

# TEST REPORT

ACCORDING TO: FCC CFR 47 PART 90 subpart Z

FOR:

**Ruggedcom Inc.**

**Base station operating in 3.65-3.70 GHz**

**Model: WiN7237-1, WiN7237-5**

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## 1 Applicant information

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

## 2 Equipment under test attributes

**Product name:** Base station operating in 3.65-3.7 GHz  
**Product type:** Transceiver  
**Model(s):** WiN7237-5  
**Serial number:** 380840003  
**Hardware version:** 03  
**Software release:** 4.1.4621.26  
**Receipt date:** 2/16/2011

## 3 Manufacturer information

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

## 4 Test details




**Project ID:** 21731  
**Location:** Hermon Laboratories Ltd. Harakevet Industrial Zone, Binyamina 30500, Israel  
**Test started:** 2/16/2011  
**Test completed:** 2/23/2011  
**Test specification(s):** FCC 47CFR part 90 subpart Z

## 5 Tests summary

Test	Status
<b>Transmitter characteristics</b>	
Section 90.205, 90.1321, Maximum output power and peak power spectral density	Pass
Section 90.209, Occupied bandwidth	Pass
Section 90.210, Emission mask	Pass
Section 90.1323, Conducted spurious emissions	Pass
Section 90.1323, Radiated spurious emissions	Pass
Section 90.213, Frequency stability	Pass
Section 90.203 (o), Contention based protocol	Pass
Section 2.1091, 90.1335, RF radiation exposure evaluation	Pass

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

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

	Name and Title	Date	Signature
<b>Tested by:</b>	Mr. E. Plotnichenko, test engineer	February 23, 2011	
<b>Reviewed by:</b>	Mrs. M. Cherniavsky, certification engineer	March 21, 2011	
<b>Approved by:</b>	Mr. M. Nikishin, EMC and Radio group manager	March 23, 2011	

## 6 EUT description

### 6.1 General information

The EUT, base station of WiMAX system operating at 3.65 GHz, comprises an Outdoor Unit (ODU) that includes modem, radio, data processing and management components, serving as an efficient platform for a wide range of services. It provides a wireless connection to the subscriber unit.

The both EUT antennas are driven incoherently and there is no beamforming gain. The WiN7237-1 model has 1 year warranty, the WiN7237-5 model has 5 year warranty.

Only model WiN7237-5 was tested.

### 6.2 Ports and lines

Port type	Port description	Connected from	Connected to	Qty.	Cable type	Cable length, m
Power	AC power	AC mains	PoE adapter	1	Unshielded	1.8
Power+signal	DC + Ethernet	PoE adapter	EUT	1	Shielded	3*
RF	Antenna	EUT	Subscriber unit	2	Coax	3
Signal	GPS	EUT	50 Ohm termination	1	Coax	0.5
Control**	RS-232	EUT	Laptop	1	Unshielded	3

\* - up to 100m in field installation

\*\* - for service only

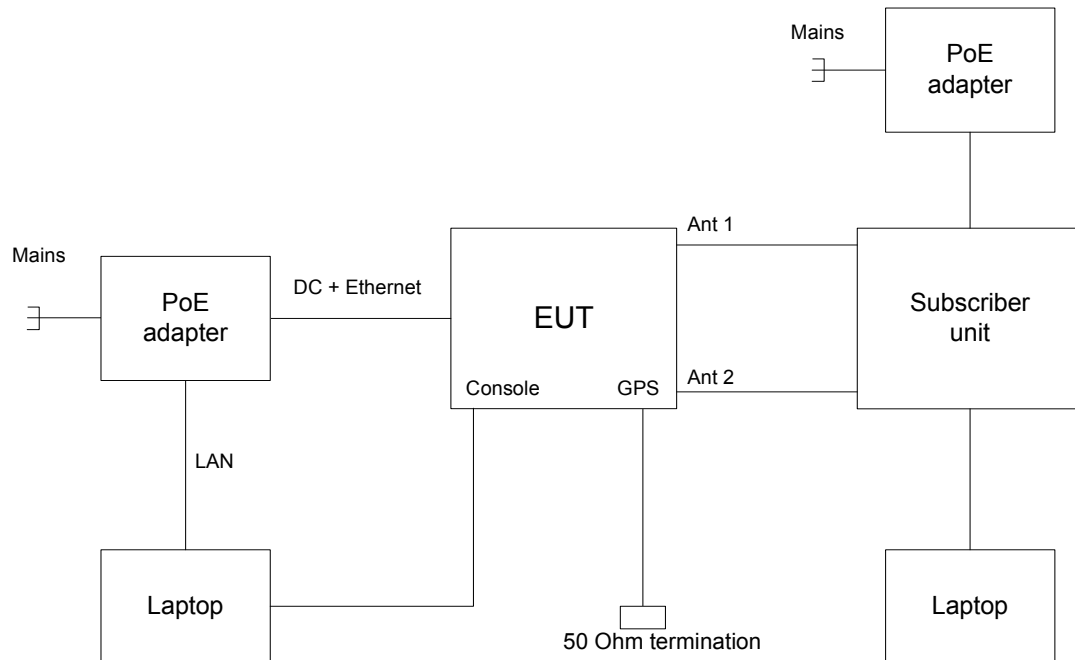
### 6.3 Support and test equipment

Description	Manufacturer	Model number	Serial number
Subscriber unit (CPE)	RuggedWireless Ltd.	WIN5137-AC	63544310100
PoE adapter (for Pico)	RuggedWireless Ltd.	0334b4848	a30828192534
PoE adapter (for CPE)	RuggedWireless Ltd.	0334b5555	dcps0006
Laptop 1	Dell	pp22l	jx190-a00
Laptop 2	IBM	1834-bwg	99rpva7

### 6.4 Changes made in EUT

No changes were implemented in the EUT.

## 6.5 Test configuration



## 6.6 Transmitter characteristics

<b>Type of equipment</b>					
<b>V</b>	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)				
<b>Intended use</b>		<b>Condition of use</b>			
<b>V</b>	fixed	Always at a distance more than 2 m from all people			
<b>V</b>	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			
<b>Assigned frequency range</b>		3650 – 3700 MHz			
<b>Operating frequency range</b>		3652.5 – 3697.5 MHz			
<b>RF channel bandwidth</b>		5 MHz, 7 MHz, 10 MHz			
<b>Maximum rated output power</b>		At transmitter 50 $\Omega$ RF output connector		24.96 dBm	
<b>Is transmitter output power variable?</b>		No			
		<b>V</b>	Yes	continuous variable	
				stepped variable with stepsize	1 dB
				minimum RF power	15 dBm
				maximum RF power	24.96 dBm
<b>Antenna connection</b>					
unique coupling	<b>V</b>	standard connector	Integral	<b>V</b> with temporary RF connector without temporary RF connector	
<b>Antenna/s technical characteristics</b>					
Type	Manufacturer		Model number	Gain	
Omni	MTI Wireless Edge Ltd.		MT – 385002/CD	6 dBi	
<b>Transmitter nominal bandwidth</b>		5 MHz, 7 MHz, 10 MHz			
<b>Type of modulation</b>		QPSK, 16QAM, 64QAM			
<b>Transmitter aggregate data rate/s</b>		5 MHz BW: QPSK - 4.19 MBps, 16QAM – 12.565 MBps, 64QAM – 18.85 MBps 7 MHz BW: QPSK - 4.19 MBps, 16QAM – 12.565 MBps, 64QAM – 18.85 MBps 10 MHz BW: QPSK - 8.38 MBps, 16QAM – 25.13 MBps, 64QAM – 37.7 MBps			
<b>Type of multiplexing</b>		OFDM			
<b>Maximum transmitter duty cycle in normal use</b>		60%			
<b>Transmitter duty cycle supplied for test</b>		60%			
<b>Transmitter power source</b>					
		<b>Nominal rated voltage</b>		Battery type	
<b>V</b>	DC	<b>Nominal rated voltage</b>	48V (via PoE powered from the mains)		
	AC mains	<b>Nominal rated voltage</b>		Frequency	
<b>Common power source for transmitter and receiver</b>		<b>V</b>	yes	no	

<b>Test specification:</b>		<b>Section 90.1321, Maximum conducted output power</b>	
<b>Test procedure:</b>		47 CFR, Section 2.1046; TIA/EIA-603-C, Section 2.2.1	
<b>Test mode:</b>	Compliance	<b>Verdict:</b>	<b>PASS</b>
<b>Date:</b>	2/16/2011 - 2/17/2011		
<b>Temperature:</b> 23 °C	<b>Air Pressure:</b> 1018 hPa	<b>Relative Humidity:</b> 45 %	<b>Power Supply:</b> 48 VDC
<b>Remarks:</b>			

## 7 Transmitter tests according to 47CFR part 90 requirements

### 7.1 Maximum output power

#### 7.1.1 General

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

Table 7.1.1 Maximum output power limits

Assigned frequency range, MHz	Occupied bandwidth, MHz	Maximum peak output power, EIRP	
		W	dBm
Base and fixed stations			
3650.0 – 3700.0	5	5	36.99
	7	7	38.45
	10	10	40.00

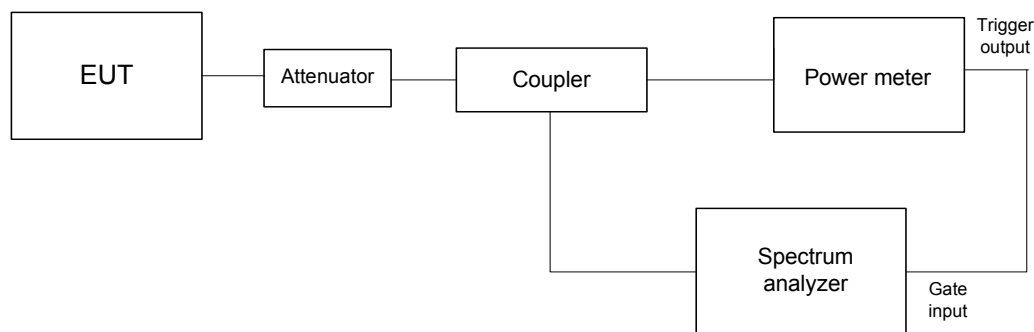
#### 7.1.2 Test procedure

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

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

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

Figure 7.1.1 Transmitter output power test setup





Test specification:	Section 90.1321, Maximum conducted output power			
Test procedure:	47 CFR, Section 2.1046; TIA/EIA-603-C, Section 2.2.1			
Test mode:	Compliance	Verdict:		PASS
Date:	2/16/2011 - 2/17/2011			
Temperature: 23 °C	Air Pressure: 1018 hPa	Relative Humidity: 45 %	Power Supply: 48 VDC	
Remarks:				

Table 7.1.2 Maximum output power test results

ASSIGNED FREQUENCY RANGE: 3650.0 – 3700.0 MHz  
DETECTOR USED: Power meter  
MODULATING SIGNAL: PRBS  
TRANSMITTER OUTPUT POWER SETTINGS: Maximum  
ANTENNA ASSEMBLY GAIN: 6 dBi

EBW:

5 MHz

Channel, MHz	Modulation	Pmeas (RF#1), dBm	Pmeas (RF#2), dBm	P <sub>meas</sub> *, dBm	Antenna assembly gain, dBi	EIRP, dBm	Limit**, dBm	Margin, dB	Verdict
3652.5	QPSK	21.54	21.80	24.68	6.00	30.68	37.01	-6.32	Pass
3675.0	QPSK	21.46	22.30	24.91	6.00	30.91	36.94	-6.03	Pass
3697.5	QPSK	21.70	21.90	24.81	6.00	30.81	37.19	-6.38	Pass
3652.5	64QAM	21.67	21.85	24.77	6.00	30.77	37.02	-6.25	Pass
3675.0	64QAM	21.45	22.4	24.96	6.00	30.96	37.01	-6.04	Pass
3697.5	64QAM	21.65	22.05	24.86	6.00	30.86	37.02	-6.15	Pass

EBW:

7 MHz

3653.5	QPSK	21.62	21.4	24.52	6.00	30.52	38.50	-7.98	Pass
3675.0	QPSK	21.6	21.65	24.64	6.00	30.64	38.38	-7.75	Pass
3696.5	QPSK	22.2	21.38	24.82	6.00	30.82	38.46	-7.64	Pass
3653.5	64QAM	21.57	21.37	24.48	6.00	30.48	38.38	-7.90	Pass
3675.0	64QAM	21.61	21.9	24.77	6.00	30.77	38.61	-7.85	Pass
3696.5	64QAM	22.18	21.56	24.89	6.00	30.89	38.43	-7.54	Pass

EBW:

10 MHz

3655.0	QPSK	21.71	21.26	24.50	6.00	30.50	40.167	-9.67	Pass
3675.0	QPSK	21.14	21.78	24.48	6.00	30.48	40.135	-9.65	Pass
3695.0	QPSK	21.8	21.4	24.61	6.00	30.61	40.171	-9.56	Pass
3655.0	64QAM	21.7	20.65	24.22	6.00	30.22	39.975	-9.76	Pass
3675.0	64QAM	21.15	21.2	24.19	6.00	30.19	40.130	-9.95	Pass
3695.0	64QAM	21.75	21	24.40	6.00	30.40	40.126	-9.72	Pass

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

\*\* - Limit for EBW =  $10 \cdot \log\{(1000 \cdot [Output\ power\ limit, W] / 25MHz) / (25MHz / EBW, MHz)\}, dBm$

<b>Test specification:</b>	<b>Section 90.1321, Maximum conducted output power</b>		
<b>Test procedure:</b>	47 CFR, Section 2.1046; TIA/EIA-603-C, Section 2.2.1		
<b>Test mode:</b>	Compliance	<b>Verdict:</b>	<b>PASS</b>
<b>Date:</b>	2/16/2011 - 2/17/2011		
<b>Temperature:</b> 23 °C	<b>Air Pressure:</b> 1018 hPa	<b>Relative Humidity:</b> 45 %	<b>Power Supply:</b> 48 VDC
<b>Remarks:</b>			

Table 7.1.3 The 26dB EBW test results

ASSIGNED FREQUENCY RANGE: 3650.0 – 3700.0 MHz  
DETECTOR USED: Power meter  
MODULATING SIGNAL: PRBS  
TRANSMITTER OUTPUT POWER SETTINGS: Maximum (see NOTE1)

**EBW: 5 MHz**

Channel, MHz	Modulation	EBW, MHz	Output power limit, W/25MHz	Limit for measured EBW*, dBm
3652.5	QPSK	5.020	25	37.007
3675.0	QPSK	4.946	25	36.943
3697.5	QPSK	5.237	25	37.191
3652.5	64QAM	4.994	25	37.018
3675.0	64QAM	5.019	25	37.006
3697.5	64QAM	5.033	25	37.018

**EBW: 7 MHz**

Channel, MHz	Modulation	EBW, MHz	Output power limit, W/25MHz	Limit for measured EBW*, dBm
3653.5	QPSK	7.080	25	38.500
3675.0	QPSK	6.888	25	38.381
3696.5	QPSK	7.007	25	38.455
3653.5	64QAM	6.894	25	38.385
3675.0	64QAM	7.267	25	38.614
3696.5	64QAM	6.971	25	38.433

**EBW: 10 MHz**

Channel, MHz	Modulation	EBW, MHz	Output power limit, W/25MHz	Limit for measured EBW*, dBm
3655.0	QPSK	10.391	25	40.167
3675.0	QPSK	10.315	25	40.135
3695.0	QPSK	10.401	25	40.171
3655.0	64QAM	9.942	25	39.975
3675.0	64QAM	10.305	25	40.130
3695.0	64QAM	10.295	25	40.126

\* - Limit for EBW =  $10 \cdot \log((1000 \cdot [\text{Output power limit, W}] / 25\text{MHz}) / (25\text{MHz} / \text{EBW, MHz}))$ , dBm

\*\* - Limit for EBW – Antenna assembly gain.

**Reference numbers of test equipment used**

HL 2951	HL 3301	HL 3302	HL 3440	HL 3784	HL 3818	HL 3868	
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Full description is given in Appendix A.

<b>Test specification:</b>	<b>Section 90.1321, Peak EIRP power density</b>		
<b>Test procedure:</b>	47 CFR, Sections 2.1046; TIA/EIA-603-C, Section 2.2.1		
<b>Test mode:</b>	Compliance	<b>Verdict:</b>	<b>PASS</b>
<b>Date:</b>	2/16/2011 - 2/17/2011		
<b>Temperature:</b> 23 °C	<b>Air Pressure:</b> 1018 hPa	<b>Relative Humidity:</b> 45 %	<b>Power Supply:</b> 48 VDC
<b>Remarks:</b>			

## 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 spectral density, EIRP	
		W/MHz	dBm/MHz
Base and fixed stations			
3650.0 – 3675.0	5	1	30
	7		
	10		
Mobile and portable stations			
3650.0 – 3675.0	5	0.04	16
	7		
	10		

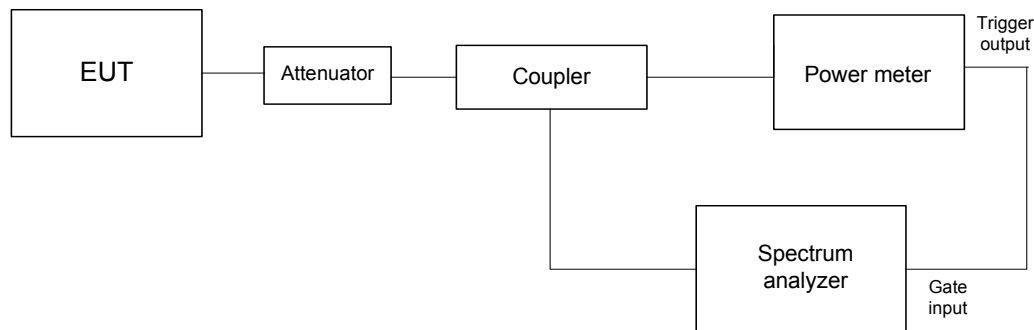
### 7.2.2 Test procedure

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

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

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

Figure 7.2.1 Peak power density test setup



<b>Test specification:</b>	<b>Section 90.1321, Peak EIRP power density</b>		
<b>Test procedure:</b>	47 CFR, Sections 2.1046; TIA/EIA-603-C, Section 2.2.1		
<b>Test mode:</b>	Compliance	<b>Verdict:</b>	<b>PASS</b>
<b>Date:</b>	2/16/2011 - 2/17/2011		
<b>Temperature:</b> 23 °C	<b>Air Pressure:</b> 1018 hPa	<b>Relative Humidity:</b> 45 %	<b>Power Supply:</b> 48 VDC
<b>Remarks:</b>			

**Table 7.2.2 Peak EIRP power density test results**

OPERATING FREQUENCY RANGE: 3650.0 – 3675.0 MHz  
DETECTOR USED: Average (RMS)  
RESOLUTION BANDWIDTH: 1000 kHz  
VIDEO BANDWIDTH: 3000 kHz  
MODULATING SIGNAL: PRBS  
TRANSMITTER OUTPUT POWER SETTINGS: Maximum

**EBW: 5 MHz**

Channel, MHz	Modulation	Pmeas (RF#1), dBm/MHz	Pmeas (RF#2), dBm/MHz	Power density *, dBm/MHz	Antenna gain, dBi	EIRP power density **, dBm/MHz	Limit, dBm/MHz	Margin, dB	Verdict
3652.5	QPSK	14.931	15.356	18.16	6.0	24.16	30.0	-5.84	Pass
3675.0	QPSK	14.732	15.877	18.35	6.0	24.35	30.0	-5.65	Pass
3697.5	QPSK	14.985	15.557	18.29	6.0	24.29	30.0	-5.71	Pass
3652.5	64QAM	14.728	15.627	18.31	6.0	24.31	30.0	-5.69	Pass
3675.0	64QAM	14.746	16.089	18.48	6.0	24.48	30.0	-5.52	Pass
3697.5	64QAM	14.956	15.764	18.39	6.0	24.39	30.0	-5.61	Pass

**EBW: 7 MHz**

Channel, MHz	Modulation	Pmeas (RF#1), dBm/MHz	Pmeas (RF#2), dBm/MHz	Power density *, dBm/MHz	Antenna gain, dBi	EIRP power density **, dBm/MHz	Limit, dBm/MHz	Margin, dB	Verdict
3653.5	QPSK	12.280	13.341	15.85	6.0	21.85	30.0	-8.15	Pass
3675.0	QPSK	12.629	13.771	16.25	6.0	22.25	30.0	-7.75	Pass
3696.5	QPSK	13.475	13.476	16.49	6.0	22.49	30.0	-7.51	Pass
3653.5	64QAM	12.984	13.441	16.23	6.0	22.23	30.0	-7.77	Pass
3675.0	64QAM	12.365	13.869	16.19	6.0	22.19	30.0	-7.81	Pass
3696.5	64QAM	13.279	13.612	16.46	6.0	22.46	30.0	-7.54	Pass

**EBW: 10 MHz**

Channel, MHz	Modulation	Pmeas (RF#1), dBm/MHz	Pmeas (RF#2), dBm/MHz	Power density *, dBm/MHz	Antenna gain, dBi	EIRP power density **, dBm/MHz	Limit, dBm/MHz	Margin, dB	Verdict
3655.0	QPSK	11.556	11.754	14.67	6.0	20.67	30.0	-9.33	Pass
3675.0	QPSK	11.142	12.323	14.78	6.0	20.78	30.0	-9.22	Pass
3695.0	QPSK	11.697	11.920	14.82	6.0	20.82	30.0	-9.18	Pass
3655.0	64QAM	11.471	11.794	14.65	6.0	20.65	30.0	-9.35	Pass
3675.0	64QAM	10.707	12.312	14.59	6.0	20.59	30.0	-9.41	Pass
3695.0	64QAM	11.816	12.062	14.95	6.0	20.95	30.0	-9.05	Pass

\* - Power density, dBm/MHz =  $10 \log\{10^4[P(\text{dBm/MHz, RF\#1})/10] + 10^4[P(\text{dBm/MHz, RF\#2})/10]\}$

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

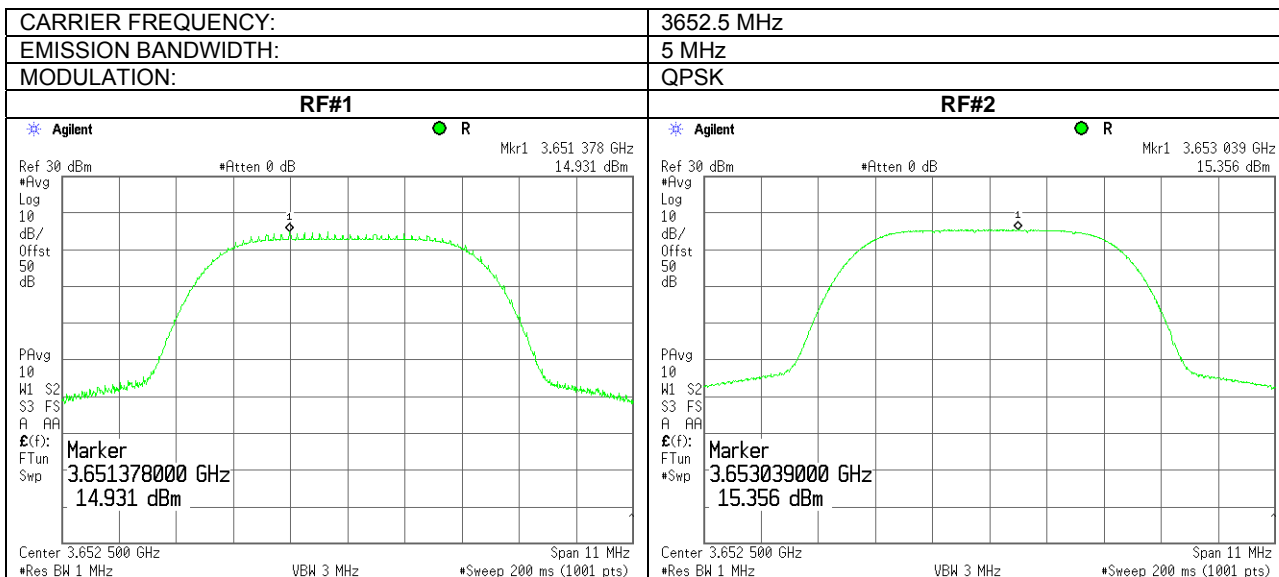
**Reference numbers of test equipment used**

HL 2214	HL 2952	HL 3301	HL 3302	HL 3440	HL 3784	HL 3818	HL 3868
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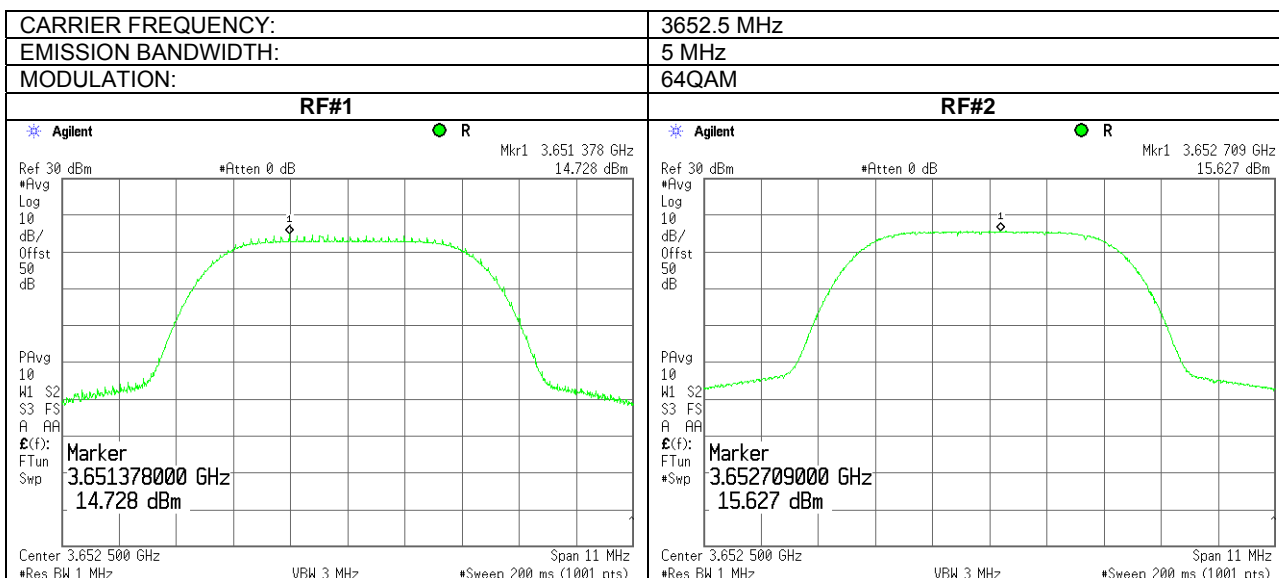
Full description is given in Appendix A.

<b>Test specification:</b>	<b>Section 90.1321, Peak EIRP power density</b>		
<b>Test procedure:</b>	47 CFR, Sections 2.1046; TIA/EIA-603-C, Section 2.2.1		
<b>Test mode:</b>	Compliance	<b>Verdict:</b>	<b>PASS</b>
<b>Date:</b>	2/16/2011 - 2/17/2011		
<b>Temperature:</b> 23 °C	<b>Air Pressure:</b> 1018 hPa	<b>Relative Humidity:</b> 45 %	<b>Power Supply:</b> 48 VDC
<b>Remarks:</b>			

Plot 7.2.1 Peak output power density test results at low frequency

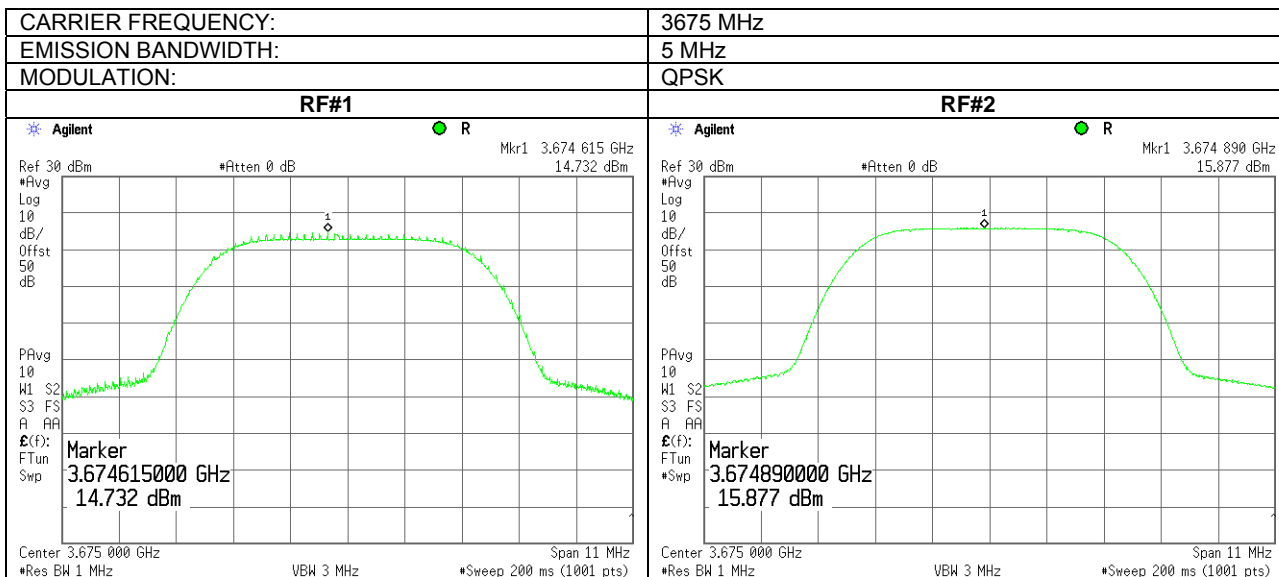


Plot 7.2.2 Peak output power density test results at low frequency

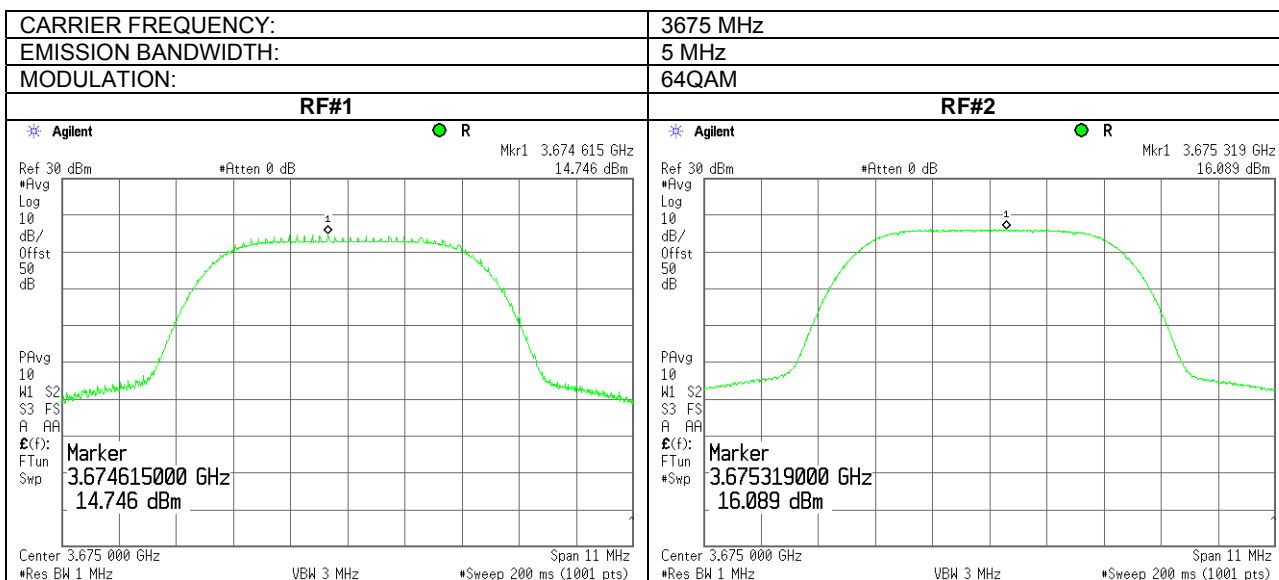


<b>Test specification:</b>	<b>Section 90.1321, Peak EIRP power density</b>		
<b>Test procedure:</b>	47 CFR, Sections 2.1046; TIA/EIA-603-C, Section 2.2.1		
<b>Test mode:</b>	Compliance	<b>Verdict:</b>	<b>PASS</b>
<b>Date:</b>	2/16/2011 - 2/17/2011		
<b>Temperature:</b> 23 °C	<b>Air Pressure:</b> 1018 hPa	<b>Relative Humidity:</b> 45 %	<b>Power Supply:</b> 48 VDC
<b>Remarks:</b>			

Plot 7.2.3 Peak output power density test results at mid frequency

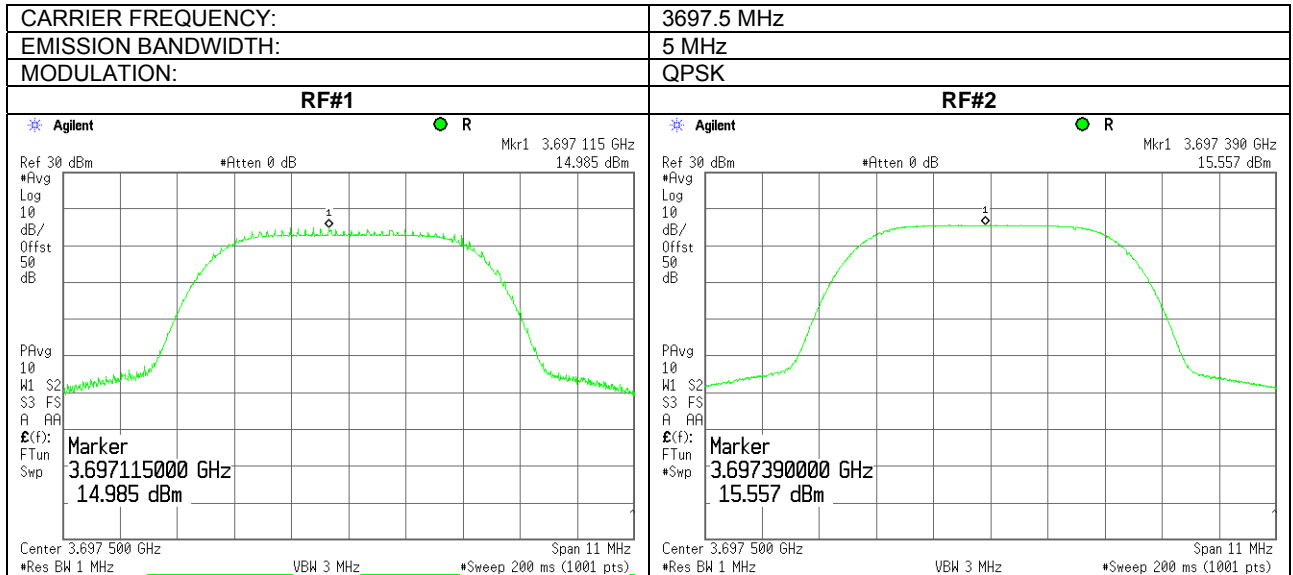


Plot 7.2.4 Peak output power density test results at mid frequency

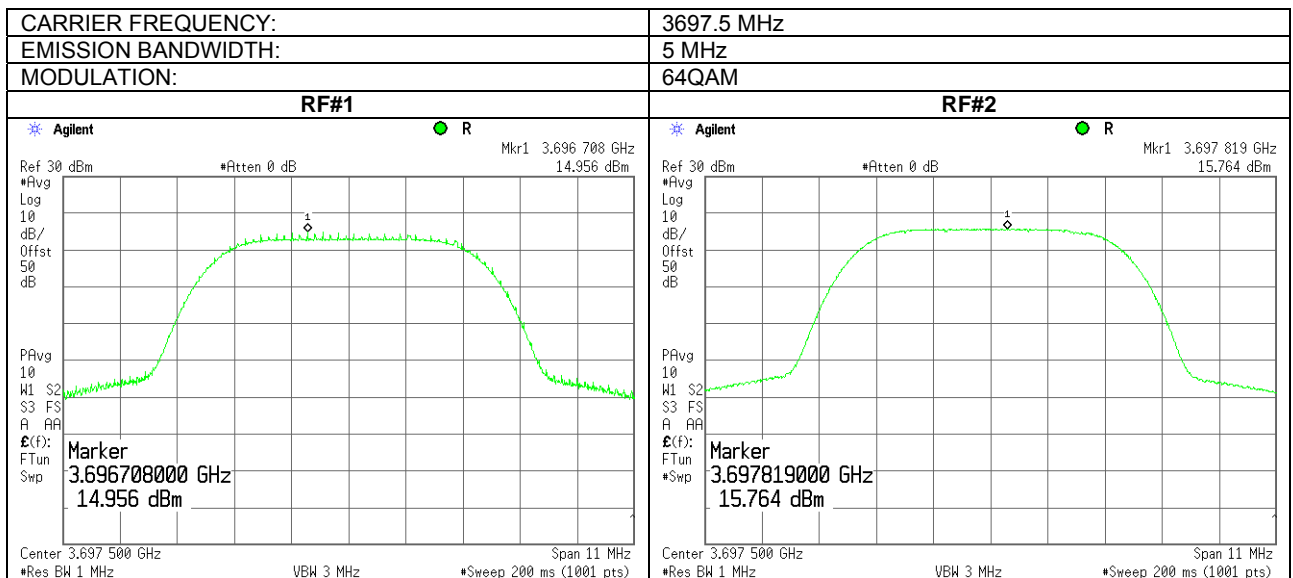


<b>Test specification:</b>	<b>Section 90.1321, Peak EIRP power density</b>		
<b>Test procedure:</b>	47 CFR, Sections 2.1046; TIA/EIA-603-C, Section 2.2.1		
<b>Test mode:</b>	Compliance	<b>Verdict:</b>	<b>PASS</b>
<b>Date:</b>	2/16/2011 - 2/17/2011		
<b>Temperature:</b> 23 °C	<b>Air Pressure:</b> 1018 hPa	<b>Relative Humidity:</b> 45 %	<b>Power Supply:</b> 48 VDC
<b>Remarks:</b>			

Plot 7.2.5 Peak output power density test results at high frequency

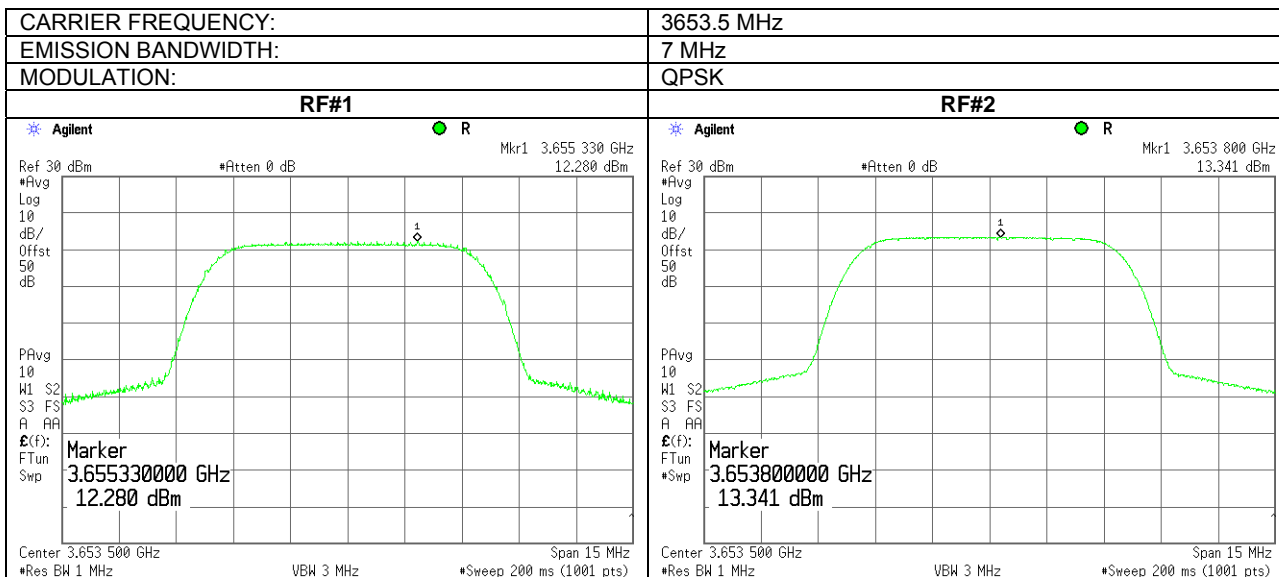


Plot 7.2.6 Peak output power density test results at high frequency

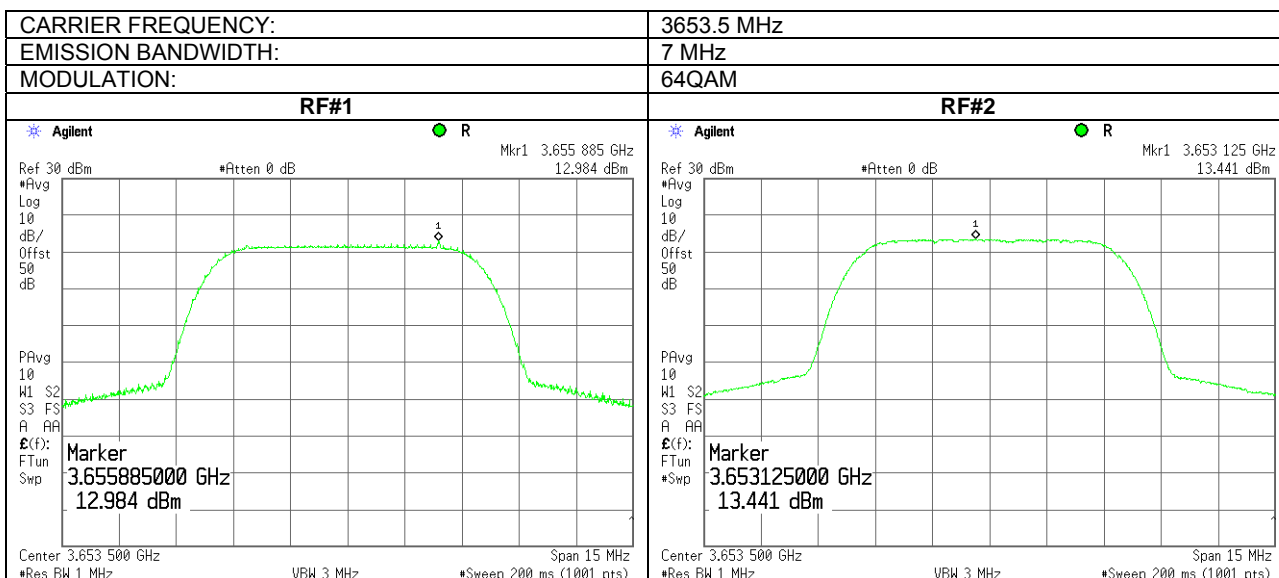


<b>Test specification:</b>	<b>Section 90.1321, Peak EIRP power density</b>		
<b>Test procedure:</b>	47 CFR, Sections 2.1046; TIA/EIA-603-C, Section 2.2.1		
<b>Test mode:</b>	Compliance	<b>Verdict:</b>	<b>PASS</b>
<b>Date:</b>	2/16/2011 - 2/17/2011		
<b>Temperature:</b> 23 °C	<b>Air Pressure:</b> 1018 hPa	<b>Relative Humidity:</b> 45 %	<b>Power Supply:</b> 48 VDC
<b>Remarks:</b>			

Plot 7.2.7 Peak output power density test results at low frequency



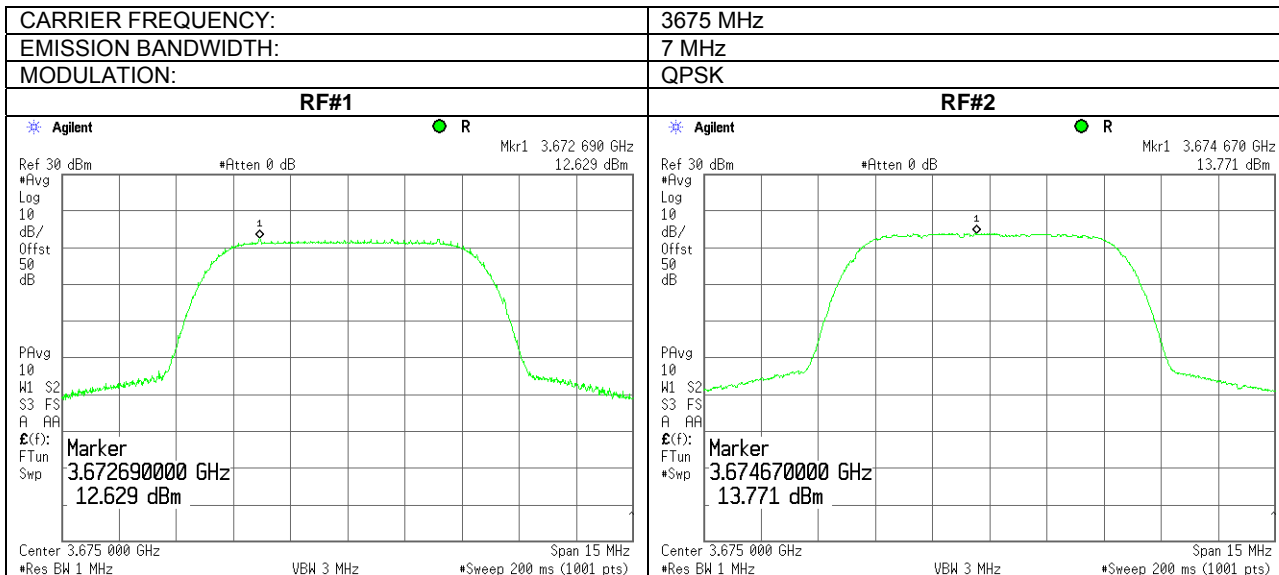
Plot 7.2.8 Peak output power density test results at low frequency



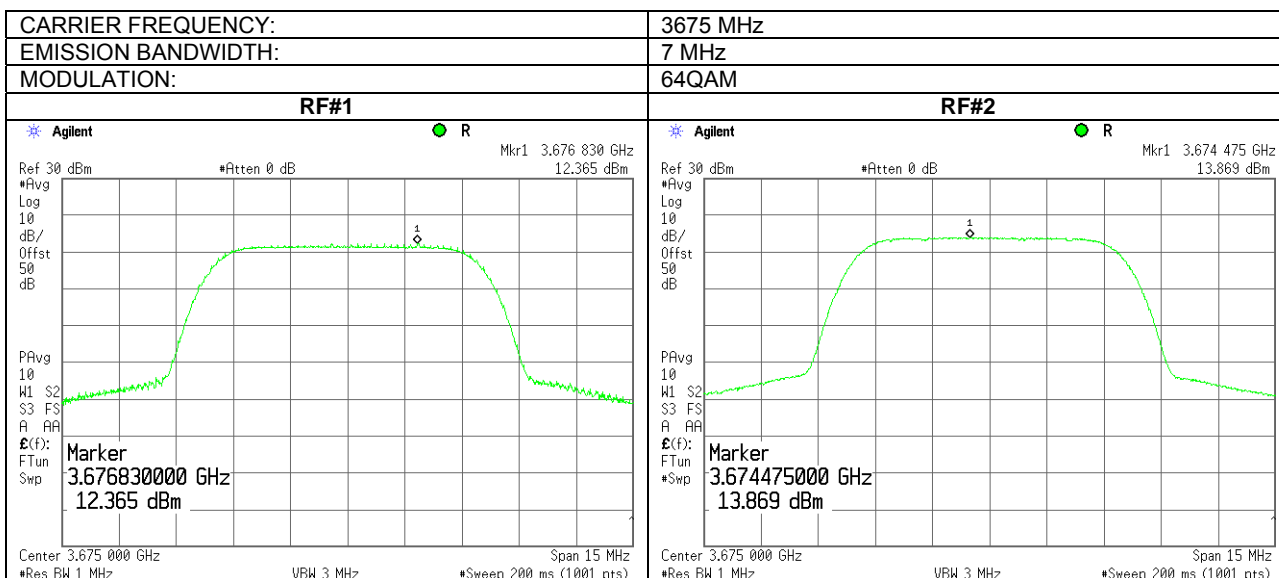


<b>Test specification:</b>	<b>Section 90.1321, Peak EIRP power density</b>		
<b>Test procedure:</b>	47 CFR, Sections 2.1046; TIA/EIA-603-C, Section 2.2.1		
<b>Test mode:</b>	Compliance	<b>Verdict:</b>	<b>PASS</b>
<b>Date:</b>	2/16/2011 - 2/17/2011		
<b>Temperature:</b> 23 °C	<b>Air Pressure:</b> 1018 hPa	<b>Relative Humidity:</b> 45 %	<b>Power Supply:</b> 48 VDC
<b>Remarks:</b>			

Plot 7.2.9 Peak output power density test results at mid frequency

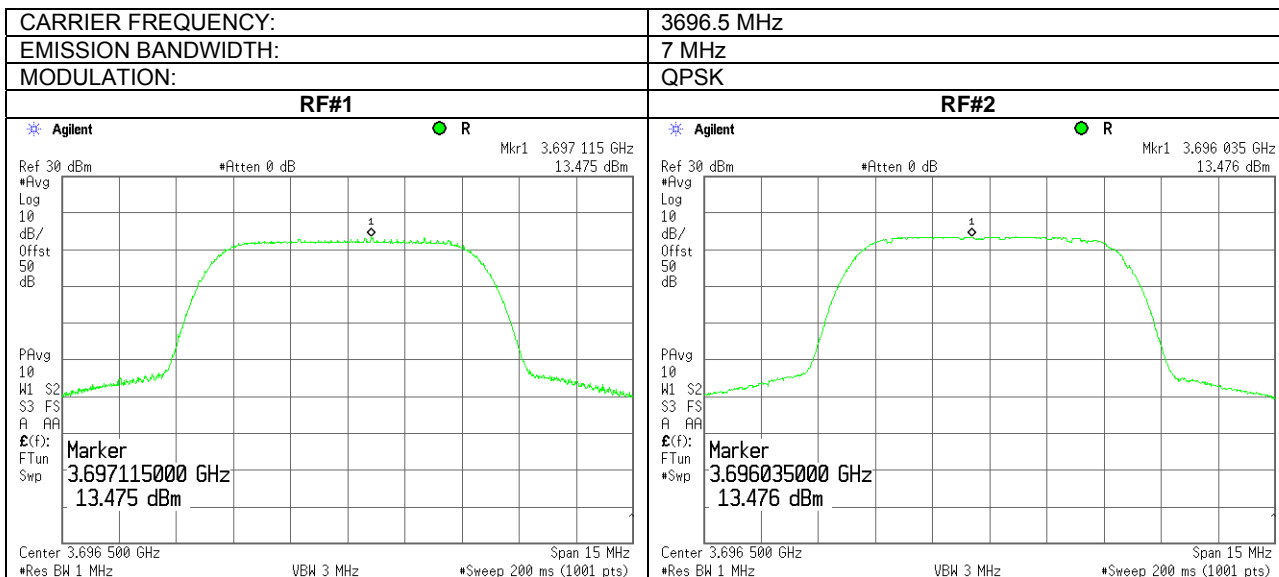


Plot 7.2.10 Peak output power density test results at mid frequency

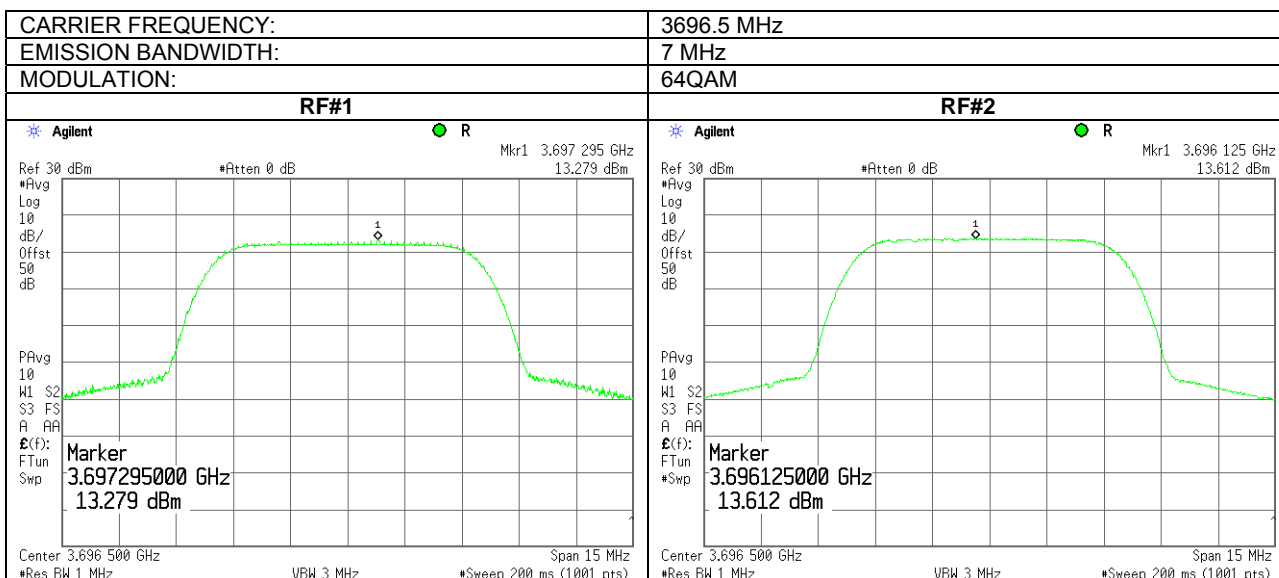


<b>Test specification:</b>	<b>Section 90.1321, Peak EIRP power density</b>		
<b>Test procedure:</b>	47 CFR, Sections 2.1046; TIA/EIA-603-C, Section 2.2.1		
<b>Test mode:</b>	Compliance	<b>Verdict:</b>	<b>PASS</b>
<b>Date:</b>	2/16/2011 - 2/17/2011		
<b>Temperature:</b> 23 °C	<b>Air Pressure:</b> 1018 hPa	<b>Relative Humidity:</b> 45 %	<b>Power Supply:</b> 48 VDC
<b>Remarks:</b>			

Plot 7.2.11 Peak output power density test results at high frequency

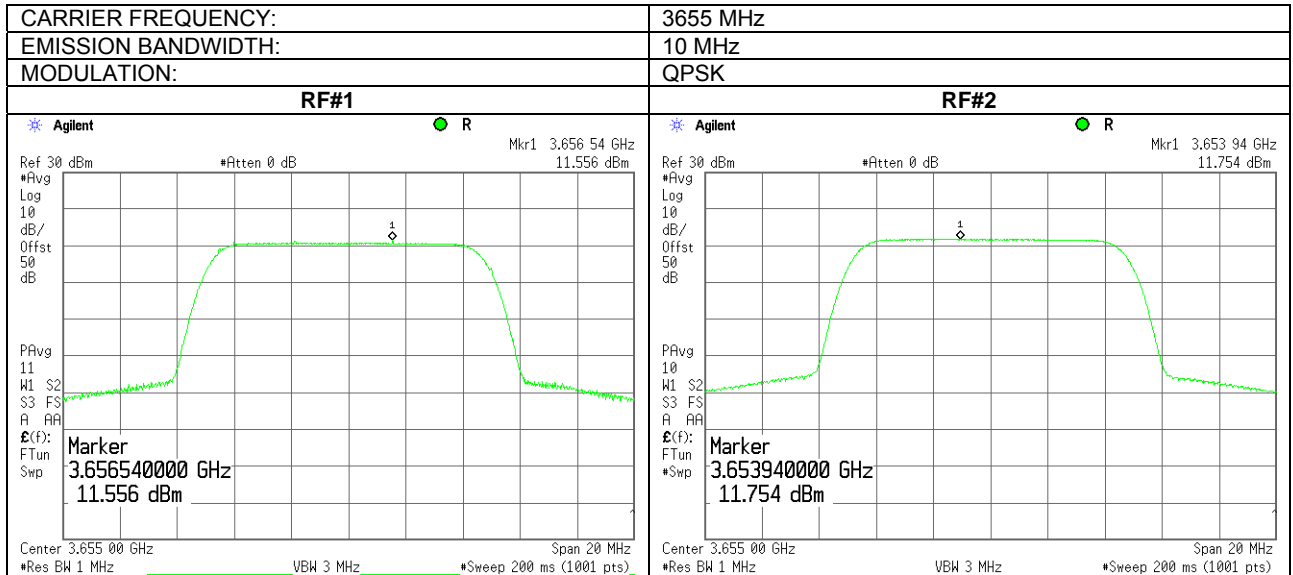


Plot 7.2.12 Peak output power density test results at high frequency

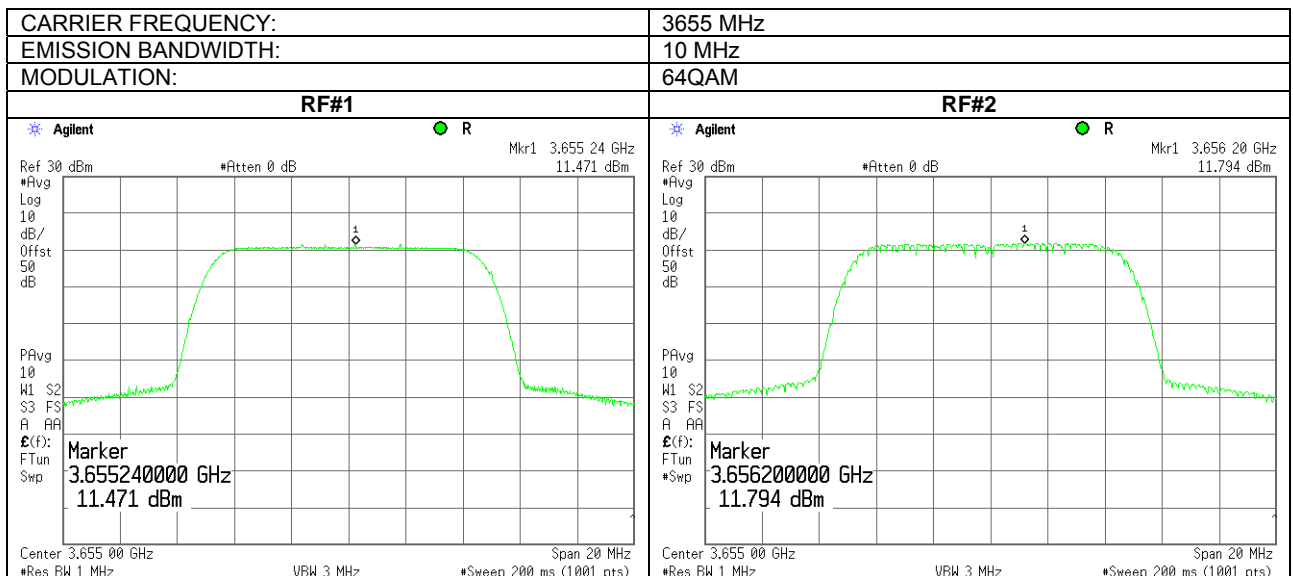


<b>Test specification:</b>		<b>Section 90.1321, Peak EIRP power density</b>	
<b>Test procedure:</b>		47 CFR, Sections 2.1046; TIA/EIA-603-C, Section 2.2.1	
<b>Test mode:</b>		Compliance	<b>Verdict:</b> PASS
<b>Date:</b>		2/16/2011 - 2/17/2011	
<b>Temperature:</b> 23 °C	<b>Air Pressure:</b> 1018 hPa	<b>Relative Humidity:</b> 45 %	<b>Power Supply:</b> 48 VDC
<b>Remarks:</b>			

Plot 7.2.13 Peak output power density test results at low frequency

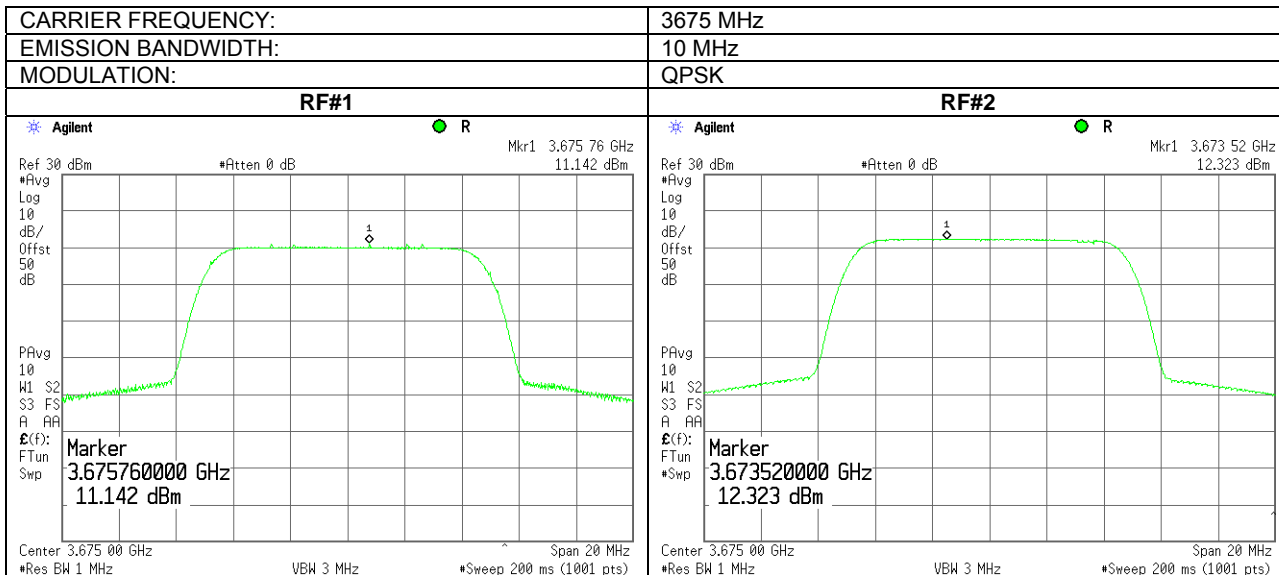


Plot 7.2.14 Peak output power density test results at low frequency

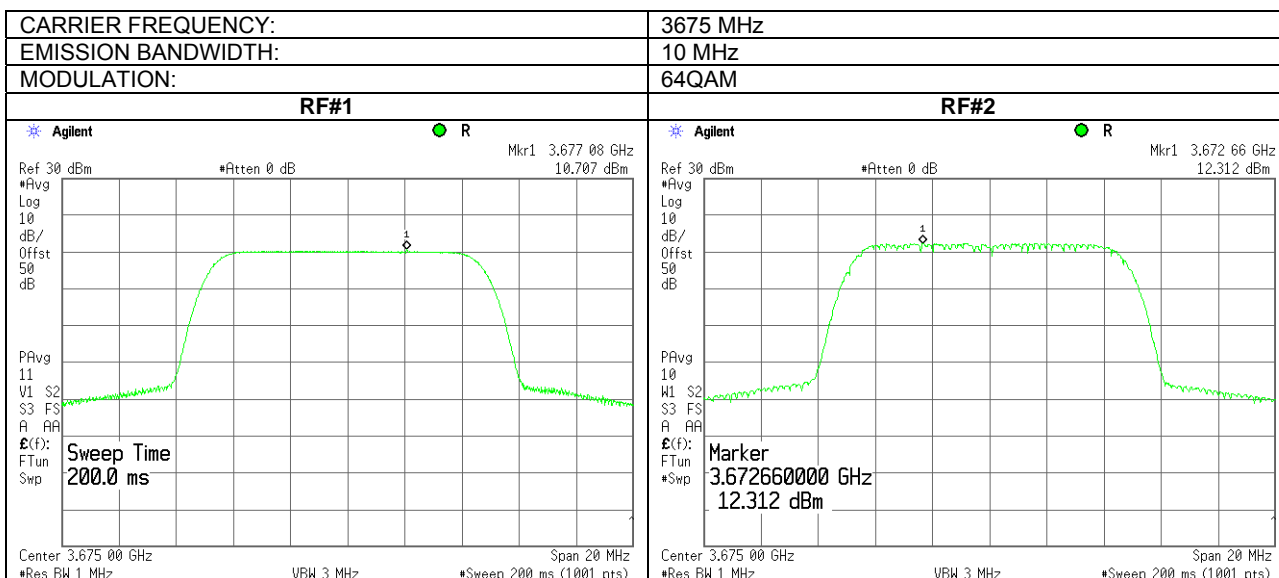


<b>Test specification:</b>	<b>Section 90.1321, Peak EIRP power density</b>		
<b>Test procedure:</b>	47 CFR, Sections 2.1046; TIA/EIA-603-C, Section 2.2.1		
<b>Test mode:</b>	Compliance	<b>Verdict: PASS</b>	
<b>Date:</b>	2/16/2011 - 2/17/2011		
<b>Temperature:</b> 23 °C	<b>Air Pressure:</b> 1018 hPa	<b>Relative Humidity:</b> 45 %	<b>Power Supply:</b> 48 VDC
<b>Remarks:</b>			

Plot 7.2.15 Peak output power density test results at mid frequency

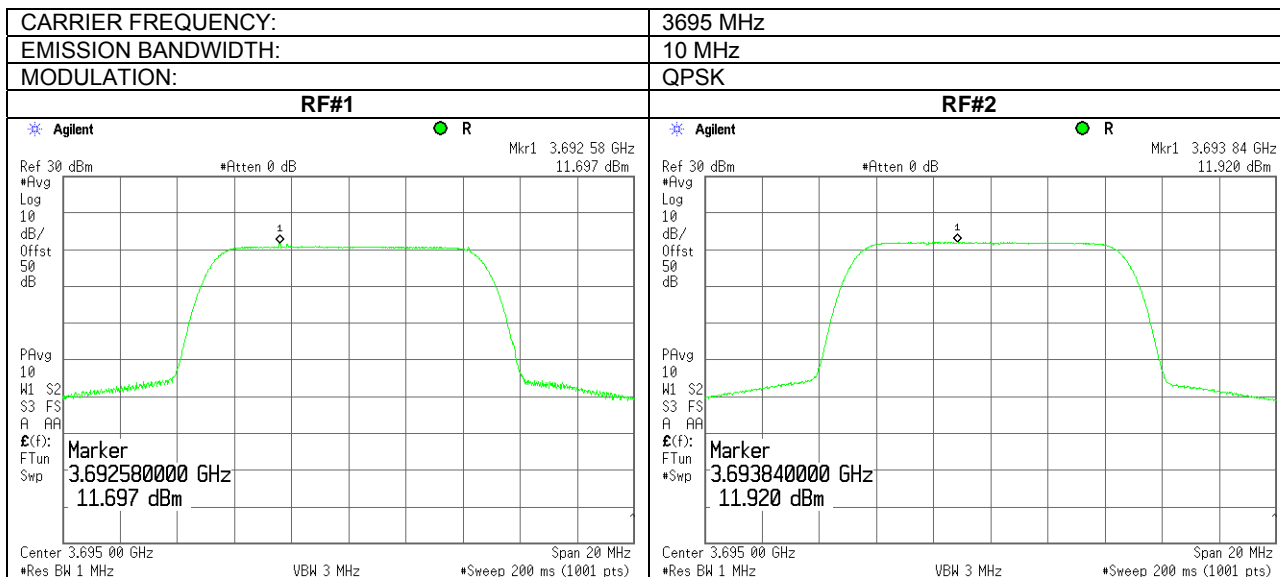


Plot 7.2.16 Peak output power density test results at mid frequency

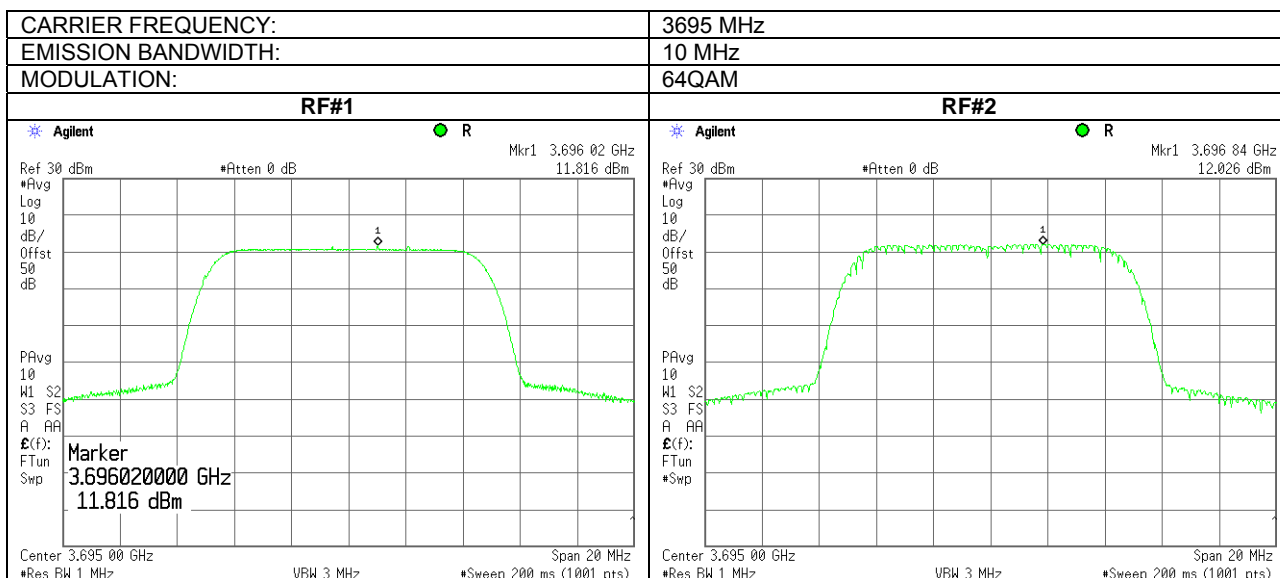


<b>Test specification:</b>	<b>Section 90.1321, Peak EIRP power density</b>		
<b>Test procedure:</b>	47 CFR, Sections 2.1046; TIA/EIA-603-C, Section 2.2.1		
<b>Test mode:</b>	Compliance	<b>Verdict:</b>	<b>PASS</b>
<b>Date:</b>	2/16/2011 - 2/17/2011		
<b>Temperature:</b> 23 °C	<b>Air Pressure:</b> 1018 hPa	<b>Relative Humidity:</b> 45 %	<b>Power Supply:</b> 48 VDC
<b>Remarks:</b>			

Plot 7.2.17 Peak output power density test results at high frequency



Plot 7.2.18 Peak output power density test results at high frequency



<b>Test specification:</b>		<b>Section 90.209, Occupied bandwidth</b>	
<b>Test procedure:</b>		47 CFR, Section 2.1049	
<b>Test mode:</b>		Compliance	<b>Verdict:</b> PASS
<b>Date:</b>		2/16/2011 - 2/17/2011	
<b>Temperature:</b> 23 °C	<b>Air Pressure:</b> 1018 hPa	<b>Relative Humidity:</b> 45 %	<b>Power Supply:</b> 48 VDC
<b>Remarks:</b>			

## 7.3 Occupied bandwidth test

### 7.3.1 General

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

Table 7.3.1 Occupied bandwidth limits

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

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

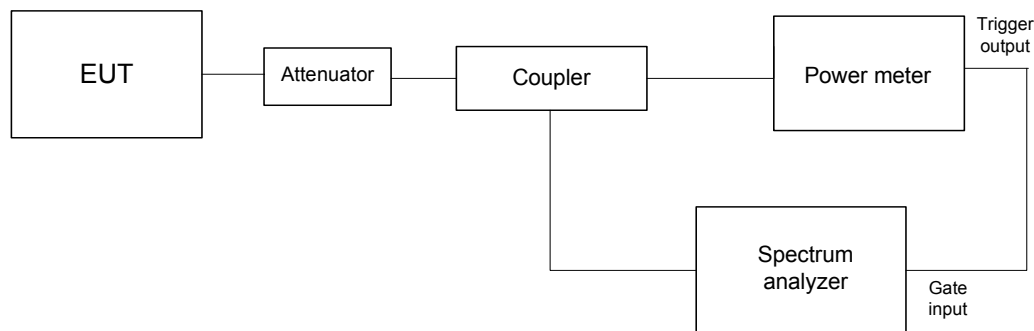
### 7.3.2 Test procedure

**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



<b>Test specification:</b>		<b>Section 90.209, Occupied bandwidth</b>	
<b>Test procedure:</b>		47 CFR, Section 2.1049	
<b>Test mode:</b>	Compliance	<b>Verdict:</b>	<b>PASS</b>
<b>Date:</b>	2/16/2011 - 2/17/2011		
<b>Temperature:</b> 23 °C	<b>Air Pressure:</b> 1018 hPa	<b>Relative Humidity:</b> 45 %	<b>Power Supply:</b> 48 VDC
<b>Remarks:</b>			

Table 7.3.2 Occupied bandwidth test results

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

Carrier frequency, MHz	Modulation	26dB point occupied bandwidth, MHz	Emission bandwidth, MHz
3652.5	QPSK	5.020	5.0
3675.0	QPSK	4.946	5.0
3697.5	QPSK	5.237	5.0
3652.5	64QAM	4.994	5.0
3675.0	64QAM	5.019	5.0
3697.5	64QAM	5.033	5.0
3653.5	QPSK	7.080	7.0
3675.0	QPSK	6.888	7.0
3696.5	QPSK	7.007	7.0
3653.5	64QAM	6.894	7.0
3675.0	64QAM	7.267	7.0
3696.5	64QAM	6.971	7.0
3655.0	QPSK	10.391	10.0
3675.0	QPSK	10.315	10.0
3695.0	QPSK	10.401	10.0
3655.0	64QAM	9.942	10.0
3675.0	64QAM	10.305	10.0
3695.0	64QAM	10.295	10.0

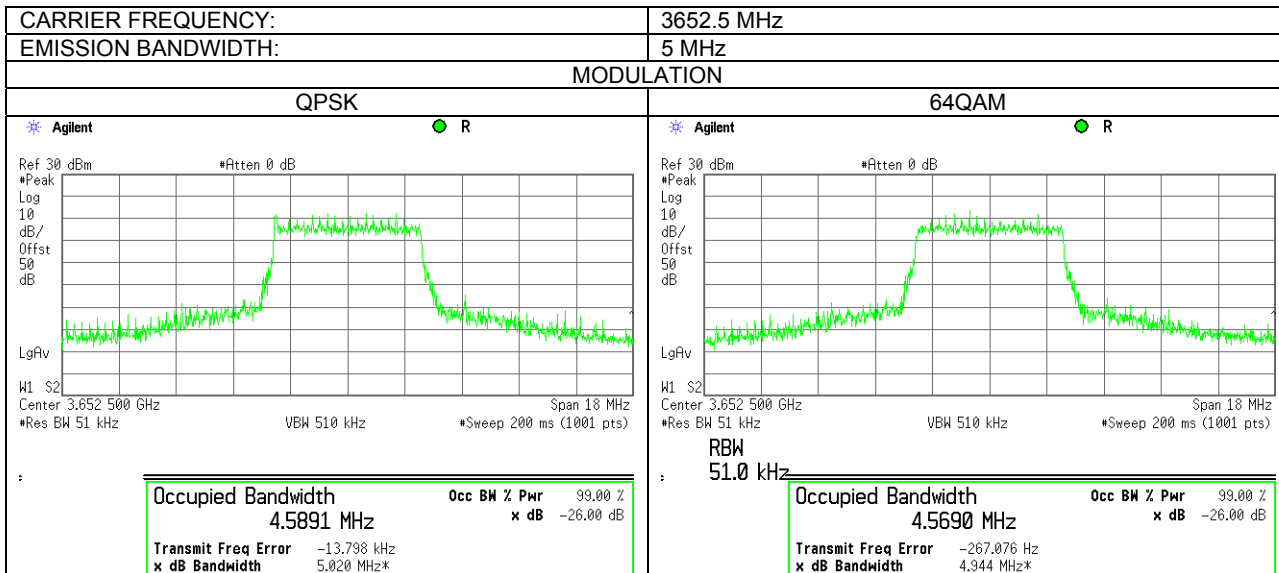
Reference numbers of test equipment used

HL 2952	HL 3818	HL 3868				
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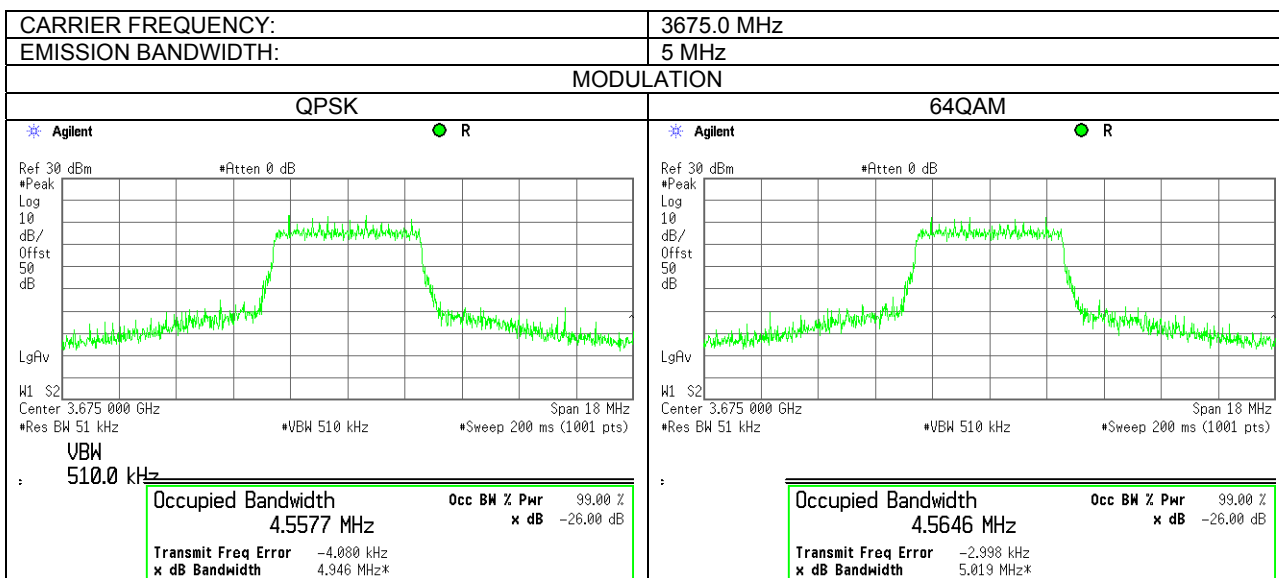
Full description is given in Appendix A.

<b>Test specification:</b>		<b>Section 90.209, Occupied bandwidth</b>	
<b>Test procedure:</b>		47 CFR, Section 2.1049	
<b>Test mode:</b>	Compliance	<b>Verdict:</b> PASS	
<b>Date:</b>	2/16/2011 - 2/17/2011		
<b>Temperature:</b> 23 °C	<b>Air Pressure:</b> 1018 hPa	<b>Relative Humidity:</b> 45 %	<b>Power Supply:</b> 48 VDC
<b>Remarks:</b>			

Plot 7.3.1 The 26 dB occupied bandwidth test results at low frequency



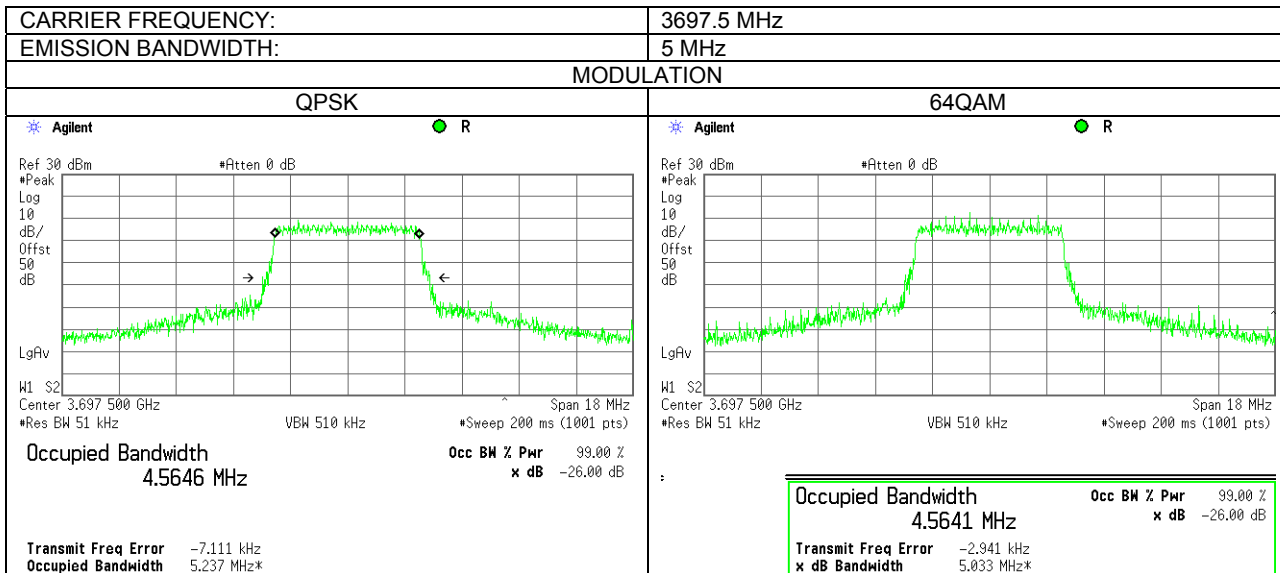
Plot 7.3.2 The 26 dB occupied bandwidth test results at mid frequency



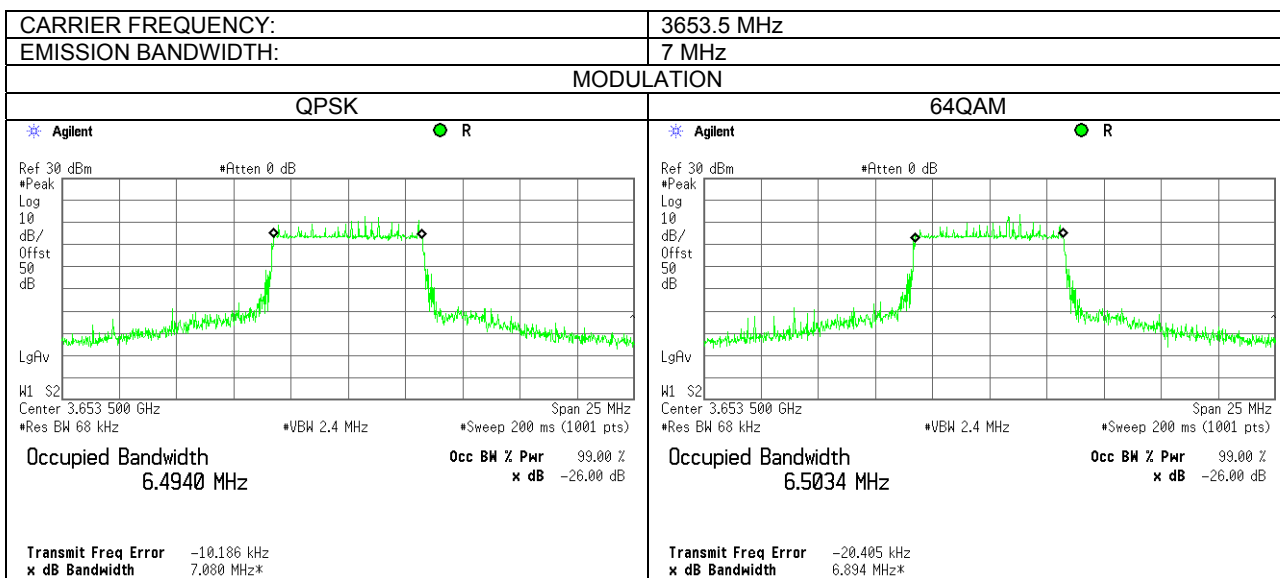


<b>Test specification:</b>	<b>Section 90.209, Occupied bandwidth</b>		
<b>Test procedure:</b>	47 CFR, Section 2.1049		
<b>Test mode:</b>	Compliance	<b>Verdict:</b>	<b>PASS</b>
<b>Date:</b>	2/16/2011 - 2/17/2011		
<b>Temperature:</b> 23 °C	<b>Air Pressure:</b> 1018 hPa	<b>Relative Humidity:</b> 45 %	<b>Power Supply:</b> 48 VDC
<b>Remarks:</b>			

Plot 7.3.3 The 26 dB occupied bandwidth test results at high frequency

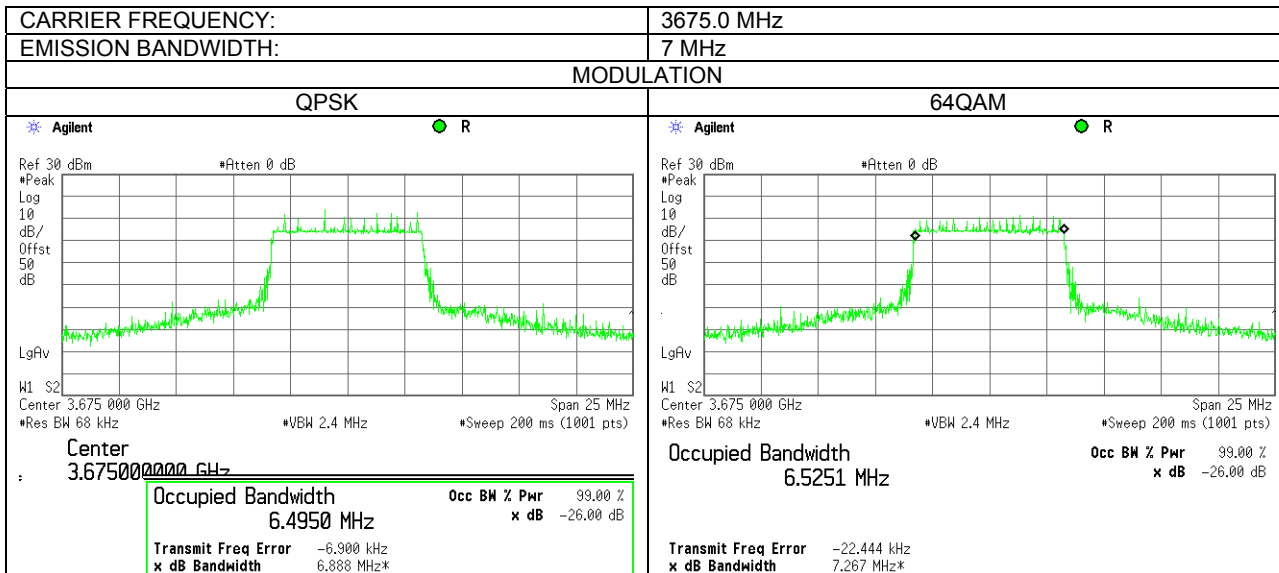


Plot 7.3.4 The 26 dB occupied bandwidth test results at low frequency

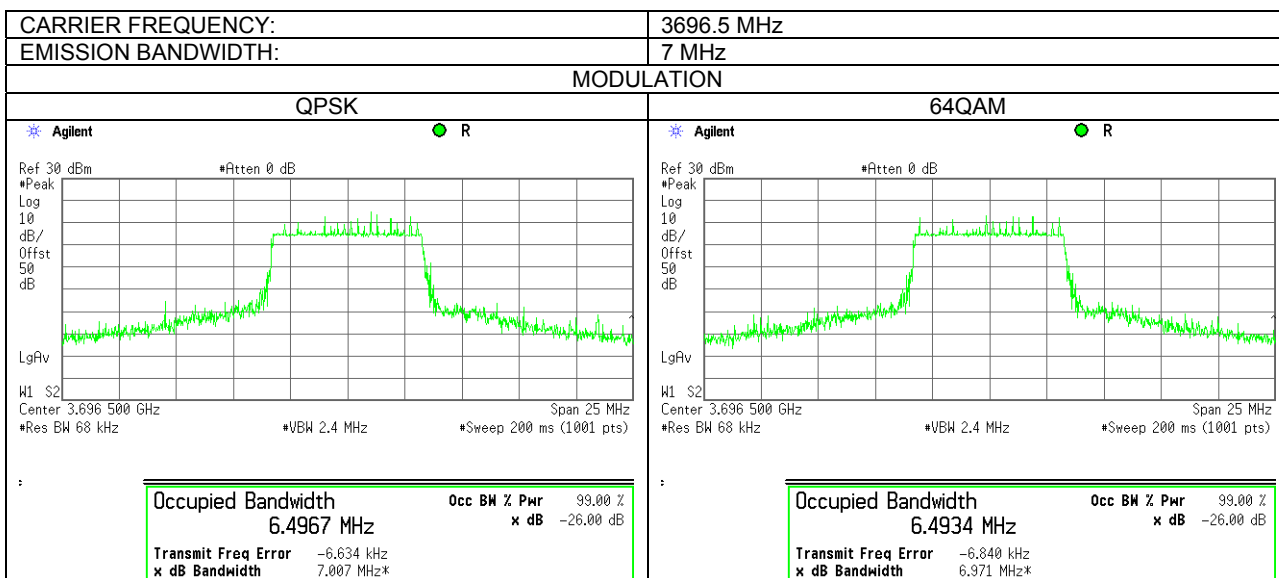


Test specification:	Section 90.209, Occupied bandwidth		
Test procedure:	47 CFR, Section 2.1049		
Test mode:	Compliance	Verdict: PASS	
Date:	2/16/2011 - 2/17/2011		
Temperature: 23 °C	Air Pressure: 1018 hPa	Relative Humidity: 45 %	Power Supply: 48 VDC
Remarks:			

Plot 7.3.5 The 26 dB occupied bandwidth test results at mid frequency

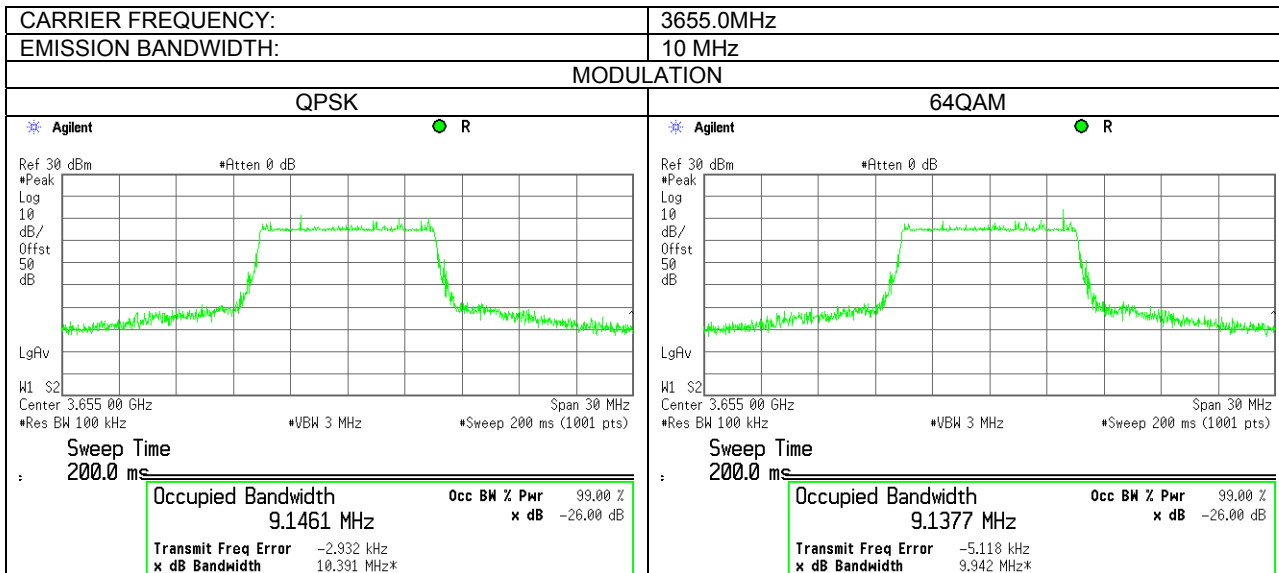


Plot 7.3.6 The 26 dB occupied bandwidth test results at high frequency

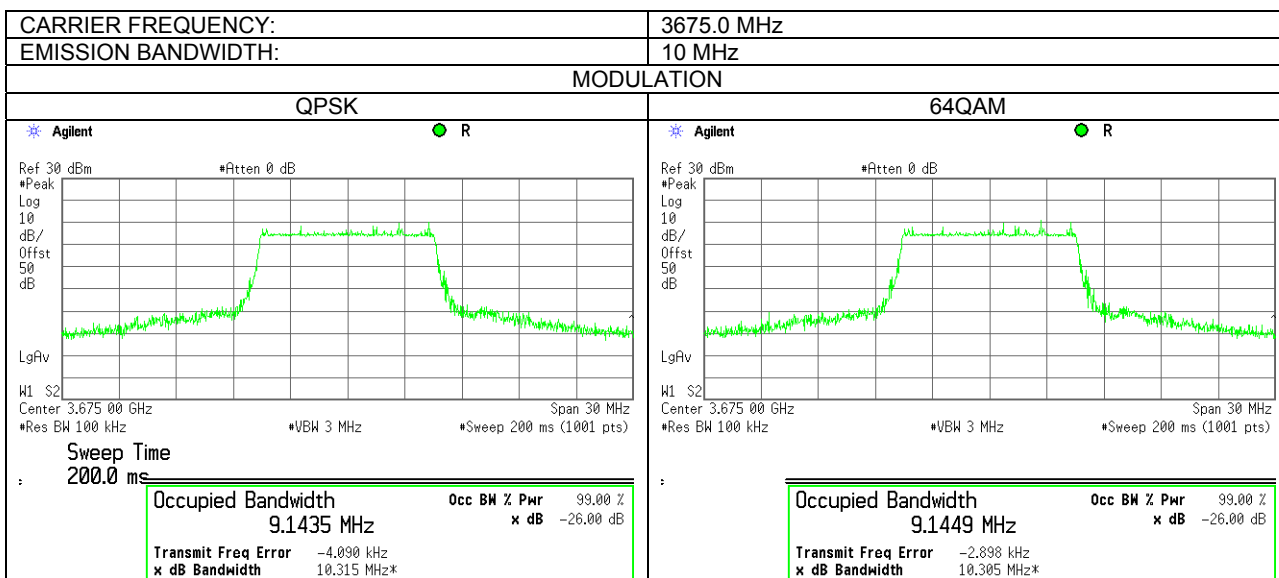


Test specification:	Section 90.209, Occupied bandwidth		
Test procedure:	47 CFR, Section 2.1049		
Test mode:	Compliance	Verdict: PASS	
Date:	2/16/2011 - 2/17/2011		
Temperature: 23 °C	Air Pressure: 1018 hPa	Relative Humidity: 45 %	Power Supply: 48 VDC
Remarks:			

Plot 7.3.7 The 26 dB occupied bandwidth test results at low frequency

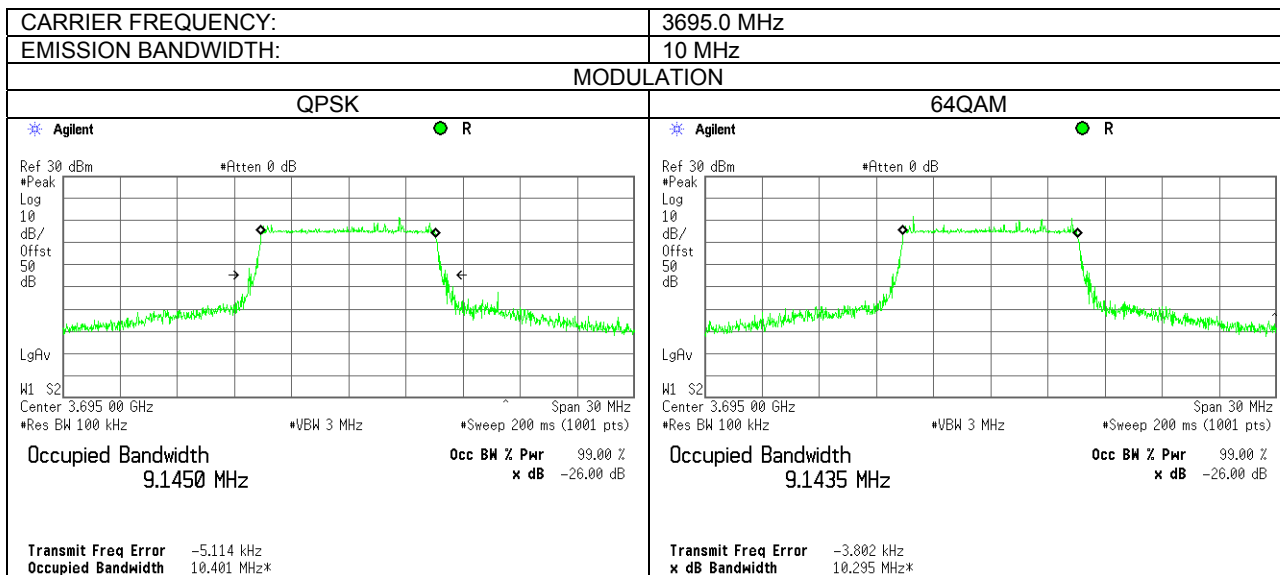


Plot 7.3.8 The 26 dB occupied bandwidth test results at mid frequency



Test specification:	Section 90.209, Occupied bandwidth		
Test procedure:	47 CFR, Section 2.1049		
Test mode:	Compliance	Verdict: PASS	
Date:	2/16/2011 - 2/17/2011		
Temperature: 23 °C	Air Pressure: 1018 hPa	Relative Humidity: 45 %	Power Supply: 48 VDC
Remarks:			

Plot 7.3.9 The 26 dB occupied bandwidth test results at high frequency



<b>Test specification:</b>	<b>Section 90.210(b), Emission mask</b>		
<b>Test procedure:</b>	47 CFR, Sections 2.1051, 2.1047, 90.210; TIA/EIA-603-C, Section 2.2.13		
<b>Test mode:</b>	Compliance	<b>Verdict:</b>	<b>PASS</b>
<b>Date:</b>	2/21/2011 - 2/22/2011		
<b>Temperature:</b> 24 °C	<b>Air Pressure:</b> 1015 hPa	<b>Relative Humidity:</b> 45 %	<b>Power Supply:</b> 48 VDC
<b>Remarks:</b>			

## 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	$43 + 10 \log(P)$

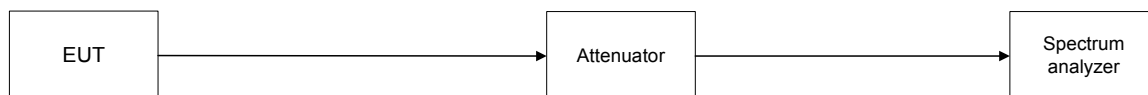
\* - emission mask includes carrier modulation envelope within  $\pm 250$  % of the authorized bandwidth; the frequency range removed beyond  $\pm 250$  % of the authorized bandwidth from carrier was investigated as spurious emission

### 7.4.2 Test procedure

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

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

Figure 7.4.1 Emission mask test setup



<b>Test specification:</b>	<b>Section 90.210(b), Emission mask</b>		
<b>Test procedure:</b>	47 CFR, Sections 2.1051, 2.1047, 90.210; TIA/EIA-603-C, Section 2.2.13		
<b>Test mode:</b>	Compliance	<b>Verdict:</b>	<b>PASS</b>
<b>Date:</b>	2/21/2011 - 2/22/2011		
<b>Temperature:</b> 24 °C	<b>Air Pressure:</b> 1015 hPa	<b>Relative Humidity:</b> 45 %	<b>Power Supply:</b> 48 VDC
<b>Remarks:</b>			

Table 7.4.2 Emission mask test results

Carrier frequency, MHz	Limit	Reference to Plot	Verdict
5 MHz			
3652.5	Emission mask B	Plot 7.4.1	Pass
3675.0		Plot 7.4.2	
3697.5		Plot 7.4.3	
7 MHz			
3653.5	Emission mask B	Plot 7.4.4	Pass
3675.0		Plot 7.4.5	
3696.5		Plot 7.4.6	
10 MHz			
3655.0	Emission mask B	Plot 7.4.7	Pass
3675.0		Plot 7.4.8	
3695.0		Plot 7.4.9	

NOTE1: Attenuation below carrier provided in terms of attenuation below total average power within occupied bandwidth. Measurement was performed with RBW set to 100 kHz and the limit mask was reduced by 10 dB to compensate the lower RBW [ $10 \cdot \log(1 \text{ MHz} / 100 \text{ kHz}) = 10 \text{ dB}$ ];

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

**Reference numbers of test equipment used**

HL 2951	HL 3301	HL 3302	HL 3440	HL 3784	HL 3818	HL 3868	
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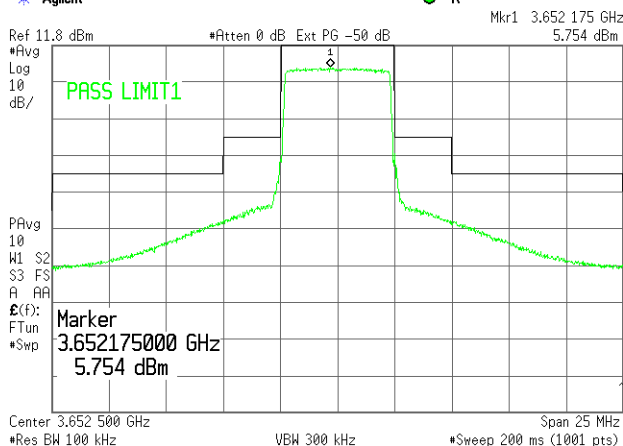
Full description is given in Appendix A.

<b>Test specification:</b>	<b>Section 90.210(b), Emission mask</b>		
<b>Test procedure:</b>	47 CFR, Sections 2.1051, 2.1047, 90.210; TIA/EIA-603-C, Section 2.2.13		
<b>Test mode:</b>	Compliance	<b>Verdict:</b>	<b>PASS</b>
<b>Date:</b>	2/21/2011 - 2/22/2011		
<b>Temperature:</b> 24 °C	<b>Air Pressure:</b> 1015 hPa	<b>Relative Humidity:</b> 45 %	<b>Power Supply:</b> 48 VDC
<b>Remarks:</b>			

Plot 7.4.1 Emission mask test results at low carrier frequency

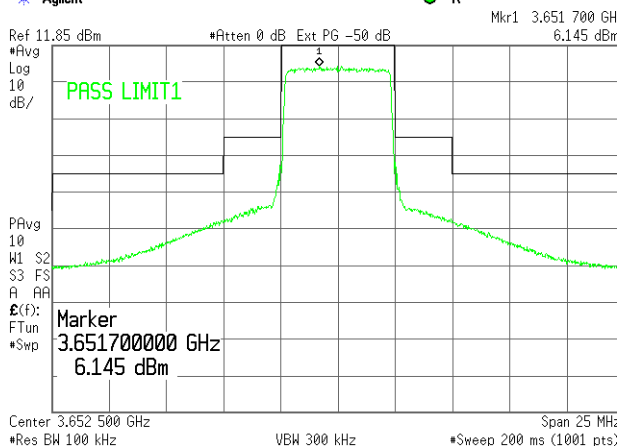
ASSIGNED FREQUENCY:  
DETECTOR USED:  
MODULATING SIGNAL:  
CHANNEL BANDWIDTH:  
TRANSMITTER OUTPUT POWER: 21.80 dBm  
MODULATION: QPSK

\* Agilent



3652.5 MHz  
Average (RMS)  
PRBS  
5MHz  
TRANSMITTER OUTPUT POWER: 21.85 dBm  
MODULATION: 64QAM

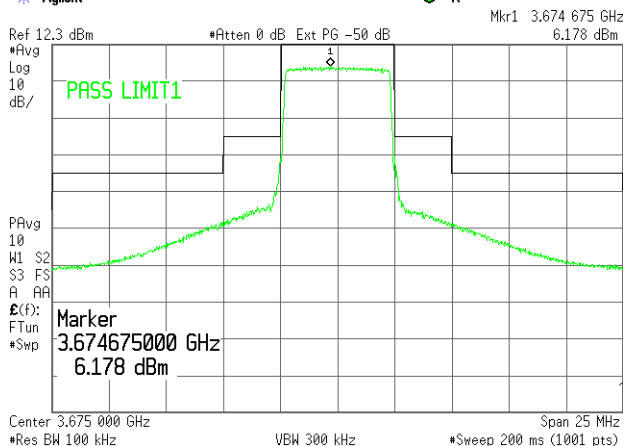
\* Agilent



Plot 7.4.2 Emission mask test results at mid carrier frequency

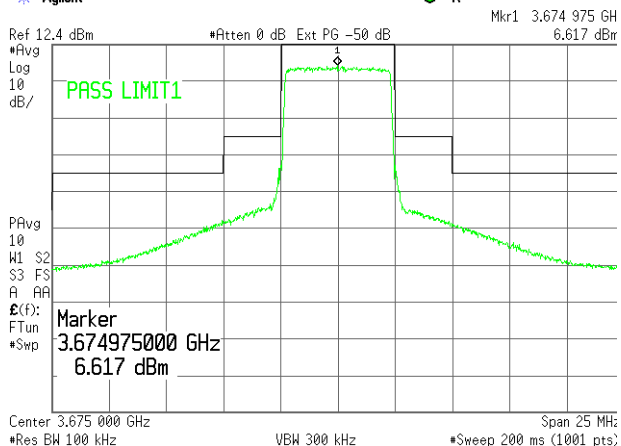
ASSIGNED FREQUENCY:  
DETECTOR USED:  
MODULATING SIGNAL:  
CHANNEL BANDWIDTH:  
TRANSMITTER OUTPUT POWER: 22.3 dBm  
MODULATION: QPSK

\* Agilent



3675 MHz  
Average (RMS)  
PRBS  
5MHz  
TRANSMITTER OUTPUT POWER: 22.4 dBm  
MODULATION: 64QAM

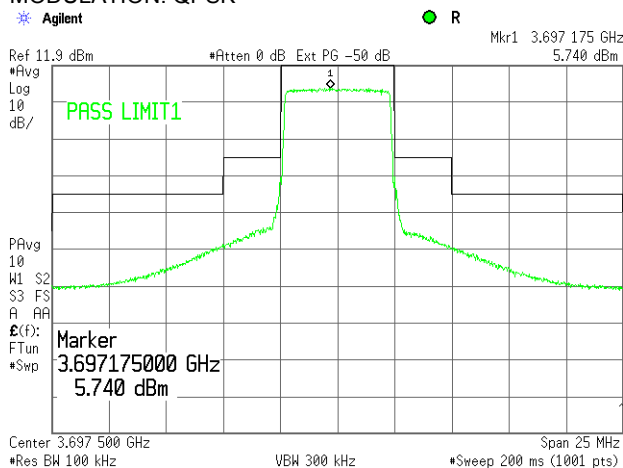
\* Agilent



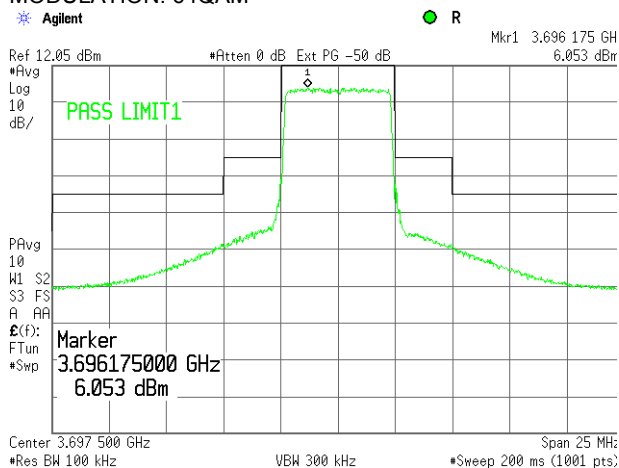
<b>Test specification:</b>	<b>Section 90.210(b), Emission mask</b>		
<b>Test procedure:</b>	47 CFR, Sections 2.1051, 2.1047, 90.210; TIA/EIA-603-C, Section 2.2.13		
<b>Test mode:</b>	Compliance	<b>Verdict:</b>	<b>PASS</b>
<b>Date:</b>	2/21/2011 - 2/22/2011		
<b>Temperature:</b> 24 °C	<b>Air Pressure:</b> 1015 hPa	<b>Relative Humidity:</b> 45 %	<b>Power Supply:</b> 48 VDC
<b>Remarks:</b>			

Plot 7.4.3 Emission mask test results at high carrier frequency

ASSIGNED FREQUENCY:  
DETECTOR USED:  
MODULATING SIGNAL:  
CHANNEL BANDWIDTH:  
TRANSMITTER OUTPUT POWER: 21.9 dBm  
MODULATION: QPSK

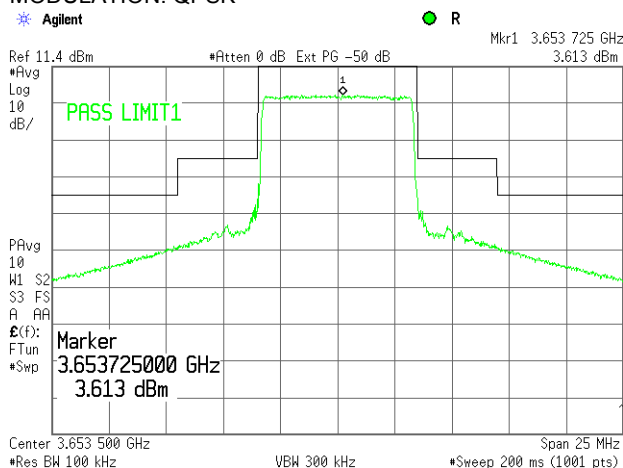


3697.5 MHz  
Average (RMS)  
PRBS  
5MHz  
TRANSMITTER OUTPUT POWER: 22.05 dBm  
MODULATION: 64QAM

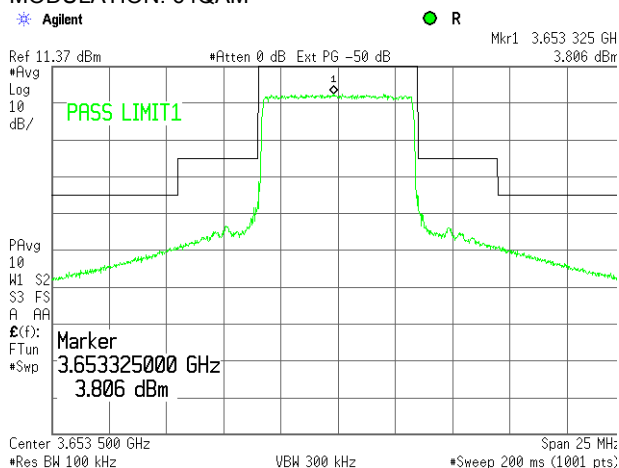


Plot 7.4.4 Emission mask test results at low carrier frequency

ASSIGNED FREQUENCY:  
DETECTOR USED:  
MODULATING SIGNAL:  
CHANNEL BANDWIDTH:  
TRANSMITTER OUTPUT POWER: 21.4 dBm  
MODULATION: QPSK



3653.5 MHz  
Average (RMS)  
PRBS  
7MHz  
TRANSMITTER OUTPUT POWER: 21.37 dBm  
MODULATION: 64QAM





<b>Test specification:</b>	<b>Section 90.210(b), Emission mask</b>		
<b>Test procedure:</b>	47 CFR, Sections 2.1051, 2.1047, 90.210; TIA/EIA-603-C, Section 2.2.13		
<b>Test mode:</b>	Compliance	<b>Verdict:</b>	<b>PASS</b>
<b>Date:</b>	2/21/2011 - 2/22/2011		
<b>Temperature:</b> 24 °C	<b>Air Pressure:</b> 1015 hPa	<b>Relative Humidity:</b> 45 %	<b>Power Supply:</b> 48 VDC
<b>Remarks:</b>			

Plot 7.4.5 Emission mask test results at mid carrier frequency

ASSIGNED FREQUENCY:

DETECTOR USED:

MODULATING SIGNAL:

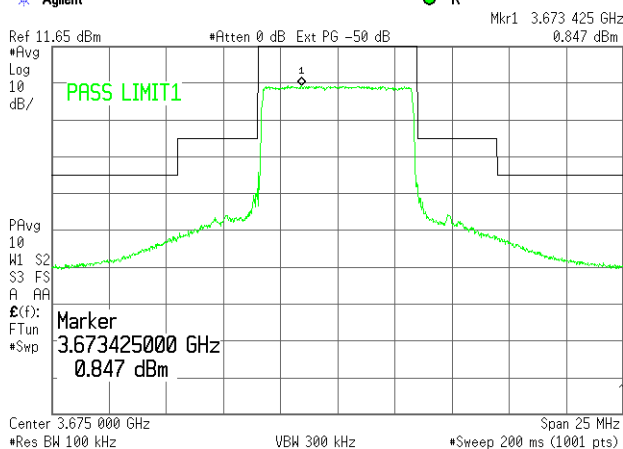
CHANNEL BANDWIDTH:

TRANSMITTER OUTPUT POWER: 21.65 dBm

MODULATION: QPSK

\* Agilent

● R



3675 MHz

Average (RMS)

PRBS

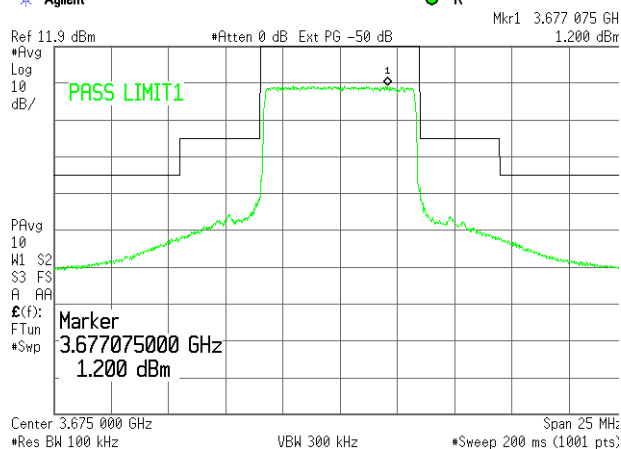
7MHz

TRANSMITTER OUTPUT POWER: 21.9 dBm

MODULATION: 64QAM

\* Agilent

● R



Plot 7.4.6 Emission mask test results at high carrier frequency

ASSIGNED FREQUENCY:

DETECTOR USED:

MODULATING SIGNAL:

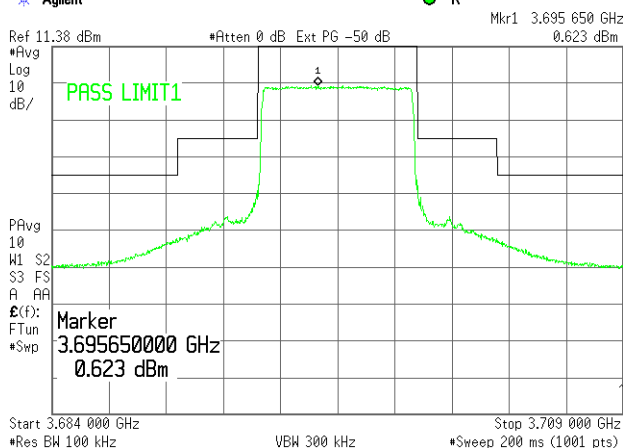
CHANNEL BANDWIDTH:

TRANSMITTER OUTPUT POWER: 21.38 dBm

MODULATION: QPSK

\* Agilent

● R



3696.5 MHz

Average (RMS)

PRBS

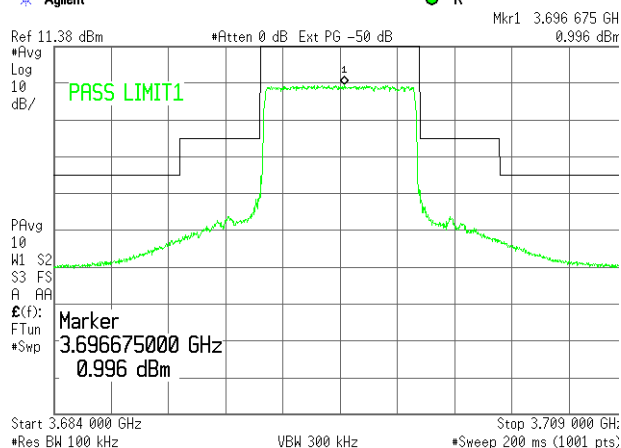
7MHz

TRANSMITTER OUTPUT POWER: 21.56 dBm

MODULATION: 64QAM

\* Agilent

● R



Note: The specified limit for 64QAM is 11.56dBm (less stringent than used)

<b>Test specification:</b>	<b>Section 90.210(b), Emission mask</b>		
<b>Test procedure:</b>	47 CFR, Sections 2.1051, 2.1047, 90.210; TIA/EIA-603-C, Section 2.2.13		
<b>Test mode:</b>	Compliance	<b>Verdict:</b>	<b>PASS</b>
<b>Date:</b>	2/21/2011 - 2/22/2011		
<b>Temperature:</b> 24 °C	<b>Air Pressure:</b> 1015 hPa	<b>Relative Humidity:</b> 45 %	<b>Power Supply:</b> 48 VDC
<b>Remarks:</b>			

**Plot 7.4.7 Emission mask test results at low carrier frequency**

ASSIGNED FREQUENCY:

DETECTOR USED:

MODULATING SIGNAL:

CHANNEL BANDWIDTH:

TRANSMITTER OUTPUT POWER: 21.26 dBm

MODULATION: QPSK

Agilent

3655 MHz

Average (RMS)

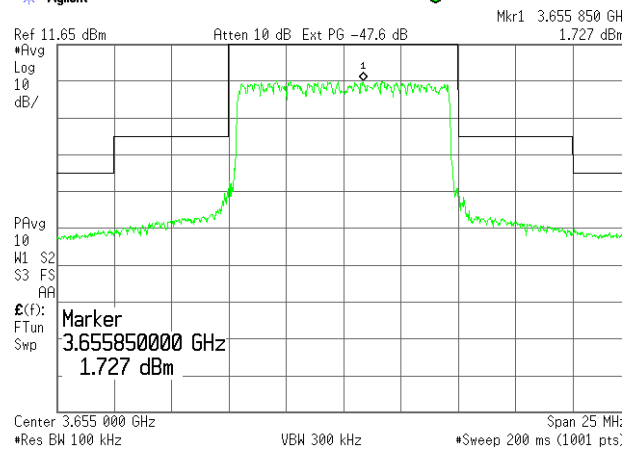
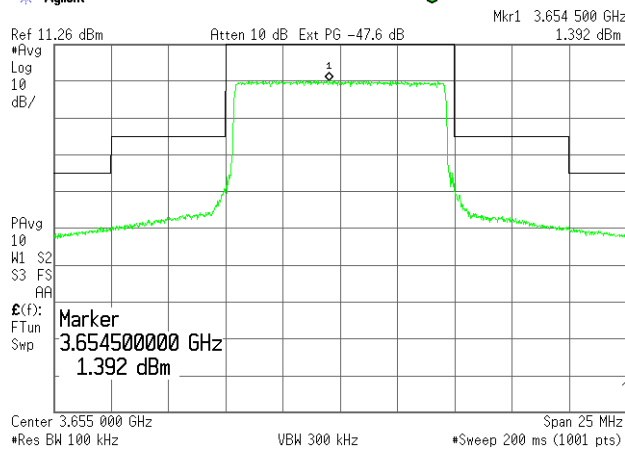
PRBS

10MHz

TRANSMITTER OUTPUT POWER: 21.65 dBm

MODULATION: 64QAM

Agilent



**Plot 7.4.8 Emission mask test results at mid carrier frequency**

ASSIGNED FREQUENCY:

DETECTOR USED:

MODULATING SIGNAL:

CHANNEL BANDWIDTH:

TRANSMITTER OUTPUT POWER: 21.78 dBm

MODULATION: QPSK

Agilent

3675 MHz

Average (RMS)

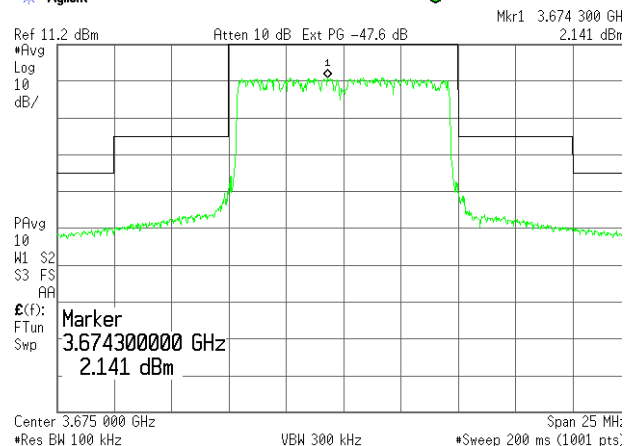
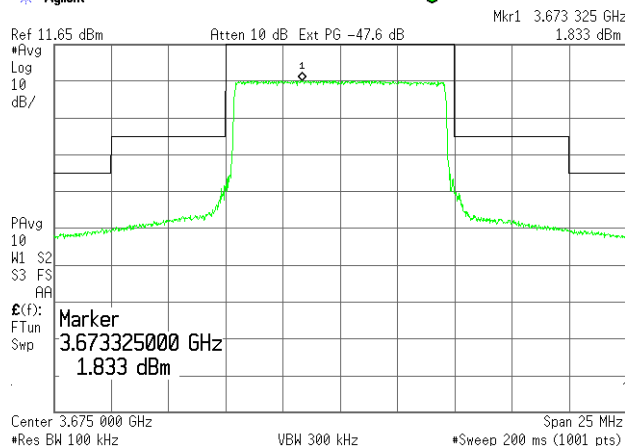
PRBS

10MHz

TRANSMITTER OUTPUT POWER: 21.2 dBm

MODULATION: 64QAM

Agilent



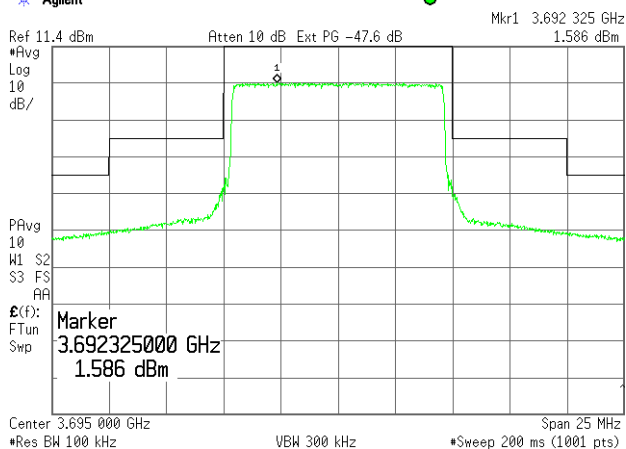
Note: The specified limit for QPSK is 11.78dBm (less stringent than taken)

<b>Test specification:</b>		<b>Section 90.210(b), Emission mask</b>	
<b>Test procedure:</b>		47 CFR, Sections 2.1051, 2.1047, 90.210; TIA/EIA-603-C, Section 2.2.13	
<b>Test mode:</b>		Compliance	<b>Verdict:</b> PASS
<b>Date:</b>		2/21/2011 - 2/22/2011	
<b>Temperature:</b> 24 °C	<b>Air Pressure:</b> 1015 hPa	<b>Relative Humidity:</b> 45 %	<b>Power Supply:</b> 48 VDC
<b>Remarks:</b>			

Plot 7.4.9 Emission mask test results at high carrier frequency

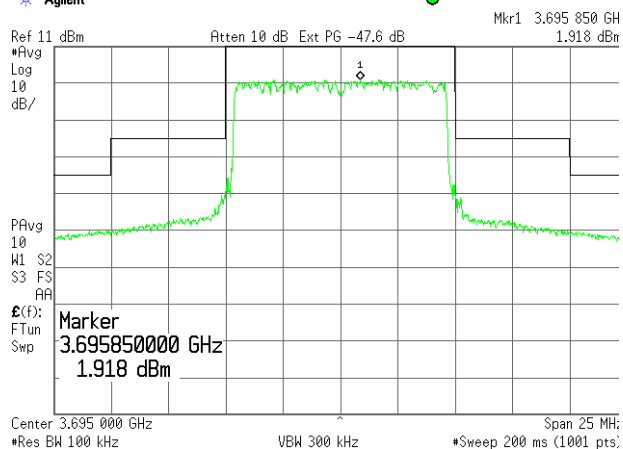
ASSIGNED FREQUENCY:  
DETECTOR USED:  
MODULATING SIGNAL:  
CHANNEL BANDWIDTH:  
TRANSMITTER OUTPUT POWER: 21.4 dBm  
MODULATION: QPSK

\* Agilent



3695 MHz  
Average (RMS)  
PRBS  
10MHz  
TRANSMITTER OUTPUT POWER: 21 dBm  
MODULATION: 64QAM

\* Agilent



<b>Test specification:</b>		<b>Section 90.1323, Spurious emissions at RF antenna connector</b>	
<b>Test procedure:</b>		47 CFR, Sections 2.1051, 90.1323; TIA/EIA-603-C, Section 2.2.13	
<b>Test mode:</b>		Compliance	<b>Verdict:</b> PASS
<b>Date:</b>		2/22/2011 - 2/23/2011	
<b>Temperature:</b> 24 °C	<b>Air Pressure:</b> 1012 hPa	<b>Relative Humidity:</b> 46 %	<b>Power Supply:</b> 48 VDC
<b>Remarks:</b>			

## 7.5 Spurious emissions at RF antenna connector test

### 7.5.1 General

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

Table 7.5.1 Spurious emission limits

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

\* - spurious emission limits do not apply to the in band emission within  $\pm 250$  % 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, Figure 7.5.2, energized and its proper operation was checked.

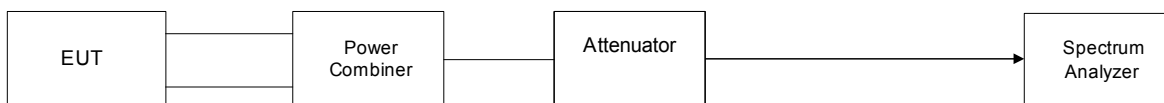
**7.5.2.2** The EUT was adjusted to produce maximum available for end user RF output power.

**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



Figure 7.5.2 Spurious emission test setup for MIMO mode



<b>Test specification:</b>	<b>Section 90.1323, Spurious emissions at RF antenna connector</b>		
<b>Test procedure:</b>	47 CFR, Sections 2.1051, 90.1323; TIA/EIA-603-C, Section 2.2.13		
<b>Test mode:</b>	Compliance	<b>Verdict:</b>	<b>PASS</b>
<b>Date:</b>	2/22/2011 - 2/23/2011		
<b>Temperature:</b> 24 °C	<b>Air Pressure:</b> 1012 hPa	<b>Relative Humidity:</b> 46 %	<b>Power Supply:</b> 48 VDC
<b>Remarks:</b>			

**Table 7.5.2 Spurious emission test results**

ASSIGNED FREQUENCY RANGE: 3650 – 3700 MHz  
 INVESTIGATED FREQUENCY RANGE: 0.009 – 40000 MHz  
 DETECTOR USED: Peak  
 VIDEO BANDWIDTH: ≥ Resolution bandwidth  
 MODULATION: 64QAM  
 MODULATING SIGNAL: PRBS  
 EMISSION BANDWIDTH: 5 MHz (as worst case for PSD test)  
 TRANSMITTER OUTPUT POWER: Maximum

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

\*- Margin = Spurious emission – specification limit.

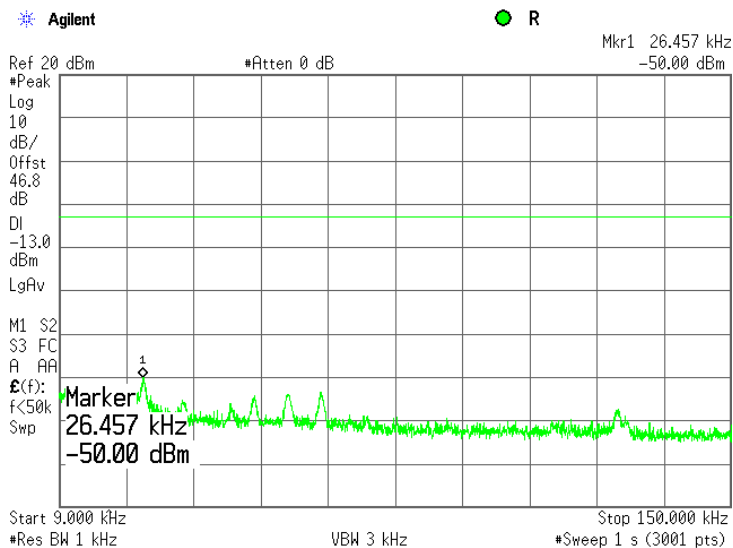
**Reference numbers of test equipment used**

HL 1906	HL 2013	HL 2214	HL 2951	HL 3301	HL 3440	HL 3472	HL 3473
HL 3474	HL 3784	HL 3818	HL 3868				

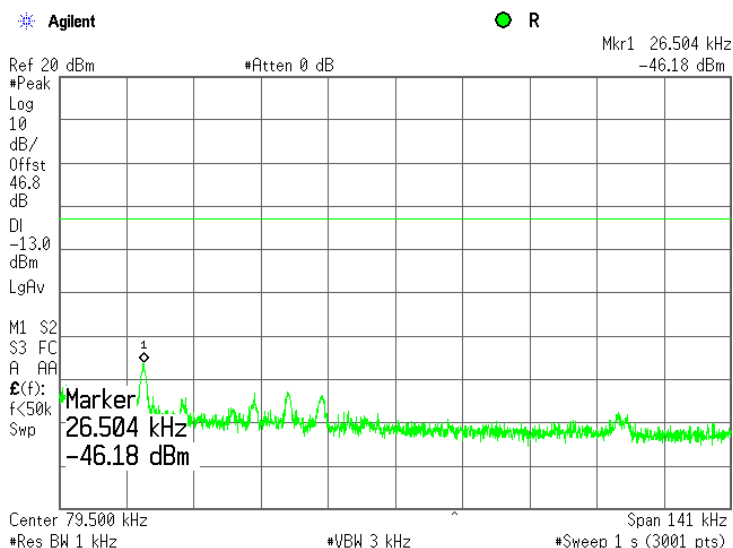
Full description is given in Appendix A.

<b>Test specification:</b>	<b>Section 90.1323, Spurious emissions at RF antenna connector</b>		
<b>Test procedure:</b>	47 CFR, Sections 2.1051, 90.1323; TIA/EIA-603-C, Section 2.2.13		
<b>Test mode:</b>	Compliance	<b>Verdict:</b>	<b>PASS</b>
<b>Date:</b>	2/22/2011 - 2/23/2011		
<b>Temperature:</b> 24 °C	<b>Air Pressure:</b> 1012 hPa	<b>Relative Humidity:</b> 46 %	<b>Power Supply:</b> 48 VDC
<b>Remarks:</b>			

Plot 7.5.1 Spurious emission measurements in 9 – 150 kHz range at low carrier frequency, single output

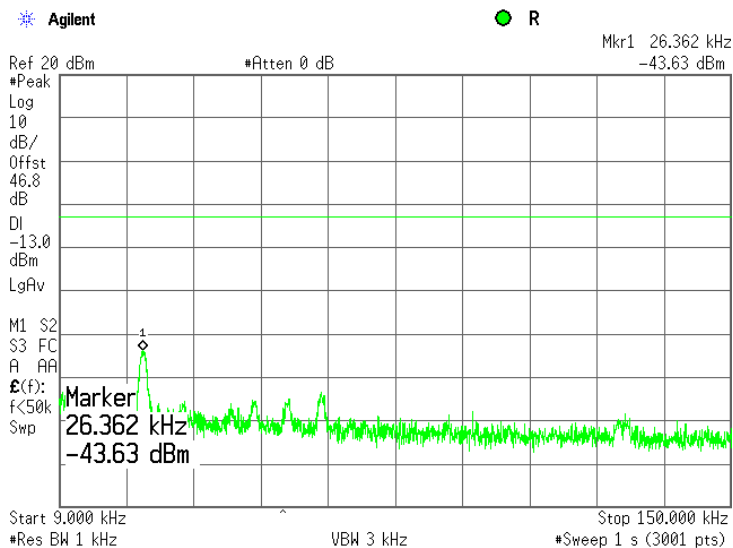


Plot 7.5.2 Spurious emission measurements in 9 – 150 kHz range at mid carrier frequency, single output

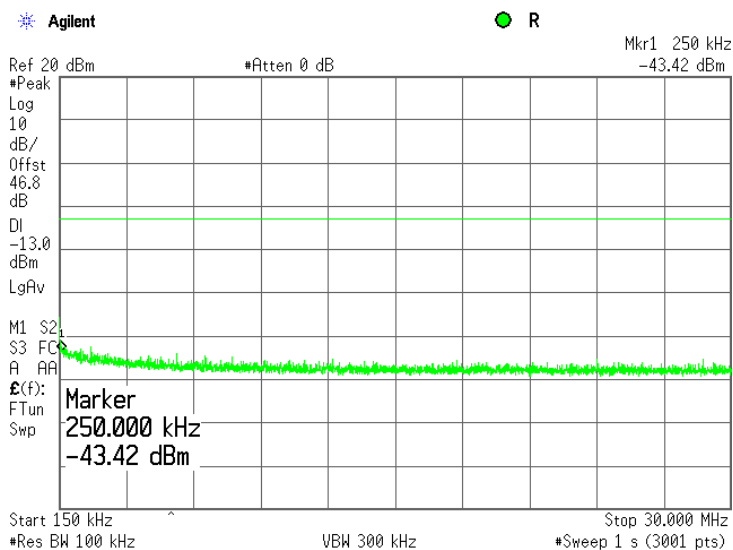


<b>Test specification:</b>	<b>Section 90.1323, Spurious emissions at RF antenna connector</b>		
<b>Test procedure:</b>	47 CFR, Sections 2.1051, 90.1323; TIA/EIA-603-C, Section 2.2.13		
<b>Test mode:</b>	Compliance	<b>Verdict:</b>	<b>PASS</b>
<b>Date:</b>	2/22/2011 - 2/23/2011		
<b>Temperature:</b> 24 °C	<b>Air Pressure:</b> 1012 hPa	<b>Relative Humidity:</b> 46 %	<b>Power Supply:</b> 48 VDC
<b>Remarks:</b>			

Plot 7.5.3 Spurious emission measurements in 9 – 150 kHz range at high carrier frequency, single output

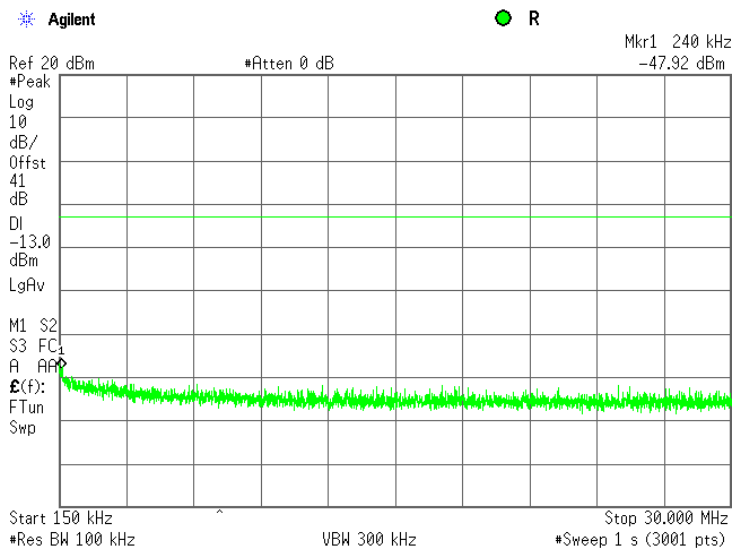


Plot 7.5.4 Spurious emission measurements in 0.150 – 30.0 MHz range at low carrier frequency, single output

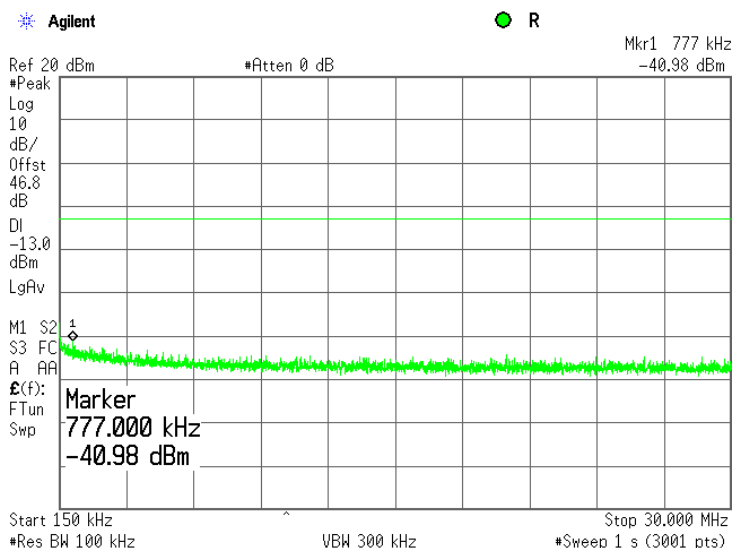


<b>Test specification:</b>	<b>Section 90.1323, Spurious emissions at RF antenna connector</b>		
<b>Test procedure:</b>	47 CFR, Sections 2.1051, 90.1323; TIA/EIA-603-C, Section 2.2.13		
<b>Test mode:</b>	Compliance	<b>Verdict:</b>	<b>PASS</b>
<b>Date:</b>	2/22/2011 - 2/23/2011		
<b>Temperature:</b> 24 °C	<b>Air Pressure:</b> 1012 hPa	<b>Relative Humidity:</b> 46 %	<b>Power Supply:</b> 48 VDC
<b>Remarks:</b>			

Plot 7.5.5 Spurious emission measurements in 0.150 – 30.0 MHz range at mid carrier frequency, single output



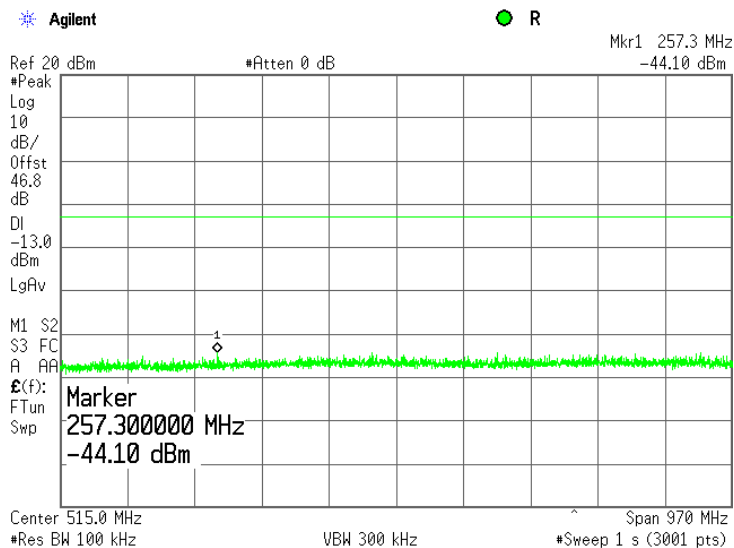
Plot 7.5.6 Spurious emission measurements in 0.150 – 30.0 MHz range at high carrier frequency, single output



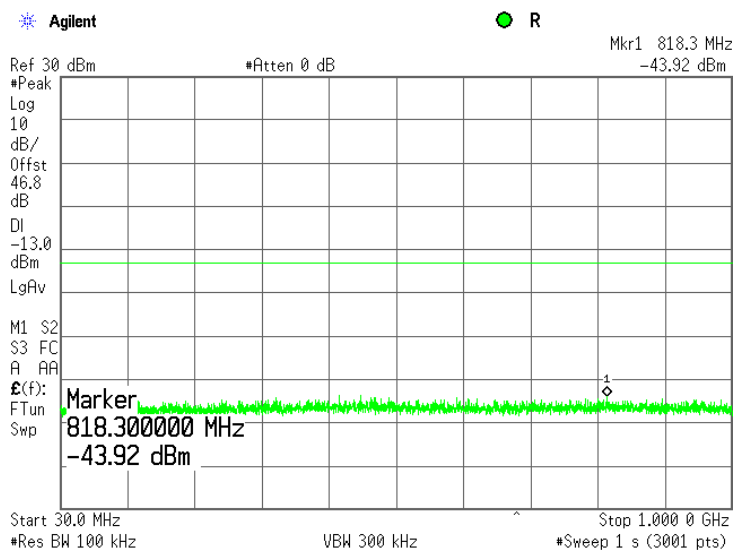


<b>Test specification:</b>	<b>Section 90.1323, Spurious emissions at RF antenna connector</b>		
<b>Test procedure:</b>	47 CFR, Sections 2.1051, 90.1323; TIA/EIA-603-C, Section 2.2.13		
<b>Test mode:</b>	Compliance	<b>Verdict:</b>	<b>PASS</b>
<b>Date:</b>	2/22/2011 - 2/23/2011		
<b>Temperature:</b> 24 °C	<b>Air Pressure:</b> 1012 hPa	<b>Relative Humidity:</b> 46 %	<b>Power Supply:</b> 48 VDC
<b>Remarks:</b>			

Plot 7.5.7 Spurious emission measurements in 30.0 – 1000 MHz range at low carrier frequency, single output

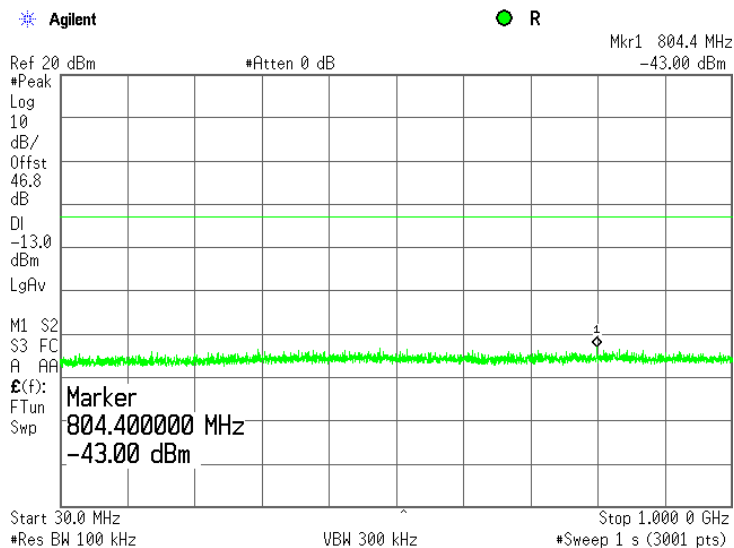


Plot 7.5.8 Spurious emission measurements in 30.0 – 1000 MHz range at mid carrier frequency, single output

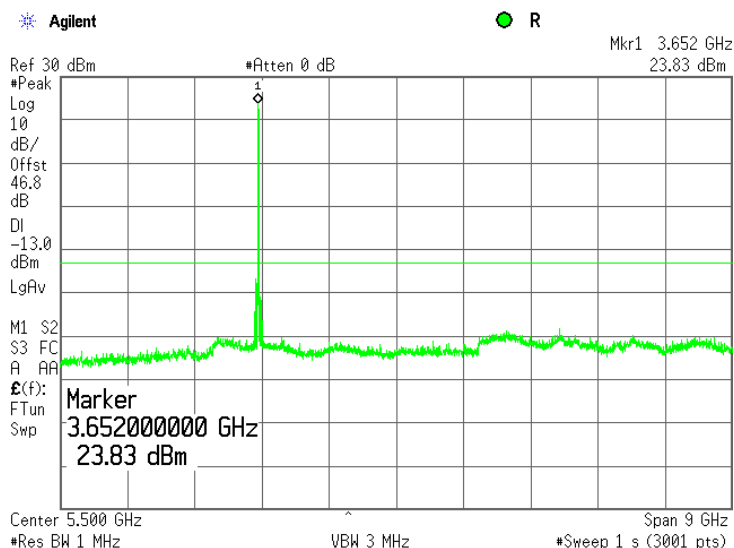


<b>Test specification:</b>	<b>Section 90.1323, Spurious emissions at RF antenna connector</b>		
<b>Test procedure:</b>	47 CFR, Sections 2.1051, 90.1323; TIA/EIA-603-C, Section 2.2.13		
<b>Test mode:</b>	Compliance	<b>Verdict:</b>	<b>PASS</b>
<b>Date:</b>	2/22/2011 - 2/23/2011		
<b>Temperature:</b> 24 °C	<b>Air Pressure:</b> 1012 hPa	<b>Relative Humidity:</b> 46 %	<b>Power Supply:</b> 48 VDC
<b>Remarks:</b>			

Plot 7.5.9 Spurious emission measurements in 30.0 – 1000 MHz range at high carrier frequency, single output

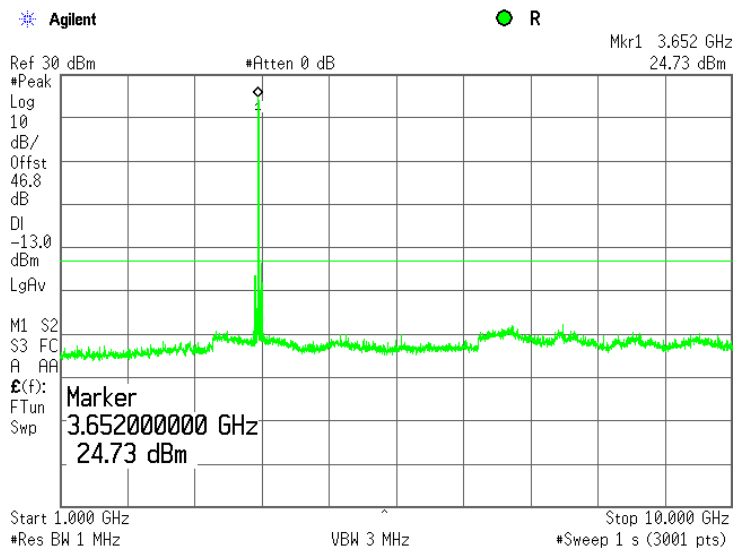


Plot 7.5.10 Spurious emission measurements in 1000 – 10000 MHz range at low carrier frequency, single output

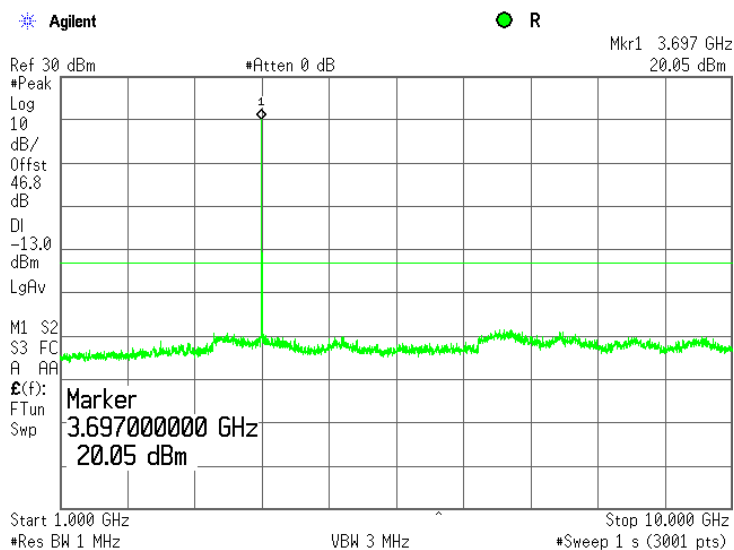


<b>Test specification:</b>	<b>Section 90.1323, Spurious emissions at RF antenna connector</b>		
<b>Test procedure:</b>	47 CFR, Sections 2.1051, 90.1323; TIA/EIA-603-C, Section 2.2.13		
<b>Test mode:</b>	Compliance	<b>Verdict:</b>	<b>PASS</b>
<b>Date:</b>	2/22/2011 - 2/23/2011		
<b>Temperature:</b> 24 °C	<b>Air Pressure:</b> 1012 hPa	<b>Relative Humidity:</b> 46 %	<b>Power Supply:</b> 48 VDC
<b>Remarks:</b>			

Plot 7.5.11 Spurious emission measurements in 1000 – 10000 MHz at mid carrier frequency, single output

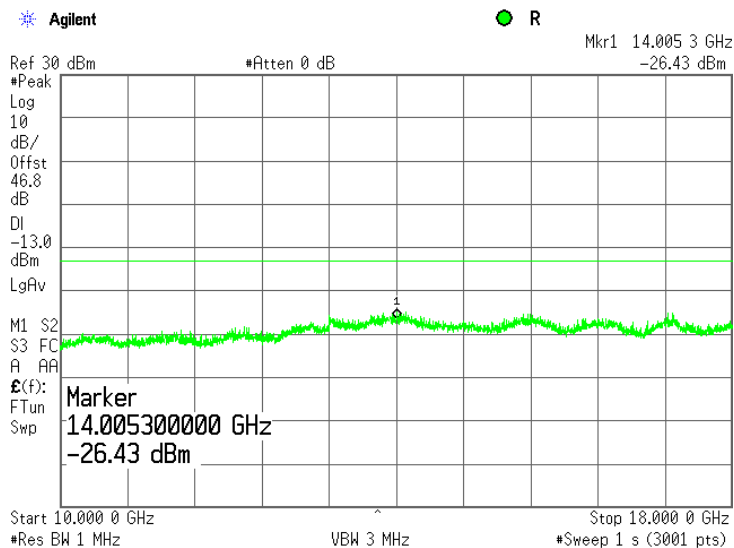


Plot 7.5.12 Spurious emission measurements in 1000 – 10000 MHz at high carrier frequency, single output

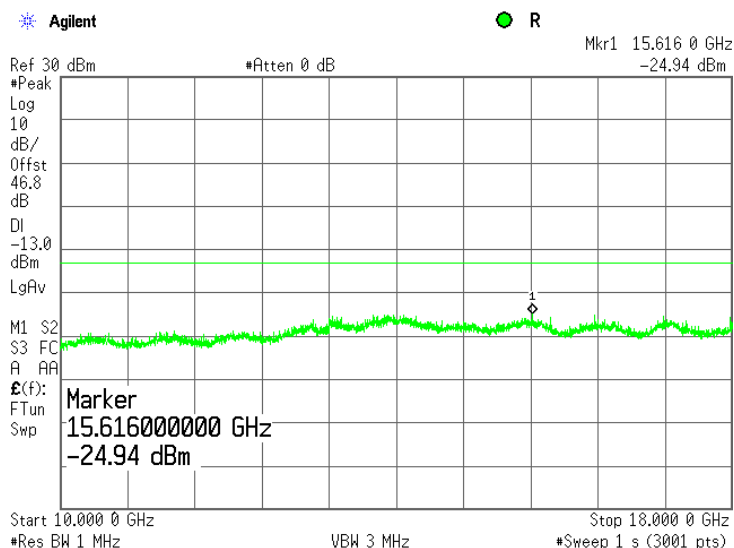


<b>Test specification:</b>	<b>Section 90.1323, Spurious emissions at RF antenna connector</b>		
<b>Test procedure:</b>	47 CFR, Sections 2.1051, 90.1323; TIA/EIA-603-C, Section 2.2.13		
<b>Test mode:</b>	Compliance	<b>Verdict:</b>	<b>PASS</b>
<b>Date:</b>	2/22/2011 - 2/23/2011		
<b>Temperature:</b> 24 °C	<b>Air Pressure:</b> 1012 hPa	<b>Relative Humidity:</b> 46 %	<b>Power Supply:</b> 48 VDC
<b>Remarks:</b>			

Plot 7.5.13 Spurious emission measurements in 10000 – 18000 MHz range at low carrier frequency, single output

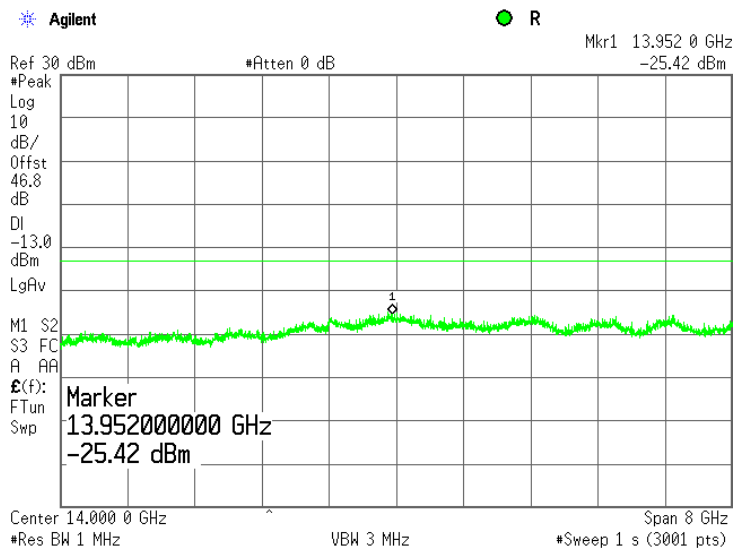


Plot 7.5.14 Spurious emission measurements in 10000 – 18000 MHz at mid carrier frequency, single output

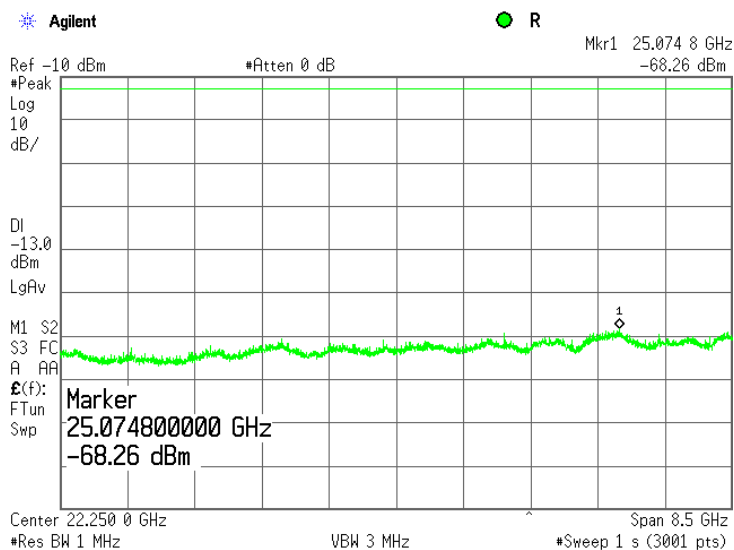


<b>Test specification:</b>	<b>Section 90.1323, Spurious emissions at RF antenna connector</b>		
<b>Test procedure:</b>	47 CFR, Sections 2.1051, 90.1323; TIA/EIA-603-C, Section 2.2.13		
<b>Test mode:</b>	Compliance	<b>Verdict:</b>	<b>PASS</b>
<b>Date:</b>	2/22/2011 - 2/23/2011		
<b>Temperature:</b> 24 °C	<b>Air Pressure:</b> 1012 hPa	<b>Relative Humidity:</b> 46 %	<b>Power Supply:</b> 48 VDC
<b>Remarks:</b>			

Plot 7.5.15 Spurious emission measurements in 10000 – 18000 MHz at high carrier frequency, single output

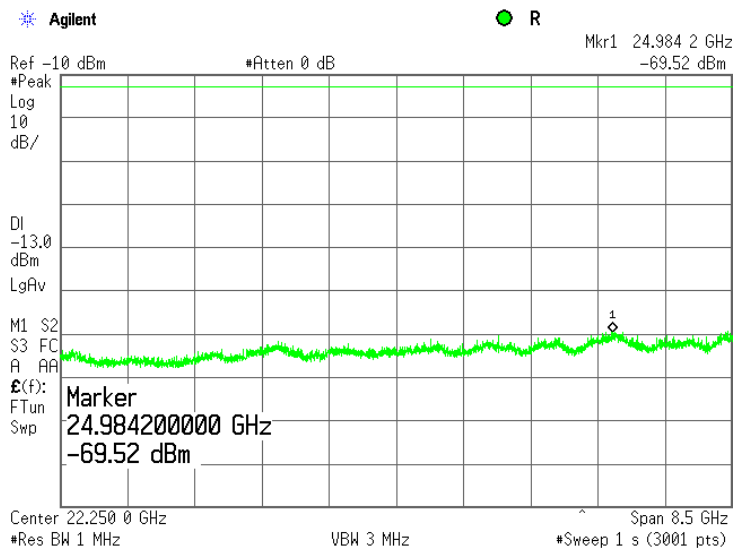


Plot 7.5.16 Spurious emission measurements in 18000 – 26500 MHz range at low carrier frequency, single output

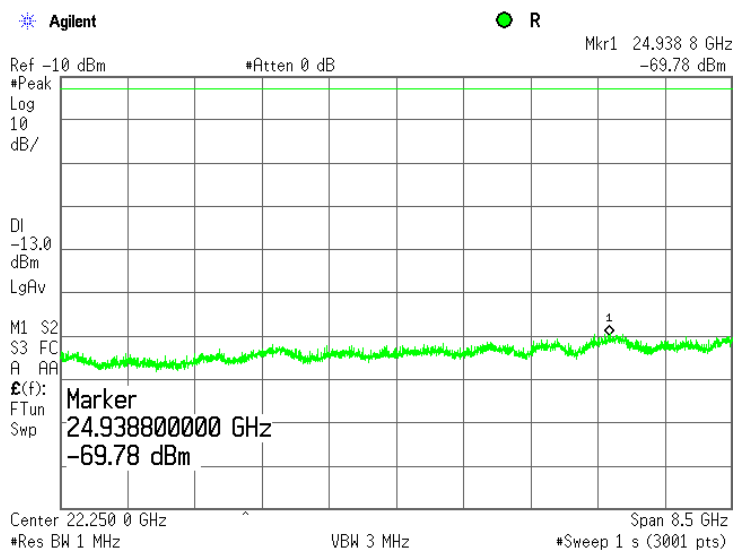


<b>Test specification:</b>	<b>Section 90.1323, Spurious emissions at RF antenna connector</b>		
<b>Test procedure:</b>	47 CFR, Sections 2.1051, 90.1323; TIA/EIA-603-C, Section 2.2.13		
<b>Test mode:</b>	Compliance	<b>Verdict:</b>	<b>PASS</b>
<b>Date:</b>	2/22/2011 - 2/23/2011		
<b>Temperature:</b> 24 °C	<b>Air Pressure:</b> 1012 hPa	<b>Relative Humidity:</b> 46 %	<b>Power Supply:</b> 48 VDC
<b>Remarks:</b>			

Plot 7.5.17 Spurious emission measurements in 18000 – 26500 MHz at mid carrier frequency, single output

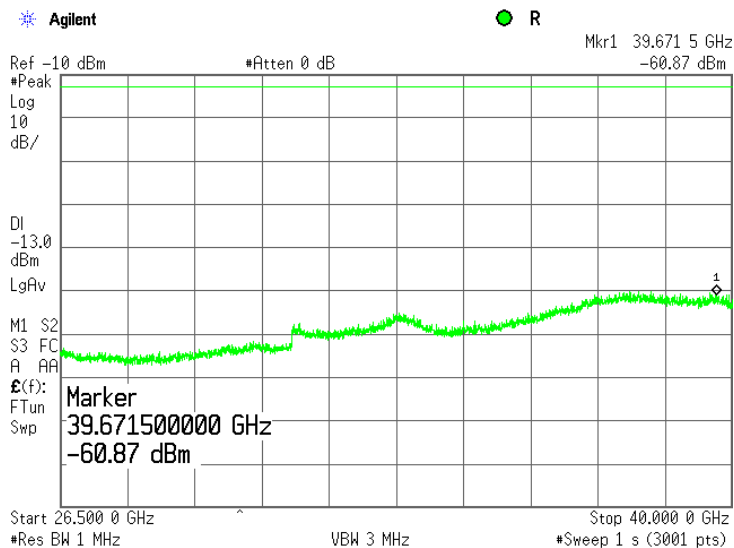


Plot 7.5.18 Spurious emission measurements in 18000 – 26500 MHz at high carrier frequency, single output

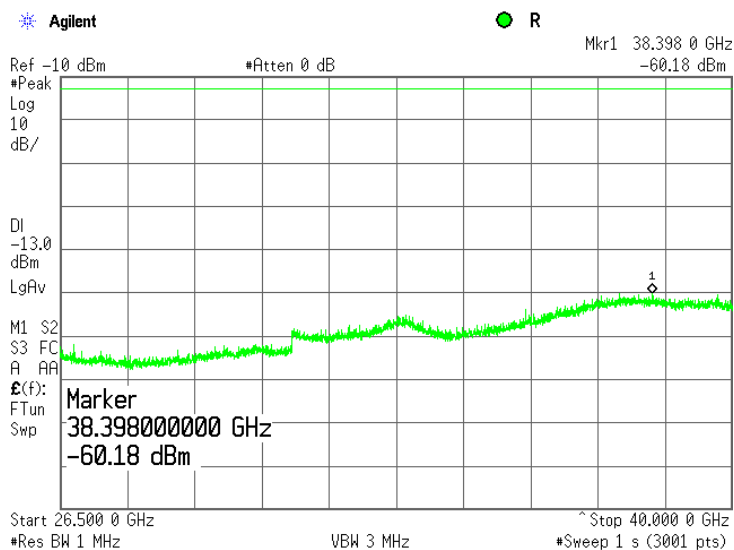


<b>Test specification:</b>	<b>Section 90.1323, Spurious emissions at RF antenna connector</b>		
<b>Test procedure:</b>	47 CFR, Sections 2.1051, 90.1323; TIA/EIA-603-C, Section 2.2.13		
<b>Test mode:</b>	Compliance	<b>Verdict:</b>	<b>PASS</b>
<b>Date:</b>	2/22/2011 - 2/23/2011		
<b>Temperature:</b> 24 °C	<b>Air Pressure:</b> 1012 hPa	<b>Relative Humidity:</b> 46 %	<b>Power Supply:</b> 48 VDC
<b>Remarks:</b>			

Plot 7.5.19 Spurious emission measurements in 26500 – 40000 MHz range at low carrier frequency, single output

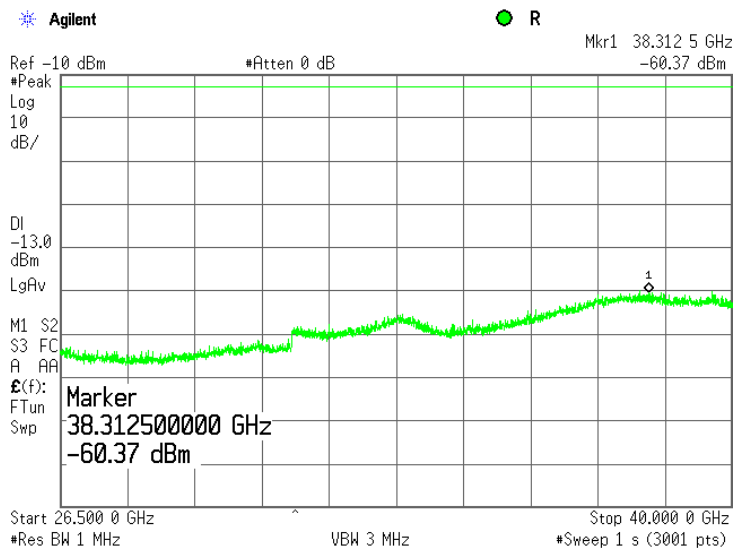


Plot 7.5.20 Spurious emission measurements in 26500 – 40000 MHz at mid carrier frequency, single output



<b>Test specification:</b>	<b>Section 90.1323, Spurious emissions at RF antenna connector</b>		
<b>Test procedure:</b>	47 CFR, Sections 2.1051, 90.1323; TIA/EIA-603-C, Section 2.2.13		
<b>Test mode:</b>	Compliance	<b>Verdict:</b>	<b>PASS</b>
<b>Date:</b>	2/22/2011 - 2/23/2011		
<b>Temperature:</b> 24 °C	<b>Air Pressure:</b> 1012 hPa	<b>Relative Humidity:</b> 46 %	<b>Power Supply:</b> 48 VDC
<b>Remarks:</b>			

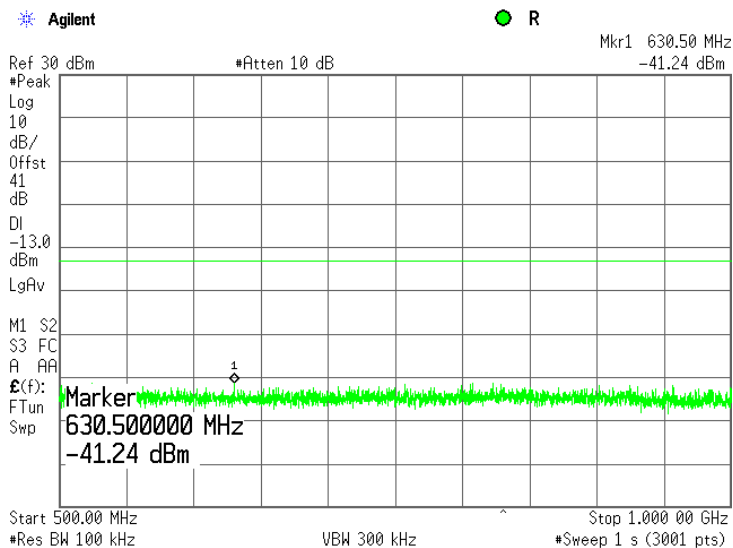
Plot 7.5.21 Spurious emission measurements in 26500 – 40000 MHz at high carrier frequency, single output



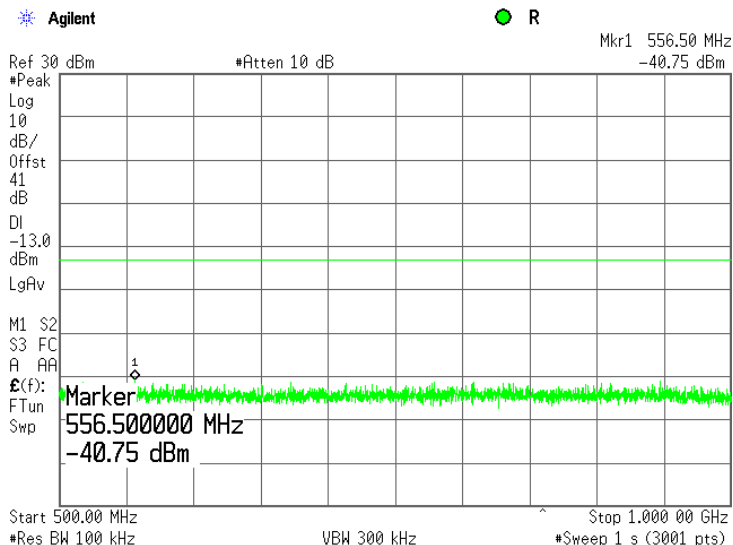


<b>Test specification:</b>	<b>Section 90.1323, Spurious emissions at RF antenna connector</b>		
<b>Test procedure:</b>	47 CFR, Sections 2.1051, 90.1323; TIA/EIA-603-C, Section 2.2.13		
<b>Test mode:</b>	Compliance	<b>Verdict:</b>	<b>PASS</b>
<b>Date:</b>	2/22/2011 - 2/23/2011		
<b>Temperature:</b> 24 °C	<b>Air Pressure:</b> 1012 hPa	<b>Relative Humidity:</b> 46 %	<b>Power Supply:</b> 48 VDC
<b>Remarks:</b>			

Plot 7.5.22 Spurious emission measurements in 500 – 1000 MHz at low carrier frequency, combined output

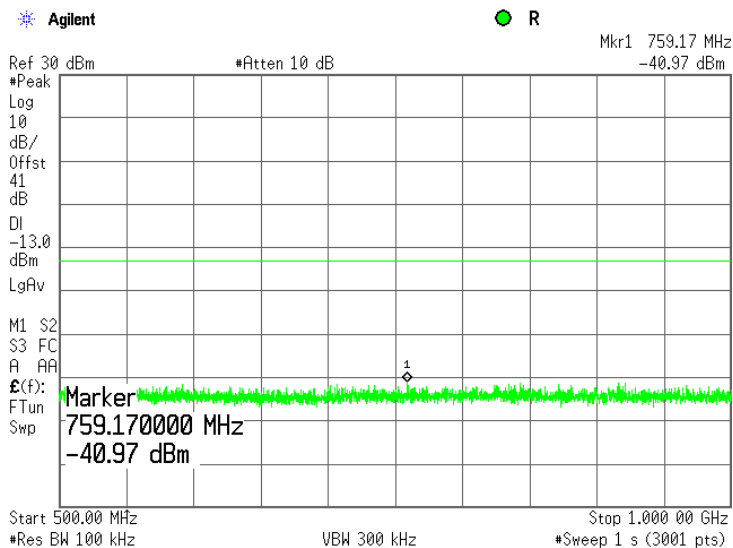


Plot 7.5.23 Spurious emission measurements in 500 – 1000 MHz at mid carrier frequency, combined output

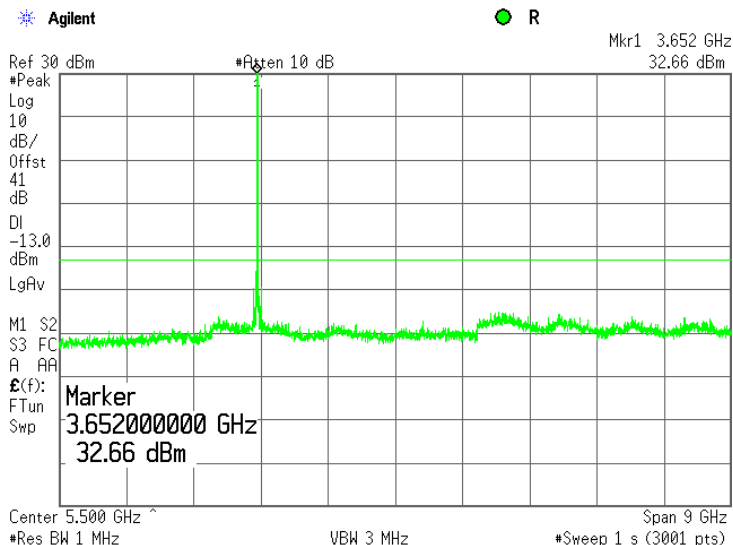


<b>Test specification:</b>	<b>Section 90.1323, Spurious emissions at RF antenna connector</b>		
<b>Test procedure:</b>	47 CFR, Sections 2.1051, 90.1323; TIA/EIA-603-C, Section 2.2.13		
<b>Test mode:</b>	Compliance	<b>Verdict:</b>	<b>PASS</b>
<b>Date:</b>	2/22/2011 - 2/23/2011		
<b>Temperature:</b> 24 °C	<b>Air Pressure:</b> 1012 hPa	<b>Relative Humidity:</b> 46 %	<b>Power Supply:</b> 48 VDC
<b>Remarks:</b>			

Plot 7.5.24 Spurious emission measurements in 500 – 1000 MHz at high carrier frequency, combined output

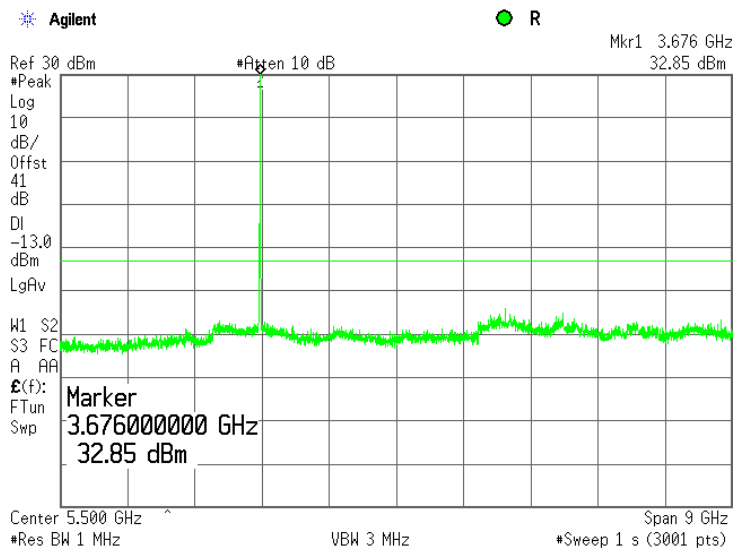


Plot 7.5.25 Spurious emission measurements in 1000 – 10000 MHz range at low carrier frequency, combined output

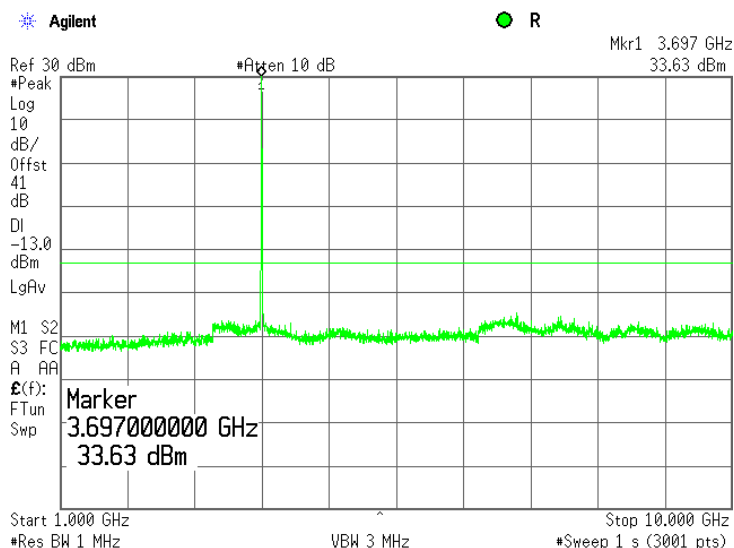


<b>Test specification:</b>	<b>Section 90.1323, Spurious emissions at RF antenna connector</b>		
<b>Test procedure:</b>	47 CFR, Sections 2.1051, 90.1323; TIA/EIA-603-C, Section 2.2.13		
<b>Test mode:</b>	Compliance	<b>Verdict:</b>	<b>PASS</b>
<b>Date:</b>	2/22/2011 - 2/23/2011		
<b>Temperature:</b> 24 °C	<b>Air Pressure:</b> 1012 hPa	<b>Relative Humidity:</b> 46 %	<b>Power Supply:</b> 48 VDC
<b>Remarks:</b>			

Plot 7.5.26 Spurious emission measurements in 1000 – 10000 MHz at mid carrier frequency, combined output

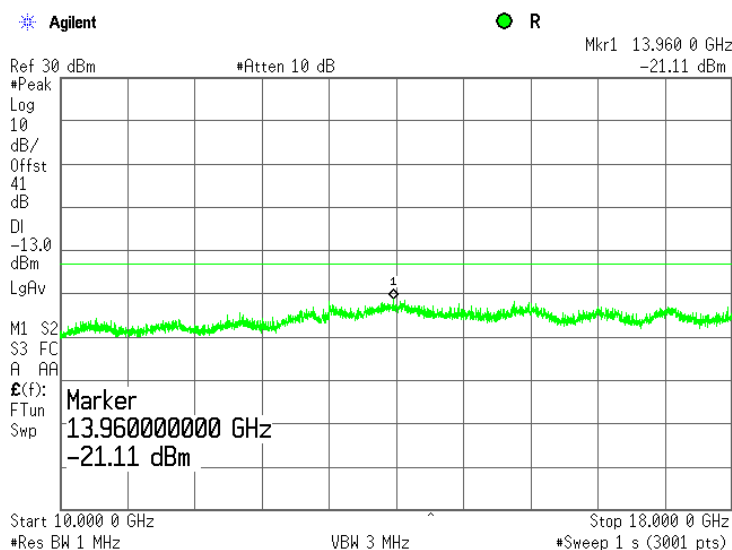


Plot 7.5.27 Spurious emission measurements in 1000 – 10000 MHz at high carrier frequency, combined output

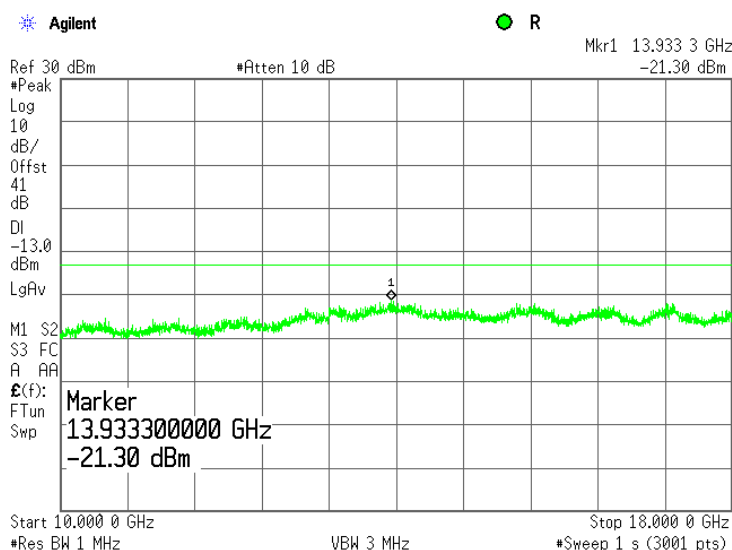


<b>Test specification:</b>	<b>Section 90.1323, Spurious emissions at RF antenna connector</b>		
<b>Test procedure:</b>	47 CFR, Sections 2.1051, 90.1323; TIA/EIA-603-C, Section 2.2.13		
<b>Test mode:</b>	Compliance	<b>Verdict:</b>	<b>PASS</b>
<b>Date:</b>	2/22/2011 - 2/23/2011		
<b>Temperature:</b> 24 °C	<b>Air Pressure:</b> 1012 hPa	<b>Relative Humidity:</b> 46 %	<b>Power Supply:</b> 48 VDC
<b>Remarks:</b>			

**Plot 7.5.28 Spurious emission measurements in 10000 – 18000 MHz range at low carrier frequency, combined output**

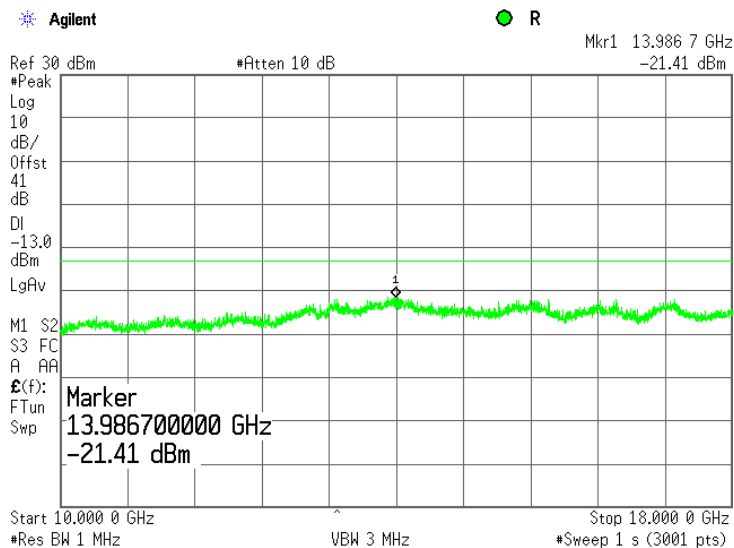


**Plot 7.5.29 Spurious emission measurements in 10000 – 18000 MHz at mid carrier frequency, combined output**



<b>Test specification:</b>	<b>Section 90.1323, Spurious emissions at RF antenna connector</b>		
<b>Test procedure:</b>	47 CFR, Sections 2.1051, 90.1323; TIA/EIA-603-C, Section 2.2.13		
<b>Test mode:</b>	Compliance	<b>Verdict:</b>	<b>PASS</b>
<b>Date:</b>	2/22/2011 - 2/23/2011		
<b>Temperature:</b> 24 °C	<b>Air Pressure:</b> 1012 hPa	<b>Relative Humidity:</b> 46 %	<b>Power Supply:</b> 48 VDC
<b>Remarks:</b>			

Plot 7.5.30 Spurious emission measurements in 10000 – 18000 MHz at high carrier frequency, combined output



<b>Test specification:</b>		<b>Section 90.1323, Radiated spurious emissions</b>	
<b>Test procedure:</b>		47 CFR, Sections 2.1053, 90.1323; TIA/EIA-603-C, Section 2.2.12	
<b>Test mode:</b>	Compliance	<b>Verdict:</b>	<b>PASS</b>
<b>Date:</b>	2/21/2011		
<b>Temperature:</b> 24 °C	<b>Air Pressure:</b> 1014 hPa	<b>Relative Humidity:</b> 50 %	<b>Power Supply:</b> 48 VDC
<b>Remarks:</b>			

## 7.6 Radiated spurious emission measurements

### 7.6.1 General

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

Table 7.6.1 Radiated spurious emission test limits

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

11-□□ - Excluding the in band emission within ± 250 % of the authorized bandwidth from the carrier

\*\* - P is transmitter output power in Watts

\*\*\* - Equivalent field strength limit was calculated from maximum allowed ERP of spurious as follows:  
 $E = \sqrt{30 \times P \times 1.64} / r$ , 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° 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° 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.

<b>Test specification:</b>		<b>Section 90.1323, Radiated spurious emissions</b>	
<b>Test procedure:</b>		47 CFR, Sections 2.1053, 90.1323; TIA/EIA-603-C, Section 2.2.12	
<b>Test mode:</b>	Compliance	<b>Verdict:</b>	<b>PASS</b>
<b>Date:</b>	2/21/2011		
<b>Temperature:</b> 24 °C	<b>Air Pressure:</b> 1014 hPa	<b>Relative Humidity:</b> 50 %	<b>Power Supply:</b> 48 VDC
<b>Remarks:</b>			

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

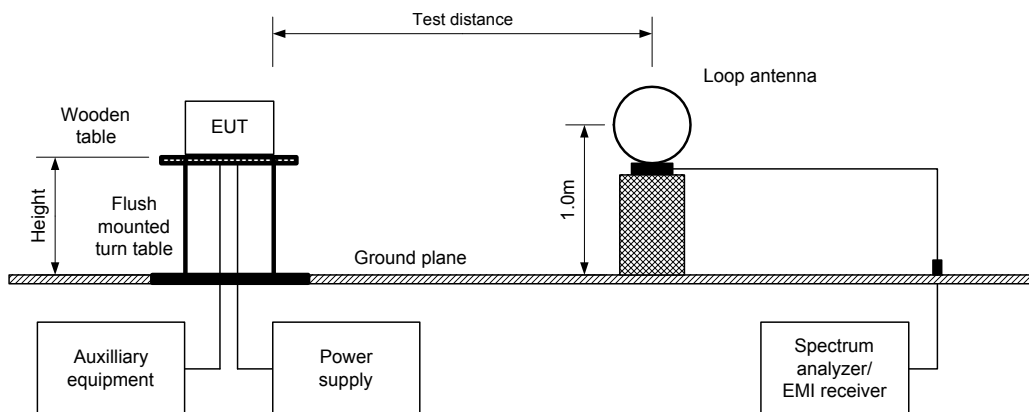
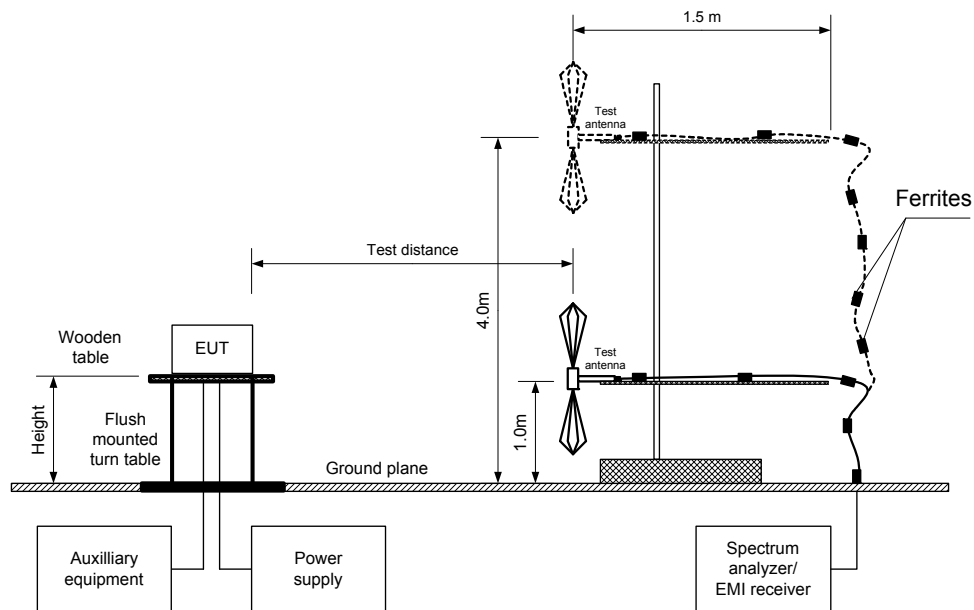


Figure 7.6.2 Setup for spurious emission field strength measurements above 30 MHz



<b>Test specification:</b>	<b>Section 90.1323, Radiated spurious emissions</b>		
<b>Test procedure:</b>	47 CFR, Sections 2.1053, 90.1323; TIA/EIA-603-C, Section 2.2.12		
<b>Test mode:</b>	Compliance	<b>Verdict:</b>	<b>PASS</b>
<b>Date:</b>	2/21/2011		
<b>Temperature:</b> 24 °C	<b>Air Pressure:</b> 1014 hPa	<b>Relative Humidity:</b> 50 %	<b>Power Supply:</b> 48 VDC
<b>Remarks:</b>			

**Table 7.6.2 Spurious emission field strength test results**

ASSIGNED FREQUENCY RANGE: 3650 – 3700MHz  
 TEST DISTANCE: 3 m  
 TEST SITE: Semi anechoic chamber  
 EUT HEIGHT: 0.8 m  
 INVESTIGATED FREQUENCY RANGE: 0.009 – 37000MHz  
 DETECTOR USED: Peak  
 VIDEO BANDWIDTH: > Resolution bandwidth  
 TEST ANTENNA TYPE: Active loop (9 kHz – 30 MHz)  
 Biconilog (30 MHz – 1000 MHz)  
 Double ridged guide (above 1000 MHz)  
 MODULATION: 64QAM  
 MODULATING SIGNAL: PRBS  
 BIT RATE: 8.48Mbps (@5MHz CBW)  
 TRANSMITTER OUTPUT POWER SETTINGS: Maximum

Frequency, MHz	Field strength, dB(μV/m)	Limit, dB(μV/m)	Margin, dB*	RBW, kHz	Antenna polarization	Antenna height, m	Turn-table position**, degrees
<b>Low carrier frequency MHz</b>							
No emissions were found							
<b>Mid carrier frequency MHz</b>							
No emissions were found							
<b>High carrier frequency MHz</b>							
No emissions were found							

\*- Margin = Field strength of spurious – calculated field strength limit.

\*\* - EUT front panel refers to 0 degrees position of turntable.

**Reference numbers of test equipment used**

HL 0446	HL 0521	HL 0604	HL 0768	HL 0769	HL 1984	HL 2870	HL 2909
HL 3123	HL 3883						

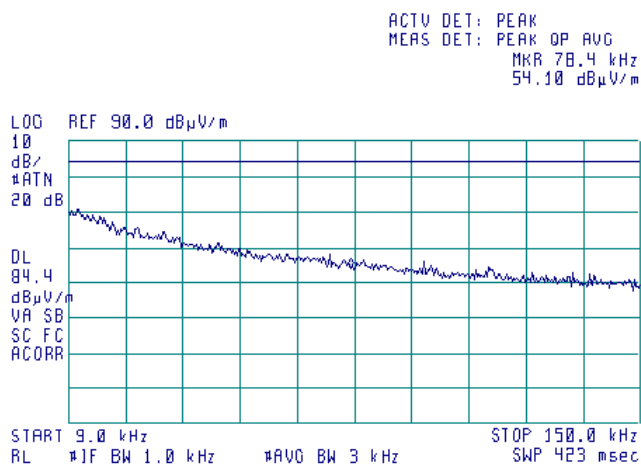
Full description is given in Appendix A.



<b>Test specification:</b>		<b>Section 90.1323, Radiated spurious emissions</b>	
<b>Test procedure:</b>		47 CFR, Sections 2.1053, 90.1323; TIA/EIA-603-C, Section 2.2.12	
<b>Test mode:</b>		Compliance	<b>Verdict:</b> PASS
<b>Date:</b>		2/21/2011	
<b>Temperature:</b> 24 °C	<b>Air Pressure:</b> 1014 hPa	<b>Relative Humidity:</b> 50 %	<b>Power Supply:</b> 48 VDC
<b>Remarks:</b>			

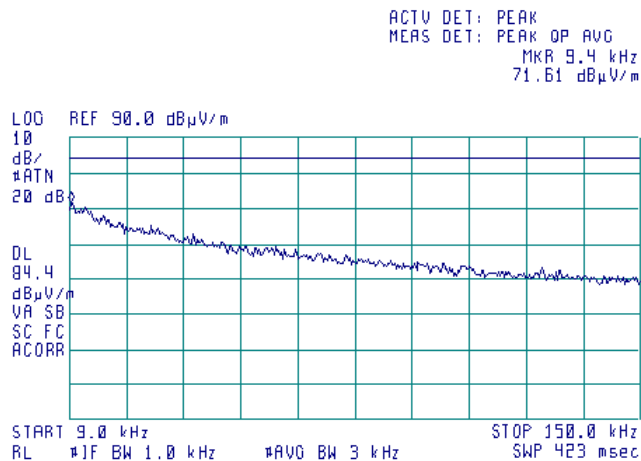
**Plot 7.6.1 Radiated emission measurements in 9 – 150 kHz range**

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



**Plot 7.6.2 Radiated emission measurements in 9 – 150 kHz range**

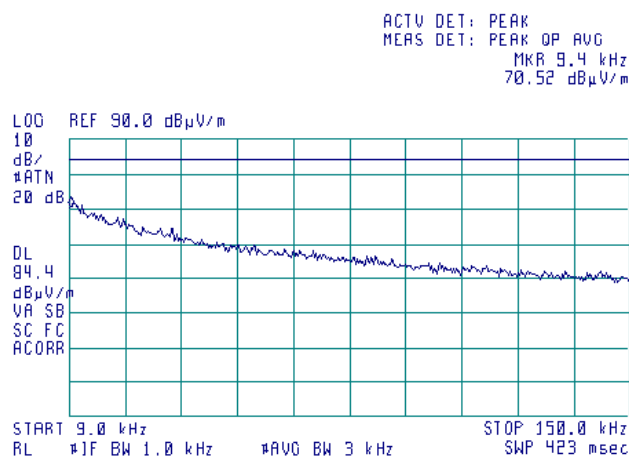
TEST SITE: Semi anechoic chamber  
CARRIER FREQUENCY: Mid  
ANTENNA POLARIZATION: Vertical and Horizontal  
TEST DISTANCE: 3 m



<b>Test specification:</b>	<b>Section 90.1323, Radiated spurious emissions</b>		
<b>Test procedure:</b>	47 CFR, Sections 2.1053, 90.1323; TIA/EIA-603-C, Section 2.2.12		
<b>Test mode:</b>	Compliance	<b>Verdict:</b>	<b>PASS</b>
<b>Date:</b>	2/21/2011		
<b>Temperature:</b> 24 °C	<b>Air Pressure:</b> 1014 hPa	<b>Relative Humidity:</b> 50 %	<b>Power Supply:</b> 48 VDC
<b>Remarks:</b>			

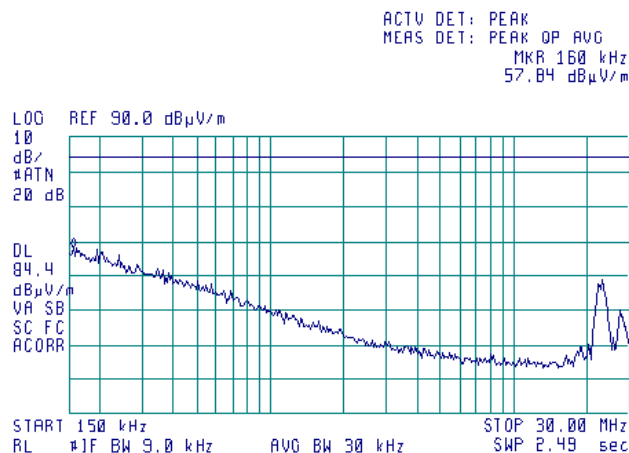
**Plot 7.6.3 Radiated emission measurements in 9 – 150 kHz range**

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



**Plot 7.6.4 Radiated emission measurements in 0.15 – 30 MHz range**

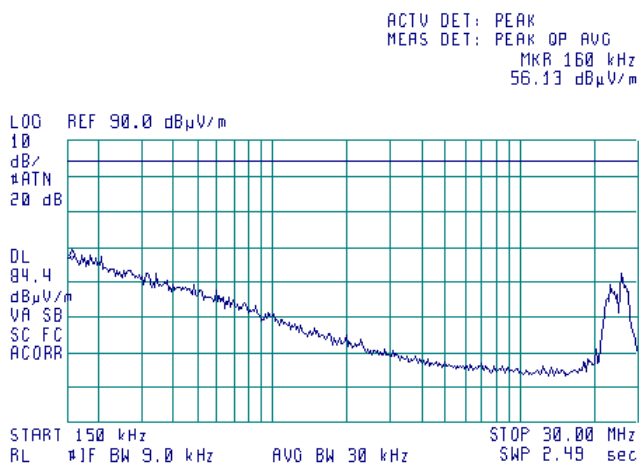
TEST SITE: Semi anechoic chamber  
CARRIER FREQUENCY: Low  
ANTENNA POLARIZATION: Vertical and Horizontal  
TEST DISTANCE: 3 m



<b>Test specification:</b>	<b>Section 90.1323, Radiated spurious emissions</b>		
<b>Test procedure:</b>	47 CFR, Sections 2.1053, 90.1323; TIA/EIA-603-C, Section 2.2.12		
<b>Test mode:</b>	Compliance	<b>Verdict:</b>	<b>PASS</b>
<b>Date:</b>	2/21/2011		
<b>Temperature:</b> 24 °C	<b>Air Pressure:</b> 1014 hPa	<b>Relative Humidity:</b> 50 %	<b>Power Supply:</b> 48 VDC
<b>Remarks:</b>			

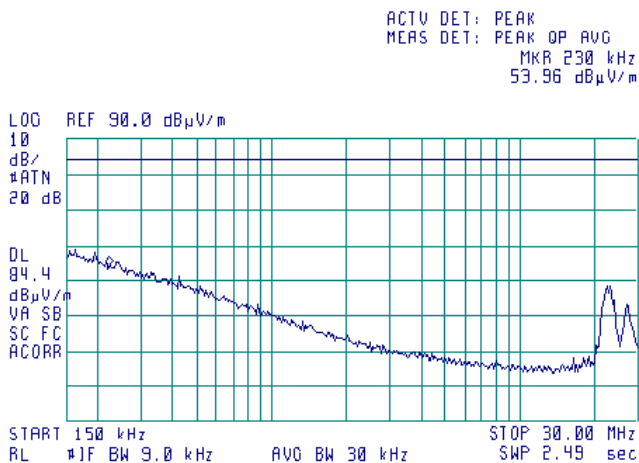
**Plot 7.6.5 Radiated emission measurements in 0.15 – 30 MHz range**

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



**Plot 7.6.6 Radiated emission measurements in 0.15 – 30 MHz range**

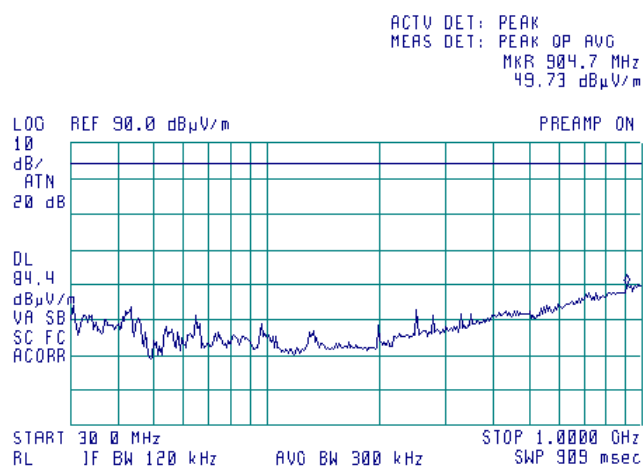
TEST SITE: Semi anechoic chamber  
CARRIER FREQUENCY: High  
ANTENNA POLARIZATION: Vertical and Horizontal  
TEST DISTANCE: 3 m



<b>Test specification:</b>		<b>Section 90.1323, Radiated spurious emissions</b>	
<b>Test procedure:</b>		47 CFR, Sections 2.1053, 90.1323; TIA/EIA-603-C, Section 2.2.12	
<b>Test mode:</b>		Compliance	<b>Verdict:</b> PASS
<b>Date:</b>		2/21/2011	
<b>Temperature:</b> 24 °C	<b>Air Pressure:</b> 1014 hPa	<b>Relative Humidity:</b> 50 %	<b>Power Supply:</b> 48 VDC
<b>Remarks:</b>			

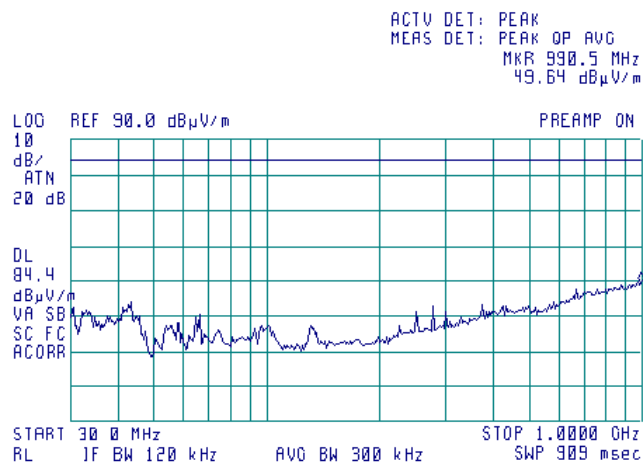
**Plot 7.6.7 Radiated emission measurements in 30 – 1000 MHz range**

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



**Plot 7.6.8 Radiated emission measurements in 30 – 1000 MHz range**

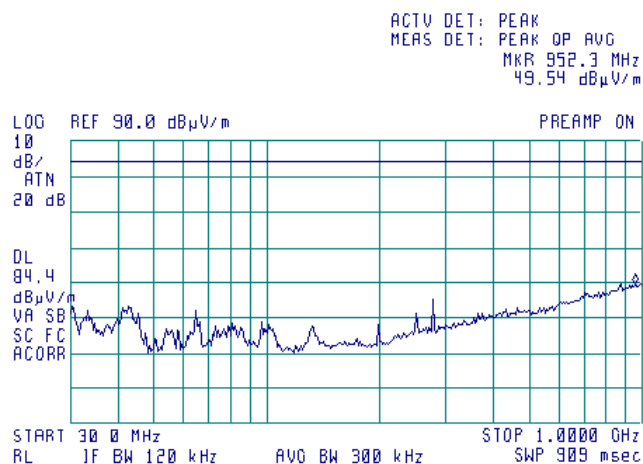
TEST SITE: Semi anechoic chamber  
CARRIER FREQUENCY: Mid  
ANTENNA POLARIZATION: Vertical and Horizontal  
TEST DISTANCE: 3 m



<b>Test specification:</b>	<b>Section 90.1323, Radiated spurious emissions</b>		
<b>Test procedure:</b>	47 CFR, Sections 2.1053, 90.1323; TIA/EIA-603-C, Section 2.2.12		
<b>Test mode:</b>	Compliance	<b>Verdict:</b>	<b>PASS</b>
<b>Date:</b>	2/21/2011		
<b>Temperature:</b> 24 °C	<b>Air Pressure:</b> 1014 hPa	<b>Relative Humidity:</b> 50 %	<b>Power Supply:</b> 48 VDC
<b>Remarks:</b>			

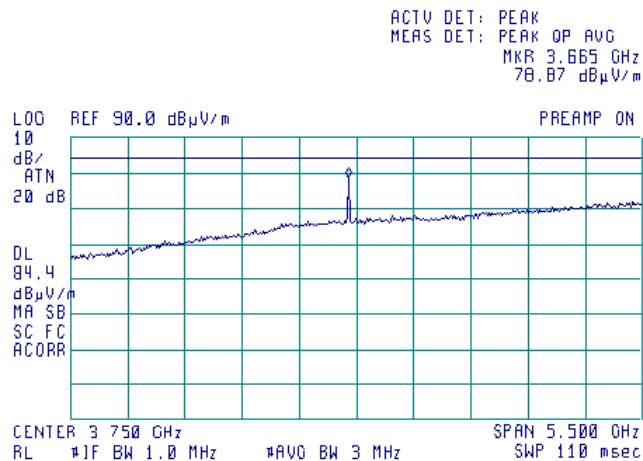
**Plot 7.6.9 Radiated emission measurements in 30 – 1000 MHz range**

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



**Plot 7.6.10 Radiated emission measurements in 1000 – 6500 MHz range**

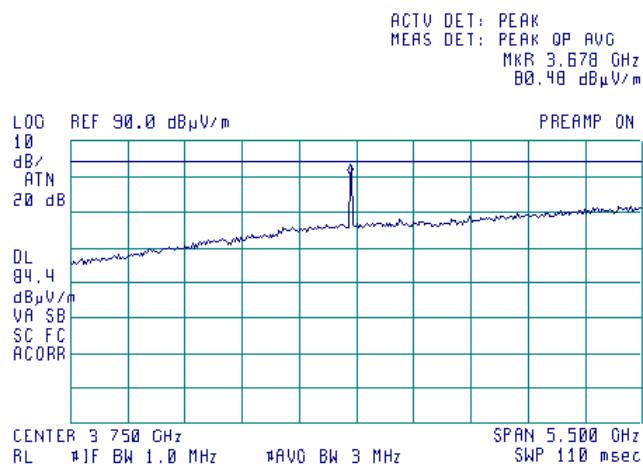
TEST SITE: Semi anechoic chamber  
CARRIER FREQUENCY: Low  
ANTENNA POLARIZATION: Vertical and Horizontal  
TEST DISTANCE: 3 m



<b>Test specification:</b>	<b>Section 90.1323, Radiated spurious emissions</b>		
<b>Test procedure:</b>	47 CFR, Sections 2.1053, 90.1323; TIA/EIA-603-C, Section 2.2.12		
<b>Test mode:</b>	Compliance	<b>Verdict:</b>	<b>PASS</b>
<b>Date:</b>	2/21/2011		
<b>Temperature:</b> 24 °C	<b>Air Pressure:</b> 1014 hPa	<b>Relative Humidity:</b> 50 %	<b>Power Supply:</b> 48 VDC
<b>Remarks:</b>			

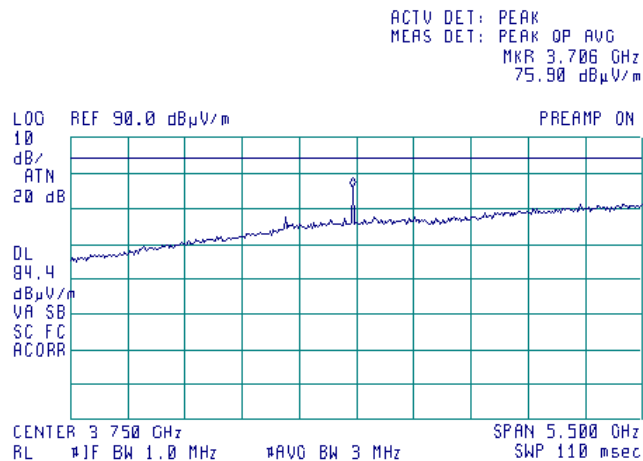
Plot 7.6.11 Radiated emission measurements in 1000 – 6500 MHz range

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



Plot 7.6.12 Radiated emission measurements in 1000 – 6500 MHz range

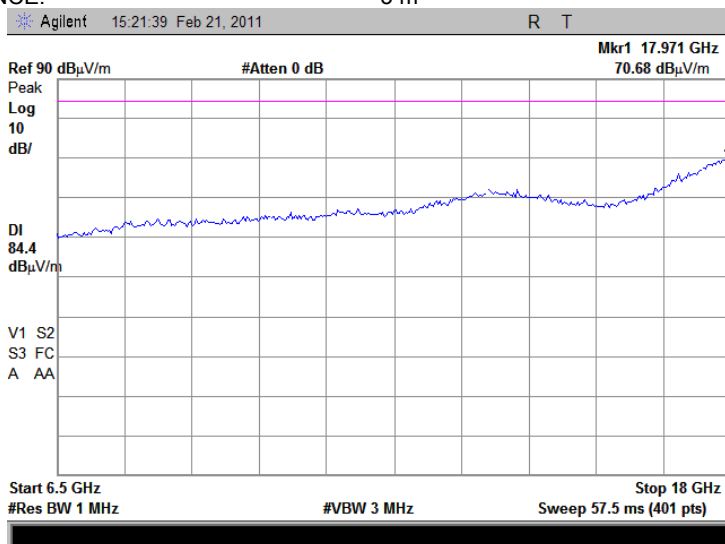
TEST SITE: Semi anechoic chamber  
CARRIER FREQUENCY: High  
ANTENNA POLARIZATION: Vertical and Horizontal  
TEST DISTANCE: 3 m



<b>Test specification:</b>		<b>Section 90.1323, Radiated spurious emissions</b>	
<b>Test procedure:</b>		47 CFR, Sections 2.1053, 90.1323; TIA/EIA-603-C, Section 2.2.12	
<b>Test mode:</b>		Compliance	<b>Verdict:</b> PASS
<b>Date:</b>		2/21/2011	
<b>Temperature:</b> 24 °C	<b>Air Pressure:</b> 1014 hPa	<b>Relative Humidity:</b> 50 %	<b>Power Supply:</b> 48 VDC
<b>Remarks:</b>			

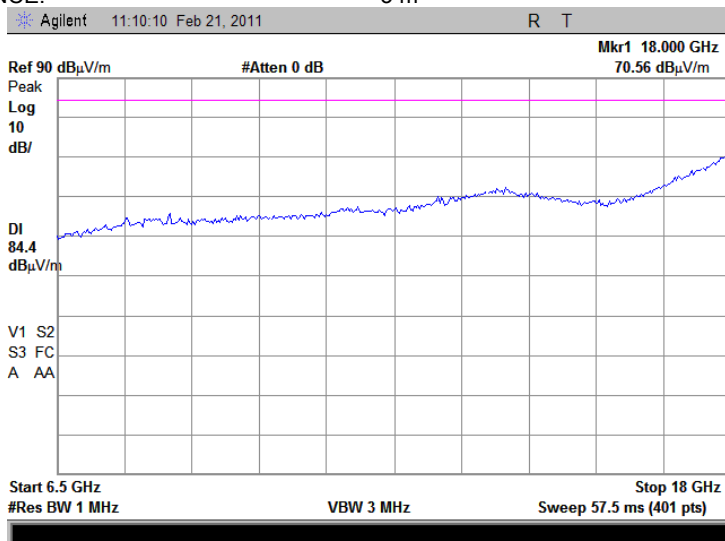
**Plot 7.6.13 Radiated emission measurements in 6500 – 18000 MHz range**

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



**Plot 7.6.14 Radiated emission measurements in 6500 – 18000 MHz range**

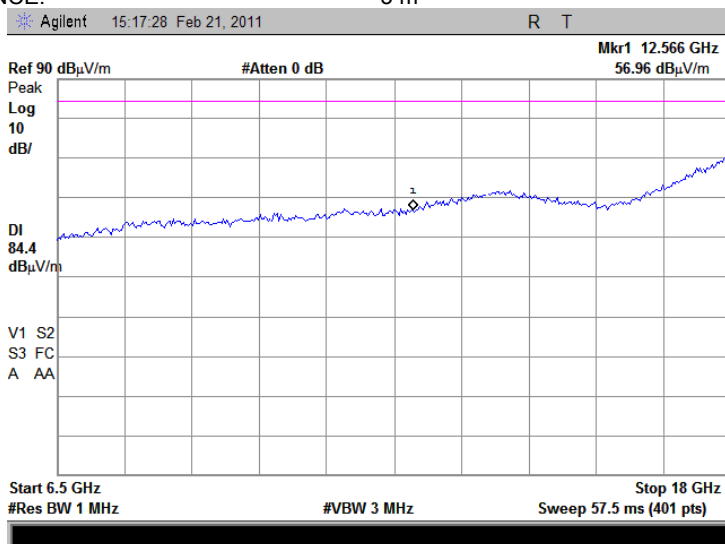
TEST SITE: Semi anechoic chamber  
CARRIER FREQUENCY: Mid  
ANTENNA POLARIZATION: Vertical and Horizontal  
TEST DISTANCE: 3 m



<b>Test specification:</b>		<b>Section 90.1323, Radiated spurious emissions</b>	
<b>Test procedure:</b>		47 CFR, Sections 2.1053, 90.1323; TIA/EIA-603-C, Section 2.2.12	
<b>Test mode:</b>		Compliance	<b>Verdict:</b> PASS
<b>Date:</b>		2/21/2011	
<b>Temperature:</b> 24 °C	<b>Air Pressure:</b> 1014 hPa	<b>Relative Humidity:</b> 50 %	<b>Power Supply:</b> 48 VDC
<b>Remarks:</b>			

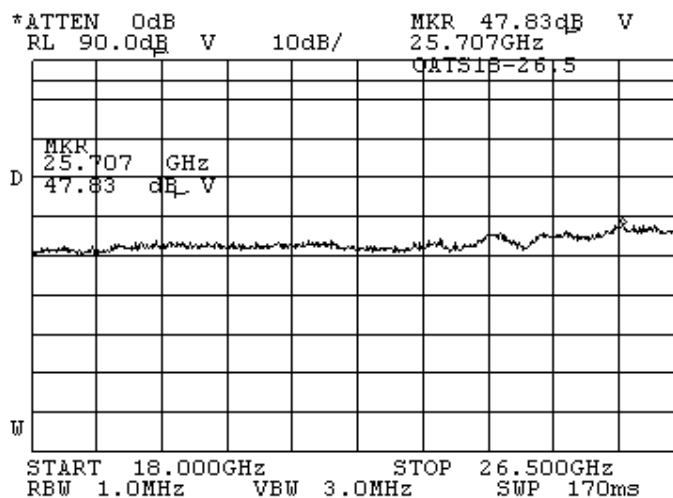
**Plot 7.6.15 Radiated emission measurements in 6500 – 18000 MHz range**

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



**Plot 7.6.16 Radiated emission measurements in 18000 – 26500 MHz range**

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

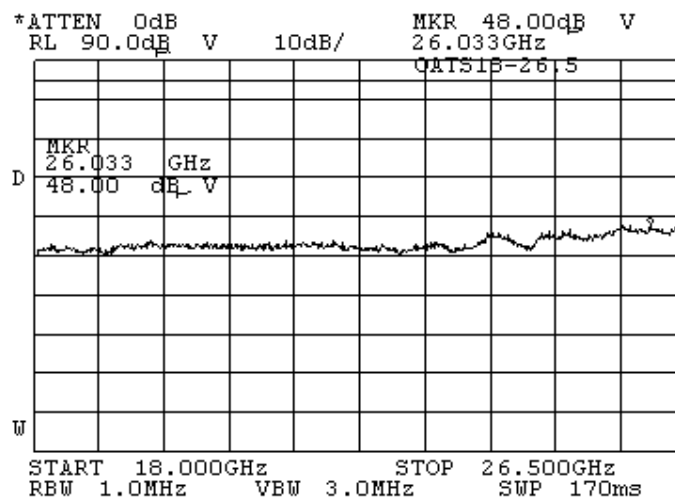




<b>Test specification:</b>		<b>Section 90.1323, Radiated spurious emissions</b>	
<b>Test procedure:</b>		47 CFR, Sections 2.1053, 90.1323; TIA/EIA-603-C, Section 2.2.12	
<b>Test mode:</b>		Compliance	<b>Verdict:</b> PASS
<b>Date:</b>		2/21/2011	
<b>Temperature:</b> 24 °C	<b>Air Pressure:</b> 1014 hPa	<b>Relative Humidity:</b> 50 %	<b>Power Supply:</b> 48 VDC
<b>Remarks:</b>			

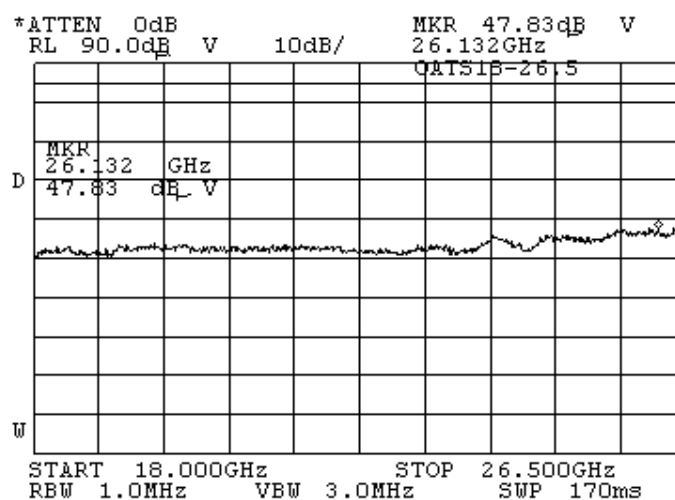
Plot 7.6.17 Radiated emission measurements in 18000 – 26500 MHz range

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



Plot 7.6.18 Radiated emission measurements in 18000 – 26500 MHz range

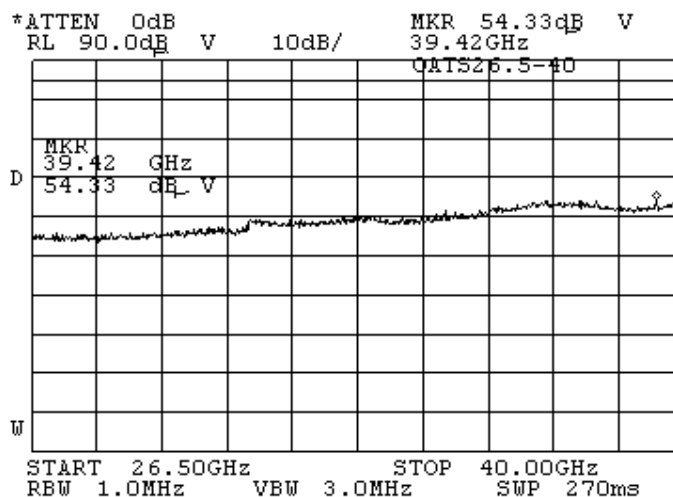
TEST SITE: OATS  
CARRIER FREQUENCY: High  
ANTENNA POLARIZATION: Vertical and Horizontal  
TEST DISTANCE: 3 m



<b>Test specification:</b>		<b>Section 90.1323, Radiated spurious emissions</b>	
<b>Test procedure:</b>		47 CFR, Sections 2.1053, 90.1323; TIA/EIA-603-C, Section 2.2.12	
<b>Test mode:</b>		Compliance	<b>Verdict:</b> PASS
<b>Date:</b>		2/21/2011	
<b>Temperature:</b> 24 °C	<b>Air Pressure:</b> 1014 hPa	<b>Relative Humidity:</b> 50 %	<b>Power Supply:</b> 48 VDC
<b>Remarks:</b>			

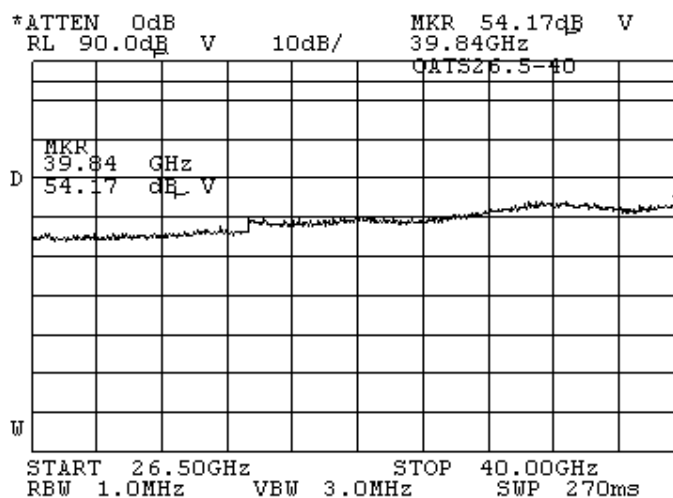
Plot 7.6.19 Radiated emission measurements in 26500 – 37000 MHz range

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



Plot 7.6.20 Radiated emission measurements in 26500 – 37000 MHz range

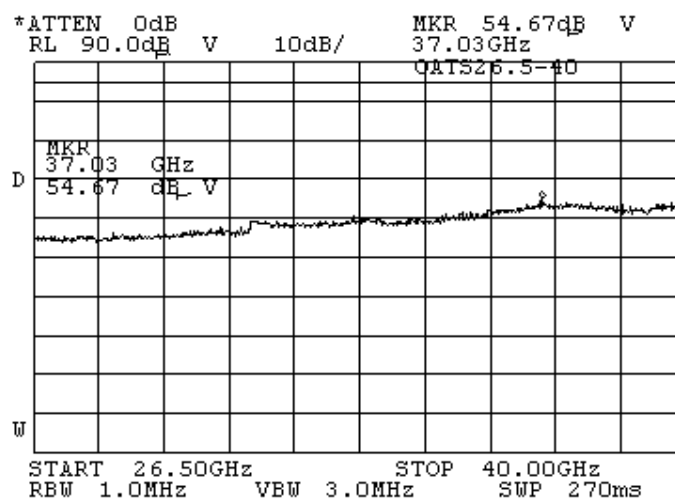
TEST SITE: OATS  
CARRIER FREQUENCY: Mid  
ANTENNA POLARIZATION: Vertical and Horizontal  
TEST DISTANCE: 3 m



<b>Test specification:</b>		<b>Section 90.1323, Radiated spurious emissions</b>	
<b>Test procedure:</b>		47 CFR, Sections 2.1053, 90.1323; TIA/EIA-603-C, Section 2.2.12	
<b>Test mode:</b>	Compliance	<b>Verdict:</b>	<b>PASS</b>
<b>Date:</b>	2/21/2011		
<b>Temperature:</b> 24 °C	<b>Air Pressure:</b> 1014 hPa	<b>Relative Humidity:</b> 50 %	<b>Power Supply:</b> 48 VDC
<b>Remarks:</b>			

Plot 7.6.21 Radiated emission measurements in 26500 – 37000 MHz range

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



<b>Test specification:</b>		<b>Section 90.213, Frequency stability</b>	
<b>Test procedure:</b>		47 CFR, Section 2.1055; TIA/EIA-603-C Section 2.2.2	
<b>Test mode:</b>	Compliance	<b>Verdict:</b>	<b>PASS</b>
<b>Date:</b>	2/20/2011		
<b>Temperature:</b> 24 °C	<b>Air Pressure:</b> 1008 hPa	<b>Relative Humidity:</b> 45 %	<b>Power Supply:</b> 120 VAC
<b>Remarks:</b>			

## 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.

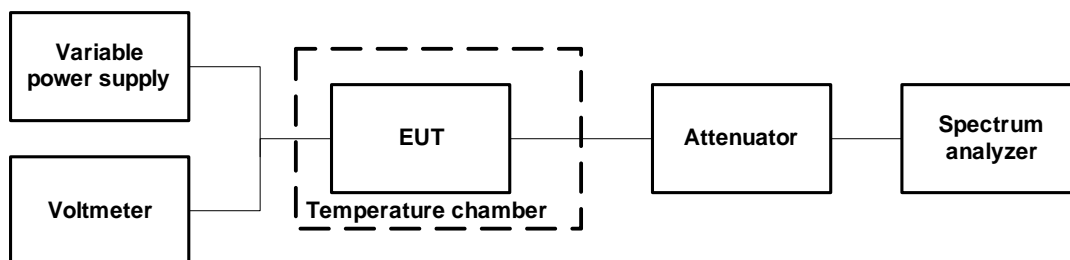
Table 7.7.1 Frequency stability limits

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	

### 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 7.7.2.

Figure 7.7.1 Frequency stability test setup



<b>Test specification:</b>	<b>Section 90.213, Frequency stability</b>		
<b>Test procedure:</b>	47 CFR, Section 2.1055; TIA/EIA-603-C Section 2.2.2		
<b>Test mode:</b>	Compliance	<b>Verdict:</b>	<b>PASS</b>
<b>Date:</b>	2/20/2011		
<b>Temperature:</b> 24 °C	<b>Air Pressure:</b> 1008 hPa	<b>Relative Humidity:</b> 45 %	<b>Power Supply:</b> 120 VAC
<b>Remarks:</b>			

Table 7.7.2 Frequency stability test results

ASSIGNED FREQUENCY RANGE: 3650.0 – 3700.0 MHz  
 NOMINAL POWER VOLTAGE: 120 VAC (at the PoE adapter power port)  
 TEMPERATURE STABILIZATION PERIOD: 20 min  
 POWER DURING TEMPERATURE TRANSITION: Off  
 SPECTRUM ANALYZER MODE: Counter  
 RESOLUTION BANDWIDTH: 100Hz  
 VIDEO BANDWIDTH: 300Hz  
 MODULATION: Unmodulated

T, °C		Voltage, VDC	Frequency, MHz							Max frequency drift, Hz		Max frequency drift, ppm	
			Start up	1 <sup>st</sup> min	2 <sup>nd</sup> min	3 <sup>rd</sup> min	4 <sup>th</sup> min	5 <sup>th</sup> min	10 <sup>th</sup> min	Positive	Negative	Positive	Negative
Low channel													
-30	120	3652.496035	3652.497259	3652.497277	3652.497285	3652.497293	3652.497297	3652.497312	0.00	-3020.00	0.00	-0.83	
-20	120	3652.498369	NA	NA	NA	NA	NA	3652.498638	0.00	-686.00	0.00	-0.19	
-10	120	3652.498907	NA	NA	NA	NA	NA	3652.499105	50.00	-148.00	0.01	-0.04	
0	120	3652.499604	NA	NA	NA	NA	NA	3652.499794	739.00	0.00	0.20	0.00	
10	120	3652.499930	NA	NA	NA	NA	NA	3652.499982	927.00	0.00	0.25	0.00	
20	138.0	3652.498982	NA	NA	NA	NA	NA	3652.499053	0.00	-73.00	0.00	-0.02	
20	120.0	3652.499046	NA	NA	NA	NA	NA	3652.499055*	0.00	-9.00	0.00	0.00	
20	102.0	3652.499015	NA	NA	NA	NA	NA	3652.499055	0.00	-40.00	0.00	-0.01	
30	120	3652.498515	3652.498509	3652.498502	3652.498499	3652.498494	3652.498493	3652.498478	0.00	-577.40	0.00	-0.16	
40	120	3652.498160	NA	NA	NA	NA	NA	3652.498138	0.00	-917.00	0.00	-0.25	
50	120	3652.497871	NA	NA	NA	NA	NA	3652.497581	0.00	-1474.00	0.00	-0.40	
Mid channel													
-30	120	3674.997208	3674.997290	3674.997304	3674.997305	3674.997306	3674.997315	3674.997312	0.00	-1847.50	0.00	-0.50	
-20	120	3674.998249	NA	NA	NA	NA	NA	3674.998626	0.00	-806.50	0.00	-0.22	
-10	120	3674.998901	NA	NA	NA	NA	NA	3674.999144	88.50	-154.50	0.02	-0.04	
0	120	3674.999431	NA	NA	NA	NA	NA	3674.999795	739.50	0.00	0.20	0.00	
10	120	3674.999915	NA	NA	NA	NA	NA	3674.999972	916.50	0.00	0.25	0.00	
20	138.0	3674.999066	NA	NA	NA	NA	NA	3674.999051	10.10	-4.50	0.00	0.00	
20	120.0	3674.999005	NA	NA	NA	NA	NA	3674.999056*	0.00	-50.30	0.00	-0.01	
20	102.0	3674.999069	NA	NA	NA	NA	NA	3674.999062	13.50	0.00	0.00	0.00	
30	120	3674.998478	3674.998478	3674.998477	3674.998475	3674.998473	3674.998473	3674.998459	0.00	-596.90	0.00	-0.16	
40	120	3674.998316	NA	NA	NA	NA	NA	3674.998221	0.00	-834.50	0.00	-0.23	
50	120	3674.997527	NA	NA	NA	NA	NA	3674.997473	0.00	-1582.50	0.00	-0.43	
High channel													
-30	120	3697.497100	3697.497264	3697.497254	3697.497251	3697.497260	3697.497258	3697.497258	0.00	-1924.80	0.00	-0.52	
-20	120	3697.498180	NA	NA	NA	NA	NA	3697.498565	0.00	-844.80	0.00	-0.23	
-10	120	3697.498871	NA	NA	NA	NA	NA	3697.499138	113.20	-153.80	0.03	-0.04	
0	120	3697.499318	NA	NA	NA	NA	NA	3697.499699	674.20	0.00	0.18	0.00	
10	120	3697.499890	NA	NA	NA	NA	NA	3697.499929	904.20	0.00	0.24	0.00	
20	138.0	3697.499059	NA	NA	NA	NA	NA	3697.499032	34.60	0.00	0.01	0.00	
20	120.0	3697.499094	NA	NA	NA	NA	NA	3697.499025*	69.50	0.00	0.02	0.00	
20	102.0	3697.499042	NA	NA	NA	NA	NA	3697.499023	17.50	-1.70	0.00	0.00	
30	120	3697.498432	3697.498433	3697.498433	3697.498431	3697.498433	3697.498431	3697.498425	0.00	-600.00	0.00	-0.16	
40	120	3697.498800	NA	NA	NA	NA	NA	3697.498305	0.00	-719.80	0.00	-0.19	
50	120	3697.497422	NA	NA	NA	NA	NA	3697.497422	0.00	-1602.80	0.00	-0.43	

\* - Reference frequency

Note1: As no limit is specified by the standard for 3650.0 – 3700.0 MHz band the worst case test results are given for information purpose only.

**Reference numbers of test equipment used**

HL 0493	HL 2951	HL 3440	HL 3784	HL 3818			
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Full description is given in Appendix A.

<b>Test specification:</b>		<b>Section 90.203 (o)/RSS-197 Section 5.4, Contention based protocol</b>	
<b>Test procedure:</b>			
<b>Test mode:</b>	Compliance	<b>Verdict:</b> PASS	
<b>Date:</b>	2/15/2011		
<b>Temperature:</b> 23.2°C	<b>Air Pressure:</b> 1007 hPa	<b>Relative Humidity:</b> 46 %	<b>Power Supply:</b> 48 VDC
<b>Remarks:</b>			

## 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 Pico 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 equipped with "listen before transmit" function that performs channel measurements across transmission bandwidth at the beginning of each downlink frame prior to transmission.

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

The EUT RSL turn-off level is operator/user defined and Backoff frame parameter is randomly chosen by the Pico Base station.

### 8.2 Test procedure

The EUT is equipped with two Tx/Rx chains. As both transmit chains operate simultaneously and only Tx1/Rx1 chain is equipped with contention-based protocol function the test was performed while interferer signal is injected in Tx<sub>1</sub>/Rx<sub>1</sub> port, the EUT operation monitored by a spectrum analyzer connected to the Tx<sub>2</sub>/Rx<sub>2</sub> port.

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

The signal generator was connected as shown in Figure 8.1.1, an interferer signal was generated. The EUT response was monitored and reported in Table 8.2.1.

Plot 8.2.1 and Plot 8.2.2 show an example of the EUT transmission operation while detecting an interferer signal at its RSL turn-off level.

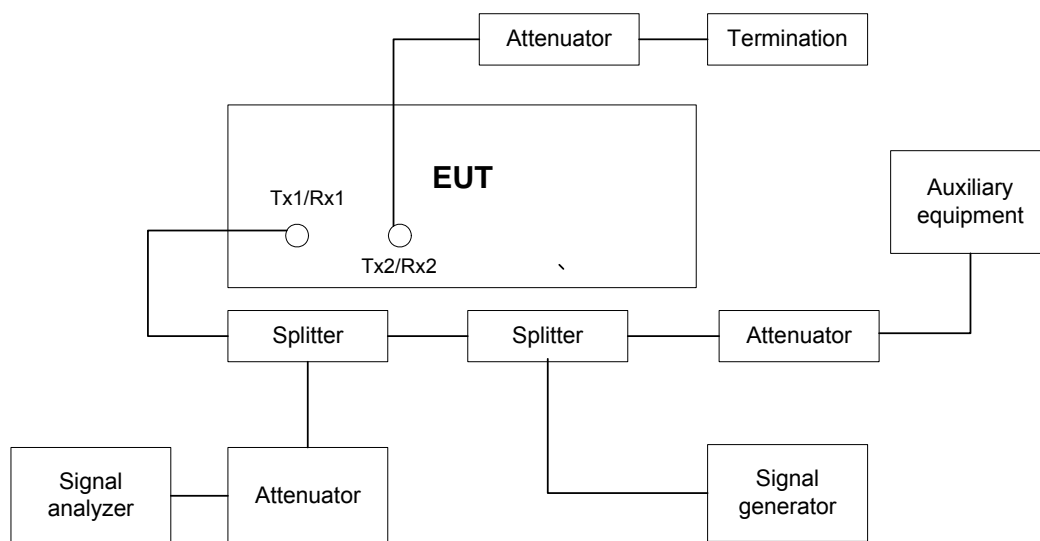
The combination of EUT transmission bandwidth, channel, interferer signal type and level was chosen according to Table 8.2.1.

The CW interferer signal was continuously injected to the receiver input.

The OFDMA interferer signal parameters are shown in Plot 8.2.3 and Plot 8.2.4.

<b>Test specification:</b>		<b>Section 90.203 (o)/RSS-197 Section 5.4, Contention based protocol</b>	
<b>Test procedure:</b>			
<b>Test mode:</b>	Compliance	<b>Verdict:</b> <b>PASS</b>	
<b>Date:</b>	2/15/2011		
<b>Temperature:</b> 23.2°C	<b>Air Pressure:</b> 1007 hPa	<b>Relative Humidity:</b> 46 %	<b>Power Supply:</b> 48 VDC
<b>Remarks:</b>			

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



<b>Test specification:</b>		<b>Section 90.203 (o)/RSS-197 Section 5.4, Contention based protocol</b>			
<b>Test procedure:</b>					
<b>Test mode:</b>	Compliance		<b>Verdict:</b> PASS		
<b>Date:</b>	2/15/2011				
<b>Temperature:</b> 23.2°C	<b>Air Pressure:</b> 1007 hPa		<b>Relative Humidity:</b> 46 %	<b>Power Supply:</b> 48 VDC	
<b>Remarks:</b>					

Table 8.2.1 Contention based protocol test results

INTERFERER SIGNAL INJECTION:  
EUT TRANSMISSION MONITORING:

To port Tx<sub>1</sub>/Rx<sub>1</sub>  
At port Tx<sub>1</sub>/Rx<sub>1</sub>

Test number	Wanted signal characteristics		RSL turn-off level settings, dBm	Interferer signal characteristics			Results		
	Channel frequency, MHz	Channel bandwidth, MHz		Frequency, MHz	Modulation	Level, dBm	Interference detection	Tx OFF time, ms**	Verdict
1	3652.5	5	-65	3650.5	CW	-65	Yes	NA***	Pass
2	3652.5		-65	3650.5	CW	-70	No	NA	Pass
3	3652.5		-85	3650.5	CW	-85	Yes	NA***	Pass
4	3652.5		-85	3650.5	CW	-90	No	NA	Pass
1	3652.5		-65	3654.5	CW	-65	Yes	NA***	Pass
2	3652.5		-65	3654.5	CW	-70	No	NA	Pass
3	3652.5		-85	3654.5	CW	-85	Yes	NA***	Pass
4	3652.5		-85	3654.5	CW	-90	No	NA	Pass
1	3652.5		-65	3655	CW	-65	Yes	NA***	Pass
2	3652.5		-65	3655	CW	-70	No	NA	Pass
3	3652.5		-85	3655	CW	-85	Yes	NA***	Pass
4	3652.5		-85	3655	CW	-90	No	NA	Pass
5	3675.0		-65	3672.5	CW	-65	Yes	445	Pass
6	3675.0		-65	3672.5	CW	-70	No	NA	Pass
7	3675.0		-85	3672.5	CW	-85	Yes	445	Pass
8	3675.0		-85	3672.5	CW	-90	No	NA	Pass
9	3675.0		-85	3675.0	OFDMA	-85	Yes	452.5	Pass
10	3675.0		-65	3677.5	CW	-65	Yes	450	Pass
11	3675.0		-65	3677.5	CW	-70	No	NA	Pass
12	3675.0		-85	3677.5	CW	-85	Yes	450	Pass
13	3675.0		-85	3677.5	CW	-90	No	NA	Pass
14	3697.5		-65	3695	CW	-65	Yes	447.5	Pass
15	3697.5		-65	3695	CW	-70	No	NA	Pass
16	3697.5		-85	3695	CW	-85	Yes	447.5	Pass
17	3697.5		-85	3695	CW	-90	No	NA	Pass
18	3697.5		-85	3697.5	OFDMA	-85	Yes	450	Pass
14	3697.5		-65	3699.5	CW	-65	Yes	447.5	Pass
15	3697.5		-65	3699.5	CW	-70	No	NA	Pass
16	3697.5		-85	3699.5	CW	-85	Yes	450	Pass
17	3697.5		-85	3699.5	CW	-90	No	NA	Pass



<b>Test specification:</b>		<b>Section 90.203 (o)/RSS-197 Section 5.4, Contention based protocol</b>			
<b>Test procedure:</b>					
<b>Test mode:</b>	Compliance		<b>Verdict:</b>		<b>PASS</b>
<b>Date:</b>	2/15/2011				
<b>Temperature:</b> 23.2°C	<b>Air Pressure:</b> 1007 hPa		<b>Relative Humidity:</b> 46 %	<b>Power Supply:</b> 48 VDC	
<b>Remarks:</b>					

Table 8.2.1 Contention based protocol test results (continued)

INTERFERER SIGNAL INJECTION: To port Tx<sub>1</sub>/Rx<sub>1</sub>  
EUT TRANSMISSION MONITORING: At port Tx<sub>1</sub>/Rx<sub>1</sub>

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
18	3653.5	7	-85	3650.5	CW	-85	Yes	NA***	Pass
19	3653.5		-85	3657	CW	-85	Yes	NA***	Pass
20	3675		-85	3671.5	CW	-85	Yes	450	Pass
21	3675		-85	3678.5	CW	-85	Yes	447.5	Pass
22	3675		-85	3675	OFDMA	-85	Yes	452.5	Pass
23	3696.5		-85	3693	CW	-85	Yes	450	Pass
24	3696.5		-85	3699.5	CW	-85	Yes	452.5	Pass
25	3696.5		-85	3696.5	OFDMA	-85	Yes	450	Pass
26	3655	10	-85	3650.5	CW	-85	Yes	NA***	Pass
27	3655		-85	3660	CW	-85	Yes	NA***	Pass
28	3675		-85	3675	OFDMA	-85	Yes	448	Pass
29	3675		-85	3670	CW	-85	Yes	452.5	Pass
30	3675		-85	3680	CW	-85	Yes	450	Pass
31	3695		-85	3690	CW	-85	Yes	452.5	Pass
32	3695		-85	3699.5	CW	-85	Yes	450	Pass
33	3695		-85	3695	OFDMA	-85	Yes	448	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 1424	HL 2016	HL 2017	HL 2952	HL 3301	HL 3559	HL 3667	HL 3868
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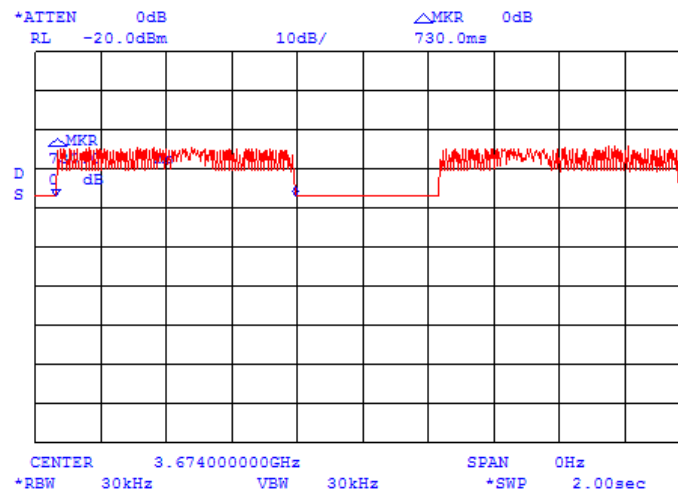
Full description is given in Appendix A.



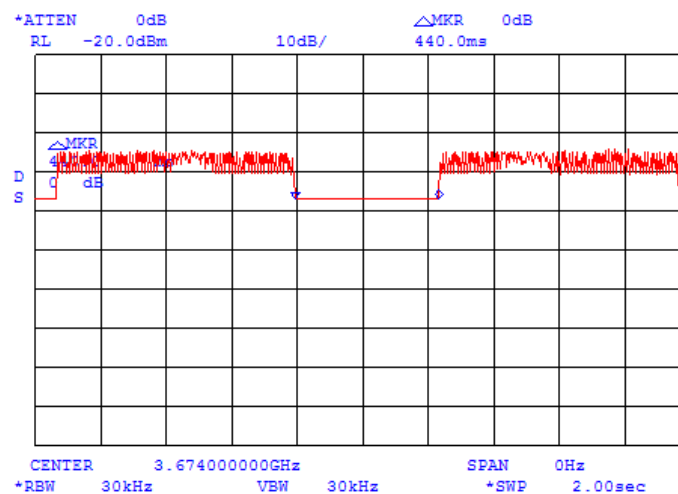
HERMON LABORATORIES

Test specification:		Section 90.203 (o)/RSS-197 Section 5.4, Contention based protocol	
Test procedure:			
Test mode:	Compliance	Verdict: PASS	
Date:	2/15/2011		
Temperature: 23.2°C	Air Pressure: 1007 hPa	Relative Humidity: 46 %	Power Supply: 48 VDC
Remarks:			

Plot 8.2.1 Tx off example, observation time



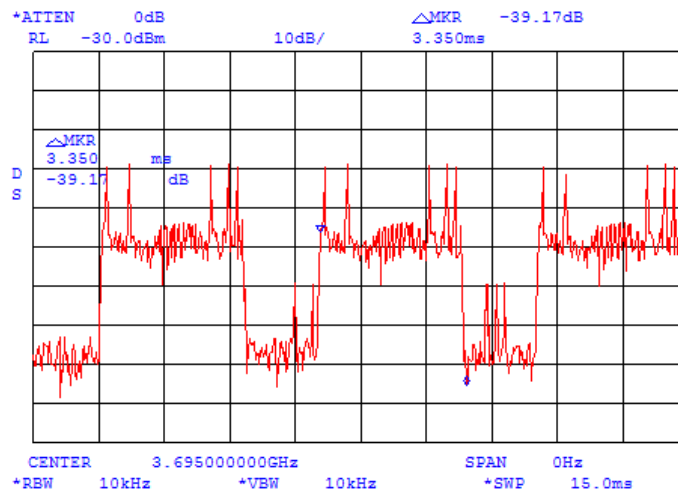
Plot 8.2.2 Tx off example, shut-off time



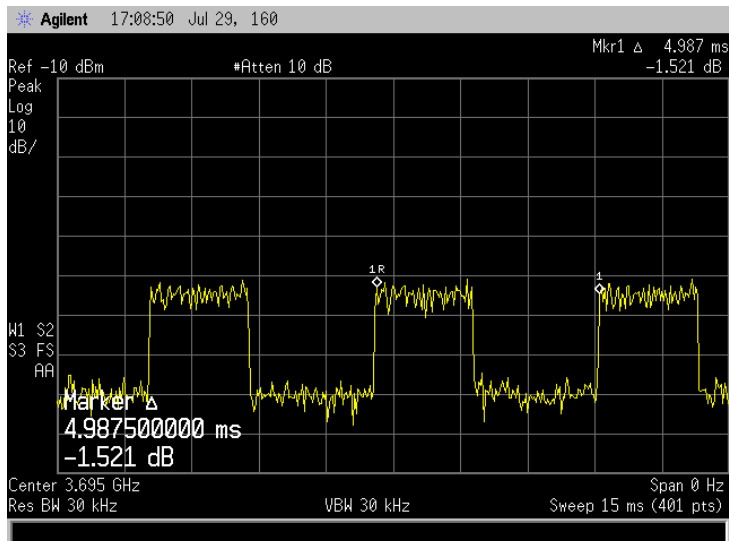
Note: Continuous CW interference present when the RF bursts aren't transmitted

<b>Test specification:</b>		<b>Section 90.203 (o)/RSS-197 Section 5.4, Contention based protocol</b>	
<b>Test procedure:</b>			
<b>Test mode:</b>	Compliance	<b>Verdict:</b> PASS	
<b>Date:</b>	2/15/2011		
<b>Temperature:</b> 23.2°C	<b>Air Pressure:</b> 1007 hPa	<b>Relative Humidity:</b> 46 %	<b>Power Supply:</b> 48 VDC
<b>Remarks:</b>			

Plot 8.2.3 OFDMA signal interferer pulse width



Plot 8.2.4 OFDMA signal interferer pulse period



## 9 APPENDIX A Test equipment and ancillaries used for tests

HL No	Description	Manufacturer	Model	Ser. No.	Last Cal.	Due Cal.
0446	Antenna, Loop, Active, 10 kHz – 30 MHz	EMCO	6502	2857	29-Jun-10	29-Jun-11
0493	Temperature Chamber -45...175 deg C	Thermotron	S-1.2 Mini-Max	14016	13-May-10	13-May-11
0521	EMI Receiver (Spectrum Analyzer) with RF filter section 9 kHz-6.5 GHz	Hewlett Packard	8546A	3617A 00319, 3448A002 53	25-Aug-10	25-Aug-11
0604	Antenna BiconiLog Log-Periodic/T Bow-TIE, 26 – 2000 MHz	EMCO	3141	9611-1011	11-Jan-11	11-Jan-12
0768	Antenna Standard Gain Horn, 18-26.5 GHz, WR-42, 25 dB gain	Quinstar Technology	QWH-4200-BA	110	26-Jan-11	26-Jan-14
0769	Antenna Standard Gain Horn, 26.5-40 GHz, WR28, 25 dB gain	Quinstar Technology	QWH-2800-BA	112	26-Jan-11	26-Jan-14
1424	Spectrum Analyzer, 30 Hz- 40 GHz	Agilent Technologies	8564EC	3946A002 19	01-Jan-11	01-Jan-12
1906	Power Divider, 0.5-18.0 GHz, 80 W	Omni Spectra	2090-6204-00	1906	01-Dec-10	01-Dec-12
1984	Antenna, Double-Ridged Waveguide Horn, 1-18 GHz, 300 W	EMC Test Systems	3115	9911-5964	11-Jun-10	11-Jun-11
2013	Power Divider, 0.5-18.0 GHz, 80 W	Omni Spectra	2090-6204-00	2013	01-Dec-10	01-Dec-12
2016	Attenuator, Manual Step, 0-9/1 dB, 0-8 GHz, 2 W	Midwest Microwave	1072	1315	7-Feb-11	7-Feb-12
2017	Attenuator, Manual Step, 0-60/10 dB, 0-8.0 GHz	Midwest Microwave	1071	2017	7-Feb-11	7-Feb-12
2214	Directional Coupler 1.7-26.5 GHz	Krytar	2616	31354	31-Aug-10	31-Aug-11
2870	Microwave Cable Assembly, 18 GHz, 6.4 m, SMA - SMA	Huber-Suhner	198-9155-00	2870	14-Sep-10	14-Sep-11
2909	Spectrum analyzer, ESA-E, 100 Hz to 26.5 GHz	Agilent Technologies	E4407B	MY414447 62	07-May-10	07-May-11
2951	Cable, RF, 18 GHz, 0.9 m, SMA-SMA	Gore	10020014	NA	04-Oct-10	04-Oct-11
2952	Cable, RF, 18 GHz, 1.2 m, SMA-SMA	Gore	10020014	NA	04-Oct-10	04-Oct-11
3123	Microwave Cable Assembly, 18 GHz, 5.0 m, SMA - SMA	Huber-Suhner	198-9155-00	3123	03-Oct-10	03-Oct-11
3301	Power Meter, P-series, 50 MHz to 40 GHz	Agilent Technologies	N1911A	MY451010 57	13-Dec-10	13-Dec-11
3302	Power sensor, P-Series, 50 MHz to 40 GHz, -35/30 to 20 dBm	Agilent Technologies	N1922A	MY452405 86	13-Dec-10	13-Dec-11
3440	Precision Fixed Attenuator, 50 Ohm, 5 W, 20 dB, DC to 18 GHz	Mini-Circuits	BW-S20W5+	NA	07-Mar-11	07-Mar-12
3472	Cable, Coax, Microwave, DC-18 GHz, SMA-SMA, 1.0 m	Gore	GORE 65474	1003478	09-May-10	09-May-11
3473	Cable, Coax, Microwave, DC-18 GHz, SMA-SMA, 0.6 m	Gore	GORE 65474	1003478	09-May-10	09-May-11

<b>HL No</b>	<b>Description</b>	<b>Manufacturer</b>	<b>Model</b>	<b>Ser. No.</b>	<b>Last Cal.</b>	<b>Due Cal.</b>
3474	Cable, Coax, Microwave, DC-18 GHz, SMA-SMA, 0.6 m	Gore	GORE 65475	1640102	09-May-10	09-May-11
3559	Cable 40 GHz, SMA-SMA, 0.95 m, Blue	Gore	PHASEFL EX	03771245	13-Jun-10	13-Jun-11
3667	Directional coupler, 2 GHz to 8 GHz, 10 dB	ELISRA	MW10162	1011	30-Jan-11	30-Jan-12
3784	Precision Fixed Attenuator, 50 Ohm, 5 W, 10 dB, DC to 18 GHz	Mini-Circuits	BW-S10W5+	NA	07-Dec-10	07-Dec-11
3818	PSA Series Spectrum Analyzer, 3 Hz- 44 GHz	Agilent Technologies	E4446A	MY48250288	26-Sep-10	26-Sep-11
3868	Directional coupler, 2 GHz to 8 GHz, 10 dB, SMA Female	Narda	4203-10	06978	13-Dec-10	13-Dec-12
3883	Preamplifier, 0.1 to 18 GHz, Gain 25 dB, N-type (f) in, N-type (m) out.	Agilent Technologies	87405C	MY47010406	30-Dec-99	30-Dec-00

## 10 APPENDIX B Measurement uncertainties

### Expanded uncertainty at 95% confidence in Hermon Labs EMC measurements

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

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

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

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

## 11 APPENDIX C Test laboratory description

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

Hermon Laboratories is listed by the Federal Communications Commission (USA) for all parts of Code of Federal Regulations 47 (CFR 47), Registration Numbers 90624 for OATS and 90623 for the anechoic chamber; by Industry Canada for electromagnetic emissions (file numbers IC 2186A-1 for OATS, 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: 2010	Private land mobile radio services
FCC 47CFR part 1: 2009	Practice and procedure
FCC 47CFR part 2: 2009	Frequency allocations and radio treaty matters; general rules and regulations
ANSI C63.2: 1996	American National Standard for Instrumentation-Electromagnetic Noise and Field Strength, 10 kHz to 40 GHz-Specifications.
ANSI C63.4: 2003	American National Standard for Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz.
ANSI/TIA/EIA-603-C:2004	Land Mobile FM or PM Communications Equipment Measurement and Performance Standards

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



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

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

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

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

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

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

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

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

**Cable loss**  
**Cable coaxial, Gore, 18 GHz, 0.9 m, SMA-SMA, S/N 10020014**  
**HL 2951**

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

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

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

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

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

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

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

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

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



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

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

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

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

## 14 APPENDIX F Abbreviations and acronyms

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

END OF DOCUMENT