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TEST REPORT

ACCORDING TO: FCC CFR 47 PART 90 subpart Z and RSS-197 Issue 1:2010

FOR:

Telrad Networks Ltd.
BreezeCOMPACT base station
Model: CMP.XT-BS-3.X
FCC ID:ARA-COMPACT3X
IC:899A-COMPACT3X

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.

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1 Applicant information

Client name: Telrad Networks Ltd.
Address: 1 Bat Sheva street, P.O.B. 6118, Lod 711600, Israel
Telephone: 972 732 467 651
Fax: 972 73.2467504
E-mail: klara.milman@telrad.com
Contact name: Ms. Klara Milman

2 Equipment under test attributes

Product name: BreezeCOMPACT base station
Product type: Transceiver
Brand: BreezeCOMPACT
Model(s): CMP.XT-BS-3.X
Serial number: 90119395
Hardware version: REV 6
Software release: Compact_4_0_0_51
Receipt date: 10/29/2013

3 Manufacturer information

Manufacturer name: Telrad Networks Ltd.
Address: 1 Bat Sheva street, P.O.B. 6118, Lod 711600, Israel
Telephone: 972 732 467 651
Fax: 972 73.2467504
E-Mail: klara.milman@telrad.com
Contact name: Ms. Klara Milman

4 Test details

Project ID: 24990
Location: Hermon Laboratories Ltd. Harakevet Industrial Zone, Binyamina 30500, Israel
Test started: 10/29/2013
Test completed: 1/14/2014
Test specification(s): 47CFR part 90 subpart Z; RSS-197 issue 1:2010

5 Tests summary

Test	Status
Transmitter characteristics	
FCC Section 90.1321 / RSS-197, Section 5.6, Maximum conducted output power	Pass
FCC Section 90.1321 / RSS-197, Section 5.6, Peak EIRP power density	Pass
FCC Section 90.209 / RSS-197, Section 5.2, Occupied bandwidth	Pass
FCC Section 90.210(b), Emission mask	Pass
FCC Section 90.1323 / RSS-197, Section 5.7, Spurious emissions at RF antenna connector	Pass
FCC Section 90.1323 / RSS-197, Section 5.7, Radiated spurious emissions	Pass
FCC Section 90.213 / RSS-197, Section 5.7, Frequency stability	Pass
FCC Section 90.203(o) / RSS-197 Section 5.4, Contention based protocol	Pass
FCC Section 90.1335 / RSS-Gen, Section 5.5, RF exposure	Pass, Exhibit attached to Application for certification
Receiver characteristics	
RSS-197, Section 5.8, Receiver spurious emissions	Pass

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

	Name and Title	Date	Signature
Tested by:	Mr. V. Einem, test engineer Mr. S. Samokha, test engineer	January 14, 2014	
Reviewed by:	Mrs. M. Cherniavsky, certification engineer	January 15, 2014	
Approved by:	Mr. M. Nikishin, EMC and Radio group manager	January 15, 2014	



6 EUT description

6.1 General information

The EUT, base station, is a part of BreezeCOMPACT Broadband Wireless Access system. The product is based on WiMAX technology TDD system covering 3400 MHz up to 3700 MHz range. The system contains an all outdoor base station unit. The ODU consists of four identical RF radio paths based on two identical RF IC chipsets, all paths terminated with antenna ports. The detailed EUT description provided in the exhibit "Operational description" attached to application for certification, the calculation for maximum power limit provided in Table 6.6.2.

6.2 Ports and lines

Port type	Port description	Connected from	Connected to	Qty.	Cable type	Cable length, m
Power	DC power	EUT	DC power supply	1	Unshielded	3
Signal	Ethernet	EUT	Cisco AUX	1	Shielded	1.5
Signal	Ethernet	EUT	PCB AUX	1	Shielded	1.5
Signal	GPS OUT	EUT	GPS	1	Shielded	3
RF	Antenna	EUT	Splitter	4	Coax	1.5
GND	GND	EUT	GND	1	Unshielded	1.5

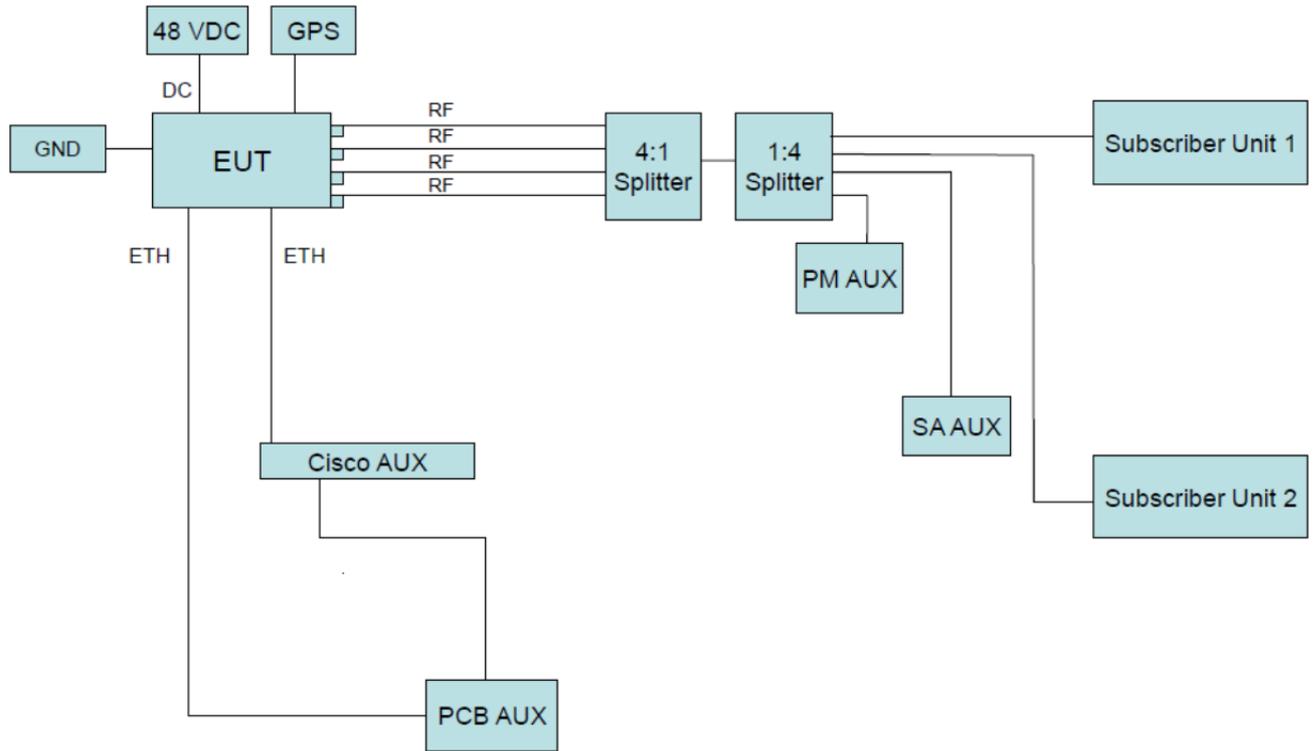
6.3 Auxiliary equipment

Description	Manufacturer	Model number	Serial number
Subscriber unit x 2	Telrad	4M-CPE6000-PRO-1D-1V-3.X	NA
DC power suply	Horizon	DHR3655D-10	773352
GPS	Alvarion	TA1556	NA
Splitter	Mini Circuits	ZN4PD1-50-S+	400914
Splitter	Mini Circuits	ZN4PD1-50-S+	800841
Cisco Hub (AUX)	Cisco	CNMZ210ARB	NA
PCB AUX (simulator)	Telrad	NA	NA
Power meter	Rohde&Schwarz	NRP-Z11	104297
Spectrum analyzer	Spirent communication	Smart Bits 2000	683831

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									
<input checked="" type="checkbox"/>	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							
<input checked="" type="checkbox"/>	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 – 3700 MHz							
Operating frequency range		3652.5 – 3697.5 MHz							
RF channel spacing		5 MHz, 7 MHz, 10 MHz							
Maximum rated output power		EIRP, total: 36.7 dBm for 5 MHz CBW 37.5 dBm for 7 MHz CBW 39.15 dBm for 10 MHz CBW							
Is transmitter output power variable?		No							
		<input checked="" type="checkbox"/>	Yes	continuous variable					
				<input checked="" type="checkbox"/>	stepped variable with stepsize	1 dB			
				minimum RF power		17 dBm			
				maximum RF power, total		19.2 dBm for 5 MHz CBW 20.0 dBm for 7 MHz CBW 21.65 dBm for 10 MHz CBW			
Antenna connection									
<input type="checkbox"/>	unique coupling	<input checked="" type="checkbox"/>	standard connector	<input checked="" type="checkbox"/>	Integral	<input checked="" type="checkbox"/>	with temporary RF connector	<input type="checkbox"/>	without temporary RF connector
Antenna/s technical characteristics									
Type	Manufacturer	Model number	Gain	Feeder loss	Assembly gain				
External sector antenna	Alpha Wireless	AW3023-PT	18 dBi	0.5 dB	17.5 dBi				
Transmitter 99% power bandwidth, MHz		5 MHz, 7 MHz, 10 MHz							
Type of modulation		QPSK1/2, QPSK3/4, 16QAM1/2, 16QAM3/4, 64QAM5/6							
Modulating test signal (baseband)		PRBS							
Maximum transmitter duty cycle in normal use		60%							
Transmitter power source									
<input checked="" type="checkbox"/>	DC	Nominal rated voltage	48 V	Battery type					
	AC mains	Nominal rated voltage		Frequency					
Common power source for transmitter and receiver		<input checked="" type="checkbox"/>	yes	<input type="checkbox"/>	no				

Table 6.6.1 Type of modulation and bit rate

Modulation type	Bit rate, Mbps		
	EBW=5 MHz	EBW=7 MHz	EBW=10 MHz
QPSK 1/2	1.728000	2.304000	3.456000
QPSK 3/4	2.592000	3.456000	5.184000
QAM16 1/2	3.456000	4.608000	6.912000
QAM16 3/4	5.184000	6.912000	10.368000
QAM64 1/2	5.184000	6.912000	10.368000
QAM64 2/3	6.192000	9.216000	13.824000
QAM64 3/4	7.776000	10.368000	15.552000
QAM64 5/6	8.640000	11.520000	17.280000

Table 6.6.2 Table of calculations for the MAX power limits

Frequency channel, MHz			Type of modulation	CBW, MHz	Number of antennas	RF output power per antenna, dBm	Aggregate output power all antennas, dBm	Single antenna gain, dBi	Beam forming gain, dBi	Total* antenna gain, dBi	Total** EIRP, dBm
Low	Mid	High									
1 carrier 1 sector (4 ports: 2 dual slant antennas- no power aggregation, 2 antenna gains aggregation)											
3650	3675	3700	OFDMA	5	4	16.5	16.5	17.5	0	20.5	37
3650	3675	3700	OFDMA	7	4	18.0	18.0	17.5	0	20.5	38.5
3650	3675	3700	OFDMA	10	4	19.5	19.5	17.5	0	20.5	40
2 carrier 1 sector- different frequencies (4 ports: 2 dual slant antennas- no power aggregation as 2 carriers occupy twice the BW, no antenna gains aggregation)											
3650	3675	3700	OFDMA	5	4	19.5	19.5	17.5	0	17.5	37 dBm per channel (40 dBm over the band)
3650	3675	3700	OFDMA	7	4	21.0	21.0	17.5	0	17.5	38.5 dBm per channel (41.5 dBm over the band)
3650	3675	3700	OFDMA	10	4	22.5	22.5	17.5	0	17.5	40 dBm per channel (43 dBm over the band)
2 carrier 2 sector – isolated sectors, therefore the carriers may use similar or different frequencies (4 ports: 2 sectors x 2 dual slant antenna, no carrier aggregation and no antenna gain aggregation)											
3650	3675	3700	OFDMA	5	2+2	19.5	19.5	17.5	0	17.5	37
3650	3675	3700	OFDMA	7	2+2	21.0	21.0	17.5	0	17.5	38.5
3650	3675	3700	OFDMA	10	2+2	22.5	22.5	17.5	0	17.5	40

* - Total antenna gain, dBi = Single antenna gain, dBi + 10 log (Number of antennas) + Beam forming gain, dBi

** - Total EIRP, dBm = RF output power per antenna, dBm + Single antenna gain, dBi + 10 log (Number of antennas) + Beam forming gain, dBi



Test specification:		FCC Section 90.1321 / RSS-197, Section 5.6, Maximum output power	
Test procedure:		47 CFR, Section 2.1046; TIA/EIA-603-C, Section 2.2.1	
Test mode:		Compliance	
Date(s):		11/4/2013-12/23/2013	
Temperature: 24 °C		Air Pressure: 1018 hPa	
Remarks:		Relative Humidity: 39 %	
		Power Supply: 48 VDC	
		Verdict: PASS	

7 Transmitter tests according to 47CFR part 90 and RSS-197 requirements

7.1 Maximum output power

7.1.1 General

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

Table 7.1.1 Maximum output power limits

Assigned frequency range, MHz	Occupied bandwidth, MHz	Maximum peak output power, EIRP	
		W	dBm
3650 – 3700	5	5	36.99
	7	7	38.45
	10	10	40.00

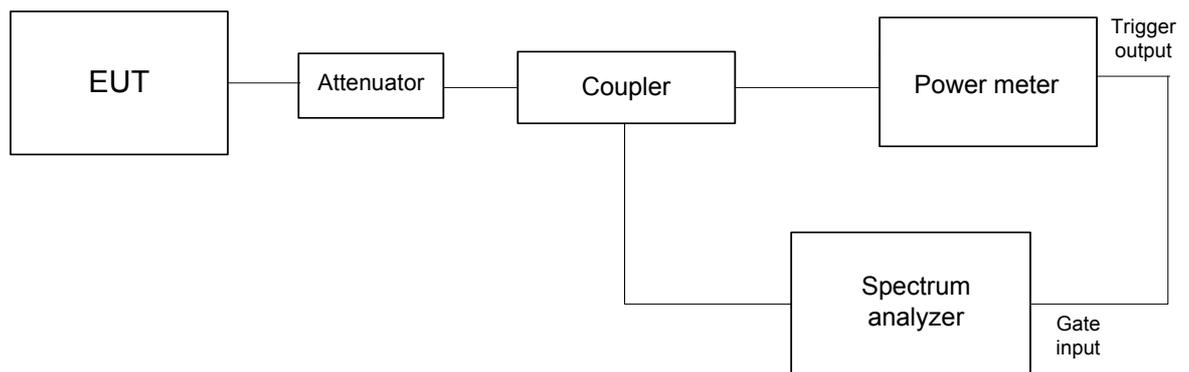
7.1.2 Test procedure

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 for end user RF output power.

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

Figure 7.1.1 Transmitter output power test setup





Test specification:		FCC Section 90.1321 / RSS-197, Section 5.6, 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):		11/4/2013-12/23/2013			
Temperature: 24 °C		Air Pressure: 1018 hPa		Relative Humidity: 39 %	
Remarks:		Power Supply: 48 VDC			

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

Channel, MHz	Modulation	P _{meas} , dBm	Loss*, dB	RF output power@con1**, dBm	Antenna assembly gain, dBi	EIRP***, dBm	Limit, dBm	Margin, dB	Verdict
EBW: 5 MHz									
3652.5	QPSK	13.30	5.75	19.05	17.5	36.55	36.99	-0.44	Pass
3675.0	QPSK	13.25	5.75	19.00	17.5	36.50	36.99	-0.49	
3697.5	QPSK	13.30	5.75	19.05	17.5	36.55	36.99	-0.44	
3652.5	64QAM	13.20	5.75	18.95	17.5	36.45	36.99	-0.54	Pass
3675.0	64QAM	13.44	5.75	19.19	17.5	36.69	36.99	-0.30	
3697.5	64QAM	13.34	5.75	19.09	17.5	36.59	36.99	-0.40	
EBW: 7 MHz									
3653.5	QPSK	14.15	5.75	19.90	17.5	37.40	38.45	-1.05	Pass
3675.0	QPSK	14.25	5.75	20.00	17.5	37.50	38.45	-0.95	
3696.5	QPSK	14.08	5.75	19.83	17.5	37.33	38.45	-1.12	
3653.5	64QAM	14.10	5.75	19.85	17.5	37.35	38.45	-1.10	Pass
3675.0	64QAM	14.10	5.75	19.85	17.5	37.35	38.45	-1.10	
3696.5	64QAM	14.05	5.75	19.80	17.5	37.30	38.45	-1.15	
EBW: 10 MHz									
3655	QPSK	15.90	5.75	21.65	17.5	39.15	40.00	-0.85	Pass
3675	QPSK	15.70	5.75	21.45	17.5	38.95	40.00	-1.05	
3695	QPSK	15.65	5.75	21.40	17.5	38.90	40.00	-1.10	
3655	64QAM	15.65	5.75	21.40	17.5	38.90	40.00	-1.10	Pass
3675	64QAM	15.68	5.75	21.43	17.5	38.93	40.00	-1.07	
3695	64QAM	15.70	5.75	21.45	17.5	38.95	40.00	-1.05	

Note 1: There are 4 completely independent RF chains, no aggregation of cross polarized antenna gains and no aggregation of sector antenna gains applies.

Note 2: In MIMO mode the maximum output power is reduced by 3 dB.

* - Loss, dB = loss from EUT antenna connector to power meter

** - RF output power@con1, dBm = P_{meas}, dBm + Loss, dB

*** - EIRP, dBm = RF output power@con1, dBm + Antenna assembly gain, dBi

Reference numbers of test equipment used

HL 1906	HL 3301	HL 3302	HL 3818	HL 3901	HL 4068	HL 4274	HL 4366
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Full description is given in Appendix A.



Test specification:	FCC Section 90.1321 / RSS-197, Section 5.6, 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):	11/4/2013-12/23/2013		
Temperature: 24 °C	Air Pressure: 1018 hPa	Relative Humidity: 39 %	Power Supply: 48 VDC
Remarks:			

7.2 Peak EIRP power density

7.2.1 General

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

Table 7.2.1 Peak power density limits

Assigned frequency range, MHz	Occupied bandwidth, MHz	Maximum peak power density, EIRP	
		W/MHz	dBm/MHz
3650 – 3700	5	1	30
	7		
	10		

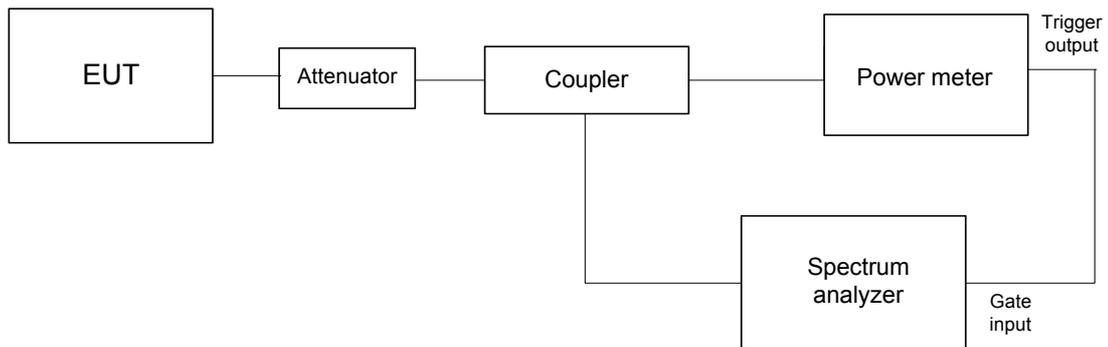
7.2.2 Test procedure

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

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

7.2.2.3 The peak output power density was measured with spectrum analyzer as provided in Table 7.2.2, Table 7.2.3 and the associated plots.

Figure 7.2.1 Peak power density test setup





Test specification:		FCC Section 90.1321 / RSS-197, Section 5.6, Peak EIRP power density	
Test procedure:		47 CFR, Sections 2.1046; TIA/EIA-603-C, Section 2.2.1	
Test mode:		Compliance	
Date(s):		11/4/2013-12/23/2013	
Temperature: 24 °C		Air Pressure: 1018 hPa	
		Relative Humidity: 39 %	
		Power Supply: 48 VDC	
Remarks:			

Table 7.2.2 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

Channel, MHz	Modulation	Power density, dBm/MHz	Antenna assembly gain, dBi	EIRP power density*, dBm/MHz	Limit, dBm/MHz	Margin, dB	Verdict
EBW: 5 MHz							
3652.5	QPSK	12.39	17.5	29.89	30	-0.11	Pass
3675.0	QPSK	12.48	17.5	29.98	30	-0.02	Pass
3697.5	QPSK	12.46	17.5	29.96	30	-0.04	Pass
3652.5	64QAM	12.47	17.5	29.97	30	-0.03	Pass
3675.0	64QAM	12.41	17.5	29.91	30	-0.09	Pass
3697.5	64QAM	12.39	17.5	29.89	30	-0.11	Pass
EBW: 7 MHz							
3653.5	QPSK	12.42	17.5	29.92	30	-0.08	Pass
3675.0	QPSK	12.49	17.5	29.99	30	-0.01	Pass
3696.5	QPSK	12.39	17.5	29.89	30	-0.11	Pass
3653.5	64QAM	12.27	17.5	29.77	30	-0.23	Pass
3675.0	64QAM	12.30	17.5	29.80	30	-0.20	Pass
3696.5	64QAM	12.40	17.5	29.90	30	-0.10	Pass
EBW: 10 MHz							
3655.0	QPSK	12.37	17.5	29.87	30	-0.13	Pass
3675.0	QPSK	12.30	17.5	29.80	30	-0.20	Pass
3695.0	QPSK	12.41	17.5	29.91	30	-0.09	Pass
3655.0	64QAM	12.37	17.5	29.87	30	-0.13	Pass
3675.0	64QAM	12.30	17.5	29.80	30	-0.20	Pass
3695.0	64QAM	12.46	17.5	29.96	30	-0.04	Pass

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

Reference numbers of test equipment used

HL 1906	HL 3301	HL 3302	HL 3818	HL 3901	HL 4068	HL 4274	HL 4366
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Full description is given in Appendix A.

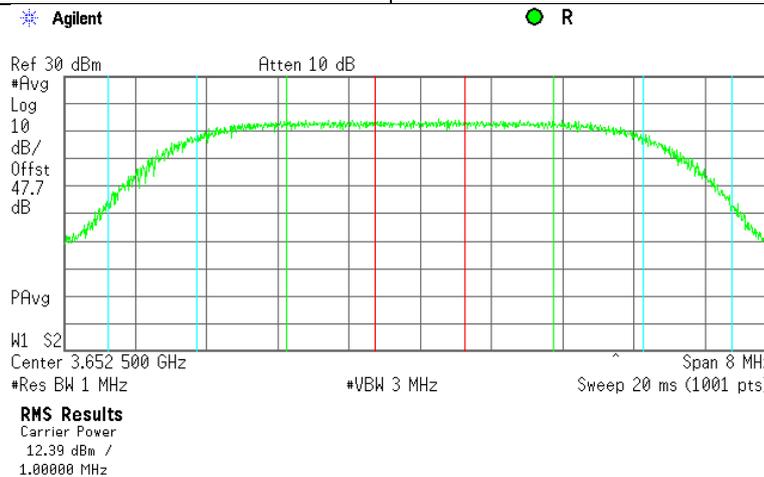


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Test specification:		FCC Section 90.1321 / RSS-197, Section 5.6, Peak EIRP power density	
Test procedure:		47 CFR, Sections 2.1046; TIA/EIA-603-C, Section 2.2.1	
Test mode:		Verdict: PASS	
Date(s):		11/4/2013-12/23/2013	
Temperature: 24 °C	Air Pressure: 1018 hPa	Relative Humidity: 39 %	Power Supply: 48 VDC
Remarks:			

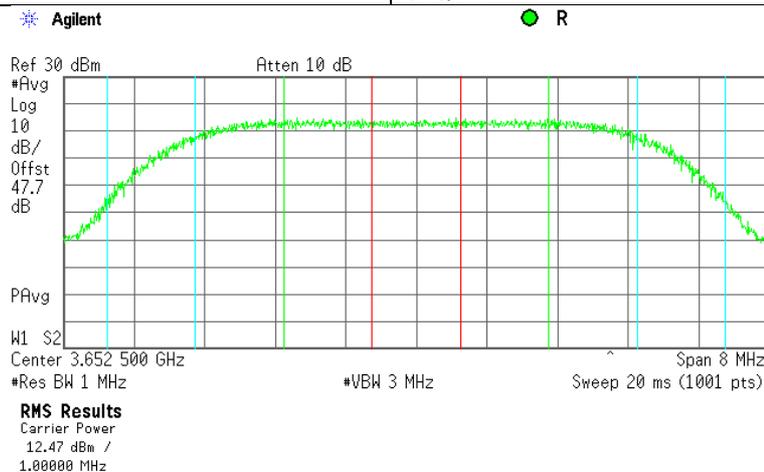
Plot 7.2.1 Peak output power density test results at low frequency

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



Plot 7.2.2 Peak output power density test results at low frequency

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





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Test specification: FCC Section 90.1321 / RSS-197, Section 5.6, 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): 11/4/2013-12/23/2013	
Temperature: 24 °C	Air Pressure: 1018 hPa
	Relative Humidity: 39 %
	Power Supply: 48 VDC
Remarks:	

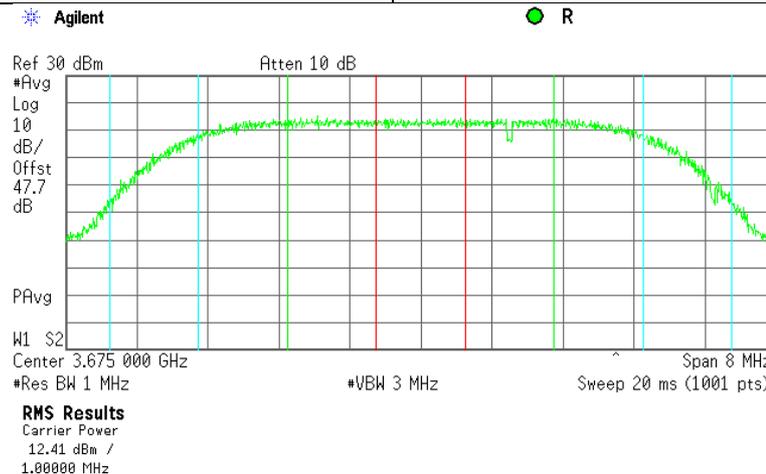
Plot 7.2.3 Peak output power density test results at mid frequency

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



Plot 7.2.4 Peak output power density test results at mid frequency

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



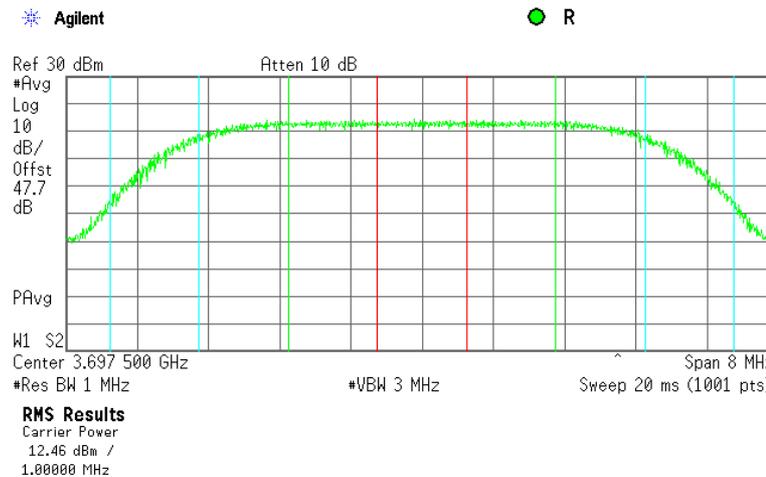


HERMON LABORATORIES

Test specification: FCC Section 90.1321 / RSS-197, Section 5.6, 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): 11/4/2013-12/23/2013	
Temperature: 24 °C	Air Pressure: 1018 hPa
Relative Humidity: 39 %	Power Supply: 48 VDC
Remarks:	

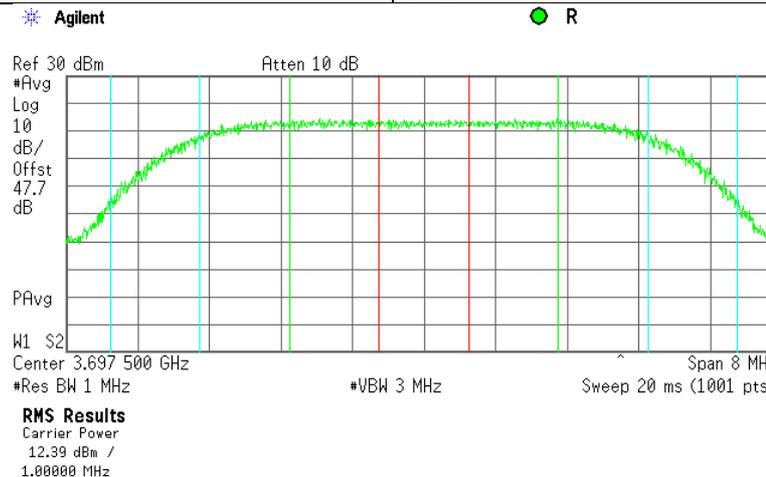
Plot 7.2.5 Peak output power density test results at high frequency

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



Plot 7.2.6 Peak output power density test results at high frequency

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



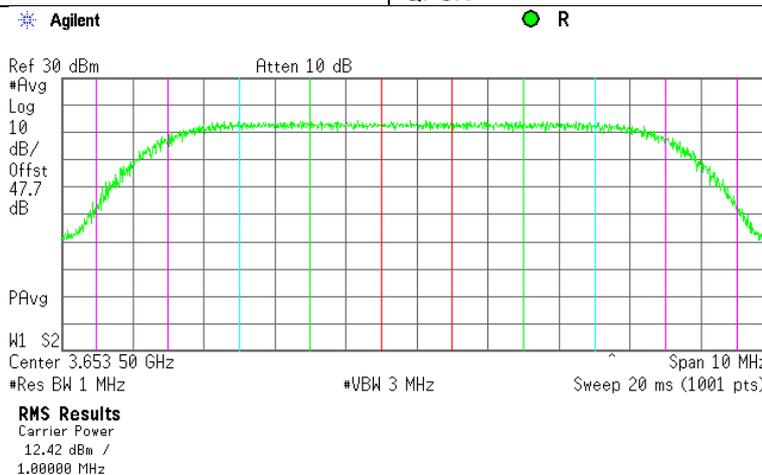


HERMON LABORATORIES

Test specification: FCC Section 90.1321 / RSS-197, Section 5.6, 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): 11/4/2013-12/23/2013	
Temperature: 24 °C	Air Pressure: 1018 hPa
Relative Humidity: 39 %	Power Supply: 48 VDC
Remarks:	

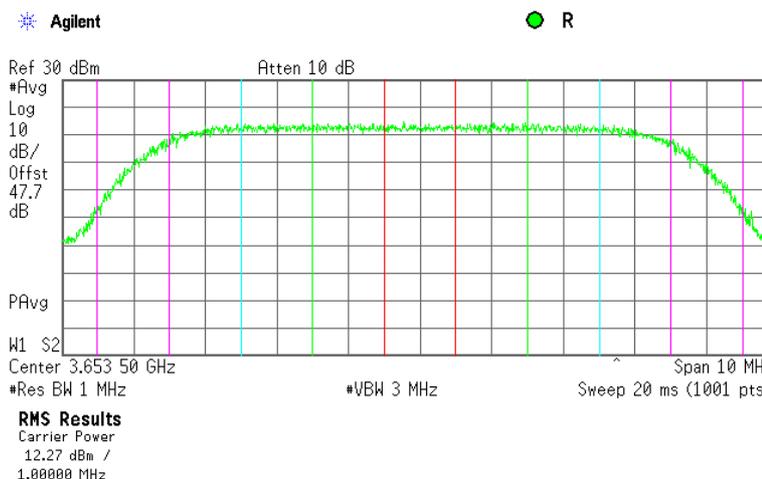
Plot 7.2.7 Peak output power density test results at low frequency

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



Plot 7.2.8 Peak output power density test results at low frequency

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



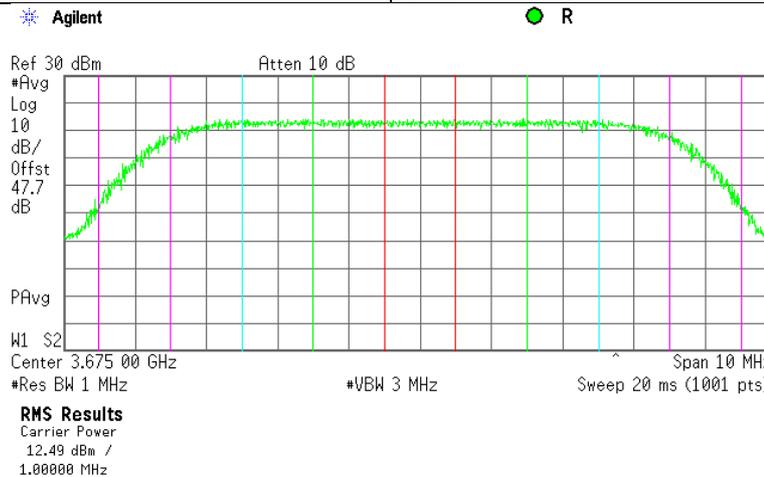


HERMON LABORATORIES

Test specification: FCC Section 90.1321 / RSS-197, Section 5.6, 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): 11/4/2013-12/23/2013	
Temperature: 24 °C	Air Pressure: 1018 hPa
Relative Humidity: 39 %	Power Supply: 48 VDC
Remarks:	

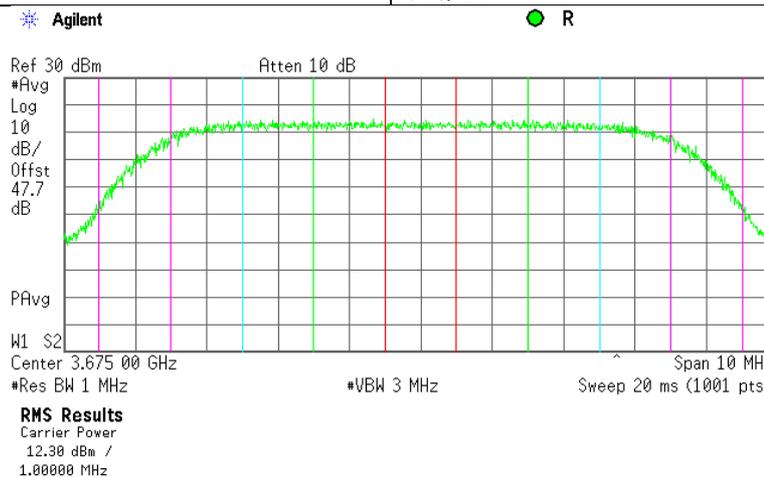
Plot 7.2.9 Peak output power density test results at mid frequency

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



Plot 7.2.10 Peak output power density test results at mid frequency

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



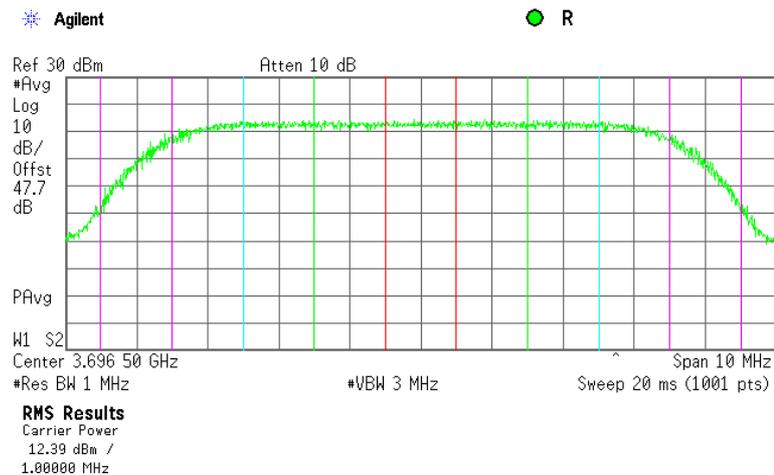


HERMON LABORATORIES

Test specification: FCC Section 90.1321 / RSS-197, Section 5.6, 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): 11/4/2013-12/23/2013	
Temperature: 24 °C	Air Pressure: 1018 hPa
	Relative Humidity: 39 %
	Power Supply: 48 VDC
Remarks:	

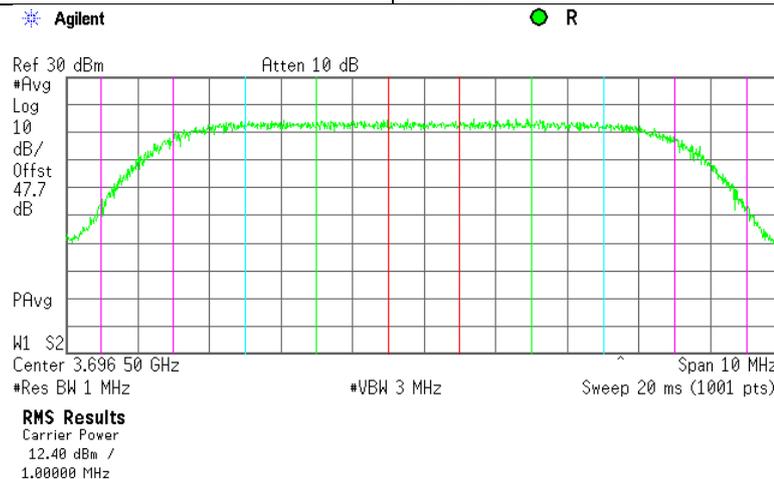
Plot 7.2.11 Peak output power density test results at high frequency

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



Plot 7.2.12 Peak output power density test results at high frequency

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



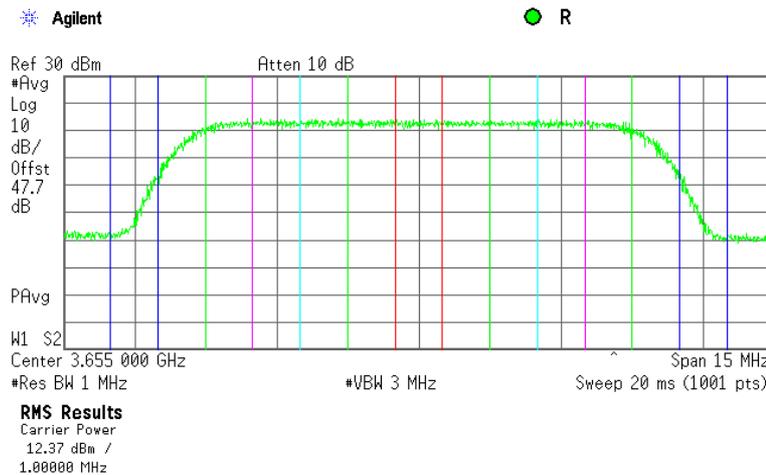


HERMON LABORATORIES

Test specification:	FCC Section 90.1321 / RSS-197, Section 5.6, 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):	11/4/2013-12/23/2013		
Temperature: 24 °C	Air Pressure: 1018 hPa	Relative Humidity: 39 %	Power Supply: 48 VDC
Remarks:			

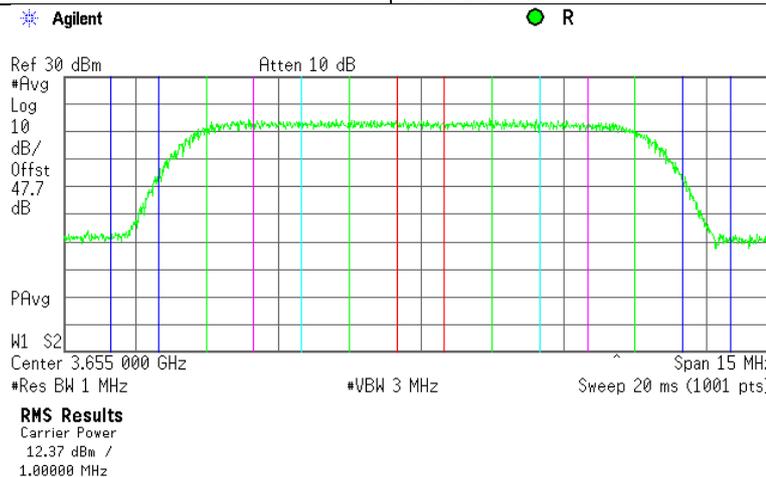
Plot 7.2.13 Peak output power density test results at low frequency

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



Plot 7.2.14 Peak output power density test results at low frequency

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



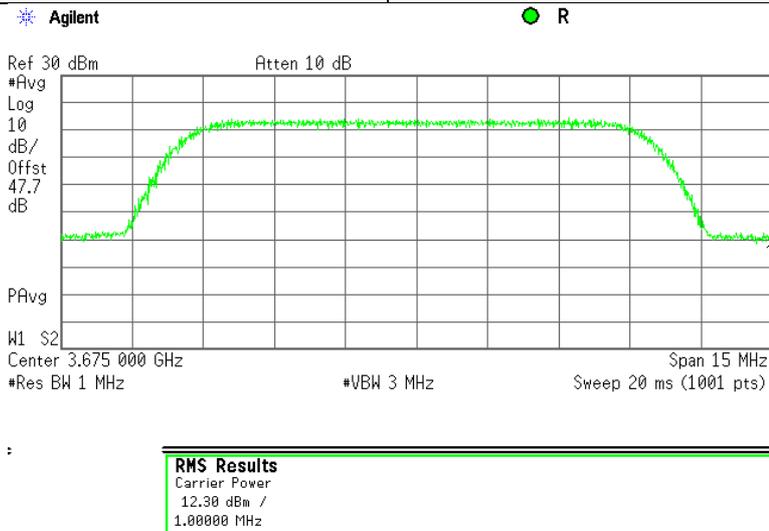


HERMON LABORATORIES

Test specification:		FCC Section 90.1321 / RSS-197, Section 5.6, Peak EIRP power density	
Test procedure:		47 CFR, Sections 2.1046; TIA/EIA-603-C, Section 2.2.1	
Test mode:		Compliance	
Date(s):		11/4/2013-12/23/2013	
Temperature: 24 °C		Air Pressure: 1018 hPa	
Relative Humidity: 39 %		Power Supply: 48 VDC	
Remarks:			
		Verdict: PASS	

Plot 7.2.15 Peak output power density test results at mid frequency

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



Plot 7.2.16 Peak output power density test results at mid frequency

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



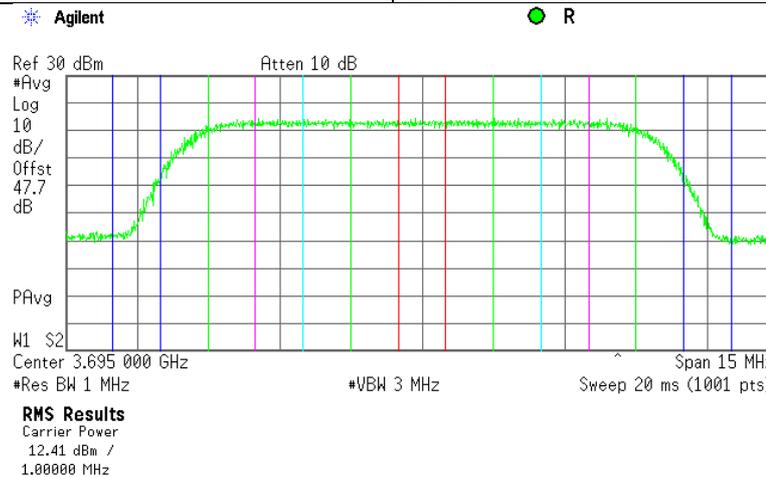


HERMON LABORATORIES

Test specification:		FCC Section 90.1321 / RSS-197, Section 5.6, Peak EIRP power density	
Test procedure:		47 CFR, Sections 2.1046; TIA/EIA-603-C, Section 2.2.1	
Test mode:		Compliance	
Date(s):		11/4/2013-12/23/2013	
Temperature: 24 °C		Air Pressure: 1018 hPa	
Relative Humidity: 39 %		Power Supply: 48 VDC	
Remarks:			
		Verdict: PASS	

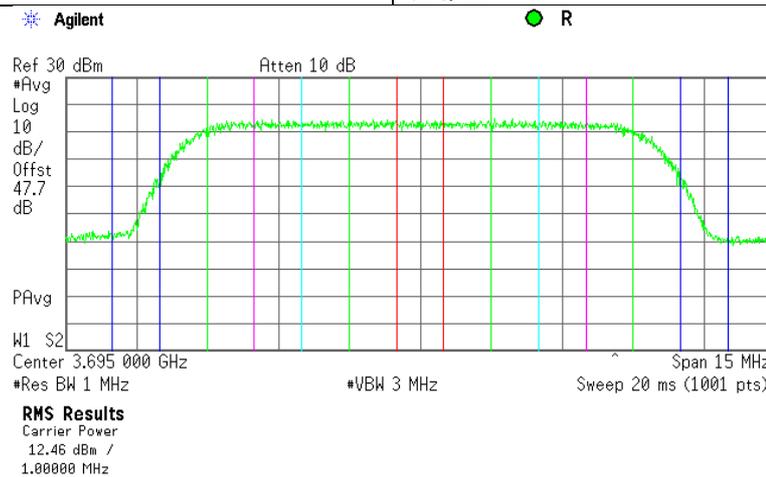
Plot 7.2.17 Peak output power density test results at high frequency

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



Plot 7.2.18 Peak output power density test results at high frequency

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





Test specification:		FCC Section 90.209 / RSS-197, Section 5.2, Occupied bandwidth	
Test procedure:		47 CFR, Section 2.1049	
Test mode:		Compliance	
Date(s):		11/4/2013-12/23/2013	
Temperature: 24 °C		Air Pressure: 1018 hPa	
		Relative Humidity: 39 %	
		Power Supply: 48 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

FCC part 90

Assigned frequency, MHz	Modulation envelope reference points*, dBc	Maximum allowed bandwidth, MHz
3650.0 – 3675.0	26	NA

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

RSS-197

Assigned frequency, MHz	Modulation envelope reference points	Maximum allowed bandwidth, MHz
3650.0 – 3675.0	99% EBW	NA

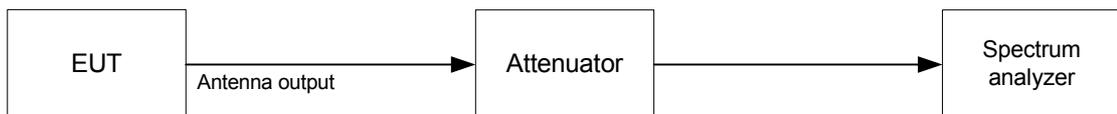
7.3.2 Test procedure

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 normally modulated carrier.

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

Figure 7.3.1 Occupied bandwidth test setup





Test specification:	FCC Section 90.209 / RSS-197, Section 5.2, Occupied bandwidth		
Test procedure:	47 CFR, Section 2.1049		
Test mode:	Compliance	Verdict:	PASS
Date(s):	11/4/2013-12/23/2013		
Temperature: 24 °C	Air Pressure: 1018 hPa	Relative Humidity: 39 %	Power Supply: 48 VDC
Remarks:			

Table 7.3.2 Occupied bandwidth test results

DETECTOR USED: Average
 RESOLUTION BANDWIDTH: 1% of the Emission bandwidth
 VIDEO BANDWIDTH: 3 times RBW
 MODULATING SIGNAL: PRBS

EMISSION BANDWIDTH: 5 MHz

Carrier frequency, MHz	Modulation	99% Occupied bandwidth, MHz	Occupied bandwidth 26 dBc, MHz	Verdict
3652.5	QPSK	4.5484	4.768	NA
3675.0		4.5618	4.768	
3697.5		4.5464	4.743	
3652.5	64QAM	4.5598	4.752	NA
3675.0		4.5637	4.733	
3697.5		4.5617	4.732	

EMISSION BANDWIDTH: 7 MHz

Carrier frequency, MHz	Modulation	99% Occupied bandwidth, MHz	Occupied bandwidth 26 dBc, MHz	Verdict
3653.5	QPSK	6.503	6.742	NA
3675.0		6.477	6.737	
3696.5		6.469	6.729	
3653.5	64QAM	6.486	6.764	NA
3675.0		6.477	6.767	
3696.5		6.483	6.766	

EMISSION BANDWIDTH: 10 MHz

Carrier frequency, MHz	Modulation	99% Occupied bandwidth, MHz	Occupied bandwidth 26 dBc, MHz	Verdict
3655	QPSK	9.070	9.387	NA
3675		9.083	9.508	
3695		9.088	9.511	
3655	64QAM	9.085	9.549	NA
3675		9.071	9.563	
3695		9.081	9.563	

Reference numbers of test equipment used

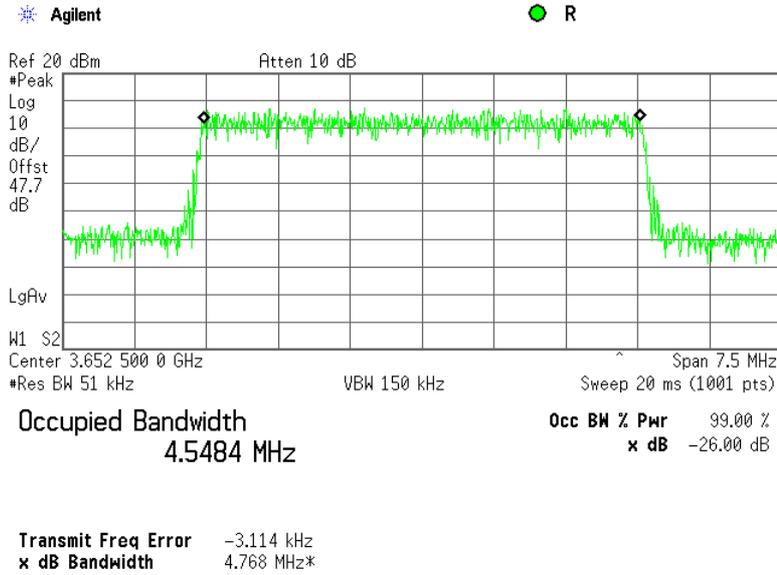
HL 1906	HL 3301	HL 3302	HL 3818	HL 3901	HL 4068	HL 4274	HL 4366
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Full description is given in Appendix A.

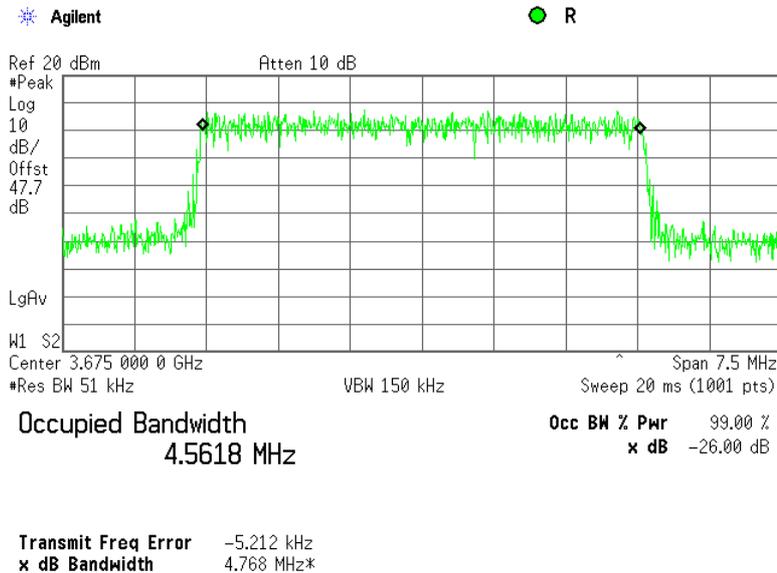


Test specification: FCC Section 90.209 / RSS-197, Section 5.2, Occupied bandwidth			
Test procedure: 47 CFR, Section 2.1049			
Test mode: Compliance	Verdict: PASS		
Date(s): 11/4/2013-12/23/2013			
Temperature: 24 °C	Air Pressure: 1018 hPa	Relative Humidity: 39 %	Power Supply: 48 VDC
Remarks:			

Plot 7.3.1 Occupied bandwidth test result at low frequency, 5 MHz BW, QPSK modulation



Plot 7.3.2 Occupied bandwidth test result at mid frequency, 5 MHz BW, QPSK modulation

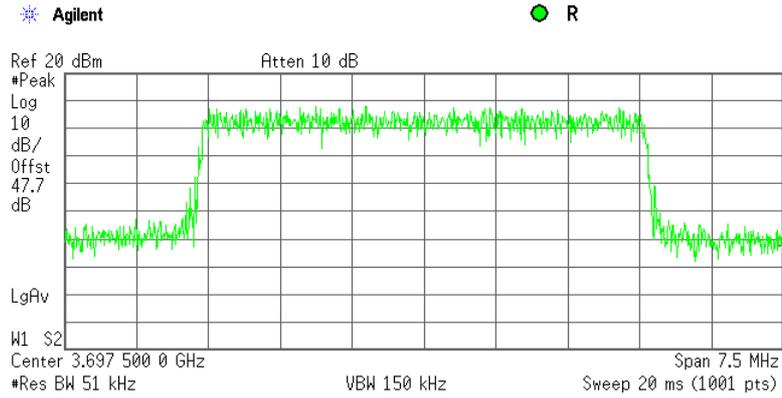




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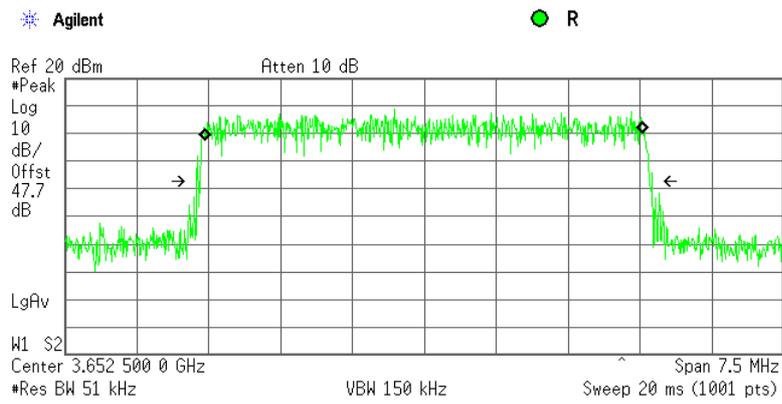
Test specification: FCC Section 90.209 / RSS-197, Section 5.2, Occupied bandwidth			
Test procedure: 47 CFR, Section 2.1049			
Test mode: Compliance	Verdict: PASS		
Date(s): 11/4/2013-12/23/2013			
Temperature: 24 °C	Air Pressure: 1018 hPa	Relative Humidity: 39 %	Power Supply: 48 VDC
Remarks:			

Plot 7.3.3 Occupied bandwidth test result at high frequency, 5 MHz BW, QPSK modulation



Occupied Bandwidth	Occ BW % Pwr	99.00 %
4.5464 MHz	x dB	-26.00 dB
Transmit Freq Error		-7.952 kHz
x dB Bandwidth		4.743 MHz*

Plot 7.3.4 Occupied bandwidth test result at low frequency, 5 MHz BW, 64QAM modulation



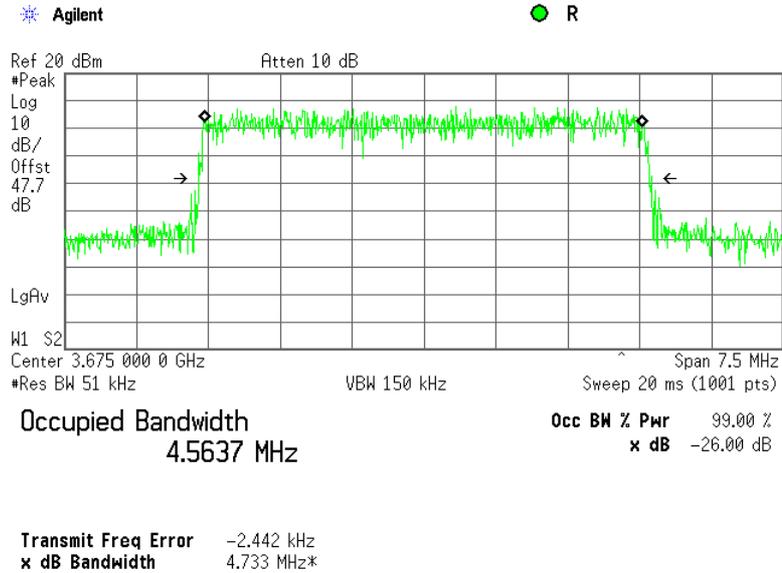
Occupied Bandwidth	Occ BW % Pwr	99.00 %
4.5598 MHz	x dB	-26.00 dB
Transmit Freq Error		-6.944 kHz
x dB Bandwidth		4.752 MHz*



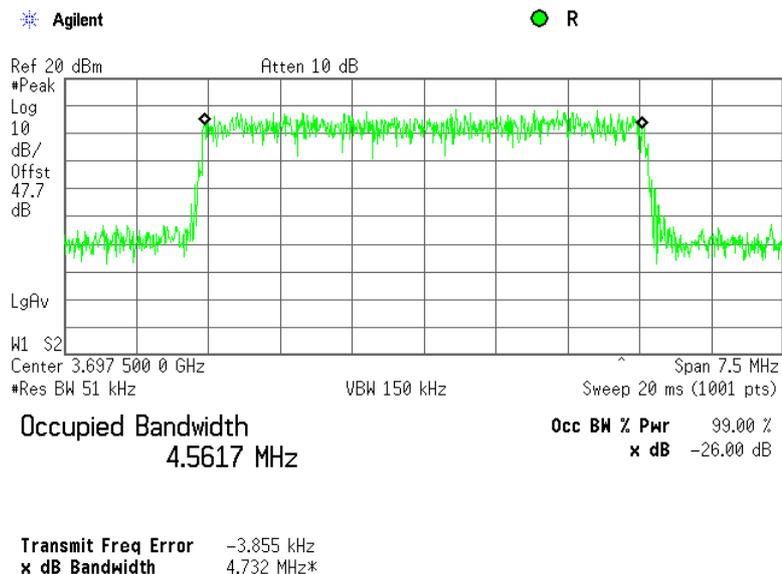
HERMON LABORATORIES

Test specification: FCC Section 90.209 / RSS-197, Section 5.2, Occupied bandwidth			
Test procedure: 47 CFR, Section 2.1049			
Test mode: Compliance	Verdict: PASS		
Date(s): 11/4/2013-12/23/2013			
Temperature: 24 °C	Air Pressure: 1018 hPa	Relative Humidity: 39 %	Power Supply: 48 VDC
Remarks:			

Plot 7.3.5 Occupied bandwidth test result at mid frequency, 5 MHz BW, 64QAM modulation



Plot 7.3.6 Occupied bandwidth test result at high frequency, 5 MHz BW, 64QAM modulation

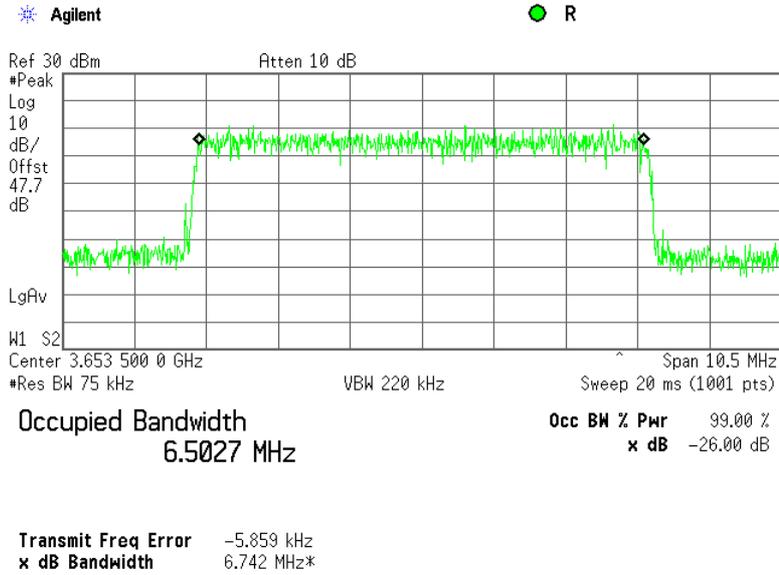




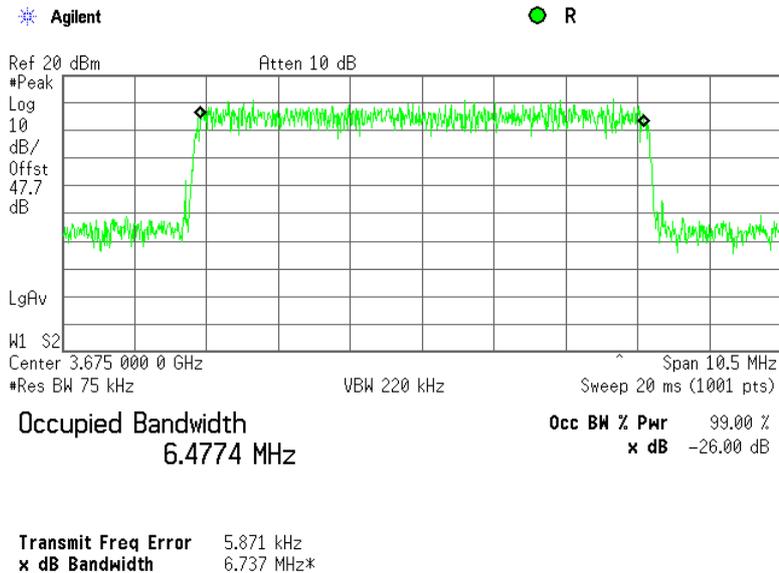
HERMON LABORATORIES

Test specification: FCC Section 90.209 / RSS-197, Section 5.2, Occupied bandwidth			
Test procedure: 47 CFR, Section 2.1049			
Test mode: Compliance	Verdict: PASS		
Date(s): 11/4/2013-12/23/2013			
Temperature: 24 °C	Air Pressure: 1018 hPa	Relative Humidity: 39 %	Power Supply: 48 VDC
Remarks:			

Plot 7.3.7 Occupied bandwidth test result at low frequency, 7 MHz BW, QPSK modulation



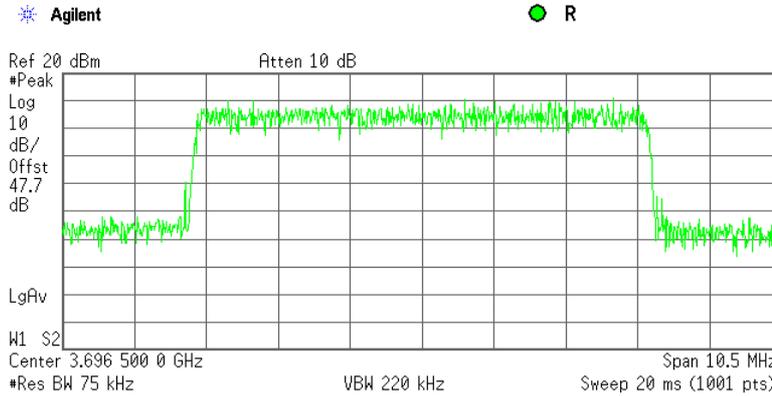
Plot 7.3.8 Occupied bandwidth test result at mid frequency, 7 MHz BW, QPSK modulation





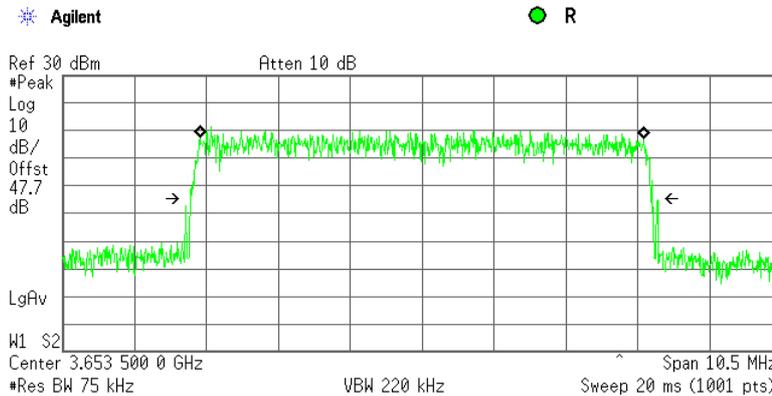
Test specification: FCC Section 90.209 / RSS-197, Section 5.2, Occupied bandwidth			
Test procedure: 47 CFR, Section 2.1049			
Test mode: Compliance	Verdict: PASS		
Date(s): 11/4/2013-12/23/2013			
Temperature: 24 °C	Air Pressure: 1018 hPa	Relative Humidity: 39 %	Power Supply: 48 VDC
Remarks:			

Plot 7.3.9 Occupied bandwidth test result at high frequency, 7 MHz BW, QPSK modulation



Occupied Bandwidth	Occ BW % Pwr	99.00 %
6.4686 MHz	x dB	-26.00 dB
Transmit Freq Error		2.120 kHz
x dB Bandwidth		6.729 MHz*

Plot 7.3.10 Occupied bandwidth test result at low frequency, 7 MHz BW, 64QAM modulation

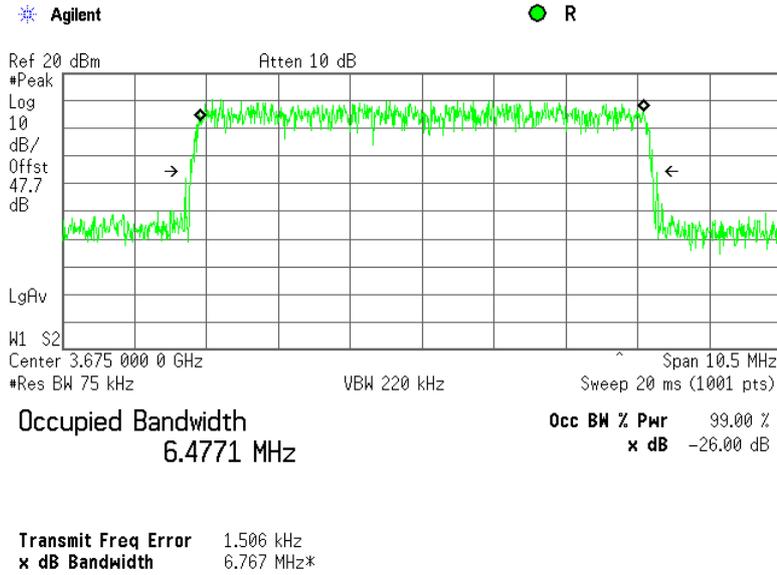


Occupied Bandwidth	Occ BW % Pwr	99.00 %
6.4860 MHz	x dB	-26.00 dB
Transmit Freq Error		-90.481 Hz
x dB Bandwidth		6.764 MHz*

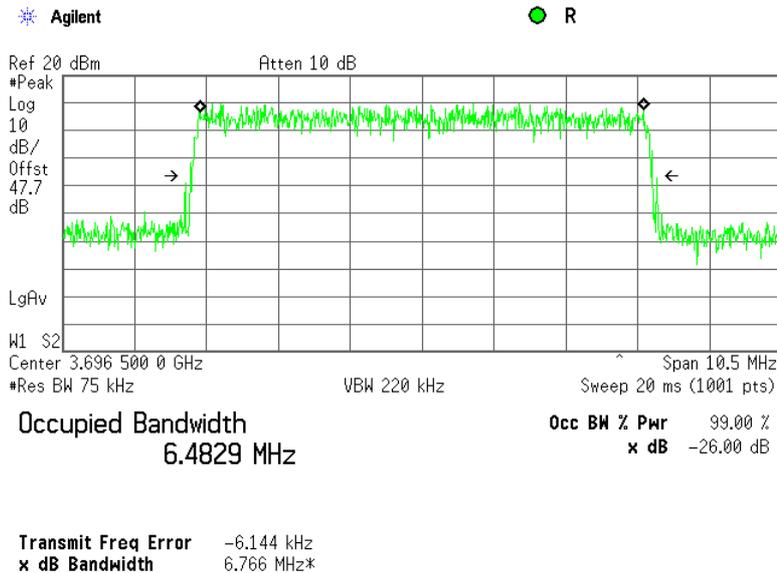


Test specification: FCC Section 90.209 / RSS-197, Section 5.2, Occupied bandwidth			
Test procedure: 47 CFR, Section 2.1049			
Test mode: Compliance	Verdict: PASS		
Date(s): 11/4/2013-12/23/2013			
Temperature: 24 °C	Air Pressure: 1018 hPa	Relative Humidity: 39 %	Power Supply: 48 VDC
Remarks:			

Plot 7.3.11 Occupied bandwidth test result at mid frequency, 7 MHz BW, 64QAM modulation



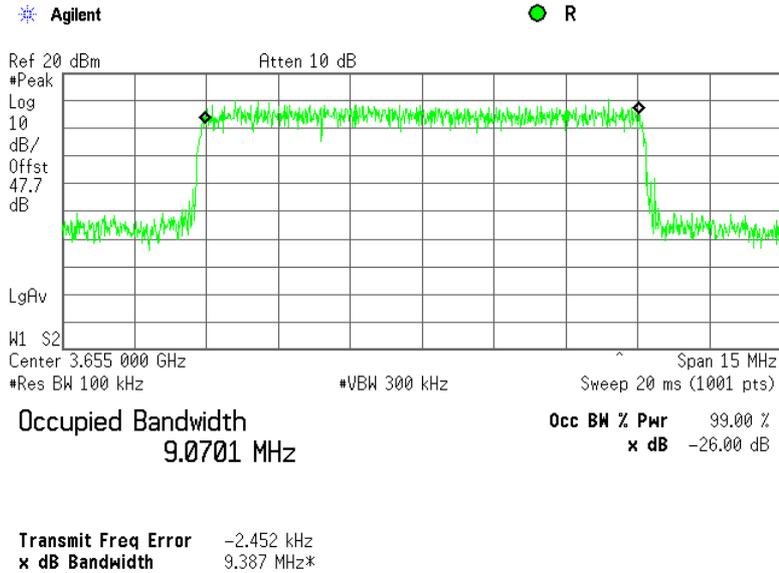
Plot 7.3.12 Occupied bandwidth test result at high frequency, 7 MHz BW, 64QAM modulation



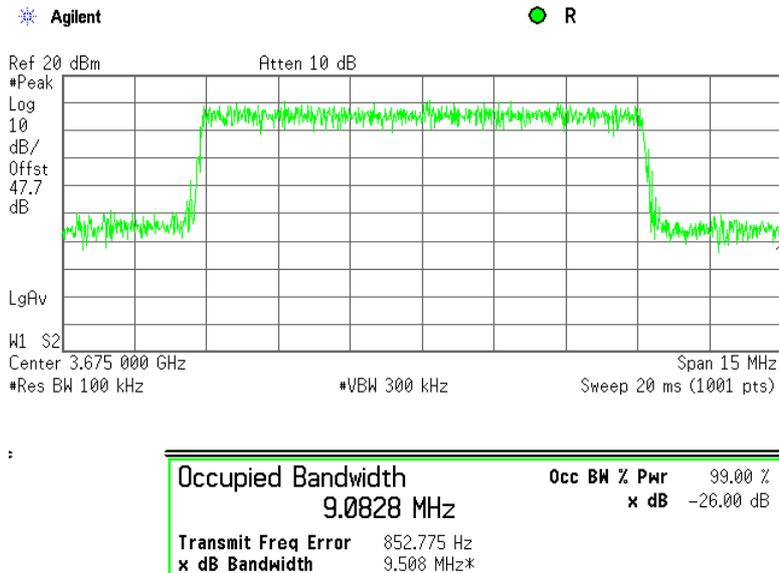


Test specification: FCC Section 90.209 / RSS-197, Section 5.2, Occupied bandwidth			
Test procedure: 47 CFR, Section 2.1049			
Test mode: Compliance	Verdict: PASS		
Date(s): 11/4/2013-12/23/2013			
Temperature: 24 °C	Air Pressure: 1018 hPa	Relative Humidity: 39 %	Power Supply: 48 VDC
Remarks:			

Plot 7.3.13 Occupied bandwidth test result at low frequency, 10 MHz BW, QPSK modulation



Plot 7.3.14 Occupied bandwidth test result at mid frequency, 10 MHz BW, QPSK modulation

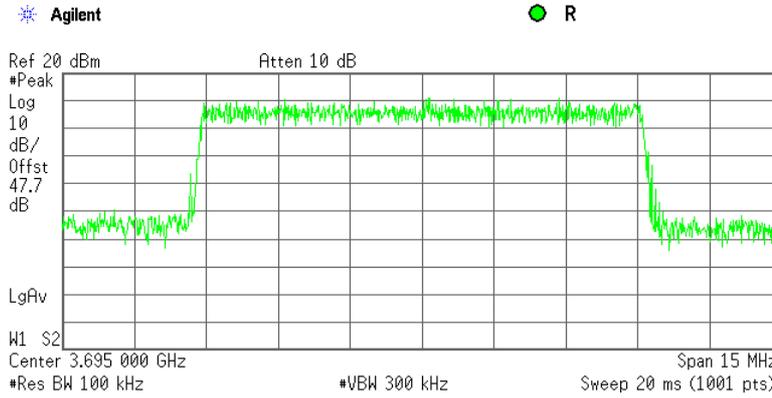




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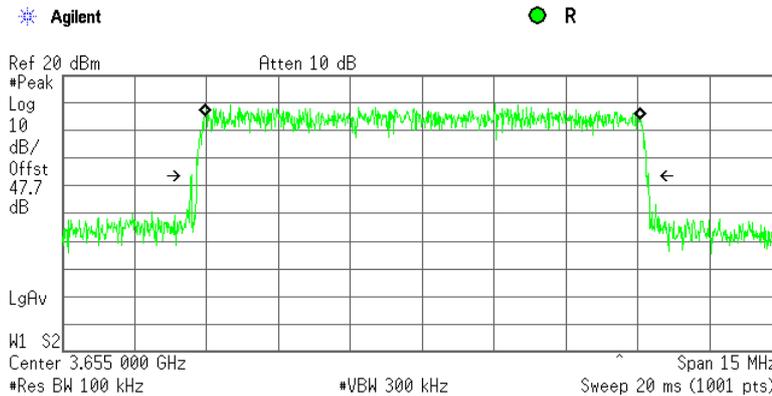
Test specification: FCC Section 90.209 / RSS-197, Section 5.2, Occupied bandwidth			
Test procedure: 47 CFR, Section 2.1049			
Test mode: Compliance	Verdict: PASS		
Date(s): 11/4/2013-12/23/2013			
Temperature: 24 °C	Air Pressure: 1018 hPa	Relative Humidity: 39 %	Power Supply: 48 VDC
Remarks:			

Plot 7.3.15 Occupied bandwidth test result at high frequency, 10 MHz BW, QPSK modulation



Occupied Bandwidth	Occ BW % Pwr	99.00 %
9.0883 MHz	x dB	-26.00 dB
Transmit Freq Error		-491.015 Hz
x dB Bandwidth		9.511 MHz*

Plot 7.3.16 Occupied bandwidth test result at low frequency, 10 MHz BW, 64QAM modulation



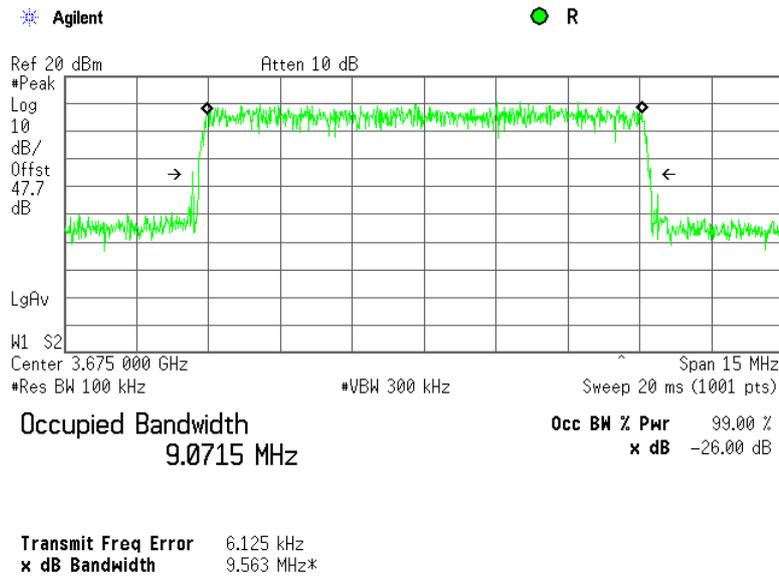
Occupied Bandwidth	Occ BW % Pwr	99.00 %
9.0847 MHz	x dB	-26.00 dB

Transmit Freq Error	6.310 kHz
x dB Bandwidth	9.549 MHz*

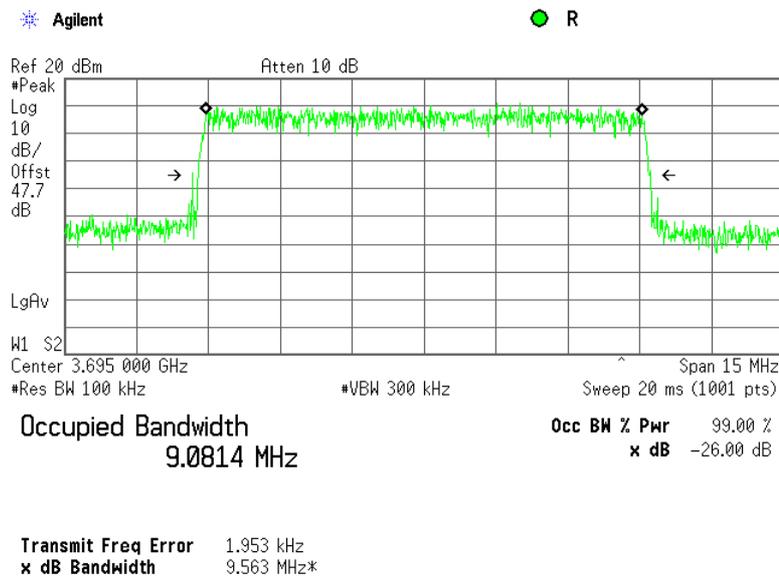


Test specification: FCC Section 90.209 / RSS-197, Section 5.2, Occupied bandwidth			
Test procedure: 47 CFR, Section 2.1049			
Test mode: Compliance	Verdict: PASS		
Date(s): 11/4/2013-12/23/2013			
Temperature: 24 °C	Air Pressure: 1018 hPa	Relative Humidity: 39 %	Power Supply: 48 VDC
Remarks:			

Plot 7.3.17 Occupied bandwidth test result at mid frequency, 10 MHz BW, 64QAM modulation



Plot 7.3.18 Occupied bandwidth test result at high frequency, 10 MHz BW, 64QAM modulation





Test specification:		FCC 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:		Verdict:	
Compliance		PASS	
Date(s):		11/5/2013 - 11/6/2013	
Temperature: 24 °C	Air Pressure: 1014 hPa	Relative Humidity: 47 %	Power Supply: 48 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 7 MHz)	
0 – 3.5 MHz	0
3.5 – 7.0 MHz	25
7.0 – 17.5 MHz	35
More than* 17.5 MHz	43 + 10 log(P)
Emission mask B (Emission bandwidth 10 MHz)	
0 – 5 MHz	0
5 – 10.0 MHz	25
10.0 – 25.0 MHz	35
More than* 25.0 MHz	43 + 10 log(P)

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

7.4.2 Test procedure

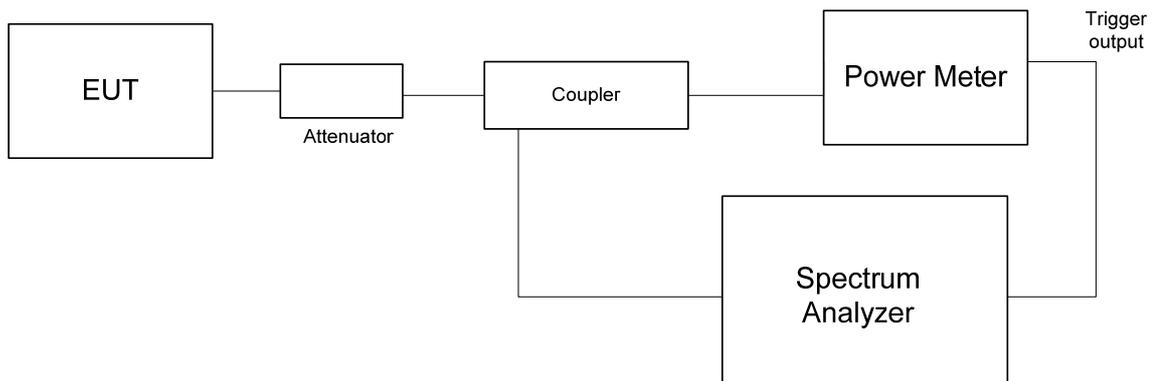
7.4.2.1 The EUT was set up as shown in Figure 7.4.1, energized and its proper operation was checked.

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.



Test specification:	FCC 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):	11/5/2013 - 11/6/2013		
Temperature: 24 °C	Air Pressure: 1014 hPa	Relative Humidity: 47 %	Power Supply: 48 VDC
Remarks:			

Figure 7.4.1 Emission mask test setup





Test specification:	FCC 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):	11/5/2013 - 11/6/2013		
Temperature: 24 °C	Air Pressure: 1014 hPa	Relative Humidity: 47 %	Power Supply: 48 VDC
Remarks:			

Table 7.4.2 Emission mask test results

Carrier frequency, MHz	Modulation	Limit	Reference to Plot	Verdict
5 MHz				
3652.5	QPSK	Emission mask B	Plot 7.4.1	Pass
3675.0	QPSK		Plot 7.4.3	
3697.5	QPSK		Plot 7.4.5	
3652.5	64QAM		Plot 7.4.2	
3675.0	64QAM		Plot 7.4.4	
3697.5	64QAM		Plot 7.4.6	
7 MHz				
3653.5	QPSK	Emission mask B	Plot 7.4.7	Pass
3675.0	QPSK		Plot 7.4.9	
3696.5	QPSK		Plot 7.4.11	
3653.5	64QAM		Plot 7.4.8	
3675.0	64QAM		Plot 7.4.10	
3696.5	64QAM		Plot 7.4.12	
10 MHz				
3655	QPSK	Emission mask B	Plot 7.4.13	Pass
3675	QPSK		Plot 7.4.15	
3695	QPSK		Plot 7.4.17	
3655	64QAM		Plot 7.4.14	
3675	64QAM		Plot 7.4.16	
3695	64QAM		Plot 7.4.18	

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

Reference numbers of test equipment used

HL 1906	HL 3301	HL 3302	HL 3818	HL 3901	HL 4068	HL 4274	HL 4366
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Full description is given in Appendix A.



HERMON LABORATORIES

Test specification: FCC 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): 11/5/2013 - 11/6/2013	
Temperature: 24 °C	Air Pressure: 1014 hPa
Relative Humidity: 47 %	
Power Supply: 48 VDC	
Remarks:	

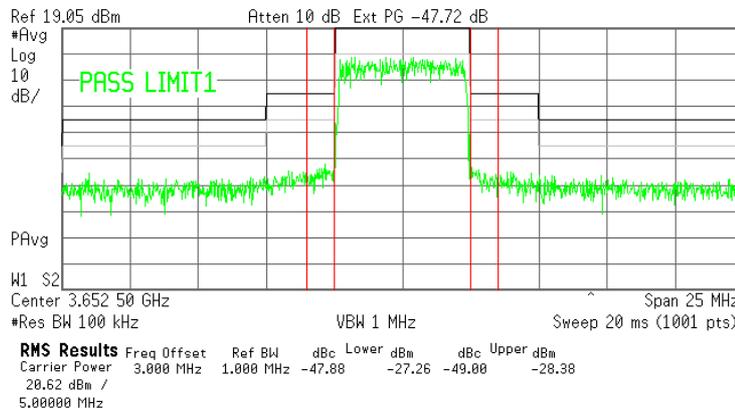
Plot 7.4.1 Emission mask test results at low carrier frequency, 5 MHz CBW

DETECTOR USED:
MODULATION:
TRANSMITTER OUTPUT POWER:

Average
QPSK
Maximum

Agilent

R



Note: Upper display line is emission mask limit.
Lower display line is emission mask limit reduced by 10 dB to compensate the lower RBW [$10 \cdot \log(1 \text{ MHz} / 100 \text{ kHz}) = 10 \text{ dB}$].

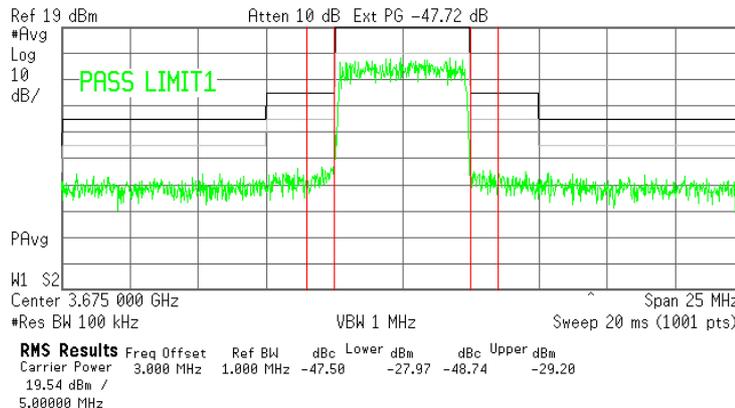
Plot 7.4.2 Emission mask test results at mid carrier frequency, 5 MHz CBW

DETECTOR USED:
MODULATION:
TRANSMITTER OUTPUT POWER:

Average
QPSK
Maximum

Agilent

R



Note: Upper display line is emission mask limit.
Lower display line is emission mask limit reduced by 10 dB to compensate the lower RBW [$10 \cdot \log(1 \text{ MHz} / 100 \text{ kHz}) = 10 \text{ dB}$].



HERMON LABORATORIES

Test specification: FCC 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): 11/5/2013 - 11/6/2013			
Temperature: 24 °C	Air Pressure: 1014 hPa	Relative Humidity: 47 %	Power Supply: 48 VDC
Remarks:			

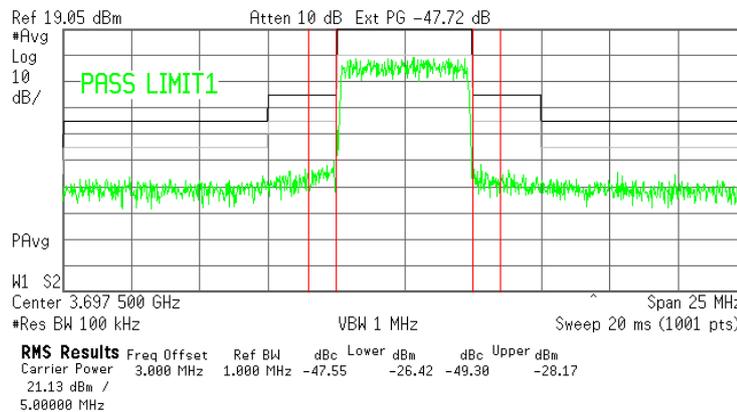
Plot 7.4.3 Emission mask test results at high carrier frequency, 5 MHz CBW

DETECTOR USED:
MODULATION:
TRANSMITTER OUTPUT POWER:

Average
QPSK
Maximum

Agilent

R



Note: Upper display line is emission mask limit.
Lower display line is emission mask limit reduced by 10 dB to compensate the lower RBW [$10 \cdot \log(1 \text{ MHz} / 100 \text{ kHz}) = 10 \text{ dB}$].

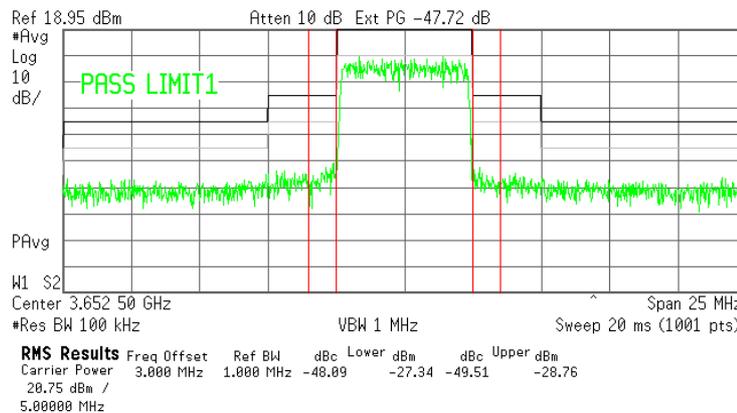
Plot 7.4.4 Emission mask test results at low carrier frequency, 5 MHz CBW

DETECTOR USED:
MODULATION:
TRANSMITTER OUTPUT POWER:

Average
64QAM
Maximum

Agilent

R



Note: Upper display line is emission mask limit.
Lower display line is emission mask limit reduced by 10 dB to compensate the lower RBW [$10 \cdot \log(1 \text{ MHz} / 100 \text{ kHz}) = 10 \text{ dB}$].

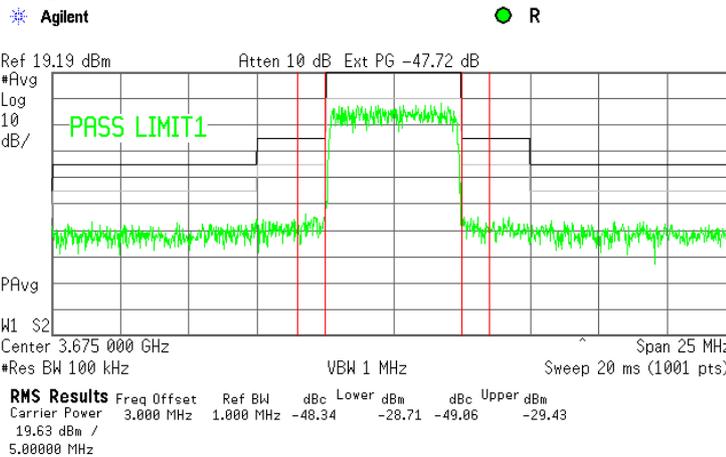


HERMON LABORATORIES

Test specification: FCC 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): 11/5/2013 - 11/6/2013			
Temperature: 24 °C	Air Pressure: 1014 hPa	Relative Humidity: 47 %	Power Supply: 48 VDC
Remarks:			

Plot 7.4.5 Emission mask test results at mid carrier frequency, 5 MHz CBW

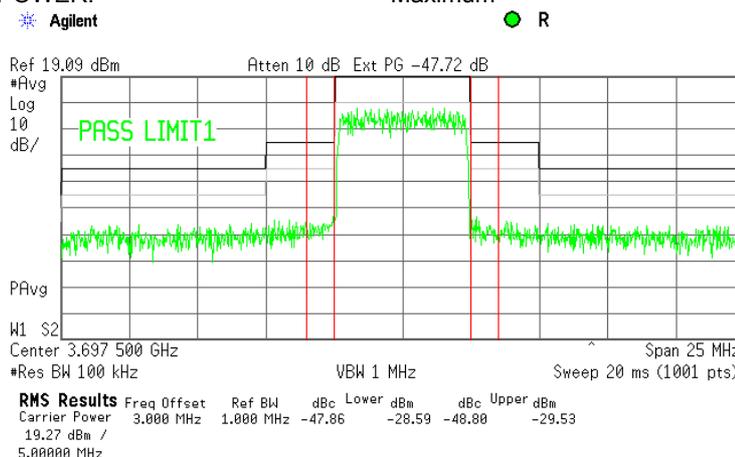
DETECTOR USED: Average
MODULATION: 64QAM
TRANSMITTER OUTPUT POWER: Maximum



Note: Upper display line is emission mask limit.
Lower display line is emission mask limit reduced by 10 dB to compensate the lower RBW [$10 \cdot \log(1 \text{ MHz} / 100 \text{ kHz}) = 10 \text{ dB}$].

Plot 7.4.6 Emission mask test results at high carrier frequency, 5 MHz CBW

DETECTOR USED: Average
MODULATION: 64QAM
TRANSMITTER OUTPUT POWER: Maximum



Note: Upper display line is emission mask limit.
Lower display line is emission mask limit reduced by 10 dB to compensate the lower RBW [$10 \cdot \log(1 \text{ MHz} / 100 \text{ kHz}) = 10 \text{ dB}$].



HERMON LABORATORIES

Test specification: FCC 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): 11/5/2013 - 11/6/2013	
Temperature: 24 °C	Air Pressure: 1014 hPa
Relative Humidity: 47 %	
Power Supply: 48 VDC	
Remarks:	

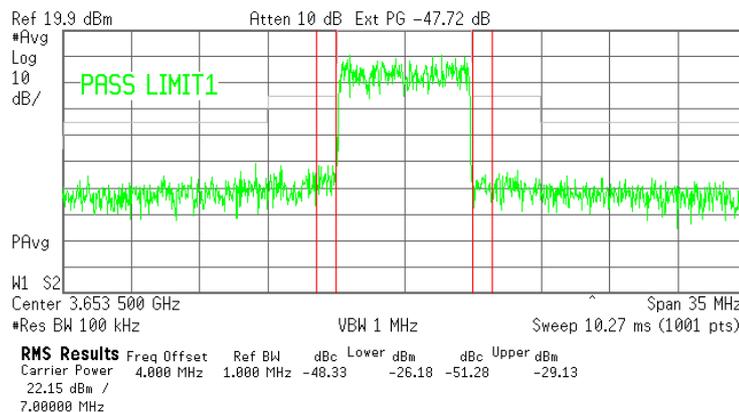
Plot 7.4.7 Emission mask test results at low carrier frequency, 7 MHz CBW

DETECTOR USED:
MODULATION:
TRANSMITTER OUTPUT POWER:

Average
QPSK
Maximum

Agilent

R



Note: Upper display line is emission mask limit.
Lower display line is emission mask limit reduced by 10 dB to compensate the lower RBW [$10 \cdot \log(1 \text{ MHz} / 100 \text{ kHz}) = 10 \text{ dB}$].

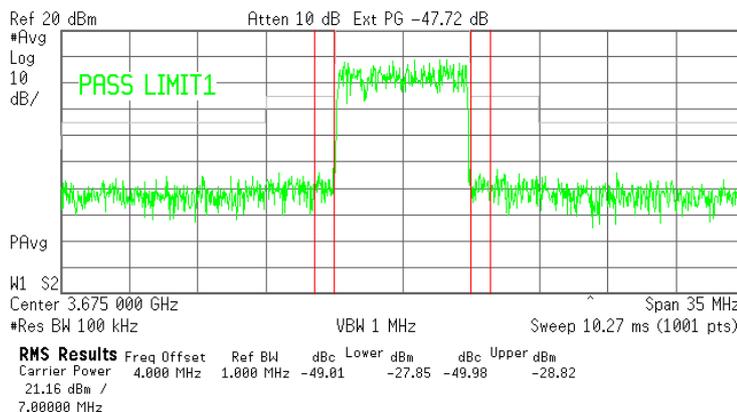
Plot 7.4.8 Emission mask test results at mid carrier frequency, 7 MHz CBW

DETECTOR USED:
MODULATION:
TRANSMITTER OUTPUT POWER:

Average
QPSK
Maximum

Agilent

R



Note: Upper display line is emission mask limit.
Lower display line is emission mask limit reduced by 10 dB to compensate the lower RBW [$10 \cdot \log(1 \text{ MHz} / 100 \text{ kHz}) = 10 \text{ dB}$].



Test specification:		FCC 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:		Verdict:	
Compliance		PASS	
Date(s):		11/5/2013 - 11/6/2013	
Temperature: 24 °C	Air Pressure: 1014 hPa	Relative Humidity: 47 %	Power Supply: 48 VDC
Remarks:			

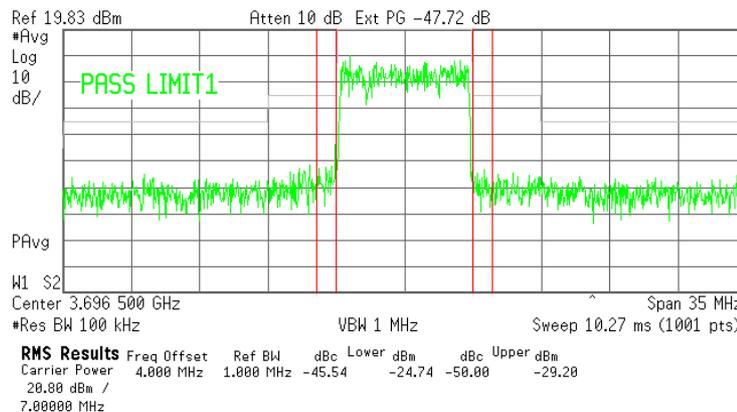
Plot 7.4.9 Emission mask test results at high carrier frequency, 7 MHz CBW

DETECTOR USED:
MODULATION:
TRANSMITTER OUTPUT POWER:

Average
QPSK
Maximum

Agilent

R



Note: Upper display line is emission mask limit.
Lower display line is emission mask limit reduced by 10 dB to compensate the lower RBW [$10 \cdot \log(1 \text{ MHz} / 100 \text{ kHz}) = 10 \text{ dB}$].

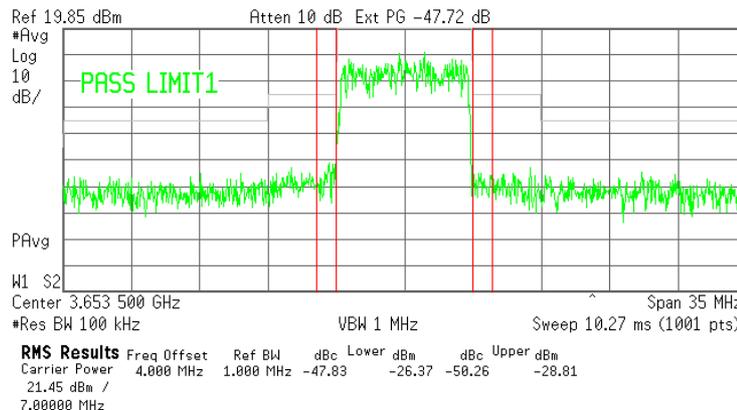
Plot 7.4.10 Emission mask test results at low carrier frequency, 7 MHz CBW

DETECTOR USED:
MODULATION:
TRANSMITTER OUTPUT POWER:

Average
64QAM
Maximum

Agilent

R



Note: Upper display line is emission mask limit.
Lower display line is emission mask limit reduced by 10 dB to compensate the lower RBW [$10 \cdot \log(1 \text{ MHz} / 100 \text{ kHz}) = 10 \text{ dB}$].



HERMON LABORATORIES

Test specification: FCC 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): 11/5/2013 - 11/6/2013			
Temperature: 24 °C	Air Pressure: 1014 hPa	Relative Humidity: 47 %	Power Supply: 48 VDC
Remarks:			

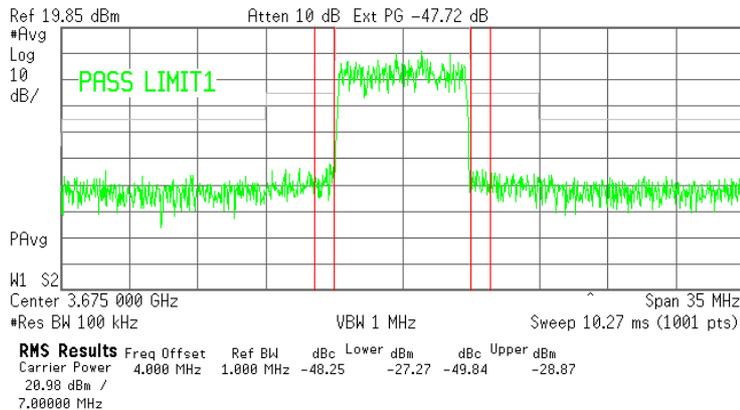
Plot 7.4.11 Emission mask test results at mid carrier frequency, 7 MHz CBW

DETECTOR USED:
MODULATION:
TRANSMITTER OUTPUT POWER:

Average
64QAM
Maximum

Agilent

R



Note: Upper display line is emission mask limit.
Lower display line is emission mask limit reduced by 10 dB to compensate the lower RBW [$10 \cdot \log(1 \text{ MHz} / 100 \text{ kHz}) = 10 \text{ dB}$].

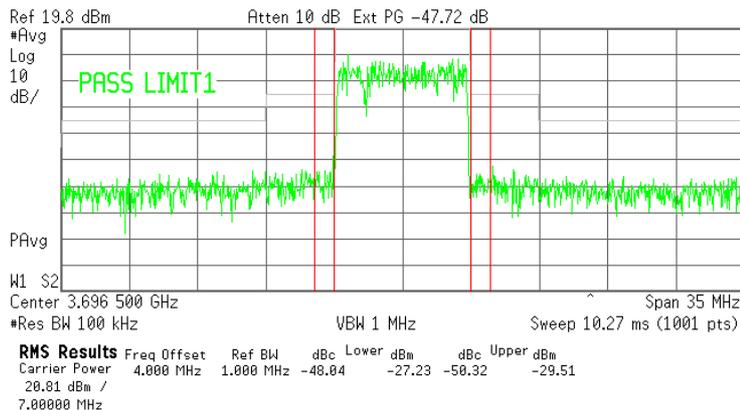
Plot 7.4.12 Emission mask test results at high carrier frequency, 10 MHz CBW

DETECTOR USED:
MODULATION:
TRANSMITTER OUTPUT POWER:

Average
64QAM
Maximum

Agilent

R



Note: Upper display line is emission mask limit.
Lower display line is emission mask limit reduced by 10 dB to compensate the lower RBW [$10 \cdot \log(1 \text{ MHz} / 100 \text{ kHz}) = 10 \text{ dB}$].



HERMON LABORATORIES

Test specification:		FCC 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	
Date(s):		11/5/2013 - 11/6/2013	
Temperature: 24 °C		Air Pressure: 1014 hPa	
Relative Humidity: 47 %		Power Supply: 48 VDC	
Remarks:			
		Verdict: PASS	

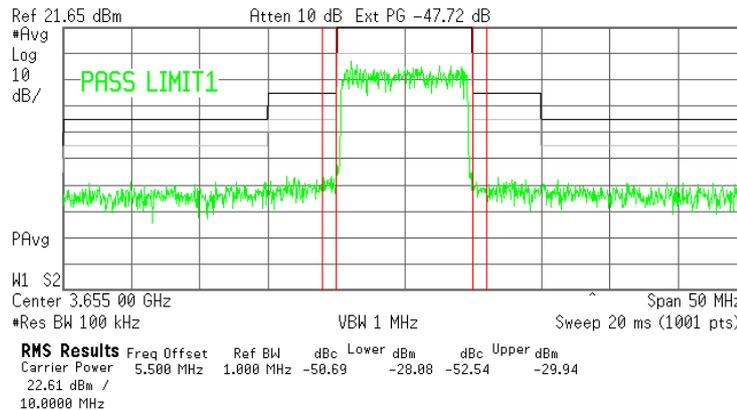
Plot 7.4.13 Emission mask test results at low carrier frequency, 10 MHz CBW

DETECTOR USED:
MODULATION:
TRANSMITTER OUTPUT POWER:

Average
QPSK
Maximum

Agilent

R



Note: Upper display line is emission mask limit.
Lower display line is emission mask limit reduced by 10 dB to compensate the lower RBW [$10 \cdot \log(1 \text{ MHz} / 100 \text{ kHz}) = 10 \text{ dB}$].

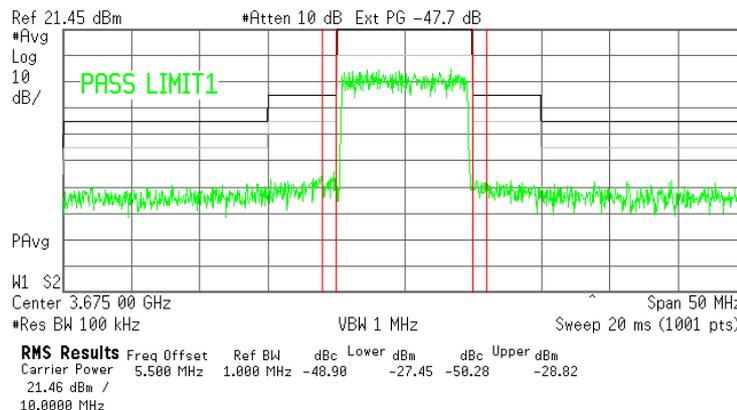
Plot 7.4.14 Emission mask test results at mid carrier frequency, 10 MHz CBW

DETECTOR USED:
MODULATION:
TRANSMITTER OUTPUT POWER:

Average
QPSK
Maximum

Agilent

R



Note: Upper display line is emission mask limit.
Lower display line is emission mask limit reduced by 10 dB to compensate the lower RBW [$10 \cdot \log(1 \text{ MHz} / 100 \text{ kHz}) = 10 \text{ dB}$].



HERMON LABORATORIES

Test specification:		FCC 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	
Date(s):		11/5/2013 - 11/6/2013	
Temperature: 24 °C		Air Pressure: 1014 hPa	
Relative Humidity: 47 %		Power Supply: 48 VDC	
Remarks:			
		Verdict: PASS	

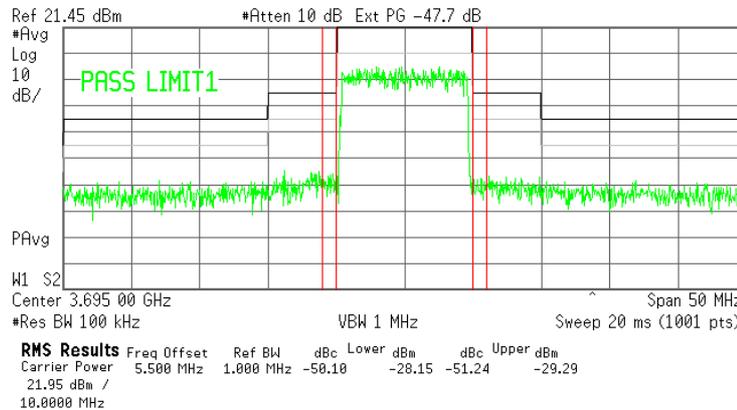
Plot 7.4.15 Emission mask test results at high carrier frequency, 10 MHz CBW

DETECTOR USED:
MODULATION:
TRANSMITTER OUTPUT POWER:

Average
QPSK
Maximum

Agilent

R



Note: Upper display line is emission mask limit.
Lower display line is emission mask limit reduced by 10 dB to compensate the lower RBW [$10 \cdot \log(1 \text{ MHz} / 100 \text{ kHz}) = 10 \text{ dB}$].

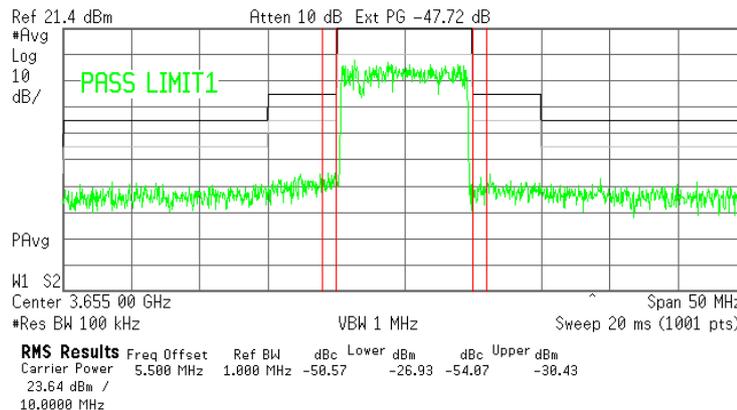
Plot 7.4.16 Emission mask test results at low carrier frequency, 10 MHz CBW

DETECTOR USED:
MODULATION:
TRANSMITTER OUTPUT POWER:

Average
64QAM
Maximum

Agilent

R



Note: Upper display line is emission mask limit.
Lower display line is emission mask limit reduced by 10 dB to compensate the lower RBW [$10 \cdot \log(1 \text{ MHz} / 100 \text{ kHz}) = 10 \text{ dB}$].



HERMON LABORATORIES

Test specification: FCC 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): 11/5/2013 - 11/6/2013	
Temperature: 24 °C	Air Pressure: 1014 hPa
Relative Humidity: 47 %	
Power Supply: 48 VDC	
Remarks:	

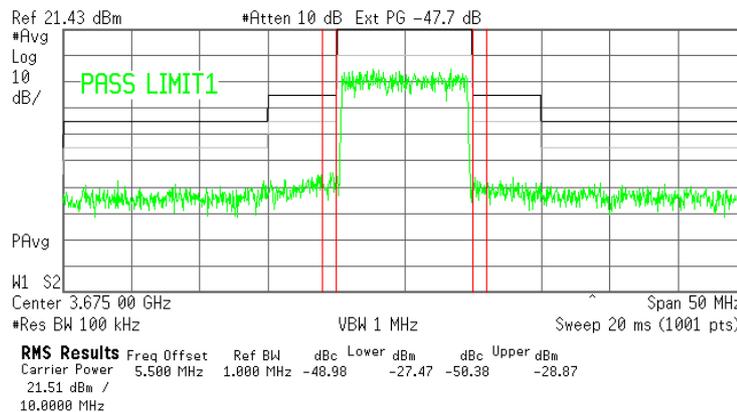
Plot 7.4.17 Emission mask test results at mid carrier frequency, 10 MHz CBW

DETECTOR USED:
MODULATION:
TRANSMITTER OUTPUT POWER:

Average
64QAM
Maximum

Agilent

R



Note: Upper display line is emission mask limit.
Lower display line is emission mask limit reduced by 10 dB to compensate the lower RBW [$10 \cdot \log(1 \text{ MHz} / 100 \text{ kHz}) = 10 \text{ dB}$].

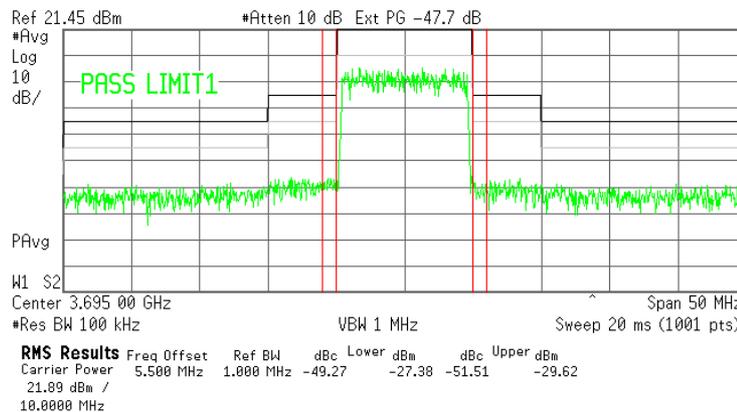
Plot 7.4.18 Emission mask test results at high carrier frequency, 10 MHz CBW

DETECTOR USED:
MODULATION:
TRANSMITTER OUTPUT POWER:

Average
64QAM
Maximum

Agilent

R



Note: Upper display line is emission mask limit.
Lower display line is emission mask limit reduced by 10 dB to compensate the lower RBW [$10 \cdot \log(1 \text{ MHz} / 100 \text{ kHz}) = 10 \text{ dB}$].



Test specification:	FCC Section 90.1323 / RSS-197, Section 5.7, 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):	11/6/2013-12/23/2013		
Temperature: 23 °C	Air Pressure: 1015 hPa	Relative Humidity: 40 %	Power Supply: 48 VDC
Remarks:			

7.5 Spurious emissions at RF antenna connector test

7.5.1 General

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

Table 7.5.1 Spurious emission limits

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

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

** - P is transmitter output power in Watts

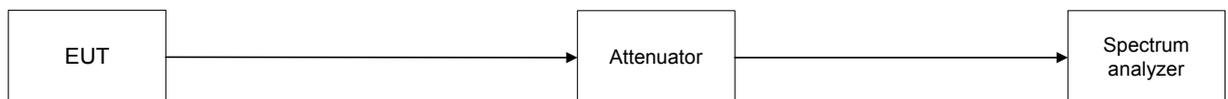
7.5.2 Test procedure

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

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

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

Figure 7.5.1 Spurious emission test setup for single antenna mode





Test specification:	FCC Section 90.1323 / RSS-197, Section 5.7, 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):	11/6/2013-12/23/2013		
Temperature: 23 °C	Air Pressure: 1015 hPa	Relative Humidity: 40 %	Power Supply: 48 VDC
Remarks:			

Table 7.5.2 Spurious emission test results

ASSIGNED FREQUENCY RANGE: 3650-3700 MHz
 INVESTIGATED FREQUENCY RANGE: 9 kHz-37000 MHz
 DETECTOR USED: Peak
 VIDEO BANDWIDTH: 3 x RBW
 MODULATION: QPSK (the worst case*)
 MODULATING SIGNAL: PRBS
 EMISSION BANDWIDTH: 10 MHz (the worst case*)
 TRANSMITTER OUTPUT POWER: 21.65 dBm at low frequency
 21.45 dBm at mid frequency
 21.40 dBm at high frequency

Frequency, MHz	SA reading, dBm	Attenuator, dB	Cable loss, dB	RBW, kHz	Spurious emission, dBm	Limit, dBm	Margin, dB**	Verdict
Low carrier frequency								
0.1393	-54.51	included	included	1	-54.51	-13	-41.51	Pass
0.150	-52.06	included	included	10	-52.06	-13	-39.06	
273.5	-45.92	included	included	100	-45.92	-13	-32.92	
3630	-27.42	included	included	1000	-27.42	-13	-14.42	
3680.8	-30.05	included	included	1000	-30.05	-13	-17.05	
7308.05	-35.46	included	included	1000	-35.46	-13	-22.46	
10972.94	-38.33	included	included	1000	-38.33	-13	-25.33	
25012.9	-38.18	included	included	1000	-38.18	-13	-25.18	
Mid carrier frequency								
0.1393	-54.85	included	included	1	-54.85	-13	-41.85	Pass
0.150	-51.68	included	included	10	-51.68	-13	-38.68	
917.6	-45.88	included	included	100	-45.88	-13	-32.88	
3649.7	-25.87	included	included	1000	-25.87	-13	-12.87	
3705.4	-30.73	included	included	1000	-30.73	-13	-17.73	
7352.5	-37.74	included	included	1000	-37.74	-13	-24.74	
11028.85	-38.94	included	included	1000	-38.94	-13	-25.94	
24974.5	-39.40	included	included	1000	-39.40	-13	-26.40	
High carrier frequency								
0.1394	-52.72	included	included	1	-52.72	-13	-39.72	Pass
0.150	-51.32	included	included	10	-51.32	-13	-38.32	
635.3	-46.22	included	included	100	-46.22	-13	-33.22	
3669.3	-26.15	included	included	1000	-26.15	-13	-13.15	
3723.8	-29.54	included	included	1000	-29.54	-13	-16.54	
7388.33	-38.21	included	included	1000	-38.21	-13	-25.21	
11087.03	-38.65	included	included	1000	-38.65	-13	-25.65	
24934.1	-39.25	included	included	1000	-39.25	-13	-26.25	

*- the worst case at maximum output power with the same power spectral density test results

**- Margin = Spurious emission – specification limit.

Reference numbers of test equipment used

HL 3357	HL 3455	HL 3818	HL 3901	HL 4068			
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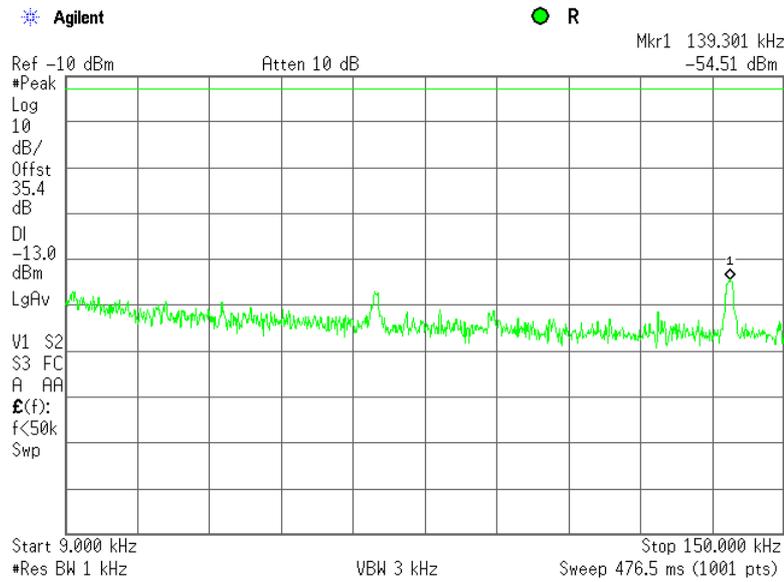
Full description is given in Appendix A.



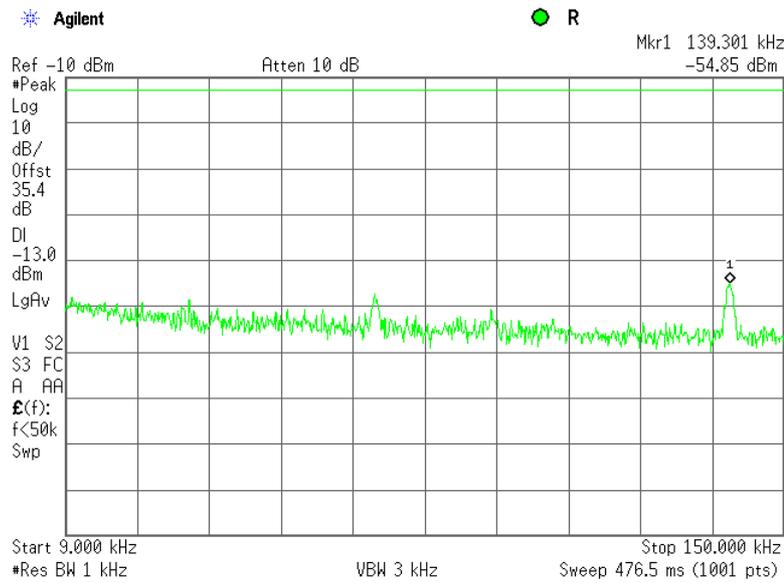
HERMON LABORATORIES

Test specification:		FCC Section 90.1323 / RSS-197, Section 5.7, 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:		Verdict: PASS	
Date(s):		11/6/2013-12/23/2013	
Temperature: 23 °C	Air Pressure: 1015 hPa	Relative Humidity: 40 %	Power Supply: 48 VDC
Remarks:			

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



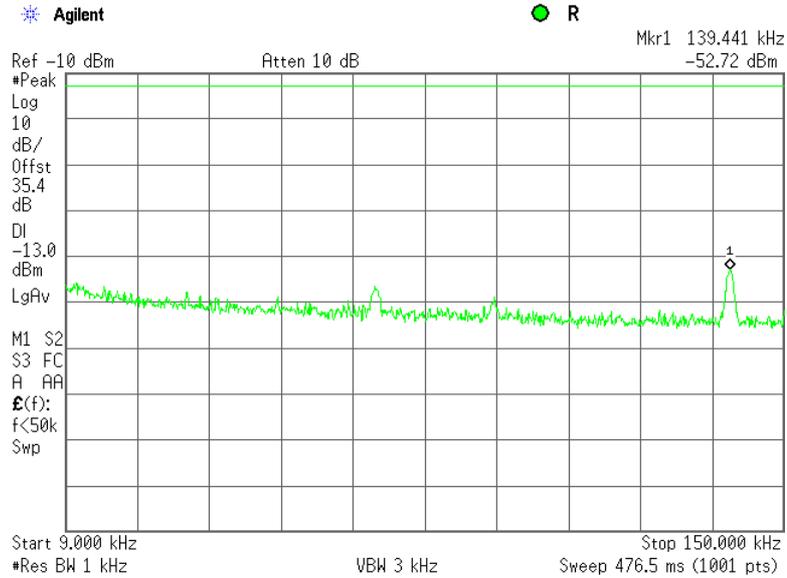
Plot 7.5.2 Spurious emission measurements in 9 - 150 kHz range at mid carrier frequency



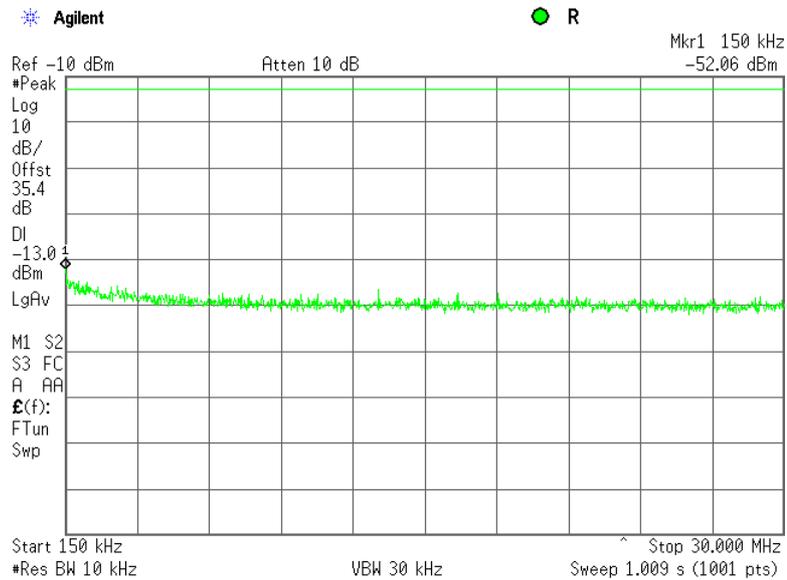


Test specification:	FCC Section 90.1323 / RSS-197, Section 5.7, Spurious emissions at RF antenna connector		
Test procedure:	47 CFR, Sections 2.1051, 90.1323; TIA/EIA-603-C, Section 2.2.13		
Test mode:	Compliance	Verdict:	PASS
Date(s):	11/6/2013-12/23/2013		
Temperature: 23 °C	Air Pressure: 1015 hPa	Relative Humidity: 40 %	Power Supply: 48 VDC
Remarks:			

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



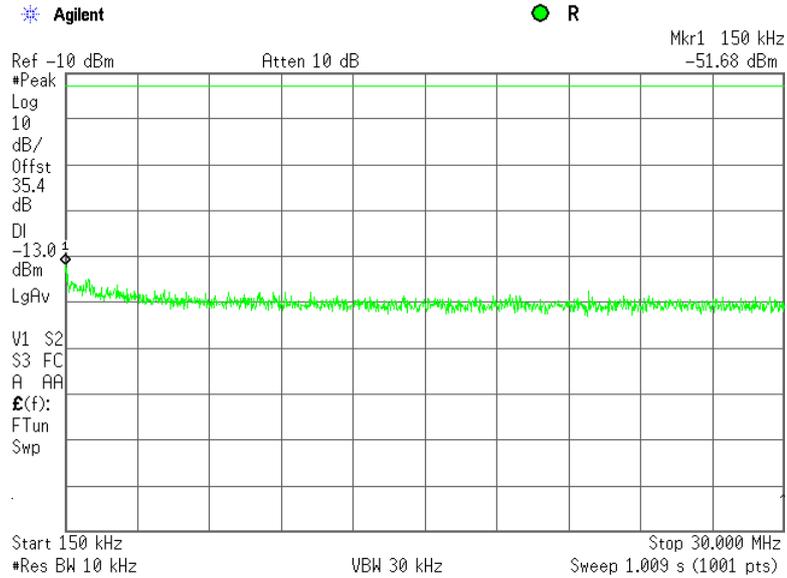
Plot 7.5.4 Spurious emission measurements in 0.150 - 30.0 MHz range at low carrier frequency



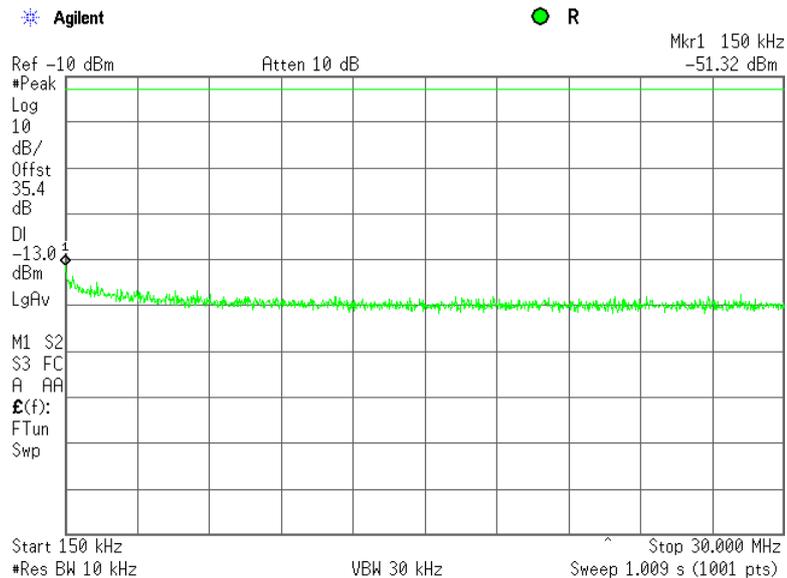


Test specification:	FCC Section 90.1323 / RSS-197, Section 5.7, Spurious emissions at RF antenna connector		
Test procedure:	47 CFR, Sections 2.1051, 90.1323; TIA/EIA-603-C, Section 2.2.13		
Test mode:	Compliance	Verdict:	PASS
Date(s):	11/6/2013-12/23/2013	Relative Humidity:	40 %
Temperature: 23 °C	Air Pressure: 1015 hPa	Power Supply:	48 VDC
Remarks:			

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



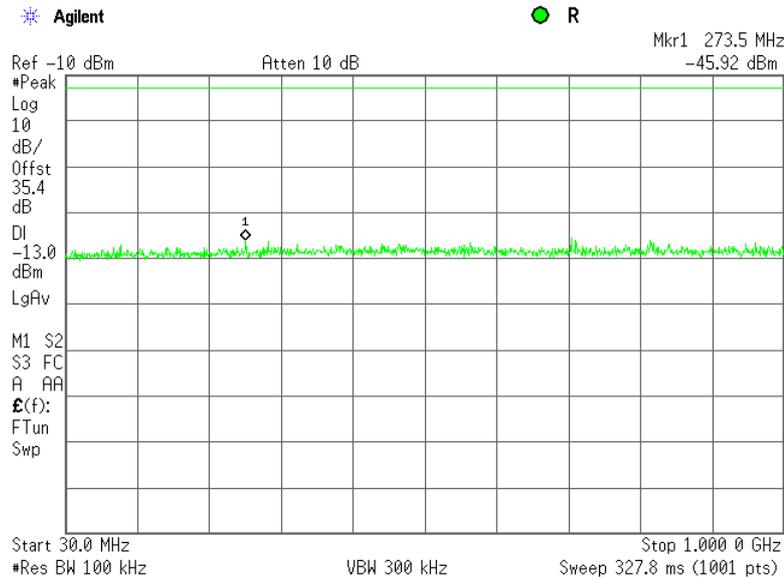
Plot 7.5.6 Spurious emission measurements in 0.150 - 30.0 MHz range at high carrier frequency



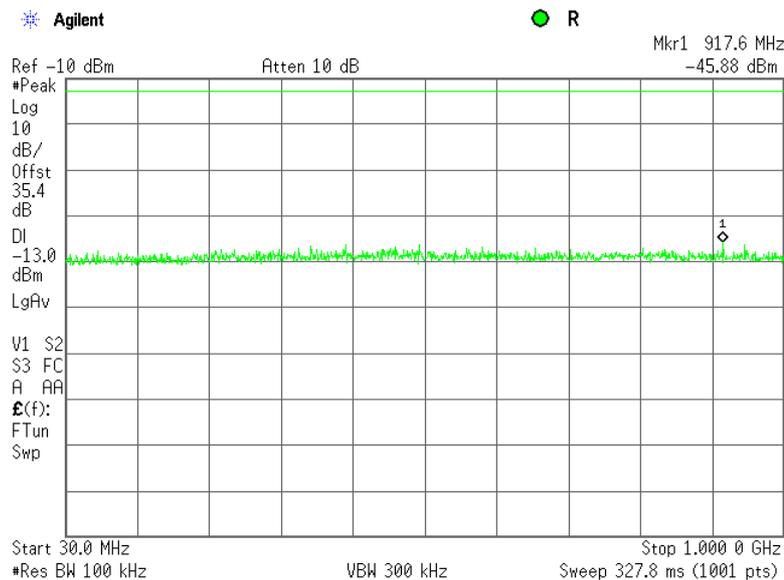


Test specification:	FCC Section 90.1323 / RSS-197, Section 5.7, Spurious emissions at RF antenna connector		
Test procedure:	47 CFR, Sections 2.1051, 90.1323; TIA/EIA-603-C, Section 2.2.13		
Test mode:	Compliance	Verdict:	PASS
Date(s):	11/6/2013-12/23/2013		
Temperature: 23 °C	Air Pressure: 1015 hPa	Relative Humidity: 40 %	Power Supply: 48 VDC
Remarks:			

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



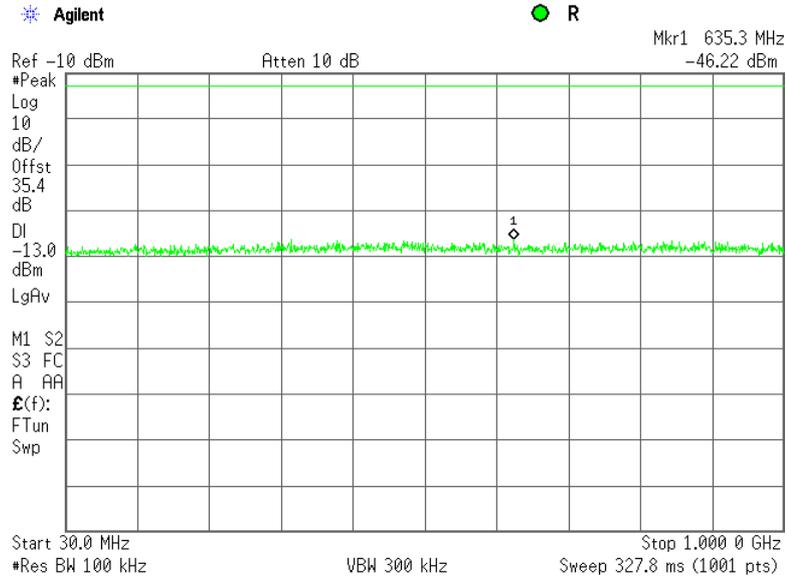
Plot 7.5.8 Spurious emission measurements in 30.0 - 1000 MHz range at mid carrier frequency



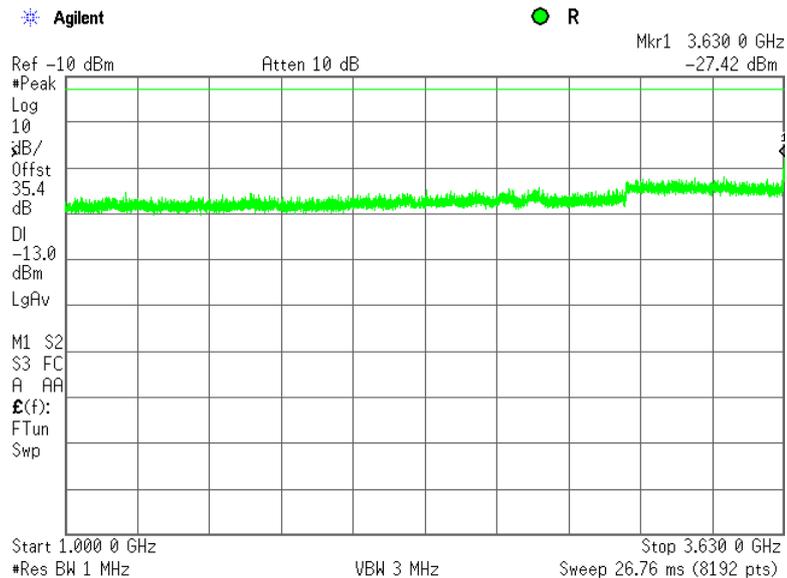


Test specification:	FCC Section 90.1323 / RSS-197, Section 5.7, Spurious emissions at RF antenna connector		
Test procedure:	47 CFR, Sections 2.1051, 90.1323; TIA/EIA-603-C, Section 2.2.13		
Test mode:	Compliance	Verdict:	PASS
Date(s):	11/6/2013-12/23/2013		
Temperature: 23 °C	Air Pressure: 1015 hPa	Relative Humidity: 40 %	Power Supply: 48 VDC
Remarks:			

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



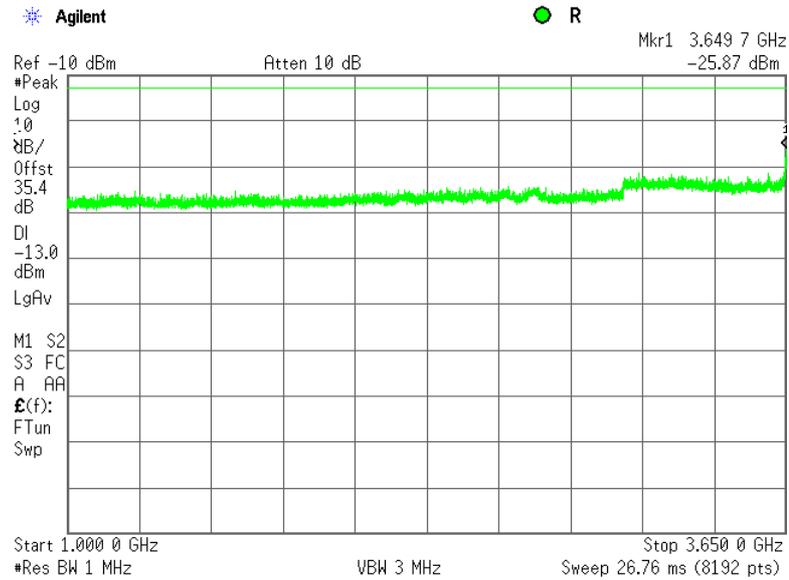
Plot 7.5.10 Spurious emission measurements in 1000 - 3630 MHz range at low carrier frequency



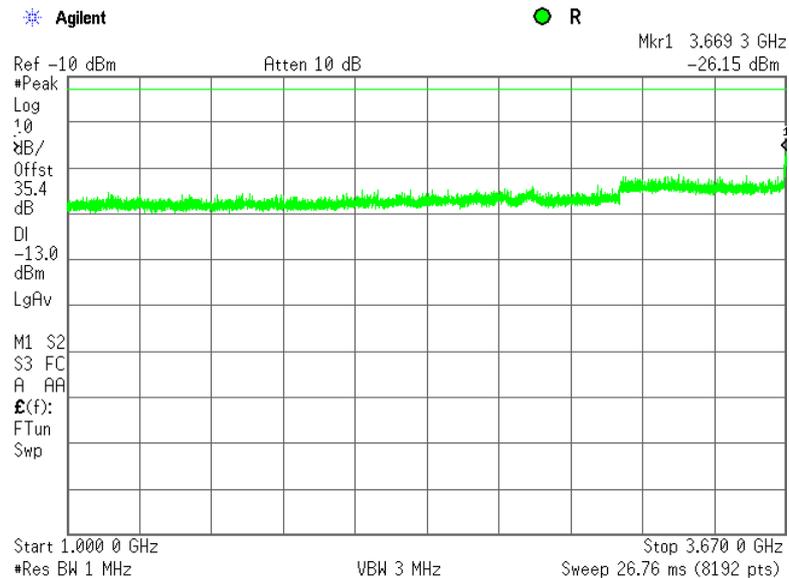


Test specification:	FCC Section 90.1323 / RSS-197, Section 5.7, Spurious emissions at RF antenna connector		
Test procedure:	47 CFR, Sections 2.1051, 90.1323; TIA/EIA-603-C, Section 2.2.13		
Test mode:	Compliance	Verdict:	PASS
Date(s):	11/6/2013-12/23/2013		
Temperature: 23 °C	Air Pressure: 1015 hPa	Relative Humidity: 40 %	Power Supply: 48 VDC
Remarks:			

Plot 7.5.11 Spurious emission measurements in 1000 - 3650 MHz at mid carrier frequency



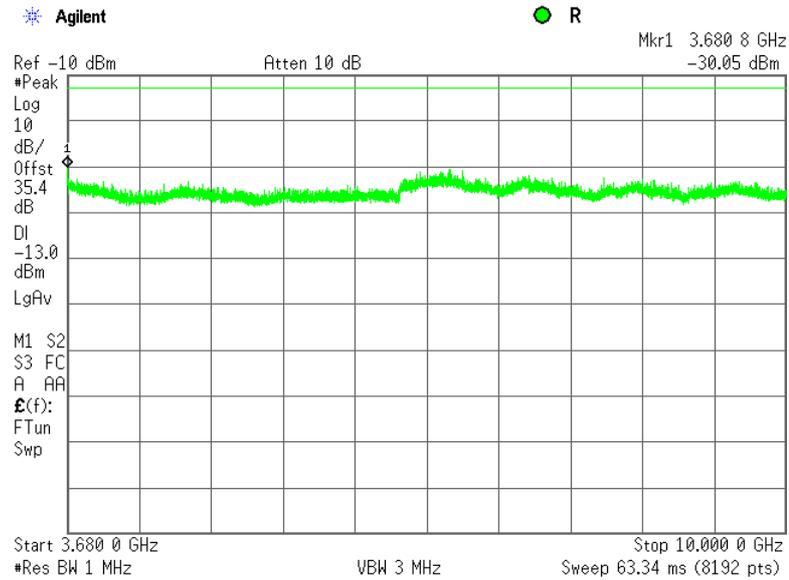
Plot 7.5.12 Spurious emission measurements in 1000 - 3670 MHz at high carrier frequency



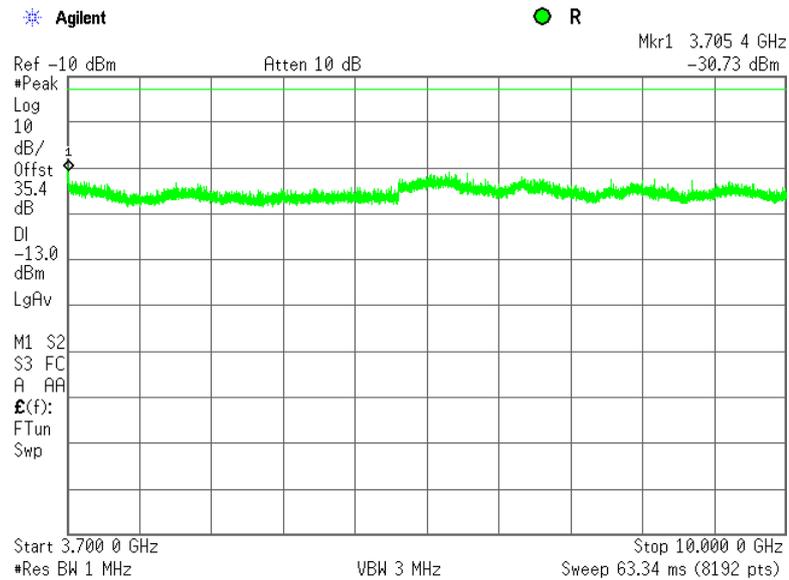


Test specification:	FCC Section 90.1323 / RSS-197, Section 5.7, Spurious emissions at RF antenna connector		
Test procedure:	47 CFR, Sections 2.1051, 90.1323; TIA/EIA-603-C, Section 2.2.13		
Test mode:	Compliance	Verdict:	PASS
Date(s):	11/6/2013-12/23/2013		
Temperature: 23 °C	Air Pressure: 1015 hPa	Relative Humidity: 40 %	Power Supply: 48 VDC
Remarks:			

Plot 7.5.13 Spurious emission measurements in 3680 - 10000 MHz range at low carrier frequency



Plot 7.5.14 Spurious emission measurements in 3700- 10000 MHz at mid carrier frequency

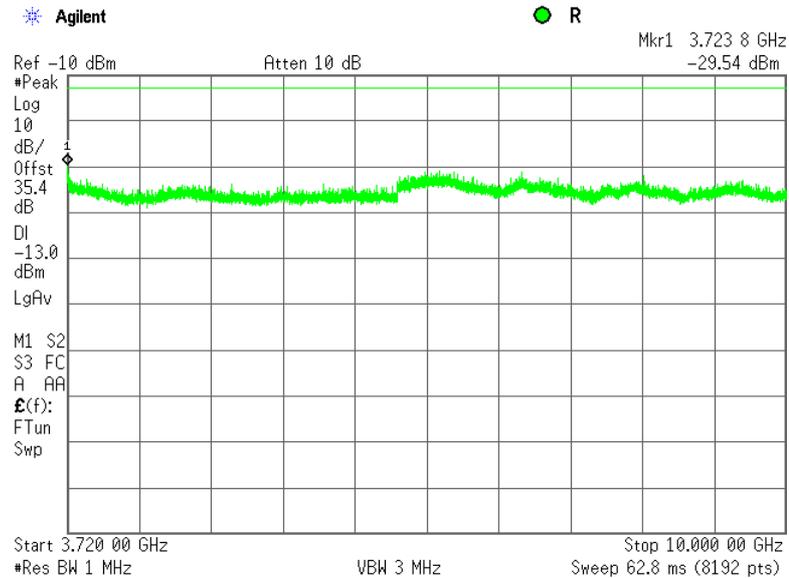




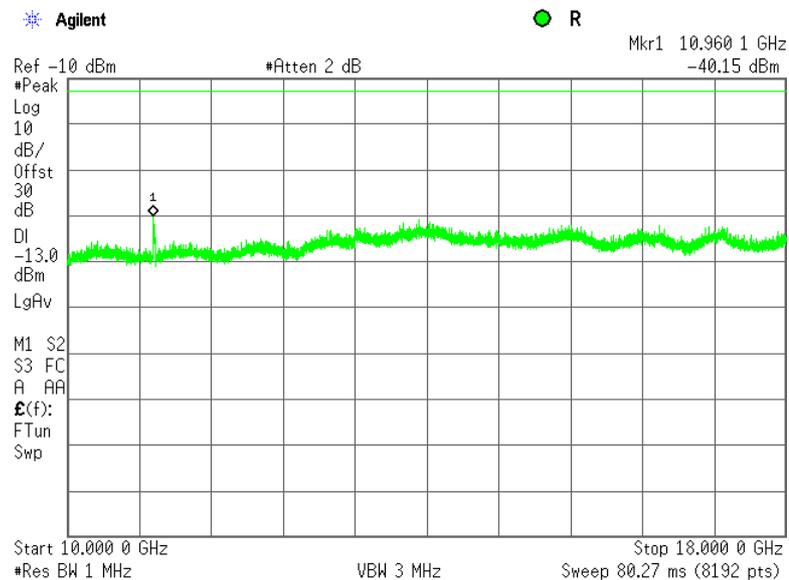
HERMON LABORATORIES

Test specification:	FCC Section 90.1323 / RSS-197, Section 5.7, 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):	11/6/2013-12/23/2013		
Temperature: 23 °C	Air Pressure: 1015 hPa	Relative Humidity: 40 %	Power Supply: 48 VDC
Remarks:			

Plot 7.5.15 Spurious emission measurements in 3720 - 10000 MHz at high carrier frequency



Plot 7.5.16 Spurious emission measurements in 10000 - 18000 MHz range at low carrier frequency

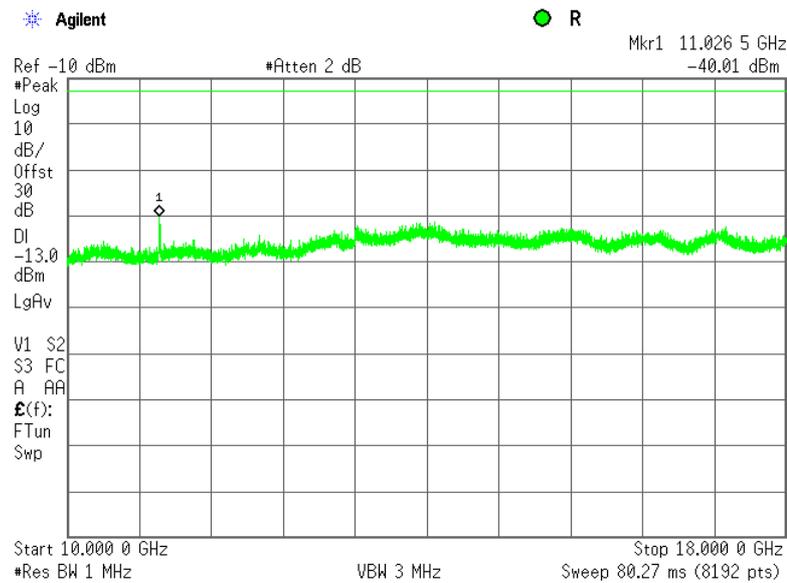




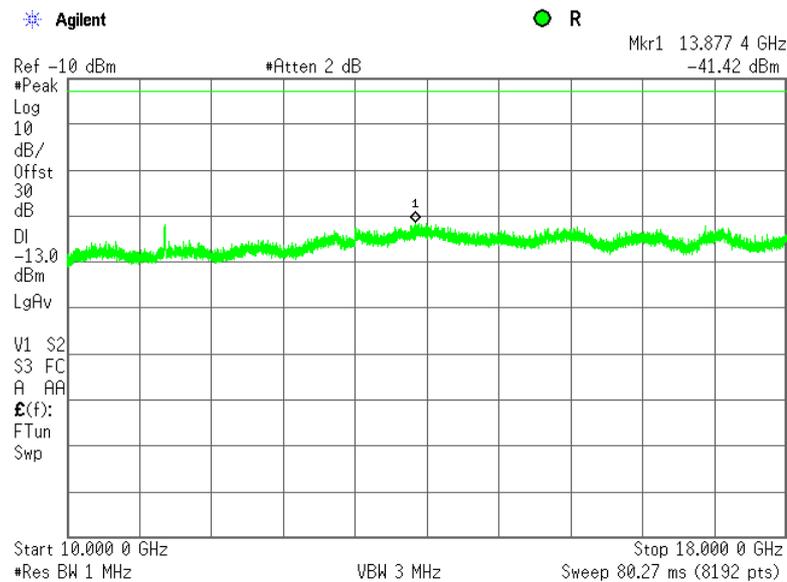
HERMON LABORATORIES

Test specification:	FCC Section 90.1323 / RSS-197, Section 5.7, 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):	11/6/2013-12/23/2013		
Temperature: 23 °C	Air Pressure: 1015 hPa	Relative Humidity: 40 %	Power Supply: 48 VDC
Remarks:			

Plot 7.5.17 Spurious emission measurements in 10000 - 18000 MHz at mid carrier frequency



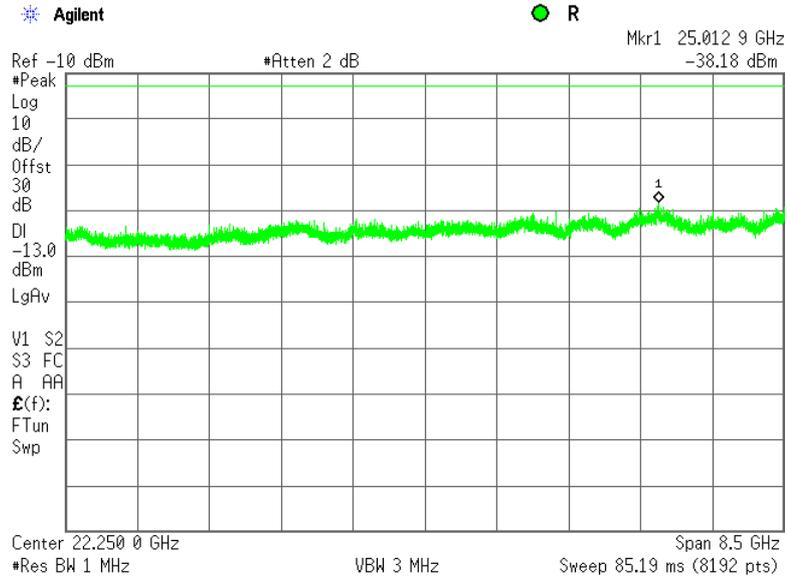
Plot 7.5.18 Spurious emission measurements in 10000 - 18000 MHz at high carrier frequency



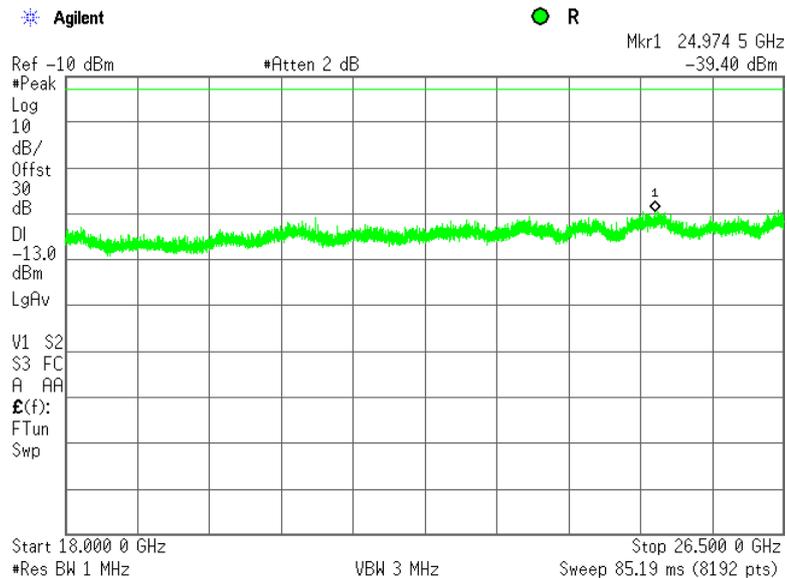


Test specification:	FCC Section 90.1323 / RSS-197, Section 5.7, Spurious emissions at RF antenna connector		
Test procedure:	47 CFR, Sections 2.1051, 90.1323; TIA/EIA-603-C, Section 2.2.13		
Test mode:	Compliance	Verdict:	PASS
Date(s):	11/6/2013-12/23/2013		
Temperature: 23 °C	Air Pressure: 1015 hPa	Relative Humidity: 40 %	Power Supply: 48 VDC
Remarks:			

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



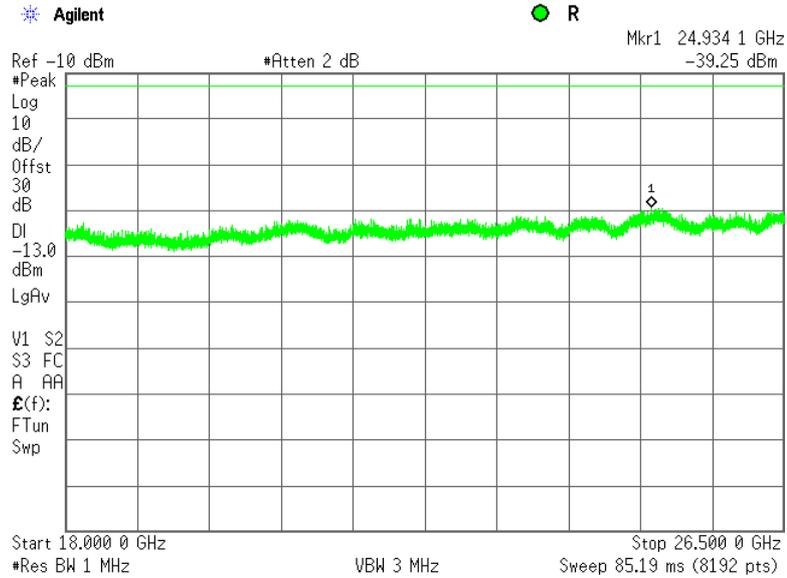
Plot 7.5.20 Spurious emission measurements in 18000 – 26500 MHz at mid carrier frequency



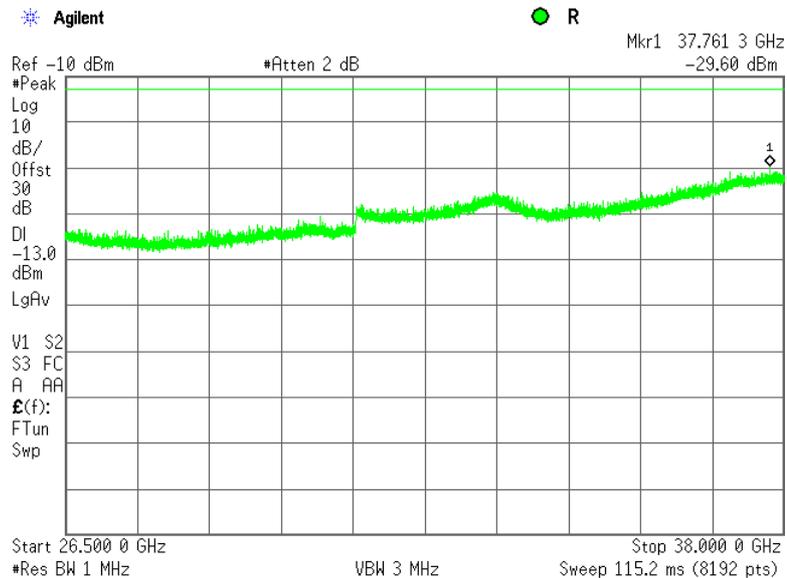


Test specification:	FCC Section 90.1323 / RSS-197, Section 5.7, Spurious emissions at RF antenna connector		
Test procedure:	47 CFR, Sections 2.1051, 90.1323; TIA/EIA-603-C, Section 2.2.13		
Test mode:	Compliance	Verdict:	PASS
Date(s):	11/6/2013-12/23/2013		
Temperature: 23 °C	Air Pressure: 1015 hPa	Relative Humidity: 40 %	Power Supply: 48 VDC
Remarks:			

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



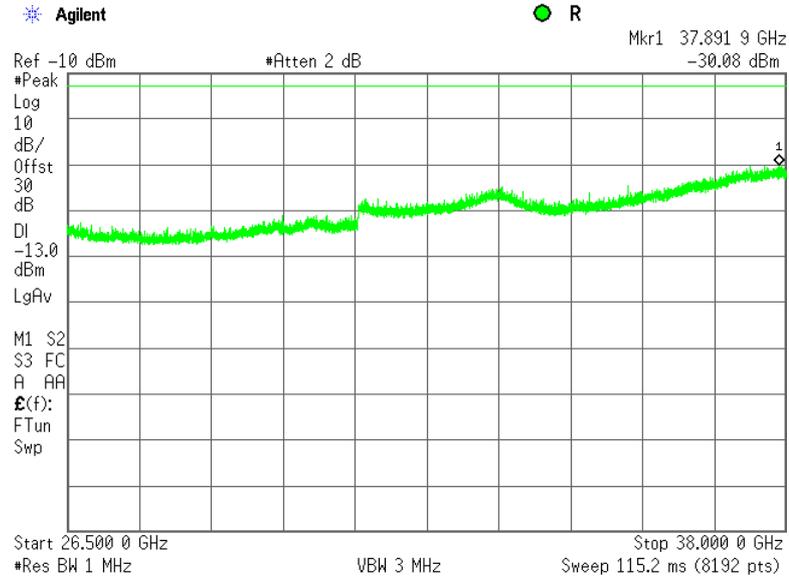
Plot 7.5.22 Spurious emission measurements in 26500 – 38000 MHz range at low carrier frequency



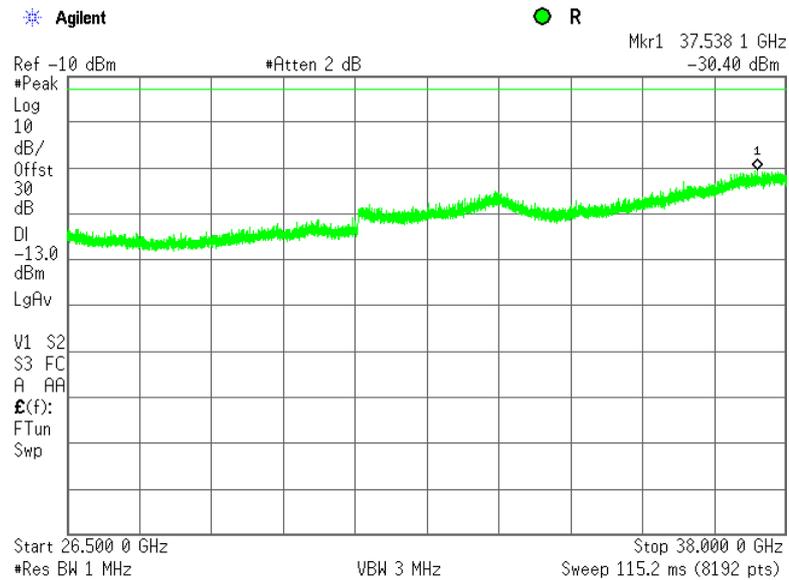


Test specification:	FCC Section 90.1323 / RSS-197, Section 5.7, Spurious emissions at RF antenna connector		
Test procedure:	47 CFR, Sections 2.1051, 90.1323; TIA/EIA-603-C, Section 2.2.13		
Test mode:	Compliance	Verdict:	PASS
Date(s):	11/6/2013-12/23/2013		
Temperature: 23 °C	Air Pressure: 1015 hPa	Relative Humidity: 40 %	Power Supply: 48 VDC
Remarks:			

Plot 7.5.23 Spurious emission measurements in 26500 – 38000 MHz at mid carrier frequency



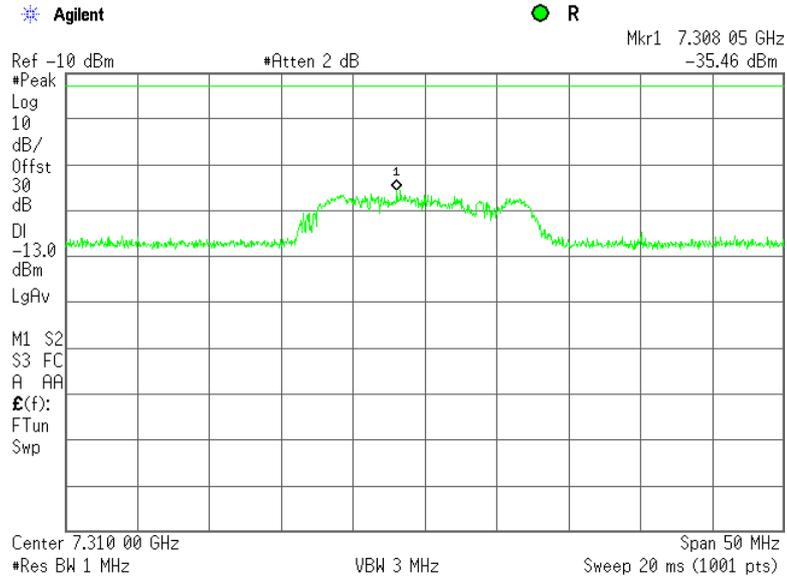
Plot 7.5.24 Spurious emission measurements in 26500 – 38000 MHz at high carrier frequency



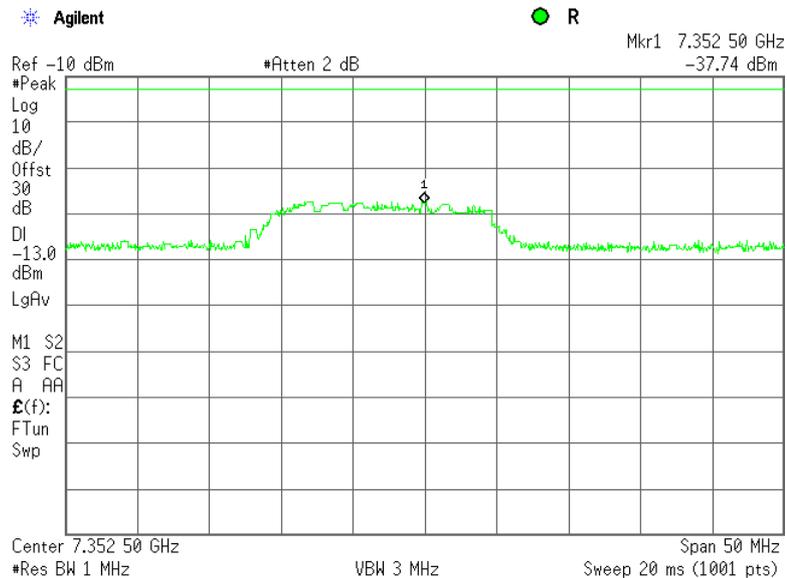


Test specification:	FCC Section 90.1323 / RSS-197, Section 5.7, Spurious emissions at RF antenna connector		
Test procedure:	47 CFR, Sections 2.1051, 90.1323; TIA/EIA-603-C, Section 2.2.13		
Test mode:	Compliance	Verdict:	PASS
Date(s):	11/6/2013-12/23/2013		
Temperature: 23 °C	Air Pressure: 1015 hPa	Relative Humidity: 40 %	Power Supply: 48 VDC
Remarks:			

Plot 7.5.25 Spurious emission measurements at the 2nd harmonic of low carrier frequency



Plot 7.5.26 Spurious emission measurements at the 2nd harmonic of mid carrier frequency

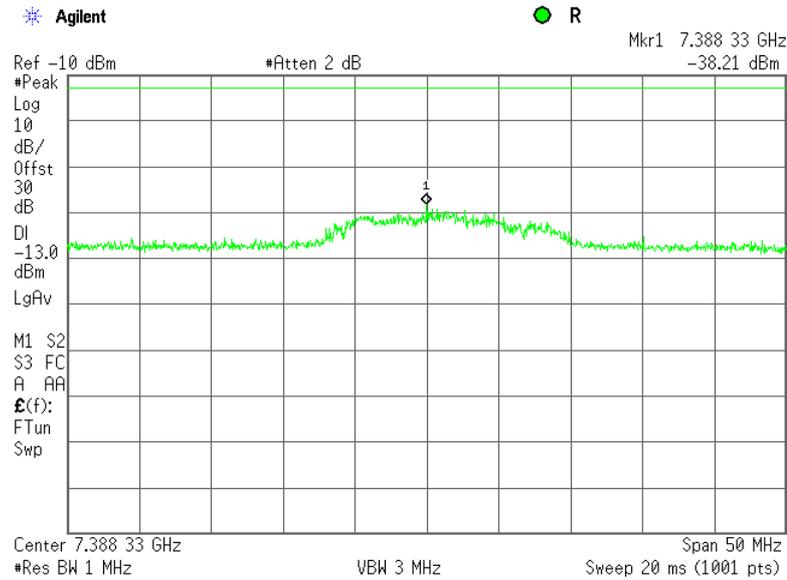




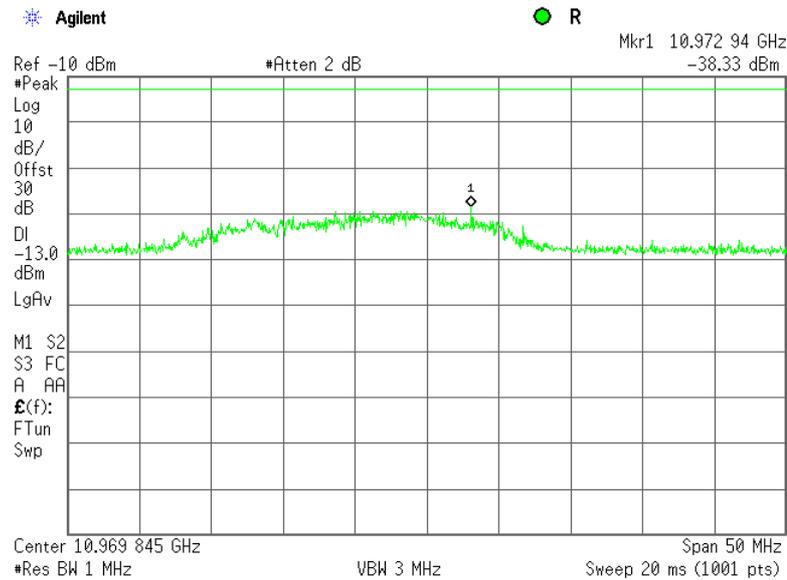
HERMON LABORATORIES

Test specification:	FCC Section 90.1323 / RSS-197, Section 5.7, 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):	11/6/2013-12/23/2013		
Temperature: 23 °C	Air Pressure: 1015 hPa	Relative Humidity: 40 %	Power Supply: 48 VDC
Remarks:			

Plot 7.5.27 Spurious emission measurements at the 2nd harmonic of high carrier frequency



Plot 7.5.28 Spurious emission measurements at the 3rd harmonic of low carrier frequency

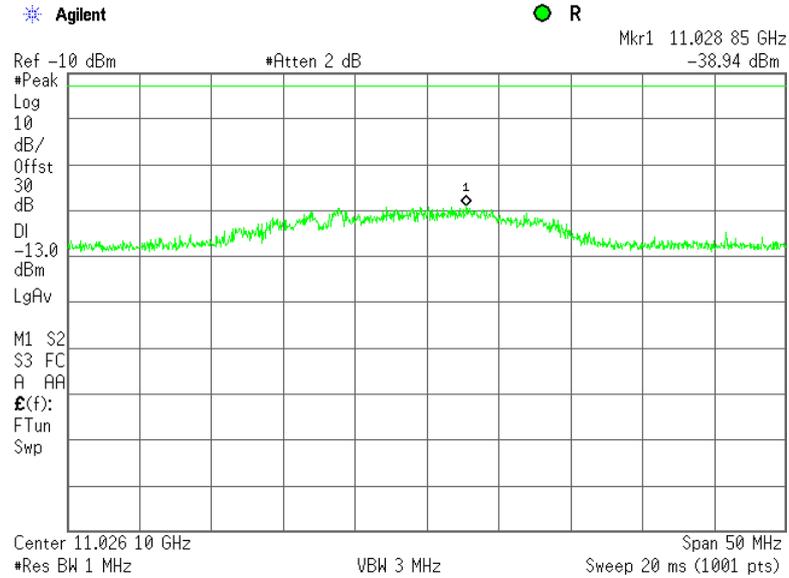




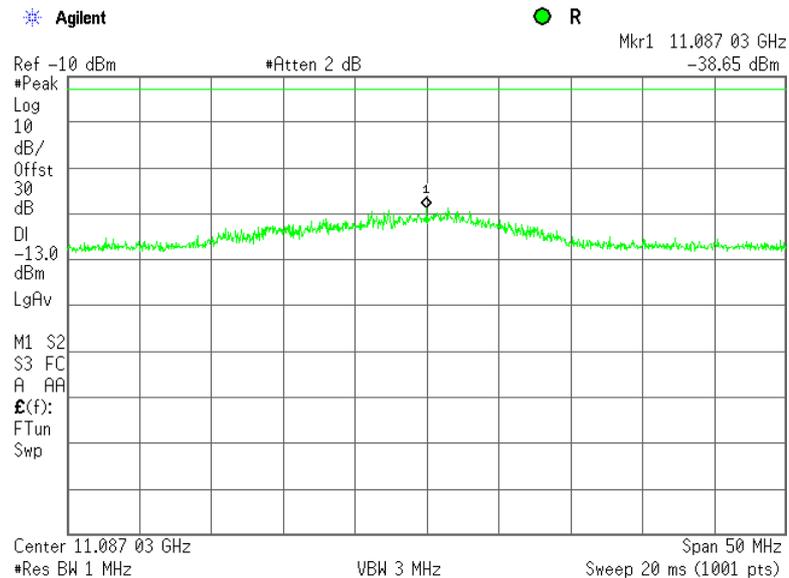
HERMON LABORATORIES

Test specification:	FCC Section 90.1323 / RSS-197, Section 5.7, 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):	11/6/2013-12/23/2013		
Temperature: 23 °C	Air Pressure: 1015 hPa	Relative Humidity: 40 %	Power Supply: 48 VDC
Remarks:			

Plot 7.5.29 Spurious emission measurements at the 3rd harmonic of mid carrier frequency



Plot 7.5.30 Spurious emission measurements at the 3rd harmonic of high carrier frequency





Test specification:	FCC Section 90.1323 / RSS-197, Section 5.7, 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):	11/5/2013		
Temperature: 25 °C	Air Pressure: 1017 hPa	Relative Humidity: 45 %	Power Supply: 48 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(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

7.6.2 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^o 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^o 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.



Test specification: FCC Section 90.1323 / RSS-197, Section 5.7, 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): 11/5/2013			
Temperature: 25 °C	Air Pressure: 1017 hPa	Relative Humidity: 45 %	Power Supply: 48 VDC
Remarks:			

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

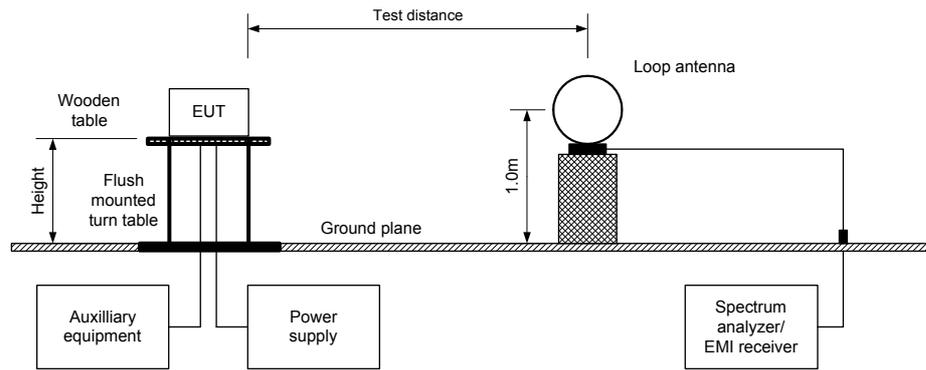
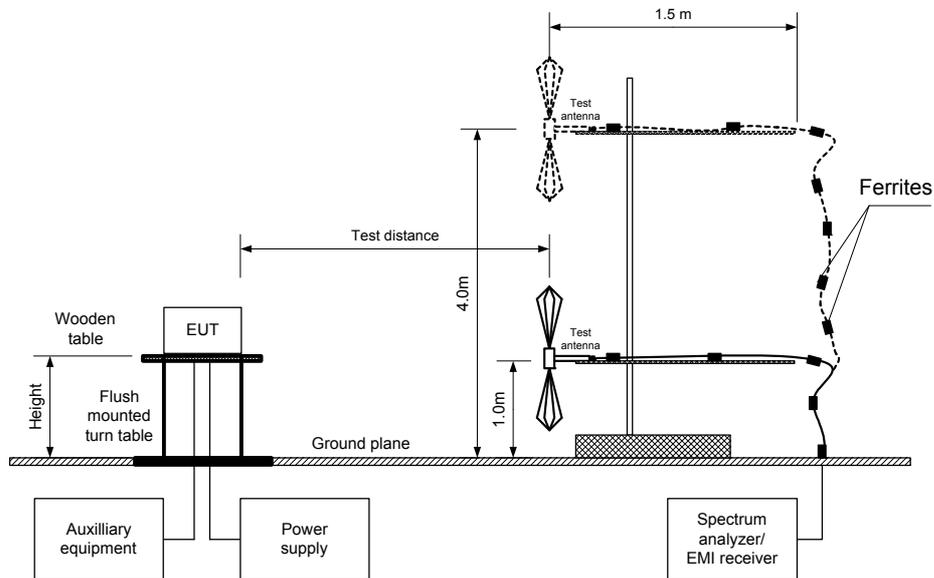


Figure 7.6.2 Setup for spurious emission field strength measurements above 30 MHz





Test specification:	FCC Section 90.1323 / RSS-197, Section 5.7, 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):	11/5/2013		
Temperature: 25 °C	Air Pressure: 1017 hPa	Relative Humidity: 45 %	Power Supply: 48 VDC
Remarks:			

Table 7.6.2 Spurious emission field strength test results

ASSIGNED FREQUENCY RANGE: 3650-3700 MHz
 TEST DISTANCE: 3 m
 TEST SITE: Semi anechoic chamber / Fully anechoic chamber
 EUT HEIGHT: 0.8 m
 INVESTIGATED FREQUENCY RANGE: 0.009 – 37000 MHz
 DETECTOR USED: Peak
 VIDEO BANDWIDTH: > Resolution bandwidth
 TEST ANTENNA TYPE: Active loop (9 kHz – 30 MHz)
 Biconilog (30 MHz – 1000 MHz)
 Double ridged guide (above 1000 MHz)
 MODULATION: QPSK (the worst case*)
 MODULATING SIGNAL: PRBS
 EMISSION BANDWIDTH: 10 MHz (the worst case*)
 BIT RATE: 3.456 Mbps
 TRANSMITTER OUTPUT POWER: 21.65 dBm at low frequency
 21.45 dBm at mid frequency
 21.40 dBm at high frequency

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							
All spurious emissions were found at least 20 dB below the specified limit							
Mid carrier frequency							
All spurious emissions were found at least 20 dB below the specified limit							
High carrier frequency							
All spurious emissions were found at least 20 dB below the specified limit							

Verdict: Pass

*- the worst case at maximum output power with the same power spectral density test results

**- Margin = Field strength of spurious –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 2432	HL 2871	HL 3535
HL 3818	HL 3901	HL 4150	HL 4276	HL 4292	HL 4353		

Full description is given in Appendix A.



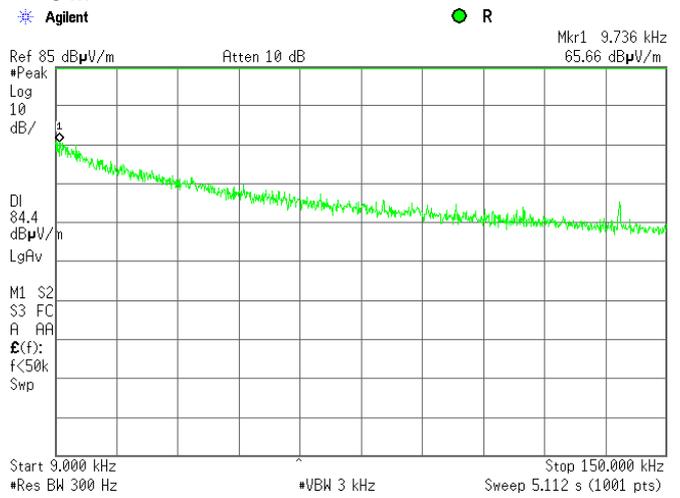
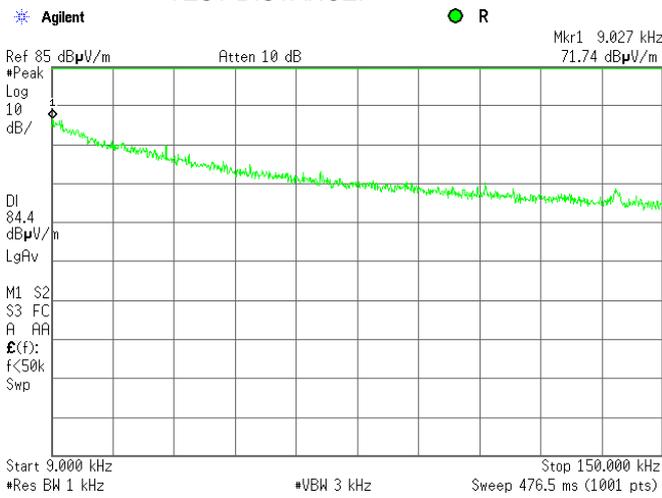
HERMON LABORATORIES

Test specification: FCC Section 90.1323 / RSS-197, Section 5.7, 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): 11/5/2013	
Temperature: 25 °C	Air Pressure: 1017 hPa
	Relative Humidity: 45 %
	Power Supply: 48 VDC
Remarks:	

Plot 7.6.1 Radiated emission measurements in 9 - 150 kHz range

TEST SITE:
CARRIER FREQUENCY:
ANTENNA POLARIZATION:
TEST DISTANCE:

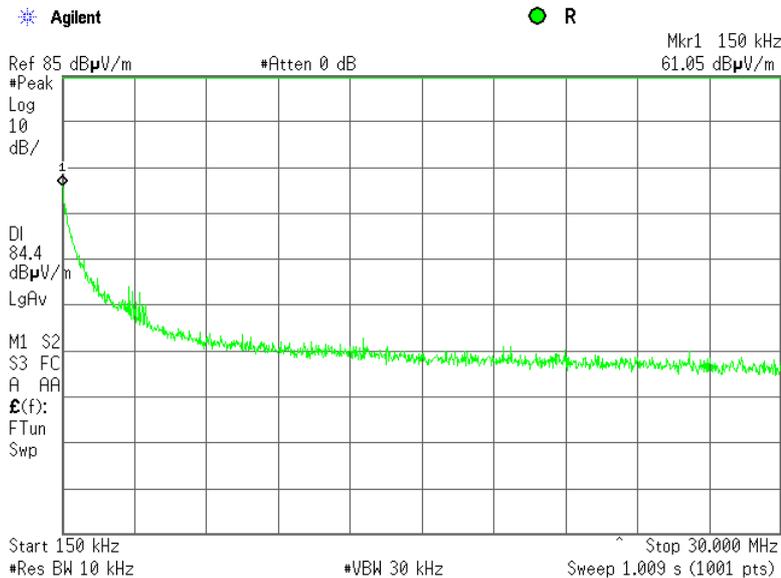
Fully anechoic chamber
Low, Mid, High
Vertical and Horizontal
3 m



Plot 7.6.2 Radiated emission measurements in 0.15 - 30 MHz range

TEST SITE:
CARRIER FREQUENCY:
ANTENNA POLARIZATION:
TEST DISTANCE:

Fully anechoic chamber
Low, Mid, High
Vertical and Horizontal
3 m



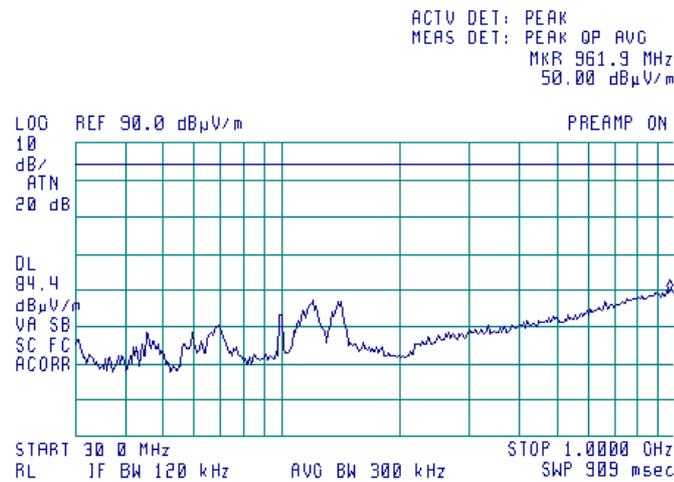


HERMON LABORATORIES

Test specification: FCC Section 90.1323 / RSS-197, Section 5.7, 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): 11/5/2013	
Temperature: 25 °C	Air Pressure: 1017 hPa
	Relative Humidity: 45 %
	Power Supply: 48 VDC
Remarks:	

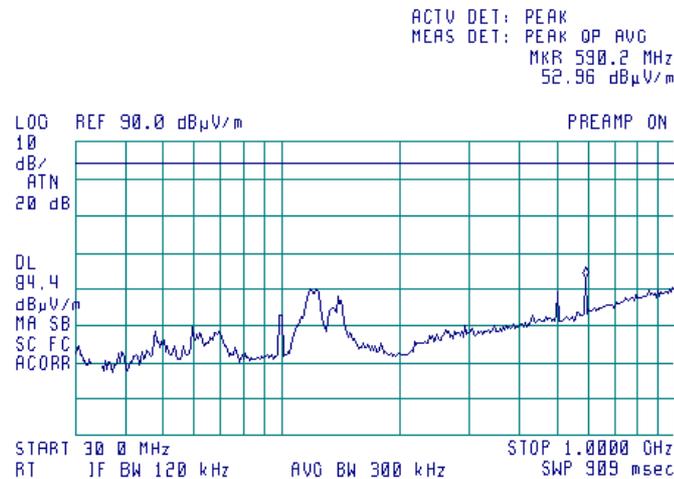
Plot 7.6.3 Radiated emission measurements in 30 - 1000 MHz range

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





HERMON LABORATORIES

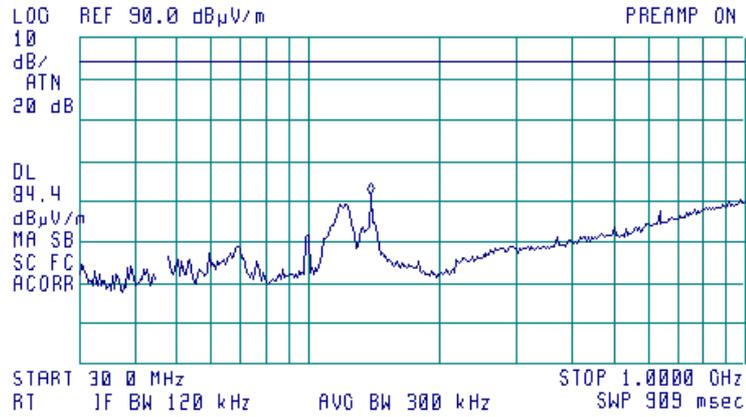
Test specification:		FCC Section 90.1323 / RSS-197, Section 5.7, Radiated spurious emissions	
Test procedure:		47 CFR, Sections 2.1053, 90.1323; TIA/EIA-603-C, Section 2.2.12	
Test mode:	Compliance	Verdict:	PASS
Date(s):	11/5/2013		
Temperature: 25 °C	Air Pressure: 1017 hPa	Relative Humidity: 45 %	Power Supply: 48 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



ACTV DET: PEAK
 MEAS DET: PEAK OP AVG
 MKR 139.1 MHz
 51.52 dBµV/m



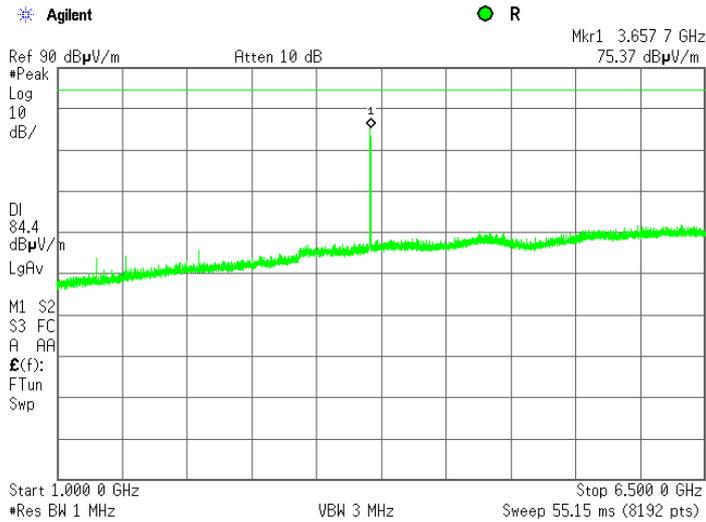


HERMON LABORATORIES

Test specification: FCC Section 90.1323 / RSS-197, Section 5.7, 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): 11/5/2013	
Temperature: 25 °C	Air Pressure: 1017 hPa
	Relative Humidity: 45 %
Power Supply: 48 VDC	
Remarks:	

Plot 7.6.6 Radiated emission measurements in 1000 – 6500 MHz range

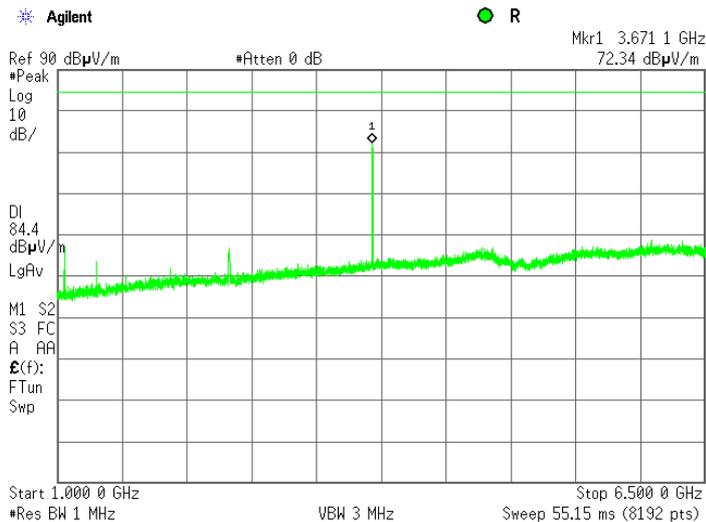
TEST SITE: Semi anechoic chamber
 CARRIER FREQUENCY: Low
 ANTENNA POLARIZATION: Vertical and Horizontal
 TEST DISTANCE: 3 m



Note: The carrier is shown

Plot 7.6.7 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



Note: The carrier is shown

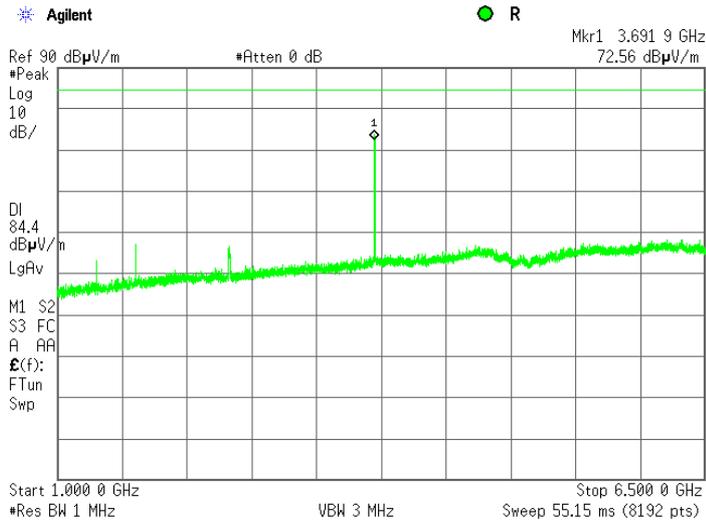


HERMON LABORATORIES

Test specification: FCC Section 90.1323 / RSS-197, Section 5.7, 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): 11/5/2013	
Temperature: 25 °C	Air Pressure: 1017 hPa
	Relative Humidity: 45 %
Power Supply: 48 VDC	
Remarks:	

Plot 7.6.8 Radiated emission measurements in 1000 – 6500 MHz range

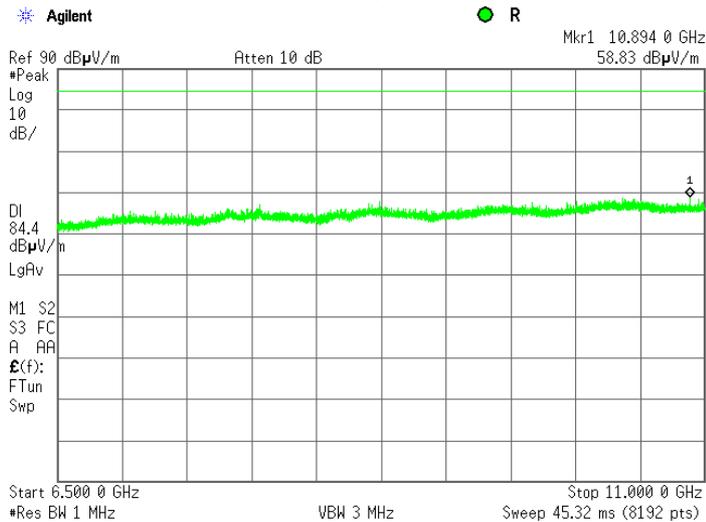
TEST SITE: Semi anechoic chamber
 CARRIER FREQUENCY: High
 ANTENNA POLARIZATION: Vertical and Horizontal
 TEST DISTANCE: 3 m



Note: The carrier is shown

Plot 7.6.9 Radiated emission measurements in 6500 – 11000 MHz range

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



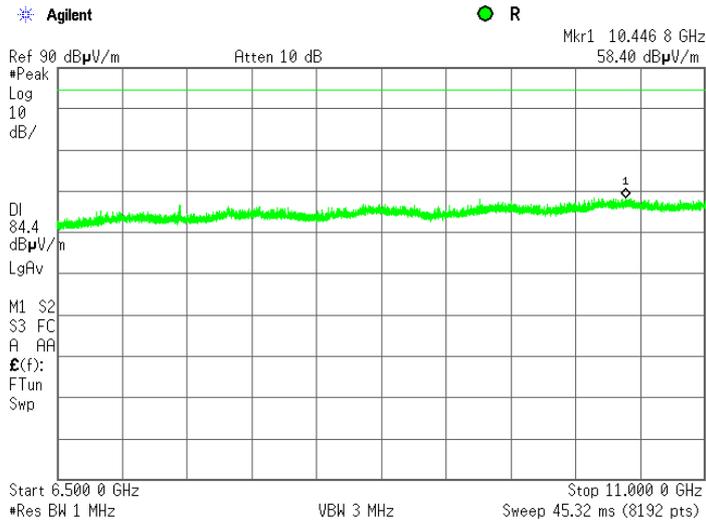


HERMON LABORATORIES

Test specification: FCC Section 90.1323 / RSS-197, Section 5.7, 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): 11/5/2013	
Temperature: 25 °C	Air Pressure: 1017 hPa
	Relative Humidity: 45 %
	Power Supply: 48 VDC
Remarks:	

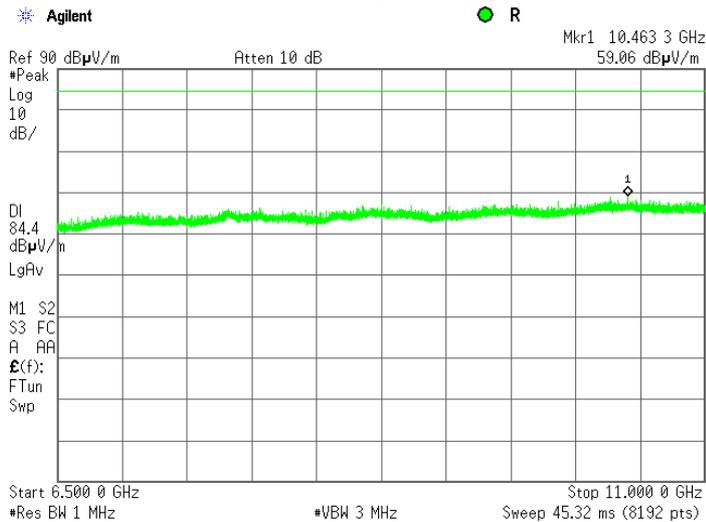
Plot 7.6.10 Radiated emission measurements in 6500 – 11000 MHz range

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



Plot 7.6.11 Radiated emission measurements in 6500 – 11000 MHz range

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





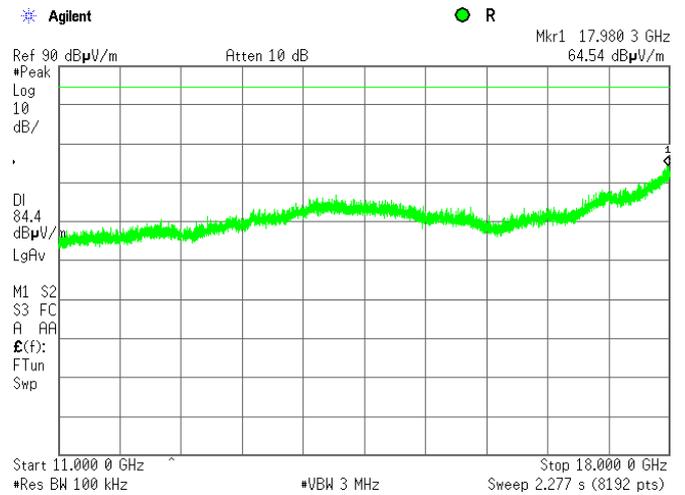
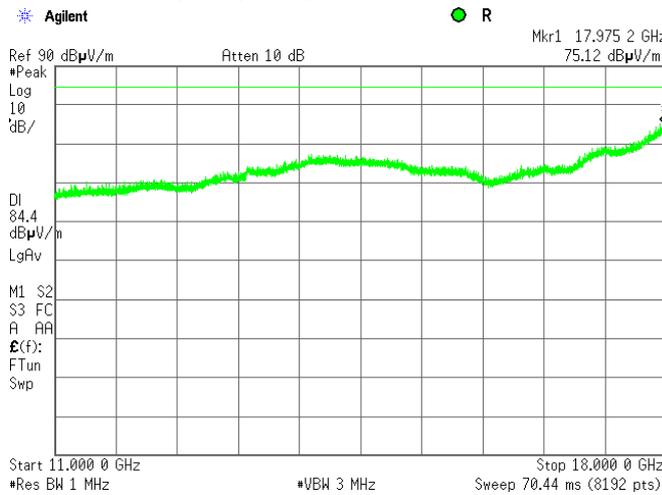
HERMON LABORATORIES

Test specification: FCC Section 90.1323 / RSS-197, Section 5.7, 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): 11/5/2013	
Temperature: 25 °C	Air Pressure: 1017 hPa
	Relative Humidity: 45 %
	Power Supply: 48 VDC
Remarks:	

Plot 7.6.12 Radiated emission measurements in 11000 – 18000 MHz range

TEST SITE:
CARRIER FREQUENCY:
ANTENNA POLARIZATION:
TEST DISTANCE:

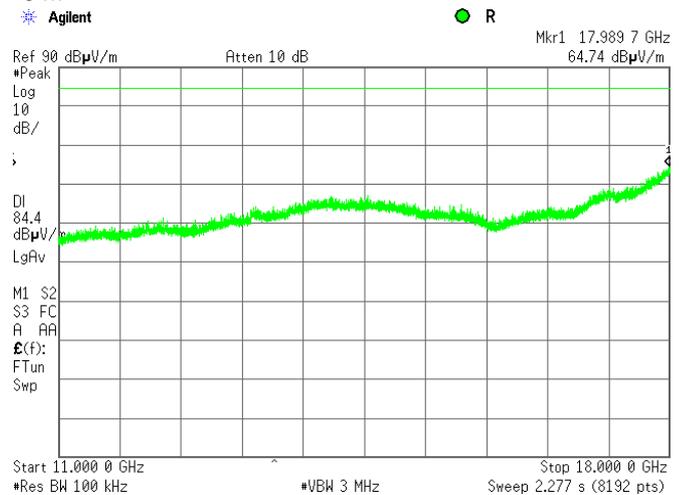
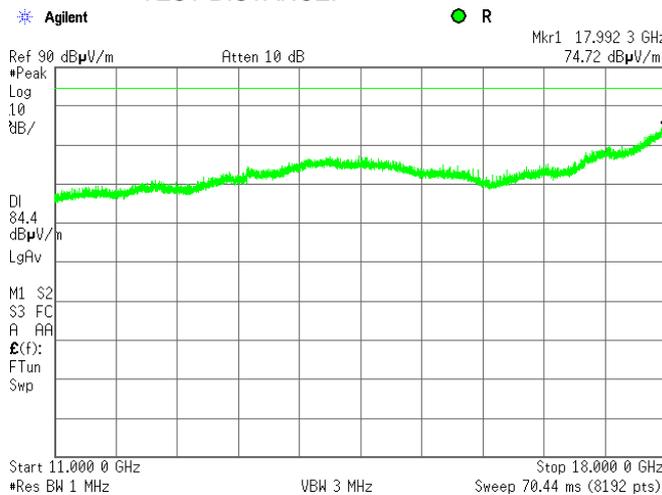
Semi anechoic chamber
Low
Vertical and Horizontal
3 m



Plot 7.6.13 Radiated emission measurements in 11000 – 18000 MHz range

TEST SITE:
CARRIER FREQUENCY:
ANTENNA POLARIZATION:
TEST DISTANCE:

Semi anechoic chamber
Mid
Vertical and Horizontal
3 m





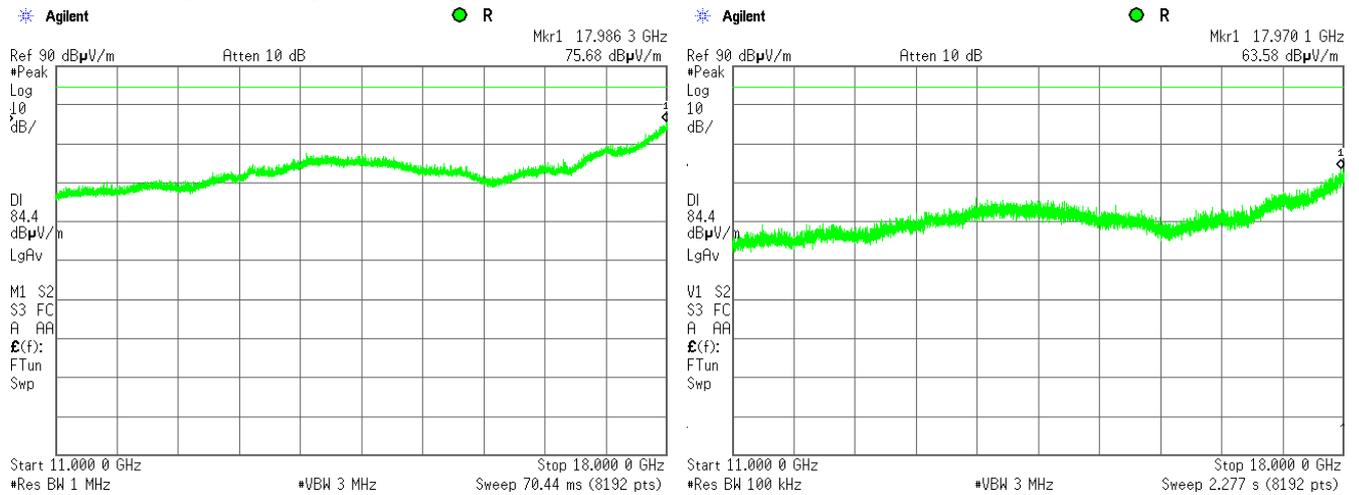
HERMON LABORATORIES

Test specification: FCC Section 90.1323 / RSS-197, Section 5.7, 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): 11/5/2013	
Temperature: 25 °C	Air Pressure: 1017 hPa
	Relative Humidity: 45 %
	Power Supply: 48 VDC
Remarks:	

Plot 7.6.14 Radiated emission measurements in 11000 – 18000 MHz range

TEST SITE:
CARRIER FREQUENCY:
ANTENNA POLARIZATION:
TEST DISTANCE:

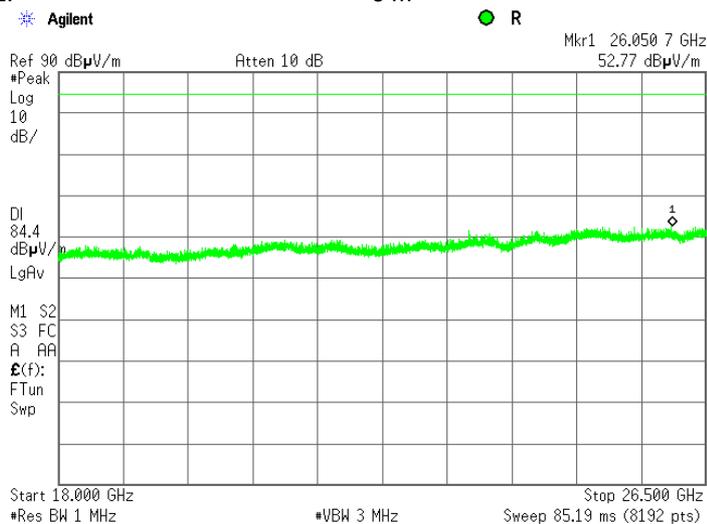
Semi anechoic chamber
High
Vertical and Horizontal
3 m



Plot 7.6.15 Radiated emission measurements in 18000 – 26500 MHz range

TEST SITE:
CARRIER FREQUENCY:
ANTENNA POLARIZATION:
TEST DISTANCE:

Semi anechoic chamber
Low
Vertical and Horizontal
3 m



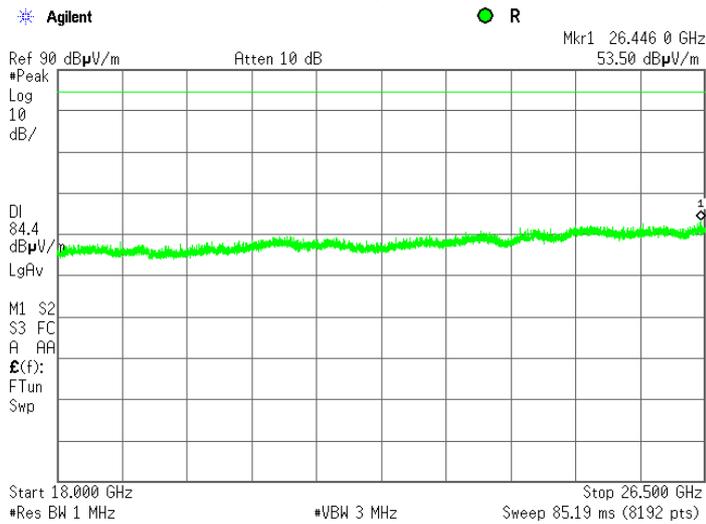


HERMON LABORATORIES

Test specification: FCC Section 90.1323 / RSS-197, Section 5.7, 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): 11/5/2013	
Temperature: 25 °C	Air Pressure: 1017 hPa
	Relative Humidity: 45 %
Power Supply: 48 VDC	
Remarks:	

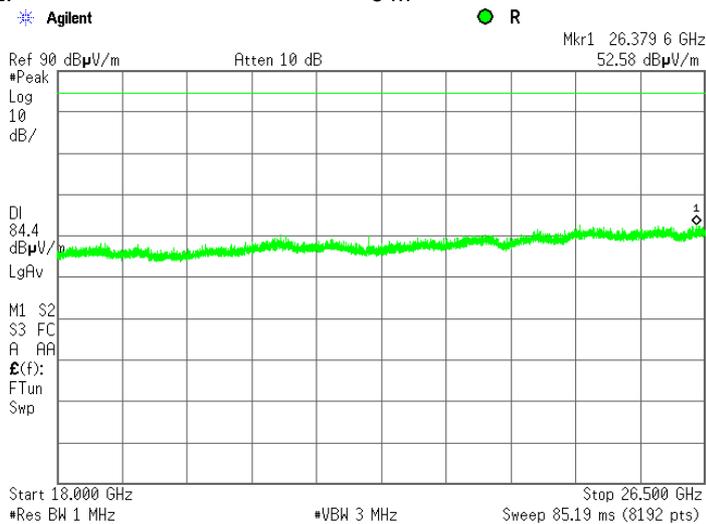
Plot 7.6.16 Radiated emission measurements in 18000 – 26500 MHz range

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



Plot 7.6.17 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





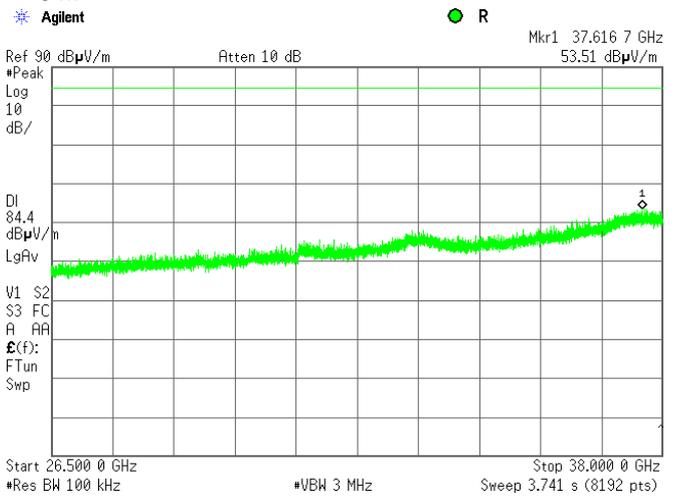
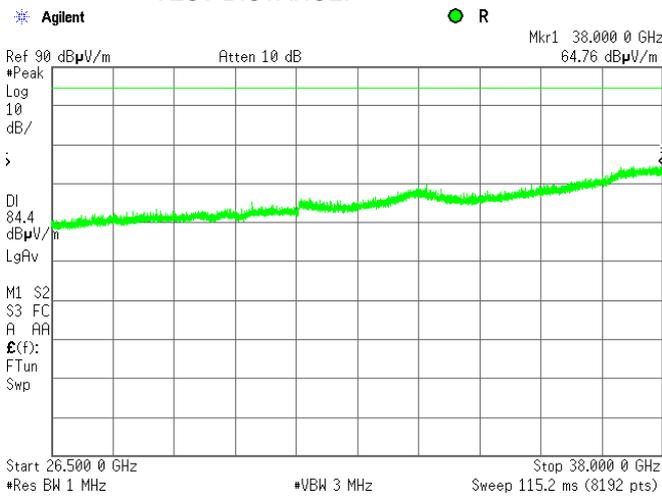
HERMON LABORATORIES

Test specification: FCC Section 90.1323 / RSS-197, Section 5.7, 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): 11/5/2013	
Temperature: 25 °C	Air Pressure: 1017 hPa
	Relative Humidity: 45 %
	Power Supply: 48 VDC
Remarks:	

Plot 7.6.18 Radiated emission measurements in 26500 – 38000 MHz range

TEST SITE:
CARRIER FREQUENCY:
ANTENNA POLARIZATION:
TEST DISTANCE:

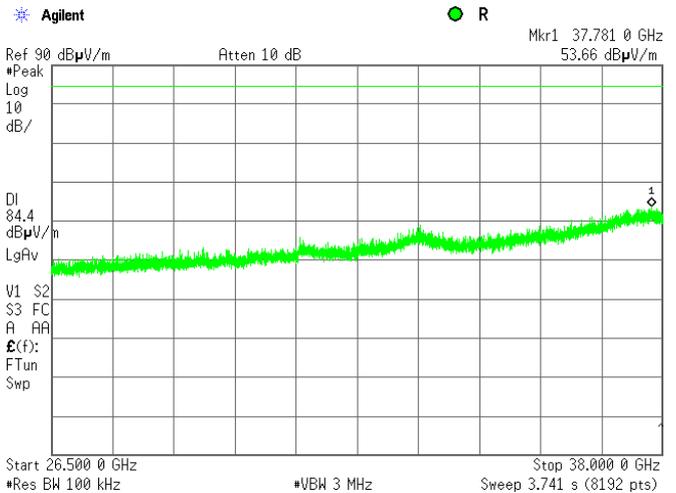
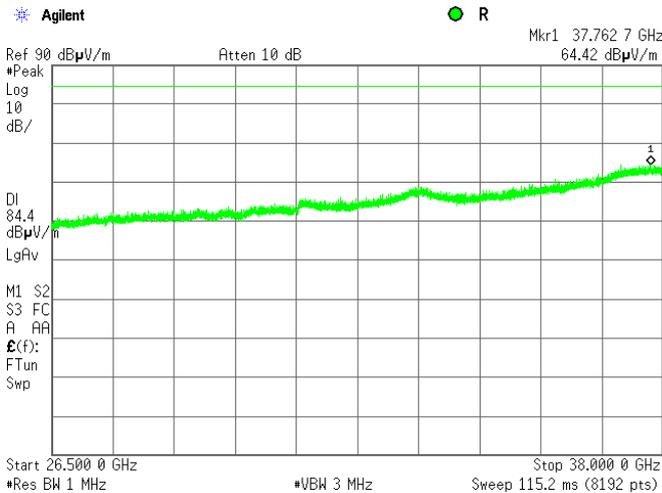
Semi anechoic chamber
Low
Vertical and Horizontal
3 m



Plot 7.6.19 Radiated emission measurements in 26500 – 38000 MHz range

TEST SITE:
CARRIER FREQUENCY:
ANTENNA POLARIZATION:
TEST DISTANCE:

Semi anechoic chamber
Mid
Vertical and Horizontal
3 m





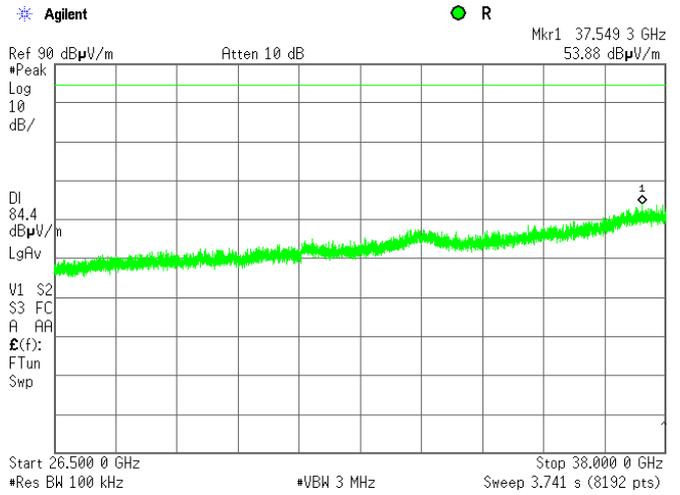
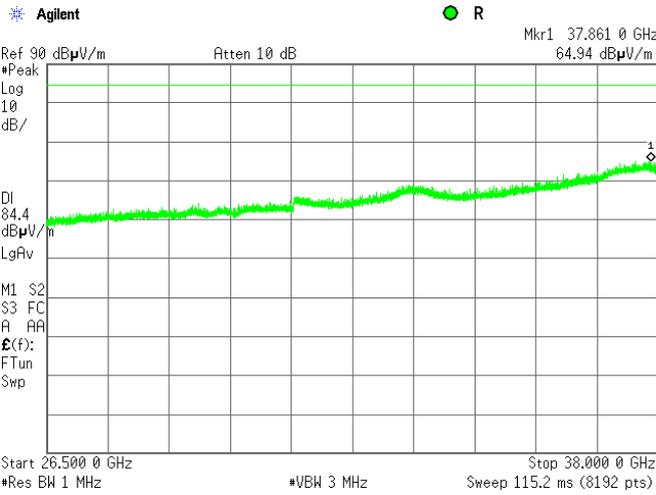
HERMON LABORATORIES

Test specification: FCC Section 90.1323 / RSS-197, Section 5.7, 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): 11/5/2013	
Temperature: 25 °C	Air Pressure: 1017 hPa
	Relative Humidity: 45 %
	Power Supply: 48 VDC
Remarks:	

Plot 7.6.20 Radiated emission measurements in 26500 – 38000 MHz range

TEST SITE:
CARRIER FREQUENCY:
ANTENNA POLARIZATION:
TEST DISTANCE:

Semi anechoic chamber
High
Vertical and Horizontal
3 m





Test specification:	FCC Section 90.213 / RSS-197, Section 5.7, Frequency stability		
Test procedure:	47 CFR, Section 2.1055; TIA/EIA-603-C Section 2.2.2		
Test mode:	Compliance	Verdict:	PASS
Date(s):	11/6/2013 - 11/10/2013		
Temperature: 23 °C	Air Pressure: 1015 hPa	Relative Humidity: 47 %	Power Supply: 48 VDC
Remarks:			

7.7 Frequency stability test

7.7.1 General

This test was performed to measure frequency stability of transmitter RF carrier. Specification test limits are given in Table 7.7.1.

Table 7.7.1 Frequency stability limits

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

Table 7.7.2 Frequency stability limits according to RSS-197

Assigned frequency, MHz	Maximum allowed frequency displacement
3650.0 – 3700.0	The frequency stability shall be sufficient to ensure that f_L minus the frequency offset and f_H plus the frequency offset shall be within the authorized band of operation

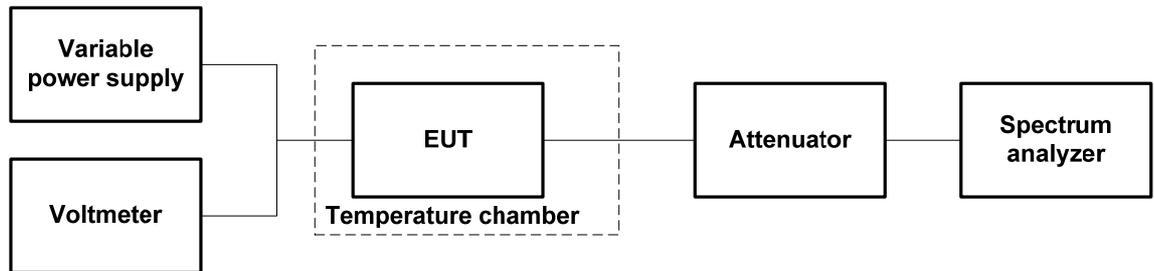
7.7.2 Test procedure

- 7.7.2.1 The EUT was set up as shown in Figure 7.7.1, energized and its proper operation was checked.
- 7.7.2.2 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.
- 7.7.2.3 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.
- 7.7.2.4 The above procedure was repeated at 0°C and at the lowest test temperature.
- 7.7.2.5 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.
- 7.7.2.6 Frequency displacement was calculated and compared with the limit as provided in Table 7.7.3.



Test specification:	FCC Section 90.213 / RSS-197, Section 5.7, Frequency stability		
Test procedure:	47 CFR, Section 2.1055; TIA/EIA-603-C Section 2.2.2		
Test mode:	Compliance	Verdict:	PASS
Date(s):	11/6/2013 - 11/10/2013		
Temperature: 23 °C	Air Pressure: 1015 hPa	Relative Humidity: 47 %	Power Supply: 48 VDC
Remarks:			

Figure 7.7.1 Frequency stability test setup





HERMON LABORATORIES

Test specification:		FCC Section 90.213 / RSS-197, Section 5.7, Frequency stability	
Test procedure:		47 CFR, Section 2.1055; TIA/EIA-603-C Section 2.2.2	
Test mode:		Compliance	
Date(s):		11/6/2013 - 11/10/2013	
Temperature: 23 °C		Air Pressure: 1015 hPa	
Remarks:		Verdict: PASS	
		Relative Humidity: 47 %	
		Power Supply: 48 VDC	

Table 7.7.3 Frequency stability test results

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

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 3652.5MHz												
-30	nominal	3652.49958	3652.49958	3652.49950	3652.49950	3652.49967	3652.49950	3652.49950	203.00	0.00	0.06	0.00
-20	nominal	3652.49967	N/A	N/A	N/A	N/A	N/A	3652.49958	203.00	0.00	0.06	0.00
-10	nominal	3652.49967	N/A	N/A	N/A	N/A	N/A	3652.49950	203.00	0.00	0.06	0.00
0	nominal	3652.49967	3652.49958	3652.49950	3652.49958	3652.49958	3652.49958	3652.49958	203.00	0.00	0.06	0.00
10	nominal	3652.49958	N/A	N/A	N/A	N/A	N/A	3652.49975	283.00	0.00	0.08	0.00
20	+15% 55.2	3652.49947	N/A	N/A	N/A	N/A	N/A	3652.49946	0.00	7.00	0.00	0.00
20	nominal	3652.49947	N/A	N/A	N/A	N/A	N/A	3652.49947	3.00	0.00	0.00	0.00
20	-15% 40.8	3652.49946	N/A	N/A	N/A	N/A	N/A	3652.49946	0.00	9.00	0.00	0.00
30	nominal	3652.49950	3652.49947	3652.49940	3652.49950	3652.49940	3652.49947	3652.49947	33.00	67.00	0.01	-0.02
40	nominal	3652.49954	N/A	N/A	N/A	N/A	N/A	3652.49938	71.10	86.00	0.02	-0.02
50	nominal	3652.49940	N/A	N/A	N/A	N/A	N/A	3652.49940	0.00	64.00	0.00	-0.02
Mid channel 3675MHz												
-30	nominal	3674.99950	3674.99950	3674.99958	3674.99958	3674.99967	3674.99958	3674.99950	90.00	80.00	0.02	-0.02
-20	nominal	3674.99967	N/A	N/A	N/A	N/A	N/A	3674.99967	90.00	0.00	0.02	0.00
-10	nominal	3674.99958	N/A	N/A	N/A	N/A	N/A	3674.99950	0.00	80.00	0.00	-0.02
0	nominal	3674.99950	3674.99958	3674.99967	3674.99958	3674.99958	3674.99958	3674.99958	90.00	80.00	0.02	-0.02
10	nominal	3674.99950	N/A	N/A	N/A	N/A	N/A	3674.99967	90.00	80.00	0.02	-0.02
20	15%	3674.99958	N/A	N/A	N/A	N/A	N/A	3674.99958	0.00	0.00	0.00	0.00
20	nominal	3674.99958	N/A	N/A	N/A	N/A	N/A	3674.99958	0.00	0.00	0.00	0.00
20	-15%	3674.99958	N/A	N/A	N/A	N/A	N/A	3674.99950	0.00	80.00	0.00	-0.02
30	nominal	3674.99958	3674.99975	3674.99958	3674.99967	3674.99975	3674.99958	3674.99967	170.00	0.00	0.05	0.00
40	nominal	3674.99939	N/A	N/A	N/A	N/A	N/A	3674.99939	0.00	194.00	0.00	-0.05
50	nominal	3674.99940	N/A	N/A	N/A	N/A	N/A	3674.99940	0.00	181.00	0.00	-0.05
High channel 3697.5MHz												
-30	nominal	3697.49967	3697.49958	3697.49958	3697.49950	3697.49958	3697.49958	3697.49950	170.00	0.00	0.05	0.00
-20	nominal	3697.49958	N/A	N/A	N/A	N/A	N/A	3697.49950	80.00	0.00	0.02	0.00
-10	nominal	3697.49958	N/A	N/A	N/A	N/A	N/A	3697.49967	170.00	0.00	0.05	0.00
0	nominal	3697.49967	3697.49958	3697.49958	3697.49958	3697.49967	3697.49975	3697.49958	250.00	0.00	0.07	0.00
10	nominal	3697.49975	N/A	N/A	N/A	N/A	N/A	3697.49958	250.00	0.00	0.07	0.00
20	15%	3697.49950	N/A	N/A	N/A	N/A	N/A	3697.49965	150.00	0.00	0.04	0.00
20	nominal	3697.49950	N/A	N/A	N/A	N/A	N/A	3697.49958	80.00	0.00	0.02	0.00
20	-15%	3697.49950	N/A	N/A	N/A	N/A	N/A	3697.49967	170.00	0.00	0.05	0.00
30	nominal	3697.49958	3697.49958	3697.49958	3697.49975	3697.49958	3697.49967	3697.49958	250.00	0.00	0.07	0.00
40	nominal	3697.49938	N/A	N/A	N/A	N/A	N/A	3697.49939	0.00	116.00	0.00	-0.03
50	nominal	3697.49939	N/A	N/A	N/A	N/A	N/A	3697.49939	0.00	107.00	0.00	-0.03

Verdict: Pass

* - Reference frequency

Reference numbers of test equipment used

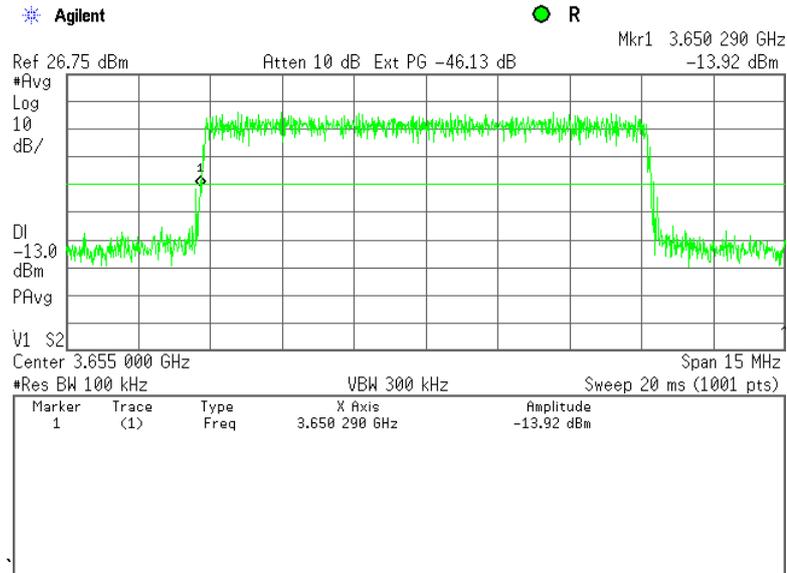
HL 1424	HL 1906	HL 3286	HL 3301	HL 3310	HL 3474	HL 3818	HL 3903
HL 4068	HL 4164	HL 4273	HL 4274	HL 4366			

Full description is given in Appendix A.

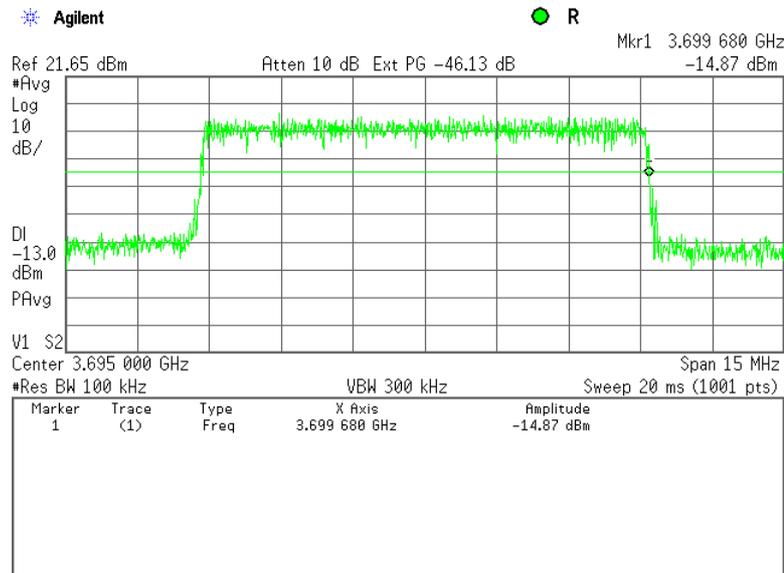


Test specification: FCC Section 90.213 / RSS-197, Section 5.7, Frequency stability	
Test procedure: 47 CFR, Section 2.1055; TIA/EIA-603-C Section 2.2.2	
Test mode: Compliance	Verdict: PASS
Date(s): 11/6/2013 - 11/10/2013	
Temperature: 23 °C	Air Pressure: 1015 hPa
	Relative Humidity: 47 %
	Power Supply: 48 VDC
Remarks:	

Plot 7.7.1 Band edge test result at low frequency, QPSK, EBW 10 MHz



Plot 7.7.2 Band edge test result at high frequency, QPSK, EBW 10 MHz

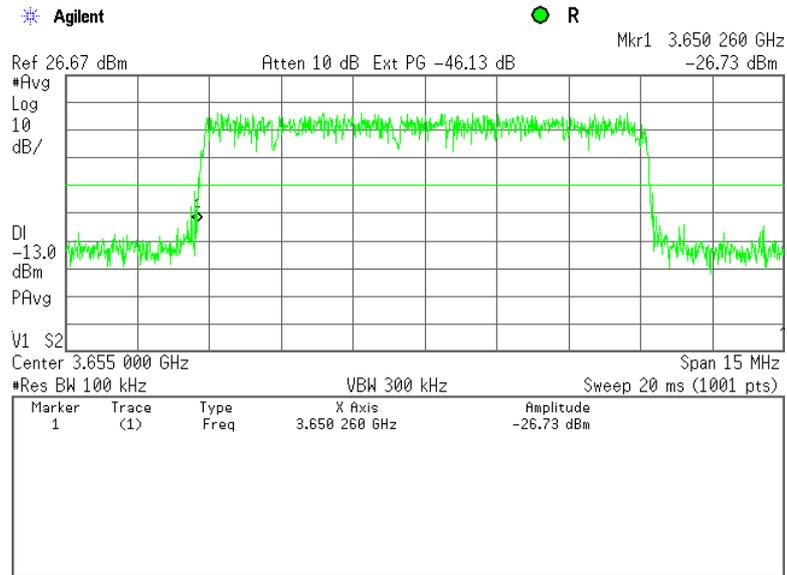




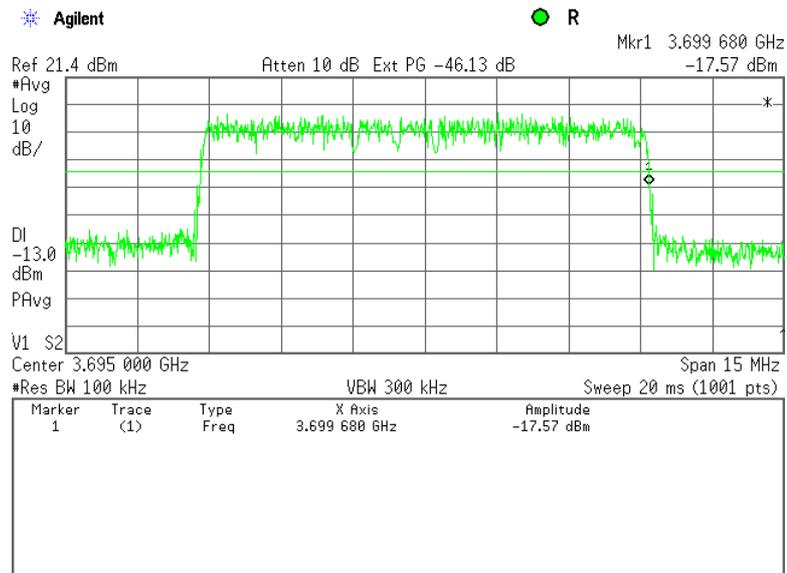
HERMON LABORATORIES

Test specification:		FCC Section 90.213 / RSS-197, Section 5.7, Frequency stability	
Test procedure:		47 CFR, Section 2.1055; TIA/EIA-603-C Section 2.2.2	
Test mode:		Verdict: PASS	
Date(s):		11/6/2013 - 11/10/2013	
Temperature: 23 °C	Air Pressure: 1015 hPa	Relative Humidity: 47 %	Power Supply: 48 VDC
Remarks:			

Plot 7.7.3 Band edge test result at low frequency, 64QAM, EBW 10 MHz



Plot 7.7.4 Band edge test result at high frequency, 64QAM, EBW 10 MHz

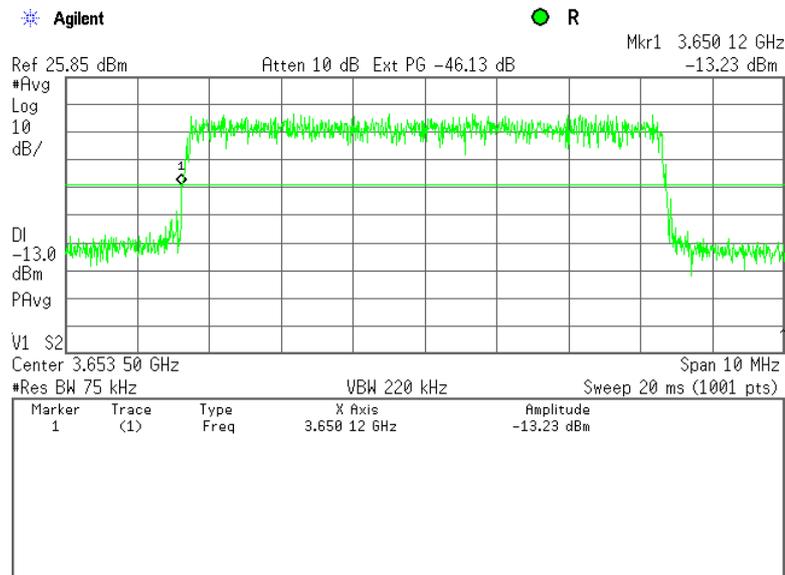




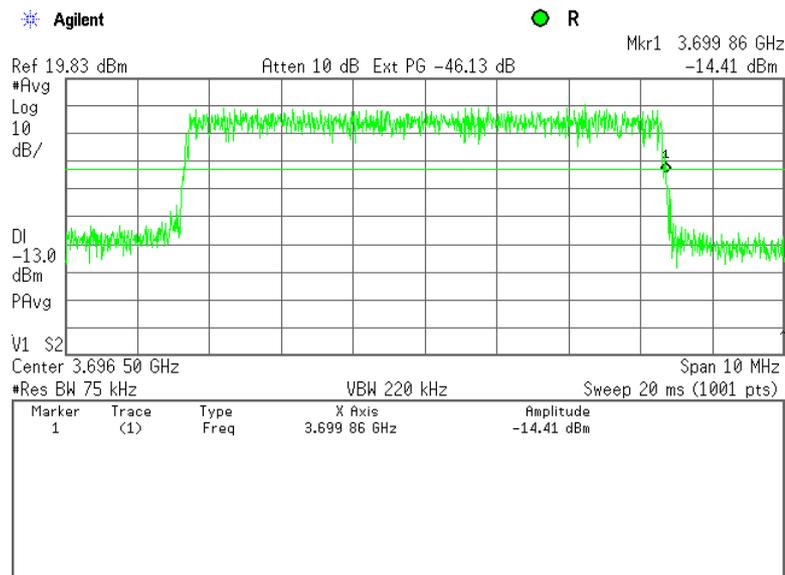
HERMON LABORATORIES

Test specification:		FCC Section 90.213 / RSS-197, Section 5.7, Frequency stability	
Test procedure:		47 CFR, Section 2.1055; TIA/EIA-603-C Section 2.2.2	
Test mode:		Verdict: PASS	
Date(s):		11/6/2013 - 11/10/2013	
Temperature: 23 °C	Air Pressure: 1015 hPa	Relative Humidity: 47 %	Power Supply: 48 VDC
Remarks:			

Plot 7.7.5 Band edge test result at low frequency, QPSK, EBW 7MHz



Plot 7.7.6 Band edge test result at high frequency, QPSK, EBW 7 MHz

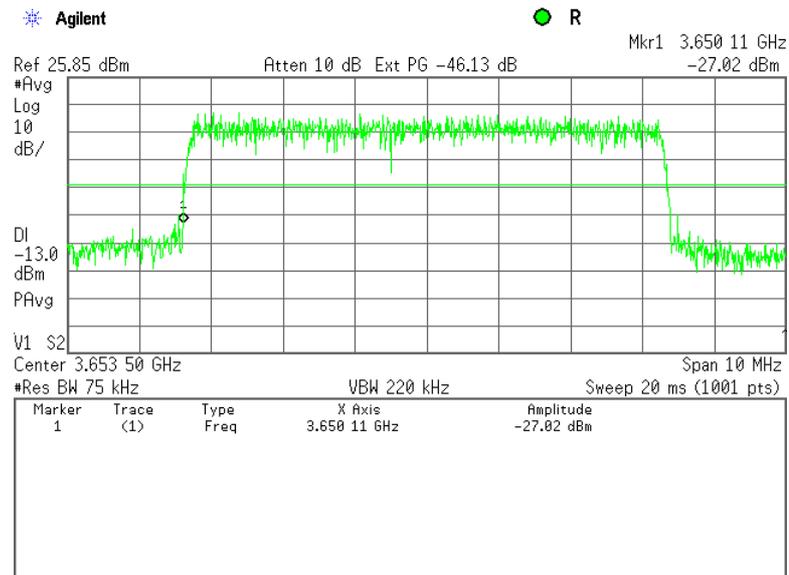




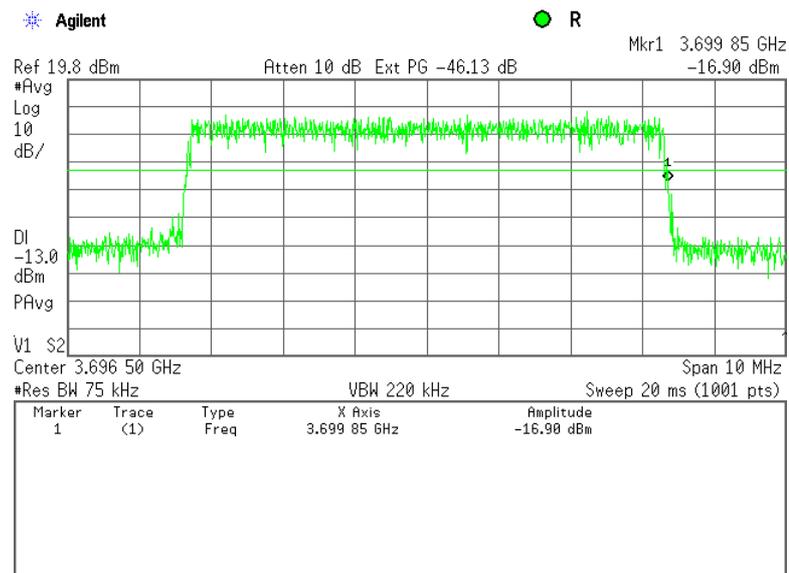
HERMON LABORATORIES

Test specification:		FCC Section 90.213 / RSS-197, Section 5.7, Frequency stability	
Test procedure:		47 CFR, Section 2.1055; TIA/EIA-603-C Section 2.2.2	
Test mode:		Verdict: PASS	
Date(s):		11/6/2013 - 11/10/2013	
Temperature: 23 °C	Air Pressure: 1015 hPa	Relative Humidity: 47 %	Power Supply: 48 VDC
Remarks:			

Plot 7.7.7 Band edge test result at low frequency, 64QAM, EBW 7 MHz



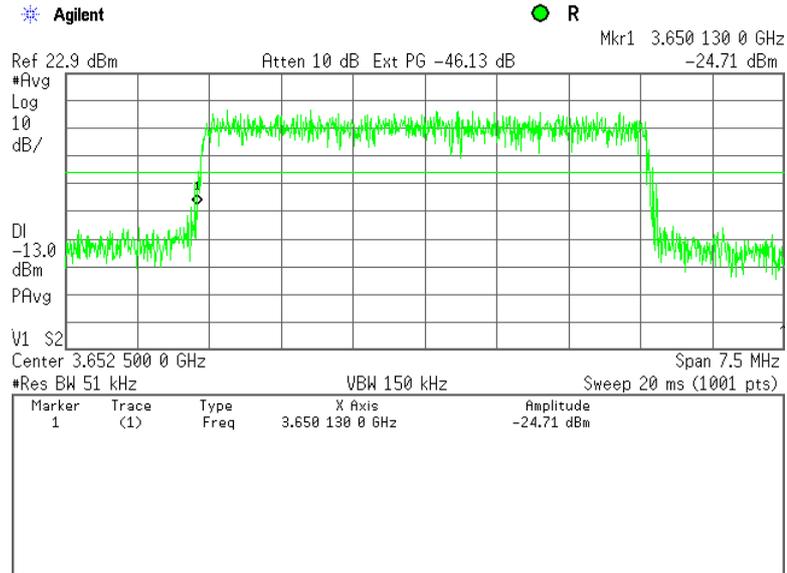
Plot 7.7.8 Band edge test result at high frequency, 64QAM, EBW 7 MHz



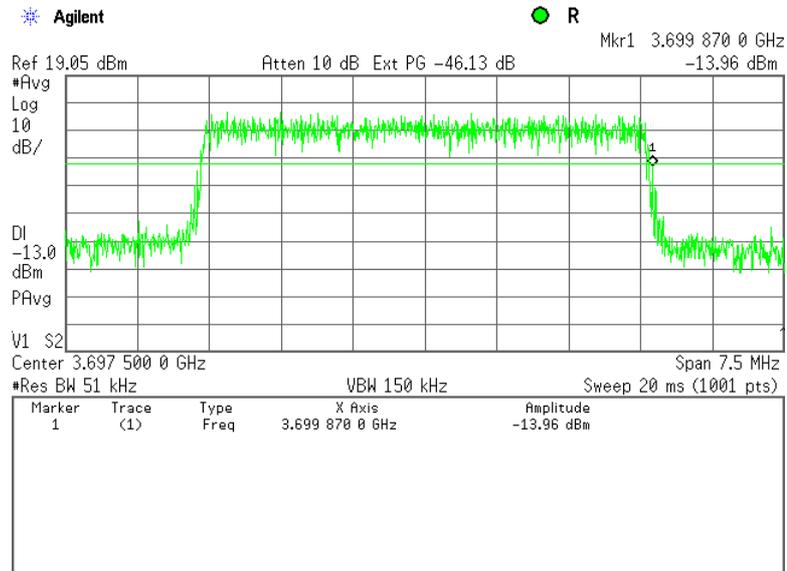


Test specification: FCC Section 90.213 / RSS-197, Section 5.7, Frequency stability	
Test procedure: 47 CFR, Section 2.1055; TIA/EIA-603-C Section 2.2.2	
Test mode: Compliance	Verdict: PASS
Date(s): 11/6/2013 - 11/10/2013	
Temperature: 23 °C	Air Pressure: 1015 hPa
	Relative Humidity: 47 %
	Power Supply: 48 VDC
Remarks:	

Plot 7.7.9 Band edge test result at low frequency, QPSK, EBW 5MHz



Plot 7.7.10 Band edge test result at high frequency, QPSK, EBW 5 MHz

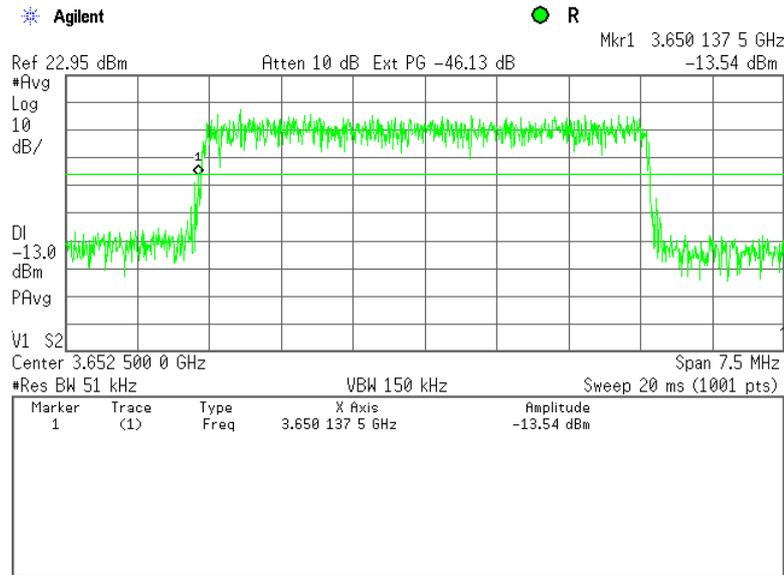




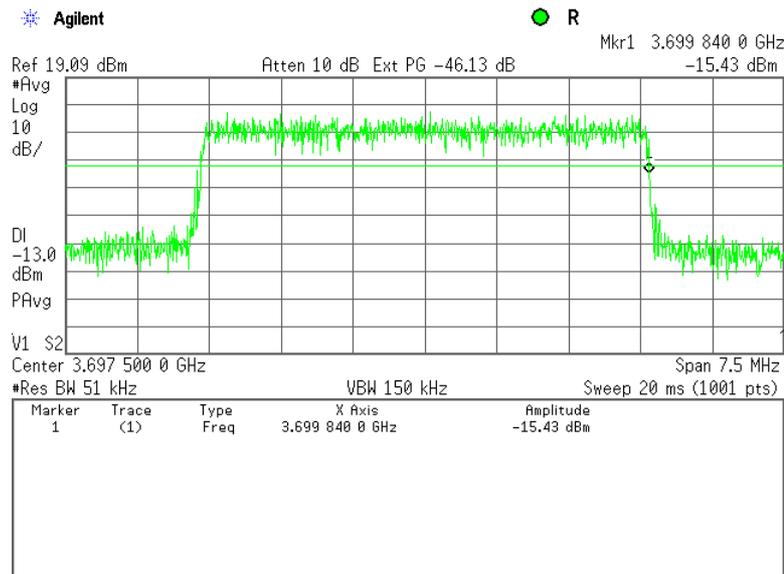
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Test specification: FCC Section 90.213 / RSS-197, Section 5.7, Frequency stability	
Test procedure: 47 CFR, Section 2.1055; TIA/EIA-603-C Section 2.2.2	
Test mode: Compliance	Verdict: PASS
Date(s): 11/6/2013 - 11/10/2013	
Temperature: 23 °C	Air Pressure: 1015 hPa
	Relative Humidity: 47 %
	Power Supply: 48 VDC
Remarks:	

Plot 7.7.11 Band edge test result at low frequency, 64QAM, EBW 5 MHz



Plot 7.7.12 Band edge test result at high frequency, 64QAM, EBW 5 MHz





Test specification:		RSS-197, Section 5.8, Receiver spurious emissions	
Test procedure:		ANSI C63.4, Sections 12.1.4, 12.1.5	
Test mode:		Verdict: PASS	
Date(s):			
Temperature: 23 °C	Air Pressure: 1014 hPa	Relative Humidity: 39 %	Power Supply: 48 VDC
Remarks:			

7.8 Receiver spurious emissions

7.8.1 General

This test was performed to measure spurious emissions at RF antenna connector of receiver. Specification test limits at antenna connector measurement are given in Table 7.8.1 **Error! Reference source not found.**

Table 7.8.1 Antenna conducted measurement spurious emission limits

Frequency range, MHz	Power of spurious		Measurement bandwidth, (min) kHz
	nW	dBm	
30 – 1000	2	-57	4
1000 – 3 rd harmonic	5	-53	4

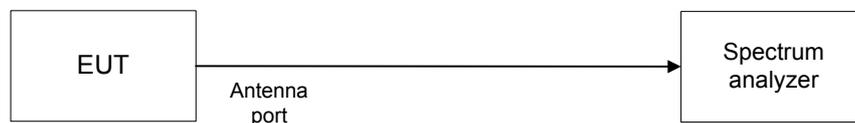
* - harmonic of the highest frequency the EUT generates, uses, operates or tunes to (without exceeding 40 GHz).

7.8.2 Test procedure for conducted measurement

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

7.8.2.2 The spurious emission was measured with spectrum analyzer as provided in Table 7.8.2 and the associated plots.

Figure 7.8.1 Spurious emission test setup





Test specification:	RSS-197, Section 5.8, Receiver spurious emissions		
Test procedure:	ANSI C63.4, Sections 12.1.4, 12.1.5		
Test mode:	Compliance	Verdict:	PASS
Date(s):	11/10/2013		
Temperature: 23 °C	Air Pressure: 1014 hPa	Relative Humidity: 39 %	Power Supply: 48 VDC
Remarks:			

Table 7.8.2 Spurious emission test results according to RSS-Gen, Section 6

INVESTIGATED FREQUENCY RANGE: 30-12000 MHz
EUT OPERATING MODE: Receive
RESOLUTION BANDWIDTH: 100 kHz (below 1000 MHz)
1000 kHz (above 1000 MHz)
VIDEO BANDWIDTH: 300 kHz (below 1000 MHz)
3000 kHz (above 1000 MHz)

Frequency, MHz	Spurious emission, dBm	Limit, dBm	Margin, dB	Verdict
No spurious emissions were found				

Reference numbers of test equipment used

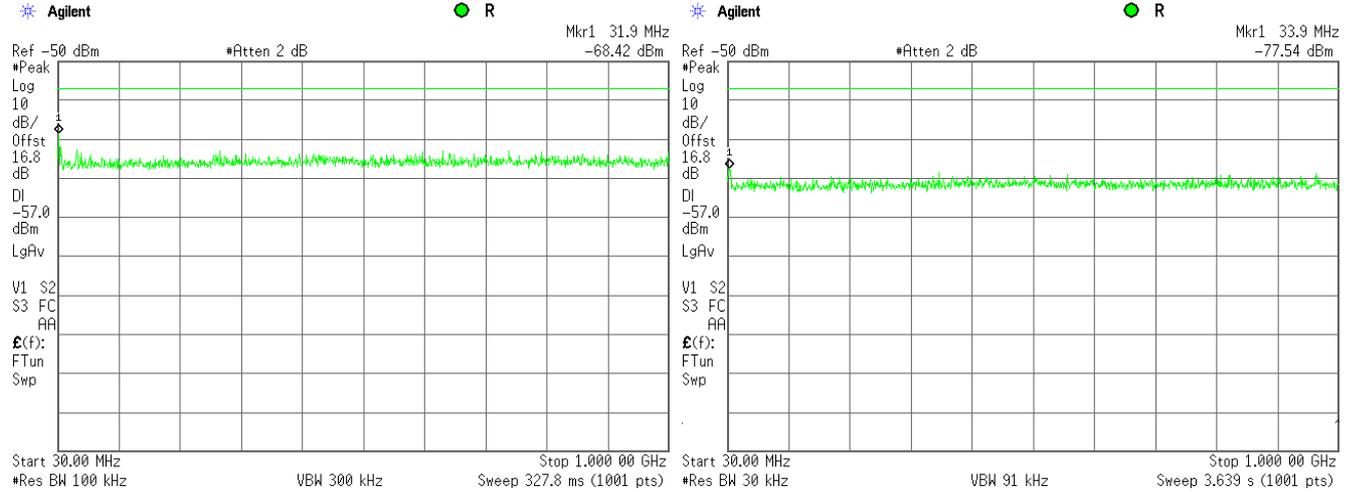
HL 1906	HL 3790	HL 3818	HL 4164	HL 4273	HL 4274		
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Full description is given in Appendix A.

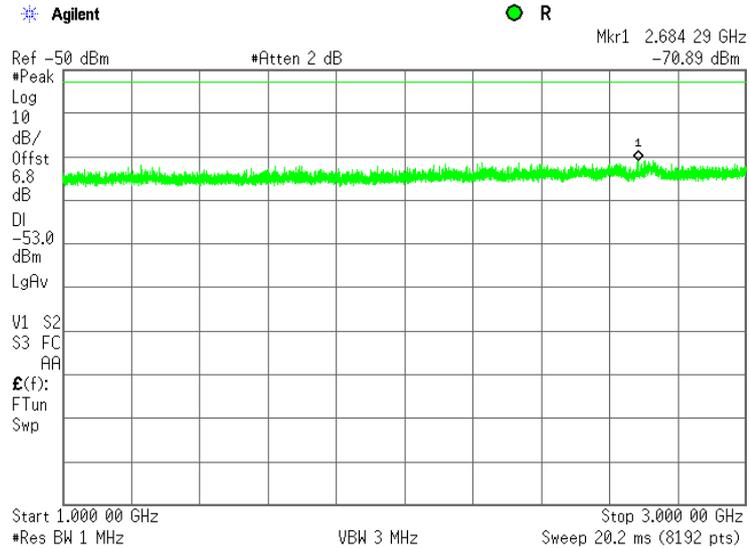


Test specification: RSS-197, Section 5.8, Receiver spurious emissions	
Test procedure: ANSI C63.4, Sections 12.1.4, 12.1.5	
Test mode: Compliance	Verdict: PASS
Date(s): 11/10/2013	
Temperature: 23 °C	Air Pressure: 1014 hPa
	Relative Humidity: 39 %
	Power Supply: 48 VDC
Remarks:	

Plot 7.8.1 Spurious emission test results in 30-1000 MHz



Plot 7.8.2 Spurious emission test results in 1-3 GHz

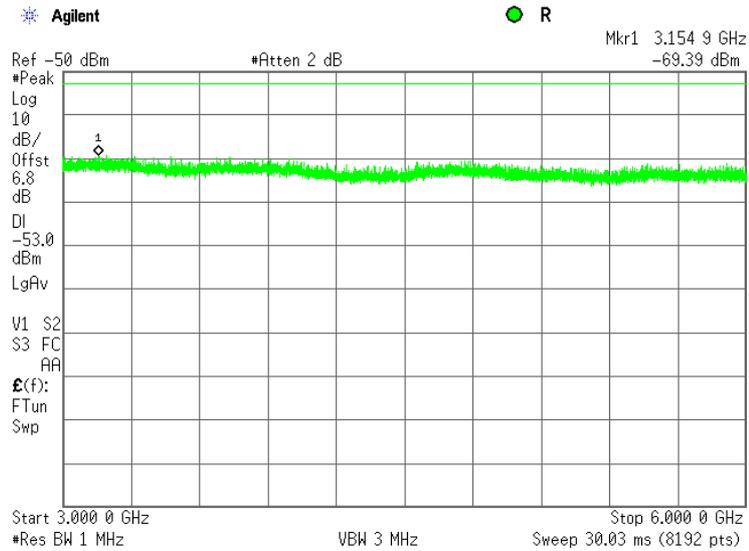




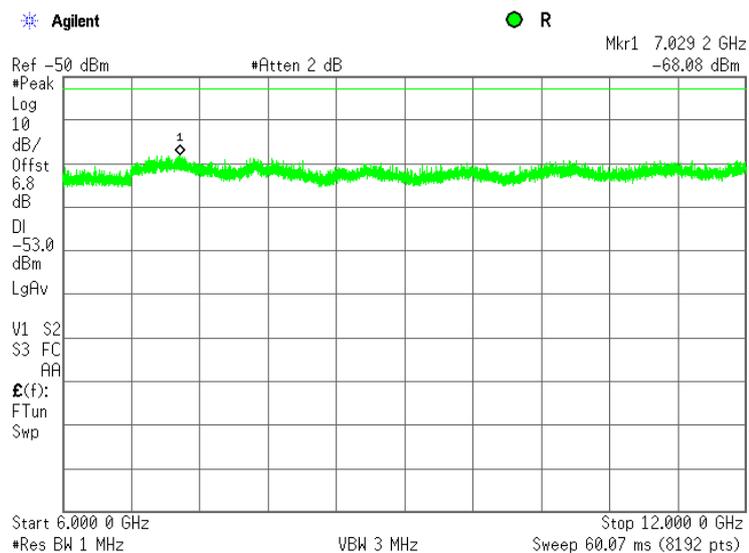
HERMON LABORATORIES

Test specification:		RSS-197, Section 5.8, Receiver spurious emissions	
Test procedure:		ANSI C63.4, Sections 12.1.4, 12.1.5	
Test mode:		Verdict:	
Compliance		PASS	
Date(s):		11/10/2013	
Temperature: 23 °C	Air Pressure: 1014 hPa	Relative Humidity: 39 %	Power Supply: 48 VDC
Remarks:			

Plot 7.8.3 Spurious emission test results in 3-6 GHz



Plot 7.8.4 Spurious emission test results in 6-12 GHz





Test specification:	FCC Section 90.203 (o) / RSS-197 Section 5.4, Contention based protocol		
Test procedure:	FCC Section 90.203 (o), RSS-197 Section 4.2		
Test mode:	Compliance	Verdict:	PASS
Date(s):	1/7/2014 - 1/13/2014		
Temperature: 23 °C	Air Pressure: 1022 hPa	Relative Humidity: 39 %	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 BreezeCOMPACT Base station linked with CPE 3.65 GHz capable to operate in TDD mode at the full 3650.0 – 3700.0 MHz band and using unrestricted Contention Based Protocol.

The EUT, BreezeCOMPACT base station, implements a channel collision sensing mechanism. The system performs a "listen before transmit" function at system startup (channel availability check) and monitoring the channel during its regular listening periods. The system will detect (both at startup and on normal operation) if another system, using any technology, is transmitting on the same frequency bandwidth, regardless of the type of transmitting protocol, raising a proper alarm and evacuate the channel as long as the channel is occupied, restarting the "listen before talk" mechanism.

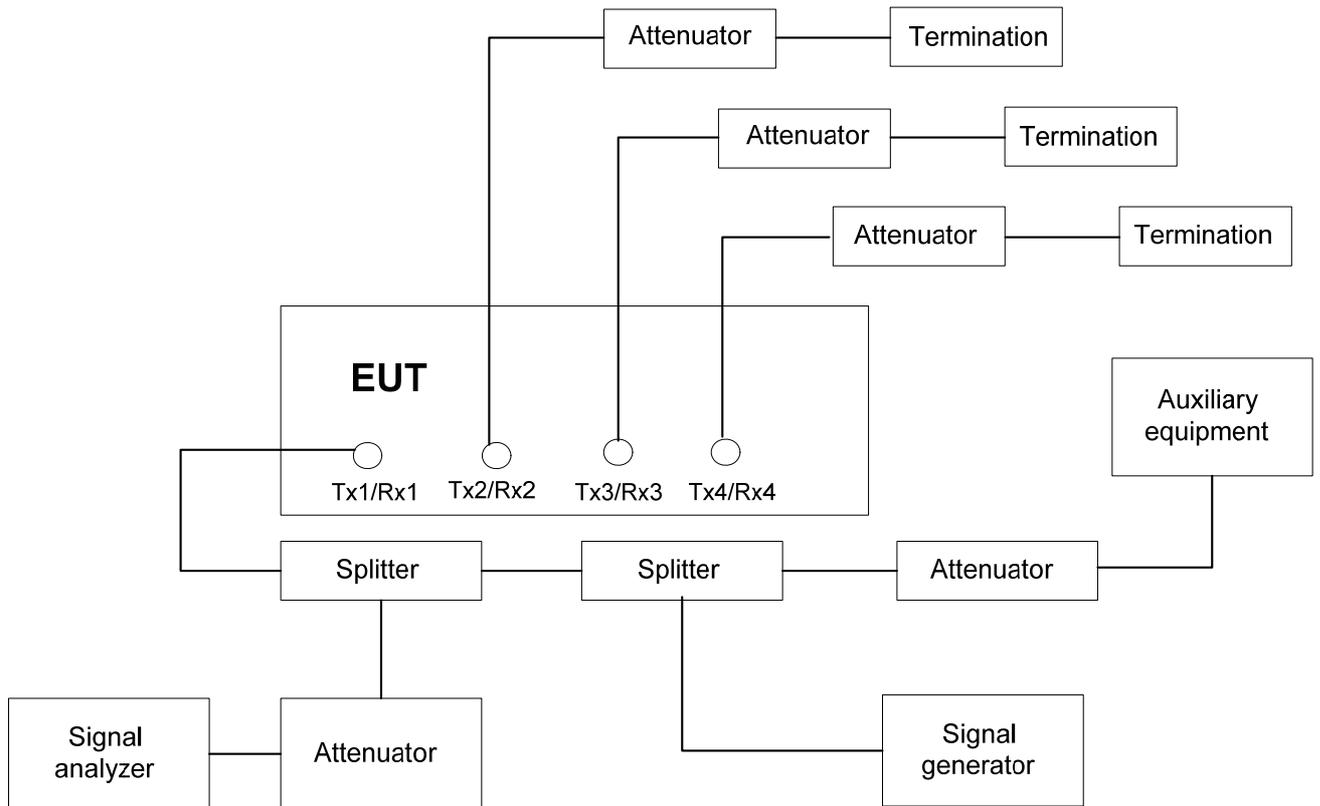
Upon alarm, the operator may manually set the base station to a new non-busy channel, always restarting the "listen before talk" mechanism.

Because of radio planning considerations, the system designed not to change automatically the carrier frequency to a new non-busy channel.



Test specification:	FCC Section 90.203 (o) / RSS-197 Section 5.4, Contention based protocol		
Test procedure:	FCC Section 90.203 (o), RSS-197 Section 4.2		
Test mode:	Compliance	Verdict:	PASS
Date(s):	1/7/2014 - 1/13/2014		
Temperature: 23 °C	Air Pressure: 1022 hPa	Relative Humidity: 39 %	Power Supply: 48 VDC
Remarks:			

Figure 8.1.1 Set-up for contention-based protocol verification test



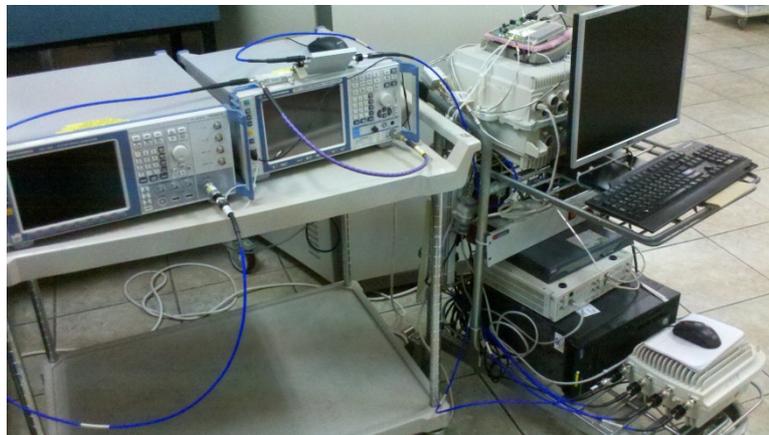


Test specification:	FCC Section 90.203 (o) / RSS-197 Section 5.4, Contention based protocol		
Test procedure:	FCC Section 90.203 (o), RSS-197 Section 4.2		
Test mode:	Compliance	Verdict:	PASS
Date(s):	1/7/2014 - 1/13/2014		
Temperature: 23 °C	Air Pressure: 1022 hPa	Relative Humidity: 39 %	Power Supply: 48 VDC
Remarks:			

Photograph 8.1.1 Test setup for contention-based protocol verification test



Photograph 8.1.2 Test setup for contention-based protocol verification test





Test specification:	FCC Section 90.203 (o) / RSS-197 Section 5.4, Contention based protocol		
Test procedure:	FCC Section 90.203 (o), RSS-197 Section 4.2		
Test mode:	Compliance	Verdict:	PASS
Date(s):	1/7/2014 - 1/13/2014		
Temperature: 23 °C	Air Pressure: 1022 hPa	Relative Humidity: 39 %	Power Supply: 48 VDC
Remarks:			

8.2 Test procedure

The EUT is equipped with four Tx/Rx chains. As four transmit chains operate simultaneously and four chains are 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 8.1.1 and the transmission was verified by the spectrum analyzer.

The signal generator was connected as shown in Figure 8.1.1, an interferer signal was generated.

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

The CW interferer signal was continuously injected to the receiver input and the EUT response was monitored and reported in Table 8.2.1.

The OFDMA interferer signal was continuously injected to the receiver input and the EUT response was monitored and reported in Table 8.2.1.



Test specification:		FCC Section 90.203 (o) / RSS-197 Section 5.4, Contention based protocol	
Test procedure:		FCC Section 90.203 (o), RSS-197 Section 4.2	
Test mode:		Compliance	
Date(s):		1/7/2014 - 1/13/2014	
Temperature: 23 °C		Air Pressure: 1022 hPa	
Remarks:		Relative Humidity: 39 %	
		Power Supply: 48 VDC	
Verdict: PASS			

Table 8.2.1 Contention based protocol test results

INTERFERER SIGNAL INJECTION: To port Tx₁/Rx₁
EUT TRANSMISSION MONITORING: At port Tx₁/Rx₁

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	3697.5	5	-87	3695.3	CW	-87	Yes	9.3	Pass
2	3697.5		-90	3695.3	CW	-90	No	NA	Pass
3	3697.5		-87	3699.7	CW	-87	Yes	10.0	Pass
4	3697.5		-90	3699.7	CW	-90	No	NA	Pass
5	3697.5		-87	3697.5	CW	-87	Yes	14.7	Pass
6	3697.5		-90	3697.5	CW	-90	No	NA	Pass
7	3697.5		-87	3697.5	OFDMA	-86.5	Yes	26.0	Pass
8	3697.5		-90	3697.5	OFDMA	-90	No	NA	Pass
9	3675		-87	3673	CW	-87	Yes	9.8	Pass
10	3675		-90	3673	CW	-90	No	NA	Pass
11	3675		-87	3677	CW	-87	Yes	9.7	Pass
12	3675		-90	3677	CW	-90	No	NA	Pass
13	3675		-87	3675	CW	-87	Yes	14.6	Pass
14	3675		-90	3675	CW	-90	No	NA	Pass
15	3675		-87	3675	OFDMA	-86.4	Yes	26.0	Pass
16	3675		-90	3675	OFDMA	-90	No	NA	Pass
17	3652.5		-87	3652.5	CW	-87	Yes	14.4	Pass
18	3652.5		-90	3652.5	CW	-90	No	NA	Pass
19	3652.5		-87	3654.5	CW	-87	Yes	8.6	Pass
20	3652.5		-90	3654.5	CW	-90	No	NA	Pass
21	3652.5		-87	3650.5	CW	-87	Yes	8.6	Pass
22	3652.5		-90	3650.5	CW	-90	NA	NA	Pass
23	3652.5		-87	3652.5	OFDMA	-86.2	Yes	30.0	Pass
24	3652.5		-90	3652.5	OFDMA	-90	No	NA	Pass



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Test specification:	FCC Section 90.203 (o) / RSS-197 Section 5.4, Contention based protocol		
Test procedure:	FCC Section 90.203 (o), RSS-197 Section 4.2		
Test mode:	Compliance	Verdict:	PASS
Date(s):	1/7/2014 - 1/13/2014		
Temperature: 23 °C	Air Pressure: 1022 hPa	Relative Humidity: 39 %	Power Supply: 48 VDC
Remarks:			

Table 8.2.1 Contention base protocol test results (continued)

INTERFERER SIGNAL
INJECTION:
EUT TRANSMISSION
MONITORING:

To port Tx₁/Rx₁
At port Tx₁/Rx₁

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
25	3696.5	7	-87	3693.5	CW	-87	Yes	9.5	Pass
26	3696.5		-90	3693.5	CW	-90	No	N/A	Pass
27	3696.5		-87	3699.8	CW	-87	Yes	9.7	Pass
28	3696.5		-90	3699.8	CW	-90	No	N/A	Pass
29	3696.5		-87	3696.5	CW	-87	Yes	10.3	Pass
30	3696.5		-90	3696.5	CW	-90	No	N/A	Pass
31	3696.5		-87	3696.5	OFDMA	-87	Yes	14.0	Pass
32	3696.5		-90	3696.5	OFDMA	-90	No	NA	Pass
33	3675		-87	3672	CW	-87	Yes	9.1	Pass
34	3675		-90	3672	CW	-90	No	N/A	Pass
35	3675		-87	3678	CW	-87	Yes	8.8	Pass
36	3675		-90	3678	CW	-90	No	N/A	Pass
37	3675		-87	3675	CW	-87	Yes	14.4	Pass
38	3675		-90	3675	CW	-90	No	N/A	Pass
39	3675		-87	3675	OFDMA	-87	Yes	10.0	Pass
40	3675		-90	3675	OFDMA	-90	No	NA	Pass
41	3653.5		-87	3650.2	CW	-87	Yes	13.4	Pass
42	3653.5		-90	3650.2	CW	-90	No	N/A	Pass
43	3653.5		-87	3656.5	CW	-87	Yes	13.5	Pass
44	3653.5		-90	3656.5	CW	-90	No	N/A	Pass
45	3653.5		-87	3653.5	CW	-87	Yes	9.7	Pass
46	3653.5		-90	3653.5	CW	-90	No	N/A	Pass
47	3653.5		-87	3653.5	OFDMA	-87	Yes	13.0	Pass
48	3653.5		-90	3653.5	OFDMA	-90	No	NA	Pass



Test specification:	FCC Section 90.203 (o) / RSS-197 Section 5.4, Contention based protocol		
Test procedure:	FCC Section 90.203 (o), RSS-197 Section 4.2		
Test mode:	Compliance	Verdict:	PASS
Date(s):	1/7/2014 - 1/13/2014		
Temperature: 23 °C	Air Pressure: 1022 hPa	Relative Humidity: 39 %	Power Supply: 48 VDC
Remarks:			

Table 8.2.1 Contention base protocol test results (continued)

INTERFERER SIGNAL INJECTION: To port Tx₁/Rx₁
EUT TRANSMISSION At port Tx₁/Rx₁
MONITORING:

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
49	3695	10	-87	3695	CW	-87	Yes	10.6	Pass
50	3695		-90	3695	CW	-90	No	N/A	Pass
51	3695		-87	3690.5	CW	-87	Yes	10.0	Pass
52	3695		-90	3690.5	CW	-90	No	N/A	Pass
53	3695		-87	3699.5	CW	-87	Yes	9.7	Pass
54	3695		-90	3699.5	CW	-90	No	N/A	Pass
55	3695		-87	3695	OFDMA	-87	Yes	14.0	Pass
56	3695		-87	3695	OFDMA	-90	No	NA	Pass
57	3675		-87	3670.5	CW	-87	Yes	9.7	Pass
58	3675		-90	3670.5	CW	-90	No	N/A	Pass
59	3675		-87	3679.5	CW	-87	Yes	10.0	Pass
60	3675		-90	3679.5	CW	-90	No	N/A	Pass
61	3675		-87	3675	CW	-87	Yes	10.6	Pass
62	3675		-90	3675	CW	-90	No	N/A	Pass
63	3675		-90	3655	OFDMA	-87	Yes	10.0	Pass
64	3675		-90	3655	OFDMA	-90	No	NA	Pass
65	3655		-87	3655	CW	-87	Yes	10.6	Pass
66	3655		-90	3655	CW	-90	No	N/A	Pass
67	3655		-87	3650.5	CW	-87	Yes	10.0	Pass
68	3655		-90	3650.5	CW	-90	No	N/A	Pass
69	3655		-87	3659.5	CW	-87	Yes	9.7	Pass
70	3655		-90	3659.5	CW	-90	No	N/A	Pass
71	3655		-87	3655	OFDMA	-87	Yes	14.6	Pass
72	3655		-90	3655	OFDMA	-90	No	NA	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

*** - Interference detection without stopping of the transmission monitored on the auxiliary PC

Reference numbers of test equipment used

HL 3901	HL 4274	HL 4354	HL 4355	HL 4367		
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Full description is given in Appendix A.

**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	03-Jul-12	03-Jul-14
0521	EMI Receiver (Spectrum Analyzer) with RF filter section 9 kHz-6.5 GHz	Hewlett Packard	8546A	3617A 00319, 3448A002 53	28-Oct-13	28-Oct-14
0604	Antenna BiconiLog Log-Periodic/T Bow-TIE, 26 - 2000 MHz	EMCO	3141	9611-1011	04-Jun-13	04-Jun-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	3946A002 19	10-Oct-13	10-Oct-14
1906	Power Divider, 0.5-18.0 GHz, 80 W	Omni Spectra	2090-6204-00	NA	02-Dec-12	02-Dec-14
2432	Antenna, Double-Ridged Waveguide Horn 1-18 GHz	EMC Test Systems	3115	00027177	07-Dec-13	07-Dec-14
2871	Microwave Cable Assembly, 18 GHz, 6.4 m, SMA - SMA	Huber-Suhner	198-8155-00	2871	04-Dec-13	04-Dec-14
3286	Temperature Chamber, (-50 to +170) °C	Thermotron	EL-8-CH-1-1-CO2	21-9048	30-Sep-13	30-Sep-14
3301	Power Meter, P-series, 50 MHz to 40 GHz	Agilent Technologies	N1911A	MY451010 57	19-Dec-13	19-Dec-14
3302	Power sensor, P-Series, 50 MHz to 40 GHz, -35/30 to 20 dBm	Agilent Technologies	N1922A	MY452405 86	19-Dec-13	19-Dec-14
3310	Multimeter	Fluke	115C	94321810	14-Jul-13	14-Jul-14
3357	Low Pass Filter, 50 Ohm, DC to 3000 MHz.	Mini-Circuits	VLF-3000+	NA	06-Oct-13	06-Oct-14
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
3474	Cable, Coax, Microwave, DC-18 GHz, SMA-SMA, 0.6 m	Gore	GORE 65475	1640102	08-May-13	08-May-14
3535	Amplifier, low noise, 18 to 40 GHz	Quinstar Technology	QLJ-18404537-J0	111590030 01	08-Oct-13	08-Oct-14
3790	Precision Fixed Attenuator, 50 Ohm, 5 W, 10 dB, DC to 18 GHz	Mini-Circuits	BW-S10W5+	NA	04-Dec-13	04-Dec-14
3818	PSA Series Spectrum Analyzer, 3 Hz- 44 GHz	Agilent Technologies	E4446A	MY482502 88	24-Apr-13	24-Apr-14
3901	Microwave Cable Assembly, 40.0 GHz, 3.5 m, SMA/SMA	Huber-Suhner	SUCOFLE X 102A	1225/2A	06-Feb-13	06-Feb-14
3903	Microwave Cable Assembly, 40.0 GHz, 1.5 m, SMA/SMA	Huber-Suhner	SUCOFLE X 102A	1226/2A	06-Feb-13	06-Feb-14
4068	Attenuator, SMA, 30 dB, DC to 12.4 GHz	Midwest Microwave	ATT-0527-30-SMA-07	NA	27-Nov-13	27-Nov-14



HL No	Description	Manufacturer	Model	Ser. No.	Last Cal./ Check	Due Cal./ Check
4150	Preamplifier, 0.1 to 18 GHz, Gain 25 dB, N-type(f) in, N-type(m) out.	Agilent Technologies	87405C	MY47010591	01-Jul-13	01-Jul-14
4164	DC Power Supply, 60V, 5A	Standig	605D	NA	17-Jan-13	17-Jan-14
4273	Test Cable , DC-18 GHz, 1.8 m, SMA/M - N/M	Mini-Circuits	CBL-6FT-SMNM+	70045	26-Nov-13	26-Nov-14
4274	Test Cable , DC-18 GHz, 1.8 m, SMA/M - N/M	Mini-Circuits	CBL-6FT-SMNM+	70047	26-Nov-13	26-Nov-14
4276	Test Cable , DC-18 GHz, 3.05 m, N/M - N/M	Mini-Circuits	APC-10FT-NMNM+	0747A	26-Nov-13	26-Nov-14
4292	Microwave Cable Assembly, 18.0 GHz, 3.4 m, SMA/SMA	Huber-Suhner	Sucoflex P103	NA	04-Dec-13	04-Dec-14
4353	Low Loss Armored Test Cable, DC - 18 GHz, 6.2 m, N type-M/N type-M	MegaPhase	NC29-N1N1-244	12025101003	06-Mar-13	06-Mar-14
4354	Vector Signal Generator, 100 kHz to 6.0 GHz	Rohde & Schwarz	SMJ 100A	1403.4507K02-101777-rc	12-Apr-13	12-Apr-14
4355	Signal and Spectrum Analyzer, 9 kHz to 7 GHz	Rohde & Schwarz	FSV 7	191000086881	24-Mar-13	24-Mar-14
4366	Directional coupler, 1 GHz to 18 GHz, 10 dB, SMA Female	Tiger Micro-Electronics Institute	TGD-A1101-10	01e-JSDE805-007	17-Apr-12	17-Apr-14
4367	Directional coupler, 1 GHz to 18 GHz, 10 dB, SMA Female	Tiger Micro-Electronics Institute	TGD-A1101-10	01e-JSDE805-006	17-Apr-12	17-Apr-14



10 APPENDIX B Measurement uncertainties

Expanded uncertainty at 95% confidence in Hermon Labs EMC measurements

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

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

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

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



11 APPENDIX C Test 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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12 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
RSS-197 Issue 1:2010	Wireless Broadband Access Equipment Operating in the Band 3650-3700 MHz
SRSP-303.65 Issue 1:2010	Technical Requirements for Wireless Broadband Services (WBS) in the Band 3650-3700 MHz
RSS-Gen Issue 3: 2010	General Requirements and Information for the certification of Radiocommunication Equipment



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(μV) to convert it into field intensity in dB(μV/m).



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

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

Antenna factor in dB(1/m) is to be added to receiver meter reading in dB(μ V) to convert it into field strength 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, Microwave, SMA-SMA, 18 GHz, 0.6 m
Gore, HL 3474

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



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



Cable loss
Test cable, Mini-Circuits, S/N 70045, 18 GHz, 1.8 m, SMA/M - N/M
CBL-6FT-SMNM+, HL 4273

Frequency, MHz	Cable loss, dB						
10	0.09	4800	1.76	9800	2.70	14800	3.59
30	0.11	4900	1.78	9900	2.71	14900	3.59
50	0.14	5000	1.81	10000	2.73	15000	3.60
100	0.20	5100	1.82	10100	2.75	15100	3.63
200	0.30	5200	1.86	10200	2.76	15200	3.67
300	0.38	5300	1.89	10300	2.79	15300	3.70
400	0.45	5400	1.92	10400	2.81	15400	3.68
500	0.50	5500	1.96	10500	2.82	15500	3.70
600	0.55	5600	2.00	10600	2.83	15600	3.71
700	0.60	5700	2.03	10700	2.87	15700	3.77
800	0.65	5800	2.04	10800	2.87	15800	3.75
900	0.69	5900	2.07	10900	2.88	15900	3.77
1000	0.73	6000	2.10	11000	2.89	16000	3.79
1100	0.77	6100	2.10	11100	2.91	16100	3.85
1200	0.80	6200	2.11	11200	2.92	16200	3.82
1300	0.84	6300	2.11	11300	2.94	16300	3.83
1400	0.88	6400	2.14	11400	2.95	16400	3.88
1500	0.92	6500	2.15	11500	2.98	16500	3.89
1600	0.95	6600	2.15	11600	3.00	16600	3.92
1700	0.98	6700	2.16	11700	3.02	16700	3.88
1800	1.01	6800	2.19	11800	3.04	16800	3.95
1900	1.04	6900	2.22	11900	3.08	16900	3.91
2000	1.07	7000	2.24	12000	3.09	17000	3.97
2100	1.09	7100	2.26	12100	3.12	17100	3.92
2200	1.13	7200	2.29	12200	3.13	17200	3.94
2300	1.15	7300	2.32	12300	3.16	17300	3.94
2400	1.18	7400	2.36	12400	3.17	17400	3.98
2500	1.21	7500	2.39	12500	3.19	17500	3.93
2600	1.24	7600	2.41	12600	3.20	17600	3.95
2700	1.27	7700	2.43	12700	3.21	17700	3.96
2800	1.30	7800	2.46	12800	3.21	17800	3.97
2900	1.34	7900	2.49	12900	3.22	17900	3.96
3000	1.36	8000	2.52	13000	3.22	18000	3.97
3100	1.38	8100	2.52	13100	3.24		
3200	1.41	8200	2.54	13200	3.24		
3300	1.45	8300	2.59	13300	3.27		
3400	1.46	8400	2.61	13400	3.28		
3500	1.49	8500	2.60	13500	3.31		
3600	1.51	8600	2.63	13600	3.31		
3700	1.55	8700	2.65	13700	3.35		
3800	1.34	8800	2.65	13800	3.37		
3900	1.36	8900	2.65	13900	3.40		
4000	1.38	9000	2.66	14000	3.43		
4100	1.41	9100	2.66	14100	3.45		
4200	1.45	9200	2.67	14200	3.46		
4300	1.46	9300	2.67	14300	3.46		
4400	1.49	9400	2.67	14400	3.49		
4500	1.51	9500	2.68	14500	3.50		
4600	1.55	9600	2.69	14600	3.50		
4700	1.34	9700	2.69	14700	3.52		



Cable loss
Test cable, Mini-Circuits, S/N 70047, 18 GHz, 1.8 m, SMA/M - N/M
CBL-6FT-SMNM+, HL 4274

Frequency, MHz	Cable loss, dB						
10	0.07	4800	1.69	9800	2.62	14800	3.42
30	0.11	4900	1.70	9900	2.63	14900	3.39
50	0.14	5000	1.72	10000	2.64	15000	3.38
100	0.21	5100	1.75	10100	2.64	15100	3.40
200	0.26	5200	1.76	10200	2.66	15200	3.41
300	0.30	5300	1.77	10300	2.67	15300	3.40
400	0.37	5400	1.79	10400	2.68	15400	3.39
500	0.44	5500	1.82	10500	2.68	15500	3.41
600	0.49	5600	1.85	10600	2.70	15600	3.44
700	0.54	5700	1.86	10700	2.71	15700	3.46
800	0.58	5800	1.87	10800	2.73	15800	3.45
900	0.63	5900	1.91	10900	2.74	15900	3.47
1000	0.67	6000	1.94	11000	2.76	16000	3.51
1100	0.71	6100	1.97	11100	2.77	16100	3.56
1200	0.75	6200	1.98	11200	2.78	16200	3.55
1300	0.78	6300	1.99	11300	2.79	16300	3.54
1400	0.81	6400	2.02	11400	2.80	16400	3.57
1500	0.85	6500	2.05	11500	2.82	16500	3.62
1600	0.88	6600	2.06	11600	2.83	16600	3.61
1700	0.91	6700	2.06	11700	2.84	16700	3.60
1800	0.94	6800	2.08	11800	2.85	16800	3.62
1900	0.97	6900	2.10	11900	2.87	16900	3.68
2000	1.00	7000	2.12	12000	2.88	17000	3.70
2100	1.03	7100	2.12	12100	2.89	17100	3.68
2200	1.06	7200	2.13	12200	2.90	17200	3.70
2300	1.08	7300	2.16	12300	2.92	17300	3.80
2400	1.11	7400	2.19	12400	2.94	17400	3.84
2500	1.14	7500	2.22	12500	2.95	17500	3.83
2600	1.16	7600	2.23	12600	2.96	17600	3.83
2700	1.19	7700	2.26	12700	2.98	17700	3.86
2800	1.21	7800	2.30	12800	3.00	17800	3.86
2900	1.27	7900	2.33	12900	3.02	17900	3.80
3000	1.29	8000	2.35	13000	3.03	18000	3.79
3100	1.32	8100	2.37	13100	3.06		
3200	1.35	8200	2.41	13200	3.08		
3300	1.37	8300	2.44	13300	3.09		
3400	1.38	8400	2.47	13400	3.10		
3500	1.41	8500	2.48	13500	3.13		
3600	1.43	8600	2.51	13600	3.17		
3700	1.46	8700	2.53	13700	3.17		
3800	1.47	8800	2.55	13800	3.18		
3900	1.49	8900	2.56	13900	3.22		
4000	1.52	9000	2.57	14000	3.26		
4100	1.55	9100	2.58	14100	3.28		
4200	1.56	9200	2.59	14200	3.30		
4300	1.58	9300	2.59	14300	3.35		
4400	1.60	9400	2.60	14400	3.39		
4500	1.63	9500	2.60	14500	3.39		
4600	1.65	9600	2.61	14600	3.39		
4700	1.67	9700	2.61	14700	3.41		



Cable loss
Test cable, Mini-Circuits, S/N 0747A, 18 GHz, 3.05 m, N/M - N/M
APC-10FT-NMNM+, HL 4276

Frequency, MHz	Cable loss, dB						
10	0.11	4500	2.81	9300	4.30	14100	5.59
30	0.19	4600	2.85	9400	4.33	14200	5.61
50	0.25	4700	2.88	9500	4.36	14300	5.63
100	0.36	4800	2.92	9600	4.39	14400	5.66
150	0.44	4900	2.95	9700	4.42	14500	5.68
200	0.52	5000	3.00	9800	4.46	14600	5.70
300	0.64	5100	3.03	9900	4.49	14700	5.72
400	0.75	5200	3.08	10000	4.53	14800	5.75
500	0.84	5300	3.11	10100	4.56	14900	5.77
600	0.93	5400	3.13	10200	4.60	15000	5.80
700	1.01	5500	3.16	10300	4.64	15100	5.82
800	1.08	5600	3.20	10400	4.66	15200	5.85
900	1.15	5700	3.22	10500	4.68	15300	5.88
1000	1.22	5800	3.26	10600	4.70	15400	5.91
1100	1.28	5900	3.30	10700	4.73	15500	5.93
1200	1.34	6000	3.34	10800	4.75	15600	5.97
1300	1.40	6100	3.39	10900	4.77	15700	5.99
1400	1.46	6200	3.42	11000	4.80	15800	6.02
1500	1.51	6300	3.47	11100	4.83	15900	6.07
1600	1.57	6400	3.50	11200	4.86	16000	6.08
1700	1.62	6500	3.52	11300	4.88	16100	6.11
1800	1.68	6600	3.55	11400	4.90	16200	6.12
1900	1.72	6700	3.58	11500	4.92	16300	6.14
2000	1.77	6800	3.60	11600	4.94	16400	6.17
2100	1.82	6900	3.62	11700	4.96	16500	6.19
2200	1.87	7000	3.64	11800	4.98	16600	6.21
2300	1.92	7100	3.66	11900	5.01	16700	6.22
2400	1.96	7200	3.68	12000	5.03	16800	6.24
2500	2.01	7300	3.71	12100	5.06	16900	6.26
2600	2.05	7400	3.74	12200	5.09	17000	6.28
2700	2.10	7500	3.78	12300	5.12	17100	6.31
2800	2.14	7600	3.81	12400	5.15	17200	6.33
2900	2.18	7700	3.84	12500	5.17	17300	6.36
3000	2.23	7800	3.87	12600	5.20	17400	6.39
3100	2.27	7900	3.90	12700	5.22	17500	6.42
3200	2.31	8000	3.93	12800	5.25	17600	6.45
3300	2.35	8100	3.96	12900	5.28	17700	6.48
3400	2.39	8200	4.00	13000	5.32	17800	6.50
3500	2.42	8300	4.03	13100	5.35	17900	6.52
3600	2.46	8400	4.06	13200	5.38	18000	6.55
3700	2.50	8500	4.08	13300	5.40		
3800	2.54	8600	4.11	13400	5.42		
3900	2.58	8700	4.13	13500	5.44		
4000	2.61	8800	4.16	13600	5.46		
4100	2.65	8900	4.18	13700	5.48		
4200	2.69	9000	4.21	13800	5.51		
4300	2.73	9100	4.24	13900	5.53		
4400	2.77	9200	4.27	14000	5.56		



Cable loss
Microwave Cable Assembly, 18.0 GHz, 3.4 m, SMA/SMA, Huber-Suhner,
Sucoflex P103, HL 4292

Frequency, MHz	Cable loss, dB						
10	0.11	5000	2.10	10200	2.95	15400	3.64
30	0.17	5100	2.14	10300	2.96	15500	3.68
50	0.22	5200	2.16	10400	2.99	15600	3.71
100	0.30	5300	2.17	10500	2.99	15700	3.74
200	0.36	5400	2.19	10600	3.03	15800	3.71
300	0.42	5500	2.19	10700	3.03	15900	3.74
400	0.51	5600	2.22	10800	3.04	16000	3.71
500	0.59	5700	2.24	10900	3.05	16100	3.73
600	0.66	5800	2.23	11000	3.09	16200	3.76
700	0.72	5900	2.26	11100	3.07	16300	3.82
800	0.77	6000	2.27	11200	3.08	16400	3.90
900	0.82	6100	2.26	11300	3.11	16500	3.81
1000	0.88	6200	2.29	11400	3.12	16600	3.88
1100	0.93	6300	2.30	11500	3.11	16700	3.87
1200	0.98	6400	2.34	11600	3.15	16800	3.89
1300	1.02	6500	2.34	11700	3.16	16900	3.95
1400	1.06	6600	2.36	11800	3.18	17000	4.02
1500	1.10	6700	2.36	11900	3.19	17100	4.04
1600	1.14	6800	2.39	12000	3.23	17200	3.99
1700	1.19	6900	2.39	12100	3.25	17300	4.03
1800	1.23	7000	2.44	12200	3.22	17400	4.03
1900	1.27	7100	2.46	12300	3.25	17500	4.06
2000	1.30	7200	2.44	12400	3.25	17600	4.05
2100	1.35	7300	2.48	12500	3.28	17700	4.12
2200	1.38	7400	2.47	12600	3.27	17800	4.14
2300	1.42	7500	2.48	12700	3.27	17900	4.18
2400	1.45	7600	2.50	12800	3.30	18000	4.14
2500	1.48	7700	2.53	12900	3.30		
2600	1.51	7800	2.56	13000	3.27		
2700	1.55	7900	2.55	13100	3.32		
2800	1.59	8000	2.56	13200	3.32		
2900	1.65	8100	2.56	13300	3.32		
3000	1.66	8200	2.57	13400	3.35		
3100	1.69	8300	2.59	13500	3.38		
3200	1.71	8400	2.62	13600	3.39		
3300	1.74	8500	2.67	13700	3.42		
3400	1.76	8600	2.65	13800	3.47		
3500	1.78	8700	2.68	13900	3.45		
3600	1.80	8800	2.68	14000	3.49		
3700	1.85	8900	2.68	14100	3.50		
3800	1.88	9000	2.74	14200	3.55		
3900	1.90	9100	2.74	14300	3.59		
4000	1.91	9200	2.76	14400	3.58		
4100	1.93	9300	2.78	14500	3.56		
4200	1.96	9400	2.79	14600	3.57		
4300	1.97	9500	2.80	14700	3.57		
4400	1.99	9600	2.83	14800	3.57		
4500	2.02	9700	2.84	14900	3.64		
4600	2.02	9800	2.86	15000	3.64		
4700	2.04	9900	2.92	15100	3.61		
4800	2.05	10000	2.90	15200	3.67		
4900	2.09	10100	2.92	15300	3.63		



Cable loss
Low Loss Armored Test Cable, MegaPhase, 18 GHz, 6.2 m, N type-M/N type-M,
NC29-N1N1-244S/N 12025101 003,
HL 4353

Frequency, MHz	Cable loss, dB	Frequency, MHz	Cable loss, dB
50	0.20	9000	2.71
100	0.27	9500	2.81
300	0.47	10000	2.90
500	0.61	10500	2.97
1000	0.87	11000	3.06
1500	1.07	11500	3.13
2000	1.24	12000	3.20
2500	1.39	12500	3.26
3000	1.53	13000	3.34
3500	1.65	13500	3.39
4000	1.77	14000	3.47
4500	1.89	14500	3.54
5000	1.99	15000	3.62
5500	2.07	15500	3.69
6000	2.20	16000	3.76
6500	2.30	16500	3.83
7000	2.39	17000	3.86
7500	2.51	17500	3.94
8000	2.58	18000	4.02
8500	2.65		



14 APPENDIX F Abbreviations and acronyms

A	ampere
AC	alternating current
A/m	ampere per meter
AM	amplitude modulation
AVRG	average (detector)
BB	broad band
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
NB	narrow band
NT	not tested
OATS	open area test site
Ω	Ohm
QP	quasi-peak
PCB	printed circuit board
PM	pulse modulation
PS	power supply
RE	radiated emission
RF	radio frequency
rms	root mean square
Rx	receive
s	second
T	temperature
Tx	transmit
V	volt
VA	volt-ampere

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