



# RADIO TEST REPORT

FCC ID

: TLZ-XH32X

Equipment

: IEEE 802.11 a/b/g/n/ac/ax Wi-Fi + Bluetooth 5.3

Combo SIP Module

**Brand Name** 

: AzureWave

**Model Name** 

: AW-XH323, AW-XH325, AW-XH327

Applicant

: AzureWave Technologies, Inc.

8F., No.94, Baozhong Rd., Xindian Dist., New

Taipei City, Taiwan 231

Manufacturer

: AzureWave Technologies, Inc.

8F., No.94, Baozhong Rd., Xindian Dist., New

Taipei City, Taiwan 231

Standard

: 47 CFR FCC Part 15.247

The product was received on Dec. 14, 2023, and testing was started from Dec. 16, 2023 and completed on Apr. 11, 2024. We, Sporton International Inc. Hsinchu Laboratory, would like to declare that the tested sample has been evaluated in accordance with the procedures given in ANSI C63.10-2013 and shown compliance with the applicable technical standards.

The test results in this 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

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Report No.	Version	Description	Issued Date
FR3O3014AE	01	Initial issue of report	Apr. 25, 2024

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# **Summary of Test Result**

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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/manufacturer 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: Sophia Shiung

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# 1 General Description

# 1.1 Information

### 1.1.1 RF General Information

Frequency Range (MHz)	Bluetooth Mode	Ch. Frequency (MHz)	Channel Number
2400-2483.5	LE	2402-2480	0-39 [40]

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Band	Mode	BWch (MHz)	Nant
2.4-2.4835GHz	BT-LE(1Mbps)	1	1TX
2.4-2.4835GHz	BT-LE(2Mbps)	2	1TX

### Note:

- Bluetooth LE uses a GFSK modulation.
- BWch is the nominal channel bandwidth.

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### 1.1.2 Antenna Information

Ant.	Brand	Model Name	Antenna Type	Connector	Gain (dBi)
1	451676715		5.54	. 557	
2	ARISTOTLE	RFA-27-JP326MHF4C198	PIFA	I-PEX	Note 1

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### Note 1:

Ant.	Port	Gain (dBi)			
Ant.	WLAN 2.4GHz / 5GHz / 6GHz	Bluetooth	WLAN 2.4GHz	WLAN 5GHz / 6GHz	Bluetooth
1	1	1	2.5	F	2.5
2	2	N/A	3.5	5	3.5

Note 2: The above information was declared by manufacturer.

Note 3: Directional gain information for 2TX/2RX

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	Directiona lGain = $10 \cdot \log \left[ \frac{\sum_{j=1}^{N_{SS}} \left\{ \sum_{k=1}^{N_{ANT}} g_{j,k} \right\}^{2}}{N_{ANT}} \right]$
BF	Directiona IGain = $10 \cdot \log \left[ \frac{\sum_{j=1}^{N_{ASY}} \left\{ \sum_{k=1}^{N_{AGY}} g_{j,k} \right\}^{2}}{N_{ANT}} \right]$	Directiona lGain = $10 \cdot \log \left[ \frac{\sum_{j=1}^{N_{sS}} \left\{ \sum_{k=1}^{N_{sAV}} g_{j,k} \right\}^{2}}{N_{sAVT}} \right]$

Ex.

$$\begin{split} &\text{NSS1}(\text{g1,1}) = \ 10^{\text{G1/20}} \ ; \, \text{NSS1}(\text{g1,2}) = \ 10^{\text{G2/20}} \ ; \, \text{NSS1}(\text{g1,2}) = \ 10^{\text{G3/20}}; \, \text{NSS1}(\text{g1,2}) = \ 10^{\text{G4/20}} \\ &\text{gj,k} = &(\text{Nss1}(\text{g1,1}) \ + \ \text{Nss1}(\text{g1,2}) \ + \ \text{Nss1}(\text{g1,3}) \ + \ \text{Nss1}(\text{g1,4}) \ )^2 \\ &\text{DG} = 10 \ \log[(\text{Nss1}(\text{g1,1}) \ + \ \text{Nss1}(\text{g1,2}) \ + \ \text{Nss1}(\text{g1,3}) \ + \ \text{Nss1}(\text{g1,4}))^2 \ / \ N_{\text{ANT}}] \Rightarrow 10 \\ &\log[(10^{\text{G1/20}} \ + \ 10^{\text{G2/20}} \ + \ 10^{\text{G3/20}} \ + \ 10^{\text{G4/20}} \ )^2 \ / \ N_{\text{ANT}}] \end{split}$$
 Where ;

2.4G G1= 3.5 dBi ;G2= 3.5 dBi ; 5G UNII-1 G1 = 5.00 dBi; G2 = 5.00 dBi; 5G UNII-2A G1 = 5.00 dBi; G2 = 5.00 dBi; 5G UNII-2C G1 = 5.00 dBi; G2 = 5.00 dBi; 5G UNII-3 G1 = 5.00 dBi; G2 = 5.00 dBi;

2.4G DG = 6.51 dBi 5G UNII-1 DG = 8.01 dBi 5G UNII-2A DG = 8.01 dBi 5G UNII-2C DG = 8.01 dBi 5G UNII-3 DG = 8.01 dBi

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### Note 4: For 2.4GHz function:

### For IEEE 802.11 b/g/n/VHT/ax (1TX/1RX):

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

### For IEEE 802.11 b/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 (1TX/1RX):

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

### For 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.

### For 6GHz function:

### For IEEE 802.11ax (1TX/1RX):

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

### For IEEE 802.11ax (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 function (1TX/1RX):

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

### 1.1.3 Mode Test Duty Cycle

Mode	DC	DCF (dB)	T (s)	VBW (Hz)_1/T
BT-LE(1Mbps)	0.626	2.03	391.25u	3k
BT-LE(2Mbps)	0.312	5.06	195.625u	10k

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### Note:

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

### 1.1.4 EUT Operational Condition

EUT Power Type		From host system				
Function	$\boxtimes$	Point-to-multipoint Doint-to-point				
<b>Test Software Version</b>	n Tera Term 4.75					
	$\boxtimes$	LE 1M PHY: 1 Mb/s				
Support Mode		LE Coded PHY (S=2): 500 Kb/s				
Support Mode		LE Coded PHY (S=8): 125 Kb/s				
		LE 2M PHY: 2 Mb/s				

Note: The above information was declared by manufacturer.

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### 1.1.5 Table for Multiple Listing

Model Name	Description
AW-XH323	
AW-XH325	All the models are identical, the different model names serve as
AW-XH327	strategies for marketing.

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Note 2: The above information was declared by manufacturer.

### 1.1.6 Table for EUT Information

The EUT has 3 SKUs. The difference between them lies in the software settings listed below:

SKU	TX/RX Function for WLAN	Supporting WLAN 6GHz
1	2TX/2RX	V
2	1TX/1RX	V
3	2TX/2RX	Х

Note 1: From the above SKUs, SKU 2 was selected to test all the test items, and SKU 1 was selected to test AC Power-line Conducted Emissions and Emissions in Restricted Frequency Bands below 1GHz. Their data was recorded in this report.

Note 2: The above information was declared by manufacturer.

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Note 1: From the above models, AW-XH323 was selected as representative model for the test, and its data was recorded in this report.

# 1.2 Applicable Standards

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

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- 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	TH01-CB	Ken Yeh	21.4~22.7 / 66~68	Dec. 21, 2023~ Jan. 15, 2024
Radiated < 1GHz	03CH04-CB	Black Lu	22.7~23.8 / 56~59	Mar. 19, 2024~ Apr. 11, 2024
Radiated > 1GHz	03CH02-CB	Black Lu	22~23 / 55~58	Dec. 16, 2023~ Jan. 12, 2024
AC Conduction	CO01-CB	Joe Chu	22~23 / 50~51	Mar. 27, 2024

# 1.4 Measurement Uncertainty

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

Test Items	Uncertainty	Remark
Conducted Emission (150kHz ~ 30MHz)	3.4 dB	Confidence levels of 95%
Radiated Emission (9kHz ~ 30MHz)	3.7 dB	Confidence levels of 95%
Radiated Emission (30MHz ~ 1,000MHz)	5.1 dB	Confidence levels of 95%
Radiated Emission (1GHz ~ 18GHz)	4.1 dB	Confidence levels of 95%
Radiated Emission (18GHz ~ 40GHz)	4.2 dB	Confidence levels of 95%
Conducted Emission	3.1 dB	Confidence levels of 95%
Output Power Measurement	0.8 dB	Confidence levels of 95%
Power Density Measurement	3.1 dB	Confidence levels of 95%
Bandwidth Measurement	2.2%	Confidence levels of 95%

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# 2 Test Configuration of EUT

# 2.1 Test Channel Mode

Mode
BT-LE(1Mbps)
2402MHz
2440MHz
2480MHz
BT-LE(2Mbps)
2402MHz
2440MHz
2480MHz

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# 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 (SKU 1)_WLAN 2.4GHz + Bluetooth		
2	EUT (SKU 1)_WLAN 5GHz + Bluetooth		
3 EUT (SKU 1)_WLAN 6GHz + Bluetooth			
4	4 EUT (SKU 2)_WLAN 2.4GHz + Bluetooth		
5	EUT (SKU 2)_WLAN 5GHz + Bluetooth		
6 EUT (SKU 2)_WLAN 6GHz + Bluetooth			
For operating, Mode 4 wa	For operating, Mode 4 was the worst case, and it was recorded in this test report.		

Tł	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			
1	EUT (SKU 2)		

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Th	e 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.
	Normal link
Operating Mode < 1GHz	The EUT was performed at X axis, Y axis and Z axis position, and the worst case was found at Z axis. Thus, the measurement will follow this same test configuration.
1	EUT (SKU 1) in Z axis_WLAN 2.4GHz + Bluetooth
2	EUT (SKU 1) in Z axis_WLAN 5GHz + Bluetooth
3	EUT (SKU 1) in Z axis_WLAN 6GHz + Bluetooth
4	EUT (SKU 2) in Z axis_WLAN 2.4GHz + Bluetooth
5	EUT (SKU 2) in Z axis_WLAN 5GHz + Bluetooth
6	EUT (SKU 2) in Z axis_WLAN 6GHz + Bluetooth
For operating, Mode 1 was	the worst case, and it was recorded in this test report.
	СТХ
Operating Mode > 1GHz	The EUT was performed at X axis, Y axis and Z axis position, and the worst case was found at Y axis. Thus, the measurement will follow this same test configuration.
1	EUT (SKU 2) in Y axis

Note: The EUT can enable the WLAN function and the Bluetooth function at the same time, but they cannot function simultaneously. There will be a time delay between switching from each function.

# 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

N/A

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# 2.5 Support Equipment

### For AC Conduction:

	Support Equipment				
No.	Equipment	Brand Name	Model Name	FCC ID	
Α	Fixture 1	AZW	2460-i3	N/A	
В	Fixture 2	AZW	2460-i6	N/A	
С	Control NB	DELL	E6430	N/A	
D	NB 1	DELL	E6430	N/A	
Е	AP Router	TP-LINK	Archer C54	N/A	
F	NB 2	DELL	E6430	N/A	
G	iPad mini	Apple	A1489	N/A	
Н	Mouse	acer	MOBVUO	N/A	
I	Earphone	e-Power	GT-02	N/A	

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### For Radiated < 1GHz:

	Support Equipment			
No.	Equipment	Brand Name	Model Name	FCC ID
Α	Fixture 1	AZW	2460-i3	N/A
В	Fixture 2	AZW	2460-i6	N/A
С	NB 1	DELL	E6230	N/A
D	WLAN AP	ASUS	RT-AX88U	N/A
Е	NB 2	DELL	E4300	N/A
F	Mouse	Logitech	M-U0026	N/A
G	Earphone	e-Power	S90W	N/A
Н	iPad	Apple	A1430	N/A

### For Radiated > 1GHz:

	Support Equipment			
No.	p. Equipment Brand Name Model Name FCC ID			
Α	Fixture 1	AZW	2460-i3	N/A
В	B Fixture 2 AZW 2460-i6 N/A		N/A	
С	NB	DELL	E6230	N/A

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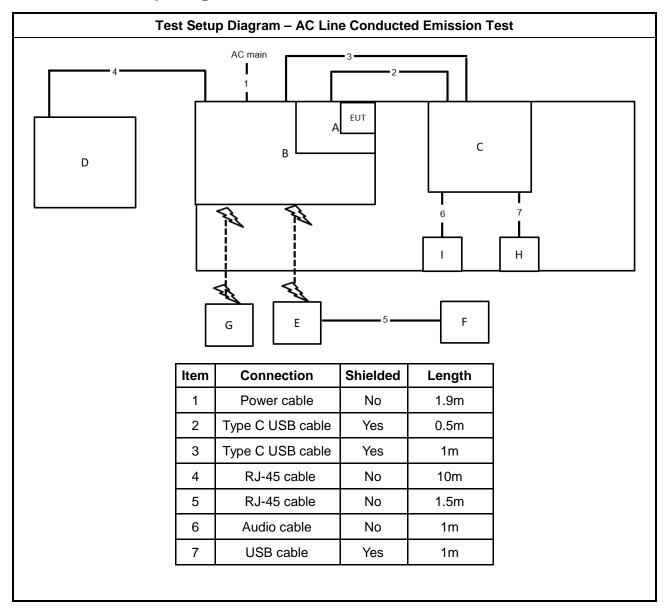
For RF Conducted:

	Support Equipment			
No.	Equipment	Brand Name	Model Name	FCC ID
Α	NB	DELL	E4300	N/A
В	USB to TypeC cable	PHILIPS	DLC4543	N/A
С	USB to TypeC cable	PHILIPS	DLC4543	N/A
D	Fixture 1	AZW	2460-i3	N/A
Е	Fixture 2	AZW	2460-i6	N/A

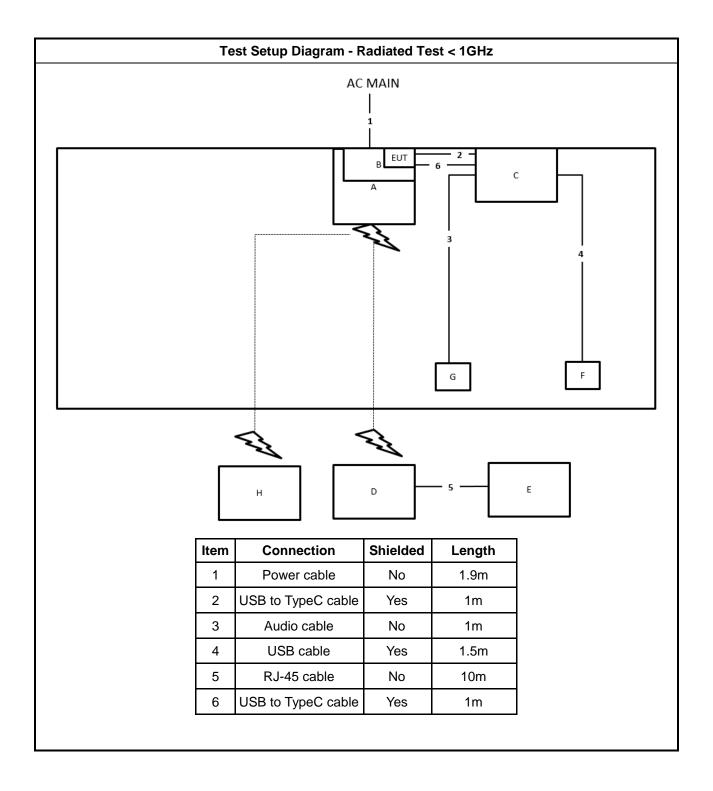
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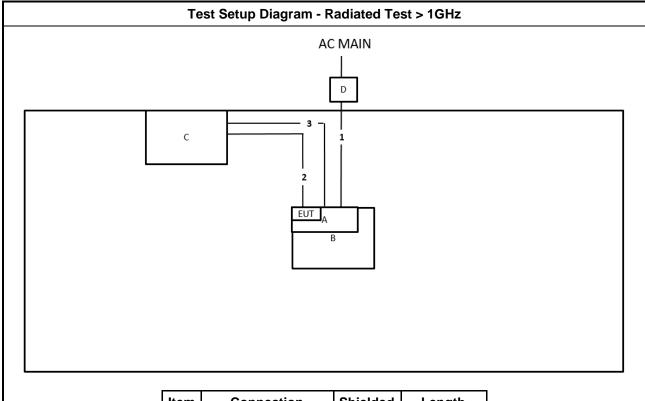
# 2.6 Test Setup Diagram



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Item	Connection	Shielded	Length
1	Power cable	No	1.9m
2	USB to TypeC cable	Yes	1m
3	USB to TypeC cable	Yes	1m

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# 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.				

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### 3.1.2 Measuring Instruments

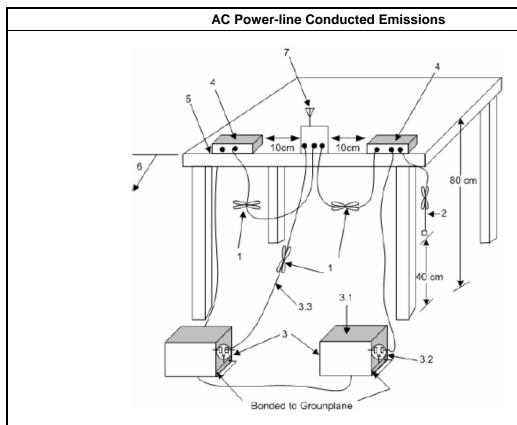
Refer a test equipment and calibration data table in this test report.

### 3.1.3 Test Procedures

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

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### 3.1.4 **Test Setup**



-Interconnecting cables that hang closer than 40 cm to the ground plane shall be folded back and forth in the center forming a bundle 30 cm to 40 cm long.

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- 2—The I/O cables that are not connected to an accessory shall be bundled in the center. The end of the cable may be terminated, if required, using the correct terminating impedance. The overall length shall not exceed 1 m.
- 3—EUT connected to one LISN. Unused LISN measuring port connectors shall be terminated in 50  $\Omega$  loads. LISN may be placed on top of, or immediately beneath, reference ground plane.
- 3.1—All other equipment powered from additional LISN(s).
- 3.2—A multiple-outlet strip may be used for multiple power cords of non-EUT equipment.
  3.3—LISN at least 80 cm from nearest part of EUT chassis.
  4—Non-EUT components of EUT system being tested.

- –Rear of EUT, including peripheráls, shall all be aligned and flush with edge of tabletop.
- 6—Edge of tabletop shall be 40 cm removed from a vertical conducting plane that is bonded to the ground
- 7—Antenna can be integral or detachable. If detachable, then the antenna shall be attached for this test.

### 1.1.1. Measurement Results Calculation

The measured Level is calculated using:

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

### Test Result of AC Power-line Conducted Emissions 3.1.5

Refer as Appendix A

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# 3.2 DTS Bandwidth

### 3.2.1 6dB Bandwidth Limit

6dB Bandwidth Limit					
Systems using digital modulation techniques:					
■ 6 dB bandwidth ≥ 500 kHz.					

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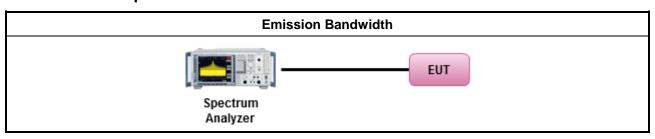
### 3.2.2 Measuring Instruments

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

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# 3.3 Maximum Conducted Output Power

### 3.3.1 Maximum Conducted Output Power Limit

# Maximum Conducted Output Power Limit If G<sub>TX</sub> ≤ 6 dBi, then P<sub>Out</sub> ≤ 30 dBm (1 W) Point-to-multipoint systems (P2M): If G<sub>TX</sub> > 6 dBi, then P<sub>Out</sub> = 30 − (G<sub>TX</sub> − 6) dBm Point-to-point systems (P2P): If G<sub>TX</sub> > 6 dBi, then P<sub>Out</sub> = 30 − (G<sub>TX</sub> − 6)/3 dBm Smart antenna system (SAS): Single beam: If G<sub>TX</sub> > 6 dBi, then P<sub>Out</sub> = 30 − (G<sub>TX</sub> − 6)/3 dBm Overlap beam: If G<sub>TX</sub> > 6 dBi, then P<sub>Out</sub> = 30 − (G<sub>TX</sub> − 6)/3 dBm Aggregate power on all beams: If G<sub>TX</sub> > 6 dBi, then P<sub>Out</sub> = 30 − (G<sub>TX</sub> − 6)/3 + 8dB dBm P<sub>Out</sub> = maximum peak conducted output power or maximum conducted output power in dBm, G<sub>TX</sub> = the maximum transmitting antenna directional gain in dBi.

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### 3.3.2 Measuring Instruments

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

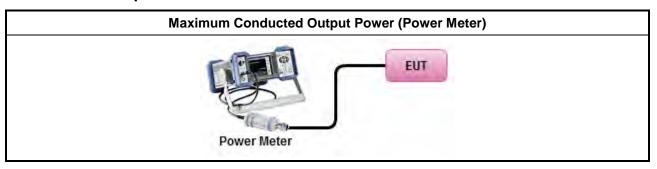
### 3.3.3 Test Procedures

	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	d).
	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 AVC (alternative)	GSA-1A.
	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 AV (alternative)	GSA-2A
	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 AV (alternative)	GSA-3A
	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 (uRF average power meter).	using an
	Refer as FCC KDB 558074, clause 8.3.2.3 & C63.10 clause 11.9.2.3.2 Method AVGPM-0 an gate RF average power meter).	G (using

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- 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<sub>total</sub> = P<sub>1</sub> + P<sub>2</sub> +... + P<sub>n</sub> (calculated in linear unit [mW] and transfer to log unit [dBm]) EIRP<sub>total</sub> = P<sub>total</sub> + DG

### 3.3.4 Test Setup



### 3.3.5 Test Result of Maximum Conducted Output Power

Refer as Appendix C

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# 3.4 Power Spectral Density

# 3.4.1 Power Spectral Density Limit

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

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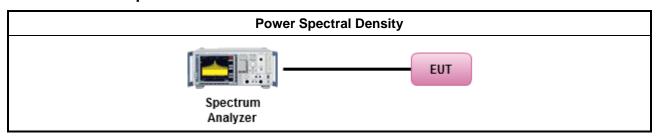
### 3.4.2 Measuring Instruments

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.							
	[duty cycle ≥ 98% or external video / power trigger]							
•	For conducted measurement.							
	If The EUT supports multiple transmit chains using options given below:							
	Option 1: Measure and sum the spectra across the outputs. Refer as FCC KDB 662911, In-band power spectral density (PSD). Sample all transmit ports simultaneously using a spectrum analyzer for each transmit port. Where the trace bin-by-bin of each transmit port summing can be performed. (i.e., in the first spectral bin of output 1 is summed with that in the first spectral bin of output 2 and that from the first spectral bin of output 3, and so on up to the NTX output to obtain the value for the first frequency bin of the summed spectrum.). Add up the amplitude (power) values for the different transmit chains and use this as the new data trace.							
Option 2: Measure and sum spectral maxima across the outputs. With this techn are measured at each output of the device at the required resolution bar maximum value (peak) of each spectrum is determined. These maximum value summed mathematically in linear power units across the outputs. These operat performed separately over frequency spans that have different out-of-band 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



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# 3.4.5 Test Result of Power Spectral Density

Refer as Appendix D

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# 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				

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- 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.

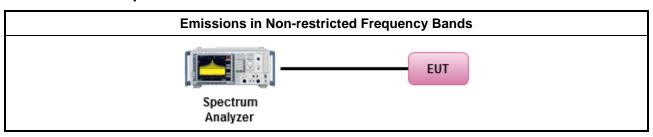
### 3.5.2 Measuring Instruments

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

### 3.5.3 Test Procedures

Test Method	
<ul> <li>Refer as FCC KDB 558074, clause 8.5 for unwanted emissions into non-restricted bands.</li> </ul>	

### 3.5.4 Test Setup



### 3.5.5 Test Result of Emissions in Non-restricted Frequency Bands

Refer as Appendix E

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# 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						

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- 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 below30 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 FLIT
- 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.

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### 3.6.3 Test Procedures

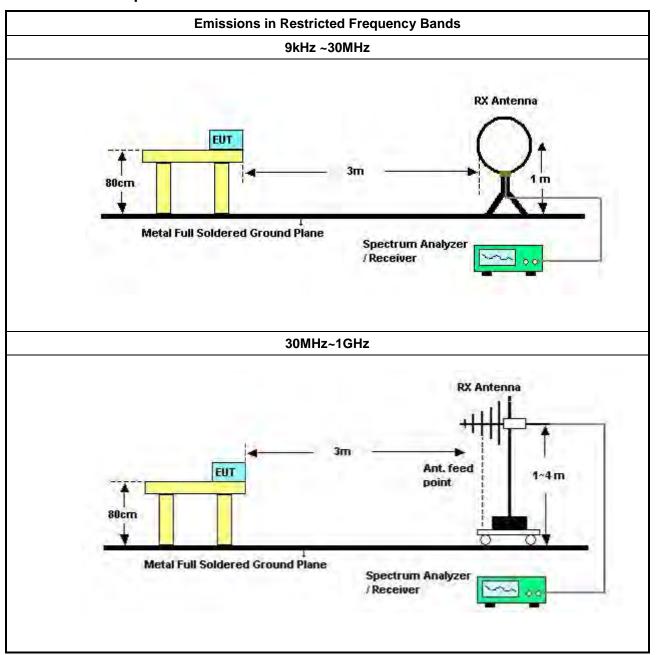
		Test Method							
•	The	average emission levels shall be measured in [duty cycle ≥ 98 or duty factor].							
•		er as ANSI C63.10, clause 6.10.3 band-edge testing shall be performed at the lowest frequency nnel and highest frequency channel within the allowed operating band.							
•	For	the transmitter 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 cycle ≥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≥1/T).							
		☐ Refer as ANSI C63.10, clause 11.12.2.5.3 (Reduced VBW). VBW ≥ 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:								
<ul> <li>Refer as FCC KDB 558074 clause 8.7 &amp; c63.10 clause 11.13.1, When the performing average radiated measurements, emissions within 2 MHz of the authorized band edge measured using the marker-delta method described below.</li> </ul>									
	•	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.							

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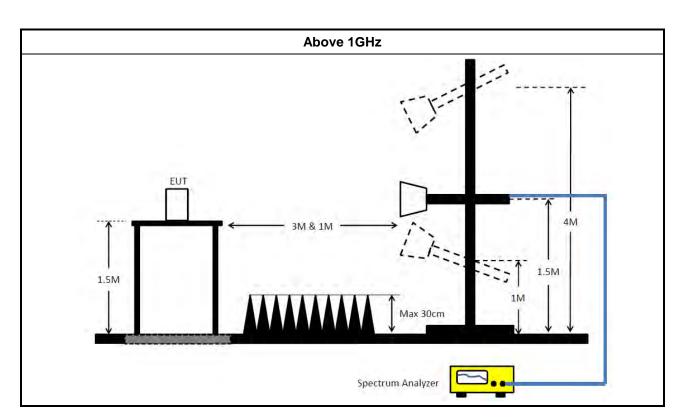


### **Test Setup** 3.6.4



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### 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

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# 4 Test Equipment and Calibration Data

Instrument	Brand	Model No.	Serial No.	( Characteristics		Calibration Due Date	Remark
EMI Receiver	Agilent	N9038A	My52260123	9kHz ~ 8.4GHz	Mar. 01, 2024	Feb. 28, 2025	Conduction (CO01-CB)
LISN	F.C.C.	FCC-LISN-50- 16-2	04083	150kHz ~ 100MHz	Feb. 19, 2024	Feb. 18, 2025	Conduction (CO01-CB)
LISN	Schwarzbeck	NSLK 8127	8127647	9kHz ~ 30MHz	Apr. 27, 2023	Apr. 26, 2024	Conduction (CO01-CB)
Pulse Limiter	Rohde&Schwarz	ESH3-Z2	100430	9kHz ~ 30MHz	Feb. 08, 2024	Feb. 07, 2025	Conduction (CO01-CB)
COND Cable	Woken	Cable	Low cable-CO01	9kHz ~ 30MHz	Oct. 17, 2023	Oct. 16, 2024	Conduction (CO01-CB)
Software	SPORTON	SENSE	V5.10	-	N.C.R.	N.C.R.	Conduction (CO01-CB)
Loop Antenna	Teseq	HLA 6121	65417	9kHz - 30 MHz	Oct. 13, 2023	Oct. 12, 2024	Radiation (03CH04-CB)
3m Semi Anechoic Chamber NSA	TDK	SAC-3M	03CH04-CB	30MHz ~ 1GHz	Aug. 01, 2023	Jul. 31, 2024	Radiation (03CH04-CB)
BILOG ANTENNA with 6 dB attenuator	Schaffner & EMCI	CBL6112B & N-6-06	22021&AT-N06 07	30MHz ~ 1GHz	Oct. 07, 2023	Oct. 06, 2024	Radiation (03CH04-CB)
Pre-Amplifier	EMCI	EMC330N	980391	20MHz ~ 3GHz	May 23, 2023	May 22, 2024	Radiation (03CH04-CB)
Spectrum Analyzer	R&S	FSP40	100142	9kHz~40GHz	Mar. 19, 2024	Mar. 18, 2025	Radiation (03CH04-CB
EMI Test Receiver	R&S	ESCS	826547/017	9kHz ~ 2.75GHz	Jun. 13, 2023	Jun. 12, 2024	Radiation (03CH04-CB)
RF Cable-low	Woken	RG402	Low Cable-03+67	30MHz – 1GHz	Oct. 02, 2023	Oct. 01, 2024	Radiation (03CH04-CB)
Test Software	SPORTON	SENSE	V5.10	-	N.C.R.	N.C.R.	Radiation (03CH04-CB)
3m Semi Anechoic Chamber VSWR	RIKEN	SAC-3M	03CH02-CB	1GHz ~18GHz	Mar. 25, 2023	Mar. 24, 2024	Radiation (03CH02-CB)
Horn Antenna	EMCO	3115	9610-4976	1GHz ~ 18GHz	Apr. 18, 2023	Apr. 17, 2024	Radiation (03CH02-CB)
Horn Antenna	Schwarzbeck	BBHA 9170	BBHA9170252	15GHz ~ 40GHz	Sep. 04, 2023	Sep. 03, 2024	Radiation (03CH02-CB)
Pre-Amplifier	Agilent	83017A	MY39501305	1GHz ~ 26.5GHz	Jun. 30, 2023	Jun. 29, 2024	Radiation (03CH02-CB)
Pre-Amplifier	SGH	SGH184	20221107-3	18GHz ~ 40GHz	Nov. 24, 2023	Nov. 23, 2024	Radiation (03CH02-CB)

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Instrument	Brand	Model No.	Serial No.	Characteristics	Calibration Date	Calibration Due Date	Remark
RF Cable-high	Woken	RG402	High Cable-18	1GHz ~ 18GHz	Oct. 02, 2023	Oct. 01, 2024	Radiation (03CH02-CB)
RF Cable-high	Woken	RG402	High Cable-18+19	1GHz ~ 18GHz	Oct. 02, 2023	Oct. 01, 2024	Radiation (03CH02-CB)
High Cable	Woken	WCA0929M	40G#5+6	1GHz ~ 40GHz	Dec. 06, 2023	Dec. 05, 2024	Radiation (03CH02-CB)
High Cable	Woken	WCA0929M	40G#5	1GHz ~ 40GHz	Oct. 02, 2023	Oct. 01, 2024	Radiation (03CH02-CB)
High Cable	Woken	WCA0929M	40G#6	1GHz ~ 40GHz	Oct. 02, 2023	Oct. 01, 2024	Radiation (03CH02-CB)
Test Software	SPORTON	SENSE	V5.10	-	N.C.R.	N.C.R.	Radiation (03CH02-CB)
Spectrum analyzer	R&S	FSV40	100979	9kHz~40GHz	May 29, 2023	May 28, 2024	Conducted (TH01-CB)
Switch	SPTCB	SP-SWI	SWI-01	1~26.5GHz	Oct. 03, 2023	Oct. 02, 2024	Conducted (TH01-CB)
RF Cable-high	Woken	RG402	High Cable-06	1GHz – 18GHz	Oct. 02, 2023	Oct. 01, 2024	Conducted (TH01-CB)
RF Cable-high	Woken	RG402	High Cable-07	1GHz – 18GHz	Oct. 02, 2023	Oct. 01, 2024	Conducted (TH01-CB)
RF Cable-high	Woken	RG402	High Cable-08	1GHz – 18GHz	Oct. 02, 2023	Oct. 01, 2024	Conducted (TH01-CB)
RF Cable-high	Woken	RG402	High Cable-09	1GHz – 18GHz	Oct. 02, 2023	Oct. 01, 2024	Conducted (TH01-CB)
RF Cable-high	Woken	RG402	High Cable-10	1GHz – 18GHz	Oct. 02, 2023	Oct. 01, 2024	Conducted (TH01-CB)
RF Cable-high	Woken	RG402	High Cable-30	1GHz – 18GHz	Oct. 02, 2023	Oct. 01, 2024	Conducted (TH01-CB)
Power Sensor	Anritsu	MA2411B	1339408	300MHz~40GHz	Sep. 12, 2023	Sep. 11, 2024	Conducted (TH01-CB)
Power Meter	Anritsu	ML2495A	1517009	300MHz~40GHz	Sep. 12, 2023	Sep. 11, 2024	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.

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# **Conducted Emissions at Powerline**

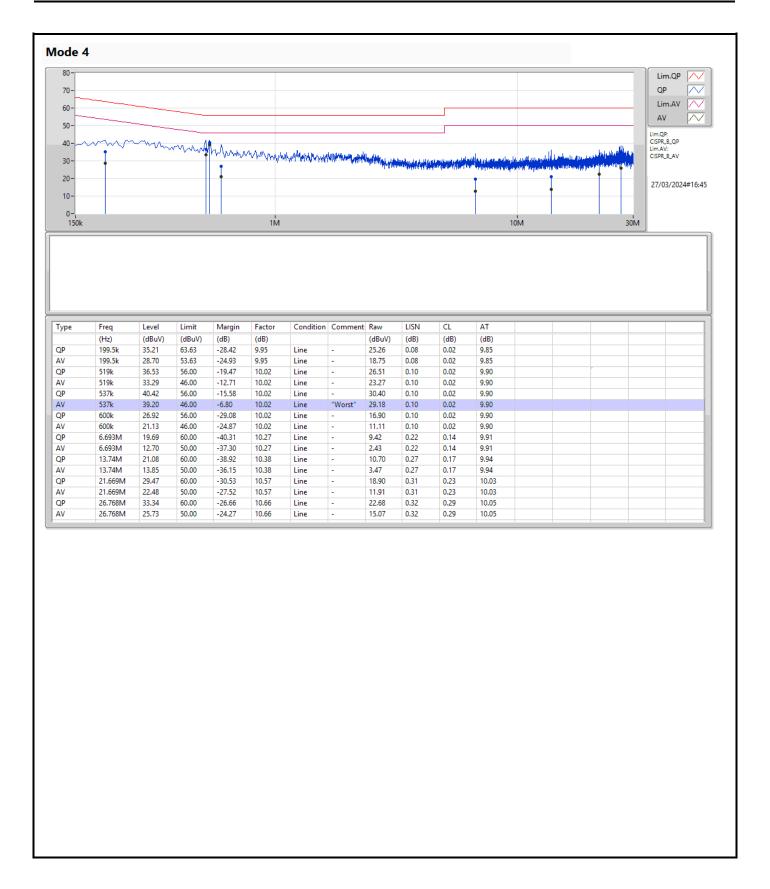
Appendix A

Summary

Mode	Result	Туре	Freq (Hz)	Level (dBuV)	Limit (dBuV)	Margin (dB)	Condition
Mode 4	Pass	AV	537k	39.20	46.00	-6.80	Line

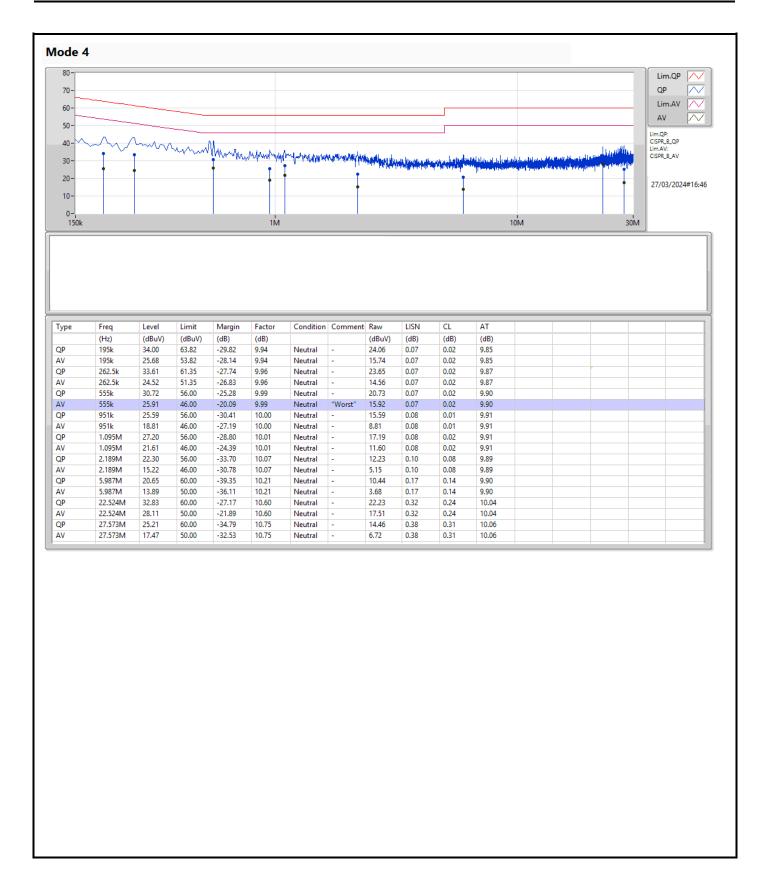
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EBW-DTS Appendix B

### Summary

Mode	Max-N dB	Max-OBW	ITU-Code	Min-N dB	Min-OBW
	(Hz)	(Hz)		(Hz)	(Hz)
2.4-2.4835GHz	-	-	-	-	-
BT-LE(1Mbps)	683.75k	1.043M	1M04F1D	677.5k	1.041M
BT-LE(2Mbps)	1.253M	2.046M	2M05F1D	1.248M	2.035M

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

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EBW-DTS Appendix B

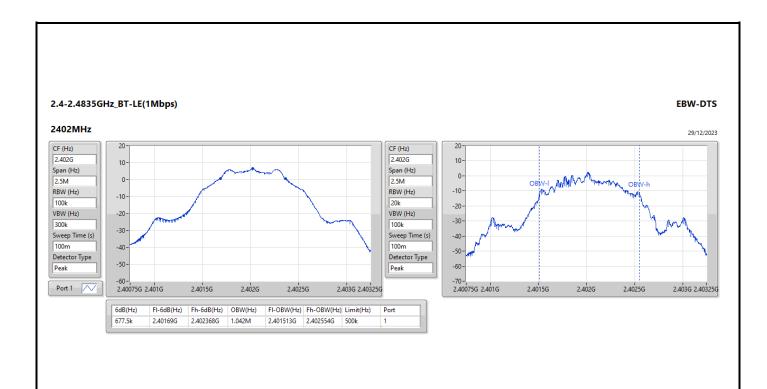
### Result

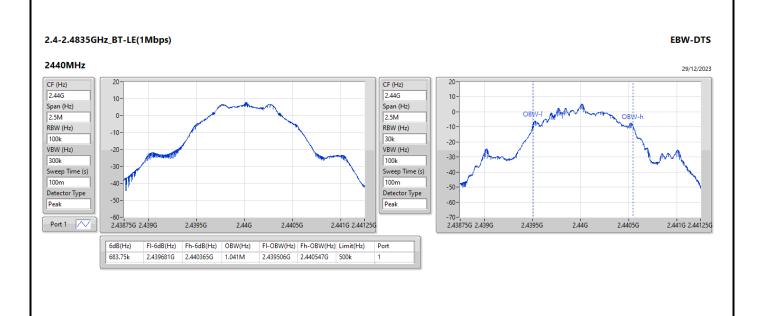
Mode	Result	Limit	Port 1-N dB	Port 1-OBW
		(Hz)	(Hz)	(Hz)
BT-LE(1Mbps)	=	-	-	-
2402MHz	Pass	500k	677.5k	1.042M
2440MHz	Pass	500k	683.75k	1.041M
2480MHz	Pass	500k	683.75k	1.043M
BT-LE(2Mbps)	-	=	-	-
2402MHz	Pass	500k	1.248M	2.035M
2440MHz	Pass	500k	1.25M	2.043M
2480MHz	Pass	500k	1.253M	2.046M

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

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EBW-DTS Appendix B

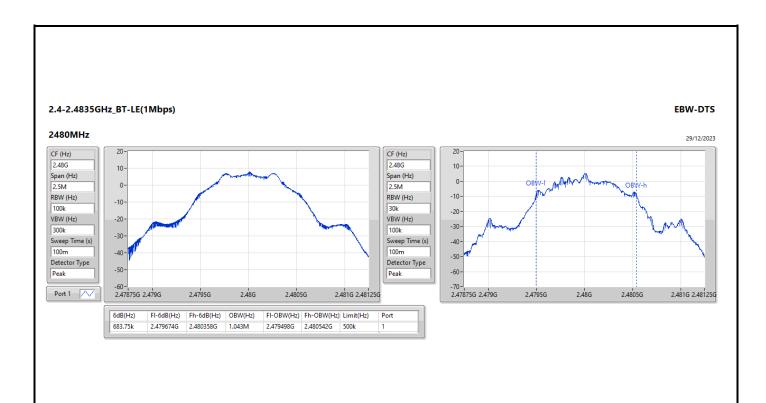


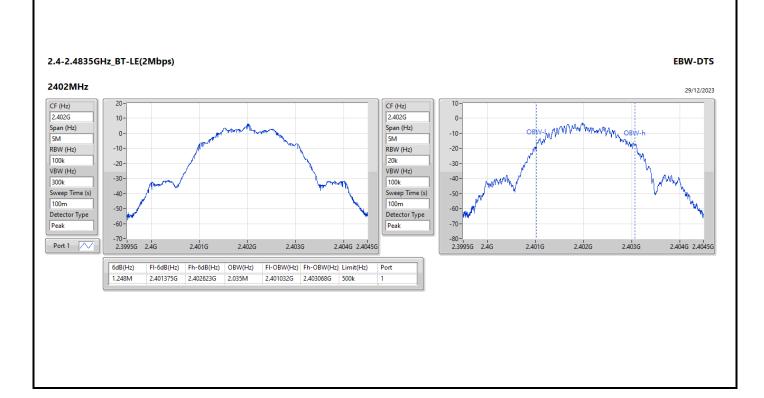


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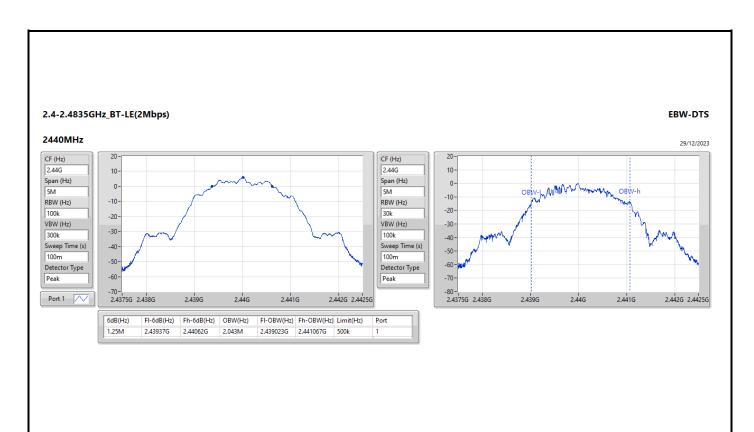


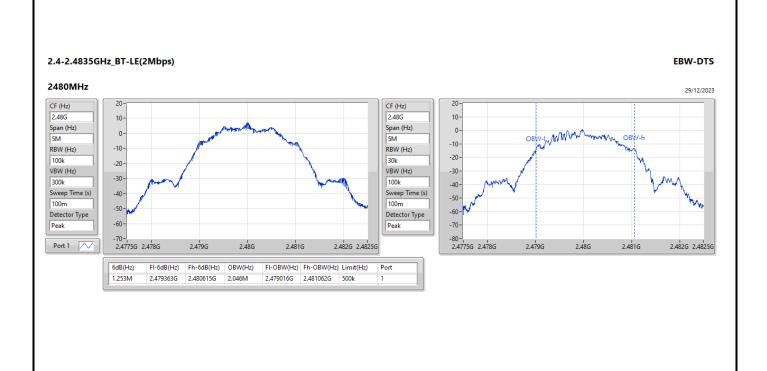


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EBW-DTS Appendix B





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# Average Power-DTS

Appendix C

Summary

Mode	Total Power	Total Power
	(dBm)	(W)
2.4-2.4835GHz	-	-
BT-LE(1Mbps)	6.68	0.00466
BT-LE(2Mbps)	5.93	0.00392

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# Average Power-DTS

Appendix C

#### Result

Mode	Result	DG (dBi)	Total Power (dBm)	Power Limit (dBm)
BT-LE(1Mbps)	-	-	-	-
2402MHz	Pass	3.50	5.81	30.00
2440MHz	Pass	3.50	6.48	30.00
2480MHz	Pass	3.50	6.68	30.00
BT-LE(2Mbps)	-	-	-	-
2402MHz	Pass	3.50	5.21	30.00
2440MHz	Pass	3.50	5.70	30.00
2480MHz	Pass	3.50	5.93	30.00

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

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PSD-DTS Appendix D

**Summary** 

Mode	PD (dBm/RBW)
2.4-2.4835GHz	-
BT-LE(1Mbps)	-6.86
BT-LE(2Mbps)	-11.25

RBW = 3kHz;

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Appendix D **PSD-DTS** 

#### Result

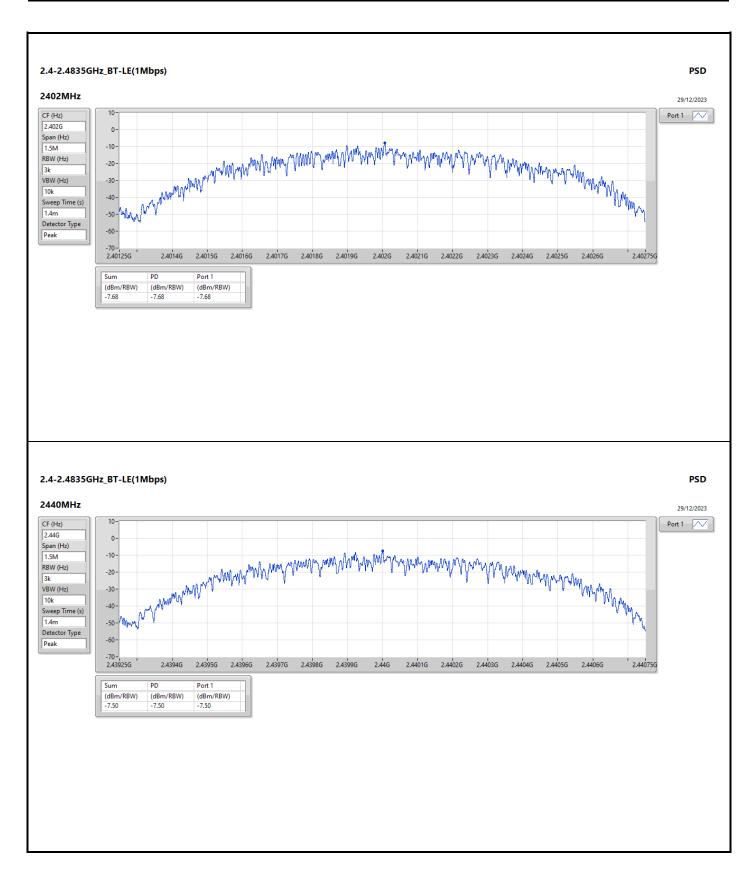
Mode	Result	DG	PD	PD Limit
		(dBi)	(dBm/RBW)	(dBm/RBW)
BT-LE(1Mbps)	-	-	-	-
2402MHz	Pass	3.50	-7.68	8.00
2440MHz	Pass	3.50	-7.50	8.00
2480MHz	Pass	3.50	-6.86	8.00
BT-LE(2Mbps)	-	-	-	-
2402MHz	Pass	3.50	-11.25	8.00
2440MHz	Pass	3.50	-11.79	8.00
2480MHz	Pass	3.50	-12.01	8.00

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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;

Appendix D



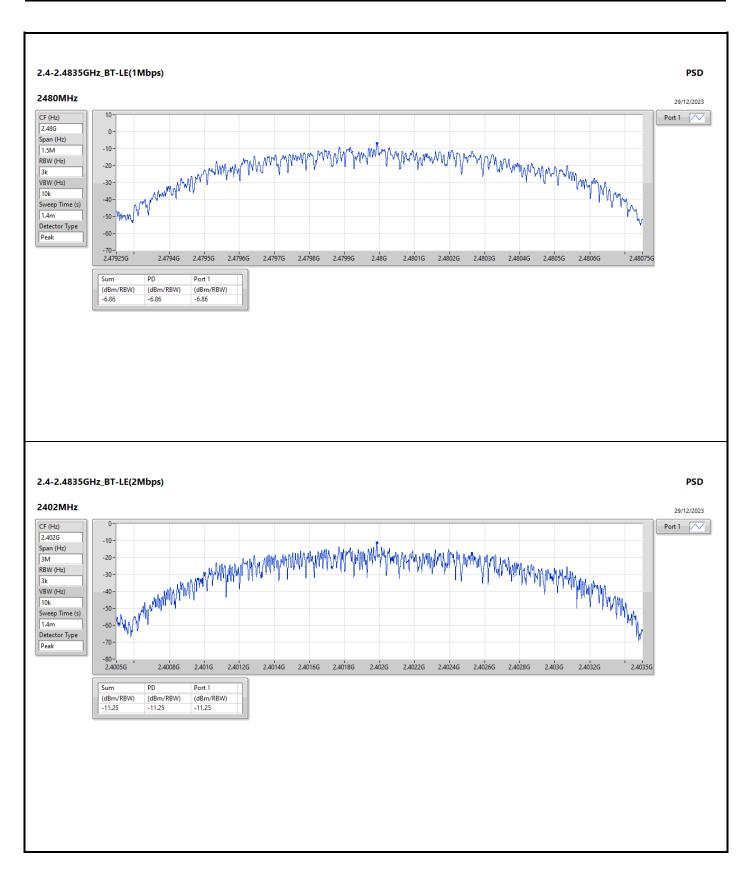


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Appendix D

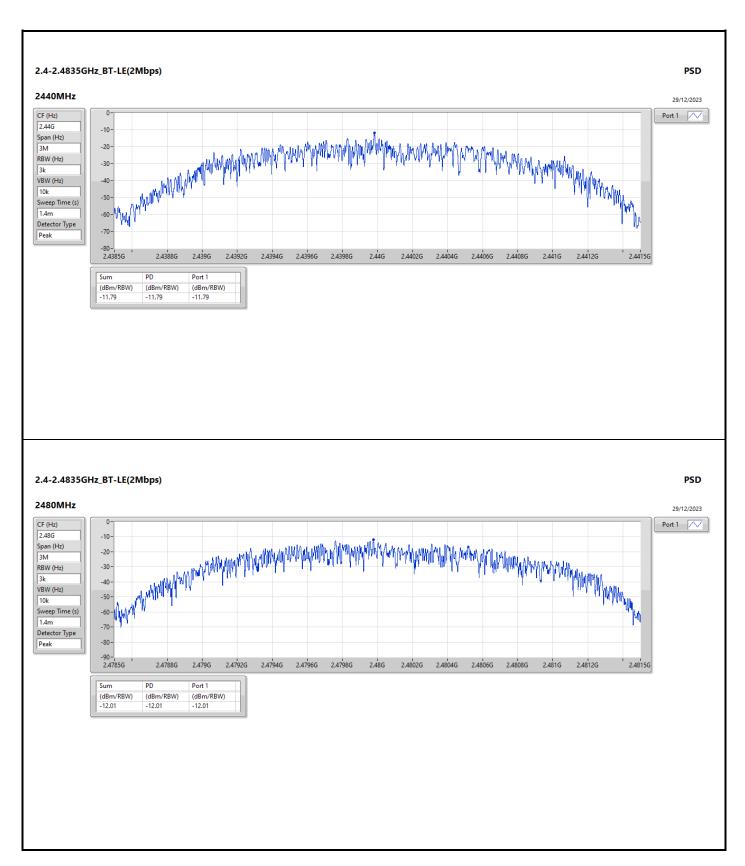




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### Summary

Mode	Result	Ref	Ref	Limit	Freq	Level	Freq	Level	Freq	Level	Freq	Level	Freq	Level	Port
		(Hz)	(dBm)	(dBm)	(Hz)	(dBm)	(Hz)	(dBm)	(Hz)	(dBm)	(Hz)	(dBm)	(Hz)	(dBm)	
2.4-2.4835GHz	-		-	-	-	-	-	-	-	-	-	-	-	-	-
BT-LE(1Mbps)	Pass	2.48016G	7.76	-22.24	1.8818G	-54.59	2.394G	-52.08	2.4G	-57.74	2.50334G	-52.58	21.52991G	-47.06	1
BT-LE(2Mbps)	Pass	2.48016G	7.01	-22.99	2.06393G	-53.32	2.4G	-34.53	2.4G	-33.58	2.50286G	-52.10	21.93485G	-48.06	1

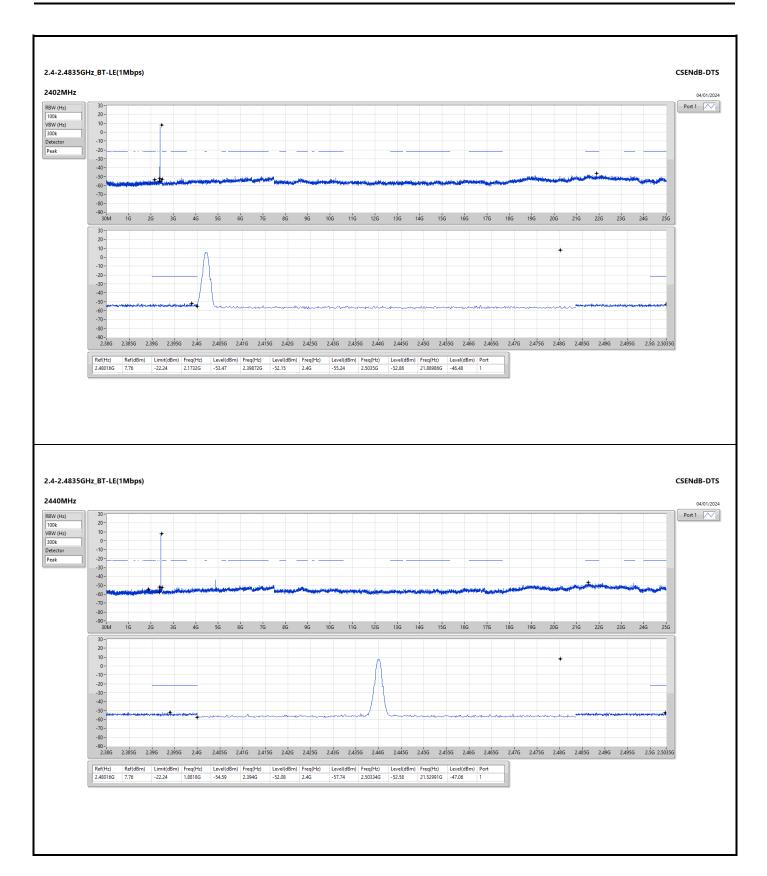
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### Result

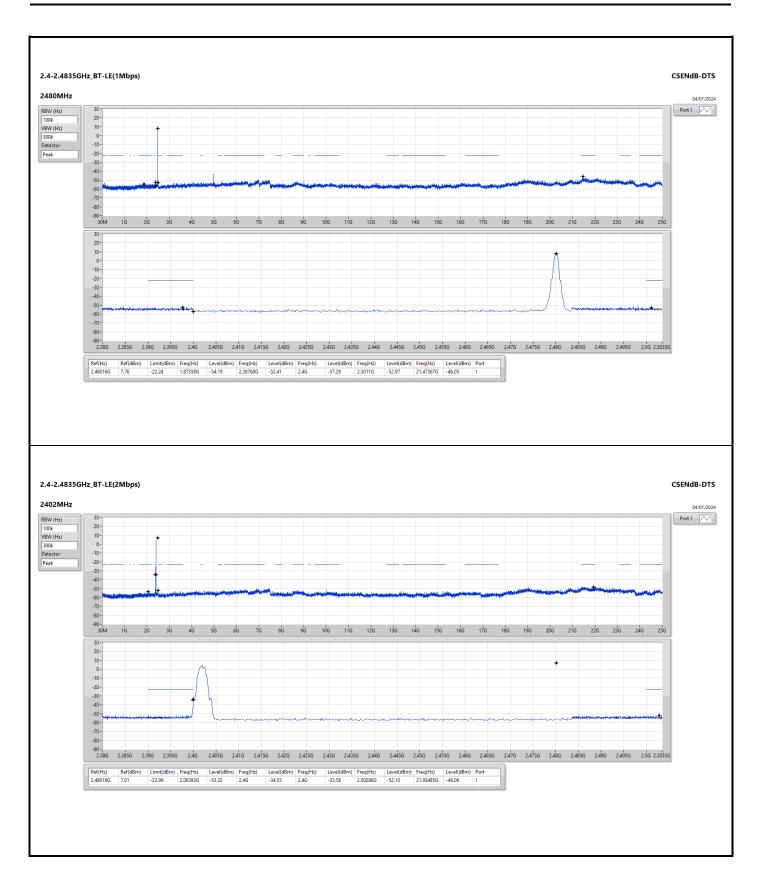
Mode	Result	Ref	Ref	Limit	Freq	Level	Freq	Level	Freq	Level	Freq	Level	Freq	Level	Port
		(Hz)	(dBm)	(dBm)	(Hz)	(dBm)	(Hz)	(dBm)	(Hz)	(dBm)	(Hz)	(dBm)	(Hz)	(dBm)	
BT-LE(1Mbps)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
2402MHz	Pass	2.48016G	7.76	-22.24	2.1732G	-53.47	2.39872G	-52.15	2.4G	-55.24	2.5035G	-52.86	21.88986G	-46.48	1
2440MHz	Pass	2.48016G	7.76	-22.24	1.8818G	-54.59	2.394G	-52.08	2.4G	-57.74	2.50334G	-52.58	21.52991G	-47.06	1
2480MHz	Pass	2.48016G	7.76	-22.24	1.87358G	-54.19	2.39768G	-52.41	2.4G	-57.29	2.5011G	-52.97	21.47367G	-46.05	1
BT-LE(2Mbps)	-		-	-	-	-	-	-	-	-	-	-	-	-	
2402MHz	Pass	2.48016G	7.01	-22.99	2.06393G	-53.32	2.4G	-34.53	2.4G	-33.58	2.50286G	-52.10	21.93485G	-48.06	1
2440MHz	Pass	2.48016G	7.01	-22.99	1.8066G	-54.29	2.39624G	-51.16	2.4G	-57.46	2.50166G	-51.80	21.49898G	-47.45	1
2480MHz	Pass	2.48016G	7.01	-22.99	234.45M	-53.27	2.39244G	-52.04	2.4G	-57.10	2.50138G	-51.97	21.64521G	-48.17	1

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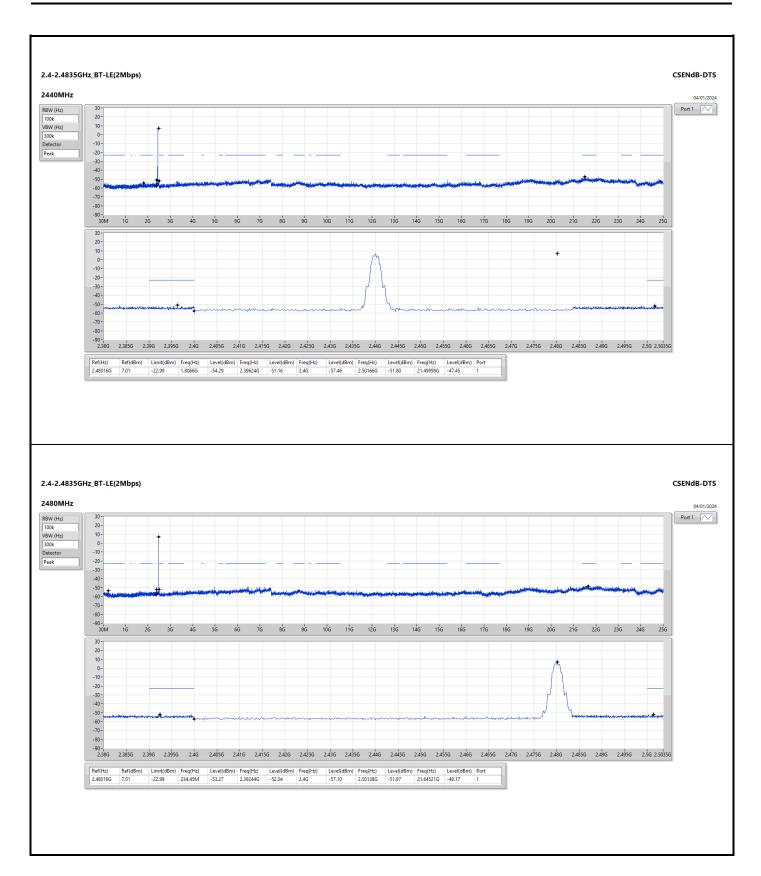
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## Radiated Emissions below 1GHz

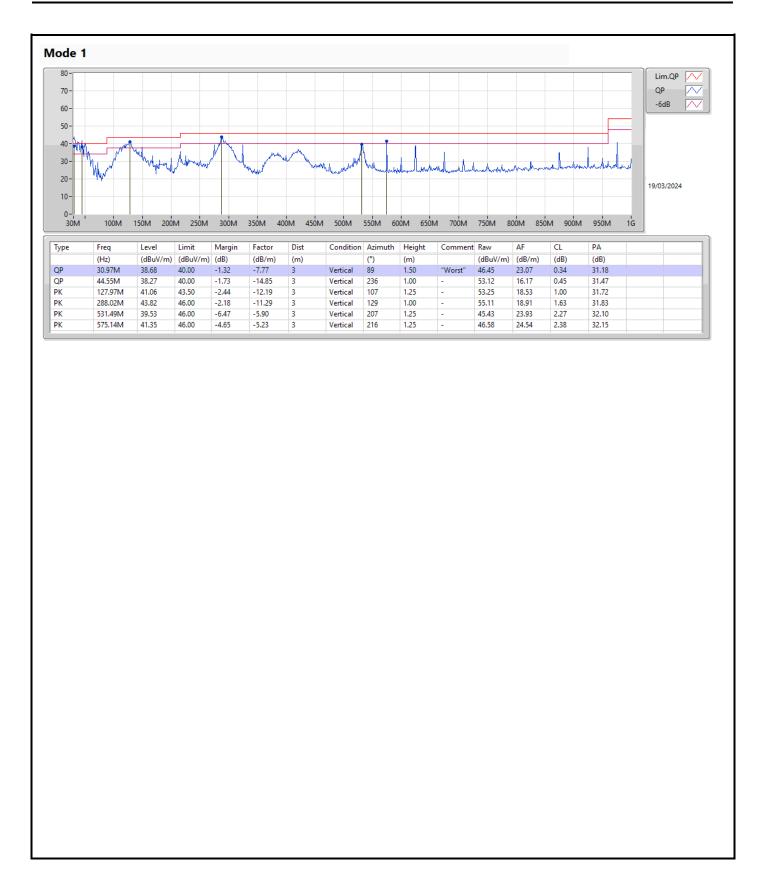
Appendix F.1

Summary

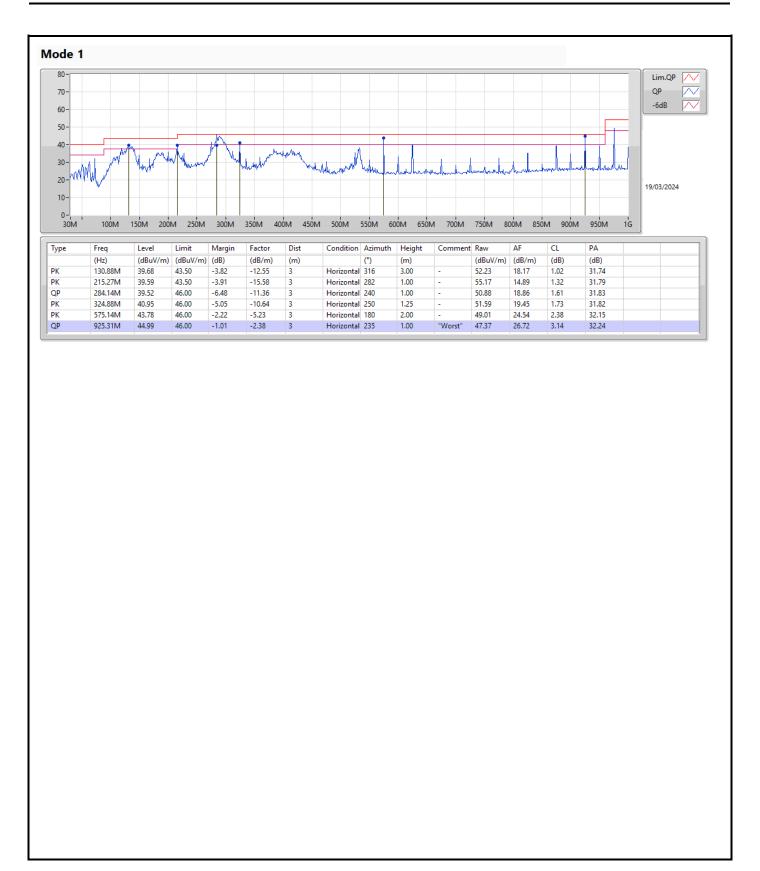
Mode	Result	Туре	Freq (Hz)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Condition
Mode 1	Pass	QP	925.31M	44.99	46.00	-1.01	Horizontal

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## RSE TX above 1GHz

Appendix F.2

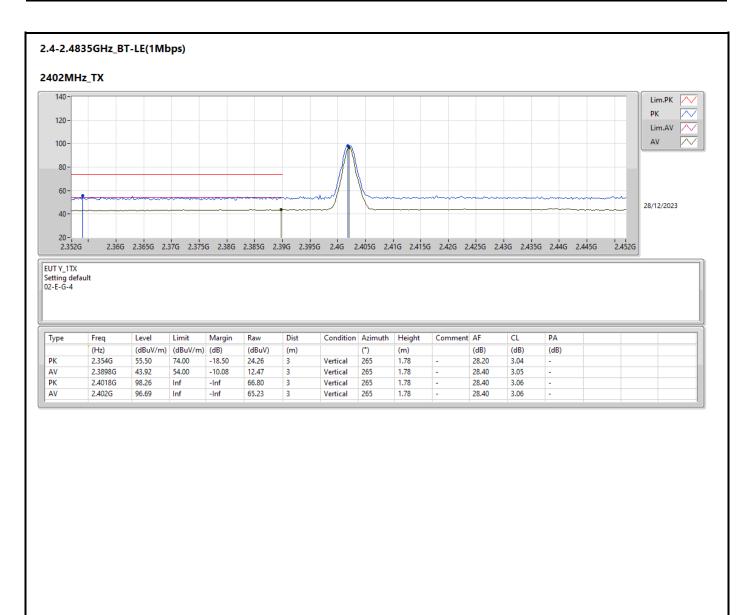
Summary

Mode	Result	Туре	Freq (Hz)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Dist (m)	Condition	Azimuth (°)	Height (m)	Comments
2.4-2.4835GHz	-	-	-	-	-	-	-	-	-	-	-
BT-LE(2Mbps)	Pass	AV	2.4835G	50.22	54.00	-3.78	3	Horizontal	341	2.36	-

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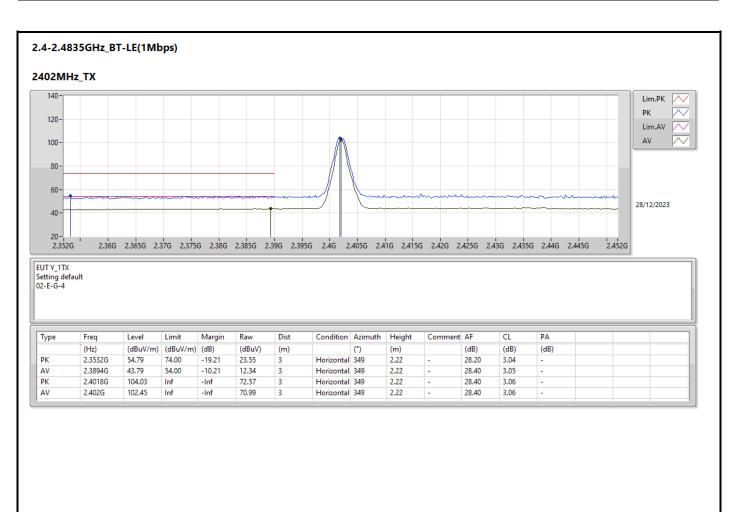
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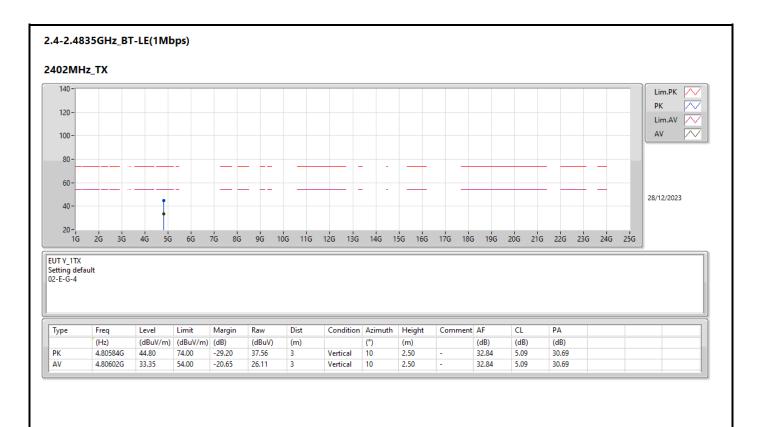




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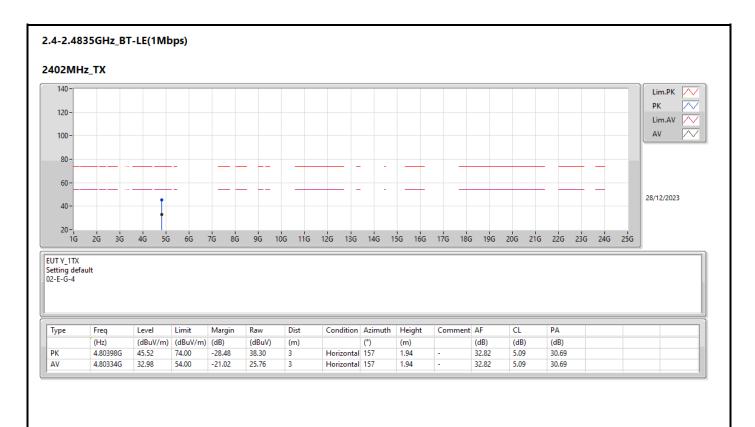




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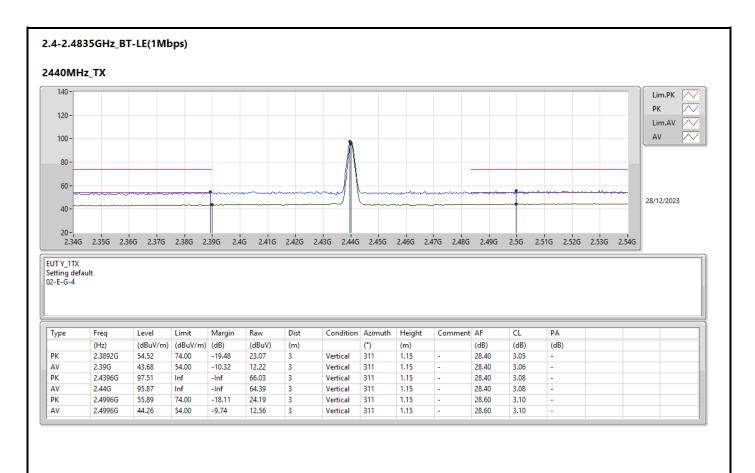




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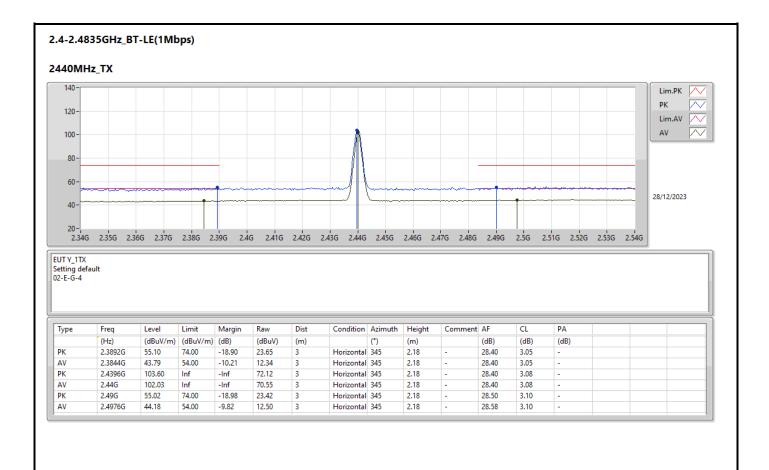
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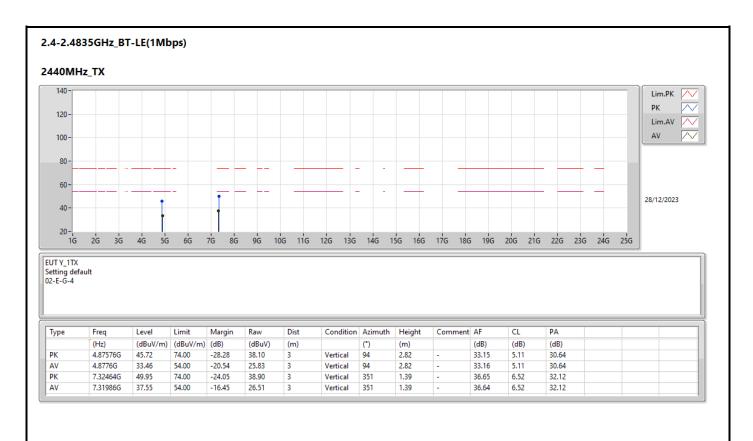
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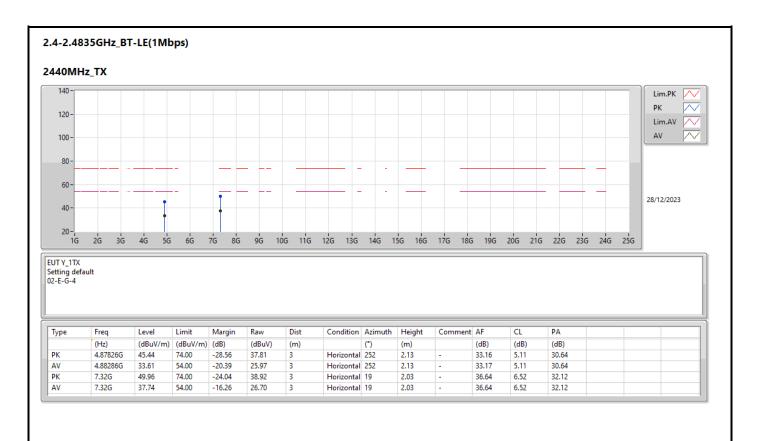




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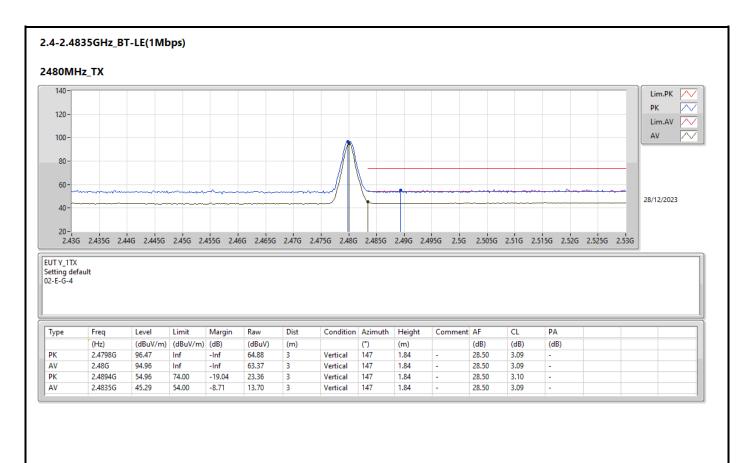




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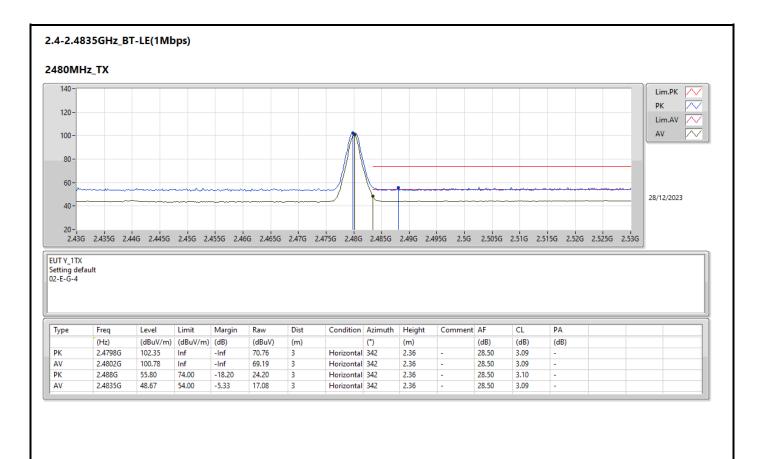




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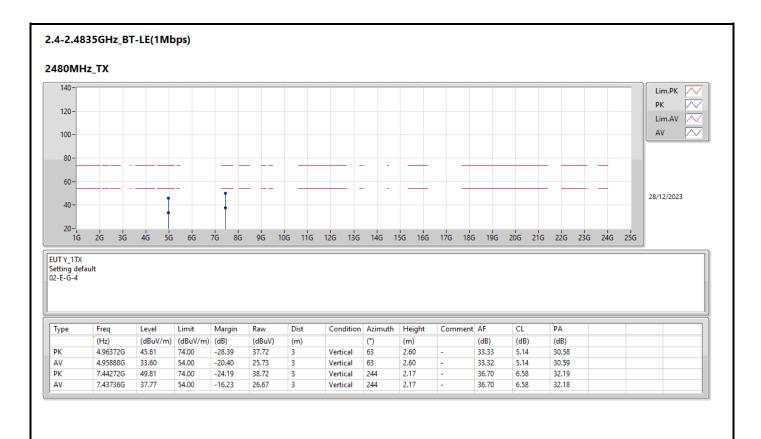
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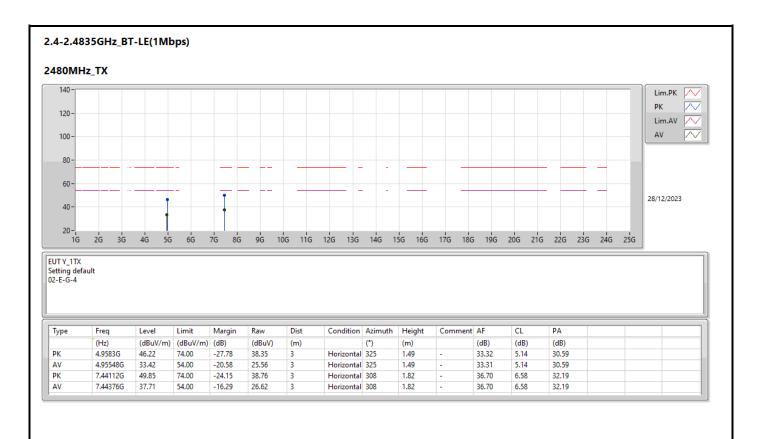
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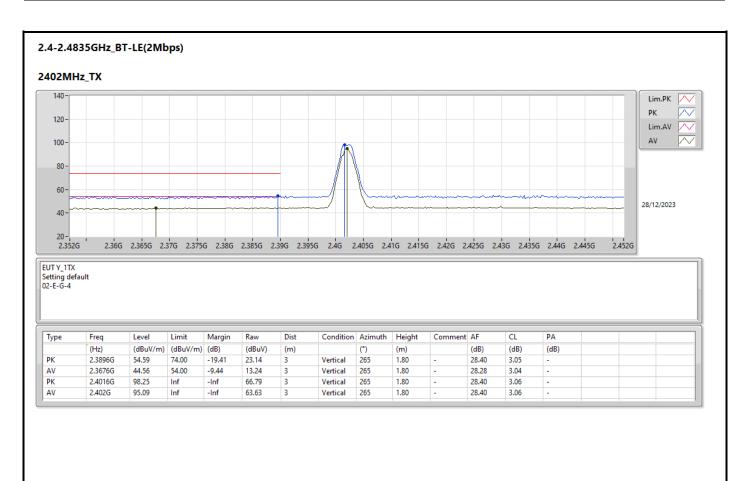
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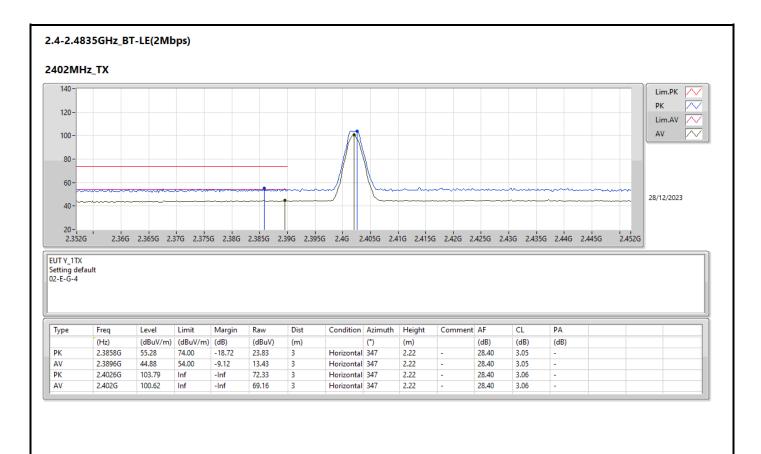
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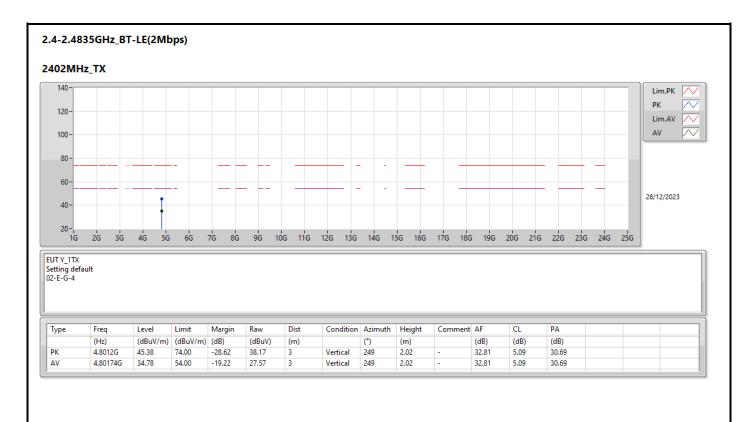
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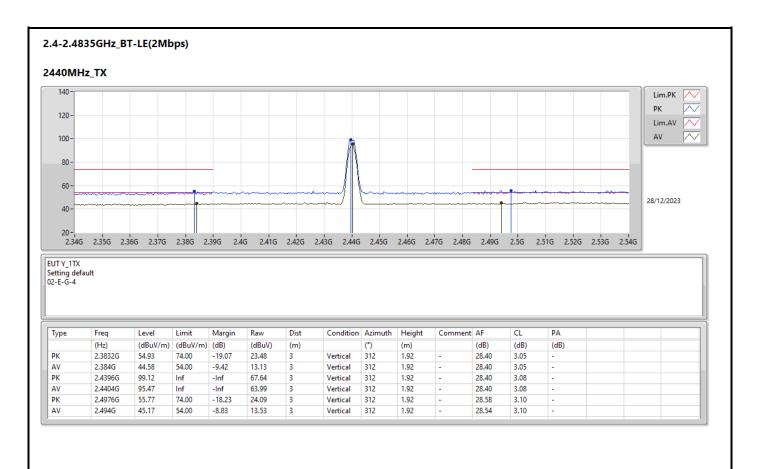
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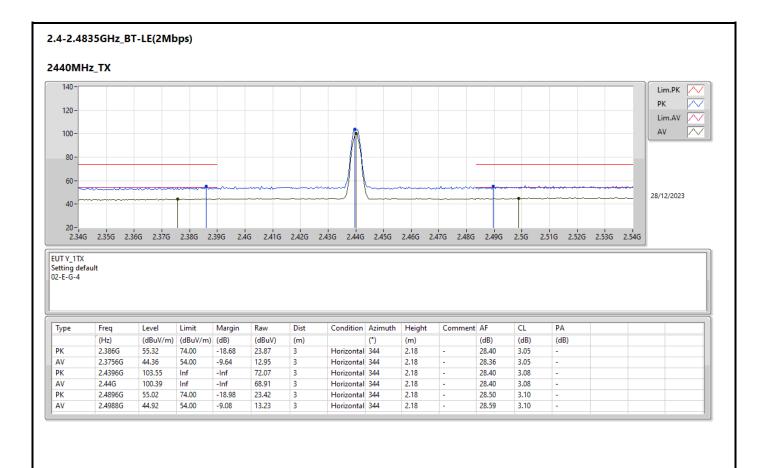
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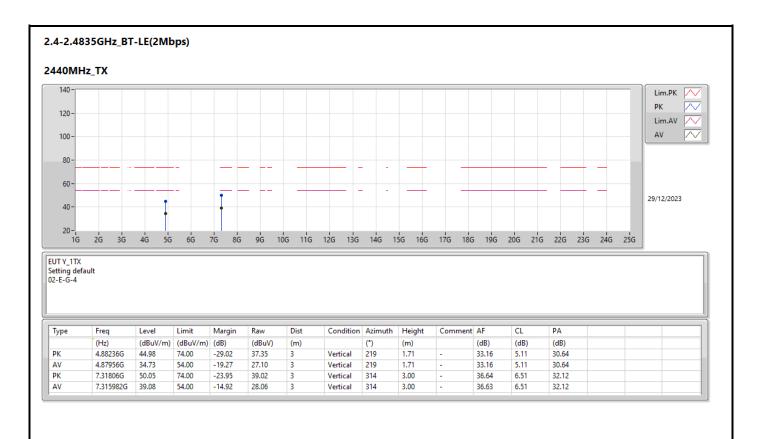
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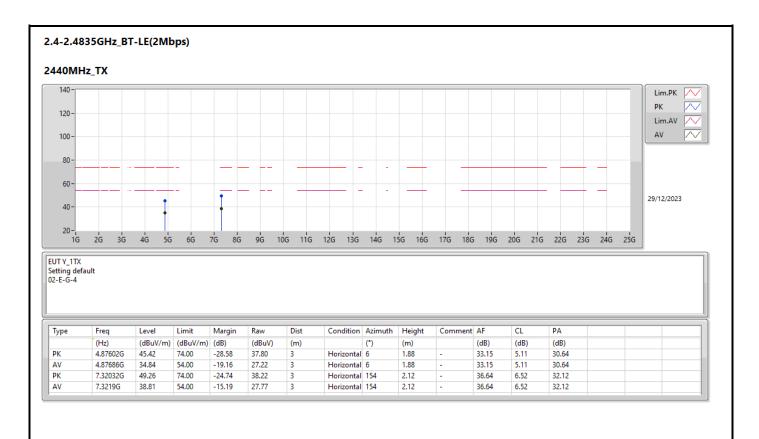
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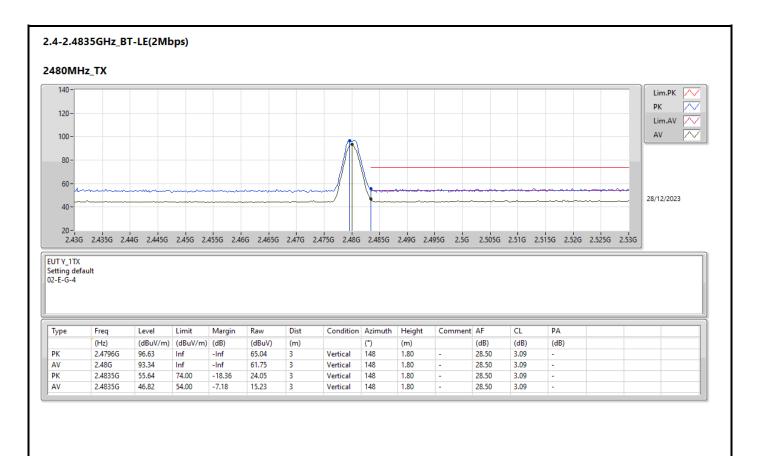
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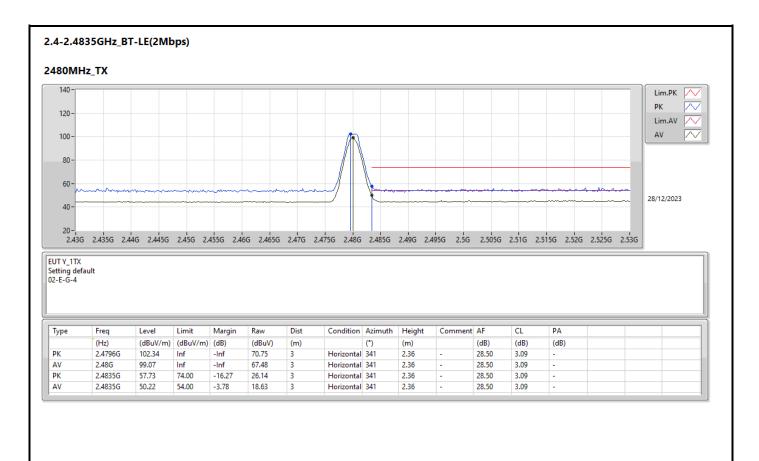
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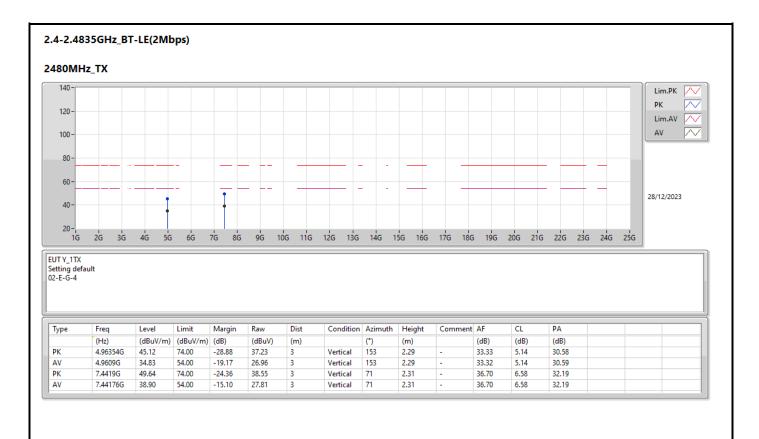
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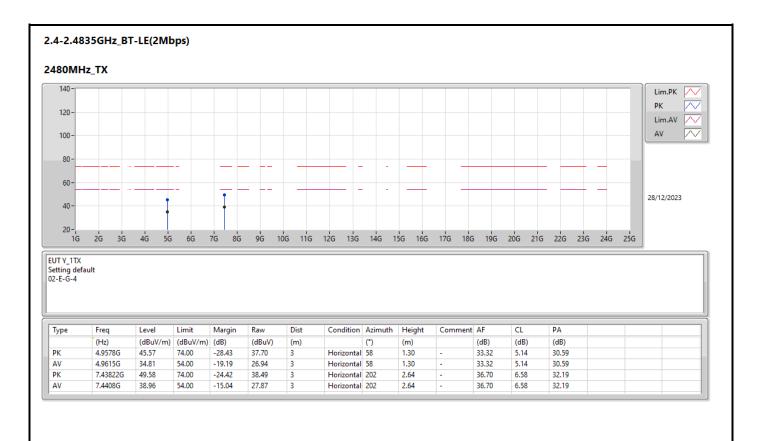
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