

Report No. : FR061820-01AB





RADIO TEST REPORT

FCC ID

: TLZ-CU442

Equipment

: IEEE 802.11 b/g/n 1T1R WLAN and Bluetooth Low Energy

Microcontroller Module

Brand Name

: AzureWave

Model Name

: AW-CU442, AW-CU442-B1

Applicant

: 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 Oct. 27, 2022, and testing was started from Nov. 08, 2022 and completed on Nov. 18, 2022. We, Sporton International Inc. Hsinchu Laboratory, would like to declare that the tested sample has been evaluated in accordance with the procedures given in ANSI C63.10-2013 and shown compliance with the applicable technical standards.

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

Approved by: Sam Chen

Sporton International Inc. Hsinchu Laboratory

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

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: 01

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History of this test report

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Report No.	Version	Description	Issued Date
FR061820-01AB	01	Initial issue of report	Dec. 16, 2022

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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(d)	Emissions in Restricted Frequency Bands	PASS	-

Declaration of Conformity:

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

Comments and Explanations:

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

Reviewed by: Sam Chen

Report Producer: Vicky Huang

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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)	1.0	1TX
2.4-2.4835GHz	BT-LE(500Kb/s)	1.0	1TX
2.4-2.4835GHz	BT-LE(125Kb/s)	1.0	1TX
2.4-2.4835GHz	BT-LE(2Mbps)	2.0	1TX

Note:

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

1.1.2 Antenna Information

Ant.	Port	Brand	Part No.	Antenna Type	Connector	Gain (dBi)
1	1	molex	2042811100	Dipole Antenna	N/A	2.0
2	1	TE	1-2344656-1	Dipole Antenna	N/A	1.76

Note1: The above information was declared by manufacturer.

Note2: Ant. 1~2 are the same type antenna. Only the highest gain Ant. 1 antenna was selected to test and record in this report.

For 2.4GHz function:

For IEEE 802.11b/g/n mode (1TX/1RX):

Only Port 1 can be use as transmit and receive antenna.

For BT function:

For BT mode (1TX/1RX):

Only Port 1 can be use as transmit and receive antenna.

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1.1.3 EUT Operational Condition

EUT Power Type	From host system				
Function	☑ Point-to-multipoint ☐ Point-to-point				
Test Software Version Bluetooth RF Test Tool (Version5.2.2.51) RTLBTAPP (Version:5.2.2.34					
	\boxtimes	LE 1M PHY: 1 Mb/s			
Support Mode	\boxtimes	LE Coded PHY (S=2): 500 Kb/s			
Support Mode	\boxtimes	LE Coded PHY (S=8): 125 Kb/s			
	\boxtimes	LE 2M PHY: 2 Mb/s			

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Note: The above information was declared by manufacturer.

1.1.4 Table for EUT Sources

This product is a transformer that has the following two Sources:

EUT	Source	Description
1	Main Source	Which are identical to each other in all aspects except Y1, L1, C27,
2	Second Source	C36, C37, C40, C41, C42.

1.1.5 Table for Multiple Listing

The EUT has two model names which are identical to each other in all aspects except for the following table:

Model Name	Description
AW-CU442	All the models are identical, the difference model served as marketing
AW-CU442-B1	strategy.

Note 1: From the above models, model: AW-CU442-B1 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.

1.1.6 Table for Permissive Change

This product is an extension of original one reported under Sporton project number: FR061820AB Below is the table for the change of the product with respect to the original one.

Modifications	Performance Checking
1. Add a new model name AW-CU442-B1.	It is not necessary to perform for all tests.
2. Add two Dinale entennes	AC Power-line Conducted Emissions
2. Add two Dipole antennas.	2. Emissions in Restricted Frequency Bands

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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
Radiated (Below 1GHz	03CH05-CB	Black Lu	22.7~24.7 / 56~60	Nov. 09, 2022
Radiated (Above 1GHz	03CH01-CB	Chris Lee	24.2-25.3 / 56-59	Nov. 08, 2022~ Nov. 09, 2022
AC Conduction	CO01-CB	Tim Chen	24~25 / 58~59	Nov. 18, 2022

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%

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2 Test Configuration of EUT

2.1 The Worst Case Measurement Configuration

Th	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 Normal Link-EUT 1+Ant. 1					
2 Normal Link-EUT 2+Ant. 1					
For operating mode 2 is th	For operating mode 2 is the worst case and it was record in this test report.				

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Th	The Worst Case Mode for Following Conformance Tests						
Tests Item Emissions in Restricted Frequency Bands Radiated measurement If EUT consist of multiple antenna assembly (multiple antenna are used in regardless of spatial multiplexing MIMO configuration), the radiated test she be performed with highest antenna gain of each antenna type.							
						Operating Mode < 1GHz	Normal Link
1	Normal Link-EUT 1 at Z-axis+Ant. 1						
2 Normal Link-EUT 1 at Y-axis+Ant. 1							
Mode 1 has been evaluate follow this same test mode	ed to be the worst case between Mode 1~2, thus measurement for Mode 3 will						
3	Normal Link-EUT 2 at Z-axis+Ant. 1						
For operating mode 1 is th	e worst case and it was record in this test report.						
Operating Mode > 1GHz	СТХ						
 The EUT was performed at X axis, Y axis and Z axis position test, and the worst case was found axis. So the measurement will follow this same test configuration. The EUT has two sources, after evaluating, EUT 1 has been evaluated to be the worst case, so it selected to test and record in this test report. 							
1	EUT 1 at Y-axis+Ant. 1						

2.2 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.

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2.3 Accessories

N/A

2.4 Support Equipment

For AC Conduction:

	Support Equipment									
No.	Equipment	Model Name	FCC ID							
Α	Fixture	Azurewave	AW-CU462-I1	N/A						
В	NB	DELL	E6430	N/A						
С	Earphone	e-Power	S90W	N/A						
D	Mouse	HP	FM100	N/A						
Е	AP Router	ASUS	RP-N53	MSQ-RPN53						
F	Smart phone	Samsung	Galaxy J2	A3LSMJ200F						

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For Radiated (below 1GHz):

1011	or radiated (below 16112).									
	Support Equipment									
No.	FCC ID									
Α	Fixture	Azurewave	AW-CU462-I1	N/A						
В	NB	DELL	E4300	N/A						
С	WLAN AP	D-LINK	DIR860L	KA2IR860LA1						
D	iPhone 4	Apple	A1332	BCG-E2380a						
Е	Earphone	SHYARO CHI	MIC-04	N/A						
F	Mouse	Logitech	M-U0026	N/A						
G	NB(WLAN AP)	DELL	E4300	N/A						

For Radiated (above 1GHz):

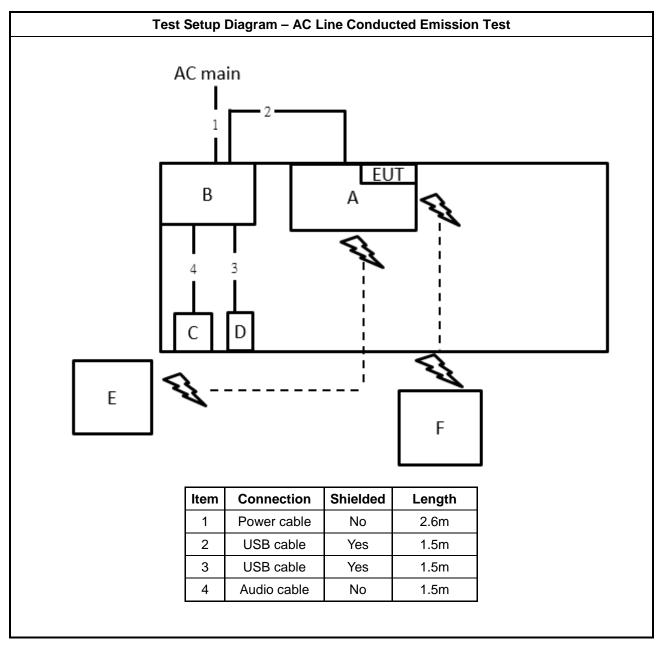
	Support Equipment								
No.	No. Equipment Brand Name Model Name FCC ID								
Α	A NB DELL E4300 N/A								
В	Fixture	Azurewave	AW-CU462-I1	N/A					

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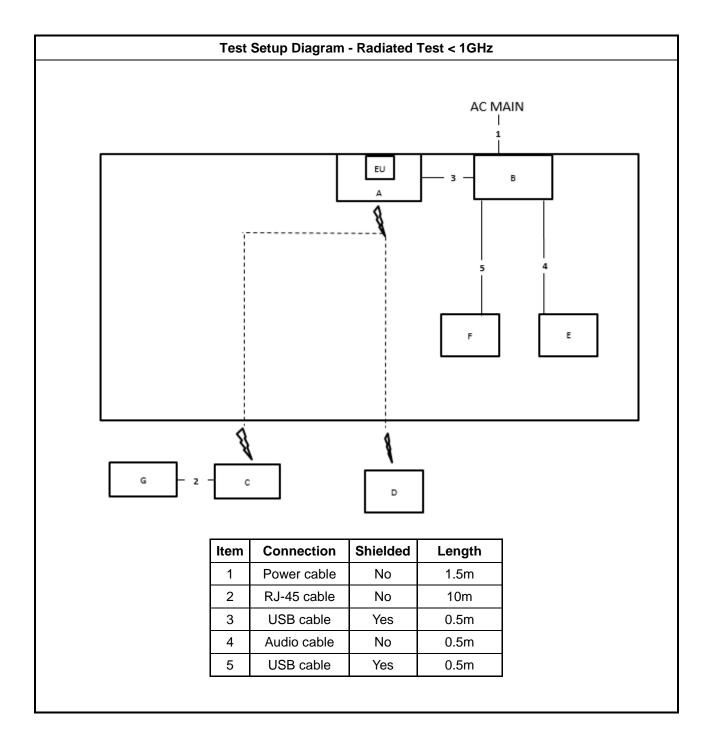
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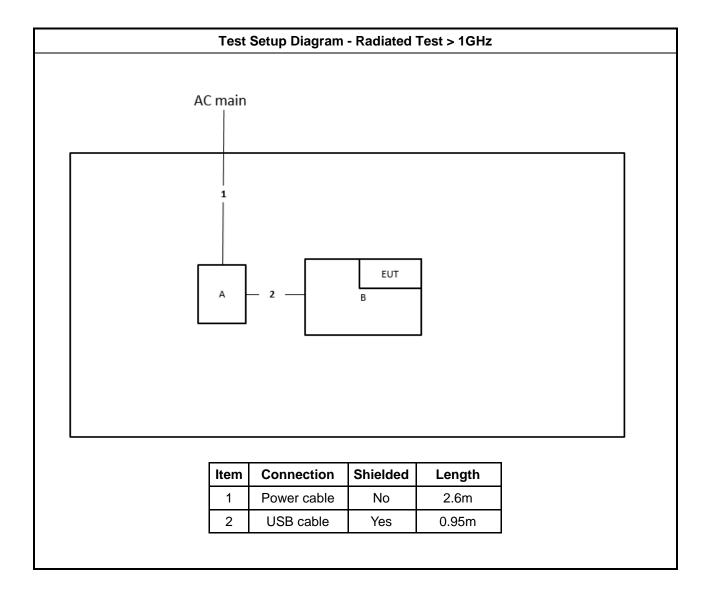
2.5 Test Setup Diagram



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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

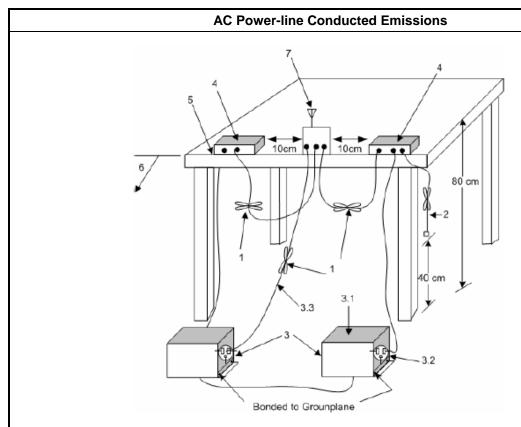
Refer a test equipment and calibration data table in this test report.

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 Ω 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 Emissions in Restricted Frequency Bands

3.2.1 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 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.

3.2.2 Measuring Instruments

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

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3.2.3 Test Procedures

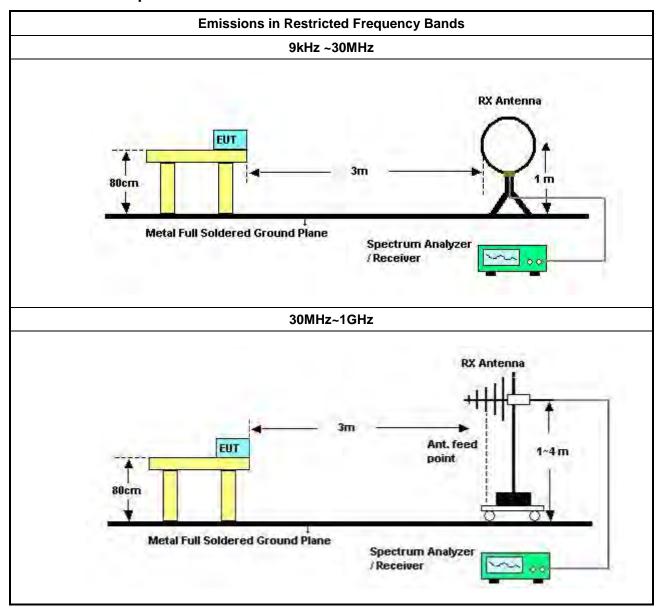
		Test Method								
•	The	average emission levels shall be measured in [duty cycle ≥ 98 or duty factor].								
•		er as ANSI C63.10, clause 6.10.3 band-edge testing shall be performed at the lowest frequency and highest frequency channel within the allowed operating band.								
•	For the transmitter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

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3.2.4 Test Setup



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Above 1GHz

SM 8 1M

AM 1.5M

1.5M

1.5M

1.5M

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3.2.5 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.

Spectrum Analyzer

3.2.6 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.

3.2.7 Test Result of Emissions in Restricted Frequency Bands

Refer as Appendix B

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4 Test Equipment and Calibration Data

Instrument	Brand	Model No.	Serial No.	Characteristics Calibration Date		Calibration Due Date	Remark
EMI Receiver	Agilent	N9038A	My52260123	9kHz ~ 8.4GHz	Feb. 22, 2022	Feb. 21, 2023	Conduction (CO01-CB)
LISN	F.C.C.	FCC-LISN-50- 16-2	04083	150kHz ~ 100MHz	Feb. 09, 2022	Feb. 08, 2023	Conduction (CO01-CB)
LISN	Schwarzbeck	NSLK 8127	8127647	9kHz ~ 30MHz	Apr. 12, 2022	Apr. 11, 2023	Conduction (CO01-CB)
Pulse Limiter	Rohde& Schwarz	ESH3-Z2	100430	9kHz ~ 30MHz	Feb. 10, 2022	Feb. 09, 2023	Conduction (CO01-CB)
COND Cable	Woken	Cable	Low cable-CO01	9kHz ~ 30MHz	Oct. 18, 2022	Oct. 17, 2023	Conduction (CO01-CB)
Software	SPORTON	SENSE	V5.10	-	N.C.R.	N.C.R.	Conduction (CO01-CB)
3m Semi Anechoic Chamber NSA	TDK	SAC-3M	03CH05-CB	30 MHz ~ 1 GHz	Aug. 03, 2022	Aug. 02, 2023	Radiation (03CH05-CB)
Loop Antenna	Teseq	HLA 6120	24155	9kHz - 30 MHz	May 14, 2022	May 13, 2023	Radiation (03CH05-CB)
Bilog Antenna with 6dB Attenuator	TESEQ & EMCI	CBL 6112D & N-6-06	35236 & AT-N0610	30MHz ~ 2GHz Mar. 25, 2022		Mar. 24, 2023	Radiation (03CH05-CB)
Pre-Amplifier	EMCI	EMC330N	980331	20MHz ~ 3GHz		Apr. 25, 2023	Radiation (03CH05-CB)
Spectrum Analyzer	R&S	FSP40	100304	9kHz ~ 40GHz Mar. 14, 2022		Mar. 13, 2023	Radiation (03CH05-CB)
EMI Test Receiver	R&S	ESCS	826547/017	9kHz ~ 2.75GHz Jun. 17, 2022		Jun. 16, 2023	Radiation (03CH05-CB)
RF Cable-low	Woken	RG402	Low Cable-04+23	30MHz~1GHz Oct. 03, 2022		Oct. 02, 2023	Radiation (03CH05-CB)
Test Software	SPORTON	SENSE	V5.10	-	N.C.R.	N.C.R.	Radiation (03CH05-CB)
3m Semi Anechoic Chamber VSWR	TDK	SAC-3M	03CH01-CB	1GHz ~18GHz 3m	1 May 06 2022 1		Radiation (03CH01-CB)
Horn Antenna	SCHWARZBE AK	BBHA9170	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	MITEQ	TTA1840-35-H G	1864479	18GHz ~ 40GHz	Jul. 20, 2022	Jul. 19, 2023	Radiation (03CH01-CB)
Pre-Amplifier	EM	EM18G40GA	060874	18GHz ~ 40GHz	Aug. 23 2022	Aug. 22 2023	Radiation (03CH01-CB)
Spectrum Analyzer	R&S	FSP40	100056	9kHz ~ 40GHz	May 06, 2022	May 05, 2023	Radiation (03CH01-CB)
RF Cable-high	Woken	RG402	High Cable-16	1 GHz ~ 18 GHz	Oct. 03, 2022	Oct. 02, 2023	Radiation (03CH01-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-16+17	1 GHz ~ 18 GHz	Oct. 03, 2022	Oct. 02, 2023	Radiation (03CH01-CB)
High Cable	Woken	WCA0929M	40G#5+7	1GHz ~ 40 GHz	Dec. 14, 2021	Dec. 13, 2022	Radiation (03CH01-CB)
High Cable	Woken	WCA0929M	40G#5	1GHz ~ 40 GHz	Dec. 08, 2021	Dec. 07, 2022	Radiation (03CH01-CB)
High Cable	Woken	WCA0929M	40G#7	1GHz ~ 40 GHz	Dec. 14, 2021	Dec. 13, 2022	Radiation (03CH01-CB)
Test Software	SPORTON	SENSE	V5.10	-	N.C.R.	N.C.R.	Radiation (03CH01-CB)

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Note: Calibration Interval of instruments listed above is one year. NCR means Non-Calibration required.

TEL: 886-3-656-9065 Page Number : 20 of 20 FAX: 886-3-656-9085 Issued Date : Dec. 16, 2022



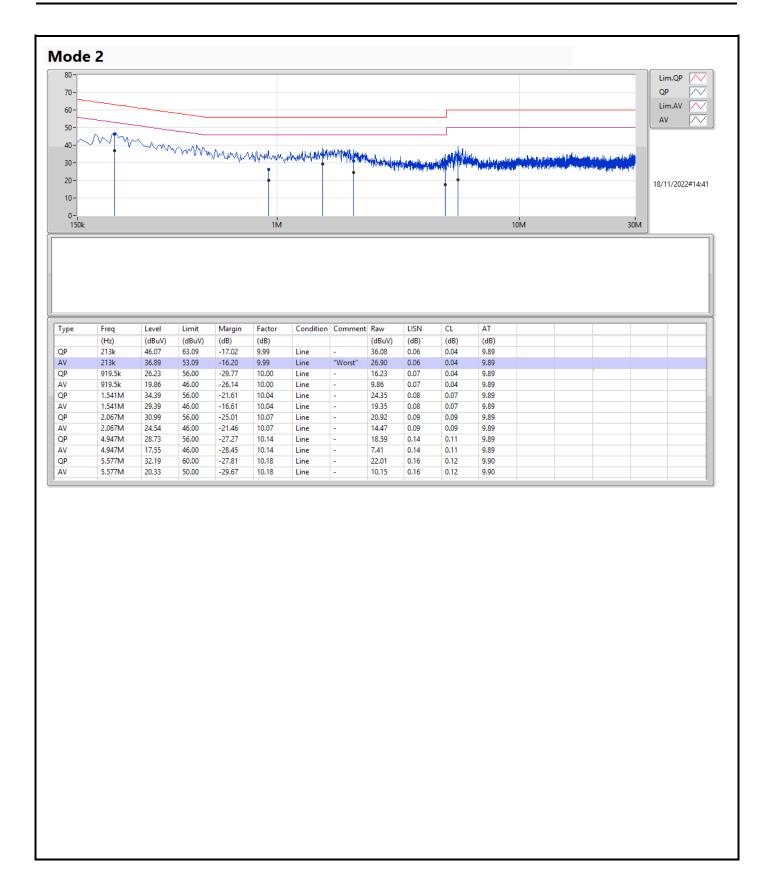
Conducted Emissions at Powerline

Appendix A

Summary

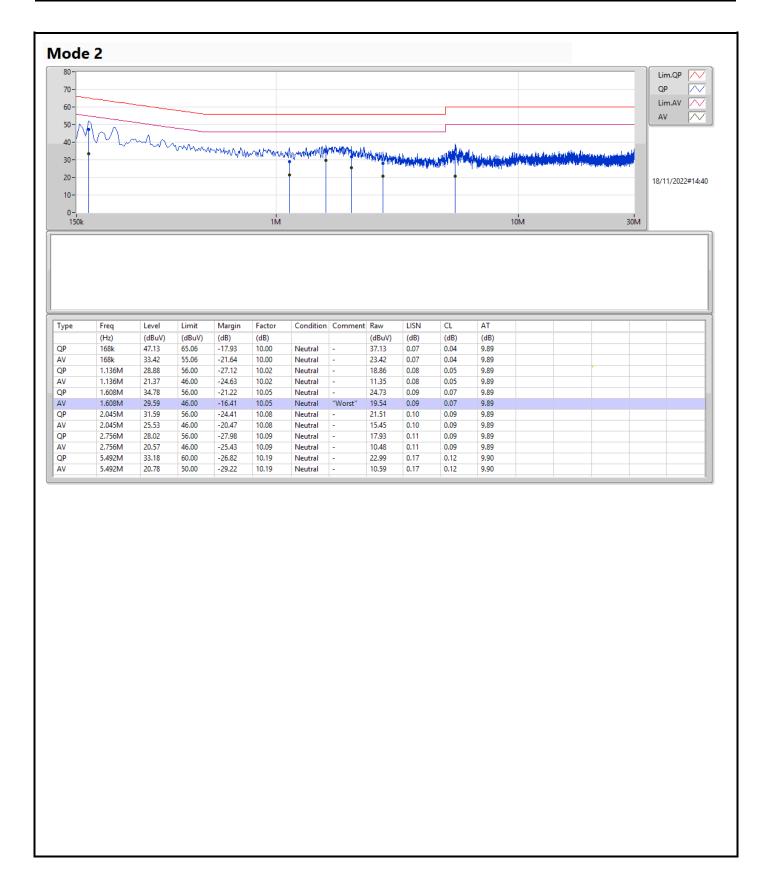
Mode	Result	Туре	Freq (Hz)	Level (dBuV)	Limit (dBuV)	Margin (dB)	Condition
Mode 2	Pass	AV	213k	36.89	53.09	-16.20	Line

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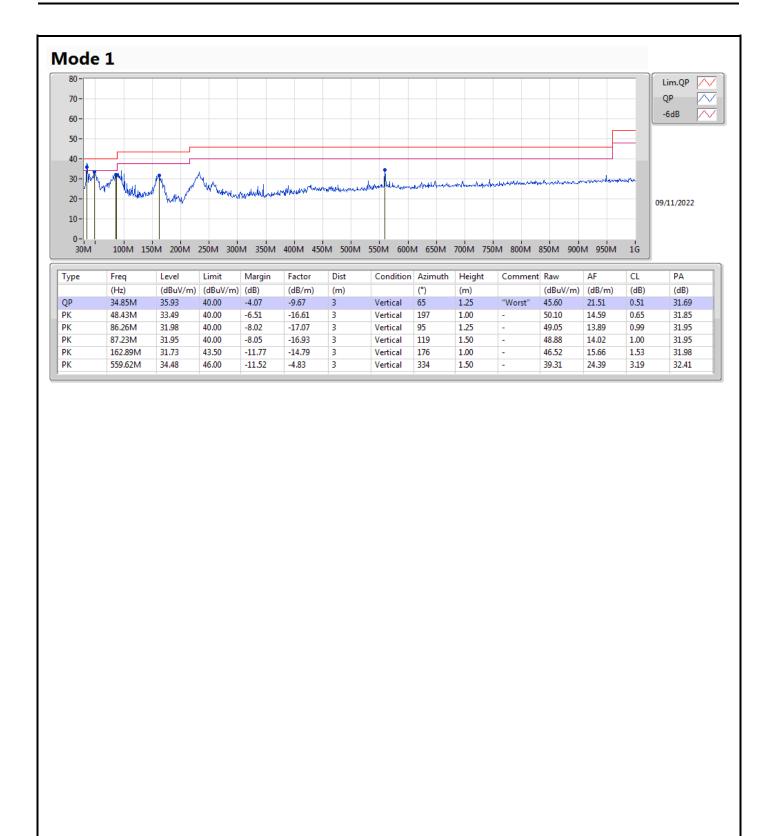
Radiated Emissions below 1GHz

Appendix B.1

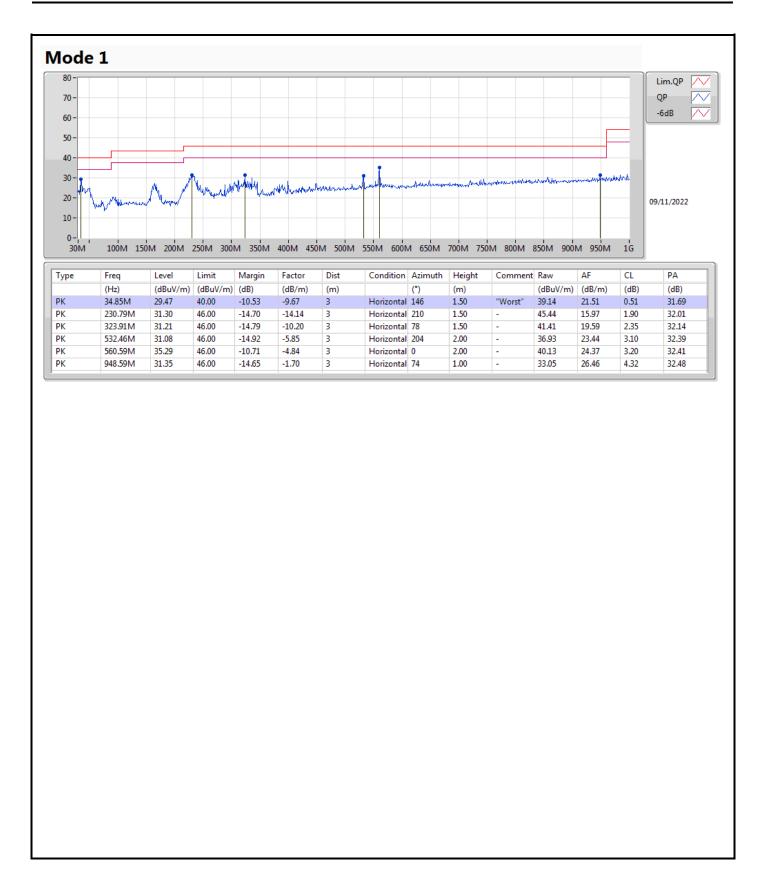
Summary

Mode	Result	Туре	Freq (Hz)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Condition
Mode 1	Pass	QP	34.85M	35.93	40.00	-4.07	Vertical

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RSE TX above 1GHz

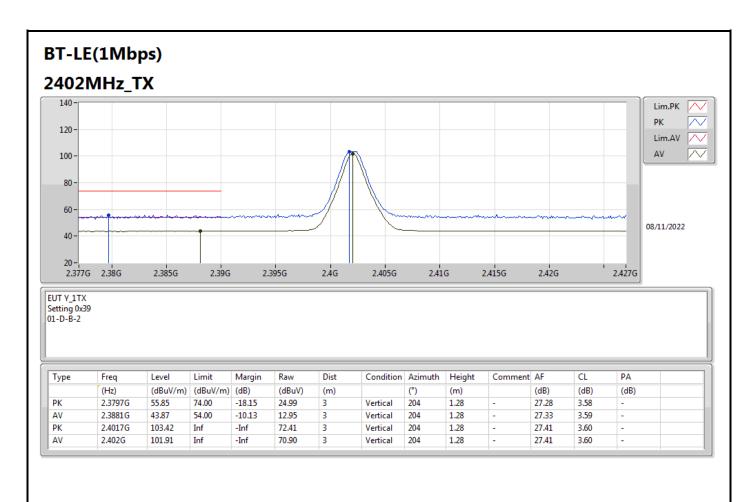
Appendix B.2

Summary

Mode	Result	Туре	Freq	Level	Limit	Margin	Dist	Condition	Azimuth	Height	Comments
			(Hz)	(dBuV/m)	(dBuV/m)	(dB)	(m)		(°)	(m)	
2.4-2.4835GHz	-	-	-	-	-	-	-	-	-	-	-
BT-LE(1Mbps)	Pass	AV	2.4835G	52.85	54.00	-1.15	3	Horizontal	188	2.62	-

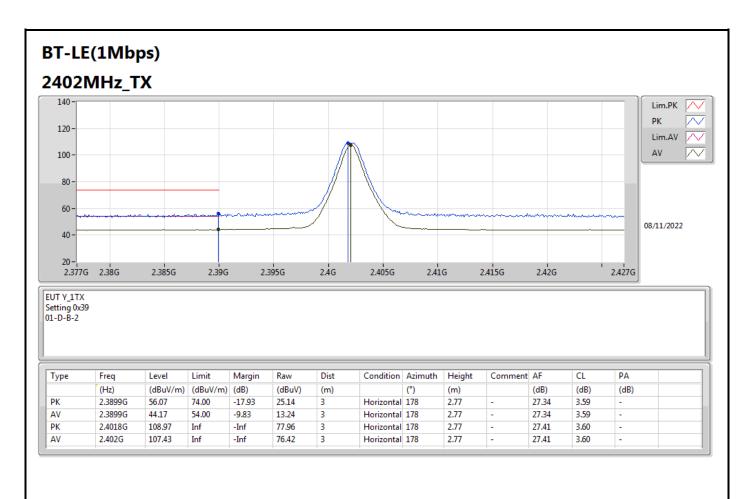
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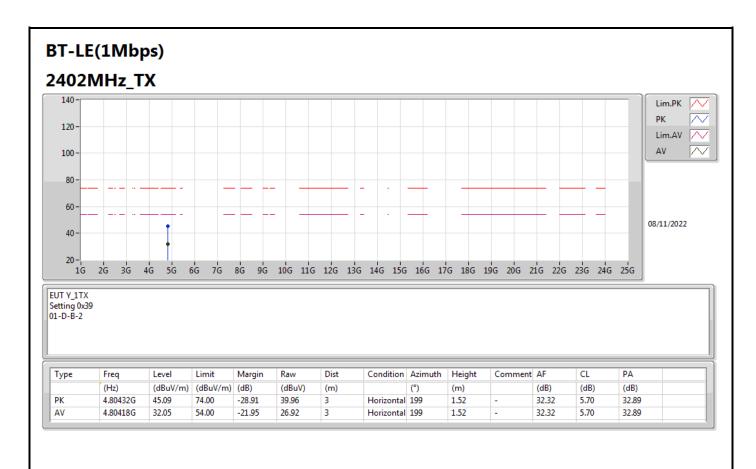
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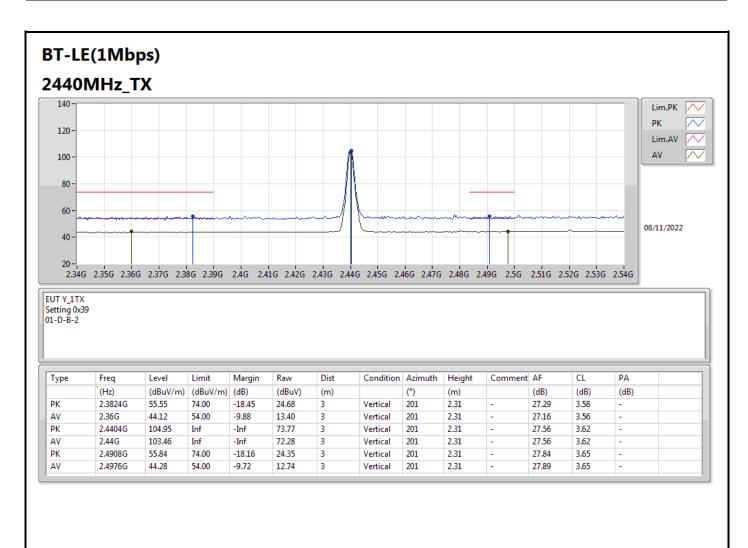
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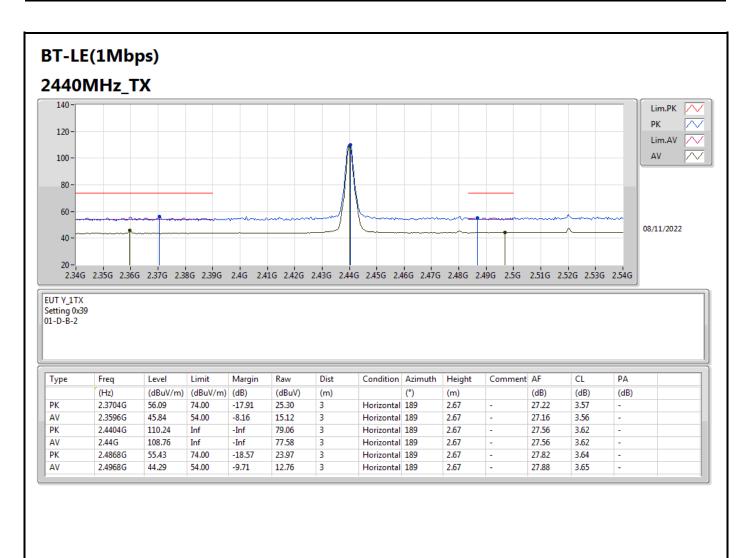
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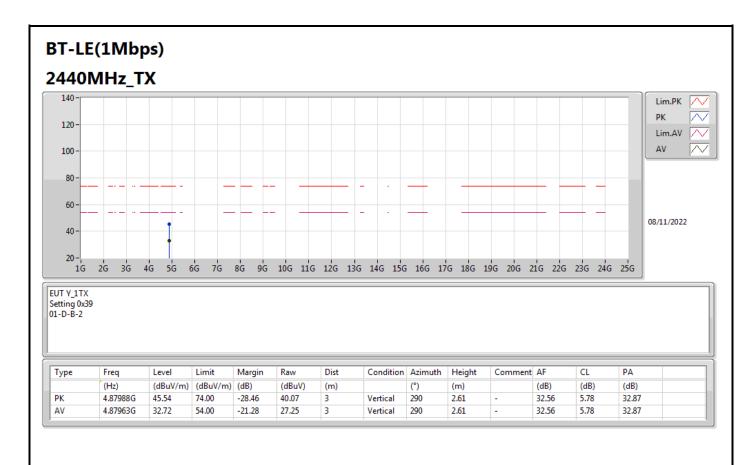
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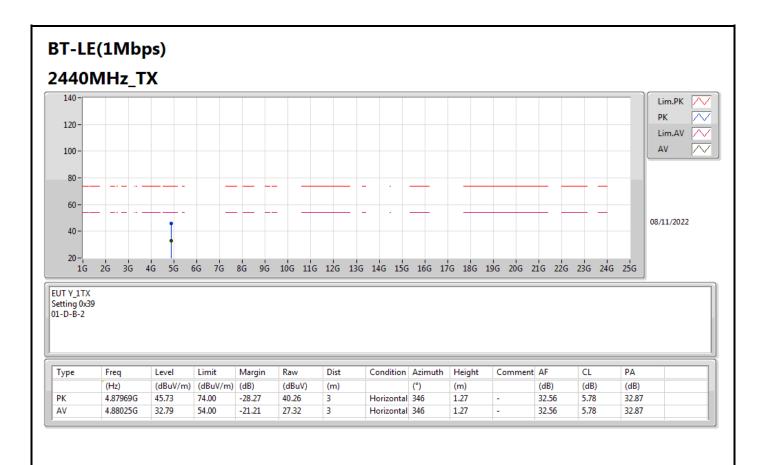
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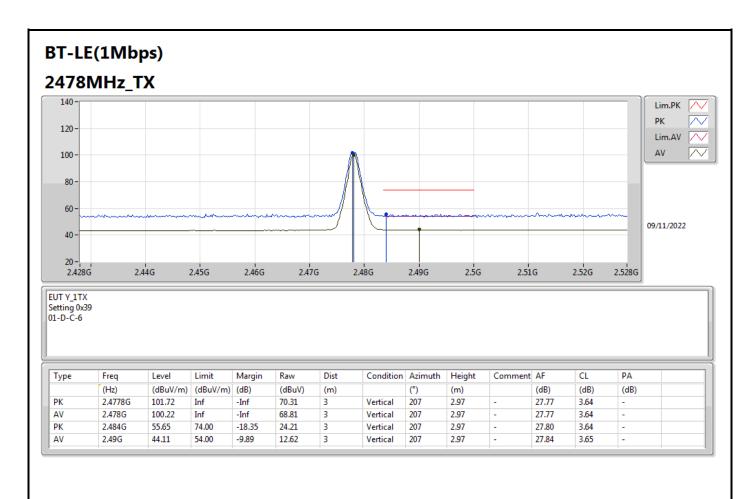
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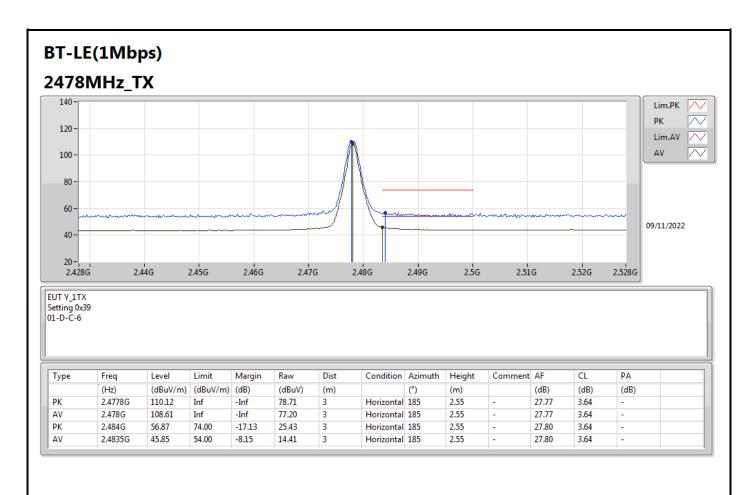
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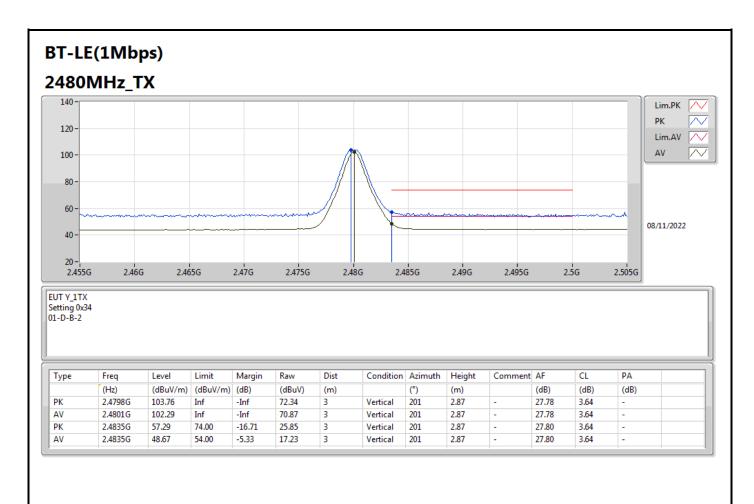
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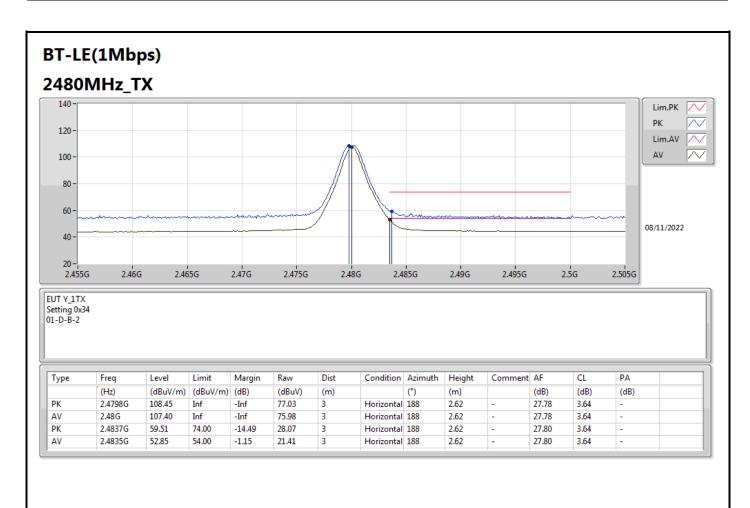
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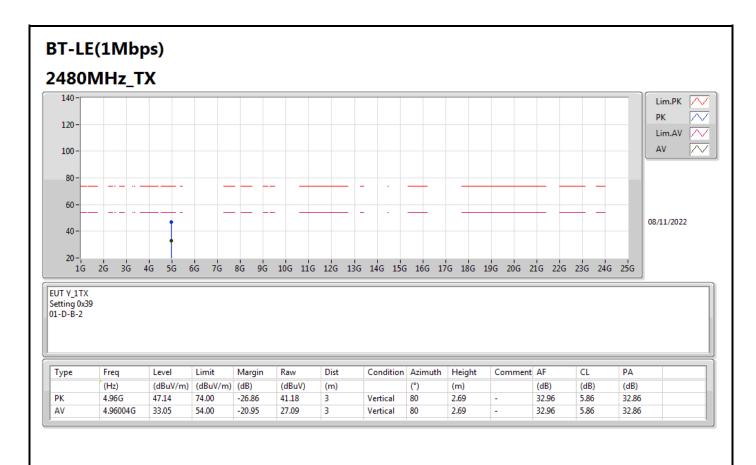
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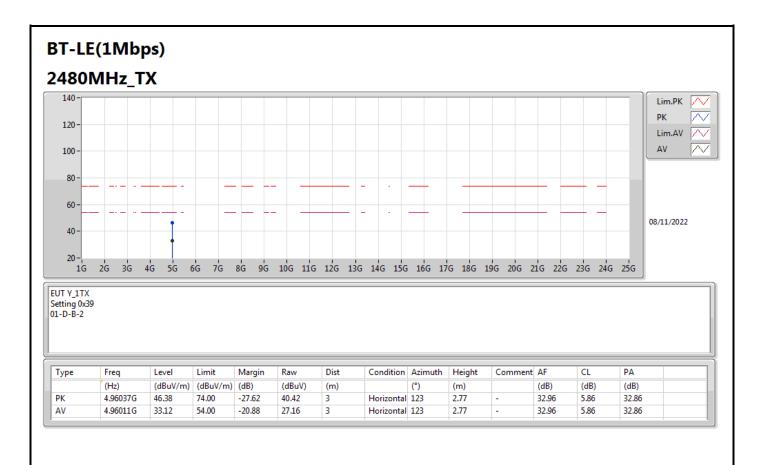
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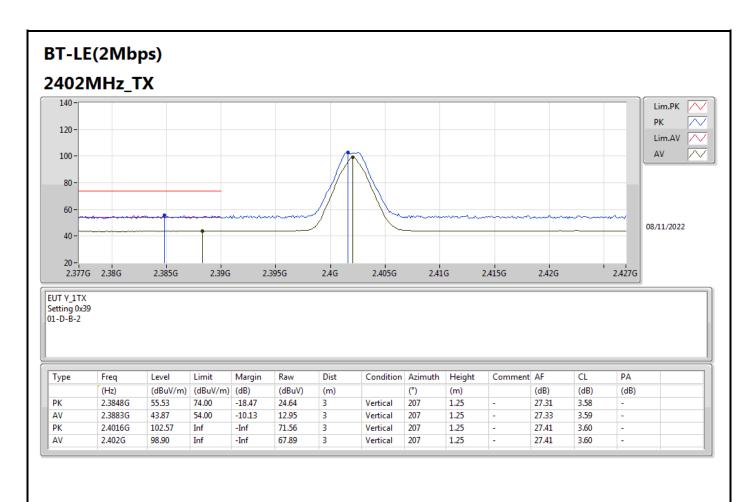
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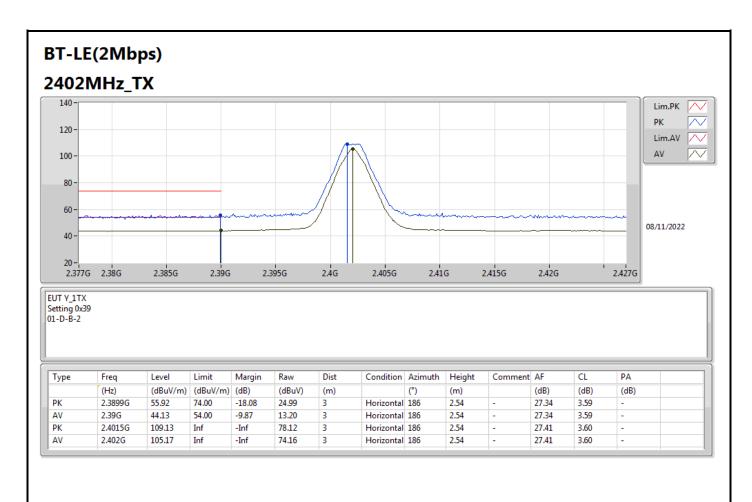
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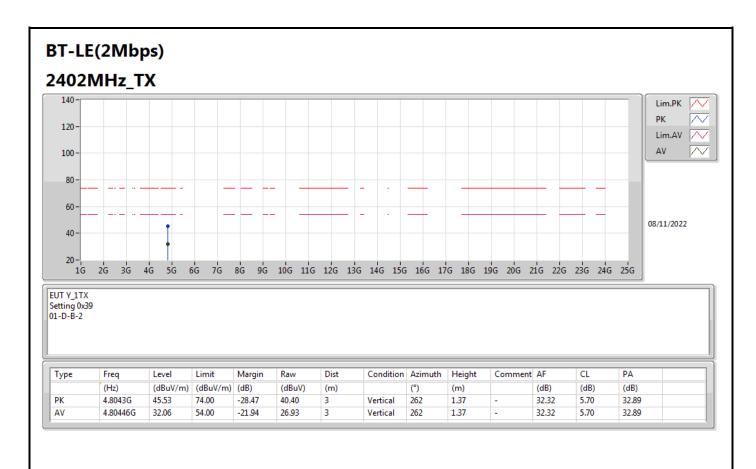
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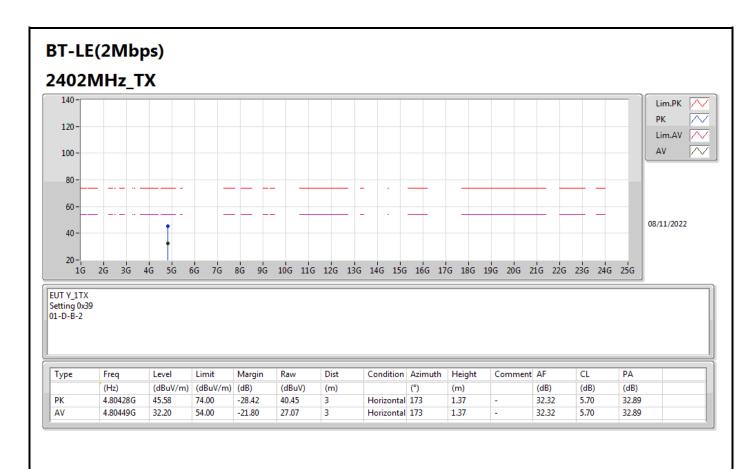
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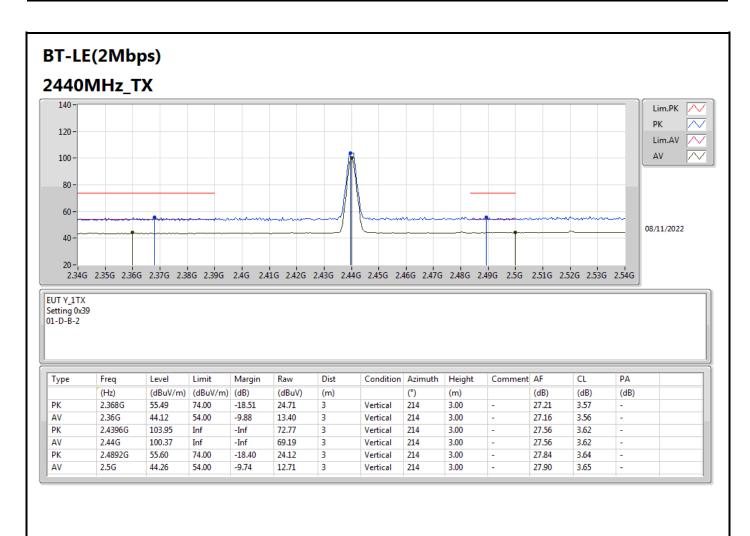
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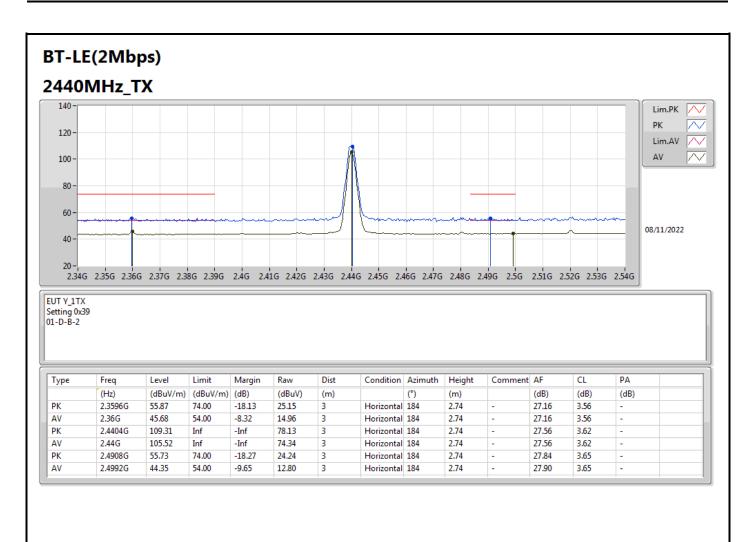
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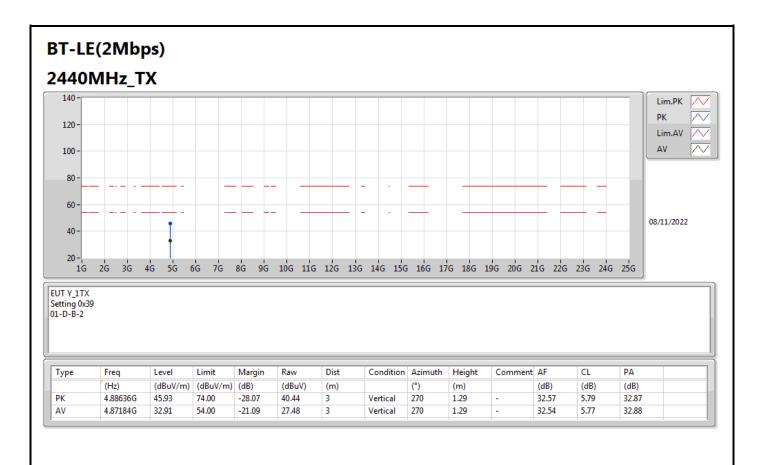
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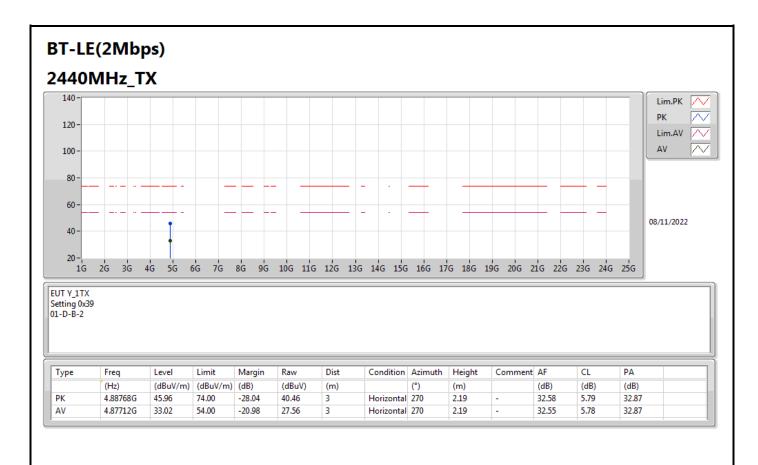
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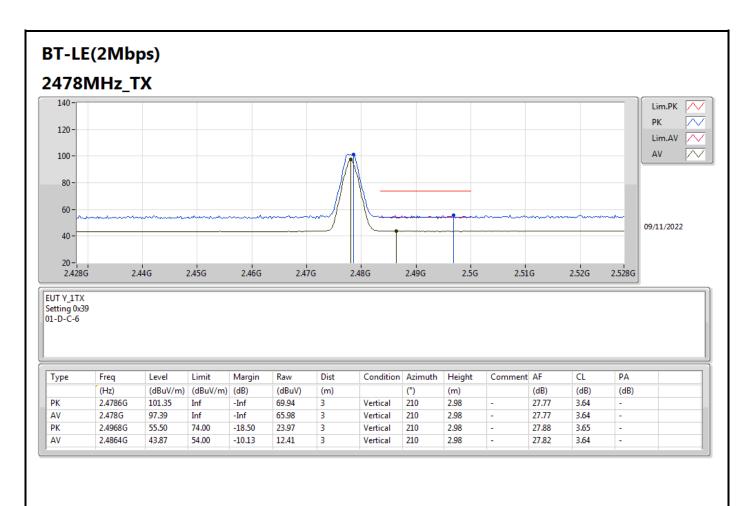
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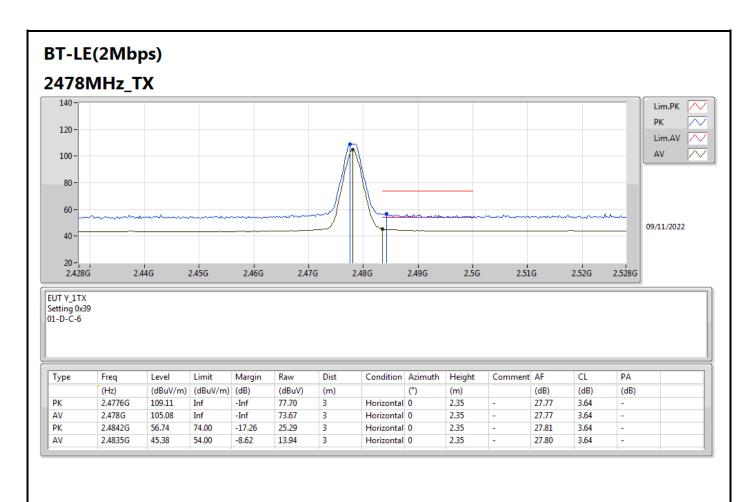
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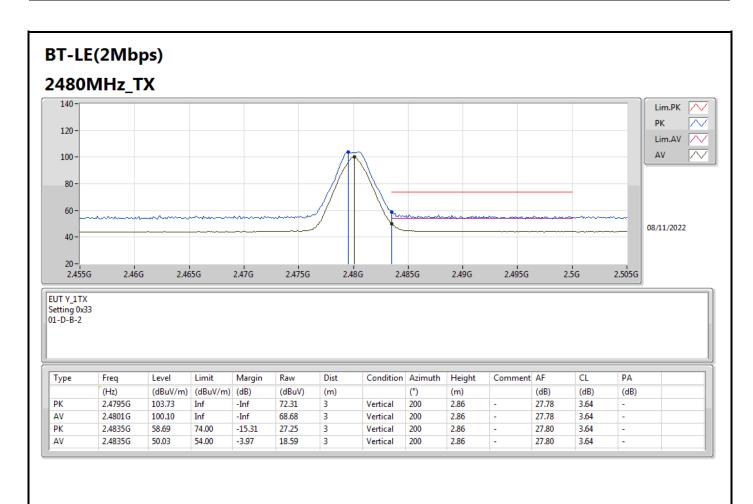
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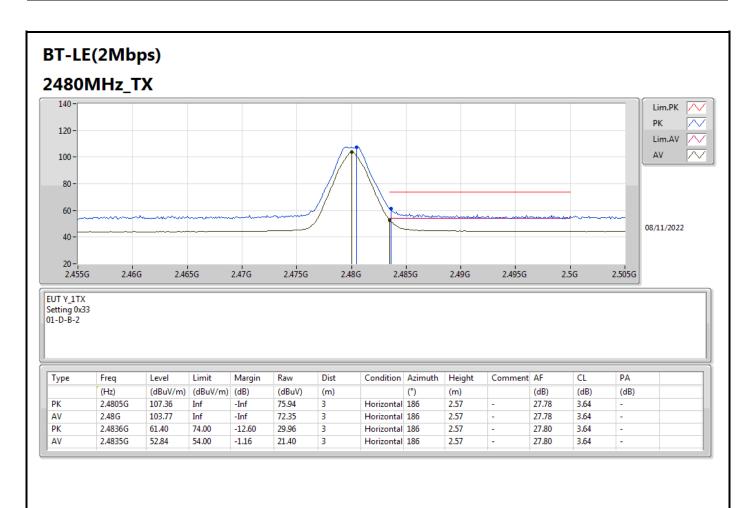
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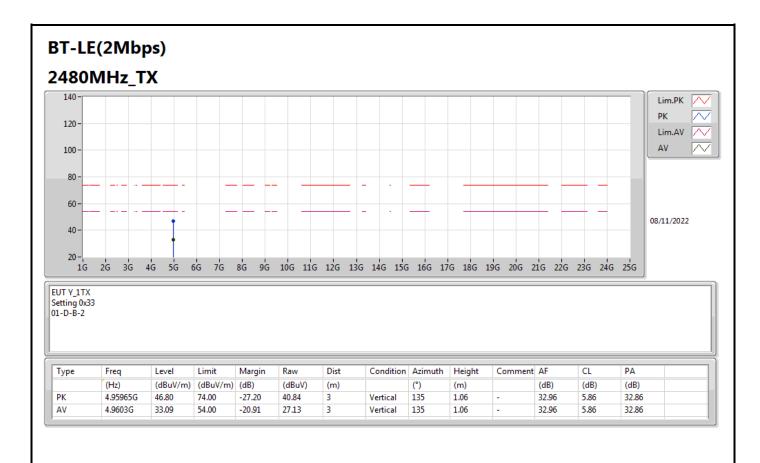
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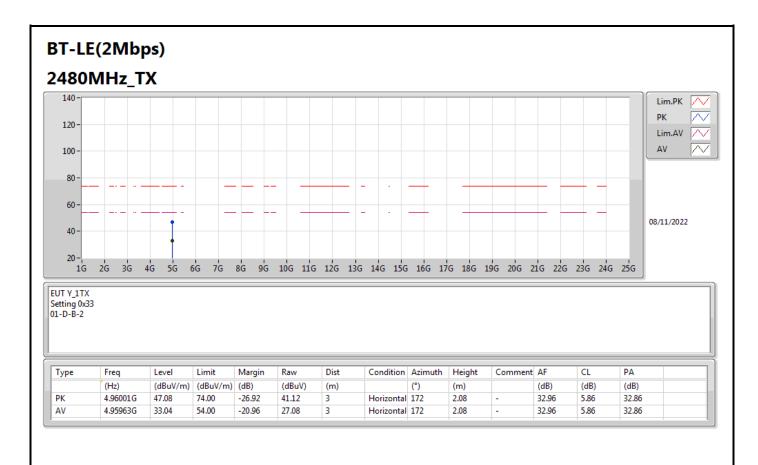
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