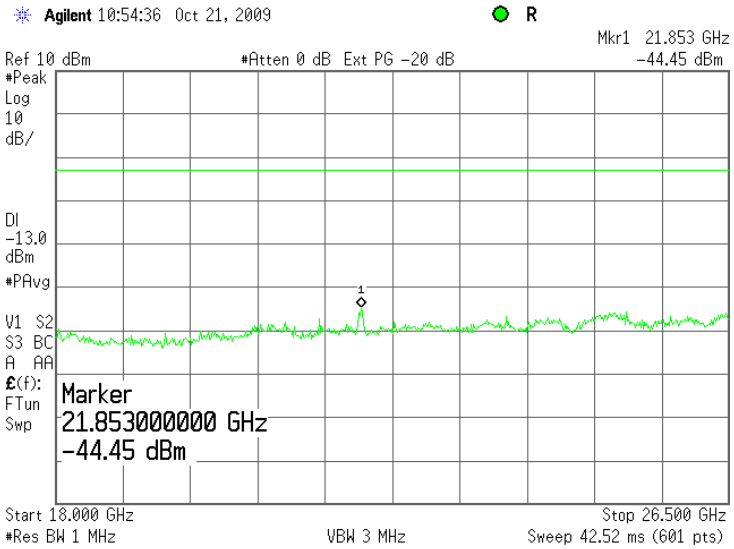


Test specification:	Section 90.210, Conducted spurious emissions		
Test procedure:	47 CFR, Sections 2.1051 and 90.210(b); TIA/EIA-603-C, Section 2.2.13		
Test mode:	Compliance	Verdict:	PASS
Date & Time:	11/1/2009 5:39:03 PM		
Temperature: 25.8 ºC	Air Pressure: 1012 hPa	Relative Humidity: 36 %	Power Supply: 24 VDC
Remarks:			

Plot 7.5.13 Spurious emission measurements in 18000 - 26500 MHz range at low carrier frequency



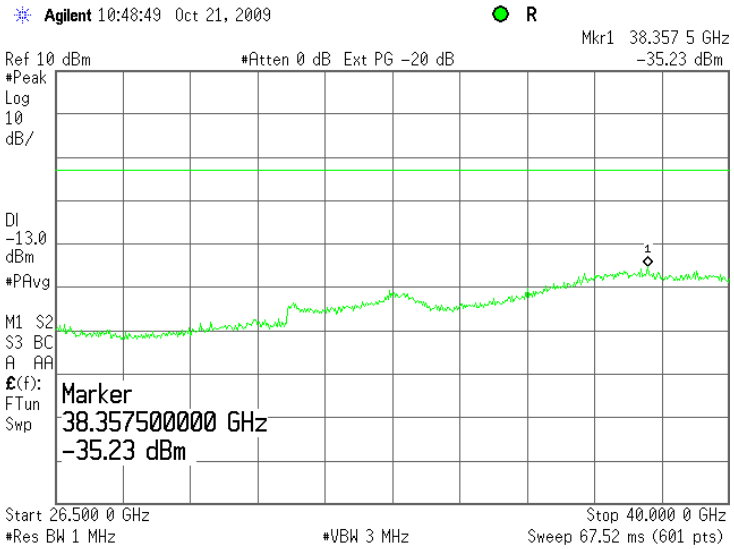
Plot 7.5.14 Spurious emission measurements in 18000 - 26500 MHz at high carrier frequency



Test specification:	Section 90.210, Conducted spurious emissions		
Test procedure:	47 CFR, Sections 2.1051 and 90.210(b); TIA/EIA-603-C, Section 2.2.13		
Test mode:	Compliance	Verdict:	PASS
Date & Time:	11/1/2009 5:39:03 PM		
Temperature: 25.8 ºC	Air Pressure: 1012 hPa	Relative Humidity: 36 %	Power Supply: 24 VDC
Remarks:			

Plot 7.5.15 Spurious emission measurements in 26500 - 40000 MHz range at low carrier frequency

Plot 7.5.16 Spurious emission measurements in 26500 - 40000 MHz at high carrier frequency



Test specification:	Section 90.213, Frequency stability		
Test procedure:	47 CFR, Section 2.1055; TIA/EIA-603-A Section 2.2.2		
Test mode:	Compliance	Verdict:	PASS
Date & Time:	11/4/2009 5:04:03 PM		
Temperature: 25.3 ºC	Air Pressure: 1011 hPa	Relative Humidity: 34 %	Power Supply: 24 VDC
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
5250.00 – 5500.00	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.

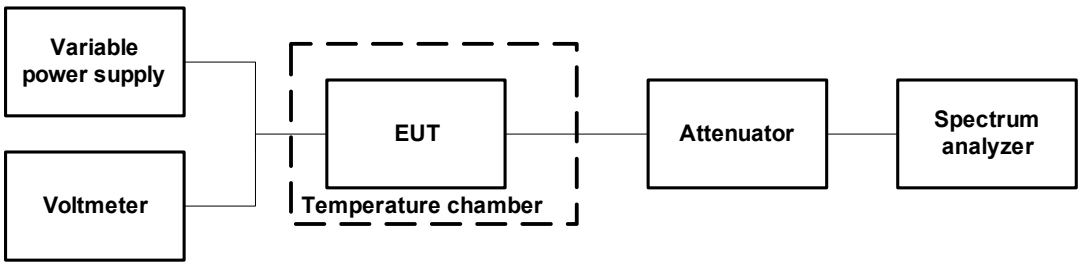
7.6.2.3 The EUT was powered on and carrier frequency was measured at start up moment and then every minute until frequency had been stabilized or 10 minutes elapsed whichever reached the last. The EUT was powered off.

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-A Section 2.2.2		
Test mode:	Compliance	**Verdict:**	PASS
Date & Time:	11/4/2009 5:04:03 PM		
Temperature: 25.3 ºC	**Air Pressure:** 1011 hPa	**Relative Humidity:** 34 %	**Power Supply:** 24 VDC
Remarks:			

Table 7.6.2 Frequency stability test results

ASSIGNED FREQUENCY RANGE: 5250.00 – 5500.00 MHz
NOMINAL POWER VOLTAGE: 24 VDC
TEMPERATURE STABILIZATION PERIOD: 20 min
POWER DURING TEMPERATURE TRANSITION: Off
SPECTRUM ANALYZER MODE: Counter
RESOLUTION BANDWIDTH: 300 Hz
VIDEO BANDWIDTH: 1000 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
Carrier frequency 5350.00 MHz												
-30	nominal	5349.917679	5349.933874	5349.936988	5349.938228	5349.939391	5349.940402	5349.944500	31580.99	0.00	5.903	0.000
-20	nominal	5349.945250	NA	NA	NA	NA	NA	5349.957105	44186.00	0.00	8.259	0.000
-10	nominal	5349.948711	NA	NA	NA	NA	NA	5349.955882	42963.00	0.00	8.030	0.000
0	nominal	5349.952448	5349.950130	5349.948664	5349.947352	5349.947027	5349.945600	5349.944726	39529.00	0.00	7.389	0.000
10	nominal	5349.946527	NA	NA	NA	NA	NA	5349.931522	33608.00	0.00	6.282	0.000
20	15%	5349.913990	NA	NA	NA	NA	NA	5349.912956	1071.00	0.00	0.200	0.000
20	nominal	5349.912694	NA	NA	NA	NA	NA	5349.912919	0.00	-225.00	0.000	-0.042
20	-15%	5349.913850	NA	NA	NA	NA	NA	5349.911210	931.00	-1709.00	0.174	-0.319
30	nominal	5349.920942	5349.914.568	5349.911588	5349.909324	5349.908129	5349.907077	5349.903601	8022.99	-9318.00	1.500	-1.742
40	nominal	5349.908462	NA	NA	NA	NA	NA	5349.900542	0.00	-12377.00	0.000	-2.313
50	nominal	5349.903451	5349.902899	5349.902584	5349.901278	5349.901997	5349.902275	5349.909891	0.00	-11641.00	0.000	-2.176

* - Reference frequency

Table 7.6.3 Frequency stability band edges calculation

Lower measured* band edge, MHz	Upper measured* band edge, MHz	Lower calculated** band edge, MHz	Upper calculated** band edge, MHz	Lower specified band edge, MHz	Upper specified band edge, MHz	Lower Margin***, MHz	Upper Margin***, MHz	Verdict
Low band								
5290.000	5498.750	5289.988	5498.794	5250.000	5500.000	-39.988	-1.206	Pass
High band								
5313.750	5498.750	5313.738	5498.794	5250.000	5500.000	-63.738	-1.206	Pass

* - Measured band edges at 26 dBc points
** - Calculated – Measured band edge + maximum measured positive/negative drift.
*** - Margin – Specified band edge – Calculated band edge

Reference numbers of test equipment used

HL 0493	HL 3818						

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:	11/11/2009 9:34:40 AM		
Temperature: ºC	Air Pressure: hPa	Relative Humidity: %	Power Supply:
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
5250.0 – 5500.0	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: 5250.0 – 5500.0 MHz
EQUIPMENT INTENDED USE: Fixed*

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				
5350.00	19.68	13.00	32.68	1.85	10.00	0.12	2.00	Pass
5420.00	19.67	13.00	32.67	1.85	10.00	0.12	2.00	Pass

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

8 APPENDIX A Test equipment and ancillaries used for tests

HL No	Description	Manufacturer	Model	Ser. No.	Last Cal.	Due Cal.
0446	Antenna, Loop, Active, 10 kHz - 30 MHz	EMCO	6502	2857	29-Jun-09	29-Jun-10
0493	Temperature Chamber -45…175 deg C	Thermotron	S-1.2 Mini-Max	14016	20-May-09	20-May-10
0521	EMI Receiver (Spectrum Analyzer) with RF filter section 9 kHz-6.5 GHz	Hewlett Packard	8546A	3617A 00319, 3448A002 53	27-Aug-09	27-Aug-10
0604	Antenna BiconiLog Log-Periodic/T Bow-TIE, 26 - 2000 MHz	EMCO	3141	9611-1011	11-Jan-09	11-Jan-10
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
1430	EMI Receiver, 9 kHz - 2.9 GHz, System: HL1431, HL1432	Agilent Technologies	8542E	3807A002 62,3705A0 0217	31-Aug-09	31-Aug-10
2254	Cable 40 GHz, 0.8 m, blue	Rhophase Microwave Limited	KPS-1503A-800-KPS	W4907	11-Jun-09	11-Jun-10
2432	Antenna, Double-Ridged Waveguide Horn 1-18 GHz	EMC Test Systems	3115	00027177	24-Aug-09	24-Aug-10
2882	Cable, 18 GHz N-type, M-F, 3 m	Bird	TC-MNFN-3.0	211539 001	04-Feb-09	04-Feb-10
2883	Cable, 18 GHz N-type, M-F, 3 m	Bird	TC-MNFN-3.0	211539 003	07-Dec-08	07-Dec-09
2909	Spectrum analyzer, ESA-E, 100 Hz to 26.5 GHz	Agilent Technologies	E4407B	MY414447 62	07-May-09	07-May-10
2953	Cable, RF, 18 GHz, 1.2 m, SMA-SMA	Gore	10020014	NA	05-Oct-09	05-Oct-10
3121	Microwave Cable Assembly, 18 GHz, 6.4 m, SMA - SMA	Huber-Suhner	198-9155-00	3121	07-Dec-08	07-Dec-09
3301	Power Meter, P-series, 50 MHz to 40 GHz	Agilent Technologies	N1911A	MY451010 57	03-Dec-08	03-Dec-09
3302	Power sensor, P-Series, 50 MHz to 40 GHz, -35/30 to 20 dBm	Agilent Technologies	N1922A	MY452405 86	05-Dec-08	05-Dec-09
3437	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
3447	Power splitter, DC to 500 MHz	HP	11652	NA	09-Mar-08	09-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
3533	Amplifier, low noise, 6 to 18 GHz	Quinstar Technology	QLJ-06184040 -J0	111590010 01	07-Dec-08	07-Dec-09
3535	Amplifier, low noise, 18 to 40 GHz	Quinstar Technology	QLJ-18404537 -J0	111590030 01	07-Dec-08	07-Dec-09
3559	Cable 40 GHz, SMA-SMA, 0.95 m, Blue	Gore	PHASEFL EX	03771245	10-Aug-09	10-Aug-10
3616	Cable RF, 6.5 m, N type-N type, DC-6.5 GHz	Suhner Switzerland	Rg 214/U	NA	07-Dec-08	07-Dec-09

HL No	Description	Manufacturer	Model	Ser. No.	Last Cal.	Due Cal.
3818	PSA Series Spectrum Analyzer, 3 Hz- 44 GHz	Agilent Technologies	E4446A	MY48250288	25-Sep-09	25-Sep-10

9 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 %

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.

10 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).

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11 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
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:2001	Land Mobile FM or PM Communications Equipment Measurement and Performance Standards

12 APPENDIX E Test equipment correction factors

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
Biconilog antenna EMCO Model 3141
Ser.No.1011, HL 0604

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

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 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).

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

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

Cable loss
Cable coaxial, 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, 25.5 GHz, 1.2 m, SMA-SMA, S/N 10020014
HL 2953

Frequency, MHz	Cable loss, dB	Frequency, MHz	Cable loss, dB	Frequency, MHz	Cable loss, dB
10	0.06	8750	1.28	18000	1.84
30	0.06	9000	1.30	18250	1.91
100	0.12	9250	1.35	18500	1.94
250	0.19	9500	1.34	18750	1.92
500	0.27	9750	1.36	19000	1.95
750	0.34	10000	1.33	19250	2.00
1000	0.40	10250	1.38	19500	1.96
1250	0.45	10500	1.39	19750	2.02
1500	0.50	10750	1.39	20000	1.92
1750	0.54	11000	1.43	20250	2.04
2000	0.57	11250	1.42	20500	2.00
2250	0.60	11500	1.48	20750	2.09
2500	0.64	11750	1.49	21000	2.01
2750	0.67	12000	1.59	21250	2.07
3000	0.70	12250	1.50	21500	2.20
3250	0.74	12500	1.55	21750	2.10
3500	0.76	12750	1.55	22000	2.24
3750	0.80	13000	1.61	22250	2.25
4000	0.83	13250	1.62	22500	2.12
4250	0.85	13500	1.56	22750	2.05
4500	0.87	13750	1.61	23000	2.10
4750	0.91	14000	1.57	23250	2.03
5000	0.92	14250	1.66	23500	2.08
5250	0.96	14500	1.58	23750	2.14
5500	0.99	14750	1.69	24000	2.16
5750	0.99	15000	1.71	24250	2.25
6000	1.03	15250	1.74	24500	2.17
6250	1.05	15500	1.75	24750	2.32
6500	1.07	15750	1.72	25000	2.32
6750	1.08	16000	1.89	25250	2.32
7000	1.12	16250	1.79	25500	2.41
7250	1.13	16500	1.84	25750	2.31
7500	1.15	16750	1.82	26000	2.28
7750	1.20	17000	1.79	26250	2.32
8000	1.20	17250	1.78	26500	2.29
8250	1.23	17500	1.85		
8500	1.27	17750	1.83		

Cable loss
Microwave Cable Assembly, 18 GHz, 6.4 m, SMA – SMA, Huber-Suhner, model 198-9155-00
HL 3121

Frequency, MHz	Cable loss, dB	Frequency, MHz	Cable loss, dB	Frequency, MHz	Cable loss, dB	Frequency, MHz	Cable loss, dB	Frequency, MHz	Cable loss, dB
10	0.08	3600	2.10	7400	3.08	11200	3.85	15100	4.58
30	0.18	3700	2.14	7500	3.11	11300	3.85	15200	4.60
50	0.26	3800	2.18	7600	3.14	11400	3.86	15300	4.63
100	0.34	3900	2.19	7700	3.16	11500	3.86	15400	4.65
200	0.47	4000	2.25	7800	3.18	11600	3.87	15500	4.71
300	0.59	4100	2.25	7900	3.20	11700	3.85	15600	4.70
400	0.66	4200	2.28	8000	3.22	11800	3.96	15700	4.69
500	0.75	4300	2.35	8100	3.26	11900	3.92	15800	4.71
600	0.83	4400	2.35	8200	3.27	12000	3.92	15900	4.74
700	0.90	4500	2.38	8300	3.29	12100	3.94	16000	4.69
800	0.96	4600	2.43	8400	3.30	12200	3.94	16100	4.72
900	1.02	4700	2.43	8500	3.31	12300	3.99	16200	4.71
1000	1.07	4800	2.45	8600	3.33	12400	4.02	16300	4.74
1100	1.12	4900	2.48	8700	3.35	12500	4.10	16400	4.74
1200	1.15	5000	2.55	8800	3.36	12600	4.09	16500	4.75
1300	1.22	5100	2.54	8900	3.38	12700	4.15	16600	4.78
1400	1.28	5200	2.56	9000	3.40	12800	4.15	16700	4.86
1500	1.29	5300	2.58	9100	3.41	12900	4.08	16800	4.84
1600	1.36	5400	2.61	9200	3.45	13000	4.21	16900	4.83
1700	1.40	5500	2.64	9300	3.48	13100	4.19	17000	4.86
1800	1.45	5600	2.69	9400	3.52	13200	4.29	17100	4.83
1900	1.51	5700	2.67	9500	3.54	13300	4.24	17200	4.90
2000	1.50	5800	2.71	9600	3.59	13400	4.26	17300	4.91
2100	1.56	5900	2.73	9700	3.59	13500	4.26	17400	4.94
2200	1.59	6000	2.75	9800	3.62	13600	4.29	17500	4.93
2300	1.63	6100	2.81	9900	3.70	13700	4.35	17600	4.93
2400	1.73	6200	2.80	10000	3.70	13800	4.31	17700	5.00
2500	1.73	6300	2.82	10100	3.72	13900	4.29	17800	5.01
2600	1.78	6400	2.85	10200	3.73	14000	4.32	17900	5.00
2700	1.84	6500	2.87	10300	3.75	14100	4.33	18000	5.00
2800	1.84	6600	2.90	10400	3.76	14200	4.34		
2900	1.91	6700	2.91	10500	3.77	14300	4.36		
3000	1.91	6800	2.94	10600	3.79	14400	4.38		
3100	1.97	6900	2.96	10700	3.80	14600	4.42		
3200	1.98	7000	2.98	10800	3.81	14700	4.42		
3300	2.04	7100	3.01	10900	3.81	14800	4.55		
3400	2.04	7200	3.02	11000	3.83	14900	4.55		
3500	2.10	7300	3.04	11100	3.84	15000	4.55		

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, 6.5 m
Suhner Switzerland, HL 3616

Frequency, MHz	Cable loss, dB	Frequency, MHz	Cable loss, dB	Frequency, MHz	Cable loss, dB	Frequency, MHz	Cable loss, dB
10	0.13	1750	2.66	3550	4.44	5350	6.08
30	0.25	1800	2.72	3600	4.46	5400	6.12
50	0.32	1850	2.78	3650	4.59	5450	6.17
100	0.48	1900	2.81	3700	4.60	5500	6.25
150	0.60	1950	2.86	3750	4.72	5550	6.31
200	0.71	2000	2.94	3800	4.72	5600	6.35
250	0.81	2050	2.97	3850	4.86	5650	6.41
300	0.91	2100	3.01	3900	4.85	5700	6.50
350	1.00	2150	3.06	3950	4.99	5750	6.52
400	1.07	2200	3.11	4000	4.90	5800	6.57
450	1.14	2250	3.16	4050	5.04	5850	6.61
500	1.23	2300	3.21	4100	5.01	5900	6.71
550	1.30	2350	3.26	4150	5.10	5950	6.70
600	1.37	2400	3.31	4200	5.08	6000	6.75
650	1.44	2450	3.35	4250	5.18	6050	6.74
700	1.50	2500	3.39	4300	5.14	6100	6.84
750	1.58	2550	3.46	4350	5.22	6150	6.87
800	1.64	2600	3.48	4400	5.21	6200	6.93
850	1.69	2650	3.55	4450	5.29	6250	6.96
900	1.77	2700	3.59	4500	5.31	6300	7.02
950	1.79	2750	3.66	4550	5.39	6350	7.04
1000	1.87	2800	3.68	4600	5.41	6400	7.10
1050	1.92	2850	3.75	4650	5.49	6450	7.11
1100	1.98	2900	3.79	4700	5.52	6500	7.19
1150	2.05	2950	3.86	4750	5.60		
1200	2.09	3000	3.89	4800	5.64		
1250	2.15	3050	3.94	4850	5.73		
1300	2.21	3100	3.98	4900	5.70		
1350	2.27	3150	4.03	4950	5.73		
1400	2.33	3200	4.06	5000	5.75		
1450	2.38	3250	4.12	5050	5.83		
1500	2.44	3300	4.14	5100	5.82		
1550	2.48	3350	4.22	5150	5.91		
1600	2.52	3400	4.24	5200	5.92		
1650	2.56	3450	4.31	5250	5.98		
1700	2.62	3500	4.35	5300	6.01		

13 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
k	kilo
kHz	kilohertz
LO	local oscillator
LRU	Large Replaceable Unit
m	meter
MHz	megahertz
min	minute
mm	millimeter
ms	millisecond
μs	microsecond
NA	not applicable
NB	narrow band
OATS	open area test site
Ω	Ohm
QP	quasi-peak
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