



RADIO TEST REPORT

FCC ID : 2AYRA-08438
Equipment : Linksys Velop Pro 7
Brand Name : LINKSYS
Model Name : MBE7000, MBE70EC, MBE70WH, MBE70MS, SPNMBE70, MBE70
Applicant : Linksys USA, Inc.
121 Theory, Irvine, CA. 92617, USA
Standard : 47 CFR FCC Part 15.247

The product was received on Dec. 01, 2022, and testing was started from Dec. 14, 2022 and completed on Mar. 13, 2023. 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.)



Table of Contents

History of this test report.....3

Summary of Test Result.....4

1 General Description5

1.1 Information.....5

1.2 Applicable Standards9

1.3 Testing Location Information9

1.4 Measurement Uncertainty9

2 Test Configuration of EUT10

2.1 Test Channel Mode10

2.2 The Worst Case Measurement Configuration11

2.3 EUT Operation during Test12

2.4 Accessories13

2.5 Support Equipment.....13

2.6 Test Setup Diagram14

3 Transmitter Test Result17

3.1 AC Power-line Conducted Emissions17

3.2 DTS Bandwidth.....19

3.3 Maximum Conducted Output Power20

3.4 Power Spectral Density23

3.5 Emissions in Non-restricted Frequency Bands25

3.6 Emissions in Restricted Frequency Bands.....26

4 Test Equipment and Calibration Data30

Appendix A. Test Results of AC Power-line Conducted Emissions

Appendix B. Test Results of DTS Bandwidth

Appendix C. Test Results of Maximum Conducted Output Power

Appendix D. Test Results of Power Spectral Density

Appendix E. Test Results of Emissions in Non-restricted Frequency Bands

Appendix F. Test Results of Emissions in Restricted Frequency Bands

Appendix G. Test Photos

Photographs of EUT v01



History of this test report

Report No.	Version	Description	Issued Date
FR291415AD	01	Initial issue of report	Jun. 14, 2023
FR291415AD	02	1. Revising the RF General Information on section 1.1.1 2. Revising the Test Channel Mode on section 2.1 3. Revising the test results of Maximum Conducted Output Power in Appendix C. 4. Revising the test results of Emissions in Restricted Frequency Bands in Appendix F.	Jun. 19, 2023



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	-

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: **Sandy Chuang**



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
2.4-2.4835GHz	Zigbee	3	1TX

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)
	2.4GHz	5GHz	6GHz	Bluetooth Zigbee					
1	1	1	-	-	Galtronics	02102140-07691-1	PCB Antenna	I-PEX	Note1
2	2	2	-	-	Galtronics	02102140-07691-2	PCB Antenna	I-PEX	
3	-	-	2	-	Galtronics	02102475-07691-2	PCB Antenna	I-PEX	
4	-	-	1	-	Galtronics	02102475-07691-1	PCB Antenna	I-PEX	
5	-	-	-	1	Galtronics	02102073-07691-2	PCB Antenna	I-PEX	

Note1:

Ant.	Antenna Gain (dBi)									
	WLAN 2.4GHz	WLAN 5GHz UNII 1	WLAN 5GHz UNII 2A	WLAN 5GHz UNII 2C	WLAN 5GHz UNII 3	WLAN 6GHz UNII 5	WLAN 6GHz UNII 6	WLAN 6GHz UNII 7	WLAN 6GHz UNII 8	Bluetooth Zigbee
1	2.626	3.600	3.535	3.323	3.333	-	-	-	-	-
2	2.626	3.600	3.535	3.323	3.333	-	-	-	-	-
3	-	-	-	-	-	3.076	3.246	3.429	3.429	-
4	-	-	-	-	-	3.076	3.246	3.429	3.429	-
5	-	-	-	-	-	-	-	-	-	1.095

Note2: The above information was declared by manufacturer.

<For 2.4GHz function>

For 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.

<For 5GHz function>

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

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

Port 1 and Port 2 could transmit/receive simultaneously.

<For 6GHz function>

For IEEE 802.11ax/be (2TX/2RX):

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

Port 1 and Port 2 could transmit/receive simultaneously.

<For Bluetooth/Zigbee function> (1TX/1RX):

Only Port 1 can be used as transmitting/receiving antenna.

Port 1 could transmit/receive simultaneously.



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

Ex.

Directional Gain (NSS1) formula :

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

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

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

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

Where ;

$$2.4G\ G1 = 2.626\ dBi ; 2.4G\ G2 = 2.626\ dBi ; DG = 5.636\ dBi$$

$$5G\ UNII-1\ G1 = 3.6\ dBi ; 5G\ UNII-1\ G2 = 3.6\ dBi ; DG = 6.610\ dBi$$

$$5G\ UNII-2A\ G1 = 3.535\ dBi ; 5G\ UNII-2A\ G2 = 3.535\ dBi ; DG = 6.545\ dBi$$

$$5G\ UNII-2C\ G1 = 3.323\ dBi ; 5G\ UNII-2C\ G2 = 3.323\ dBi ; DG = 6.333\ dBi$$

$$5G\ UNII-3\ G1 = 3.33\ dBi ; 5G\ UNII-3\ G2 = 3.33\ dBi ; DG = 6.343\ dBi$$

$$6G\ UNII-5\ G1 = 3.076\ dBi ; 6G\ UNII-5\ G2 = 3.076\ dBi ; DG = 6.086\ dBi$$

$$6G\ UNII-6\ G1 = 3.246\ dBi ; 6G\ UNII-6\ G2 = 3.246\ dBi ; DG = 6.256\ dBi$$

$$6G\ UNII-7\ G1 = 3.429\ dBi ; 6G\ UNII-7\ G2 = 3.429\ dBi ; DG = 6.439\ dBi$$

$$6G\ UNII-8\ G1 = 3.429\ dBi ; 6G\ UNII-7\ G2 = 3.429\ dBi ; DG = 6.439\ dBi$$



1.1.3 Mode Test Duty Cycle

Mode	DC	DCF(dB)	T(s)
Zigbee	1	0	n/a (DC>=0.98)

Note:

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

1.1.4 EUT Operational Condition

EUT Power Type	From Power Adapter		
Beamforming Function	<input type="checkbox"/> With beamforming	<input checked="" type="checkbox"/> Without beamforming	
Function	<input checked="" type="checkbox"/> Point-to-multipoint	<input type="checkbox"/> Point-to-point	
Test Software Version	QSPR V5.0-00202		

Note: The above information was declared by manufacturer.

1.1.5 Table for Bluetooth/Zigbee Chipset Source Information

EUT	Source	Model Name	Chipset Supports NFC	EUT Supports NFC
1	Main	K32W061	V	X
2	Second	K32W041	X	X

Note: From the above, EUT 1 was selected as representative model for the test and its data was recorded in this report.

1.1.6 Table for Multiple Listing

The model names in the following table are all refer to the identical product.

Model Name	Description
MBE7000	All the models are identical, the difference model for difference model served as marketing strategy.
MBE70EC	
MBE70WH	
MBE70MS	
SPNMBE70	
MBE70	

Note 1: From the above models, model: MBE7000 was selected as representative model for the test and its data was recorded in this report.

Note 2: The above information was declared by manufacturer.



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 15.247
- ♦ 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 414788 D01 v01r01

1.3 Testing Location Information

Testing Location Information	
Test Lab. : Sporton International Inc. Hsinchu Laboratory	
Hsinchu	ADD: No.8, Ln. 724, Bo'ai St., Zhubei City, Hsinchu County 302010, Taiwan (R.O.C.)
(TAF: 3787)	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	TH03-CB	Owen Hsu	23.1-24.1 / 52-63	Dec. 14, 2022~ Mar. 06, 2023
Radiated <Below 1GHz>	03CH06-CB	Roy Mai	21.3~23.2 / 61~64	Feb. 23, 2023~ Mar. 13, 2023
Radiated <Above 1GHz>	03CH01-CB	Roy Mai	20.9~22.6 / 63~67	Feb. 23, 2023~ Mar. 13, 2023
	03CH03-CB		21.7~22.7 / 61~63	
AC Conduction	CO01-CB	Elvin Yeh	22~23 / 50~51	Feb. 23, 2023

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
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	10
2440MHz	10
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 1(WiFi+Bluetooth) + Adapter 3 + US plug
2	EUT 1(WiFi+Bluetooth) + Adapter 4 + US plug
3	EUT 1(WiFi+Bluetooth) + Adapter 1
4	EUT 1(WiFi+Bluetooth) + Adapter 2
Mode 2 has been evaluated to be the worst case among Mode 1~4, thus measurement for Mode 5 will follow this same test mode.	
5	EUT 1(WiFi+Zigbee) + Adapter 4 + US plug
For operating mode 5 is the worst case and it was record in this test 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
Operating Mode	1 EUT 1



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	CTX
After evaluating, the worst case was found at Z axis from Radiated Emission test Above 1GHz., So the measurement will follow this same test configuration.	
1	EUT 1 in Z axis + WLAN 2.4GHz + Adapter 1
2	EUT 1 in Z axis + WLAN 2.4GHz + Adapter 2
3	EUT 1 in Z axis + WLAN 2.4GHz + Adapter 4 + US plug
4	EUT 1 in Z axis + WLAN 2.4GHz + Adapter 3 + US plug
Mode 2 has been evaluated to be the worst case among Mode 1~4, thus measurement for Mode 5~8 will follow this same test mode.	
5	EUT 1 in Z axis + WLAN 5GHz + Adapter 2
6	EUT 1 in Z axis + WLAN 6GHz + Adapter 2
7	EUT 1 in Z axis + Bluetooth + Adapter 2
8	EUT 1 in Z axis + Zigbee + Adapter 2
For operating mode 2 is the worst case and it was record in this test report.	
Operating Mode > 1GHz	CTX
After evaluating, the worst case was found at Z axis. Thus the measurement will follow this same test configuration.	
1	EUT 1 in Z 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 + WLAN 6GHz + Bluetooth
2	WLAN 2.4GHz + WLAN 5GHz + WLAN 6GHz + Zigbee
Refer to Sporton Test Report No.: FA291415 for Co-location RF Exposure Evaluation.	

2.3 EUT Operation during Test

For CTX Mode:

The EUT was programmed to be in continuously transmitting mode.

For Normal Link Mode:

During the test, the EUT operation to normal function.



2.4 Accessories

Accessories			
Equipment Name	Brand Name	Model Name	Rating
Adapter 1	Ktec	KSA-30W-120250VU	Input: 100-240V~50/60Hz, 1.0A Output: 12.0V, 2.5A
Adapter 2	APD	WA-30P12FU	Input: 100-240V~, 50-60Hz, 0.9A Max. Output: 12.0V, 2.5A
Adapter 3	Ktec	KSA-30W-120250D5	Input: 100-240V~50/60Hz, 1.0A Output: 12.0V, 2.5A, 30.0W
Adapter 4	APD	WA-30P12R	Input: 100-240V~, 50-60Hz, 0.9A Max. Output: 12.0V, 2.5A, 30.0W
Others			
RJ-45 cable*1, non-shielded, 0.9m			
Plug*1 (Equip with Adapter 3 use only)			
Plug*1 (Equip with Adapter 4 use only)			

2.5 Support Equipment

For AC Conduction:

Support Equipment				
No.	Equipment	Brand Name	Model Name	FCC ID
A	LAN NB	DELL	E6430	N/A
B	WAN NB	DELL	E6430	N/A
C	2.4G NB	DELL	E6430	N/A
D	5G NB	DELL	E6430	N/A
E	6G NB	DELL	E6430	N/A
F	Client	Linksys	MX6000	N/A
G	Client NB	DELL	E6430	N/A
H	AX210	Intel	AX210NGW	N/A

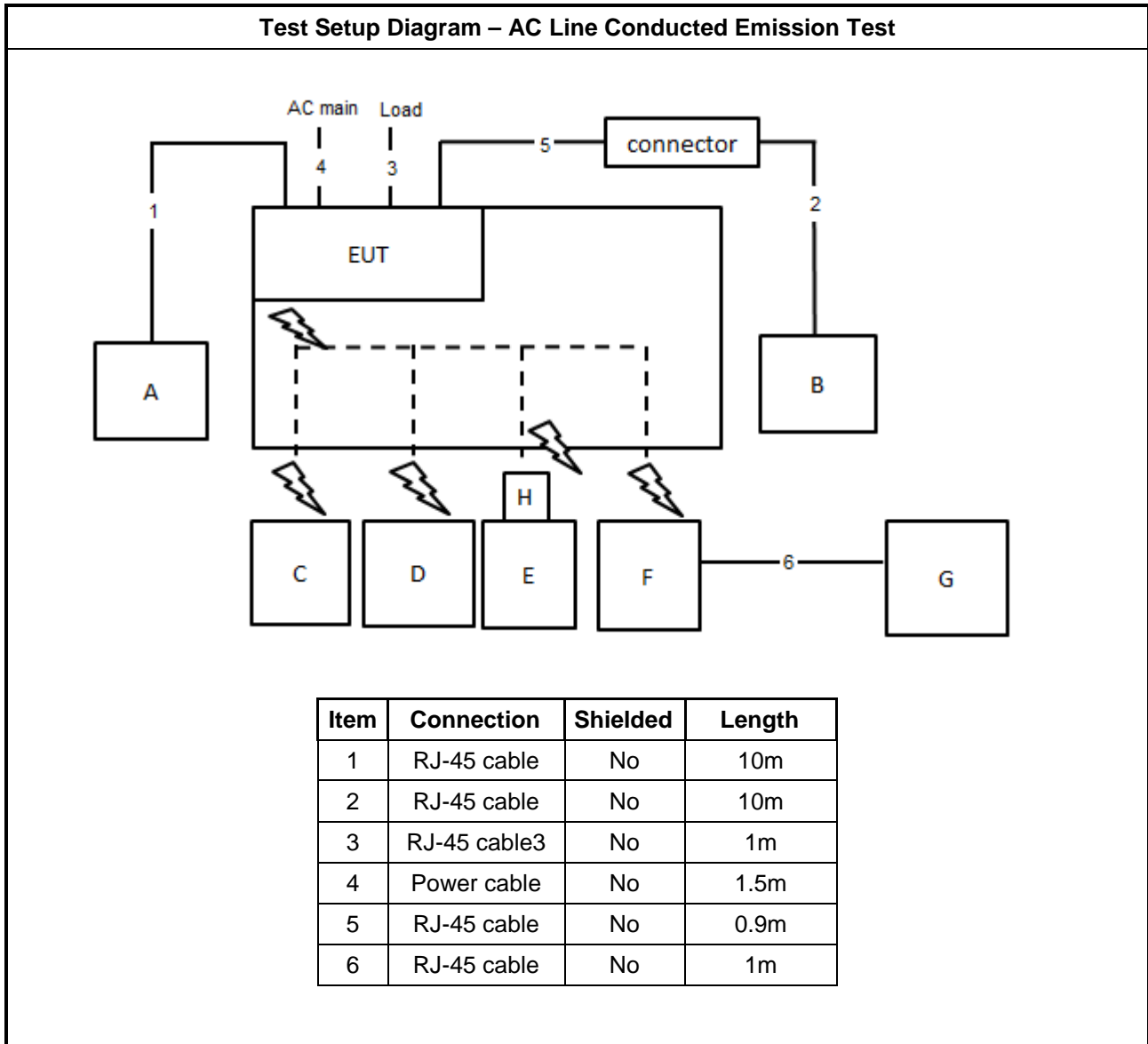
For Radiated:

Support Equipment				
No.	Equipment	Brand Name	Model Name	FCC ID
A	NB	Lenovo	L440	N/A

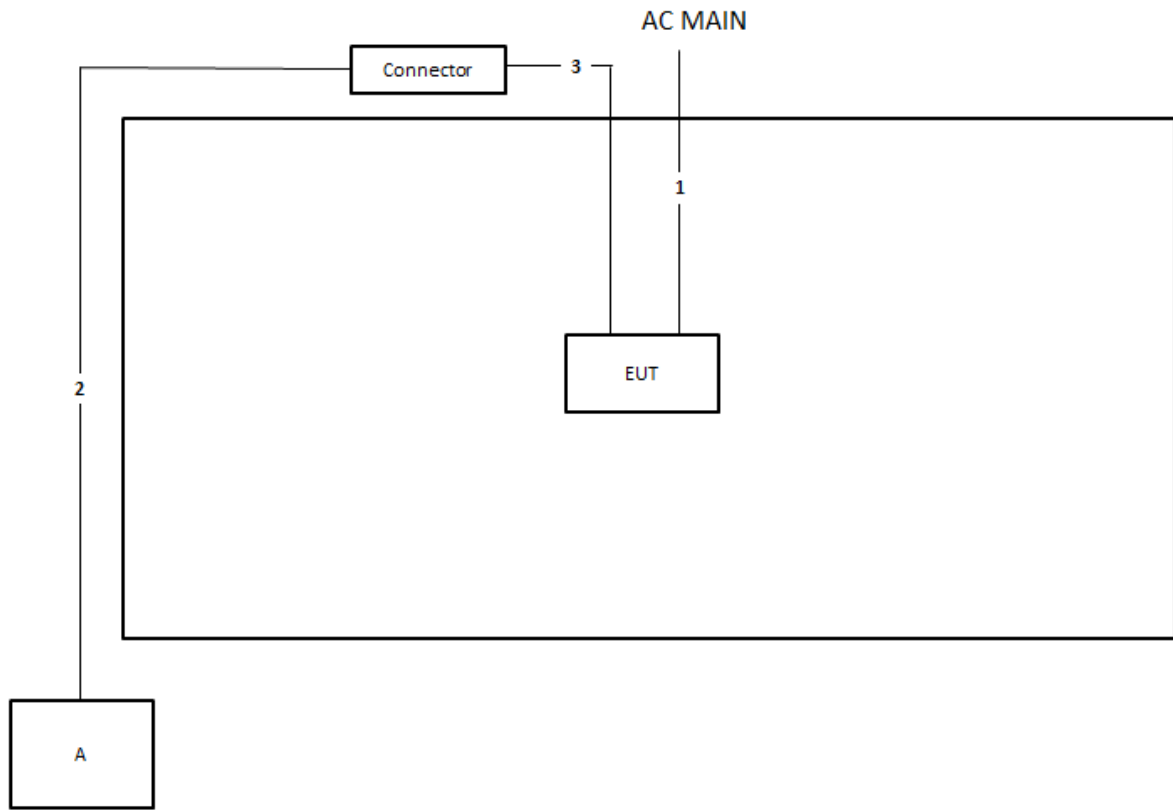
For RF Conducted:

Support Equipment				
No.	Equipment	Brand Name	Model Name	FCC ID
A	NB	DELL	E4300	N/A

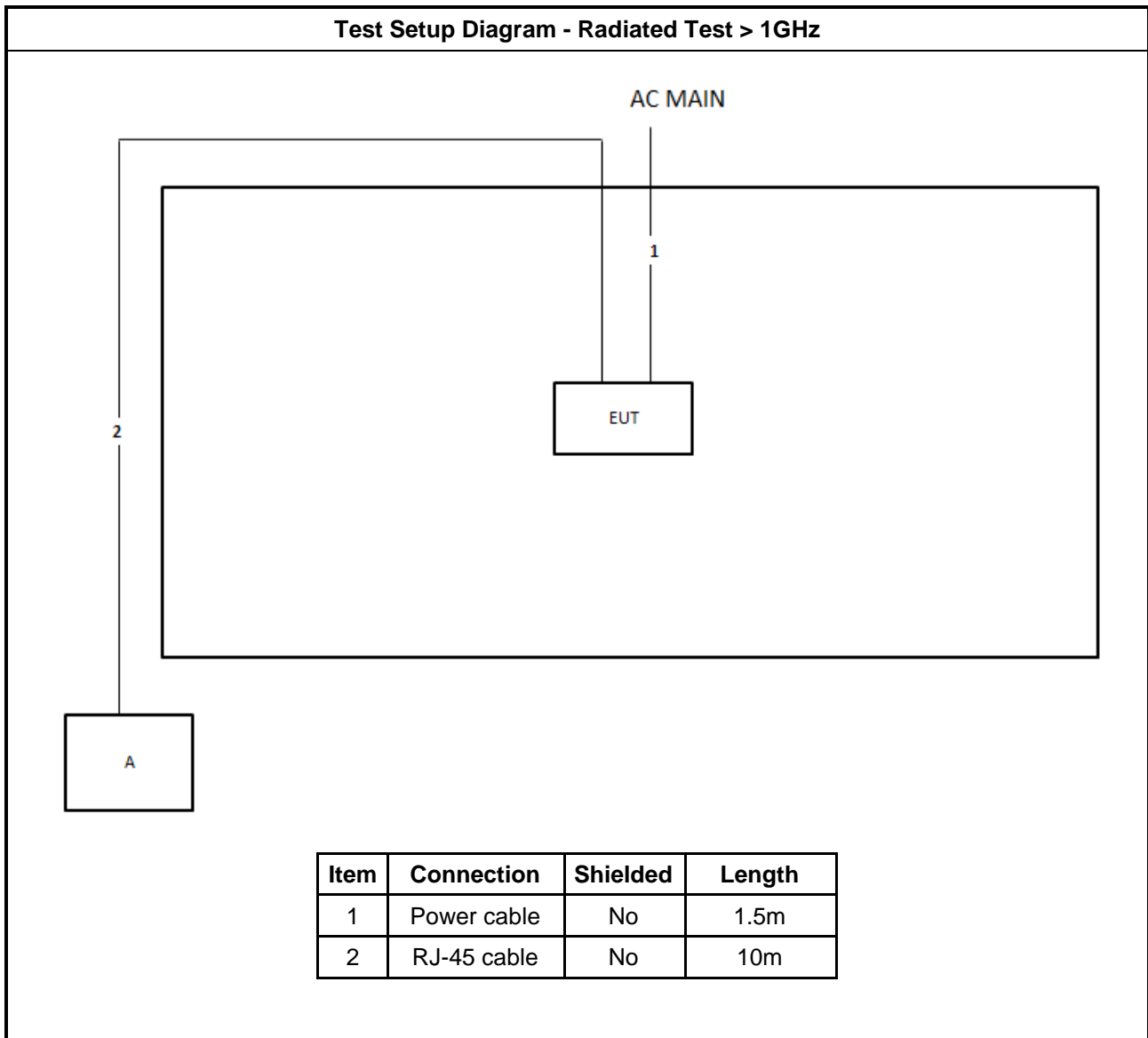
2.6 Test Setup Diagram



Test Setup Diagram - Radiated Test < 1GHz



Item	Connection	Shielded	Length
1	Power cable	No	1.5m
2	RJ-45 cable	No	10m
3	RJ-45 cable	No	0.9m





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.

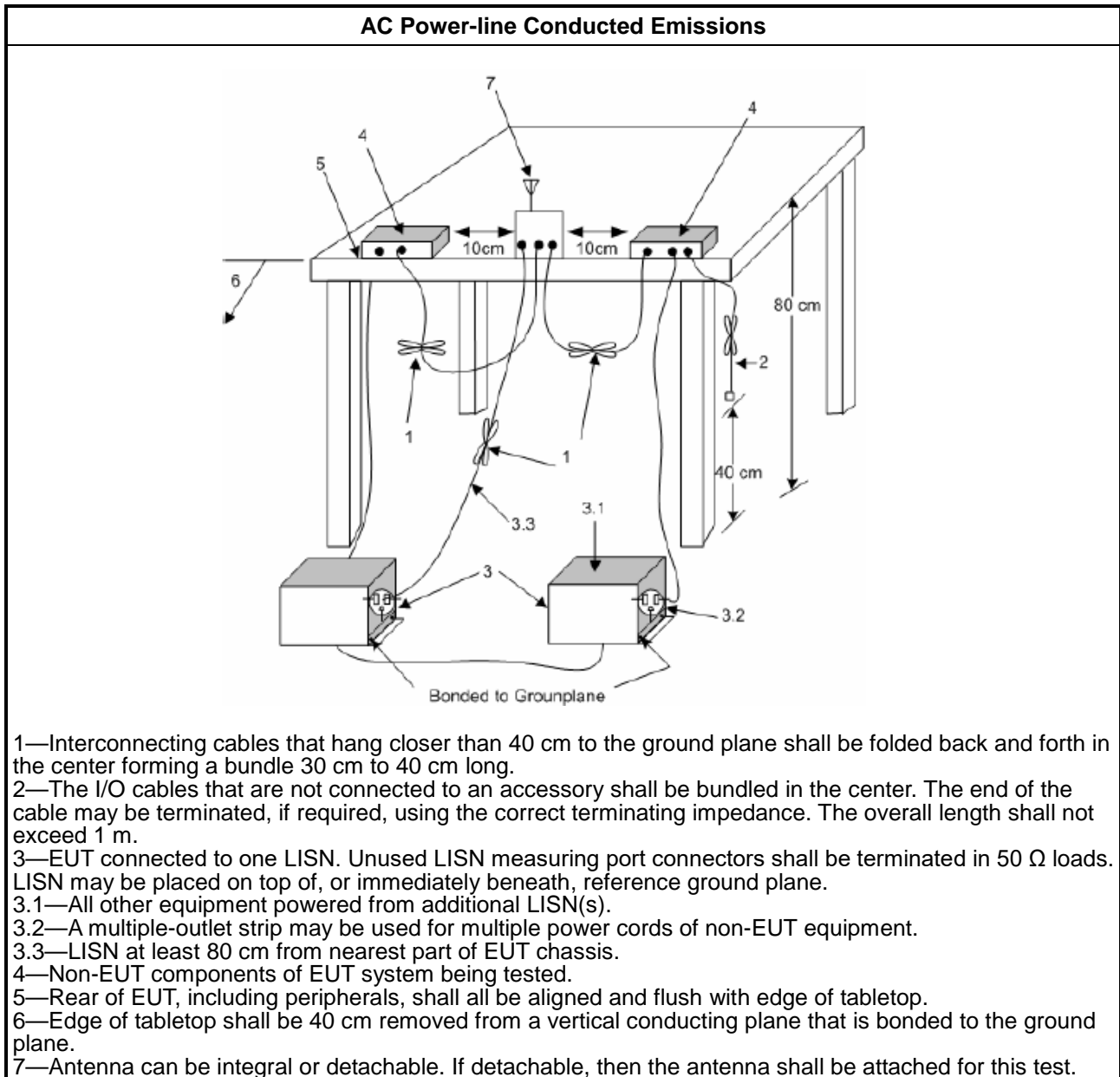
3.1.2 Measuring Instruments

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

3.1.3 Test Procedures

Test Method
<input checked="" type="checkbox"/> 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:
<ul style="list-style-type: none"> ▪ 6 dB bandwidth \geq 500 kHz.

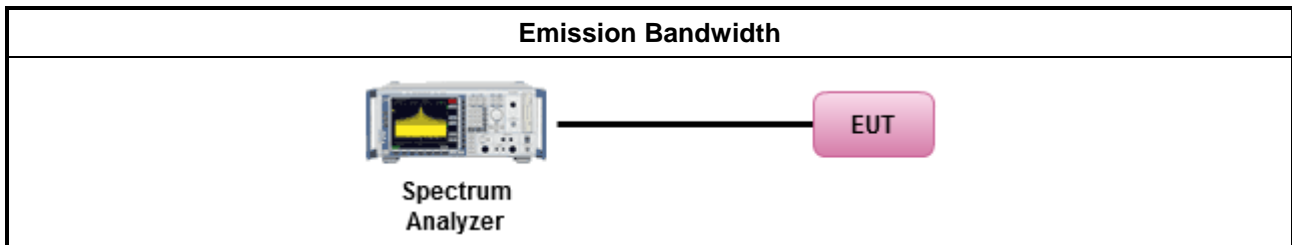
3.2.2 Measuring Instruments

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

3.2.3 Test Procedures

Test Method
<ul style="list-style-type: none"> ▪ For the emission bandwidth shall be measured using one of the options below:
<input checked="" type="checkbox"/> Refer as FCC KDB 558074, clause 8.2 & C63.10 clause 11.8.1 Option 1 for 6 dB bandwidth measurement.
<input type="checkbox"/> Refer as FCC KDB 558074, clause 8.2 & C63.10 clause 11.8.2 Option 2 for 6 dB bandwidth measurement.
<input type="checkbox"/> 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	
	<ul style="list-style-type: none"> ▪ If $G_{TX} \leq 6$ dBi, then $P_{Out} \leq 30$ dBm (1 W)
	<ul style="list-style-type: none"> ▪ Point-to-multipoint systems (P2M): If $G_{TX} > 6$ dBi, then $P_{Out} = 30 - (G_{TX} - 6)$ dBm
	<ul style="list-style-type: none"> ▪ Point-to-point systems (P2P): If $G_{TX} > 6$ dBi, then $P_{Out} = 30 - (G_{TX} - 6)/3$ dBm
	<ul style="list-style-type: none"> ▪ Smart antenna system (SAS):
	<ul style="list-style-type: none"> - Single beam: If $G_{TX} > 6$ dBi, then $P_{Out} = 30 - (G_{TX} - 6)/3$ dBm
	<ul style="list-style-type: none"> - Overlap beam: If $G_{TX} > 6$ dBi, then $P_{Out} = 30 - (G_{TX} - 6)/3$ dBm
	<ul style="list-style-type: none"> - Aggregate power on all beams: If $G_{TX} > 6$ dBi, then $P_{Out} = 30 - (G_{TX} - 6)/3 + 8$ dB dBm
<p>P_{Out} = maximum peak conducted output power or maximum conducted output power in dBm, G_{TX} = the maximum transmitting antenna directional gain in dBi.</p>	

3.3.2 Measuring Instruments

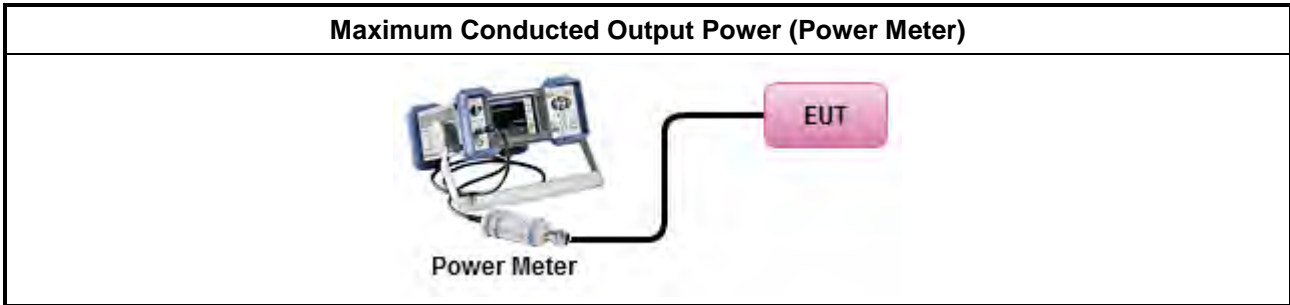
Refer a test equipment and calibration data table in this test report.



3.3.3 Test Procedures

Test Method	
<ul style="list-style-type: none"> ▪ Maximum Peak Conducted Output Power 	
	<input type="checkbox"/> Refer as FCC KDB 558074, clause 8.3.1.1 & C63.10 clause 11.9.1.1 (RBW ≥ EBW method).
	<input type="checkbox"/> Refer as FCC KDB 558074, clause 8.3.1.3 & C63.10 clause 11.9.1.3 (peak power meter).
<ul style="list-style-type: none"> ▪ Maximum Conducted Output Power 	
[duty cycle ≥ 98% or external video / power trigger]	
	<input type="checkbox"/> Refer as FCC KDB 558074, clause 8.3.2.2 & C63.10 clause 11.9.2.2.2 Method AVGSA-1.
	<input type="checkbox"/> 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	
	<input type="checkbox"/> Refer as FCC KDB 558074, clause 8.3.2.2 & C63.10 clause 11.9.2.2.4 Method AVGSA-2.
	<input type="checkbox"/> Refer as FCC KDB 558074, clause 8.3.2.2 & C63.10 clause 11.9.2.2.5 Method AVGSA-2A (alternative)
	<input type="checkbox"/> Refer as FCC KDB 558074, clause 8.3.2.2 & C63.10 clause 11.9.2.2.6 Method AVGSA-3
	<input type="checkbox"/> 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)	
	<input type="checkbox"/> 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).
	<input checked="" type="checkbox"/> 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).
<ul style="list-style-type: none"> ▪ For conducted measurement. 	
<ul style="list-style-type: none"> ▪ 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. 	
<ul style="list-style-type: none"> ▪ 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
<ul style="list-style-type: none"> Power Spectral Density (PSD) \leq 8 dBm/3kHz

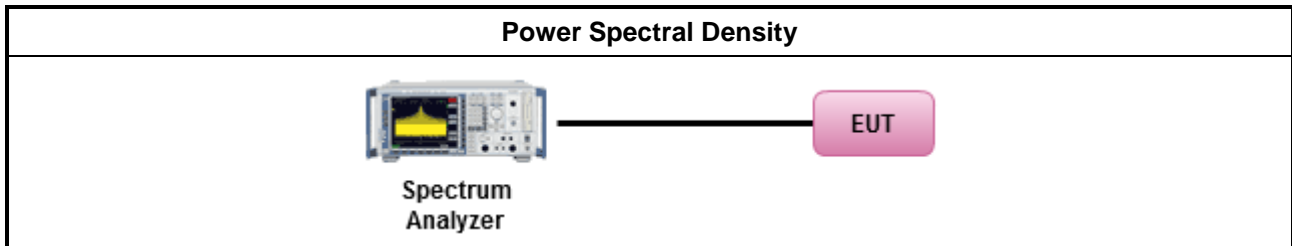
3.4.2 Measuring Instruments

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

3.4.3 Test Procedures

Test Method			
<ul style="list-style-type: none"> 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). 			
<input checked="" type="checkbox"/> Refer as FCC KDB 558074, clause 8.4 & C63.10 clause 11.10 Method Max. PSD.			
<ul style="list-style-type: none"> For conducted measurement. <ul style="list-style-type: none"> If The EUT supports multiple transmit chains using options given below: <table border="1"> <tbody> <tr> <td> <input checked="" type="checkbox"/> 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> <input type="checkbox"/> 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> <input type="checkbox"/> 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> </tbody> </table> 	<input checked="" type="checkbox"/> 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.	<input type="checkbox"/> 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,	<input type="checkbox"/> 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.
<input checked="" type="checkbox"/> 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.			
<input type="checkbox"/> 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,			
<input type="checkbox"/> 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.

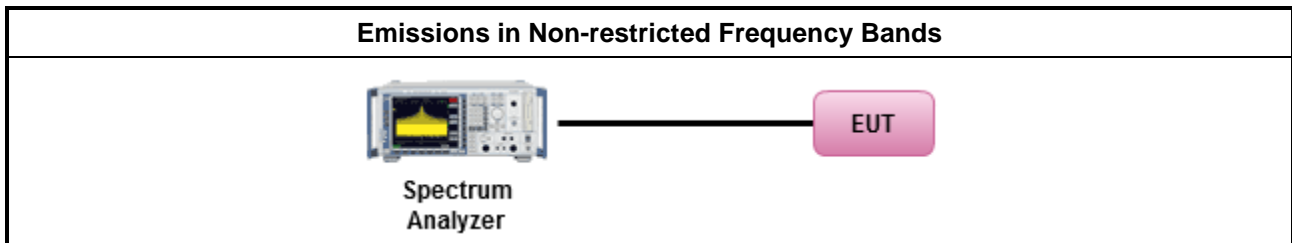
3.5.2 Measuring Instruments

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

3.5.3 Test Procedures

Test Method
<ul style="list-style-type: none"> 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

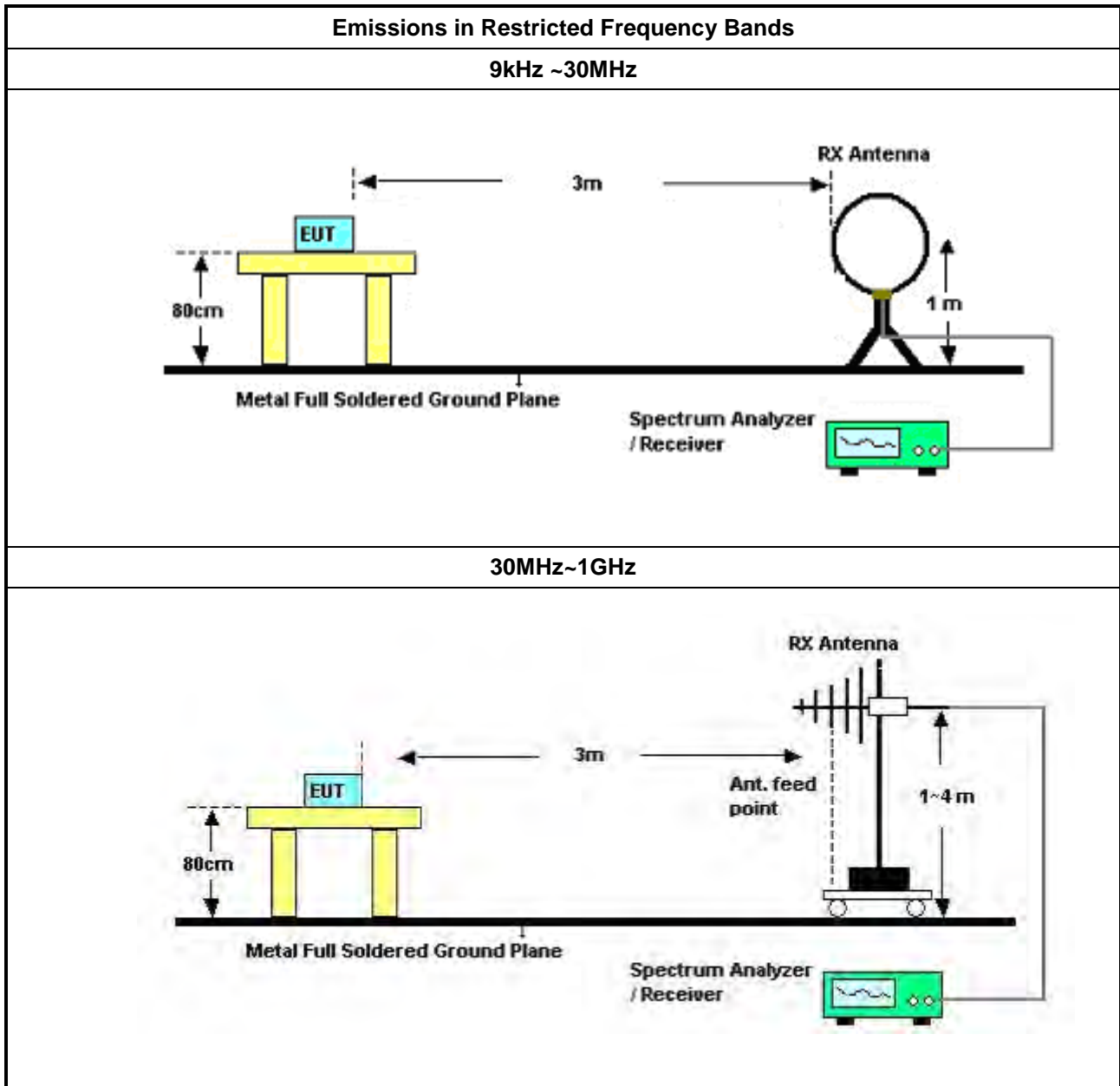
Refer a test equipment and calibration data table in this test report.

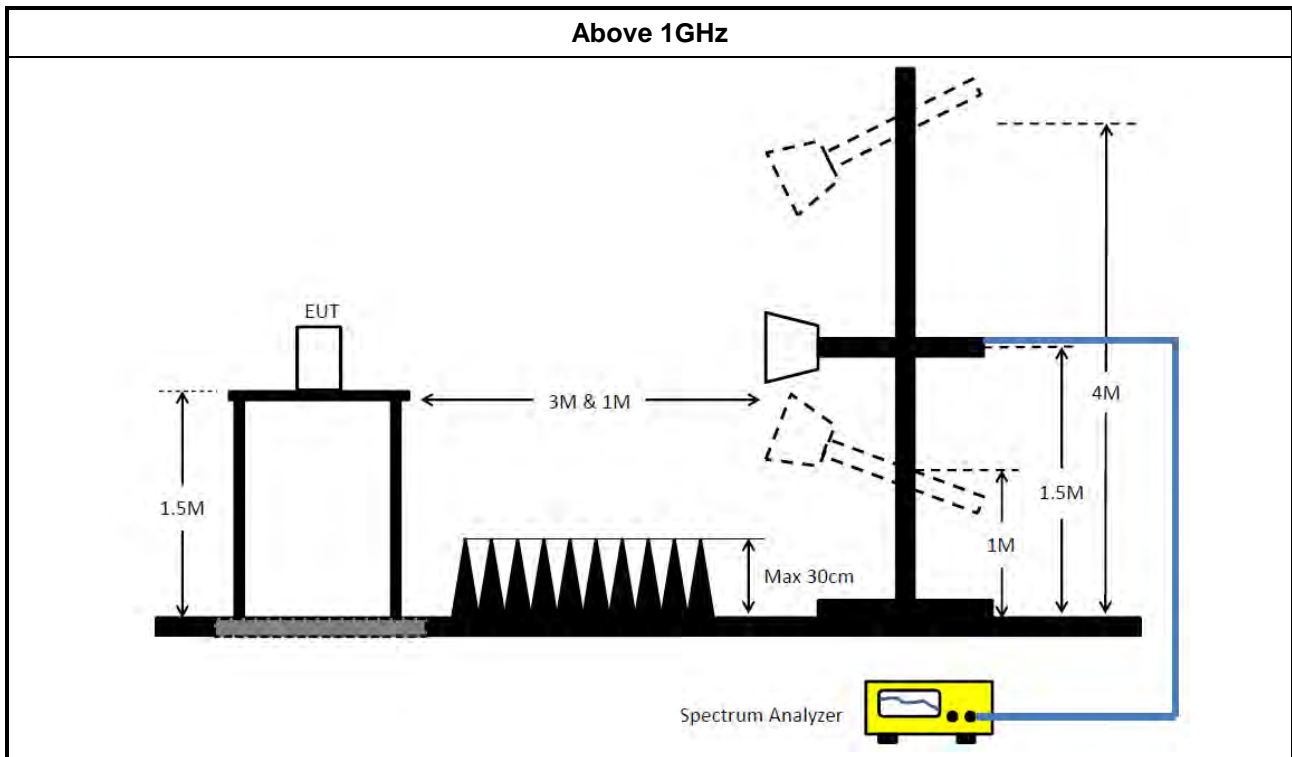


3.6.3 Test Procedures

Test Method	
<ul style="list-style-type: none"> ▪ The average emission levels shall be measured in [duty cycle \geq 98 or duty factor]. 	
<ul style="list-style-type: none"> ▪ 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. 	
<ul style="list-style-type: none"> ▪ For the transmitter unwanted emissions shall be measured using following options below: 	
	<ul style="list-style-type: none"> ▪ Refer as FCC KDB 558074, clause 8.6 for unwanted emissions into restricted bands.
	<input type="checkbox"/> Refer as FCC KDB 558074, clause 8.6 & C63.10 clause 11.12.2.5.1(trace averaging for duty cycle \geq 98%).
	<input type="checkbox"/> Refer as FCC KDB 558074, clause 8.6 & C63.10 clause 11.12.2.5.2(trace averaging + duty factor).
	<input checked="" type="checkbox"/> Refer as FCC KDB 558074, clause 8.6 & C63.10 clause 11.12.2.5.3(Reduced VBW \geq 1/T).
	<input type="checkbox"/> Refer as ANSI C63.10, clause 11.12.2.5.3 (Reduced VBW). VBW \geq 1/T, where T is pulse time.
	<input type="checkbox"/> Refer as ANSI C63.10, clause 7.5 average value of pulsed emissions.
	<input checked="" type="checkbox"/> Refer as FCC KDB 558074, clause 8.6 & C63.10 clause 11.12.2.4 measurement procedure peak limit.
<ul style="list-style-type: none"> ▪ For the transmitter band-edge emissions shall be measured using following options below: 	
	<ul style="list-style-type: none"> ▪ 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.
	<ul style="list-style-type: none"> ▪ Refer as FCC KDB 558074, clause 8.7 (ANSI C63.10, clause 6.10.6) for marker-delta method for band-edge measurements.
	<ul style="list-style-type: none"> ▪ 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).
	<ul style="list-style-type: none"> ▪ 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
	<ul style="list-style-type: none"> ▪ 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	MY52260140	9kHz ~ 8.4GHz	May 06, 2022	May 05, 2023	Conduction (CO01-CB)
LISN	F.C.C.	FCC-LISN-50-16-2	04083	150kHz ~ 100MHz	Feb. 16, 2023	Feb. 15, 2024	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. 09, 2023	Feb. 08, 2024	Conduction (CO01-CB)
COND Cable	Woken	Cable	Low cable-CO01	9kHz ~ 30MHz	Oct. 18, 2022	Oct. 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 (03CH06-CB)
3m Semi Anechoic Chamber NSA	TDK	SAC-3M	03CH06-CB	30 MHz ~ 1 GHz	Aug. 04, 2022	Aug. 03, 2023	Radiation (03CH06-CB)
Bilog Antenna with 6 dB attenuator	TESEQ & EMCI	CBL6112D & N-6-06	37878 & AT-N0606	20MHz ~ 2GHz	Jul. 31, 2022	Jul. 30, 2023	Radiation (03CH06-CB)
Pre-Amplifier	Agilent	310N	187290	0.1MHz ~ 1GHz	Nov. 04, 2022	Nov. 03, 2023	Radiation (03CH06-CB)
Signal Analyzer	R&S	FSV40	101904	9kHz ~ 40GHz	Apr. 26, 2022	Apr. 25, 2023	Radiation (03CH06-CB)
EMI Test Receiver	R&S	ESCS	826547/017	9kHz ~ 2.75GHz	Jun. 17, 2022	Jun. 16, 2023	Radiation (03CH06-CB)
RF Cable-low	Woken	RG402	Low Cable-24+68	30MHz~1GHz	Oct. 03, 2022	Oct. 02, 2023	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	03CH01-CB	1GHz ~ 18GHz 3m	May 06, 2022	May 05, 2023	Radiation (03CH01-CB)
Horn Antenna	ETS-LINDGREN	3115	00075790	750MHz ~ 18GHz	Nov. 04, 2022	Nov. 03, 2023	Radiation (03CH01-CB)
Horn Antenna	Schwarzbeck	BBHA 9170	BBHA9170252	15GHz ~ 40GHz	Aug. 22, 2022	Aug. 21, 2023	Radiation (03CH01-CB)
Pre-Amplifier	Agilent	8449B	3008A02121	1GHz ~ 26.5GHz	May 19, 2022	May 18, 2023	Radiation (03CH01-CB)
Pre-Amplifier	SGH	SGH184	20221107-3	18GHz ~ 40GHz	Nov. 16, 2022	Nov. 15, 2023	Radiation (03CH01-CB)
Spectrum Analyzer	R&S	FSP40	100056	9kHz ~ 40GHz	May 06, 2022	May 05, 2023	Radiation (03CH01-CB)



Instrument	Brand	Model No.	Serial No.	Characteristics	Calibration Date	Calibration Due Date	Remark
RF Cable-high	Woken	RG402	High Cable-16	1 GHz ~ 18 GHz	Oct. 03, 2022	Oct. 02, 2023	Radiation (03CH01-CB)
RF Cable-high	Woken	RG402	High Cable-16+17	1 GHz ~ 18 GHz	Oct. 03, 2022	Oct. 02, 2023	Radiation (03CH01-CB)
High Cable	Woken	WCA0929M	40G#5+6	1GHz ~ 40 GHz	Dec. 07, 2022	Dec. 06, 2023	Radiation (03CH01-CB)
High Cable	Woken	WCA0929M	40G#5	1GHz ~ 40 GHz	Dec. 07, 2022	Dec. 06, 2023	Radiation (03CH01-CB)
High Cable	Woken	WCA0929M	40G#6	1GHz ~ 40 GHz	Dec. 07, 2022	Dec. 06, 2023	Radiation (03CH01-CB)
Test Software	SPORTON	SENSE	V5.10	-	N.C.R.	N.C.R.	Radiation (03CH01-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	Feb. 03, 2023	Feb. 02, 2024	Radiation (03CH03-CB)
Horn Antenna	Schwarzbeck	BBHA 9170	BBHA9170252	15GHz ~ 40GHz	Aug. 22, 2022	Aug. 21, 2023	Radiation (03CH03-CB)
Pre-Amplifier	Agilent	8449B	3008A02097	1GHz ~ 26.5GHz	Jul. 01, 2022	Jun. 30, 2023	Radiation (03CH03-CB)
Pre-Amplifier	SGH	SGH184	20221107-3	18GHz ~ 40GHz	Nov. 16, 2022	Nov. 15, 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. 03, 2022	Oct. 02, 2023	Radiation (03CH03-CB)
RF Cable-high	Woken	RG402	High Cable-29	1GHz ~ 18GHz	Oct. 03, 2022	Oct. 02, 2023	Radiation (03CH03-CB)
High Cable	Woken	WCA0929M	40G#5+6	1GHz ~ 40 GHz	Dec. 07, 2022	Dec. 06, 2023	Radiation (03CH03-CB)
High Cable	Woken	WCA0929M	40G#5	1GHz ~ 40 GHz	Dec. 07, 2022	Dec. 06, 2023	Radiation (03CH03-CB)
High Cable	Woken	WCA0929M	40G#6	1GHz ~ 40 GHz	Dec. 07, 2022	Dec. 06, 2023	Radiation (03CH03-CB)
Test Software	SPORTON	SENSE	V5.10	-	N.C.R.	N.C.R.	Radiation (03CH03-CB)
Signal Analyzer	R&S	FSV40	101903	9kHz ~ 40GHz	May 27, 2022	May 26, 2023	Conducted (TH03-CB)
Power Sensor	Anritsu	MA2411B	1726195	300MHz~40GHz	Sep. 04, 2022	Sep. 03, 2023	Conducted (TH03-CB)
Power Meter	Anritsu	ML2495A	1035008	300MHz~40GHz	Sep. 04, 2022	Sep. 03, 2023	Conducted (TH03-CB)
RF Cable-high	Woken	RG402	High Cable-11	1 GHz ~18 GHz	Oct. 03, 2022	Oct. 02, 2023	Conducted (TH03-CB)



Instrument	Brand	Model No.	Serial No.	Characteristics	Calibration Date	Calibration Due Date	Remark
RF Cable-high	Woken	RG402	High Cable-12	1 GHz –18 GHz	Oct. 03, 2022	Oct. 02, 2023	Conducted (TH03-CB)
RF Cable-high	Woken	RG402	High Cable-13	1 GHz –18 GHz	Oct. 03, 2022	Oct. 02, 2023	Conducted (TH03-CB)
RF Cable-high	Woken	RG402	High Cable-14	1 GHz –18 GHz	Oct. 03, 2022	Oct. 02, 2023	Conducted (TH03-CB)
RF Cable-high	Woken	RG402	High Cable-15	1 GHz –18 GHz	Oct. 03, 2022	Oct. 02, 2023	Conducted (TH03-CB)
Switch	SPTCB	SP-SWI	SWI-03	1 GHz –26.5 GHz	Oct. 04, 2022	Oct. 03, 2023	Conducted (TH03-CB)
Test Software	SPORTON	SENSE	V5.10	-	N.C.R.	N.C.R.	Conducted (TH03-CB)

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

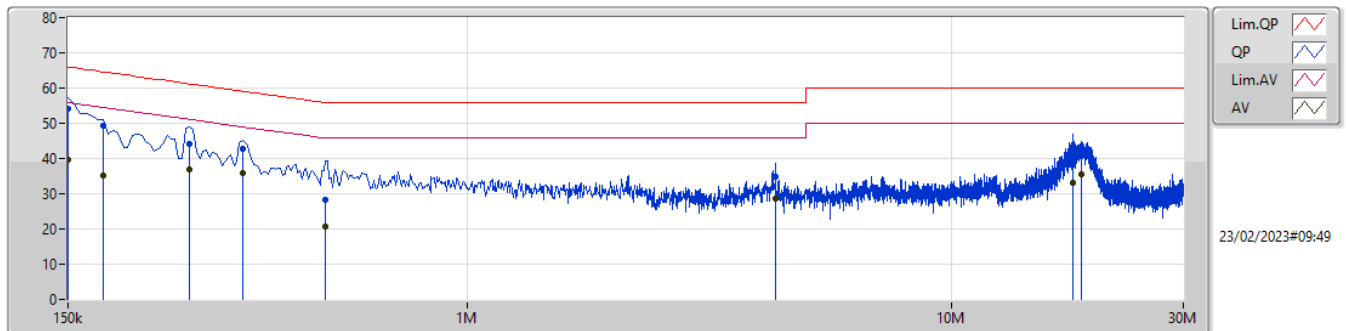
NCR means Non-Calibration required.



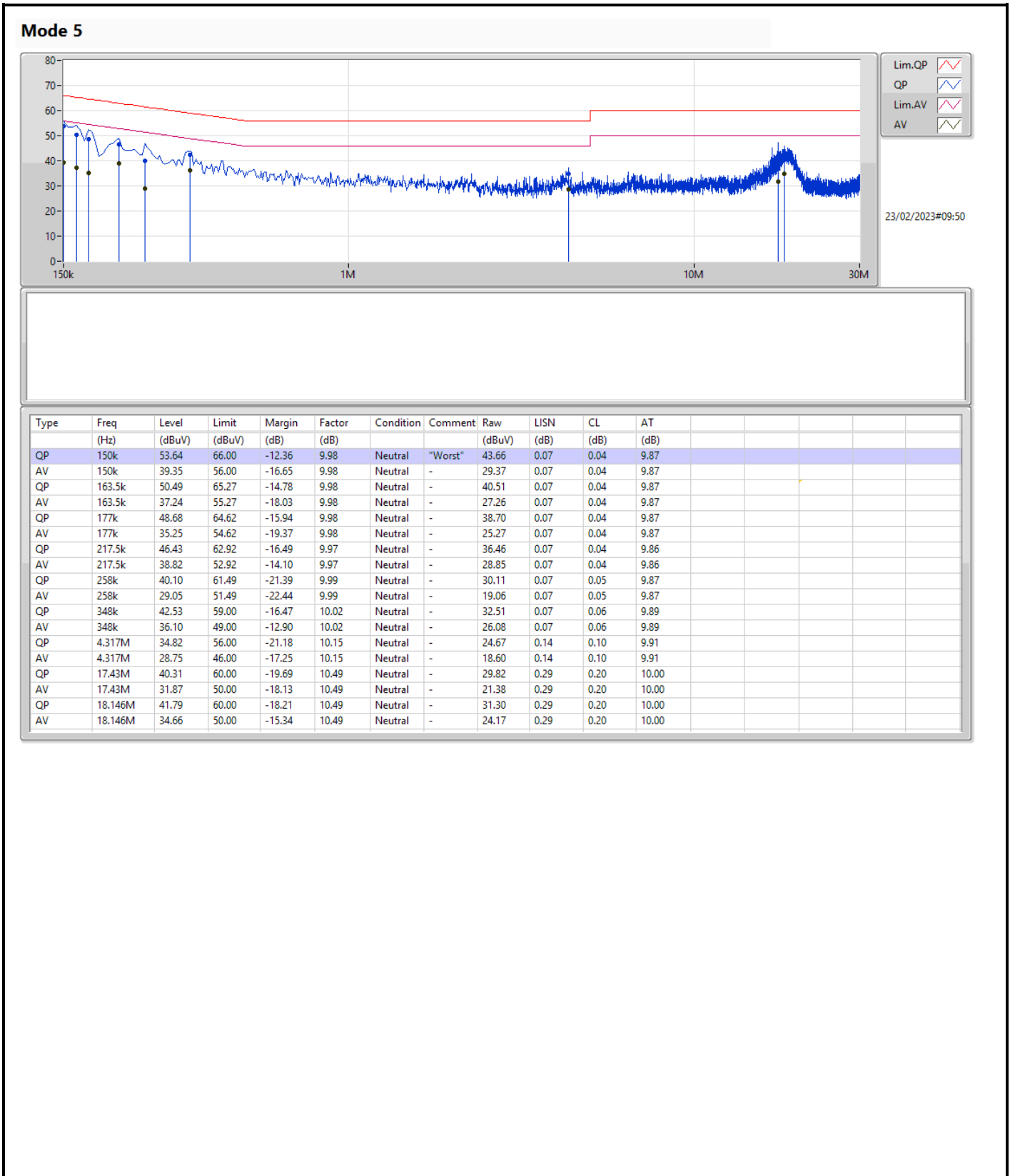
Summary

Mode	Result	Type	Freq (Hz)	Level (dBuV)	Limit (dBuV)	Margin (dB)	Condition
Mode 5	Pass	QP	150k	54.20	66.00	-11.80	Line

Mode 5



Type	Freq (Hz)	Level (dBuV)	Limit (dBuV)	Margin (dB)	Factor (dB)	Condition	Comment	Raw (dBuV)	LISN (dB)	CL (dB)	AT (dB)
QP	150k	54.20	66.00	-11.80	9.97	Line	"Worst"	44.23	0.06	0.04	9.87
AV	150k	39.64	56.00	-16.36	9.97	Line	-	29.67	0.06	0.04	9.87
QP	177k	49.19	64.62	-15.43	9.97	Line	-	39.22	0.06	0.04	9.87
AV	177k	35.26	54.62	-19.36	9.97	Line	-	25.29	0.06	0.04	9.87
QP	267k	44.02	61.20	-17.18	9.99	Line	-	34.03	0.06	0.05	9.88
AV	267k	36.78	51.20	-14.42	9.99	Line	-	26.79	0.06	0.05	9.88
QP	343.5k	42.62	59.12	-16.50	10.01	Line	-	32.61	0.06	0.06	9.89
AV	343.5k	35.97	49.12	-13.15	10.01	Line	-	25.96	0.06	0.06	9.89
QP	510k	28.21	56.00	-27.79	10.01	Line	-	18.20	0.06	0.05	9.90
AV	510k	20.84	46.00	-25.16	10.01	Line	-	10.83	0.06	0.05	9.90
QP	4.317M	34.83	56.00	-21.17	10.14	Line	-	24.69	0.13	0.10	9.91
AV	4.317M	28.76	46.00	-17.24	10.14	Line	-	18.62	0.13	0.10	9.91
QP	17.759M	41.07	60.00	-18.93	10.49	Line	-	30.58	0.29	0.20	10.00
AV	17.759M	32.99	50.00	-17.01	10.49	Line	-	22.50	0.29	0.20	10.00
QP	18.492M	42.37	60.00	-17.63	10.50	Line	-	31.87	0.29	0.21	10.00
AV	18.492M	35.47	50.00	-14.53	10.50	Line	-	24.97	0.29	0.21	10.00





Summary

Mode	Max-N dB (Hz)	Max-OBW (Hz)	ITU-Code	Min-N dB (Hz)	Min-OBW (Hz)
2.4-2.4835GHz	-	-	-	-	-
Zigbee	1.544M	2.314M	2M31G1D	1.506M	2.081M

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

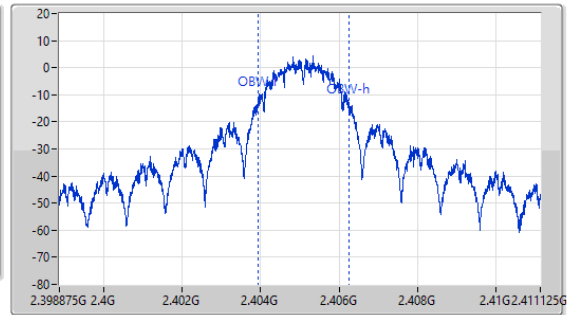
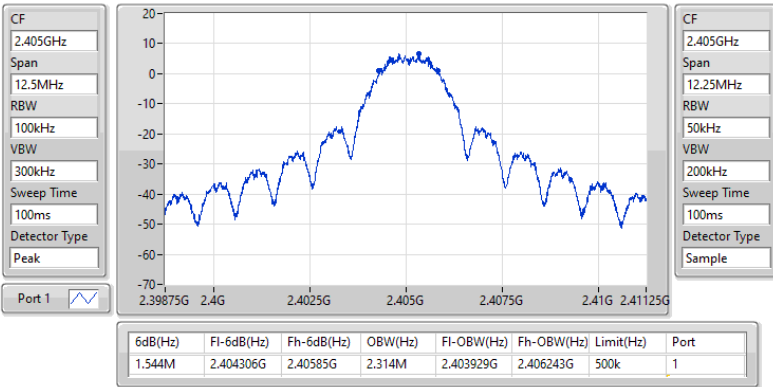
Mode	Result	Limit (Hz)	Port 1-N dB (Hz)	Port 1-OBW (Hz)
Zigbee	-	-	-	-
2405MHz	Pass	500k	1.544M	2.314M
2440MHz	Pass	500k	1.544M	2.314M
2480MHz	Pass	500k	1.506M	2.081M

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

2.4-2.4835GHz_Zigbee
2405MHz

EBW

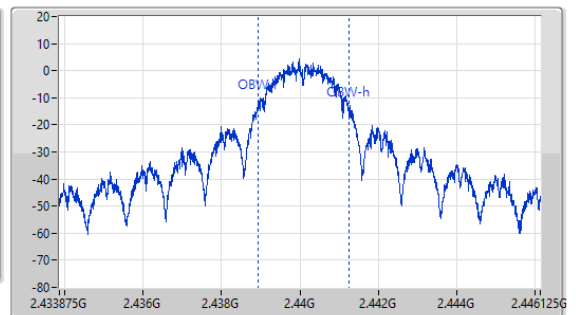
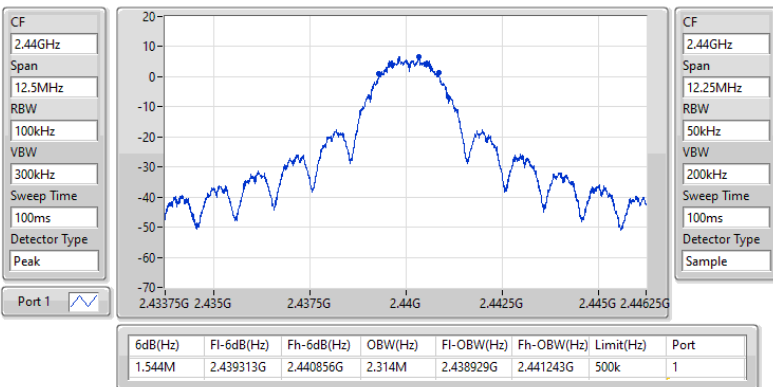
08/02/2023



2.4-2.4835GHz_Zigbee
2440MHz

EBW

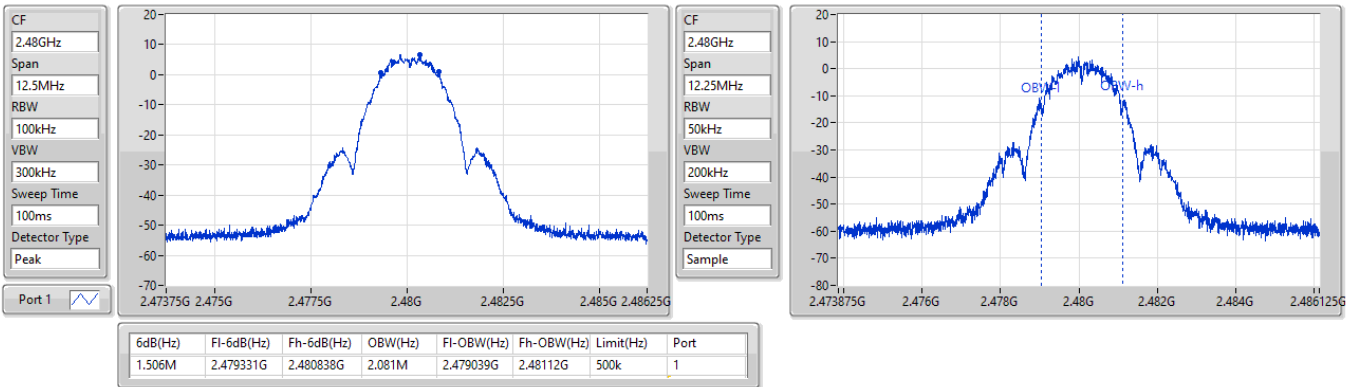
08/02/2023



2.4-2.4835GHz_Zigbee
2480MHz

EBW

08/03/2023





Summary

Mode	Total Power (dBm)	Total Power (W)
2.4-2.4835GHz	-	-
Zigbee	9.37	0.00865



Result

Mode	Result	DG (dBi)	Port 1 (dBm)	Total Power (dBm)	Power Limit (dBm)
Zigbee	-	-	-	-	-
2405MHz	Pass	1.095	9.37	9.37	30.00
2440MHz	Pass	1.095	9.29	9.29	30.00
2480MHz	Pass	1.095	9.12	9.12	30.00

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



Summary

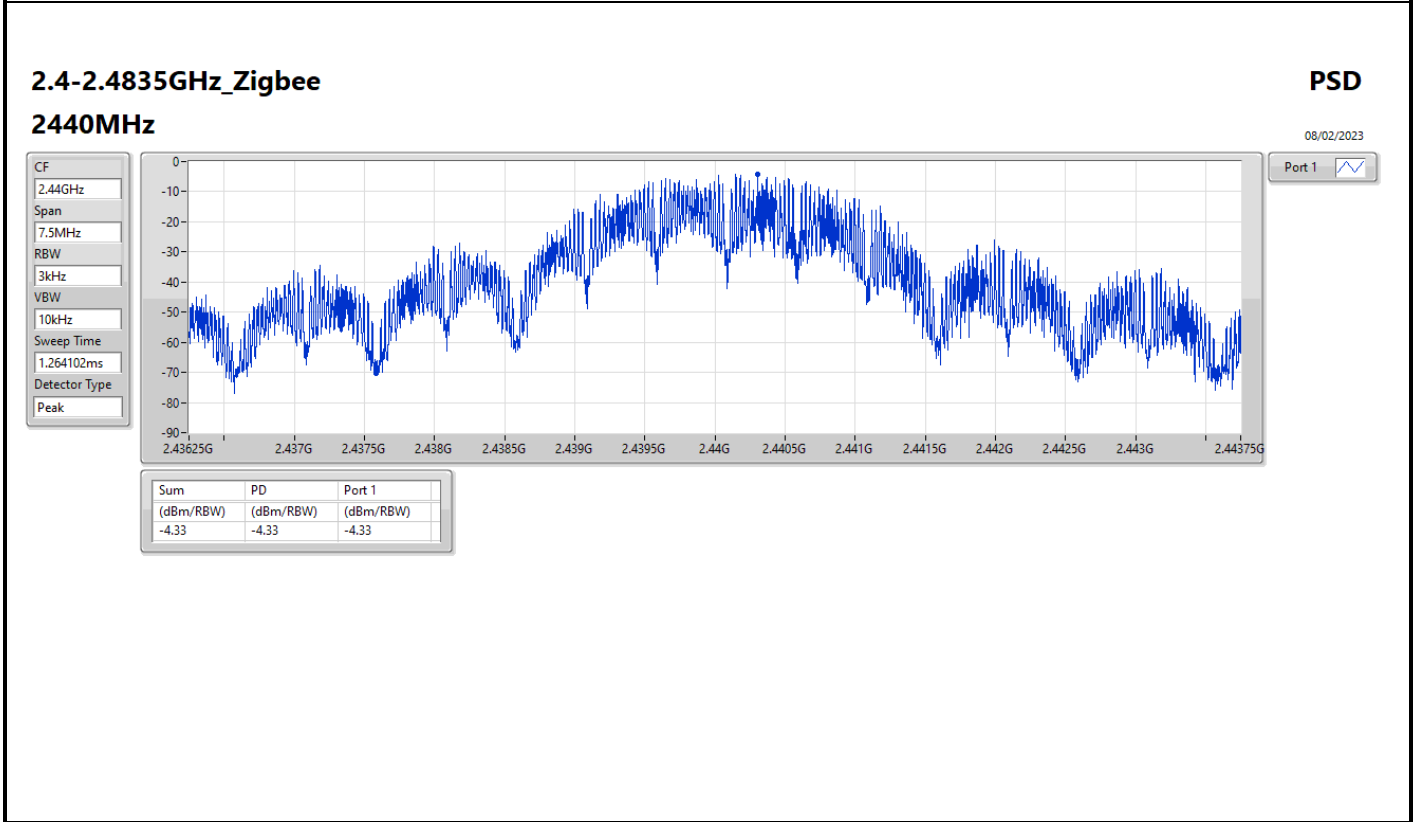
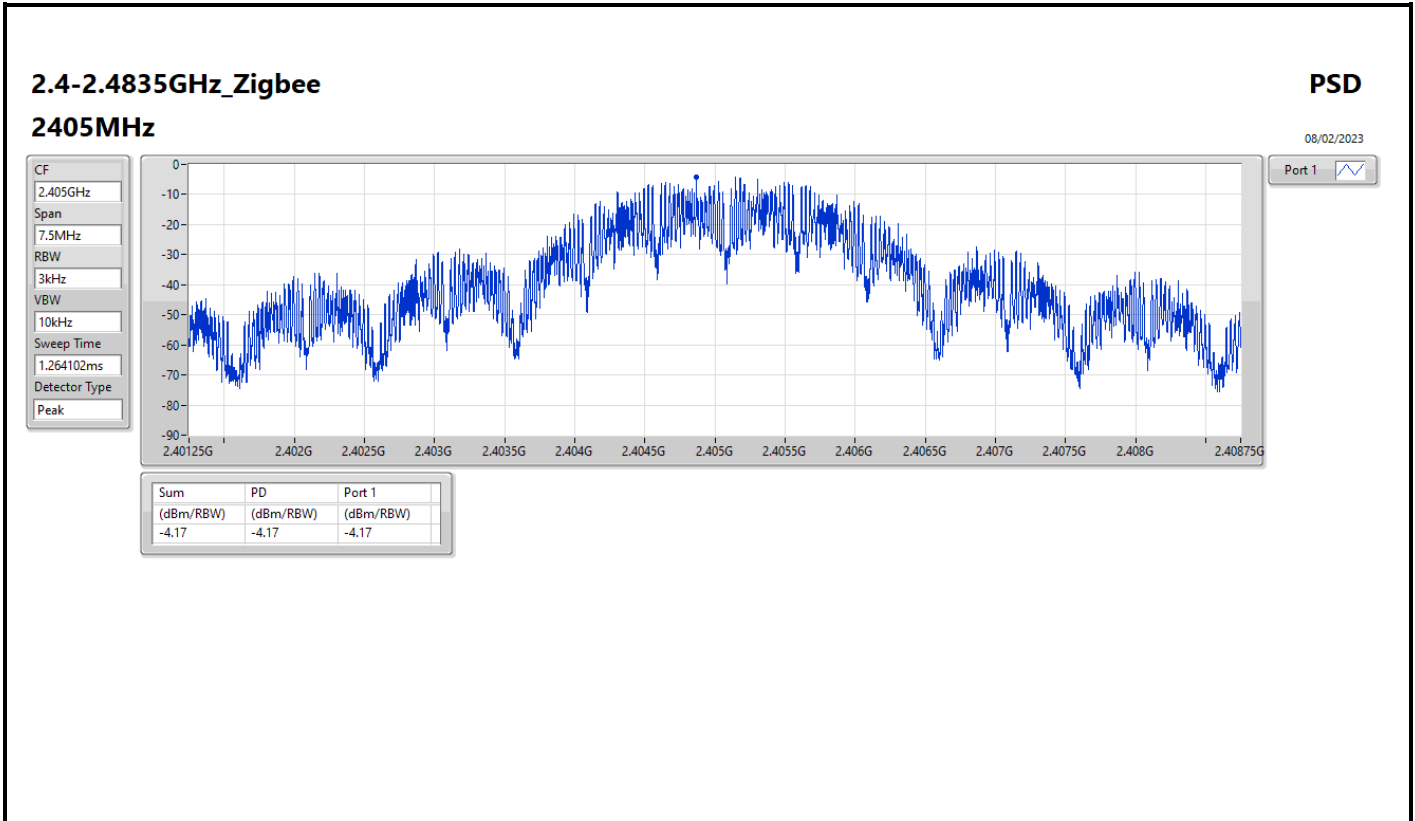
Mode	PD (dBm/RBW)
2.4-2.4835GHz	-
Zigbee	-4.17

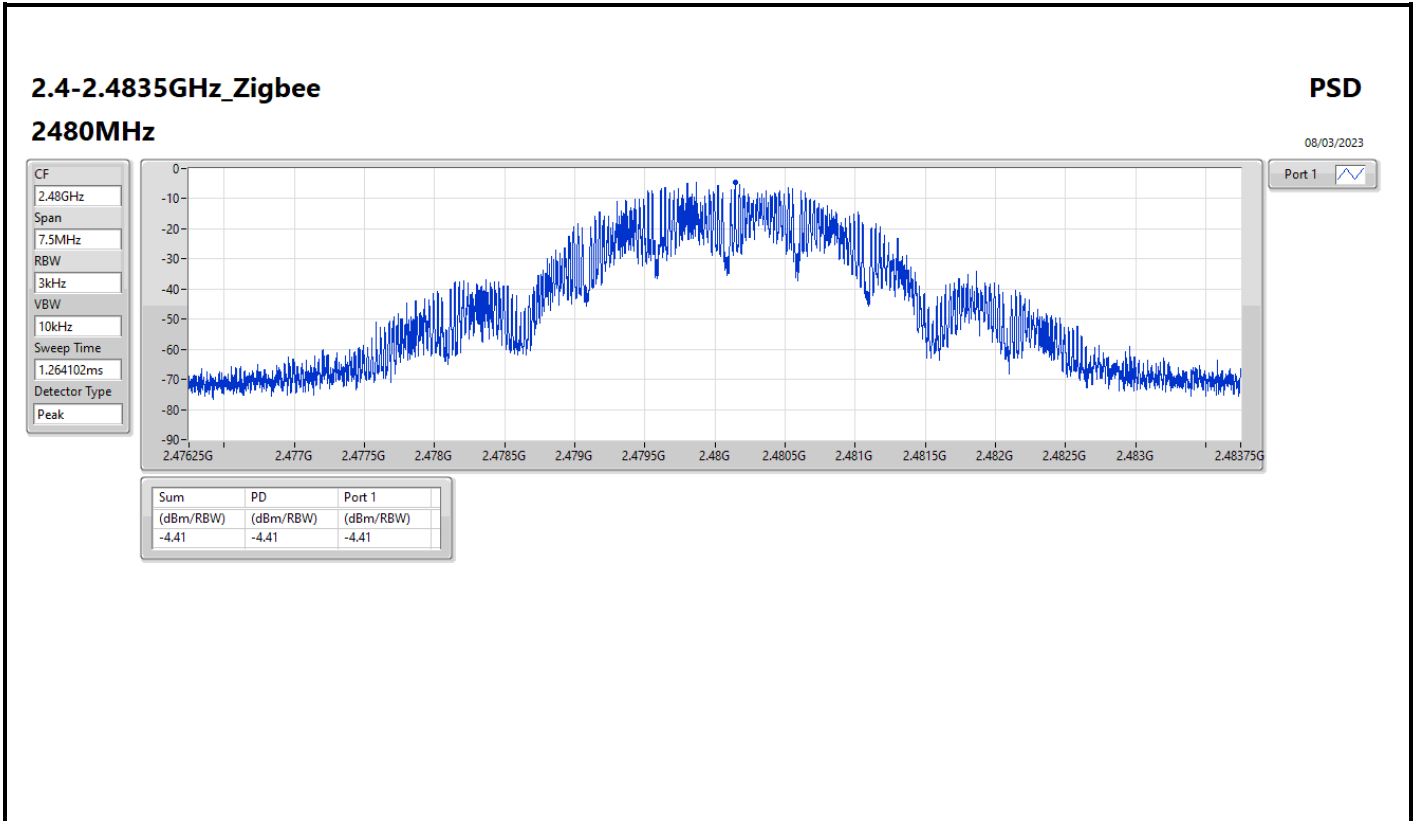
RBW = 3kHz;

Result

Mode	Result	DG (dBi)	Port 1 (dBm/RBW)	PD (dBm/RBW)	PD Limit (dBm/RBW)
Zigbee	-	-	-	-	-
2405MHz	Pass	1.095	-4.17	-4.17	8.00
2440MHz	Pass	1.095	-4.33	-4.33	8.00
2480MHz	Pass	1.095	-4.41	-4.41	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;







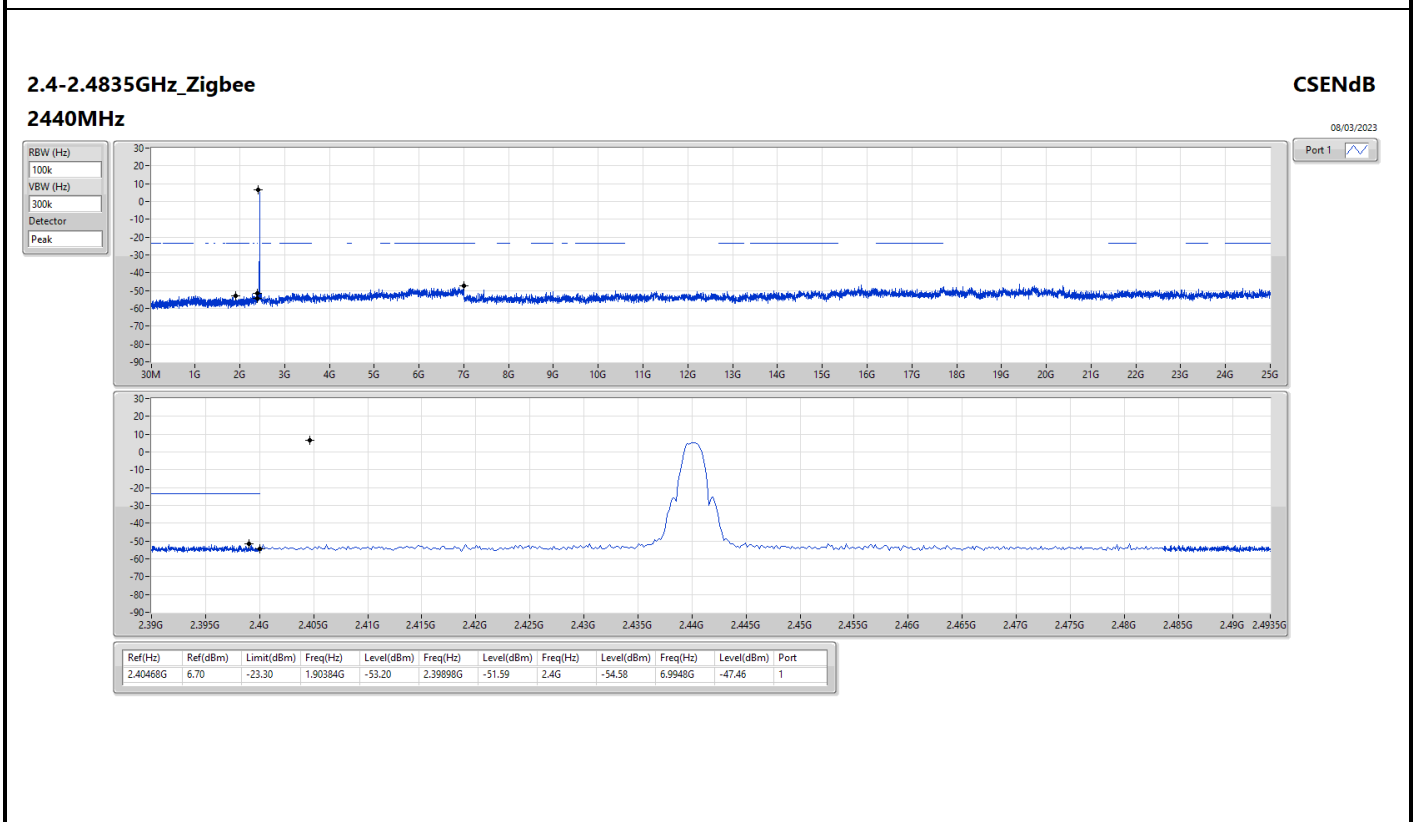
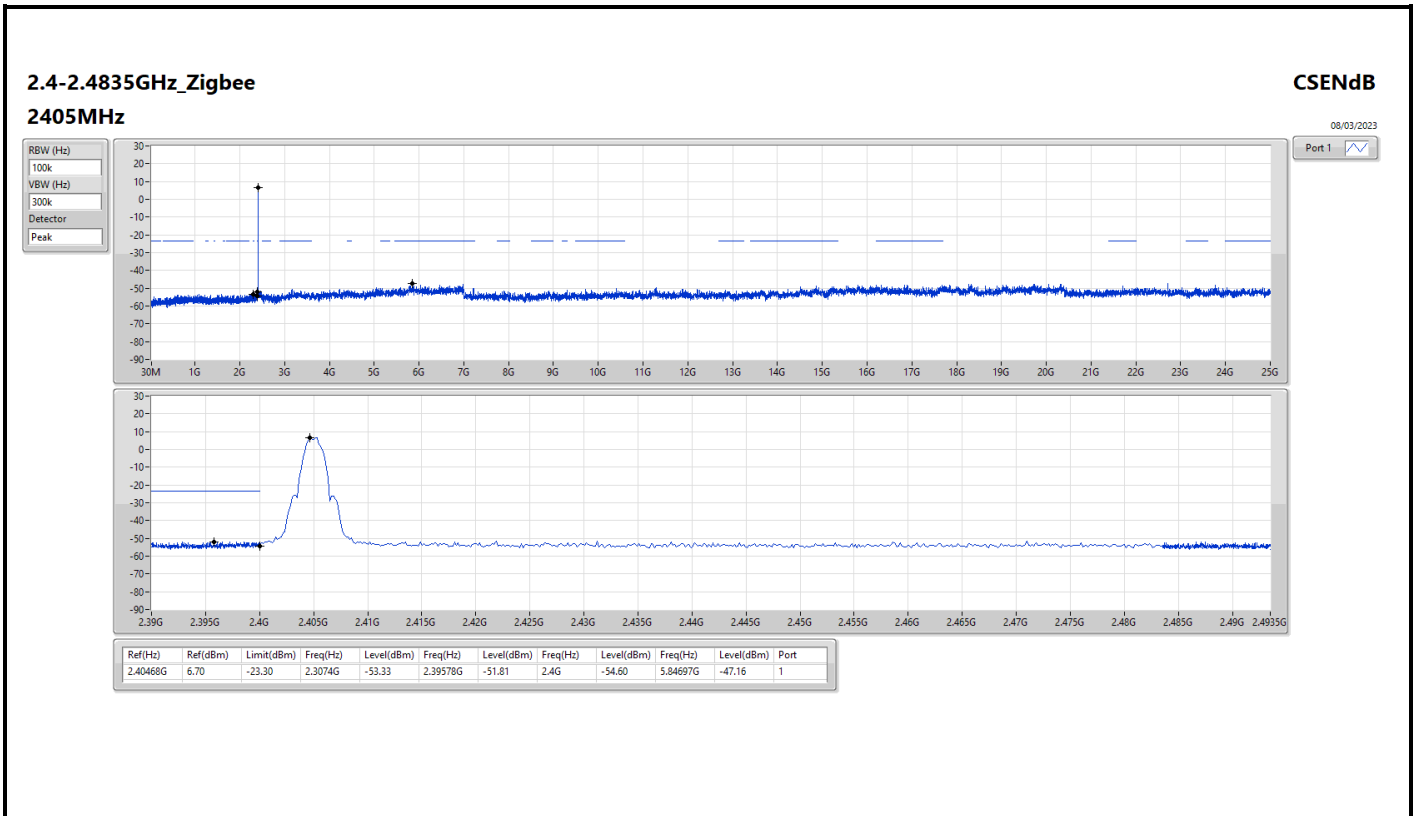
Summary

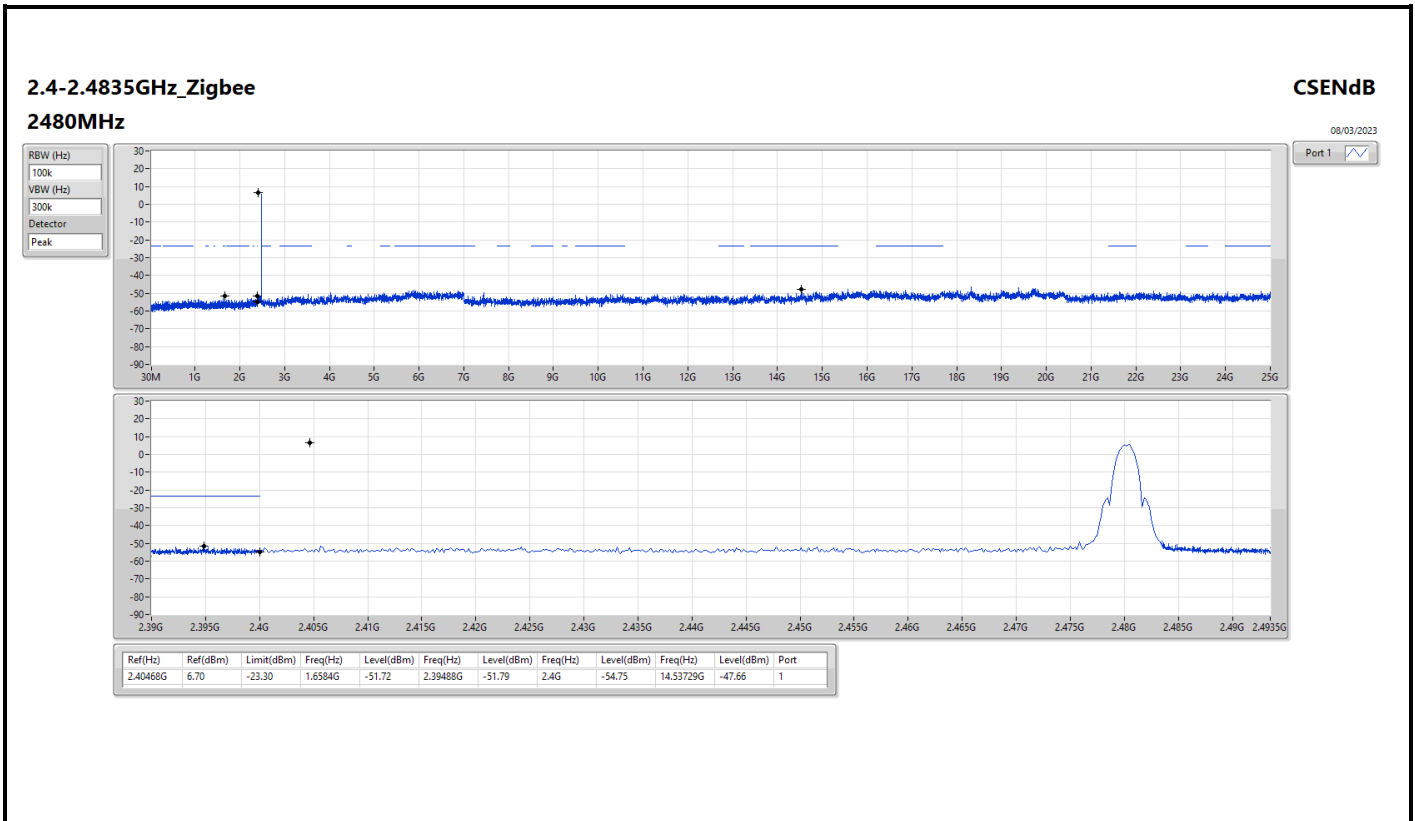
Mode	Result	Ref (Hz)	Ref (dBm)	Limit (dBm)	Freq (Hz)	Level (dBm)	Freq (Hz)	Level (dBm)	Freq (Hz)	Level (dBm)	Freq (Hz)	Level (dBm)	Port
2.4-2.4835GHz	-	-	-	-	-	-	-	-	-	-	-	-	-
Zigbee	Pass	2.40468G	6.70	-23.30	2.3074G	-53.33	2.39578G	-51.81	2.4G	-54.60	5.84697G	-47.16	1



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)	Port
Zigbee	-	-	-	-	-	-	-	-	-	-	-	-	-
2405MHz	Pass	2.40468G	6.70	-23.30	2.3074G	-53.33	2.39578G	-51.81	2.4G	-54.60	5.84697G	-47.16	1
2440MHz	Pass	2.40468G	6.70	-23.30	1.90384G	-53.20	2.39898G	-51.59	2.4G	-54.58	6.9948G	-47.46	1
2480MHz	Pass	2.40468G	6.70	-23.30	1.6584G	-51.72	2.39488G	-51.79	2.4G	-54.75	14.53729G	-47.66	1



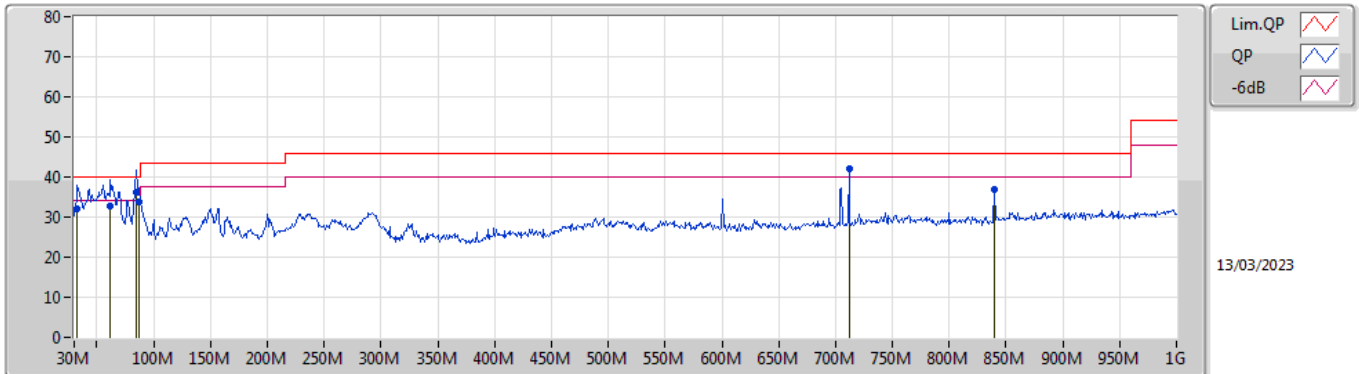




Summary

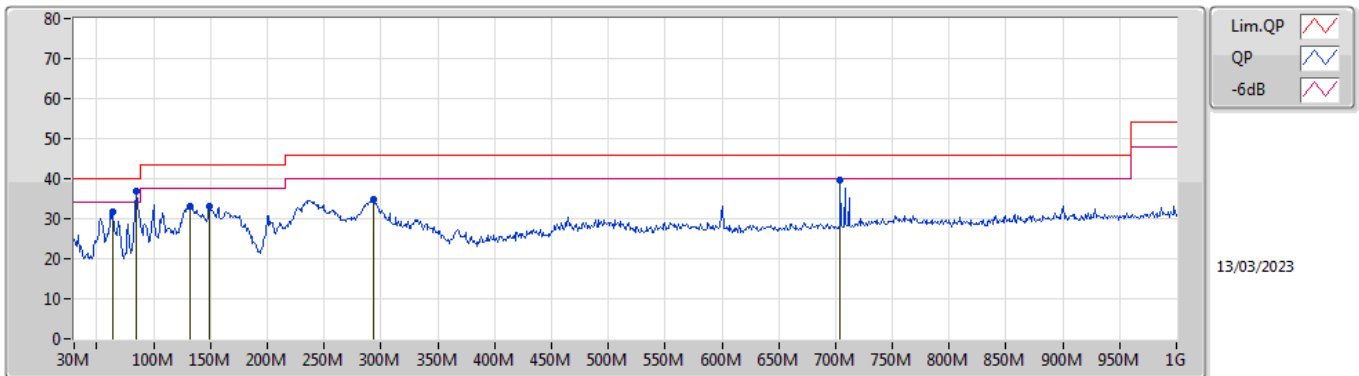
Mode	Result	Type	Freq (Hz)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Condition
Mode 2	Pass	PK	84.32M	36.75	40.00	-3.25	Horizontal

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)
QP	32.91M	32.07	40.00	-7.93	-8.33	3	Vertical	197	1.00	-	40.40	22.88	0.80	32.01
QP	62.01M	32.81	40.00	-7.19	-18.69	3	Vertical	309	1.25	-	51.50	12.40	1.08	32.17
QP	84.32M	36.18	40.00	-3.82	-17.12	3	Vertical	202	1.25	"Worst"	53.30	13.62	1.23	31.97
QP	87.23M	33.80	40.00	-6.20	-16.60	3	Vertical	215	1.00	-	50.40	14.16	1.25	32.01
PK	711.91M	41.92	46.00	-4.08	-3.12	3	Vertical	337	1.25	-	45.04	24.93	3.65	31.70
PK	839.95M	36.84	46.00	-9.16	-1.14	3	Vertical	264	1.25	-	37.98	26.08	3.98	31.20

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	63.95M	31.59	40.00	-8.41	-18.63	3	Horizontal	301	3.00	-	50.22	12.41	1.10	32.14
PK	84.32M	36.75	40.00	-3.25	-17.12	3	Horizontal	129	2.00	"Worst"	53.87	13.62	1.23	31.97
PK	131.85M	33.27	43.50	-10.23	-12.71	3	Horizontal	111	1.50	-	45.98	17.73	1.52	31.96
PK	149.31M	33.09	43.50	-10.41	-13.97	3	Horizontal	143	2.00	-	47.06	16.48	1.59	32.04
PK	292.87M	34.68	46.00	-11.32	-10.56	3	Horizontal	310	1.25	-	45.24	18.94	2.26	31.76
PK	704.15M	39.64	46.00	-6.36	-3.22	3	Horizontal	211	1.50	-	42.86	24.88	3.63	31.73

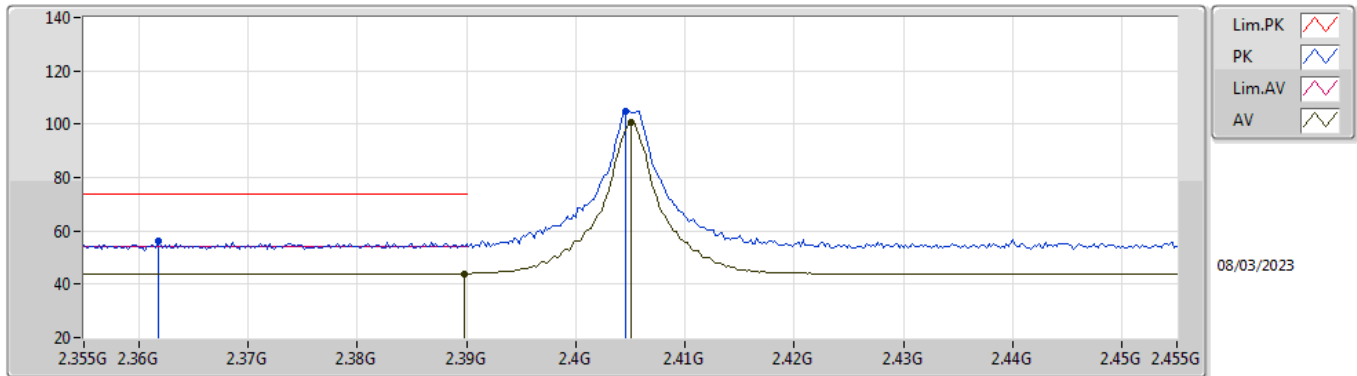


Summary

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	Pass	AV	2.4835G	52.77	54.00	-1.23	3	Vertical	212	1.76	-

2.4-2.4835GHz_Zigbee

2405MHz_TX

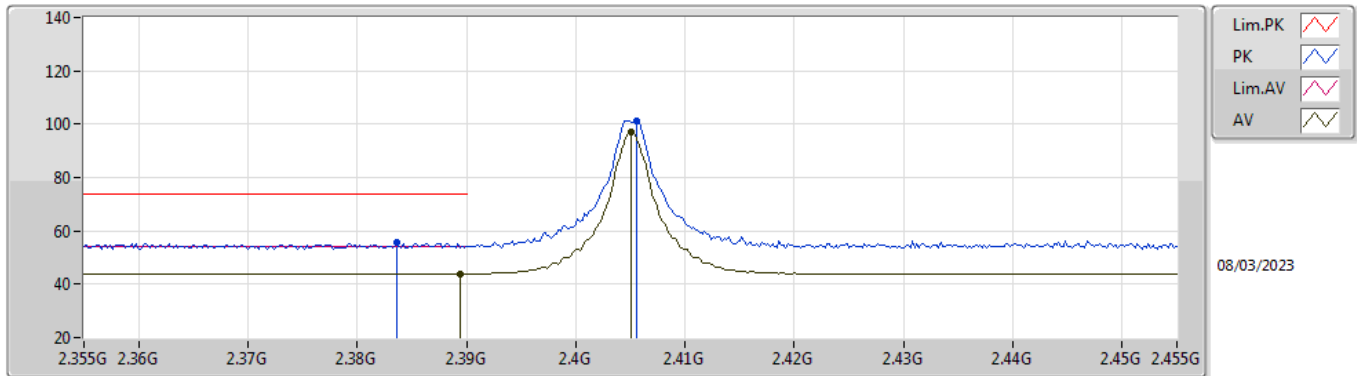


EUT_Z_1TX
Setting 10
03-F-R-7

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	2.3618G	55.95	74.00	-18.05	23.84	3	Vertical	232	1.80	-	28.15	3.96	-
AV	2.3898G	44.05	54.00	-9.95	11.80	3	Vertical	232	1.80	-	28.26	3.99	-
PK	2.4046G	105.06	Inf	-Inf	72.76	3	Vertical	232	1.80	-	28.30	4.00	-
AV	2.405G	100.91	Inf	-Inf	68.61	3	Vertical	232	1.80	-	28.30	4.00	-

2.4-2.4835GHz_Zigbee

2405MHz_TX

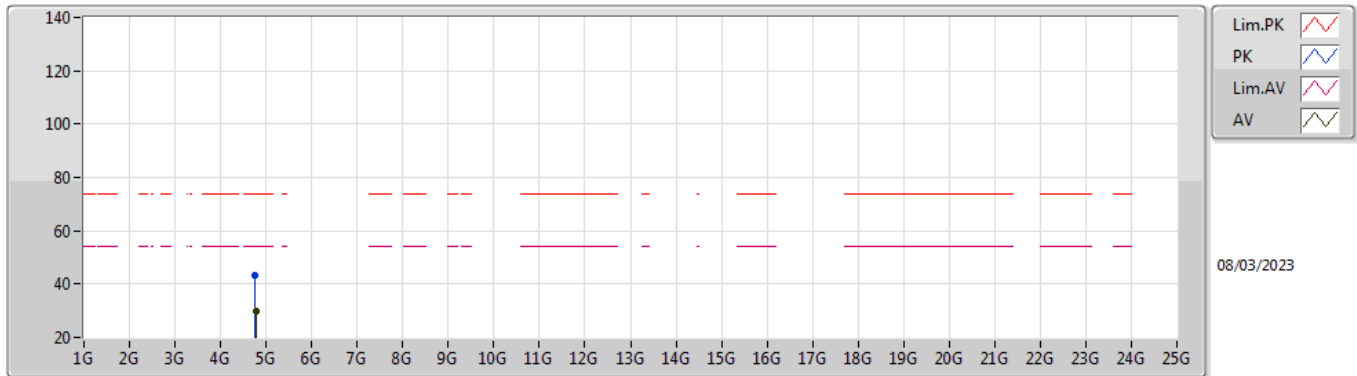


EUT_Z_1TX
 Setting 10
 03-F-R-7

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	2.3836G	55.54	74.00	-18.46	23.33	3	Horizontal	116	1.84	-	28.23	3.98	-
AV	2.3894G	43.92	54.00	-10.08	11.67	3	Horizontal	116	1.84	-	28.26	3.99	-
PK	2.4056G	101.46	Inf	-Inf	69.15	3	Horizontal	116	1.84	-	28.30	4.01	-
AV	2.405G	97.31	Inf	-Inf	65.01	3	Horizontal	116	1.84	-	28.30	4.00	-

2.4-2.4835GHz_Zigbee

2405MHz_TX

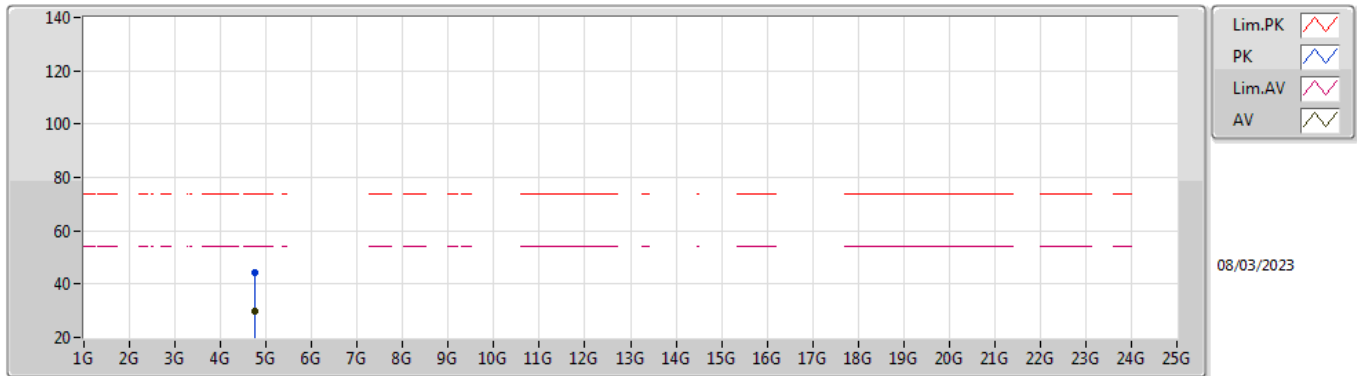


EUT_Z_1TX
Setting 10
03-F-R-7

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	4.766G	43.15	74.00	-30.85	38.30	3	Vertical	0	2.78	-	33.27	6.48	34.90
AV	4.7768G	29.68	54.00	-24.32	24.84	3	Vertical	0	2.78	-	33.25	6.49	34.90

2.4-2.4835GHz_Zigbee

2405MHz_TX

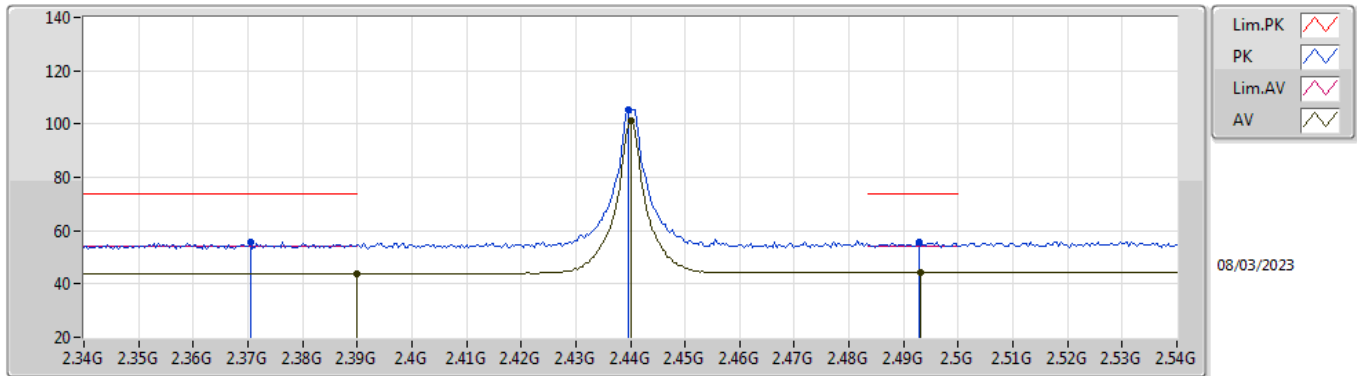


EUT_Z_1TX
Setting 10
03-F-R-7

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	4.766G	44.43	74.00	-29.57	39.58	3	Horizontal	0	2.26	-	33.27	6.48	34.90
AV	4.7608G	29.59	54.00	-24.41	24.73	3	Horizontal	0	2.26	-	33.28	6.48	34.90

2.4-2.4835GHz_Zigbee

2440MHz_TX

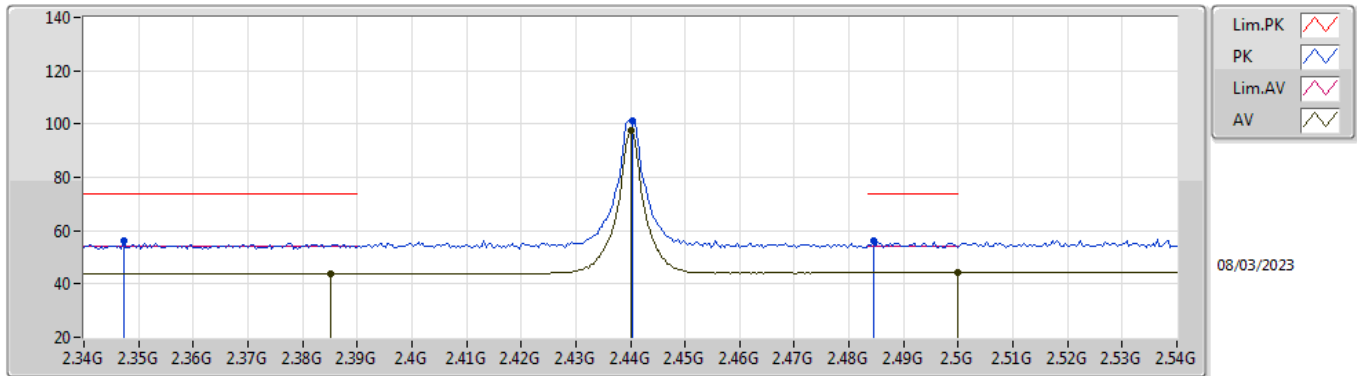


EUT_Z_1TX
Setting 10
03-F-R-7

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	2.3704G	55.58	74.00	-18.42	23.43	3	Vertical	228	1.83	-	28.18	3.97	-
AV	2.39G	43.90	54.00	-10.10	11.65	3	Vertical	228	1.83	-	28.26	3.99	-
PK	2.4396G	105.24	Inf	-Inf	72.90	3	Vertical	228	1.83	-	28.30	4.04	-
AV	2.44G	101.16	Inf	-Inf	68.82	3	Vertical	228	1.83	-	28.30	4.04	-
PK	2.4928G	55.94	74.00	-18.06	23.38	3	Vertical	228	1.83	-	28.47	4.09	-
AV	2.4932G	44.28	54.00	-9.72	11.72	3	Vertical	228	1.83	-	28.47	4.09	-

2.4-2.4835GHz_Zigbee

2440MHz_TX

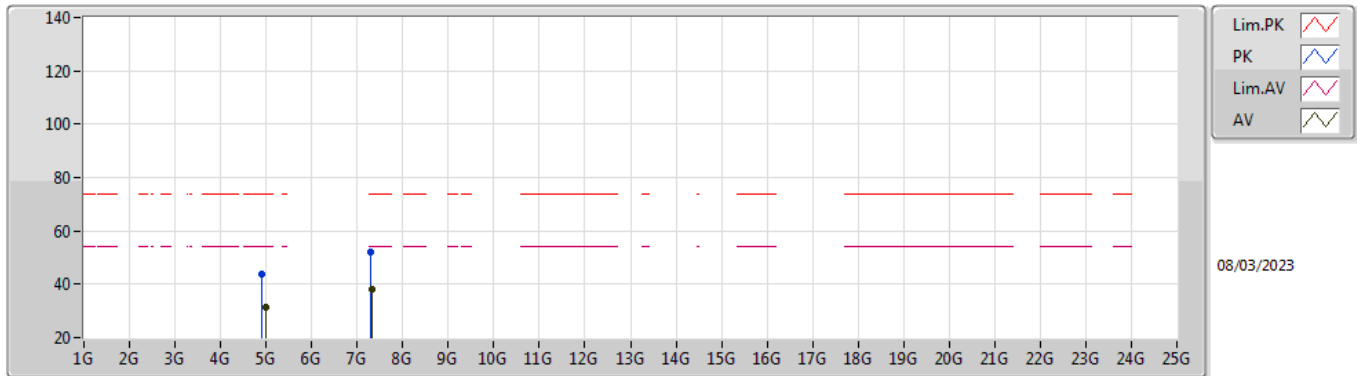


EUT_Z_1TX
 Setting 10
 03-F-R-7

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	2.3472G	56.07	74.00	-17.93	24.03	3	Horizontal	115	1.42	-	28.09	3.95	-
AV	2.3852G	43.86	54.00	-10.14	11.63	3	Horizontal	115	1.42	-	28.24	3.99	-
PK	2.4404G	101.42	Inf	-Inf	69.08	3	Horizontal	115	1.42	-	28.30	4.04	-
AV	2.44G	97.35	Inf	-Inf	65.01	3	Horizontal	115	1.42	-	28.30	4.04	-
PK	2.4844G	56.00	74.00	-18.00	23.48	3	Horizontal	115	1.42	-	28.44	4.08	-
AV	2.5G	44.28	54.00	-9.72	11.68	3	Horizontal	115	1.42	-	28.50	4.10	-

2.4-2.4835GHz_Zigbee

2440MHz_TX

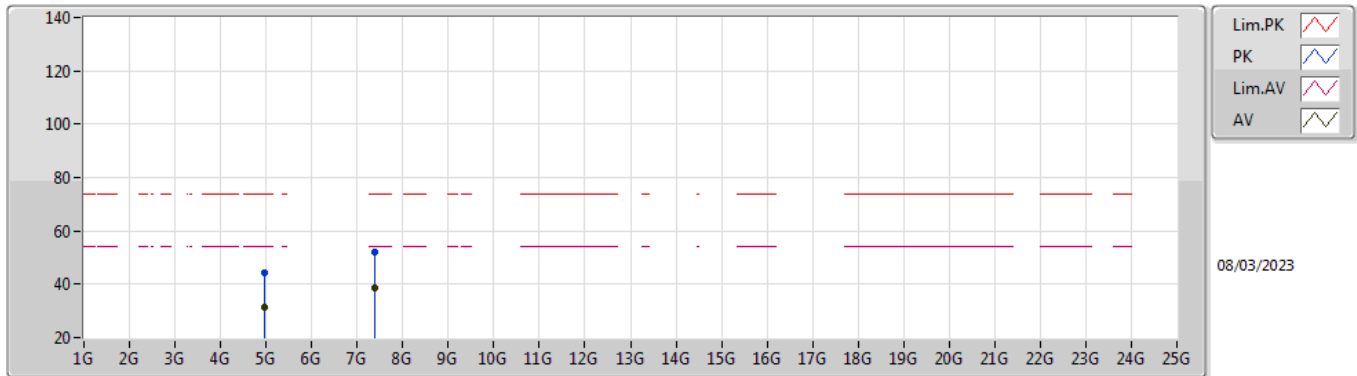


EUT_Z_1TX
Setting 10
03-F-R-7

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	4.916G	43.84	74.00	-30.16	38.44	3	Vertical	64	1.80	-	33.73	6.56	34.89
AV	4.98G	31.17	54.00	-22.83	25.73	3	Vertical	64	1.80	-	33.74	6.59	34.89
PK	7.30668G	52.02	74.00	-21.98	41.55	3	Vertical	315	1.80	-	36.91	8.70	35.14
AV	7.31106G	38.28	54.00	-15.72	27.80	3	Vertical	315	1.80	-	36.92	8.70	35.14

2.4-2.4835GHz_Zigbee

2440MHz_TX

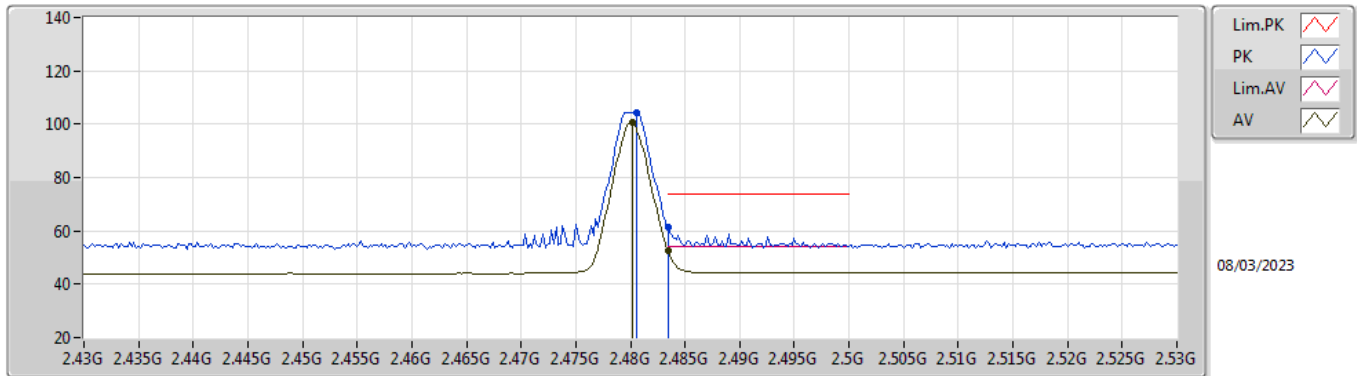


EUT_Z_1TX
Setting 10
03-F-R-7

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	4.9668G	44.16	74.00	-29.84	38.70	3	Horizontal	160	1.15	-	33.77	6.58	34.89
AV	4.976G	31.23	54.00	-22.77	25.78	3	Horizontal	160	1.15	-	33.75	6.59	34.89
PK	7.3928G	51.97	74.00	-22.03	41.45	3	Horizontal	88	1.80	-	37.00	8.70	35.18
AV	7.3736G	38.48	54.00	-15.52	27.95	3	Horizontal	88	1.80	-	37.00	8.70	35.17

2.4-2.4835GHz_Zigbee

2480MHz_TX

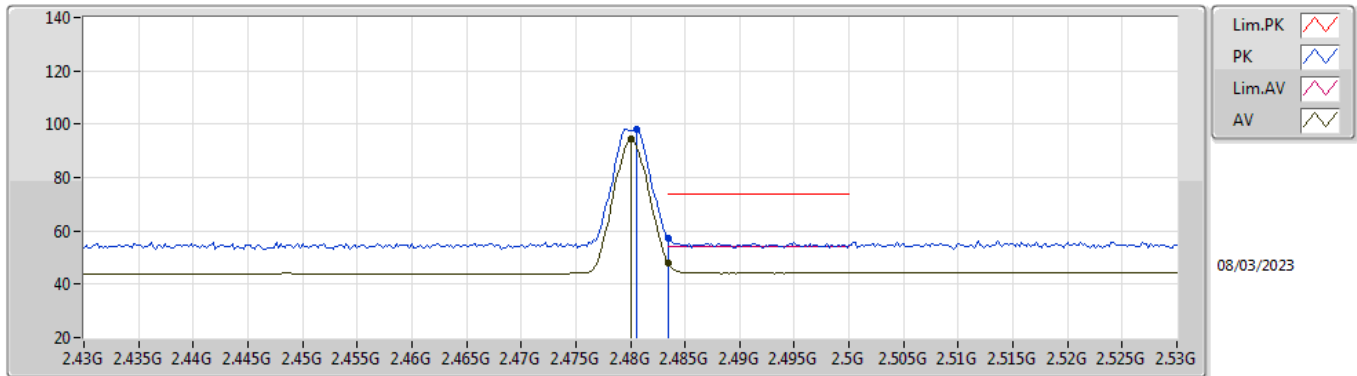


EUT_Z_1TX
 Setting 10
 01-F-M-2

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	2.4806G	104.55	Inf	-Inf	72.83	3	Vertical	212	1.76	-	28.08	3.64	-
AV	2.4802G	100.78	Inf	-Inf	69.06	3	Vertical	212	1.76	-	28.08	3.64	-
PK	2.4835G	61.38	74.00	-12.62	29.64	3	Vertical	212	1.76	-	28.10	3.64	-
AV	2.4835G	52.77	54.00	-1.23	21.03	3	Vertical	212	1.76	-	28.10	3.64	-

2.4-2.4835GHz_Zigbee

2480MHz_TX

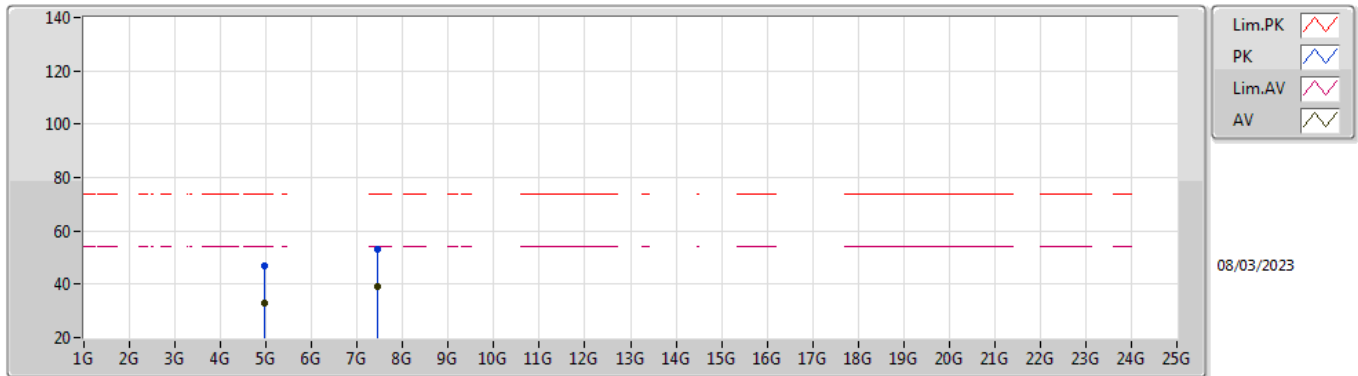


EUT_Z_1TX
Setting 10
01-F-M-2

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	2.4806G	98.21	Inf	-Inf	66.49	3	Horizontal	111	1.75	-	28.08	3.64	-
AV	2.48G	94.30	Inf	-Inf	62.58	3	Horizontal	111	1.75	-	28.08	3.64	-
PK	2.4835G	57.49	74.00	-16.51	25.75	3	Horizontal	111	1.75	-	28.10	3.64	-
AV	2.4835G	48.15	54.00	-5.85	16.41	3	Horizontal	111	1.75	-	28.10	3.64	-

2.4-2.4835GHz_Zigbee

2480MHz_TX

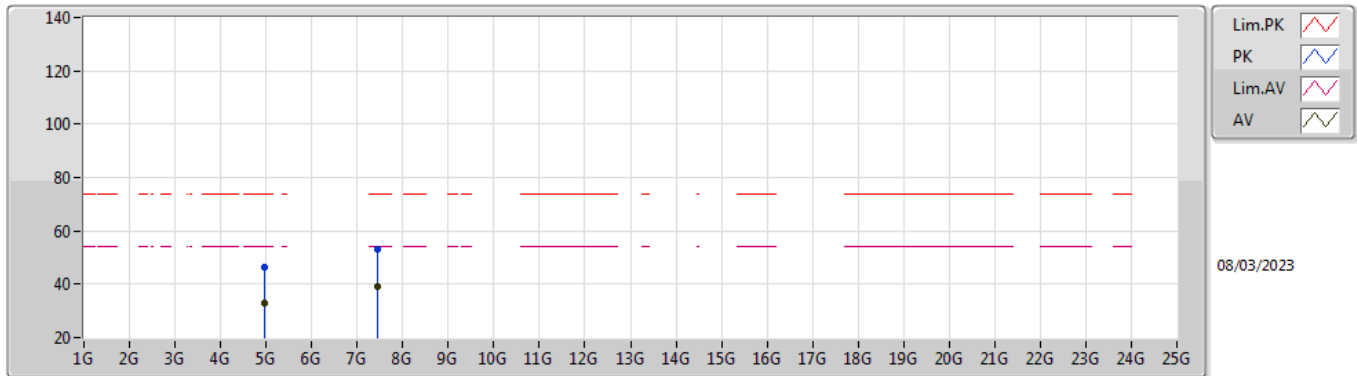


EUT_Z_1TX
 Setting 10
 01-F-M-2

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	4.95796G	46.82	74.00	-27.18	40.80	3	Vertical	176	1.80	-	33.02	5.86	32.86
AV	4.96203G	32.84	54.00	-21.16	26.82	3	Vertical	176	1.80	-	33.02	5.86	32.86
PK	7.43826G	53.04	74.00	-20.96	41.57	3	Vertical	308	1.80	-	37.50	7.22	33.25
AV	7.44078G	39.01	54.00	-14.99	27.54	3	Vertical	308	1.80	-	37.50	7.22	33.25

2.4-2.4835GHz_Zigbee

2480MHz_TX



EUT_Z_1TX
 Setting 10
 01-F-M-2

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	4.96179G	46.57	74.00	-27.43	40.55	3	Horizontal	208	1.04	-	33.02	5.86	32.86
AV	4.96218G	32.89	54.00	-21.11	26.87	3	Horizontal	208	1.04	-	33.02	5.86	32.86
PK	7.43939G	52.88	74.00	-21.12	41.41	3	Horizontal	87	1.80	-	37.50	7.22	33.25
AV	7.43901G	39.00	54.00	-15.00	27.53	3	Horizontal	87	1.80	-	37.50	7.22	33.25