

TEST REPORT

ACCORDING TO: FCC 47CFR part 27

FOR:

Airspan Networks Inc.

LTE Base Station

Model: AirStrand 1300, 2.6 GHz (B41)

FCC ID:PIDAS1300

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.
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1 Applicant information

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Contact name: Mr. Zion Levi

2 Equipment under test attributes

Product name: LTE Base Station
Product type: Transceiver
Model(s): AirStrand 1300, 2.6 GHz (B41)
Serial number: DB4F1CCD2454
Hardware version: B0
Software release: 6_4_1_142
Receipt date 10-Dec-17

3 Manufacturer information

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E-Mail: zlevi@airspan.com
Contact name: Mr. Zion Levi

4 Test details

Project ID: 30379
Location: Hermon Laboratories Ltd. P.O. Box 23, Binyamina 3055001, Israel
Test started: 11-Dec-17
Test completed: 14-Dec-17
Test specification(s): FCC 47CFR part 27

5 Tests summary

Test	Status
Transmitter characteristics	
Section 2.1049, Occupied bandwidth	Pass
Section 27.50(h), Peak output power at RF antenna connector	Pass
Section 27.50(h)(4), Spectral power density	Pass
Section 2.1091, 27.52, RF safety	Pass, exhibit provided in Application for certification
Section 27.53(m)(2), Spurious emissions at RF antenna connector	Pass
Section 27.53(m)(2), Band edge emissions at RF antenna connector	Pass
Section 27.53(m)(2), Radiated spurious emissions	Pass
Section 27.54, Frequency stability	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.

This test report supersedes the previously issued test report identified by Doc ID: AIR RAD_FCC.30379.

	Name and Title	Date	Signature
Tested by:	Mr. S. Samokha, test engineer	December 14, 2017	
Reviewed by:	Mrs. M. Cherniavsky, certification engineer	December 21, 2017	
Approved by:	Mr. M. Nikishin, EMC and Radio group manager	January 8, 2018	

6 EUT description

6.1 General information

The EUT, LTE Base station, model AirStrand1300 2.6GHz (B41), 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 AirStrand's transceiver/receiver (Up to 64 QAM modulation, data rate up to 95 Mbps) equipped with a 10.5 dBi external antenna. Advanced Antenna Techniques 2x2 MIMO are supported. The maximum total RF output power (not including antenna gain) is 30.4 dBm for 10.5 dBi and it can be reduced by software.

The AirStrand is installed outdoors. 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 + Data	EUT	Combiner+AC/DC Blocker	1	Shielded	20
Signal	GPS	EUT	GPS external antenna	1	Coax	0.5
Signal	Antenna	EUT	Termination 50 Ohm	4	Coax	0.1
Signal	Serial*	Not connected	Not connected	1	NA	NA

*for maintenance only

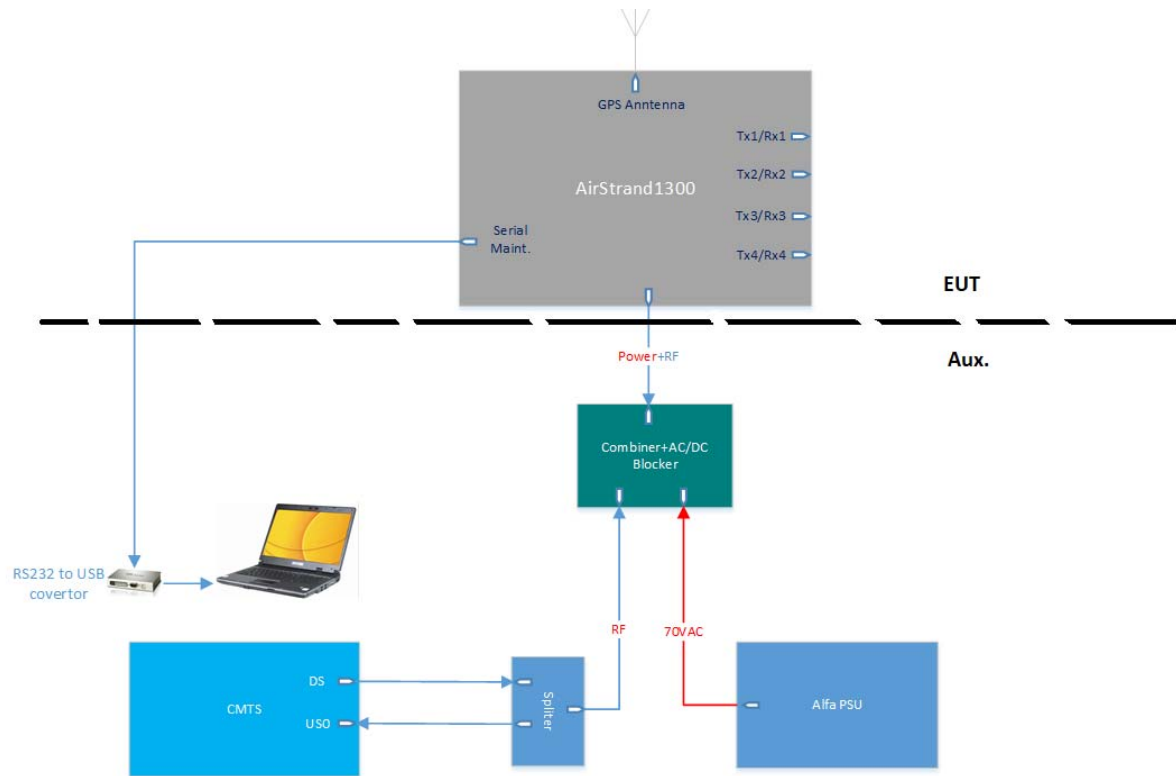
6.3 Support and test equipment

Description	Manufacturer	Model number	Serial number
Laptop	Dell	E7450	8TYRP32
Switch	HPE	HPE 1420	CN64HDD2S4
Power inserter	Lindsay Broadband Inc.	LHI 100	00094291
Non-standby power supply	Alpha	APX2 615G	11749
Cable Modem Termination System (CMTS)	Casa System	C1G	00566

6.4 Changes made in the EUT

No changes were implemented in the EUT during testing.

6.5 Test configuration



6.6 Transmitter characteristics

Type of equipment					
V	Stand-alone (Equipment with or without its own control provisions)				
	Combined equipment (Equipment where the radio part is fully integrated within another type of equipment)				
	Plug-in card (Equipment intended for a variety of host systems)				
Intended use		Condition of use			
V	fixed	Always at a distance more than 2 m from all people			
	mobile	Always at a distance more than 20 cm from all people			
	portable	May operate at a distance closer than 20 cm to human body			
Assigned frequency range		2496.0 – 2690.0 MHz			
Operating frequency (full bands)		2501.0 – 2685.0 MHz 2506.0 – 2680.0 MHz			
RF channel spacing		10 MHz, 20 MHz			
Maximum rated output power		At transmitter 50 Ω RF output connector (aggregate power of both RF chains)		30.39 dBm	
Is transmitter output power variable?		No			
		V	Yes	continuous variable	
				stepped variable with step size	0.25 dB
				minimum RF power	-30 dBm
		maximum RF power at antenna connector			30.39 dBm
Antenna connection					
unique coupling	V	standard connector	Integral	V with temporary RF connector without temporary RF connector	
Antenna/s technical characteristics					
Type	Manufacturer	Model number	Gain		
External, sector antenna	ALPHA Wireless Ltd	AW3649-1	10.5 dBi		
External, sector antenna	ALPHA Wireless Ltd	AW3649-2	10.5 dBi		
Transmitter aggregate data rate/s, MBps					
Transmitter 26dBc power bandwidth		Type of modulation			
		QPSK	16QAM	64QAM	
10 MHz		10.7	22.7	47.3	
20 MHz		23.4	45.4	95.0	
Type of multiplexing		TDD			
Modulating test signal (baseband)		PRBS			
Maximum transmitter duty cycle in normal use		55%			
Transmitter power source					
		Nominal rated voltage	Battery type		
	DC	Nominal rated voltage			
V	AC mains	Nominal rated voltage	70 VAC	Frequency	
Common power source for transmitter and receiver		V	yes	no	

Test specification: Section 2.1049, Occupied bandwidth			
Test procedure: 47 CFR, Section 2.1049			
Test mode: Compliance		Verdict: PASS	
Date(s): 12-Dec-17			
Temperature: 24.5 °C	Relative Humidity: 45 %	Air Pressure: 1020 hPa	Power: 70 VAC, 50 Hz
Remarks:			

7 Transmitter tests according to 47CFR part 27

7.1 Occupied bandwidth test

7.1.1 General

This test was performed to measure transmitter occupied bandwidth. Specification test limits are given in Table 7.1.1.

Table 7.1.1 Occupied bandwidth limits

Assigned frequency, MHz	Modulation envelope reference points*, dBc	Maximum allowed bandwidth, kHz
2614.0 – 2690.0 MHz	99%	NA

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

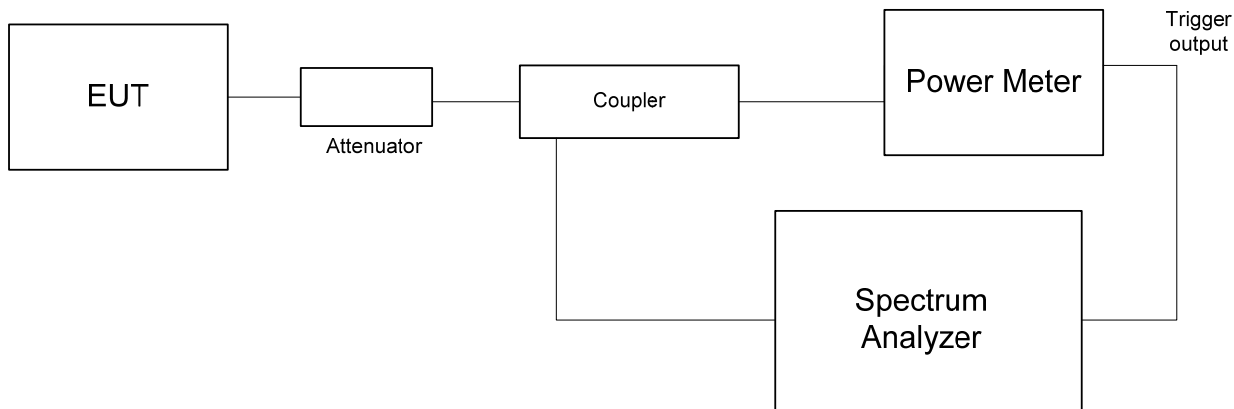
7.1.2 Test procedure

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 set to transmit the normal modulated signal and actual channel width was measured at the 26 dBc modulation envelope reference points.

7.1.2.3 The transmitter occupied bandwidth was measured with spectrum analyzer as a frequency delta between the reference points on modulation envelope and provided in Table 7.1.2 and the associated plots.

Figure 7.1.1 Occupied bandwidth test setup





Test specification: Section 2.1049, Occupied bandwidth			
Test procedure: 47 CFR, Section 2.1049			
Test mode: Compliance		Verdict: PASS	
Date(s): 12-Dec-17			
Temperature: 24.5 °C	Relative Humidity: 45 %	Air Pressure: 1020 hPa	Power: 70 VAC, 50 Hz
Remarks:			

Table 7.1.2 Occupied bandwidth test results

DETECTOR USED: Peak
MODULATION ENVELOPE REFERENCE POINTS: 26 dBc; 99%

RESOLUTION BANDWIDTH: 200 kHz
EBW: 10 MHz

Carrier frequency, MHz	OBW 26 dBc, MHz	OBW 99%. MHz	Limit, kHz	Verdict
QPSK				
2501.0	9.506	8.9243	NA	Pass
2624.0	9.560	8.8888	NA	Pass
2685.0	9.560	8.8967	NA	Pass
64QAM				
2501.0	9.564	8.9378	NA	Pass
2624.0	9.444	8.8870	NA	Pass
2685.0	9.444	8.9034	NA	Pass

RESOLUTION BANDWIDTH: 390 kHz
EBW: 20 MHz

Carrier frequency, MHz	OBW 26 dBc, MHz	OBW 99%. MHz	Limit, kHz	Verdict
QPSK				
2506.0	19.188	17.8517	NA	Pass
2624.0	19.046	17.8545	NA	Pass
2680.0	19.196	17.8690	NA	Pass
64QAM				
2506.0	18.820	17.8777	NA	Pass
2624.0	19.181	17.8348	NA	Pass
2680.0	19.198	17.8705	NA	Pass

Reference numbers of test equipment used

HL 3301	HL 3302	HL 3445	HL 3818	HL 3901	HL 4366		
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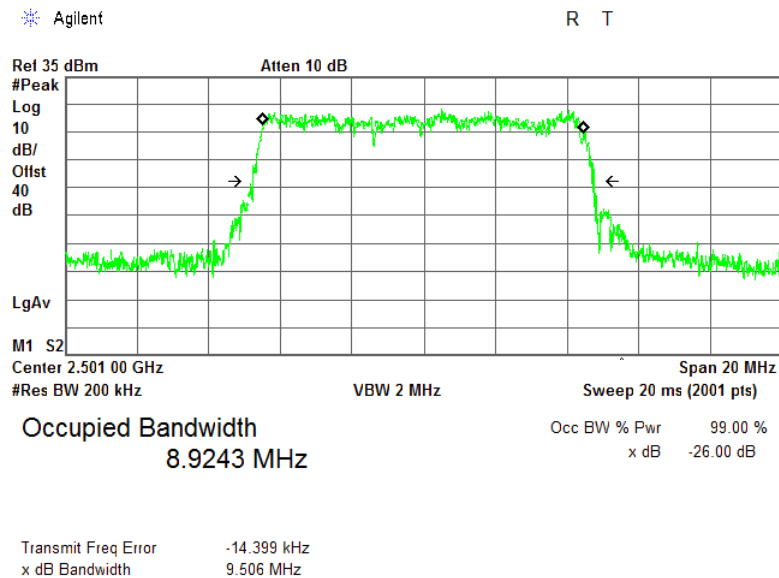
Full description is given in Appendix A.



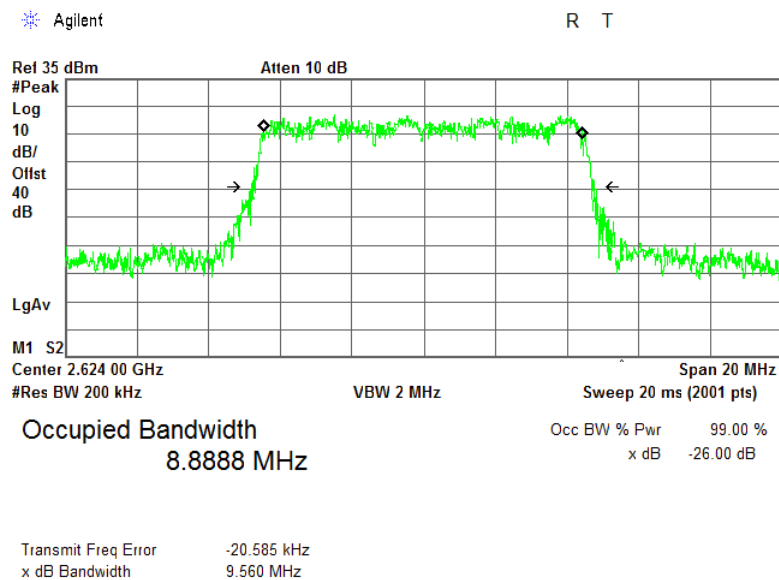
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Test specification:		Section 2.1049, Occupied bandwidth	
Test procedure:		47 CFR, Section 2.1049	
Test mode:		Verdict: PASS	
Date(s):			
12-Dec-17			
Temperature: 24.5 °C	Relative Humidity: 45 %	Air Pressure: 1020 hPa	Power: 70 VAC, 50 Hz
Remarks:			

Plot 7.1.1 Occupied bandwidth test results at low frequency, 10 MHz EBW, QPSK



Plot 7.1.2 Occupied bandwidth test results at mid frequency, 10 MHz EBW, QPSK

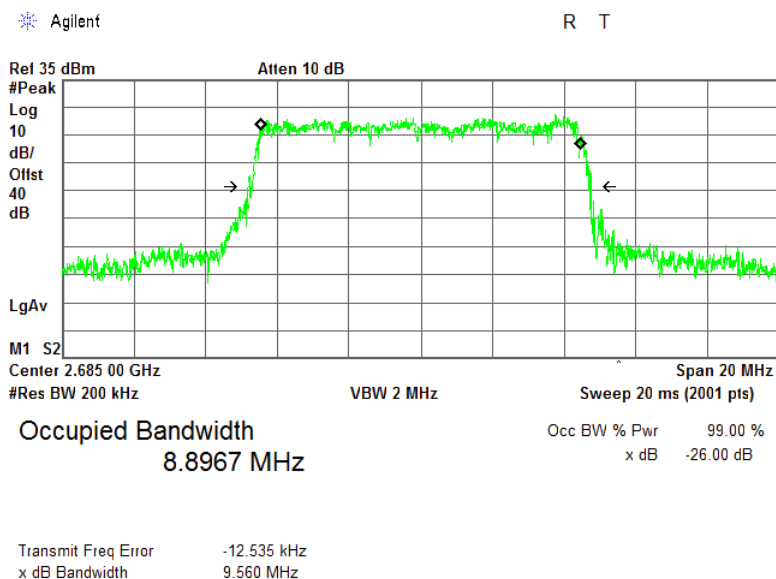




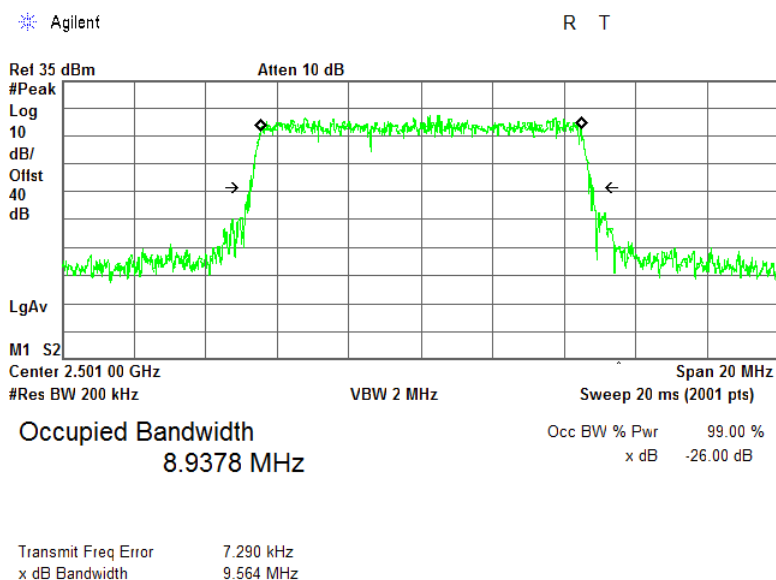
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Test specification: Section 2.1049, Occupied bandwidth			
Test procedure: 47 CFR, Section 2.1049			
Test mode: Compliance		Verdict: PASS	
Date(s): 12-Dec-17			
Temperature: 24.5 °C	Relative Humidity: 45 %	Air Pressure: 1020 hPa	Power: 70 VAC, 50 Hz
Remarks:			

Plot 7.1.3 Occupied bandwidth test results at high frequency, 10 MHz EBW, QPSK



Plot 7.1.4 Occupied bandwidth test results at low frequency, 10 MHz EBW, 64QAM

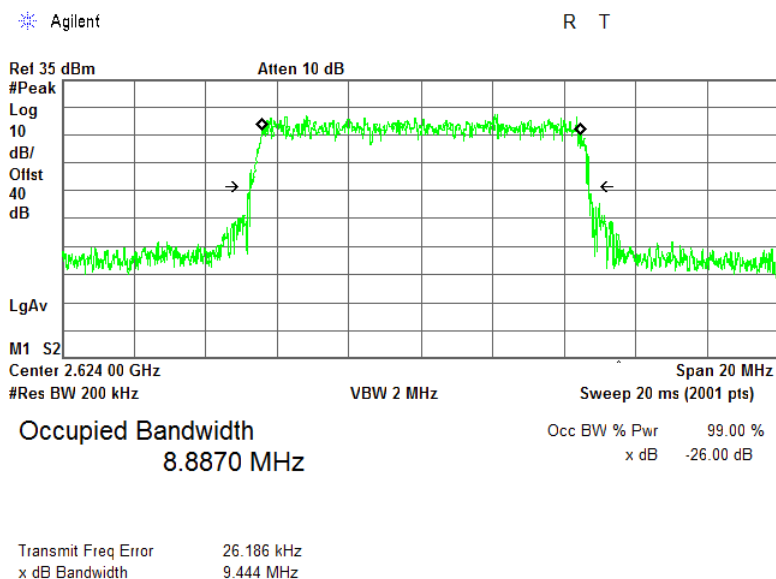




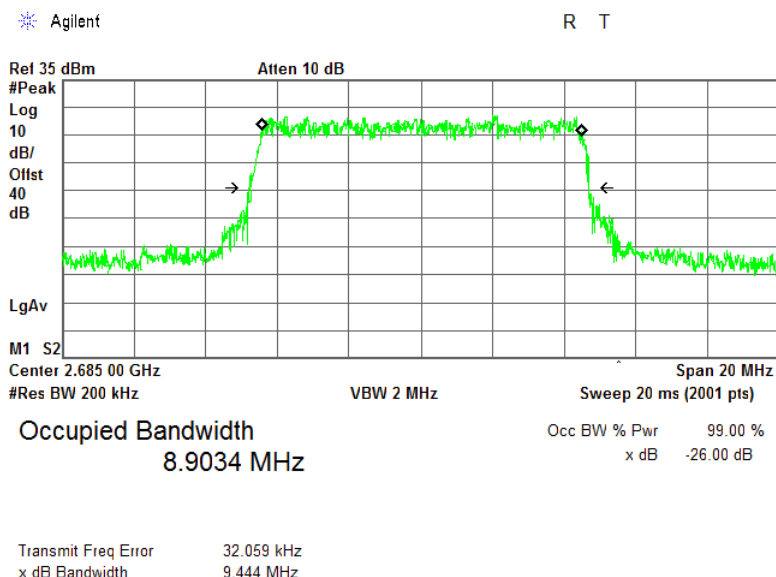
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Test specification: Section 2.1049, Occupied bandwidth			
Test procedure: 47 CFR, Section 2.1049			
Test mode: Compliance		Verdict: PASS	
Date(s): 12-Dec-17			
Temperature: 24.5 °C	Relative Humidity: 45 %	Air Pressure: 1020 hPa	Power: 70 VAC, 50 Hz
Remarks:			

Plot 7.1.5 Occupied bandwidth test results at mid frequency, 10 MHz EBW, 64QAM



Plot 7.1.6 Occupied bandwidth test results at high frequency, 10 MHz EBW, 64QAM

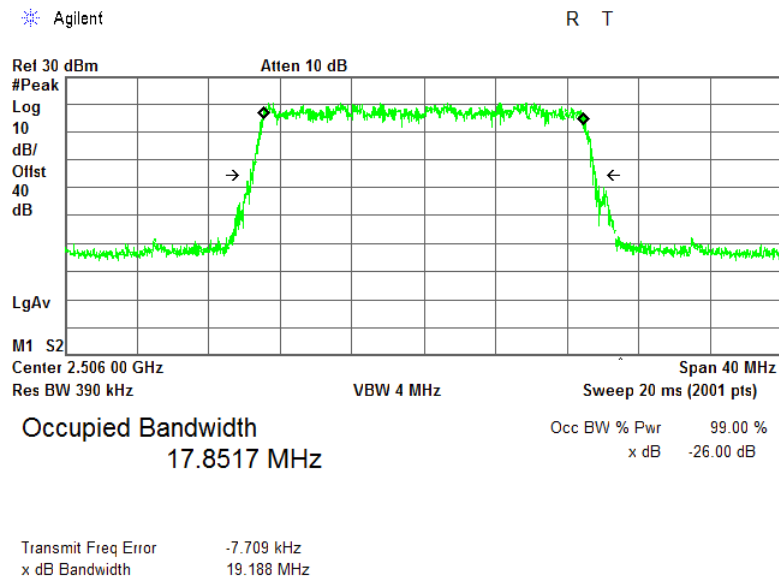




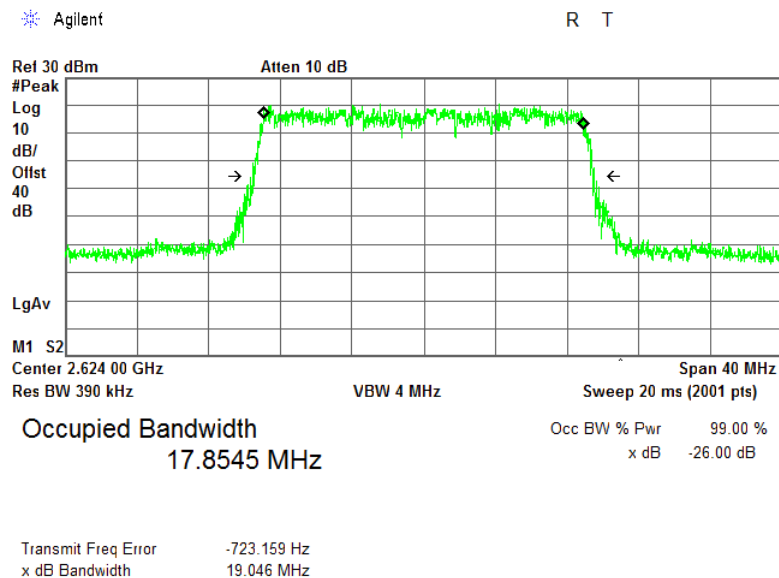
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Test specification:		Section 2.1049, Occupied bandwidth	
Test procedure:		47 CFR, Section 2.1049	
Test mode:		Verdict: PASS	
Date(s):			
12-Dec-17			
Temperature: 24.5 °C	Relative Humidity: 45 %	Air Pressure: 1020 hPa	Power: 70 VAC, 50 Hz
Remarks:			

Plot 7.1.7 Occupied bandwidth test results at low frequency, 20 MHz EBW, QPSK



Plot 7.1.8 Occupied bandwidth test results at mid frequency, 20 MHz EBW, QPSK

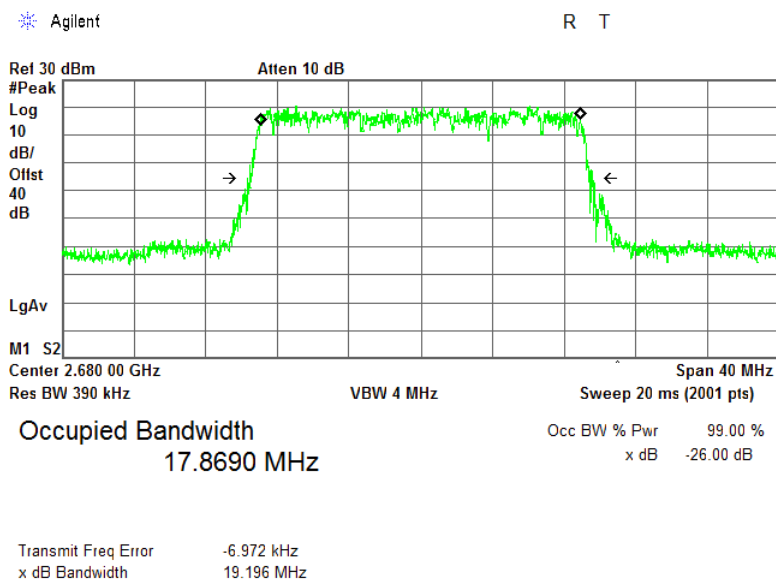




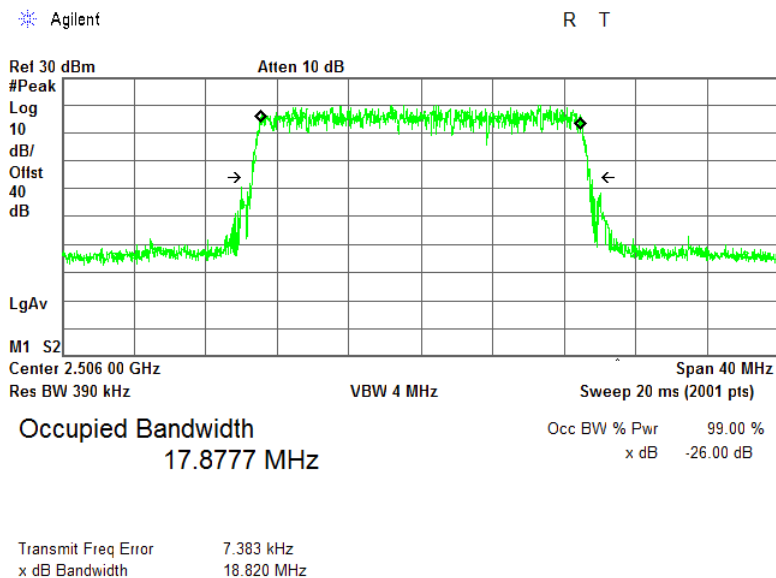
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Test specification: Section 2.1049, Occupied bandwidth			
Test procedure: 47 CFR, Section 2.1049			
Test mode: Compliance		Verdict: PASS	
Date(s): 12-Dec-17			
Temperature: 24.5 °C	Relative Humidity: 45 %	Air Pressure: 1020 hPa	Power: 70 VAC, 50 Hz
Remarks:			

Plot 7.1.9 Occupied bandwidth test results at high frequency, 20 MHz EBW, QPSK



Plot 7.1.10 Occupied bandwidth test results at low frequency, 20 MHz EBW, 64QAM

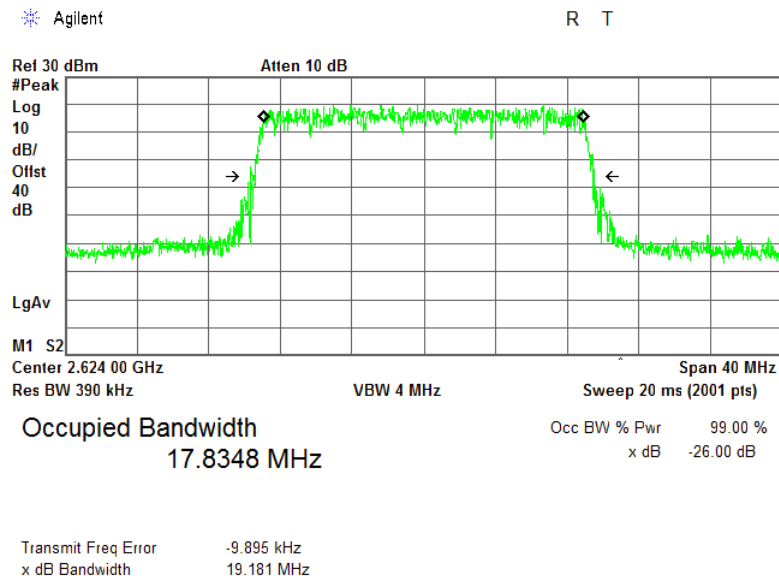




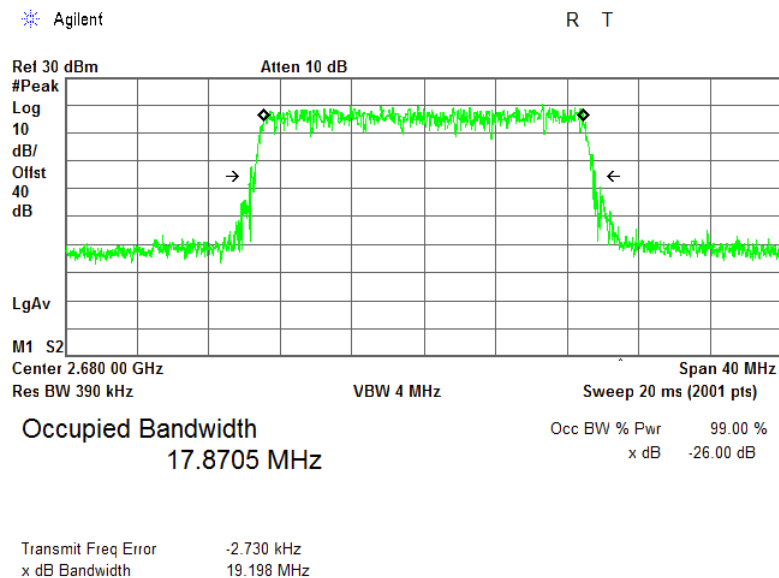
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Test specification:		Section 2.1049, Occupied bandwidth	
Test procedure:		47 CFR, Section 2.1049	
Test mode:		Verdict: PASS	
Date(s):			
12-Dec-17			
Temperature: 24.5 °C	Relative Humidity: 45 %	Air Pressure: 1020 hPa	Power: 70 VAC, 50 Hz
Remarks:			

Plot 7.1.11 Occupied bandwidth test results at mid frequency, 20 MHz EBW, 64QAM



Plot 7.1.12 Occupied bandwidth test results at high frequency, 20 MHz EBW, 64QAM



Test specification: Section 27.50, Peak output power			
Test procedure: 47 CFR, Section 2.1046; TIA/EIA-603-E, Section 2.2.1			
Test mode: Compliance		Verdict: PASS	
Date(s): 12-Dec-17			
Temperature: 23.8 °C	Relative Humidity: 45 %	Air Pressure: 1020 hPa	Power: 70 VAC, 50 Hz
Remarks:			

7.2 Peak output power test

7.2.1 General

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

Table 7.2.1 Peak output power limits

Transmitter type	Assigned frequency range, MHz	Maximum peak output power dBm
Main, booster and base stations	2496.0 – 2690.0	$63 + 10\log(X/Y) + 10\log(360/\text{beamwidth})$
		Maximum peak power density dBm/100 kHz
		$\text{EIRP} + 10\log(0.1/Y)$

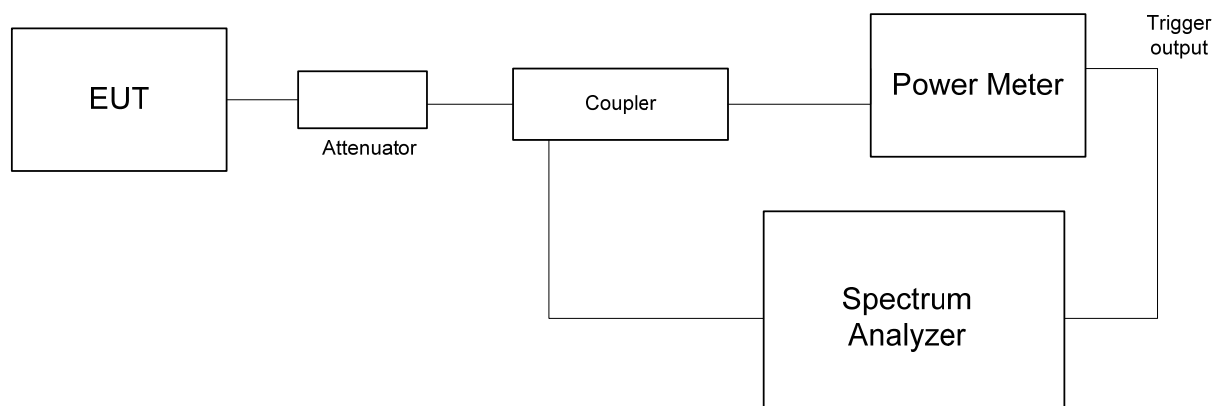
*- X is the actual channel width in MHz (occupied bandwidth), Y is either

- 1) 6 MHz if prior to transition or the station is in the MBS following transition or
- 2) 5.5 MHz if the station is in the LBS and UBS following transition, and
- 3) beamwidth is the total horizontal plane beam width of the individual transmitting antenna for the station or any sector measured at the half-power points.

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 to the end user RF output power.
- 7.2.2.3 The average output power was measured with power meter as provided in Table 7.2.2.
- 7.2.2.4 The resolution bandwidth was changed to 100 kHz and power spectral density was measured with spectrum analyzer as provided in Table 7.2.3.
- 7.2.2.5 The test results are provided in the tables below and the associated plots.

Figure 7.2.1 Peak output power test setup





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Test specification: Section 27.50, Peak output power			
Test procedure: 47 CFR, Section 2.1046; TIA/EIA-603-E, Section 2.2.1			
Test mode: Compliance		Verdict: PASS	
Date(s): 12-Dec-17			
Temperature: 23.8 °C	Relative Humidity: 45 %	Air Pressure: 1020 hPa	Power: 70 VAC, 50 Hz
Remarks:			

Table 7.2.2 Peak output power test results

DETECTOR USED:

Average within Tx burst

DUTY CYCLE:

55%

Carrier frequency, MHz	Power Meter reading RF#1, dBm	Power Meter reading RF#2, dBm	Total RF power**, dBm	Antenna gain, dBi	Total EIRP*, dBm	Limit***, dBm	Margin, dB	Verdict
EBW 10 MHz, Antenna Chain RF #1 / #2 (antenna port number 12 / 12S)								
QPSK								
2501.0	26.76	26.74	29.75	10.5	40.25	68.89	-28.64	Pass
2624.0	27.33	27.03	30.18	10.5	40.70	68.87	-28.17	Pass
2685.0	26.68	26.46	29.57	10.5	40.07	69.07	-29.00	Pass
64QAM								
2501.0	26.80	26.68	29.74	10.5	40.26	68.90	-28.64	Pass
2624.0	26.87	26.77	29.82	10.5	40.32	68.87	-28.55	Pass
2685.0	26.67	26.47	29.57	10.5	40.09	69.07	-28.98	Pass
EBW 10 MHz, Antenna Chain RF #3 / #4 (antenna port number 21 / 21S)								
QPSK								
2501.0	26.63	26.67	29.65	10.5	40.15	68.89	-28.74	Pass
2624.0	27.29	26.90	30.10	10.5	40.62	68.87	-28.26	Pass
2685.0	26.17	26.92	29.56	10.5	40.06	69.07	-29.01	Pass
64QAM								
2501.0	26.73	26.69	29.71	10.5	40.23	68.90	-28.67	Pass
2624.0	26.39	26.85	29.63	10.5	40.13	68.87	-28.74	Pass
2685.0	26.05	26.93	29.51	10.5	40.03	69.07	-29.04	Pass
EBW 20 MHz, Antenna Chain RF #1 / #2 (antenna port number 12 / 12S)								
QPSK								
2506.0	27.17	27.25	30.21	10.5	40.71	68.98	-28.27	Pass
2624.0	27.07	26.92	30.00	10.5	40.51	69.28	-28.77	Pass
2680.0	26.68	26.44	29.56	10.5	40.06	69.09	-29.02	Pass
64QAM								
2506.0	27.35	27.28	30.32	10.5	40.83	68.99	-28.16	Pass
2624.0	27.24	26.96	30.10	10.5	40.60	69.28	-28.68	Pass
2680.0	26.96	26.83	29.90	10.5	40.41	69.09	-28.68	Pass
EBW 20 MHz, Antenna Chain RF #3 / #4 (antenna port number 21 / 21S)								
QPSK								
2506.0	27.43	27.35	30.39	10.5	40.89	68.98	-28.09	Pass
2624.0	27.13	26.81	29.97	10.5	40.49	69.28	-28.80	Pass
2680.0	26.38	26.91	29.65	10.5	40.15	69.09	-28.93	Pass
64QAM								
2506.0	27.26	27.37	30.32	10.5	40.83	68.99	-28.16	Pass
2624.0	27.07	26.74	29.91	10.5	40.41	69.28	-28.87	Pass
2680.0	26.37	26.99	29.69	10.5	40.21	69.09	-28.88	Pass

* - EIRP total, dBm = Total RF power**, dBm + Antenna Gain, dBi

** - Total RF power, dBm = 10*log[10^(Power RF#1 / 10) + 10^(Power RF#2 / 10)]

*** - See Table 7.2.6

Reference numbers of test equipment used

HL 2214	HL 3301	HL 3302					
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Full description is given in Appendix A.



Test specification: Section 27.50, Peak output power			
Test procedure: 47 CFR, Section 2.1046; TIA/EIA-603-E, Section 2.2.1			
Test mode: Compliance		Verdict: PASS	
Date(s): 12-Dec-17			
Temperature: 23.8 °C	Relative Humidity: 45 %	Air Pressure: 1020 hPa	Power: 70 VAC, 50 Hz
Remarks:			

Table 7.2.3 Power spectral density test results

DETECTOR USED: Average gated
 RESOLUTION BANDWIDTH: 100 kHz
 VIDEO BANDWIDTH: 300 kHz
 CHANNEL BANDWIDTH: 10 MHz
 DUTY CYCLE: 55%

Carrier frequency, MHz	SA reading*, RF #1 dBm/100kHz	SA reading*, RF #2 dBm/100kHz	Total PSD dBm/100kHz	Antenna gain, dBi	Total EIRP*, dBm/100kHz	Limit***, dBm/100kHz	Margin, dB	Verdict
Antenna Chain RF #1 / #2 (antenna port number 12 / 12S)								
QPSK								
2501.0	9.40	9.90	12.66	10.5	23.16	48.28	-25.12	Pass
2624.0	9.67	9.54	12.61	10.5	23.11	48.26	-25.16	Pass
2685.0	8.85	8.78	11.82	10.5	22.32	48.65	-26.34	Pass
64QAM								
2501.0	9.49	9.77	12.63	10.5	23.13	48.29	-25.16	Pass
2624.0	9.54	9.45	12.50	10.5	23.00	48.26	-25.27	Pass
2685.0	9.35	9.12	12.24	10.5	22.74	48.66	-25.92	Pass
Antenna Chain RF #3 / #4 (antenna port number 21 / 21S)								
QPSK								
2501.0	9.28	9.37	12.33	10.5	22.83	48.28	-25.46	Pass
2624.0	9.84	9.44	12.64	10.5	23.14	48.26	-25.12	Pass
2685.0	8.69	9.28	12.00	10.5	22.50	48.65	-26.16	Pass
64QAM								
2501.0	9.43	9.66	12.55	10.5	23.05	48.29	-25.24	Pass
2624.0	9.16	9.52	12.34	10.5	22.84	48.26	-25.42	Pass
2685.0	9.41	9.41	12.41	10.5	22.91	48.66	-25.75	Pass

* SA reading including attenuation, cable loss and Duty Cycle correction factor

** - Total EIRP PSD #1, dBm = $10 \cdot \log[10^{\text{SA reading Max (dBm/100kHz, RF\#1/10)}} + 10^{\text{SA reading Max (dBm/100kHz, RF\#2/10)}}] + \text{Antenna Gain, dBi}$

*** See Table 7.2.7



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Test specification: Section 27.50, Peak output power			
Test procedure: 47 CFR, Section 2.1046; TIA/EIA-603-E, Section 2.2.1			
Test mode: Compliance		Verdict: PASS	
Date(s): 12-Dec-17			
Temperature: 23.8 °C	Relative Humidity: 45 %	Air Pressure: 1020 hPa	Power: 70 VAC, 50 Hz
Remarks:			

Table 7.2.3 Power spectral density test results (continued)

DETECTOR USED: Average gated
 RESOLUTION BANDWIDTH: 100 kHz
 VIDEO BANDWIDTH: 300 kHz
 CHANNEL BANDWIDTH: 20 MHz
 DUTY CYCLE: 55%

Carrier frequency, MHz	SA reading*, RF #1 dBm/100kHz	SA reading*, RF #2 dBm/100kHz	Total PSD dBm/100kHz	Antenna gain, dBi	Total EIRP*, dBm/100kHz	Limit***, dBm/100kHz	Margin, dB	Verdict
Antenna Chain RF #1 / #2 (antenna port number 12 / 12S)								
QPSK								
2506.0	6.20	6.18	9.19	10.5	19.69	45.46	-25.77	Pass
2624.0	6.19	6.05	9.12	10.5	19.62	46.06	-26.44	Pass
2680.0	5.78	5.73	8.76	10.5	19.26	45.66	-26.41	Pass
64QAM								
2506.0	6.66	6.95	9.81	10.5	20.31	45.47	-25.16	Pass
2624.0	6.66	6.47	9.57	10.5	20.07	46.06	-25.99	Pass
2680.0	6.66	6.61	9.64	10.5	20.14	45.66	-25.53	Pass
Antenna Chain RF #3 / #4 (antenna port number 21 / 21S)								
QPSK								
2506.0	6.27	6.09	9.18	10.5	19.68	45.46	-25.78	Pass
2624.0	6.07	5.95	9.01	10.5	19.53	46.06	-26.54	Pass
2680.0	5.55	6.56	9.08	10.5	19.58	45.66	-26.08	Pass
64QAM								
2506.0	6.77	7.10	9.94	10.5	20.45	45.47	-25.02	Pass
2624.0	6.53	6.20	9.37	10.5	19.87	46.06	-26.19	Pass
2680.0	6.08	6.99	9.56	10.5	20.07	45.66	-25.59	Pass

* SA reading including attenuation, cable loss and Duty Cycle correction factor

** - Total EIRP PSD #1, dBm = $10 \cdot \log[10^{\text{SA reading Max (dBm/100kHz, RF\#1/10)}} + 10^{\text{SA reading Max (dBm/100kHz, RF\#2/10)}}] + \text{Antenna Gain, dBi}$

*** See Table 7.2.7

Reference numbers of test equipment used

HL 3301	HL 3302	HL 3667	HL 3818	HL 3903			
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Full description is given in Appendix A.



Test specification: Section 27.50, Peak output power			
Test procedure: 47 CFR, Section 2.1046; TIA/EIA-603-E, Section 2.2.1			
Test mode: Compliance		Verdict: PASS	
Date(s): 12-Dec-17			
Temperature: 23.8 °C	Relative Humidity: 45 %	Air Pressure: 1020 hPa	Power: 70 VAC, 50 Hz
Remarks:			

Table 7.2.4 Post - transition frequency channels assignment

Channel	OBW, MHz	Peak power limit, dBm	Power density limit, dBm/100kHz
10 MHz QPSK			
2501.0 MHz BRS1+EBS A1	8.9494	$63+10\log(\text{OBW}/11.5)+10\log(360/\text{beamwidth})$	$\text{EIRP}+10\log(0.1/11.5)$
2624.0 MHz BRS 2A+ BRS/EBS E1	8.9386	$63+10\log(\text{OBW}/11.5)+10\log(360/\text{beamwidth})$	$\text{EIRP}+10\log(0.1/11.5)$
2685.0 MHz EBS G2+G3	8.9453	$63+10\log(\text{OBW}/11.0)+10\log(360/\text{beamwidth})$	$\text{EIRP}+10\log(0.1/11.0)$
10 MHz 64QAM			
2501.0 MHz BRS1+EBS A1	8.8836	$63+10\log(\text{OBW}/11.5)+10\log(360/\text{beamwidth})$	$\text{EIRP}+10\log(0.1/11.5)$
2624.0 MHz BRS 2A+ BRS/EBS E1	8.8864	$63+10\log(\text{OBW}/11.5)+10\log(360/\text{beamwidth})$	$\text{EIRP}+10\log(0.1/11.5)$
2685.0 MHz EBS G2+G3	8.8966	$63+10\log(\text{OBW}/11.0)+10\log(360/\text{beamwidth})$	$\text{EIRP}+10\log(0.1/11.0)$

Table 7.2.5 Post - transition frequency channels assignment

Channel	OBW, MHz	Peak power limit, dBm	Power density limit, dBm/100kHz
20 MHz QPSK			
2506.0 MHz BRS1+EBS A1+A2+A3	17.8517	$63+10\log(\text{OBW}/22.5)+10\log(360/\text{beamwidth})$	$\text{EIRP}+10\log(0.1/22.5)$
2624.0 MHz BRS KH1+KH2+KH3+KG1KG2+KG3+ KF1+KF2+KF3+KE1+KE2+KE3 + BRS 2A+ BRS/EBS E1+E2	17.8545	$63+10\log(\text{OBW}/24.0)+10\log(360/\text{beamwidth})$	$\text{EIRP}+10\log(0.1/21.0)$
2680.0 MHz EBS H3+G1+G2+G3	17.869	$63+10\log(\text{OBW}/22.0)+10\log(360/\text{beamwidth})$	$\text{EIRP}+10\log(0.1/22.0)$
20 MHz 64QAM			
2506.0 MHz BRS1+EBS A1+A2+A3	17.8777	$63+10\log(\text{OBW}/22.5)+10\log(360/\text{beamwidth})$	$\text{EIRP}+10\log(0.1/22.5)$
2624.0 MHz BRS KH1+KH2+KH3+KG1KG2+KG3+ KF1+KF2+KF3+KE1+KE2+KE3 + BRS 2A+ BRS/EBS E1+E2	17.8348	$63+10\log(\text{OBW}/24.0)+10\log(360/\text{beamwidth})$	$\text{EIRP}+10\log(0.1/21.0)$
2680.0 MHz EBS H3+G1+G2+G3	17.8705	$63+10\log(\text{OBW}/22.0)+10\log(360/\text{beamwidth})$	$\text{EIRP}+10\log(0.1/22.0)$



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Test specification: Section 27.50, Peak output power			
Test procedure: 47 CFR, Section 2.1046; TIA/EIA-603-E, Section 2.2.1			
Test mode: Compliance		Verdict: PASS	
Date(s): 12-Dec-17			
Temperature: 23.8 °C	Relative Humidity: 45 %	Air Pressure: 1020 hPa	Power: 70 VAC, 50 Hz
Remarks:			

Table 7.2.6 EIRP limits

Channel	Channel BW, MHz	Peak power limit, dBm
		10.5 dBi, 72° beamwidth
10 MHz QPSK		
2501.0 MHz BRS1+EBS A1	11.5	68.89
2624.0 MHz BRS 2A+ BRS/EBS E1	11.5	68.87
2685.0 MHz EBS G2+G3	11.0	69.07
10 MHz 64 QAM		
2501.0 MHz BRS1+EBS A1	11.5	68.90
2624.0 MHz BRS 2A+ BRS/EBS E1	11.5	68.87
2685.0 MHz EBS G2+G3	11.0	69.07
20 MHz QPSK		
2506.0 MHz BRS1+EBS A1+A2+A3	22.5	68.98
2624.0 MHz BRS KH1+KH2+KH3+KG1KG2+KG3+ KF1+KF2+KF3+KE1+KE2+KE3 + BRS 2A+ BRS/EBS E1+E2	21.0	69.28
2680.0 MHz EBS H3+G1+G2+G3	22.0	69.09
20 MHz 64 QAM		
2506.0 MHz BRS1+EBS A1+A2+A3	22.5	68.99
2624.0 MHz BRS KH1+KH2+KH3+KG1KG2+KG3+ KF1+KF2+KF3+KE1+KE2+KE3 + BRS 2A+ BRS/EBS E1+E2	21.0	69.28
2680.0 MHz EBS H3+G1+G2+G3	22.0	69.09



Test specification: Section 27.50, Peak output power			
Test procedure: 47 CFR, Section 2.1046; TIA/EIA-603-E, Section 2.2.1			
Test mode: Compliance		Verdict: PASS	
Date(s): 12-Dec-17			
Temperature: 23.8 °C	Relative Humidity: 45 %	Air Pressure: 1020 hPa	Power: 70 VAC, 50 Hz
Remarks:			

Table 7.2.7 Peak power density limits

Channel	Channel BW, MHz	Peak power density, dBm/100kHz
		10.5 dBi, 72° beamwidth
10 MHz QPSK		
2501.0 MHz BRS1+EBS A1	11.5	48.28
2624.0 MHz BRS 2A+ BRS/EBS E1	11.5	48.26
2685.0 MHz EBS G2+G3	11.0	48.65
10 MHz 64 QAM		
2501.0 MHz BRS1+EBS A1	11.5	48.29
2624.0 MHz BRS 2A+ BRS/EBS E1	11.5	48.26
2685.0 MHz EBS G2+G3	11.0	48.66
20 MHz QPSK		
2506.0 MHz BRS1+EBS A1+A2+A3	22.5	45.46
2624.0 MHz BRS KH1+KH2+KH3+KG1KG2+KG3+ KF1+KF2+KF3+KE1+KE2+KE3 + BRS 2A+ BRS/EBS E1+E2	21.0	46.06
2680.0 MHz EBS H3+G1+G2+G3	22.0	45.66
20 MHz 64 QAM		
2506.0 MHz BRS1+EBS A1+A2+A3	22.5	45.47
2624.0 MHz BRS KH1+KH2+KH3+KG1KG2+KG3+ KF1+KF2+KF3+KE1+KE2+KE3 + BRS 2A+ BRS/EBS E1+E2	21.0	46.06
2680.0 MHz EBS H3+G1+G2+G3	22.0	45.66

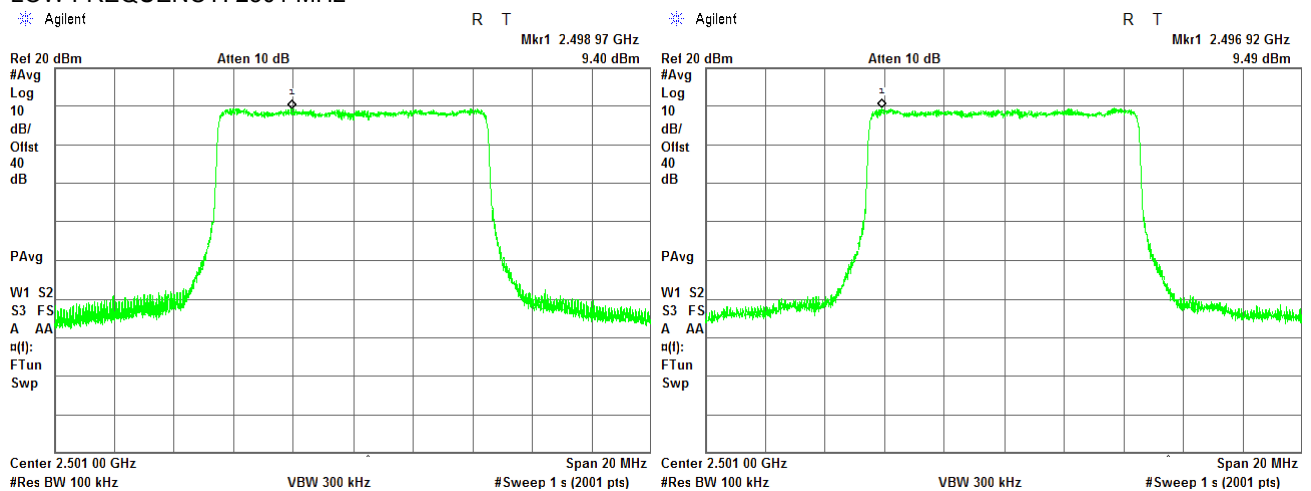
Test specification:		Section 27.50, Peak output power	
Test procedure:		47 CFR, Section 2.1046; TIA/EIA-603-E, Section 2.2.1	
Test mode:		Verdict: PASS	
Date(s):			
12-Dec-17			
Temperature: 23.8 °C	Relative Humidity: 45 %	Air Pressure: 1020 hPa	Power: 70 VAC, 50 Hz
Remarks:			

Plot 7.2.1 Peak output power test results at antenna chain RF # 1

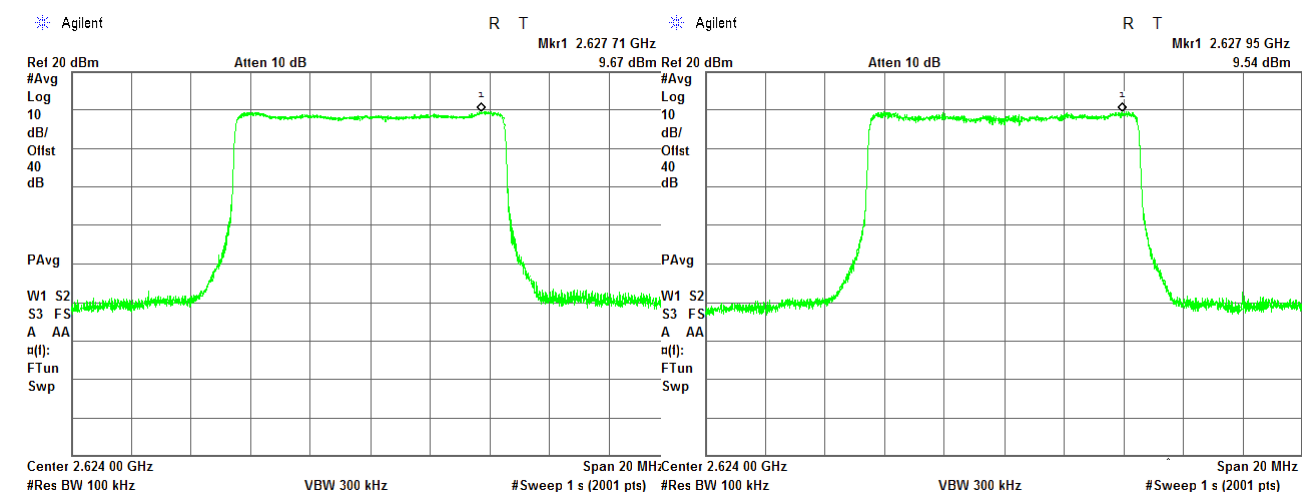
CHANNEL BANDWIDTH:
NUMBER OF ANTENNA:
MODULATION: QPSK

10 MHz
12
MODULATION: 64 QAM

LOW FREQUENCY: 2501 MHz



MID FREQUENCY: 2624 MHz





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Report ID: AIRRAD_FCC.30379_rev1.docx

Date of Issue: 8-Jan-18

Test specification:		Section 27.50, Peak output power	
Test procedure:		47 CFR, Section 2.1046; TIA/EIA-603-E, Section 2.2.1	
Test mode:		Verdict: PASS	
Date(s):			
12-Dec-17			
Temperature: 23.8 °C	Relative Humidity: 45 %	Air Pressure: 1020 hPa	Power: 70 VAC, 50 Hz
Remarks:			

Plot 7.2.2 Peak output power test results at antenna chain RF # 1

CHANNEL BANDWIDTH:

10 MHz

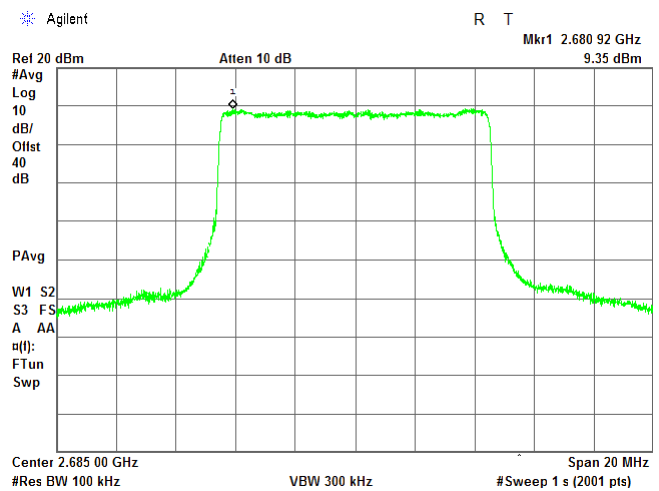
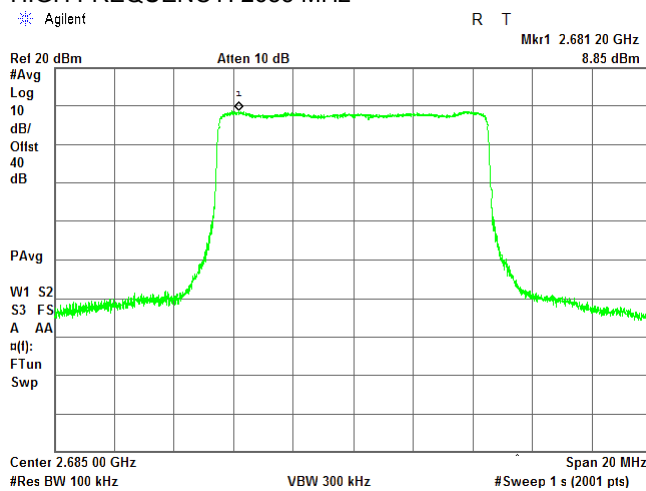
NUMBER OF ANTENNA:

12

MODULATION: QPSK

MODULATION: 64 QAM

HIGH FREQUENCY: 2685 MHz



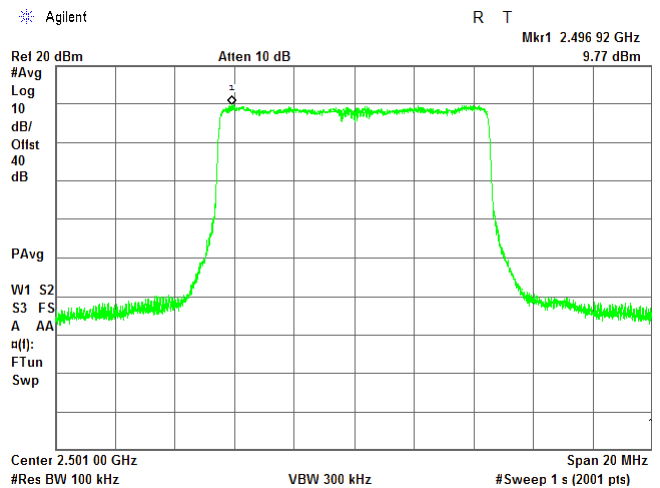
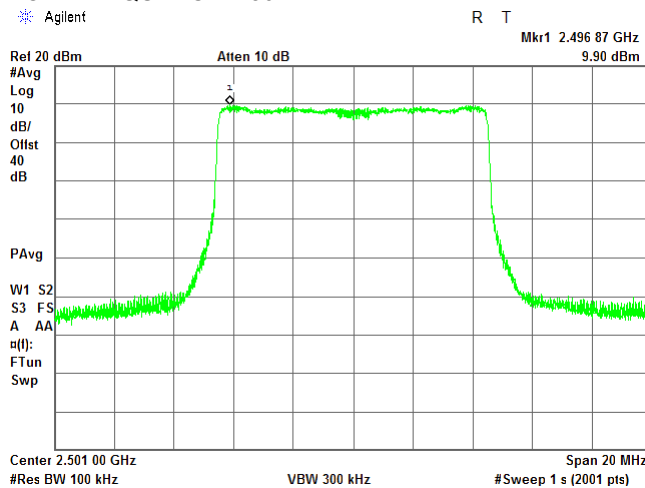
Test specification:		Section 27.50, Peak output power	
Test procedure:		47 CFR, Section 2.1046; TIA/EIA-603-E, Section 2.2.1	
Test mode:		Verdict: PASS	
Date(s):			
12-Dec-17			
Temperature: 23.8 °C	Relative Humidity: 45 %	Air Pressure: 1020 hPa	Power: 70 VAC, 50 Hz
Remarks:			

Plot 7.2.3 Peak output power test results at antenna chain RF # 2

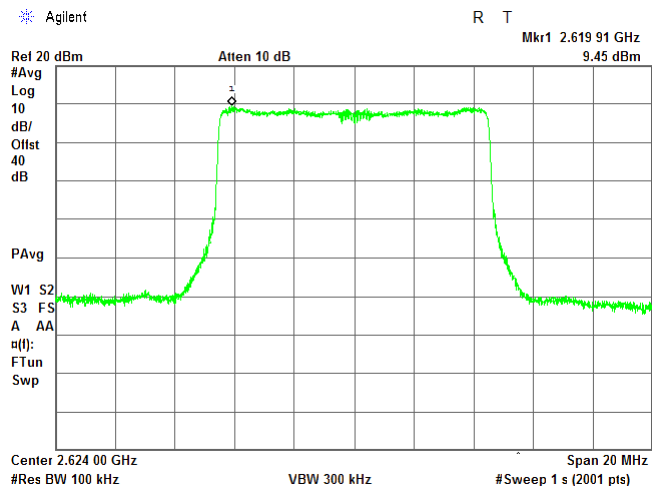
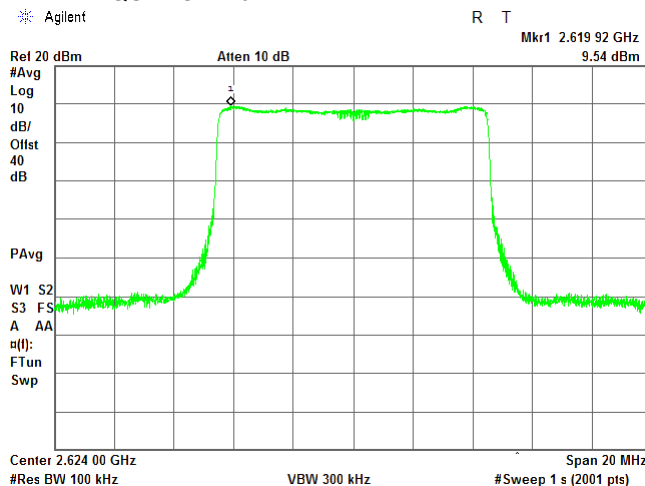
CHANNEL BANDWIDTH:
NUMBER OF ANTENNA:
MODULATION: QPSK

10 MHz
12S
MODULATION: 64 QAM

LOW FREQUENCY: 2501 MHz



MID FREQUENCY: 2624 MHz





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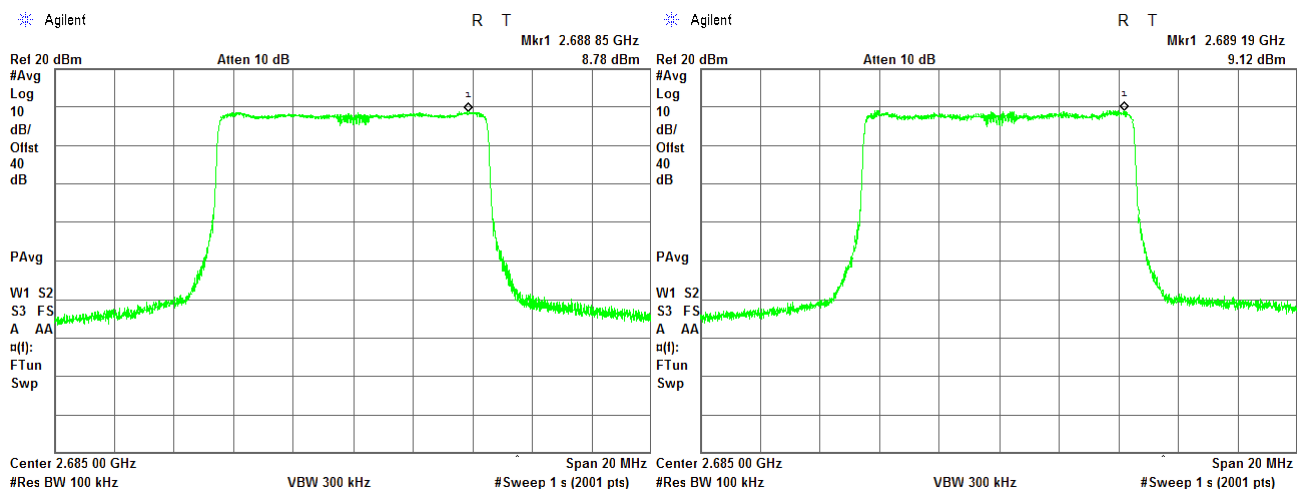
Test specification:		Section 27.50, Peak output power	
Test procedure:		47 CFR, Section 2.1046; TIA/EIA-603-E, Section 2.2.1	
Test mode:		Verdict: PASS	
Date(s):			
12-Dec-17			
Temperature: 23.8 °C	Relative Humidity: 45 %	Air Pressure: 1020 hPa	Power: 70 VAC, 50 Hz
Remarks:			

Plot 7.2.4 Peak output power test results at antenna chain RF # 2

CHANNEL BANDWIDTH:
NUMBER OF ANTENNA:
MODULATION: QPSK

10 MHz
12S
MODULATION: 64 QAM

HIGH FREQUENCY: 2685 MHz



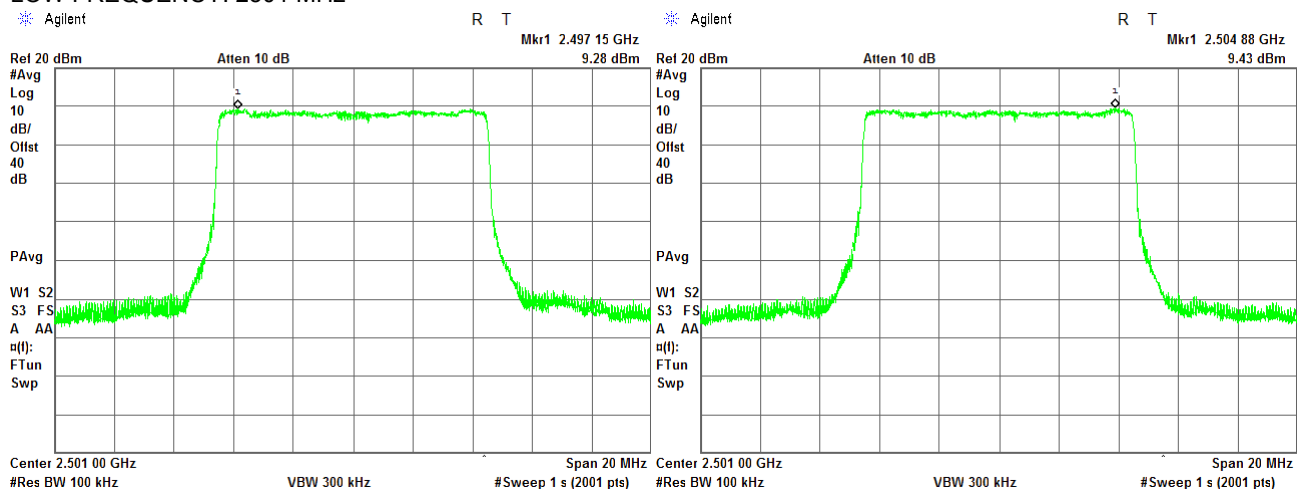
Test specification:		Section 27.50, Peak output power	
Test procedure:		47 CFR, Section 2.1046; TIA/EIA-603-E, Section 2.2.1	
Test mode:		Verdict: PASS	
Date(s):			
12-Dec-17			
Temperature: 23.8 °C	Relative Humidity: 45 %	Air Pressure: 1020 hPa	Power: 70 VAC, 50 Hz
Remarks:			

Plot 7.2.5 Peak output power test results at antenna chain RF # 3

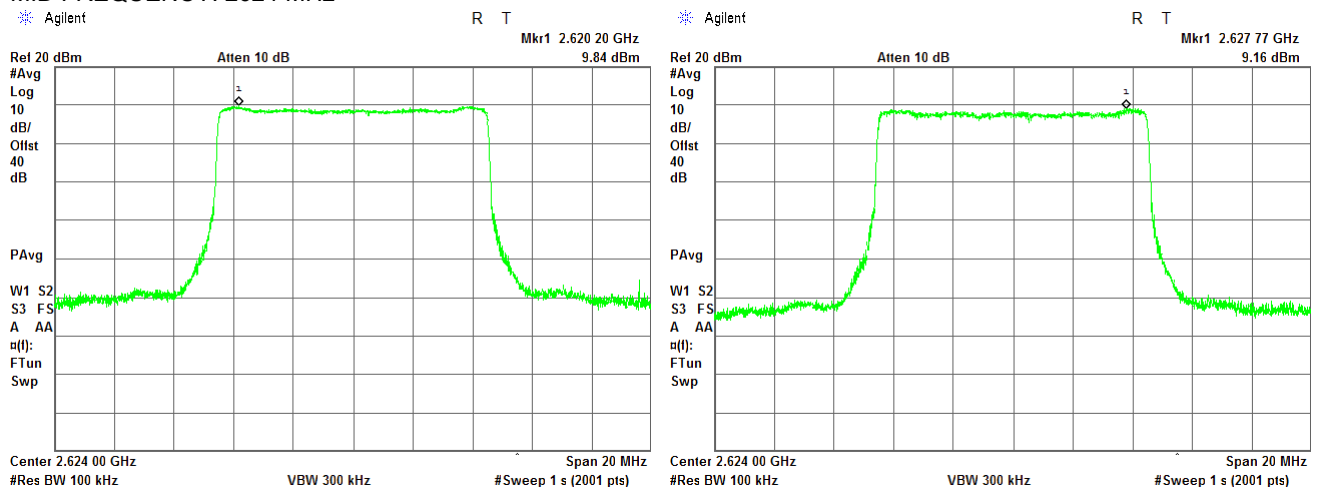
CHANNEL BANDWIDTH:
NUMBER OF ANTENNA:
Modulation: QPSK

10 MHz
21
Modulation: 64 QAM

LOW FREQUENCY: 2501 MHz



MID FREQUENCY: 2624 MHz



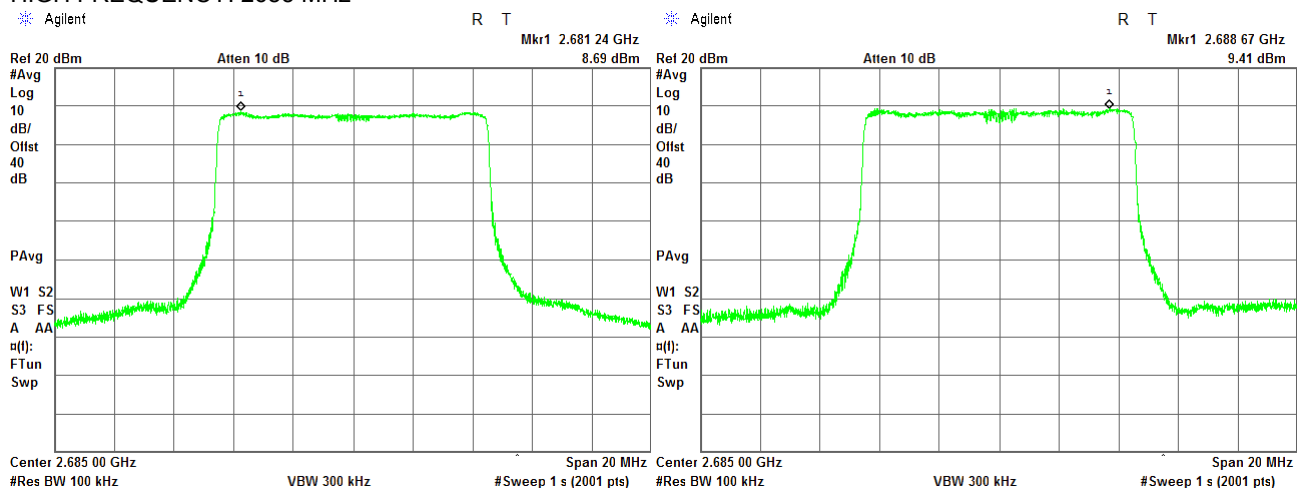
Test specification:		Section 27.50, Peak output power	
Test procedure:		47 CFR, Section 2.1046; TIA/EIA-603-E, Section 2.2.1	
Test mode:		Verdict: PASS	
Date(s):			
12-Dec-17			
Temperature: 23.8 °C	Relative Humidity: 45 %	Air Pressure: 1020 hPa	Power: 70 VAC, 50 Hz
Remarks:			

Plot 7.2.6 Peak output power test results at antenna chain RF # 3

CHANNEL BANDWIDTH:
NUMBER OF ANTENNA:
Modulation: QPSK

10 MHz
21
Modulation: 64 QAM

HIGH FREQUENCY: 2685 MHz



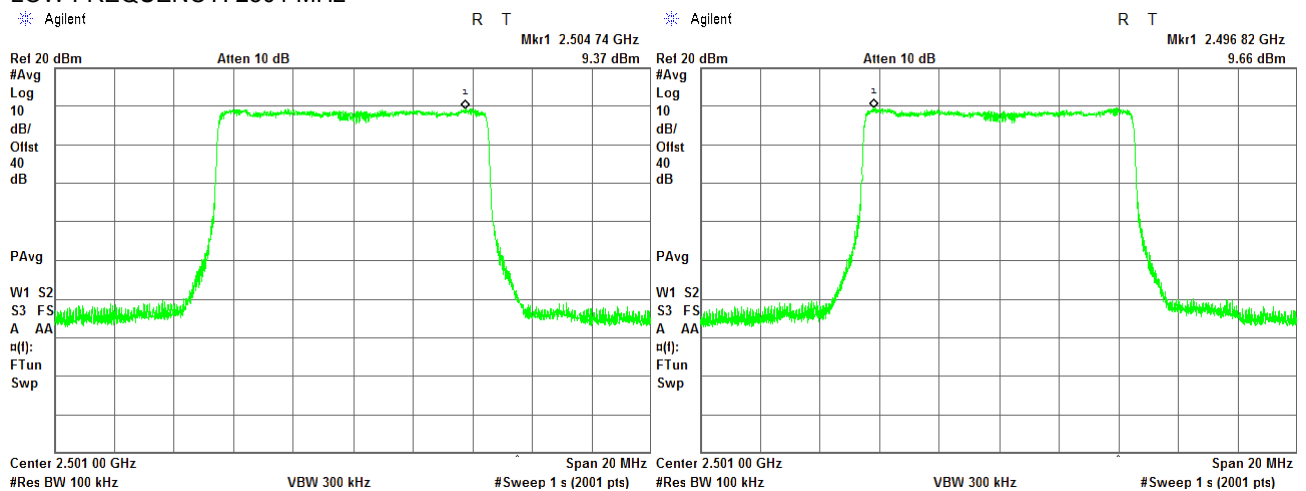
Test specification:		Section 27.50, Peak output power	
Test procedure:		47 CFR, Section 2.1046; TIA/EIA-603-E, Section 2.2.1	
Test mode:		Verdict: PASS	
Date(s):			
12-Dec-17			
Temperature: 23.8 °C	Relative Humidity: 45 %	Air Pressure: 1020 hPa	Power: 70 VAC, 50 Hz
Remarks:			

Plot 7.2.7 Peak output power test results at antenna chain, RF # 4

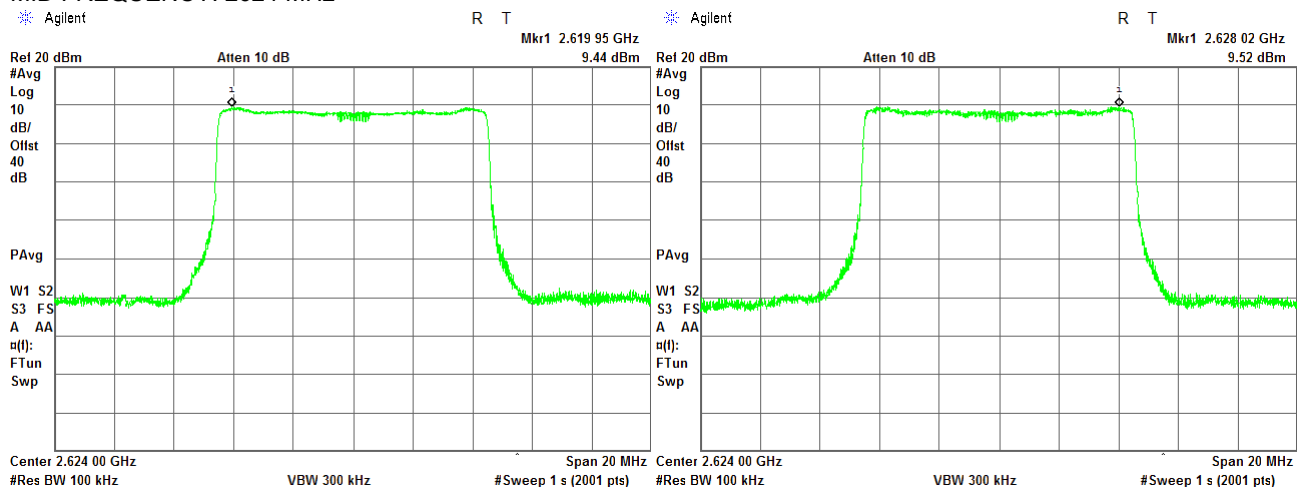
CHANNEL BANDWIDTH:
NUMBER OF ANTENNA:
Modulation: QPSK

10 MHz
21S
Modulation: 64 QAM

LOW FREQUENCY: 2501 MHz



MID FREQUENCY: 2624 MHz



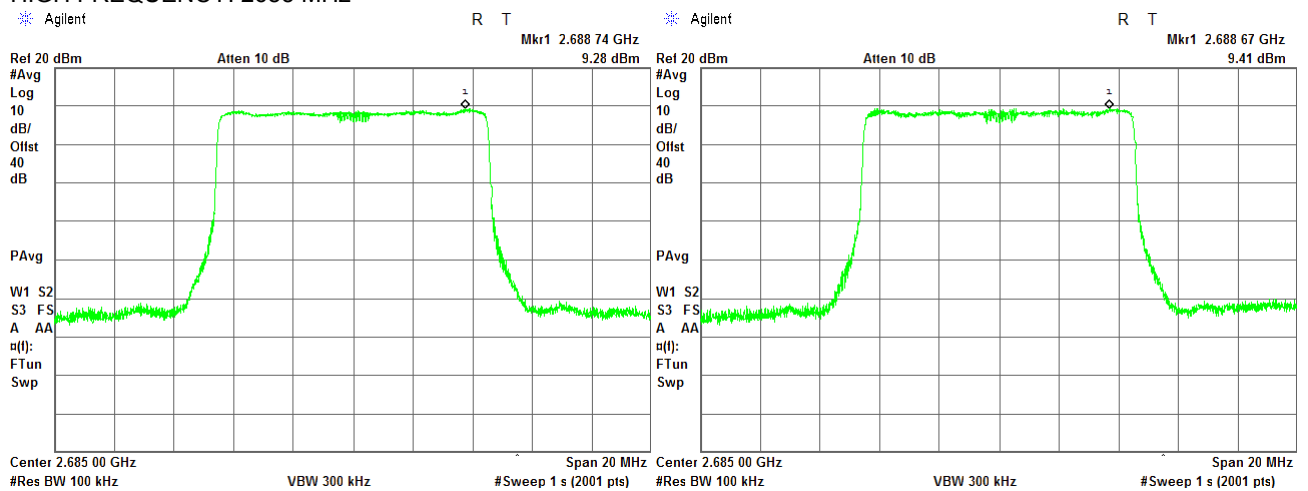
Test specification:		Section 27.50, Peak output power	
Test procedure:		47 CFR, Section 2.1046; TIA/EIA-603-E, Section 2.2.1	
Test mode:		Verdict: PASS	
Date(s):			
12-Dec-17			
Temperature: 23.8 °C	Relative Humidity: 45 %	Air Pressure: 1020 hPa	Power: 70 VAC, 50 Hz
Remarks:			

Plot 7.2.8 Peak output power test results at antenna chain, RF # 4

CHANNEL BANDWIDTH:
NUMBER OF ANTENNA:
Modulation: QPSK

10 MHz
21S
Modulation: 64 QAM

HIGH FREQUENCY: 2685 MHz



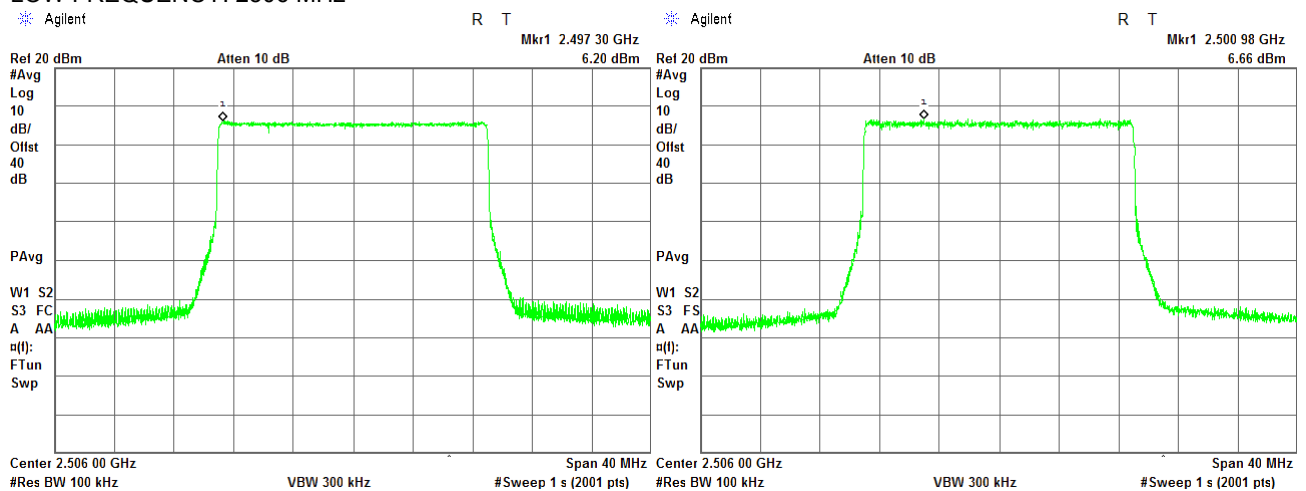
Test specification:		Section 27.50, Peak output power	
Test procedure:		47 CFR, Section 2.1046; TIA/EIA-603-E, Section 2.2.1	
Test mode:		Verdict: PASS	
Date(s):			
12-Dec-17			
Temperature: 23.8 °C	Relative Humidity: 45 %	Air Pressure: 1020 hPa	Power: 70 VAC, 50 Hz
Remarks:			

Plot 7.2.9 Peak output power test results at antenna chain RF # 1

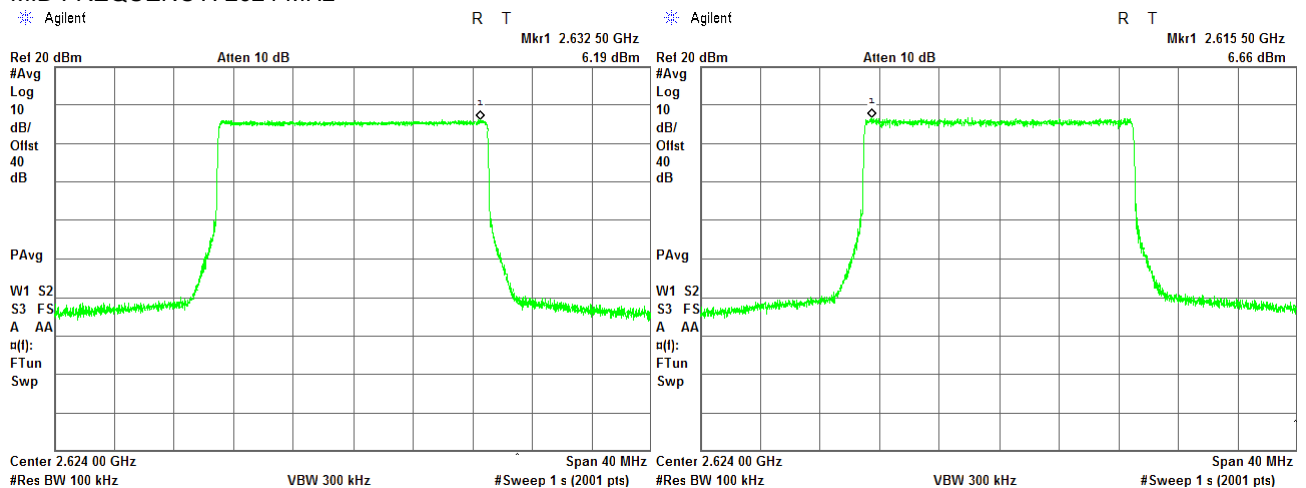
CHANNEL BANDWIDTH:
NUMBER OF ANTENNA:
Modulation: QPSK

20 MHz
12
Modulation: 64 QAM

LOW FREQUENCY: 2506 MHz



MID FREQUENCY: 2624 MHz





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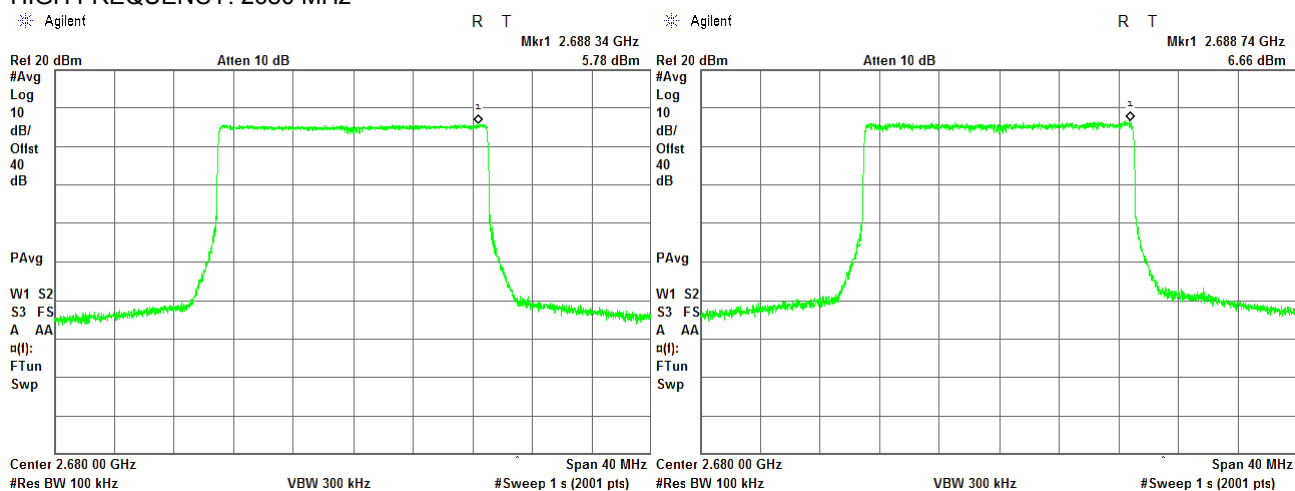
Test specification: Section 27.50, Peak output power			
Test procedure: 47 CFR, Section 2.1046; TIA/EIA-603-E, Section 2.2.1			
Test mode: Compliance		Verdict: PASS	
Date(s): 12-Dec-17			
Temperature: 23.8 °C	Relative Humidity: 45 %	Air Pressure: 1020 hPa	Power: 70 VAC, 50 Hz
Remarks:			

Plot 7.2.10 Peak output power test results at antenna chain RF # 1

CHANNEL BANDWIDTH:
NUMBER OF ANTENNA:
Modulation: QPSK

20 MHz
12
Modulation: 64 QAM

HIGH FREQUENCY: 2680 MHz



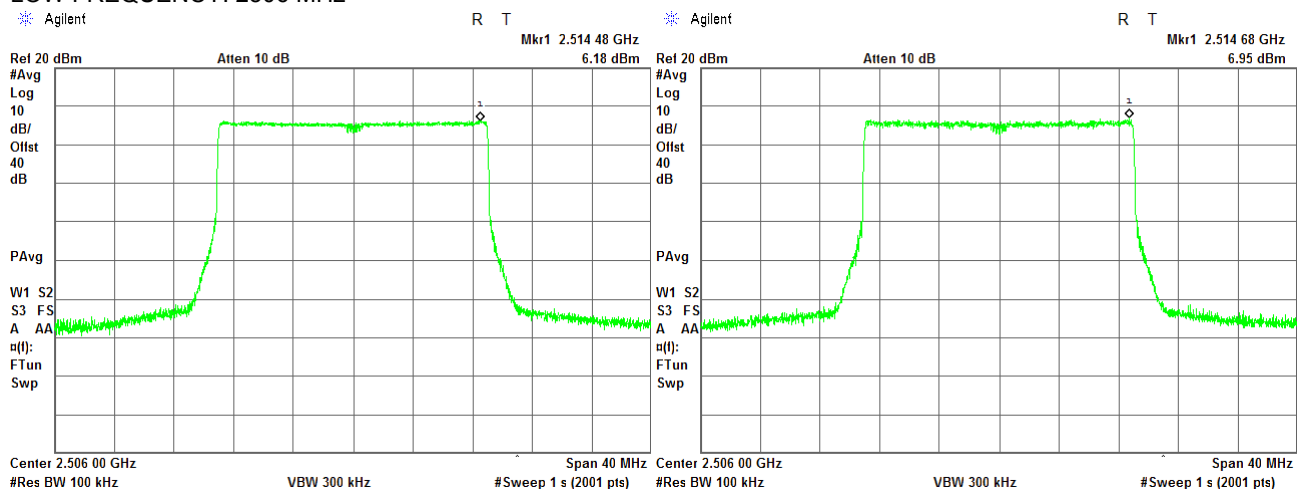
Test specification:		Section 27.50, Peak output power	
Test procedure:		47 CFR, Section 2.1046; TIA/EIA-603-E, Section 2.2.1	
Test mode:		Verdict: PASS	
Date(s):			
12-Dec-17			
Temperature: 23.8 °C	Relative Humidity: 45 %	Air Pressure: 1020 hPa	Power: 70 VAC, 50 Hz
Remarks:			

Plot 7.2.11 Peak output power test results at antenna chain RF # 2

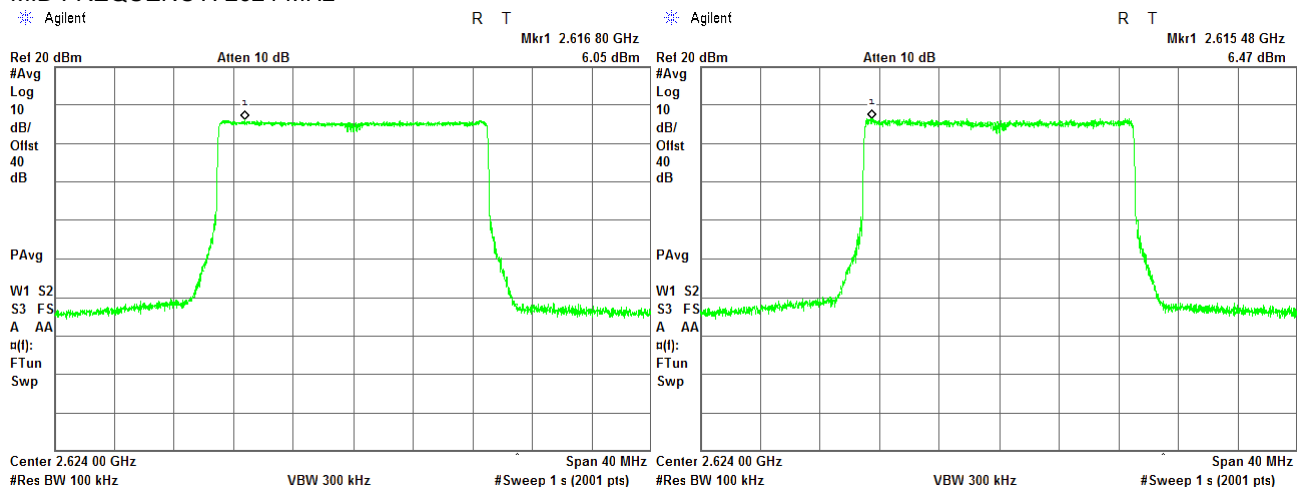
CHANNEL BANDWIDTH:
NUMBER OF ANTENNA:
Modulation: QPSK

20 MHz
12S
Modulation: 64 QAM

LOW FREQUENCY: 2506 MHz



MID FREQUENCY: 2624 MHz





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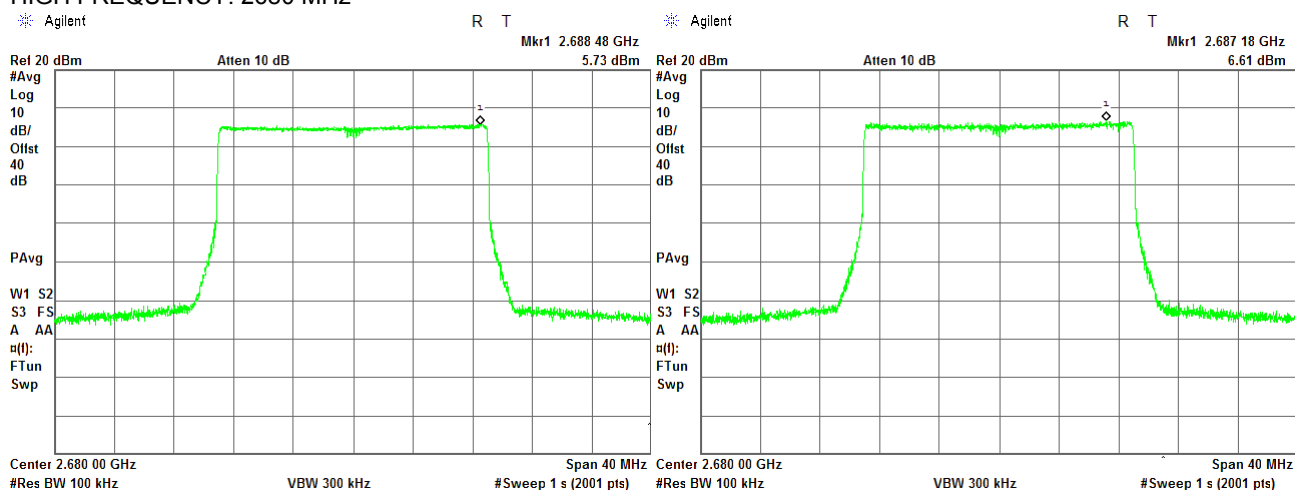
Test specification: Section 27.50, Peak output power			
Test procedure: 47 CFR, Section 2.1046; TIA/EIA-603-E, Section 2.2.1			
Test mode: Compliance		Verdict: PASS	
Date(s): 12-Dec-17			
Temperature: 23.8 °C	Relative Humidity: 45 %	Air Pressure: 1020 hPa	Power: 70 VAC, 50 Hz
Remarks:			

Plot 7.2.12 Peak output power test results at antenna chain RF # 2

CHANNEL BANDWIDTH:
NUMBER OF ANTENNA:
Modulation: QPSK

20 MHz
12S
Modulation: 64 QAM

HIGH FREQUENCY: 2680 MHz



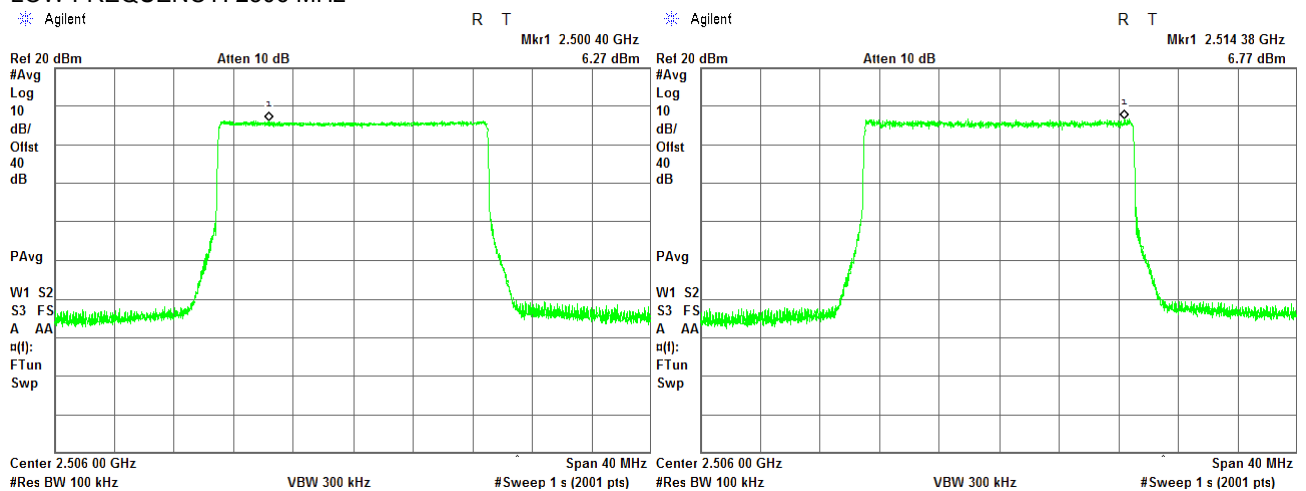
Test specification:		Section 27.50, Peak output power	
Test procedure:		47 CFR, Section 2.1046; TIA/EIA-603-E, Section 2.2.1	
Test mode:		Verdict: PASS	
Date(s):			
12-Dec-17			
Temperature: 23.8 °C	Relative Humidity: 45 %	Air Pressure: 1020 hPa	Power: 70 VAC, 50 Hz
Remarks:			

Plot 7.2.13 Peak output power test results at antenna chain RF # 3

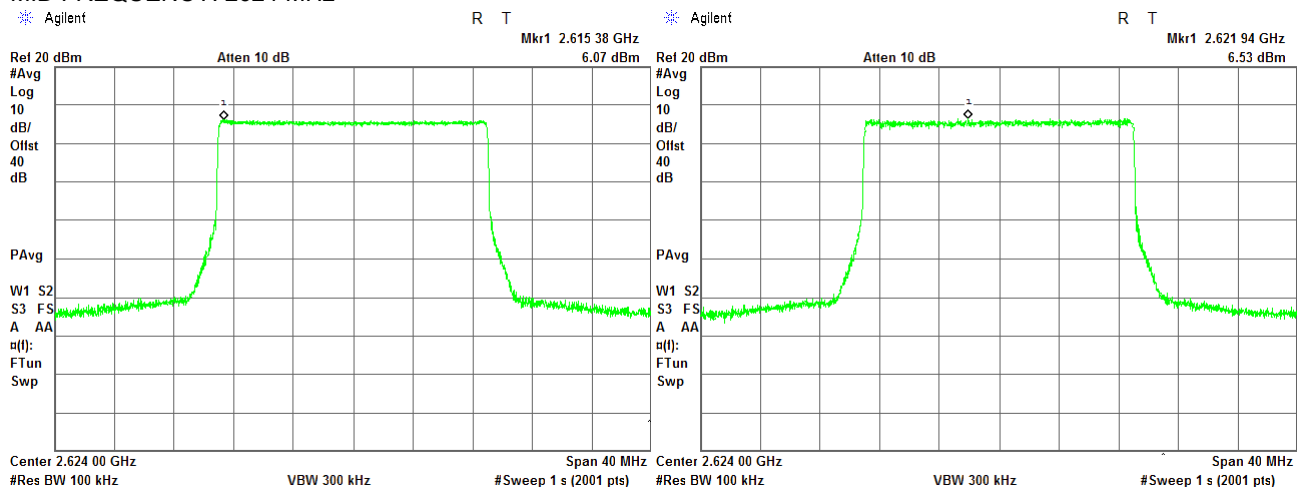
CHANNEL BANDWIDTH:
NUMBER OF ANTENNA:
Modulation: QPSK

20 MHz
21
Modulation: 64 QAM

LOW FREQUENCY: 2506 MHz



MID FREQUENCY: 2624 MHz





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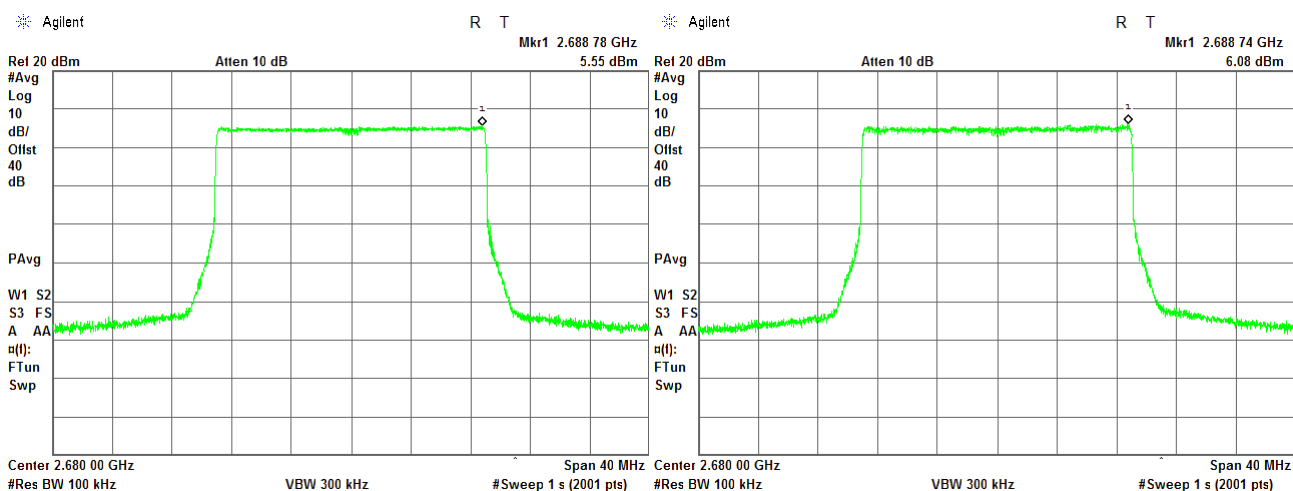
Test specification: Section 27.50, Peak output power			
Test procedure: 47 CFR, Section 2.1046; TIA/EIA-603-E, Section 2.2.1			
Test mode: Compliance		Verdict: PASS	
Date(s): 12-Dec-17			
Temperature: 23.8 °C	Relative Humidity: 45 %	Air Pressure: 1020 hPa	Power: 70 VAC, 50 Hz
Remarks:			

Plot 7.2.14 Peak output power test results at antenna chain RF # 3

CHANNEL BANDWIDTH:
NUMBER OF ANTENNA:
Modulation: QPSK

20 MHz
21
Modulation: 64 QAM

HIGH FREQUENCY: 2680 MHz



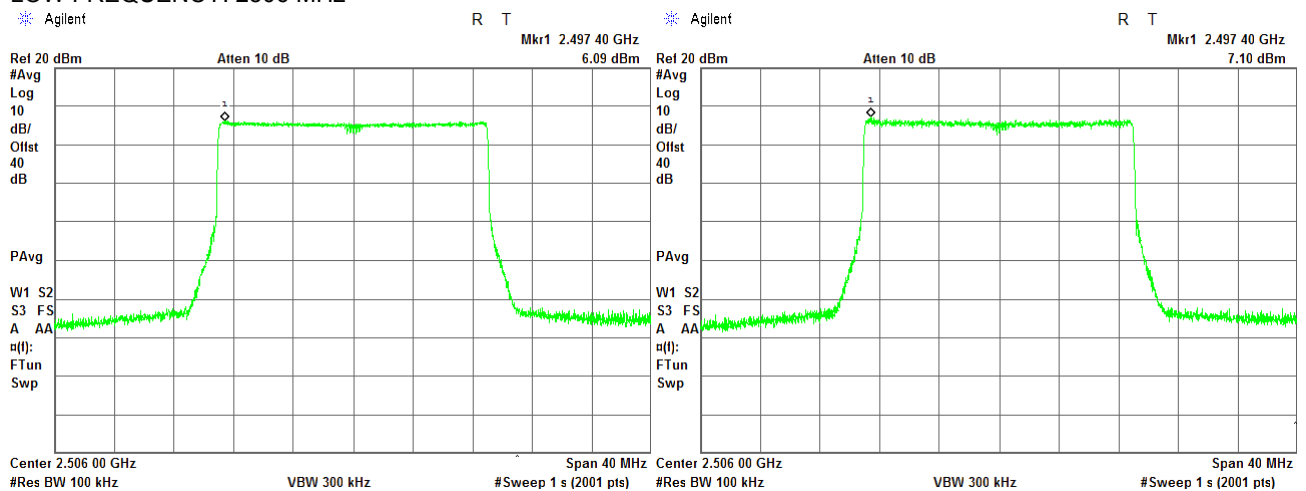
Test specification:		Section 27.50, Peak output power	
Test procedure:		47 CFR, Section 2.1046; TIA/EIA-603-E, Section 2.2.1	
Test mode:		Verdict: PASS	
Date(s):			
12-Dec-17			
Temperature: 23.8 °C	Relative Humidity: 45 %	Air Pressure: 1020 hPa	Power: 70 VAC, 50 Hz
Remarks:			

Plot 7.2.15 Peak output power test results at antenna chain RF # 4

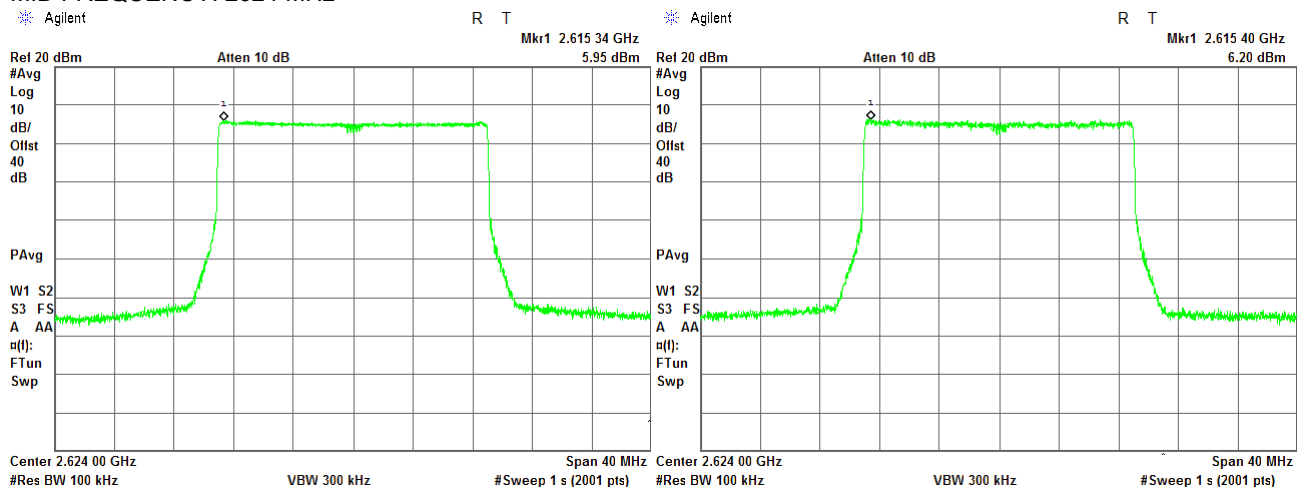
CHANNEL BANDWIDTH:
NUMBER OF ANTENNA:
Modulation: QPSK

20 MHz
21S
Modulation: 64 QAM

LOW FREQUENCY: 2506 MHz



MID FREQUENCY: 2624 MHz





HERMON LABORATORIES

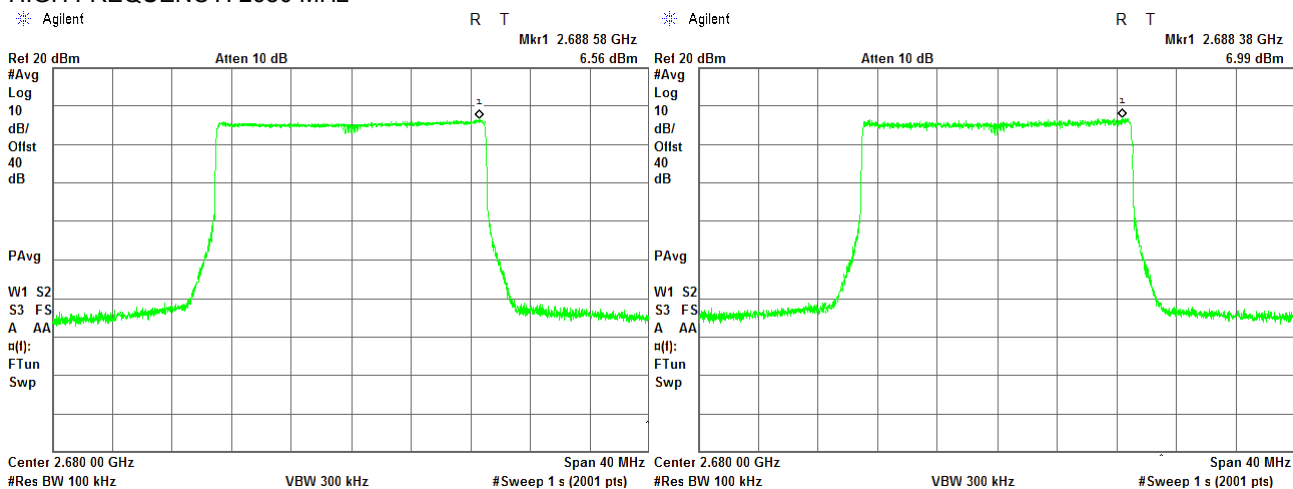
Test specification: Section 27.50, Peak output power			
Test procedure: 47 CFR, Section 2.1046; TIA/EIA-603-E, Section 2.2.1			
Test mode: Compliance		Verdict: PASS	
Date(s): 12-Dec-17			
Temperature: 23.8 °C	Relative Humidity: 45 %	Air Pressure: 1020 hPa	Power: 70 VAC, 50 Hz
Remarks:			

Plot 7.2.16 Peak output power test results at antenna chain RF # 4

CHANNEL BANDWIDTH:
NUMBER OF ANTENNA:
Modulation: QPSK

20 MHz
21S
Modulation: 64 QAM

HIGH FREQUENCY: 2680 MHz



Test specification: Section 27.53, Band edge emissions			
Test procedure: 47 CFR, Sections 2.1051, 27.53; TIA/EIA-603-E, Section 2.2.13			
Test mode: Compliance		Verdict: PASS	
Date(s): 11-Dec-17			
Temperature: 24.5 °C	Relative Humidity: 46 %	Air Pressure: 1024 hPa	Power: 70 VAC, 50 Hz
Remarks:			

7.3 Band edge emissions at RF connector test

7.3.1 General

This test was performed to measure spurious emissions at the channel edge at the RF antenna connector. Specification test limits are given in Table 7.3.1.

Table 7.3.1 Spurious emission limits at band edges

Channel, MHz	Frequency range	RBW, kHz	Attenuation below carrier, dBc	Limit, dBm
2496.0 – 2507.5	Below 2495 MHz	1000	43+ 10*Log (P*)	-13.0
	2495.0 – 2496.0	100/300	43+ 10*Log (P*)	-13.0
	2507.5 – 2508.5	100/300	43+ 10*Log (P*)	-13.0
	Above 2508.5 MHz	1000	43+ 10*Log (P*)	-13.0
2618.0 – 2629.5	Below 2617.0 MHz	1000	43+ 10*Log (P*)	-13.0
	2617.0 – 2618.0	100/300	43+ 10*Log (P*)	-13.0
	2629.5 – 2630.5	100/300	43+ 10*Log (P*)	-13.0
	Above 2630.5 MHz	1000	43+ 10*Log (P*)	-13.0
2679.0 – 2690.0	Below 2678.0 MHz	1000	43+ 10*Log (P*)	-13.0
	2678.0 – 2679.0	100/300	43+ 10*Log (P*)	-13.0
	2690.0 – 2691.0	100/300	43+ 10*Log (P*)	-13.0
	Above 2691.0	1000	43+ 10*Log (P*)	-13.0

* - P is transmitter output power in Watts

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

Figure 7.3.1 Spurious emission test setup for single output





Test specification: Section 27.53, Band edge emissions			
Test procedure: 47 CFR, Sections 2.1051, 27.53; TIA/EIA-603-E, Section 2.2.13			
Test mode: Compliance		Verdict: PASS	
Date(s): 11-Dec-17			
Temperature: 24.5 °C	Relative Humidity: 46 %	Air Pressure: 1024 hPa	Power: 70 VAC, 50 Hz
Remarks:			

Table 7.3.2 Spurious emission at the low band edge test results

ASSIGNED FREQUENCY RANGE: 2496.0 – 2690.0 MHz
 DETECTOR USED: Average (gated)
 RESOLUTION BANDWIDTH: 100 KHz
 VIDEO BANDWIDTH: ≥ Resolution bandwidth
 EBW: 10 MHz
 NUMBER OF CHAINS: 2
 ANTENNA CHAIN: #1
 ANTENNA PORT: #12

Frequency MHz	Band edge	SA reading over 1 chain, dBm	Total band edge*, dBm	RBW, kHz	Integration BW, kHz	Limit, dBm	Verdict
QPSK							
Low frequency 2506.0 MHz							
2496.00	Low	-28.11	-25.11	100	NA	-13.0	Pass
2495.00	Low	-23.03	-20.03	1000	NA	-13.0	
2507.50	High	-42.48	-39.48	100	NA	-13.0	
2508.50	High	-31.96	-28.96	1000	NA	-13.0	
Mid frequency 2624.0 MHz							
2617.83	Low	-39.53	-36.53	100	NA	-13.0	Pass
2617.00	Low	-29.18	-26.18	1000	NA	-13.0	
2629.55	High	-35.51	-32.51	100	NA	-13.0	
2630.50	High	-29.28	-26.28	1000	NA	-13.0	
High frequency 2680.0 MHz							
2679.00	Low	-39.04	-36.04	100	NA	-13.0	Pass
2678.00	Low	-29.47	-26.47	1000	NA	-13.0	
2690.00	High	-26.15	-23.15	100	NA	-13.0	
2691.00	High	-22.92	-19.92	1000	NA	-13.0	
64QAM							
Low frequency 2506.0 MHz							
2496.00	Low	-27.70	-24.70	100	NA	-13.0	Pass
2495.00	Low	-22.51	-19.51	1000	NA	-13.0	
2507.50	High	-39.94	-36.94	100	NA	-13.0	
2508.50	High	-31.46	-28.46	1000	NA	-13.0	
Mid frequency 2624.0 MHz							
2617.97	Low	-38.61	-35.61	100	NA	-13.0	Pass
2617.00	Low	-28.82	-25.82	1000	NA	-13.0	
2629.51	High	-35.15	-32.15	100	NA	-13.0	
2630.50	High	-28.17	-25.17	1000	NA	-13.0	
High frequency 2680.0 MHz							
2679.00	Low	-38.80	-35.80	100	NA	-13.0	Pass
2677.94	Low	-29.62	-26.62	1000	NA	-13.0	
2690.00	High	-27.20	-24.20	100	NA	-13.0	
2691.00	High	-22.69	-19.69	1000	NA	-13.0	

*- Total band edge, dBm = SA Reading band edge, dBm + 10*log(N) = SA Reading band edge, dBm + 3 dB

Reference numbers of test equipment used

HL 3301	HL 3302	HL 3667	HL 3818	HL 3903	HL 4071		
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Full description is given in Appendix A.



Test specification: Section 27.53, Band edge emissions			
Test procedure: 47 CFR, Sections 2.1051, 27.53; TIA/EIA-603-E, Section 2.2.13			
Test mode: Compliance	Verdict: PASS		
Date(s): 11-Dec-17			
Temperature: 24.5 °C	Relative Humidity: 46 %	Air Pressure: 1024 hPa	Power: 70 VAC, 50 Hz
Remarks:			

Table 7.3.3 Spurious emission at the low band edge test results

ASSIGNED FREQUENCY RANGE: 2496.0 – 2690.0 MHz
 DETECTOR USED: Average (gated)
 RESOLUTION BANDWIDTH: 100 KHz
 VIDEO BANDWIDTH: ≥ Resolution bandwidth
 EBW: 20 MHz
 NUMBER OF CHAINS: 2
 ANTENNA CHAIN: #1
 ANTENNA PORT: #12

Frequency MHz	Band edge	SA reading over 1chain, dBm	Total band edge*, dBm	RBW, kHz	Integration BW, kHz	Limit, dBm	Verdict
QPSK							
Low frequency 2506.0 MHz							
2496.00	Low	-27.90	-24.90	300	NA	-13.0	Pass
2495.00	Low	-32.76	-29.76	1000	NA	-13.0	
2518.50	High	-40.82	-37.82	300	NA	-13.0	
2518.50	High	-35.68	-32.68	1000	NA	-13.0	
Mid frequency 2624.0 MHz							
2614.00	Low	-28.36	-25.36	300	NA	-13.0	Pass
2613.00	Low	-30.61	-27.61	1000	NA	-13.0	
2635.00	High	-39.09	-36.09	300	NA	-13.0	
2636.00	High	-34.40	-31.40	1000	NA	-13.0	
High frequency 2680.0 MHz							
2668.00	Low	-38.90	-35.90	300	NA	-13.0	Pass
2667.00	Low	-33.92	-30.92	1000	NA	-13.0	
2690.00	High	-27.02	-24.02	300	NA	-13.0	
2691.00	High	-29.39	-26.39	1000	NA	-13.0	
64QAM							
Low frequency 2506.0 MHz							
2496.00	Low	-28.71	-25.71	300	NA	-13.0	Pass
2495.00	Low	-32.21	-29.21	1000	NA	-13.0	
2515.00	High	-40.17	-37.17	300	NA	-13.0	
2517.00	High	-35.53	-32.53	1000	NA	-13.0	
Mid frequency 2624.0 MHz							
2614.00	Low	-27.77	-24.77	300	NA	-13.0	Pass
2613.00	Low	-30.51	-27.51	1000	NA	-13.0	
2635.00	High	-38.99	-35.99	300	NA	-13.0	
2636.00	High	-34.40	-31.40	1000	NA	-13.0	
High frequency 2680.0 MHz							
2668.00	Low	-39.00	-36.00	300	NA	-13.0	Pass
2667.00	Low	-33.20	-30.20	1000	NA	-13.0	
2690.00	High	-27.44	-24.44	300	NA	-13.0	
2691.00	High	-30.28	-27.28	1000	NA	-13.0	

*- Total band edge, dBm = SA Reading band edge, dBm + 10*log(N) = SA Reading band edge, dBm + 3 dB

Reference numbers of test equipment used

HL 3301	HL 3302	HL 3667	HL 3818	HL 3903	HL 4071		
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Full description is given in Appendix A.

Test specification:		Section 27.53, Band edge emissions	
Test procedure:		47 CFR, Sections 2.1051, 27.53; TIA/EIA-603-E, Section 2.2.13	
Test mode:		Verdict: PASS	
Date(s):			
11-Dec-17			
Temperature: 24.5 °C	Relative Humidity: 46 %	Air Pressure: 1024 hPa	Power: 70 VAC, 50 Hz
Remarks:			

Plot 7.3.1 Spurious emission at band edges test results at low carrier frequency

ASSIGNED FREQUENCY RANGE:

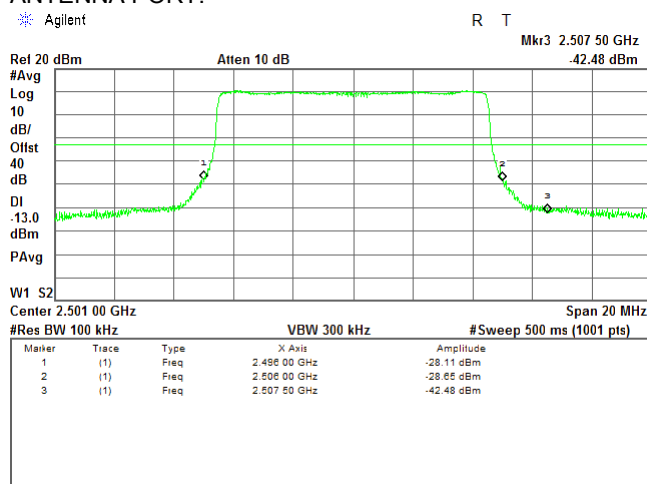
DETECTOR USED:

MODULATION:

EBW:

TRANSMITTER OUTPUT POWER SETTINGS:

ANTENNA PORT:



2496 – 2690 MHz

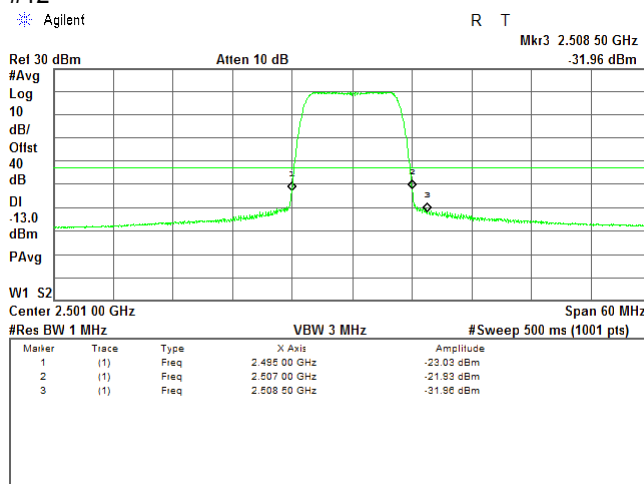
Average

QPSK

10 MHz

Maximum

#12



Plot 7.3.2 Spurious emission at band edges test results at mid carrier frequency

ASSIGNED FREQUENCY RANGE:

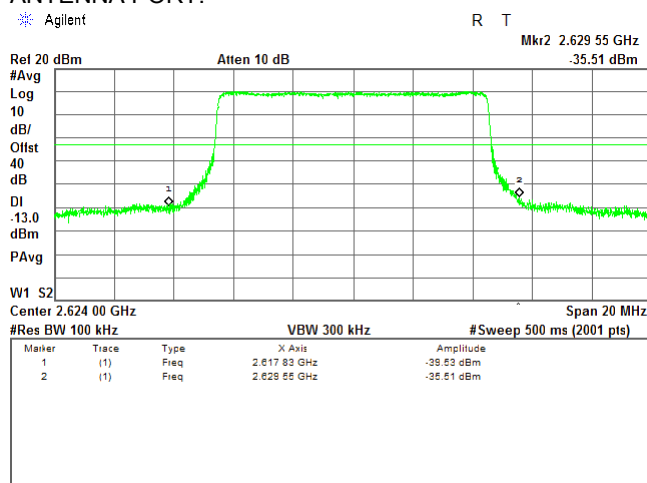
DETECTOR USED:

MODULATION:

EBW:

TRANSMITTER OUTPUT POWER SETTINGS:

ANTENNA PORT:



2496 – 2690 MHz

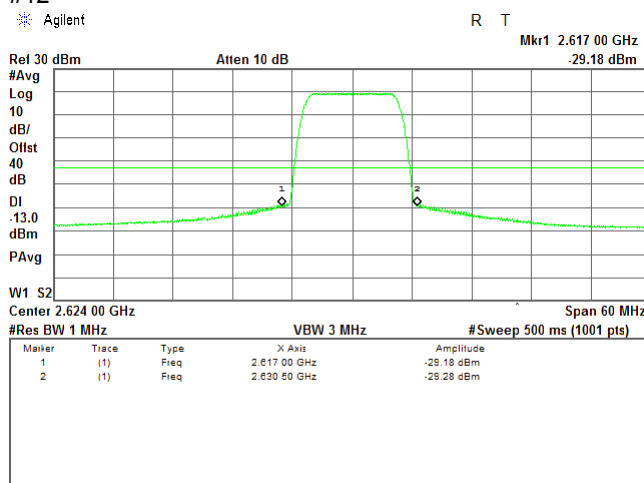
Average

QPSK

10 MHz

Maximum

#12



Test specification:		Section 27.53, Band edge emissions	
Test procedure:		47 CFR, Sections 2.1051, 27.53; TIA/EIA-603-E, Section 2.2.13	
Test mode:		Compliance	Verdict: PASS
Date(s):		11-Dec-17	
Temperature: 24.5 °C	Relative Humidity: 46 %	Air Pressure: 1024 hPa	Power: 70 VAC, 50 Hz
Remarks:			

Plot 7.3.3 Spurious emission at band edges test results at high carrier frequency

ASSIGNED FREQUENCY RANGE:

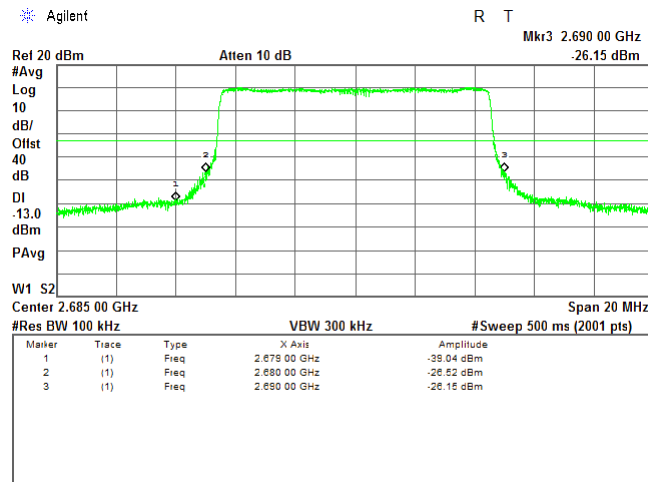
DETECTOR USED:

MODULATION:

EBW:

TRANSMITTER OUTPUT POWER SETTINGS:

ANTENNA PORT:



2496 – 2690 MHz

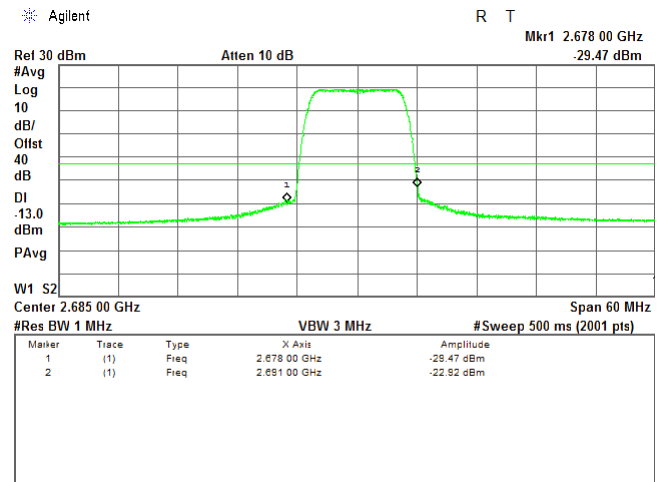
Average

QPSK

10 MHz

Maximum

#12



Plot 7.3.4 Spurious emission at band edges test results at low carrier frequency

ASSIGNED FREQUENCY RANGE:

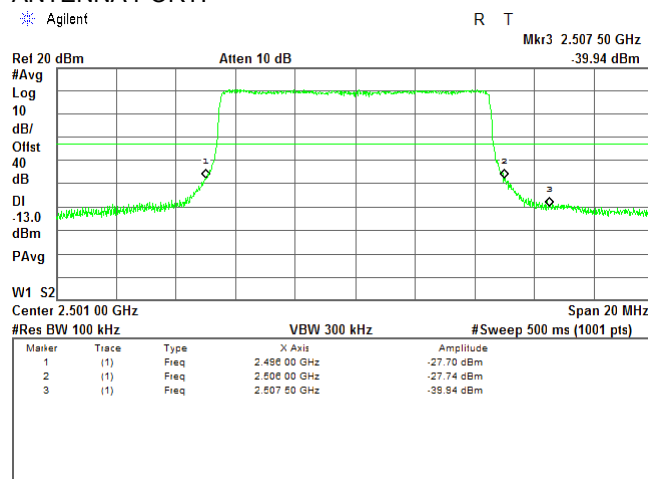
DETECTOR USED:

MODULATION:

EBW:

TRANSMITTER OUTPUT POWER SETTINGS:

ANTENNA PORT:



2496 – 2690 MHz

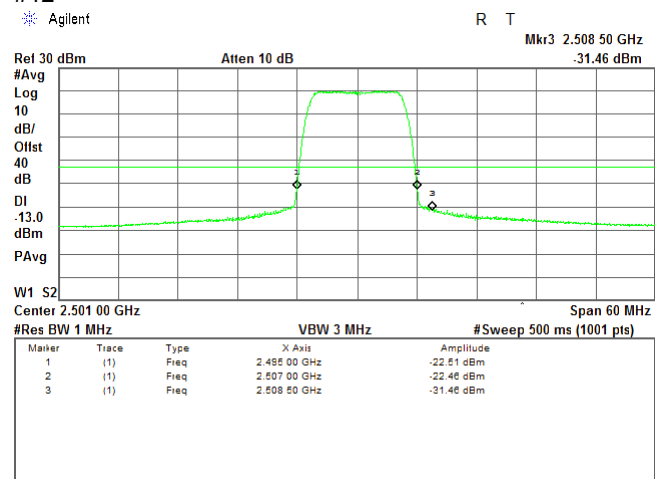
Average

64QAM

10 MHz

Maximum

#12



Test specification:		Section 27.53, Band edge emissions	
Test procedure:		47 CFR, Sections 2.1051, 27.53; TIA/EIA-603-E, Section 2.2.13	
Test mode:		Compliance	Verdict: PASS
Date(s):		11-Dec-17	
Temperature: 24.5 °C	Relative Humidity: 46 %	Air Pressure: 1024 hPa	Power: 70 VAC, 50 Hz
Remarks:			

Plot 7.3.5 Spurious emission at band edges test results at mid carrier frequency

ASSIGNED FREQUENCY RANGE:

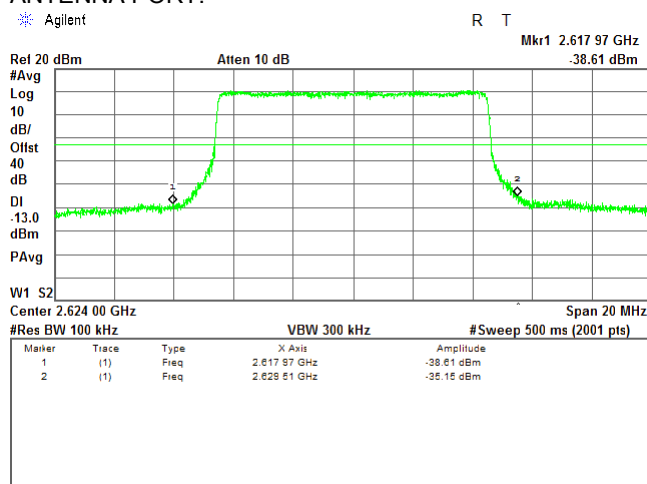
DETECTOR USED:

MODULATION:

EBW:

TRANSMITTER OUTPUT POWER SETTINGS:

ANTENNA PORT:



2496 – 2690 MHz

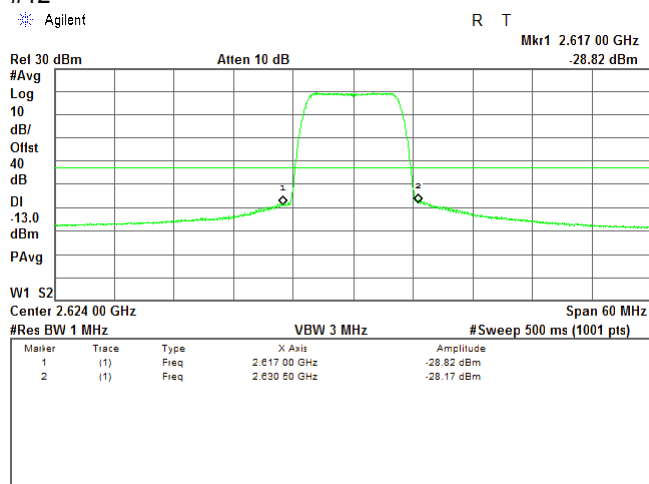
Average

64QAM

10 MHz

Maximum

#12



Plot 7.3.6 Spurious emission at band edges test results at high carrier frequency

ASSIGNED FREQUENCY RANGE:

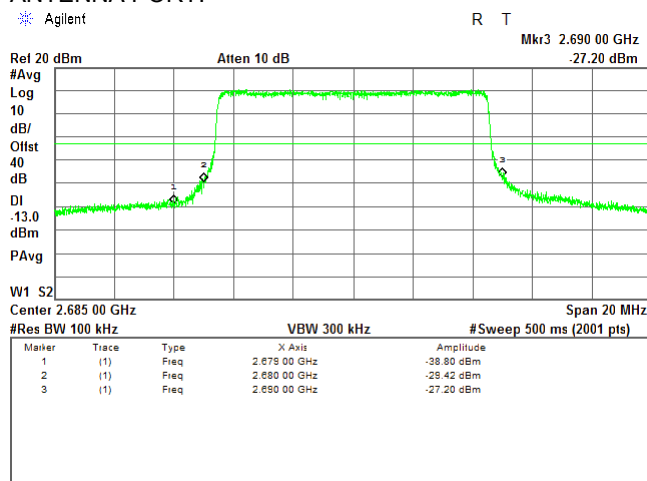
DETECTOR USED:

MODULATION:

EBW:

TRANSMITTER OUTPUT POWER SETTINGS:

ANTENNA PORT:



2496 – 2690 MHz

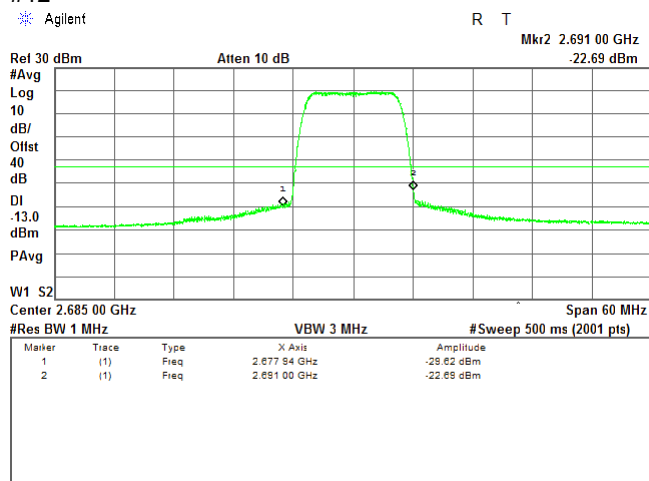
Average

64QAM

10 MHz

Maximum

#12



Test specification:		Section 27.53, Band edge emissions	
Test procedure:		47 CFR, Sections 2.1051, 27.53; TIA/EIA-603-E, Section 2.2.13	
Test mode:		Compliance	Verdict: PASS
Date(s):		11-Dec-17	
Temperature: 24.5 °C	Relative Humidity: 46 %	Air Pressure: 1024 hPa	Power: 70 VAC, 50 Hz
Remarks:			

Plot 7.3.7 Spurious emission at band edges test results at low carrier frequency

ASSIGNED FREQUENCY RANGE:

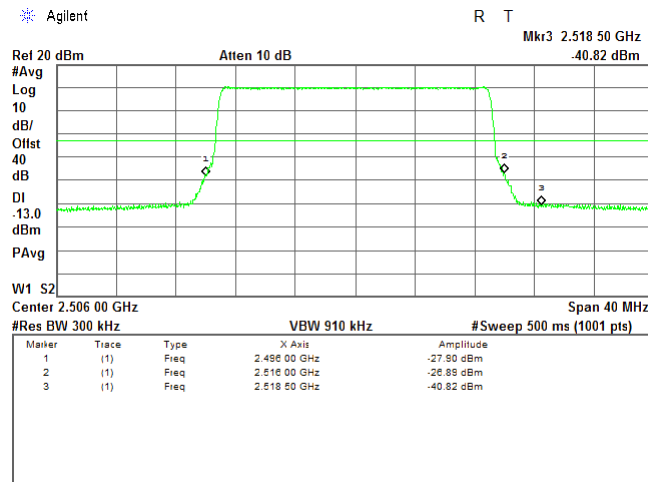
DETECTOR USED:

MODULATION:

EBW:

TRANSMITTER OUTPUT POWER SETTINGS:

ANTENNA PORT:



2496 – 2690 MHz

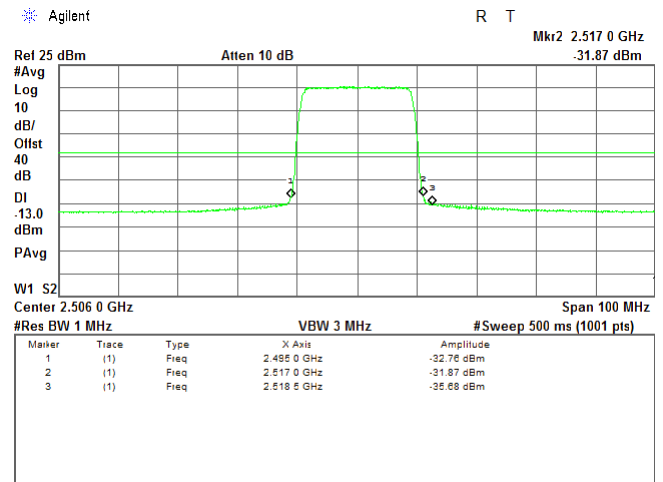
Average

QPSK

20 MHz

Maximum

#12



Plot 7.3.8 Spurious emission at band edges test results at mid carrier frequency

ASSIGNED FREQUENCY RANGE:

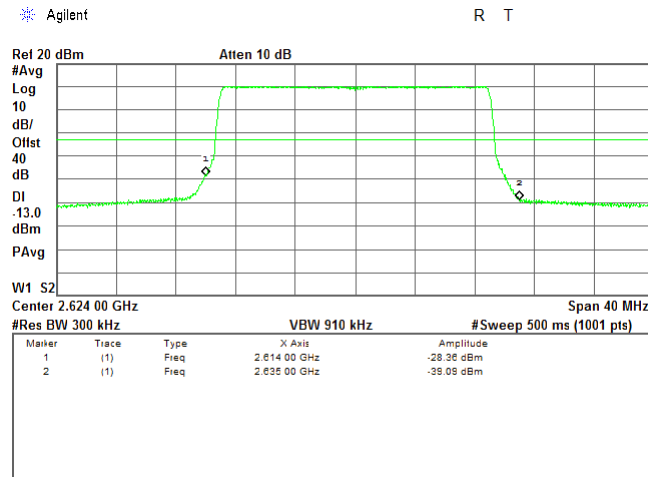
DETECTOR USED:

MODULATION:

EBW:

TRANSMITTER OUTPUT POWER SETTINGS:

ANTENNA PORT:



2496 – 2690 MHz

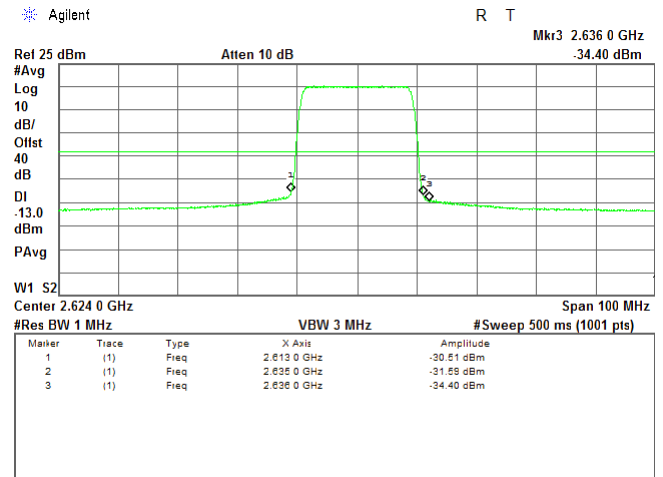
Average

QPSK

20 MHz

Maximum

#12



Test specification:		Section 27.53, Band edge emissions	
Test procedure:		47 CFR, Sections 2.1051, 27.53; TIA/EIA-603-E, Section 2.2.13	
Test mode:		Verdict: PASS	
Date(s):			
11-Dec-17			
Temperature: 24.5 °C	Relative Humidity: 46 %	Air Pressure: 1024 hPa	Power: 70 VAC, 50 Hz
Remarks:			

Plot 7.3.9 Spurious emission at band edges test results at high carrier frequency

ASSIGNED FREQUENCY RANGE:

DETECTOR USED:

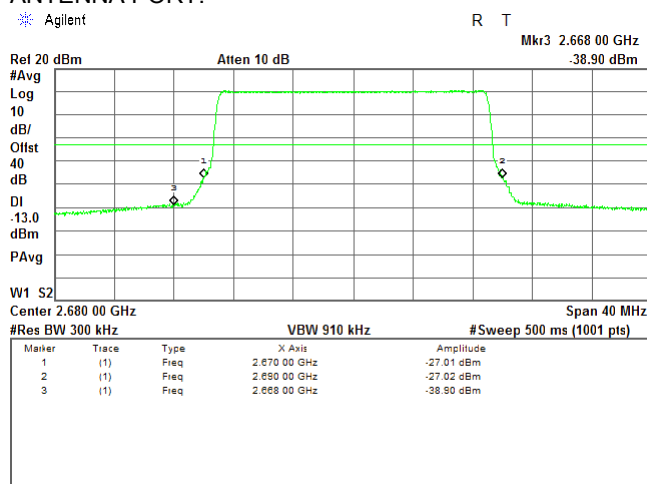
MODULATION:

EBW:

TRANSMITTER OUTPUT POWER SETTINGS:

ANTENNA PORT:

Agilent



2496 – 2690 MHz

Average

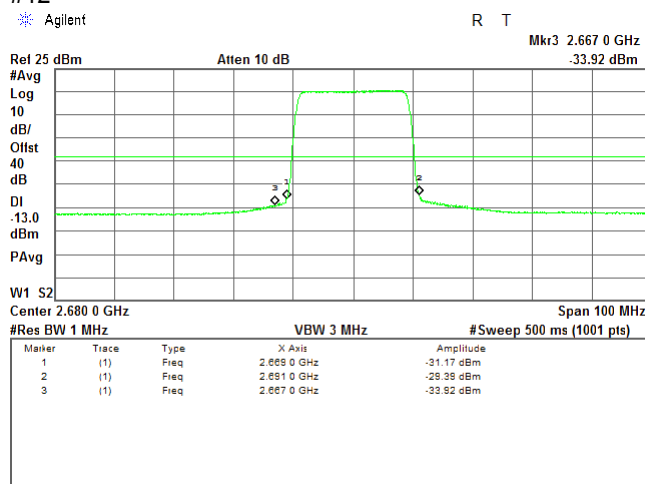
QPSK

20 MHz

Maximum

#12

Agilent



Plot 7.3.10 Spurious emission at band edges test results at low carrier frequency

ASSIGNED FREQUENCY RANGE:

DETECTOR USED:

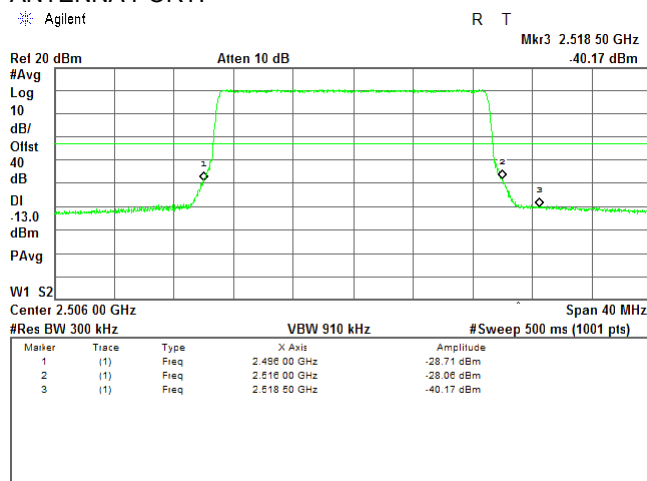
MODULATION:

EBW:

TRANSMITTER OUTPUT POWER SETTINGS:

ANTENNA PORT:

Agilent



2496 – 2690 MHz

Average

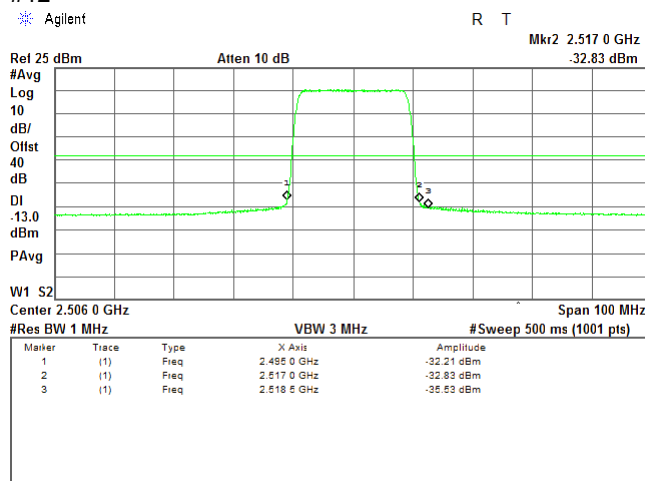
64QAM

20 MHz

Maximum

#12

Agilent



Test specification:		Section 27.53, Band edge emissions	
Test procedure:		47 CFR, Sections 2.1051, 27.53; TIA/EIA-603-E, Section 2.2.13	
Test mode:		Compliance	Verdict: PASS
Date(s):		11-Dec-17	
Temperature: 24.5 °C	Relative Humidity: 46 %	Air Pressure: 1024 hPa	Power: 70 VAC, 50 Hz
Remarks:			

Plot 7.3.11 Spurious emission at band edges test results at mid carrier frequency

ASSIGNED FREQUENCY RANGE:

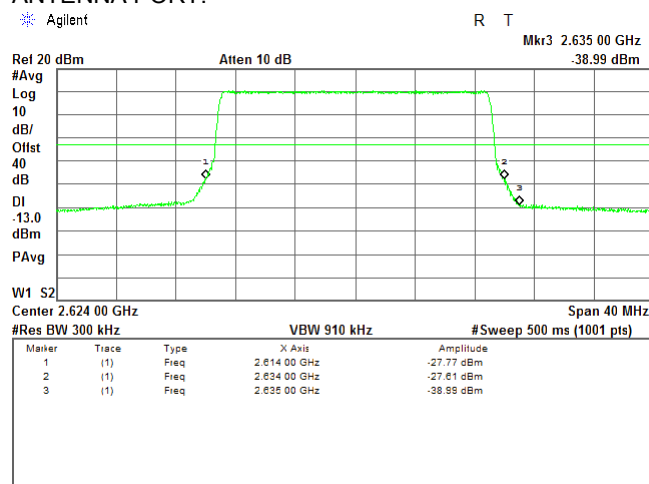
DETECTOR USED:

MODULATION:

EBW:

TRANSMITTER OUTPUT POWER SETTINGS:

ANTENNA PORT:



2496 – 2690 MHz

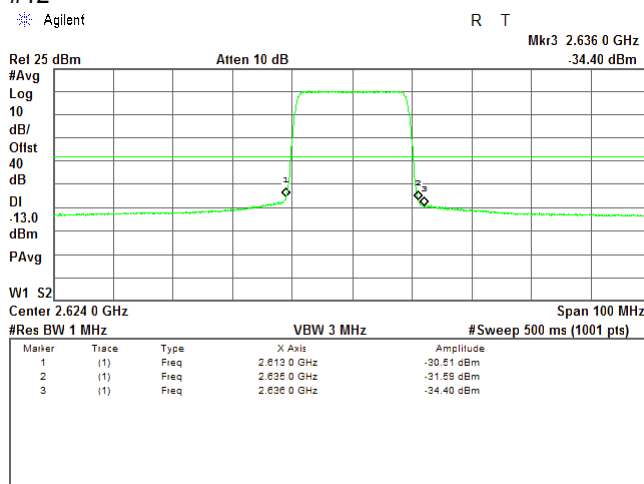
Average

64QAM

20 MHz

Maximum

#12



Plot 7.3.12 Spurious emission at band edges test results at high carrier frequency

ASSIGNED FREQUENCY RANGE:

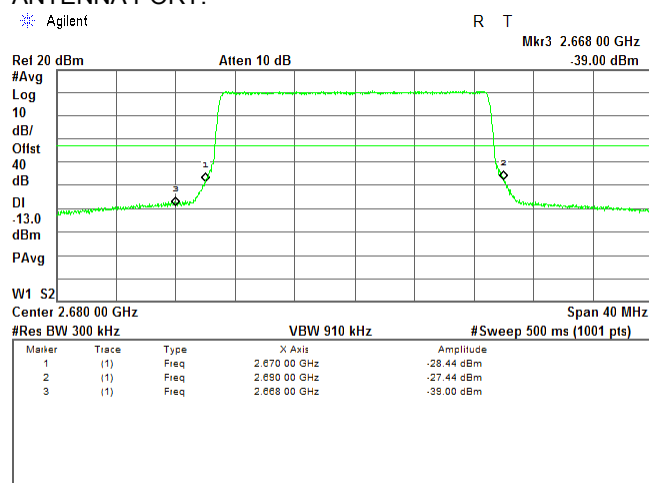
DETECTOR USED:

MODULATION:

EBW:

TRANSMITTER OUTPUT POWER SETTINGS:

ANTENNA PORT:



2496 – 2690 MHz

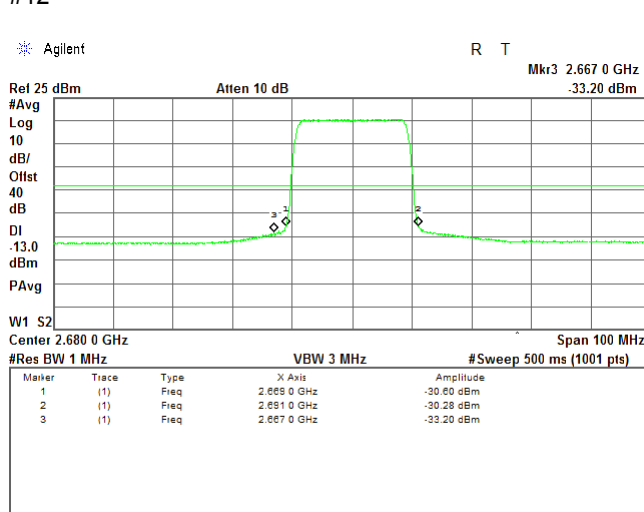
Average

64QAM

20 MHz

Maximum

#12



Test specification: Section 27.53, Spurious emissions at RF antenna connector			
Test procedure: 47 CFR, Sections 2.1051, 27.53; TIA/EIA-603-E, Section 2.2.13			
Test mode: Compliance		Verdict: PASS	
Date(s): 11-Dec-17			
Temperature: 24.5 °C	Relative Humidity: 46 %	Air Pressure: 1024 hPa	Power: 70 VAC, 50 Hz
Remarks:			

7.4 Spurious emissions at RF antenna connector test

7.4.1 General

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

Table 7.4.1 Spurious emission limits

Frequency, MHz	Attenuation below carrier, dBc	Spurious emissions, dBm
Base and fixed user stations		
0.009 – 10th harmonic	43+10logP(W)**	-13.0
Mobile stations		
0.009 – 10th harmonic*	55+10logP(W)**	-25.0

* - spurious emission limits do not apply to the channel edge emission investigated in course of band edge emission testing

** - P is transmitter output power in watts

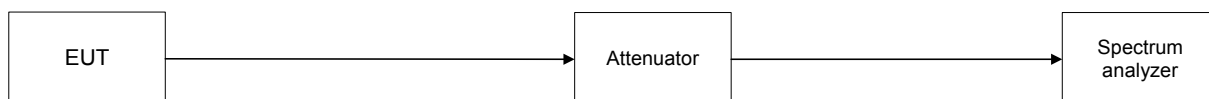
7.4.2 Test procedure

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

7.4.2.3 The spurious emission was measured with spectrum analyzer as provided in Table 7.4.2 and associated plots.

Figure 7.4.1 Spurious emission test setup, single output





Test specification: Section 27.53, Spurious emissions at RF antenna connector			
Test procedure: 47 CFR, Sections 2.1051, 27.53; TIA/EIA-603-E, Section 2.2.13			
Test mode:	Compliance	Verdict: PASS	
Date(s):	11-Dec-17		
Temperature: 24.5 °C	Relative Humidity: 46 %	Air Pressure: 1024 hPa	Power: 70 VAC, 50 Hz
Remarks:			

Table 7.4.2 Spurious emission test results

ASSIGNED FREQUENCY RANGE: 2496-2690 MHz
 INVESTIGATED FREQUENCY RANGE: 0.009 – 26900 MHz
 DETECTOR USED: Peak
 VIDEO BANDWIDTH: ≥ Resolution bandwidth
 MODULATION: 64QAM
 MODULATING SIGNAL: PRBS
 TRANSMITTER OUTPUT POWER SETTINGS: Maximum

NUMBER OF CHAINS: N=1
 ANTENNA PORT: 12

Frequency, MHz	SA reading, dBm	Attenuation, dB	Cable loss, dB	RBW, kHz	Spurious emission, dBm**	Limit, dBm	Margin, dB*	Verdict
Low carrier frequency								
2501.0	-27.74	Included	Included	1	-27.74	-13.0	-14.74	Pass
Mid carrier frequency								
2624.0	-27.46	Included	Included	1	-27.46	-13.0	-14.46	Pass
High carrier frequency								
2685.0	-28.30	Included	Included	1	-28.30	-13.0	-15.30	Pass

*- Margin = Spurious emission – specification limit.

** - Total spurious emission, dBm = SA Reading, dBm + 10*log(N) = SA Reading, dBm

NUMBER OF CHAINS: N=2
 ANTENNA PORT: 12S

Frequency, MHz	SA reading, dBm	Attenuation, dB	Cable loss, dB	RBW, kHz	Total Spurious emission, dBm**	Limit, dBm	Margin, dB*	Verdict
Low carrier frequency								
2501.0	-27.74	Included	Included	1	-24.74	-13.0	-11.74	Pass
Mid carrier frequency								
2624.0	-27.46	Included	Included	1	-24.46	-13.0	-11.46	Pass
High carrier frequency								
2685.0	-28.30	Included	Included	1	-25.30	-13.0	-12.30	Pass

*- Margin = Spurious emission – specification limit.

** - Total spurious emission, dBm = SA Reading, dBm + 10*log(N) = SA Reading, dBm + 3 dB

Reference numbers of test equipment used

HL 3787	HL 3818	HL 3901	HL 4342	HL 4372			
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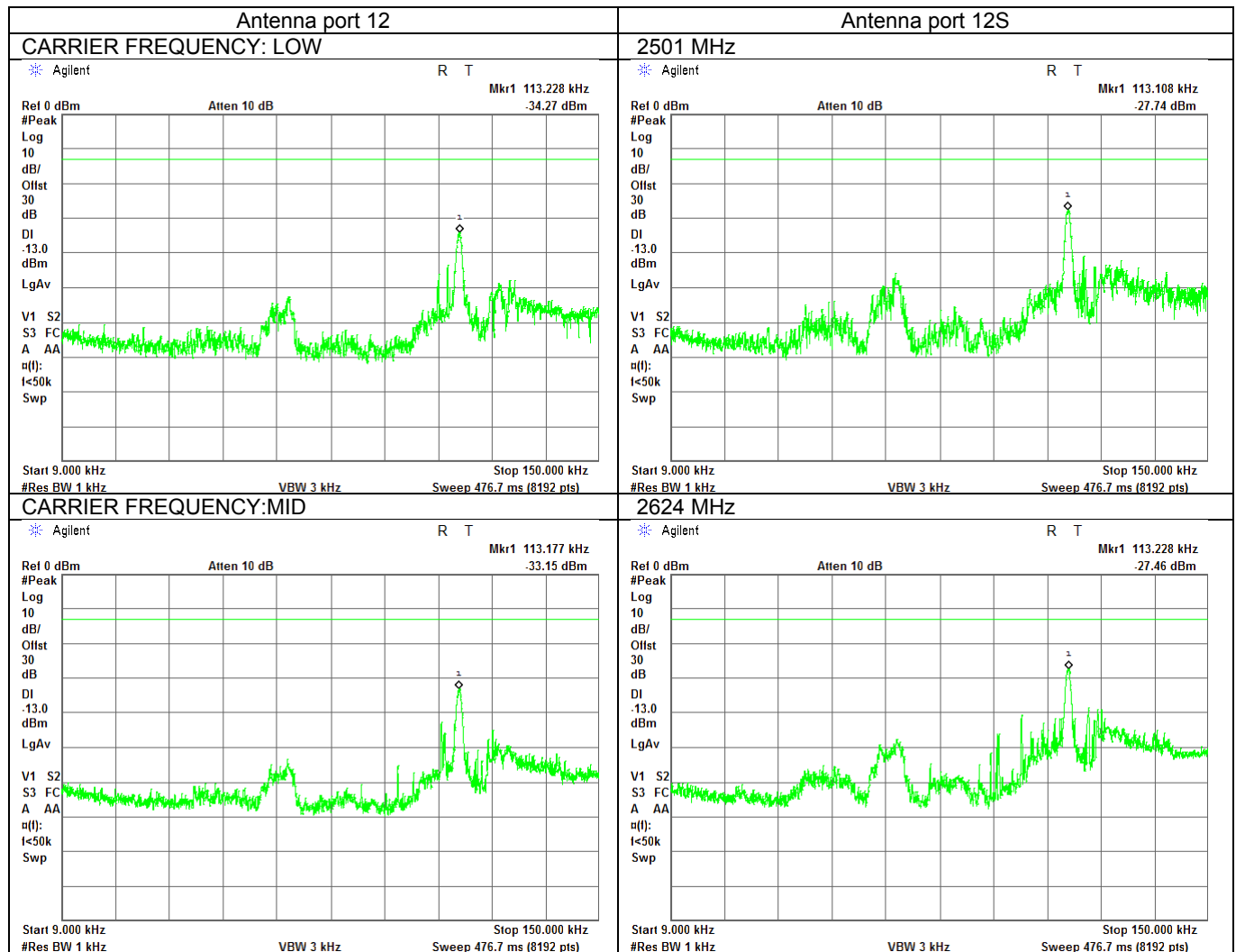
Full description is given in Appendix A.



HERMON LABORATORIES

Test specification:		Section 27.53, Spurious emissions at RF antenna connector	
Test procedure:		47 CFR, Sections 2.1051, 27.53; TIA/EIA-603-E, Section 2.2.13	
Test mode:	Compliance	Verdict: PASS	
Date(s):	11-Dec-17		
Temperature: 24.5 °C	Relative Humidity: 46 %	Air Pressure: 1024 hPa	Power: 70 VAC, 50 Hz
Remarks:			

Plot 7.4.1 Spurious emission measurements in 9 - 150 kHz range

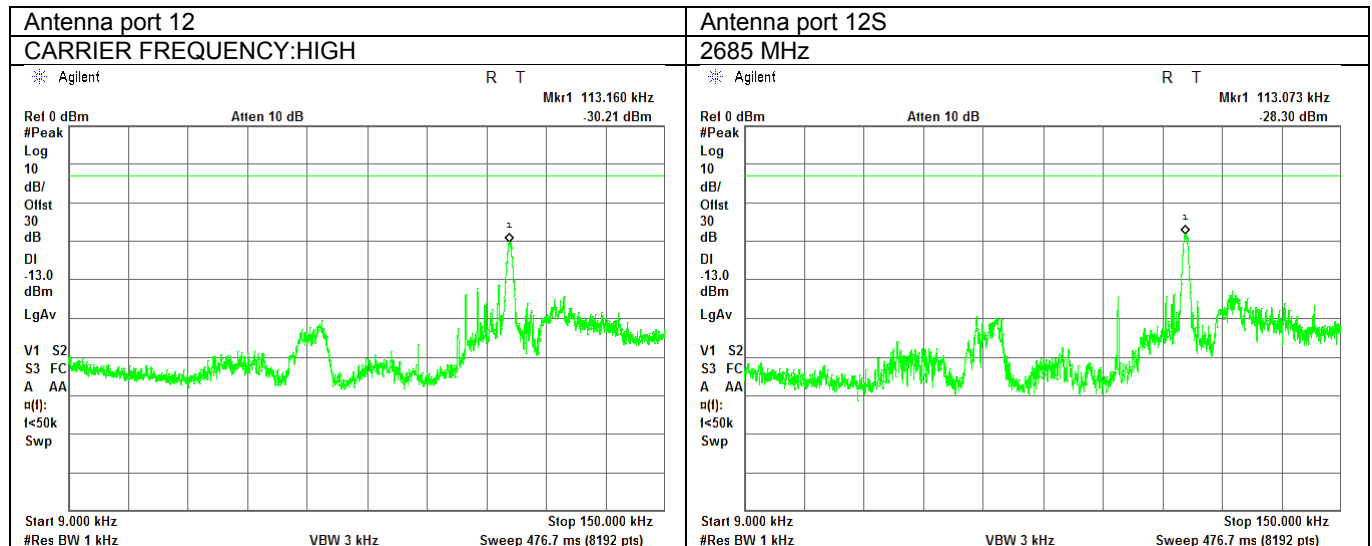




HERMON LABORATORIES

Test specification:		Section 27.53, Spurious emissions at RF antenna connector	
Test procedure:		47 CFR, Sections 2.1051, 27.53; TIA/EIA-603-E, Section 2.2.13	
Test mode:		Compliance	Verdict: PASS
Date(s):		11-Dec-17	
Temperature: 24.5 °C	Relative Humidity: 46 %	Air Pressure: 1024 hPa	Power: 70 VAC, 50 Hz
Remarks:			

Plot 7.4.2 Spurious emission measurements in 9 - 150 kHz range

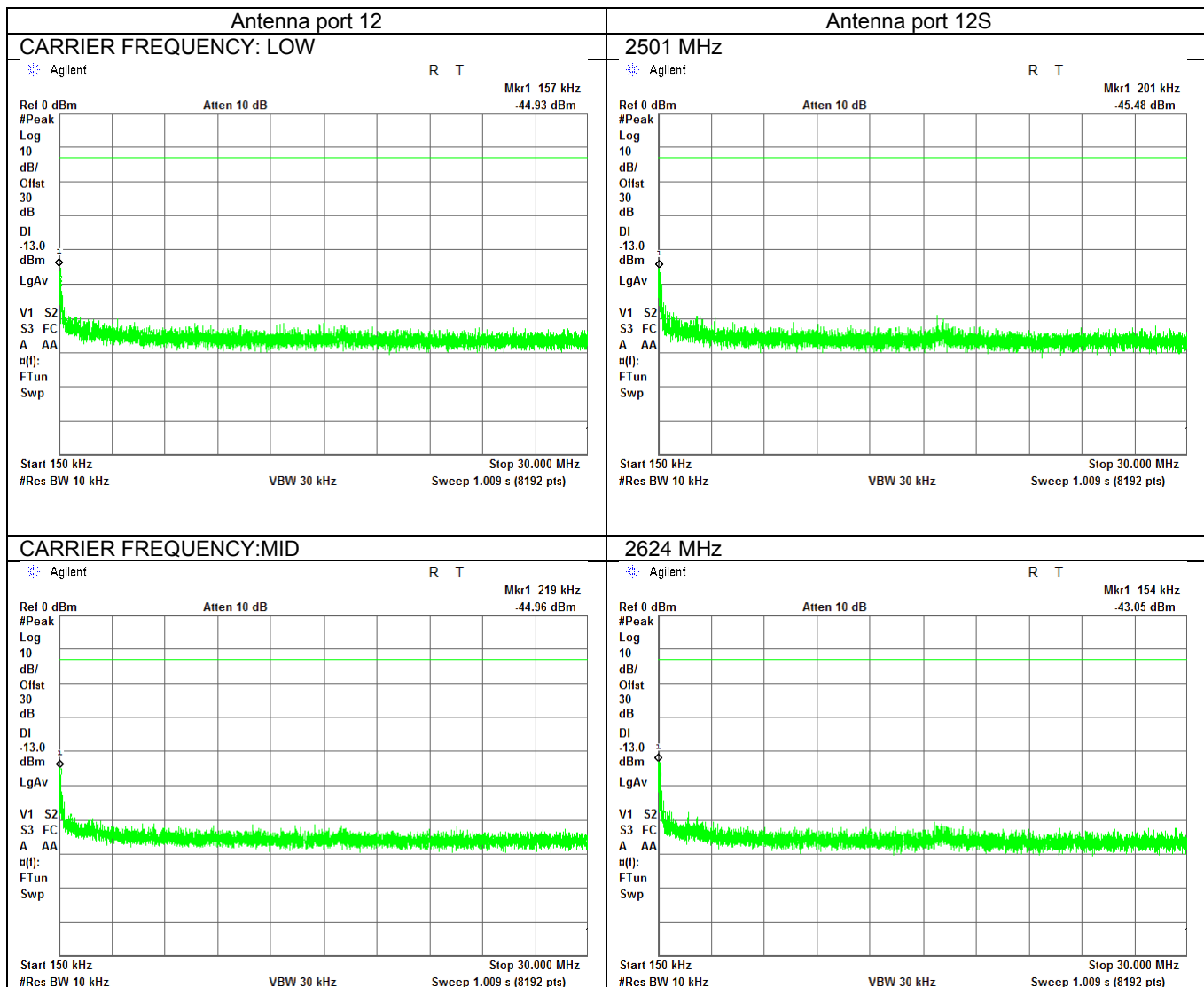




HERMON LABORATORIES

Test specification:		Section 27.53, Spurious emissions at RF antenna connector			
Test procedure:		47 CFR, Sections 2.1051, 27.53; TIA/EIA-603-E, Section 2.2.13			
Test mode:		Compliance		Verdict: PASS	
Date(s):		11-Dec-17			
Temperature: 24.5 °C	Relative Humidity: 46 %		Air Pressure: 1024 hPa	Power: 70 VAC, 50 Hz	
Remarks:					

Plot 7.4.3 Spurious emission measurements in 0.15 - 30 MHz range



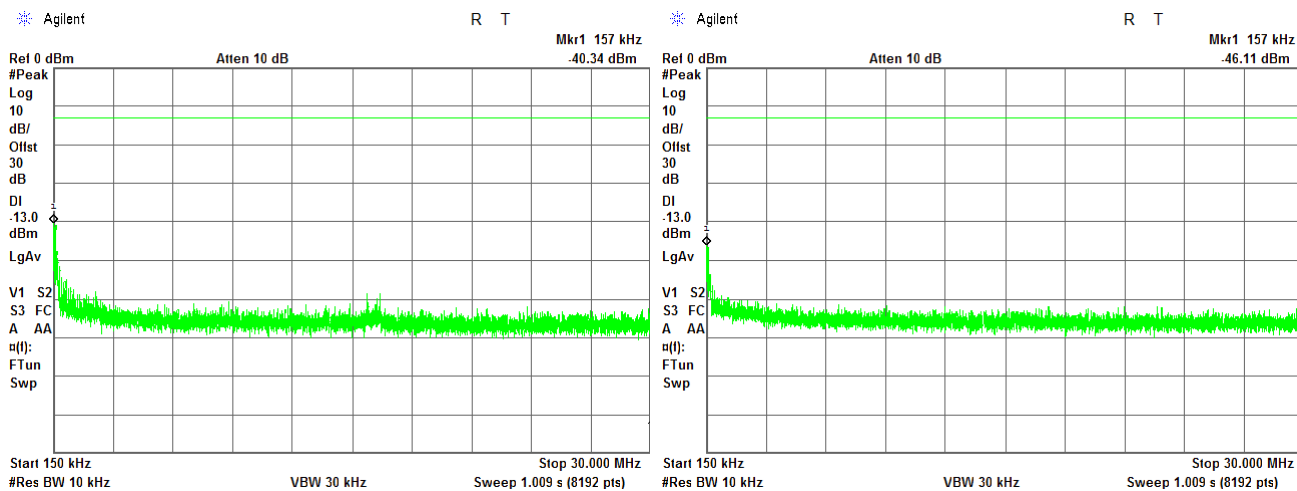


HERMON LABORATORIES

Test specification:		Section 27.53, Spurious emissions at RF antenna connector			
Test procedure:		47 CFR, Sections 2.1051, 27.53; TIA/EIA-603-E, Section 2.2.13			
Test mode:		Compliance		Verdict: PASS	
Date(s):		11-Dec-17			
Temperature: 24.5 °C	Relative Humidity: 46 %		Air Pressure: 1024 hPa	Power: 70 VAC, 50 Hz	
Remarks:					

Plot 7.4.4 Spurious emission measurements in 0.15 - 30 MHz range

Antenna port 12	Antenna port 12S
CARRIER FREQUENCY:HIGH	2685 MHz





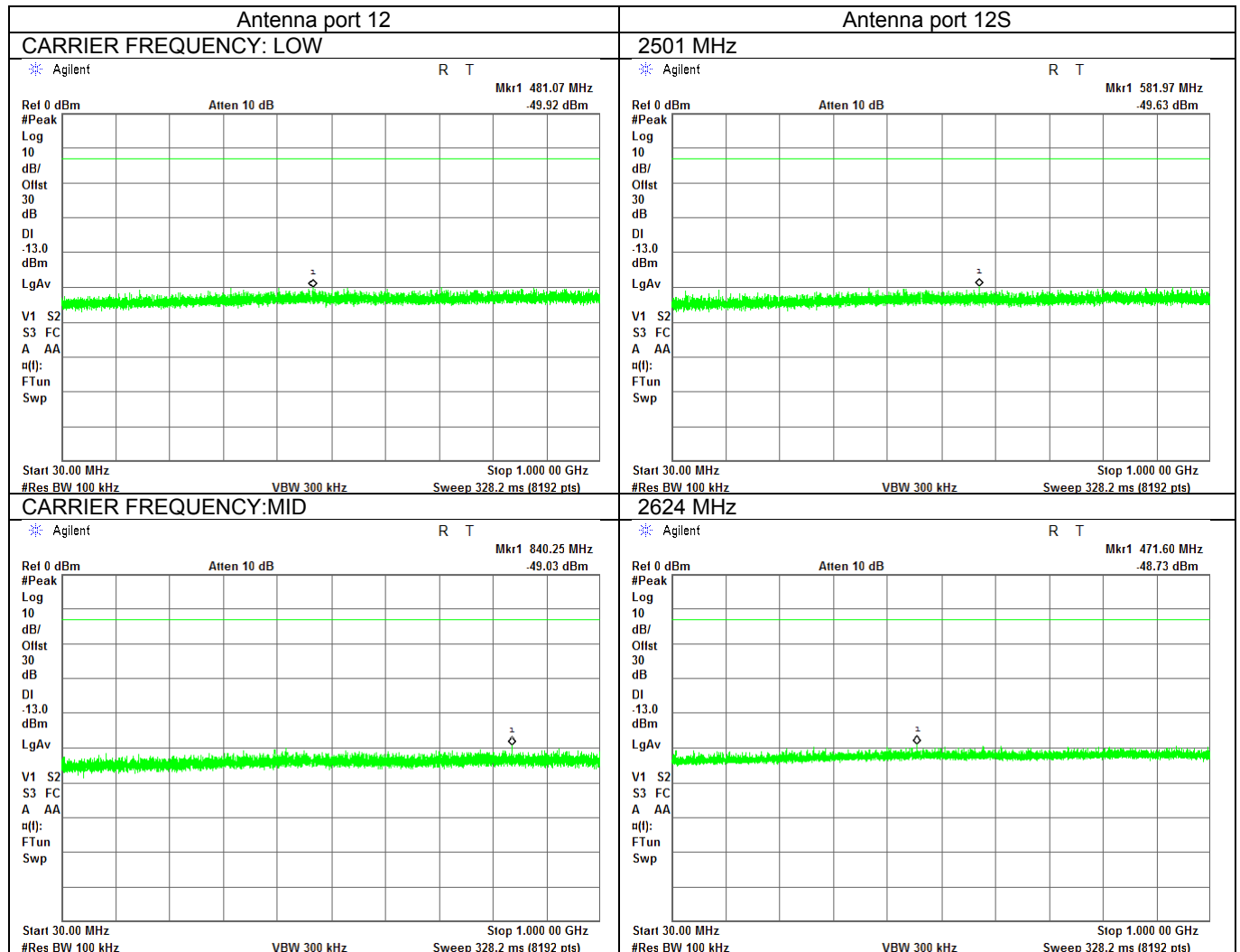
HERMON LABORATORIES

Report ID: AIRRAD_FCC.30379_rev1.docx

Date of Issue: 8-Jan-18

Test specification:		Section 27.53, Spurious emissions at RF antenna connector	
Test procedure:		47 CFR, Sections 2.1051, 27.53; TIA/EIA-603-E, Section 2.2.13	
Test mode:		Verdict: PASS	
Date(s):			
11-Dec-17			
Temperature: 24.5 °C	Relative Humidity: 46 %	Air Pressure: 1024 hPa	Power: 70 VAC, 50 Hz
Remarks:			

Plot 7.4.5 Spurious emission measurements in 30 - 1000 MHz range

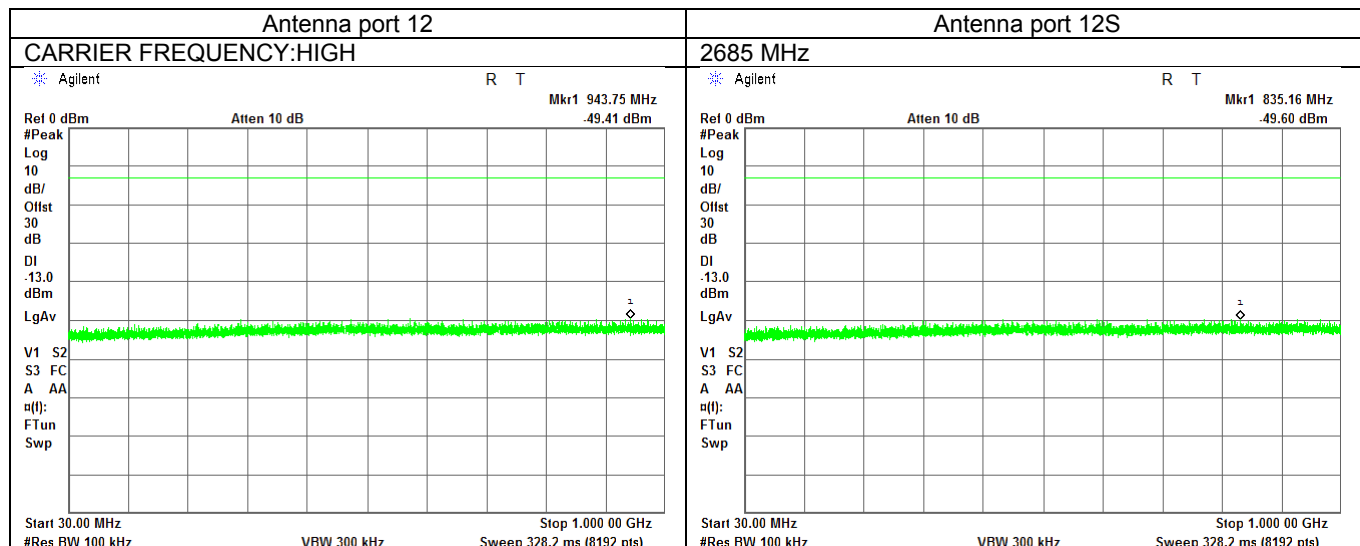




HERMON LABORATORIES

Test specification: Section 27.53, Spurious emissions at RF antenna connector			
Test procedure: 47 CFR, Sections 2.1051, 27.53; TIA/EIA-603-E, Section 2.2.13			
Test mode: Compliance		Verdict: PASS	
Date(s): 11-Dec-17			
Temperature: 24.5 °C	Relative Humidity: 46 %	Air Pressure: 1024 hPa	Power: 70 VAC, 50 Hz
Remarks:			

Plot 7.4.6 Spurious emission measurements in 30 - 1000 MHz range

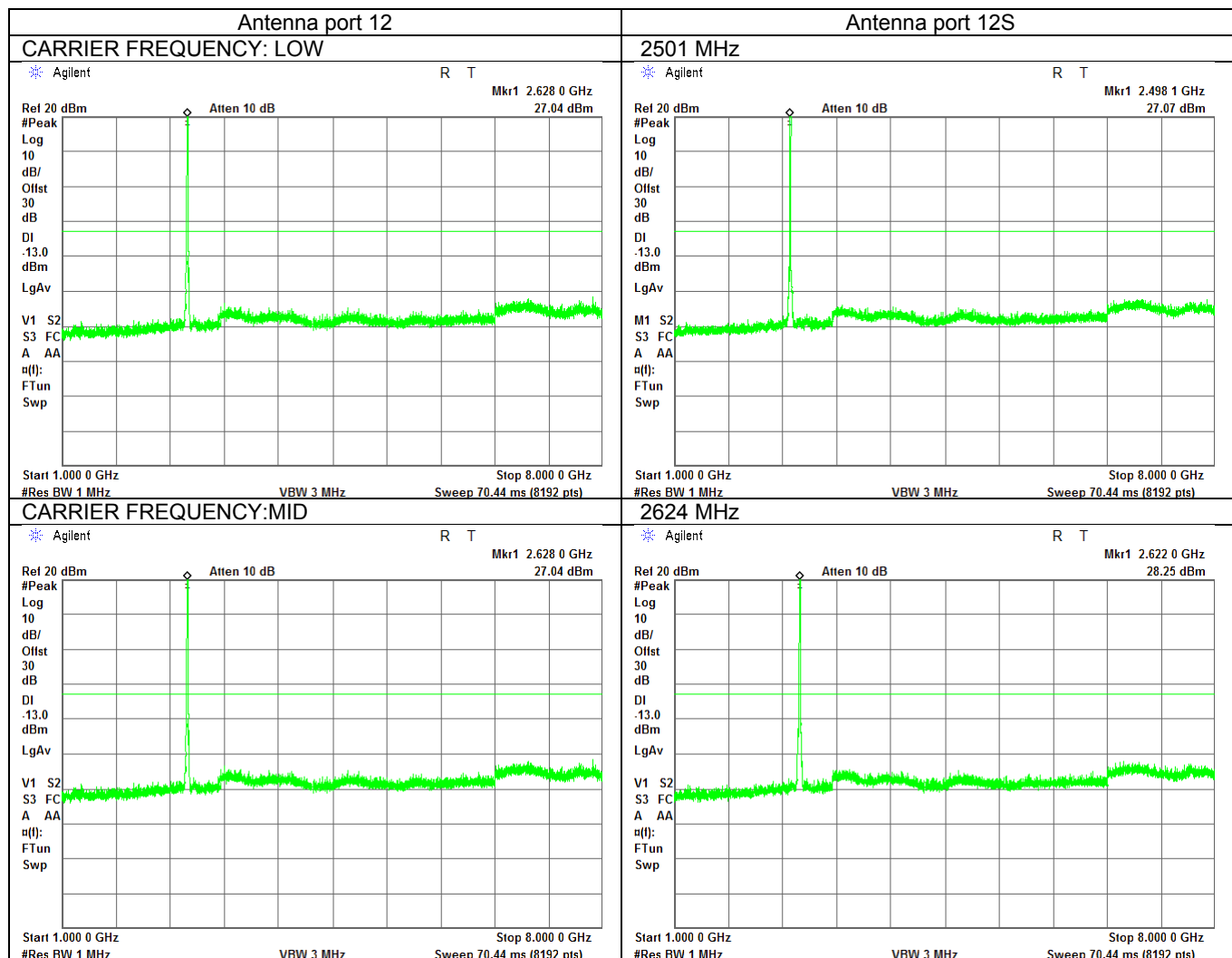




HERMON LABORATORIES

Test specification:		Section 27.53, Spurious emissions at RF antenna connector	
Test procedure:		47 CFR, Sections 2.1051, 27.53; TIA/EIA-603-E, Section 2.2.13	
Test mode:		Verdict: PASS	
Date(s):			
11-Dec-17			
Temperature: 24.5 °C	Relative Humidity: 46 %	Air Pressure: 1024 hPa	Power: 70 VAC, 50 Hz
Remarks:			

Plot 7.4.7 Spurious emission measurements in 1000 - 8000 MHz range

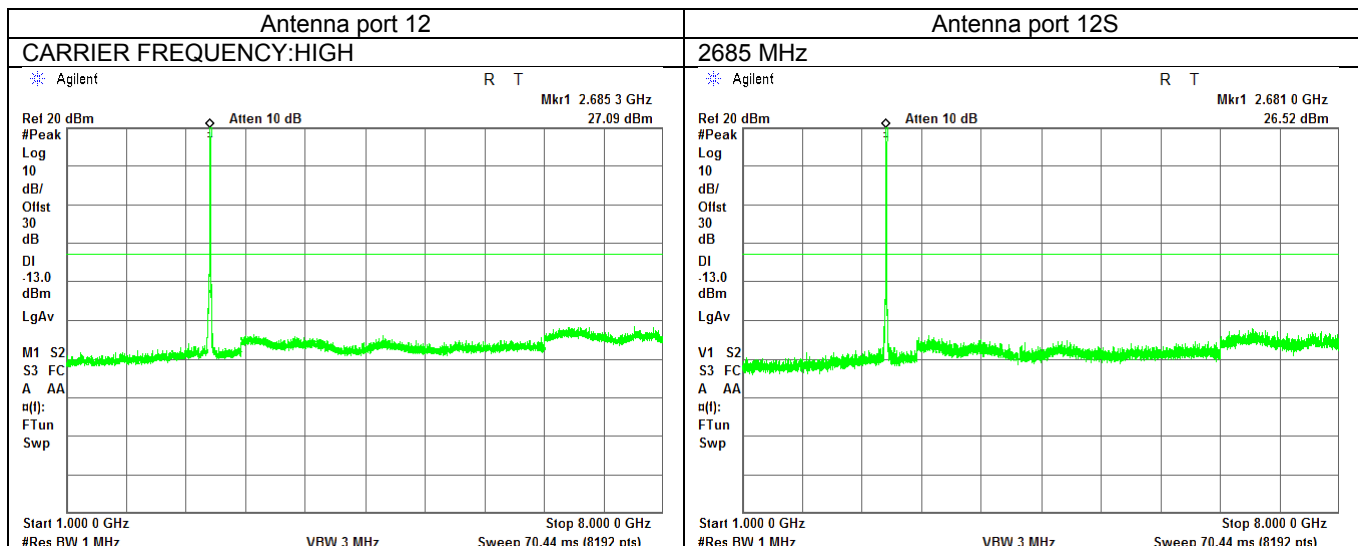




HERMON LABORATORIES

Test specification:		Section 27.53, Spurious emissions at RF antenna connector			
Test procedure:		47 CFR, Sections 2.1051, 27.53; TIA/EIA-603-E, Section 2.2.13			
Test mode:		Compliance		Verdict: PASS	
Date(s):		11-Dec-17			
Temperature: 24.5 °C	Relative Humidity: 46 %		Air Pressure: 1024 hPa	Power: 70 VAC, 50 Hz	
Remarks:					

Plot 7.4.8 Spurious emission measurements in 1000 - 8000 MHz range





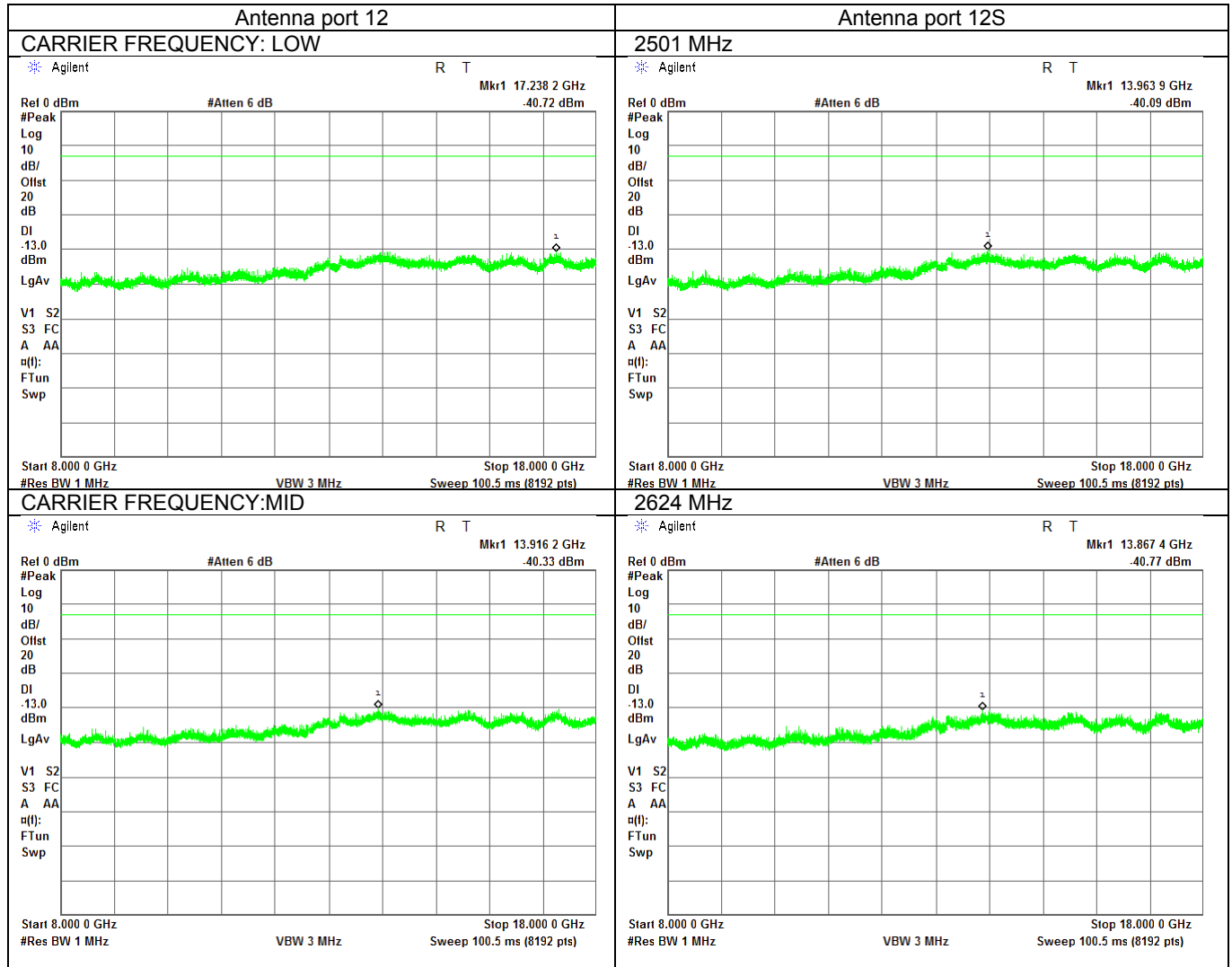
HERMON LABORATORIES

Report ID: AIRRAD_FCC.30379_rev1.docx

Date of Issue: 8-Jan-18

Test specification:		Section 27.53, Spurious emissions at RF antenna connector	
Test procedure:		47 CFR, Sections 2.1051, 27.53; TIA/EIA-603-E, Section 2.2.13	
Test mode:		Compliance	Verdict: PASS
Date(s):		11-Dec-17	
Temperature: 24.5 °C	Relative Humidity: 46 %	Air Pressure: 1024 hPa	Power: 70 VAC, 50 Hz
Remarks:			

Plot 7.4.9 Spurious emission measurements in 8000 - 18000 MHz range at low carrier frequency

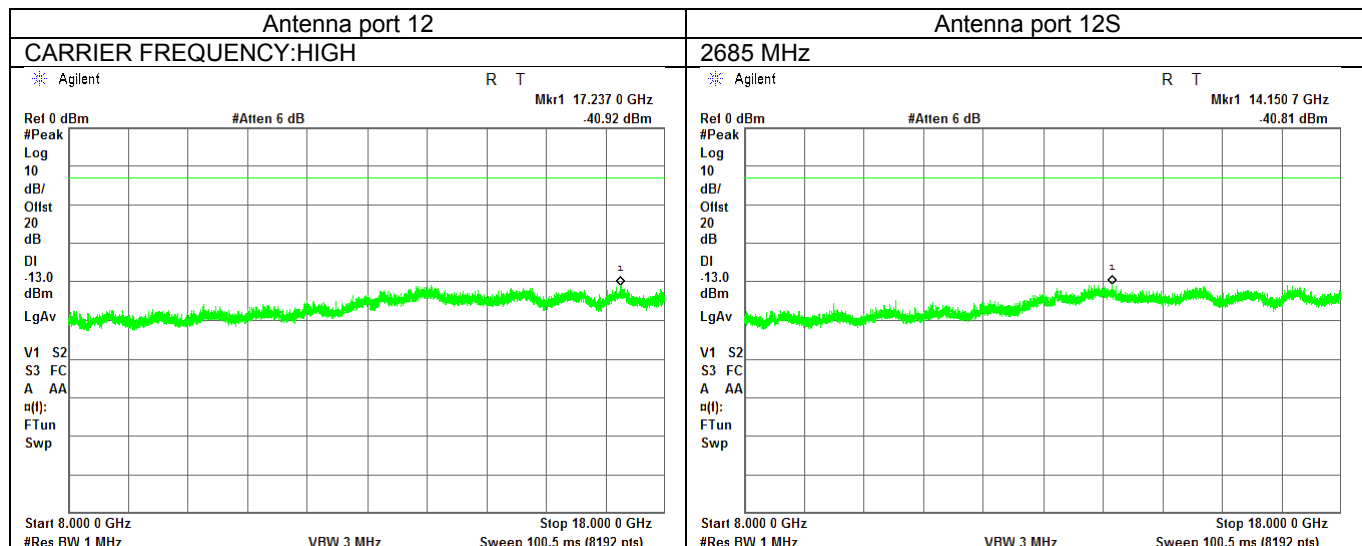




HERMON LABORATORIES

Test specification: Section 27.53, Spurious emissions at RF antenna connector			
Test procedure: 47 CFR, Sections 2.1051, 27.53; TIA/EIA-603-E, Section 2.2.13			
Test mode: Compliance		Verdict: PASS	
Date(s): 11-Dec-17			
Temperature: 24.5 °C	Relative Humidity: 46 %	Air Pressure: 1024 hPa	Power: 70 VAC, 50 Hz
Remarks:			

Plot 7.4.10 Spurious emission measurements in 8000 - 18000 MHz range at low carrier frequency

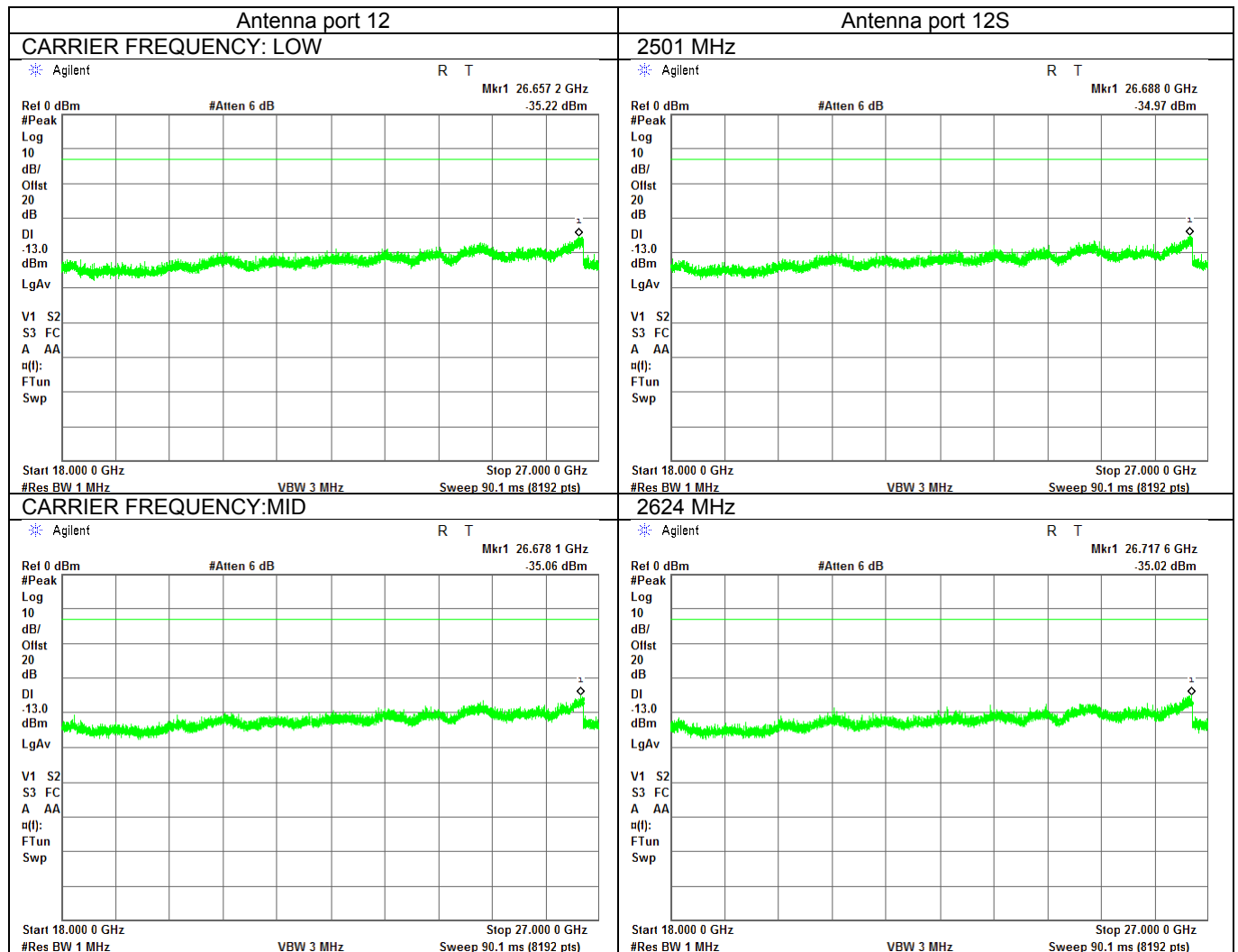




HERMON LABORATORIES

Test specification: Section 27.53, Spurious emissions at RF antenna connector			
Test procedure: 47 CFR, Sections 2.1051, 27.53; TIA/EIA-603-E, Section 2.2.13			
Test mode: Compliance		Verdict: PASS	
Date(s): 11-Dec-17			
Temperature: 24.5 °C	Relative Humidity: 46 %	Air Pressure: 1024 hPa	Power: 70 VAC, 50 Hz
Remarks:			

Plot 7.4.11 Spurious emission measurements in 18000 - 27000 MHz range

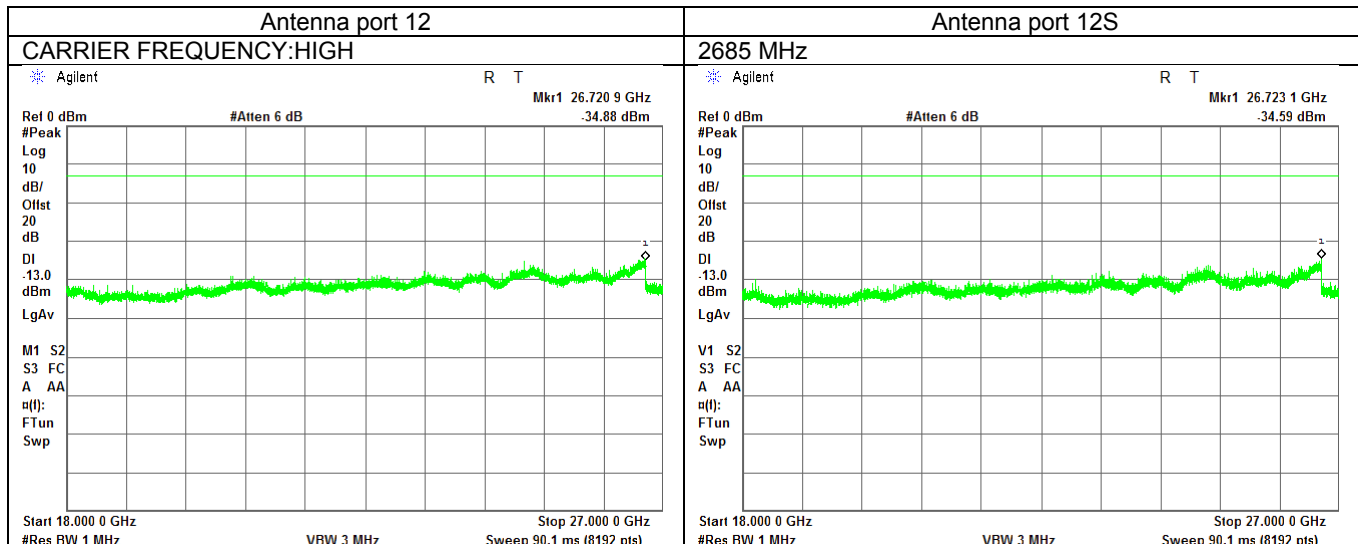




HERMON LABORATORIES

Test specification:		Section 27.53, Spurious emissions at RF antenna connector	
Test procedure:		47 CFR, Sections 2.1051, 27.53; TIA/EIA-603-E, Section 2.2.13	
Test mode:		Verdict: PASS	
Date(s):			
11-Dec-17			
Temperature: 24.5 °C	Relative Humidity: 46 %	Air Pressure: 1024 hPa	Power: 70 VAC, 50 Hz
Remarks:			

Plot 7.4.12 Spurious emission measurements in 18000 - 27000 MHz range





Test specification: Section 27.53, Radiated spurious emissions			
Test procedure: 47 CFR, Sections 2.1053; TIA/EIA-603-E, Section 2.2.12			
Test mode: Compliance		Verdict: PASS	
Date(s): 13-Dec-17 - 14-Dec-17			
Temperature: 24.2 °C	Relative Humidity: 47 %	Air Pressure: 1018 hPa	Power: 70 VAC, 50 Hz
Remarks:			

7.5 Radiated spurious emission measurements

7.5.1 General

This test was performed to measure radiated spurious emissions from the EUT. Specification test limits are given in Table 7.5.1.

Table 7.5.1 Radiated spurious emission test limits

For operation in 2496-2690 MHz

Frequency, MHz	Attenuation below carrier, dBc	ERP of spurious, dBm	Equivalent field strength limit @ 3m, dB(μV/m)***
0.009 – 10 th harmonic*	43+10logP** fixed	-13	84.4
0.009 – 10th harmonic*	55+10logP** mobile	-25	72.4

* - Excluding the band emission

** - 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

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

7.5.2.1 The EUT was set up as shown in Figure 7.5.1, energized and the performance check was conducted.

7.5.2.2 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.

7.5.2.3 The worst test results (the lowest margins) were recorded in Table 7.5.2 and shown in the associated plots.

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

7.5.3.1 The EUT was set up as shown in Figure 7.5.2, energized and the performance check was conducted.

7.5.3.2 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.

7.5.3.3 The worst test results (the lowest margins) were recorded in Table 7.5.2 and shown in the associated plots.

Test specification: Section 27.53, Radiated spurious emissions			
Test procedure: 47 CFR, Sections 2.1053; TIA/EIA-603-E, Section 2.2.12			
Test mode: Compliance		Verdict: PASS	
Date(s): 13-Dec-17 - 14-Dec-17			
Temperature: 24.2 °C	Relative Humidity: 47 %	Air Pressure: 1018 hPa	Power: 70 VAC, 50 Hz
Remarks:			

Figure 7.5.1 Setup for spurious emission field strength measurements in 9 kHz to 30 MHz band

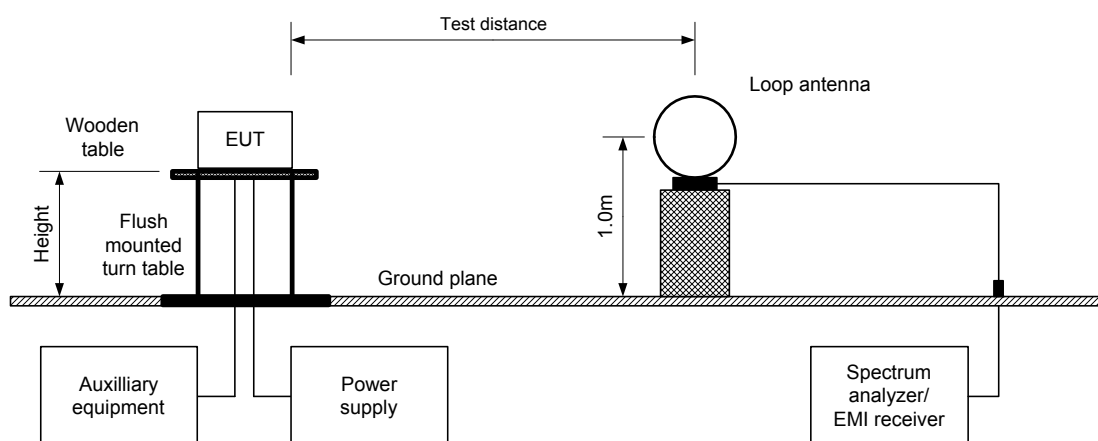
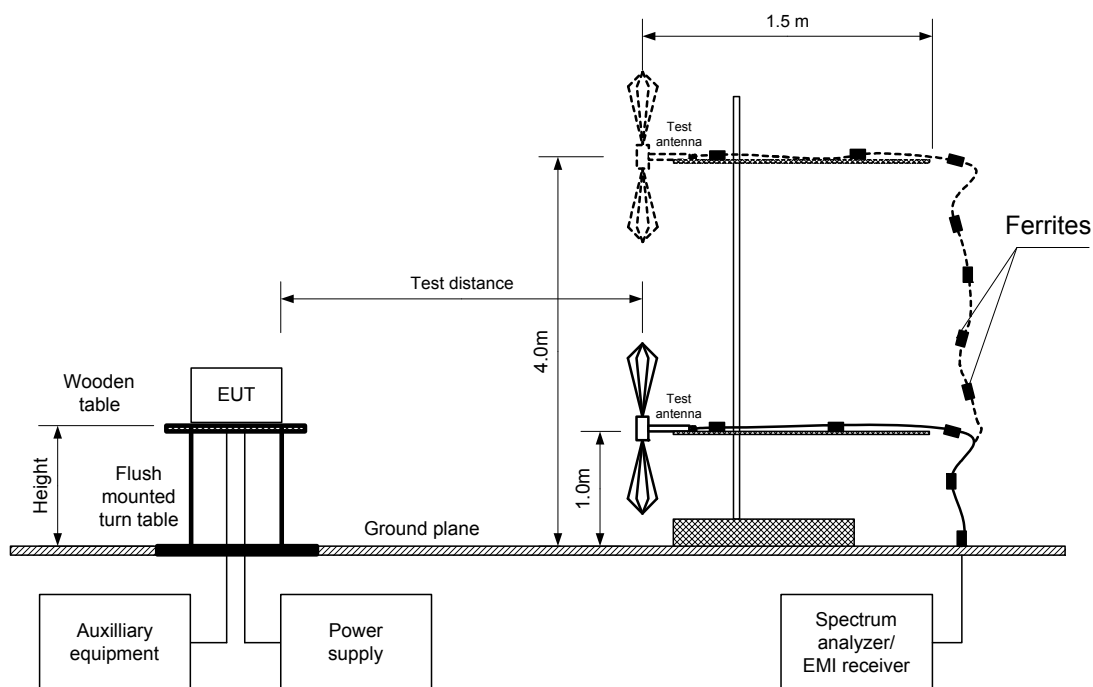


Figure 7.5.2 Setup for spurious emission field strength measurements above 30 MHz





HERMON LABORATORIES

Test specification: Section 27.53, Radiated spurious emissions			
Test procedure: 47 CFR, Sections 2.1053; TIA/EIA-603-E, Section 2.2.12			
Test mode:	Compliance	Verdict: PASS	
Date(s):	13-Dec-17 - 14-Dec-17		
Temperature: 24.2 °C	Relative Humidity: 47 %	Air Pressure: 1018 hPa	Power: 70 VAC, 50 Hz
Remarks:			

Table 7.5.2 Spurious emission field strength test results

ASSIGNED FREQUENCY RANGE: 2496.0 – 2690.0 MHz
 TEST DISTANCE: 3 m
 TEST SITE: OATS
 EUT HEIGHT: 0.8 m
 INVESTIGATED FREQUENCY RANGE: 0.009 – 27000 MHz
 DETECTOR USED: Peak
 VIDEO BANDWIDTH: > Resolution bandwidth
 TEST ANTENNA TYPE: Active loop (9 kHz – 30 MHz)
 Biconilog (30 MHz – 1000 MHz)
 Double ridged guide (above 1000 MHz)
 MODULATION: QPSK
 MODULATING SIGNAL: PRBS
 TRANSMITTER OUTPUT POWER SETTINGS: Maximum

Frequency, MHz	Field strength, dB(μV/m)	Limit, dB(μV/m)	Margin, dB*	RBW, kHz	Antenna polarization	Antenna height, m	Turn-table position**, degrees	Verdict
Low carrier frequency								
No emissions were found								Pass
Mid carrier frequency								
No emissions were found								Pass
High carrier frequency								
No emissions were found								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 0604	HL 0661	HL 2909	HL 3818	HL 4114	HL 4353	HL 4360
HL 4933	HL 4956	HL 5110	HL 5111	HL 5112			

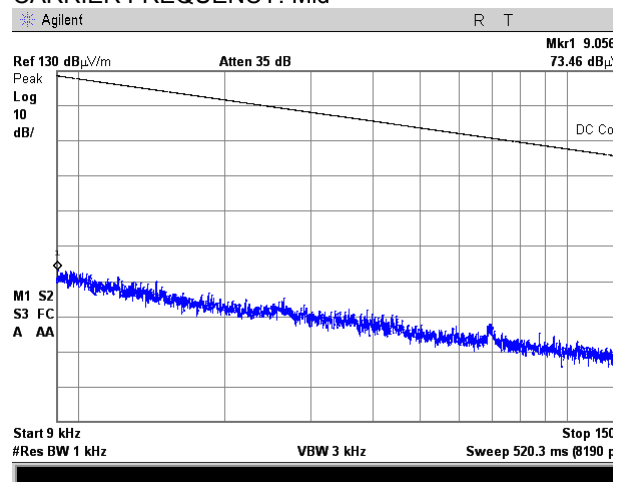
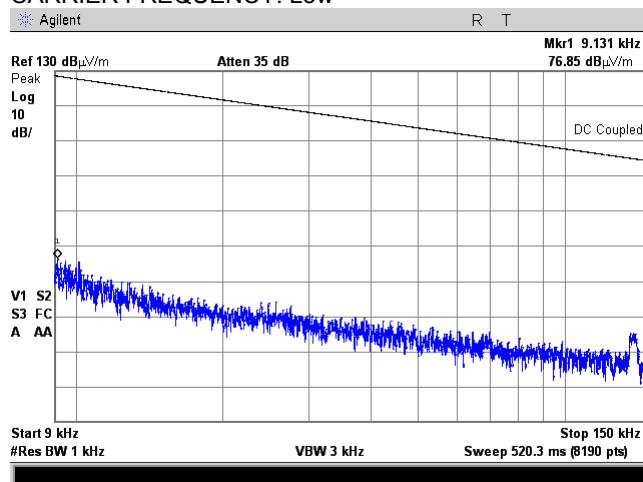
Full description is given in Appendix A.

Test specification:		Section 27.53, Radiated spurious emissions	
Test procedure:		47 CFR, Sections 2.1053; TIA/EIA-603-E, Section 2.2.12	
Test mode:		Verdict: PASS	
Date(s):			
13-Dec-17 - 14-Dec-17			
Temperature: 24.2 °C	Relative Humidity: 47 %	Air Pressure: 1018 hPa	Power: 70 VAC, 50 Hz
Remarks:			

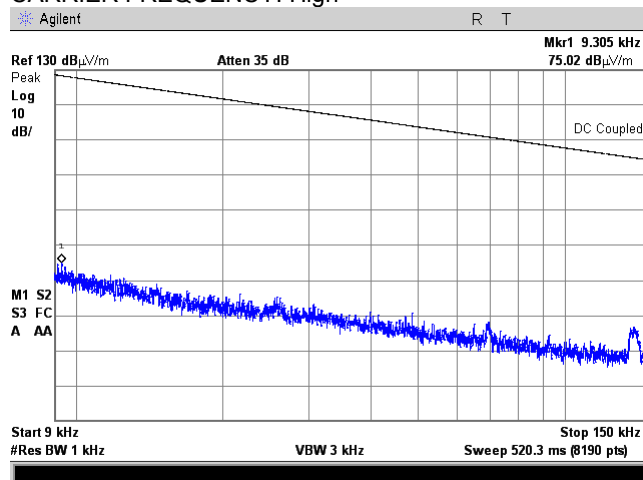
Plot 7.5.1 Radiated emission measurements in 9 - 150 kHz range

TEST SITE:
TEST DISTANCE:
ANTENNA POLARIZATION:
EUT POSITION:
CARRIER FREQUENCY: Low

Semi anechoic chamber
3 m
Vertical
Typical (Vertical)
CARRIER FREQUENCY: Mid



CARRIER FREQUENCY: High

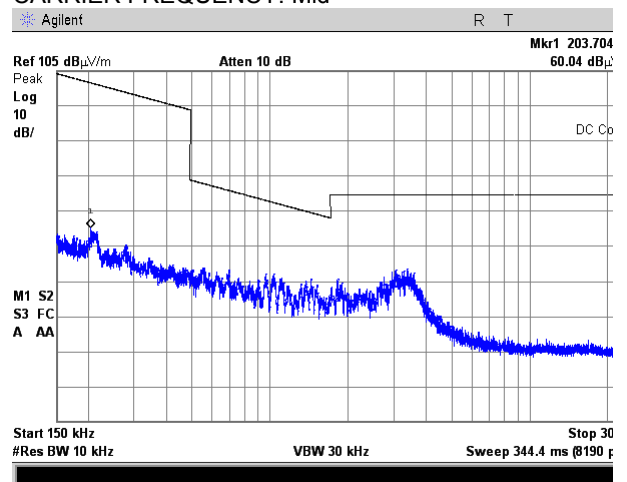
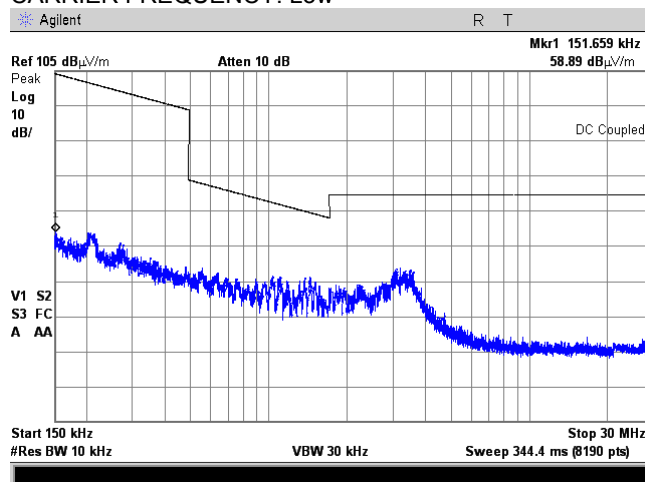


Test specification: Section 27.53, Radiated spurious emissions			
Test procedure: 47 CFR, Sections 2.1053; TIA/EIA-603-E, Section 2.2.12			
Test mode: Compliance		Verdict: PASS	
Date(s): 13-Dec-17 - 14-Dec-17			
Temperature: 24.2 °C	Relative Humidity: 47 %	Air Pressure: 1018 hPa	Power: 70 VAC, 50 Hz
Remarks:			

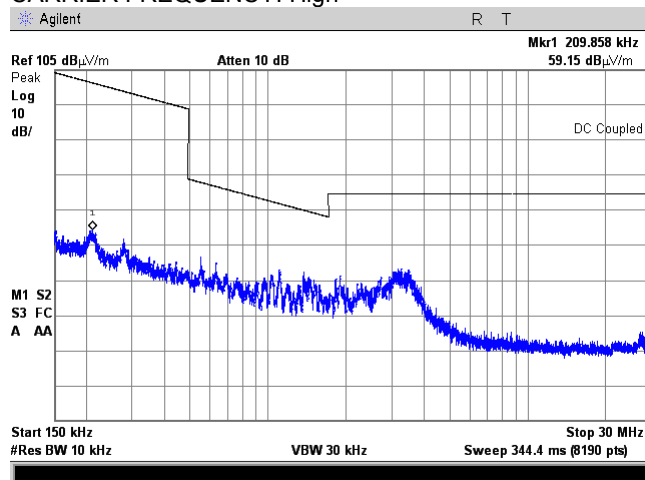
Plot 7.5.2 Radiated emission measurements in 0.15 - 30 MHz range

TEST SITE:
TEST DISTANCE:
ANTENNA POLARIZATION:
EUT POSITION:
CARRIER FREQUENCY: Low

Semi anechoic chamber
3 m
Vertical
Typical (Vertical)
CARRIER FREQUENCY: Mid



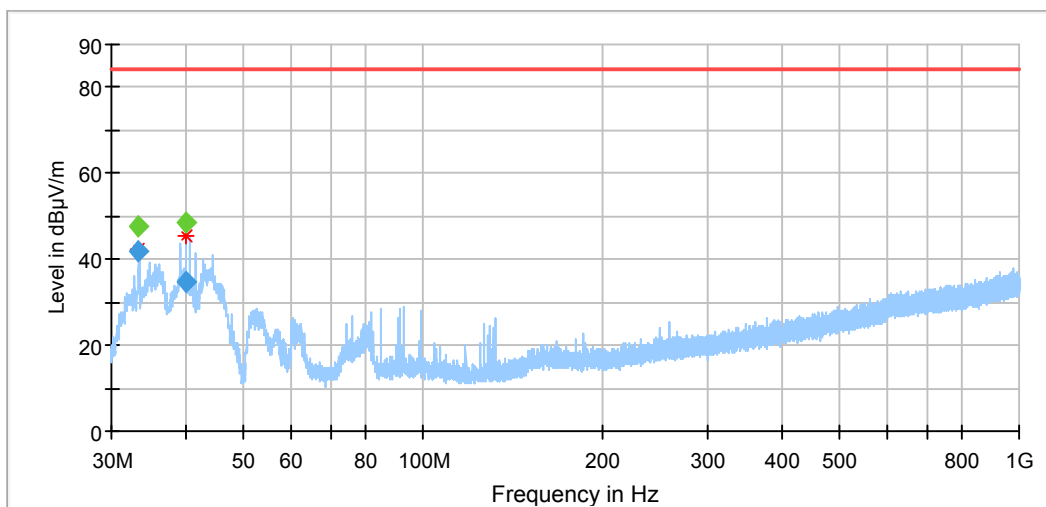
CARRIER FREQUENCY: High



Test specification: Section 27.53, Radiated spurious emissions			
Test procedure: 47 CFR, Sections 2.1053; TIA/EIA-603-E, Section 2.2.12			
Test mode: Compliance		Verdict: PASS	
Date(s): 13-Dec-17 - 14-Dec-17			
Temperature: 24.2 °C	Relative Humidity: 47 %	Air Pressure: 1018 hPa	Power: 70 VAC, 50 Hz
Remarks:			

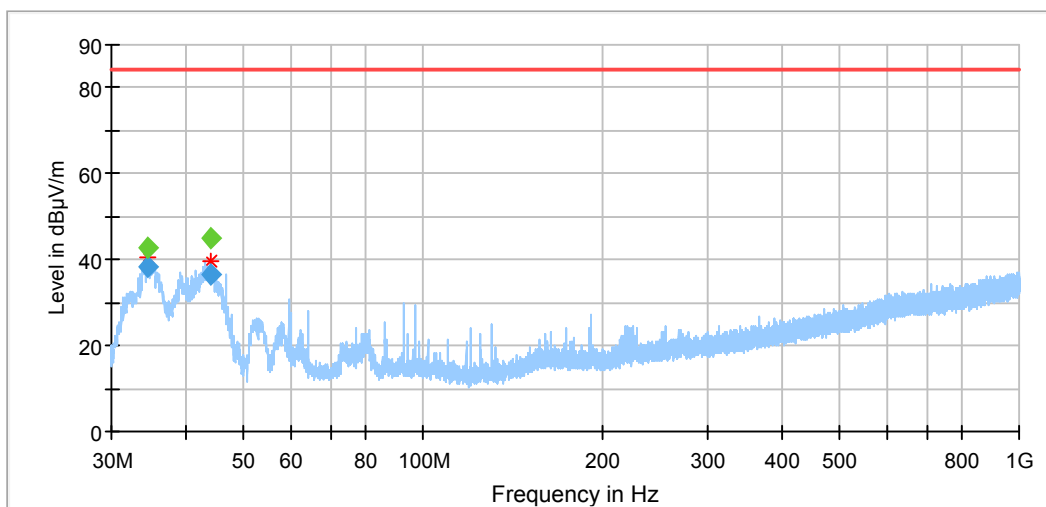
Plot 7.5.3 Radiated emission measurements in 30 - 1000 MHz range

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



Plot 7.5.4 Radiated emission measurements in 30 - 1000 MHz range

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



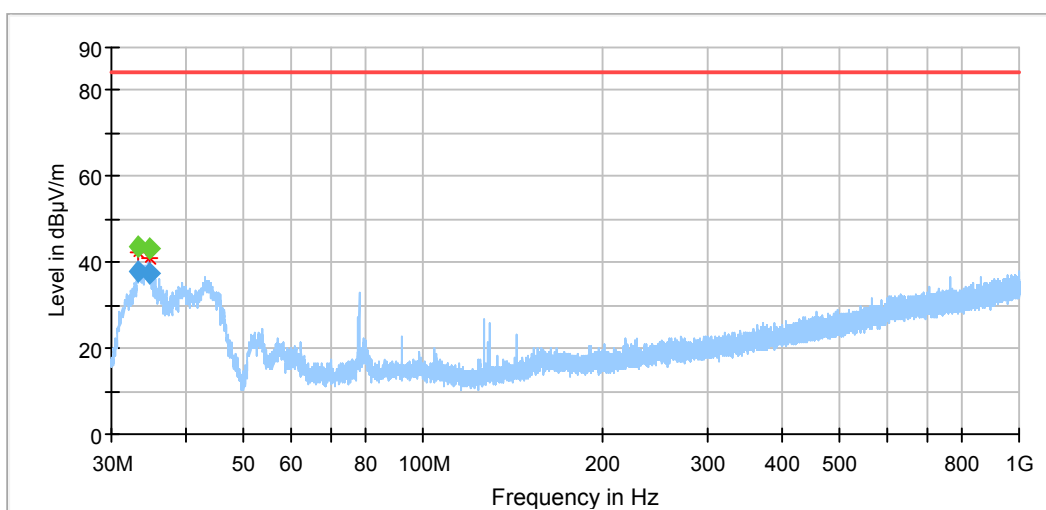


HERMON LABORATORIES

Test specification: Section 27.53, Radiated spurious emissions			
Test procedure: 47 CFR, Sections 2.1053; TIA/EIA-603-E, Section 2.2.12			
Test mode: Compliance		Verdict: PASS	
Date(s): 13-Dec-17 - 14-Dec-17			
Temperature: 24.2 °C	Relative Humidity: 47 %	Air Pressure: 1018 hPa	Power: 70 VAC, 50 Hz
Remarks:			

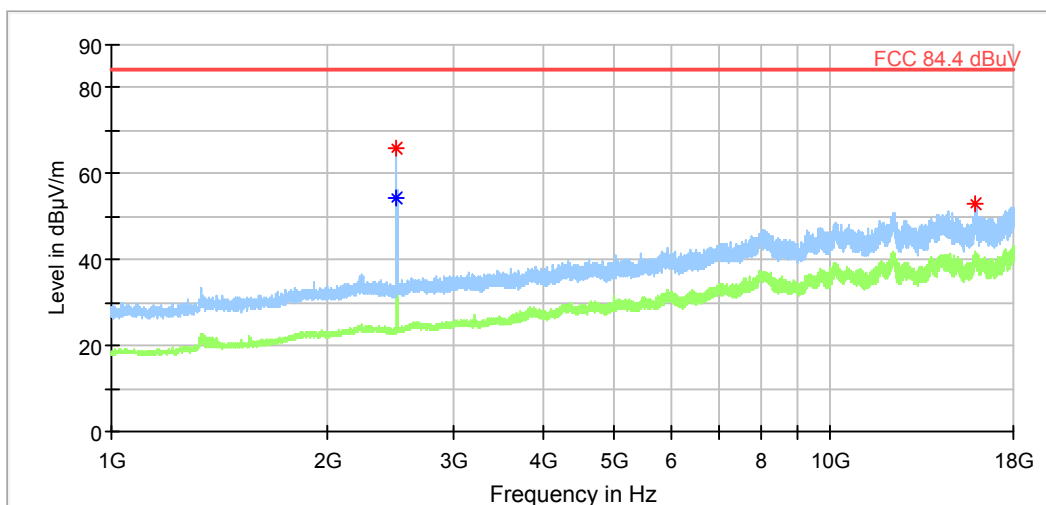
Plot 7.5.5 Radiated emission measurements in 30 - 1000 MHz range

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



Plot 7.5.6 Radiated emission measurements in 1000 – 18000 MHz range

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



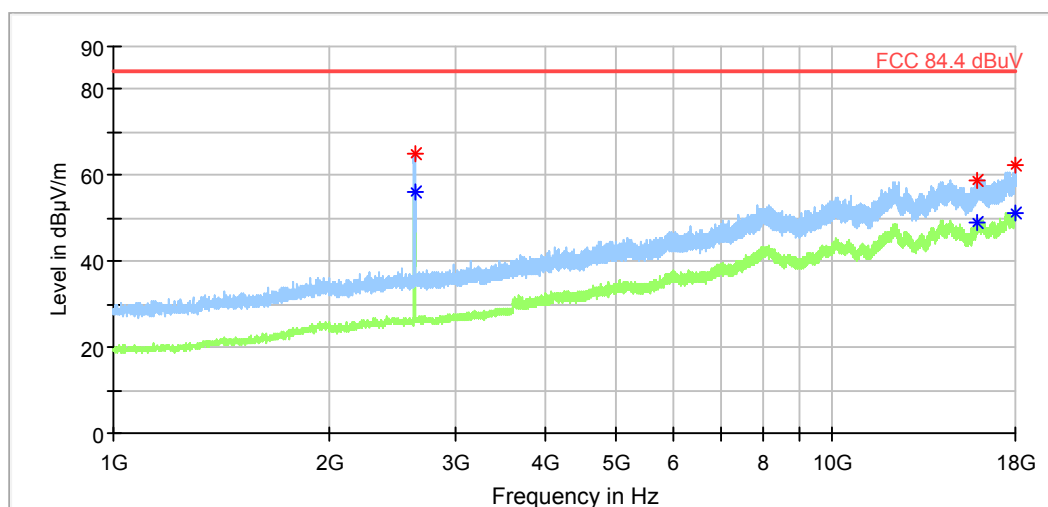


HERMON LABORATORIES

Test specification: Section 27.53, Radiated spurious emissions			
Test procedure: 47 CFR, Sections 2.1053; TIA/EIA-603-E, Section 2.2.12			
Test mode: Compliance		Verdict: PASS	
Date(s): 13-Dec-17 - 14-Dec-17			
Temperature: 24.2 °C	Relative Humidity: 47 %	Air Pressure: 1018 hPa	Power: 70 VAC, 50 Hz
Remarks:			

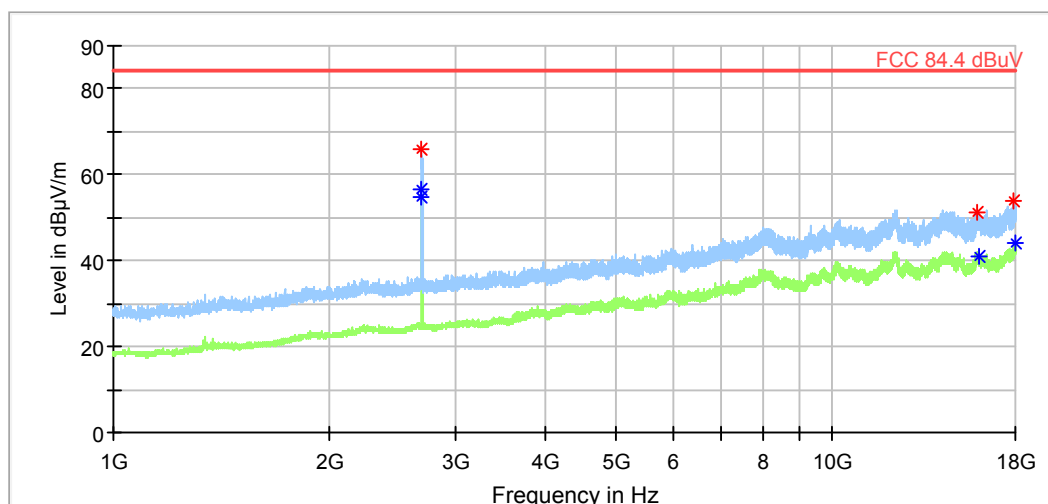
Plot 7.5.7 Radiated emission measurements in 1000 – 18000 MHz range

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



Plot 7.5.8 Radiated emission measurements in 1000 – 18000 MHz range

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





HERMON LABORATORIES

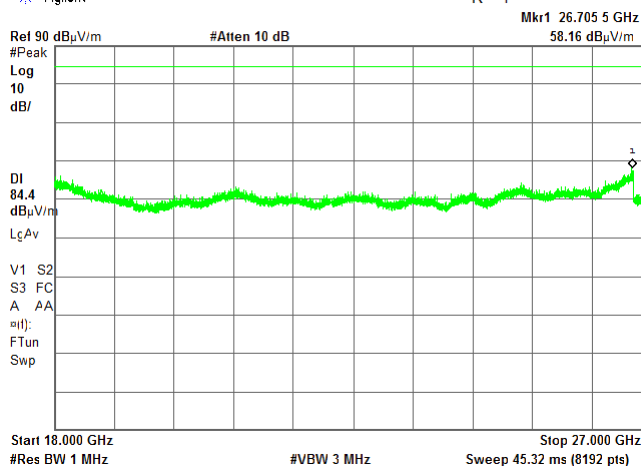
Test specification:		Section 27.53, Radiated spurious emissions	
Test procedure:		47 CFR, Sections 2.1053; TIA/EIA-603-E, Section 2.2.12	
Test mode:		Verdict: PASS	
Date(s):			
13-Dec-17 - 14-Dec-17			
Temperature: 24.2 °C	Relative Humidity: 47 %	Air Pressure: 1018 hPa	Power: 70 VAC, 50 Hz
Remarks:			

Plot 7.5.9 Radiated emission measurements in 18000 – 27000 MHz range

TEST SITE:
TEST DISTANCE:
ANTENNA POLARIZATION:
EUT POSITION:
CARRIER FREQUENCY: Low

✱ Agilent

R T



Semi anechoic chamber

3 m

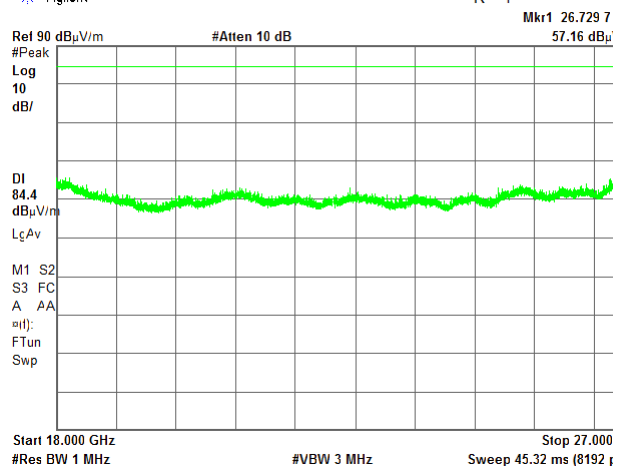
Vertical

Typical (Vertical)

CARRIER FREQUENCY: Mid

✱ Agilent

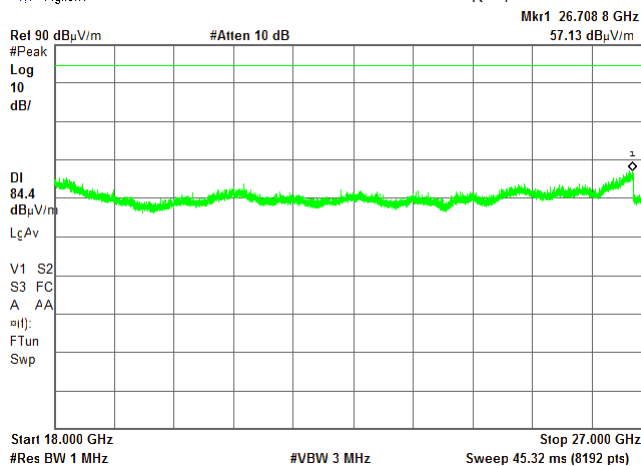
R T



CARRIER FREQUENCY: High

✱ Agilent

R T



Test specification: Section 27.54, Frequency stability			
Test procedure: 47 CFR, Section 2.1055; TIA/EIA-603-E Section 2.2.2			
Test mode: Compliance		Verdict: PASS	
Date(s): 12-Dec-17 - 13-Dec-17			
Temperature: 24.2 °C	Relative Humidity: 49 %	Air Pressure: 1018 hPa	Power: 70 VAC, 50 Hz
Remarks:			

7.6 Frequency stability test

7.6.1 General

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

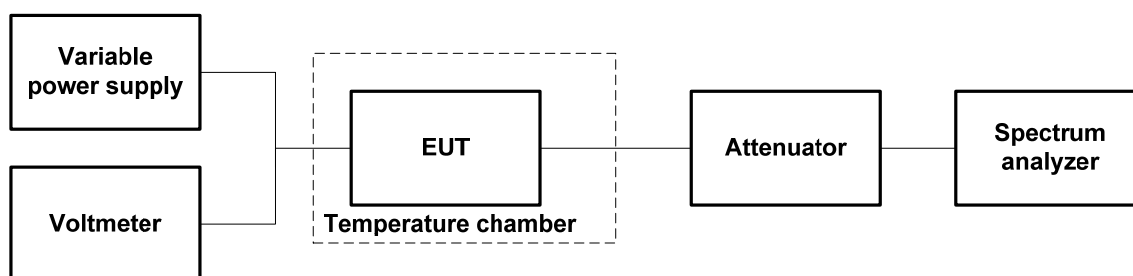
Table 7.6.1 Frequency stability limits

Assigned frequency, MHz	Maximum allowed frequency displacement
2496.0 - 2690.0	The frequency stability shall be sufficient to ensure that the fundamental emissions stay within the authorized bands of operation.

7.6.2 Test procedure

- 7.6.2.1 The EUT was set up as shown in Figure 7.6.1, energized and its proper operation was checked.
- 7.6.2.2 The EUT power was turned off. Temperature within test chamber was set to +30°C and a period of time sufficient to stabilize all of the oscillator circuit components was allowed.
- 7.6.2.3 The EUT was powered on and carrier frequency was measured at start up moment and then every minute until frequency had been stabilized or 10 minutes elapsed whichever reached the last. The EUT was powered off.
- 7.6.2.4 The above procedure was repeated at 0°C and at the lowest test temperature.
- 7.6.2.5 The EUT was powered on and carrier frequency was measured at start up moment and at the end of stabilization period at the rest of test temperatures and voltages. The EUT was powered off.
- 7.6.2.6 Frequency displacement was calculated and provided in Table 7.6.2, Table 7.6.3.
- 7.6.2.7 The test results provided in Table 7.6.4..

Figure 7.6.1 Frequency stability test setup



Test specification: Section 27.54, Frequency stability			
Test procedure: 47 CFR, Section 2.1055; TIA/EIA-603-E Section 2.2.2			
Test mode: Compliance		Verdict: PASS	
Date(s): 12-Dec-17 - 13-Dec-17			
Temperature: 24.2 °C	Relative Humidity: 49 %	Air Pressure: 1018 hPa	Power: 70 VAC, 50 Hz
Remarks:			

Table 7.6.2 Frequency stability test results

OPERATING FREQUENCY: 2496.0 – 2690.0 MHz
 NOMINAL POWER VOLTAGE: 70 VAC
 TEMPERATURE STABILIZATION PERIOD: 20 min
 POWER DURING TEMPERATURE TRANSITION: Off
 SPECTRUM ANALYZER MODE: Counter
 RESOLUTION BANDWIDTH: 10 Hz
 VIDEO BANDWIDTH: 30 Hz
 MODULATION: Unmodulated

T, °C	Voltage, V	Frequency, MHz							Max frequency drift, Hz	
		Start up	1 st min	2 nd min	3 rd min	4 th min	5 th min	10 th min	Positive	Negative
Low carrier frequency										
-30	nominal	2500998.813	2500998.811	2500998.817	2500998.823	2500998.819	2500998.827	2500998.823	0	-718
-20	nominal	2500998.634	NA	NA	NA	NA	NA	2500998.658	0	-895
-10	nominal	2500998.545	NA	NA	NA	NA	NA	2500998.564	0	-984
0	nominal	2500998.589	2500998.598	2500998.597	2500998.596	2500998.593	2500998.591	2500998.59	0	-984
10	nominal	2500998.647	NA	NA	NA	NA	NA	2500998.659	0	-940
20	15%	2500999.532	NA	NA	NA	NA	NA	2500999.531	3	-882
20	nominal	2500999.528	NA	NA	NA	NA	NA	2500999.529	0	-1
20	-15%	2500999.532	NA	NA	NA	NA	NA	2500999.53	3	-1
30	nominal	2500999.579	2500999.584	2500999.582	2500999.583	2500999.583	2500999.578	2500999.577	55	0
40	nominal	2500999.613	NA	NA	NA	NA	NA	2500999.621	92	0
50	nominal	2500999.641	NA	NA	NA	NA	NA	2500999.613	112	0
Mid carrier frequency										
-30	nominal	2623998.775	2623998.764	2623998.767	2623998.762	2623998.767	2623998.771	2623998.7	0	-811
-20	nominal	2623998.575	NA	NA	NA	NA	NA	2623998.599	0	-936
-10	nominal	2623998.484	NA	NA	NA	NA	NA	2623998.504	0	-1027
0	nominal	2623998.524	2623998.517	2623998.519	2623998.521	2623998.529	2623998.517	2623998.514	0	-997
10	nominal	2623998.592	NA	NA	NA	NA	NA	2623998.594	0	-919
20	15%	2623999.505	NA	NA	NA	NA	NA	2623999.513	2	-6
20	nominal	2623999.507	NA	NA	NA	NA	NA	2623999.511	0	-4
20	-15%	2623999.503	NA	NA	NA	NA	NA	2623999.512	1	-8
30	nominal	2623999.557	2623999.561	2623999.563	2623999.562	2623999.561	2623999.565	2623999.564	54	0
40	nominal	2623999.599	NA	NA	NA	NA	NA	2623999.599	88	0
50	nominal	2623999.627	NA	NA	NA	NA	NA	2623999.64	129	0
High carrier frequency										
-30	nominal	2684998.749	2684998.748	2684998.748	2684998.753	2684998.754	2684998.751	2684998.759	0	-758
-20	nominal	2684998.543	NA	NA	NA	NA	NA	2684998.571	0	-963
-10	nominal	2684998.445	NA	NA	NA	NA	NA	2684998.469	0	-1061
0	nominal	2684998.487	2684998.488	2684998.489	2684998.488	2684998.489	2684998.489	2684998.491	0	-1019
10	nominal	2684998.552	NA	NA	NA	NA	NA	2684998.557	0	-954
20	15%	2684999.503	NA	NA	NA	NA	NA	2684999.504	0	-3
20	nominal	2684999.502	NA	NA	NA	NA	NA	2684999.506	0	-4
20	-15%	2684999.501	NA	NA	NA	NA	NA	2684999.507	1	-5
30	nominal	2684999.556	2684999.555	2684999.554	2684999.551	2684999.553	2684999.552	2684999.551	50	0
40	nominal	2684999.588	NA	NA	NA	NA	NA	2684999.591	85	0
50	nominal	2684999.638	NA	NA	NA	NA	NA	2684999.641	135	0

* - Reference frequency

Test specification: Section 27.54, Frequency stability			
Test procedure: 47 CFR, Section 2.1055; TIA/EIA-603-E Section 2.2.2			
Test mode: Compliance	Verdict: PASS		
Date(s): 12-Dec-17 - 13-Dec-17			
Temperature: 24.2 °C	Relative Humidity: 49 %	Air Pressure: 1018 hPa	Power: 70 VAC, 50 Hz
Remarks:			

Table 7.6.3 Maximum frequency displacement

Channel	Maximum frequency displacement			
	ppm		Hz	
	Negative	Positive	Negative	Positive
Low	0.393	0.034	984	112
High	0.411	0.046	1019	132

Table 7.6.4 Transmission occupied bandwidth with frequency drift test results

Lower measured* band edge, MHz	Upper measured* band edge, MHz	Lower calculated** band edge, MHz	Upper calculated** band edge, MHz	Lower specified band edge, MHz	Upper specified band edge, MHz	Lower margin***, MHz	Upper margin***, MHz	Verdict
Low frequency 2501 MHz								
2496.09	2505.98	2496.089016	2505.980112	2496.000000	2507.500000	0.089016	-1.519888	Pass
2496.11	2505.86	2496.109016	2505.860000	2496.000000	2507.500000	0.109016	-1.640000	Pass
Mid frequency 2624 MHz								
2619.11	2628.86	2619.108973	2628.860116	2618.000000	2629.500000	1.108973	-0.639884	Pass
2619.13	2628.84	2619.128973	2628.840000	2618.000000	2629.500000	1.128973	-0.660000	Pass
High frequency 2685 MHz								
2680.15	2689.82	2680.148981	2689.820132	2679.000000	2690.000000	1.148981	-0.179868	Pass
2680.17	2689.86	2680.168981	2689.860000	2679.000000	2690.000000	1.168981	-0.140000	Pass
Low frequency 2506 MHz								
2496.39	2515.64	2496.389016	2515.640000	2496.000000	2518.500000	0.389016	-2.860000	Pass
2496.35	2515.6	2496.349016	2515.600000	2496.000000	2518.500000	0.349016	-2.900000	Pass
Mid frequency 2624 MHz								
2614.39	2633.68	2614.388973	2633.680000	2614.000000	2635.000000	0.388973	-1.320000	Pass
2614.35	2633.6	2614.348973	2633.600000	2614.000000	2635.000000	0.348973	-1.400000	Pass
High frequency 2680 MHz								
2670.35	2689.64	2670.348981	2689.640000	2668.000000	2690.000000	2.348981	-0.360000	Pass
2670.47	2689.6	2670.468981	2689.600000	2668.000000	2690.000000	2.468981	-0.400000	Pass

* - Measured under normal test conditions at 26 dBc points

** - Measured band edge with proper drift addition

*** - Margin = Calculated band edge – specified band edge

Reference numbers of test equipment used

HL 3818	HL 3901	HL 5174	HL 5175				
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Full description is given in Appendix A.

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	19-Jan-17	19-Jan-18
0604	Antenna BiconiLog Log-Periodic/T Bow-TIE, 26 - 2000 MHz	EMCO	3141	9611-1011	12-May-17	12-May-18
0661	Generator Swept Signal, 10 MHz to 40 GHz, + 10 dBm	Hewlett Packard	83640B	3614A002 66	10-May-17	10-May-18
2214	Directional Coupler 1.7-26.5 GHz	Krytar	2616	31354	19-Sep-17	19-Sep-19
2909	Spectrum analyzer, ESA-E, 100 Hz to 26.5 GHz	Agilent Technologies	E4407B	MY414447 62	09-Mar-17	09-Mar-18
3301	Power Meter, P-series, 50 MHz to 40 GHz	Agilent Technologies	N1911A	MY451010 57	09-Apr-17	09-Apr-18
3302	Power sensor, P-Series, 50 MHz to 40 GHz, -35/30 to 20 dBm	Agilent Technologies	N1922A	MY452405 86	09-Apr-17	09-Apr-18
3445	LISN FCC/VDE/50 Ohm/50 uH + 5 Ohm, MIL-STD-461E, CISPR 16-1	Electro-Metrics	3825/2	1352	06-Jul-17	06-Jul-18
3667	Directional coupler, 2 GHz to 8 GHz, 10 dB	ELISRA	MW10162	1011	15-Jun-17	15-Jun-18
3787	Precision Fixed Attenuator, 50 Ohm, 5 W, 10 dB, DC to 18 GHz	Mini-Circuits	BW-S10W5+	NA	07-Dec-17	07-Dec-18
3818	PSA Series Spectrum Analyzer, 3 Hz- 44 GHz	Agilent Technologies	E4446A	MY482502 88	07-May-17	07-May-18
3901	Microwave Cable Assembly, 40.0 GHz, 3.5 m, SMA/SMA	Huber-Suhner	SUCOFLE X 102A	1225/2A	20-Feb-17	20-Feb-18
3903	Microwave Cable Assembly, 40.0 GHz, 1.5 m, SMA/SMA	Huber-Suhner	SUCOFLE X 102A	1226/2A	20-Feb-17	20-Feb-18
4071	Attenuator, SMA, 30 dB, DC to 18 GHz, 5 W	Weinschel	WA7	NA	16-Aug-17	16-Aug-18
4114	Antenna, Double-Ridged Waveguide Horn, 1 to 18 GHz	ETS Lindgren	3117	00123515	17-Jan-17	17-Jan-18
4342	High Pass Filter, 50 Ohm, 10.6 to 26.5 GHz, SMA-M / SMA-FM	RLC Electronics	F-5738A	8425	14-May-17	14-May-18
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-17	15-Mar-18
4360	EMI Test Receiver, 20 Hz to 40 GHz.	Rohde & Schwarz	ESU40	100322	04-Dec-16	04-Jan-18
4366	Directional coupler, 1 GHz to 18 GHz, 10 dB, SMA Female	Tiger Micro-Electronics Institute	TGD-A1101-10	01e-JSDE805-007	26-May-16	26-May-18
4372	High Pass Filter, 50 Ohm, 8.0 to 18.0 GHz, SMA-FM / SMA-FM	Tiger Micro-Electronics Institute	TGF-A2118-001	r-JSFG308-001	14-May-17	14-May-18
4933	Active Horn Antenna, 1 GHz to 18 GHz	Com-Power Corporation	AHA-118	701046	14-Oct-16	14-Jan-18
4956	Active horn antenna, 18 to 40 GHz	Com-Power Corporation	AHA-840	105004	17-Jan-17	17-Jan-18



HL No	Description	Manufacturer	Model	Ser. No.	Last Cal./ Check	Due Cal./ Check
5110	RF cable, 18 GHz, 3 m, N-type	Huber-Suhner	ST18A/N m/Nm/300 0	600818/18 A	27-Jul-17	27-Jul-18
5111	RF cable, 40 GHz, 5.5 m, K-type	Huber-Suhner	SF102EA/ 11SK/11S K/5500M M	502493/2E A	27-Jul-17	27-Jul-18
5112	RF cable, 40 GHz, 5.5 m, K-type	Huber-Suhner	SF102EA/ 11SK/11S K/5500M M	502494/2E A	27-Jul-17	27-Jul-18
5174	Medium Power Fixed Coaxial Attenuator DC to 40 GHz, 10 dB, 5 W	API Weinschel, Inc	75A-10-12	TD854	20-Feb-17	20-Feb-18
5175	Medium Power Fixed Coaxial Attenuator DC to 40 GHz, 20 dB, 5 W	API Weinschel, Inc	75A-20-12	TE289	20-Feb-17	20-Feb-18

9 APPENDIX B Measurement uncertainties

Expanded uncertainty at 95% confidence in Hermon Labs EMC measurements

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

Tests were performed at Hermon Laboratories Ltd., which is a fully independent, private, EMC, Radio, Safety, Environmental and Telecommunication testing facility.

Hermon Laboratories is recognized and accredited by the Federal Communications Commission (USA) for 1, 2, 15, 18 parts of Code of Federal Regulations 47 (CFR 47), Test Firm Registration Number is 927748, Designation Number is IL1001; registered 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-869 for RE measurements above 1 GHz, C-845 for conducted emissions site and T-1606 for conducted emissions at telecommunication ports).

The laboratory is accredited by American Association for Laboratory Accreditation (USA) according to ISO/IEC 17025 for electromagnetic compatibility, product safety, telecommunications testing, environmental simulation and calibration (for exact scope please refer to Certificate No. 839.01, 839.03 and 839.04).

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Person for contact: Mr. Michael Nikishin, EMC&Radio group manager

11 APPENDIX D Specification references

47CFR part 27: 2016	Private land mobile radio services
47CFR part 1: 2016	Practice and procedure
47CFR part 2: 2016	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: 2014	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-E:2016	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(μ V) to convert it into field strength in dB(μ 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(μ V) to convert it into field strength in dB(μ V/m).

Antenna factor
Double-ridged waveguide horn antenna
ETS Lindgren, Model 3117, serial number: 00123515, HL 4114

Frequency, MHz	Antenna factor, dB/m		
	Measured	Manufacturer	Deviation
1000	28.0	28.4	-0.4
1500	28.0	27.4	0.6
2000	31.2	30.9	0.3
2500	32.5	33.4	-0.9
3000	32.9	32.6	0.3
3500	32.7	32.8	-0.1
4000	33.1	33.4	-0.3
4500	33.8	33.9	-0.1
5000	33.8	34.1	-0.3
5500	34.4	34.5	-0.1
6000	35.0	35.2	-0.2
6500	35.4	35.5	-0.1
7000	35.7	35.7	0.0
7500	35.9	35.7	0.2
8000	35.8	35.8	0.0
8500	35.9	35.8	0.1
9000	36.3	36.2	0.1
9500	36.6	36.6	0.0
10000	37.1	37.1	0.0
10500	37.6	37.5	0.1
11000	37.9	37.7	0.2
11500	38.5	38.1	0.4
12000	39.2	38.7	0.5
12500	39.0	38.9	0.1
13000	39.1	39.1	0.0
13500	38.9	38.8	0.1
14000	39.0	38.8	0.2
14500	39.6	39.9	-0.3
15000	39.9	39.7	0.2
15500	39.9	40.1	-0.2
16000	40.7	40.8	-0.1
16500	41.3	41.8	-0.5
17000	42.5	42.1	0.4
17500	41.3	41.2	0.1
18000	41.4	40.9	0.5

Antenna factor is to be added to receiver meter reading in dB(μ V) to convert to field strength in dB(μ V/meter)



HERMON LABORATORIES

Antenna factor, HL 4933

**Active Horn Antenna Factor Calibration**

1 GHz to 18 GHz

Equipment:			ACTIVE HORN ANTENNA		
Model:			AHA-118		
Serial Number:			701046		
Calibration Distance:			3 Meter		
Polarization:			Horizontal		
Calibration Date:			11/12/2014		
Frequency (GHz)	Preamplifier Gain (dB)	Antenna Factor with pre-amp (dB/m)	Frequency (GHz)	Preamplifier Gain (dB)	Antenna Factor with pre-amp (dB/m)
1	40.96	-16.47	10	40.94	-1.97
1.5	41.21	-14.53	10.5	40.63	-1.06
2	41.44	-13.30	11	40.74	-1.50
2.5	41.71	-12.87	11.5	40.65	-0.52
3	41.96	-12.26	12	40.76	-0.15
3.5	42.14	-11.77	12.5	41.03	-0.85
4	42.13	-10.91	13	41.37	-0.81
4.5	41.79	-9.41	13.5	41.18	0.05
5	41.44	-7.54	14	40.98	0.36
5.5	40.91	-6.47	14.5	40.81	1.26
6	40.69	-5.48	15	40.65	0.25
6.5	40.64	-5.53	15.5	40.93	-1.05
7	40.76	-4.12	16	41.31	-1.44
7.5	40.94	-3.12	16.5	40.96	-0.80
8	40.68	-1.69	17	40.64	-0.02
8.5	40.08	-1.71	17.5	40.57	1.81
9	40.41	-1.86	18	40.08	3.63
9.5	41.21	-2.73			
Calibration according to ARP 958					
Antenna Factor to be added to receiver reading: Meter Reading (dBuV) + Antenna Factor (dB/m) = Corrected Reading (dBuV/m)					



HERMON LABORATORIES

Antenna factor, HL 4956

**Active Horn Antenna Factor Calibration**

18 GHz to 40 GHz

Equipment:			ACTIVE HORN ANTENNA		
Model:			AHA-840		
Serial Number:			105004		
Calibration Distance:			3 meter		
Polarization:			Horizontal		
Calibration Date:			1/26/2015		
Frequency (GHz)	Preamplifier Gain (dB)	Antenna Factor with pre-amp (dB/m)	Frequency (GHz)	Preamplifier Gain (dB)	Antenna Factor with pre-amp (dB/m)
18	38.83	-1.06	29.5	42.47	-5.33
18.5	39.34	-2.65	30	41.91	-4.86
19	39.71	-3.88	30.5	41.60	-4.64
19.5	39.87	-4.35	31	41.52	-4.60
20	39.98	-3.97	31.5	41.56	-4.79
20.5	40.42	-3.68	32	41.80	-5.21
21	41.12	-4.06	32.5	42.29	-5.54
21.5	41.74	-5.46	33	42.79	-5.63
22	42.14	-6.22	33.5	42.88	-5.38
22.5	42.35	-6.42	34	42.62	-4.76
23	42.50	-6.59	34.5	42.63	-4.84
23.5	42.65	-6.82	35	43.15	-5.13
24	42.81	-7.01	35.5	43.91	-5.83
24.5	42.86	-7.37	36	44.59	-6.39
25	42.73	-7.53	36.5	45.04	-6.64
25.5	42.77	-7.45	37	45.08	-6.40
26	42.85	-7.21	37.5	44.82	-5.75
26.5	42.98	-7.17	38	44.16	-4.58
27	43.14	-7.22	38.5	42.90	-2.66
27.5	43.18	-7.32	39	42.39	-1.71
28	43.04	-7.10	39.5	43.76	-2.49
28.5	43.01	-6.73	40	45.98	-5.21
Calibration per ANSI C63.5: 2006 Standard Site Method, Equations 1-6 (3-antenna) Corrected Reading (dBμV/m) = Meter Reading (dBμV) + AFE(dB/m)					

Cable loss
Microwave Cable Assembly, Huber-Suhner, 40 GHz, 3.5 m, SMA-SMA, S/N 1225/2A
HL 3901

Frequency, MHz	Cable loss, dB	Frequency, MHz	Cable loss, dB	Frequency, MHz	Cable loss, dB
10	0.09	9500	4.29	21000	6.67
100	0.41	10000	4.40	22000	6.92
500	0.93	10500	4.52	23000	7.00
1000	1.33	11000	4.64	24000	7.18
1500	1.63	11500	4.76	25000	7.29
2000	1.90	12000	4.87	26000	7.55
2500	2.12	12500	4.99	27000	7.70
3000	2.33	13000	5.11	28000	7.88
3500	2.50	13500	5.20	29000	8.02
4000	2.67	14000	5.31	30000	8.15
4500	2.82	14500	5.42	31000	8.35
5000	2.99	15000	5.51	32000	8.40
5500	3.16	15500	5.58	33000	8.62
6000	3.32	16000	5.68	34000	8.73
6500	3.51	16500	5.78	35000	8.78
7000	3.65	17000	5.91	36000	8.94
7500	3.79	17500	5.99	37000	9.21
8000	3.92	18000	6.07	38000	9.37
8500	4.04	19000	6.36	39000	9.45
9000	4.18	20000	6.49	40000	9.52

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

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

Cable loss
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		



Cable loss
RF Cable, Huber-Suhner, 18 GHz, 3 m, N- type,
ST18A/Nm/Nm/3000, S/N 600818/18A
HL 5110

Frequency, MHz	Cable loss, dB	Frequency, MHz	Cable loss, dB
0.1	0.01	5500	1.99
50	0.17	6000	2.10
100	0.24	6500	2.20
200	0.34	7000	2.29
300	0.42	7500	2.38
400	0.48	8000	2.47
500	0.54	8500	2.57
600	0.59	9000	2.65
700	0.64	9500	2.74
800	0.69	10000	2.83
900	0.73	10500	2.91
1000	0.77	11000	2.99
1100	0.82	11500	3.07
1200	0.86	12000	3.14
1300	0.89	12500	3.22
1400	0.93	13000	3.29
1500	0.96	13500	3.37
1600	1.00	14000	3.45
1700	1.03	14500	3.52
1800	1.06	15000	3.59
1900	1.10	15500	3.66
2000	1.13	16000	3.74
2500	1.28	16500	3.80
3000	1.41	17000	3.88
3500	1.54	17500	4.00
4000	1.66	18000	4.02
4500	1.78		
5000	1.89		

Cable loss
RF Cable, Huber-Suhner, 40 GHz, 5.5 m, K type,
SF102EA/11SK/11SK/5500MM, S/N 502493/2EA
HL 5111

Frequency, MHz	Cable loss, dB	Frequency, MHz	Cable loss, dB
100	0.68	20500	10.17
200	0.97	21000	10.30
300	1.18	21500	10.43
500	1.52	22000	10.58
1000	2.14	22500	10.73
1500	2.62	23000	10.85
2000	3.03	23500	10.98
2500	3.39	24000	11.11
3000	3.72	24500	11.20
3500	4.03	25000	11.32
4000	4.32	25500	11.47
4500	4.59	26000	11.59
5000	4.84	26500	11.72
5500	5.09	27000	11.83
6000	5.32	27500	11.94
6500	5.55	28000	12.04
7000	5.77	28500	12.16
7500	5.99	29000	12.28
8000	6.19	29500	12.40
8500	6.40	30000	12.50
9000	6.60	30500	12.59
9500	6.79	31000	12.68
10000	6.98	31500	12.80
10500	7.16	32000	12.94
11000	7.34	32500	13.09
11500	7.51	33000	13.23
12000	7.68	33500	13.32
12500	7.84	34000	13.44
13000	8.00	34500	13.54
13500	8.15	35000	13.68
14000	8.31	35500	13.81
14500	8.46	36000	13.90
15000	8.62	36500	13.99
15500	8.76	37000	14.12
16000	8.91	37500	14.22
16500	9.06	38000	14.33
17000	9.21	38500	14.47
17500	9.35	39000	14.54
18000	9.49	39500	14.62
18500	9.62	40000	14.75
19000	9.76		
19500	9.90		
20000	10.05		

Cable loss
RF Cable, Huber-Suhner, 40 GHz, 5.5 m, K type,
SF102EA/11SK/11SK/5500MM, S/N 502494/2EA
HL 5112

Frequency, MHz	Cable loss, dB	Frequency, MHz	Cable loss, dB
100	0.69	20500	10.18
200	0.97	21000	10.32
300	1.18	21500	10.47
500	1.52	22000	10.60
1000	2.14	22500	10.75
1500	2.62	23000	10.87
2000	3.03	23500	11.00
2500	3.40	24000	11.12
3000	3.73	24500	11.23
3500	4.04	25000	11.35
4000	4.33	25500	11.52
4500	4.60	26000	11.64
5000	4.86	26500	11.73
5500	5.10	27000	11.84
6000	5.34	27500	11.93
6500	5.57	28000	12.05
7000	5.79	28500	12.19
7500	6.00	29000	12.33
8000	6.21	29500	12.44
8500	6.43	30000	12.53
9000	6.62	30500	12.58
9500	6.82	31000	12.71
10000	7.01	31500	12.86
10500	7.17	32000	13.00
11000	7.34	32500	13.11
11500	7.51	33000	13.24
12000	7.68	33500	13.33
12500	7.84	34000	13.44
13000	8.00	34500	13.58
13500	8.16	35000	13.69
14000	8.32	35500	13.81
14500	8.48	36000	13.93
15000	8.63	36500	14.05
15500	8.77	37000	14.24
16000	8.92	37500	14.28
16500	9.08	38000	14.38
17000	9.23	38500	14.50
17500	9.37	39000	14.61
18000	9.51	39500	14.70
18500	9.66	40000	14.83
19000	9.78		
19500	9.92		
20000	10.07		

13 APPENDIX F Abbreviations and acronyms

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