

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-N367-CCP-PoE-MWB

FCC ID: 2ACYESK-MH60TG-A5

IC:12353A-MH60TGA5

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1 Applicant information

Client name: Siklu Communication Ltd.
Address: 43 Hasivim St. Petach-Tikva 4959501, Israel
Telephone: +972 72-2454110
Fax: +972 3921 4162
E-mail: michael.k@siklu.com
Contact name: Mr. Michael Kopit

2 Equipment under test attributes

Product name: MultiHaul™ Terragraph Point-to-Multipoint wireless V-Band system
Product type: Transceiver
Model(s): MH-N367-CCP-PoE-MWB
Serial number: FB02436355
Hardware version: A0
Software release: 1.1.1
Receipt date: 14-Feb-22

3 Manufacturer information

Manufacturer name: Siklu Communication Ltd.
Address: 43 Hasivim St. Petach-Tikva 4959501, Israel
Telephone: +972 72-2454110
Fax: +972 3921 4162
E-Mail: michael.k@siklu.com
Contact name: Mr. Michael Kopit

4 Test details

Project ID: 46093
Location: Hermon Laboratories Ltd. P.O. Box 23, Binyamina 3055001, Israel
Test started: 16-Mar-22
Test completed: 10-Apr-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*

Note*. The relevant tests were performed under project #46018. The purpose of the reissue of the test report for compliance with minor modifications that was made in MH-N367-CCP-PoE-MWB and includes:

1. Antenna's mechanical housing.
2. External Coax cables from Main Chassis to Antenna's
3. External plastic covers that exist on MH-N367-CCP-PoE-MWB are nonexistent in N880-CCP-PoE.

The above modifications stated in manufacturer's declaration (refer to Appendix G of the test report).

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, EMC & Radio	16-Mar-22 – 10-Apr-22	
Reviewed by:	Mrs. S. Peysahov Sheynin, test engineer, EMC & Radio	10-Jun-22	
Approved by:	Mr. M. Nikishin, group leader, EMC & Radio	19-Oct-22	



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 N367 60GHz 4 sectors system, model MH-N367-CCP-PoE-MWB. 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

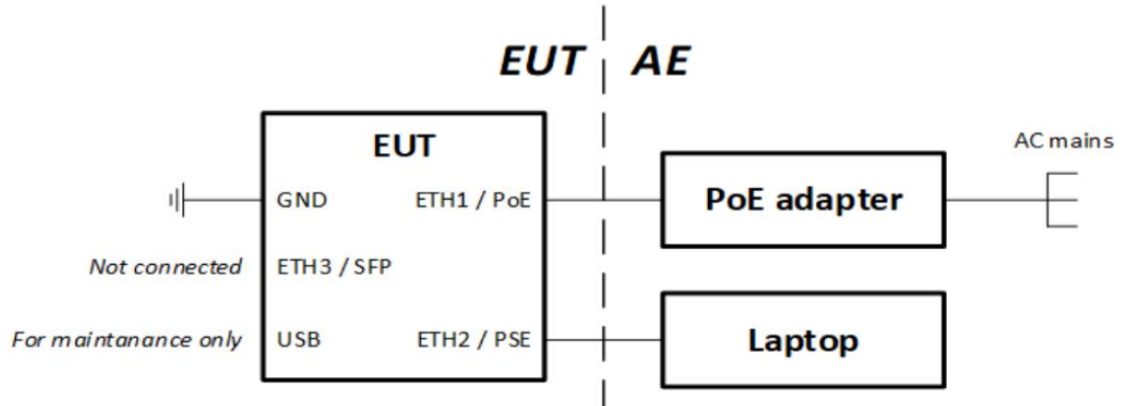
Description	Manufacturer	Model number	Serial number
Laptop	Lenovo	X220	R9L080Z
PoE adapter	Power Dsine Microsemi	PD-9501GC/AC	C18466280000000058

6.4 Changes made in the EUT

No changes were performed in the EUT during testing.



6.5 Test configuration





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6.6 Transmitter characteristics

Type of equipment				
<input checked="" type="checkbox"/>	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		
<input checked="" type="checkbox"/>	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	41.33 dBm	
Is transmitter output power variable?		<input checked="" type="checkbox"/>	No	
			continuous variable	
			stepped variable with stepsize	dB
			minimum RF power	dBm
			maximum RF power	
Antenna connection				
unique coupling	standard connector	<input checked="" type="checkbox"/>	Integral	
			with temporary RF connector	
			without temporary RF connector	
Antenna/s technical characteristics				
Type	Manufacturer	Model number	Gain	
Patch antenna array	Siklu Ltd.	PCB267A	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				
	Nominal rated voltage	Battery type		
<input checked="" type="checkbox"/>	DC	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		<input checked="" type="checkbox"/>	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: Compliance	Verdict: PASS
Date(s): 16-Mar-22	
Temperature: 22 °C	Relative Humidity: 45 %
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: Compliance		Verdict: PASS	
Date(s): 16-Mar-22			
Temperature: 22 °C	Relative Humidity: 45 %	Air Pressure: 1016 hPa	Power: 48 VDC
Remarks:			

Figure 7.1.1 Peak output power test setup

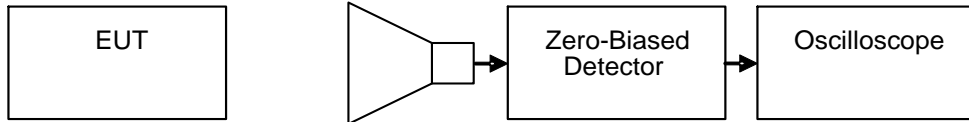


Figure 7.1.2 Peak output power test setup

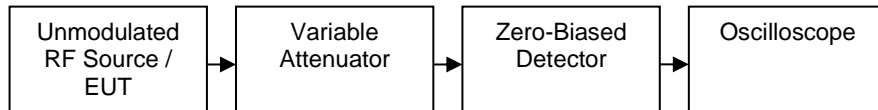
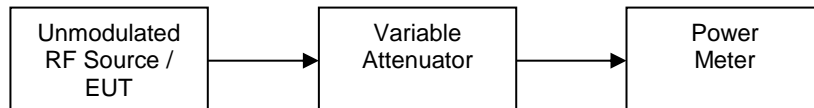


Figure 7.1.3 Peak output power test setup





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:		Compliance	
Date(s):		16-Mar-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	4.16	-4.80	24	143.77	39.07	43	-3.93	Pass
62640	0.004789	5.38	-5.15	24	144.04	39.34	43	-3.66	Pass
64800	0.00463	6.28	-5.01	24	144.48	39.78	43	-3.22	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	3.58	-4.55	24	144.02	39.32	43	-3.68	Pass
62640	0.004789	5.02	-4.22	24	144.97	40.27	43	-2.73	Pass
64800	0.004630	5.28	-4.60	24	144.89	40.19	43	-2.81	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	-4.45	24	144.12	39.42	43	-3.58	Pass
62640	0.004789	3.46	-4.42	24	144.77	40.07	43	-2.93	Pass
64800	0.004630	4.56	-3.76	24	145.73	41.03	43	-1.97	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	3.48	-4.43	24	144.14	39.44	43	-3.56	Pass
62640	0.004789	4.00	-3.85	24	145.34	40.64	43	-2.36	Pass
64800	0.004630	5.86	-3.46	24	146.03	41.33	43	-1.67	Pass

Note: Max peak conducted power is 41.33 dBm – 22.5 dBi = 18.83 dBm
 * - $\lambda = 300/\text{Frequency}(\text{MHz})$
 ** - $E_{meas} = 126.8 - 20\log(\lambda) + \text{Power measured} - \text{Measurement Antenna Gain} (24 \text{ dBi})$
 *** - $\text{EIRP} = E_{meas} + 20\log(\text{Measurements distance}) - 104.7$
 **** - $\text{Margin} = \text{EIRP} - \text{Limit}$



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:	Compliance	Verdict: PASS	
Date(s):	16-Mar-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	3.17	-4.60	24	143.97	39.27	40	-0.73	Pass
62640	0.004789	4.06	-5.40	24	143.79	39.09	40	-0.91	Pass
64800	0.004630	5.15	-4.92	24	144.57	39.87	40	-0.13	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	2.65	-5.02	24	143.55	38.85	40	-1.15	Pass
62640	0.004789	3.84	-5.33	24	143.86	39.16	40	-0.84	Pass
64800	0.004630	4.39	-4.91	24	144.58	39.88	40	-0.12	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	-5.09	24	143.48	38.78	40	-1.22	Pass
62640	0.004789	2.62	-5.02	24	144.17	39.47	40	-0.53	Pass
64800	0.004630	3.54	-4.90	24	144.59	39.89	40	-0.11	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	2.6	-5.00	24	143.57	38.87	40	-1.13	Pass
62640	0.004789	3.1	-4.81	24	144.38	39.68	40	-0.32	Pass
64800	0.004630	4.8	-4.82	24	144.67	39.97	40	-0.03	Pass

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

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

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

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

Reference numbers of test equipment used

HL 0771	HL 3291	HL 5360	HL 5371	HL 5377	HL 5971		
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Full description is given in Appendix A.



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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	
Date(s):		16-Mar-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





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-Mar-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





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-Mar-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





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-Mar-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





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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	
Date(s):		16-Mar-22	
Temperature: 22 °C		Relative Humidity: 45 %	
Air Pressure: 1016 hPa		Power: 48 VDC	
Remarks:			
		Verdict: PASS	

Plot 7.1.5 Output power test result at the 64.80 GHz frequency

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



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





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	
Date(s):		16-Mar-22	
Temperature: 22 °C		Relative Humidity: 45 %	
Air Pressure: 1016 hPa		Power: 48 VDC	
Remarks:			
		Verdict: PASS	

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: Compliance	Verdict: PASS
Date(s): 16-Feb-22 - 17-Feb-22	
Temperature: 22 °C	Relative Humidity: 45 %
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	
57000 - 71000	6 dBc	99%

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

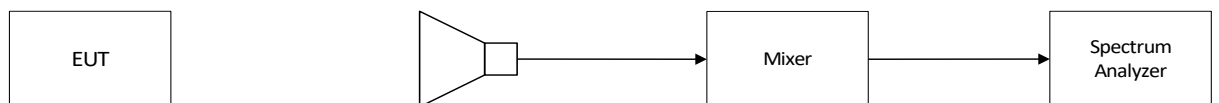
7.2.2 Test procedure

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	
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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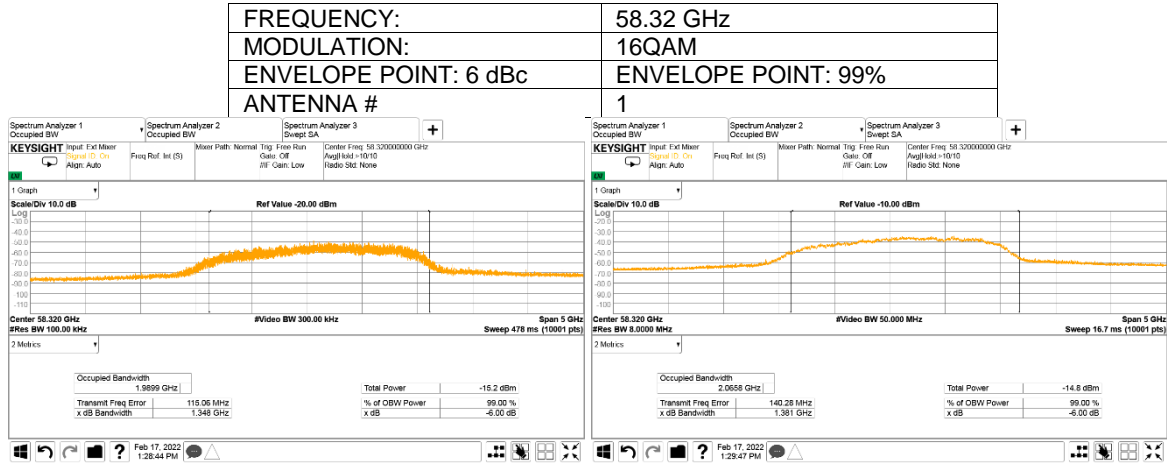
Full description is given in Appendix A.



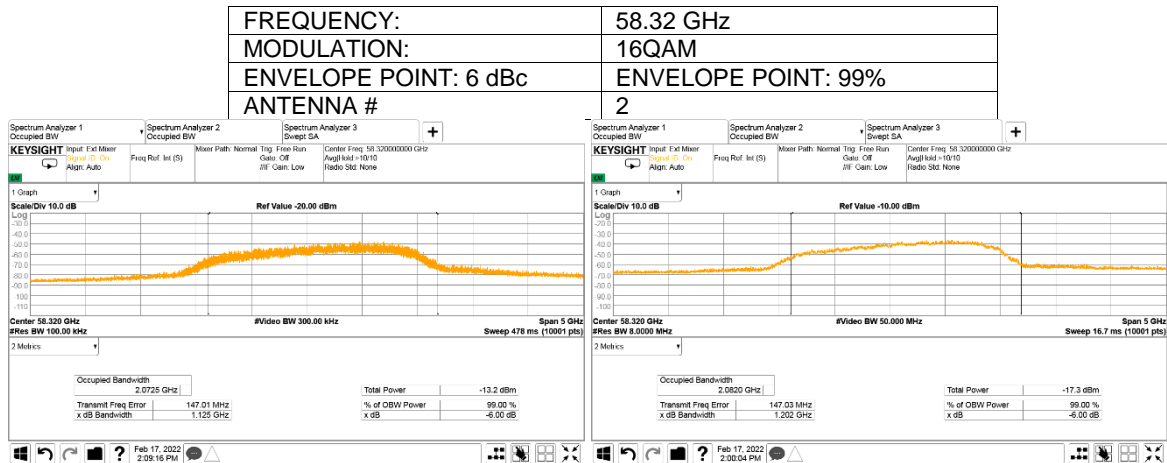
HERMON LABORATORIES

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



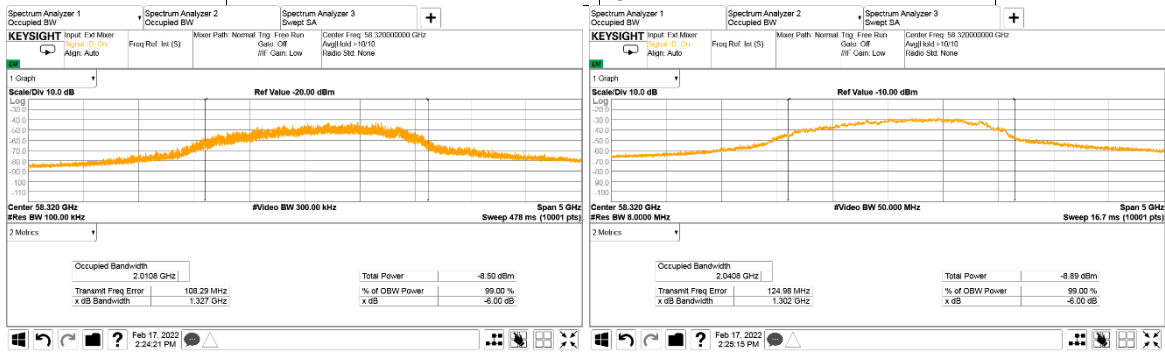


HERMON LABORATORIES

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:	

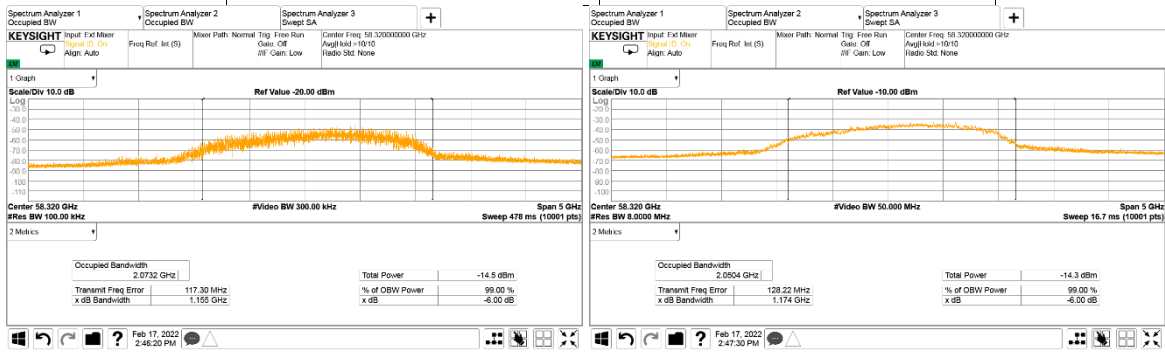
Plot 7.2.3 The 6dBc and 99% occupied bandwidth

FREQUENCY:	58.32 GHz
MODULATION:	16QAM
ENVELOPE POINT: 6 dBc	ENVELOPE POINT: 99%
ANTENNA #	3



Plot 7.2.4 The 6dBc and 99% occupied bandwidth

FREQUENCY:	58.32 GHz
MODULATION:	16QAM
ENVELOPE POINT: 6 dBc	ENVELOPE POINT: 99%
ANTENNA #	4



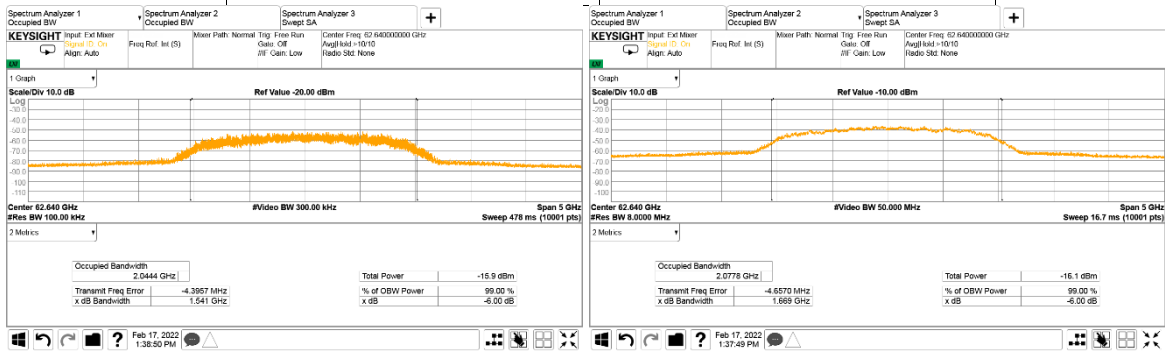


HERMON LABORATORIES

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:	

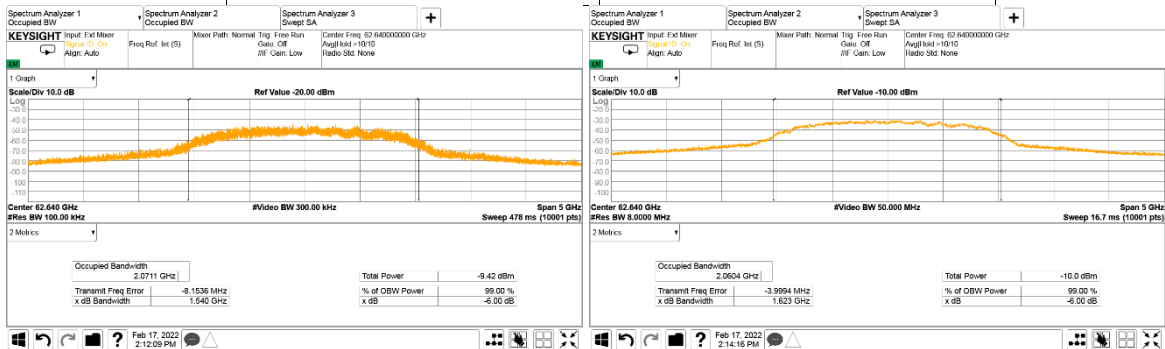
Plot 7.2.5 The 6dBc and 99% occupied bandwidth

FREQUENCY:	62.64 GHz
MODULATION:	16QAM
ENVELOPE POINT: 6 dBc	ENVELOPE POINT: 99%
ANTENNA #	1



Plot 7.2.6 The 6dBc and 99% occupied bandwidth

FREQUENCY:	62.64 GHz
MODULATION:	16QAM
ENVELOPE POINT: 6 dBc	ENVELOPE POINT: 99%
ANTENNA #	2

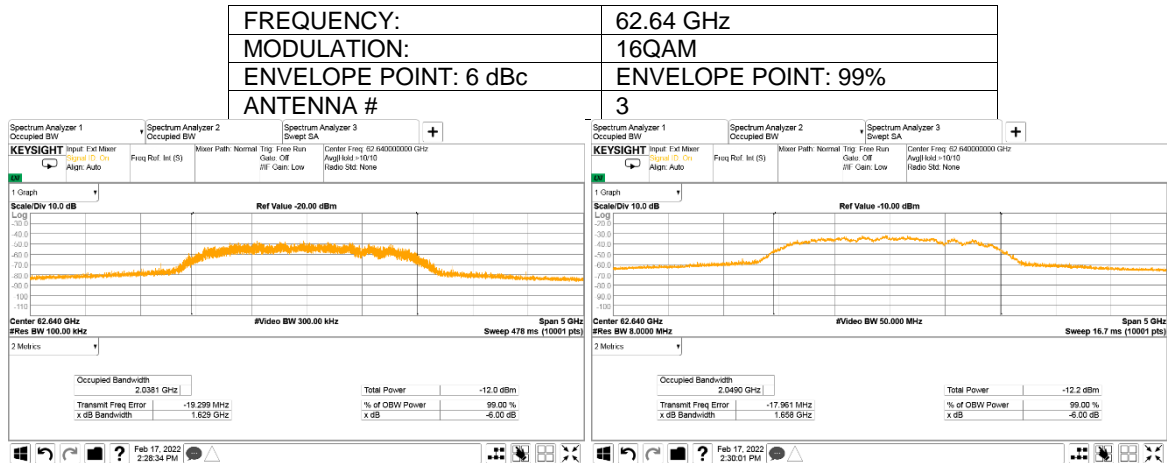




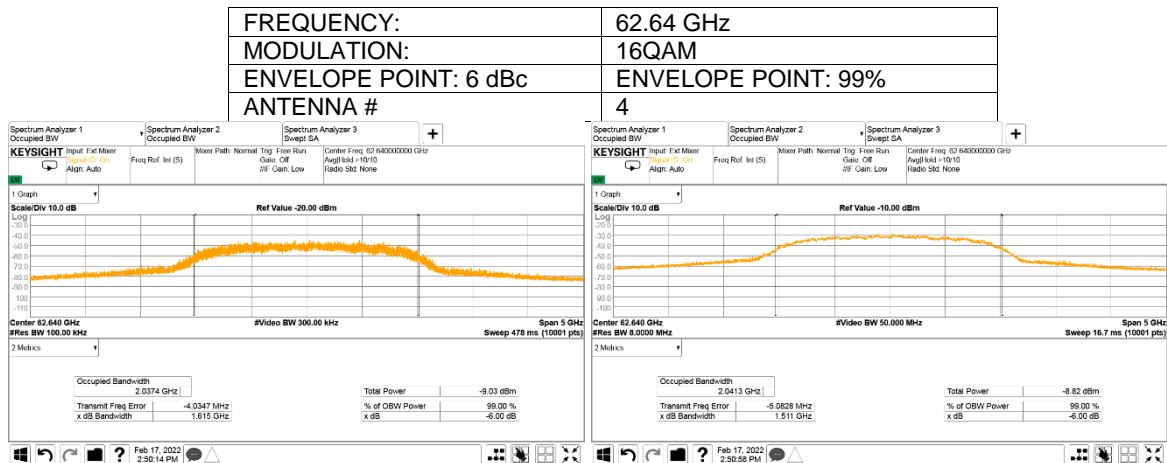
HERMON LABORATORIES

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

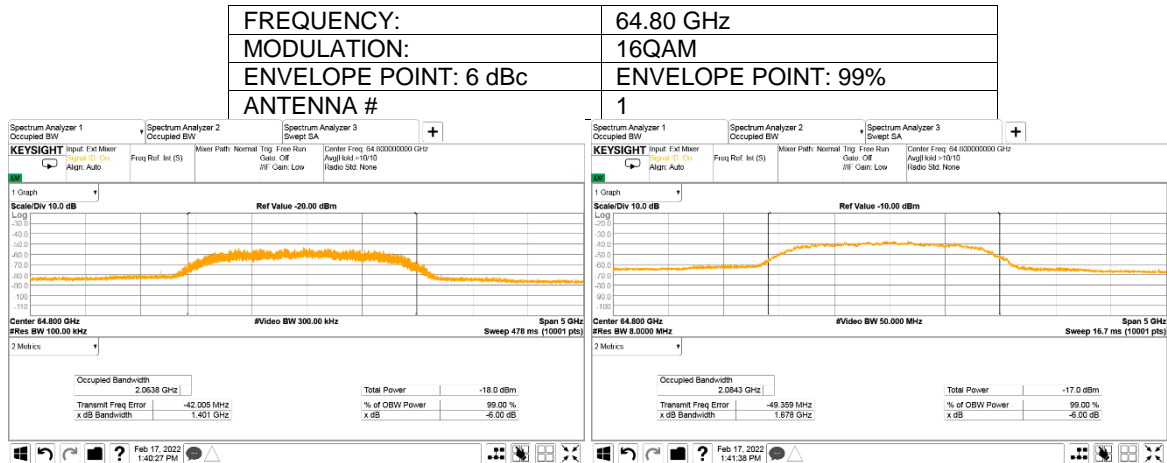




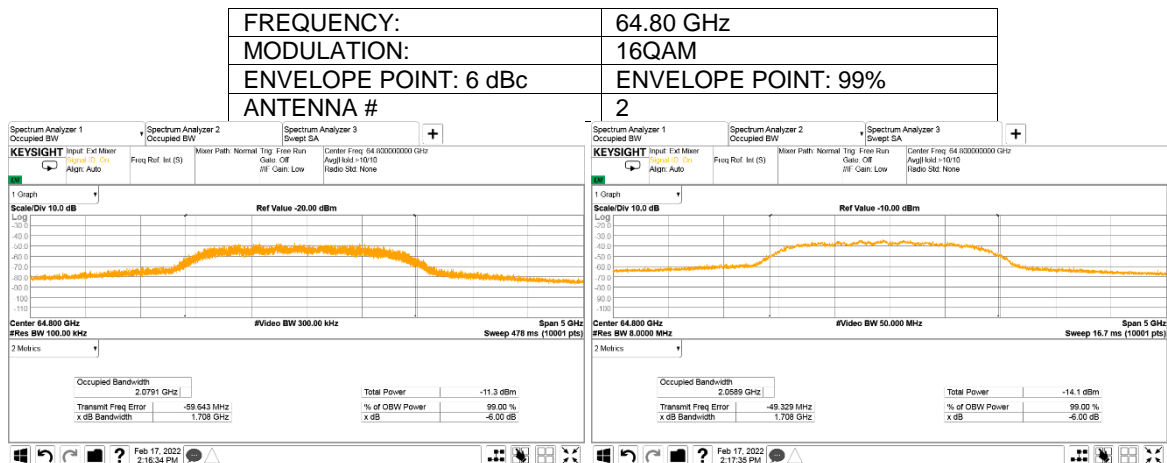
HERMON LABORATORIES

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



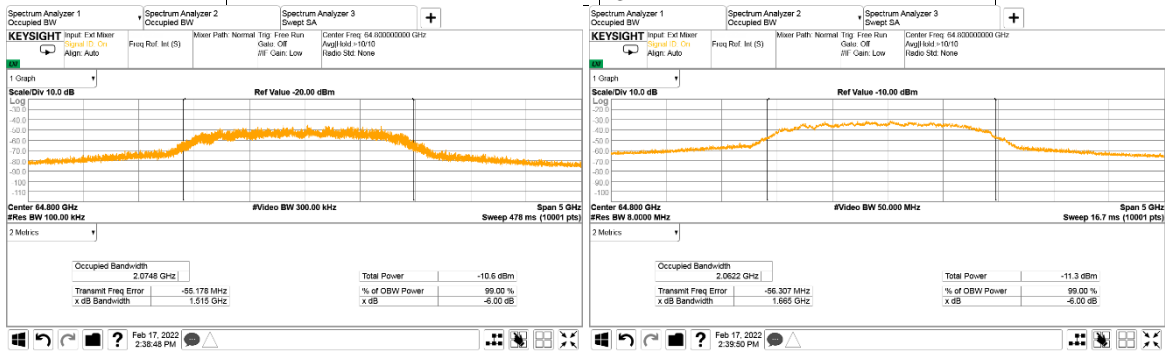


HERMON LABORATORIES

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:	

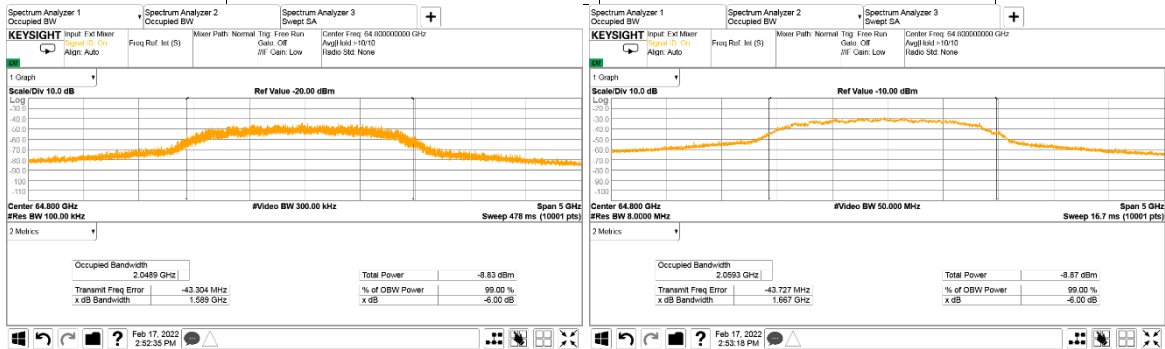
Plot 7.2.11 The 6dBc and 99% occupied bandwidth

FREQUENCY:	64.80 GHz
MODULATION:	16QAM
ENVELOPE POINT: 6 dBc	ENVELOPE POINT: 99%
ANTENNA #	3



Plot 7.2.12 The 6dBc and 99% occupied bandwidth

FREQUENCY:	64.80 GHz
MODULATION:	16QAM
ENVELOPE POINT: 6 dBc	ENVELOPE POINT: 99%
ANTENNA #	4





Test specification: FCC Section 15.255(d)(3), RSS-210 section J.3, Out of band radiated emissions above 40 GHz			
Test procedure: ANSI C63.10, Sections 9.9, 9.12			
Test mode: Compliance		Verdict: PASS	
Date(s): 17-Mar-22			
Temperature: 10 °C	Relative Humidity: 48 %	Air Pressure: 1020 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	

*- 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)(3), RSS-210 section J.3, Out of band radiated emissions above 40 GHz			
Test procedure: ANSI C63.10, Sections 9.9, 9.12			
Test mode: Compliance	Verdict: PASS		
Date(s): 17-Mar-22			
Temperature: 10 °C	Relative Humidity: 48 %	Air Pressure: 1020 hPa	Power: 48 VDC
Remarks:			

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

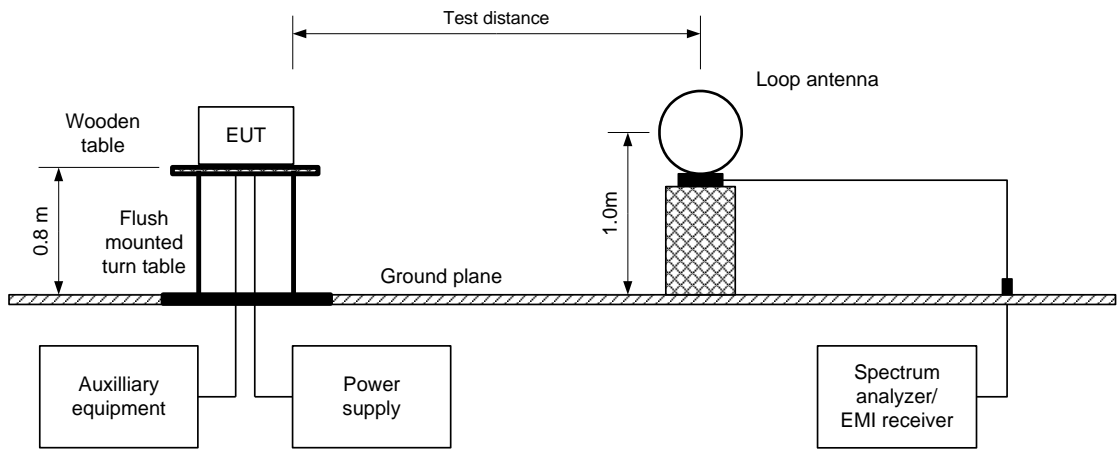
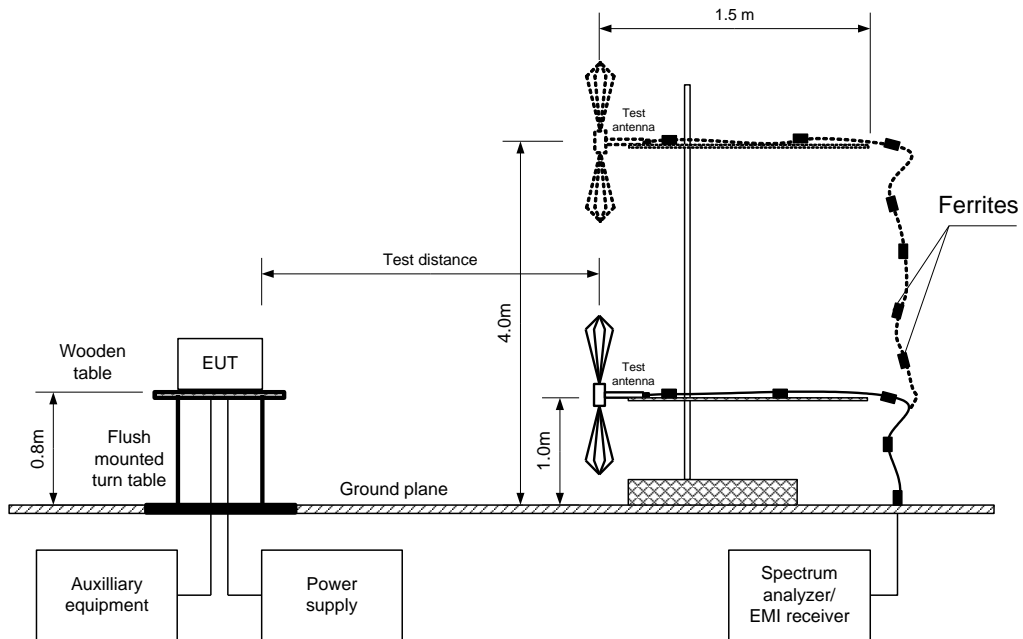


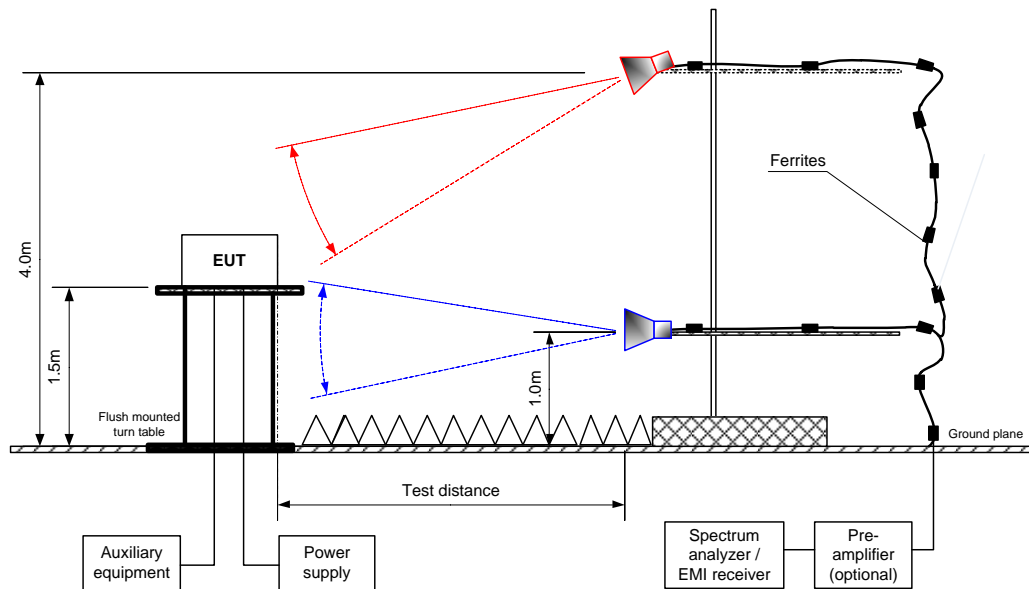
Figure 7.3.2 Setup for spurious emission field strength measurements in 30 – 1000 MHz





Test specification: FCC Section 15.255(d)(3), RSS-210 section J.3, Out of band radiated emissions above 40 GHz			
Test procedure: ANSI C63.10, Sections 9.9, 9.12			
Test mode: Compliance	Verdict: PASS		
Date(s): 17-Mar-22			
Temperature: 10 °C	Relative Humidity: 48 %	Air Pressure: 1020 hPa	Power: 48 VDC
Remarks:			

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





Test specification: FCC Section 15.255(d)(3), RSS-210 section J.3, Out of band radiated emissions above 40 GHz			
Test procedure: ANSI C63.10, Sections 9.9, 9.12			
Test mode: Compliance		Verdict: PASS	
Date(s): 17-Mar-22			
Temperature: 10 °C	Relative Humidity: 48 %	Air Pressure: 1020 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											
7290	Ver	1.50	179	52.57	74.0	-21.43	50.00	NA	54.0	-4.00	Pass
14154	Ver	1.50	212	57.87	74.0	-16.13	50.08	NA	54.0	-3.92	
14606	Ver	1.50	360	59.46	74.0	-14.54	51.12	NA	54.0	-2.88	
14662	Ver	1.50	0	58.58	74.0	-15.42	50.10	NA	54.0	-3.90	
Mid frequency 62640 MHz											
7830	Ver	1.50	172	53.16	74.0	-20.84	50.86	NA	54.0	-3.14	Pass
High frequency 64800 MHz											
No emissions found											Pass

*- 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)(3), RSS-210 section J.3, Out of band radiated emissions above 40 GHz			
Test procedure: ANSI C63.10, Sections 9.9, 9.12			
Test mode: Compliance		Verdict: PASS	
Date(s): 17-Mar-22			
Temperature: 10 °C	Relative Humidity: 48 %	Air Pressure: 1020 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 frequency								
640.167	50.41	44.35	46.0	-1.65	Horizontal	1.26	185	Pass
741.324	45.87	39.70	46.0	-6.30	Horizontal	1.00	157	
779.326	50.82	44.95	46.0	-1.05	Horizontal	1.00	308	
786.597	50.34	44.06	46.0	-1.94	Horizontal	1.00	201	
789.924	51.39	45.20	46.0	-0.80	Horizontal	1.02	308	

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*				
Mid frequency								
628.522	51.19	44.51	46.0	-1.49	Horizontal	1.26	186	Pass
661.398	47.11	40.98	46.0	-5.02	Horizontal	1.24	157	
785.379	50.10	44.39	46.0	-1.61	Horizontal	1.02	191	
790.027	51.58	45.59	46.0	-0.41	Horizontal	1.85	302	
791.015	51.71	45.54	46.0	-0.46	Horizontal	1.87	302	



Test specification: FCC Section 15.255(d)(3), RSS-210 section J.3, Out of band radiated emissions above 40 GHz			
Test procedure: ANSI C63.10, Sections 9.9, 9.12			
Test mode: Compliance		Verdict: PASS	
Date(s): 17-Mar-22			
Temperature: 10 °C	Relative Humidity: 48 %	Air Pressure: 1020 hPa	Power: 48 VDC
Remarks:			

Table 7.3.4 Field strength of emissions below 1 GHz (continuation)

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*				
High frequency								
38.915	40.13	33.71	40.0	-6.29	Vertical	1.00	99	Pass
789.599	52.30	45.76	46.0	-0.24	Horizontal	1.04	308	
790.280	50.50	44.21	46.0	-1.79	Vertical	1.85	221	
790.792	50.19	43.82	46.0	-2.18	Horizontal	1.00	273	
791.160	51.86	45.38	46.0	-0.62	Horizontal	1.02	302	

*- 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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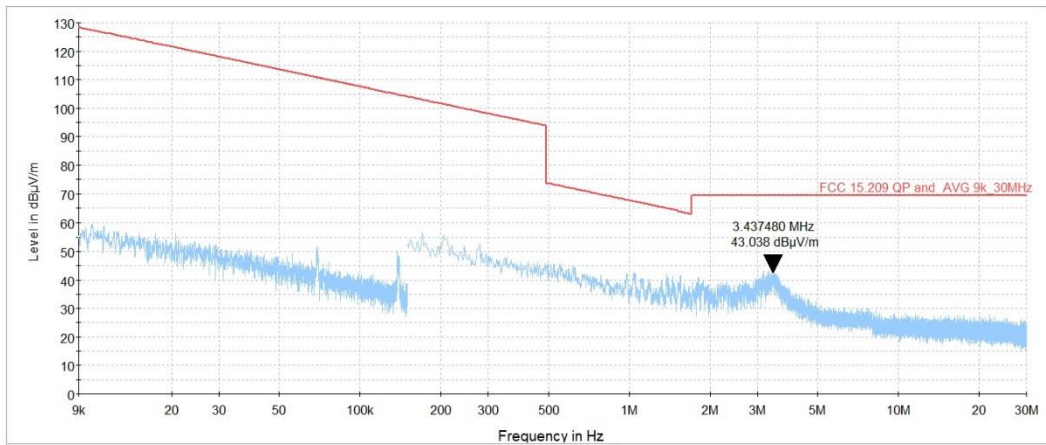
Full description is given in Appendix A.



Test specification: FCC Section 15.255(d)(3), RSS-210 section J.3, Out of band radiated emissions above 40 GHz	
Test procedure: ANSI C63.10, Sections 9.9, 9.12	
Test mode: Compliance	Verdict: PASS
Date(s): 17-Mar-22	
Temperature: 10 °C	Relative Humidity: 48 %
Remarks:	

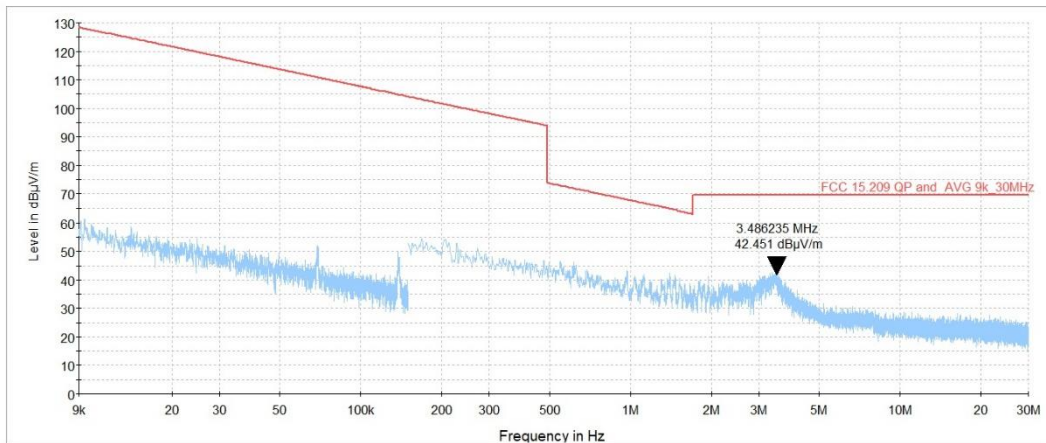
Plot 7.3.1 Radiated emission measurements from 9 KHz to 30 MHz at low frequency

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

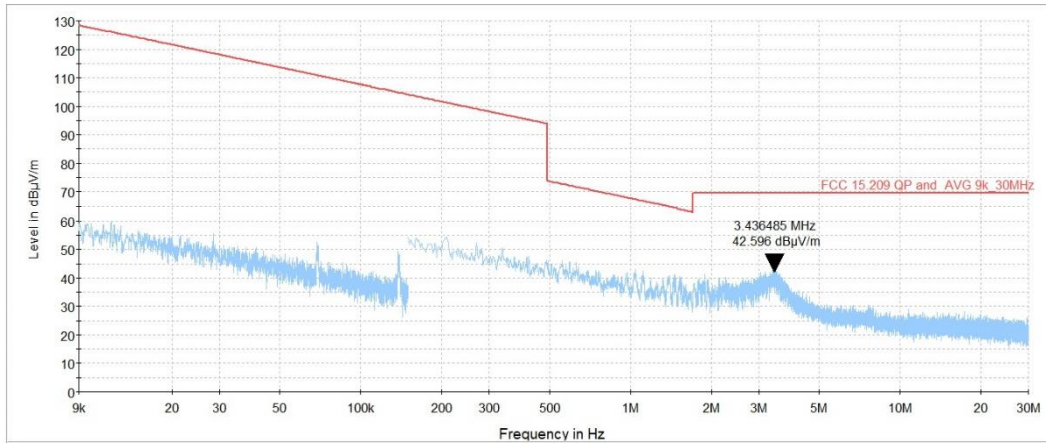




Test specification: FCC Section 15.255(d)(3), RSS-210 section J.3, Out of band radiated emissions above 40 GHz	
Test procedure: ANSI C63.10, Sections 9.9, 9.12	
Test mode: Compliance	Verdict: PASS
Date(s): 17-Mar-22	
Temperature: 10 °C	Relative Humidity: 48 %
Remarks:	

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

