

TEST REPORT

ACCORDING TO: FCC 47CFR part 27

FOR:

Airspan Networks Inc.

WiMAX base station

Model: MacroMAXe 2310L 2.29-2.35G

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1 Applicant information

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Contact name: Mr. Zion Levi

2 Equipment under test attributes

Product name: WiMAX base station
Product type: Transceiver
Model(s): Air4G-MacroMAXe 2310L 2.29-2.35G
Serial number: 51AAB151AAC
Hardware version: A7
Software release: 13.9.60.007
Receipt date: 5/22/2011

3 Manufacturer information

Manufacturer name: Airspan Networks Inc.
Address: 777 Yamato Rd, Suite 310, Boca Raton 33431, Florida, USA
Telephone: +1 561 893 8686
Fax: +1 561 893 8671
E-Mail: zlevi@airspan.com
Contact name: Mr. Zion Levi

4 Test details

Project ID: 22030
Location: Hermon Laboratories Ltd. Harakevet Industrial Zone, Binyamina 30500, Israel
Test started: 5/22/2011
Test completed: 5/27/2011
Test specification(s): FCC 47CFR part 27

5 Tests summary

Test	Status
Transmitter characteristics	
Section 27.50(a)(1), Peak output power at RF antenna connector	Pass
Section 2.1091, 27.52, RF safety	Pass, exhibit provided in Application for certification
Section 27.53(a)(1), Emission mask	Pass
Section 27.53(a)(1), Spurious emissions at RF antenna connector	Pass
Section 27.53(a)(1), Radiated spurious emissions	Pass
Section 27.54, Frequency stability	Pass
Section 2.1049, Occupied bandwidth	Pass

Testing was completed against all relevant requirements of the test standard. 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. S. Samokha, test engineer	May 27, 2011	
Reviewed by:	Mrs. M. Cherniavsky, certification engineer	June 5, 2011	
Approved by:	Mr. M. Nikishin, EMC and Radio group manager	June 9, 2011	

6 EUT description

6.1 General information

The EUT, base station radio MacroMAXe 2310L 2.29-2.35G, is a part of a WiMAX broadband fixed cellular wireless access system. The system provides a radio link between an end-user (a subscriber) and a network to give high-speed data access. The MacroMAXe's transceiver (up to 64 QAM modulation, data rate up to 46) uses OFDM and operating in TDD duplexing mode, equipped with a 18 dBi external antenna.

The MacroMAXe is installed outdoors and typically is mounted on a pole. The Subscriber transmits and receives traffic to and from the base station respectively. The transceiver provides subscribers with "always-on" Internet, high speed data only, or data and voice (VoIP) services and is configured with a unique base station reference number, preventing the ProST from relocating to another subscriber premises without authorization.

6.2 Ports and lines

Port type	Port description	Connected from	Connected to	Qty.	Cable type	Cable length, m
Power	DC power	DC power supply	EUT	1	Unshielded	10
Signal	Ethernet	ETH2 port	ETH3 port	1	Shielded	1.5
Signal	Ethernet	ETH1 port	Laptop	1	Shielded	10
Signal	Antenna	EUT	GPS external antenna	1	Coax	5
RF	Antenna	EUT	Termination 50 Ohm	4	Coax	NA
Signal	RS-232	EUT	Laptop	1	Unshielded	2

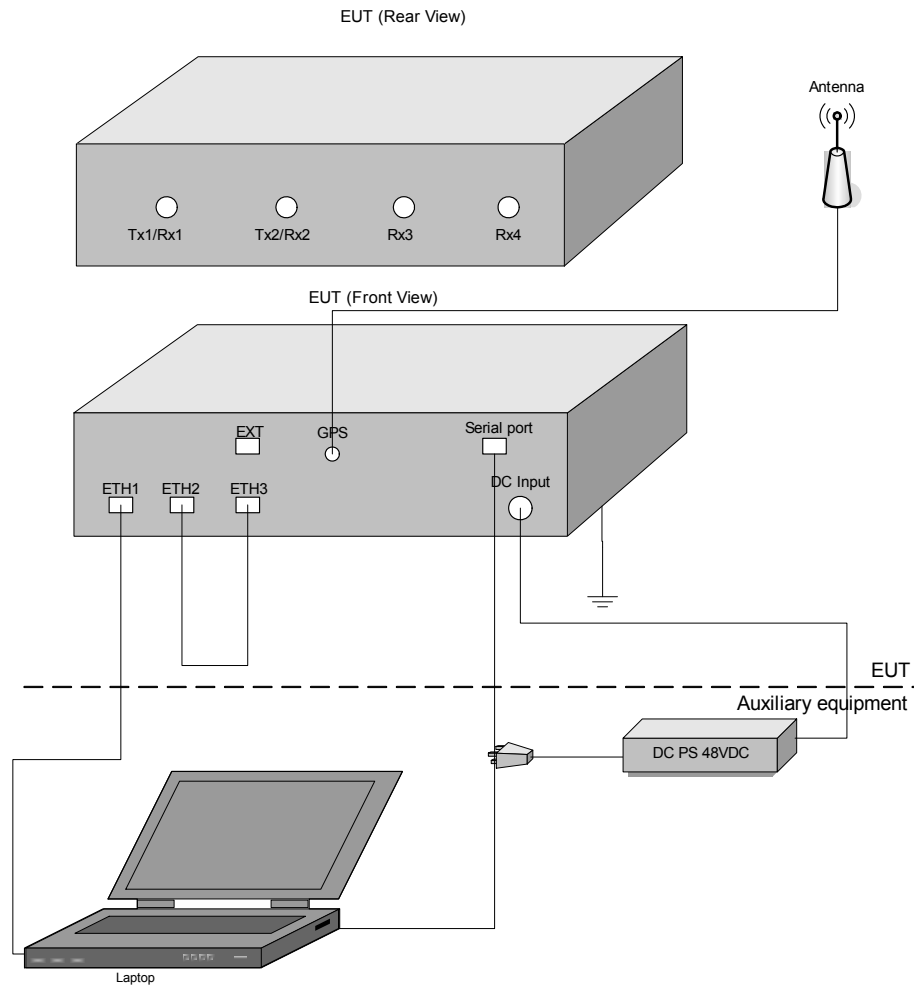
6.3 Support and test equipment

Description	Manufacturer	Model number	Serial number
DC power supply	Horizon Electronics	DHR3655D	767469
Laptop	IBM	X31	99-TXWYC
GPS Antenna	Trimble	P/N 57861-00	01880177

6.4 Changes made in EUT

No changes were implemented.

6.5 Test configuration



6.6 Transmitter characteristics

Type of equipment					
V	Stand-alone (Equipment with or without its own control provisions)				
	Combined equipment (Equipment where the radio part is fully integrated within another type of equipment)				
	Plug-in card (Equipment intended for a variety of host systems)				
Intended use		Condition of use			
V	fixed	Always at a distance more than 2 m from all people			
	mobile	Always at a distance more than 20 cm from all people			
	portable	May operate at a distance closer than 20 cm to human body			
Assigned frequency range		2315.0 – 2320.0 MHz; 2345.0-2350.0 MHz			
Operating frequency		2316.75; 2348.25 MHz			
RF channel spacing		3.5 MHz			
Maximum rated output power		At transmitter 50 Ω RF output connector	40.26 dBm		
Is transmitter output power variable?		No			
		V	Yes	continuous variable	
				stepped variable with stepsize	0.5 dB
				minimum RF power	-30 dBm
		maximum RF power at antenna connector	40.26 dBm		
Antenna connection					
unique coupling	V	standard connector	Integral		
			with temporary RF connector without temporary RF connector		
Antenna/s technical characteristics					
Type	Manufacturer	Model number	Gain		
Dual Polarized 65° Sector Antenna, Fixed Tilt	Alpha Wireless	AW3007	18 dBi		
Dual Polarized 90° Sector Antenna, Fixed Tilt	Alpha Wireless	AW3008	17 dBi		
Transmitter aggregate data rate/s, Mbps					
Transmitter 99% power bandwidth	Type of modulation				
3.5 MHz	QPSK	16QAM	64QAM		
	4	9	14		
Type of multiplexing	OFDMA/TDD				
Modulating test signal (baseband)	PRBS				
Maximum transmitter duty cycle in normal use	75%				
Transmitter power source					
V	DC	Nominal rated voltage	48 VDC via DC power supply		
Common power source for transmitter and receiver		V	yes no		

Test specification:		Section 27.50(a)(1), Peak output power	
Test procedure:		47 CFR, Section 2.1046; TIA/EIA-603-C, Section 2.2.1	
Test mode:		Compliance	Verdict: PASS
Date:		5/23/2011	
Temperature: 23.4 °C	Air Pressure: 1013 hPa	Relative Humidity: 47 %	Power Supply: 48 VDC
Remarks:			

7 Transmitter tests according to 47CFR part 27

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 EIRP	
	W	dBm
2315.0 – 2320.0	2000	63
2345.0 – 2350.0	2000	63

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 spectrum analyzer as provided in Table 7.1.2 and associated plots.

Figure 7.1.1 Peak output power test setup



Test specification:		Section 27.50(a)(1), Peak output power	
Test procedure:		47 CFR, Section 2.1046; TIA/EIA-603-C, Section 2.2.1	
Test mode:	Compliance	Verdict:	PASS
Date:	5/23/2011		
Temperature: 23.4 °C	Air Pressure: 1013 hPa	Relative Humidity: 47 %	Power Supply: 48 VDC
Remarks:			

Table 7.1.2 Peak output power test results

ASSIGNED FREQUENCY RANGE: 2315.0-2320.0 MHz
2345.0-2350.0 MHz

DETECTOR USED: Average

MODULATING SIGNAL: PRBS

TRANSMITTER OUTPUT POWER SETTINGS: Maximum

DUTY CYCLE: 75%

EBW: 3.5 MHz

MAXIMUM ANTENNA GAIN: 18 dBi

Carrier frequency, MHz	Power Meter reading RF#1, dBm	Power Meter reading RF#2, dBm	Total RF power*, dBm	Antenna gain, dBi	Total EIRP**, dBm	Limit, dBm	Margin, dB	Verdict
QPSK 4 Mbps								
2316.75	37.26	37.24	40.26	18.0	58.26	63.0	-4.74	Pass
2348.25	37.20	37.11	40.17	18.0	58.17	63.0	-4.83	Pass
64QAM 14 Mbps								
2316.75	37.28	37.17	40.24	18.0	58.26	63.0	-4.74	Pass
2348.25	37.21	37.18	40.21	18.0	58.17	63.0	-4.83	Pass

* - Total RF power, dBm = $10 \log\{10^{[P(\text{dBm}, \text{RF}\#1)/10]} + 10^{[P(\text{dBm}, \text{RF}\#2)/10]}\}$

** - EIRP total, dBm = Total RF power**, dBm + Antenna Gain, dBi

MAXIMUM ANTENNA GAIN: 17 dBi

Carrier frequency, MHz	Power Meter reading RF#1, dBm	Power Meter reading RF#2, dBm	Total RF power*, dBm	Antenna gain, dBi	Total EIRP**, dBm	Limit, dBm	Margin, dB	Verdict
QPSK 4 Mbps								
2316.75	37.26	37.24	40.26	17.0	57.26	63.0	-5.74	Pass
2348.25	37.20	37.11	40.17	17.0	57.17	63.0	-5.83	Pass
64QAM 14 Mbps								
2316.75	37.28	37.17	40.24	17.0	57.25	63.0	-5.75	Pass
2348.25	37.21	37.18	40.21	17.0	57.21	63.0	-5.79	Pass

* - Total RF power, dBm = $10 \log\{10^{[P(\text{dBm}, \text{RF}\#1)/10]} + 10^{[P(\text{dBm}, \text{RF}\#2)/10]}\}$

** - EIRP total, dBm = Total RF power**, dBm + Antenna Gain, dBi

Reference numbers of test equipment used

HL 3301	HL 3302	HL 3868	HL 3901				
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Full description is given in Appendix A.

Test specification:		Section 2.1049, Occupied bandwidth	
Test procedure:		47 CFR, Section 2.1049	
Test mode:		Compliance	Verdict: PASS
Date:		5/22/2011	
Temperature: 22.6 °C	Air Pressure: 1012 hPa	Relative Humidity: 44 %	Power Supply: 48 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
2305.0 – 2320.0 2345.0 – 2350.0	26	NA

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

7.2.2 Test procedure

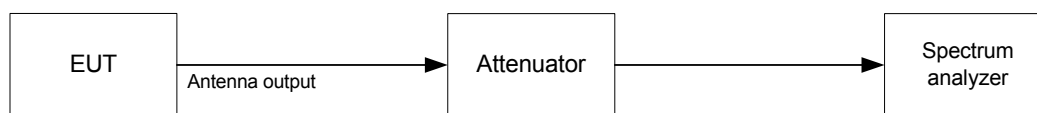
7.2.2.1 The EUT was set up as shown in Figure 7.2.1, energized and its proper operation was checked.

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 2.1049, Occupied bandwidth	
Test procedure:		47 CFR, Section 2.1049	
Test mode:	Compliance	Verdict:	PASS
Date:	5/22/2011		
Temperature: 22.6 °C	Air Pressure: 1012 hPa	Relative Humidity: 44 %	Power Supply: 48 VDC
Remarks:			

Table 7.2.2 Occupied bandwidth test results

DETECTOR USED: Peak hold
RESOLUTION BANDWIDTH: 36 kHz
VIDEO BANDWIDTH: 110 kHz
MODULATION ENVELOPE REFERENCE POINTS: 26 dBc
MODULATION: OFDM
MODULATING SIGNAL: PRBS
EBW: 3.5 MHz

Carrier frequency, MHz	Occupied bandwidth, kHz	Limit, kHz	Margin, kHz	Verdict
QPSK 4 Mbps				
2316.75	3403.0	NA	NA	Pass
2348.25	3403.0	NA	NA	Pass
64QAM 14 Mbps				
2316.75	3403.0	NA	NA	Pass
2348.25	3378.0	NA	NA	Pass

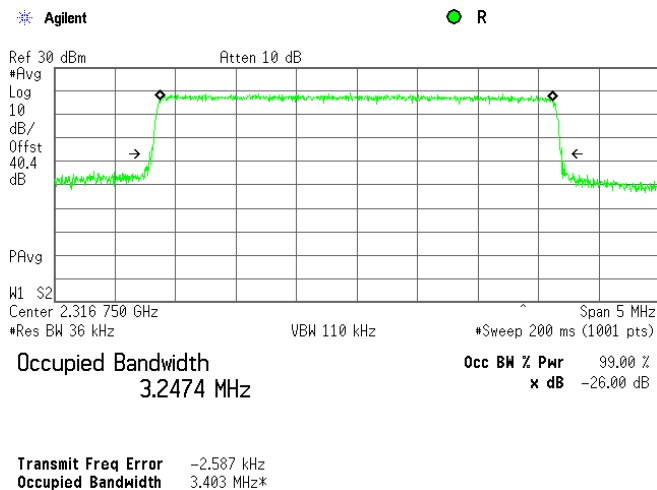
Reference numbers of test equipment used

HL 2953	HL 3787	HL 3818					
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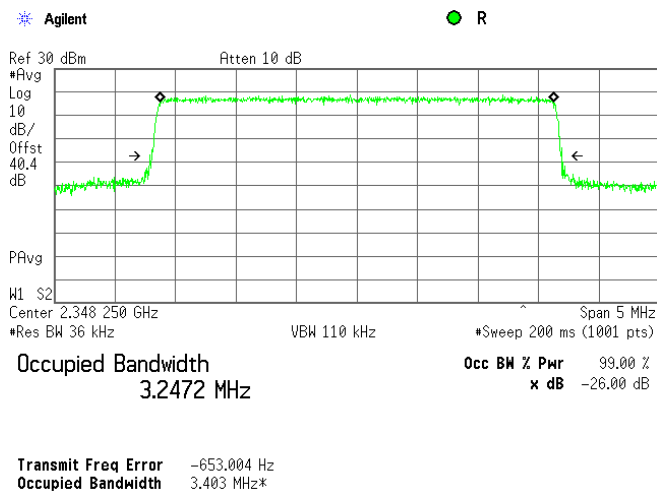
Full description is given in Appendix A.

Test specification:	Section 2.1049, Occupied bandwidth		
Test procedure:	47 CFR, Section 2.1049		
Test mode:	Compliance	Verdict:	PASS
Date:	5/22/2011		
Temperature: 22.6 °C	Air Pressure: 1012 hPa	Relative Humidity: 44 %	Power Supply: 48 VDC
Remarks:			

Plot 7.2.1 Occupied bandwidth test result at low frequency, 3.5 MHz EBW, QPSK

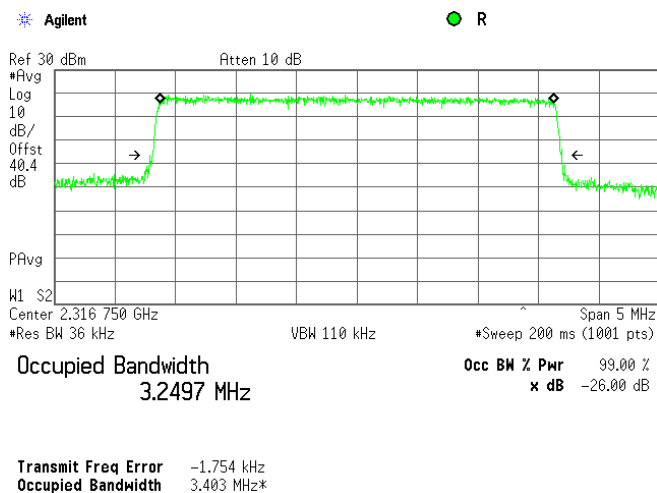


Plot 7.2.2 Occupied bandwidth test result at high frequency, 3.5 MHz EBW, QPSK

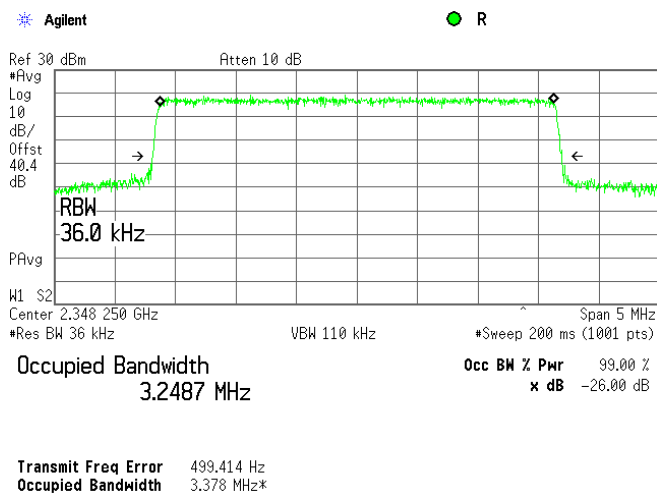


Test specification: Section 2.1049, Occupied bandwidth			
Test procedure: 47 CFR, Section 2.1049			
Test mode: Compliance		Verdict: PASS	
Date: 5/22/2011			
Temperature: 22.6 °C	Air Pressure: 1012 hPa	Relative Humidity: 44 %	Power Supply: 48 VDC
Remarks:			

Plot 7.2.3 Occupied bandwidth test results at low frequency, 3.5 MHz EBW, 64QAM



Plot 7.2.4 Occupied bandwidth test results at high frequency, 3.5 MHz EBW, 64QAM



Test specification:		Section 27.53(a)(1), Emission mask	
Test procedure:		47 CFR, Sections 2.1051, Section 27.53 (5)	
Test mode:	Compliance	Verdict:	PASS
Date:	5/23/2011		
Temperature: 23.6 °C	Air Pressure: 1013 hPa	Relative Humidity: 47 %	Power Supply: 48 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

Channel	Frequency range	Attenuation below carrier, dBc	Limit, dBm
Channel bandwidth 3.5 MHz			
2316.75	Below 2285.0	$75 + 10\log(P^*)$	-45.0
	2287.5	$72 + 10\log(P^*)$	-42.0
	2300.0	$70 + 10\log(P^*)$	-40.0
	2305.0	$43 + 10\log(P^*)$	-13.0
	2305.0 – 2320.0	$43 + 10\log(P^*)$	-13.0
	2320.0 – 2345.0	$75 + 10\log(P^*)$	-45.0
2348.25	2320.0 – 2345.0	$75 + 10\log(P^*)$	-45.0
	2345.0 – 2360.0	$43 + 10\log(P^*)$	-13.0
	2360.0	$43 + 10\log(P^*)$	-13.0
	2362.5	$55 + 10\log(P^*)$	-25.0
	2365.0	$70 + 10\log(P^*)$	-40.0
	2367.5	$72 + 10\log(P^*)$	-42.0
	Above 2370.0	$75 + 10\log(P^*)$	-45.0

* - P is a transmitter output power in watts.

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 the associated plots.
- 7.3.2.3 The worst case results are provided in the associated tables and shown in the associated plots.

Test specification:		Section 27.53(a)(1), Emission mask	
Test procedure:		47 CFR, Sections 2.1051, Section 27.53 (5)	
Test mode:	Compliance	Verdict:	PASS
Date:	5/23/2011		
Temperature: 23.6 °C	Air Pressure: 1013 hPa	Relative Humidity: 47 %	Power Supply: 48 VDC
Remarks:			

Figure 7.3.1 Emission mask test setup



Test specification:	Section 27.53(a)(1), Emission mask		
Test procedure:	47 CFR, Sections 2.1051, Section 27.53 (5)		
Test mode:	Compliance	Verdict:	PASS
Date:	5/23/2011		
Temperature: 23.6 °C	Air Pressure: 1013 hPa	Relative Humidity: 47 %	Power Supply: 48 VDC
Remarks:			

Table 7.3.2 Spurious emission at the band edges test results (single output)

ASSIGNED FREQUENCY RANGE: 2315.0 – 2320.0 MHz; 2345.0 – 2350.0 MHz
 RBW: 100 kHz
 DETECTOR USED: Average
 VIDEO BANDWIDTH: ≥ Resolution bandwidth
 MODULATING SIGNAL: PRBS
 TRANSMITTER OUTPUT POWER SETTINGS: Maximum
 MODULATION: QPSK, 64QAM
 EBW: 3.5MHz

Frequency offset, MHz	SA reading, dBm low range	SA reading, dBm high range	RBW, kHz	Integration BW, kHz	Limit, dBm	Verdict
Low carrier frequency 2316.75 MHz, QPSK						
2313.955	-23.12	NA	100	1000	-13.0	Pass
2314.998	-24.65	NA	36	NA	-13.0	
2320.079	NA	-53.12	36	NA	-45.0	
2321.500	NA	-48.80	100	1000	-45.0	
Low carrier frequency 2316.75 MHz, 64QAM						
2313.991	-22.99	NA	100	1000	-13.0	Pass
2314.998	-24.65	NA	36	NA	-13.0	
2320.039	NA	-54.49	36	NA	-45.0	
2321.500	NA	-49.23	100	1000	-45.0	
High carrier frequency 2348.25 MHz, QPSK						
2343.500	-49.19	NA	36	1000	-45.0	Pass
2344.981	-53.88	NA	36	NA	-45.0	
2350.002	NA	-23.82	36	NA	-13.0	
2351.009	NA	-21.84	100	1000	-13.0	
2363.810	NA	-48.42	100	1000	-45.0	
High carrier frequency 2348.25 MHz, 64QAM						
2343.500	-48.68	NA	36	1000	-45.0	Pass
2344.953	-55.82	NA	36	NA	-45.0	
2350.002	NA	-23.62	36	NA	-13.0	
2351.189	NA	-22.91	100	1000	-13.0	

Reference numbers of test equipment used

HL 3206	HL 3301	HL 3302	HL 3818	HL 3868	HL 3901		
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Full description is given in Appendix A.

Test specification:	Section 27.53(a)(1), Emission mask		
Test procedure:	47 CFR, Sections 2.1051, Section 27.53 (5)		
Test mode:	Compliance	Verdict:	PASS
Date:	5/23/2011		
Temperature: 23.6 °C	Air Pressure: 1013 hPa	Relative Humidity: 47 %	Power Supply: 48 VDC
Remarks:			

Table 7.3.3 Spurious emission at the band edges test results (combined output)

ASSIGNED FREQUENCY RANGE: 2315.0 – 2320.0 MHz; 2345.0 – 2350.0 MHz
 RBW: 100 kHz
 DETECTOR USED: Average
 VIDEO BANDWIDTH: ≥ Resolution bandwidth
 MODULATING SIGNAL: PRBS
 TRANSMITTER OUTPUT POWER SETTINGS: Maximum
 MODULATION: QPSK, 64QAM
 EBW: 3.5MHz

Frequency, MHz	Low band SA reading, dBm	Low band test result, dBm*	High band SA reading, dBm	High band test result, dBm**	RBW, kHz	Integration BW, kHz	Limit, dBm	Verdict
Low carrier frequency 2316.75 MHz QPSK								
2313.955	-23.12	-20.12	NA	NA	100	1000	-13.0	Pass
2314.998	-24.65	-21.65	NA	NA	36	NA	-13.0	
2320.079	NA	NA	-53.12	-50.12	36	NA	-45.0	
2321.500	NA	NA	-48.80	-45.80	100	1000	-45.0	
Low carrier frequency 2316.75 MHz 64QAM								
2313.991	-22.99	-19.99	NA	NA	100	1000	-13.0	Pass
2314.998	-24.65	-21.65	NA	NA	36	NA	-13.0	
2320.039	NA	NA	-54.49	-51.49	36	NA	-45.0	
2321.500	NA	NA	-49.23	-46.23	100	1000	-45.0	
High carrier frequency 2348.25 MHz QPSK								
2343.500	-49.19	-46.19	NA	NA	100	1000	-45.0	Pass
2344.981	-53.88	-50.88	NA	NA	36	NA	-45.0	
2350.002	NA	NA	-23.82	-20.82	36	NA	-13.0	
2351.009	NA	NA	-21.84	-18.84	100	1000	-13.0	
2363.810	NA	NA	-48.42	-45.42	1000	NA	-45.0	
High carrier frequency 2348.25 MHz 64QAM								
2343.500	-48.68	-45.68	NA	NA	100	1000	-45.0	Pass
2344.953	-55.82	-52.82	NA	NA	36	NA	-45.0	
2350.002	NA	NA	-23.62	-20.62	36	NA	-13.0	
2351.189	NA	NA	-22.91	-19.91	100	1000	-13.0	

* - Low band test result = Low band SA Reading + 10log(2)

** - High band test result = High band SA Reading + 10log(2)

Reference numbers of test equipment used

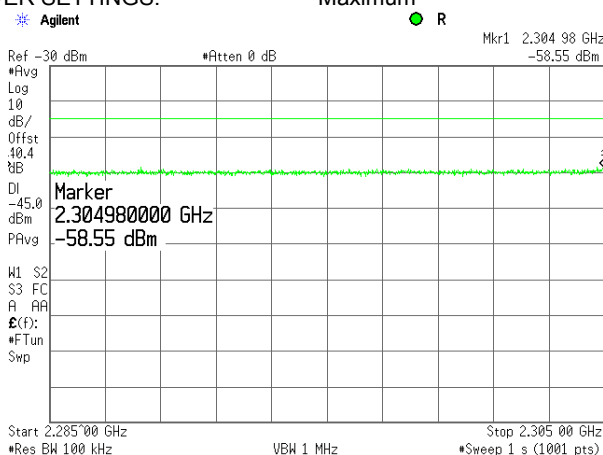
HL 3206	HL 3301	HL 3302	HL 3818	HL 3868	HL 3901			
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Full description is given in Appendix A.

Test specification:	Section 27.53(a)(1), Emission mask		
Test procedure:	47 CFR, Sections 2.1051, Section 27.53 (5)		
Test mode:	Compliance	Verdict:	PASS
Date:	5/23/2011		
Temperature: 23.6 °C	Air Pressure: 1013 hPa	Relative Humidity: 47 %	Power Supply: 48 VDC
Remarks:			

Plot 7.3.1 Emission mask test results at low carrier frequency in frequency range 2285-2305 MHz (single output)

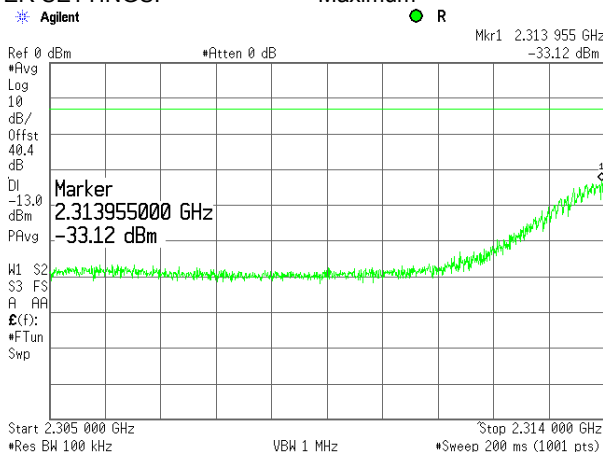
OPERATING FREQUENCY RANGE: 2315.0 – 2320.0 MHz
DETECTOR USED: Average
MODULATION: QPSK
MODULATING SIGNAL: PRBS
BIT RATE: 4 Mbps
TRANSMITTER OUTPUT POWER SETTINGS: Maximum



Test result = SA reading + 10*log(1MHz/RBW) = -58.55 + 10 = -48.55 dBm

Plot 7.3.2 Emission mask test results at low carrier frequency in frequency range 2305-2314 MHz (single output)

OPERATING FREQUENCY RANGE: 2315.0 – 2320.0 MHz
DETECTOR USED: Average
MODULATION: QPSK
MODULATING SIGNAL: PRBS
BIT RATE: 4 Mbps
TRANSMITTER OUTPUT POWER SETTINGS: Maximum



Test result = SA reading + 10*log(1MHz/RBW) = -33.12 + 10 = -23.12 dBm

Test specification:	Section 27.53(a)(1), Emission mask		
Test procedure:	47 CFR, Sections 2.1051, Section 27.53 (5)		
Test mode:	Compliance	Verdict:	PASS
Date:	5/23/2011		
Temperature: 23.6 °C	Air Pressure: 1013 hPa	Relative Humidity: 47 %	Power Supply: 48 VDC
Remarks:			

Plot 7.3.3 Emission mask test results at low carrier frequency in frequency range 2314-2321 MHz (single output)

OPERATING FREQUENCY RANGE:

DETECTOR USED:

MODULATION:

MODULATING SIGNAL:

BIT RATE:

TRANSMITTER OUTPUT POWER SETTINGS:

Low band edge

2315.0 – 2320.0 MHz

Average

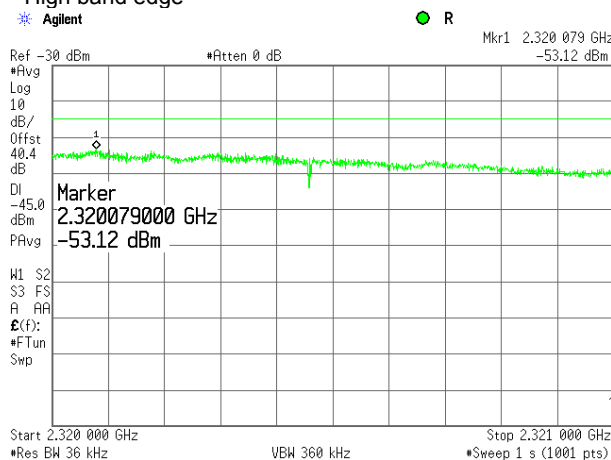
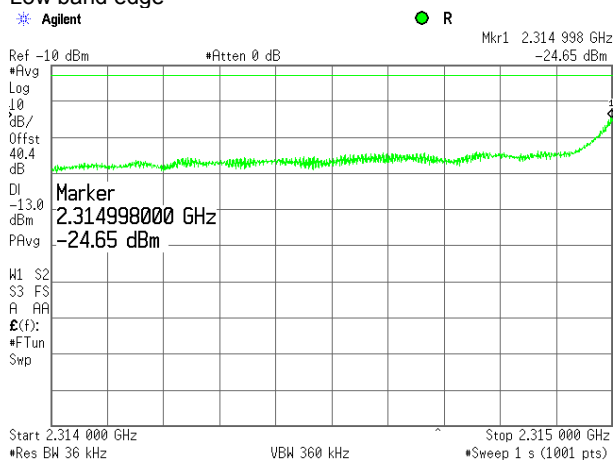
QPSK

PRBS

4 Mbps

Maximum

High band edge



Plot 7.3.4 Emission mask test results at low carrier frequency in frequency range 2321-2345 MHz (single output)

OPERATING FREQUENCY RANGE:

DETECTOR USED:

MODULATION:

MODULATING SIGNAL:

BIT RATE:

TRANSMITTER OUTPUT POWER SETTINGS:

2315.0 – 2320.0 MHz

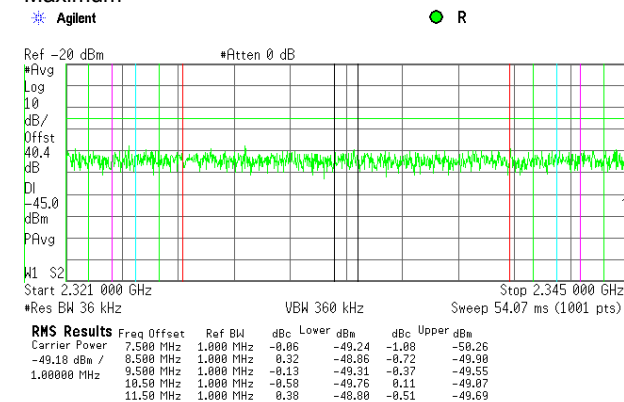
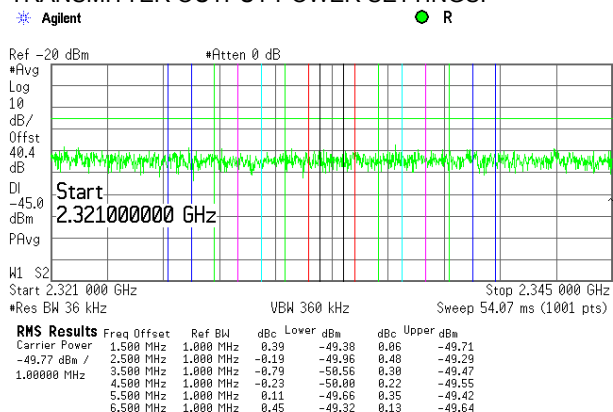
Average

QPSK

PRBS

4 Mbps

Maximum



Test specification:	Section 27.53(a)(1), Emission mask		
Test procedure:	47 CFR, Sections 2.1051, Section 27.53 (5)		
Test mode:	Compliance	Verdict:	PASS
Date:	5/23/2011		
Temperature: 23.6 °C	Air Pressure: 1013 hPa	Relative Humidity: 47 %	Power Supply: 48 VDC
Remarks:			

Plot 7.3.5 Emission mask test results at high carrier frequency in frequency range 2320-2344 MHz (single output)

OPERATING FREQUENCY RANGE:

DETECTOR USED:

MODULATION:

MODULATING SIGNAL:

BIT RATE:

TRANSMITTER OUTPUT POWER SETTINGS:

Agilent

R

2345.0 – 2350.0 MHz

Average

QPSK

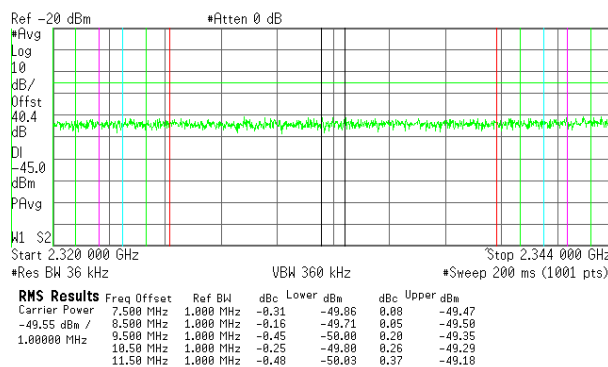
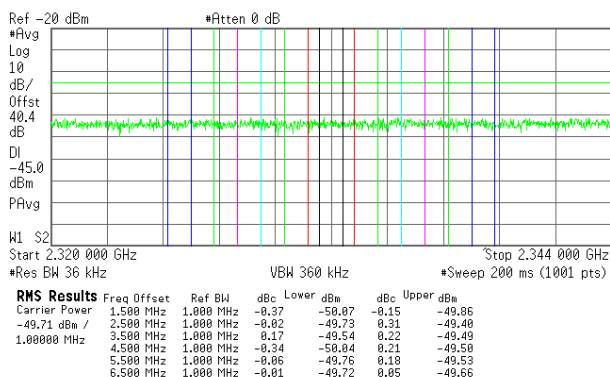
PRBS

4 Mbps

Maximum

Agilent

R



Plot 7.3.6 Emission mask test results at high carrier frequency in frequency range 2344-2351 MHz (single output)

OPERATING FREQUENCY RANGE:

DETECTOR USED:

MODULATION:

MODULATING SIGNAL:

BIT RATE:

TRANSMITTER OUTPUT POWER SETTINGS:

Low band edge

Agilent

R

2344.0 – 2351.0 MHz

Average

QPSK

PRBS

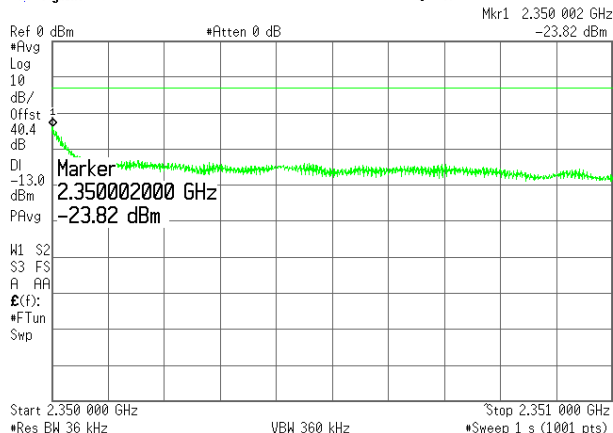
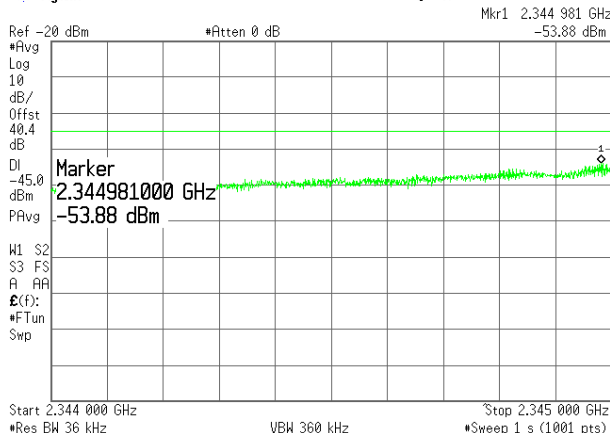
4 Mbps

Maximum

High band edge

Agilent

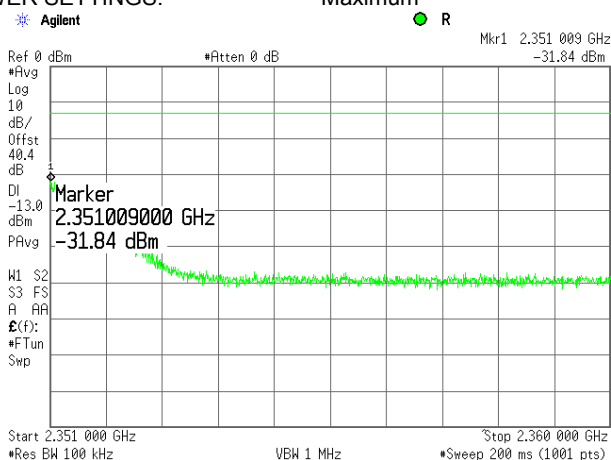
R



Test specification:		Section 27.53(a)(1), Emission mask	
Test procedure:		47 CFR, Sections 2.1051, Section 27.53 (5)	
Test mode:	Compliance	Verdict:	PASS
Date:	5/23/2011		
Temperature: 23.6 °C	Air Pressure: 1013 hPa	Relative Humidity: 47 %	Power Supply: 48 VDC
Remarks:			

Plot 7.3.7 Emission mask test results at high carrier frequency in frequency range 2351-2360 MHz (single output)

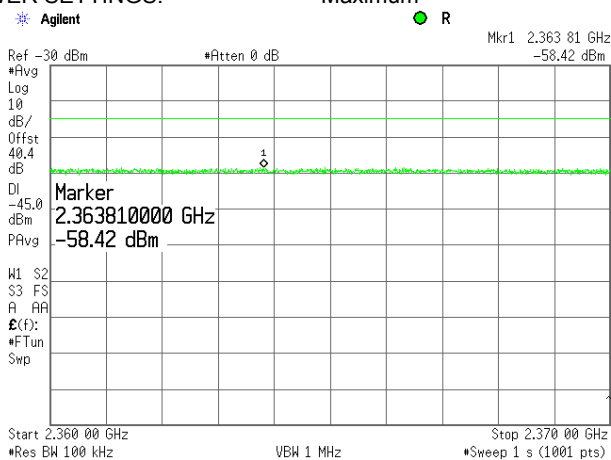
OPERATING FREQUENCY RANGE: 2345.0 – 2350.0 MHz
DETECTOR USED: Average
MODULATION: QPSK
MODULATING SIGNAL: PRBS
BIT RATE: 4 Mbps
TRANSMITTER OUTPUT POWER SETTINGS: Maximum



Test result = SA reading + 10*log(1MHz/RBW) = -31.84 + 10 = -21.84 dBm

Plot 7.3.8 Emission mask test results at high carrier frequency in frequency range 2360-2370 MHz (single output)

OPERATING FREQUENCY RANGE: 2345.0 – 2350.0 MHz
DETECTOR USED: Average
MODULATION: QPSK
MODULATING SIGNAL: PRBS
BIT RATE: 4 Mbps
TRANSMITTER OUTPUT POWER SETTINGS: Maximum



Test result = SA reading + 10*log(1MHz/RBW) = -58.42 + 10 = -48.42 dBm

Test specification:		Section 27.53(a)(1), Emission mask	
Test procedure:		47 CFR, Sections 2.1051, Section 27.53 (5)	
Test mode:	Compliance	Verdict:	PASS
Date:	5/23/2011		
Temperature: 23.6 °C	Air Pressure: 1013 hPa	Relative Humidity: 47 %	Power Supply: 48 VDC
Remarks:			

Plot 7.3.9 Emission mask test results at low carrier frequency in frequency range 2285-2305 MHz (single output)

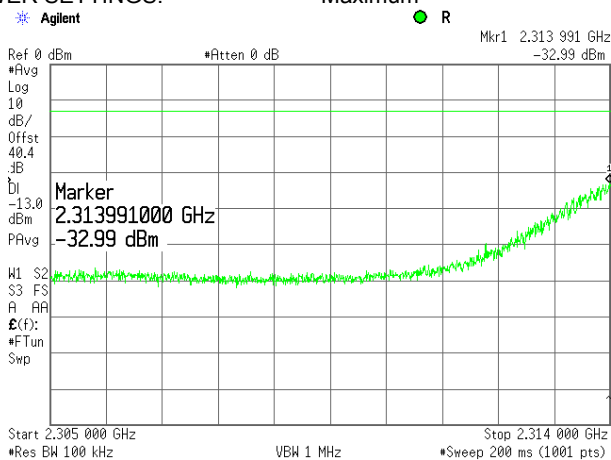
OPERATING FREQUENCY RANGE: 2315.0 – 2320.0 MHz
DETECTOR USED: Average
MODULATION: 64QAM
MODULATING SIGNAL: PRBS
BIT RATE: 14 Mbps
TRANSMITTER OUTPUT POWER SETTINGS: Maximum



Test result = SA reading + 10*log(1MHz/RBW) = -58.53 + 10 = -48.53 dBm

Plot 7.3.10 Emission mask test results at low carrier frequency in frequency range 2305-2314 MHz (single output)

OPERATING FREQUENCY RANGE: 2315.0 – 2320.0 MHz
DETECTOR USED: Average
MODULATION: 64QAM
MODULATING SIGNAL: PRBS
BIT RATE: 14 Mbps
TRANSMITTER OUTPUT POWER SETTINGS: Maximum



Test result = SA reading + 10*log(1MHz/RBW) = -32.99 + 10 = -22.99 dBm

Test specification:	Section 27.53(a)(1), Emission mask		
Test procedure:	47 CFR, Sections 2.1051, Section 27.53 (5)		
Test mode:	Compliance	Verdict:	PASS
Date:	5/23/2011		
Temperature: 23.6 °C	Air Pressure: 1013 hPa	Relative Humidity: 47 %	Power Supply: 48 VDC
Remarks:			

Plot 7.3.11 Emission mask test results at low carrier frequency in frequency range 2314-2321 MHz (single output)

OPERATING FREQUENCY RANGE:

DETECTOR USED:

MODULATION:

MODULATING SIGNAL:

BIT RATE:

TRANSMITTER OUTPUT POWER SETTINGS:

Low band edge

2315.0 – 2320.0 MHz

Average

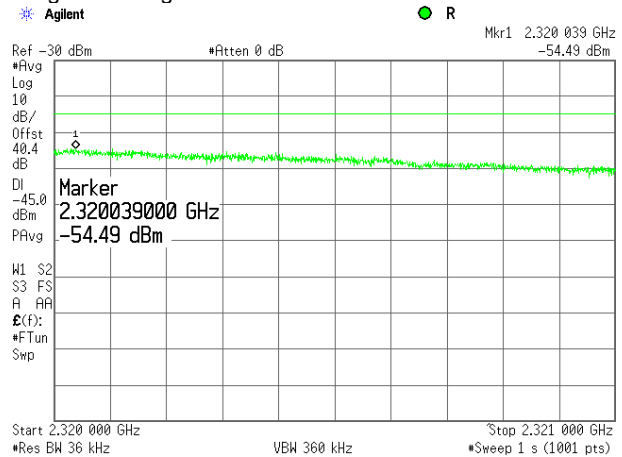
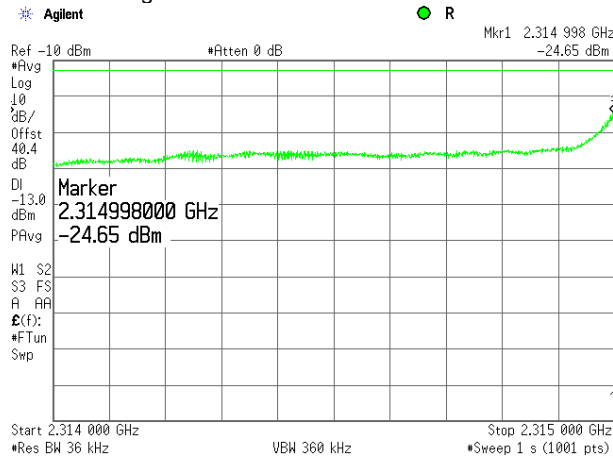
64QAM

PRBS

14 Mbps

Maximum

High band edge



Plot 7.3.12 Emission mask test results at low carrier frequency in frequency range 2321-2345 MHz (single output)

OPERATING FREQUENCY RANGE:

DETECTOR USED:

MODULATION:

MODULATING SIGNAL:

BIT RATE:

TRANSMITTER OUTPUT POWER SETTINGS:

Agilent

R

2315.0 – 2320.0 MHz

Average

64QAM

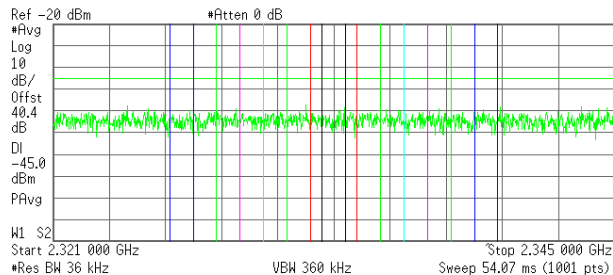
PRBS

14 Mbps

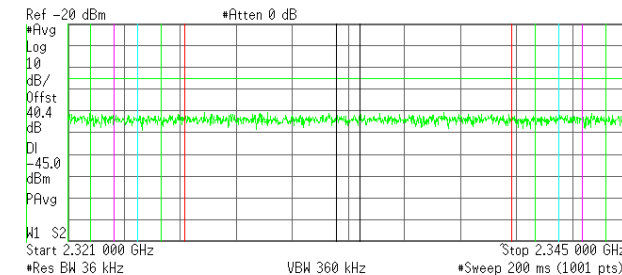
Maximum

Agilent

R



RMS Results	Freq Offset	Ref BW	dBc	Lower dBm	dBc	Upper dBm
Carrier Power	1.500 MHz	1.000 MHz	0.48	-49.36	0.57	-49.28
-49.85 dBm /	2.500 MHz	1.000 MHz	0.34	-49.58	0.16	-49.68
1.000000 MHz	3.500 MHz	1.000 MHz	-0.08	-49.93	-0.03	-49.88
	4.500 MHz	1.000 MHz	0.37	-49.48	0.47	-49.37
	5.500 MHz	1.000 MHz	0.17	-49.68	-0.47	-50.32
	6.500 MHz	1.000 MHz	-0.52	-50.37	0.27	-49.57



RMS Results	Freq Offset	Ref BW	dBc	Lower dBm	dBc	Upper dBm
Carrier Power	7.500 MHz	1.000 MHz	0.01	-49.71	-0.46	-50.18
-49.71 dBm /	8.500 MHz	1.000 MHz	0.09	-49.63	-0.21	-49.92
1.000000 MHz	9.500 MHz	1.000 MHz	-0.17	-49.88	0.24	-49.47
	10.50 MHz	1.000 MHz	-0.08	-49.79	0.00	-49.71
	11.50 MHz	1.000 MHz	0.49	-49.23	-0.27	-49.98

Test specification:	Section 27.53(a)(1), Emission mask		
Test procedure:	47 CFR, Sections 2.1051, Section 27.53 (5)		
Test mode:	Compliance	Verdict:	PASS
Date:	5/23/2011		
Temperature: 23.6 °C	Air Pressure: 1013 hPa	Relative Humidity: 47 %	Power Supply: 48 VDC
Remarks:			

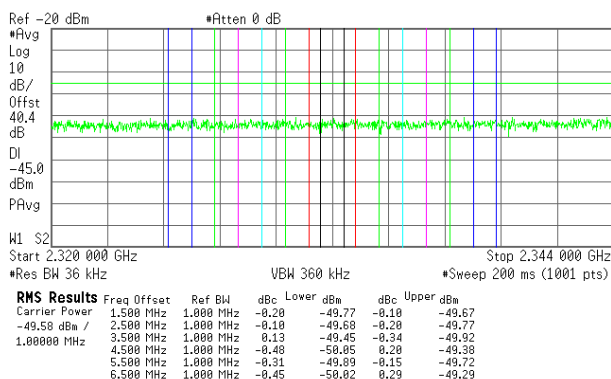
Plot 7.3.13 Emission mask test results at high carrier frequency in frequency range 2320-2344 MHz (single output)

OPERATING FREQUENCY RANGE:
DETECTOR USED:
MODULATION:
MODULATING SIGNAL:
BIT RATE:
TRANSMITTER OUTPUT POWER SETTINGS:

2345.0 – 2350.0 MHz
Average
64QAM
PRBS
14 Mbps
Maximum

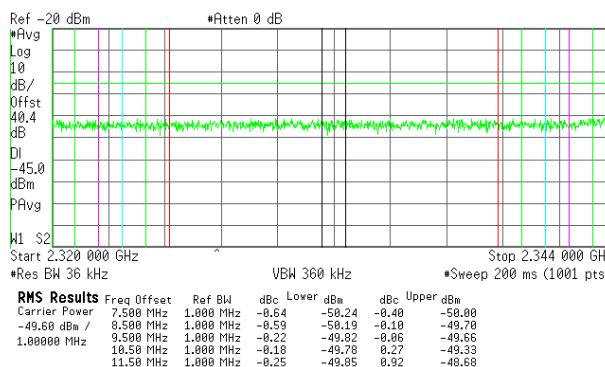
Agilent

R



Agilent

R



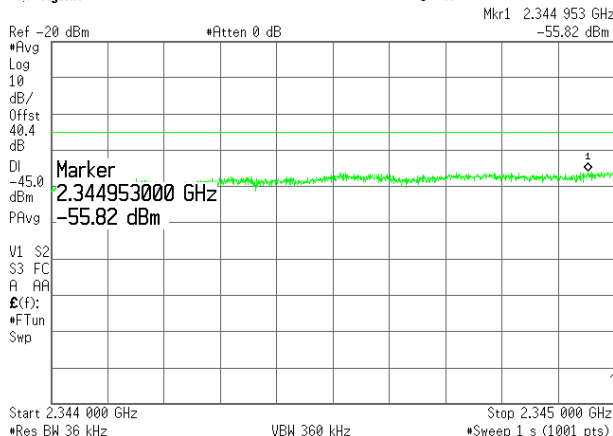
Plot 7.3.14 Emission mask test results at high carrier frequency in frequency range 2344-2351 MHz (single output)

OPERATING FREQUENCY RANGE:
DETECTOR USED:
MODULATION:
MODULATING SIGNAL:
BIT RATE:
TRANSMITTER OUTPUT POWER SETTINGS:
Low band edge

2345.0 – 2350.0 MHz
Average
64QAM
PRBS
14 Mbps
Maximum
High band edge

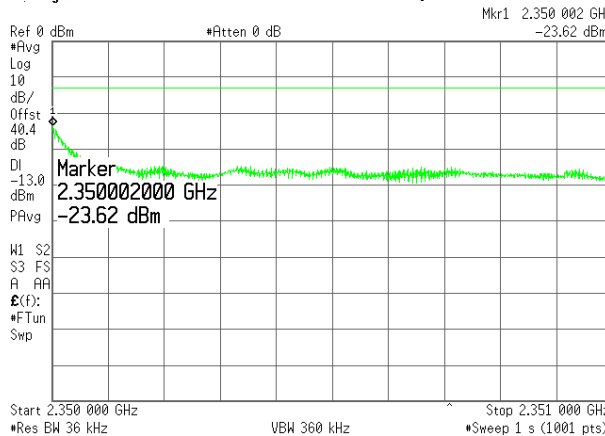
Agilent

R



Agilent

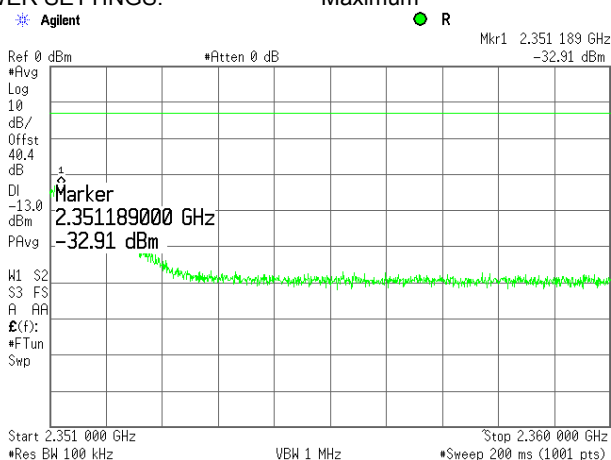
R



Test specification:		Section 27.53(a)(1), Emission mask	
Test procedure:		47 CFR, Sections 2.1051, Section 27.53 (5)	
Test mode:	Compliance	Verdict:	PASS
Date:	5/23/2011		
Temperature: 23.6 °C	Air Pressure: 1013 hPa	Relative Humidity: 47 %	Power Supply: 48 VDC
Remarks:			

Plot 7.3.15 Emission mask test results at high carrier frequency in frequency range 2351-2360 MHz (single output)

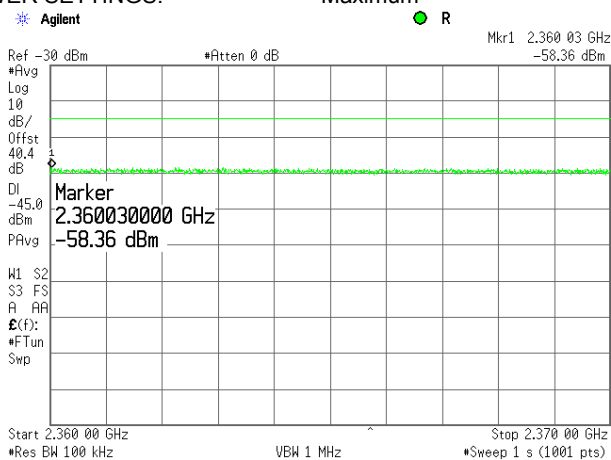
OPERATING FREQUENCY RANGE: 2345.0 – 2350.0 MHz
DETECTOR USED: Average
MODULATION: 64QAM
MODULATING SIGNAL: PRBS
BIT RATE: 14 Mbps
TRANSMITTER OUTPUT POWER SETTINGS: Maximum



Test result = SA reading + 10*log(1MHz/RBW) = -32.91 + 10 = -22.91 dBm

Plot 7.3.16 Emission mask test results at high carrier frequency in frequency range 2360-2370 MHz (single output)

OPERATING FREQUENCY RANGE: 2345.0 – 2350.0 MHz
DETECTOR USED: Average
MODULATION: 64QAM
MODULATING SIGNAL: PRBS
BIT RATE: 14 Mbps
TRANSMITTER OUTPUT POWER SETTINGS: Maximum



Test result = SA reading + 10*log(1MHz/RBW) = -58.36 = -48.36 dBm

Test specification:	Section 27.53(a)(1), Radiated spurious emissions		
Test procedure:	47 CFR, Section 2.1053, Section 27.53 (5), TIA/EIA-603-C, Section 2.2.12		
Test mode:	Compliance	Verdict:	PASS
Date:	5/24/2011 - 5/25/2011		
Temperature: 23.2 °C	Air Pressure: 1014 hPa	Relative Humidity: 45 %	Power Supply: 48 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)***
2305 – 2320 2345 - 2360	43+10logP**	-13	82.2
0.009 – 10th harmonic*	75+10logP**	-45	50.2

* - Excluding the in band emission within ± 250 % of the authorized bandwidth from the carrier

** - P is a transmitter output power in watts

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

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° 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° 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.

7.4.4 Test procedure for substitution ERP measurements of spurious

7.4.4.1 The test equipment was set up as shown in Figure 7.4.3 and energized.

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

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

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

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

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

7.4.4.7 The worst test results (the lowest margins) were recorded in Table 7.4.3 and shown in the associated plots.

Test specification:		Section 27.53(a)(1), Radiated spurious emissions	
Test procedure:		47 CFR, Section 2.1053, Section 27.53 (5), TIA/EIA-603-C, Section 2.2.12	
Test mode:		Compliance	Verdict: PASS
Date:		5/24/2011 - 5/25/2011	
Temperature: 23.2 °C	Air Pressure: 1014 hPa	Relative Humidity: 45 %	Power Supply: 48 VDC
Remarks:			

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

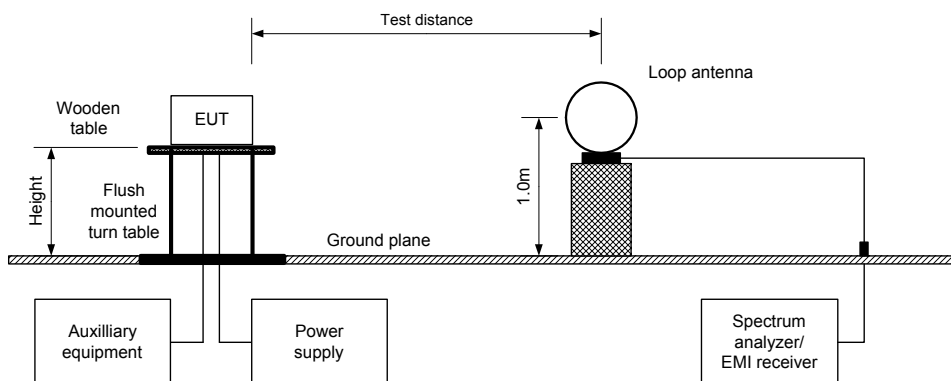
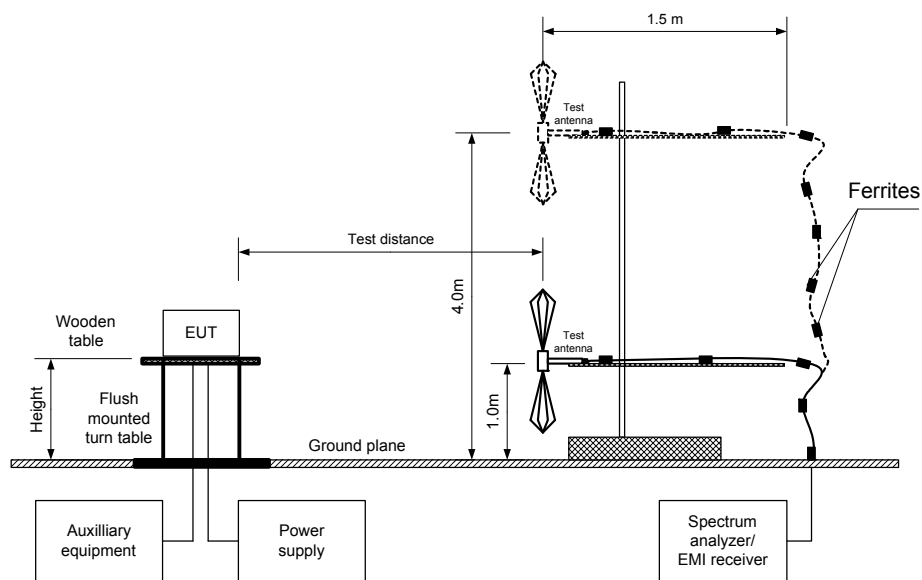
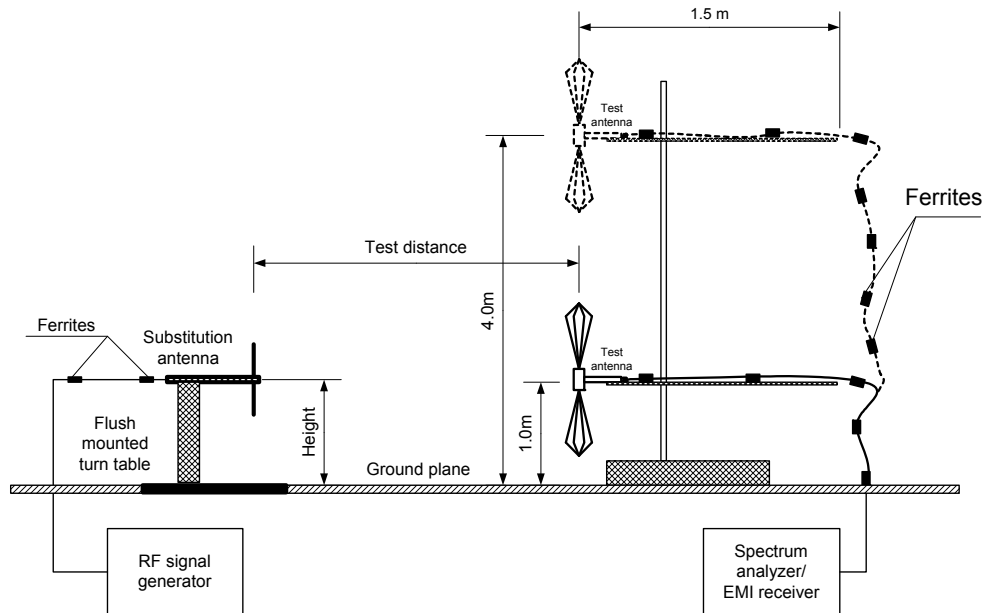


Figure 7.4.2 Setup for spurious emission field strength measurements above 30 MHz



Test specification:		Section 27.53(a)(1), Radiated spurious emissions	
Test procedure:		47 CFR, Section 2.1053, Section 27.53 (5), TIA/EIA-603-C, Section 2.2.12	
Test mode:	Compliance	Verdict:	PASS
Date:	5/24/2011 - 5/25/2011		
Temperature: 23.2 °C	Air Pressure: 1014 hPa	Relative Humidity: 45 %	Power Supply: 48 VDC
Remarks:			

Figure 7.4.3 Setup for substitution ERP measurements of spurious



Test specification: Section 27.53(a)(1), Radiated spurious emissions			
Test procedure: 47 CFR, Section 2.1053, Section 27.53 (5), TIA/EIA-603-C, Section 2.2.12			
Test mode: Compliance	Verdict: PASS		
Date: 5/24/2011 - 5/25/2011			
Temperature: 23.2 °C	Air Pressure: 1014 hPa	Relative Humidity: 45 %	Power Supply: 48 VDC
Remarks:			

Table 7.4.2 Spurious emission field strength test results

ASSIGNED FREQUENCY RANGE: 2315.0 – 2320.0 MHz; 2345.0 – 2350.0 MHz
 TEST DISTANCE: 3 m
 TEST SITE: Semi anechoic chamber
 EUT HEIGHT: 0.8 m
 INVESTIGATED FREQUENCY RANGE: 0.009 – 24000 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
 BIT RATE: 14 Mbps
 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
Low carrier frequency 2316.75 MHz							
30.1647	37.3	50.2	-12.90	120	Vert	1.0	104
205.5826	37.8	50.2	-12.40	120	Hor	1.4	234
299.1418	38.9	50.2	-11.30	120	Hor	1.0	354
599.9952	48.9	50.2	-1.30	120	Vert	1.0	253
666.6618	43.5	50.2	-6.70	120	Vert	1.05	200
1199.500	42.65	50.2	-7.55	1000	Vert	1.0	181
2604.760	41.91	50.2	-8.29	1000	Vert	1.0	181
4633.580	48.73	50.2	-1.47	1000	Vert	1.2	176
5269.488	46.25	50.2	-3.95	1000	Vert	1.4	322
6949.920	39.83	50.2	-10.37	1000	Vert	1.0	0
13900.55	44.17	50.2	-6.03	1000	Vert	1.0	0
High carrier frequency 2348.25 MHz							
30.2052	41.1	50.2	-9.10	120	Vert	1.0	0
205.6254	37.0	50.2	-13.20	120	Hor	1.4	234
299.1398	39.6	50.2	-10.60	120	Hor	1.0	354
599.9964	46.9	50.2	-3.30	120	Vert	1.0	247
666.6608	43.2	50.2	-7.00	120	Vert	1.1	200
1199.500	42.65	50.2	-7.55	1000	Vert	1.0	181
2636.214	43.54	50.2	-6.66	1000	Vert	1.2	316
4696.100	46.30	50.2	-3.90	1000	Vert	1.4	322
7044.530	41.00	50.2	-9.20	1000	Vert	1.2	176
14089.530	47.50	50.2	-2.70	1000	Vert	1.0	0

*- Margin = Field strength of spurious – calculated field strength limit.

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

Test specification:	Section 27.53(a)(1), Radiated spurious emissions		
Test procedure:	47 CFR, Section 2.1053, Section 27.53 (5), TIA/EIA-603-C, Section 2.2.12		
Test mode:	Compliance	Verdict:	PASS
Date:	5/24/2011 - 5/25/2011		
Temperature: 23.2 °C	Air Pressure: 1014 hPa	Relative Humidity: 45 %	Power Supply: 48 VDC
Remarks:			

Table 7.4.3 Substitution ERP of spurious test results

ASSIGNED FREQUENCY RANGE: 2315.0 – 2320.0 MHz; 2345.0 – 2350.0 MHz
TEST SITE: Semi anechoic chamber
TEST DISTANCE: 3 m
SUBSTITUTION ANTENNA HEIGHT: 0.8 m
DETECTOR USED: Peak
VIDEO BANDWIDTH: > Resolution bandwidth
SUBSTITUTION ANTENNA TYPE: Tunable dipole (30 MHz – 1000 MHz)
Double ridged guide (above 1000 MHz)

Frequency, MHz	Field strength, dB(μV/m)	RBW, kHz	Antenna polarization	RF generator output, dBm	Ant gain, dBd	Cable loss, dB	ERP, dBm	Limit, dBc	Margin, dB*	Verdict
Low carrier frequency 2316.75 MHz										
30.1647	37.3	120	Vert	-60.04	-0.51	0.18	-60.73	-45.00	-15.73	Pass
205.5826	37.8	120	Hor	-59.34	-0.28	0.45	-60.07	-45.00	-15.07	Pass
299.1418	38.9	120	Hor	-57.53	-0.90	0.53	-58.96	-45.00	-13.96	Pass
599.9952	48.9	120	Vert	-48.04	-0.59	0.68	-49.31	-45.00	-4.31	Pass
666.6618	43.5	120	Vert	-52.16	-0.80	0.72	-53.68	-45.00	-8.68	Pass
1199.500	42.65	1000	Vert	-59.22	5.07	0.98	-55.13	-45.00	-10.13	Pass
2604.760	41.91	1000	Vert	-61.63	7.14	1.53	-56.02	-45.00	-11.02	Pass
4633.580	48.73	1000	Vert	-55.15	8.18	2.09	-49.06	-45.00	-4.06	Pass
5269.488	46.25	1000	Vert	-57.71	8.06	2.18	-51.83	-45.00	-6.83	Pass
6949.920	39.83	1000	Vert	-63.79	8.70	2.63	-57.72	-45.00	-12.72	Pass
13900.55	44.17	1000	Vert	-58.84	8.89	3.89	-53.84	-45.00	-8.84	Pass
High carrier frequency 2348.25 MHz										
30.2052	41.1	120	Vert	-56.24	-0.50	0.18	-56.92	-45.00	-11.92	Pass
205.6254	37.0	120	Hor	-60.14	-0.28	0.45	-60.87	-45.00	-15.87	Pass
299.1398	39.6	120	Hor	-56.83	-0.90	0.53	-58.26	-45.00	-13.26	Pass
599.9964	46.9	120	Vert	-50.04	-0.59	0.68	-51.31	-45.00	-6.31	Pass
666.6608	43.2	120	Vert	-52.46	-0.80	0.72	-53.98	-45.00	-8.98	Pass
1199.500	42.65	1000	Vert	-59.22	5.07	0.98	-55.13	-45.00	-10.13	Pass
2636.214	43.54	1000	Vert	-60.00	7.24	1.53	-54.29	-45.00	-9.29	Pass
4696.100	46.30	1000	Vert	-57.58	8.29	2.09	-51.38	-45.00	-6.38	Pass
7044.530	41.00	1000	Vert	-62.62	8.63	2.63	-56.62	-45.00	-11.62	Pass
14089.530	47.50	1000	Vert	-55.63	9.01	3.89	-50.51	-45.00	-5.51	Pass

*- Margin = Spurious emission – specification limit.

Reference numbers of test equipment used

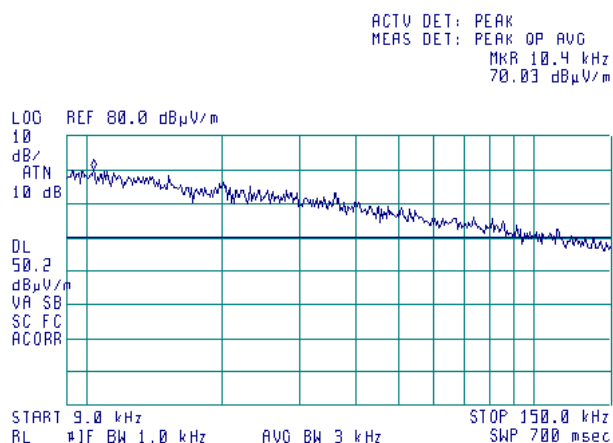
HL 0446	HL 0521	HL 0604	HL 0661	HL 0768	HL 1424	HL 1984	HL 2432
HL 2870	HL 2871	HL 2909	HL 3390	HL 3533	HL 3535	HL 3623	HL 3901

Full description is given in Appendix A.

Test specification:	Section 27.53(a)(1), Radiated spurious emissions		
Test procedure:	47 CFR, Section 2.1053, Section 27.53 (5), TIA/EIA-603-C, Section 2.2.12		
Test mode:	Compliance	Verdict:	PASS
Date:	5/24/2011 - 5/25/2011		
Temperature: 23.2 °C	Air Pressure: 1014 hPa	Relative Humidity: 45 %	Power Supply: 48 VDC
Remarks:			

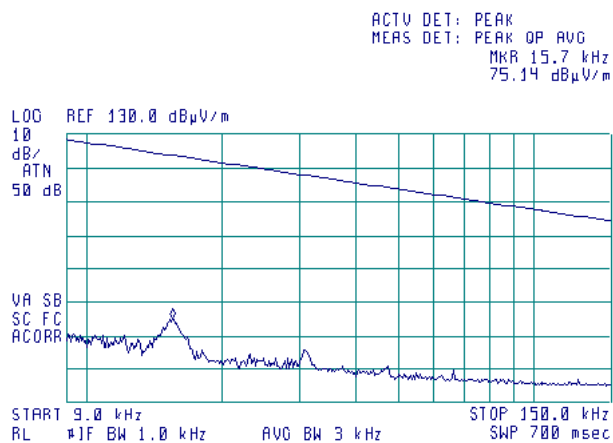
Plot 7.4.1 Radiated emission measurements from 9 to 150 kHz

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



Plot 7.4.2 Radiated emission measurements from 9 to 150 kHz

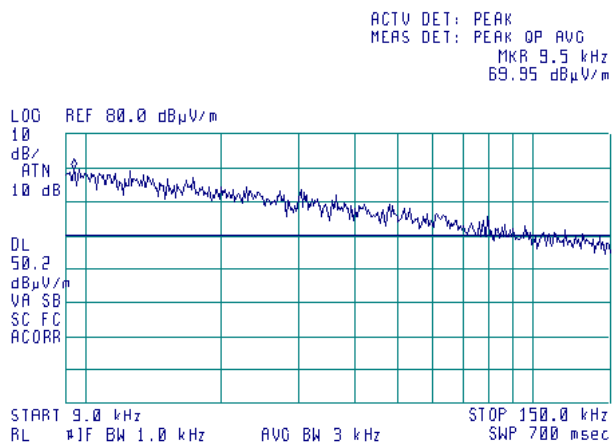
TEST SITE: Semi anechoic chamber
CARRIER FREQUENCY: Low
ANTENNA POLARIZATION: Vertical and Horizontal
TEST DISTANCE: 3 m
LIMIT: Part 15, class B



Test specification:		Section 27.53(a)(1), Radiated spurious emissions	
Test procedure:		47 CFR, Section 2.1053, Section 27.53 (5), TIA/EIA-603-C, Section 2.2.12	
Test mode:		Compliance	Verdict: PASS
Date:		5/24/2011 - 5/25/2011	
Temperature: 23.2 °C	Air Pressure: 1014 hPa	Relative Humidity: 45 %	Power Supply: 48 VDC
Remarks:			

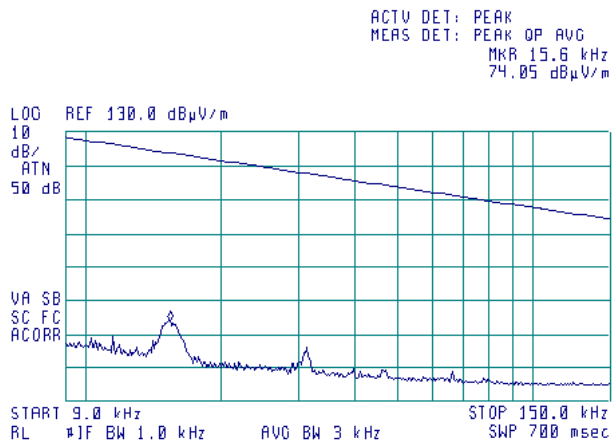
Plot 7.4.3 Radiated emission measurements from 9 to 150 kHz

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



Plot 7.4.4 Radiated emission measurements from 9 to 150 kHz

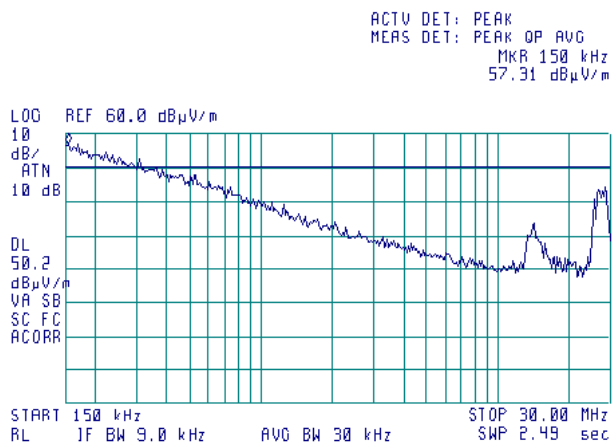
TEST SITE: Semi anechoic chamber
CARRIER FREQUENCY: High
ANTENNA POLARIZATION: Vertical and Horizontal
TEST DISTANCE: 3 m
LIMIT: Part 15, class B



Test specification:	Section 27.53(a)(1), Radiated spurious emissions		
Test procedure:	47 CFR, Section 2.1053, Section 27.53 (5), TIA/EIA-603-C, Section 2.2.12		
Test mode:	Compliance	Verdict:	PASS
Date:	5/24/2011 - 5/25/2011		
Temperature: 23.2 °C	Air Pressure: 1014 hPa	Relative Humidity: 45 %	Power Supply: 48 VDC
Remarks:			

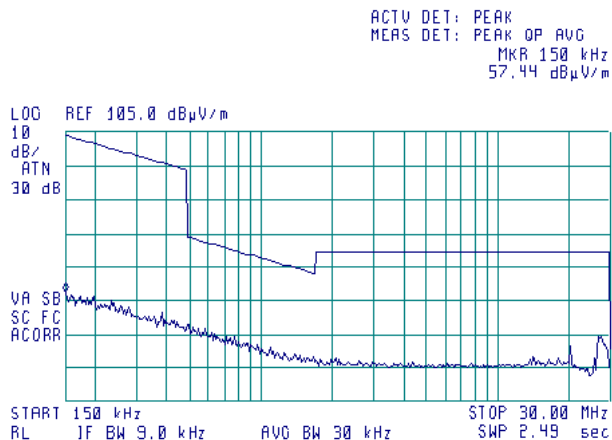
Plot 7.4.5 Radiated emission measurements from 0.15 to 30 MHz

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



Plot 7.4.6 Radiated emission measurements from 0.15 to 30 MHz

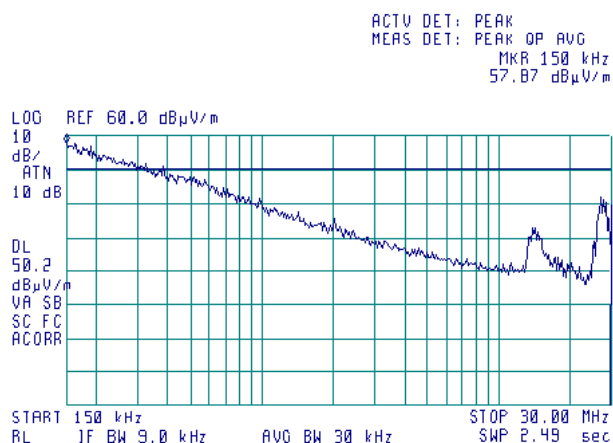
TEST SITE: Semi anechoic chamber
CARRIER FREQUENCY: Low
ANTENNA POLARIZATION: Vertical and Horizontal
TEST DISTANCE: 3 m
LIMIT: Part 15, class B



Test specification:	Section 27.53(a)(1), Radiated spurious emissions		
Test procedure:	47 CFR, Section 2.1053, Section 27.53 (5), TIA/EIA-603-C, Section 2.2.12		
Test mode:	Compliance	Verdict:	PASS
Date:	5/24/2011 - 5/25/2011		
Temperature: 23.2 °C	Air Pressure: 1014 hPa	Relative Humidity: 45 %	Power Supply: 48 VDC
Remarks:			

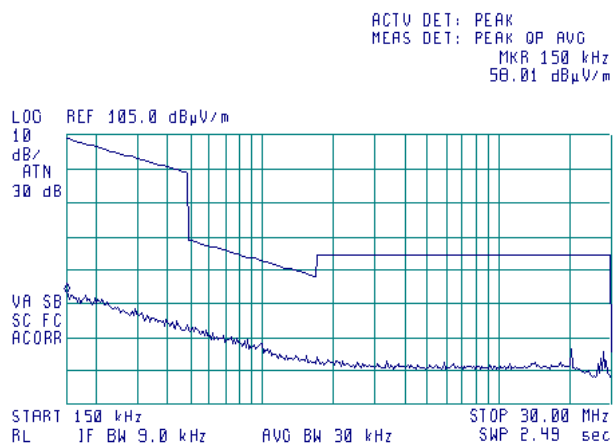
Plot 7.4.7 Radiated emission measurements from 0.15 to 30 MHz

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



Plot 7.4.8 Radiated emission measurements from 0.15 to 30 MHz

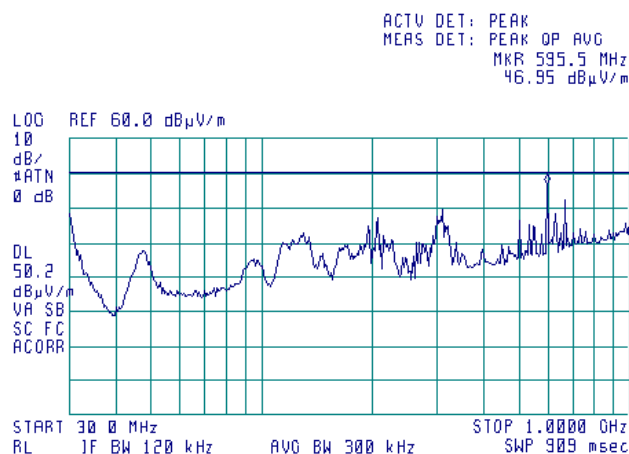
TEST SITE: Semi anechoic chamber
CARRIER FREQUENCY: High
ANTENNA POLARIZATION: Vertical and Horizontal
TEST DISTANCE: 3 m
LIMIT: Part 15, class B



Test specification:		Section 27.53(a)(1), Radiated spurious emissions	
Test procedure:		47 CFR, Section 2.1053, Section 27.53 (5), TIA/EIA-603-C, Section 2.2.12	
Test mode:		Compliance	Verdict: PASS
Date:		5/24/2011 - 5/25/2011	
Temperature: 23.2 °C	Air Pressure: 1014 hPa	Relative Humidity: 45 %	Power Supply: 48 VDC
Remarks:			

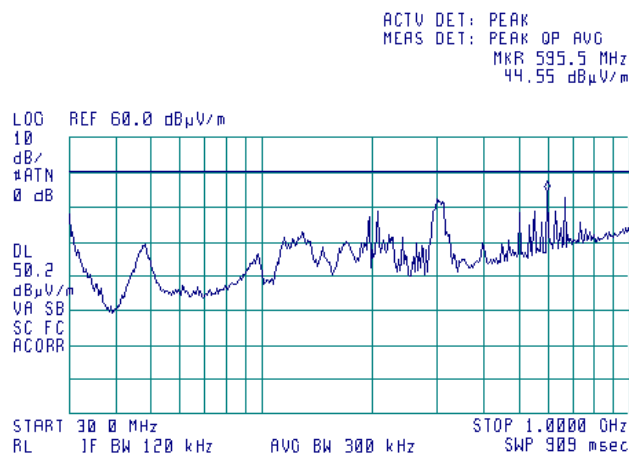
Plot 7.4.9 Radiated emission measurements in 30 - 1000 MHz range

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



Plot 7.4.10 Radiated emission measurements in 30 - 1000 MHz range

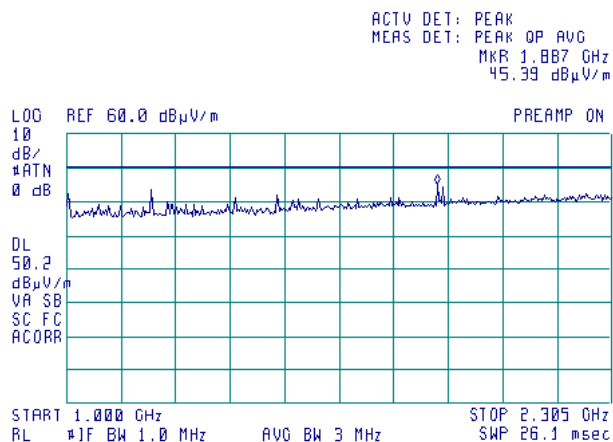
TEST SITE: Semi anechoic chamber
CARRIER FREQUENCY: High
ANTENNA POLARIZATION: Vertical and Horizontal
TEST DISTANCE: 3 m



Test specification:		Section 27.53(a)(1), Radiated spurious emissions	
Test procedure:		47 CFR, Section 2.1053, Section 27.53 (5), TIA/EIA-603-C, Section 2.2.12	
Test mode:		Compliance	Verdict: PASS
Date:		5/24/2011 - 5/25/2011	
Temperature: 23.2 °C	Air Pressure: 1014 hPa	Relative Humidity: 45 %	Power Supply: 48 VDC
Remarks:			

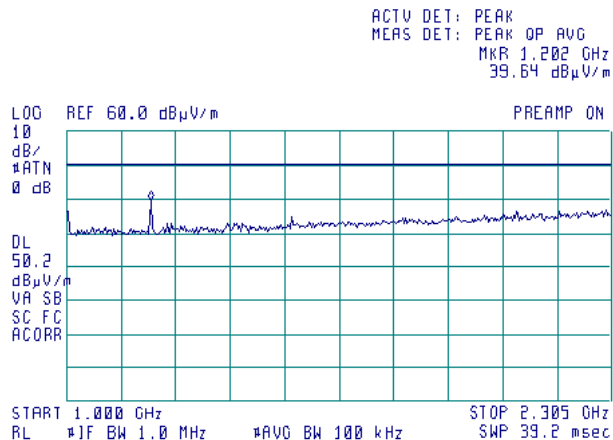
Plot 7.4.11 Radiated emission measurements in 1000 – 2305 MHz range

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



Plot 7.4.12 Radiated emission measurements in 1000 – 2305 MHz range

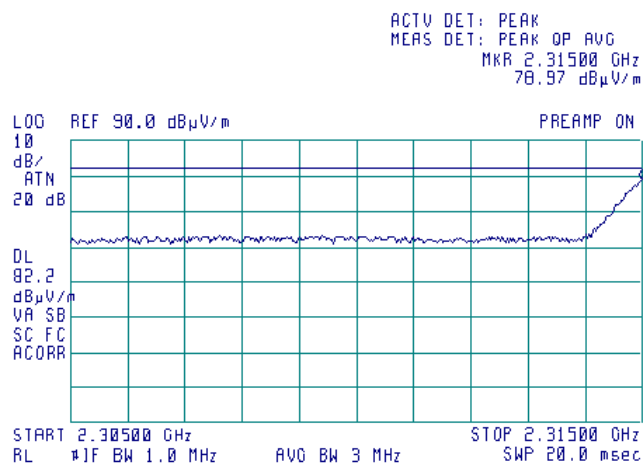
TEST SITE: Semi anechoic chamber
CARRIER FREQUENCY: Low
ANTENNA POLARIZATION: Vertical and Horizontal
TEST DISTANCE: 3 m
DETECTOR: Average



Test specification:		Section 27.53(a)(1), Radiated spurious emissions	
Test procedure:		47 CFR, Section 2.1053, Section 27.53 (5), TIA/EIA-603-C, Section 2.2.12	
Test mode:	Compliance	Verdict:	PASS
Date:	5/24/2011 - 5/25/2011		
Temperature: 23.2 °C	Air Pressure: 1014 hPa	Relative Humidity: 45 %	Power Supply: 48 VDC
Remarks:			

Plot 7.4.13 Radiated emission measurements in 2305 – 2315 MHz range

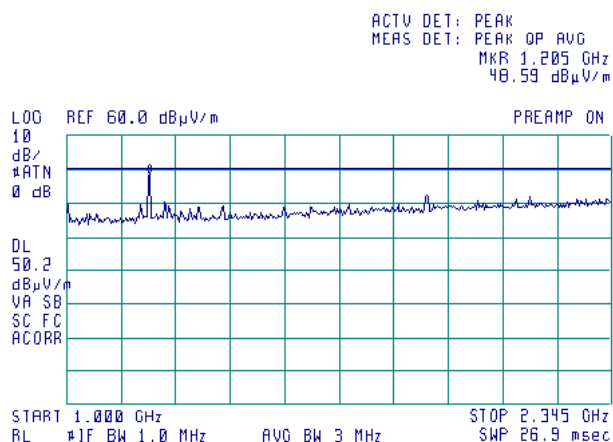
TEST SITE: Semi anechoic chamber
CARRIER FREQUENCY: Low
ANTENNA POLARIZATION: Vertical and Horizontal
TEST DISTANCE: 3 m



Test specification:	Section 27.53(a)(1), Radiated spurious emissions		
Test procedure:	47 CFR, Section 2.1053, Section 27.53 (5), TIA/EIA-603-C, Section 2.2.12		
Test mode:	Compliance	Verdict:	PASS
Date:	5/24/2011 - 5/25/2011		
Temperature: 23.2 °C	Air Pressure: 1014 hPa	Relative Humidity: 45 %	Power Supply: 48 VDC
Remarks:			

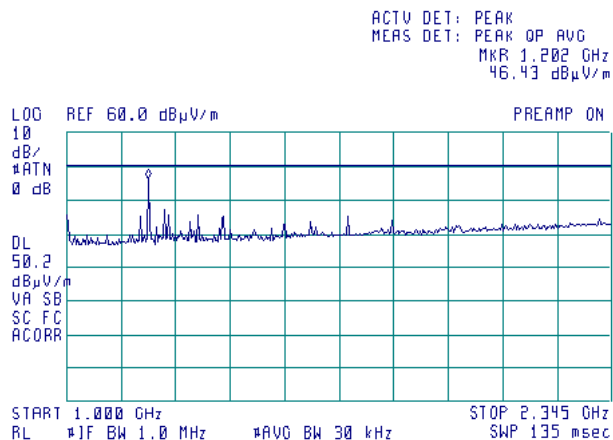
Plot 7.4.14 Radiated emission measurements in 1000 – 2345 MHz range

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



Plot 7.4.15 Radiated emission measurements in 1000 – 2345 MHz range

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

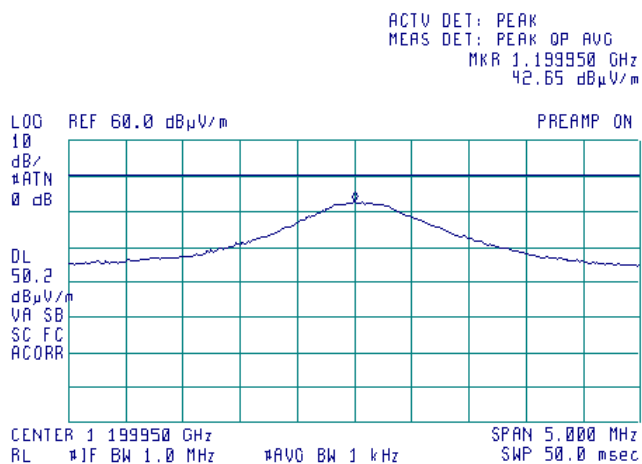


Test specification:		Section 27.53(a)(1), Radiated spurious emissions	
Test procedure:		47 CFR, Section 2.1053, Section 27.53 (5), TIA/EIA-603-C, Section 2.2.12	
Test mode:	Compliance	Verdict:	PASS
Date:	5/24/2011 - 5/25/2011		
Temperature: 23.2 °C	Air Pressure: 1014 hPa	Relative Humidity: 45 %	Power Supply: 48 VDC
Remarks:			

Plot 7.4.16 Radiated emission measurements at 1199 MHz

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

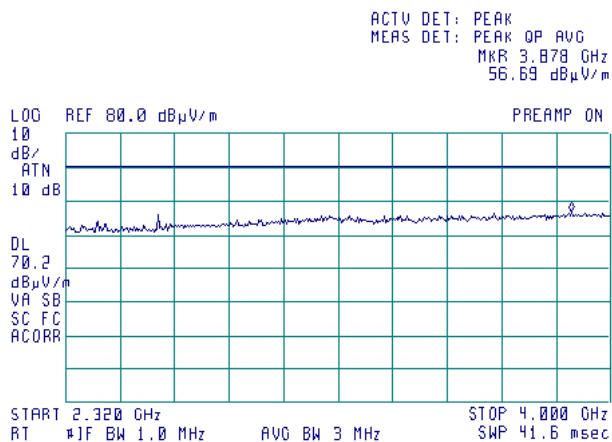
(42)



Test specification:	Section 27.53(a)(1), Radiated spurious emissions		
Test procedure:	47 CFR, Section 2.1053, Section 27.53 (5), TIA/EIA-603-C, Section 2.2.12		
Test mode:	Compliance	Verdict:	PASS
Date:	5/24/2011 - 5/25/2011		
Temperature: 23.2 °C	Air Pressure: 1014 hPa	Relative Humidity: 45 %	Power Supply: 48 VDC
Remarks:			

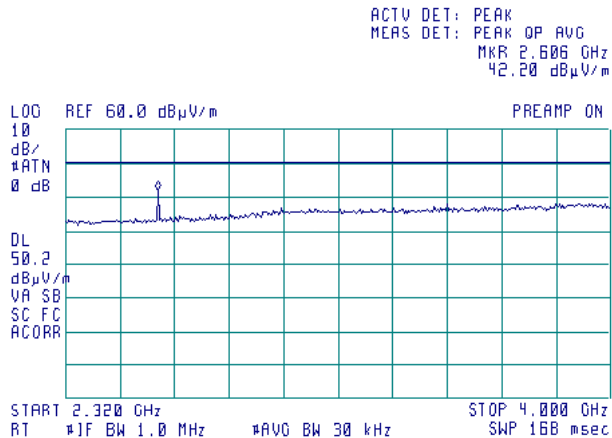
Plot 7.4.17 Radiated emission measurements in 2320 – 4000 MHz range

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



Plot 7.4.18 Radiated emission measurements in 2320 – 4000 MHz range

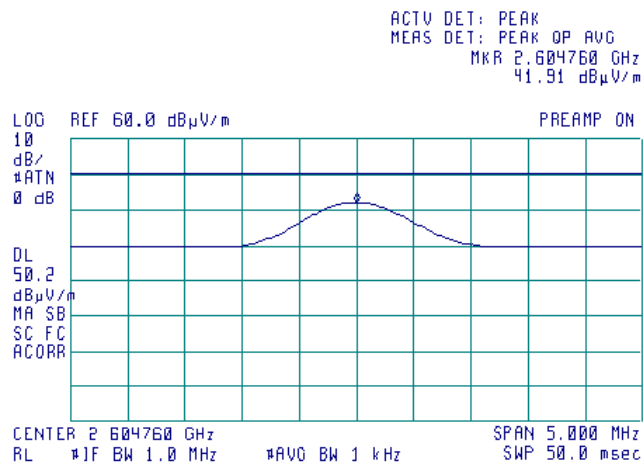
TEST SITE: Semi anechoic chamber
CARRIER FREQUENCY: Low
ANTENNA POLARIZATION: Vertical and Horizontal
TEST DISTANCE: 3 m
DETECTOR: Average



Test specification:		Section 27.53(a)(1), Radiated spurious emissions	
Test procedure:		47 CFR, Section 2.1053, Section 27.53 (5), TIA/EIA-603-C, Section 2.2.12	
Test mode:	Compliance	Verdict:	PASS
Date:	5/24/2011 - 5/25/2011		
Temperature: 23.2 °C	Air Pressure: 1014 hPa	Relative Humidity: 45 %	Power Supply: 48 VDC
Remarks:			

Plot 7.4.19 Radiated emission measurements at 2604 MHz

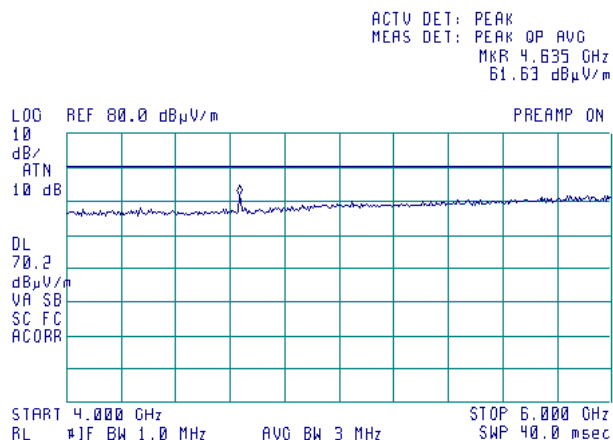
TEST SITE:	Semi anechoic chamber
CARRIER FREQUENCY:	High
ANTENNA POLARIZATION:	Vertical and Horizontal
TEST DISTANCE:	3 m
DETECTOR:	Average



Test specification:	Section 27.53(a)(1), Radiated spurious emissions		
Test procedure:	47 CFR, Section 2.1053, Section 27.53 (5), TIA/EIA-603-C, Section 2.2.12		
Test mode:	Compliance	Verdict:	PASS
Date:	5/24/2011 - 5/25/2011		
Temperature: 23.2 °C	Air Pressure: 1014 hPa	Relative Humidity: 45 %	Power Supply: 48 VDC
Remarks:			

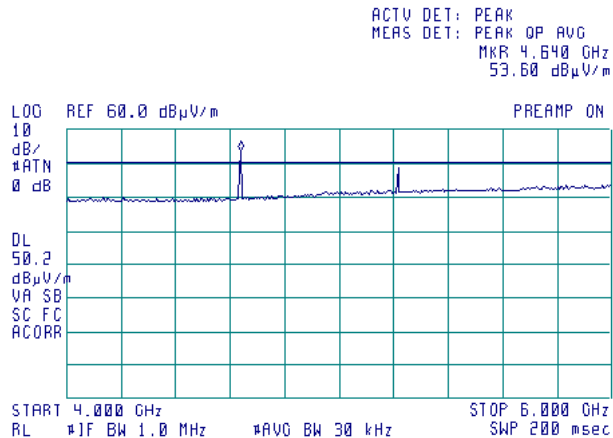
Plot 7.4.20 Radiated emission measurements in 4000 – 6000 MHz range

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



Plot 7.4.21 Radiated emission measurements in 4000 – 6000 MHz range

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

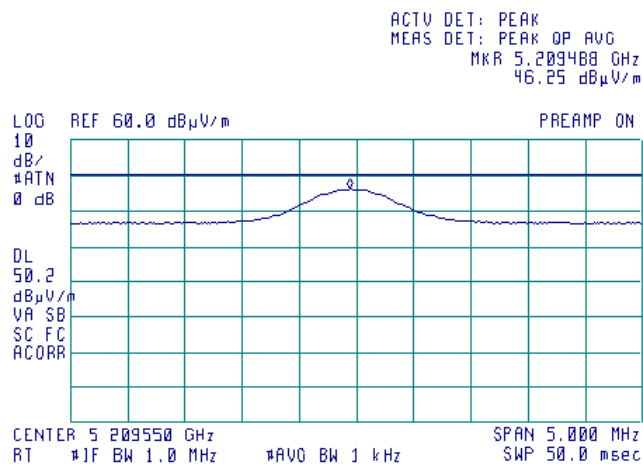


Test specification:		Section 27.53(a)(1), Radiated spurious emissions	
Test procedure:		47 CFR, Section 2.1053, Section 27.53 (5), TIA/EIA-603-C, Section 2.2.12	
Test mode:	Compliance	Verdict:	PASS
Date:	5/24/2011 - 5/25/2011		
Temperature: 23.2 °C	Air Pressure: 1014 hPa	Relative Humidity: 45 %	Power Supply: 48 VDC
Remarks:			

Plot 7.4.22 Radiated emission measurements at 5209 MHz

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

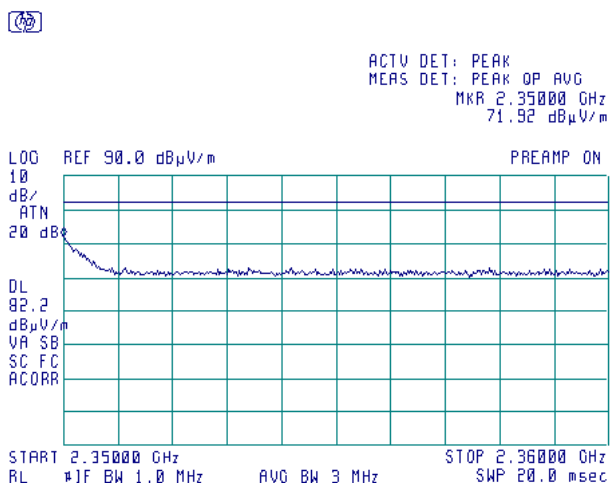
(42)



Test specification:		Section 27.53(a)(1), Radiated spurious emissions	
Test procedure:		47 CFR, Section 2.1053, Section 27.53 (5), TIA/EIA-603-C, Section 2.2.12	
Test mode:		Compliance	Verdict: PASS
Date:		5/24/2011 - 5/25/2011	
Temperature: 23.2 °C	Air Pressure: 1014 hPa	Relative Humidity: 45 %	Power Supply: 48 VDC
Remarks:			

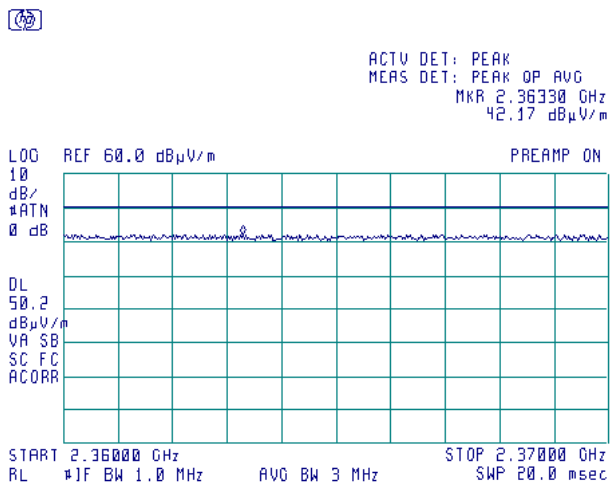
Plot 7.4.23 Radiated emission measurements in 2350 – 2360 MHz range

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



Plot 7.4.24 Radiated emission measurements in 2360 – 2370 MHz range

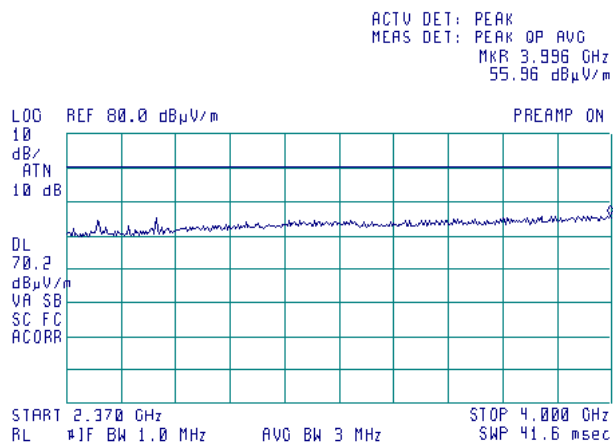
TEST SITE: Semi anechoic chamber
CARRIER FREQUENCY: High
ANTENNA POLARIZATION: Vertical and Horizontal
TEST DISTANCE: 3 m



Test specification:	Section 27.53(a)(1), Radiated spurious emissions		
Test procedure:	47 CFR, Section 2.1053, Section 27.53 (5), TIA/EIA-603-C, Section 2.2.12		
Test mode:	Compliance	Verdict:	PASS
Date:	5/24/2011 - 5/25/2011		
Temperature: 23.2 °C	Air Pressure: 1014 hPa	Relative Humidity: 45 %	Power Supply: 48 VDC
Remarks:			

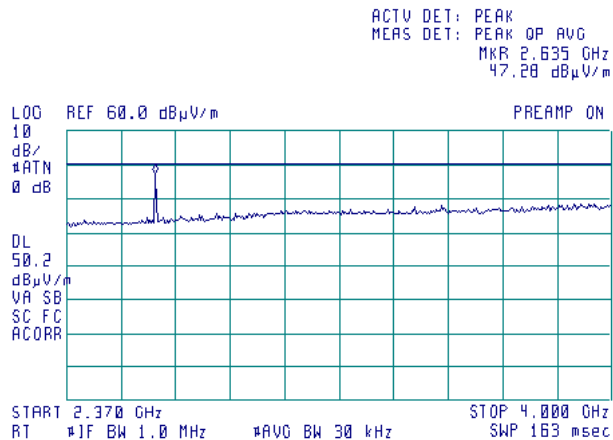
Plot 7.4.25 Radiated emission measurements in 2370 – 4000 MHz range

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



Plot 7.4.26 Radiated emission measurements in 2370 – 4000 MHz range

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

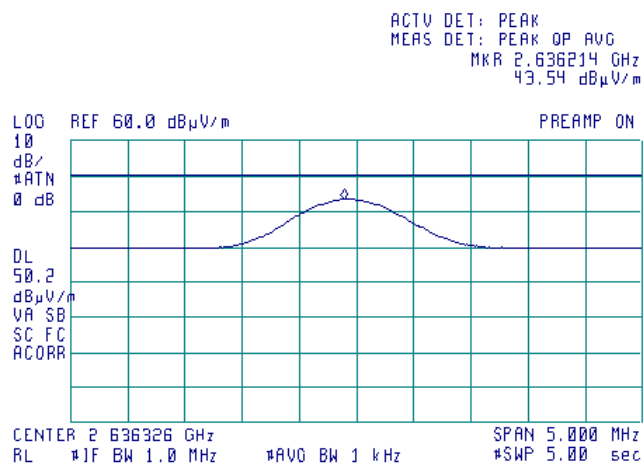


Test specification:		Section 27.53(a)(1), Radiated spurious emissions	
Test procedure:		47 CFR, Section 2.1053, Section 27.53 (5), TIA/EIA-603-C, Section 2.2.12	
Test mode:	Compliance	Verdict:	PASS
Date:	5/24/2011 - 5/25/2011		
Temperature: 23.2 °C	Air Pressure: 1014 hPa	Relative Humidity: 45 %	Power Supply: 48 VDC
Remarks:			

Plot 7.4.27 Radiated emission measurements at 2636 MHz

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

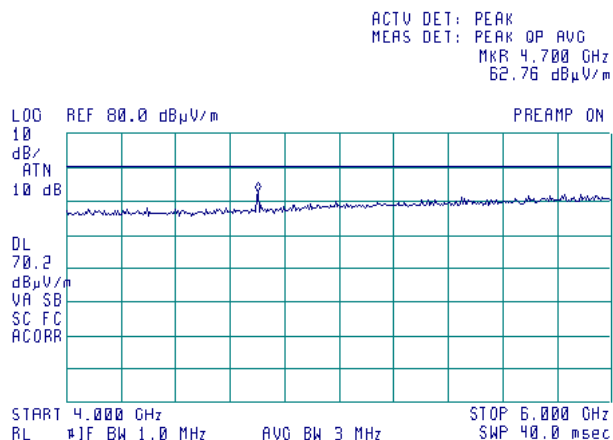
(42)



Test specification:	Section 27.53(a)(1), Radiated spurious emissions		
Test procedure:	47 CFR, Section 2.1053, Section 27.53 (5), TIA/EIA-603-C, Section 2.2.12		
Test mode:	Compliance	Verdict:	PASS
Date:	5/24/2011 - 5/25/2011		
Temperature: 23.2 °C	Air Pressure: 1014 hPa	Relative Humidity: 45 %	Power Supply: 48 VDC
Remarks:			

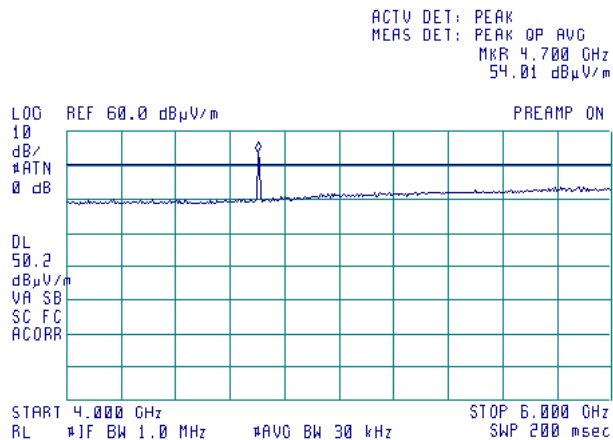
Plot 7.4.28 Radiated emission measurements in 4000 – 6000 MHz range

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



Plot 7.4.29 Radiated emission measurements in 4000 – 6000 MHz range

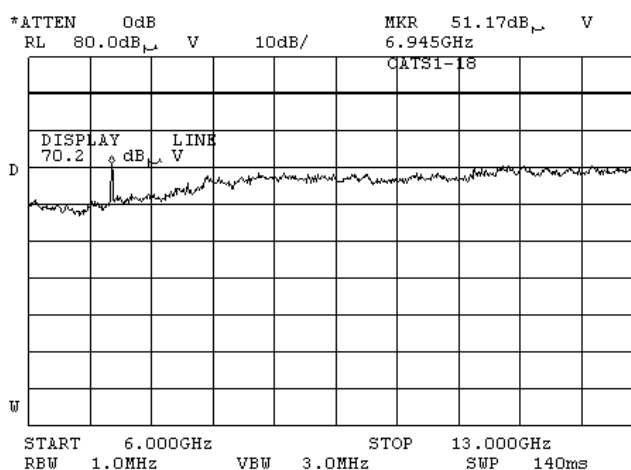
TEST SITE: Semi anechoic chamber
CARRIER FREQUENCY: High
ANTENNA POLARIZATION: Vertical and Horizontal
TEST DISTANCE: 3 m
DETECTOR: Average



Test specification:	Section 27.53(a)(1), Radiated spurious emissions		
Test procedure:	47 CFR, Section 2.1053, Section 27.53 (5), TIA/EIA-603-C, Section 2.2.12		
Test mode:	Compliance	Verdict:	PASS
Date:	5/24/2011 - 5/25/2011		
Temperature: 23.2 °C	Air Pressure: 1014 hPa	Relative Humidity: 45 %	Power Supply: 48 VDC
Remarks:			

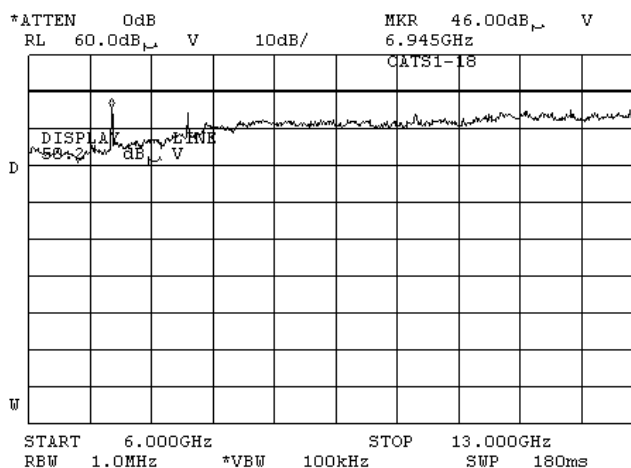
Plot 7.4.30 Radiated emission measurements in 6000 – 13000 MHz range

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



Plot 7.4.31 Radiated emission measurements in 6000 – 13000 MHz range

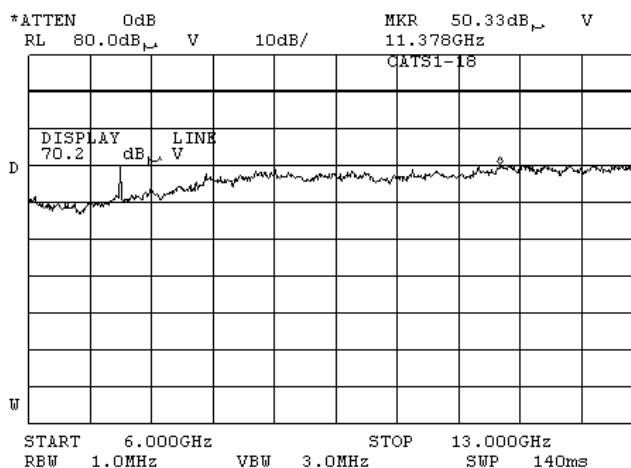
TEST SITE: Semi anechoic chamber
CARRIER FREQUENCY: Low
ANTENNA POLARIZATION: Vertical and Horizontal
TEST DISTANCE: 3 m
DETECTION: Average



Test specification:	Section 27.53(a)(1), Radiated spurious emissions		
Test procedure:	47 CFR, Section 2.1053, Section 27.53 (5), TIA/EIA-603-C, Section 2.2.12		
Test mode:	Compliance	Verdict:	PASS
Date:	5/24/2011 - 5/25/2011		
Temperature: 23.2 °C	Air Pressure: 1014 hPa	Relative Humidity: 45 %	Power Supply: 48 VDC
Remarks:			

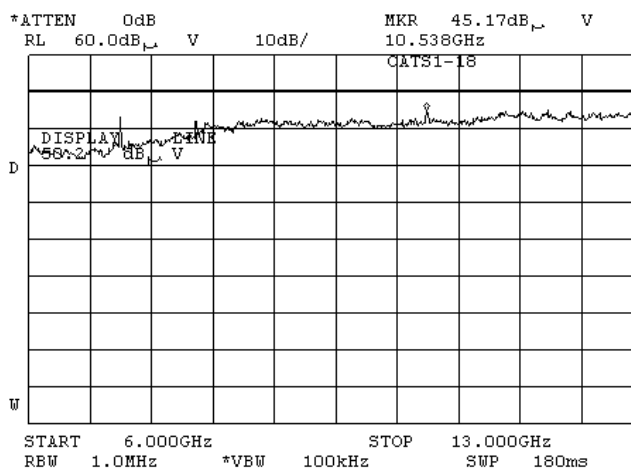
Plot 7.4.32 Radiated emission measurements in 6000 – 13000 MHz range

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



Plot 7.4.33 Radiated emission measurements in 6000 – 13000 MHz range

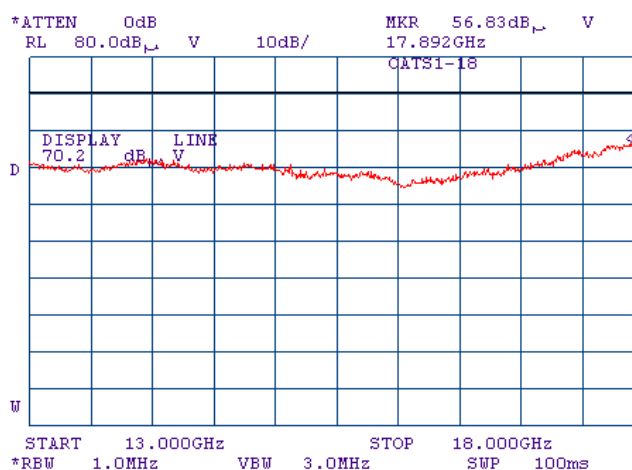
TEST SITE: Semi anechoic chamber
CARRIER FREQUENCY: High
ANTENNA POLARIZATION: Vertical and Horizontal
TEST DISTANCE: 3 m
DETECTION: Average



Test specification:		Section 27.53(a)(1), Radiated spurious emissions	
Test procedure:		47 CFR, Section 2.1053, Section 27.53 (5), TIA/EIA-603-C, Section 2.2.12	
Test mode:		Compliance	Verdict: PASS
Date:		5/24/2011 - 5/25/2011	
Temperature: 23.2 °C	Air Pressure: 1014 hPa	Relative Humidity: 45 %	Power Supply: 48 VDC
Remarks:			

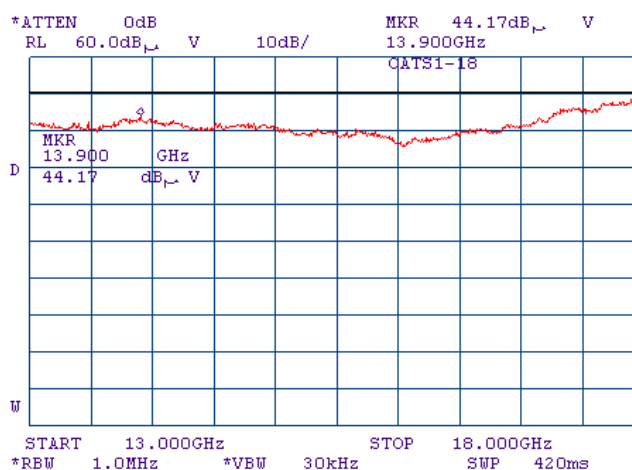
Plot 7.4.34 Radiated emission measurements in 13000 – 18000 MHz range

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



Plot 7.4.35 Radiated emission measurements in 13000 – 18000 MHz range

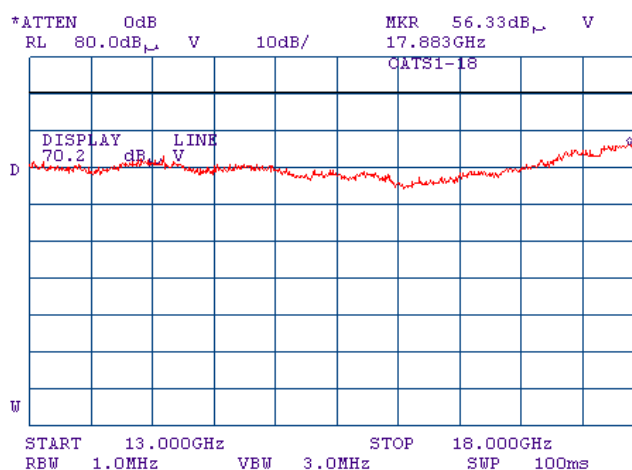
TEST SITE: OATS
CARRIER FREQUENCY: Low
ANTENNA POLARIZATION: Vertical and Horizontal
TEST DISTANCE: 3 m
DETECTION: Average



Test specification:		Section 27.53(a)(1), Radiated spurious emissions	
Test procedure:		47 CFR, Section 2.1053, Section 27.53 (5), TIA/EIA-603-C, Section 2.2.12	
Test mode:	Compliance	Verdict:	PASS
Date:	5/24/2011 - 5/25/2011		
Temperature: 23.2 °C	Air Pressure: 1014 hPa	Relative Humidity: 45 %	Power Supply: 48 VDC
Remarks:			

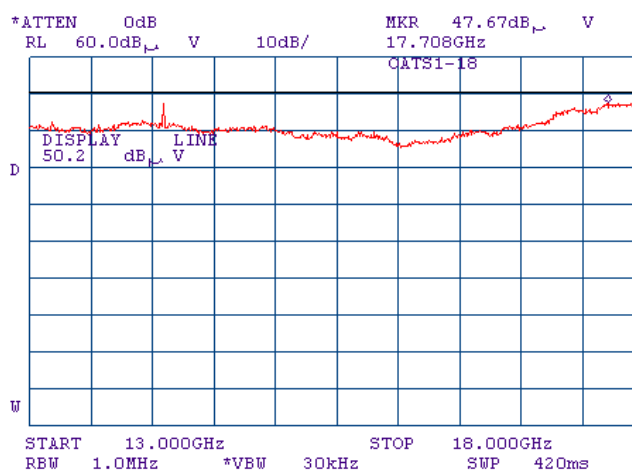
Plot 7.4.36 Radiated emission measurements in 13000 – 18000 MHz range

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



Plot 7.4.37 Radiated emission measurements in 13000 – 18000 MHz range

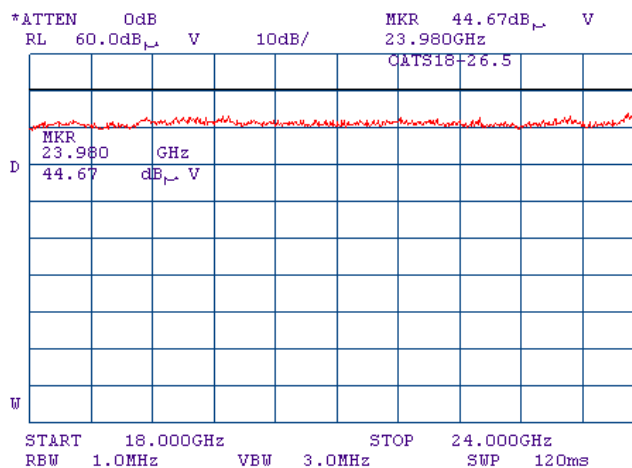
TEST SITE: OATS
CARRIER FREQUENCY: High
ANTENNA POLARIZATION: Vertical and Horizontal
TEST DISTANCE: 3 m
DETECTION: Average



Test specification:		Section 27.53(a)(1), Radiated spurious emissions	
Test procedure:		47 CFR, Section 2.1053, Section 27.53 (5), TIA/EIA-603-C, Section 2.2.12	
Test mode:	Compliance	Verdict:	PASS
Date:	5/24/2011 - 5/25/2011		
Temperature: 23.2 °C	Air Pressure: 1014 hPa	Relative Humidity: 45 %	Power Supply: 48 VDC
Remarks:			

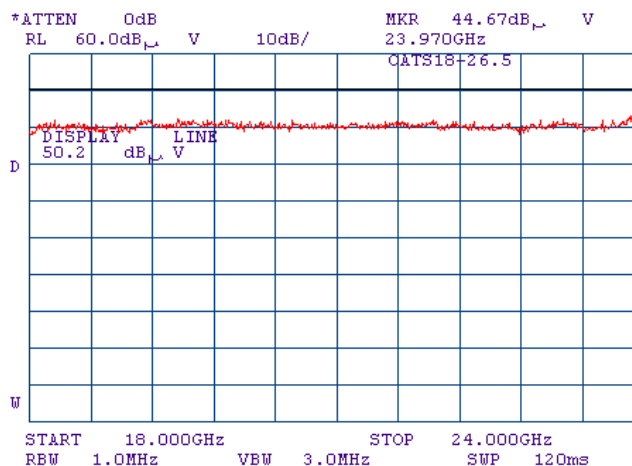
Plot 7.4.38 Radiated emission measurements in 18000 – 24000 MHz range

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



Plot 7.4.39 Radiated emission measurements in 18000 – 24000 MHz range

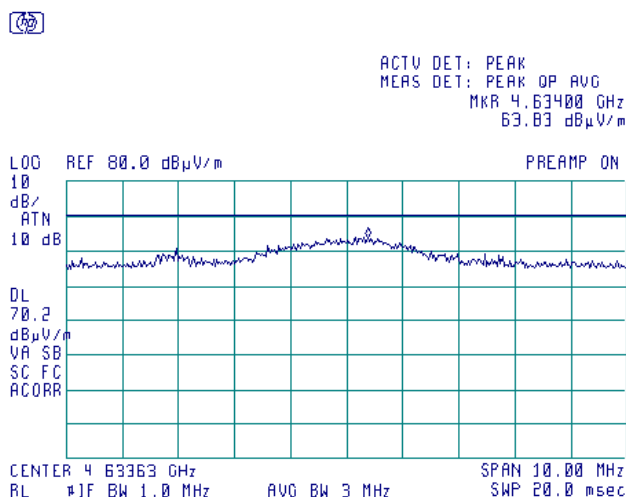
TEST SITE: OATS
CARRIER FREQUENCY: High
ANTENNA POLARIZATION: Vertical and Horizontal
TEST DISTANCE: 3 m



Test specification:		Section 27.53(a)(1), Radiated spurious emissions	
Test procedure:		47 CFR, Section 2.1053, Section 27.53 (5), TIA/EIA-603-C, Section 2.2.12	
Test mode:	Compliance	Verdict:	PASS
Date:	5/24/2011 - 5/25/2011		
Temperature: 23.2 °C	Air Pressure: 1014 hPa	Relative Humidity: 45 %	Power Supply: 48 VDC
Remarks:			

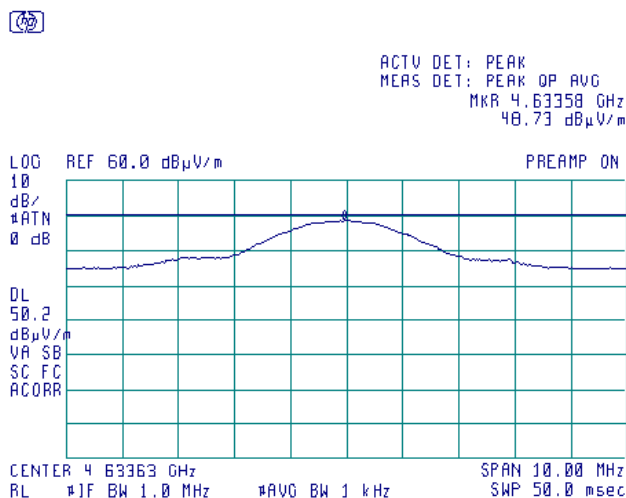
Plot 7.4.40 Radiated emission measurements at the 2nd harmonic

TEST SITE: Semi anechoic chamber
CARRIER FREQUENCY: Low
ANTENNA POLARIZATION: Vertical
TEST DISTANCE: 3 m
DETECTOR: Peak



Plot 7.4.41 Radiated emission measurements at the 2nd harmonic

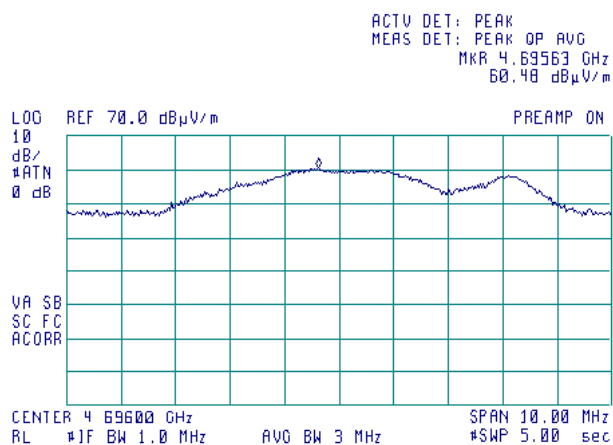
TEST SITE: Semi anechoic chamber
CARRIER FREQUENCY: Low
ANTENNA POLARIZATION: Vertical
TEST DISTANCE: 3 m
DETECTOR: Average



Test specification:	Section 27.53(a)(1), Radiated spurious emissions		
Test procedure:	47 CFR, Section 2.1053, Section 27.53 (5), TIA/EIA-603-C, Section 2.2.12		
Test mode:	Compliance	Verdict:	PASS
Date:	5/24/2011 - 5/25/2011		
Temperature: 23.2 °C	Air Pressure: 1014 hPa	Relative Humidity: 45 %	Power Supply: 48 VDC
Remarks:			

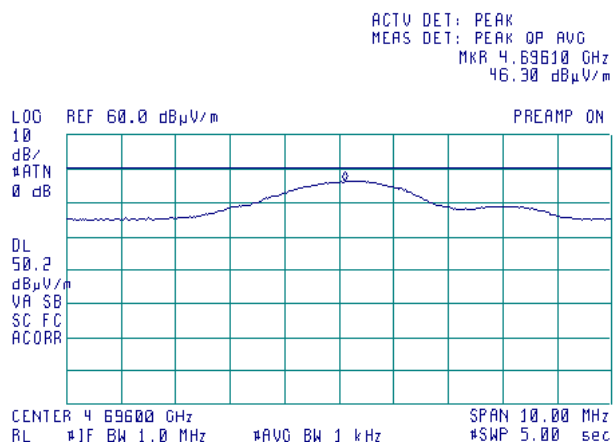
Plot 7.4.42 Radiated emission measurements at the 2nd harmonic

TEST SITE: Semi anechoic chamber
CARRIER FREQUENCY: High
ANTENNA POLARIZATION: Vertical
TEST DISTANCE: 3 m
DETECTOR: Peak



Plot 7.4.43 Radiated emission measurements at the 2nd harmonic

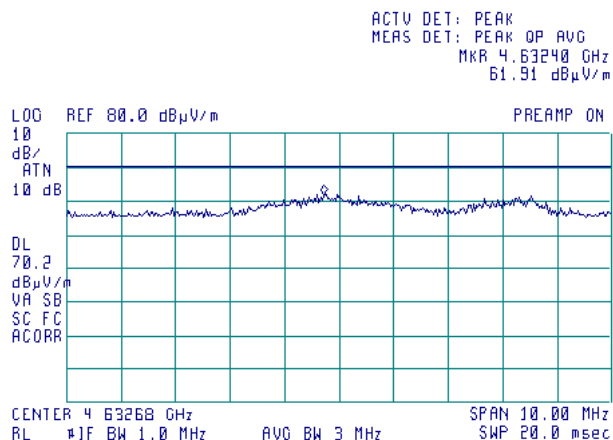
TEST SITE: Semi anechoic chamber
CARRIER FREQUENCY: High
ANTENNA POLARIZATION: Vertical
TEST DISTANCE: 3 m
DETECTOR: Average



Test specification:	Section 27.53(a)(1), Radiated spurious emissions		
Test procedure:	47 CFR, Section 2.1053, Section 27.53 (5), TIA/EIA-603-C, Section 2.2.12		
Test mode:	Compliance	Verdict:	PASS
Date:	5/24/2011 - 5/25/2011		
Temperature: 23.2 °C	Air Pressure: 1014 hPa	Relative Humidity: 45 %	Power Supply: 48 VDC
Remarks:			

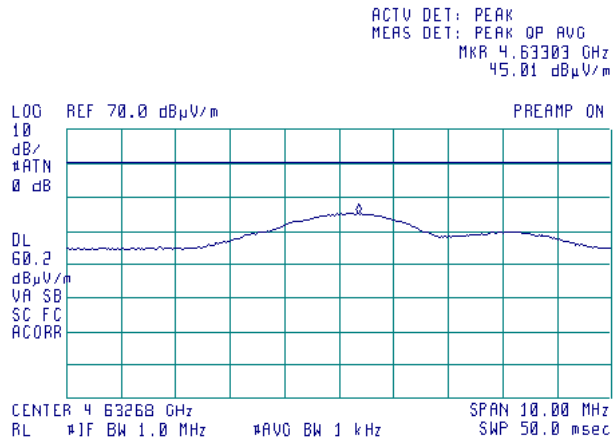
Plot 7.4.44 Radiated emission measurements at the 2nd harmonic

TEST SITE: Semi anechoic chamber
CARRIER FREQUENCY: Low
ANTENNA POLARIZATION: Horizontal
TEST DISTANCE: 3 m
DETECTOR: Peak



Plot 7.4.45 Radiated emission measurements at the 2nd harmonic

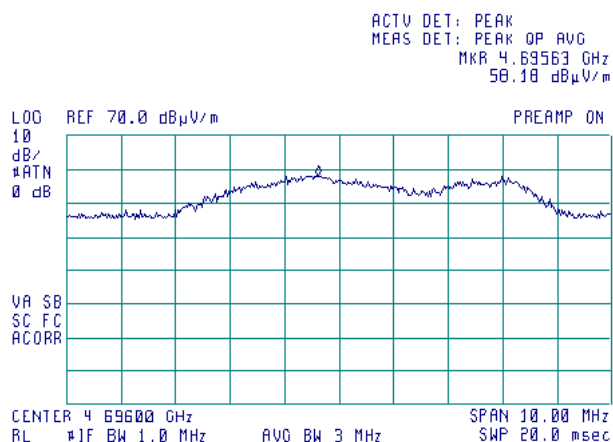
TEST SITE: Semi anechoic chamber
CARRIER FREQUENCY: Low
ANTENNA POLARIZATION: Horizontal
TEST DISTANCE: 3 m
DETECTOR: Average



Test specification:	Section 27.53(a)(1), Radiated spurious emissions		
Test procedure:	47 CFR, Section 2.1053, Section 27.53 (5), TIA/EIA-603-C, Section 2.2.12		
Test mode:	Compliance	Verdict:	PASS
Date:	5/24/2011 - 5/25/2011		
Temperature: 23.2 °C	Air Pressure: 1014 hPa	Relative Humidity: 45 %	Power Supply: 48 VDC
Remarks:			

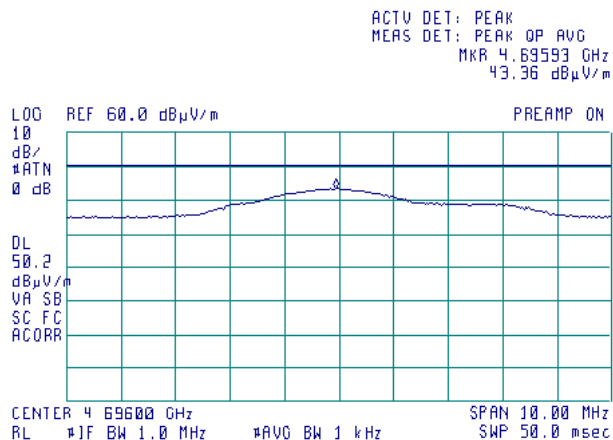
Plot 7.4.46 Radiated emission measurements at the 2nd harmonic

TEST SITE: Semi anechoic chamber
CARRIER FREQUENCY: High
ANTENNA POLARIZATION: Horizontal
TEST DISTANCE: 3 m
DETECTOR: Peak



Plot 7.4.47 Radiated emission measurements at the 2nd harmonic

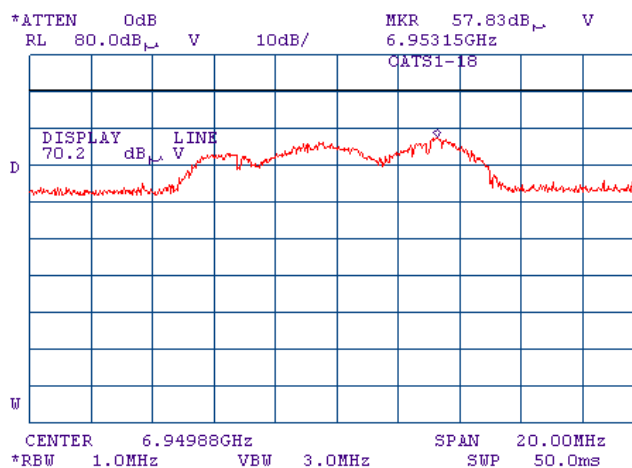
TEST SITE: Semi anechoic chamber
CARRIER FREQUENCY: High
ANTENNA POLARIZATION: Horizontal
TEST DISTANCE: 3 m
DETECTOR: Average



Test specification:	Section 27.53(a)(1), Radiated spurious emissions		
Test procedure:	47 CFR, Section 2.1053, Section 27.53 (5), TIA/EIA-603-C, Section 2.2.12		
Test mode:	Compliance	Verdict:	PASS
Date:	5/24/2011 - 5/25/2011		
Temperature: 23.2 °C	Air Pressure: 1014 hPa	Relative Humidity: 45 %	Power Supply: 48 VDC
Remarks:			

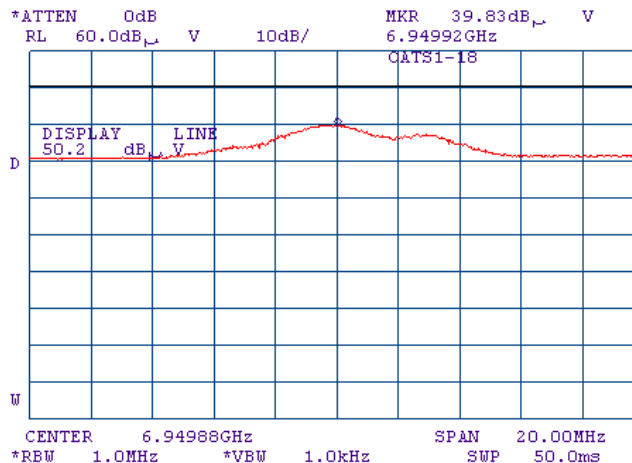
Plot 7.4.48 Radiated emission measurements at the 3rd harmonic

TEST SITE: OATS
CARRIER FREQUENCY: Low
ANTENNA POLARIZATION: Vertical
TEST DISTANCE: 3 m
DETECTOR: Peak



Plot 7.4.49 Radiated emission measurements at the 3rd harmonic

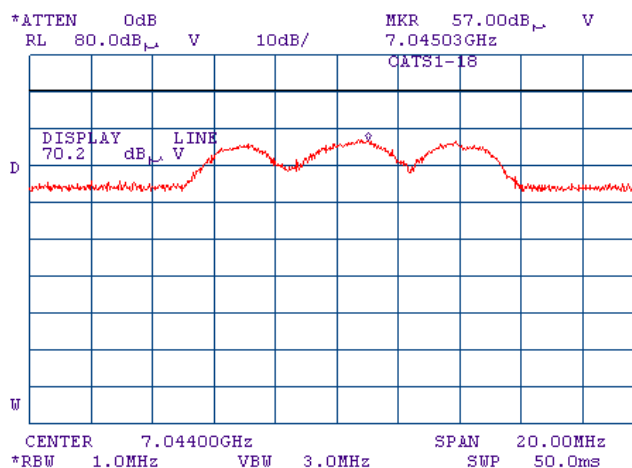
TEST SITE: OATS
CARRIER FREQUENCY: Low
ANTENNA POLARIZATION: Vertical
TEST DISTANCE: 3 m
DETECTOR: Average



Test specification:		Section 27.53(a)(1), Radiated spurious emissions	
Test procedure:		47 CFR, Section 2.1053, Section 27.53 (5), TIA/EIA-603-C, Section 2.2.12	
Test mode:	Compliance	Verdict:	PASS
Date:	5/24/2011 - 5/25/2011		
Temperature: 23.2 °C	Air Pressure: 1014 hPa	Relative Humidity: 45 %	Power Supply: 48 VDC
Remarks:			

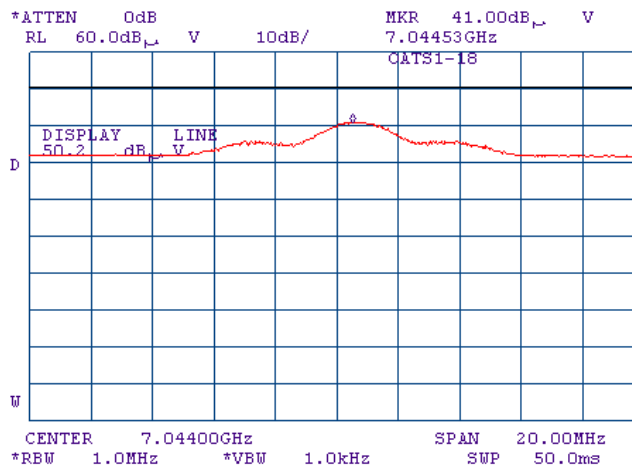
Plot 7.4.50 Radiated emission measurements at the 3rd harmonic

TEST SITE: OATS
CARRIER FREQUENCY: High
ANTENNA POLARIZATION: Vertical
TEST DISTANCE: 3 m
DETECTOR: Peak



Plot 7.4.51 Radiated emission measurements at the 3rd harmonic

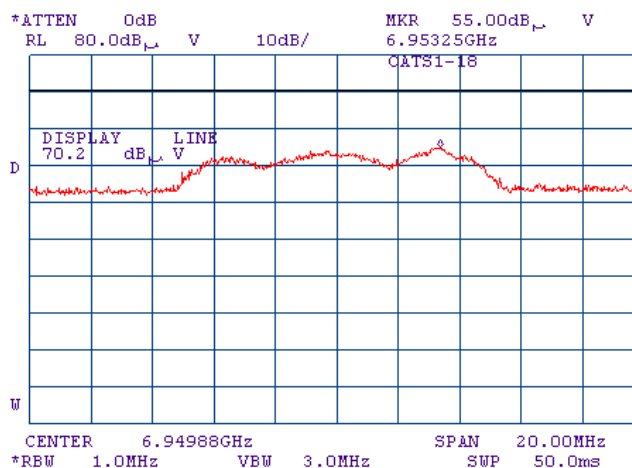
TEST SITE: OATS
CARRIER FREQUENCY: High
ANTENNA POLARIZATION: Vertical
DETECTOR: Average



Test specification:	Section 27.53(a)(1), Radiated spurious emissions		
Test procedure:	47 CFR, Section 2.1053, Section 27.53 (5), TIA/EIA-603-C, Section 2.2.12		
Test mode:	Compliance	Verdict:	PASS
Date:	5/24/2011 - 5/25/2011		
Temperature: 23.2 °C	Air Pressure: 1014 hPa	Relative Humidity: 45 %	Power Supply: 48 VDC
Remarks:			

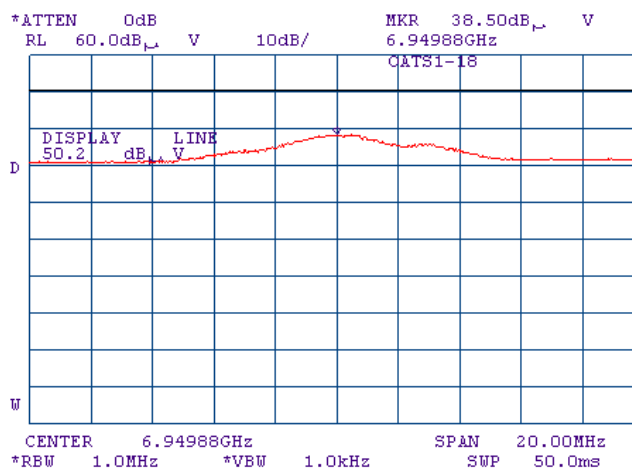
Plot 7.4.52 Radiated emission measurements at the 3rd harmonic

TEST SITE: OATS
CARRIER FREQUENCY: Low
ANTENNA POLARIZATION: Horizontal
TEST DISTANCE: 3 m
DETECTOR: Peak



Plot 7.4.53 Radiated emission measurements at the 3rd harmonic

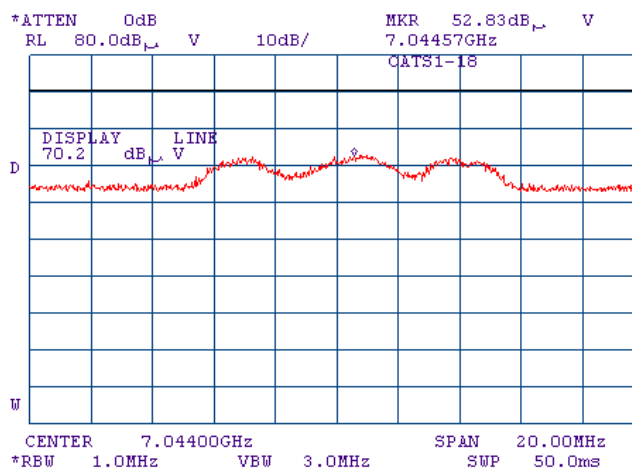
TEST SITE: OATS
CARRIER FREQUENCY: Low
ANTENNA POLARIZATION: Horizontal
TEST DISTANCE: 3 m
DETECTOR: Average



Test specification:	Section 27.53(a)(1), Radiated spurious emissions		
Test procedure:	47 CFR, Section 2.1053, Section 27.53 (5), TIA/EIA-603-C, Section 2.2.12		
Test mode:	Compliance	Verdict:	PASS
Date:	5/24/2011 - 5/25/2011		
Temperature: 23.2 °C	Air Pressure: 1014 hPa	Relative Humidity: 45 %	Power Supply: 48 VDC
Remarks:			

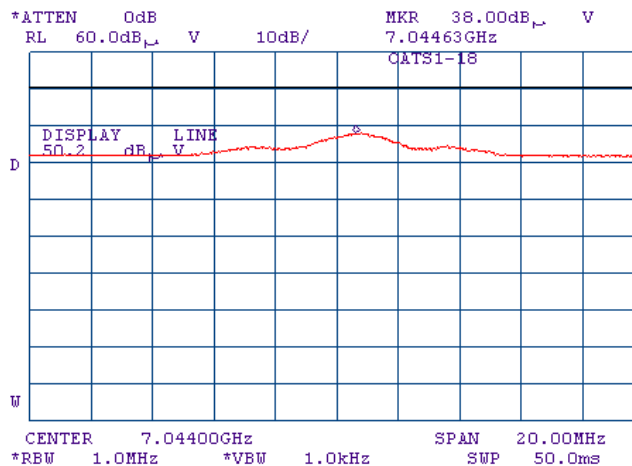
Plot 7.4.54 Radiated emission measurements at the 3rd harmonic

TEST SITE: OATS
CARRIER FREQUENCY: High
ANTENNA POLARIZATION: Horizontal
TEST DISTANCE: 3 m
DETECTOR: Peak



Plot 7.4.55 Radiated emission measurements at the 3rd harmonic

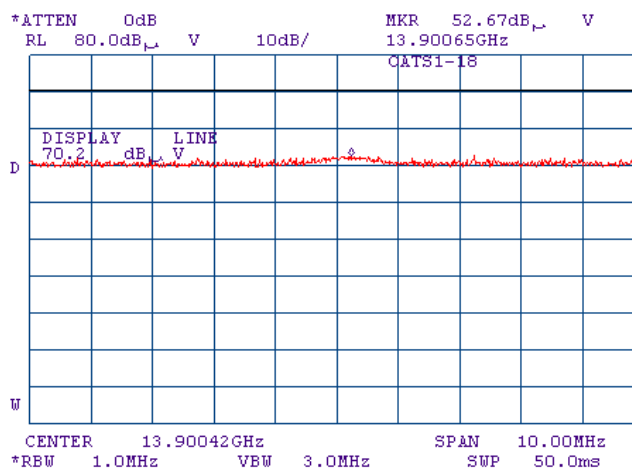
TEST SITE: OATS
CARRIER FREQUENCY: High
ANTENNA POLARIZATION: Horizontal
TEST DISTANCE: 3 m
DETECTOR: Average



Test specification:	Section 27.53(a)(1), Radiated spurious emissions		
Test procedure:	47 CFR, Section 2.1053, Section 27.53 (5), TIA/EIA-603-C, Section 2.2.12		
Test mode:	Compliance	Verdict:	PASS
Date:	5/24/2011 - 5/25/2011		
Temperature: 23.2 °C	Air Pressure: 1014 hPa	Relative Humidity: 45 %	Power Supply: 48 VDC
Remarks:			

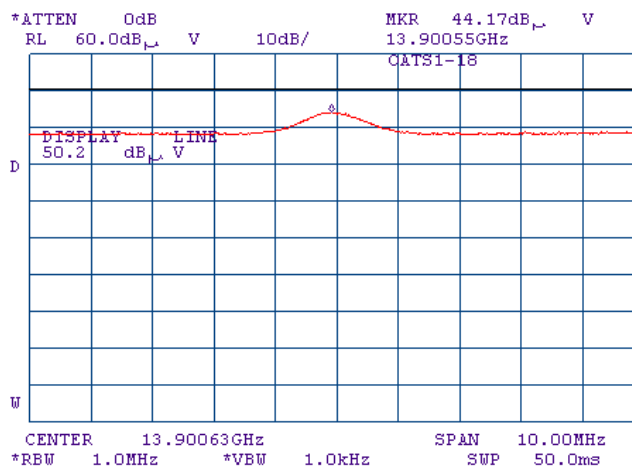
Plot 7.4.56 Radiated emission measurements at the 6th harmonic

TEST SITE: OATS
CARRIER FREQUENCY: Low
ANTENNA POLARIZATION: Horizontal
TEST DISTANCE: 3 m
DETECTOR: Peak



Plot 7.4.57 Radiated emission measurements at the 6th harmonic

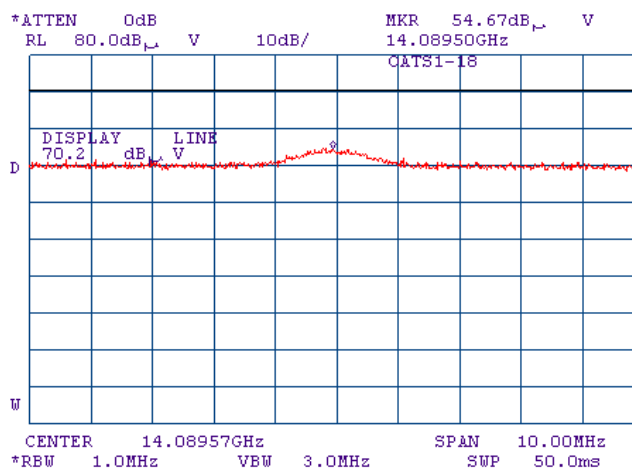
TEST SITE: OATS
CARRIER FREQUENCY: Low
ANTENNA POLARIZATION: Horizontal
TEST DISTANCE: 3 m
DETECTOR: Average



Test specification:	Section 27.53(a)(1), Radiated spurious emissions		
Test procedure:	47 CFR, Section 2.1053, Section 27.53 (5), TIA/EIA-603-C, Section 2.2.12		
Test mode:	Compliance	Verdict:	PASS
Date:	5/24/2011 - 5/25/2011		
Temperature: 23.2 °C	Air Pressure: 1014 hPa	Relative Humidity: 45 %	Power Supply: 48 VDC
Remarks:			

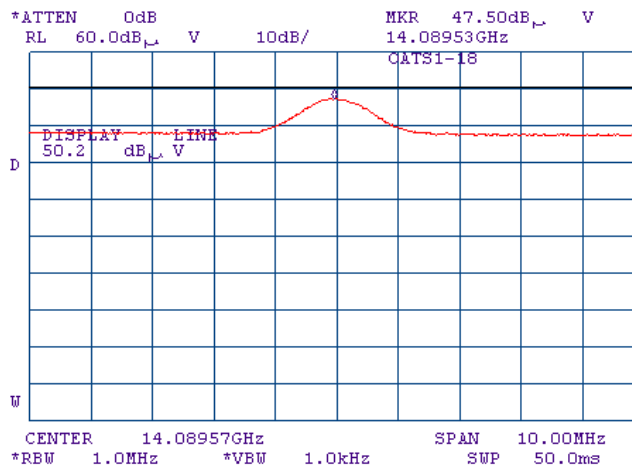
Plot 7.4.58 Radiated emission measurements at the 6th harmonic

TEST SITE: OATS
CARRIER FREQUENCY: High
ANTENNA POLARIZATION: Horizontal
TEST DISTANCE: 3 m
DETECTOR: Peak



Plot 7.4.59 Radiated emission measurements at the 6th harmonic

TEST SITE: OATS
CARRIER FREQUENCY: High
ANTENNA POLARIZATION: Horizontal
TEST DISTANCE: 3 m
DETECTOR: Average



Test specification:		Section 27.53(a)(1), Conducted spurious emissions	
Test procedure:		47 CFR, Section 2.1051 Section 27.53 (5), TIA/EIA-603-C, Section 2.2.13	
Test mode:		Compliance	Verdict: PASS
Date:		5/22/2011	
Temperature: 22.6 °C	Air Pressure: 1012 hPa	Relative Humidity: 44 %	Power Supply: 48VDC
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*	$75+10\log P^{**}$	-45.0

* - 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 a transmitter output power in watts.

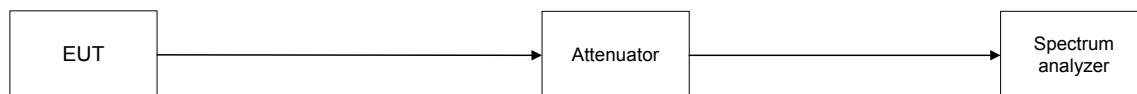
7.5.2 Test procedure

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 27.53(a)(1), Conducted spurious emissions		
Test procedure:	47 CFR, Section 2.1051 Section 27.53 (5), TIA/EIA-603-C, Section 2.2.13		
Test mode:	Compliance	Verdict:	PASS
Date:	5/22/2011		
Temperature: 22.6 °C	Air Pressure: 1012 hPa	Relative Humidity: 44 %	Power Supply: 48VDC
Remarks:			

Table 7.5.2 Spurious emission test results

ASSIGNED FREQUENCY RANGE: 2315.0 – 2320.0 MHz; 2345.0 – 2350.0 MHz
 INVESTIGATED FREQUENCY RANGE: 0.009 – 24000 MHz
 DETECTOR USED: Peak
 VIDEO BANDWIDTH: ≥ Resolution bandwidth
 MODULATION: 64QAM
 MODULATING SIGNAL: PRBS
 BIT RATE: 14.0 Mbps
 TRANSMITTER OUTPUT POWER SETTINGS: Maximum

Frequency, MHz	SA reading, dBm	Attenuator, dB	Cable loss, dB	RBW, kHz	Spurious emission, dBm	Attenuation below carrier, dBc	Limit, dBc	Margin, dB*	Verdict
Low carrier frequency									
No emissions were found									Pass
High carrier frequency									
No emissions were found									Pass

*- Margin = Spurious emission – specification limit.

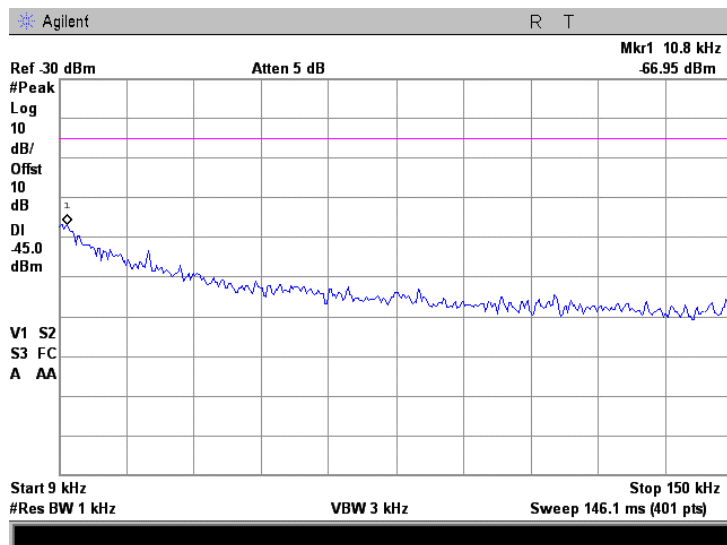
Reference numbers of test equipment used

HL 3206	HL 3301	HL 3302	HL 3818	HL 3868	HL 3901		
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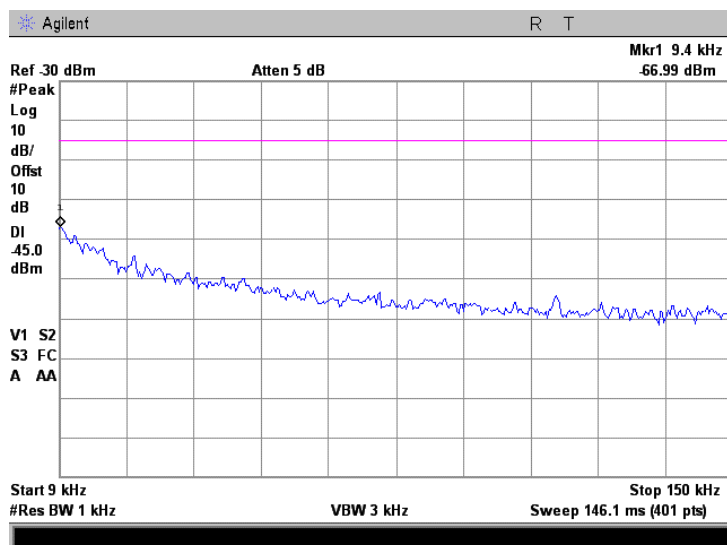
Full description is given in Appendix A.

Test specification:		Section 27.53(a)(1), Conducted spurious emissions	
Test procedure:		47 CFR, Section 2.1051 Section 27.53 (5), TIA/EIA-603-C, Section 2.2.13	
Test mode:		Compliance	Verdict: PASS
Date:		5/22/2011	
Temperature: 22.6 °C	Air Pressure: 1012 hPa	Relative Humidity: 44 %	Power Supply: 48VDC
Remarks:			

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

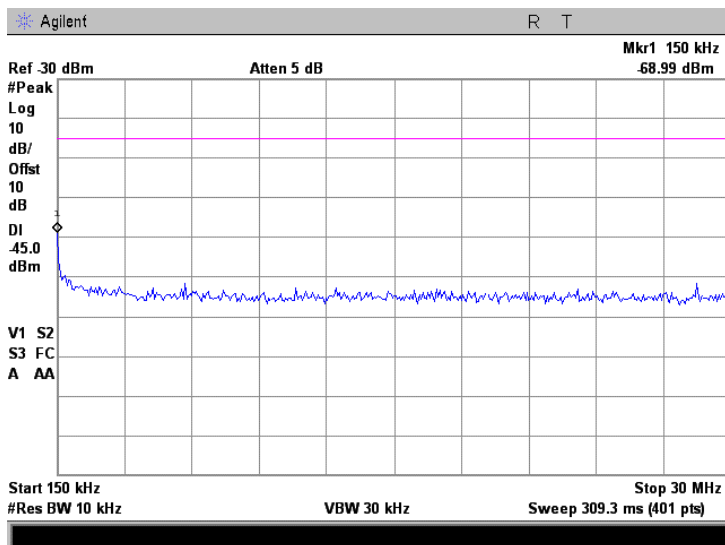


Plot 7.5.2 Spurious emission measurements in 9 - 150 kHz range at high carrier frequency, single output

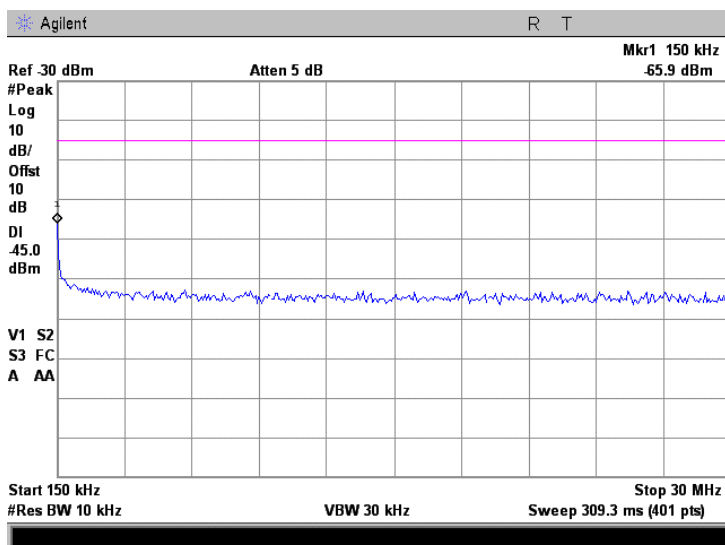


Test specification:		Section 27.53(a)(1), Conducted spurious emissions	
Test procedure:		47 CFR, Section 2.1051 Section 27.53 (5), TIA/EIA-603-C, Section 2.2.13	
Test mode:		Compliance	Verdict: PASS
Date:		5/22/2011	
Temperature: 22.6 °C	Air Pressure: 1012 hPa	Relative Humidity: 44 %	Power Supply: 48VDC
Remarks:			

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

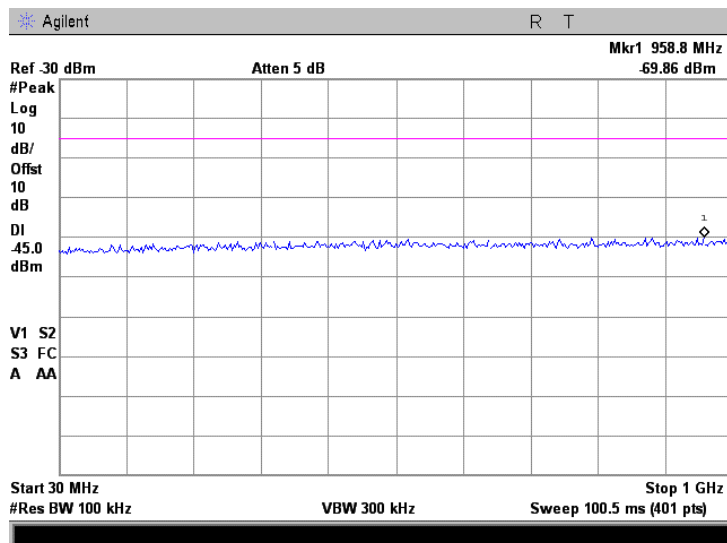


Plot 7.5.4 Spurious emission measurements in 0.15 – 30.0 MHz range at high carrier frequency, single output

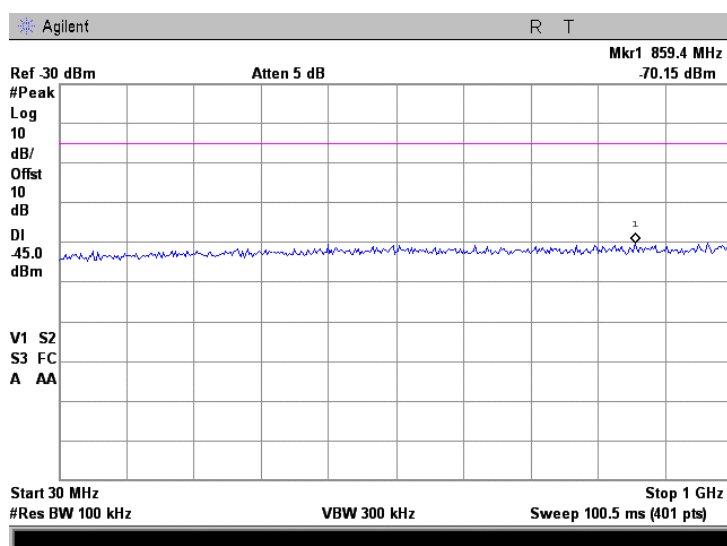


Test specification:		Section 27.53(a)(1), Conducted spurious emissions	
Test procedure:		47 CFR, Section 2.1051 Section 27.53 (5), TIA/EIA-603-C, Section 2.2.13	
Test mode:		Compliance	Verdict: PASS
Date:		5/22/2011	
Temperature: 22.6 °C	Air Pressure: 1012 hPa	Relative Humidity: 44 %	Power Supply: 48VDC
Remarks:			

Plot 7.5.5 Spurious emission measurements in 30.0 – 1000.0 MHz range at low carrier frequency, single output

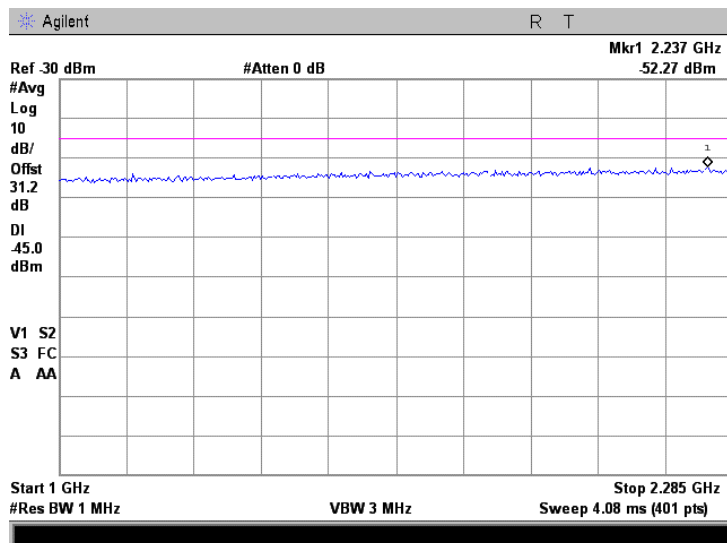


Plot 7.5.6 Spurious emission measurements in 30.0 – 1000.0 MHz range at high carrier frequency, single output

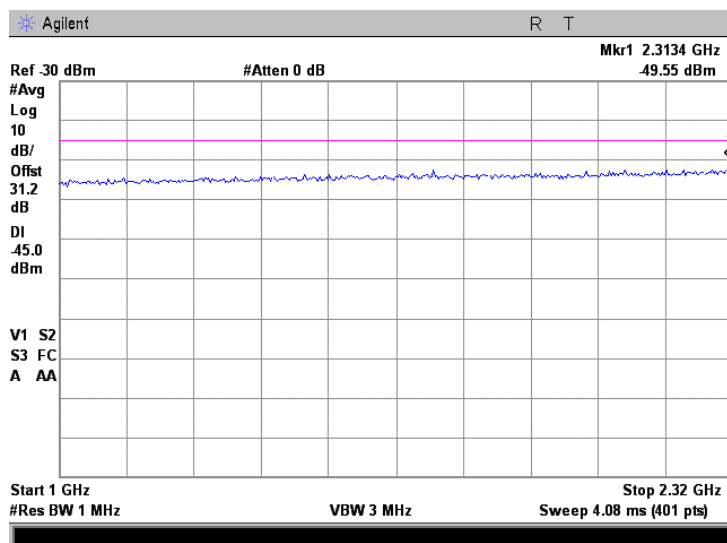


Test specification:		Section 27.53(a)(1), Conducted spurious emissions	
Test procedure:		47 CFR, Section 2.1051 Section 27.53 (5), TIA/EIA-603-C, Section 2.2.13	
Test mode:		Compliance	Verdict: PASS
Date:		5/22/2011	
Temperature: 22.6 °C	Air Pressure: 1012 hPa	Relative Humidity: 44 %	Power Supply: 48VDC
Remarks:			

Plot 7.5.7 Spurious emission measurements in 1000.0 – 2285.0 MHz range at low carrier frequency, single output

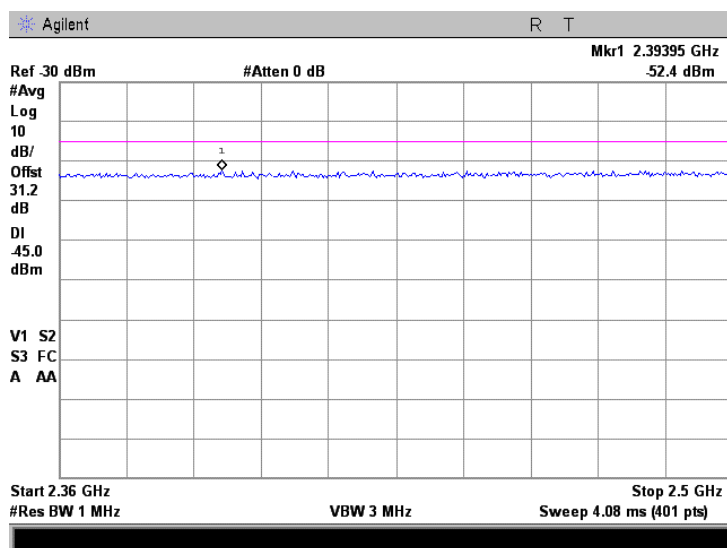


Plot 7.5.8 Spurious emission measurements in 1000.0 – 2320.0 MHz at high carrier frequency, single output

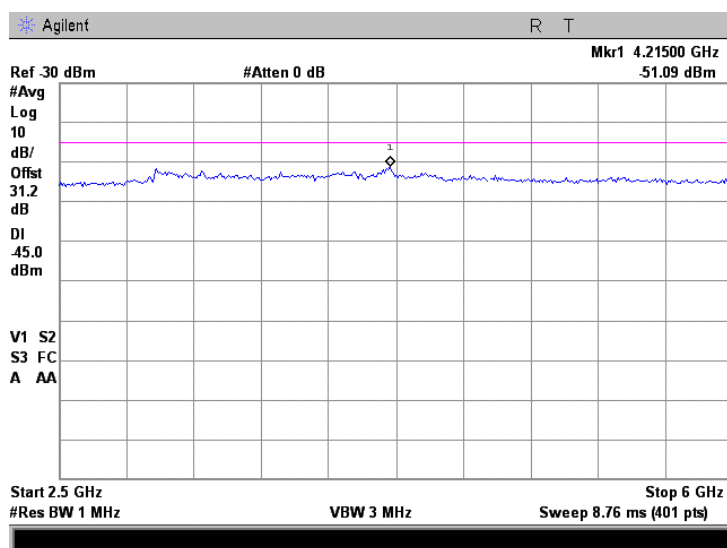


Test specification:	Section 27.53(a)(1), Conducted spurious emissions		
Test procedure:	47 CFR, Section 2.1051 Section 27.53 (5), TIA/EIA-603-C, Section 2.2.13		
Test mode:	Compliance	Verdict:	PASS
Date:	5/22/2011		
Temperature: 22.6 °C	Air Pressure: 1012 hPa	Relative Humidity: 44 %	Power Supply: 48VDC
Remarks:			

Plot 7.5.9 Spurious emission measurements in 2360 - 2500 MHz range at low carrier frequency, single output

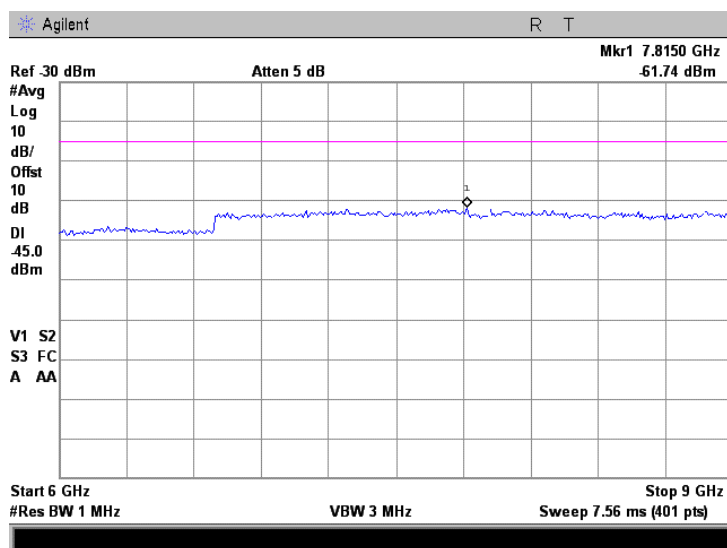


Plot 7.5.10 Spurious emission measurements in 2500 – 6000 MHz range at low carrier frequency, single output

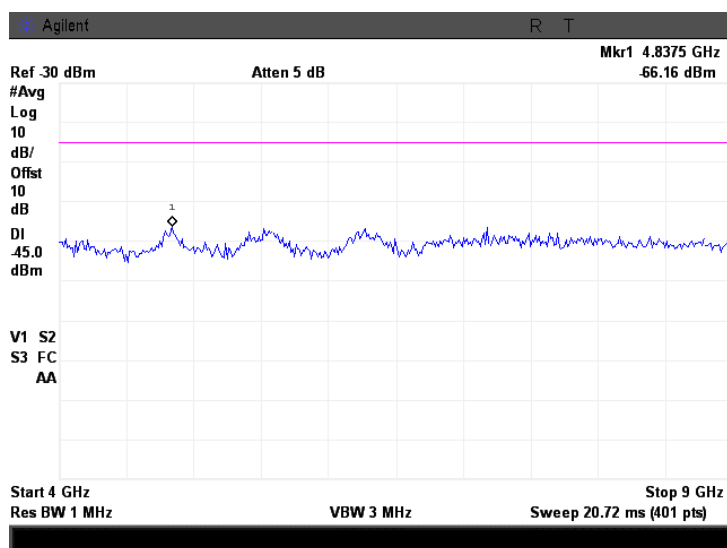


Test specification:	Section 27.53(a)(1), Conducted spurious emissions		
Test procedure:	47 CFR, Section 2.1051 Section 27.53 (5), TIA/EIA-603-C, Section 2.2.13		
Test mode:	Compliance	Verdict:	PASS
Date:	5/22/2011		
Temperature: 22.6 °C	Air Pressure: 1012 hPa	Relative Humidity: 44 %	Power Supply: 48VDC
Remarks:			

Plot 7.5.11 Spurious emission measurements in 6000 – 9000 MHz range at low carrier frequency, single output

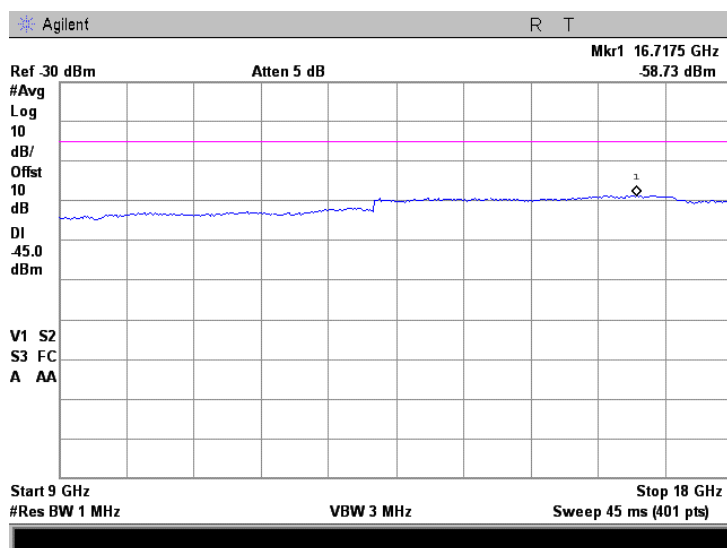


Plot 7.5.12 Spurious emission measurements in 2370 – 9000 MHz range at high carrier frequency, single output

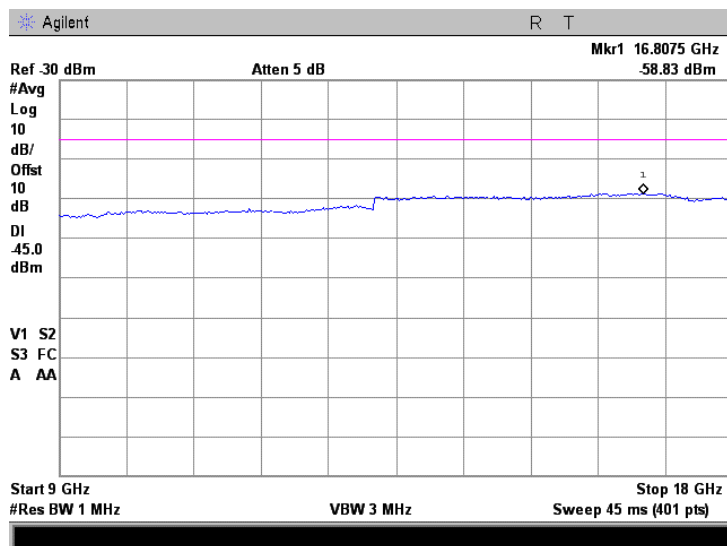


Test specification:		Section 27.53(a)(1), Conducted spurious emissions	
Test procedure:		47 CFR, Section 2.1051 Section 27.53 (5), TIA/EIA-603-C, Section 2.2.13	
Test mode:		Compliance	Verdict: PASS
Date:		5/22/2011	
Temperature: 22.6 °C	Air Pressure: 1012 hPa	Relative Humidity: 44 %	Power Supply: 48VDC
Remarks:			

Plot 7.5.13 Spurious emission measurements in 9000 – 18000 MHz range at low carrier frequency, single output

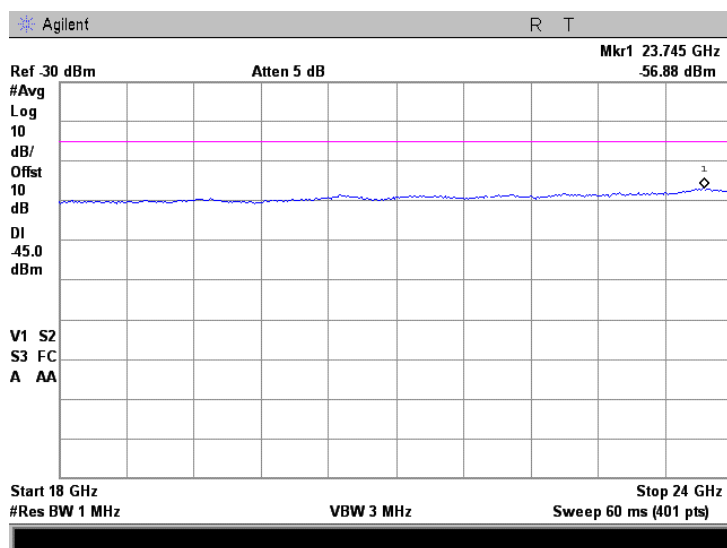


Plot 7.5.14 Spurious emission measurements in 9000 – 18000 MHz range at high carrier frequency, single output

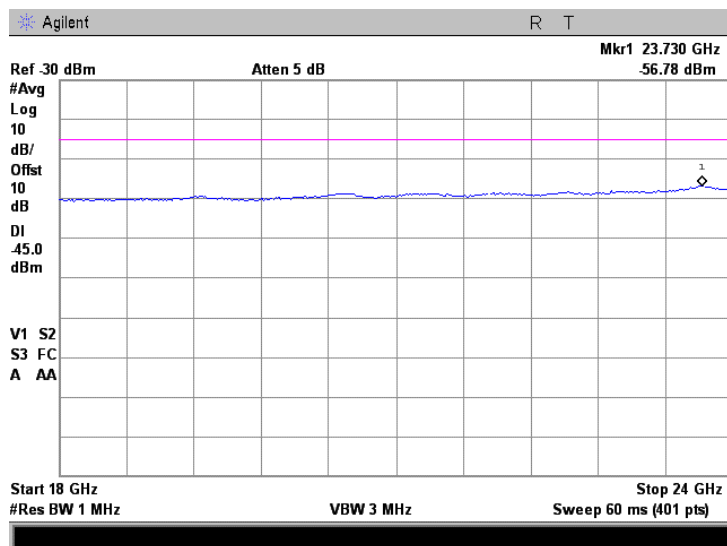


Test specification:		Section 27.53(a)(1), Conducted spurious emissions	
Test procedure:		47 CFR, Section 2.1051 Section 27.53 (5), TIA/EIA-603-C, Section 2.2.13	
Test mode:		Compliance	Verdict: PASS
Date:		5/22/2011	
Temperature: 22.6 °C	Air Pressure: 1012 hPa	Relative Humidity: 44 %	Power Supply: 48VDC
Remarks:			

Plot 7.5.15 Spurious emission measurements in 18000 – 24000 MHz range at low carrier frequency, single output



Plot 7.5.16 Spurious emission measurements in 18000 – 24000 MHz range at high carrier frequency, single output



Test specification:		Section 27.54, Frequency stability	
Test procedure:		47 CFR, Section 2.1055	
Test mode:		Compliance	Verdict: PASS
Date:		5/23/2011 - 5/25/2011	
Temperature: 24.9 °C	Air Pressure: 1014 hPa	Relative Humidity: 45 %	Power Supply: 48 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.

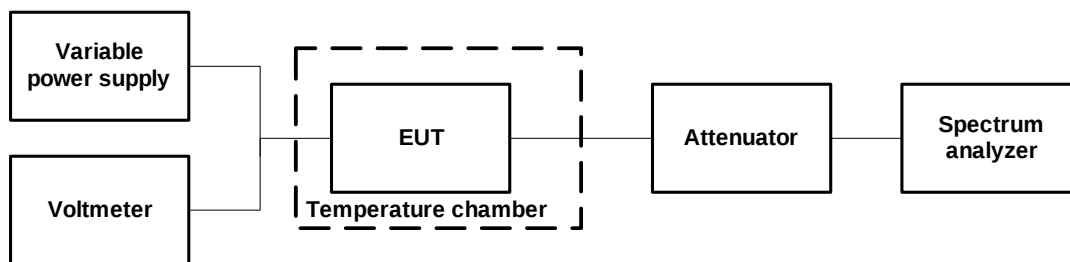
Table 7.6.1 Frequency stability limits

Assigned frequency, MHz	Maximum allowed frequency displacement
2315.0 – 2320.0 2345.0 – 2350.0	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 to Table 7.6.4.

Figure 7.6.1 Frequency stability test setup



Test specification:	Section 27.54, Frequency stability			
Test procedure:	47 CFR, Section 2.1055			
Test mode:	Compliance	Verdict:		PASS
Date:	5/23/2011 - 5/25/2011			
Temperature: 24.9 °C	Air Pressure: 1014 hPa	Relative Humidity: 45 %	Power Supply: 48 VDC	
Remarks:				

Table 7.6.2 Frequency stability test results

OPERATING FREQUENCY RANGE: 2315.0 – 2320.0 MHz
2345.0 – 2350.0 MHz

NOMINAL POWER VOLTAGE: 48 VDC

TEMPERATURE STABILIZATION PERIOD: 20 min

POWER DURING TEMPERATURE TRANSITION: Off

SPECTRUM ANALYZER MODE: Counter

RESOLUTION BANDWIDTH: 1 KHz

VIDEO BANDWIDTH: 3 KHz

MODULATION: Unmodulated

T, °C	Voltage, V	Frequency, MHz							Max frequency drift Hz	
		Start up	1 st min	2 nd min	3 rd min	4 th min	5 th min	10 th min	Positive	Negative
Low carrier frequency 2316.75 MHz										
-30	nominal	2316.749857	2316.749887	2316.749933	2316.749940	2316.749923	2316.749930	2316.750073	0	-300
-20	nominal	2316.750456	NA	NA	NA	NA	NA	2316.750146	299	-11
-10	nominal	2316.749186	NA	NA	NA	NA	NA	2316.748845	0	-1312
0	nominal	2316.750247	2316.750161	2316.750210	2316.749055	2316.748813	2316.749135	2316.748748	90	-1409
10	nominal	2316.749824	NA	NA	NA	NA	NA	2316.750235	78	-333
20	15%	2316.750342	NA	NA	NA	NA	NA	2316.750124	185	-33
20	nominal	2316.749870	NA	NA	NA	NA	NA	2316.750157*	0	-287
20	-15%	2316.750284	NA	NA	NA	NA	NA	2316.750141	127	-16
30	nominal	2316.750580	2316.750293	2316.750275	2316.750200	2316.750200	2316.750200	2316.750200	423	0
40	nominal	2316.750428	NA	NA	NA	NA	NA	2316.750286	271	0
50	nominal	2316.750146	NA	NA	NA	NA	NA	2316.750287	130	-11
High carrier frequency 2348.25 MHz										
-30	nominal	2348.249325	2348.249083	2348.249783	2348.249708	2348.249613	2348.249640	2348.249803	0	-1175
-20	nominal	2348.250197	NA	NA	NA	NA	NA	2348.250253	0	-61
-10	nominal	2348.249349	NA	NA	NA	NA	NA	2348.249849	0	-909
0	nominal	2348.250196	2348.250123	2348.249978	2348.249625	2348.249544	2348.249622	2348.249516	0	-742
10	nominal	2348.251925	NA	NA	NA	NA	NA	2348.249792	1667	-466
20	15%	2348.249882	NA	NA	NA	NA	NA	2348.249714	0	-544
20	nominal	2348.250250	NA	NA	NA	NA	NA	2348.250258*	0	-8
20	-15%	2348.249703	NA	NA	NA	NA	NA	2348.249991	0	-555
30	nominal	2348.250250	2348.250125	2348.250225	2348.250150	2348.250150	2348.250125	2348.250275	17	-133
40	nominal	2348.250288	NA	NA	NA	NA	NA	2348.250420	162	0
50	nominal	2348.250289	NA	NA	NA	NA	NA	2348.250256	31	-2

* - Reference frequency

Test specification:		Section 27.54, Frequency stability	
Test procedure:		47 CFR, Section 2.1055	
Test mode:	Compliance	Verdict:	PASS
Date:	5/23/2011 - 5/25/2011		
Temperature: 24.9 °C	Air Pressure: 1014 hPa	Relative Humidity: 45 %	Power Supply: 48 VDC
Remarks:			

Table 7.6.3 Maximum frequency displacement

Channel	Maximum frequency displacement			
	ppm		Hz	
	Negative	Positive	Negative	Positive
Low (2316.75 MHz)	-0.61	0.18	1409	423
High (2348.25 MHz)	-0.50	0.71	1175	1667

Table 7.6.4 Transmission occupied bandwidth with frequency drift test results

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
QPSK								
2315.022000	2319.292000	2315.020591	2319.292423	2315.000000	2320.000000	0.020591	-0.707577	Pass
2315.023000	2319.676000	2315.021591	2319.676423	2315.000000	2320.000000	0.021591	-0.323577	Pass
64QAM								
2345.745000	2349.956000	2345.743825	2349.957667	2345.000000	2350.000000	0.743825	-0.042333	Pass
2345.568400	2349.961600	2345.567225	2349.963267	2345.000000	2350.000000	0.567225	-0.036733	Pass

* - Measured under normal test conditions at 26 dBc points

** - Measured band edge with proper drift addition

*** - Margin = Calculated band edge – specified band edge

Reference numbers of test equipment used

HL 1424	HL 1464						
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Full description is given in Appendix A.

8 APPENDIX A Test equipment and ancillaries used for tests

HL No	Description	Manufacturer	Model	Ser. No.	Last Cal. / Check	Due Cal. / Check
0446	Antenna, Loop, Active, 10 kHz - 30 MHz	EMCO	6502	2857	29-Jun-10	29-Jun-11
0521	EMI Receiver (Spectrum Analyzer) with RF filter section 9 kHz-6.5 GHz	Hewlett Packard	8546A	3617A 00319, 3448A002 53	25-Aug-10	25-Aug-11
0604	Antenna BiconiLog Log-Periodic/T Bow-TIE, 26 - 2000 MHz	EMCO	3141	9611-1011	11-Jan-11	11-Jan-12
0661	Generator Swept Signal, 10 MHz to 40 GHz, + 10 dBm	HP	83640B	3614A002 66	17-Dec-10	17-Dec-11
0768	Antenna Standard Gain Horn, 18-26.5 GHz, WR-42, 25 dB gain	Quinstar Technology	QWH-4200-BA	110	26-Jan-11	26-Jan-14
1424	Spectrum Analyzer, 30 Hz- 40 GHz	Agilent Technologies	8564EC	3946A002 19	30-Dec-10	30-Dec-11
1464	Cable, 0.5 m, N-Type/N-Type	Harbour Industries	MIL 17/60-RG142	1464	06-Apr-11	06-Apr-12
1984	Antenna, Double-Ridged Waveguide Horn, 1-18 GHz, 300 W	EMC Test Systems	3115	9911-5964	11-Jun-10	11-Jun-11
2432	Antenna, Double-Ridged Waveguide Horn 1-18 GHz	EMC Test Systems	3115	00027177	11-Jun-10	11-Jun-11
2870	Microwave Cable Assembly, 18 GHz, 6.4 m, SMA - SMA	Huber-Suhner	198-9155-00	2870	30-Dec-10	30-Dec-11
2871	Microwave Cable Assembly, 18 GHz, 6.4 m, SMA - SMA	Huber-Suhner	198-8155-00	2871	14-Sep-10	14-Sep-11
2909	Spectrum analyzer, ESA-E, 100 Hz to 26.5 GHz	Agilent Technologies	E4407B	MY414447 62	08-May-11	08-May-12
2953	Cable, RF, 18 GHz, 1.2 m, SMA-SMA	Gore	10020014	NA	04-Oct-10	04-Oct-11
3206	Cable 40 GHz, 0.6 m	Gore	GOR245	05118336	13-Jun-10	13-Jun-11
3301	Power Meter, P-series, 50 MHz to 40 GHz	Agilent Technologies	N1911A	MY451010 57	13-Dec-10	13-Dec-11
3302	Power sensor, P-Series, 50 MHz to 40 GHz, -35/30 to 20 dBm	Agilent Technologies	N1922A	MY452405 86	13-Dec-10	13-Dec-11
3390	Microwave Cable Assembly, 26.5 GHz, 1.0 m, N type/N type	Suhner Sucoflex	104EA	3390	07-Feb-11	07-Feb-12
3533	Amplifier, low noise, 6 to 18 GHz	Quinstar Technology	QLJ-06184040-J0	111590010 01	23-Dec-10	23-Dec-11
3535	Amplifier, low noise, 18 to 40 GHz	Quinstar Technology	QLJ-18404537-J0	111590030 01	06-Dec-10	06-Dec-11
3623	Cable RF, 6.0 m, N type-N type, DC-6.5 GHz	Belden	MIL C-17	NA	19-May-11	19-May-12
3787	Precision Fixed Attenuator, 50 Ohm, 5 W, 10 dB, DC to 18 GHz	Mini-Circuits	BW-S10W5+	NA	07-Dec-10	07-Dec-11
3818	PSA Series Spectrum Analyzer, 3 Hz- 44 GHz	Agilent Technologies	E4446A	MY482502 88	25-Sep-09	25-Sep-11

HL No	Description	Manufacturer	Model	Ser. No.	Last Cal. / Check	Due Cal. / Check
3868	Directional coupler, 2 GHz to 8 GHz, 10 dB, SMA Female	Narda	4203-10	06978	13-Dec-10	13-Dec-12
3901	Microwave Cable Assembly, 40.0 GHz, 3.5 m, SMA/SMA	Huber-Suhner	SUCOFLE X 102A	1225/2A	07-Feb-11	07-Feb-12

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	$\pm 8\%$
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 $\pm 13.9\%$
Duty cycle, timing (Tx ON / OFF) and average factor measurements	$\pm 1.0\%$

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, IC 2186A-2 for anechoic chamber, IC 2186A-3 for full-anechoic chamber for RE measurements above 1 GHz), certified by VCCI, Japan (the registration numbers are R-808 for OATS, R-1082 for anechoic chamber, G-27 for full-anechoic chamber for RE measurements above 1 GHz, C-845 for conducted emissions site, T-1606 for conducted emissions at telecommunication ports), 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). The FCC Designation Number is US1003.

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website: www.hermonlabs.com

Person for contact: Mr. Alex Usoskin, CEO.

11 APPENDIX D Specification references

FCC 47CFR part 27: 2010	Miscellaneous wireless communications services
FCC 47CFR part 1: 2010	Practice and procedure
FCC 47CFR part 2: 2010	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.

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

Antenna factor
Standard gain horn antenna
Quinstar Technology
Model QWH
Ser.No.110, HL 0768

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

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

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

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

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

Cable loss
Cable coaxial, Huber-Suhner, 18 GHz, 6.4 m, SMA - SMA, model 198-9155-00,
HL 2870

Frequency, MHz	Cable loss, dB	Frequency, MHz	Cable loss, dB	Frequency, MHz	Cable loss, dB
10	0.09	5750	2.49	12000	3.71
30	0.17	6000	2.53	12250	3.81
100	0.32	6250	2.58	12500	3.84
250	0.49	6500	2.64	12750	3.88
500	0.70	6750	2.69	13000	3.92
750	0.86	7000	2.75	13250	3.96
1000	1.00	7250	2.80	13500	3.98
1250	1.11	7500	2.87	13750	4.01
1500	1.23	7750	2.93	14000	4.03
1750	1.34	8000	2.94	14250	4.09
2000	1.41	8250	3.00	14500	4.08
2250	1.51	8500	3.04	14750	4.10
2500	1.59	8750	3.08	15000	4.15
2750	1.68	9000	3.14	15250	4.22
3000	1.76	9250	3.16	15500	4.31
3250	1.83	9500	3.22	15750	4.42
3500	1.91	9750	3.26	16000	4.48
3750	1.97	10000	3.36	16250	4.54
4000	2.05	10250	3.41	16500	4.56
4250	2.11	10500	3.46	16750	4.57
4500	2.18	10750	3.50	17000	4.59
4750	2.24	11000	3.54	17250	4.66
5000	2.30	11250	3.58	17500	4.70
5250	2.36	11500	3.63	17750	4.76
5500	2.43	11750	3.66	18000	4.72

Cable loss
Cable coaxial, Huber-Suhner, 18 GHz, 6.4 m, SMA - SMA, model 198-8155-00,
HL 2871

Frequency, MHz	Cable loss, dB	Frequency, MHz	Cable loss, dB	Frequency, MHz	Cable loss, dB
10	0.12	5750	2.34	12000	3.55
30	0.14	6000	2.39	12250	3.61
100	0.27	6250	2.46	12500	3.67
250	0.45	6500	2.52	12750	3.74
500	0.63	6750	2.58	13000	3.79
750	0.76	7000	2.64	13250	3.82
1000	0.89	7250	2.68	13500	3.83
1250	1.01	7500	2.73	13750	3.83
1500	1.12	7750	2.78	14000	3.88
1750	1.23	8000	2.83	14250	3.93
2000	1.32	8250	2.88	14500	3.96
2250	1.41	8500	2.94	14750	4.01
2500	1.49	8750	2.97	15000	4.00
2750	1.58	9000	3.02	15250	4.01
3000	1.66	9250	3.07	15500	4.00
3250	1.73	9500	3.13	15750	4.13
3500	1.80	9750	3.18	16000	4.22
3750	1.87	10000	3.21	16250	4.29
4000	1.93	10250	3.26	16500	4.29
4250	2.01	10500	3.30	16750	4.32
4500	2.06	10750	3.36	17000	4.37
4750	2.12	11000	3.39	17250	4.45
5000	2.17	11250	3.44	17500	4.49
5250	2.24	11500	3.48	17750	4.53
5500	2.29	11750	3.52	18000	4.55

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
Cable coaxial, GORE-TEX, GOR245, 40 GHz, 0.6 m, SMA-SMA, S/N 05118336
HL 3206

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	0.09	4900	0.85	10000	1.20	15200	1.51	29500	1.94
30	0.09	5000	0.85	10100	1.23	15300	1.56	30000	2.11
50	0.10	5100	0.86	10200	1.24	15400	1.54	30500	2.25
100	0.14	5200	0.87	10300	1.25	15500	1.55	31000	2.23
200	0.18	5300	0.88	10400	1.24	15600	1.50	31500	2.24
300	0.22	5400	0.89	10500	1.20	15700	1.56	32000	2.21
400	0.26	5500	0.90	10600	1.23	15800	1.50	32500	2.19
500	0.29	5600	0.92	10700	1.25	15900	1.58	33000	2.24
600	0.31	5700	0.93	10800	1.28	16000	1.56	33500	2.26
700	0.33	5800	0.93	10900	1.35	16100	1.59	34000	2.25
800	0.35	5900	0.95	11000	1.30	16200	1.57	34500	2.28
900	0.38	6000	0.93	11100	1.31	16300	1.59	35000	2.27
1000	0.39	6100	0.97	11200	1.31	16400	1.57	35500	2.31
1100	0.41	6200	0.95	11300	1.35	16500	1.60	36000	2.36
1200	0.42	6300	0.99	11400	1.32	16600	1.60	36500	2.39
1300	0.45	6400	0.98	11500	1.38	16700	1.63	37000	2.39
1400	0.46	6500	0.99	11600	1.33	16800	1.66	37500	2.41
1500	0.48	6600	0.99	11700	1.37	16900	1.64	38000	2.40
1600	0.49	6700	0.99	11800	1.36	17000	1.66	38500	2.40
1700	0.50	6800	0.99	11900	1.42	17100	1.65	39000	2.54
1800	0.52	6900	1.02	12000	1.34	17200	1.67	39500	2.39
1900	0.53	7000	1.02	12100	1.41	17300	1.66	40000	2.48
2000	0.53	7100	1.06	12200	1.36	17400	1.69		
2100	0.54	7200	1.05	12300	1.40	17500	1.66		
2200	0.55	7300	1.02	12400	1.34	17600	1.69		
2300	0.56	7400	1.03	12500	1.39	17700	1.70		
2400	0.57	7500	1.04	12600	1.40	17800	1.74		
2500	0.59	7600	1.05	12700	1.42	17900	1.67		
2600	0.60	7700	1.10	12800	1.37	18000	1.72		
2700	0.62	7800	1.11	12900	1.39	18500	1.72		
2800	0.62	7900	1.10	13000	1.40	19000	1.78		
2900	0.65	8000	1.10	13100	1.42	19500	1.77		
3000	0.65	8100	1.10	13200	1.41	20000	1.82		
3100	0.66	8200	1.10	13300	1.43	20500	1.82		
3200	0.67	8300	1.16	13400	1.45	21000	1.94		
3300	0.69	8400	1.15	13500	1.45	21500	1.92		
3400	0.70	8500	1.20	13600	1.54	22000	2.07		
3500	0.71	8600	1.19	13700	1.54	22500	1.90		
3600	0.71	8700	1.15	13800	1.49	23000	1.96		
3700	0.73	8800	1.16	13900	1.50	23500	1.88		
3800	0.74	8900	1.19	14000	1.50	24000	1.96		
3900	0.75	9000	1.18	14100	1.52	24500	1.96		
4000	0.76	9100	1.23	14200	1.60	25000	2.10		
4100	0.76	9200	1.20	14300	1.57	25500	2.05		
4200	0.78	9300	1.20	14400	1.57	26000	2.05		
4300	0.79	9400	1.19	14600	1.50	26500	2.05		
4400	0.80	9500	1.23	14700	1.54	27000	1.97		
4500	0.80	9600	1.21	14800	1.51	27500	2.09		
4600	0.82	9700	1.22	14900	1.54	28000	2.10		
4700	0.82	9800	1.20	15000	1.57	28500	2.05		
4800	0.83	9900	1.18	15100	1.56	29000	2.08		

Cable loss
Cable coaxial, Microwave Cable Assembly, 104EA, 18 GHz, 1.0 m
Suhner Sucoflex, HL 3390

Frequency, MHz	Cable loss, dB	Frequency, MHz	Cable loss, dB	Frequency, MHz	Cable loss, dB	Frequency, MHz	Cable loss, dB
10	0.03	4800	0.55	9800	0.89	14900	1.07
30	0.04	4900	0.56	9900	0.89	15000	1.07
50	0.05	5000	0.57	10000	0.86	15100	1.08
100	0.07	5100	0.58	10100	0.86	15200	1.07
200	0.10	5200	0.58	10200	0.88	15300	1.09
300	0.12	5300	0.59	10300	0.92	15400	1.10
400	0.14	5400	0.59	10400	0.94	15500	1.10
500	0.16	5500	0.60	10500	0.96	15600	1.12
600	0.17	5600	0.61	10600	0.93	15700	1.15
700	0.18	5700	0.61	10700	0.89	15800	1.15
800	0.20	5800	0.63	10800	0.89	15900	1.17
900	0.21	5900	0.63	10900	0.88	16000	1.14
1000	0.23	6000	0.64	11000	0.92	16100	1.14
1100	0.24	6100	0.64	11100	0.91	16200	1.15
1200	0.25	6200	0.64	11200	0.89	16300	1.14
1300	0.27	6300	0.65	11300	0.88	16400	1.13
1400	0.28	6400	0.65	11400	0.88	16500	1.13
1500	0.28	6500	0.66	11500	0.90	16600	1.13
1600	0.30	6600	0.67	11600	0.94	16700	1.14
1700	0.31	6700	0.67	11700	0.96	16800	1.14
1800	0.32	6800	0.67	11800	0.92	16900	1.14
1900	0.33	6900	0.68	11900	0.92	17000	1.14
2000	0.34	7000	0.67	12000	0.91	17100	1.15
2100	0.35	7100	0.68	12100	0.92	17200	1.14
2200	0.35	7200	0.69	12200	0.95	17300	1.15
2300	0.36	7300	0.69	12300	0.98	17400	1.15
2400	0.37	7400	0.68	12400	0.96	17500	1.16
2500	0.39	7500	0.69	12500	0.99	17600	1.16
2600	0.40	7600	0.70	12600	0.96	17700	1.16
2700	0.41	7700	0.71	12700	0.93	17800	1.19
2800	0.42	7800	0.72	12800	0.94	17900	1.21
2900	0.42	7900	0.72	12900	0.98	18000	1.25
3000	0.43	8000	0.72	13000	0.99		
3100	0.44	8100	0.73	13100	0.99		
3200	0.45	8200	0.74	13200	0.99		
3300	0.46	8300	0.75	13300	0.99		
3400	0.46	8400	0.74	13400	1.00		
3500	0.47	8500	0.73	13500	1.02		
3600	0.47	8600	0.73	13600	1.05		
3700	0.47	8700	0.75	13700	1.03		
3800	0.49	8800	0.77	13800	1.02		
3900	0.49	8900	0.77	13900	1.03		
4000	0.50	9000	0.77	14000	1.03		
4100	0.51	9100	0.77	14100	1.05		
4200	0.52	9200	0.78	14200	1.05		
4300	0.52	9300	0.80	14300	1.04		
4400	0.53	9400	0.82	14400	1.03		
4500	0.53	9500	0.82	14600	1.06		
4600	0.54	9600	0.83	14700	1.07		
4700	0.56	9700	0.89	14800	1.08		

Cable loss
Cable coaxial, MIL C-17, N type-N type, 6 m
Belden, HL 3623

Frequency, MHz	Cable loss, dB	Frequency, MHz	Cable loss, dB	Frequency, MHz	Cable loss, dB
10	0.13	2600	4.38	5400	7.76
30	0.25	2700	4.53	5500	7.79
50	0.33	2800	4.64	5600	7.88
100	0.49	2900	4.79	5700	7.93
200	0.76	3000	4.93	5800	8.05
300	0.97	3100	5.02	5900	8.03
400	1.18	3200	5.18	6000	8.07
500	1.38	3300	5.27	6100	8.14
600	1.54	3400	5.41	6200	8.21
700	1.71	3500	5.57	6300	8.28
800	1.88	3600	5.65	6400	8.35
900	2.04	3700	5.82	6500	8.43
1000	2.19	3800	5.89		
1100	2.38	3900	6.02		
1200	2.61	4000	6.15		
1300	2.63	4100	6.26		
1400	2.79	4200	6.37		
1500	2.90	4300	6.52		
1600	3.08	4400	6.63		
1700	3.21	4500	6.74		
1800	3.31	4600	6.86		
1900	3.47	4700	6.98		
2000	3.59	4800	7.09		
2100	3.74	4900	7.17		
2200	3.86	5000	7.30		
2300	3.98	5100	7.41		
2400	4.12	5200	7.59		
2500	4.24	5300	7.71		

Cable loss
Microwave Cable Assembly, Huber-Suhner, 40 GHz, 3.5 m, SMA-SMA, S/N 1225/2A
HL 3901

Frequency, MHz	Cable loss, dB	Frequency, MHz	Cable loss, dB	Frequency, MHz	Cable loss, dB
10	0.09	9500	4.29	21000	6.67
100	0.41	10000	4.40	22000	6.92
500	0.93	10500	4.52	23000	7.00
1000	1.33	11000	4.64	24000	7.18
1500	1.63	11500	4.76	25000	7.29
2000	1.90	12000	4.87	26000	7.55
2500	2.12	12500	4.99	27000	7.70
3000	2.33	13000	5.11	28000	7.88
3500	2.50	13500	5.20	29000	8.02
4000	2.67	14000	5.31	30000	8.15
4500	2.82	14500	5.42	31000	8.35
5000	2.99	15000	5.51	32000	8.40
5500	3.16	15500	5.58	33000	8.62
6000	3.32	16000	5.68	34000	8.73
6500	3.51	16500	5.78	35000	8.78
7000	3.65	17000	5.91	36000	8.94
7500	3.79	17500	5.99	37000	9.21
8000	3.92	18000	6.07	38000	9.37
8500	4.04	19000	6.36	39000	9.45
9000	4.18	20000	6.49	40000	9.52

13 APPENDIX F Abbreviations and acronyms

A	ampere
AC	alternating current
A/m	ampere per meter
AM	amplitude modulation
AVRG	average (detector)
CBW	channel bandwidth
cm	centimeter
dB	decibel
dBm	decibel referred to one milliwatt
dB(μ V)	decibel referred to one microvolt
dB(μ V/m)	decibel referred to one microvolt per meter
dB(μ A)	decibel referred to one microampere
DC	direct current
EBW	emission bandwidth
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
m	meter
MHz	megahertz
min	minute
mm	millimeter
ms	millisecond
μ s	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

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