



RADIO TEST REPORT

FCC ID : Z8H89FT0077
Equipment : XV2-22H Wallplate Wi-Fi 6 Access Point
Brand Name : Cambium Networks
Model Name : XV2-22H
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 15.247

The product was received on Jul. 01, 2022, and testing was started from Jul. 07, 2022 and completed on Aug. 02, 2022. 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 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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History of this test report

[illegible]



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	15.207	AC Power-line Conducted Emissions	PASS	-
3.2	15.247(a)	DTS Bandwidth	PASS	-
3.3	15.247(b)	Maximum Conducted Output Power	PASS	-
3.4	15.247(e)	Power Spectral Density	PASS	-
3.5	15.247(d)	Emissions in Non-restricted Frequency Bands	PASS	-
3.6	15.247(d)	Emissions in Restricted Frequency Bands	PASS	-

Declaration of Conformity:

1. The test results with all measurement uncertainty excluded are presented in accordance with the regulation limits or requirements declared by manufacturers. It's means measurement values may risk exceeding the limit of regulation standards, if measurement uncertainty is include in test results.
2. The measurement uncertainty please refer to report "Measurement Uncertainty".

Comments and Explanations:

The declared of product specification for EUT presented in the report are provided by the manufacturer, and the manufacturer takes all the responsibilities for the accuracy of product specification.

Reviewed by: Sam Chen**Report Producer: Penny Kao**



1 General Description

1.1 Information

1.1.1 RF General Information

Frequency Range (MHz)	IEEE Std.	Ch. Frequency (MHz)	Channel Number
2400-2483.5	802.15.4	2405-2480	11-26 [16]

Band	Mode	BWch (MHz)	Nant
2.4G	Zigbee	5	1

Note:

- ♦ Zigbee uses a O-QPSK (250kbps) modulation.
- ♦ BWch is the nominal channel bandwidth.

1.1.2 Antenna Information

Ant.	Port			Brand	Model Name	Antenna Type	Connector	Gain (dBi)
	WLAN 2.4GHz	WLAN 5GHz	Bluetooth / Zigbee					
1	1	-	-	Gemtek	WRTQ-372AX	PIFA	I-Pex	Note1
2	2	-	-	Gemtek	WRTQ-372AX	PIFA	I-Pex	
3	-	2	-	Gemtek	WRTQ-372AX	PIFA	I-Pex	
4	-	1	-	Gemtek	WRTQ-372AX	PIFA	I-Pex	
5	-	-	1	Gemtek	WRTQ-372AX	Dipole	I-Pex	

Note1: Antenna Gain information

Ant.	Port			Antenna Gain (dBi)			
	WLAN 2.4GHz	WLAN 5GHz	Bluetooth / Zigbee	WLAN 2.4GHz	WLAN 5GHz		Bluetooth / Zigbee
					UNII 1	UNII 3	
1	1	-	-	4.47	-	-	-
2	2	-	-	4.42	-	-	-
3	-	2	-	-	5.56	5.48	-
4	-	1	-	-	5.45	5.51	-
5	-	-	1	-	-	-	5.18

Note 2: 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 ≤ 4	$DirectionalGain = 10 \cdot \log \left[\frac{\sum_{j=1}^{N_{SS}} \left\{ \sum_{k=1}^{N_{ANT}} g_{j,k} \right\}^2}{N_{ANT}} \right]$
BF	$DirectionalGain = 10 \cdot \log \left[\frac{\sum_{j=1}^{N_{SS}} \left\{ \sum_{k=1}^{N_{ANT}} g_{j,k} \right\}^2}{N_{ANT}} \right]$	$DirectionalGain = 10 \cdot \log \left[\frac{\sum_{j=1}^{N_{SS}} \left\{ \sum_{k=1}^{N_{ANT}} g_{j,k} \right\}^2}{N_{ANT}} \right]$

Ex.

Directional Gain (NSS1) formula :

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

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

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

$$DG = 10 \log[(NSS1(g1,1) + NSS1(g1,2))^2 / N_{ANT}] \Rightarrow 10 \log[(10^{G1/20} + 10^{G2/20})^2 / N_{ANT}]$$

Where ;

$$G1 = 10 ; G2 = 10 ;$$

$$2.4G \ G1 = 4.47 \text{ dBi} ; G2 = 4.42 \text{ dBi} ; DG = 7.46 \text{ dBi}$$

$$5G \text{ Band1 } G1 = 5.56 \text{ dBi} ; G2 = 5.45 \text{ dBi} ; DG = 8.52 \text{ dBi}$$

$$5G \text{ Band4 } G1 = 5.48 \text{ dBi} ; G2 = 5.51 \text{ dBi} ; DG = 8.51 \text{ dBi}$$

Note 3: The above information was declared by manufacturer.

Note 4: The EUT has five antennas.

<WLAN 2.4GHz Function>

IEEE 802.11b/g/n/VHT/ax (2TX/2RX):

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

Port 1 and Port 2 could transmit/receive simultaneously.

<WLAN 5GHz Function>

IEEE 802.11a/n/ac/ax (2TX/2RX):

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

Port 1 and Port 2 could transmit/receive simultaneously.

<Bluetooth/Zigbee function>

Bluetooth/Zigbee (1TX/1RX):

Port 1 can be used as transmitting/receiving antenna.

1.1.3 Mode Test Duty Cycle

Mode	DC	DCF(dB)	T(s)	VBW(Hz) $\geq 1/T$
Zigbee	1	0	n/a (DC $\geq$ 0.98)	n/a (DC $\geq$ 0.98)

Note:

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

1.1.4 EUT Operational Condition

EUT Power Type	From PoE			
Function	☒	Point-to-multipoint	☐	Point-to-point
Test Software Version	RF Conducted	QSPR Version 5.0-00199		
	Radiated	DOS [ver 6.1.7601]		

Note: The above information was declared by manufacturer.

1.1.5 Table for EUT supports functions

Function
AP
Bridge
Mesh

Note 1: After evaluating, AP Mode was selected to test and record in the report.

Note 2: The above information was declared by manufacturer.



1.1.6 Applicable Standards

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

- ♦ 47 CFR FCC Part 15.247
- ♦ ANSI C63.10-2013

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

- ♦ FCC KDB 558074 D01 v05r02
- ♦ FCC KDB 662911 D01 v02r01
- ♦ FCC KDB 414788 D01 v01r01

1.2 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 ISCED.

Test Condition	Test Site No.	Test Engineer	Test Environment (°C / %)	Test Date
RF Conducted	TH01-CB	Serway Lee	24.9-26.4 / 65-71	Jul. 13, 2022~ Jul. 22, 2022
Radiated below 1GHz	03CH05-CB	Simmon Cheng	23.8-24.9 / 55-58	Jul. 21, 2022~ Jul. 29, 2022
Radiated above 1GHz	03CH06-CB	Stim Sung	24.6~25.5 / 63~68	Jul. 07, 2022~ Jul. 15, 2022
	03CH03-CB		24.4-25.5 / 55-58	
AC Conduction	CO01-CB	Dean Chang	22-23 / 52-53	Jul. 26, 2022~ Aug. 02, 2022

1.3 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
Conducted Emission (150kHz ~ 30MHz)	3.4 dB	Confidence levels of 95%
Radiated Emission (9kHz ~ 30MHz)	3.4 dB	Confidence levels of 95%
Radiated Emission (30MHz ~ 1,000MHz)	5.6 dB	Confidence levels of 95%
Radiated Emission (1GHz ~ 18GHz)	5.2 dB	Confidence levels of 95%
Radiated Emission (18GHz ~ 40GHz)	4.7 dB	Confidence levels of 95%
Conducted Emission	3.2 dB	Confidence levels of 95%
Output Power Measurement	0.8 dB	Confidence levels of 95%
Power Density Measurement	3.2 dB	Confidence levels of 95%
Bandwidth Measurement	2.0 %	Confidence levels of 95%



2 Test Configuration of EUT

2.1 Test Channel Mode

Mode	Power Setting
Zigbee	-
2405MHz	19
2440MHz	20
2475MHz	20
2480MHz	10



2.2 The Worst Case Measurement Configuration

The Worst Case Mode for Following Conformance Tests	
Tests Item	AC power-line conducted emissions
Condition	AC power-line conducted measurement for line and neutral Test Voltage: 120Vac / 60Hz
Operating Mode	Normal Link
1	EUT (2.4GHz +5GHz+ Zigbee) + PoE: Power by Eth1 / PoE IN
2	EUT (2.4GHz +5GHz+ Zigbee) + PoE: Power by Pass Thru
3	EUT (2.4GHz +5GHz+ Zigbee) + PoE: Power by Eth2 / PoE IN
Mode 2 has been evaluated to be the worst case among Mode 1~3, thus measurement for Mode 4 will follow this same test mode.	
4	EUT (2.4GHz +5GHz+ Bluetooth) + PoE: Power by Pass Thru
Mode 4 generated the worst test result, so it was recorded in this report.	

The Worst Case Mode for Following Conformance Tests	
Tests Item	DTS Bandwidth Maximum Conducted Output Power Power Spectral Density Emissions in Non-restricted Frequency Bands
Test Condition	Conducted measurement at transmit chains

The Worst Case Mode for Following Conformance Tests	
Tests Item	Emissions in Restricted Frequency Bands
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	Normal Link
1	EUT in Z axis (2.4GHz +5GHz+ Zigbee) + PoE: Power by Eth1 / PoE IN
2	EUT in Y axis (2.4GHz +5GHz+ Zigbee) + PoE: Power by Eth1 / PoE IN
3	EUT in X axis (2.4GHz +5GHz+ Zigbee) + PoE: Power by Eth1 / PoE IN
Mode 2 has been evaluated to be the worst case among Mode 1~3, thus measurement for Mode 4~5 will follow this same test mode.	
4	EUT in Y axis (2.4GHz +5GHz+ Zigbee) + PoE: Power by Pass Thru
5	EUT in Y axis (2.4GHz +5GHz+ Zigbee) + PoE: Power by Eth2 / PoE IN
Mode 2 has been evaluated to be the worst case among Mode 1~5, thus measurement for Mode 6 will follow this same test mode.	
6	EUT in Y axis (2.4GHz +5GHz+ Bluetooth) + PoE: Power by Eth1 / PoE IN



For operating mode 2 is the worst case and it was record in this test report.

Operating Mode > 1GHz	CTX
	The EUT was performed at X axis, Y axis and Z axis position, and the worst case as below:
1	EUT in Y axis

The Worst Case Mode for Following Conformance Tests

Tests Item	Simultaneous Transmission Analysis - Co-location RF Exposure Evaluation
Operating Mode	
1	WLAN 2.4GHz + WLAN 5GHz + Bluetooth
2	WLAN 2.4GHz + WLAN 5GHz + Zigbee

Refer to Sporton Test Report No.: FA270109 for Co-location RF Exposure Evaluation.

Note: The PoE is for measurement only, would not be marketed.

The PoE information as below:

Support Unit	Brand	Model Name
PoE	Cambium	NET-P30-56IN

2.3 EUT Operation during Test

For CTX Mode:

The EUT was programmed to be in continuously transmitting mode.

For Normal Link:

During the test, the EUT operation to normal function.

2.4 Accessories

Others
RJ-45 cable*1: Non-shielded, 0.1m
Wall-mounted rack*1



2.5 Support Equipment

For AC Conduction:

Support Equipment				
No.	Equipment	Brand Name	Model Name	FCC ID
A	LAN EUT Eth1 NB	DELL	E6430	N/A
B	LAN EUT Eth2 NB	DELL	E6430	N/A
C	2.4G NB	DELL	E6430	N/A
D	5G NB	DELL	E6430	N/A
E	PD Load	Cambium Networks	WRTQ 372AX	N/A
F	LAN Eth2 NB	DELL	E6430	N/A
G	Smart phone	Samusung	J2	N/A
H	PoE	Cambium	NET-P30-56IN	N/A

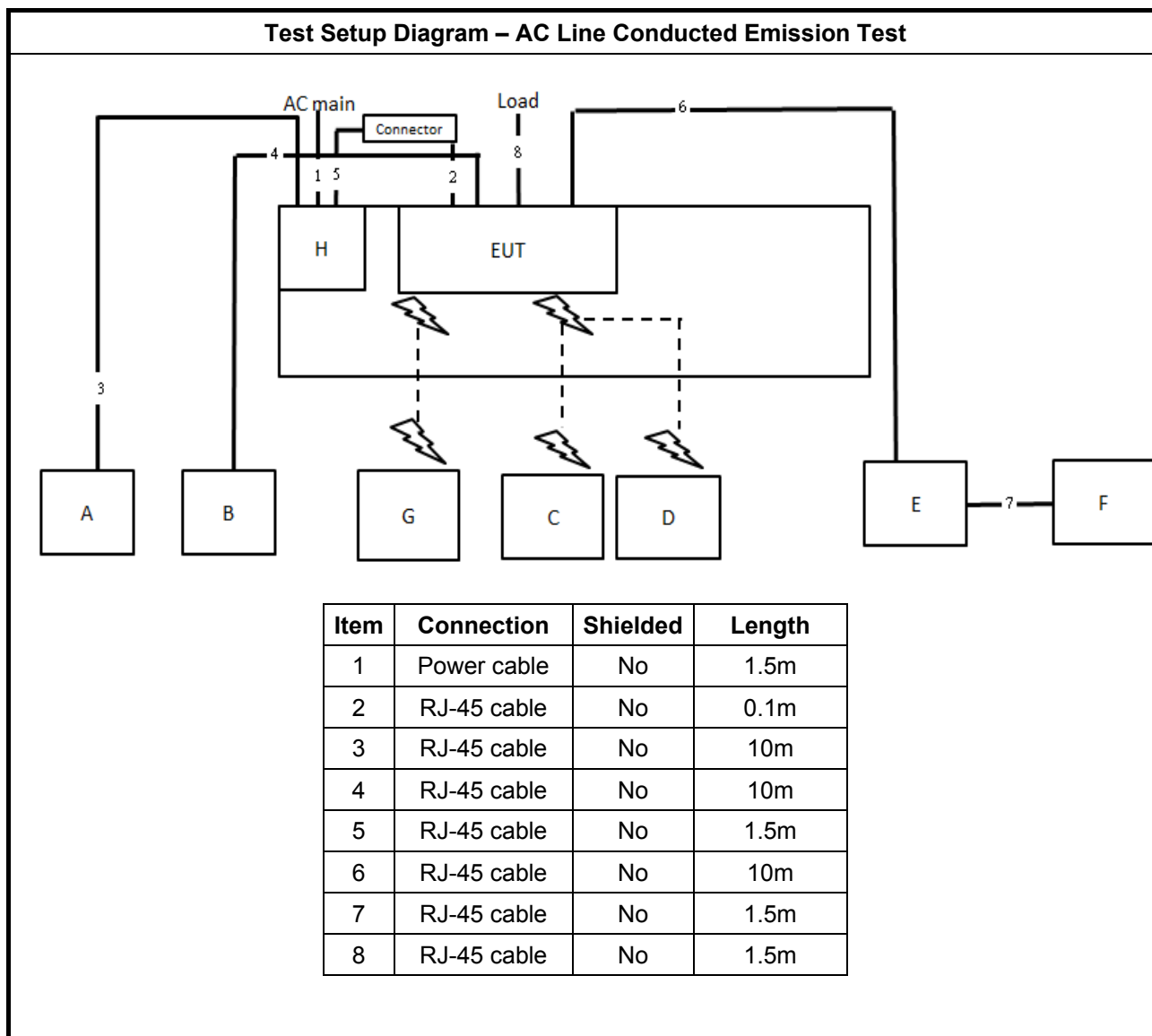
For Radiated (below 1GHz):

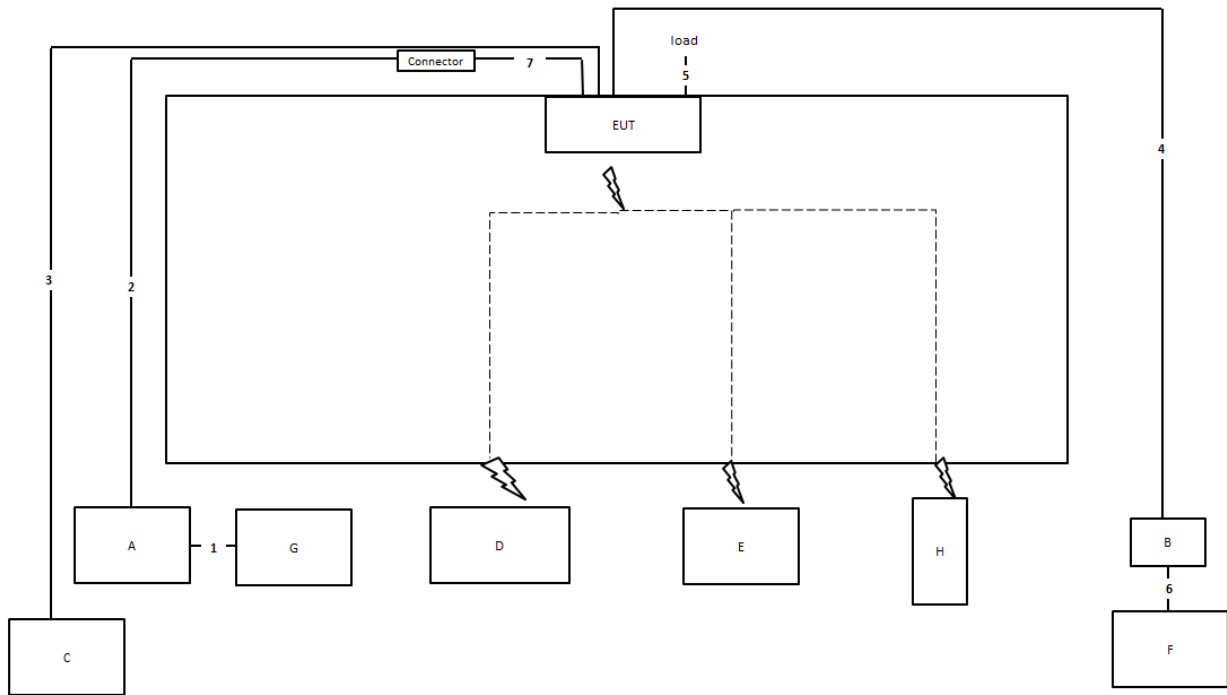
Support Equipment				
No.	Equipment	Brand Name	Model Name	FCC ID
A	PoE	Cambium Networks	NET-P30-56IN	N/A
B	PD Load	Cambium Networks	WRTQ_372AX	N/A
C	NB (LAN)	DELL	E4300	N/A
D	NB (WIFI 2.4G)	DELL	E4300	N/A
E	NB (WIFI 5G)	DELL	E4300	N/A
F	NB (PD LAN)	DELL	E4300	N/A
G	NB (PoE)	DELL	E4300	N/A
H	Bulb	Bitc	TWM6027P25-NWW1008H	N/A

For Radiated (above 1GHz) and RF Conducted:

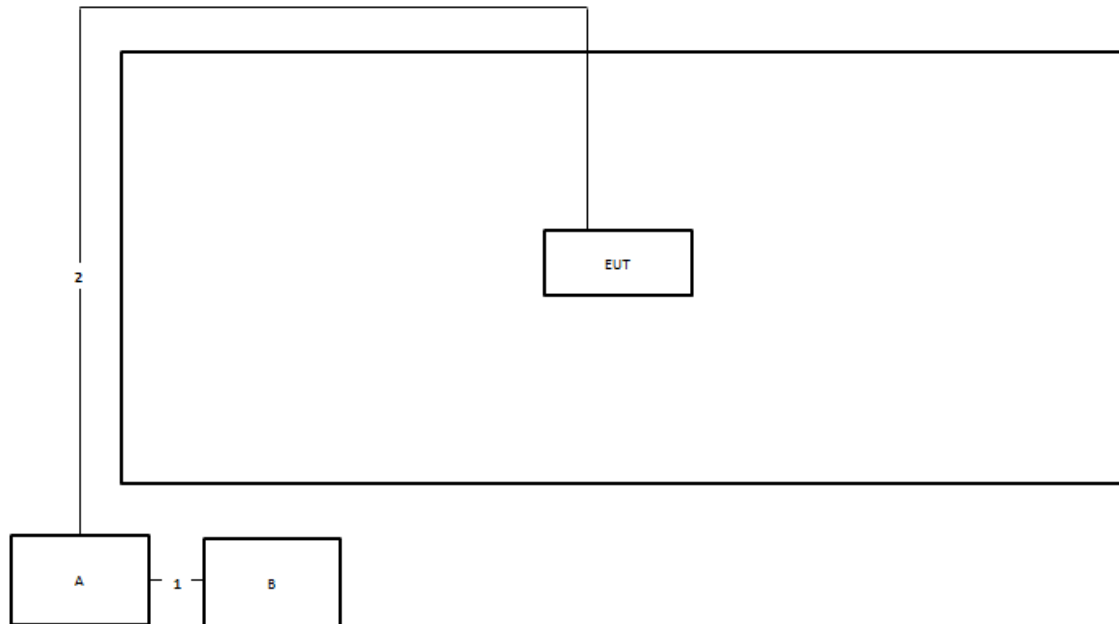
Support Equipment				
No.	Equipment	Brand Name	Model Name	FCC ID
A	PoE	Cambium Networks	NET-P30-56IN	N/A
B	Notebook	DELL	E4300	N/A

2.6 Test Setup Diagram



Test Setup Diagram - Radiated Test < 1GHz


Item	Connection	Shielded	Length
1	RJ-45 cable	No	1.5m
2	RJ-45 cable	No	10m
3	RJ-45 cable	No	10m
4	RJ-45 cable	No	1.0m
5	RJ-45 cable	No	1.5m
6	RJ-45 cable	No	1.5m
7	RJ-45 cable	No	0.1m

Test Setup Diagram - Radiated Test > 1GHz


Item	Connection	Shielded	Length
1	RJ-45 cable	No	1.5m
2	RJ-45 cable	No	10m



3 Transmitter Test Result

3.1 AC Power-line Conducted Emissions

3.1.1 AC Power-line Conducted Emissions Limit

AC Power-line Conducted Emissions Limit		
Frequency Emission (MHz)	Quasi-Peak	Average
0.15-0.5	66 - 56 *	56 - 46 *
0.5-5	56	46
5-30	60	50

Note 1: * Decreases with the logarithm of the frequency.

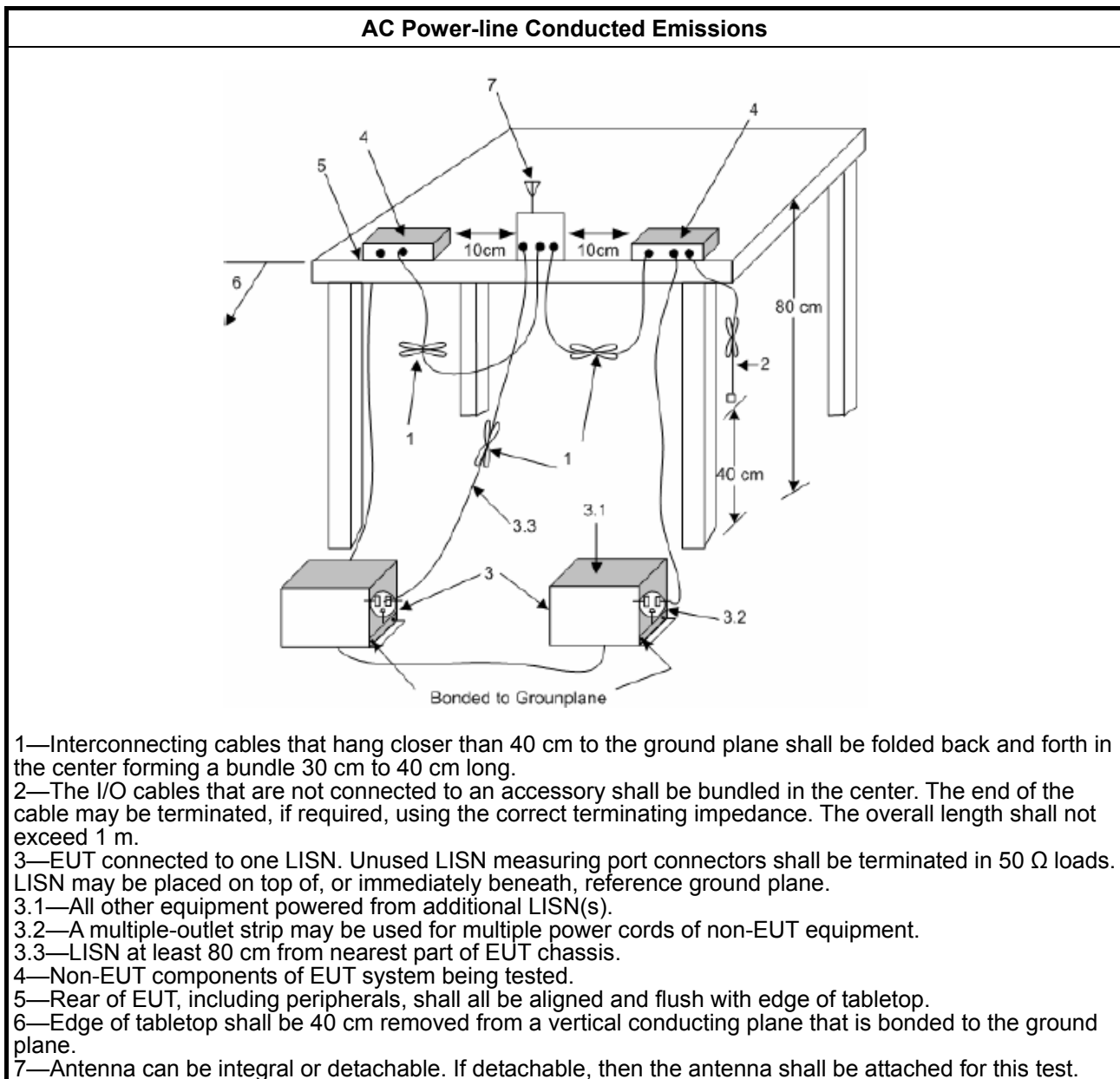
3.1.2 Measuring Instruments

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

3.1.3 Test Procedures

Test Method
☒ Refer as ANSI C63.10-2013, clause 6.2 for AC power-line conducted emissions.

3.1.4 Test Setup



3.1.5 Measurement Results Calculation

The measured Level is calculated using:

- a. Corrected Reading: LISN Factor (LISN) + Attenuator (AT/AUX) + Cable Loss (CL) + Read Level (Raw) = Level
- b. Margin = -Limit + Level

3.1.6 Test Result of AC Power-line Conducted Emissions

Refer as Appendix A

3.2 DTS Bandwidth

3.2.1 6dB Bandwidth Limit

6dB Bandwidth Limit
Systems using digital modulation techniques:
6 dB bandwidth $\geq$ 500 kHz.

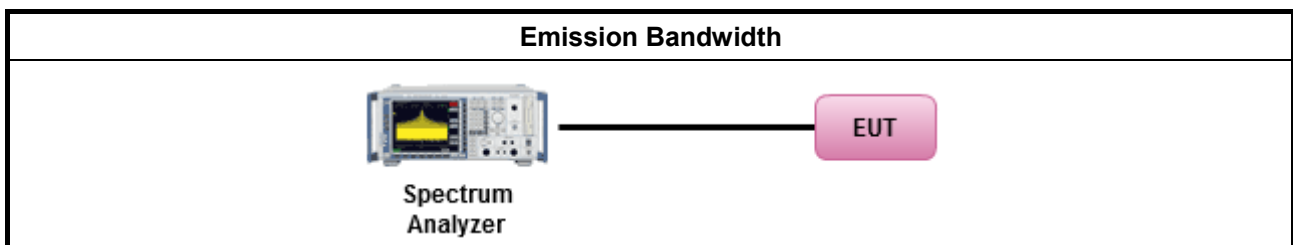
3.2.2 Measuring Instruments

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

3.2.3 Test Procedures

Test Method
For the emission bandwidth shall be measured using one of the options below:
☒ Refer as FCC KDB 558074, clause 8.2 & C63.10 clause 11.8.1 Option 1 for 6 dB bandwidth measurement.
☐ Refer as FCC KDB 558074, clause 8.2 & C63.10 clause 11.8.2 Option 2 for 6 dB bandwidth measurement.
☐ Refer as ANSI C63.10, clause 6.9.1 for occupied bandwidth testing.

3.2.4 Test Setup



3.2.5 Test Result of Emission Bandwidth

Refer as Appendix B

3.3 Maximum Conducted Output Power

3.3.1 Maximum Conducted Output Power Limit

Maximum Conducted Output Power Limit	
	▪ If $G_{TX} \leq 6$ dBi, then $P_{Out} \leq 30$ dBm (1 W)
	▪ Point-to-multipoint systems (P2M): If $G_{TX} > 6$ dBi, then $P_{Out} = 30 - (G_{TX} - 6)$ dBm
	▪ Point-to-point systems (P2P): If $G_{TX} > 6$ dBi, then $P_{Out} = 30 - (G_{TX} - 6)/3$ dBm
	▪ Smart antenna system (SAS):
	- Single beam: If $G_{TX} > 6$ dBi, then $P_{Out} = 30 - (G_{TX} - 6)/3$ dBm
	- Overlap beam: If $G_{TX} > 6$ dBi, then $P_{Out} = 30 - (G_{TX} - 6)/3$ dBm
	- Aggregate power on all beams: If $G_{TX} > 6$ dBi, then $P_{Out} = 30 - (G_{TX} - 6)/3 + 8$ dB dBm
P_{Out} = maximum peak conducted output power or maximum conducted output power in dBm, G_{TX} = the maximum transmitting antenna directional gain in dBi.	

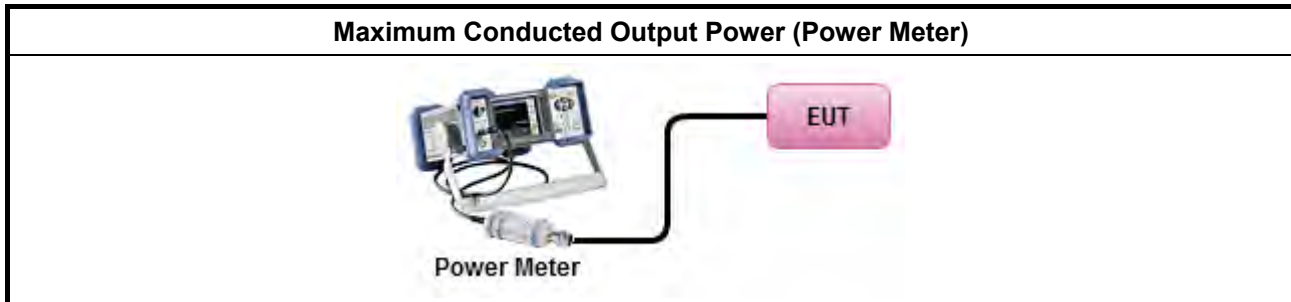
3.3.2 Measuring Instruments

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

3.3.3 Test Procedures

Test Method	
Maximum Peak Conducted Output Power	
☐	Refer as FCC KDB 558074, clause 8.3.1.1 & C63.10 clause 11.9.1.1 (RBW ≥ EBW method).
☐	Refer as FCC KDB 558074, clause 8.3.1.3 & C63.10 clause 11.9.1.3 (peak power meter).
Maximum Conducted Output Power	
[duty cycle ≥ 98% or external video / power trigger]	
☐	Refer as FCC KDB 558074, clause 8.3.2.2 & C63.10 clause 11.9.2.2.2 Method AVGSA-1.
☐	Refer as FCC KDB 558074, clause 8.3.2.2 & C63.10 clause 11.9.2.2.3 Method AVGSA-1A. (alternative)
duty cycle < 98% and average over on/off periods with duty factor	
☐	Refer as FCC KDB 558074, clause 8.3.2.2 & C63.10 clause 11.9.2.2.4 Method AVGSA-2.
☐	Refer as FCC KDB 558074, clause 8.3.2.2 & C63.10 clause 11.9.2.2.5 Method AVGSA-2A (alternative)
☐	Refer as FCC KDB 558074, clause 8.3.2.2 & C63.10 clause 11.9.2.2.6 Method AVGSA-3
☐	Refer as FCC KDB 558074, clause 8.3.2.2 & C63.10 clause 11.9.2.2.7 Method AVGSA-3A (alternative)
Measurement using a power meter (PM)	
☐	Refer as FCC KDB 558074, clause 8.3.2.3 & C63.10 clause 11.9.2.3.1 Method AVGPM (using an RF average power meter).
☒	Refer as FCC KDB 558074, clause 8.3.2.3 & C63.10 clause 11.9.2.3.2 Method AVGPM-G (using an gate 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]) $EIRP_{total} = P_{total} + DG$	

3.3.4 Test Setup



3.3.5 Test Result of Maximum Conducted Output Power

Refer as Appendix C

3.4 Power Spectral Density

3.4.1 Power Spectral Density Limit

Power Spectral Density Limit
Power Spectral Density (PSD) ≤ 8 dBm/3kHz

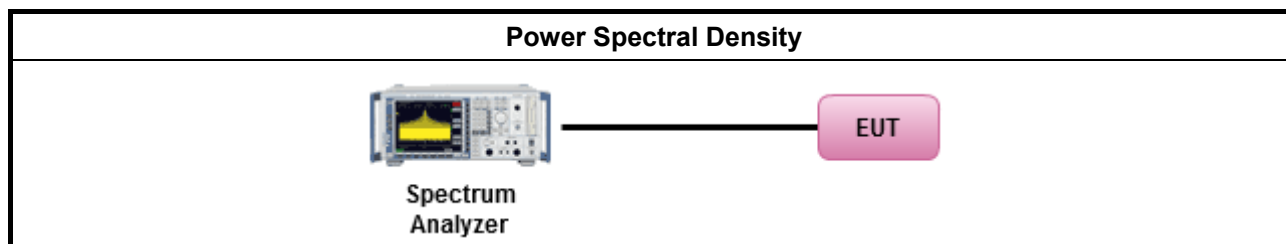
3.4.2 Measuring Instruments

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

3.4.3 Test Procedures

Test Method			
Peak power spectral density procedures that the same method as used to determine the conducted output power. If maximum peak conducted output power was measured to demonstrate compliance to the output power limit, then the peak PSD procedure below (Method PKPSD) shall be used. If maximum conducted output power was measured to demonstrate compliance to the output power limit, then one of the average PSD procedures shall be used, as applicable based on the following criteria (the peak PSD procedure is also an acceptable option).			
☒ Refer as FCC KDB 558074, clause 8.4 & C63.10 clause 11.10 Method Max. PSD.			
- For conducted measurement. - If The EUT supports multiple transmit chains using options given below: <table border="1"> <tr> <td> ☒ 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. </td></tr> <tr> <td> ☐ 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, </td></tr> <tr> <td> ☐ 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. </td></tr> </table>	☒ 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.
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☐ 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.			

3.4.4 Test Setup



3.4.5 Test Result of Power Spectral Density

Refer as Appendix D

3.5 Emissions in Non-restricted Frequency Bands

3.5.1 Emissions in Non-restricted Frequency Bands Limit

Un-restricted Band Emissions Limit	
RF output power procedure	Limit (dBc)
Peak output power procedure	20
Average output power procedure	30
Note 1: If the peak output power procedure is used to measure the fundamental emission power to demonstrate compliance to requirements, then the peak conducted output power measured within any 100 kHz outside the authorized frequency band shall be attenuated by at least 20 dB relative to the maximum measured in-band peak PSD level. Note 2: If the average output power procedure is used to measure the fundamental emission power to demonstrate compliance to requirements, then the power in any 100 kHz outside of the authorized frequency band shall be attenuated by at least 30 dB relative to the maximum measured in-band average PSD level.	

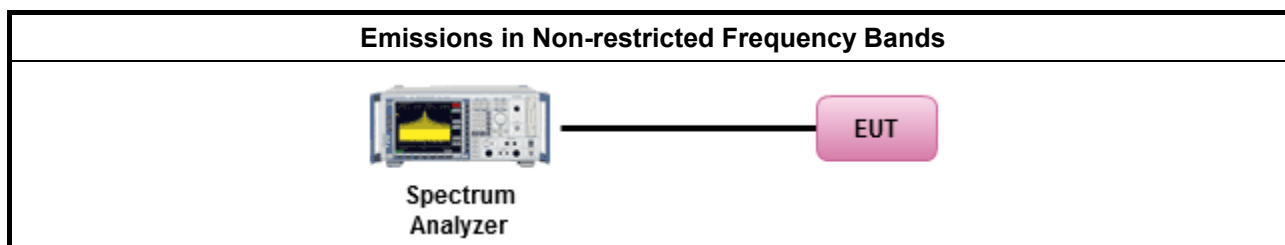
3.5.2 Measuring Instruments

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

3.5.3 Test Procedures

Test Method
Refer as FCC KDB 558074, clause 8.5 for unwanted emissions into non-restricted bands.

3.5.4 Test Setup



3.5.5 Test Result of Emissions in Non-restricted Frequency Bands

Refer as Appendix E

3.6 Emissions in Restricted Frequency Bands

3.6.1 Emissions in Restricted Frequency Bands Limit

Restricted Band Emissions 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.

3.6.2 Measuring Instruments

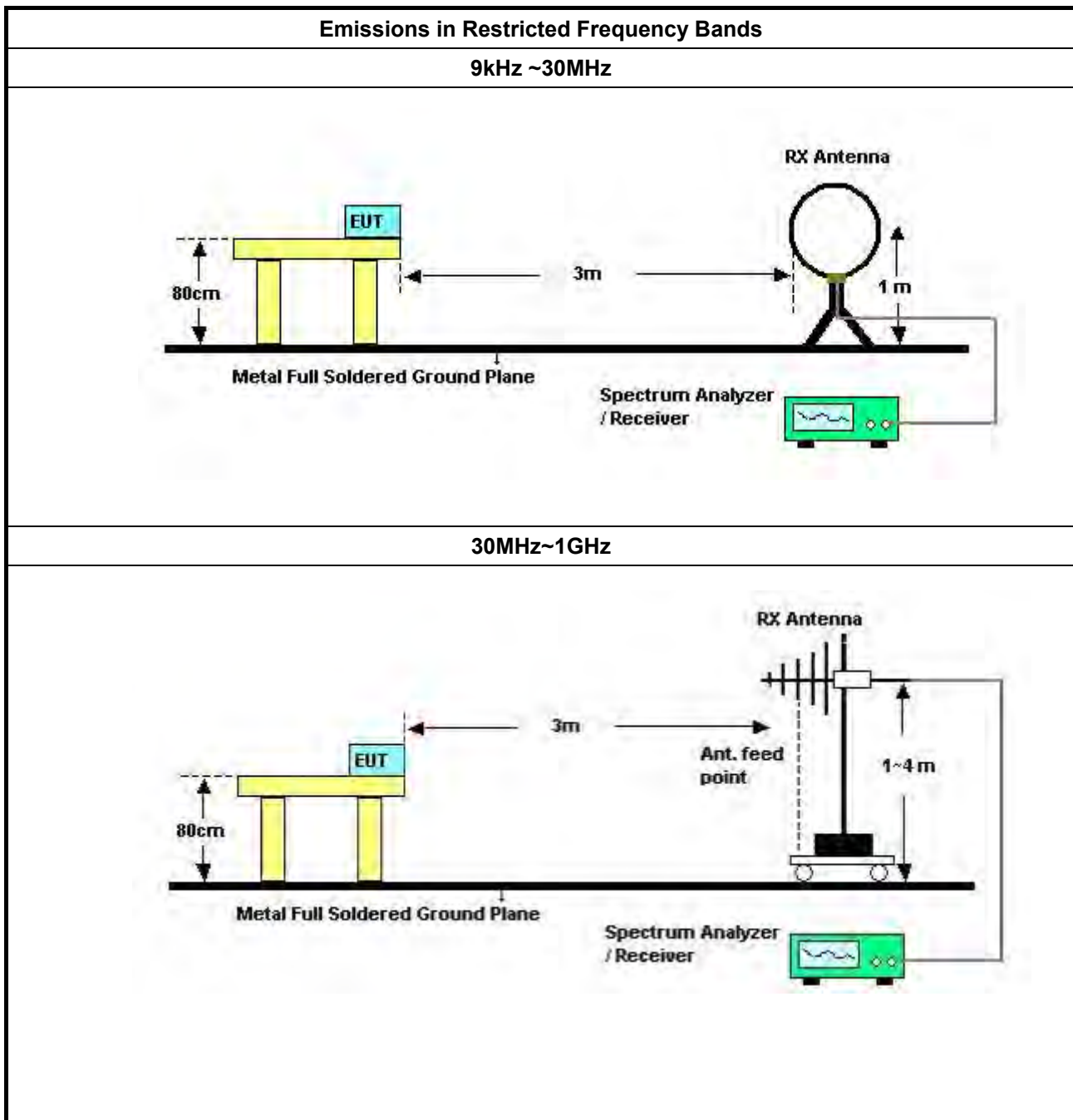
Refer a test equipment and calibration data table in this test report.

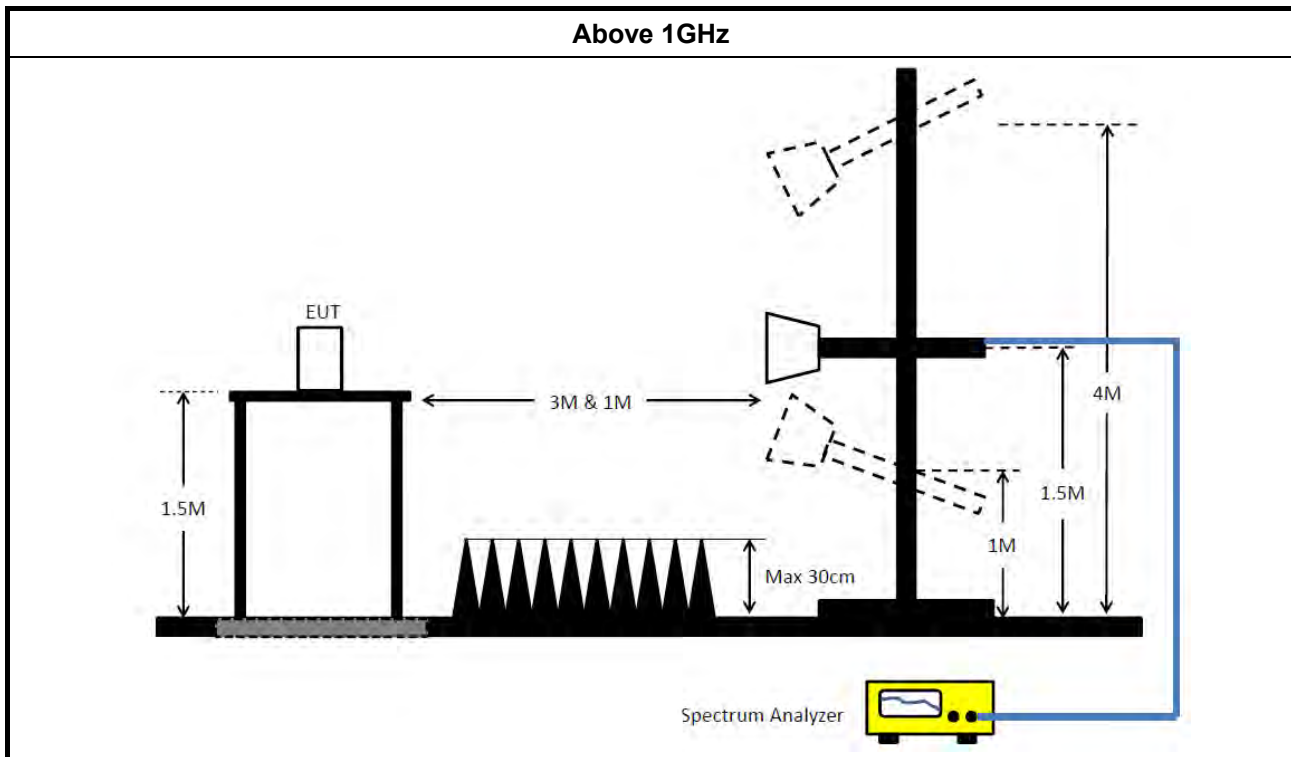


3.6.3 Test Procedures

Test Method	
▪ The average emission levels shall be measured in [duty cycle ≥ 98 or duty factor].	
▪ Refer as ANSI C63.10, clause 6.10.3 band-edge testing shall be performed at the lowest frequency channel and highest frequency channel within the allowed operating band.	
▪ For the transmitter unwanted emissions shall be measured using following options below:	
	▪ Refer as FCC KDB 558074, clause 8.6 for unwanted emissions into restricted bands.
	☐ Refer as FCC KDB 558074, clause 8.6 & C63.10 clause 11.12.2.5.1(trace averaging for duty cycle $\geq 98\%$).
	☐ Refer as FCC KDB 558074, clause 8.6 & C63.10 clause 11.12.2.5.2(trace averaging + duty factor).
	☒ Refer as FCC KDB 558074, clause 8.6 & C63.10 clause 11.12.2.5.3(Reduced VBW $\geq 1/T$).
	☐ Refer as ANSI C63.10, clause 11.12.2.5.3 (Reduced VBW). VBW $\geq 1/T$, where T is pulse time.
	☐ Refer as ANSI C63.10, clause 7.5 average value of pulsed emissions.
	☒ Refer as FCC KDB 558074, clause 8.6 & C63.10 clause 11.12.2.4 measurement procedure peak limit.
▪ For the transmitter band-edge emissions shall be measured using following options below:	
	▪ Refer as FCC KDB 558074 clause 8.7 & c63.10 clause 11.13.1, When the performing peak or average radiated measurements, emissions within 2 MHz of the authorized band edge may be measured using the marker-delta method described below.
	▪ Refer as FCC KDB 558074, clause 8.7 (ANSI C63.10, clause 6.10.6) for marker-delta method for band-edge measurements.
	▪ Refer as FCC KDB 558074, clause 8.7 for narrower resolution bandwidth (100kHz) using the band power and summing the spectral levels (i.e., 1 MHz).
	▪ For conducted unwanted emissions into restricted bands (absolute emission limits). Devices with multiple transmit chains using options given below: (1) Measure and sum the spectra across the outputs or (2) Measure and add 10 log(N) dB
	▪ For FCC KDB 662911 The methodology described here may overestimate array gain, thereby resulting in apparent failures to satisfy the out-of-band limits even if the device is actually compliant. In such cases, compliance may be demonstrated by performing radiated tests around the frequencies at which the apparent failures occurred.

3.6.4 Test Setup





3.6.5 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.

3.6.6 Emissions in Restricted Frequency Bands (Below 30MHz)

There is a comparison data of both open-field test site and alternative test site - semi-Anechoic chamber according to KDB414788 Radiated Test Site, and the result came out very similar.

All amplitude of spurious emissions that are attenuated by more than 20 dB below the permissible value has no need to be reported.

The radiated emissions were investigated from 9 kHz or the lowest frequency generated within the device, up to the 10th harmonic or 40 GHz, whichever is appropriate.

3.6.7 Test Result of Emissions in Restricted Frequency Bands

Refer as Appendix F



4 Test Equipment and Calibration Data

Instrument	Brand	Model No.	Serial No.	Characteristics	Calibration Date	Calibration Due Date	Remark
EMI Receiver	Agilent	N9038A	My52260123	9kHz ~ 8.4GHz	Feb. 22, 2022	Feb. 21, 2023	Conduction (CO01-CB)
LISN	F.C.C.	FCC-LISN-50-16-2	04083	150kHz ~ 100MHz	Feb. 09, 2022	Feb. 08, 2023	Conduction (CO01-CB)
LISN	Schwarzbeck	NSLK 8127	8127647	9kHz ~ 30MHz	Apr. 12, 2022	Apr. 11, 2023	Conduction (CO01-CB)
Pulse Limiter	Rohde&Schwarz	ESH3-Z2	100430	9kHz ~ 30MHz	Feb. 10, 2022	Feb. 09, 2023	Conduction (CO01-CB)
COND Cable	Woken	Cable	Low cable-CO01	9kHz ~ 30MHz	May 18, 2022	May 17, 2023	Conduction (CO01-CB)
Software	SPORTON	SENSE	V5.10	-	N.C.R.	N.C.R.	Conduction (CO01-CB)
Loop Antenna	Teseq	HLA 6120	24155	9kHz - 30 MHz	May 14, 2022	May 13, 2023	Radiation (03CH05-CB)
3m Semi Anechoic Chamber NSA	TDK	SAC-3M	03CH05-CB	30 MHz ~ 1 GHz	Aug. 09, 2021	Aug. 08, 2022	Radiation (03CH05-CB)
Bilog Antenna with 6dB Attenuator	TESEQ & EMCI	CBL 6112D & N-6-06	35236 & AT-N0610	30MHz ~ 2GHz	Mar. 25, 2022	Mar. 24, 2023	Radiation (03CH05-CB)
Pre-Amplifier	EMCI	EMC330N	980331	20MHz ~ 3GHz	Apr. 26, 2022	Apr. 25, 2023	Radiation (03CH05-CB)
Spectrum Analyzer	R&S	FSP40	100304	9kHz ~ 40GHz	Mar. 14, 2022	Mar. 13, 2023	Radiation (03CH05-CB)
EMI Test Receiver	R&S	ESCS	826547/017	9kHz ~ 2.75GHz	Jun. 17, 2022	Jun. 16, 2023	Radiation (03CH05-CB)
RF Cable-low	Woken	RG402	Low Cable-04+23	30MHz~1GHz	Oct. 13, 2021	Oct. 12, 2022	Radiation (03CH05-CB)
Test Software	SPORTON	SENSE	V5.10	-	N.C.R.	N.C.R.	Radiation (03CH05-CB)
3m Semi Anechoic Chamber VSWR	TDK	SAC-3M	03CH06-CB	1GHz ~18GHz 3m	Oct. 01, 2021	Sep. 30, 2022	Radiation (03CH06-CB)
Horn Antenna	SCHWARZBECK	BBHA9120D	BBHA 9120D-1292	1GHz~18GHz	Aug. 04, 2021	Aug. 03, 2022	Radiation (03CH06-CB)
Horn Antenna	Schwarzbeck	BBHA 9170	BBHA9170252	15GHz ~ 40GHz	Aug. 05, 2021	Aug. 04, 2022	Radiation (03CH06-CB)
Pre-Amplifier	Agilent	SGH5265	20211115-1	1GHz ~ 26.5GHz	Jan. 19, 2022	Jan. 18, 2023	Radiation (03CH06-CB)
Pre-Amplifier	-	-	TF-130N-R1	18GHz ~ 40GHz	Jun. 21, 2022	Jun. 20, 2023	Radiation (03CH06-CB)
Spectrum analyzer	R&S	FSP40	100080	9kHz~40GHz	Dec. 24, 2021	Dec. 23, 2022	Radiation (03CH06-CB)
RF Cable-high	Woken	RG402	High Cable-67	1GHz~18GHz	Feb. 24, 2022	Feb. 23, 2023	Radiation (03CH06-CB)



Instrument	Brand	Model No.	Serial No.	Characteristics	Calibration Date	Calibration Due Date	Remark
RF Cable-high	Woken	RG402	High Cable-05+67	1GHz~18GHz	Feb. 24, 2022	Feb. 23, 2023	Radiation (03CH06-CB)
High Cable	Woken	WCA0929M	40G#5+7	1GHz ~ 40 GHz	Dec. 14, 2021	Dec. 13, 2022	Radiation (03CH06-CB)
High Cable	Woken	WCA0929M	40G#5	1GHz ~ 40 GHz	Dec. 08, 2021	Dec. 07, 2022	Radiation (03CH06-CB)
High Cable	Woken	WCA0929M	40G#7	1GHz ~ 40 GHz	Dec. 14, 2021	Dec. 13, 2022	Radiation (03CH06-CB)
Test Software	SPORTON	SENSE	V5.10	-	N.C.R.	N.C.R.	Radiation (03CH06-CB)
3m Semi Anechoic Chamber VSWR	TDK	SAC-3M	03CH03-CB	1GHz ~18GHz 3m	May 05, 2022	May 04, 2023	Radiation (03CH03-CB)
Horn Antenna	ETS • Lindgren	3115	6821	750MHz~18GHz	Jan. 21, 2022	Jan. 20, 2023	Radiation (03CH03-CB)
Horn Antenna	Schwarzbeck	BBHA 9170	BBHA9170252	15GHz ~ 40GHz	Aug. 05, 2021	Aug. 04, 2022	Radiation (03CH03-CB)
Pre-Amplifier	Agilent	8449B	3008A02097	1GHz ~ 26.5GHz	Jul. 01, 2022	Jun. 30, 2023	Radiation (03CH03-CB)
Pre-Amplifier	-	-	TF-130N-R1	18GHz ~ 40GHz	Jun. 21, 2022	Jun. 20, 2023	Radiation (03CH03-CB)
Spectrum Analyzer	R&S	FSP40	100019	9kHz ~ 40GHz	Jun. 10, 2022	Jun. 09, 2023	Radiation (03CH03-CB)
RF Cable-high	Woken	RG402	High Cable-20+29	1GHz ~ 18GHz	Oct. 04, 2021	Oct. 03, 2022	Radiation (03CH03-CB)
RF Cable-high	Woken	RG402	High Cable-29	1GHz ~ 18GHz	Oct. 04, 2021	Oct. 03, 2022	Radiation (03CH03-CB)
High Cable	Woken	WCA0929M	40G#5+7	1GHz ~ 40 GHz	Dec. 14, 2021	Dec. 13, 2022	Radiation (03CH03-CB)
High Cable	Woken	WCA0929M	40G#5	1GHz ~ 40 GHz	Dec. 08, 2021	Dec. 07, 2022	Radiation (03CH03-CB)
High Cable	Woken	WCA0929M	40G#7	1GHz ~ 40 GHz	Dec. 14, 2021	Dec. 13, 2022	Radiation (03CH03-CB)
Test Software	SPORTON	SENSE	V5.10	-	N.C.R.	N.C.R.	Radiation (03CH03-CB)
Spectrum analyzer	R&S	FSV40	100979	9kHz~40GHz	May 27, 2022	May 26, 2023	Conducted (TH01-CB)
RF Cable-high	Woken	RG402	High Cable-06	1 GHz – 26.5 GHz	Oct. 04, 2021	Oct. 03, 2022	Conducted (TH01-CB)
RF Cable-high	Woken	RG402	High Cable-07	1 GHz –26.5 GHz	Oct. 04, 2021	Oct. 03, 2022	Conducted (TH01-CB)
RF Cable-high	Woken	RG402	High Cable-08	1 GHz –26.5 GHz	Oct. 04, 2021	Oct. 03, 2022	Conducted (TH01-CB)
RF Cable-high	Woken	RG402	High Cable-09	1 GHz –26.5 GHz	Oct. 04, 2021	Oct. 03, 2022	Conducted (TH01-CB)
RF Cable-high	Woken	RG402	High Cable-10	1 GHz –26.5 GHz	Oct. 04, 2021	Oct. 03, 2022	Conducted (TH01-CB)
RF Cable-high	Woken	RG402	High Cable-30	1 GHz –26.5 GHz	Oct. 04, 2021	Oct. 03, 2022	Conducted (TH01-CB)



Instrument	Brand	Model No.	Serial No.	Characteristics	Calibration Date	Calibration Due Date	Remark
Switch	SPTCB	SP-SWI	SWI-01	1 GHz –26.5 GHz	Dec. 13, 2021	Dec. 12, 2022	Conducted (TH01-CB)
RF Cable-high	Woken	RG402	SWI-01-P1	1 GHz –26.5 GHz	Dec. 13, 2021	Dec. 12, 2022	Conducted (TH01-CB)
RF Cable-high	Woken	RG402	SWI-01-P2	1 GHz –26.5 GHz	Dec. 13, 2021	Dec. 12, 2022	Conducted (TH01-CB)
RF Cable-high	Woken	RG402	SWI-01-P3	1 GHz –26.5 GHz	Dec. 13, 2021	Dec. 12, 2022	Conducted (TH01-CB)
RF Cable-high	Woken	RG402	SWI-01-P4	1 GHz –26.5 GHz	Dec. 13, 2021	Dec. 12, 2022	Conducted (TH01-CB)
RF Cable-high	Woken	RG402	SWI-01-P5	1 GHz –26.5 GHz	Dec. 13, 2021	Dec. 12, 2022	Conducted (TH01-CB)
Power Sensor	Agilent	E9327A	US40442088	50MHz~18GHz	Feb. 21, 2022	Feb. 20, 2023	Conducted (TH01-CB)
Power Meter	Agilent	E4416A	GB41291199	50MHz~18GHz	Feb. 21, 2022	Feb. 20, 2023	Conducted (TH01-CB)
Test Software	SPORTON	SENSE	V5.10	-	N.C.R.	N.C.R.	Conducted (TH01-CB)

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

NCR means Non-Calibration required.



Conducted Emissions at Powerline

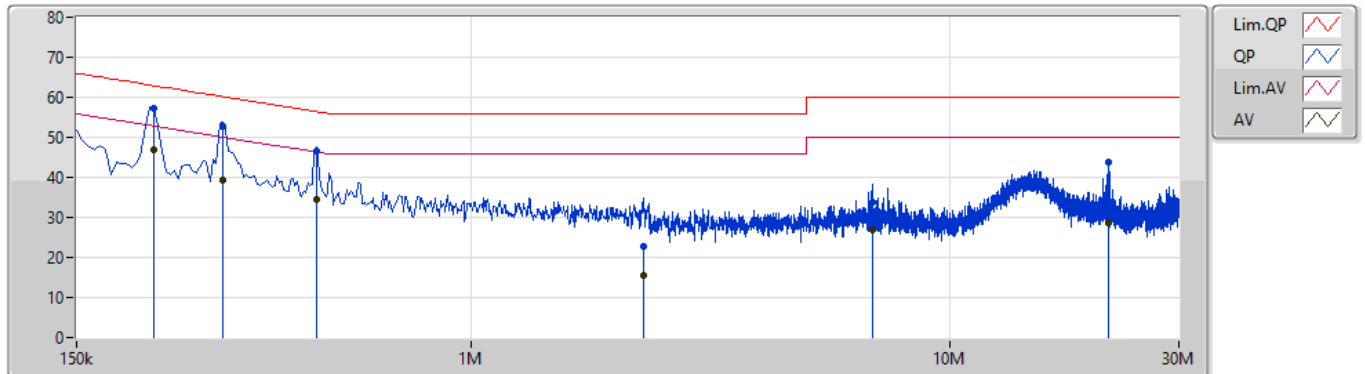
Appendix A

Summary

Mode	Result	Type	Freq (Hz)	Level (dBuV)	Limit (dBuV)	Margin (dB)	Condition
Mode 4	Pass	QP	217.5k	57.87	62.92	-5.05	Neutral

Mode 4

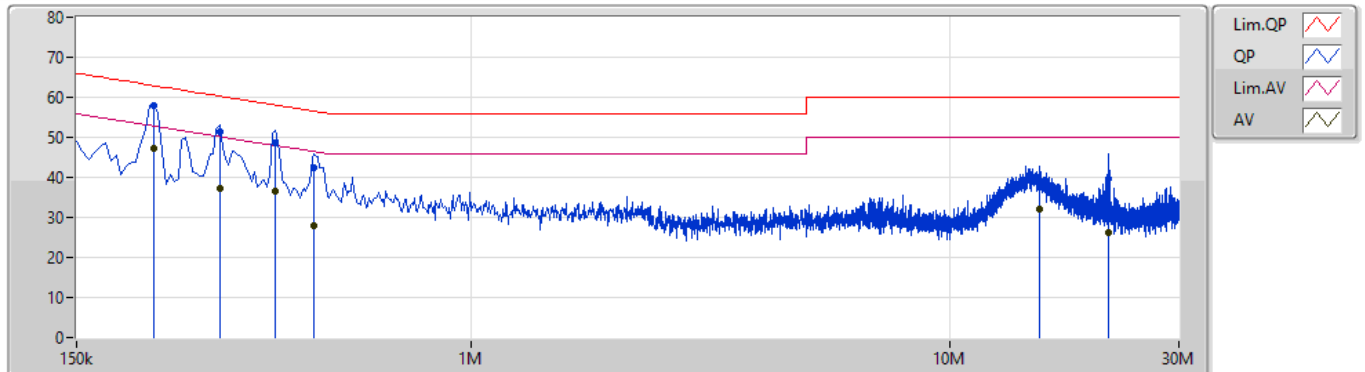
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Type	Freq (Hz)	Level (dBuV)	Limit (dBuV)	Margin (dB)	Factor (dB)	Condition	Comment	Raw (dBuV)	LISN (dB)	CL (dB)	AT (dB)			
QP	217.5k	57.34	62.92	-5.58	9.99	Line	"Worst"	47.35	0.06	0.04	9.89			
AV	217.5k	46.81	52.92	-6.11	9.99	Line	-	36.82	0.06	0.04	9.89			
QP	303k	52.82	60.17	-7.35	10.00	Line	-	42.82	0.06	0.05	9.89			
AV	303k	39.25	50.17	-10.92	10.00	Line	-	29.25	0.06	0.05	9.89			
QP	474k	46.40	56.44	-10.04	10.01	Line	-	36.39	0.06	0.06	9.89			
AV	474k	34.56	46.44	-11.88	10.01	Line	-	24.55	0.06	0.06	9.89			
QP	2.297M	22.72	56.00	-33.28	10.08	Line	-	12.64	0.10	0.09	9.89			
AV	2.297M	15.47	46.00	-30.53	10.08	Line	-	5.39	0.10	0.09	9.89			
QP	6.878M	33.69	60.00	-26.31	10.22	Line	-	23.47	0.18	0.14	9.90			
AV	6.878M	26.95	50.00	-23.05	10.22	Line	-	16.73	0.18	0.14	9.90			
QP	21.35M	43.81	60.00	-16.19	10.52	Line	-	33.29	0.32	0.24	9.96			
AV	21.35M	28.78	50.00	-21.22	10.52	Line	-	18.26	0.32	0.24	9.96			

Mode 4

02/08/2022



Type	Freq (Hz)	Level (dBuV)	Limit (dBuV)	Margin (dB)	Factor (dB)	Condition	Comment	Raw (dBuV)	LISN (dB)	CL (dB)	AT (dB)			
QP	217.5k	57.87	62.92	-5.05	10.00	Neutral	"Worst"	47.87	0.07	0.04	9.89			
AV	217.5k	47.34	52.92	-5.58	10.00	Neutral	-	37.34	0.07	0.04	9.89			
QP	298.5k	51.22	60.28	-9.06	10.01	Neutral	-	41.21	0.07	0.05	9.89			
AV	298.5k	37.18	50.28	-13.10	10.01	Neutral	-	27.17	0.07	0.05	9.89			
QP	388.5k	48.50	58.10	-9.60	10.02	Neutral	-	38.48	0.07	0.06	9.89			
AV	388.5k	36.57	48.10	-11.53	10.02	Neutral	-	26.55	0.07	0.06	9.89			
QP	469.5k	42.56	56.52	-13.96	10.02	Neutral	-	32.54	0.07	0.06	9.89			
AV	469.5k	27.88	46.52	-18.64	10.02	Neutral	-	17.86	0.07	0.06	9.89			
QP	15.342M	37.99	60.00	-22.01	10.39	Neutral	-	27.60	0.28	0.17	9.94			
AV	15.342M	32.17	50.00	-17.83	10.39	Neutral	-	21.78	0.28	0.17	9.94			
QP	21.404M	39.61	60.00	-20.39	10.50	Neutral	-	29.11	0.30	0.24	9.96			
AV	21.404M	26.31	50.00	-23.69	10.50	Neutral	-	15.81	0.30	0.24	9.96			

Summary

Mode	Max-N dB (Hz)	Max-OBW (Hz)	ITU-Code	Min-N dB (Hz)	Min-OBW (Hz)
2.4-2.4835GHz	-	-	-	-	-
Zigbee	1.644M	2.268M	2M27G1D	1.638M	2.261M

Max-N dB = Maximum 6dB down bandwidth; Max-OBW = Maximum 99% occupied bandwidth;
Min-N dB = Minimum 6dB down bandwidth; Min-OBW = Minimum 99% occupied bandwidth

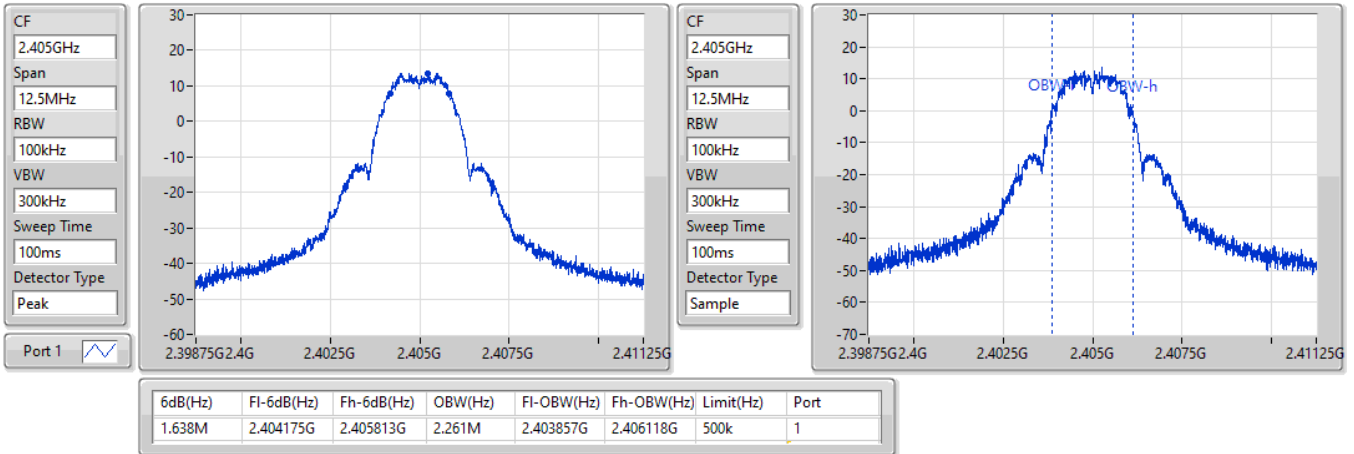
Result

Mode	Result	Limit (Hz)	Port 1-N dB (Hz)	Port 1-OBW (Hz)
Zigbee	-	-	-	-
2405MHz	Pass	500k	1.638M	2.261M
2440MHz	Pass	500k	1.638M	2.268M
2480MHz	Pass	500k	1.644M	2.268M

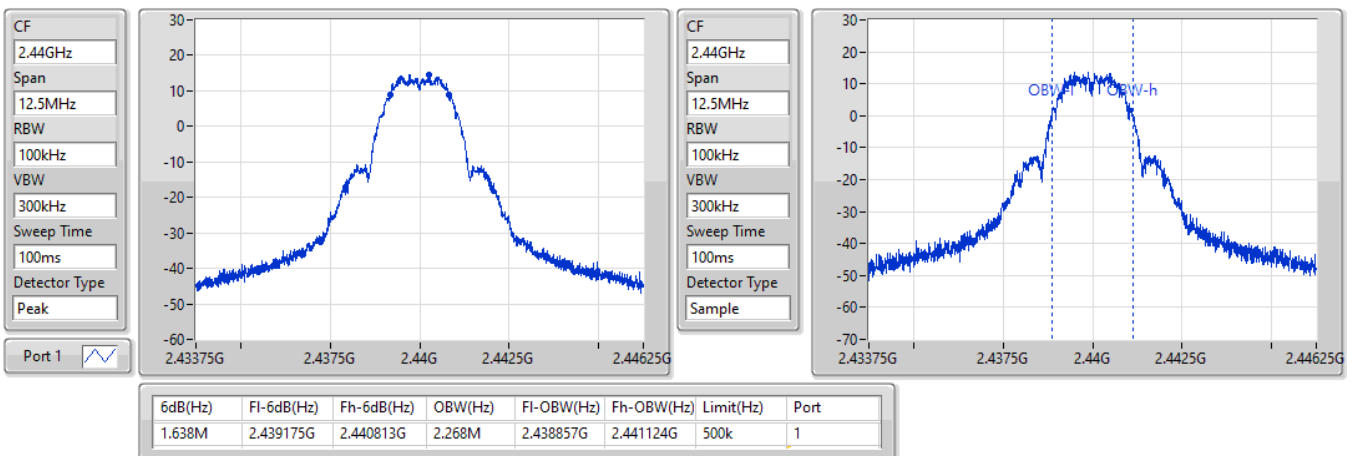
Port X-N dB = Port X 6dB down bandwidth;
Port X-OBW = Port X 99% occupied bandwidth

Zigbee
2405MHz
EBW

13/07/2022


Zigbee
2440MHz
EBW

13/07/2022

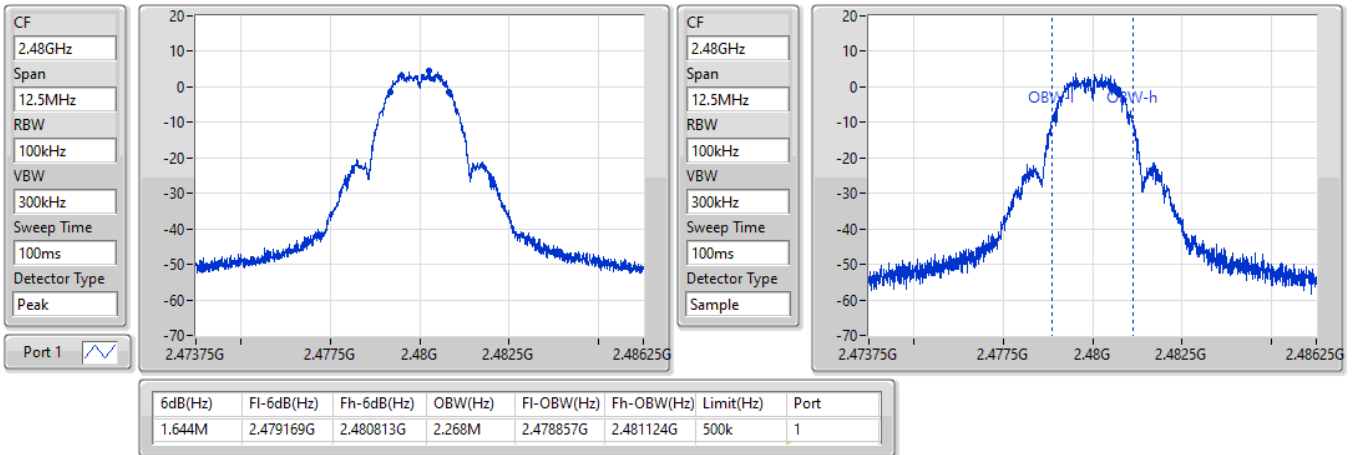


Zigbee

2480MHz

EBW

13/07/2022



Summary

Mode	Total Power (dBm)	Total Power (W)
2.4-2.4835GHz	-	-
Zigbee	18.19	0.06592

Result

Mode	Result	DG (dBi)	Port 1 (dBm)	Total Power (dBm)	Power Limit (dBm)
Zigbee	-	-	-	-	-
2405MHz	Pass	5.18	17.36	17.36	30.00
2440MHz	Pass	5.18	18.19	18.19	30.00
2475MHz	Pass	5.18	18.02	18.02	30.00
2480MHz	Pass	5.18	8.09	8.09	30.00

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

Summary

Mode	PD (dBm/RBW)
2.4-2.4835GHz	-
Zigbee	1.73

RBW = 3kHz;

Result

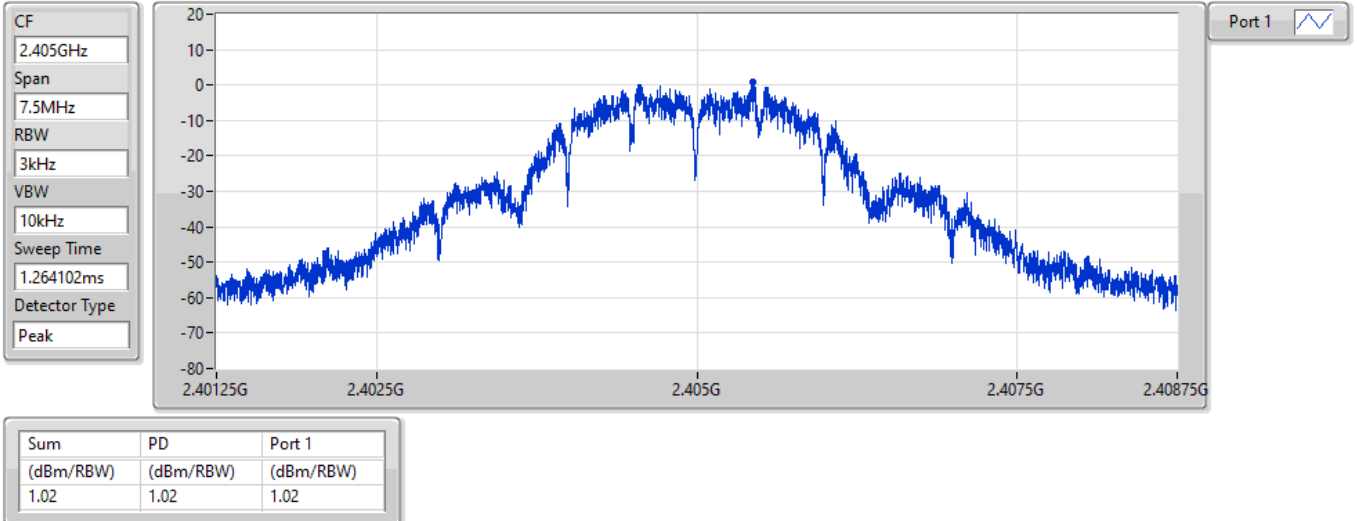
Mode	Result	DG (dBi)	Port 1 (dBm/RBW)	PD (dBm/RBW)	PD Limit (dBm/RBW)
Zigbee	-	-	-	-	-
2405MHz	Pass	5.18	1.02	1.02	8.00
2440MHz	Pass	5.18	1.73	1.73	8.00
2480MHz	Pass	5.18	-8.29	-8.29	8.00

DG = Directional Gain; RBW = 3kHz;
PD = trace bin-by-bin of each transmits port summing can be performed maximum power density; Port X = Port X Power Density;

Zigbee

2405MHz

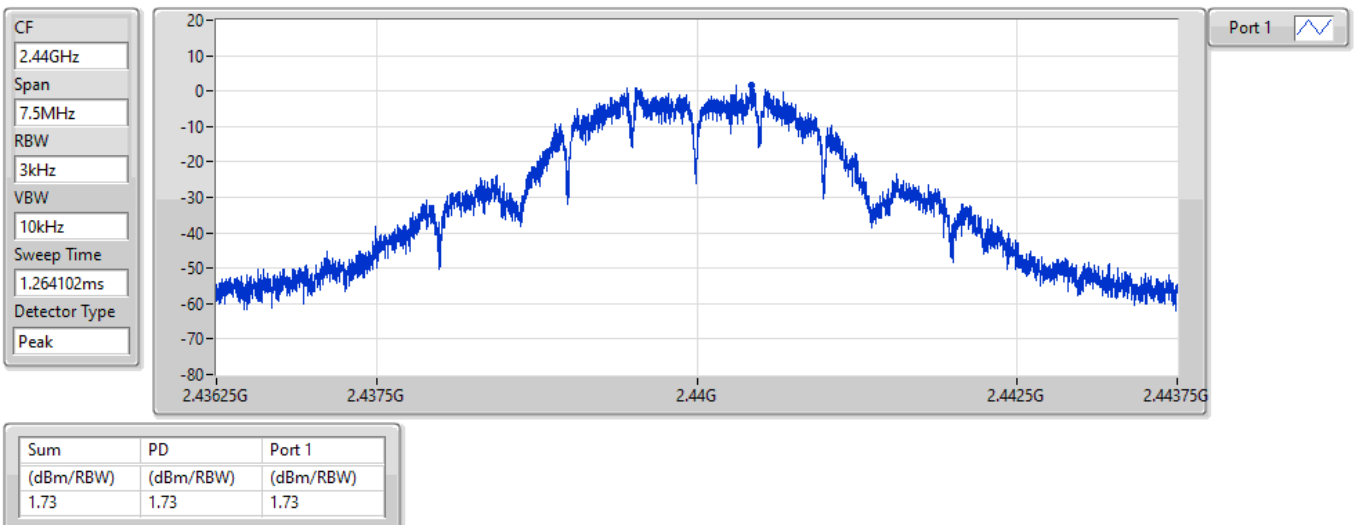
13/07/2022



Zigbee

2440MHz

13/07/2022

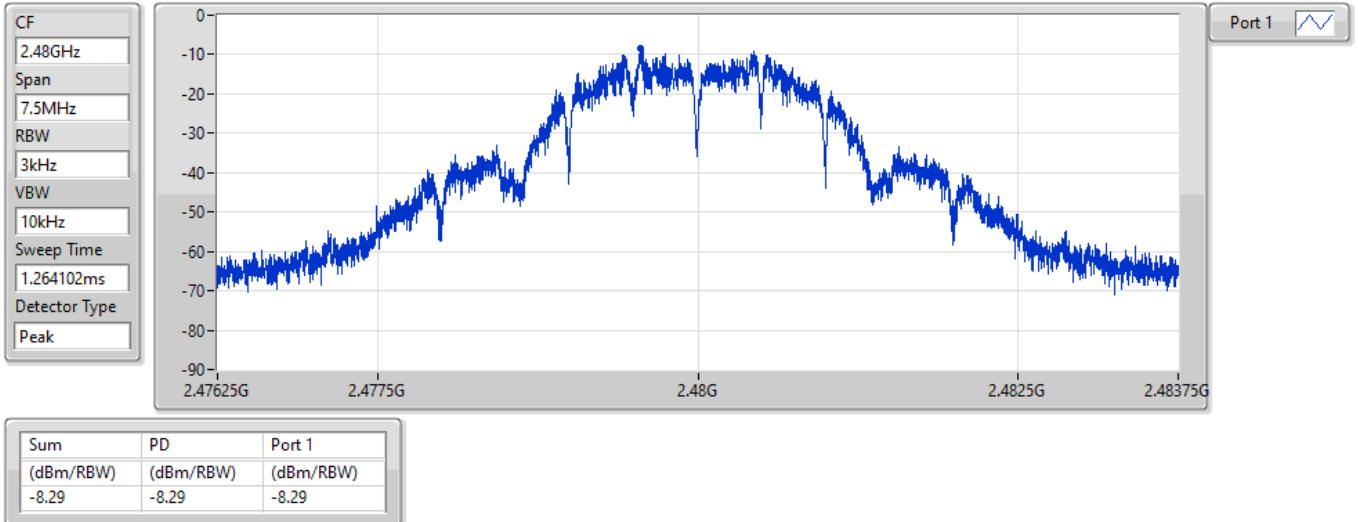


Zigbee

2480MHz

PSD

13/07/2022



Summary

Mode	Result	Ref (Hz)	Ref (dBm)	Limit (dBm)	Freq (Hz)	Level (dBm)	Freq (Hz)	Level (dBm)	Freq (Hz)	Level (dBm)	Freq (Hz)	Level (dBm)	Freq (Hz)	Level (dBm)	Port
2.4-2.4835GHz	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Zigbee	Pass	2.44025G	14.64	-15.36	687.26M	-51.94	2.39988G	-38.99	2.4G	-43.21	2.48996G	-50.73	7.21705G	-34.90	1

Result

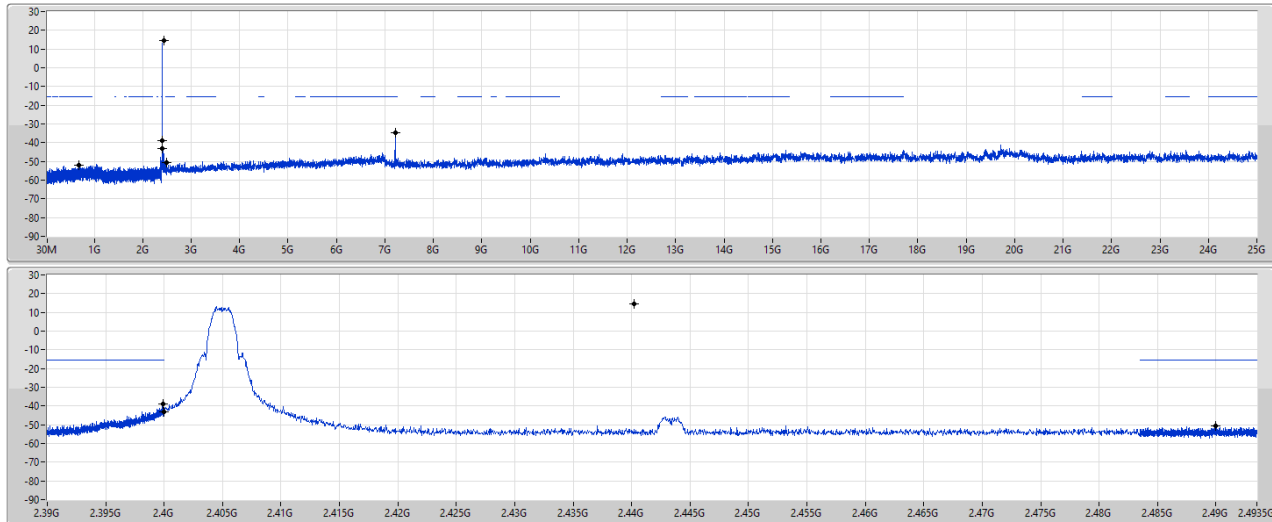
Mode	Result	Ref (Hz)	Ref (dBm)	Limit (dBm)	Freq (Hz)	Level (dBm)	Freq (Hz)	Level (dBm)	Freq (Hz)	Level (dBm)	Freq (Hz)	Level (dBm)	Freq (Hz)	Level (dBm)	Port
Zigbee	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2405MHz	Pass	2.44025G	14.64	-15.36	687.26M	-51.94	2.39988G	-38.99	2.4G	-43.21	2.48996G	-50.73	7.21705G	-34.90	1
2440MHz	Pass	2.44025G	14.64	-15.36	904.38M	-51.91	2.39471G	-50.82	2.4835G	-54.17	2.48476G	-50.70	17.69383G	-44.35	1
2480MHz	Pass	2.44025G	14.64	-15.36	650.09M	-51.47	2.3989G	-50.85	2.4835G	-44.83	2.48351G	-44.42	17.28308G	-44.44	1

Zigbee 2405MHz

CSENdB

13/07/2022

Port 1



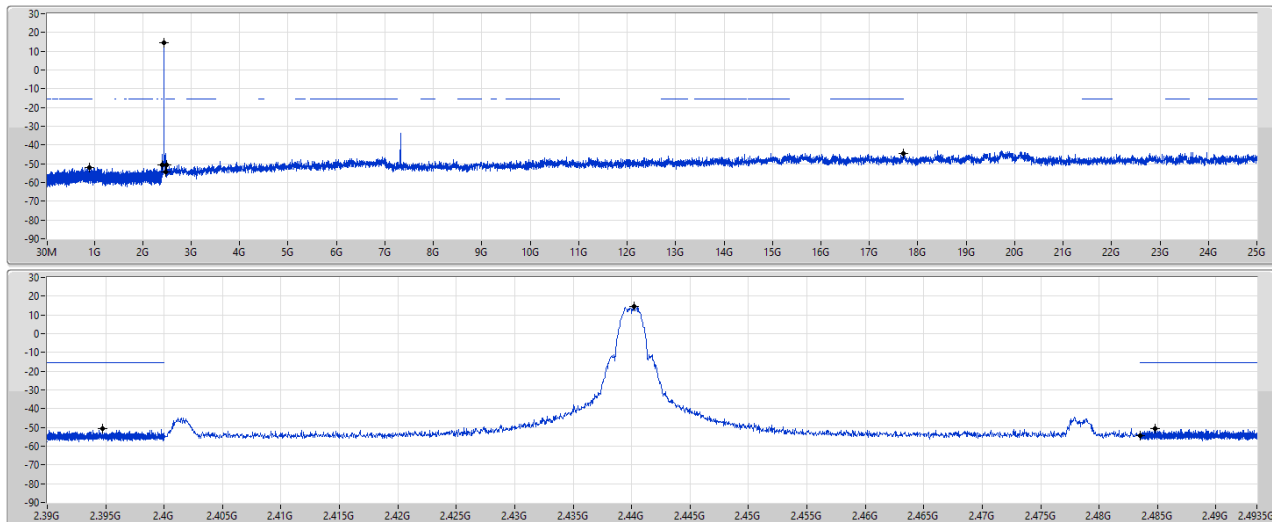
Ref(Hz)	Ref(dBm)	Limit(dBm)	Freq(Hz)	Level(dBm)	Freq(Hz)	Level(dBm)	Freq(Hz)	Level(dBm)	Freq(Hz)	Level(dBm)	Freq(Hz)	Level(dBm)	Port
2.44025G	14.64	-15.36	687.26M	-51.94	2.39988G	-38.99	2.4G	-43.21	2.48996G	-50.73	7.21705G	-34.90	1

Zigbee 2440MHz

CSENdB

13/07/2022

Port 1



Ref(Hz)	Ref(dBm)	Limit(dBm)	Freq(Hz)	Level(dBm)	Freq(Hz)	Level(dBm)	Freq(Hz)	Level(dBm)	Freq(Hz)	Level(dBm)	Freq(Hz)	Level(dBm)	Port
2.44025G	14.64	-15.36	904.38M	-51.91	2.39471G	-50.82	2.4835G	-54.17	2.48476G	-50.70	17.69383G	-44.35	1

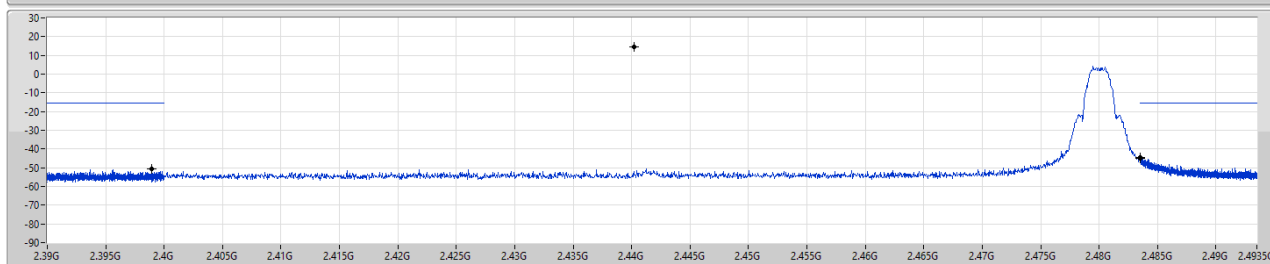
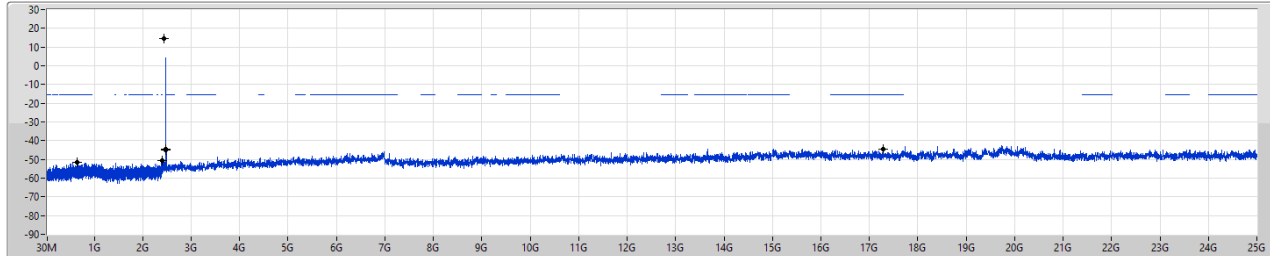
Zigbee

2480MHz

CSEndB

13/07/2022

Port 1



RBW (Hz)
100K
VBW (Hz)
300K
Detector
Peak

Ref(Hz)	Ref(dBm)	Limit(dBm)	Freq(Hz)	Level(dBm)	Freq(Hz)	Level(dBm)	Freq(Hz)	Level(dBm)	Freq(Hz)	Level(dBm)	Freq(Hz)	Level(dBm)	Port
2.44025G	14.64	-15.36	650.09M	-51.47	2.3989G	-50.85	2.4835G	-44.83	2.48351G	-44.42	17.28308G	-44.44	1



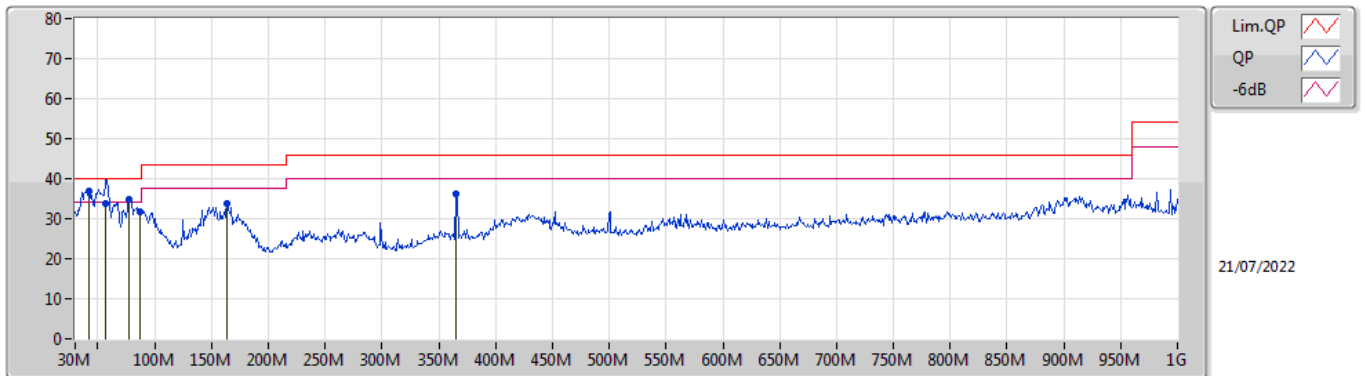
Radiated Emissions below 1GHz

Appendix F.1

Summary

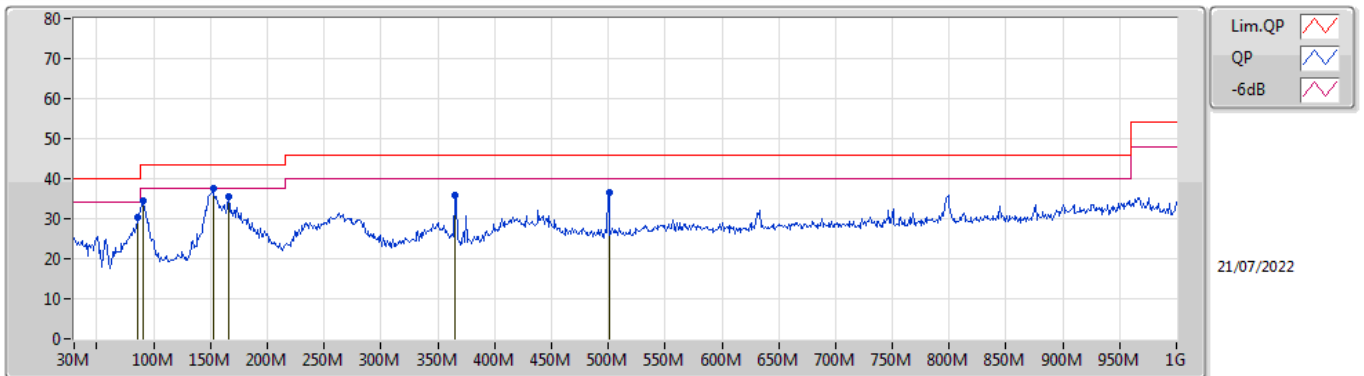
Mode	Result	Type	Freq (Hz)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Condition
Mode 2	Pass	PK	42.61M	36.89	40.00	-3.11	Vertical

Mode 2



Type	Freq (Hz)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Factor (dB/m)	Dist (m)	Condition	Azimuth (°)	Height (m)	Comment	Raw (dBuV/m)	AF (dB/m)	CL (dB)	PA (dB)
PK	42.61M	36.89	40.00	-3.11	-13.61	3	Vertical	358	1.00	"Worst"	50.50	17.23	0.95	31.79
QP	57.16M	33.77	40.00	-6.23	-18.33	3	Vertical	305	1.00	-	52.10	12.43	1.14	31.90
PK	77.53M	34.83	40.00	-5.17	-18.14	3	Vertical	209	1.00	-	52.97	12.49	1.35	31.98
PK	87.23M	31.59	40.00	-8.41	-16.49	3	Vertical	113	1.50	-	48.08	14.02	1.44	31.95
PK	163.86M	33.87	43.50	-9.63	-14.29	3	Vertical	360	1.00	-	48.16	15.67	2.02	31.98
PK	364.65M	36.31	46.00	-9.69	-8.40	3	Vertical	153	1.25	-	44.71	20.71	3.06	32.17

Mode 2



Type	Freq (Hz)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Factor (dB/m)	Dist (m)	Condition	Azimuth (°)	Height (m)	Comment	Raw (dBuV/m)	AF (dB/m)	CL (dB)	PA (dB)
PK	86.26M	30.31	40.00	-9.69	-16.63	3	Horizontal	157	2.00	-	46.94	13.89	1.43	31.95
PK	91.11M	34.33	43.50	-9.17	-15.53	3	Horizontal	173	2.00	-	49.86	14.95	1.48	31.96
PK	152.22M	37.46	43.50	-6.04	-13.90	3	Horizontal	142	1.50	"Worst"	51.36	16.18	1.92	32.00
PK	165.8M	35.57	43.50	-7.93	-14.33	3	Horizontal	120	1.25	-	49.90	15.63	2.03	31.99
PK	364.65M	35.95	46.00	-10.05	-8.40	3	Horizontal	188	1.00	-	44.35	20.71	3.06	32.17
PK	500.45M	36.69	46.00	-9.31	-5.60	3	Horizontal	93	1.50	-	42.29	23.20	3.60	32.40

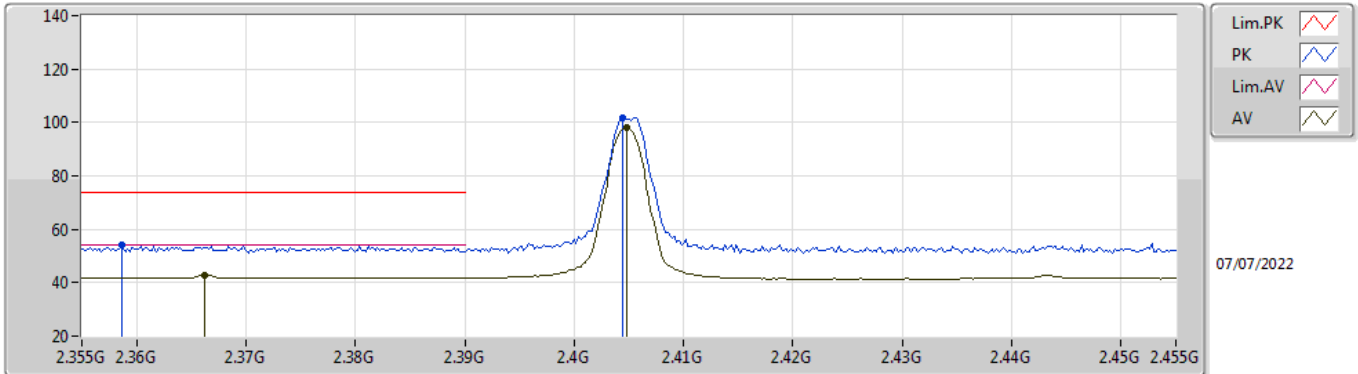


Summary

Mode	Result	Type	Freq (Hz)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Dist (m)	Condition	Azimuth (°)	Height (m)	Comments
2.4-2.4835GHz	-	-	-	-	-	-	-	-	-	-	-
Zigbee_Nss1_1TX	Pass	AV	2.4835G	53.94	54.00	-0.06	3	Horizontal	360	2.33	-

Zigbee_Nss1_1TX

2405MHz_TX

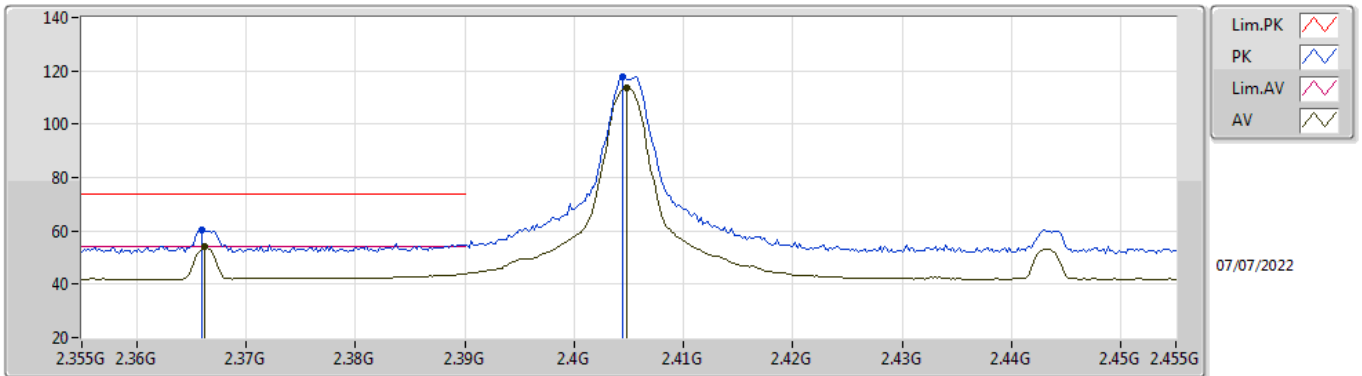


EUT Y_1TX
Setting 19
06-F-S-5

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	2.3586G	54.38	74.00	-19.62	22.80	3	Vertical	134	2.97	-	27.73	3.85	-
AV	2.3662G	42.90	54.00	-11.10	11.37	3	Vertical	134	2.97	-	27.67	3.86	-
PK	2.4044G	101.70	Inf	-Inf	70.42	3	Vertical	134	2.97	-	27.38	3.90	-
AV	2.4048G	97.94	Inf	-Inf	66.66	3	Vertical	134	2.97	-	27.38	3.90	-

Zigbee_Nss1_1TX

2405MHz_TX

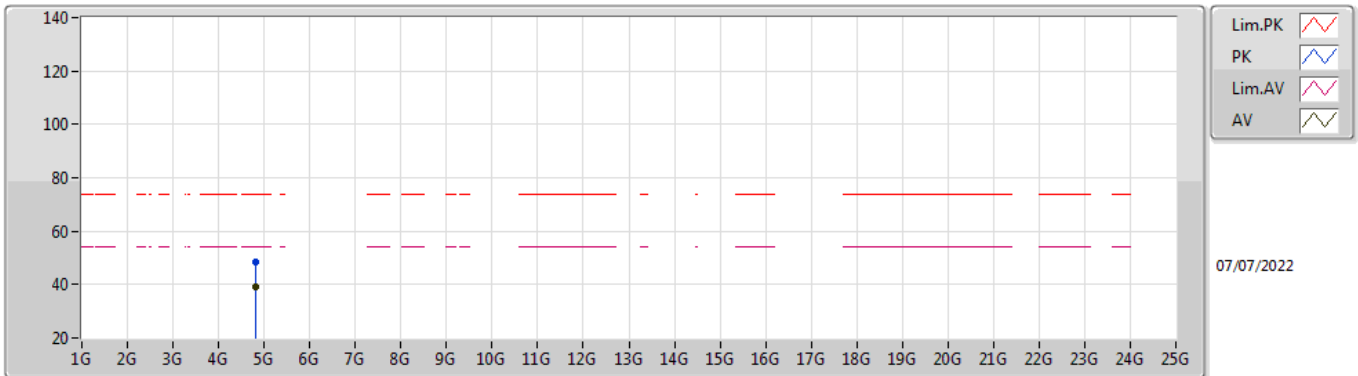


EUT_V_1TX
Setting 19
06-F-S-5

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	2.366G	60.26	74.00	-13.74	28.73	3	Horizontal	358	2.41	-	27.67	3.86	-	
AV	2.3662G	53.89	54.00	-0.11	22.36	3	Horizontal	358	2.41	-	27.67	3.86	-	
PK	2.4044G	117.52	Inf	-Inf	86.24	3	Horizontal	358	2.41	-	27.38	3.90	-	
AV	2.4048G	113.76	Inf	-Inf	82.48	3	Horizontal	358	2.41	-	27.38	3.90	-	

Zigbee_Nss1_1TX

2405MHz_TX

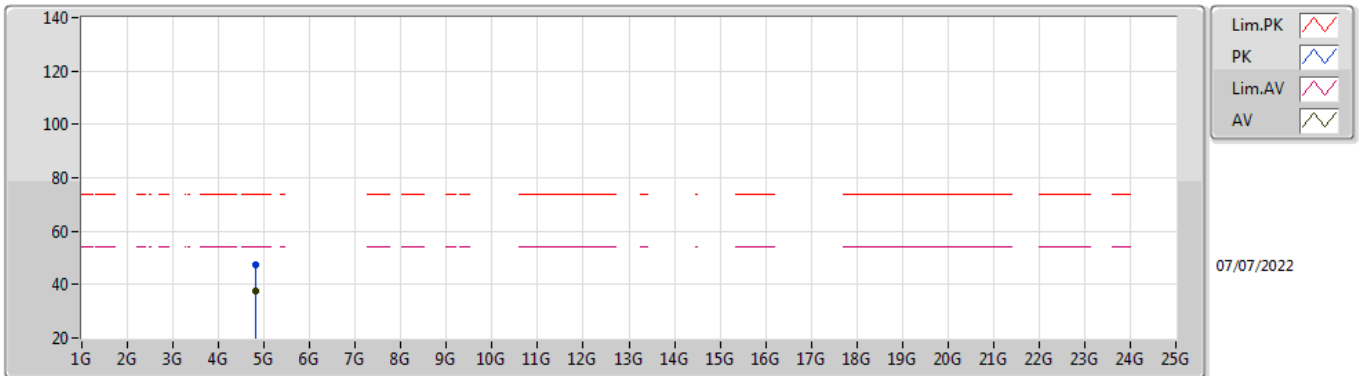


EUT V_1TX
Setting 19
06-F-S-5

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	4.81132G	48.52	74.00	-25.48	55.31	3	Vertical	357	1.63	-	31.08	5.36	43.23
AV	4.8108G	39.16	54.00	-14.84	45.95	3	Vertical	357	1.63	-	31.08	5.36	43.23

Zigbee_Nss1_1TX

2405MHz_TX

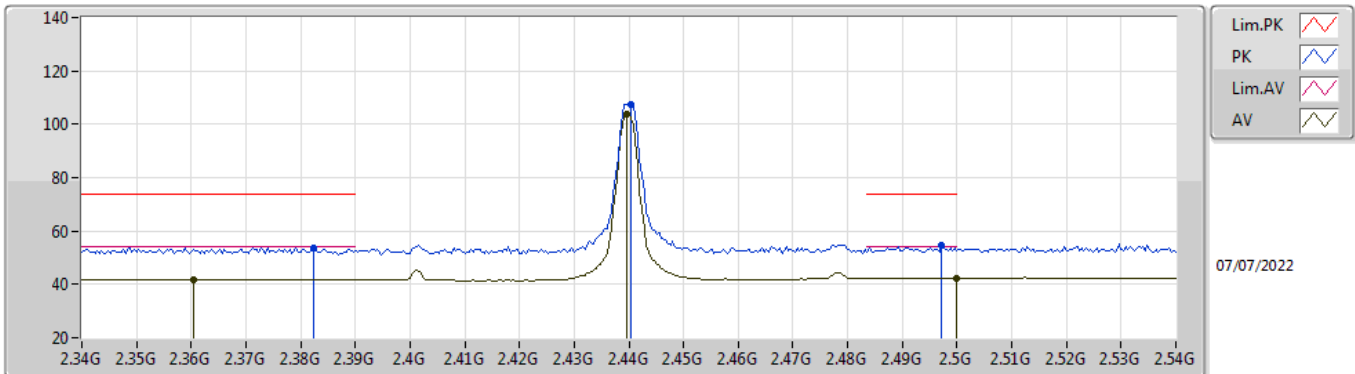


EUT Y_1TX
Setting 19
06-F-S-5

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	4.81084G	47.25	74.00	-26.75	54.04	3	Horizontal	343	1.03	-	31.08	5.36	43.23
AV	4.80876G	37.50	54.00	-16.50	44.29	3	Horizontal	343	1.03	-	31.08	5.36	43.23

Zigbee_Nss1_1TX

2440MHz_TX

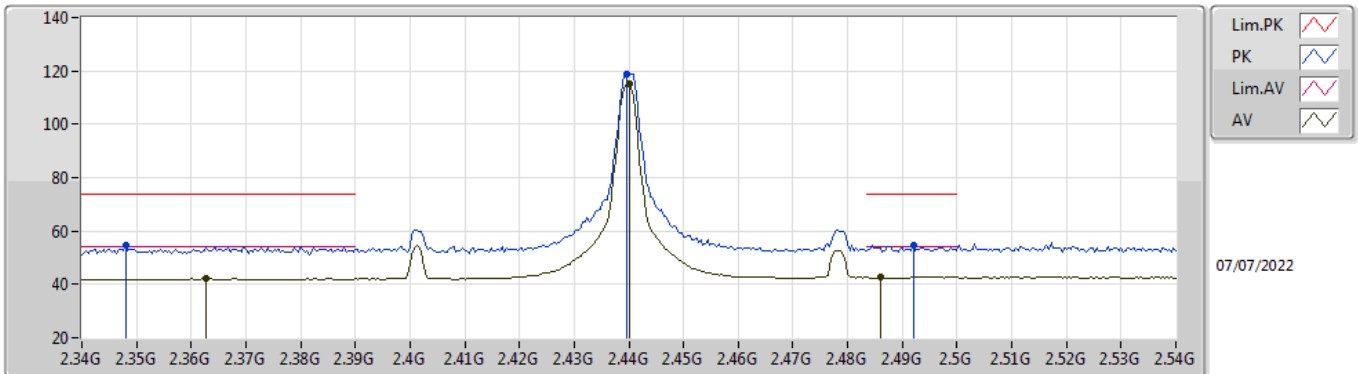


EUT_V_1TX
Setting 20
06-F-S-5

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	2.3824G	53.63	74.00	-20.37	22.21	3	Vertical	302	3.00	-	27.54	3.88	-
AV	2.3604G	41.97	54.00	-12.03	10.40	3	Vertical	302	3.00	-	27.72	3.85	-
PK	2.4404G	107.37	Inf	-Inf	76.22	3	Vertical	302	3.00	-	27.24	3.91	-
AV	2.4396G	103.62	Inf	-Inf	72.47	3	Vertical	302	3.00	-	27.24	3.91	-
PK	2.4972G	54.58	74.00	-19.42	23.38	3	Vertical	302	3.00	-	27.29	3.91	-
AV	2.5G	42.37	54.00	-11.63	11.15	3	Vertical	302	3.00	-	27.30	3.92	-

Zigbee_Nss1_1TX

2440MHz_TX

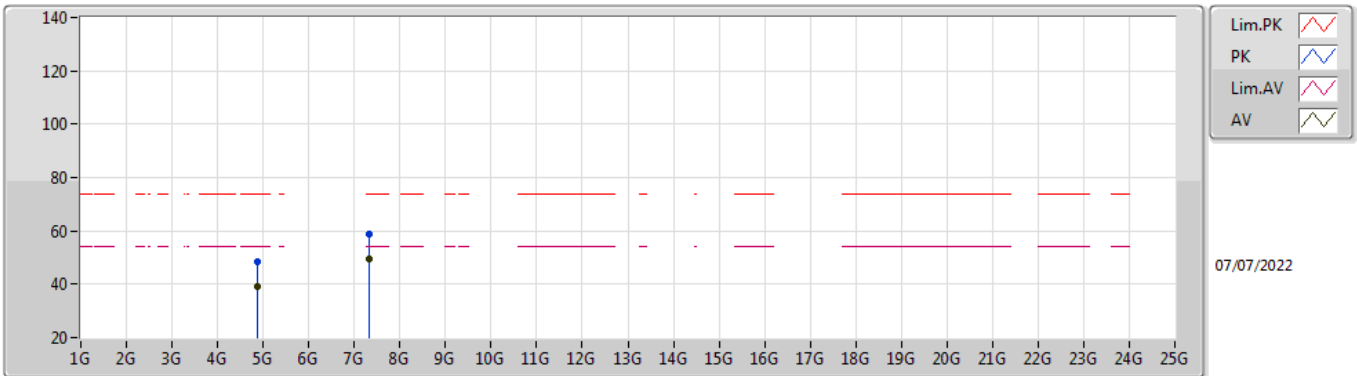


EUT V_1TX
Setting 20
06-F-S-5

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	2.348G	54.50	74.00	-19.50	22.85	3	Horizontal	1	2.41	-	27.81	3.84	-
AV	2.3628G	42.22	54.00	-11.78	10.66	3	Horizontal	1	2.41	-	27.70	3.86	-
PK	2.4396G	118.72	Inf	-Inf	87.57	3	Horizontal	1	2.41	-	27.24	3.91	-
AV	2.44G	114.97	Inf	-Inf	83.82	3	Horizontal	1	2.41	-	27.24	3.91	-
PK	2.492G	54.70	74.00	-19.30	23.51	3	Horizontal	1	2.41	-	27.28	3.91	-
AV	2.486G	42.68	54.00	-11.32	11.50	3	Horizontal	1	2.41	-	27.27	3.91	-

Zigbee_Nss1_1TX

2440MHz_TX

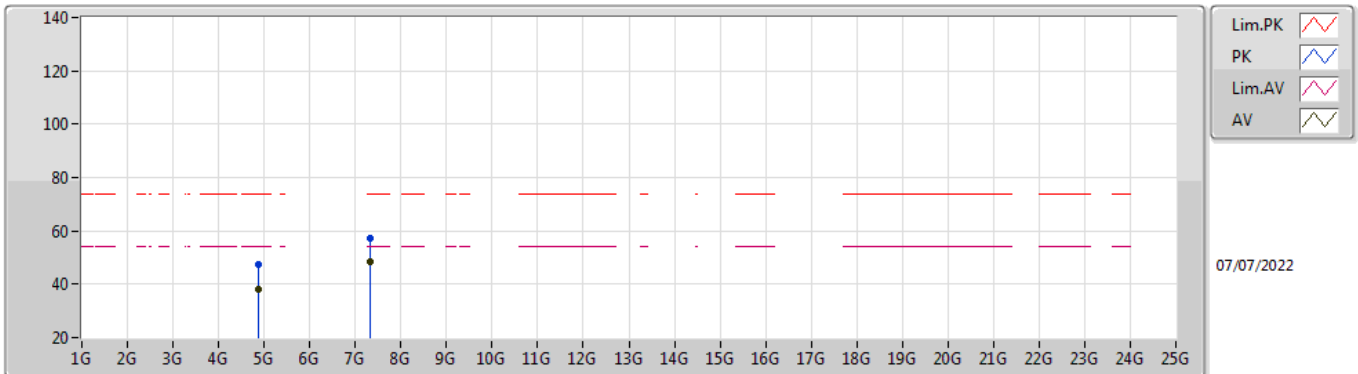


EUT V_1TX
Setting 20
06-F-S-5

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	4.88088G	48.23	74.00	-25.77	54.98	3	Vertical	350	1.57	-	31.06	5.39	43.20
AV	4.87876G	39.08	54.00	-14.92	45.83	3	Vertical	350	1.57	-	31.06	5.39	43.20
PK	7.32148G	58.71	74.00	-15.29	57.71	3	Vertical	20	2.12	-	36.31	6.71	42.02
AV	7.32136G	49.67	54.00	-4.33	48.67	3	Vertical	20	2.12	-	36.31	6.71	42.02

Zigbee_Nss1_1TX

2440MHz_TX

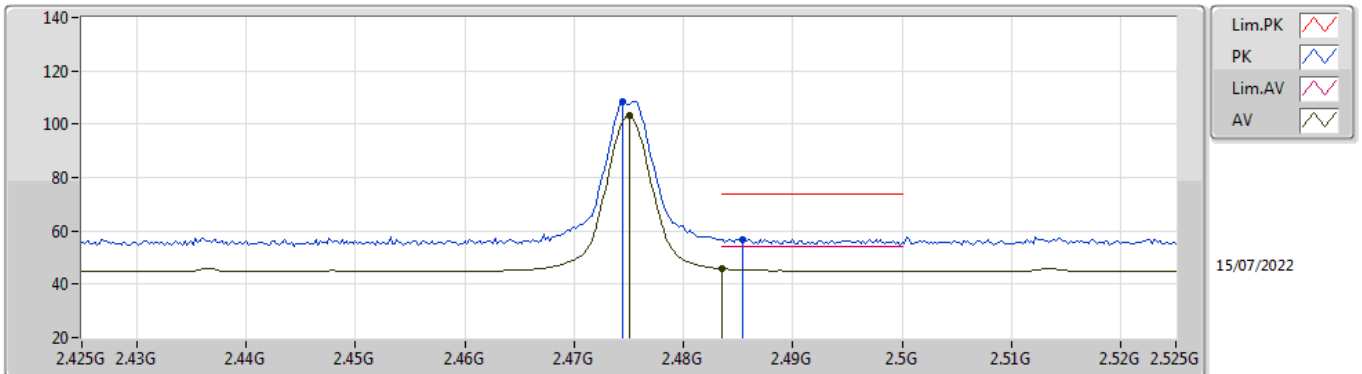


EUT V_1TX
Setting 20
06-F-S-5

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	4.87872G	47.54	74.00	-26.46	54.29	3	Horizontal	328	1.00	-	31.06	5.39	43.20	
AV	4.87876G	37.91	54.00	-16.09	44.66	3	Horizontal	328	1.00	-	31.06	5.39	43.20	
PK	7.31844G	57.31	74.00	-16.69	56.30	3	Horizontal	20	2.03	-	36.33	6.70	42.02	
AV	7.32128G	48.33	54.00	-5.67	47.33	3	Horizontal	20	2.03	-	36.31	6.71	42.02	

Zigbee_Nss1_1TX

2475MHz_TX

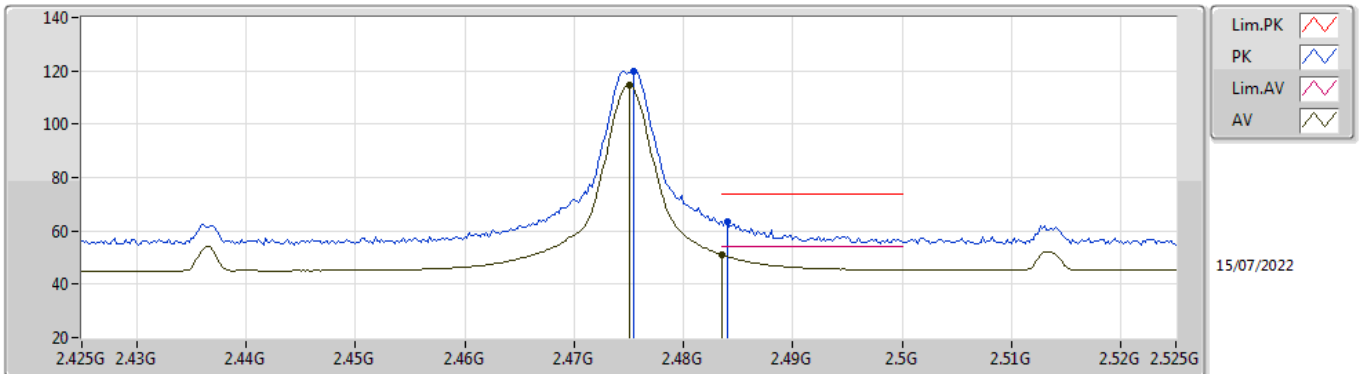


EUT V_1TX
Setting 20
03-D-E-5

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	2.4744G	108.32	Inf	-Inf	75.48	3	Vertical	53	2.75	-	28.40	4.44	-	
AV	2.475G	103.38	Inf	-Inf	70.54	3	Vertical	53	2.75	-	28.40	4.44	-	
PK	2.4854G	56.97	74.00	-17.03	24.09	3	Vertical	53	2.75	-	28.44	4.44	-	
AV	2.4835G	45.83	54.00	-8.17	12.96	3	Vertical	53	2.75	-	28.43	4.44	-	

Zigbee_Nss1_1TX

2475MHz_TX

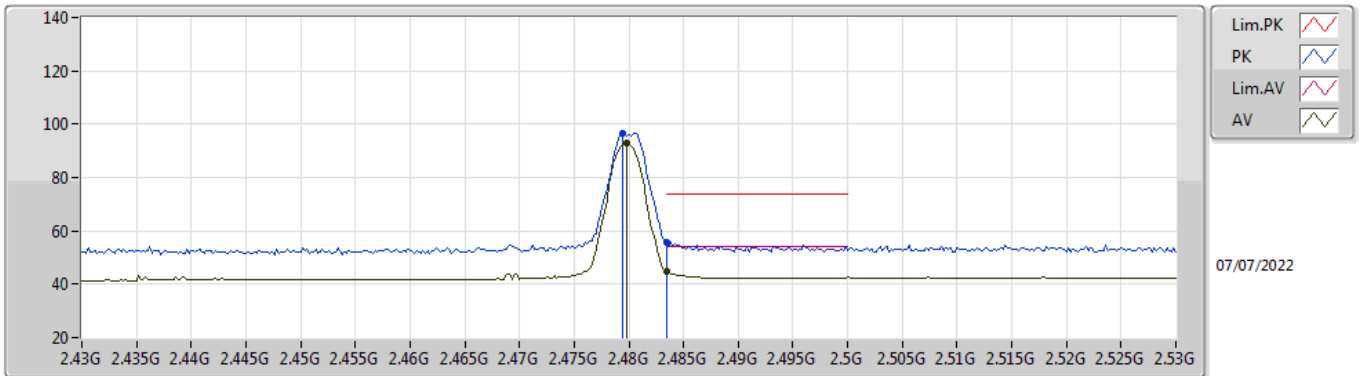


EUT V_1TX
Setting 20
03-D-E-5

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	2.4754G	119.83	Inf	-Inf	86.99	3	Horizontal	2	2.48	-	28.40	4.44	-	
AV	2.475G	114.89	Inf	-Inf	82.05	3	Horizontal	2	2.48	-	28.40	4.44	-	
PK	2.484G	63.32	74.00	-10.68	30.44	3	Horizontal	2	2.48	-	28.44	4.44	-	
AV	2.4835G	51.13	54.00	-2.87	18.26	3	Horizontal	2	2.48	-	28.43	4.44	-	

Zigbee_Nss1_1TX

2480MHz_TX

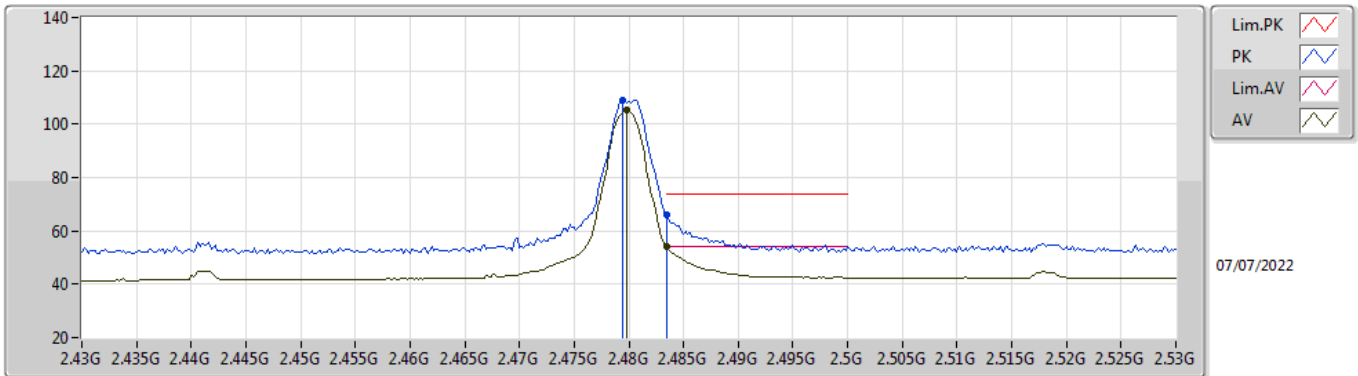


EUT V_1TX
Setting 10
06-F-S-5

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	2.4794G	96.58	Inf	-Inf	65.41	3	Vertical	302	2.81	-	27.26	3.91	-	
AV	2.4798G	92.82	Inf	-Inf	61.65	3	Vertical	302	2.81	-	27.26	3.91	-	
PK	2.4835G	55.94	74.00	-18.06	24.76	3	Vertical	302	2.81	-	27.27	3.91	-	
AV	2.4835G	44.78	54.00	-9.22	13.60	3	Vertical	302	2.81	-	27.27	3.91	-	

Zigbee_Nss1_1TX

2480MHz_TX

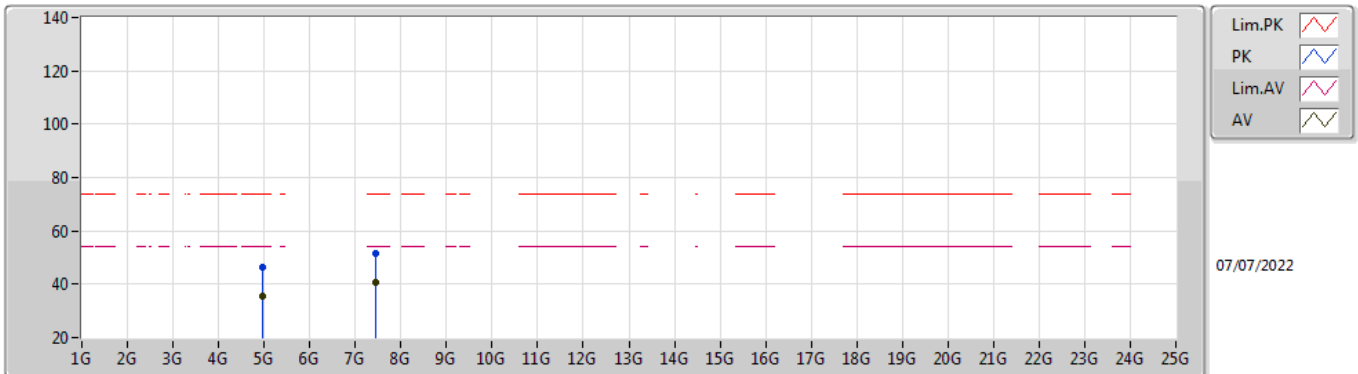


EUT_V_1TX
Setting 10
06-F-S-5

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	2.4794G	108.91	Inf	-Inf	77.74	3	Horizontal	360	2.33	-	27.26	3.91	-	
AV	2.4798G	105.17	Inf	-Inf	74.00	3	Horizontal	360	2.33	-	27.26	3.91	-	
PK	2.4835G	66.09	74.00	-7.91	34.91	3	Horizontal	360	2.33	-	27.27	3.91	-	
AV	2.4835G	53.94	54.00	-0.06	22.76	3	Horizontal	360	2.33	-	27.27	3.91	-	

Zigbee_Nss1_1TX

2480MHz_TX

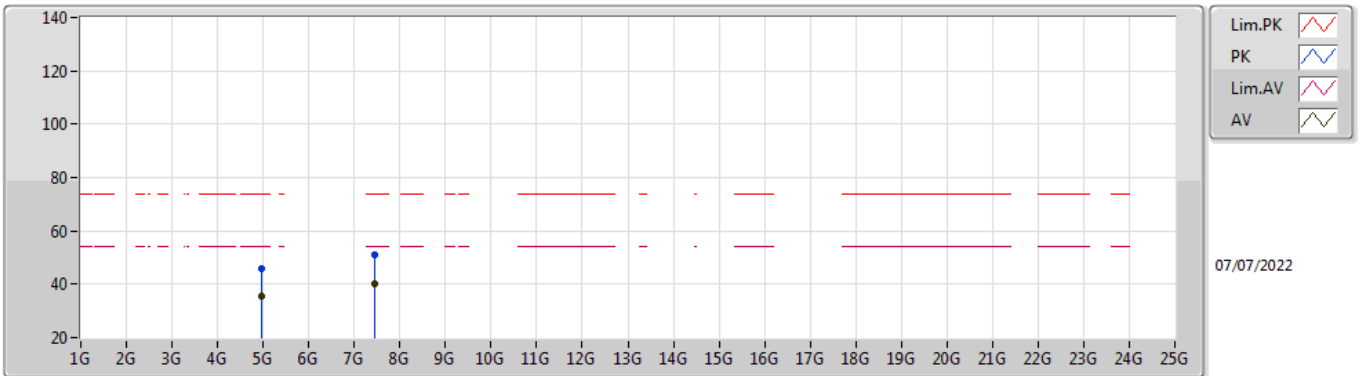


EUT V_1TX
Setting 10
06-F-S-5

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	4.96106G	46.40	74.00	-27.60	52.85	3	Vertical	354	1.56	-	31.30	5.42	43.17	
AV	4.96088G	35.50	54.00	-18.50	41.95	3	Vertical	354	1.56	-	31.30	5.42	43.17	
PK	7.44136G	51.52	74.00	-22.48	50.55	3	Vertical	17	1.77	-	36.17	6.79	41.99	
AV	7.44134G	40.87	54.00	-13.13	39.90	3	Vertical	17	1.77	-	36.17	6.79	41.99	

Zigbee_Nss1_1TX

2480MHz_TX



EUT_V_1TX
Setting 10
06-F-S-5

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	4.95886G	45.94	74.00	-28.06	52.39	3	Horizontal	0	1.00	-	31.30	5.42	43.17
AV	4.96082G	35.29	54.00	-18.71	41.74	3	Horizontal	0	1.00	-	31.30	5.42	43.17
PK	7.44168G	51.23	74.00	-22.77	50.26	3	Horizontal	6	2.71	-	36.17	6.79	41.99
AV	7.44136G	40.06	54.00	-13.94	39.09	3	Horizontal	6	2.71	-	36.17	6.79	41.99