

TEST REPORT

ACCORDING TO: FCC 47 CFR part 15 section 15.255;
RSS-210 issue 10 Annex J, RSS-Gen issue 5 with Am.1

FOR:

Siklu Communication Ltd.

MultiHaul™ Terragraph Point-to-Multipoint wireless V-Band system

Model: MH-N880-CCP-PoE

FCC ID: 2ACYESK-MH60TG-A6

IC:12353A-MH60TGA6

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1 Applicant information

Client name: Siklu Communication Ltd.
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Telephone: +972 3921 4015
Fax: +972 3921 4162
E-mail: baruch@siklu.com
Contact name: Mr. Baruch Schwarz

2 Equipment under test attributes

Product name: MultiHaul™ Terragraph Point-to-Multipoint wireless
V-Band system
Product type: Transceiver
Model(s): MH-N880-CCP-PoE
Serial number: SC02000001
Hardware version: A0
Software release: 1.1.5
Receipt date 14-Feb-22

3 Manufacturer information

Manufacturer name: Siklu Communication Ltd.
Address: 43 Hasivim street, Petach-Tikva 49517, Israel
Telephone: +972 3921 4015
Fax: +972 3921 4162
E-Mail: baruch@siklu.com
Contact name: Mr. Baruch Schwarz

4 Test details

Project ID: 46018
Location: Hermon Laboratories Ltd. P.O. Box 23, Binyamina 3055001, Israel
Test started: 16-Feb-22
Test completed: 16-Mar-22
Test specification(s): FCC 47CFR part 15 subpart C sec. 15.255;
RSS-210 issue 10 Annex J, RSS-Gen issue 5 with Am.1

5 Tests summary

Test	Status
Transmitter characteristics	
FCC section 15.255(c)(1)(i),(e) / RSS-210 section J.2.2(b), J.4, Transmitter power and power spectral density	Pass
FCC section 15.215(c)/ RSS-210 section J.4(c), RSS-Gen, Section 6.7, Occupied bandwidth	Pass
FCC section 15.255(d)(2)/ RSS-210 section J.3, Radiated spurious emissions below 40 GHz	Pass
FCC section 15.255(d)(3)/ RSS-210 section J.3, Radiated emissions outside assigned band and above 40 GHz up to 200 GHz	Pass
FCC section 15.255(f)/ RSS-210 section J.6, Frequency stability	Pass

Revision history:

Date	File No.	Change Description
October 17, 2023	SIKRAD_FCC.46018_Rev1	Title page: The model name was corrected
April 22, 2022	SIKRAD_FCC.46018	Original report

This test report supersedes the previously issued test report identified by Doc ID: SIKRAD_FCC.46018

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

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

	Name and Title	Date	Signature
Tested by:	Mrs. E. Pitt, test engineer	16-Feb-22 – 16-Mar-22	
Reviewed by:	Mrs. S. Peysahov Sheynin, test engineer, EMC & Radio	01-Apr-22	
Approved by:	Mr. S. Samokha, technical manager, EMC & Radio	10-Apr-22	
Test Report Correction			
Prepared by:	Mrs. S. Peysahov Sheynin, test engineer, EMC & Radio	17-Oct-23	
Approved by:	Mr. M. Nikishin, group leader, EMC & Radio	17-Oct-23	

6 EUT description

Note: The following data in this clause is provided by the customer and represents his sole responsibility

6.1 General information

The EUT is the MultiHaul™ TG Node N880 60GHz 4 sectors system, model MH-N880-CCP-PoE. It consists of 4 sectors operating in the 57-66GHz regulated millimeter waves V-band, in a self-backhaul redundant mesh and connecting a suite of MultiHaul TG terminal units (TU).

6.2 Ports and lines

Port type	Port description	Conn. from	Conn. to	Qty.	Cable type	Cable length, m
Telecom	Ethernet 1-POE	EUT	POE	1	Shielded	100
Telecom	Ethernet 2-PSE	EUT	Laptop	1	Shielded	100
Telecom	Ethernet 3-SFP	EUT	Not connected	1	Fiber optic	100
Telecom	USB	EUT	For maintenance only	1	NA	NA

6.3 Support and test equipment

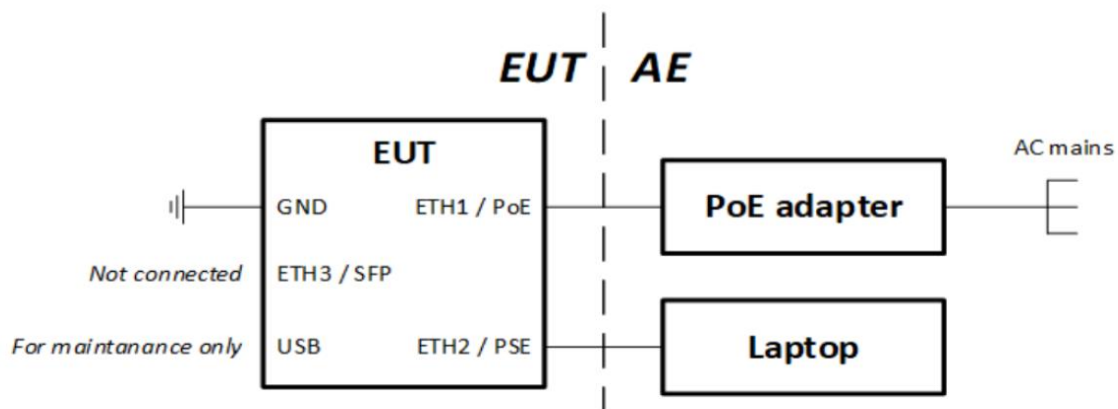
Description	Manufacturer	Model number	Serial number
Laptop	Lenovo	X220	R9L080Z
PoE adapter	Power Dsine Microsemi	PD-9501GC/AC	C18466280000000058

6.4 Changes made in the EUT

No changes were performed 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		57.0 GHz – 66.0 GHz		
Operating frequency range		58320 -64800 MHz		
Test frequencies		58320 MHz, 62640 MHz, 64800 MHz		
Maximum rated output power		EIRP	40.69 dBm	
Is transmitter output power variable?		V	No	
			Yes	continuous variable
			stepped variable with stepsize	dB
			minimum RF power	dBm
			maximum RF power	
Antenna connection				
unique coupling	standard connector	V	Integral	
			with temporary RF connector	
			without temporary RF connector	
Antenna/s technical characteristics				
Type	Manufacturer	Model number	Gain	
Patch antenna array	Siklu Ltd.	PCB240A	22.5 dBi	
Data Rate Configuration	Transmitter 99% power bandwidth, MHz	Transmitter aggregate data rate/s, Mbps	Type of modulation	
MCS1	2126.9	385	BPSK	
MCS12	2109.4	4600	16QAM	
Type of multiplexing		TDD		
Transmitter power source				
V	DC	Nominal rated voltage	Battery type	
		Nominal rated voltage	48 V via POE	
		Voltage range		
	AC mains	Nominal rated voltage	120 V	
		Frequency	60 Hz	
Common power source for transmitter and receiver		V	yes no	



Test specification:		FCC Section 15.255(c)(1)(i),(e), RSS-210 section J.2.2(b), J.4, Transmitter power	
Test procedure:		47 CFR, Section 2.1046; Section 15.255(b); ANSI C63.10, Sections 9.4, 9.5	
Test mode:		Verdict: PASS	
Date(s):			
Date(s):			
Temperature: 22 °C	Relative Humidity: 45 %	Air Pressure: 1016 hPa	Power: 48 VDC
Remarks:			

7 Transmitter tests

7.1 Transmitter power test

7.1.1 General

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

Table 7.1.1 Output power limits

Assigned frequency range, MHz	Maximum output power			
	Peak conducted output power		EIRP, dBm	
	mW	dBm	Peak	Average
57000 – 71000	500	27.0	43	40

7.1.2 Test procedure

- 7.1.2.1 The EUT was set up as shown in Figure 7.1.1, energized and its proper operation was checked.
- 7.1.2.2 The EUT was adjusted to produce maximum available for end user RF output power.
- 7.1.2.3 The average and peak voltage was measured at the low and high frequency channels with oscilloscope connected to RF detector and provided in the associated plots.
- 7.1.2.4 The unmodulated signal was applied to Zero-Biased Detector via variable attenuator as shown in Figure 7.1.2.
- 7.1.2.5 The variable attenuator was adjusted such that the oscilloscope indicated a voltage equal to the peak voltage recorded in the step 7.1.2.3.
- 7.1.2.6 The variable attenuator was disconnected from the Zero-Biased Detector.
- 7.1.2.7 Without changing any settings, the variable attenuator was connected to a power meter as shown in Figure 7.1.3.
- 7.1.2.8 The power was measured and result was recorded in Table 7.1.2 and Table 7.1.3.
- 7.1.2.9 The steps 7.1.2.4 through 7.1.2.8 were repeated for the average voltage recorded in the step 7.1.2.3 and 7.1.2.4.



Test specification:		FCC Section 15.255(c)(1)(i),(e), RSS-210 section J.2.2(b), J.4, Transmitter power	
Test procedure:		47 CFR, Section 2.1046; Section 15.255(b); ANSI C63.10, Sections 9.4, 9.5	
Test mode:		Verdict: PASS	
Date(s):			
16-Feb-22 - 17-Feb-22			
Temperature: 22 °C	Relative Humidity: 45 %	Air Pressure: 1016 hPa	Power: 48 VDC
Remarks:			

Figure 7.1.1 Peak output power test setup

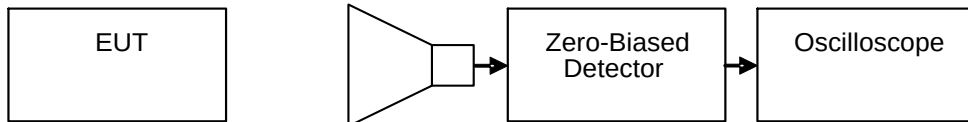


Figure 7.1.2 Peak output power test setup

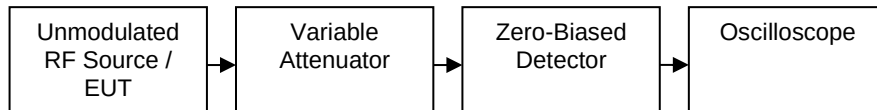
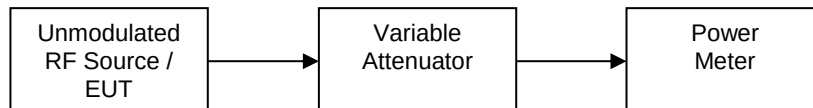


Figure 7.1.3 Peak output power test setup





Test specification:		FCC Section 15.255(c)(1)(i),(e), RSS-210 section J.2.2(b), J.4, Transmitter power	
Test procedure:		47 CFR, Section 2.1046; Section 15.255(b); ANSI C63.10, Sections 9.4, 9.5	
Test mode:		Verdict: PASS	
Date(s):			
16-Feb-22 - 17-Feb-22			
Temperature: 22 °C	Relative Humidity: 45 %	Air Pressure: 1016 hPa	Power: 48 VDC
Remarks:			

Table 7.1.2 Peak output power test results

ASSIGNED FREQUENCY RANGE: 57.0 – 71.0 GHz
 DETECTOR USED: Peak
 MEASUREMENTS DISTANCE: 1 m
 TRANSMITTER OUTPUT POWER SETTINGS: Maximum
 EUT ANTENNA GAIN: 22.5 dBi
 ANTENNA GAIN: 24.0 dBi
 MODULATION: 16QAM
 ANTENNA # 1

Frequency, MHz	λ^* , m	DSO, mV	Power measured, dBm	Antenna Gain, dBi	E_{meas}^{**} , dBuV/m	EIRP ^{***} , dBm	Limit, dBm	Margin ^{****} , dB	Verdict
58320	0.005144	3.38	-4.79	24.0	143.78	39.08	43.0	-3.92	Pass
62640	0.004789	5.44	-5.37	24.0	143.83	39.13	43.0	-3.87	Pass
64800	0.004630	6.26	-4.17	24.0	145.32	40.62	43.0	-2.38	Pass

ANTENNA # 2

Frequency, MHz	λ^* , m	DSO, mV	Power measured, dBm	Antenna Gain, dBi	E_{meas}^{**} , dBuV/m	EIRP ^{***} , dBm	Limit, dBm	Margin ^{****} , dB	Verdict
58320	0.005144	3.36	-4.82	24.0	143.75	39.05	43.0	-3.95	Pass
62640	0.004789	5.34	-5.33	24.0	143.87	39.17	43.0	-3.83	Pass
64800	0.004630	6.32	-4.13	24.0	145.36	40.66	43.0	-2.34	Pass

ANTENNA # 3

Frequency, MHz	λ^* , m	DSO, mV	Power measured, dBm	Antenna Gain, dBi	E_{meas}^{**} , dBuV/m	EIRP ^{***} , dBm	Limit, dBm	Margin ^{****} , dB	Verdict
58320	0.005144	3.46	-4.89	24.0	143.68	38.98	43.0	-4.02	Pass
62640	0.004789	5.32	-5.39	24.0	143.81	39.11	43.0	-3.89	Pass
64800	0.004630	6.16	-4.10	24.0	145.39	40.69	43.0	-2.31	Pass

ANTENNA # 4

Frequency, MHz	λ^* , m	DSO, mV	Power measured, dBm	Antenna Gain, dBi	E_{meas}^{**} , dBuV/m	EIRP ^{***} , dBm	Limit, dBm	Margin ^{****} , dB	Verdict
58320	0.005144	3.50	-4.83	24.0	143.74	39.04	43.0	-3.96	Pass
62640	0.004789	5.28	-5.36	24.0	143.84	39.14	43.0	-3.86	Pass
64800	0.004630	6.24	-4.16	24.0	145.33	40.63	43.0	-2.37	Pass

Note: Max peak conducted power is 40.69 dBm – 22.5 dBi = 18.19 dBm

* - $\lambda = 300/\text{Frequency(MHz)}$

** - $E_{\text{meas}} = 126.8 - 20\log(\lambda) + \text{Power measured} - \text{Measurement Antenna Gain (24 dBi)}$

*** - $\text{EIRP} = E_{\text{meas}} + 20\log(\text{Measurements distance}) - 104.7$

**** - $\text{Margin} = \text{EIRP} - \text{Limit}$



Test specification:		FCC Section 15.255(c)(1)(i),(e), RSS-210 section J.2.2(b), J.4, Transmitter power	
Test procedure:		47 CFR, Section 2.1046; Section 15.255(b); ANSI C63.10, Sections 9.4, 9.5	
Test mode:		Verdict: PASS	
Date(s):			
16-Feb-22 - 17-Feb-22			
Temperature: 22 °C	Relative Humidity: 45 %	Air Pressure: 1016 hPa	Power: 48 VDC
Remarks:			

Table 7.1.3 Average output power test results

ASSIGNED FREQUENCY RANGE: 57.0 – 71.0 GHz
 DETECTOR USED: Average
 MEASUREMENTS DISTANCE: 1 m
 TRANSMITTER OUTPUT POWER SETTINGS: Maximum
 EUT ANTENNA GAIN: 22.5 dBi
 ANTENNA GAIN: 24.0 dBi
 MODULATION: 16QAM
 ANTENNA # 1

Frequency, MHz	λ^* , m	DSO, mV	Power measured, dBm	Antenna Gain, dBi	E_{meas}^{**} , dBuV/m	EIRP ^{***} , dBm	Limit, dBm	Margin ^{****} , dB	Verdict
58320	0.005144	2.44	-5.44	24.0	143.13	38.43	40.0	-1.57	Pass
62640	0.004789	3.98	-4.59	24.0	144.61	39.91	40.0	-0.09	Pass
64800	0.004630	4.95	-4.83	24.0	144.66	39.96	40.0	-0.04	Pass

ANTENNA # 2

Frequency, MHz	λ^* , m	DSO, mV	Power measured, dBm	Antenna Gain, dBi	E_{meas}^{**} , dBuV/m	EIRP ^{***} , dBm	Limit, dBm	Margin ^{****} , dB	Verdict
58320	0.005144	2.51	-5.38	24.0	143.19	38.49	40.0	-1.51	Pass
62640	0.004789	3.96	-4.61	24.0	144.59	39.89	40.0	-0.11	Pass
64800	0.00463	5.05	-4.82	24.0	144.67	39.97	40.0	-0.03	Pass

ANTENNA # 3

Frequency, MHz	λ^* , m	DSO, mV	Power measured, dBm	Antenna Gain, dBi	E_{meas}^{**} , dBuV/m	EIRP ^{***} , dBm	Limit, dBm	Margin ^{****} , dB	Verdict
58320	0.005144	2.62	-5.36	24.0	143.21	38.51	40.0	-1.49	Pass
62640	0.004789	4.04	-4.66	24.0	144.54	39.84	40.0	-0.16	Pass
64800	0.00463	4.97	-4.92	24.0	144.57	39.87	40.0	-0.13	Pass

ANTENNA # 4

Frequency, MHz	λ^* , m	DSO, mV	Power measured, dBm	Antenna Gain, dBi	E_{meas}^{**} , dBuV/m	EIRP ^{***} , dBm	Limit, dBm	Margin ^{****} , dB	Verdict
58320	0.005144	2.71	-5.31	24.0	143.26	38.56	40.0	-1.44	Pass
62640	0.004789	4.01	-4.55	24.0	144.65	39.95	40.0	-0.05	Pass
64800	0.00463	5.04	-4.86	24.0	144.63	39.93	40.0	-0.07	Pass

* - $\lambda = 300/\text{Frequency(MHz)}$

** - $E_{\text{meas}} = 126.8 - 20\log(\lambda) + \text{Power measured} - \text{Measurement Antenna Gain (24 dBi)}$

*** - $\text{EIRP} = E_{\text{meas}} + 20\log(\text{Measurements distance}) - 104.7$

**** - $\text{Margin} = \text{EIRP} - \text{Limit}$

Reference numbers of test equipment used

HL 5376	HL 5377	HL 5371	HL 4856	HL 3293	HL 3901	HL 5380	HL 5377
HL 0771							

Full description is given in Appendix A.

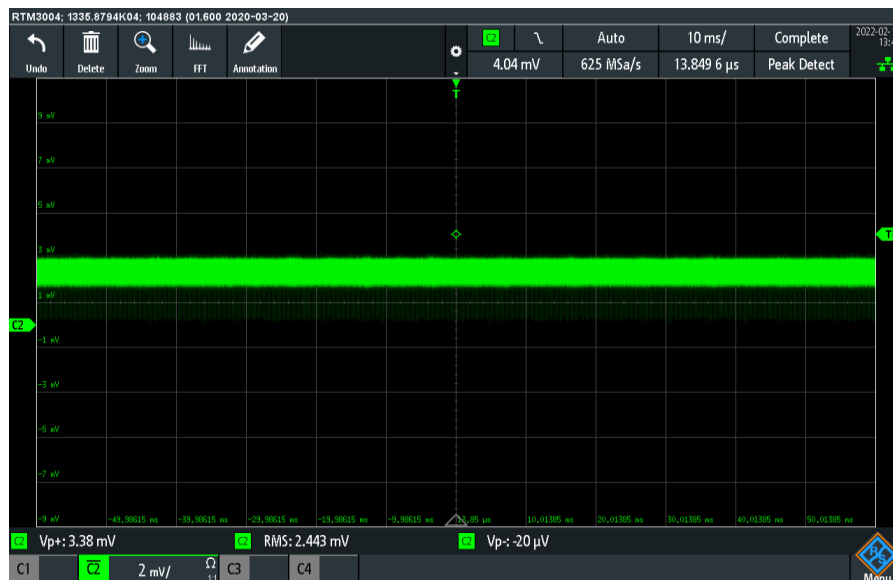


HERMON LABORATORIES

Test specification:		FCC Section 15.255(c)(1)(i),(e), RSS-210 section J.2.2(b), J.4, Transmitter power	
Test procedure:		47 CFR, Section 2.1046; Section 15.255(b); ANSI C63.10, Sections 9.4, 9.5	
Test mode:		Verdict: PASS	
Date(s):			
16-Feb-22 - 17-Feb-22			
Temperature: 22 °C	Relative Humidity: 45 %	Air Pressure: 1016 hPa	Power: 48 VDC
Remarks:			

Plot 7.1.1 Output power test result at the 58.32 GHz frequency

DETECTOR:	Peak/Average
MODULATION:	16QAM
ANTENNA #	1



DETECTOR:	Peak/Average
MODULATION:	16QAM
ANTENNA #	2





HERMON LABORATORIES

Test specification:	FCC Section 15.255(c)(1)(i),(e), RSS-210 section J.2.2(b), J.4, Transmitter power		
Test procedure:	47 CFR, Section 2.1046; Section 15.255(b); ANSI C63.10, Sections 9.4, 9.5		
Test mode:	Compliance	Verdict:	PASS
Date(s):	16-Feb-22 - 17-Feb-22		
Temperature: 22 °C	Relative Humidity: 45 %	Air Pressure: 1016 hPa	Power: 48 VDC
Remarks:			

Plot 7.1.2 Output power test result at the 58.32 GHz frequency

DETECTOR:	Peak/Average
MODULATION:	16QAM
ANTENNA #	3



DETECTOR:	Peak/Average
MODULATION:	16QAM
ANTENNA #	4



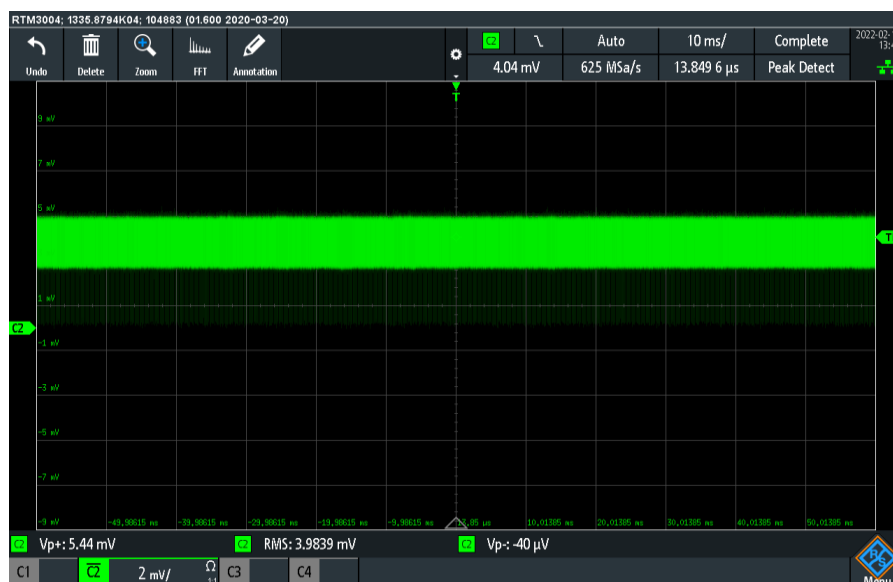


HERMON LABORATORIES

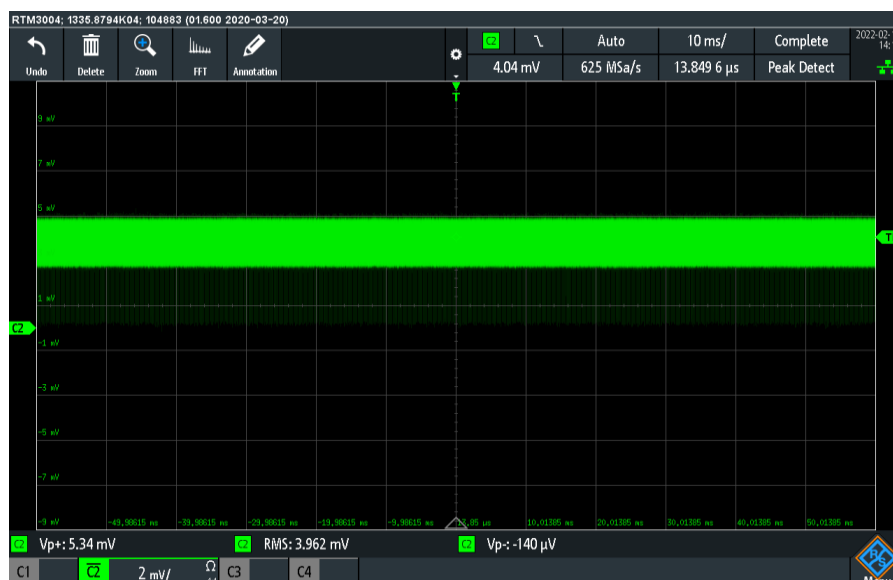
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Test procedure:	47 CFR, Section 2.1046; Section 15.255(b); ANSI C63.10, Sections 9.4, 9.5		
Test mode:	Compliance	Verdict:	PASS
Date(s):	16-Feb-22 - 17-Feb-22		
Temperature: 22 °C	Relative Humidity: 45 %	Air Pressure: 1016 hPa	Power: 48 VDC
Remarks:			

Plot 7.1.3 Output power test result at the 62.64 GHz frequency

DETECTOR:	Peak/Average
MODULATION:	16QAM
ANTENNA #	1



DETECTOR:	Peak/Average
MODULATION:	16QAM
ANTENNA #	2



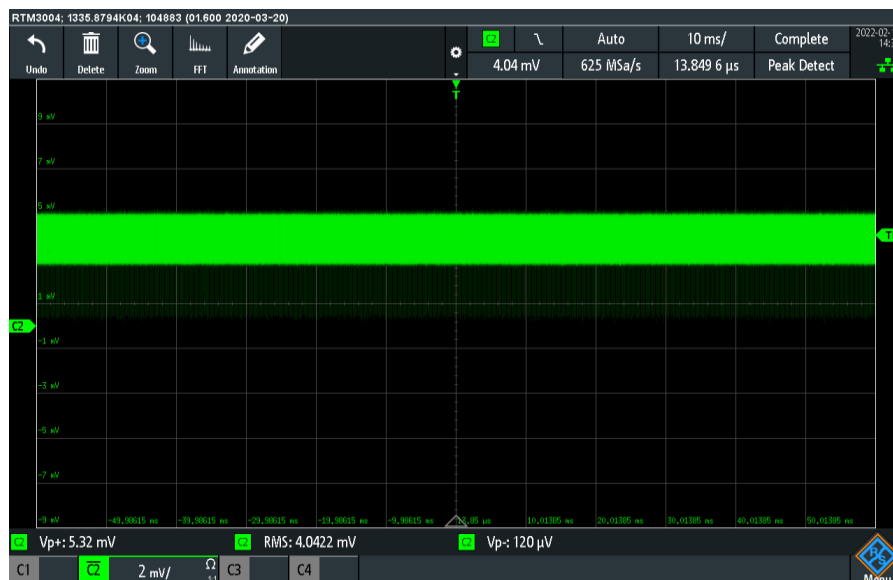


HERMON LABORATORIES

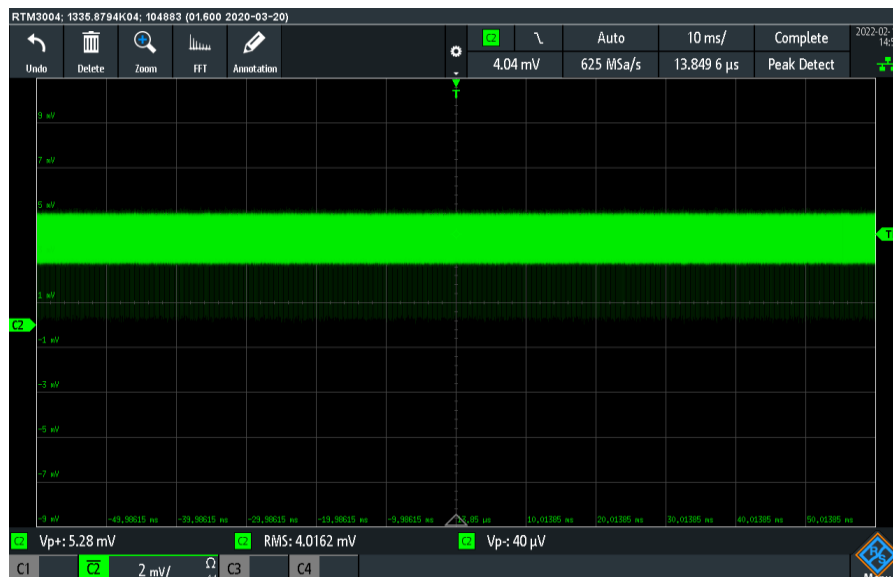
Test specification:	FCC Section 15.255(c)(1)(i),(e), RSS-210 section J.2.2(b), J.4, Transmitter power		
Test procedure:	47 CFR, Section 2.1046; Section 15.255(b); ANSI C63.10, Sections 9.4, 9.5		
Test mode:	Compliance	Verdict:	PASS
Date(s):	16-Feb-22 - 17-Feb-22		
Temperature: 22 °C	Relative Humidity: 45 %	Air Pressure: 1016 hPa	Power: 48 VDC
Remarks:			

Plot 7.1.4 Output power test result at the 62.64 GHz frequency

DETECTOR:	Peak/Average
MODULATION:	16QAM
ANTENNA #	3



DETECTOR:	Peak/Average
MODULATION:	16QAM
ANTENNA #	4





HERMON LABORATORIES

Test specification:		FCC Section 15.255(c)(1)(i),(e), RSS-210 section J.2.2(b), J.4, Transmitter power	
Test procedure:		47 CFR, Section 2.1046; Section 15.255(b); ANSI C63.10, Sections 9.4, 9.5	
Test mode:		Verdict: PASS	
Date(s):			
16-Feb-22 - 17-Feb-22			
Temperature: 22 °C	Relative Humidity: 45 %	Air Pressure: 1016 hPa	Power: 48 VDC
Remarks:			

Plot 7.1.6 Output power test result at the 64.80 GHz frequency

DETECTOR:	Peak/Average
MODULATION:	16QAM
ANTENNA #	3



DETECTOR:	Peak/Average
MODULATION:	16QAM
ANTENNA #	4





Test specification:		FCC Section 15.215(c), RSS-210 section J.4(c), RSS-Gen section 6.7, Occupied bandwidth	
Test procedure:		47 CFR, Section 2.1049, ANSI C63.10, Section 9.3	
Test mode:		Verdict: PASS	
Date(s):			
16-Feb-22 - 17-Feb-22			
Temperature: 22 °C	Relative Humidity: 45 %	Air Pressure: 1016 hPa	Power: 48 VDC
Remarks:			

7.2 Occupied bandwidth test

7.2.1 General

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

Table 7.2.1 Occupied bandwidth limits

Assigned frequency range, MHz	Modulation envelope reference points	
	6 dBc	99%
57000 - 71000		

NOTE: Modulation envelope reference points provided in terms of attenuation below unmodulated carrier.

7.2.2 Test procedure

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

7.2.2.2 The EUT was set to transmit modulated carrier as provided in Table 7.2.2.

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

Figure 7.2.1 Occupied bandwidth test setup





Test specification:	FCC Section 15.215(c), RSS-210 section J.4(c), RSS-Gen section 6.7, Occupied bandwidth		
Test procedure:	47 CFR, Section 2.1049, ANSI C63.10, Section 9.3		
Test mode:	Compliance	Verdict:	PASS
Date(s):	16-Feb-22 - 17-Feb-22		
Temperature: 22 °C	Relative Humidity: 45 %	Air Pressure: 1016 hPa	Power: 48 VDC
Remarks:			

Table 7.2.2 Occupied bandwidth test results

ASSIGNED FREQUENCY RANGE: 57000 –71000 MHz
DETECTOR USED: Peak
MODULATION: 16QAM

Frequency, GHz	Antenna #	Occupied bandwidth 6 dBc, MHz	Occupied bandwidth 99%, MHz	Verdict
58.32	1	1492.0	1961.1	Pass
	2	1489.0	1971.0	Pass
	3	1492.0	1961.4	Pass
	4	1447.0	1955.4	Pass
62.64	1	1582.0	1948.6	Pass
	2	1671.0	2003.4	Pass
	3	1520.0	1974.9	Pass
	4	1671.0	1973.9	Pass
64.80	1	1965.0	1959.3	Pass
	2	1619.0	1946.8	Pass
	3	1506.0	1949.1	Pass
	4	1564.0	1919.0	Pass

Reference numbers of test equipment used

HL 0771	HL 5376	HL 5380					
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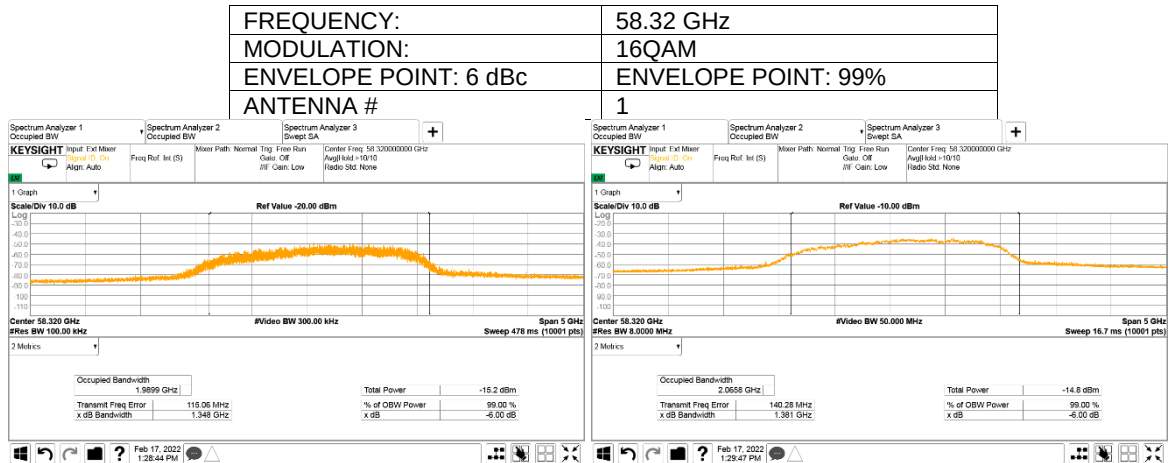
Full description is given in Appendix A.



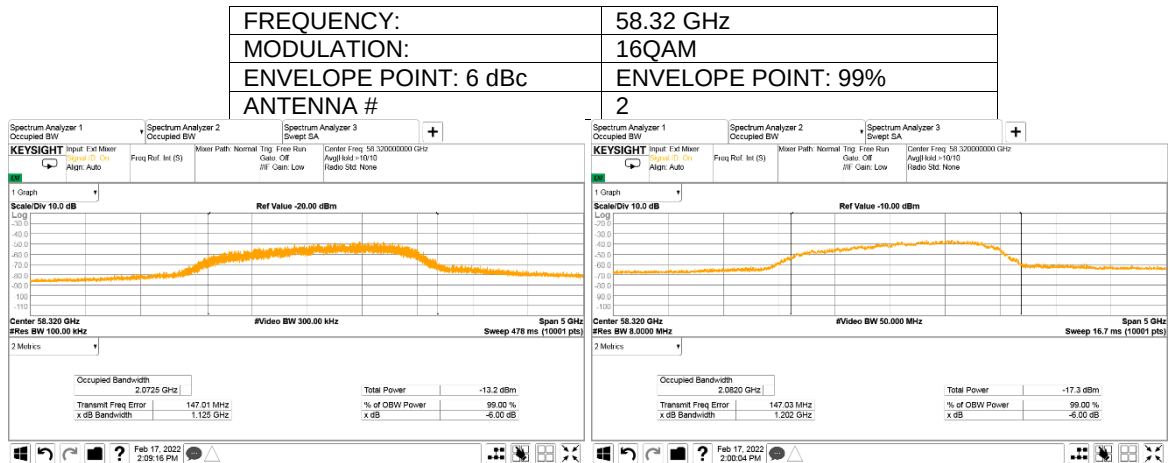
HERMON LABORATORIES

Test specification:		FCC Section 15.215(c), RSS-210 section J.4(c), RSS-Gen section 6.7, Occupied bandwidth	
Test procedure:		47 CFR, Section 2.1049, ANSI C63.10, Section 9.3	
Test mode:		Compliance	Verdict: PASS
Date(s):		16-Feb-22 - 17-Feb-22	
Temperature: 22 °C	Relative Humidity: 45 %	Air Pressure: 1016 hPa	Power: 48 VDC
Remarks:			

Plot 7.2.1 The 6dBc and 99% occupied bandwidth



Plot 7.2.2 The 6dBc and 99% occupied bandwidth

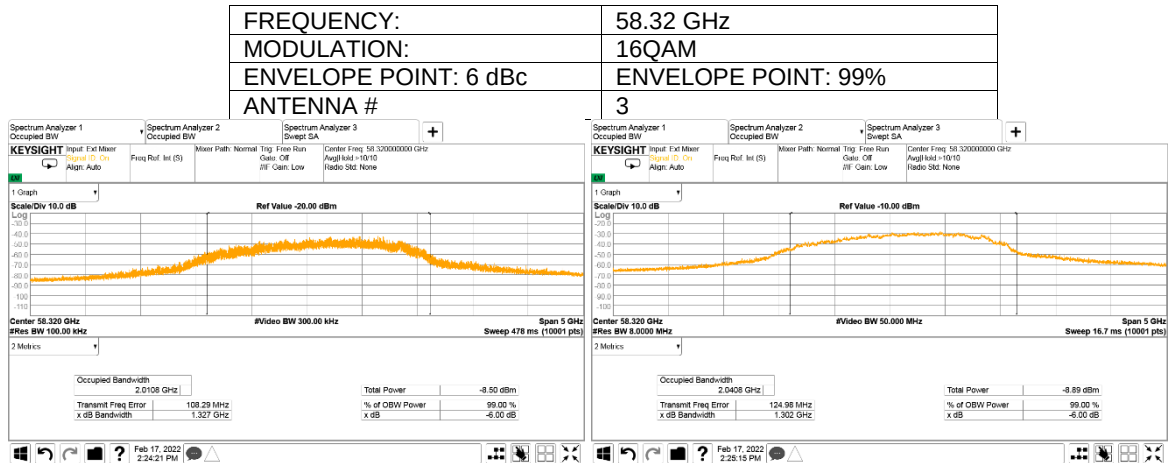




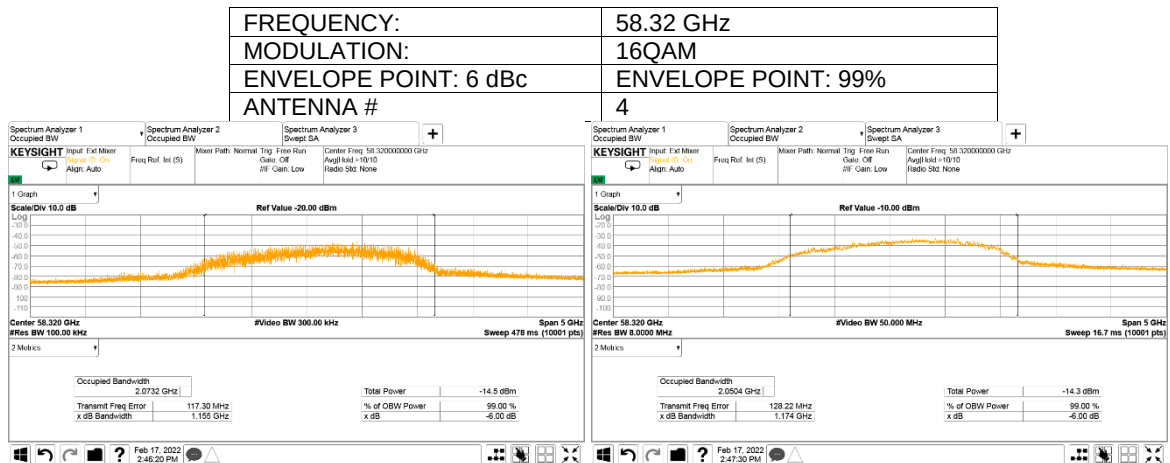
HERMON LABORATORIES

Test specification:		FCC Section 15.215(c), RSS-210 section J.4(c), RSS-Gen section 6.7, Occupied bandwidth	
Test procedure:		47 CFR, Section 2.1049, ANSI C63.10, Section 9.3	
Test mode:		Compliance	Verdict: PASS
Date(s):		16-Feb-22 - 17-Feb-22	
Temperature: 22 °C	Relative Humidity: 45 %	Air Pressure: 1016 hPa	Power: 48 VDC
Remarks:			

Plot 7.2.3 The 6dBc and 99% occupied bandwidth



Plot 7.2.4 The 6dBc and 99% occupied bandwidth

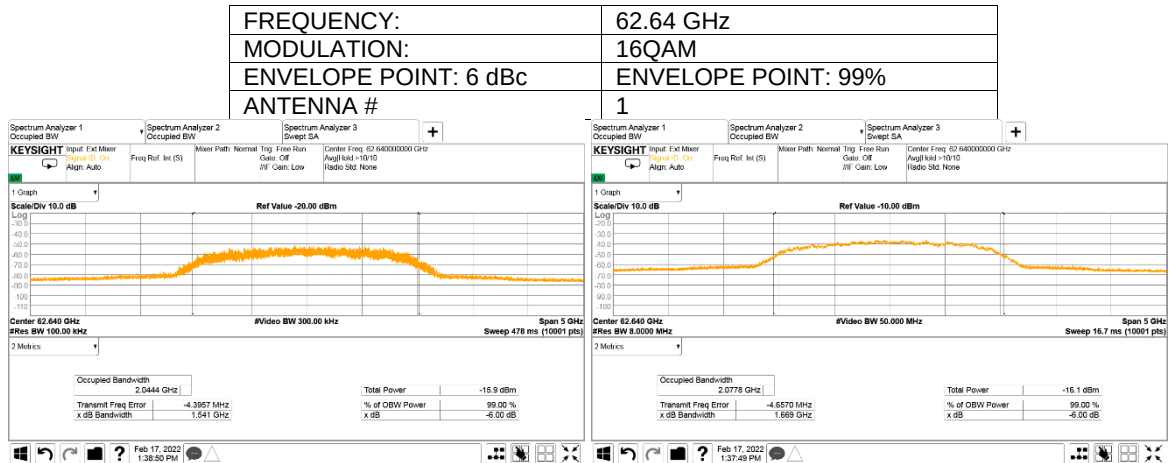




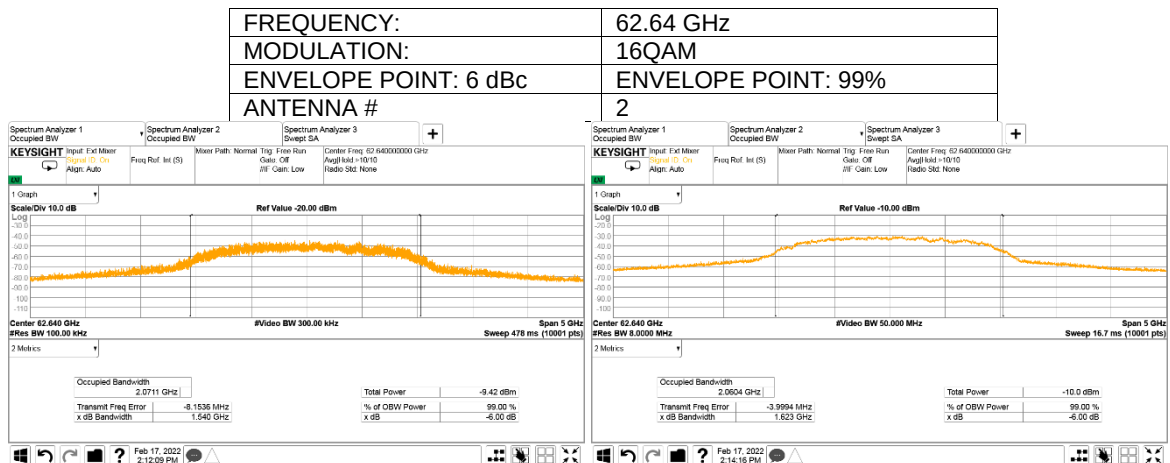
HERMON LABORATORIES

Test specification:		FCC Section 15.215(c), RSS-210 section J.4(c), RSS-Gen section 6.7, Occupied bandwidth	
Test procedure:		47 CFR, Section 2.1049, ANSI C63.10, Section 9.3	
Test mode:		Compliance	Verdict: PASS
Date(s):		16-Feb-22 - 17-Feb-22	
Temperature: 22 °C	Relative Humidity: 45 %	Air Pressure: 1016 hPa	Power: 48 VDC
Remarks:			

Plot 7.2.5 The 6dBc and 99% occupied bandwidth



Plot 7.2.6 The 6dBc and 99% occupied bandwidth

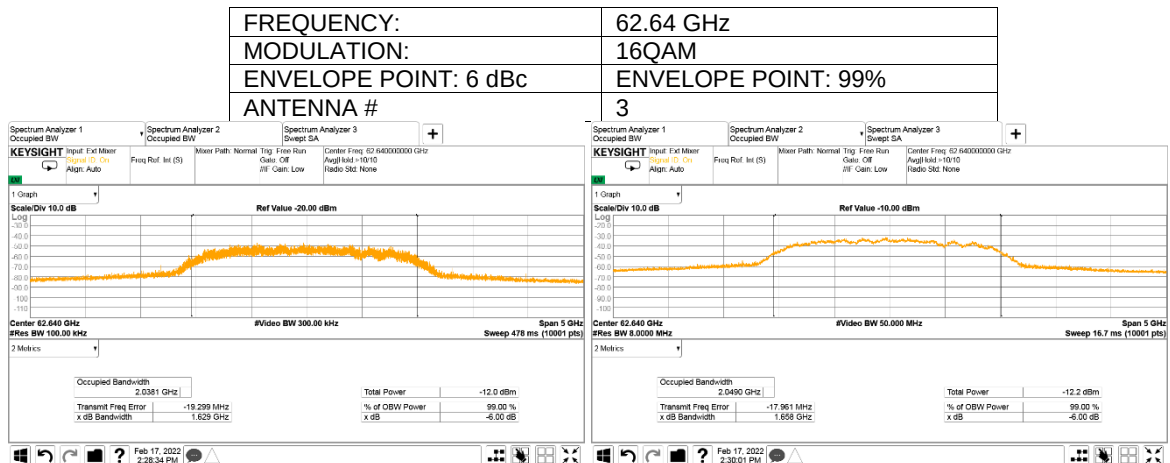




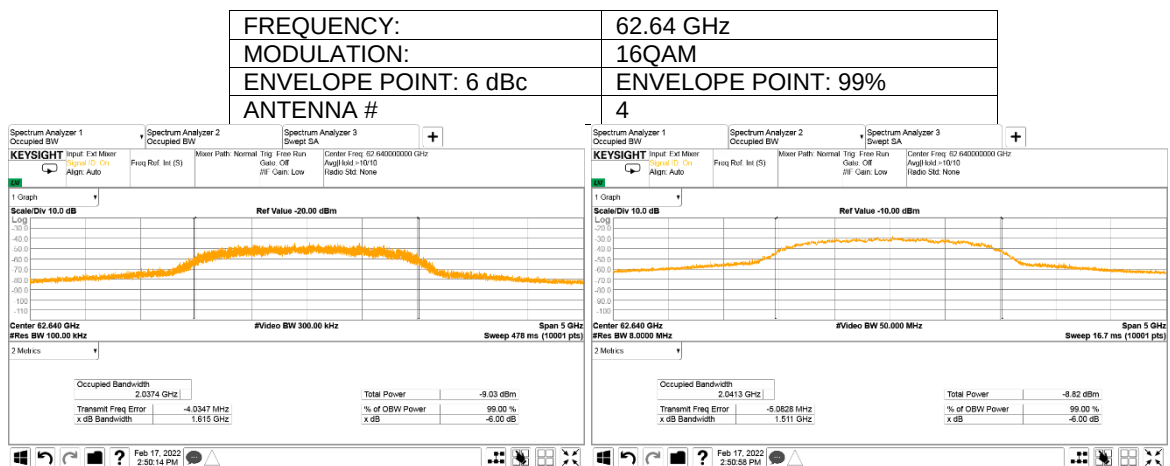
HERMON LABORATORIES

Test specification:	FCC Section 15.215(c), RSS-210 section J.4(c), RSS-Gen section 6.7, Occupied bandwidth		
Test procedure:	47 CFR, Section 2.1049, ANSI C63.10, Section 9.3		
Test mode:	Compliance	Verdict:	PASS
Date(s):	16-Feb-22 - 17-Feb-22		
Temperature: 22 °C	Relative Humidity: 45 %	Air Pressure: 1016 hPa	Power: 48 VDC
Remarks:			

Plot 7.2.7 The 6dBc and 99% occupied bandwidth



Plot 7.2.8 The 6dBc and 99% occupied bandwidth

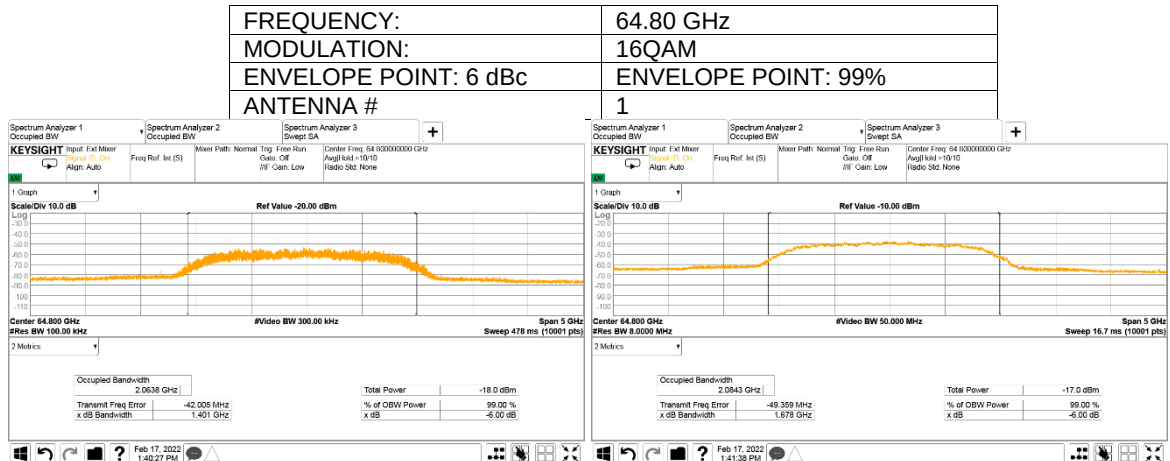




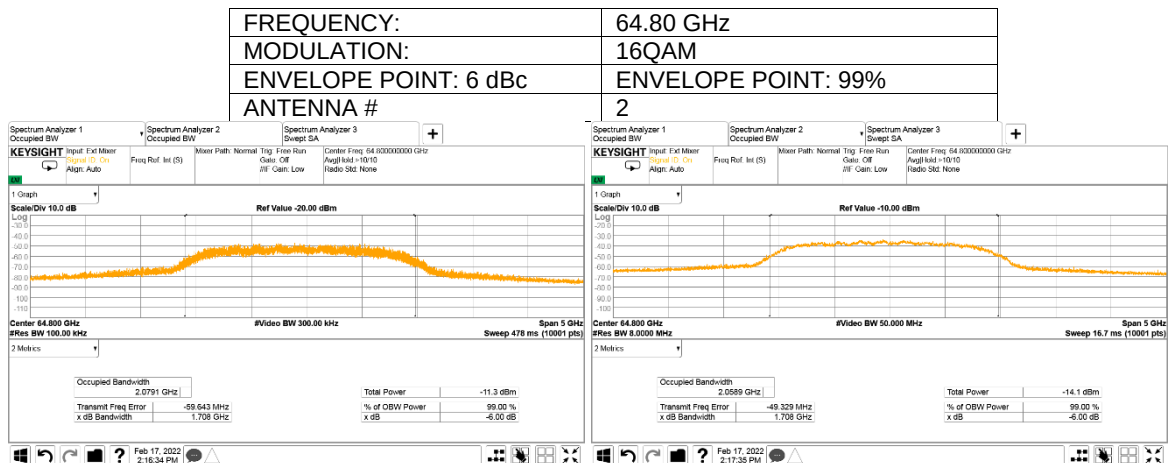
HERMON LABORATORIES

Test specification:		FCC Section 15.215(c), RSS-210 section J.4(c), RSS-Gen section 6.7, Occupied bandwidth	
Test procedure:		47 CFR, Section 2.1049, ANSI C63.10, Section 9.3	
Test mode:		Compliance	Verdict: PASS
Date(s):		16-Feb-22 - 17-Feb-22	
Temperature: 22 °C	Relative Humidity: 45 %	Air Pressure: 1016 hPa	Power: 48 VDC
Remarks:			

Plot 7.2.9 The 6dBc and 99% occupied bandwidth



Plot 7.2.10 The 6dBc and 99% occupied bandwidth

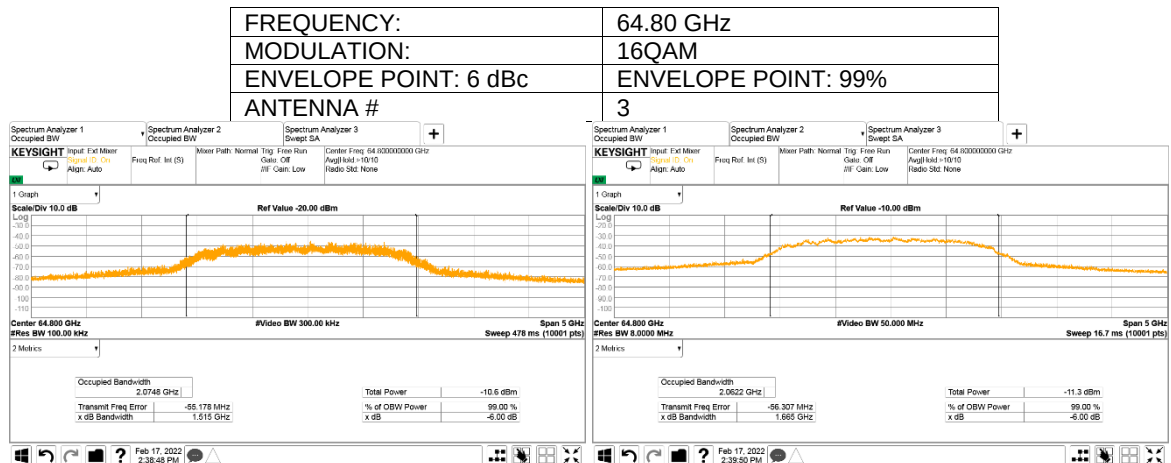




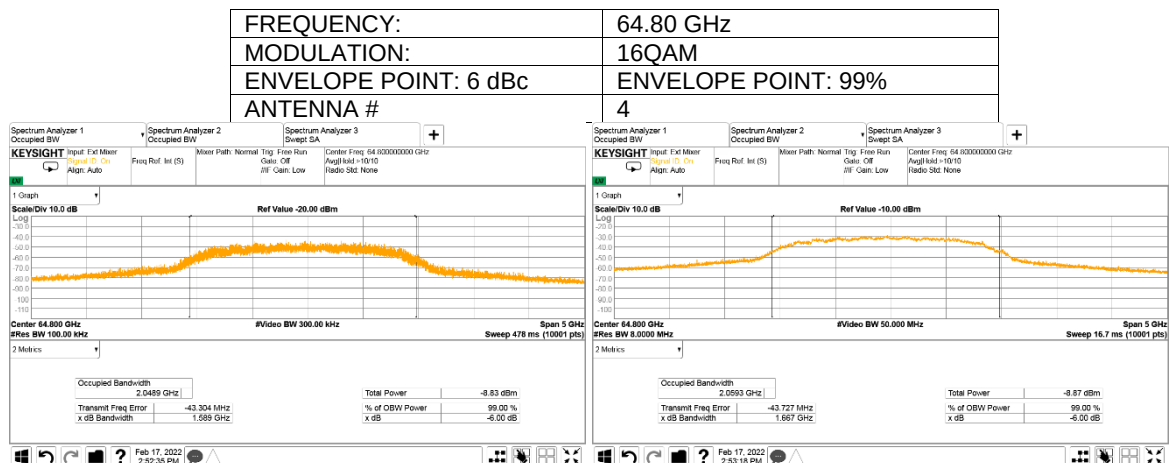
HERMON LABORATORIES

Test specification:		FCC Section 15.215(c), RSS-210 section J.4(c), RSS-Gen section 6.7, Occupied bandwidth	
Test procedure:		47 CFR, Section 2.1049, ANSI C63.10, Section 9.3	
Test mode:		Compliance	Verdict: PASS
Date(s):		16-Feb-22 - 17-Feb-22	
Temperature: 22 °C	Relative Humidity: 45 %	Air Pressure: 1016 hPa	Power: 48 VDC
Remarks:			

Plot 7.2.11 The 6dBc and 99% occupied bandwidth



Plot 7.2.12 The 6dBc and 99% occupied bandwidth





Test specification: FCC Section 15.255(d)(2), RSS-210 section J.3, Out of band radiated emissions below 40 GHz			
Test procedure: 47 CFR, Section 2.1053; ANSI C63.10, Section 9.13			
Test mode: Compliance		Verdict: PASS	
Date(s): 25-Feb-22			
Temperature: 23 °C	Relative Humidity: 54 %	Air Pressure: 1012 hPa	Power: 48 VDC
Remarks:			

7.3 Field strength of emissions

7.3.1 General

This test was performed to measure field strength of fundamental and spurious emissions from the EUT. Specification test limits are given in Table 7.3.1.

Table 7.3.1 Radiated spurious emissions limits

Frequency range, MHz	Field strength at 3 m, dB(μV/m)*		
	Within restricted bands		
	Peak	Quasi Peak	Average
0.009 – 0.090	148.5 – 128.5	NA	128.5 – 108.5**
0.090 – 0.110	NA	108.5 – 106.8**	NA
0.110 – 0.490	126.8 – 113.8	NA	106.8 – 93.8**
0.490 – 1.705	NA	73.8 – 63.0**	NA
1.705 – 30.0*		69.5	
30 – 88		40.0	
88 – 216		43.5	
216 – 960		46.0	
960 – 1000		54.0	
1000 – 40000	74.0	NA	54.0

*- The limit for 3 m test distance was calculated using the inverse square distance extrapolation factor as follows:

$$\text{Lims}_2 = \text{Lims}_1 + 40 \log (S_1/S_2),$$

where S_1 and S_2 – standard defined and test distance respectively in meters.

** - The limit decreases linearly with the logarithm of frequency.

Note: The above field strength limits applied from the lowest radio frequency generated in the device, without going below 9 kHz up to the tenth harmonic of the highest fundamental frequency but not exceeding 40 GHz for intentional radiators operated below 10 GHz and up to the fifth harmonic of the highest fundamental frequency but not exceeding 100 GHz for intentional radiators operated above 10 GHz.

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

7.3.2.1 The EUT was set up as shown in Figure 7.3.1, energized and the performance check was conducted.

7.3.2.2 The specified frequency range was investigated with antenna connected to spectrum analyzer/ EMI receiver. To find maximum radiation the turntable was rotated 3600 and the measuring antenna was rotated around its vertical axis.

7.3.2.3 The worst test results (the lowest margins) were recorded in Table 7.3.3 and shown in the associated plots.

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

7.3.3.1 The EUT was set up as shown in Figure 7.3.2, Figure 7.3.3, energized and the performance check was conducted.

7.3.3.2 The specified frequency range was investigated with antenna connected to spectrum analyzer/ EMI receiver. To find maximum radiation the turntable was rotated 3600, the measuring antenna height was changed from 1 to 4 m, its polarization was switched from vertical to horizontal.

7.3.3.3 The worst test results (the lowest margins) were recorded in Table 7.3.2 and shown in the associated plots.



Test specification: FCC Section 15.255(d)(2), RSS-210 section J.3, Out of band radiated emissions below 40 GHz			
Test procedure: 47 CFR, Section 2.1053; ANSI C63.10, Section 9.13			
Test mode: Compliance		Verdict: PASS	
Date(s): 25-Feb-22			
Temperature: 23 °C	Relative Humidity: 54 %	Air Pressure: 1012 hPa	Power: 48 VDC
Remarks:			

Figure 7.3.1 Setup for spurious emission field strength measurements below 30 MHz

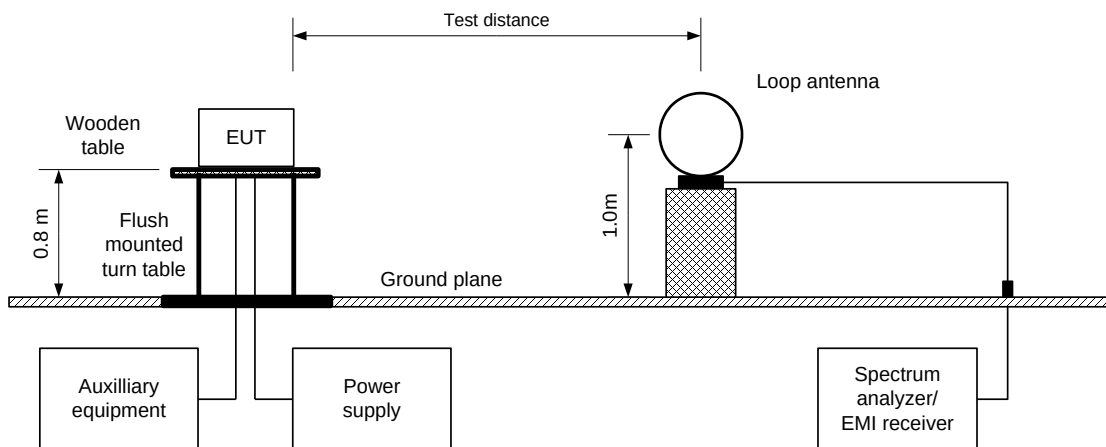
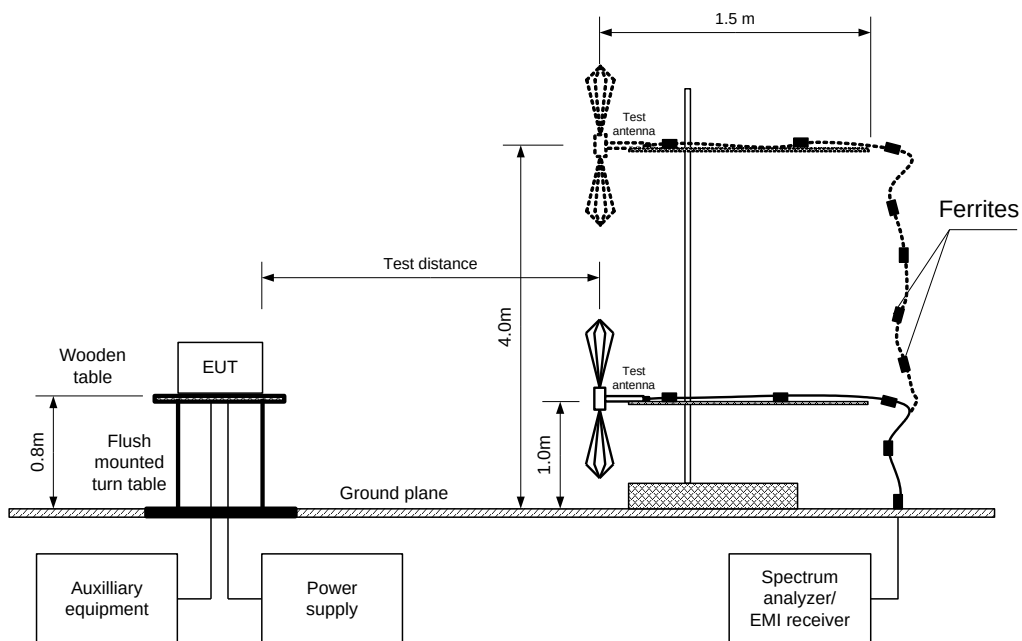


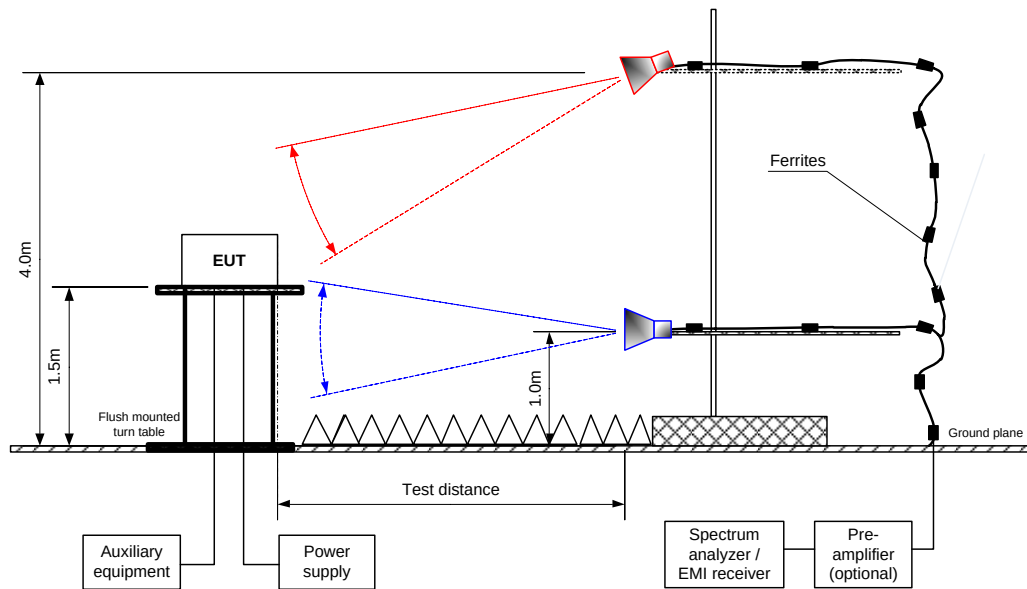
Figure 7.3.2 Setup for spurious emission field strength measurements in 30 – 1000 MHz





Test specification:		FCC Section 15.255(d)(2), RSS-210 section J.3, Out of band radiated emissions below 40 GHz	
Test procedure:		47 CFR, Section 2.1053; ANSI C63.10, Section 9.13	
Test mode:		Verdict: PASS	
Date(s):			
25-Feb-22			
Temperature: 23 °C	Relative Humidity: 54 %	Air Pressure: 1012 hPa	Power: 48 VDC
Remarks:			

Figure 7.3.3 Setup for spurious emission field strength measurements above 1000 MHz





HERMON LABORATORIES

Test specification: FCC Section 15.255(d)(2), RSS-210 section J.3, Out of band radiated emissions below 40 GHz			
Test procedure: 47 CFR, Section 2.1053; ANSI C63.10, Section 9.13			
Test mode: Compliance		Verdict: PASS	
Date(s): 25-Feb-22			
Temperature: 23 °C	Relative Humidity: 54 %	Air Pressure: 1012 hPa	Power: 48 VDC
Remarks:			

Table 7.3.2 Field strength of spurious emissions at frequencies above 1 GHz

TEST DISTANCE: 3 m
EUT POSITION: Typical
MODULATION: 16QAM
TRANSMITTER OUTPUT POWER SETTINGS: Maximum
INVESTIGATED FREQUENCY RANGE: 0.009 - 40000 MHz
DETECTOR USED: Peak
RESOLUTION BANDWIDTH: 1.0 MHz
VIDEO BANDWIDTH: ≥ Resolution bandwidth
TEST ANTENNA TYPE: Double ridged guide (above 1000 MHz)

F, MHz	Antenna		Azimuth, degrees*	Peak field strength			Avr factor, dB	Average field strength			Verdict
	Pol.	Height, m		Measured, dB(μV/m)	Limit, dB(μV/m)	Margin, dB**		Measured, dB(μV/m)	Limit, dB(μV/m)	Margin, dB**	
Low frequency 58320 MHz											
2000.7	V	1.6	21	43.8	74	-30.2	NA	32.6	54	-21.4	Pass
8100.2	V	1.5	137	55.3	74	-18.7	NA	49.7	54	-4.3	
15443.8	V	1.5	67	57.8	74	-16.2	NA	44.2	54	-9.8	
16310.2	H	1.5	74	61.3	74	-12.7	NA	46.4	54	-7.6	
16736.3	H	1.5	74	60.3	74	-13.7	NA	45.9	54	-8.1	
38754.8	V	2.8	9	61.8	74	-12.2	NA	48.1	54	-5.9	
Mid frequency 62640 MHz											
1998.0	V	1.5	19	44.3	74.0	-29.7	NA	33.4	54.0	-20.6	Pass
7830.0	V	1.5	136	57.2	74.0	-16.8	NA	49.9	54.0	-5.1	
14793.8	V	1.6	65	58.1	74.0	15.9	NA	44.7	54.0	-9.3	
15151.4	V	1.6	65	61.2	74.0	-12.8	NA	46.7	54.0	-7.3	
15288.6	V	1.6	65	60.3	74.0	-13.7	NA	44.8	54.0	-9.2	
38476.1	V	2.8	163	61.8	74.0	-12.2	NA	47.7	54.0	-6.3	
High frequency 64800 MHz											
2001.9	V	1.5	32	43.8	74.0	-30.2	NA	32.4	54.0	-21.6	Pass
7290.0	V	1.5	-180	54.2	74.0	-19.8	NA	47.7	54.0	-6.3	
14511.0	V	1.6	74	61.5	74.0	-12.5	NA	47.2	54.0	-6.8	
14662.4	V	1.6	74	65.4	74.0	-8.6	NA	48.3	54.0	-5.7	
14813.7	V	1.6	74	63.3	74.0	-10.7	NA	48.3	54.0	-5.7	
38673.0	V	2.7	180	61.2	74.0	-12.8	NA	47.9	54.0	-6.1	

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

** - Margin = dB below (negative if above) specification limit.



Test specification:		FCC Section 15.255(d)(2), RSS-210 section J.3, Out of band radiated emissions below 40 GHz	
Test procedure:		47 CFR, Section 2.1053; ANSI C63.10, Section 9.13	
Test mode:		Verdict: PASS	
Date(s):			
25-Feb-22			
Temperature: 23 °C	Relative Humidity: 54 %	Air Pressure: 1012 hPa	Power: 48 VDC
Remarks:			

Table 7.3.3 Field strength of emissions below 1 GHz

TEST DISTANCE: 3 m
 EUT POSITION: Typical
 MODULATION: 16QAM
 INVESTIGATED FREQUENCY RANGE: 0.009 – 1000 MHz
 DETECTOR USED: Peak
 RESOLUTION BANDWIDTH: 0.2 kHz (9 kHz – 150 kHz)
 9.0 kHz (150 kHz – 30 MHz)
 120 kHz (30 MHz – 1000 MHz)
 VIDEO BANDWIDTH: ≥ Resolution bandwidth
 TEST ANTENNA TYPE: Active loop (9 kHz – 30 MHz)
 Biconilog (30 MHz – 1000 MHz)

Frequency, MHz	Peak emission, dB(μV/m)	Quasi-peak			Antenna polarization	Antenna height, m	Turn-table position**, degrees	Verdict
		Measured emission, dB(μV/m)	Limit, dB(μV/m)	Margin, dB*				
Low, mid, high frequencies								
30.7	36.0	31.2	40	-8.8	Vertical	1.0	166	Pass
400.0	38.9	36.3	46	-9.7	Horizontal	1.0	56	
630.4	41.4	35.2	46	-10.8	Vertical	1.0	-16	
730.4	46.3	39.2	46	-6.8	Horizontal	1.0	-180	
800.4	45.9	41.3	46	-4.7	Horizontal	1.0	16	
849.0	42.6	36.1	46	-9.9	Horizontal	1.0	-131	

*- Margin = Measured emission - specification limit.

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

Reference numbers of test equipment used

HL 0446	HL 3903	HL 4360	HL 4933	HL 4956	HL 5902	HL 5288	HL 5112
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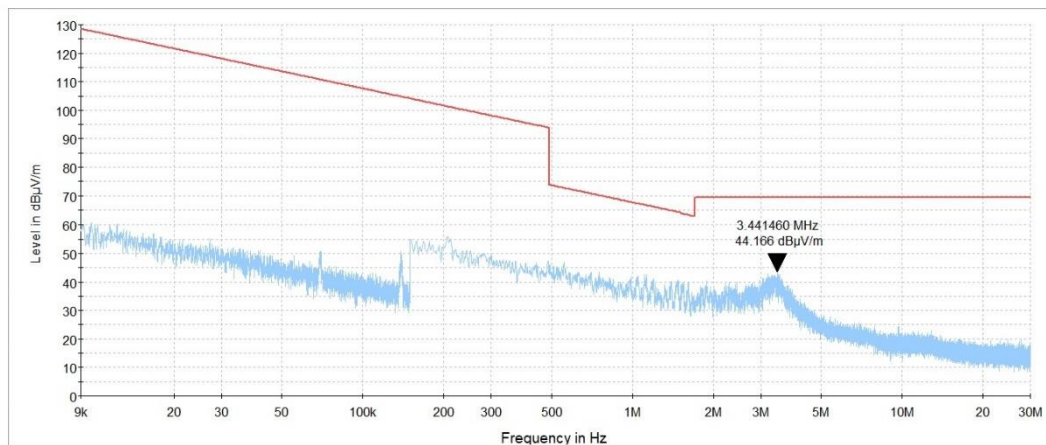
Full description is given in Appendix A.



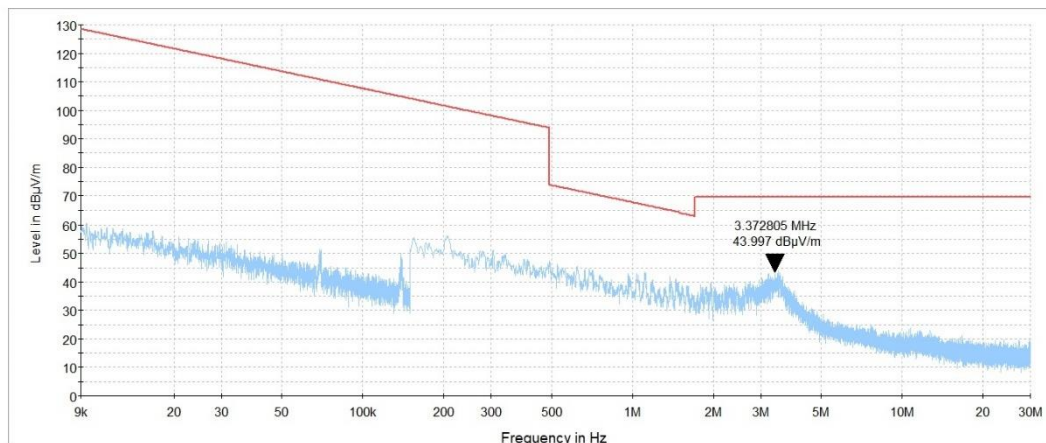
Test specification:		FCC Section 15.255(d)(2), RSS-210 section J.3, Out of band radiated emissions below 40 GHz	
Test procedure:		47 CFR, Section 2.1053; ANSI C63.10, Section 9.13	
Test mode:		Verdict: PASS	
Date(s):			
25-Feb-22			
Temperature: 23 °C	Relative Humidity: 54 %	Air Pressure: 1012 hPa	Power: 48 VDC
Remarks:			

Plot 7.3.1 Radiated emission measurements from 9 KHz to 30 MHz at low frequency

TEST SITE: Semi anechoic chamber
TEST DISTANCE: 3 m
EUT POSITION: Typical

**Plot 7.3.2 Radiated emission measurements from 9 KHz to 30 MHz at mid frequency**

TEST SITE: Semi anechoic chamber
TEST DISTANCE: 3 m
EUT POSITION: Typical



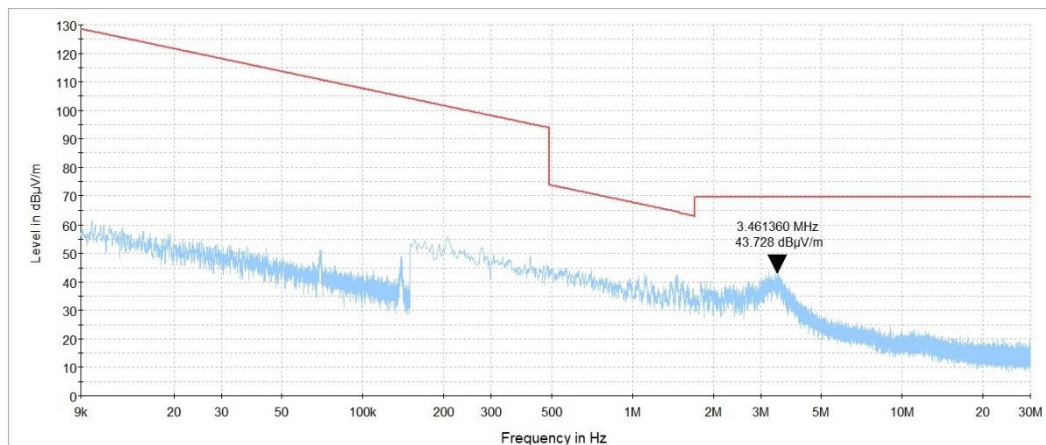


HERMON LABORATORIES

Test specification:		FCC Section 15.255(d)(2), RSS-210 section J.3, Out of band radiated emissions below 40 GHz	
Test procedure:		47 CFR, Section 2.1053; ANSI C63.10, Section 9.13	
Test mode:		Verdict: PASS	
Date(s):			
25-Feb-22			
Temperature: 23 °C	Relative Humidity: 54 %	Air Pressure: 1012 hPa	Power: 48 VDC
Remarks:			

Plot 7.3.3 Radiated emission measurements from 9 KHz to 30 MHz at high frequency

TEST SITE: Semi anechoic chamber
TEST DISTANCE: 3 m
EUT POSITION: Typical



Plot 7.3.4 Radiated emission measurements from 30 to 1000 MHz at low frequency

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

