HERMON LABORATORIES

ELECTRICAL TESTING
0839.01

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TEST REPORT

ACCORDING TO: FCC 47CFR part 90, subpart Z

FOR:

Airspan Networks (Israel) Ltd.
Terminal station
Model: SSRM 3.65GHz
FCC ID:PIDASMAX3700

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1 Applicant information

Client name:	Airspan Networks Inc.
Address:	777 Yamato, Road Suite 310 Boca Raton, FL 33431, USA
Telephone:	+1 561 893 8670
Fax:	+1 561 893 8671
E-mail:	zlevi@airspan.com
Contact name:	Mr. Zion Levi

2 Equipment under test attributes

Product name:	Terminal station
Product type:	Transceiver
Model(s):	SSRM 3.65 GHz
Serial number:	A2DFC6D20ED2
Hardware version:	Ver D
Software release:	10.3.1.23
Receipt date	4/10/2013

3 Manufacturer information

Manufacturer name:	Airspan Networks Inc.
Address:	777 Yamato, Road Suite 310 Boca Raton, FL 33431, USA
Telephone:	+1 561 893 8670
Fax:	+1 561 893 8671
E-Mail:	zlevi@airspan.com
Contact name:	Mr. Zion Levi

4 Test details

Project ID:	24404
Location:	Hermon Laboratories Ltd. Harakevet Industrial Zone, Binyamina 30500, Israel
Test started:	4/10/2013
Test completed:	4/14/2013
Test specification(s):	FCC 47CFR part 90, subpart Z

5 Tests summary

Test	Status
Transmitter characteristics	
Section 90.1321, Maximum conducted output power	Pass
Section 90.1321, Peak EIRP power density	Pass
Section 90.209, Occupied bandwidth	Pass
Section 90.210(b), Emission mask	Pass
Section 90.1323, Spurious emissions at RF antenna connector	Pass
Section 90.1323, Radiated spurious emissions	Pass
Section 90.213, Frequency stability	Not required*
Section 90.1335, RF exposure	Not required*

The product was approved by FCC under FCC ID:PIDASMAX3700.

The RF power amplifiers U13 and U24 of RF5623 type in the approved device have been replaced with AWT6283R type in order to improve the RF output signal performance (EVM) and linearity.

Only relevant tests were performed for application for Class II permissive change. No changes in RF output power beyond ±0.5 dB was observed and no changes in the frequency stabilizing circuit were implemented.

* Test results provided in approved test report AIRRAD_FCC.23306.

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	April 14, 2013	
Reviewed by:	Mrs. M. Cherniavsky, certification engineer	April 22, 2013	
Approved by:	Mr. M. Nikishin, EMC and Radio group leader	April 28, 2013	

6 EUT description

6.1 General information

The EUT, subscriber premises radio, SSRM 3.65 GHz TDD 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 SSRM's transceiver/receiver (up to 64 QAM modulation, data rate up to 46 Mbps) uses OFDMA and operating in TDD duplexing mode.

6.2 Ports and lines

Port type	Port description	Connected from	Connected to	Qty.	Cable type	Cable length, m
Power	DC power	Power Supply	PC MCI Extender	1	Unshielded	1.5
Signal	Power/Data	PCI Extender	EUT	1	Flat cable 2x26	0.15
RF	Antenna	EUT	Open circuit	2	NA	NA

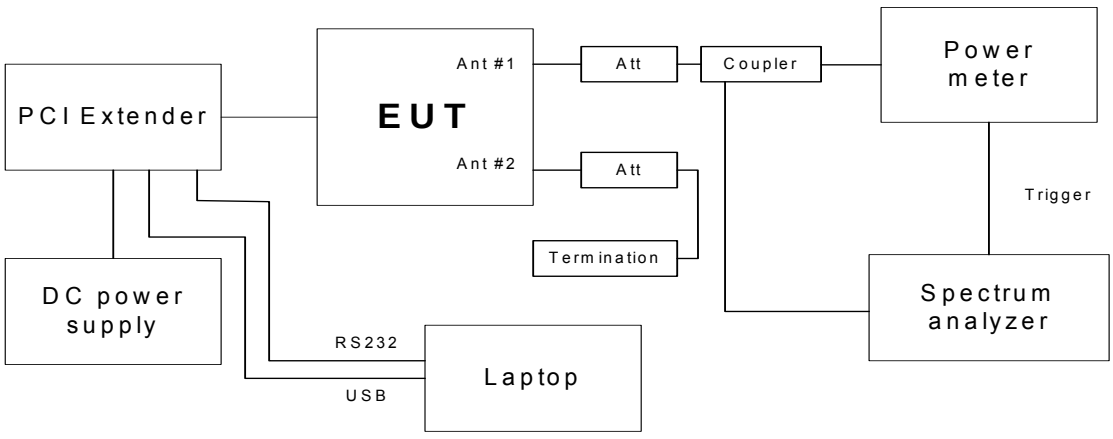
6.3 Support and test equipment

Description	Manufacturer	Model number	Serial number
5.5 VDC power supply	Fuhua	UE15WCP	0000298
Mini PCI Express Male to Female Extender	Orbit Micro	DRU-149-81772	NA
Laptop	IBM	ThinkPad T43	L3-AFKW5 05/09
AC/DC Adapter	IBM	08K8202	Z1ZAPW5940EL

6.4 Changes made in EUT

No changes were implemented in the EUT during testing.

6.5 Test configuration



6.6 Transmitter characteristics

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

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

Assigned frequency range	3650.0 – 3700.0 MHz
Operating frequency range	3652.5 – 3697.5 MHz for 5 MHz OBW 3655.0 – 3695.0 MHz for 10 MHz OBW
RF channel spacing	5, 10 MHz
Maximum rated output power	At transmitter 50 Ω RF output connector (aggregate power of both RF chains): 25.95 dBm – 5 MHz OBW; 26.35 dBm – 10 MHz OBW
	EIRP, dBm (with 19.5 dBi antenna): 35.26 dBm – 5 MHz OBW; 39.12 dBm – 10 MHz OBW

Is transmitter output power variable?				
	No			
V	Yes		continuous variable	
		V	stepped variable with stepsize	0.5 dB
		minimum RF power		-10 dBm
		maximum RF power		26.35 dBm

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

Antenna/s technical characteristics

Type	Manufacturer	Model number	Gain
Directional Panel Antenna	PCTEL	07-1161-01	19.5 dBi
Direct Mount LPT Style Antenna	Pulse Electronics	W1982	5.6 dBi

Transmitter aggregate data rate/s, Mbps			
Transmitter 99% power bandwidth	Type of modulation		
	QPSK	16QAM	64QAM
5 MHz	7	14	23
10 MHz	13	27	46

Type of multiplexing	OFDM
Modulating test signal (baseband)	PRBS
Maximum transmitter duty cycle in normal use	Maximum 38 %

Transmitter power source			
V	DC	Nominal rated voltage	5.5 VDC via PC MCI slot

Common power source for transmitter and receiver	V	yes	no

Test specification:	Section 90.1321, Maximum output power		
Test procedure:	47 CFR, Section 2.1046; TIA/EIA-603-C, Section 2.2.1		
Test mode:	Compliance	Verdict:	PASS
Date(s):	4/10/2013		
Temperature: 24.1 ºC	Air Pressure: 1014 hPa	Relative Humidity: 39 %	Power Supply: 5.5 VDC
Remarks:			

7 Transmitter tests according to FCC 47CFR part 90 requirements

7.1 Maximum output power

7.1.1 General

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

Table 7.1.1 Output power limits

Assigned frequency range, MHz	Occupied bandwidth, MHz	Maximum output power, EIRP	
		W	dBm
Base and fixed stations			
3650.0 – 3700.0	5	5	36.99
	10	10	40.00

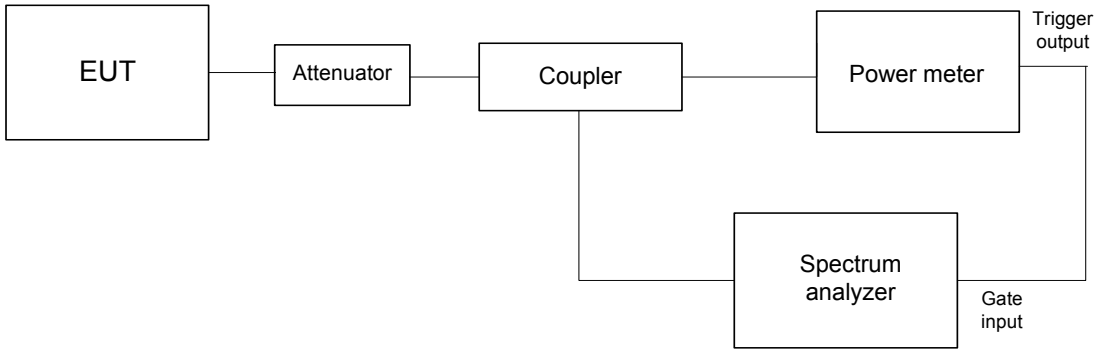
7.1.2 Test procedure

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

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

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

Figure 7.1.1 Output power test setup



Test specification:	**Section 90.1321, Maximum output power**		
Test procedure:	47 CFR, Section 2.1046; TIA/EIA-603-C, Section 2.2.1		
Test mode:	Compliance	**Verdict:**	PASS
Date(s):	4/10/2013		
Temperature: 24.1 ºC	**Air Pressure:** 1014 hPa	**Relative Humidity:** 39 %	**Power Supply:** 5.5 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
ANTENNA GAIN: 19.5 dBi
EBW: 5 MHz

Modulation& Bit rate, Mbps	Power meter reading, dBm	Total power*, dBm	EIRP**, dBm	Limit, dBm	Margin***, dB	Verdict
5 MHz BW, Low channel 3652.5 MHz						
QPSK, 7.0	12.76	15.76	35.26	37.0	-1.74	Pass
64QAM, 23.0	12.62	15.62	35.12	37.0	-1.88	Pass
5 MHz BW, Mid channel 3675.0 MHz						
QPSK, 7.0	12.70	15.70	35.20	37.0	-1.80	Pass
64QAM, 23.0	12.53	15.53	35.03	37.0	-1.97	Pass
5 MHz BW, High channel 3697.5 MHz						
QPSK, 7.0	12.57	15.57	35.07	37.0	-1.93	Pass
64QAM, 23.0	12.35	15.35	34.85	37.0	-2.15	Pass

EBW: 10 MHz

10 MHz BW, Low channel 3655 MHz						
QPSK, 13.0	16.19	19.19	38.69	40.0	-1.31	Pass
64QAM, 46.0	16.62	19.62	39.12	40.0	-0.88	Pass
10 MHz BW, Mid channel 3675.0 MHz						
QPSK, 13.0	16.14	19.14	38.64	40.0	-1.36	Pass
64QAM, 46.0	16.54	19.54	39.04	40.0	-0.96	Pass
10 MHz BW, High channel 3695.0 MHz						
QPSK, 13.0	16.49	19.49	38.99	40.0	-1.01	Pass
64QAM, 46.0	16.39	19.39	38.89	40.0	-1.11	Pass

* - Total power ,dBm = Power meter reading + 10*log(N)
** - EIRP, dBm = Total power*, dBm + Antenna Gain, dBi
*** - Margin, dB = EIRP, dBm – Limit, dBm

Test specification:	**Section 90.1321, Maximum output power**		
Test procedure:	47 CFR, Section 2.1046; TIA/EIA-603-C, Section 2.2.1		
Test mode:	Compliance	**Verdict:**	PASS
Date(s):	4/10/2013		
Temperature: 24.1 ºC	**Air Pressure:** 1014 hPa	**Relative Humidity:** 39 %	**Power Supply:** 5.5 VDC
Remarks:			

Table 7.1.3 Peak EIRP output power test results

ASSIGNED FREQUENCY RANGE: 3650.0 – 3700.0 MHz
DETECTOR USED: Average (Power Meter)
MODULATING SIGNAL: PRBS
TRANSMITTER OUTPUT POWER SETTINGS: Maximum
ANTENNA GAIN: 5.6 dBi
EBW: 5 MHz

Modulation& Bit rate, Mbps	Power meter reading, dBm	Total power*, dBm	EIRP**, dBm	Limit, dBm	Margin***, dB	Verdict
5 MHz BW, Low channel 3652.5 MHz						
QPSK, 7.0	22.75	25.75	31.35	37.0	-5.65	Pass
64QAM, 23.0	22.93	25.93	31.53	37.0	-5.47	Pass
5 MHz BW, Mid channel 3675.0 MHz						
QPSK, 7.0	22.95	25.95	31.55	37.0	-5.45	Pass
64QAM, 23.0	22.82	25.82	31.42	37.0	-5.58	Pass
5 MHz BW, High channel 3697.5 MHz						
QPSK, 7.0	22.82	25.82	31.42	37.0	-5.58	Pass
64QAM, 23.0	22.70	25.70	31.30	37.0	-5.70	Pass

EBW: 10 MHz

10 MHz BW, Low channel 3655 MHz						
QPSK, 13.0	23.35	26.35	31.95	40.0	-8.05	Pass
64QAM, 46.0	23.22	26.22	31.82	40.0	-8.18	Pass
10 MHz BW, Mid channel 3675.0 MHz						
QPSK, 13.0	23.31	26.31	31.91	40.0	-8.09	Pass
64QAM, 46.0	23.00	26.00	31.60	40.0	-8.40	Pass
10 MHz BW, High channel 3695.0 MHz						
QPSK, 13.0	23.19	26.19	31.79	40.0	-8.21	Pass
64QAM, 46.0	22.35	25.35	30.95	40.0	-9.05	Pass

* - Total power ,dBm = Power meter reading + 10*log(N)
** - EIRP, dBm = Total power*, dBm + Antenna Gain, dBi
*** - Margin, dB = EIRP, dBm – Limit, dBm

Reference numbers of test equipment used

HL 2214	HL 3301	HL 3302	HL 3818	HL 3901			

Full description is given in Appendix A.

Test specification:	Section 90.1321, Peak EIRP power density		
Test procedure:	47 CFR, Sections 2.1046; TIA/EIA-603-C, Section 2.2.1		
Test mode:	Compliance	Verdict:	PASS
Date(s):	4/10/2013		
Temperature: 24.1 ºC	Air Pressure: 1014 hPa	Relative Humidity: 41 %	Power Supply: 5.5 VDC
Remarks:			

7.2 Peak EIRP power density

7.2.1 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 7.2.1 Peak output power limits

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

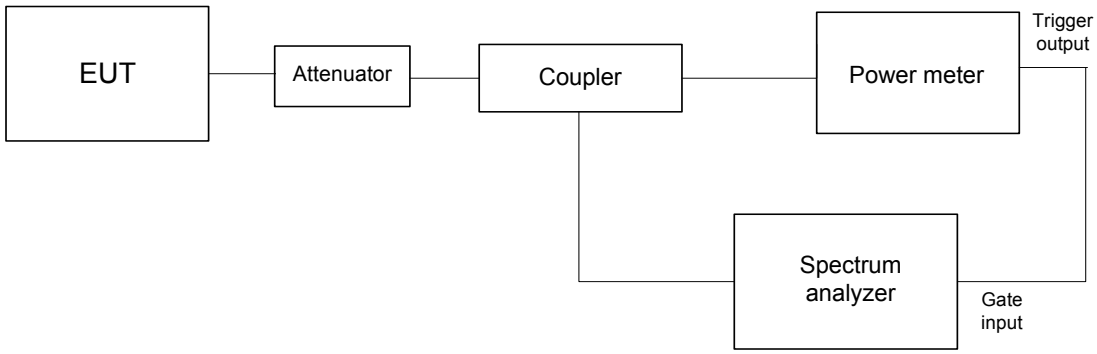
7.2.2 Test procedure

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

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

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

Figure 7.2.1 Peak output power test setup



Test specification:	Section 90.1321, Peak EIRP power density		
Test procedure:	47 CFR, Sections 2.1046; TIA/EIA-603-C, Section 2.2.1		
Test mode:	Compliance	Verdict:	PASS
Date(s):	4/10/2013		
Temperature: 24.1 ºC	Air Pressure: 1014 hPa	Relative Humidity: 41 %	Power Supply: 5.5 VDC
Remarks:			

Table 7.2.2 Peak EIRP power density test results

ASSIGNED FREQUENCY RANGE: 3650.0 – 3700.0 MHz
DETECTOR USED: Average (RMS)
RESOLUTION BANDWIDTH: 100 kHz with integration over a 1 MHz slice of spectrum
VIDEO BANDWIDTH: 300 kHz
MODULATING SIGNAL: PRBS
ANTENNA GAIN: 19.5 dBi
TRANSMITTER OUTPUT POWER SETTINGS: Maximum

EBW: 5 MHz

Channel, MHz	Modulation	SA reading (RF#2), dBm/MHz	Total power density *, dBm/MHz	Antenna gain, dBi	EIRP power density**, dBm/MHz	Limit, dBm/MHz	Margin, dB	Verdict
3652.5	QPSK	5.72	8.72	19.5	28.22	30.0	-1.78	Pass
3675.0	QPSK	5.71	8.71	19.5	28.21	30.0	-1.79	Pass
3697.5	QPSK	5.57	8.57	19.5	28.07	30.0	-1.93	Pass
3652.5	64QAM	5.52	8.52	19.5	28.02	30.0	-1.98	Pass
3675.0	64QAM	5.54	8.54	19.5	28.04	30.0	-1.96	Pass
3697.5	64QAM	5.37	8.37	19.5	27.87	30.0	-2.13	Pass

EBW: 10 MHz

Channel, MHz	Modulation	SA reading (RF#2), dBm/MHz	Total power density *, dBm/MHz	Antenna gain, dBi	EIRP power density**, dBm/MHz	Limit, dBm/MHz	Margin, dB	Verdict
3655.0	QPSK	6.57	9.57	19.5	29.07	30.0	-0.93	Pass
3675.0	QPSK	6.48	9.48	19.5	28.98	30.0	-1.02	Pass
3695.0	QPSK	6.86	9.86	19.5	29.36	30.0	-0.64	Pass
3655.0	64QAM	7.13	10.13	19.5	29.63	30.0	-0.37	Pass
3675.0	64QAM	6.32	9.32	19.5	28.82	30.0	-1.18	Pass
3695.0	64QAM	6.76	9.76	19.5	29.26	30.0	-0.74	Pass

* - Total power density, dBm/MHz = SA reading, dBm/MHz + 10*log(N)
** - EIRP power density, dBm/MHz = Total power density, dBm/MHz + Antenna gain, dBi

Test specification:	Section 90.1321, Peak EIRP power density		
Test procedure:	47 CFR, Sections 2.1046; TIA/EIA-603-C, Section 2.2.1		
Test mode:	Compliance	Verdict:	PASS
Date(s):	4/10/2013		
Temperature: 24.1 ºC	Air Pressure: 1014 hPa	Relative Humidity: 41 %	Power Supply: 5.5 VDC
Remarks:			

Table 7.2.3 Peak EIRP power density test results

ASSIGNED FREQUENCY RANGE: 3650.0 – 3700.0 MHz
DETECTOR USED: Average (RMS)
RESOLUTION BANDWIDTH: 100 kHz with integration over a 1 MHz slice of spectrum
VIDEO BANDWIDTH: 300 kHz
MODULATING SIGNAL: PRBS
ANTENNA GAIN: 5.6 dBi
TRANSMITTER OUTPUT POWER SETTINGS: Maximum

EBW: 5 MHz

Channel, MHz	Modulation	SA reading (RF#2), dBm/MHz	Total power density *, dBm/MHz	Antenna gain, dBi	EIRP power density**, dBm/MHz	Limit, dBm/MHz	Margin, dB	Verdict
3652.5	QPSK	15.36	18.36	5.6	23.96	30.0	-6.04	Pass
3675.0	QPSK	15.47	18.47	5.6	24.07	30.0	-5.93	Pass
3697.5	QPSK	15.28	18.28	5.6	23.88	30.0	-6.12	Pass
3652.5	64QAM	15.65	18.65	5.6	24.25	30.0	-5.75	Pass
3675.0	64QAM	15.49	18.49	5.6	24.09	30.0	-5.91	Pass
3697.5	64QAM	15.29	18.29	5.6	23.89	30.0	-6.11	Pass

EBW: 10 MHz

Channel, MHz	Modulation	SA reading (RF#2), dBm/MHz	Total power density *, dBm/MHz	Antenna gain, dBi	EIRP power density**, dBm/MHz	Limit, dBm/MHz	Margin, dB	Verdict
3655.0	QPSK	13.88	16.88	5.6	22.48	30.0	-7.52	Pass
3675.0	QPSK	13.74	16.74	5.6	22.34	30.0	-7.66	Pass
3695.0	QPSK	13.58	16.58	5.6	22.18	30.0	-7.82	Pass
3655.0	64QAM	13.77	16.77	5.6	22.37	30.0	-7.63	Pass
3675.0	64QAM	13.42	16.42	5.6	22.02	30.0	-7.98	Pass
3695.0	64QAM	12.71	15.71	5.6	21.31	30.0	-8.69	Pass

* - Total power density, dBm/MHz = SA reading, dBm/MHz + 10*log(N)
** - EIRP power density, dBm/MHz = Total power density, dBm/MHz + Antenna gain, dBi

Reference numbers of test equipment used

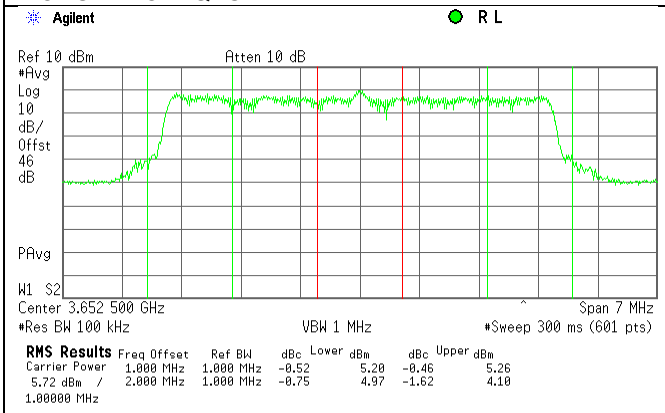
HL 2214	HL 3301	HL 3302	HL 3818	HL 3901			

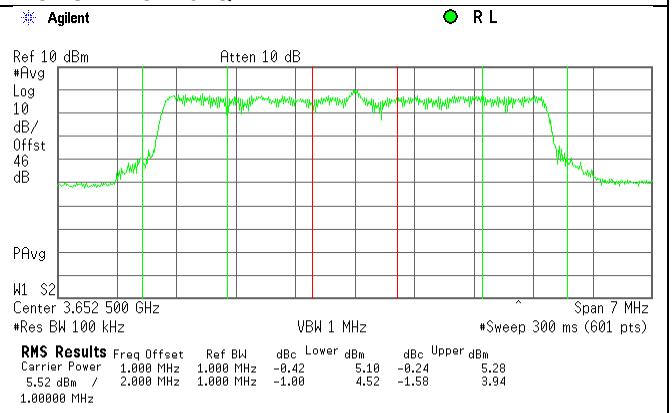
Full description is given in Appendix A.

Test specification:	Section 90.1321, Peak EIRP power density		
Test procedure:	47 CFR, Sections 2.1046; TIA/EIA-603-C, Section 2.2.1		
Test mode:	Compliance	Verdict:	PASS
Date(s):	4/10/2013		
Temperature: 24.1 °C	Air Pressure: 1014 hPa	Relative Humidity: 41 %	Power Supply: 5.5 VDC
Remarks:			

Plot 7.2.1 EIRP spectral density test results at low frequency, antenna gain 19.5 dBi

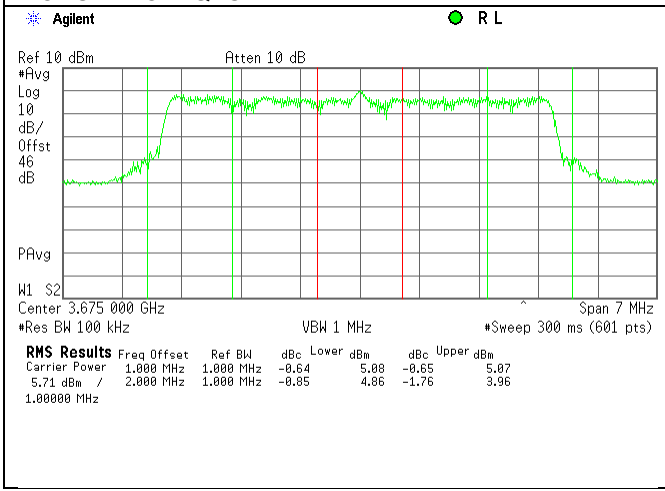
CARRIER FREQUENCY:	3652.5 MHz
EMISSION BANDWIDTH:	5 MHz
RF OUTPUT:	Antenna #2
MODULATION: QPSK	MODULATION: 64QAM

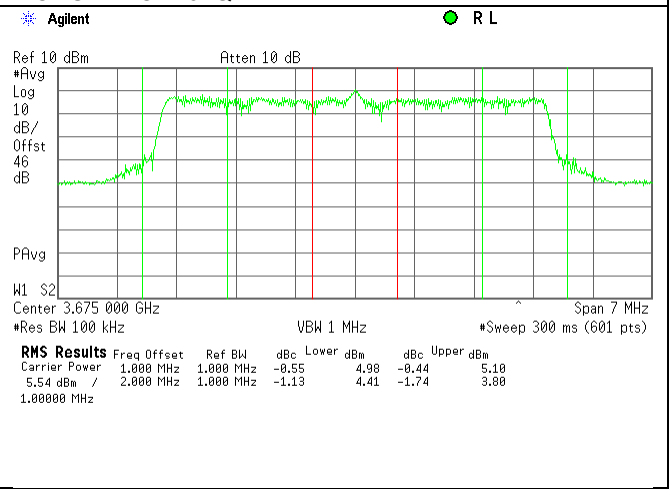




Plot 7.2.2 EIRP spectral density test results at mid frequency, antenna gain 19.5 dBi

CARRIER FREQUENCY:	3675.0 MHz
EMISSION BANDWIDTH:	5 MHz
RF OUTPUT:	Antenna #2
MODULATION: QPSK	MODULATION: 64QAM

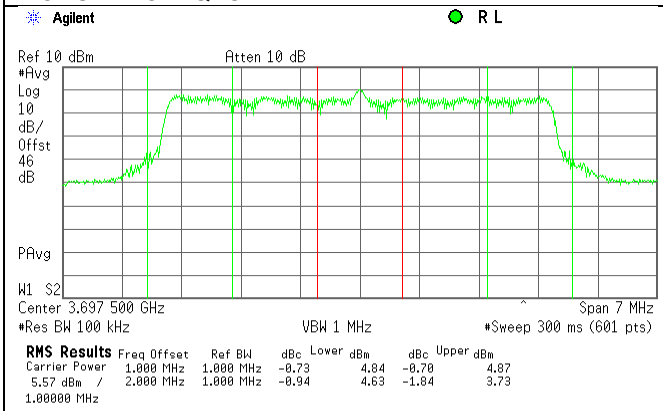


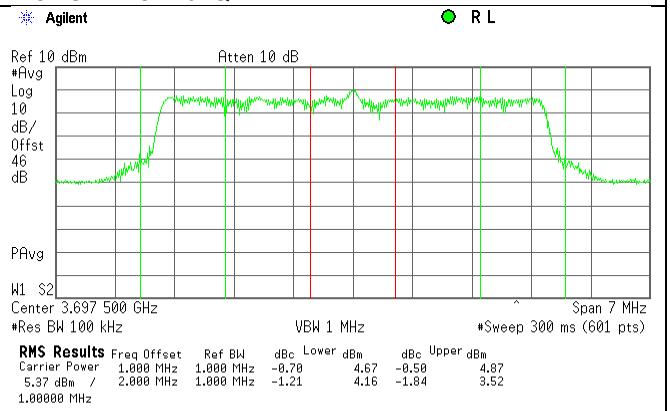


Test specification:	Section 90.1321, Peak EIRP power density		
Test procedure:	47 CFR, Sections 2.1046; TIA/EIA-603-C, Section 2.2.1		
Test mode:	Compliance	Verdict:	PASS
Date(s):	4/10/2013		
Temperature: 24.1 °C	Air Pressure: 1014 hPa	Relative Humidity: 41 %	Power Supply: 5.5 VDC
Remarks:			

Plot 7.2.3 EIRP spectral density test results at high frequency, antenna gain 19.5 dBi

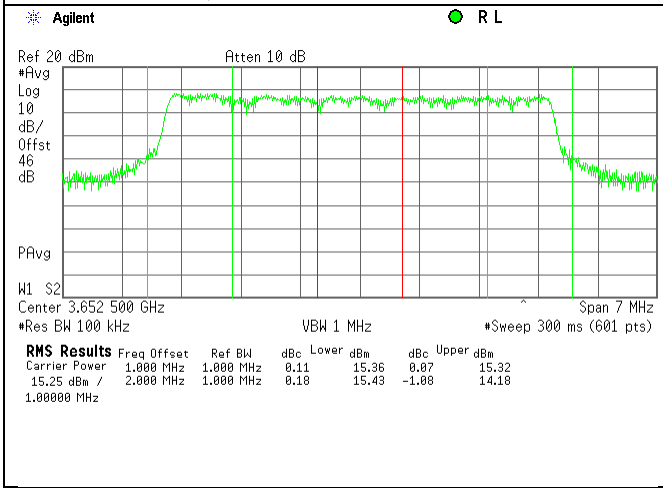
CARRIER FREQUENCY:	3697.5 MHz
EMISSION BANDWIDTH:	5 MHz
RF OUTPUT:	Antenna #2
MODULATION: QPSK	MODULATION: 64QAM

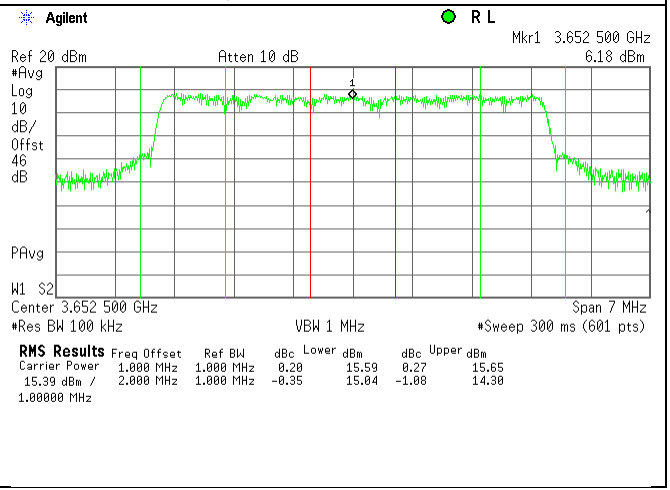




Plot 7.2.4 EIRP spectral density test results at low frequency, antenna gain 5.6 dBi

CARRIER FREQUENCY:	3652.5 MHz
EMISSION BANDWIDTH:	5 MHz
RF OUTPUT:	Antenna #2
MODULATION: QPSK	MODULATION: 64QAM

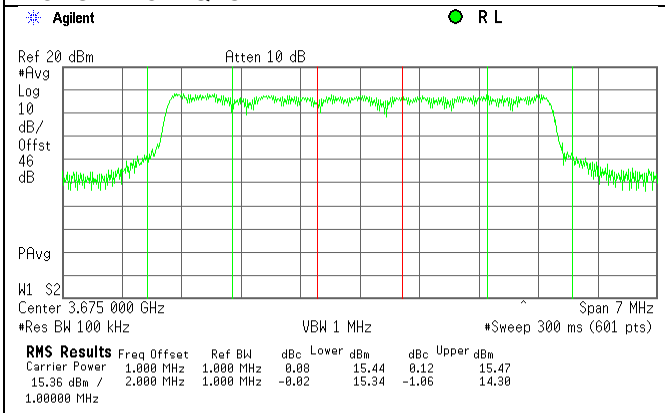


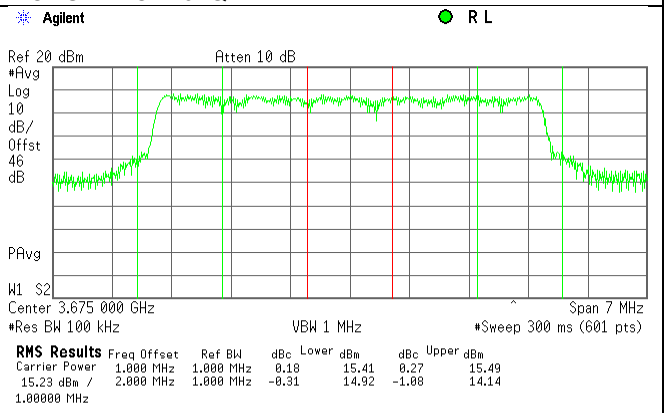


Test specification:	Section 90.1321, Peak EIRP power density		
Test procedure:	47 CFR, Sections 2.1046; TIA/EIA-603-C, Section 2.2.1		
Test mode:	Compliance	Verdict:	PASS
Date(s):	4/10/2013		
Temperature: 24.1 °C	Air Pressure: 1014 hPa	Relative Humidity: 41 %	Power Supply: 5.5 VDC
Remarks:			

Plot 7.2.5 EIRP spectral density test results at mid frequency, antenna gain 5.6 dBi

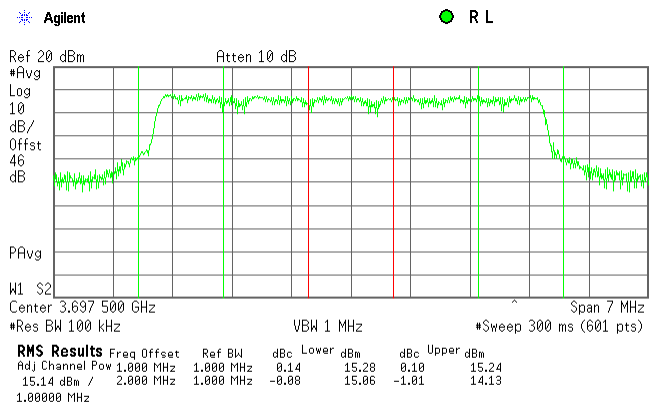
CARRIER FREQUENCY:	3675.0 MHz
EMISSION BANDWIDTH:	5 MHz
RF OUTPUT:	Antenna #2
MODULATION: QPSK	MODULATION: 64QAM

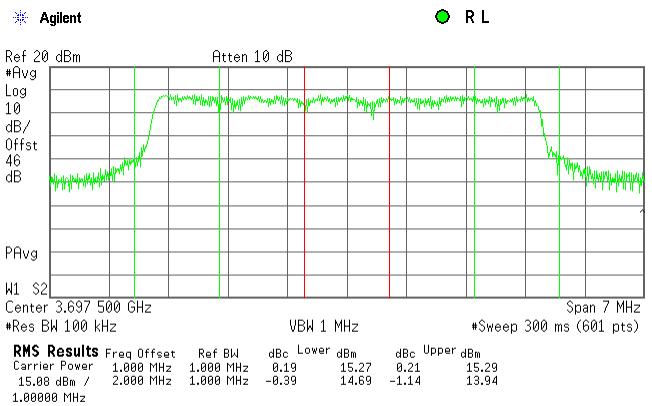




Plot 7.2.6 EIRP spectral density test results at high frequency, antenna gain 5.6 dBi

CARRIER FREQUENCY:	3697.5 MHz
EMISSION BANDWIDTH:	5 MHz
RF OUTPUT:	Antenna #2
MODULATION: QPSK	MODULATION: 64QAM

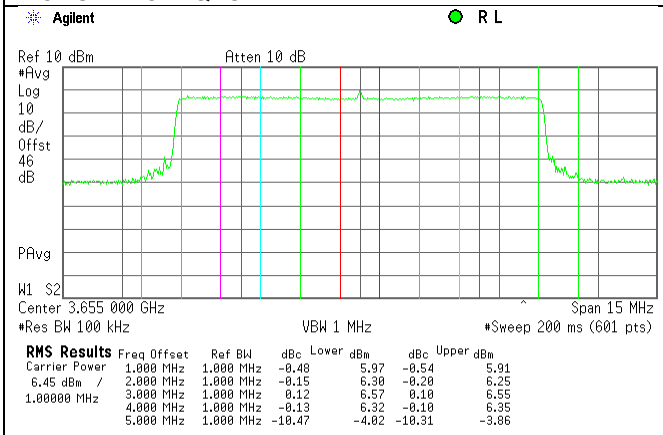


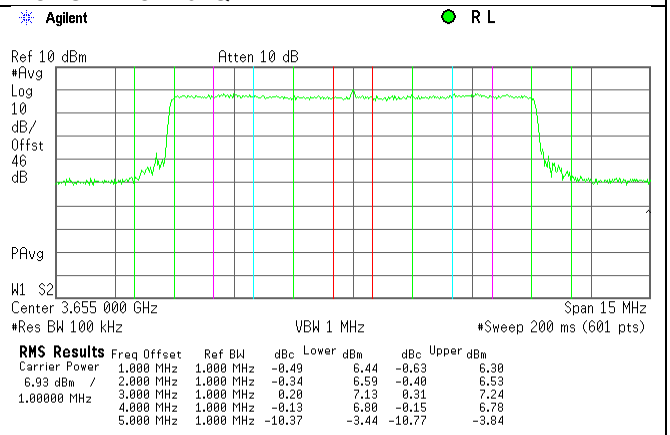


Test specification:	Section 90.1321, Peak EIRP power density		
Test procedure:	47 CFR, Sections 2.1046; TIA/EIA-603-C, Section 2.2.1		
Test mode:	Compliance	Verdict:	PASS
Date(s):	4/10/2013		
Temperature: 24.1 ºC	Air Pressure: 1014 hPa	Relative Humidity: 41 %	Power Supply: 5.5 VDC
Remarks:			

Plot 7.2.7 EIRP spectral density test results at low frequency, antenna gain 19.5 dBi

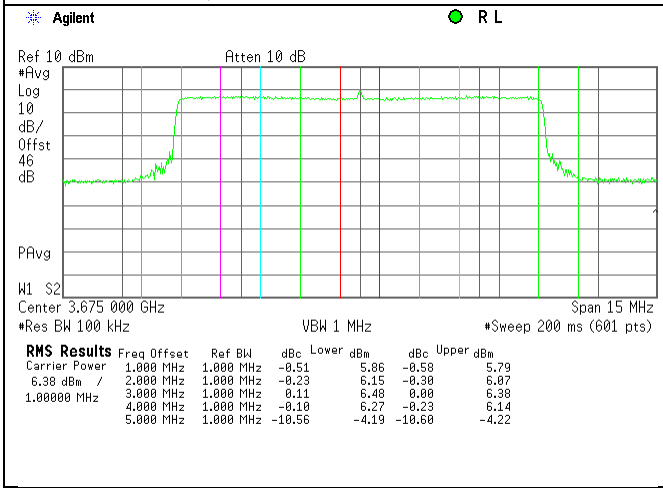
CARRIER FREQUENCY:	3680 MHz
EMISSION BANDWIDTH:	10 MHz
RF OUTPUT:	Antenna #2
MODULATION: QPSK	MODULATION: 64QAM

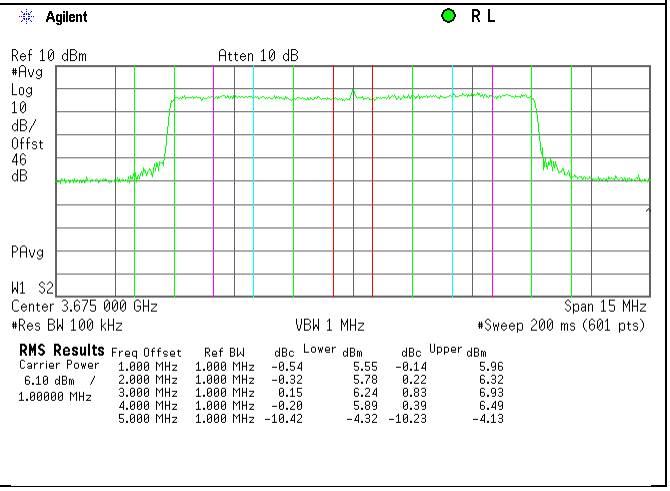




Plot 7.2.8 EIRP spectral density test results at mid frequency, antenna gain 19.5 dBi

CARRIER FREQUENCY:	3675.0 MHz
EMISSION BANDWIDTH:	10 MHz
RF OUTPUT:	Antenna #2
MODULATION: QPSK	MODULATION: 64QAM

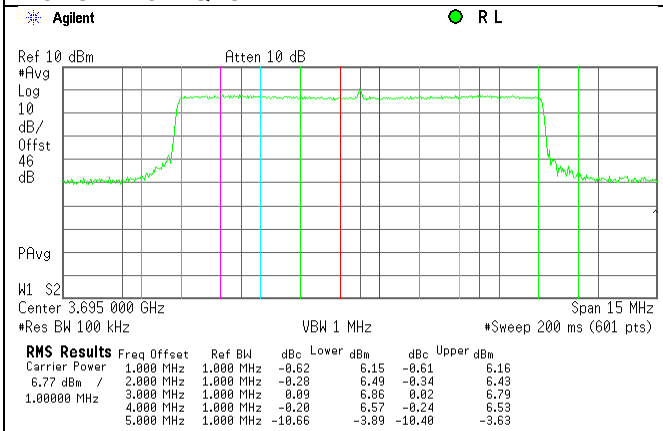


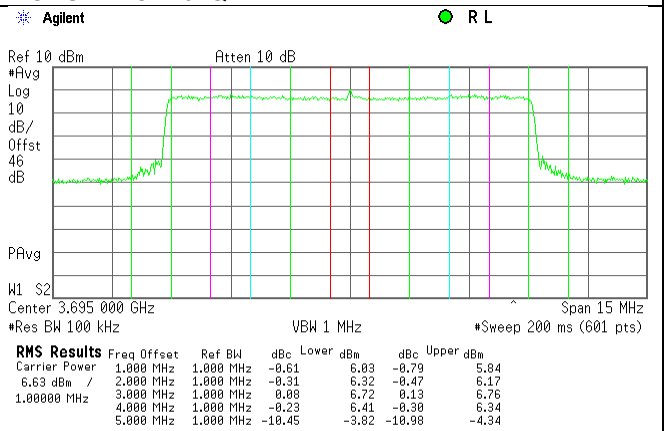


Test specification:	Section 90.1321, Peak EIRP power density		
Test procedure:	47 CFR, Sections 2.1046; TIA/EIA-603-C, Section 2.2.1		
Test mode:	Compliance	Verdict:	PASS
Date(s):	4/10/2013		
Temperature: 24.1 °C	Air Pressure: 1014 hPa	Relative Humidity: 41 %	Power Supply: 5.5 VDC
Remarks:			

Plot 7.2.9 EIRP spectral density test results at high frequency, antenna gain 19.5 dBi

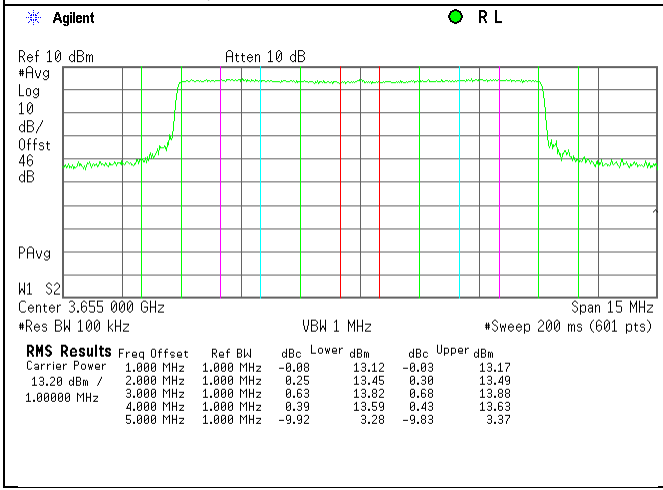
CARRIER FREQUENCY:	3695.0 MHz
EMISSION BANDWIDTH:	10 MHz
RF OUTPUT:	Antenna #2
MODULATION: QPSK	MODULATION: 64QAM

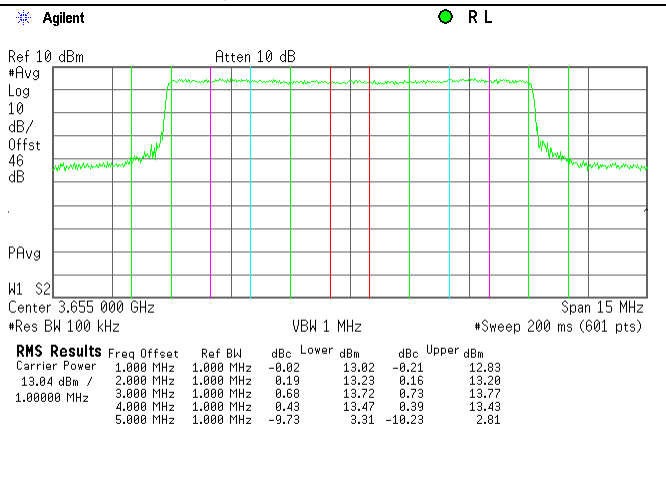




Plot 7.2.10 EIRP spectral density test results at low frequency, antenna gain 5.6 dBi

CARRIER FREQUENCY:	3680 MHz
EMISSION BANDWIDTH:	10 MHz
RF OUTPUT:	Antenna #2
MODULATION: QPSK	MODULATION: 64QAM

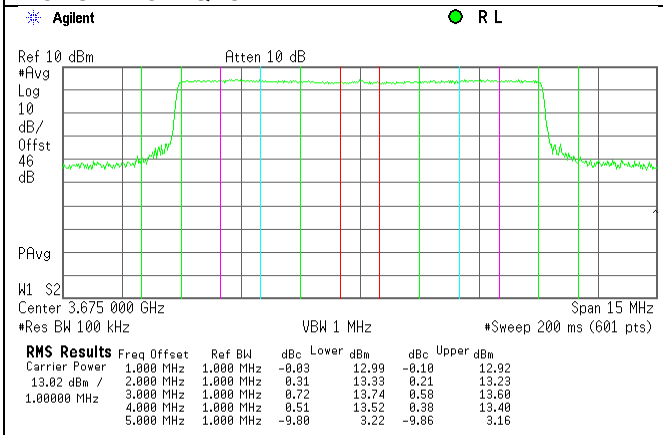


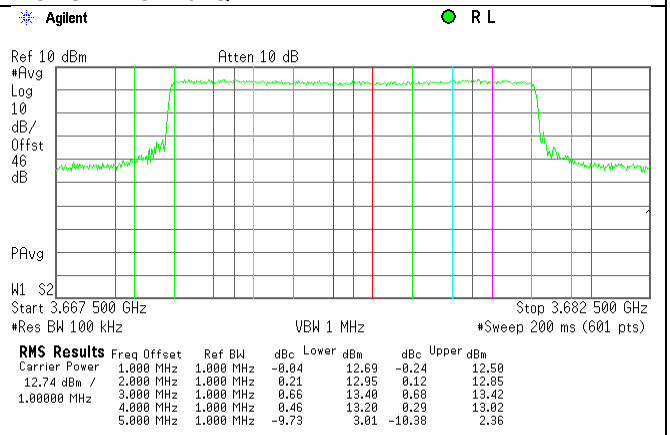


Test specification:	Section 90.1321, Peak EIRP power density		
Test procedure:	47 CFR, Sections 2.1046; TIA/EIA-603-C, Section 2.2.1		
Test mode:	Compliance	Verdict:	PASS
Date(s):	4/10/2013		
Temperature: 24.1 °C	Air Pressure: 1014 hPa	Relative Humidity: 41 %	Power Supply: 5.5 VDC
Remarks:			

Plot 7.2.11 EIRP spectral density test results at mid frequency, antenna gain 5.6 dBi

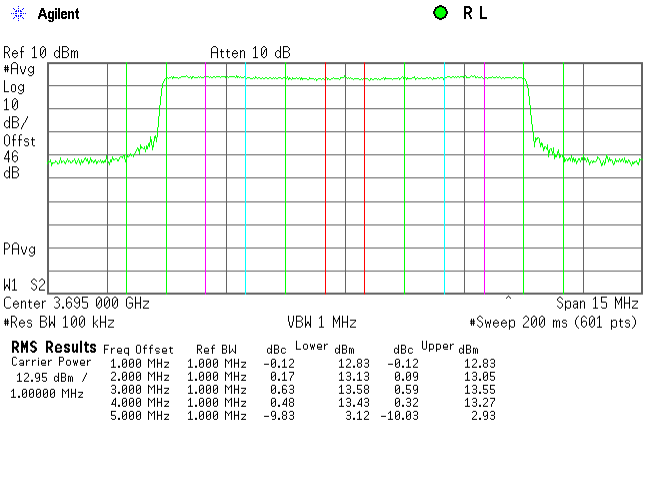
CARRIER FREQUENCY:	3675.0 MHz
EMISSION BANDWIDTH:	10 MHz
RF OUTPUT:	Antenna #2
MODULATION: QPSK	MODULATION: 64QAM

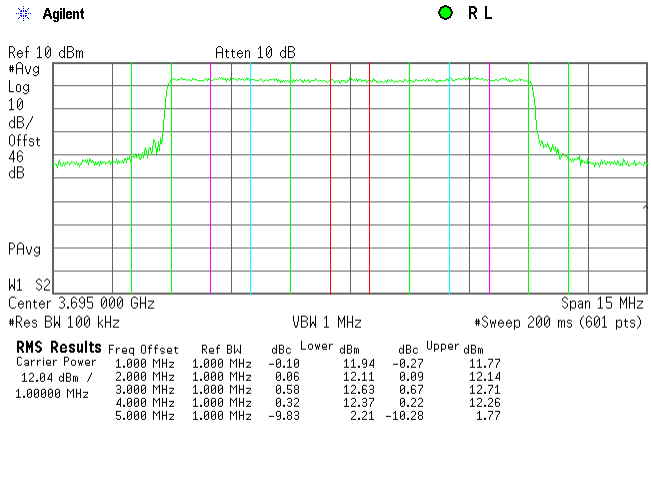




Plot 7.2.12 EIRP spectral density test results at high frequency, antenna gain 5.6 dBi

CARRIER FREQUENCY:	3695.0 MHz
EMISSION BANDWIDTH:	10 MHz
RF OUTPUT:	Antenna #2
MODULATION: QPSK	MODULATION: 64QAM





Test specification:	Section 90.209, Occupied bandwidth		
Test procedure:	47 CFR, Section 2.1049		
Test mode:	Compliance	Verdict:	PASS
Date(s):	4/10/2013		
Temperature: 24.1 ºC	Air Pressure: 1014 hPa	Relative Humidity: 41 %	Power Supply: 5.5 VDC
Remarks:			

7.3 Occupied bandwidth test

7.3.1 General

This test was performed to measure transmitter occupied bandwidth. Specification test limits are given in Table 7.3.1.

Table 7.3.1 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.

7.3.2 Test procedure

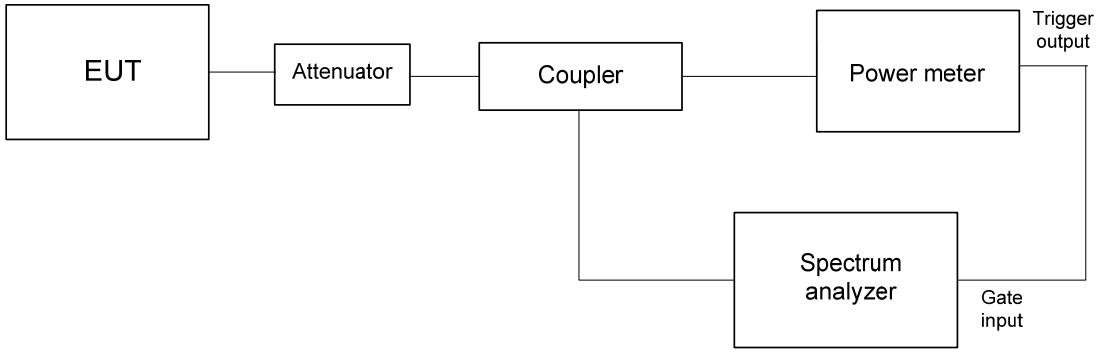
7.3.2.1 The EUT was set up as shown in Figure 7.3.1, energized and its proper operation was checked.

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

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

7.3.2.4 The transmitter occupied bandwidth was measured with spectrum analyzer as a frequency delta between the reference points on modulation envelope and provided in Table 7.3.2 and the associated plots.

Figure 7.3.1 Occupied bandwidth test setup



Test specification:	**Section 90.209, Occupied bandwidth**		
Test procedure:	47 CFR, Section 2.1049		
Test mode:	Compliance	**Verdict:**	PASS
Date(s):	4/10/2013		
Temperature: 24.1 ºC	**Air Pressure:** 1014 hPa	**Relative Humidity:** 41 %	**Power Supply:** 5.5 VDC
Remarks:			

Table 7.3.2 Occupied bandwidth test results

DETECTOR USED: Average
RESOLUTION BANDWIDTH: 0.5-2% of the Emission bandwidth
VIDEO BANDWIDTH: 3 times RBW
MODULATION ENVELOPE REFERENCE POINTS: 26 dB below total average power
MODULATING SIGNAL: PRBS
EMISSION BANDWIDTH: 5 MHz

Carrier frequency, MHz	Modulation	26 dBc Occupied bandwidth, MHz	Emission Bandwidth, MHz	Verdict
3652.5	QPSK	4.4772	5.0	Pass
3675.0	QPSK	4.4779	5.0	Pass
3697.5	QPSK	4.4755	5.0	Pass
3652.5	64QAM	4.4674	5.0	Pass
3675.0	64QAM	4.4698	5.0	Pass
3697.5	64QAM	4.4692	5.0	Pass

EMISSION BANDWIDTH: 10 MHz

Carrier frequency, MHz	Modulation	26 dBc Occupied bandwidth, MHz	Emission Bandwidth, MHz	Verdict
3655.0	QPSK	9.0786	10.0	Pass
3675.0	QPSK	9.0729	10.0	Pass
3695.0	QPSK	9.0852	10.0	Pass
3655.0	64QAM	9.0838	10.0	Pass
3675.0	64QAM	9.0706	10.0	Pass
3695.0	64QAM	9.0667	10.0	Pass

Reference numbers of test equipment used

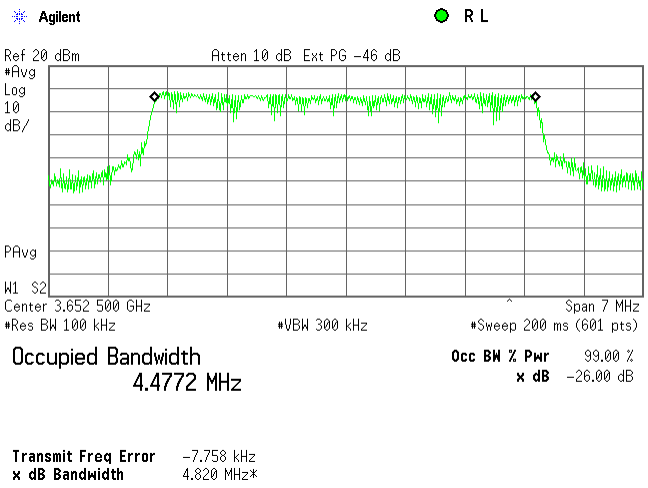
HL 2214	HL 3301	HL 3302	HL 3818	HL 3903			

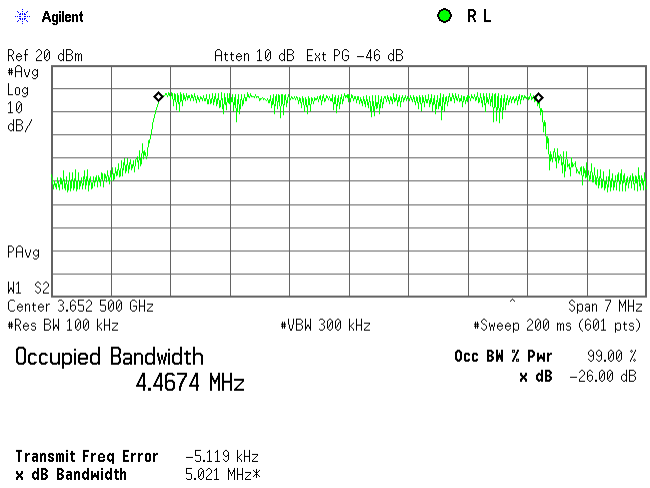
Full description is given in Appendix A.

Test specification:	Section 90.209, Occupied bandwidth		
Test procedure:	47 CFR, Section 2.1049		
Test mode:	Compliance	Verdict:	PASS
Date(s):	4/10/2013		
Temperature: 24.1 °C	Air Pressure: 1014 hPa	Relative Humidity: 41 %	Power Supply: 5.5 VDC
Remarks:			

Plot 7.3.1 Occupied bandwidth test result at low frequency

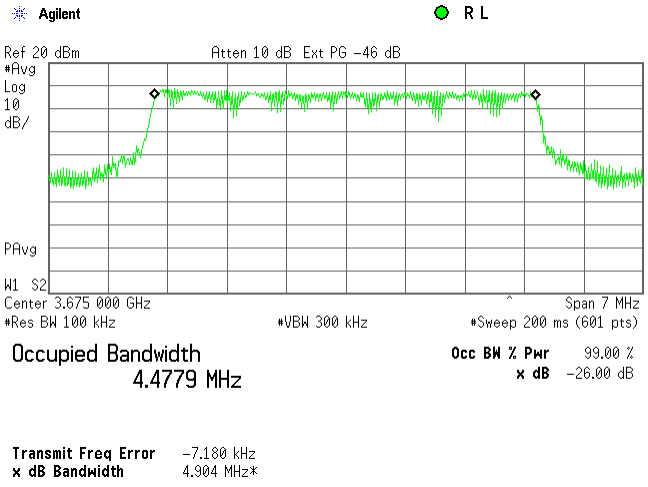
CARRIER FREQUENCY:	3652.5 MHz
EMISSION BANDWIDTH:	5 MHz
MODULATION: QPSK	MODULATION: 64QAM

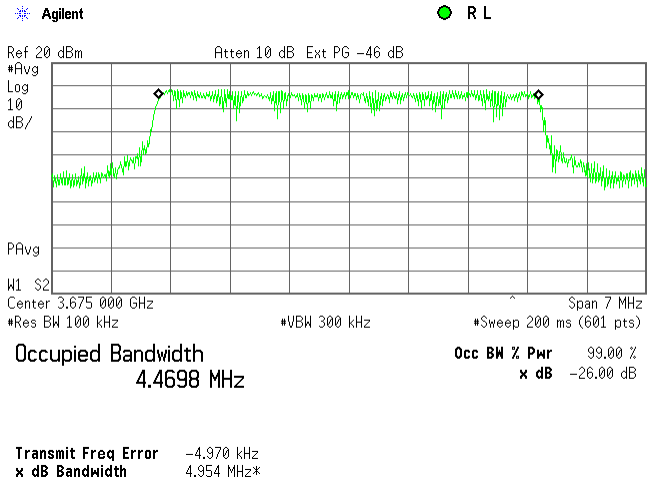




Plot 7.3.2 Occupied bandwidth test result at mid frequency

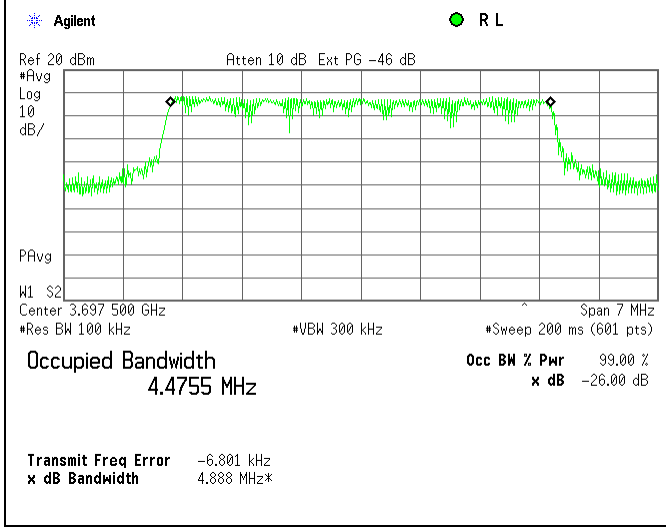
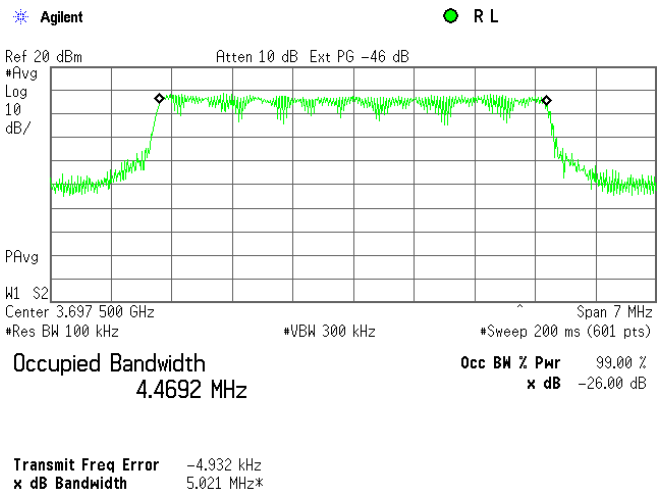
CARRIER FREQUENCY:	3675.0 MHz
EMISSION BANDWIDTH:	5 MHz
MODULATION: QPSK	MODULATION: 64QAM



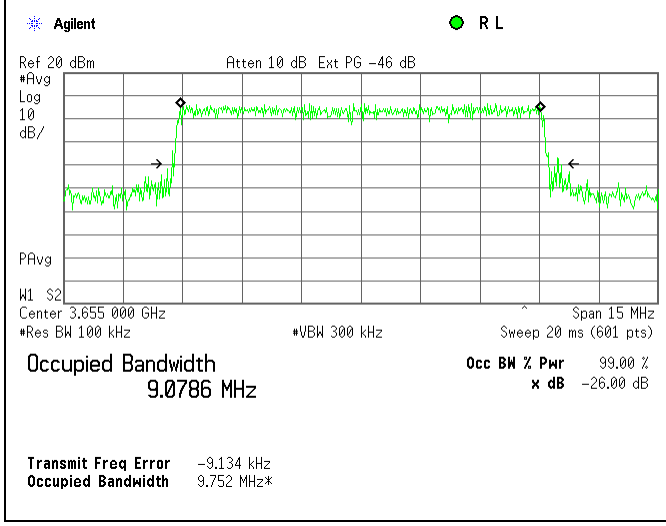
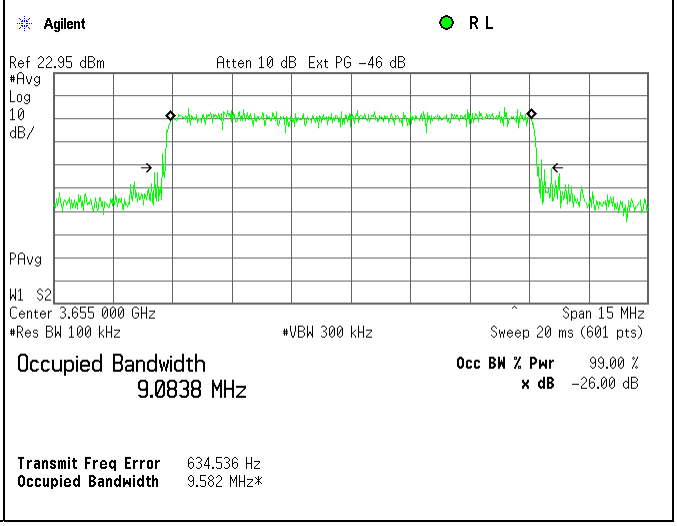


Test specification:	Section 90.209, Occupied bandwidth		
Test procedure:	47 CFR, Section 2.1049		
Test mode:	Compliance	Verdict:	PASS
Date(s):	4/10/2013		
Temperature: 24.1 °C	Air Pressure: 1014 hPa	Relative Humidity: 41 %	Power Supply: 5.5 VDC
Remarks:			

Plot 7.3.3 Occupied bandwidth test result at high frequency

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

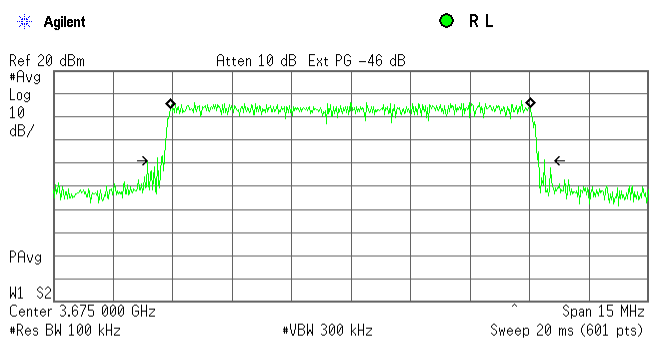
Plot 7.3.4 Occupied bandwidth test result at low frequency

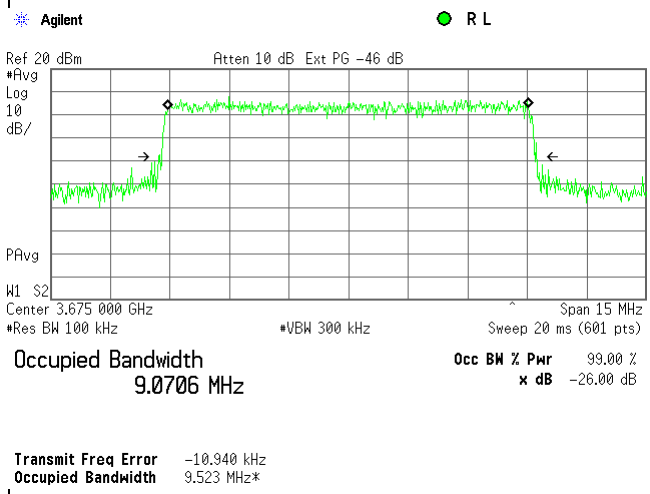
CARRIER FREQUENCY:	3655.0 MHz
EMISSION BANDWIDTH:	10 MHz
MODULATION: QPSK	MODULATION: 64QAM
	

Test specification:	Section 90.209, Occupied bandwidth		
Test procedure:	47 CFR, Section 2.1049		
Test mode:	Compliance	Verdict:	PASS
Date(s):	4/10/2013		
Temperature: 24.1 °C	Air Pressure: 1014 hPa	Relative Humidity: 41 %	Power Supply: 5.5 VDC
Remarks:			

Plot 7.3.5 Occupied bandwidth test result at mid frequency

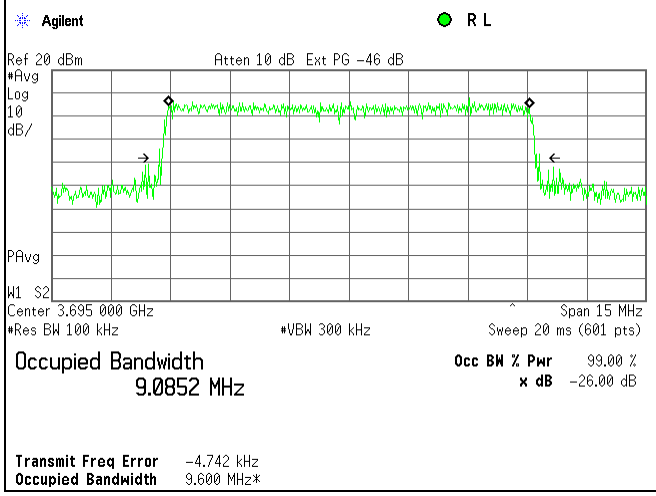
CARRIER FREQUENCY:	3675.0 MHz
EMISSION BANDWIDTH:	10 MHz
MODULATION: QPSK	MODULATION: 64QAM

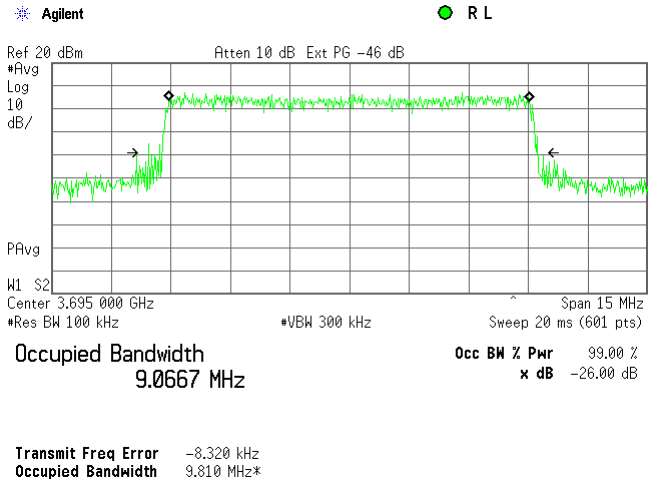




Plot 7.3.6 Occupied bandwidth test result at high frequency

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





Test specification:	Section 90.210(b), Emission mask		
Test procedure:	47 CFR, Sections 2.1051, 2.1047, 90.210; TIA/EIA-603-C, Section 2.2.13		
Test mode:	Compliance	Verdict:	PASS
Date(s):	4/10/2013		
Temperature: 24.1 ºC	Air Pressure: 1014 hPa	Relative Humidity: 41 %	Power Supply: 5.5 VDC
Remarks:			

7.4 Emission mask test

7.4.1 General

This test was performed to measure emission mask at RF antenna connector. Specification test limits are given in Table 7.4.1.

Table 7.4.1 Emission mask limits

Frequency displacement from carrier	Attenuation below carrier, dBc
Emission mask B (Emission bandwidth 5 MHz)	
0 – 2.5 MHz	0
2.5 – 5.0 MHz	25
5.0 – 12.5 MHz	35
More than* 12.5 MHz	43 + 10 log(P)
Emission mask B (Emission bandwidth 10 MHz)	
0 – 5 MHz	0
5 – 10.0 MHz	25
10.0 – 25.0 MHz	35
More than* 25.0 MHz	43 + 10 log(P)

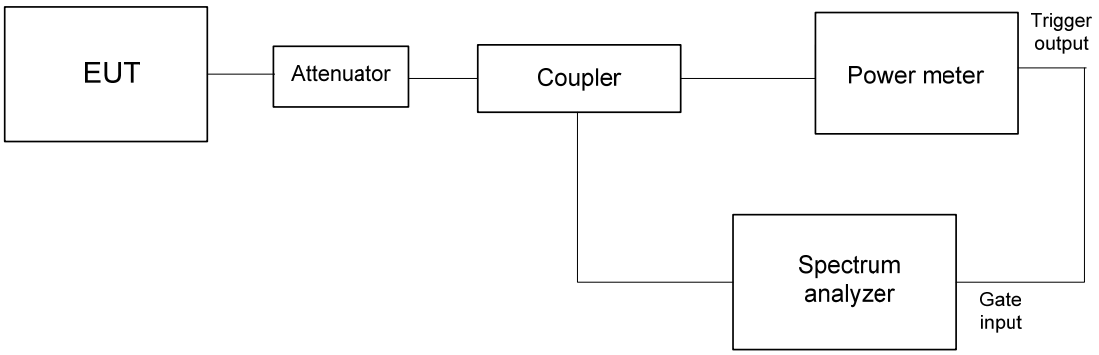
* - emission mask includes carrier modulation envelope within ± 250 % of the authorized bandwidth; the frequency range removed beyond ± 250 % of the authorized bandwidth from carrier was investigated as spurious emission

7.4.2 Test procedure

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

7.4.2.2 The emission mask was measured with spectrum analyzer as provided in the associated plots. The test results recorded in Table 7.4.2.

Figure 7.4.1 Emission mask test setup



Test specification:	**Section 90.210(b), Emission mask**		
Test procedure:	47 CFR, Sections 2.1051, 2.1047, 90.210; TIA/EIA-603-C, Section 2.2.13		
Test mode:	Compliance	**Verdict:**	PASS
Date(s):	4/10/2013		
Temperature: 24.1 ºC	**Air Pressure:** 1014 hPa	**Relative Humidity:** 41 %	**Power Supply:** 5.5 VDC
Remarks:			

Table 7.4.2 Emission mask test results

EMISSION BANDWIDTH: 5 MHz

Carrier frequency, MHz	Limit	Reference to Plot	Verdict
3652.5	Emission mask B	Plot 7.4.1	Pass
3675.0		Plot 7.4.2	
3697.5		Plot 7.4.3	

EMISSION BANDWIDTH: 10 MHz

Carrier frequency, MHz	Limit	Reference to Plot	Verdict
3655.0	Emission mask B	Plot 7.4.4	Pass
3675.0		Plot 7.4.5	
3695.0		Plot 7.4.6	

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*log(1 MHz/ 100 kHz] = 10 dB

Reference numbers of test equipment used

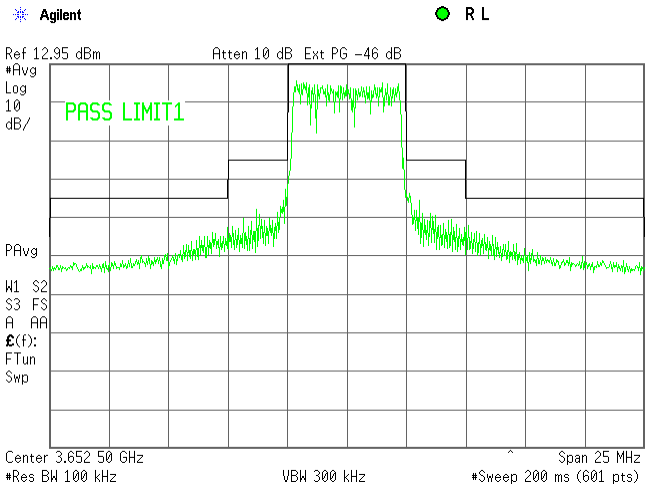
HL 2214	HL 3301	HL 3302	HL 3818	HL 3901			

Full description is given in Appendix A.

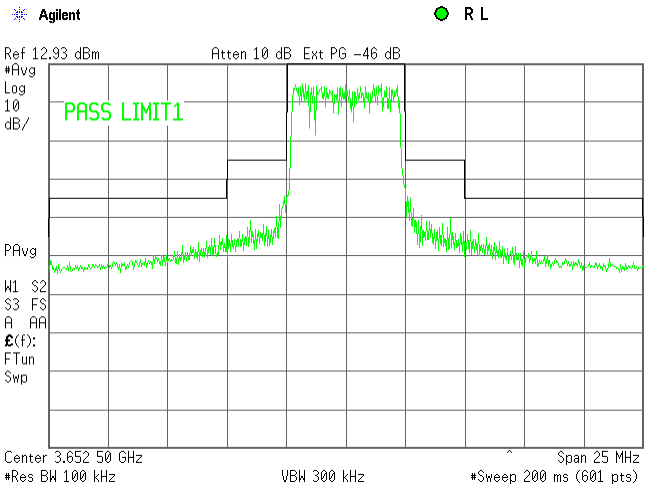
Test specification:	Section 90.210(b), Emission mask		
Test procedure:	47 CFR, Sections 2.1051, 2.1047, 90.210; TIA/EIA-603-C, Section 2.2.13		
Test mode:	Compliance	Verdict:	PASS
Date(s):	4/10/2013		
Temperature: 24.1 °C	Air Pressure: 1014 hPa	Relative Humidity: 41 %	Power Supply: 5.5 VDC
Remarks:			

Plot 7.4.1 Emission mask test results at low carrier frequency

ASSIGNED FREQUENCY RANGE: 3650.0 - 3700.0 MHz
DETECTOR USED: Average
MODULATING SIGNAL: PRBS
EMISSION BANDWIDTH: 5 MHz
TRANSMITTER OUTPUT POWER: 22.75 dBm
MODULATION: QPSK

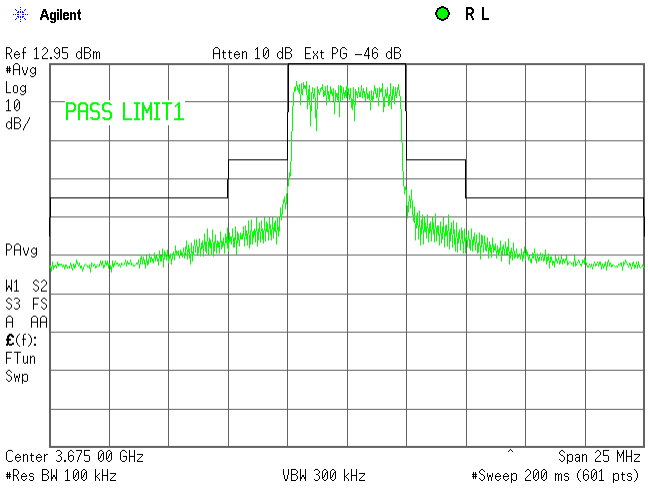


TRANSMITTER OUTPUT POWER: 22.93 dBm
MODULATION: 64QAM

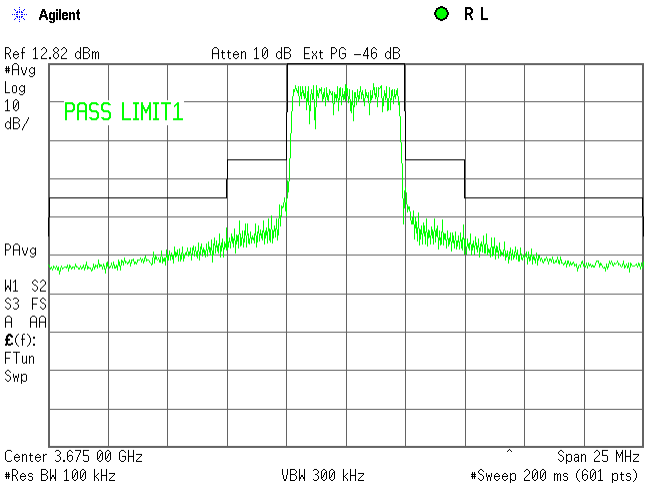


Plot 7.4.2 Emission mask test results at mid carrier frequency

ASSIGNED FREQUENCY RANGE: 3650.0 - 3700.0 MHz
DETECTOR USED: Average
MODULATING SIGNAL: PRBS
EMISSION BANDWIDTH: 5 MHz
TRANSMITTER OUTPUT POWER: 22.95 dBm
MODULATION: QPSK



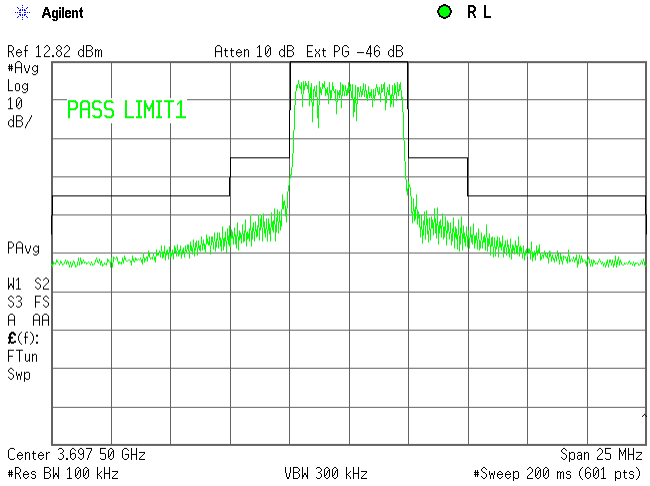
TRANSMITTER OUTPUT POWER: 22.82 dBm
MODULATION: 64QAM



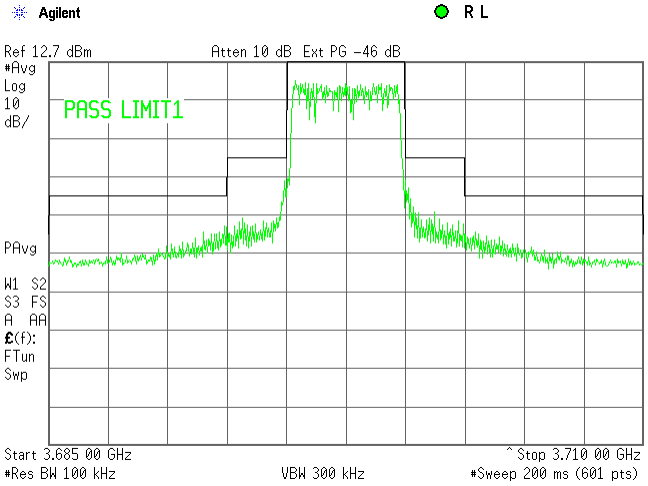
Test specification:	Section 90.210(b), Emission mask		
Test procedure:	47 CFR, Sections 2.1051, 2.1047, 90.210; TIA/EIA-603-C, Section 2.2.13		
Test mode:	Compliance	Verdict:	PASS
Date(s):	4/10/2013		
Temperature: 24.1 °C	Air Pressure: 1014 hPa	Relative Humidity: 41 %	Power Supply: 5.5 VDC
Remarks:			

Plot 7.4.3 Emission mask test results at high carrier frequency

ASSIGNED FREQUENCY RANGE: 3650.0 - 3700.0 MHz
DETECTOR USED: Average
MODULATING SIGNAL: PRBS
EMISSION BANDWIDTH: 5 MHz
TRANSMITTER OUTPUT POWER: 22.82 dBm
MODULATION: QPSK

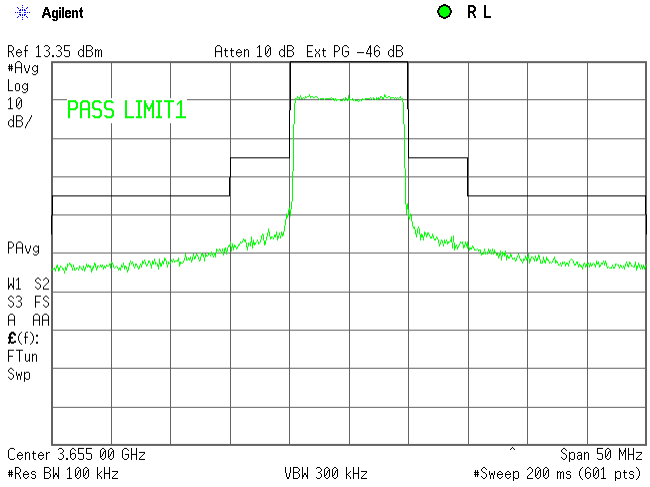


ASSIGNED FREQUENCY RANGE: 3650.0 - 3700.0 MHz
DETECTOR USED: Average
MODULATING SIGNAL: PRBS
EMISSION BANDWIDTH: 5 MHz
TRANSMITTER OUTPUT POWER: 22. 70dBm
MODULATION: 64QAM

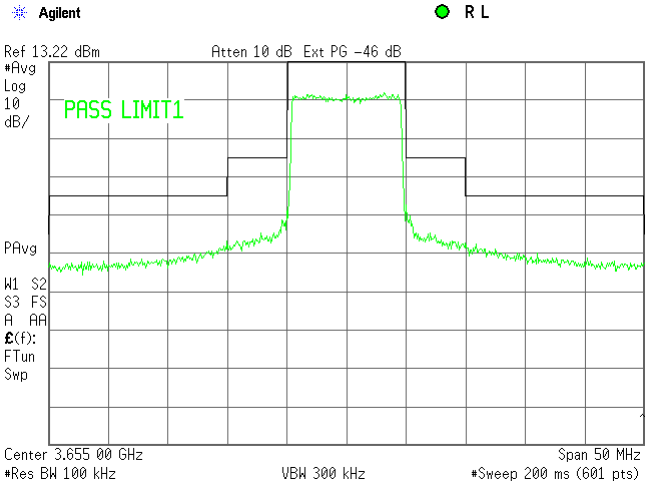


Plot 7.4.4 Emission mask test results at low carrier frequency

ASSIGNED FREQUENCY RANGE: 3650.0 - 3700.0 MHz
DETECTOR USED: Average
MODULATING SIGNAL: PRBS
EMISSION BANDWIDTH: 10 MHz
TRANSMITTER OUTPUT POWER: 23.35 dBm
MODULATION: QPSK



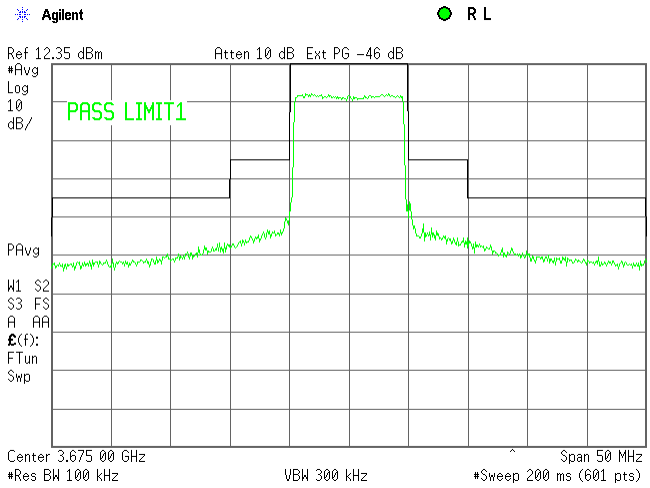
ASSIGNED FREQUENCY RANGE: 3650.0 - 3700.0 MHz
DETECTOR USED: Average
MODULATING SIGNAL: PRBS
EMISSION BANDWIDTH: 10 MHz
TRANSMITTER OUTPUT POWER: 23.22 dBm
MODULATION: 64QAM



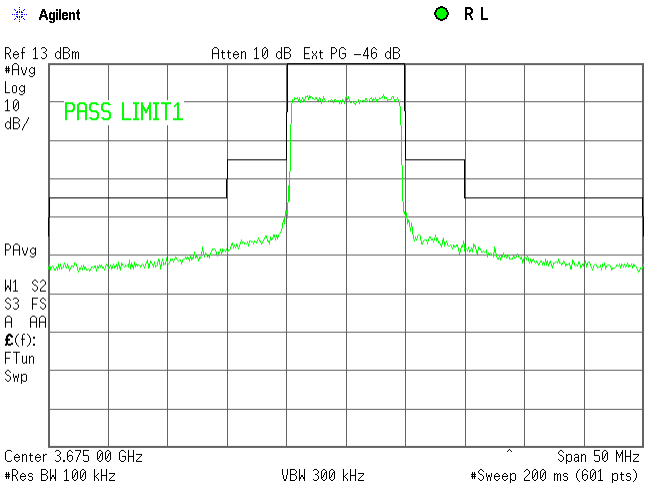
Test specification:	Section 90.210(b), Emission mask		
Test procedure:	47 CFR, Sections 2.1051, 2.1047, 90.210; TIA/EIA-603-C, Section 2.2.13		
Test mode:	Compliance	Verdict:	PASS
Date(s):	4/10/2013		
Temperature: 24.1 °C	Air Pressure: 1014 hPa	Relative Humidity: 41 %	Power Supply: 5.5 VDC
Remarks:			

Plot 7.4.5 Emission mask test results at mid carrier frequency

ASSIGNED FREQUENCY RANGE: 3650.0 - 3700.0 MHz
DETECTOR USED: Average
MODULATING SIGNAL: PRBS
EMISSION BANDWIDTH: 10 MHz
TRANSMITTER OUTPUT POWER: 23.31 dBm
MODULATION: QPSK

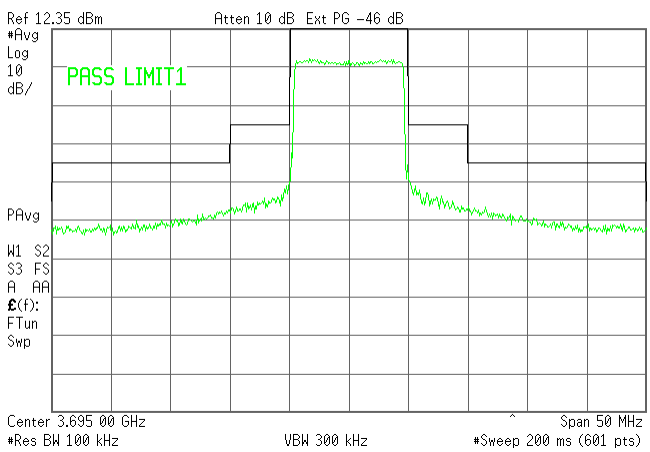


TRANSMITTER OUTPUT POWER: 23.00 dBm
MODULATION: 64QAM

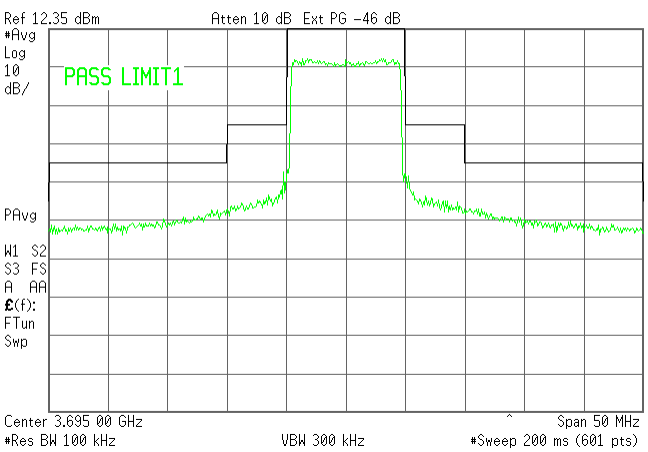


Plot 7.4.6 Emission mask test results at high carrier frequency

ASSIGNED FREQUENCY RANGE: 3650.0 - 3700.0 MHz
DETECTOR USED: Average
MODULATING SIGNAL: PRBS
EMISSION BANDWIDTH: 10 MHz
TRANSMITTER OUTPUT POWER: 23.19 dBm
MODULATION: QPSK



TRANSMITTER OUTPUT POWER: 22.35 dBm
MODULATION: 64QAM



Test specification:	Section 90.1323, Spurious emissions at RF antenna connector		
Test procedure:	47 CFR, Sections 2.1051, 90.1323; TIA/EIA-603-C, Section 2.2.13		
Test mode:	Compliance	Verdict:	PASS
Date(s):	4/11/2013		
Temperature: 23.7 ºC	Air Pressure: 1014 hPa	Relative Humidity: 44 %	Power Supply: 5.5 VDC
Remarks:			

7.5 Spurious emissions at RF antenna connector test

7.5.1 General

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

Table 7.5.1 Spurious emission limits

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

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

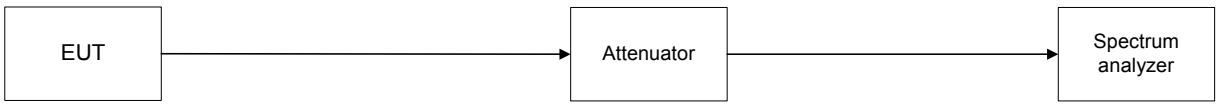
7.5.2 Test procedure

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

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

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

Figure 7.5.1 Spurious emission test setup



Test specification:	Section 90.1323, Spurious emissions at RF antenna connector		
Test procedure:	47 CFR, Sections 2.1051, 90.1323; TIA/EIA-603-C, Section 2.2.13		
Test mode:	Compliance	Verdict:	PASS
Date(s):	4/11/2013		
Temperature: 23.7 ºC	Air Pressure: 1014 hPa	Relative Humidity: 44 %	Power Supply: 5.5 VDC
Remarks:			

Table 7.5.2 Spurious emission test results

ASSIGNED FREQUENCY RANGE: 3650.0 – 3700.0 MHz
INVESTIGATED FREQUENCY RANGE: 0.009 – 37000 MHz
DETECTOR USED: Peak
VIDEO BANDWIDTH: ≥ Resolution bandwidth
MODULATION: 64QAM
MODULATING SIGNAL: PRBS
NUMBER OF OUTPUTS: N = 2
EMISSION BANDWIDTH: 5 MHz (worst case output power and density)

Frequency, MHz	SA reading, dBm	Attenuator, dB	Cable loss, dB	RBW, kHz	Spurious emission, dBm*	Limit, dBm	Margin, dB**	Verdict
Low carrier frequency 3652.5 MHz								
10955.50	-21.31	Included	Included	1000	-18.31	-13.0	-5.31	Pass
Mid carrier frequency 3675.0 MHz								
11025.75	-21.28	Included	Included	1000	-18.28	-13.0	-5.28	Pass
High carrier frequency 3697.5 MHz								
11095.08	-26.46	Included	Included	1000	-23.46	-13.0	-10.46	Pass

*****- Spurious emission = SA Reading + 10*log(N) = . SA Reading + 3dB
******- Margin = Spurious emission – specification limit.

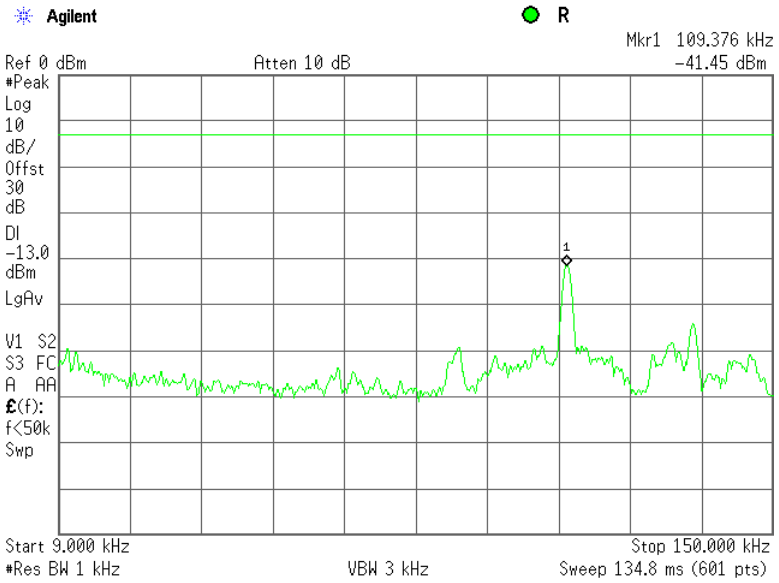
Reference numbers of test equipment used

HL 3455	HL 3787	HL 3818	HL 3901				

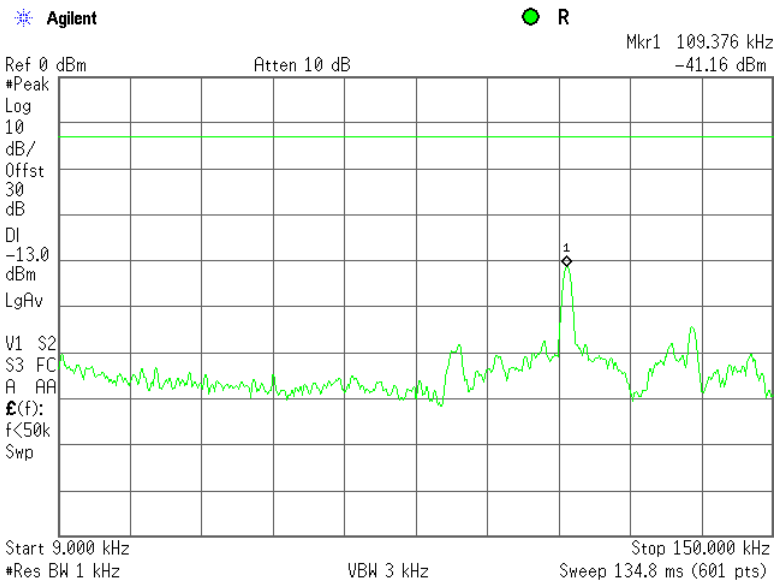
Full description is given in Appendix A.

Test specification:	Section 90.1323, Spurious emissions at RF antenna connector		
Test procedure:	47 CFR, Sections 2.1051, 90.1323; TIA/EIA-603-C, Section 2.2.13		
Test mode:	Compliance	Verdict:	PASS
Date(s):	4/11/2013		
Temperature: 23.7 °C	Air Pressure: 1014 hPa	Relative Humidity: 44 %	Power Supply: 5.5 VDC
Remarks:			

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

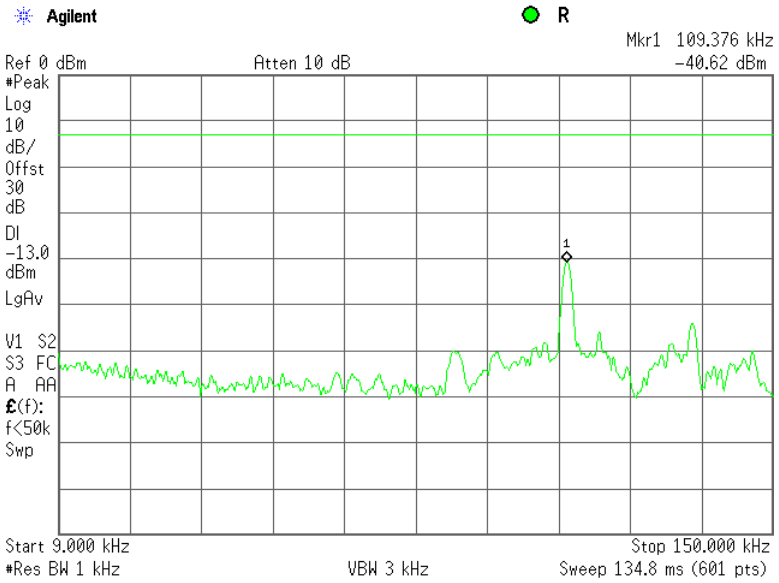


Plot 7.5.2 Spurious emission measurements in 9 - 150 kHz range at mid carrier frequency

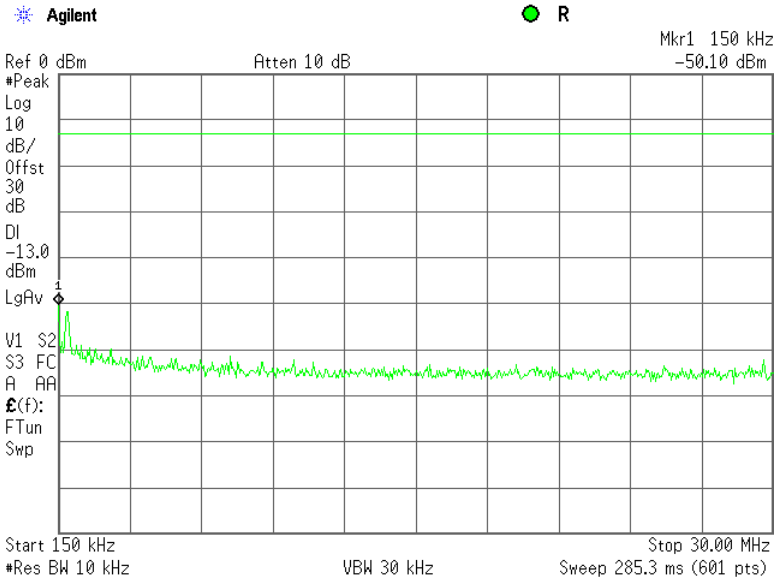


Test specification:	Section 90.1323, Spurious emissions at RF antenna connector		
Test procedure:	47 CFR, Sections 2.1051, 90.1323; TIA/EIA-603-C, Section 2.2.13		
Test mode:	Compliance	Verdict:	PASS
Date(s):	4/11/2013		
Temperature: 23.7 °C	Air Pressure: 1014 hPa	Relative Humidity: 44 %	Power Supply: 5.5 VDC
Remarks:			

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

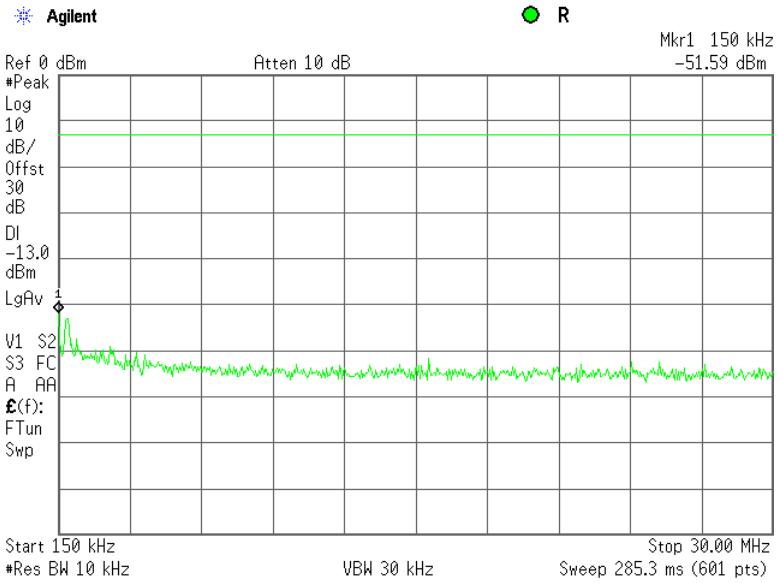


Plot 7.5.4 Spurious emission measurements in 0.150 - 30.0 MHz range at low carrier frequency

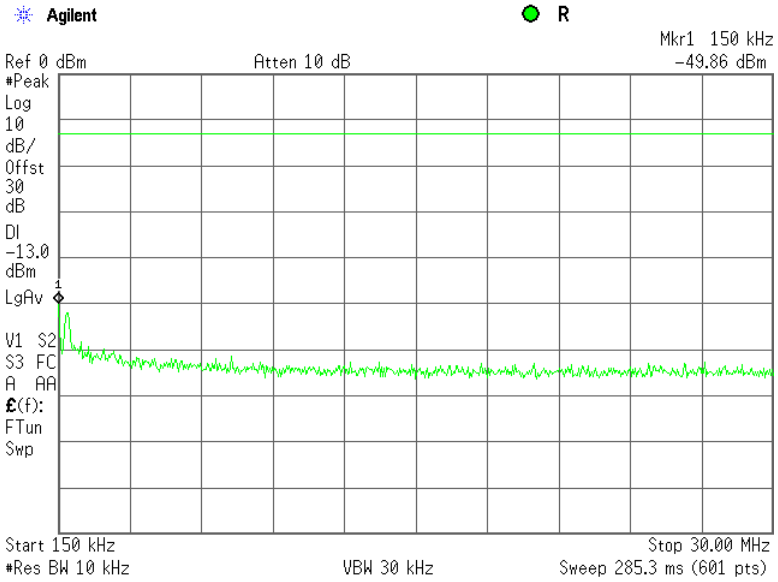


Test specification:	Section 90.1323, Spurious emissions at RF antenna connector		
Test procedure:	47 CFR, Sections 2.1051, 90.1323; TIA/EIA-603-C, Section 2.2.13		
Test mode:	Compliance	Verdict:	PASS
Date(s):	4/11/2013		
Temperature: 23.7 °C	Air Pressure: 1014 hPa	Relative Humidity: 44 %	Power Supply: 5.5 VDC
Remarks:			

Plot 7.5.5 Spurious emission measurements in 0.150 - 30.0 MHz range at mid carrier frequency

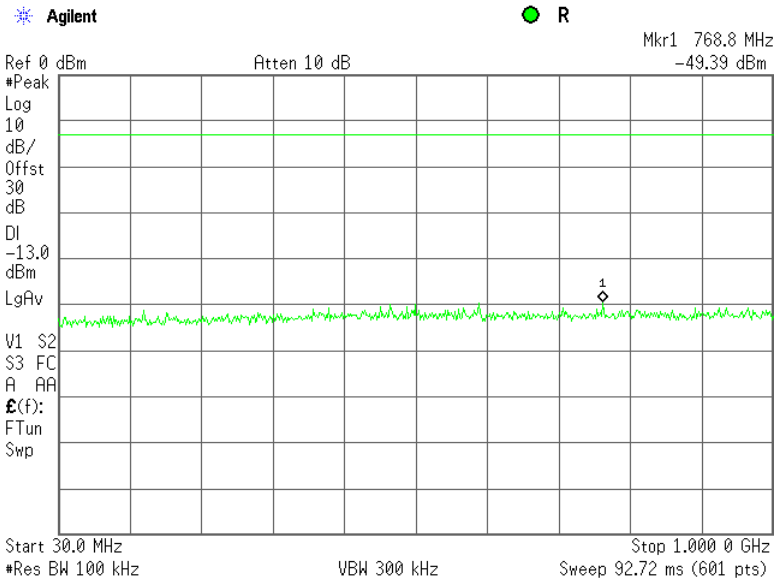


Plot 7.5.6 Spurious emission measurements in 0.150 - 30.0 MHz range at high carrier frequency

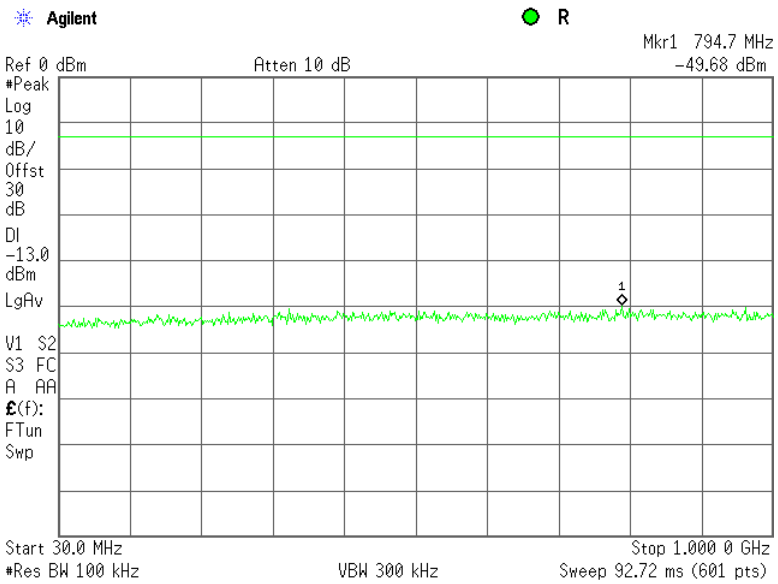


Test specification:	Section 90.1323, Spurious emissions at RF antenna connector		
Test procedure:	47 CFR, Sections 2.1051, 90.1323; TIA/EIA-603-C, Section 2.2.13		
Test mode:	Compliance	Verdict:	PASS
Date(s):	4/11/2013		
Temperature: 23.7 °C	Air Pressure: 1014 hPa	Relative Humidity: 44 %	Power Supply: 5.5 VDC
Remarks:			

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

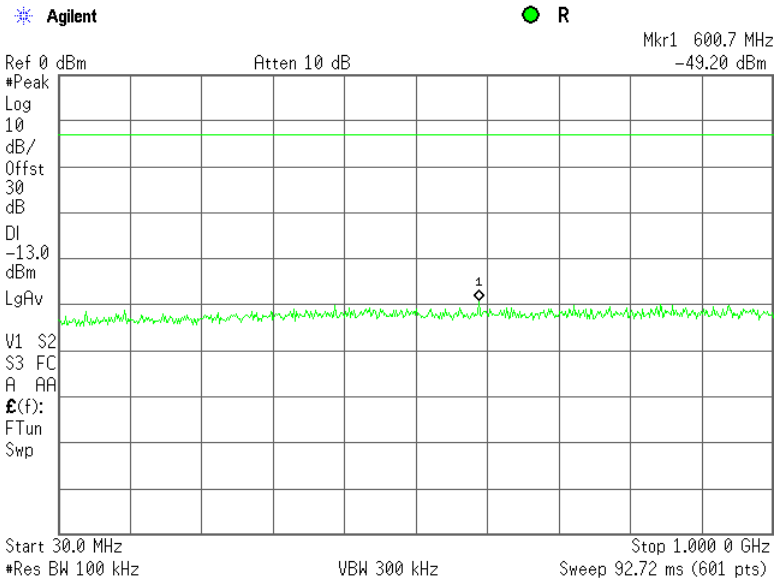


Plot 7.5.8 Spurious emission measurements in 30.0 - 1000 MHz range at mid carrier frequency

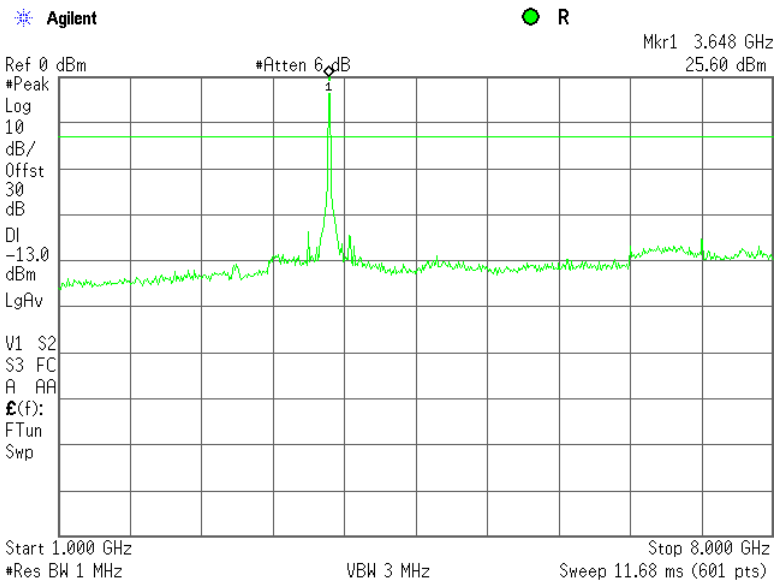


Test specification:	Section 90.1323, Spurious emissions at RF antenna connector		
Test procedure:	47 CFR, Sections 2.1051, 90.1323; TIA/EIA-603-C, Section 2.2.13		
Test mode:	Compliance	Verdict:	PASS
Date(s):	4/11/2013		
Temperature: 23.7 °C	Air Pressure: 1014 hPa	Relative Humidity: 44 %	Power Supply: 5.5 VDC
Remarks:			

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

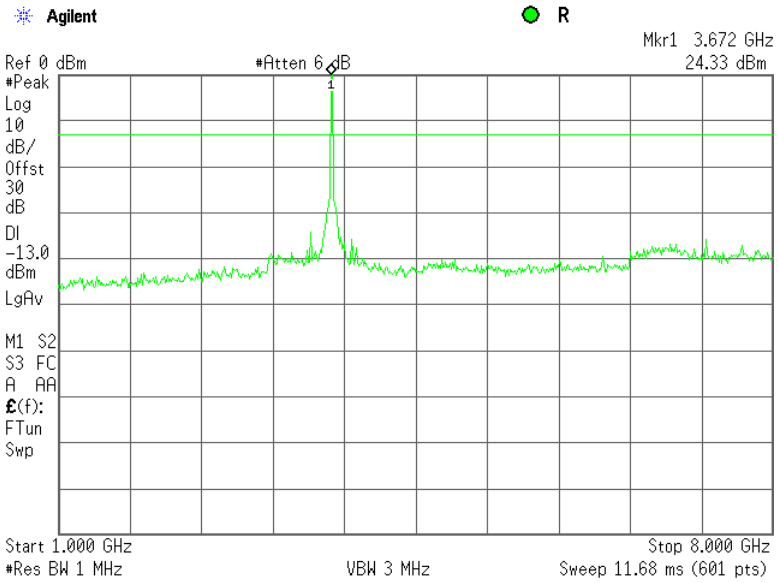


Plot 7.5.10 Spurious emission measurements in 1000 - 8000 MHz range at low carrier frequency

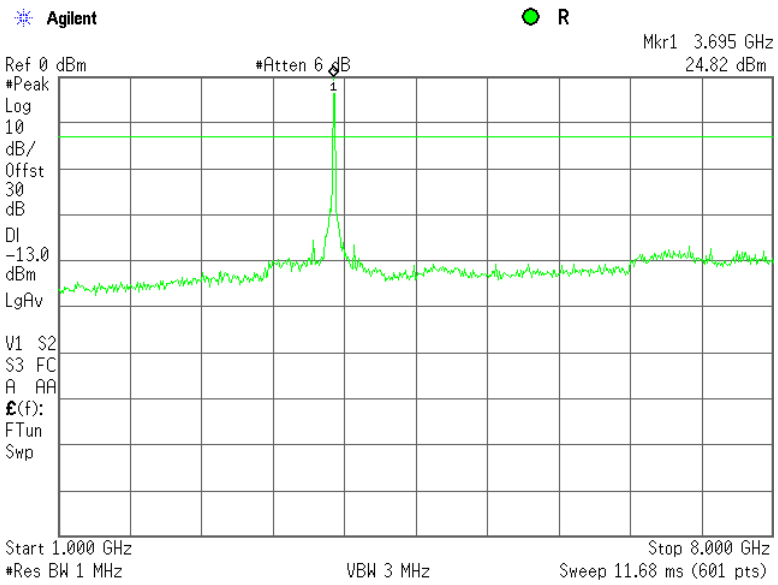


Test specification:	Section 90.1323, Spurious emissions at RF antenna connector		
Test procedure:	47 CFR, Sections 2.1051, 90.1323; TIA/EIA-603-C, Section 2.2.13		
Test mode:	Compliance	Verdict:	PASS
Date(s):	4/11/2013		
Temperature: 23.7 °C	Air Pressure: 1014 hPa	Relative Humidity: 44 %	Power Supply: 5.5 VDC
Remarks:			

Plot 7.5.11 Spurious emission measurements in 1000 - 8000 MHz at mid carrier frequency

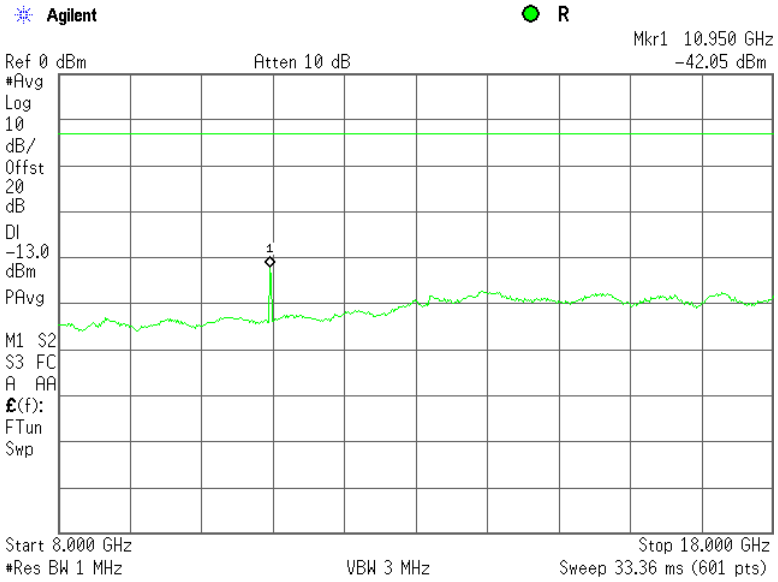


Plot 7.5.12 Spurious emission measurements in 1000 - 8000 MHz at high carrier frequency

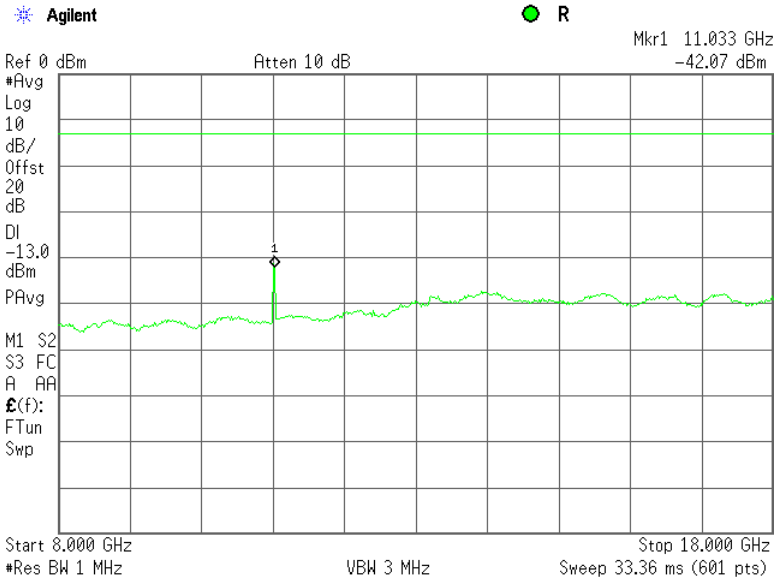


Test specification:	Section 90.1323, Spurious emissions at RF antenna connector		
Test procedure:	47 CFR, Sections 2.1051, 90.1323; TIA/EIA-603-C, Section 2.2.13		
Test mode:	Compliance	Verdict:	PASS
Date(s):	4/11/2013		
Temperature: 23.7 °C	Air Pressure: 1014 hPa	Relative Humidity: 44 %	Power Supply: 5.5 VDC
Remarks:			

Plot 7.5.13 Spurious emission measurements in 8000 - 18000 MHz range at low carrier frequency

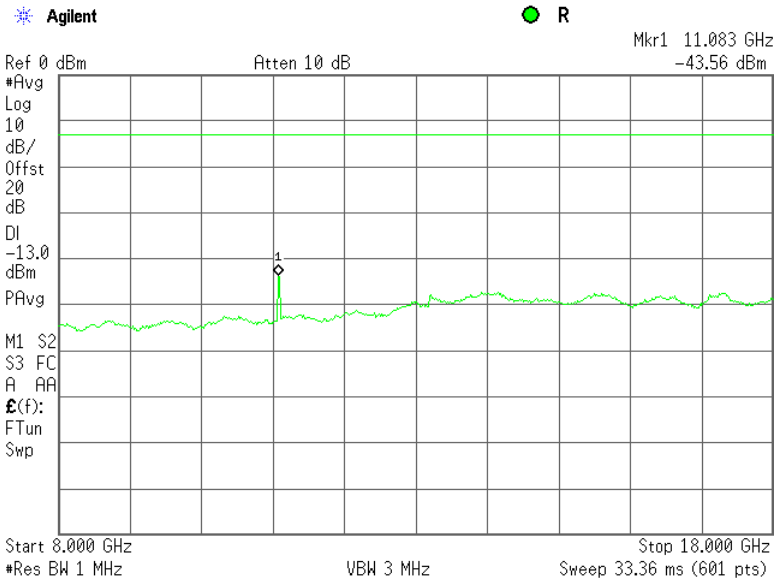


Plot 7.5.14 Spurious emission measurements in 8000 - 18000 MHz at mid carrier frequency

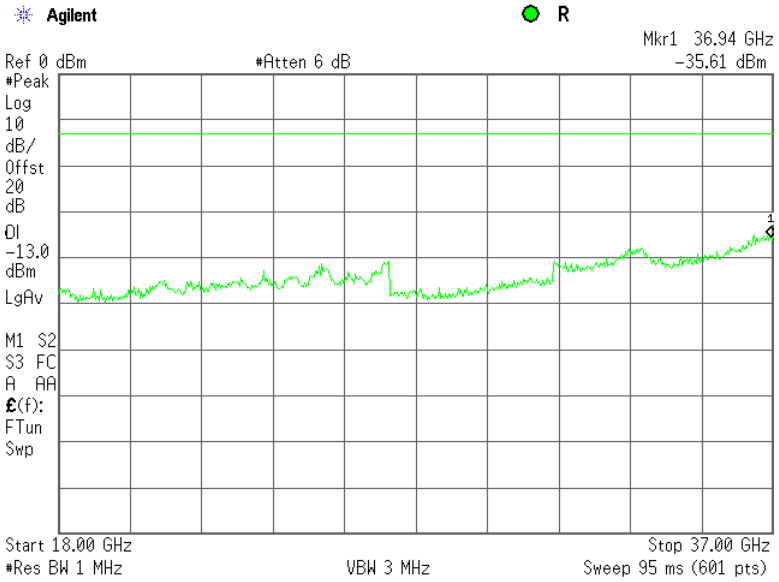


Test specification:	Section 90.1323, Spurious emissions at RF antenna connector		
Test procedure:	47 CFR, Sections 2.1051, 90.1323; TIA/EIA-603-C, Section 2.2.13		
Test mode:	Compliance	Verdict:	PASS
Date(s):	4/11/2013		
Temperature: 23.7 °C	Air Pressure: 1014 hPa	Relative Humidity: 44 %	Power Supply: 5.5 VDC
Remarks:			

Plot 7.5.15 Spurious emission measurements in 8000 - 18000 MHz at high carrier frequency

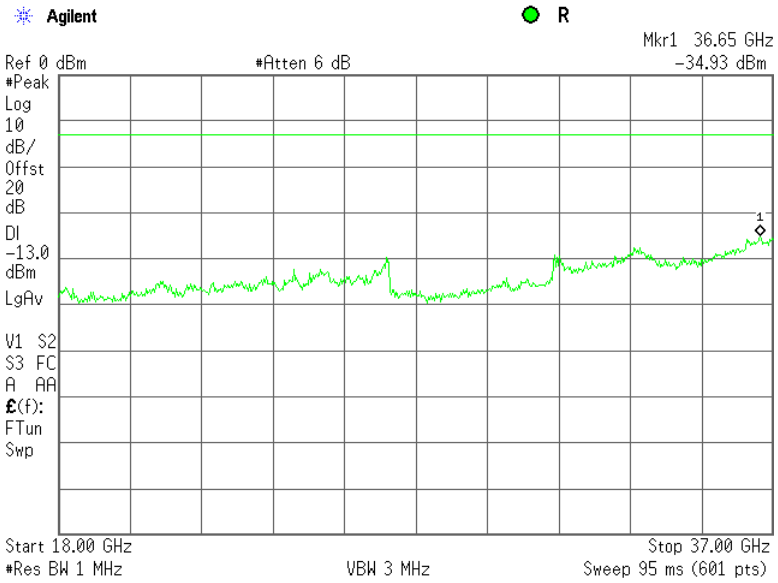


Plot 7.5.16 Spurious emission measurements in 18000 – 37000 MHz range at low carrier frequency

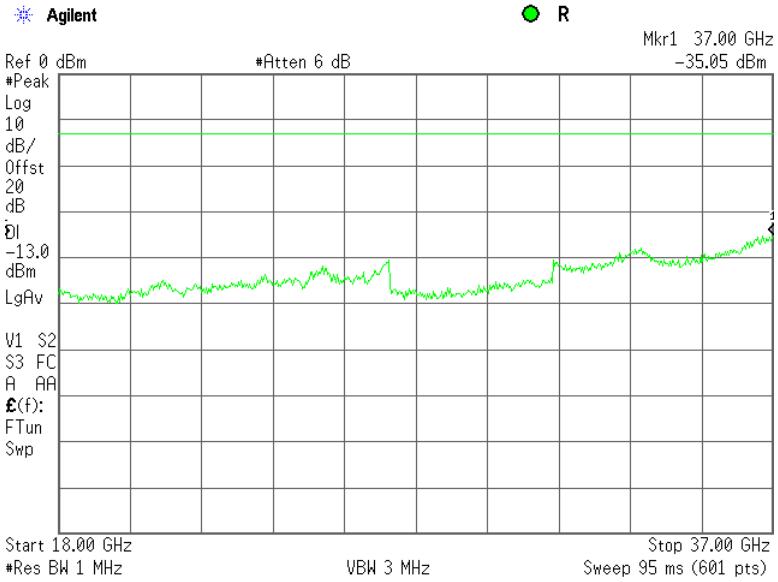


Test specification:	Section 90.1323, Spurious emissions at RF antenna connector		
Test procedure:	47 CFR, Sections 2.1051, 90.1323; TIA/EIA-603-C, Section 2.2.13		
Test mode:	Compliance	Verdict:	PASS
Date(s):	4/11/2013		
Temperature: 23.7 °C	Air Pressure: 1014 hPa	Relative Humidity: 44 %	Power Supply: 5.5 VDC
Remarks:			

Plot 7.5.17 Spurious emission measurements in 18000 – 37000 MHz at mid carrier frequency

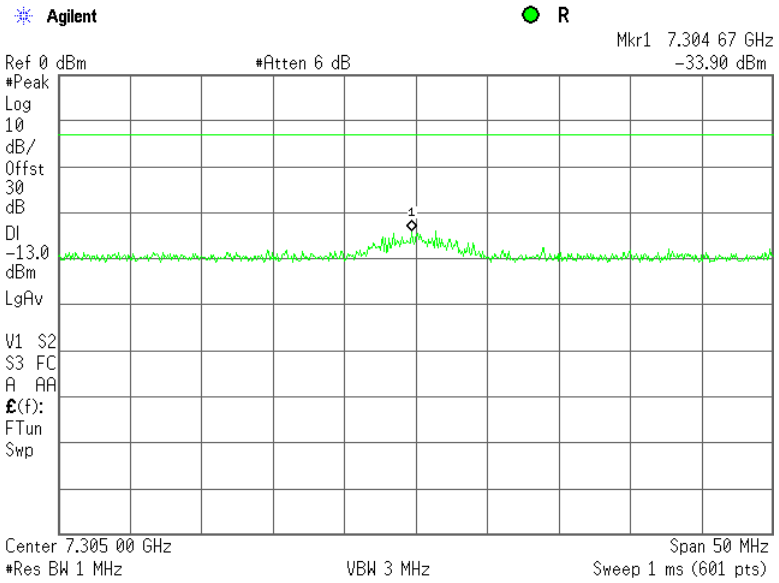


Plot 7.5.18 Spurious emission measurements in 18000 – 37000 MHz at high carrier frequency

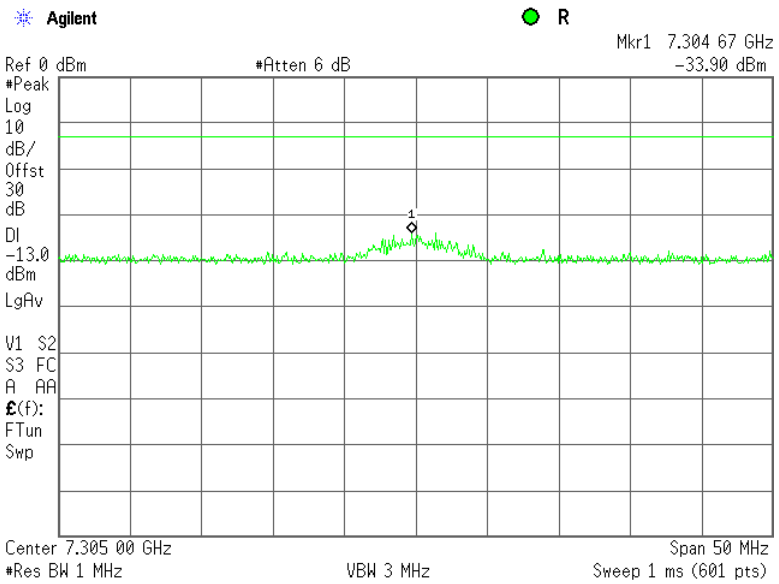


Test specification:	Section 90.1323, Spurious emissions at RF antenna connector		
Test procedure:	47 CFR, Sections 2.1051, 90.1323; TIA/EIA-603-C, Section 2.2.13		
Test mode:	Compliance	Verdict:	PASS
Date(s):	4/11/2013		
Temperature: 23.7 °C	Air Pressure: 1014 hPa	Relative Humidity: 44 %	Power Supply: 5.5 VDC
Remarks:			

Plot 7.5.19 Conducted spurious emission measurements at the 2nd harmonic of low carrier frequency

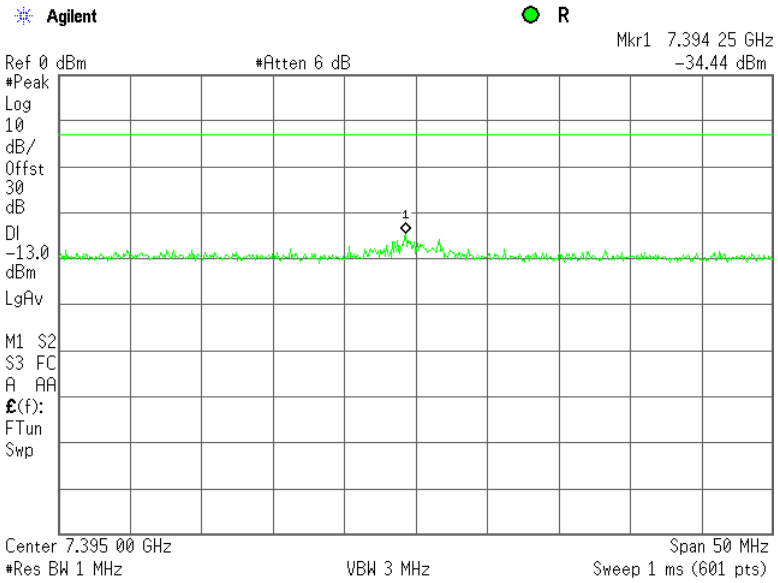


Plot 7.5.20 Conducted spurious emission measurements at the 2nd harmonic of mid carrier frequency

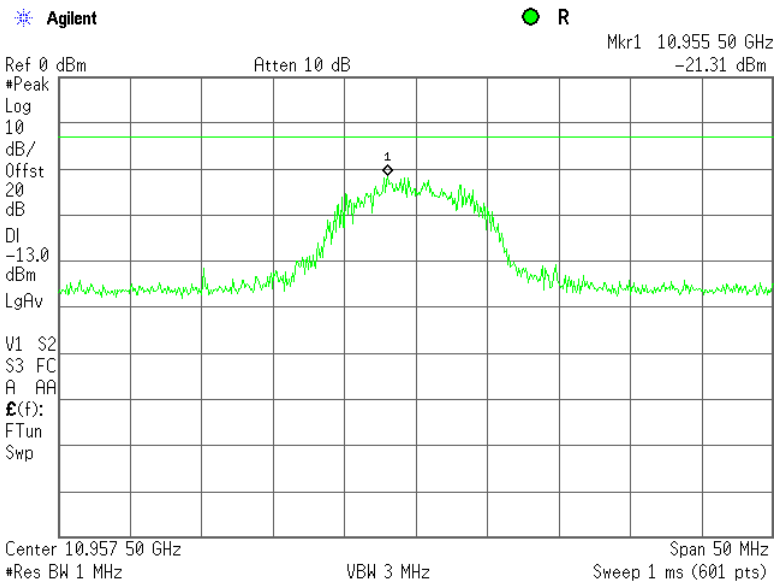


Test specification:	Section 90.1323, Spurious emissions at RF antenna connector		
Test procedure:	47 CFR, Sections 2.1051, 90.1323; TIA/EIA-603-C, Section 2.2.13		
Test mode:	Compliance	Verdict:	PASS
Date(s):	4/11/2013		
Temperature: 23.7 °C	Air Pressure: 1014 hPa	Relative Humidity: 44 %	Power Supply: 5.5 VDC
Remarks:			

Plot 7.5.21 Conducted spurious emission measurements at the 2nd harmonic of high carrier frequency

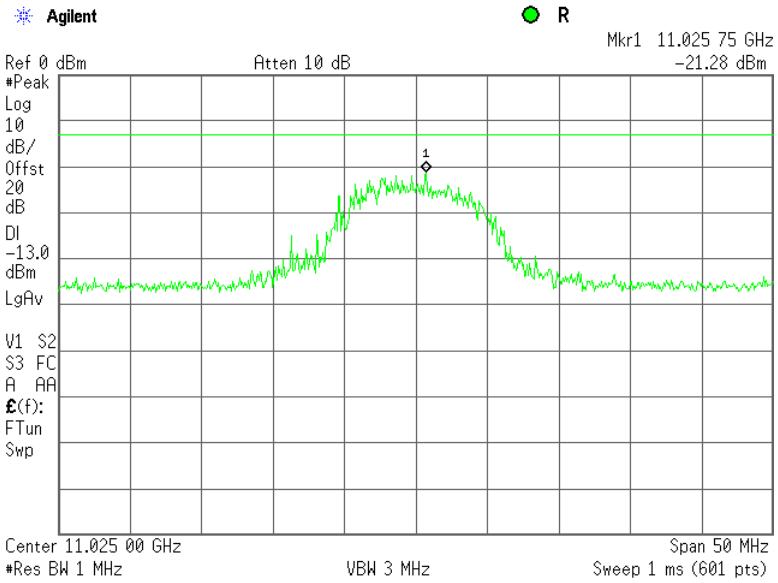


Plot 7.5.22 Conducted spurious emission measurements at the 3rd harmonic of low carrier frequency

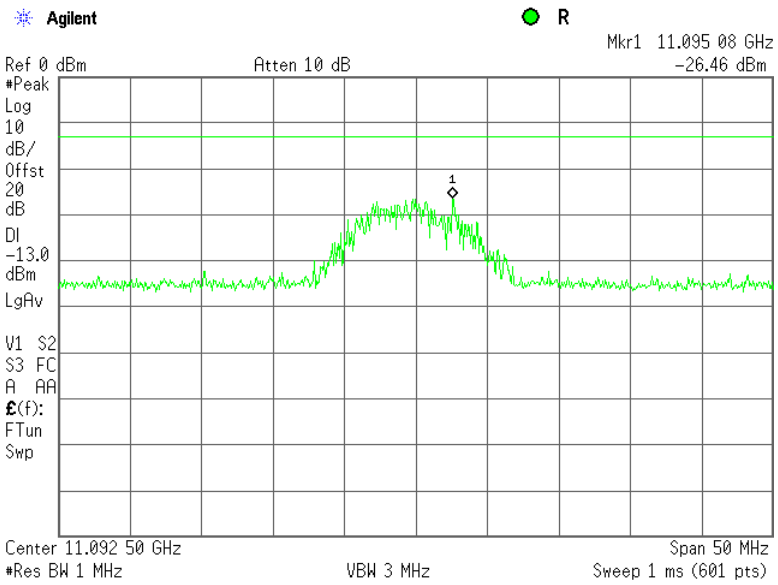


Test specification:	Section 90.1323, Spurious emissions at RF antenna connector		
Test procedure:	47 CFR, Sections 2.1051, 90.1323; TIA/EIA-603-C, Section 2.2.13		
Test mode:	Compliance	Verdict:	PASS
Date(s):	4/11/2013		
Temperature: 23.7 °C	Air Pressure: 1014 hPa	Relative Humidity: 44 %	Power Supply: 5.5 VDC
Remarks:			

Plot 7.5.23 Conducted spurious emission measurements at the 3rd harmonic of mid carrier frequency



Plot 7.5.24 Conducted spurious emission measurements at the 3rd harmonic of high carrier frequency



Test specification:	Section 90.1323, Radiated spurious emissions		
Test procedure:	47 CFR, Sections 2.1053, 90.1323; TIA/EIA-603-C, Section 2.2.12		
Test mode:	Compliance	Verdict:	PASS
Date(s):	4/14/2013		
Temperature: 23 ºC	Air Pressure: 1018 hPa	Relative Humidity: 55 %	Power Supply: 5.5 VDC
Remarks:			

7.6 Radiated spurious emission measurements

7.6.1 General

This test was performed to measure radiated spurious emissions from the EUT. Specification test limits are given in Table 7.6.1.

Table 7.6.1 Radiated spurious emission test limits

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

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

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

7.6.2.1 The EUT was set up as shown in Figure 7.6.1, energized and the performance check was conducted.

7.6.2.2 The specified frequency range was investigated with antenna connected to spectrum analyzer. To find maximum radiation the turntable was rotated 360^0 and the measuring antenna was rotated around its vertical axis.

7.6.2.3 The worst test results (the lowest margins) were recorded in Table 7.6.2 and shown in the associated plots.

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

7.6.3.1 The EUT was set up as shown in Figure 7.6.2, energized and the performance check was conducted.

7.6.3.2 The specified frequency range was investigated with antenna connected to spectrum analyzer. To find maximum radiation the turntable was rotated 360^0 and the measuring antenna height was swept from 1 to 4 m in both, vertical and horizontal, polarizations.

7.6.3.3 The worst test results (the lowest margins) were recorded in Table 7.6.2 and shown in the associated plots.

7.6.4 Test procedure for substitution ERP measurements of spurious

7.6.4.1 The test equipment was set up as shown in Figure 7.6.3 and energized.

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

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

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

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

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

7.6.4.7 The worst test results (the lowest margins) were recorded in Table 7.6.3 and shown in the associated plots.

Test specification:	Section 90.1323, Radiated spurious emissions		
Test procedure:	47 CFR, Sections 2.1053, 90.1323; TIA/EIA-603-C, Section 2.2.12		
Test mode:	Compliance	Verdict:	PASS
Date(s):	4/14/2013		
Temperature: 23 ºC	Air Pressure: 1018 hPa	Relative Humidity: 55 %	Power Supply: 5.5 VDC
Remarks:			

Figure 7.6.1 Setup for spurious emission field strength measurements in 9 kHz to 30 MHz band

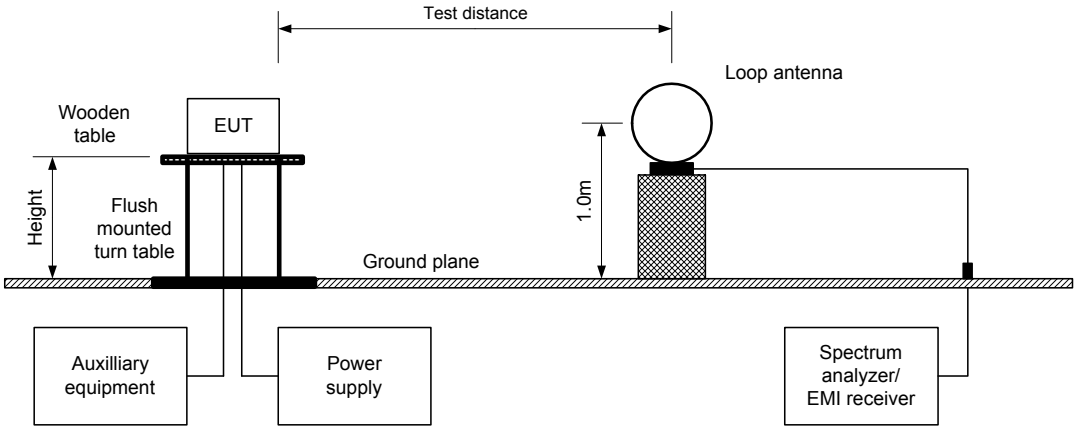
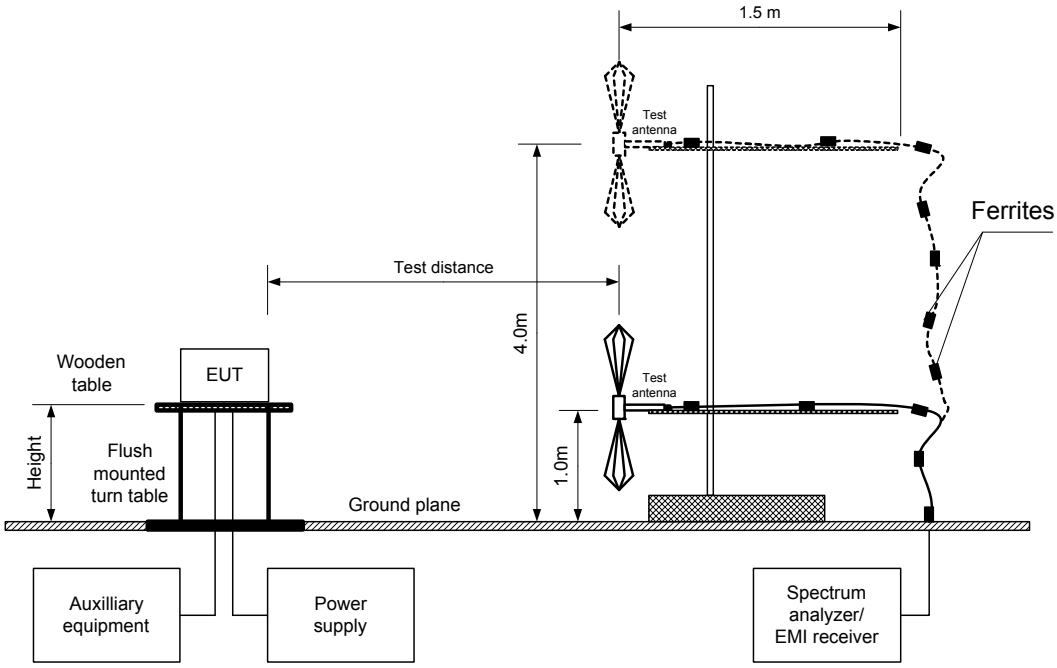
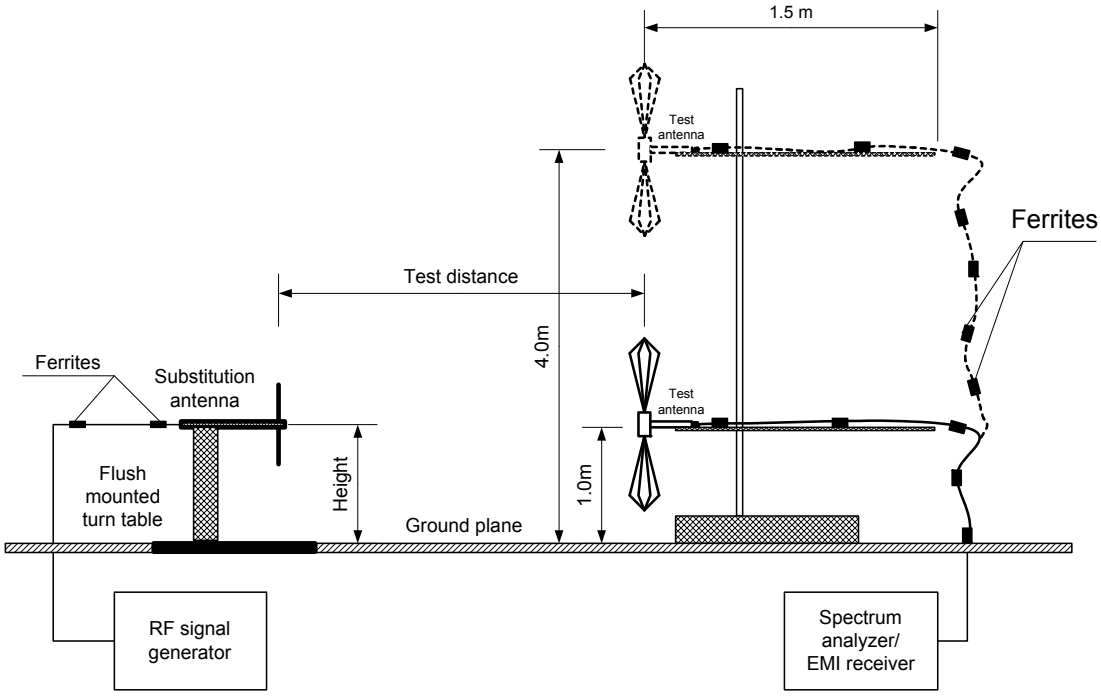


Figure 7.6.2 Setup for spurious emission field strength measurements above 30 MHz



Test specification:	Section 90.1323, Radiated spurious emissions		
Test procedure:	47 CFR, Sections 2.1053, 90.1323; TIA/EIA-603-C, Section 2.2.12		
Test mode:	Compliance	Verdict:	PASS
Date(s):	4/14/2013		
Temperature: 23 ºC	Air Pressure: 1018 hPa	Relative Humidity: 55 %	Power Supply: 5.5 VDC
Remarks:			

Figure 7.6.3 Setup for substitution ERP measurements of spurious



Test specification:	Section 90.1323, Radiated spurious emissions		
Test procedure:	47 CFR, Sections 2.1053, 90.1323; TIA/EIA-603-C, Section 2.2.12		
Test mode:	Compliance	Verdict:	PASS
Date(s):	4/14/2013		
Temperature: 23 ºC	Air Pressure: 1018 hPa	Relative Humidity: 55 %	Power Supply: 5.5 VDC
Remarks:			

Table 7.6.2 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 – 37000 MHz
DETECTOR USED: Peak
VIDEO BANDWIDTH: > Resolution bandwidth
TEST ANTENNA TYPE: Active loop (9 kHz – 30 MHz)
Biconilog (30 MHz – 1000 MHz)
Double ridged guide (above 1000 MHz)
MODULATION: 64QAM
MODULATING SIGNAL: PRBS
BIT RATE: 23 Mbps
TRANSMITTER OUTPUT POWER SETTINGS: Maximum
EMISSION BANDWIDTH: 5 MHz (worst case output power and density)

Frequency, MHz	Field strength, dB(µV/m)	Limit, dB(µV/m)	Margin, dB*	RBW, kHz	Antenna polarization	Antenna height, m	Turn-table position**, degrees
Low carrier frequency 3652.5 MHz							
7304.85	68.28	84.4	-16.12	1000	Vert	1.2	180
Mid carrier frequency 3675.0 MHz							
7350.05	64.70	84.4	-19.70	1000	Vert	1.2	180
High carrier frequency 3697.5 MHz							
7395.35	63.29	84.4	-21.11	1000	Vert	1.2	180

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

Table 7.6.3 Substitution ERP of spurious test results

ASSIGNED FREQUENCY RANGE: 3650.0 – 3700.0 MHz
TEST SITE: Semi anechoic chamber
TEST DISTANCE: 3 m
SUBSTITUTION ANTENNA HEIGHT: 0.8 m
DETECTOR USED: Peak
VIDEO BANDWIDTH: > Resolution bandwidth
SUBSTITUTION ANTENNA TYPE: Double ridged guide (above 1000 MHz)

Frequency, MHz	Field strength, dB(µV/m)	RBW, kHz	Antenna polarization	RF generator output, dBm	Ant gain, dBd	Cable loss, dB	ERP, dBm	Limit, dBm	Margin, dB*	Verdict
Low carrier frequency 3652.5 MHz										
7304.85	68.28	1000	Vert	-36.5	9.5	4.0	-31.0	-13.00	-18.0	Pass
Mid carrier frequency 3675.0 MHz										
7350.05	64.70	1000	Vert	-40.0	9.5	4.0	-34.5	-13.00	-21.5	Pass
High carrier frequency 3697.5 MHz										
7395.35	63.29	1000	Vert	-41.5	9.5	4.0	-36.0	-13.00	-23.0	Pass

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

Reference numbers of test equipment used

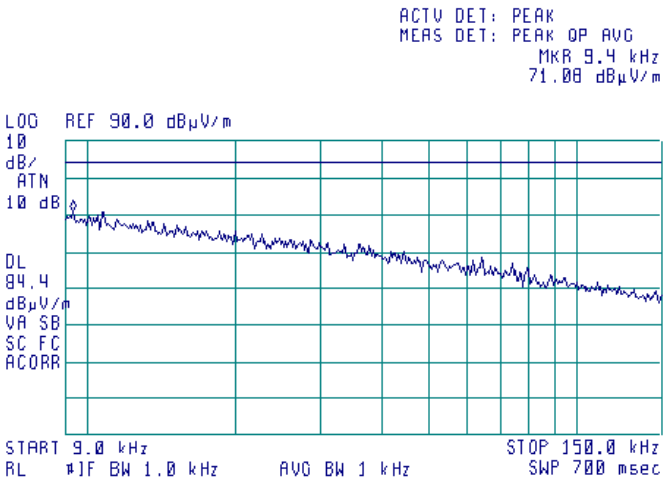
HL 0446	HL 0604	HL 0661	HL 0768	HL 0769	HL 1424	HL 2432	HL 2871
HL 2909	HL 3353	HL 3355	HL 3535	HL 3901			

Full description is given in Appendix A.

Test specification:	Section 90.1323, Radiated spurious emissions		
Test procedure:	47 CFR, Sections 2.1053, 90.1323; TIA/EIA-603-C, Section 2.2.12		
Test mode:	Compliance	Verdict:	PASS
Date(s):	4/14/2013		
Temperature: 23 ºC	Air Pressure: 1018 hPa	Relative Humidity: 55 %	Power Supply: 5.5 VDC
Remarks:			

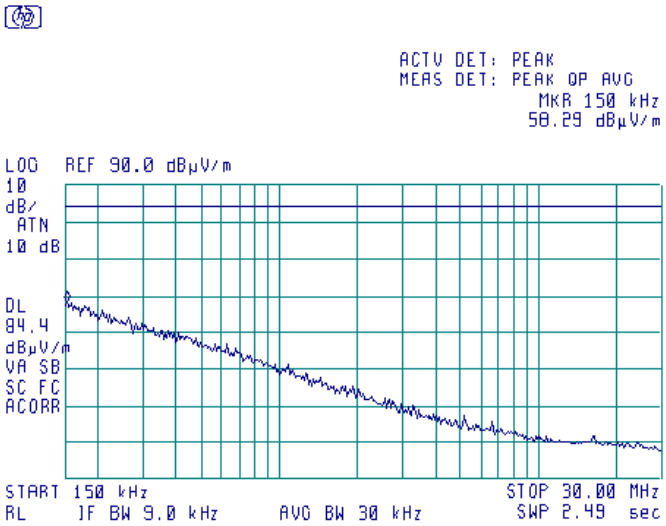
Plot 7.6.1 Radiated emission measurements in 9 - 150 kHz range

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



Plot 7.6.2 Radiated emission measurements in 0.15 - 30 MHz range

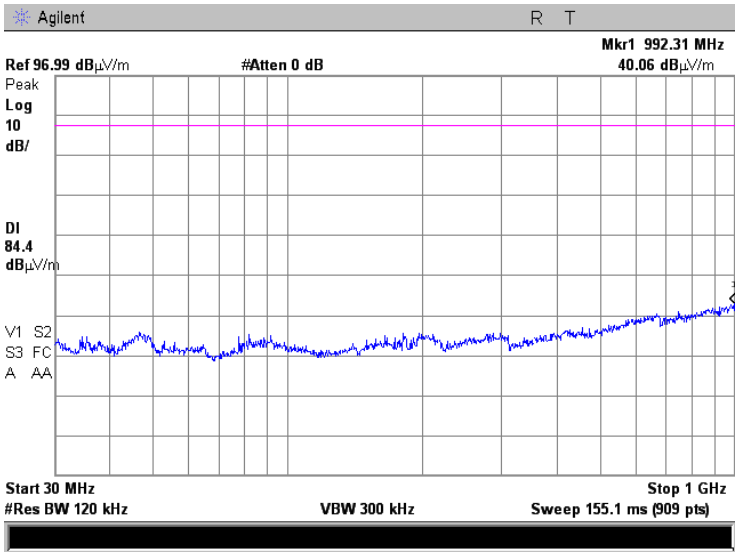
TEST SITE:	Semi anechoic chamber
CARRIER FREQUENCY:	Low, Mid; High
ANTENNA POLARIZATION:	Vertical and Horizontal
TEST DISTANCE:	3 m



Test specification:	Section 90.1323, Radiated spurious emissions		
Test procedure:	47 CFR, Sections 2.1053, 90.1323; TIA/EIA-603-C, Section 2.2.12		
Test mode:	Compliance	Verdict:	PASS
Date(s):	4/14/2013		
Temperature: 23 ºC	Air Pressure: 1018 hPa	Relative Humidity: 55 %	Power Supply: 5.5 VDC
Remarks:			

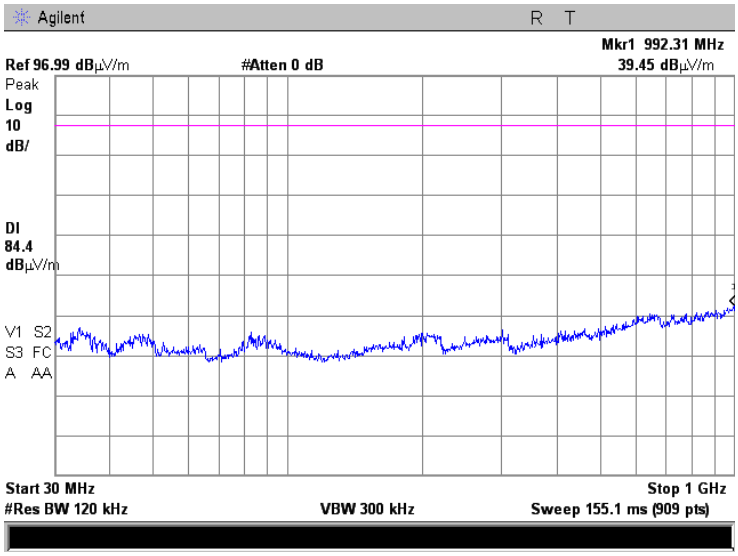
Plot 7.6.3 Radiated emission measurements in 30 - 1000 MHz range

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



Plot 7.6.4 Radiated emission measurements in 30 - 1000 MHz range

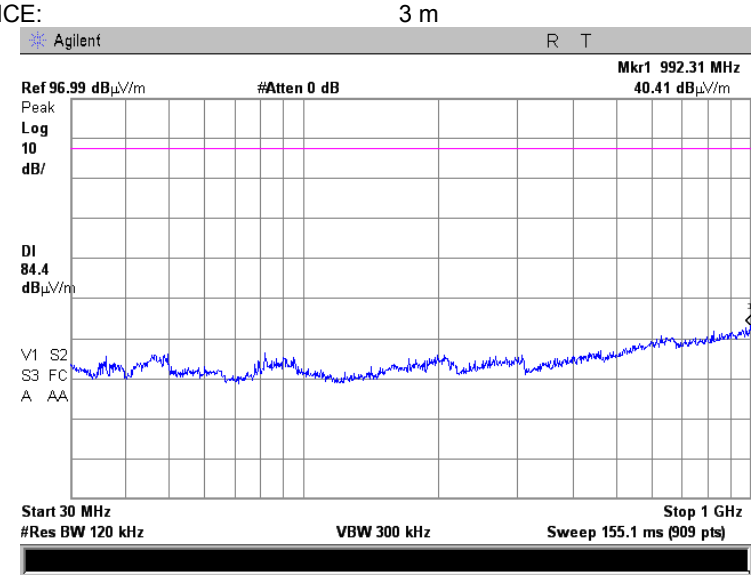
TEST SITE: Semi anechoic chamber
CARRIER FREQUENCY: Mid
ANTENNA POLARIZATION: Vertical and Horizontal
TEST DISTANCE: 3 m



Test specification:	Section 90.1323, Radiated spurious emissions		
Test procedure:	47 CFR, Sections 2.1053, 90.1323; TIA/EIA-603-C, Section 2.2.12		
Test mode:	Compliance	Verdict:	PASS
Date(s):	4/14/2013		
Temperature: 23 ºC	Air Pressure: 1018 hPa	Relative Humidity: 55 %	Power Supply: 5.5 VDC
Remarks:			

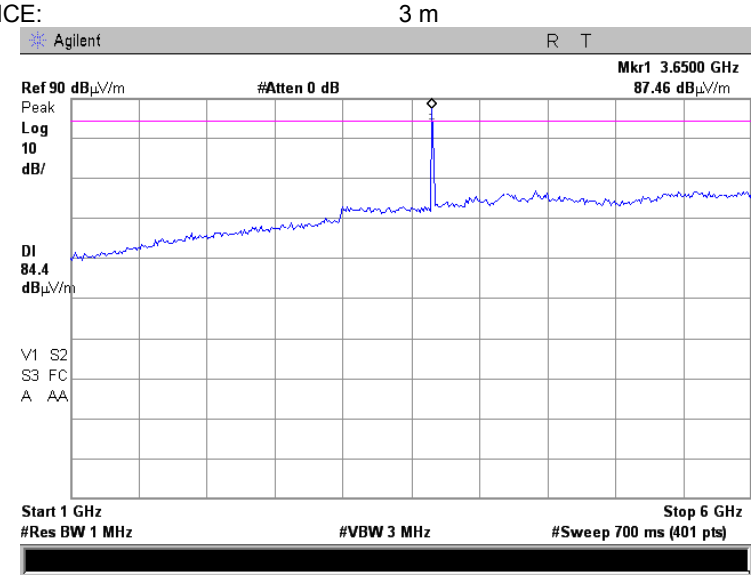
Plot 7.6.5 Radiated emission measurements in 30 - 1000 MHz range

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



Plot 7.6.6 Radiated emission measurements in 1000 – 6000 MHz range

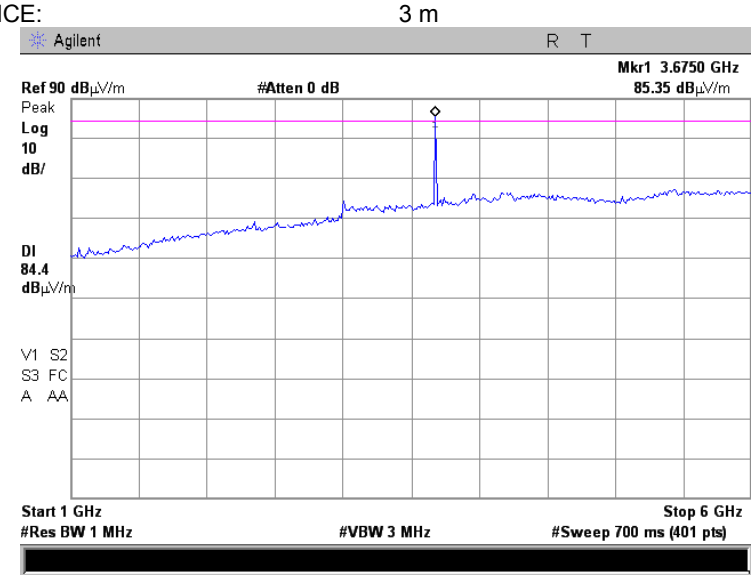
TEST SITE: Semi anechoic chamber
CARRIER FREQUENCY: Low
ANTENNA POLARIZATION: Vertical and Horizontal
TEST DISTANCE: 3 m



Test specification:	Section 90.1323, Radiated spurious emissions		
Test procedure:	47 CFR, Sections 2.1053, 90.1323; TIA/EIA-603-C, Section 2.2.12		
Test mode:	Compliance	Verdict:	PASS
Date(s):	4/14/2013		
Temperature: 23 ºC	Air Pressure: 1018 hPa	Relative Humidity: 55 %	Power Supply: 5.5 VDC
Remarks:			

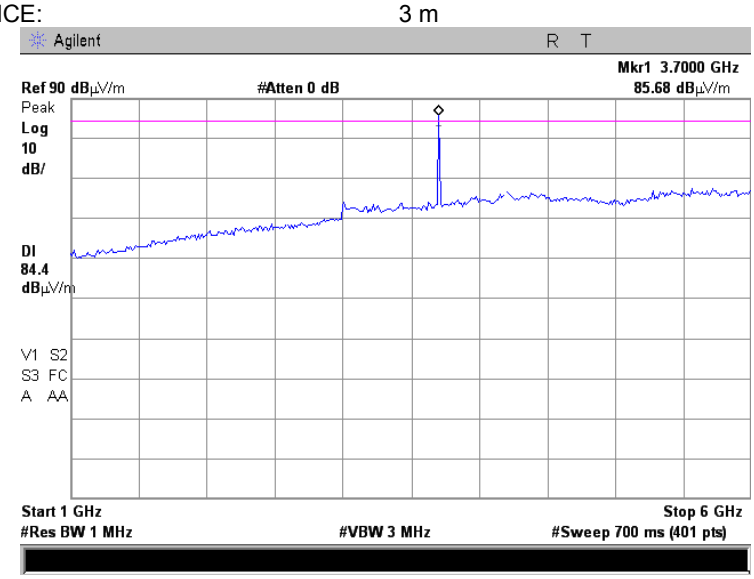
Plot 7.6.7 Radiated emission measurements in 1000 – 6000 MHz range

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



Plot 7.6.8 Radiated emission measurements in 1000 – 6000 MHz range

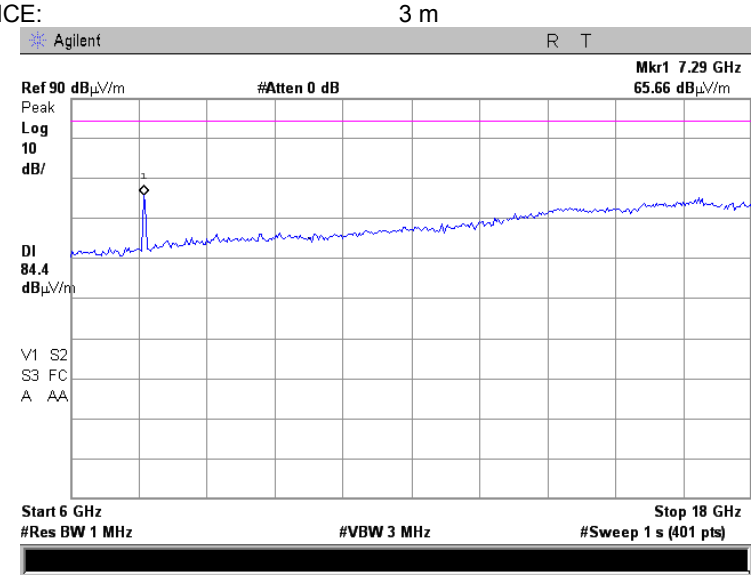
TEST SITE: Semi anechoic chamber
CARRIER FREQUENCY: High
ANTENNA POLARIZATION: Vertical and Horizontal
TEST DISTANCE: 3 m



Test specification:	Section 90.1323, Radiated spurious emissions		
Test procedure:	47 CFR, Sections 2.1053, 90.1323; TIA/EIA-603-C, Section 2.2.12		
Test mode:	Compliance	Verdict:	PASS
Date(s):	4/14/2013		
Temperature: 23 ºC	Air Pressure: 1018 hPa	Relative Humidity: 55 %	Power Supply: 5.5 VDC
Remarks:			

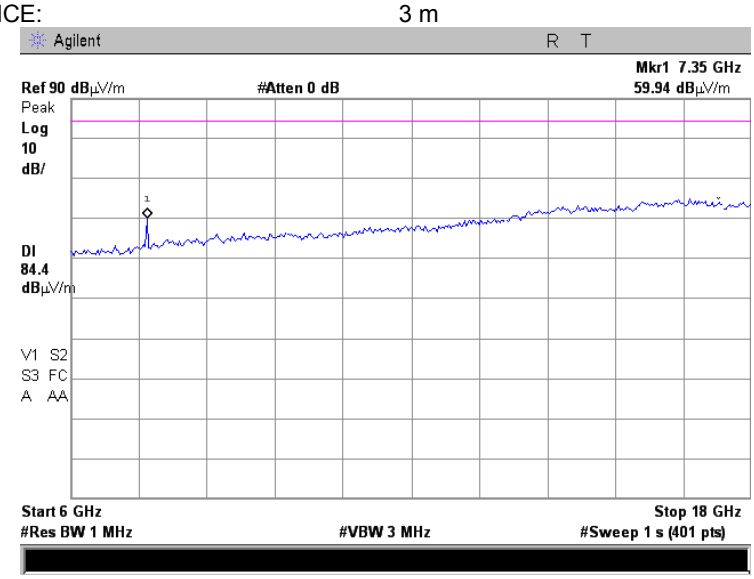
Plot 7.6.9 Radiated emission measurements in 6000 – 18000 MHz range

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



Plot 7.6.10 Radiated emission measurements in 6000 – 18000 MHz range

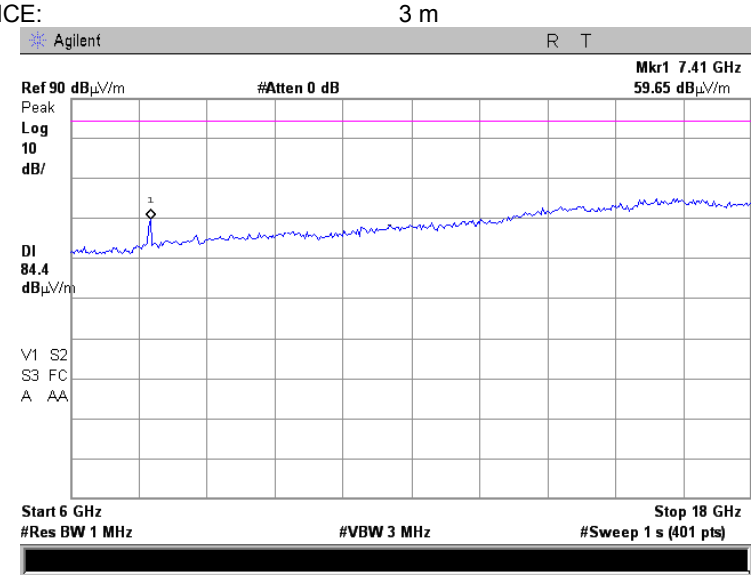
TEST SITE: Semi anechoic chamber
CARRIER FREQUENCY: Mid
ANTENNA POLARIZATION: Vertical and Horizontal
TEST DISTANCE: 3 m



Test specification:	Section 90.1323, Radiated spurious emissions		
Test procedure:	47 CFR, Sections 2.1053, 90.1323; TIA/EIA-603-C, Section 2.2.12		
Test mode:	Compliance	Verdict:	PASS
Date(s):	4/14/2013		
Temperature: 23 ºC	Air Pressure: 1018 hPa	Relative Humidity: 55 %	Power Supply: 5.5 VDC
Remarks:			

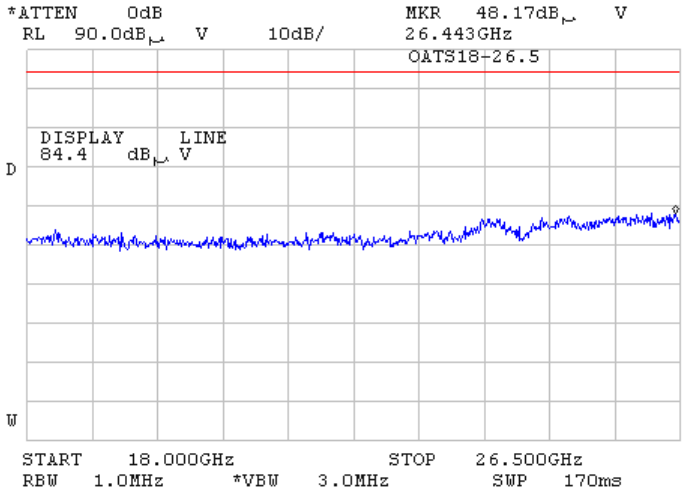
Plot 7.6.11 Radiated emission measurements in 6000 – 18000 MHz range

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



Plot 7.6.12 Radiated emission measurements in 18000 – 26500 MHz range

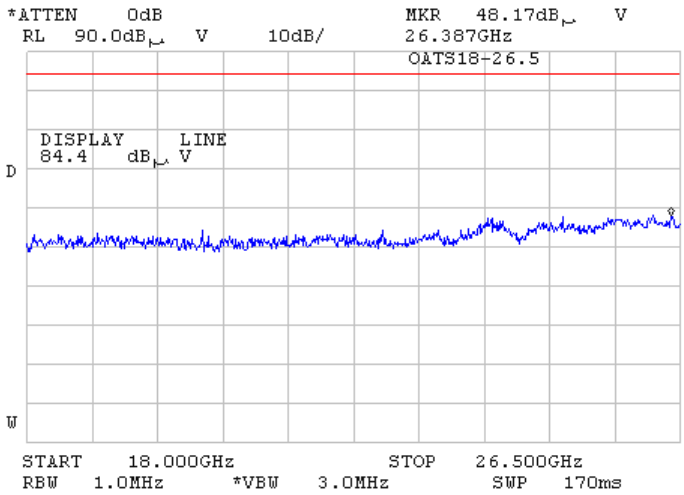
TEST SITE: Semi anechoic chamber
CARRIER FREQUENCY: Low
ANTENNA POLARIZATION: Vertical and Horizontal
TEST DISTANCE: 3 m



Test specification:	Section 90.1323, Radiated spurious emissions		
Test procedure:	47 CFR, Sections 2.1053, 90.1323; TIA/EIA-603-C, Section 2.2.12		
Test mode:	Compliance	Verdict:	PASS
Date(s):	4/14/2013		
Temperature: 23 ºC	Air Pressure: 1018 hPa	Relative Humidity: 55 %	Power Supply: 5.5 VDC
Remarks:			

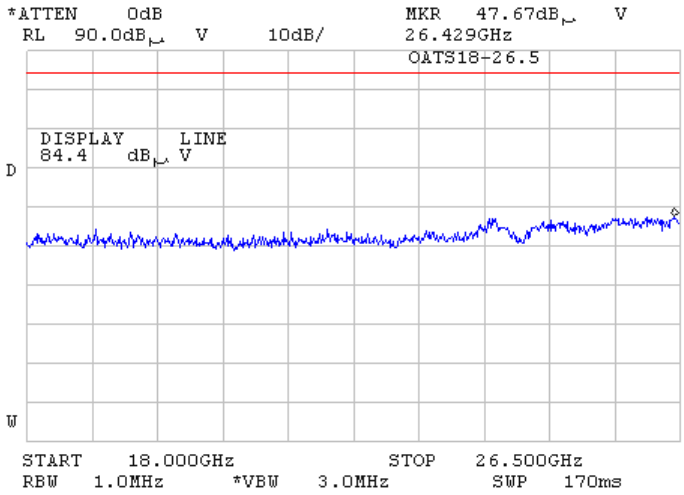
Plot 7.6.13 Radiated emission measurements in 18000 – 26500 MHz range

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



Plot 7.6.14 Radiated emission measurements in 18000 – 26500 MHz range

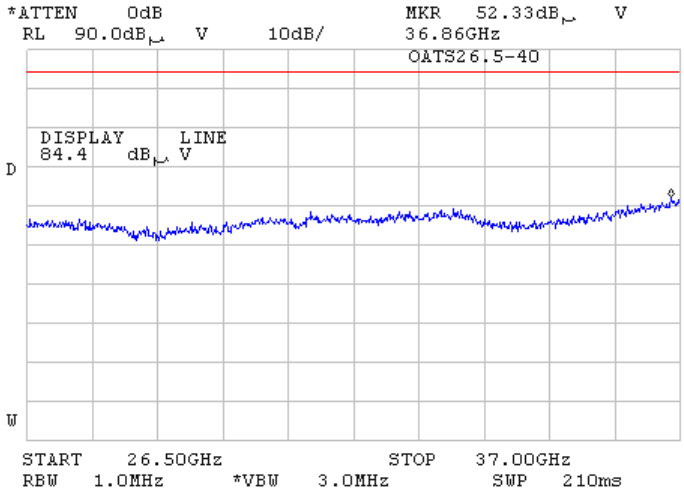
TEST SITE:	Semi anechoic chamber
CARRIER FREQUENCY:	High
ANTENNA POLARIZATION:	Vertical and Horizontal
TEST DISTANCE:	3 m



Test specification:	Section 90.1323, Radiated spurious emissions		
Test procedure:	47 CFR, Sections 2.1053, 90.1323; TIA/EIA-603-C, Section 2.2.12		
Test mode:	Compliance	Verdict:	PASS
Date(s):	4/14/2013		
Temperature: 23 ºC	Air Pressure: 1018 hPa	Relative Humidity: 55 %	Power Supply: 5.5 VDC
Remarks:			

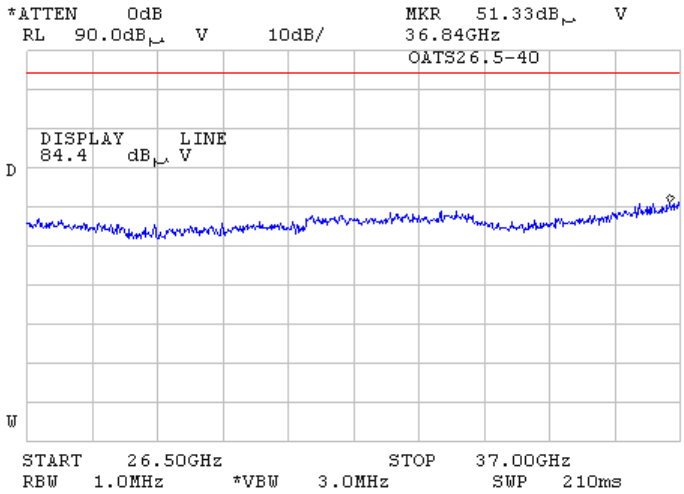
Plot 7.6.15 Radiated emission measurements in 26500 – 37000 MHz range

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



Plot 7.6.16 Radiated emission measurements in 26500 – 37000 MHz range

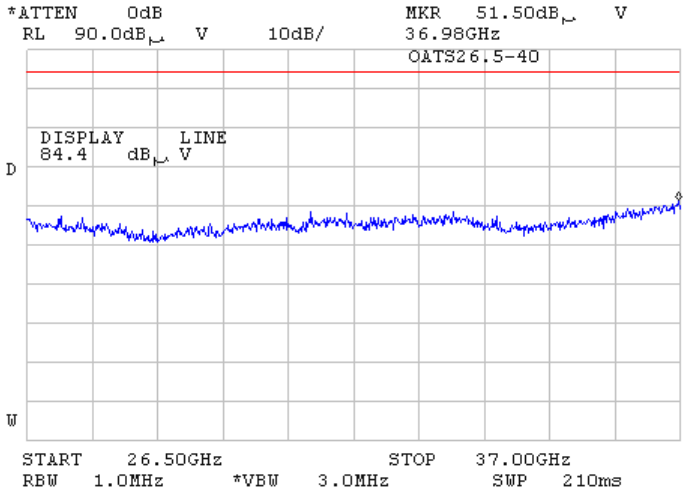
TEST SITE:	Semi anechoic chamber
CARRIER FREQUENCY:	Mid
ANTENNA POLARIZATION:	Vertical and Horizontal
TEST DISTANCE:	3 m



Test specification:	Section 90.1323, Radiated spurious emissions		
Test procedure:	47 CFR, Sections 2.1053, 90.1323; TIA/EIA-603-C, Section 2.2.12		
Test mode:	Compliance	Verdict:	PASS
Date(s):	4/14/2013		
Temperature: 23 ºC	Air Pressure: 1018 hPa	Relative Humidity: 55 %	Power Supply: 5.5 VDC
Remarks:			

Plot 7.6.17 Radiated emission measurements in 26500 – 37000 MHz range

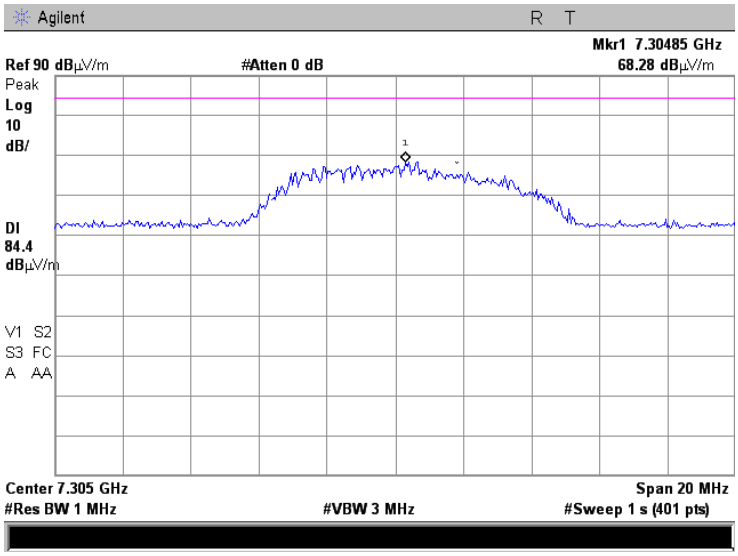
TEST SITE:	Semi anechoic chamber
CARRIER FREQUENCY:	High
ANTENNA POLARIZATION:	Vertical and Horizontal
TEST DISTANCE:	3 m



Test specification:	Section 90.1323, Radiated spurious emissions		
Test procedure:	47 CFR, Sections 2.1053, 90.1323; TIA/EIA-603-C, Section 2.2.12		
Test mode:	Compliance	Verdict:	PASS
Date(s):	4/14/2013		
Temperature: 23 ºC	Air Pressure: 1018 hPa	Relative Humidity: 55 %	Power Supply: 5.5 VDC
Remarks:			

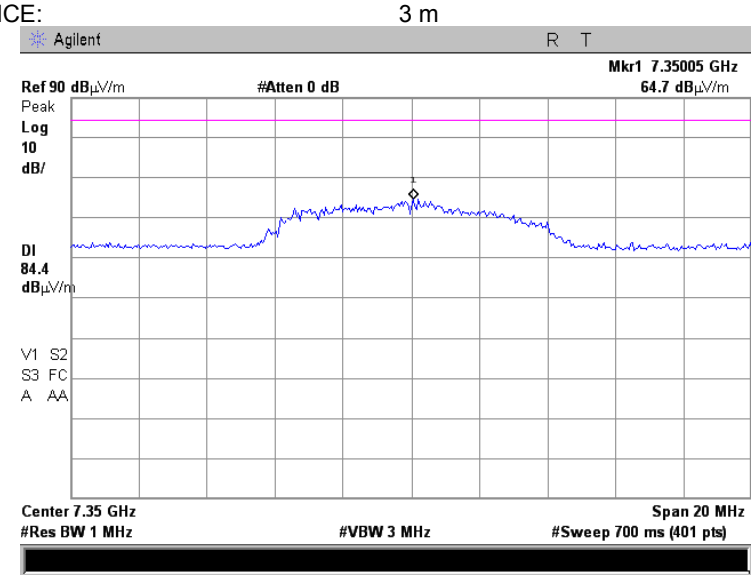
Plot 7.6.18 Radiated emission measurements at the 2 harmonic

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



Plot 7.6.19 Radiated emission measurements at the 2 harmonic

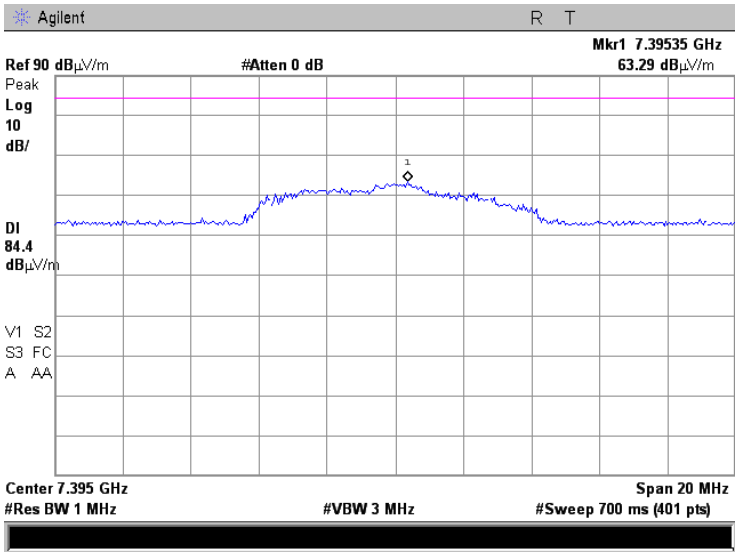
TEST SITE: Semi anechoic chamber
CARRIER FREQUENCY: Mid
ANTENNA POLARIZATION: Vertical
TEST DISTANCE: 3 m



Test specification:	Section 90.1323, Radiated spurious emissions		
Test procedure:	47 CFR, Sections 2.1053, 90.1323; TIA/EIA-603-C, Section 2.2.12		
Test mode:	Compliance	Verdict:	PASS
Date(s):	4/14/2013		
Temperature: 23 ºC	Air Pressure: 1018 hPa	Relative Humidity: 55 %	Power Supply: 5.5 VDC
Remarks:			

Plot 7.6.20 Radiated emission measurements at the 2 harmonic

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



8 APPENDIX A Test equipment and ancillaries used for tests

HL No	Description	Manufacturer	Model	Ser. No.	Last Cal./ Check	Due Cal./ Check
0446	Antenna, Loop, Active, 10 kHz - 30 MHz	EMCO	6502	2857	03-Jul-12	03-Jul-13
0604	Antenna BiconiLog Log-Periodic/T Bow-TIE, 26 - 2000 MHz	EMCO	3141	9611-1011	20-May-12	20-May-14
0661	Generator Swept Signal, 10 MHz to 40 GHz, + 10 dBm	Hewlett Packard	83640B	3614A00266	16-Jan-13	16-Jan-14
0768	Antenna Standard Gain Horn, 18-26.5 GHz, WR-42, 25 dB gain	Quinstar Technology	QWH-4200-BA	110	12-Dec-12	12-Dec-15
0769	Antenna Standard Gain Horn, 26.5-40 GHz, WR28, 25 dB gain	Quinstar Technology	QWH-2800-BA	112	12-Dec-12	12-Dec-15
1424	Spectrum Analyzer, 30 Hz- 40 GHz	Agilent Technologies	8564EC	3946A00219	04-Oct-12	04-Oct-13
2214	Directional Coupler 1.7-26.5 GHz	Krytar	2616	31354	31-Aug-11	31-Aug-13
2432	Antenna, Double-Ridged Waveguide Horn 1-18 GHz	EMC Test Systems	3115	00027177	07-Dec-12	07-Dec-13
2871	Microwave Cable Assembly, 18 GHz, 6.4 m, SMA - SMA	Huber-Suhner	198-8155-00	2871	04-Dec-12	04-Dec-13
2909	Spectrum analyzer, ESA-E, 100 Hz to 26.5 GHz	Agilent Technologies	E4407B	MY41444762	20-Dec-12	20-Dec-13
3301	Power Meter, P-series, 50 MHz to 40 GHz	Agilent Technologies	N1911A	MY45101057	19-Dec-12	19-Dec-13
3302	Power sensor, P-Series, 50 MHz to 40 GHz, -35/30 to 20 dBm	Agilent Technologies	N1922A	MY45240586	19-Dec-12	19-Dec-13
3353	Low Pass Filter, 50 Ohm, DC to 530 MHz.	Mini-Circuits	VLF-530+	NA	03-Oct-12	03-Oct-13
3355	Low Pass Filter, 50 Ohm, DC to 450 MHz	Mini-Circuits	VLF-1450+	NA	03-Oct-12	03-Oct-13
3455	Medium Power Fixed Coaxial Attenuator DC to 40 GHz, 20 dB, 5 W	Aeroflex / Weinschel	75A-20-12	1182	18-Mar-13	18-Mar-14
3535	Amplifier, low noise, 18 to 40 GHz	Quinstar Technology	QLJ-18404537-J0	11159003001	10-Jul-12	10-Jul-13
3787	Precision Fixed Attenuator, 50 Ohm, 5 W, 10 dB, DC to 18 GHz	Mini-Circuits	BW-S10W5+	NA	04-Dec-12	04-Dec-13
3818	PSA Series Spectrum Analyzer, 3 Hz- 44 GHz	Agilent Technologies	E4446A	MY48250288	16-Feb-12	16-Feb-14
3901	Microwave Cable Assembly, 40.0 GHz, 3.5 m, SMA/SMA	Huber-Suhner	SUCOFLEX 102A	1225/2A	06-Feb-13	06-Feb-14
3903	Microwave Cable Assembly, 40.0 GHz, 1.5 m, SMA/SMA	Huber-Suhner	SUCOFLEX 102A	1226/2A	06-Feb-13	06-Feb-14

9 APPENDIX B Measurement uncertainties

Expanded uncertainty at 95% confidence in Hermon Labs EMC measurements

Test description	Expanded uncertainty
Transmitter tests	
Carrier power conducted at antenna connector	± 1.7 dB
Carrier power radiated (substitution method)	± 4.5 dB
Occupied bandwidth	±8%
Conducted emissions at RF antenna connector	9 kHz to 2.9 GHz: ± 2.6 dB 2.9 GHz to 6.46 GHz: ± 3.5 dB 6.46 GHz to 13.2 GHz: ± 4.3 dB 13.2 GHz to 22.0 GHz: ± 5.0 dB 22.0 GHz to 26.8 GHz: ± 5.5 dB 26.8 GHz to 40.0 GHz: ± 4.8 dB
Spurious emissions radiated 30 MHz – 40 GHz (substitution method)	± 4.5 dB

Hermon Laboratories is accredited by A2LA for calibration according to present requirements of ISO/IEC 17025 and NCSL Z540-1. The accreditation is granted to perform calibration of parameters that are listed in the Scope of Hermon Laboratories Accreditation.
Hermon Laboratories calibrates its reference and transfer standards by calibration laboratories accredited to ISO/IEC 17025 by a mutually recognized Accreditation Body or by a recognized national metrology institute. All reference and transfer standards used in the calibration system are traceable to national or international standards.
In-house calibration of all test and measurement equipment is performed on a regular basis according to Hermon Laboratories calibration procedures, manufacturer calibration/verification procedures or procedures defined in the relevant standards. The Hermon Laboratories test and measurement equipment is calibrated within the tolerances specified by the manufacturers and/or by the relevant standards.

10 APPENDIX C Test laboratory description

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

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Person for contact: Mr. Alex Usoskin, CEO.

11 APPENDIX D Specification references

FCC 47CFR part 90: 2012	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

13 APPENDIX E Test equipment correction factors

Antenna factor
Active loop antenna
Model 6502, S/N 2857, HL 0446

Frequency, MHz	Magnetic antenna factor, dB	Electric antenna factor, dB
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	9.8
0.750	-41.9	9.7
1.000	-41.4	10.1
2.000	-41.5	10.0
3.000	-41.4	10.2
4.000	-41.4	10.1
5.000	-41.5	10.1
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(1/m) is to be added to receiver meter reading in dB(μV) to convert it into field strength in dB(μV/m).

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

Frequency min, GHz	Frequency max, GHz	Antenna factor, dB(1/m)
18.000	26.500	32.01
26.500	40.000	35.48

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

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

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

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

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

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

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

Cable loss
Microwave Cable Assembly, Huber-Suhner, 40 GHz, 1.5 m, SMA-SMA, S/N 1226/2A
HL 3903

Frequency, MHz	Cable loss, dB	Frequency, MHz	Cable loss, dB	Frequency, MHz	Cable loss, dB
10	-0.02	9500	1.84	21000	2.98
100	0.15	10000	1.86	22000	3.07
500	0.38	10500	1.93	23000	3.13
1000	0.56	11000	1.99	24000	3.21
1500	0.69	11500	2.04	25000	3.26
2000	0.82	12000	2.10	26000	3.48
2500	0.90	12500	2.15	27000	3.44
3000	0.98	13000	2.21	28000	3.53
3500	1.06	13500	2.25	29000	3.59
4000	1.11	14000	2.29	30000	3.66
4500	1.17	14500	2.34	31000	3.70
5000	1.24	15000	2.36	32000	3.79
5500	1.32	15500	2.40	33000	3.88
6000	1.40	16000	2.45	34000	3.94
6500	1.50	16500	2.48	35000	3.91
7000	1.56	17000	2.56	36000	4.05
7500	1.62	17500	2.58	37000	4.22
8000	1.68	18000	2.60	38000	4.25
8500	1.74	19000	2.84	39000	4.27
9000	1.78	20000	2.88	40000	4.33

14 APPENDIX F Abbreviations and acronyms

A	ampere
AC	alternating current
AM	amplitude modulation
AVRG	average (detector)
CBW	channel bandwidth
cm	centimeter
dB	decibel
dBm	decibel referred to one milliwatt
dB(μV)	decibel referred to one microvolt
dB(μV/m)	decibel referred to one microvolt per meter
dB(μA)	decibel referred to one microampere
DC	direct current
EBW	emission bandwidth
EIRP	equivalent isotropically radiated power
ERP	effective radiated power
EUT	equipment under test
F	frequency
GHz	gigahertz
H	height
HL	Hermon laboratories
Hz	hertz
k	kilo
kHz	kilohertz
LO	local oscillator
m	meter
MHz	megahertz
mm	millimeter
ms	millisecond
μs	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

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