Report No.: FR181814AD





RADIO TEST REPORT

FCC ID

: TLZ-CM467

Equipment

: IEEE 802.11 a/b/g/n/ac and Bluetooth 5.0 Module

Brand Name

: AzureWave

Model Name

: AW-CM467-SUR, AW-CM467-USB,

AW-CM467-SUR-I, AW-CM467-USB-I

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 Aug. 30, 2021, and testing was started from Sep. 11, 2021 and completed on Dec. 08, 2021. 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
FR181814AD	01	Initial issue of report	Dec. 15, 2021

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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	-

Declaration of Conformity:

The test results with all measurement uncertainty excluded are presented in accordance with the regulation limits or requirements declared by manufacturers.

Comments and Explanations:

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

Reviewed by: Sam Chen Report Producer: Penny Kao

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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	Band Mode BWch (MHz)		Nant
2.4-2.4835GHz	BT-LE(1Mbps)	1.0	1TX

Note:

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

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1.1.2 Antenna Information

						Gain (d	dBi)	
Ant.	Port	Brand	Model Name	Antenna Type	Connector	WLAN 2.4GHz / Bluetooth	WLAN 5GHz	Remark
1	1	Nienyi	NYS4939	PCB	I-PEX	3.58	3.89	External
2	1	Genesis	650-10045-01	PCB	I-PEX	2.50	3.85	External
3	1	Lynwave	5-PP005737	PCB	I-PEX	4.20	3.60	Internal
4	1	Maglayers	MSA-4008-25GC1-A1	PIFA	I-PEX	2.98	5.16	External
5	1	Maglayers	MSA-4008-25GC1-A2	PIFA	I-PEX	2.98	5.16	External

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Note 1: The above information was declared by manufacturer.

Note 2: The EUT has five antennas.

For AC power-line conducted emissions and radiated emission measurement, "Ant. 1", "Ant. 3" and "Ant.4" was tested and recorded in the report.

For conducted measurement, only the highest gain antenna "Ant. 3" for WLAN 2.4GHz/Bluetooth and "Ant.4" for WLAN 5GHz were selected to test and recorded in the report.

For 2.4GHz WLAN function

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

Only Port 1 can be used as transmitting/receiving.

For 5GHz WLAN function

IEEE 802.11a/n/ac mode (1TX/1RX):

Only Port 1 can be used as transmitting/receiving.

For Bluetooth function (1TX/1RX):

Only Port 1 can be used as transmitting/receiving.

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

Note:

• DC is Duty Cycle.

DCF is Duty Cycle Factor.

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1.1.4 EUT Operational Condition

EUT Power Type	From Host System				
Function	✓ Point-to-multipoint ☐ Point-to-point				
Test Software Version	Terminal 6.04				
	☐ LE 1M PHY: 1 Mb/s				
Support Mode	LE Coded PHY (S=2): 500 Kb/s				
Support wode	LE Coded PHY (S=8): 125 Kb/s				
	LE 2M PHY: 2 Mb/s				

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Note: The above information was declared by manufacturer.

1.1.5 Table for Multiple Listing

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

EUT	Model Name	Interface	Equip Antenna	Description
1	AW-CM467-SUR	SDIO-UART External or Internal Antenna		All the models are identical, the difference model for difference brand
	AW-CM467-SUR-I		served as marketing strategy.	
2	AW-CM467-USB	USB-USB	External Antenna	All the models are identical, the difference model for difference brand
	AW-CM467-USB-I	030-030	External Antenna	served as marketing strategy.

Note 1: From the above models, model: AW-CM467-SUR (EUT 1) and AW-CM467-USB (EUT 2) 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.

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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
RF Conducted	TH01-CB	Caster Chang	21.9-22.4 / 69-72	Sep. 18, 2021
Radiated	Radiated 03CH03-CB		24.1-25.2 / 55-58	Sep. 11, 2021~
(Below 1GHz)	03CH05-CB	Stim Sung	23.5-24.6 / 55-59 Dec. 08, 202	Dec. 08, 2021
Radiated (Above 1GHz)	03CH06-CB	Stim Sung	23.7-24.8 / 56-59	Sep. 11, 2021~ Dec. 08, 2021
Radiated (Emission Co-location)	03CH06-CB	Stim Sung	23.7-24.8 / 56-59	Sep. 11, 2021~ Dec. 08, 2021
AC Conduction	CO01-CB	Joe Chu	22~24 / 58~60	Nov. 29, 2021

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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)

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Test Items	Uncertainty	Remark
Conducted Emission (150kHz ~ 30MHz)	2.0 dB	Confidence levels of 95%
Radiated Emission (9kHz ~ 30MHz)	4.2 dB	Confidence levels of 95%
Radiated Emission (30MHz ~ 1,000MHz)	5.5 dB	Confidence levels of 95%
Radiated Emission (1GHz ~ 18GHz)	4.7 dB	Confidence levels of 95%
Radiated Emission (18GHz ~ 40GHz)	4.2 dB	Confidence levels of 95%
Conducted Emission	2.5 dB	Confidence levels of 95%
Output Power Measurement	1.3 dB	Confidence levels of 95%
Power Density Measurement	2.5 dB	Confidence levels of 95%
Bandwidth Measurement	0.9%	Confidence levels of 95%

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2 Test Configuration of EUT

2.1 Test Channel Mode

Mode	Power Setting
BT-LE(1Mbps)	-
2402MHz	Default
2440MHz	Default
2480MHz	Default

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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 2 + WLAN 2.4GHz + Bluetooth + Ant. 1	
2	EUT 2 + WLAN 5GHz + Bluetooth + Ant. 1	
Mode 1 has been evaluated to be the worst case among Mode 1~2, thus measurement for Mode 3 will follow this same test mode.		
3	EUT 1 + WLAN 2.4GHz + Bluetooth + Ant. 1	
Mode 3 has been evaluated to be the worst case among Mode 1~3, thus measurement for Mode 4~5 will follow this same test mode.		
4	EUT 1 + WLAN 2.4GHz + Bluetooth + Ant. 4	
5	EUT 1 + WLAN 5GHz + Bluetooth + Ant. 4	
6	EUT 1 + WLAN 2.4GHz + Bluetooth + Ant. 3	
7	EUT 1 + WLAN 5GHz + Bluetooth + Ant. 3	
For operating mode 3 is the worst case and it was record in this test report.		

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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	After verifying, the output power is the same with EUT 1 and EUT 2. Thus only EUT 2 was selected to execute all test.	
1	EUT 2 + Ant. 3	

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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.	
	СТХ	
Operating Mode < 1GHz	 The EUT was performed at X axis, Y axis and Z axis position for Emissions in Restricted Frequency Bands above 1GHz test. The worst case was found is below. So the measurement will follow this same test configuration. 	
1	EUT 1 in X axis + WLAN 2.4GHz + Ant.3	
2	EUT 1 in X axis + Bluetooth + Ant.3	
3	EUT 2 in Y axis + WLAN 5GHz + Ant.1	
4	EUT 1 in Y axis + WLAN 5GHz + Ant.1	
5	EUT 2 in Y axis + WLAN 2.4GHz + Ant.1	
6	EUT 2 in Y axis + Bluetooth + Ant.1	
7	EUT 2 in Y axis + WLAN 2.4GHz + Ant.4	
8	EUT 1 in Y axis + WLAN 2.4GHz + Ant.4	
9	EUT 2 in Y axis + Bluetooth + Ant.4	
10	EUT 1 in Y axis + Bluetooth + Ant.4	
11	EUT 2 in Y axis + WLAN 5GHz + Ant.4	
12	EUT 1 in Y axis + WLAN 5GHz + Ant.4	
For operating mode 1 is the worst case and it was record in this test report.		
	CTX	
Operating Mode > 1GHz	 The EUT was performed at X axis, Y axis and Z axis position. The antenna 1, antenna 4 was performed testing with EUT 1 and EUT 2. The antenna 3 was performed testing. The worst case was found is below. So the measurement will follow this same test configuration. 	
1	EUT 1 in X axis + Ant.3	
2	EUT 1 in Y axis + Ant.4	

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The Worst Case Mode for Following Conformance Tests		
Tests Item Simultaneous Transmission Analysis - Radiated Emission Co-location		
Test Condition	Radiated measurement	
	Normal Link	
Operating Mode	The EUT was performed at X axis, Y axis and Z axis position for Emissions in Restricted Frequency Bands above 1GHz test. The worst case was found is below. So the measurement will follow this same test configuration.	
1	EUT 1 in X axis - WLAN 2.4GHz + Bluetooth + Ant.3	
2	EUT 1 in X axis - WLAN 5GHz + Bluetooth + Ant.3	
3	EUT 2 in Y axis - WLAN 2.4GHz + Bluetooth + Ant.4	
4	EUT 2 in Y axis - WLAN 5GHz + Bluetooth + Ant.4	
5	EUT 1 in Y axis - WLAN 2.4GHz + Bluetooth + Ant.4	
6	EUT 1 in Y axis - WLAN 5GHz + Bluetooth + Ant.4	
For operating mode 3 is the worst case and it was record in this test report.		
Refer to Appendix G for Radiated Emission Co-location.		

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The Worst Case Mode for Following Conformance Tests		
Tests Item Simultaneous Transmission Analysis - Co-location RF Exposure Evaluation		
Operating Mode		
1	WLAN 2.4GHz with Ant.3 + Bluetooth with Ant.3	
2	WLAN 5GHz with Ant.4 + Bluetooth with Ant.3	
Refer to Sporton Test Report No.: FA181814 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

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	AzureWave	9007-I12 CK77	N/A	
В	NB	HP	3168NGW	N/A	
С	Bluetooth Speaker	MARUS	MSK06C-RD	N/A	
D	AP Router	ASUS	RP-N53	N/A	
Е	Mouse	Logitech	M-U0026	N/A	
F	Earphone	SHYARO CHI	MIC-04	N/A	

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For Radiated below 1GHz, Radiated above 1GHz mode 1 and RF Conducted:

Support Equipment				
No.	Equipment	Brand Name	Model Name	FCC ID
Α	Notebook	DELL	E4300	N/A
В	Fixture	AzureWare	2532 I1	N/A

For Radiated above 1GHz mode 2:

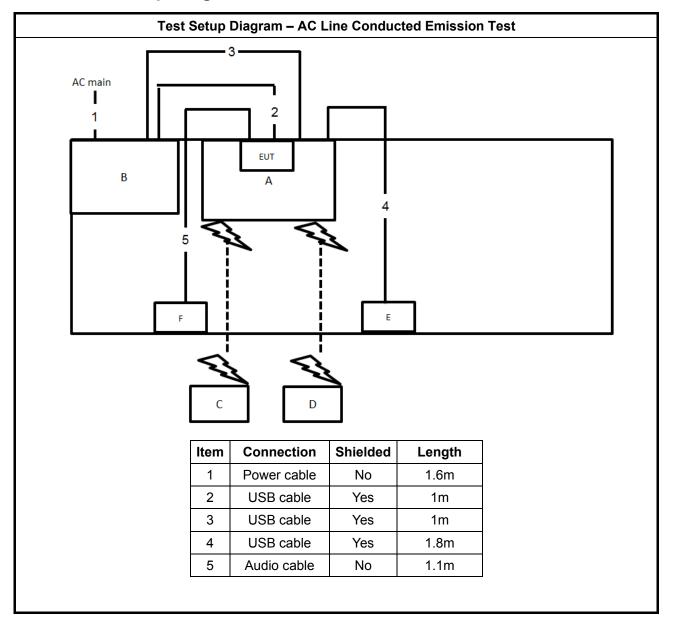
Support Equipment				
No. Equipment Brand Name Model Name FCC ID		FCC ID		
Α	Notebook	DELL	E4300	N/A
В	Fixture	AzureWare	9007-I12 CK77	N/A

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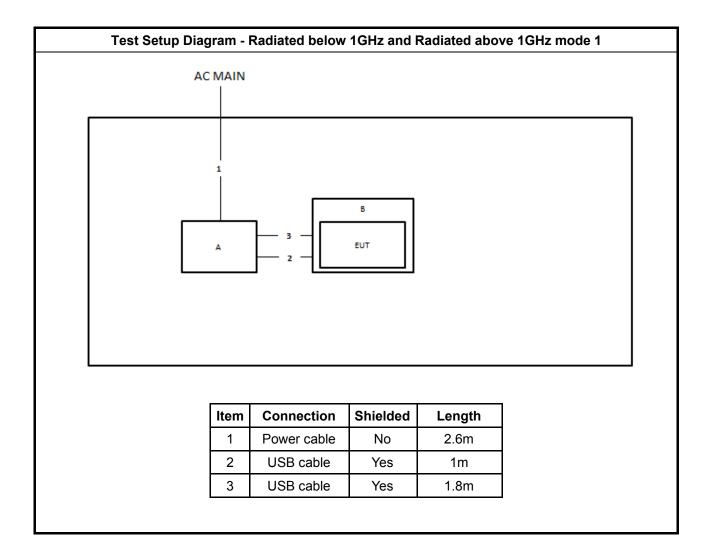
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2.6 Test Setup Diagram



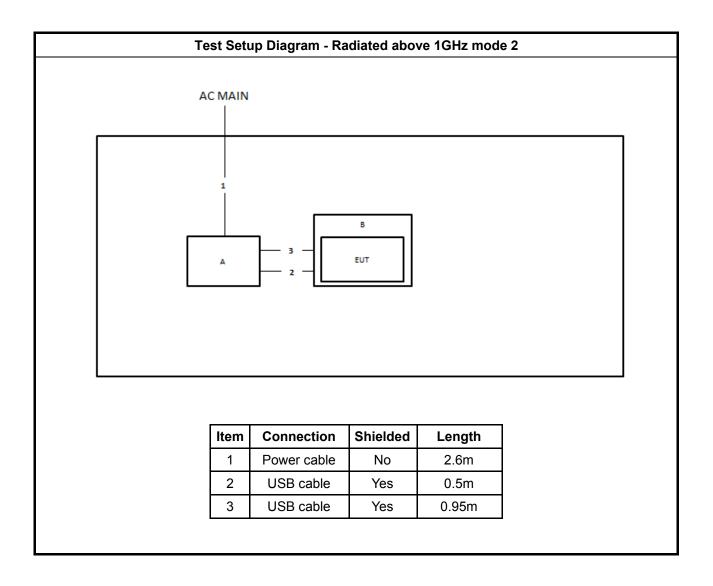
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3 Transmitter Test Result

3.1 AC Power-line Conducted Emissions

3.1.1 AC Power-line Conducted Emissions Limit

AC Powe	er-line Conducted Emissions L	imit
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	of the frequency.	

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3.1.2 Measuring Instruments

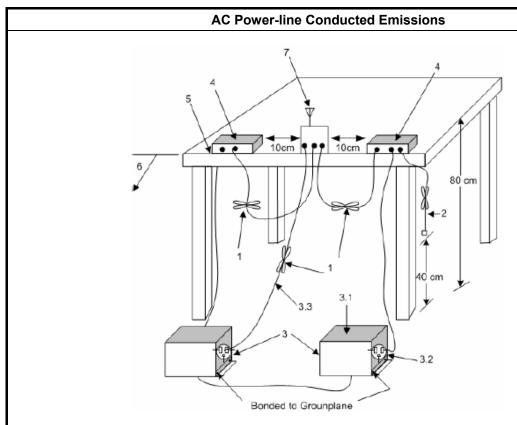
Refer a test equipment and calibration data table in this test report.

3.1.3 Test Procedures

	Test Method
Refer a	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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- -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 peripherals, 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
- —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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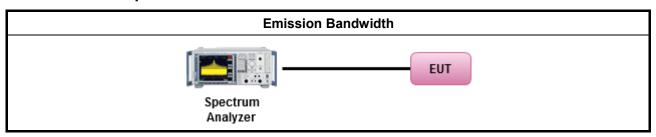
3.2.2 Measuring Instruments

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:		
	\boxtimes	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_{TX} ≤ 6 dBi, then P_{Out} ≤ 30 dBm (1 W)
- Point-to-multipoint systems (P2M): If $G_{TX} > 6$ dBi, then $P_{Out} = 30 (G_{TX} 6)$ dBm
- Point-to-point systems (P2P): If $G_{TX} > 6$ dBi, then $P_{Out} = 30 (G_{TX} 6)/3$ dBm
- Smart antenna system (SAS):
 - Single beam: If $G_{TX} > 6$ dBi, then $P_{Out} = 30 (G_{TX} 6)/3$ dBm
 - Overlap beam: If $G_{TX} > 6$ dBi, then $P_{Out} = 30 (G_{TX} 6)/3$ dBm
 - Aggregate power on all beams: If $G_{TX} > 6$ dBi, then $P_{Out} = 30 (G_{TX} 6)/3 + 8$ dB dBm

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 \mathbf{P}_{Out} = maximum peak conducted output power or maximum conducted output power in dBm, \mathbf{G}_{TX} = the maximum transmitting antenna directional gain in dBi.

3.3.2 Measuring Instruments

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

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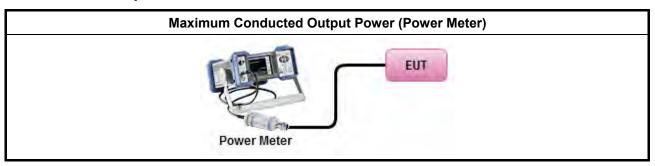
3.3.3 Test Procedures

		Test Method
•	Max	imum Peak Conducted Output Power
		Refer as FCC KDB 558074, clause 8.3.1.1 & C63.10 clause 11.9.1.1 (RBW ≥ EBW method).
		Refer as FCC KDB 558074, clause 8.3.1.3 & C63.10 clause 11.9.1.3 (peak power meter).
•	Max	imum Conducted Output Power
	[duty	/ cycle ≥ 98% or external video / power trigger]
		Refer as FCC KDB 558074, clause 8.3.2.2 & C63.10 clause 11.9.2.2.2 Method AVGSA-1.
		Refer as FCC KDB 558074, clause 8.3.2.2 & C63.10 clause 11.9.2.2.3 Method AVGSA-1A. (alternative)
	duty	cycle < 98% and average over on/off periods with duty factor
		Refer as FCC KDB 558074, clause 8.3.2.2 & C63.10 clause 11.9.2.2.4 Method AVGSA-2.
		Refer as FCC KDB 558074, clause 8.3.2.2 & C63.10 clause 11.9.2.2.5 Method AVGSA-2A (alternative)
		Refer as FCC KDB 558074, clause 8.3.2.2 & C63.10 clause 11.9.2.2.6 Method AVGSA-3
		Refer as FCC KDB 558074, clause 8.3.2.2 & C63.10 clause 11.9.2.2.7 Method AVGSA-3A (alternative)
	Mea	surement using a power meter (PM)
		Refer as FCC KDB 558074, clause 8.3.2.3 & C63.10 clause 11.9.2.3.1 Method AVGPM (using an RF average power meter).
		Refer as FCC KDB 558074, clause 8.3.2.3 & C63.10 clause 11.9.2.3.2 Method AVGPM-G (using an gate RF average power meter).
•	For	conducted measurement.
	•	If the EUT supports multiple transmit chains using options given below: Refer as FCC KDB 662911, In-band power measurements. Using the measure-and-sum approach, measured all transmit ports individually. Sum the power (in linear power units e.g., mW) of all ports for each individual sample and save them.
	•	If multiple transmit chains, EIRP calculation could be following as methods: $P_{total} = P_1 + P_2 + + P_n$ (calculated in linear unit [mW] and transfer to log unit [dBm]) EIRP _{total} = $P_{total} + DG$

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3.3.4 Test Setup



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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

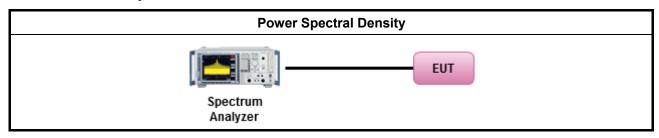
Refer a test equipment and calibration data table in this test report.

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 c	ycle ≥ 98% or external video / power trigger]								
•	For co	nducted measurement.								
	If The EUT supports multiple transmit chains using options given below:									
		Option 1: Measure and sum the spectra across the outputs. Refer as FCC KDB 662911, In-band power spectral density (PSD). Sample all transmit ports simultaneously using a spectrum analyzer for each transmit port. Where the trace bin-by-bin of each transmit port summing can be performed. (i.e., in the first spectral bin of output 1 is summed with that in the first spectral bin of output 2 and that from the first spectral bin of output 3, and so on up to the NTX output to obtain the value for the first frequency bin of the summed spectrum.). Add up the amplitude (power) values for the different transmit chains and use this as the new data trace.								
		Option 2: Measure and sum spectral maxima across the outputs. With this technique, spectra are measured at each output of the device at the required resolution bandwidth. The maximum value (peak) of each spectrum is determined. These maximum values are then summed mathematically in linear power units across the outputs. These operations shall be performed separately over frequency spans that have different out-of-band or spurious emission limits,								
		Option 3: Measure and add 10 log(N) dB, where N is the number of transmit chains. Refer as FCC KDB 662911, In-band power spectral density (PSD). Performed at each transmit chains and each transmit chains shall be compared with the limit have been reduced with 10 log(N). Or each transmit chains shall be add 10 log(N) to compared with the limit.								

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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.

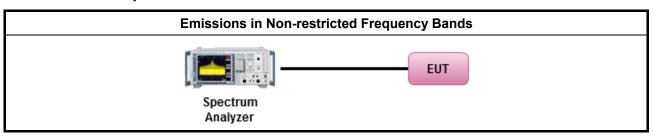
3.5.2 Measuring Instruments

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

3.5.3 Test Procedures

	Test Method
•	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

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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 ELIT
- 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].								
•	Refer as ANSI C63.10, clause 6.10.3 band-edge testing shall be performed at the lowest frequency channel and highest frequency channel within the allowed operating band.								
•	For the transmitter unwanted emissions shall be measured using following options below:								
	 Refer as FCC KDB 558074, clause 8.6 for unwanted emissions into restricted bands. 								
		Refer as FCC KDB 558074, clause 8.6 & C63.10 clause 11.12.2.5.1(trace averaging for duty cycle ≥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.							

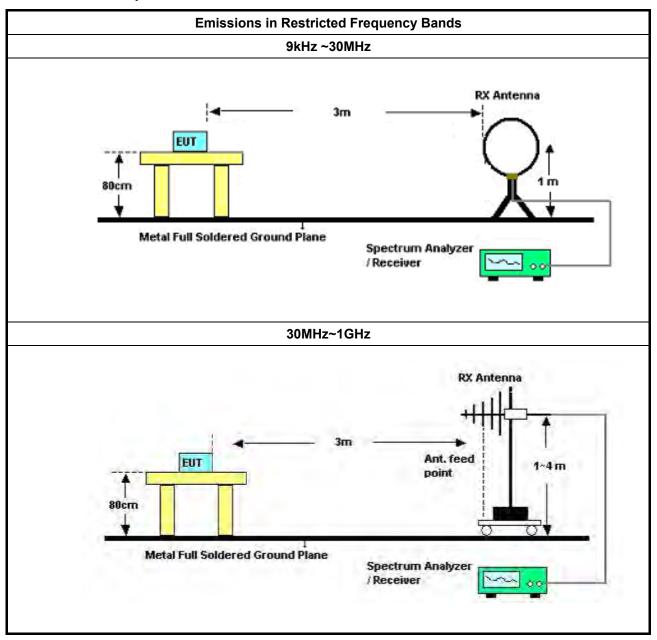
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3.6.4 Test Setup



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Above 1GHz

EUT

3M & 1M

1.5M

Max 30cm

Name of the contract of the contract

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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 Date	Calibration Due Date	Remark
EMI Receiver	Agilent	N9038A	My52260123	9kHz ~ 8.4GHz	Mar. 03, 2021	Mar. 02, 2022	Conduction (CO01-CB)
LISN	F.C.C.	FCC-LISN-50- 16-2	04083	150kHz ~ 100MHz	Jan. 06, 2021	Jan. 05, 2022	Conduction (CO01-CB)
LISN	Schwarzbeck	NSLK 8127	8127647	9kHz ~ 30MHz	Mar. 07, 2021	Mar. 06, 2022	Conduction (CO01-CB)
Pulse Limiter	Rohde&Schwa rz	ESH3-Z2	100430	9kHz ~ 30MHz	Jan. 30, 2021	Jan. 29, 2022	Conduction (CO01-CB)
COND Cable	Woken	Cable	Low cable-CO01	9kHz ~ 30MHz	May 19, 2021	May 18, 2022	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	Apr. 14, 2021	Apr. 13, 2022	Radiation (03CH03-CB)
3m Semi Anechoic Chamber NSA	TDK	SAC-3M	03CH03-CB	30 MHz ~ 1 GHz	Jan. 27, 2021	Jan. 26, 2022	Radiation (03CH03-CB)
Bilog Antenna with 6 dB attenuator	Schaffner & EMCI	CBL6112B & N-6-06	2928 & AT-N0608	20MHz ~ 2GHz	Feb. 22, 2021	Feb. 21, 2022	Radiation (03CH03-CB)
Pre-Amplifier	Agilent	8447D	2944A10259	9kHz ~ 1.3GHz	Jan. 11, 2021	Jan. 10, 2022	Radiation (03CH03-CB)
Spectrum Analyzer	R&S	FSP40	100019	9kHz ~ 40GHz	Jun. 04, 2021	Jun. 03, 2022	Radiation (03CH03-CB)
EMI Test Receiver	R&S	ESCS	826547/017	9kHz ~ 2.75GHz	Jun. 21, 2021	Jun. 20, 2022	Radiation (03CH03-CB)
RF Cable-low	Woken	RG402	Low Cable-04+23	30MHz~1GHz	Oct. 05, 2020	Oct. 04, 2021	Radiation (03CH05-CB)
RF Cable-low	Woken	RG402	Low Cable-02+29	30MHz ~ 1GHz	Oct. 04, 2021	Oct. 03, 2022	Radiation (03CH03-CB)
Test Software	SPORTON	SENSE	V5.10	-	N.C.R.	N.C.R.	Radiation (03CH03-CB)
Loop Antenna	Teseq	HLA 6120	24155	9kHz - 30 MHz	Apr. 14, 2021	Apr. 13, 2022	Radiation (03CH05-CB)
3m Semi Anechoic Chamber NSA	TDK	SAC-3M	03CH05-CB	30 MHz ~ 1 GHz	Aug. 09, 2021	Aug. 08, 2022	Radiation (03CH05-CB)
Bilog Antenna with 6dB Attenuator	TESEQ & EMCI	CBL 6112D & N-6-06	35236 & AT-N0610	30MHz ~ 2GHz	Mar. 26, 2021	Mar. 25, 2022	Radiation (03CH05-CB)
Pre-Amplifier	EMCI	EMC330N	980331	20MHz ~ 3GHz	Apr. 27, 2021	Apr. 26, 2022	Radiation (03CH05-CB)
Signal Analyzer	R&S	FSV40	101903	9kHz ~ 40GHz	Mar. 22, 2021	Mar. 21, 2022	Radiation (03CH05-CB)

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Calibration Calibration Instrument **Brand** Model No. Serial No. Characteristics Remark Date **Due Date EMI Test** Radiation Jun. 21, 2021 R&S **ESCS** 826547/017 9kHz ~ 2 75GHz Jun. 20, 2022 Receiver (03CH05-CB) Low Radiation RF Cable-low Woken RG402 30MHz~1GHz Oct. 05, 2020 Oct. 04, 2021 Cable-04+23 (03CH05-CB) Low Radiation RF Cable-low Woken RG402 30MHz~1GHz Oct. 04, 2021 Oct. 03, 2022 Cable-04+23 (03CH05-CB) Radiation **SPORTON** SENSE V5.10 N.C.R. N.C.R. Test Software (03CH05-CB) 3m Semi Anechoic 1GHz ~18GHz Radiation TDK SAC-3M 03CH06-CB Oct. 02, 2020 Oct. 01, 2021 Chamber 3m (03CH06-CB) **VSWR** 3m Semi Anechoic 1GHz ~18GHz Radiation 03CH06-CB Oct. 01, 2021 TDK SAC-3M Sep. 30, 2022 Chamber 3m (03CH06-CB) **VSWR** SCHWAR7BF **BBHA** Radiation BBHA9120D Horn Antenna 1GHz~18GHz Aug. 04, 2021 Aug. 03, 2022 CK 9120D-1292 (03CH06-CB) Radiation Horn Antenna Schwarzbeck **BBHA 9170** BBHA9170252 15GHz ~ 40GHz Aug. 05, 2021 Aug. 04, 2022 (03CH06-CB) 0.5GHz ~ Radiation Pre-Amplifier 83017A MY53270064 May 06, 2021 May 05, 2022 Agilent 26.5GHz (03CH06-CB) TTA1840-35-H Radiation Pre-Amplifier **MITEQ** 1864479 18GHz ~ 40GHz Jul. 13, 2021 Jul. 12, 2022 (03CH06-CB) Spectrum Radiation R&S FSP40 100080 9kHz~40GHz Dec. 15, 2020 Dec. 14, 2021 analyzer (03CH06-CB) Radiation RF Cable-high Woken RG402 High Cable-05 1GHz~18GHz Oct. 05, 2020 Oct. 04, 2021 (03CH06-CB) Radiation RF Cable-high Woken RG402 High Cable-05 1GHz~18GHz Oct. 04, 2021 Oct. 03, 2022 (03CH06-CB) High Radiation 1GHz~18GHz RF Cable-high Woken RG402 Oct. 05, 2020 Oct. 04, 2021 Cable-05+24 (03CH06-CB) High Radiation Woken RG402 1GHz~18GHz Oct. 04, 2021 Oct. 03, 2022 RF Cable-high Cable-05+24 (03CH06-CB) High Radiation 18GHz ~ 40 GHz RF Cable-high Woken RG402 Jul. 15, 2021 Jul. 14, 2022 Cable-40G#1 (03CH06-CB) Radiation High RF Cable-high Woken **RG402** 18GHz ~ 40 GHz Jul. 15, 2021 Jul. 14, 2022 Cable-40G#2 (03CH06-CB) Radiation **SPORTON** SENSE V5.10 N.C.R. N.C.R. **Test Software** (03CH06-CB)

100979

9kHz~40GHz

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Spectrum

analyzer

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R&S

FSV40

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May 20, 2022

Conducted

(TH01-CB)

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May 21, 2021

Instrument	Brand	Model No.	Serial No.	Characteristics	Calibration Date	Calibration Due Date	Remark
RF Cable-high	Woken	RG402	High Cable-06	1 GHz – 26.5 GHz	Oct. 05, 2020	Oct. 04, 2021	Conducted (TH01-CB)
RF Cable-high	Woken	RG402	High Cable-07	1 GHz –26.5 GHz	Oct. 05, 2020	Oct. 04, 2021	Conducted (TH01-CB)
RF Cable-high	Woken	RG402	High Cable-08	1 GHz –26.5 GHz	Oct. 05, 2020	Oct. 04, 2021	Conducted (TH01-CB)
RF Cable-high	Woken	RG402	High Cable-09	1 GHz –26.5 GHz	Oct. 05, 2020	Oct. 04, 2021	Conducted (TH01-CB)
RF Cable-high	Woken	RG402	High Cable-10	1 GHz –26.5 GHz	Oct. 05, 2020	Oct. 04, 2021	Conducted (TH01-CB)
RF Cable-high	Woken	RG402	High Cable-30	1 GHz –26.5 GHz	Oct. 05, 2020	Oct. 04, 2021	Conducted (TH01-CB)
Power Sensor	Agilent	E9327A	US40442088	50MHz~18GHz	Feb. 23, 2021	Feb. 22, 2022	Conducted (TH01-CB)
Power Meter	Agilent	E4416A	GB41291199	50MHz~18GHz	Feb. 23, 2021	Feb. 22, 2022	Conducted (TH01-CB)
Test Software	SPORTON	SENSE	V5.10	-	N.C.R.	N.C.R.	Conducted (TH01-CB)

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

NCR means Non-Calibration required.

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Conducted Emissions at Powerline

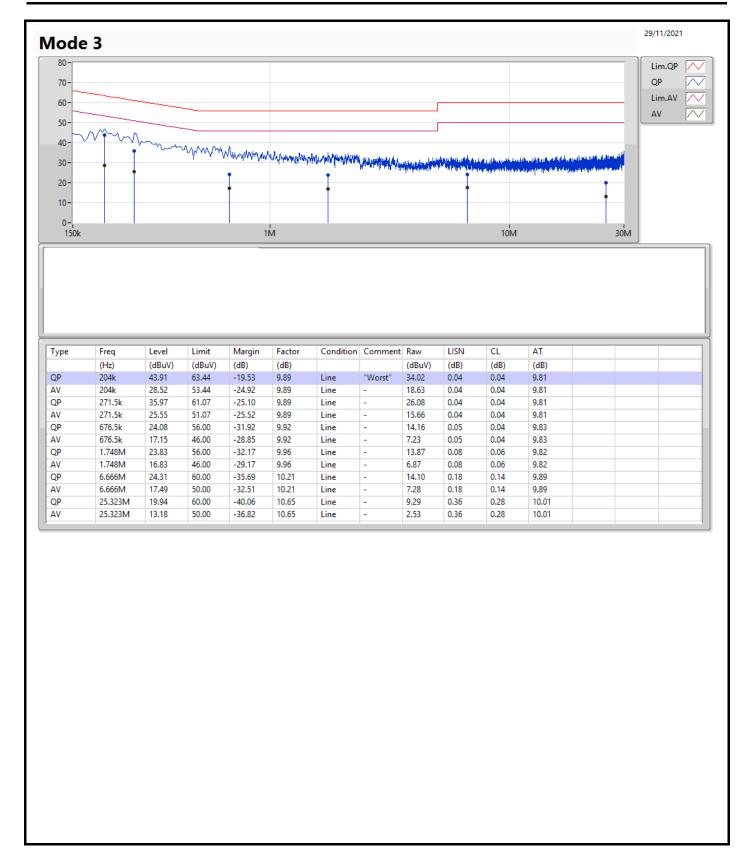
Appendix A

Summary

Mode	Result	Туре	Freq (Hz)	Level (dBuV)	Limit (dBuV)	Margin (dB)	Condition
Mode 3	Pass	QP	150k	52.95	66.00	-13.05	Neutral

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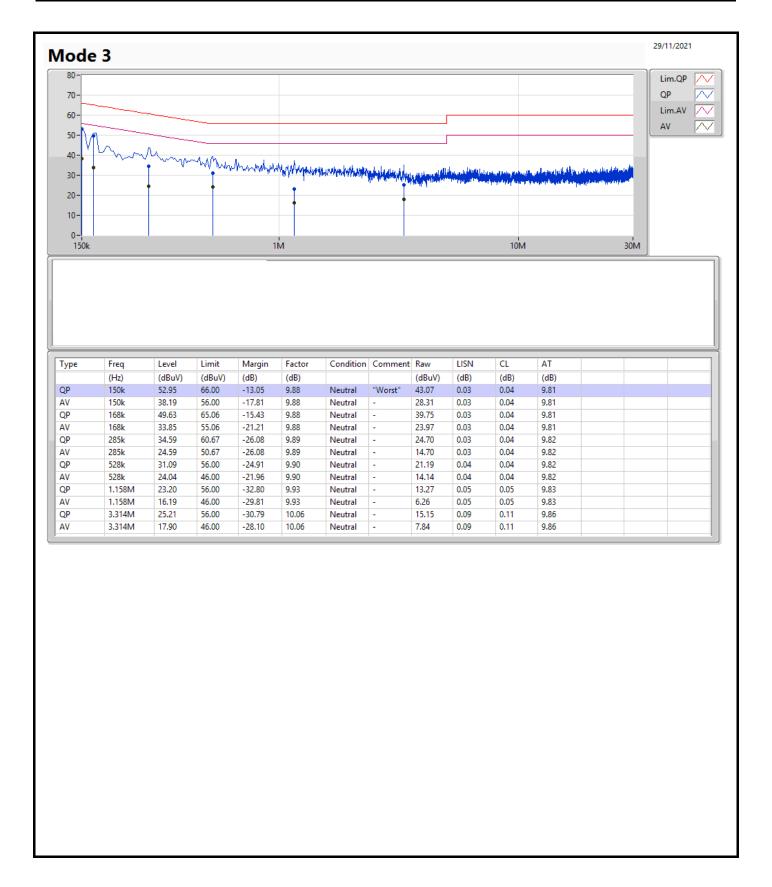
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Summary

Mode	Max-N dB	Max-OBW	ITU-Code	Min-N dB	Min-OBW
	(Hz)	(Hz)		(Hz)	(Hz)
2.4-2.4835GHz	-	-	-	-	-
BT-LE(1Mbps)	721.25k	1.048M	1M05F1D	705k	1.042M

 $Max\text{-N }dB = Maximum \ 6dB \ down \ bandwidth; \ Max\text{-OBW} = Maximum \ 99\% \ occupied \ bandwidth; \ Min\text{-OBW} = Minimum \ 99\% \ occu$

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Result

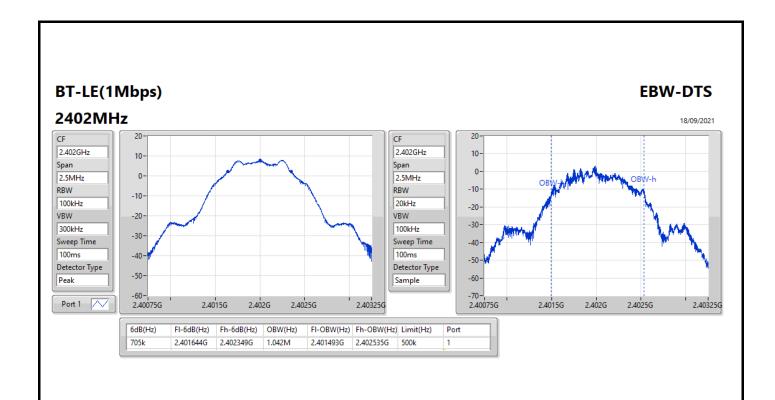
Mode	Result	Limit	Port 1-N dB	Port 1-OBW
	(Hz)		(Hz)	(Hz)
BT-LE(1Mbps)	-	-	-	-
2402MHz	Pass	500k	705k	1.042M
2440MHz	Pass	500k	712.5k	1.042M
2480MHz	Pass	500k	721.25k	1.048M

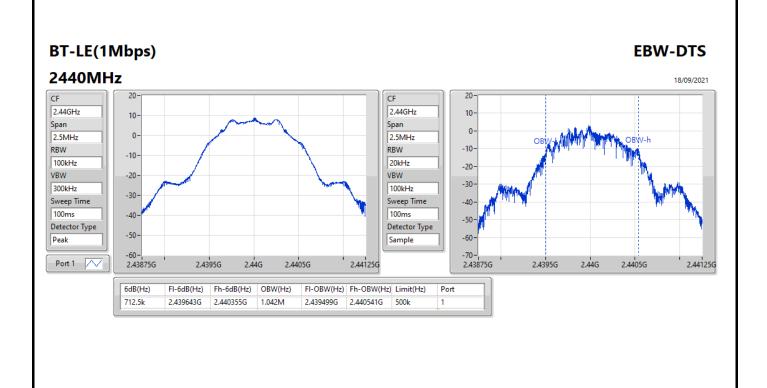
Port X-N dB = Port X 6dB down bandwidth; Port X-OBW = Port X 99% occupied bandwidth

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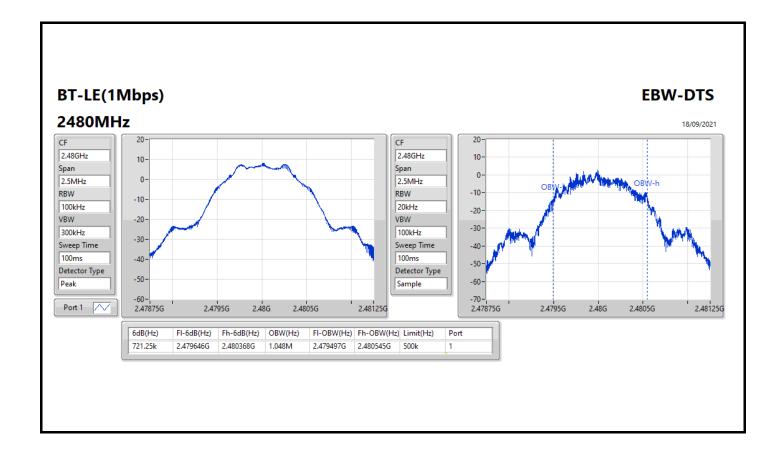
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Average Power-DTS

Appendix C

Summary

Mode	Power (dBm)	Power (W)
2.4-2.4835GHz	-	-
BT-LE(1Mbps)	8.55	0.00716

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Average Power-DTS

Appendix C

Result

Mode	Result	Gain	Power	Power Limit
		(dBi)	(dBm)	(dBm)
BT-LE(1Mbps)	-	-	-	-
2402MHz	Pass	4.20	8.37	30.00
2440MHz	Pass	4.20	8.55	30.00
2480MHz	Pass	4.20	8.11	30.00

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



PSD-DTS Appendix D

Summary

Mode	PD
	(dBm/RBW)
2.4-2.4835GHz	·
BT-LE(1Mbps)	-5.94

RBW = 3kHz;

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Appendix D **PSD-DTS**

Result

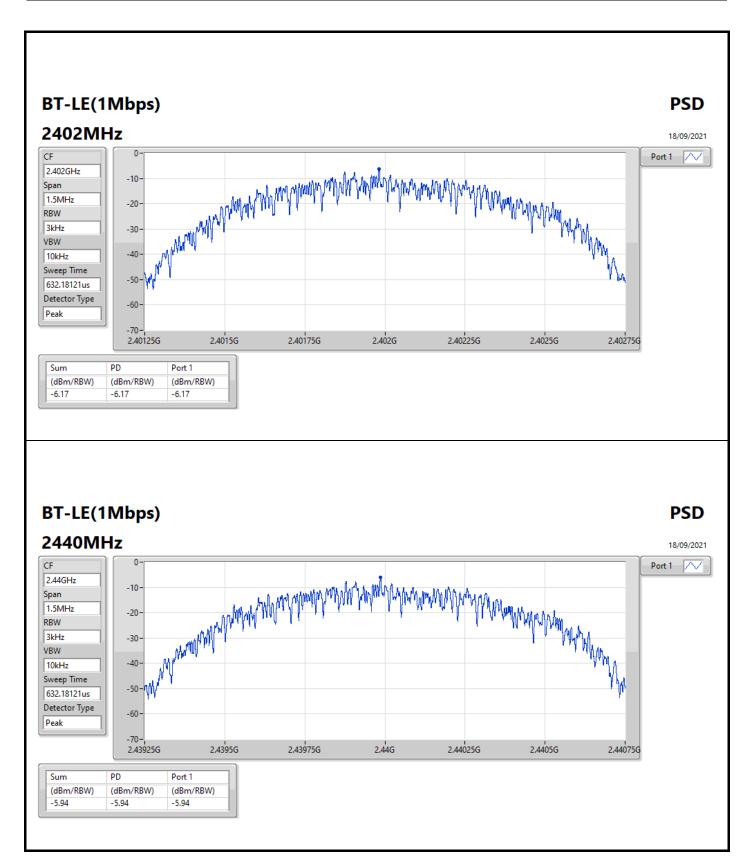
Mode	Result	Gain	PD	PD Limit
		(dBi)	(dBm/RBW)	(dBm/RBW)
BT-LE(1Mbps)	-	-	-	-
2402MHz	Pass	4.20	-6.17	8.00
2440MHz	Pass	4.20	-5.94	8.00
2480MHz	Pass	4.20	-6.48	8.00

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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;

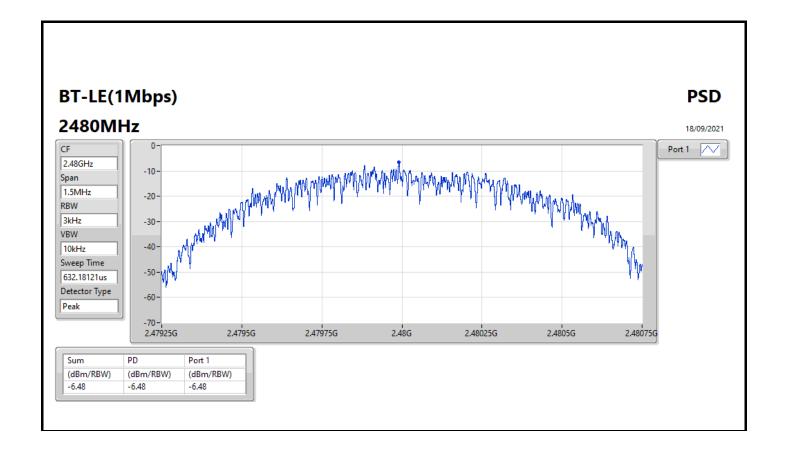




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PSD-DTS Appendix D



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CSE (Non-restricted Band)-DTS

Appendix E

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	2.44G	7.96	-22.04	2.10828G	-52.73	2.39992G	-50.24	2.4G	-54.12	2.48504G	-50.71	24.74973G	-43.36	1

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CSE (Non-restricted Band)-DTS

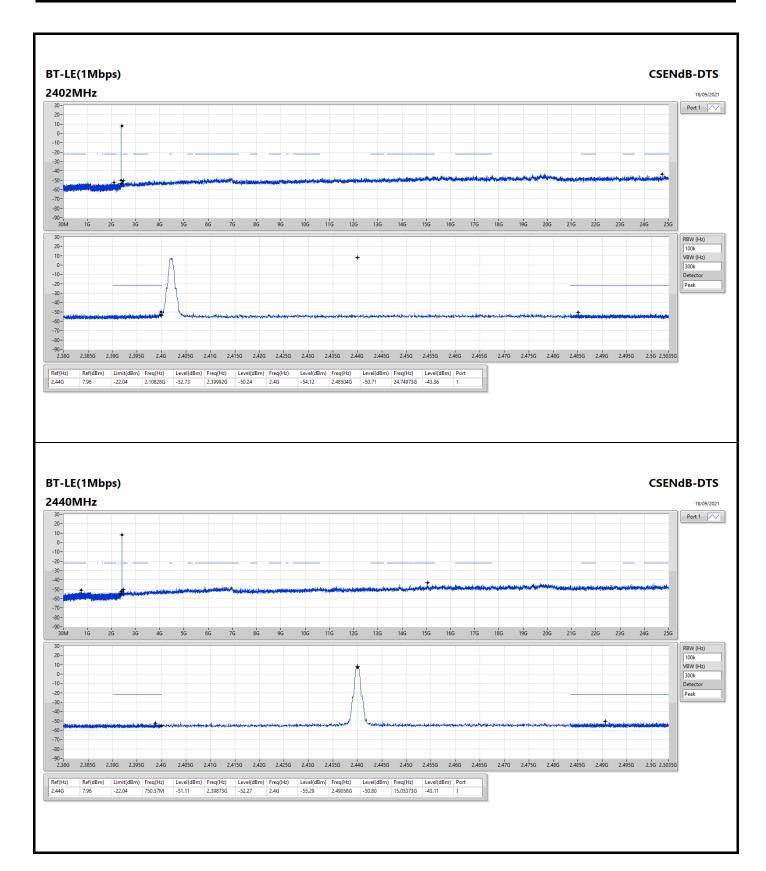
Appendix E

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	2.44G	7.96	-22.04	2.10828G	-52.73	2.39992G	-50.24	2.4G	-54.12	2.48504G	-50.71	24.74973G	-43.36	1
2440MHz	Pass	2.44G	7.96	-22.04	750.57M	-51.11	2.39873G	-52.27	2.4G	-55.29	2.49058G	-50.80	15.05373G	-43.11	1
2480MHz	Pass	2.44G	7.96	-22.04	936.22M	-51.79	2.39633G	-52.36	2.4G	-53.48	2.48847G	-51.55	15.27308G	-43.35	1

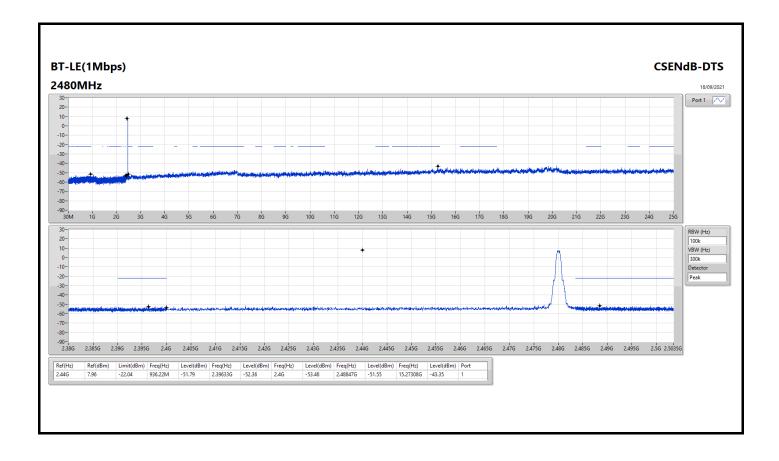
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Radiated Emissions below 1GHz

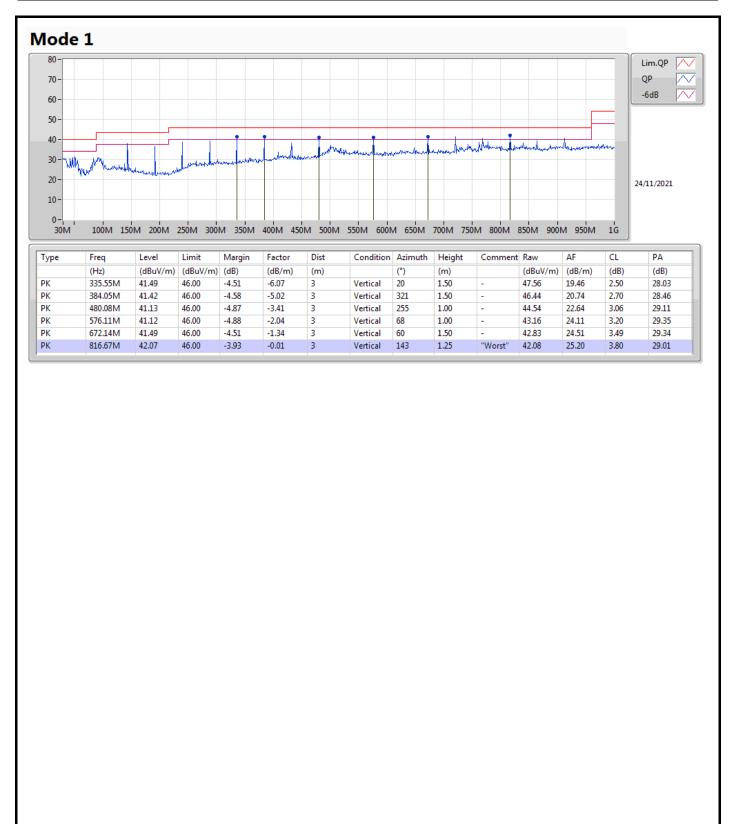
Appendix F.1

Summary

Mode	Result	Туре	Freq (Hz)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Condition
Mode 1	Pass	PK	240M	42.34	46.00	-3.66	Horizontal

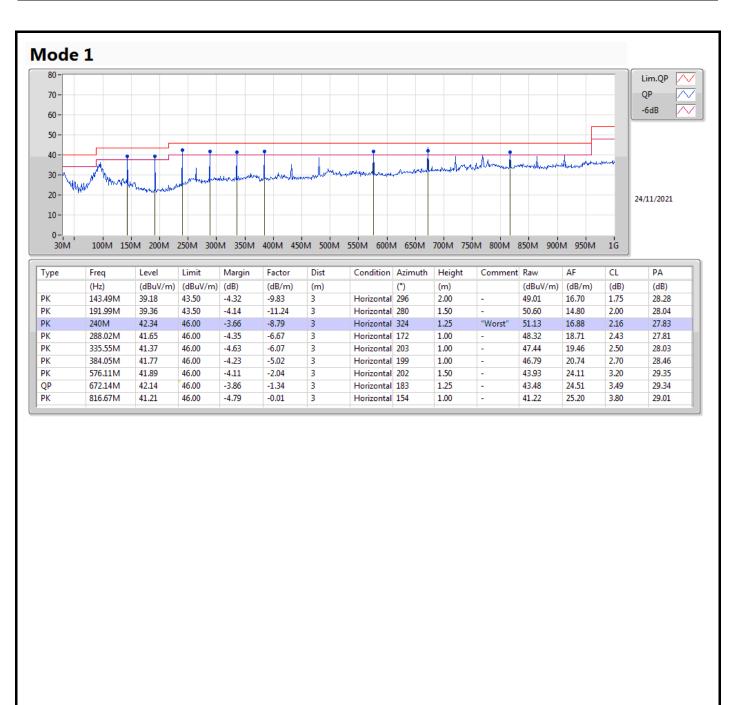
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RSE TX above 1GHz_EUT1 + Ant. 3

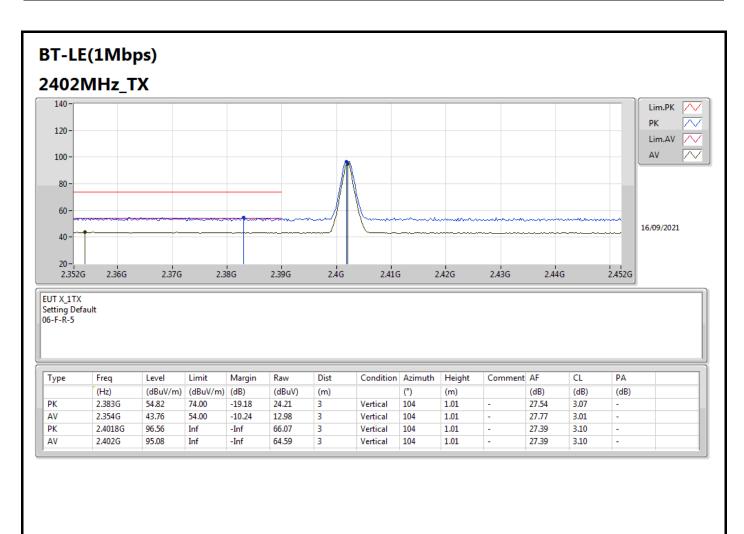
Appendix F.2

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(1Mbps)	Pass	AV	2.4835G	50.10	54.00	-3.90	3	Horizontal	30	1.00	-

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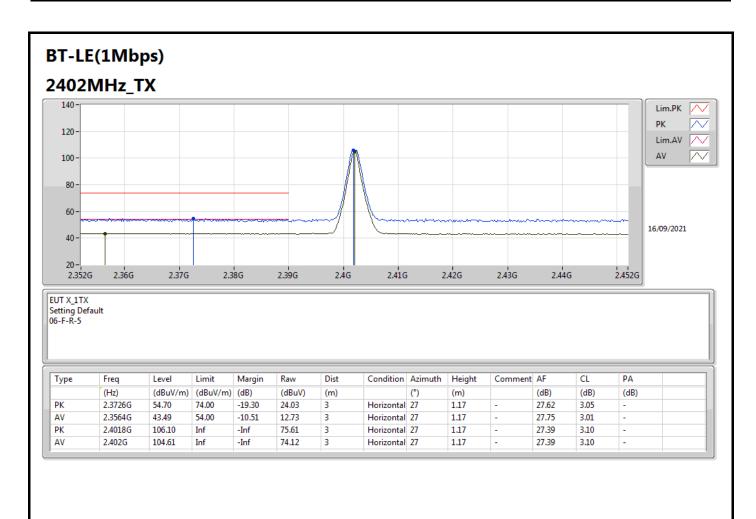




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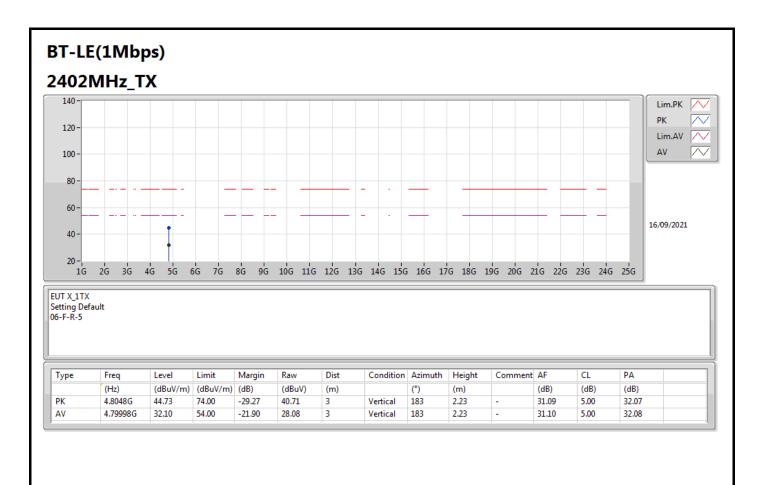




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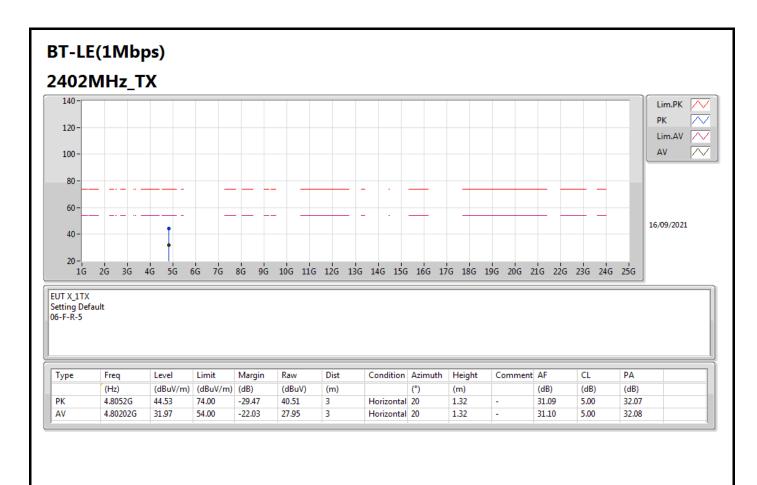




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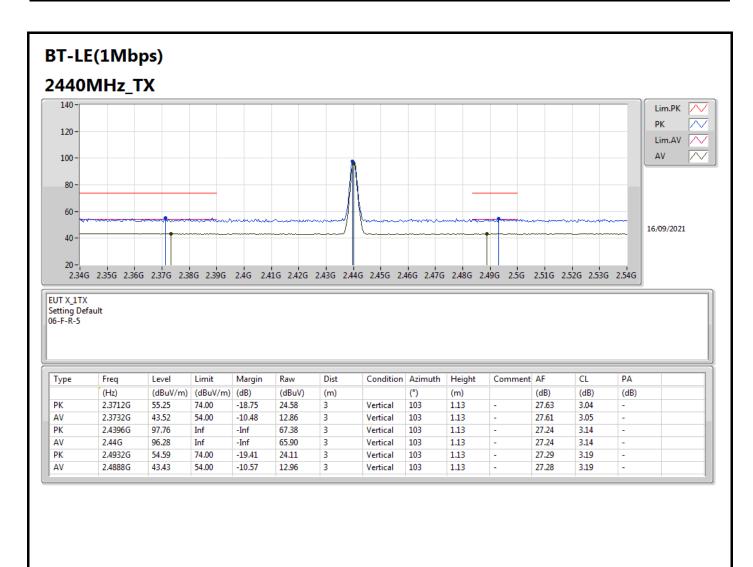




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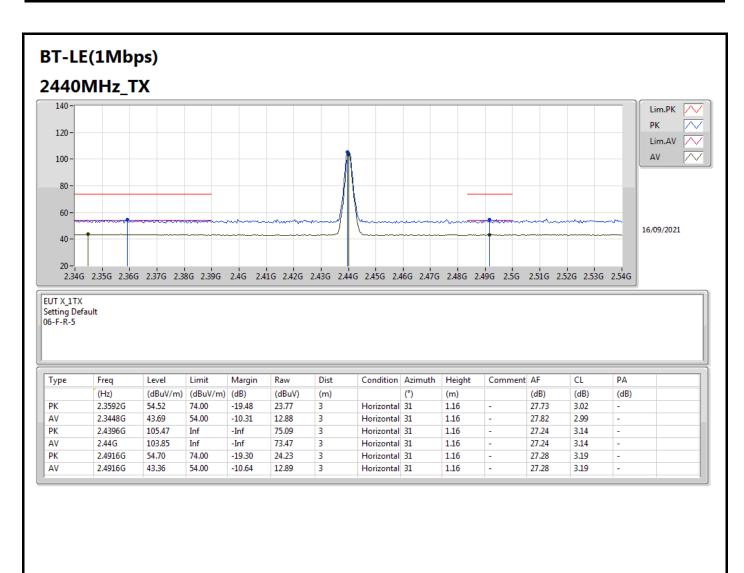




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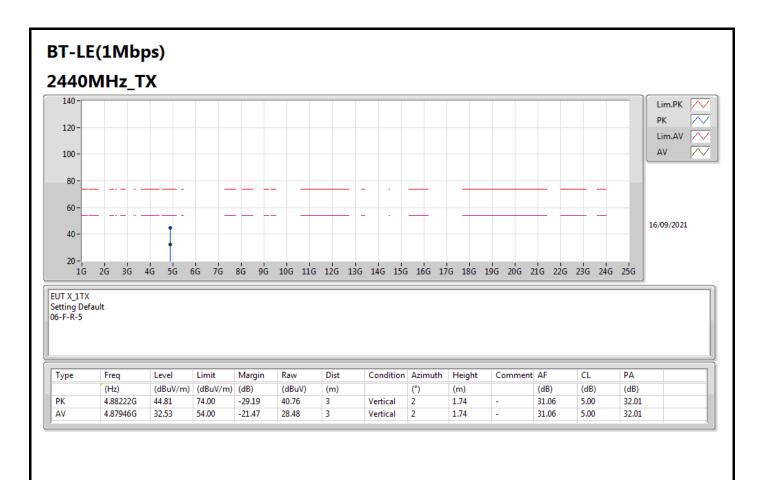




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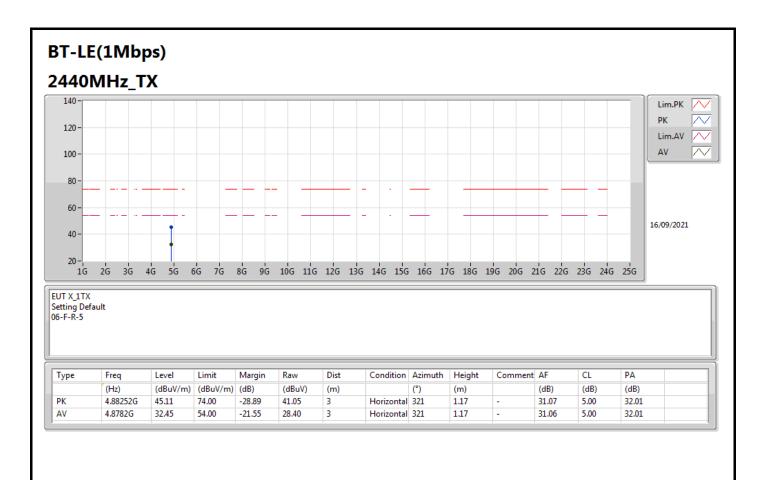




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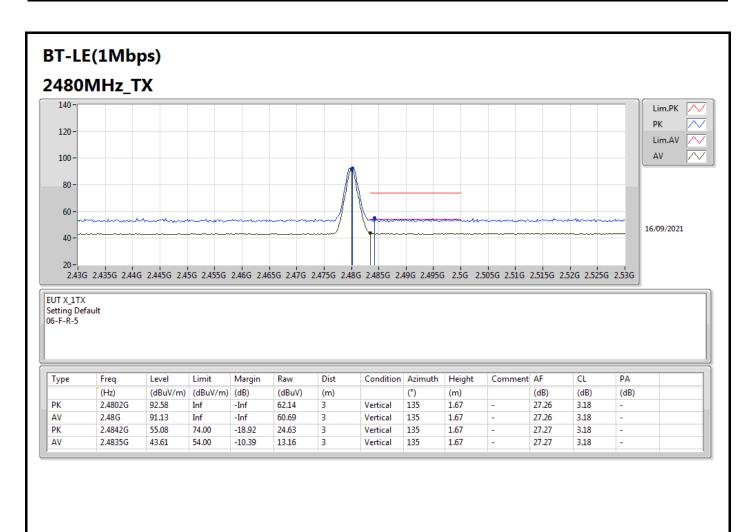




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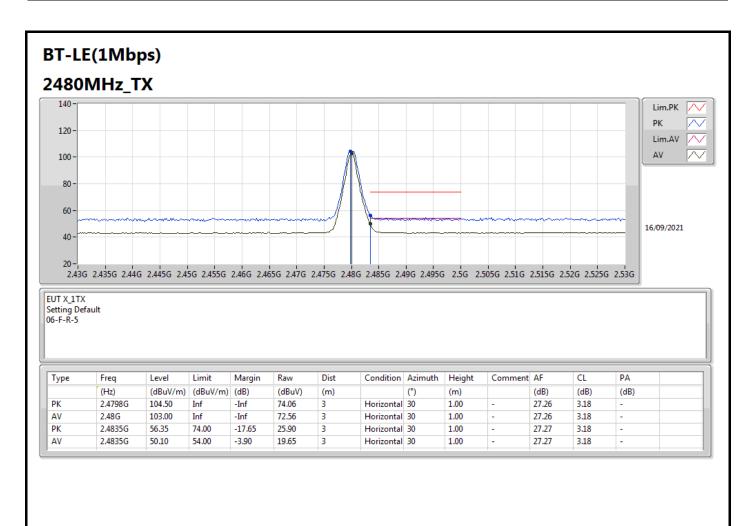




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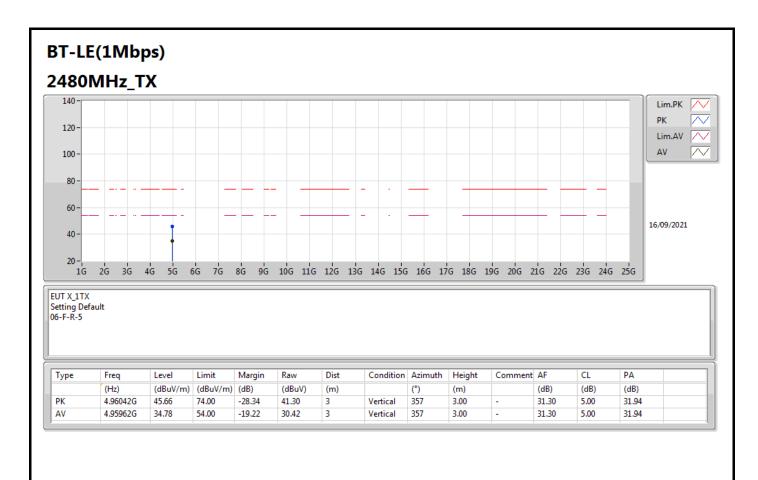




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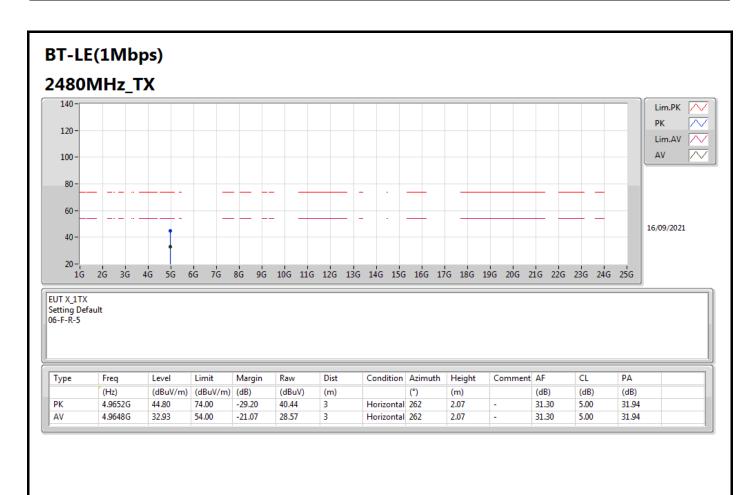




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RSE TX above 1GHz_EUT 1 + Ant. 4

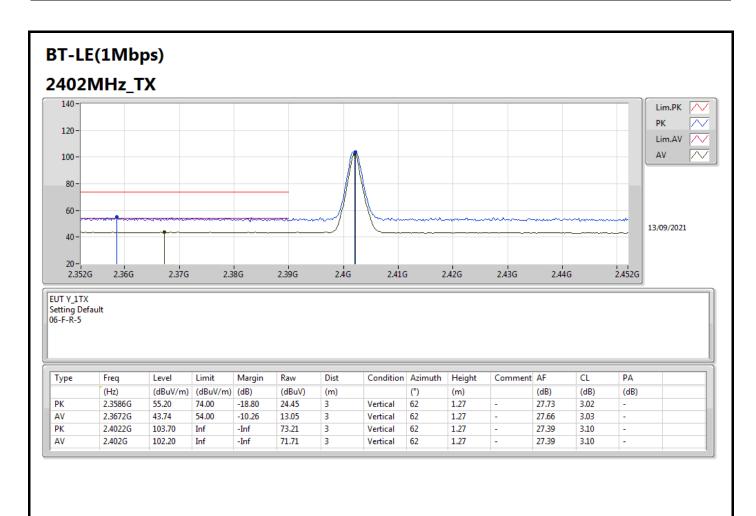
Appendix F.3

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	51.11	54.00	-2.89	3	Vertical	323	2.78	-

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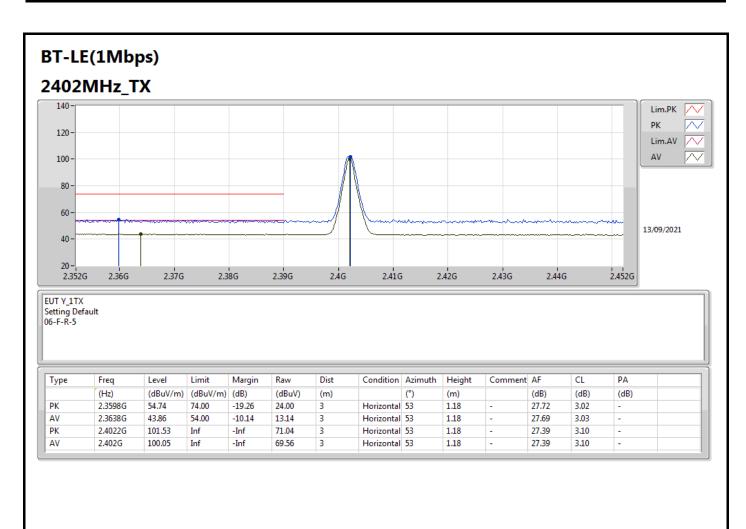




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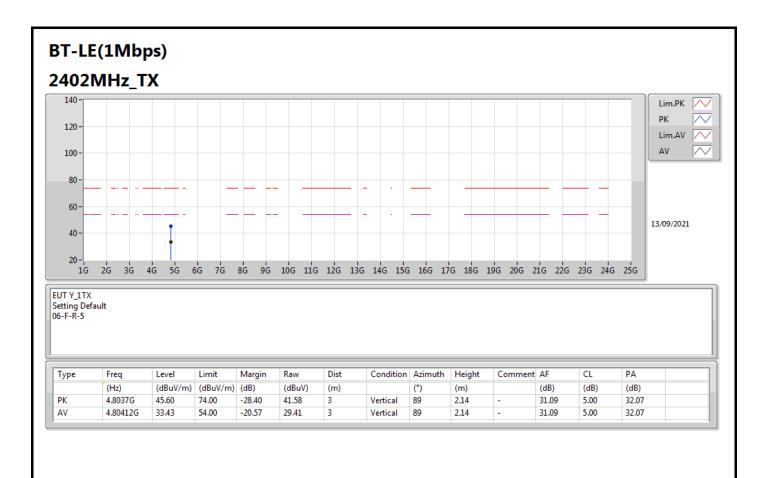




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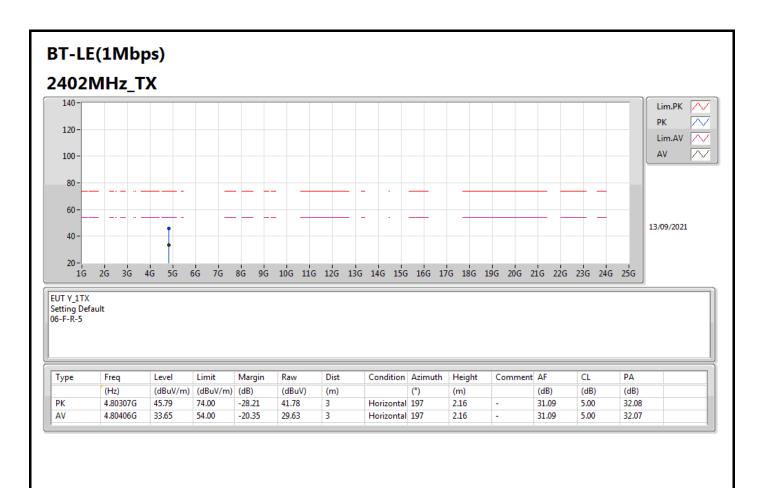




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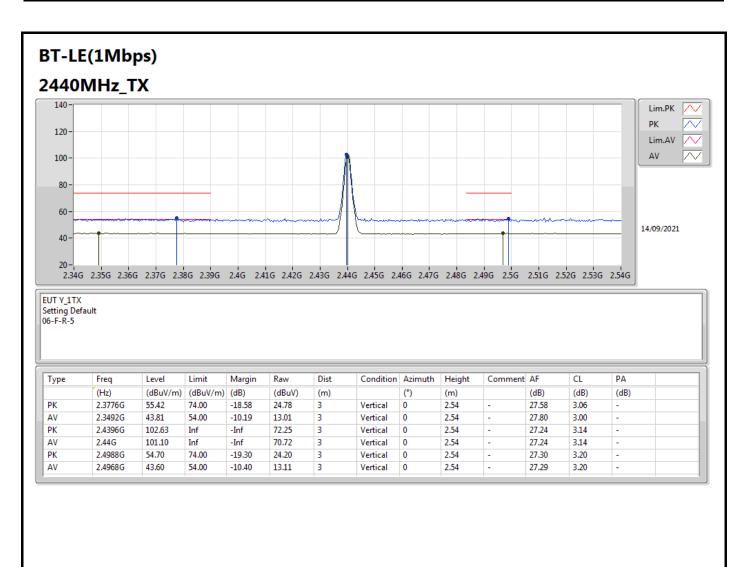




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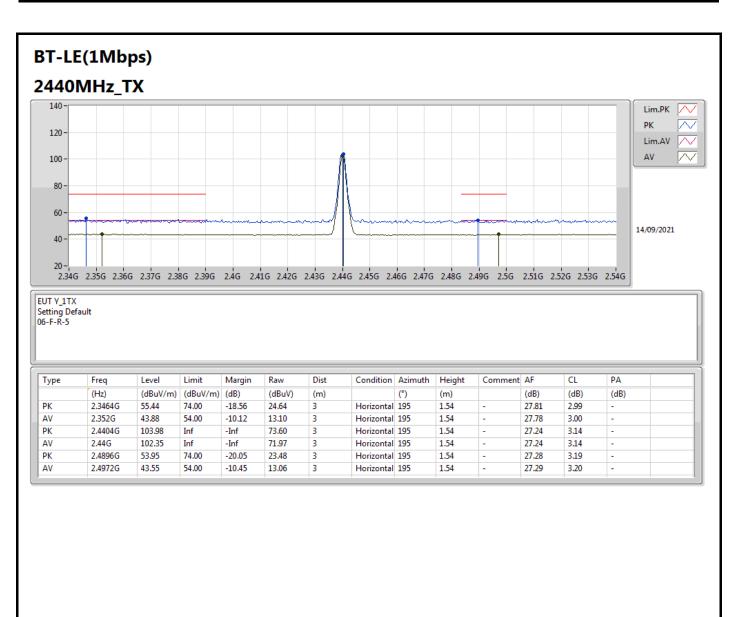




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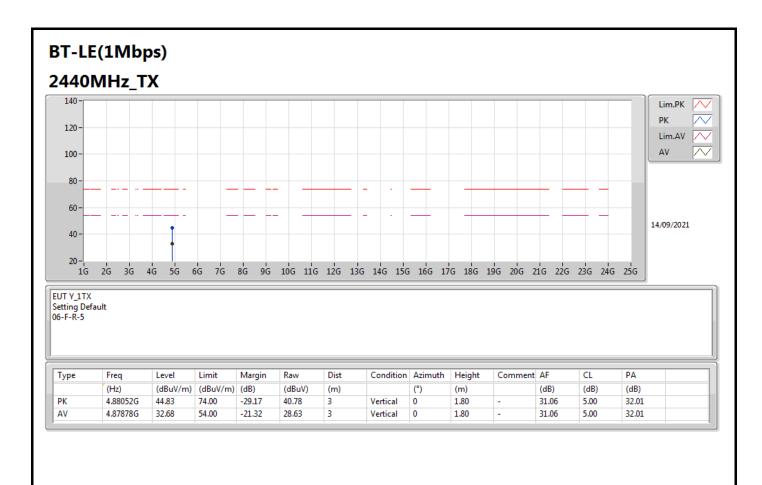




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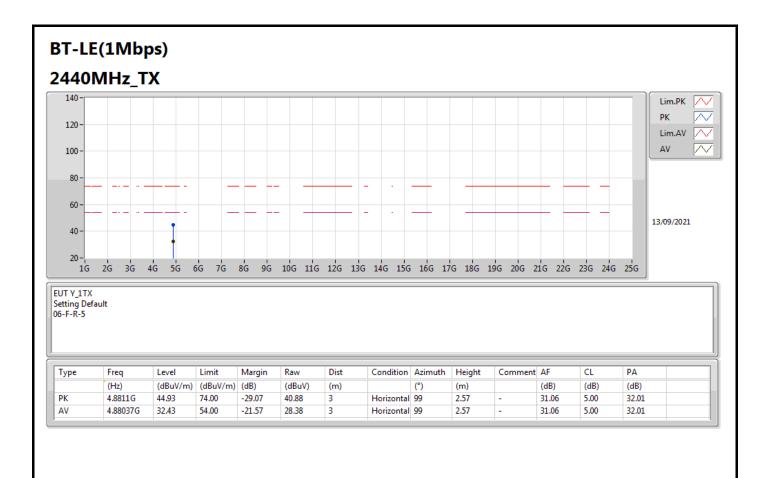




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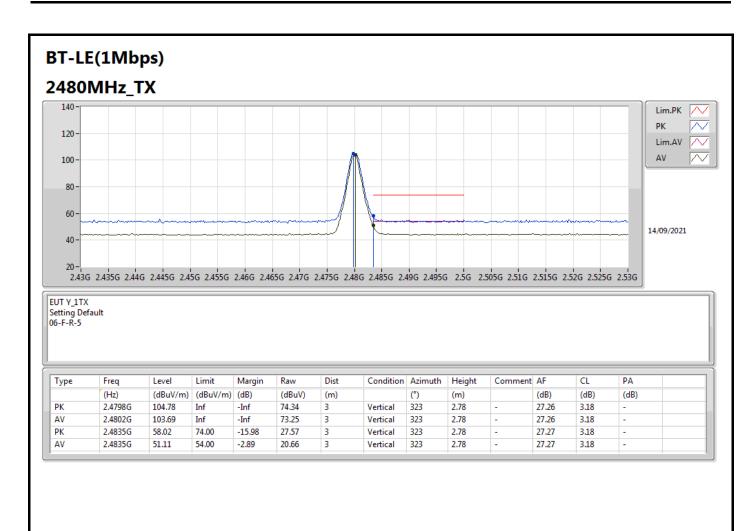




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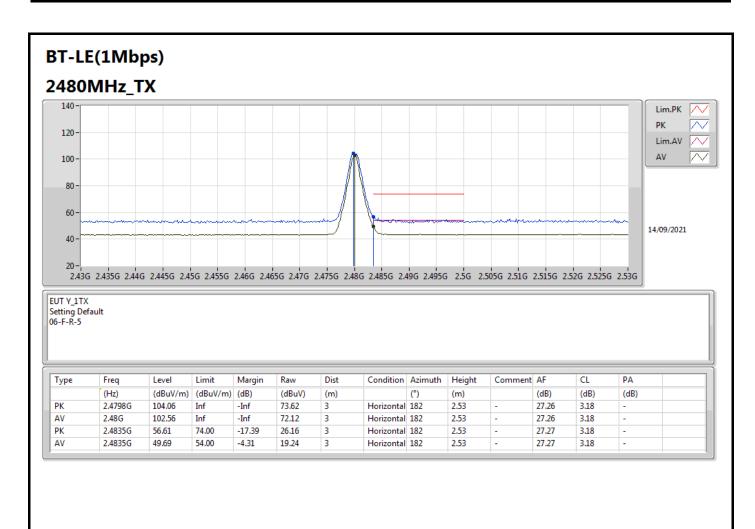




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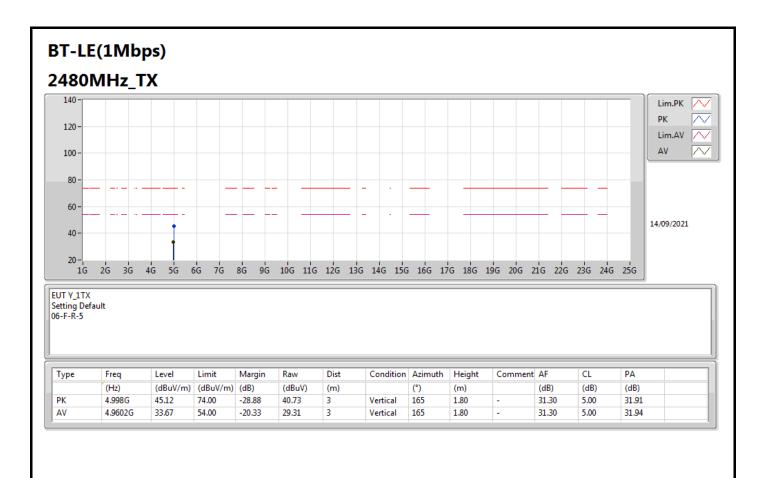




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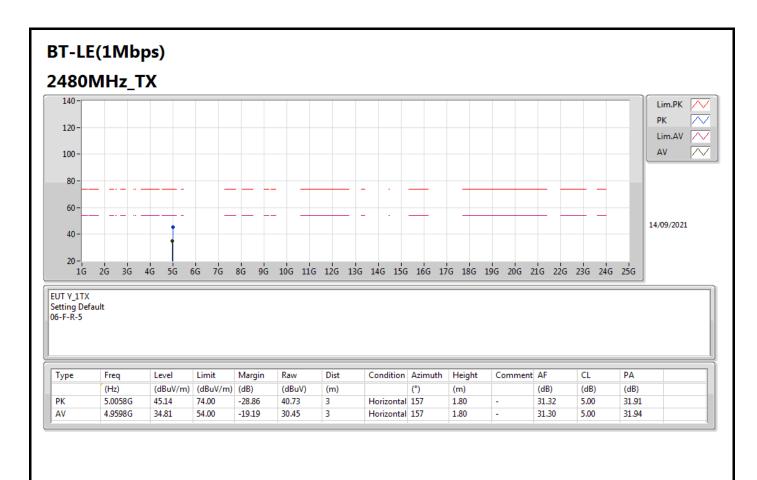




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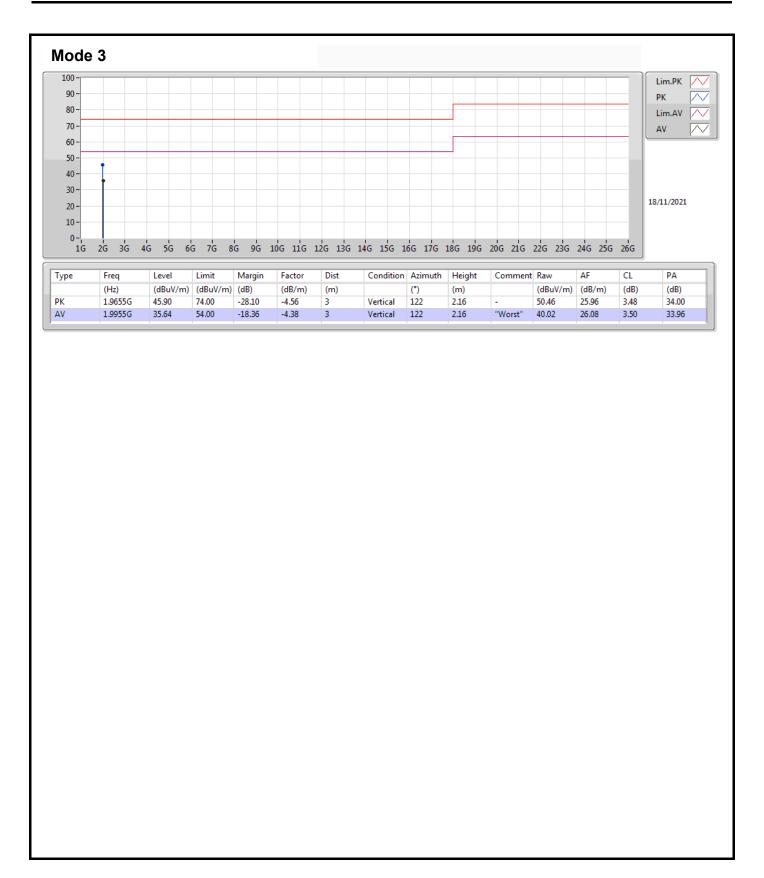
Radiated Emissions above 1GHz_ Co- location

Appendix G

Summary

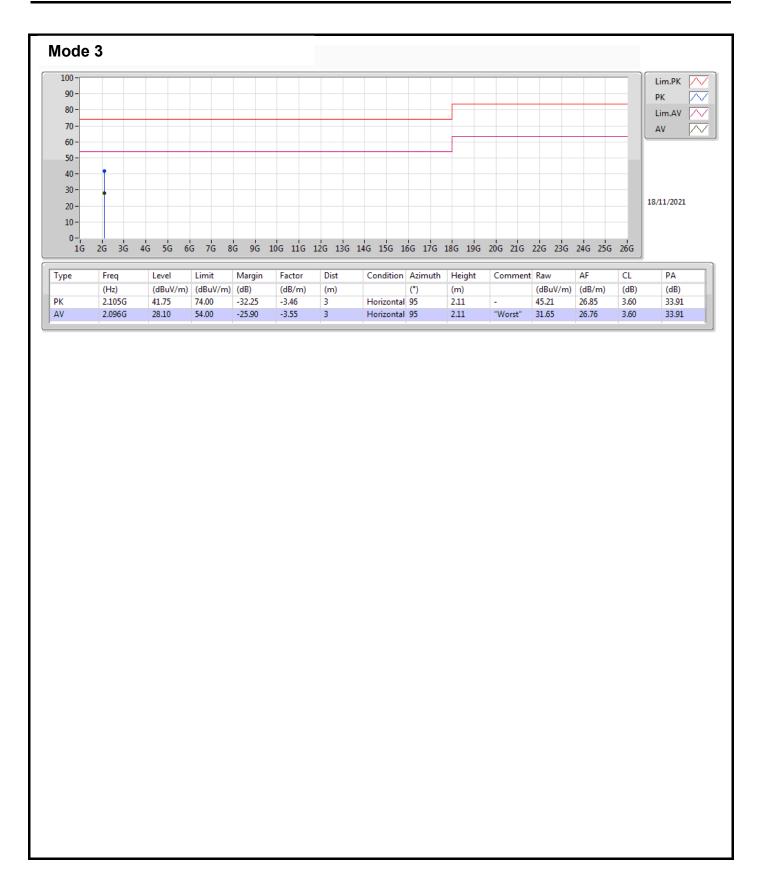
Mode	Result	Туре	Freq (Hz)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Condition
Mode 3	Pass	AV	1.9955G	35.64	54.00	-18.36	Vertical

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