

FCC Radio Test Report

FCC ID : 2AEIM-BTVMS01
Equipment : TPMS sensor
Brand Name : Tesla
Model Name : BTVMS01
Applicant : Tesla, Inc
3500 Deer Creek Road, Palo Alto, CA. 94304
Manufacturer : Tesla, Inc
3500 Deer Creek Road, Palo Alto, CA. 94304
Standard : 47 CFR FCC Part 15.247

The product was received on May 29, 2023, and testing was started from Jun. 30, 2023 and completed on Jul. 18, 2023. We, SPORTON INTERNATIONAL INC. Hsinhua 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. Hsinhua Laboratory, the test report shall not be reproduced except in full.


Approved by: Jackson Tsai

SPORTON INTERNATIONAL INC. Hsinhua Laboratory

No.52, Huaya 1st Rd., Guishan Dist., Taoyuan City 333411, Taiwan (R.O.C.)



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History of this test report

[illegible]

Summary of Test Result

Report Clause	Ref.Std. Clause	Test Items	Result (PASS/FAIL)	Remark
1.1.2	15.203	Antenna Requirement	PASS	-
3.1	15.207	AC Power-line Conducted Emissions	Not Required	Only employ battery power.
3.1	15.247(a)	DTS Bandwidth	PASS	-
3.2	15.247(b)	Maximum Conducted Output Power	PASS	-
3.3	15.247(e)	Power Spectral Density	PASS	-
3.4	15.247(d)	Emissions in Non-restricted Frequency Bands	PASS	-
3.5	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:

None

Reviewed by: Ryan Hsiao

Report Producer: Amber Chiu

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]

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

Note:

- ♦ Bluetooth LE uses a GFSK (1Mbps) modulation.
- ♦ BWch is the nominal channel bandwidth.

1.1.2 Antenna Information

Ant.	Brand	Model Name	Antenna Type	Connector	Gain (dBi)
1	Sensata Technologies	JP20230601-1	PCB Trace Antenna	N/A	-3.8

For Bluetooth function:

For Bluetooth mode (1TX/1RX)

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

1.1.3 EUT Information

Operational Condition			
EUT Power Type	From Battery		
EUT Function	☒ Point-to-multipoint	☐ Point-to-point	
Type of EUT			
☒	Stand-alone		
☐	Combined (EUT where the radio part is fully integrated within another device)		
	Combined Equipment - Brand Name / Model No.:		...
☐	Plug-in radio (EUT intended for a variety of host systems)		
	Host System - Brand Name / Model No.:		...
☐	Other:		

1.1.4 Mode Test Duty Cycle

Mode	DC	DCF(dB)	T(s)	VBW(Hz) $\geq \frac{1}{T}$
BT-LE(1Mbps)	0.633	1.99	395.625u	3k

Note. If DC < 0.98, the DCF was added while measuring Output power and PSD.



1.1.5 Table for Multiple Listing

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

Sample	Description
1	All the samples are identical, only the color of appearance is different.
2	

1.2 Testing Applied Standards

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

- ♦ 47 CFR FCC Part 15
- ♦ ANSI C63.10-2013

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

- ♦ KDB 558074 D01 v05r02
- ♦ KDB 414788 D01 v01r01

1.3 Testing Location Information

Test Lab. : Sporton International Inc. Hsinhua Laboratory				
☒ Hsinhua (TAF: 3785)	ADD: No.52, Huaya 1st Rd., Guishan Dist., Taoyuan City 333411, Taiwan (R.O.C.) TEL: 886-3-327-3456 FAX: 886-3-327-0973			
Test site Designation No. TW3785 with FCC.				
Test Condition	Test Site No.	Test Engineer	Test Environment	Test Date
RF Conducted	TH07-HY	Xie Xun	23.5~24.4°C / 51~54%	03/Jul/2023
Radiated (Below 1GHz)	03CH02-HY	Jack Tang	21.8~22.4°C / 51~52%	18/Jul/2023
Radiated (Above 1GHz)	03CH03-HY	Jack Tang	22.2~23.4°C / 53~58%	30/Jun/2023~01/Jul/2023
☐ Wen 33rd.St. (TAF: 3785)	ADD: No.14-1, Ln. 19, Wen 33rd St., Guishan Dist., Taoyuan City 333010, Taiwan (R.O.C.) TEL: 886-3-318-0787 FAX: 886-3-318-0287			
Test site Designation No. TW0008 with FCC.				

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
AC Power-line Conducted Emissions	4.53 dB	Confidence levels of 95%
Bandwidth	3 MHz	Confidence levels of 95%
Maximum Conducted Output Power	2 dB	Confidence levels of 95%
Power Spectral Density	2 dB	Confidence levels of 95%
Emissions in Non-restricted Frequency Bands	0.14 dB	Confidence levels of 95%
Emissions in Restricted Frequency Bands	4.8 dB	Confidence levels of 95%
Temperature	0.41 °C	Confidence levels of 95%
Humidity	3.4 %	Confidence levels of 95%



2 Test Configuration of EUT

2.1 Test Channel Mode

Test Software Version	N/A
------------------------------	-----

The EUT was linked with the CMW270 and transmitted RF signal continuously.

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

2.2 The Worst Case Measurement Configuration

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

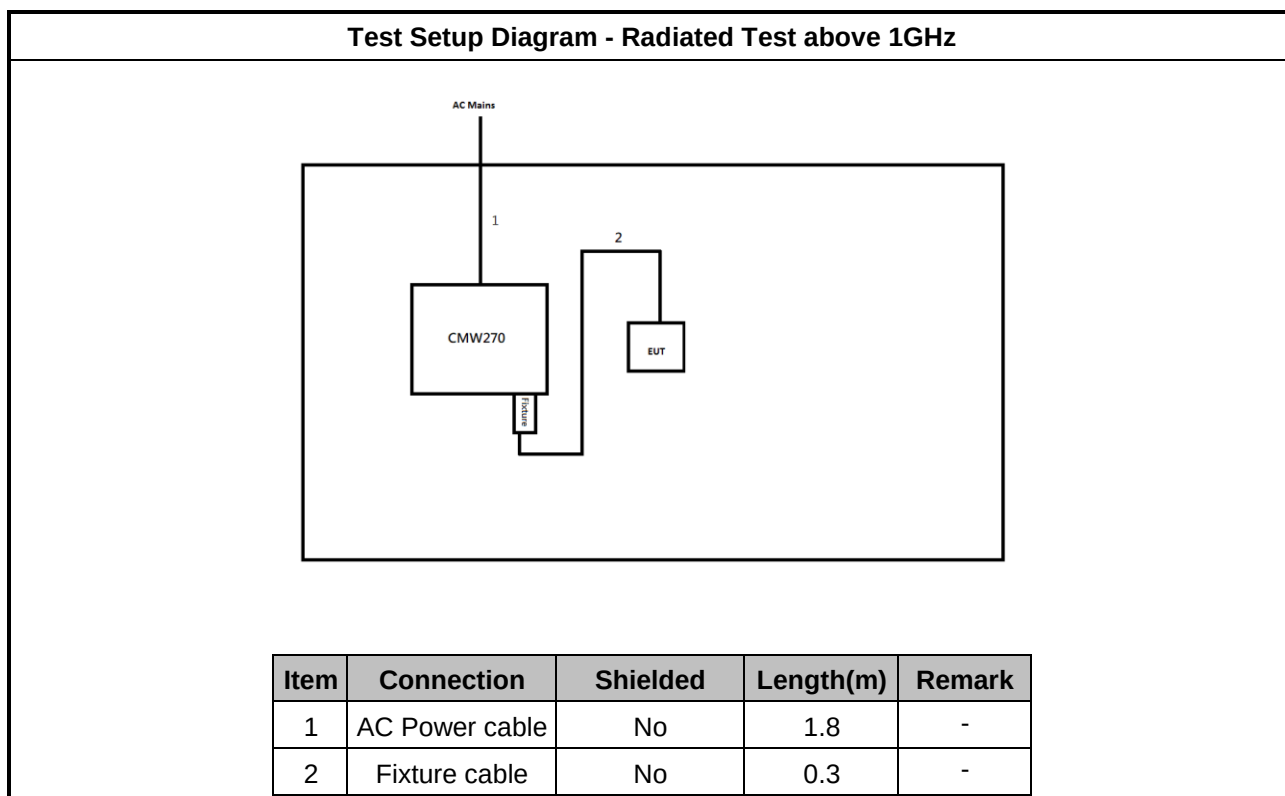
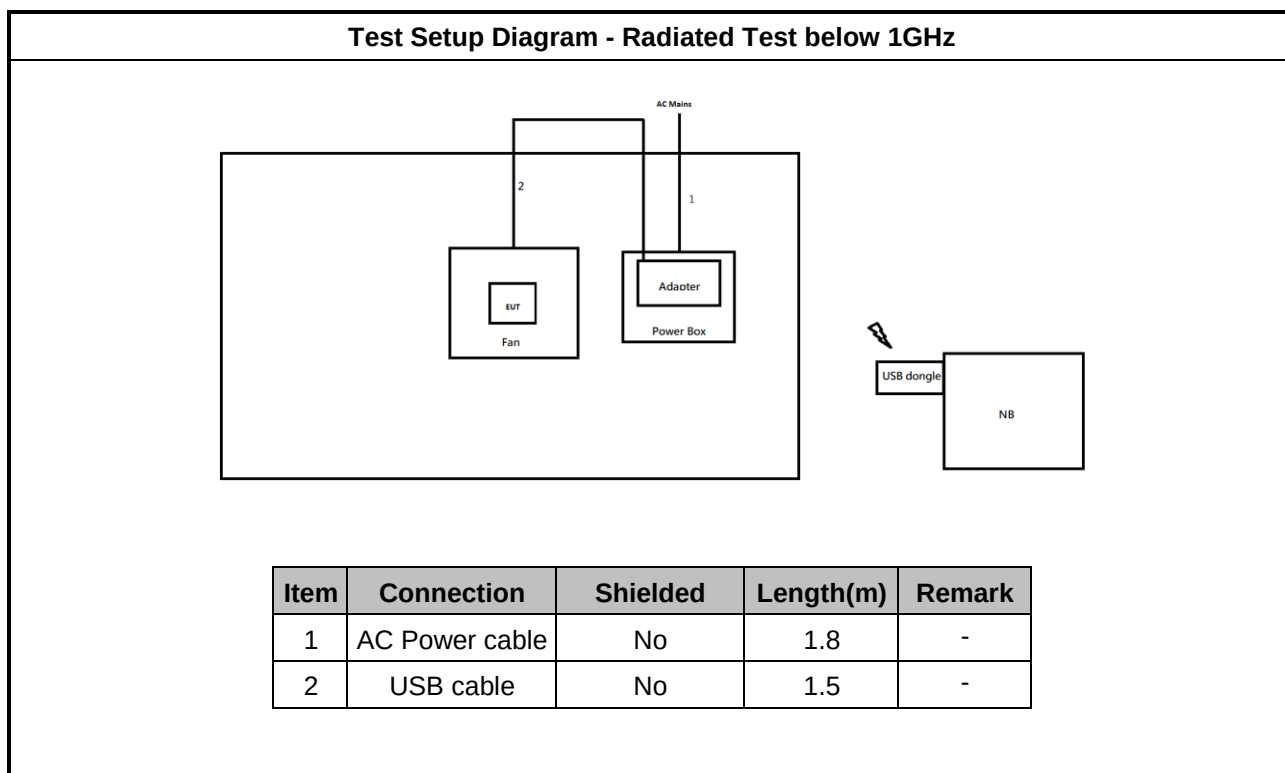
The Worst Case Mode for Following Conformance Tests			
Tests Item	Emissions in Restricted Frequency Bands		
Test Condition	Radiated measurement If EUT consist of multiple antenna assembly (multiple antenna are used in EUT regardless of spatial multiplexing MIMO configuration), the radiated test should be performed with highest antenna gain of each antenna type.		
Operating Mode			
1	Battery Mode (Normal link for TX below 1GHz)		
2	Fixture Mode (CTX for TX Above 1GHz)		
Orthogonal Planes of EUT	X Plane	Y Plane	Z Plane
			
Worst Planes of EUT	V		

2.3 Support Equipment

Support Equipment – Conducted					
No.	Equipment	Brand Name	Model Name	FCC ID	Remark
1	DC Power Supply	GW	GPS-3030DD	-	-
2	Fixture board	DFRobot	FIT0781	-	Provided by Customer

Support Equipment – Radiated					
No.	Equipment	Brand Name	Model Name	FCC ID	Remark
1	Fixture board	DFRobot	FIT0781	-	Provided by Customer
2	Fan	Baseus	CXZD-01	-	-
3	Adapter	APPLE	A1385	-	-
4	Notebook (Remote)	DELL	Latitude 7290	-	-
5	USB dongle (Remote)	Nordic	nRF52840-Dongle	-	Provided by Customer

2.4 Test Setup Diagram



3 Transmitter Test Result

3.1 DTS Bandwidth

3.1.1 6dB Bandwidth Limit

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

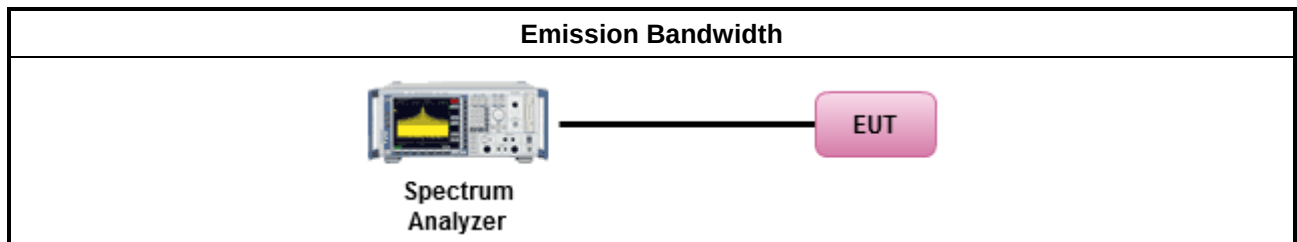
3.1.2 Measuring Instruments

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

3.1.3 Test Procedures

Test Method	
▪	For the emission bandwidth shall be measured using one of the options below:
☒	Refer as KDB 558074, clause 8.2 (11.8 of ANSI C63.10) DTS bandwidth measurement.
☐	Refer as RSS-Gen, clause 6.7 for occupied bandwidth testing.
☐	Refer as ANSI C63.10, clause 6.9.3 for occupied bandwidth testing.

3.1.4 Test Setup



3.1.5 Test Result of Emission Bandwidth

Refer as Appendix A

3.2 Maximum Conducted Output Power

3.2.1 Maximum Conducted Output Power Limit

Maximum Conducted Output Power Limit	
	If $G_{TX} \leq 6$ dBi, then $P_{Out} \leq 30$ dBm (1 W)
	Point-to-multipoint systems (P2M): If $G_{TX} > 6$ dBi, then $P_{Out} = 30 - (G_{TX} - 6)$ dBm
	Point-to-point systems (P2P): If $G_{TX} > 6$ dBi, then $P_{Out} = 30 - (G_{TX} - 6)/3$ dBm
	Smart antenna system (SAS):
	- Single beam: If $G_{TX} > 6$ dBi, then $P_{Out} = 30 - (G_{TX} - 6)/3$ dBm
	- Overlap beam: If $G_{TX} > 6$ dBi, then $P_{Out} = 30 - (G_{TX} - 6)/3$ dBm
	- Aggregate power on all beams: If $G_{TX} > 6$ dBi, then $P_{Out} = 30 - (G_{TX} - 6)/3 + 8$ dB dBm
e.i.r.p. Power Limit:	
	2400-2483.5 MHz Band
	Point-to-multipoint systems (P2M): $P_{eirp} \leq 36$ dBm (4 W)
	Point-to-point systems (P2P): $P_{eirp} \leq \text{MAX}(36, [P_{Out} + G_{TX}])$ dBm
	Smart antenna system (SAS)
	- Single beam: $P_{eirp} \leq \text{MAX}(36, P_{Out} + G_{TX})$ dBm
	- Overlap beam: $P_{eirp} \leq \text{MAX}(36, P_{Out} + G_{TX})$ dBm
	- Aggregate power on all beams: $P_{eirp} \leq \text{MAX}(36, [P_{Out} + G_{TX} + 8])$ dBm
P_{Out} = maximum peak conducted output power or maximum conducted output power in dBm, G_{TX} = the maximum transmitting antenna directional gain in dBi.	

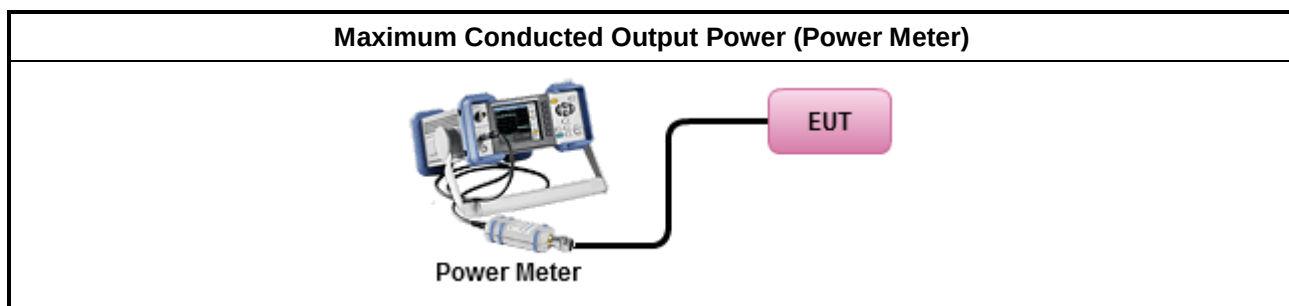
3.2.2 Measuring Instruments

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

3.2.3 Test Procedures

Test Method	
Maximum Peak Conducted Output Power	
☐	Refer as KDB 558074, clause 8.3.1.1 (11.9.1.1 of ANSI C63.10) RBW ≥ EBW method.
☐	Refer as KDB 558074, clause 8.3.1.2 (11.9.1.2 of ANSI C63.10) integrated band power method.
☐	Refer as KDB 558074, clause 8.3.1.3 (11.9.1.3 of ANSI C63.10) peak power meter.
Maximum Average Conducted Output Power	
☐	Refer as KDB 558074, clause 8.3.2.2 (11.9.2.2 of ANSI C63.10) using a spectrum analyzer.
☒	Refer as KDB 558074, clause 8.3.2.3 (11.9.2.3 of ANSI C63.10) using a power meter.
For conducted measurement.	
If the EUT supports multiple transmit chains using options given below: Refer as KDB 662911, In-band power measurements. Using the measure-and-sum approach, measured all transmit ports individually. Sum the power (in linear power units e.g., mW) of all ports for each individual sample and save them.	
If multiple transmit chains, EIRP calculation could be following as methods: $P_{total} = P_1 + P_2 + \dots + P_n$ (calculated in linear unit [mW] and transfer to log unit [dBm]) $EIRP_{total} = P_{total} + DG$	

3.2.4 Test Setup



3.2.5 Test Result of Maximum Conducted Output Power

Refer as Appendix B

3.3 Power Spectral Density

3.3.1 Power Spectral Density Limit

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

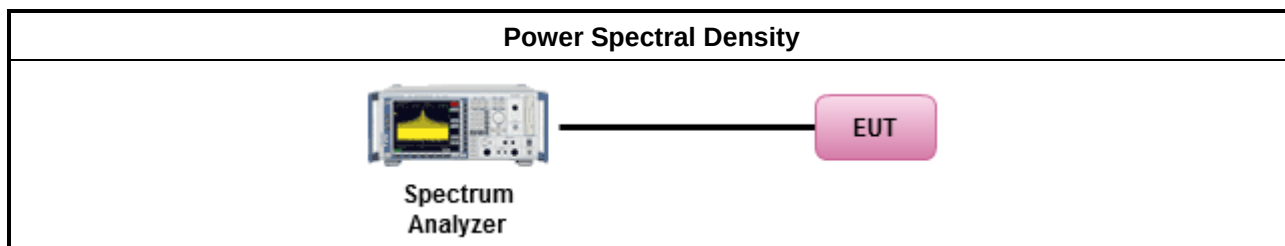
3.3.2 Measuring Instruments

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

3.3.3 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 KDB 558074, clause 8.4 (11.10 of ANSI C63.10) Max. PSD.
▪	For conducted measurement.
▪	If The EUT supports multiple transmit chains using options given below:
▪	Measure and sum the spectra across the outputs. Refer as 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.

3.3.4 Test Setup



3.3.5 Test Result of Power Spectral Density

Refer as Appendix C

3.4 Emissions in Non-restricted Frequency Bands

3.4.1 Emissions in Non-restricted Frequency Bands Limit

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

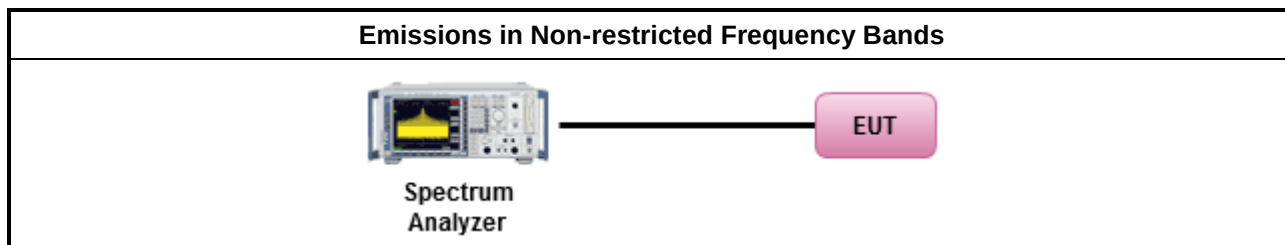
3.4.2 Measuring Instruments

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

3.4.3 Test Procedures

Test Method
Refer as KDB 558074, clause 8.5 (11.11 of ANSI C63.10) for non-restricted frequency bands.

3.4.4 Test Setup



3.4.5 Test Result of Emissions in Non-restricted Frequency Bands

Refer as Appendix D

3.5 Emissions in Restricted Frequency Bands

3.5.1 Emissions in Restricted Frequency Bands Limit

Restricted Band Emissions Limit			
Frequency Range (MHz)	Field Strength (uV/m)	Field Strength (dBuV/m)	Measure Distance (m)
0.009~0.490	2400/F(kHz)	48.5 - 13.8	300
0.490~1.705	24000/F(kHz)	33.8 - 23	30
1.705~30.0	30	29	30
30~88	100	40	3
88~216	150	43.5	3
216~960	200	46	3
Above 960	500	54	3

Note 1: Test distance for frequencies at or above 30 MHz, measurements may be performed at a distance other than the limit distance provided they are not performed in the near field and the emissions to be measured can be detected by the measurement equipment. When performing measurements at a distance other than that specified, the results shall be extrapolated to the specified distance using an extrapolation factor of 20 dB/decade (inverse of linear distance for field-strength measurements, inverse of linear distance-squared for power-density measurements).

Note 2: Test distance for frequencies at below 30 MHz, measurements may be performed at a distance closer than the EUT limit distance; however, an attempt should be made to avoid making measurements in the near field. When performing measurements below 30 MHz at a closer distance than the limit distance, the results shall be extrapolated to the specified distance by either making measurements at a minimum of two or more distances on at least one radial to determine the proper extrapolation factor or by using the square of an inverse linear distance extrapolation factor (40 dB / decade). The test report shall specify the extrapolation method used to determine compliance of the EUT.

Note 3: Using the distance of 1m during the test for above 18 GHz, and the test value to correct for the distance factor at 3m.

3.5.2 Measuring Instruments

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

3.5.3 Test Procedures

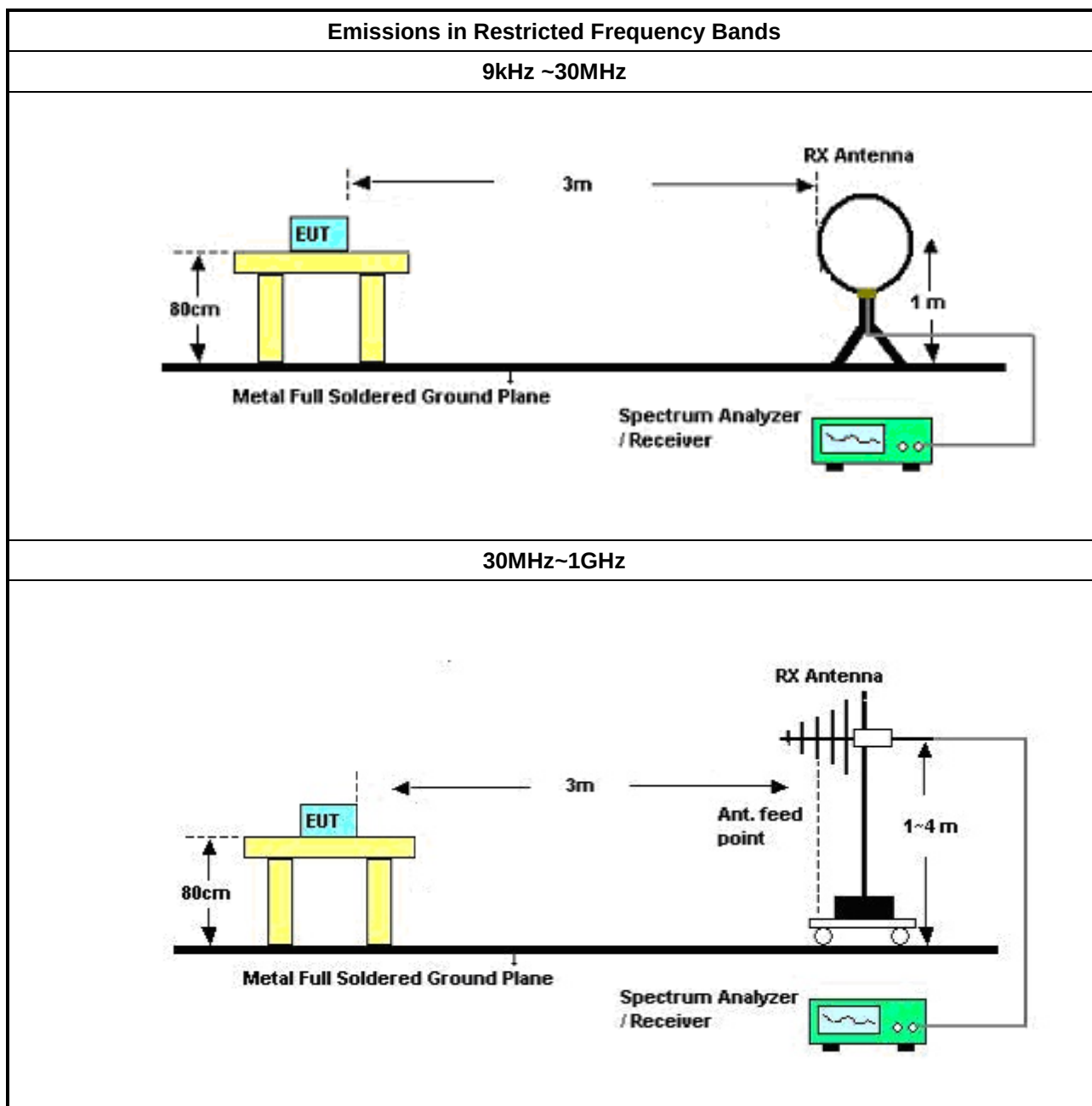
Test Method	
	The average emission levels shall be measured in [duty cycle $\geq$ 98 or duty factor].
	Refer as ANSI C63.10, clause 6.10.3 band-edge testing shall be performed at the lowest frequency channel and highest frequency channel within the allowed operating band.
	For the transmitter unwanted emissions shall be measured using following options below:
	Refer as KDB 558074, clause 8.6 (11.12 of ANSI C63.10) for restricted frequency bands.
	For the transmitter band-edge emissions shall be measured using following options below:
	Refer as KDB 558074 clause 8.7.1, 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 KDB 558074, clause 8.7.2 (6.10.6 of ANSI C63.10) for marker-delta method for band-edge measurements.
	Refer as KDB 558074, clause 8.7.3 for narrower resolution bandwidth (100kHz) using the band power and summing the spectral levels.
	Use the following spectrum analyzer settings:
	Set RBW=100 kHz for $f < 1$ GHz; VBW=3 * RBW; Sweep = auto; Detector function = peak; Trace = max hold.
	Set RBW = 1 MHz, VBW= 3MHz for $f \geq 1$ GHz for peak measurement. For average measurement, refer as 1.1.4.
	KDB 414788 Open-Field Test Sites and Chamber Correlation Justification.
	Based on FCC 15.31(f)(2): measurements may be performed at a distance closer than that specified in regulations; however, an attempt should be made to avoid making measurements in the near field.
	Open-field site and chamber correlation testing had been performed and chamber measured test result is the worst case test result.

3.5.4 Measurement Results Calculation

The measured Level is calculated using:

Corrected Reading: Raw(Read Level) + AF(Antenna Factor) + CL(Cable Loss) - PA(Preamplifier Factor)

3.5.5 Test Setup





3.5.7 Test Result of Emissions in Restricted Frequency Bands

TEL : 886-3-3273456
FAX : 886-3-3270973
Report Template No.: HE1-C10 Ver.4.3
FCC ID: 2AEIM-BTVMS01

4 Test Equipment and Calibration Data

Instrument for Conducted Test

Instrument	Manufacturer /Brand	Model No.	Serial No.	Spec.	Calibration Date	Calibration Due Date
Signal Analyzer	R&S	FSV 40	101515	10Hz~40GHz	14/Feb/2023	13/Feb/2024
SMB100A Signal Generator	R&S	SMB100A	181147	100kHz~40GHz	21/Oct/2022	20/Oct/2023
Pulse Sensor	Anritsu	MA2411B	1339407	300MHz~40GHz	14/Dec/2022	13/Dec/2023
Power Meter	Anritsu	ML2495A	1517010	300MHz~40GHz	14/Dec/2022	13/Dec/2023
Wireless connectivity tester	R&S	CMW270	100855	70MHz ~6GHz	27/Nov/2022	26/Nov/2023
SENSE-15247_FS	Sporton	V5.11.2	N/A	N/A	N/A	N/A

Instrument for Radiated Test (03CH02-HY)

Instrument	Manufacturer /Brand	Model No.	Serial No.	Spec.	Calibration Date	Calibration Due Date
3m Semi Anechoic Chamber	SIDT FRANKONIA	SAC-3M	03CH02-HY	30MHz~1GHz 3m	31/Jul/2022	30/Jul/2023
Signal Analyzer	R&S	FSP 40	100305	9kHz~40GHz	25/Mar/2023	24/Mar/2024
Amplifier	Agilent	8447D	2944A11149	100kHz~1.3GHz	27/Jun/2023	26/Jun/2024
Bilog Antenna & 5dB Attenuator	SCHAFFNER / MTJ	CBL 6112B / MTJ6102-05	2723 / 2	30MHz~1GHz	28/Aug/2022	27/Aug/2023
RF Cable	MVE	400LL+SN 200207	03CH02-cable-02	9kHz~30MHz	20/Dec/2022	19/Dec/2023
RF Cable	MVE	400LL+SN 200207	03CH02-cable-02	30MHz~1GHz	20/Dec/2022	19/Dec/2023
Loop Antenna	TESEQ	HLA 6120	31244	9kHz~30MHz	23/Mar/2023	22/Mar/2024
EMI Test Receiver	R&S	ESR	102052	9kHz~3.6GHz	26/May/2023	25/May/2024
SENSE-15247_FS	Sporton	v5.11.2	NA	BT	NA	NA

**Instrument for Radiated Test (03CH03-HY)**

Instrument	Manufacturer /Brand	Model No.	Serial No.	Spec.	Calibration Date	Calibration Due Date
3m Semi Anechoic Chamber	SIDT FRANKONIA	SAC-3M	03CH03-HY	1GHz~18GHz 3m	02/Aug/2022	01/Aug/2023
Signal Analyzer	R&S	FSV40	101500	10Hz~40GHz	26/Oct/2022	25/Oct/2023
Double Ridged Guide Horn Antenna	SCHWARZBECK	BBHA 9120 D	02267	1GHz ~18GHz	27/Sep/2022	26/Sep/2023
RF CABLE 5+6m	HUBER+SUHNER	SUOFLEX 104	03CH03-cable-01	1GHz~40GHz	27/Jul/2022	26/Jul/2023
Broadband Horn Antenna	SCHWARZBECK	BBHA 9170	BBHA 9170221	15GHz~40GHz	25/Mar/2023	24/Mar/2024
Microwave Premplifier	Agilent	8449B	3008A02326	1GHz~26.5GHz	14/Jul/2022	13/Jul/2023
Microwave Premplifier	EMC INSTRUMENTS	EM18G40G	060604	18GHz ~ 40GHz	16/Mar/2023	15/Mar/2024
EMI Test Receiver	R&S	ESR3	102052	9kHz~3.6GHz	26/May/2023	25/May/2024
Wireless connectivity tester	R&S	CMW270	100855	70MHz ~6GHz	27/Nov/2022	26/Nov/2023
SENSE-15247_FS	Sporton	v5.11.2	NA	BT	NA	NA



Summary

Mode	Max-N dB (Hz)	Max-OBW (Hz)	ITU-Code	Min-N dB (Hz)	Min-OBW (Hz)
2.4-2.4835GHz	-	-	-	-	-
BT-LE(1Mbps)	648.75k	1.018M	1M02F1D	648.75k	1.017M

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



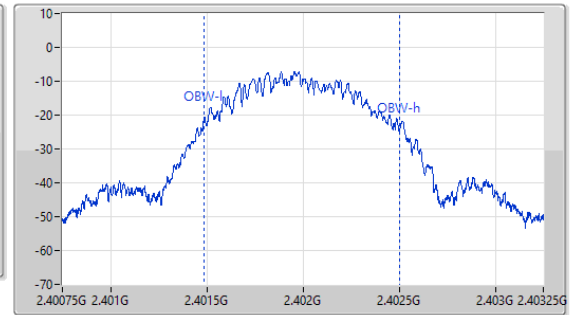
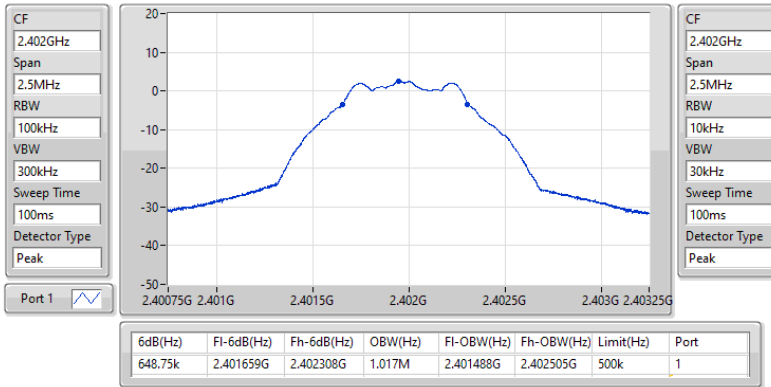
Result

Mode	Result	Limit (Hz)	Port 1-N dB (Hz)	Port 1-OBW (Hz)
BT-LE(1Mbps)	-	-	-	-
2402MHz	Pass	500k	648.75k	1.017M
2440MHz	Pass	500k	648.75k	1.018M
2480MHz	Pass	500k	648.75k	1.018M

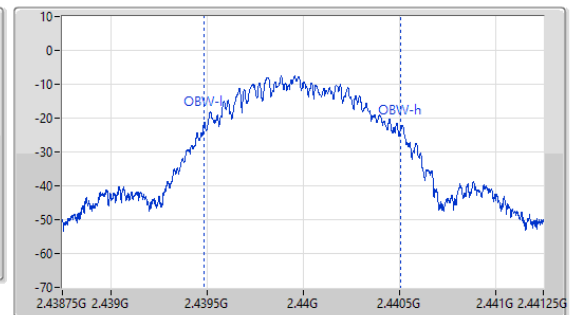
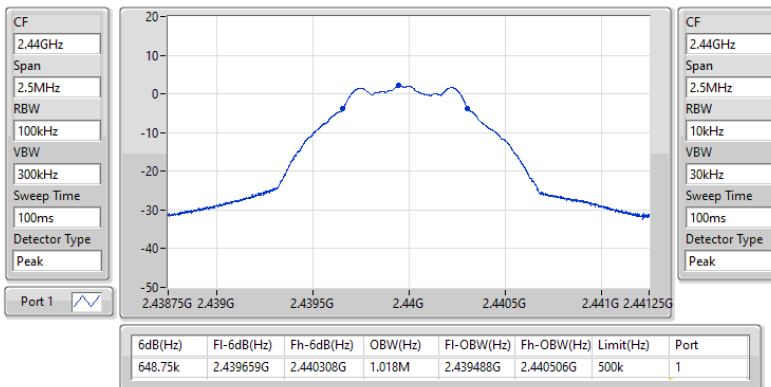
Port X-N dB = Port X 6dB down bandwidth;
Port X-OBW = Port X 99% occupied bandwidth

2.4-2.4835GHz_BT-LE(1Mbps)
EBW-DTS
2402MHz

03/07/2023


2.4-2.4835GHz_BT-LE(1Mbps)
EBW-DTS
2440MHz

03/07/2023

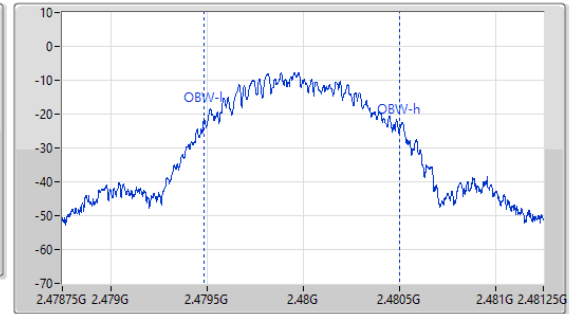
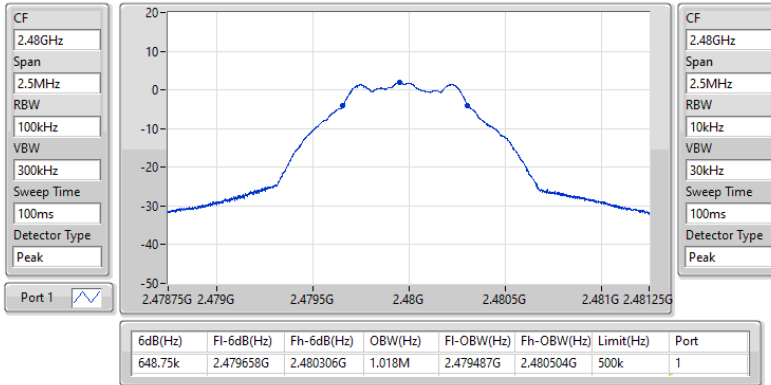


2.4-2.4835GHz_BT-LE(1Mbps)

EBW-DTS

2480MHz

03/07/2023





Average Power-DTS

Appendix B

Summary

Mode	Total Power (dBm)	Power (W)
2.4-2.4835GHz	-	-
BT-LE(1Mbps)	2.81	0.00191



Result

Mode	Result	DG (dBi)	Total Power (dBm)	Power Limit (dBm)
BT-LE(1Mbps)	-	-	-	-
2402MHz	Pass	-3.80	2.81	30.00
2440MHz	Pass	-3.80	2.32	30.00
2480MHz	Pass	-3.80	2.02	30.00

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



Summary

Mode	PD (dBm/RBW)
2.4-2.4835GHz	-
BT-LE(1Mbps)	-12.13

RBW = 3kHz;



Result

Mode	Result	DG (dBi)	PD (dBm/RBW)	PD Limit (dBm/RBW)
BT-LE(1Mbps)	-	-	-	-
2402MHz	Pass	-3.80	-12.13	8.00
2440MHz	Pass	-3.80	-12.47	8.00
2480MHz	Pass	-3.80	-12.73	8.00

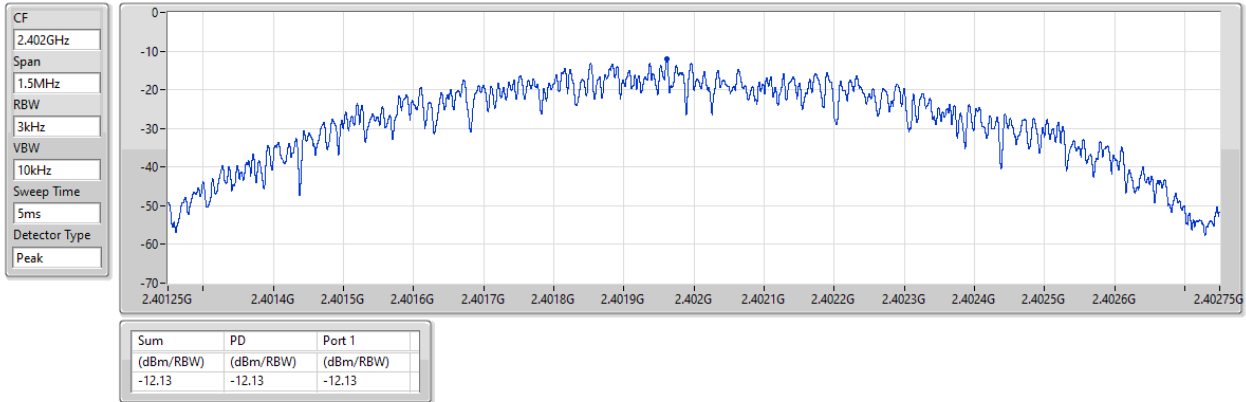
DG = Directional Gain; RBW = 3kHz;
PD = trace bin-by-bin of each transmits port summing can be performed maximum power density; Port X = Port X Power Density;

2.4-2.4835GHz_BT-LE(1Mbps)

PSD

2402MHz

03/07/2023

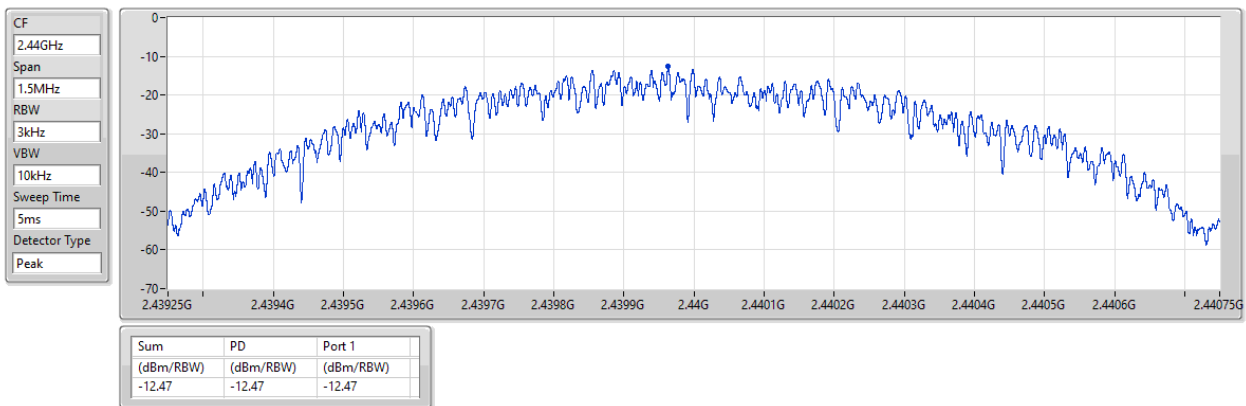


2.4-2.4835GHz_BT-LE(1Mbps)

PSD

2440MHz

03/07/2023

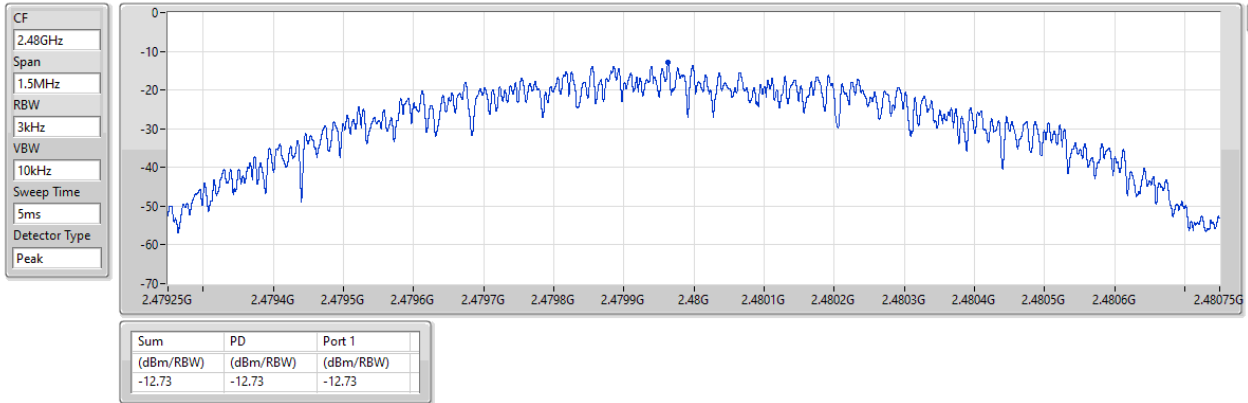


2.4-2.4835GHz_BT-LE(1Mbps)

PSD

2480MHz

03/07/2023





Summary

Mode	Result	Ref (Hz)	Ref (dBm)	Limit (dBm)	Freq (Hz)	Level (dBm)	Freq (Hz)	Level (dBm)	Freq (Hz)	Level (dBm)	Freq (Hz)	Level (dBm)	Freq (Hz)	Level (dBm)	Port
2.4-2.4835GHz	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
BT-LE(1Mbps)	Pass	2.40184G	2.46	-27.54	1.95348G	-52.09	2.39996G	-36.59	2.4G	-36.08	2.50294G	-49.46	21.51585G	-40.73	1

Result

Mode	Result	Ref (Hz)	Ref (dBm)	Limit (dBm)	Freq (Hz)	Level (dBm)	Freq (Hz)	Level (dBm)	Freq (Hz)	Level (dBm)	Freq (Hz)	Level (dBm)	Freq (Hz)	Level (dBm)	Port
BT-LE(1Mbps)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2402MHz	Pass	2.40184G	2.46	-27.54	1.95348G	-52.09	2.39996G	-36.59	2.4G	-36.08	2.50294G	-49.46	21.51585G	-40.73	1
2440MHz	Pass	2.40184G	2.46	-27.54	1.78898G	-52.44	2.39232G	-49.19	2.4G	-55.12	2.50054G	-49.44	21.67614G	-41.18	1
2480MHz	Pass	2.40184G	2.46	-27.54	1.9946G	-51.30	2.39188G	-49.63	2.4G	-54.20	2.50082G	-49.29	21.69864G	-41.61	1

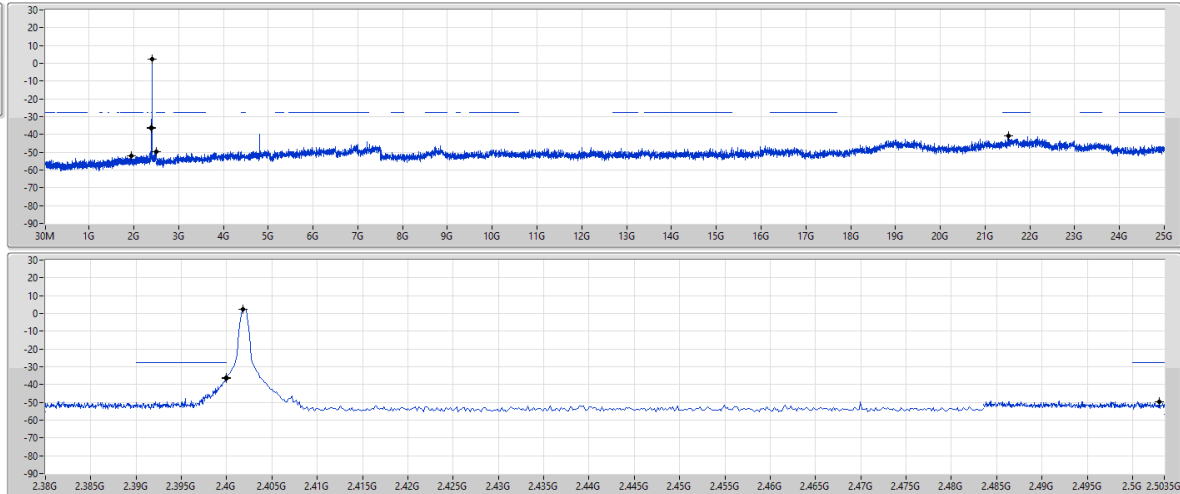
2.4-2.4835GHz_BT-LE(1Mbps)

CSEndB-DTS

2402MHz

03/07/2023

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



Ref(Hz)	Ref(dBm)	Limit(dBm)	Freq(Hz)	Level(dBm)	Freq(Hz)	Level(dBm)	Freq(Hz)	Level(dBm)	Freq(Hz)	Level(dBm)	Freq(Hz)	Level(dBm)	Port
2.40184G	2.46	-27.54	1.95348G	-52.09	2.39996G	-36.59	2.4G	-36.08	2.50294G	-49.46	21.51585G	-40.73	1

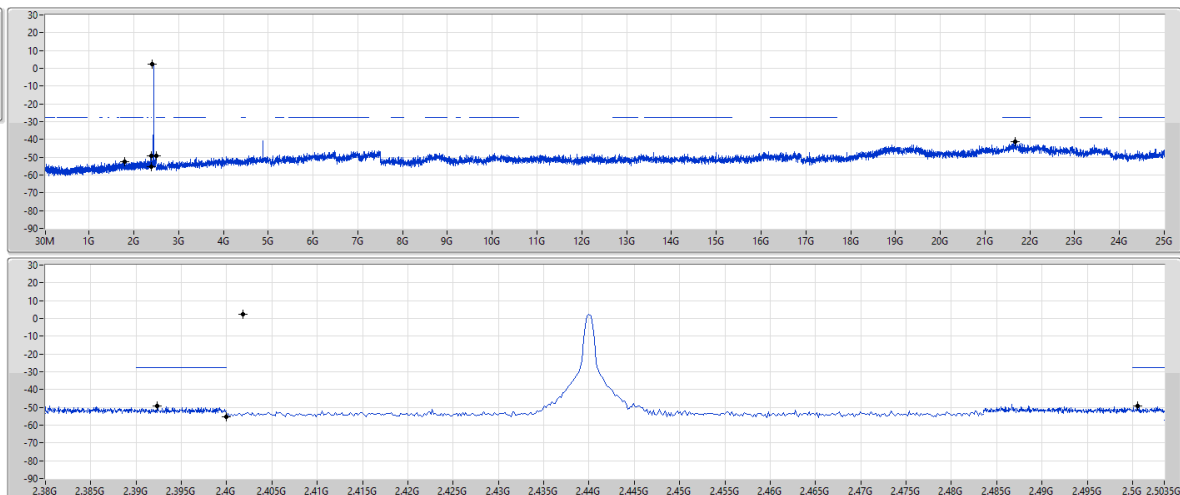
2.4-2.4835GHz_BT-LE(1Mbps)

CSEndB-DTS

2440MHz

03/07/2023

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



Ref(Hz)	Ref(dBm)	Limit(dBm)	Freq(Hz)	Level(dBm)	Freq(Hz)	Level(dBm)	Freq(Hz)	Level(dBm)	Freq(Hz)	Level(dBm)	Freq(Hz)	Level(dBm)	Port
2.40184G	2.46	-27.54	1.78898G	-52.44	2.39232G	-49.19	2.4G	-55.12	2.50054G	-49.44	21.67614G	-41.18	1

2.4-2.4835GHz_BT-LE(1Mbps)

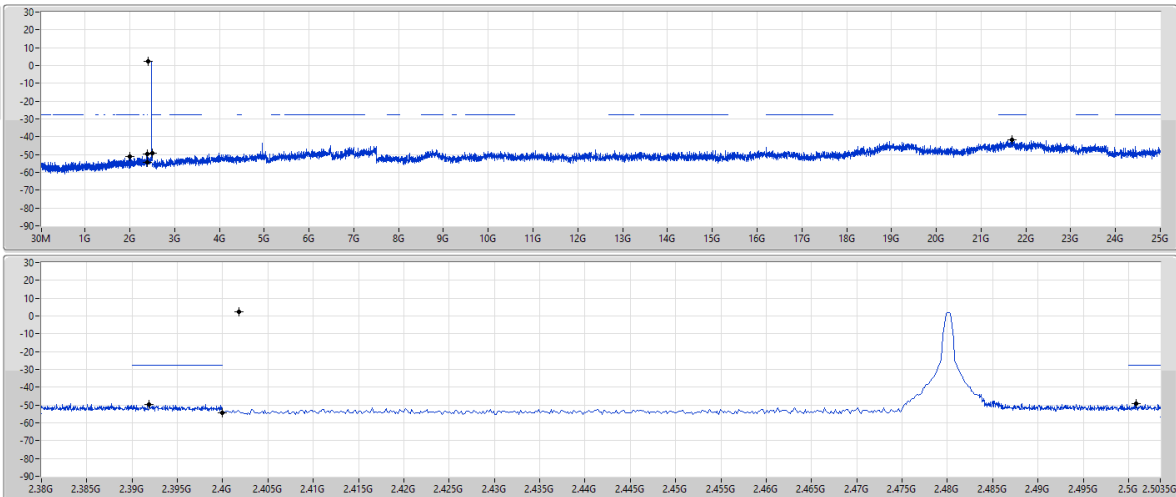
CSEndB-DTS

2480MHz

03/07/2023

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

Port 1



Ref(Hz)	Ref(dBm)	Limit(dBm)	Freq(Hz)	Level(dBm)	Freq(Hz)	Level(dBm)	Freq(Hz)	Level(dBm)	Freq(Hz)	Level(dBm)	Freq(Hz)	Level(dBm)	Port
2.40184G	2.46	-27.54	1.9946G	-51.30	2.39188G	-49.63	2.4G	-54.20	2.50082G	-49.29	21.69864G	-41.61	1



Summary

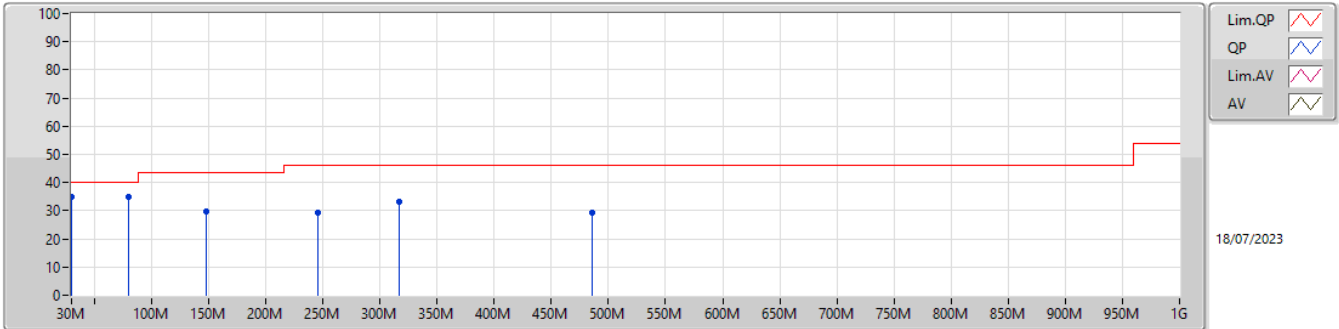
Mode	Result	Type	Freq (Hz)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Dist (m)	Condition	Azimuth (°)	Height (m)
2.4-2.4835GHz	-	-	-	-	-	-	-	-	-	-
BT-LE(1Mbps)	Pass	PK	30M	35.08	40.00	-4.92	3	Vertical	360	1.00

Result

Mode	Result	Type	Freq (Hz)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Dist (m)	Condition	Azimuth (°)	Height (m)
BT-LE(1Mbps)	-	-	-	-	-	-	-	-	-	-
2480MHz	Pass	PK	30M	35.08	40.00	-4.92	3	Vertical	360	1.00
2480MHz	Pass	PK	80.44M	34.71	40.00	-5.29	3	Vertical	360	1.00
2480MHz	Pass	PK	148.34M	29.71	43.50	-13.79	3	Vertical	360	1.00
2480MHz	Pass	PK	245.34M	29.24	46.00	-16.76	3	Vertical	360	1.00
2480MHz	Pass	PK	317.12M	33.30	46.00	-12.70	3	Vertical	360	1.00
2480MHz	Pass	PK	485.9M	29.48	46.00	-16.52	3	Vertical	360	1.00
2480MHz	Pass	PK	30M	26.54	40.00	-13.46	3	Horizontal	0	1.00
2480MHz	Pass	PK	148.34M	33.07	43.50	-10.43	3	Horizontal	0	1.00
2480MHz	Pass	PK	206.54M	31.18	43.50	-12.32	3	Horizontal	0	1.00
2480MHz	Pass	PK	264.74M	29.11	46.00	-16.89	3	Horizontal	0	1.00
2480MHz	Pass	PK	497.54M	35.28	46.00	-10.72	3	Horizontal	0	1.00
2480MHz	Pass	PK	730.34M	38.34	46.00	-7.66	3	Horizontal	0	1.00

2.4-2.4835GHz_BT-LE(1Mbps)

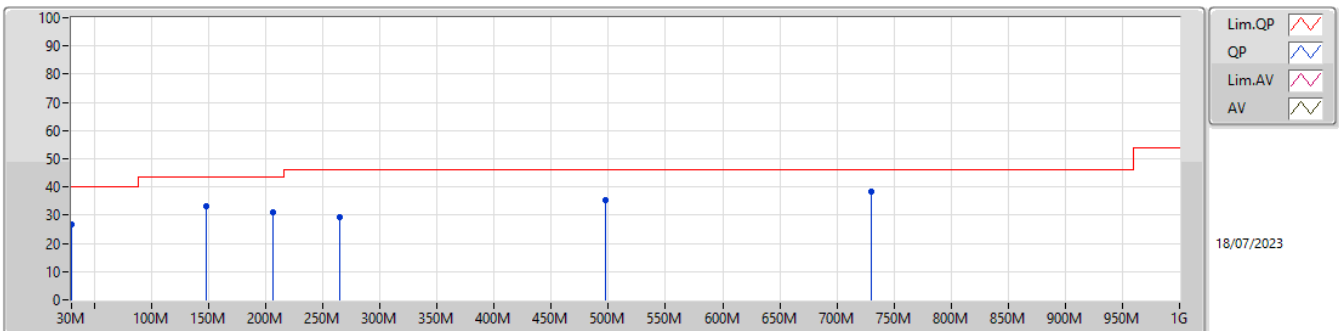
2480MHz_Battery



Type	Freq	Level	Limit	Margin	Factor	Dist	Condition	Azimuth	Height	Raw	AF	CL	PA				
(Hz)	(dBuV/m)	(dBuV/m)	(dB)	(dB)	(dB)	(m)		(°)	(m)	(dBuV)	(dB)	(dB)	(dB)				
PK	30M	35.08	40.00	-4.92	-3.05	3	Vertical	360	1.00	38.13	23.14	1.21	27.40				
PK	80.44M	34.71	40.00	-5.29	-13.71	3	Vertical	360	1.00	48.42	12.18	1.89	27.78				
PK	148.34M	29.71	43.50	-13.79	-9.74	3	Vertical	360	1.00	39.45	15.61	2.39	27.74				
PK	245.34M	29.24	46.00	-16.76	-7.16	3	Vertical	360	1.00	36.40	17.06	3.02	27.24				
PK	317.12M	33.30	46.00	-12.70	-5.24	3	Vertical	360	1.00	38.54	18.73	3.42	27.39				
PK	485.9M	29.48	46.00	-16.52	-1.30	3	Vertical	360	1.00	30.78	22.72	4.37	28.39				

2.4-2.4835GHz_BT-LE(1Mbps)

2480MHz_Battery



Type	Freq	Level	Limit	Margin	Factor	Dist	Condition	Azimuth	Height	Raw	AF	CL	PA				
(Hz)	(dBuV/m)	(dBuV/m)	(dB)	(dB)	(dB)	(m)		(°)	(m)	(dBuV)	(dB)	(dB)	(dB)				
PK	30M	26.54	40.00	-13.46	-3.05	3	Horizontal	0	1.00	29.59	23.14	1.21	27.40				
PK	148.34M	33.07	43.50	-10.43	-9.74	3	Horizontal	0	1.00	42.81	15.61	2.39	27.74				
PK	206.54M	31.18	43.50	-12.32	-10.22	3	Horizontal	0	1.00	41.40	14.40	2.83	27.45				
PK	264.74M	29.11	46.00	-16.89	-5.48	3	Horizontal	0	1.00	34.59	18.65	3.11	27.24				
PK	497.54M	35.28	46.00	-10.72	-1.36	3	Horizontal	0	1.00	36.64	22.65	4.40	28.41				
PK	730.34M	38.34	46.00	-7.66	1.74	3	Horizontal	0	1.00	36.60	24.64	5.45	28.35				



Summary

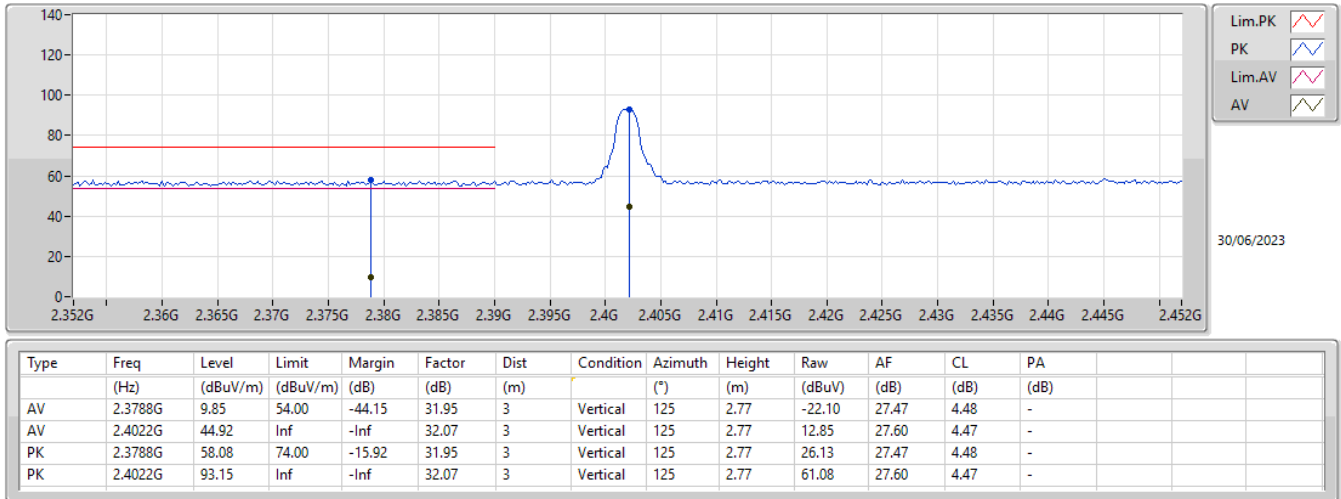
Mode	Result	Type	Freq (Hz)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Dist (m)	Condition	Azimuth (°)	Height (m)
2.4-2.4835GHz	-	-	-	-	-	-	-	-	-	-
BT-LE(1Mbps)	Pass	PK	4.80443G	68.75	74.00	-5.25	3	Horizontal	192	2.73

Result

Mode	Result	Type	Freq (Hz)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Dist (m)	Condition	Azimuth (°)	Height (m)
BT-LE(1Mbps)	-	-	-	-	-	-	-	-	-	-
2402MHz	Pass	AV	2.3788G	9.85	54.00	-44.15	3	Vertical	125	2.77
2402MHz	Pass	AV	2.4022G	44.92	Inf	-Inf	3	Vertical	125	2.77
2402MHz	Pass	PK	2.3788G	58.08	74.00	-15.92	3	Vertical	125	2.77
2402MHz	Pass	PK	2.4022G	93.15	Inf	-Inf	3	Vertical	125	2.77
2402MHz	Pass	AV	2.3574G	10.61	54.00	-43.39	3	Horizontal	179	1.21
2402MHz	Pass	AV	2.4018G	47.47	Inf	-Inf	3	Horizontal	179	1.21
2402MHz	Pass	PK	2.3574G	58.84	74.00	-15.16	3	Horizontal	179	1.21
2402MHz	Pass	PK	2.4018G	95.70	Inf	-Inf	3	Horizontal	179	1.21
2402MHz	Pass	AV	4.80446G	16.29	54.00	-37.71	3	Vertical	235	1.16
2402MHz	Pass	PK	4.80446G	64.52	74.00	-9.48	3	Vertical	235	1.16
2402MHz	Pass	AV	4.80443G	20.52	54.00	-33.48	3	Horizontal	192	2.73
2402MHz	Pass	PK	4.80443G	68.75	74.00	-5.25	3	Horizontal	192	2.73
2440MHz	Pass	AV	2.346G	9.71	54.00	-44.29	3	Vertical	145	2.11
2440MHz	Pass	AV	2.4404G	46.74	Inf	-Inf	3	Vertical	145	2.11
2440MHz	Pass	AV	2.4876G	9.68	54.00	-44.32	3	Vertical	145	2.11
2440MHz	Pass	PK	2.346G	57.94	74.00	-16.06	3	Vertical	145	2.11
2440MHz	Pass	PK	2.4404G	94.97	Inf	-Inf	3	Vertical	145	2.11
2440MHz	Pass	PK	2.4876G	57.91	74.00	-16.09	3	Vertical	145	2.11
2440MHz	Pass	AV	2.3712G	9.57	54.00	-44.43	3	Horizontal	177	2.70
2440MHz	Pass	AV	2.4404G	48.90	Inf	-Inf	3	Horizontal	177	2.70
2440MHz	Pass	AV	2.4988G	10.51	54.00	-43.49	3	Horizontal	177	2.70
2440MHz	Pass	PK	2.3712G	57.80	74.00	-16.20	3	Horizontal	177	2.70
2440MHz	Pass	PK	2.4404G	97.13	Inf	-Inf	3	Horizontal	177	2.70
2440MHz	Pass	PK	2.4988G	58.74	74.00	-15.26	3	Horizontal	177	2.70
2440MHz	Pass	AV	4.87995G	20.11	54.00	-33.89	3	Vertical	145	1.08
2440MHz	Pass	AV	7.31921G	19.73	54.00	-34.27	3	Vertical	154	1.26
2440MHz	Pass	PK	4.87995G	68.34	74.00	-5.66	3	Vertical	145	1.08
2440MHz	Pass	PK	7.31921G	67.96	74.00	-6.04	3	Vertical	154	1.26
2440MHz	Pass	AV	4.87948G	19.98	54.00	-34.02	3	Horizontal	145	1.08
2440MHz	Pass	AV	7.31918G	18.89	54.00	-35.11	3	Horizontal	173	1.25
2440MHz	Pass	PK	4.87948G	68.21	74.00	-5.79	3	Horizontal	145	1.08
2440MHz	Pass	PK	7.31918G	67.12	74.00	-6.88	3	Horizontal	173	1.25
2480MHz	Pass	AV	2.4798G	47.69	Inf	-Inf	3	Vertical	149	1.53
2480MHz	Pass	AV	2.4835G	10.35	54.00	-43.65	3	Vertical	149	1.53
2480MHz	Pass	PK	2.4798G	95.92	Inf	-Inf	3	Vertical	149	1.53
2480MHz	Pass	PK	2.4835G	58.58	74.00	-15.42	3	Vertical	149	1.53
2480MHz	Pass	AV	2.4798G	50.24	Inf	-Inf	3	Horizontal	172	3.00
2480MHz	Pass	AV	2.484G	10.99	54.00	-43.01	3	Horizontal	172	3.00
2480MHz	Pass	PK	2.4798G	98.47	Inf	-Inf	3	Horizontal	172	3.00
2480MHz	Pass	PK	2.484G	59.22	74.00	-14.78	3	Horizontal	172	3.00
2480MHz	Pass	AV	4.95999G	15.76	54.00	-38.24	3	Vertical	42	1.34
2480MHz	Pass	AV	7.43925G	16.40	54.00	-37.60	3	Vertical	322	1.11
2480MHz	Pass	PK	4.95999G	63.99	74.00	-10.01	3	Vertical	42	1.34
2480MHz	Pass	PK	7.43925G	64.63	74.00	-9.37	3	Vertical	322	1.11
2480MHz	Pass	AV	4.95986G	15.70	54.00	-38.30	3	Horizontal	139	2.16
2480MHz	Pass	AV	7.43987G	14.07	54.00	-39.93	3	Horizontal	175	1.00
2480MHz	Pass	PK	4.95986G	63.93	74.00	-10.07	3	Horizontal	139	2.16
2480MHz	Pass	PK	7.43987G	62.30	74.00	-11.70	3	Horizontal	175	1.00

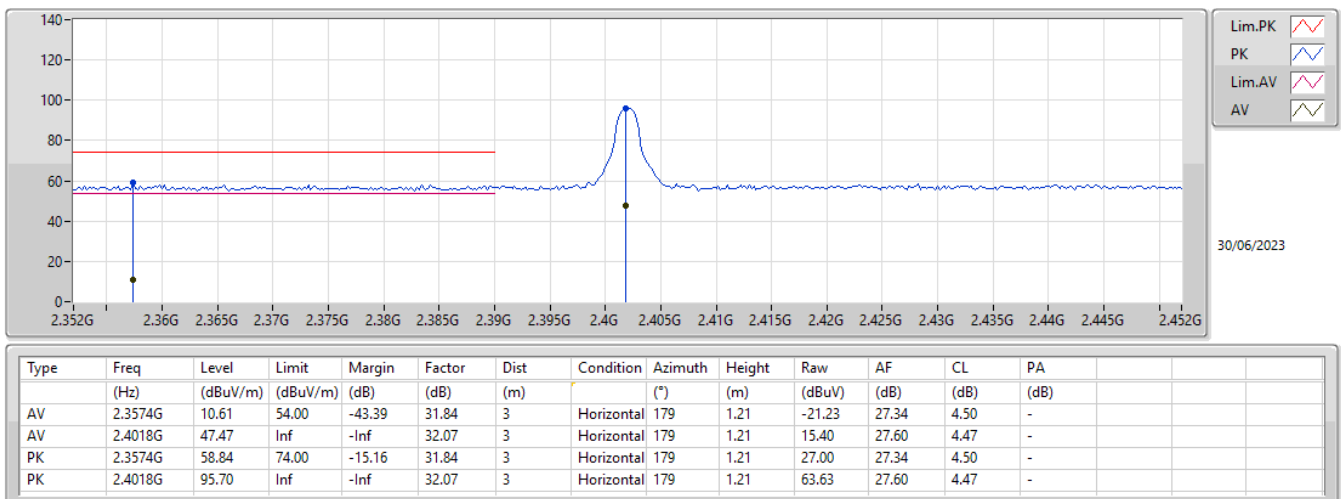
2.4-2.4835GHz_BT-LE(1Mbps)

2402MHz_TX



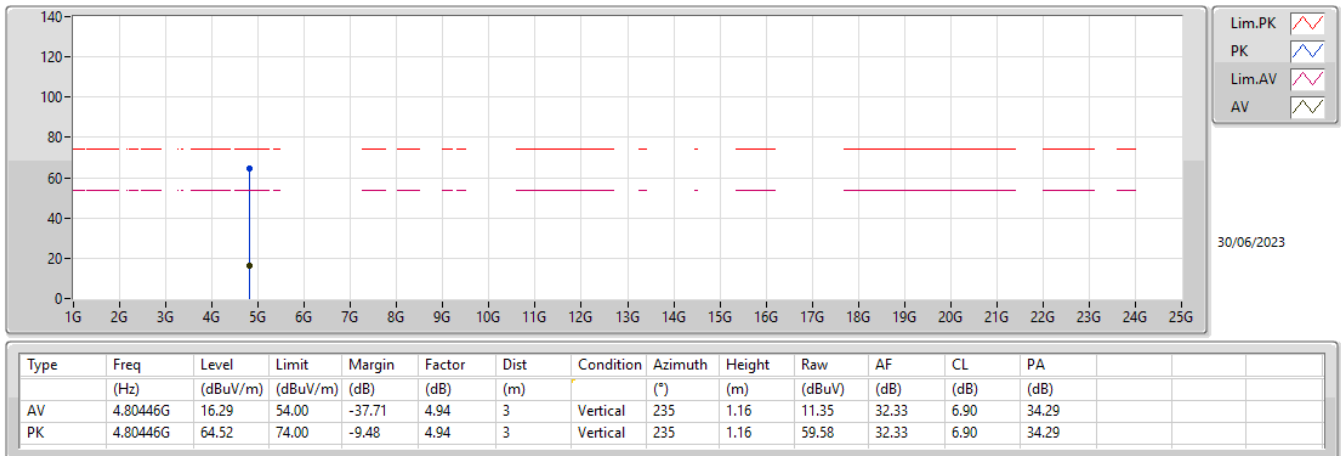
2.4-2.4835GHz_BT-LE(1Mbps)

2402MHz_TX



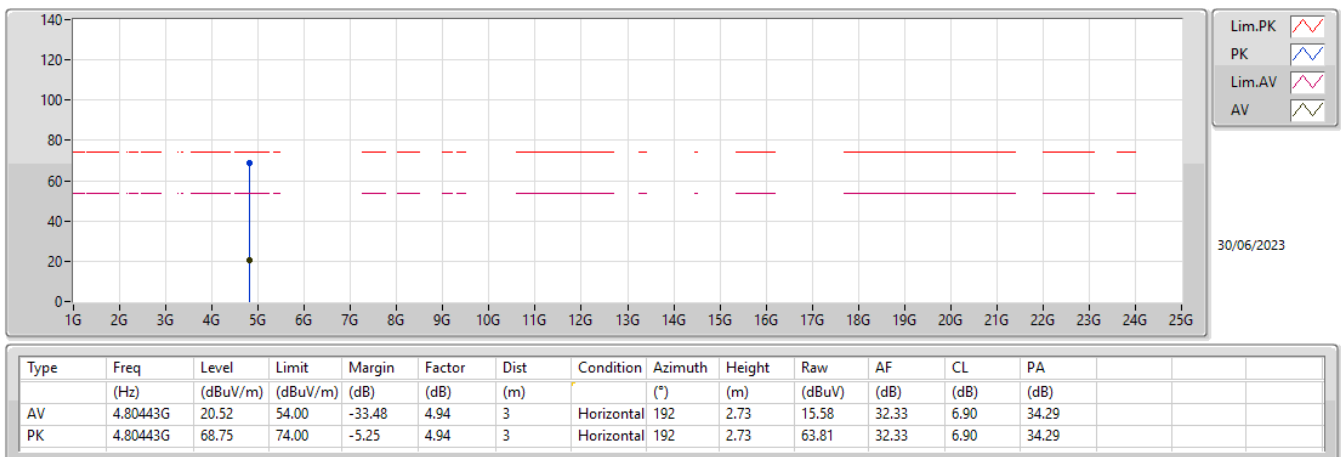
2.4-2.4835GHz_BT-LE(1Mbps)

2402MHz_TX



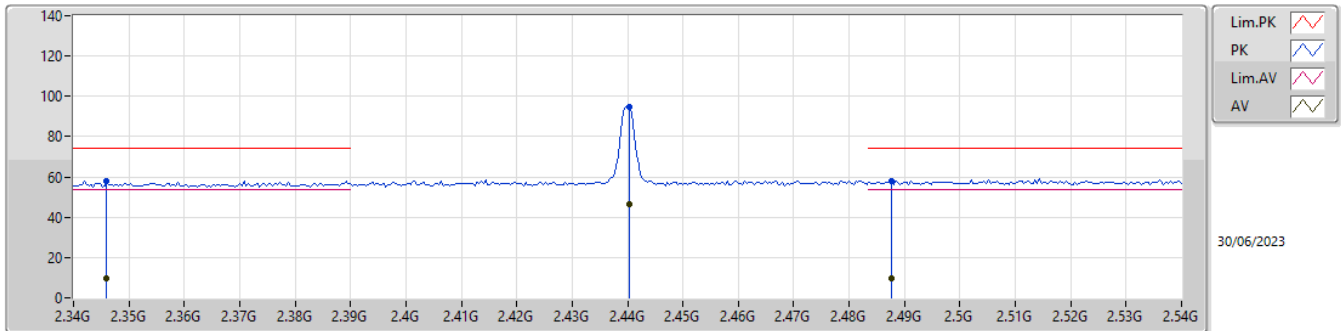
2.4-2.4835GHz_BT-LE(1Mbps)

2402MHz_TX



2.4-2.4835GHz_BT-LE(1Mbps)

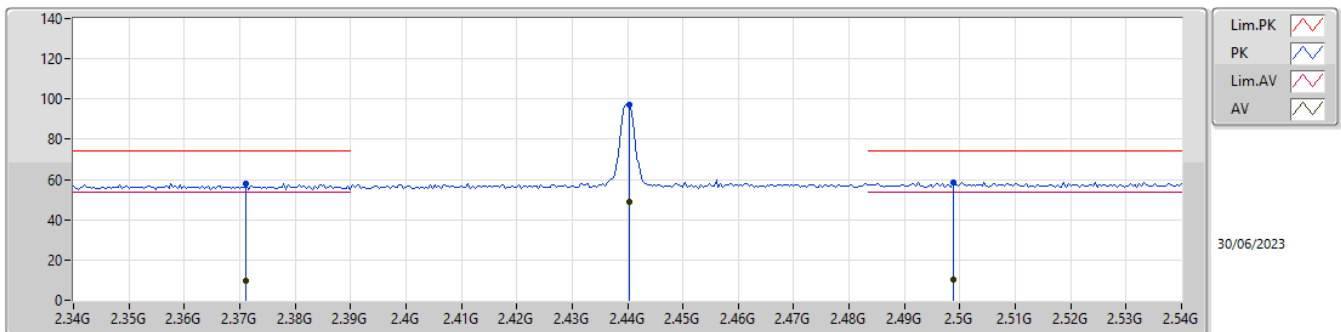
2440MHz_TX



Type	Freq	Level	Limit	Margin	Factor	Dist	Condition	Azimuth	Height	Raw	AF	CL	PA				
	(Hz)	(dBuV/m)	(dBuV/m)	(dB)	(dB)	(m)		(°)	(m)	(dBuV)	(dB)	(dB)	(dB)				
AV	2.346G	9.71	54.00	-44.29	31.79	3	Vertical	145	2.11	-22.08	27.29	4.50	-				
AV	2.440G	46.74	Inf	-Inf	32.16	3	Vertical	145	2.11	14.58	27.68	4.48	-				
AV	2.4876G	9.68	54.00	-44.32	32.41	3	Vertical	145	2.11	-22.73	27.93	4.48	-				
PK	2.346G	57.94	74.00	-16.06	31.79	3	Vertical	145	2.11	26.15	27.29	4.50	-				
PK	2.440G	94.97	Inf	-Inf	32.16	3	Vertical	145	2.11	62.81	27.68	4.48	-				
PK	2.4876G	57.91	74.00	-16.09	32.41	3	Vertical	145	2.11	25.50	27.93	4.48	-				

2.4-2.4835GHz_BT-LE(1Mbps)

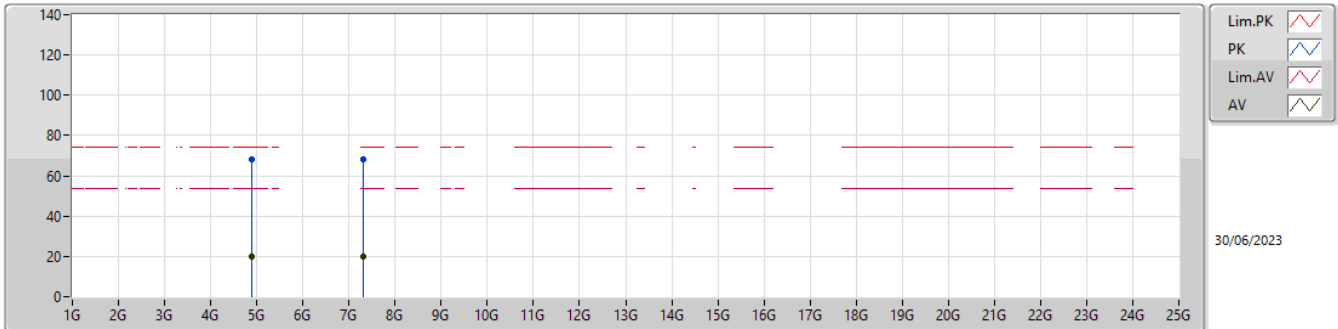
2440MHz_TX



Type	Freq	Level	Limit	Margin	Factor	Dist	Condition	Azimuth	Height	Raw	AF	CL	PA				
	(Hz)	(dBuV/m)	(dBuV/m)	(dB)	(dB)	(m)		(°)	(m)	(dBuV)	(dB)	(dB)	(dB)				
AV	2.3712G	9.57	54.00	-44.43	31.92	3	Horizontal	177	2.70	-22.35	27.43	4.49	-				
AV	2.440G	48.90	Inf	-Inf	32.16	3	Horizontal	177	2.70	16.74	27.68	4.48	-				
AV	2.4988G	10.51	54.00	-43.49	32.47	3	Horizontal	177	2.70	-21.96	27.99	4.48	-				
PK	2.3712G	57.80	74.00	-16.20	31.92	3	Horizontal	177	2.70	25.88	27.43	4.49	-				
PK	2.440G	97.13	Inf	-Inf	32.16	3	Horizontal	177	2.70	64.97	27.68	4.48	-				
PK	2.4988G	58.74	74.00	-15.26	32.47	3	Horizontal	177	2.70	26.27	27.99	4.48	-				

2.4-2.4835GHz_BT-LE(1Mbps)

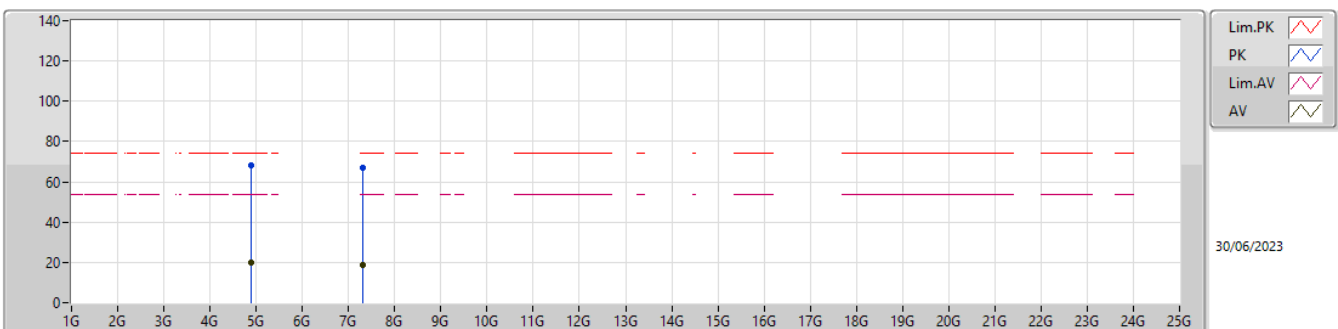
2440MHz_TX



Type	Freq (Hz)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Factor (dB)	Dist (m)	Condition	Azimuth (°)	Height (m)	Raw (dBuV)	AF (dB)	CL (dB)	PA (dB)
AV	4.87995G	20.11	54.00	-33.89	5.34	3	Vertical	145	1.08	14.77	32.72	6.90	34.28
AV	7.31921G	19.73	54.00	-34.27	10.56	3	Vertical	154	1.26	9.17	36.82	8.54	34.80
PK	4.87995G	68.34	74.00	-5.66	5.34	3	Vertical	145	1.08	63.00	32.72	6.90	34.28
PK	7.31921G	67.96	74.00	-6.04	10.56	3	Vertical	154	1.26	57.40	36.82	8.54	34.80

2.4-2.4835GHz_BT-LE(1Mbps)

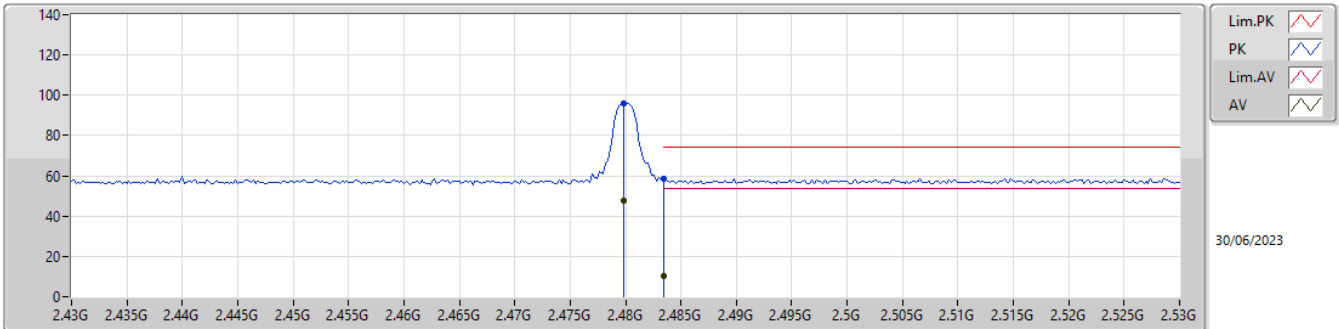
2440MHz_TX



Type	Freq (Hz)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Factor (dB)	Dist (m)	Condition	Azimuth (°)	Height (m)	Raw (dBuV)	AF (dB)	CL (dB)	PA (dB)
AV	4.87948G	19.98	54.00	-34.02	5.34	3	Horizontal	145	1.08	14.64	32.72	6.90	34.28
AV	7.31918G	18.89	54.00	-35.11	10.56	3	Horizontal	173	1.25	8.33	36.82	8.54	34.80
PK	4.87948G	68.21	74.00	-5.79	5.34	3	Horizontal	145	1.08	62.87	32.72	6.90	34.28
PK	7.31918G	67.12	74.00	-6.88	10.56	3	Horizontal	173	1.25	56.56	36.82	8.54	34.80

2.4-2.4835GHz_BT-LE(1Mbps)

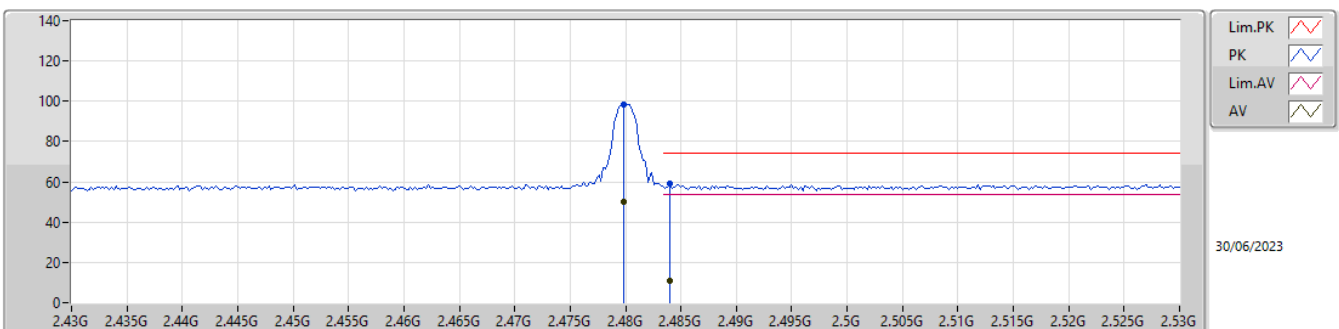
2480MHz_TX



Type	Freq	Level	Limit	Margin	Factor	Dist	Condition	Azimuth	Height	Raw	AF	CL	PA
	(Hz)	(dBuV/m)	(dBuV/m)	(dB)	(dB)	(m)		(°)	(m)	(dBuV)	(dB)	(dB)	(dB)
AV	2.4798G	47.69	Inf	-Inf	32.36	3	Vertical	149	1.53	15.33	27.88	4.48	-
AV	2.4835G	10.35	54.00	-43.65	32.38	3	Vertical	149	1.53	-22.03	27.90	4.48	-
PK	2.4798G	95.92	Inf	-Inf	32.36	3	Vertical	149	1.53	63.56	27.88	4.48	-
PK	2.4835G	58.58	74.00	-15.42	32.38	3	Vertical	149	1.53	26.20	27.90	4.48	-

2.4-2.4835GHz_BT-LE(1Mbps)

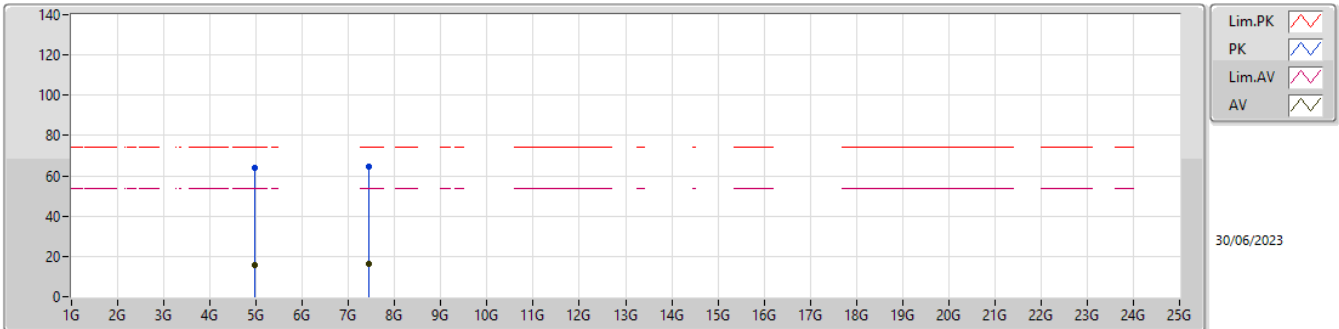
2480MHz_TX



Type	Freq	Level	Limit	Margin	Factor	Dist	Condition	Azimuth	Height	Raw	AF	CL	PA
	(Hz)	(dBuV/m)	(dBuV/m)	(dB)	(dB)	(m)		(°)	(m)	(dBuV)	(dB)	(dB)	(dB)
AV	2.4798G	50.24	Inf	-Inf	32.36	3	Horizontal	172	3.00	17.88	27.88	4.48	-
AV	2.484G	10.99	54.00	-43.01	32.38	3	Horizontal	172	3.00	-21.39	27.90	4.48	-
PK	2.4798G	98.47	Inf	-Inf	32.36	3	Horizontal	172	3.00	66.11	27.88	4.48	-
PK	2.484G	59.22	74.00	-14.78	32.38	3	Horizontal	172	3.00	26.84	27.90	4.48	-

2.4-2.4835GHz_BT-LE(1Mbps)

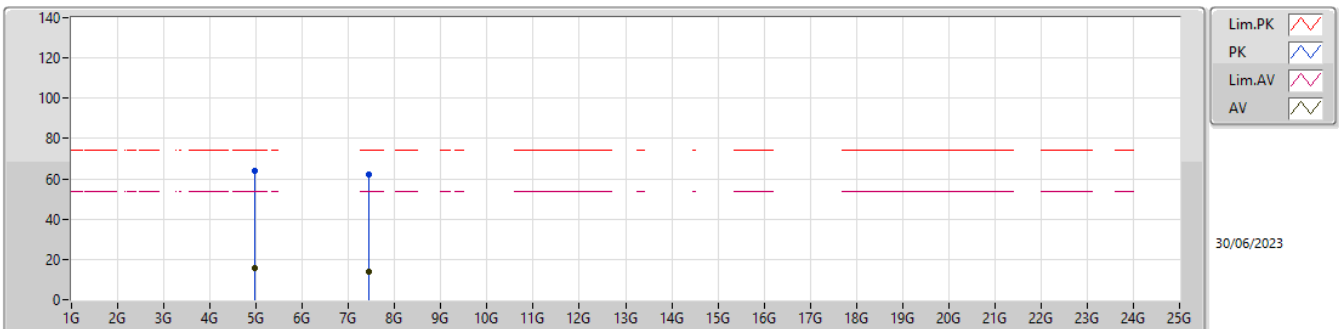
2480MHz_TX



Type	Freq (Hz)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Factor (dB)	Dist (m)	Condition	Azimuth (°)	Height (m)	Raw (dBuV)	AF (dB)	CL (dB)	PA (dB)
AV	4.95999G	15.76	54.00	-38.24	5.76	3	Vertical	42	1.34	10.00	33.12	6.91	34.27
AV	7.43925G	16.40	54.00	-37.60	10.33	3	Vertical	322	1.11	6.07	36.50	8.65	34.82
PK	4.95999G	63.99	74.00	-10.01	5.76	3	Vertical	42	1.34	58.23	33.12	6.91	34.27
PK	7.43925G	64.63	74.00	-9.37	10.33	3	Vertical	322	1.11	54.30	36.50	8.65	34.82

2.4-2.4835GHz_BT-LE(1Mbps)

2480MHz_TX



Type	Freq (Hz)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Factor (dB)	Dist (m)	Condition	Azimuth (°)	Height (m)	Raw (dBuV)	AF (dB)	CL (dB)	PA (dB)
AV	4.95986G	15.70	54.00	-38.30	5.76	3	Horizontal	139	2.16	9.94	33.12	6.91	34.27
AV	7.43987G	14.07	54.00	-39.93	10.33	3	Horizontal	175	1.00	3.74	36.50	8.65	34.82
PK	4.95986G	63.93	74.00	-10.07	5.76	3	Horizontal	139	2.16	58.17	33.12	6.91	34.27
PK	7.43987G	62.30	74.00	-11.70	10.33	3	Horizontal	175	1.00	51.97	36.50	8.65	34.82