



Hermon Laboratories Ltd.
P.O. Box 23, Binyamina 3055001, Israel
Tel. +972 4628 8001
Fax. +972 4628 8277
E-mail: mail@hermonlabs.com

TEST REPORT

ACCORDING TO: FCC 47CFR part 96

FOR:

Airspan Networks Inc.

LTE Base Station Radio

Model: AirHarmony 4200 3550-3700MHz (B48)

FCC ID:PIDAH4200A

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



Table of contents

1	Applicant information.....	3
2	Equipment under test attributes	3
3	Manufacturer information	3
4	Test details.....	3
5	Tests summary.....	4
6	EUT description.....	5
6.1	General information.....	5
6.2	Ports and lines	5
6.3	Support and test equipment	5
6.4	Changes made in the EUT	5
6.5	Test configuration.....	6
6.6	Transmitter characteristics	7
7	Transmitter tests according to 47CFR part 96.....	8
7.1	Maximum EIRP and maximum power spectral density test.....	8
7.2	Emission mask test	35
7.3	Spurious emissions at RF antenna connector test	40
8	APPENDIX A Test equipment and ancillaries used for tests	49
9	APPENDIX B Measurement uncertainties.....	50
10	APPENDIX C Test facility description	51
11	APPENDIX D Specification references	51
12	APPENDIX E Test equipment correction factors.....	52
13	APPENDIX F Abbreviations and acronyms.....	54

1 Applicant information

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

2 Equipment under test attributes

Product name: LTE Base Station Radio
Product type: Transceiver
Model(s): AirHarmony 4200 3550-3700MHz (B48)
Serial number: D5EF25CED5BC
Hardware version: C2
Software release: SR 16.00
Receipt date 05-Jun-19

3 Manufacturer information

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

4 Test details

Project ID: 33454
Location: Hermon Laboratories Ltd. P.O. Box 23, Binyamina 3055001, Israel
Test started: 18-Jun-19
Test completed: 24-Jun-19
Test specification(s): FCC 47CFR part 96

5 Tests summary




Test	Status
Transmitter characteristics	
Section 96.41(b), Maximum EIRP and maximum power spectral density	Pass
Section 96.41(g), Peak-to- average power ratio	Pass*
Section 2.1049, Occupied bandwidth	Pass*
Section 96.41(e), Emission mask	Pass**
Section 96.41(e)(2), Radiated spurious emissions	Pass*
Section 96.41(e)(3), Conducted spurious emissions	Pass**
Section 2.1055, Frequency stability	Pass*

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

* According to "KDB 484596 D01 Referencing Test Data v01" the results were re-used from FCC ID:PIDAH4200, test report AIRRAD_FCC.31875_rev2. The explanation of differences between FCC ID:PIDAH4200 and FCC ID:PIDAH4200A provided as an exhibit in Application for certification.

** The spot check at mid frequency was conducted, the results were not worse that the original ones, so sufficient evidence of the similarity provided.

This test report supersedes the previously issued test report identified by Doc ID: AIRRAD_FCC.33454_REV4

	Name and Title	Date	Signature
Tested by:	Mr. S. Samokha, test engineer	June 24, 2019	
Reviewed by:	Mrs. S Peysahov Sheynin test engineer EMC & Radio	November 18 2019	
Approved by:	Mr. M. Nikishin, EMC and Radio group manager	November 19 2019	



6 EUT description

6.1 General information

The EUT, Mobile Digital station, AirHarmony 4200 3550-3700MHz (B48), is part of a LTE broadband fixed cellular wireless access system. The system provides a radio link between an end-user (a subscriber) and a network to give high-speed data access. The AirHarmony's transceiver/receiver (Up to 64 QAM modulation, data rate up to 95 Mbps) equipped with a 18 dBi external antenna. Advanced Antenna Techniques 2x2 MIMO are supported. The maximum RF output power (not including antenna gain) is 28.99 dBm for 16.5dBi antenna assembly gain (with an external feeder cables which introduces additional losses) and it can be reduced by software.

The AirHarmony 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.

Note: The AH4200 equipment defined as Category B CBSD (Citizens Broadband Radio Service Device). Antennas 1/2 arrange one sector while antenna 1 is cross polarized to antenna 2 and antennas 3/4 arrange another sector while antenna 3 is cross polarized to antenna 4. The transmitter output signals are completely uncorrelated. The sectors are either non overlapping by operation on different frequency channels or by different sectors coverage without overlapping of antenna beams.

6.2 Ports and lines

Port type	Port description	Connected from	Connected to	Qty.	Cable type	Cable length, m
Power	DC power	EUT	AC/DC adapter	1	Unshielded	20
Signal	Ethernet	EUT	Laptop	1	Shielded	20
Signal*	Serial*	Not connected	Not connected	1	NA	NA

*for maintenance only

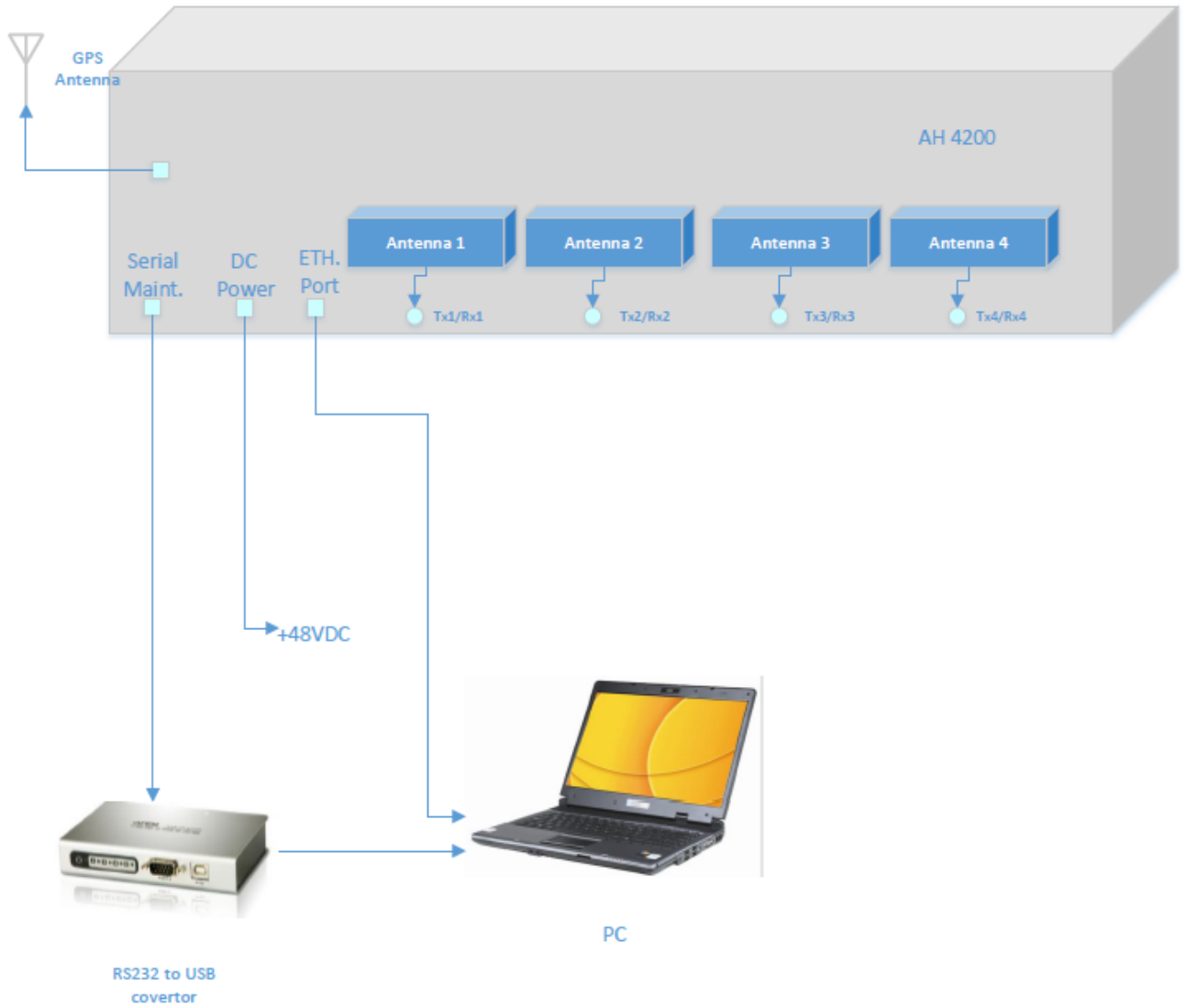
6.3 Support and test equipment

Description	Manufacturer	Model number	Serial number
Laptop	Dell	E7450	8TYRP32
USB to RS-232 convertor	ATEN	UC2324	NA
AC/DC adapter	DVE	DSA-96PFB-12 1 120750	P/N DSA-96PFB-12 1 120750-W25

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						
<input checked="" type="checkbox"/>	Stand-alone (Equipment with or without its own control provisions)					
<input type="checkbox"/>	Combined equipment (Equipment where the radio part is fully integrated within another type of equipment)					
<input type="checkbox"/>	Plug-in card (Equipment intended for a variety of host systems)					
Intended use		Condition of use				
<input checked="" type="checkbox"/>	fixed	Always at a distance more than 2 m from all people				
<input type="checkbox"/>	mobile	Always at a distance more than 20 cm from all people				
<input type="checkbox"/>	portable	May operate at a distance closer than 20 cm to human body				
Assigned frequency range		3550.0 – 3700.0 MHz				
Operating frequency (full bands)		3555.0 – 3695.0 MHz				
RF channel spacing		10 MHz, 20 MHz				
Maximum rated output power		At transmitter 50 Ω RF output connector (per port)	28.99 dBm			
Is transmitter output power variable?		No				
		<input checked="" type="checkbox"/>	Yes	continuous variable		
			Yes	<input checked="" type="checkbox"/>	stepped variable with step size	0.25 dB
					minimum RF power	-30 dBm
		maximum RF power at antenna connector	dBm			
Antenna connection						
<input type="checkbox"/>	unique coupling	<input checked="" type="checkbox"/>	standard connector			
<input type="checkbox"/>		<input type="checkbox"/>	Integral			
<input checked="" type="checkbox"/>		<input type="checkbox"/>	with temporary RF connector			
<input type="checkbox"/>		<input type="checkbox"/>	without temporary RF connector			
Antenna/s technical characteristics						
Type	Manufacturer	Model number	Gain			
External	ALPHA Wireless Ltd.	AW3089	18 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			
Type of multiplexing		TDD				
Modulating test signal (baseband)		PRBS				
Maximum transmitter duty cycle in normal use		0.74				
Transmitter power source						
	Nominal rated voltage		Battery type			
<input checked="" type="checkbox"/>	DC	Nominal rated voltage	48 VDC			
	AC mains	Nominal rated voltage	Frequency			
Common power source for transmitter and receiver		<input checked="" type="checkbox"/>	yes			
		<input type="checkbox"/>	no			



Test specification: Section 96.41(b), Maximum EIRP and maximum power spectral density			
Test procedure: Section 96.41(e)(3)			
Test mode: Compliance		Verdict: PASS	
Date(s): 19-Jun-19			
Temperature: 24 °C	Relative Humidity: 52 %	Air Pressure: 1010 hPa	Power: 48 VDC
Remarks:			

7 Transmitter tests according to 47CFR part 96

7.1 Maximum EIRP and maximum power spectral density test

7.1.1 General

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

Table 7.1.1 Peak output power limits

Assigned frequency range, MHz	ERP	
	W/10 MHz	dBm/10 MHz
3550 - 3700	17.0	47.0

Table 7.1.2 Peak spectral power density limits

Assigned frequency range, MHz	Measurement bandwidth, MHz	Peak spectral power density, dBm
3550 - 3700	1.0	37.0

7.1.2 Test procedure

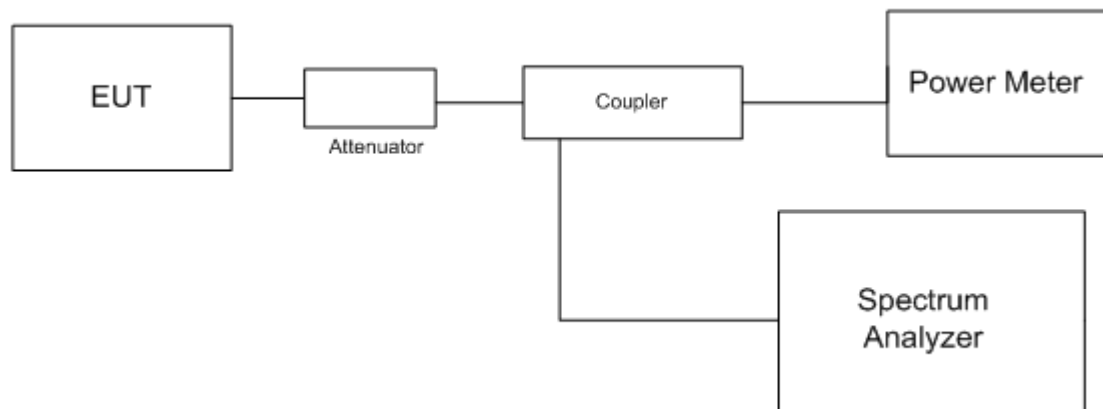
7.1.2.1 The EUT was set up as shown in Figure 7.1.1, energized and its proper operation was checked.

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

7.1.2.3 The peak output power was measured with power meter as provided in Table 7.1.3.

7.1.2.4 Spectrum analyzer was set in average mode, sufficient number of sweeps was allowed for trace stabilization and peak spectral power density was measured as provided in Table 7.1.4 and the associated plots.

Figure 7.1.1 Peak output power and spectral power density test setup





Test specification: Section 96.41(b), Maximum EIRP and maximum power spectral density			
Test procedure: Section 96.41(e)(3)			
Test mode: Compliance		Verdict: PASS	
Date(s): 19-Jun-19			
Temperature: 24 °C	Relative Humidity: 52 %	Air Pressure: 1010 hPa	Power: 48 VDC
Remarks:			

Table 7.1.3 Maximum EIRP test results

ASSIGNED FREQUENCY RANGE: 3550.0 – 3700.0 MHz
 DETECTOR USED: Average (gated)
 ANTENNA ASSEMBLY GAIN: 16.5 dBi

CHANNEL SPACING: 10 MHz

Frequency, MHz	RF Output power, dBm				EIRP dBm/10 Hz	Limit, dBm/10 MHz	Margin, dB**	Verdict
	Chain RF#1,	Chain RF#2,	Chain RF#3,	Chain RF#4,				
Modulation QPSK								
3555.0	28.50	28.80	28.36	28.66	45.30	47.0	-1.70	Pass
3625.0	28.00	28.50	28.49	28.80	45.30	47.0	-1.70	Pass
3695.0	28.52	28.48	28.99	28.00	45.49	47.0	-1.51	Pass
Modulation 16QAM								
3555.0	28.40	28.97	28.80	28.85	45.47	47.0	-1.53	Pass
3625.0	28.00	28.55	28.49	28.75	45.25	47.0	-1.75	Pass
3695.0	28.70	28.48	28.30	28.70	45.20	47.0	-1.80	Pass
Modulation 64QAM								
3555.0	28.65	28.90	28.80	28.60	45.40	47.0	-1.60	Pass
3625.0	28.45	28.45	28.30	28.60	45.10	47.0	-1.90	Pass
3695.0	28.62	28.83	28.65	28.55	45.33	47.0	-1.67	Pass

* - Total EIRP = Max SA reading (Chains #1&2and #3&4) + Antenna assembly gain, where
 Antenna assembly gain (dBi) = Antenna gain (dBi) – Feeder loss (dB) = 18 – 1.5 = 16.5 dBi
 ** - Margin = EIRP, dBm/10MHz – specification limit.

CHANNEL SPACING: 20 MHz

Frequency, MHz	RF Output power, dBm				Total EIRP, dBm*	EIRP dBm/10 MHz**	Limit, dBm/10 MHz	Margin, dB	Verdict
	Chain RF#1,	Chain RF#2,	Chain RF#3,	Chain RF#4,					
Modulation QPSK									
3560.0	31.10	31.75	31.80	31.55	48.30	45.85	47.0	-1.15	Pass
3625.0	31.97	31.30	31.51	31.95	48.47	46.02	47.0	-0.98	Pass
3690.0	31.40	31.70	31.22	31.60	48.20	45.75	47.0	-1.25	Pass
Modulation 16QAM									
3560.0	31.23	31.23	31.25	31.38	47.88	45.43	47.0	-1.57	Pass
3625.0	31.98	31.40	31.51	31.37	48.48	46.03	47.0	-0.97	Pass
3690.0	31.50	31.82	31.33	31.60	48.32	45.87	47.0	-1.13	Pass
Modulation 64QAM									
3560.0	31.56	31.88	31.38	31.33	48.38	45.93	47.0	-1.07	Pass
3625.0	31.31	31.35	31.83	31.99	48.49	46.04	47.0	-0.96	Pass
3690.0	31.60	31.82	31.97	31.66	48.47	46.02	47.0	-0.98	Pass

* - Total EIRP = Max SA reading (Chains #1&2and #3&4) + Antenna assembly gain, where
 Antenna assembly gain (dBi) = Antenna gain (dBi) – Feeder loss (dB) = 18 – 1.5 = 16.5 dBi
 ** - EIRP dBm/10MHz = Total EIRP, dBm + 10*log[10 MHz/OBW(MHz)]
 *** - Margin = EIRP, dBm/10MHz – specification limit.



Test specification: Section 96.41(b), Maximum EIRP and maximum power spectral density			
Test procedure: Section 96.41(e)(3)			
Test mode: Compliance		Verdict: PASS	
Date(s): 19-Jun-19			
Temperature: 24 °C	Relative Humidity: 52 %	Air Pressure: 1010 hPa	Power: 48 VDC
Remarks:			

Table 7.1.4 Peak spectral power density test results

ASSIGNED FREQUENCY RANGE: 3550.0 – 3700.0 MHz
DETECTOR USED: Average (gated)
VIDEO BANDWIDTH: ≥ Resolution bandwidth
NUMBER OF CHAINS: 4
ANTENNA ASSEMBLY GAIN: 16.5 dBi

Frequency, MHz	RF Output power				Total PSD*, dBm/MHz	Limit, dBm/MHz	Margin, dB	Verdict
	Chain RF#1, dBm	Chain RF#2, dBm	Chain RF#3, dBm	Chain RF#4, dBm				
Channel Spacing 10 MHz								
Modulation QPSK								
3555.0	19.75	20.22	19.67	20.18	36.72	37.0	-0.28	Pass
3625.0	19.14	19.65	19.68	19.89	36.39	37.0	-0.61	Pass
3695.0	19.54	19.43	20.25	19.11	36.75	37.0	-0.25	Pass
Modulation 16QAM								
3555.0	19.62	20.32	19.83	20.24	36.82	37.0	-0.18	Pass
3625.0	19.11	19.76	19.12	19.31	36.26	37.0	-0.74	Pass
3695.0	19.77	20.11	19.47	19.99	36.61	37.0	-0.39	Pass
Modulation 64QAM								
3555.0	20.17	20.08	20.14	20.06	36.67	37.0	-0.33	Pass
3625.0	19.60	19.89	19.14	19.96	36.46	37.0	-0.54	Pass
3695.0	20.00	19.99	20.05	19.65	36.55	37.0	-0.45	Pass
Channel Spacing 20 MHz								
Modulation QPSK								
3560.0	20.01	20.21	20.29	20.38	36.88	37.0	-0.12	Pass
3625.0	19.88	19.38	20.39	20.39	36.89	37.0	-0.11	Pass
3690.0	20.38	20.16	20.12	20.11	36.88	37.0	-0.12	Pass
Modulation 16QAM								
3560.0	19.92	20.22	20.26	20.17	36.76	37.0	-0.24	Pass
3625.0	20.31	19.76	20.47	19.95	36.97	37.0	-0.03	Pass
3690.0	20.10	20.16	20.33	19.94	36.83	37.0	-0.17	Pass
Modulation 64QAM								
3560.0	20.46	20.21	20.21	20.30	36.96	37.0	-0.04	Pass
3625.0	20.11	19.94	20.28	19.93	36.78	37.0	-0.22	Pass
3690.0	20.11	20.26	20.39	20.14	36.89	37.0	-0.11	Pass

* - Total EIRP = Max SA reading (Chains #1&2and #3&4) + Antenna assembly gain, where
Antenna assembly gain (dBi) = Antenna gain (dBi) – Feeder loss (dB) = 18 – 1.5 = 16.5 dBi

** - Margin = Total PSD, dBm – specification limit.

Reference numbers of test equipment used

HL 3301	HL 3302	HL 4366	HL 5409	HL 5376	
---------	---------	---------	---------	---------	--

Full description is given in Appendix A.

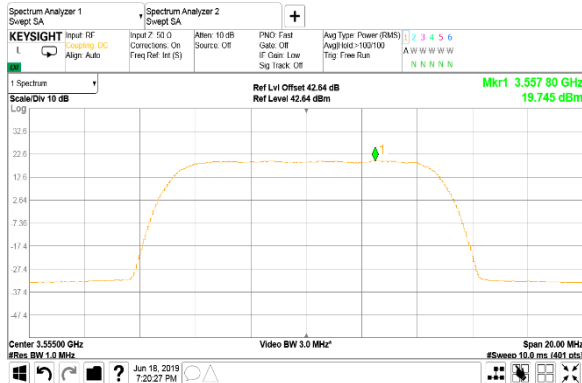


HERMON LABORATORIES

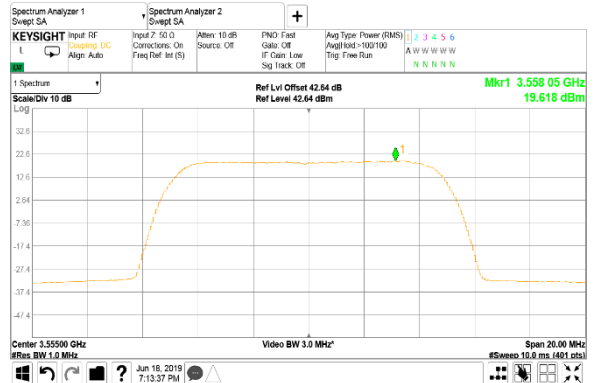
Test specification: Section 96.41(b), Maximum EIRP and maximum power spectral density			
Test procedure: Section 96.41(e)(3)			
Test mode: Compliance		Verdict: PASS	
Date(s): 19-Jun-19			
Temperature: 24 °C	Relative Humidity: 52 %	Air Pressure: 1010 hPa	Power: 48 VDC
Remarks:			

Plot 7.1.1 Peak spectral power density at low frequency

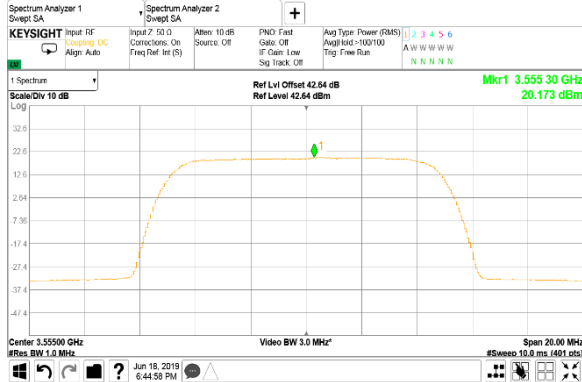
CHANNEL SPACING:
ANTENNA CHAIN:
Modulation: QPSK



10 MHz
1
Modulation: 16QAM



Modulation: 64QAM



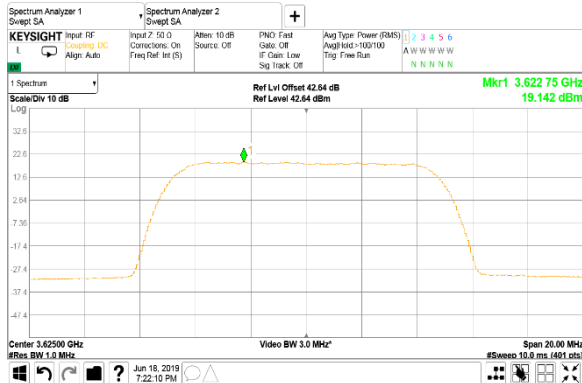


HERMON LABORATORIES

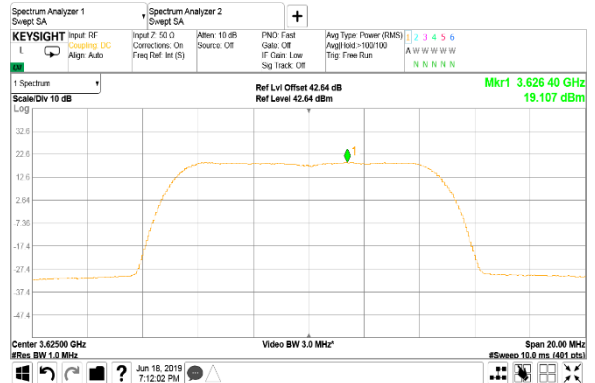
Test specification: Section 96.41(b), Maximum EIRP and maximum power spectral density			
Test procedure: Section 96.41(e)(3)			
Test mode: Compliance		Verdict: PASS	
Date(s): 19-Jun-19			
Temperature: 24 °C	Relative Humidity: 52 %	Air Pressure: 1010 hPa	Power: 48 VDC
Remarks:			

Plot 7.1.2 Peak spectral power density at mid frequency

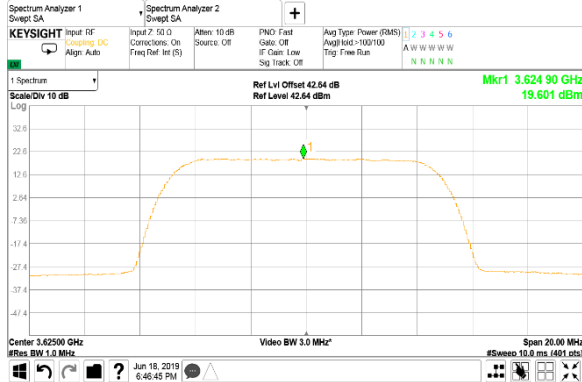
CHANNEL SPACING:
ANTENNA CHAIN:
Modulation: QPSK



10 MHz
1
Modulation: 16QAM



Modulation: 64QAM



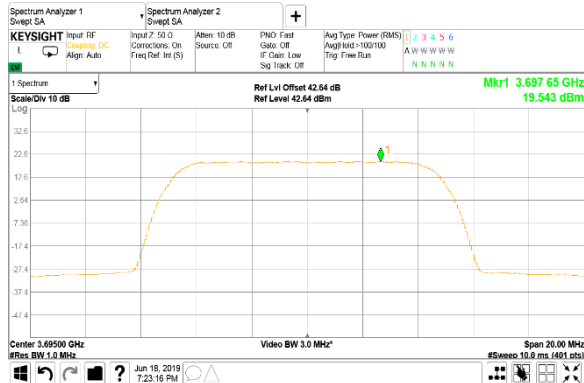


HERMON LABORATORIES

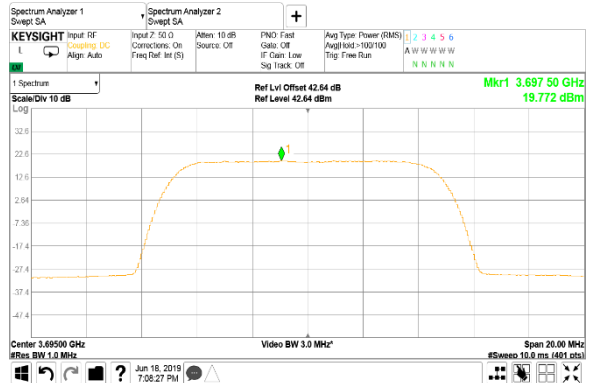
Test specification: Section 96.41(b), Maximum EIRP and maximum power spectral density			
Test procedure: Section 96.41(e)(3)			
Test mode: Compliance	Verdict: PASS		
Date(s): 19-Jun-19			
Temperature: 24 °C	Relative Humidity: 52 %	Air Pressure: 1010 hPa	Power: 48 VDC
Remarks:			

Plot 7.1.3 Peak spectral power density at high frequency

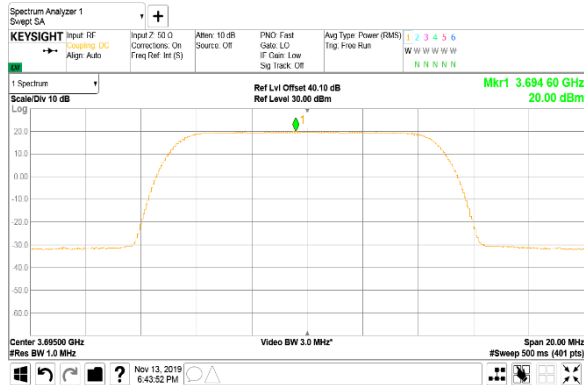
HANNEL SPACING:
ANTENNA CHAIN:
Modulation: QPSK



10 MHz
1
Modulation: 16QAM



Modulation: 64QAM



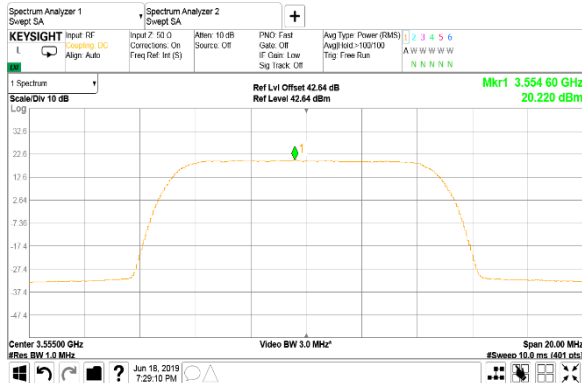


HERMON LABORATORIES

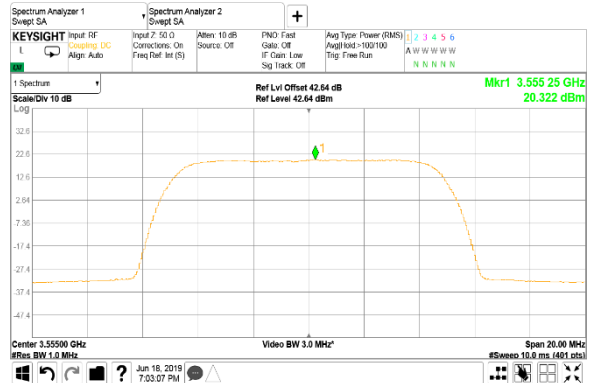
Test specification: Section 96.41(b), Maximum EIRP and maximum power spectral density			
Test procedure: Section 96.41(e)(3)			
Test mode: Compliance		Verdict: PASS	
Date(s): 19-Jun-19			
Temperature: 24 °C	Relative Humidity: 52 %	Air Pressure: 1010 hPa	Power: 48 VDC
Remarks:			

Plot 7.1.4 Peak spectral power density at low frequency

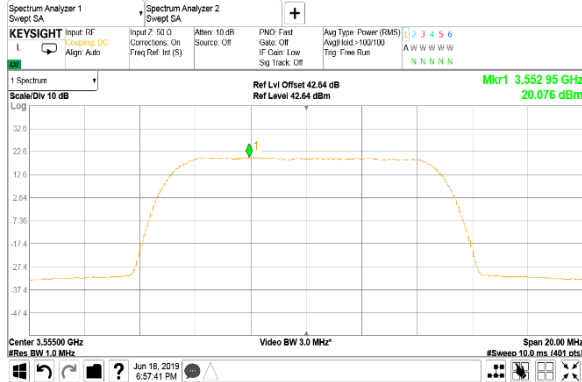
CHANNEL SPACING:
ANTENNA CHAIN:
Modulation: QPSK



10 MHz
2
Modulation: 16QAM



Modulation: 64QAM



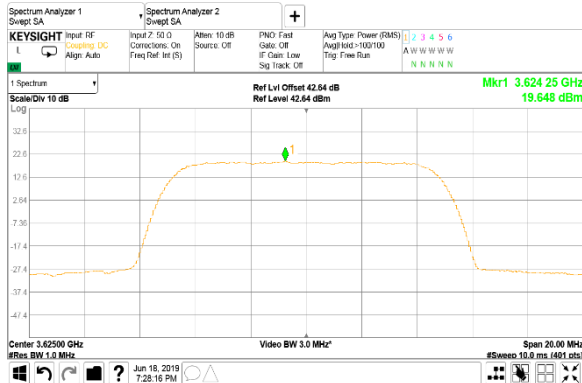


HERMON LABORATORIES

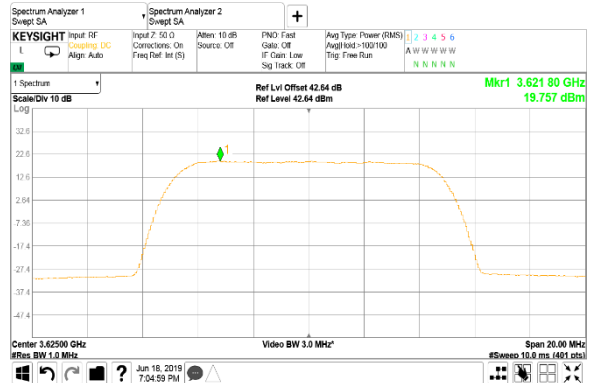
Test specification: Section 96.41(b), Maximum EIRP and maximum power spectral density			
Test procedure: Section 96.41(e)(3)			
Test mode: Compliance		Verdict: PASS	
Date(s): 19-Jun-19			
Temperature: 24 °C	Relative Humidity: 52 %	Air Pressure: 1010 hPa	Power: 48 VDC
Remarks:			

Plot 7.1.5 Peak spectral power density at mid frequency

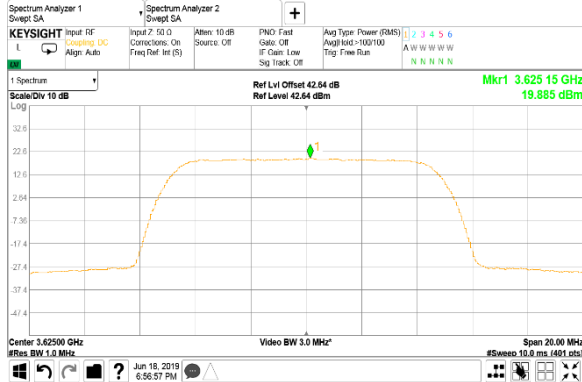
CHANNEL SPACING:
ANTENNA CHAIN:
Modulation: QPSK



10 MHz
2
Modulation: 16QAM



Modulation: 64QAM



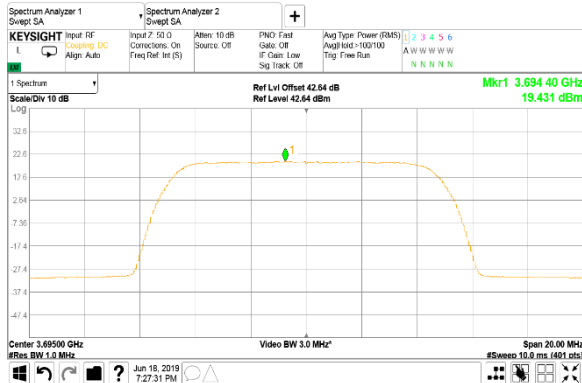


HERMON LABORATORIES

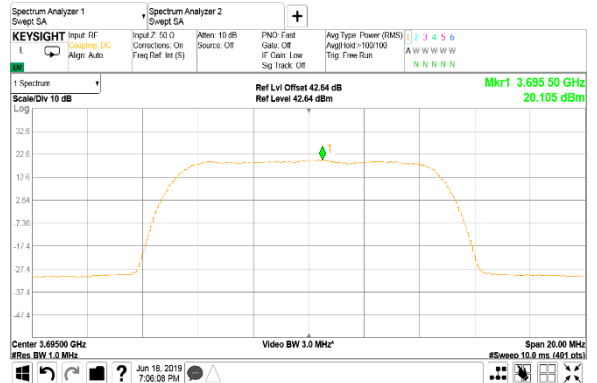
Test specification: Section 96.41(b), Maximum EIRP and maximum power spectral density			
Test procedure: Section 96.41(e)(3)			
Test mode: Compliance		Verdict: PASS	
Date(s): 19-Jun-19			
Temperature: 24 °C	Relative Humidity: 52 %	Air Pressure: 1010 hPa	Power: 48 VDC
Remarks:			

Plot 7.1.6 Peak spectral power density at high frequency

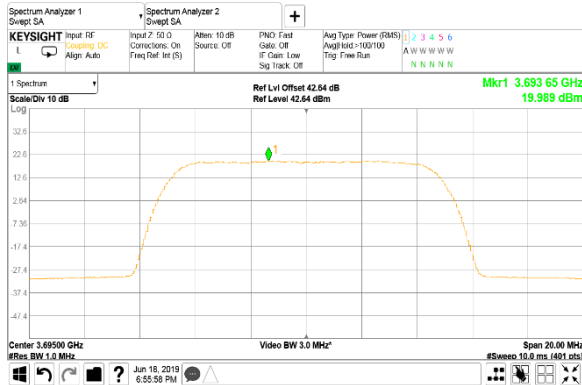
HANNEL SPACING:
ANTENNA CHAIN:
Modulation: QPSK



10 MHz
2
Modulation: 16QAM



Modulation: 64QAM



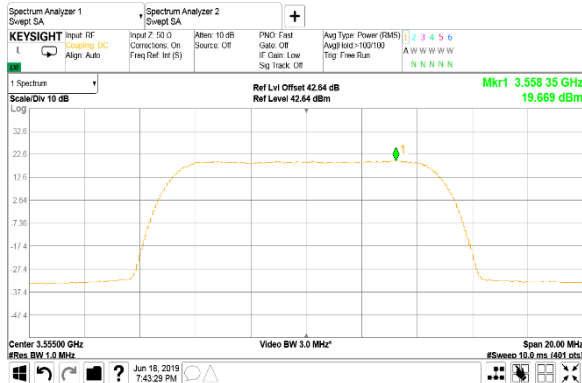


HERMON LABORATORIES

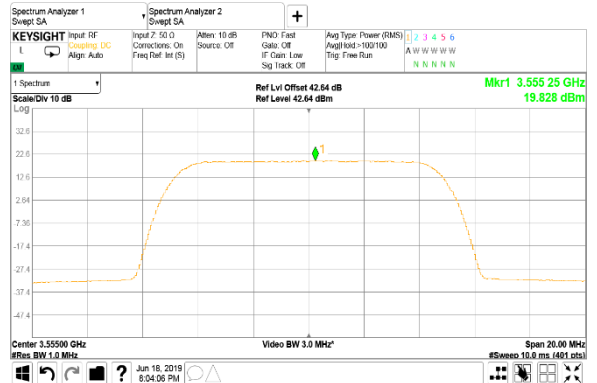
Test specification: Section 96.41(b), Maximum EIRP and maximum power spectral density			
Test procedure: Section 96.41(e)(3)			
Test mode: Compliance		Verdict: PASS	
Date(s): 19-Jun-19			
Temperature: 24 °C	Relative Humidity: 52 %	Air Pressure: 1010 hPa	Power: 48 VDC
Remarks:			

Plot 7.1.7 Peak spectral power density at low frequency

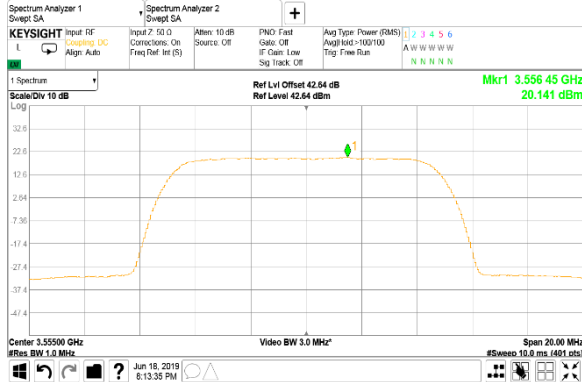
CHANNEL SPACING:
ANTENNA CHAIN:
Modulation: QPSK



10 MHz
3
Modulation: 16QAM



Modulation: 64QAM



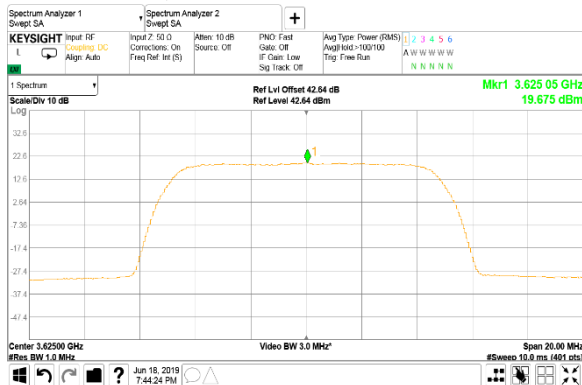


HERMON LABORATORIES

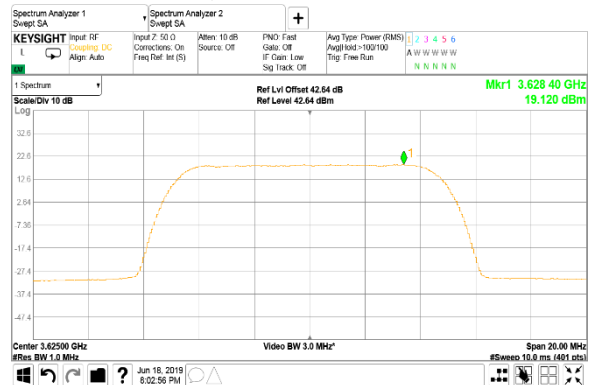
Test specification: Section 96.41(b), Maximum EIRP and maximum power spectral density			
Test procedure: Section 96.41(e)(3)			
Test mode: Compliance		Verdict: PASS	
Date(s): 19-Jun-19			
Temperature: 24 °C	Relative Humidity: 52 %	Air Pressure: 1010 hPa	Power: 48 VDC
Remarks:			

Plot 7.1.8 Peak spectral power density at mid frequency

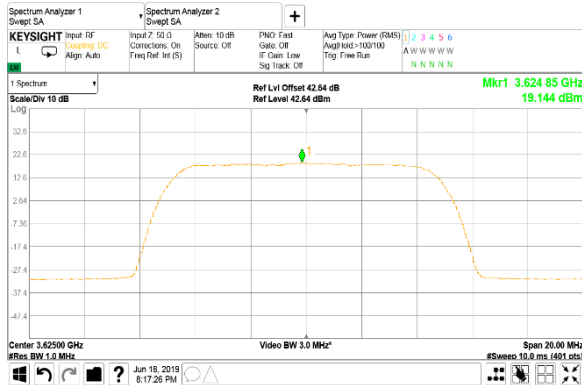
CHANNEL SPACING:
ANTENNA CHAIN:
Modulation: QPSK



10 MHz
3
Modulation: 16QAM



Modulation: 64QAM



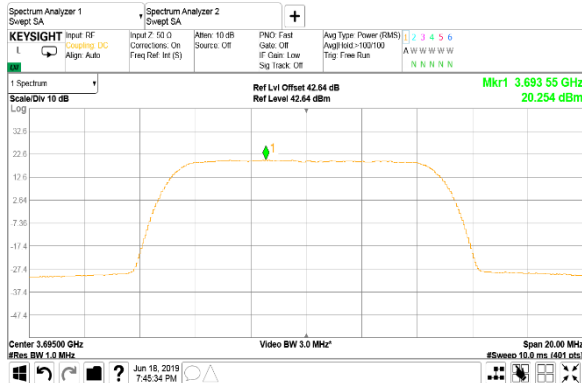


HERMON LABORATORIES

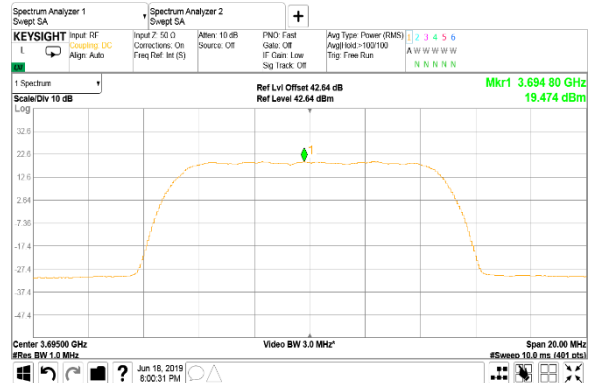
Test specification: Section 96.41(b), Maximum EIRP and maximum power spectral density	
Test procedure: Section 96.41(e)(3)	
Test mode: Compliance	Verdict: PASS
Date(s): 19-Jun-19	
Temperature: 24 °C	Relative Humidity: 52 %
Air Pressure: 1010 hPa	Power: 48 VDC
Remarks:	

Plot 7.1.9 Peak spectral power density at high frequency

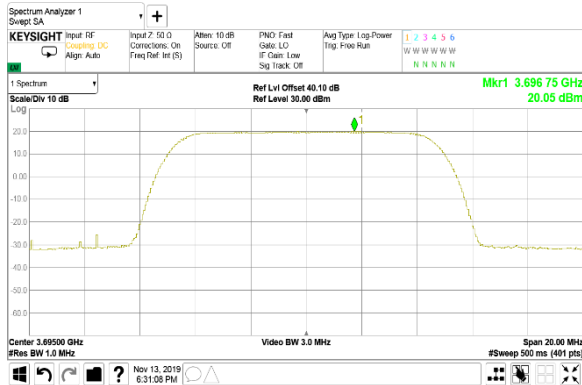
HANNEL SPACING:
ANTENNA CHAIN:
Modulation: QPSK



10 MHz
3
Modulation: 16QAM



Modulation: 64QAM



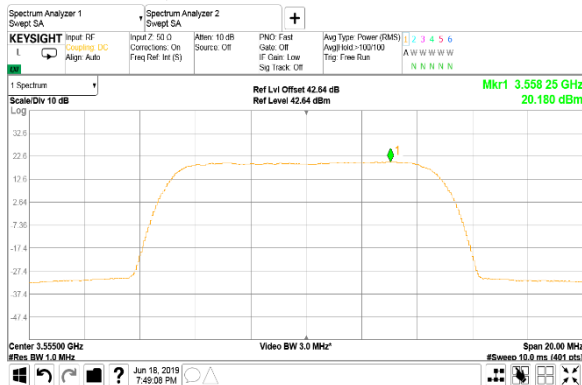


HERMON LABORATORIES

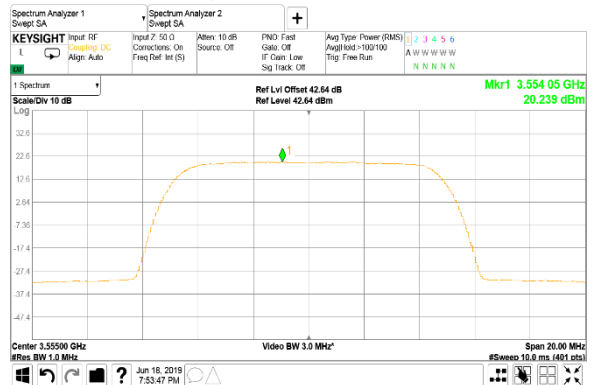
Test specification: Section 96.41(b), Maximum EIRP and maximum power spectral density			
Test procedure: Section 96.41(e)(3)			
Test mode: Compliance		Verdict: PASS	
Date(s): 19-Jun-19			
Temperature: 24 °C	Relative Humidity: 52 %	Air Pressure: 1010 hPa	Power: 48 VDC
Remarks:			

Plot 7.1.10 Peak spectral power density at low frequency

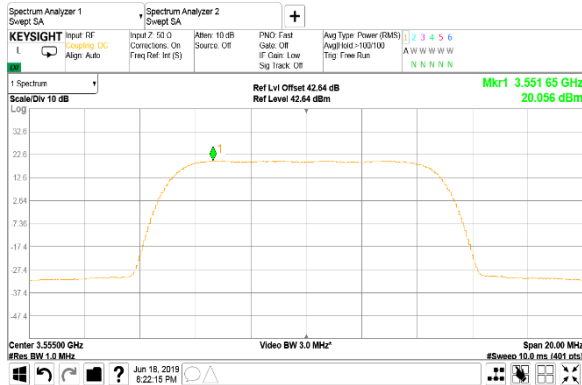
CHANNEL SPACING:
ANTENNA CHAIN:
Modulation: QPSK



10 MHz
4
Modulation: 16QAM



Modulation: 64QAM



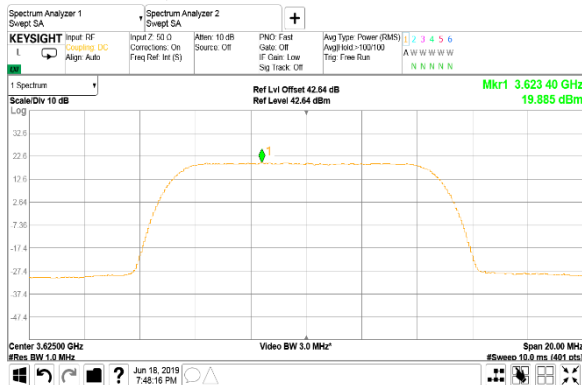


HERMON LABORATORIES

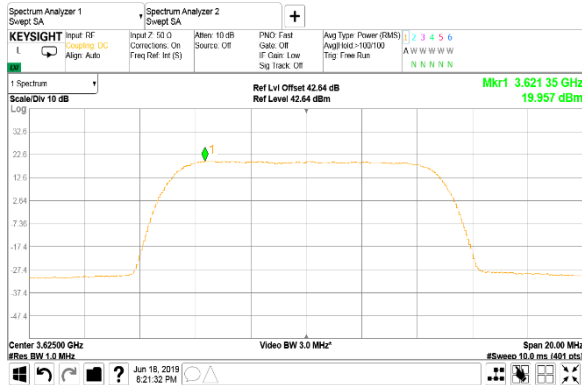
Test specification: Section 96.41(b), Maximum EIRP and maximum power spectral density			
Test procedure: Section 96.41(e)(3)			
Test mode: Compliance		Verdict: PASS	
Date(s): 19-Jun-19			
Temperature: 24 °C	Relative Humidity: 52 %	Air Pressure: 1010 hPa	Power: 48 VDC
Remarks:			

Plot 7.1.11 Peak spectral power density at mid frequency

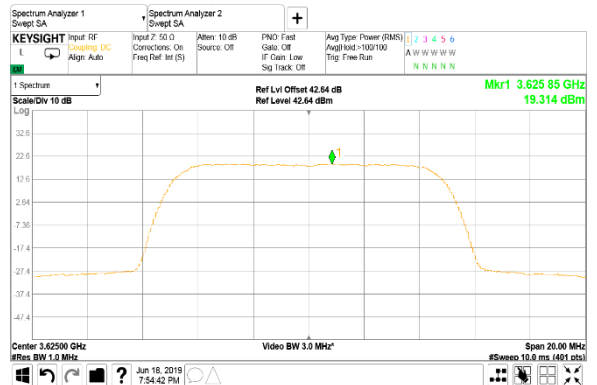
CHANNEL SPACING:
ANTENNA CHAIN:
Modulation: QPSK



Modulation: 64QAM



10 MHz
4
Modulation: 16QAM



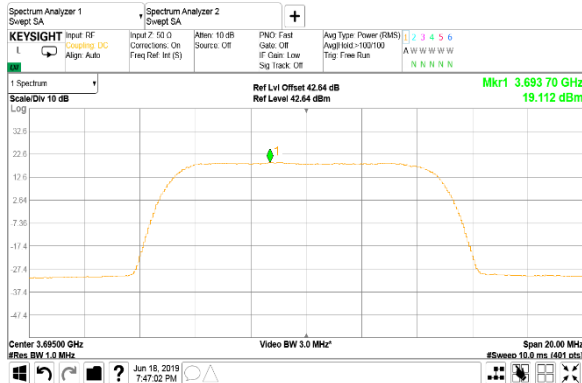


HERMON LABORATORIES

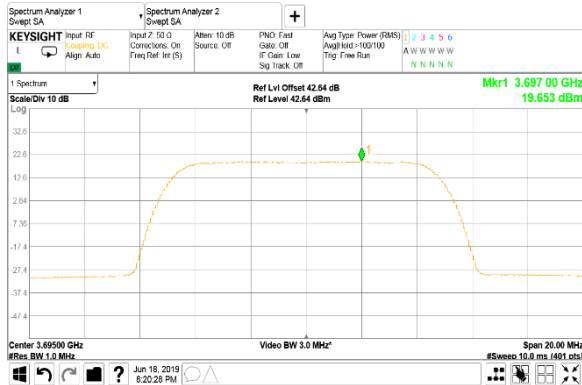
Test specification: Section 96.41(b), Maximum EIRP and maximum power spectral density	
Test procedure: Section 96.41(e)(3)	
Test mode: Compliance	Verdict: PASS
Date(s): 19-Jun-19	
Temperature: 24 °C	Relative Humidity: 52 %
Air Pressure: 1010 hPa	Power: 48 VDC
Remarks:	

Plot 7.1.12 Peak spectral power density at high frequency

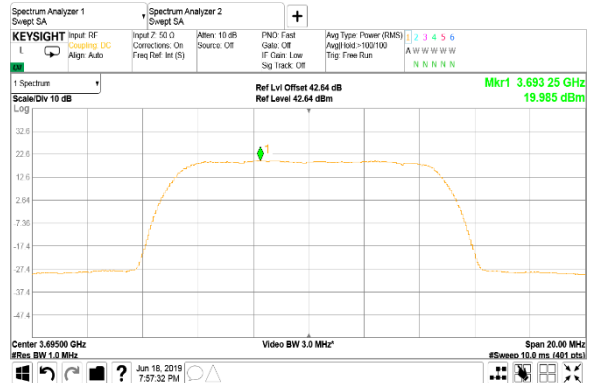
HANNEL SPACING:
ANTENNA CHAIN:
Modulation: QPSK



Modulation: 64QAM



10 MHz
4
Modulation: 16QAM



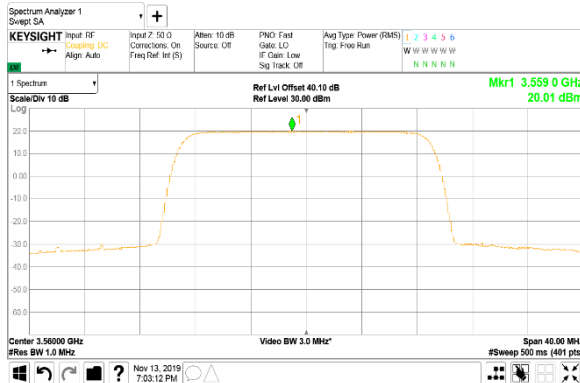


HERMON LABORATORIES

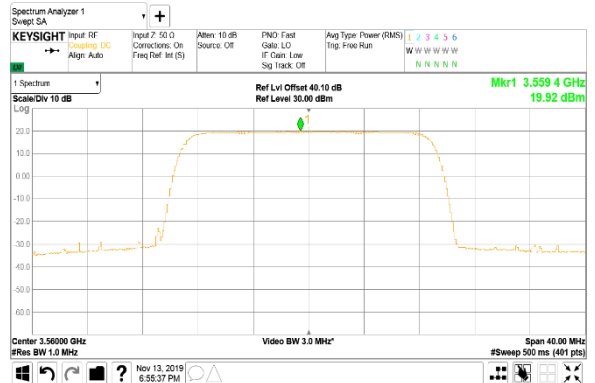
Test specification: Section 96.41(b), Maximum EIRP and maximum power spectral density	
Test procedure: Section 96.41(e)(3)	
Test mode: Compliance	Verdict: PASS
Date(s): 19-Jun-19	
Temperature: 24 °C	Relative Humidity: 52 %
Air Pressure: 1010 hPa	Power: 48 VDC
Remarks:	

Plot 7.1.13 Peak spectral power density at low frequency

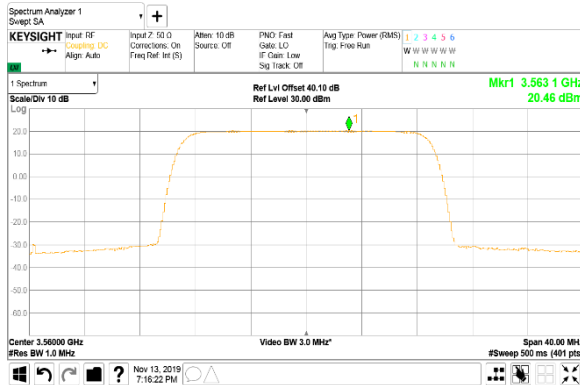
CHANNEL SPACING:
ANTENNA CHAIN:
Modulation: QPSK



20 MHz
1
Modulation: 16QAM



Modulation: 64QAM



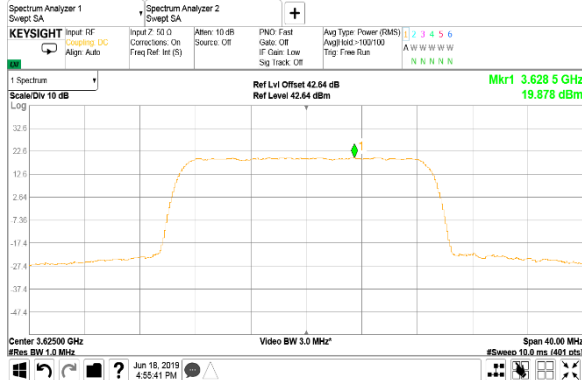


HERMON LABORATORIES

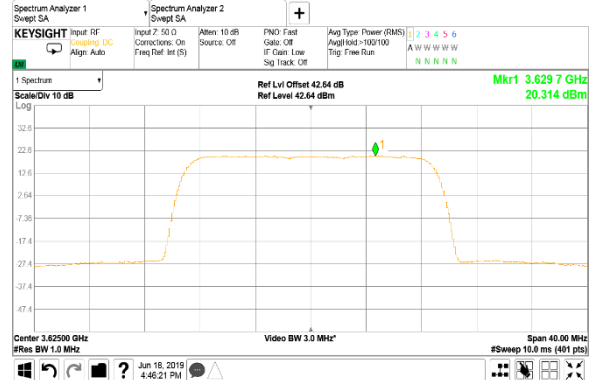
Test specification: Section 96.41(b), Maximum EIRP and maximum power spectral density			
Test procedure: Section 96.41(e)(3)			
Test mode: Compliance		Verdict: PASS	
Date(s): 19-Jun-19			
Temperature: 24 °C	Relative Humidity: 52 %	Air Pressure: 1010 hPa	Power: 48 VDC
Remarks:			

Plot 7.1.14 Peak spectral power density at mid frequency

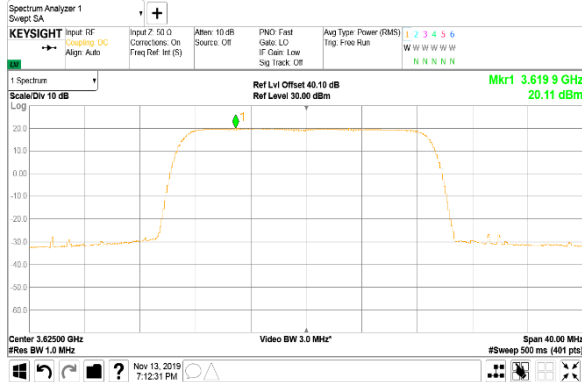
CHANNEL SPACING:
ANTENNA CHAIN:
Modulation: QPSK



20 MHz
1
Modulation: 16QAM



Modulation: 64QAM



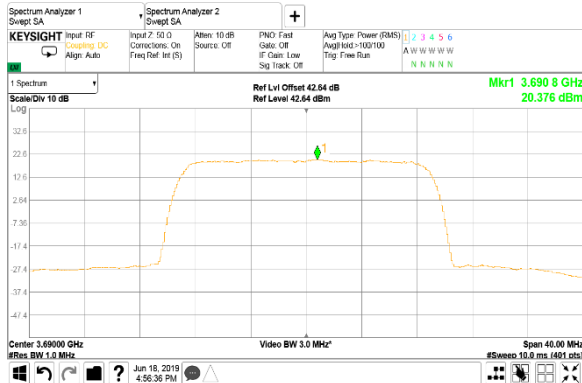


HERMON LABORATORIES

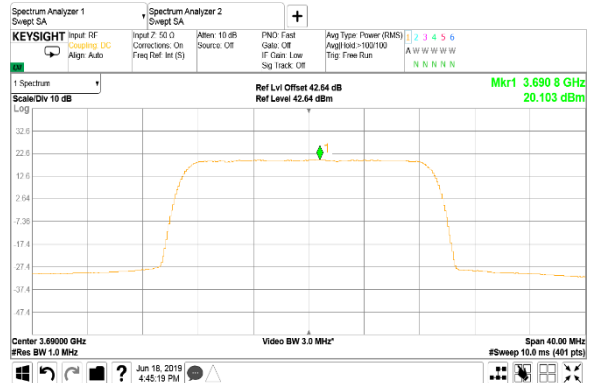
Test specification: Section 96.41(b), Maximum EIRP and maximum power spectral density			
Test procedure: Section 96.41(e)(3)			
Test mode: Compliance		Verdict: PASS	
Date(s): 19-Jun-19			
Temperature: 24 °C	Relative Humidity: 52 %	Air Pressure: 1010 hPa	Power: 48 VDC
Remarks:			

Plot 7.1.15 Peak spectral power density at high frequency

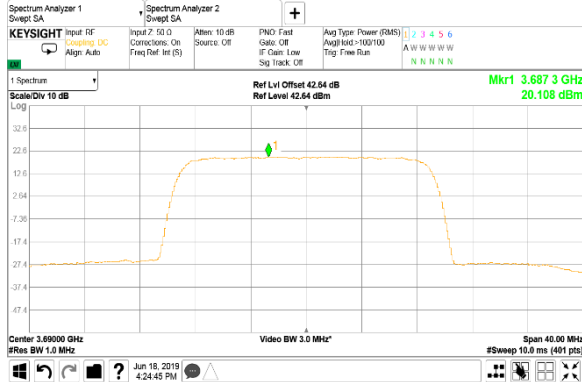
CHANNEL SPACING:
ANTENNA CHAIN:
Modulation: QPSK



20 MHz
1
Modulation: 16QAM



Modulation: 64QAM



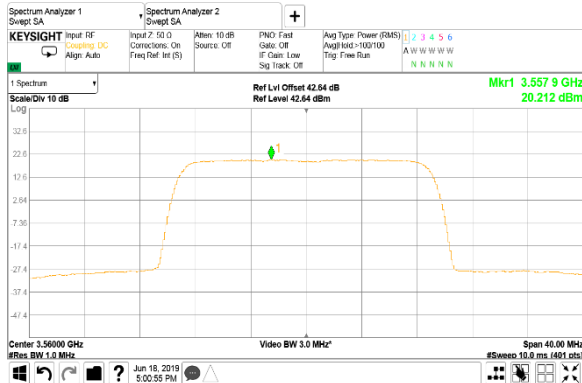


HERMON LABORATORIES

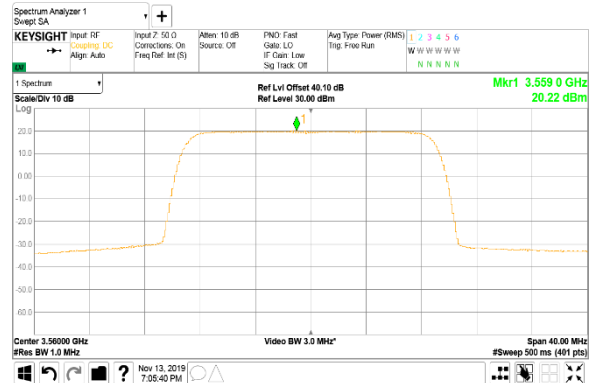
Test specification: Section 96.41(b), Maximum EIRP and maximum power spectral density			
Test procedure: Section 96.41(e)(3)			
Test mode: Compliance		Verdict: PASS	
Date(s): 19-Jun-19			
Temperature: 24 °C	Relative Humidity: 52 %	Air Pressure: 1010 hPa	Power: 48 VDC
Remarks:			

Plot 7.1.16 Peak spectral power density at low frequency

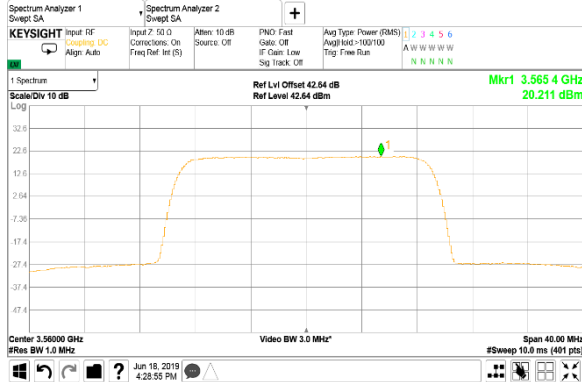
CHANNEL SPACING:
ANTENNA CHAIN:
Modulation: QPSK



20 MHz
2
Modulation: 16QAM



Modulation: 64QAM



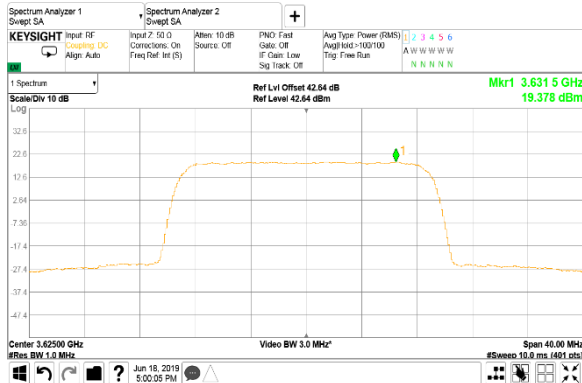


HERMON LABORATORIES

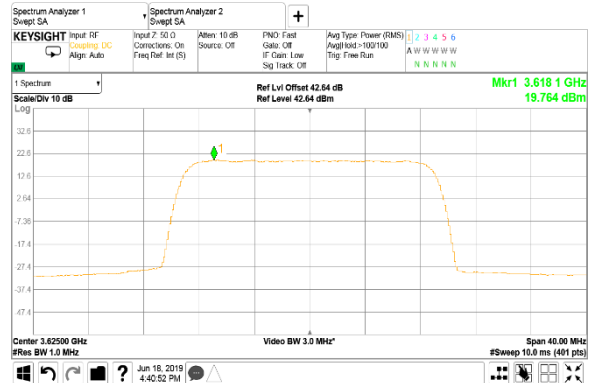
Test specification: Section 96.41(b), Maximum EIRP and maximum power spectral density			
Test procedure: Section 96.41(e)(3)			
Test mode: Compliance		Verdict: PASS	
Date(s): 19-Jun-19			
Temperature: 24 °C	Relative Humidity: 52 %	Air Pressure: 1010 hPa	Power: 48 VDC
Remarks:			

Plot 7.1.17 Peak spectral power density at mid frequency

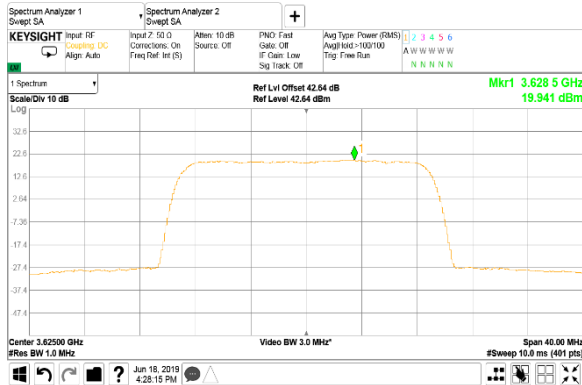
CHANNEL SPACING:
ANTENNA CHAIN:
Modulation: QPSK



20 MHz
2
Modulation: 16QAM



Modulation: 64QAM



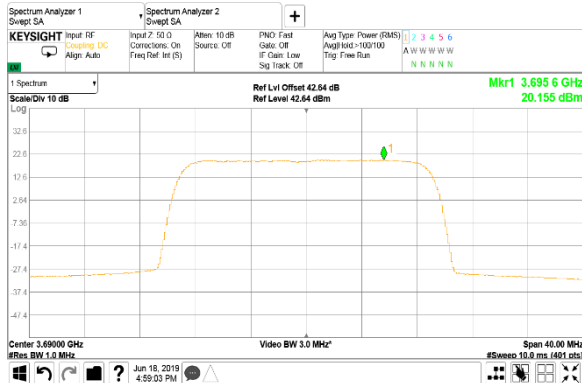


HERMON LABORATORIES

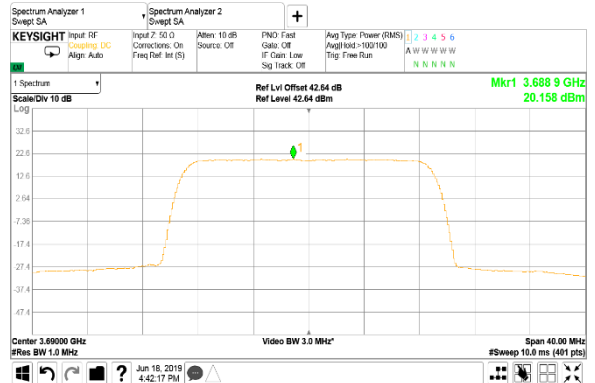
Test specification: Section 96.41(b), Maximum EIRP and maximum power spectral density			
Test procedure: Section 96.41(e)(3)			
Test mode: Compliance		Verdict: PASS	
Date(s): 19-Jun-19			
Temperature: 24 °C	Relative Humidity: 52 %	Air Pressure: 1010 hPa	Power: 48 VDC
Remarks:			

Plot 7.1.18 Peak spectral power density at high frequency

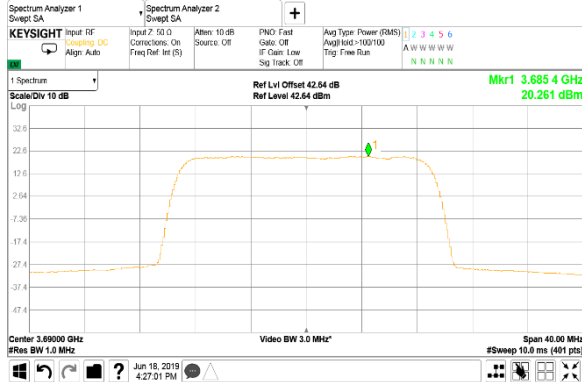
CHANNEL SPACING:
ANTENNA CHAIN:
Modulation: QPSK



20 MHz
2
Modulation: 16QAM



Modulation: 64QAM



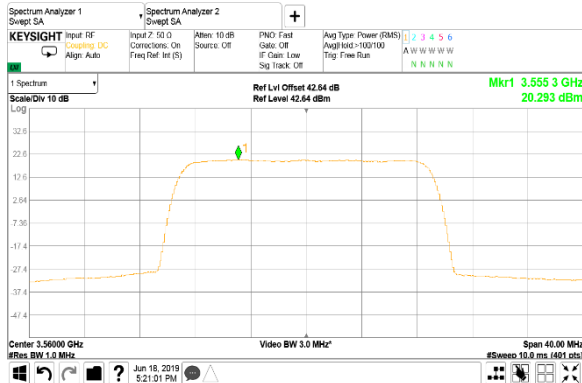


HERMON LABORATORIES

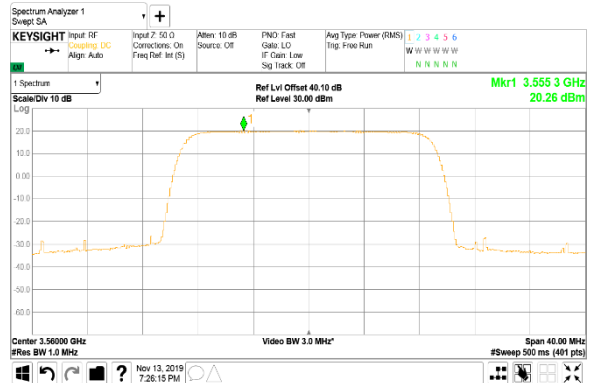
Test specification: Section 96.41(b), Maximum EIRP and maximum power spectral density			
Test procedure: Section 96.41(e)(3)			
Test mode: Compliance		Verdict: PASS	
Date(s): 19-Jun-19			
Temperature: 24 °C	Relative Humidity: 52 %	Air Pressure: 1010 hPa	Power: 48 VDC
Remarks:			

Plot 7.1.19 Peak spectral power density at low frequency

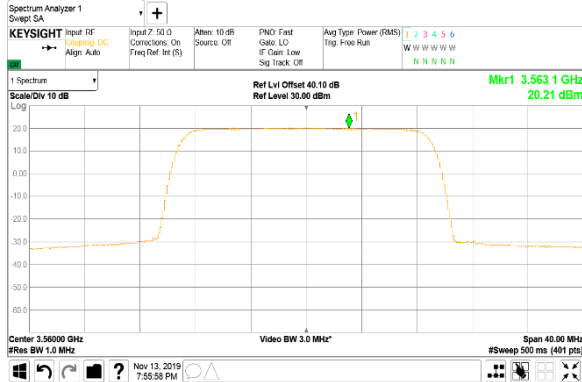
CHANNEL SPACING:
ANTENNA CHAIN:
Modulation: QPSK



20 MHz
3
Modulation: 16QAM



Modulation: 64QAM



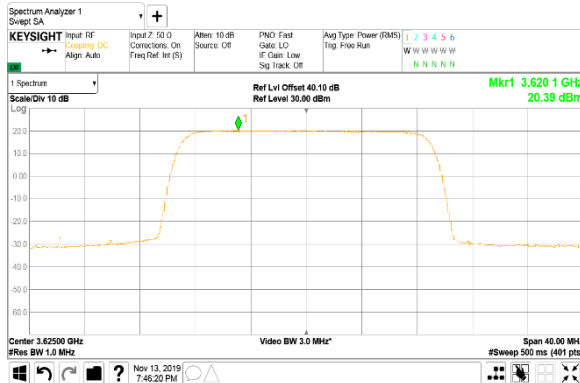


HERMON LABORATORIES

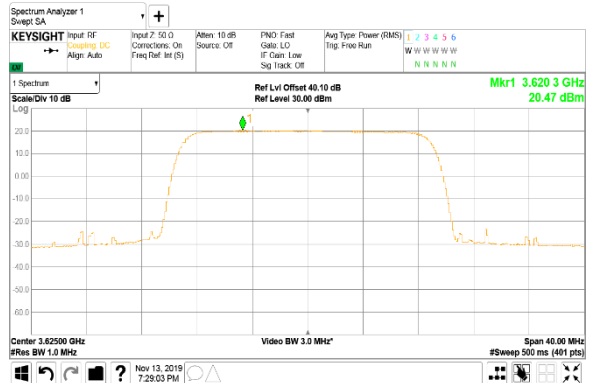
Test specification: Section 96.41(b), Maximum EIRP and maximum power spectral density			
Test procedure: Section 96.41(e)(3)			
Test mode: Compliance		Verdict: PASS	
Date(s): 19-Jun-19			
Temperature: 24 °C	Relative Humidity: 52 %	Air Pressure: 1010 hPa	Power: 48 VDC
Remarks:			

Plot 7.1.20 Peak spectral power density at mid frequency

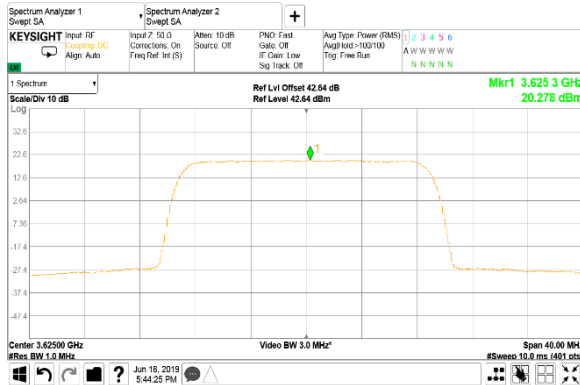
CHANNEL SPACING:
ANTENNA CHAIN:
Modulation: QPSK



20 MHz
3
Modulation: 16QAM



Modulation: 64QAM



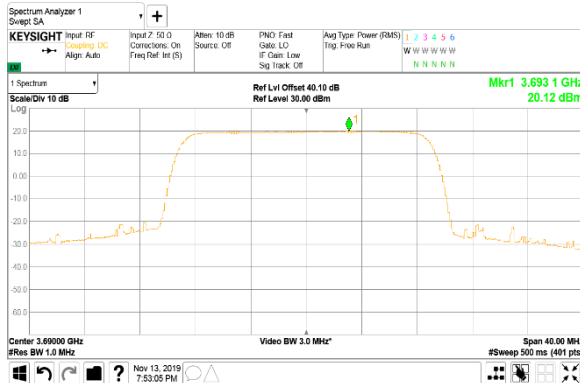


HERMON LABORATORIES

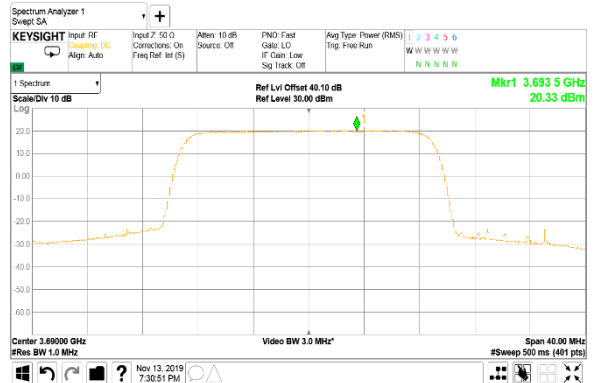
Test specification: Section 96.41(b), Maximum EIRP and maximum power spectral density			
Test procedure: Section 96.41(e)(3)			
Test mode: Compliance		Verdict: PASS	
Date(s): 19-Jun-19			
Temperature: 24 °C	Relative Humidity: 52 %	Air Pressure: 1010 hPa	Power: 48 VDC
Remarks:			

Plot 7.1.21 Peak spectral power density at high frequency

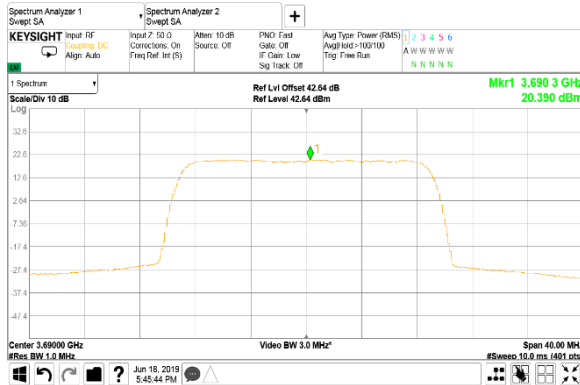
CHANNEL SPACING:
ANTENNA CHAIN:
Modulation: QPSK



20 MHz
3
Modulation: 16QAM



Modulation: 64QAM



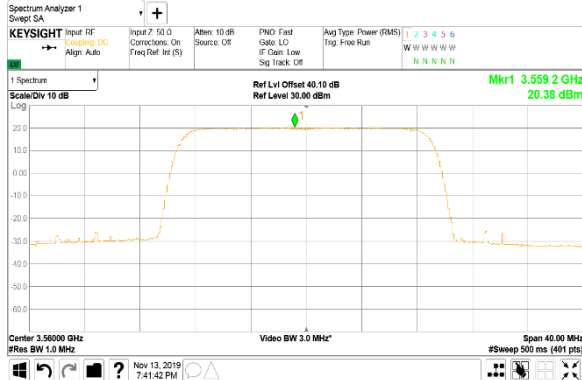


HERMON LABORATORIES

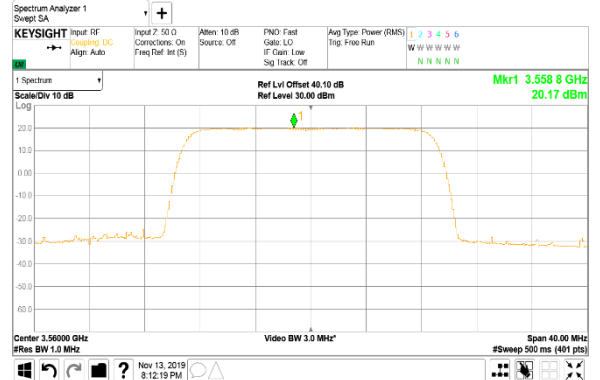
Test specification: Section 96.41(b), Maximum EIRP and maximum power spectral density			
Test procedure: Section 96.41(e)(3)			
Test mode: Compliance		Verdict: PASS	
Date(s): 19-Jun-19			
Temperature: 24 °C	Relative Humidity: 52 %	Air Pressure: 1010 hPa	Power: 48 VDC
Remarks:			

Plot 7.1.22 Peak spectral power density at low frequency

CHANNEL SPACING:
ANTENNA CHAIN:
Modulation: QPSK



20 MHz
4
Modulation: 16QAM



Modulation: 64QAM



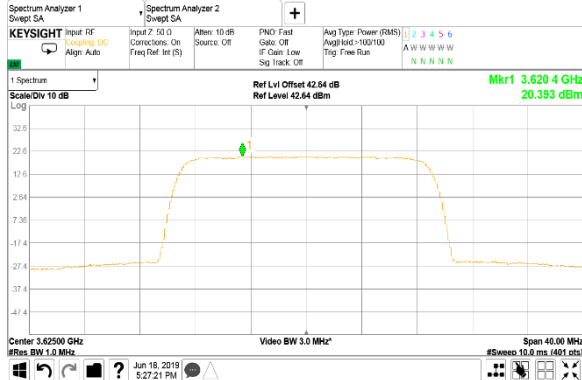


HERMON LABORATORIES

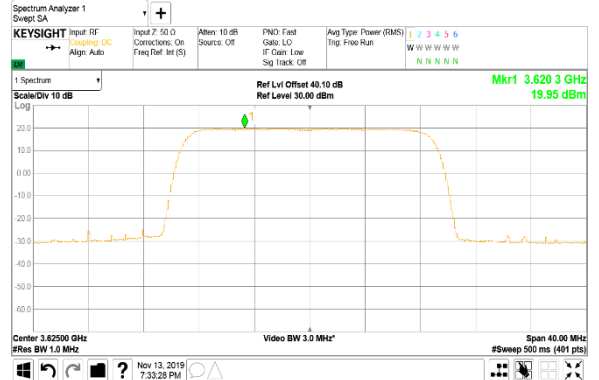
Test specification: Section 96.41(b), Maximum EIRP and maximum power spectral density			
Test procedure: Section 96.41(e)(3)			
Test mode: Compliance		Verdict: PASS	
Date(s): 19-Jun-19			
Temperature: 24 °C	Relative Humidity: 52 %	Air Pressure: 1010 hPa	Power: 48 VDC
Remarks:			

Plot 7.1.23 Peak spectral power density at mid frequency

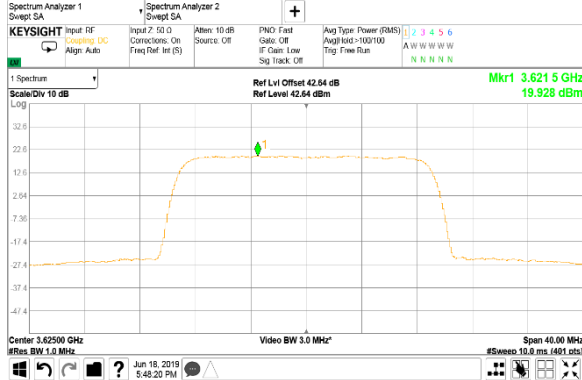
CHANNEL SPACING:
ANTENNA CHAIN:
Modulation: QPSK



20 MHz
4
Modulation: 16QAM



Modulation: 64QAM



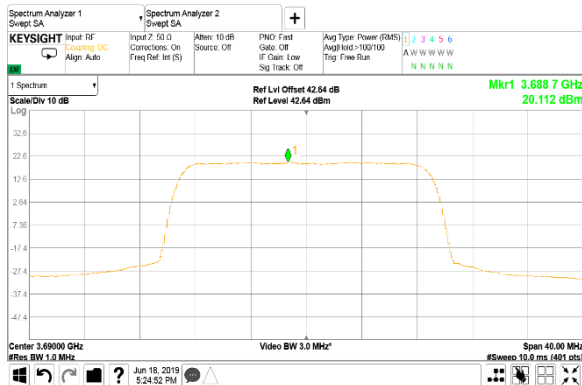


HERMON LABORATORIES

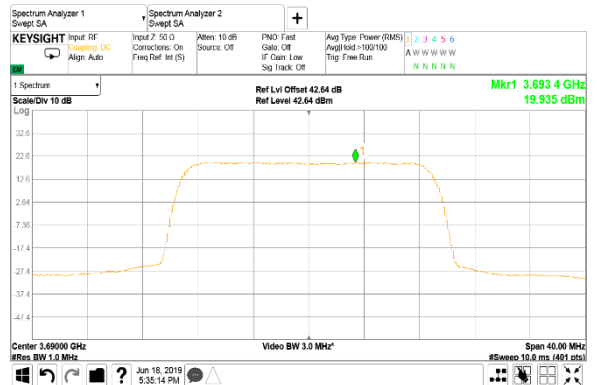
Test specification: Section 96.41(b), Maximum EIRP and maximum power spectral density			
Test procedure: Section 96.41(e)(3)			
Test mode: Compliance		Verdict: PASS	
Date(s): 19-Jun-19			
Temperature: 24 °C	Relative Humidity: 52 %	Air Pressure: 1010 hPa	Power: 48 VDC
Remarks:			

Plot 7.1.24 Peak spectral power density at high frequency

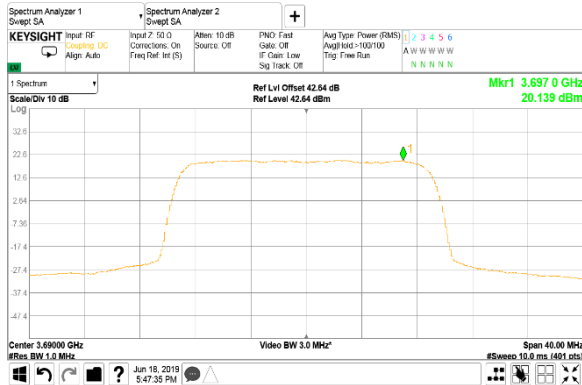
CHANNEL SPACING:
ANTENNA CHAIN:
Modulation: QPSK



20 MHz
4
Modulation: 16QAM



Modulation: 64QAM





Test specification: Section 96.41(e), Emission mask			
Test procedure: Section 96.41(e)(3)			
Test mode: Compliance		Verdict: PASS	
Date(s): 19-Jun-19			
Temperature: 24 °C	Relative Humidity: 52 %	Air Pressure: 1010 hPa	Power: 48 VDC
Remarks:			

7.2 Emission mask test

7.2.1 General

This test was performed to measure emission mask at RF antenna connector. Specification test limits are given in Table 7.2.1.

Table 7.2.1 Emission mask limits

Frequency displacement from frequency block	Limit*, dBm/MHz	RBW, kHz
Channel Spacing 10 MHz		
0 – 1 MHz	- 13	100
0 – 10 MHz	- 13	1000
10 – 20 MHz	- 25	1000
Above 3530 MHz and below 3720 MHz	- 25	1000
Below 3530 MHz and above 3720 MHz	- 40	1000
Channel Spacing 20 MHz		
0 – 1 MHz	- 13	200
0 – 10 MHz	- 13	1000
10 – 20 MHz	- 25	1000
Above 3530 MHz and below 3720 MHz	- 25	1000
Below 3530 MHz and above 3720 MHz	- 40	1000

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

7.2.2 Test procedure

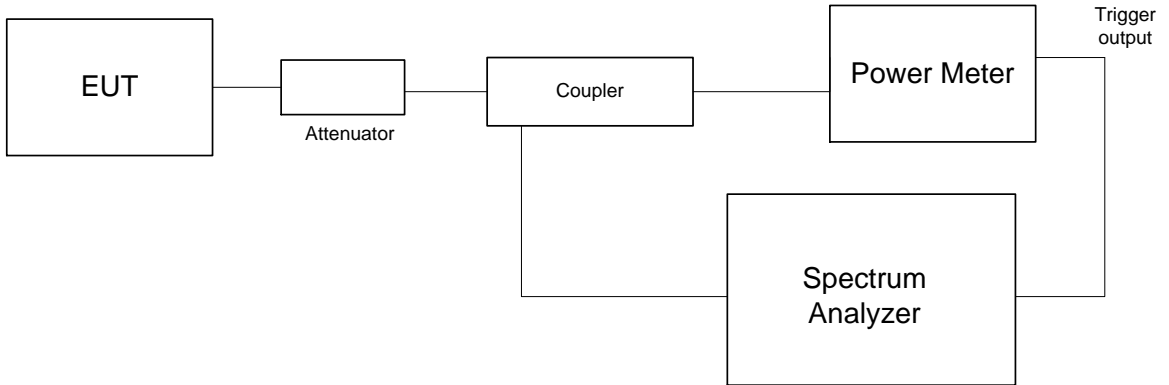
7.2.2.1 The EUT was set up as shown in Figure 7.2.1, energized and its proper operation was checked.

7.2.2.2 The emission mask was measured with spectrum analyzer as provided in Table 7.2.2, Table 7.2.3 and the the associated plots.



Test specification: Section 96.41(e), Emission mask			
Test procedure: Section 96.41(e)(3)			
Test mode: Compliance		Verdict: PASS	
Date(s): 19-Jun-19			
Temperature: 24 °C	Relative Humidity: 52 %	Air Pressure: 1010 hPa	Power: 48 VDC
Remarks:			

Figure 7.2.1 Emission mask test setup





Test specification: Section 96.41(e), Emission mask			
Test procedure: Section 96.41(e)(3)			
Test mode: Compliance		Verdict: PASS	
Date(s): 19-Jun-19			
Temperature: 24 °C	Relative Humidity: 52 %	Air Pressure: 1010 hPa	Power: 48 VDC
Remarks:			

Table 7.2.2 Emission mask test results, CS=10 MHz

Modulation	Carrier frequency, MHz	Frequency displacement from EA frequency block	Test result, dBm/MHz	Limit*, dBm/MHz	Verdict
QPSK	Mid	Within 0 to 10 MHz	-27.08	-16.0	Pass
		Greater than 10 MHz	-37.54	-28.0	Pass
16QAM	Mid	Within 0 to 10 MHz	-25.96	-16.0	Pass
		Greater than 10 MHz	-36.98	-28.0	Pass
64QAM	Mid	Within 0 to 10 MHz	-24.36	-16.0	Pass
		Greater than 10 MHz	-37.60	-28.0	Pass

*The limit was reduced by $10 \cdot \log(N)$, where $N=2$ – is number of antennas.

Table 7.2.3 Emission mask test results, CS=20 MHz

Modulation	Carrier frequency, MHz	Frequency displacement from EA frequency block	Test result dBm/MHz	Limit* dBm/MHz	Verdict
QPSK	Mid	Within 0 to 10 MHz	-28.90	-16.0	Pass
		Greater than 10 MHz	-34.11	-28.0	Pass
16QAM	Mid	Within 0 to 10 MHz	-28.02	-16.0	Pass
		Greater than 10 MHz	-33.81	-28.0	Pass
64QAM	Mid	Within 0 to 10 MHz	-25.30	-16.0	Pass
		Greater than 10 MHz	-31.25	-28.0	Pass

*The limit was reduced by $10 \cdot \log(N)$, where $N=2$ – is number of antennas.

Reference numbers of test equipment used

HL 5376	HL 5409				
---------	---------	--	--	--	--

Full description is given in Appendix A.

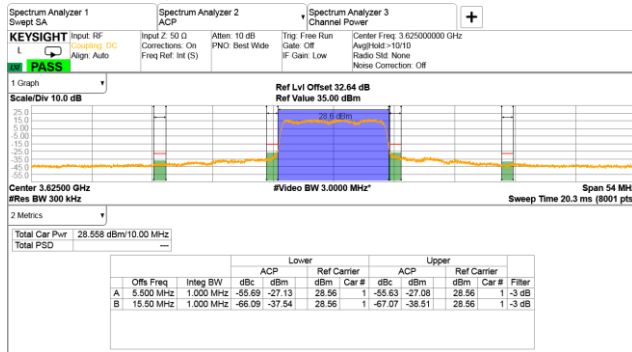


HERMON LABORATORIES

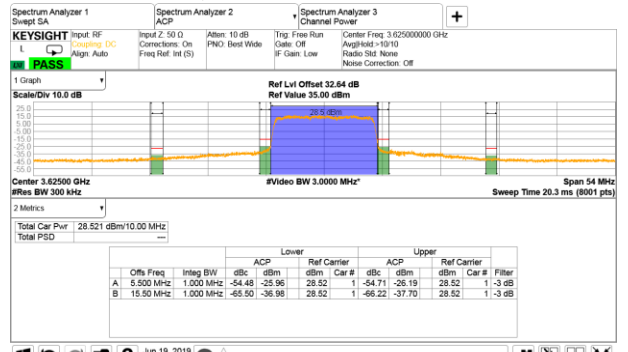
Test specification: Section 96.41(e), Emission mask			
Test procedure: Section 96.41(e)(3)			
Test mode: Compliance		Verdict: PASS	
Date(s): 19-Jun-19			
Temperature: 24 °C	Relative Humidity: 52 %	Air Pressure: 1010 hPa	Power: 48 VDC
Remarks:			

Plot 7.2.1 Emission outside the fundamental test results at mid carrier frequency

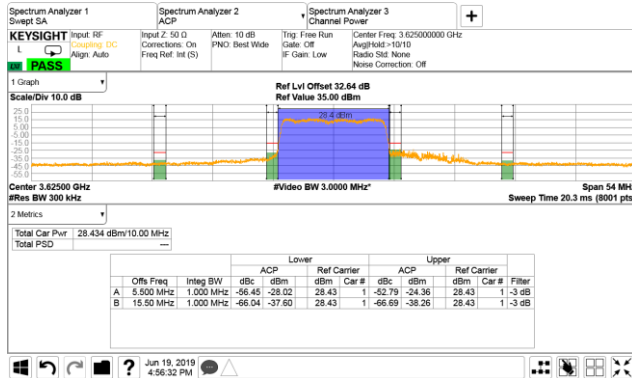
CHANNEL SPACING:
ANTENNA CHAIN:
Modulation: QPSK



10 MHz
4
Modulation: 16 QAM



Modulation: 64 QAM



Spectrum Offset = Attenuator + DC factor = 30 + 2.64 = 32.64 dB

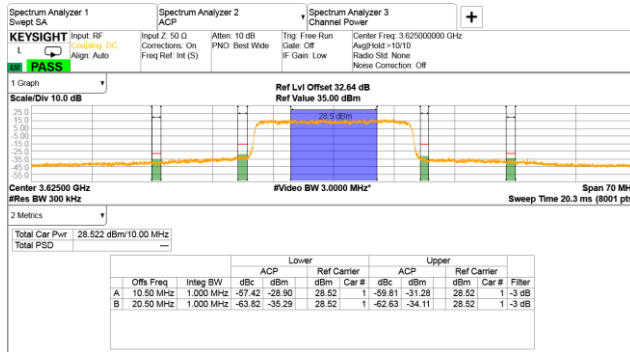


HERMON LABORATORIES

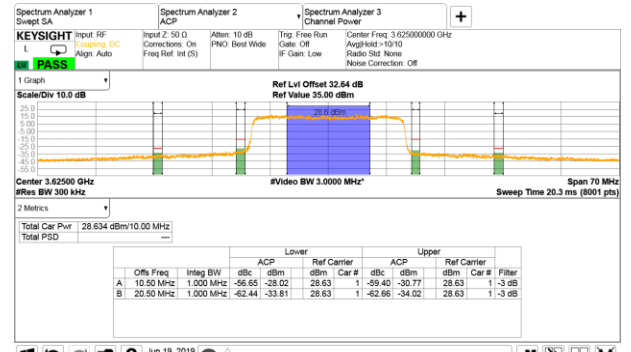
Test specification: Section 96.41(e), Emission mask			
Test procedure: Section 96.41(e)(3)			
Test mode: Compliance		Verdict: PASS	
Date(s): 19-Jun-19			
Temperature: 24 °C	Relative Humidity: 52 %	Air Pressure: 1010 hPa	Power: 48 VDC
Remarks:			

Plot 7.2.2 Emission outside the fundamental test results at mid carrier frequency

CHANNEL SPACING:
ANTENNA CHAIN:
Modulation: QPSK



20 MHz
4
Modulation: 16 QAM



Modulation: 64 QAM



Spectrum Offset = Attenuator + DC factor = 30 + 2.64 = 32.64 dB



Test specification: Section 96.41(e)(3), Conducted spurious emissions			
Test procedure: Section 96.41(e)(3)			
Test mode: Compliance		Verdict: PASS	
Date(s): 19-Jun-19			
Temperature: 24 °C	Relative Humidity: 54 %	Air Pressure: 1010 hPa	Power: 48 VDC
Remarks:			

7.3 Spurious emissions at RF antenna connector test

7.3.1 General

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

Table 7.3.1 Spurious emission limits

Frequency offset from channel band edge, MHz	Attenuation below carrier, dBc	ERP of spurious, dBm
0 – 10	NA	-13.0
10 – 20	NA	-25.0
More than 20	NA	-40.0

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

** - P is transmitter output power in Watts

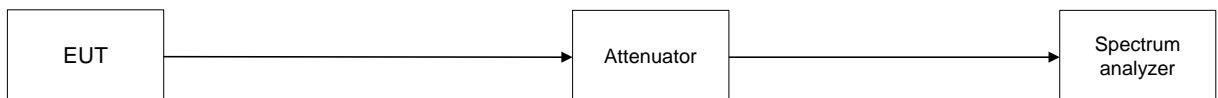
7.3.2 Test procedure

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

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

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

Figure 7.3.1 Spurious emission test setup





Test specification: Section 96.41(e)(3), Conducted spurious emissions			
Test procedure: Section 96.41(e)(3)			
Test mode: Compliance		Verdict: PASS	
Date(s): 19-Jun-19			
Temperature: 24 °C	Relative Humidity: 54 %	Air Pressure: 1010 hPa	Power: 48 VDC
Remarks:			

Table 7.3.2 Spurious emission test results

ASSIGNED FREQUENCY RANGE: 3550 - 3700 MHz
 INVESTIGATED FREQUENCY RANGE: 0.009 – 37000 MHz
 DETECTOR USED: Peak
 VIDEO BANDWIDTH: ≥ Resolution bandwidth
 MODULATION: QPSK
 MODULATING SIGNAL: PRBS
 CHANNEL SPACING: 10 MHz
 TRANSMITTER OUTPUT POWER SETTINGS: Maximum

Frequency, MHz	SA reading, dBm	Attenuator, dB	Cable loss, dB	RBW, kHz	Spurious emission, dBm	Attenuation below carrier, dBc	Limit, dBc	Margin, dB*	Verdict
Low carrier frequency 3555 MHz									
No emissions were found									Pass
Mid carrier frequency 3625 MHz									
No emissions were found									Pass
High carrier frequency 3695 MHz									
No emissions were found									Pass

*- Margin = Spurious emission – specification limit.

Note: in 0.009-18000 MHz range the offset 31.6 dB included: attenuator 30 dB, cables loss 1.6 dB
in 18-37 GHz range the offset 32.9 dB included: attenuator 30 dB, cables loss 2.9 dB

Reference numbers of test equipment used

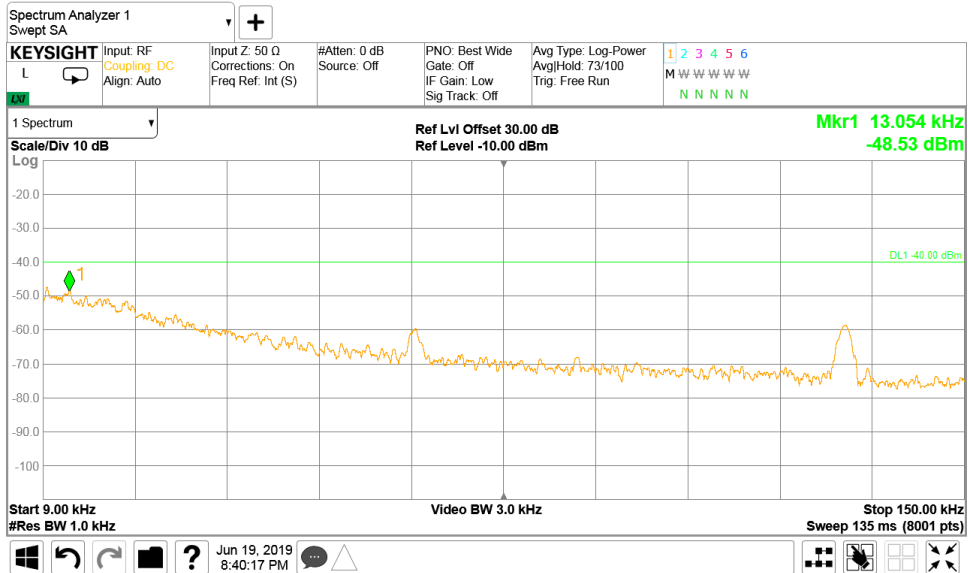
HL 4355	HL 3818	HL 3903	HL 3434	HL 4366	HL 5286
HL 3287	HL 4342	HL 5174	HL 5175		

Full description is given in Appendix A.

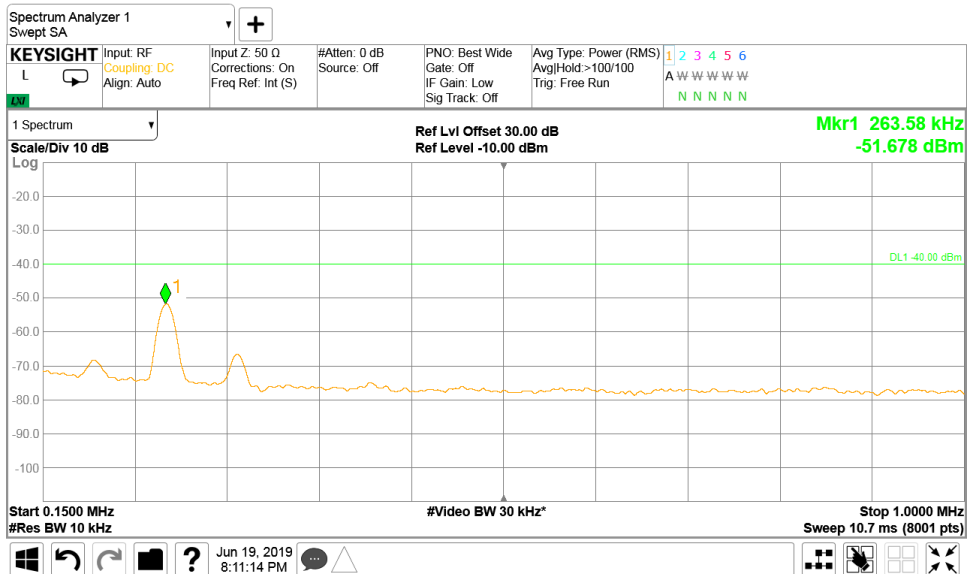


Test specification: Section 96.41(e)(3), Conducted spurious emissions			
Test procedure: Section 96.41(e)(3)			
Test mode: Compliance		Verdict: PASS	
Date(s): 19-Jun-19			
Temperature: 24 °C	Relative Humidity: 54 %	Air Pressure: 1010 hPa	Power: 48 VDC
Remarks:			

Plot 7.3.1 Spurious emission measurements in 9 - 150 kHz range at mid carrier frequency



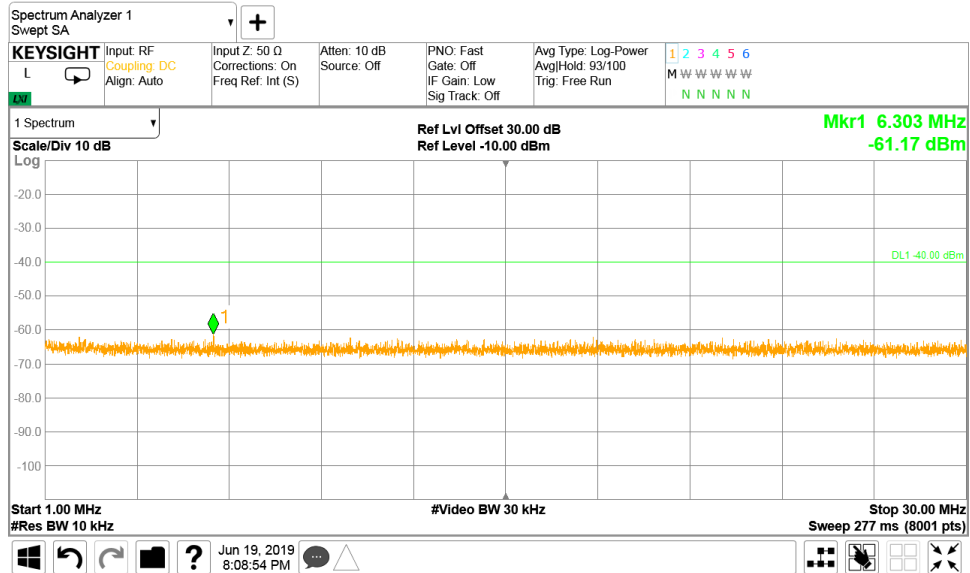
Plot 7.3.2 Spurious emission measurements in 0.15 - 1 MHz range at mid carrier frequency



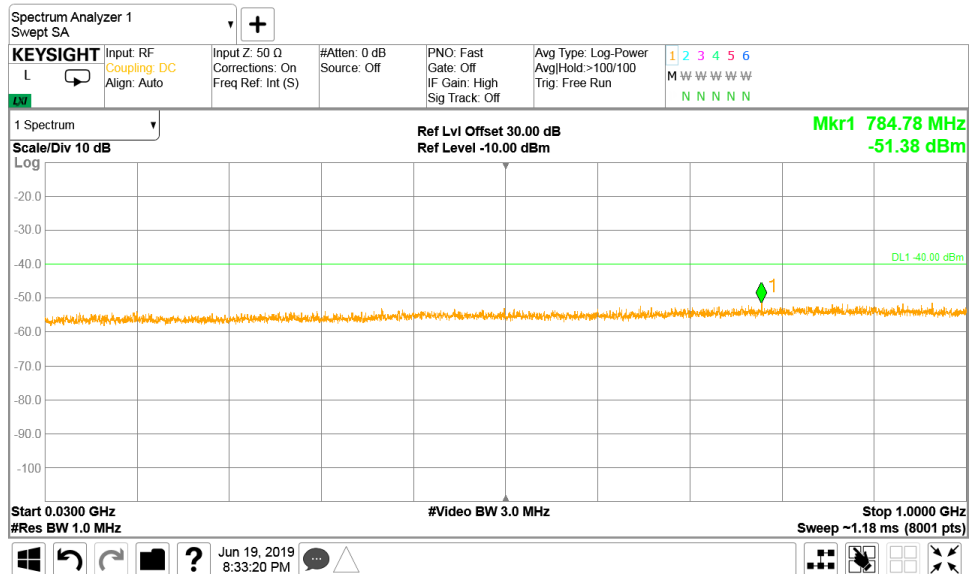


Test specification: Section 96.41(e)(3), Conducted spurious emissions			
Test procedure: Section 96.41(e)(3)			
Test mode: Compliance		Verdict: PASS	
Date(s): 19-Jun-19			
Temperature: 24 °C	Relative Humidity: 54 %	Air Pressure: 1010 hPa	Power: 48 VDC
Remarks:			

Plot 7.3.3 Spurious emission measurements in 1- 30.0 MHz range at mid carrier frequency



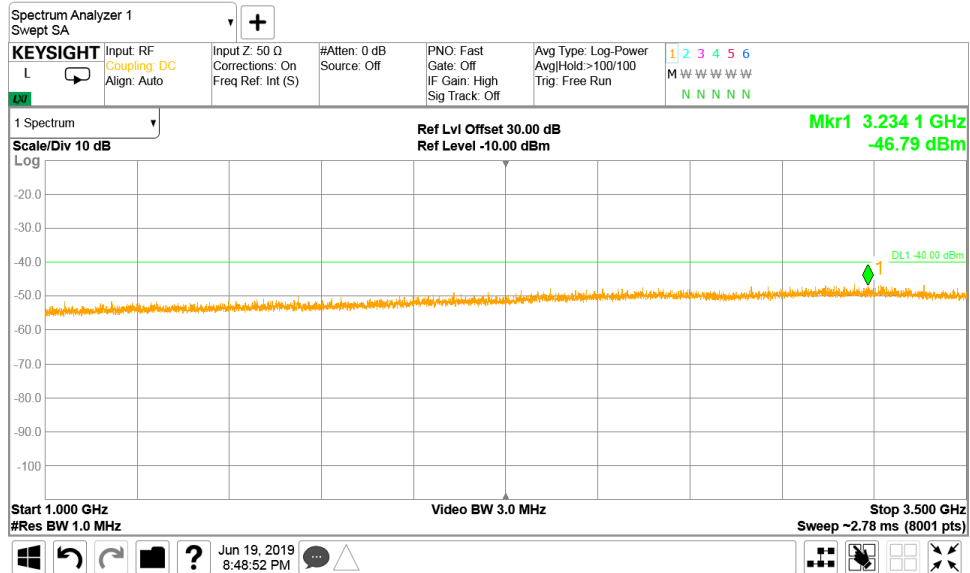
Plot 7.3.4 Spurious emission measurements in 30.0 - 1000 MHz range at mid carrier frequency



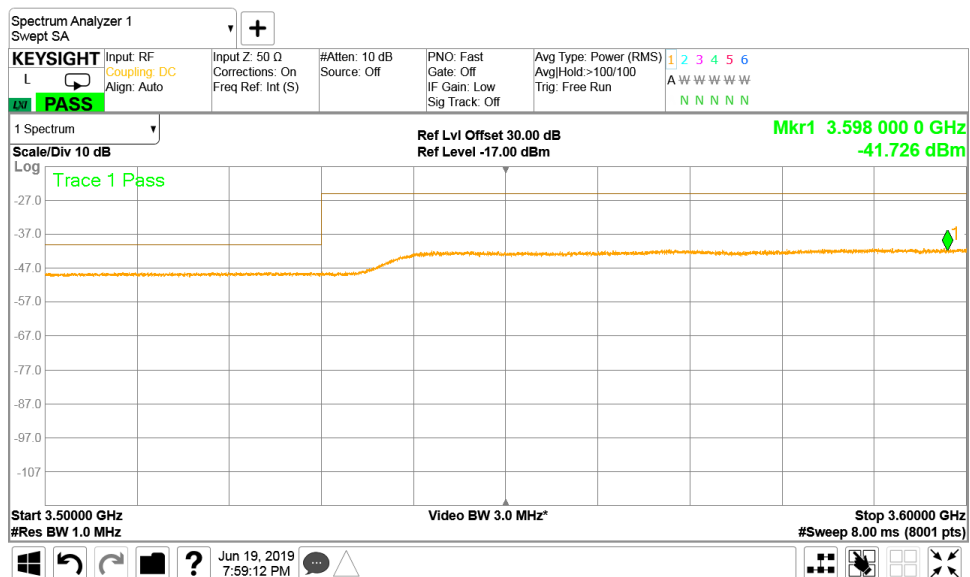


Test specification: Section 96.41(e)(3), Conducted spurious emissions			
Test procedure: Section 96.41(e)(3)			
Test mode: Compliance		Verdict: PASS	
Date(s): 19-Jun-19			
Temperature: 24 °C	Relative Humidity: 54 %	Air Pressure: 1010 hPa	Power: 48 VDC
Remarks:			

Plot 7.3.5 Spurious emission measurements in 1000 - 3500 MHz at mid carrier frequency



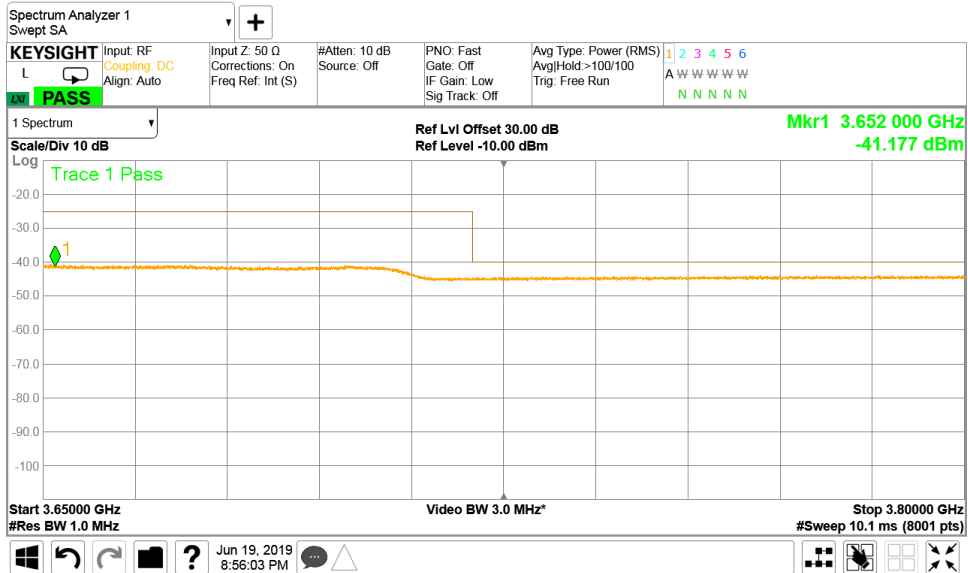
Plot 7.3.6 Spurious emission measurements in 3500 - 3600 MHz at mid carrier frequency



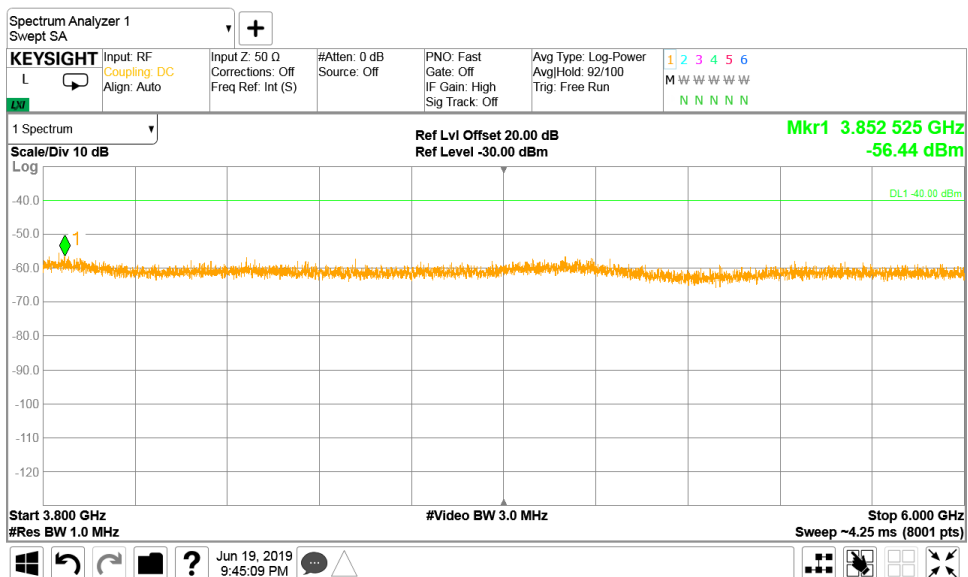


Test specification: Section 96.41(e)(3), Conducted spurious emissions			
Test procedure: Section 96.41(e)(3)			
Test mode: Compliance		Verdict: PASS	
Date(s): 19-Jun-19			
Temperature: 24 °C	Relative Humidity: 54 %	Air Pressure: 1010 hPa	Power: 48 VDC
Remarks:			

Plot 7.3.7 Spurious emission measurements in 3650 - 3800 MHz range at mid carrier frequency



Plot 7.3.8 Spurious emission measurements in 3800 - 6000 MHz at mid carrier frequency

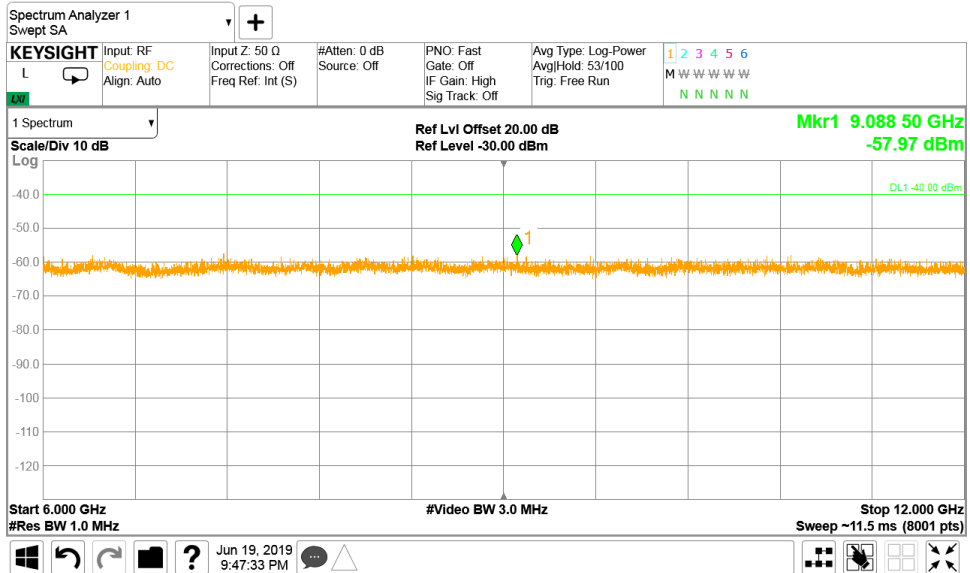




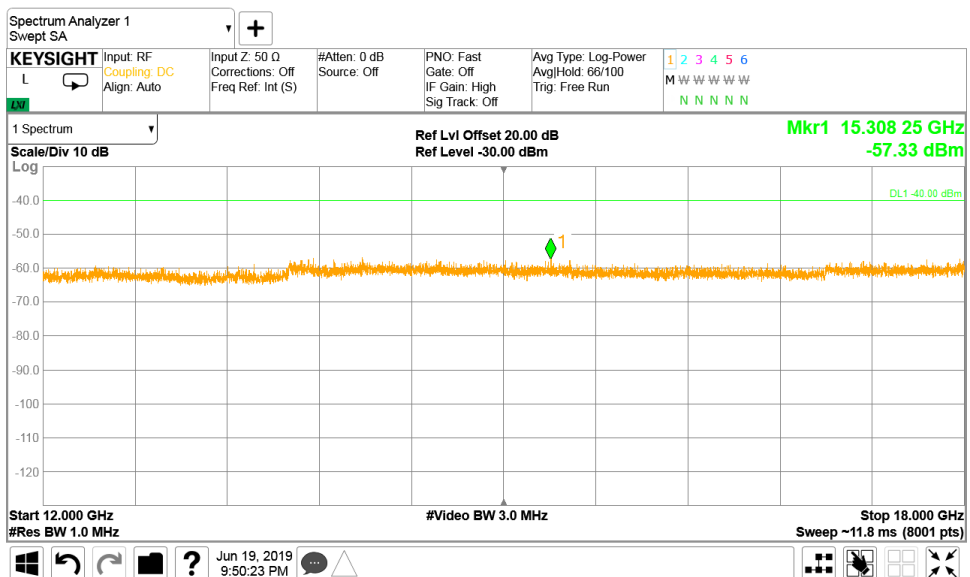
HERMON LABORATORIES

Test specification: Section 96.41(e)(3), Conducted spurious emissions			
Test procedure: Section 96.41(e)(3)			
Test mode: Compliance		Verdict: PASS	
Date(s): 19-Jun-19			
Temperature: 24 °C	Relative Humidity: 54 %	Air Pressure: 1010 hPa	Power: 48 VDC
Remarks:			

Plot 7.3.9 Spurious emission measurements in 6000 - 12000 MHz at mid carrier frequency



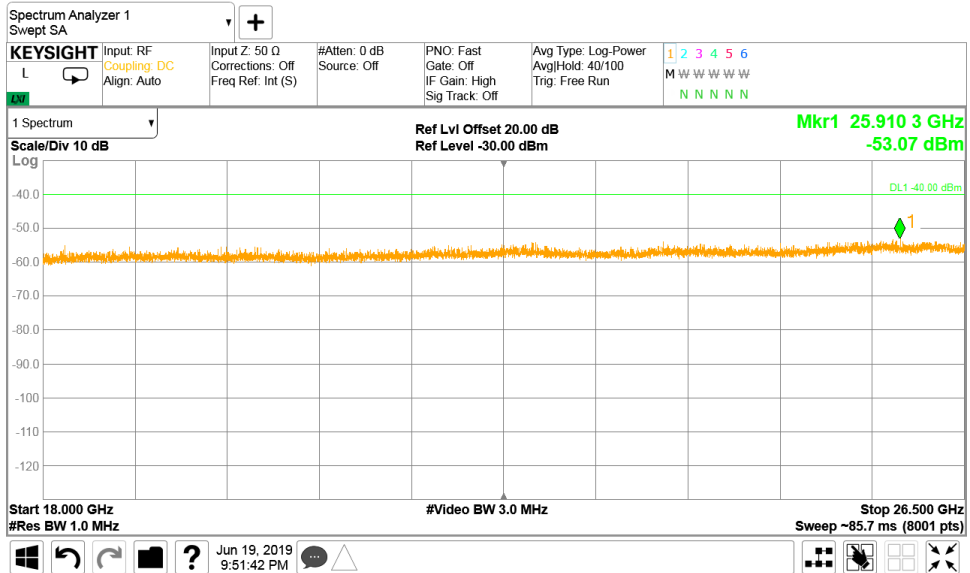
Plot 7.3.10 Spurious emission measurements in 12000 - 18000 MHz at mid carrier frequency



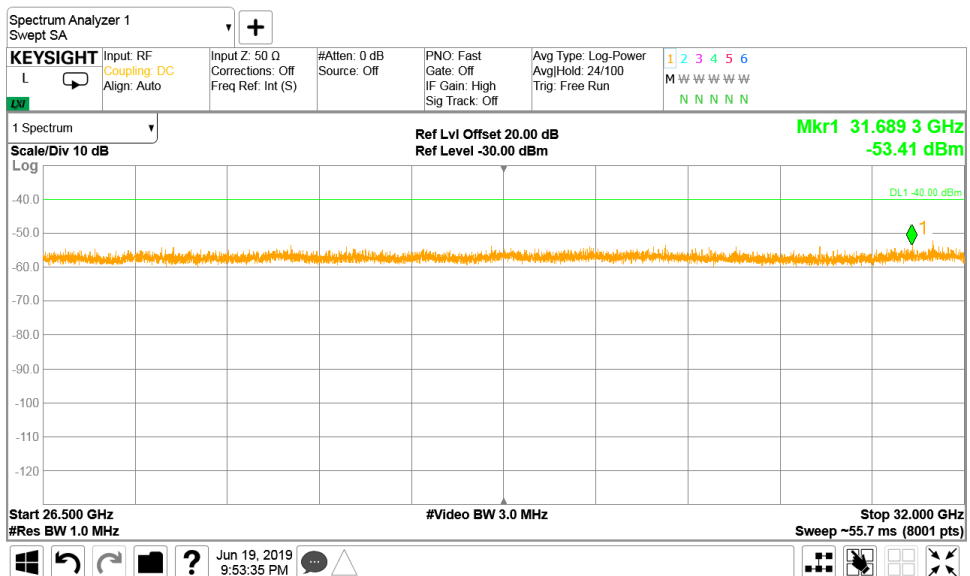


Test specification: Section 96.41(e)(3), Conducted spurious emissions			
Test procedure: Section 96.41(e)(3)			
Test mode: Compliance		Verdict: PASS	
Date(s): 19-Jun-19			
Temperature: 24 °C	Relative Humidity: 54 %	Air Pressure: 1010 hPa	Power: 48 VDC
Remarks:			

Plot 7.3.11 Spurious emission measurements in 18000 - 26500 MHz at mid carrier frequency



Plot 7.3.12 Spurious emission measurements in 26500 - 32000 MHz at mid carrier frequency

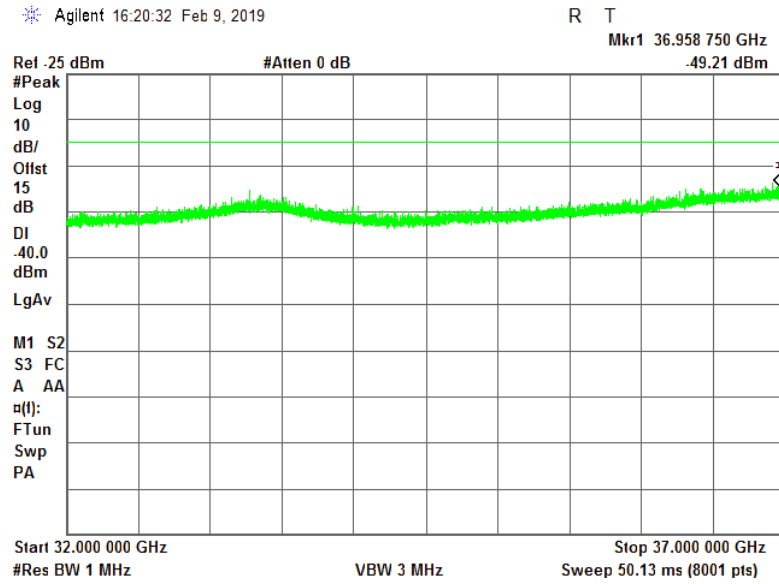




HERMON LABORATORIES

Test specification: Section 96.41(e)(3), Conducted spurious emissions			
Test procedure: Section 96.41(e)(3)			
Test mode: Compliance		Verdict: PASS	
Date(s): 19-Jun-19			
Temperature: 24 °C	Relative Humidity: 54 %	Air Pressure: 1010 hPa	Power: 48 VDC
Remarks:			

Plot 7.3.13 Spurious emission measurements in 32000 - 37000 MHz at mid carrier frequency



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

HL No	Description	Manufacturer	Model	Ser. No.	Last Cal./ Check	Due Cal./ Check
3287	Low pass filter, DC-3.0 GHz	Unknown	NA	3287	05-Jun-19	05-Jun-20
3301	Power Meter, P-series, 50 MHz to 40 GHz	Agilent Technologies	N1911A	MY45101057	28-Apr-19	28-Apr-20
3302	Power sensor, P-Series, 50 MHz to 40 GHz, -35/30 to 20 dBm	Agilent Technologies	N1922A	MY45240586	28-Apr-19	28-Apr-20
3434	Test Cable , DC-18 GHz, 1.5 m, SMA - SMA	Mini-Circuits	CBL-5FT-SMSM+	25683	15-Apr-19	15-Apr-20
3818	PSA Series Spectrum Analyzer, 3 Hz- 44 GHz	Agilent Technologies	E4446A	MY48250288	24-Apr-19	24-Apr-20
3903	Microwave Cable Assembly, 40.0 GHz, 1.5 m, SMA/SMA	Huber-Suhner	SUCOFL EX 102A	1226/2A	07-Apr-19	07-Apr-20
4342	High Pass Filter, 50 Ohm, 10.6 to 26.5 GHz,SMA-M / SMA-FM	RLC Electronics	F-5738A	8425	05-Jun-19	05-Jun-20
4355	Signal and Spectrum Analyzer, 9 kHz to 7 GHz	Rohde & Schwarz	FSV 7	101630	28-Jun-19	28-Jun-20
4366	Directional coupler, 1 GHz to 18 GHz, 10 dB, SMA Female	Tiger Micro-Electronics Institute	TGD-A1101-10	01e-JSDE805-007	21-May-18	21-May-20
5174	Medium Power Fixed Coaxial Attenuator DC to 40 GHz, 10 dB, 5 W	API Weinschel, Inc	75A-10-12	TD854	07-Apr-19	07-Apr-20
5175	Medium Power Fixed Coaxial Attenuator DC to 40 GHz, 20 dB, 5 W	API Weinschel, Inc	75A-20-12	TE289	07-Apr-19	07-Apr-20
5286	Band Pass Filter, 50 Ohm, 4.4 to 18 GHz, SMA/M-SMA/F	A-INFOMW	WBLB-T-HP-4.4-18-S	J10800000305	05-Jun-19	05-Jun-20
5376	EXA Signal Analyzer, 10 Hz - 32 GHz	Keysight Technologies	N9010B	MY57470404	18-Mar-19	18-Mar-20
5409	RF cable, 40 GHz, SMA-SMA, 2 m	Huber-Suhner	SF102EA/11SK/11SK/2000M	503973/2EA	19-Aug-18	19-Aug-19

**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 relevant parts of Code of Federal Regulations 47 (CFR 47), Test Firm Registration Number is 927748, Designation Number is IL1001; Recognized by Innovation, Science and Economic Development Canada for wireless and terminal testing (ISED), ISED #2186A, CAB identifier is IL1001; Certified by VCCI, Japan (the registration numbers are R-10808 for OATS, R-1082 for anechoic chamber, G-10869 for RE measurements above 1 GHz, C-10845 for conducted emissions site and T-11606 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).

Address: P.O. Box 23, Binyamina 3055001, Israel.
Telephone: +972 4628 8001
Fax: +972 4628 8277
e-mail: mail@hermonlabs.com
website: www.hermonlabs.com

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

11 APPENDIX D Specification references

FCC 47CFR part 96: 2018	Citizens Broadband Radio Service
FCC 47CFR part 1: 2018	Practice and procedure
FCC 47CFR part 2: 2018	Frequency allocations and radio treaty matters; general rules and regulations
ANSI C63.26:2015	American National Standard for Compliance Testing of Transmitters Used in Licensed Radio Services
ANSI C63.2: 1996	American National Standard for Instrumentation-Electromagnetic Noise and Field Strength, 10 kHz to 40 GHz-Specifications.
ANSI C63.4: 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.
KDB 971168 D01 v03r01	Measurement Guidance for Certification of Licensed Digital Transmitters
KDB 940660 D01 v01	Certification and Test Procedures for Citizens Broadband Radio Service Devices Authorized under Part 96
KDB 662911 D01 v02r01	Emissions Testing of Transmitters with Multiple Outputs in the Same Band
KDB 662911 D02 v01	MIMO with Cross-Polarized Antenna



12 APPENDIX E Test equipment correction factors

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
RF Cable, Huber-Suhner, 40 GHz, 2 m, ,
SF102EA/11SK/11SK/2000MM, S/N 503973/2EA
HL 5409

Frequency, MHz	Cable loss, dB	Frequency, MHz	Cable loss, dB
100	0.26	20500	3.75
200	0.36	21000	3.80
300	0.45	21500	3.85
500	0.58	22000	3.90
1000	0.82	22500	3.95
1500	0.99	23000	4.00
2000	1.15	23500	4.04
2500	1.28	24000	4.09
3000	1.40	24500	4.13
3500	1.51	25000	4.19
4000	1.61	25500	4.25
4500	1.71	26000	4.30
5000	1.80	26500	4.37
5500	1.89	27000	4.45
6000	1.98	27500	4.47
6500	2.06	28000	4.45
7000	2.14	28500	4.49
7500	2.22	29000	4.57
8000	2.29	29500	4.60
8500	2.36	30000	4.59
9000	2.43	30500	4.63
9500	2.50	31000	4.68
10000	2.58	31500	4.74
10500	2.63	32000	4.81
11000	2.70	32500	4.89
11500	2.76	33000	4.89
12000	2.82	33500	4.92
12500	2.87	34000	4.94
13000	2.94	34500	4.99
13500	3.00	35000	5.07
14000	3.06	35500	5.12
14500	3.11	36000	5.14
15000	3.17	36500	5.22
15500	3.23	37000	5.28
16000	3.29	37500	5.30
16500	3.35	38000	5.39
17000	3.41	38500	5.48
17500	3.47	39000	5.44
18000	3.51	39500	5.45
18500	3.56	40000	5.51
19000	3.60		
19500	3.66		
20000	3.71		



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