



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

TEST REPORT

ACCORDING TO: FCC CFR 47 PART 90 subpart Z

FOR:

Airspan Networks Inc.

WiMAX base station

Model: uMAXe/AirGrid 3.65 GHz TDD Ext

This report is in conformity with ISO/ IEC 17025. The "A2LA Accredited" symbol endorsement applies only to the tests and calibrations that are listed in the scope of Hermon Laboratories accreditation. The test results relate only to the items tested. This test report shall not be reproduced in any form except in full with the written approval of Hermon Laboratories Ltd.



Table of contents

1	Applicant information	3
2	Equipment under test attributes	3
3	Manufacturer information	3
4	Test details	3
5	Tests summary	4
6	EUT description	5
6.1	General information	5
6.2	Ports and lines	5
6.3	Support and test equipment	5
6.4	Operating frequencies	5
6.5	Changes made in EUT	5
6.6	Test configuration	6
6.7	Transmitter characteristics	7
7	Transmitter tests according to 47CFR part 90 requirements.....	8
7.1	Peak output power and EIRP power density test	8
7.2	Occupied bandwidth test	25
7.3	Emission mask test.....	39
7.4	Radiated spurious emission measurements	48
7.5	Spurious emissions at RF antenna connector test	65
7.6	Frequency stability test.....	78
8	Contention Based Protocol.....	80
8.1	General	80
8.2	Test procedure.....	80
9	APPENDIX A Test equipment and ancillaries used for tests.....	85
10	APPENDIX B Measurement uncertainties	87
11	APPENDIX C Test laboratory description	88
12	APPENDIX D Specification references	88
13	APPENDIX E Test equipment correction factors	89
14	APPENDIX F Abbreviations and acronyms	103



HERMON LABORATORIES

1 Applicant information

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

2 Equipment under test attributes

Product name: WiMAX base station
Product type: Transceiver
Model(s): uMAXe / AirGrid 3.65GHz TDD Ext
Serial number: 5B3AB4136731
Hardware version: A1
Software release: 13.9.60.003
Receipt date: 3/27/2011

3 Manufacturer information

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

4 Test details




Project ID: 21823
Location: Hermon Laboratories Ltd. Harakevet Industrial Zone, Binyamina 30500, Israel
Test started: 3/27/2011
Test completed: 5/16/2011
Test specification(s): 47CFR part 90 subpart Z

5 Tests summary

Test	Status
Transmitter characteristics	
FCC Section 90.1321, Maximum conducted output power	Pass
FCC Section 90.1321, Peak EIRP power density	Pass
FCC Section 90.209, Occupied bandwidth	Pass
FCC Section 90.210(b), Emission mask	Pass
FCC Section 90.1323, Spurious emissions at RF antenna connector	Pass
FCC Section 90.1323, Radiated spurious emissions	Pass
FCC Section 90.213, Frequency stability	Pass
FCC Section 90.203 (o), Contention based protocol	Pass
FCC Section 90.1335, RF exposure	Pass, Exhibit attached to Application for certification

Testing was completed against all relevant requirements of the test standard. The results obtained indicate that the product under test complies in full with the requirements tested.

The test results relate only to the items tested. Pass/ fail decision was based on nominal values.

	Name and Title	Date	Signature
Tested by:	Mr. S. Samokha, test engineer	May 16, 2011	
Reviewed by:	Mrs. M. Cherniavsky, certification engineer	May 24, 2011	
Approved by:	Mr. M. Nikishin, EMC and Radio group manager	May 31, 2011	



6 EUT description

6.1 General information

The EUT, base station radio, uMAXe/AirGrid 3.65GHz TDD Ext, is part of a WiMAX broadband fixed cellular wireless access system. The system provides a radio link between an end-user (a subscriber) and a network to give high-speed data access. The uMAX's transceiver/receiver (up to 64 QAM modulation, data rate up to 46) uses OFDMA and operating in TDD duplexing mode, equipped with a 2 dBi external antenna.

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

6.2 Ports and lines

Port type	Port description	Connected from	Connected to	Qty.	Cable type	Cable length, m
Power	DC Power	PS	EUT	1	Unshielded	3.5
RF (Tx/Rx)	Antenna 1	EUT	Antenna	1	Coax	10
RF (Tx/Rx)	Antenna 2	EUT	Antenna	1	Coax	10
Signal	GPS	EUT	GPS Antenna	1	Coax	1.5
Control	Manage	EUT	PC	1	Not in use	Not in use
Telecom	Ethernet	EUT	Laptop	1	STP	3

6.3 Support and test equipment

Description	Manufacturer	Model number	Serial number
DC power supply	Horizon Electronics	DHR3655D	S/N 767469
Laptop	IBM	X31	99-TXWYC
GPS Antenna	Trimble	P/N 57861-00	S/N 01880177
Power Splitter	Mini-Circuits	ZA4PD-4	SF118400430
Power Splitter	Mini-Circuits	ZAPD-4-S+	SF273900809
Terminal Station	Airspan	WIXS-168 V01	00A00A158390
PS (for Terminal Station)	Power Dsine	PD-3001/AC	RO8268050024397001
AC Adapter	IBM	92P1014	11S92P1014Z1ZD2N74T2LS
Attenuator 30 dB (2 units)	Aeroflex	33-30-34	NA

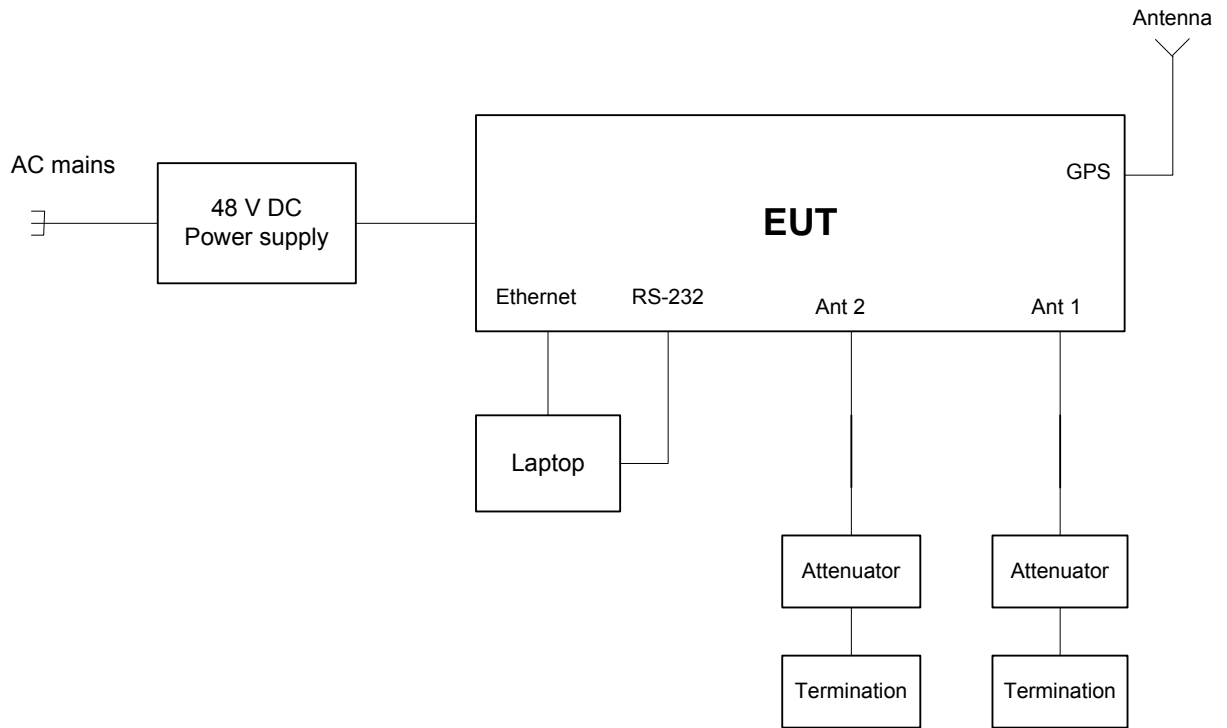
6.4 Operating frequencies

Source	Frequency, MHz		
Tx	3651.75	3675	3698.25
LO	153		

6.5 Changes made in EUT

No changes were implemented.

6.6 Test configuration





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		
	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		3650.0 – 3700.0 MHz		
Operating frequency range		3651.75 – 3698.25 MHz for 3.5 MHz EBW 3652.50 – 3697.50 MHz for 5 MHz EBW 3653.50 – 3696.50 MHz for 7 MHz EBW 3655.00 – 3695.00 MHz for 10 MHz EBW		
RF channel spacing		3.5 MHz, 5 MHz, 7 MHz, 10 MHz		
Maximum rated output power		At transmitter 50 Ω RF output connector (aggregate power of both RF chains)		
		33.08 dBm – 3.5 MHz OBW 34.55 dBm – 5 MHz OBW 36.07 dBm – 7 MHz OBW 36.08 dBm – 10 MHz OBW		
Is transmitter output power variable?		No		
		V	Yes	
				continuous variable
			V	stepped variable with stepsize
		minimum RF power	0 dBm	
		maximum RF power	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	
Blade antenna	European Antennas Ltd.	SBA-3800-D1/1040	2.0 dBi	
Omni Directional Antenna	MTI Wireless Edge Ltd.	MT-403017/N	10.5 dBi	
Manual Tilt Panel Antenna, Dual Slant ± 45°	Argus Technologies Pty Ltd.	SSPX310M	18.0 dBi	
Transmitter aggregate data rate/s, Mbps				
Transmitter 99% power bandwidth	Type of modulation			
		64QAM	16QAM	QPSK
	10 MHz	43	26	13
	7 MHz	26	16	8
	5 MHz	22	13	6
3.5 MHz	11	7	3	
Type of multiplexing	OFDMA/TDD			
Modulating test signal (baseband)	PRBS			
Maximum transmitter duty cycle in normal use	75 %			
Transmitter power source				
V	DC	Nominal rated voltage	48 VDC	
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:	3/27/2011		
Temperature: 22.4 °C	Air Pressure: 1022 hPa	Relative Humidity: 46 %	Power Supply: 48 VDC
Remarks:			

7 Transmitter tests according to 47CFR part 90 requirements

7.1 Peak output power and EIRP power density test

7.1.1 General

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

Table 7.1.1 Peak output power limits

Assigned frequency range, MHz	Occupied Bandwidth, MHz	Maximum peak output power, EIRP	
		W	dBm
3650.0 – 3700.0	3.5	3.5	35.44
	5	5	36.99
	7	7	38.45
	10	10	40.00
Assigned frequency range, MHz	Occupied Bandwidth, MHz	Maximum peak power spectral density, EIRP	
		W/MHz	dBm/MHz
3650.0 – 3700.0	5	1	30
	7		
	10		

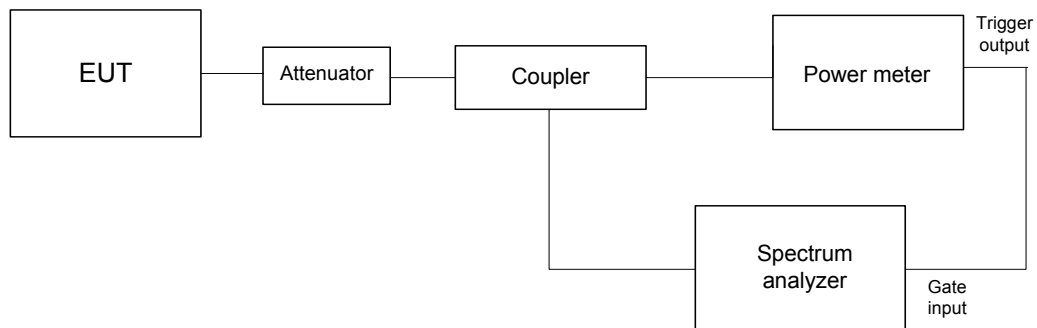
7.1.2 Test procedure

7.1.2.1 The EUT was set up as shown in Figure 7.1.1, energized and its proper operation was checked.

7.1.2.2 The EUT was adjusted to produce maximum available to the end user RF output power.

7.1.2.3 The peak output power was measured with spectrum analyzer as provided in Table 7.1.2 and associated plots.

Figure 7.1.1 Peak output power test setup





Test specification:		Section 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:	3/27/2011				
Temperature: 22.4 °C	Air Pressure: 1022 hPa	Relative Humidity: 46 %	Power Supply: 48 VDC		
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 (see NOTE 1)
EBW: 3.5 MHz

Channel, MHz	Modulation	P _{meas} (RF#1), dBm	P _{meas} (RF#2), dBm	P _{meas} *, dBm	Antenna gain, dBi	EIRP total**, dBm	Limit, dBm	Margin, dB	Verdict
3651.75	QPSK	30.10	30.01	33.07	2.0	35.07	35.44	-0.37	Pass
3675.00	QPSK	30.07	30.04	33.07	2.0	35.07	35.44	-0.37	Pass
3698.25	QPSK	30.06	30.01	33.05	2.0	35.05	35.44	-0.39	Pass
3651.75	64QAM	30.11	30.03	33.08	2.0	35.08	35.44	-0.36	Pass
3675.00	64QAM	30.08	30.04	33.07	2.0	35.07	35.44	-0.37	Pass
3698.25	64QAM	30.08	30.05	33.08	2.0	35.08	35.44	-0.36	Pass

EBW: 5 MHz

Channel, MHz	Modulation	P _{meas} (RF#1), dBm	P _{meas} (RF#2), dBm	P _{meas} *, dBm	Antenna gain, dBi	EIRP total**, dBm	Limit, dBm	Margin, dB	Verdict
3652.50	QPSK	31.32	31.54	34.44	2.0	36.44	36.70	-0.26	Pass
3675.00	QPSK	31.45	31.52	34.50	2.0	36.50	36.70	-0.20	Pass
3697.50	QPSK	31.56	31.46	34.52	2.0	36.52	36.70	-0.18	Pass
3652.50	64QAM	31.46	31.62	34.55	2.0	36.55	36.70	-0.15	Pass
3675.00	64QAM	31.47	31.54	34.52	2.0	36.52	36.70	-0.18	Pass
3697.50	64QAM	31.57	31.41	34.50	2.0	36.50	36.70	-0.20	Pass

EBW: 7 MHz

Channel, MHz	Modulation	P _{meas} (RF#1), dBm	P _{meas} (RF#2), dBm	P _{meas} *, dBm	Antenna gain, dBi	EIRP total**, dBm	Limit, dBm	Margin, dB	Verdict
3653.50	QPSK	32.96	33.04	36.01	2.0	38.01	38.45	-0.44	Pass
3675.00	QPSK	33.02	32.90	35.97	2.0	37.97	38.45	-0.48	Pass
3696.50	QPSK	33.06	32.41	35.76	2.0	37.76	38.45	-0.69	Pass
3653.50	64QAM	33.04	33.07	36.07	2.0	38.07	38.45	-0.38	Pass
3675.00	64QAM	33.11	32.96	36.05	2.0	38.05	38.45	-0.40	Pass
3696.50	64QAM	33.09	32.49	35.81	2.0	37.81	38.45	-0.64	Pass

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:	3/27/2011		
Temperature: 22.4 °C	Air Pressure: 1022 hPa	Relative Humidity: 46 %	Power Supply: 48 VDC
Remarks:			

Table 7.1.2 Peak EIRP output power test results (continued)

ASSIGNED FREQUENCY RANGE: 3650.0 – 3700.0 MHz
 DETECTOR USED: Average (Power Meter)
 MODULATING SIGNAL: PRBS
 TRANSMITTER OUTPUT POWER SETTINGS: Maximum (see NOTE 1)

EBW: 10 MHz

Channel, MHz	Modulation	Pmeas (RF#1), dBm	Pmeas (RF#2), dBm	P _{meas} *, dBm	Antenna gain, dBi	EIRP total**, dBm	Limit, dBm	Margin, dB	Verdict
3655.00	QPSK	32.91	33.24	36.08	2.0	38.08	40.00	-1.92	Pass
3675.00	QPSK	32.81	32.95	35.89	2.0	37.89	40.00	-2.11	Pass
3695.00	QPSK	33.31	32.65	36.00	2.0	38.00	40.00	-2.00	Pass
3655.00	64QAM	32.89	33.23	36.07	2.0	38.07	40.00	-1.93	Pass
3675.00	64QAM	32.75	32.96	35.87	2.0	37.87	40.00	-2.13	Pass
3695.00	64QAM	33.29	32.64	35.99	2.0	37.99	40.00	-2.01	Pass

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

** - $EIRP\ total, dBm = P_{meas}^*, dBm + Antenna\ Gain, dBi$

NOTE 1: EUT was configured to produce maximum conducted RF power for minimum declared Antenna gain of 2 dBi. RF output power will vary depending on the antenna assembly gain to ensure that the total EIRP power and power limits withstand with EIRP limits. For actual settings of power levels with respect to actual antenna assembly used, please refer to the User's Manual.

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:	3/27/2011				
Temperature: 22.4 °C	Air Pressure: 1022 hPa	Relative Humidity: 46 %	Power Supply: 48 VDC		
Remarks:					

Table 7.1.3 Peak EIRP power density test results

OPERATING 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 (see NOTE 1)
EBW: 3.5 MHz

Channel, MHz	Modulation	Pmeas (RF#1), dBm/MHz	Pmeas (RF#2), dBm/MHz	Power density *, dBm/MHz	Antenna gain, dBi	EIRP power density**, dBm/MHz	Limit, dBm/MHz	Margin, dB	Verdict
3651.75	QPSK	24.12	24.56	27.36	2.0	29.36	30.0	-0.64	Pass
3675.00	QPSK	24.40	24.68	27.55	2.0	29.55	30.0	-0.45	Pass
3698.25	QPSK	24.25	24.19	27.23	2.0	29.23	30.0	-0.77	Pass
3651.75	64QAM	24.05	24.49	27.29	2.0	29.30	30.0	-0.70	Pass
3675.00	64QAM	24.31	24.56	27.45	2.0	29.45	30.0	-0.55	Pass
3698.25	64QAM	24.22	24.42	27.33	2.0	29.35	30.0	-0.65	Pass

EBW: 5 MHz

Channel, MHz	Modulation	Pmeas (RF#1), dBm/MHz	Pmeas (RF#2), dBm/MHz	Power density *, dBm/MHz	Antenna gain, dBi	EIRP power density**, dBm/MHz	Limit, dBm/MHz	Margin, dB	Verdict
3652.50	QPSK	24.48	24.46	27.48	2.0	29.48	30.0	-0.52	Pass
3675.00	QPSK	24.38	24.37	27.39	2.0	29.40	30.0	-0.60	Pass
3697.50	QPSK	24.45	24.06	27.27	2.0	29.27	30.0	-0.73	Pass
3652.50	64QAM	24.62	24.52	27.58	2.0	29.60	30.0	-0.40	Pass
3675.00	64QAM	24.55	24.58	27.58	2.0	29.58	30.0	-0.42	Pass
3697.50	64QAM	24.67	24.30	27.50	2.0	29.51	30.0	-0.49	Pass

EBW: 7 MHz

Channel, MHz	Modulation	Pmeas (RF#1), dBm/MHz	Pmeas (RF#2), dBm/MHz	Power density *, dBm/MHz	Antenna gain, dBi	EIRP power density **, dBm/MHz	Limit, dBm/MHz	Margin, dB	Verdict
3653.50	QPSK	24.22	24.77	27.51	2.0	29.51	30.0	-0.49	Pass
3675.00	QPSK	24.59	24.66	27.64	2.0	29.65	30.0	-0.35	Pass
3696.50	QPSK	24.51	24.83	27.68	2.0	29.68	30.0	-0.32	Pass
3653.50	64QAM	24.37	24.95	27.68	2.0	29.70	30.0	-0.30	Pass
3675.00	64QAM	24.69	24.80	27.76	2.0	29.76	30.0	-0.24	Pass
3696.50	64QAM	24.59	24.87	27.74	2.0	29.76	30.0	-0.24	Pass

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:	3/27/2011		
Temperature: 22.4 °C	Air Pressure: 1022 hPa	Relative Humidity: 46 %	Power Supply: 48 VDC
Remarks:			

Table 7.1.3 Peak EIRP power density test results (continued)

OPERATING 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 (see NOTE 1)

EBW: 10 MHz

Channel, MHz	Modulation	Pmeas (RF#1), dBm/MHz	Pmeas (RF#2), dBm/MHz	Power density *, dBm/MHz	Antenna gain, dBi	EIRP power density **, dBm/MHz	Limit, dBm/MHz	Margin, dB	Verdict
3655.00	QPSK	23.86	24.20	27.04	2.0	29.04	30.0	-0.96	Pass
3675.00	QPSK	23.81	24.05	26.94	2.0	28.96	30.0	-1.04	Pass
3695.00	QPSK	23.41	23.44	26.44	2.0	28.44	30.0	-1.56	Pass
3655.00	64QAM	23.72	24.40	27.08	2.0	29.10	30.0	-0.90	Pass
3675.00	64QAM	23.78	24.04	26.92	2.0	28.92	30.0	-1.08	Pass
3695.00	64QAM	23.44	23.60	26.53	2.0	28.55	30.0	-1.45	Pass

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

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

NOTE1: EUT was configured to produce maximum conducted RF power for minimum declared Antenna gain of 2 dBi. RF output power will vary depending on the antenna assembly gain to ensure that the total EIRP power and power limits withstand with EIRP limits. For actual settings of power levels with respect to actual antenna assembly used, please refer to the User's Manual.

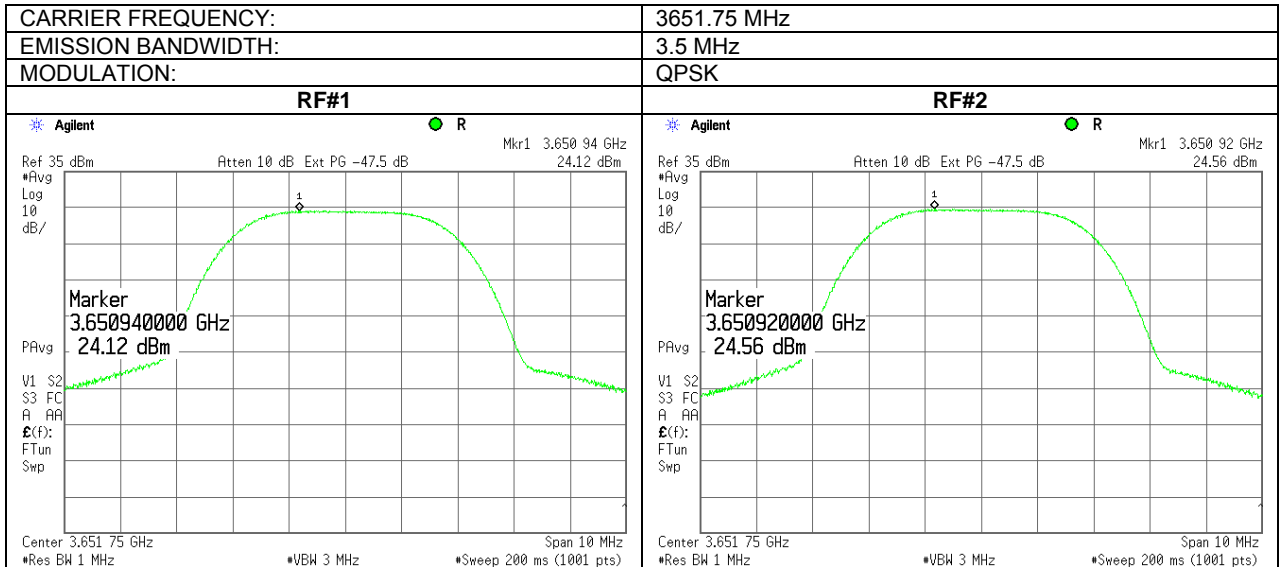
Reference numbers of test equipment used

HL 1906	HL 2013	HL 2952	HL 3301	HL 3302	HL 3472	HL 3474	HL 3782
HL 3818							

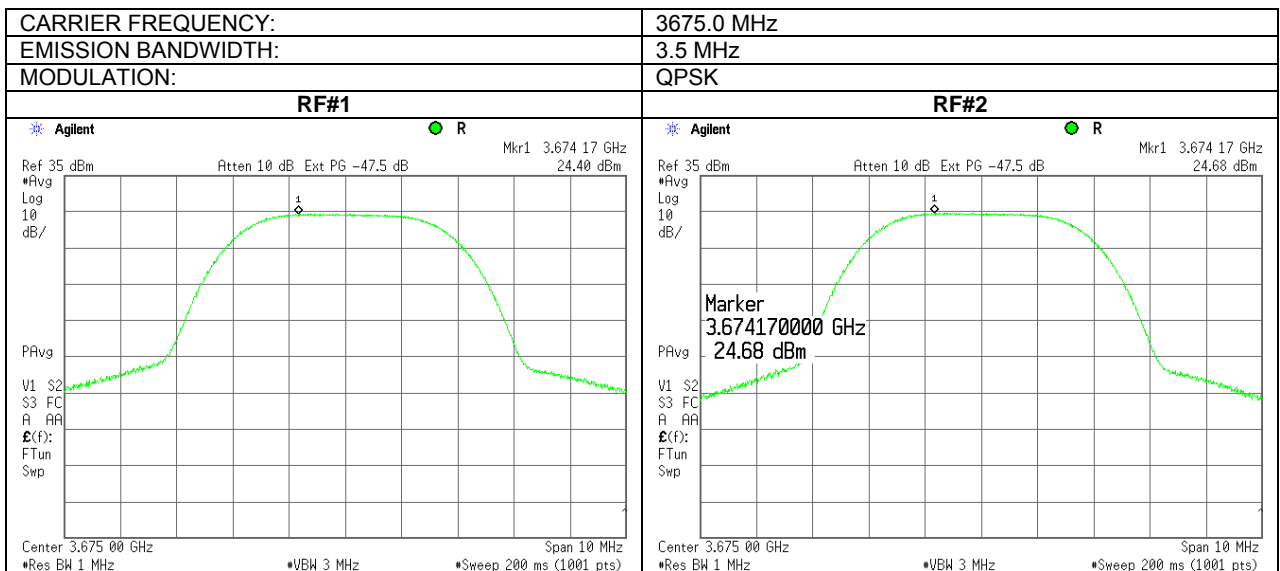
Full description is given in Appendix A.

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: 3/27/2011			
Temperature: 22.4 °C	Air Pressure: 1022 hPa	Relative Humidity: 46 %	Power Supply: 48 VDC
Remarks:			

Plot 7.1.1 Peak output power density test results at low frequency

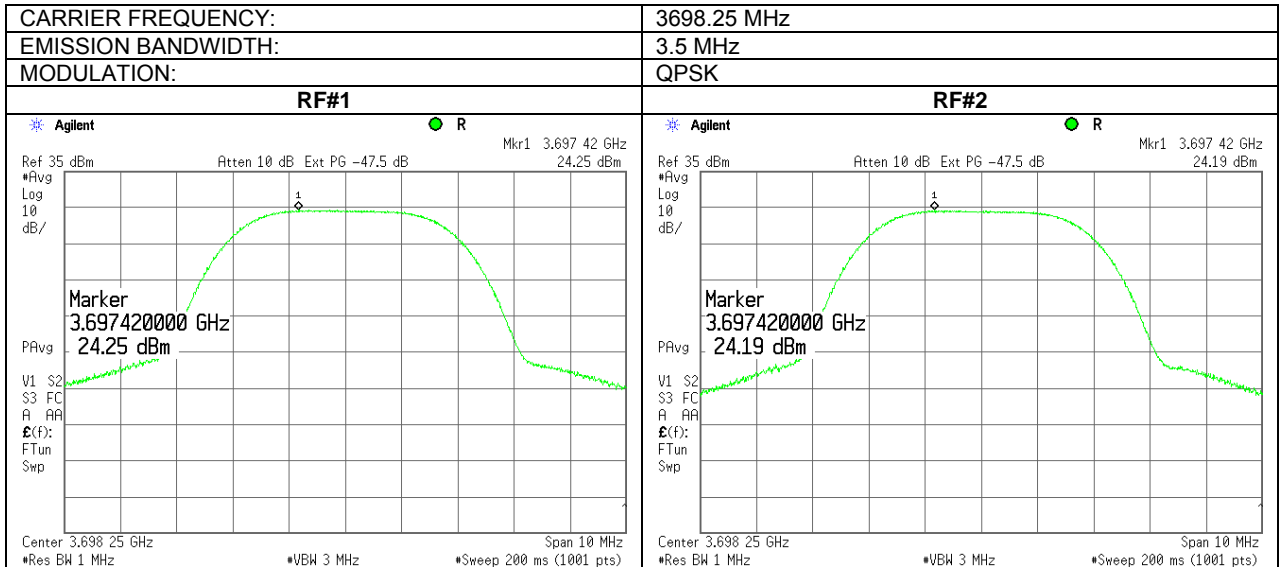


Plot 7.1.2 Peak output power density test results at mid frequency

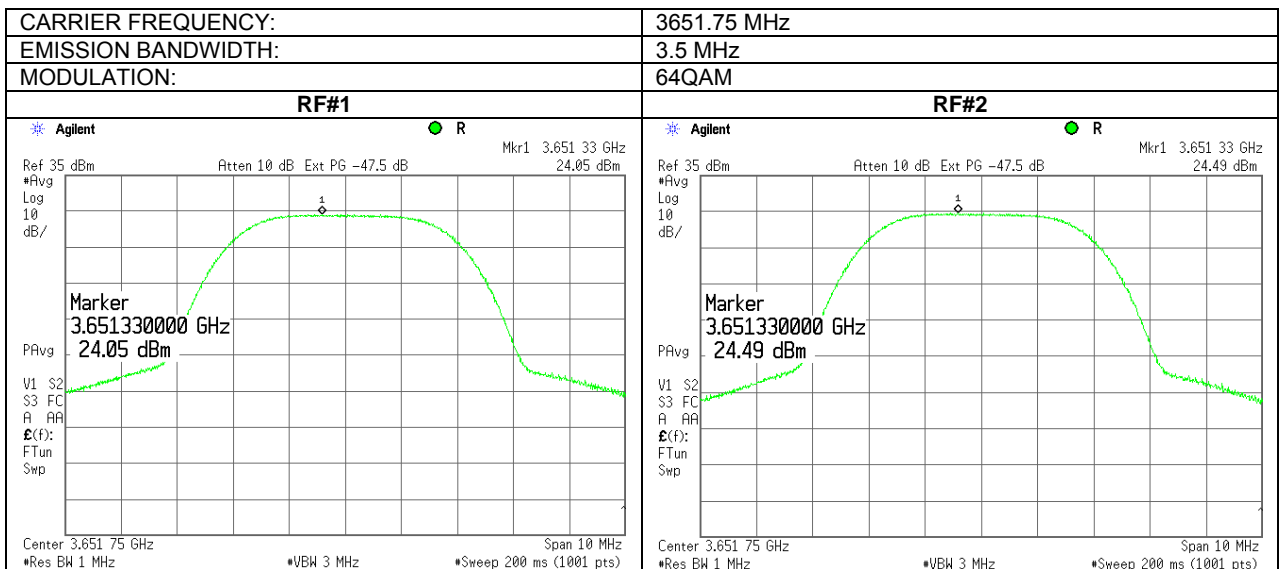


Test specification:		Section 90.1321, Maximum conducted output power	
Test procedure:		47 CFR, Section 2.1046; TIA/EIA-603-C, Section 2.2.1	
Test mode:	Compliance	Verdict:	PASS
Date:	3/27/2011		
Temperature: 22.4 °C	Air Pressure: 1022 hPa	Relative Humidity: 46 %	Power Supply: 48 VDC
Remarks:			

Plot 7.1.3 Peak output power test results at high frequency

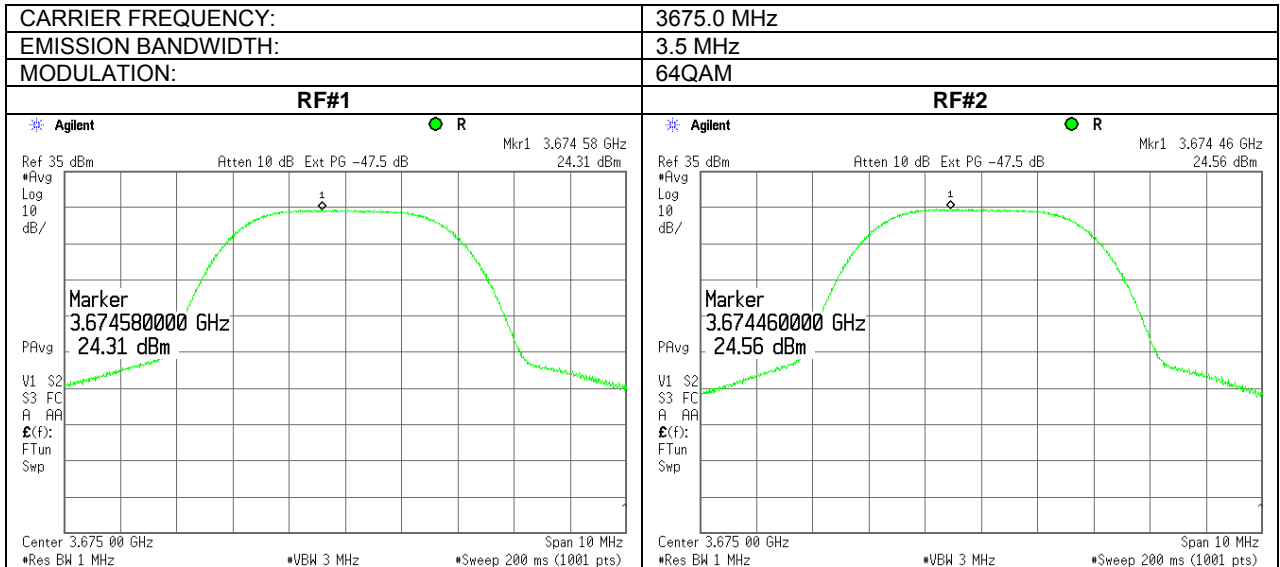


Plot 7.1.4 Peak output power density test results at low frequency

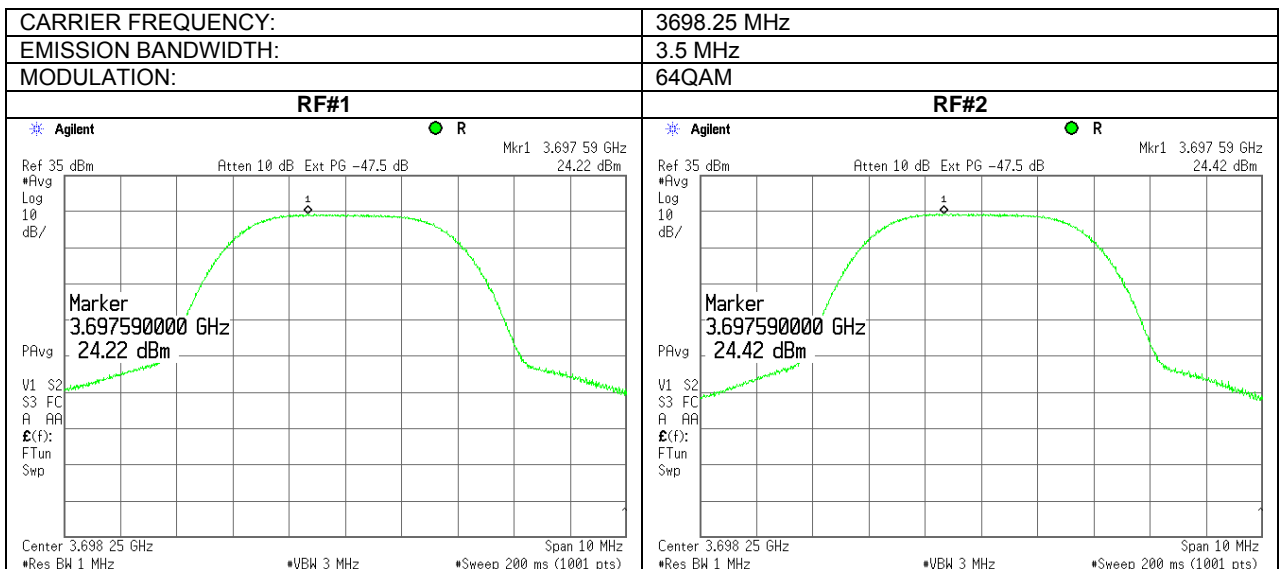


Test specification:		Section 90.1321, Maximum conducted output power	
Test procedure:		47 CFR, Section 2.1046; TIA/EIA-603-C, Section 2.2.1	
Test mode:	Compliance	Verdict:	PASS
Date:	3/27/2011		
Temperature: 22.4 °C	Air Pressure: 1022 hPa	Relative Humidity: 46 %	Power Supply: 48 VDC
Remarks:			

Plot 7.1.5 Peak output power density test results at mid frequency

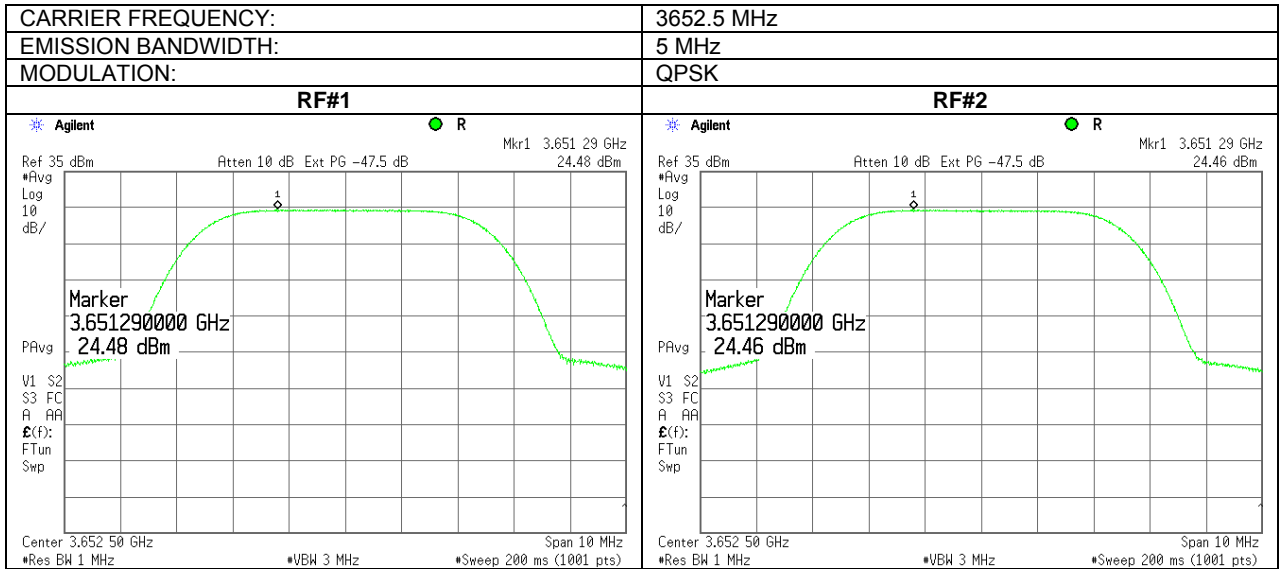


Plot 7.1.6 Peak output power test results at high frequency

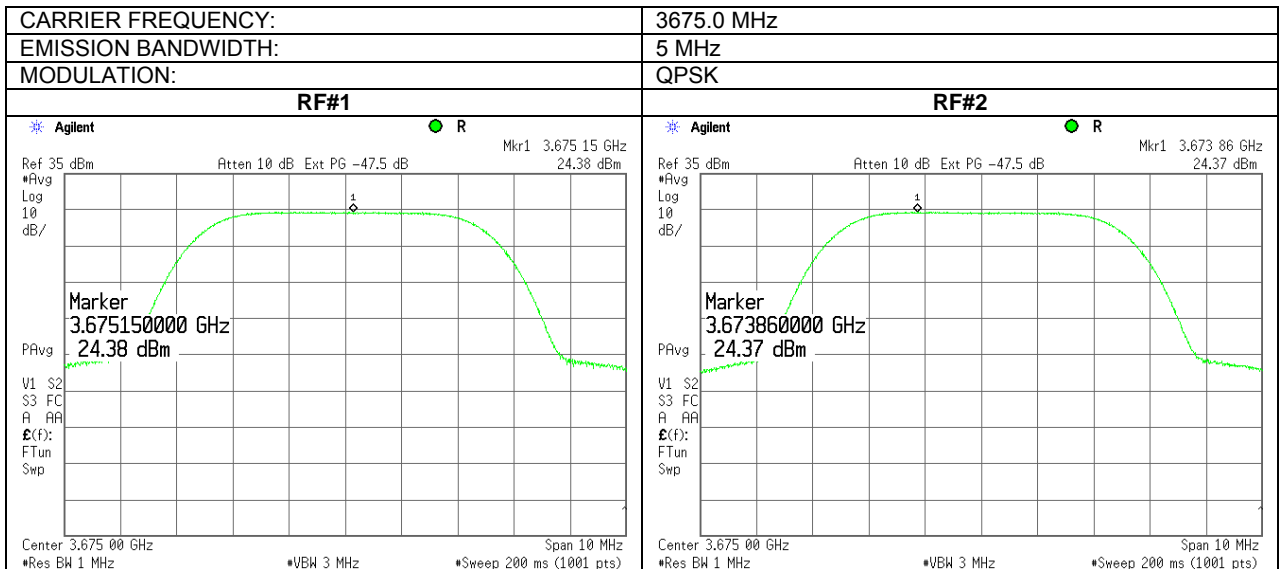


Test specification: Section 90.1321, Maximum conducted output power			
Test procedure: 47 CFR, Section 2.1046; TIA/EIA-603-C, Section 2.2.1			
Test mode: Compliance	Verdict: PASS		
Date: 3/27/2011			
Temperature: 22.4 °C	Air Pressure: 1022 hPa	Relative Humidity: 46 %	Power Supply: 48 VDC
Remarks:			

Plot 7.1.7 Peak output power density test results at low frequency

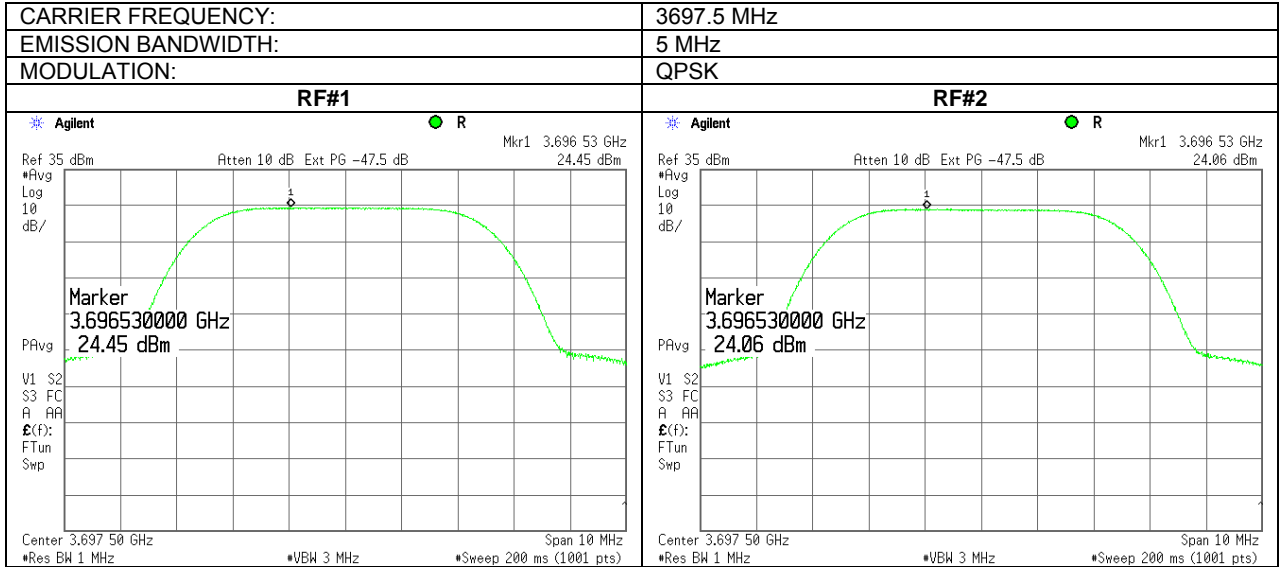


Plot 7.1.8 Peak output power density test results at mid frequency

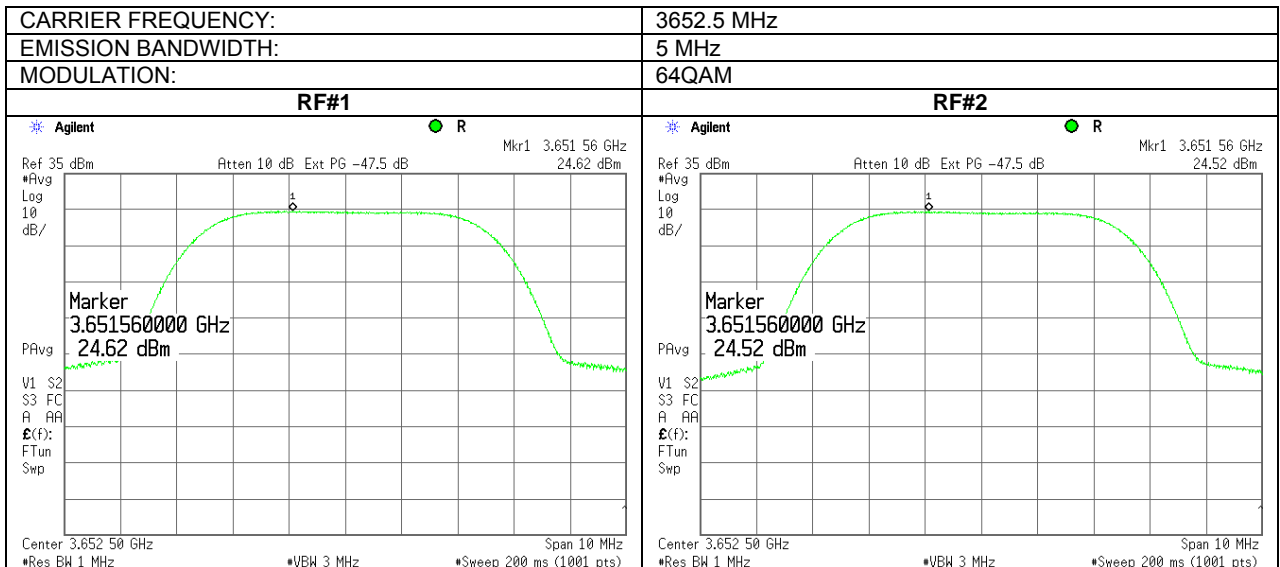


Test specification:		Section 90.1321, Maximum conducted output power	
Test procedure:		47 CFR, Section 2.1046; TIA/EIA-603-C, Section 2.2.1	
Test mode:		Compliance	Verdict: PASS
Date:		3/27/2011	
Temperature: 22.4 °C	Air Pressure: 1022 hPa	Relative Humidity: 46 %	Power Supply: 48 VDC
Remarks:			

Plot 7.1.9 Peak output power test results at high frequency

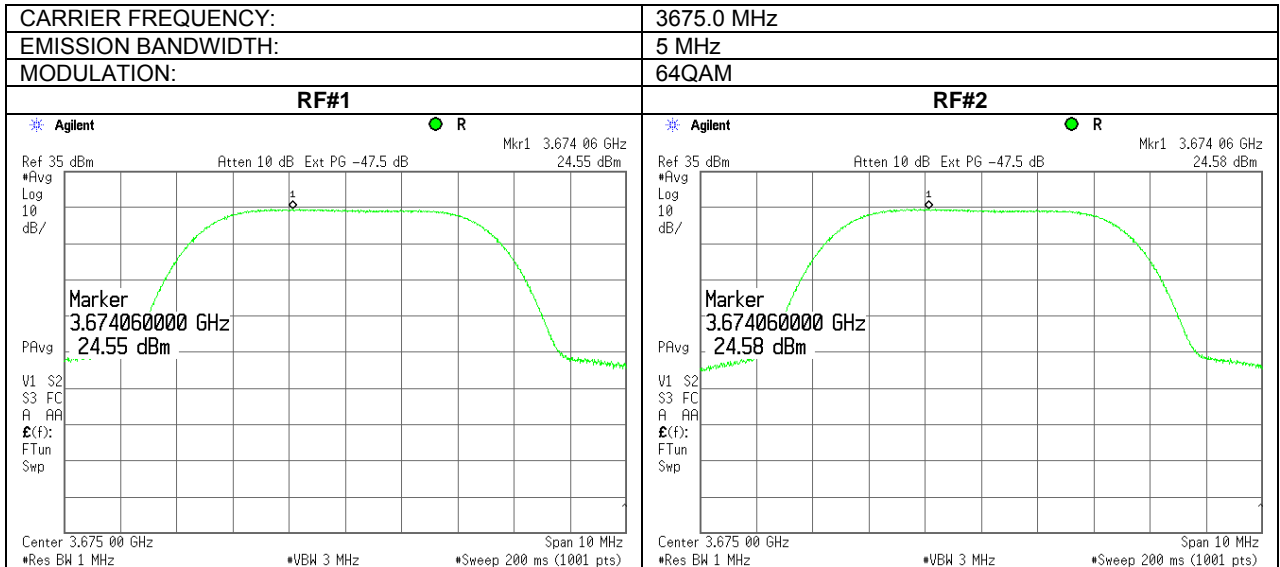


Plot 7.1.10 Peak output power test results at low frequency

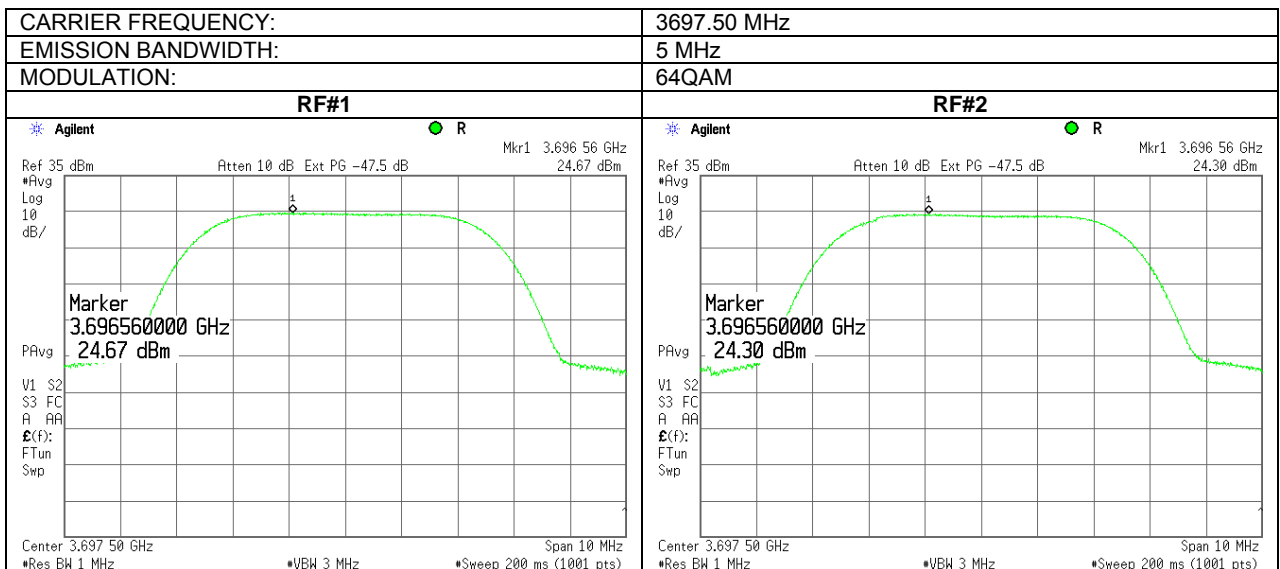


Test specification: Section 90.1321, Maximum conducted output power			
Test procedure: 47 CFR, Section 2.1046; TIA/EIA-603-C, Section 2.2.1			
Test mode: Compliance	Verdict: PASS		
Date: 3/27/2011			
Temperature: 22.4 °C	Air Pressure: 1022 hPa	Relative Humidity: 46 %	Power Supply: 48 VDC
Remarks:			

Plot 7.1.11 Peak output power test results at mid frequency

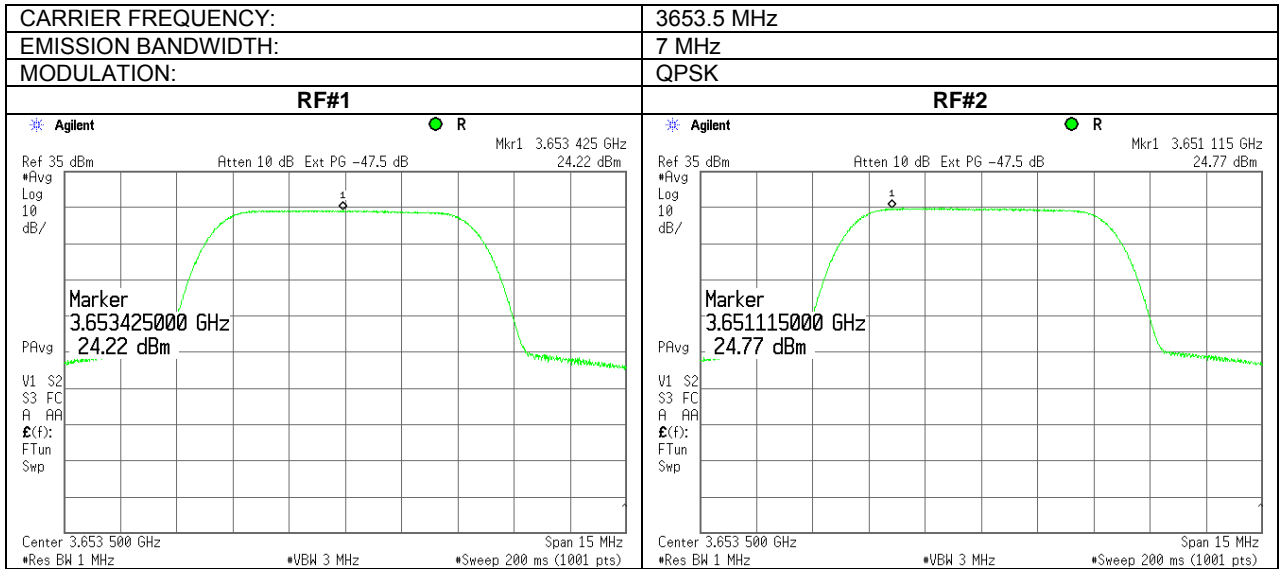


Plot 7.1.12 Peak output power test results at high frequency

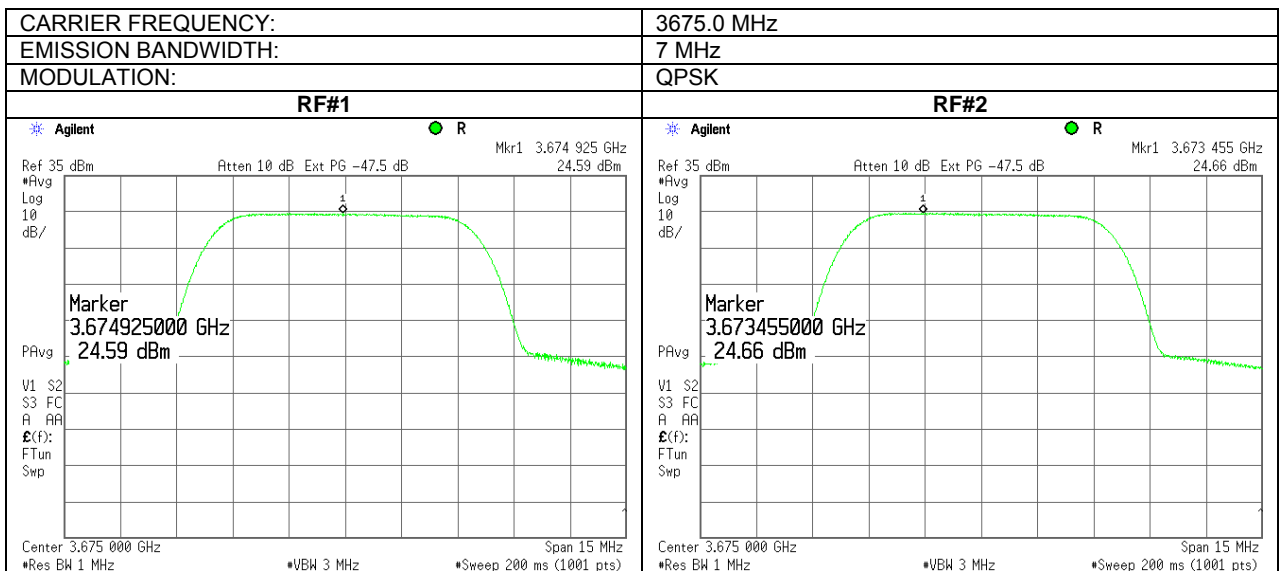


Test specification:		Section 90.1321, Maximum conducted output power	
Test procedure:		47 CFR, Section 2.1046; TIA/EIA-603-C, Section 2.2.1	
Test mode:	Compliance	Verdict:	PASS
Date:	3/27/2011		
Temperature: 22.4 °C	Air Pressure: 1022 hPa	Relative Humidity: 46 %	Power Supply: 48 VDC
Remarks:			

Plot 7.1.13 Peak output power test results at low frequency

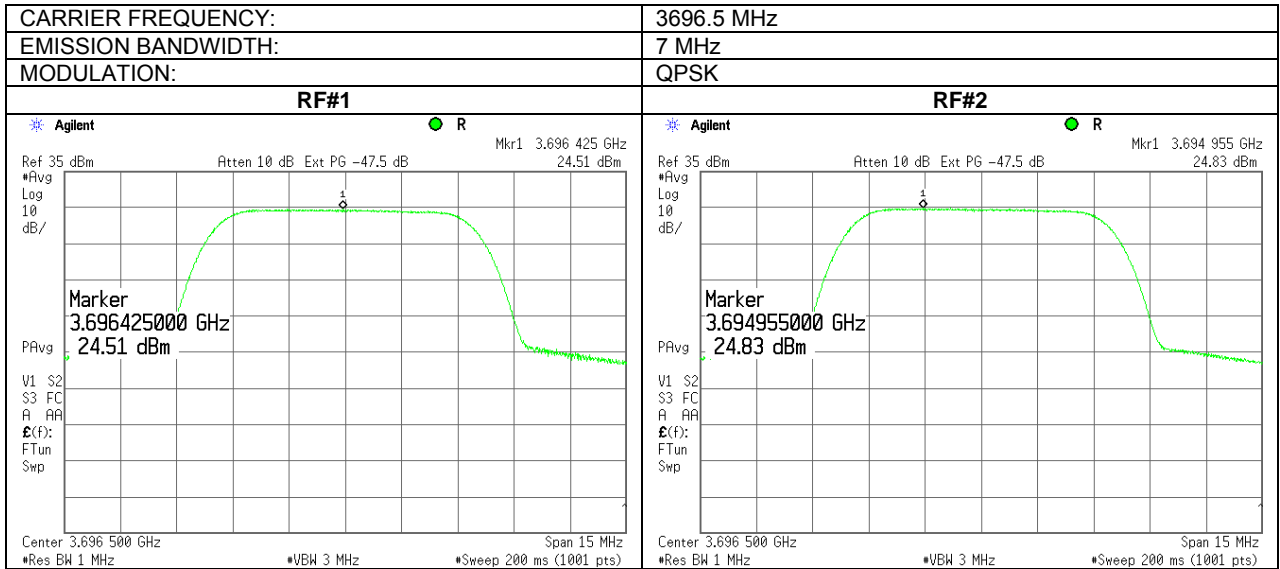


Plot 7.1.14 Peak output power test results at mid frequency

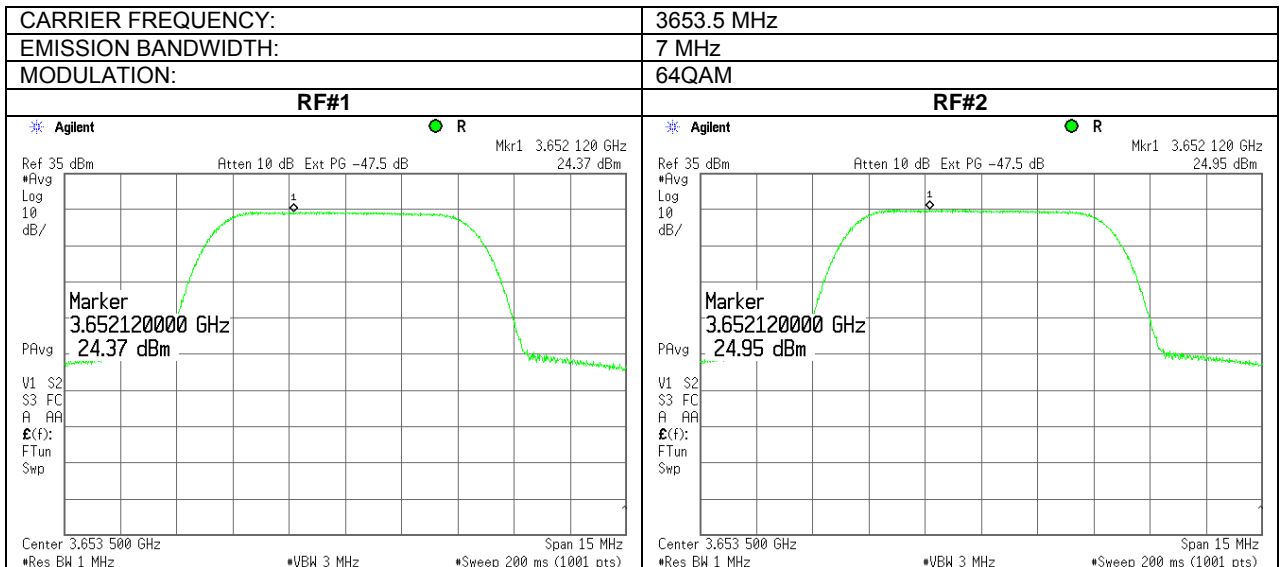


Test specification: Section 90.1321, Maximum conducted output power			
Test procedure: 47 CFR, Section 2.1046; TIA/EIA-603-C, Section 2.2.1			
Test mode: Compliance	Verdict: PASS		
Date: 3/27/2011			
Temperature: 22.4 °C	Air Pressure: 1022 hPa	Relative Humidity: 46 %	Power Supply: 48 VDC
Remarks:			

Plot 7.1.15 Peak output power test results at high frequency

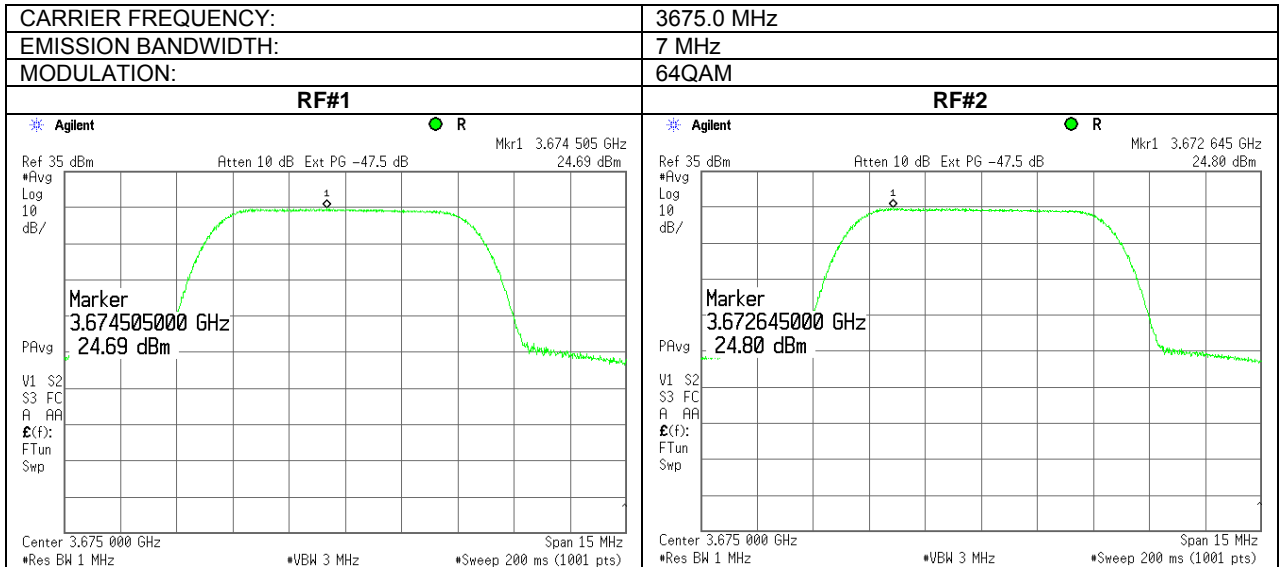


Plot 7.1.16 Peak output power test results at low frequency

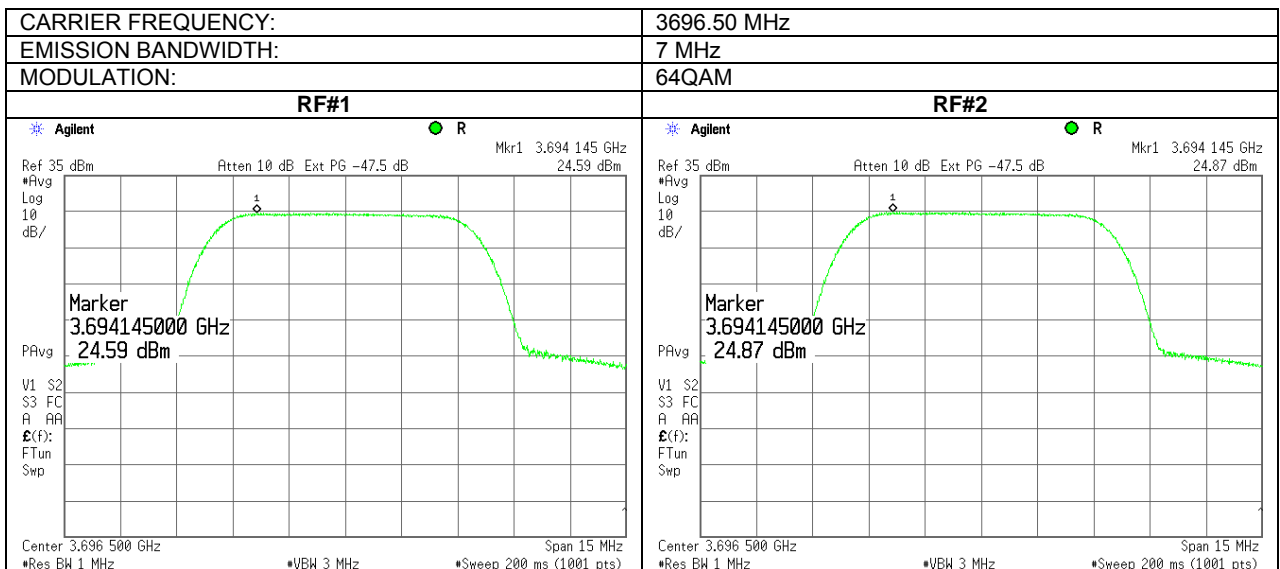


Test specification: Section 90.1321, Maximum conducted output power			
Test procedure: 47 CFR, Section 2.1046; TIA/EIA-603-C, Section 2.2.1			
Test mode: Compliance	Verdict: PASS		
Date: 3/27/2011			
Temperature: 22.4 °C	Air Pressure: 1022 hPa	Relative Humidity: 46 %	Power Supply: 48 VDC
Remarks:			

Plot 7.1.17 Peak output power test results at mid frequency

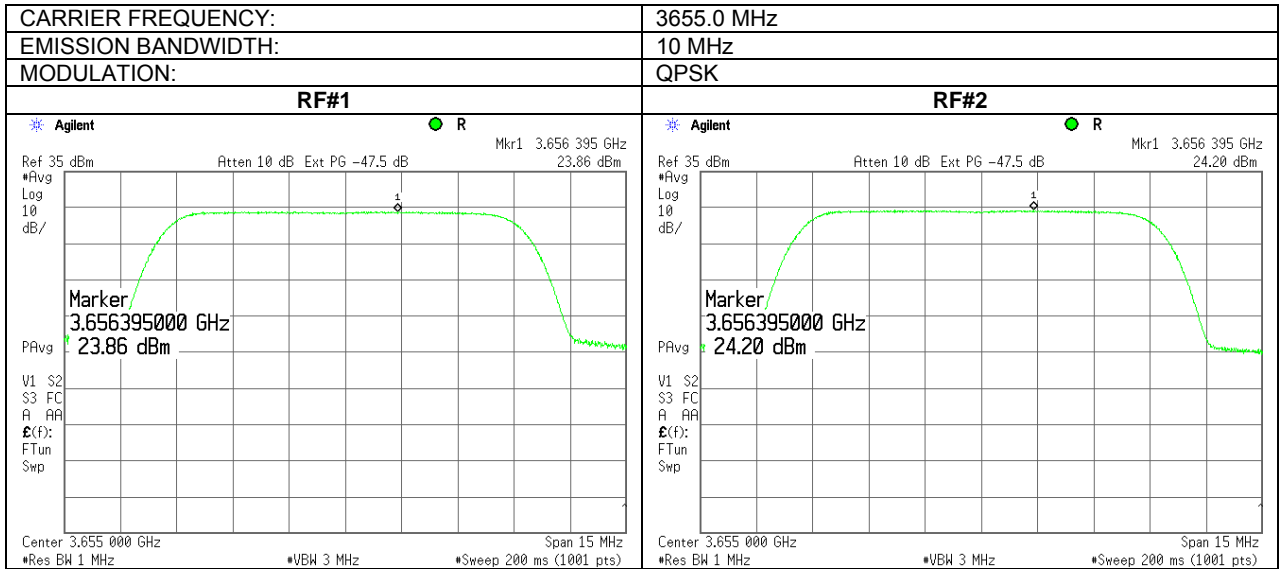


Plot 7.1.18 Peak output power test results at high frequency

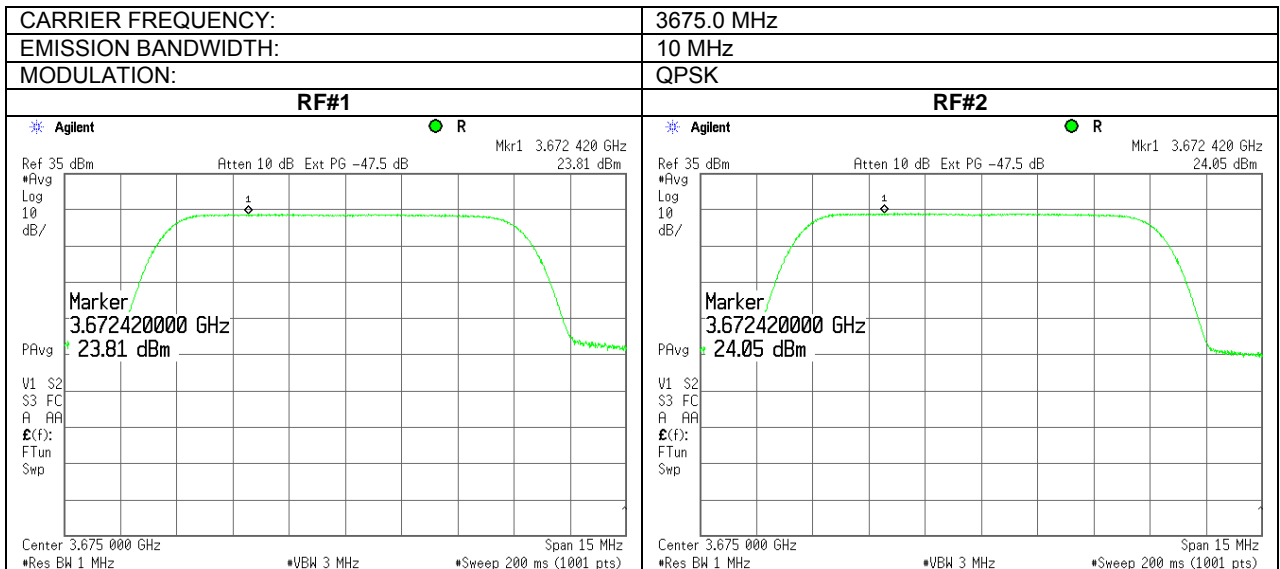


Test specification: Section 90.1321, Maximum conducted output power			
Test procedure: 47 CFR, Section 2.1046; TIA/EIA-603-C, Section 2.2.1			
Test mode: Compliance	Verdict: PASS		
Date: 3/27/2011			
Temperature: 22.4 °C	Air Pressure: 1022 hPa	Relative Humidity: 46 %	Power Supply: 48 VDC
Remarks:			

Plot 7.1.19 Peak output power test results at low frequency

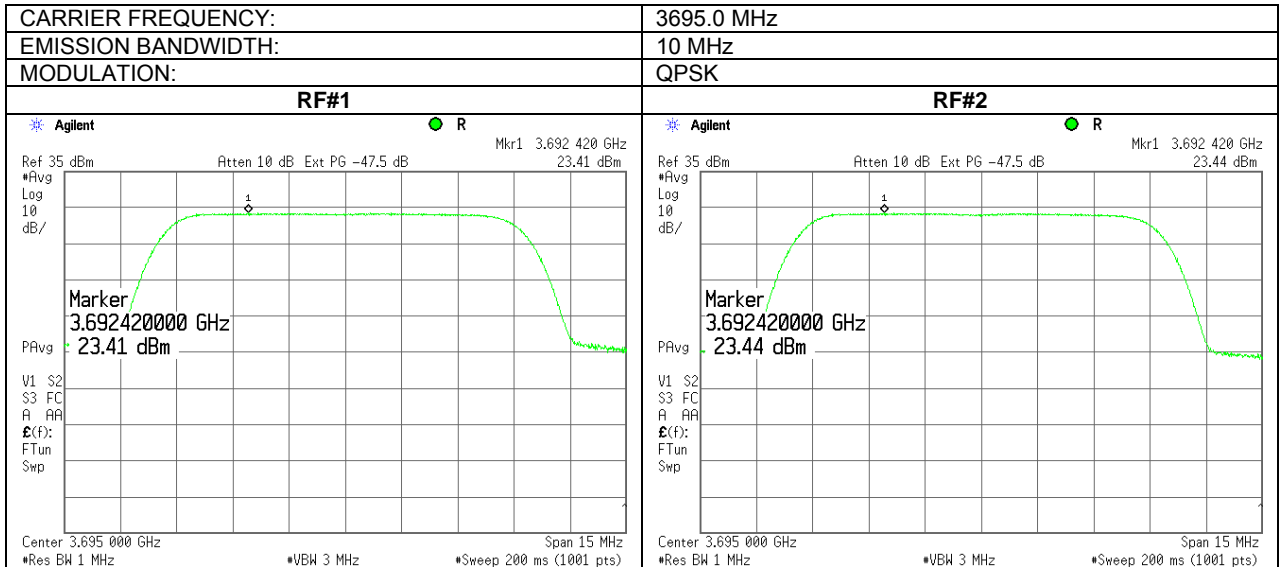


Plot 7.1.20 Peak output power test results at mid frequency

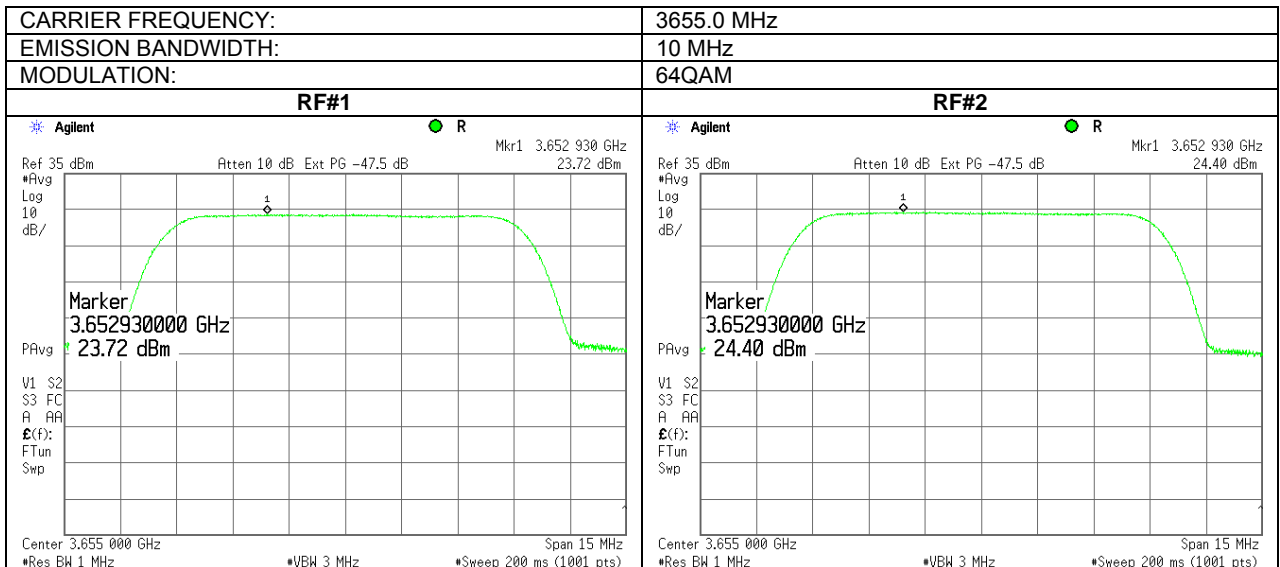


Test specification: Section 90.1321, Maximum conducted output power			
Test procedure: 47 CFR, Section 2.1046; TIA/EIA-603-C, Section 2.2.1			
Test mode: Compliance	Verdict: PASS		
Date: 3/27/2011			
Temperature: 22.4 °C	Air Pressure: 1022 hPa	Relative Humidity: 46 %	Power Supply: 48 VDC
Remarks:			

Plot 7.1.21 Peak output power test results at high frequency

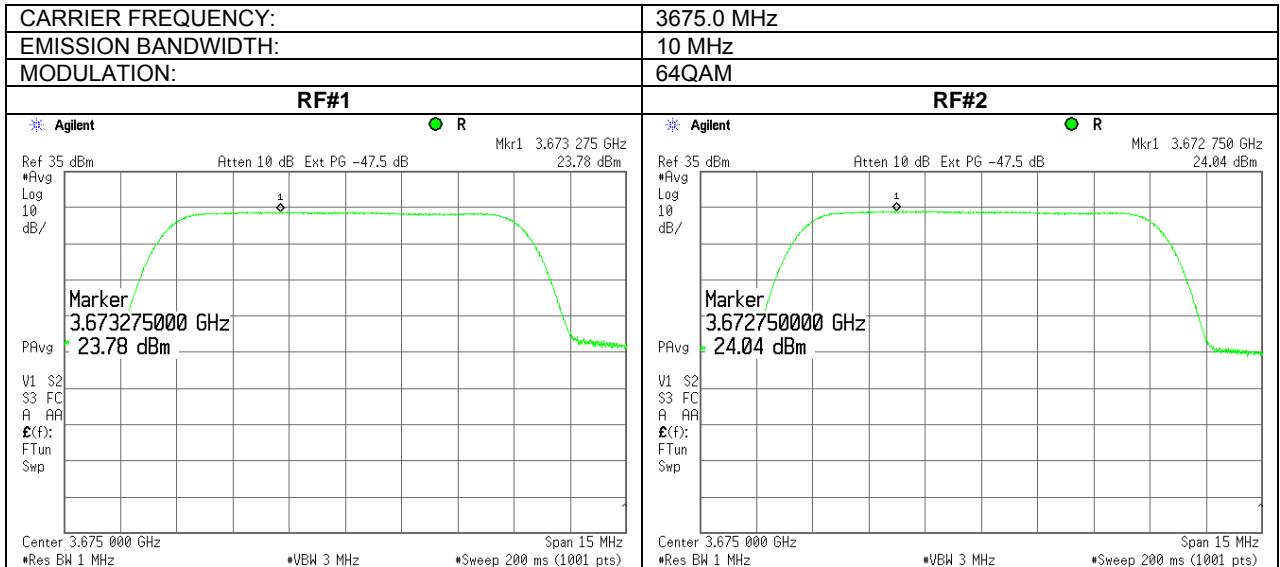


Plot 7.1.22 Peak output power test results at low frequency

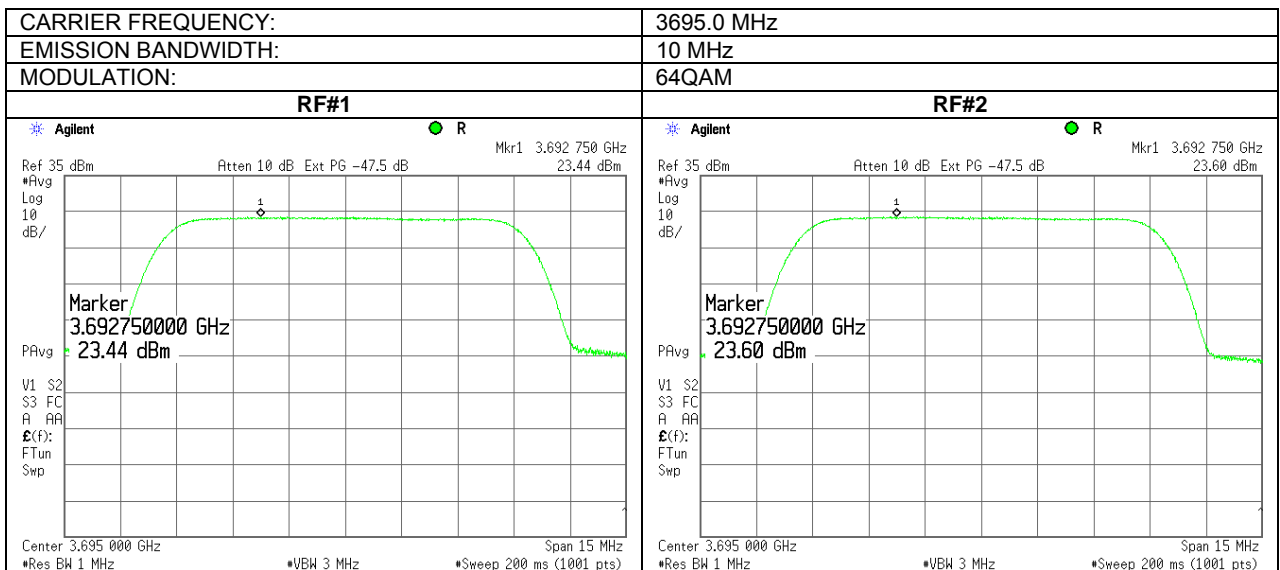


Test specification:	Section 90.1321, Maximum conducted output power		
Test procedure:	47 CFR, Section 2.1046; TIA/EIA-603-C, Section 2.2.1		
Test mode:	Compliance	Verdict: PASS	
Date:	3/27/2011		
Temperature: 22.4 °C	Air Pressure: 1022 hPa	Relative Humidity: 46 %	Power Supply: 48 VDC
Remarks:			

Plot 7.1.23 Peak output power test results at mid frequency



Plot 7.1.24 Peak output power test results at high frequency



Test specification:		Section 90.209, Occupied bandwidth	
Test procedure:		47 CFR, Section 2.1049	
Test mode:	Compliance	Verdict:	PASS
Date:	3/27/2011		
Temperature: 22.4 °C	Air Pressure: 1022 hPa	Relative Humidity: 46 %	Power Supply: 48 VDC
Remarks:			

7.2 Occupied bandwidth test

7.2.1 General

This test was performed to measure transmitter occupied bandwidth. Specification test limits are given in Table 7.2.1.

Table 7.2.1 Occupied bandwidth limits

Assigned frequency, MHz	Modulation envelope reference points*, dBc	Maximum allowed bandwidth, kHz
3650.0 – 3700.0	26	NA

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

7.2.2 Test procedure

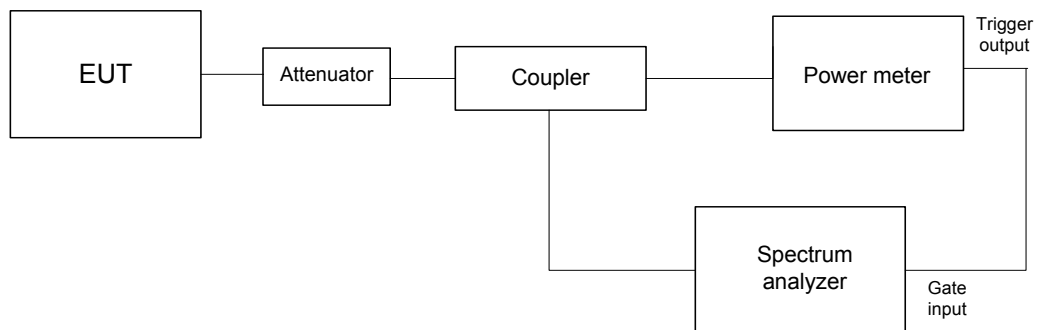
7.2.2.1 The EUT was set up as shown in Figure 7.2.1, energized and its proper operation was checked.

7.2.2.2 The EUT was set to transmit the unmodulated carrier and the reference peak power level was measured.

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

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

Figure 7.2.1 Occupied bandwidth test setup



Test specification: Section 90.209, Occupied bandwidth	
Test procedure: 47 CFR, Section 2.1049	
Test mode: Compliance	Verdict: PASS
Date: 3/27/2011	
Temperature: 22.4 °C	Air Pressure: 1022 hPa
Relative Humidity: 46 %	
Power Supply: 48 VDC	
Remarks:	

Table 7.2.2 Occupied bandwidth test results

DETECTOR USED: Average
 RESOLUTION BANDWIDTH: 0.5-2% of the Emission bandwidth
 VIDEO BANDWIDTH: 10 times RBW
 MODULATION ENVELOPE REFERENCE POINTS: 26 dB below total average power
 MODULATING SIGNAL: PRBS

Carrier frequency, MHz	Modulation	Occupied bandwidth, MHz	Emission bandwidth, MHz	Verdict
3651.75	QPSK	3.335	3.5	Pass
3675.00	QPSK	3.330	3.5	Pass
3698.25	QPSK	3.335	3.5	Pass
3651.75	64QAM	3.330	3.5	Pass
3675.00	64QAM	3.320	3.5	Pass
3698.25	64QAM	3.310	3.5	Pass
3652.50	QPSK	4.662	5.0	Pass
3675.00	QPSK	4.634	5.0	Pass
3697.50	QPSK	4.641	5.0	Pass
3652.50	64QAM	4.648	5.0	Pass
3675.00	64QAM	4.655	5.0	Pass
3697.50	64QAM	4.655	5.0	Pass
3653.50	QPSK	6.620	7.0	Pass
3675.00	QPSK	6.610	7.0	Pass
3696.50	QPSK	6.610	7.0	Pass
3653.50	64QAM	6.610	7.0	Pass
3675.00	64QAM	6.610	7.0	Pass
3696.50	64QAM	6.610	7.0	Pass
3655.00	QPSK	9.264	10.0	Pass
3675.00	QPSK	9.240	10.0	Pass
3695.00	QPSK	9.240	10.0	Pass
3655.00	64QAM	9.276	10.0	Pass
3675.00	64QAM	9.276	10.0	Pass
3695.00	64QAM	9.300	10.0	Pass

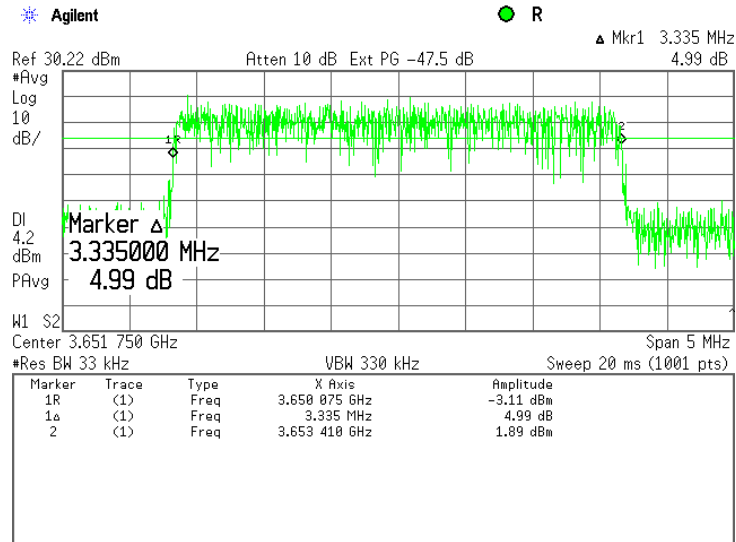
Reference numbers of test equipment used

HL 1906	HL 2013	HL 2952	HL 3301	HL 3302	HL 3472	HL 3474	HL 3782
HL 3818							

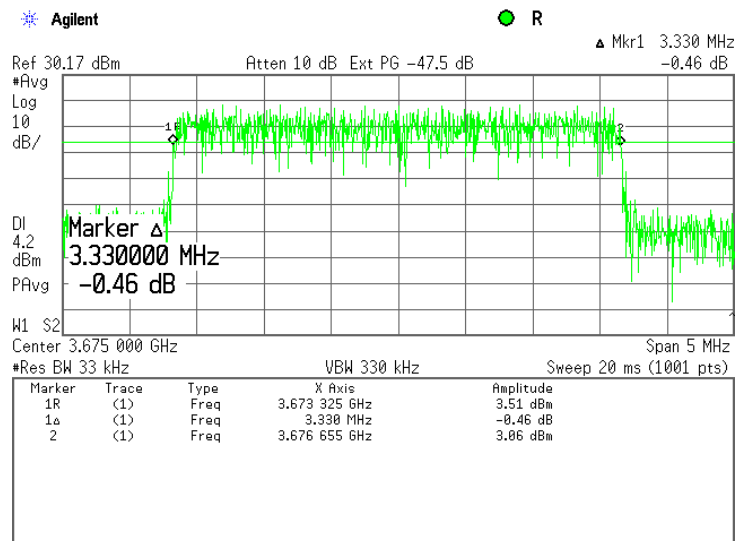
Full description is given in Appendix A.

Test specification:	Section 90.209, Occupied bandwidth		
Test procedure:	47 CFR, Section 2.1049		
Test mode:	Compliance	Verdict:	PASS
Date:	3/27/2011		
Temperature: 22.4 °C	Air Pressure: 1022 hPa	Relative Humidity: 46 %	Power Supply: 48 VDC
Remarks:			

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

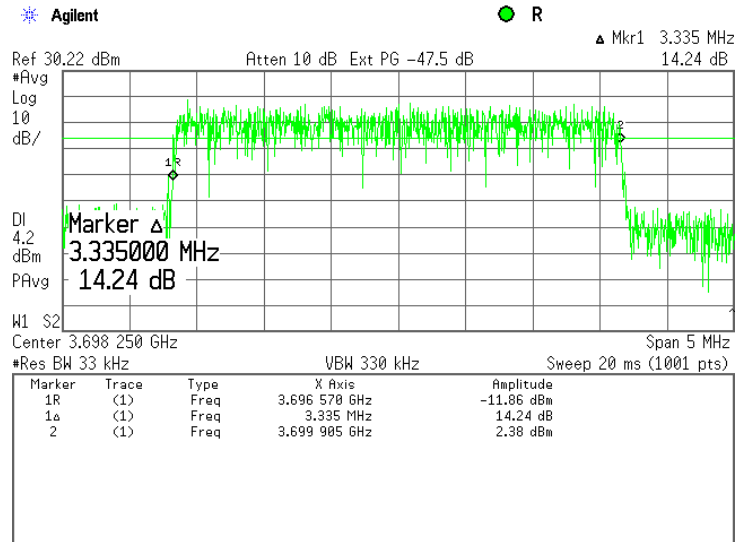


Plot 7.2.2 Occupied bandwidth test result at mid frequency, 3.5 MHz EBW, QPSK

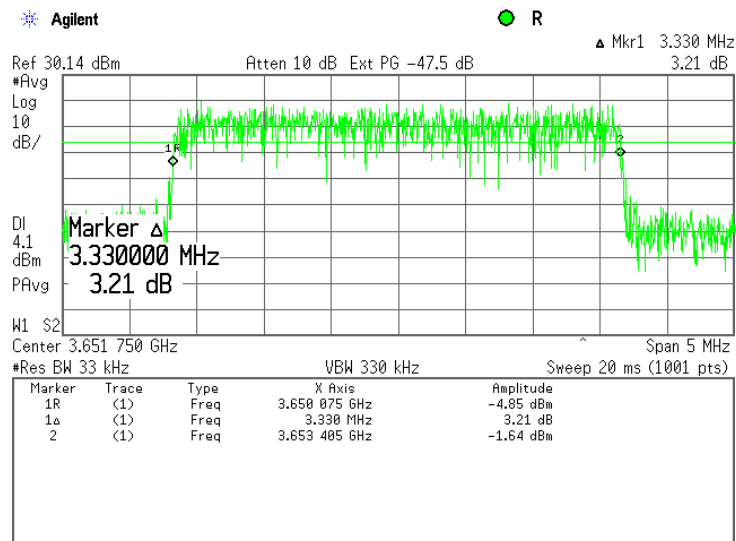


Test specification:	Section 90.209, Occupied bandwidth		
Test procedure:	47 CFR, Section 2.1049		
Test mode:	Compliance	Verdict:	PASS
Date:	3/27/2011		
Temperature: 22.4 °C	Air Pressure: 1022 hPa	Relative Humidity: 46 %	Power Supply: 48 VDC
Remarks:			

Plot 7.2.3 Occupied bandwidth test result at high frequency, 3.5 MHz EBW, QPSK

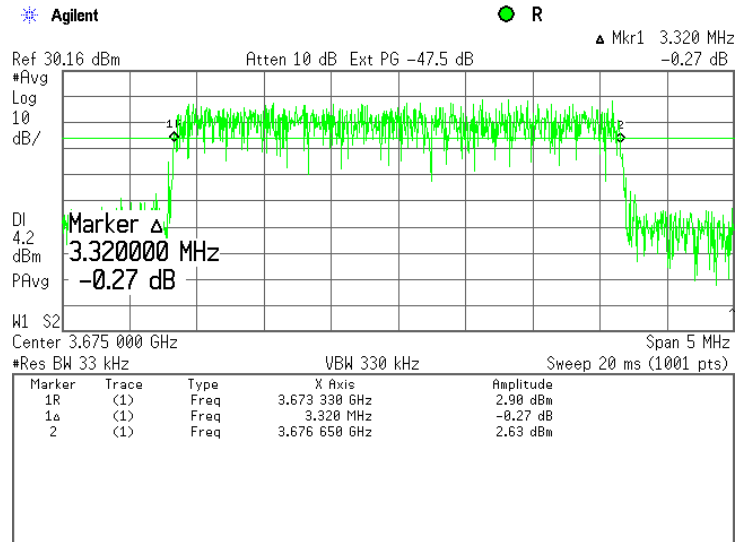


Plot 7.2.4 Occupied bandwidth test result at low frequency, 3.5 MHz EBW, 64QAM

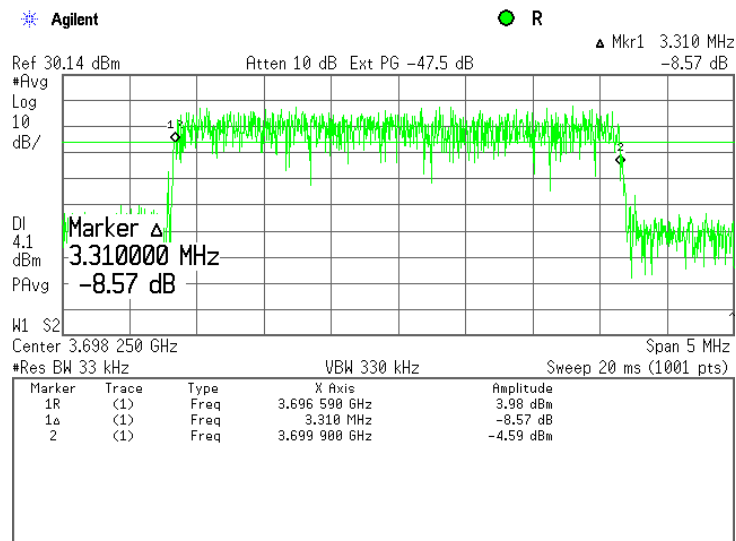


Test specification:	Section 90.209, Occupied bandwidth		
Test procedure:	47 CFR, Section 2.1049		
Test mode:	Compliance	Verdict:	PASS
Date:	3/27/2011		
Temperature: 22.4 °C	Air Pressure: 1022 hPa	Relative Humidity: 46 %	Power Supply: 48 VDC
Remarks:			

Plot 7.2.5 Occupied bandwidth test result at mid frequency, 3.5 MHz EBW, 64QAM

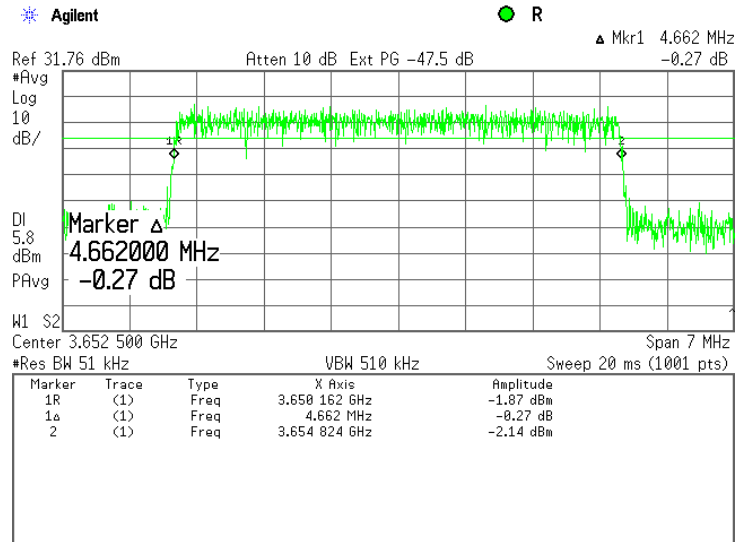


Plot 7.2.6 Occupied bandwidth test result at high frequency, 3.5 MHz EBW, 64QAM

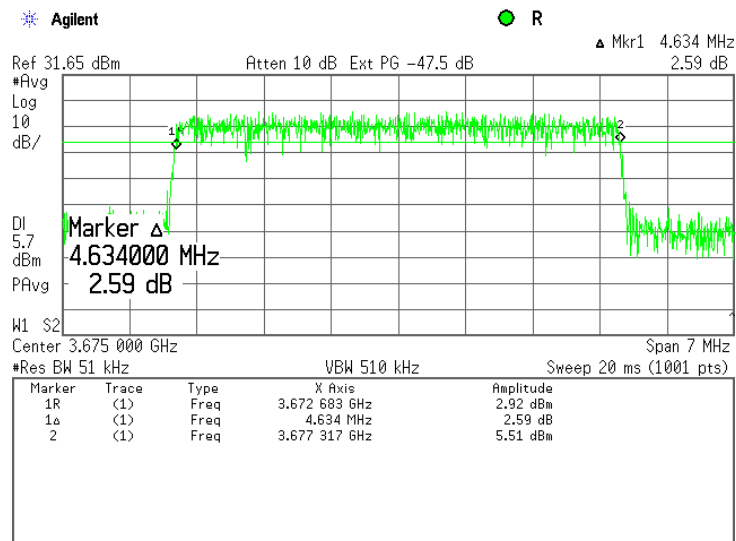


Test specification: Section 90.209, Occupied bandwidth			
Test procedure: 47 CFR, Section 2.1049			
Test mode: Compliance	Verdict: PASS		
Date: 3/27/2011			
Temperature: 22.4 °C	Air Pressure: 1022 hPa	Relative Humidity: 46 %	Power Supply: 48 VDC
Remarks:			

Plot 7.2.7 Occupied bandwidth test result at low frequency, 5 MHz EBW, QPSK

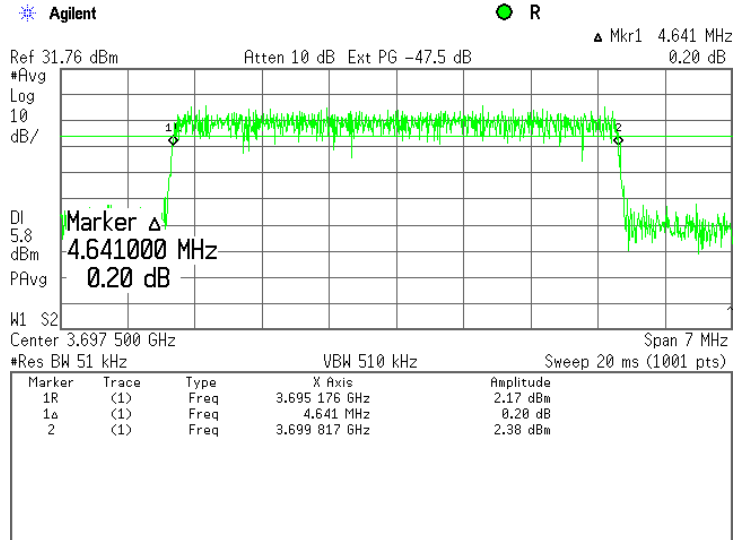


Plot 7.2.8 Occupied bandwidth test result at mid frequency, 5 MHz EBW, QPSK

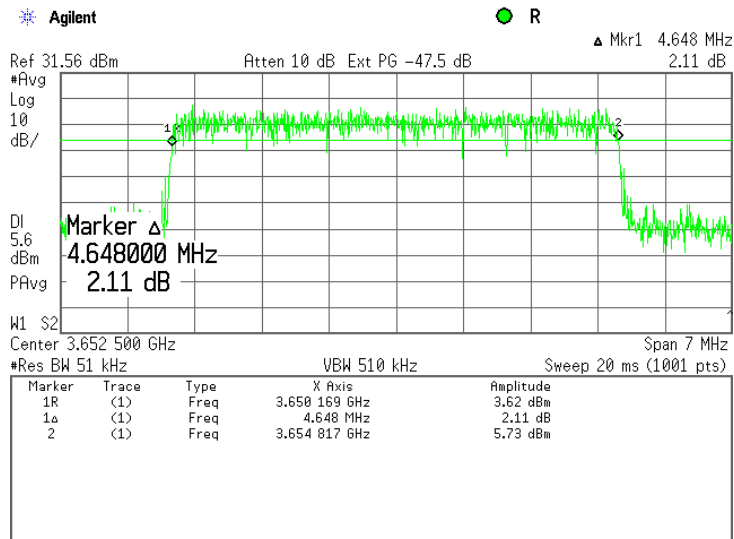


Test specification:	Section 90.209, Occupied bandwidth		
Test procedure:	47 CFR, Section 2.1049		
Test mode:	Compliance	Verdict:	PASS
Date:	3/27/2011		
Temperature: 22.4 °C	Air Pressure: 1022 hPa	Relative Humidity: 46 %	Power Supply: 48 VDC
Remarks:			

Plot 7.2.9 Occupied bandwidth test result at high frequency, 5 MHz EBW, QPSK

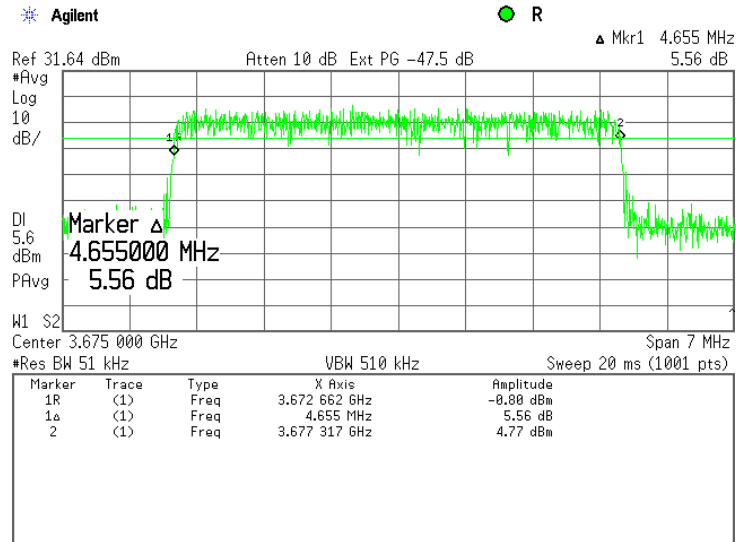


Plot 7.2.10 Occupied bandwidth test result at low frequency, 5 MHz EBW, 64QAM

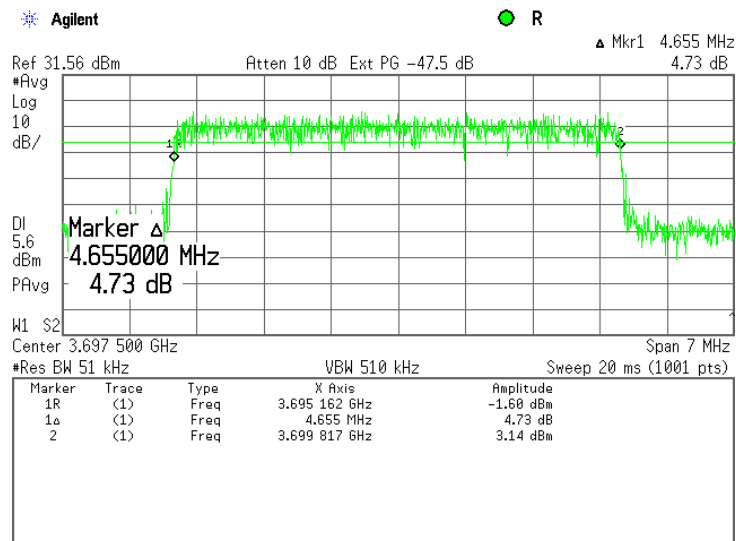


Test specification: Section 90.209, Occupied bandwidth			
Test procedure: 47 CFR, Section 2.1049			
Test mode: Compliance	Verdict: PASS		
Date: 3/27/2011			
Temperature: 22.4 °C	Air Pressure: 1022 hPa	Relative Humidity: 46 %	Power Supply: 48 VDC
Remarks:			

Plot 7.2.11 Occupied bandwidth test result at mid frequency, 5 MHz EBW, 64QAM

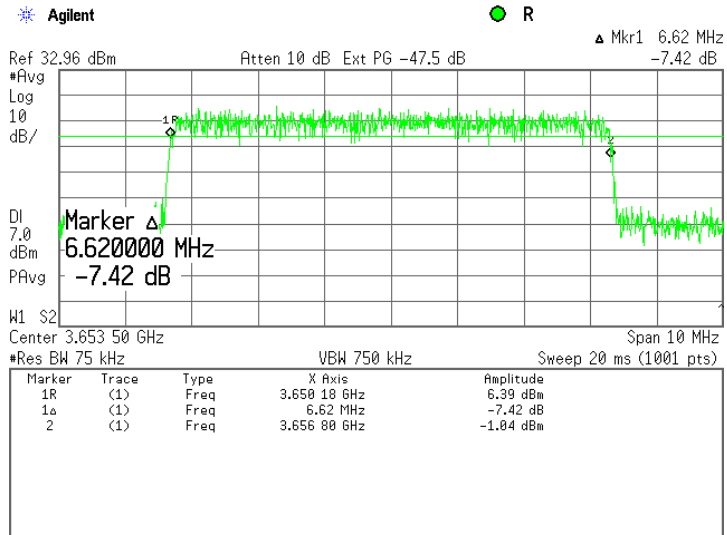


Plot 7.2.12 Occupied bandwidth test result at high frequency, 5 MHz EBW, 64QAM

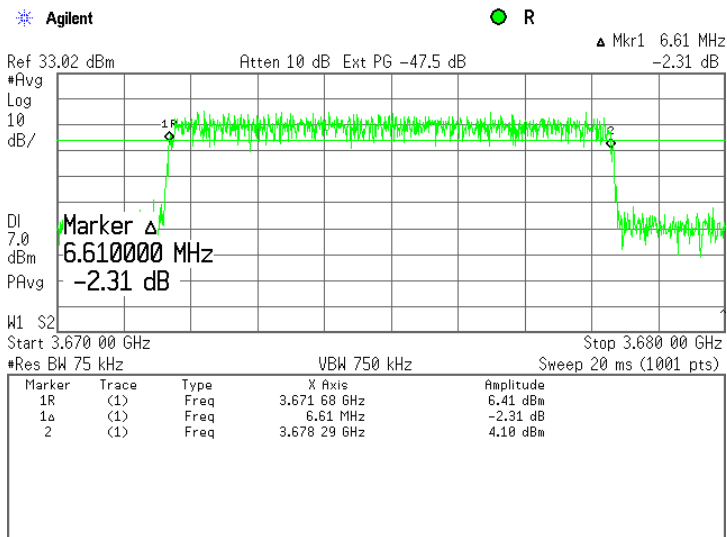


Test specification: Section 90.209, Occupied bandwidth			
Test procedure: 47 CFR, Section 2.1049			
Test mode: Compliance	Verdict: PASS		
Date: 3/27/2011			
Temperature: 22.4 °C	Air Pressure: 1022 hPa	Relative Humidity: 46 %	Power Supply: 48 VDC
Remarks:			

Plot 7.2.13 Occupied bandwidth test result at low frequency, 7 MHz EBW, QPSK

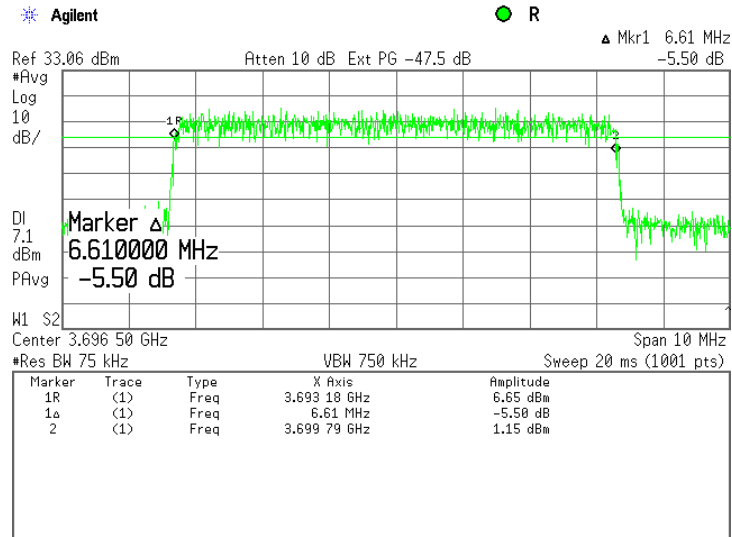


Plot 7.2.14 Occupied bandwidth test result at mid frequency, 7 MHz EBW, QPSK

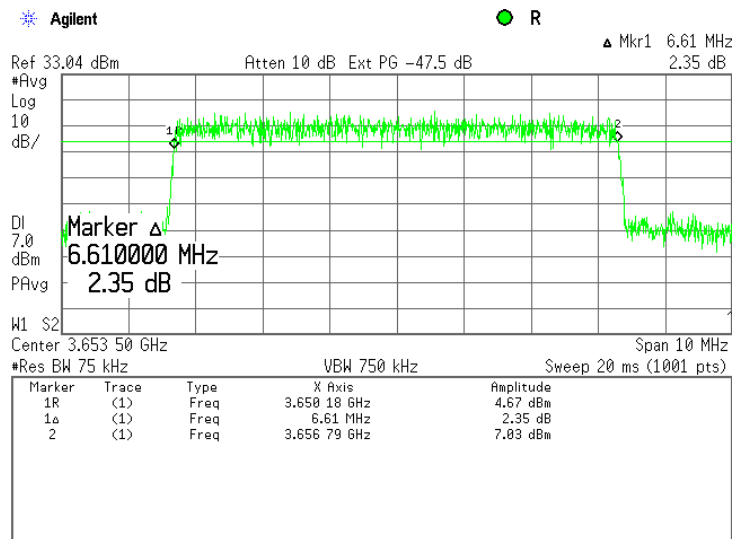


Test specification: Section 90.209, Occupied bandwidth			
Test procedure: 47 CFR, Section 2.1049			
Test mode: Compliance	Verdict: PASS		
Date: 3/27/2011			
Temperature: 22.4 °C	Air Pressure: 1022 hPa	Relative Humidity: 46 %	Power Supply: 48 VDC
Remarks:			

Plot 7.2.15 Occupied bandwidth test result at high frequency, 7 MHz EBW, QPSK

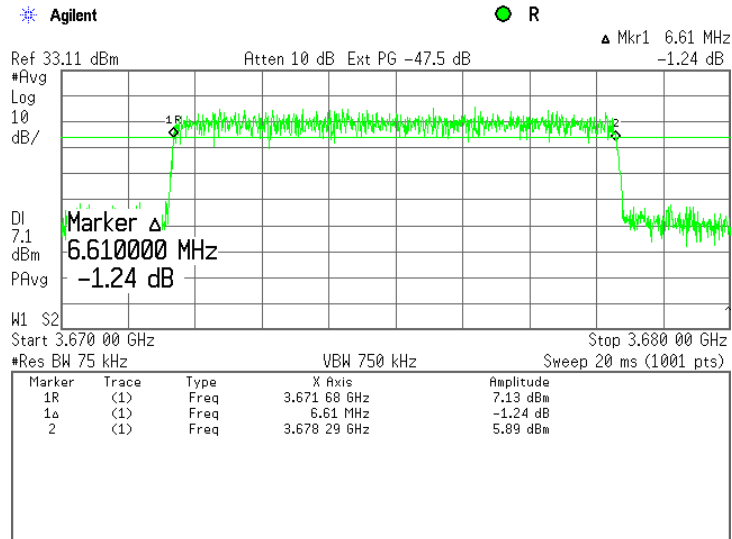


Plot 7.2.16 Occupied bandwidth test result at low frequency, 7 MHz EBW, 64QAM

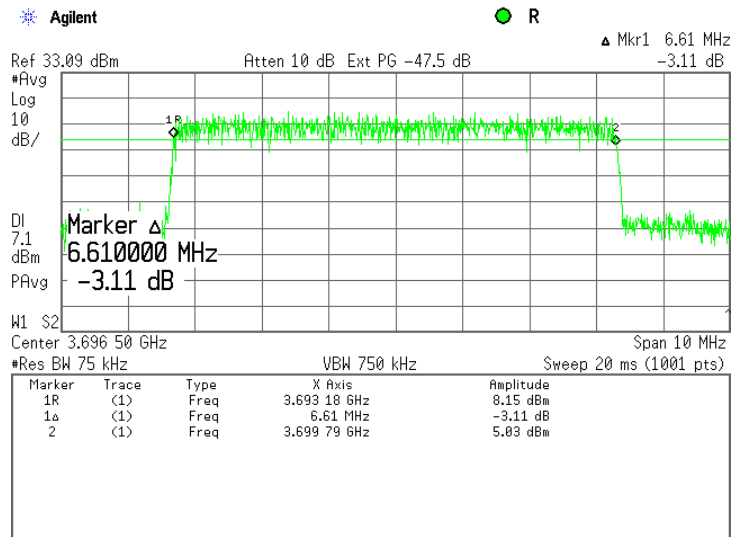


Test specification: Section 90.209, Occupied bandwidth			
Test procedure: 47 CFR, Section 2.1049			
Test mode: Compliance	Verdict: PASS		
Date: 3/27/2011			
Temperature: 22.4 °C	Air Pressure: 1022 hPa	Relative Humidity: 46 %	Power Supply: 48 VDC
Remarks:			

Plot 7.2.17 Occupied bandwidth test result at mid frequency, 7 MHz EBW, 64QAM

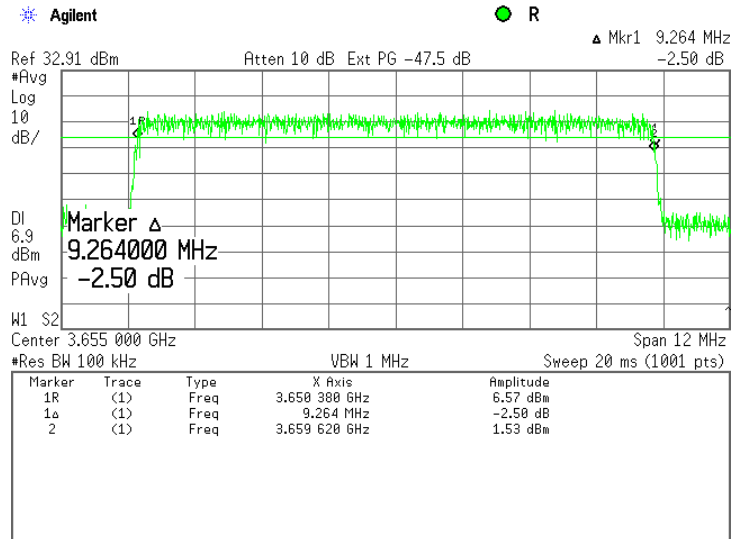


Plot 7.2.18 Occupied bandwidth test result at high frequency, 7 MHz EBW, 64QAM

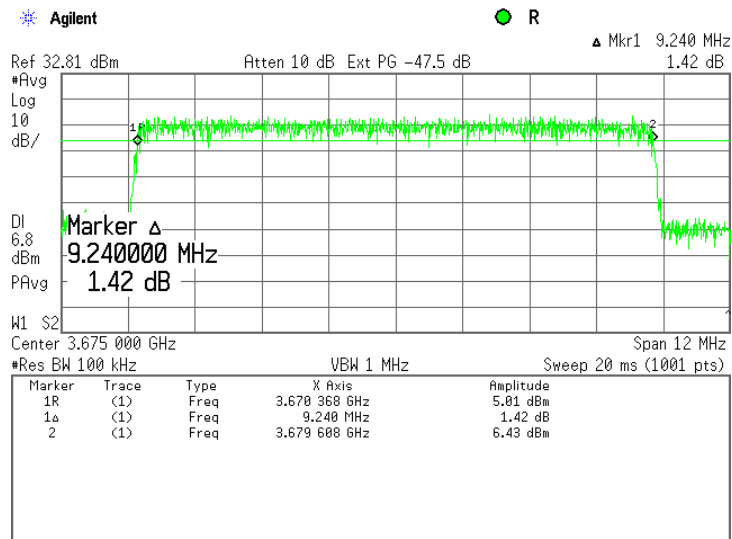


Test specification:	Section 90.209, Occupied bandwidth		
Test procedure:	47 CFR, Section 2.1049		
Test mode:	Compliance	Verdict:	PASS
Date:	3/27/2011		
Temperature: 22.4 °C	Air Pressure: 1022 hPa	Relative Humidity: 46 %	Power Supply: 48 VDC
Remarks:			

Plot 7.2.19 Occupied bandwidth test result at low frequency, 10 MHz EBW, QPSK

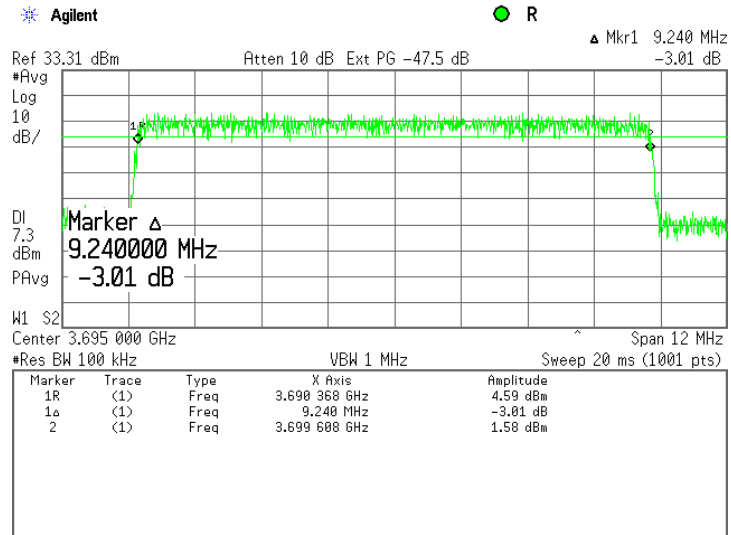


Plot 7.2.20 Occupied bandwidth test result at mid frequency, 10 MHz EBW, QPSK

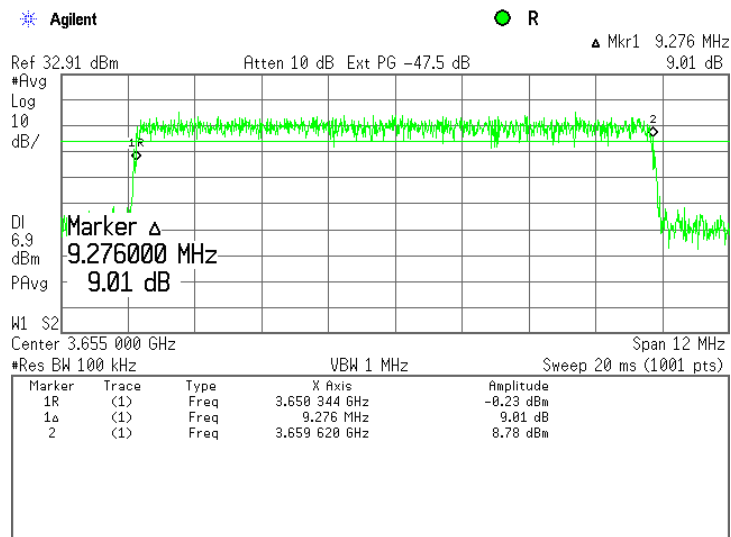


Test specification: Section 90.209, Occupied bandwidth			
Test procedure: 47 CFR, Section 2.1049			
Test mode: Compliance	Verdict: PASS		
Date: 3/27/2011			
Temperature: 22.4 °C	Air Pressure: 1022 hPa	Relative Humidity: 46 %	Power Supply: 48 VDC
Remarks:			

Plot 7.2.21 Occupied bandwidth test result at high frequency, 10 MHz EBW, QPSK

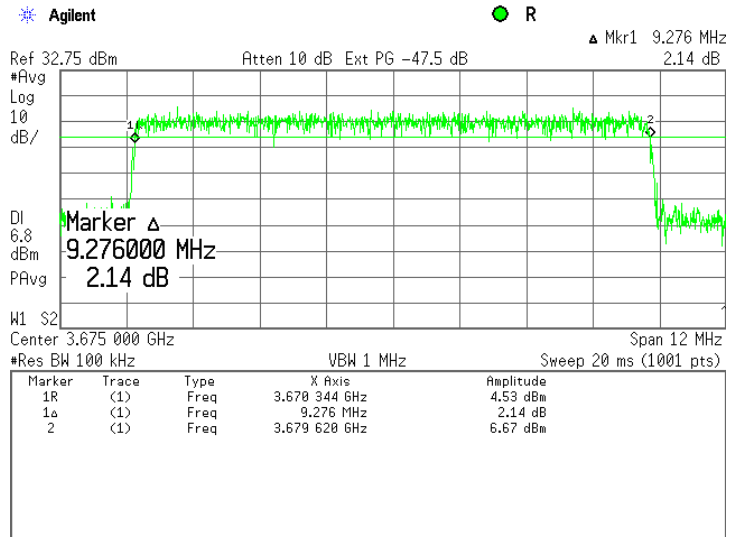


Plot 7.2.22 Occupied bandwidth test result at low frequency, 10 MHz EBW, 64QAM

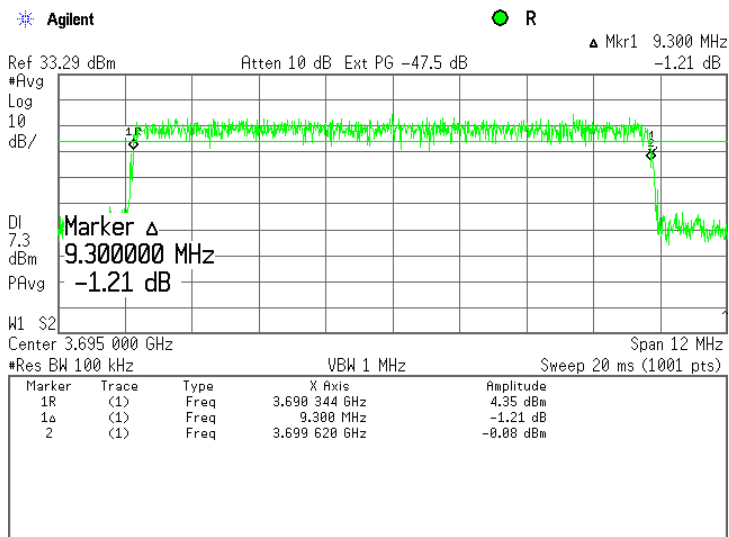


Test specification:	Section 90.209, Occupied bandwidth		
Test procedure:	47 CFR, Section 2.1049		
Test mode:	Compliance	Verdict:	PASS
Date:	3/27/2011		
Temperature: 22.4 °C	Air Pressure: 1022 hPa	Relative Humidity: 46 %	Power Supply: 48 VDC
Remarks:			

Plot 7.2.23 Occupied bandwidth test result at mid frequency, 10 MHz EBW, 64QAM



Plot 7.2.24 Occupied bandwidth test result at high frequency, 10 MHz EBW, 64QAM



Test specification:		Section 90.210(b), Emission mask	
Test procedure:		47 CFR, Sections 2.1051, 2.1047 and 90.210; TIA/EIA-603-C, Section 2.2.13	
Test mode:	Compliance	Verdict:	PASS
Date:	3/27/2011		
Temperature: 22.4 °C	Air Pressure: 1022 hPa	Relative Humidity: 46 %	Power Supply: 48 VDC
Remarks:			

7.3 Emission mask test

7.3.1 General

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

Table 7.3.1 Emission mask limits

Frequency displacement from carrier	Attenuation below carrier, dBc
Emission mask B (Emission bandwidth 3.5 MHz)	
0 – 1.75 MHz	0
1.75 – 3.5 MHz	25
3.5 – 7.0 MHz	35
More than** 8.75 MHz	43 + 10 log(P)
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)

* - linearly increase with frequency

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

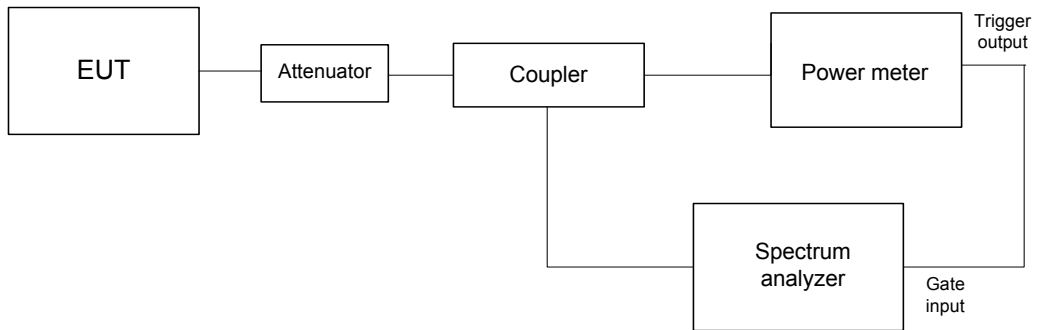
7.3.2 Test procedure

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



Test specification: Section 90.210(b), Emission mask			
Test procedure: 47 CFR, Sections 2.1051, 2.1047 and 90.210; TIA/EIA-603-C, Section 2.2.13			
Test mode: Compliance	Verdict: PASS		
Date: 3/27/2011			
Temperature: 22.4 °C	Air Pressure: 1022 hPa	Relative Humidity: 46 %	Power Supply: 48 VDC
Remarks:			

Figure 7.3.1 Emission mask test setup



Test specification: Section 90.210(b), Emission mask	
Test procedure: 47 CFR, Sections 2.1051, 2.1047 and 90.210; TIA/EIA-603-C, Section 2.2.13	
Test mode: Compliance	Verdict: PASS
Date: 3/27/2011	
Temperature: 22.4 °C	Air Pressure: 1022 hPa
Relative Humidity: 46 %	
Power Supply: 48 VDC	
Remarks:	

Table 7.3.2 Emission mask test results

Carrier frequency, MHz	Limit	Reference to Plot	Verdict
3.5 MHz EBW, 64QAM			
3651.75	Emission mask B	Plot 7.3.1	Pass
3675.00		Plot 7.3.2	
3698.25		Plot 7.3.3	
5 MHz EBW, 64QAM			
3652.50	Emission mask B	Plot 7.3.4	Pass
3675.00		Plot 7.3.5	
3697.50		Plot 7.3.6	
7 MHz EBW, 64QAM			
3653.50	Emission mask B	Plot 7.3.7	Pass
3675.00		Plot 7.3.8	
3696.50		Plot 7.3.9	
10 MHz EBW, 64QAM			
3655.00	Emission mask B	Plot 7.3.10	Pass
3675.00		Plot 7.3.11	
3695.00		Plot 7.3.12	

NOTE1: 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 [$10 \cdot \log(1 \text{ MHz} / 100 \text{ kHz}) = 10 \text{ dB}$];

NOTE2: Measurement was performed at 64QAM modulation as represent the worst case of power and power density.

Reference numbers of test equipment used

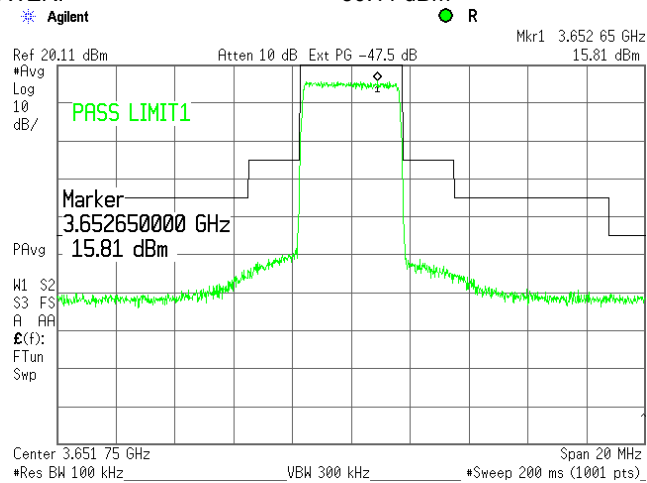
HL 1906	HL 2013	HL 2952	HL 3301	HL 3302	HL 3472	HL 3474	HL 3782
HL 3818							

Full description is given in Appendix A.

Test specification: Section 90.210(b), Emission mask			
Test procedure: 47 CFR, Sections 2.1051, 2.1047 and 90.210; TIA/EIA-603-C, Section 2.2.13			
Test mode: Compliance	Verdict: PASS		
Date: 3/27/2011			
Temperature: 22.4 °C	Air Pressure: 1022 hPa	Relative Humidity: 46 %	Power Supply: 48 VDC
Remarks:			

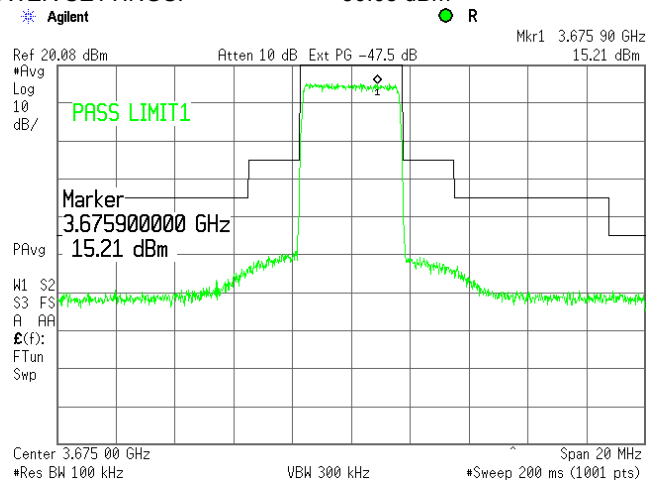
Plot 7.3.1 Emission mask test results at low carrier frequency

ASSIGNED FREQUENCY RANGE: 3650.0 - 3700.0 MHz
DETECTOR USED: Average
MODULATION: 64QAM
MODULATING SIGNAL: PRBS
CHANNEL BANDWIDTH: 3.5 MHz
TRANSMITTER OUTPUT POWER: 30.11 dBm



Plot 7.3.2 Emission mask test results at mid carrier frequency

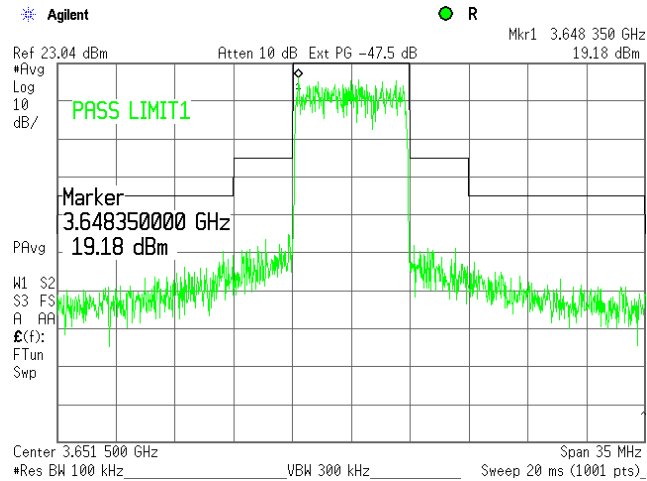
ASSIGNED FREQUENCY RANGE: 3650.0 - 3700.0 MHz
DETECTOR USED: Average
MODULATION: 64QAM
MODULATING SIGNAL: PRBS
CHANNEL BANDWIDTH: 3.5 MHz
TRANSMITTER OUTPUT POWER SETTINGS: 30.08 dBm



Test specification: Section 90.210(b), Emission mask			
Test procedure: 47 CFR, Sections 2.1051, 2.1047 and 90.210; TIA/EIA-603-C, Section 2.2.13			
Test mode: Compliance	Verdict: PASS		
Date: 3/27/2011			
Temperature: 22.4 °C	Air Pressure: 1022 hPa	Relative Humidity: 46 %	Power Supply: 48 VDC
Remarks:			

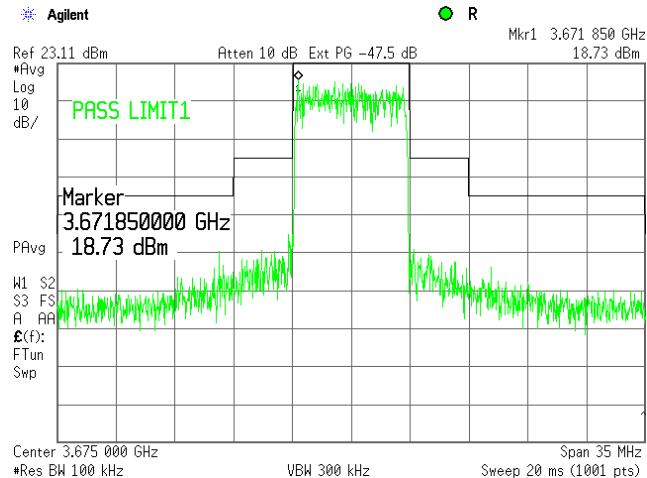
Plot 7.3.7 Emission mask test results at low carrier frequency

ASSIGNED FREQUENCY RANGE: 3650.0 - 3700.0 MHz
DETECTOR USED: Average
MODULATION: 64QAM
MODULATING SIGNAL: PRBS
CHANNEL BANDWIDTH: 7 MHz
TRANSMITTER OUTPUT POWER: 33.04 dBm



Plot 7.3.8 Emission mask test results at mid carrier frequency

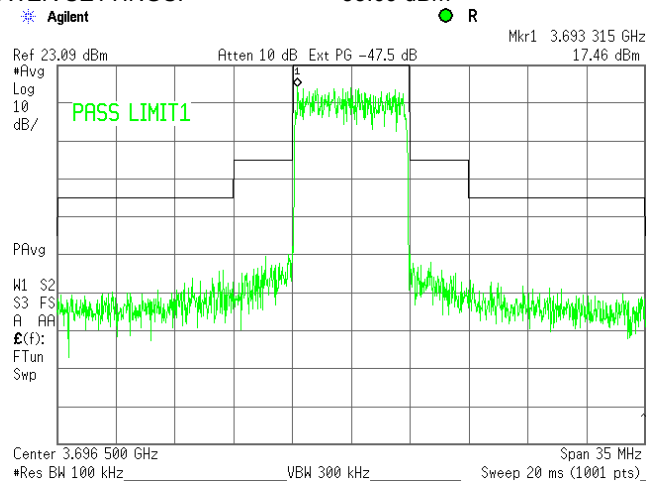
ASSIGNED FREQUENCY RANGE: 3650.0 - 3700.0 MHz
DETECTOR USED: Average
MODULATION: 64QAM
MODULATING SIGNAL: PRBS
CHANNEL BANDWIDTH: 7 MHz
TRANSMITTER OUTPUT POWER SETTINGS: 33.11dBm



Test specification: Section 90.210(b), Emission mask			
Test procedure: 47 CFR, Sections 2.1051, 2.1047 and 90.210; TIA/EIA-603-C, Section 2.2.13			
Test mode: Compliance	Verdict: PASS		
Date: 3/27/2011			
Temperature: 22.4 °C	Air Pressure: 1022 hPa	Relative Humidity: 46 %	Power Supply: 48 VDC
Remarks:			

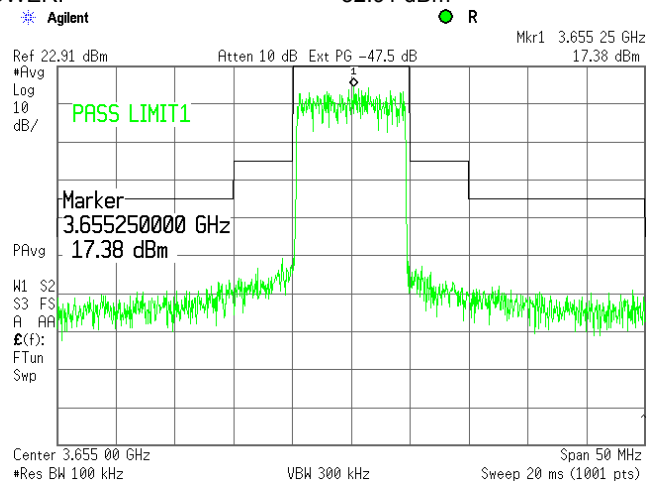
Plot 7.3.9 Emission mask test results at high carrier frequency

ASSIGNED FREQUENCY RANGE: 3650.0 - 3700.0 MHz
 DETECTOR USED: Average
 MODULATION: 64QAM
 MODULATING SIGNAL: PRBS
 CHANNEL BANDWIDTH: 7 MHz
 TRANSMITTER OUTPUT POWER SETTINGS: 33.09 dBm



Plot 7.3.10 Emission mask test results at low carrier frequency

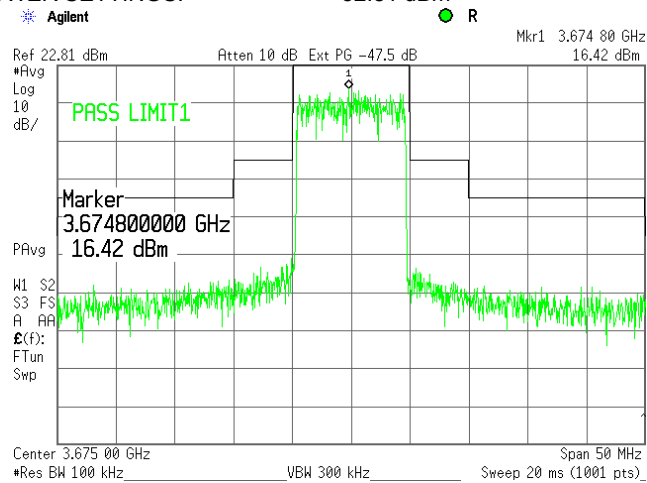
ASSIGNED FREQUENCY RANGE: 3650.0 - 3700.0 MHz
 DETECTOR USED: Average
 MODULATION: 64QAM
 MODULATING SIGNAL: PRBS
 CHANNEL BANDWIDTH: 10 MHz
 TRANSMITTER OUTPUT POWER: 32.91 dBm



Test specification: Section 90.210(b), Emission mask			
Test procedure: 47 CFR, Sections 2.1051, 2.1047 and 90.210; TIA/EIA-603-C, Section 2.2.13			
Test mode: Compliance	Verdict: PASS		
Date: 3/27/2011			
Temperature: 22.4 °C	Air Pressure: 1022 hPa	Relative Humidity: 46 %	Power Supply: 48 VDC
Remarks:			

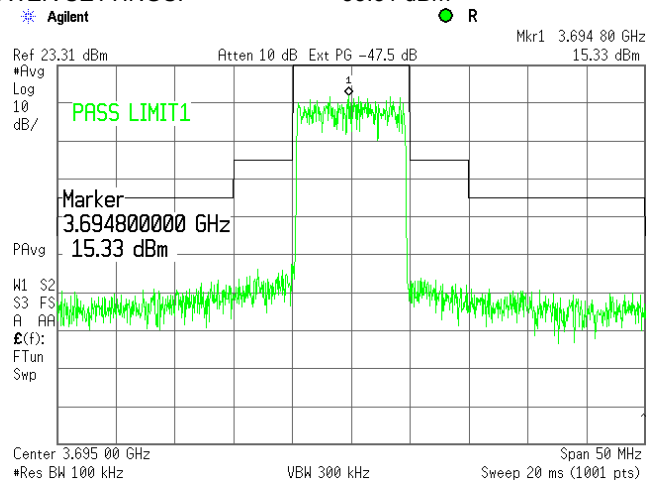
Plot 7.3.11 Emission mask test results at mid carrier frequency

ASSIGNED FREQUENCY RANGE: 3650.0 - 3700.0 MHz
DETECTOR USED: Average
MODULATION: 64QAM
MODULATING SIGNAL: PRBS
CHANNEL BANDWIDTH: 10 MHz
TRANSMITTER OUTPUT POWER SETTINGS: 32.81 dBm



Plot 7.3.12 Emission mask test results at high carrier frequency

ASSIGNED FREQUENCY RANGE: 3650.0 - 3700.0 MHz
DETECTOR USED: Average
MODULATION: 64QAM
MODULATING SIGNAL: PRBS
CHANNEL BANDWIDTH: 10 MHz
TRANSMITTER OUTPUT POWER SETTINGS: 33.31 dBm



Test specification:		Section 90.1323, Radiated spurious emissions	
Test procedure:		47 CFR, Sections 2.1053 and 90.1323; TIA/EIA-603-C, Section 2.2.12	
Test mode:	Compliance	Verdict:	PASS
Date:	3/29/2011		
Temperature: 22.4 °C	Air Pressure: 1021 hPa	Relative Humidity: 47 %	Power Supply: 48 VDC
Remarks:			

7.4 Radiated spurious emission measurements

7.4.1 General

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

Table 7.4.1 Radiated spurious emission test limits

Frequency, MHz	Attenuation below carrier dBc	ERP of spurious, dBm	Equivalent field strength limit @ 3m, dB(μ V/m) ^{***}
0.009 – 10 th harmonic*	43+10logP ^{**}	-13	84.4

* - Excluding the in band emission within \pm 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:
 $E = \sqrt{(30 \times P \times 1.64)} / r$, where P is ERP in Watts, 1.64 is numeric gain of ideal dipole and r is antenna to EUT distance in meters

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

7.4.2.1 The EUT was set up as shown in Figure 7.4.1, energized and the performance check was conducted.

7.4.2.2 The specified frequency range was investigated with antenna connected to spectrum analyzer. To find maximum radiation the turntable was rotated 360° and the measuring antenna was rotated around its vertical axis.

7.4.2.3 The worst test results (the lowest margins) were recorded in Table 7.4.2 and shown in the associated plots.

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

7.4.3.1 The EUT was set up as shown in Figure 7.4.2, energized and the performance check was conducted.

7.4.3.2 The specified frequency range was investigated with antenna connected to spectrum analyzer. To find maximum radiation the turntable was rotated 360° and the measuring antenna height was swept from 1 to 4 m in both, vertical and horizontal, polarizations.

7.4.3.3 The worst test results (the lowest margins) were recorded in Table 7.4.2 and shown in the associated plots.

Test specification: Section 90.1323, Radiated spurious emissions			
Test procedure: 47 CFR, Sections 2.1053 and 90.1323; TIA/EIA-603-C, Section 2.2.12			
Test mode: Compliance		Verdict: PASS	
Date: 3/29/2011			
Temperature: 22.4 °C	Air Pressure: 1021 hPa	Relative Humidity: 47 %	Power Supply: 48 VDC
Remarks:			

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

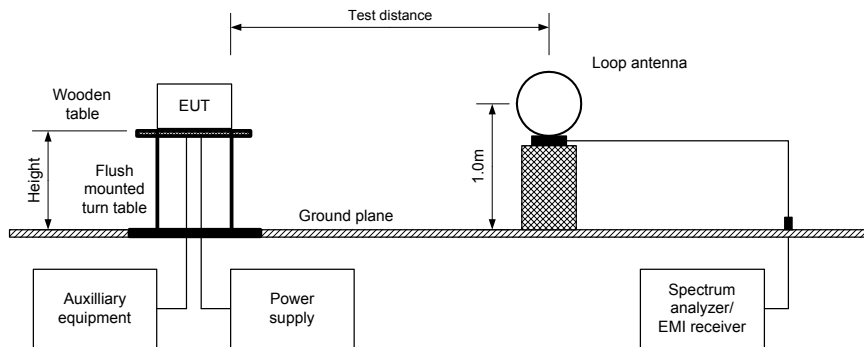
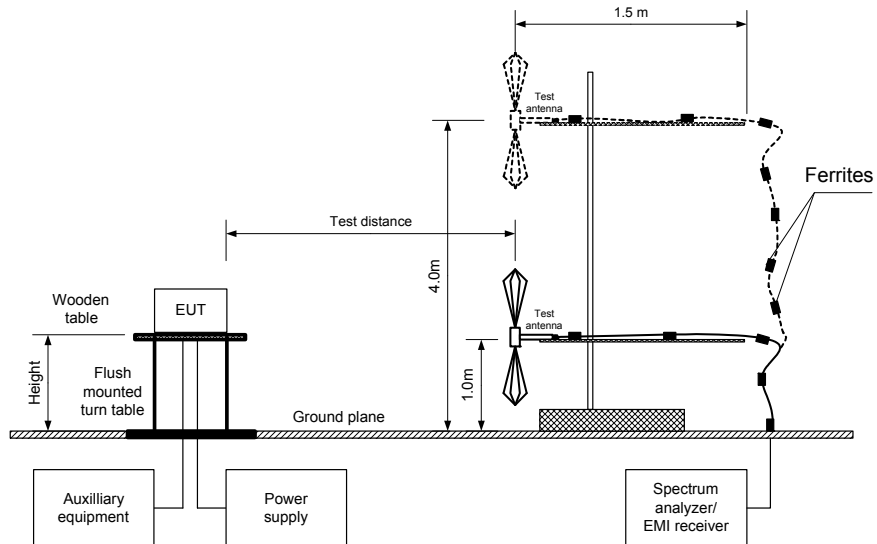


Figure 7.4.2 Setup for spurious emission field strength measurements above 30 MHz



Test specification:		Section 90.1323, Radiated spurious emissions	
Test procedure:		47 CFR, Sections 2.1053 and 90.1323; TIA/EIA-603-C, Section 2.2.12	
Test mode:	Compliance	Verdict:	PASS
Date:	3/29/2011		
Temperature: 22.4 °C	Air Pressure: 1021 hPa	Relative Humidity: 47 %	Power Supply: 48 VDC
Remarks:			

Table 7.4.2 Spurious emission field strength test results

ASSIGNED FREQUENCY RANGE: 3650.0 – 3700.0 MHz
TEST DISTANCE: 3 m
TEST SITE: Semi anechoic chamber
EUT HEIGHT: 0.8 m
INVESTIGATED FREQUENCY RANGE: 0.009 – 40000 MHz
DETECTOR USED: Peak
VIDEO BANDWIDTH: > Resolution bandwidth
TEST ANTENNA TYPE: Active loop (9 kHz – 30 MHz)
Biconilog (30 MHz – 1000 MHz)
Double ridged guide (above 1000 MHz)
EMISSION BANDWIDTH: 7 MHz (Highest power settings)
MODULATION: 64QAM
MODULATING SIGNAL: PRBS
BIT RATE: 26 Mbps
TRANSMITTER OUTPUT POWER SETTINGS: Maximum

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

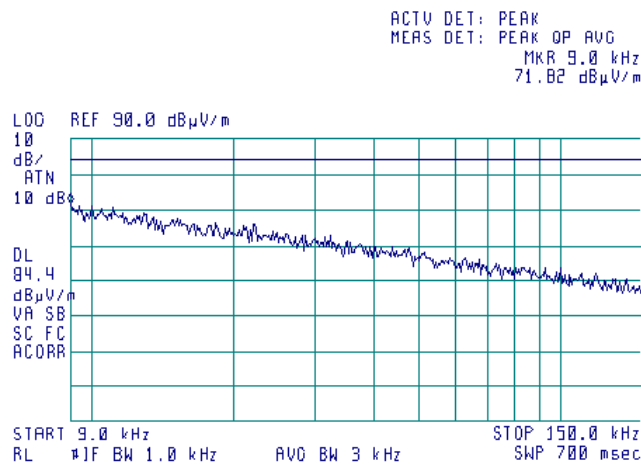
HL 0446	HL 0521	HL 0604	HL 0768	HL 0769	HL 1424	HL 1984	HL 2871
HL 3123	HL 3534	HL 3535	HL 3623	HL 3818			

Full description is given in Appendix A.

Test specification: Section 90.1323, Radiated spurious emissions			
Test procedure: 47 CFR, Sections 2.1053 and 90.1323; TIA/EIA-603-C, Section 2.2.12			
Test mode: Compliance	Verdict: PASS		
Date: 3/29/2011			
Temperature: 22.4 °C	Air Pressure: 1021 hPa	Relative Humidity: 47 %	Power Supply: 48 VDC
Remarks:			

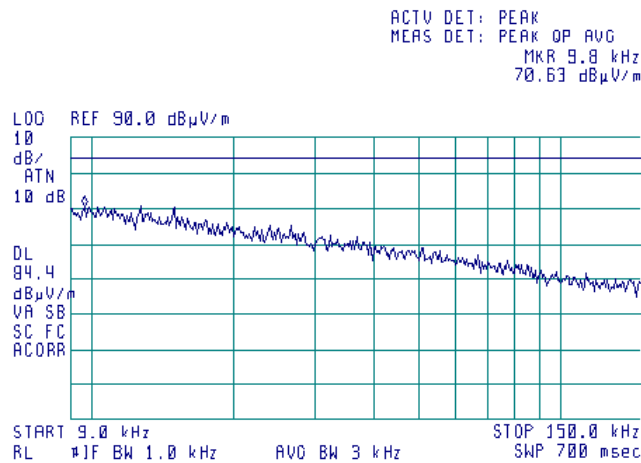
Plot 7.4.1 Radiated emission measurements in 9 - 150 kHz range

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



Plot 7.4.2 Radiated emission measurements in 9 - 150 kHz range

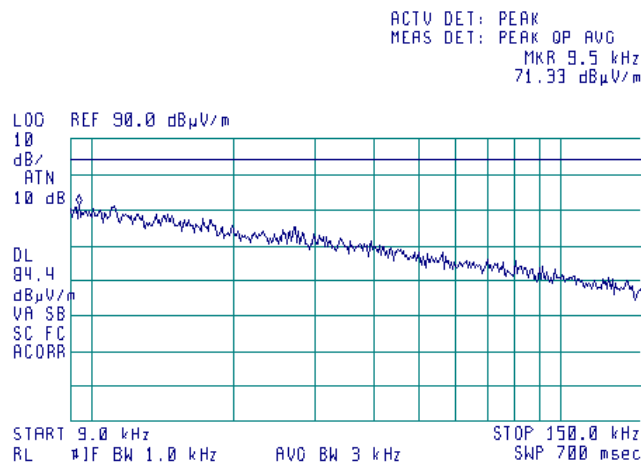
TEST SITE: Semi anechoic chamber
CARRIER FREQUENCY: Mid
ANTENNA POLARIZATION: Vertical and Horizontal
TEST DISTANCE: 3 m



Test specification: Section 90.1323, Radiated spurious emissions			
Test procedure: 47 CFR, Sections 2.1053 and 90.1323; TIA/EIA-603-C, Section 2.2.12			
Test mode: Compliance	Verdict: PASS		
Date: 3/29/2011			
Temperature: 22.4 °C	Air Pressure: 1021 hPa	Relative Humidity: 47 %	Power Supply: 48 VDC
Remarks:			

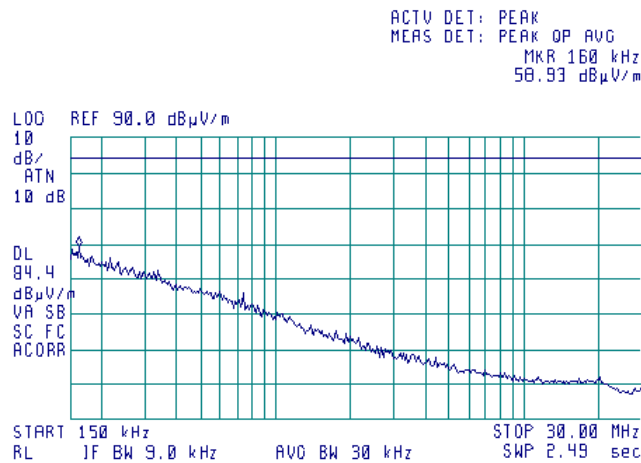
Plot 7.4.3 Radiated emission measurements in 9 - 150 kHz range

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



Plot 7.4.4 Radiated emission measurements in 0.15 - 30 MHz range

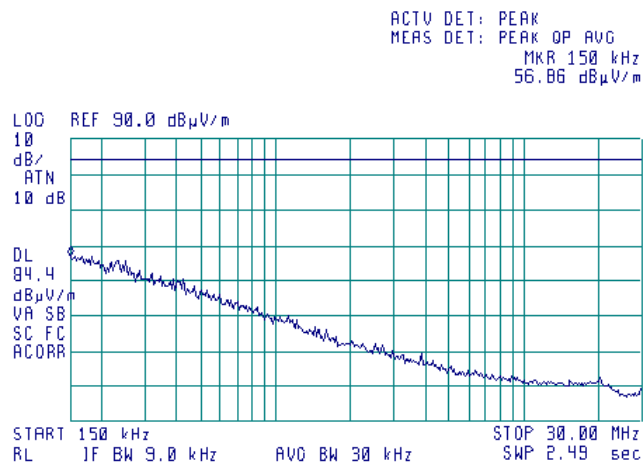
TEST SITE: Semi anechoic chamber
 CARRIER FREQUENCY: Low
 ANTENNA POLARIZATION: Vertical and Horizontal
 TEST DISTANCE: 3 m



Test specification: Section 90.1323, Radiated spurious emissions			
Test procedure: 47 CFR, Sections 2.1053 and 90.1323; TIA/EIA-603-C, Section 2.2.12			
Test mode: Compliance	Verdict: PASS		
Date: 3/29/2011			
Temperature: 22.4 °C	Air Pressure: 1021 hPa	Relative Humidity: 47 %	Power Supply: 48 VDC
Remarks:			

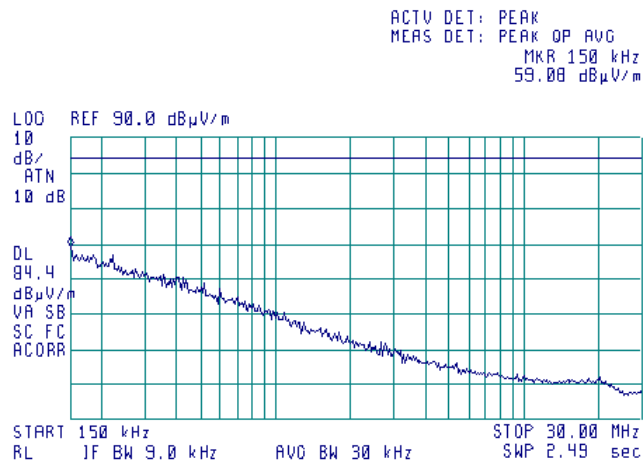
Plot 7.4.5 Radiated emission measurements in 0.15 - 30 MHz range

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



Plot 7.4.6 Radiated emission measurements in 0.15 - 30 MHz range

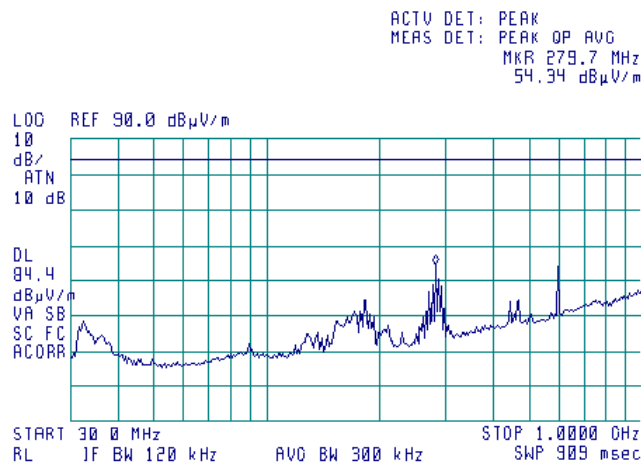
TEST SITE: Semi anechoic chamber
 CARRIER FREQUENCY: High
 ANTENNA POLARIZATION: Vertical and Horizontal
 TEST DISTANCE: 3 m



Test specification: Section 90.1323, Radiated spurious emissions			
Test procedure: 47 CFR, Sections 2.1053 and 90.1323; TIA/EIA-603-C, Section 2.2.12			
Test mode: Compliance	Verdict: PASS		
Date: 3/29/2011			
Temperature: 22.4 °C	Air Pressure: 1021 hPa	Relative Humidity: 47 %	Power Supply: 48 VDC
Remarks:			

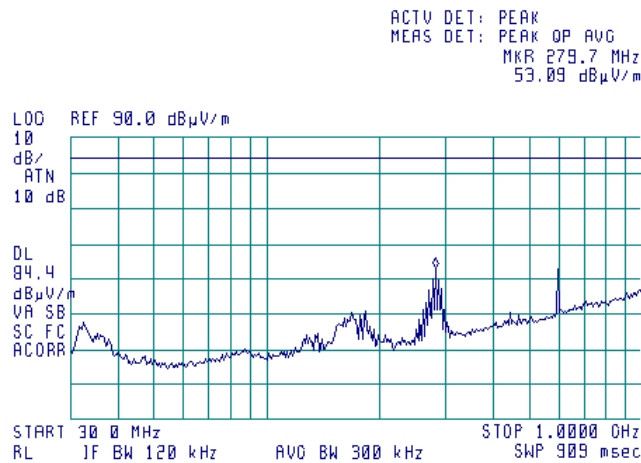
Plot 7.4.7 Radiated emission measurements in 30 - 1000 MHz range

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



Plot 7.4.8 Radiated emission measurements in 30 - 1000 MHz range

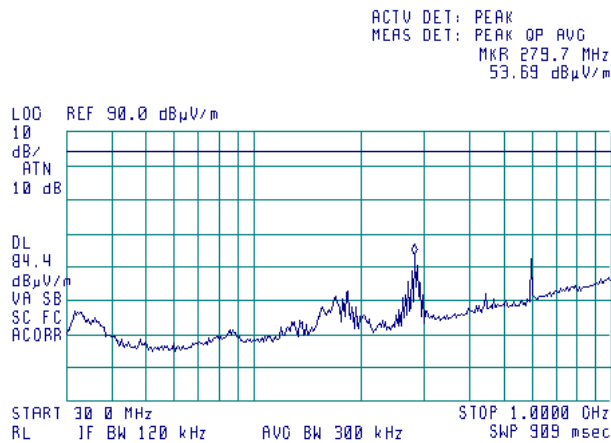
TEST SITE: Semi anechoic chamber
 CARRIER FREQUENCY: Mid
 ANTENNA POLARIZATION: Vertical and Horizontal
 TEST DISTANCE: 3 m



Test specification: Section 90.1323, Radiated spurious emissions			
Test procedure: 47 CFR, Sections 2.1053 and 90.1323; TIA/EIA-603-C, Section 2.2.12			
Test mode: Compliance	Verdict: PASS		
Date: 3/29/2011			
Temperature: 22.4 °C	Air Pressure: 1021 hPa	Relative Humidity: 47 %	Power Supply: 48 VDC
Remarks:			

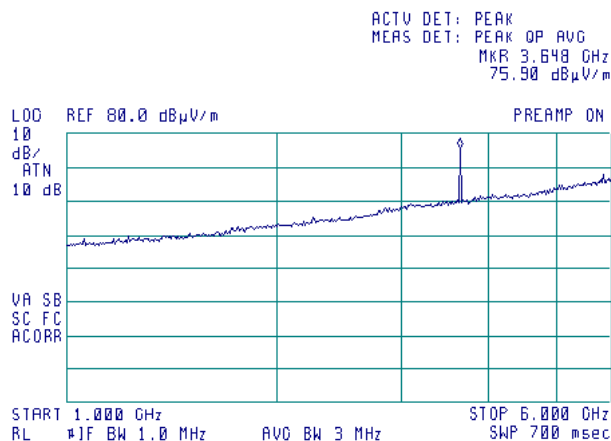
Plot 7.4.9 Radiated emission measurements in 30 - 1000 MHz range

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



Plot 7.4.10 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

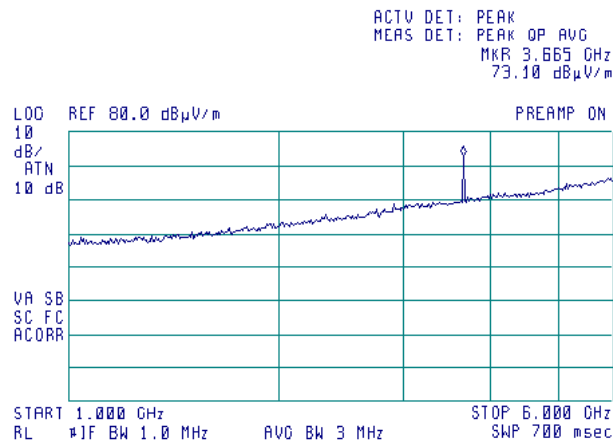


Notes: The 84.4 dBuV limit was applied;
 3648.0 MHz is a low carrier channel

Test specification:		Section 90.1323, Radiated spurious emissions	
Test procedure:		47 CFR, Sections 2.1053 and 90.1323; TIA/EIA-603-C, Section 2.2.12	
Test mode:	Compliance	Verdict:	PASS
Date:	3/29/2011		
Temperature: 22.4 °C	Air Pressure: 1021 hPa	Relative Humidity: 47 %	Power Supply: 48 VDC
Remarks:			

Plot 7.4.11 Radiated emission measurements in 1000 – 6500 MHz range

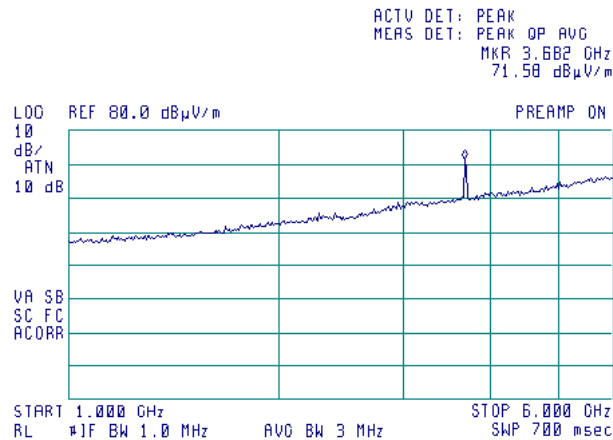
TEST SITE: Semi anechoic chamber
 CARRIER FREQUENCY: Mid
 ANTENNA POLARIZATION: Vertical and Horizontal
 TEST DISTANCE: 3 m



Notes: The 84.4 dBuV limit was applied; 3665.0 MHz is a mid carrier channel

Plot 7.4.12 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

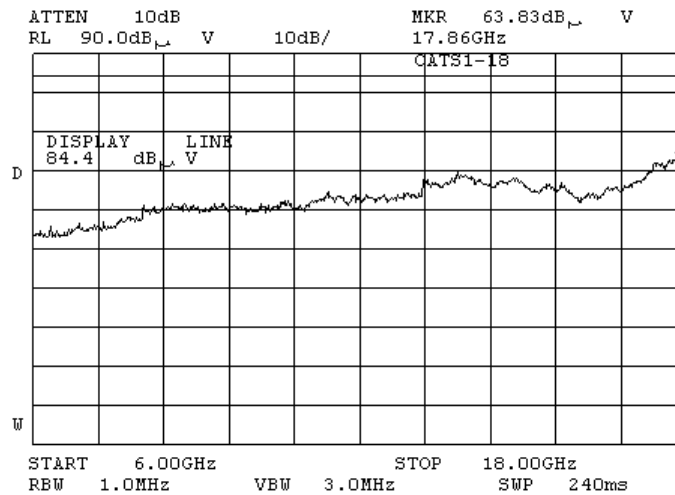


Notes: The 84.4 dBuV limit was applied; 3682.0 MHz is a high carrier channel

Test specification: Section 90.1323, Radiated spurious emissions			
Test procedure: 47 CFR, Sections 2.1053 and 90.1323; TIA/EIA-603-C, Section 2.2.12			
Test mode: Compliance	Verdict: PASS		
Date: 3/29/2011			
Temperature: 22.4 °C	Air Pressure: 1021 hPa	Relative Humidity: 47 %	Power Supply: 48 VDC
Remarks:			

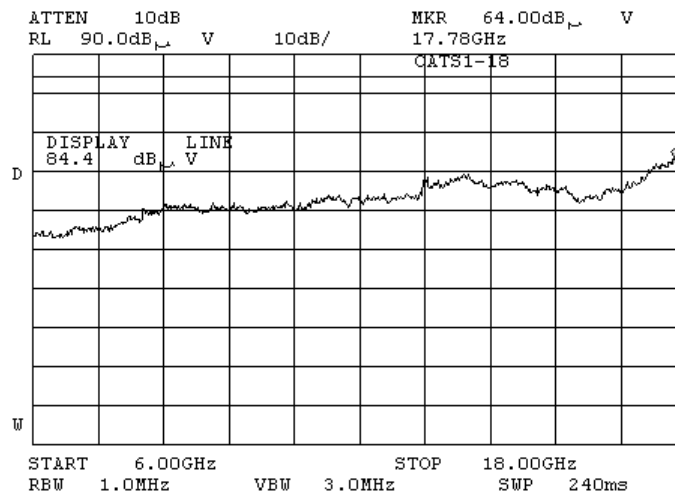
Plot 7.4.13 Radiated emission measurements in 6000 – 18000 MHz range

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



Plot 7.4.14 Radiated emission measurements in 6000 – 18000 MHz range

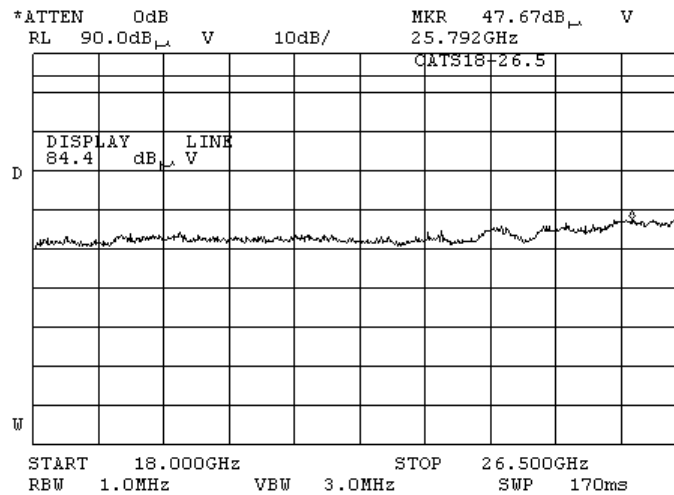
TEST SITE: Semi anechoic chamber
 CARRIER FREQUENCY: Mid
 ANTENNA POLARIZATION: Vertical and Horizontal
 TEST DISTANCE: 3 m



Test specification: Section 90.1323, Radiated spurious emissions			
Test procedure: 47 CFR, Sections 2.1053 and 90.1323; TIA/EIA-603-C, Section 2.2.12			
Test mode: Compliance	Verdict: PASS		
Date: 3/29/2011			
Temperature: 22.4 °C	Air Pressure: 1021 hPa	Relative Humidity: 47 %	Power Supply: 48 VDC
Remarks:			

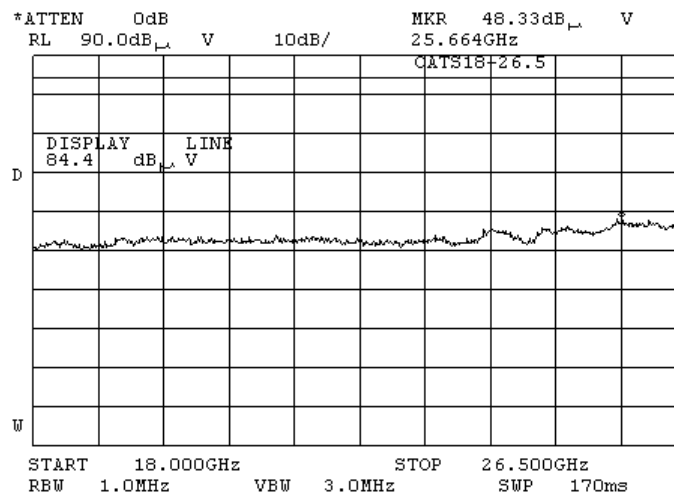
Plot 7.4.17 Radiated emission measurements in 18000 – 26500 MHz range

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



Plot 7.4.18 Radiated emission measurements in 18000 – 26500 MHz range

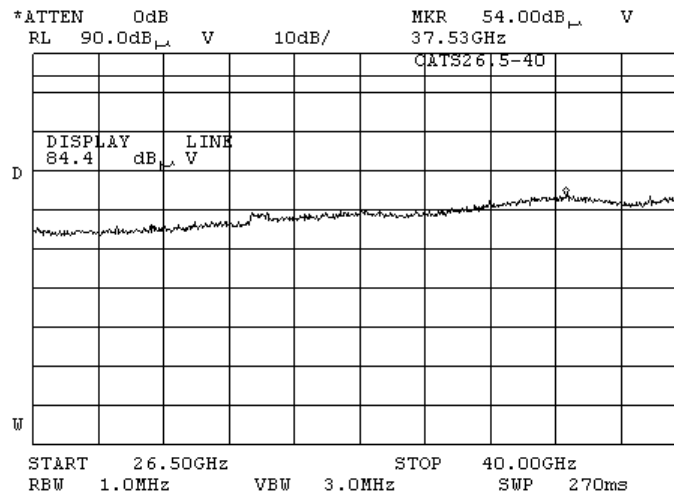
TEST SITE: Semi anechoic chamber
 CARRIER FREQUENCY: High
 ANTENNA POLARIZATION: Vertical and Horizontal
 TEST DISTANCE: 3 m



Test specification: Section 90.1323, Radiated spurious emissions			
Test procedure: 47 CFR, Sections 2.1053 and 90.1323; TIA/EIA-603-C, Section 2.2.12			
Test mode: Compliance	Verdict: PASS		
Date: 3/29/2011			
Temperature: 22.4 °C	Air Pressure: 1021 hPa	Relative Humidity: 47 %	Power Supply: 48 VDC
Remarks:			

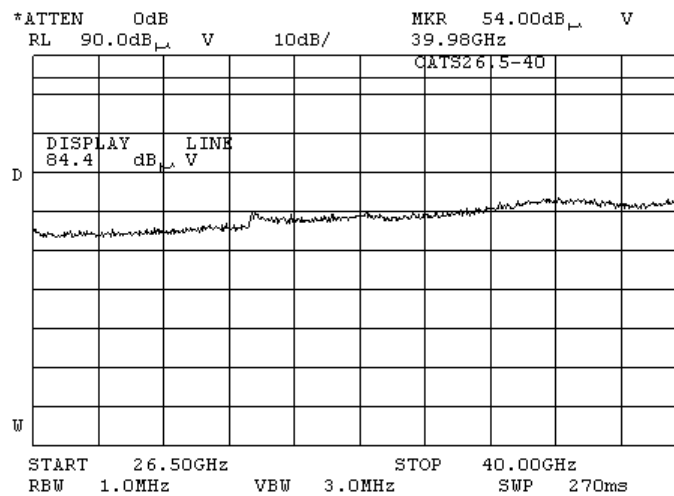
Plot 7.4.19 Radiated emission measurements in 26500 – 40000 MHz range

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



Plot 7.4.20 Radiated emission measurements in 26500 – 40000 MHz range

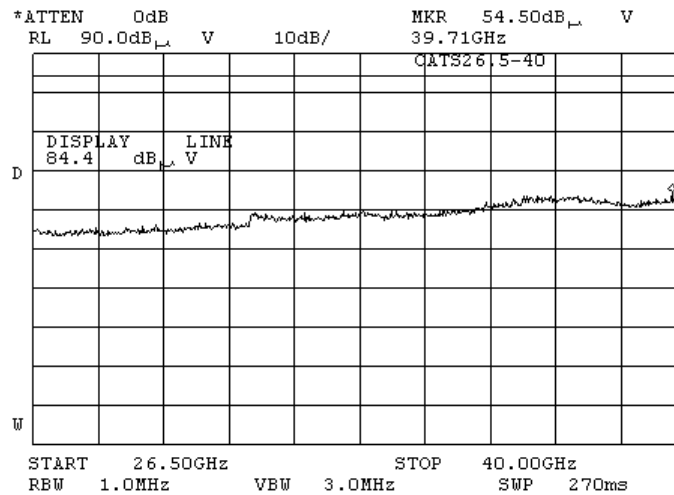
TEST SITE: Semi anechoic chamber
 CARRIER FREQUENCY: Mid
 ANTENNA POLARIZATION: Vertical and Horizontal
 TEST DISTANCE: 3 m



Test specification:		Section 90.1323, Radiated spurious emissions	
Test procedure:		47 CFR, Sections 2.1053 and 90.1323; TIA/EIA-603-C, Section 2.2.12	
Test mode:	Compliance	Verdict:	PASS
Date:	3/29/2011		
Temperature: 22.4 °C	Air Pressure: 1021 hPa	Relative Humidity: 47 %	Power Supply: 48 VDC
Remarks:			

Plot 7.4.21 Radiated emission measurements in 26500 – 40000 MHz range

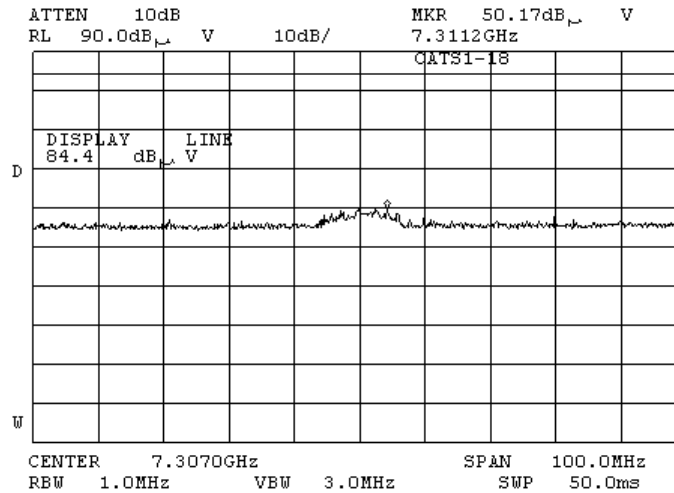
TEST SITE: Semi anechoic chamber
 CARRIER FREQUENCY: High
 ANTENNA POLARIZATION: Vertical and Horizontal
 TEST DISTANCE: 3 m



Test specification:	Section 90.1323, Radiated spurious emissions		
Test procedure:	47 CFR, Sections 2.1053 and 90.1323; TIA/EIA-603-C, Section 2.2.12		
Test mode:	Compliance	Verdict:	PASS
Date:	3/29/2011		
Temperature: 22.4 °C	Air Pressure: 1021 hPa	Relative Humidity: 47 %	Power Supply: 48 VDC
Remarks:			

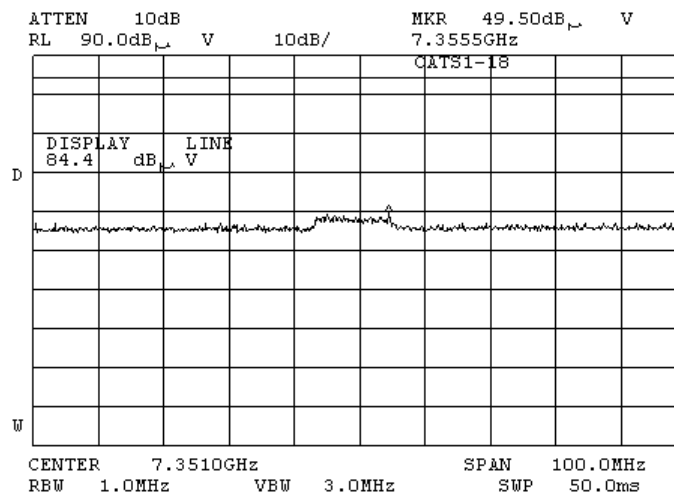
Plot 7.4.22 Radiated emission measurements at the 2nd harmonic

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



Plot 7.4.23 Radiated emission measurements at the 2nd harmonic

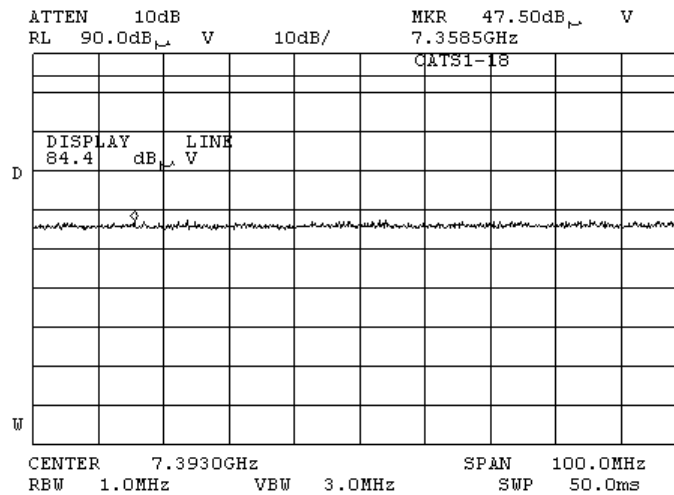
TEST SITE: Semi anechoic chamber
 CARRIER FREQUENCY: Mid
 ANTENNA POLARIZATION: Vertical and Horizontal
 TEST DISTANCE: 3 m



Test specification: Section 90.1323, Radiated spurious emissions			
Test procedure: 47 CFR, Sections 2.1053 and 90.1323; TIA/EIA-603-C, Section 2.2.12			
Test mode: Compliance	Verdict: PASS		
Date: 3/29/2011			
Temperature: 22.4 °C	Air Pressure: 1021 hPa	Relative Humidity: 47 %	Power Supply: 48 VDC
Remarks:			

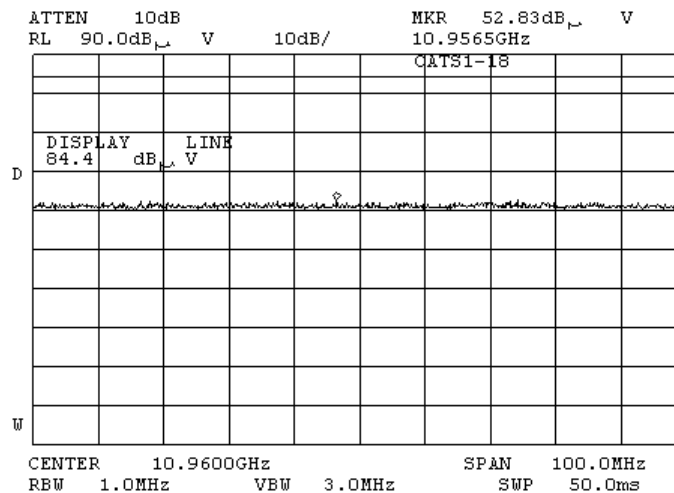
Plot 7.4.24 Radiated emission measurements at the 2nd harmonic

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



Plot 7.4.25 Radiated emission measurements at the 3rd harmonic

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



Test specification:		Section 90.1323, Conducted spurious emissions	
Test procedure:		47 CFR, Sections 2.1051 and 90.1323; FCC guidance 662911 D01	
Test mode:	Compliance	Verdict:	PASS
Date:	3/28/2011		
Temperature: 22.4 °C	Air Pressure: 1021 hPa	Relative Humidity: 43 %	Power Supply: 48 VDC
Remarks:			

7.5 Spurious emissions at RF antenna connector test

7.5.1 General

This test was performed to measure spurious emissions at RF antenna connector. Specification test limits are given in Table 7.5.1. The test results are provided in Table 7.5.2 and associated plots.

Table 7.5.1 Spurious emission limits

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

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

** - P is transmitter output power in Watts

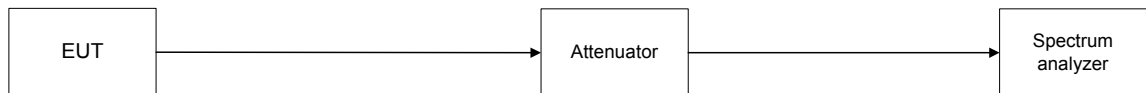
7.5.2 Test procedure

7.5.2.1 The EUT was set up as shown in Figure 7.5.1, energized and its proper operation was checked.

7.5.2.2 The EUT was adjusted to produce maximum available for end user RF output power.

7.5.2.3 The spurious emission was measured with spectrum analyzer as provided in Table 7.5.2 and associated plots.

Figure 7.5.1 Spurious emission test setup for single output mode



Test specification:		Section 90.1323, Conducted spurious emissions	
Test procedure:		47 CFR, Sections 2.1051 and 90.1323; FCC guidance 662911 D01	
Test mode:	Compliance	Verdict:	PASS
Date:	3/28/2011		
Temperature: 22.4 °C	Air Pressure: 1021 hPa	Relative Humidity: 43 %	Power Supply: 48 VDC
Remarks:			

Table 7.5.2 Spurious emission test results

ASSIGNED FREQUENCY RANGE: 3650.0 – 3675.0 MHz
 INVESTIGATED FREQUENCY RANGE: 0.009 – 40000 MHz
 DETECTOR USED: Peak
 VIDEO BANDWIDTH: ≥ Resolution bandwidth
 MODULATION: 64QAM
 MODULATING SIGNAL: PRBS
 BIT RATE: Mbps
 EMISSION BANDWIDTH: 7 MHz (worst case output power and density)
 TRANSMITTER OUTPUT POWER SETTINGS: Maximum
 TRANSMITTER OUTPUT POWER: Maximum

Frequency, MHz	SA reading, dBm	Attenuator, dB	Cable loss, dB	RBW, kHz	Spurious emission, dBm	Attenuation below carrier, dBc	Limit, dBc	Margin, dB*	Verdict
Low carrier frequency									
All spurious were found at least 20 db below the specified limit									Pass
Mid carrier frequency									
All spurious were found at least 20 db below the specified limit									Pass
High carrier frequency									
All spurious were found at least 20 db below the specified limit									Pass

*- Margin = Spurious emission – specification limit.

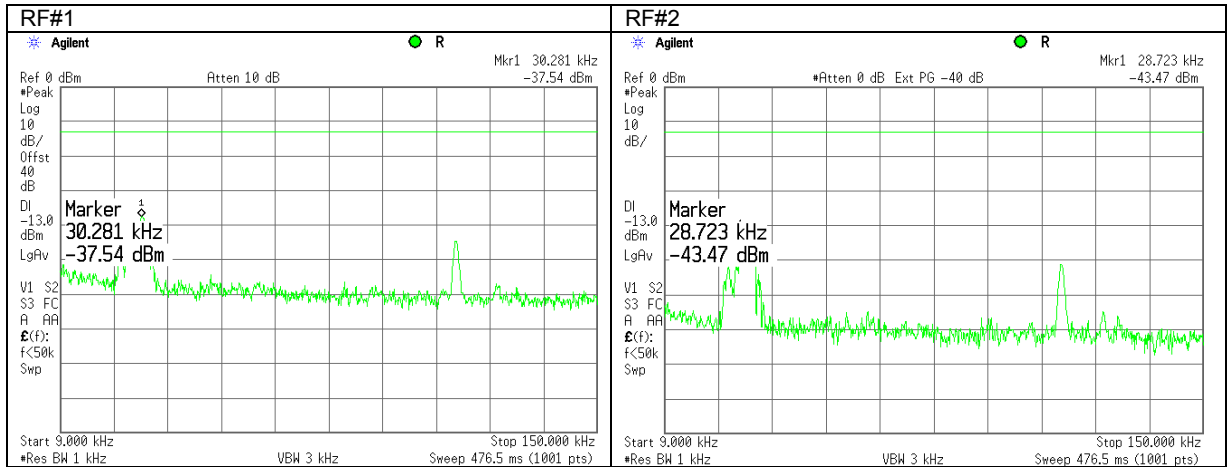
Reference numbers of test equipment used

HL 1906	HL 2951	HL 3455	HL 3473	HL 3474	HL 3768	HL 3776	HL 3787
HL 3818	HL 3901						

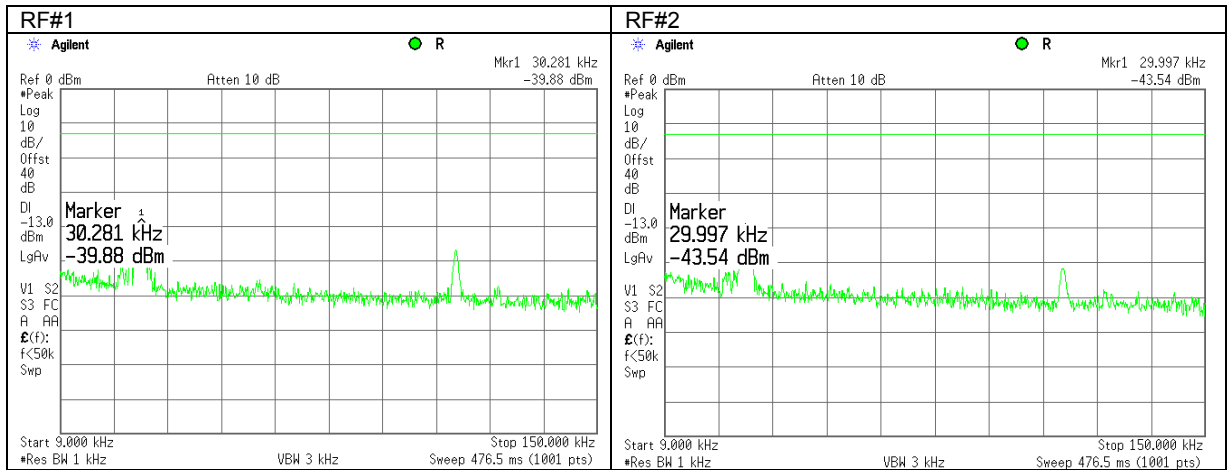
Full description is given in Appendix A.

Test specification: Section 90.1323, Conducted spurious emissions	
Test procedure: 47 CFR, Sections 2.1051 and 90.1323; FCC guidance 662911 D01	
Test mode: Compliance	Verdict: PASS
Date: 3/28/2011	
Temperature: 22.4 °C	Air Pressure: 1021 hPa
Relative Humidity: 43 %	Power Supply: 48 VDC
Remarks:	

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

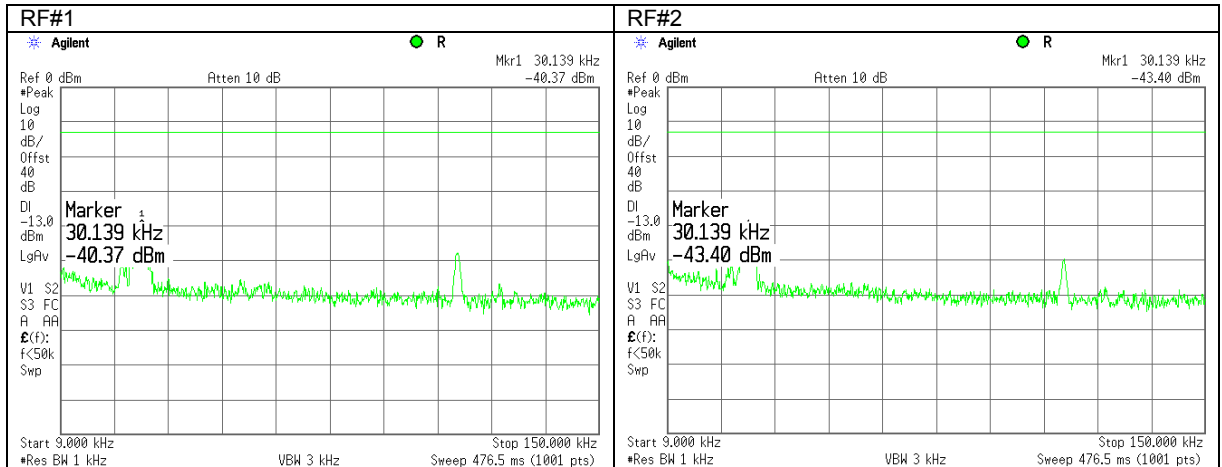


Plot 7.5.2 Spurious emission measurements in 9 - 150 kHz range at mid carrier frequency

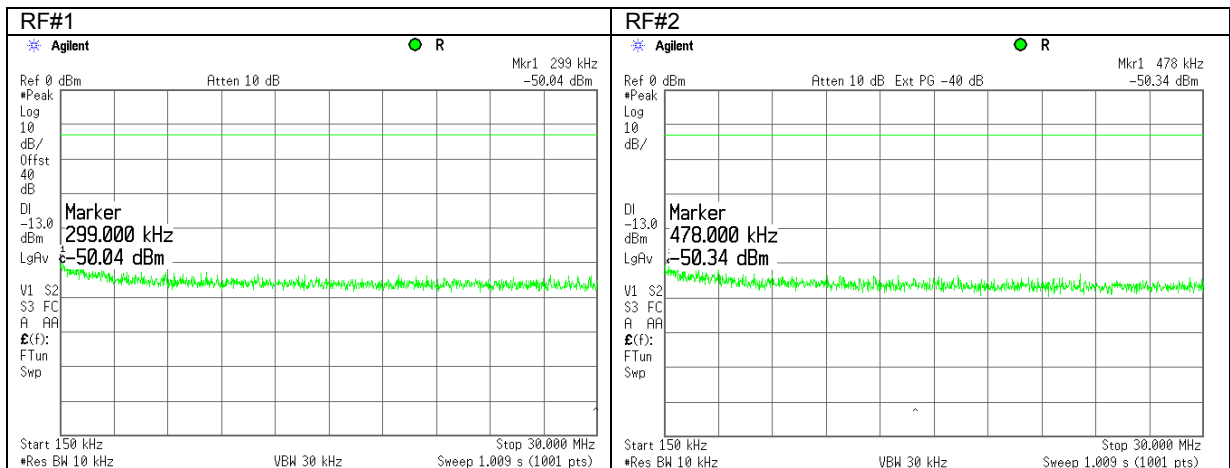


Test specification: Section 90.1323, Conducted spurious emissions	
Test procedure: 47 CFR, Sections 2.1051 and 90.1323; FCC guidance 662911 D01	
Test mode: Compliance	Verdict: PASS
Date: 3/28/2011	
Temperature: 22.4 °C	Air Pressure: 1021 hPa
	Relative Humidity: 43 %
	Power Supply: 48 VDC
Remarks:	

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

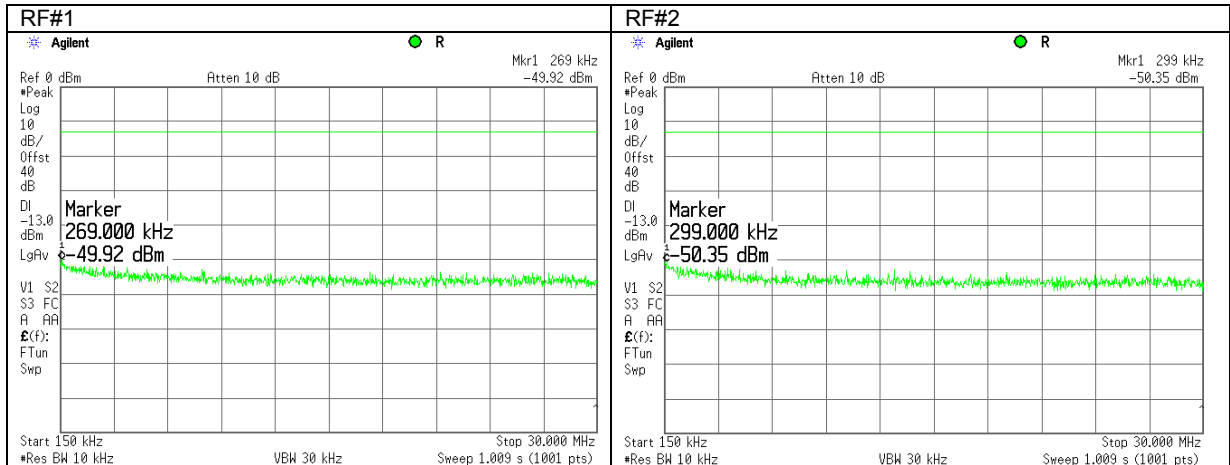


Plot 7.5.4 Spurious emission measurements in 0.15 - 30.0 MHz range at low carrier frequency

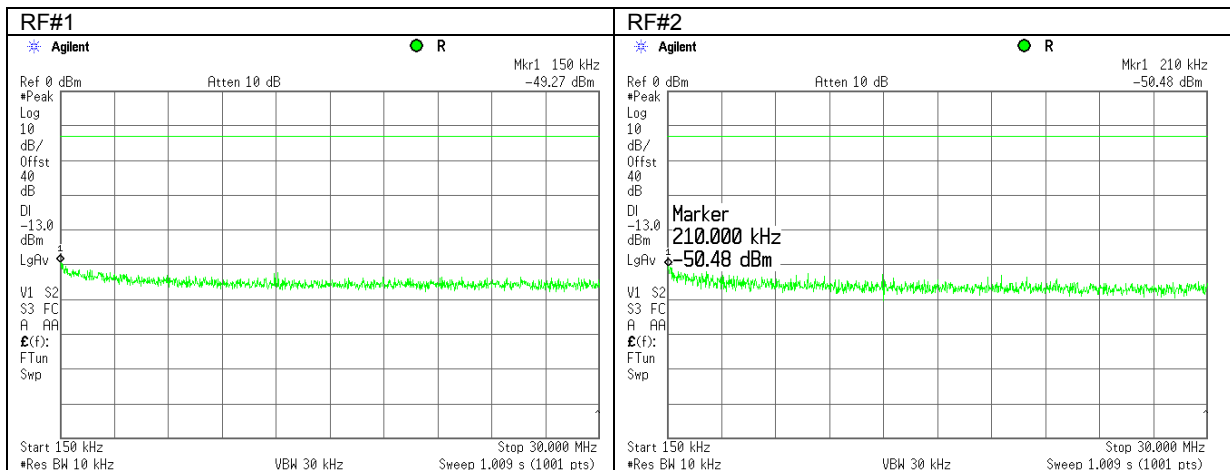


Test specification: Section 90.1323, Conducted spurious emissions	
Test procedure: 47 CFR, Sections 2.1051 and 90.1323; FCC guidance 662911 D01	
Test mode: Compliance	Verdict: PASS
Date: 3/28/2011	
Temperature: 22.4 °C	Air Pressure: 1021 hPa
Relative Humidity: 43 %	Power Supply: 48 VDC
Remarks:	

Plot 7.5.5 Spurious emission measurements in 0.15 - 30.0 MHz range at mid carrier frequency

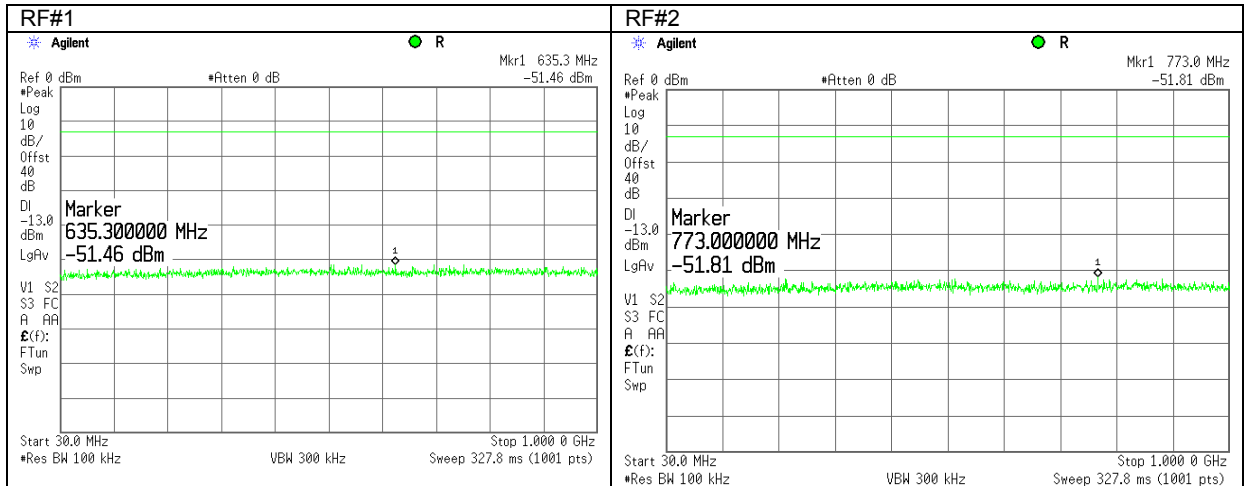


Plot 7.5.6 Spurious emission measurements in 0.15 - 30.0 MHz range at high carrier frequency

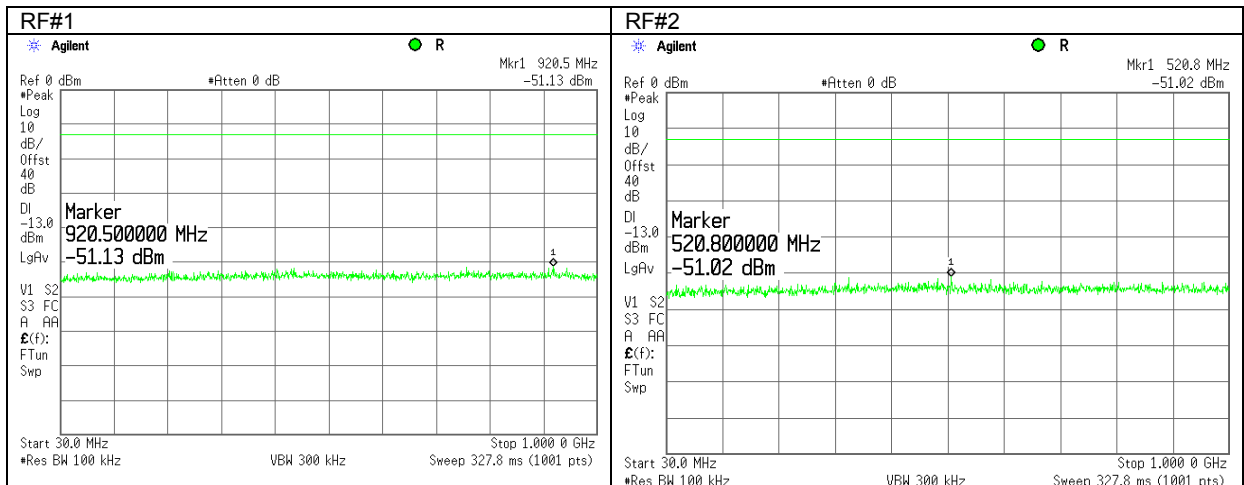


Test specification: Section 90.1323, Conducted spurious emissions			
Test procedure: 47 CFR, Sections 2.1051 and 90.1323; FCC guidance 662911 D01			
Test mode: Compliance	Verdict: PASS		
Date: 3/28/2011			
Temperature: 22.4 °C	Air Pressure: 1021 hPa	Relative Humidity: 43 %	Power Supply: 48 VDC
Remarks:			

Plot 7.5.7 Spurious emission measurements in 30.0 - 1000 MHz range at low carrier frequency

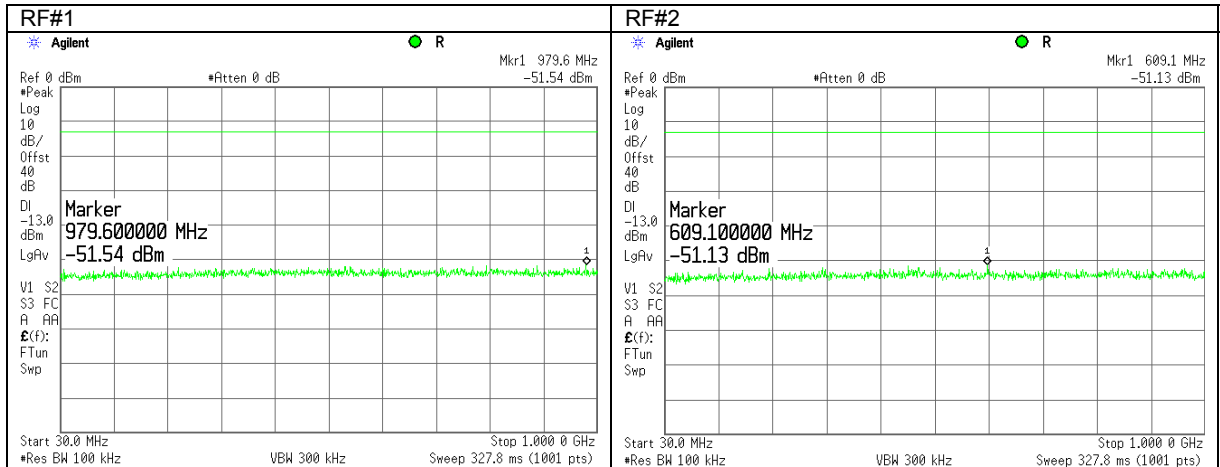


Plot 7.5.8 Spurious emission measurements in 30.0 - 1000 MHz range at mid carrier frequency

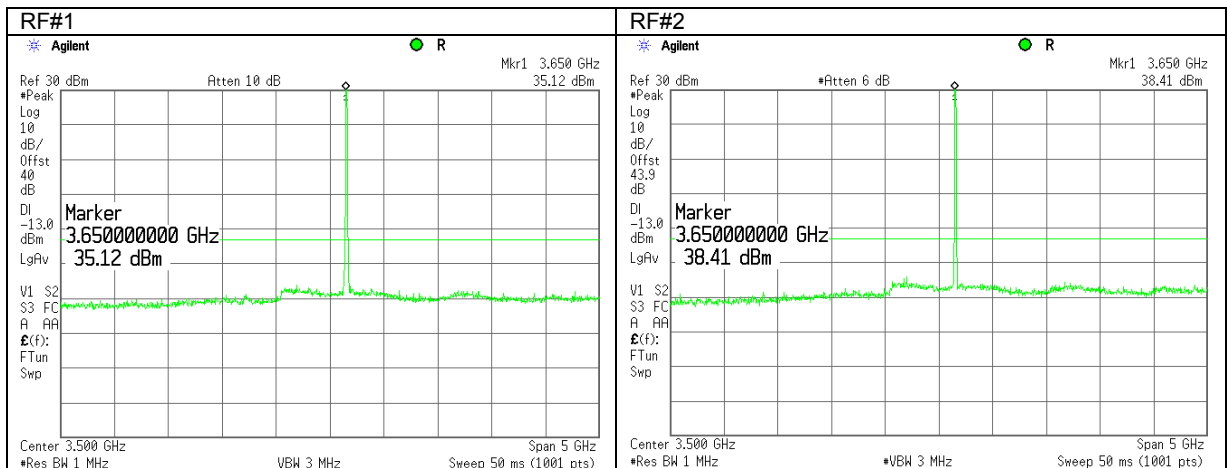


Test specification: Section 90.1323, Conducted spurious emissions			
Test procedure: 47 CFR, Sections 2.1051 and 90.1323; FCC guidance 662911 D01			
Test mode: Compliance	Verdict: PASS		
Date: 3/28/2011			
Temperature: 22.4 °C	Air Pressure: 1021 hPa	Relative Humidity: 43 %	Power Supply: 48 VDC
Remarks:			

Plot 7.5.9 Spurious emission measurements in 30.0 - 1000 MHz range at high carrier frequency

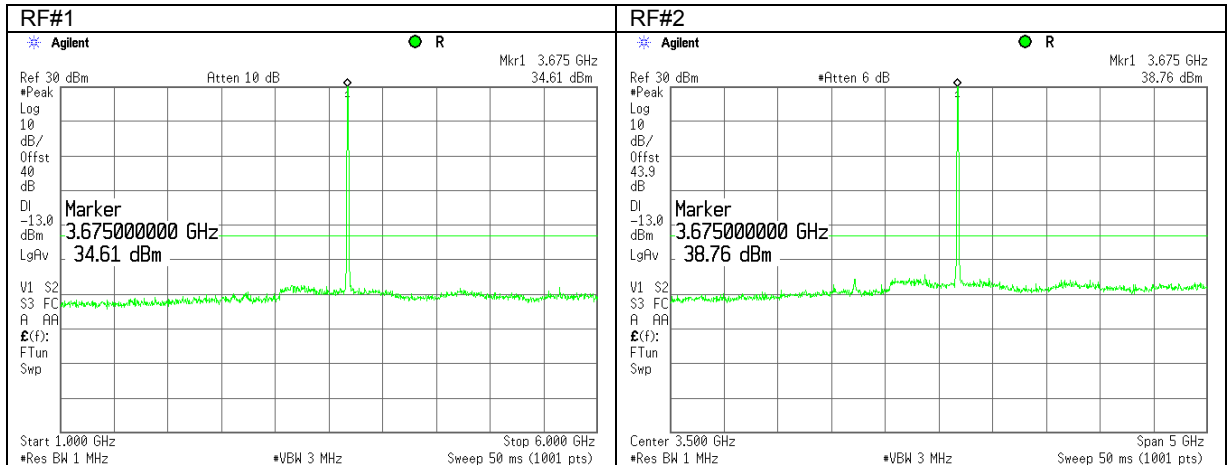


Plot 7.5.10 Spurious emission measurements in 1000 - 6000 MHz range at low carrier frequency

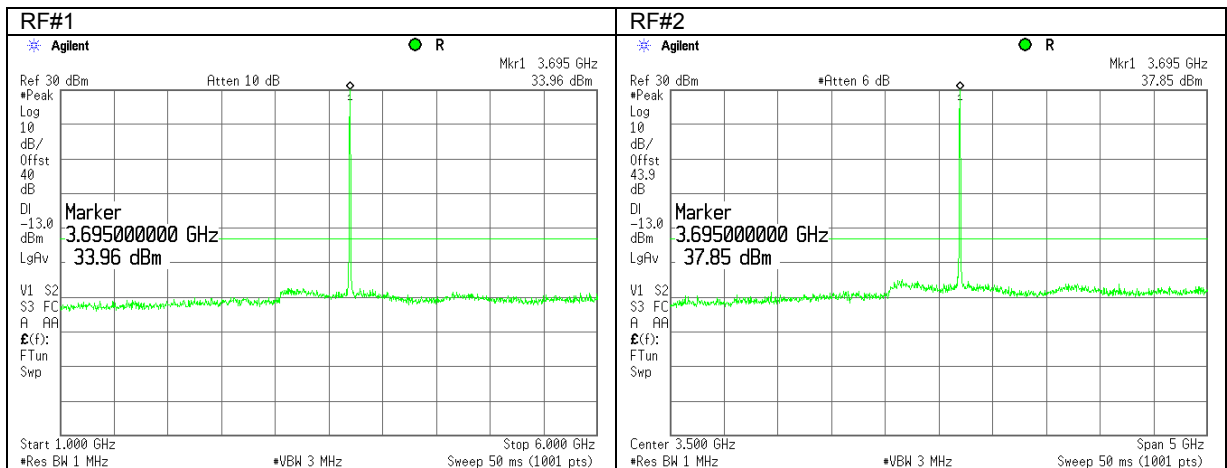


Test specification: Section 90.1323, Conducted spurious emissions			
Test procedure: 47 CFR, Sections 2.1051 and 90.1323; FCC guidance 662911 D01			
Test mode: Compliance	Verdict: PASS		
Date: 3/28/2011			
Temperature: 22.4 °C	Air Pressure: 1021 hPa	Relative Humidity: 43 %	Power Supply: 48 VDC
Remarks:			

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

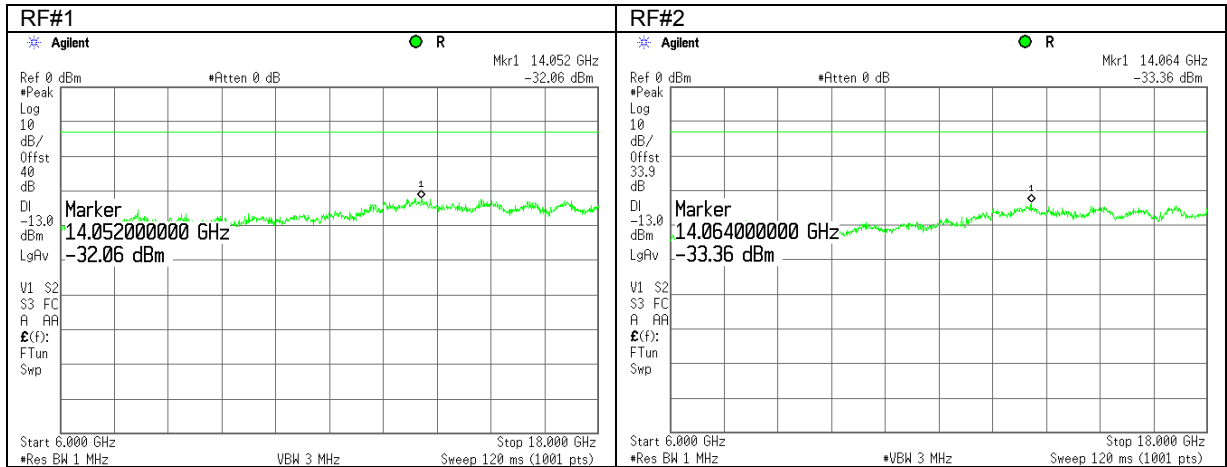


Plot 7.5.12 Spurious emission measurements in 1000 - 6000 MHz range at high carrier frequency

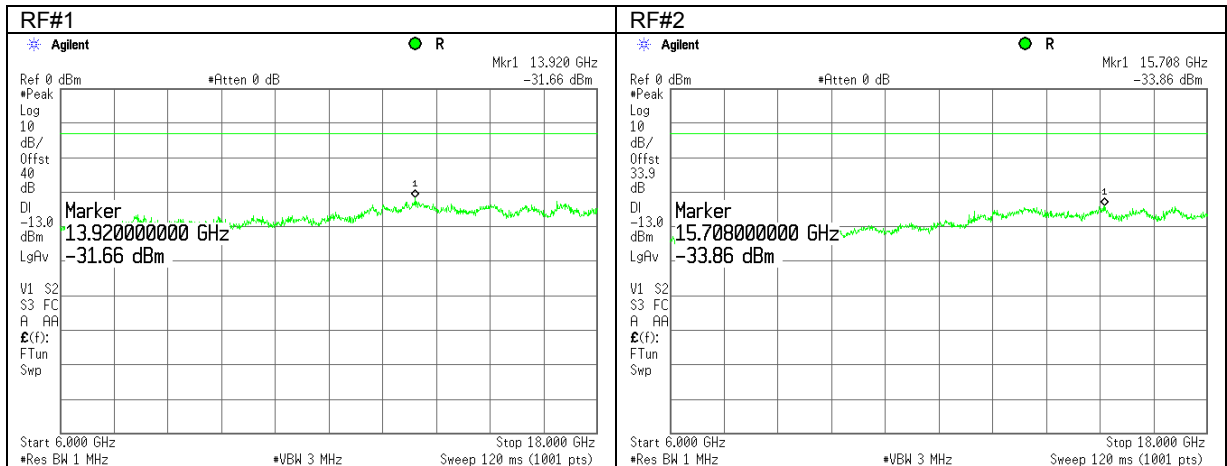


Test specification: Section 90.1323, Conducted spurious emissions	
Test procedure: 47 CFR, Sections 2.1051 and 90.1323; FCC guidance 662911 D01	
Test mode: Compliance	Verdict: PASS
Date: 3/28/2011	
Temperature: 22.4 °C	Air Pressure: 1021 hPa
Relative Humidity: 43 %	Power Supply: 48 VDC
Remarks:	

Plot 7.5.13 Spurious emission measurements in 6000 - 18000 MHz range at low carrier frequency

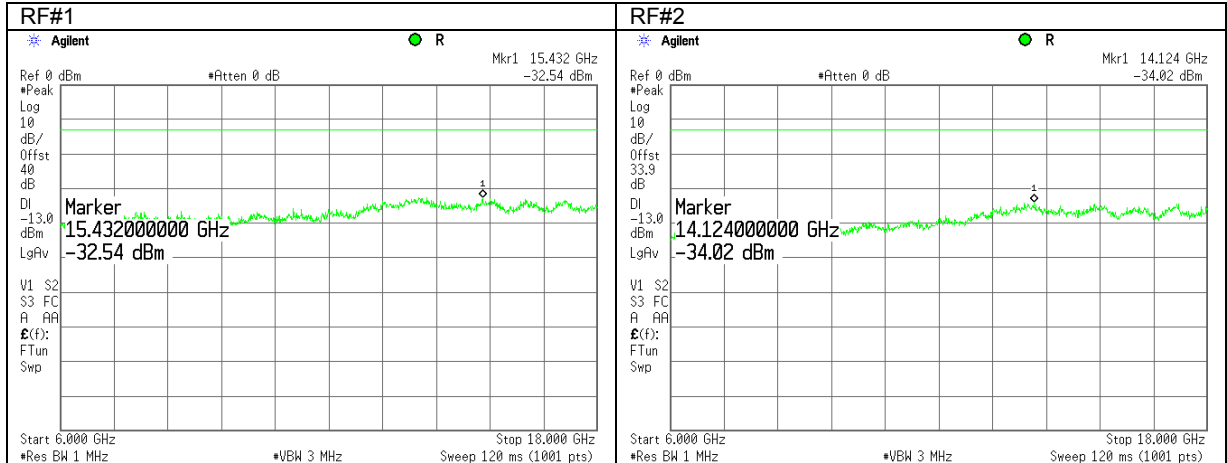


Plot 7.5.14 Spurious emission measurements in 6000 - 18000 MHz at mid carrier frequency

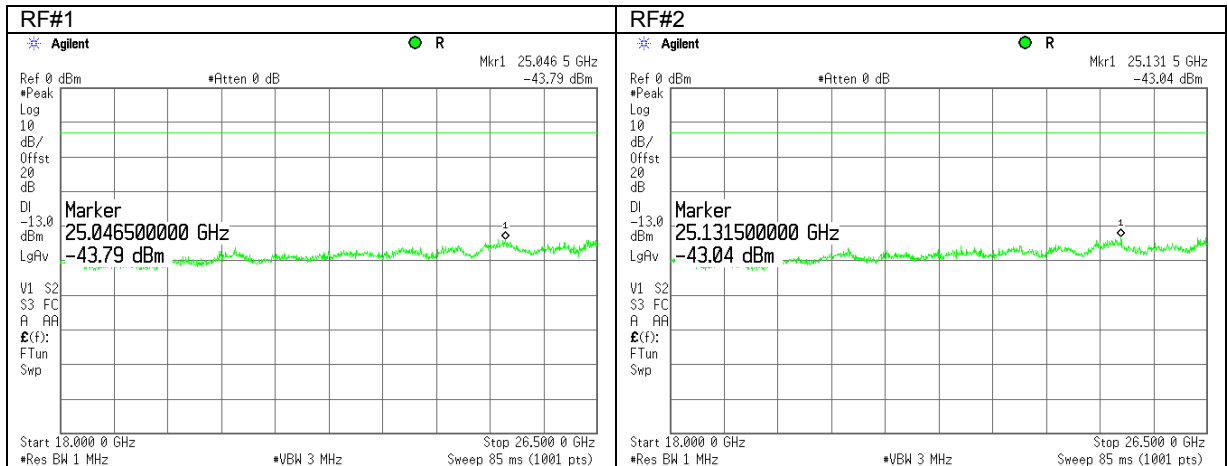


Test specification: Section 90.1323, Conducted spurious emissions	
Test procedure: 47 CFR, Sections 2.1051 and 90.1323; FCC guidance 662911 D01	
Test mode: Compliance	Verdict: PASS
Date: 3/28/2011	
Temperature: 22.4 °C	Air Pressure: 1021 hPa
	Relative Humidity: 43 %
	Power Supply: 48 VDC
Remarks:	

Plot 7.5.15 Spurious emission measurements in 6000 - 18000 MHz at high carrier frequency

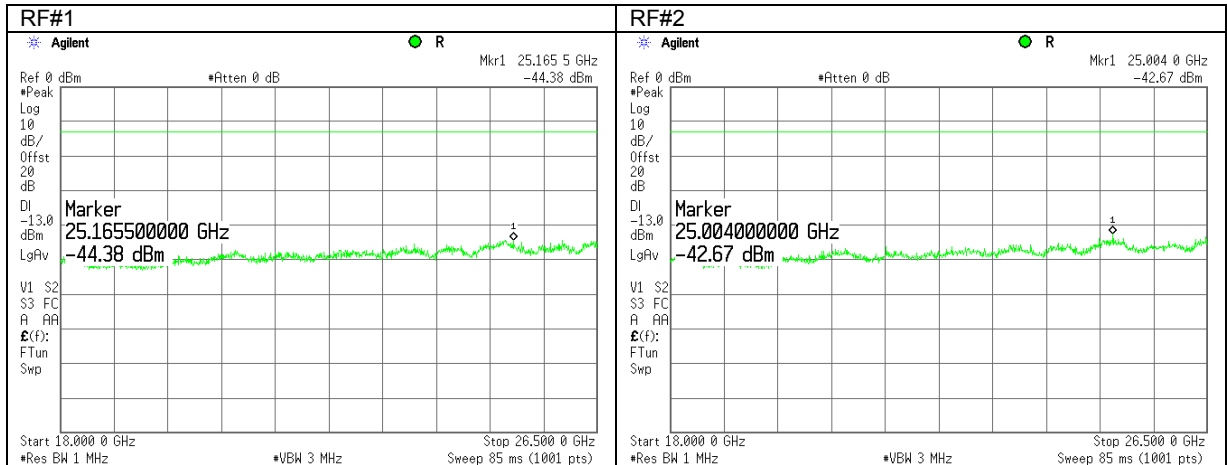


Plot 7.5.16 Spurious emission measurements in 18000 - 26500 MHz range at low carrier frequency

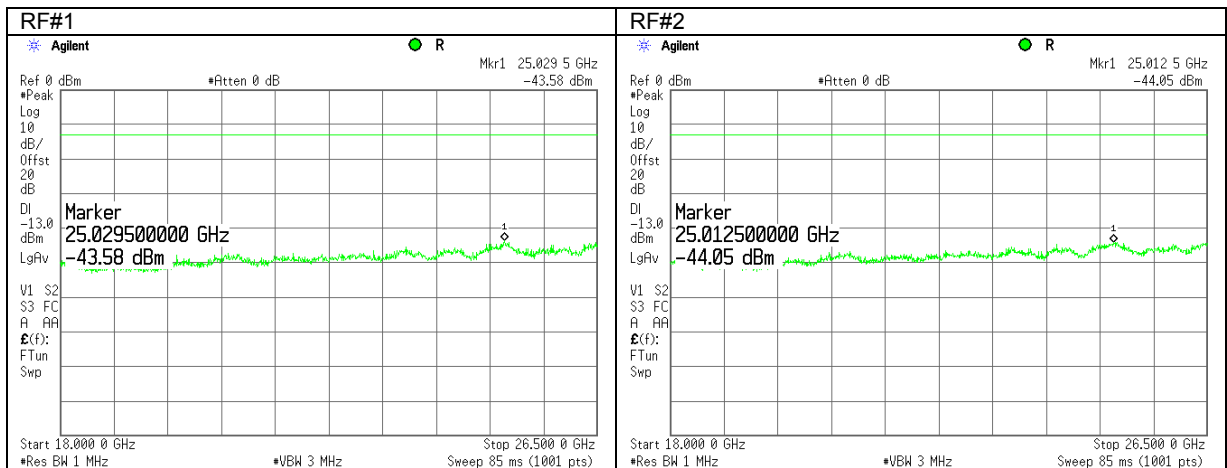


Test specification: Section 90.1323, Conducted spurious emissions			
Test procedure: 47 CFR, Sections 2.1051 and 90.1323; FCC guidance 662911 D01			
Test mode: Compliance	Verdict: PASS		
Date: 3/28/2011			
Temperature: 22.4 °C	Air Pressure: 1021 hPa	Relative Humidity: 43 %	Power Supply: 48 VDC
Remarks:			

Plot 7.5.17 Spurious emission measurements in 18000 - 26500 MHz at mid carrier frequency

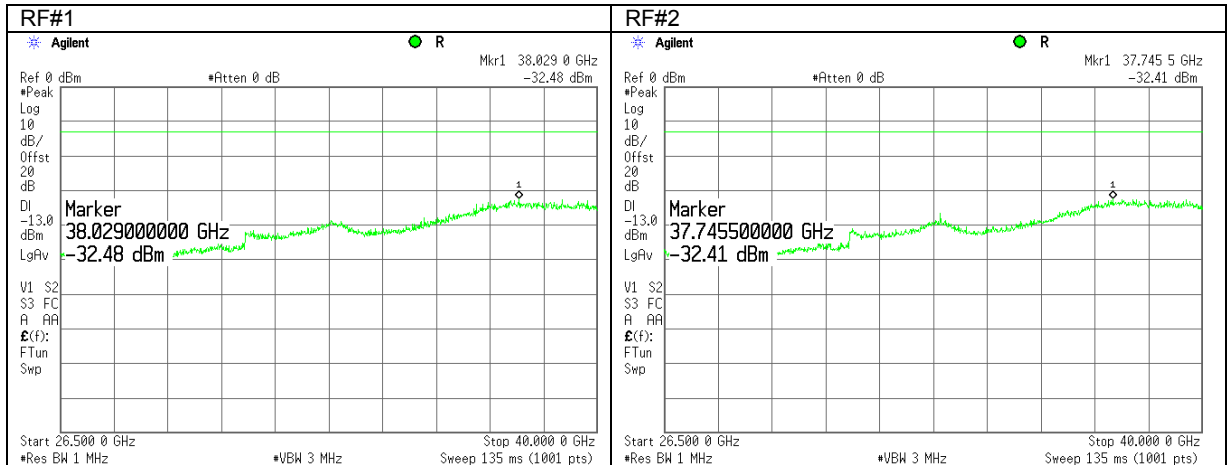


Plot 7.5.18 Spurious emission measurements in 18000 - 26500 MHz at high carrier frequency

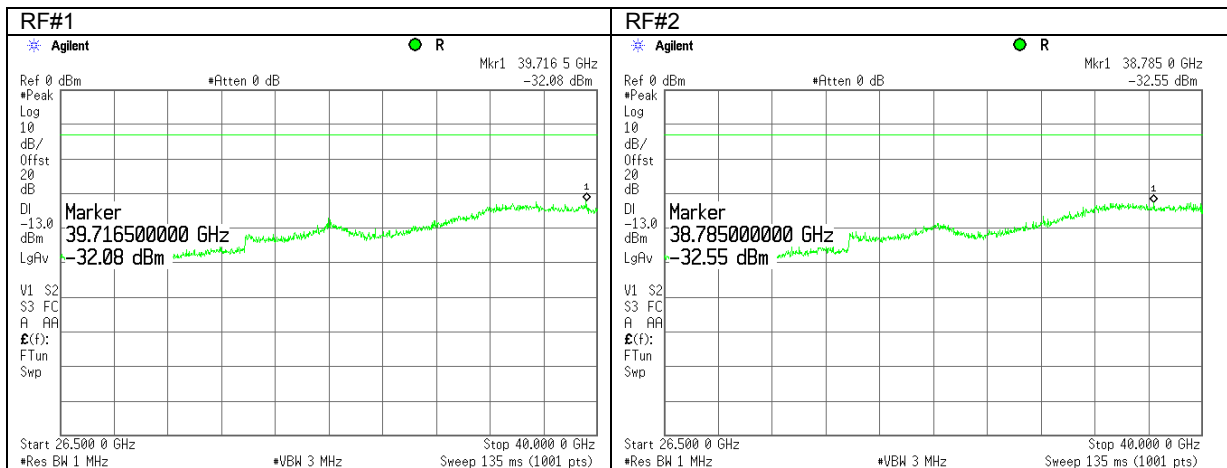


Test specification: Section 90.1323, Conducted spurious emissions	
Test procedure: 47 CFR, Sections 2.1051 and 90.1323; FCC guidance 662911 D01	
Test mode: Compliance	Verdict: PASS
Date: 3/28/2011	
Temperature: 22.4 °C	Air Pressure: 1021 hPa
Relative Humidity: 43 %	Power Supply: 48 VDC
Remarks:	

Plot 7.5.19 Spurious emission measurements in 26500 - 40000 MHz range at low carrier frequency

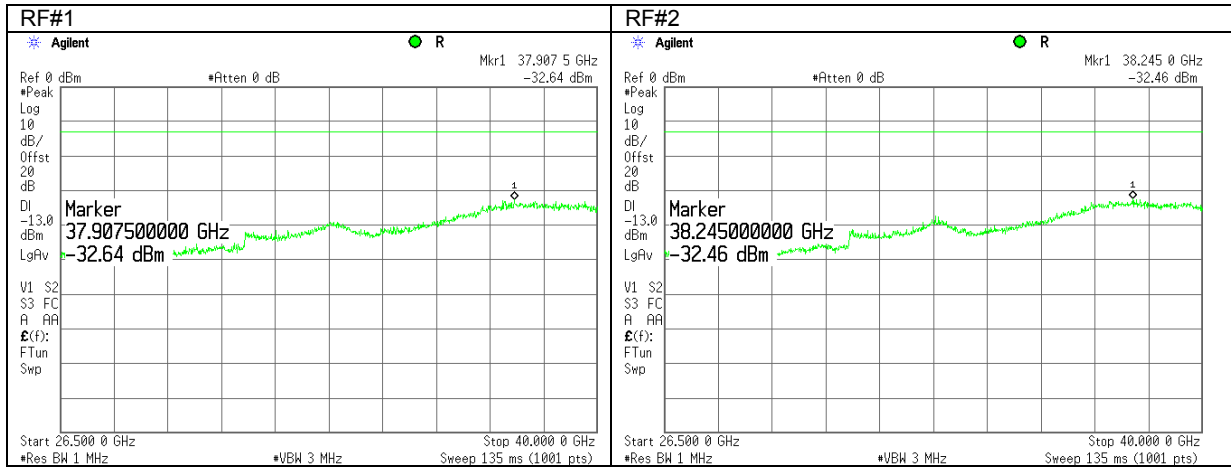


Plot 7.5.20 Spurious emission measurements in 26500 - 40000 MHz at mid carrier frequency



Test specification: Section 90.1323, Conducted spurious emissions			
Test procedure: 47 CFR, Sections 2.1051 and 90.1323; FCC guidance 662911 D01			
Test mode: Compliance	Verdict: PASS		
Date: 3/28/2011			
Temperature: 22.4 °C	Air Pressure: 1021 hPa	Relative Humidity: 43 %	Power Supply: 48 VDC
Remarks:			

Plot 7.5.21 Spurious emission measurements in 26500 - 40000 MHz at high carrier frequency



Test specification:		Section 90.213, Frequency stability	
Test procedure:		47 CFR, Section 2.1055; TIA/EIA-603-C Section 2.2.2	
Test mode:	Compliance	Verdict:	PASS
Date:	3/29/2011 - 3/30/2011		
Temperature: 23.2 °C	Air Pressure: 1020 hPa	Relative Humidity: 46 %	Power Supply: 48 VDC
Remarks:			

7.6 Frequency stability test

7.6.1 General

This test was performed to measure frequency stability of transmitter RF carrier. Specification test limits are given in Table 7.6.1. The test results are provided in Table 7.6.2.

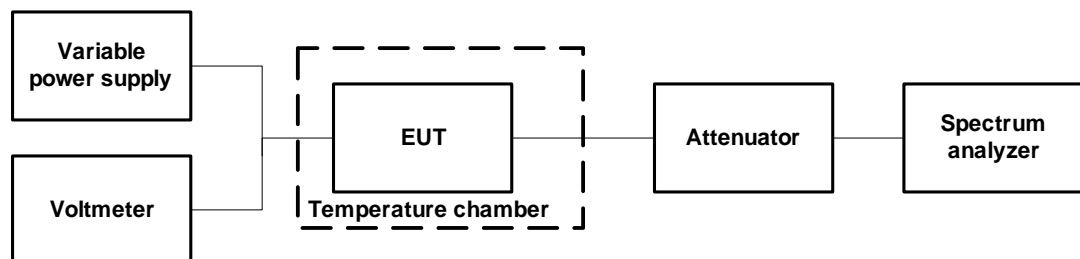
Table 7.6.1 Frequency stability limits

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

7.6.2 Test procedure

- 7.6.2.1 The EUT was set up as shown in Figure 7.6.1, energized and its proper operation was checked.
- 7.6.2.2 The EUT power was turned off. Temperature within test chamber was set to +30°C and a period of time sufficient to stabilize all of the oscillator circuit components was allowed.
- 7.6.2.3 The EUT was powered on and carrier frequency was measured at start up moment and then every minute until frequency had been stabilized or 10 minutes elapsed whichever reached the last. The EUT was powered off.
- 7.6.2.4 The above procedure was repeated at 0°C and at the lowest test temperature.
- 7.6.2.5 The EUT was powered on and carrier frequency was measured at start up moment and at the end of stabilization period at the rest of test temperatures and voltages. The EUT was powered off.
- 7.6.2.6 Frequency displacement was calculated and compared with the limit as provided in Table 7.6.2.

Figure 7.6.1 Frequency stability test setup



Test specification:		Section 90.213, Frequency stability	
Test procedure:		47 CFR, Section 2.1055; TIA/EIA-603-C Section 2.2.2	
Test mode:	Compliance	Verdict:	PASS
Date:	3/29/2011 - 3/30/2011		
Temperature: 23.2 °C	Air Pressure: 1020 hPa	Relative Humidity: 46 %	Power Supply: 48 VDC
Remarks:			

Table 7.6.2 Frequency stability test results

ASSIGNED FREQUENCY: 3650.0 – 3700.0 MHz
 NOMINAL POWER VOLTAGE: 48 VDC
 TEMPERATURE STABILIZATION PERIOD: 20 min
 POWER DURING TEMPERATURE TRANSITION: Off
 SPECTRUM ANALYZER MODE: Counter
 RESOLUTION BANDWIDTH: 1 kHz
 VIDEO BANDWIDTH: 3 kHz
 MODULATION: Unmodulated

T, °C	Voltage, 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 3651.75 MHz												
-30	nominal	3651.745638	3651.745648	3651.745658	3651.745648	3651.745648	3651.745648	3651.745638	20.0	0.0	0.01	0.00
-20	nominal	3651.745637	NA	NA	NA	NA	NA	3651.745646	8.0	-1.0	0.00	0.00
-10	nominal	3651.745680	NA	NA	NA	NA	NA	3651.745650	22.0	0.0	0.01	0.00
0	nominal	3651.745653	3651.745653	3651.745663	3651.745663	3651.745653	3651.745663	3651.745674	36.0	0.0	0.01	0.00
10	nominal	3651.745666	NA	NA	NA	NA	NA	3651.745655	28.0	0.0	0.01	0.00
20	55.2	3651.745656	NA	NA	NA	NA	NA	3651.745657	19.0	0.0	0.01	0.00
20	48.0	3651.745731	NA	NA	NA	NA	NA	3651.745638*	93.0	0.0	0.03	0.00
20	40.8	3651.745654	NA	NA	NA	NA	NA	3651.745666	28.0	0.0	0.01	0.00
30	nominal	3651.745645	3651.745665	3651.745665	3651.745665	3651.745665	3651.745656	3651.745656	27.0	0.0	0.01	0.00
40	nominal	3651.745679	NA	NA	NA	NA	NA	3651.745669	41.0	0.0	0.01	0.00
50	nominal	3651.745696	3651.745675	3651.745672	3651.745674	3651.745679	3651.745684	3651.745686	58.0	0.0	0.02	0.00
Mid Channel 3675.0 MHz												
-30	nominal	3674.995610	3674.995610	3674.995620	3674.995620	3674.995610	3674.995631	3674.995631	15.0	-6.0	0.00	0.00
-20	nominal	3674.995608	NA	NA	NA	NA	NA	3674.995619	3.0	-8.0	0.00	0.00
-10	nominal	3674.995622	NA	NA	NA	NA	NA	3674.995623	7.0	0.0	0.00	0.00
0	nominal	3674.995625	3674.995645	3674.995635	3674.995635	3674.995625	3674.995635	3674.995635	29.0	0.0	0.01	0.00
10	nominal	3674.995638	NA	NA	NA	NA	NA	3674.995634	22.0	0.0	0.01	0.00
20	55.2	3674.995649	NA	NA	NA	NA	NA	3674.995610	33.0	-6.0	0.01	0.00
20	48.0	3674.995611	NA	NA	NA	NA	NA	3674.995616*	0.0	-5.0	0.00	0.00
20	40.8	3674.995613	NA	NA	NA	NA	NA	3674.995626	10.0	-3.0	0.00	0.00
30	nominal	3674.995645	3674.995647	3674.995637	3674.995637	3674.995627	3674.995637	3674.995638	31.0	0.0	0.01	0.00
40	nominal	3674.995672	NA	NA	NA	NA	NA	3674.995663	56.0	0.0	0.02	0.00
50	nominal	3674.995657	3674.995657	3674.995647	3674.995637	3674.995638	3674.995648	3674.995648	41.0	0.0	0.01	0.00
High channel 3698.25 MHz												
-30	nominal	3698.245593	3698.245593	3698.245593	3698.245593	3698.245583	3698.245583	3698.245584	19.0	0.0	0.01	0.00
-20	nominal	3698.245598	NA	NA	NA	NA	NA	3698.245581	24.0	0.0	0.01	0.00
-10	nominal	3698.245605	NA	NA	NA	NA	NA	3698.245605	31.0	0.0	0.01	0.00
0	nominal	3698.245587	3698.245597	3698.245607	3698.245607	3698.245597	3698.245597	3698.245597	33.0	0.0	0.01	0.00
10	nominal	3698.245610	NA	NA	NA	NA	NA	3698.245609	36.0	0.0	0.01	0.00
20	55.2	3698.245593	NA	NA	NA	NA	NA	3698.245614	40.0	0.0	0.01	0.00
20	48.0	3698.245589	NA	NA	NA	NA	NA	3698.245574*	15.0	0.0	0.00	0.00
20	40.8	3698.245595	NA	NA	NA	NA	NA	3698.245585	21.0	0.0	0.01	0.00
30	nominal	3698.245608	3698.245579	3698.245619	3698.245609	3698.245609	3698.245599	3698.245609	45.0	0.0	0.01	0.00
40	nominal	3698.245616	NA	NA	NA	NA	NA	3698.245636	62.0	0.0	0.02	0.00
50	nominal	3698.245609	3698.245639	3698.245619	3698.245629	3698.245629	3698.245619	3698.245619	65.0	0.0	0.02	0.00

* - Reference frequency

Note1: As no limit is specified by the applicable rule for 3650.0 – 3700.0 MHz band the test results are given in Table above for information purpose only.

Reference numbers of test equipment used

HL 1455	HL 3286	HL 3818				
---------	---------	---------	--	--	--	--

Full description is given in Appendix A.



Test specification:		Section 90.203 (o), Contention based protocol	
Test procedure:			
Test mode:	Compliance	Verdict:	PASS
Date:	5/13/2011 – 5/16/2011		
Temperature: 23.2°C	Air Pressure: 1007 hPa	Relative Humidity: 46 %	Power Supply: 48 VDC
Remarks:			

8 Contention Based Protocol

8.1 General

This test was performed to verify the EUT contention-based protocol function. Contention-based protocol is defined as:

A protocol that allows multiple users to share the same spectrum by defining the events that must occur when two or more transmitters attempt to simultaneously access the same channel and establishing rules by which a transmitter provides reasonable opportunities for other transmitters to operate. Such a protocol may consist of procedures for initiating new transmissions, procedures for determining the state of the channel (available or unavailable), and procedures for managing retransmissions in the event of a busy channel. Contention-based protocols shall fall into one of two categories:

- (1) An unrestricted contention-based protocol is one which can avoid co-frequency interference with devices using all other types of contention-based protocols.
- (2) A restricted contention-based protocol is one that does not qualify as unrestricted.

The EUT is WiMax Base station capable to operate in TDD mode in the full 3650.0 – 3700.0 MHz band and using unrestricted Contention Based Protocol. The EUT equipped with "listen before transmit" function that performs channel measurements across transmission bandwidth at the beginning of each downlink frame prior to transmission.

In case a signal level measured is above the RSL Turn-off level the EUT will not transmit for the next timeslot (defined by Backoff frame parameter).

The EUT RSL turn-off level and Backoff frame are operator/user defined.

8.2 Test procedure

The EUT is equipped with two Tx/Rx chains. As both transmit chains operate simultaneously and only Tx1/Rx1 chain is equipped with contention-based protocol function the test was performed while interferer signal is injected in Tx₁/Rx₁ port, the EUT operation monitored by a spectrum analyzer connected to the Tx₁/Rx₁ port.

The EUT was set to transmit as shown in Figure 8.2.1 and the transmission was verified by the spectrum analyzer.

The signal generator was connected as shown in Figure 8.2.1, interferer signal was generated and EUT response was monitored and reported at Table 8.2.1 to Table 8.2.2.

Plot 8.2.1 shows an example of EUT transmission operation while detecting an interferer signal at its RSL turn-off level.

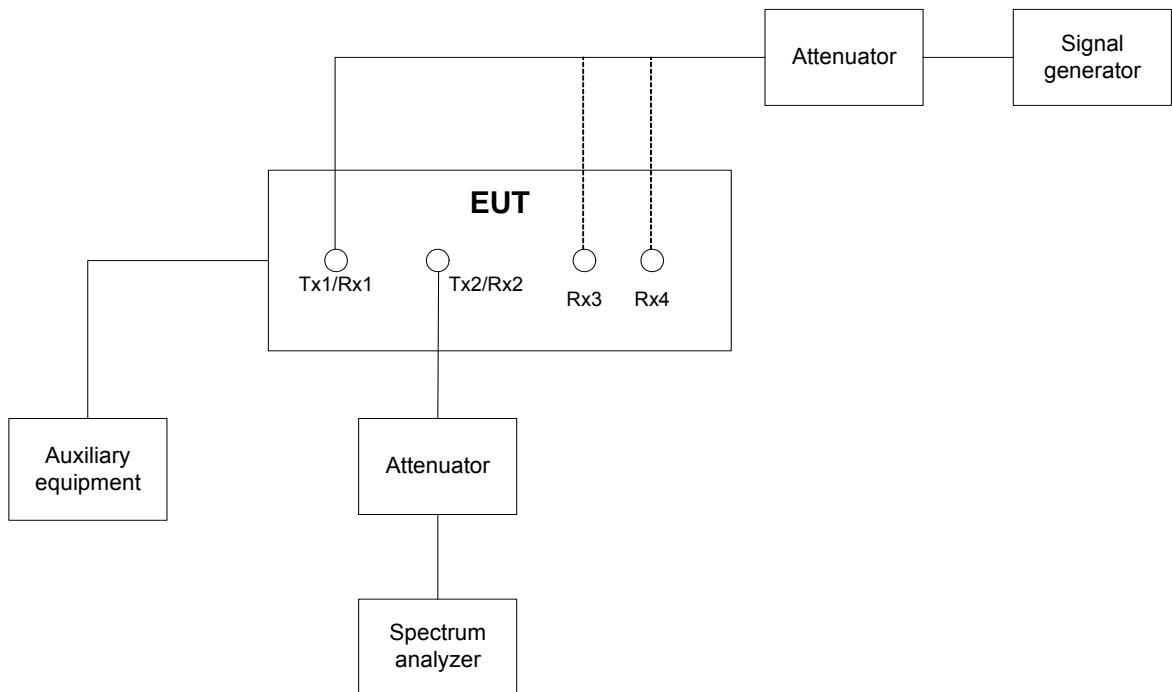
The combination of EUT transmission bandwidth, channel, interferer signal type and level was chosen according to Table 8.2.1 to Table 8.2.2.

The OFDM interferer signal parameters are shown in Plot 8.1.1.



Test specification: Section 90.203 (o), Contention based protocol			
Test procedure:			
Test mode: Compliance	Verdict: PASS		
Date: 5/13/2011 – 5/16/2011			
Temperature: 23.2°C	Air Pressure: 1007 hPa	Relative Humidity: 46 %	Power Supply: 48 VDC
Remarks:			

Figure 8.2.1 Set-up for contention-based protocol verification test





Test specification: Section 90.203 (o), Contention based protocol	
Test procedure:	
Test mode: Compliance	Verdict: PASS
Date: 5/13/2011 – 5/16/2011	
Temperature: 23.2°C	Air Pressure: 1007 hPa
Relative Humidity: 46 %	
Power Supply: 48 VDC	
Remarks:	

Table 8.2.1 Contention Base Protocol test results

INTERFERER SIGNAL INJECTION:				To port Tx ₁ /Rx ₁					
EUT TRANSMISSION MONITORING:				At port Tx ₂ /Rx ₂					
Test number	Wanted signal characteristics			Interferer signal characteristics			Results		
	Channel frequency, MHz	Channel Bandwidth, MHz	RSL turn-off level settings, dBm	Frequency, MHz	Modulation	Level, dBm	Interference detection	Tx OFF time, ms**	Verdict
1	3652.5	5	-65	3652.5	CW	-65	Yes	6.50	Pass
2	3652.5		-65	3652.5	CW	-70	No	NA	Pass
3	3652.5		-85	3652.5	CW	-85	Yes	7.80	Pass
4	3652.5		-85	3652.5	CW	-90	No	NA	Pass
5	3675.0		-65	3675.0	CW	-65	Yes	5.88	Pass
6	3675.0		-65	3675.0	CW	-70	No	NA	Pass
7	3675.0		-85	3675.0	CW	-85	Yes	7.75	Pass
8	3675.0		-85	3675.0	CW	-90	No	NA	Pass
9	3675.0		-85	3672.5	CW	-85	Yes	6.25	Pass
10	3675.0		-85	3677.5	CW	-85	Yes	8.75	Pass
11	3675.0		-85	3675.0	OFDMA	-85	Yes	6.00	Pass
12	3697.5		-65	3697.5	CW	-65	Yes	5.88	Pass
13	3697.5		-65	3697.5	CW	-70	No	NA	Pass
14	3697.5		-85	3697.5	CW	-85	Yes	6.39	Pass
15	3697.5		-85	3697.5	CW	-90	No	NA	Pass
16	3653.5	7	-85	3653.5	CW	-85	Yes	7.80	Pass
17	3675.0		-85	3675.0	OFDMA	-85	Yes	8.50	Pass
18	3696.5		-85	3696.5	CW	-85	Yes	6.50	Pass
19	3655.0	10	-85	3655.0	CW	-85	Yes	6.70	Pass
20	3675.0		-85	3670.0	CW	-85	Yes	7.80	Pass
21	3675.0		-85	3680.0	CW	-85	Yes	8.72	Pass
22	3675.0		-85	3675.0	OFDMA	-85	Yes	7.81	Pass
23	3695.0		-85	3695.0	CW	-85	Yes	6.90	Pass
24	3655.0	10	-85	3655.0	CW	-85	Yes	6.10	Pass
25	3675.0		-85	3670.0	CW	-85	Yes	7.34	Pass
26	3675.0		-85	3680.0	CW	-85	Yes	6.75	Pass
27	3675.0		-85	3675.0	OFDMA	-85	Yes	8.25	Pass
28	3695.0		-85	3695.0	CW	-85	Yes	7.30	Pass

* - Interference and wanted signal durations are measured in ms and each frame duration is 5 ms

** - Tx OFF time is measured as a time period from the start of interference signal (interference signal exceeds the threshold level) and till the EUT ceases to transmit.



Test specification:		Section 90.203 (o), Contention based protocol	
Test procedure:			
Test mode:	Compliance	Verdict: PASS	
Date:	5/13/2011 – 5/16/2011		
Temperature: 23.2°C	Air Pressure: 1007 hPa	Relative Humidity: 46 %	Power Supply: 48 VDC
Remarks:			

Table 8.2.2 Contention Base Protocol test results

INTERFERER SIGNAL INJECTION:				To port Tx ₂ /Rx ₂					
EUT TRANSMISSION MONITORING:				At port Tx ₁ /Rx ₁					
Test number	Wanted signal characteristics			Interferer signal characteristics			Results		
	Channel frequency, MHz	Channel Bandwidth, MHz	RSL turn-off level settings, dBm	Frequency, MHz	Modulation	Level, dBm	Interference detection	Tx OFF time, ms**	Verdict
29	3655.0	10	-85	3655.0	CW	-85	Yes	6.56	Pass
30	3675.0		-85	3670.0	CW	-85	Yes	5.24	Pass
31	3675.0		-85	3680.0	CW	-85	Yes	7.42	Pass
32	3675.0		-85	3675.0	OFDMA	-85	Yes	6.27	Pass
33	3695.0		-85	3695.0	CW	-85	Yes	8.45	Pass

* - Interference and wanted signal durations are measured in ms and each frame duration is 5 ms

** - Tx OFF time is measured as a time period from the start of interference signal (interference signal exceeds the threshold level) and till the EUT ceases to transmit.

Reference numbers of test equipment used

HL 2016	HL 2017	HL 2952	HL 3301	HL 3559	HL 3667	HL 3818	HL 3868
---------	---------	---------	---------	---------	---------	---------	---------

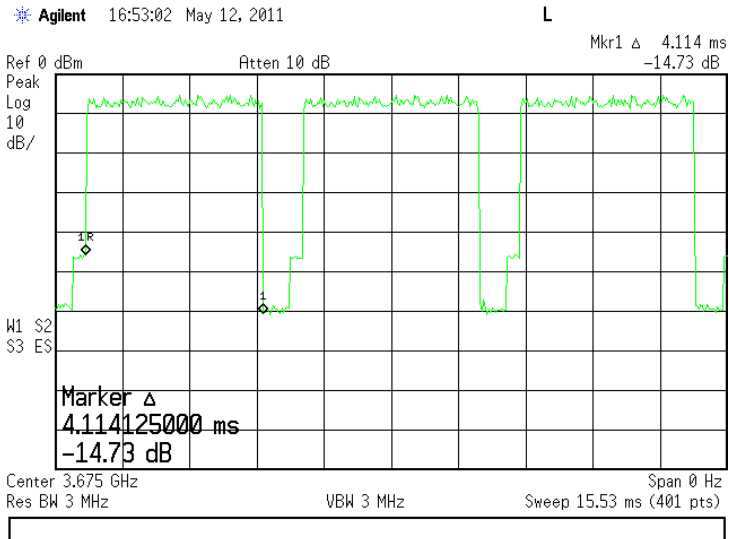
Full description is given in Appendix A.



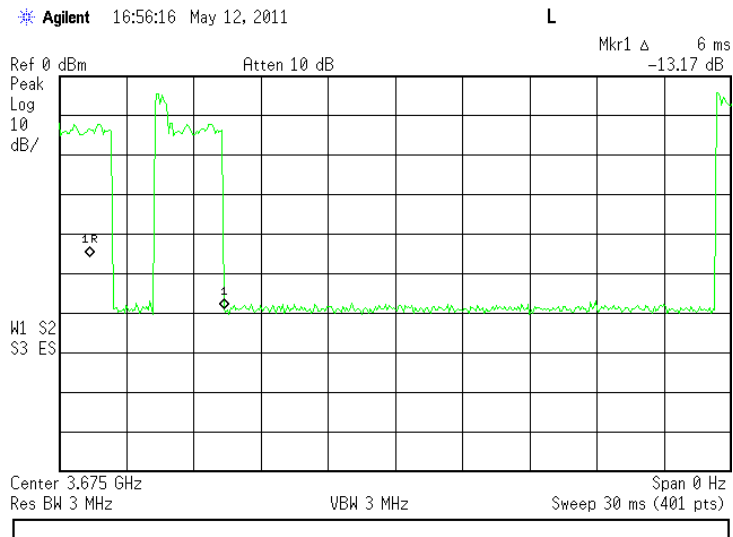
HERMON LABORATORIES

Test specification: Section 90.203 (o), Contention based protocol			
Test procedure:			
Test mode: Compliance	Verdict: PASS		
Date: 5/13/2011 – 5/16/2011			
Temperature: 23.2°C	Air Pressure: 1007 hPa	Relative Humidity: 46 %	Power Supply: 48 VDC
Remarks:			

Plot 8.2.1 OFDMA signal interferer pulse width



Plot 8.2.2 Tx off example



9 APPENDIX A Test equipment and ancillaries used for tests

HL No	Description	Manufacturer	Model	Ser. No.	Last Cal./ Check	Due Cal./ Check
0446	Antenna, Loop, Active, 10 kHz - 30 MHz	EMCO	6502	2857	29-Jun-10	29-Jun-11
0521	EMI Receiver (Spectrum Analyzer) with RF filter section 9 kHz-6.5 GHz	Hewlett Packard	8546A	3617A 00319, 3448A002 53	25-Aug-10	25-Aug-11
0604	Antenna BiconiLog Log-Periodic/T Bow-TIE, 26 - 2000 MHz	EMCO	3141	9611-1011	11-Jan-11	11-Jan-12
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
1455	Cable, 1.3 m, N/N -type	Harbour Industries	MIL 17/60- RG142	1455	01-Sep-10	01-Sep-11
1906	Power Divider, 0.5-18.0 GHz, 80 W	Omni Spectra	2090- 6204-00	1906	01-Dec-10	01-Dec-12
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
2016	Attenuator, Manual Step, 0-9/1 dB, 0-8 GHz, 2 W	Midwest Microwave	1072	1315	7-Feb-11	7-Feb-12
2017	Attenuator, Manual Step, 0-60/10 dB, 0-8.0 GHz	Midwest Microwave	1071	2017	7-Feb-11	7-Feb-12
2871	Microwave Cable Assembly, 18 GHz, 6.4 m, SMA - SMA	Huber-Suhner	198-8155- 00	2871	14-Sep-10	14-Sep-11
2951	Cable, RF, 18 GHz, 0.9 m, SMA-SMA	Gore	10020014	NA	04-Oct-10	04-Oct-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
3123	Microwave Cable Assembly, 18 GHz, 5.0 m, SMA - SMA	Huber-Suhner	198-9155- 00	3123	03-Oct-10	03-Oct-11
3286	Temperature Chamber, (-50 to +170) °C	Thermotron	EL-8-CH- 1-1-CO2	21-9048	12-Sep-10	12-Sep-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
3455	Medium Power Fixed Coaxial Attenuator DC to 40 GHz, 20 dB, 5 W	Aeroflex / Weinschel	75A-20-12	1182	27-Mar-11	27-Mar-12
3472	Cable, Coax, Microwave, DC-18 GHz, SMA-SMA, 1.0 m	Gore	GORE 65474	1003478	09-May-11	09-May-12
3473	Cable, Coax, Microwave, DC-18 GHz, SMA-SMA, 0.6 m	Gore	GORE 65474	1003478	09-May-11	09-May-12
3474	Cable, Coax, Microwave, DC-18 GHz, SMA-SMA, 0.6 m	Gore	GORE 65475	1640102	09-May-11	09-May-12



HL No	Description	Manufacturer	Model	Ser. No.	Last Cal./ Check	Due Cal./ Check
3534	Amplifier, low noise, 6 to 18 GHz	Quinstar Technology	QLJ-06184040-J0	11159001002	30-Dec-10	30-Dec-11
3535	Amplifier, low noise, 18 to 40 GHz	Quinstar Technology	QLJ-18404537-J0	11159003001	06-Dec-10	06-Dec-11
3559	Cable 40 GHz, SMA-SMA, 0.95 m, Blue	Gore	PHASEFL EX	03771245	13-Jun-10	13-Jun-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
3776	Attenuator, N-type, 10 dB, DC to 18 GHz, 5 W	Mini-Circuits	BW-N10W5+	NA	31-Aug-10	31-Aug-11
3782	Precision Fixed Attenuator, 50 Ohm, 5 W, 10 dB, DC to 18 GHz	Mini-Circuits	BW-S10W5+	NA	07-Dec-10	07-Dec-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	MY48250288	25-Sep-09	25-Sep-11
3868	Directional coupler, 2 GHz to 8 GHz, 10 dB, SMA Female	Narda	4203-10	06978	13-Dec-10	13-Dec-12
3901	Microwave Cable Assembly, 40.0 GHz, 3.5 m, SMA/SMA	Huber-Suhner	SUCOFLEX 102A	1225/2A	07-Feb-11	07-Feb-12

10 APPENDIX B Measurement uncertainties

Expanded uncertainty at 95% confidence in Hermon Labs EMC measurements

Test description	Expanded uncertainty
Transmitter tests	
Carrier power conducted at antenna connector	± 1.7 dB
Carrier power radiated (substitution method)	± 4.5 dB
Occupied bandwidth	±8%
Conducted emissions at RF antenna connector	9 kHz to 2.9 GHz: ± 2.6 dB 2.9 GHz to 6.46 GHz: ± 3.5 dB 6.46 GHz to 13.2 GHz: ± 4.3 dB 13.2 GHz to 22.0 GHz: ± 5.0 dB 22.0 GHz to 26.8 GHz: ± 5.5 dB 26.8 GHz to 40.0 GHz: ± 4.8 dB
Spurious emissions radiated 30 MHz – 40 GHz (substitution method)	± 4.5 dB
Frequency error	30 – 300 MHz: ± 50.5 Hz (1.68 ppm) 300 – 1000 MHz: ± 168 Hz (0.56 ppm)
Transient frequency behaviour	187 Hz ± 13.9 %
Duty cycle, timing (Tx ON / OFF) and average factor measurements	± 1.0 %

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

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

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

11 APPENDIX C Test laboratory description

Tests were performed at Hermon Laboratories Ltd., which is a fully independent, private, EMC, safety, environmental and telecommunication testing facility.

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

Address: P.O. Box 23, Binyamina 30500, Israel.
Telephone: +972 4628 8001
Fax: +972 4628 8277
e-mail: mail@hermonlabs.com
website: www.hermonlabs.com

Person for contact: Mr. Alex Usoskin, CEO.

12 APPENDIX D Specification references

FCC 47CFR part 90: 2010	Private land mobile radio services
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
662911 D01: 4/04/2011	FCC Guidance for Multiple Transmitter Output v01

13 APPENDIX E Test equipment correction factors

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

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

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

Antenna factor
Standard gain horn antenna
Quinstar Technology
Model QWH, Ser.No.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(μ V) to convert it into field intensity in dB(μ V/m).

Antenna factor

Biconilog antenna EMCO, model 3141, serial number 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	560	19.8	1300	27.0
28	7.8	580	20.6	1320	27.8
30	7.8	600	21.3	1340	28.3
40	7.2	620	21.5	1360	28.2
60	7.1	640	21.2	1380	27.9
70	8.5	660	21.4	1400	27.9
80	9.4	680	21.9	1420	27.9
90	9.8	700	22.2	1440	27.8
100	9.7	720	22.2	1460	27.8
110	9.3	740	22.1	1480	28.0
120	8.8	760	22.3	1500	28.5
130	8.7	780	22.6	1520	28.9
140	9.2	800	22.7	1540	29.6
150	9.8	820	22.9	1560	29.8
160	10.2	840	23.1	1580	29.6
170	10.4	860	23.4	1600	29.5
180	10.4	880	23.8	1620	29.3
190	10.3	900	24.1	1640	29.2
200	10.6	920	24.1	1660	29.4
220	11.6	940	24.0	1680	29.6
240	12.4	960	24.1	1700	29.8
260	12.8	980	24.5	1720	30.3
280	13.7	1000	24.9	1740	30.8
300	14.7	1020	25.0	1760	31.1
320	15.2	1040	25.2	1780	31.0
340	15.4	1060	25.4	1800	30.9
360	16.1	1080	25.6	1820	30.7
380	16.4	1100	25.7	1840	30.6
400	16.6	1120	26.0	1860	30.6
420	16.7	1140	26.4	1880	30.6
440	17.0	1160	27.0	1900	30.6
460	17.7	1180	27.0	1920	30.7
480	18.1	1200	26.7	1940	30.9
500	18.5	1220	26.5	1960	31.2
520	19.1	1240	26.5	1980	31.6
540	19.5	1260	26.5	2000	32.0
		1280	26.6		

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

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

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

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

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, 0.9 m, SMA-SMA, S/N 10020014
HL 2951

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

Cable loss
Cable coaxial, 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
Microwave Cable Assembly, 18 GHz, 6.4 m, SMA – SMA, Huber-Suhner, model 198-9155-00
HL 3123

Frequency, MHz	Cable loss, dB	Frequency, MHz	Cable loss, dB	Frequency, MHz	Cable loss, dB	Frequency, MHz	Cable loss, dB	Frequency, MHz	Cable loss, dB
10	0.11	3600	1.97	7400	3.12	11200	3.90	15100	4.74
30	0.17	3700	1.97	7500	3.13	11300	3.93	15200	4.70
50	0.25	3800	2.03	7600	3.16	11400	3.88	15300	4.73
100	0.32	3900	2.04	7700	3.18	11500	3.87	15400	4.78
200	0.46	4000	2.10	7800	3.20	11600	3.90	15500	4.75
300	0.58	4100	1.97	7900	3.23	11700	3.86	15600	4.76
400	0.65	4200	1.97	8000	3.25	11800	3.88	15700	4.75
500	0.74	4300	2.03	8100	3.26	11900	3.86	15800	4.78
600	0.82	4400	2.04	8200	3.28	12000	3.89	15900	4.79
700	0.89	4500	2.10	8300	3.31	12100	3.94	16000	4.73
800	0.95	4600	1.97	8400	3.31	12200	3.92	16100	4.78
900	1.01	4700	1.97	8500	3.32	12300	3.96	16200	4.84
1000	1.07	4800	2.03	8600	3.34	12400	4.01	16300	4.90
1100	1.11	4900	2.04	8700	3.35	12500	4.07	16400	4.87
1200	1.17	5000	2.10	8800	3.37	12600	4.08	16500	4.90
1300	1.22	5100	2.53	8900	3.39	12700	4.17	16600	4.98
1400	1.27	5200	2.55	9000	3.42	12800	4.26	16700	5.05
1500	1.29	5300	2.60	9100	3.43	12900	4.16	16800	5.04
1600	1.35	5400	2.61	9200	3.51	13000	4.21	16900	5.02
1700	1.40	5500	2.64	9300	3.52	13100	4.24	17000	5.09
1800	1.44	5600	2.70	9400	3.54	13200	4.27	17100	5.07
1900	1.51	5700	2.67	9500	3.63	13300	4.31	17200	5.10
2000	1.49	5800	2.71	9600	3.61	13400	4.33	17300	5.13
2100	1.55	5900	2.74	9700	3.71	13500	4.25	17400	5.23
2200	1.58	6000	2.80	9800	3.66	13600	4.27	17500	5.21
2300	1.62	6100	2.79	9900	3.77	13700	4.33	17600	5.22
2400	1.72	6200	2.81	10000	3.75	13800	4.33	17700	5.36
2500	1.76	6300	2.83	10100	3.77	13900	4.31	17800	5.35
2600	1.78	6400	2.86	10200	3.80	14000	4.30	17900	5.45
2700	1.80	6500	2.88	10300	3.79	14100	4.30	18000	5.43
2800	1.86	6600	2.90	10400	3.87	14200	4.31		
2900	1.90	6700	2.92	10500	3.83	14300	4.37		
3000	1.90	6800	2.98	10600	3.88	14400	4.35		
3100	1.97	6900	2.98	10700	3.86	14600	4.53		
3200	1.97	7000	3.00	10800	3.87	14700	4.50		
3300	2.03	7100	3.02	10900	3.90	14800	4.62		
3400	2.04	7200	3.04	11000	3.84	14900	4.65		
3500	2.10	7300	3.06	11100	3.88	15000	4.79		



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

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

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

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

Cable loss
Cable coaxial, Microwave, SMA-SMA, 18 GHz, 0.6 m
Gore, HL 3474

Frequency, MHz	Cable loss, dB	Frequency, MHz	Cable loss, dB	Frequency, MHz	Cable loss, dB	Frequency, MHz	Cable loss, dB
10	0.00	5000	0.44	10200	0.72	15500	0.84
30	0.02	5100	0.44	10300	0.68	15600	0.95
50	0.03	5200	0.44	10400	0.75	15700	0.82
100	0.03	5300	0.44	10500	0.64	15800	0.94
200	0.07	5400	0.46	10600	0.75	15900	0.91
300	0.10	5500	0.45	10700	0.80	16000	0.91
400	0.11	5600	0.46	10800	0.77	16100	0.86
500	0.12	5700	0.47	10900	0.80	16200	0.86
600	0.14	5800	0.48	11000	0.79	16300	0.86
700	0.14	5900	0.48	11100	0.70	16400	0.84
800	0.15	6000	0.49	11200	0.76	16500	0.83
900	0.18	6100	0.51	11300	0.70	16600	0.87
1000	0.17	6200	0.50	11400	0.73	16700	0.90
1100	0.18	6300	0.50	11500	0.67	16800	0.91
1200	0.21	6400	0.51	11600	0.74	16900	0.90
1300	0.20	6500	0.51	11700	0.64	17000	0.97
1400	0.21	6600	0.52	11800	0.68	17100	0.94
1500	0.22	6700	0.54	11900	0.67	17200	1.01
1600	0.23	6800	0.51	12000	0.71	17300	0.97
1700	0.23	6900	0.55	12100	0.64	17400	1.02
1800	0.24	7000	0.54	12200	0.64	17500	1.06
1900	0.25	7100	0.55	12300	0.71	17600	1.01
2000	0.27	7200	0.55	12400	0.62	17700	1.10
2100	0.26	7300	0.54	12500	0.80	17800	1.16
2200	0.28	7400	0.52	12600	0.69	17900	1.12
2300	0.28	7500	0.58	12700	0.85	18000	1.00
2400	0.28	7600	0.56	12800	0.67		
2500	0.29	7700	0.57	12900	0.84		
2600	0.30	7800	0.62	13000	0.76		
2700	0.31	7900	0.57	13100	0.85		
2800	0.32	8000	0.55	13200	0.77		
2900	0.32	8100	0.59	13300	0.82		
3000	0.32	8200	0.59	13400	0.79		
3100	0.33	8300	0.60	13500	0.82		
3200	0.33	8400	0.66	13600	0.91		
3300	0.35	8500	0.60	13700	0.81		
3400	0.35	8600	0.59	13800	0.76		
3500	0.36	8700	0.59	13900	0.75		
3600	0.36	8800	0.58	14000	0.81		
3700	0.37	8900	0.60	14100	0.77		
3800	0.38	9000	0.60	14200	0.89		
3900	0.38	9100	0.60	14300	0.92		
4000	0.38	9200	0.57	14400	0.78		
4100	0.41	9300	0.57	14600	0.85		
4200	0.40	9400	0.58	14700	0.83		
4300	0.41	9500	0.60	14800	0.95		
4400	0.42	9600	0.62	14900	0.89		
4500	0.43	9700	0.58	15000	0.96		
4600	0.42	9800	0.63	15100	0.90		
4700	0.44	9900	0.58	15200	0.96		
4800	0.43	10000	0.67	15300	0.90		
4900	0.44	10100	0.69	15400	0.95		

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

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

Cable loss
Cable coaxial, 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

14 APPENDIX F Abbreviations and acronyms

A	ampere
AC	alternating current
A/m	ampere per meter
AM	amplitude modulation
AVRG	average (detector)
cm	centimeter
dB	decibel
dBm	decibel referred to one milliwatt
dB(μ V)	decibel referred to one microvolt
dB(μ V/m)	decibel referred to one microvolt per meter
dB(μ A)	decibel referred to one microampere
dB Ω	decibel referred to one Ohm
DC	direct current
EIRP	equivalent isotropically radiated power
ERP	effective radiated power
EUT	equipment under test
F	frequency
GHz	gigahertz
GND	ground
H	height
HL	Hermon laboratories
Hz	hertz
ITE	information technology equipment
k	kilo
kHz	kilohertz
LO	local oscillator
m	meter
MHz	megahertz
min	minute
mm	millimeter
ms	millisecond
μ s	microsecond
NA	not applicable
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