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839.01
Electrical

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TEST REPORT

ACCORDING TO: FCC CFR 47 PART 90 subpart Z; part 15 subpart B

FOR:

WiNetworks Ltd.

Base station operating in 3.65-3.675 GHz

Model: Pico BS WiN7237

Table of contents

1 Applicant information

Client name:	WiNetworks Ltd.
Address:	32 Maskit Street, P.O.Box 12412, Herzeliya 46733, Israel
Telephone:	+972 9951 9556
Fax:	+972 9951 9557
E-mail:	shayc@winetworks.com
Contact name:	Mr. Shay Chaim

2 Equipment under test attributes

Product name:	Base station operating in 3.65-3.675 GHz
Product type:	Transceiver
Model(s):	Pico BS WiN7237
Receipt date	2/16/2009

3 Manufacturer information

Manufacturer name:	WiNetworks Ltd.
Address:	32 Maskit Street, P.O.Box 12412, Herzeliya 46733, Israel
Telephone:	+972 9951 9556
Fax:	+972 9951 9557
E-Mail:	shayc@winetworks.com
Contact name:	Mr. Shay Chaim

4 Test details

Project ID:	19456
Location:	Hermon Laboratories Ltd. Harakevet Industrial Zone, Binyamina 30500, Israel
Test started:	2/16/2009
Test completed:	4/12/2009
Test specification(s):	47CFR part 90 subpart Z, part 15 subpart B

5 Tests summary

Test	Status
Transmitter characteristics	
Section 90.205, 90.1321, Maximum output power and peak power spectral density	Pass
Section 90.209, Occupied bandwidth	Pass
Section 90.210, Emission mask	Pass
Section 90.1323, Radiated spurious emissions	Pass
Section 90.1323, Conducted spurious emissions	Pass
Section 90.213, Frequency stability	Pass
Section 2.1091, 90.1335, RF radiation exposure evaluation	Pass, Exhibit attached to Application for certification
Unintentional emissions	
Section 15.107, Conducted emission at AC power port	Pass
Section 15.109, Radiated emission	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:	Mrs. E. Pitt, test engineer	April 12, 2009	
Reviewed by:	Mrs. M. Cherniavsky, certification engineer	April 23, 2009	
Approved by:	Mr. M. Nikishin, EMC and Radio group manager	April 26, 2009	

6 EUT description

6.1 General information

The EUT is a base station of WiMAX system operating in3.65-3.675 GHz band. It comprises an Outdoor Unit (ODU) that includes modem, radio, data processing and management components, serving as an efficient platform for a wide range of services. It provides a wireless connection to the subscriber unit.

6.2 Ports and lines

Port type	Port description	Connected		Qty.	Cable type	Cable length
		From	To			
Signal	48 VDC& Ethernet	EUT	DC power supply	1	STP	3 m
RF	Antenna	EUT	50 Ohm termination	2	NA	NA
Signal	GPS	EUT	50 Ohm termination	1	coax	15 m
Signal	Console	EUT	PC	1	FTP	10 m
Signal	LAN	DC power supply	PC	1	unshielded	1.5 m
Power	AC power	DC power supply	mains	1	unshielded	1.5 m

6.3 Support and test equipment

Description	Manufacturer	Model number	Serial number
PC	IBM	1834	BWG99
Adapter to laptop	IBM	08K8202	18990
Mouse	Lenovo	MO28V0L	4465430
DC power supply	WiNetworks	WIN1010 0334B4848	192307

6.4 Changes made in the EUT

No changes were performed in the EUT.

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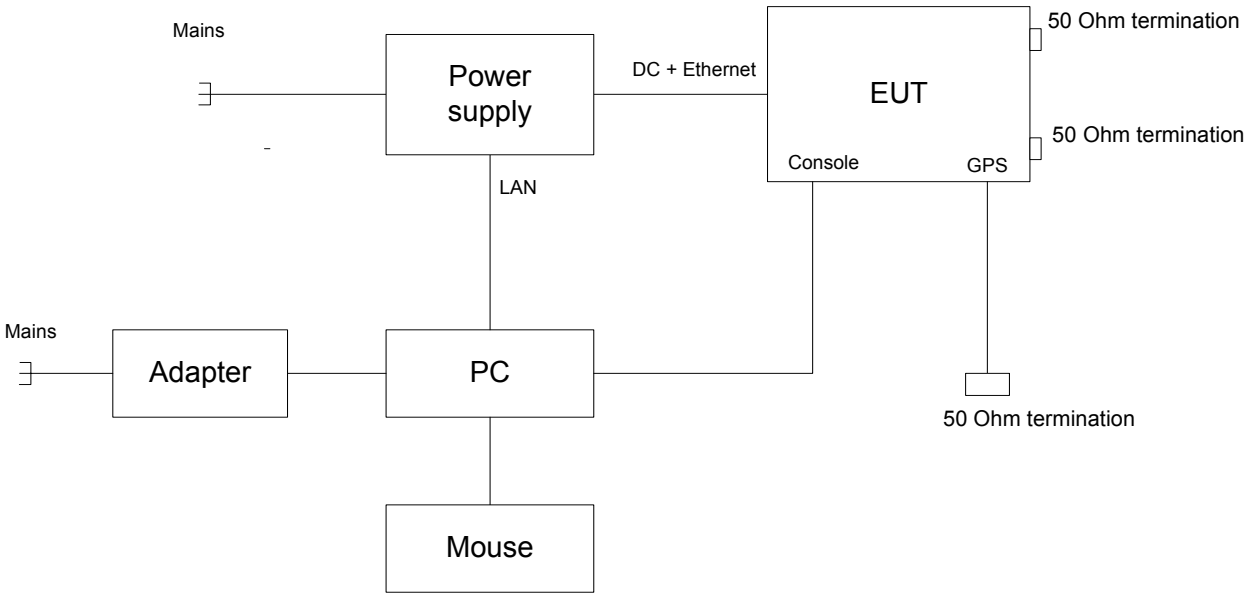
6.5 Test configuration



6.6 Transmitter characteristics

Type of equipment								
V	Stand-alone (Equipment with or without its own control provisions)							
	Combined equipment (Equipment where the radio part is fully integrated within another type of equipment)							
	Plug-in card (Equipment intended for a variety of host systems)							
Intended use		**Condition of use**						
V	fixed	Always at a distance more than 2 m from all people						
	mobile	Always at a distance more than 20 cm from all people						
	portable	May operate at a distance closer than 20 cm to human body						
Assigned frequency range		3650 – 3675 MHz						
Operating frequency range		3652.5 – 3672.5 MHz						
RF channel bandwidth		5 MHz, 7 MHz, 10 MHz						
Maximum rated output power		At transmitter 50 Ω RF output connector						26.28 dBm
Is transmitter output power variable?			No					
		V	Yes		continuous variable			
				V	stepped variable with stepsize			0.5 dB
				minimum RF power				17.5 dBm
				maximum EIRP power				32.28 dBm
Antenna connection								
unique coupling		standard connector		**V**	Integral	**V**	with temporary RF connector	
							without temporary RF connector	

Antenna/s technical characteristics			
Type	Manufacturer	Model number	Gain
OMNI	KBT	TQJ-3700AT6-NJ	6 dBi

Transmitter 99% power bandwidth		5 MHz, 7 MHz, 10 MHz						
Transmitter aggregate data rate/s		5 MHz BW: QPSK - 1.15 MBps, 64QAM –8.65 MBps 7 MHz BW: QPSK - 2.8 MBps, 64QAM – 14.7 MBps 10 MHz BW: QPSK - 3.8 MBps, 64QAM – 19.5 MBps						
Type of modulation		QPSK, 64QAM						
Type of multiplexing		OFDM						
Modulating test signal (baseband)		PRBS						
Maximum transmitter duty cycle in normal use		90%						
Transmitter power source								
		Nominal rated voltage		Battery type				
V	DC	**Nominal rated voltage**	48 V (via DC power supply from the mains)					
	AC mains	**Nominal rated voltage**		Frequency				
Common power source for transmitter and receiver			**V**	yes		no		

Test specification:	Section 90.1321, Maximum output power		
Test procedure:	47 CFR, Section 2.1046; TIA/EIA-603-C, Section 2.2.1		
Test mode:	Compliance	Verdict:	PASS
Date & Time:	3/29/2009 3:34:38 PM		
Temperature: 23ºC	Air Pressure: 1013 hPa	Relative Humidity: 41%	Power Supply: 48 VDC
Remarks:			

7 Transmitter tests according to 47CFR part 90 requirements

7.1 Peak output power test

7.1.1 General

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

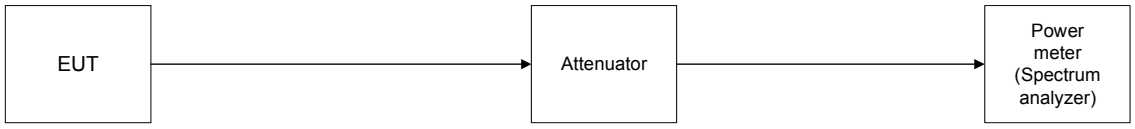
Table 7.1.1 Peak output power and spectral density limits

Assigned frequency range, MHz	Channel bandwidth, MHz	Maximum peak output power		Power spectral density, dBm/MHz
		W	dBm	
3650.0 – 3675.0	5	5.0	31.00	24.0
	7	7.0	32.45	
	10	10.0	34.00	

7.1.2 Test procedure

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

Figure 7.1.1 Peak output power test setup



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Test specification:	Section 90.1321, Maximum output power		
Test procedure:	47 CFR, Section 2.1046; TIA/EIA-603-C, Section 2.2.1		
Test mode:	Compliance	Verdict:	PASS
Date & Time:	3/29/2009 3:34:38 PM		
Temperature: 23ºC	Air Pressure: 1013 hPa	Relative Humidity: 41%	Power Supply: 48 VDC
Remarks:			

Table 7.1.2 Peak output power test results

ASSIGNED FREQUENCY RANGE: 3650.0 – 3675.0 MHz
MODULATION: QPSK(min data rate), 64QAM (max data rate)
MODULATING SIGNAL: OFDM
TRANSMITTER OUTPUT POWER SETTINGS: Maximum
GAIN OF THE EACH ANTENNA 6 dBi

Carrier frequency, MHz	Modulation and data rate Mbps	Power meter reading at antenna 1 dBm	Power meter reading at antenna 2 dBm	Calculated Power dBm	Limit, dBm	Margin, dB	Verdict
Channel bandwidth 5 MHz							
3652.5	**64QAM, 8.65 Mbps**	22.58	20.58	24.70	31.00	-5.30	Pass
3662.5		23.76	20.47	25.43	31.00	-4.53	Pass
3672.5		22.70	21.27	25.05	31.00	-4.95	Pass
3652.5	**QPSK, 1.15 Mbps**	22.67	20.79	24.84	31.00	-6.16	Pass
3662.5		23.26	20.47	25.10	31.00	-5.90	Pass
3672.5		22.52	21.33	24.98	31.00	-6.02	Pass
Channel bandwidth 7 MHz							
3653.5	**64QAM, 14.7 Mbps**	24.57	20.04	25.88	32.45	-6.57	Pass
3662.5		23.12	19.87	24.80	32.45	-7.65	Pass
3671.5		23.10	19.72	24.74	32.45	-7.71	Pass
3653.5	**QPSK, 2.8 Mbps**	24.71	19.82	25.93	32.45	-6.52	Pass
3662.5		23.05	19.82	24.74	32.45	-7.71	Pass
3671.5		23.23	19.54	24.78	32.45	-7.75	Pass
Channel bandwidth 10 MHz							
3655.0	**64QAM, 19.5 Mbps**	25.06	20.15	26.28	34.00	-7.72	Pass
3662.5		24.59	19.84	25.84	34.00	-8.16	Pass
3670.0		25.10	19.72	26.21	34.00	-7.79	Pass
3655.0	**QPSK, 3.8 Mbps**	24.96	20.15	26.20	34.00	-7.80	Pass
3662.5		24.39	19.87	25.70	34.00	-8.30	Pass
3670.0		25.02	19.74	26.15	34.00	-7.85	Pass

Reference numbers of test equipment used

HL 2013	HL 3301	HL 3302	HL 3441	HL 3474			

Full description is given in Appendix A.

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Test specification:	Section 90.1321, Maximum output power		
Test procedure:	47 CFR, Section 2.1046; TIA/EIA-603-C, Section 2.2.1		
Test mode:	Compliance	Verdict:	PASS
Date & Time:	3/29/2009 3:34:38 PM		
Temperature: 23ºC	Air Pressure: 1013 hPa	Relative Humidity: 41%	Power Supply: 48 VDC
Remarks:			

Table 7.1.3 Peak output power density test results

ASSIGNED FREQUENCY RANGE: 3650.0 – 3675.0 MHz
MODULATION: QPSK(min data rate), 64QAM (max data rate)
MODULATING SIGNAL: OFDM
TRANSMITTER OUTPUT POWER SETTINGS: Maximum
GAIN OF THE EACH ANTENNA 6 dBi

Carrier frequency, MHz	Modulation and data rate Mbps	Spectrum analyzer reading at antenna 1 dBm/MHz	Spectrum analyzer reading at antenna 2 dBm/MHz	Power density dBm/MHz	Limit, dBm/MHz	Margin, dB	Verdict
Channel bandwidth 5 MHz							
3652.5	**64QAM, 8.65 Mbps**	17.67	12.98	18.94	24	-5.06	Pass
3662.5		16.60	12.77	18.10	24	-5.90	Pass
3672.5		17.86	12.72	19.02	24	-4.98	Pass
3652.5	**QPSK 1.15 Mbps**	16.81	12.84	18.27	24	-5.73	Pass
3662.5		17.86	12.83	19.05	24	-4.95	Pass
3672.5		.17.69	12.73	18.89	24	-5.11	Pass
Channel bandwidth 7 MHz							
3653.5	**64QAM, 14.7 Mbps**	15.46	12.64	17.29	24	-6.71	Pass
3662.5		14.55	12.49	16.65	24	-7.35	Pass
3671.5		16.01	12.44	17.59	24	-6.41	Pass
3653.5	**QPSK 2.8 Mbps**	16.70	12.66	18.14	24	-5.86	Pass
3662.5		15.22	12.51	17.08	24	-6.92	Pass
3671.5		16.87	12.44	18.21	24	-5.79	Pass
Channel bandwidth 10 MHz							
3655.0	**64QAM, 19.5 Mbps**	13.80	11.27	15.73	24	-8.27	Pass
3662.5		16.49	11.13	17.60	24	-6.40	Pass
3670.0		14.95	11.12	16.45	24	-7.55	Pass
3655.0	**QPSK 3.8 Mbps**	14.78	11.33	16.40	24	-7.60	Pass
3662.5		14.78	11.06	16.32	24	-7.68	Pass
3670.0		15.88	10.99	17.10	24	-6.90	Pass

Reference numbers of test equipment used

HL 2013	HI 2909	HL 3441	HL 3474				

Full description is given in Appendix A.

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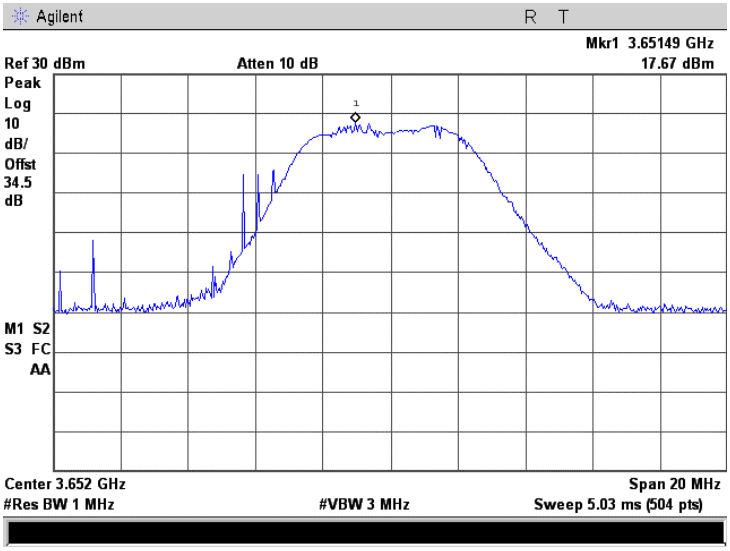
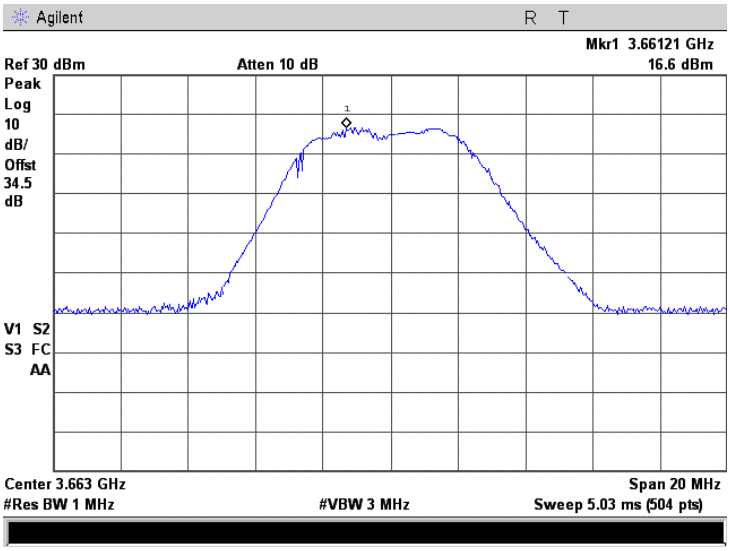
Test specification:	Section 90.1321, Maximum output power		
Test procedure:	47 CFR, Section 2.1046; TIA/EIA-603-C, Section 2.2.1		
Test mode:	Compliance	Verdict:	PASS
Date & Time:	3/29/2009 3:34:38 PM		
Temperature: 23ºC	Air Pressure: 1013 hPa	Relative Humidity: 41%	Power Supply: 48 VDC
Remarks: Antenna 1			

Plot 7.1.1 Peak output power density test results at low frequency, 64QAM, 5MHz CBW



Plot 7.1.2 Peak output power test results at mid frequency, 64QAM, 5MHz CBW



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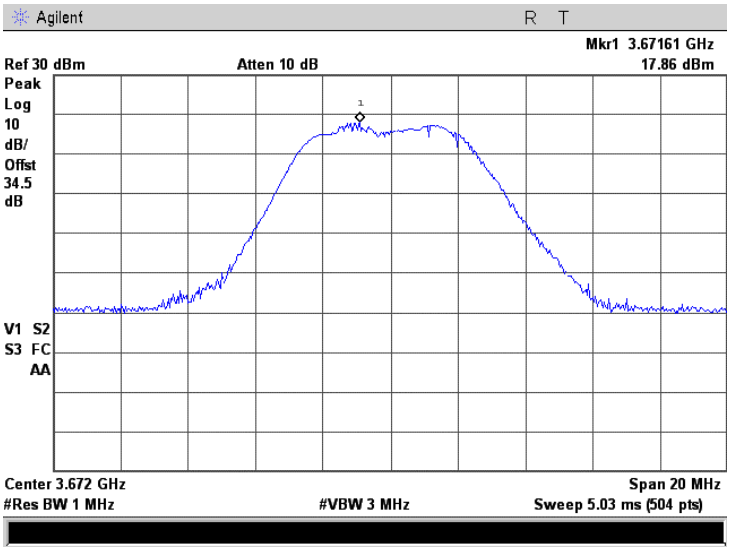
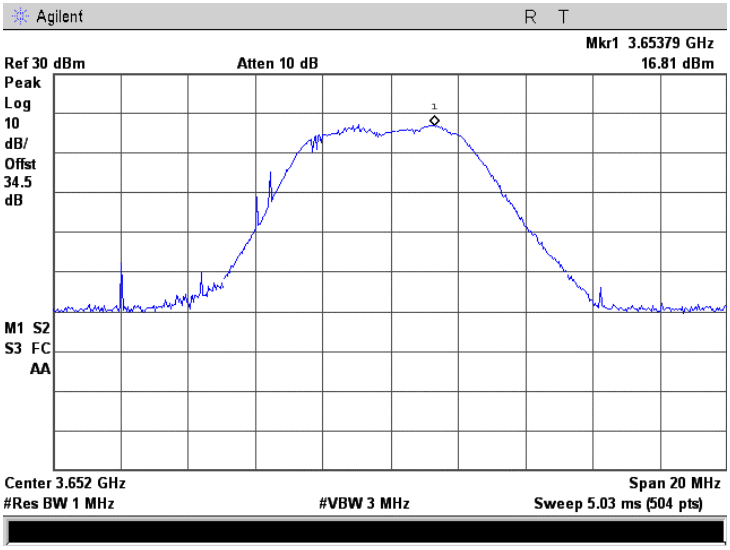
Test specification:	Section 90.1321, Maximum output power		
Test procedure:	47 CFR, Section 2.1046; TIA/EIA-603-C, Section 2.2.1		
Test mode:	Compliance	Verdict:	PASS
Date & Time:	3/29/2009 3:34:38 PM		
Temperature: 23ºC	Air Pressure: 1013 hPa	Relative Humidity: 41%	Power Supply: 48 VDC
Remarks: Antenna 1			

Plot 7.1.3 Peak output power test results at high frequency, 64QAM, 5MHz CBW

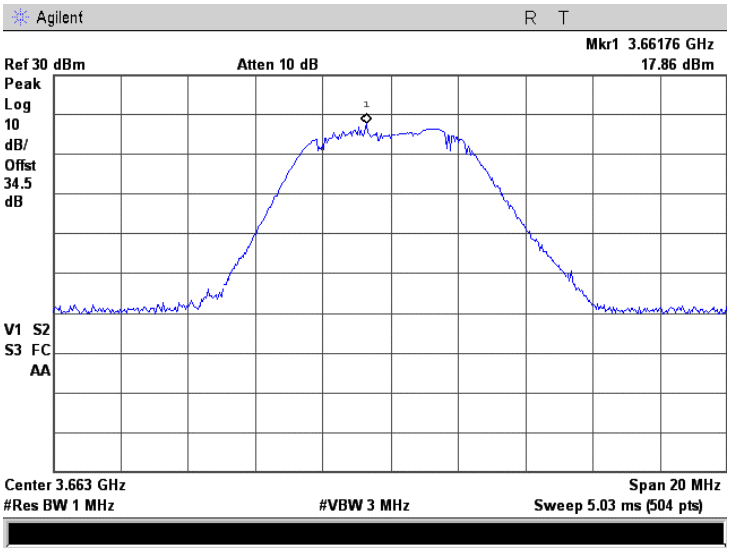


Plot 7.1.4 Peak output power test results at low frequency, QPSK, 5MHz CBW

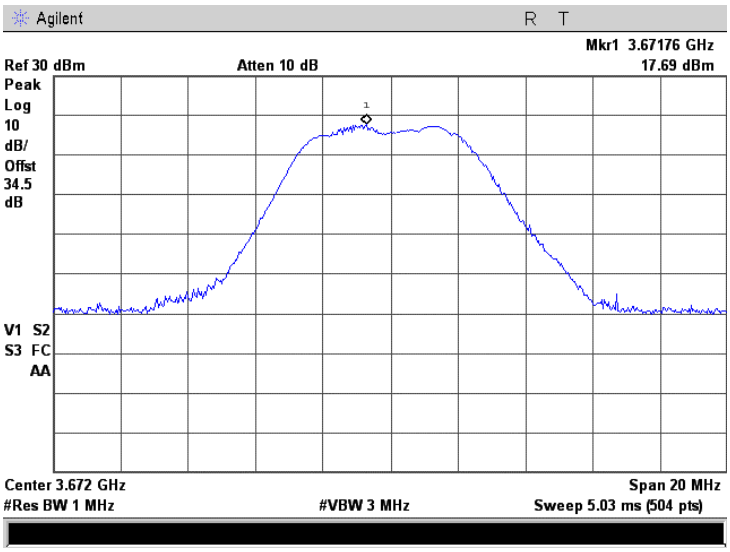


Test specification:	Section 90.1321, Maximum output power		
Test procedure:	47 CFR, Section 2.1046; TIA/EIA-603-C, Section 2.2.1		
Test mode:	Compliance	Verdict:	PASS
Date & Time:	3/29/2009 3:34:38 PM		
Temperature: 23ºC	Air Pressure: 1013 hPa	Relative Humidity: 41%	Power Supply: 48 VDC
Remarks: Antenna 1			

Plot 7.1.5 Peak output power test results at mid frequency, QPSK, 5MHz CBW

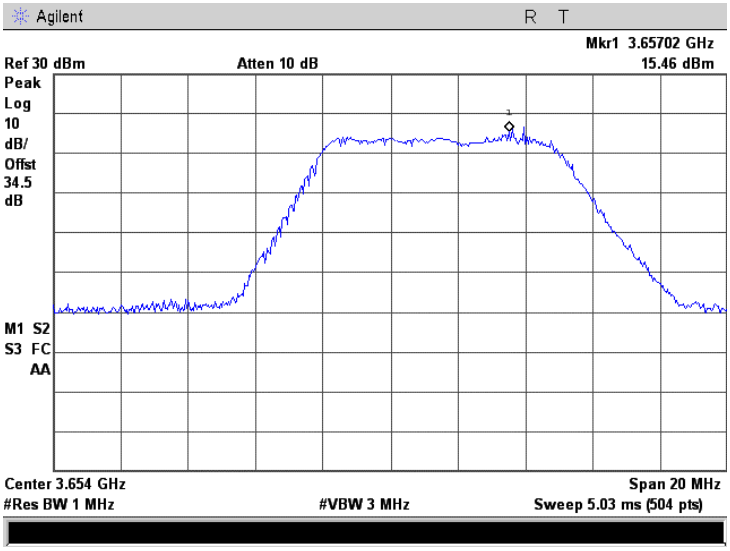


Plot 7.1.6 Peak output power test results at high frequency, QPSK 5MHz, CBW

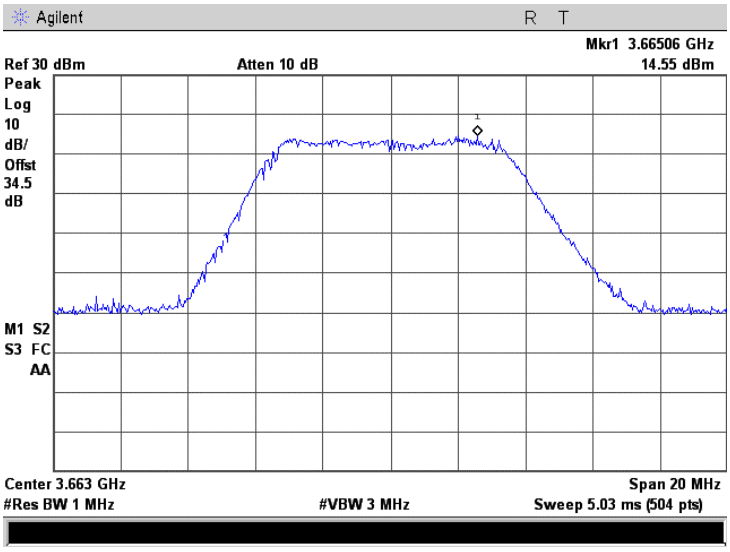


Test specification:	Section 90.1321, Maximum output power		
Test procedure:	47 CFR, Section 2.1046; TIA/EIA-603-C, Section 2.2.1		
Test mode:	Compliance	Verdict:	PASS
Date & Time:	3/29/2009 3:34:38 PM		
Temperature: 23ºC	Air Pressure: 1013 hPa	Relative Humidity: 41%	Power Supply: 48 VDC
Remarks: Antenna 1			

Plot 7.1.7 Peak output power density test results at low frequency, 64QAM, 7MHz CBW



Plot 7.1.8 Peak output power test results at mid frequency, 64QAM, 7MHz CBW



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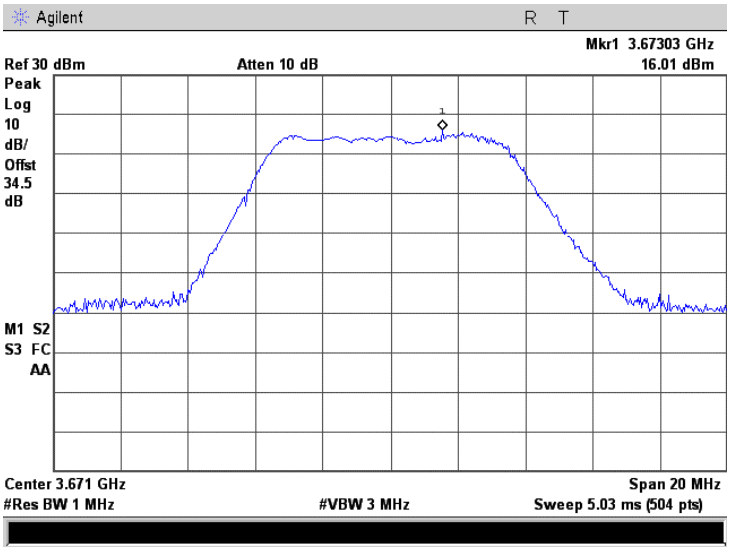
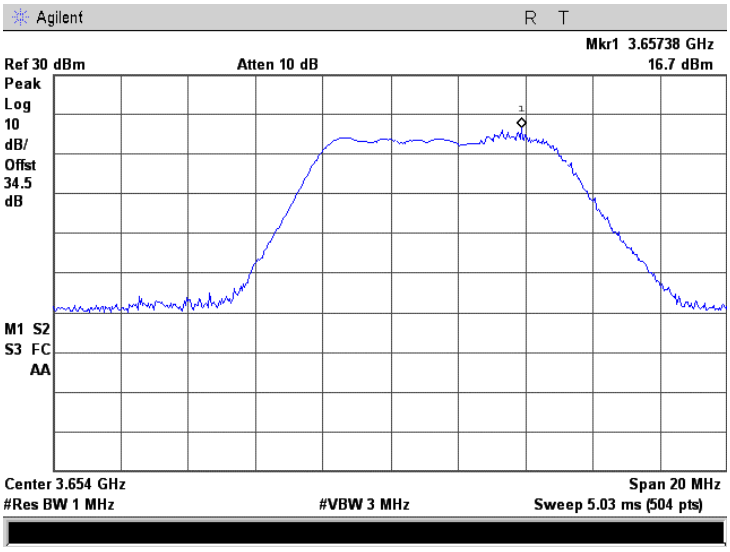
Test specification:	Section 90.1321, Maximum output power		
Test procedure:	47 CFR, Section 2.1046; TIA/EIA-603-C, Section 2.2.1		
Test mode:	Compliance	Verdict:	PASS
Date & Time:	3/29/2009 3:34:38 PM		
Temperature: 23ºC	Air Pressure: 1013 hPa	Relative Humidity: 41%	Power Supply: 48 VDC
Remarks: Antenna 1			

Plot 7.1.9 Peak output power test results at high frequency, 64QAM, 7MHz CBW



Plot 7.1.10 Peak output power test results at low frequency, QPSK, 7MHz CBW



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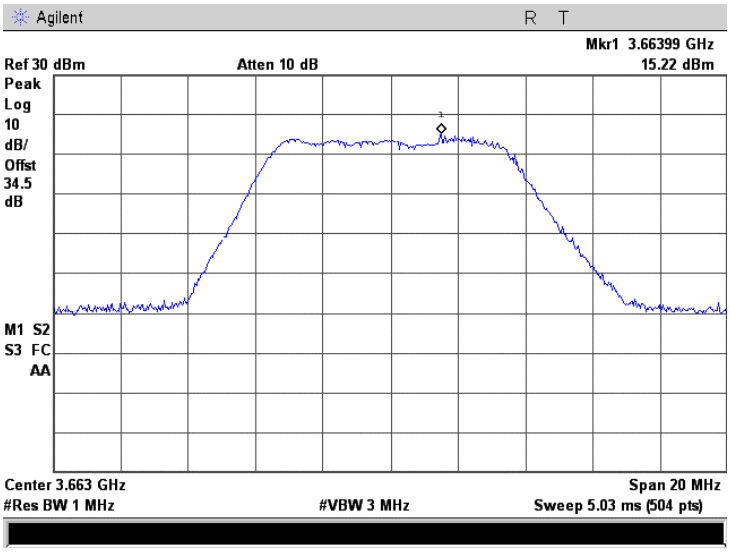
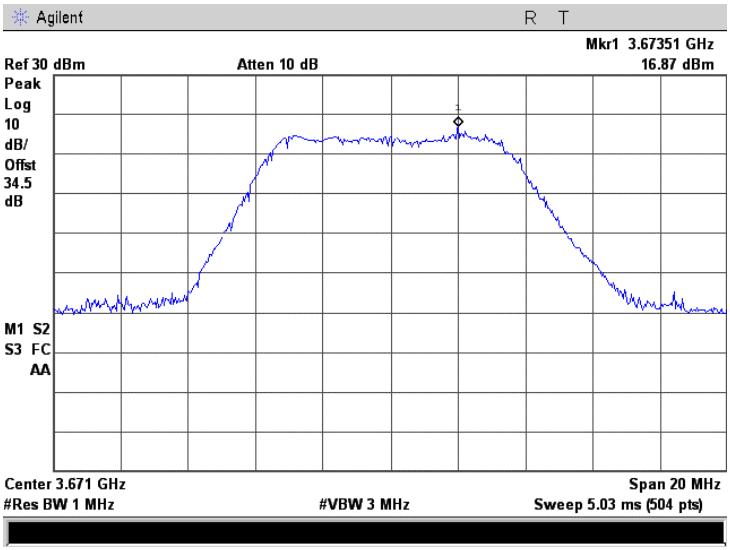
Test specification:	Section 90.1321, Maximum output power		
Test procedure:	47 CFR, Section 2.1046; TIA/EIA-603-C, Section 2.2.1		
Test mode:	Compliance	Verdict:	PASS
Date & Time:	3/29/2009 3:34:38 PM		
Temperature: 23ºC	Air Pressure: 1013 hPa	Relative Humidity: 41%	Power Supply: 48 VDC
Remarks: Antenna 1			

Plot 7.1.11 Peak output power test results at mid frequency, QPSK, 7MHz CBW



Plot 7.1.12 Peak output power test results at high frequency, QPSK, 7MHz CBW



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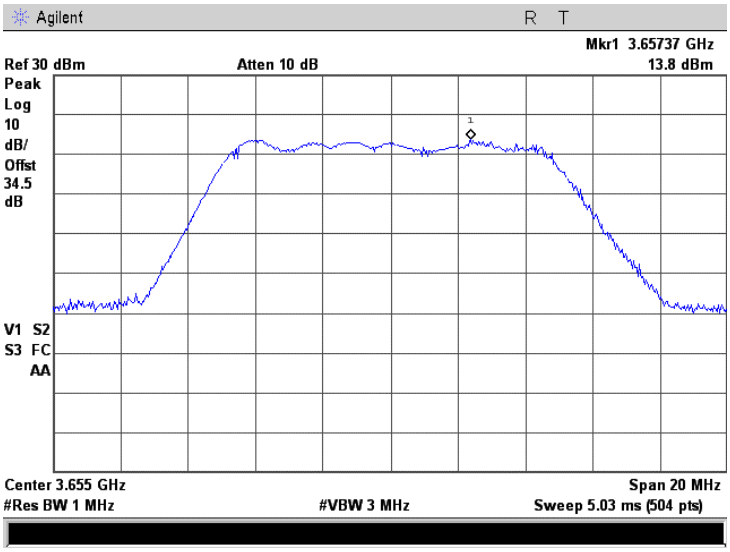
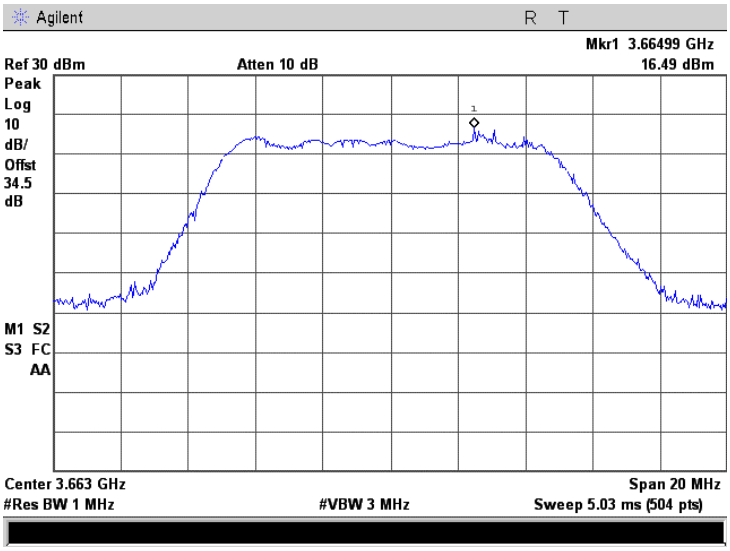
Test specification:	Section 90.1321, Maximum output power		
Test procedure:	47 CFR, Section 2.1046; TIA/EIA-603-C, Section 2.2.1		
Test mode:	Compliance	Verdict:	PASS
Date & Time:	3/29/2009 3:34:38 PM		
Temperature: 23ºC	Air Pressure: 1013 hPa	Relative Humidity: 41%	Power Supply: 48 VDC
Remarks: Antenna 1			

Plot 7.1.13 Peak output power test results at low frequency, 64QAM, 10 MHz CBW

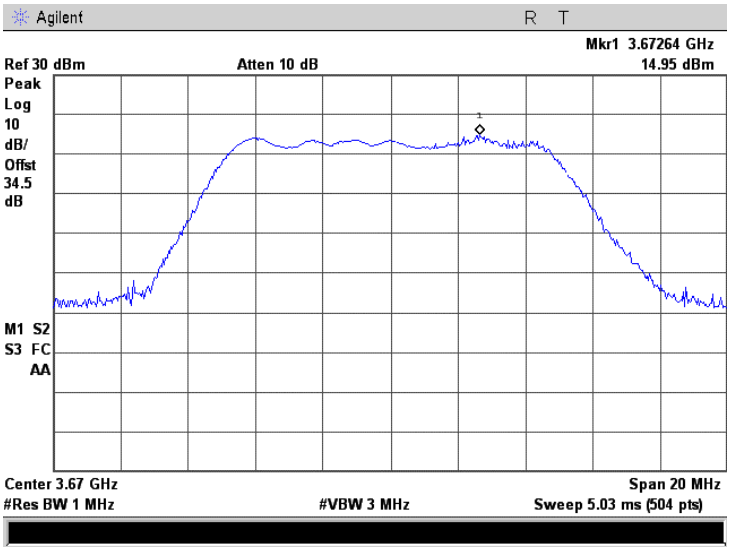


Plot 7.1.14 Peak output power test results at mid frequency, 64QAM, 10 MHz CBW

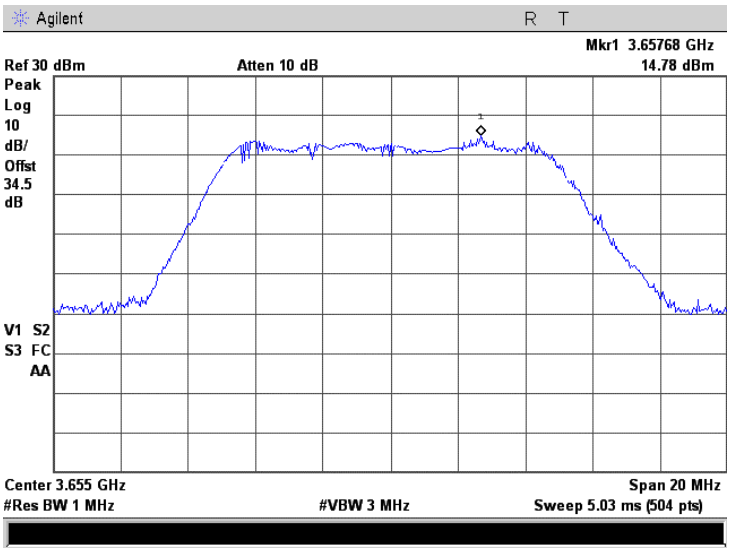


Test specification:	Section 90.1321, Maximum output power		
Test procedure:	47 CFR, Section 2.1046; TIA/EIA-603-C, Section 2.2.1		
Test mode:	Compliance	Verdict:	PASS
Date & Time:	3/29/2009 3:34:38 PM		
Temperature: 23ºC	Air Pressure: 1013 hPa	Relative Humidity: 41%	Power Supply: 48 VDC
Remarks: Antenna 1			

Plot 7.1.15 Peak output power test results at high frequency, 64QAM, 10 MHz CBW



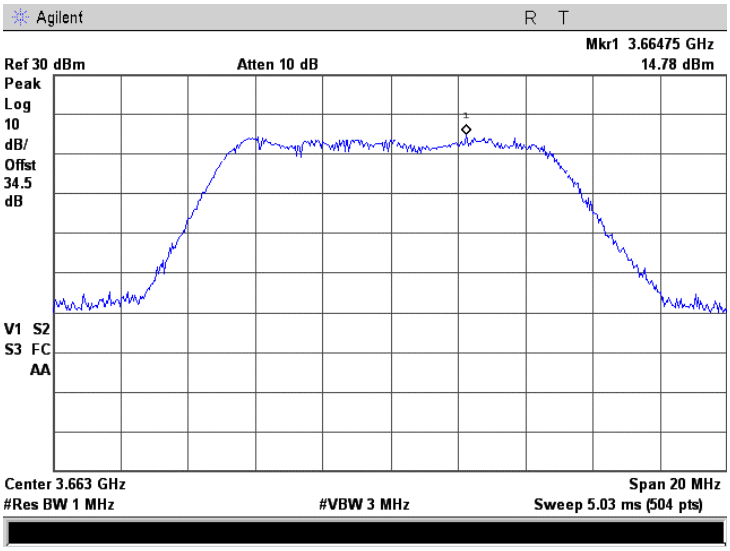
Plot 7.1.16 Peak output power test results at low frequency, QPSK, 10 MHz CBW



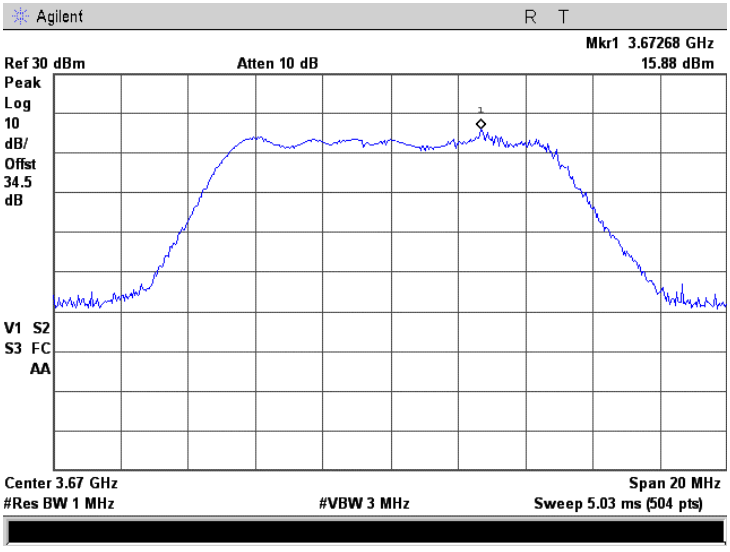
HERMON LABORATORIES

Test specification:	Section 90.1321, Maximum output power		
Test procedure:	47 CFR, Section 2.1046; TIA/EIA-603-C, Section 2.2.1		
Test mode:	Compliance	Verdict:	PASS
Date & Time:	3/29/2009 3:34:38 PM		
Temperature: 23ºC	Air Pressure: 1013 hPa	Relative Humidity: 41%	Power Supply: 48 VDC
Remarks: Antenna 1			

Plot 7.1.17 Peak output power test results at mid frequency, QPSK, 10 MHz CBW



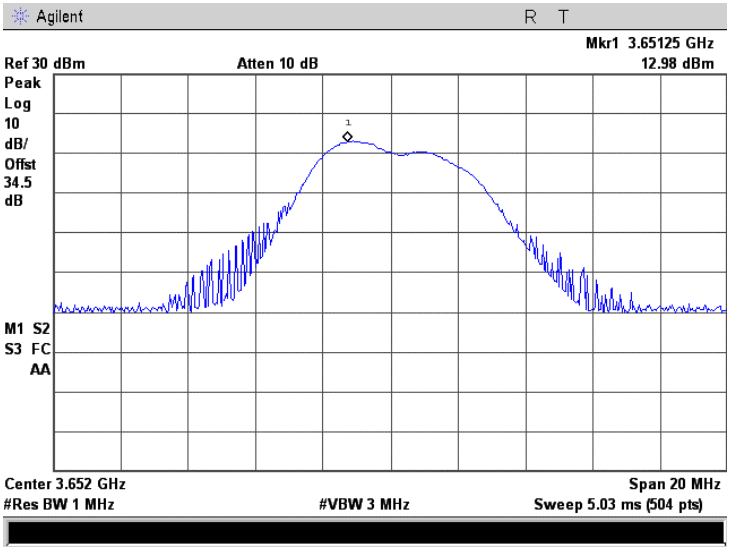
Plot 7.1.18 Peak output power test results at high frequency, QPSK, 10 MHz CBW



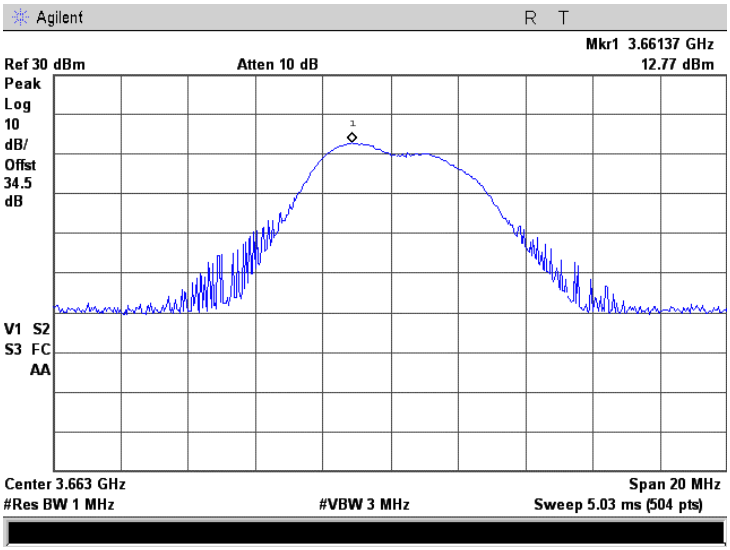
HERMON LABORATORIES

Test specification:	Section 90.1321, Maximum output power		
Test procedure:	47 CFR, Section 2.1046; TIA/EIA-603-C, Section 2.2.1		
Test mode:	Compliance	Verdict:	PASS
Date & Time:	3/29/2009 3:34:38 PM		
Temperature: 23ºC	Air Pressure: 1013 hPa	Relative Humidity: 41%	Power Supply: 48 VDC
Remarks: Antenna 2			

Plot 7.1.19 Peak output power density test results at low frequency, 64QAM, 5 MHz CBW



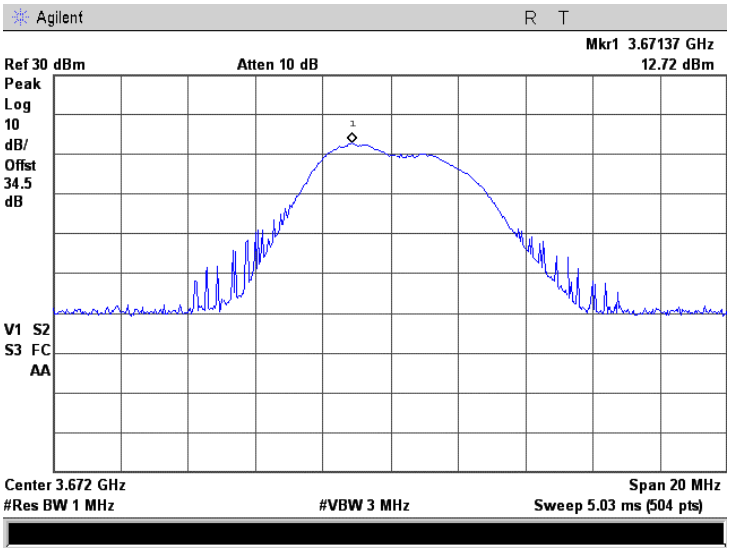
Plot 7.1.20 Peak output power test results at mid frequency, 64QAM, 5 MHz CBW



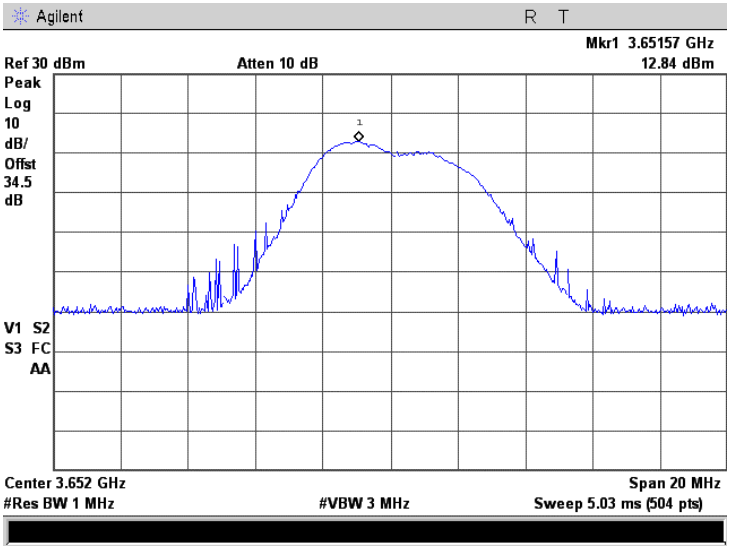
HERMON LABORATORIES

Test specification:	Section 90.1321, Maximum output power		
Test procedure:	47 CFR, Section 2.1046; TIA/EIA-603-C, Section 2.2.1		
Test mode:	Compliance	Verdict:	PASS
Date & Time:	3/29/2009 3:34:38 PM		
Temperature: 23ºC	Air Pressure: 1013 hPa	Relative Humidity: 41%	Power Supply: 48 VDC
Remarks: Antenna 2			

Plot 7.1.21 Peak output power test results at high frequency, 64QAM, 5 MHz CBW



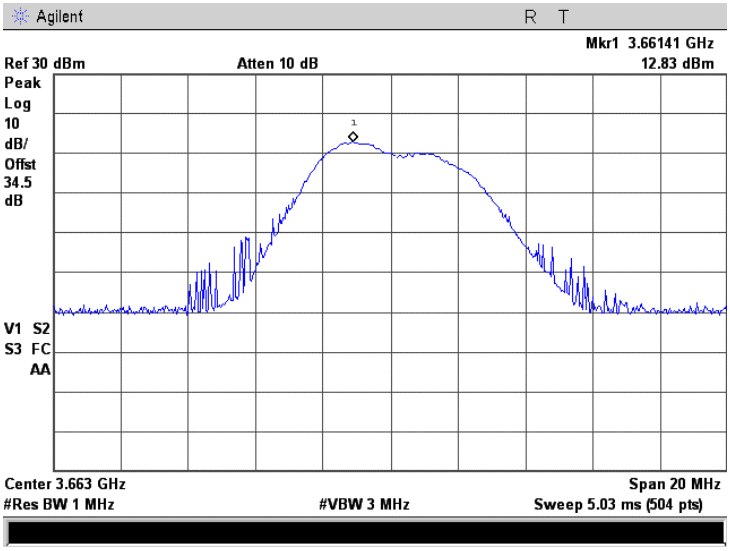
Plot 7.1.22 Peak output power test results at low frequency, QPSK, 5 MHz CBW



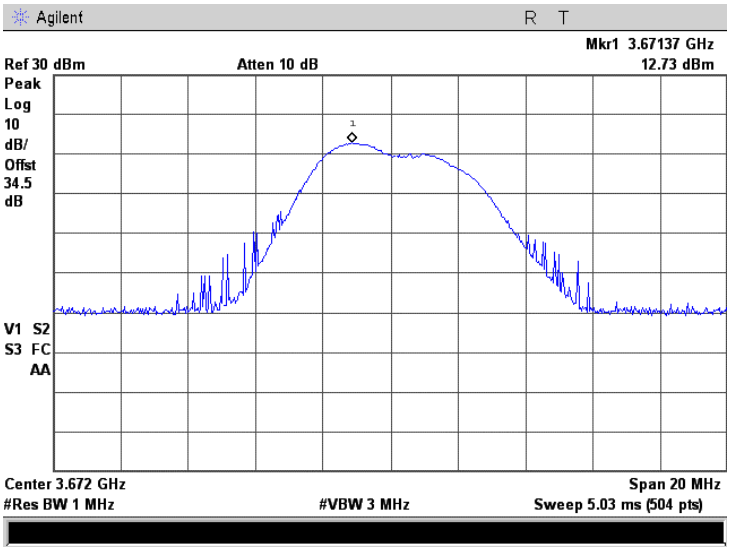
HERMON LABORATORIES

Test specification:	Section 90.1321, Maximum output power		
Test procedure:	47 CFR, Section 2.1046; TIA/EIA-603-C, Section 2.2.1		
Test mode:	Compliance	Verdict:	PASS
Date & Time:	3/29/2009 3:34:38 PM		
Temperature: 23ºC	Air Pressure: 1013 hPa	Relative Humidity: 41%	Power Supply: 48 VDC
Remarks: Antenna 2			

Plot 7.1.23 Peak output power test results at mid frequency, QPSK, 5 MHz CBW

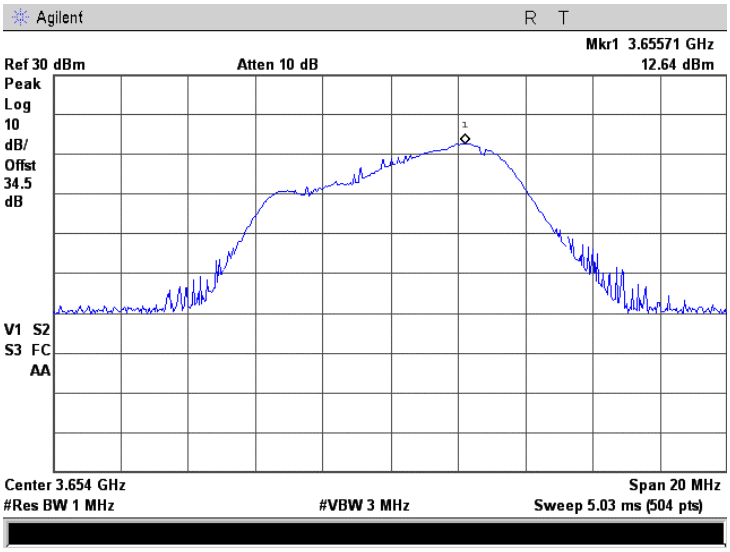


Plot 7.1.24 Peak output power test results at high frequency, QPSK, 5 MHz CBW

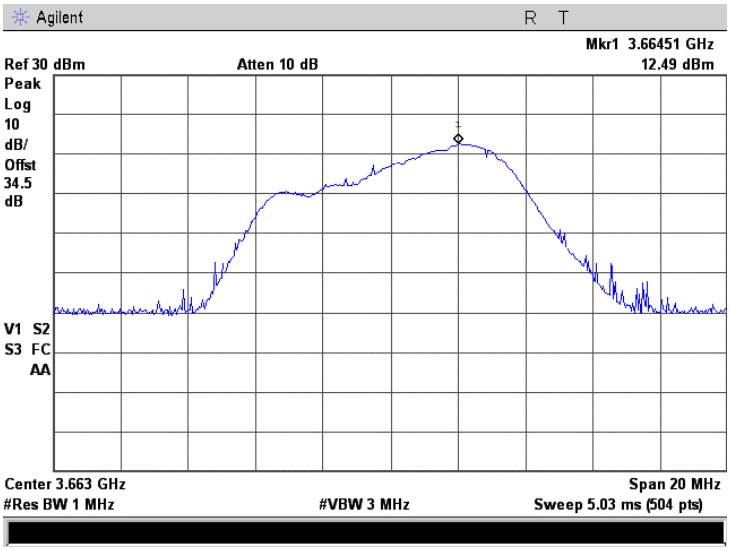


Test specification:	Section 90.1321, Maximum output power		
Test procedure:	47 CFR, Section 2.1046; TIA/EIA-603-C, Section 2.2.1		
Test mode:	Compliance	Verdict:	PASS
Date & Time:	3/29/2009 3:34:38 PM		
Temperature: 23ºC	Air Pressure: 1013 hPa	Relative Humidity: 41%	Power Supply: 48 VDC
Remarks: Antenna 2			

Plot 7.1.25 Peak output power density test results at low frequency, 64QAM, 7 MHz CBW



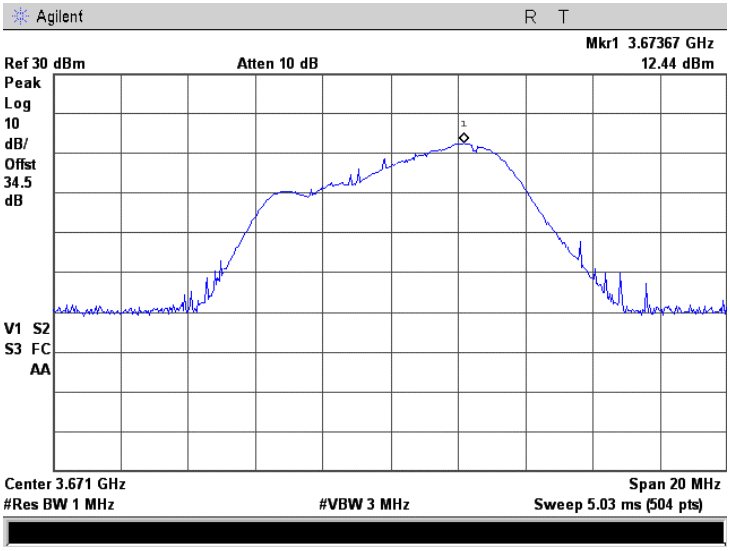
Plot 7.1.26 Peak output power test results at mid frequency, 64QAM, 7 MHz CBW



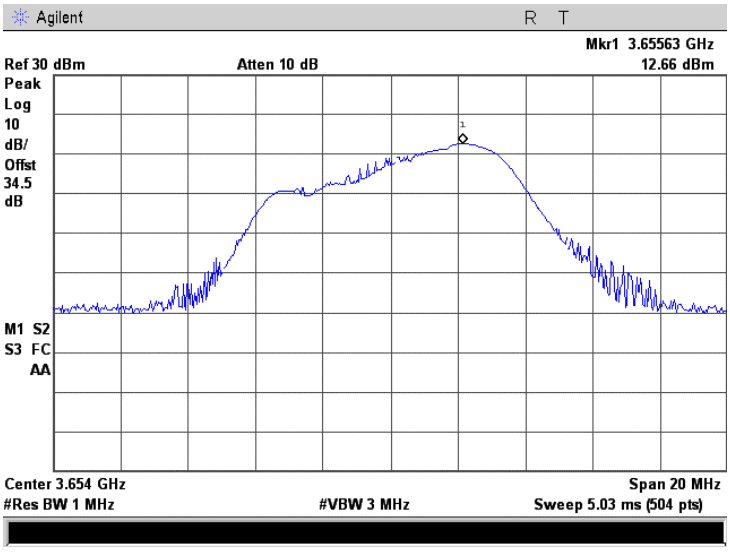
HERMON LABORATORIES

Test specification:	Section 90.1321, Maximum output power		
Test procedure:	47 CFR, Section 2.1046; TIA/EIA-603-C, Section 2.2.1		
Test mode:	Compliance	Verdict:	PASS
Date & Time:	3/29/2009 3:34:38 PM		
Temperature: 23ºC	Air Pressure: 1013 hPa	Relative Humidity: 41%	Power Supply: 48 VDC
Remarks: Antenna 2			

Plot 7.1.27 Peak output power test results at high frequency, 64QAM, 7 MHz CBW



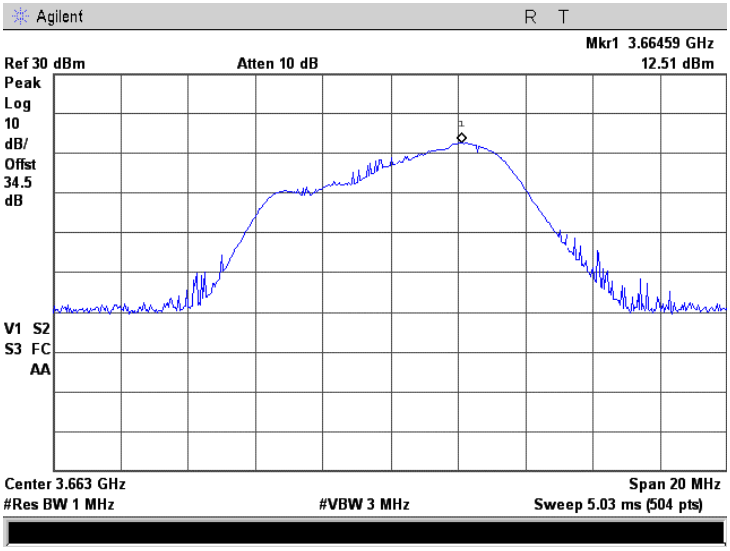
Plot 7.1.28 Peak output power test results at low frequency, QPSK, 7 MHz CBW



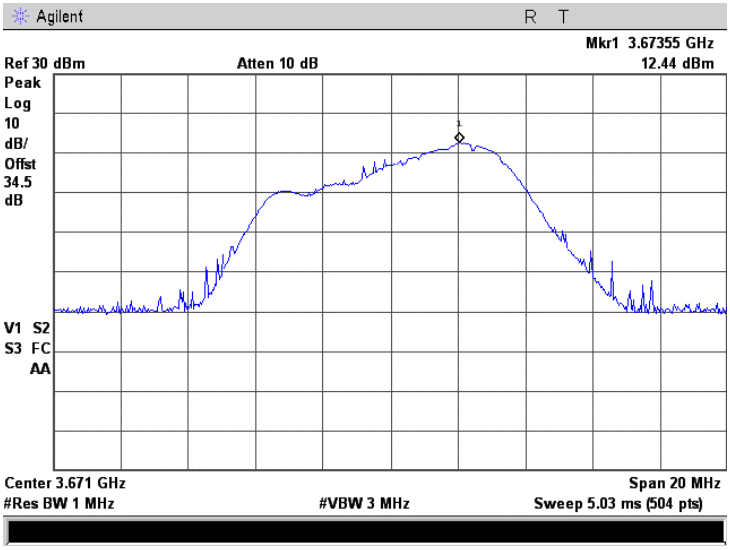
HERMON LABORATORIES

Test specification:	Section 90.1321, Maximum output power		
Test procedure:	47 CFR, Section 2.1046; TIA/EIA-603-C, Section 2.2.1		
Test mode:	Compliance	Verdict:	PASS
Date & Time:	3/29/2009 3:34:38 PM		
Temperature: 23ºC	Air Pressure: 1013 hPa	Relative Humidity: 41%	Power Supply: 48 VDC
Remarks: Antenna 2			

Plot 7.1.29 Peak output power test results at mid frequency, QPSK, 7 MHz CBW

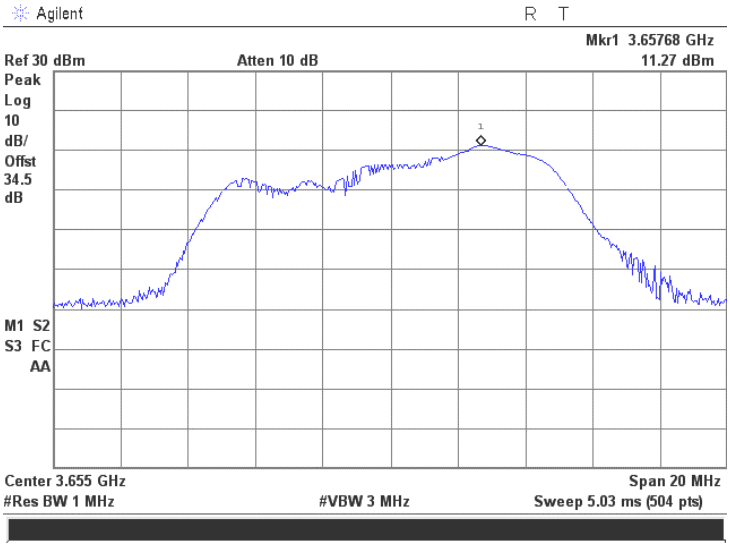


Plot 7.1.30 Peak output power test results at high frequency, QPSK, 7 MHz CBW

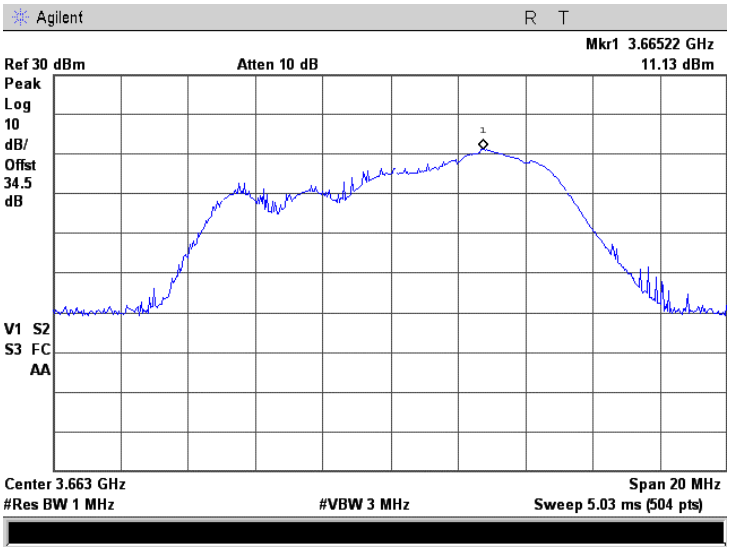


Test specification:	Section 90.1321, Maximum output power		
Test procedure:	47 CFR, Section 2.1046; TIA/EIA-603-A, Section 2.2.1		
Test mode:	Compliance	Verdict:	PASS
Date & Time:	3/29/2009 3:34:38 PM		
Temperature: 23ºC	Air Pressure: 1013 hPa	Relative Humidity: 41%	Power Supply: 48 VDC
Remarks: Antenna 2			

Plot 7.1.31 Peak output power test results at low frequency, 64QAM, 10 MHz CBW

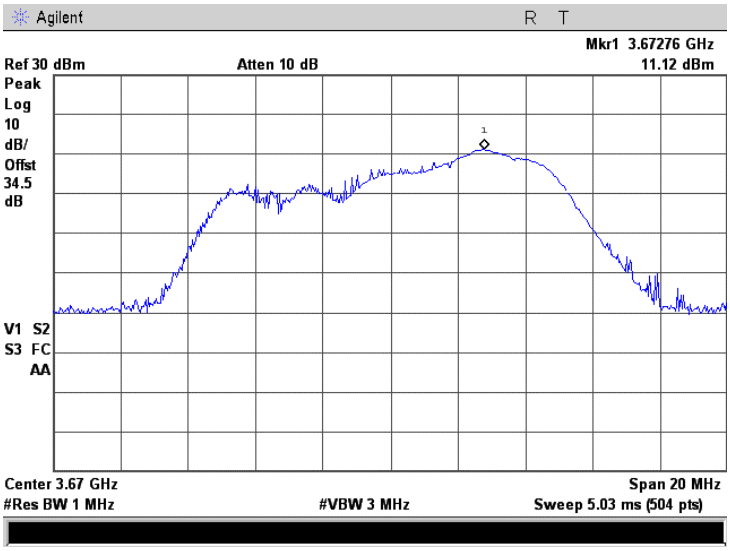


Plot 7.1.32 Peak output power test results at mid frequency, 64QAM, 10 MHz CBW

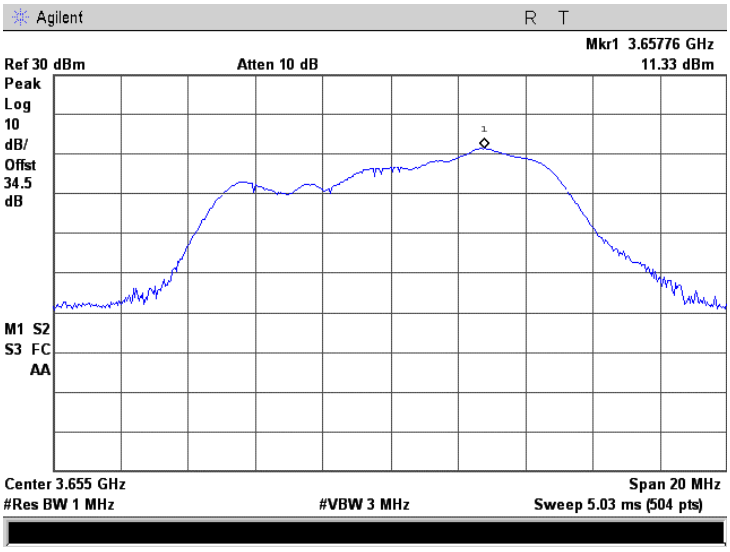


Test specification:	Section 90.1321, Maximum output power		
Test procedure:	47 CFR, Section 2.1046; TIA/EIA-603-A, Section 2.2.1		
Test mode:	Compliance	Verdict:	PASS
Date & Time:	3/29/2009 3:34:38 PM		
Temperature: 23ºC	Air Pressure: 1013 hPa	Relative Humidity: 41%	Power Supply: 48 VDC
Remarks: Antenna 2			

Plot 7.1.33 Peak output power test results at high frequency, 64QAM, 10 MHz CBW

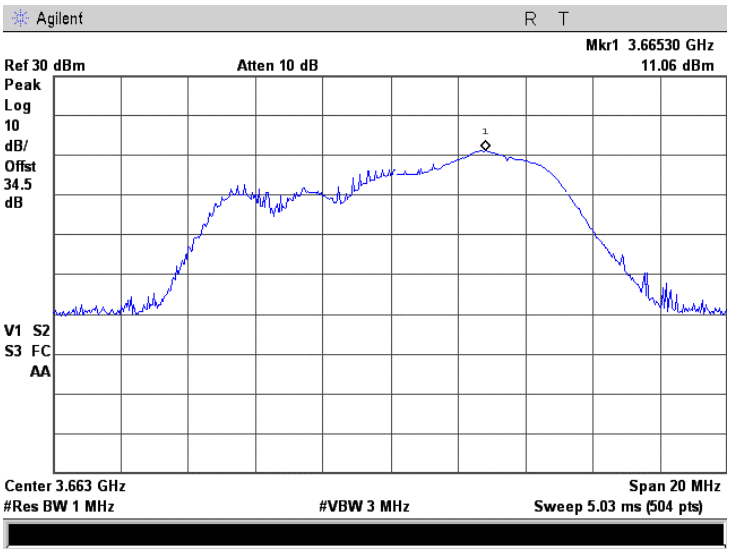


Plot 7.1.34 Peak output power test results at low frequency, QPSK, 10 MHz CBW

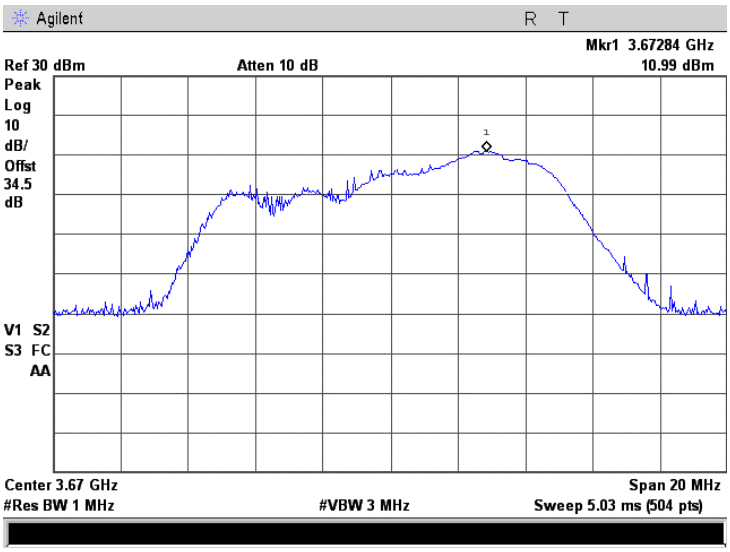


Test specification:	Section 90.1321, Maximum output power		
Test procedure:	47 CFR, Section 2.1046; TIA/EIA-603-A, Section 2.2.1		
Test mode:	Compliance	Verdict:	PASS
Date & Time:	3/29/2009 3:34:38 PM		
Temperature: 23ºC	Air Pressure: 1013 hPa	Relative Humidity: 41%	Power Supply: 48 VDC
Remarks: Antenna 2			

Plot 7.1.35 Peak output power test results at mid frequency, QPSK, 10 MHz CBW



Plot 7.1.36 Peak output power test results at high frequency, QPSK, 10 MHz CBW



Test specification:	Section 90.209, Occupied bandwidth		
Test procedure:	47 CFR, Section 2.1049		
Test mode:	Compliance	Verdict:	PASS
Date & Time:	3/29/2009 5:03:04 PM		
Temperature: 23ºC	Air Pressure: 1013 hPa	Relative Humidity: 41%	Power Supply: 48 VDC
Remarks: Antenna 1			

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	Channel bandwidth, MHz	Maximum allowed bandwidth, MHz
3650.0-3675.0	26	5	5
		7	7
		10	10

* - Modulation envelope reference points are provided in terms of attenuation below the maximum peak output power of 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 Maximum peak output power of carrier was taken as the reference level.

7.2.2.3 The transmitter occupied bandwidth was measured with spectrum analyzer as a frequency delta between the reference points on modulation envelope and provided in Table 7.2.2, Table 7.2.3 and the associated plots.

Figure 7.2.1 Occupied bandwidth test setup

Test specification:	Section 90.209, Occupied bandwidth		
Test procedure:	47 CFR, Section 2.1049		
Test mode:	Compliance	Verdict:	PASS
Date & Time:	3/29/2009 5:03:04 PM		
Temperature: 23ºC	Air Pressure: 1013 hPa	Relative Humidity: 41%	Power Supply: 48 VDC
Remarks: Antenna 1			

Table 7.2.2 Occupied bandwidth test results for antenna 1

RESOLUTION BANDWIDTH: 100 kHz*
VIDEO BANDWIDTH: 300 kHz
MODULATION ENVELOPE REFERENCE POINTS: 26 dBc
MODULATING SIGNAL: OFDM

Carrier frequency, MHz	Occupied bandwidth, MHz	Limit, MHz	Margin, MHz	Verdict
Channel bandwidth 5 MHz				
64QAM,Bit Rate 8.65Mbps				
3652.5	4.900	5	-0.100	Pass
3662.5	4.950	5	-0.050	Pass
3672.5	4.975	5	-0.025	Pass
QPSK ,Bit Rate 1.15 Mbps				
3652.5	4.925	5	-0.075	Pass
3662.5	4.950	5	-0.050	Pass
3672.5	4.975	5	-0.025	Pass
Channel bandwidth 7 MHz				
64QAM,Bit Rate 14.7 Mbps				
3653.5	6.863	7	-0.137	Pass
3662.5	6.975	7	-0.025	Pass
3671.5	6.863	7	-0.137	Pass
QPSK ,Bit Rate 2.8 Mbps				
3653.5	6.863	7	-0.137	Pass
3662.5	6.900	7	-0.100	Pass
3671.5	6.863	7	-0.137	Pass
Channel bandwidth 10 MHz				
64QAM,Bit Rate 8.65Mbps				
3655.0	9.450	10	-0.550	Pass
3662.5	9.400	10	-0.600	Pass
3665.0	9.600	10	-0.400	Pass
QPSK ,Bit Rate 1.15 Mbps9.500				
3655.0	9.500	10	-0.500	Pass
3662.5	9.550	10	-0.450	Pass
3665.0	9.500	10	-0.500	Pass

* - RBW ≥ 1% of OBW; 1 % of 10 MHz is 100 kHz.

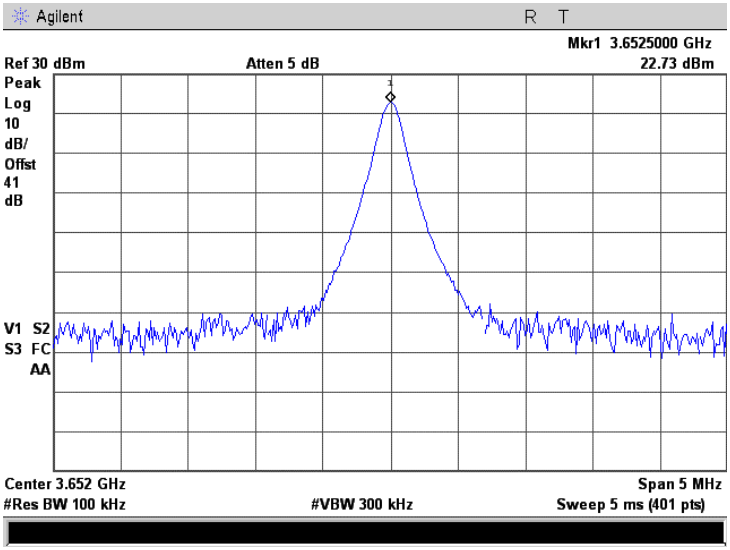
Reference numbers of test equipment used

HL 2909	HL 2952	HL 3439	HL 3441				

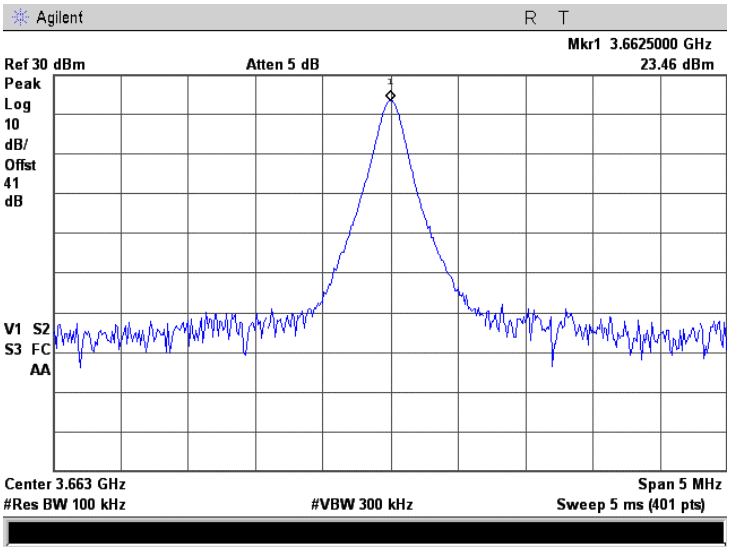
Full description is given in Appendix A.

Test specification:	Section 90.209, Occupied bandwidth		
Test procedure:	47 CFR, Section 2.1049		
Test mode:	Compliance	Verdict:	PASS
Date & Time:	3/29/2009 5:03:04 PM		
Temperature: 23ºC	Air Pressure: 1013 hPa	Relative Humidity: 41%	Power Supply: 48 VDC
Remarks: Antenna 1, 5 MHz CBW			

Plot 7.2.1 Unmodulated signal for reference level at low frequency

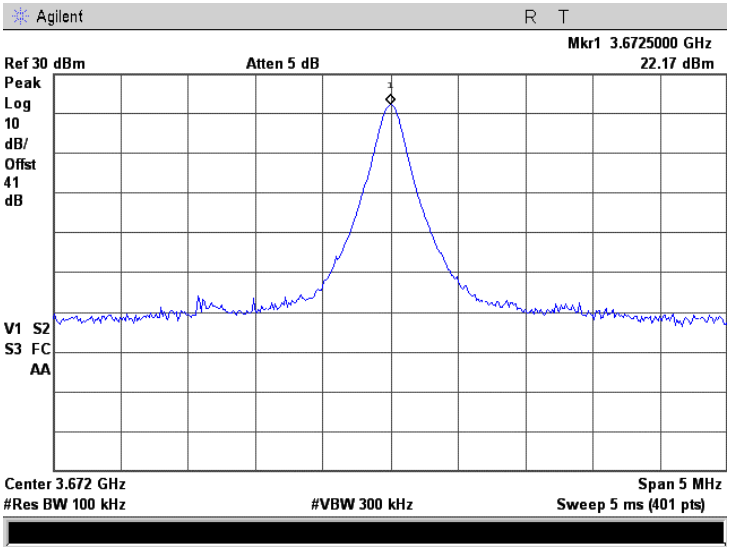


Plot 7.2.2 Unmodulated signal for reference level at mid frequency

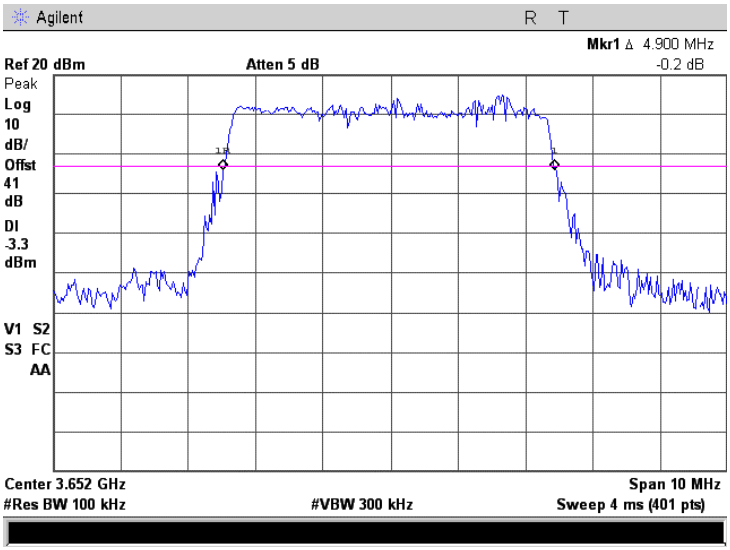


Test specification:	Section 90.209, Occupied bandwidth		
Test procedure:	47 CFR, Section 2.1049		
Test mode:	Compliance	Verdict:	PASS
Date & Time:	3/29/2009 5:03:04 PM		
Temperature: 23ºC	Air Pressure: 1013 hPa	Relative Humidity: 41%	Power Supply: 48 VDC
Remarks: Antenna 1, 5 MHz CBW			

Plot 7.2.3 Unmodulated signal for reference level at high frequency

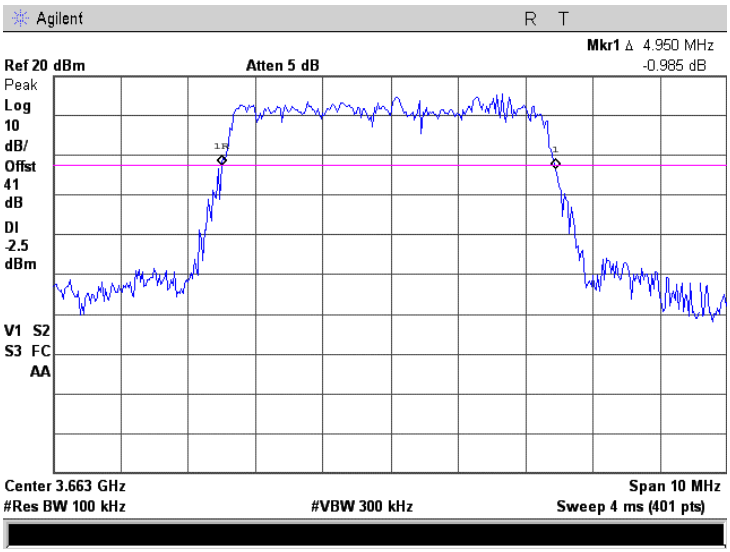


Plot 7.2.4 Occupied bandwidth test result at low frequency, 64QAM, bit rate 8.65 Mbps

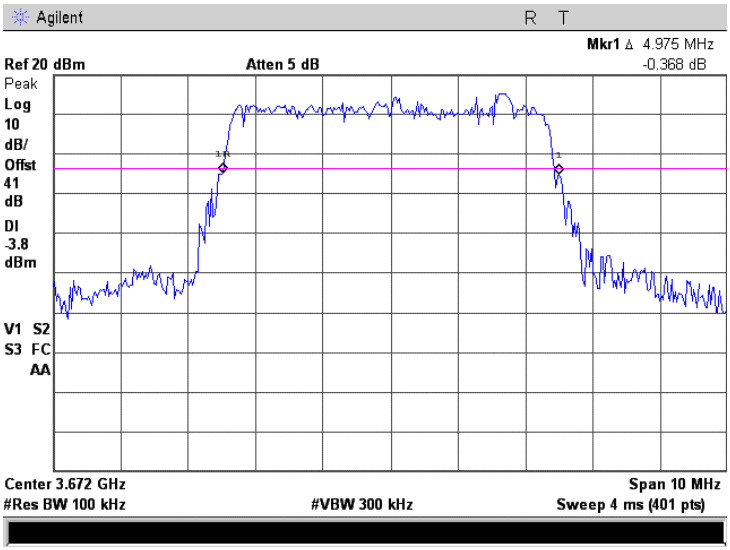


Test specification:	Section 90.209, Occupied bandwidth		
Test procedure:	47 CFR, Section 2.1049		
Test mode:	Compliance	Verdict:	PASS
Date & Time:	3/29/2009 5:03:04 PM		
Temperature: 23ºC	Air Pressure: 1013 hPa	Relative Humidity: 41%	Power Supply: 48 VDC
Remarks: Antenna 1, 5 MHz CBW			

Plot 7.2.5 Occupied bandwidth test result at mid frequency, 64QAM, bit rate 8.65 Mbps

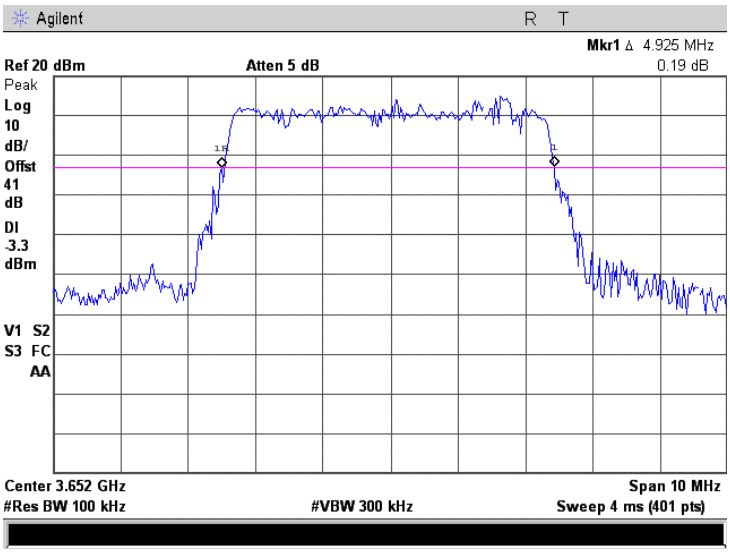


Plot 7.2.6 Occupied bandwidth test result at high frequency, 64QAM, bit rate 8.65 Mbps

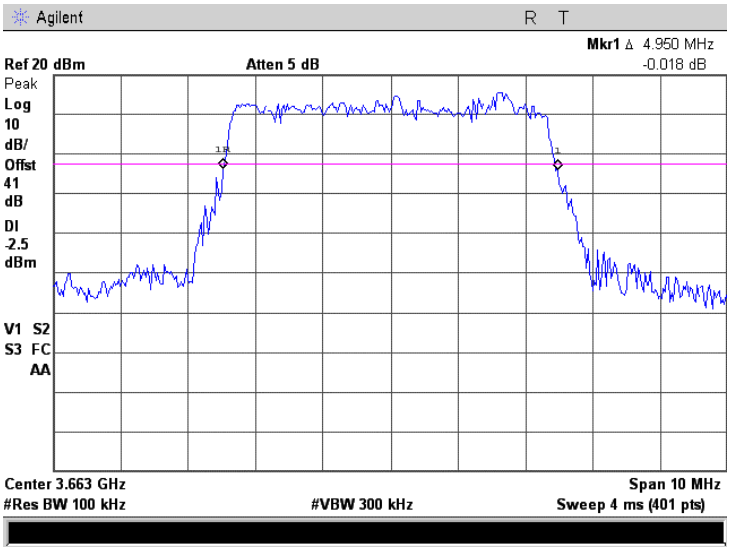


Test specification:	Section 90.209, Occupied bandwidth		
Test procedure:	47 CFR, Section 2.1049		
Test mode:	Compliance	Verdict:	PASS
Date & Time:	3/29/2009 5:03:04 PM		
Temperature: 23ºC	Air Pressure: 1013 hPa	Relative Humidity: 41%	Power Supply: 48 VDC
Remarks: Antenna 1, 5 MHz CBW			

Plot 7.2.7 Occupied bandwidth test result at low frequency, QPSK, bit rate 1.15 Mbps

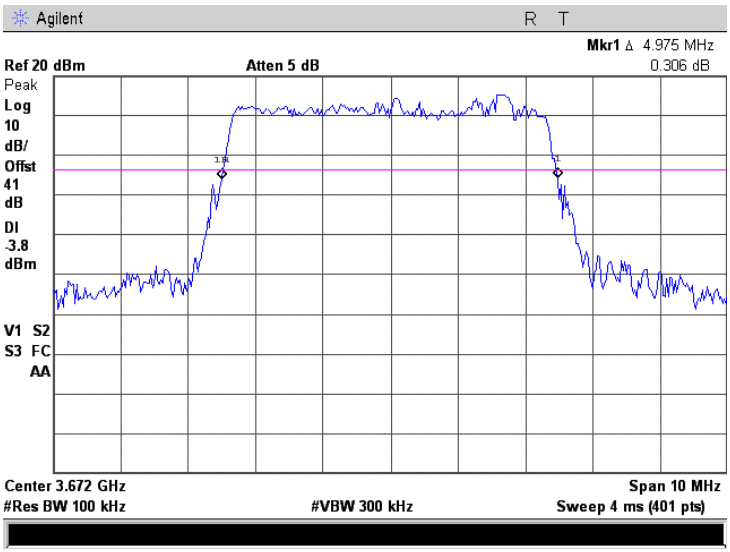


Plot 7.2.8 Occupied bandwidth test result at mid frequency, QPSK, bit rate 1.15 Mbps



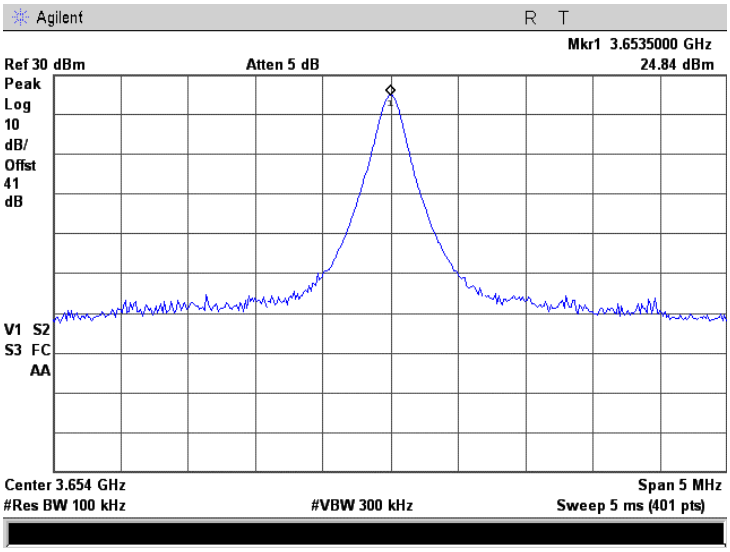
Test specification:	Section 90.209, Occupied bandwidth		
Test procedure:	47 CFR, Section 2.1049		
Test mode:	Compliance	Verdict:	PASS
Date & Time:	3/29/2009 5:03:04 PM		
Temperature: 23ºC	Air Pressure: 1013 hPa	Relative Humidity: 41%	Power Supply: 48 VDC
Remarks: Antenna 1, 5 MHz CBW			

Plot 7.2.9 Occupied bandwidth test result at high frequency, QPSK, bit rate 1.15 Mbps

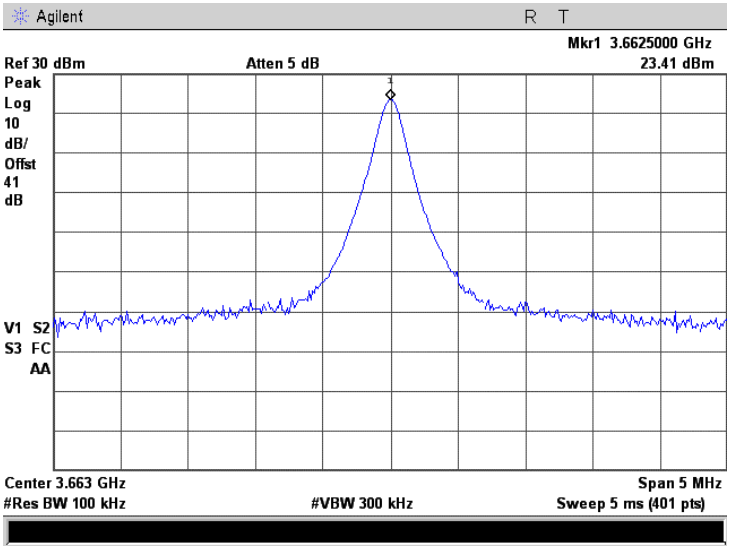


Test specification:	Section 90.209, Occupied bandwidth		
Test procedure:	47 CFR, Section 2.1049		
Test mode:	Compliance	Verdict:	PASS
Date & Time:	3/29/2009 5:03:04 PM		
Temperature: 23ºC	Air Pressure: 1013 hPa	Relative Humidity: 41%	Power Supply: 48 VDC
Remarks: Antenna 1, 7 MHz CBW			

Plot 7.2.10 Unmodulated signal for reference level at low frequency

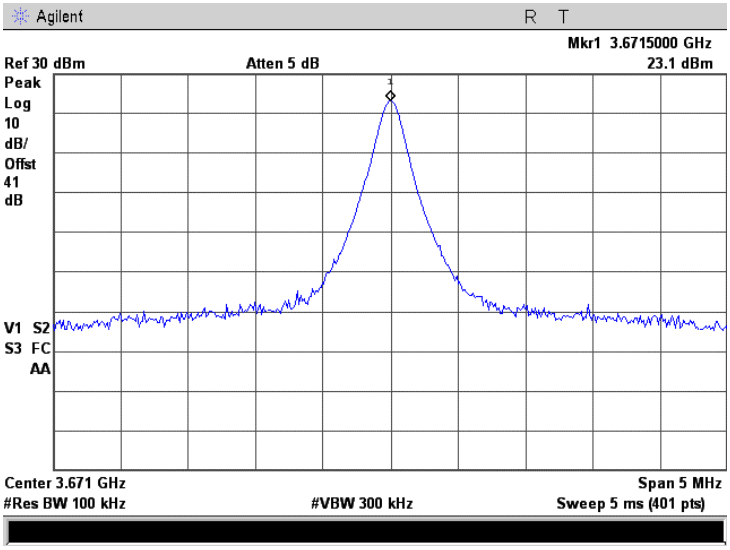


Plot 7.2.11 Unmodulated signal for reference level at mid frequency

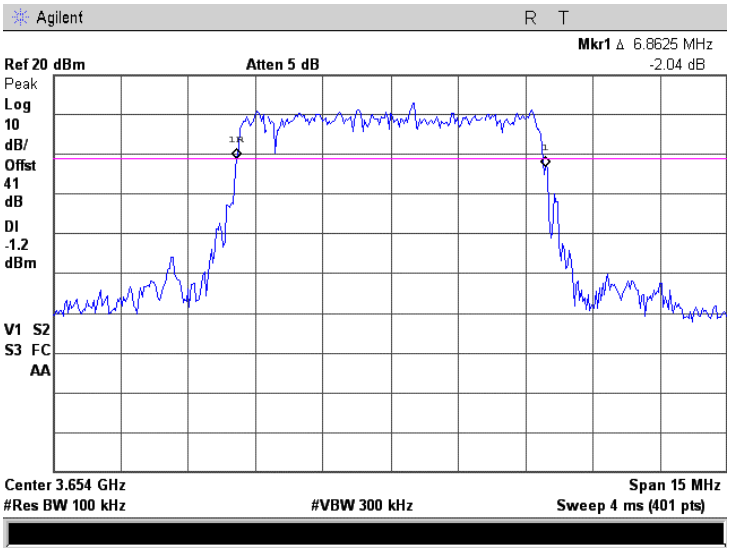


Test specification:	Section 90.209, Occupied bandwidth		
Test procedure:	47 CFR, Section 2.1049		
Test mode:	Compliance	Verdict:	PASS
Date & Time:	3/29/2009 5:03:04 PM		
Temperature: 23ºC	Air Pressure: 1013 hPa	Relative Humidity: 41%	Power Supply: 48 VDC
Remarks: Antenna 1, 7 MHz CBW			

Plot 7.2.12 Unmodulated signal for reference level at high frequency

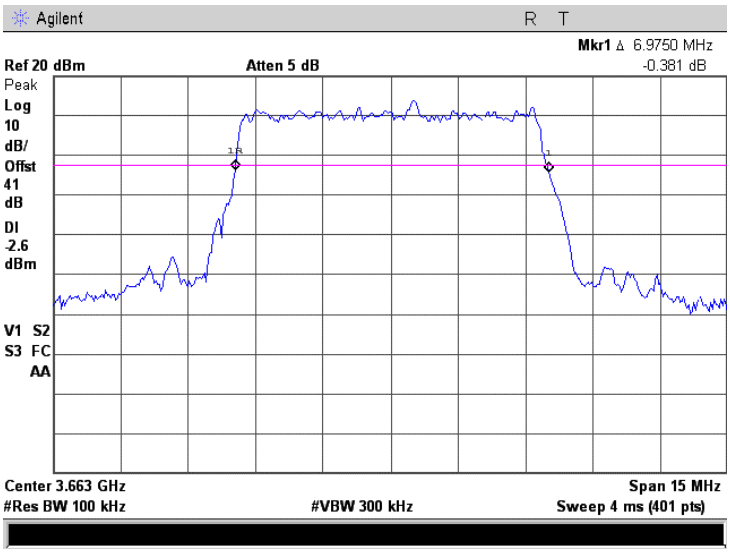


Plot 7.2.13 Occupied bandwidth test result at low frequency, 64QAM, bit rate 14.7 Mbps

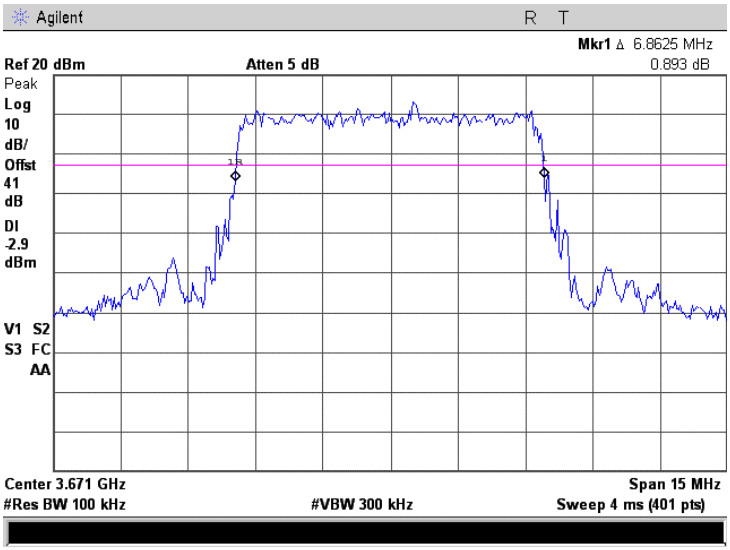


Test specification:	Section 90.209, Occupied bandwidth		
Test procedure:	47 CFR, Section 2.1049		
Test mode:	Compliance	Verdict:	PASS
Date & Time:	3/29/2009 5:03:04 PM		
Temperature: 23ºC	Air Pressure: 1013 hPa	Relative Humidity: 41%	Power Supply: 48 VDC
Remarks: Antenna 1, 7 MHz CBW			

Plot 7.2.14 Occupied bandwidth test result at mid frequency, 64QAM, bit rate 14.7 Mbps

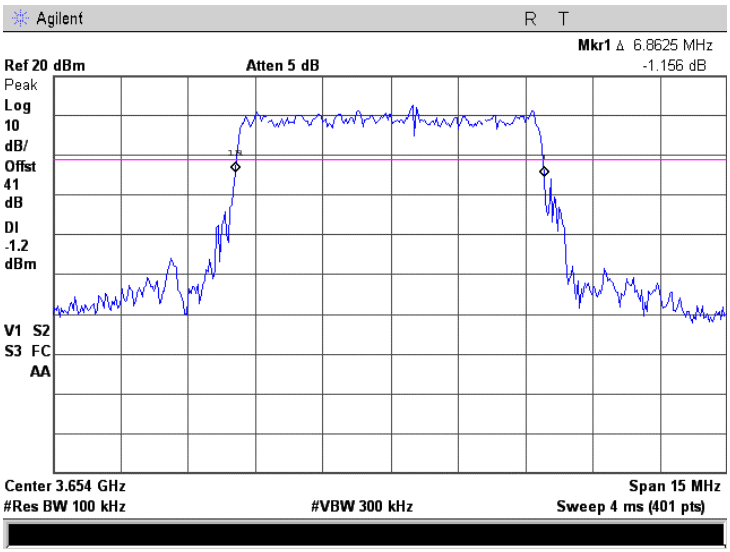


Plot 7.2.15 Occupied bandwidth test result at high frequency, 64QAM, bit rate 14.7 Mbps

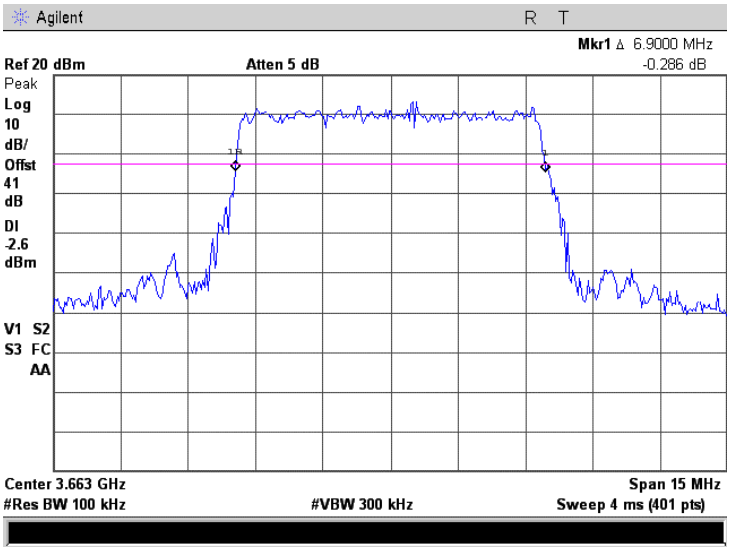


Test specification:	Section 90.209, Occupied bandwidth		
Test procedure:	47 CFR, Section 2.1049		
Test mode:	Compliance	Verdict:	PASS
Date & Time:	3/29/2009 5:03:04 PM		
Temperature: 23ºC	Air Pressure: 1013 hPa	Relative Humidity: 41%	Power Supply: 48 VDC
Remarks: Antenna 1, 7 MHz CBW			

Plot 7.2.16 Occupied bandwidth test result at low frequency, QPSK, bit rate 2.8 Mbps

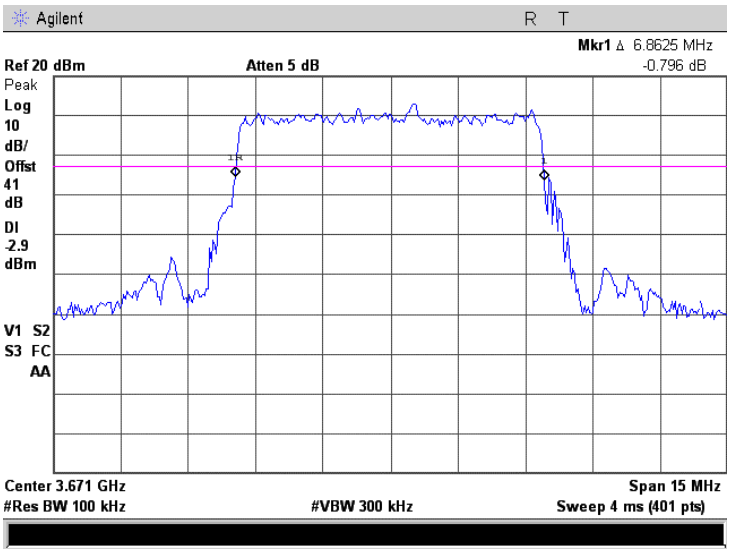


Plot 7.2.17 Occupied bandwidth test result at mid frequency, QPSK, bit rate 2.8 Mbps



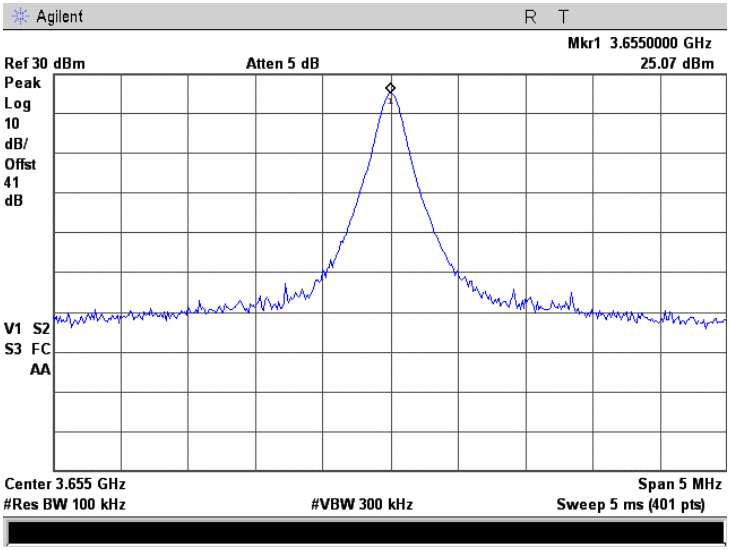
Test specification:	Section 90.209, Occupied bandwidth		
Test procedure:	47 CFR, Section 2.1049		
Test mode:	Compliance	Verdict:	PASS
Date & Time:	3/29/2009 5:03:04 PM		
Temperature: 23ºC	Air Pressure: 1013 hPa	Relative Humidity: 41%	Power Supply: 48 VDC
Remarks: Antenna 1, 7 MHz CBW			

Plot 7.2.18 Occupied bandwidth test result at high frequency, QPSK, bit rate 2.8 Mbps

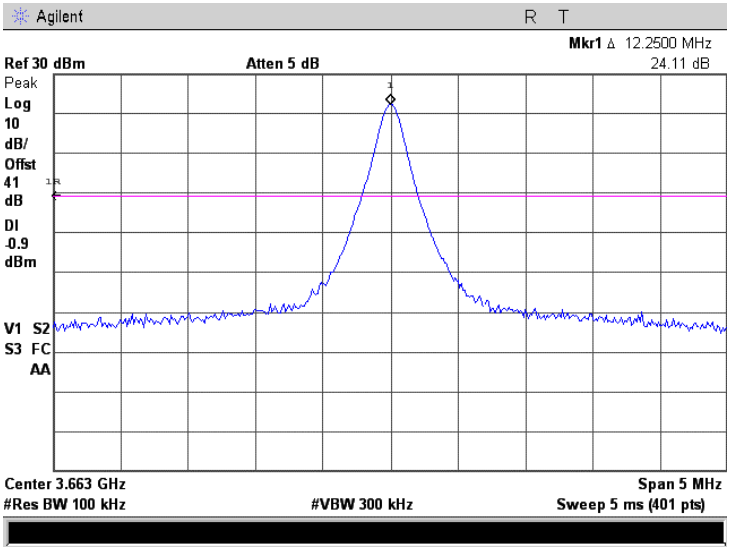


Test specification:	Section 90.209, Occupied bandwidth		
Test procedure:	47 CFR, Section 2.1049		
Test mode:	Compliance	Verdict:	PASS
Date & Time:	3/29/2009 5:03:04 PM		
Temperature: 23ºC	Air Pressure: 1013 hPa	Relative Humidity: 41%	Power Supply: 48 VDC
Remarks: Antenna 1, 10 MHz CBW			

Plot 7.2.19 Unmodulated signal for reference level at low frequency

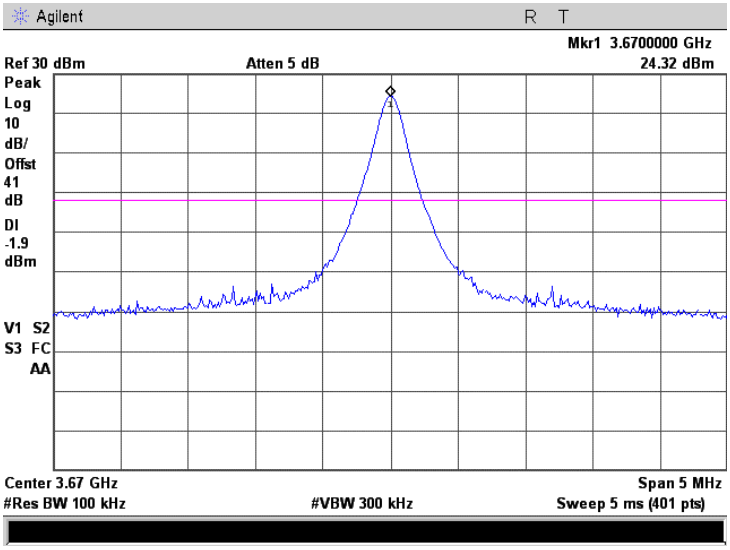


Plot 7.2.20 Unmodulated signal for reference level at mid frequency

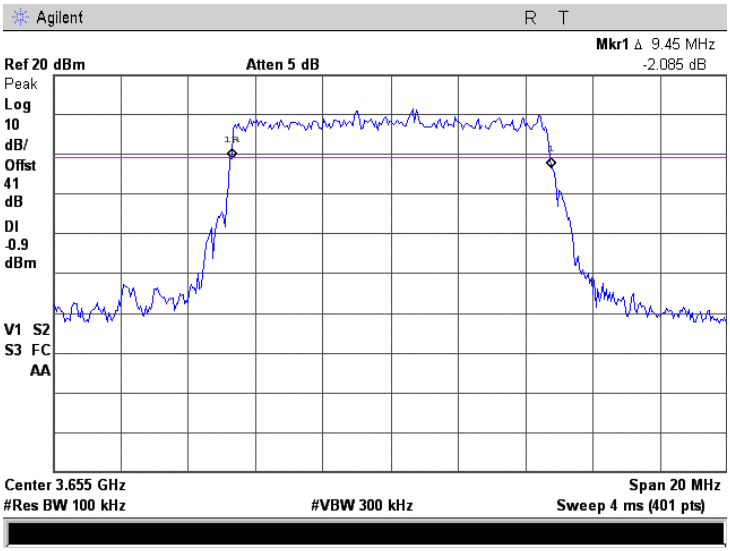


Test specification:	Section 90.209, Occupied bandwidth		
Test procedure:	47 CFR, Section 2.1049		
Test mode:	Compliance	Verdict:	PASS
Date & Time:	3/29/2009 5:03:04 PM		
Temperature: 23ºC	Air Pressure: 1013 hPa	Relative Humidity: 41%	Power Supply: 48 VDC
Remarks: Antenna 1, 10 MHz CBW			

Plot 7.2.21 Unmodulated signal for reference level at high frequency

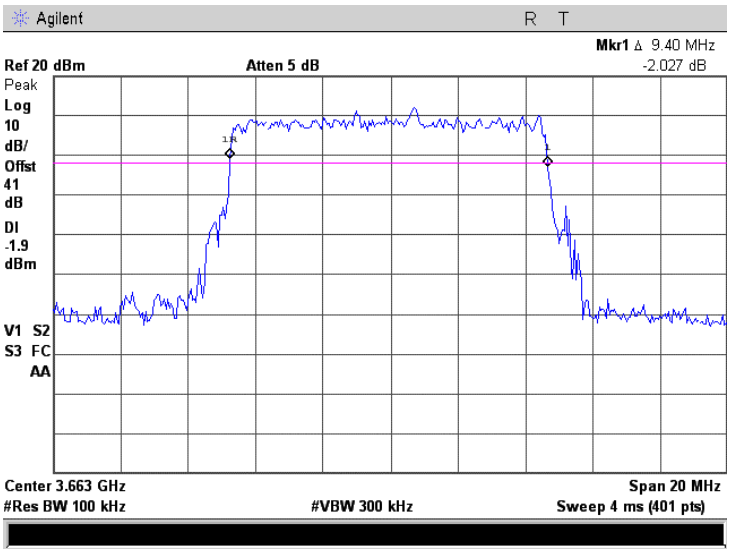


Plot 7.2.22 Occupied bandwidth test result at low frequency, 64QAM,bit rate 19.5 Mbps

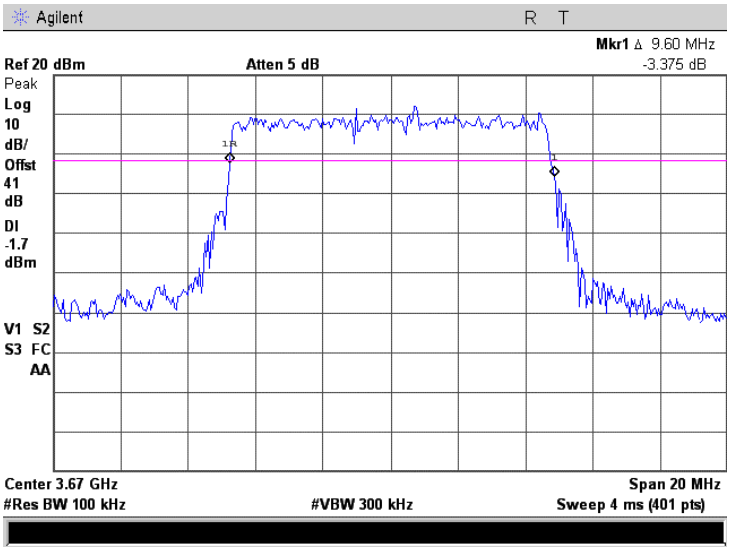


Test specification:	Section 90.209, Occupied bandwidth		
Test procedure:	47 CFR, Section 2.1049		
Test mode:	Compliance	Verdict:	PASS
Date & Time:	3/29/2009 5:03:04 PM		
Temperature: 23ºC	Air Pressure: 1013 hPa	Relative Humidity: 41%	Power Supply: 48 VDC
Remarks: Antenna 1, 10 MHz CBW			

Plot 7.2.23 Occupied bandwidth test result at mid frequency, 64QAM, bit rate 19.5 Mbps

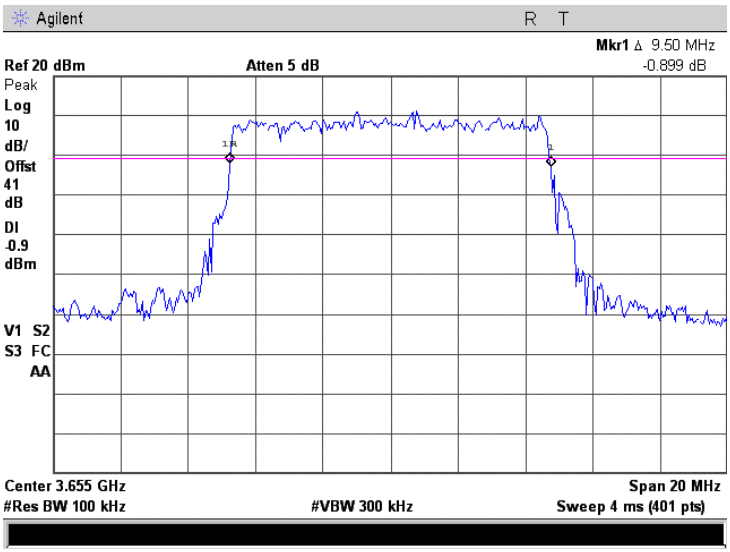


Plot 7.2.24 Occupied bandwidth test result at high frequency, 64QAM, bit rate 19.5 Mbps

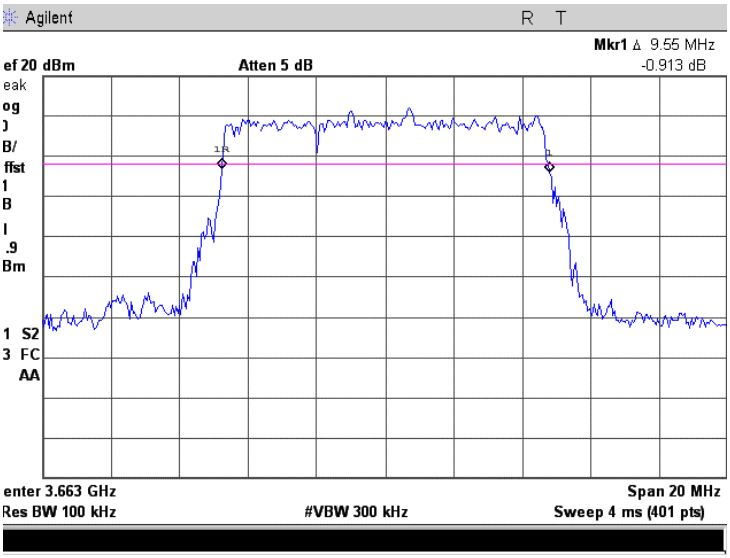


Test specification:	Section 90.209, Occupied bandwidth		
Test procedure:	47 CFR, Section 2.1049		
Test mode:	Compliance	Verdict:	PASS
Date & Time:	3/29/2009 5:03:04 PM		
Temperature: 23ºC	Air Pressure: 1013 hPa	Relative Humidity: 41%	Power Supply: 48 VDC
Remarks: Antenna 1, 10 MHz CBW			

Plot 7.2.25 Occupied bandwidth test result at low frequency, QPSK, bit rate 3.8 Mbps

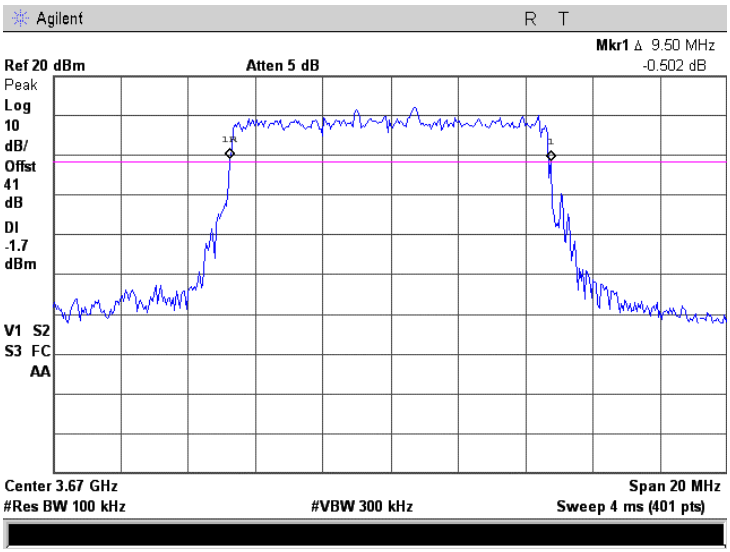


Plot 7.2.26 Occupied bandwidth test result at mid frequency, QPSK, bit rate 3.8 Mbps



Test specification:	Section 90.209, Occupied bandwidth		
Test procedure:	47 CFR, Section 2.1049		
Test mode:	Compliance	Verdict:	PASS
Date & Time:	3/29/2009 5:03:04 PM		
Temperature: 23ºC	Air Pressure: 1013 hPa	Relative Humidity: 41%	Power Supply: 48 VDC
Remarks: Antenna 1, 10 MHz CBW			

Plot 7.2.27 Occupied bandwidth test result at high frequency, QPSK, bit rate 3.8 Mbps



Test specification:	Section 90.210, Emission mask		
Test procedure:	47 CFR, Sections 2.1051, 2.1047 and 90.210(b); TIA/EIA-603-C, Section 2.2.13		
Test mode:	Compliance	Verdict:	PASS
Date & Time:	3/26/2009 1:55:02 PM		
Temperature: 24ºC	Air Pressure: 1020 hPa	Relative Humidity: 37%	Power Supply: 48 VDC
Remarks:			

7.3 Emission mask test

7.3.1 General

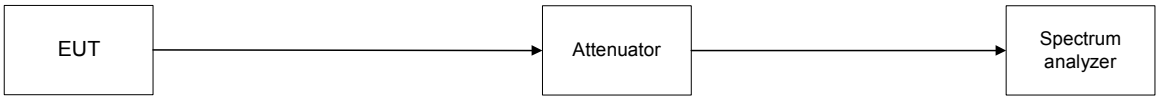
This test was performed to measure emission mask at RF antenna connector. Specification test limits are given in Table 7.3.1.

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. The test results are provided in Table 7.3.2.

Figure 7.3.1 Emission mask test setup



Test specification:	Section 90.210, Emission mask		
Test procedure:	47 CFR, Sections 2.1051, 2.1047 and 90.210(b); TIA/EIA-603-C, Section 2.2.13		
Test mode:	Compliance	Verdict:	PASS
Date & Time:	3/26/2009 1:55:02 PM		
Temperature: 24ºC	Air Pressure: 1020 hPa	Relative Humidity: 37%	Power Supply: 48 VDC
Remarks:			

Table 7.3.1 Emission mask limits

Frequency displacement from carrier	Attenuation below carrier, dBc
Emission mask B (Channel bandwidth 5 MHz)	
0 – 2.5 MHz	0
2.5 – 5.0 MHz	25
5.0 – 12.5 MHz	35
More than** 12.5 MHz	43 + 10 log(P)
Emission mask B (Channel bandwidth 7 MHz)	
0 – 3.5 MHz	0
3.5 – 7.0 MHz	25
7.0 – 17.5 MHz	35
More than** 17.5 MHz	43 + 10 log(P)
Emission mask B (Channel bandwidth 10 MHz)	
0 – 5 MHz	0
5 – 10 MHz	25
10 – 25 MHz	35
More than** 25 MHz	43 + 10 log(P)

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

Table 7.3.2 Emission mask test results

Carrier frequency, MHz	Limit	Verdict
5 MHz Channel BW		
3652.5	Emission mask B	Pass
3662.5		
3672.5		
7 MHz Channel BW		
3653.5	Emission mask B	Pass
3662.5		
3671.5		
10 MHz Channel BW		
3655.0	Emission mask B	Pass
3662.5		
3670.0		

The zero dB reference is measured relative to the highest average power of the fundamental emission measured across the designated channel bandwidth

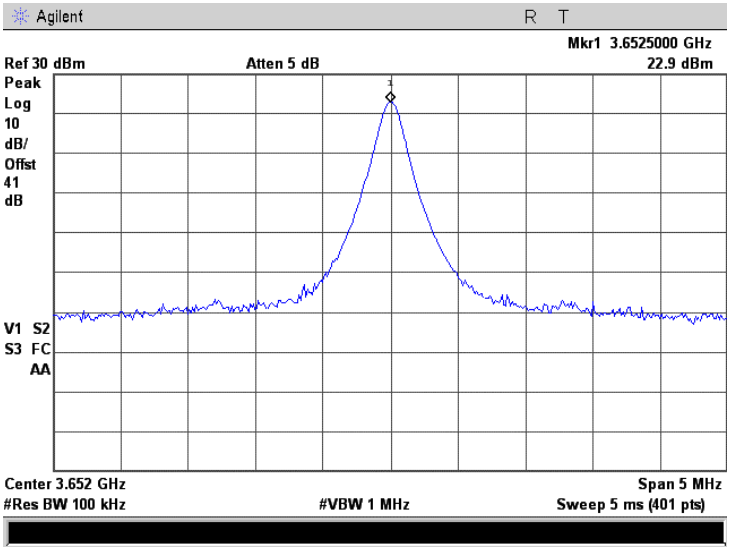
Reference numbers of test equipment used

HL 2909	HL 2952	HL 3441	HL 3439				

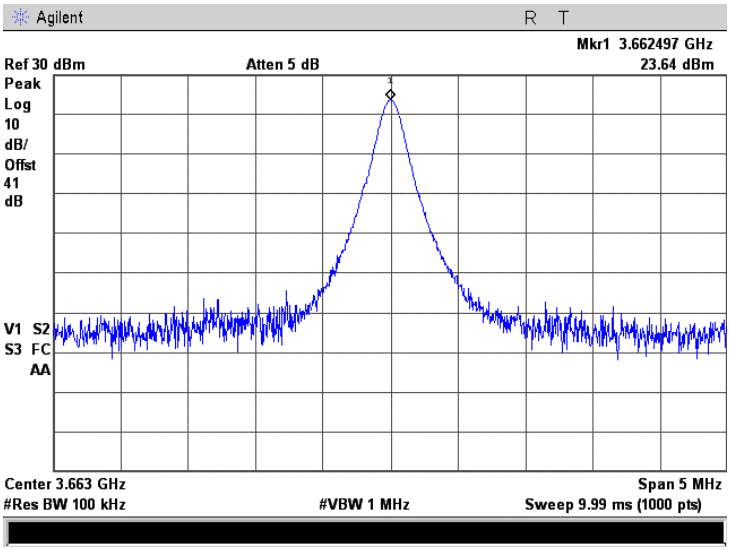
Full description is given in Appendix A.

Test specification:	Section 90.210, Emission mask		
Test procedure:	47 CFR, Sections 2.1051, 2.1047 and 90.210(b); TIA/EIA-603-C, Section 2.2.13		
Test mode:	Compliance	Verdict:	PASS
Date & Time:	3/26/2009 1:55:02 PM		
Temperature: 24ºC	Air Pressure: 1020 hPa	Relative Humidity: 37%	Power Supply: 48 VDC
Remarks: Antenna 1, 5 MHz CBW			

Plot.1 Unmodulated signal for reference level at low frequency

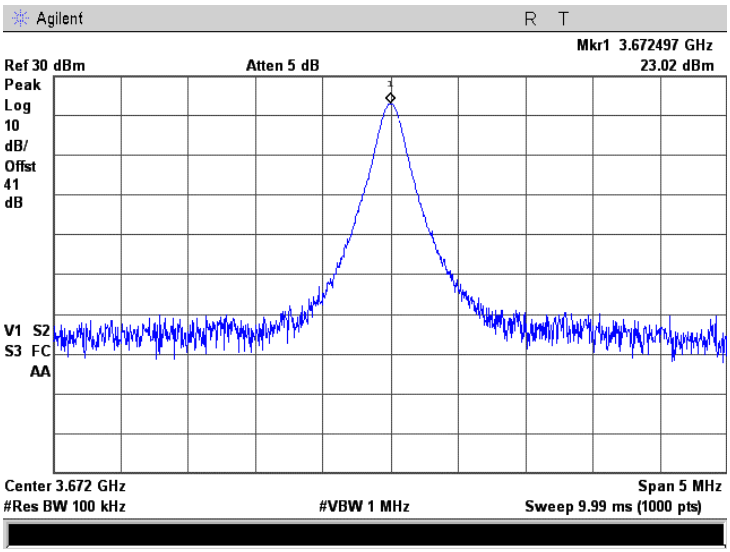


Plot.2 Unmodulated signal for reference level at mid frequency

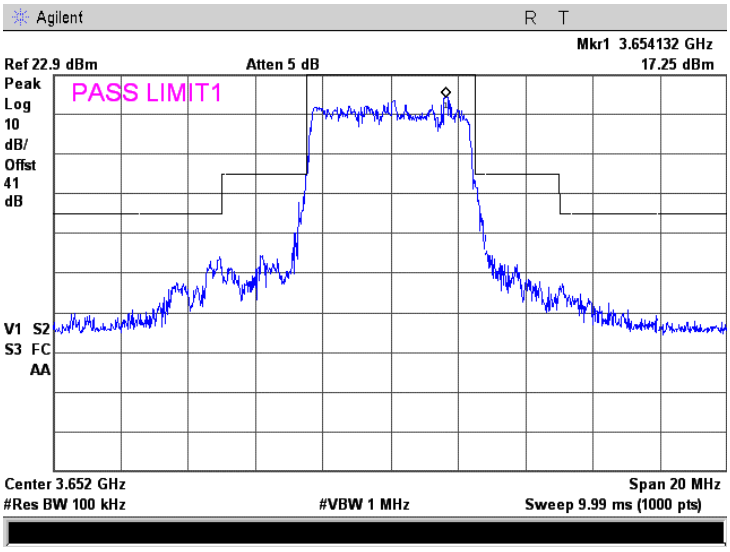


Test specification:	Section 90.210, Emission mask		
Test procedure:	47 CFR, Sections 2.1051, 2.1047 and 90.210(b); TIA/EIA-603-C, Section 2.2.13		
Test mode:	Compliance	Verdict:	PASS
Date & Time:	3/26/2009 1:55:02 PM		
Temperature: 24ºC	Air Pressure: 1020 hPa	Relative Humidity: 37%	Power Supply: 48 VDC
Remarks: Antenna 1, 5 MHz CBW			

Plot.3 Unmodulated signal for reference level at high frequency

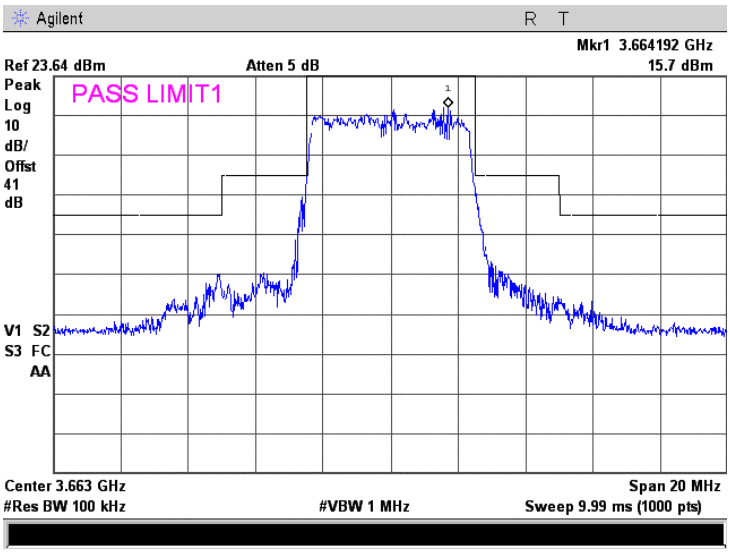


Plot 4 Emission mask test result at low frequency, 64QAM, bit rate 8.65 Mbps

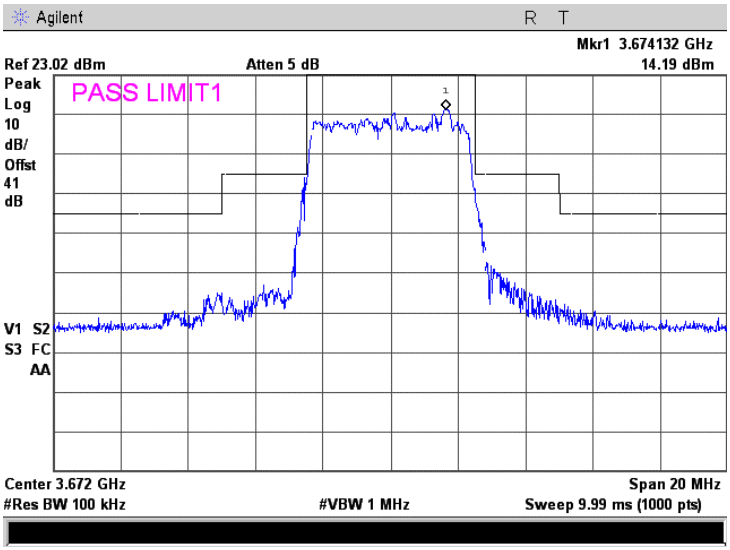


Test specification:	Section 90.210, Emission mask		
Test procedure:	47 CFR, Sections 2.1051, 2.1047 and 90.210(b); TIA/EIA-603-C, Section 2.2.13		
Test mode:	Compliance	Verdict:	PASS
Date & Time:	3/26/2009 1:55:02 PM		
Temperature: 24ºC	Air Pressure: 1020 hPa	Relative Humidity: 37%	Power Supply: 48 VDC
Remarks: Antenna 1, 5 MHz CBW			

Plot Emission mask test result at mid frequency, 64QAM, bit rate 8.65 Mbps

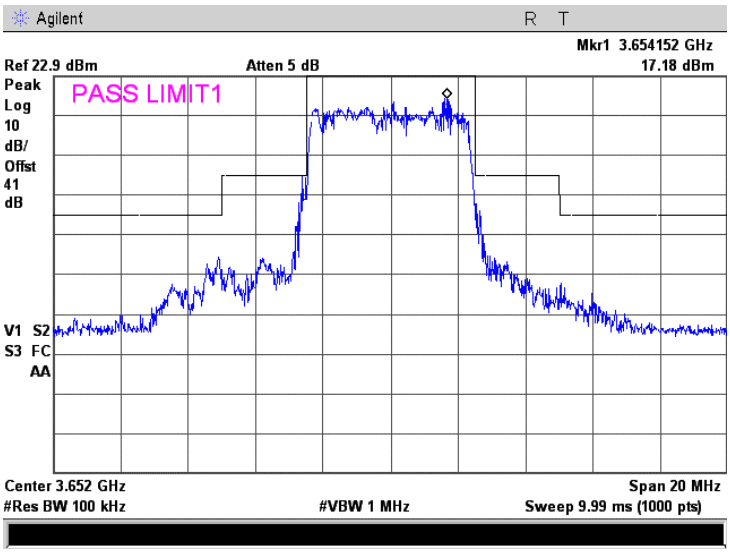


Plot 5 Emission mask test result at high frequency, 64QAM, bit rate 8.65 Mbps

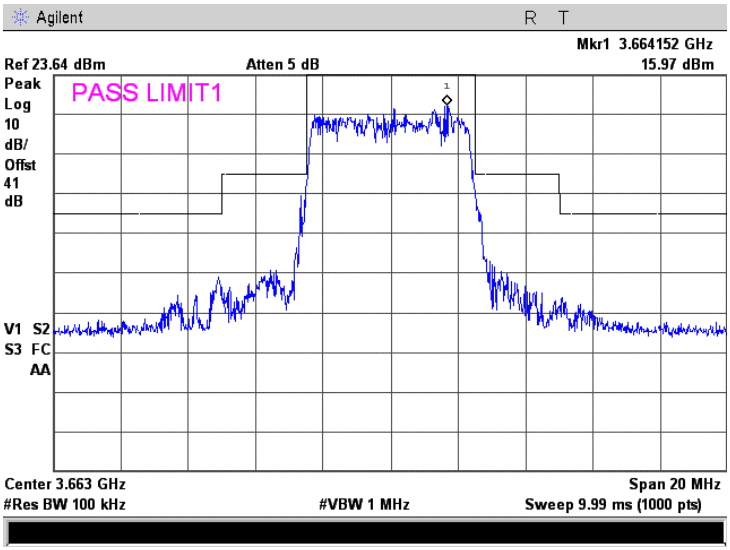


Test specification:	Section 90.210, Emission mask		
Test procedure:	47 CFR, Sections 2.1051, 2.1047 and 90.210(b); TIA/EIA-603-C, Section 2.2.13		
Test mode:	Compliance	Verdict:	PASS
Date & Time:	3/26/2009 1:55:02 PM		
Temperature: 24ºC	Air Pressure: 1020 hPa	Relative Humidity: 37%	Power Supply: 48 VDC
Remarks: Antenna 1, 5 MHz CBW			

Plot.6 Emission mask test result at low frequency, QPSK, bit rate 1.15 Mbps

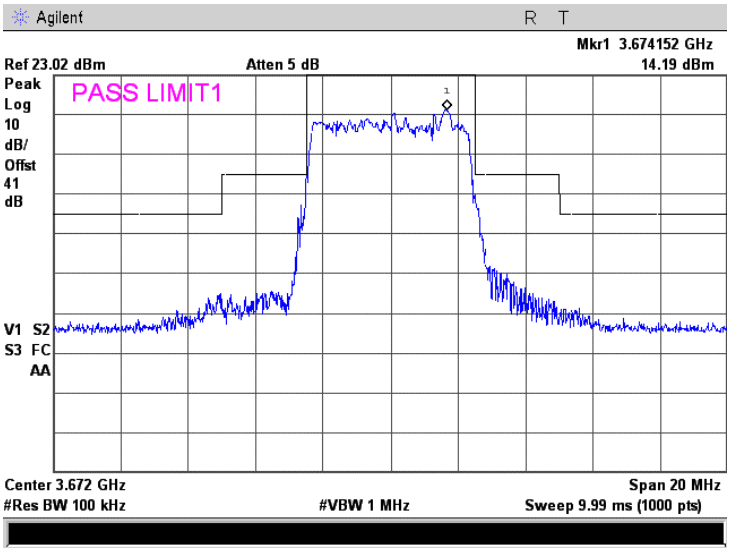


Plot.7 Emission mask test result at mid frequency, QPSK, bit rate 1.15 Mbps



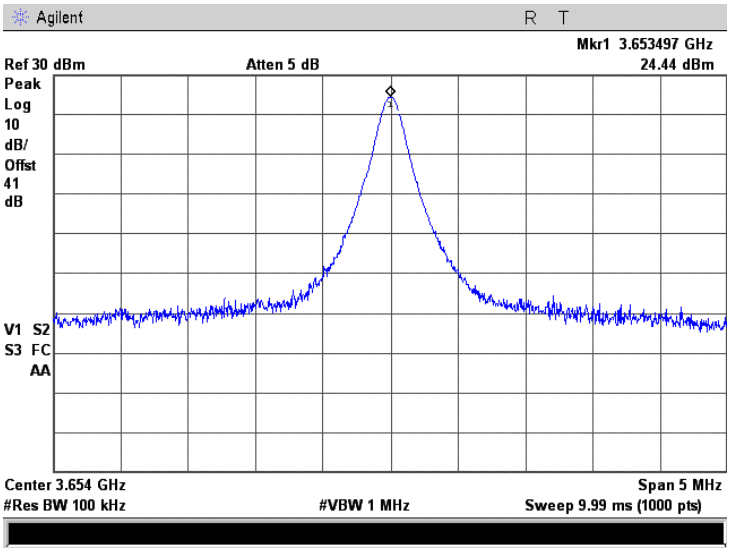
Test specification:	Section 90.210, Emission mask		
Test procedure:	47 CFR, Sections 2.1051, 2.1047 and 90.210(b); TIA/EIA-603-C, Section 2.2.13		
Test mode:	Compliance	Verdict:	PASS
Date & Time:	3/26/2009 1:55:02 PM		
Temperature: 24ºC	Air Pressure: 1020 hPa	Relative Humidity: 37%	Power Supply: 48 VDC
Remarks: Antenna 1, 5 MHz CBW			

Plot 8 Emission mask test result at high frequency, QPSK, bit rate 1.15 Mbps

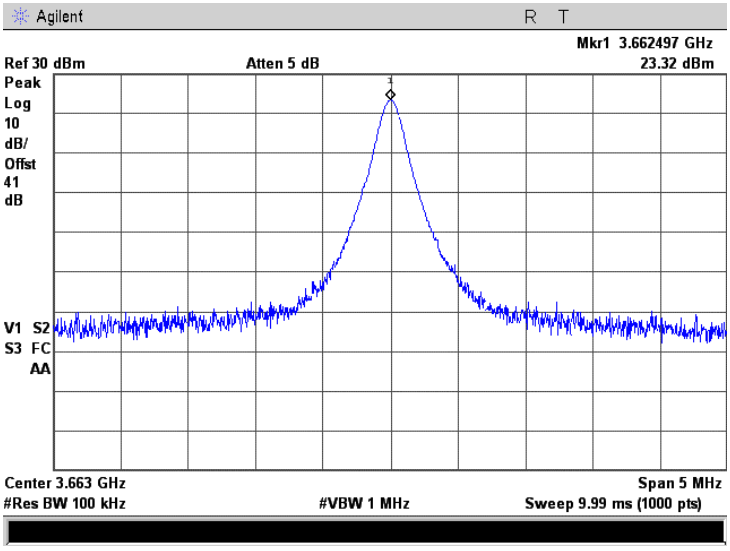


Test specification:	Section 90.210, Emission mask		
Test procedure:	47 CFR, Sections 2.1051, 2.1047 and 90.210(b); TIA/EIA-603-C, Section 2.2.13		
Test mode:	Compliance	Verdict:	PASS
Date & Time:	3/26/2009 1:55:02 PM		
Temperature: 24ºC	Air Pressure: 1020 hPa	Relative Humidity: 37%	Power Supply: 48 VDC
Remarks: Antenna 1, 7 MHz CBW			

Plot 7.3.9 Unmodulated signal for reference level at low frequency

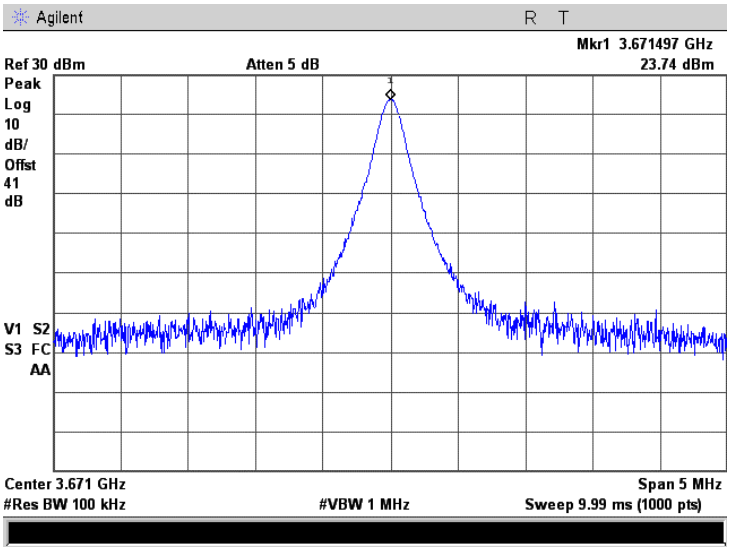


Plot 7.3.10 Unmodulated signal for reference level at mid frequency

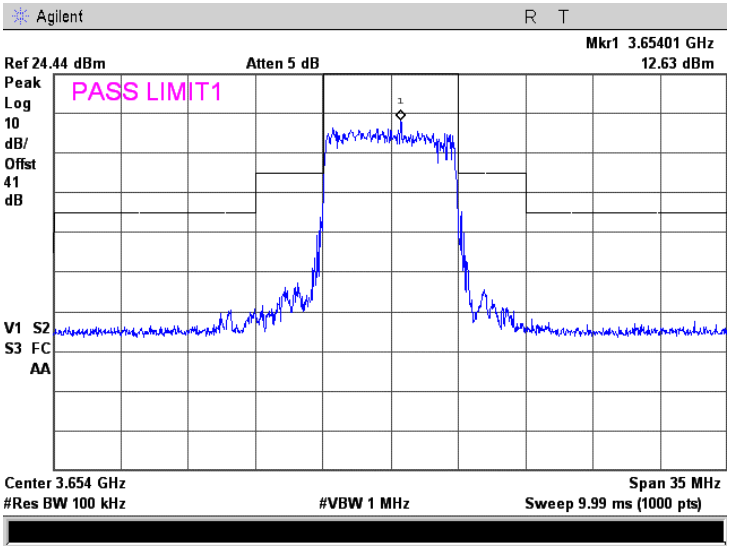


Test specification:	Section 90.210, Emission mask		
Test procedure:	47 CFR, Sections 2.1051, 2.1047 and 90.210(b); TIA/EIA-603-C, Section 2.2.13		
Test mode:	Compliance	Verdict:	PASS
Date & Time:	3/26/2009 1:55:02 PM		
Temperature: 24ºC	Air Pressure: 1020 hPa	Relative Humidity: 37%	Power Supply: 48 VDC
Remarks: Antenna 1, 7 MHz CBW			

Plot 7.3.11 Unmodulated signal for reference level at high frequency

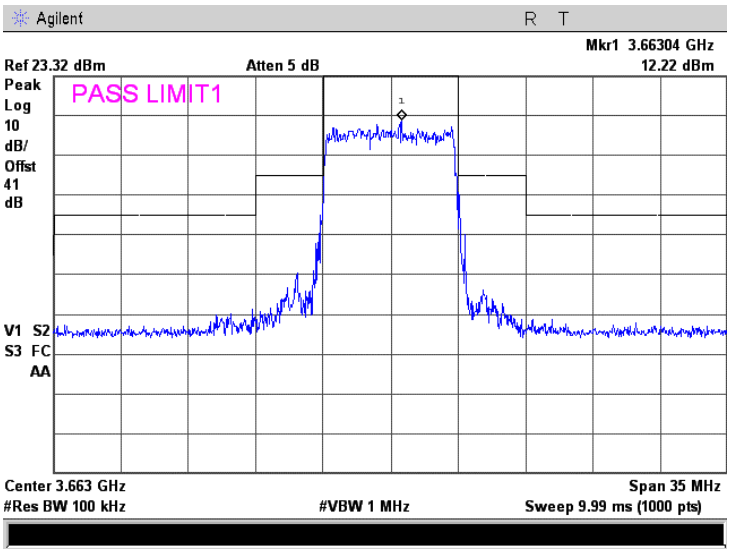


Plot 7.3.12 Emission mask test result at low frequency, 64QAM, bit rate 14.7 Mbps

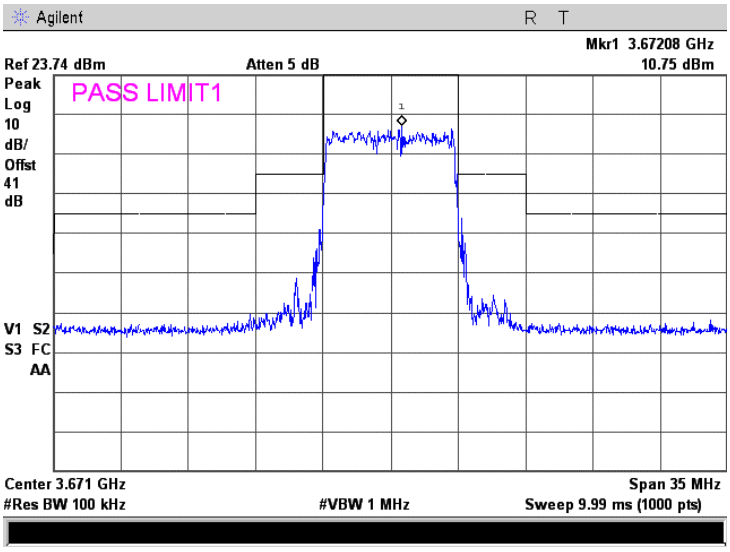


Test specification:	Section 90.210, Emission mask		
Test procedure:	47 CFR, Sections 2.1051, 2.1047 and 90.210(b); TIA/EIA-603-C, Section 2.2.13		
Test mode:	Compliance	Verdict:	PASS
Date & Time:	3/26/2009 1:55:02 PM		
Temperature: 24ºC	Air Pressure: 1020 hPa	Relative Humidity: 37%	Power Supply: 48 VDC
Remarks: Antenna 1, 7 MHz CBW			

Plot 7.3.13 Emission mask test result at mid frequency, 64QAM, bit rate 14.7 Mbps

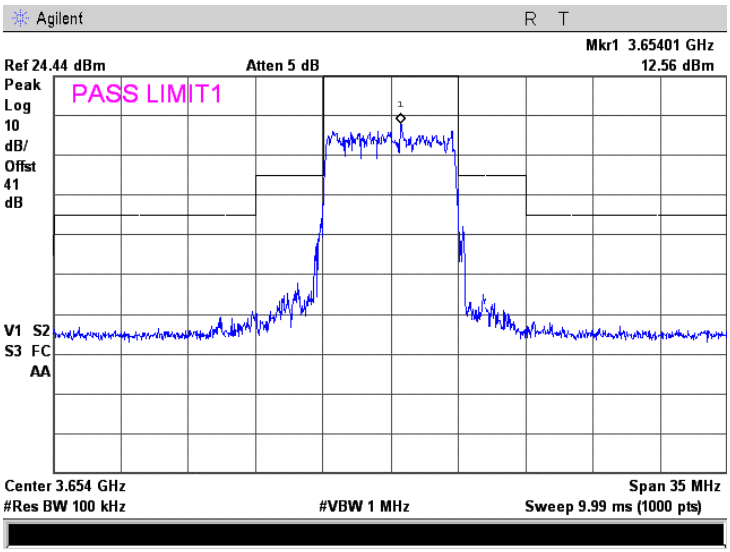


Plot 7.3.14 Emission mask test result at high frequency, 64QAM, bit rate 14.7 Mbps

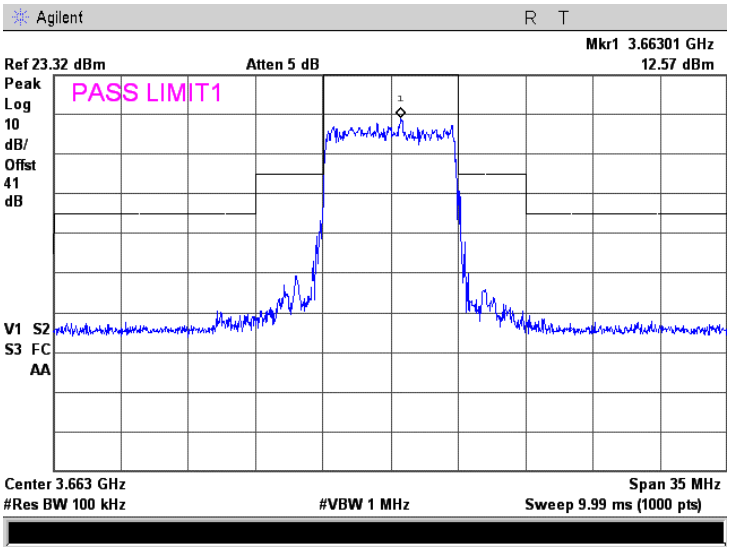


Test specification:	Section 90.210, Emission mask		
Test procedure:	47 CFR, Sections 2.1051, 2.1047 and 90.210(b); TIA/EIA-603-C, Section 2.2.13		
Test mode:	Compliance	Verdict:	PASS
Date & Time:	3/26/2009 1:55:02 PM		
Temperature: 24ºC	Air Pressure: 1020 hPa	Relative Humidity: 37%	Power Supply: 48 VDC
Remarks: Antenna 1, 7 MHz CBW			

Plot 7.3.15 Emission mask test result at low frequency, QPSK, bit rate 2.8 Mbps

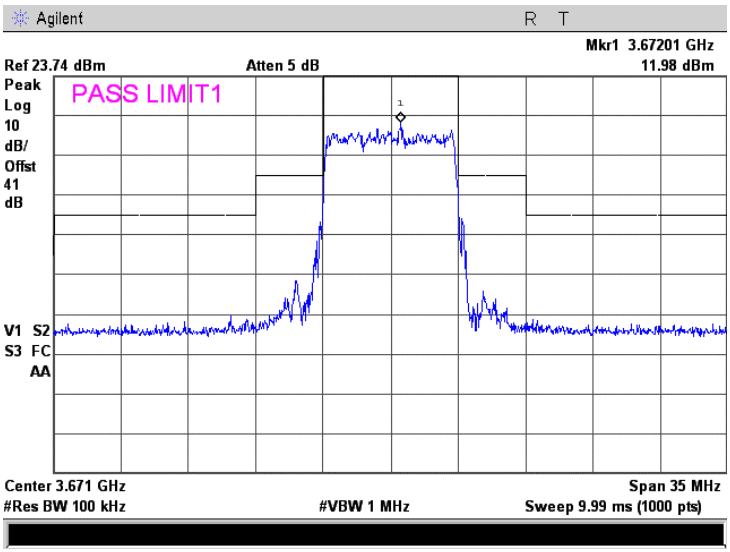


Plot 7.3.16 Emission mask test result at mid frequency, QPSK, bit rate 2.8 Mbps



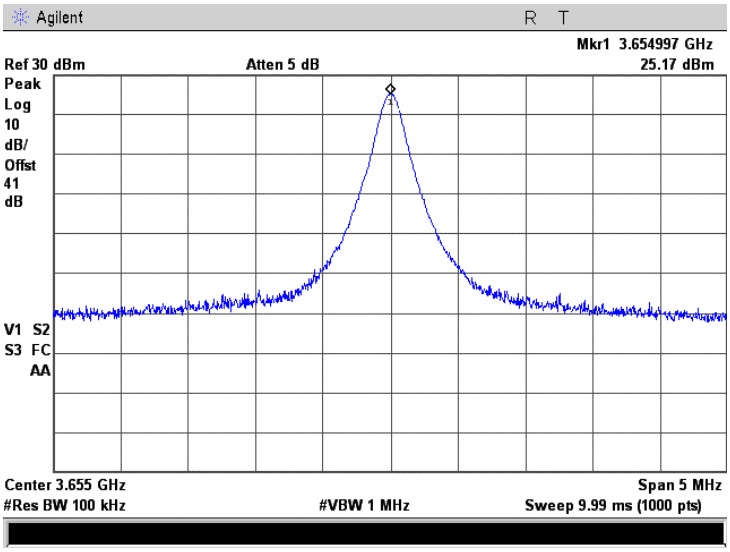
Test specification:	Section 90.210, Emission mask		
Test procedure:	47 CFR, Sections 2.1051, 2.1047 and 90.210(b); TIA/EIA-603-C, Section 2.2.13		
Test mode:	Compliance	Verdict:	PASS
Date & Time:	3/26/2009 1:55:02 PM		
Temperature: 24ºC	Air Pressure: 1020 hPa	Relative Humidity: 37%	Power Supply: 48 VDC
Remarks: Antenna 1, 7 MHz CBW			

Plot 7.3.17 Emission mask test result at high frequency, QPSK, bit rate 2.8 Mbps

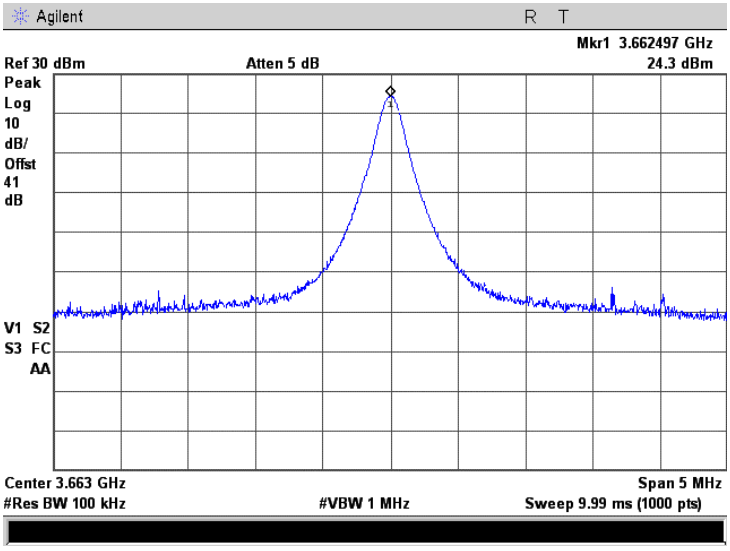


Test specification:	Section 90.210, Emission mask		
Test procedure:	47 CFR, Sections 2.1051, 2.1047 and 90.210(b); TIA/EIA-603-C, Section 2.2.13		
Test mode:	Compliance	Verdict:	PASS
Date & Time:	3/26/2009 1:55:02 PM		
Temperature: 24ºC	Air Pressure: 1020 hPa	Relative Humidity: 37%	Power Supply: 48 VDC
Remarks: Antenna 1, 10 MHz CBW			

Plot 7.3.18 Unmodulated signal for reference level at low frequency

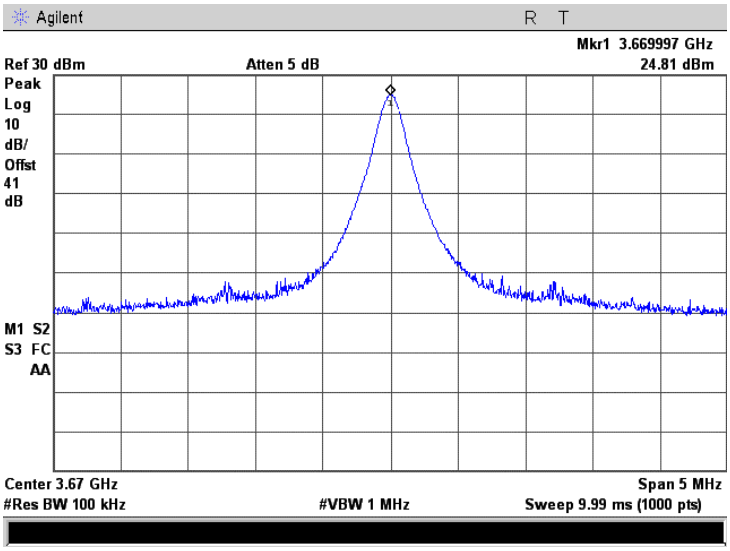


Plot 7.3.19 Unmodulated signal for reference level at mid frequency

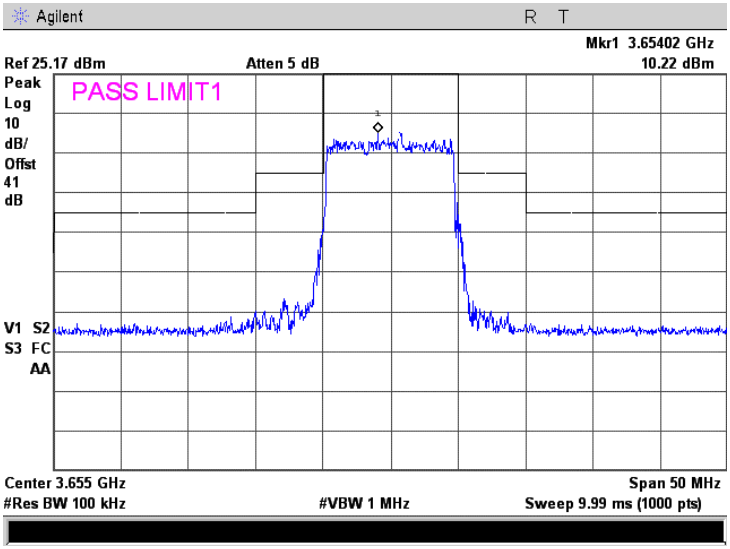


Test specification:	Section 90.210, Emission mask		
Test procedure:	47 CFR, Sections 2.1051, 2.1047 and 90.210(b); TIA/EIA-603-C, Section 2.2.13		
Test mode:	Compliance	Verdict:	PASS
Date & Time:	3/26/2009 1:55:02 PM		
Temperature: 24ºC	Air Pressure: 1020 hPa	Relative Humidity: 37%	Power Supply: 48 VDC
Remarks: Antenna 1, 10 MHz CBW			

Plot 7.3.20 Unmodulated signal for reference level at high frequency

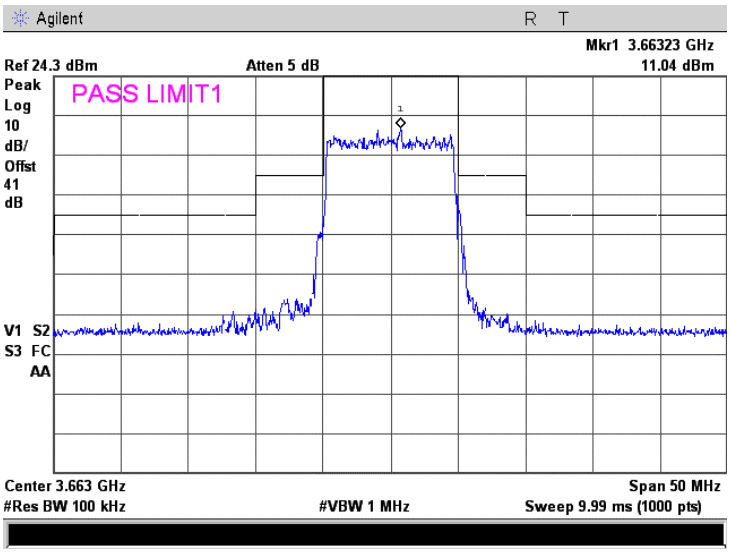


Plot 7.3.21 Emission mask test result at low frequency, 64QAM,bit rate 19.5 Mbps

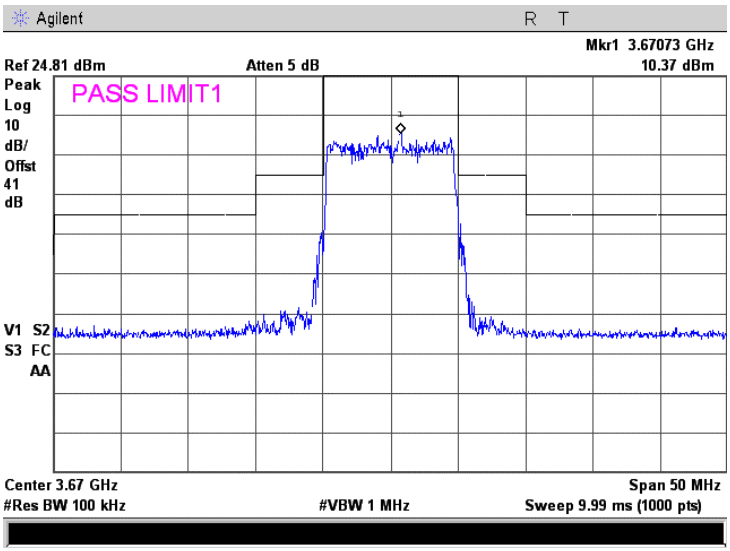


Test specification:	Section 90.210, Emission mask		
Test procedure:	47 CFR, Sections 2.1051, 2.1047 and 90.210(b); TIA/EIA-603-C, Section 2.2.13		
Test mode:	Compliance	Verdict:	PASS
Date & Time:	3/26/2009 1:55:02 PM		
Temperature: 24ºC	Air Pressure: 1020 hPa	Relative Humidity: 37%	Power Supply: 48 VDC
Remarks: Antenna 1, 10 MHz CBW			

Plot 7.3.22 Emission mask test result at mid frequency, 64QAM, bit rate 19.5 Mbps

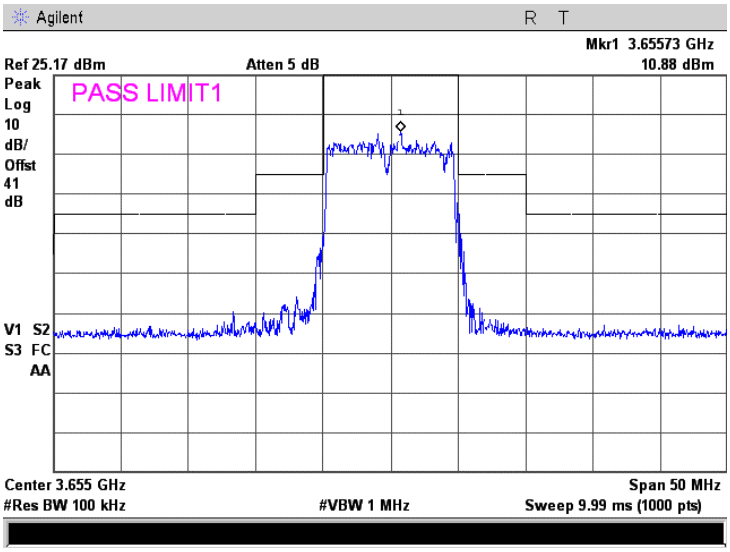


Plot 7.3.23 Emission mask test result at high frequency, 64QAM, bit rate 19.5 Mbps

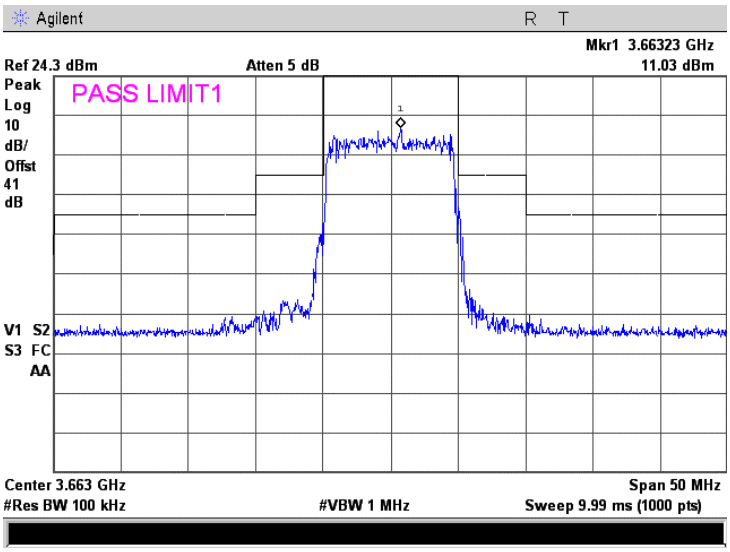


Test specification:	Section 90.210, Emission mask		
Test procedure:	47 CFR, Sections 2.1051, 2.1047 and 90.210(b); TIA/EIA-603-C, Section 2.2.13		
Test mode:	Compliance	Verdict:	PASS
Date & Time:	3/26/2009 1:55:02 PM		
Temperature: 24ºC	Air Pressure: 1020 hPa	Relative Humidity: 37%	Power Supply: 48 VDC
Remarks: Antenna 1, 10 MHz CBW			

Plot 7.3.24 Emission mask test result at low frequency, QPSK, bit rate 3.8 Mbps

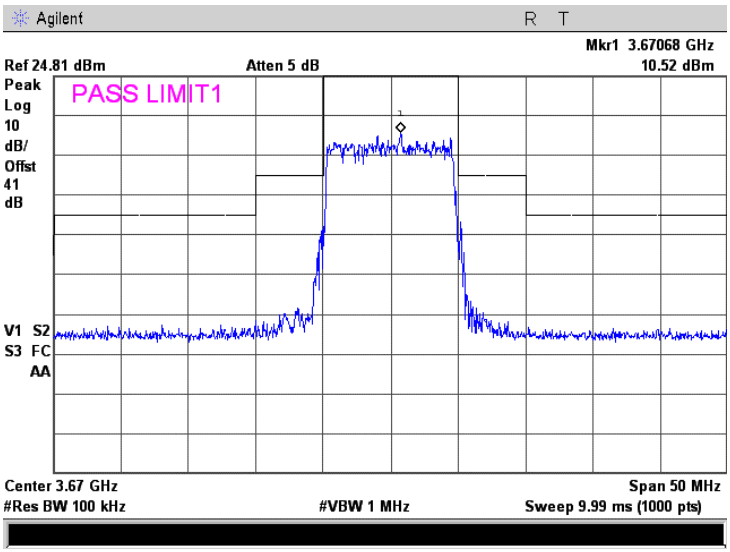


Plot 7.3.25 Emission mask test result at mid frequency, QPSK, bit rate 3.8 Mbps



Test specification:	Section 90.210, Emission mask		
Test procedure:	47 CFR, Sections 2.1051, 2.1047 and 90.210(b); TIA/EIA-603-C, Section 2.2.13		
Test mode:	Compliance	Verdict:	PASS
Date & Time:	3/26/2009 1:55:02 PM		
Temperature: 24ºC	Air Pressure: 1020 hPa	Relative Humidity: 37%	Power Supply: 48 VDC
Remarks: Antenna 1, 10 MHz CBW			

Plot 7.3.26 Emission mask test result at high frequency, QPSK, bit rate 3.8 Mbps



Test specification:	Section 90.1323, Radiated spurious emissions		
Test procedure:	47 CFR, Sections 2.1053 and 90.1323; TIA/EIA-603-C, Section 2.2.12		
Test mode:	Compliance	Verdict:	PASS
Date & Time:	3/23/2009 4:28:02 PM		
Temperature: 22ºC	Air Pressure: 1010 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)***
0.009 – 10th harmonic*	43+10logP**	-13	84.4

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

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

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

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

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

Test specification:	Section 90.1323, Radiated spurious emissions		
Test procedure:	47 CFR, Sections 2.1053 and 90.1323; TIA/EIA-603-C, Section 2.2.12		
Test mode:	Compliance	Verdict:	PASS
Date & Time:	3/23/2009 4:28:02 PM		
Temperature: 22ºC	Air Pressure: 1010 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

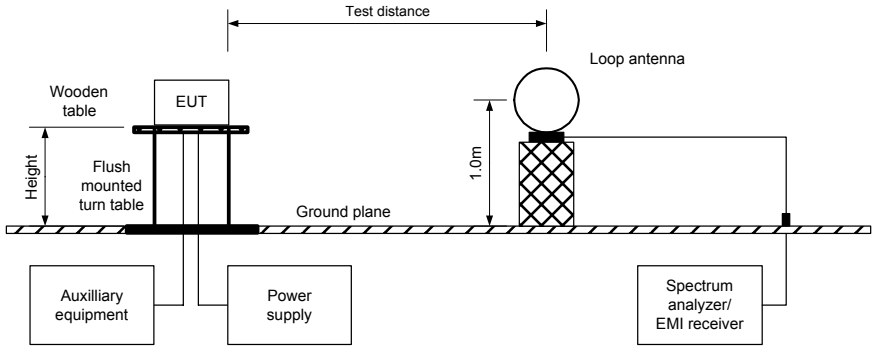
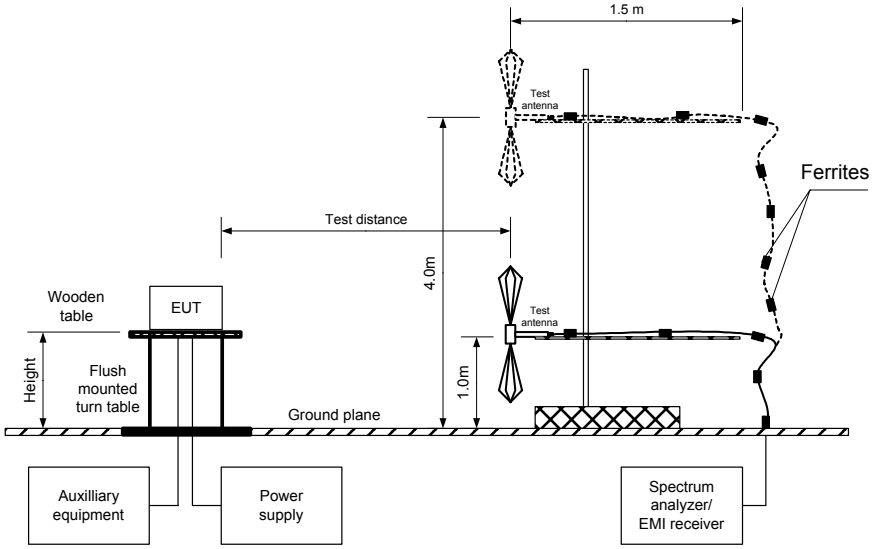


Figure 7.4.2 Setup for spurious emission field strength measurements above 30 MHz



Test specification:	**Section 90.1323, Radiated spurious emissions**		
Test procedure:	47 CFR, Sections 2.1053 and 90.1323; TIA/EIA-603-C, Section 2.2.12		
Test mode:	Compliance	**Verdict:**	PASS
Date & Time:	3/23/2009 4:28:02 PM		
Temperature: 22ºC	**Air Pressure:** 1010 hPa	**Relative Humidity:** 45%	**Power Supply:** 48 VDC
Remarks:			

Table 7.4.2 Spurious emission field strength test results

ASSIGNED FREQUENCY RANGE: 3650 – 3675 MHz
TEST DISTANCE: 3 m
TEST SITE: Full anechoic chamber / OATS
EUT HEIGHT: 0.8 m
INVESTIGATED FREQUENCY RANGE: 0.009 – 37000 MHz
DETECTOR USED: Peak
VIDEO BANDWIDTH: > Resolution bandwidth
TEST ANTENNA TYPE: Active loop (9 kHz – 30 MHz)
Biconical (30 MHz – 200 MHz)
Log periodic (200 MHz – 1000 MHz)
Biconilog (30 MHz – 1000 MHz)
Double ridged guide (above 1000 MHz)
MODULATION: 64QAM
MODULATING SIGNAL: OFDM
BIT RATE: 8.65 Mbps
TRANSMITTER OUTPUT POWER SETTINGS: Maximum
CHANNEL SPACING: 5 MHz

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 3652.5 MHz							
All spurious are at least 20 dB below the limit							
Mid carrier frequency 3662.5 MHz							
All spurious are at least 20 dB below the limit							
High carrier frequency 3672.5 MHz							
All spurious are at least 20 dB below the limit							

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

Reference numbers of test equipment used

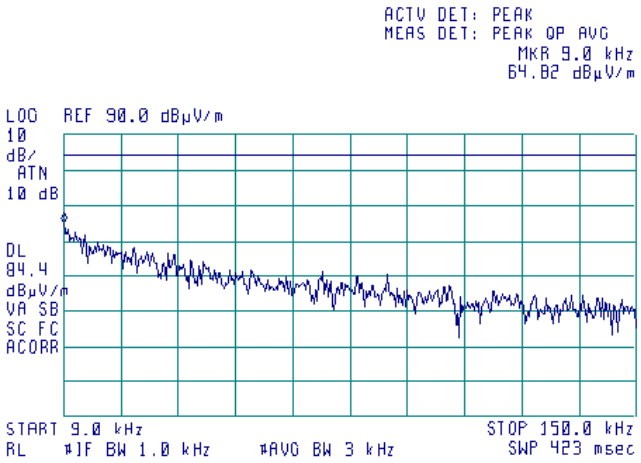
HL 0446	HL 1425	HL 2697	HL 1984	HL 0768	HL 0769	HL 1424	HL 2254
HL 1553	HL 3119	HL 2780	HL 2882	HL 3532	HL 3534	HL 3535	

Full description is given in Appendix A.

Test specification:	Section 90.1323, Radiated spurious emissions		
Test procedure:	47 CFR, Sections 2.1053 and 90.1323; TIA/EIA-603-C, Section 2.2.12		
Test mode:	Compliance	Verdict:	PASS
Date & Time:	3/23/2009 4:28:02 PM		
Temperature: 22ºC	Air Pressure: 1010 hPa	Relative Humidity: 45%	Power Supply: 48 VDC
Remarks:			

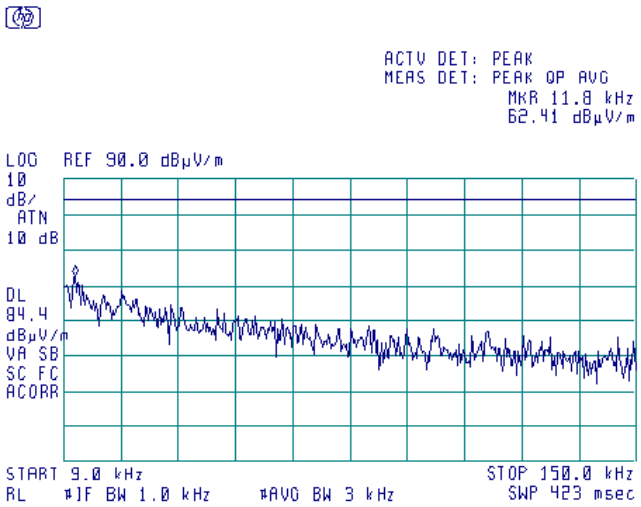
Plot 7.4.1 Radiated emission measurements in 9 - 150 kHz range

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



Plot 7.4.2 Radiated emission measurements in 9 - 150 kHz range

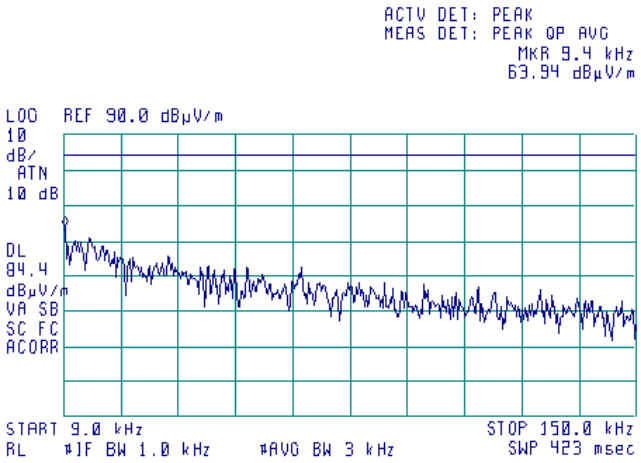
TEST SITE:	Full anechoic chamber
CARRIER FREQUENCY:	Mid
ANTENNA POLARIZATION:	Vertical and Horizontal
TEST DISTANCE:	3 m



Test specification:	Section 90.1323, Radiated spurious emissions		
Test procedure:	47 CFR, Sections 2.1053 and 90.1323; TIA/EIA-603-C, Section 2.2.12		
Test mode:	Compliance	Verdict:	PASS
Date & Time:	3/23/2009 4:28:02 PM		
Temperature: 22ºC	Air Pressure: 1010 hPa	Relative Humidity: 45%	Power Supply: 48 VDC
Remarks:			

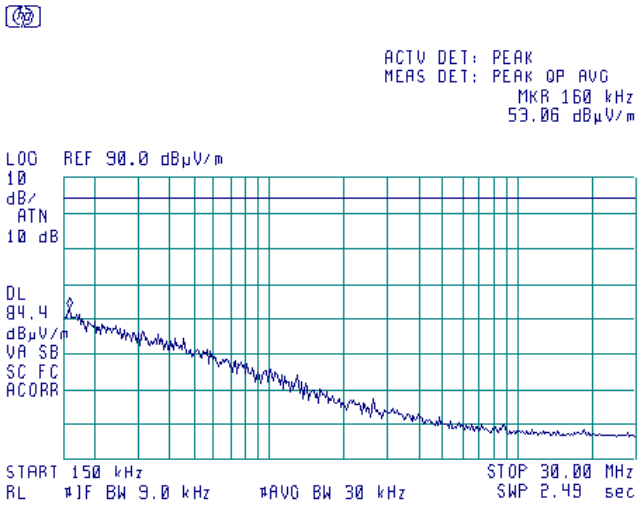
Plot 7.4.3 Radiated emission measurements in 9 - 150 kHz range

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



Plot 7.4.4 Radiated emission measurements in 0.15 - 30 MHz range

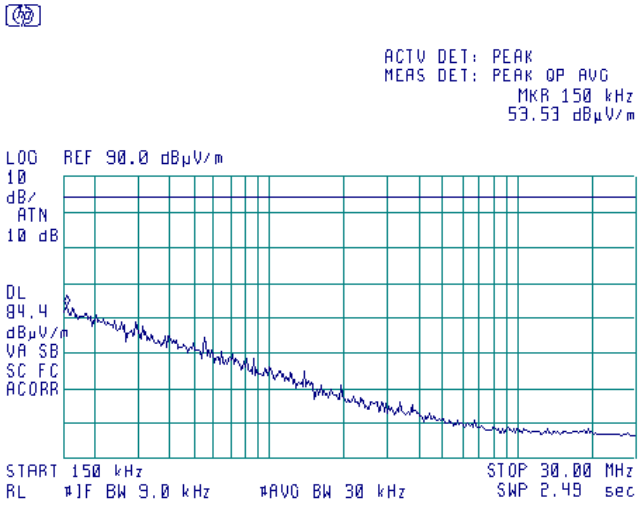
TEST SITE:	Full anechoic chamber
CARRIER FREQUENCY:	Low
ANTENNA POLARIZATION:	Vertical and Horizontal
TEST DISTANCE:	3 m



Test specification:	Section 90.1323, Radiated spurious emissions		
Test procedure:	47 CFR, Sections 2.1053 and 90.1323; TIA/EIA-603-C, Section 2.2.12		
Test mode:	Compliance	Verdict:	PASS
Date & Time:	3/23/2009 4:28:02 PM		
Temperature: 22ºC	Air Pressure: 1010 hPa	Relative Humidity: 45%	Power Supply: 48 VDC
Remarks:			

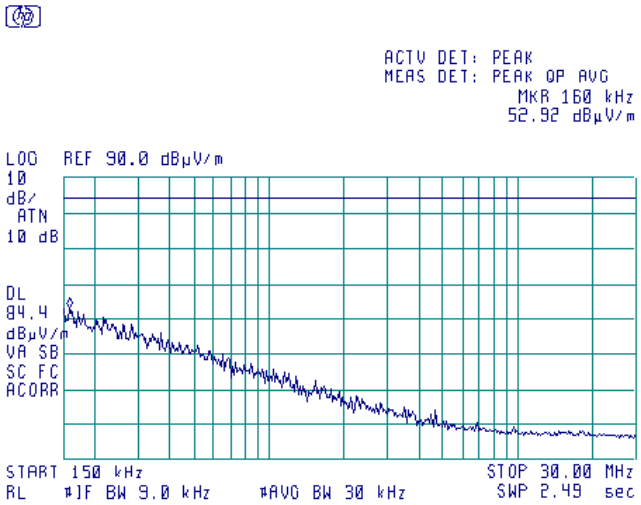
Plot 7.4.5 Radiated emission measurements in 0.15 - 30 MHz range

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



Plot 7.4.6 Radiated emission measurements in 0.15 - 30 MHz range

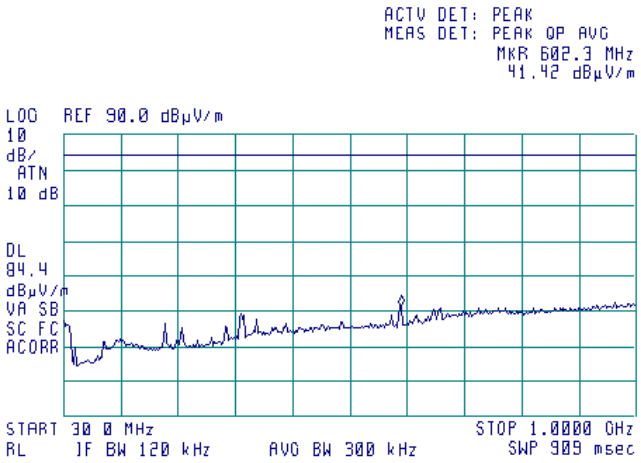
TEST SITE:	Full anechoic chamber
CARRIER FREQUENCY:	High
ANTENNA POLARIZATION:	Vertical and Horizontal
TEST DISTANCE:	3 m



Test specification:	Section 90.1323, Radiated spurious emissions		
Test procedure:	47 CFR, Sections 2.1053 and 90.1323; TIA/EIA-603-C, Section 2.2.12		
Test mode:	Compliance	Verdict:	PASS
Date & Time:	3/23/2009 4:28:02 PM		
Temperature: 22ºC	Air Pressure: 1010 hPa	Relative Humidity: 45%	Power Supply: 48 VDC
Remarks:			

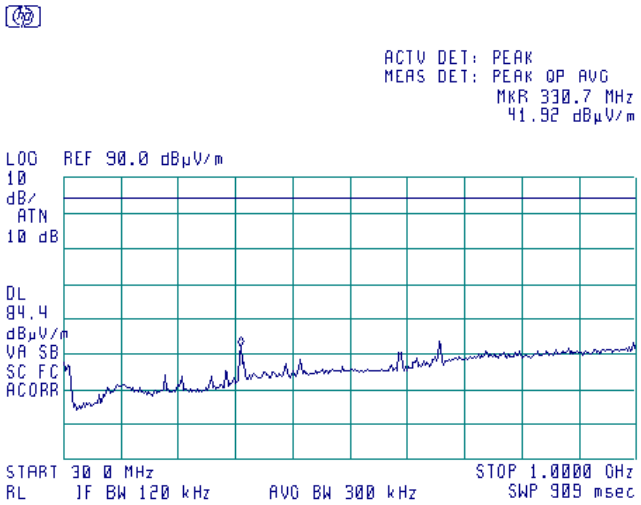
Plot 7.4.7 Radiated emission measurements in 30 - 1000 MHz range

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



Plot 7.4.8 Radiated emission measurements in 30 - 1000 MHz range

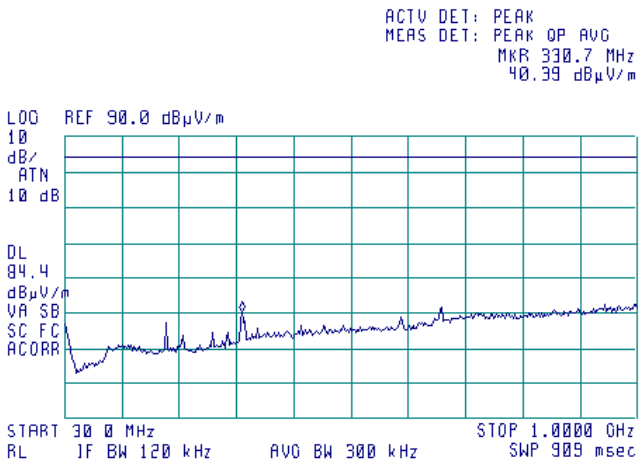
TEST SITE:	Full anechoic chamber
CARRIER FREQUENCY:	Mid
ANTENNA POLARIZATION:	Vertical and Horizontal
TEST DISTANCE:	3 m



Test specification:	Section 90.1323, Radiated spurious emissions		
Test procedure:	47 CFR, Sections 2.1053 and 90.1323; TIA/EIA-603-C, Section 2.2.12		
Test mode:	Compliance	Verdict:	PASS
Date & Time:	3/23/2009 4:28:02 PM		
Temperature: 22ºC	Air Pressure: 1010 hPa	Relative Humidity: 45%	Power Supply: 48 VDC
Remarks:			

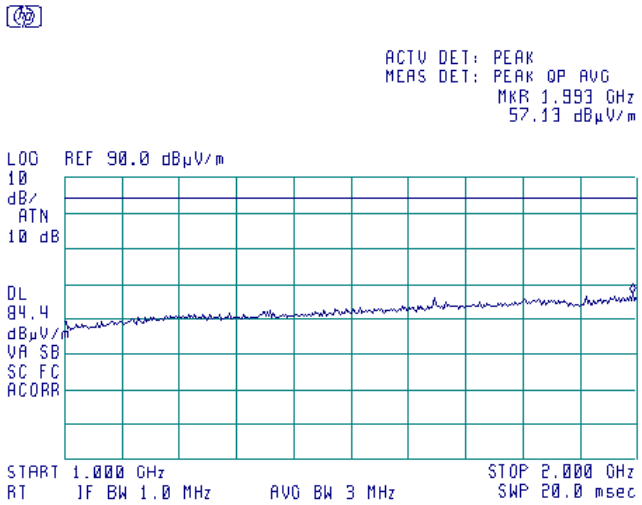
Plot 7.4.9 Radiated emission measurements in 30 - 1000 MHz range

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



Plot 7.4.10 Radiated emission measurements in 1000-2000 MHz range

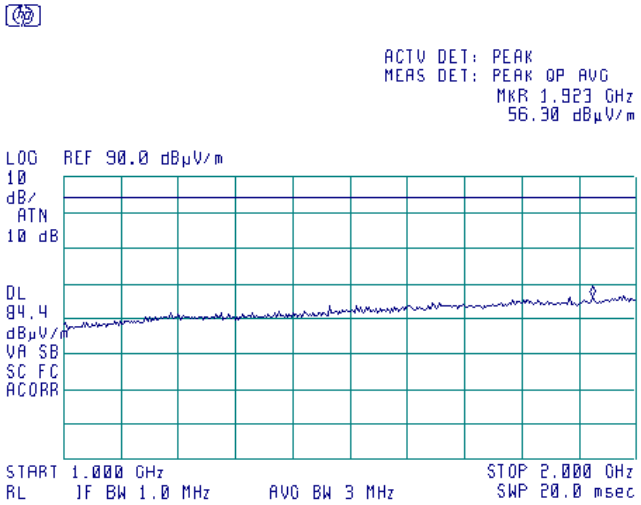
TEST SITE:	Full anechoic chamber
CARRIER FREQUENCY:	Low
ANTENNA POLARIZATION:	Vertical and Horizontal
TEST DISTANCE:	3 m



Test specification:	Section 90.1323, Radiated spurious emissions		
Test procedure:	47 CFR, Sections 2.1053 and 90.1323; TIA/EIA-603-C, Section 2.2.12		
Test mode:	Compliance	Verdict:	PASS
Date & Time:	3/23/2009 4:28:02 PM		
Temperature: 22ºC	Air Pressure: 1010 hPa	Relative Humidity: 45%	Power Supply: 48 VDC
Remarks:			

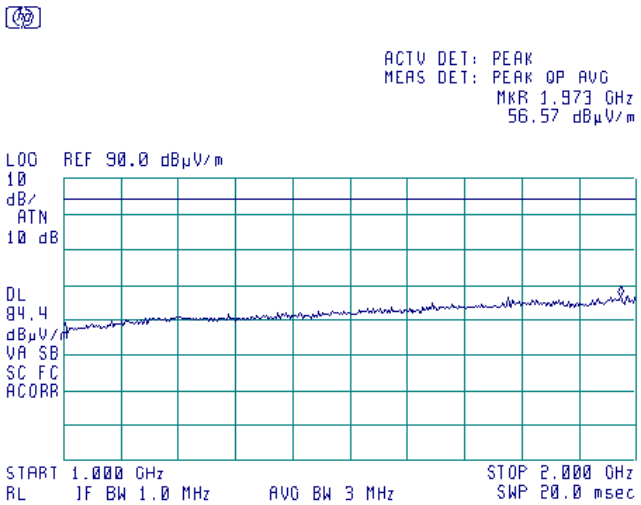
Plot 7.4.11 Radiated emission measurements in 1000-2000 MHz range

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



Plot 7.4.12 Radiated emission measurements in 1000-2000 MHz range

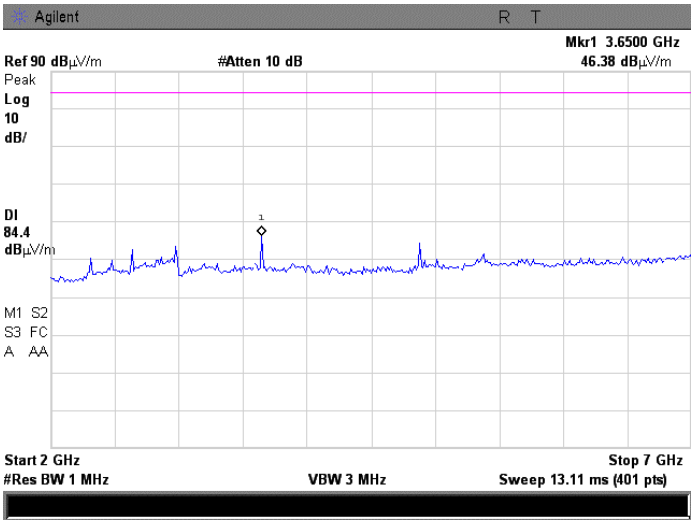
TEST SITE:	Full anechoic chamber
CARRIER FREQUENCY:	High
ANTENNA POLARIZATION:	Vertical and Horizontal
TEST DISTANCE:	3 m



Test specification:	Section 90.1323, Radiated spurious emissions		
Test procedure:	47 CFR, Sections 2.1053 and 90.1323; TIA/EIA-603-C, Section 2.2.12		
Test mode:	Compliance	Verdict:	PASS
Date & Time:	3/23/2009 4:28:02 PM		
Temperature: 22ºC	Air Pressure: 1010 hPa	Relative Humidity: 45%	Power Supply: 48 VDC
Remarks:			

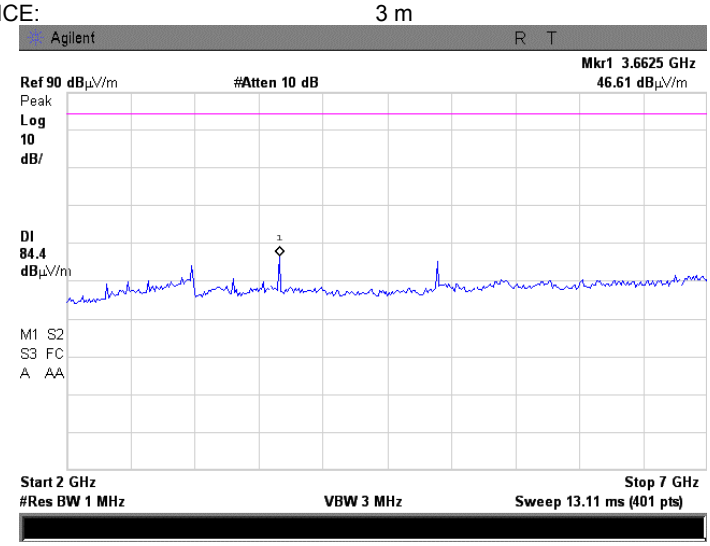
Plot 7.4.13 Radiated emission measurements in 2000 – 7000 MHz range

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



Plot 7.4.14 Radiated emission measurements in 2000 – 7000 MHz range

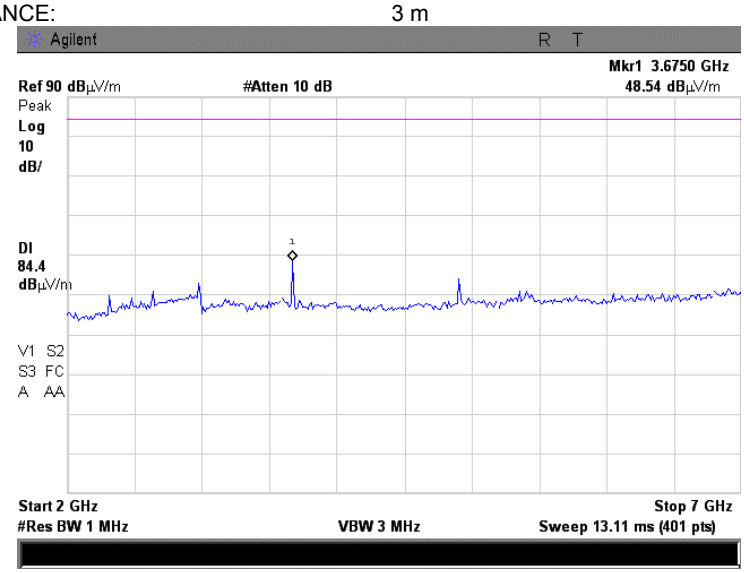
TEST SITE:	Full anechoic chamber
CARRIER FREQUENCY:	Mid
ANTENNA POLARIZATION:	Vertical and Horizontal
TEST DISTANCE:	3 m



Test specification:	Section 90.1323, Radiated spurious emissions		
Test procedure:	47 CFR, Sections 2.1053 and 90.1323; TIA/EIA-603-C, Section 2.2.12		
Test mode:	Compliance	Verdict:	PASS
Date & Time:	3/23/2009 4:28:02 PM		
Temperature: 22ºC	Air Pressure: 1010 hPa	Relative Humidity: 45%	Power Supply: 48 VDC
Remarks:			

Plot 7.4.15 Radiated emission measurements in 2000 – 7000 MHz range

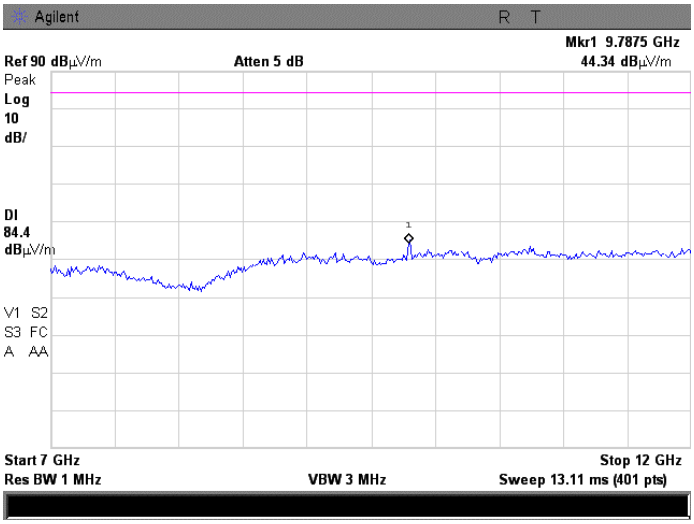
TEST SITE:	Full anechoic chamber
CARRIER FREQUENCY:	High
ANTENNA POLARIZATION:	Vertical and Horizontal
TEST DISTANCE:	3 m



Test specification:	Section 90.1323, Radiated spurious emissions		
Test procedure:	47 CFR, Sections 2.1053 and 90.1323; TIA/EIA-603-C, Section 2.2.12		
Test mode:	Compliance	Verdict:	PASS
Date & Time:	3/23/2009 4:28:02 PM		
Temperature: 22ºC	Air Pressure: 1010 hPa	Relative Humidity: 45%	Power Supply: 48 VDC
Remarks:			

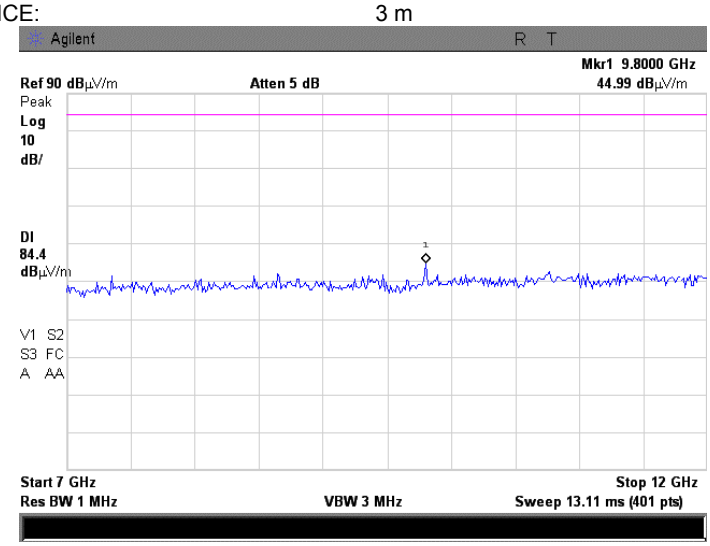
Plot 7.4.16 Radiated emission measurements in 7000 – 12000 MHz range

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



Plot 7.4.17 Radiated emission measurements in 7000 – 12000 MHz range

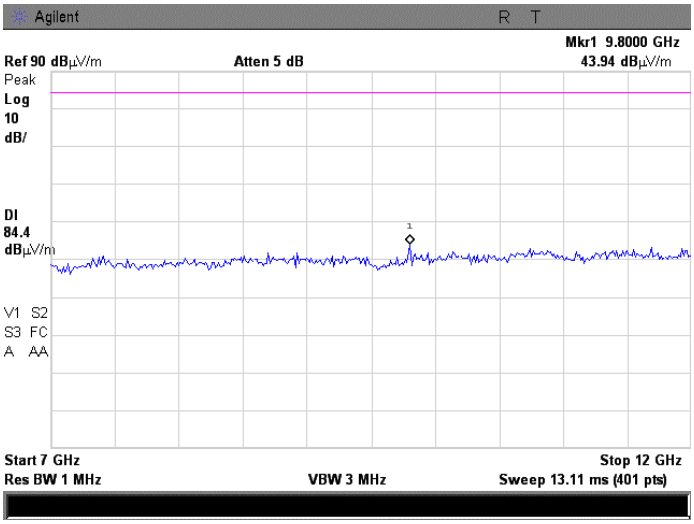
TEST SITE:	Full anechoic chamber
CARRIER FREQUENCY:	Mid
ANTENNA POLARIZATION:	Vertical and Horizontal
TEST DISTANCE:	3 m



Test specification:	Section 90.1323, Radiated spurious emissions		
Test procedure:	47 CFR, Sections 2.1053 and 90.1323; TIA/EIA-603-C, Section 2.2.12		
Test mode:	Compliance	Verdict:	PASS
Date & Time:	3/23/2009 4:28:02 PM		
Temperature: 22ºC	Air Pressure: 1010 hPa	Relative Humidity: 45%	Power Supply: 48 VDC
Remarks:			

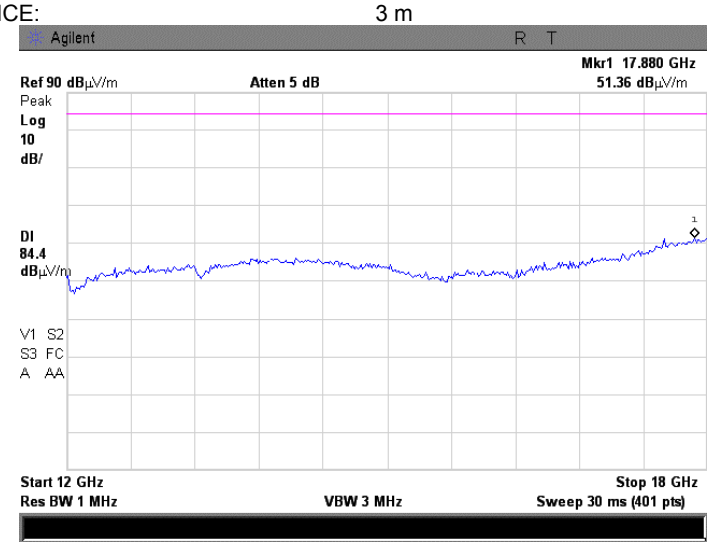
Plot 7.4.18 Radiated emission measurements in 7000 – 12000 MHz range

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



Plot 7.4.19 Radiated emission measurements in 12000 – 18000 MHz range

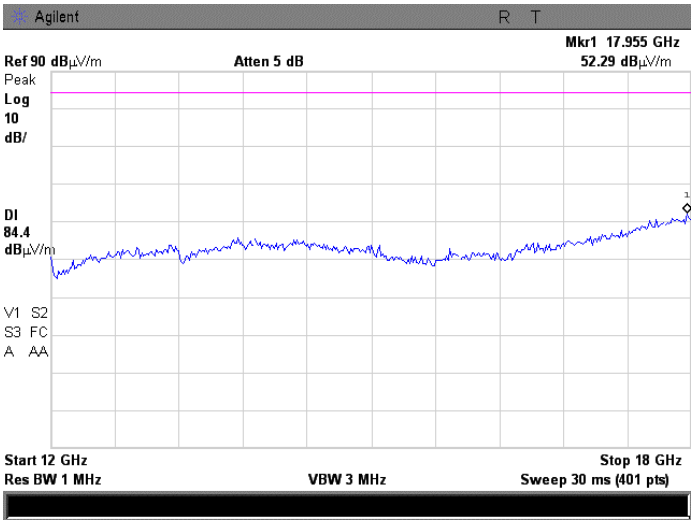
TEST SITE: Full anechoic chamber
CARRIER FREQUENCY: Low
ANTENNA POLARIZATION: Vertical and Horizontal
TEST DISTANCE: 3 m



Test specification:	Section 90.1323, Radiated spurious emissions		
Test procedure:	47 CFR, Sections 2.1053 and 90.1323; TIA/EIA-603-C, Section 2.2.12		
Test mode:	Compliance	Verdict:	PASS
Date & Time:	3/23/2009 4:28:02 PM		
Temperature: 22ºC	Air Pressure: 1010 hPa	Relative Humidity: 45%	Power Supply: 48 VDC
Remarks:			

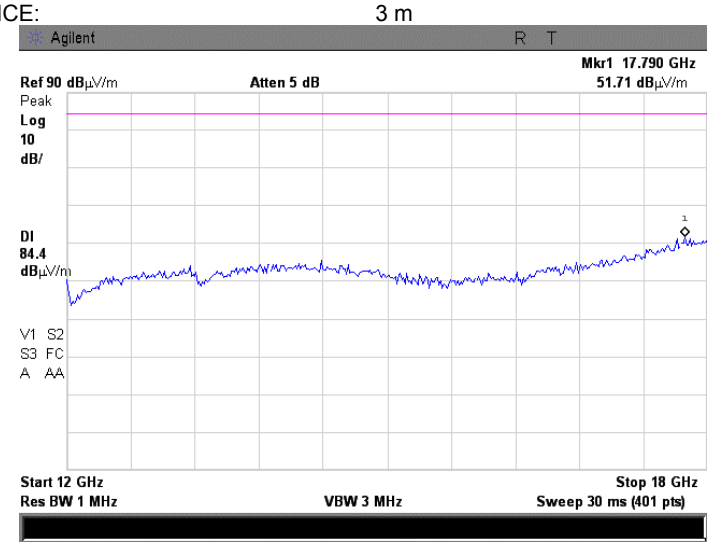
Plot 7.4.20 Radiated emission measurements in 12000 – 18000 MHz range

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



Plot 7.4.21 Radiated emission measurements in 12000 – 18000 MHz range

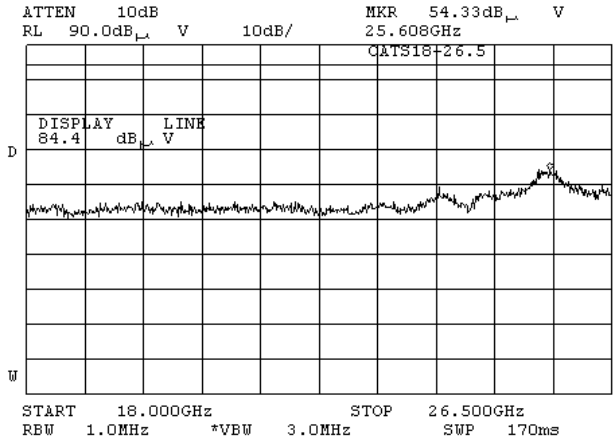
TEST SITE:	Full anechoic chamber
CARRIER FREQUENCY:	High
ANTENNA POLARIZATION:	Vertical and Horizontal
TEST DISTANCE:	3 m



Test specification:	Section 90.1323, Radiated spurious emissions		
Test procedure:	47 CFR, Sections 2.1053 and 90.1323; TIA/EIA-603-C, Section 2.2.12		
Test mode:	Compliance	Verdict:	PASS
Date & Time:	3/23/2009 4:28:02 PM		
Temperature: 22ºC	Air Pressure: 1010 hPa	Relative Humidity: 45%	Power Supply: 48 VDC
Remarks:			

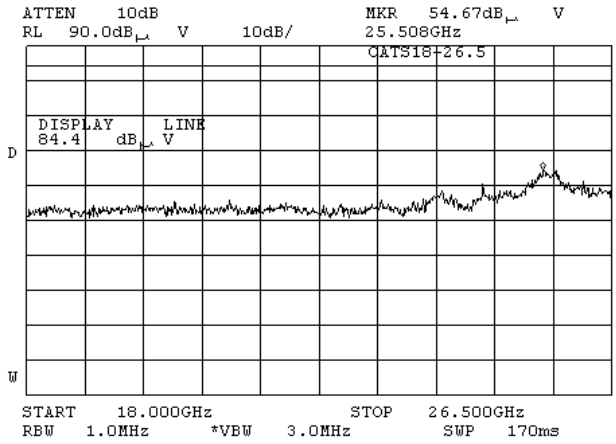
Plot 7.4.22 Radiated emission measurements in 18000 – 26500 MHz range

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



Plot 7.4.23 Radiated emission measurements in 18000 – 26500 MHz range

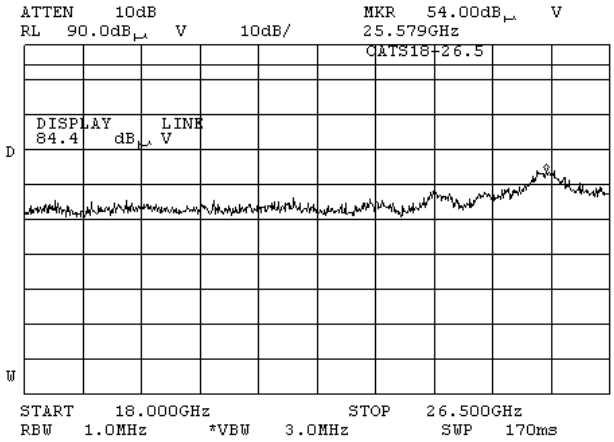
TEST SITE:	OATS
CARRIER FREQUENCY:	Mid
ANTENNA POLARIZATION:	Vertical and Horizontal
TEST DISTANCE:	3 m



Test specification:	Section 90.1323, Radiated spurious emissions		
Test procedure:	47 CFR, Sections 2.1053 and 90.1323; TIA/EIA-603-C, Section 2.2.12		
Test mode:	Compliance	Verdict:	PASS
Date & Time:	3/23/2009 4:28:02 PM		
Temperature: 22ºC	Air Pressure: 1010 hPa	Relative Humidity: 45%	Power Supply: 48 VDC
Remarks:			

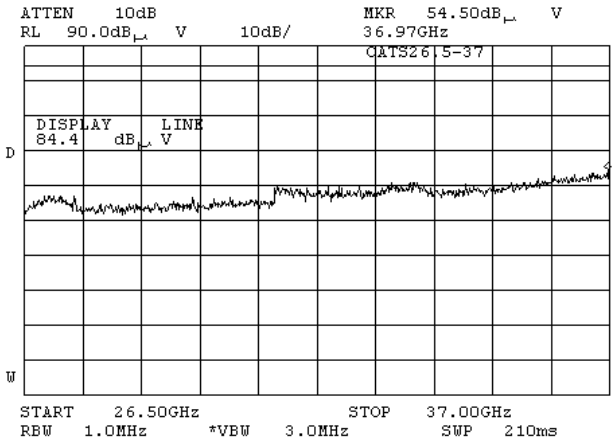
Plot 7.4.24 Radiated emission measurements in 18000 – 26500 MHz range

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



Plot 7.4.25 Radiated emission measurements in 26500 –37000 MHz range

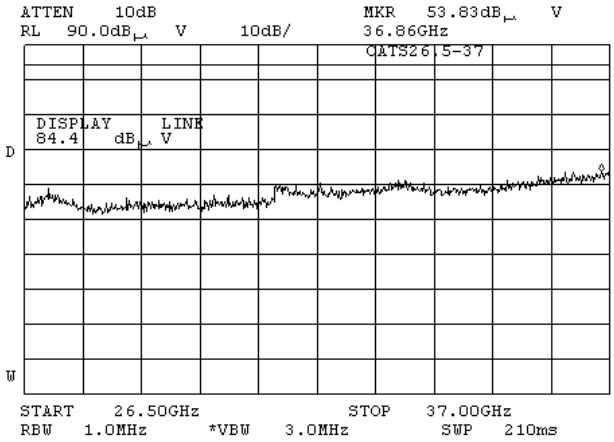
TEST SITE:	OATS
CARRIER FREQUENCY:	Low
ANTENNA POLARIZATION:	Vertical and Horizontal
TEST DISTANCE:	3 m



Test specification:	Section 90.1323, Radiated spurious emissions		
Test procedure:	47 CFR, Sections 2.1053 and 90.1323; TIA/EIA-603-C, Section 2.2.12		
Test mode:	Compliance	Verdict:	PASS
Date & Time:	3/23/2009 4:28:02 PM		
Temperature: 22ºC	Air Pressure: 1010 hPa	Relative Humidity: 45%	Power Supply: 48 VDC
Remarks:			

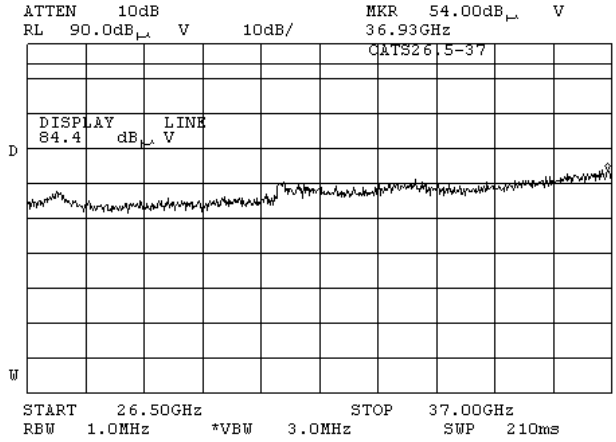
Plot 7.4.26 Radiated emission measurements in 26500 –37000 MHz range

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



Plot 7.4.27 Radiated emission measurements in 26500 –37000 MHz range

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



Test specification:	Section 90.1323, Conducted spurious emissions		
Test procedure:	47 CFR, Sections 2.1051 and 1323; TIA/EIA-603-C, Section 2.2.13		
Test mode:	Compliance	Verdict:	PASS
Date & Time:	3/29/2009 10:30:15 AM		
Temperature: 23ºC	Air Pressure: 1013 hPa	Relative Humidity: 41%	Power Supply: 48 VDC
Remarks:			

7.5 Spurious emissions at RF antenna connector test

7.5.1 General

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

Table 7.5.1 Spurious emission limits

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

* - spurious emission limits do not apply to the in band emission within ± 250 % of the authorized bandwidth from the carrier; investigated in course of emission mask testing
** - P is transmitter output power in Watts

7.5.2 Test procedure

7.5.2.1 The EUT was set up as shown in Figure 7.5.1, energized and its proper operation was checked.
7.5.2.2 The EUT was adjusted to produce maximum available for end user RF output power.
7.5.2.3 The spurious emission was measured with spectrum analyzer as provided in Table 7.5.2 and the associated plots.
7.5.2.4 The EUT was set up as shown in Figure 7.5.2, energized and its proper operation was checked. The test was repeated, the test results were recorded in Table 7.5.3 and the associated plots.

Figure 7.5.1 Spurious emission test setup at antenna 1

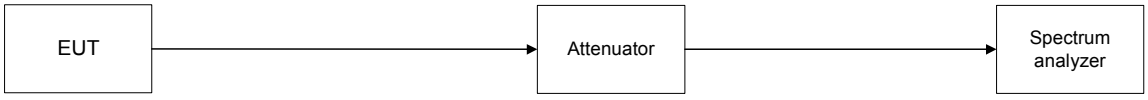
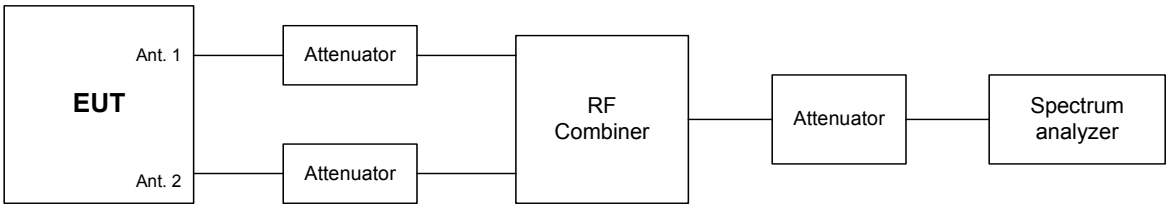


Figure 7.5.2 Spurious emission test setup with combiner



Test specification:	**Section 90.1323, Conducted spurious emissions**		
Test procedure:	47 CFR, Sections 2.1051 and 1323; TIA/EIA-603-C, Section 2.2.13		
Test mode:	Compliance	**Verdict:**	PASS
Date & Time:	3/29/2009 10:30:15 AM		
Temperature: 23ºC	**Air Pressure:** 1013 hPa	**Relative Humidity:** 41%	**Power Supply:** 48 VDC
Remarks: at antenna 1			

Table 7.5.2 Spurious emission test results at Antenna 1

ASSIGNED FREQUENCY RANGE:	3650-3675 MHz
INVESTIGATED FREQUENCY RANGE:	0.009 – 37000 MHz
DETECTOR USED:	Peak
VIDEO BANDWIDTH:	≥ Resolution bandwidth
MODULATION:	64 QAM
MODULATING SIGNAL:	OFDM
BIT RATE:	19.5 Mbps
CHANNEL BANDWIDTH:	10 MHz
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 3655 MHz									
No signals were found									
Mid carrier frequency 3662.5 MHz									
No signals were found									
High carrier frequency 3670 MHz									
No signals were found									

Verdict: Pass

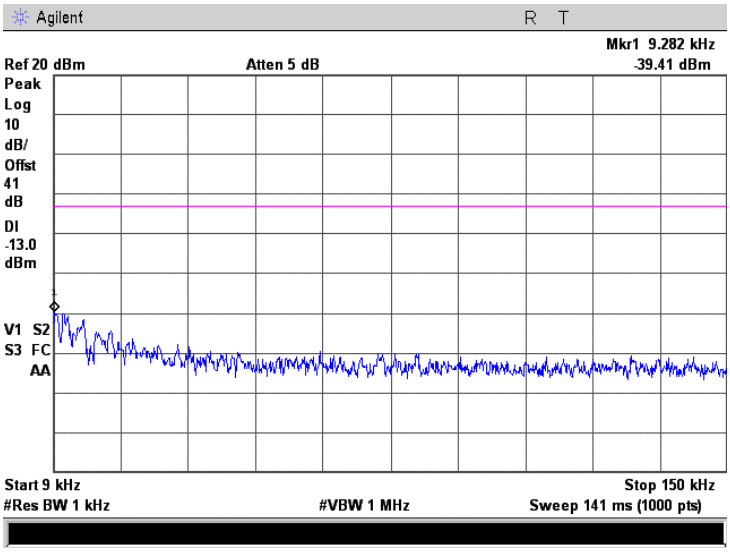
Reference numbers of test equipment used

HL 2909	HL 2911	HL 3439	HL 3441				

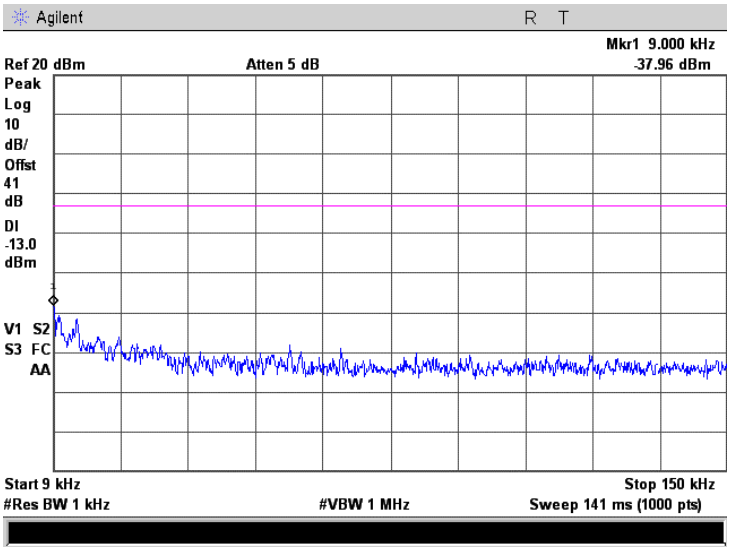
Full description is given in Appendix A.

Test specification:	Section 90.1323, Conducted spurious emissions		
Test procedure:	47 CFR, Sections 2.1051 and 1323; TIA/EIA-603-C, Section 2.2.13		
Test mode:	Compliance	Verdict:	PASS
Date & Time:	3/29/2009 10:30:15 AM		
Temperature: 23ºC	Air Pressure: 1013 hPa	Relative Humidity: 41%	Power Supply: 48 VDC
Remarks: at antenna 1			

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

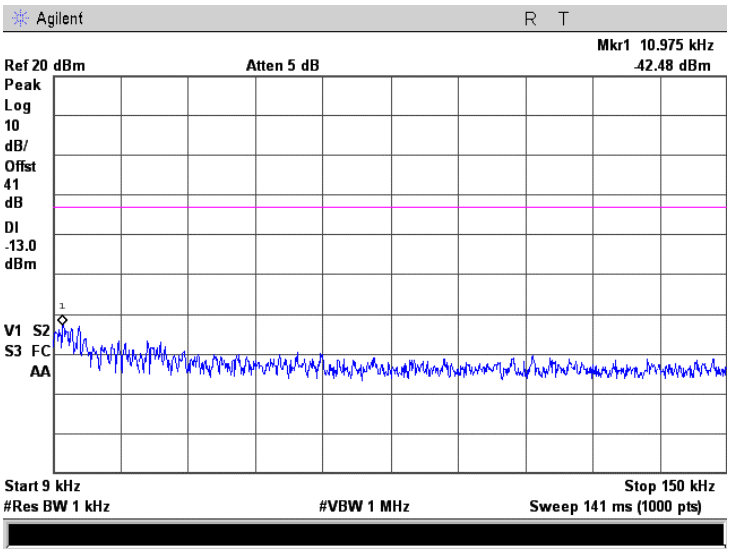


Plot 7.5.2 Spurious emission measurements in 9 - 150 kHz range at mid carrier frequency

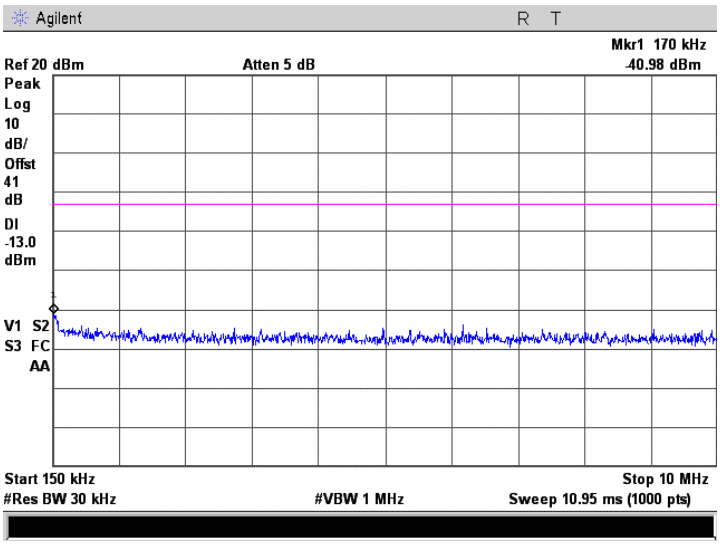


Test specification:	Section 90.1323, Conducted spurious emissions		
Test procedure:	47 CFR, Sections 2.1051 and 1323; TIA/EIA-603-C, Section 2.2.13		
Test mode:	Compliance	Verdict:	PASS
Date & Time:	3/29/2009 10:30:15 AM		
Temperature: 23ºC	Air Pressure: 1013 hPa	Relative Humidity: 41%	Power Supply: 48 VDC
Remarks: at antenna 1			

Plot 7.5.3 Spurious emission measurements in 9 - 150 kHz range at high carrier frequency

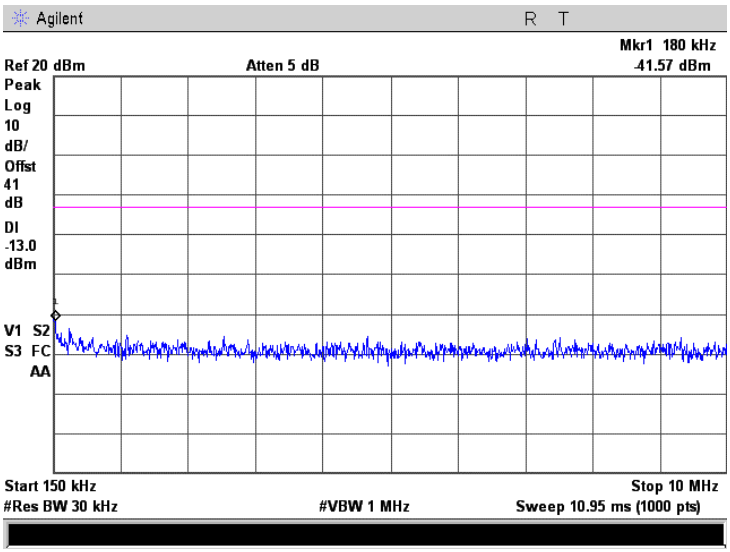


Plot 7.5.4 Spurious emission measurements in 0.15 - 10 MHz range at low carrier frequency

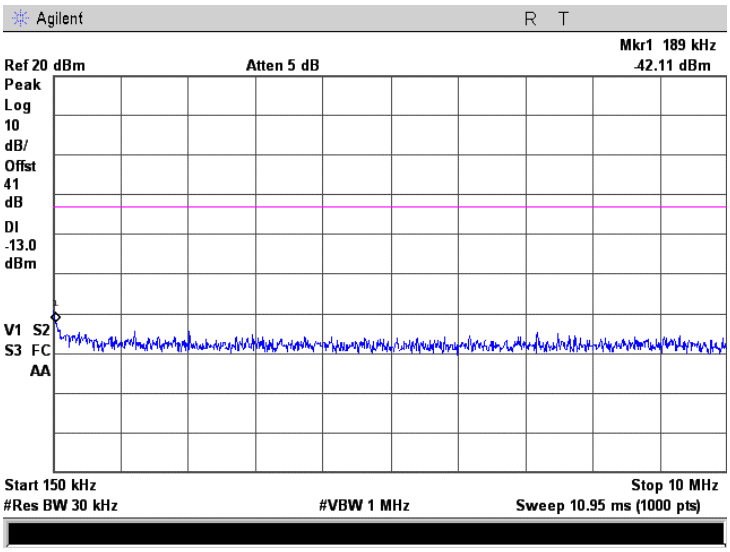


Test specification:	Section 90.1323, Conducted spurious emissions		
Test procedure:	47 CFR, Sections 2.1051 and 1323; TIA/EIA-603-C, Section 2.2.13		
Test mode:	Compliance	Verdict:	PASS
Date & Time:	3/29/2009 10:30:15 AM		
Temperature: 23ºC	Air Pressure: 1013 hPa	Relative Humidity: 41%	Power Supply: 48 VDC
Remarks: at antenna 1			

Plot 7.5.5 Spurious emission measurements in 0.15 - 10 MHz range at mid carrier frequency

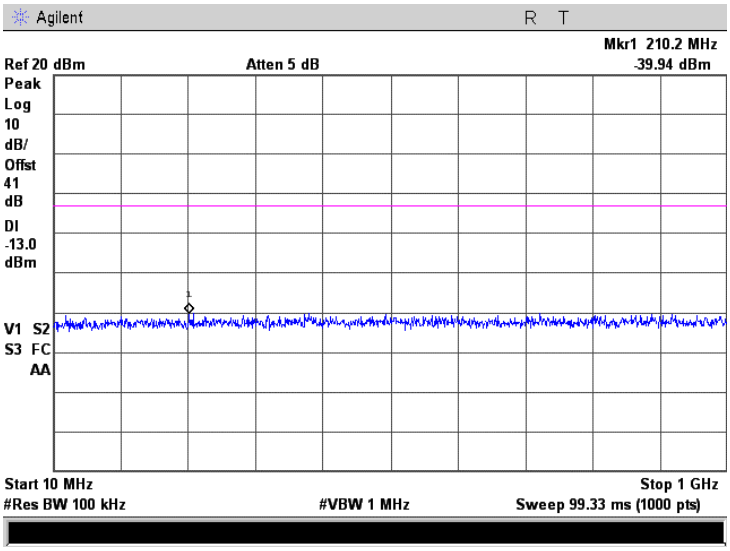


Plot 7.5.6 Spurious emission measurements in 0.15 – 10 MHz range at high carrier frequency

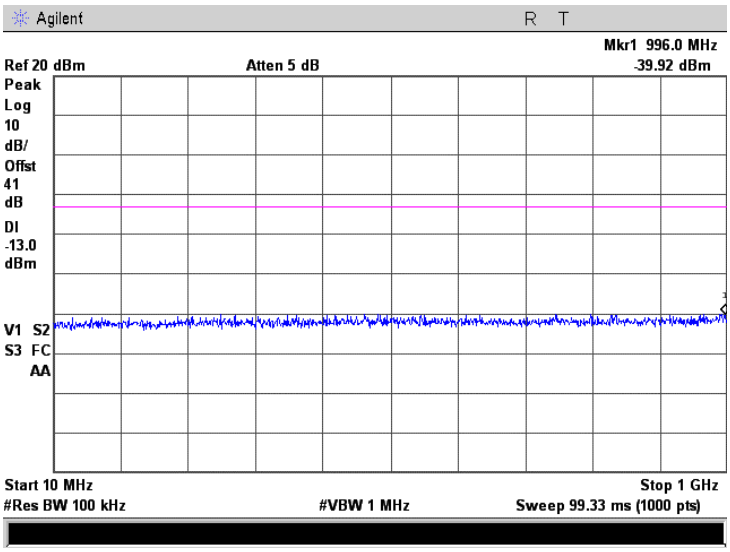


Test specification:	Section 90.1323, Conducted spurious emissions		
Test procedure:	47 CFR, Sections 2.1051 and 1323; TIA/EIA-603-C, Section 2.2.13		
Test mode:	Compliance	Verdict:	PASS
Date & Time:	3/29/2009 10:30:15 AM		
Temperature: 23ºC	Air Pressure: 1013 hPa	Relative Humidity: 41%	Power Supply: 48 VDC
Remarks: at antenna 1			

Plot 7.5.7 Spurious emission measurements in 10 - 1000 MHz range at low carrier frequency

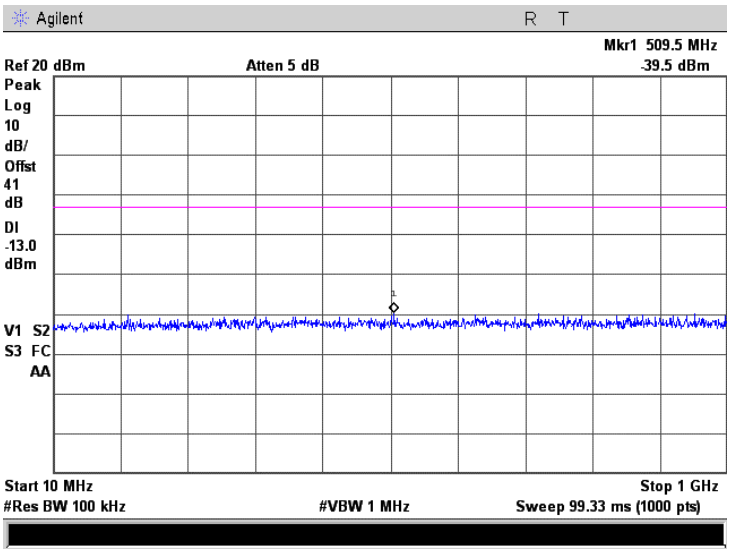


Plot 7.5.8 Spurious emission measurements in 10 - 1000 MHz range at mid carrier frequency

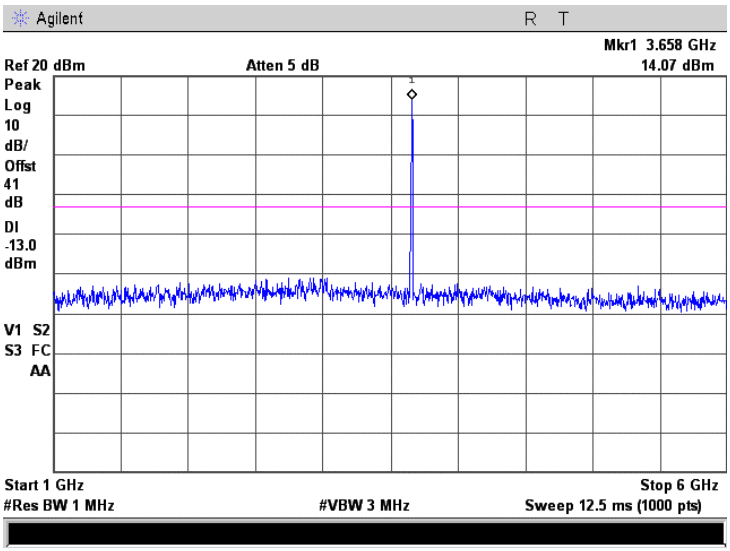


Test specification:	Section 90.1323, Conducted spurious emissions		
Test procedure:	47 CFR, Sections 2.1051 and 1323; TIA/EIA-603-C, Section 2.2.13		
Test mode:	Compliance	Verdict:	PASS
Date & Time:	3/29/2009 10:30:15 AM		
Temperature: 23ºC	Air Pressure: 1013 hPa	Relative Humidity: 41%	Power Supply: 48 VDC
Remarks: at antenna 1			

Plot 7.5.9 Spurious emission measurements in 10 - 1000 MHz range at high carrier frequency

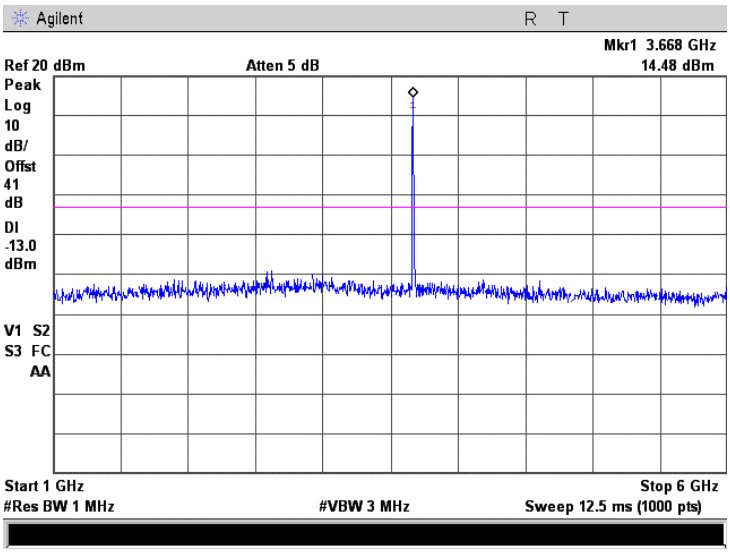


Plot 7.5.10 Spurious emission measurements in 1000 - 6000 MHz range at low carrier frequency

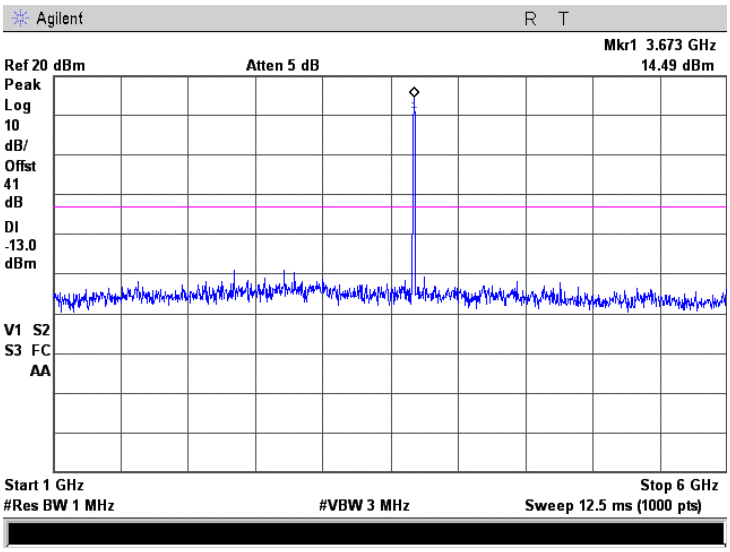


Test specification:	Section 90.1323, Conducted spurious emissions		
Test procedure:	47 CFR, Sections 2.1051 and 1323; TIA/EIA-603-C, Section 2.2.13		
Test mode:	Compliance	Verdict:	PASS
Date & Time:	3/29/2009 10:30:15 AM		
Temperature: 23ºC	Air Pressure: 1013 hPa	Relative Humidity: 41%	Power Supply: 48 VDC
Remarks: at antenna 1			

Plot 7.5.11 Spurious emission measurements in 1000 - 6000 MHz at mid carrier frequency

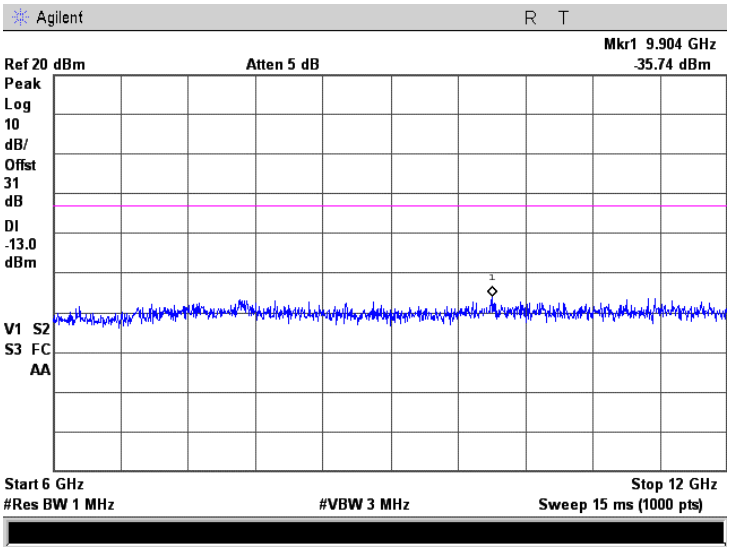


Plot 7.5.12 Spurious emission measurements in 1000 - 6000 MHz at high carrier frequency

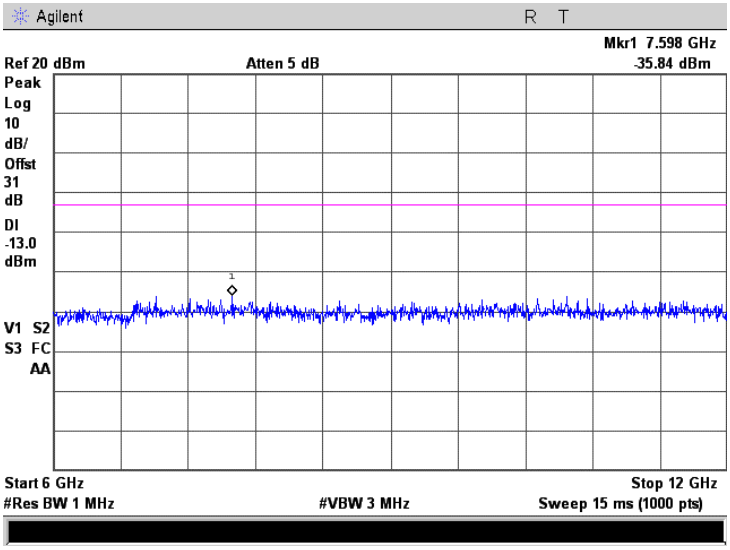


Test specification:	Section 90.1323, Conducted spurious emissions		
Test procedure:	47 CFR, Sections 2.1051 and 1323; TIA/EIA-603-C, Section 2.2.13		
Test mode:	Compliance	Verdict:	PASS
Date & Time:	3/29/2009 10:30:15 AM		
Temperature: 23ºC	Air Pressure: 1013 hPa	Relative Humidity: 41%	Power Supply: 48 VDC
Remarks: at antenna 1			

Plot 7.5.13 Spurious emission measurements in 6000 - 12000 MHz at low carrier frequency

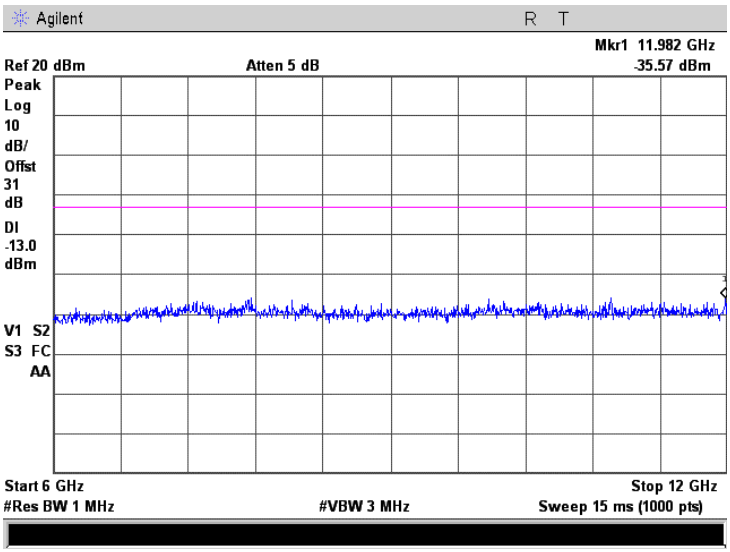


Plot 7.5.14 Spurious emission measurements in 6000 - 12000 MHz at mid carrier frequency

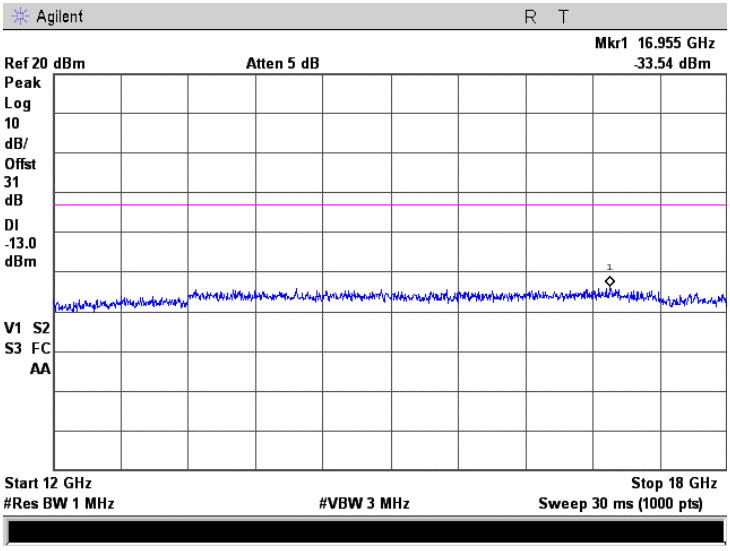


Test specification:	Section 90.1323, Conducted spurious emissions		
Test procedure:	47 CFR, Sections 2.1051 and 1323; TIA/EIA-603-C, Section 2.2.13		
Test mode:	Compliance	Verdict:	PASS
Date & Time:	3/29/2009 10:30:15 AM		
Temperature: 23ºC	Air Pressure: 1013 hPa	Relative Humidity: 41%	Power Supply: 48 VDC
Remarks: at antenna 1			

Plot 7.5.15 Spurious emission measurements in 6000 - 12000 MHz at high carrier frequency

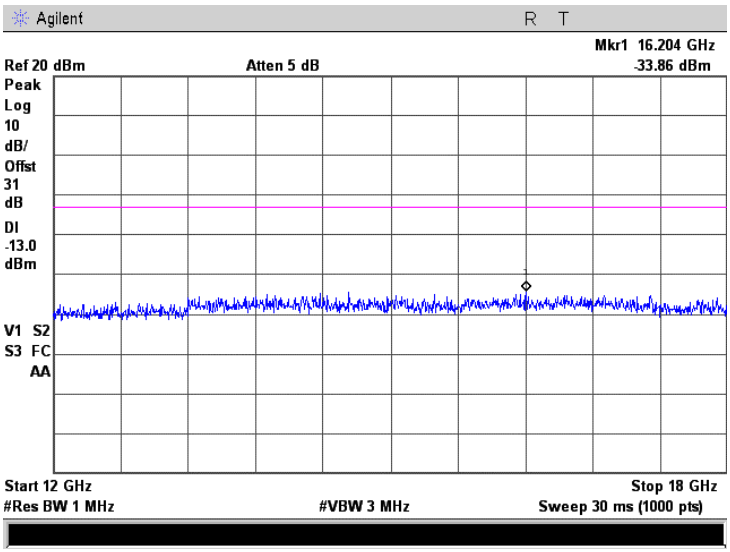


Plot 7.5.16 Spurious emission measurements in 12000 - 18000 MHz at low carrier frequency

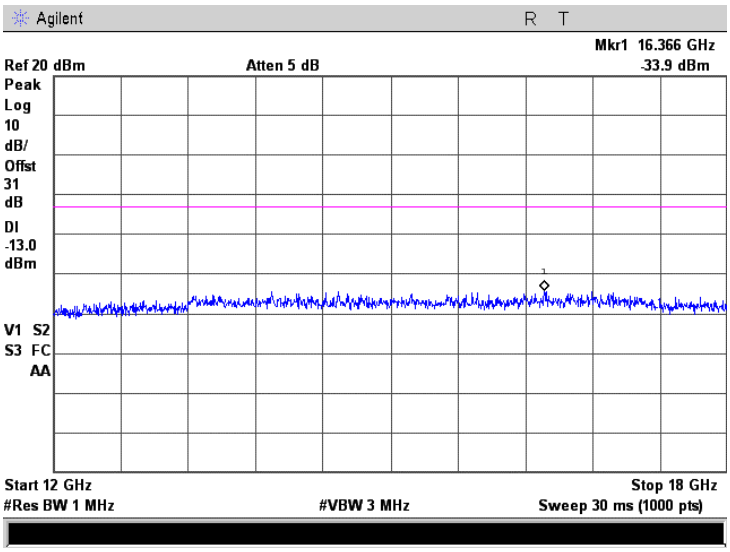


Test specification:	Section 90.1323, Conducted spurious emissions		
Test procedure:	47 CFR, Sections 2.1051 and 1323; TIA/EIA-603-C, Section 2.2.13		
Test mode:	Compliance	Verdict:	PASS
Date & Time:	3/29/2009 10:30:15 AM		
Temperature: 23ºC	Air Pressure: 1013 hPa	Relative Humidity: 41%	Power Supply: 48 VDC
Remarks: at antenna 1			

Plot 7.5.17 Spurious emission measurements in 12000 - 18000 MHz at mid carrier frequency

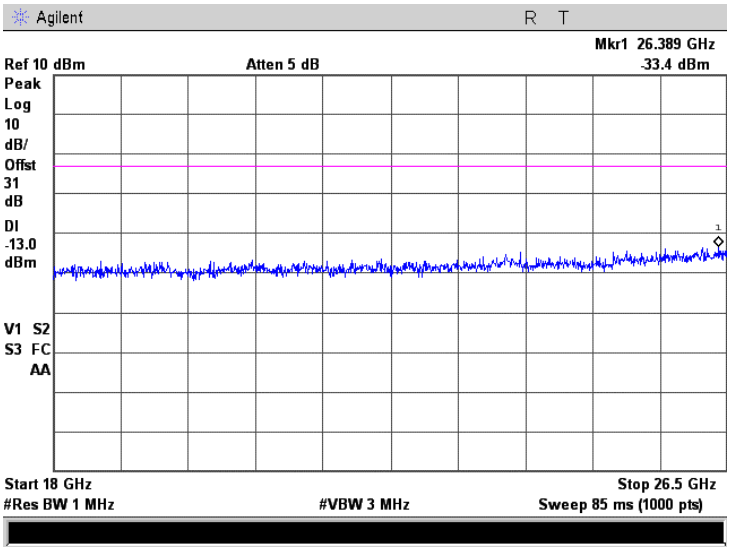


Plot 7.5.18 Spurious emission measurements in 12000 - 18000 MHz at high carrier frequency

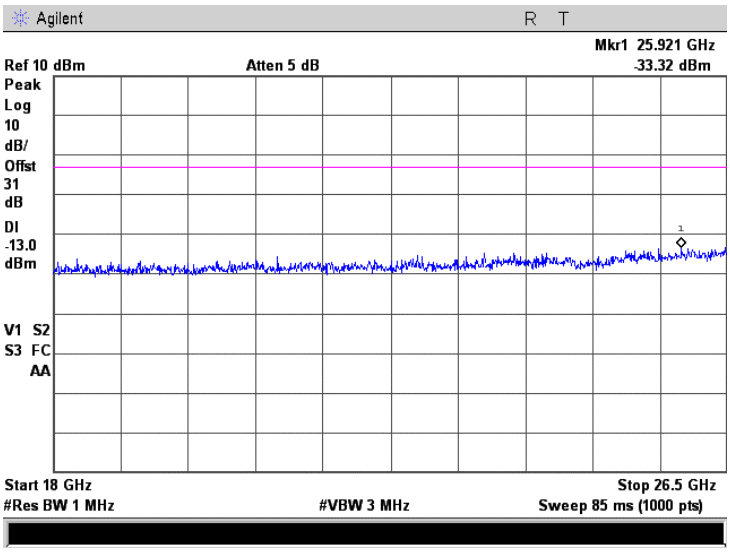


Test specification:	Section 90.1323, Conducted spurious emissions		
Test procedure:	47 CFR, Sections 2.1051 and 1323; TIA/EIA-603-C, Section 2.2.13		
Test mode:	Compliance	Verdict:	PASS
Date & Time:	3/29/2009 10:30:15 AM		
Temperature: 23ºC	Air Pressure: 1013 hPa	Relative Humidity: 41%	Power Supply: 48 VDC
Remarks: at antenna 1			

Plot 7.5.19 Spurious emission measurements in 18000 – 26500 MHz at low carrier frequency

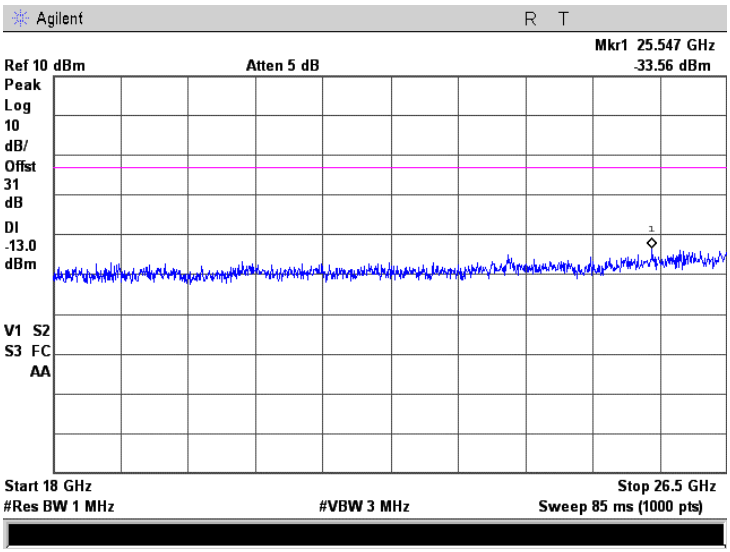


Plot 7.5.20 Spurious emission measurements in 18000 - 26500 MHz at mid carrier frequency

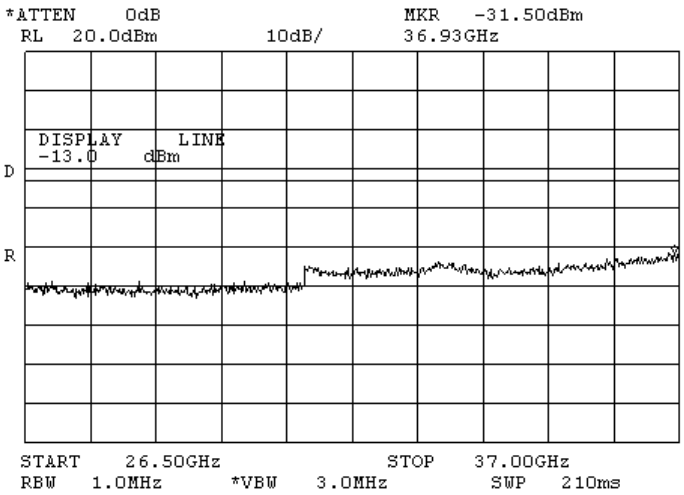


Test specification:	Section 90.1323, Conducted spurious emissions		
Test procedure:	47 CFR, Sections 2.1051 and 1323; TIA/EIA-603-C, Section 2.2.13		
Test mode:	Compliance	Verdict:	PASS
Date & Time:	3/29/2009 10:30:15 AM		
Temperature: 23ºC	Air Pressure: 1013 hPa	Relative Humidity: 41%	Power Supply: 48 VDC
Remarks: at antenna 1			

Plot 7.5.21 Spurious emission measurements in 18000 - 26500 MHz at high carrier frequency

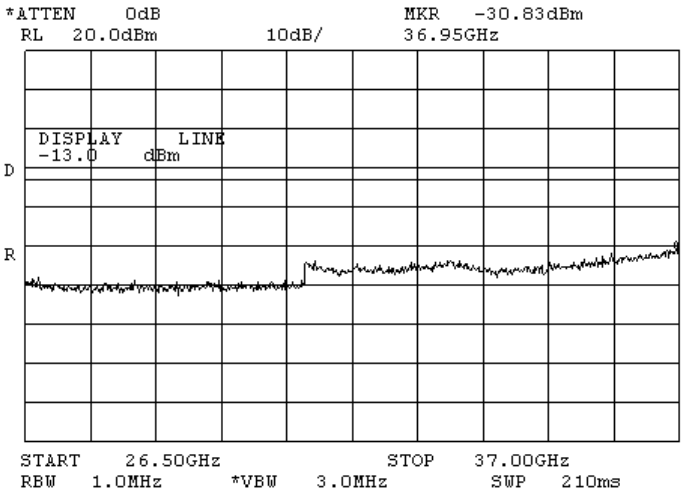


Plot 7.5.22 Spurious emission measurements in 26500 - 37000 MHz at low carrier frequency

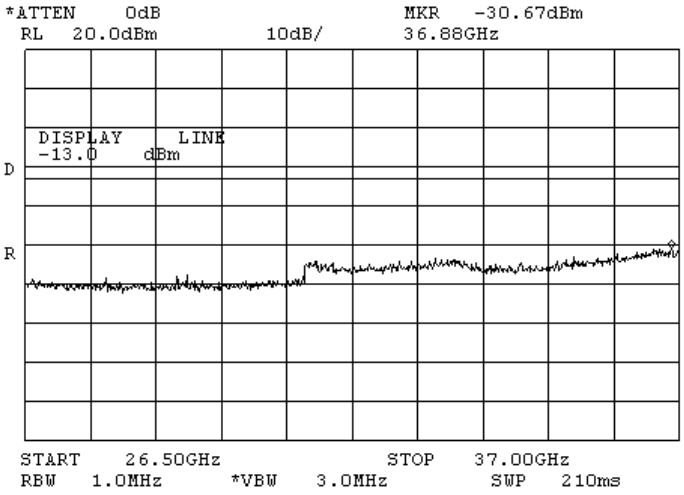


Test specification:	Section 90.1323, Conducted spurious emissions		
Test procedure:	47 CFR, Sections 2.1051 and 1323; TIA/EIA-603-C, Section 2.2.13		
Test mode:	Compliance	Verdict:	PASS
Date & Time:	3/29/2009 10:30:15 AM		
Temperature: 23ºC	Air Pressure: 1013 hPa	Relative Humidity: 41%	Power Supply: 48 VDC
Remarks: at antenna 1			

Plot 7.5.23 Spurious emission measurements in 26500 - 37000 MHz at mid carrier frequency



Plot 7.5.24 Spurious emission measurements in 26500 - 37000 MHz at high carrier frequency



Test specification:	**Section 90.1323, Conducted spurious emissions**		
Test procedure:	47 CFR, Sections 2.1051 and 1323; TIA/EIA-603-C, Section 2.2.13		
Test mode:	Compliance	**Verdict:**	PASS
Date & Time:	3/29/2009 10:30:15 AM		
Temperature: 23ºC	**Air Pressure:** 1013 hPa	**Relative Humidity:** 41%	**Power Supply:** 48 VDC
Remarks: at antenna 1 and antenna 2 via combiner			

Table 7.5.3 Spurious emission test results at Antenna 1 and Antenna 2 (via combiner)

ASSIGNED FREQUENCY RANGE: 3650-3675 MHz
INVESTIGATED FREQUENCY RANGE: 0.5 – 18000 MHz
DETECTOR USED: Peak
VIDEO BANDWIDTH: ≥ Resolution bandwidth
MODULATION: 64 QAM
MODULATING SIGNAL: OFDM
BIT RATE: 19.5 Mbps
CHANNEL BANDWIDTH: 10 MHz
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 3655 MHz									
No signals were found									
Mid carrier frequency 3662.5 MHz									
No signals were found									
High carrier frequency 3670 MHz									
No signals were found									

Verdict: Pass

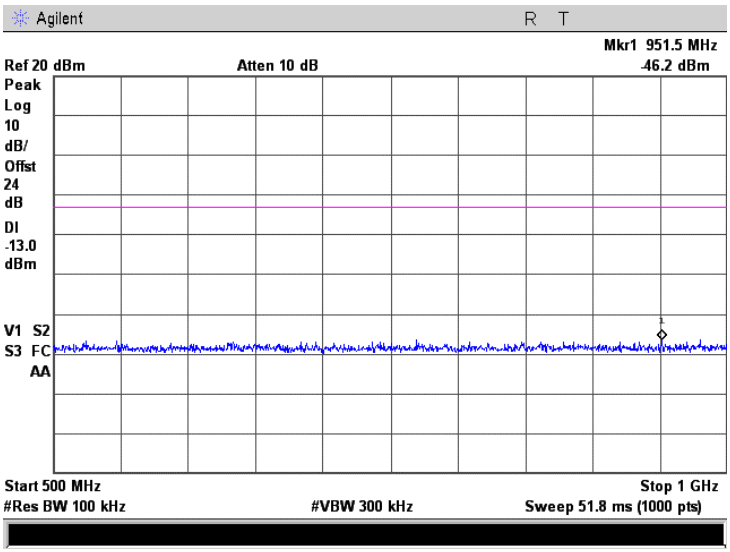
Reference numbers of test equipment used

HL 2013	HL 2909	HL 2911	HL 2952	HL 2953	HL 3439	HL 3441	

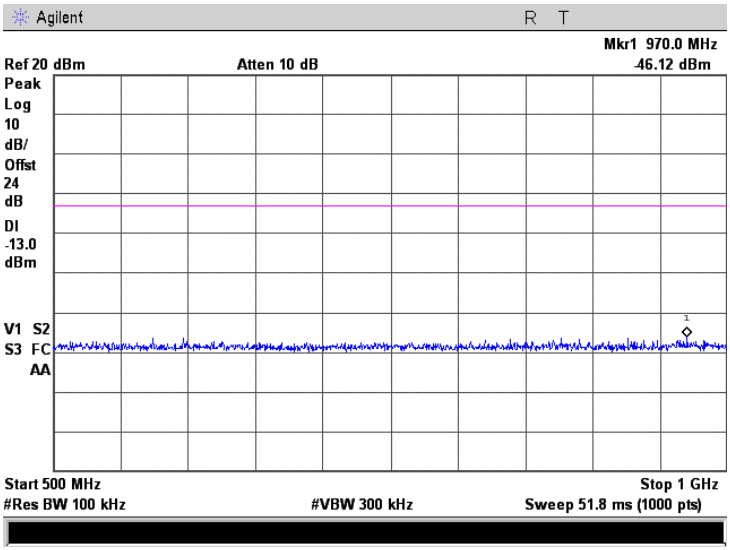
Full description is given in Appendix A.

Test specification:	Section 90.1323, Conducted spurious emissions		
Test procedure:	47 CFR, Sections 2.1051 and 1323; TIA/EIA-603-C, Section 2.2.13		
Test mode:	Compliance	Verdict:	PASS
Date & Time:	3/29/2009 10:30:15 AM		
Temperature: 23ºC	Air Pressure: 1013 hPa	Relative Humidity: 41%	Power Supply: 48 VDC
Remarks: at antenna 1 and antenna 2 via combiner			

Plot 7.5.25 Spurious emission measurements in 500 - 1000 MHz range at low carrier frequency

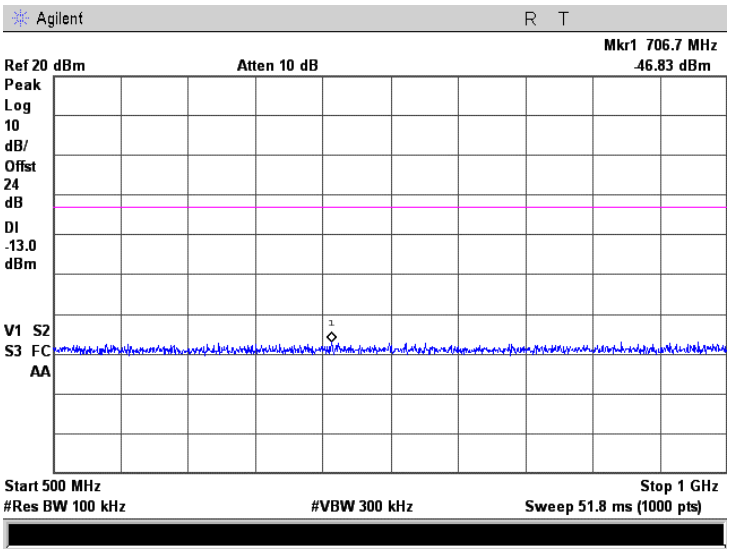


Plot 7.5.26 Spurious emission measurements in 500 - 1000 MHz range at mid carrier frequency

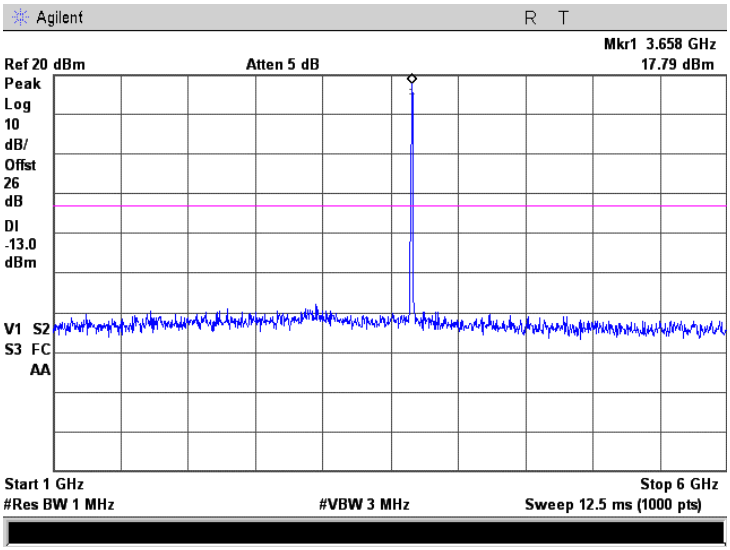


Test specification:	Section 90.1323, Conducted spurious emissions		
Test procedure:	47 CFR, Sections 2.1051 and 1323; TIA/EIA-603-C, Section 2.2.13		
Test mode:	Compliance	Verdict:	PASS
Date & Time:	3/29/2009 10:30:15 AM		
Temperature: 23ºC	Air Pressure: 1013 hPa	Relative Humidity: 41%	Power Supply: 48 VDC
Remarks: at antenna 1 and antenna 2 via combiner			

Plot 7.5.27 Spurious emission measurements in 500 - 1000 MHz range at high carrier frequency

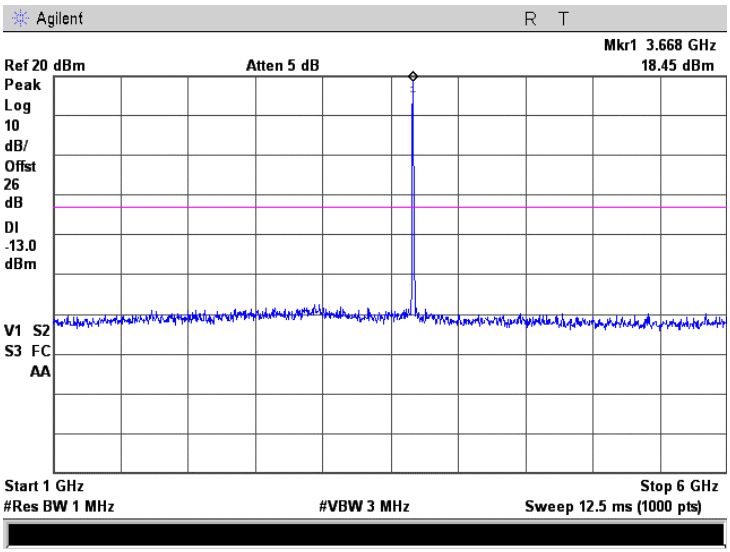


Plot 7.5.28 Spurious emission measurements in 1000 - 6000 MHz range at low carrier frequency

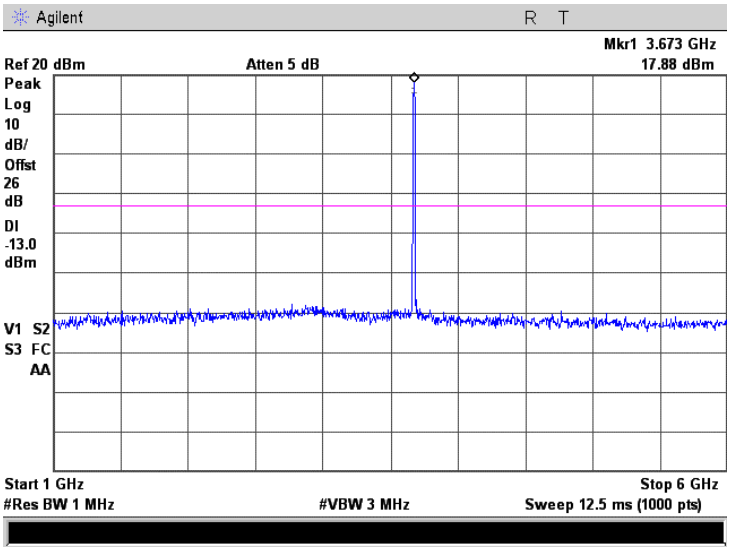


Test specification:	Section 90.1323, Conducted spurious emissions		
Test procedure:	47 CFR, Sections 2.1051 and 1323; TIA/EIA-603-C, Section 2.2.13		
Test mode:	Compliance	Verdict:	PASS
Date & Time:	3/29/2009 10:30:15 AM		
Temperature: 23ºC	Air Pressure: 1013 hPa	Relative Humidity: 41%	Power Supply: 48 VDC
Remarks: at antenna 1 and antenna 2 via combiner			

Plot 7.5.29 Spurious emission measurements in 1000 - 6000 MHz at mid carrier frequency

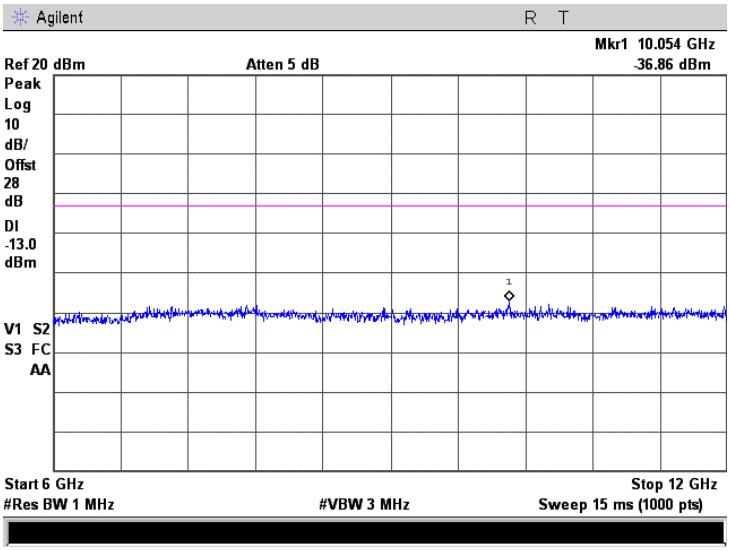


Plot 7.5.30 Spurious emission measurements in 1000 - 6000 MHz at high carrier frequency

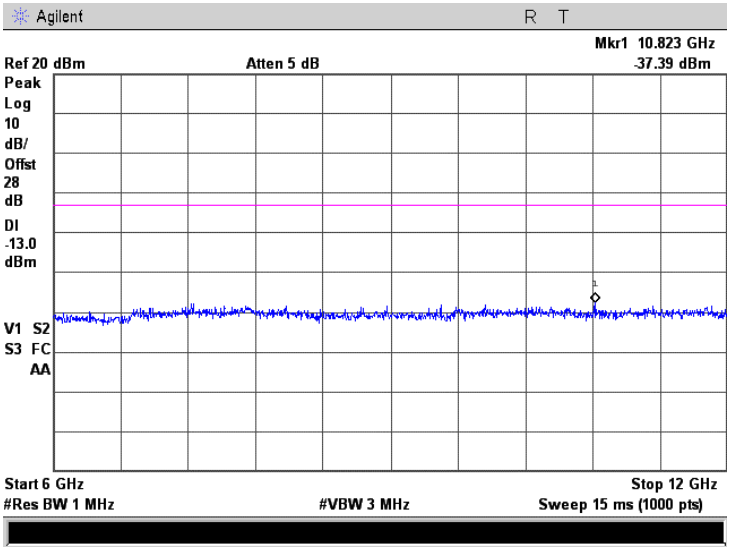


Test specification:	Section 90.1323, Conducted spurious emissions		
Test procedure:	47 CFR, Sections 2.1051 and 1323; TIA/EIA-603-C, Section 2.2.13		
Test mode:	Compliance	Verdict:	PASS
Date & Time:	3/29/2009 10:30:15 AM		
Temperature: 23ºC	Air Pressure: 1013 hPa	Relative Humidity: 41%	Power Supply: 48 VDC
Remarks: at antenna 1 and antenna 2 via combiner			

Plot 7.5.31 Spurious emission measurements in 6000 - 12000 MHz at low carrier frequency

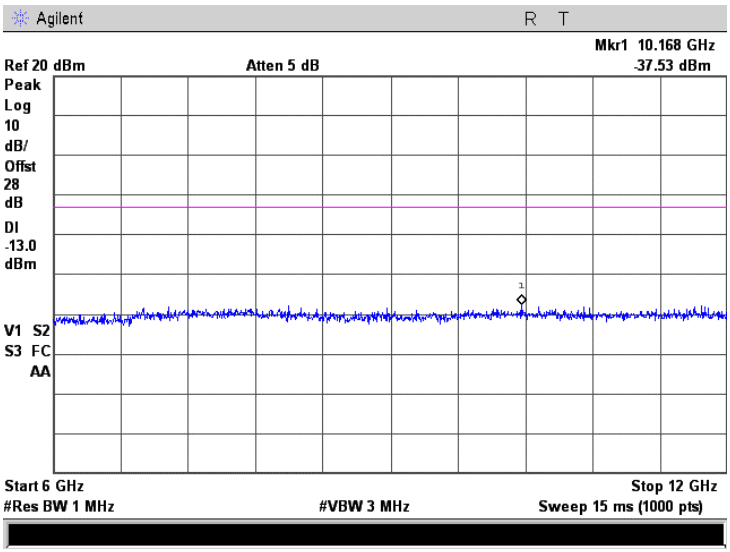


Plot 7.5.32 Spurious emission measurements in 6000 - 12000 MHz at mid carrier frequency

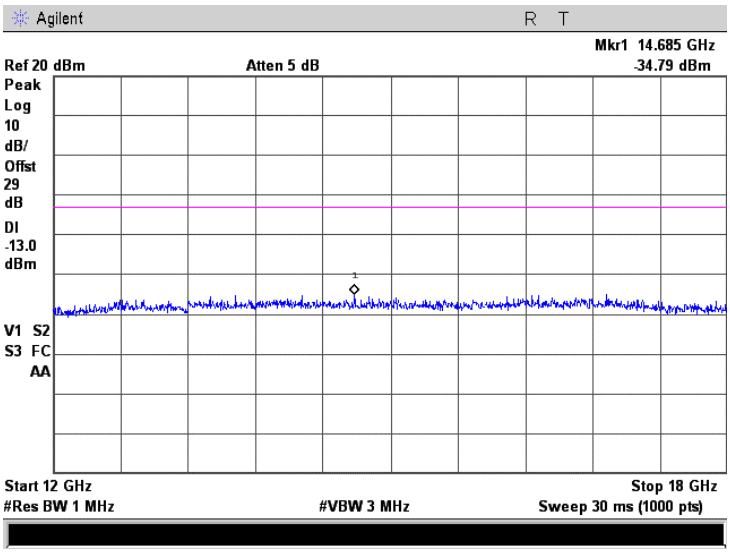


Test specification:	Section 90.1323, Conducted spurious emissions		
Test procedure:	47 CFR, Sections 2.1051 and 1323; TIA/EIA-603-C, Section 2.2.13		
Test mode:	Compliance	Verdict:	PASS
Date & Time:	3/29/2009 10:30:15 AM		
Temperature: 23ºC	Air Pressure: 1013 hPa	Relative Humidity: 41%	Power Supply: 48 VDC
Remarks: at antenna 1 and antenna 2 via combiner			

Plot 7.5.33 Spurious emission measurements in 6000 - 12000 MHz at high carrier frequency

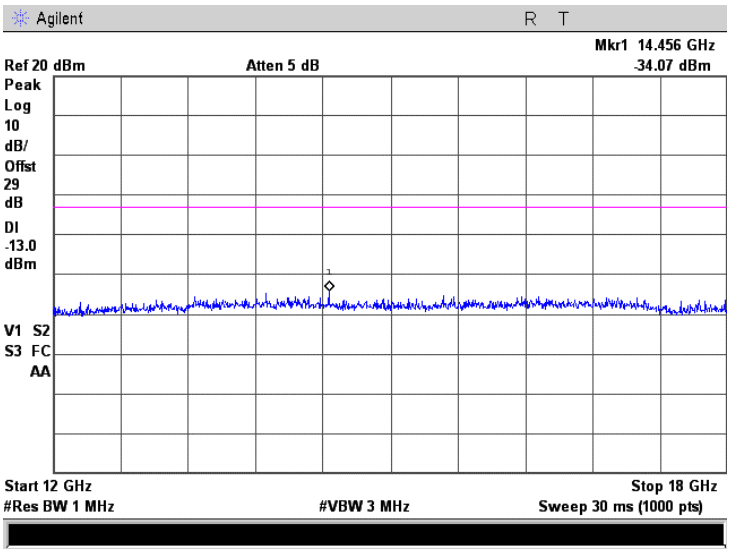


Plot 7.5.34 Spurious emission measurements in 12000 - 18000 MHz at low carrier frequency

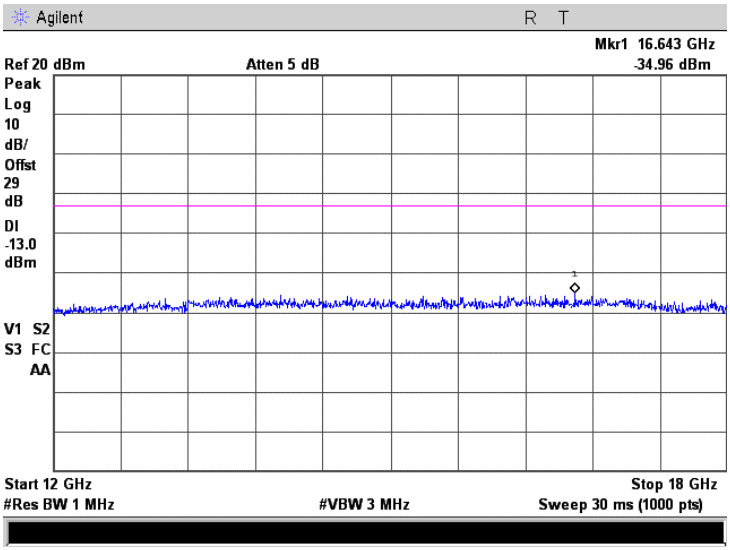


Test specification:	Section 90.1323, Conducted spurious emissions		
Test procedure:	47 CFR, Sections 2.1051 and 1323; TIA/EIA-603-C, Section 2.2.13		
Test mode:	Compliance	Verdict:	PASS
Date & Time:	3/29/2009 10:30:15 AM		
Temperature: 23ºC	Air Pressure: 1013 hPa	Relative Humidity: 41%	Power Supply: 48 VDC
Remarks: at antenna 1 and antenna 2 via combiner			

Plot 7.5.35 Spurious emission measurements in 12000 - 18000 MHz at mid carrier frequency



Plot 7.5.36 Spurious emission measurements in 12000 - 18000 MHz at high carrier frequency



Test specification:	Section 90.213, Frequency stability		
Test procedure:	47 CFR, Section 2.1055; TIA/EIA-603-C Section 2.2.2		
Test mode:	Compliance	Verdict:	PASS
Date & Time:	3/30/2009 1:44:27 PM		
Temperature: 23ºC	Air Pressure: 1012 hPa	Relative Humidity: 46%	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	
	ppm	Hz
3652.5	20	73050
3662.5		73300
3672.5		73450

7.6.2 Test procedure

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

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

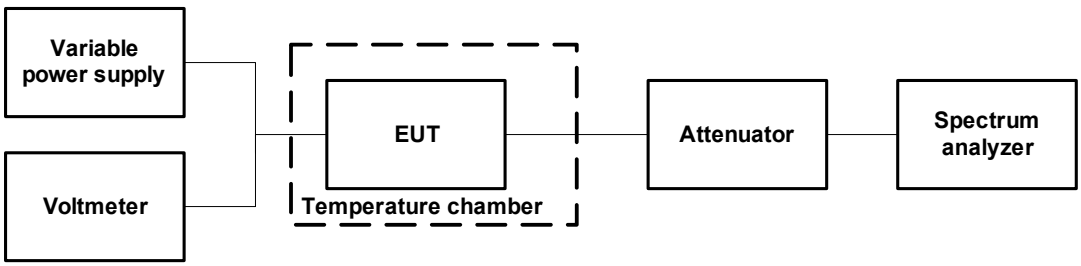
7.6.2.3 The EUT was powered on and carrier frequency was measured at start up moment and then every minute until frequency had been stabilized or 10 minutes elapsed whichever reached the last. The EUT was powered off.

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

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

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

Figure 7.6.1 Frequency stability test setup



Test specification:	**Section 90.213, Frequency stability**		
Test procedure:	47 CFR, Section 2.1055; TIA/EIA-603-C Section 2.2.2		
Test mode:	Compliance	**Verdict:**	PASS
Date & Time:	3/30/2009 1:44:27 PM		
Temperature: 23ºC	**Air Pressure:** 1012 hPa	**Relative Humidity:** 46%	**Power Supply:** 48 VDC
Remarks:			

Table 7.6.2 Frequency stability test results

OPERATING FREQUENCY: 3650 – 3675 MHz
NOMINAL POWER VOLTAGE: 48 VDC
TEMPERATURE STABILIZATION PERIOD: 20 min
POWER DURING TEMPERATURE TRANSITION: Off
SPECTRUM ANALYZER MODE: Peak Hold
RESOLUTION BANDWIDTH: 100 Hz
VIDEO BANDWIDTH: 300 Hz
MODULATION: Unmodulated

T, ºC	Voltage V	Frequency, MHz							Max frequency drift, Hz		Limit, Hz	Margin, Hz	Verdict
		Start up	1st min	2nd min	3rd min	4th min	5th min	10th min	Positive	Negative			
Low frequency 3652.5 MHz													
-30	48	3652.49800	3652.49820	3652.49825	3652.49840	3652.49845	3652.49851	3652.49855	1350	0		-71700	Pass
-20	48	3652.49975	3652.49988	3652.49992	3652.49993	3652.49994	3652.49995	3652.49995	2750	0		-70300	Pass
-10	48	3652.50002	3652.50004	3652.50005	3652.50007	3652.50008	3652.50009	3652.50010	2900	0		-70150	Pass
0	48	3652.50012	3652.50035	3652.50045	3652.50052	3652.50055	3652.50057	3652.50062	3420	0		-69630	Pass
10	48	3652.50061	3652.50060	3652.50059	3652.50057	3652.50056	3652.50055	3652.50055	3350	60		-69700	Pass
20	55.2	3652.49965	3652.49957	3652.49948	3652.49945	3652.49941	3652.49937	3652.49720	2450	0	73050	-70600	Pass
20	48	3652.49960	3652.49957	3652.49948	3652.49945	3652.49941	3652.49937	**3652.49720***	2400	0		-70650	Pass
20	40.8	3652.49958	3652.49957	3652.49948	3652.49945	3652.49941	3652.49937	3652.49720	2380	0		-70670	Pass
30	48	3652.49835	3652.49823	3652.49820	3652.49818	3652.49818	3652.49818	3652.49818	1150	0		-71900	Pass
40	48	3652.49748	3652.49739	3652.49731	3652.49727	3652.49722	3652.49719	3652.49715	280	50		-72770	Pass
50	48	3652.49743	3652.49700	3652.49688	3652.49675	3652.49661	3652.49643	3652.49625	230	950		-72100	Pass
Mid frequency 3662.5 MHz													
-30	48	3662.49800	3662.49815	3662.49825	3662.49830	3662.49835	3662.49840	3662.49845	0	1410		-71890	Pass
-20	48	3662.49975	3662.49985	3662.49990	3662.49990	3662.49990	3662.49995	3662.49995	540	0		-72760	Pass
-10	48	3662.50002	3662.50003	3662.50005	3662.50006	3662.50007	3662.50008	3662.50010	690	0		-72610	Pass
0	48	3662.50026	3662.50032	3662.50039	3662.50048	3662.50055	3662.50061	3662.50065	240	0		-73060	Pass
10	48	3662.50060	3662.50059	3662.50058	3662.50057	3662.50056	3662.50055	3662.50055	190	0		-73110	Pass
20	55.2	3662.49981	3662.49962	3662.49957	3662.49950	3662.49947	3662.49944	3662.49941	400	0	73300	-72900	Pass
20	48	3662.49981	3662.49962	3662.49957	3662.49950	3662.49947	3662.49944	**3662.49941***	400	0		-72900	Pass
20	40.8	3662.49981	3662.49962	3662.49957	3662.49950	3662.49947	3662.49944	3662.49941	400	0		-72900	Pass
30	48	3662.49812	3662.49805	3662.49803	3662.49805	3662.49808	3662.49808	3662.49813	0	1280		-72020	Pass
40	48	3662.49790	3662.49768	3662.49751	3662.49745	3662.49737	3662.49730	3662.49728	0	2130		-71170	Pass
50	48	3662.49650	3662.49628	3662.49622	3662.49618	3662.49610	3662.49607	3662.49605	0	3360		-69940	Pass
High frequency 3672.5 MHz													
-30	48	3672.49785	3672.49790	3672.49795	3672.49805	3672.49815	3672.49820	3672.49830	0	1570		-71880	Pass
-20	48	3672.49980	3672.49985	3672.49985	3672.49985	3672.49985	3672.49990	3672.49990	480	0		-72970	Pass
-10	48	3672.50002	3672.50004	3672.50005	3672.50006	3672.50007	3672.50007	3672.50009	670	0		-72780	Pass
0	48	3672.50030	3672.50039	3672.50055	3672.50060	3672.50062	3672.50064	3672.50065	1230	0		-72220	Pass
10	48	3672.50060	3672.50059	3672.50058	3672.50058	3672.50057	3672.50057	3672.50057	1180	0		-72270	Pass
20	55.2	3672.49980	3672.49960	3672.49955	3672.49952	3672.49950	3672.49947	3672.49942	380	0	73450	-73070	Pass
20	48	3672.49980	3672.49960	3672.49955	3672.49952	3672.49950	3672.49947	**3672.49942***	380	0		-73070	Pass
20	40.8	3672.49980	3672.49960	3672.49955	3672.49952	3672.49950	3672.49947	3672.49942	380	0		-73070	Pass
30	48	3672.49838	3672.49828	3672.49825	3672.49823	3672.49820	3672.49818	3672.49817	0	1250		-72200	Pass
40	48	3672.49853	3672.49848	3672.49833	3672.49808	3672.49791	3672.49777	3672.49772	0	1700		-71750	Pass
50	48	3672.49650	3672.49630	3672.49617	3672.496	3672.49612	3672.49610	3672.49605	0	3370		-70080	Pass

* - Reference frequency

Reference numbers of test equipment used

HL 0493	HL 2909	HL 2911	HL 3310	HL 3439	HL 3441		

Full description is given in Appendix A.

Test specification:	Section 15.107, Conducted emission at AC power port		
Test procedure:	ANSI C63.4, Sections 11.5 and 12.1.3		
Test mode:	Compliance	Verdict:	PASS
Date & Time:	3/29/2009 2:35:40 PM		
Temperature: 23ºC	Air Pressure: 1013 hPa	Relative Humidity: 41%	Power Supply: 48 VDC
Remarks:			

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

8.1 Conducted emissions

8.1.1 General

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

Table 8.1.1 Limits for conducted emissions

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

* The limit decreases linearly with the logarithm of frequency.

8.1.2 Test procedure

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

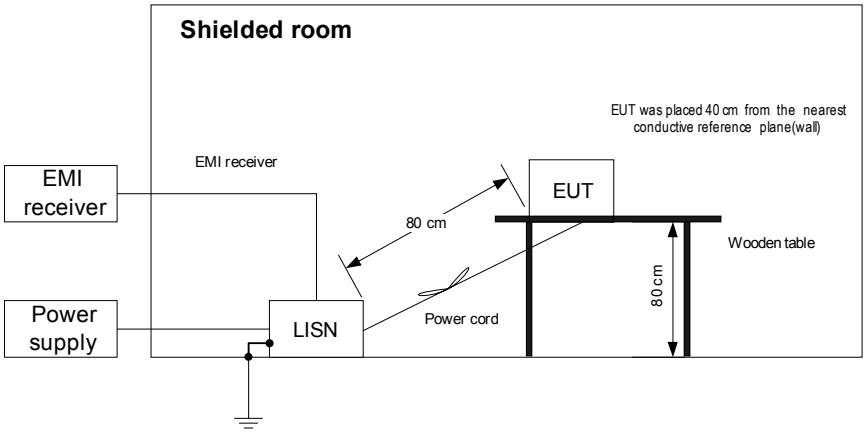
8.1.2.2 The measurements were performed at power terminals with the LISN, connected to a spectrum analyzer in the frequency range referred to in Table 8.1.2. Unused coaxial connector of the LISN was terminated with 50 Ohm. Quasi-peak and average detectors were used throughout the testing.

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

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

Test specification:	Section 15.107, Conducted emission at AC power port		
Test procedure:	ANSI C63.4, Sections 11.5 and 12.1.3		
Test mode:	Compliance	Verdict:	PASS
Date & Time:	3/29/2009 2:35:40 PM		
Temperature: 23ºC	Air Pressure: 1013 hPa	Relative Humidity: 41%	Power Supply: 48 VDC
Remarks:			

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



Test specification:	**Section 15.107, Conducted emission at AC power port**		
Test procedure:	ANSI C63.4, Sections 11.5 and 12.1.3		
Test mode:	Compliance	**Verdict:**	PASS
Date & Time:	3/29/2009 2:35:40 PM		
Temperature: 23ºC	**Air Pressure:** 1013 hPa	**Relative Humidity:** 41%	**Power Supply:** 48 VDC
Remarks:			

Table 8.1.2 Conducted emission test results

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

Frequency, MHz	Peak emission, dB(µV)	Quasi-peak			Average			Line ID	Verdict
		Measured emission, dB(µV)	Limit, dB(µV)	Margin, dB*	Measured emission, dB(µV)	Limit, dB(µV)	Margin, dB*		
0.150750	53.11	52.26	65.96	-13.70	46.23	55.96	-9.73	L1	Pass
0.202500	47.51	46.47	63.56	-17.09	40.63	53.56	-12.93		
0.253195	42.94	41.72	61.69	-19.97	37.69	51.69	-14.00		
0.303820	41.71	40.54	60.16	-19.62	38.36	50.16	-11.80		
0.353820	40.59	39.14	58.93	-19.79	36.34	48.93	-12.59		
0.453820	39.95	37.77	56.86	-19.09	34.52	46.86	-12.34		
0.150950	53.18	52.43	65.95	-13.52	40.20	55.95	-15.75	L2	Pass
0.201800	47.46	46.57	63.58	-17.01	34.69	53.58	-18.89		
0.252100	42.73	41.67	61.72	-20.05	28.58	51.72	-23.14		
0.281835	46.09	44.98	60.82	-15.84	42.95	50.82	-7.87		
0.353045	40.57	39.07	58.95	-19.88	33.20	48.95	-15.75		
0.453750	40.10	38.62	56.86	-18.24	35.08	46.86	-11.78		

*- Margin = Measured emission - specification limit.

Reference numbers of test equipment used

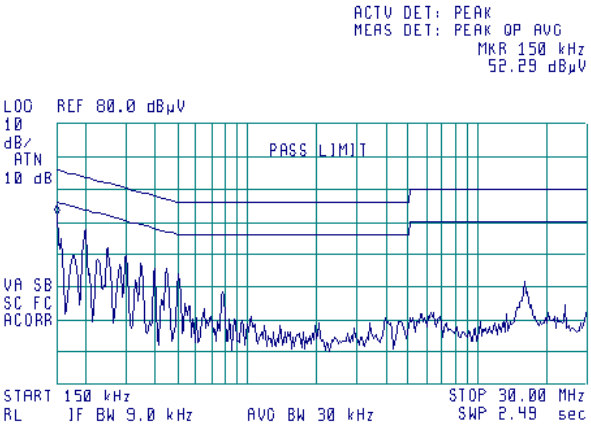
HL 0787	HL 1430	HL 1553	HL 2888	HL 3016	HL 3612		

Full description is given in Appendix A.

Test specification:	Section 15.107, Conducted emission at AC power port		
Test procedure:	ANSI C63.4, Sections 11.5 and 12.1.3		
Test mode:	Compliance	Verdict:	PASS
Date & Time:	3/29/2009 2:35:40 PM		
Temperature: 23ºC	Air Pressure: 1013 hPa	Relative Humidity: 41%	Power Supply: 48 VDC
Remarks:			

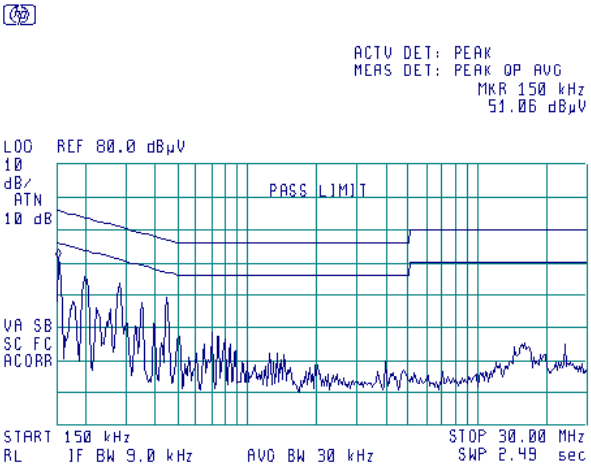
Plot 8.1.1 Conducted emission measurements

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



Plot 8.1.2 Conducted emission measurements

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



Test specification:	Section 15.109, Radiated emission		
Test procedure:	ANSI C63.4, Sections 11.6 and 12.1.4		
Test mode:	Compliance	Verdict:	PASS
Date & Time:	4/3/2009 11:51:30 AM		
Temperature: 23ºC	Air Pressure: 1009 hPa	Relative Humidity: 48%	Power Supply: 48 VDC
Remarks:			

8.2 Radiated emission measurements

8.2.1 General

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

Table 8.2.1 Radiated emission test limits

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

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

8.2.2 Test procedure

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

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

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

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

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

Test specification:	Section 15.109, Radiated emission		
Test procedure:	ANSI C63.4, Sections 11.6 and 12.1.4		
Test mode:	Compliance	Verdict:	PASS
Date & Time:	4/3/2009 11:51:30 AM		
Temperature: 23ºC	Air Pressure: 1009 hPa	Relative Humidity: 48%	Power Supply: 48 VDC
Remarks:			

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

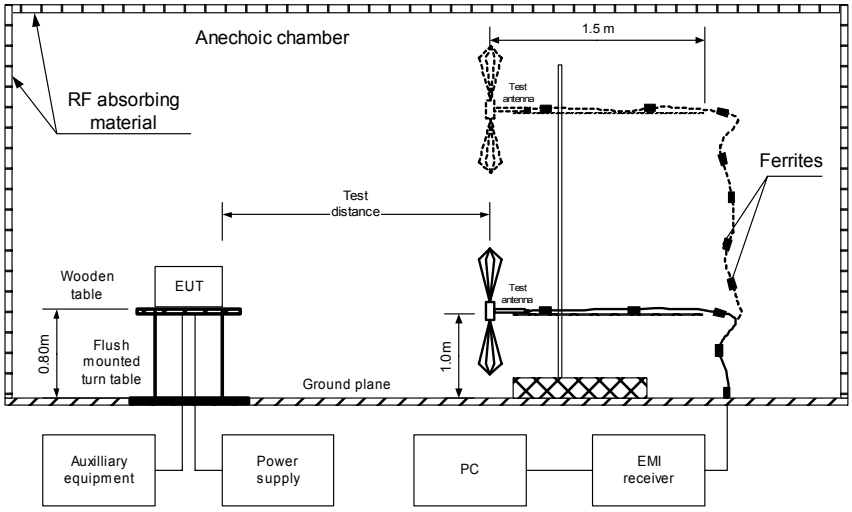
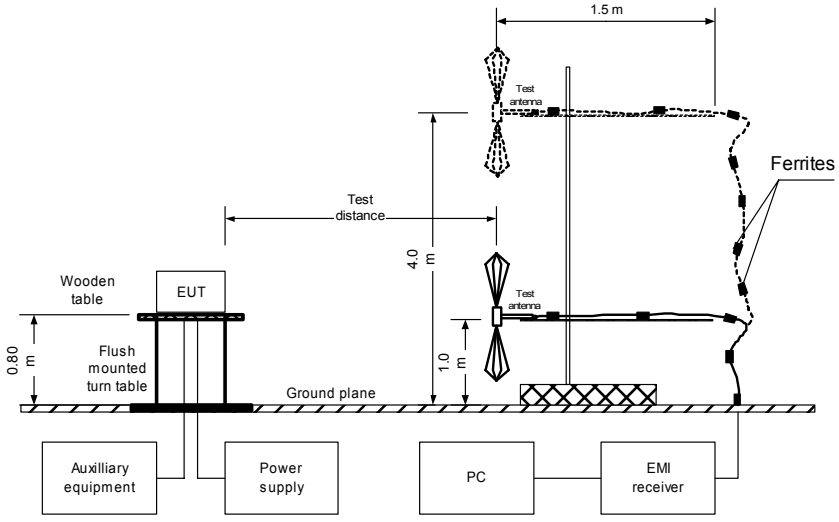


Figure 8.2.2 Setup for radiated emission measurements at OATS, table-top equipment



Test specification:	**Section 15.109, Radiated emission**		
Test procedure:	ANSI C63.4, Sections 11.6 and 12.1.4		
Test mode:	Compliance	**Verdict:**	PASS
Date & Time:	4/3/2009 11:51:30 AM		
Temperature: 23ºC	**Air Pressure:** 1009 hPa	**Relative Humidity:** 48%	**Power Supply:** 48 VDC
Remarks:			

Table 8.2.2 Radiated emission test results

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

Frequency, MHz	Peak emission, dB(µV/m)	Quasi-peak			Antenna polarization	Antenna height, m	Turn-table position**, degrees	Verdict
		Measured emission, dB(µV/m)	Limit, dB(µV/m)	Margin, dB*				
197.9999	41.40	39.04	43.50	-4.46	H	1.4	280	PASS
274.9949	42.70	41.56	46.00	-4.44	H	1.2	330	
299.9898	41.34	40.20	46.00	-5.80	H	1.2	78	
324.9926	41.44	40.06	46.00	-5.94	H	1.1	331	
329.9916	39.96	38.52	46.00	-7.48	H	1.2	230	
374.9771	44.13	42.96	46.00	-3.04	H	1.2	20	
594.0048	45.57	43.83	46.00	-2.17	H	1.5	62	
990.01440	48.71	46.74	54.00	-7.26	V	1.2	120	

TEST SITE: OATS
TEST DISTANCE: 3 m
DETECTORS USED: PEAK / AVERAGE
FREQUENCY RANGE: 1000 MHz – 18000 MHz
RESOLUTION BANDWIDTH: 1000 kHz

Frequency, MHz	Peak			Average			Antenna polarization	Antenna height, m	Turn-table position**, degrees	Verdict
	Measured emission, dB(µV/m)	Limit, dB(µV/m)	Margin, dB*	Measured emission, dB(µV/m)	Limit, dB(µV/m)	Margin, dB*				
1649.9925	52.9	74	-21.1	46.5	54	-7.5	H	1.3	64	PASS

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

Reference numbers of test equipment used

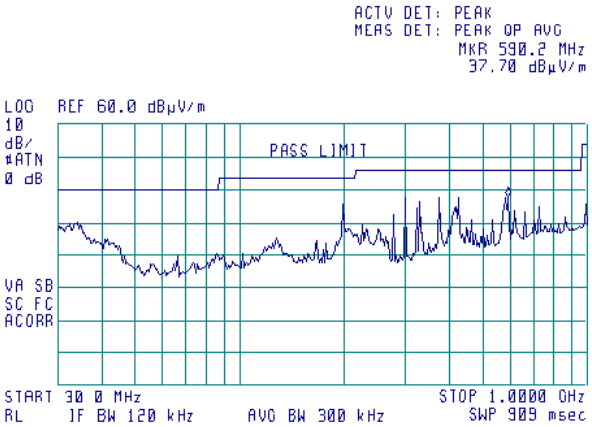
HL 0032	HL 0415	HL 0569	HL 0812	HL 1430	HL 1984	HL 2432	HL 2697
HL 2882	HL 3119	HL 3531	HL 3534				

Full description is given in Appendix A.

Test specification:	Section 15.109, Radiated emission		
Test procedure:	ANSI C63.4, Sections 11.6 and 12.1.4		
Test mode:	Compliance	Verdict:	PASS
Date & Time:	4/3/2009 11:51:30 AM		
Temperature: 23ºC	Air Pressure: 1009 hPa	Relative Humidity: 48%	Power Supply: 48 VDC
Remarks:			

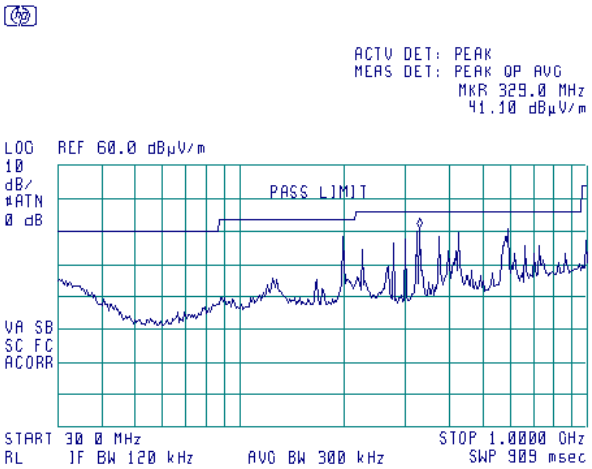
Plot 8.2.1 Radiated emission measurements in 30 - 1000 MHz range

TEST SITE:	Anechoic chamber
LIMIT:	Class B
TEST DISTANCE:	3 m
EUT OPERATING MODE:	Receive
ANTENNA POLARIZATION	Vertical



Plot 8.2.2 Radiated emission measurements in 30 - 1000 MHz range

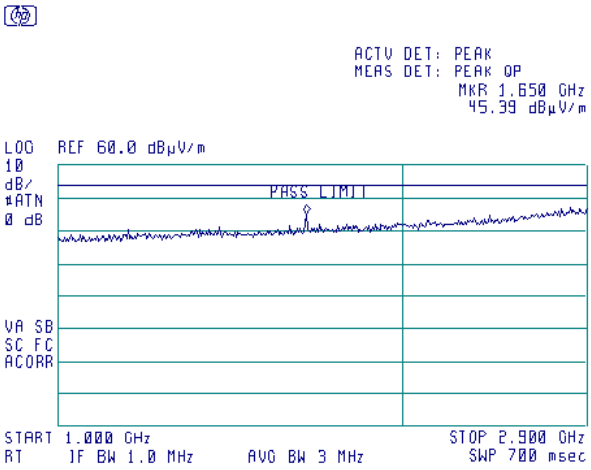
TEST SITE:	Anechoic chamber
LIMIT:	Class B
TEST DISTANCE:	3 m
EUT OPERATING MODE:	Receive
ANTENNA POLARIZATION	Horizontal



Test specification:	Section 15.109, Radiated emission		
Test procedure:	ANSI C63.4, Sections 11.6 and 12.1.4		
Test mode:	Compliance	Verdict:	PASS
Date & Time:	4/3/2009 11:51:30 AM		
Temperature: 23ºC	Air Pressure: 1009 hPa	Relative Humidity: 48%	Power Supply: 48 VDC
Remarks:			

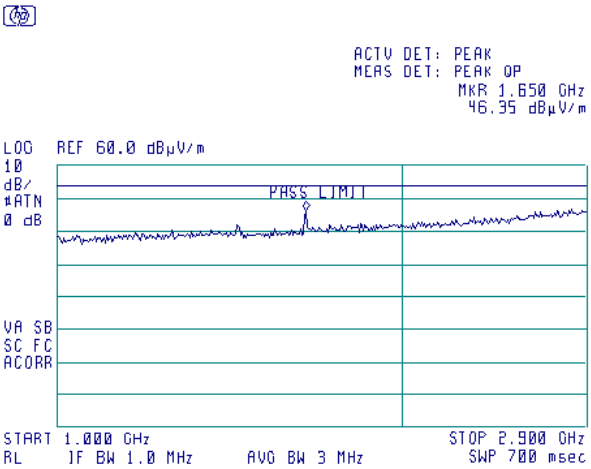
Plot 8.2.3 Radiated emission measurements 1000-2900 MHz

TEST SITE:	Anechoic chamber
LIMIT:	Class B
TEST DISTANCE:	3 m
EUT OPERATING MODE:	Receive
ANTENNA POLARIZATION	Vertical



Plot 8.2.4 Radiated emission measurements 1000-2900 MHz

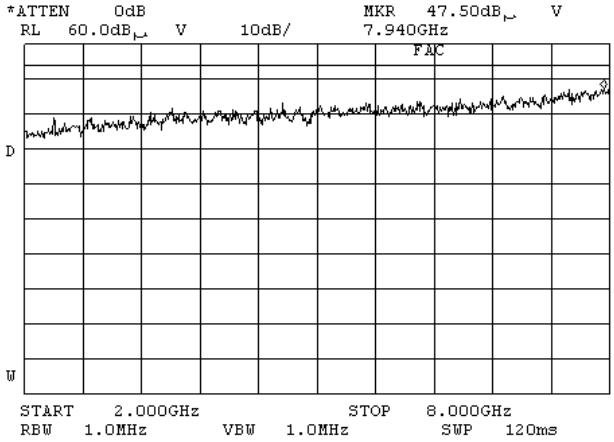
TEST SITE:	Anechoic chamber
LIMIT:	Class B
TEST DISTANCE:	3 m
EUT OPERATING MODE:	Receive
ANTENNA POLARIZATION	Horizontal



Test specification:	Section 15.109, Radiated emission		
Test procedure:	ANSI C63.4, Sections 11.6 and 12.1.4		
Test mode:	Compliance	Verdict:	PASS
Date & Time:	4/3/2009 11:51:30 AM		
Temperature: 23ºC	Air Pressure: 1009 hPa	Relative Humidity: 48%	Power Supply: 48 VDC
Remarks:			

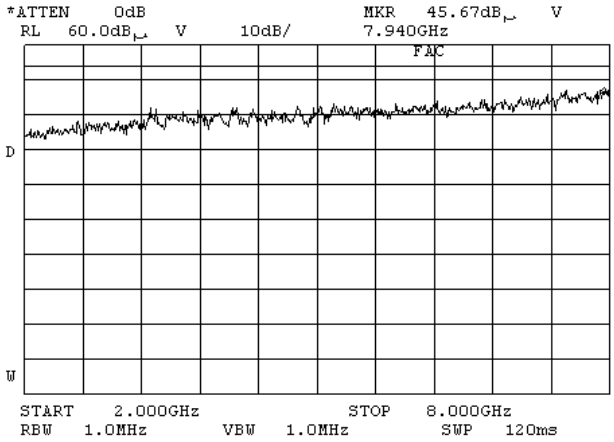
Plot 8.2.5 Radiated emission measurements –2000-8000 MHz

TEST SITE:	Anechoic chamber
LIMIT:	Class B
TEST DISTANCE:	3 m
EUT OPERATING MODE:	Receive
ANTENNA POLARIZATION	Vertical



Plot 8.2.6 Radiated emission measurements 2000-8000 MHz

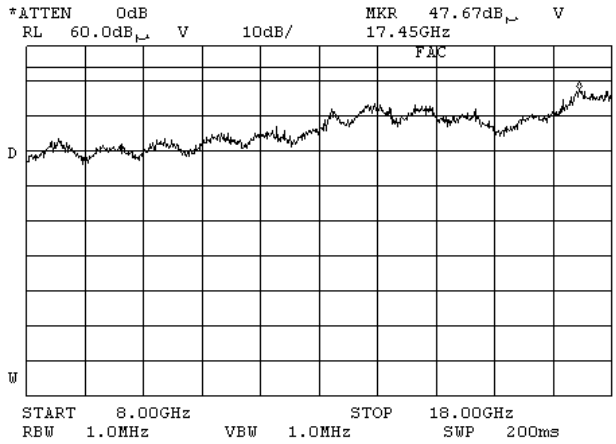
TEST SITE:	Anechoic chamber
LIMIT:	Class B
TEST DISTANCE:	3 m
EUT OPERATING MODE:	Receive
ANTENNA POLARIZATION	Horizontal



Test specification:	Section 15.109, Radiated emission		
Test procedure:	ANSI C63.4, Sections 11.6 and 12.1.4		
Test mode:	Compliance	Verdict:	PASS
Date & Time:	4/3/2009 11:51:30 AM		
Temperature: 23ºC	Air Pressure: 1009 hPa	Relative Humidity: 48%	Power Supply: 48 VDC
Remarks:			

Plot 8.2.7 Radiated emission measurements 8000-18000 MHz

TEST SITE:	Anechoic chamber
LIMIT:	Class B
TEST DISTANCE:	3 m
EUT OPERATING MODE:	Receive
ANTENNA POLARIZATION	Vertical and Horizontal



9 APPENDIX A Test equipment and ancillaries used for tests

HL No	Description	Manufacturer	Model	Ser. No.	Last Cal.	Due Cal.
0032	Antenna, Biconical, 20 - 200 MHz	Electro-Metrics	BIA 25/30	3577	25-Sep-08	25-Sep-09
0415	Cable, Coax, RF, RG-214	Hermon Laboratories	CC-3	056	02-Dec-08	02-Dec-09
0446	Antenna, Loop, Active, 10 kHz - 30 MHz	EMCO	6502	2857	29-Jun-08	29-Jun-09
0493	Temperature Chamber -45…175 deg C	Thermotron	S-1.2 Mini-Max	14016	19-May-08	19-May-09
0569	Antenna, Log Periodic, 200 - 1000 MHz	Electro-Metrics	LPA 25/30	1953	25-Sep-08	25-Sep-10
0768	Antenna Standard Gain Horn,18-26.5 GHz, WR-42, 25 dB gain	Quinstar Technology	QWH-4200-BA	110	08-Dec-06	08-Dec-09
0769	Antenna Standard Gain Horn, 26.5-40 GHz, WR28, 25 dB gain	Quinstar Technology	QWH-2800-BA	112	08-Dec-06	08-Dec-09
0787	Transient Limiter 9 kHz-200 MHz	Hewlett Packard Co	11947A	3107A01877	16-Oct-08	16-Oct-09
0812	Cable Coax, RG-214, 11.5 m, N-type connectors	Hermon Laboratories	C214-11	148	02-Dec-08	02-Dec-09
1424	Spectrum Analyzer, 30 Hz- 40 GHz	Agilent Technologies	8564EC	3946A00219	28-Aug-08	28-Aug-09
1425	EMI Receiver, 9 kHz - 2.9 GHz, System: HL1426, HL1427	Agilent Technologies	8542E	3710A00222, 3705A00204	03-Sep-08	03-Sep-09
1430	EMI Receiver, 9 kHz - 2.9 GHz, System: HL1431, HL1432	Agilent Technologies	8542E	3807A00262,3705A00217	31-Aug-08	31-Aug-09
1553	Cable RF, 3.5 m, N/N-type	Alpha Wire	RG-214	1553	08-Sep-08	08-Sep-09
1984	Antenna, Double-Ridged Waveguide Horn, 1-18 GHz, 300 W	EMC Test Systems	3115	9911-5964	23-Jan-09	23-Jan-10
2013	Power Divider, 0.5-18.0 GHz, 80 W	Omni Spectra	2090-6204-00	2013	01-Dec-08	01-Dec-09
2254	Cable 40 GHz, 0.8 m, blue	Rhophase Microwave Limited	KPS-1503A-800-KPS	W4907	10-Jun-08	10-Jun-09
2432	Antenna, Double-Ridged Waveguide Horn 1-18 GHz	EMC Test Systems	3115	00027177	23-Jan-09	23-Jan-10
2697	Antenna, 30 MHz - 3.0 GHz	Sunol Sciences. Corp. Pleasanton, California USA	JB3	A022805	11-Jan-09	11-Jan-10
2780	EMC analyzer, 100 Hz to 26.5 GHz	Agilent Technologies	E7405A	MY45102406	11-Jun-07	11-Jun-09
2882	Cable, 18 GHz N-type, M-F, 3 m	Bird	TC-MNFN-3.0	211539001	04-Feb-09	04-Feb-10
2888	LISN Two-line V-Network 50 Ohm / 50 uH + 5 Ohm, 16A, MIL STD 461E, CISPR 16-1	Rolf Heine	NNB-2/16Z	02/10018	09-Jul-08	09-Jul-09

HL No	Description	Manufacturer	Model	Ser. No.	Last Cal.	Due Cal.
2909	Spectrum analyzer, ESA-E, 100 Hz to 26.5 GHz	Agilent Technologies	E4407B	MY41444762	07-May-08	07-May-09
2911	Cable 18 GHz, 1.5 m, SMA-SMA	Gore	NA	89386	05-Oct-08	05-Oct-09
2952	Cable, RF, 18 GHz, 1.2 m, SMA-SMA	Gore	10020014	NA	05-Oct-08	05-Oct-09
2953	Cable, RF, 18 GHz, 1.2 m, SMA-SMA	Gore	10020014	NA	05-Oct-08	05-Oct-09
3016	LISN, Two-line V-network, 9 kHz to 30 MHz, (50 uH+5 Ohm), CISPR16-1, MIL-461E	Rohde & Schwarz	ESH 3-Z5	892239/002	10-Dec-08	10-Dec-09
3119	Cable, 18 GHz N-type, M-F, 3 m	Bird	TC-MNFN-3.0	211539004	07-Dec-08	07-Dec-09
3301	Power Meter, P-series, 50 MHz to 40 GHz	Agilent Technologies	N1911A	MY45101057	03-Dec-08	03-Dec-09
3302	Power sensor, P-Series, 50 MHz to 40 GHz, -35/30 to 20 dBm	Agilent Technologies	N1922A	MY45240586	05-Dec-08	05-Dec-09
3310	Multimeter	Fluke	115C	94321810	29-Jul-08	29-Jul-09
3439	Precision Fixed Attenuator, 50 Ohm, 5 W, 20 dB, DC to 18 GHz	Mini-Circuits	BW-S20W5+	NA	08-Mar-09	08-Mar-10
3441	Precision Fixed Attenuator, 50 Ohm, 5 W, 20 dB, DC to 18 GHz	Mini-Circuits	BW-S20W5+	NA	08-Mar-09	08-Mar-10
3474	Cable, Coax, Microwave, DC-18 GHz, SMA-SMA, 0.6 m	Gore	65475	1640102	12-May-08	12-May-09
3531	Amplifier, low noise, 2 to 8 GHz	Quinstar Technology	QLJ-02084040-J0	11159002002	07-Dec-08	07-Dec-09
3532	Amplifier, low noise, 2 to 8 GHz	Quinstar Technology	QLJ-02084040-J0	11159002001	23-Nov-08	23-Nov-09
3534	Amplifier, low noise, 6 to 18 GHz	Quinstar Technology	QLJ-06184040-J0	11159001002	07-Dec-08	07-Dec-09
3535	Amplifier, low noise, 18 to 40 GHz	Quinstar Technology	QLJ-18404537-J0	11159003001	07-Dec-08	07-Dec-09
3612	Cable RF, 17.5 m, N type-N type	Teldor	RG-214/U	NA	17-Nov-08	17-Nov-09

10 APPENDIX B Measurement uncertainties

Expanded uncertainty at 95% confidence in Hermon Labs EMC measurements

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

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

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

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

11 APPENDIX C Test facility description

Tests were performed at Hermon Laboratories Ltd., which is a fully independent, private, EMC, safety, environmental and telecommunication testing facility. Hermon Laboratories is listed by the Federal Communications Commission (USA) for all parts of Code of Federal Regulations 47 (CFR 47) and by Industry Canada for electromagnetic emissions (file numbers IC 2186A-1 for OATS and IC 2186A-2 for anechoic chamber), certified by VCCI, Japan (the registration numbers are R-808 for OATS, R-1082 for anechoic chamber, C-845 for conducted emissions site), assessed by TNO Certification EP&S (Netherlands) for a number of EMC, telecommunications, environmental, safety standards, and by AMTAC (UK) for safety of medical devices. The laboratory is accredited by American Association for Laboratory Accreditation (USA) according to ISO/IEC 17025 for electromagnetic compatibility, product safety, telecommunications testing and environmental simulation (for exact scope please refer to Certificate No. 839.01).

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Person for contact: Mr. Alex Usoskin, CEO.

12 APPENDIX D Specification references

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

13 APPENDIX E Test equipment correction factors

Antenna Factor
Active Loop Antenna
EMC Test Systems, model 6502, S/N 2857, HL 0446

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

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

Antenna factor
Standard gain horn antenna
Quinstar Technology
Model QWH, Ser.No.112, HL 0768, 0769

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

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

Antenna factor
Biconical antenna
Electro-Metrics, model BIA-25/30
Ser.No.3577, HL 0032

Frequency MHz	Antenna Factor dB(1/m)	Frequency MHz	Antenna Factor dB(1/m)
20	15.1	115	16.7
25	14.6	120	14.1
30	13.7	125	13.1
35	11.8	130	13.0
40	11.4	135	12.9
45	11.7	140	12.7
50	11.4	145	12.5
55	10.5	150	14.3
60	10.3	155	14.8
65	8.9	160	14.7
70	7.6	165	15.1
75	7.3	170	15.6
80	7.3	175	16.5
85	7.8	180	16.7
90	9.4	185	17.3
95	10.6	190	17.9
100	11.8	195	17.6
105	12.5	200	17.9
110	13.7		

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

Antenna factor
Log periodic antenna
Electro-Metrics, model LPA-25/30
Ser.No.1953, HL 0569

Frequency MHz	Antenna Factor dB(1/m)	Frequency MHz	Antenna Factor dB(1/m)
200	15.2	625	25.2
225	15.1	650	25.8
250	16.3	675	27.2
275	17.2	700	27.6
300	19.6	725	27.6
325	18.4	750	27.6
350	19.0	775	28.0
375	20.0	800	28.2
400	20.9	825	29.4
425	21.3	850	29.9
450	22.1	875	30.0
475	22.7	900	30.4
500	23.2	925	30.6
525	23.9	950	30.8
550	24.2	975	31.6
575	24.6	1000	32.1
600	24.7		

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

Antenna factor
Double-ridged wave guide horn antenna
Model 3115, S/N 9911-5964, HL 1984

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

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

Antenna factor
Double-ridged guide horn antenna
Model 3115, serial number: 00027177, HL 2432

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

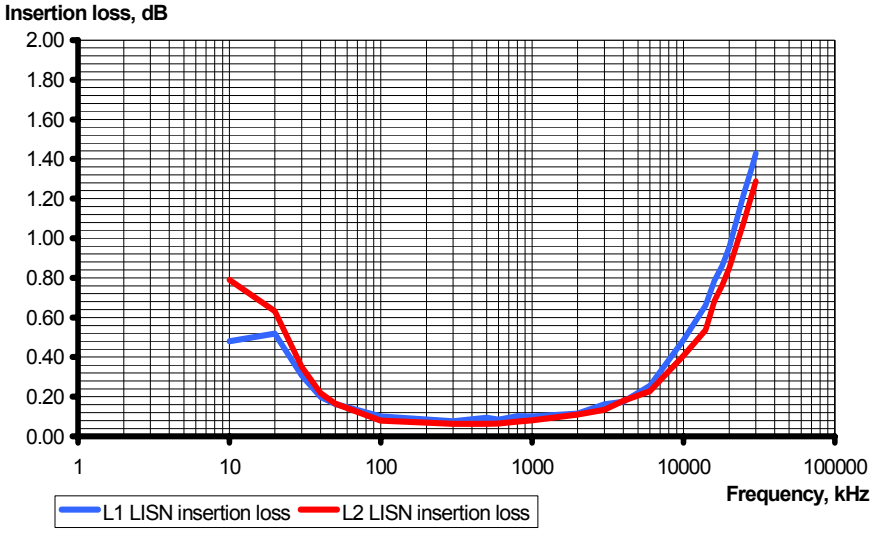
Antenna factor in dB(1/m) is to be added to receiver meter reading in dB(μV) to convert it into field intensity in dB(μV/m).

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

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

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

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



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

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

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

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

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

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

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

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

Cable loss
Cable coaxial, Gore, 18 GHz, 1.5 m, SMA-SMA, S/N 89386
HL 2911

Frequency, MHz	Cable loss, dB	Frequency, MHz	Cable loss, dB	Frequency, MHz	Cable loss, dB
10	0.06	5750	1.32	12000	2.04
30	0.09	6000	1.34	12250	2.04
100	0.16	6250	1.41	12500	2.07
250	0.27	6500	1.43	12750	1.96
500	0.38	6750	1.46	13000	1.97
750	0.49	7000	1.49	13250	2.01
1000	0.55	7250	1.52	13500	2.04
1250	0.62	7500	1.56	13750	2.12
1500	0.68	7750	1.66	14000	2.16
1750	0.74	8000	1.69	14250	2.16
2000	0.78	8250	1.78	14500	2.28
2250	0.83	8500	1.73	14750	2.26
2500	0.88	8750	1.71	15000	2.22
2750	0.97	9000	1.72	15250	2.34
3000	1.00	9250	1.74	15500	2.41
3250	1.03	9500	1.76	15750	2.45
3500	1.05	9750	1.80	16000	2.57
3750	1.09	10000	1.89	16250	2.54
4000	1.14	10250	1.94	16500	2.55
4250	1.17	10500	1.99	16750	2.52
4500	1.21	10750	1.92	17000	2.42
4750	1.22	11000	1.96	17250	2.49
5000	1.24	11250	1.97	17500	2.62
5250	1.28	11500	2.02	17750	2.70
5500	1.30	11750	2.07	18000	2.76

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

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

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 18 GHz, N-type, M-F, 3 m, Bird Electronic Corp., model TC-MNFN-3.0, S/N 211539004
HL 3119

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	0.06	3600	1.34	7400	2.00	11200	2.48	15100	2.90
30	0.09	3700	1.36	7500	2.01	11300	2.45	15200	2.89
50	0.11	3800	1.37	7600	2.03	11400	2.51	15300	2.91
100	0.23	3900	1.39	7700	2.05	11500	2.45	15400	2.85
200	0.30	4000	1.39	7800	2.07	11600	2.49	15500	2.83
300	0.42	4100	1.42	7900	2.06	11700	2.51	15600	2.89
400	0.39	4200	1.45	8000	2.06	11800	2.50	15700	2.85
500	0.47	4300	1.47	8100	2.09	11900	2.52	15800	2.87
600	0.49	4400	1.49	8200	2.10	12000	2.48	15900	2.91
700	0.63	4500	1.51	8300	2.11	12100	2.53	16000	2.90
800	0.62	4600	1.53	8400	2.15	12200	2.54	16100	2.94
900	0.70	4700	1.55	8500	2.15	12300	2.56	16200	2.91
1000	0.70	4800	1.54	8600	2.17	12400	2.57	16300	2.96
1100	0.77	4900	1.57	8700	2.19	12500	2.57	16400	3.01
1200	0.78	5000	1.60	8800	2.20	12600	2.55	16500	3.01
1300	0.83	5100	1.60	8900	2.21	12700	2.50	16600	2.98
1400	0.86	5200	1.62	9000	2.22	12800	2.57	16700	3.00
1500	0.85	5300	1.65	9100	2.23	12900	2.57	16800	3.01
1600	0.94	5400	1.66	9200	2.25	13000	2.55	16900	3.06
1700	0.90	5500	1.69	9300	2.24	13100	2.62	17000	3.07
1800	0.90	5600	1.70	9400	2.28	13200	2.60	17100	3.09
1900	0.95	5700	1.72	9500	2.28	13300	2.67	17200	3.10
2000	0.97	5800	1.74	9600	2.27	13400	2.66	17300	3.11
2100	1.00	5900	1.75	9700	2.30	13500	2.71	17400	3.16
2200	1.02	6000	1.77	9800	2.30	13600	2.73	17500	3.15
2300	1.05	6100	1.79	9900	2.34	13700	2.73	17600	3.21
2400	1.08	6200	1.82	10000	2.32	13800	2.85	17700	3.21
2500	1.10	6300	1.83	10100	2.31	13900	2.83	17800	3.18
2600	1.13	6400	1.83	10200	2.31	14000	2.83	17900	3.25
2700	1.15	6500	1.87	10300	2.26	14100	2.83	18000	3.14
2800	1.17	6600	1.88	10400	2.32	14200	2.84		
2900	1.21	6700	1.90	10500	2.26	14300	2.90		
3000	1.22	6800	1.93	10600	2.26	14400	2.84		
3100	1.25	6900	1.92	10700	2.31	14600	2.88		
3200	1.27	7000	1.95	10800	2.24	14700	2.85		
3300	1.29	7100	1.96	10900	2.39	14800	2.92		
3400	1.28	7200	1.99	11000	2.41	14900	2.93		
3500	1.31	7300	2.00	11100	2.46	15000	2.83		

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

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

14 APPENDIX F Abbreviations and acronyms

A	ampere
AC	alternating current
AM	amplitude modulation
AVRG	average (detector)
cm	centimeter
dB	decibel
dBm	decibel referred to one milliwatt
dB(μV)	decibel referred to one microvolt
dB(μV/m)	decibel referred to one microvolt per meter
DC	direct current
EIRP	equivalent isotropically radiated power
ERP	effective radiated power
EUT	equipment under test
F	frequency
GHz	gigahertz
H	height
HL	Hermon Laboratories
Hz	hertz
kHz	kilohertz
LO	local oscillator
m	meter
MHz	megahertz
min	minute
mm	millimeter
ms	millisecond
μs	microsecond
NA	not applicable
OATS	open area test site
Ω	Ohm
QP	quasi-peak
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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