

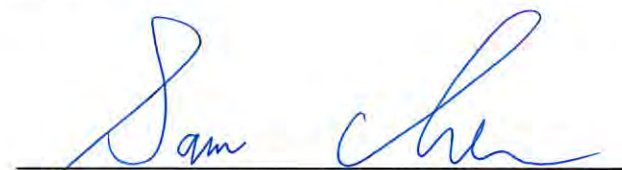


RADIO TEST REPORT

FCC ID : Z8H89FT0068
Equipment : ePMP 4600 6 GHz 4x4 Access Point
Brand Name : Cambium Networks
Model Name : ePMP 4600 6 GHz 4x4 Access Point
Model Number : C060940P021A
Applicant : Cambium Networks Inc.
3800 Golf Road, Suite 360 Rolling Meadows, IL 60008, USA
Manufacturer : Cambium Networks, Ltd.
Ashburton, TQ13 7UP, UK
Standard : 47 CFR FCC Part 15.407

The product was received on Jun. 07, 2024, and testing was started from Jun. 07, 2024 and completed on Jun. 19, 2024. We, Sporton International Inc. Hsinchu Laboratory, would like to declare that the tested sample has been evaluated in accordance with the procedures given in ANSI C63.10-2013 and shown compliance with the applicable technical standards.

The test results in this variant report apply exclusively to the tested model / sample. Without written approval of Sporton International Inc. Hsinchu Laboratory, the test report shall not be reproduced except in full.


Approved by: Sam Chen

Sporton International Inc. Hsinchu Laboratory

No.8, Ln. 724, Bo'ai St., Zhubei City, Hsinchu County 302010, Taiwan (R.O.C.)



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TEL : 886-3-656-9065
FAX : 886-3-656-9085
Report Template No.: CB-A12_5 Ver1.1



Summary of Test Result

Report Clause	Ref Std. Clause	Test Items	Result (PASS/FAIL)	Remark
1.1.2	15.203	Antenna Requirement	PASS	-
3.1	15.407(a)	Emission Bandwidth	PASS	-
3.2	15.407(a)	Maximum Equivalent Isotropically Radiated Power (E.I.R.P.)	PASS	-
3.3	15.407(a)	Peak Power Spectral Density (E.I.R.P.)	PASS	-
3.4	15.407(b)	Unwanted Emissions	PASS	-

Conformity Assessment Condition:

1. The test results (PASS/FAIL) with all measurement uncertainty excluded are presented against the regulation limits or in accordance with the requirements stipulated by the applicant/manufacture who shall bear all the risks of non-compliance that may potentially occur if measurement uncertainty is taken into account.
2. The measurement uncertainty please refer to each test result in the chapter "Measurement Uncertainty".

Disclaimer:

The product specifications of the EUT presented in the test report that may affect the test assessments are declared by the manufacturer who shall take full responsibility for the authenticity.

Reviewed by: Sam Chen

Report Producer: Cathy Chiu



1 General Description

1.1 Information

1.1.1 RF General Information

For IEEE:

Frequency Range (MHz)	IEEE Std. 802.11	Ch. Frequency (MHz)	Channel Number
5925-6425	ax (HEW20)	5955-6415	1-93 [24]
6525-6875		6535-6855	117-181 [17]
5925-6425	ax (HEW40)	5965-6405	3-91 [12]
6525-6875		6565-6845	123-179 [8]
5925-6425	ax (HEW80)	5985-6385	7-87 [6]
6525-6875		6625-6785	135-167 [3]
5925-6425	ax (HEW160)	6025-6345	15-79 [3]
6525-6875		6665	143 [1]

Band	Mode	BWch (MHz)	Nant
5.925-6.425GHz	802.11ax HEW20	20	4TX
6.525-6.875GHz	802.11ax HEW20	20	4TX
5.925-6.425GHz	802.11ax HEW40	40	4TX
6.525-6.875GHz	802.11ax HEW40	40	4TX
5.925-6.425GHz	802.11ax HEW80	80	4TX
6.525-6.875GHz	802.11ax HEW80	80	4TX
5.925-6.425GHz	802.11ax HEW160	160	4TX
6.525-6.875GHz	802.11ax HEW160	160	4TX

Note:

- ♦ HEW20, HEW40, HEW80 and HEW160 use a combination of OFDMA-BPSK, QPSK, 16QAM, 64QAM, 256QAM, 1024QAM modulation.
- ♦ BWch is the nominal channel bandwidth.

**For Non IEEE:**

Frequency Range (MHz)	Mode	Ch. Frequency (MHz)
6525-6875	80	6835
6525-6875	160	6795

Band	Mode	BWch (MHz)	Nant
6.525-6.875GHz	80	80	4TX
6.525-6.875GHz	160	160	4TX

Note:

- ♦ 80 and 160 use a combination of OFDMA-BPSK, QPSK, 16QAM, 64QAM, 256QAM, 1024QAM modulation.
- ♦ BWch is the nominal channel bandwidth.

1.1.2 Antenna Information

Ant.	Port	Brand	Model Name	Antenna Type	Connector	Gain (dBi)		
						UNII3	UNII5	UNII7
1	1	Cabmium Networks	ePMP 4x4 6GHz MU-MIMO Sector Antenna	Sector Antenna	Reversed-SMA	18	18	18.73
	2	Cabmium Networks	ePMP 4x4 6GHz MU-MIMO Sector Antenna	Sector Antenna	Reversed-SMA	18	18	18.73
	3	Cabmium Networks	ePMP 4x4 6GHz MU-MIMO Sector Antenna	Sector Antenna	Reversed-SMA	18	18	18.73
	4	Cabmium Networks	ePMP 4x4 6GHz MU-MIMO Sector Antenna	Sector Antenna	Reversed-SMA	18	18	18.73

Note 1: The above information was declared by manufacturer.

Note 2: Antenna polarization: 2 Vertical (port 1, 3) and 2 Horizontal (port 2, 4).

Note 3: Directional gain information

Type	Maximum Output Power	Power Spectral Density
Non-BF	Directional gain = Max.gain + array gain. For power measurements on IEEE 802.11 devices Array Gain = 0 dB (i.e., no array gain) for $N_{ANT} \leq 4$	$Directional\ Gain = 10 \cdot \log \left[\frac{\sum_{j=1}^{N_{ANT}} \left[\sum_{k=1}^{N_{ANT}} g_{j,k} \right]^2}{N_{ANT}} \right]$
BF	$Directional\ Gain = 10 \cdot \log \left[\frac{\sum_{j=1}^{N_{ANT}} \left[\sum_{k=1}^{N_{ANT}} g_{j,k} \right]^2}{N_{ANT}} \right]$	$Directional\ Gain = 10 \cdot \log \left[\frac{\sum_{j=1}^{N_{ANT}} \left[\sum_{k=1}^{N_{ANT}} g_{j,k} \right]^2}{N_{ANT}} \right]$

Ex.

Directional Gain (NSS1) formula :

$$Directional\ Gain = 10 \cdot \log \left[\frac{\sum_{j=1}^{N_{ANT}} \left[\sum_{k=1}^{N_{ANT}} g_{j,k} \right]^2}{N_{ANT}} \right]$$

$$NSS1(g1,1) = 10^{G1/20} ; NSS1(g1,2) = 10^{G2/20} ; NSS1(g1,3) = 10^{G3/20} ; NSS1(g1,4) = 10^{G4/20}$$

$$g_{j,k} = (NSS1(g1,1) + NSS1(g1,2) + NSS1(g1,3) + NSS1(g1,4))^2$$

$$DG = 10 \log[(NSS1(g1,1) + NSS1(g1,2) + NSS1(g1,3) + NSS1(g1,4))^2 / N_{ANT}] \Rightarrow 10$$

$$\log[(10^{G1/20} + 10^{G2/20} + 10^{G3/20} + 10^{G4/20})^2 / N_{ANT}]$$

Where ;

Two polarization, port 1, 3 for vertical polarization and port 2, 4 for horizontal polarization

$$5G\ G1 = 18\ dBi; G2 = 18\ dBi; G3 = 18\ dBi; G4 = 18\ dBi; DG = 21.01\ dBi$$

Cross-Polarized Antenna

$$6G\ UNII-5\ G1 = 18\ dBi; G2 = 18\ dBi; G3 = 18\ dBi; G4 = 18\ dBi; DG = 21.01\ dBi$$

$$6G\ UNII-7\ G1 = 18.73\ dBi; G2 = 18.73\ dBi; G3 = 18.73\ dBi; G4 = 18.73\ dBi; DG = 21.74\ dBi$$

**For 5GHz:****IEEE 802.11a/n/ac/ax mode (4TX/4RX):**

Port 1, Port 2, Port 3 and Port 4 can be used as transmitting/receiving antenna.

Port 1, Port 2, Port 3 and Port 4 could transmit/receive simultaneously.

For 6GHz:**For IEEE:****IEEE 802.11ax mode (4TX/4RX):**

Port 1, Port 2, Port 3 and Port 4 can be used as transmitting/receiving antenna.

Port 1, Port 2, Port 3 and Port 4 could transmit/receive simultaneously.

For Non IEEE:**4TX/4RX:**

Port 1, Port 2, Port 3 and Port 4 can be used as transmitting/receiving antenna.

Port 1, Port 2, Port 3 and Port 4 could transmit/receive simultaneously.

1.1.3 Mode Test Duty Cycle

Mode	DC	DCF(dB)	T(s)	VBW(Hz)_1/T
80	0.862	0.64	5.457m	300
160	0.869	0.61	5.456m	300

Note:

- ♦ DC is Duty Cycle.
- ♦ DCF is Duty Cycle Factor.

1.1.4 EUT Operational Condition

EUT Power Type	From PoE			
Beamforming Function	☐	With beamforming	☒	Without beamforming
Device Type	☐	Indoor Access Point	☐	Subordinate
	☐	Indoor Client	☒	Standard Power Access Point
	☐	Dual Client	☐	Standard Client
	☐	Fixed Client	☐	Very Low Power
Condition of EUT	☐	Indoor	☒	Outdoor
Channel Puncturing Function	☐	Supported	☒	Unsupported
Support RU	☒	Full RU	☐	Partial RU
Test Software Version	QRCT: V4.0.00192.0			

Note: The above information was declared by manufacturer.



1.1.5 Table for Permissive Change

This product is an extension of original one reported under Sporton project number: FR133141-01

Below is the table for the change of the product with respect to the original one.

Modifications	Performance Checking
Adding frequencies for 6835 MHz at 80MHz and 6795 MHz at 160MHz for Non IEEE.	1. Emission Bandwidth 2. Maximum Equivalent Isotropically Radiated Power (E.I.R.P.) 3. Peak Power Spectral Density (E.I.R.P.) 4. Unwanted Emissions



1.2 Applicable Standards

According to the specifications of the manufacturer, the EUT must comply with the requirements of the following standards:

- ♦ 47 CFR FCC Part 15.407
- ♦ ANSI C63.10-2013
- ♦ FCC KDB 789033 D02 v02r01

The following reference test guidance is not within the scope of accreditation of TAF.

- ♦ FCC KDB 987594 D02 v02r01
- ♦ FCC KDB 662911 D01 v02r01
- ♦ FCC KDB 412172 D01 v01r01

1.3 Testing Location Information

Testing Location Information	
Test Lab. : Sporton International Inc. Hsinchu Laboratory	
Hsinchu (TAF: 3787)	ADD: No.8, Ln. 724, Bo'ai St., Zhubei City, Hsinchu County 302010, Taiwan (R.O.C.) TEL: 886-3-656-9065 FAX: 886-3-656-9085 Test site Designation No. TW3787 with FCC. Conformity Assessment Body Identifier (CABID) TW3787 with ISED.

Test Condition	Test Site No.	Test Engineer	Test Environment (°C / %)	Test Date
RF Conducted	TH02-CB	Owen Hsu	21.6~23 / 63~68	Jun. 19, 2024
Radiated	03CH01-CB	Alex Kuo	22-23 / 55-58	Jun. 07, 2024



1.4 Measurement Uncertainty

ISO/IEC 17025 requires that an estimate of the measurement uncertainties associated with the emissions test results be included in the report. The measurement uncertainties given below are based on a 95% confidence level (based on a coverage factor (k=2))

Test Items	Uncertainty	Remark
Radiated Emission (1GHz ~ 18GHz)	4.2 dB	Confidence levels of 95%
Radiated Emission (18GHz ~ 40GHz)	4.0 dB	Confidence levels of 95%
Conducted Emission	3.1 dB	Confidence levels of 95%
Output Power Measurement	0.8 dB	Confidence levels of 95%
Power Density Measurement	3.1 dB	Confidence levels of 95%
Bandwidth Measurement	2.1 %	Confidence levels of 95%



2 Test Configuration of EUT

2.1 Test Channel Mode

Mode
80_Nss1,(MCS0)_4TX
6835MHz
160_Nss1,(MCS0)_4TX
6795MHz

2.2 The Worst Case Measurement Configuration

The Worst Case Mode for Following Conformance Tests	
Tests Item	Emission Bandwidth Maximum Equivalent Isotropically Radiated Power (E.I.R.P.) Peak Power Spectral Density (E.I.R.P.)
Test Condition	Conducted measurement at transmit chains

The Worst Case Mode for Following Conformance Tests	
Tests Item	Unwanted Emissions
Test Condition	Radiated measurement If EUT consist of multiple antenna assembly (multiple antenna are used in EUT regardless of spatial multiplexing MIMO configuration), the radiated test should be performed with highest antenna gain of each antenna type.
Operating Mode > 1GHz	CTX
After evaluating, EUT in Y axis was the worst case, so the measurement will follow this same test configuration.	
1	EUT in Y axis + PoE

The Worst Case Mode for Following Conformance Tests	
Tests Item	Emission MASK
Test Condition	Conducted measurement at transmit chains

Note: The PoE was for measurement only and would not be marketed.

Its information is shown as below:

Equipment	Brand Name	Model Name
PoE	Cambium Networks	NET-P30-56IN

2.3 EUT Operation during Test

The EUT was programmed to be in continuously transmitting mode.



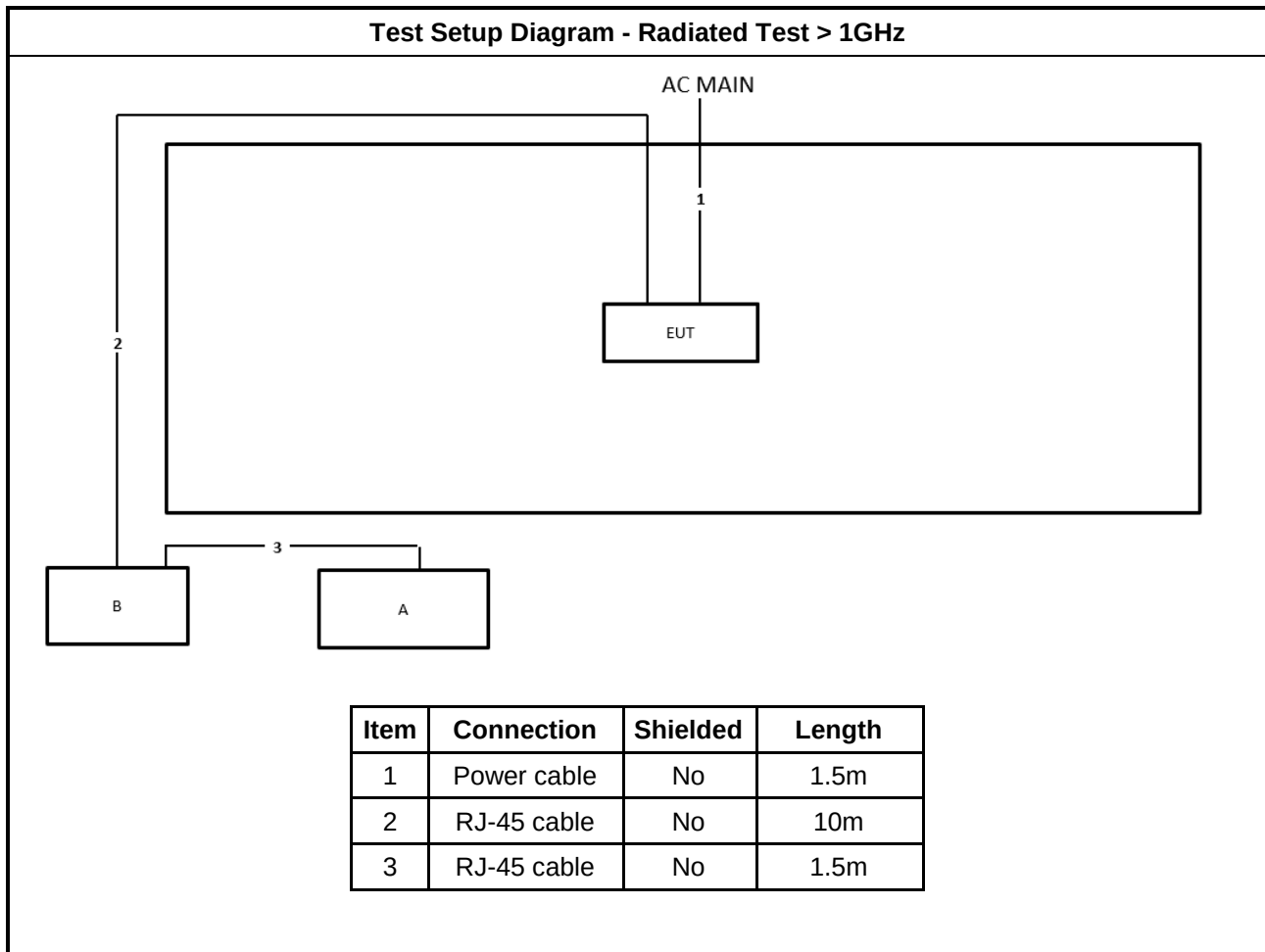
2.4 Accessories

Accessories
Wall Bracket*1

2.5 Support Equipment

Support Equipment				
No.	Equipment	Brand Name	Model Name	FCC ID
A	Notebook	DELL	E4300	N/A
B	PoE	Cambium Networks	NET-P30-56IN	N/A

2.6 Test Setup Diagram



3 Transmitter Test Result

3.1 Emission Bandwidth

3.1.1 Emission Bandwidth Limit

Emission Bandwidth Limit	
UNII Devices	
☐	For the 5925-6425 GHz band, N/A
☐	For the 6425-6525 GHz band, N/A
☒	For the 6525-6875 GHz band, N/A
☐	For the 6875-7125 GHz band, N/A
RLAN Devices	
☐	For the 5925-6425 GHz band, N/A
☐	For the 6425-6525 GHz band, N/A
☐	For the 6525-6875 GHz band, N/A
☐	For the 6875-7125 GHz band, N/A

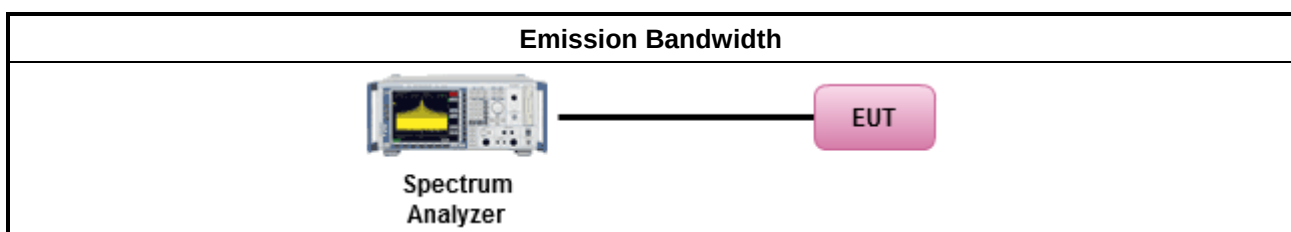
3.1.2 Measuring Instruments

Refer a test equipment and calibration data table in this test report.

3.1.3 Test Procedures

Test Method	
▪ For the emission bandwidth shall be measured using one of the options below:	
☒	According to FCC KDB 987594 D02 clause II.C, measurement procedure shall refer to FCC KDB 789033 D02, clause C for EBW and clause D for OBW measurement.
☐	Refer as ANSI C63.10, clause 6.9.1 for occupied bandwidth testing.
☐	Refer as IC RSS-Gen, clause 4.6 for bandwidth testing.

3.1.4 Test Setup



3.1.5 Test Result of Emission Bandwidth

Refer as Appendix A



3.2 Maximum Equivalent Isotropically Radiated Power (E.I.R.P.)

3.2.1 Maximum Equivalent Isotropically Radiated Power (E.I.R.P.) Limit

Maximum Equivalent Isotropically Radiated Power (E.I.R.P.) Limit	
UNII Devices	
☐ For the 5.925 ~ 6.425 GHz band:	
	■ For standard power access point and fixed client device : e.i.r.p < 36 dBm. For outdoor devices, the maximum e.i.r.p. at any elevation angle above 30 degrees not exceed 125 mW (21 dBm).
	■ For indoor access point : e.i.r.p < 30 dBm.
	■ For subordinate device control of an indoor access point : e.i.r.p < 30 dBm.
	■ For client device control of a standard power access point : e.i.r.p < 30 dBm.
	■ For client device control of an indoor access point : e.i.r.p < 24 dBm.
	■ For very low power device : e.i.r.p < 14 dBm.
☐ For the 6.425 ~ 6.525 GHz band:	
	■ For indoor access point : e.i.r.p < 30 dBm.
	■ For client device control of an indoor access point : e.i.r.p < 24 dBm.
☒ For the 6.525 ~ 6.875 GHz band:	
	■ For standard power access point and fixed client device : e.i.r.p < 36 dBm. For outdoor devices, the maximum e.i.r.p. at any elevation angle above 30 degrees not exceed 125 mW (21 dBm).
	■ For indoor access point : e.i.r.p < 30 dBm.
	■ For subordinate device control of an indoor access point : e.i.r.p < 30 dBm.
	■ For client device control of a standard power access point : e.i.r.p < 30 dBm.
	■ For client device control of an indoor access point : e.i.r.p < 24 dBm.
	■ For very low power device : e.i.r.p < 14 dBm.
☐ For the 6.875 ~ 7.125 GHz band:	
	■ For indoor access point : e.i.r.p < 30 dBm.
	■ For client device control of an indoor access point : e.i.r.p < 24 dBm.
RLAN Devices	
☐ For the 5.925 ~ 7.125 GHz band:	
	■ For low-power indoor access-points & indoor subordinate devices < 30 dBm .
	■ For low-power client devices < 24 dBm.
☐ For the 5.925 ~ 6.875 GHz band:	
	■ For standard-power access points & fixed client devices < 36 dBm. For outdoor devices, the maximum e.i.r.p. at any elevation angle above 30 degrees not exceed 125 mW (21 dBm).
	■ For standard client devices < 30 dBm.

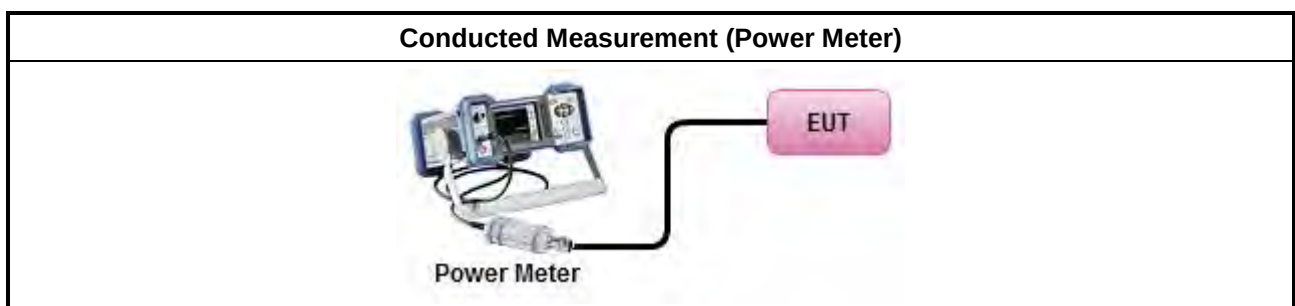
3.2.2 Measuring Instruments

Refer a test equipment and calibration data table in this test report.

3.2.3 Test Procedures

Test Method	
According to FCC KDB 987594 D02 clause II.E, the test measurement procedure shall refer to KDB 789033.	
Average over on/off periods with duty factor	
☐	Refer as FCC KDB 789033 D02, clause E Method SA-2 (spectral trace averaging). Spectrum analyzer setting: RBW/VBW : 1/3MHz ; Detector : RMS ; Trace mode : Average ; Sweep Count 100.
☐	Refer as FCC KDB 789033 D02, clause E Method SA-2 Alt. (RMS detection with slow sweep speed)
Wideband RF power meter and average over on/off periods with duty factor	
☒	Refer as FCC KDB 789033 D02, clause E Method PM-G (using an RF average power meter).
☒ For conducted measurement.	
If the EUT supports multiple transmit chains using options given below: Refer as FCC KDB 662911, In-band power measurements. Using the measure-and-sum approach, measured all transmit ports individually. Sum the power (in linear power units e.g., mW) of all ports for each individual sample and save them.	
If multiple transmit chains, EIRP calculation could be following as methods: $P_{total} = P_1 + P_2 + \dots + P_n$ (calculated in linear unit [mW] and transfer to log unit [dBm]) $EIRP_{total} = P_{total} + DG$	
☐ For radiated measurement.	
Refer as FCC KDB 789033 D02 clause II A.1.F "Antenna-port Conducted versus Radiated Testing"	
Refer as ANSI C63.10, clause 6.6 for radiated emissions above 1GHz.	
Refer as FCC KDB 412172 D01 clause 2.2 for EIRP calculation.	

3.2.4 Test Setup



3.2.5 Test Result of Maximum Equivalent Isotopically Radiated Power (E.I.R.P)

Refer as Appendix B



3.3 Peak Power Spectral Density (E.I.R.P.)

3.3.1 Peak Power Spectral Density (E.I.R.P.) Limit

Peak Power Spectral Density (E.I.R.P.) Limit	
UNII Devices	
☐ For the 5.925 ~ 6.425 GHz band:	
	■ For standard power access point and fixed client device : e.i.r.p PSD < 23 dBm/MHz.
	■ For indoor access point : e.i.r.p PSD < 5 dBm/MHz.
	■ For subordinate device control of an indoor access point : e.i.r.p PSD < 5 dBm/MHz.
	■ For client device control of a standard power access point : e.i.r.p PSD < 17 dBm/MHz.
	■ For client device control of an indoor access point : e.i.r.p PSD < -1 dBm/MHz.
	■ For very low power device : e.i.r.p PSD < -5 dBm/MHz.
☐ For the 6.425 ~ 6.525 GHz band:	
	■ For indoor access point : e.i.r.p PSD < 5 dBm/MHz.
	■ For client device control of an indoor access point : e.i.r.p PSD < -1 dBm/MHz.
☒ For the 6.525 ~ 6.875 GHz band:	
	■ For standard power access point and fixed client device : e.i.r.p PSD < 23 dBm/MHz.
	■ For indoor access point : e.i.r.p PSD < 5 dBm/MHz.
	■ For subordinate device control of an indoor access point : e.i.r.p PSD < 5 dBm/MHz.
	■ For client device control of a standard power access point : e.i.r.p PSD < 17 dBm/MHz.
	■ For client device control of an indoor access point : e.i.r.p PSD < -1 dBm/MHz.
	■ For very low power device : e.i.r.p PSD < -5 dBm/MHz.
☐ For the 6.875 ~ 7.125 GHz band:	
	■ For indoor access point : e.i.r.p PSD < 5 dBm/MHz.
	■ For client device control of an indoor access point : e.i.r.p PSD < -1 dBm/MHz.
RLAN Devices	
☐ For the 5.925 ~ 7.125 GHz band:	
	■ For low-power indoor access-points & indoor subordinate devices < 5 dBm / MHz.
	■ For low-power client devices < -1 dBm / MHz.
☐ For the 5.925 ~ 6.875 GHz band:	
	■ For standard-power access points & fixed client devices < 23 dBm / MHz.
	■ For standard client devices < 17 dBm / MHz.

3.3.2 Measuring Instruments

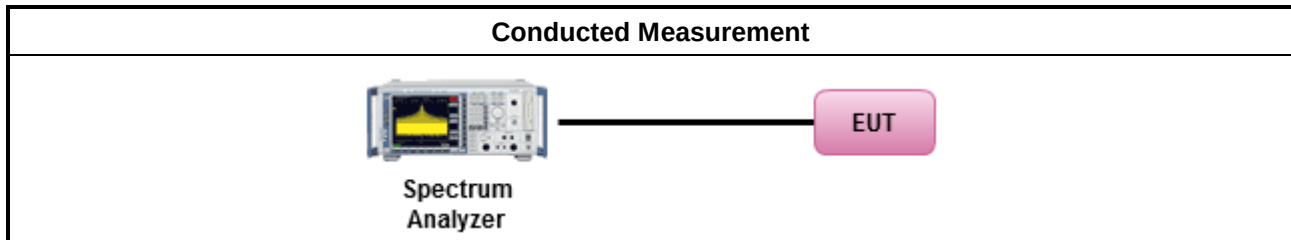
Refer a test equipment and calibration data table in this test report.

**3.3.3 Test Procedures**

Test Method	
According to FCC KDB 987594 D02 clause II.F, the measurement procedure shall refer to KDB 789033. Peak power spectral density procedures that the same method as used to determine the conducted output power shall be used to determine the peak power spectral density and use the peak search function on the spectrum analyzer to find the peak of the spectrum. For the peak power spectral density shall be measured using below options:	
☐	Refer as FCC KDB 789033 D02, F)5) power spectral density can be measured using resolution bandwidths < 1 MHz provided that the results are integrated over 1 MHz bandwidth
[duty cycle ≥ 98% or external video / power trigger]	
☒	Refer as FCC KDB 789033 D02, clause E Method SA-1 (spectral trace averaging).
☐	Refer as FCC KDB 789033 D02, clause E Method SA-1 Alt. (RMS detection with slow sweep speed)
duty cycle < 98% and average over on/off periods with duty factor	
☒	Refer as FCC KDB 789033 D02, clause E Method SA-2 (spectral trace averaging).
☐	Refer as FCC KDB 789033 D02, clause E Method SA-2 Alt. (RMS detection with slow sweep speed)
☒	For conducted measurement.
If the EUT supports multiple transmit chains using options given below:	
☒	Option 1: Measure and sum the spectra across the outputs. Refer as FCC KDB 662911, In-band power spectral density (PSD). Sample all transmit ports simultaneously using a spectrum analyzer for each transmit port. Where the trace bin-by-bin of each transmit port summing can be performed. (i.e., in the first spectral bin of output 1 is summed with that in the first spectral bin of output 2 and that from the first spectral bin of output 3, and so on up to the NTX output to obtain the value for the first frequency bin of the summed spectrum.). Add up the amplitude (power) values for the different transmit chains and use this as the new data trace.
☐	Option 2: Measure and sum spectral maxima across the outputs. With this technique, spectra are measured at each output of the device at the required resolution bandwidth. The maximum value (peak) of each spectrum is determined. These maximum values are then summed mathematically in linear power units across the outputs. These operations shall be performed separately over frequency spans that have different out-of-band or spurious emission limits,
☐	Option 3: Measure and add 10 log(N) dB, where N is the number of transmit chains. Refer as FCC KDB 662911, In-band power spectral density (PSD). Performed at each transmit chains and each transmit chains shall be compared with the limit have been reduced with 10 log(N). Or each transmit chains shall be add 10 log(N) to compared with the limit.
If multiple transmit chains, EIRP PPSD calculation could be following as methods: $PPSD_{total} = PPSD_1 + PPSD_2 + \dots + PPSD_n$ (calculated in linear unit [mW] and transfer to log unit [dBm]) $EIRP_{total} = PPSD_{total} + DG$	
☐	For radiated measurement.
- Refer as FCC KDB 789033 D02 clause II A.1.F "Antenna-port Conducted versus Radiated Testing" - Refer as ANSI C63.10, clause 6.6 for radiated emissions above 1GHz.	

Test Method	
	Refer as FCC KDB 412172 D01 clause 2.2 for EIRP calculation.

3.3.4 Test Setup



3.3.5 Test Result of Peak Power Spectral Density (E.I.R.P.)

Refer as Appendix C



3.4 Unwanted Emissions

3.4.1 Transmitter Unwanted Emissions Limit

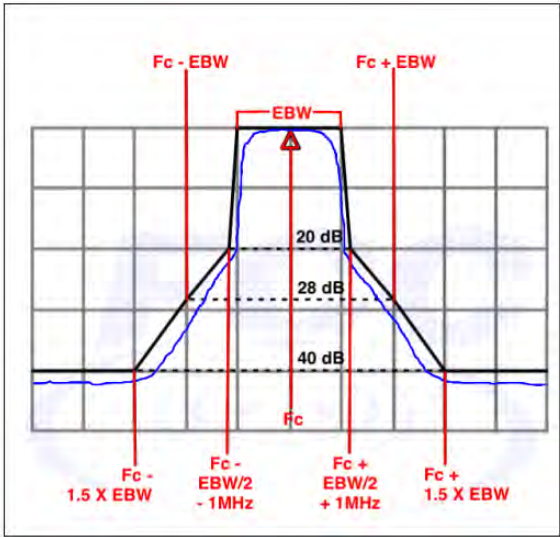
Unwanted emissions below 1 GHz and restricted band emissions above 1GHz limit			
Frequency Range (MHz)	Field Strength (uV/m)	Field Strength (dBuV/m)	Measure Distance (m)
0.009~0.490	2400/F(kHz)	48.5 - 13.8	300
0.490~1.705	24000/F(kHz)	33.8 - 23	30
1.705~30.0	30	29	30
30~88	100	40	3
88~216	150	43.5	3
216~960	200	46	3
Above 960	500	54	3

Note 1: Test distance for frequencies at or above 30 MHz, measurements may be performed at a distance other than the limit distance provided they are not performed in the near field and the emissions to be measured can be detected by the measurement equipment. When performing measurements at a distance other than that specified, the results shall be extrapolated to the specified distance using an extrapolation factor of 20 dB/decade (inverse of linear distance for field-strength measurements, inverse of linear distance-squared for power-density measurements).

Note 2: Test distance for frequencies at below 30 MHz, measurements may be performed at a distance closer than the EUT limit distance; however, an attempt should be made to avoid making measurements in the near field. When performing measurements below 30 MHz at a closer distance than the limit distance, the results shall be extrapolated to the specified distance by either making measurements at a minimum of two or more distances on at least one radial to determine the proper extrapolation factor or by using the square of an inverse linear distance extrapolation factor (40 dB/decade). The test report shall specify the extrapolation method used to determine compliance of the EUT.

Note 3: Using the distance of 1m during the test for above 18 GHz, and the test value to correct for the distance factor at 3m($20 \times \log(\text{standard distance}/\text{test distance}) = 20\log(3/1) = 9.54\text{dB}$).
EX. Above 18GHz emission limit calculation (3m to 1m) = $54\text{dBuV/m at 3m} + 9.54\text{dB} = 63.54\text{dBuV/m at 1m}$.

Un-restricted band emissions above 1GHz Limit	
Frequency	Limit
Any outside the 5.945 – 7.125 GHz emission	e.i.r.p. -27 dBm [68.2 dBuV/m@3m] Note 1: Using the distance of 1m during the test for above 18 GHz, and the test value to correct for the distance factor at 3m($20 \times \log(\text{standard distance}/\text{test distance}) = 20\log(3/1) = 9.54\text{dB}$). EX. Above 18GHz emission limit calculation (3m to 1m) = $68.2\text{dBuV/m at 3m} + 9.54\text{dB} = 77.74\text{dBuV/m at 1m}$. Note 2:-27 dBm EIRP OOBE is measured RMS which is a deviation from the current 15E rules for 5 GHz bands. In addition, 15.35(b) applies where the peak emissions must be limited to no more than 20 dB above the average limit.

Frequency	Emission MASK Limit
5.945 – 7.125 GHz	Power spectral density must be suppressed by 20 dB at 1 MHz outside of channel edge, by 28 dB at one channel bandwidth from the channel center, and by 40 dB at one- and one-half times the channel bandwidth away from channel center. At frequencies between one megahertz outside an unlicensed device's channel edge and one channel bandwidth from the center of the channel, the limits must be linearly interpolated between 20 dB and 28 dB suppression, and at frequencies between one and one- and one-half times an unlicensed device's channel bandwidth, the limits must be linearly interpolated between 28 dB and 40 dB suppression. Emissions removed from the channel center by more than one- and one-half times the channel bandwidth must be suppressed by at least 40 dB. 



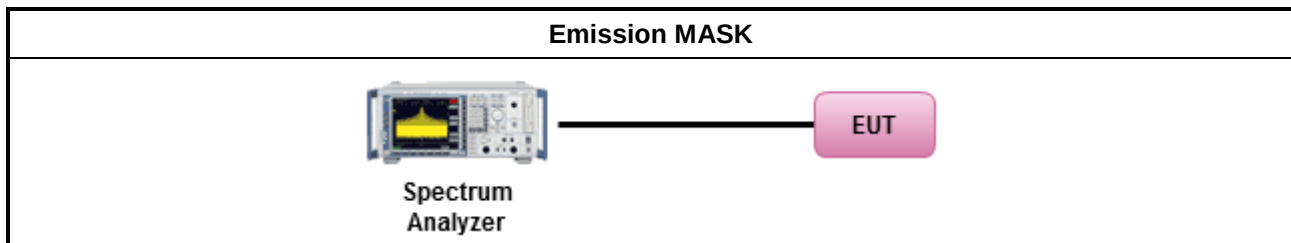
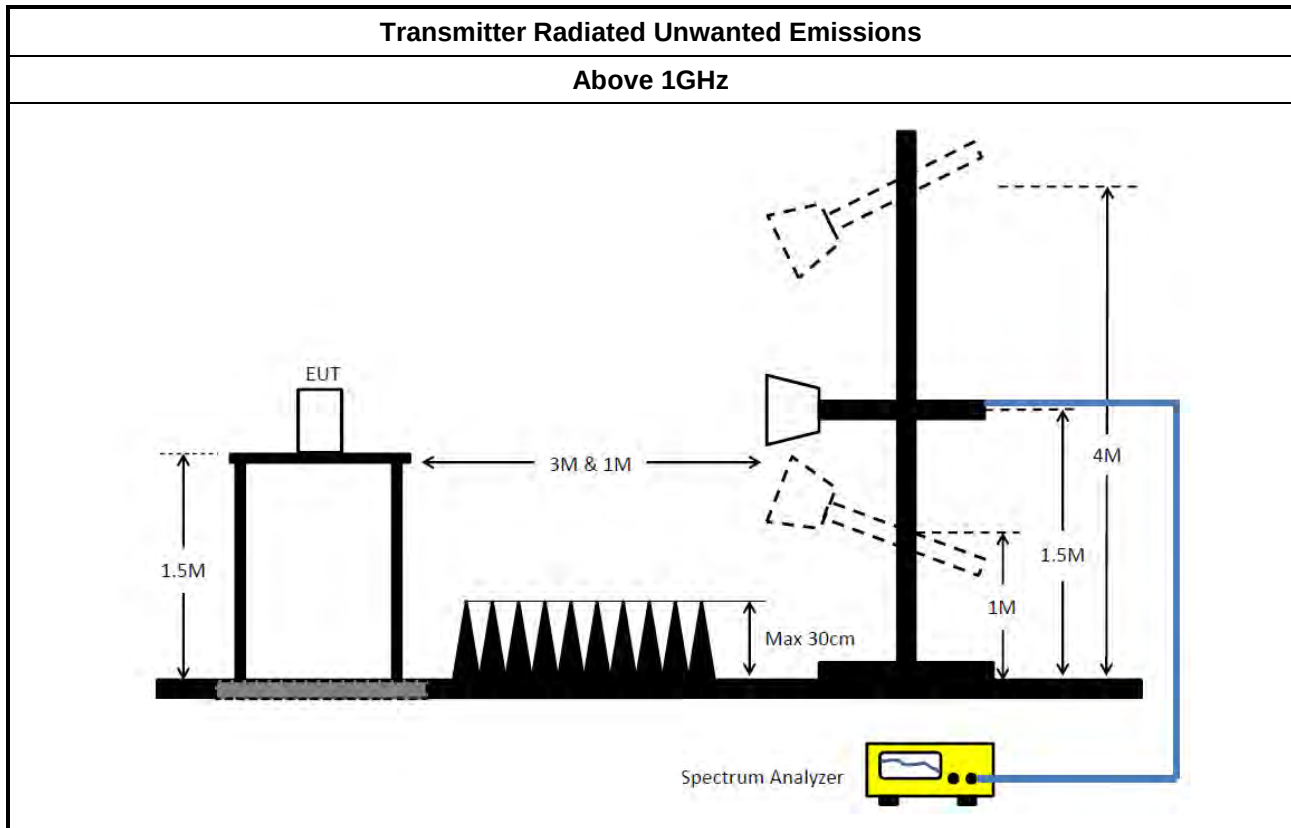
3.4.2 Measuring Instruments

Refer a test equipment and calibration data table in this test report.

3.4.3 Test Procedures

Test Method	
According to FCC KDB 987594 D02 II.G. the unwanted emission measurement procedure shall refer to KDB 789300(except emission MASK). Measurements may be performed at a distance other than the limit distance provided they are not performed in the near field and the emissions to be measured can be detected by the measurement equipment. Measurements shall not be performed at a distance greater than 30 m for frequencies above 30 MHz, unless it can be further demonstrated that measurements at a distance of 30 m or less are impractical. When performing measurements at a distance other than that specified, the results shall be extrapolated to the specified distance using an extrapolation factor of 20 dB/decade (inverse of linear distance for field-strength measurements, inverse of linear distance-squared for power-density measurements).	
The average emission levels shall be measured in [duty cycle $\geq$ 98 or duty factor].	
For the transmitter unwanted emissions shall be measured using following options below:	
	Refer as FCC KDB 789033 D02, clause G)2) for unwanted emissions into non-restricted bands.
	Refer as FCC KDB 789033 D02, clause G)1) for unwanted emissions into restricted bands.
	☒ Refer as FCC KDB 789033 D02, G)6) Method AD (Trace Averaging). (For unrestricted band measurement)
	☐ Refer as FCC KDB 789033 D02, G)6) Method VB (Reduced VBW).
	☒ Refer as ANSI C63.10, clause 11.12.2.5.3 (Reduced VBW). VBW $\geq$ 1/T, where T is pulse time.(For restricted band average measurement)
	☐ Refer as ANSI C63.10, clause 7.5 average value of pulsed emissions.
	☒ Refer as FCC KDB 789033 D02, clause G)5) measurement procedure peak limit.
	☐ Refer as ANSI C63.10, clause 4.1.4.2.2 measurement procedure peak limit.
Refer as FCC KDB 789033 D02, clause G)3)d)ii) for Band edge Integration measurements.	
For emission MASK shall be measured using following options below:	
	☒ Refer as FCC KDB 987594 D02, J) In-Band Emissions
For radiated measurement.	
	Refer as ANSI C63.10, clause 6.4 for radiated emissions below 30 MHz and test distance is 3m.
	Refer as ANSI C63.10, clause 6.5 for radiated emissions 30 MHz to 1 GHz and test distance is 3m.
	Refer as ANSI C63.10, clause 6.6 for radiated emissions above 1GHz.
The any unwanted emissions level shall not exceed the fundamental emission level.	
All amplitude of spurious emissions that are attenuated by more than 20 dB below the permissible value has no need to be reported.	

3.4.4 Test Setup



3.4.5 Measurement Results Calculation

The measured Level is calculated using:

Corrected Reading: Antenna factor (AF) + Cable loss (CL) + Read level (Raw) - Preamp factor (PA)(if applicable)
= Level

3.4.6 Test Result of Transmitter Unwanted Emissions

Refer as Appendix D



4 Test Equipment and Calibration Data

Instrument	Brand	Model No.	Serial No.	Characteristics	Calibration Date	Calibration Due Date	Remark
3m Semi Anechoic Chamber VSWR	TDK	SAC-3M	03CH01-CB	1GHz ~18GHz 3m	May 04, 2024	May 03, 2025	Radiation (03CH01-CB)
Horn Antenna	SCHWARZBECK	BBHA 9120 D	BBHA 9120D-01816	1GHz~18GHz	Dec. 20, 2023	Dec. 19, 2024	Radiation (03CH01-CB)
Horn Antenna	Schwarzbeck	BBHA 9170	BBHA9170252	15GHz ~ 40GHz	Sep. 04, 2023	Sep. 03, 2024	Radiation (03CH01-CB)
Pre-Amplifier	Agilent	8449B	3008A02121	1GHz ~ 26.5GHz	May 17, 2024	May 16, 2025	Radiation (03CH01-CB)
Pre-Amplifier	SGH	SGH184	20221107-3	18GHz ~ 40GHz	Nov. 24, 2023	Nov. 23, 2024	Radiation (03CH01-CB)
Signal Analyzer	R&S	FSV3044	101437	10kHz ~ 44GHz	Nov. 28, 2023	Nov. 27, 2024	Radiation (03CH01-CB)
RF Cable-high	Woken	RG402	High Cable-16	1 GHz ~ 18 GHz	Nov. 06, 2023	Nov. 05, 2024	Radiation (03CH01-CB)
RF Cable-high	Woken	RG402	High Cable-16+17	1 GHz ~ 18 GHz	Nov. 06, 2023	Nov. 05, 2024	Radiation (03CH01-CB)
High Cable	Woken	WCA0929M	40G#5+6	1GHz ~ 40 GHz	Jan. 11, 2024	Jan. 10, 2025	Radiation (03CH01-CB)
Test Software	SPORTON	SENSE	V5.10	-	N.C.R.	N.C.R.	Radiation (03CH01-CB)
Spectrum analyzer	R&S	FSV40	101027	9kHz~40GHz	Aug. 14, 2023	Aug. 13, 2024	Conducted (TH02-CB)
Power Sensor	Anritsu	MA2411B	1126203	300MHz~ 40GHz	Oct. 19, 2023	Oct. 18, 2024	Conducted (TH02-CB)
Power Meter	Anritsu	ML2495A	1210004	300MHz~ 40GHz	Oct. 19, 2023	Oct. 18, 2024	Conducted (TH02-CB)
RF Cable-high	Woken	RG402	High Cable-01	1 GHz – 18 GHz	Oct. 02, 2023	Oct. 01, 2024	Conducted (TH02-CB)
RF Cable-high	Woken	RG402	High Cable-02	1 GHz – 18 GHz	Oct. 02, 2023	Oct. 01, 2024	Conducted (TH02-CB)
RF Cable-high	Woken	RG402	High Cable-03	1 GHz – 18 GHz	Oct. 02, 2023	Oct. 01, 2024	Conducted (TH02-CB)
RF Cable-high	Woken	RG402	High Cable-04	1 GHz – 18 GHz	Oct. 02, 2023	Oct. 01, 2024	Conducted (TH02-CB)
RF Cable-high	Woken	RG402	High Cable-05	1 GHz – 18 GHz	Oct. 02, 2023	Oct. 01, 2024	Conducted (TH02-CB)



RADIO TEST REPORT

Report No. : FR133141-08

Instrument	Brand	Model No.	Serial No.	Characteristics	Calibration Date	Calibration Due Date	Remark
Switch	SPTCB	SP-SWI	SWI-02	1 -26.5 GHz	Oct. 03, 2023	Oct. 02, 2024	Conducted (TH02-CB)
Test Software	SPORTON	SENSE	V5.10	-	N.C.R.	N.C.R.	Conducted (TH02-CB)

Note: Calibration Interval of instruments listed above is one year.

NCR means Non-Calibration required.

Summary

Mode	Max-N dB (Hz)	Max-OBW (Hz)	ITU-Code	Min-N dB (Hz)	Min-OBW (Hz)
6.525-6.875GHz	-	-	-	-	-
80_Nss1,(MCS0)_4TX	82.5M	77.261M	77M3D1D	81.18M	76.962M
160_Nss1,(MCS0)_4TX	162.36M	154.923M	155MD1D	161.48M	154.523M

Max-N dB = Maximum 6dB down bandwidth for 5.725-5.85GHz band / Maximum 26dB down bandwidth for other band;
Max-OBW = Maximum 99% occupied bandwidth;
Min-N dB = Minimum 6dB down bandwidth for 5.725-5.85GHz band / Maximum 26dB down bandwidth for other band;
Min-OBW = Minimum 99% occupied bandwidth

Result

Mode	Result	Limit (Hz)	Port 1-N dB (Hz)	Port 1-OBW (Hz)	Port 2-N dB (Hz)	Port 2-OBW (Hz)	Port 3-N dB (Hz)	Port 3-OBW (Hz)	Port 4-N dB (Hz)	Port 4-OBW (Hz)
80_Nss1,(MCS0)_4TX	-	-	-	-	-	-	-	-	-	-
6835MHz	Pass	Inf	82.5M	77.161M	81.84M	77.061M	81.18M	77.261M	81.18M	76.962M
160_Nss1,(MCS0)_4TX	-	-	-	-	-	-	-	-	-	-
6795MHz	Pass	Inf	161.48M	154.523M	162.36M	154.923M	161.92M	154.923M	162.36M	154.523M

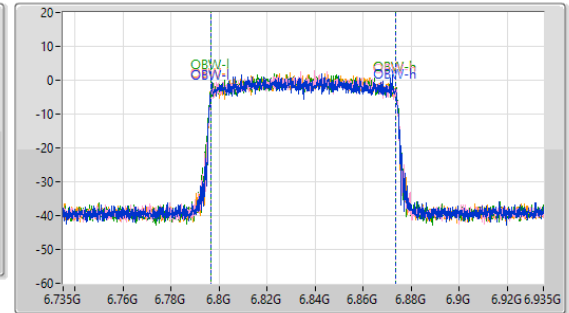
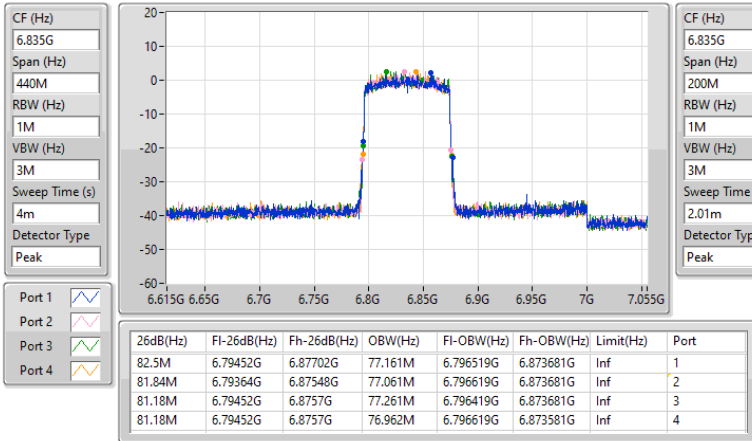
Port X-N dB = Port X 6dB down bandwidth for 5.725-5.85GHz band / 26dB down bandwidth for other band
Port X-OBW = Port X 99% occupied bandwidth

6.525-6.875GHz_80_Nss1,(MCS0)_4TX

EBW

6835MHz

19/06/2024

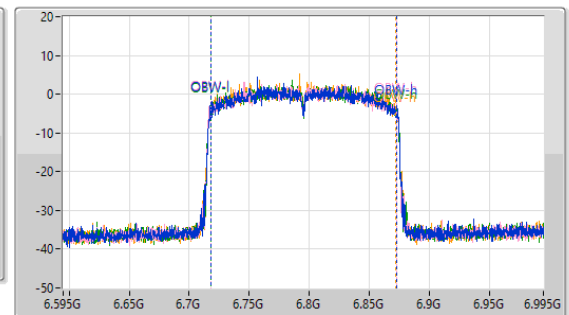
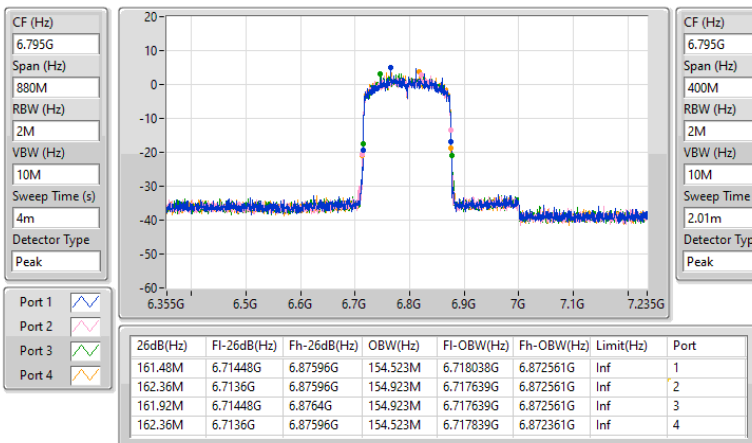


6.525-6.875GHz_160_Nss1,(MCS0)_4TX

EBW

6795MHz

19/06/2024





Summary

Mode	Total Power (dBm)	Total Power (W)	EIRP / EIRP [Phi 30°] (dBm)	EIRP / EIRP [Phi 30°] (W)
6.525-6.875GHz	-	-	-	-
802.11ax HEW80_Nss1,(MCS0)_4TX	16.96	0.04966	35.69/17.94	3.70681/0.062230
802.11ax HEW160_Nss1,(MCS0)_4TX	17.03	0.05047	35.76/18.01	3.76704/0.063241



Result

Mode	Result	DG (dBi)	Port 1 (dBm)	Port 2 (dBm)	Port 3 (dBm)	Port 4 (dBm)	Total Power (dBm)	EIRP / EIRP [Phi 30°] (dBm)	EIRP/ EIRP [Phi 30°]Limit (dBm)
802.11ax HEW80_Nss1,(MCS0)_4TX	-	-	-	-	-	-	-	-	-
6835MHz	Pass	18.73/0.98	10.87	10.80	11.08	11.02	16.96	35.69/17.94	36.00/21.00
802.11ax HEW160_Nss1,(MCS0)_4TX	-	-	-	-	-	-	-	-	-
6795MHz	Pass	18.73/0.98	10.80	10.98	11.07	11.18	17.03	35.76/18.01	36.00/21.00

DG = Directional Gain; Port X = Port X output power

Summary

Mode	PD (dBm/RBW)	EIRP PD (dBm/RBW)
6.525-6.875GHz	-	-
80_Nss1,(MCS0)_4TX	-2.35	19.39
160_Nss1,(MCS0)_4TX	-5.07	16.67

RBW = 500kHz for 5.725-5.85GHz band / 1MHz for other band;

Result

Mode	Result	DG (dBi)	Port 1 (dBm/RBW)	Port 2 (dBm/RBW)	Port 3 (dBm/RBW)	Port 4 (dBm/RBW)	PD (dBm/RBW)	PD Limit (dBm/RBW)	EIRP PD (dBm/RBW)	EIRP PD Limit (dBm/RBW)
80_Nss1,(MCS0)_4TX	-	-	-	-	-	-	-	-	-	-
6835MHz	Pass	21.74	-8.41	-8.27	-8.13	-8.30	-2.35	Inf	19.39	23.00
160_Nss1,(MCS0)_4TX	-	-	-	-	-	-	-	-	-	-
6795MHz	Pass	21.74	-11.02	-10.97	-10.92	-10.90	-5.07	Inf	16.67	23.00

DG = Directional Gain; RBW = 500kHz for 5.725-5.85GHz band / 1MHz for other band;

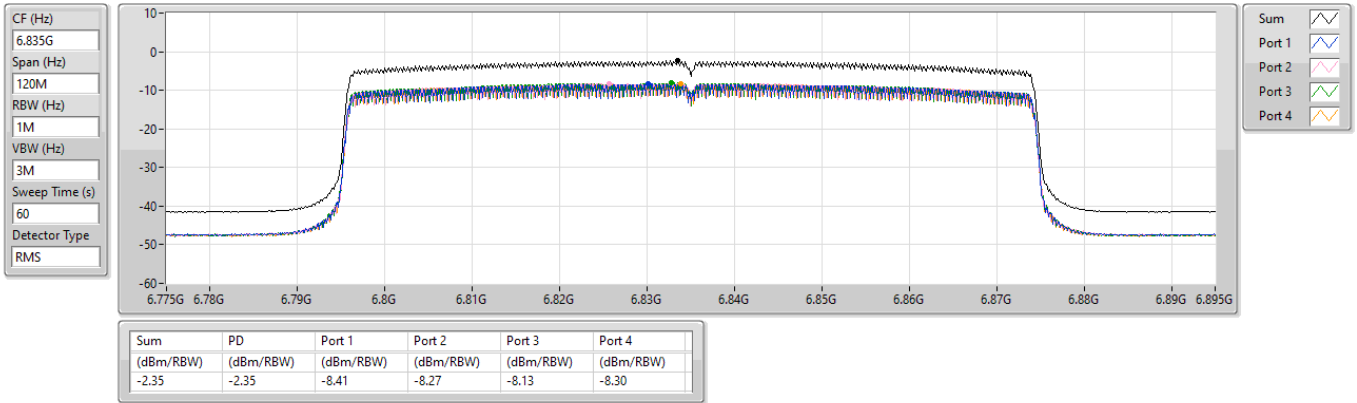
PD = trace bin-by-bin of each transmits port summing can be performed maximum power density; Port X = Port X Power Density;

6.525-6.875GHz_80_Nss1,(MCS0)_4TX

PSD

6835MHz

19/06/2024

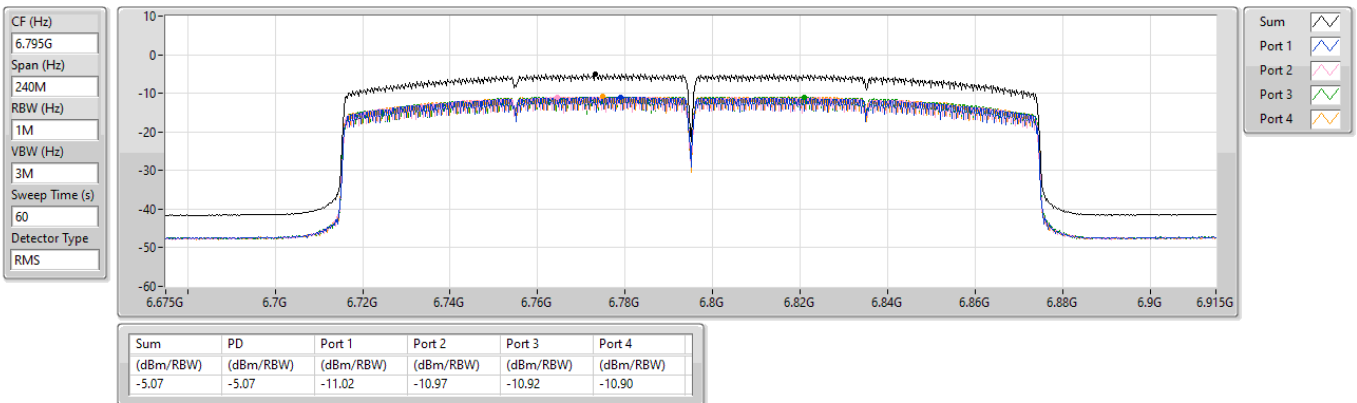


6.525-6.875GHz_160_Nss1,(MCS0)_4TX

PSD

6795MHz

19/06/2024



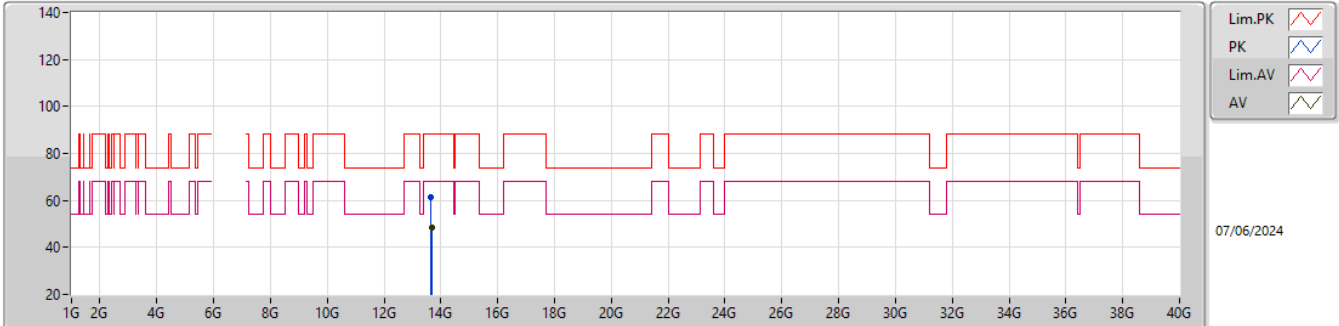


Summary

Mode	Result	Type	Freq (Hz)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Dist (m)	Condition	Azimuth (°)	Height (m)	Comments
6.525-6.875GHz	-	-	-	-	-	-	-	-	-	-	-
80_Nss1,(MCS0)_4TX	Pass	AV	20.4898G	45.02	63.54	-18.52	1	Horizontal	161	1.50	-

6.525-6.875GHz_80_Nss1,(MCS0)_4TX

6835MHz_TX

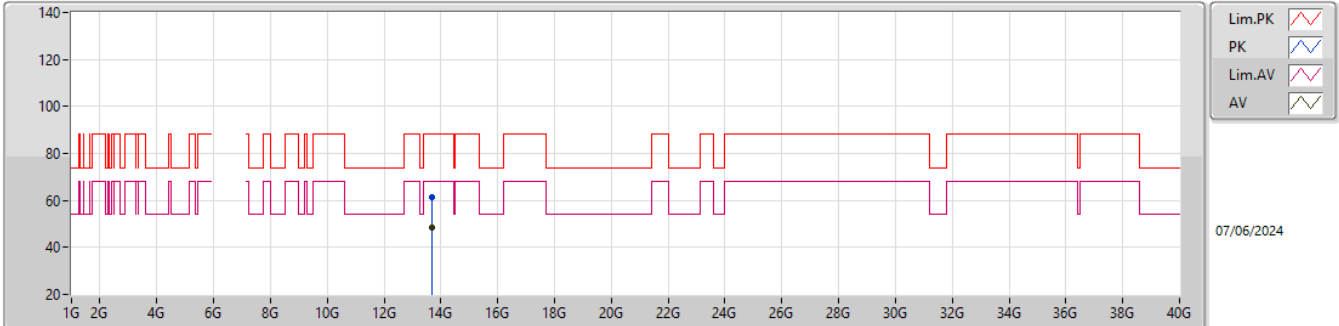


EUT_V_4TX
Setting 28
01-I-C-6

Type	Freq	Level	Limit	Margin	Raw	Dist	Condition	Azimuth	Height	Comment	AF	CL	PA			
	(Hz)	(dBuV/m)	(dBuV/m)	(dB)	(dBuV)	(m)		(°)	(m)		(dB)	(dB)	(dB)			
PK	13.65833G	61.52	88.20	-26.68	40.78	3	Vertical	291	1.80	-	40.10	11.75	31.11			
RMS	13.69275G	48.53	68.20	-19.67	27.79	3	Vertical	291	1.80	-	40.10	11.76	31.12			

6.525-6.875GHz_80_Nss1,(MCS0)_4TX

6835MHz_TX

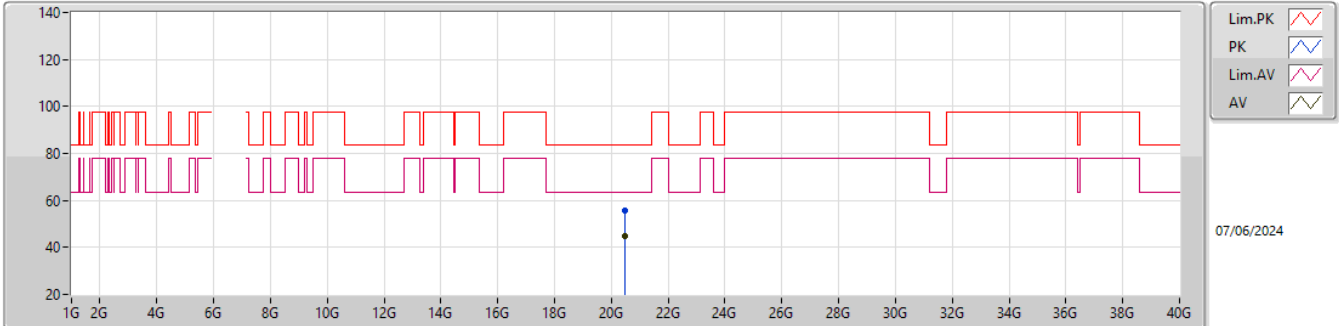


EUT_V_4TX
Setting 28
01-I-C-6

Type	Freq (Hz)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Raw (dBuV)	Dist (m)	Condition	Azimuth (°)	Height (m)	Comment	AF (dB)	CL (dB)	PA (dB)			
PK	13.6927G	61.33	88.20	-26.87	40.59	3	Horizontal	45	1.80	-	40.10	11.76	31.12			
RMS	13.69395G	48.59	68.20	-19.61	27.86	3	Horizontal	45	1.80	-	40.10	11.76	31.13			

6.525-6.875GHz_80_Nss1,(MCS0)_4TX

6835MHz_TX

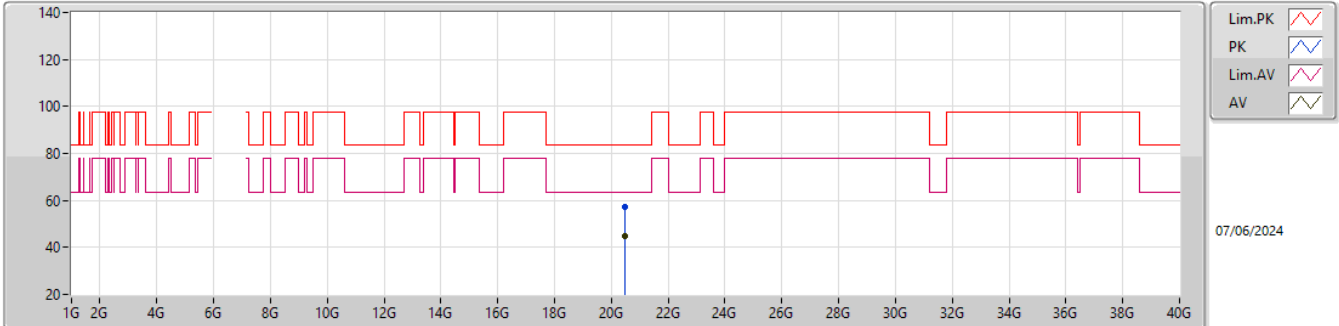


EUT_V_4TX
Setting 28
01-I-C-6

Type	Freq (Hz)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Raw (dBuV)	Dist (m)	Condition	Azimuth (°)	Height (m)	Comment	AF (dB)	CL (dB)	PA (dB)			
PK	20.4902G	55.48	83.54	-28.06	51.35	1	Vertical	164	1.50	-	37.68	15.59	49.14			
AV	20.4902G	44.65	63.54	-18.89	40.52	1	Vertical	164	1.50	-	37.68	15.59	49.14			

6.525-6.875GHz_80_Nss1,(MCS0)_4TX

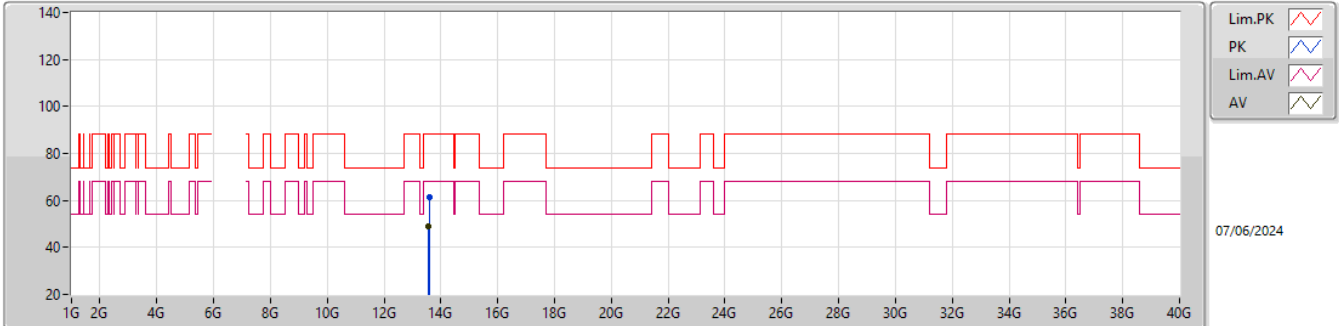
6835MHz_TX

EUT_V_4TX
Setting 28
01-I-C-6

Type	Freq (Hz)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Raw (dBuV)	Dist (m)	Condition	Azimuth (°)	Height (m)	Comment	AF (dB)	CL (dB)	PA (dB)			
PK	20.4902G	57.32	83.54	-26.22	53.19	1	Horizontal	161	1.50	-	37.68	15.59	49.14			
AV	20.4898G	45.02	63.54	-18.52	40.89	1	Horizontal	161	1.50	-	37.68	15.59	49.14			

6.525-6.875GHz_160_Nss1,(MCS0)_4TX

6795MHz_TX

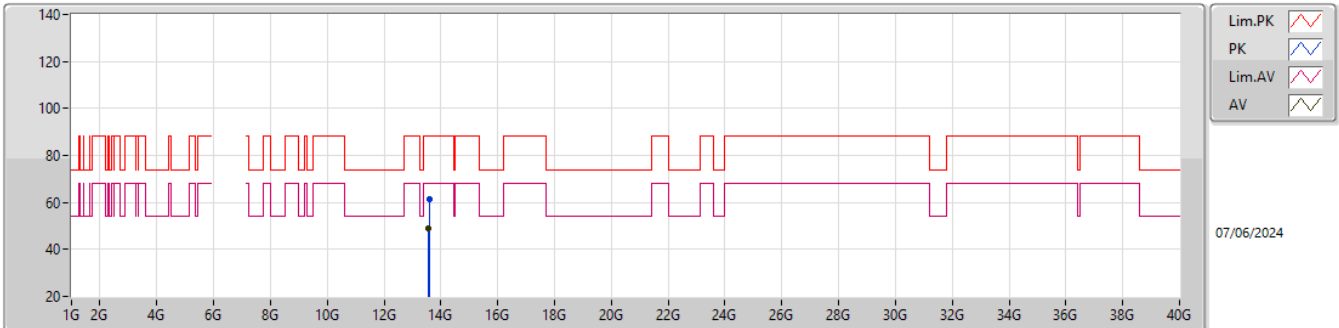


EUT_Y_4TX
Setting 28
01-I-C-6

Type	Freq	Level	Limit	Margin	Raw	Dist	Condition	Azimuth	Height	Comment	AF	CL	PA			
	(Hz)	(dBuV/m)	(dBuV/m)	(dB)	(dBuV)	(m)		(°)	(m)		(dB)	(dB)	(dB)			
PK	13.6117G	61.44	88.20	-26.76	40.70	3	Vertical	316	1.44	-	40.10	11.73	31.09			
RMS	13.5755G	48.71	68.20	-19.49	27.86	3	Vertical	316	1.44	-	40.20	11.72	31.07			

6.525-6.875GHz_160_Nss1,(MCS0)_4TX

6795MHz_TX

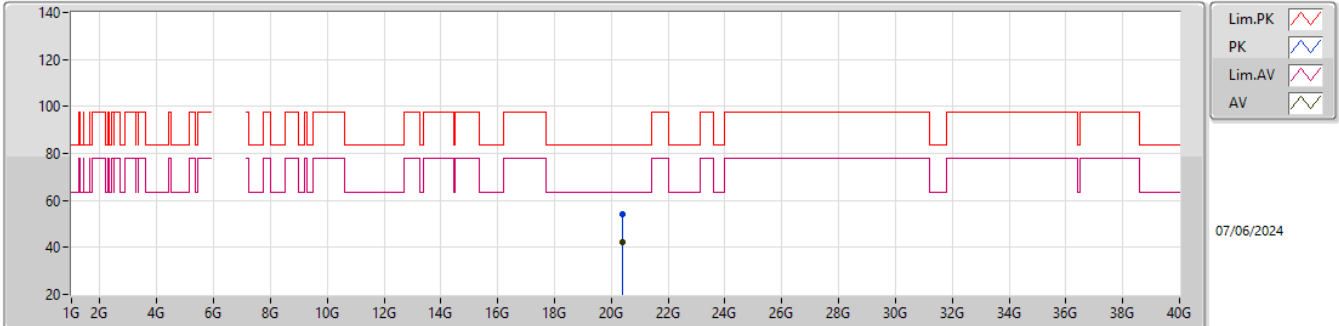


EUT_V_4TX
Setting 28
01-I-C-6

Type	Freq (Hz)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Raw (dBuV)	Dist (m)	Condition	Azimuth (°)	Height (m)	Comment	AF (dB)	CL (dB)	PA (dB)			
PK	13.5877G	61.34	88.20	-26.86	40.55	3	Horizontal	145	1.80	-	40.15	11.72	31.08			
RMS	13.57535G	48.71	68.20	-19.49	27.86	3	Horizontal	145	1.80	-	40.20	11.72	31.07			

6.525-6.875GHz_160_Nss1,(MCS0)_4TX

6795MHz_TX

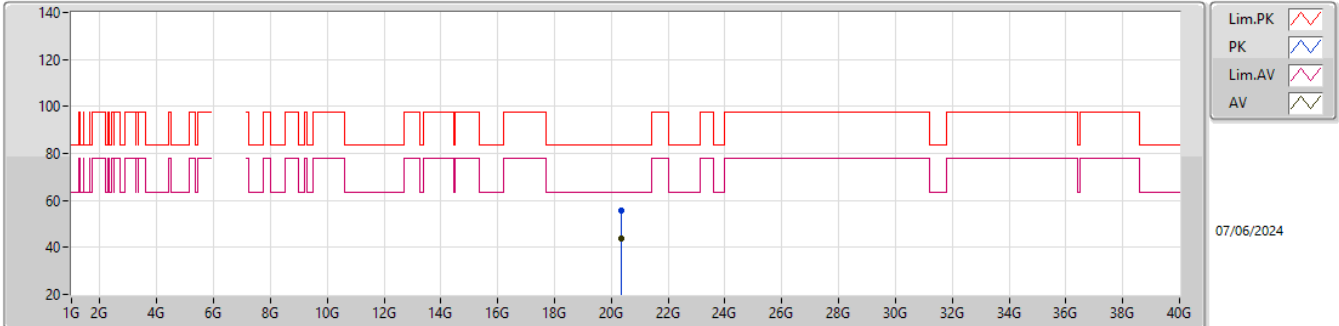


EUT_Y_4TX
Setting 28
01-I-C-6

Type	Freq (Hz)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Raw (dBuV)	Dist (m)	Condition	Azimuth (°)	Height (m)	Comment	AF (dB)	CL (dB)	PA (dB)			
PK	20.4106G	54.30	83.54	-29.24	49.93	1	Vertical	163	1.49	-	38.00	15.53	49.16			
AV	20.391G	42.40	63.54	-21.14	38.04	1	Vertical	163	1.49	-	38.02	15.51	49.17			

6.525-6.875GHz_160_Nss1,(MCS0)_4TX

6795MHz_TX

EUT_V_4TX
Setting 28
01-I-C-6

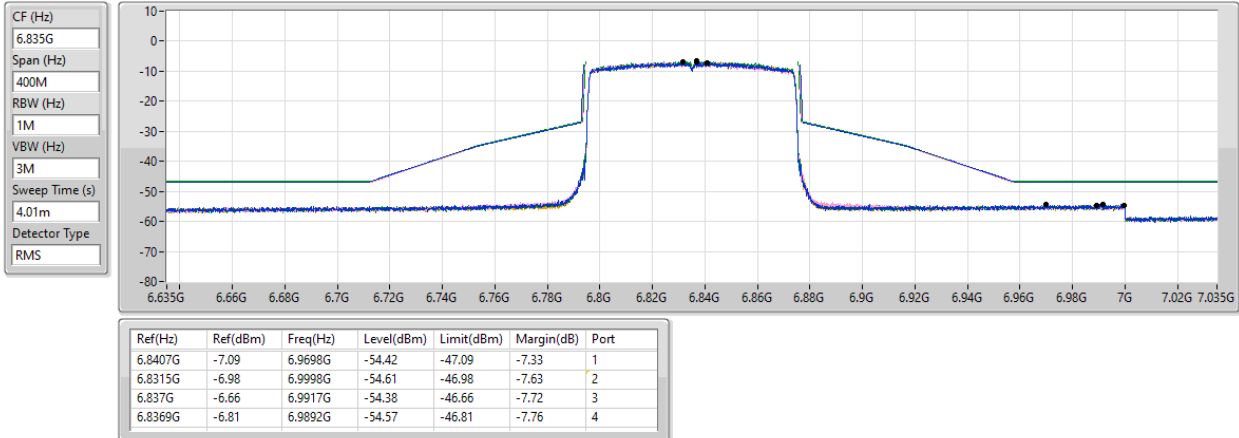
Type	Freq	Level	Limit	Margin	Raw	Dist	Condition	Azimuth	Height	Comment	AF	CL	PA			
	(Hz)	(dBuV/m)	(dBuV/m)	(dB)	(dBuV)	(m)		(°)	(m)		(dB)	(dB)	(dB)			
PK	20.3498G	55.56	83.54	-27.98	51.16	1	Horizontal	197.5	1.50	-	38.10	15.48	49.18			
AV	20.3694G	43.70	63.54	-19.84	39.31	1	Horizontal	197.5	1.50	-	38.06	15.50	49.17			

6.525-6.875GHz_80_Nss1,(MCS0)_4TX

MASK

6835MHz_TX

19/06/2024



6.525-6.875GHz_160_Nss1,(MCS0)_4TX

MASK

6795MHz_TX

19/06/2024

