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# TEST REPORT

ACCORDING TO: FCC 47CFR part 90

FOR:

**Airspan Networks Inc.**

**LTE Base Station**

**Model: AirHarmony 4000 866 MHz (B26)**

**FCC ID:PIDHAR4K85**

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

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## 1 Applicant information

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

## 2 Equipment under test attributes

**Product name:** LTE Base Station  
**Product type:** Transceiver  
**Model(s):** AirHarmony 4000 866MHz (B26)  
**Serial number:** D01FF8CC97d4  
**Hardware version:** A2  
**Software release:** 14.14.50.095  
**Receipt date:** 06-Dec-15

## 3 Manufacturer information

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




## 4 Test details

**Project ID:** 27591  
**Location:** Hermon Laboratories Ltd. Harakevet Industrial Zone, Binyamina 30500, Israel  
**Test started:** 06-Dec-15  
**Test completed:** 10-Dec-15  
**Test specification(s):** FCC CFR 47 Part 90

## 5 Tests summary

Test	Status
<b>Transmitter characteristics</b>	
Section 90.205, 90.635, Maximum output power	Pass
Section 90.209, Occupied bandwidth	Pass
Section 90.691, Emission mask	Pass
Section 90.210, Radiated spurious emissions	Pass
Section 90.210, Conducted spurious emissions	Pass
Section 90.213, Frequency stability	Pass
Section 90.214, Transient frequency behaviour	Not required
Section 2.1091, RF radiation exposure evaluation	Pass, exhibit provided in Application for certification

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

	Name and Title	Date	Signature
<b>Tested by:</b>	Mrs. E. Pitt, test engineer	December 10, 2015	
<b>Reviewed by:</b>	Mrs. M. Cherniavsky, certification engineer	February 2, 2016	
<b>Approved by:</b>	Mr. M. Nikishin, EMC and Radio group manager	February 10, 2016	

## 6 EUT description

### 6.1 General information

The EUT, Base station radio, AirHarmony 4000 866 MHz (B26), is part of a LTE broadband fixed cellular wireless access system. The system provides a radio link between an end-user (a subscriber) and a network to give high-speed data access. The AirHarmony's transceiver/receiver (Up to 64 QAM modulation, data rate up to 37 Mbps) uses OFDM and operating in FDD mode, equipped with a 13.5dBi External antenna. The maximum total RF output power (not including antenna gain) is 46.16 dBm for 13.5dBi and it can be reduced by software.

The Third parties cannot have any ability to configure or operate transmitters configure on non-US frequencies, or in any parameters (frequency range, modulation type, maximum output power or other radio parameters) in any other way than granted. The AirHarmony 4000 866 MHz (B26) isn't capable of operating in any other way than granted.

AirHarmony4000 is based on two transmitters and two receivers (2T2R) and employs the following MIMO schemes:

Space Frequency Block Code (SFBC) transmit diversity

Two layers open loop spatial multiplexing using large delay cyclic diversity

Two layers closed loop spatial multiplexing

(Antenna1 transmits symbol 1 on subcarrier n and symbol 2 on subcarrier n + 1

Antenna 2 transmits complex conjugate of symbol 1 on subcarrier n+1 and negative complex conjugate of symbol 2 on subcarrier n)

It compliance with "662911 D01 Multiple Transmitter Output MIMO v02r01" Alamouti coding.

Completely uncorrelated signals include those transmitted in the following modes, if they are not combined with any correlated modes, such as beamforming:

- Space Time Block Codes (STBC) or Space Time Codes (STC) for which different digital data is carried by each transmit antenna during any symbol period (e.g., WiMAX Matrix A [Alamouti coding]).

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

### 6.2 Ports and lines

Port Type	Port description	Connected from	Connected to	Qty.	Cable type	Cable length, m
Power	AC power	EUT	AC mains	1	Unshielded	3
Signal	GPS	EUT	GPS external antenna	1	Coax	3
Signal	Eth. POE	EUT	Laptop	1	FTP	3
Signal	Eth. POE	EUT	Open circuit	1	FTP	3
Signal	Eth.	EUT	Open circuit	2	FTP	3
RF	RF Link (Tx/Rx)	EUT	Antenna (via filter)	2	Coax	0.5
Signal*	Serial*	Not connected	Not connected	1	NA	NA

\*for maintenance only

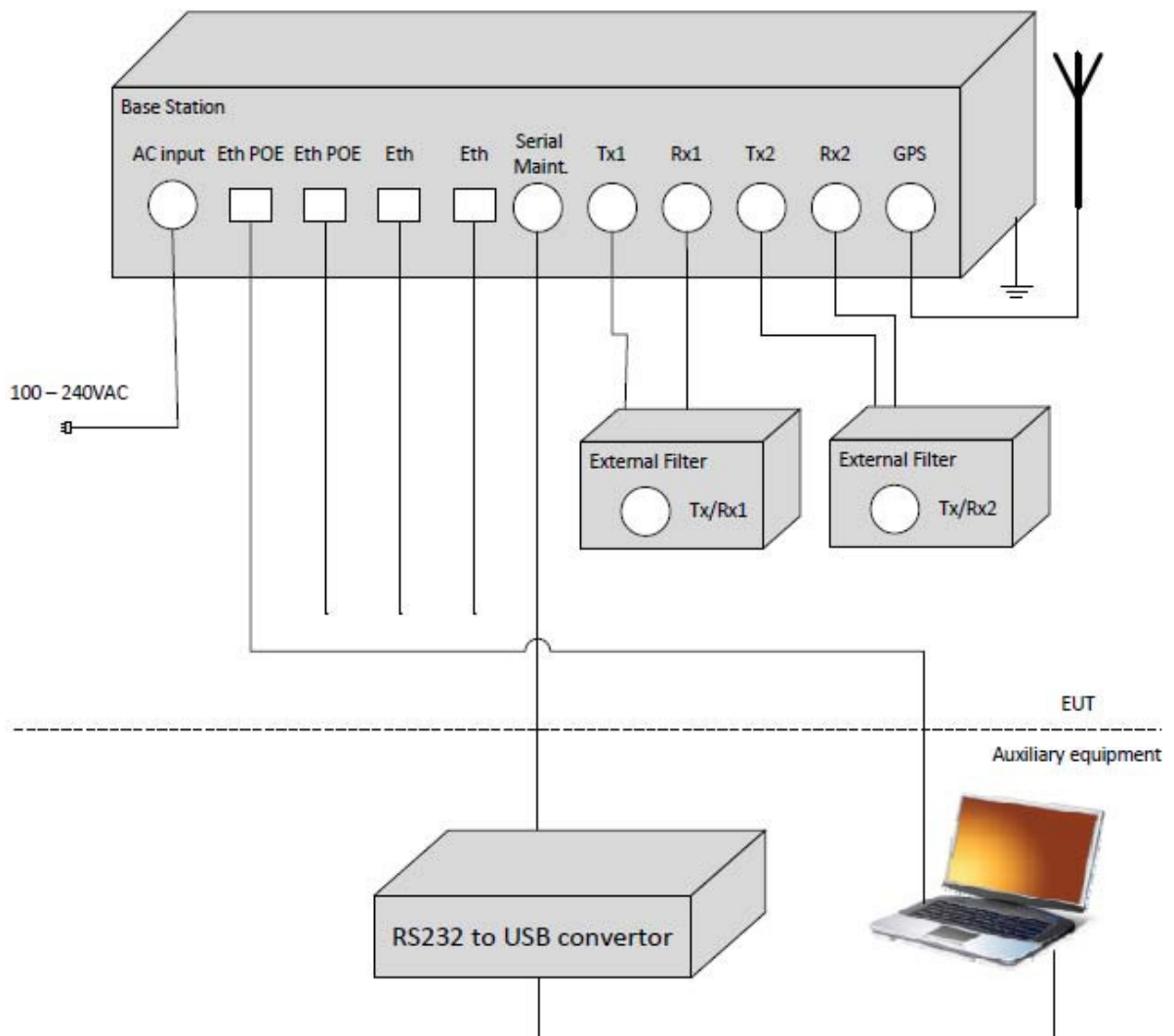
### 6.3 Support and test equipment

Description	Manufacturer	Model number	Serial number
Laptop	Dell	E7450	8TYRP32

### 6.4 Changes made in the EUT

No changes were implemented in the EUT during testing.

## 6.5 Test configuration





### 6.6 Transmitter characteristics

<b>Type of equipment</b>			
V	Stand-alone (Equipment with or without its own control provisions)		
	Combined equipment (Equipment where the radio part is fully integrated within another type of equipment)		
	Plug-in card (Equipment intended for a variety of host systems)		
<b>Intended use</b>		<b>Condition of use</b>	
V	fixed	Always at a distance more than 2 m from all people	
	mobile	Always at a distance more than 20 cm from all people	
	portable	May operate at a distance closer than 20 cm to human body	
<b>Assigned frequency range</b>		862-869 MHz	
<b>Operating frequency (full bands)</b>		866.3 MHz	
<b>RF channel spacing</b>		5 MHz	
<b>Maximum rated output power</b>		At transmitter 50 Ω RF output connector (aggregate power of both RF chains)	
		46.16 dBm	
<b>Is transmitter output power variable?</b>			
		No	
			continuous variable
V	Yes	V	stepped variable with step size
			0.25 dB
			minimum RF power
			-30 dBm
			maximum RF power at antenna connector
			43.00 dBm
<b>Antenna connection</b>			
unique coupling	V	standard connector	Integral
			V with temporary RF connector
			without temporary RF connector
<b>Antenna/s technical characteristics</b>			
Type	Manufacturer	Model number	Gain
External	ALPHA Wireless Ltd	AW3141	13.5 dBi
<b>Transmitter aggregate data rate/s</b>			
Transmitter 26dBc power bandwidth		Type of modulation	
5 MHz		QPSK	16QAM
		7 Mbps	15 Mbps
			64QAM
			37 Mbps
<b>Type of multiplexing</b>		FDD	
<b>Modulating test signal (baseband)</b>		PRBS	
<b>Maximum transmitter duty cycle in normal use</b>		100%	
<b>Transmitter power source</b>			
	Nominal rated voltage	Battery type	
	DC		
	Nominal rated voltage		
V	AC mains	120VAC	Frequency
<b>Common power source for transmitter and receiver</b>		V	yes
			no



<b>Test specification:</b>	<b>Sections 90.205, 90.635, Maximum output power</b>		
<b>Test procedure:</b>	47 CFR, Section 2.1046; TIA/EIA-603-D, Section 2.2.1		
<b>Test mode:</b>	Compliance	<b>Verdict:</b>	<b>PASS</b>
<b>Date(s):</b>	07-Dec-15		
<b>Temperature:</b> 23 °C	<b>Air Pressure:</b> 1027 hPa	<b>Relative Humidity:</b> 55 %	<b>Power Supply:</b> 120 VAC
<b>Remarks:</b>			

## 7 Transmitter tests according to 47CFR part 90

### 7.1 Peak output power test

#### 7.1.1 General

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

Table 7.1.1 Peak output power limits

Assigned frequency range, MHz	ERP	
	W	dBm
851-869	1000	60

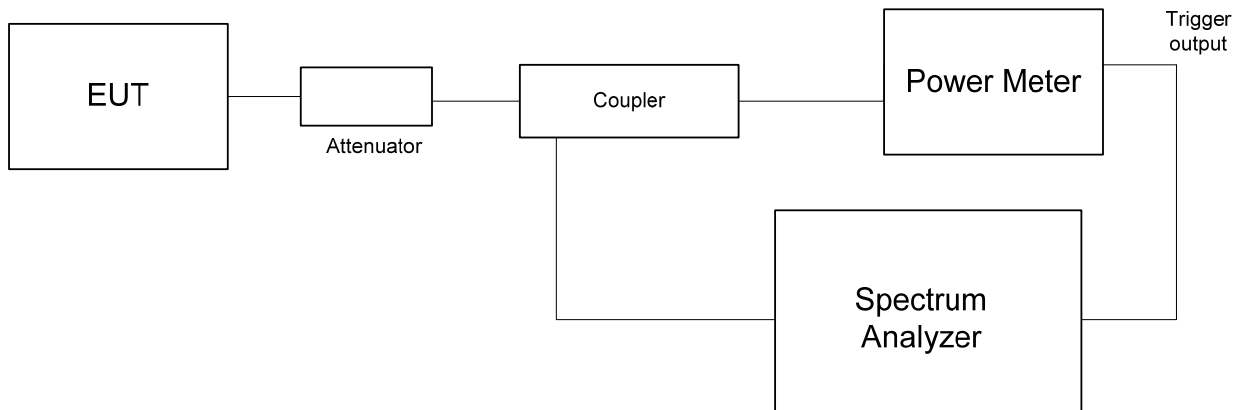
#### 7.1.2 Test procedure

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

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

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

Figure 7.1.1 Peak output power test setup







<b>Test specification:</b>	<b>Sections 90.205, 90.635, Maximum output power</b>		
<b>Test procedure:</b>	47 CFR, Section 2.1046; TIA/EIA-603-D, Section 2.2.1		
<b>Test mode:</b>	Compliance	<b>Verdict:</b>	<b>PASS</b>
<b>Date(s):</b>	07-Dec-15		
<b>Temperature:</b> 23 °C	<b>Air Pressure:</b> 1027 hPa	<b>Relative Humidity:</b> 55 %	<b>Power Supply:</b> 120 VAC
<b>Remarks:</b>			

Table 7.1.2 Peak output power test results

OPERATING FREQUENCY: 866.3 MHz  
ANTENNA GAIN 13.5 dBi

Modulation	RF output power at ant#0 dBm	RF output power at ant#1 dBm	Total RF power* , dBm	ERP** dBm	Limit, dBm	Margin, dB	Verdict
QPSK	43.02	43.03	46.04	57.42	60	-2.58	Pass
64QAM	43.21	43.08	46.16	57.54	60	-2.46	Pass

\* Total RF power , dBm = 10 log{10^[P(dBm,RF#0)/10]+ 10^[P(dBm, RF#1)/10]}

\*\* ERP (dBm)=RF output power (dBm) + Antenna gain (dBi) - 2.12(dB)

Reference numbers of test equipment used

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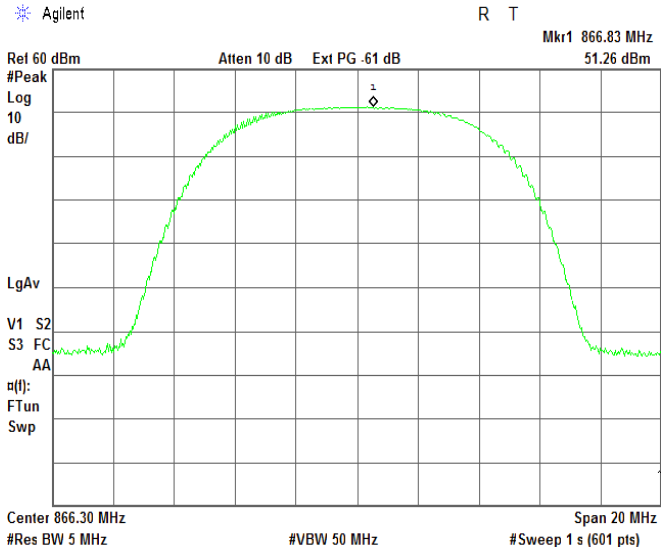
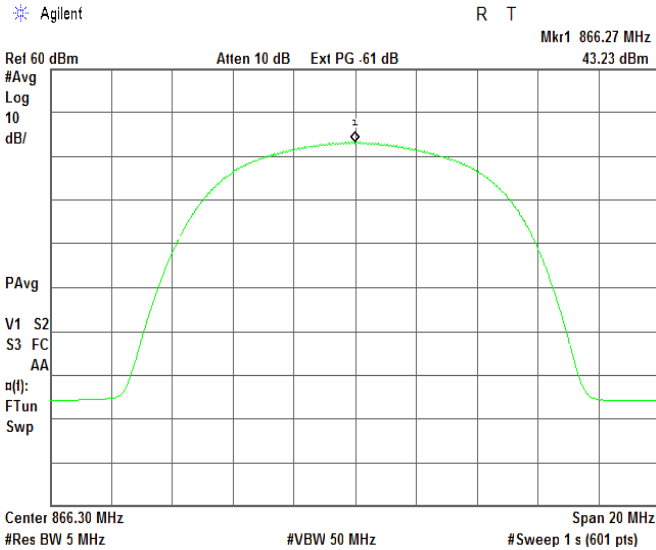
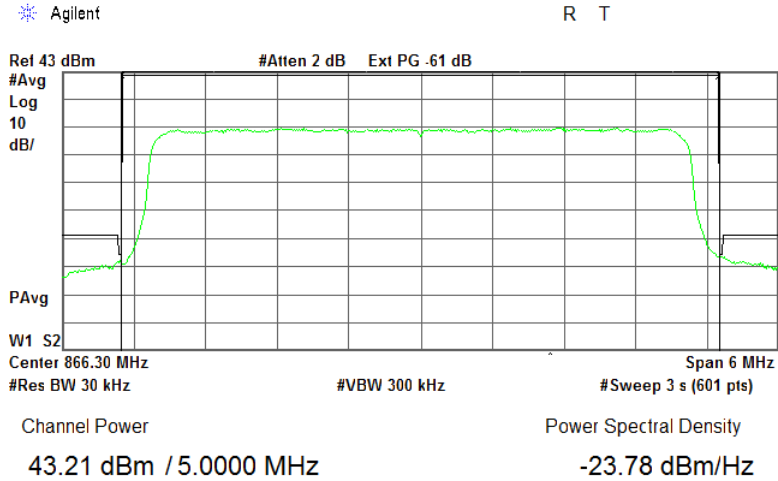
Full description is given in Appendix A.



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<b>Test specification:</b>	<b>Sections 90.205, 90.635, Maximum output power</b>		
<b>Test procedure:</b>	47 CFR, Section 2.1046; TIA/EIA-603-D, Section 2.2.1		
<b>Test mode:</b>	Compliance	<b>Verdict:</b>	<b>PASS</b>
<b>Date(s):</b>	07-Dec-15		
<b>Temperature:</b> 23 °C	<b>Air Pressure:</b> 1027 hPa	<b>Relative Humidity:</b> 55 %	<b>Power Supply:</b> 120 VAC
<b>Remarks:</b>			

Plot 7.1.1 Peak output power test results, 64QAM, ant.0

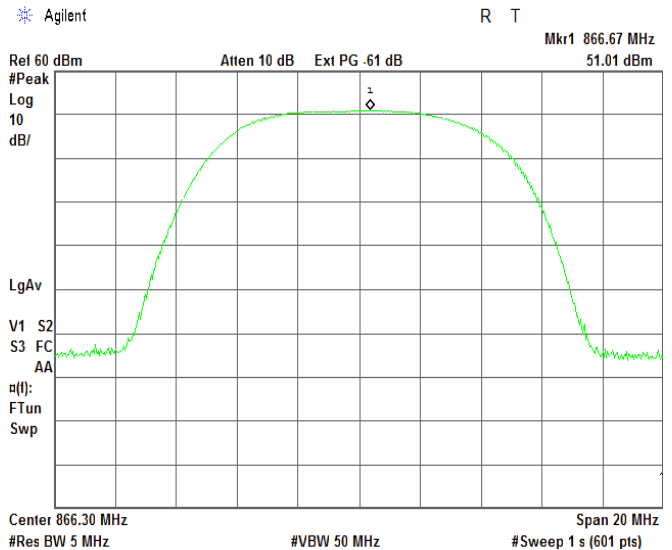
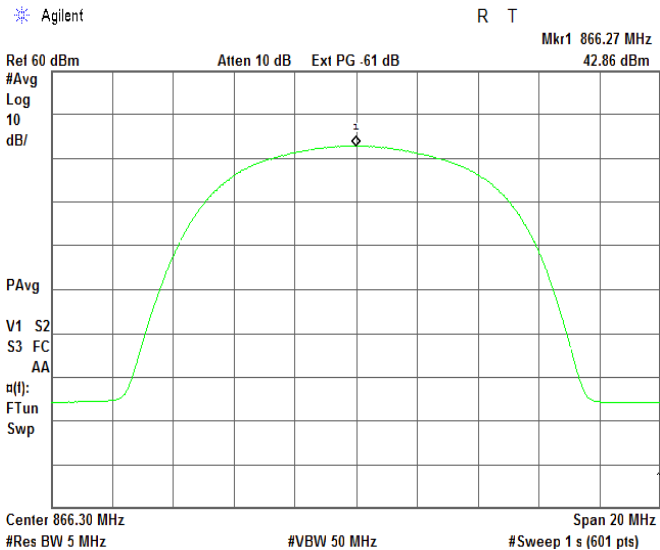
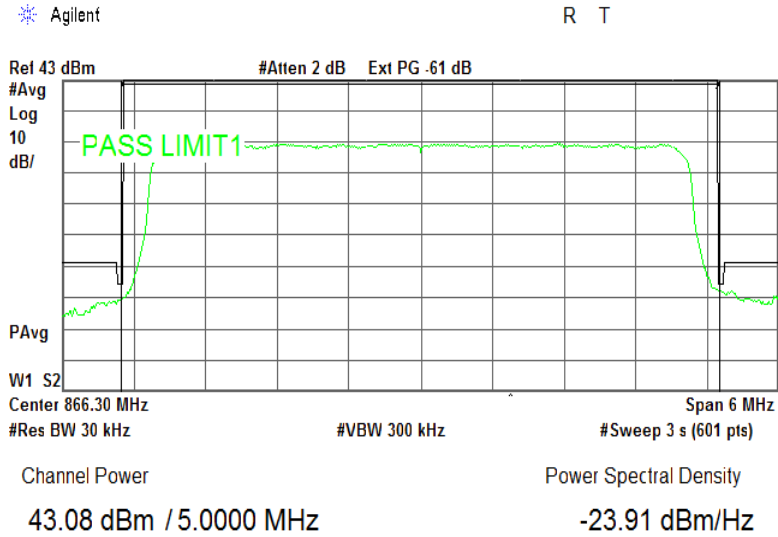




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<b>Test specification:</b>	<b>Sections 90.205, 90.635, Maximum output power</b>		
<b>Test procedure:</b>	47 CFR, Section 2.1046; TIA/EIA-603-D, Section 2.2.1		
<b>Test mode:</b>	Compliance	<b>Verdict:</b>	<b>PASS</b>
<b>Date(s):</b>	07-Dec-15		
<b>Temperature:</b> 23 °C	<b>Air Pressure:</b> 1027 hPa	<b>Relative Humidity:</b> 55 %	<b>Power Supply:</b> 120 VAC
<b>Remarks:</b>			

Plot 7.1.2 Peak output power test results, 64QAM, ant.1

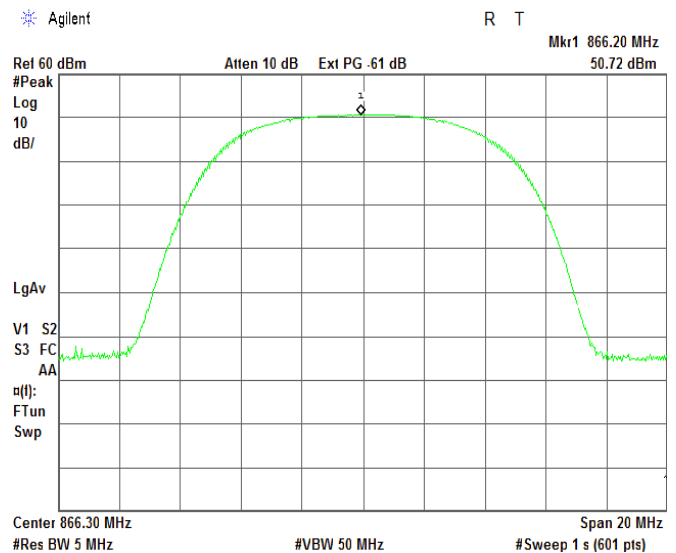
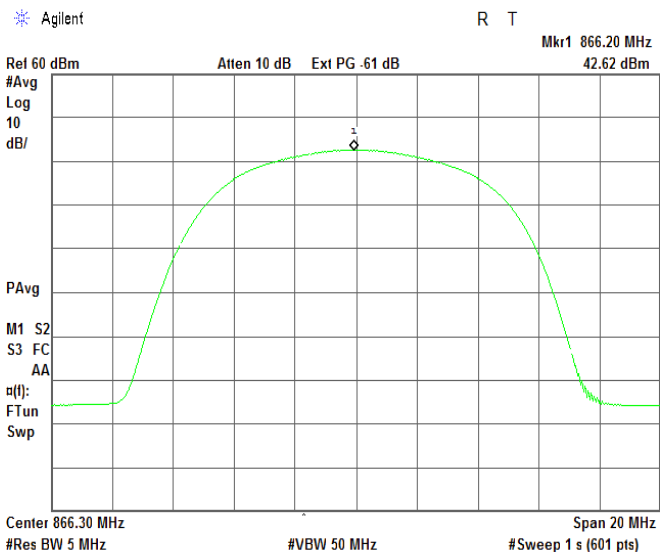
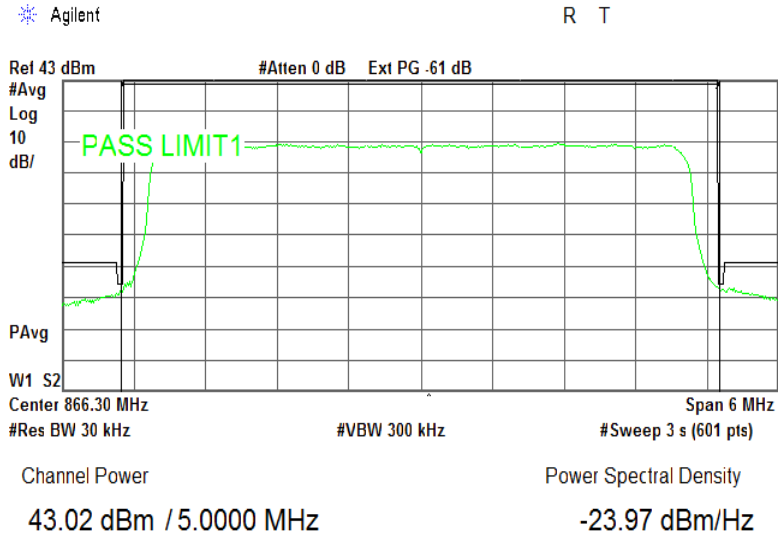




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<b>Test specification:</b>		<b>Sections 90.205, 90.635, Maximum output power</b>	
<b>Test procedure:</b>		47 CFR, Section 2.1046; TIA/EIA-603-D, Section 2.2.1	
<b>Test mode:</b>		Compliance	
<b>Date(s):</b>		07-Dec-15	
<b>Temperature: 23 °C</b>		<b>Air Pressure: 1027 hPa</b>	
<b>Relative Humidity: 55 %</b>		<b>Power Supply: 120 VAC</b>	
<b>Remarks:</b>			
		<b>Verdict: PASS</b>	

Plot 7.1.3 Peak output power test results, QPSK, ant.0

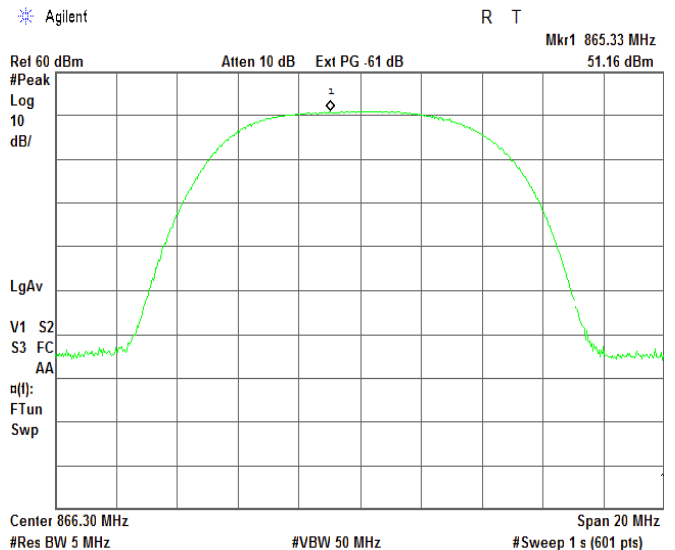
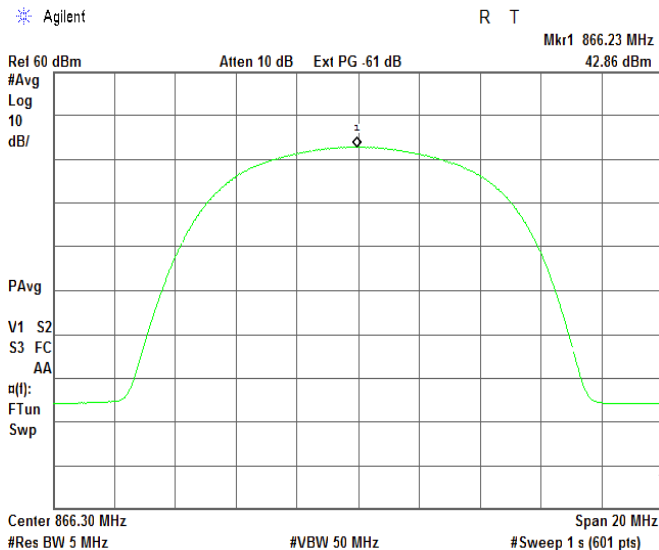
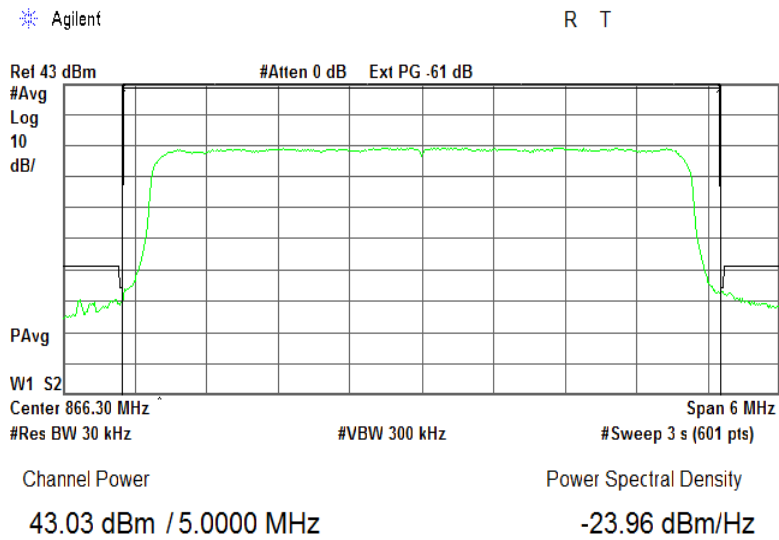




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<b>Test specification:</b>	<b>Sections 90.205, 90.635, Maximum output power</b>		
<b>Test procedure:</b>	47 CFR, Section 2.1046; TIA/EIA-603-D, Section 2.2.1		
<b>Test mode:</b>	Compliance	<b>Verdict:</b>	<b>PASS</b>
<b>Date(s):</b>	07-Dec-15		
<b>Temperature:</b> 23 °C	<b>Air Pressure:</b> 1027 hPa	<b>Relative Humidity:</b> 55 %	<b>Power Supply:</b> 120 VAC
<b>Remarks:</b>			

Plot 7.1.4 Peak output power test results, QPSK, ant.1





<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>Date(s):</b>		06-Dec-15	
<b>Temperature:</b> 23 °C		<b>Air Pressure:</b> 1028 hPa	
		<b>Relative Humidity:</b> 55 %	
		<b>Power Supply:</b> 120 VAC	
<b>Remarks:</b>			

## 7.2 Occupied bandwidth test

### 7.2.1 General

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

Table 7.2.1 Occupied bandwidth limits

Assigned frequency, MHz	Modulation envelope reference points*, dBc	Maximum allowed bandwidth, kHz
866.3	26	NA

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

### 7.2.2 Test procedure

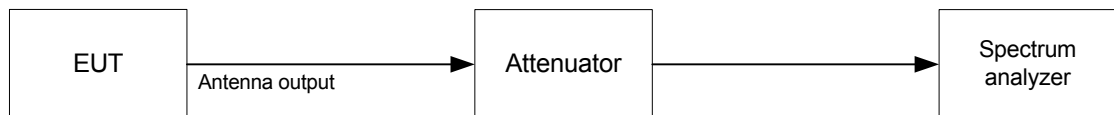
7.2.2.1 The EUT was set up as shown in Figure 7.2.1, energized and its proper operation was checked.

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

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

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

Figure 7.2.1 Occupied bandwidth test setup





<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>Date(s):</b>		06-Dec-15	
<b>Temperature:</b> 23 °C		<b>Air Pressure:</b> 1028 hPa	
		<b>Relative Humidity:</b> 55 %	
		<b>Power Supply:</b> 120 VAC	
<b>Remarks:</b>			

Table 7.2.2 Occupied bandwidth test results

DETECTOR USED: Peak hold  
RESOLUTION BANDWIDTH: 51 kHz  
VIDEO BANDWIDTH: 300 kHz  
MODULATION ENVELOPE REFERENCE POINTS: 26 dBc / 99%  
CARRIER FREQUENCY: 866.3MHz

Modulation	Antenna	Occupied bandwidth 26dBc, kHz	Occupied bandwidth 99%, kHz
QPSK	Ant 0	4.659	4.3782
	Ant 1	4.657	4.3758
64QAM	Ant 0	4.658	4.3937
	Ant 1	4.656	4.3904

Reference numbers of test equipment used

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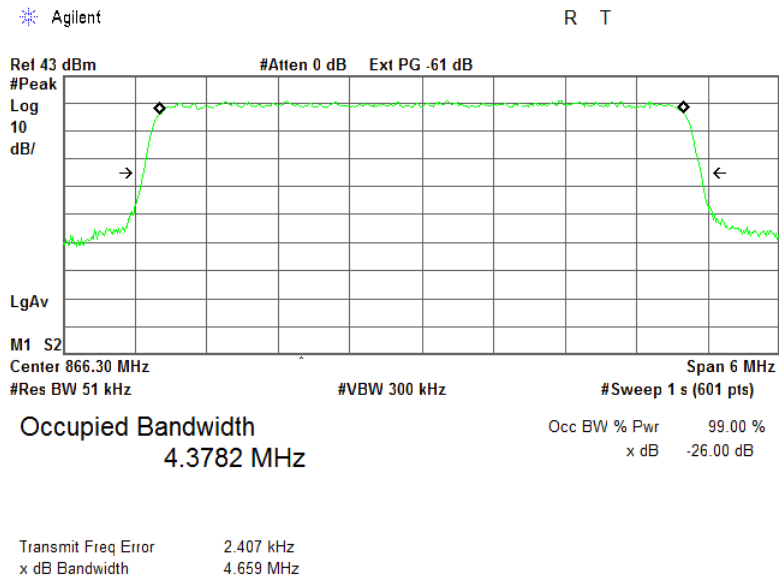
Full description is given in Appendix A.



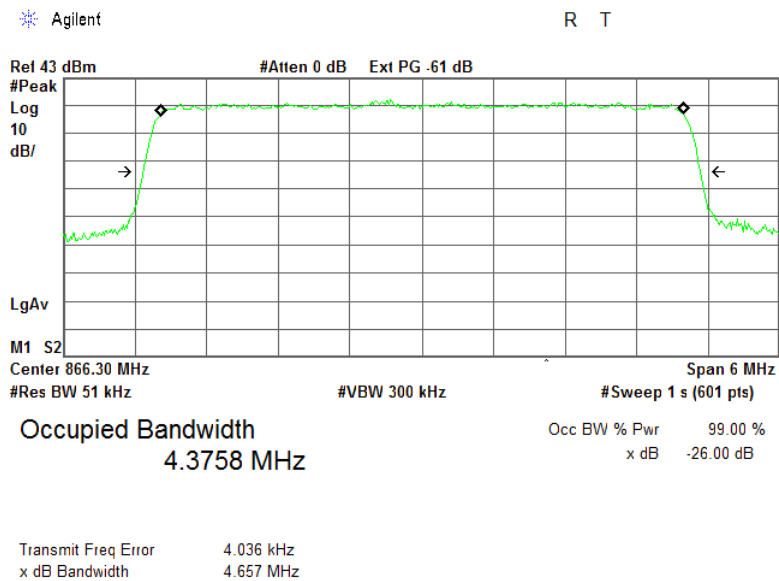
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<b>Test specification:</b>		<b>Section 90.209, Occupied bandwidth</b>	
<b>Test procedure:</b>		47 CFR, Section 2.1049	
<b>Test mode:</b>		Compliance	
<b>Date(s):</b>		06-Dec-15	
<b>Temperature: 23 °C</b>		<b>Air Pressure: 1028 hPa</b>	
<b>Relative Humidity: 55 %</b>		<b>Power Supply: 120 VAC</b>	
<b>Remarks:</b>			
		<b>Verdict: PASS</b>	

Plot 7.2.1 Occupied bandwidth test result, QPSK, ant.0



Plot 7.2.2 Occupied bandwidth test result, QPSK, ant.1



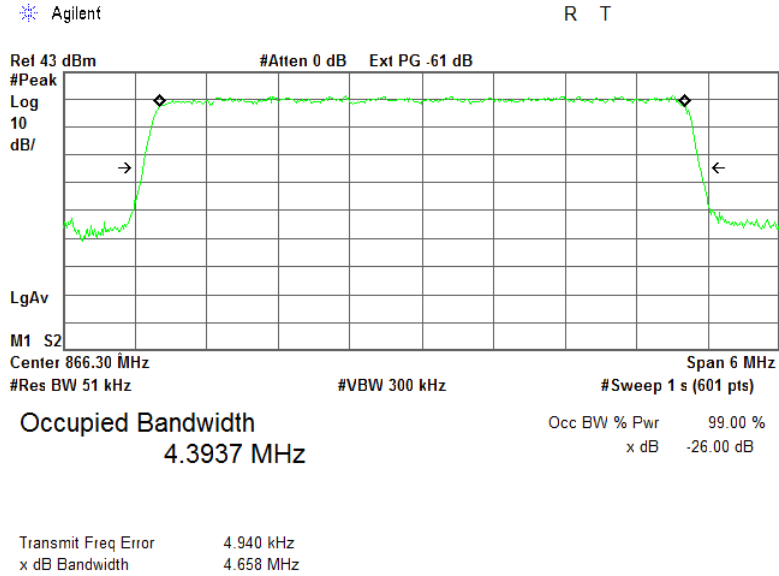




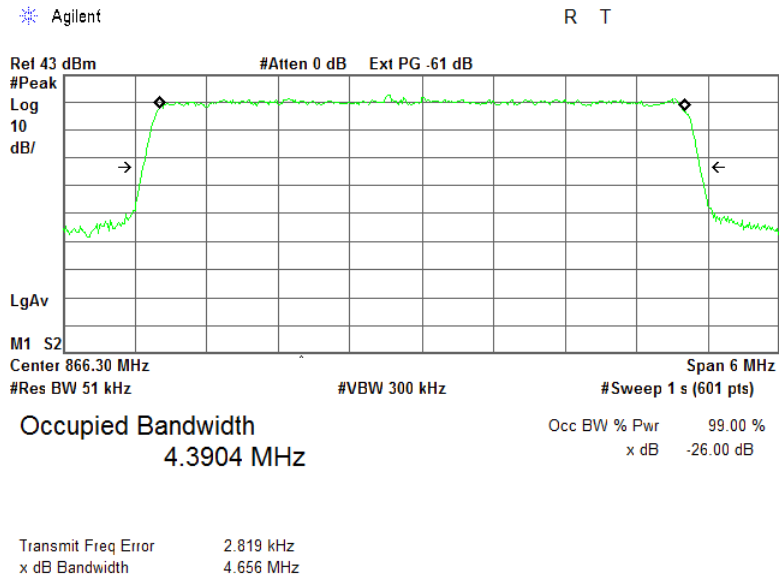
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<b>Test specification:</b>		<b>Section 90.209, Occupied bandwidth</b>	
<b>Test procedure:</b>		47 CFR, Section 2.1049	
<b>Test mode:</b>		Compliance	
<b>Date(s):</b>		06-Dec-15	
<b>Temperature: 23 °C</b>		<b>Air Pressure: 1028 hPa</b>	
<b>Relative Humidity: 55 %</b>		<b>Power Supply: 120 VAC</b>	
<b>Remarks:</b>			
		<b>Verdict: PASS</b>	

Plot 7.2.3 Occupied bandwidth test result, 64QAM, ant.0



Plot 7.2.4 Occupied bandwidth test result, 64QAM, ant.1





<b>Test specification:</b>	<b>Section 90.210, Emission mask</b>		
<b>Test procedure:</b>	47 CFR, Sections 2.1051, 2.1047 and 90.691; TIA/EIA-603-D, Section 2.2.13		
<b>Test mode:</b>	Compliance	<b>Verdict: PASS</b>	
<b>Date(s):</b>	06-Dec-15		
<b>Temperature:</b> 23 °C	<b>Air Pressure:</b> 1028 hPa	<b>Relative Humidity:</b> 55 %	<b>Power Supply:</b> 120 VAC
<b>Remarks:</b>			

### 7.3 Emission mask test

#### 7.3.1 General

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

Table 7.3.1 Emission mask limits

Frequency displacement from EA frequency block	Limit*, dBm	RBW, kHz
0 – 37.5 kHz	-23	30
37.5 – 50.0 kHz	-16	30
More than 50.0 kHz	-16	100/1000**

\* - Limit at each antenna connector (amount of antennas N = 2)

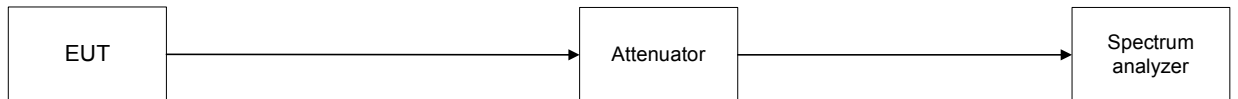
\*\* - RBW=100 kHz for frequencies below 1000 MHz, RBW=1 MHz for frequencies above 1 GHz.

#### 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 emission mask was measured with spectrum analyzer as provided in Table 7.3.2 and the the associated plots.

Figure 7.3.1 Emission mask test setup





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<b>Test specification:</b>	<b>Section 90.210, Emission mask</b>		
<b>Test procedure:</b>	47 CFR, Sections 2.1051, 2.1047 and 90.691; TIA/EIA-603-D, Section 2.2.13		
<b>Test mode:</b>	Compliance	<b>Verdict: PASS</b>	
<b>Date(s):</b>	06-Dec-15		
<b>Temperature:</b> 23 °C	<b>Air Pressure:</b> 1028 hPa	<b>Relative Humidity:</b> 55 %	<b>Power Supply:</b> 120 VAC
<b>Remarks:</b>			

Table 7.3.2 Emission mask test results

Carrier frequency, MHz	Limit	Verdict
866.3	EA based systems FCC 90.691*	Pass

\*The limit was reduced 3 dB due to 2 antennae.

**Reference numbers of test equipment used**

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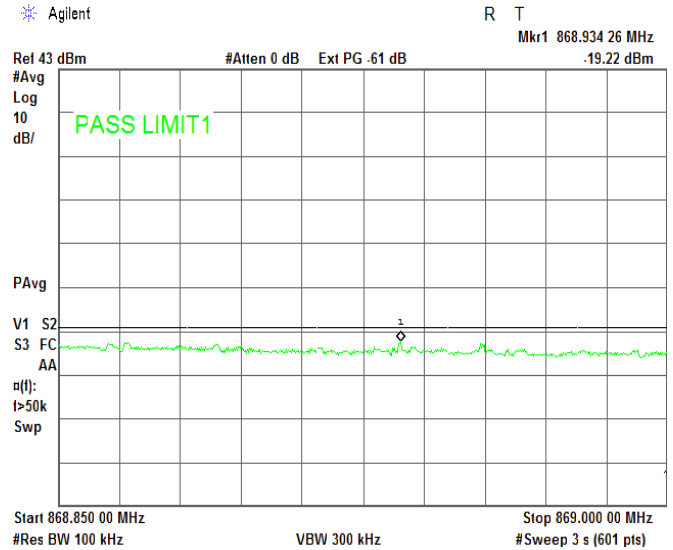
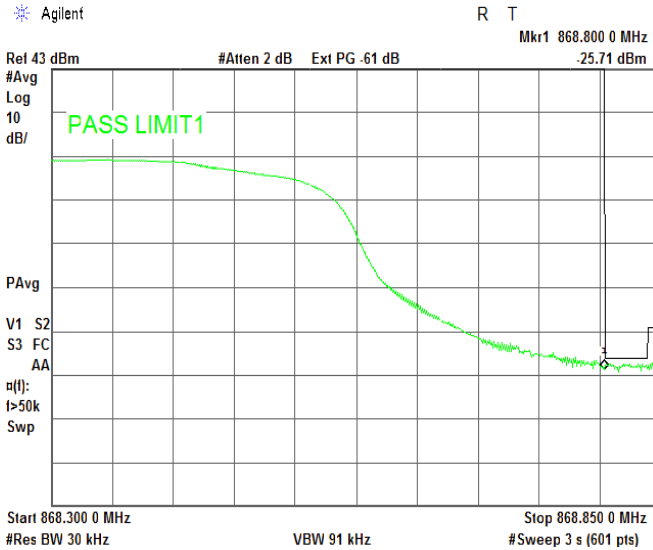
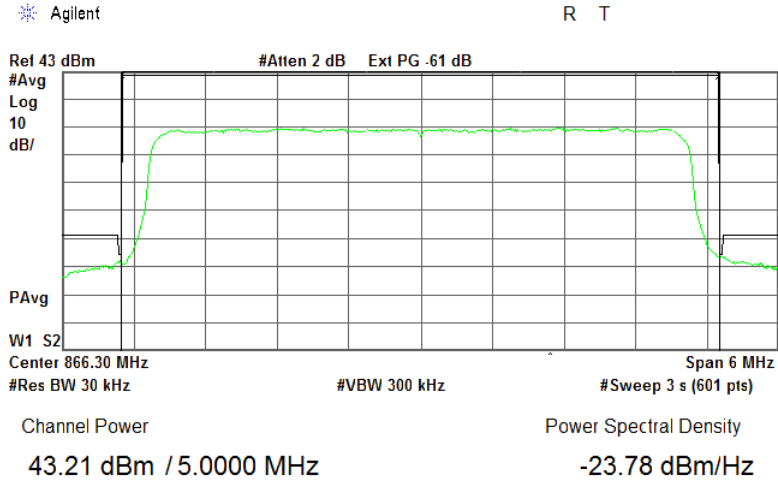
Full description is given in Appendix A.



HERMON LABORATORIES

<b>Test specification:</b>	<b>Section 90.210, Emission mask</b>		
<b>Test procedure:</b>	47 CFR, Sections 2.1051, 2.1047 and 90.691; TIA/EIA-603-D, Section 2.2.13		
<b>Test mode:</b>	Compliance	<b>Verdict:</b>	<b>PASS</b>
<b>Date(s):</b>	06-Dec-15		
<b>Temperature:</b> 23 °C	<b>Air Pressure:</b> 1028 hPa	<b>Relative Humidity:</b> 55 %	<b>Power Supply:</b> 120 VAC
<b>Remarks:</b>			

Plot 7.3.1 Emission mask test results, 64QAM, ant. 0

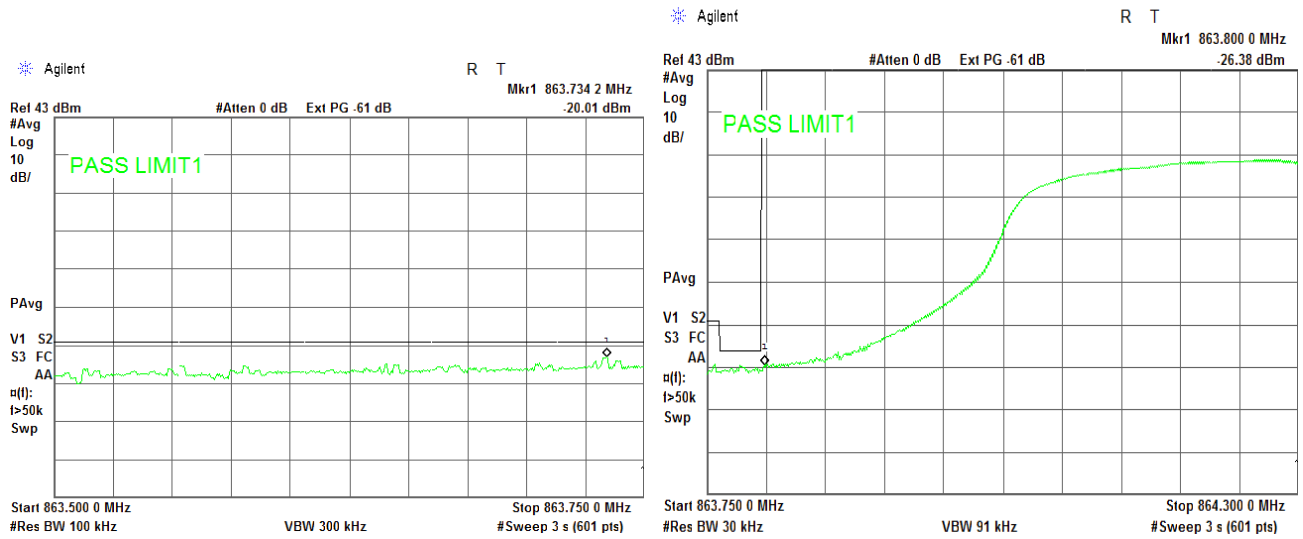




HERMON LABORATORIES

<b>Test specification:</b>	<b>Section 90.210, Emission mask</b>		
<b>Test procedure:</b>	47 CFR, Sections 2.1051, 2.1047 and 90.691; TIA/EIA-603-D, Section 2.2.13		
<b>Test mode:</b>	Compliance	<b>Verdict: PASS</b>	
<b>Date(s):</b>	06-Dec-15		
<b>Temperature:</b> 23 °C	<b>Air Pressure:</b> 1028 hPa	<b>Relative Humidity:</b> 55 %	<b>Power Supply:</b> 120 VAC
<b>Remarks:</b>			

Plot 7.3.1 Emission mask test results, 64QAM, ant. 0 (continued)

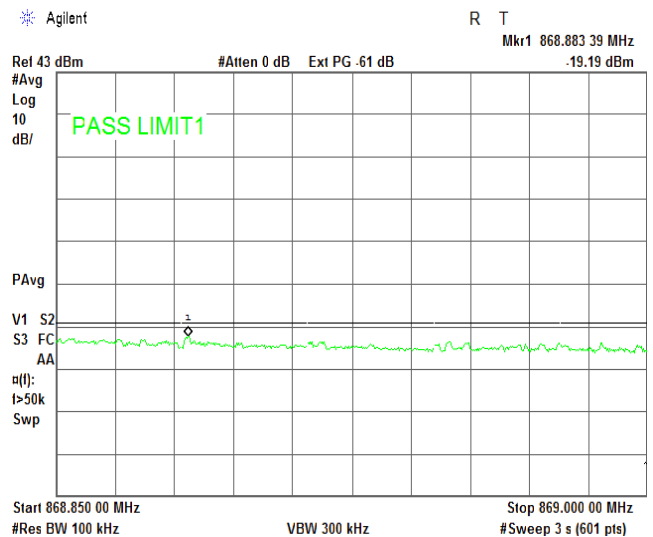
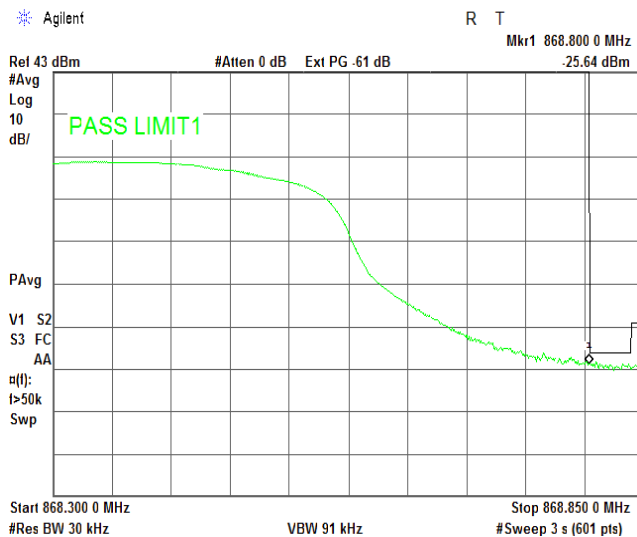
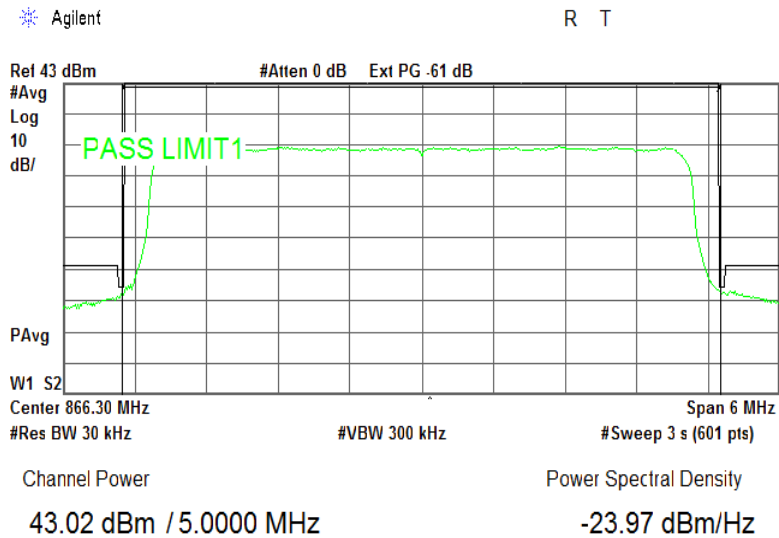




HERMON LABORATORIES

<b>Test specification:</b>	<b>Section 90.210, Emission mask</b>		
<b>Test procedure:</b>	47 CFR, Sections 2.1051, 2.1047 and 90.691; TIA/EIA-603-D, Section 2.2.13		
<b>Test mode:</b>	Compliance	<b>Verdict:</b>	<b>PASS</b>
<b>Date(s):</b>	06-Dec-15		
<b>Temperature:</b> 23 °C	<b>Air Pressure:</b> 1028 hPa	<b>Relative Humidity:</b> 55 %	<b>Power Supply:</b> 120 VAC
<b>Remarks:</b>			

Plot 7.3.2 Emission mask test s results, QPSK, ant. 0

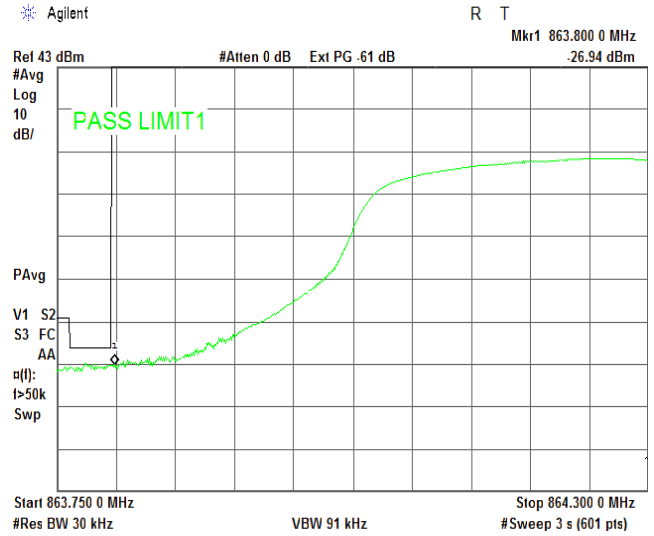
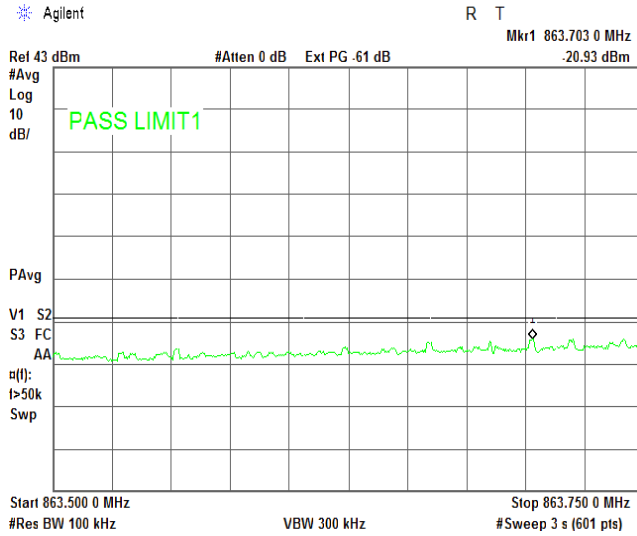




HERMON LABORATORIES

<b>Test specification:</b>	<b>Section 90.210, Emission mask</b>		
<b>Test procedure:</b>	47 CFR, Sections 2.1051, 2.1047 and 90.691; TIA/EIA-603-D, Section 2.2.13		
<b>Test mode:</b>	Compliance	<b>Verdict: PASS</b>	
<b>Date(s):</b>	06-Dec-15		
<b>Temperature:</b> 23 °C	<b>Air Pressure:</b> 1028 hPa	<b>Relative Humidity:</b> 55 %	<b>Power Supply:</b> 120 VAC
<b>Remarks:</b>			

Plot 7.3.2 Emission mask test s results, QPSK, ant. 0 (continued)

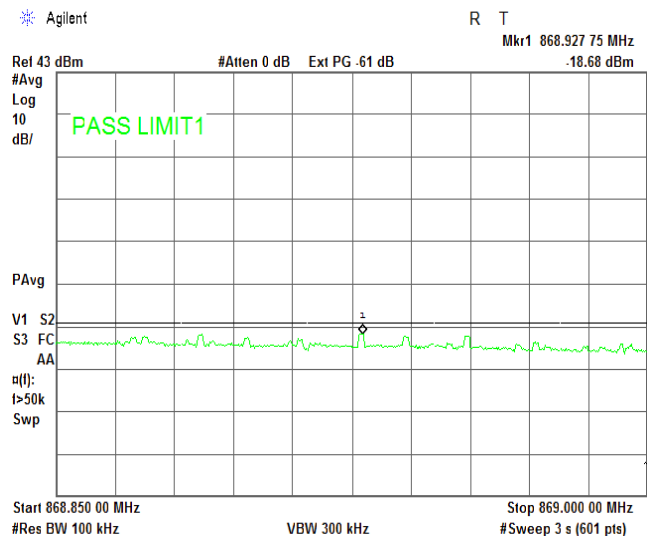
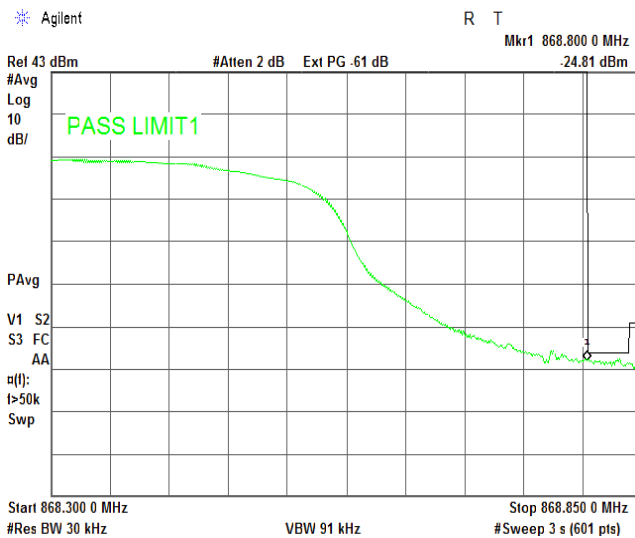
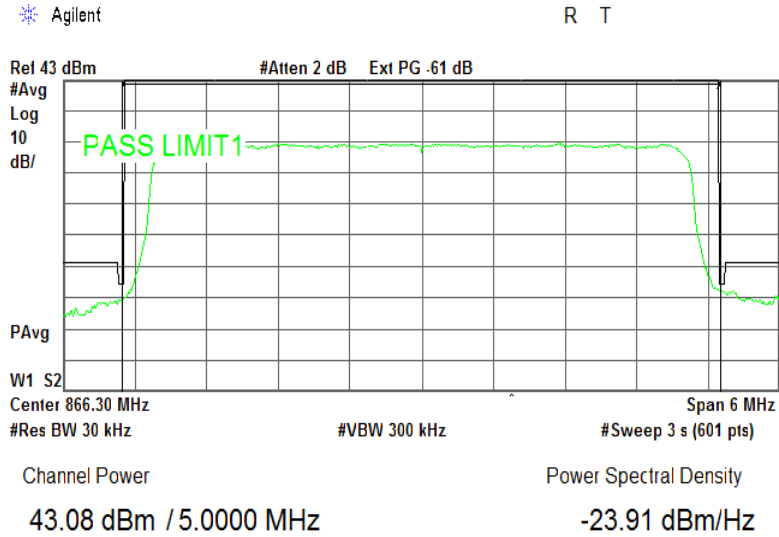




HERMON LABORATORIES

<b>Test specification:</b>		<b>Section 90.210, Emission mask</b>	
<b>Test procedure:</b>		47 CFR, Sections 2.1051, 2.1047 and 90.691; TIA/EIA-603-D, Section 2.2.13	
<b>Test mode:</b>		<b>Verdict: PASS</b>	
<b>Date(s):</b>		06-Dec-15	
<b>Temperature:</b> 23 °C	<b>Air Pressure:</b> 1028 hPa	<b>Relative Humidity:</b> 55 %	<b>Power Supply:</b> 120 VAC
<b>Remarks:</b>			

Plot 7.3.3 Emission mask test, 64QAM, ant. 1



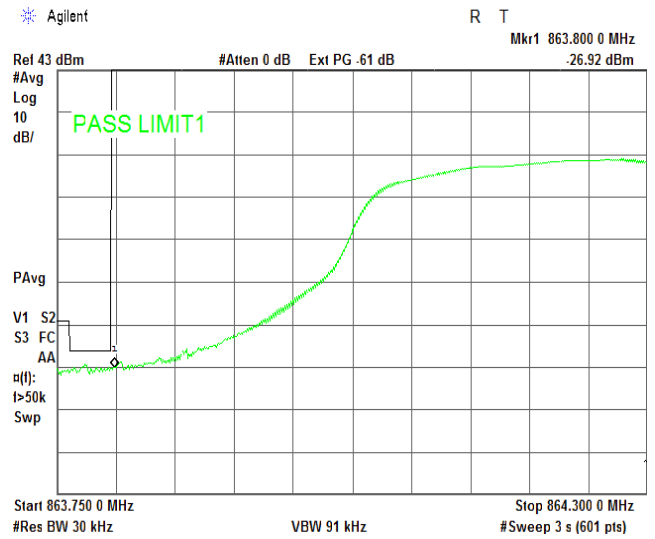
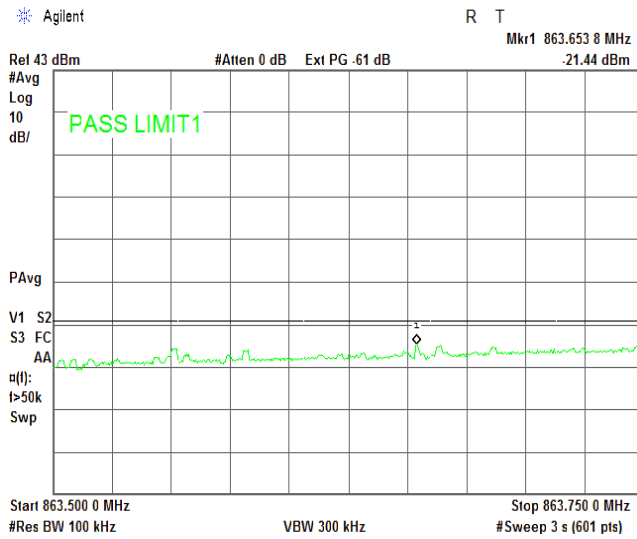




HERMON LABORATORIES

<b>Test specification:</b>	<b>Section 90.210, Emission mask</b>		
<b>Test procedure:</b>	47 CFR, Sections 2.1051, 2.1047 and 90.691; TIA/EIA-603-D, Section 2.2.13		
<b>Test mode:</b>	Compliance	<b>Verdict: PASS</b>	
<b>Date(s):</b>	06-Dec-15		
<b>Temperature:</b> 23 °C	<b>Air Pressure:</b> 1028 hPa	<b>Relative Humidity:</b> 55 %	<b>Power Supply:</b> 120 VAC
<b>Remarks:</b>			

Plot 7.3.3 Emission mask test, 64QAM, ant. 1 (continued)

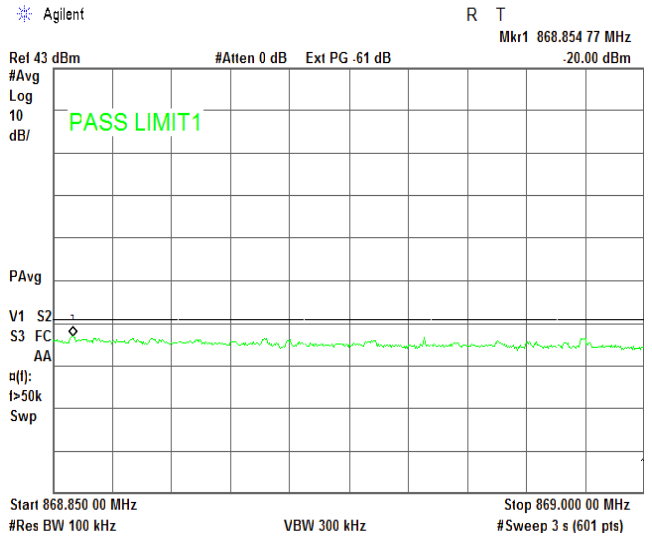
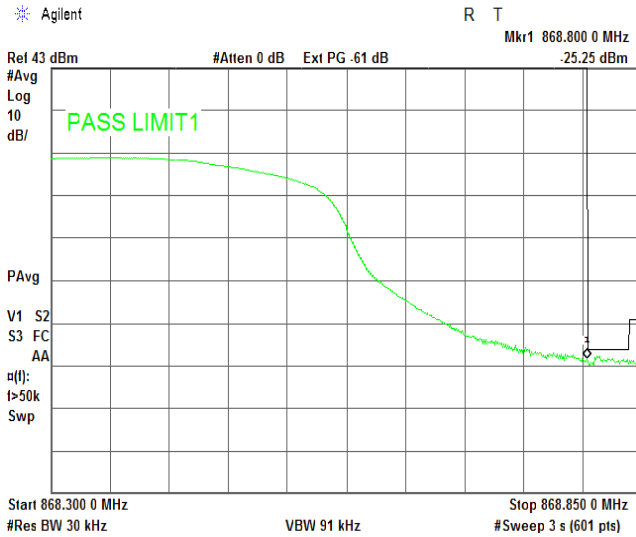
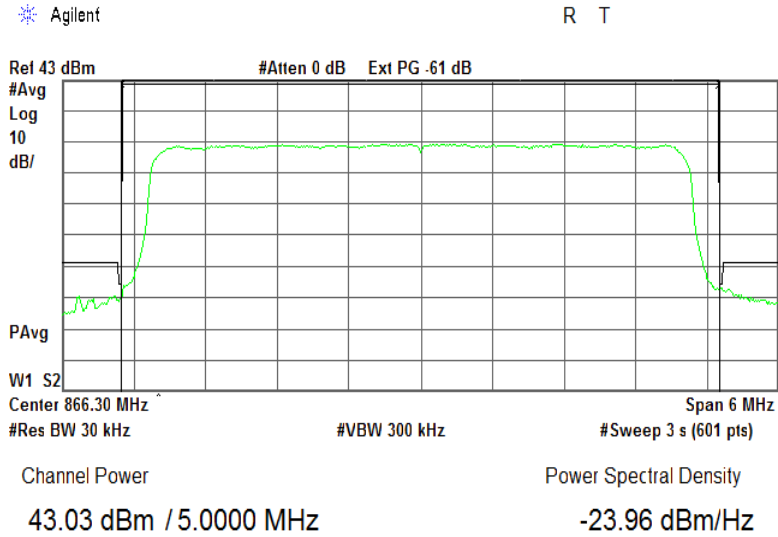




HERMON LABORATORIES

<b>Test specification:</b>	<b>Section 90.210, Emission mask</b>		
<b>Test procedure:</b>	47 CFR, Sections 2.1051, 2.1047 and 90.691; TIA/EIA-603-D, Section 2.2.13		
<b>Test mode:</b>	Compliance	<b>Verdict:</b>	<b>PASS</b>
<b>Date(s):</b>	06-Dec-15		
<b>Temperature:</b> 23 °C	<b>Air Pressure:</b> 1028 hPa	<b>Relative Humidity:</b> 55 %	<b>Power Supply:</b> 120 VAC
<b>Remarks:</b>			

Plot 7.3.4 Emission mask test, QPSK, ant. 1

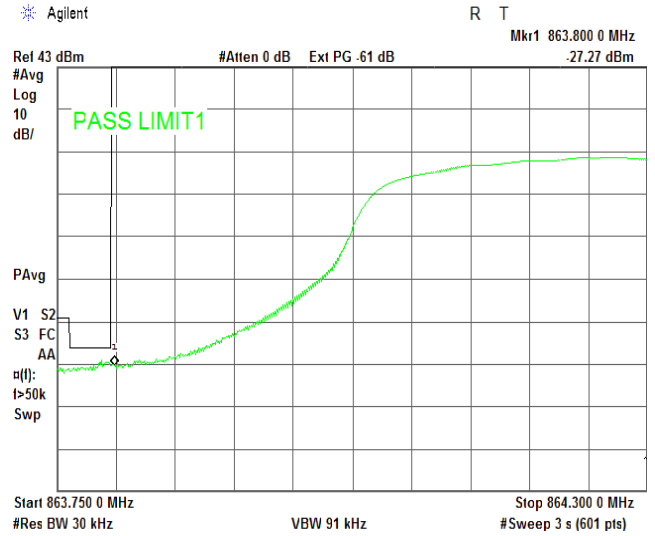
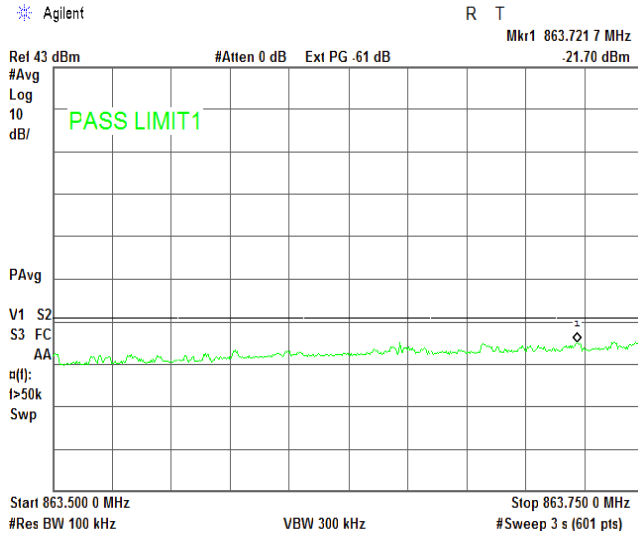




HERMON LABORATORIES

<b>Test specification:</b>	<b>Section 90.210, Emission mask</b>		
<b>Test procedure:</b>	47 CFR, Sections 2.1051, 2.1047 and 90.691; TIA/EIA-603-D, Section 2.2.13		
<b>Test mode:</b>	Compliance	<b>Verdict: PASS</b>	
<b>Date(s):</b>	06-Dec-15		
<b>Temperature:</b> 23 °C	<b>Air Pressure:</b> 1028 hPa	<b>Relative Humidity:</b> 55 %	<b>Power Supply:</b> 120 VAC
<b>Remarks:</b>			

Plot 7.3.4 Emission mask test, QPSK, ant. 1 (continued)





<b>Test specification:</b>		<b>Section 90.210, Radiated spurious emissions</b>	
<b>Test procedure:</b>		47 CFR, Sections 2.1053 and 90.210; TIA/EIA-603-D, Section 2.2.12	
<b>Test mode:</b>		Compliance	
<b>Date(s):</b>		10-Dec-15	
<b>Temperature:</b> 23 °C		<b>Air Pressure:</b> 1020 hPa	
<b>Remarks:</b>		<b>Verdict:</b> PASS	
		<b>Relative Humidity:</b> 54 %	
		<b>Power Supply:</b> 120 VAC	

## 7.4 Radiated spurious emission measurements

### 7.4.1 General

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

Table 7.4.1 Radiated spurious emission test limits

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

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

\*\*\* - Equivalent field strength limit was calculated from maximum allowed ERP of spurious as follows:  $E = \sqrt{30 \times P \times 1.64} / r$ , where P is ERP in Watts, 1.64 is numeric gain of ideal dipole and r is antenna to EUT distance in meters

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

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

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

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

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

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

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

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



<b>Test specification:</b> Section 90.210, Radiated spurious emissions			
<b>Test procedure:</b> 47 CFR, Sections 2.1053 and 90.210; TIA/EIA-603-D, Section 2.2.12			
<b>Test mode:</b> Compliance	<b>Verdict:</b> PASS		
<b>Date(s):</b> 10-Dec-15			
<b>Temperature:</b> 23 °C	<b>Air Pressure:</b> 1020 hPa	<b>Relative Humidity:</b> 54 %	<b>Power Supply:</b> 120 VAC
<b>Remarks:</b>			

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

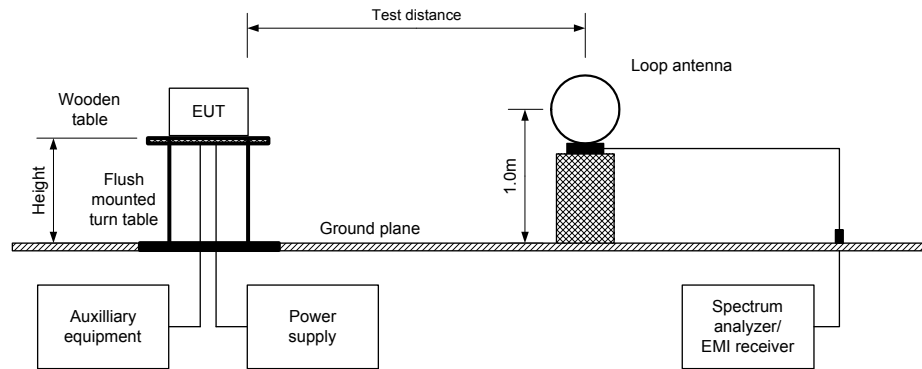
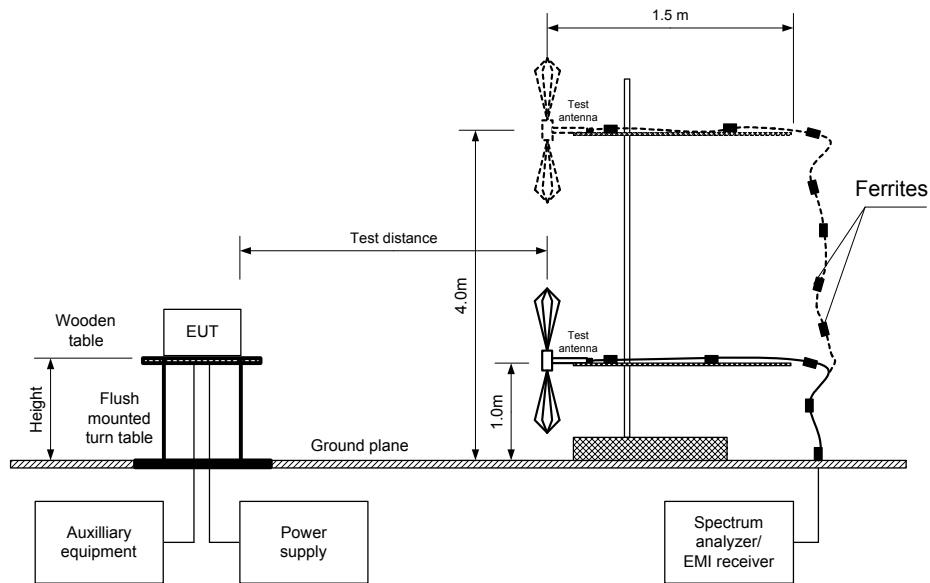


Figure 7.4.2 Setup for spurious emission field strength measurements above 30 MHz





<b>Test specification:</b>		<b>Section 90.210, Radiated spurious emissions</b>	
<b>Test procedure:</b>		47 CFR, Sections 2.1053 and 90.210; TIA/EIA-603-D, Section 2.2.12	
<b>Test mode:</b>		Compliance	
<b>Date(s):</b>		10-Dec-15	
<b>Temperature:</b> 23 °C		<b>Air Pressure:</b> 1020 hPa	
		<b>Relative Humidity:</b> 54 %	
		<b>Power Supply:</b> 120 VAC	
<b>Remarks:</b>			

Table 7.4.2 Spurious emission field strength test results

ASSIGNED FREQUENCY RANGE: 862-869 MHz  
TEST DISTANCE: 3 m  
TEST SITE: Semi anechoic chamber  
EUT HEIGHT: 0.8 m  
INVESTIGATED FREQUENCY RANGE: 0.009 – 9000 MHz  
DETECTOR USED: Peak  
VIDEO BANDWIDTH: > Resolution bandwidth  
TEST ANTENNA TYPE: Active loop (9 kHz – 30 MHz)  
Biconilog (30 MHz – 1000 MHz)  
Double ridged guide (above 1000 MHz)  
MODULATION: 64 QAM

Frequency, MHz	Field strength, dB(µV/m)	Limit, dB(µV/m)	Margin, dB*	RBW, kHz	Antenna polarization	Antenna height, m	Turn-table position**, degrees
No spurious were found							

Verdict: Pass

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

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

Reference numbers of test equipment used

HL 0446	HL 0521	HL 0604	HL 1984	HL 3342	HL 3818	HL 4278	HL 4353
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Full description is given in Appendix A.



HERMON LABORATORIES

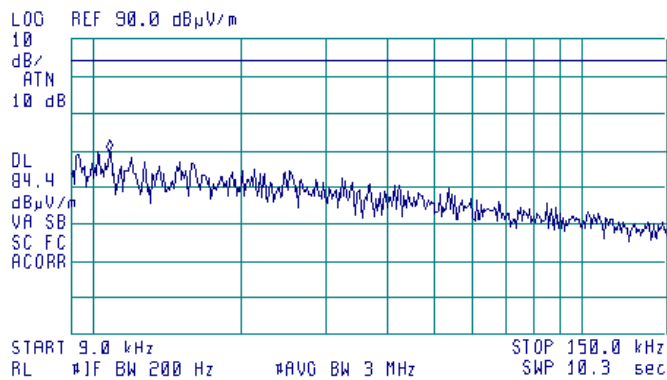
<b>Test specification:</b>		<b>Section 90.210, Radiated spurious emissions</b>	
<b>Test procedure:</b>		47 CFR, Sections 2.1053 and 90.210; TIA/EIA-603-D, Section 2.2.12	
<b>Test mode:</b>		<b>Verdict:</b> PASS	
<b>Date(s):</b>		10-Dec-15	
<b>Temperature:</b> 23 °C	<b>Air Pressure:</b> 1020 hPa	<b>Relative Humidity:</b> 54 %	<b>Power Supply:</b> 120 VAC
<b>Remarks:</b>			

Plot 7.4.1 Radiated emission measurements in 9 - 150 kHz range

TEST SITE: Semi anechoic chamber  
TEST DISTANCE: 3 m



ACTV DET: PEAK  
MEAS DET: PEAK OP AVG  
MKR 10.8 kHz  
59.66 dBµV/m

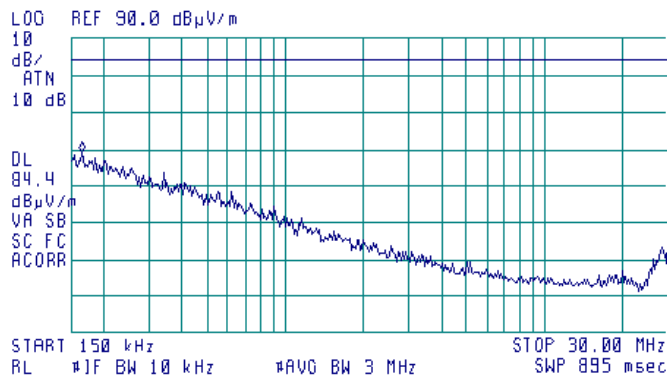


Plot 7.4.2 Radiated emission measurements in 0.15 - 30 MHz range

TEST SITE: Semi anechoic chamber  
TEST DISTANCE: 3 m



ACTV DET: PEAK  
MEAS DET: PEAK OP AVG  
MKR 170 kHz  
59.01 dBµV/m





HERMON LABORATORIES

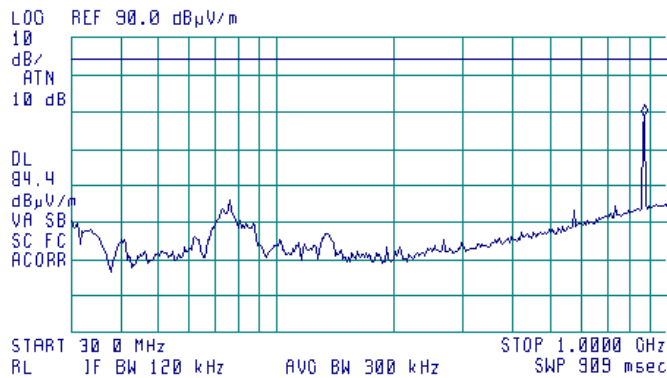
<b>Test specification:</b>		<b>Section 90.210, Radiated spurious emissions</b>	
<b>Test procedure:</b>		47 CFR, Sections 2.1053 and 90.210; TIA/EIA-603-D, Section 2.2.12	
<b>Test mode:</b>		<b>Verdict:</b> PASS	
<b>Date(s):</b>		10-Dec-15	
<b>Temperature:</b> 23 °C	<b>Air Pressure:</b> 1020 hPa	<b>Relative Humidity:</b> 54 %	<b>Power Supply:</b> 120 VAC
<b>Remarks:</b>			

**Plot 7.4.3 Radiated emission measurements in 30 - 1000 MHz range**

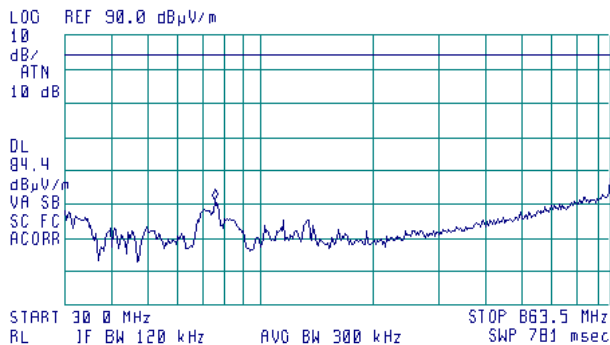
TEST SITE: Semi anechoic chamber  
 ANTENNA POLARIZATION: Vertical and Horizontal  
 TEST DISTANCE: 3 m



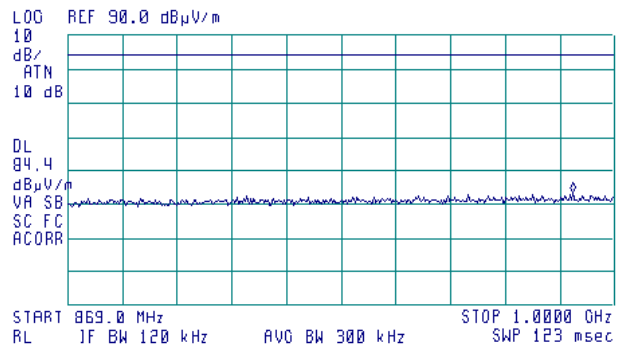
ACTV DET: PEAK  
 MEAS DET: PEAK OP AVG  
 MKR 865.5 MHz  
 60.80 dBµV/m



ACTV DET: PEAK  
 MEAS DET: PEAK OP AVG  
 MKR 75.7 MHz  
 41.22 dBµV/m



ACTV DET: PEAK  
 MEAS DET: PEAK OP AVG  
 MKR 989.8 MHz  
 43.66 dBµV/m





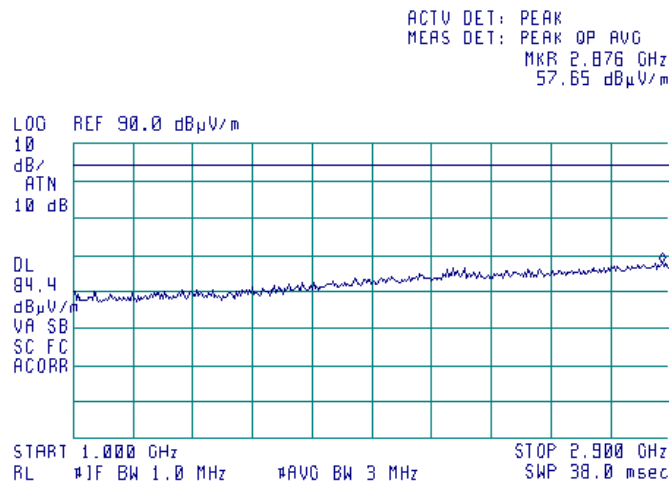


HERMON LABORATORIES

<b>Test specification:</b>		<b>Section 90.210, Radiated spurious emissions</b>	
<b>Test procedure:</b>		47 CFR, Sections 2.1053 and 90.210; TIA/EIA-603-D, Section 2.2.12	
<b>Test mode:</b>		Compliance	
<b>Date(s):</b>		10-Dec-15	
<b>Temperature:</b> 23 °C		<b>Air Pressure:</b> 1020 hPa	
<b>Remarks:</b>		<b>Verdict:</b> PASS	
		<b>Relative Humidity:</b> 54 %	
		<b>Power Supply:</b> 120 VAC	

Plot 7.4.4 Radiated emission measurements in 1000 – 2900 MHz range

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

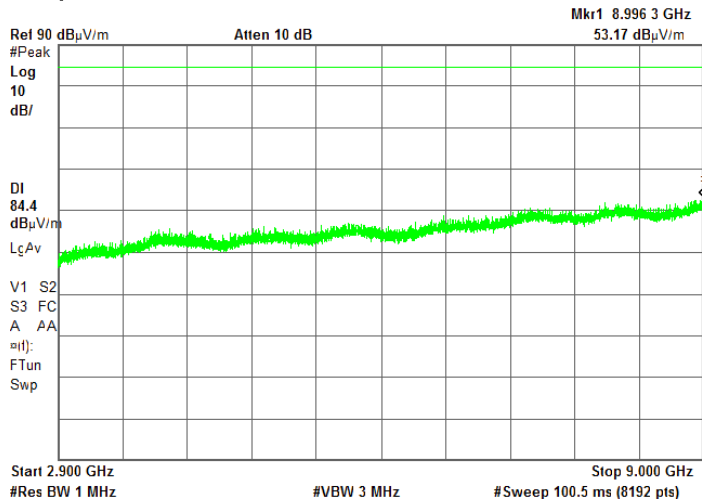


Plot 7.4.5 Radiated emission measurements in 2900 - 9000 MHz range

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

\* Agilent

R T





<b>Test specification:</b>		<b>Section 90.210, Conducted spurious emissions</b>	
<b>Test procedure:</b>		47 CFR, Sections 2.1051 and 90.210; TIA/EIA-603-D, Section 2.2.13	
<b>Test mode:</b>		<b>Verdict:</b> PASS	
<b>Date(s):</b>			
<b>Temperature:</b> 23 °C	<b>Air Pressure:</b> 1028 hPa	<b>Relative Humidity:</b> 55 %	<b>Power Supply:</b> 120 VAC
<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**	-13.0

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

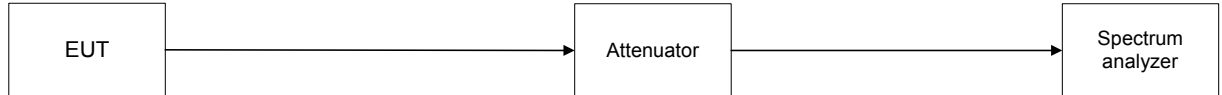
### 7.5.2 Test procedure

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

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

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

Figure 7.5.1 Spurious emission test setup





<b>Test specification:</b>		<b>Section 90.210, Conducted spurious emissions</b>	
<b>Test procedure:</b>		47 CFR, Sections 2.1051 and 90.210; TIA/EIA-603-D, Section 2.2.13	
<b>Test mode:</b>		Compliance	
<b>Date(s):</b>		06-Dec-15	
<b>Temperature:</b> 23 °C		<b>Air Pressure:</b> 1028 hPa	
		<b>Relative Humidity:</b> 55 %	
		<b>Power Supply:</b> 120 VAC	
<b>Remarks:</b>			

**Table 7.5.2 Spurious emission test results**

ASSIGNED FREQUENCY RANGE: 862- 869 MHz  
 INVESTIGATED FREQUENCY RANGE: 0.009 – 9000 MHz  
 VIDEO BANDWIDTH: ≥ Resolution bandwidth  
 MODULATION: 64 QAM  
 BIT RATE: 37 Mbps

Antenna connector	Frequency, MHz	SA reading, dBm	Attenuator, dB	Cable loss, dB	RBW, kHz	Spurious emission, dBm	Calculated limit,* dBm	Margin, dB*	Verdict
0	0.027	-24.30	included	included	0.3	-24.30	-16	-8.30	Pass
	0.824	-28.58	included	included	10	-28.58	-16	-12.58	Pass
	863.5	-27.95	included	included	100	-27.95	-16	-11.95	Pass
	869.0	-24.83	included	included	100	-24.83	-16	-8.83	Pass
1	0.064	-34.66	included	included	0.3	-34.66	-16	-18.66	Pass
	1.108	-31.35	included	included	10	-31.35	-16	-15.35	Pass
	863.5	-26.59	included	included	100	-26.59	-16	-10.59	Pass
	869.0	-23.33	included	included	100	-23.33	-16	-7.33	Pass

\*Calculated limit, dBm = Limit, dBm - 10 log (number of RF chains), dB = -13 – 10 log 2 = -16 dBm

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

**Reference numbers of test equipment used**

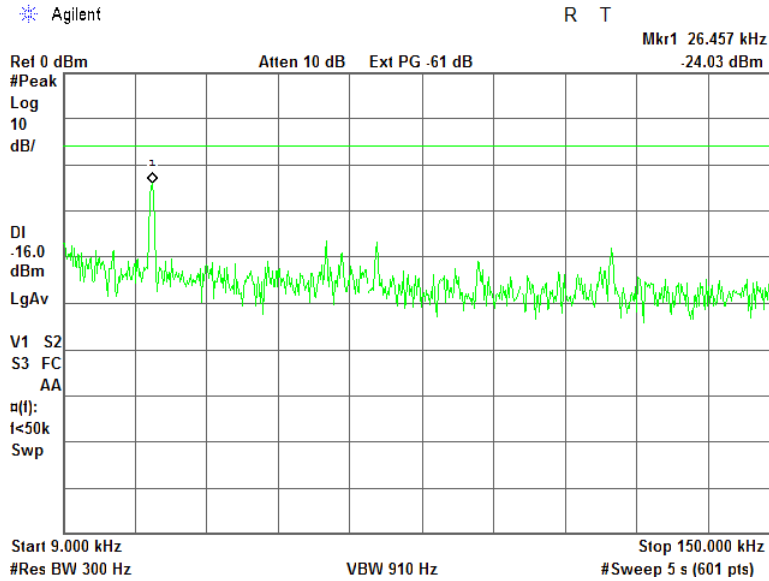
HL 3818						
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Full description is given in Appendix A.

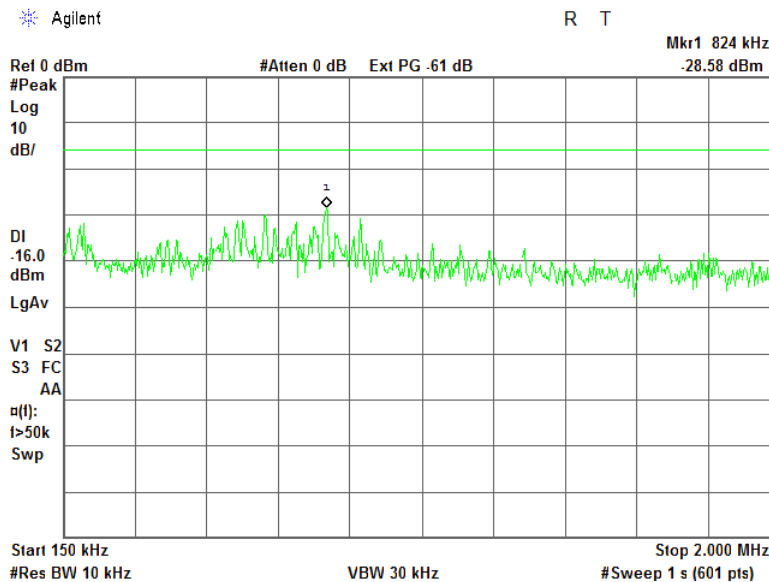


<b>Test specification:</b>		<b>Section 90.210, Conducted spurious emissions</b>	
<b>Test procedure:</b>		47 CFR, Sections 2.1051 and 90.210; TIA/EIA-603-D, Section 2.2.13	
<b>Test mode:</b>		Compliance	
<b>Date(s):</b>		06-Dec-15	
<b>Temperature:</b> 23 °C		<b>Air Pressure:</b> 1028 hPa	
		<b>Relative Humidity:</b> 55 %	
		<b>Power Supply:</b> 120 VAC	
<b>Remarks:</b>			
		<b>Verdict: PASS</b>	

Plot 7.5.1 Spurious emission measurements in 9 - 150 kHz range at ant.0



Plot 7.5.2 Spurious emission measurements in 0.15 - 2.0 MHz range at ant.0

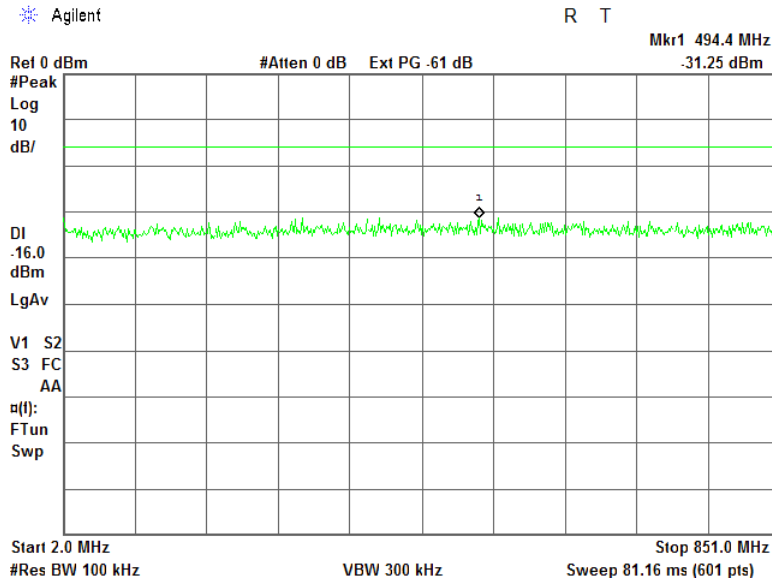




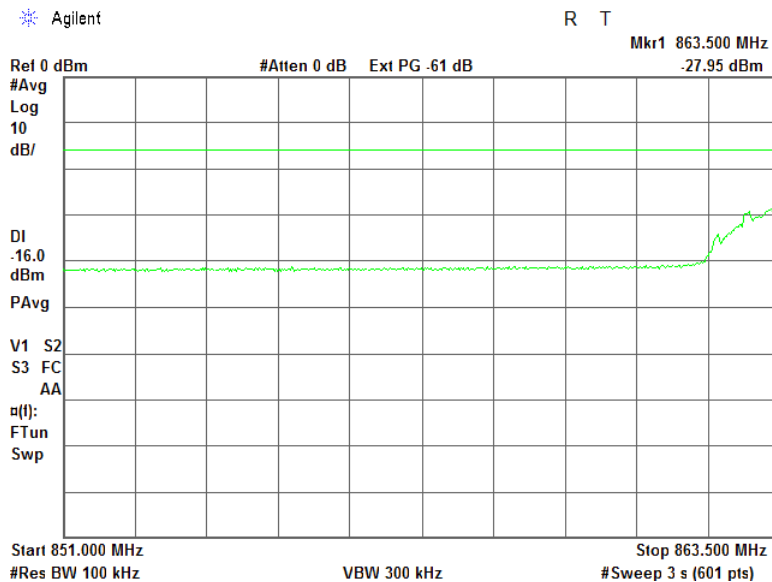
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<b>Test specification:</b>		<b>Section 90.210, Conducted spurious emissions</b>	
<b>Test procedure:</b>		47 CFR, Sections 2.1051 and 90.210; TIA/EIA-603-D, Section 2.2.13	
<b>Test mode:</b>		Compliance	
<b>Date(s):</b>		06-Dec-15	
<b>Temperature:</b> 23 °C		<b>Air Pressure:</b> 1028 hPa	
		<b>Relative Humidity:</b> 55 %	
		<b>Power Supply:</b> 120 VAC	
<b>Remarks:</b>			
		<b>Verdict: PASS</b>	

Plot 7.5.3 Spurious emission measurements in 2.0 - 851 MHz range at ant.0



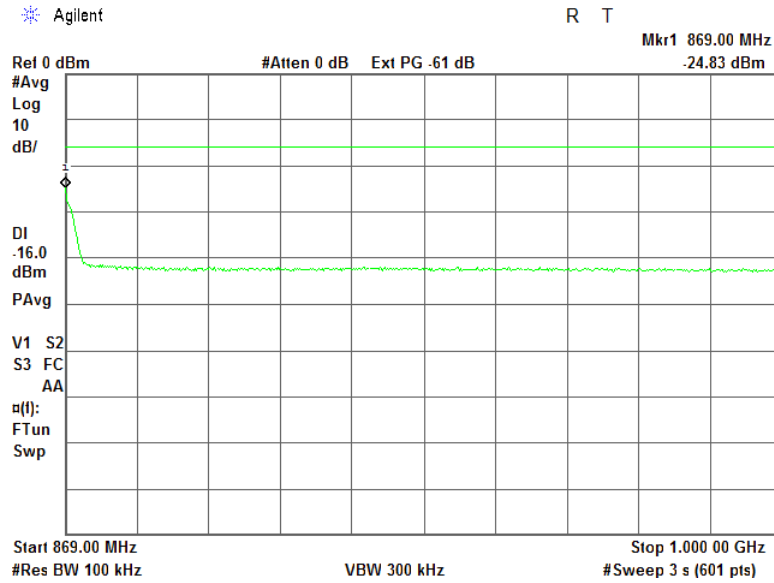
Plot 7.5.4 Spurious emission measurements in 851.0 – 863.5 MHz range at ant.0



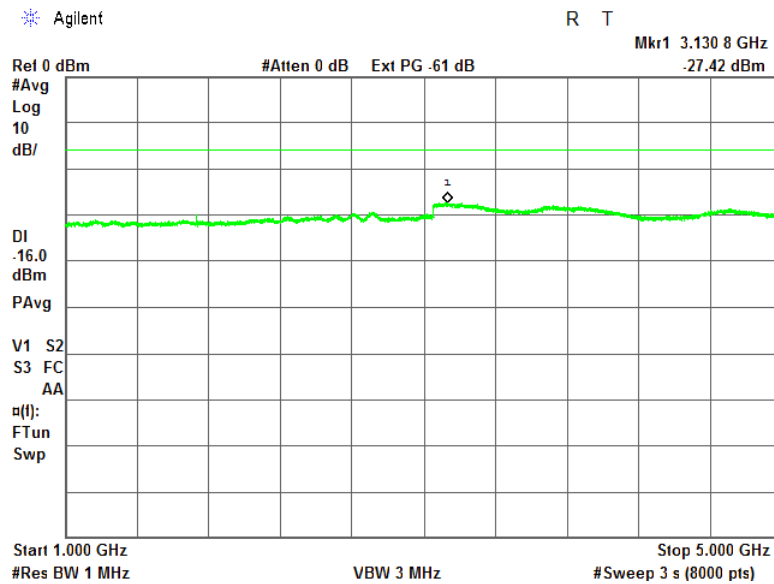


<b>Test specification:</b>		<b>Section 90.210, Conducted spurious emissions</b>	
<b>Test procedure:</b>		47 CFR, Sections 2.1051 and 90.210; TIA/EIA-603-D, Section 2.2.13	
<b>Test mode:</b>		Compliance	
<b>Date(s):</b>		06-Dec-15	
<b>Temperature:</b> 23 °C		<b>Air Pressure:</b> 1028 hPa	
		<b>Relative Humidity:</b> 55 %	
		<b>Power Supply:</b> 120 VAC	
<b>Remarks:</b>			
		<b>Verdict: PASS</b>	

Plot 7.5.5 Spurious emission measurements in 869 - 1000 MHz frequency range at ant.0



Plot 7.5.6 Spurious emission measurements in 1000 - 5000 MHz at ant.0

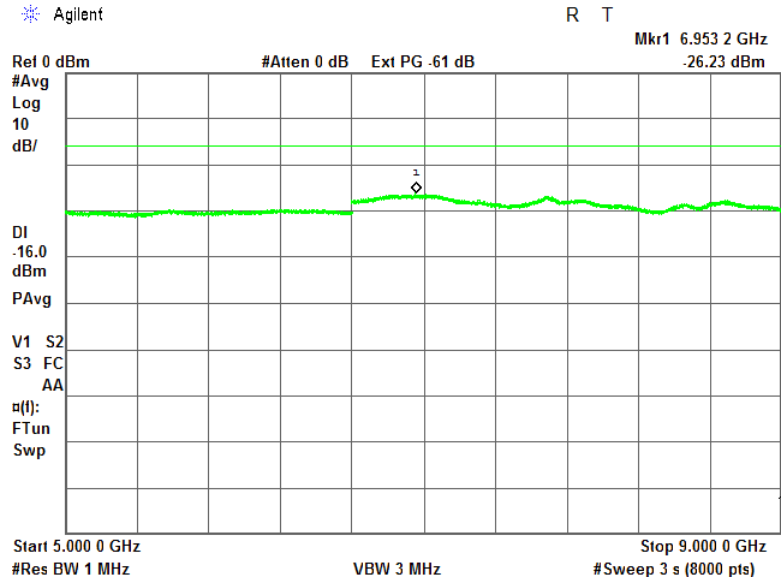




HERMON LABORATORIES

<b>Test specification:</b>	<b>Section 90.210, Conducted spurious emissions</b>		
<b>Test procedure:</b>	47 CFR, Sections 2.1051 and 90.210; TIA/EIA-603-D, Section 2.2.13		
<b>Test mode:</b>	Compliance	<b>Verdict: PASS</b>	
<b>Date(s):</b>	06-Dec-15		
<b>Temperature:</b> 23 °C	<b>Air Pressure:</b> 1028 hPa	<b>Relative Humidity:</b> 55 %	<b>Power Supply:</b> 120 VAC
<b>Remarks:</b>			

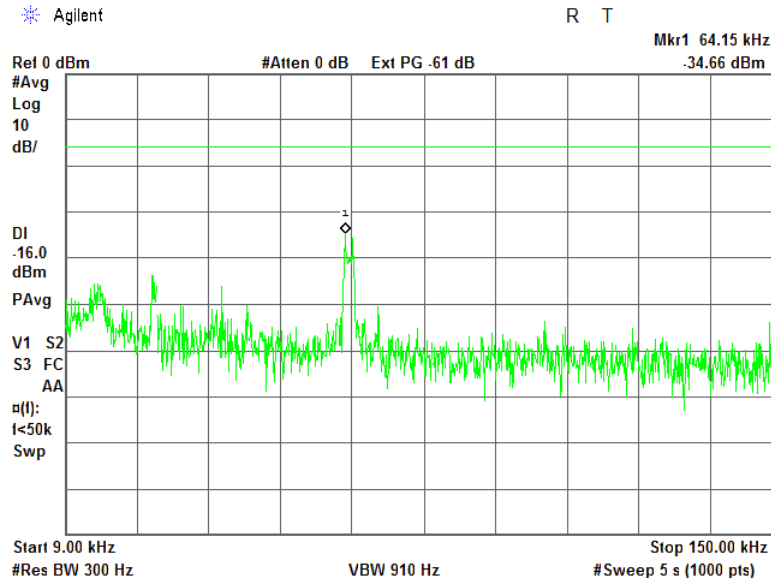
Plot 7.5.7 Spurious emission measurements in 5000 - 9000 MHz at ant.0



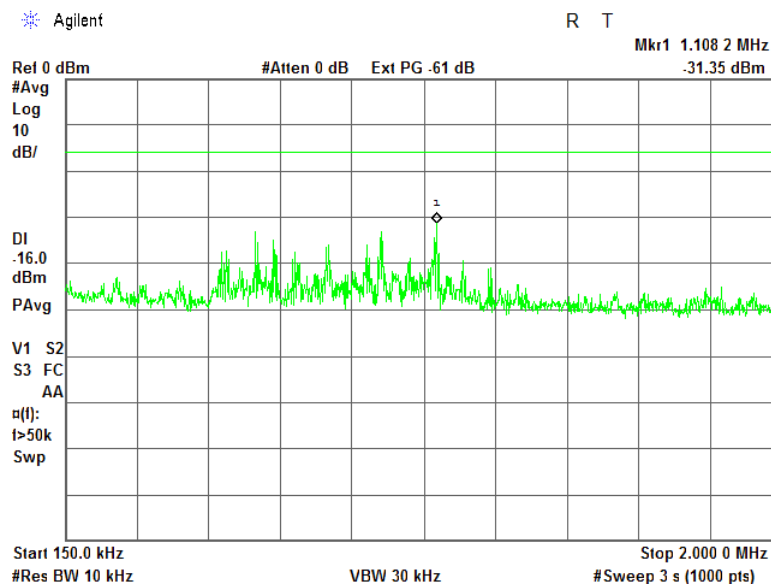


<b>Test specification:</b>	<b>Section 90.210, Conducted spurious emissions</b>		
<b>Test procedure:</b>	47 CFR, Sections 2.1051 and 90.210; TIA/EIA-603-D, Section 2.2.13		
<b>Test mode:</b>	Compliance	<b>Verdict:</b>	<b>PASS</b>
<b>Date(s):</b>	06-Dec-15		
<b>Temperature:</b> 23 °C	<b>Air Pressure:</b> 1028 hPa	<b>Relative Humidity:</b> 55 %	<b>Power Supply:</b> 120 VAC
<b>Remarks:</b>			

Plot 7.5.8 Spurious emission measurements in 9 - 150 kHz range at ant.1



Plot 7.5.9 Spurious emission measurements in 0.15 - 2.0 MHz range at ant.1

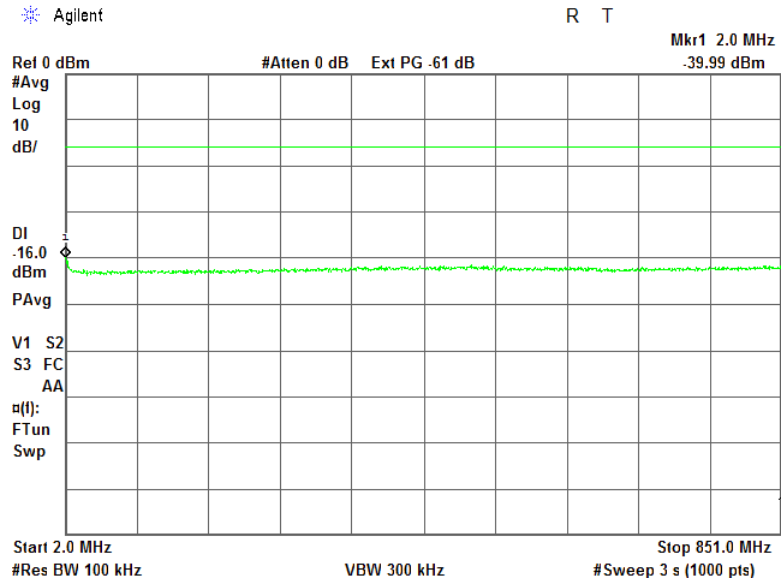




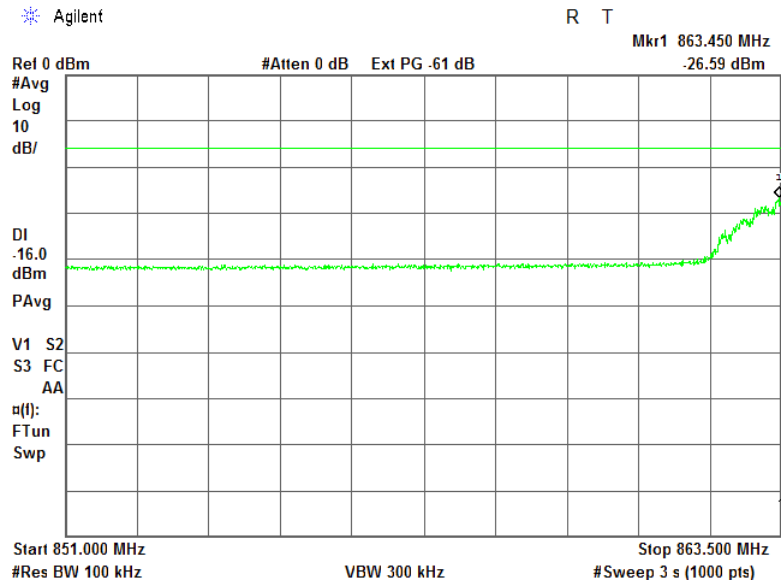


<b>Test specification:</b>	<b>Section 90.210, Conducted spurious emissions</b>		
<b>Test procedure:</b>	47 CFR, Sections 2.1051 and 90.210; TIA/EIA-603-D, Section 2.2.13		
<b>Test mode:</b>	Compliance	<b>Verdict:</b>	<b>PASS</b>
<b>Date(s):</b>	06-Dec-15	<b>Relative Humidity:</b>	55 %
<b>Temperature:</b> 23 °C	<b>Air Pressure:</b> 1028 hPa	<b>Power Supply:</b>	120 VAC
<b>Remarks:</b>			

Plot 7.5.10 Spurious emission measurements in 2.0 - 851 MHz range at ant.1



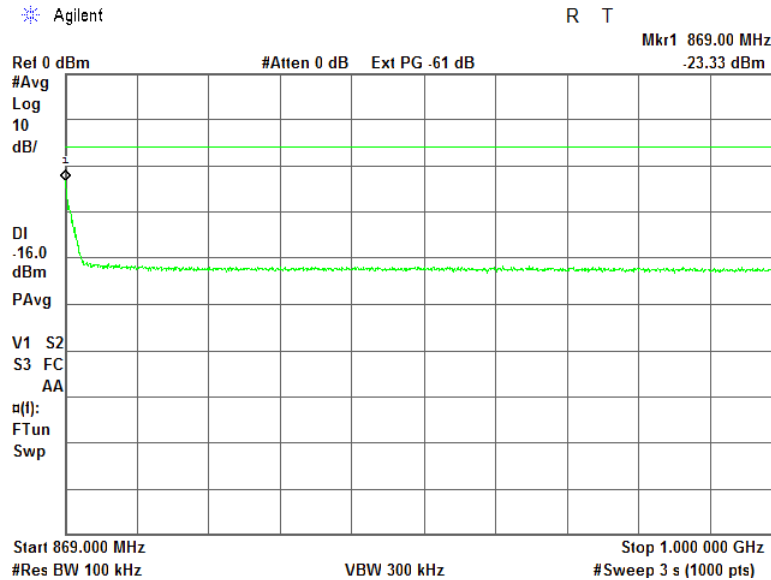
Plot 7.5.11 Spurious emission measurements in 851.0 – 863.5 MHz range at ant.1



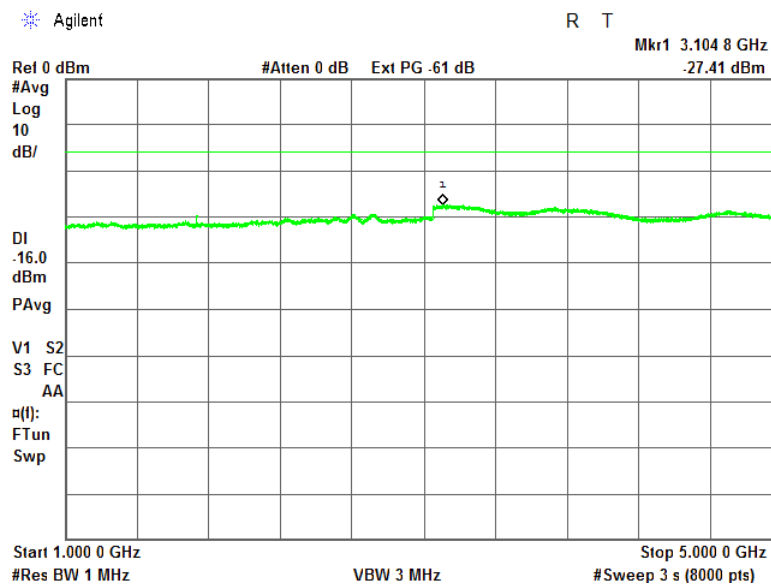


<b>Test specification:</b>		<b>Section 90.210, Conducted spurious emissions</b>	
<b>Test procedure:</b>		47 CFR, Sections 2.1051 and 90.210; TIA/EIA-603-D, Section 2.2.13	
<b>Test mode:</b>		Compliance	
<b>Date(s):</b>		06-Dec-15	
<b>Temperature:</b> 23 °C		<b>Air Pressure:</b> 1028 hPa	
		<b>Relative Humidity:</b> 55 %	
		<b>Power Supply:</b> 120 VAC	
<b>Remarks:</b>			
		<b>Verdict: PASS</b>	

Plot 7.5.12 Spurious emission measurements in 869 - 1000 MHz frequency range at ant.1



Plot 7.5.13 Spurious emission measurements in 1000 - 5000 MHz at ant.1

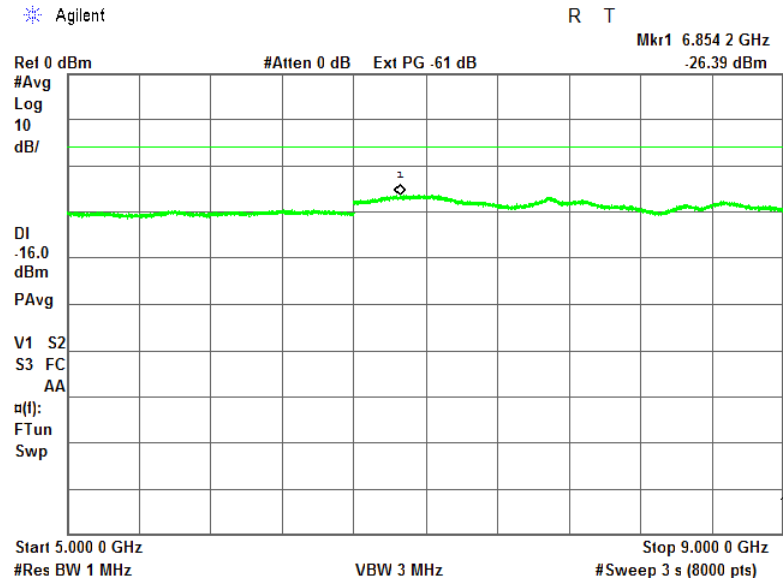




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<b>Test specification:</b>	<b>Section 90.210, Conducted spurious emissions</b>		
<b>Test procedure:</b>	47 CFR, Sections 2.1051 and 90.210; TIA/EIA-603-D, Section 2.2.13		
<b>Test mode:</b>	Compliance	<b>Verdict:</b>	<b>PASS</b>
<b>Date(s):</b>	06-Dec-15	<b>Relative Humidity:</b>	55 %
<b>Temperature:</b> 23 °C	<b>Air Pressure:</b> 1028 hPa	<b>Power Supply:</b>	120 VAC
<b>Remarks:</b>			

Plot 7.5.14 Spurious emission measurements in 5000 - 9000 MHz at ant.1





<b>Test specification:</b> Section 90.213, Frequency stability	
<b>Test procedure:</b> 47 CFR, Section 2.1055; TIA/EIA-603-D, Section 2.2.2	
<b>Test mode:</b> Compliance	<b>Verdict:</b> PASS
<b>Date(s):</b> 07-Dec-15	
<b>Temperature:</b> 23 °C	<b>Air Pressure:</b> 1027 hPa
<b>Relative Humidity:</b> 55 %	
<b>Power Supply:</b> 120 VAC	
<b>Remarks:</b>	

## 7.6 Frequency stability test

### 7.6.1 General

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

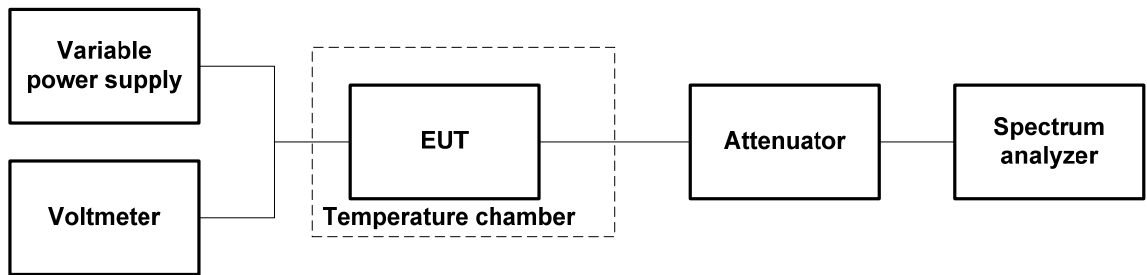
Table 7.6.1 Frequency stability limits

Assigned frequency, MHz	Maximum allowed frequency displacement	
	ppm	Hz
866.3	1.5	1299.45

### 7.6.2 Test procedure

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

Figure 7.6.1 Frequency stability test setup





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<b>Test specification:</b>		<b>Section 90.213, Frequency stability</b>			
<b>Test procedure:</b>		47 CFR, Section 2.1055; TIA/EIA-603-D, Section 2.2.2			
<b>Test mode:</b>		Compliance		<b>Verdict:</b> PASS	
<b>Date(s):</b>		07-Dec-15			
<b>Temperature:</b> 23 °C		<b>Air Pressure:</b> 1027 hPa		<b>Relative Humidity:</b> 55 %	<b>Power Supply:</b> 120 VAC
<b>Remarks:</b>					

Table 7.6.2 Frequency stability test results

OPERATING FREQUENCY: 866.3 MHz  
 NOMINAL POWER VOLTAGE: 120 V AC  
 TEMPERATURE STABILIZATION PERIOD: 20 min  
 POWER DURING TEMPERATURE TRANSITION: Off  
 RESOLUTION BANDWIDTH: 300 Hz  
 VIDEO BANDWIDTH: 300 Hz  
 MODULATION: Unmodulated

T, °C	Voltage, V	Frequency, MHz							Max frequency drift, Hz		Limit, Hz	Verdict
		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		
-30	nominal	866.30007	866.30007	866.30008	866.30007	866.30009	866.30007	866.30008	10	10	1299.45	Pass
-20	nominal	866.30008	NA	NA	NA	NA	NA	866.30010	20	0		Pass
-10	nominal	866.30008	NA	NA	NA	NA	NA	866.30008	0	0		Pass
0	nominal	866.30008	866.30008	866.30007	866.30008	866.30010	866.30007	866.30008	0	10		Pass
10	nominal	866.30008	NA	NA	NA	NA	NA	866.30008	0	0		Pass
20	+15%	866.30008	NA	NA	NA	NA	NA	866.30008	0	0		Pass
20	nominal	866.30008	NA	NA	NA	NA	NA	866.30008	0	0		Pass
20	-15%	866.30008	NA	NA	NA	NA	NA	866.30008	0	0		Pass
30	nominal	866.30008	866.30008	866.30008	866.30009	866.30008	866.30008	866.30008	10	0		Pass
40	nominal	866.30008	NA	NA	NA	NA	NA	866.30008	0	0		Pass
50	nominal	866.30008	NA	NA	NA	NA	NA	866.30008	0	0		Pass

\* - Reference frequency

Reference numbers of test equipment used

HL 0495	HL 1424	HL 3210	HL 3310				
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Full description is given in Appendix A.



<b>Test specification:</b>	<b>Section 15.111, Conducted emission at receiver antenna port</b>		
<b>Test procedure:</b>	ANSI C63.4, Section 12.1.5		
<b>Test mode:</b>	Compliance	<b>Verdict:</b>	<b>PASS</b>
<b>Date(s):</b>	06-Dec-15		
<b>Temperature:</b> 23 °C	<b>Air Pressure:</b> 1028 hPa	<b>Relative Humidity:</b> 55 %	<b>Power Supply:</b> 120 VAC
<b>Remarks:</b>			

## 7.7 Spurious emissions at RF antenna connector

### 7.7.1 General

This test was performed to measure spurious emissions at RF antenna connector of receiver operated within 30 to 960 MHz band or a citizens band (CB) receiver which was tested for compliance with radiated emission limits with the antenna port connected to resistive termination. Specification test limits are given in Table 7.7.1.

Table 7.7.1 Spurious emission limits

Frequency, MHz	EUT type	Power of spurious	
		nW	dBm
25 MHz – 5 <sup>th</sup> harmonic*	Citizens band (CB) receiver	2.0	-57.0
30 MHz – 2 <sup>nd</sup> harmonic**	Superheterodyne receiver		
30 MHz – 5 <sup>th</sup> harmonic*	Other receiver operates within 30 – 960 MHz		

\* - harmonic of the highest frequency the EUT generates, uses, operates or tunes to.

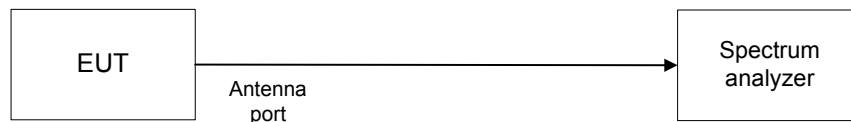
\*\* - harmonic of the local oscillator frequency.

### 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 spurious emission was measured with spectrum analyzer as provided in Table 7.7.2 and the associated plots.

Figure 7.7.1 Spurious emission test setup





<b>Test specification:</b>	<b>Section 15.111, Conducted emission at receiver antenna port</b>		
<b>Test procedure:</b>	ANSI C63.4, Section 12.1.5		
<b>Test mode:</b>	Compliance	<b>Verdict:</b>	<b>PASS</b>
<b>Date(s):</b>	06-Dec-15		
<b>Temperature:</b> 23 °C	<b>Air Pressure:</b> 1028 hPa	<b>Relative Humidity:</b> 55 %	<b>Power Supply:</b> 120 VAC
<b>Remarks:</b>			

**Table 7.7.2 Spurious emission test results**

INVESTIGATED FREQUENCY RANGE: 25-5000 MHz  
 RECEIVER TYPE: Other than CB or superheterodyne  
 EUT OPERATING MODE: Receive  
 DETECTOR USED: Peak  
 RESOLUTION BANDWIDTH: 100 kHz / 1 MHz  
 VIDEO BANDWIDTH: 300 kHz / 3MHz

Frequency, MHz	Spurious emission, dBm	Limit, dBm	Margin, dB	Verdict
25-5000	Not found	-57.0	NA	Pass

**Reference numbers of test equipment used**

HL 3818	HL						
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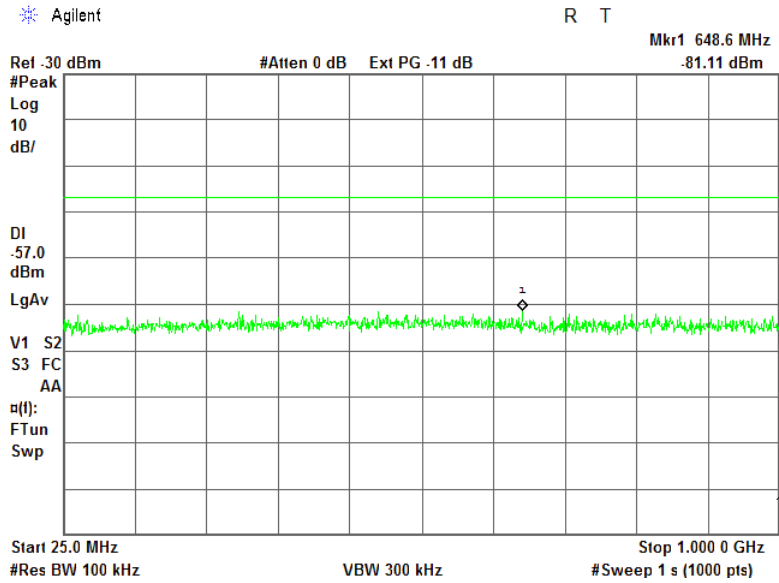
Full description is given in Appendix A.



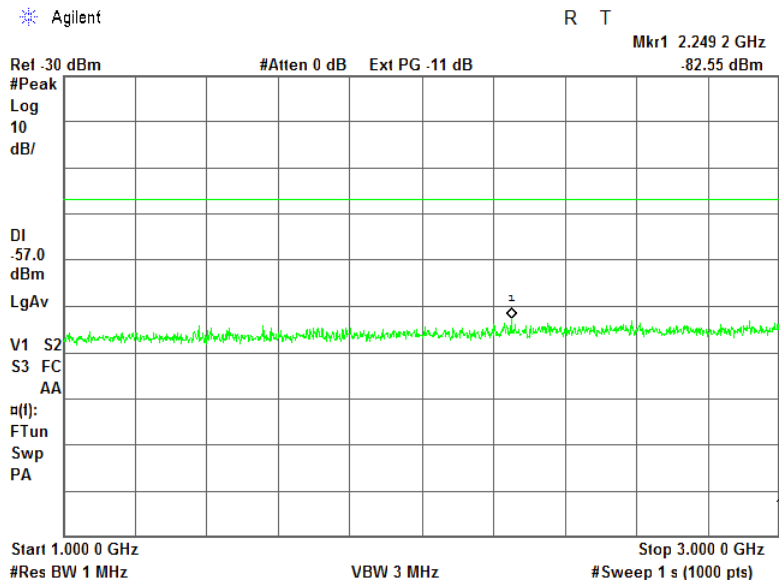
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<b>Test specification:</b>		<b>Section 15.111, Conducted emission at receiver antenna port</b>	
<b>Test procedure:</b>		ANSI C63.4, Section 12.1.5	
<b>Test mode:</b>		Compliance	
<b>Date(s):</b>		06-Dec-15	
<b>Temperature:</b> 23 °C		<b>Air Pressure:</b> 1028 hPa	
		<b>Relative Humidity:</b> 55 %	
		<b>Power Supply:</b> 120 VAC	
<b>Remarks:</b>			

Plot 7.7.1 Spurious emission test results in 25 – 1000 MHz range



Plot 7.7.2 Spurious emission test results in 1000 -3000 MHz range



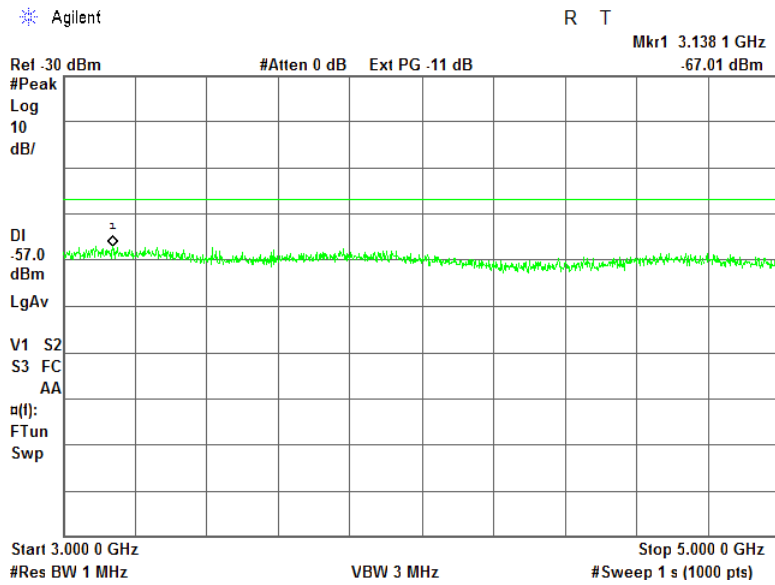




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<b>Test specification:</b>	<b>Section 15.111, Conducted emission at receiver antenna port</b>		
<b>Test procedure:</b>	ANSI C63.4, Section 12.1.5		
<b>Test mode:</b>	Compliance	<b>Verdict:</b>	<b>PASS</b>
<b>Date(s):</b>	06-Dec-15		
<b>Temperature:</b> 23 °C	<b>Air Pressure:</b> 1028 hPa	<b>Relative Humidity:</b> 55 %	<b>Power Supply:</b> 120 VAC
<b>Remarks:</b>			

Plot 7.7.3 Spurious emission test results in 3000 – 5000 MHz range



**8 APPENDIX A Test equipment and ancillaries used for tests**

HL No	Description	Manufacturer	Model	Ser. No.	Last Cal./ Check	Due Cal./ Check
0446	Antenna, Loop, Active, 10 kHz - 30 MHz	EMCO	6502	2857	18-Jan-16	18-Jan-17
0495	Autotransformer 0-255V, 10A	Variac	EMPL01	495	02-Jun-15	02-Jun-16
0521	EMI Receiver (Spectrum Analyzer) with RF filter section 9 kHz-6.5 GHz	Hewlett Packard	8546A	3617A 00319, 3448A002 53	27-Oct-15	27-Oct-16
0604	Antenna BiconiLog Log-Periodic/T Bow-TIE, 26 - 2000 MHz	EMCO	3141	9611-1011	15-May-15	15-May-16
1424	Spectrum Analyzer, 30 Hz- 40 GHz	Agilent Technologies	8564EC	3946A002 19	12-Apr-15	12-Apr-16
1984	Antenna, Double-Ridged Waveguide Horn, 1 to 18 GHz, 300 W	EMC Test Systems	3115	9911-5964	17-Apr-15	17-Apr-16
3210	Temperature Chamber, (-50...+100) °C	Associated Environmental Systems	NA	NA	09-Sep-15	09-Sep-16
3310	Multimeter	Fluke	115C	94321810	13-Jul-15	13-Jul-16
3342	High Pass Filter, 50 Ohm, 2000 to 5200 MHz.	Mini-Circuits	VHF-1910+	NA	01-Oct-15	01-Oct-17
3818	PSA Series Spectrum Analyzer, 3 Hz- 44 GHz	Agilent Technologies	E4446A	MY482502 88	29-Apr-15	29-Apr-16
4278	Test Cable , DC-18 GHz, 4.6 m, N/M - N/M	Mini-Circuits	APC-15FT-NMNM+	0755A	22-Nov-15	22-Nov-16
4353	Low Loss Armored Test Cable, DC - 18 GHz, 6.2 m, N type-M/N type-M	MegaPhase	NC29-N1N1-244	12025101 003	15-Mar-15	15-Mar-16

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

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

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

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

## 10 APPENDIX C Test facility description

ests 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 number IC 2186A-1 for OATS), 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 IL1001.

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Person for contact: Mr. Alex Usoskin, CEO.

## 11 APPENDIX D Specification references

47CFR part 90: 2014	Private land mobile radio services
47CFR part 1: 2014	Practice and procedure
47CFR part 2: 2014	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: 2009	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-D:2010	Land Mobile FM or PM Communications Equipment Measurement and Performance Standards



## 12 APPENDIX E Test equipment correction factors

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

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

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



**Cable loss**  
**Test cable, Mini-Circuits, S/N 0755A, 18 GHz, 4.6 m, N/M - N/M**  
**APC-15FT-NMNM+, HL 4278**

Frequency, MHz	Cable loss, dB	Frequency, MHz	Cable loss, dB	Frequency, MHz	Cable loss, dB	Frequency, MHz	Cable loss, dB
10	0.24	4900	4.19	10000	6.47	15100	8.33
30	0.26	5000	4.25	10100	6.50	15200	8.35
50	0.34	5100	4.29	10200	6.52	15300	8.37
100	0.50	5200	4.32	10300	6.57	15400	8.40
200	0.72	5300	4.38	10400	6.59	15500	8.42
300	0.90	5400	4.41	10500	6.61	15600	8.46
400	1.06	5500	4.46	10600	6.64	15700	8.50
500	1.20	5600	4.51	10700	6.64	15800	8.52
600	1.32	5700	4.56	10800	6.65	15900	8.56
700	1.44	5800	4.59	10900	6.68	16000	8.61
800	1.54	5900	4.64	11000	6.68	16100	8.64
900	1.64	6000	4.69	11100	6.69	16200	8.66
1000	1.74	6100	4.72	11200	6.70	16300	8.70
1100	1.83	6200	4.77	11300	6.74	16400	8.73
1200	1.92	6300	4.80	11400	6.78	16500	8.74
1300	2.01	6400	4.83	11500	6.81	16600	8.75
1400	2.09	6500	4.89	11600	6.84	16700	8.78
1500	2.18	6600	4.90	11700	6.87	16800	8.79
1600	2.25	6700	4.95	11800	6.92	16900	8.81
1700	2.33	6800	5.01	11900	6.98	17000	8.85
1800	2.39	6900	4.99	12000	7.02	17100	8.90
1900	2.47	7000	5.04	12100	7.08	17200	8.95
2000	2.53	7100	5.11	12200	7.15	17300	8.99
2100	2.60	7200	5.14	12300	7.20	17400	9.03
2200	2.67	7300	5.21	12400	7.26	17500	9.07
2300	2.73	7400	5.29	12500	7.31	17600	9.11
2400	2.80	7500	5.33	12600	7.36	17700	9.15
2500	2.87	7600	5.38	12700	7.41	17800	9.19
2600	2.93	7700	5.46	12800	7.46	17900	9.24
2700	3.00	7800	5.52	12900	7.51	18000	9.28
2800	3.06	7900	5.58	13000	7.55		
2900	3.12	8000	5.64	13100	7.59		
3000	3.18	8100	5.69	13200	7.65		
3100	3.24	8200	5.75	13300	7.69		
3200	3.30	8300	5.80	13400	7.72		
3300	3.35	8400	5.84	13500	7.78		
3400	3.42	8500	5.90	13600	7.82		
3500	3.46	8600	5.97	13700	7.86		
3600	3.52	8700	5.99	13800	7.91		
3700	3.57	8800	6.04	13900	7.96		
3800	3.61	8900	6.10	14000	8.01		
3900	3.67	9000	6.13	14100	8.06		
4000	3.71	9100	6.17	14200	8.10		
4100	3.77	9200	6.23	14300	8.13		
4200	3.83	9300	6.27	14400	8.16		
4300	3.89	9400	6.30	14500	8.19		
4400	3.94	9500	6.35	14600	8.21		
4500	4.00	9600	6.37	14700	8.23		
4600	4.05	9700	6.40	14800	8.26		
4700	4.10	9800	6.44	14900	8.28		
4800	4.16	9900	6.45	15000	8.30		





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

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



## 13 APPENDIX F Abbreviations and acronyms

A	ampere
AC	alternating current
AM	amplitude modulation
AVRG	average (detector)
BB	broad band
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
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
RE	radiated emission
RF	radio frequency
rms	root mean square
Rx	receive
s	second
T	temperature
Tx	transmit
V	volt

END OF DOCUMENT