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ELECTRICAL TESTING
0839.01

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TEST REPORT

ACCORDING TO: FCC CFR 47 PART 90 subpart Z

FOR:

Ruggedcom Ltd.

Subscriber unit operating in 3.65-3.70 GHz

Model: WIN5137-AC, WIN5137-DC, WIN5237

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1 Applicant information

Client name:	Ruggedcom Ltd.
Address:	32 Maskit Street, P.O.Box 12412, Herzeliya 46733, Israel
Telephone:	+972 9951 9556
Fax:	+972 9951 9557
E-mail:	DudiMagen@ruggedcom.com
Contact name:	Mr. Dudi Magen

2 Equipment under test attributes

Product name:	Subscriber unit operating in 3650 – 3700 MHz
Product type:	Transciever
Model(s):	WIN5137-AC
Serial number:	63544310100
Hardware version:	Rev 01
Software release:	4.1.4612.18
Receipt date	2/01/2011

3 Manufacturer information

Manufacturer name:	Ruggedcom Ltd.
Address:	32 Maskit Street, P.O.Box 12412, Herzeliya 46733, Israel
Telephone:	+972 9951 9556
Fax:	+972 9951 9557
E-Mail:	DudiMagen@ruggedcom.com
Contact name:	Mr. Dudi Magen

4 Test details

Project ID:	21650
Location:	Hermon Laboratories Ltd. Harakevet Industrial Zone, Binyamina 30500, Israel
Test started:	2/01/2011
Test completed:	2/07/2011
Test specification(s):	FCC 47CFR part 90 subpart Z

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, Conducted spurious emissions	Pass
Section 90.1323, Radiated spurious emissions	Pass
Section 90.213, Frequency stability	Pass
Section 2.1091, 90.1335, RF radiation exposure evaluation	Pass

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

	Name and Title	Date	Signature
Tested by:	Mr. S. Samokha, test engineer	February 7, 2011	
Reviewed by:	Mrs. M. Cherniavsky, certification engineer	March 13, 2011	
Approved by:	Mr. M. Nikishin, EMC and Radio group manager	March 23, 2011	

6 EUT description

6.1 General information

The EUT, WIN5137/WIN5237, is a subscriber unit of WiMAX system, installed at the customer premises. 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 base station. Data is fed to the EUT through the RJ-45 port. The EUT is sending the data via wireless connection to the base station.
The difference between WIN5137 and WIN5237 is the antenna connectors. The WIN5237 has internal (on-mechanic) antenna, and it is powered by WIN1010 power adapter unit (48 VDC). The WIN5137 has external N-Type connectors for antennas. The WIN5137 has 2 sub-models, WIN5137-AC and WIN5137-DC.
The WIN5137-AC is powered by WIN1010 power adapter unit (48 VDC), and the WIN5137-DC is powered by car's 12V battery. The "Mobile subscriber unit" is installed in car (vehicular environment); "Fixed subscriber unit" is installed on roofs, towers, etc.

6.2 EUT modules and sub-assemblies

Description	Manufacturer	Model or P/N	Hardware rev.	Serial number
Subscriber	RuggedWireless Ltd.	WIN5137-AC	REV 01	63544310100
Subscriber	RuggedWireless Ltd.	WIN5137-DC	REV 01	53544310040
PoE power supply	RuggedWireless Ltd.	WIN1010	Rev 1	A30802183371

6.3 Ports and lines

Port type	Port description	Connected from	Connected to	Qty.	Cable type	Cable length, m
Fixed subscriber unit						
Power	AC power	WIN 1010 power adapter	AC mains	1	Unshielded	1.5
Signal	DC+Ethernet	WIN 1010 power adapter	CPE	1	Shielded	4*
RF	Antenna	CPE	Base station	2	Coax	3
Mobile subscriber unit						
Power	DC power	12 VDC	CPE	1	Unshielded	4
Signal	Ethernet	CPE	Laptop 1	1	Shielded	4*
RF	Antenna	CPE	Base station	2	Coax	3

* may be up to 100 m

6.4 Support and test equipment

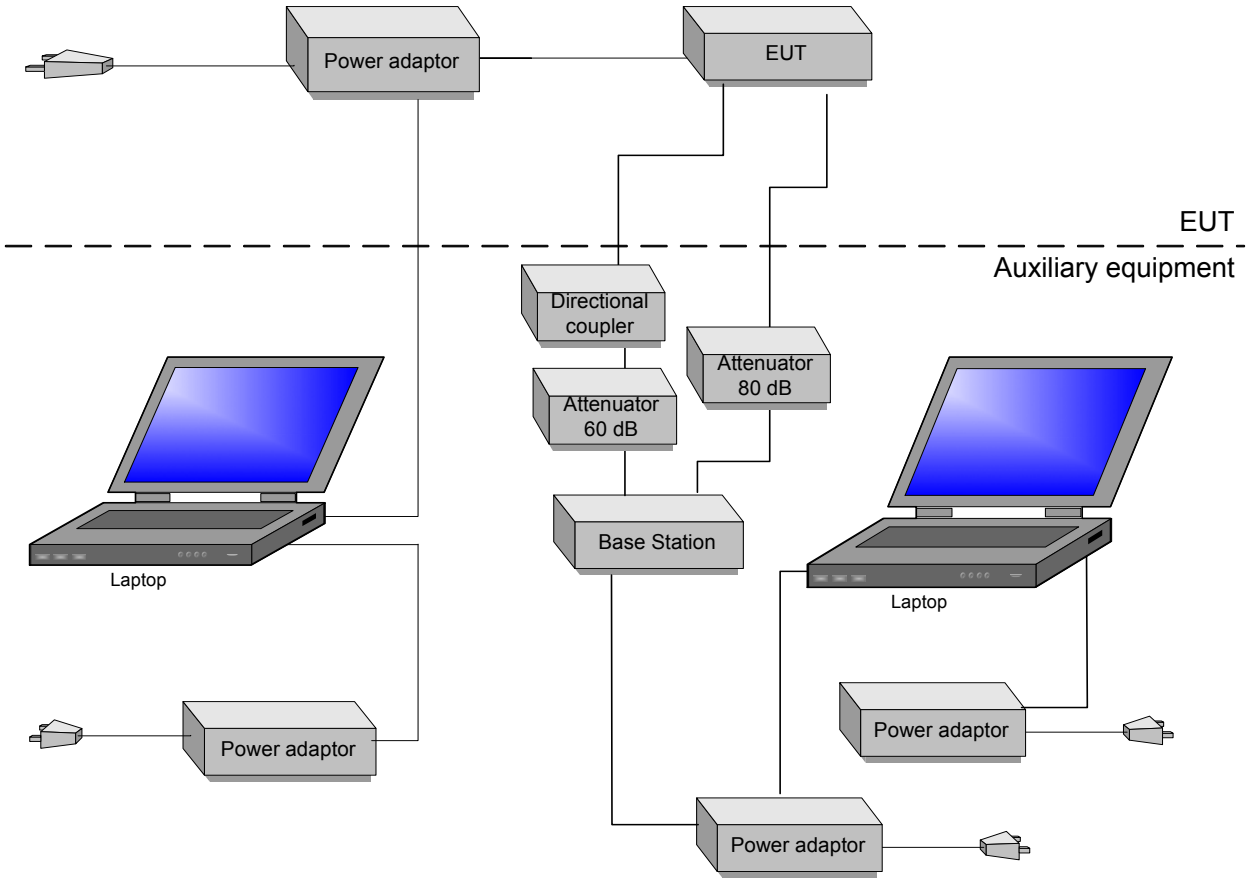
Description	Manufacturer	Model number	Serial number
Laptop	LENOVO	ThinkPad R61	L3-F7833 07/11
AC/DC adapter	LENOVO	92P1157	S29P1158Z1ZD2H81EA22
Laptop	DELL	Insirion 1520	(01)07898349890825
AC/DC adapter	DELL	DA90PSFS-00	CN-0XD757-48661-751-7JZ9
Base station	Ruggedmax	WIN7237	43544810005

6.5 Changes made in EUT

To withstand the standard requirements the following changes were implemented in the EUT:
1) the C409 capacitor was removed from power supply PCB;
2) the ceramic capacitor 22uF, P/N C3225X7R1C226M, was installed at power supply PCB.

6.6 Test configuration

6.6.1 Fixed subscriber unit measurements



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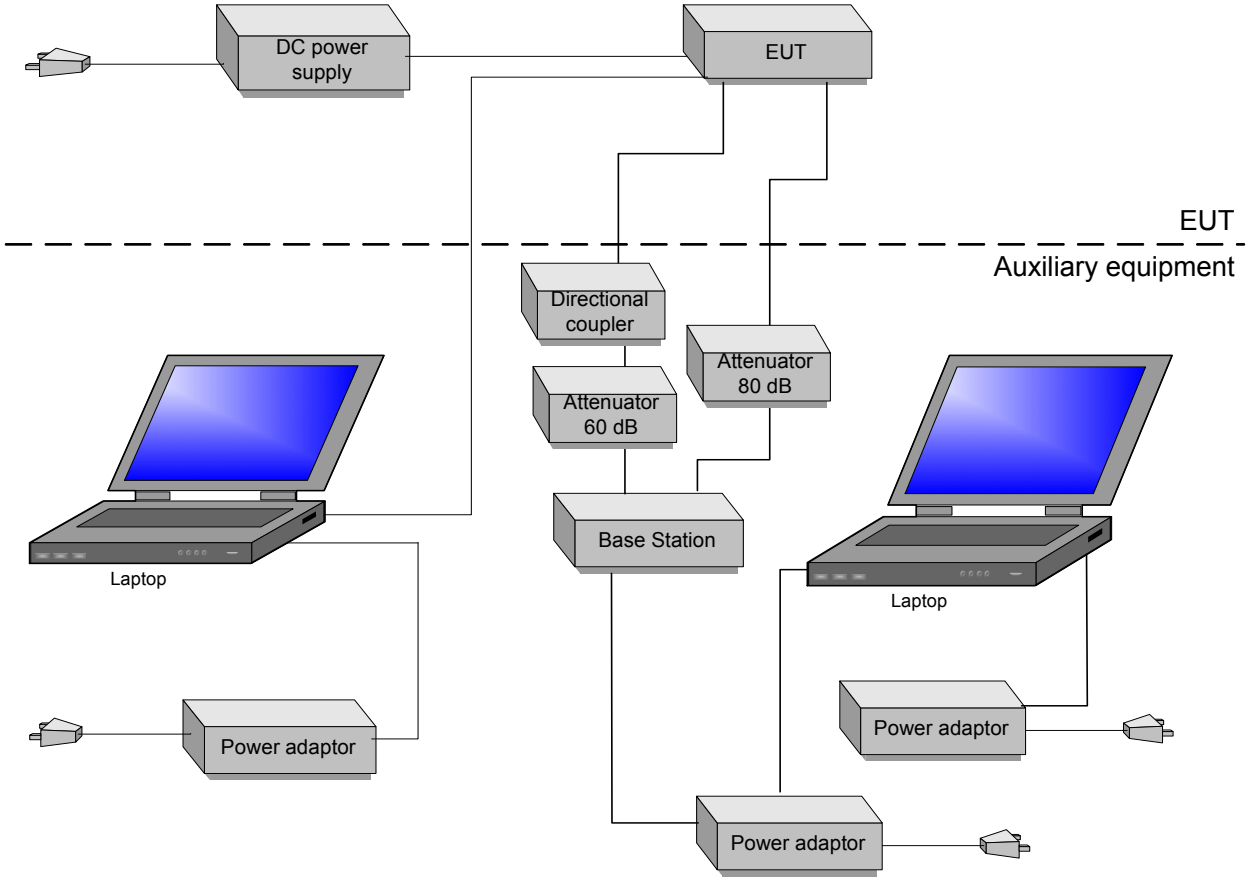
6.6.2 Mobile subscriber unit measurements



6.7 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					
V	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 – 3700 MHz					
Operating frequency range		3652.5 – 3697.5 MHz					
RF channel bandwidth		5 MHz, 7 MHz, 10 MHz					
Maximum rated output power		At transmitter 50 Ω RF output connector					18 dBm
Is transmitter output power variable?			No				
		V	Yes		continuous variable		
				V	stepped variable with stepsize		0.5 dB
				minimum RF power			10 dBm
				maximum RF power			18 dBm
Antenna connection							
unique coupling		**V** standard connector		Integral	**V** with temporary RF connector		
					without temporary RF connector		

Antenna/s technical characteristics

Type	Manufacturer	Model number	Gain
Dual slant subscriber panel	MTI Wireless Edge Ltd.	MT–385002/ND	18 dBi
Omnidirectional	Kenbotong Communication Ltd.	TQJ-3700AT6-NJ	6 dBi

Transmitter 99% power bandwidth	5 MHz, 7 MHz, 10 MHz
Type of modulation	QPSK, 16QAM, 64QAM
Transmitter aggregate data rate/s	5 MHz BW: QPSK - 4.19 MBps, 16QAM – 12.565 MBps, 64QAM – 18.85 MBps 7 MHz BW: QPSK - 4.19 MBps, 16QAM – 12.565 MBps, 64QAM – 18.85 MBps 10 MHz BW: QPSK - 8.38 MBps, 16QAM – 25.13 MBps, 64QAM – 37.7 MBps
Type of multiplexing	OFDM
Maximum transmitter duty cycle in normal use	60%
Transmitter duty cycle supplied for test	60%

Transmitter power source 1					
		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	
Transmitter power source 2					
		Nominal rated voltage		Battery type	
V	DC	**Nominal rated voltage**	12 VDC from power supply		
	AC mains	**Nominal rated voltage**		Frequency	
Common power source for transmitter and receiver			**V** yes		no

Test specification:	Section 90.1321, Maximum conducted output power		
Test procedure:	47 CFR, Section 2.1046; TIA/EIA-603-C, Section 2.2.1		
Test mode:	Compliance	Verdict:	PASS
Date:	2/1/2011		
Temperature: 23.2 ºC	Air Pressure: 1013 hPa	Relative Humidity: 41 %	Power Supply: 48VDC
Remarks:			

7 Transmitter tests according to 47CFR part 90 requirements

7.1 Maximum output power

7.1.1 General

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

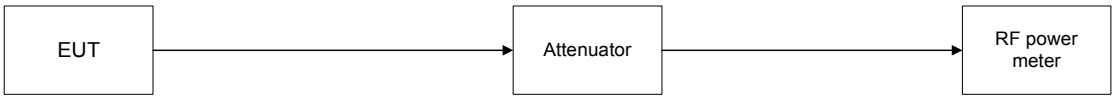
Table 7.1.1 Maximum output power limits

Assigned frequency range, MHz	Occupied bandwidth, MHz	Maximum peak output power, EIRP	
		W	dBm
Base and fixed stations			
3650.0 – 3700.0	5	5	36.99
	7	7	38.45
	10	10	40.00
Mobile and portable stations			
3650.0 – 3700.0	5	0.2	23.00
	7	0.28	24.50
	10	0.4	26.00

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 for end user RF output power.
7.1.2.3 The peak output power was measured with a power meter as provided in Table 7.1.2.

Figure 7.1.1 Transmitter output power test setup



Test specification:	Section 90.1321, Maximum conducted output power		
Test procedure:	47 CFR, Section 2.1046; TIA/EIA-603-C, Section 2.2.1		
Test mode:	Compliance	Verdict:	PASS
Date:	2/1/2011		
Temperature: 23.2 ºC	Air Pressure: 1013 hPa	Relative Humidity: 41 %	Power Supply: 48VDC
Remarks:			

Table 7.1.2 Peak EIRP output power test results

ASSIGNED FREQUENCY RANGE: 3650.0 – 3700.0 MHz
DETECTOR USED: Average (Power Meter)
MODULATING SIGNAL: PRBS
TRANSMITTER OUTPUT POWER SETTINGS: Maximum (NOTE 1)
ANTENNA ASSEMBLY GAIN: 18 dBi
EBW: 5 MHz

Channel, MHz	Modulation	Pmeas, dBm	Antenna gain, dBi	EIRP total*, dBm	Limit**, dBm	Margin, dB	Verdict
3652.5	QPSK	15.32	18.0	33.32	36.47	-3.15	Pass
	64QAM	15.53	18.0	33.53	36.45	-2.92	Pass
3675.0	QPSK	15.02	18.0	33.02	36.48	-3.46	Pass
	64QAM	15.05	18.0	33.05	36.49	-3.44	Pass
3697.5	QPSK	14.52	18.0	32.52	36.49	-3.97	Pass
	64QAM	14.46	18.0	32.46	36.48	-4.02	Pass

EBW: 7 MHz

Channel, MHz	Modulation	Pmeas, dBm	Antenna gain, dBi	EIRP total*, dBm	Limit, dBm	Margin, dB	Verdict
3653.5	QPSK	17.02	18.0	35.02	38.13	-3.11	Pass
	64QAM	16.98	18.0	34.98	38.09	-3.11	Pass
3675.0	QPSK	16.44	18.0	34.44	38.13	-3.69	Pass
	64QAM	16.42	18.0	34.42	38.11	-3.69	Pass
3696.5	QPSK	15.98	18.0	33.98	38.12	-4.14	Pass
	64QAM	15.83	18.0	33.83	38.11	-4.28	Pass

EBW: 10 MHz

Channel, MHz	Modulation	Pmeas, dBm	Antenna gain, dBi	EIRP total*, dBm	Limit, dBm	Margin, dB	Verdict
3655.0	QPSK	18.01	18.0	36.01	39.59	-3.58	Pass
	64QAM	17.95	18.0	35.95	39.59	-3.64	Pass
3675.0	QPSK	17.52	18.0	35.52	39.59	-4.07	Pass
	64QAM	17.44	18.0	35.44	39.58	-4.14	Pass
3695.0	QPSK	17.05	18.0	35.05	39.59	-4.54	Pass
	64QAM	16.89	18.0	34.89	39.59	-4.70	Pass

NOTE 1: the EUT was configured to produce maximum conducted RF power for maximum declared antenna gain of 18 dBi. RF output power will vary depending on the antenna assembly gain to ensure that the total EIRP power and power limits comply with EIRP limits. The maximum power is limited by software, the user cannot change the value above the limit. For actual settings of power levels with respect to actual antenna assembly used, please refer to the User's Manual.
* - EIRP total, dBm = Pmeas*, dBm + Antenna Gain, dBi
** - EIRP limit corresponds to the actual emission bandwidth

Test specification:	Section 90.1321, Maximum conducted output power		
Test procedure:	47 CFR, Section 2.1046; TIA/EIA-603-C, Section 2.2.1		
Test mode:	Compliance	Verdict:	PASS
Date:	2/1/2011		
Temperature: 23.2 ºC	Air Pressure: 1013 hPa	Relative Humidity: 41 %	Power Supply: 48VDC
Remarks:			

Table 7.1.3 Peak EIRP output power test results

ASSIGNED FREQUENCY RANGE: 3650.0 – 3700.0 MHz
DETECTOR USED: Average (Power Meter)
MODULATING SIGNAL: PRBS
TRANSMITTER OUTPUT POWER SETTINGS: Maximum
ANTENNA ASSEMBLY GAIN: 6 dBi
EBW: 5 MHz

Channel, MHz	Modulation	Pmeas, dBm	Antenna gain, dBi	EIRP total*, dBm	Limit**, dBm	Margin, dB	Verdict
3652.5	QPSK	13.57	6.0	19.57	22.50	-2.93	Pass
	64QAM	13.52	6.0	19.52	22.47	-2.95	Pass
3675.0	QPSK	12.93	6.0	18.93	22.50	-3.57	Pass
	64QAM	12.94	6.0	18.94	22.51	-3.57	Pass
3697.5	QPSK	12.39	6.0	18.39	22.51	-4.12	Pass
	64QAM	12.32	6.0	18.32	22.50	-4.18	Pass

EBW: 7 MHz

Channel, MHz	Modulation	Pmeas, dBm	Antenna gain, dBi	EIRP total*, dBm	Limit, dBm	Margin, dB	Verdict
3653.5	QPSK	15.97	6.0	21.97	24.15	-2.18	Pass
	64QAM	15.92	6.0	21.92	24.11	-2.19	Pass
3675.0	QPSK	15.43	6.0	21.43	24.15	-2.72	Pass
	64QAM	15.36	6.0	21.36	24.13	-2.77	Pass
3696.5	QPSK	14.92	6.0	20.92	24.14	-3.22	Pass
	64QAM	14.86	6.0	20.86	24.13	-3.27	Pass

EBW: 10 MHz

Channel, MHz	Modulation	Pmeas, dBm	Antenna gain, dBi	EIRP total*, dBm	Limit, dBm	Margin, dB	Verdict
3655.0	QPSK	16.08	6.0	22.08	25.61	-3.53	Pass
	64QAM	16.01	6.0	22.01	25.61	-3.60	Pass
3675.0	QPSK	15.58	6.0	21.58	25.61	-4.03	Pass
	64QAM	15.47	6.0	21.47	25.60	-4.13	Pass
3695.0	QPSK	15.08	6.0	21.08	25.61	-4.53	Pass
	64QAM	15.00	6.0	21.00	25.61	-4.61	Pass

* - EIRP total, dBm = Pmeas*, dBm + Antenna Gain, dBi
** - EIRP limit corresponds to the actual emission bandwidth

Reference numbers of test equipment used

HL 3301	HL 3302	HL 3768					

Full description is given in Appendix A.

Test specification:	Section 90.1321, Peak EIRP power density		
Test procedure:	47 CFR, Sections 2.1046; TIA/EIA-603-C, Section 2.2.1		
Test mode:	Compliance	Verdict:	PASS
Date:	2/1/2011		
Temperature: 23.2 ºC	Air Pressure: 1013 hPa	Relative Humidity: 41 %	Power Supply: 12 VDC
Remarks: With 6 dBi gain antenna			

7.2 Peak EIRP power density for mobile subscriber unit

7.2.1 General

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

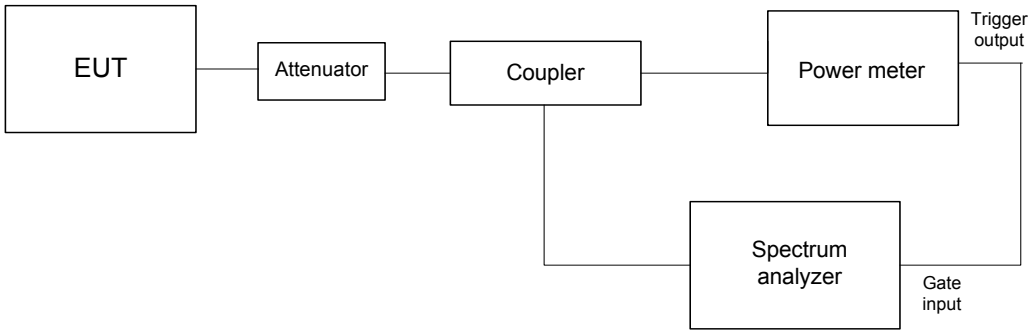
Table 7.2.1 Peak power density limits

Assigned frequency range, MHz	Occupied bandwidth, MHz	Maximum peak power spectral density, EIRP	
		W/MHz	dBm/MHz
Base and fixed stations			
3650.0 – 3700.0	5	1	30
	7		
	10		
Mobile and portable stations			
3650.0 – 3700.0	5	0.04	16
	7		
	10		

7.2.2 Test procedure

7.2.2.1 The EUT was set up as shown in Figure 7.2.1, energized and its proper operation was checked.
7.2.2.2 The EUT was adjusted to produce maximum available for end user RF output power.
7.2.2.3 The peak output power density was measured with spectrum analyzer as provided in Table 7.2.2 and the associated plots.

Figure 7.2.1 Peak power density test setup



Test specification:	**Section 90.1321, Peak EIRP power density**		
Test procedure:	47 CFR, Sections 2.1046; TIA/EIA-603-C, Section 2.2.1		
Test mode:	Compliance	**Verdict:**	PASS
Date:	2/1/2011		
Temperature: 23.2 ºC	**Air Pressure:** 1013 hPa	**Relative Humidity:** 41 %	**Power Supply:** 12 VDC
Remarks: With 6 dBi gain antenna			

Table 7.2.2 Peak EIRP power density test results

ASSIGNED FREQUENCY RANGE: 3650.0 – 3700.0 MHz
DETECTOR USED: Average (RMS)
RESOLUTION BANDWIDTH: 1000 kHz
VIDEO BANDWIDTH: 3000 kHz
MODULATING SIGNAL: PRBS
TRANSMITTER OUTPUT POWER SETTINGS: Maximum
ANTENNA ASSEMBLY GAIN: 6 dBi
EBW: 5 MHz

Channel, MHz	Modulation	Pmeas , dBm/MHz	Antenna gain, dBi	EIRP power density*, dBm/MHz	Limit, dBm/MHz	Margin, dB	Verdict
3652.5	QPSK	9.27	6.0	15.27	16.0	-0.73	Pass
3652.5	64QAM	9.27	6.0	15.27	16.0	-0.73	Pass
3675.0	QPSK	8.43	6.0	14.43	16.0	-1.57	Pass
3675.0	64QAM	8.57	6.0	14.57	16.0	-1.43	Pass
3697.5	QPSK	8.13	6.0	14.13	16.0	-1.87	Pass
3697.5	64QAM	8.34	6.0	14.34	16.0	-1.66	Pass

EBW: 7 MHz

Channel, MHz	Modulation	Pmeas , dBm/MHz	Antenna gain, dBi	EIRP power density *, dBm/MHz	Limit, dBm/MHz	Margin, dB	Verdict
3653.5	QPSK	9.81	6.0	15.81	16.0	-0.19	Pass
3653.5	64QAM	9.62	6.0	15.62	16.0	-0.38	Pass
3675.0	QPSK	9.32	6.0	15.32	16.0	-0.68	Pass
3675.0	64QAM	9.35	6.0	15.35	16.0	-0.65	Pass
3696.5	QPSK	8.95	6.0	14.95	16.0	-1.05	Pass
3696.5	64QAM	8.80	6.0	14.80	16.0	-1.20	Pass

EBW: 10 MHz

Channel, MHz	Modulation	Pmeas , dBm/MHz	Antenna gain, dBi	EIRP power density *, dBm/MHz	Limit, dBm/MHz	Margin, dB	Verdict
3655.0	QPSK	8.45	6.0	14.45	16.0	-1.55	Pass
3655.0	64QAM	8.85	6.0	14.85	16.0	-1.15	Pass
3675.0	QPSK	8.03	6.0	14.03	16.0	-1.97	Pass
3675.0	64QAM	7.82	6.0	13.82	16.0	-2.18	Pass
3695.0	QPSK	7.50	6.0	13.50	16.0	-2.50	Pass
3695.0	64QAM	7.54	6.0	13.54	16.0	-2.46	Pass

- EIRP power density, dBm/MHz = Pmeas, dBm/MHz + Antenna Gain, dBi

Reference numbers of test equipment used

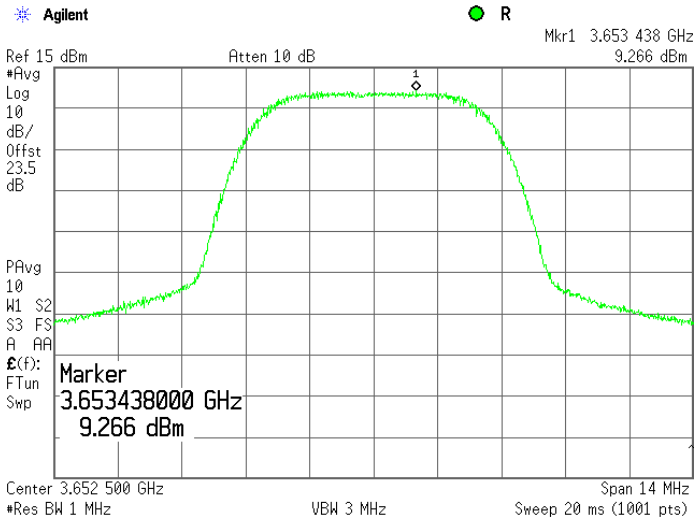
HL 2013	HL 2952	HL 3768	HL 3818				

Full description is given in Appendix A.

Test specification:	**Section 90.1321, Peak EIRP power density**		
Test procedure:	47 CFR, Sections 2.1046; TIA/EIA-603-C, Section 2.2.1		
Test mode:	Compliance	**Verdict:**	PASS
Date:	2/1/2011		
Temperature: 23.2 ºC	**Air Pressure:** 1013 hPa	**Relative Humidity:** 41 %	**Power Supply:** 12 VDC
Remarks: With 6 dBi gain antenna			

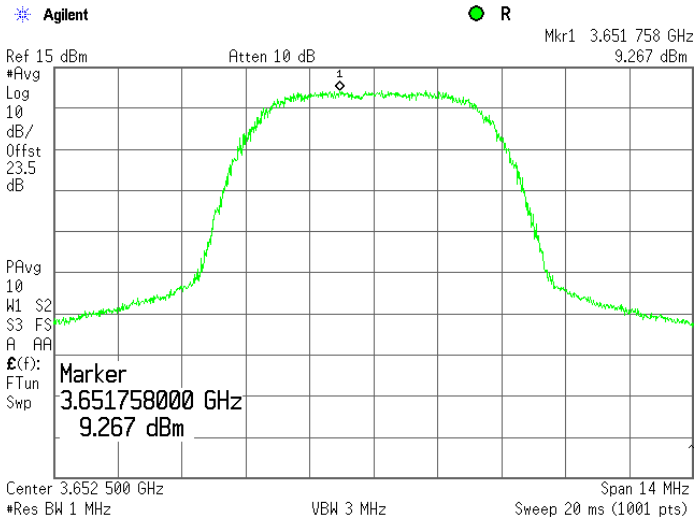
Plot 7.2.1 Peak output power density test results at low frequency

CARRIER FREQUENCY:	3652.5 MHz
EMISSION BANDWIDTH:	5 MHz
MODULATION:	QPSK



Plot 7.2.2 Peak output power density test results at low frequency

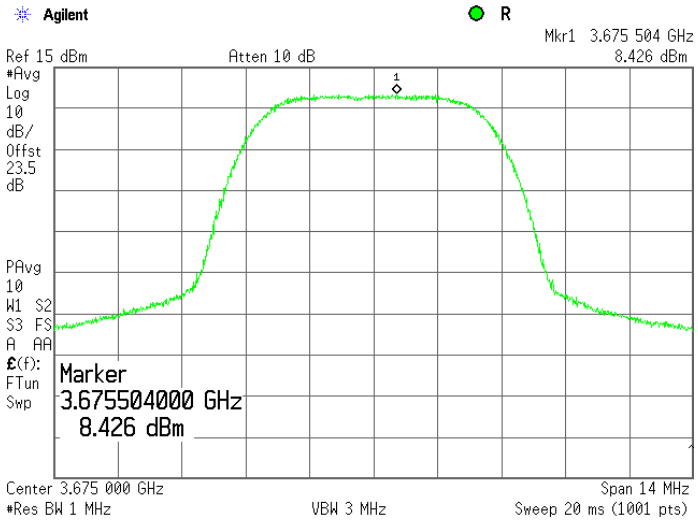
CARRIER FREQUENCY:	3652.5 MHz
EMISSION BANDWIDTH:	5 MHz
MODULATION:	64QAM



Test specification:	Section 90.1321, Peak EIRP power density		
Test procedure:	47 CFR, Sections 2.1046; TIA/EIA-603-C, Section 2.2.1		
Test mode:	Compliance	Verdict:	PASS
Date:	2/1/2011		
Temperature: 23.2 ºC	Air Pressure: 1013 hPa	Relative Humidity: 41 %	Power Supply: 12 VDC
Remarks: With 6 dBi gain antenna			

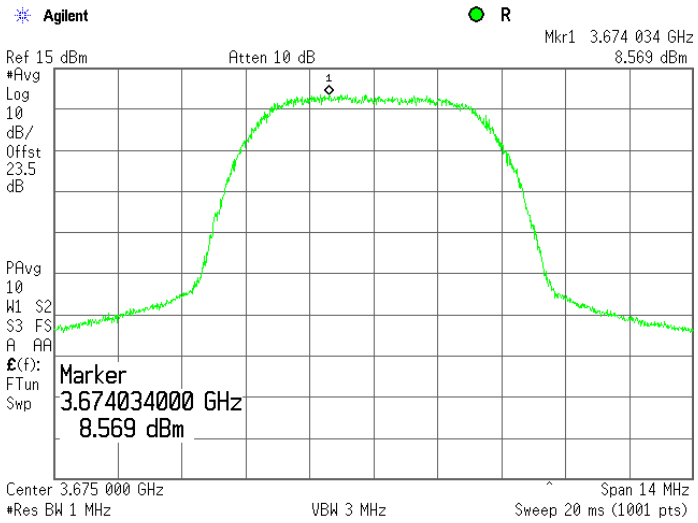
Plot 7.2.3 Peak output power density test results at mid frequency

CARRIER FREQUENCY:	3675 MHz
EMISSION BANDWIDTH:	5 MHz
MODULATION:	QPSK



Plot 7.2.4 Peak output power density test results at mid frequency

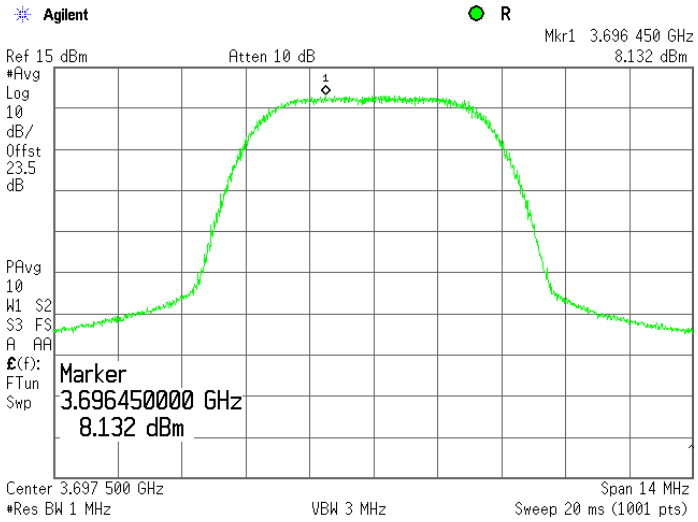
CARRIER FREQUENCY:	3675 MHz
EMISSION BANDWIDTH:	5 MHz
MODULATION:	64QAM



Test specification:	Section 90.1321, Peak EIRP power density		
Test procedure:	47 CFR, Sections 2.1046; TIA/EIA-603-C, Section 2.2.1		
Test mode:	Compliance	Verdict:	PASS
Date:	2/1/2011		
Temperature: 23.2 ºC	Air Pressure: 1013 hPa	Relative Humidity: 41 %	Power Supply: 12 VDC
Remarks: With 6 dBi gain antenna			

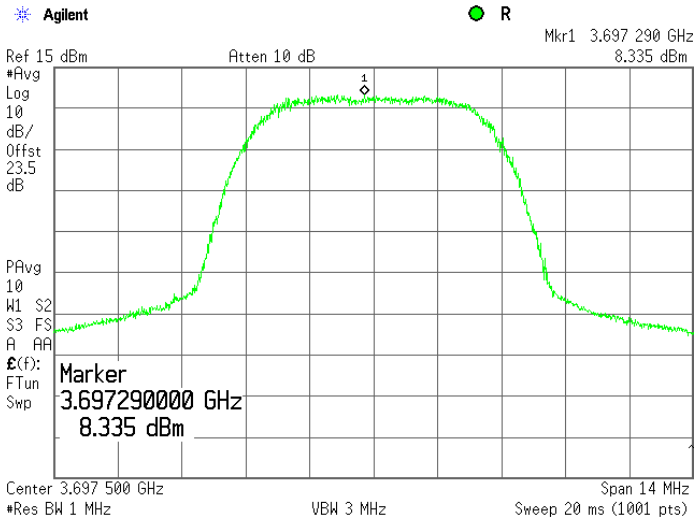
Plot 7.2.5 Peak output power density test results at high frequency

CARRIER FREQUENCY:	3697.5 MHz
EMISSION BANDWIDTH:	5 MHz
MODULATION:	QPSK



Plot 7.2.6 Peak output power density test results at high frequency

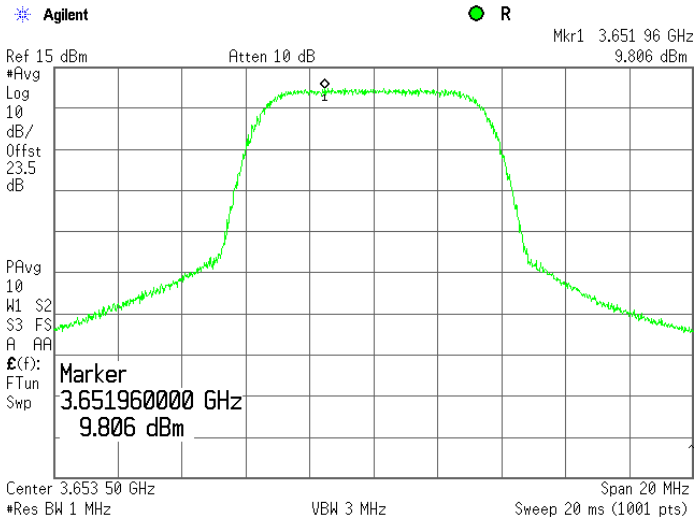
CARRIER FREQUENCY:	3697.5 MHz
EMISSION BANDWIDTH:	5 MHz
MODULATION:	64QAM



Test specification:	Section 90.1321, Peak EIRP power density		
Test procedure:	47 CFR, Sections 2.1046; TIA/EIA-603-C, Section 2.2.1		
Test mode:	Compliance	Verdict:	PASS
Date:	2/1/2011		
Temperature: 23.2 ºC	Air Pressure: 1013 hPa	Relative Humidity: 41 %	Power Supply: 12 VDC
Remarks: With 6 dBi gain antenna			

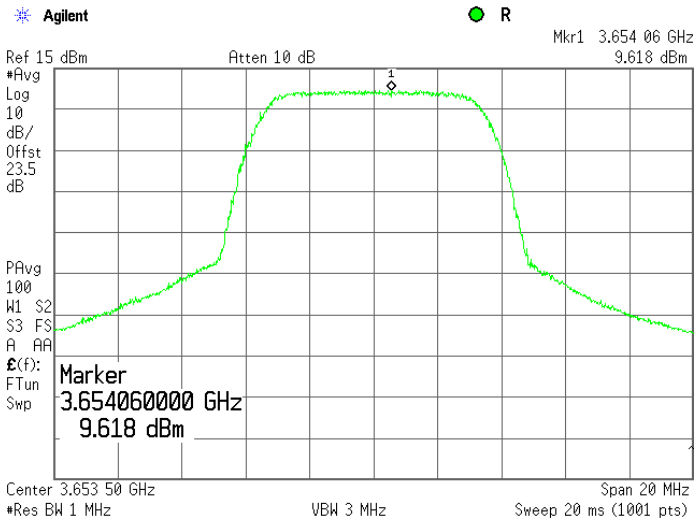
Plot 7.2.7 Peak output power density test results at low frequency

CARRIER FREQUENCY:	3653.5 MHz
EMISSION BANDWIDTH:	7 MHz
MODULATION:	QPSK



Plot 7.2.8 Peak output power density test results at low frequency

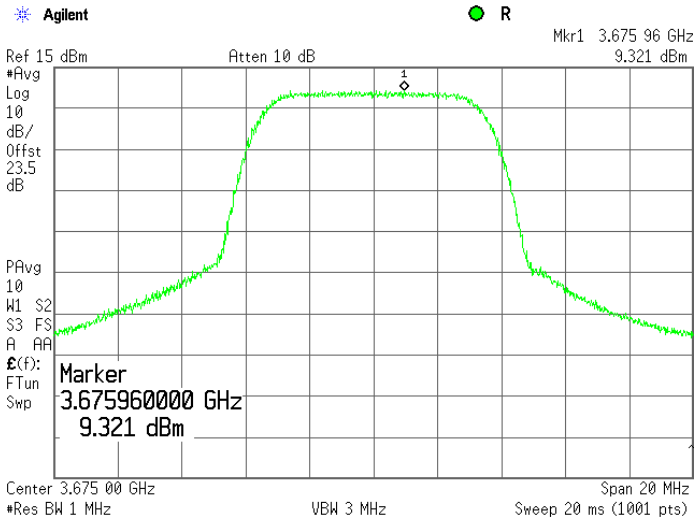
CARRIER FREQUENCY:	3653.5 MHz
EMISSION BANDWIDTH:	7 MHz
MODULATION:	64QAM



Test specification:	Section 90.1321, Peak EIRP power density		
Test procedure:	47 CFR, Sections 2.1046; TIA/EIA-603-C, Section 2.2.1		
Test mode:	Compliance	Verdict:	PASS
Date:	2/1/2011		
Temperature: 23.2 ºC	Air Pressure: 1013 hPa	Relative Humidity: 41 %	Power Supply: 12 VDC
Remarks: With 6 dBi gain antenna			

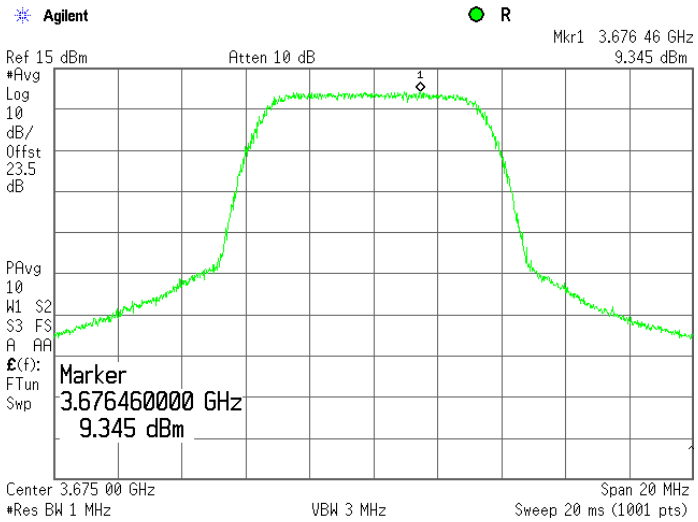
Plot 7.2.9 Peak output power density test results at mid frequency

CARRIER FREQUENCY:	3675 MHz
EMISSION BANDWIDTH:	7 MHz
MODULATION:	QPSK



Plot 7.2.10 Peak output power density test results at mid frequency

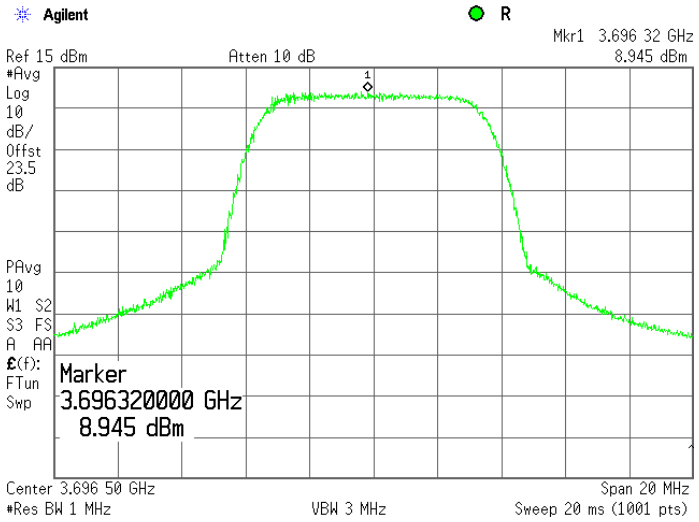
CARRIER FREQUENCY:	3675 MHz
EMISSION BANDWIDTH:	7 MHz
MODULATION:	64QAM



Test specification:	Section 90.1321, Peak EIRP power density		
Test procedure:	47 CFR, Sections 2.1046; TIA/EIA-603-C, Section 2.2.1		
Test mode:	Compliance	Verdict:	PASS
Date:	2/1/2011		
Temperature: 23.2 ºC	Air Pressure: 1013 hPa	Relative Humidity: 41 %	Power Supply: 12 VDC
Remarks: With 6 dBi gain antenna			

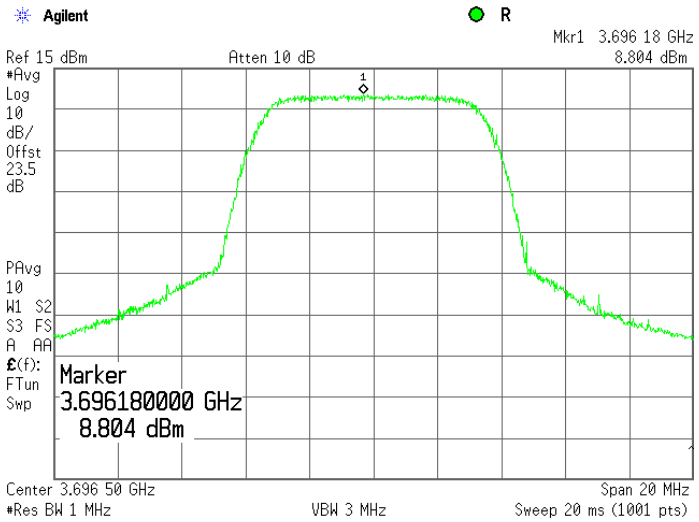
Plot 7.2.11 Peak output power density test results at high frequency

CARRIER FREQUENCY:	3696.5 MHz
EMISSION BANDWIDTH:	7 MHz
MODULATION:	QPSK



Plot 7.2.12 Peak output power density test results at high frequency

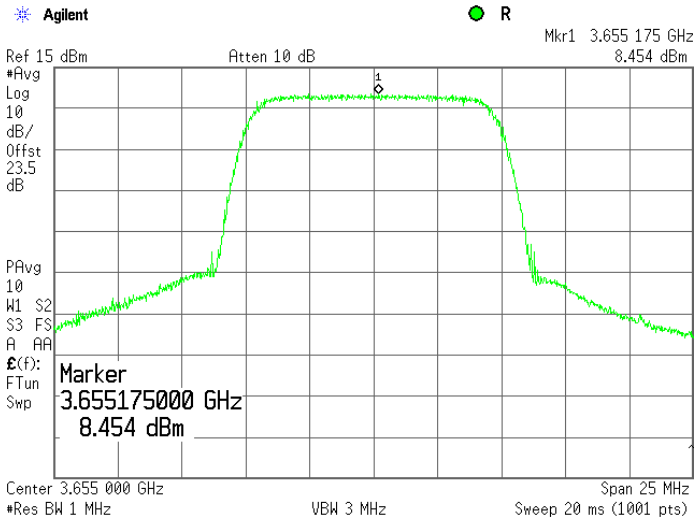
CARRIER FREQUENCY:	3696.5 MHz
EMISSION BANDWIDTH:	7 MHz
MODULATION:	64QAM



Test specification:	Section 90.1321, Peak EIRP power density		
Test procedure:	47 CFR, Sections 2.1046; TIA/EIA-603-C, Section 2.2.1		
Test mode:	Compliance	Verdict:	PASS
Date:	2/1/2011		
Temperature: 23.2 ºC	Air Pressure: 1013 hPa	Relative Humidity: 41 %	Power Supply: 12 VDC
Remarks: With 6 dBi gain antenna			

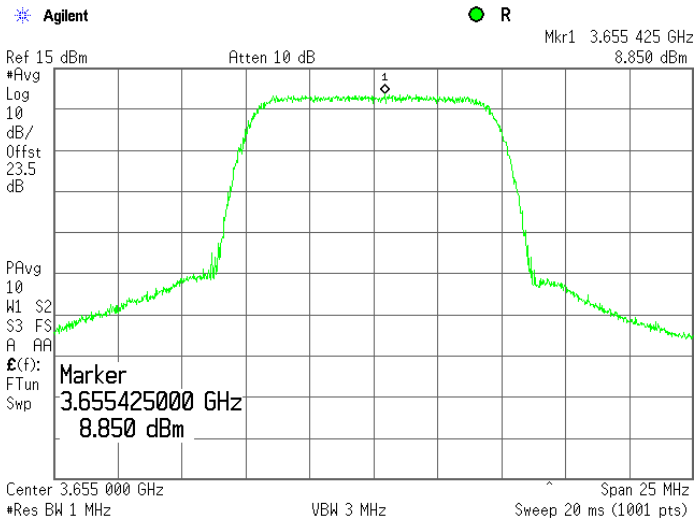
Plot 7.2.13 Peak output power density test results at low frequency

CARRIER FREQUENCY:	3655 MHz
EMISSION BANDWIDTH:	10 MHz
MODULATION:	QPSK



Plot 7.2.14 Peak output power density test results at low frequency

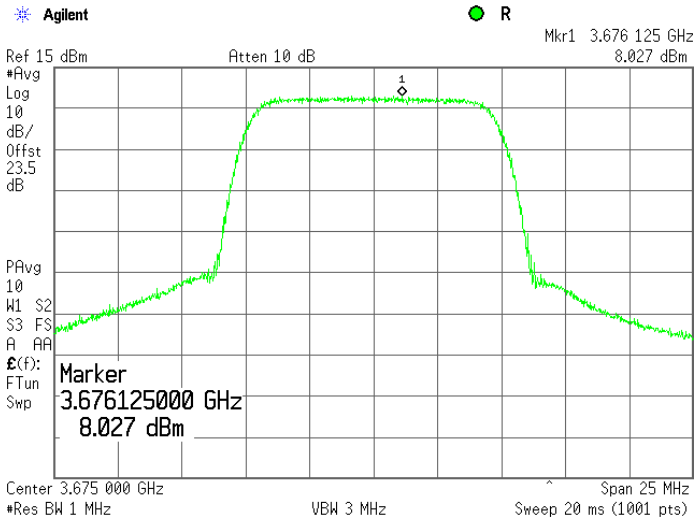
CARRIER FREQUENCY:	3655 MHz
EMISSION BANDWIDTH:	10 MHz
MODULATION:	64QAM



Test specification:	**Section 90.1321, Peak EIRP power density**		
Test procedure:	47 CFR, Sections 2.1046; TIA/EIA-603-C, Section 2.2.1		
Test mode:	Compliance	**Verdict:**	PASS
Date:	2/1/2011		
Temperature: 23.2 ºC	**Air Pressure:** 1013 hPa	**Relative Humidity:** 41 %	**Power Supply:** 12 VDC
Remarks: With 6 dBi gain antenna			

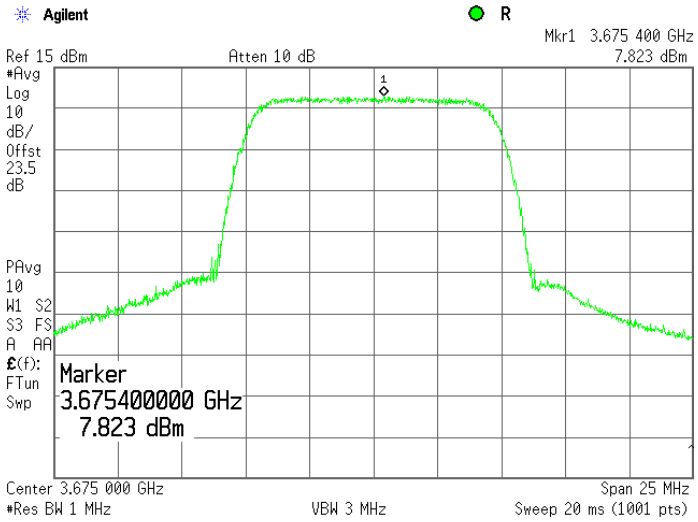
Plot 7.2.15 Peak output power density test results at mid frequency

CARRIER FREQUENCY:	3675 MHz
EMISSION BANDWIDTH:	10 MHz
MODULATION:	QPSK



Plot 7.2.16 Peak output power density test results at mid frequency

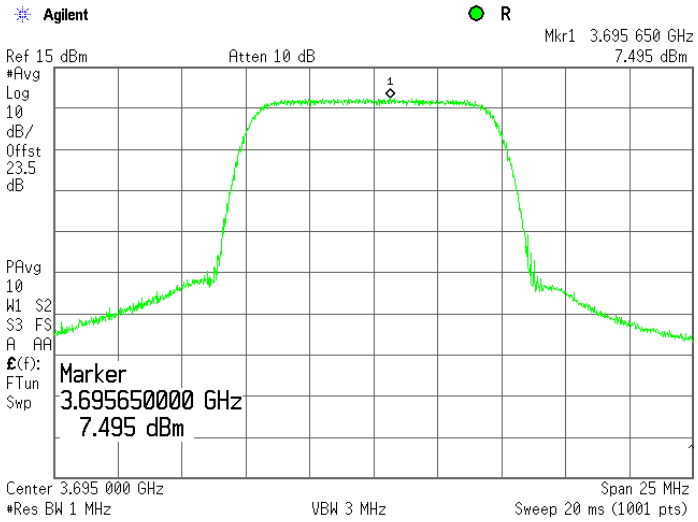
CARRIER FREQUENCY:	3675 MHz
EMISSION BANDWIDTH:	10 MHz
MODULATION:	64QAM



Test specification:	Section 90.1321, Peak EIRP power density		
Test procedure:	47 CFR, Sections 2.1046; TIA/EIA-603-C, Section 2.2.1		
Test mode:	Compliance	Verdict:	PASS
Date:	2/1/2011		
Temperature: 23.2 ºC	Air Pressure: 1013 hPa	Relative Humidity: 41 %	Power Supply: 12 VDC
Remarks: With 6 dBi gain antenna			

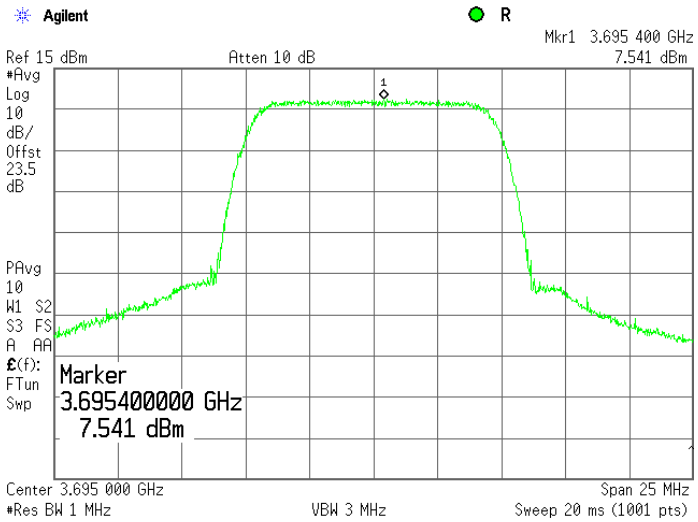
Plot 7.2.17 Peak output power density test results at high frequency

CARRIER FREQUENCY:	3695 MHz
EMISSION BANDWIDTH:	10 MHz
MODULATION:	QPSK



Plot 7.2.18 Peak output power density test results at high frequency

CARRIER FREQUENCY:	3695 MHz
EMISSION BANDWIDTH:	10 MHz
MODULATION:	64QAM



Test specification:	Section 90.1321, Peak EIRP power density		
Test procedure:	47 CFR, Sections 2.1046; TIA/EIA-603-C, Section 2.2.1		
Test mode:	Compliance	Verdict:	PASS
Date:	2/1/2011		
Temperature: 23.2 ºC	Air Pressure: 1013 hPa	Relative Humidity: 41 %	Power Supply: 48VDC
Remarks: With 18 dBi gain antenna			

7.3 Peak EIRP power density for fixed subscriber unit

7.3.1 General

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

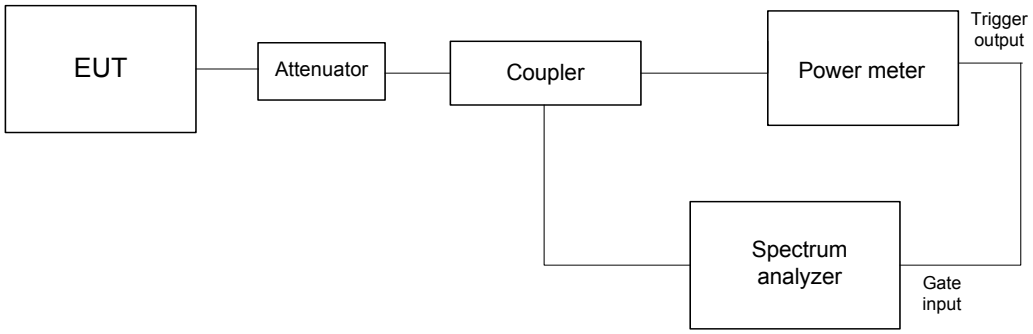
Table 7.3.1 Peak power density limits

Assigned frequency range, MHz	Occupied bandwidth, MHz	Maximum peak power spectral density, EIRP	
		W/MHz	dBm/MHz
Base and fixed stations			
3650.0 – 3700.0	5	1	30
	7		
	10		
Mobile and portable stations			
3650.0 – 3700.0	5	0.04	16
	7		
	10		

7.3.2 Test procedure

7.3.2.1 The EUT was set up as shown in Figure 7.3.1, energized and its proper operation was checked.
7.3.2.2 The EUT was adjusted to produce maximum available for end user RF output power.
7.3.2.3 The peak output power density was measured with spectrum analyzer as provided in Table 7.3.2 and the associated plots.

Figure 7.3.1 Peak power density test setup



Test specification:	**Section 90.1321, Peak EIRP power density**		
Test procedure:	47 CFR, Sections 2.1046; TIA/EIA-603-C, Section 2.2.1		
Test mode:	Compliance	**Verdict:**	PASS
Date:	2/1/2011		
Temperature: 23.2 ºC	**Air Pressure:** 1013 hPa	**Relative Humidity:** 41 %	**Power Supply:** 48VDC
Remarks: With 18 dBi gain antenna			

Table 7.3.2 Peak EIRP power density test results

ASSIGNED FREQUENCY RANGE: 3650.0 – 3700.0 MHz
DETECTOR USED: Average (RMS)
RESOLUTION BANDWIDTH: 1000 kHz
VIDEO BANDWIDTH: 3000 kHz
MODULATING SIGNAL: PRBS
TRANSMITTER OUTPUT POWER SETTINGS: Maximum
ANTENNA ASSEMBLY GAIN: 18 dBi
EBW: 5 MHz

Channel, MHz	Modulation	Pmeas , dBm/MHz	Antenna gain, dBi	EIRP power density*, dBm/MHz	Limit, dBm/MHz	Margin, dB	Verdict
3652.5	QPSK	11.23	18.0	29.23	30.00	-0.77	Pass
3652.5	64QAM	11.39	18.0	29.39	30.00	-0.61	Pass
3675.0	QPSK	10.70	18.0	28.70	30.00	-1.30	Pass
3675.0	64QAM	10.60	18.0	28.60	30.00	-1.40	Pass
3697.5	QPSK	10.09	18.0	28.09	30.00	-1.91	Pass
3697.5	64QAM	10.05	18.0	28.05	30.00	-1.95	Pass

EBW: 7 MHz

Channel, MHz	Modulation	Pmeas , dBm/MHz	Antenna gain, dBi	EIRP power density *, dBm/MHz	Limit, dBm/MHz	Margin, dB	Verdict
3653.5	QPSK	11.20	18.0	29.20	30.00	-0.80	Pass
3653.5	64QAM	11.58	18.0	29.58	30.00	-0.42	Pass
3675.0	QPSK	10.31	18.0	28.31	30.00	-1.69	Pass
3675.0	64QAM	10.52	18.0	28.52	30.00	-1.48	Pass
3696.5	QPSK	9.79	18.0	27.79	30.00	-2.21	Pass
3696.5	64QAM	10.08	18.0	28.08	30.00	-1.92	Pass

EBW: 10 MHz

Channel, MHz	Modulation	Pmeas , dBm/MHz	Antenna gain, dBi	EIRP power density *, dBm/MHz	Limit, dBm/MHz	Margin, dB	Verdict
3655.0	QPSK	10.55	18.0	28.55	30.00	-1.45	Pass
3655.0	64QAM	10.60	18.0	28.60	30.00	-1.40	Pass
3675.0	QPSK	9.86	18.0	27.86	30.00	-2.14	Pass
3675.0	64QAM	10.33	18.0	28.33	30.00	-1.67	Pass
3695.0	QPSK	9.56	18.0	27.56	30.00	-2.44	Pass
3695.0	64QAM	9.61	18.0	27.61	30.00	-2.39	Pass

- EIRP power density, dBm/MHz = Pmeas, dBm/MHz + Antenna Gain, dBi

Reference numbers of test equipment used

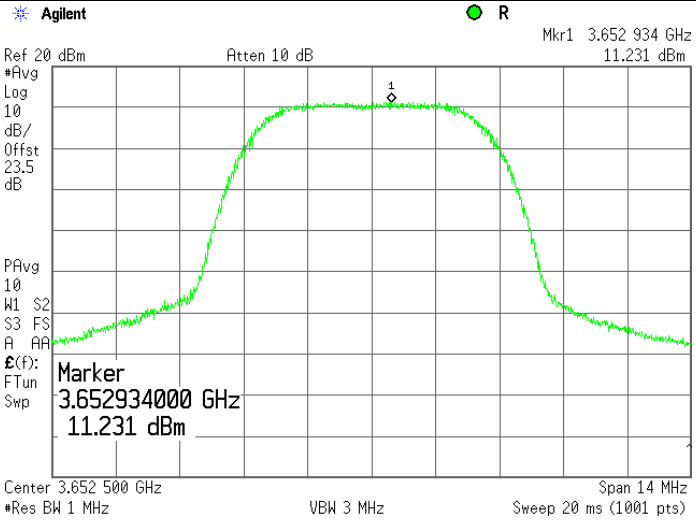
HL 2013	HL 2952	HL 3768	HL 3818				

Full description is given in Appendix A.

Test specification:	**Section 90.1321, Peak EIRP power density**		
Test procedure:	47 CFR, Sections 2.1046; TIA/EIA-603-C, Section 2.2.1		
Test mode:	Compliance	**Verdict:**	PASS
Date:	2/1/2011		
Temperature: 23.2 ºC	**Air Pressure:** 1013 hPa	**Relative Humidity:** 41 %	**Power Supply:** 48VDC
Remarks: With 18 dBi gain antenna			

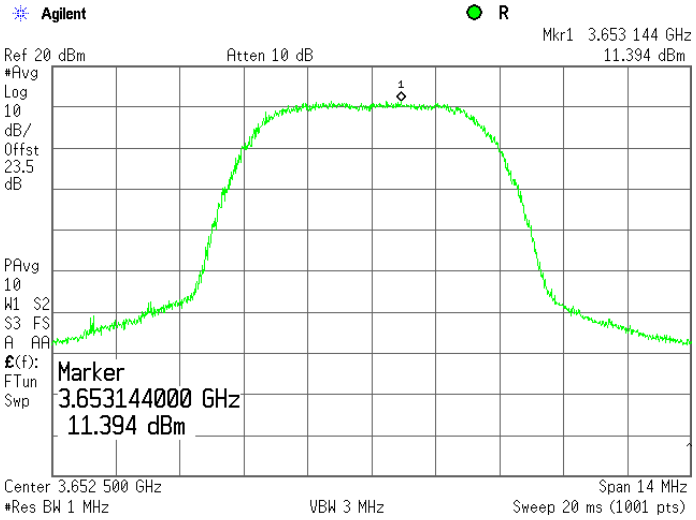
Plot 7.3.1 Peak output power density test results at low frequency

CARRIER FREQUENCY:	3652.5 MHz
EMISSION BANDWIDTH:	5 MHz
MODULATION:	QPSK



Plot 7.3.2 Peak output power density test results at low frequency

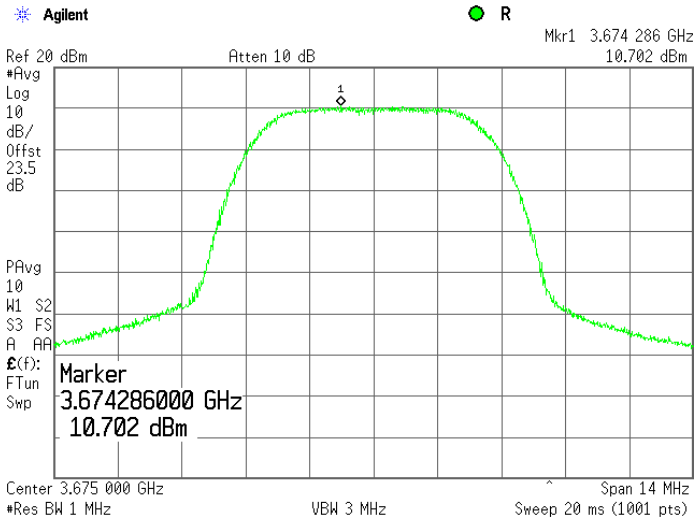
CARRIER FREQUENCY:	3652.5 MHz
EMISSION BANDWIDTH:	5 MHz
MODULATION:	64QAM



Test specification:	Section 90.1321, Peak EIRP power density		
Test procedure:	47 CFR, Sections 2.1046; TIA/EIA-603-C, Section 2.2.1		
Test mode:	Compliance	Verdict:	PASS
Date:	2/1/2011		
Temperature: 23.2 ºC	Air Pressure: 1013 hPa	Relative Humidity: 41 %	Power Supply: 48VDC
Remarks: With 18 dBi gain antenna			

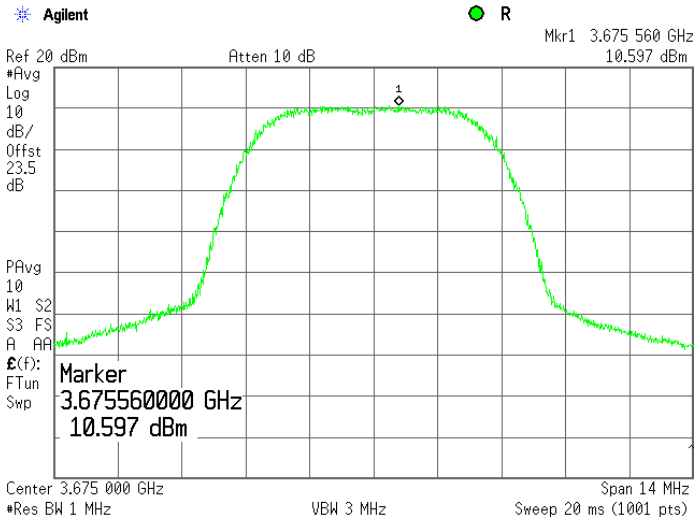
Plot 7.3.3 Peak output power density test results at mid frequency

CARRIER FREQUENCY:	3675 MHz
EMISSION BANDWIDTH:	5 MHz
MODULATION:	QPSK



Plot 7.3.4 Peak output power density test results at mid frequency

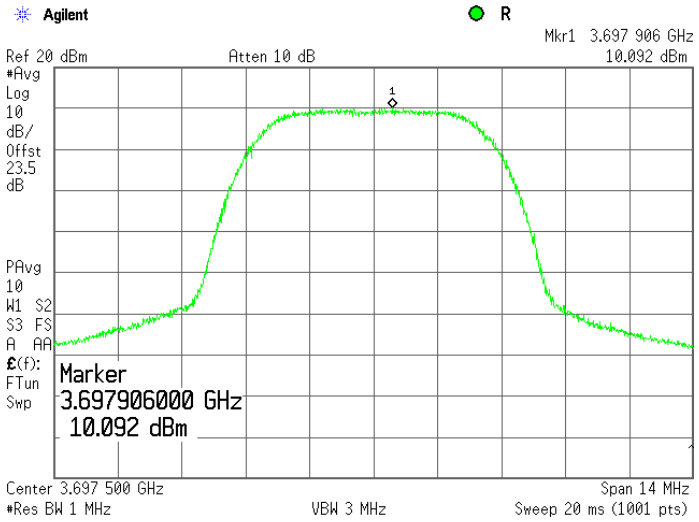
CARRIER FREQUENCY:	3675 MHz
EMISSION BANDWIDTH:	5 MHz
MODULATION:	64QAM



Test specification:	Section 90.1321, Peak EIRP power density		
Test procedure:	47 CFR, Sections 2.1046; TIA/EIA-603-C, Section 2.2.1		
Test mode:	Compliance	Verdict:	PASS
Date:	2/1/2011		
Temperature: 23.2 ºC	Air Pressure: 1013 hPa	Relative Humidity: 41 %	Power Supply: 48VDC
Remarks: With 18 dBi gain antenna			

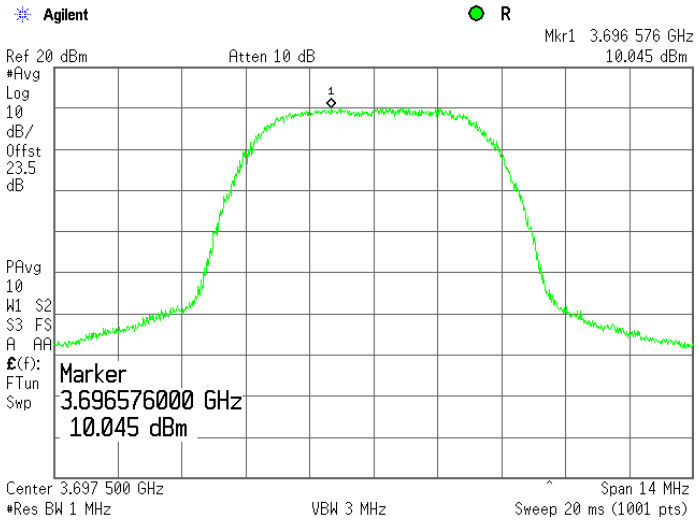
Plot 7.3.5 Peak output power density test results at high frequency

CARRIER FREQUENCY:	3697.5 MHz
EMISSION BANDWIDTH:	5 MHz
MODULATION:	QPSK



Plot 7.3.6 Peak output power density test results at high frequency

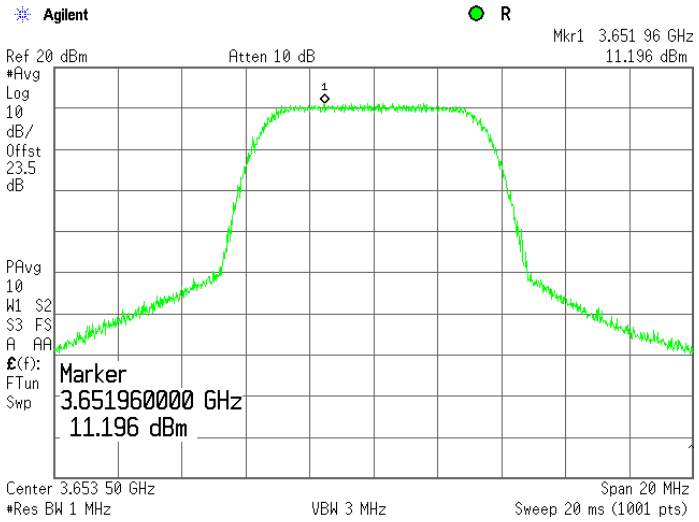
CARRIER FREQUENCY:	3697.5 MHz
EMISSION BANDWIDTH:	5 MHz
MODULATION:	64QAM



Test specification:	Section 90.1321, Peak EIRP power density		
Test procedure:	47 CFR, Sections 2.1046; TIA/EIA-603-C, Section 2.2.1		
Test mode:	Compliance	Verdict:	PASS
Date:	2/1/2011		
Temperature: 23.2 ºC	Air Pressure: 1013 hPa	Relative Humidity: 41 %	Power Supply: 48VDC
Remarks: With 18 dBi gain antenna			

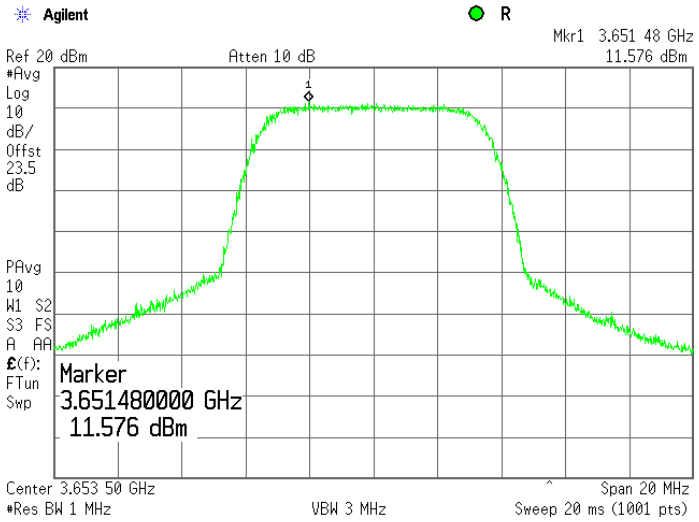
Plot 7.3.7 Peak output power density test results at low frequency

CARRIER FREQUENCY:	3653.5 MHz
EMISSION BANDWIDTH:	7 MHz
MODULATION:	QPSK



Plot 7.3.8 Peak output power density test results at low frequency

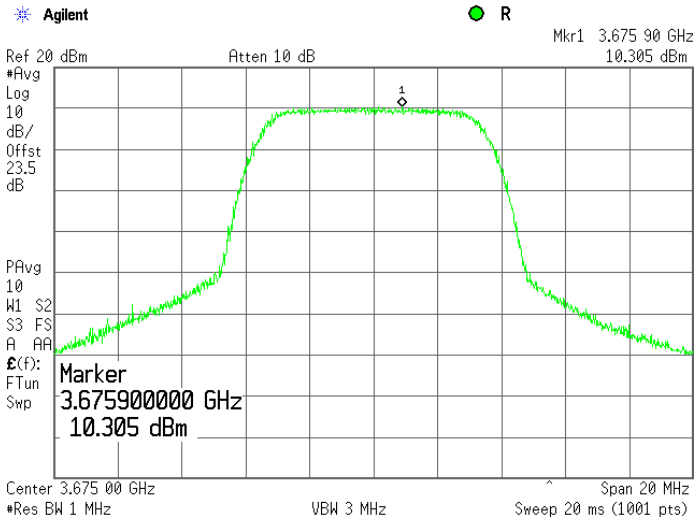
CARRIER FREQUENCY:	3653.5 MHz
EMISSION BANDWIDTH:	7 MHz
MODULATION:	64QAM



Test specification:	Section 90.1321, Peak EIRP power density		
Test procedure:	47 CFR, Sections 2.1046; TIA/EIA-603-C, Section 2.2.1		
Test mode:	Compliance	Verdict:	PASS
Date:	2/1/2011		
Temperature: 23.2 ºC	Air Pressure: 1013 hPa	Relative Humidity: 41 %	Power Supply: 48VDC
Remarks: With 18 dBi gain antenna			

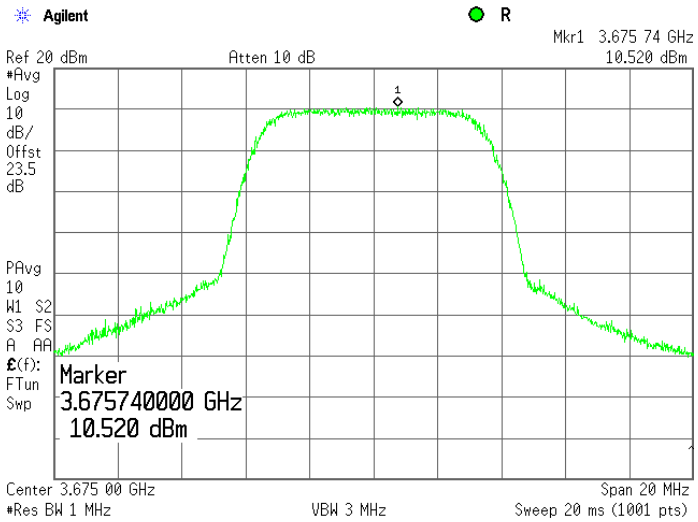
Plot 7.3.9 Peak output power density test results at mid frequency

CARRIER FREQUENCY:	3675 MHz
EMISSION BANDWIDTH:	7 MHz
MODULATION:	QPSK



Plot 7.3.10 Peak output power density test results at mid frequency

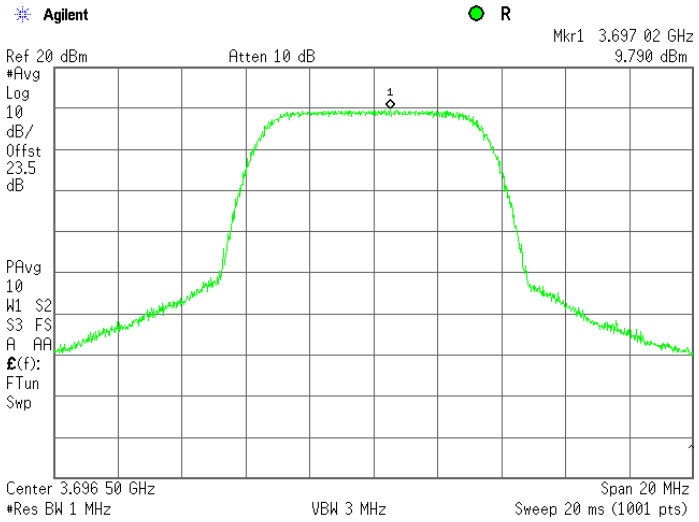
CARRIER FREQUENCY:	3675 MHz
EMISSION BANDWIDTH:	7 MHz
MODULATION:	64QAM



Test specification:	Section 90.1321, Peak EIRP power density		
Test procedure:	47 CFR, Sections 2.1046; TIA/EIA-603-C, Section 2.2.1		
Test mode:	Compliance	Verdict:	PASS
Date:	2/1/2011		
Temperature: 23.2 ºC	Air Pressure: 1013 hPa	Relative Humidity: 41 %	Power Supply: 48VDC
Remarks: With 18 dBi gain antenna			

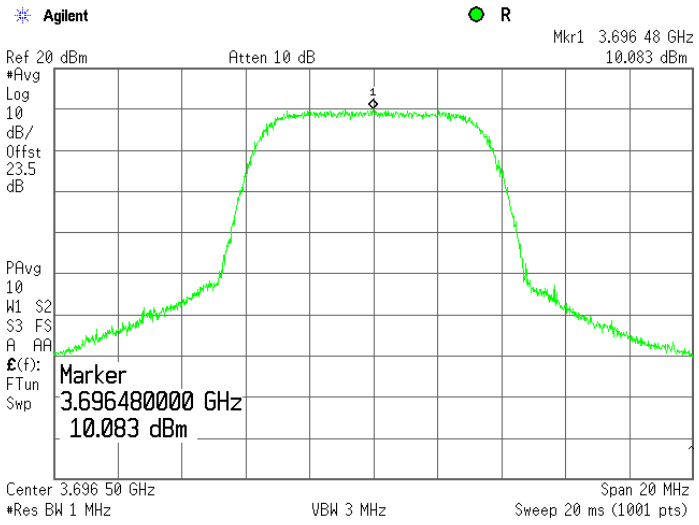
Plot 7.3.11 Peak output power density test results at high frequency

CARRIER FREQUENCY:	3696.5 MHz
EMISSION BANDWIDTH:	7 MHz
MODULATION:	QPSK



Plot 7.3.12 Peak output power density test results at high frequency

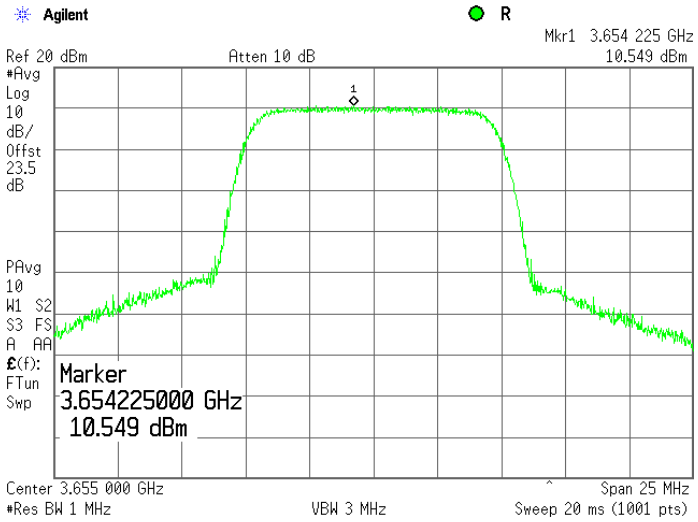
CARRIER FREQUENCY:	3696.5 MHz
EMISSION BANDWIDTH:	7 MHz
MODULATION:	64QAM



Test specification:	Section 90.1321, Peak EIRP power density		
Test procedure:	47 CFR, Sections 2.1046; TIA/EIA-603-C, Section 2.2.1		
Test mode:	Compliance	Verdict:	PASS
Date:	2/1/2011		
Temperature: 23.2 ºC	Air Pressure: 1013 hPa	Relative Humidity: 41 %	Power Supply: 48VDC
Remarks: With 18 dBi gain antenna			

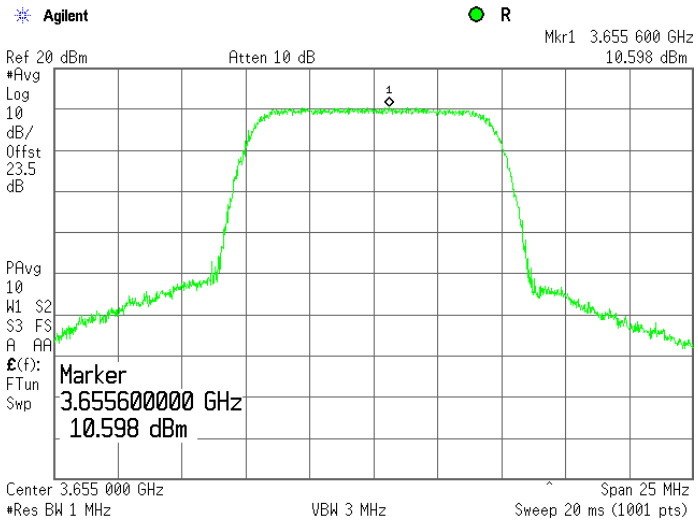
Plot 7.3.13 Peak output power density test results at low frequency

CARRIER FREQUENCY:	3655 MHz
EMISSION BANDWIDTH:	10 MHz
MODULATION:	QPSK



Plot 7.3.14 Peak output power density test results at low frequency

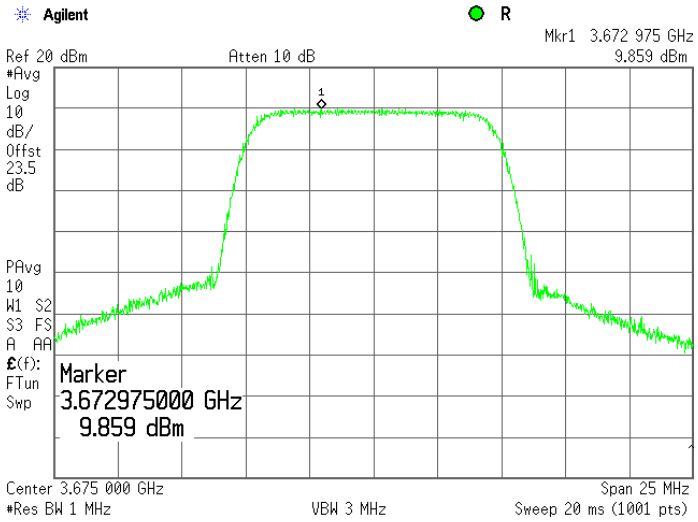
CARRIER FREQUENCY:	3655 MHz
EMISSION BANDWIDTH:	10 MHz
MODULATION:	64QAM



Test specification:	Section 90.1321, Peak EIRP power density		
Test procedure:	47 CFR, Sections 2.1046; TIA/EIA-603-C, Section 2.2.1		
Test mode:	Compliance	Verdict:	PASS
Date:	2/1/2011		
Temperature: 23.2 ºC	Air Pressure: 1013 hPa	Relative Humidity: 41 %	Power Supply: 48VDC
Remarks: With 18 dBi gain antenna			

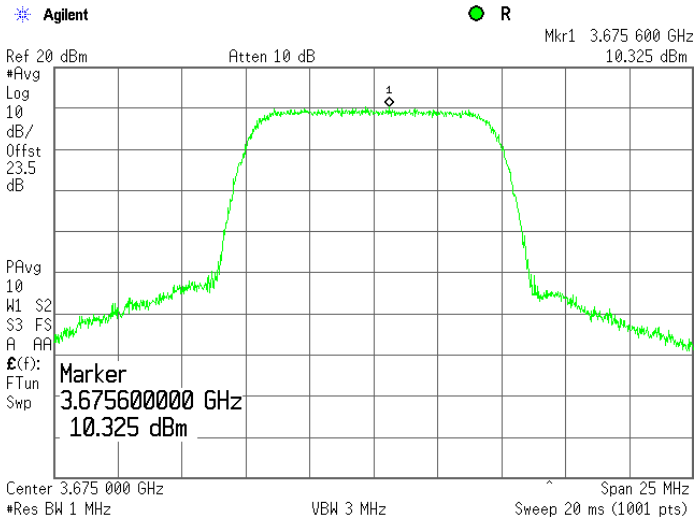
Plot 7.3.15 Peak output power density test results at mid frequency

CARRIER FREQUENCY:	3675 MHz
EMISSION BANDWIDTH:	10 MHz
MODULATION:	QPSK



Plot 7.3.16 Peak output power density test results at mid frequency

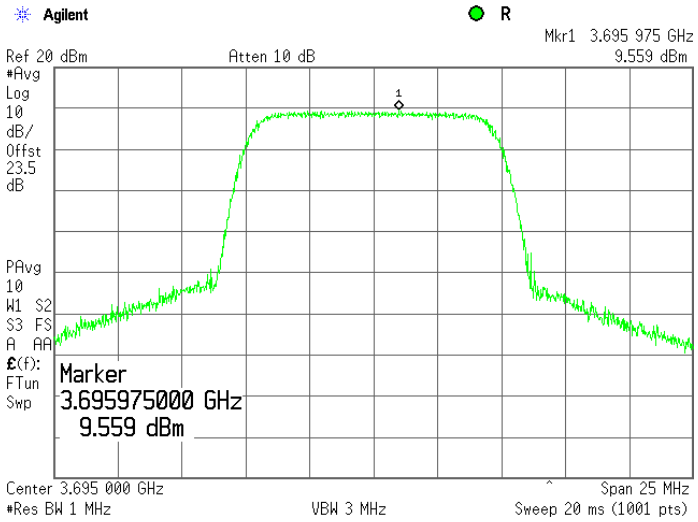
CARRIER FREQUENCY:	3675 MHz
EMISSION BANDWIDTH:	10 MHz
MODULATION:	64QAM



Test specification:	Section 90.1321, Peak EIRP power density		
Test procedure:	47 CFR, Sections 2.1046; TIA/EIA-603-C, Section 2.2.1		
Test mode:	Compliance	Verdict:	PASS
Date:	2/1/2011		
Temperature: 23.2 ºC	Air Pressure: 1013 hPa	Relative Humidity: 41 %	Power Supply: 48VDC
Remarks: With 18 dBi gain antenna			

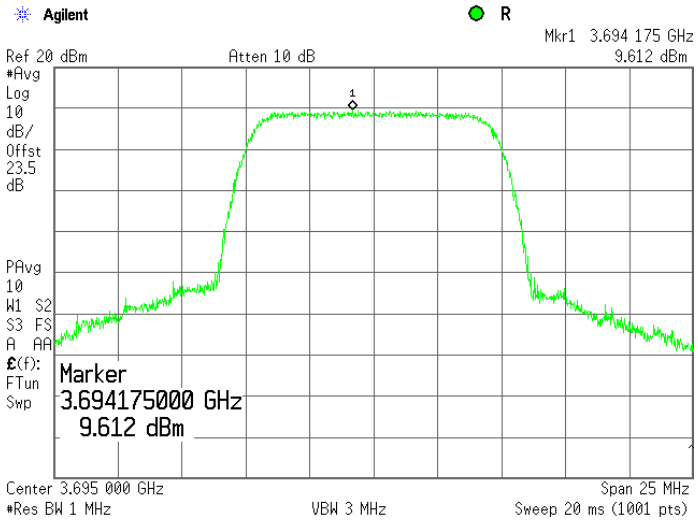
Plot 7.3.17 Peak output power density test results at high frequency

CARRIER FREQUENCY:	3695 MHz
EMISSION BANDWIDTH:	10 MHz
MODULATION:	QPSK



Plot 7.3.18 Peak output power density test results at high frequency

CARRIER FREQUENCY:	3695 MHz
EMISSION BANDWIDTH:	10 MHz
MODULATION:	64QAM



Test specification:	Section 90.209, Occupied bandwidth		
Test procedure:	47 CFR, Section 2.1049		
Test mode:	Compliance	Verdict:	PASS
Date:	2/2/2011		
Temperature: 23.4 ºC	Air Pressure: 1015 hPa	Relative Humidity: 42 %	Power Supply: 48VDC
Remarks:			

7.4 Occupied bandwidth test

7.4.1 General

This test was performed to measure transmitter occupied bandwidth. Specification test limits are given in Table 7.4.1.

Table 7.4.1 Occupied bandwidth limits

Assigned frequency, MHz	Modulation envelope reference points*, dBc	Maximum allowed bandwidth, MHz
3650.0 – 3700.0	99% power	NA

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

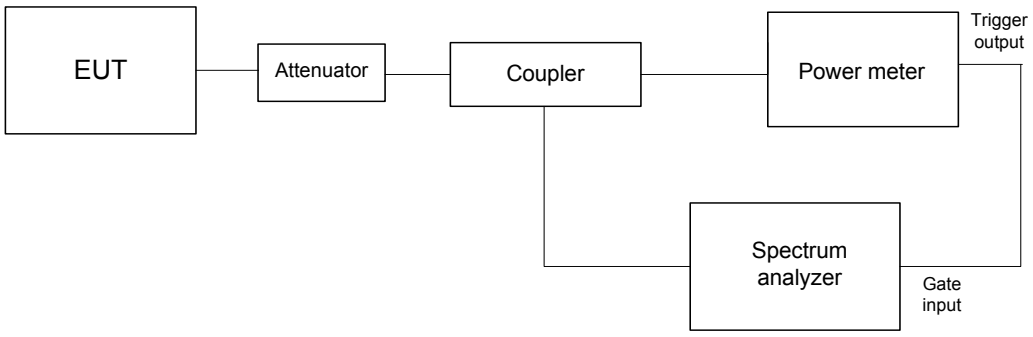
7.4.2 Test procedure

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

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

7.4.2.3 The transmitter occupied bandwidth was measured with spectrum analyzer as a frequency delta between the reference points on modulation envelope and provided in Table 7.4.2 and the associated plots.

Figure 7.4.1 Occupied bandwidth test setup



Test specification:	Section 90.209, Occupied bandwidth		
Test procedure:	47 CFR, Section 2.1049		
Test mode:	Compliance	Verdict:	PASS
Date:	2/2/2011		
Temperature: 23.4 ºC	Air Pressure: 1015 hPa	Relative Humidity: 42 %	Power Supply: 48VDC
Remarks:			

Table 7.4.2 Occupied bandwidth test results

DETECTOR USED: Average
RESOLUTION BANDWIDTH: 0.5-2% of the Emission bandwidth
VIDEO BANDWIDTH: 10 times RBW
MODULATING SIGNAL: PRBS

Carrier frequency, MHz	Measured with antenna assembly gain	Modulation	99% Occupied bandwidth, MHz	Emission bandwidth, MHz
3652.5	18.0	QPSK	4.4406	5.0
	18.0	64QAM	4.4170	5.0
3675.0	18.0	QPSK	4.4420	5.0
	18.0	64QAM	4.4569	5.0
3697.5	18.0	QPSK	4.4532	5.0
	18.0	64QAM	4.4491	5.0
3653.5	18.0	QPSK	6.4999	7.0
	18.0	64QAM	6.4446	7.0
3675.0	18.0	QPSK	6.5064	7.0
	18.0	64QAM	6.4690	7.0
3696.5	18.0	QPSK	6.4918	7.0
	18.0	64QAM	6.4646	7.0
3655.0	18.0	QPSK	9.1044	10.0
	18.0	64QAM	9.1027	10.0
3675.0	18.0	QPSK	9.1045	10.0
	18.0	64QAM	9.0797	10.0
3695.0	18.0	QPSK	9.1013	10.0
	18.0	64QAM	9.0993	10.0

Reference numbers of test equipment used

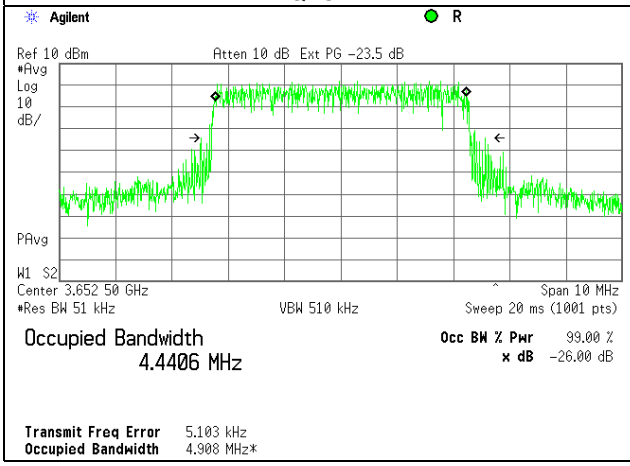
HL 2013	HL 2952	HL 3768	HL 3818				

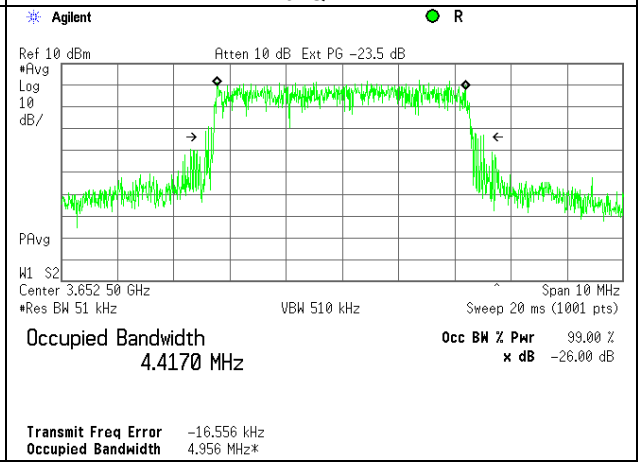
Full description is given in Appendix A.

Test specification:	**Section 90.209, Occupied bandwidth**		
Test procedure:	47 CFR, Section 2.1049		
Test mode:	Compliance	**Verdict:**	PASS
Date:	2/2/2011		
Temperature: 23.4 ºC	**Air Pressure:** 1015 hPa	**Relative Humidity:** 42 %	**Power Supply:** 48VDC
Remarks:			

Plot 7.4.1 The 99% occupied bandwidth test results at low frequency

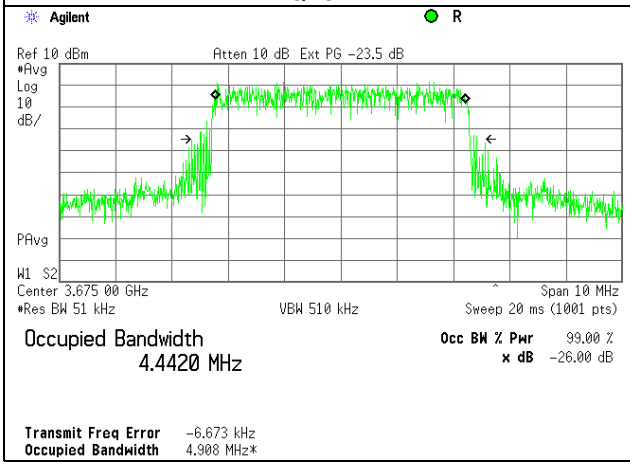
CARRIER FREQUENCY:	3652.5 MHz
EMISSION BANDWIDTH:	5 MHz
MODULATION	
QPSK	64QAM

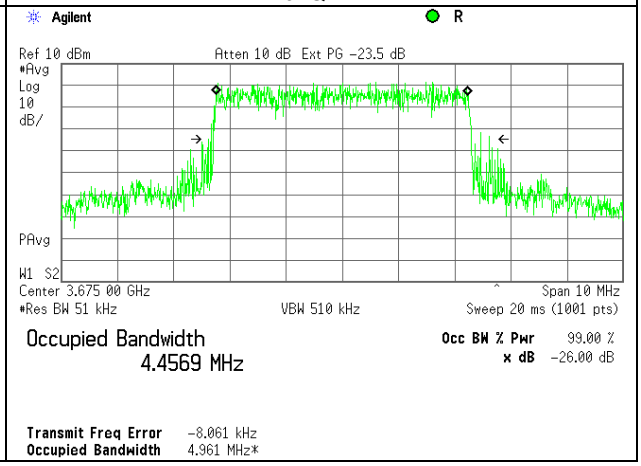




Plot 7.4.2 The 99% occupied bandwidth test results at mid frequency

CARRIER FREQUENCY:	3675.0 MHz
EMISSION BANDWIDTH:	5 MHz
MODULATION	
QPSK	64QAM

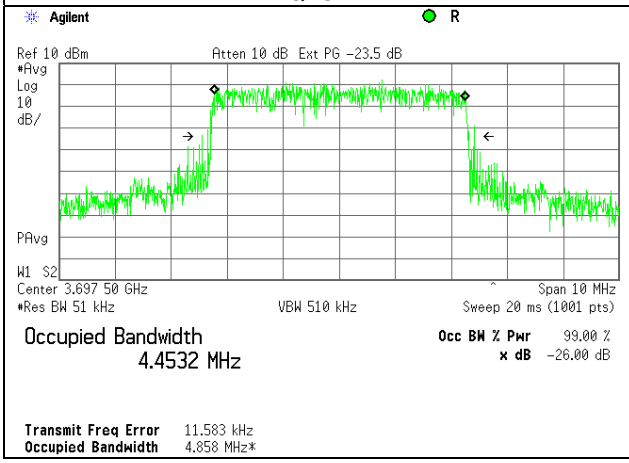


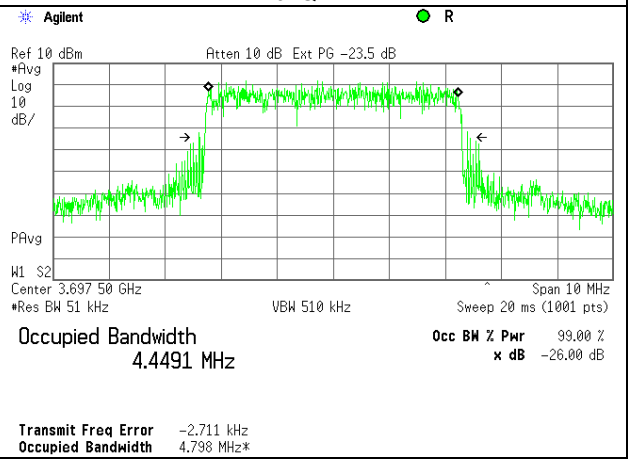


Test specification:	**Section 90.209, Occupied bandwidth**		
Test procedure:	47 CFR, Section 2.1049		
Test mode:	Compliance	**Verdict:**	PASS
Date:	2/2/2011		
Temperature: 23.4 ºC	**Air Pressure:** 1015 hPa	**Relative Humidity:** 42 %	**Power Supply:** 48VDC
Remarks:			

Plot 7.4.3 The 99% occupied bandwidth test results at high frequency

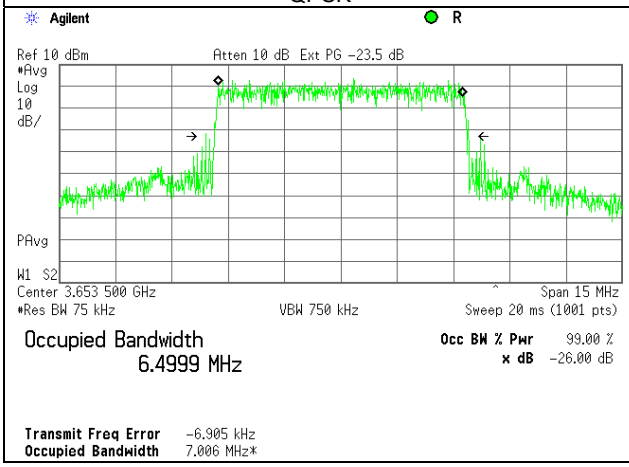
CARRIER FREQUENCY:	3697.5 MHz
EMISSION BANDWIDTH:	5 MHz
MODULATION	
QPSK	64QAM

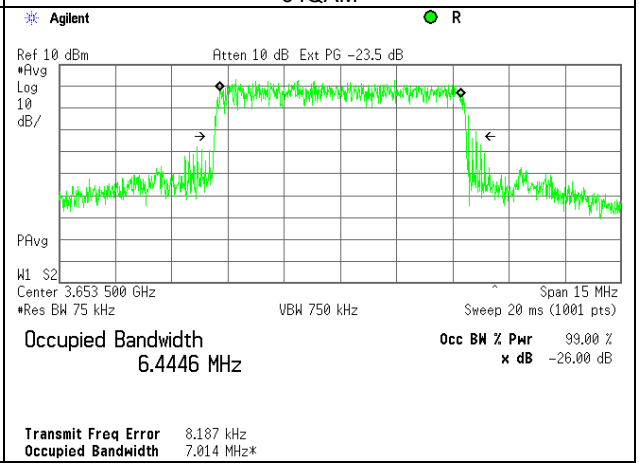




Plot 7.4.4 The 99% occupied bandwidth test results at low frequency

CARRIER FREQUENCY:	3653.5 MHz
EMISSION BANDWIDTH:	7 MHz
MODULATION	
QPSK	64QAM

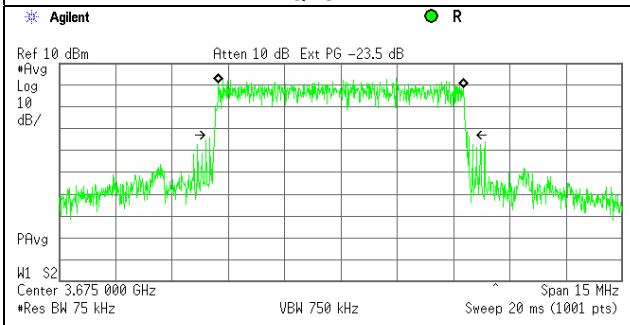


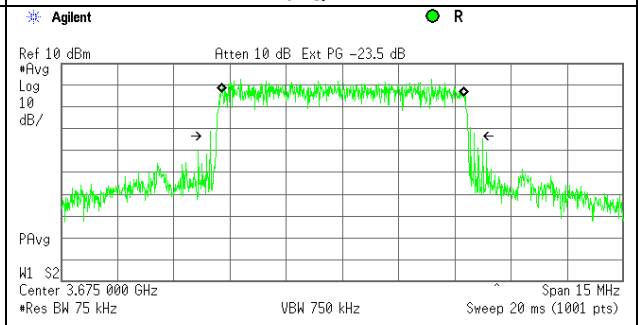


Test specification:	**Section 90.209, Occupied bandwidth**		
Test procedure:	47 CFR, Section 2.1049		
Test mode:	Compliance	**Verdict:**	PASS
Date:	2/2/2011		
Temperature: 23.4 ºC	**Air Pressure:** 1015 hPa	**Relative Humidity:** 42 %	**Power Supply:** 48VDC
Remarks:			

Plot 7.4.5 The 99% occupied bandwidth test results at mid frequency

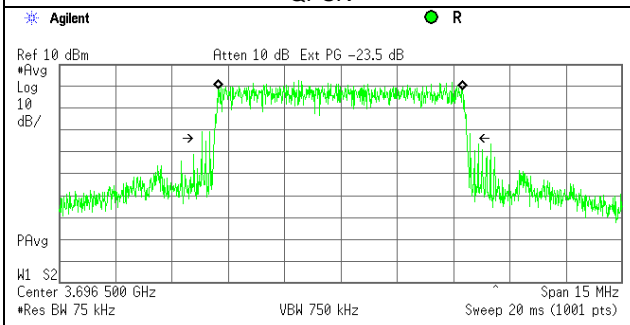
CARRIER FREQUENCY:	3675.0 MHz
EMISSION BANDWIDTH:	7 MHz
MODULATION	
QPSK	64QAM

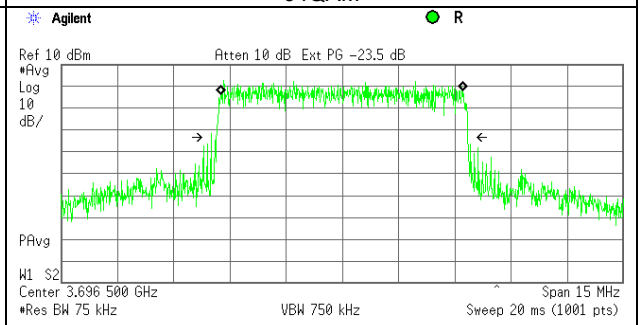




Plot 7.4.6 The 99% occupied bandwidth test results at high frequency

CARRIER FREQUENCY:	3696.5 MHz
EMISSION BANDWIDTH:	7 MHz
MODULATION	
QPSK	64QAM

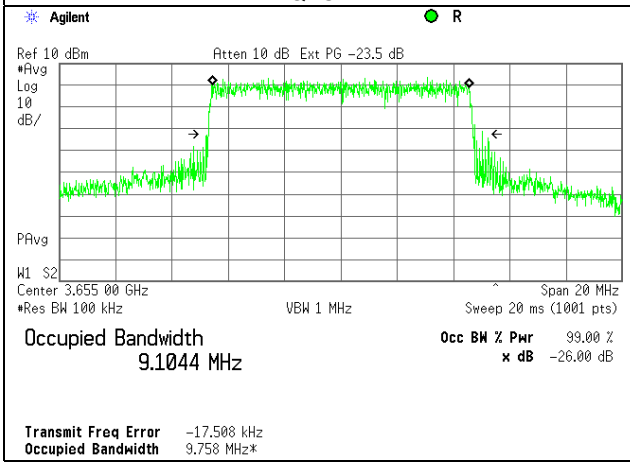


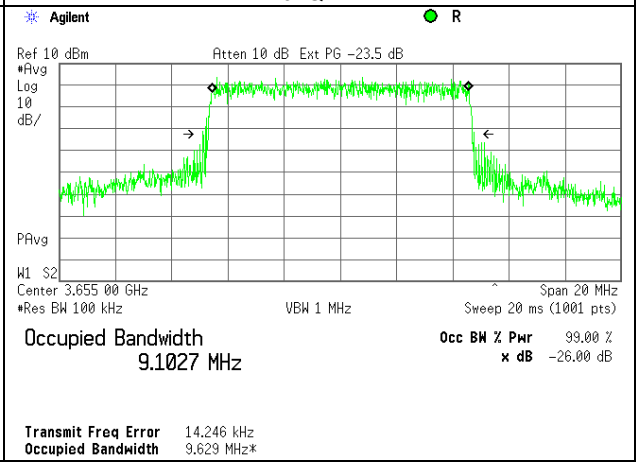


Test specification:	**Section 90.209, Occupied bandwidth**		
Test procedure:	47 CFR, Section 2.1049		
Test mode:	Compliance	**Verdict:**	PASS
Date:	2/2/2011		
Temperature: 23.4 ºC	**Air Pressure:** 1015 hPa	**Relative Humidity:** 42 %	**Power Supply:** 48VDC
Remarks:			

Plot 7.4.7 The 99% occupied bandwidth test results at low frequency

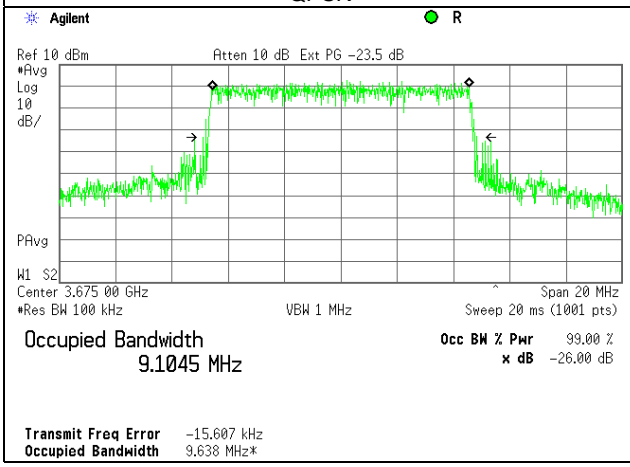
CARRIER FREQUENCY:	3655.0 MHz
EMISSION BANDWIDTH:	10 MHz
MODULATION	
QPSK	64QAM

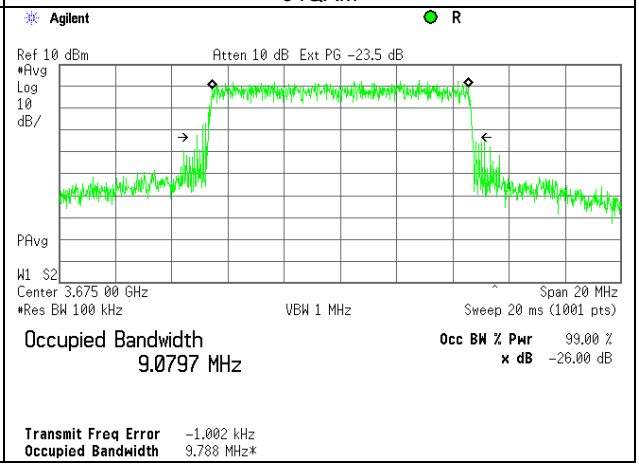




Plot 7.4.8 The 99% occupied bandwidth test results at mid frequency

CARRIER FREQUENCY:	3675.0 MHz
EMISSION BANDWIDTH:	10 MHz
MODULATION	
QPSK	64QAM

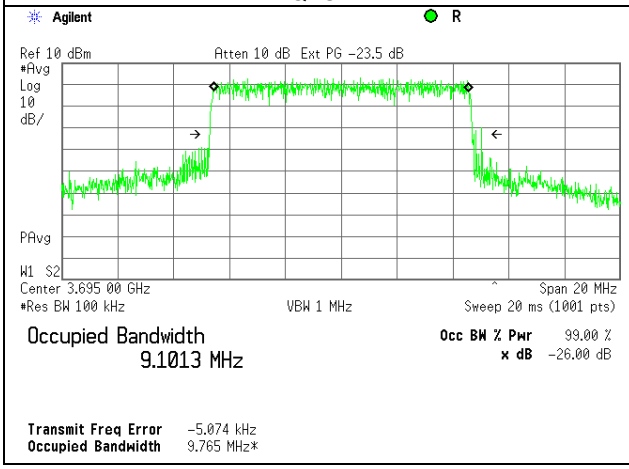


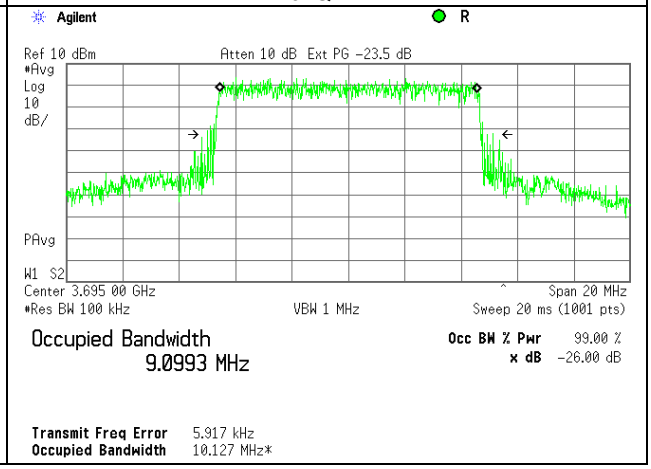


Test specification:	**Section 90.209, Occupied bandwidth**		
Test procedure:	47 CFR, Section 2.1049		
Test mode:	Compliance	**Verdict:**	PASS
Date:	2/2/2011		
Temperature: 23.4 ºC	**Air Pressure:** 1015 hPa	**Relative Humidity:** 42 %	**Power Supply:** 48VDC
Remarks:			

Plot 7.4.9 The 99% occupied bandwidth test results at high frequency

CARRIER FREQUENCY:	3695.0 MHz
EMISSION BANDWIDTH:	10 MHz
MODULATION	
QPSK	64QAM





Test specification:	Section 90.210(b), Emission mask		
Test procedure:	47 CFR, Sections 2.1051, 2.1047, 90.210; TIA/EIA-603-C, Section 2.2.13		
Test mode:	Compliance	Verdict:	PASS
Date:	2/2/2011		
Temperature: 23.4 ºC	Air Pressure: 1015 hPa	Relative Humidity: 42 %	Power Supply: 48VDC
Remarks:			

7.5 Emission mask test

7.5.1 General

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

Table 7.5.1 Emission mask limits

Frequency displacement from carrier	Attenuation below carrier, dBc
Emission mask B (Emission 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 (Emission 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 (Emission bandwidth 10 MHz)	
0 – 5 MHz	0
5 – 10.0 MHz	25
10.0 – 25.0 MHz	35
More than* 25.0 MHz	43 + 10 log(P)

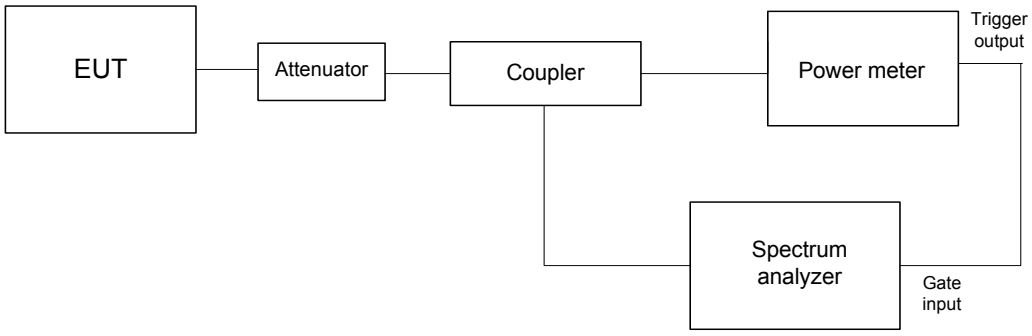
* - emission mask includes carrier modulation envelope within ± 250 % of the authorized bandwidth; the frequency range removed beyond ± 250 % of the authorized bandwidth from carrier was investigated as spurious emission

7.5.2 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 emission mask was measured with spectrum analyzer as provided in the associated plots. The test results recorded in Table 7.5.2.

Figure 7.5.1 Emission mask test setup



Test specification:	Section 90.210(b), Emission mask		
Test procedure:	47 CFR, Sections 2.1051, 2.1047, 90.210; TIA/EIA-603-C, Section 2.2.13		
Test mode:	Compliance	Verdict:	PASS
Date:	2/2/2011		
Temperature: 23.4 ºC	Air Pressure: 1015 hPa	Relative Humidity: 42 %	Power Supply: 48VDC
Remarks:			

Table 7.5.2 Emission mask test results

Carrier frequency, MHz	RBW, kHz (NOTE)	Limit	Reference to Plot	Verdict
Channel bandwidth 5 MHz				
3652.5	100	Emission mask B	Plot 7.5.1	Pass
3675.0	100		Plot 7.5.2	
3697.5	100		Plot 7.5.3	
Channel bandwidth 7 MHz				
3655.0	100	Emission mask B	Plot 7.5.4	Pass
3675.0	100		Plot 7.5.5	
3695.0	100		Plot 7.5.6	
Channel bandwidth 10 MHz				
3660.0	100	Emission mask B	Plot 7.5.7	Pass
3675.0	100		Plot 7.5.8	
3690.0	100		Plot 7.5.9	

NOTE: Attenuation below carrier provided in terms of attenuation below total average power within occupied bandwidth. Measurement was performed with RBW set to 100 kHz and the limit mask was reduced by 10 dB to compensate the lower RBW [10*log(1 MHz/ 100 kHz] = 10 dB.

Reference numbers of test equipment used

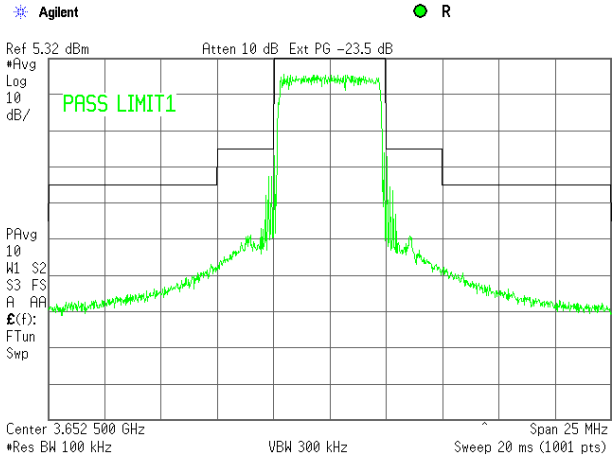
HL 2013	HL 2952	HL 3768	HL 3818				

Full description is given in Appendix A.

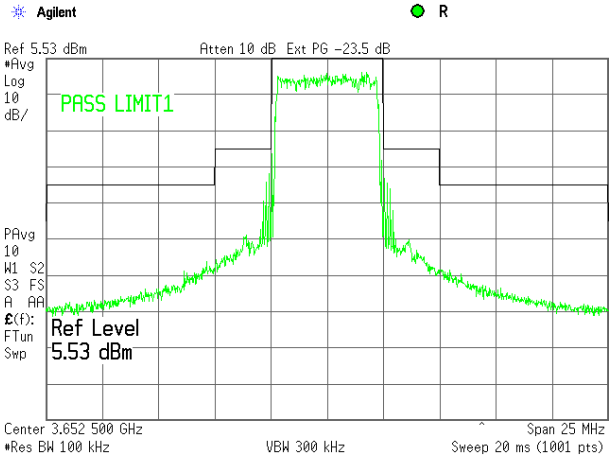
Test specification:	Section 90.210(b), Emission mask		
Test procedure:	47 CFR, Sections 2.1051, 2.1047, 90.210; TIA/EIA-603-C, Section 2.2.13		
Test mode:	Compliance	Verdict:	PASS
Date:	2/2/2011		
Temperature: 23.4 ºC	Air Pressure: 1015 hPa	Relative Humidity: 42 %	Power Supply: 48VDC
Remarks:			

Plot 7.5.1 Emission mask test results at low carrier frequency

ASSIGNED FREQUENCY RANGE: 3650 – 3700 MHz
DETECTOR USED: Average (RMS)
MODULATING SIGNAL: PRBS
CHANNEL BANDWIDTH: 5MHz
TRANSMITTER OUTPUT POWER: 15.32dBm
MODULATION: QPSK

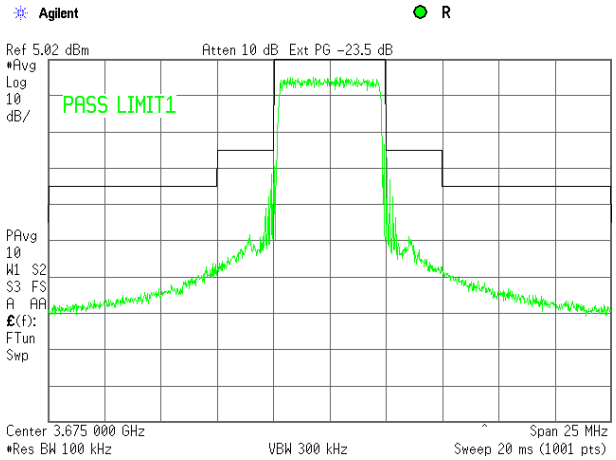


TRANSMITTER OUTPUT POWER: 15.53dBm
MODULATION: 64QAM

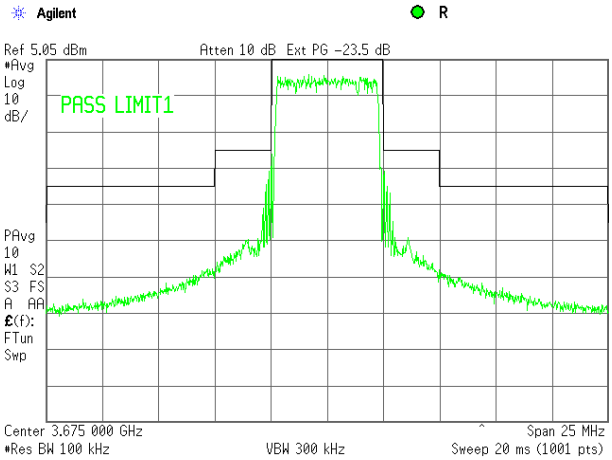


Plot 7.5.2 Emission mask test results at mid carrier frequency

ASSIGNED FREQUENCY RANGE: 3650 – 3700 MHz
DETECTOR USED: Average (RMS)
MODULATING SIGNAL: PRBS
CHANNEL BANDWIDTH: 5MHz
TRANSMITTER OUTPUT POWER: 15.02dBm
MODULATION: QPSK



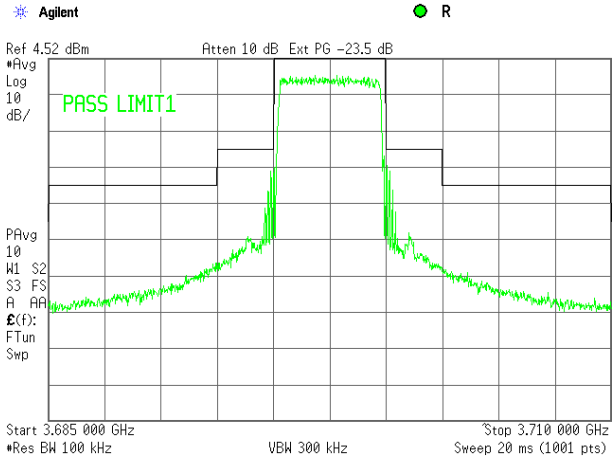
TRANSMITTER OUTPUT POWER: 15.05dBm
MODULATION: 64QAM



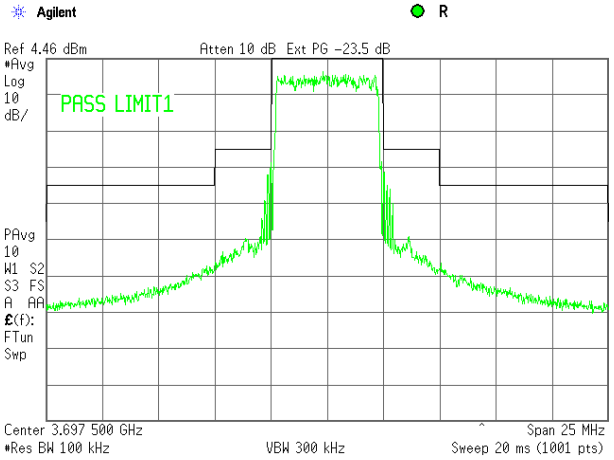
Test specification:	Section 90.210(b), Emission mask		
Test procedure:	47 CFR, Sections 2.1051, 2.1047, 90.210; TIA/EIA-603-C, Section 2.2.13		
Test mode:	Compliance	Verdict:	PASS
Date:	2/2/2011		
Temperature: 23.4 ºC	Air Pressure: 1015 hPa	Relative Humidity: 42 %	Power Supply: 48VDC
Remarks:			

Plot 7.5.3 Emission mask test results at high carrier frequency

ASSIGNED FREQUENCY RANGE: 3650 – 3700 MHz
DETECTOR USED: Average (RMS)
MODULATING SIGNAL: PRBS
CHANNEL BANDWIDTH: 5MHz
TRANSMITTER OUTPUT POWER: 14.52dBm
MODULATION: QPSK

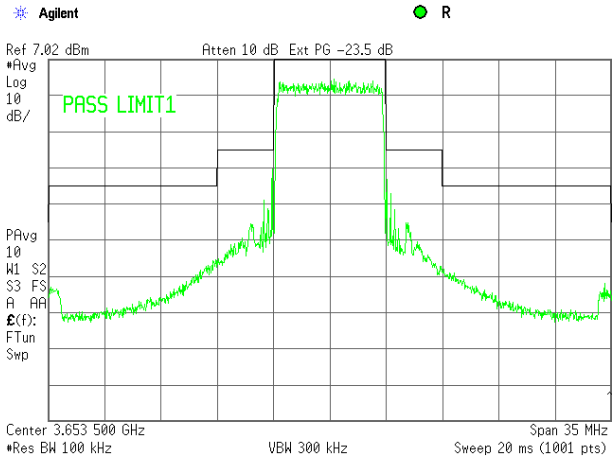


TRANSMITTER OUTPUT POWER: 14.46dBm
MODULATION: 64QAM

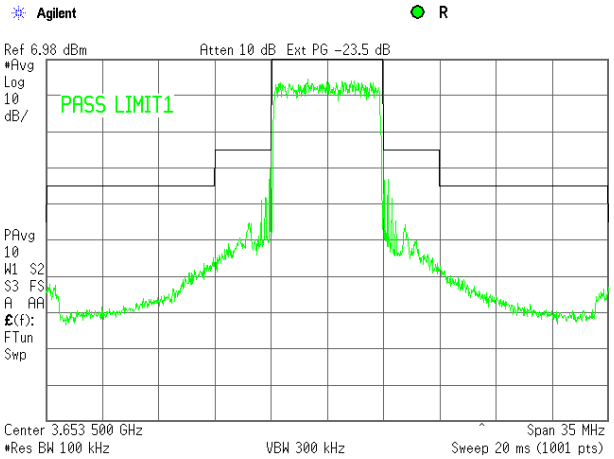


Plot 7.5.4 Emission mask test results at low carrier frequency

ASSIGNED FREQUENCY RANGE: 3650 – 3700 MHz
DETECTOR USED: Average (RMS)
MODULATING SIGNAL: PRBS
CHANNEL BANDWIDTH: 7MHz
TRANSMITTER OUTPUT POWER: 17.02dBm
MODULATION: QPSK



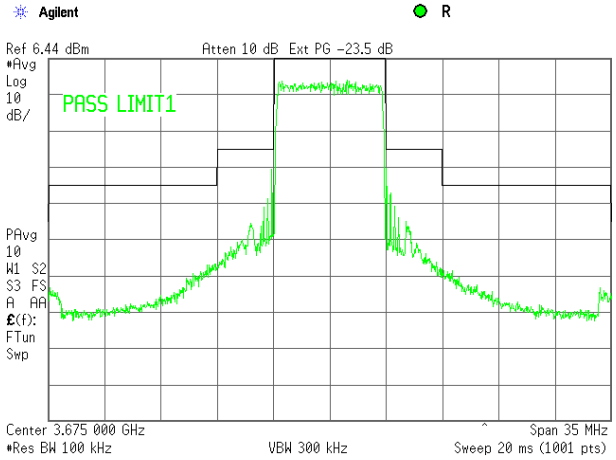
TRANSMITTER OUTPUT POWER: 16.98dBm
MODULATION: 64QAM



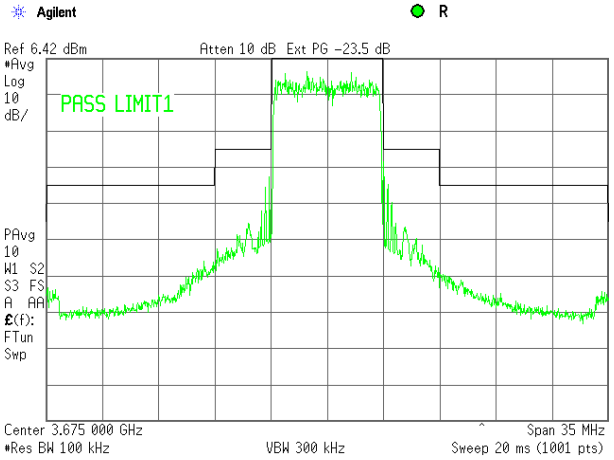
Test specification:	Section 90.210(b), Emission mask		
Test procedure:	47 CFR, Sections 2.1051, 2.1047, 90.210; TIA/EIA-603-C, Section 2.2.13		
Test mode:	Compliance	Verdict:	PASS
Date:	2/2/2011		
Temperature: 23.4 ºC	Air Pressure: 1015 hPa	Relative Humidity: 42 %	Power Supply: 48VDC
Remarks:			

Plot 7.5.5 Emission mask test results at mid carrier frequency

ASSIGNED FREQUENCY RANGE: 3650 – 3700 MHz
DETECTOR USED: Average (RMS)
MODULATING SIGNAL: PRBS
CHANNEL BANDWIDTH: 7MHz
TRANSMITTER OUTPUT POWER: 16.44dBm
MODULATION: QPSK

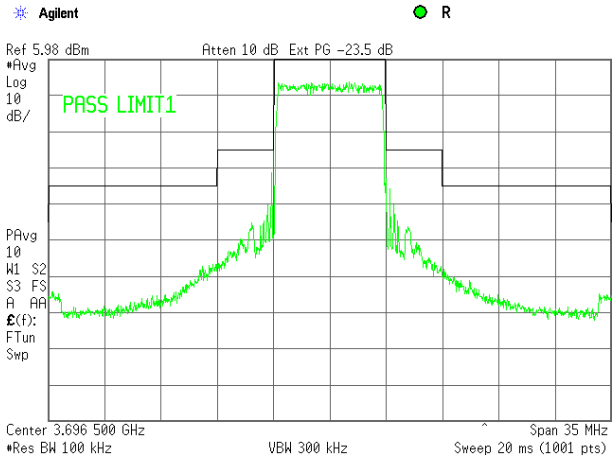


TRANSMITTER OUTPUT POWER: 16.42dBm
MODULATION: 64QAM

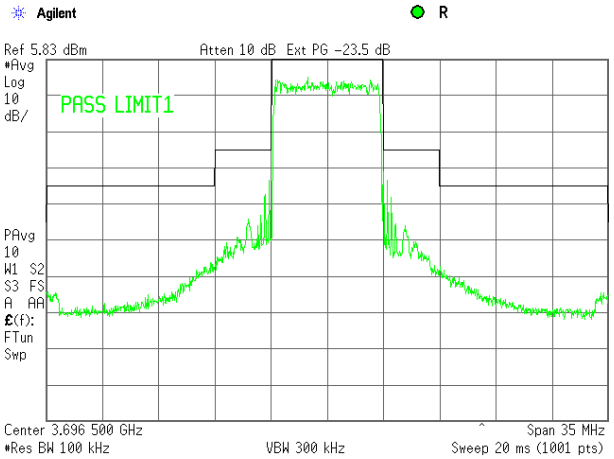


Plot 7.5.6 Emission mask test results at high carrier frequency

ASSIGNED FREQUENCY RANGE: 3650 – 3700 MHz
DETECTOR USED: Average (RMS)
MODULATING SIGNAL: PRBS
CHANNEL BANDWIDTH: 7MHz
TRANSMITTER OUTPUT POWER: 15.98dBm
MODULATION: QPSK



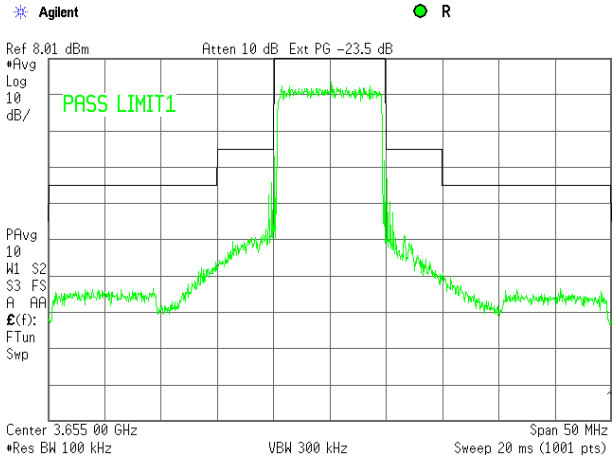
TRANSMITTER OUTPUT POWER: 15.83dBm
MODULATION: 64QAM



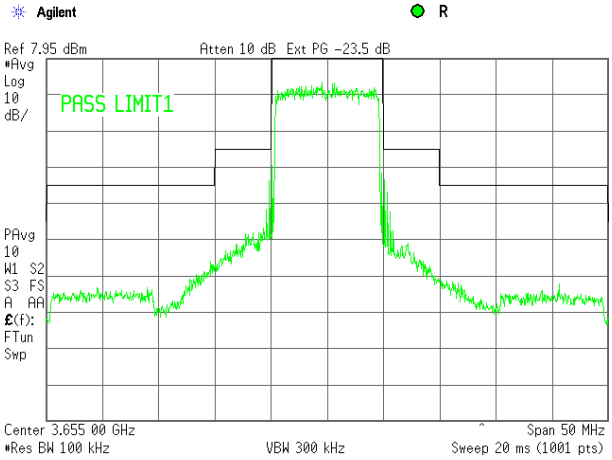
Test specification:	Section 90.210(b), Emission mask		
Test procedure:	47 CFR, Sections 2.1051, 2.1047, 90.210; TIA/EIA-603-C, Section 2.2.13		
Test mode:	Compliance	Verdict:	PASS
Date:	2/2/2011		
Temperature: 23.4 ºC	Air Pressure: 1015 hPa	Relative Humidity: 42 %	Power Supply: 48VDC
Remarks:			

Plot 7.5.7 Emission mask test results at low carrier frequency

ASSIGNED FREQUENCY RANGE: 3650 – 3700 MHz
DETECTOR USED: Average (RMS)
MODULATING SIGNAL: PRBS
CHANNEL BANDWIDTH: 10MHz
TRANSMITTER OUTPUT POWER: 18.01dBm
MODULATION: QPSK

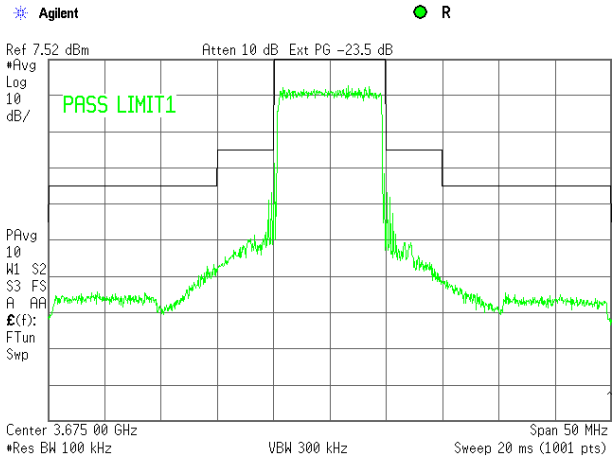


TRANSMITTER OUTPUT POWER: 17.95dBm
MODULATION: 64QAM

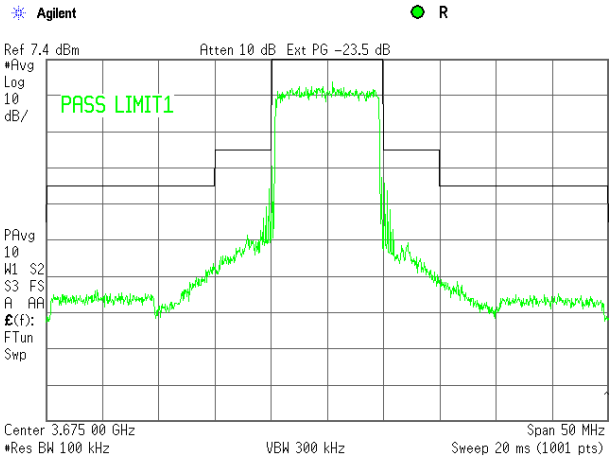


Plot 7.5.8 Emission mask test results at mid carrier frequency

ASSIGNED FREQUENCY RANGE: 3650 – 3700 MHz
DETECTOR USED: Average (RMS)
MODULATING SIGNAL: PRBS
CHANNEL BANDWIDTH: 10MHz
TRANSMITTER OUTPUT POWER: 17.52dBm
MODULATION: QPSK



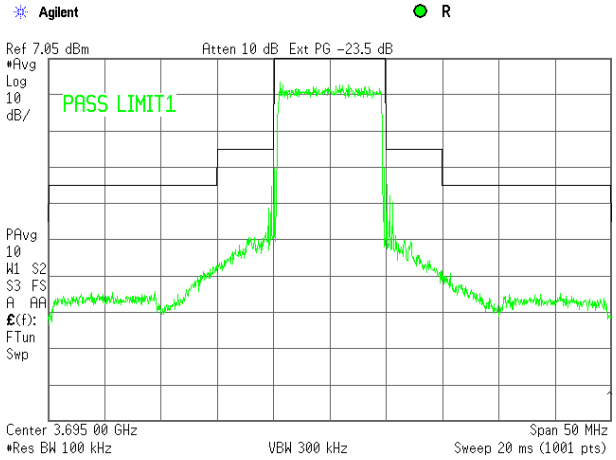
TRANSMITTER OUTPUT POWER: 17.40dBm
MODULATION: 64QAM



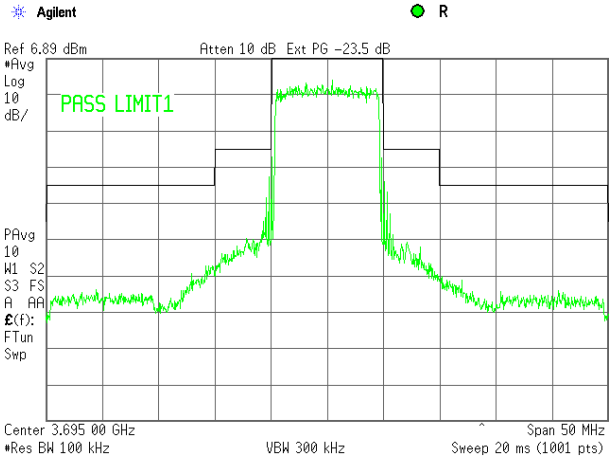
Test specification:	Section 90.210(b), Emission mask		
Test procedure:	47 CFR, Sections 2.1051, 2.1047, 90.210; TIA/EIA-603-C, Section 2.2.13		
Test mode:	Compliance	Verdict:	PASS
Date:	2/2/2011		
Temperature: 23.4 ºC	Air Pressure: 1015 hPa	Relative Humidity: 42 %	Power Supply: 48VDC
Remarks:			

Plot 7.5.9 Emission mask test results at high carrier frequency

ASSIGNED FREQUENCY RANGE: 3650 – 3700 MHz
DETECTOR USED: Average (RMS)
MODULATING SIGNAL: PRBS
CHANNEL BANDWIDTH: 10MHz
TRANSMITTER OUTPUT POWER: 17.05dBm
MODULATION: QPSK



TRANSMITTER OUTPUT POWER: 16.89dBm
MODULATION: 64QAM



Test specification:	Section 90.1323, Spurious emissions at RF antenna connector		
Test procedure:	47 CFR, Sections 2.1051, 90.1323; TIA/EIA-603-C, Section 2.2.13		
Test mode:	Compliance	Verdict:	PASS
Date:	2/2/2011		
Temperature: 23.4 ºC	Air Pressure: 1015 hPa	Relative Humidity: 42 %	Power Supply: 48VDC
Remarks:			

7.6 Spurious emissions at RF antenna connector test

7.6.1 General

This test was performed to measure spurious emissions at RF antenna connector. Specification test limits are given in Table 7.6.1.

Table 7.6.1 Spurious emission limits

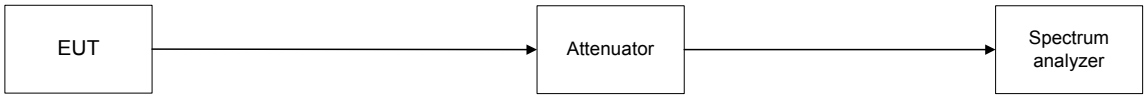
Frequency, MHz	Attenuation below carrier, dBc	ERP of spurious, dBm
0.009 – 10th harmonic*	43+10logP** (mask B)	-13.0

* - 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

7.6.2 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 was adjusted to produce maximum available for end user RF output power.
7.6.2.3 The spurious emission was measured with spectrum analyzer as provided in Table 7.6.2 and associated plots.

Figure 7.6.1 Spurious emission test setup for single antenna mode



Test specification:	**Section 90.1323, Spurious emissions at RF antenna connector**		
Test procedure:	47 CFR, Sections 2.1051, 90.1323; TIA/EIA-603-C, Section 2.2.13		
Test mode:	Compliance	**Verdict:**	PASS
Date:	2/2/2011		
Temperature: 23.4 ºC	**Air Pressure:** 1015 hPa	**Relative Humidity:** 42 %	**Power Supply:** 48VDC
Remarks:			

Table 7.6.2 Spurious emission test results

ASSIGNED FREQUENCY RANGE: 3650.0 – 3700.0 MHz
INVESTIGATED FREQUENCY RANGE: 0.009 – 37000 MHz
DETECTOR USED: Peak
VIDEO BANDWIDTH: ≥ Resolution bandwidth
MODULATION: QPSK
MODULATING SIGNAL: PRBS
EMISSION BANDWIDTH: 10 MHz
TRANSMITTER OUTPUT POWER: 18.01 dBm at low frequency
17.52 dBm at mid frequency
17.05 dBm at high frequency

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

*****- Margin = Spurious emission – specification limit.

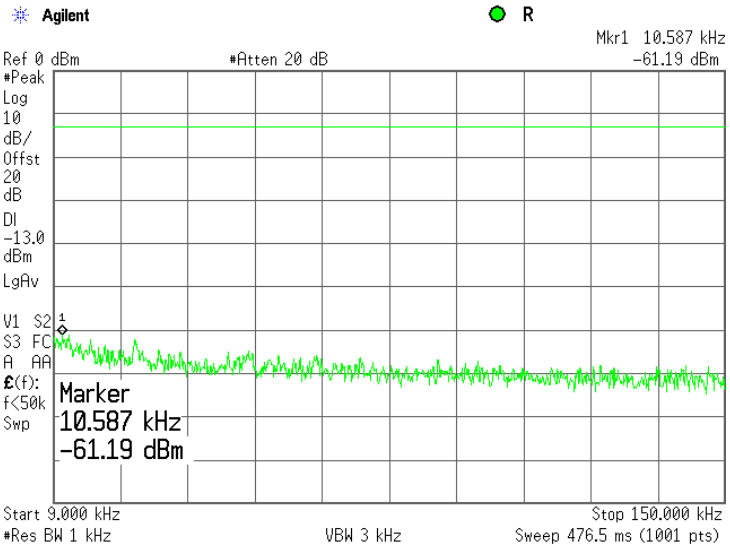
Reference numbers of test equipment used

HL 2013	HL 2952	HL 3301	HL 3302	HL 3768	HL 3818		

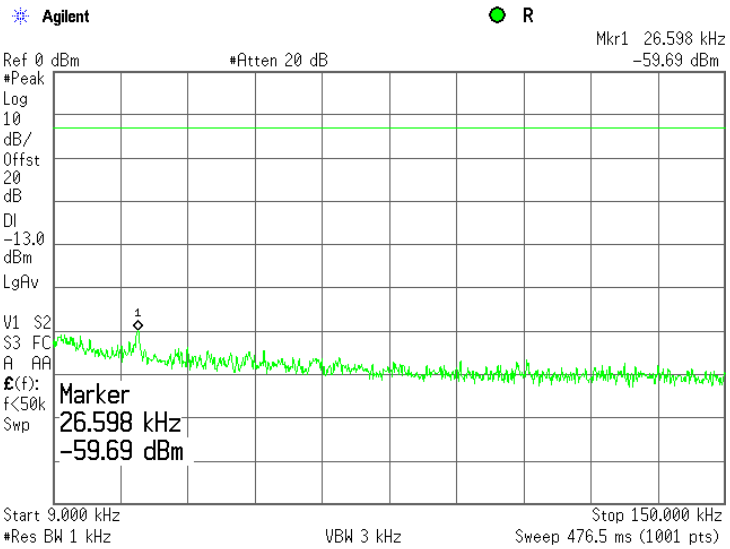
Full description is given in Appendix A.

Test specification:	Section 90.1323, Spurious emissions at RF antenna connector		
Test procedure:	47 CFR, Sections 2.1051, 90.1323; TIA/EIA-603-C, Section 2.2.13		
Test mode:	Compliance	Verdict:	PASS
Date:	2/2/2011		
Temperature: 23.4 ºC	Air Pressure: 1015 hPa	Relative Humidity: 42 %	Power Supply: 48VDC
Remarks:			

Plot 7.6.1 Spurious emission measurements in 9 - 150 kHz range at low carrier frequency

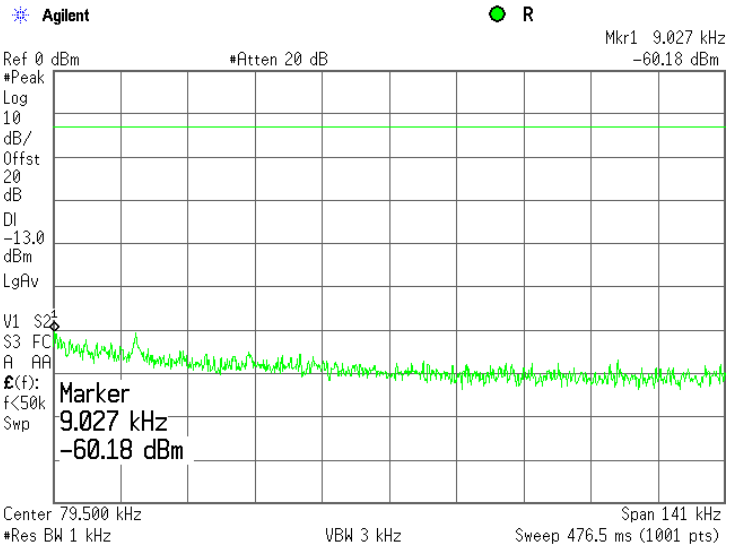


Plot 7.6.2 Spurious emission measurements in 9 - 150 kHz range at mid carrier frequency

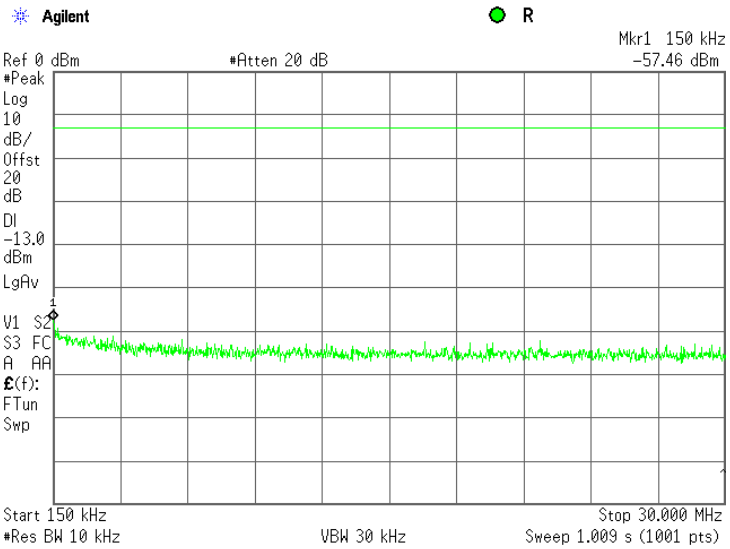


Test specification:	Section 90.1323, Spurious emissions at RF antenna connector		
Test procedure:	47 CFR, Sections 2.1051, 90.1323; TIA/EIA-603-C, Section 2.2.13		
Test mode:	Compliance	Verdict:	PASS
Date:	2/2/2011		
Temperature: 23.4 ºC	Air Pressure: 1015 hPa	Relative Humidity: 42 %	Power Supply: 48VDC
Remarks:			

Plot 7.6.3 Spurious emission measurements in 9 - 150 kHz range at high carrier frequency

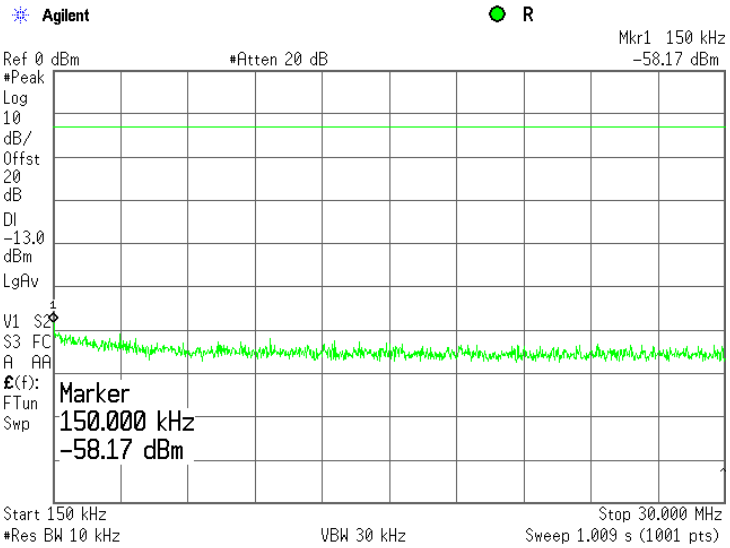


Plot 7.6.4 Spurious emission measurements in 0.150 - 30.0 MHz range at low carrier frequency

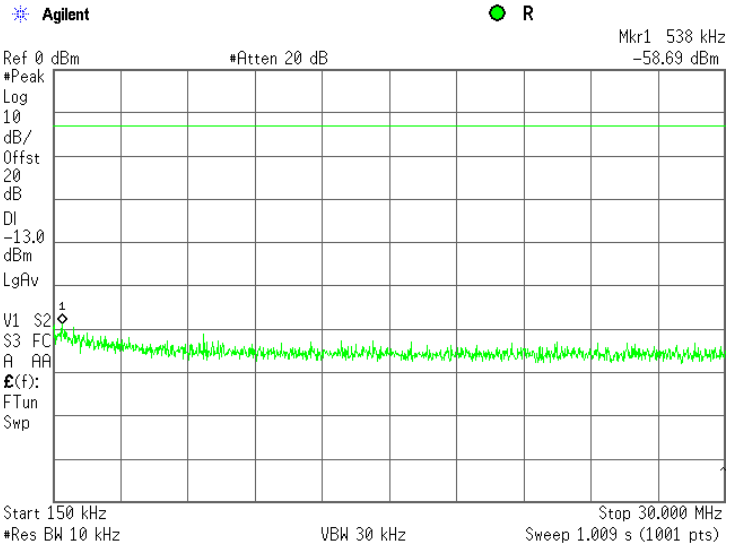


Test specification:	Section 90.1323, Spurious emissions at RF antenna connector		
Test procedure:	47 CFR, Sections 2.1051, 90.1323; TIA/EIA-603-C, Section 2.2.13		
Test mode:	Compliance	Verdict:	PASS
Date:	2/2/2011		
Temperature: 23.4 ºC	Air Pressure: 1015 hPa	Relative Humidity: 42 %	Power Supply: 48VDC
Remarks:			

Plot 7.6.5 Spurious emission measurements in 0.150 - 30.0 MHz range at mid carrier frequency

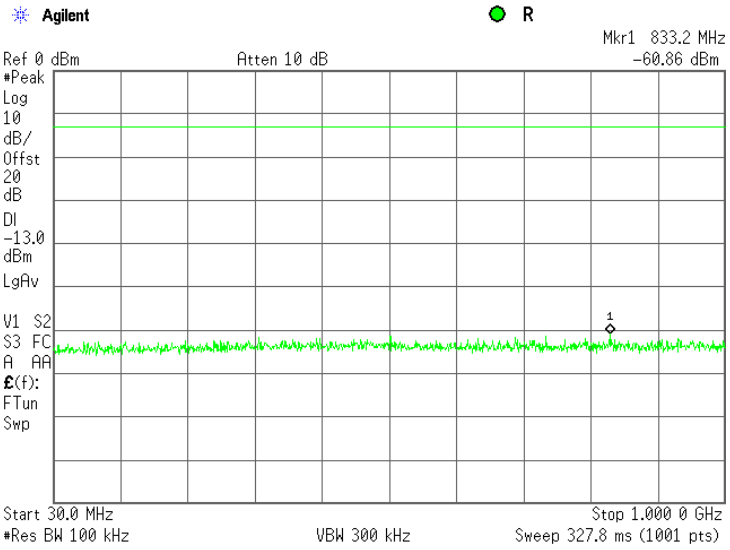


Plot 7.6.6 Spurious emission measurements in 0.150 - 30.0 MHz range at high carrier frequency

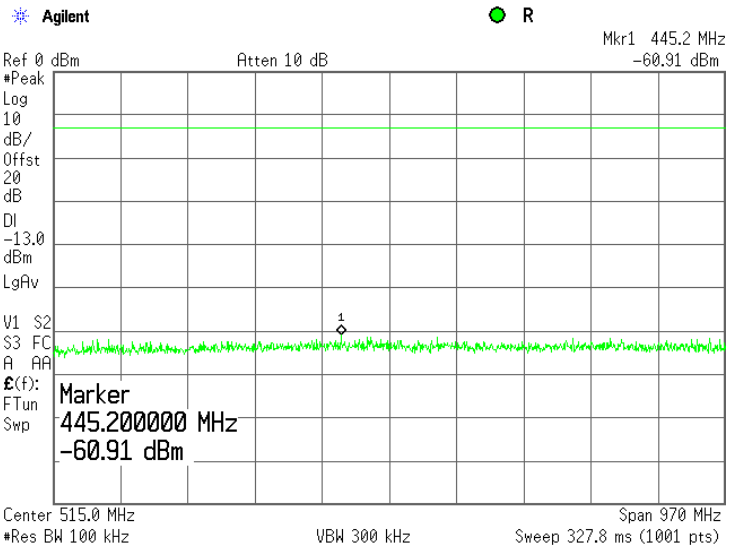


Test specification:	Section 90.1323, Spurious emissions at RF antenna connector		
Test procedure:	47 CFR, Sections 2.1051, 90.1323; TIA/EIA-603-C, Section 2.2.13		
Test mode:	Compliance	Verdict:	PASS
Date:	2/2/2011		
Temperature: 23.4 ºC	Air Pressure: 1015 hPa	Relative Humidity: 42 %	Power Supply: 48VDC
Remarks:			

Plot 7.6.7 Spurious emission measurements in 30.0 - 1000 MHz range at low carrier frequency

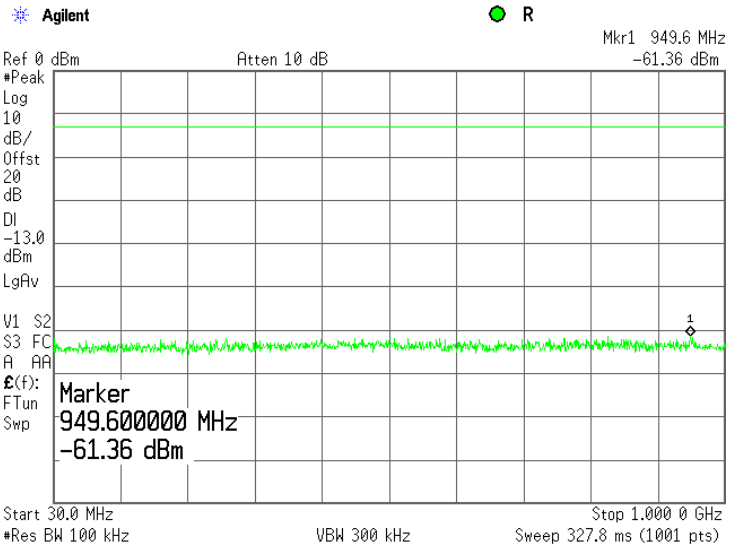


Plot 7.6.8 Spurious emission measurements in 30.0 - 1000 MHz range at mid carrier frequency

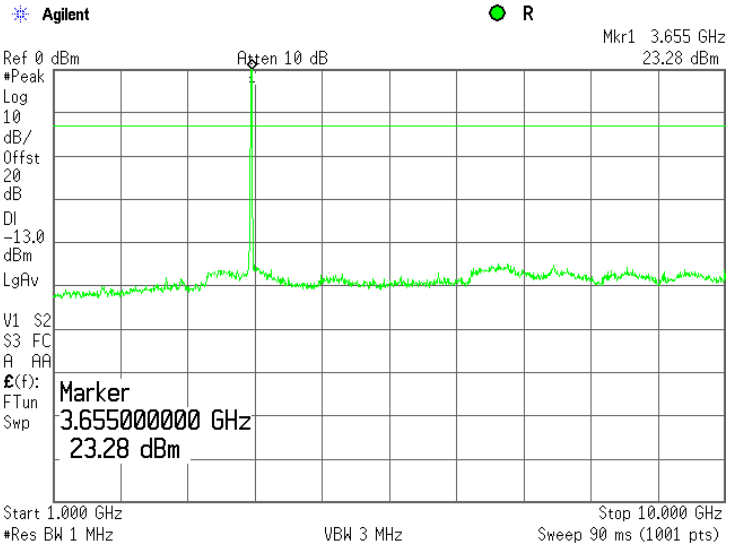


Test specification:	Section 90.1323, Spurious emissions at RF antenna connector		
Test procedure:	47 CFR, Sections 2.1051, 90.1323; TIA/EIA-603-C, Section 2.2.13		
Test mode:	Compliance	Verdict:	PASS
Date:	2/2/2011		
Temperature: 23.4 ºC	Air Pressure: 1015 hPa	Relative Humidity: 42 %	Power Supply: 48VDC
Remarks:			

Plot 7.6.9 Spurious emission measurements in 30.0 - 1000 MHz range at high carrier frequency

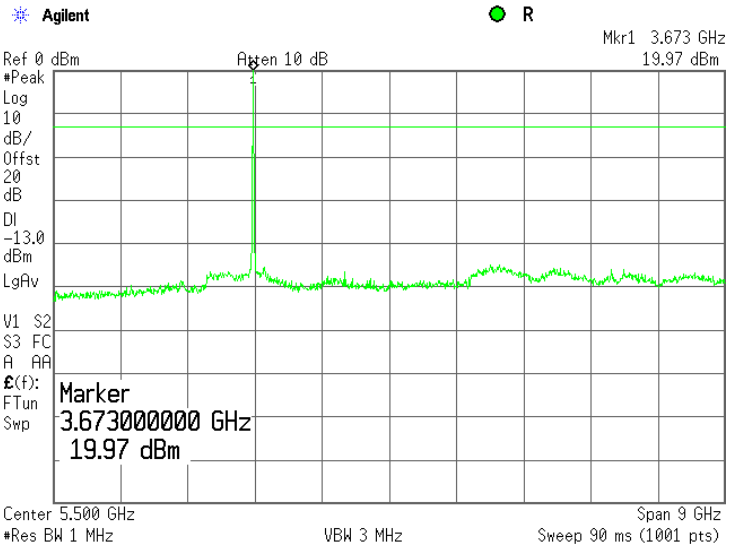


Plot 7.6.10 Spurious emission measurements in 1000 - 10000 MHz range at low carrier frequency

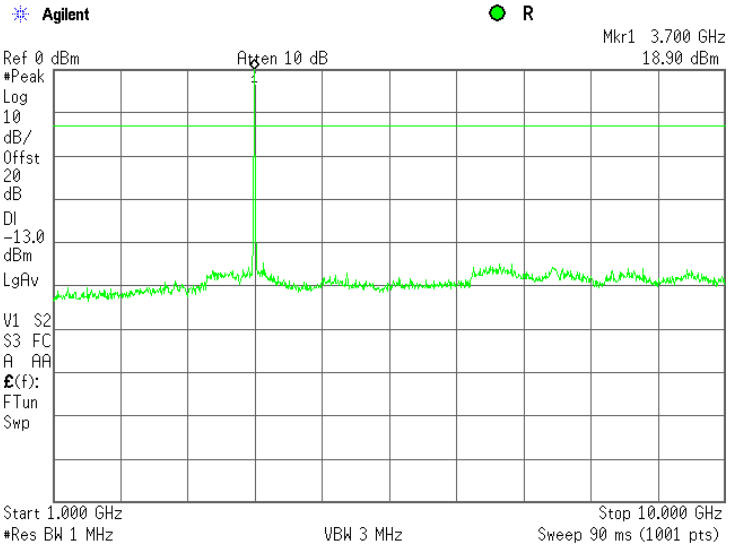


Test specification:	Section 90.1323, Spurious emissions at RF antenna connector		
Test procedure:	47 CFR, Sections 2.1051, 90.1323; TIA/EIA-603-C, Section 2.2.13		
Test mode:	Compliance	Verdict:	PASS
Date:	2/2/2011		
Temperature: 23.4 ºC	Air Pressure: 1015 hPa	Relative Humidity: 42 %	Power Supply: 48VDC
Remarks:			

Plot 7.6.11 Spurious emission measurements in 1000 - 10000 MHz at mid carrier frequency

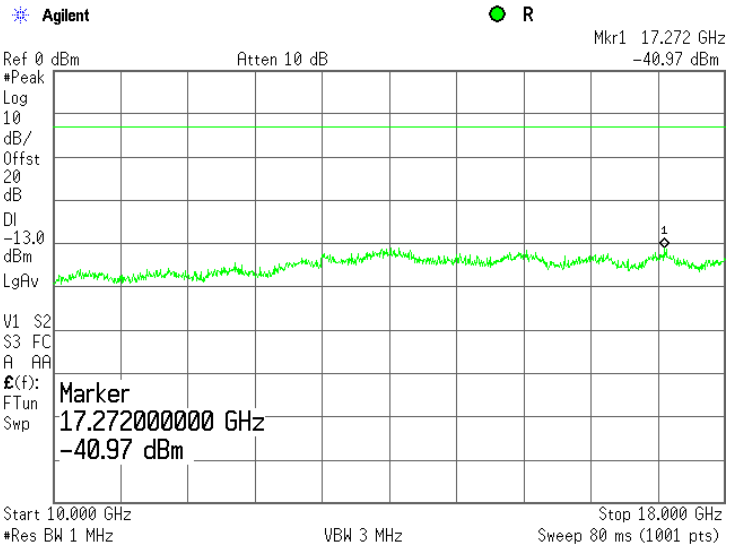


Plot 7.6.12 Spurious emission measurements in 1000 - 10000 MHz at high carrier frequency

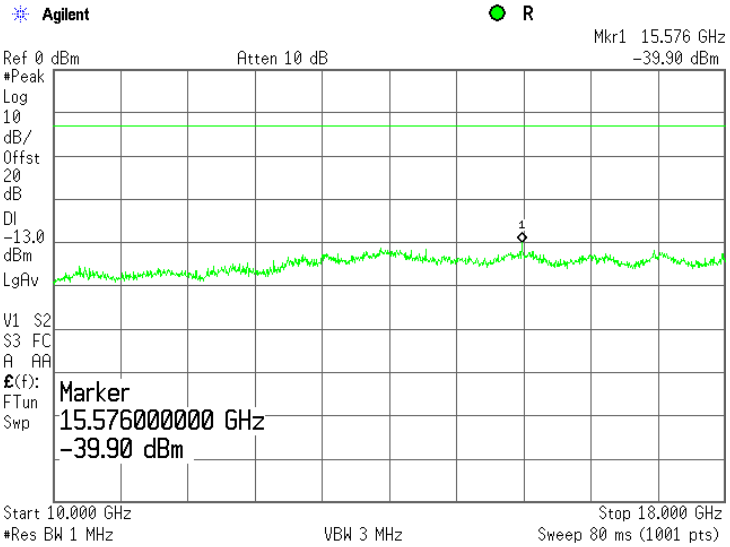


Test specification:	Section 90.1323, Spurious emissions at RF antenna connector		
Test procedure:	47 CFR, Sections 2.1051, 90.1323; TIA/EIA-603-C, Section 2.2.13		
Test mode:	Compliance	Verdict:	PASS
Date:	2/2/2011		
Temperature: 23.4 ºC	Air Pressure: 1015 hPa	Relative Humidity: 42 %	Power Supply: 48VDC
Remarks:			

Plot 7.6.13 Spurious emission measurements in 10000 - 18000 MHz range at low carrier frequency

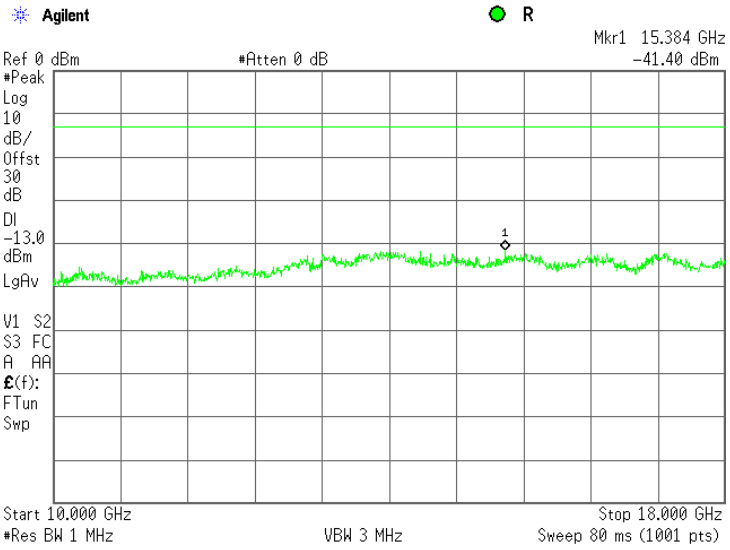


Plot 7.6.14 Spurious emission measurements in 10000 - 18000 MHz at mid carrier frequency

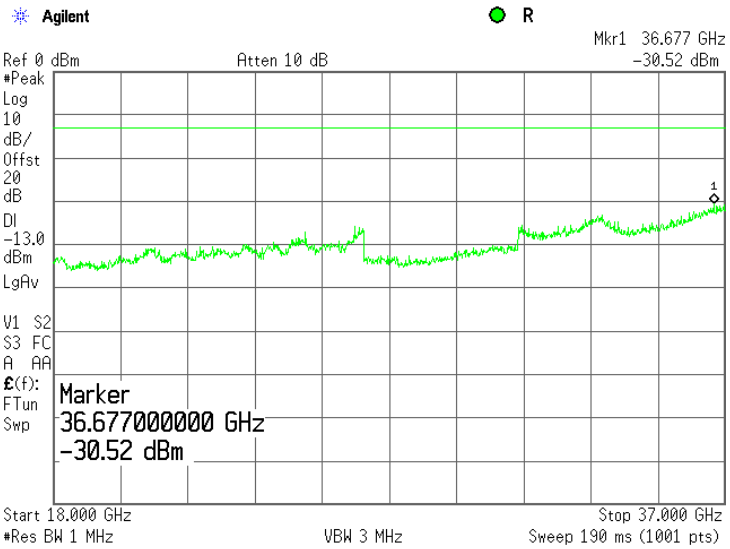


Test specification:	Section 90.1323, Spurious emissions at RF antenna connector		
Test procedure:	47 CFR, Sections 2.1051, 90.1323; TIA/EIA-603-C, Section 2.2.13		
Test mode:	Compliance	Verdict:	PASS
Date:	2/2/2011		
Temperature: 23.4 ºC	Air Pressure: 1015 hPa	Relative Humidity: 42 %	Power Supply: 48VDC
Remarks:			

Plot 7.6.15 Spurious emission measurements in 10000 - 18000 MHz at high carrier frequency

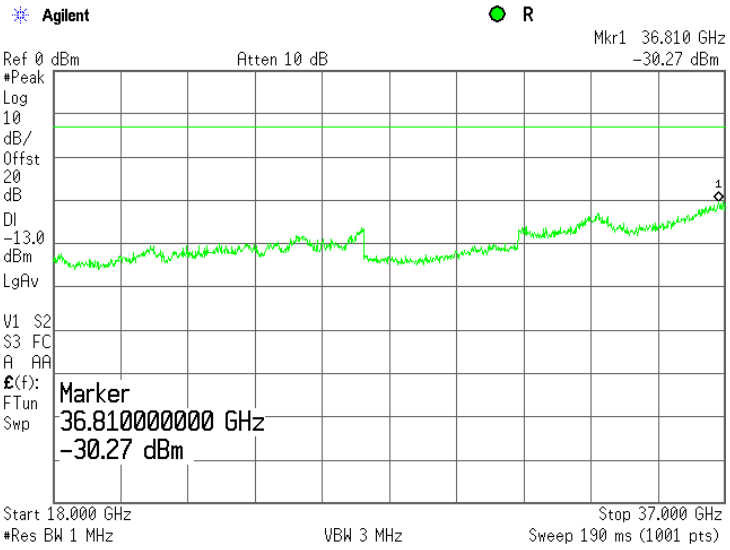


Plot 7.6.16 Spurious emission measurements in 18000 – 37000 MHz range at low carrier frequency

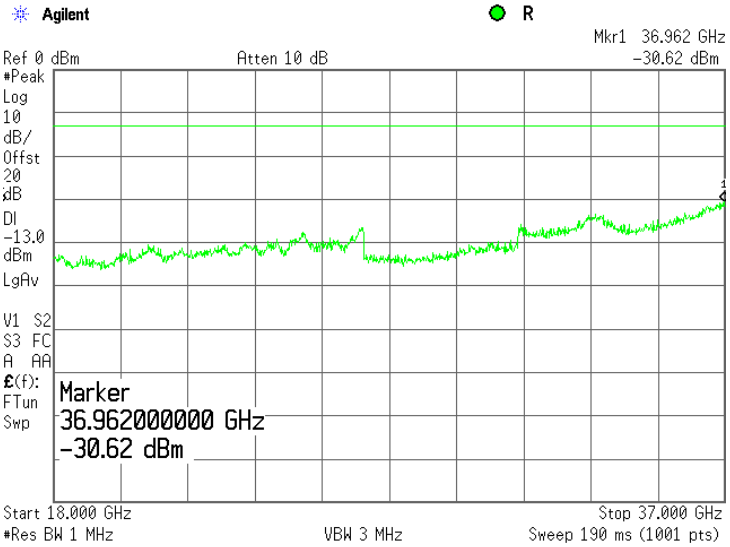


Test specification:	Section 90.1323, Spurious emissions at RF antenna connector		
Test procedure:	47 CFR, Sections 2.1051, 90.1323; TIA/EIA-603-C, Section 2.2.13		
Test mode:	Compliance	Verdict:	PASS
Date:	2/2/2011		
Temperature: 23.4 ºC	Air Pressure: 1015 hPa	Relative Humidity: 42 %	Power Supply: 48VDC
Remarks:			

Plot 7.6.17 Spurious emission measurements in 18000 – 37000 MHz at mid carrier frequency



Plot 7.6.18 Spurious emission measurements in 18000 – 37000 MHz at high carrier frequency



Test specification:	Section 90.1323, Radiated spurious emissions		
Test procedure:	47 CFR, Sections 2.1053, 90.1323; TIA/EIA-603-C, Section 2.2.12		
Test mode:	Compliance	Verdict:	PASS
Date:	2/6/2011 - 2/7/2011		
Temperature: 22.3 ºC	Air Pressure: 1014 hPa	Relative Humidity: 47 %	Power Supply: 120VAC
Remarks:			

7.7 Radiated spurious emission measurements

7.7.1 General

This test was performed to measure radiated spurious emissions from the EUT. Specification test limits are given in Table 7.7.1.

Table 7.7.1 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

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

7.7.2.1 The EUT was set up as shown in Figure 7.7.1, energized and the performance check was conducted.
7.7.2.2 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.
7.7.2.3 The worst test results (the lowest margins) were recorded in Table 7.7.2 and shown in the associated plots.

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

7.7.3.1 The EUT was set up as shown in Figure 7.7.2, energized and the performance check was conducted.
7.7.3.2 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.
7.7.3.3 The worst test results (the lowest margins) were recorded in Table 7.7.2 and shown in the associated plots.

Test specification:	Section 90.1323, Radiated spurious emissions		
Test procedure:	47 CFR, Sections 2.1053, 90.1323; TIA/EIA-603-C, Section 2.2.12		
Test mode:	Compliance	Verdict:	PASS
Date:	2/6/2011 - 2/7/2011		
Temperature: 22.3 ºC	Air Pressure: 1014 hPa	Relative Humidity: 47 %	Power Supply: 120VAC
Remarks:			

Figure 7.7.1 Setup for spurious emission field strength measurements in 9 kHz to 30 MHz band

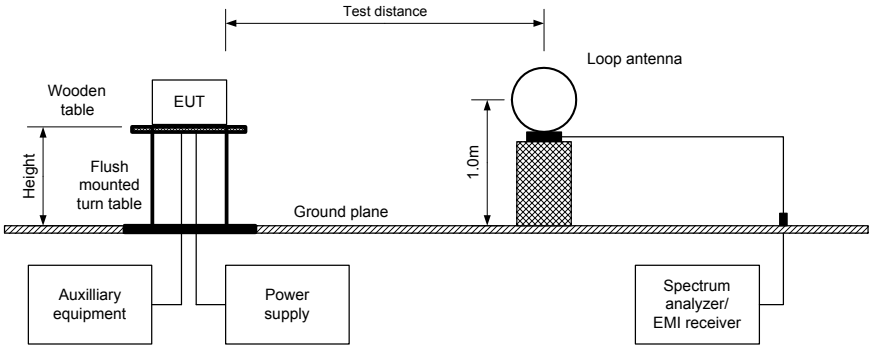
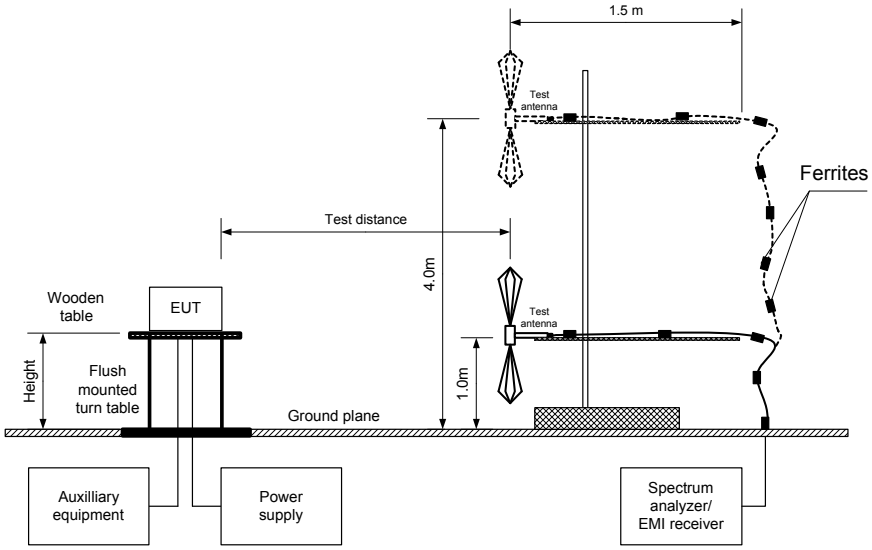


Figure 7.7.2 Setup for spurious emission field strength measurements above 30 MHz



Test specification:	**Section 90.1323, Radiated spurious emissions**		
Test procedure:	47 CFR, Sections 2.1053, 90.1323; TIA/EIA-603-C, Section 2.2.12		
Test mode:	Compliance	**Verdict:**	PASS
Date:	2/6/2011 - 2/7/2011		
Temperature: 22.3 ºC	**Air Pressure:** 1014 hPa	**Relative Humidity:** 47 %	**Power Supply:** 120VAC
Remarks:			

Table 7.7.2 Spurious emission field strength test results

ASSIGNED FREQUENCY RANGE: 3650.0 – 3700.0MHz
TEST DISTANCE: 3 m
TEST SITE: Semi anechoic chamber
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)
Biconilog (30 MHz – 1000 MHz)
Double ridged guide (above 1000 MHz)
MODULATION: QPSK
MODULATING SIGNAL: PRBS
BIT RATE: 4.19 Mbps
TRANSMITTER OUTPUT POWER SETTINGS: Maximum
CHANNEL SPASING: 5MHz

Frequency, MHz	Field strength, dB(µV/m)	Limit, dB(µV/m)	Margin, dB*	RBW, kHz	Antenna polarization	Antenna height, m	Turn-table position**, degrees	Verdict
Low carrier frequency 3652.5 MHz								
All emission were found more than 20 dB below the specified limit								Pass
Mid carrier frequency 3675.0MHz								
All emission were found more than 20 dB below the specified limit								Pass
High carrier frequency 3697.5MHz								
All emission were found more than 20 dB below the specified limit								Pass

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

Reference numbers of test equipment used

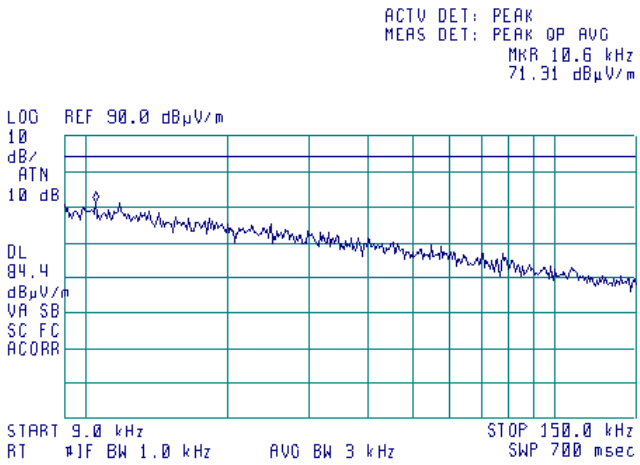
HL 0446	HL 0521	HL 0604	HL 0768	HL 0769	HL 1424	HL 1984	HL 2870
HL 2871	HL 3533	HL 3535	HL 3623	HL 3901			

Full description is given in Appendix A.

Test specification:	Section 90.1323, Radiated spurious emissions		
Test procedure:	47 CFR, Sections 2.1053, 90.1323; TIA/EIA-603-C, Section 2.2.12		
Test mode:	Compliance	Verdict:	PASS
Date:	2/6/2011 - 2/7/2011		
Temperature: 22.3 ºC	Air Pressure: 1014 hPa	Relative Humidity: 47 %	Power Supply: 120VAC
Remarks:			

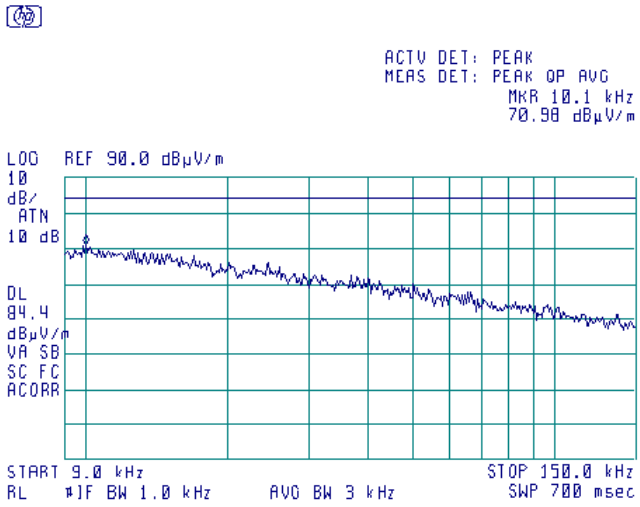
Plot 7.7.1 Radiated emission measurements in 9 - 150 kHz range

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



Plot 7.7.2 Radiated emission measurements in 9 - 150 kHz range

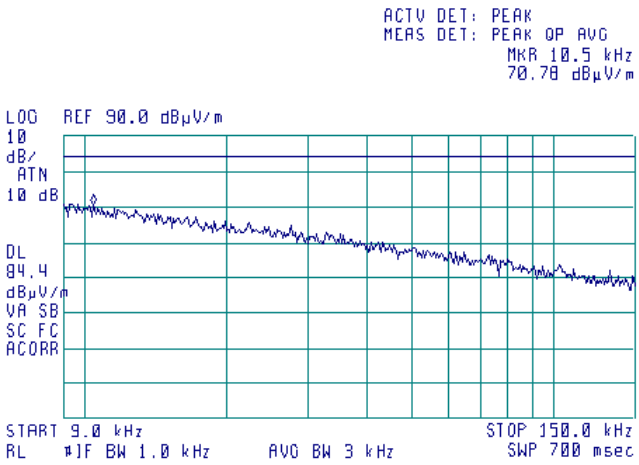
TEST SITE:	Semi anechoic chamber
CARRIER FREQUENCY:	Mid
ANTENNA POLARIZATION:	Vertical and Horizontal
TEST DISTANCE:	3 m



Test specification:	Section 90.1323, Radiated spurious emissions		
Test procedure:	47 CFR, Sections 2.1053, 90.1323; TIA/EIA-603-C, Section 2.2.12		
Test mode:	Compliance	Verdict:	PASS
Date:	2/6/2011 - 2/7/2011		
Temperature: 22.3 ºC	Air Pressure: 1014 hPa	Relative Humidity: 47 %	Power Supply: 120VAC
Remarks:			

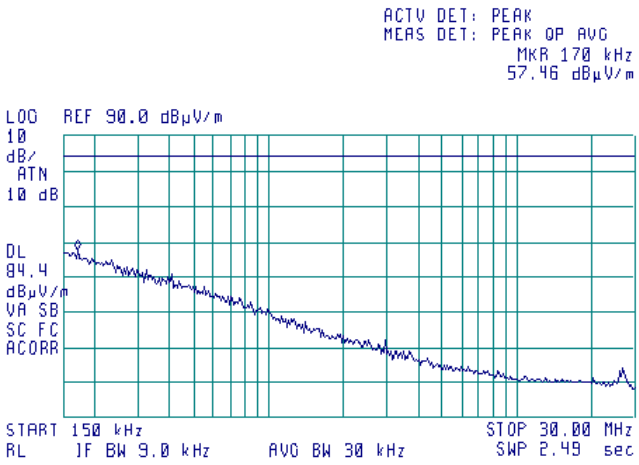
Plot 7.7.3 Radiated emission measurements in 9 - 150 kHz range

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



Plot 7.7.4 Radiated emission measurements in 0.15 - 30 MHz range

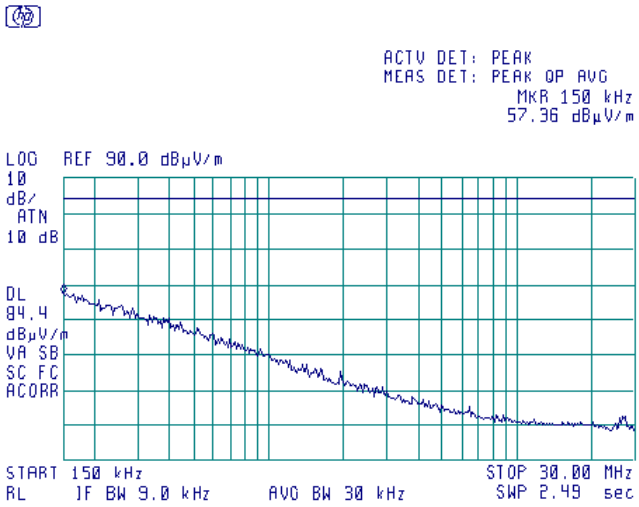
TEST SITE:	Semi anechoic chamber
CARRIER FREQUENCY:	Low
ANTENNA POLARIZATION:	Vertical and Horizontal
TEST DISTANCE:	3 m



Test specification:	Section 90.1323, Radiated spurious emissions		
Test procedure:	47 CFR, Sections 2.1053, 90.1323; TIA/EIA-603-C, Section 2.2.12		
Test mode:	Compliance	Verdict:	PASS
Date:	2/6/2011 - 2/7/2011		
Temperature: 22.3 ºC	Air Pressure: 1014 hPa	Relative Humidity: 47 %	Power Supply: 120VAC
Remarks:			

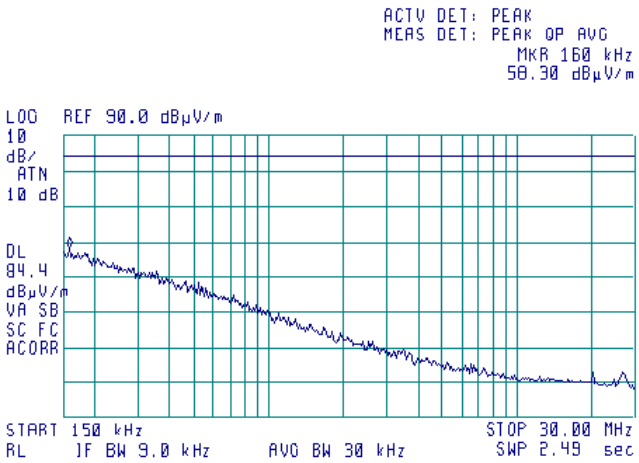
Plot 7.7.5 Radiated emission measurements in 0.15 - 30 MHz range

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



Plot 7.7.6 Radiated emission measurements in 0.15 - 30 MHz range

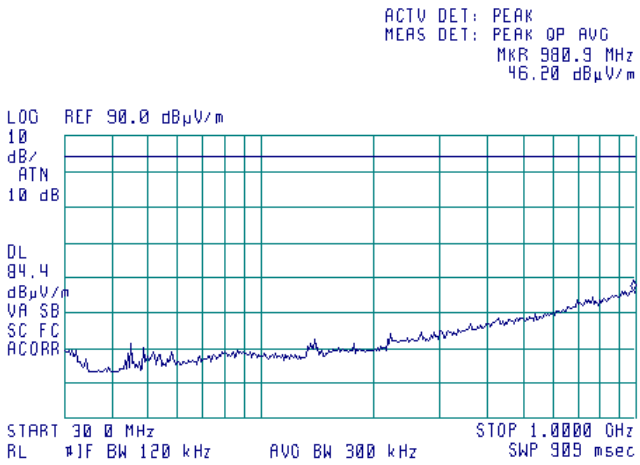
TEST SITE:	Semi anechoic chamber
CARRIER FREQUENCY:	High
ANTENNA POLARIZATION:	Vertical and Horizontal
TEST DISTANCE:	3 m



Test specification:	Section 90.1323, Radiated spurious emissions		
Test procedure:	47 CFR, Sections 2.1053, 90.1323; TIA/EIA-603-C, Section 2.2.12		
Test mode:	Compliance	Verdict:	PASS
Date:	2/6/2011 - 2/7/2011		
Temperature: 22.3 ºC	Air Pressure: 1014 hPa	Relative Humidity: 47 %	Power Supply: 120VAC
Remarks:			

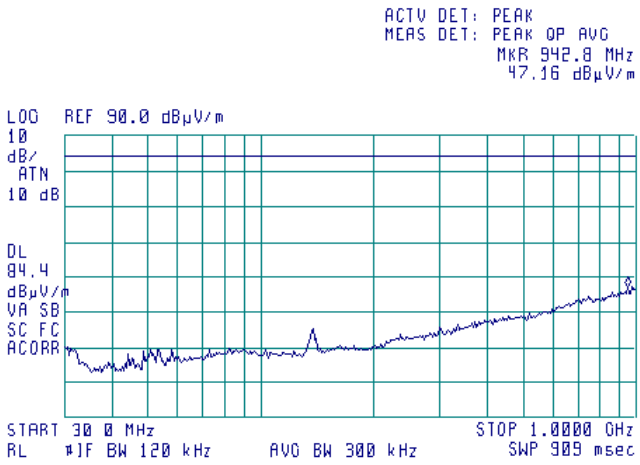
Plot 7.7.7 Radiated emission measurements in 30 - 1000 MHz range

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



Plot 7.7.8 Radiated emission measurements in 30 - 1000 MHz range

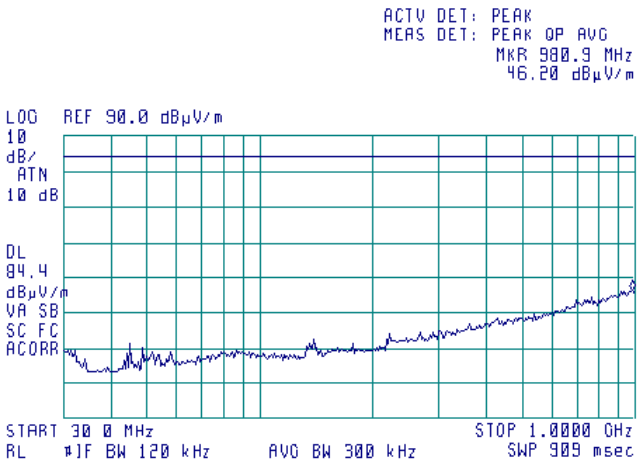
TEST SITE:	Semi anechoic chamber
CARRIER FREQUENCY:	Mid
ANTENNA POLARIZATION:	Vertical and Horizontal
TEST DISTANCE:	3 m



Test specification:	Section 90.1323, Radiated spurious emissions		
Test procedure:	47 CFR, Sections 2.1053, 90.1323; TIA/EIA-603-C, Section 2.2.12		
Test mode:	Compliance	Verdict:	PASS
Date:	2/6/2011 - 2/7/2011		
Temperature: 22.3 ºC	Air Pressure: 1014 hPa	Relative Humidity: 47 %	Power Supply: 120VAC
Remarks:			

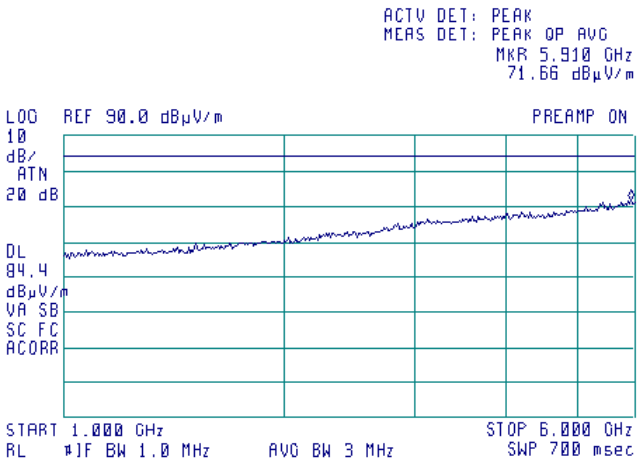
Plot 7.7.9 Radiated emission measurements in 30 - 1000 MHz range

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



Plot 7.7.10 Radiated emission measurements in 1000 – 6500 MHz range

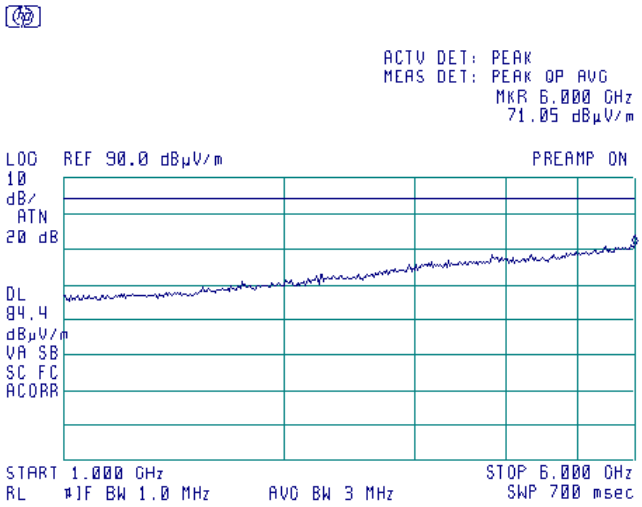
TEST SITE:	Semi anechoic chamber
CARRIER FREQUENCY:	Low
ANTENNA POLARIZATION:	Vertical and Horizontal
TEST DISTANCE:	3 m



Test specification:	Section 90.1323, Radiated spurious emissions		
Test procedure:	47 CFR, Sections 2.1053, 90.1323; TIA/EIA-603-C, Section 2.2.12		
Test mode:	Compliance	Verdict:	PASS
Date:	2/6/2011 - 2/7/2011		
Temperature: 22.3 ºC	Air Pressure: 1014 hPa	Relative Humidity: 47 %	Power Supply: 120VAC
Remarks:			

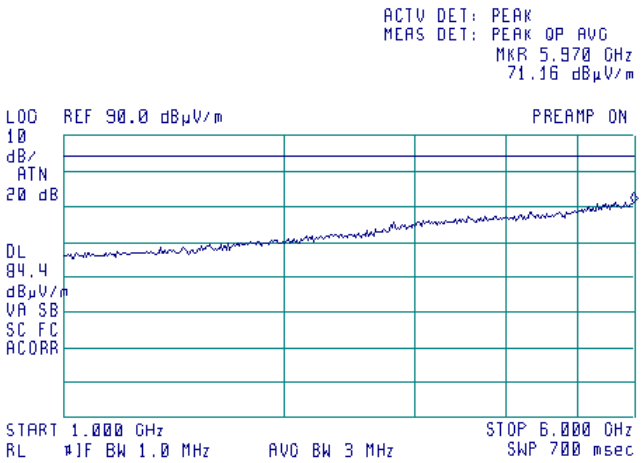
Plot 7.7.11 Radiated emission measurements in 1000 – 6500 MHz range

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



Plot 7.7.12 Radiated emission measurements in 1000 – 6500 MHz range

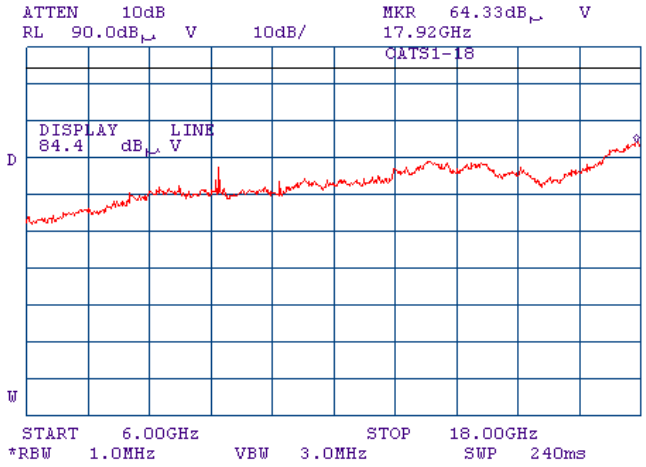
TEST SITE:	Semi anechoic chamber
CARRIER FREQUENCY:	High
ANTENNA POLARIZATION:	Vertical and Horizontal
TEST DISTANCE:	3 m



Test specification:	Section 90.1323, Radiated spurious emissions		
Test procedure:	47 CFR, Sections 2.1053, 90.1323; TIA/EIA-603-C, Section 2.2.12		
Test mode:	Compliance	Verdict:	PASS
Date:	2/6/2011 - 2/7/2011		
Temperature: 22.3 ºC	Air Pressure: 1014 hPa	Relative Humidity: 47 %	Power Supply: 120VAC
Remarks:			

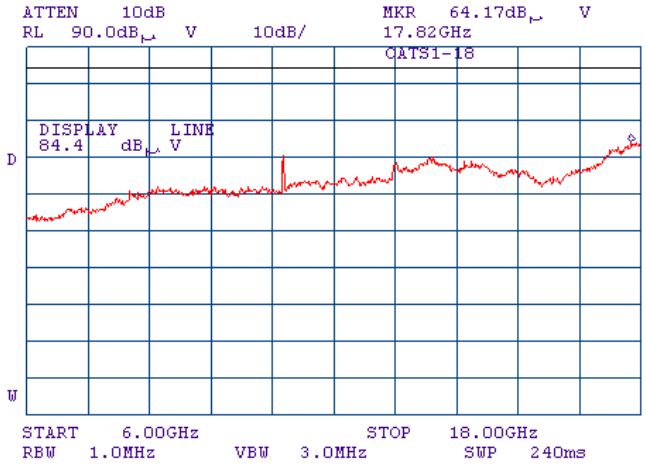
Plot 7.7.13 Radiated emission measurements in 6000 – 18000 MHz range

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



Plot 7.7.14 Radiated emission measurements in 6000 – 18000 MHz range

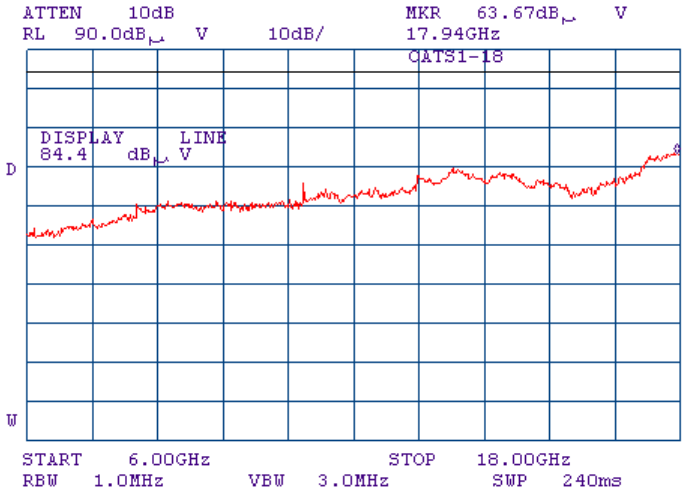
TEST SITE:	Semi anechoic chamber
CARRIER FREQUENCY:	Mid
ANTENNA POLARIZATION:	Vertical and Horizontal
TEST DISTANCE:	3 m



Test specification:	Section 90.1323, Radiated spurious emissions		
Test procedure:	47 CFR, Sections 2.1053, 90.1323; TIA/EIA-603-C, Section 2.2.12		
Test mode:	Compliance	Verdict:	PASS
Date:	2/6/2011 - 2/7/2011		
Temperature: 22.3 ºC	Air Pressure: 1014 hPa	Relative Humidity: 47 %	Power Supply: 120VAC
Remarks:			

Plot 7.7.15 Radiated emission measurements in 6000 – 18000 MHz range

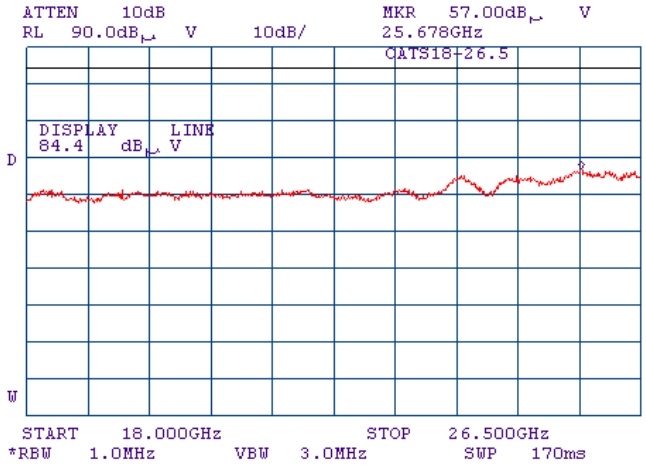
TEST SITE:	Semi anechoic chamber
CARRIER FREQUENCY:	High
ANTENNA POLARIZATION:	Vertical and Horizontal
TEST DISTANCE:	3 m



Test specification:	Section 90.1323, Radiated spurious emissions		
Test procedure:	47 CFR, Sections 2.1053, 90.1323; TIA/EIA-603-C, Section 2.2.12		
Test mode:	Compliance	Verdict:	PASS
Date:	2/6/2011 - 2/7/2011		
Temperature: 22.3 ºC	Air Pressure: 1014 hPa	Relative Humidity: 47 %	Power Supply: 120VAC
Remarks:			

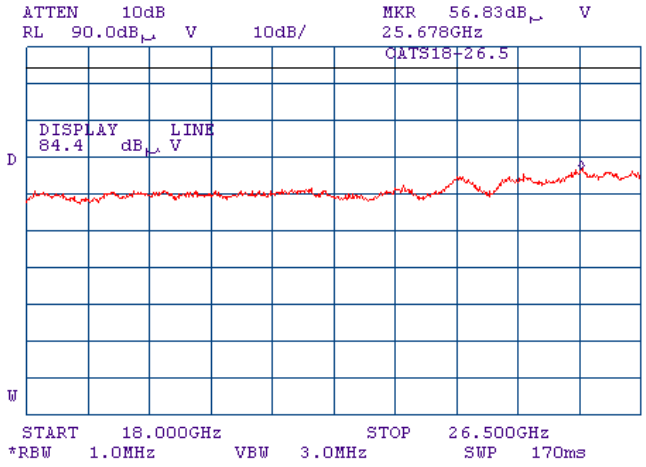
Plot 7.7.16 Radiated emission measurements in 18000 – 26500 MHz range

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



Plot 7.7.17 Radiated emission measurements in 18000 – 26500 MHz range

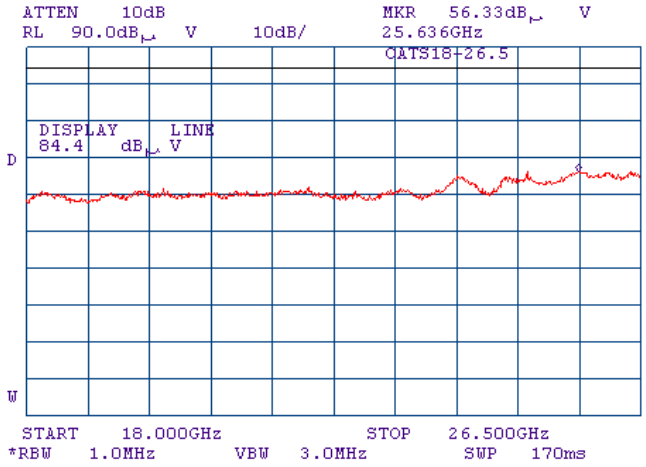
TEST SITE:	Semi anechoic chamber
CARRIER FREQUENCY:	Mid
ANTENNA POLARIZATION:	Vertical and Horizontal
TEST DISTANCE:	3 m



Test specification:	Section 90.1323, Radiated spurious emissions		
Test procedure:	47 CFR, Sections 2.1053, 90.1323; TIA/EIA-603-C, Section 2.2.12		
Test mode:	Compliance	Verdict:	PASS
Date:	2/6/2011 - 2/7/2011		
Temperature: 22.3 ºC	Air Pressure: 1014 hPa	Relative Humidity: 47 %	Power Supply: 120VAC
Remarks:			

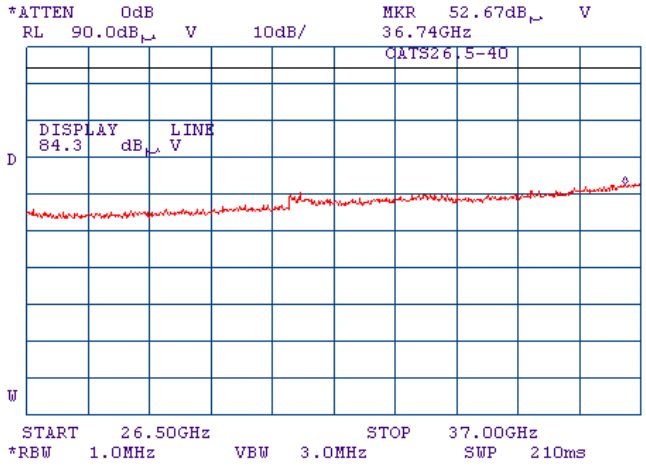
Plot 7.7.18 Radiated emission measurements in 18000 – 26500 MHz range

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



Plot 7.7.19 Radiated emission measurements in 26500 – 37000 MHz range

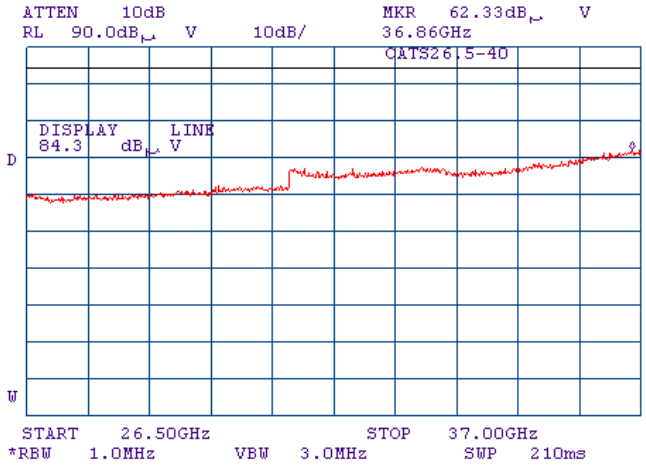
TEST SITE:	Semi anechoic chamber
CARRIER FREQUENCY:	Low
ANTENNA POLARIZATION:	Vertical and Horizontal
TEST DISTANCE:	3 m



Test specification:	Section 90.1323, Radiated spurious emissions		
Test procedure:	47 CFR, Sections 2.1053, 90.1323; TIA/EIA-603-C, Section 2.2.12		
Test mode:	Compliance	Verdict:	PASS
Date:	2/6/2011 - 2/7/2011		
Temperature: 22.3 ºC	Air Pressure: 1014 hPa	Relative Humidity: 47 %	Power Supply: 120VAC
Remarks:			

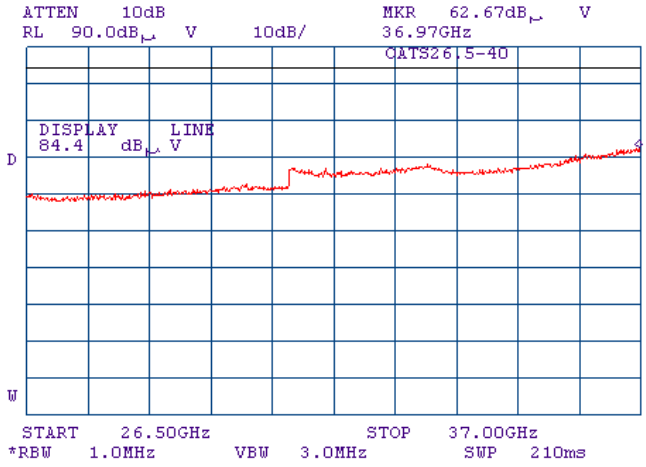
Plot 7.7.20 Radiated emission measurements in 26500 – 37000 MHz range

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



Plot 7.7.21 Radiated emission measurements in 26500 – 37000 MHz range

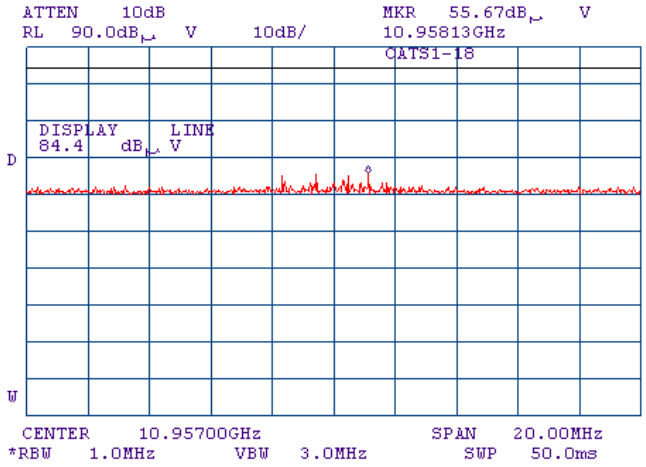
TEST SITE: Semi anechoic chamber
CARRIER FREQUENCY: High
ANTENNA POLARIZATION: Vertical and Horizontal
TEST DISTANCE: 3 m



Test specification:	Section 90.1323, Radiated spurious emissions		
Test procedure:	47 CFR, Sections 2.1053, 90.1323; TIA/EIA-603-C, Section 2.2.12		
Test mode:	Compliance	Verdict:	PASS
Date:	2/6/2011 - 2/7/2011		
Temperature: 22.3 ºC	Air Pressure: 1014 hPa	Relative Humidity: 47 %	Power Supply: 120VAC
Remarks:			

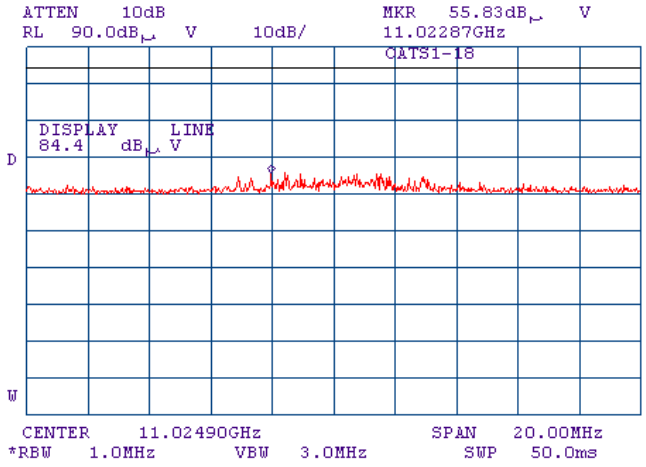
Plot 7.7.22 Radiated emission measurements at the 3rd harmonic

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



Plot 7.7.23 Radiated emission measurements at the 3rd harmonic

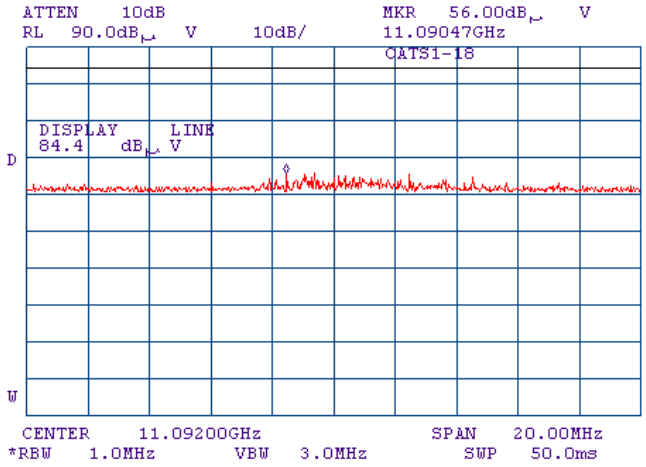
TEST SITE:	Semi anechoic chamber
CARRIER FREQUENCY:	Mid
ANTENNA POLARIZATION:	Vertical
TEST DISTANCE:	3 m



Test specification:	Section 90.1323, Radiated spurious emissions		
Test procedure:	47 CFR, Sections 2.1053, 90.1323; TIA/EIA-603-C, Section 2.2.12		
Test mode:	Compliance	Verdict:	PASS
Date:	2/6/2011 - 2/7/2011		
Temperature: 22.3 ºC	Air Pressure: 1014 hPa	Relative Humidity: 47 %	Power Supply: 120VAC
Remarks:			

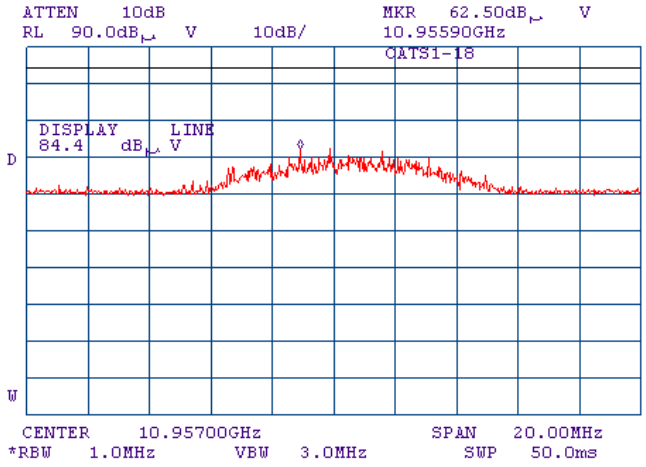
Plot 7.7.24 Radiated emission measurements at the 3rd harmonic

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



Plot 7.7.25 Radiated emission measurements at the 3rd harmonic

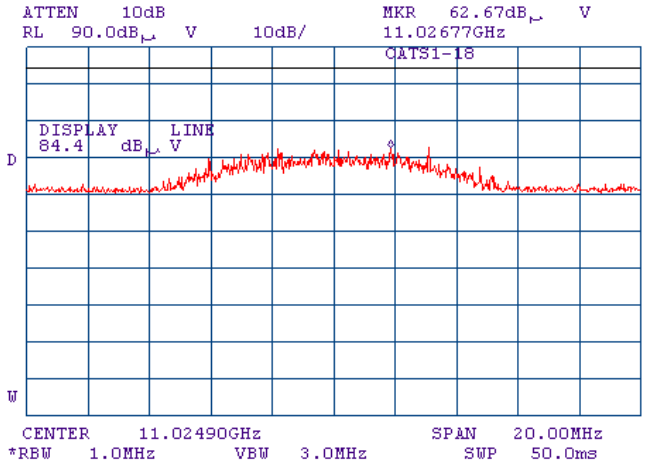
TEST SITE:	Semi anechoic chamber
CARRIER FREQUENCY:	Low
ANTENNA POLARIZATION:	Horizontal
TEST DISTANCE:	3 m



Test specification:	Section 90.1323, Radiated spurious emissions		
Test procedure:	47 CFR, Sections 2.1053, 90.1323; TIA/EIA-603-C, Section 2.2.12		
Test mode:	Compliance	Verdict:	PASS
Date:	2/6/2011 - 2/7/2011		
Temperature: 22.3 ºC	Air Pressure: 1014 hPa	Relative Humidity: 47 %	Power Supply: 120VAC
Remarks:			

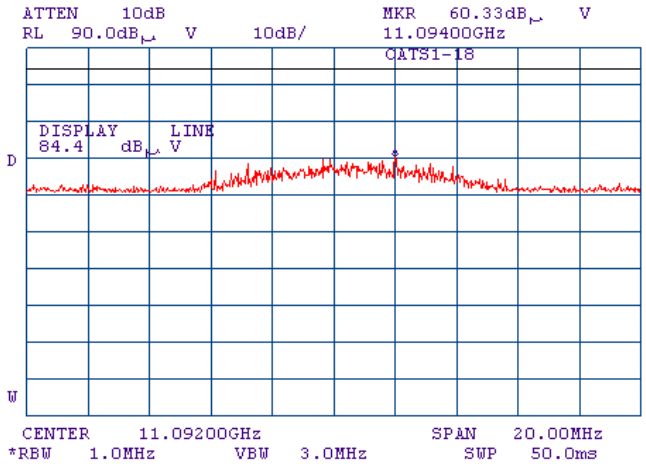
Plot 7.7.26 Radiated emission measurements at the 3rd harmonic

TEST SITE:	Semi anechoic chamber
CARRIER FREQUENCY:	Mid
ANTENNA POLARIZATION:	Horizontal
TEST DISTANCE:	3 m



Plot 7.7.27 Radiated emission measurements at the 3rd harmonic

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



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:	2/3/2011 - 2/6/2011		
Temperature: 22.4 ºC	Air Pressure: 1022 hPa	Relative Humidity: 46 %	Power Supply: 120VAC
Remarks:			

7.8 Frequency stability test

7.8.1 General

This test was performed to measure frequency stability of transmitter RF carrier. Specification test limits are given in Table 7.8.1.

Table 7.8.1 Frequency stability limits

Assigned frequency, MHz	Maximum allowed frequency displacement	
	ppm	Hz
3650.0 – 3700.0	The frequency stability shall be sufficient to ensure that the fundamental emissions stay within the authorized bands of operation	

7.8.2 Test procedure

7.8.2.1 The EUT was set up as shown in Figure 7.8.1, energized and its proper operation was checked.

7.8.2.2 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.

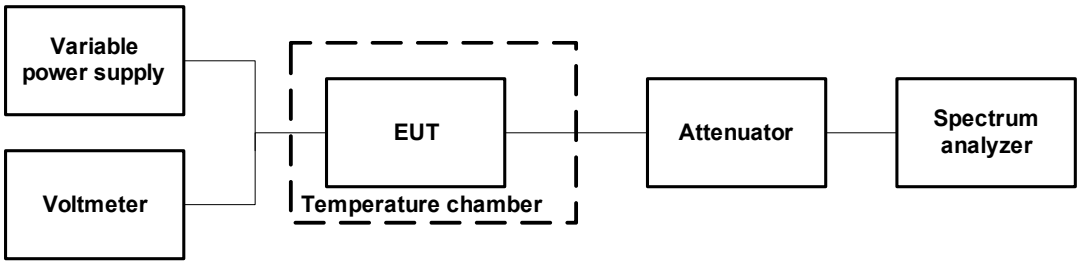
7.8.2.3 The EUT was powered on and carrier frequency was measured at start up moment and then every minute until frequency had been stabilized or 10 minutes elapsed whichever reached the last. The EUT was powered off.

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

7.8.2.5 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.

7.8.2.6 Frequency displacement was calculated and compared with the limit as provided in Table 7.8.2.

Figure 7.8.1 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:	2/3/2011 - 2/6/2011		
Temperature: 22.4 ºC	**Air Pressure:** 1022 hPa	**Relative Humidity:** 46 %	**Power Supply:** 120VAC
Remarks:			

Table 7.8.2 Frequency stability test results

ASSIGNED FREQUENCY RANGE: 3650.0 – 3700.0 MHz
NOMINAL POWER VOLTAGE: 120VAC
TEMPERATURE STABILIZATION PERIOD: 20 min
POWER DURING TEMPERATURE TRANSITION: Off
SPECTRUM ANALYZER MODE: Counter
RESOLUTION BANDWIDTH: 1kHz
VIDEO BANDWIDTH: 3kHz
MODULATION: Unmodulated

T, ºC	Voltage, VDC	Frequency, MHz							Max frequency drift, Hz		Max frequency drift, ppm	
		Start up	1st min	2nd min	3rd min	4th min	5th min	10th min	Positive	Negative	Positive	Negative
Low channel 3652.5MHz												
-30	nominal	3652.500231	3652.499836	3652.499646	3652.499595	3652.499489	3652.499451	3652.499314	0	-1114	0.00	-0.30
-20	nominal	3652.498340	NA	NA	NA	NA	NA	3652.498983	0	-2088	0.00	-0.57
-10	nominal	3652.499213	NA	NA	NA	NA	NA	3652.499163	0	-1265	0.00	-0.35
0	nominal	3652.499181	3652.499273	3652.499376	3652.499443	3652.499444	3652.499449	3652.499516	0	1247	0.00	0.34
10	nominal	3652.500272	NA	NA	NA	NA	NA	3652.500286	0	-156	0.00	-0.04
20	+15%	3652.500237	NA	NA	NA	NA	NA	3652.500358	0	-191	0.00	-0.05
20	nominal	3652.500493	NA	NA	NA	NA	NA	3652.500428*	65	0	0.02	0.00
20	-15%	3652.500304	NA	NA	NA	NA	NA	3652.500281	0	-147	0.00	-0.04
30	nominal	3652.500382	3652.500403	3652.500409	3652.500379	3652.500371	3652.500367	3652.500367	0	-61	0.00	-0.02
40	nominal	3652.500106	NA	NA	NA	NA	NA	3652.500073	0	-355	0.00	-0.10
50	nominal	3652.500116	NA	NA	NA	NA	NA	3652.499942	0	-486	0.00	-0.13
Mid channel 3675.0MHz												
-30	nominal	3674.999302	3674.999241	3674.999261	3674.999212	3674.999194	3674.999194	3674.999178	0	-1199	0.00	-0.33
-20	nominal	3674.999043	NA	NA	NA	NA	NA	3674.998984	0	-1393	0.00	-0.38
-10	nominal	3674.999158	NA	NA	NA	NA	NA	3674.999173	0	-1219	0.00	-0.33
0	nominal	3674.999511	3674.999523	3674.999537	3674.999539	3674.999528	3674.999537	3674.999546	0	-866	0.00	-0.24
10	nominal	3675.000078	NA	NA	NA	NA	NA	3675.000296	0	-299	0.00	-0.08
20	+15%	3675.000391	NA	NA	NA	NA	NA	3675.000416	39	0	0.01	0.00
20	nominal	3675.000439	NA	NA	NA	NA	NA	3675.000377*	62	0	0.02	0.00
20	-15%	3675.000307	NA	NA	NA	NA	NA	3675.000257	0	-120	0.00	-0.03
30	nominal	3675.000385	3675.000428	3675.000369	3675.000359	3675.000356	3675.000373	3675.000363	51	-18	0.01	0.00
40	nominal	3675.000113	NA	NA	NA	NA	NA	3675.000123	0	-264	0.00	-0.07
50	nominal	3674.999946	NA	NA	NA	NA	NA	3674.999895	0	-482	0.00	-0.13
High channel 3697.5MHz												
-30	nominal	3697.500284	3697.499788	3697.499644	3697.499504	3697.499439	3697.499376	3697.499233	0	-1095	0.00	-0.30
-20	nominal	3697.498928	NA	NA	NA	NA	NA	3697.498922	0	-1406	0.00	-0.38
-10	nominal	3697.499134	NA	NA	NA	NA	NA	3697.499169	0	-1194	0.00	-0.33
0	nominal	3697.499531	3697.499505	3697.499489	3697.499459	3697.499449	3697.499439	3697.499468	0	-889	0.00	-0.24
10	nominal	3697.500011	NA	NA	NA	NA	NA	3697.500262	0	-317	0.00	-0.09
20	+15%	3697.500424	NA	NA	NA	NA	NA	3697.500432	104	0	0.03	0.00
20	nominal	3697.500393	NA	NA	NA	NA	NA	3697.500328*	65	0	0.02	0.00
20	-15%	3697.500254	NA	NA	NA	NA	NA	3697.500229	0	-99	0.00	-0.03
30	nominal	3697.500373	3697.500334	3697.500356	3697.500347	3697.500334	3697.500366	3697.500353	45	0	0.01	0.00
40	nominal	3697.500201	NA	NA	NA	NA	NA	3697.500098	0	-230	0.00	-0.06
50	nominal	3697.499921	NA	NA	NA	NA	NA	3697.499881	0	-447	0.00	-0.12

* - Reference frequency

Reference numbers of test equipment used

HL 2909	HL 2953	HL 3787					

Full description is given in Appendix A.

8 APPENDIX A Test equipment and ancillaries used for tests

HL No	Description	Manufacturer	Model	Ser. No.	Last Cal.	Due Cal.
0446	Antenna, Loop, Active, 10 kHz - 30 MHz	EMCO	6502	2857	29-Jun-10	29-Jun-11
0521	EMI Receiver (Spectrum Analyzer) with RF filter section 9 kHz-6.5 GHz	Hewlett Packard	8546A	3617A 00319, 3448A002 53	25-Aug-10	25-Aug-11
0604	Antenna BiconiLog Log-Periodic/T Bow-TIE, 26 - 2000 MHz	EMCO	3141	9611-1011	11-Jan-11	11-Jan-12
0768	Antenna Standard Gain Horn,18-26.5 GHz, WR-42, 25 dB gain	Quinstar Technology	QWH-4200-BA	110	26-Jan-11	26-Jan-14
0769	Antenna Standard Gain Horn, 26.5-40 GHz, WR28, 25 dB gain	Quinstar Technology	QWH-2800-BA	112	26-Jan-11	26-Jan-14
1424	Spectrum Analyzer, 30 Hz- 40 GHz	Agilent Technologies	8564EC	3946A002 19	31-Aug-10	31-Aug-11
1984	Antenna, Double-Ridged Waveguide Horn, 1-18 GHz, 300 W	EMC Test Systems	3115	9911-5964	11-Jun-10	11-Jun-11
2013	Power Divider, 0.5-18.0 GHz, 80 W	Omni Spectra	2090-6204-00	2013	01-Dec-10	01-Dec-12
2015	Power Divider, 0.5-18.0 GHz, 80 W	Omni Spectra	2090-6204-00	2015	01-Dec-10	01-Dec-12
2870	Microwave Cable Assembly, 18 GHz, 6.4 m, SMA - SMA	Huber-Suhner	198-9155-00	2870	14-Sep-10	14-Sep-11
2871	Microwave Cable Assembly, 18 GHz, 6.4 m, SMA - SMA	Huber-Suhner	198-8155-00	2871	14-Sep-10	14-Sep-11
2909	Spectrum analyzer, ESA-E, 100 Hz to 26.5 GHz	Agilent Technologies	E4407B	MY414447 62	07-May-10	07-May-11
2952	Cable, RF, 18 GHz, 1.2 m, SMA-SMA	Gore	10020014	NA	04-Oct-10	04-Oct-11
2953	Cable, RF, 18 GHz, 1.2 m, SMA-SMA	Gore	10020014	NA	04-Oct-10	04-Oct-11
3301	Power Meter, P-series, 50 MHz to 40 GHz	Agilent Technologies	N1911A	MY451010 57	13-Dec-10	13-Dec-11
3302	Power sensor, P-Series, 50 MHz to 40 GHz, -35/30 to 20 dBm	Agilent Technologies	N1922A	MY452405 86	13-Dec-10	13-Dec-11
3533	Amplifier, low noise, 6 to 18 GHz	Quinstar Technology	QLJ-06184040 -J0	111590010 01	23-Dec-10	23-Dec-11
3535	Amplifier, low noise, 18 to 40 GHz	Quinstar Technology	QLJ-18404537 -J0	111590030 01	06-Dec-10	06-Dec-11
3623	Cable RF, 6.0 m, N type-N type, DC-6.5 GHz	Belden	MIL C-17	NA	27-May-10	27-May-11
3768	Attenuator, N-type, 20 dB, DC to 18 GHz, 5 W	Mini-Circuits	BW-N20W5+	NA	31-Aug-10	31-Aug-11
3787	Precision Fixed Attenuator, 50 Ohm, 5 W, 10 dB, DC to 18 GHz	Mini-Circuits	BW-S10W5+	NA	07-Dec-10	07-Dec-11
3818	PSA Series Spectrum Analyzer, 3 Hz- 44 GHz	Agilent Technologies	E4446A	MY482502 88	26-Sep-10	26-Sep-11
3901	Microwave Cable Assembly, 40.0 GHz, 3.5 m, SMA/SMA	Huber-Suhner	SUCOFLEX 102A	1225/2A	07-Feb-11	07-Feb-12

9 APPENDIX B Measurement uncertainties

Expanded uncertainty at 95% confidence in Hermon Labs EMC measurements

Test description	Expanded uncertainty
Transmitter tests	
Carrier power conducted at antenna connector	± 1.7 dB
Carrier power radiated (substitution method)	± 4.5 dB
Occupied bandwidth	±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)
Duty cycle, timing (Tx ON / OFF) and average factor measurements	± 1.0 %

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

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

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

10 APPENDIX C Test laboratory description

Tests were performed at Hermon Laboratories Ltd., which is a fully independent, private, EMC, safety, environmental and telecommunication testing facility.
Hermon Laboratories is listed by the Federal Communications Commission (USA) for all parts of Code of Federal Regulations 47 (CFR 47), Registration Numbers 90624 for OATS and 90623 for the anechoic chamber; by Industry Canada for electromagnetic emissions (file numbers IC 2186A-1 for OATS, IC 2186A-2 for anechoic chamber, IC 2186A-3 for full-anechoic chamber for RE measurements above 1 GHz), certified by VCCI, Japan (the registration numbers are R-808 for OATS, R-1082 for anechoic chamber, G-27 for full-anechoic chamber for RE measurements above 1 GHz, C-845 for conducted emissions site, T-1606 for conducted emissions at telecommunication ports), has a status of a Telefication - Listed Testing Laboratory, Certificate No. L138/00. The laboratory is accredited by American Association for Laboratory Accreditation (USA) according to ISO/IEC 17025 for electromagnetic compatibility, product safety, telecommunications testing and environmental simulation (for exact scope please refer to Certificate No. 839.01). The FCC Designation Number is US1003.

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e-mail: mail@hermonlabs.com
website: www.hermonlabs.com

Person for contact: Mr. Alex Usoskin, CEO.

11 APPENDIX D Specification references

FCC 47CFR part 90: 2009	Private land mobile radio services
FCC 47CFR part 1: 2009	Practice and procedure
FCC 47CFR part 2: 2009	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

12 APPENDIX E Test equipment correction factors

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

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

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

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

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

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

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

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

Antenna factor in dB(1/m) is to be added to receiver meter reading in dB(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, HL1984

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

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

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

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

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

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

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

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

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

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

13 APPENDIX F Abbreviations and acronyms

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

END OF DOCUMENT