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Date: 22 August 2022

I.T.L. Product Testing Ltd.

FCC/IC Radio Test Report

for

Amimon Ltd.

Equipment under test:

Low Power Indoor Access Point

AMNPTTX01

Tested by: _____
I. Mansky

Approved by: _____
M. Zohar

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Measurement/Technical Report for

Amimon Ltd.

Low Power Indoor Access Point

AMNPTTX01

FCC ID: VQSAMNPTTX01
IC: 7680A-AMNPTTX01

This report concerns:	Original Grant
Equipment type:	FCC: Low Power Indoor Access Point (6ID) IC: Wireless Local Area Network Device
Limits used:	47 CFR § 15.407, Section (a)(4-8) IC: RSS-248, Issue 1, November 19, 2021, RSS-Gen, Issue 5, April 2018
Measurement procedures used:	FCC: KDB 789033 D02 v02r01, ANSI C63.10:2013 and KDB 987594 D02 U-NII 6GHz EMC Measurement v01 IC: RSS-248 Issue 1, RSS-Gen

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Table of Contents

1. General Information

1.1 Administrative Information

Manufacturer:	Amimon Ltd.
Manufacturer's Address:	26 Zarhin St. PO Box 2308 Ra'anana, Israel 4366250
Manufacturer's Representative:	Gabi Nocham
Equipment Under Test (E.U.T):	Low Power Indoor Access Point
Equipment Model:	AMNPTTX01
Equipment Serial No.:	Not designated
Date of Receipt of E.U.T:	August 23, 2021
Start of Test:	August 23, 2021
Start of Frequency Stability test:	June 26, 2022
End of Test:	February 20, 2022
End of Frequency Stability test:	June 26, 2022
Test Laboratory Location:	I.T.L (Product Testing) Ltd. 1 Bat Sheva St., Lod 7120101, Israel
Test Specifications:	47CFR15, Part 15, Subpart E, Section 15.407 KDB 987594 D02 U-NII 6GHz EMC Measurement v01 RSS-248 Issue 1, November 19, 2021

1.2 List of Accreditations

The EMC laboratory of I.T.L. is accredited by the following bodies:

1. The American Association for Laboratory Accreditation (A2LA) (U.S.A.), Certificate No. 1152.01.
2. The Federal Communications Commission (FCC) (U.S.A.), FCC Designation No. IL1005.
3. Department of Innovation, Science and Economic Development (ISED) Canada, CAB identifier: IL1002

I.T.L. Product Testing Ltd. is accredited by the American Association for Laboratory Accreditation (A2LA) and the results shown in this test report have been determined in accordance with I.T.L.'s terms of accreditation unless stated otherwise in the report.

1.3 Product Description

Supply Voltage Range	$5V_{DC}$ ± 10%
Mode of operation	Transceiver, two ports
Modulations	OFDM
Assigned Frequency Range	5925.0-7125.0
Operating Frequency Range	5925.0-6425.0
Total transmit power (conducted)	~14.0dBm (for 20MHz BW) ~18.0dBm (for 40MHz BW)
Antenna Gain	2.0dBi (dipole)
Modulation BW	20/40 MHz
EUT class	Low-Power indoor access point (6ID)

1.4 Test Methodology

Both conducted and radiated testing was performed according to the procedures in KDB 789003 D02 v02r01, KDB 987594 D02 U-NII 6GHz EMC Measurement v01 987594 D02 v01 and ANSI C63.10: 2013, and RSS-Gen Issue 5, March 2019, Amendment 1. Radiated testing was performed at an antenna to EUT distance of three meters.

1.5 Test Facility

Emissions tests were performed at I.T.L.'s testing facility in Lod, Israel. I.T.L.'s EMC Laboratory is accredited by the A2LA, certificate No. 1152.01 and its FCC Designation Number is IL1005.

1.6 Measurement Uncertainty

Conducted Emission
Conducted Emission (CISPR 11, EN 55011, CISPR 22, EN 55022, ANSI C63.4)

0.15 – 30 MHz:
Expanded Uncertainty (95% Confidence, K=2):
± 3.44 dB

Radiated Emission
Radiated Emission (CISPR 11, EN 55011, CISPR 22, EN 55022, ANSI C63.4) for open site:

30-1000MHz:
Expanded Uncertainty (95% Confidence, K=2):
± 4.96 dB

1 GHz to 6 GHz
Expanded Uncertainty (95% Confidence, K=2):
±5.19 dB

>6 GHz
Expanded Uncertainty (95% Confidence, K=2):
±5.51 dB

2. System Test Configuration

2.1 Justification

1. The E.U.T. contains a 6 GHz band transceiver module that can transmit at two ports and in two optional BW's: 20 MHz and 40 MHz. Only Full Resource Unit (RU) configuration is supported.
2. The E.U.T. was tested at UNII5.
3. The unit was evaluated while transmitting at 20MHz BW in the low channel (5935.0 MHz), the mid channel (6175.0 MHz), and the high channel (6415.0 MHz), and at 40MHz BW in the low channel (5945.0 MHz), the mid channel (6185.0 MHz), and the high channel (6405.0MHz), each with duty cycle above 98%.
4. Conducted emission tests were performed with the E.U.T. antenna terminal connected by an RF cable to the Spectrum Analyzer, through an external attenuator.
5. Only for testing, the E.U.T. was powered by a typical AC/DC adapter.
6. As agreed upon with the customer and their TCB, Peak Power and PSD tests were performed on all Tx ports, and all other tests were performed on the highest power port.
7. Final radiated emission was performed for the two antenna types: dipole and PCB.

2.2 EUT Exercise Software

No special exercise software was used.

2.3 Special Accessories

No special accessories were used

2.4 Equipment Modifications

Customer reduced the power for each port to comply with the PSD limits.

2.5 Configuration of Tested System

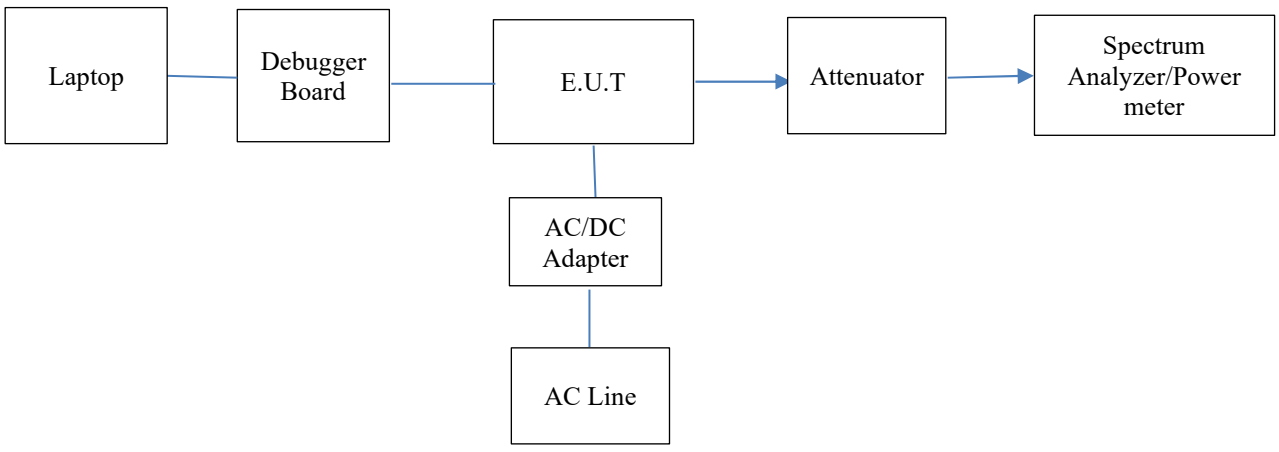


Figure 1. Configuration of Tested System Conducted

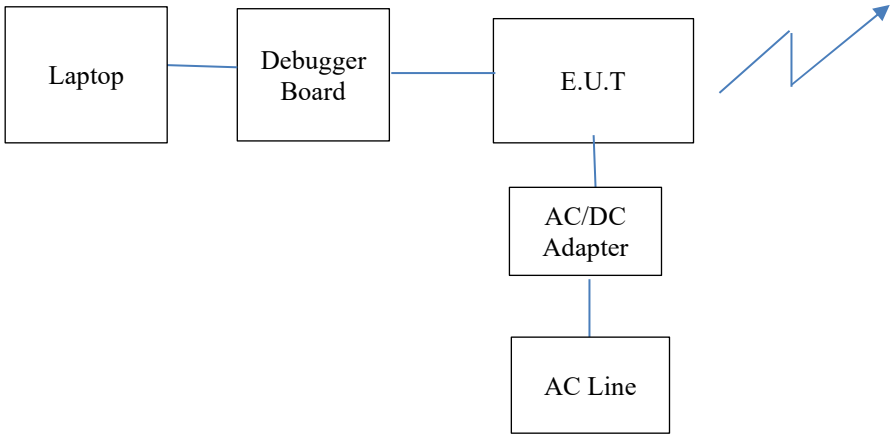


Figure 2. Configuration of Tested System Radiated

3. Conducted and Radiated Measurement Test Setup Photos

See a separate file.

4. Conducted Emission from AC Mains

4.1 Test Specification

FCC Part 15, Subpart C, Section 15.207

RSS-Gen, Issue 5, March 2019, Amendment 1, Section 8.8

RSS-248, Section 4.7.2(e)

4.2 Test Procedure

(Temperature (22°C)/ Humidity (56%RH))

The E.U.T. operation mode and test setup are as described in Section 2 of this report. In order to minimize background noise interference, the conducted emission testing was performed inside a shielded room, with the E.U.T. placed on a 0.8 meter high wooden table, 0.4 meter from the room's vertical wall. In the case of a floor-standing E.U.T., it was placed on the horizontal ground plane.

The E.U.T. was powered from 115 V AC / 60 Hz via 50 Ohm / 50 µHn Line Impedance Stabilization Network (LISN) on the phase and neutral lines. The LISN's were grounded to the shielded room ground plane (floor), and were kept at least 0.8 meters from the nearest boundary of the E.U.T.

The center of the E.U.T.'s AC cable was folded back and forth, in order to form a bundle less than 0.40 meters and a total cable length of 1 meter.

The effect of varying the position of the cables was investigated to find the configuration that produces maximum emission.

The emission voltages at the LISN's outputs were measured using a computerized receiver, complying with CISPR 16 requirements. The specification limits are loaded to the receiver and are displayed on the receiver's spectrum display.

The E.U.T. was evaluated in TX operation mode.

A frequency scan between 0.15 and 30 MHz was performed at 9 kHz I.F. band width, using peak detection.

The spectral components having the highest level on each line were measured using a quasi-peak and average detector.

4.3 Test Limit

Frequency of Emission (MHz)	Conducted Limit (dBµV)	
	Quasi-peak	Average
0.15-0.5	66 to 56*	56 to 46*
0.5-5	56	46
5-30	60	50

* *Decreases with the logarithm of the frequency.*

4.4 Test Results

JUDGEMENT: Passed by 9.00 dB

The margin between the emission levels and the specification limit is, in the worst case, -9.00 dB for the phase line at 24.022 MHz and -9.88 dB at 24.022 MHz for the neutral line.

The EUT met the FCC Part 15, Subpart C, and RSS-Gen, Issue 5, March 2019 Amendment 1 specification requirements.

The details of the highest emissions are given in *Figure 3* to *Figure 6*.

Conducted Emission

Specification:	FCC Part 15, Subpart C; RSS-Gen, Issue 5
Lead:	Phase
Detectors: :	Peak, Quasi-peak, Average
Power Operation	AC/DC Adapter

EDIT PEAK LIST (Final Measurement Results)

Trace1: CE22BQP
Trace2: CE22BAP
Trace3: ---

	TRACE	FREQUENCY	LEVEL dBµV	DELTA LIMIT dB
1	Quasi Peak	162 kHz	36.02	-29.33
1	Quasi Peak	214 kHz	32.80	-30.24
1	Quasi Peak	578 kHz	33.29	-22.70
2	Average	578 kHz	28.47	-17.52
1	Quasi Peak	734 kHz	30.63	-25.37
2	Average	734 kHz	25.13	-20.86
1	Quasi Peak	1.122 MHz	30.77	-25.22
2	Average	17.822 MHz	21.32	-28.67
2	Average	18.366 MHz	25.31	-24.68
2	Average	18.702 MHz	26.75	-23.24
1	Quasi Peak	18.918 MHz	31.22	-28.77
1	Quasi Peak	20.258 MHz	33.50	-26.50
2	Average	20.258 MHz	28.07	-21.93
1	Quasi Peak	20.81 MHz	30.33	-29.66
2	Average	20.81 MHz	25.02	-24.97
1	Quasi Peak	20.994 MHz	29.96	-30.03
2	Average	20.994 MHz	24.37	-25.62
2	Average	21.666 MHz	24.76	-25.24
1	Quasi Peak	24.022 MHz	35.27	-24.72
2	Average	24.022 MHz	35.66	-14.33

Date: 23.AUG.2021 17:06:42

Figure 3. Detectors: Peak, Quasi-peak, Average

Note: QP Delta/Av Delta refers to the test results obtained minus specified requirement; thus a positive number indicates failure, and a negative result indicates that the product passes the test.

Conducted Emission

Specification:	FCC Part 15, Subpart C; RSS-Gen, Issue 5
Lead:	Phase
Detectors:	Peak, Quasi-peak, Average
Power Operation	AC/DC Adapter

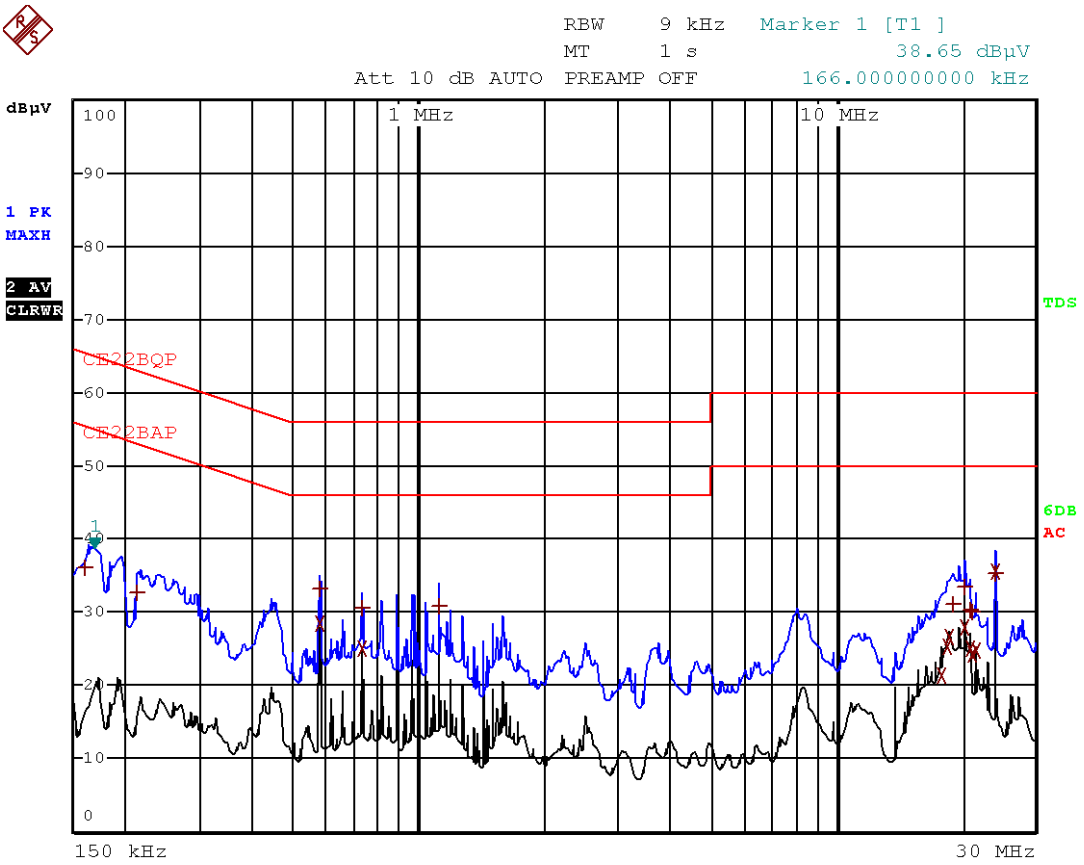


Figure 4. Detectors: Peak, Quasi-peak, Average

Conducted Emission

Specification:	FCC Part 15, Subpart C; RSS-Gen, Issue 5
Lead:	Neutral
Detectors:	Peak, Quasi-peak, Average
Power Operation	AC/DC Adapter

EDIT PEAK LIST (Final Measurement Results)

Trace1: CE22BQP
Trace2: CE22BAP
Trace3: ---

TRACE		FREQUENCY	LEVEL dBµV	DELTA LIMIT dB
2	Average	13.942 MHz	29.82	-20.17
1	Quasi Peak	15.998 MHz	25.78	-34.21
1	Quasi Peak	16.674 MHz	26.35	-33.64
1	Quasi Peak	16.898 MHz	26.98	-33.01
1	Quasi Peak	16.922 MHz	25.67	-34.32
2	Average	17.894 MHz	30.85	-19.14
2	Average	18.022 MHz	31.49	-18.51
2	Average	18.246 MHz	29.95	-20.04
1	Quasi Peak	18.506 MHz	31.55	-28.44
2	Average	18.702 MHz	33.00	-16.99
1	Quasi Peak	18.71 MHz	33.90	-26.09
1	Quasi Peak	18.73 MHz	32.75	-27.24
1	Quasi Peak	18.958 MHz	33.24	-26.75
2	Average	19.382 MHz	31.16	-18.83
1	Quasi Peak	19.614 MHz	28.32	-31.67
1	Quasi Peak	19.634 MHz	28.51	-31.49
2	Average	19.71 MHz	32.21	-17.78
2	Average	20.382 MHz	30.17	-19.82
2	Average	20.81 MHz	28.57	-21.42
2	Average	24.022 MHz	40.99	-9.00

Date: 23.AUG.2021 17:14:50

Figure 5. Detectors: Peak, Quasi-peak, Average

Note: QP Delta/Av Delta refers to the test results obtained minus specified requirement; thus a positive number indicates failure, and a negative result indicates that the product passes the test.

Conducted Emission

Specification:	FCC Part 15, Subpart C; RSS-Gen, Issue 5
Lead:	Neutral
Detectors:	Peak, Quasi-peak, Average
Power Operation	AC/DC Adapter

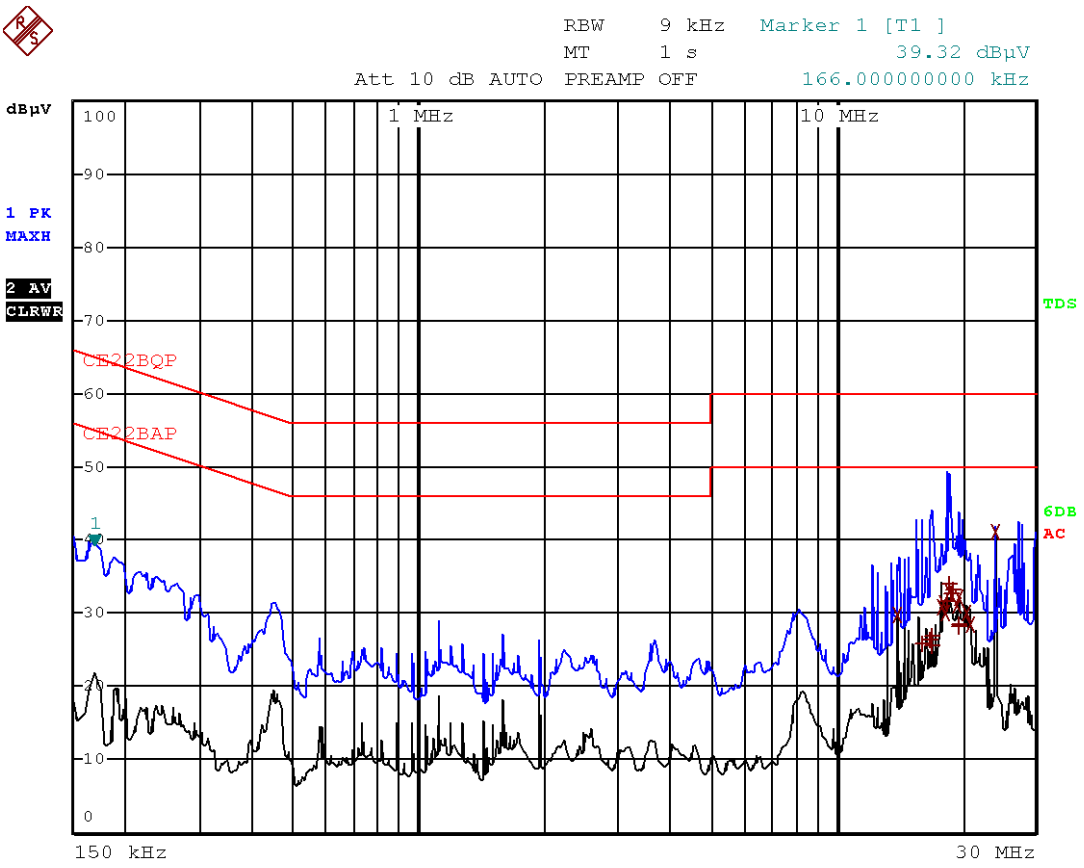


Figure 6 Detectors: Peak, Quasi-peak, Average

4.5 Test Equipment Used; Conducted Emission

Instrument	Manufacturer	Model	Serial No.	Last Calibration Date	Next Calibration Due
LISN	Fischer	FCC-LISN-25A	128	January 18, 2021	January 18, 2022
Transient Limiter	HP	11947A	3107A03041	September 14, 2020	September 14, 2021
EMI Receiver	Rohde & Schwarz	ESCI7	100724	February 23, 2021	February 23, 2022
Cable CE Chamber 5M	Telrad	RJ214	-	April 25, 2021	April 25, 2022

Figure 7 Test Equipment Used

5. Maximum Conducted Output Power

5.1 Test Specification

FCC, Part 15, Subpart E, Section 407(a)

RSS-248, Issue 1, November 19, 2021, Section 4.6.2(b)

5.2 Test Procedure

(Temperature (20°C)/ Humidity (51%RH))

The E.U.T. operation mode and test set-up are as described in Section 2 of this report. The E.U.T. antenna terminal was connected to the Spectrum Analyzer through an external attenuator and an appropriate coaxial cable (total loss=32.5 dB). Special attention was taken to prevent Spectrum Analyzer RF input overload.
Spectrum setting done according KDB 789033, method SA-1 instructions.

5.3 Test Limit

For an indoor access point operating in the 5.925-7.125 GHz band the maximum e.i.r.p. over the frequency band of operation must not exceed 30 dBm.

5.4 Test Results

JUDGMENT: Passed by 9.1dB

The EUT met the requirements of the F.C.C. Part 15, Subpart E, Section 15.407(a) specifications.

For additional information see *Figure 8* and *Figure 20.*

BW	Operation Frequency	Port 1 Reading	Port 2 Reading	Total Power*	Antenna Gain	EIRP	Limit	Margin
(MHz)	(MHz)	(dBm)	(dBm)	(dBm)	(dBi)	(dBm)	(dBm)	(dB)
20.0	5935.0	12.7	12.9	15.8	2.0	17.8	30.0	-12.2
	6175.0	12.7	12.4	15.6	2.0	17.6	30.0	-12.4
	6415.0	12.5	12.4	15.5	2.0	17.5	30.0	-12.5
40.0	5945.0	15.6	15.8	18.7	2.0	20.7	30.0	-9.3
	6185.0	15.2	15.4	18.3	2.0	20.3	30.0	-9.7
	6405.0	15.8	16.1	18.9	2.0	20.9	30.0	-9.1

**total power (dBm)= 10 log [port1(W)+port2(W)]*

Figure 8 FCC and IC Test Results Test Results 2TX mode

2TX mode:

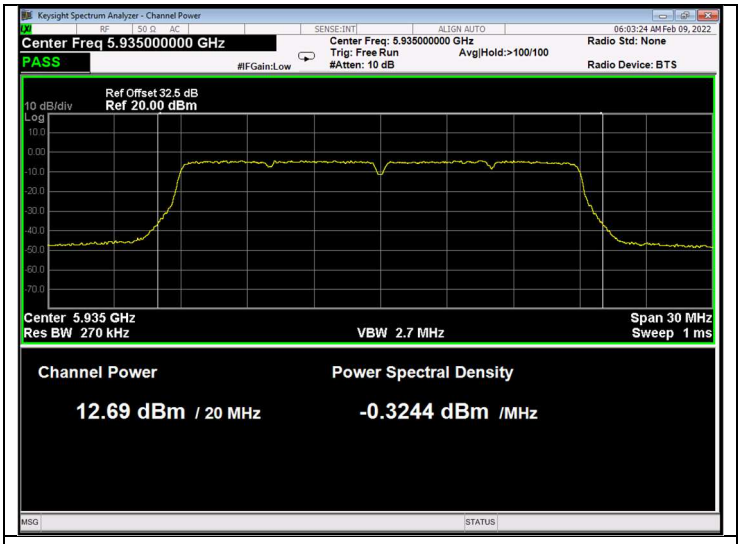


Figure 9. 5935.0MHz,20MHz BW, port1

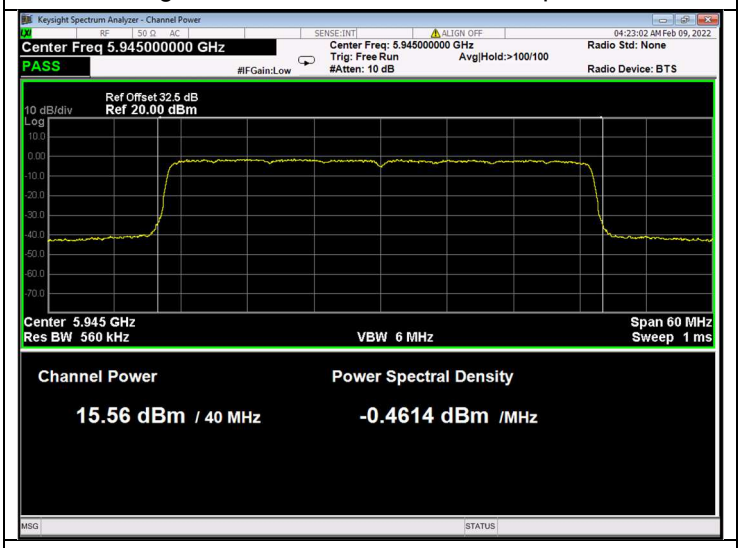


Figure 10. 5945.0MHz,40MHz BW, port1

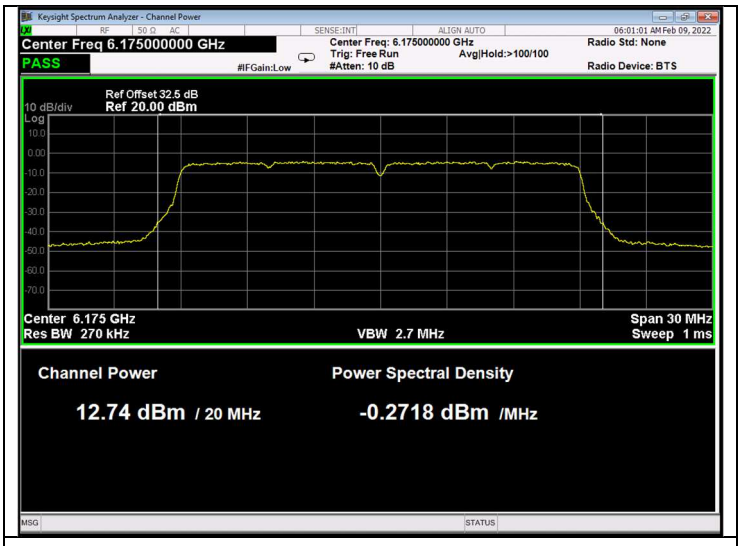


Figure 11. 6175.0MHz,20MHz BW, port1

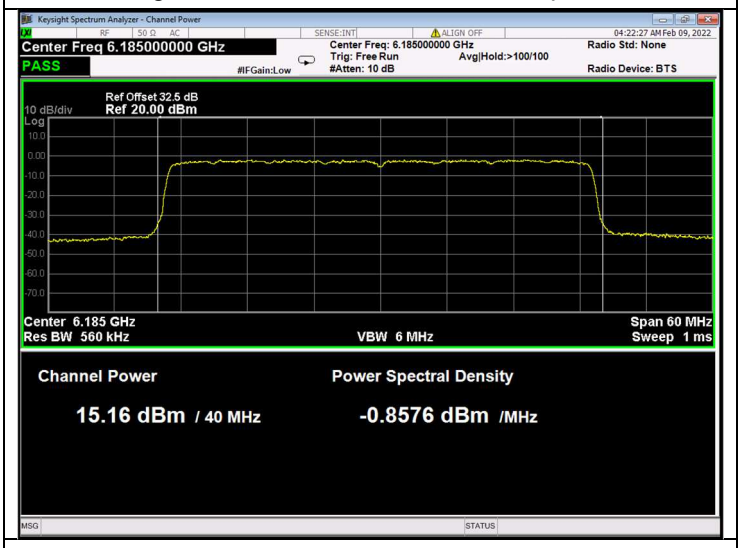


Figure 12. 6185.0MHz,40MHz BW, port1

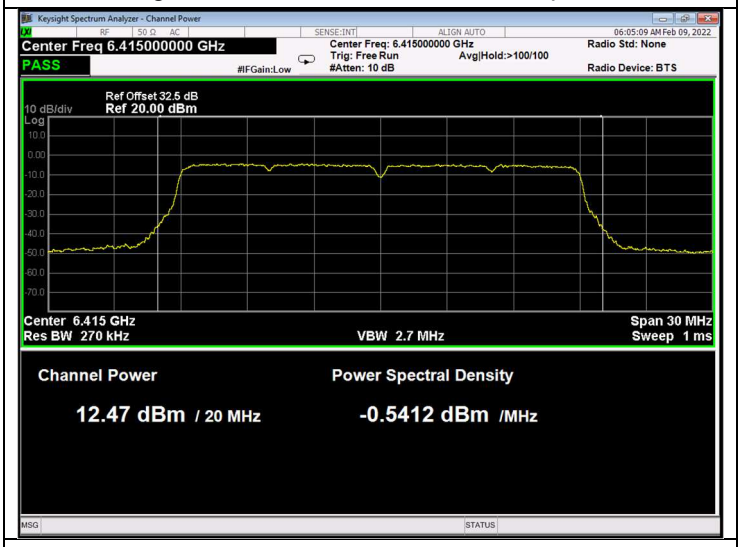


Figure 13. 6415.0MHz,20MHz BW, port1

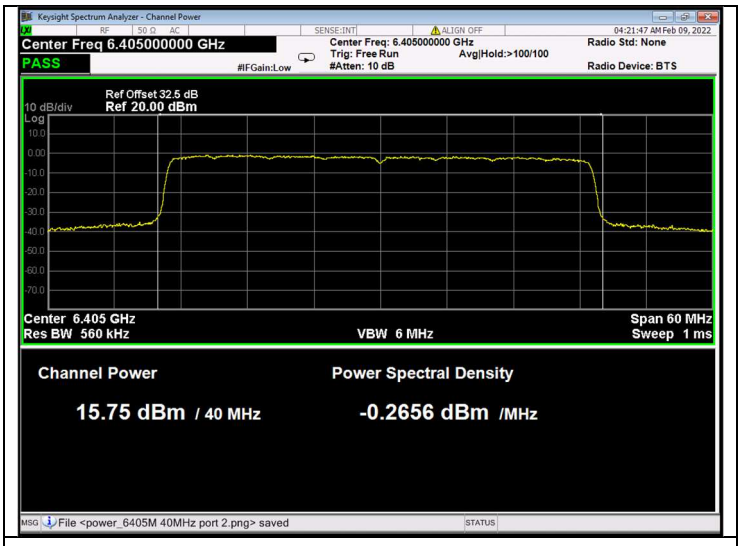


Figure 14. 6405.0MHz,40MHz BW, port1

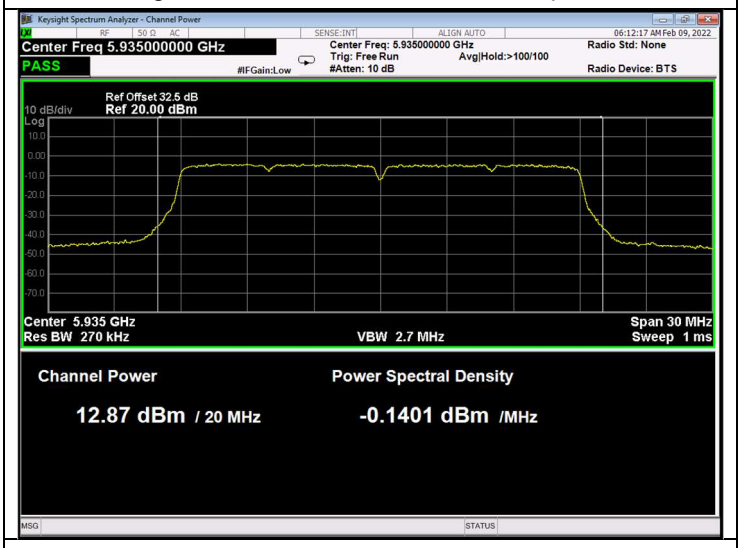


Figure 15. 5935.0MHz,20MHz BW, port2

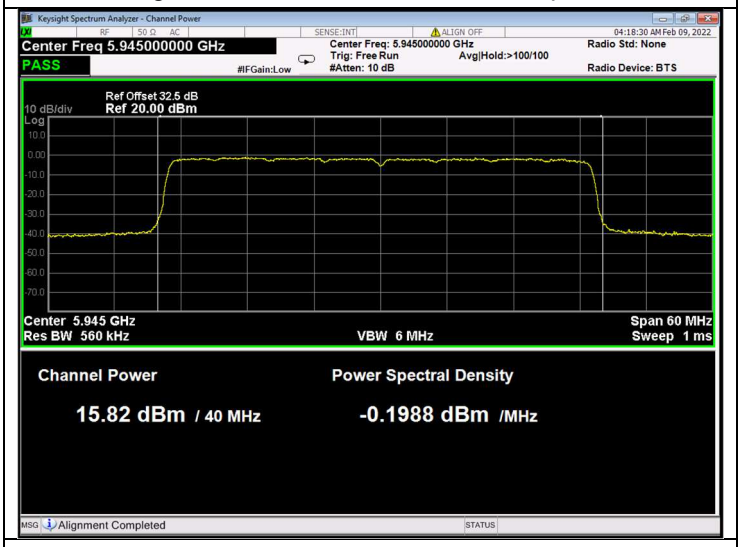


Figure 16. 5945.0MHz,40MHz BW, port2

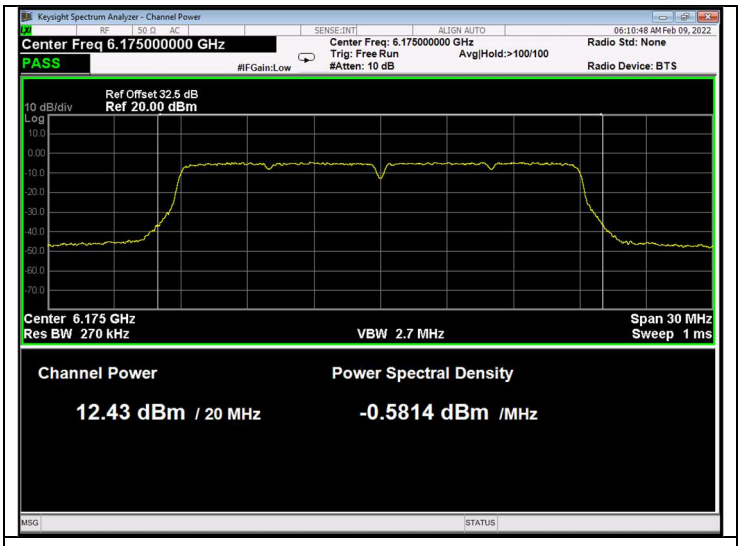


Figure 17. 6175.0MHz,20MHz BW, port2

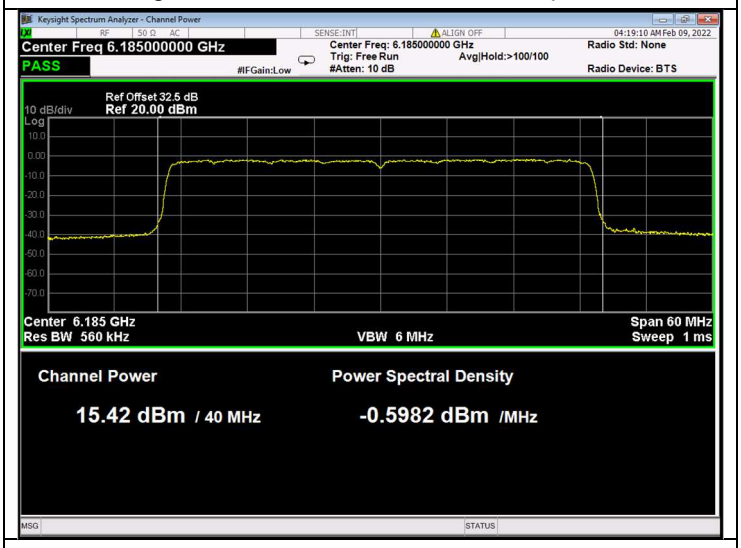


Figure 18. 6185.0MHz,40MHz BW, port2

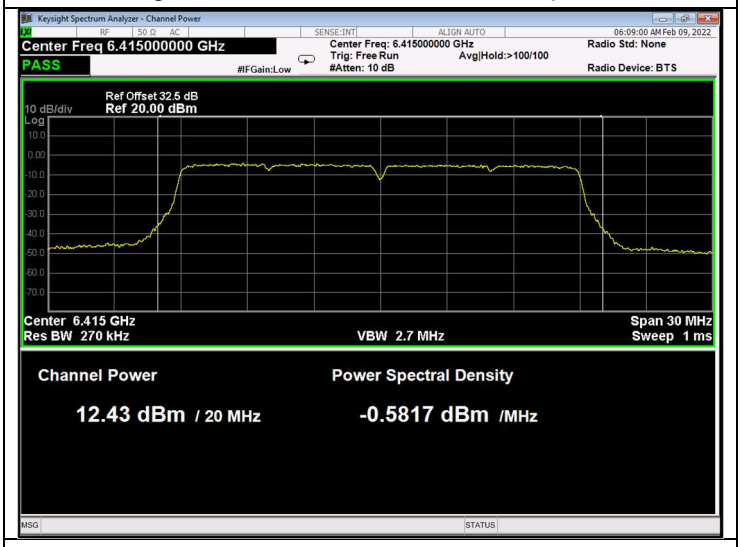


Figure 19. 6415.0MHz,20MHz BW, port2

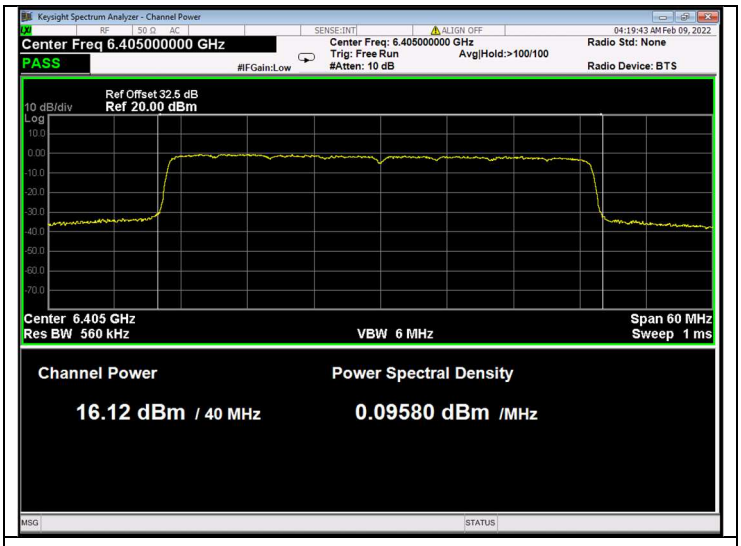


Figure 20. 6405.0MHz,40MHz BW, port2

5.5 Test Equipment Used; Maximum Peak Power Output

Instrument	Manufacturer	Model	Serial No.	Last Calibration Date	Next Calibration Due
Spectrum Analyzer	Keysight	N9010A	MY54510348	April 25, 2021	April 25, 2023
30dB Attenuator	MCL	BW-S30W5	533	May 23, 2021	May 23, 2022
RF Cable	Huber Suhner	Sucofelex	28239/4PEA	May 23, 2021	May 23, 2022

Figure 21 Test Equipment Used

6. Maximum Power Spectral Density (PSD)

6.1 Test Specification

FCC, Part 15, Subpart E, Section 407(a)

RSS-248, Issue 1, November 19, 2021, Section 4.6.2(a)

6.2 Test Procedure

(Temperature (22°C)/ Humidity (56%RH))

The E.U.T. operation mode and test set-up are as described in Section 2 of this report. The E.U.T. antenna terminal was connected to the Spectrum Analyzer through an external attenuator and an appropriate coaxial cable (total loss= 32.5dB). Special attention was taken to prevent Spectrum Analyzer RF input overload. Spectrum setting done according KDB 789033 instructions (section E).

6.3 Test Limit

For an indoor access point operating in the 5.925-7.125 GHz band, the maximum power spectral density must not exceed 5 dBm e.i.r.p. in any 1-megahertz band.

6.4 Test Results

JUDGEMENT: Passed by -0.1dB

The EUT met the requirements of the FCC Part 15, Subpart E, Section 15.407(a) , and RSS-248, Issue 1, Section 4.6.2(a) specifications.

For additional information see Figure 22 *to* Figure 34.

BW	Operation Frequency	Port 1 Reading	Port 2 Reading	Total Power*	Antenna Gain	EIRP	Limit	Margin
(MHz)	(MHz)	(dBm)	(dBm)	(dBm)	(dBi)	(dBm)	(dBm)	(dB)
20.0	5935.0	-0.3	-0.1	2.8	2.0	4.8	5.0	-0.2
	6175.0	-0.3	-0.6	2.6	2.0	4.6	5.0	-0.4
	6415.0	-0.5	-0.6	2.4	2.0	4.4	5.0	-0.6
40.0	5945.0	-0.5	-0.2	2.7	2.0	4.7	5.0	-0.3
	6185.0	-0.8	-0.6	2.3	2.0	4.3	5.0	-0.7
	6405.0	-0.3	0.1	2.9	2.0	4.9	5.0	-0.1

**total power (dBm)= 10 log [port1(W)+port2(W)]*

Figure 22 FCC and IC Test Results 2TX mode

2TX mode:

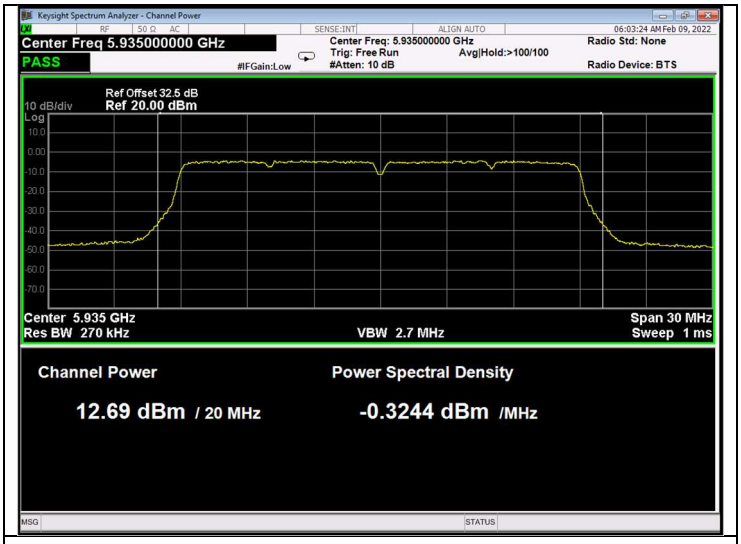


Figure 23. 5935.0MHz,20MHz BW, port1

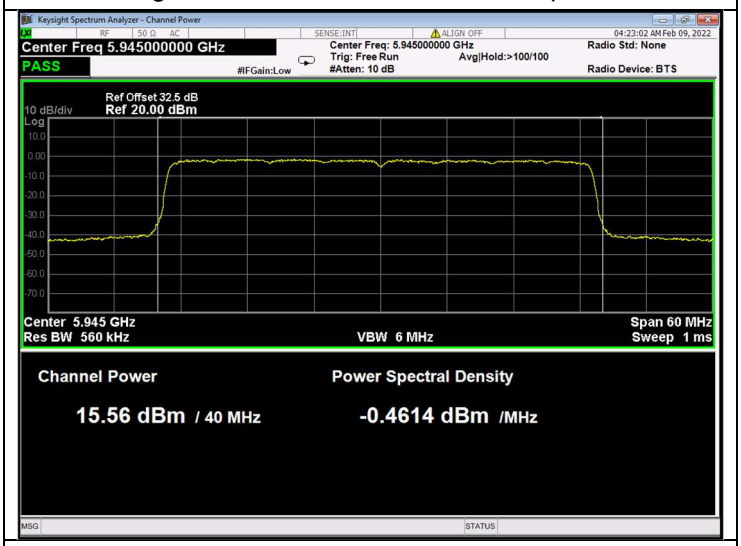


Figure 24. 5945.0MHz,40MHz BW, port1

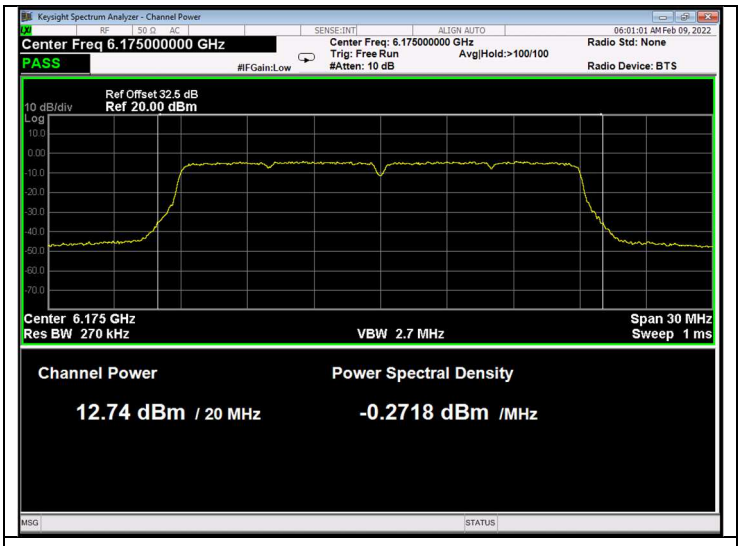


Figure 25. 6175.0MHz,20MHz BW, port1

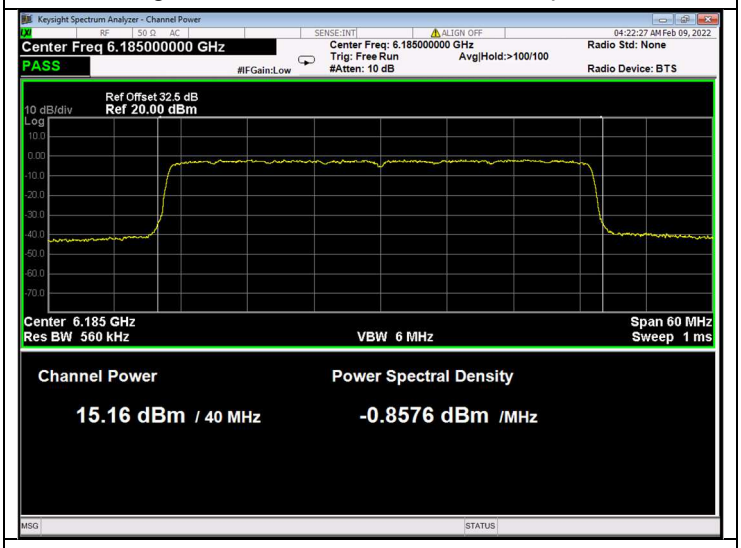


Figure 26. 6185.0MHz,40MHz BW, port1

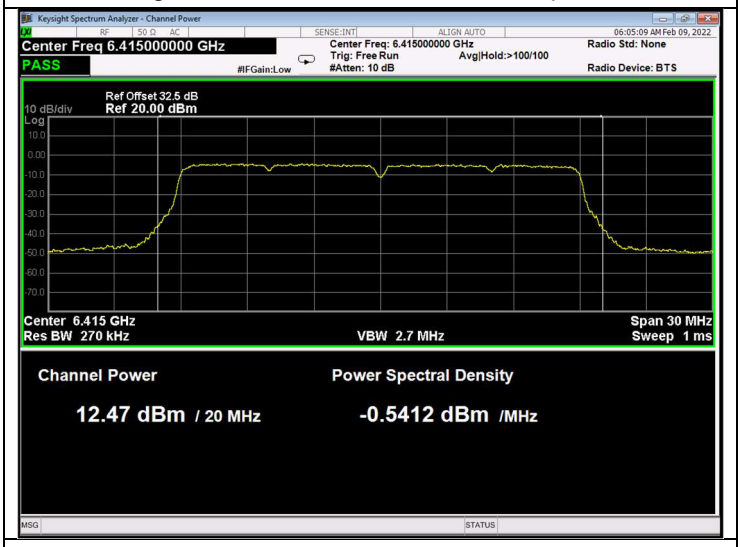


Figure 27. 6415.0MHz,20MHz BW, port1

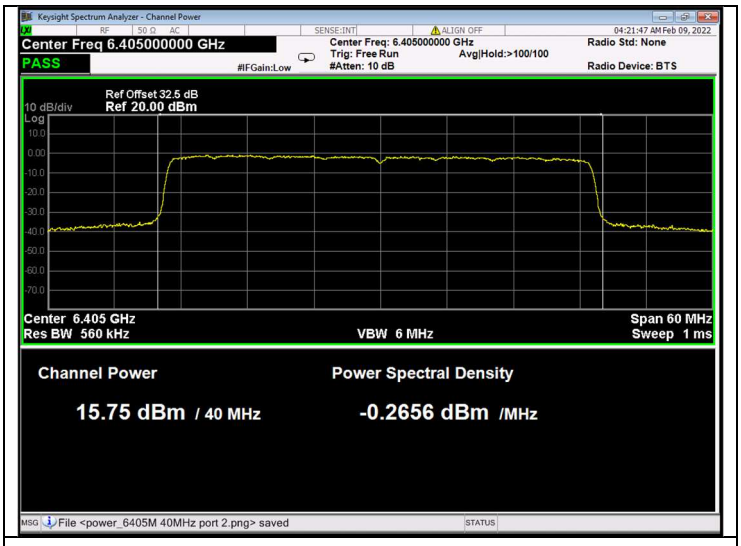


Figure 28. 6405.0MHz,40MHz BW, port1

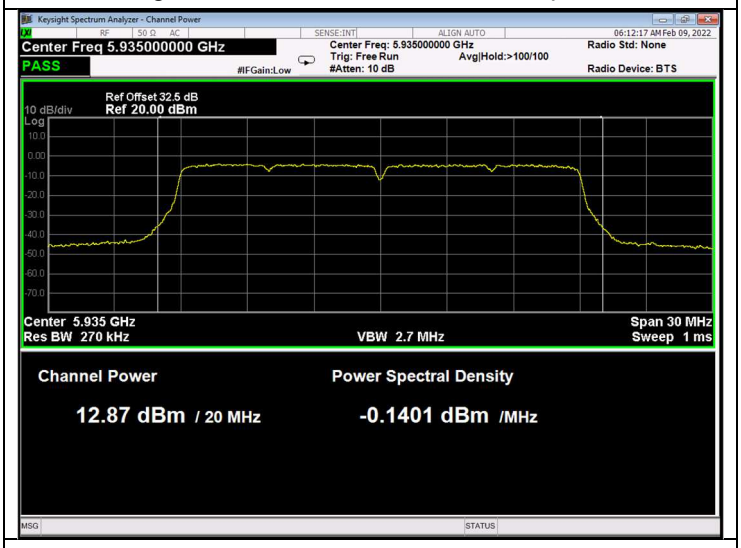


Figure 29. 5935.0MHz,20MHz BW, port2

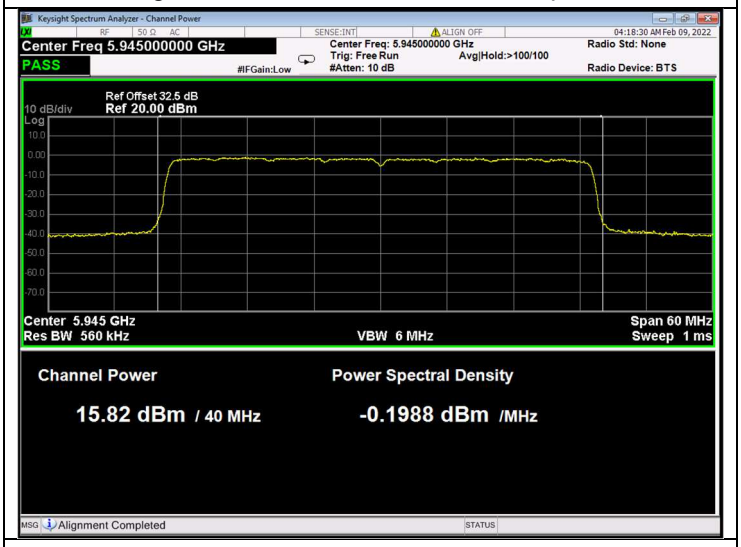


Figure 30. 5945.0MHz,40MHz BW, port2

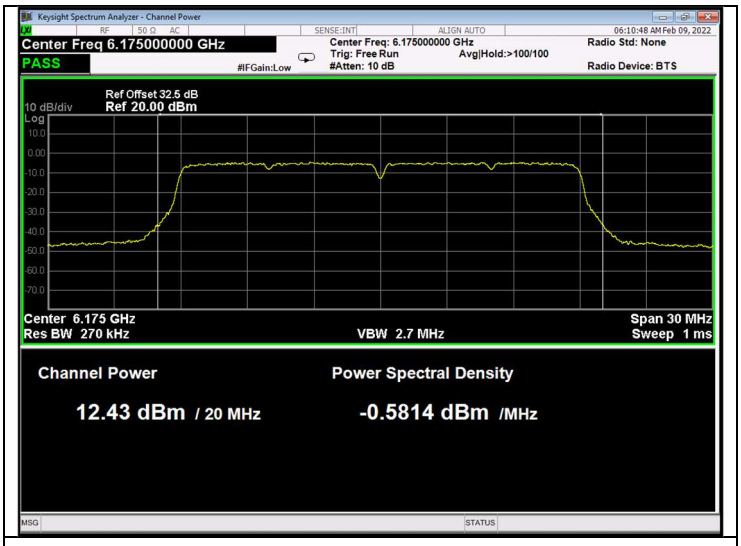


Figure 31. 6175.0MHz,20MHz BW, port2

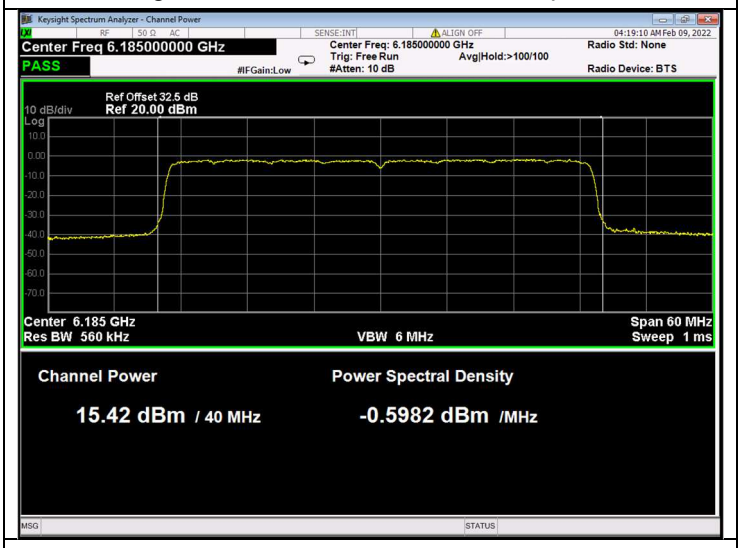


Figure 32. 6185.0MHz,40MHz BW, port2

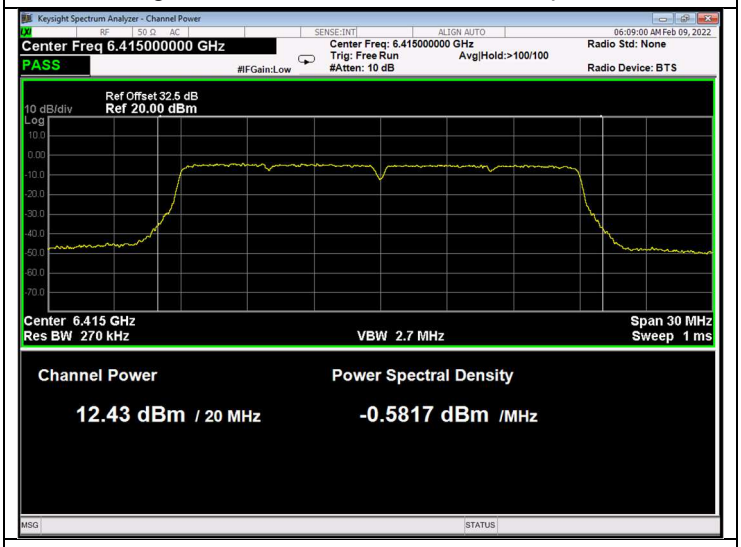


Figure 33. 6415.0MHz,20MHz BW, port2

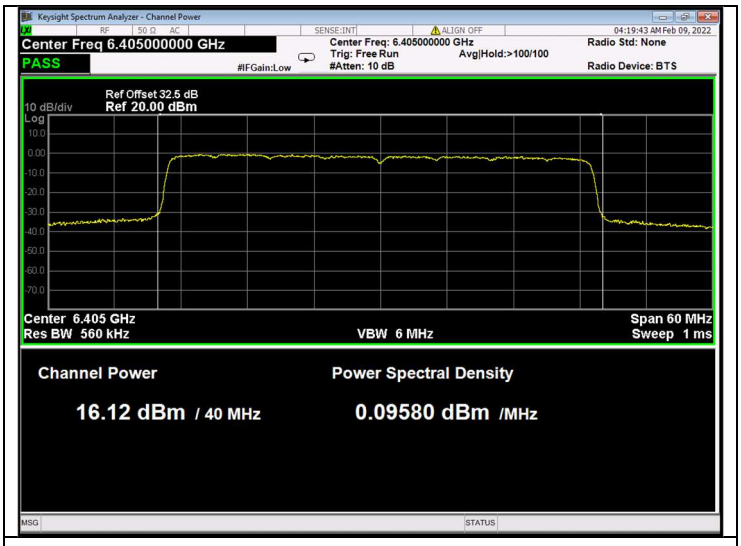


Figure 34. 6405.0MHz,40MHz BW, port2

6.5 Test Equipment Used; Transmitted Power Density

Instrument	Manufacturer	Model	Serial No.	Last Calibration Date	Next Calibration Due
Spectrum Analyzer	Keysight	N9010A	MY54510348	April 25, 2021	April 25, 2023
30dB Attenuator	MCL	BW-S30W5	533	May 23, 2021	May 23, 2022
RF Cable	Huber Suhner	Sucofelex	28239/4PEA	May 23, 2021	May 23, 2022

Figure 35 Test Equipment Used

7. Band Edge

7.1 Test Specification

FCC Part 15, Subpart E, Section 15.407(b)(5)
RSS-248, Issue 1, November 19, 2021, Section 4.7.2(a)

7.2 Test Procedure

(Temperature (22°C)/ Humidity (56%RH))

The E.U.T. antenna terminal was connected to the Spectrum Analyzer through an external attenuator and an appropriate coaxial cable (loss = 34.5dB). The offset calculation: attenuator (30dB) + cable loss(2.5dB) E.U.T. gain antenna (2dBi) +=34.5dB. channel power over 1MHz used

7.3 Test Limits

For transmitters operating within the 5.925-7.125 GHz band: Any emissions outside of the 5.925-7.125 GHz band must not exceed an e.i.r.p. of −27 dBm/MHz.

7.4 Test Results

JUDGEMENT: Passed

The EUT met the requirements of the F.C.C. Part 15, Subpart E, Section 15.407(b)(5) , and RSS-248, Issue 1, Section 4.7.2(a) specifications.

For details see *Figure 36* to *Figure 39.*

2TX mode:

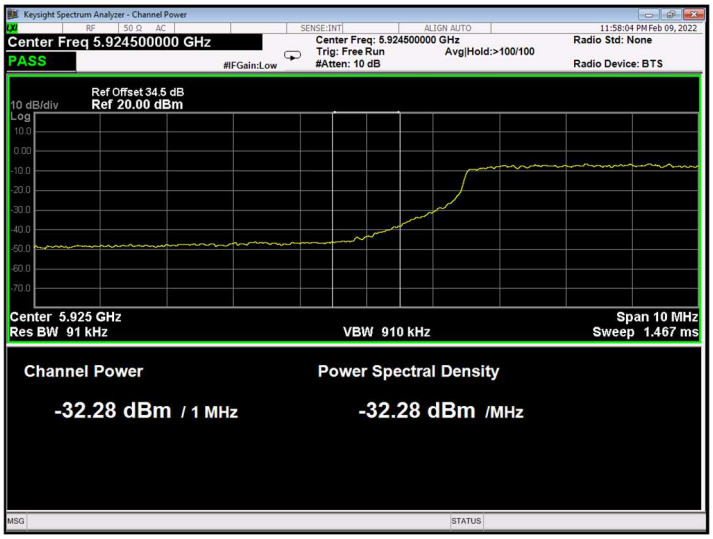


Figure 36 Lower Band Edge, 20MHz BW

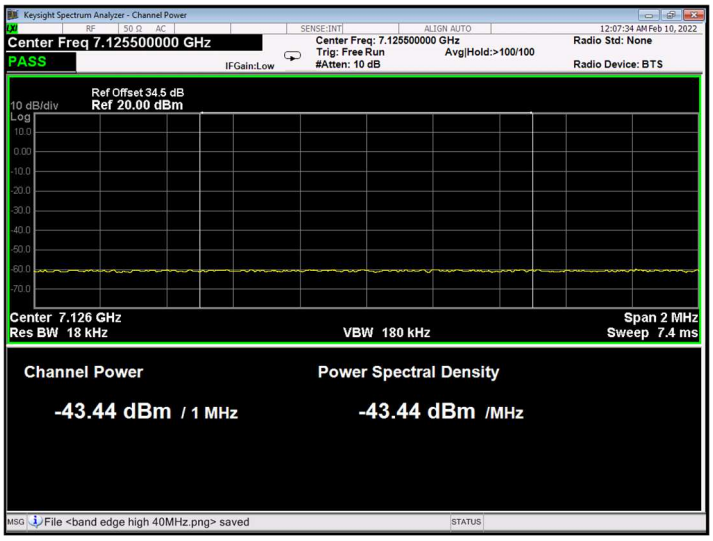


Figure 37 Higher Band Edge, 20MHz BW

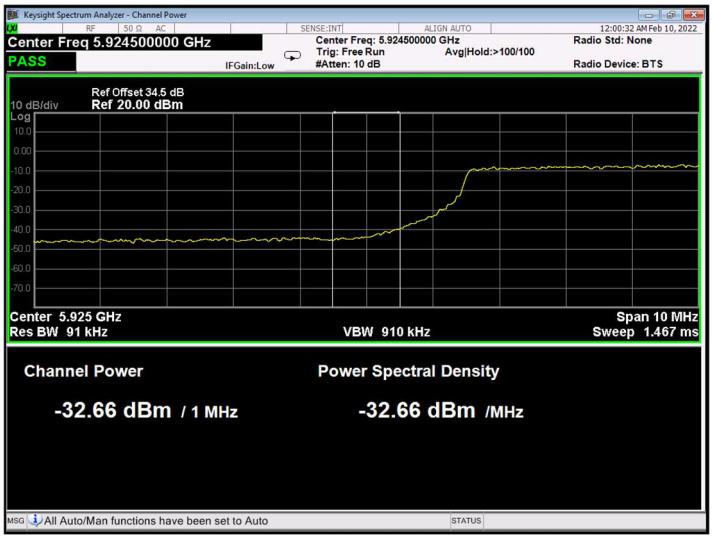


Figure 38 Lower Band Edge, 40MHz BW

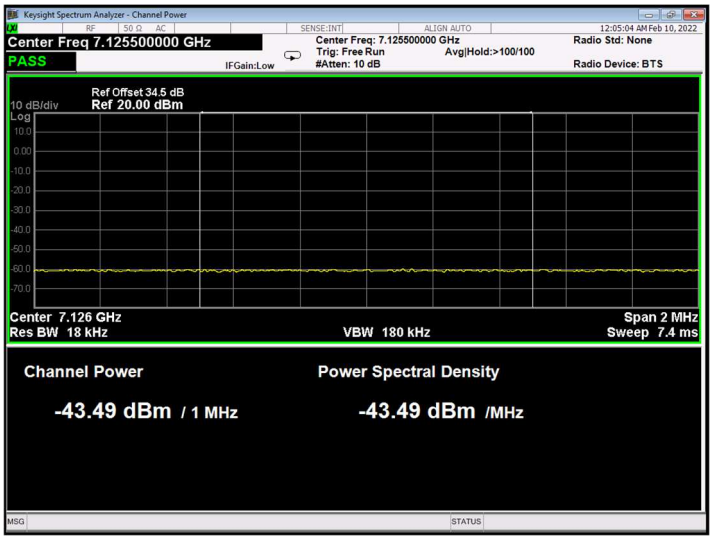


Figure 39 Higher Band Edge, 40MHz BW

7.5 Test Instrumentation Used, Band Edge

Instrument	Manufacturer	Model	Serial No.	Last Calibration Date	Next Calibration Due
Spectrum Analyzer	Keysight	N9010A	MY54510348	April 25, 2021	April 25, 2023
30dB Attenuator	MCL	BW-S30W5	533	May 23, 2021	May 23, 2022
RF Cable	Huber Suhner	Sucofelex	28239/4PEA	May 23, 2021	May 23, 2022

Figure 40 Test Equipment Used

8. Undesirable/Unwanted Emissions

8.1 Test Specification

FCC Part 15, Subpart E, Section 15.407(b)(1-7)
RSS-248, Issue 1, November 19, 2021, Section 4.7.2(a,c,d)

8.2 Test Procedure

(Temperature (22°C)/ Humidity (56%RH))
Testing was performed for both Radiated Emission for Emissions in the Non-Restricted Bands & in the Restricted Bands:

For measurements between 0.009-30MHz:

The E.U.T. was tested inside the shielded room and placed on a non-metallic table, 0.8 meters above the ground. The emissions were measured at a distance of 3 meters. The readings were maximized by the turntable azimuth between 0-360°, and the antenna polarization.
The frequency range 0.009MHz-30MHz was scanned.

For measurements between 30-1000MHz:
A preliminary measurement to characterize the E.U.T. was performed inside the shielded room at a distance of 3 meters, using peak detection mode and broadband antennas. The preliminary measurements produced a list of the highest emissions. The E.U.T. was then transferred to the open site, and placed on a remote-controlled turntable. The E.U.T. was placed on a non-metallic table, 0.8 meters above the ground. The emissions were measured at a distance of 3 meters. The readings were maximized by adjusting the antenna height between 1-4 meters, the turntable azimuth between 0-360°, and the antenna polarization. The frequency range 30MHz -1000MHz was scanned and the list of the highest emissions was verified and updated accordingly.

For measurements between 1GHz-40GHz:

The E.U.T. was tested inside the shielded room and placed on a non-metallic table, 1.5 meters above the ground. The emissions were measured at a distance of 3 meters. The readings were maximized by the turntable azimuth between 0-360°, and the antenna polarization.
The frequency range 1GHz - 40GHz was scanned.

Evaluation was performed for both 20 and 40MHz BW transmissions.

The highest radiations are described in the tables below.

8.3 Test Limits

EIRP Above 1.0GHz	Field strength Above 1.0GHz	Below 1.0GHz
(dBm/MHz)	(dBµV/m/MHz@3m)	(dBµV/m)
-27.0	68.2	As describe in section 15.209

Figure 41 Non-Restricted Band Limits

Frequency (MHz)	Field strength (microvolts/meter)	Measurement distance (meters)	Field strength (dBµV/m)	Field strength* (dBµV/m)@3m
0.009-0.490	2400/F(kHz)	300	48.5-13.8	128.5-73.8
0.490-1.705	24000/F(kHz)	30	33.8-23.0	73.8-63.0
1.705-30.0	30	30	29.5	69.5
30-88	100	3	40.0	40.0
88-216	150	3	43.5	43.5
216-960	200	3	46.0	46.0
Above 960	500	3	54.0	54.0

*The emission limits shown in the above table are based on measurements employing a CISPR quasi-peak detector except for the frequency bands 9-90 kHz, 110-490 kHz and above 1000 MHz. Radiated emission limits in these three bands are based on measurements employing an average detector. For average radiated emission measurements above 1000 MHz, there is also a limit corresponding to 20 dB above the indicated values in the table is specified when measuring with peak detector function.

Figure 42 FCC Restricted Band Limits

8.4 Test Results

JUDGEMENT: Passed

The EUT met the requirements of the FCC Part 15, Subpart E, Section 15.407(b)(1-7), and RSS-248, Issue 1, November 19, 2021, Section 4.7.2(a,c,d) specification.

Undesirable/Unwanted Emission

Specifications: FCC, Part 15, Subpart E, Section 15.407(b)(1-7)
RSS-248, Issue 1, November 19, 2021, Section 4.7.2(a,c,d)

Antenna Polarization: Horizontal/Vertical
Frequency Range: 9kHz to 40.0 GHz
BW: 20MHz
Detector: Peak, Average

Operation Frequency	Freq.	Pol	Peak Reading	Peak Limit	Peak Margin	Average Reading	Average Limit	Average Margin
(MHz)	(MHz)	(H/V)	(dBµV/m)	(dBµV/m)	(dB)	(dBµV/m)	(dBµV/m)	(dB)
5935.0	No emissions detected above the spectrum analyzer noise level which have at least 10dB margin below the limit							
6175.0								
6415.0								

Figure 43. Radiated Emission Results for 20MHz BW

Margin refers to the test results obtained minus specified requirement; thus a positive number indicates failure, and a negative result indicates that the product passes the test.

"Peak Amp" includes correction factor.

* "Correction Factor" = Antenna Factor + Cable Loss- Low Noise Amplifier Gain

Undesirable/Unwanted Emission

Specifications: FCC, Part 15, Subpart E, Section 15.407(b)(1-7)
RSS-248, Issue 1, November 19, 2021, Section 4.7.2(a,c,d)

Antenna Polarization: Horizontal/Vertical
Frequency Range: 9kHz to 40.0 GHz
BW : 40MHz
Detector: Peak, Average

Operation Frequency	Freq.	Pol	Peak Reading	Peak Limit	Peak Margin	Average Reading	Average Limit	Average Margin
(MHz)	(MHz)	(H/V)	(dBµV/m)	(dBµV/m)	(dB)	(dBµV/m)	(dBµV/m)	(dB)
5945.0	No emissions detected above the spectrum analyzer noise level which have at least 10dB margin below the limit							
6185.0								
6405.0								

Figure 44. Radiated Emission Results for 40MHz BW

Margin refers to the test results obtained minus specified requirement; thus a positive number indicates failure, and a negative result indicates that the product passes the test.

"Peak Amp" includes correction factor.

* "Correction Factor" = Antenna Factor + Cable Loss- Low Noise Amplifier Gain

8.5 Test Instrumentation Used, Emissions in Non Restricted Frequency Bands

Instrument	Manufacturer	Model	Serial No.	Last Calibration Date	Next Calibration Due
EMI Receiver	Rohde & Schwarz	ESCI7	100724	February 23, 2021	February 23, 2022
EMI Receiver	HP	8542E	3906A00276	February 24, 2021	February 24, 2022
RF Filter Section	HP	85420E	3705A00248	February 24, 2021	February 24, 2022
EMC Analyzer	HP	8593 EM	3826A00265	February 22, 2021	February 22, 2022
Active Loop Antenna	EMCO	6502	2950	May 03, 2021	May 03, 2022
Biconical Antenna	EMCO	3110B	9912-3337	January 18, 2021	January 18, 2023
Log Periodic Antenna	EMCO	3146	9505-4081	January 20, 2021	January 20, 2023

Instrument	Manufacturer	Model	Serial No.	Last Calibration Date	Next Calibration Due
Horn Antenna	ETS	3115	29845	May 25, 2021	May 25, 2024
Horn Antenna	ARA	SWH-28	1007	November 02, 2020	November 02, 2023
MicroWave System Amplifier	HP	83006A	3104A00589	August 23, 2020	August 23, 2021
RF Cable Chamber	Commscope ORS	0623 WBC-400	G020132	May 25, 2021	May 25, 2022
RF Cable Oats	EIM	RG214-11N(X2)	-	NCR	NCR
Filter Band Pass 4-20 GHz	Meuro	MFL040120H50	902252	May 24, 2021	May 24, 2022
Full Anechoic Civil Chamber	ETS	S81	SL 11643	NCR	NCR
Antenna Mast	ETS	2070-2	9608-1497	NCR	NCR
Turntable	ETS	2087	-	NCR	NCR
Mast & Table Controller	ETS/EMCO	2090	9608-1456	NCR	NCR

Figure 45 Test Equipment Used

8.6 Field Strength Calculation

The field strength is calculated directly by the EMI Receiver software, and a "Correction Factors", using the following equation:

$$FS = RA + AF + CF$$

FS: Field Strength [dBµv/m]
RA: Receiver Amplitude [dBµv]
AF: Receiving Antenna Correction Factor [dB/m]
CF: Cable Attenuation Factor [dB]

Example: FS = 30.7 dBµV (RA) + 14.0 dB (AF) + 0.9 dB (CF) = 45.6 dBµV

No external pre-amplifiers are used.

9. 99% Occupied Bandwidth

9.1 Test Specification

FCC Part 2, Sub part J, Section 2.1049
FCC Part 15, Subpart E, Section 15.407(a)(10)
RSS-Gen, Issue 5, April 2018, Section 6.7
RSS-248, Issue 1, November 19, 2021, Section 4.4

9.2 Test Procedure

(Temperature (22°C)/ Humidity (56%RH))
The E.U.T. operation mode and test set-up are as described in Section 2 of this report. The E.U.T. antenna terminal was connected to the Spectrum Analyzer through an external attenuator and an appropriate coaxial cable (total loss= 32.5dB). Special attention was taken to prevent Spectrum Analyzer RF input overload.

The RBW was set to the range of 1%-5% of the OBW.

9.3 FCC and IC Test Limit

The maximum transmitter channel bandwidth for U-NII devices in the 5.925-7.125 GHz band is 320 megahertz.

9.4 Test Results

BW	Operation Frequency	Reading
(MHz)	(MHz)	(MHz)
20.0	5935.0	17.9
	6175.0	17.9
	6415.0	18.0
40.0	5945.0	37.5
	6185.0	37.6
	6405.0	37.6

Figure 46. Bandwidth Test Results, 2TX mode

JUDGEMENT: Passed

See additional information in *Figure 47* to *Figure 52.*

2TX mode:

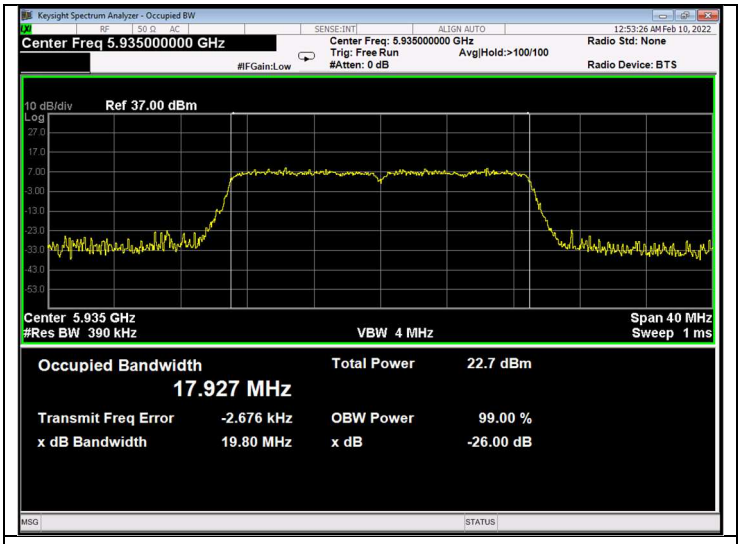


Figure 47. 5935.0MHz, 20MHz BW

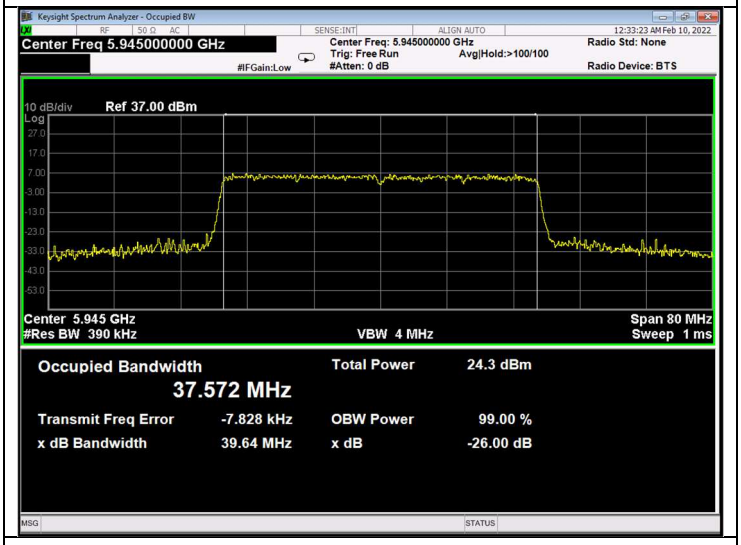


Figure 48. 5945.0MHz, 40MHz BW

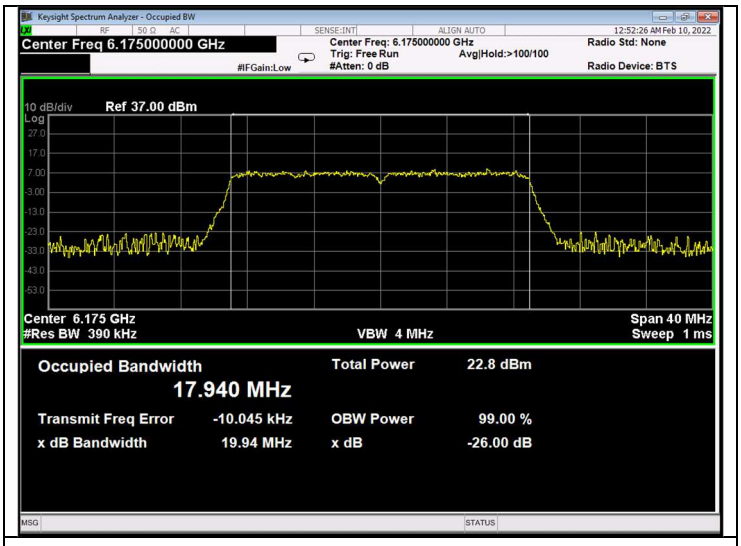


Figure 49. 6175.0MHz, 20MHz BW

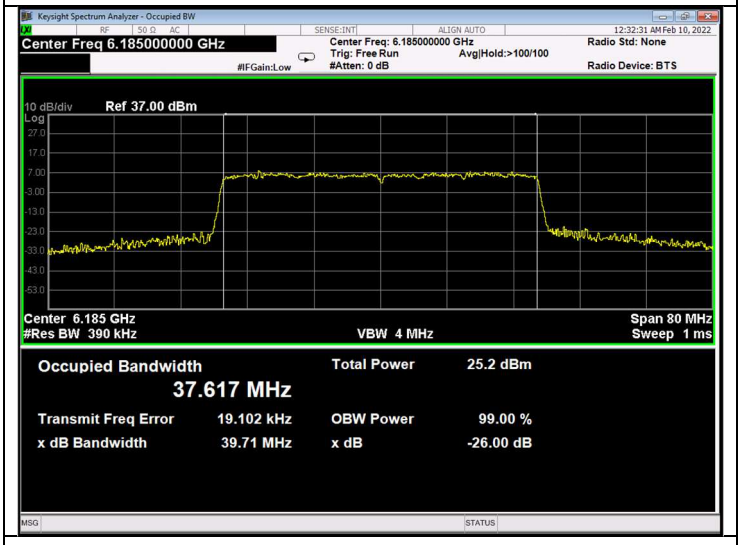


Figure 50. 6185.0MHz, 40MHz BW

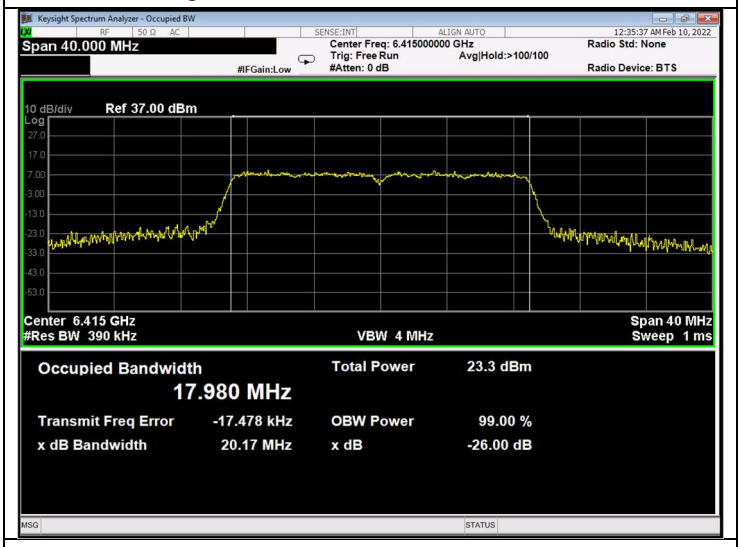


Figure 51. 6415.0MHz, 20MHz BW

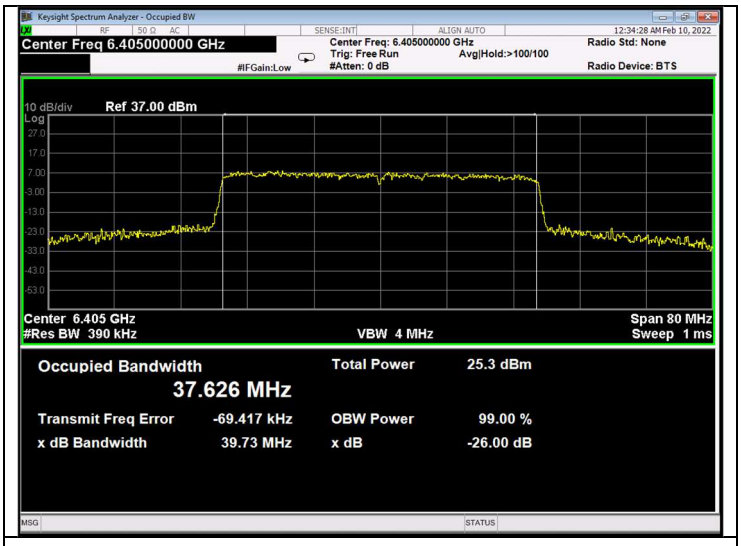


Figure 52. 6405.0MHz, 40MHz BW

9.5 Test Equipment Used; Occupied Bandwidth

Instrument	Manufacturer	Model	Serial No.	Last Calibration Date	Next Calibration Due
Spectrum Analyzer	Keysight	N9010A	MY54510348	April 25, 2021	April 25, 2023
30dB Attenuator	MCL	BW-S30W5	533	May 23, 2021	May 23, 2022
RF Cable	Huber Suhner	Sucofelex	28239/4PEA	May 23, 2021	May 23, 2022

Figure 53 Test Equipment Used

10. 26dB Bandwidth

10.1 Test Specification

FCC Part 2, Sub part J, Section 2.1049
RSS-Gen, Issue 5, April 2018, Section 6.7
RSS-248, Issue 1, November 19, 2021, Section 4.4

10.2 Test Procedure

(Temperature (22°C)/ Humidity (56%RH))
The E.U.T. operation mode and test set-up are as described in Section 2 of this report. The E.U.T. antenna terminal was connected to the Spectrum Analyzer through an external attenuator and an appropriate coaxial cable (total loss= 31.0dB). Special attention was taken to prevent Spectrum Analyzer RF input overload.

The RBW set to the range of 1% of the EBW.

10.3 Test Limit

N/A

10.4 Test Results

BW	Operation Frequency	Reading
(MHz)	(MHz)	(MHz)
20.0	5935.0	19.8
	6175.0	19.9
	6415.0	20.1
40.0	5945.0	39.6
	6185.0	39.7
	6405.0	39.7

Figure 54. 26dB Bandwidth Test Results, 2TX mode

JUDGEMENT: Passed

See additional information in Figure 55 to Figure 60.

2TX mode:

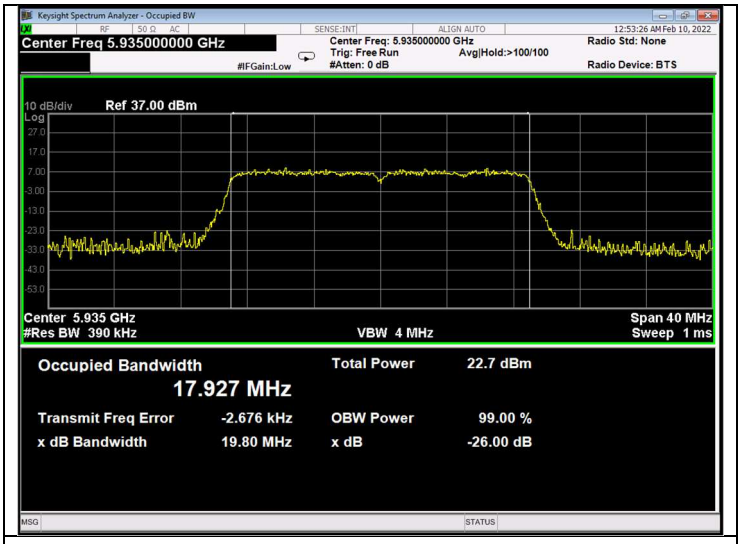


Figure 55. 5935.0MHz, 20MHz BW

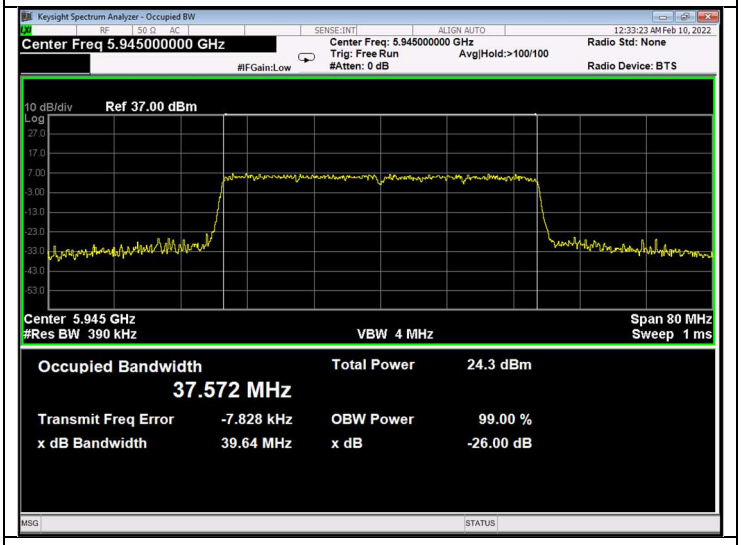


Figure 56. 5945.0MHz, 40MHz BW

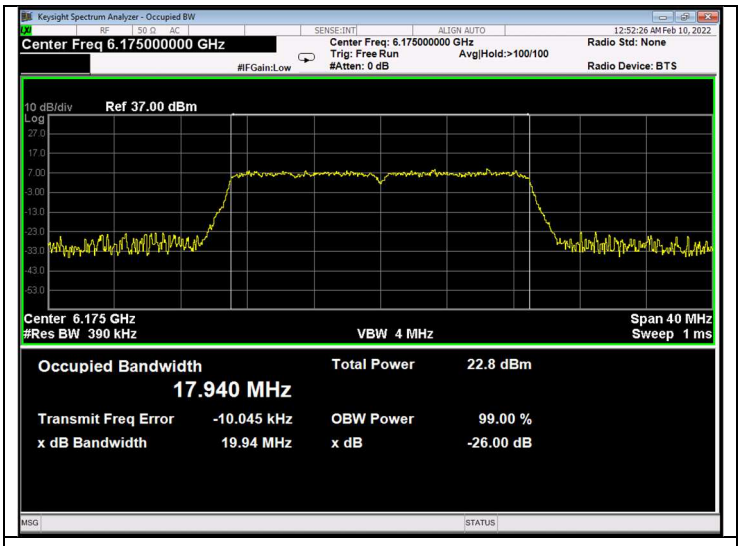


Figure 57. 6175.0MHz, 20MHz BW

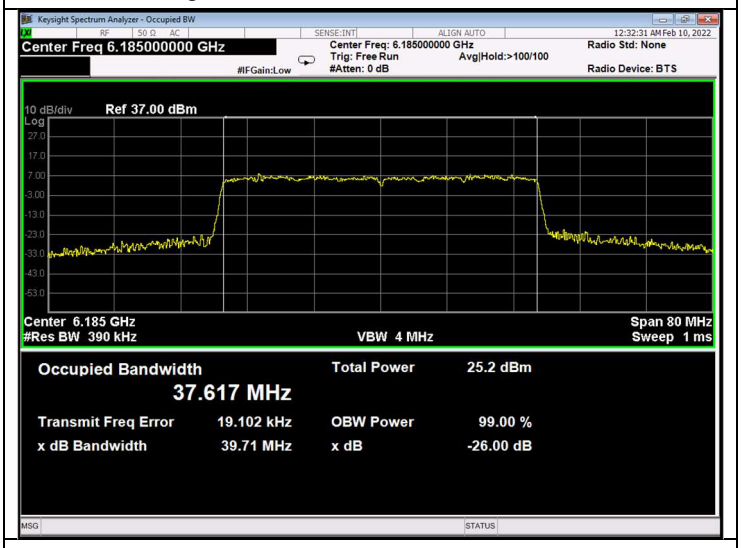


Figure 58. 6185.0MHz, 40MHz BW

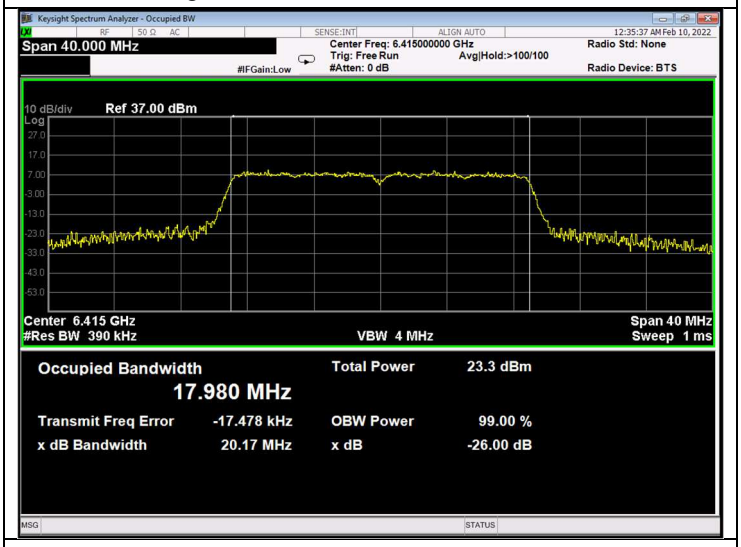


Figure 59. 6415.0MHz, 20MHz BW

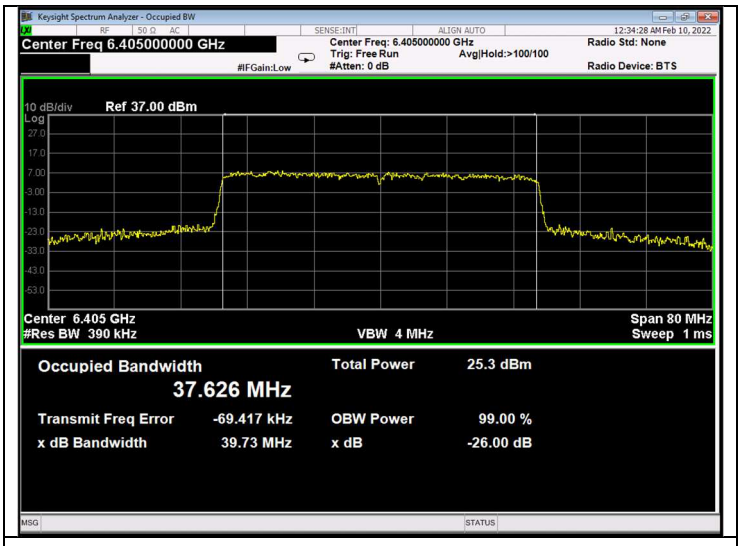


Figure 60. 6405.0MHz, 40MHz BW

10.5 Test Equipment Used; 26dB Bandwidth

Instrument	Manufacturer	Model	Serial No.	Last Calibration Date	Next Calibration Due
Spectrum Analyzer	Keysight	N9010A	MY54510348	April 25, 2021	April 25, 2023
30dB Attenuator	MCL	BW-S30W5	533	May 23, 2021	May 23, 2022
RF Cable	Huber Suhner	Sucofelex	28239/4PEA	May 23, 2021	May 23, 2022

Figure 61 Test Equipment Used

11. In-Band Emission Mask

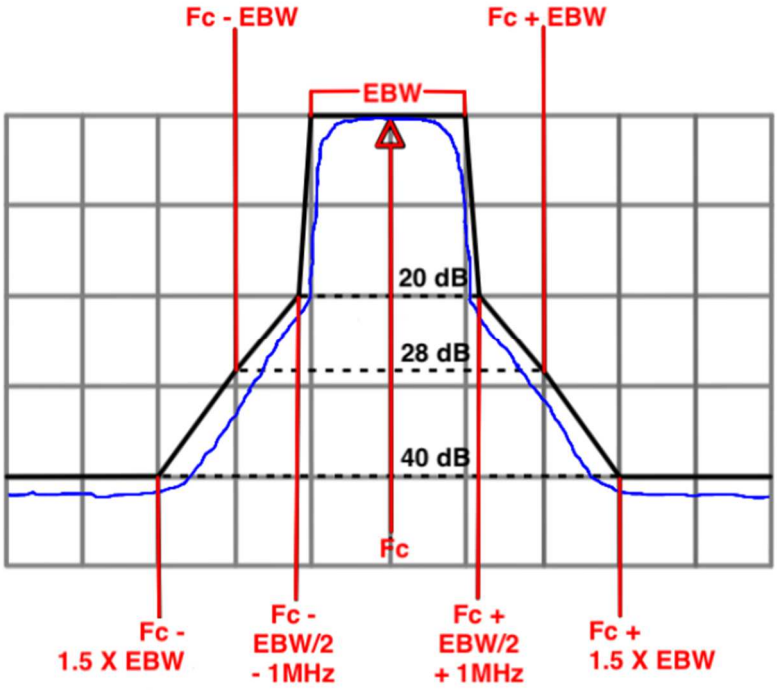
11.1 Test Specification

FCC, Part 2, Sub part J, Section 2.1049

11.2 Test Procedure

(Temperature (22°C)/ Humidity (56%RH))
The E.U.T. operation mode and test set-up are as described in Section 2 of this report. The E.U.T. antenna terminal was connected to the Spectrum Analyzer through an external attenuator and an appropriate coaxial cable (total loss= 32.5dB). Special attention was taken to prevent Spectrum Analyzer RF input overload. Test procedure was performed according to Section J in KDB 987594.

11.3 Test Limit



11.4 Test Results

JUDGEMENT: Passed

See additional information in Figure 62 to Figure 67.

2TX mode:

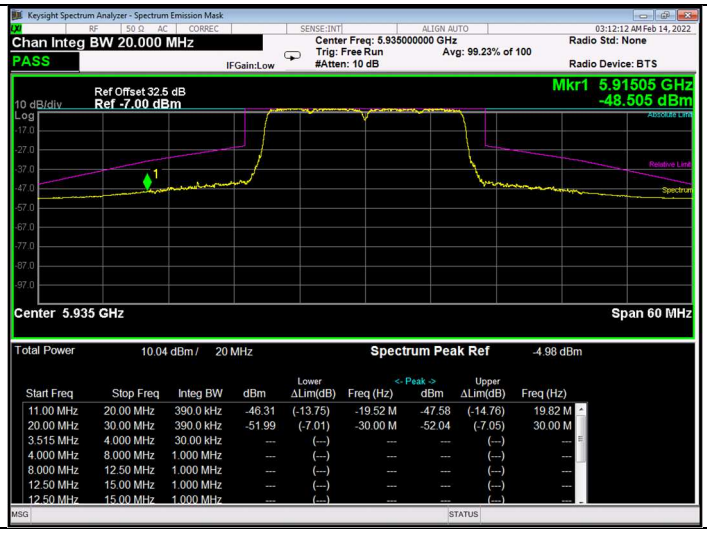


Figure 62. 5935.0MHz, 20MHz BW

Figure 63. 5945.0MHz, 40MHz BW

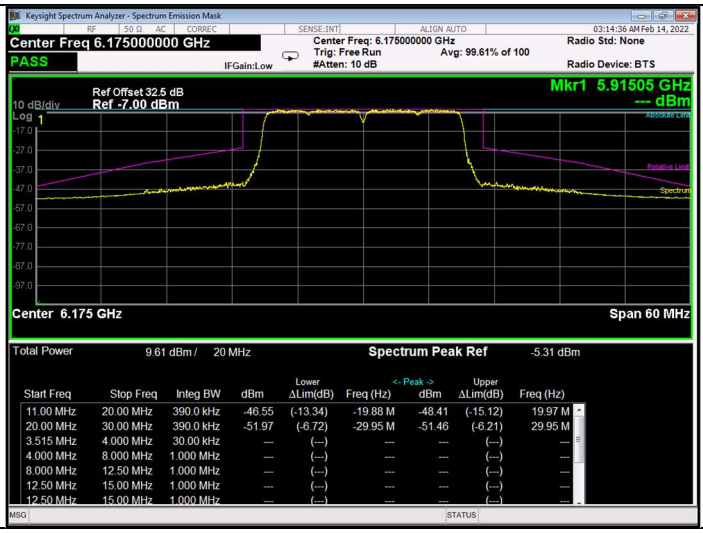


Figure 64. 6175.0MHz, 20MHz BW

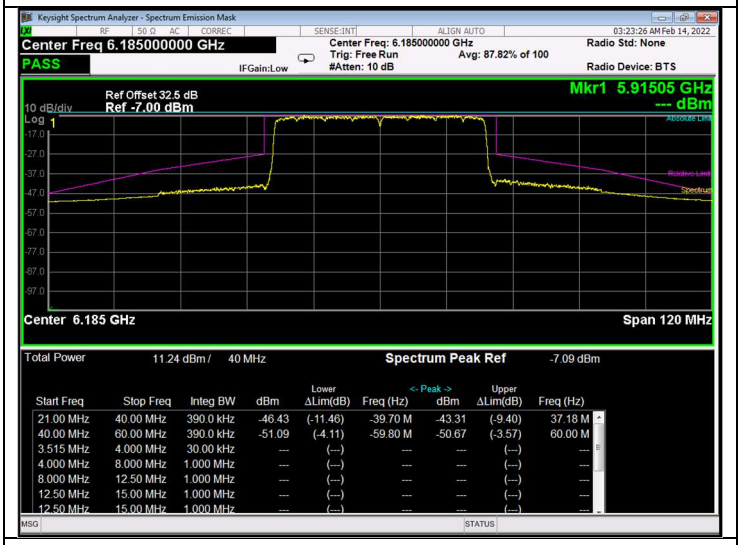


Figure 65. 6185.0MHz, 40MHz BW

Figure 66. 6415.0MHz, 20MHz BW

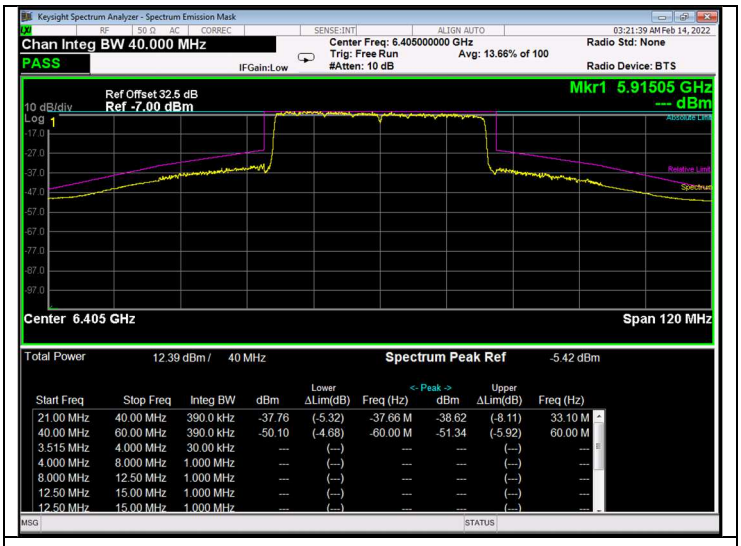


Figure 67. 6405.0MHz, 40MHz BW

11.5 Test Equipment Used; In-Band Emission Mask

Instrument	Manufacturer	Model	Serial No.	Last Calibration Date	Next Calibration Due
Spectrum Analyzer	Keysight	N9010A	MY54510348	April 25, 2021	April 25, 2023
30dB Attenuator	MCL	BW-S30W5	533	May 23, 2021	May 23, 2022
RF Cable	Huber Suhner	Sucofelex	28239/4PEA	May 23, 2021	May 23, 2022

Figure 68 Test Equipment Used

12. Contention Based Protocol

12.1 Test Specification

KDB 987594 D02 U-NII 6GHz EMC Measurement v01
RSS-248 Issue 1 November 19, 2021, Section 4.8

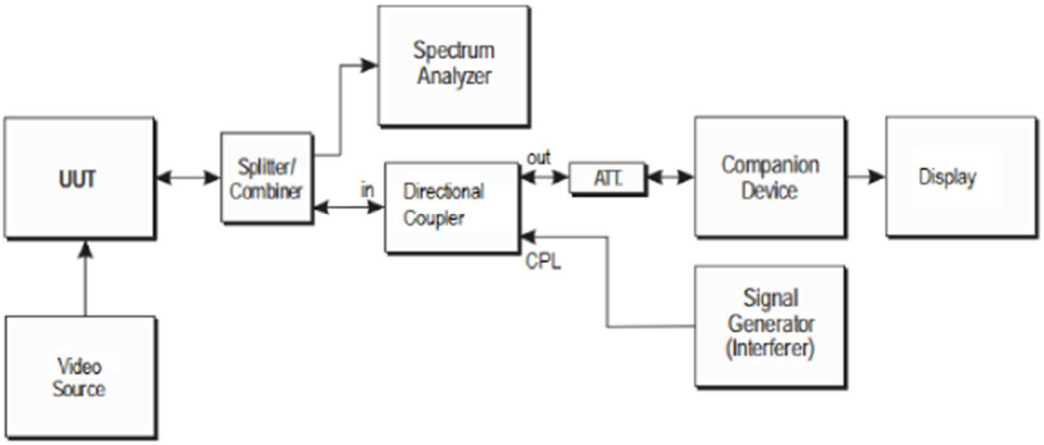
12.2 Test Procedure

(Temperature (21°C)/ Humidity (54%RH))
Test procedure was performed according to Section I in KDB 987594.
Criteria for Pass: evacuation of channel when interferer was detected.

1. The E.U.T. was configured to transmit with a constant duty cycle at the power level, frequency, and BW listed in the results table.
2. An AWGN signal of 10 MHz-wide was generated and the AWGN power injected was calibrated to -60dBm at the EUT RF connector assuming 0dBi antenna gain
3. The setup shown below per KDB 617641was connected to the setup.
4. The EUT was set to 20MHz BW and was set to transmit at 5935MHz, as shown in figure 105.
5. The AWGN signal was set to the center frequencies 5930MHz (according to table 1 of KDB987594 D02) at AWGN signal power of -85dBm (which is 25 dB below the -62 dBm threshold when assuming 0dBi antenna gain).
6. The AWGN signal source was turned ON.
7. The AWGN signal was increased until the EUT stopped transmission. The AWGN signal level is listed in the results table.
8. The procedure was repeated 10 times to verify the EUT can detect an AWGN signal at the same level.
9. The process was repeated for 40MHz BW performance: at the AWGN signal center frequencies of 5930MHz and 5960MHz for a 40MHz wide EUT signal transmitting at 5945MHz (according to table 1 of KDB987594 D02).
10. The procedure was repeated 10 times to verify the EUT can detect an AWGN signal at the same level.

12.3 Test Procedure Modification

Contention based protocol setup was done in link mode, which was approved by FCC in KDB 617641. The setup is shown in the following diagram.



12.4 Test Limit

Unlicensed low-power indoor devices must detect co-channel radio frequency power that is at least -62 dBm or lower. The -62 dBm (or lower) threshold is referenced to a 0 dBi antenna gain.

12.5 Test Results

EUT frequency	BW_{EUT}	Incumbent frequency	BW_{inc}	AWGN Power	Ant. gain	Adjusted AWGN Power	Detection Limit	Success no./Trial no.	Verdict
F_{c1}[MHz]	[MHz]	F_{c2}[MHz]	[MHz]	[dBm]	[dBi]	[dBm]	[dBm]		p/f
5935	20	5930	10	-66.0	2	-68.0	-62	10/10	pass
5945	40	5930	10	-65.0	2	-67.0	-62	10/10	pass
5945	40	5960	10	-65.5	2	-67.5	-62	10/10	pass

BW_{EUT}: Transmission bandwidth of EUT signal
BW_{Inc}: Transmission bandwidth of the simulated incumbent signal (10 MHz wide AWGN signal)
$fc1$: Center frequency of EUT transmission
$fc2$: Center frequency of simulated incumbent signal
AWGN power: detection of incumbent signal and transmitter evacuated of the center frequency

AWGN Power was turned on at -85dBm. Therefore, there was no impact on transmission starting from -85dBm, which is 23dB below the defined threshold (-62dBm), assuming 0dBi antenna gain.

Minimal: this condition is not supported due to technical design

*Note: the E.U.T.'s antenna gain is 2 dBi, therefore the limit is -60dBm

JUDGEMENT: Pass

Criteria for Pass: evacuation of channel when interferer was detected

The channel was vacated at every trial.

The AWGN signal at 5930MHz that was detected for the 40MHz transmission at 5945MHz, was recorded in the plot below. See additional information in *Figure 70* to *Figure 72*

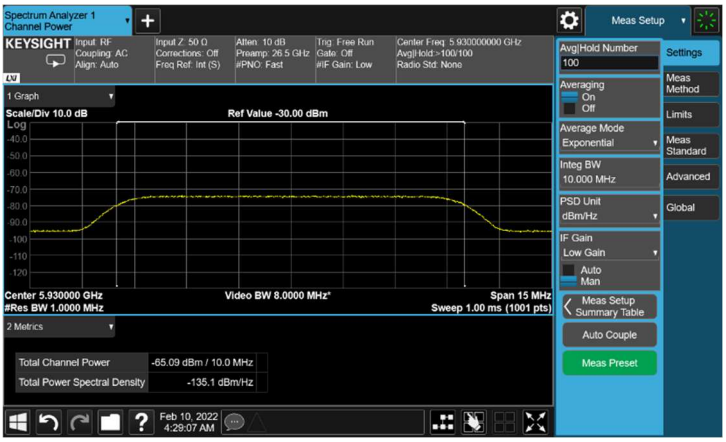


Figure 69. AWGN signal at 5930MHz

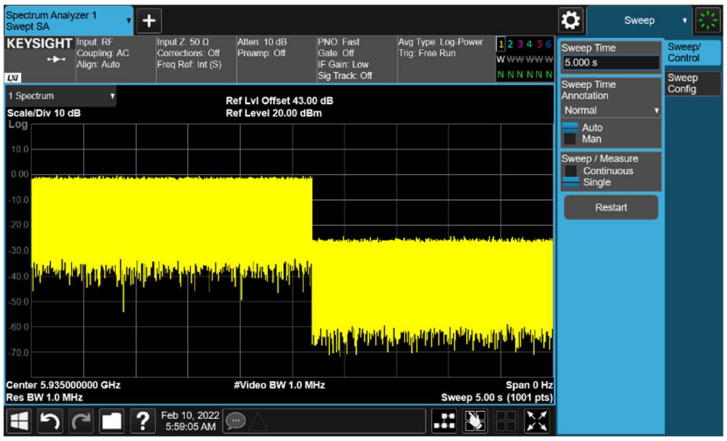


Figure 70. EUT evacuation of frequency 5935.0MHz (20.0MHz BW) due to incumbent signal at 5930.0MHz

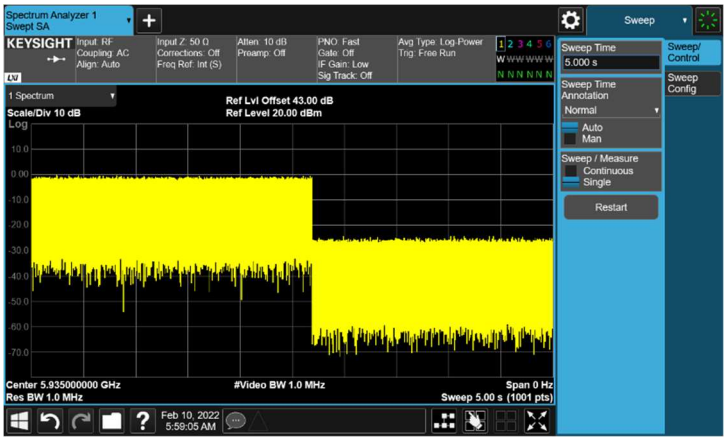


Figure 71. EUT evacuation of frequency 5945.0MHz (40.0MHz BW) due to incumbent signal at 5930.0MHz

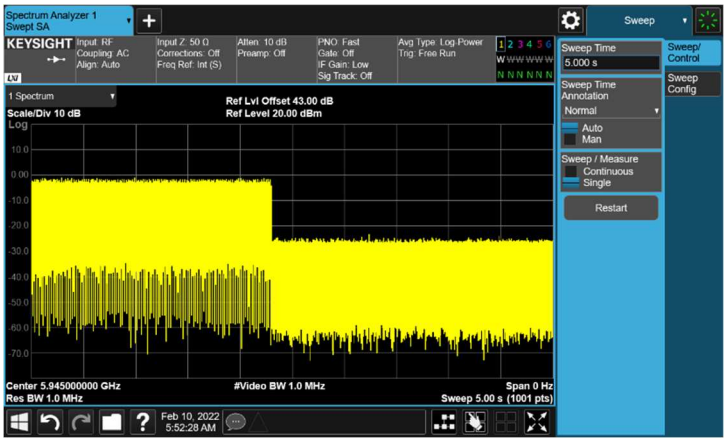


Figure 72. EUT evacuation of frequency 5945.0MHz (40.0MHz BW) due to incumbent signal at 5960.0MHz

12.6 Test Equipment Used; Contention Based Protocol

a

Instrument	Manufacturer	Model	Serial No.	Last Calibration Date	Next Calibration Due
EXA Signal Analyzer	Agilent Technologies	N9010B	902A000401	April 27, 2021	April 27, 2023
MXG Vector Signal Generator	Agilent Technologies	N5182A	MY47070174	November 10, 2020	November 10, 2023

Figure 73 Test Equipment Used

13. Frequency Stability

13.1 Test Specification

RSS-Gen, Issue 5, Section 6.11

RSS-248 Issue 1, Section 4.5

13.2 Test Procedure

(Temperature (23°C)/ Humidity (52%RH))

The E.U.T operation mode and test setup are as described in Section 2.

The E.U.T. was placed inside a temperature chamber. The E.U.T. was powered with nominal voltage of 5 V DC

13.3 IC Test Limit

The frequency stability shall be sufficient to ensure that the occupied bandwidth stays within the 5925-7125 MHz frequency band when tested at the temperature and supply voltage variations specified in RSS-Gen.

13.4 Test Results

The E.U.T met the requirements of RSS-248 Issue 1 November 19, 2021specifications.

The details of the results are given in Figure 74 to Figure 75.

Operation frequency		5935 MHz		6415 MHz		Verdict
Temperature	Voltage	99% OBW	Lowest frequency	99% OBW	Highest frequency	
(°C)	(VDC)	(MHz)	(GHz)	(MHz)	(GHz)	(pass/fail)
+20.0	+15%	17.990	5.9259	18.039	6.4240	pass
	5.0	17.992	5.9260	18.060	6.4240	pass
	-15%	18.006	5.9258	18.078	6.4239	pass
-20.0	5.0	18.012	5.9258	18.017	6.4240	pass
+50.0	5.0	17.971	5.9260	18.023	6.4240	pass

Figure 74 Frequency Stability Results ,20 MHz BW

Operation frequency		5945MHz		6405MHz		Verdict
Temperature	Voltage	99% OBW	Lowest frequency	99% OBW	Highest frequency	
(°C)	(VDC)	(MHz)	(GHz)	(MHz)	(GHz)	(pass/fail)
+20.0	+15%	37.856	5.9260	37.947	6.4240	pass
	5.0	37.901	5.9261	37.832	6.4239	pass
	-15%	37.908	5.9260	37.852	6.4239	pass
-20.0	5.0	37.881	5.9260	37.885	6.4239	pass
+50.0	5.0	37.871	5.9260	37.857	6.4239	pass

Figure 75 Frequency Stability Results, 40 MHz BW

13.5 Test Equipment Used; Frequency Stability

Instrument	Manufacturer	Model	Serial No.	Last Calibration Date	Next Calibration Due
30dB Attenuator	MCL	BW-S30W5	533	16/05/2022	16/05/2023
RF Cable	Huber Suhner	Sucofelex	28239/4PEA	23 May. 2021	30 Jun. 2022
Climatic temperature chamber	Thermotron	S-4	33562	22 Feb 2022	22 Feb 2023

Figure 76 Test Equipment Used

14. Antenna Gain/Information

14.1 Test Specification

FCC, Part 15, Subpart B. section 212 (a)(iv)

14.2 Test Limit

The modular transmitter must comply with the antenna and transmission system requirements of §§15.203, 15.204(b) and 15.204(c). The antenna must either be permanently attached or employ a “unique” antenna coupler (at all connections between the module and the antenna, including the cable).

14.3 Test Results

Judgment: Passed

△ The table below describes the antenna used for testing the device:

Antenna	Gain	Type
AMN_ANT_1012-0	0 dBi	Dipole
AMN_ANT_1010	2 dBi	Dipole

15. Appendix A - Correction Factors

15.1 For ITL #1911 OATS RF Cable

Frequency (MHz)	Cable Loss (dB)		Frequency (MHz)	Cable Loss (dB)
1.0	0.5		450.00	5.83
10.00	1.0		500.00	6.33
20.00	1.34		550.00	6.67
30.00	1.5		600.00	6.83
50.00	1.83		650.00	7.17
100.00	2.67		700.00	7.66
150.00	3.17		750.00	7.83
200.00	3.83		800.00	8.16
250.00	4.17		850.00	8.5
300.00	4.5		900.00	8.83
350.00	5.17		950.00	8.84
400.00	5.5		1000.00	9.0

15.2 For ITL #1840 Anechoic Chamber RF Cable

Frequency (MHz)	Cable Loss (dB)		Frequency (MHz)	Cable Loss (dB)
1000.0	-1.4		10000.0	-6.0
1500.0	-1.7		10500.0	-6.2
2000.0	-2.0		11000.0	-6.2
2500.0	-2.3		11500.0	-6.0
3000.0	-2.6		12000.0	-6.0
3500.0	-2.8		12500.0	-6.1
4000.0	-3.1		13000.0	-6.3
4500.0	-3.3		13500.0	-6.5
5000.0	-3.6		14000.0	-6.7
5500.0	-3.7		14500.0	-7.0
6000.0	-4.0		15000.0	-7.3
6500.0	-4.4		15500.0	-7.5
7000.0	-4.7		16000.0	-7.6
7500.0	-4.8		16500.0	-8.0
8000.0	-5.0		17000.0	-8.0
8500.0	-5.1		17500.0	-8.1
9000.0	-5.6		18000.0	-8.2
9500.0	-5.8			

15.3 For ITL # 1075 Active Loop Antenna

Frequency (MHz)	MAF (dBs/m)	AF (dB/m)
0.01	-33.1	18.4
0.02	-37.2	14.3
0.03	-38.2	13.3
0.05	-39.8	11.7
0.1	-40.1	11.4
0.2	-40.3	11.2
0.3	-40.3	11.2
0.5	-40.3	11.2
0.7	-40.3	11.2
1	-40.1	11.4
2	-40.0	11.5
3	-40.0	11.5
4	-40.1	11.4
5	-40.2	11.3
6	-40.4	11.1
7	-40.4	11.1
8	-40.4	11.1
9	-40.5	11.0
10	-40.5	11.0
20	-41.5	10.0
30	-43.5	8.0

15.4 For ITL #1356 Biconical Antenna

Frequency (MHz)	AF (dB/m)
30	13.00
35	10.89
40	10.59
45	10.63
50	10.12
60	9.26
70	7.74
80	6.63
90	8.23
100	11.12
120	13.16
140	13.07
160	14.80
180	16.95
200	17.17

15.5 For ITL # 1349 Log Periodic Antenna

Frequency (MHz)	AF (dB/m)
200	11.58
250	12.04
300	14.76
400	15.55
500	17.85
600	18.66
700	20.87
800	21.15
900	22.32
1000	24.22

15.6 For ITL # 1352 1-18 Horn Antenna

Frequency (GHz)	AF (dB/m)		Frequency (GHz)	AF (dB/m)
0.75	25		9.5	38
1.0	23.5		10.0	38.5
1.5	26.0		10.5	38.5
2.0	29.0		11.0	38.5
2.5	27.5		11.5	38.5
3.0	30.0		12.0	38.0
3.5	31.5		12.5	38.5
4.0	32.5		13.0	40.0
4.5	32.5		13.5	41.0
5.0	33.0		14.0	40.0
5.5	35.0		14.5	39.0
6.0	36.5		15.0	38.0
6.5	36.5		15.5	37.5
7.0	37.5		16.0	37.5
7.5	37.5		16.5	39.0
8.0	37.5		17.0	40.0
8.5	38.0		17.5	42.0
9.0	37.5		18.0	42.5

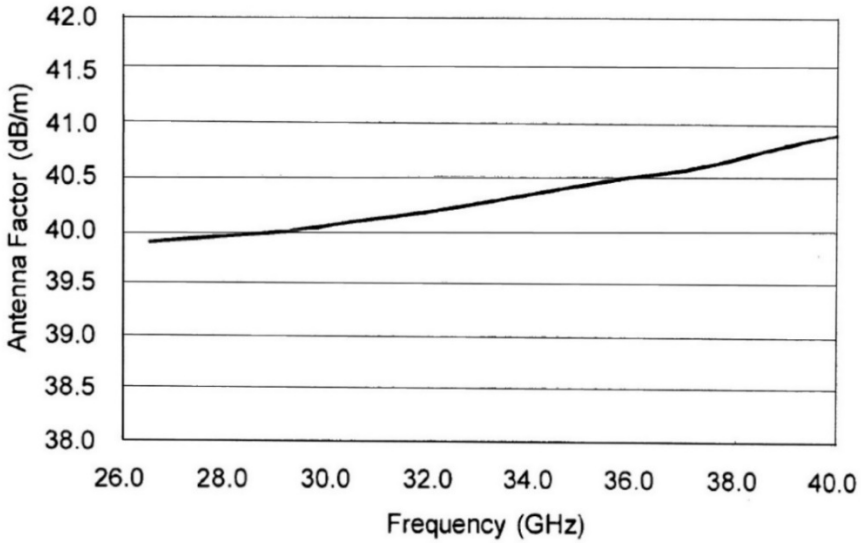
15.7 For ITL # 1353 18-26.5 GHz Horn Antenna

Frequency (MHz)	Measured antenna factor dB/m
18000	32.4
18500	32.0
19000	32.3
19500	32.4
20000	32.3

Frequency (MHz)	Measured antenna factor dB/m
20500	32.8
21000	32.8
21500	32.7
22000	33.1
22500	33.0
23000	33.1
23500	33.8
24000	33.5
24500	33.5
25000	33.8
25500	33.9
26000	34.2
26500	34.7

The antenna factor shall be added to the receiver reading in dBµV to obtain field strength in dBµV/m.

15.8 For ITL # 1777 26.5-40 GHz Horn Antenna



15.9 For Horn Antenna Model: SWH-28

CALIBRATION DATA

3 m distance

Frequency MHZ	Measured antenna factor dB/m
18000	32.4
18500	32.0
19000	32.3
19500	32.4
20000	32.3
20500	32.8
21000	32.8
21500	32.7
22000	33.1
22500	33.0
23000	33.1
23500	33.8
24000	33.5
24500	33.5
25000	33.8
25500	33.9
26000	34.2
26500	34.7

[1] The antenna factor shall be added to receiver reading in dBµV to obtain field strength in dBµV/m.

End of Test Report