

TEST REPORT

ACCORDING TO: FCC 47 CFR part 15 section 15.255 and subpart B;
RSS-210 issue 10 Annex J, RSS-Gen issue 5

FOR:

**Siklu Communication Ltd.
MultiHaul™ TG Long Reach Terminal Unit**

Models:

MH-T280-CCP-PoE-MWB

MH-T280-CNN-PoE-MWB

MH-T270-CCP-PoE-MWB

MH-T270-CNN-PoE-MWB

FCC ID: 2ACYESK-MH60TG-A3

IC: 12353A-MH60TGA3

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1 Applicant information

Client name: Siklu Communication Ltd.
Address: 43 Hasivim street, Petach-Tikva 49517, Israel
Telephone: +972 3921 4015
Fax: +972 3921 4162
E-mail: igor.f@siklu.com
Contact name: Mr. Igor Efimov

2 Equipment under test attributes

Product name: MultiHaul™ TG Long Reach Terminal Unit
Product type: Transceiver
Model(s): MH-T280-CCP-PoE-MWB
Serial number: S040000026
Hardware version: A0
Software release: R1.0.3
Receipt date 28-Oct-20

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: igor.f@siklu.com
Contact name: Mr. Igor Efimov

4 Test details

Project ID: 42253
Location: Hermon Laboratories Ltd. P.O. Box 23, Binyamina 3055001, Israel
Test started: 16-Mar-21
Test completed: 06-Apr-21
Test specification(s): FCC 47 CFR part 15 section 15.255 and subpart B;
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) (ii),(d)(1) / 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
FCC Section 15.207(a)/ RSS-Gen, section 8.8, Conducted emission	Pass
FCC section 15.255(g)/ RSS-Gen, section 3.4, RF exposure	Pass, exhibit included in Application for certification
Unintentional emissions	
FCC Section 15.107, Conducted emission at AC power port	Pass
Section 15.109, Radiated emission	Pass

This test report supersedes the previously issued test report identified by Doc ID: SIKRAD_FCC.42253_Rev2

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:	Mr. A. Morozov, test engineer, EMC & Radio	16-Mar-21 – 06-Apr-21	
Reviewed by:	Mrs. S. Peysahov Sheynin, test engineer, EMC & Radio	27-Jun-21	
Approved by:	Mr. S. Samokha, technical manager, EMC & Radio	27-Jun-21	

6 EUT description


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

6.1 General information

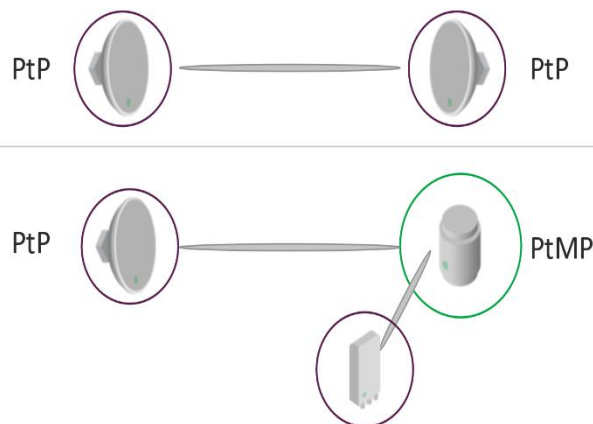
The EUT is the MultiHaul™ Long Range Terminal unit. The unit operates in 57-66GHz regulated V-band using the TG protocol. It supports both PtP (Point-to-Point) and PtMP (Point-to-Multipoint) applications.

In PtP application, it communicates with another Long Range Terminal. In PtMP applications, it communicates to the MH-N3666-CCP-PoE-NWB TG Distribution Node acting as an end point in fully meshed MultiHaul™ TG topology.

In both applications the EUT is point-to-point transmitter.

T280 always in PtP mode, connected to a single device through a single high-gain beam with a fixed boresight direction 

The other device can be a T280, which we refer to as PtP application, or a N3666 which is working in PtMP, hence the reference to PtMP



Siklu

According to manufacturer's declaration provided in Appendix F of the test report, the same EUT hardware can be used as MH-T280-CCP-PoE-MWB and MH-T270-CCP-PoE-MWB. MH-T280-CCP-PoE-MWB has default software configuration to communicate with another MH-T280-CCP-PoE-MWB in PtP application. MH-T270-CCP-PoE-MWB has default software configuration to communicate with MH-N3666-CCP-PoE-MWB in PtMP application.

6.2 Ports and lines

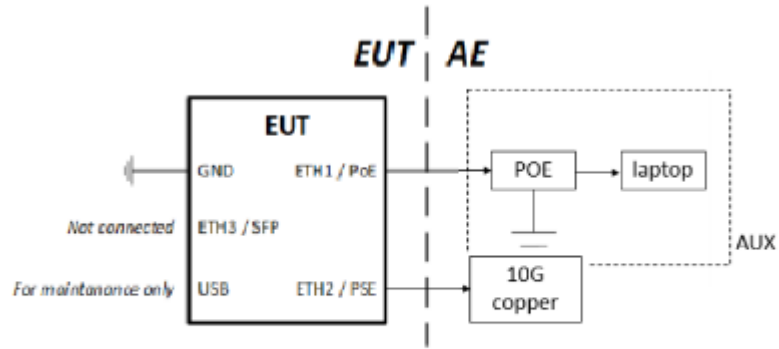
Port type	Port description	Conn. from	Conn. to	Qty.	Cable type	Cable length, m	Indoor / outdoor
Power	Data	EUT	RJ-45	1	Shielded	100	outdoor
Interconnecting	Data	EUT	RJ-45	1	Shielded	100	outdoor
Interconnecting	Data	EUT	SFP+	1	Fiber optic	100	outdoor

6.3 Changes made in the EUT

No changes were performed in the EUT during testing.



6.4 Test configuration





6.5 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	62.23 dBm
Is transmitter output power variable?	V	No	
		continuous variable	
		stepped variable with stepsize	
	Yes	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
0.5 Ft dish antenna	Siklu	NA / Integrated	36 dBi +/-2 dB
1 Ft dish antenna	Siklu	EH-ANT-1ft-60GHz	43 dBi +/-2 dB
2 Ft dish antenna	Shenglu	EH-ANT-2ft-60GHz	48 dBi +/-2 dB
Transmitter 99% power bandwidth, MHz		Transmitter aggregate data rate/s, Mbps	Type of modulation
2153.6		385 / 4620	16QAM
Type of multiplexing		TDD	
Transmitter power source			
	Nominal rated voltage	Battery type	
V	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		V	yes no



Test specification: FCC Section 15.255(c)(1) (ii),(d)(1), RSS-210 section J.2.2(b), J.4, Transmitter power and power spectral density			
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): 04-Apr-21			
Temperature: 21 °C	Relative Humidity: 39 %	Air Pressure: 1010 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 – 66000	500	27.0	85*	82*

* - The average/peak power of any emission shall not exceed 82 (average) or 85 (peak) dBm, and shall be reduced by 2 dB for every dB that the antenna gain is less than 51 dBi.

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) (ii),(d)(1), RSS-210 section J.2.2(b), J.4, Transmitter power and power spectral density		
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):	04-Apr-21		
Temperature: 21 °C	Relative Humidity: 39 %	Air Pressure: 1010 hPa	Power: 48 VDC
Remarks:			

Figure 7.1.1 Peak output power test setup

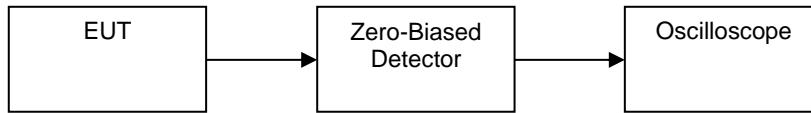


Figure 7.1.2 Peak output power test setup

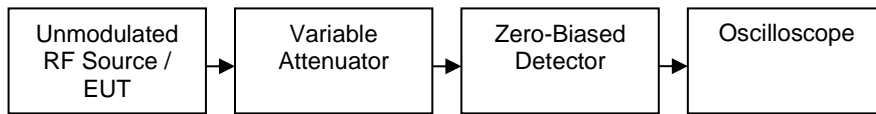
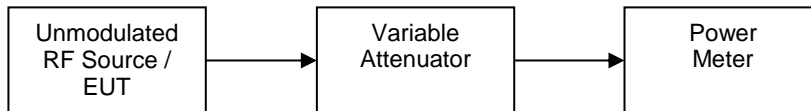


Figure 7.1.3 Peak output power test setup





Test specification:	FCC Section 15.255(c)(1) (ii),(d)(1), RSS-210 section J.2.2(b), J.4, Transmitter power and power spectral density		
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):	04-Apr-21		
Temperature: 21 °C	Relative Humidity: 39 %	Air Pressure: 1010 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
MODULATION: 16QAM
EUT ANTENNA GAIN: 38 dBi

Frequency, MHz	λ^* , m	DSO, mV	Power measured, dBm	Antenna Gain, dBi	EIRP**, dBm	Limit, dBm	Margin***, dB	Verdict
EUT configuration: MCS1								
58320	0.005144	4.00	12.21	38.0	50.21	59.0	-8.79	Pass
62640	0.004789	4.37	12.11	38.0	50.11	59.0	-8.89	Pass
64800	0.004630	4.31	10.90	38.0	48.90	59.0	-10.10	Pass
EUT configuration: MCS12								
58320	0.005144	3.88	12.03	38.0	50.03	59.0	-8.97	Pass
62640	0.004789	4.47	12.23	38.0	50.23	59.0	-8.77	Pass
64800	0.004630	4.35	10.95	38.0	48.95	59.0	-10.05	Pass

EUT ANTENNA GAIN: 45 dBi

Frequency, MHz	λ^* , m	DSO, mV	Power measured, dBm	Antenna Gain, dBi	EIRP**, dBm	Limit, dBm	Margin***, dB	Verdict
EUT configuration: MCS1								
58320	0.005144	4.00	12.21	45.0	57.21	73.0	-15.79	Pass
62640	0.004789	4.37	12.11	45.0	57.11	73.0	-15.89	Pass
64800	0.004630	4.31	10.90	45.0	55.90	73.0	-17.10	Pass
EUT configuration: MCS12								
58320	0.005144	3.88	12.03	45.0	57.03	73.0	-15.97	Pass
62640	0.004789	4.47	12.23	45.0	57.23	73.0	-15.77	Pass
64800	0.004630	4.35	10.95	45.0	55.95	73.0	-17.05	Pass

EUT ANTENNA GAIN: 50 dBi

Frequency, MHz	λ^* , m	DSO, mV	Power measured, dBm	Antenna Gain, dBi	EIRP**, dBm	Limit, dBm	Margin***, dB	Verdict
EUT configuration: MCS1								
58320	0.005144	4.00	12.21	50.0	62.21	83.0	-20.79	Pass
62640	0.004789	4.37	12.11	50.0	62.11	83.0	-20.89	Pass
64800	0.004630	4.31	10.90	50.0	60.90	83.0	-22.10	Pass
EUT configuration: MCS12								
58320	0.005144	3.88	12.03	50.0	62.03	83.0	-20.97	Pass
62640	0.004789	4.47	12.23	50.0	62.23	83.0	-20.77	Pass
64800	0.004630	4.35	10.95	50.0	60.95	83.0	-22.05	Pass

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

** - EIRP= Power measured + Antenna Gain

*** - Margin = EIRP – Limit



Test specification: FCC Section 15.255(c)(1) (ii),(d)(1), RSS-210 section J.2.2(b), J.4, Transmitter power and power spectral density			
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): 04-Apr-21			
Temperature: 21 °C	Relative Humidity: 39 %	Air Pressure: 1010 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
MODULATION: 16QAM
EUT ANTENNA GAIN: 38 dBi

Frequency, MHz	λ^* , m	DSO, mV	Power measured, dBm	Antenna Gain, dBi	EIRP**, dBm	Limit, dBm	Margin***, dB	Verdict
EUT configuration: MCS1								
58320	0.005144	3.42	12.21	38.0	50.21	56.0	-3.79	Pass
62640	0.004789	3.77	11.89	38.0	49.89	56.0	-4.11	Pass
64800	0.004630	3.75	10.64	38.0	48.64	56.0	-5.36	Pass
EUT configuration: MCS12								
58320	0.005144	3.23	12.21	38.0	50.21	56.0	-3.79	Pass
62640	0.004789	3.80	11.94	38.0	49.94	56.0	-4.06	Pass
64800	0.004630	3.73	10.63	38.0	48.63	56.0	-5.37	Pass

EUT ANTENNA GAIN: 45 dBi

Frequency, MHz	λ^* , m	DSO, mV	Power measured, dBm	Antenna Gain, dBi	EIRP**, dBm	Limit, dBm	Margin***, dB	Verdict
EUT configuration: MCS1								
58320	0.005144	3.42	12.21	45.0	57.21	70.0	-10.79	Pass
62640	0.004789	3.77	11.89	45.0	56.89	70.0	-11.11	Pass
64800	0.004630	3.75	10.64	45.0	55.64	70.0	-12.36	Pass
EUT configuration: MCS12								
58320	0.005144	3.23	12.21	45.0	57.21	70.0	-10.79	Pass
62640	0.004789	3.80	11.94	45.0	56.94	70.0	-11.06	Pass
64800	0.004630	3.73	10.63	45.0	55.63	70.0	-12.37	Pass

EUT ANTENNA GAIN: 50 dBi

Frequency, MHz	λ^* , m	DSO, mV	Power measured, dBm	Antenna Gain, dBi	EIRP**, dBm	Limit, dBm	Margin***, dB	Verdict
EUT configuration: MCS1								
58320	0.005144	3.42	12.21	50.0	62.21	80.0	-15.79	Pass
62640	0.004789	3.77	11.89	50.0	61.89	80.0	-16.11	Pass
64800	0.004630	3.75	10.64	50.0	60.64	80.0	-17.36	Pass
EUT configuration: MCS12								
58320	0.005144	3.23	12.21	50.0	62.21	80.0	-15.79	Pass
62640	0.004789	3.80	11.94	50.0	61.94	80.0	-16.06	Pass
64800	0.004630	3.73	10.63	50.0	60.63	80.0	-17.37	Pass

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

** - EIRP= Power measured + Antenna Gain

*** - Margin = EIRP – Limit

Reference numbers of test equipment used

HL 3291	HL 3293	HL 3301	HL 3302	HL 4856	HL 5236	HL 5714	HL 5371
HL 5377	HL 5663						

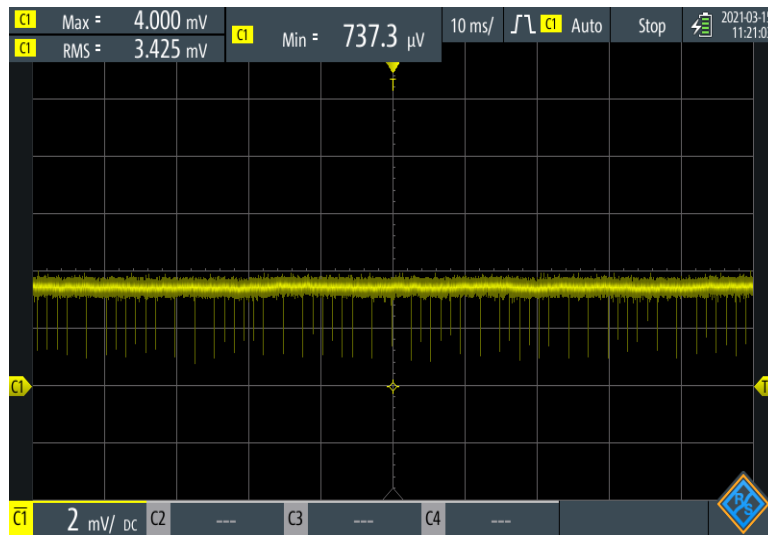


Test specification: FCC Section 15.255(c)(1) (ii),(d)(1), RSS-210 section J.2.2(b), J.4, Transmitter power and power spectral density			
Test procedure: 47 CFR, Section 2.1046; Section 15.255(b); ANSI C63.10, Sections 9.4, 9.5			
Test mode: Compliance		Verdict: PASS	
Date(s): 04-Apr-21			
Temperature: 21 °C	Relative Humidity: 39 %	Air Pressure: 1010 hPa	Power: 48 VDC
Remarks:			

Full description is given in Appendix A.

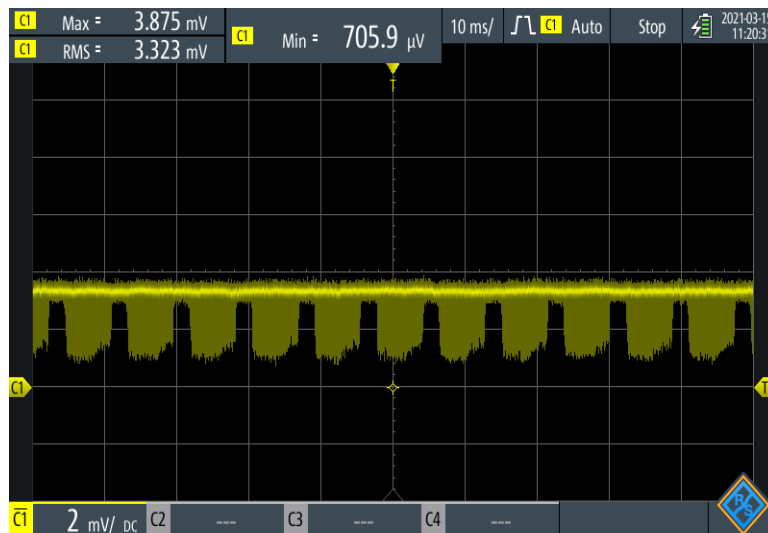
Plot 7.1.1 Output power test result at the 58.32 GHz frequency

DETECTOR:	Peak/Average
MODULATION:	16QAM
EUT CONFIGURATION:	MCS1 385Mbps



Plot 7.1.2 Output power test result at the 58.32 GHz frequency

DETECTOR:	Peak/Average
MODULATION:	16QAM
EUT CONFIGURATION:	MCS12 4620Mbps

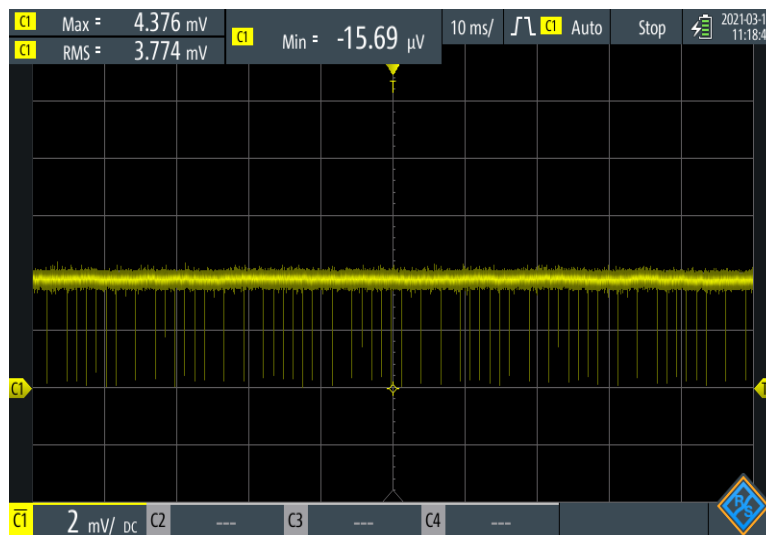




Test specification: FCC Section 15.255(c)(1) (ii),(d)(1), RSS-210 section J.2.2(b), J.4, Transmitter power and power spectral density			
Test procedure: 47 CFR, Section 2.1046; Section 15.255(b); ANSI C63.10, Sections 9.4, 9.5			
Test mode: Compliance		Verdict: PASS	
Date(s): 04-Apr-21			
Temperature: 21 °C	Relative Humidity: 39 %	Air Pressure: 1010 hPa	Power: 48 VDC
Remarks:			

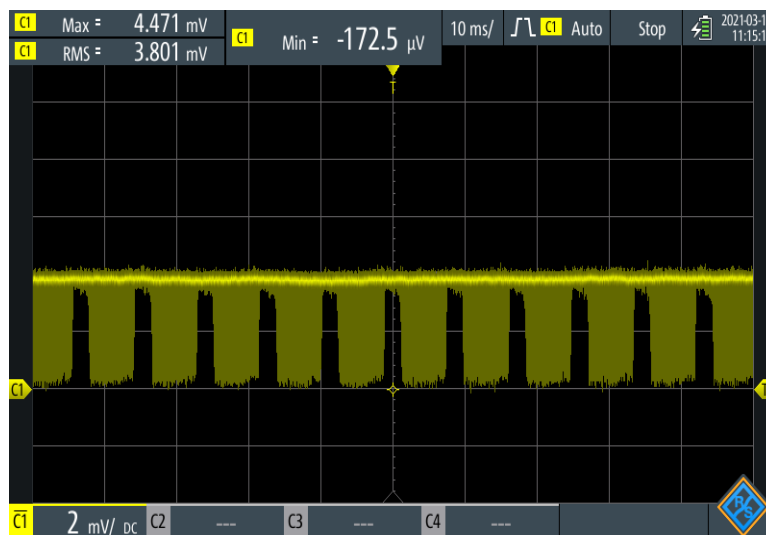
Plot 7.1.3 Output power test result at the 62.64 GHz frequency

DETECTOR:	Peak/Average
MODULATION:	16QAM
EUT CONFIGURATION:	MCS1 385Mbps



Plot 7.1.4 Output power test result at the 62.64 GHz frequency

DETECTOR:	Peak/Average
MODULATION:	16QAM
EUT CONFIGURATION:	MCS12 4620Mbps

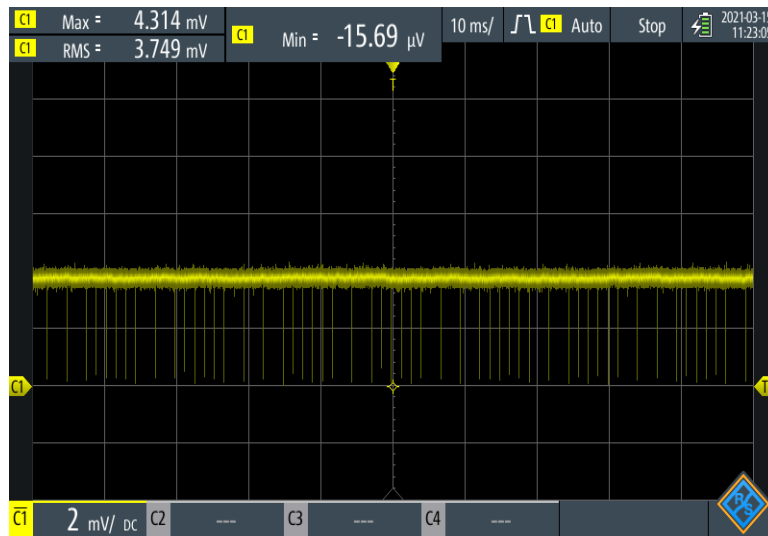




Test specification: FCC Section 15.255(c)(1) (ii),(d)(1), RSS-210 section J.2.2(b), J.4, Transmitter power and power spectral density			
Test procedure: 47 CFR, Section 2.1046; Section 15.255(b); ANSI C63.10, Sections 9.4, 9.5			
Test mode: Compliance	Verdict: PASS		
Date(s): 04-Apr-21			
Temperature: 21 °C	Relative Humidity: 39 %	Air Pressure: 1010 hPa	Power: 48 VDC
Remarks:			

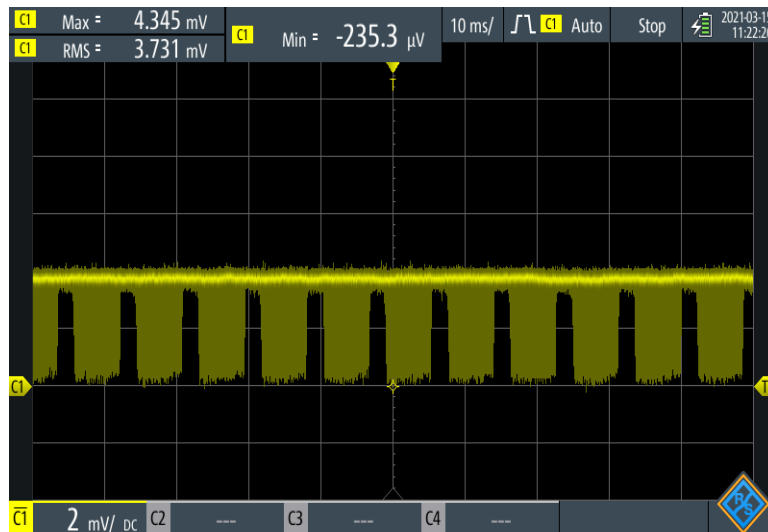
Plot 7.1.5 Output power test result at the 64.80 GHz frequency

DETECTOR:	Peak/Average
MODULATION:	16QAM
EUT CONFIGURATION:	LCS1 385Mbps



Plot 7.1.6 Output power test result at the 64.80 GHz frequency

DETECTOR:	Peak/Average
MODULATION:	16QAM
EUT CONFIGURATION:	MCS12 4620Mbps





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): 04-Apr-21	
Temperature: 21 °C	Relative Humidity: 39 %
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.

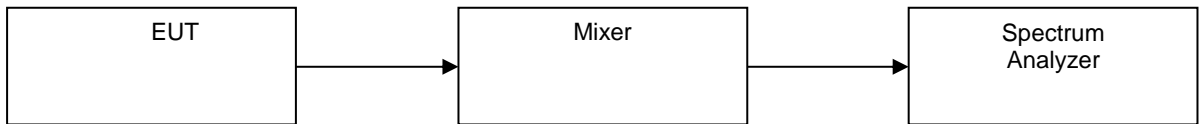
7.2.2 Test procedure

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	Verdict: PASS
Date(s): 04-Apr-21	
Temperature: 21 °C	Relative Humidity: 39 %
Air Pressure: 1010 hPa	
Power: 48 VDC	
Remarks:	

Table 7.2.2 Occupied bandwidth test results

ASSIGNED FREQUENCY RANGE: 57000 –71000 MHz
DETECTOR USED: Peak

Frequency, GHz	Occupied bandwidth 6 dBc, MHz	Occupied bandwidth 99%, MHz	Verdict
EUT configuration MCS1			
58.32	1579.0	2045.6	Pass
62.64	1762.0	1987.6	Pass
64.80	1503.0	2020.7	Pass
EUT configuration MCS12			
58.32	1572.0	2081.3	Pass
62.64	1616.0	2153.6	Pass
64.80	1454.0	2107.7	Pass

Reference numbers of test equipment used

HL 0770	HL 0771	HL 3290	HL 3291	HL 5236	HL 5380		
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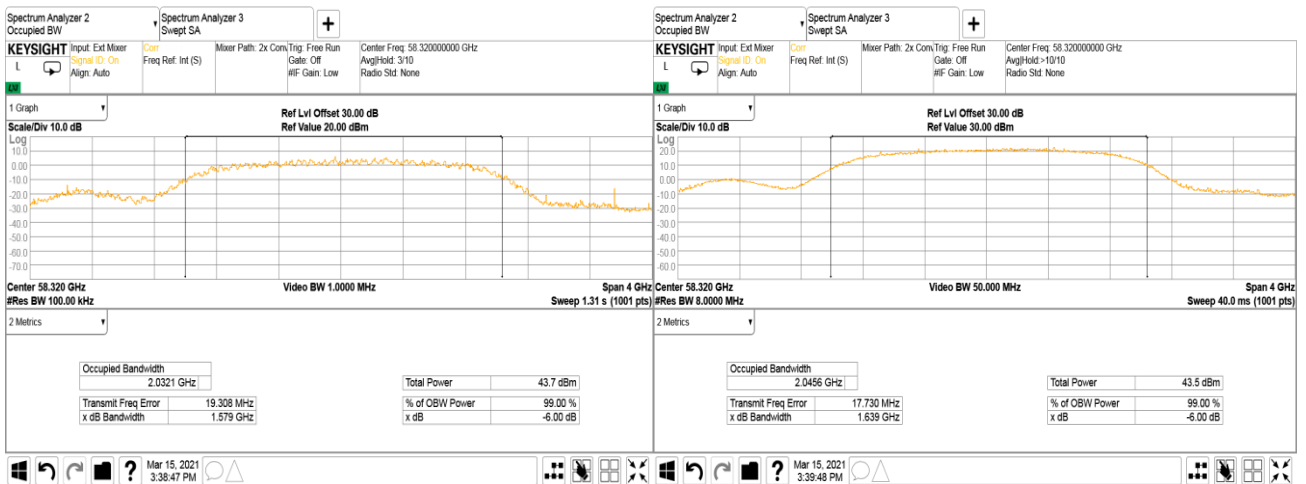
Full description is given in Appendix A.



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): 04-Apr-21	
Temperature: 21 °C	Relative Humidity: 39 %
Air Pressure: 1010 hPa	Power: 48 VDC
Remarks:	

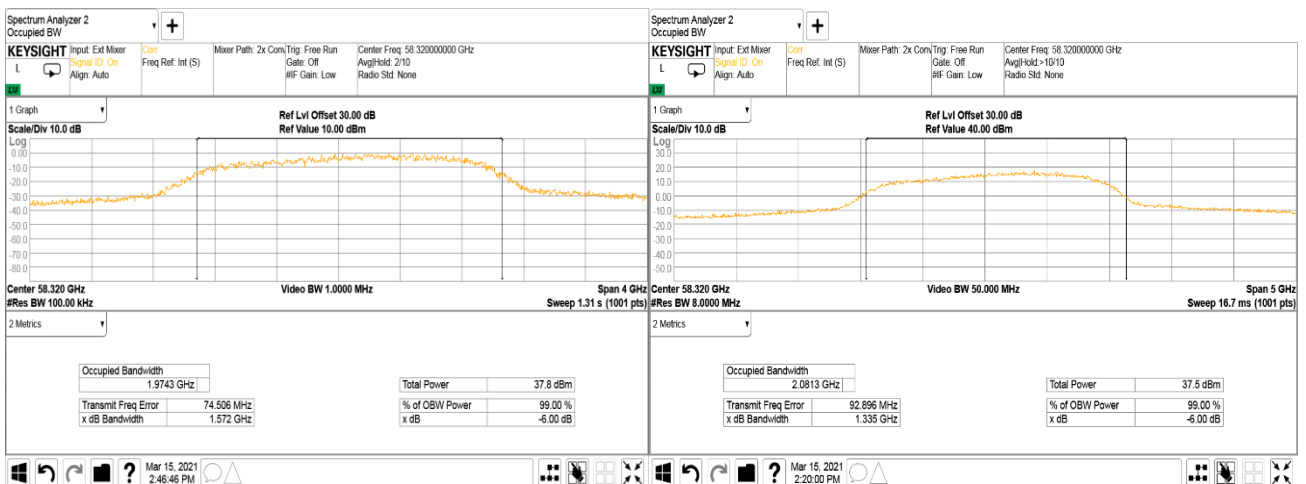
Plot 7.2.1 The 6dBc and 99% occupied bandwidth

FREQUENCY:	58.32 GHz
MODULATION:	16QAM
ENVELOPE POINT: 6 dBc	ENVELOPE POINT: 99%
EUT CONFIGURATION:	MCS1



Plot 7.2.2 The 6dBc and 99% occupied bandwidth

FREQUENCY:	58.32 GHz
MODULATION:	16QAM
ENVELOPE POINT: 6 dBc	ENVELOPE POINT: 99%
EUT CONFIGURATION:	MCS12



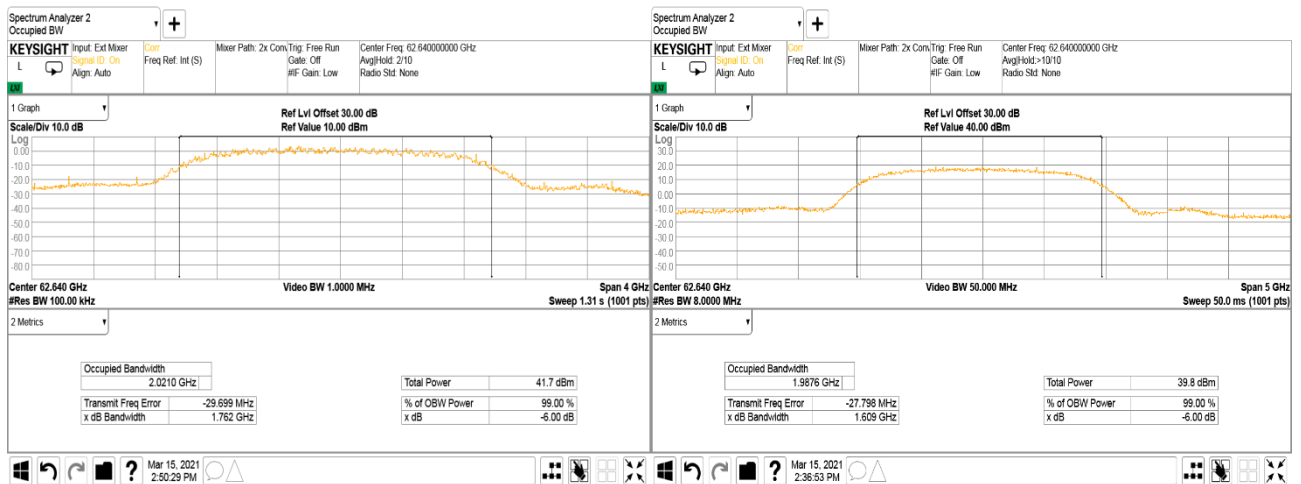


HERMON LABORATORIES

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): 04-Apr-21	
Temperature: 21 °C	Relative Humidity: 39 %
Air Pressure: 1010 hPa	Power: 48 VDC
Remarks:	

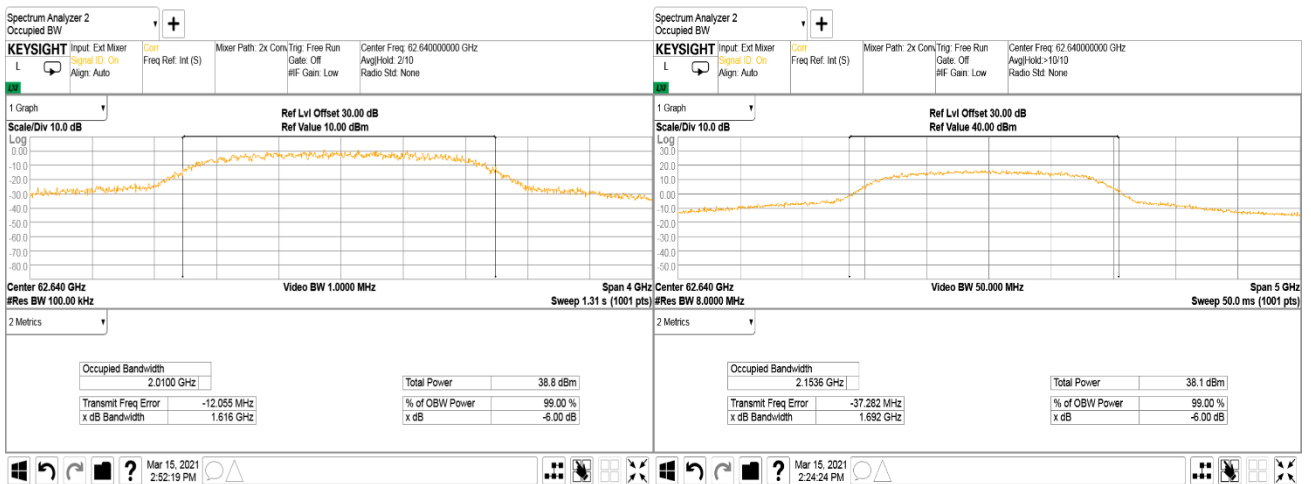
Plot 7.2.3 The 6dBc and 99% occupied bandwidth

FREQUENCY:	62.64 GHz
MODULATION:	16QAM
ENVELOPE POINT: 6 dBc	ENVELOPE POINT: 99%
EUT CONFIGURATION:	MCS1



Plot 7.2.4 The 6dBc and 99% occupied bandwidth

FREQUENCY:	62.64 GHz
MODULATION:	16QAM
ENVELOPE POINT: 6 dBc	ENVELOPE POINT: 99%
EUT CONFIGURATION:	MCS12



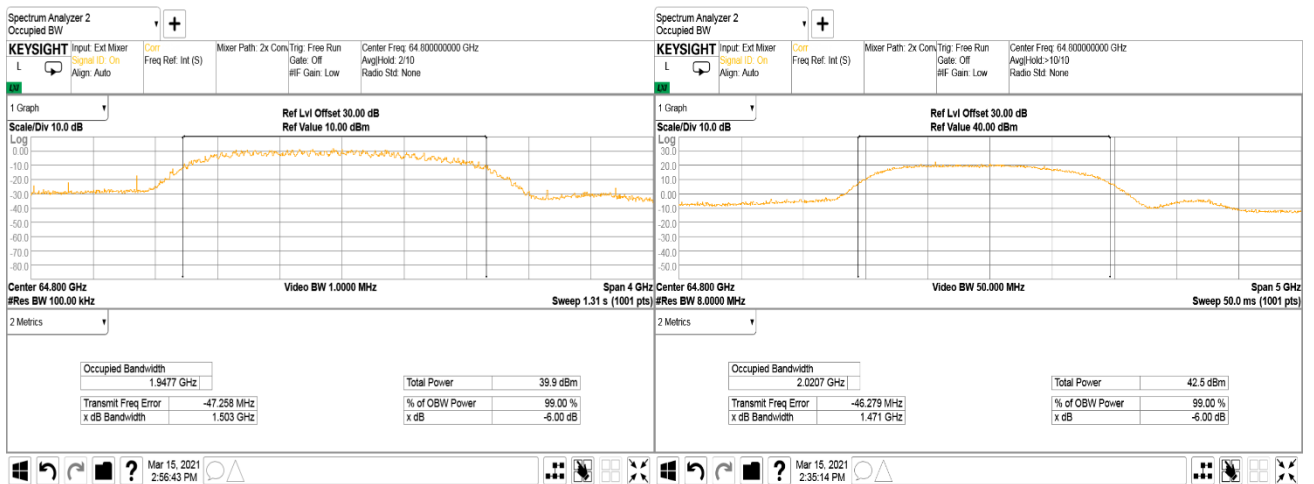


HERMON LABORATORIES

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:		Verdict: PASS	
Date(s):		04-Apr-21	
Temperature: 21 °C	Relative Humidity: 39 %	Air Pressure: 1010 hPa	Power: 48 VDC
Remarks:			

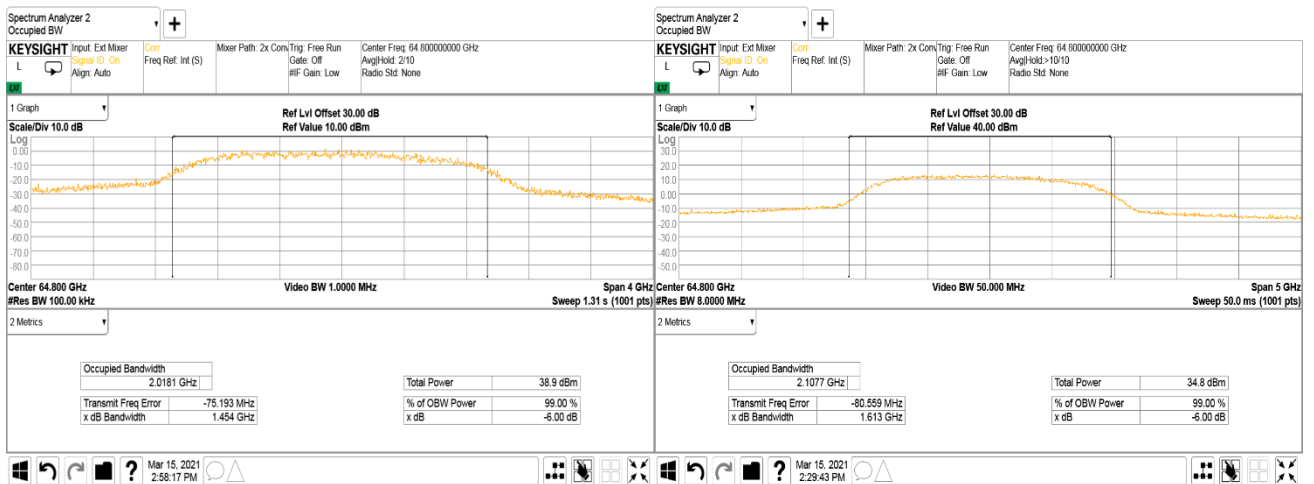
Plot 7.2.5 The 6dBc and 99% occupied bandwidth

FREQUENCY:	64.80 GHz
MODULATION:	16QAM
ENVELOPE POINT: 6 dBc	ENVELOPE POINT: 99%
EUT CONFIGURATION:	MCS1



Plot 7.2.6 The 6dBc and 99% occupied bandwidth

FREQUENCY:	64.80 GHz
MODULATION:	16QAM
ENVELOPE POINT: 6 dBc	ENVELOPE POINT: 99%
EUT CONFIGURATION:	MCS12





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): 04-Apr-21	
Temperature: 21 °C	Relative Humidity: 39 %
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:

$$\text{Lims}_2 = \text{Lims}_1 + 20 \log (S_1/S_2),$$

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.



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): 04-Apr-21			
Temperature: 21 °C	Relative Humidity: 39 %	Air Pressure: 1010 hPa	Power: 48 VDC
Remarks:			

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 360° 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.

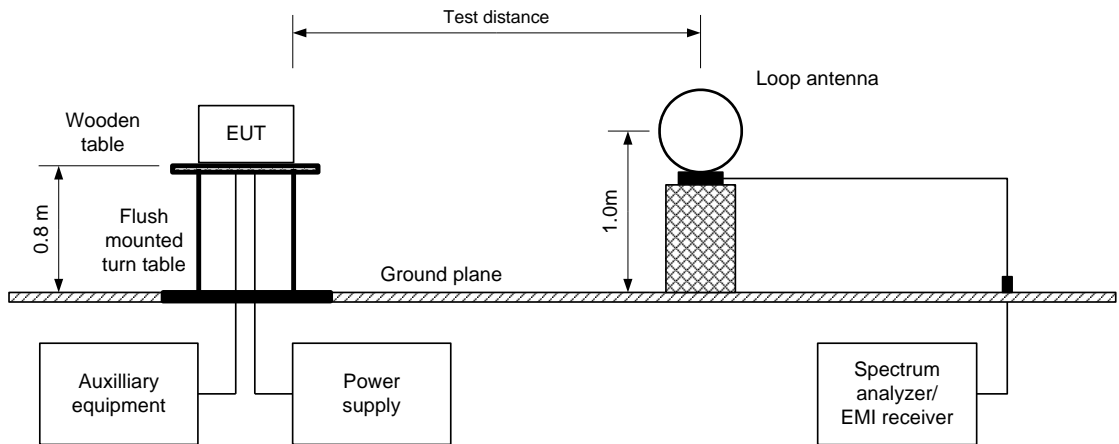
7.3.3 Test procedure for spurious emission field strength measurements above 30 MHz

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 360°, 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 Table 7.3.3 and shown in the associated plots.

Figure 7.3.1 Setup for spurious emission field strength measurements below 30 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: Compliance	Verdict: PASS		
Date(s): 04-Apr-21			
Temperature: 21 °C	Relative Humidity: 39 %	Air Pressure: 1010 hPa	Power: 48 VDC
Remarks:			

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

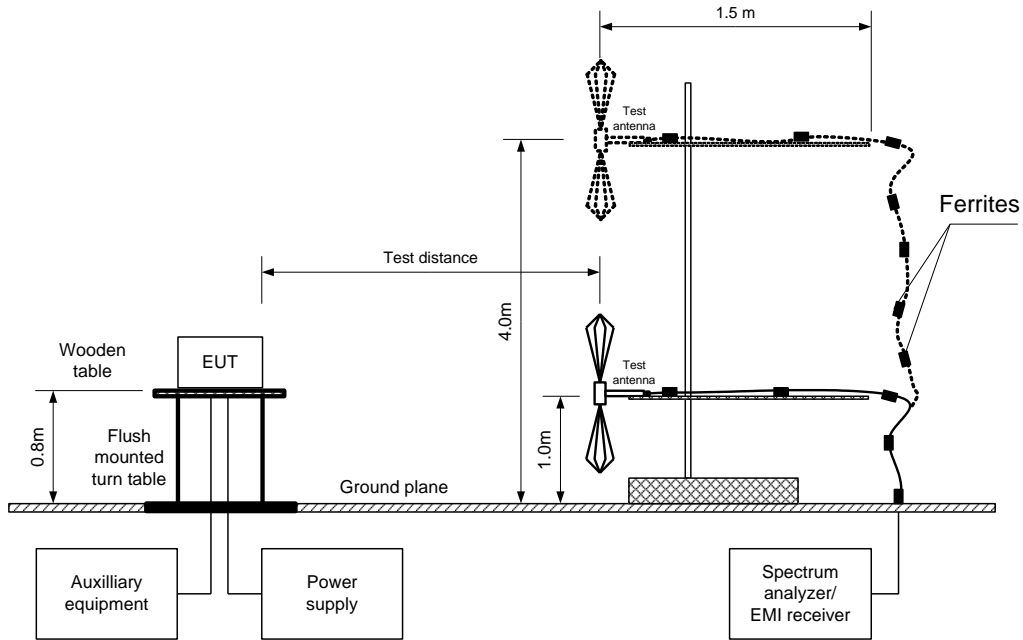
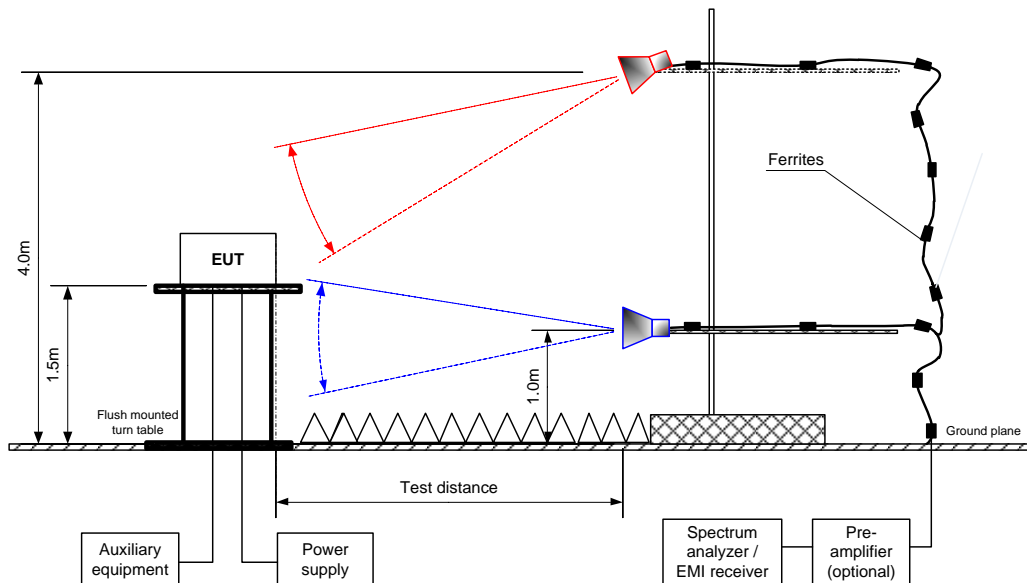


Figure 7.3.3 Setup for spurious emission field strength measurements above 1000 MHz





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:		Compliance	
Date(s):		04-Apr-21	
Temperature: 21 °C		Relative Humidity: 39 %	
Air Pressure: 1010 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 (Vertical)
 MODULATION: 16QAM
 TRANSMITTER OUTPUT POWER SETTINGS: Maximum
 INVESTIGATED FREQUENCY RANGE: 0.009 – 40000 MHz
 DETECTOR USED: Peak
 RESOLUTION BANDWIDTH: 1.0 MHz (above 1000 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											
All emission were found 20dB below the limit											Pass
Low frequency 62640 MHz											
All emission were found 20dB below the limit											Pass
Low frequency 64800 MHz											
All emission were found 20dB below the limit											Pass

*- EUT front panel refers to 0 degrees position of turntable.
 **- Margin = dB below (negative if above) specification limit.

Reference numbers of test equipment used

HL 4360	HL 3903	HL 4933	HL 4956	HL 5112	HL 5902	HL 4339	
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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: Compliance		Verdict: PASS	
Date(s): 04-Apr-21			
Temperature: 21 °C	Relative Humidity: 39 %	Air Pressure: 1010 hPa	Power: 48 VDC
Remarks:			

Table 7.3.3 Field strength of emissions below 1 GHz

TEST DISTANCE: 3 m
 EUT POSITION: Typical (Vertical)
 MODULATION: 16QAM
 TRANSMITTER OUTPUT POWER SETTINGS: Maximum
 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								
33.281697	38.16	31.20	40.0	-8.80	Vertical	1.02	0	Pass
62.531165	30.84	22.87	40.0	-17.13	Vertical	1.34	24	
106.656798	26.06	23.18	43.5	-20.32	Vertical	1.02	13	
188.134984	28.00	22.25	43.5	-21.25	Horizontal	1.02	60	
374.997917	33.09	29.93	46.0	-16.07	Vertical	1.02	162	
749.999748	40.41	37.87	46.0	-8.13	Horizontal	1.00	217	
950.037083	41.90	39.24	46.0	-6.76	Vertical	1.32	136	

*- Margin = Measured emission - specification limit.
 **- EUT front panel refer to 0 degrees position of turntable.

Reference numbers of test equipment used

HL 4360	HL 3903	HL 0446	HL 5288	HL 5085	HL 5902		
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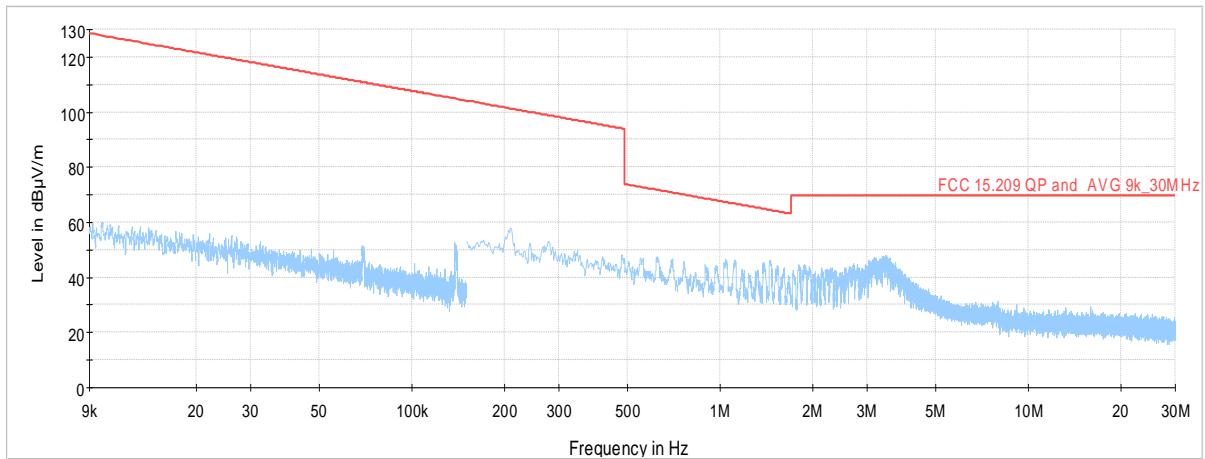
Full description is given in Appendix A.



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: Compliance	Verdict: PASS
Date(s): 04-Apr-21	
Temperature: 21 °C	Relative Humidity: 39 %
Remarks:	

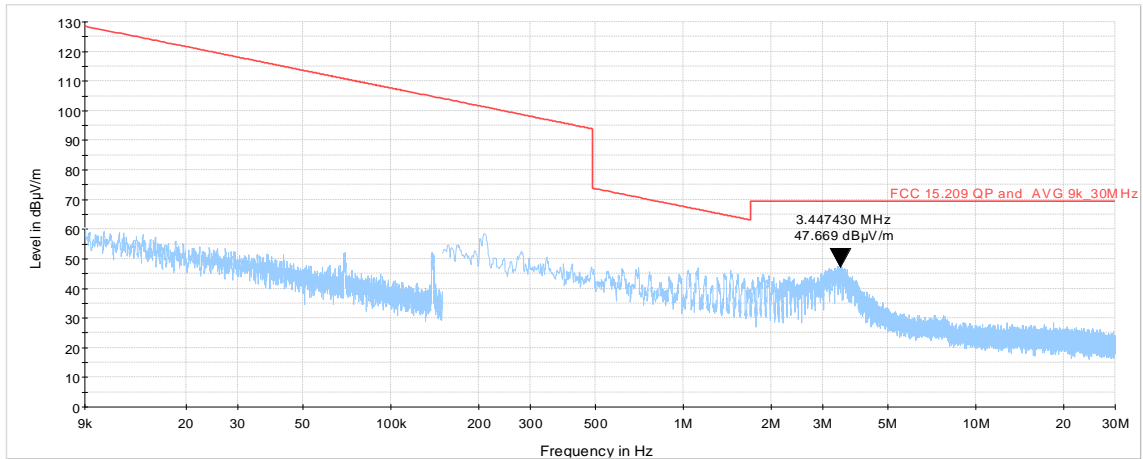
Plot 7.3.1 Radiated emission measurements from 9 kHz to 30 MHz at low frequency

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



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 (Vertical)

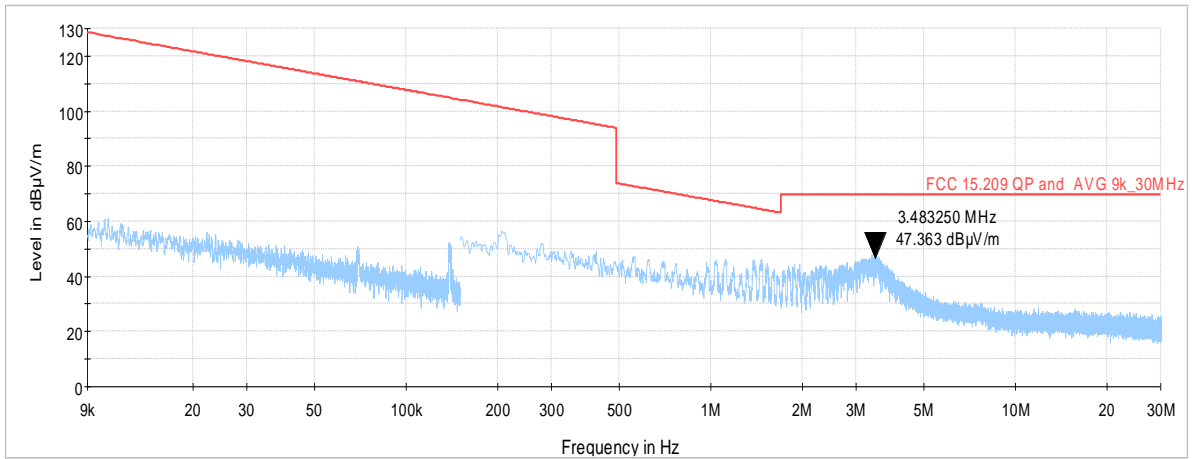




Test specification: FCC Section 15.255(d)(2), RSS-210 section J.3, Out of band radiated emissions below 40 GHz			
Test procedure: 47 CFR, Section 2.1053; ANSI C63.10, Section 9.13			
Test mode: Compliance		Verdict: PASS	
Date(s): 04-Apr-21			
Temperature: 21 °C	Relative Humidity: 39 %	Air Pressure: 1010 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 (Vertical)

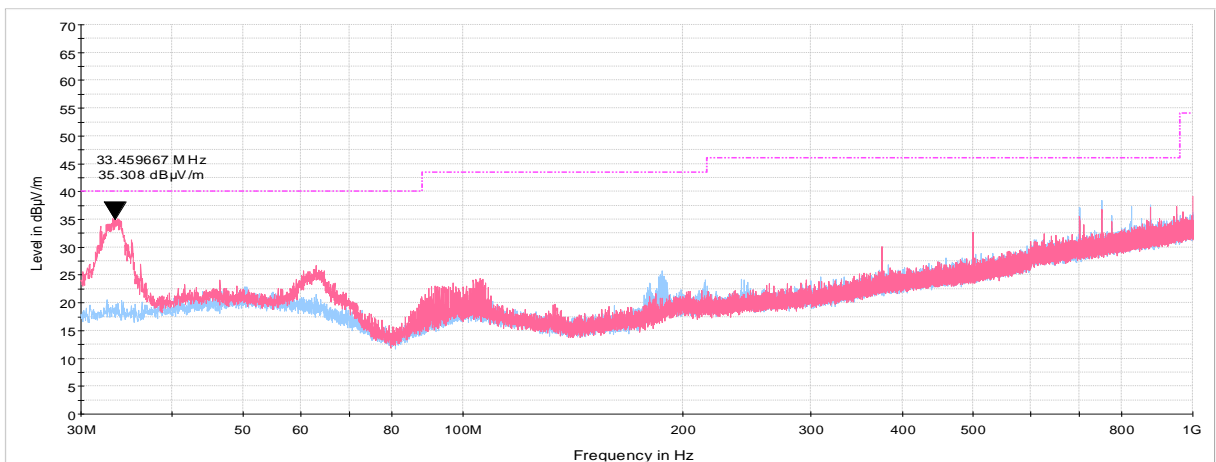




Test specification: FCC Section 15.255(d)(2), RSS-210 section J.3, Out of band radiated emissions below 40 GHz	
Test procedure: 47 CFR, Section 2.1053; ANSI C63.10, Section 9.13	
Test mode: Compliance	Verdict: PASS
Date(s): 04-Apr-21	
Temperature: 21 °C	Relative Humidity: 39 %
Air Pressure: 1010 hPa	
Power: 48 VDC	
Remarks:	

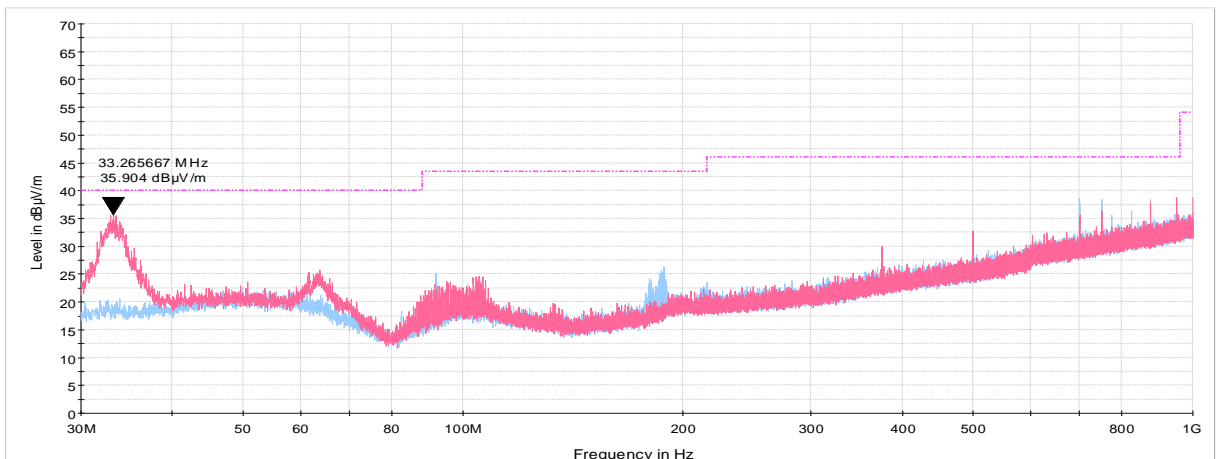
Plot 7.3.4 Radiated emission measurements from 30 to 1000 MHz at low frequency

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



Plot 7.3.5 Radiated emission measurements from 30 to 1000 MHz at mid frequency

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





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): 04-Apr-21	
Temperature: 21 °C	Relative Humidity: 39 %
Remarks:	

Plot 7.3.6 Radiated emission measurements from 30 to 1000 MHz at high frequency

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

