

Testing Laboratory
3787

RADIO TEST REPORT

FCC ID : 2AV57GS1LTE1
Equipment : Video Telematics Sensor
Brand Name : Geotab Inc.
Model Name : GS1-LTE1
Applicant : Geotab Inc.
2440 Winston Park Drive, Oakville, Ontario, L6H 7V2, Canada
Manufacturer : Geotab Inc.
2440 Winston Park Drive, Oakville, Ontario, L6H 7V2, Canada
Standard : 47 CFR FCC Part 15.247

The product was received on Jan. 29, 2024, and testing was started from Feb. 22, 2024 and completed on Jun. 27, 2024. We, Sporton International Inc. Hsinchu Laboratory, would like to declare that the tested sample has been evaluated in accordance with the procedures given in ANSI C63.10-2013 and shown compliance with the applicable technical standards.

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

Approved by: Sam Chen

Sportun International Inc. Hsinchu Laboratory

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



Table of Contents

History of this test report.....	3
Summary of Test Result.....	4
1 General Description	5
1.1 Information.....	5
1.2 Applicable Standards	7
1.3 Testing Location Information.....	7
1.4 Measurement Uncertainty	7
2 Test Configuration of EUT.....	8
2.1 Test Channel Mode	8
2.2 The Worst Case Measurement Configuration.....	8
2.3 EUT Operation during Test	9
2.4 Accessories	9
2.5 Support Equipment.....	9
2.6 Test Setup Diagram	10
3 Transmitter Test Result	11
3.1 DTS Bandwidth	11
3.2 Maximum Conducted Output Power	12
3.3 Power Spectral Density	14
3.4 Emissions in Non-restricted Frequency Bands	16
3.5 Emissions in Restricted Frequency Bands.....	17
4 Test Equipment and Calibration Data	21

Appendix A. Test Results of DTS Bandwidth**Appendix B. Test Results of Maximum Conducted Output Power****Appendix C. Test Results of Power Spectral Density****Appendix D. Test Results of Emissions in Non-restricted Frequency Bands****Appendix E. Test Results of Emissions in Restricted Frequency Bands****Appendix F. Test Photos****Photographs of EUT v01**



History of this test report



Summary of Test Result

Report Clause	Ref Std. Clause	Test Items	Result (PASS/FAIL)	Remark
1.1.2	15.203	Antenna Requirement	PASS	-
-	15.207	AC Power-line Conducted Emissions	N/A	Note 1
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	-

Note 1: The EUT was supplied power by DC-Powered (vehicle battery); it's not necessary to apply to AC Power-line Conducted Emissions test.

Note 2: Reference to Sporton Project No.: 411919

Conformity Assessment Condition:

1. The test results (PASS/FAIL) with all measurement uncertainty excluded are presented against the regulation limits or in accordance with the requirements stipulated by the applicant/manufacturer who shall bear all the risks of non-compliance that may potentially occur if measurement uncertainty is taken into account.
2. The measurement uncertainty please refer to each test result in the chapter "Measurement Uncertainty".

Disclaimer:

The product specifications of the EUT presented in the test report that may affect the test assessments are declared by the manufacturer who shall take full responsibility for the authenticity.

Reviewed by: Sam Chen

Report Producer: Muse Chan



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 modulation.
- BWch is the nominal channel bandwidth.

1.1.2 Antenna Information

Ant.	Port	Brand	Model Name	Antenna Type	Connector	Gain (dBi)
1	1	WNC	UCD-LI80	Monopole	N/A	2.55

Note 1: The WLAN 2.4GHz and Bluetooth cannot function at the same time.

Note 2: The above information was declared by manufacturer.

Note 3: For 2.4GHz function:

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

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

For Bluetooth function (1TX/1RX):

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

1.1.3 Mode Test Duty Cycle

Mode	DC	DCF (dB)	T (s)	VBW (Hz)_1/T
BT-LE(1Mbps)	0.628	2.02	392.5u	3k

Note:

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



1.1.4 EUT Operational Condition

EUT Power Type	From host vehicle (12/24V)			
EUT Power Type for Testing	From DC power supply (24V)			
Function	<input checked="" type="checkbox"/>	Point-to-multipoint	<input type="checkbox"/>	Point-to-point
Test Software Version	DOS V6.1.7601			
Support Mode	<input checked="" type="checkbox"/>	LE 1M PHY: 1 Mb/s		
	<input checked="" type="checkbox"/>	LE Coded PHY (S=2): 500 Kb/s		
	<input checked="" type="checkbox"/>	LE Coded PHY (S=8): 125 Kb/s		
	<input type="checkbox"/>	LE 2M PHY: 2 Mb/s		

Note: The above information was declared by manufacturer.

1.1.5 Table of WWAN Module Function

Brand Name	Model Name	Function
Quectel	EG91-NAXD	LTE Band: 2 / 4 / 5 / 12 / 13 / 25 / 26

Note: The above information was declared by manufacturer.



1.2 Applicable Standards

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

- ♦ 47 CFR FCC Part 15.247
- ♦ ANSI C63.10-2013

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

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

1.3 Testing Location Information

Testing Location Information				
Test Lab. : Sporton International Inc. Hsinchu Laboratory				
Hsinchu (TAF: 3787)	ADD: No.8, Ln. 724, Bo'ai St., Zhubei City, Hsinchu County 302010, Taiwan (R.O.C.) 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	TH02-CB	Mason Chan	20.6~22 / 66~71	Feb. 26, 2024~ Mar. 07, 2024
Radiated < 1GHz	03CH05-CB		21.6~22.7 / 55~58	Jun. 27, 2024
Radiated > 1GHz	03CH04-CB	Young Yang	22.7~23.8 / 56~59	Feb. 22, 2024~ Mar. 05, 2024

Note: The tested sample of the Radiated below 1GHz test item was received on Jun. 27, 2024.

1.4 Measurement Uncertainty

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

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



2 Test Configuration of EUT

2.1 Test Channel Mode

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

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 < 1GHz	CTX "EUT in X axis" generated the worst case at Radiated measurement > 1GHz. Consequently, the measurement will follow this same test mode.
1	EUT in X axis_Bluetooth
2	EUT in X axis_WLAN 2.4GHz
For operating, mode 1 is the worst case and it was record in this test report.	
Operating Mode > 1GHz	CTX After evaluating, EUT in X axis was the worst case, so the measurement will follow this same test configuration.
1	EUT in X axis



The Worst Case Mode for Following Conformance Tests	
Tests Item	Simultaneous Transmission Analysis - Co-location RF Exposure Evaluation
Operating Mode	
1	WWAN + WLAN 2.4GHz
2	WWAN + Bluetooth

Refer to Sporton Test Report No.: FA411919-01 for Co-location RF Exposure Evaluation.

2.3 EUT Operation during Test

The EUT was programmed to be in continuously transmitting mode.

2.4 Accessories

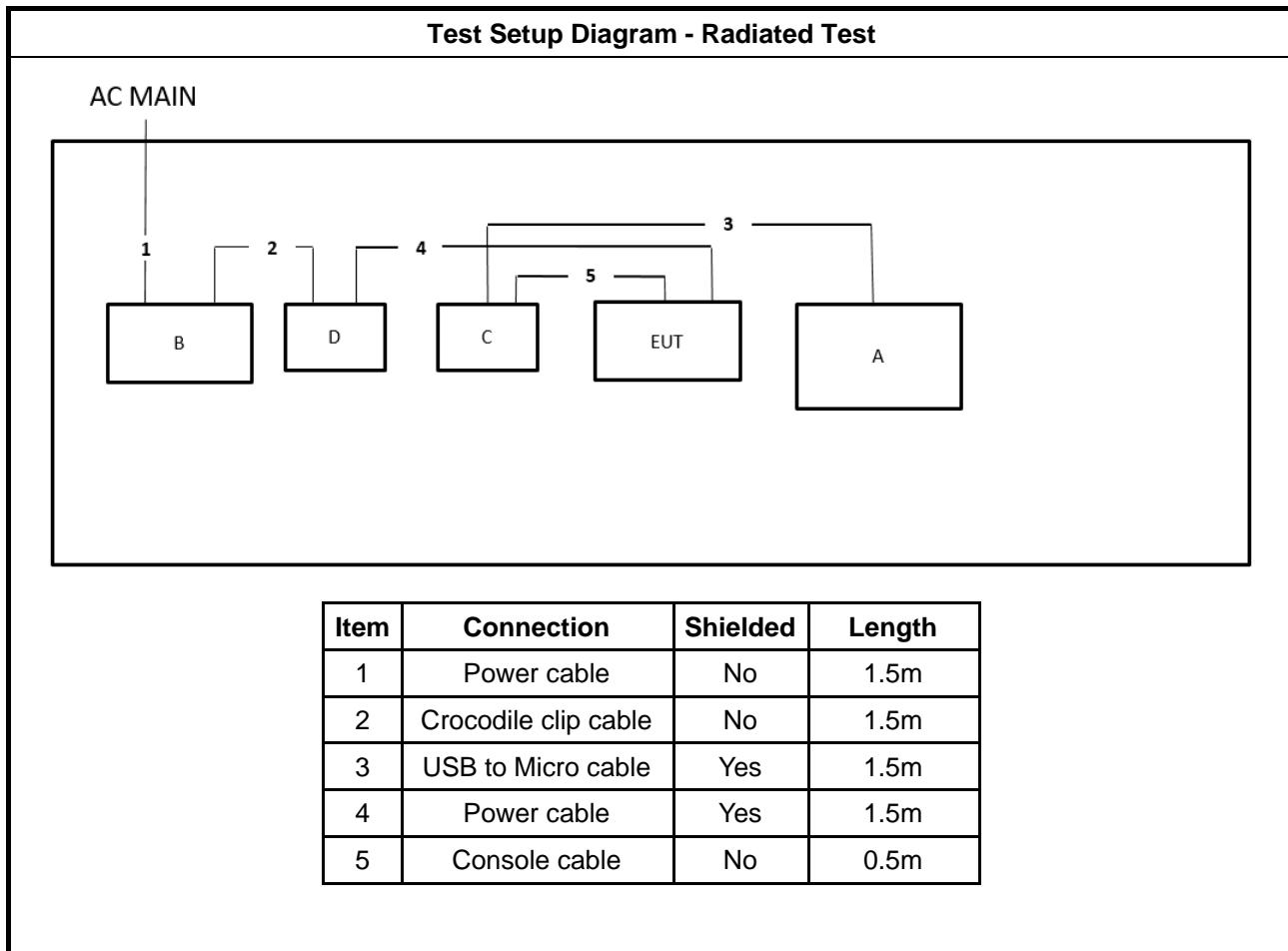
N/A

2.5 Support Equipment

Support Equipment				
No.	Equipment	Brand Name	Model Name	FCC ID
A	Notebook	DELL	E4300	N/A
B	DC Power Supply	MOTECH	LPS-305	N/A
C	Fixture	WNC	E24447	N/A
D	Power fixture	SHIG YANG	USB-02	N/A



2.6 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.

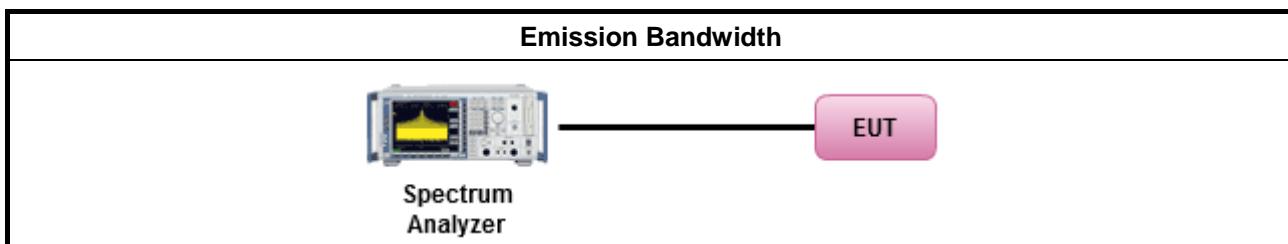
3.1.2 Measuring Instruments

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:
<input checked="" type="checkbox"/> Refer as FCC KDB 558074, clause 8.2 & C63.10 clause 11.8.1 Option 1 for 6 dB bandwidth measurement.
<input type="checkbox"/> Refer as FCC KDB 558074, clause 8.2 & C63.10 clause 11.8.2 Option 2 for 6 dB bandwidth measurement.
<input type="checkbox"/> Refer as ANSI C63.10, clause 6.9.1 for occupied bandwidth testing.

3.1.4 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	
	<ul style="list-style-type: none">▪ If $G_{TX} \leq 6 \text{ dBi}$, then $P_{Out} \leq 30 \text{ dBm}$ (1 W)
	<ul style="list-style-type: none">▪ Point-to-multipoint systems (P2M): If $G_{TX} > 6 \text{ dBi}$, then $P_{Out} = 30 - (G_{TX} - 6) \text{ dBm}$
	<ul style="list-style-type: none">▪ Point-to-point systems (P2P): If $G_{TX} > 6 \text{ dBi}$, then $P_{Out} = 30 - (G_{TX} - 6)/3 \text{ dBm}$
	<ul style="list-style-type: none">▪ Smart antenna system (SAS):<ul style="list-style-type: none">- Single beam: If $G_{TX} > 6 \text{ dBi}$, then $P_{Out} = 30 - (G_{TX} - 6)/3 \text{ dBm}$- Overlap beam: If $G_{TX} > 6 \text{ dBi}$, then $P_{Out} = 30 - (G_{TX} - 6)/3 \text{ dBm}$- Aggregate power on all beams: If $G_{TX} > 6 \text{ dBi}$, then $P_{Out} = 30 - (G_{TX} - 6)/3 + 8\text{dB}$ 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	
	<ul style="list-style-type: none">▪ Maximum Peak Conducted Output Power
<input type="checkbox"/>	Refer as FCC KDB 558074, clause 8.3.1.1 & C63.10 clause 11.9.1.1 (RBW \geq EBW method).
<input type="checkbox"/>	Refer as FCC KDB 558074, clause 8.3.1.3 & C63.10 clause 11.9.1.3 (peak power meter).
	<ul style="list-style-type: none">▪ Maximum Conducted Output Power
	[duty cycle $\geq 98\%$ or external video / power trigger]
<input type="checkbox"/>	Refer as FCC KDB 558074, clause 8.3.2.2 & C63.10 clause 11.9.2.2.2 Method AVGSA-1.
<input type="checkbox"/>	Refer as FCC KDB 558074, clause 8.3.2.2 & C63.10 clause 11.9.2.2.3 Method AVGSA-1A. (alternative)
	duty cycle $< 98\%$ and average over on/off periods with duty factor
<input type="checkbox"/>	Refer as FCC KDB 558074, clause 8.3.2.2 & C63.10 clause 11.9.2.2.4 Method AVGSA-2.
<input type="checkbox"/>	Refer as FCC KDB 558074, clause 8.3.2.2 & C63.10 clause 11.9.2.2.5 Method AVGSA-2A (alternative)
<input type="checkbox"/>	Refer as FCC KDB 558074, clause 8.3.2.2 & C63.10 clause 11.9.2.2.6 Method AVGSA-3
<input type="checkbox"/>	Refer as FCC KDB 558074, clause 8.3.2.2 & C63.10 clause 11.9.2.2.7 Method AVGSA-3A (alternative)
	Measurement using a power meter (PM)
<input type="checkbox"/>	Refer as FCC KDB 558074, clause 8.3.2.3 & C63.10 clause 11.9.2.3.1 Method AVGPM (using an RF average power meter).
<input checked="" type="checkbox"/>	Refer as FCC KDB 558074, clause 8.3.2.3 & C63.10 clause 11.9.2.3.2 Method AVGPM-G (using an gate RF average power meter).



- For conducted measurement.

- | | |
|--|---|
| | <ul style="list-style-type: none">If the EUT supports multiple transmit chains using options given below:
Refer as FCC KDB 662911, In-band power measurements. Using the measure-and-sum approach, measured all transmit ports individually. Sum the power (in linear power units e.g., mW) of all ports for each individual sample and save them.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

Maximum Conducted Output Power (Power Meter)



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

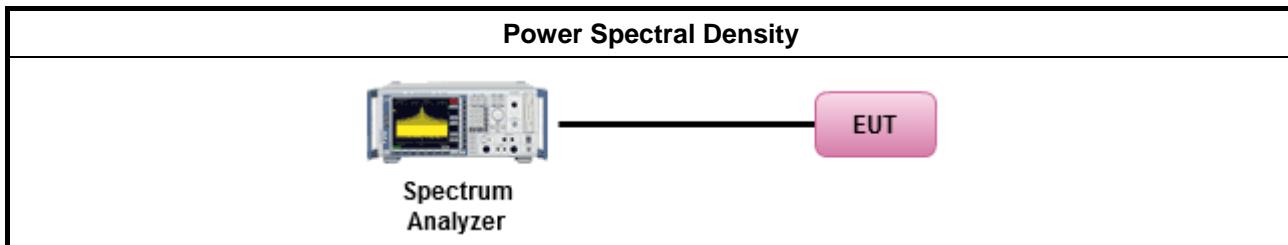
Refer a test equipment and calibration data table in this test report.

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).
<input checked="" type="checkbox"/> Refer as FCC KDB 558074, clause 8.4 & C63.10 clause 11.10 Method Max. PSD. [duty cycle ≥ 98% or external video / power trigger]
▪ For conducted measurement.
<ul style="list-style-type: none">▪ If The EUT supports multiple transmit chains using options given below:<ul style="list-style-type: none"><input type="checkbox"/> Option 1: Measure and sum the spectra across the outputs. Refer as FCC KDB 662911, In-band power spectral density (PSD). Sample all transmit ports simultaneously using a spectrum analyzer for each transmit port. Where the trace bin-by-bin of each transmit port summing can be performed. (i.e., in the first spectral bin of output 1 is summed with that in the first spectral bin of output 2 and that from the first spectral bin of output 3, and so on up to the NTX output to obtain the value for the first frequency bin of the summed spectrum.). Add up the amplitude (power) values for the different transmit chains and use this as the new data trace.<input type="checkbox"/> Option 2: Measure and sum spectral maxima across the outputs. With this technique, spectra are measured at each output of the device at the required resolution bandwidth. The maximum value (peak) of each spectrum is determined. These maximum values are then summed mathematically in linear power units across the outputs. These operations shall be performed separately over frequency spans that have different out-of-band or spurious emission limits,<input type="checkbox"/> Option 3: Measure and add $10 \log(N)$ dB, where N is the number of transmit chains. Refer as FCC KDB 662911, In-band power spectral density (PSD). Performed at each transmit chains and each transmit chains shall be compared with the limit have been reduced with $10 \log(N)$. Or each transmit chains shall be add $10 \log(N)$ to compared with the limit.



3.3.4 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 (dBc)
Peak output power procedure	20
Average output power procedure	30

Note 1: If the peak output power procedure is used to measure the fundamental emission power to demonstrate compliance to requirements, then the peak conducted output power measured within any 100 kHz outside the authorized frequency band shall be attenuated by at least 20 dB relative to the maximum measured in-band peak PSD level.

Note 2: If the average output power procedure is used to measure the fundamental emission power to demonstrate compliance to requirements, then the power in any 100 kHz outside of the authorized frequency band shall be attenuated by at least 30 dB relative to the maximum measured in-band average PSD level.

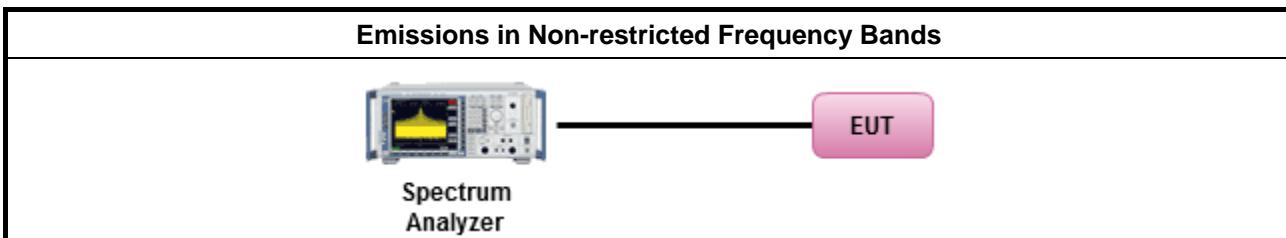
3.4.2 Measuring Instruments

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

3.4.3 Test Procedures

Test Method
▪ Refer as FCC KDB 558074, clause 8.5 for unwanted emissions into non-restricted 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

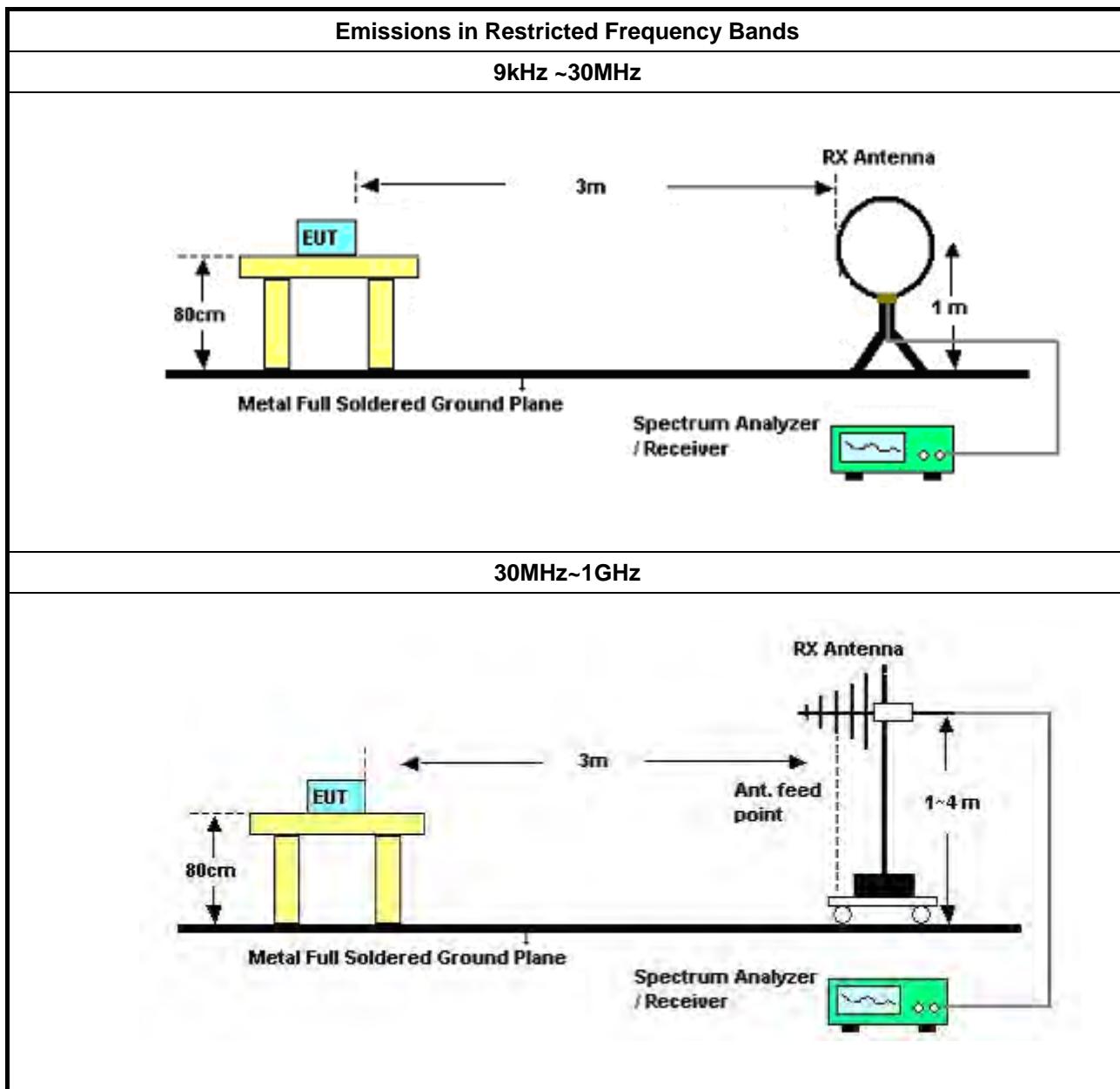
Refer a test equipment and calibration data table in this test report.

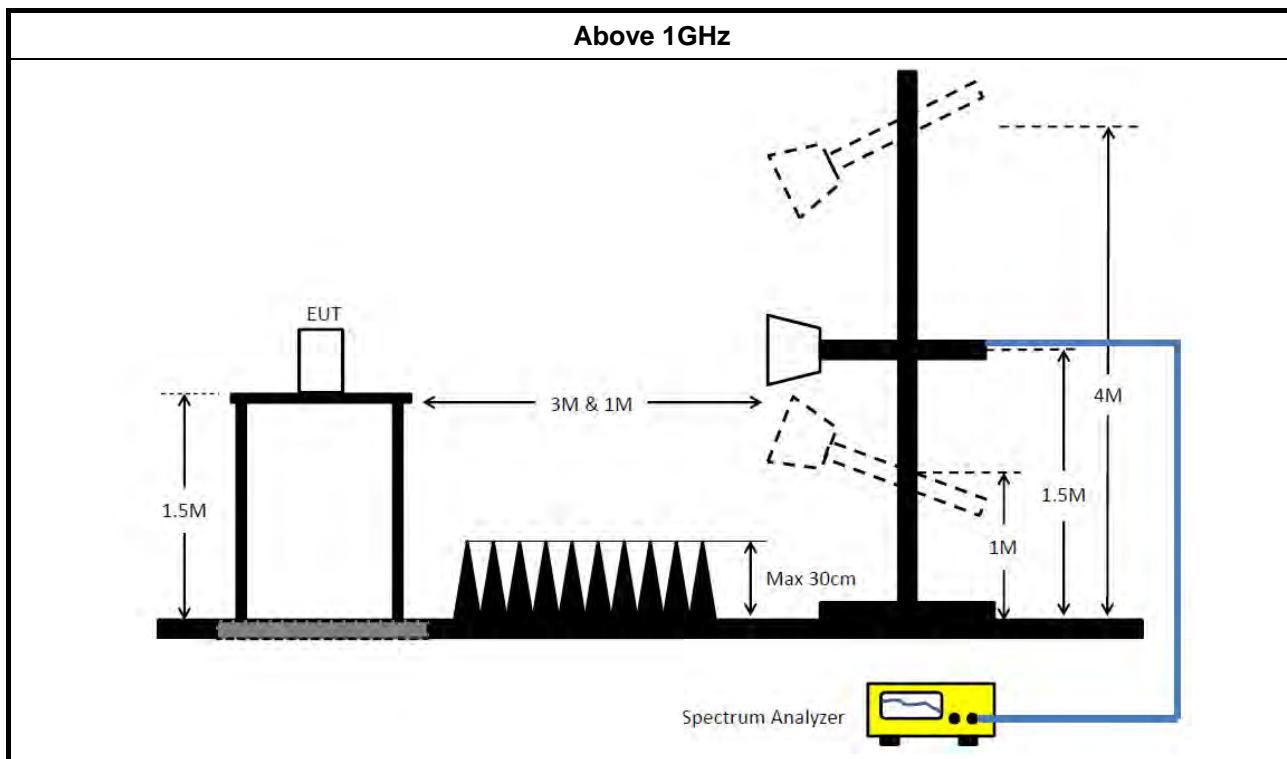


3.5.3 Test Procedures

Test Method	
<ul style="list-style-type: none">▪ The average emission levels shall be measured in [duty cycle \geq 98 or duty factor].	
<ul style="list-style-type: none">▪ Refer as ANSI C63.10, clause 6.10.3 band-edge testing shall be performed at the lowest frequency channel and highest frequency channel within the allowed operating band.	
<ul style="list-style-type: none">▪ For the transmitter unwanted emissions shall be measured using following options below:	
<ul style="list-style-type: none">▪ Refer as FCC KDB 558074, clause 8.6 for unwanted emissions into restricted bands.	<ul style="list-style-type: none"><input type="checkbox"/> Refer as FCC KDB 558074, clause 8.6 & C63.10 clause 11.12.2.5.1(trace averaging for duty cycle \geq98%).
	<ul style="list-style-type: none"><input type="checkbox"/> Refer as FCC KDB 558074, clause 8.6 & C63.10 clause 11.12.2.5.2(trace averaging + duty factor).
	<ul style="list-style-type: none"><input checked="" type="checkbox"/> Refer as FCC KDB 558074, clause 8.6 & C63.10 clause 11.12.2.5.3(Reduced $VBW \geq 1/T$).
	<ul style="list-style-type: none"><input type="checkbox"/> Refer as ANSI C63.10, clause 11.12.2.5.3 (Reduced VBW). $VBW \geq 1/T$, where T is pulse time.
	<ul style="list-style-type: none"><input type="checkbox"/> Refer as ANSI C63.10, clause 7.5 average value of pulsed emissions.
	<ul style="list-style-type: none"><input checked="" type="checkbox"/> Refer as FCC KDB 558074, clause 8.6 & C63.10 clause 11.12.2.4 measurement procedure peak limit.
	<ul style="list-style-type: none">▪ For the transmitter band-edge emissions shall be measured using following options below:
<ul style="list-style-type: none">▪ Refer as FCC KDB 558074 clause 8.7 & c63.10 clause 11.13.1, When the performing peak or average radiated measurements, emissions within 2 MHz of the authorized band edge may be measured using the marker-delta method described below.	<ul style="list-style-type: none">▪ Refer as FCC KDB 558074, clause 8.7 (ANSI C63.10, clause 6.10.6) for marker-delta method for band-edge measurements.
	<ul style="list-style-type: none">▪ Refer as FCC KDB 558074, clause 8.7 for narrower resolution bandwidth (100kHz) using the band power and summing the spectral levels (i.e., 1 MHz).
	<ul style="list-style-type: none">▪ For conducted unwanted emissions into restricted bands (absolute emission limits). Devices with multiple transmit chains using options given below: (1) Measure and sum the spectra across the outputs or (2) Measure and add $10 \log(N)$ dB
<ul style="list-style-type: none">▪ For FCC KDB 662911 The methodology described here may overestimate array gain, thereby resulting in apparent failures to satisfy the out-of-band limits even if the device is actually compliant. In such cases, compliance may be demonstrated by performing radiated tests around the frequencies at which the apparent failures occurred.	

3.5.4 Test Setup





3.5.5 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.

3.5.6 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.

3.5.7 Test Result of Emissions in Restricted Frequency Bands

Refer as Appendix E



4 Test Equipment and Calibration Data

Instrument	Brand	Model No.	Serial No.	Characteristics	Calibration Date	Calibration Due Date	Remark
Loop Antenna	Teseq	HLA 6121	65417	9kHz - 30MHz	Oct. 13, 2023	Oct. 12, 2024	Radiation (03CH05-CB)
3m Semi Anechoic Chamber NSA	TDK	SAC-3M	03CH05-CB	30 MHz ~ 1 GHz	Aug. 02, 2023	Aug. 01, 2024	Radiation (03CH05-CB)
Bilog Antenna with 6dB Attenuator	TESEQ & EMCI	CBL 6112D & N-6-06	35236 & AT-N0610	30MHz ~ 2GHz	Mar. 23, 2024	Mar. 22, 2025	Radiation (03CH05-CB)
Amplifier	EMCI	EMC330N	980331	20MHz ~ 3GHz	May 02, 2024	May 01, 2025	Radiation (03CH05-CB)
Spectrum Analyzer	R&S	FSP40	100304	9kHz ~ 40GHz	Apr. 17, 2024	Apr. 16, 2025	Radiation (03CH05-CB)
EMI Test Receiver	R&S	ESR7	102172	9kHz ~ 7GHz	Oct. 20, 2023	Oct. 19, 2024	Radiation (03CH05-CB)
RF Cable-low	Woken	RG402	Low Cable-04+23	30MHz~1GHz	Dec. 06, 2023	Dec. 05, 2024	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	03CH04-CB	1GHz ~18GHz 3m	Feb. 24, 2022	Feb. 23, 2023	Radiation (03CH04-CB)
3m Semi Anechoic Chamber VSWR	TDK	SAC-3M	03CH04-CB	1GHz ~18GHz 3m	Feb. 23, 2023	Feb. 22, 2024	Radiation (03CH04-CB)
Horn Antenna	ETS • Lindgren	3115	00143147	750MHz~18GHz	Oct. 12, 2022	Oct. 11, 2023	Radiation (03CH04-CB)
Horn Antenna	Schwarzbeck	BBHA 9170	BBHA9170252	15GHz ~ 40GHz	Sep. 04, 2023	Sep. 03, 2024	Radiation (03CH04-CB)
Pre-Amplifier	Agilent	83017A	MY53270063	0.5GHz ~ 26.5GHz	Jul. 01, 2022	Jun. 30, 2023	Radiation (03CH04-CB)
Pre-Amplifier	SGH	SGH184	20221107-3	18GHz ~ 40GHz	Nov. 24, 2023	Nov. 23, 2024	Radiation (03CH04-CB)
Spectrum Analyzer	R&S	FSP40	100142	9kHz~40GHz	Mar. 28, 2022	Mar. 27, 2023	Radiation (03CH04-CB)
RF Cable-high	Woken	RG402	High Cable-21	1GHz - 18GHz	Oct. 03, 2022	Oct. 02, 2023	Radiation (03CH04-CB)
RF Cable-high	Woken	RG402	High Cable-21+67	1GHz - 18GHz	Oct. 03, 2022	Oct. 02, 2023	Radiation (03CH04-CB)
High Cable	Woken	WCA0929M	40G#5+6	1GHz ~ 40GHz	Jan. 11, 2024	Jan. 10, 2025	Radiation (03CH04-CB)
Test Software	SPORTON	SENSE	V5.10	-	N.C.R.	N.C.R.	Radiation (03CH04-CB)



Instrument	Brand	Model No.	Serial No.	Characteristics	Calibration Date	Calibration Due Date	Remark
Spectrum analyzer	R&S	FSV40	101027	9kHz~40GHz	Aug. 14, 2023	Aug. 13, 2024	Conducted (TH02-CB)
Power Sensor	Anritsu	MA2411B	1126203	300MHz~40GHz	Oct. 19, 2023	Oct. 18, 2024	Conducted (TH02-CB)
Power Meter	Anritsu	ML2495A	1210004	300MHz~40GHz	Oct. 19, 2023	Oct. 18, 2024	Conducted (TH02-CB)
RF Cable-high	Woken	RG402	High Cable-01	1GHz – 18GHz	Oct. 02, 2023	Oct. 01, 2024	Conducted (TH02-CB)
RF Cable-high	Woken	RG402	High Cable-02	1GHz – 18GHz	Oct. 02, 2023	Oct. 01, 2024	Conducted (TH02-CB)
RF Cable-high	Woken	RG402	High Cable-03	1GHz – 18GHz	Oct. 02, 2023	Oct. 01, 2024	Conducted (TH02-CB)
RF Cable-high	Woken	RG402	High Cable-04	1GHz – 18GHz	Oct. 02, 2023	Oct. 01, 2024	Conducted (TH02-CB)
RF Cable-high	Woken	RG402	High Cable-05	1GHz – 18GHz	Oct. 02, 2023	Oct. 01, 2024	Conducted (TH02-CB)
Switch	SPTCB	SP-SWI	SWI-02	1–26.5GHz	Oct. 03, 2023	Oct. 02, 2024	Conducted (TH02-CB)
Test Software	SPORTON	SENSE	V5.10	-	N.C.R.	N.C.R.	Conducted (TH02-CB)

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

NCR means Non-Calibration required.

**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)	710k	1.051M	1M05F1D	710k	1.051M
BT-LE(1Mbps)	646.25k	1.054M	1M05F1D	646.25k	1.054M
BT-LE(1Mbps)	648.75k	1.061M	1M06F1D	648.75k	1.061M

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	710k	1.051M
2440MHz	Pass	500k	646.25k	1.054M
2480MHz	Pass	500k	648.75k	1.061M

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

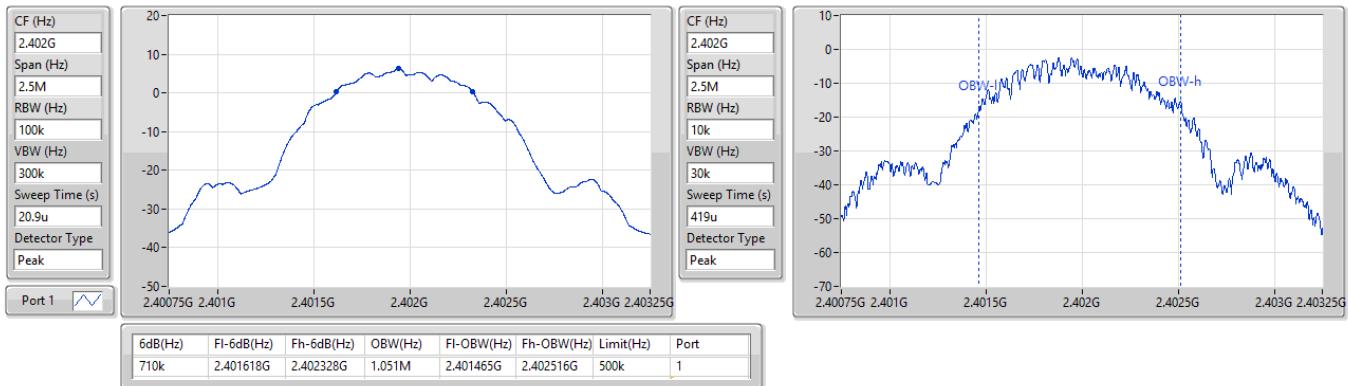


2.4-2.4835GHz_BT-LE(1Mbps)

EBW-DTS

2402MHz

26/02/2024



2.4-2.4835GHz_BT-LE(1Mbps)

EBW-DTS

2440MHz

26/02/2024

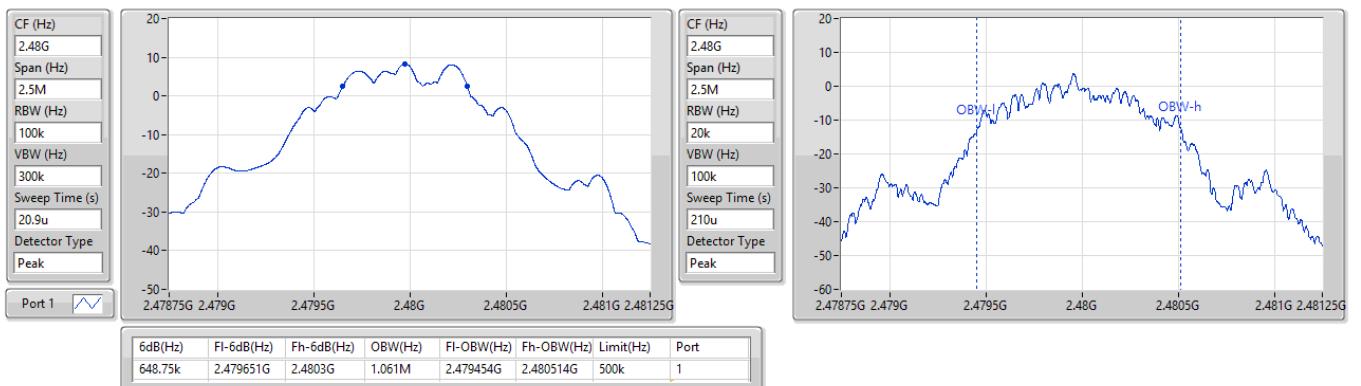


2.4-2.4835GHz_BT-LE(1Mbps)

EBW-DTS

2480MHz

26/02/2024



**Summary**

Mode	Total Power (dBm)	Total Power (W)
2.4-2.4835GHz	-	-
BT-LE(1Mbps)	7.80	0.00603
BT-LE(1Mbps)	8.47	0.00703
BT-LE(1Mbps)	8.85	0.00767

**Result**

Mode	Result	DG (dBi)	Total Power (dBm)	Power Limit (dBm)
BT-LE(1Mbps)	-	-	-	-
2402MHz	Pass	2.55	7.80	30.00
2440MHz	Pass	2.55	8.47	30.00
2480MHz	Pass	2.55	8.85	30.00

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

**Summary**

Mode	PD (dBm/RBW)
2.4-2.4835GHz	-
BT-LE(1Mbps)	-6.76
BT-LE(1Mbps)	-5.97
BT-LE(1Mbps)	-5.82

RBW = 3kHz;

**Result**

Mode	Result	DG (dB) 	PD (dBm/RBW)	PD Limit (dBm/RBW)
BT-LE(1Mbps)	-	-	-	-
2402MHz	Pass	2.55	-6.76	8.00
2440MHz	Pass	2.55	-5.97	8.00
2480MHz	Pass	2.55	-5.82	8.00

DG = Directional Gain; RBW = 3kHz;

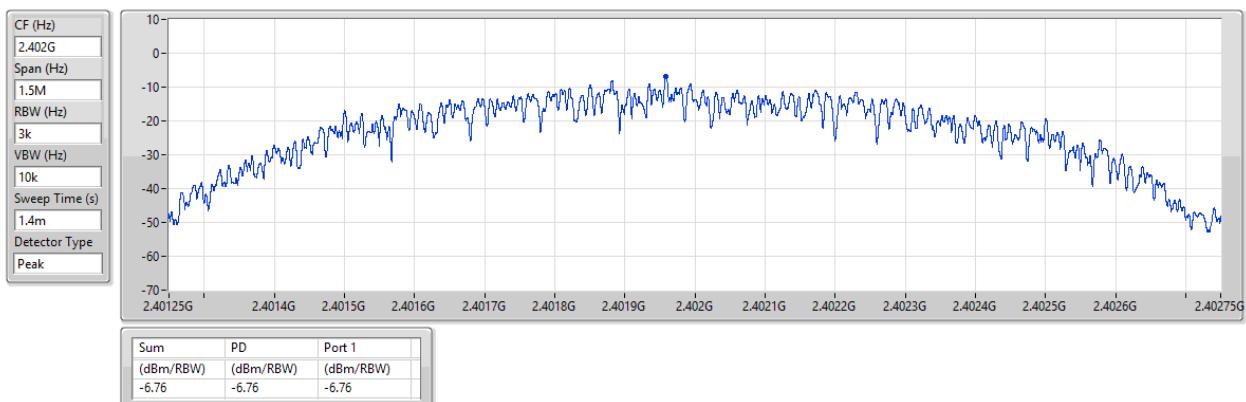
PD = trace bin-by-bin of each transmits port summing can be performed maximum power density; Port X = Port X Power Density;

2.4-2.4835GHz_BT-LE(1Mbps)

PSD

2402MHz

26/02/2024

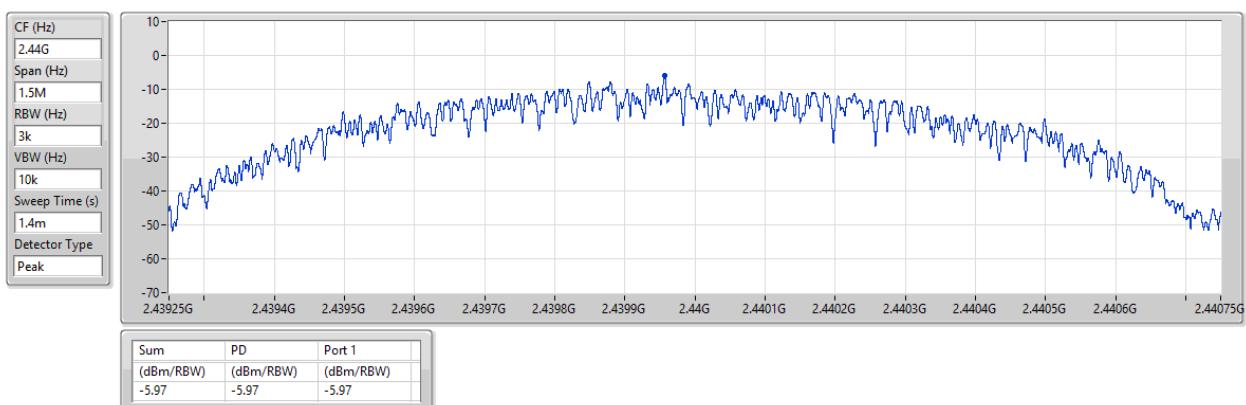


2.4-2.4835GHz_BT-LE(1Mbps)

PSD

2440MHz

26/02/2024

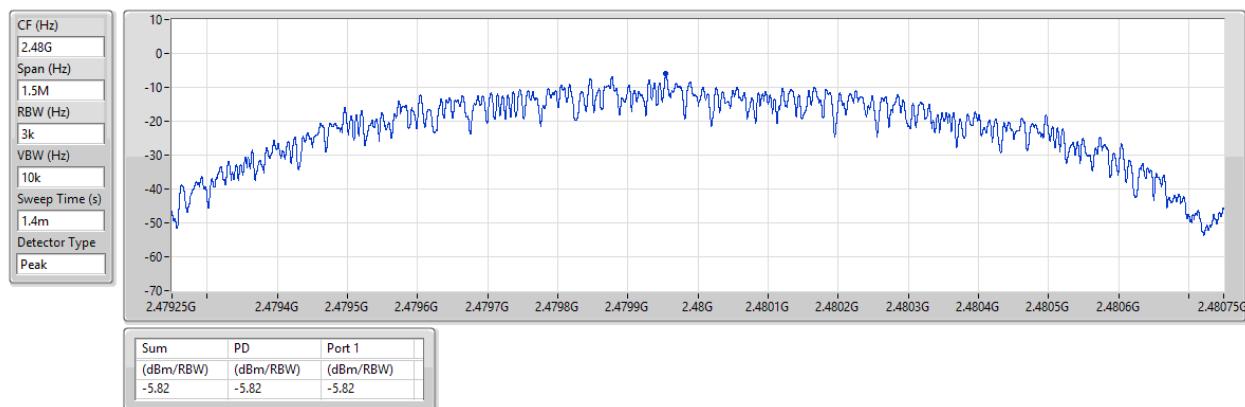


2.4-2.4835GHz_BT-LE(1Mbps)

PSD

2480MHz

26/02/2024

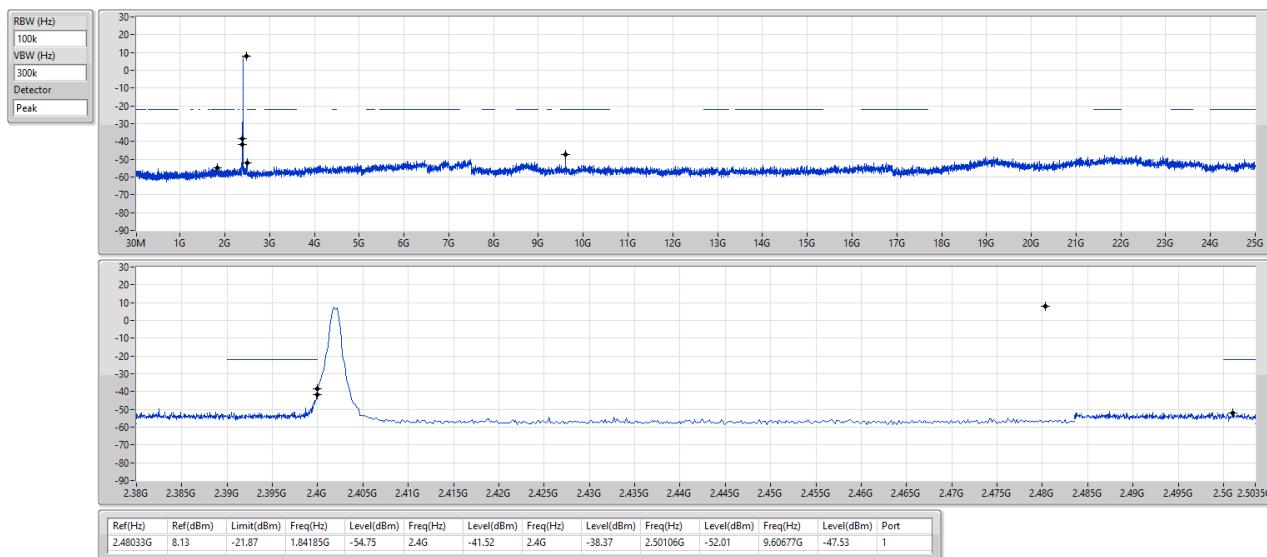
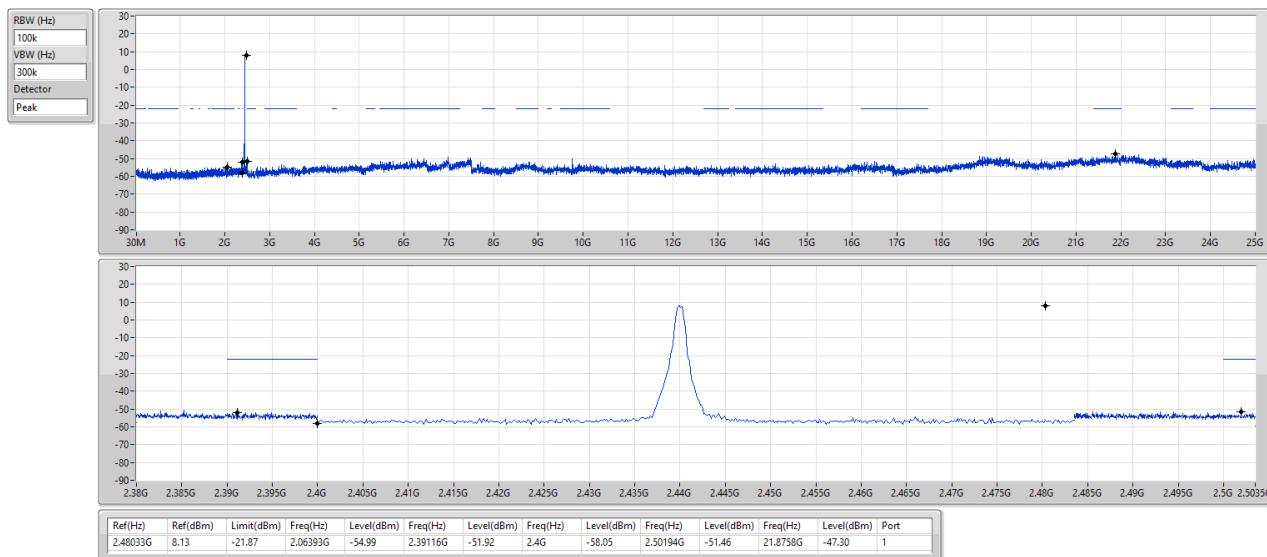


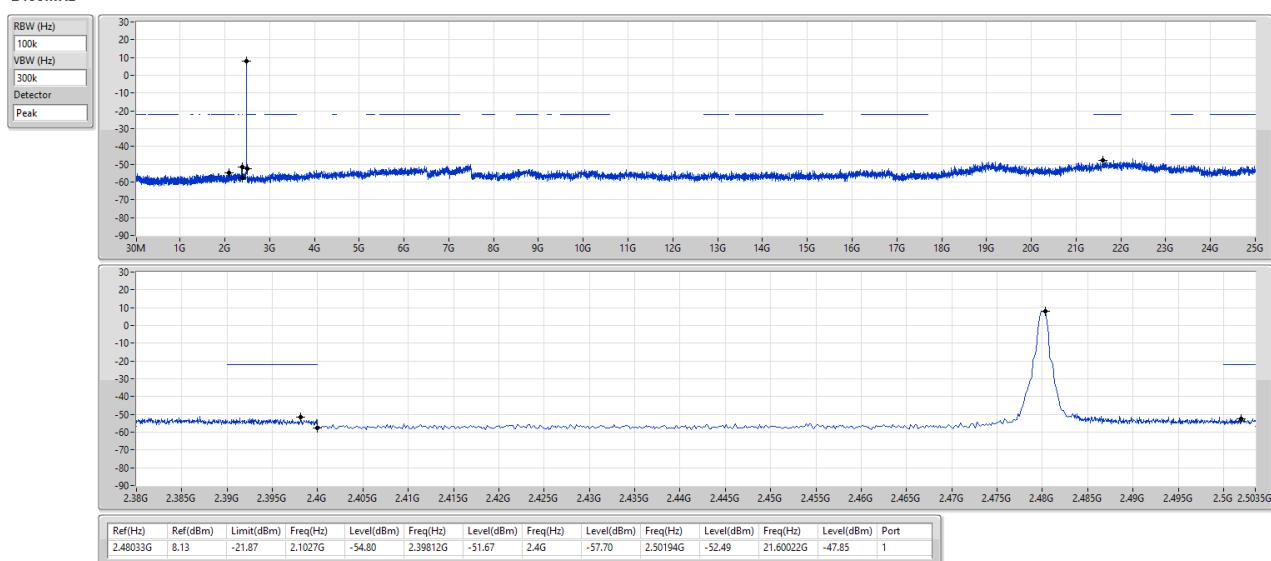
**Summary**

Mode	Result	Ref (Hz)	Ref (dBm)	Limit (dBm)	Freq (Hz)	Level (dBm)	Port								
2.4-2.4835GHz	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
BT-LE(1Mbps)	Pass	2.48033G	8.13	-21.87	1.84185G	-54.75	2.4G	-41.52	2.4G	-38.37	2.50106G	-52.01	9.60677G	-47.53	1
BT-LE(1Mbps)	Pass	2.48033G	8.13	-21.87	2.06393G	-54.99	2.39116G	-51.92	2.4G	-58.05	2.50194G	-51.46	21.8758G	-47.30	1
BT-LE(1Mbps)	Pass	2.48033G	8.13	-21.87	2.1027G	-54.80	2.39812G	-51.67	2.4G	-57.70	2.50194G	-52.49	21.60022G	-47.85	1

**Result**

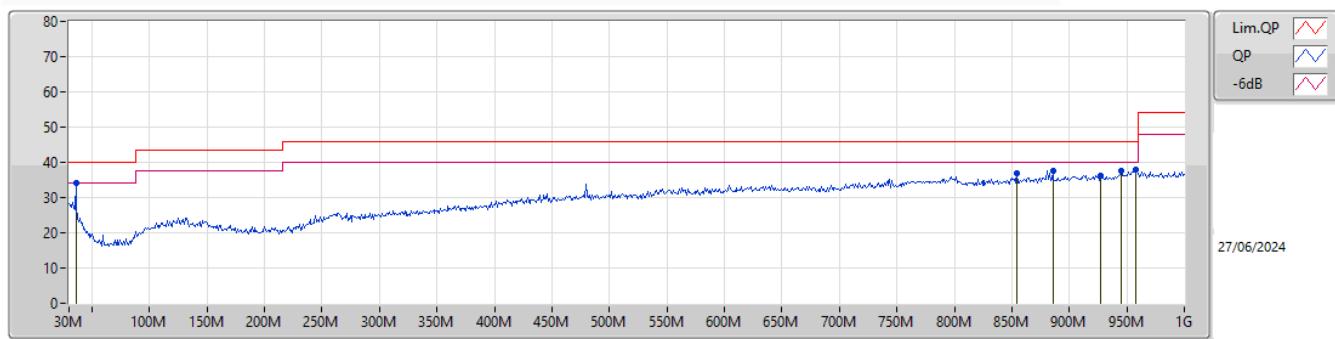
Mode	Result	Ref (Hz)	Ref (dBm)	Limit (dBm)	Freq (Hz)	Level (dBm)	Port								
BT-LE(1Mbps)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2402MHz	Pass	2.48033G	8.13	-21.87	1.84185G	-54.75	2.4G	-41.52	2.4G	-38.37	2.50106G	-52.01	9.60677G	-47.53	1
2440MHz	Pass	2.48033G	8.13	-21.87	2.06393G	-54.99	2.39116G	-51.92	2.4G	-58.05	2.50194G	-51.46	21.8758G	-47.30	1
2480MHz	Pass	2.48033G	8.13	-21.87	2.1027G	-54.80	2.39812G	-51.67	2.4G	-57.70	2.50194G	-52.49	21.60022G	-47.85	1

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

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


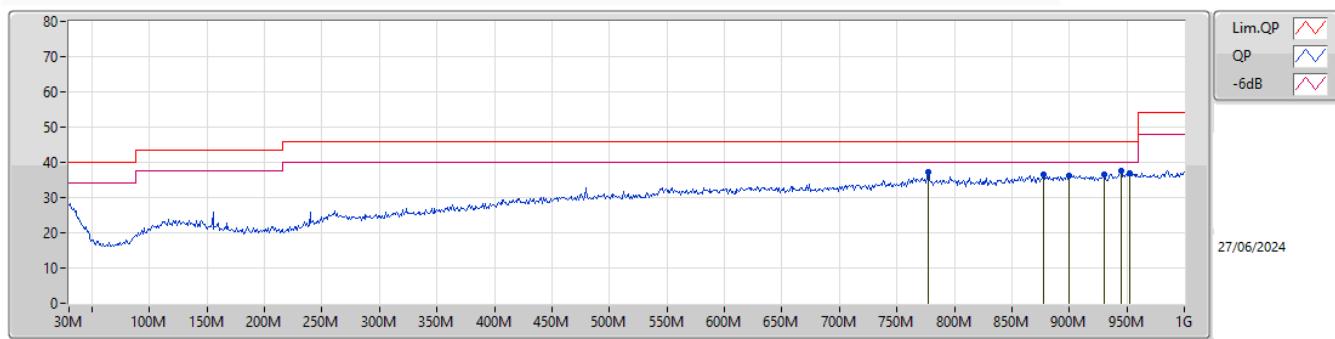
2.4-2.4835GHz_BT-LE(1Mbps)
CSENdB-DTS
2480MHz


**Summary**

Mode	Result	Type	Freq (Hz)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Condition
Mode 1	Pass	PK	35.82M	34.09	40.00	-5.91	Vertical

**Mode 1**

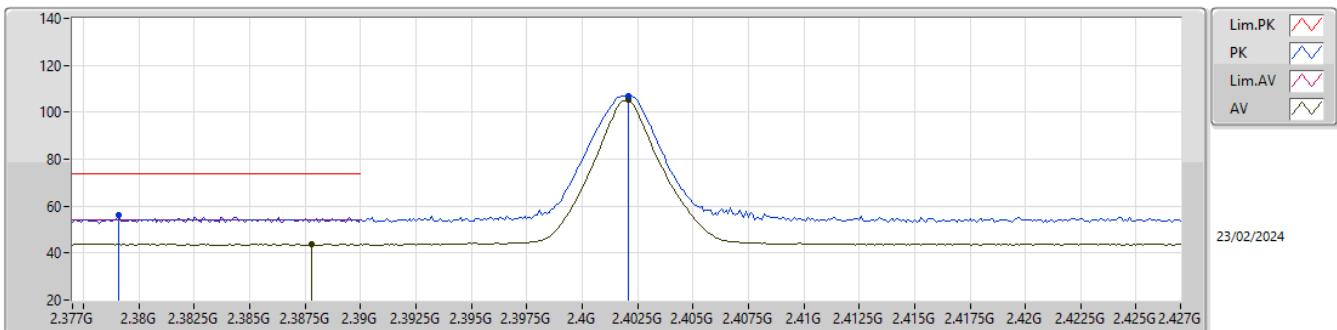
Type	Freq (Hz)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Factor (dB/m)	Dist (m)	Condition	Azimuth (°)	Height (m)	Comment	Raw (dBuV/m)	AF (dB/m)	CL (dB)	PA (dB)		
PK	35.82M	34.09	40.00	-5.91	-9.13	3	Vertical	18	1.50	"Worst"	43.22	21.27	1.10	31.50		
PK	854.5M	36.87	46.00	-9.13	-0.59	3	Vertical	80	3.00	-	37.46	26.10	5.63	32.32		
PK	885.54M	37.49	46.00	-8.51	-0.21	3	Vertical	322	1.25	-	37.70	26.37	5.77	32.35		
PK	927.25M	36.21	46.00	-9.79	0.04	3	Vertical	185	1.25	-	36.17	26.45	5.92	32.33		
PK	944.71M	37.65	46.00	-8.35	0.25	3	Vertical	179	1.25	-	37.40	26.59	5.97	32.31		
PK	958.29M	37.98	46.00	-8.02	0.42	3	Vertical	26	2.00	-	37.56	26.72	6.01	32.31		

**Mode 1**

Type	Freq (Hz)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Factor (dB/m)	Dist (m)	Condition	Azimuth (°)	Height (m)	Comment	Raw (dBuV/m)	AF (dB/m)	CL (dB)	PA (dB)	
PK	776.9M	37.37	46.00	-8.63	-1.37	3	Horizontal	338	3.00	-	38.74	25.64	5.34	32.35	
PK	877.78M	36.38	46.00	-9.62	-0.30	3	Horizontal	314	1.25	-	36.68	26.30	5.74	32.34	
PK	900.09M	36.29	46.00	-9.71	-0.12	3	Horizontal	129	2.00	-	36.41	26.41	5.84	32.37	
PK	930M	36.58	46.00	-9.42	0.04	3	Horizontal	349	3.00	-	36.54	26.45	5.92	32.33	
PK	944.71M	37.65	46.00	-8.35	0.25	3	Horizontal	343	1.00	"Worst"	37.40	26.59	5.97	32.31	
PK	952.47M	36.85	46.00	-9.15	0.32	3	Horizontal	310	3.00	-	36.53	26.63	5.99	32.30	

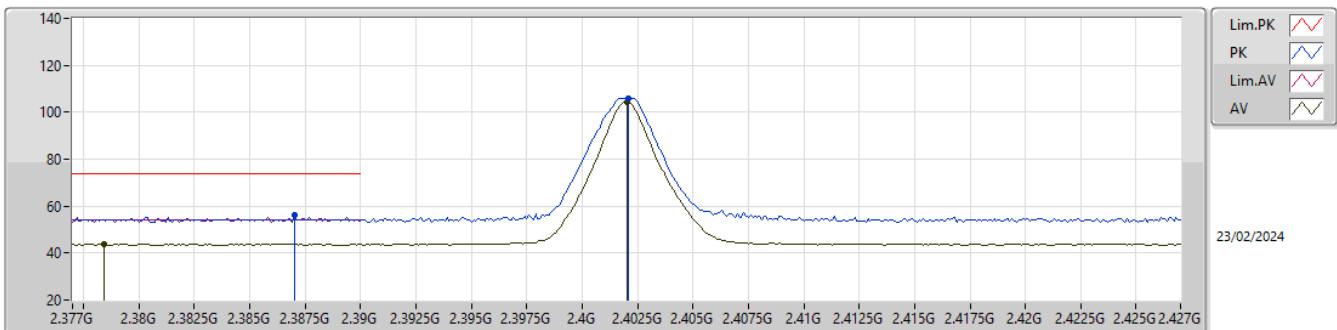
**Summary**

Mode	Result	Type	Freq (Hz)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Dist (m)	Condition	Azimuth (°)	Height (m)	Comments
2.4-2.4835GHz	-	-	-	-	-	-	-	-	-	-	-
BT-LE(1Mbps)	Pass	AV	2.4835G	50.86	54.00	-3.14	3	Vertical	106	1.31	-

2.4-2.4835GHz_BT-LE(1Mbps)
2402MHz_TX


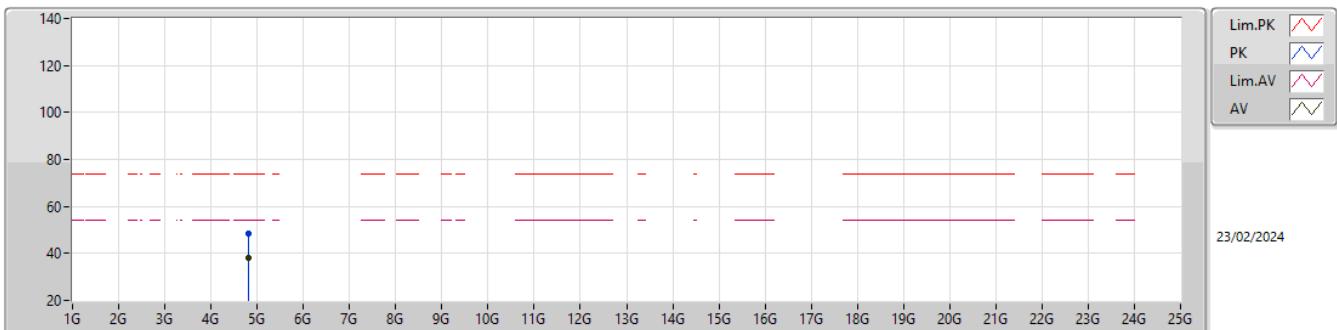
EUT X_1TX
Setting Default
04-C-Y-1

Type	Freq (Hz)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Raw (dBuV)	Dist (m)	Condition (*)	Azimuth (m)	Height (m)	Comment	AF (dB)	CL (dB)	PA (dB)			
PK	2.3791G	56.34	74.00	-17.66	25.59	3	Vertical	90	1.16	-	27.41	3.34	-			
AV	2.3878G	44.01	54.00	-9.99	13.26	3	Vertical	90	1.16	-	27.40	3.35	-			
PK	2.4021G	106.76	Inf	-Inf	75.91	3	Vertical	90	1.16	-	27.50	3.35	-			
AV	2.4021G	105.09	Inf	-Inf	74.24	3	Vertical	90	1.16	-	27.50	3.35	-			

2.4-2.4835GHz_BT-LE(1Mbps)
2402MHz_TX


EUT X_1TX
Setting Default
04-C-Y-1

Type	Freq (Hz)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Raw (dBuV)	Dist (m)	Condition (*)	Azimuth (°)	Height (m)	Comment	AF (dB)	CL (dB)	PA (dB)			
PK	2.387G	55.96	74.00	-18.04	25.22	3	Horizontal	97	1.19	-	27.40	3.34	-			
AV	2.3784G	43.99	54.00	-10.01	13.23	3	Horizontal	97	1.19	-	27.42	3.34	-			
PK	2.4021G	105.93	Inf	-Inf	75.08	3	Horizontal	97	1.19	-	27.50	3.35	-			
AV	2.402G	104.34	Inf	-Inf	73.49	3	Horizontal	97	1.19	-	27.50	3.35	-			

2.4-2.4835GHz_BT-LE(1Mbps)
2402MHz_TX


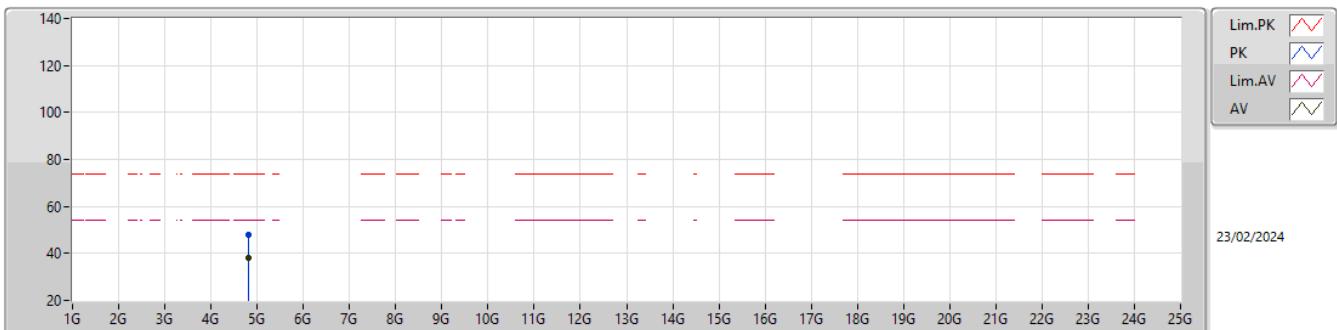
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Setting Default
04-C-Y-1

Type	Freq (Hz)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Raw (dBuV)	Dist (m)	Condition (*)	Azimuth (m)	Height (m)	Comment	AF (dB)	CL (dB)	PA (dB)			
PK	4.80388G	48.31	74.00	-25.69	43.63	3	Vertical	108	1.80	-	32.31	5.65	33.28			
AV	4.80414G	38.29	54.00	-15.71	33.61	3	Vertical	108	1.80	-	32.31	5.65	33.28			



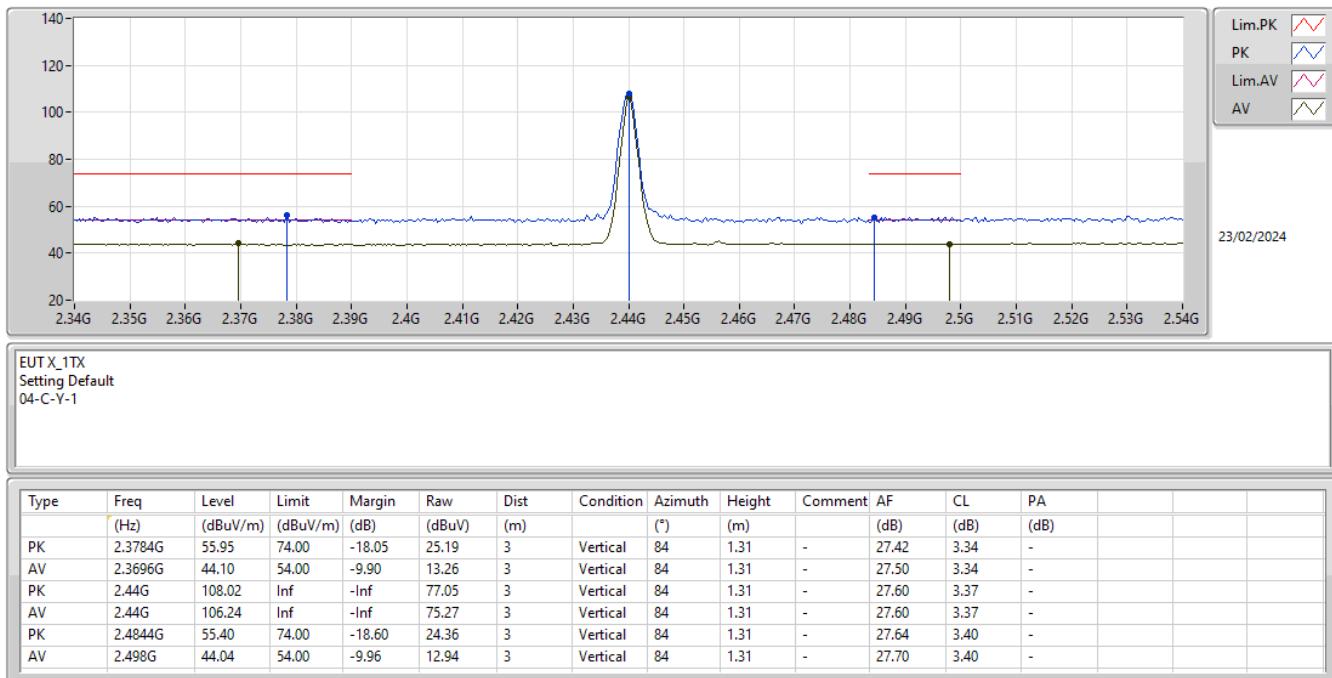
2.4-2.4835GHz_BT-LE(1Mbps)

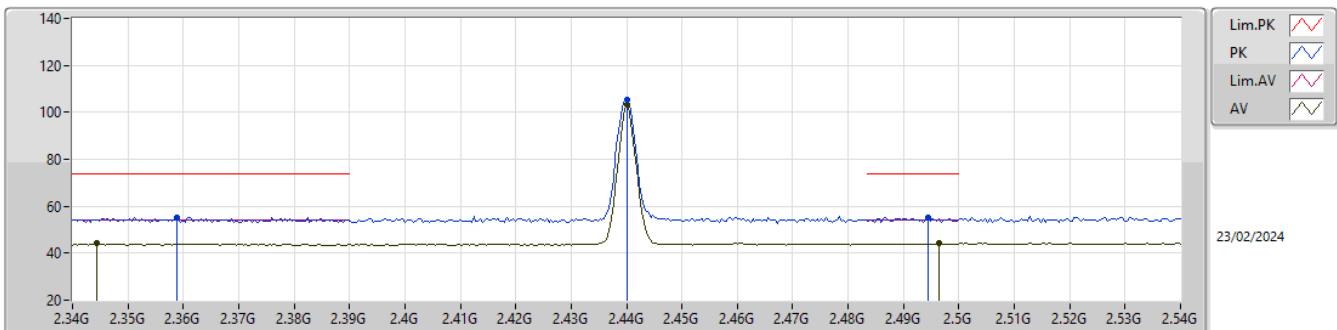
2402MHz_TX



EUT X_1TX
Setting Default
04-C-Y-1

Type	Freq (Hz)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Raw (dBuV)	Dist (m)	Condition (*)	Azimuth (m)	Height (m)	Comment	AF (dB)	CL (dB)	PA (dB)			
PK	4.80366G	47.82	74.00	-26.18	43.14	3	Horizontal	173	2.90	-	32.31	5.65	33.28			
AV	4.80386G	38.19	54.00	-15.81	33.51	3	Horizontal	173	2.90	-	32.31	5.65	33.28			

2.4-2.4835GHz_BT-LE(1Mbps)
2440MHz_TX


2.4-2.4835GHz_BT-LE(1Mbps)
2440MHz_TX


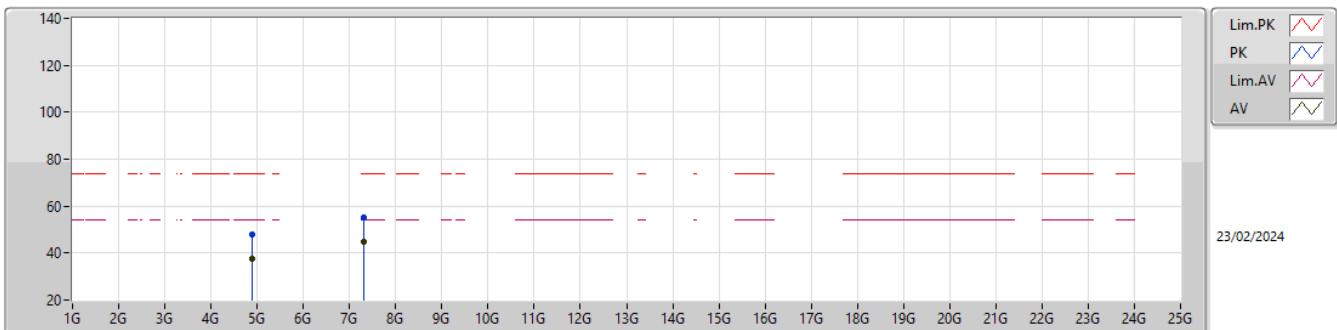
EUT X_1TX
Setting Default
04-C-Y-1

Type	Freq (Hz)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Raw (dBuV)	Dist (m)	Condition (*)	Azimuth (°)	Height (m)	Comment	AF (dB)	CL (dB)	PA (dB)			
PK	2.3588G	55.37	74.00	-18.63	24.64	3	Horizontal	38	1.30	-	27.40	3.33	-			
AV	2.3444G	44.21	54.00	-9.79	13.48	3	Horizontal	38	1.30	-	27.40	3.33	-			
PK	2.44G	105.55	Inf	-Inf	74.58	3	Horizontal	38	1.30	-	27.60	3.37	-			
AV	2.44G	103.51	Inf	-Inf	72.54	3	Horizontal	38	1.30	-	27.60	3.37	-			
PK	2.4944G	55.30	74.00	-18.70	24.20	3	Horizontal	38	1.30	-	27.70	3.40	-			
AV	2.4964G	44.08	54.00	-9.92	12.98	3	Horizontal	38	1.30	-	27.70	3.40	-			



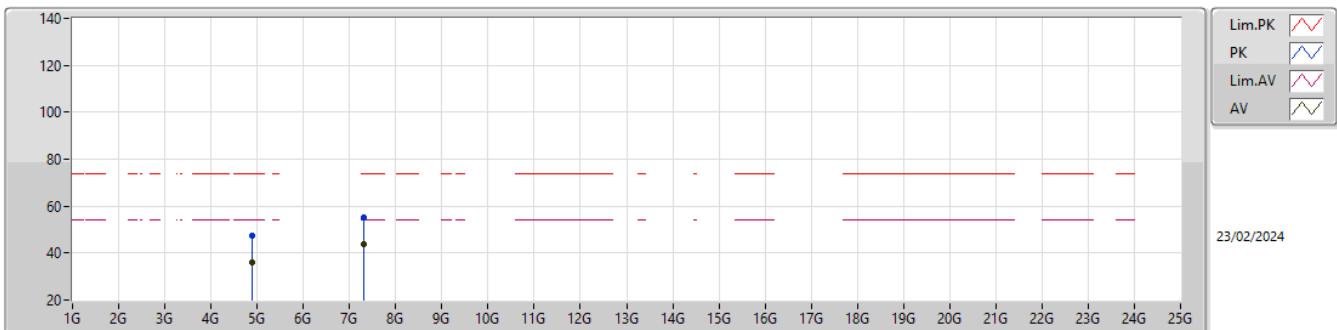
2.4-2.4835GHz_BT-LE(1Mbps)

2440MHz_TX



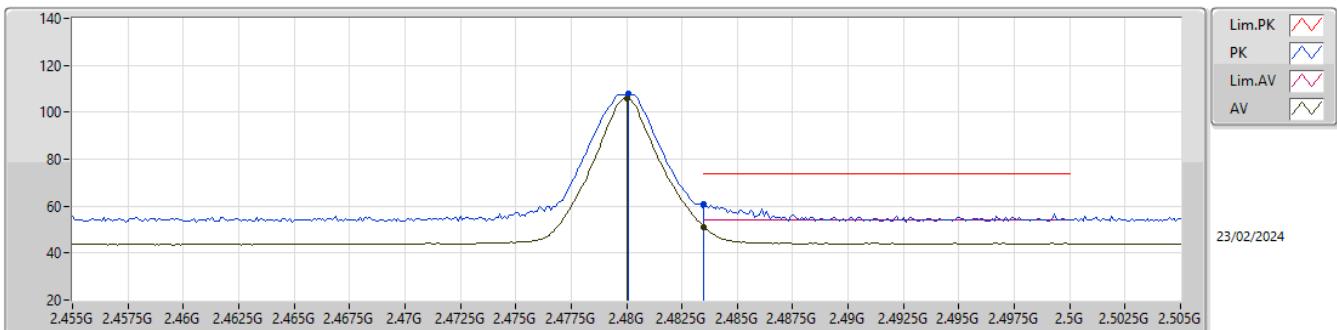
EUT X_1TX
Setting Default
04-C-Y-1

Type	Freq (Hz)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Raw (dBuV)	Dist (m)	Condition (*)	Azimuth (m)	Height (m)	Comment	AF (dB)	CL (dB)	PA (dB)				
PK	4.88024G	48.05	74.00	-25.95	43.06	3	Vertical	95	1.41	-	32.52	5.72	33.25				
AV	4.87952G	37.48	54.00	-16.52	32.49	3	Vertical	95	1.41	-	32.52	5.72	33.25				
PK	7.31914G	55.19	74.00	-18.81	44.96	3	Vertical	198	2.15	-	37.20	7.13	34.10				
AV	7.31924G	44.64	54.00	-9.36	34.41	3	Vertical	198	2.15	-	37.20	7.13	34.10				

2.4-2.4835GHz_BT-LE(1Mbps)
2440MHz_TX


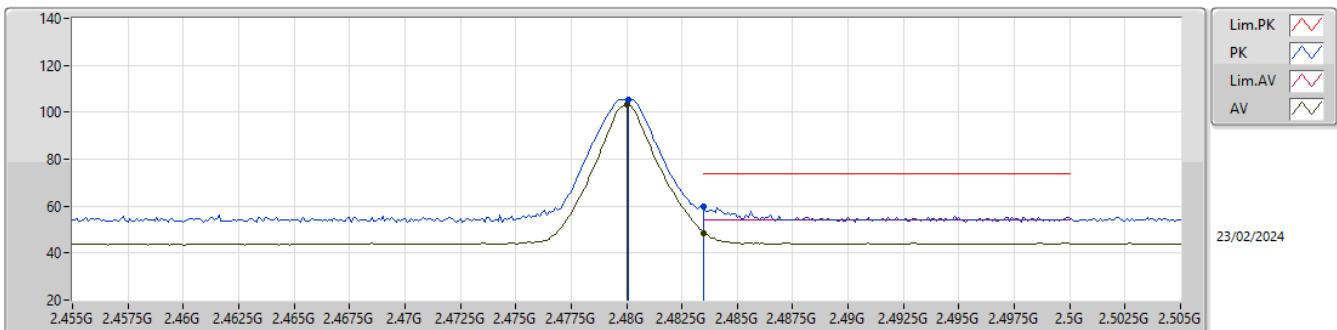
EUT X_1TX
Setting Default
04-C-Y-1

Type	Freq (Hz)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Raw (dBuV)	Dist (m)	Condition (*)	Azimuth (m)	Height (m)	Comment	AF (dB)	CL (dB)	PA (dB)			
PK	4.88018G	47.33	74.00	-26.67	42.34	3	Horizontal	170	1.02	-	32.52	5.72	33.25			
AV	4.87948G	36.26	54.00	-17.74	31.27	3	Horizontal	170	1.02	-	32.52	5.72	33.25			
PK	7.3206G	55.00	74.00	-19.00	44.77	3	Horizontal	30	1.00	-	37.20	7.13	34.10			
AV	7.31928G	43.99	54.00	-10.01	33.76	3	Horizontal	30	1.00	-	37.20	7.13	34.10			

2.4-2.4835GHz_BT-LE(1Mbps)
2480MHz_TX


EUT X_1TX
 Setting Default
 04-C-Y-1

Type	Freq (Hz)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Raw (dBuV)	Dist (m)	Condition (*)	Azimuth (m)	Height (m)	Comment	AF (dB)	CL (dB)	PA (dB)			
PK	2.4801G	107.69	Inf	-Inf	76.70	3	Vertical	106	1.31	-	27.60	3.39	-			
AV	2.48G	105.99	Inf	-Inf	75.00	3	Vertical	106	1.31	-	27.60	3.39	-			
PK	2.4835G	60.65	74.00	-13.35	29.61	3	Vertical	106	1.31	-	27.64	3.40	-			
AV	2.4835G	50.86	54.00	-3.14	19.82	3	Vertical	106	1.31	-	27.64	3.40	-			

2.4-2.4835GHz_BT-LE(1Mbps)
2480MHz_TX


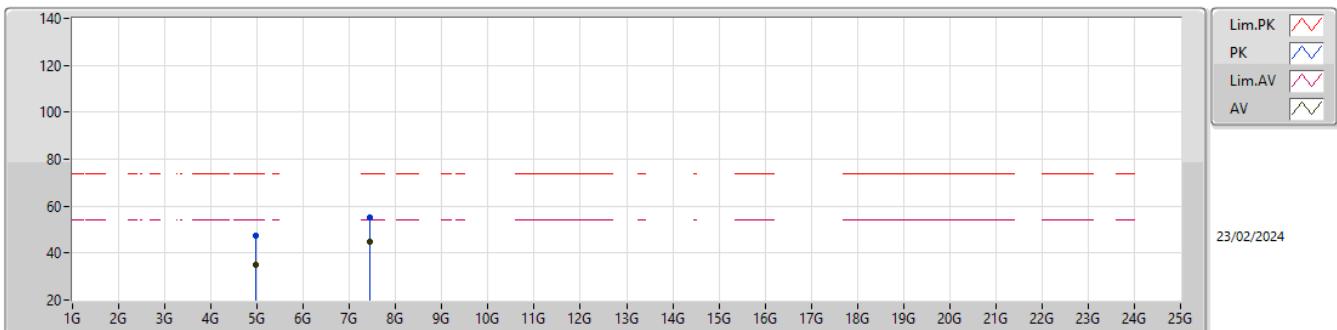
EUT X_1TX
Setting Default
04-C-Y-1

Type	Freq (Hz)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Raw (dBuV)	Dist (m)	Condition (*)	Azimuth	Height (m)	Comment	AF (dB)	CL (dB)	PA (dB)			
PK	2.4801G	105.45	Inf	-Inf	74.46	3	Horizontal	39	2.72	-	27.60	3.39	-			
AV	2.48G	103.22	Inf	-Inf	72.23	3	Horizontal	39	2.72	-	27.60	3.39	-			
PK	2.4835G	59.64	74.00	-14.36	28.60	3	Horizontal	39	2.72	-	27.64	3.40	-			
AV	2.4835G	48.63	54.00	-5.37	17.59	3	Horizontal	39	2.72	-	27.64	3.40	-			



2.4-2.4835GHz_BT-LE(1Mbps)

2480MHz_TX



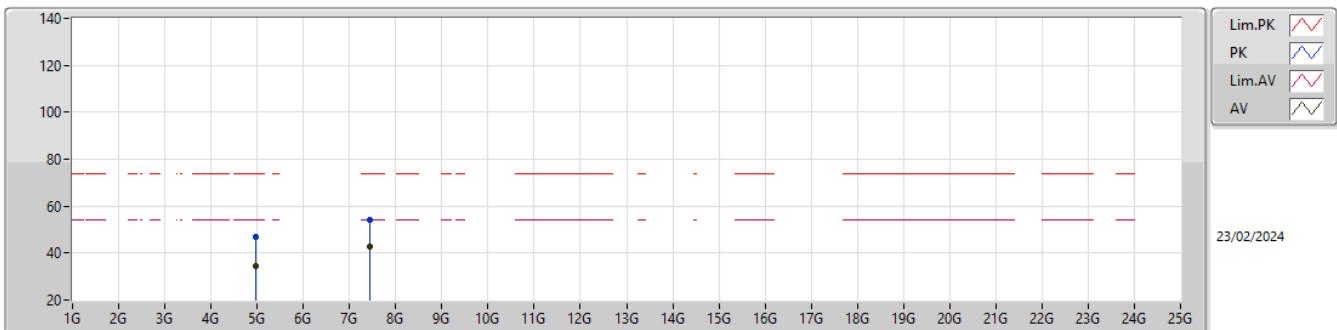
EUT X_1TX
Setting Default
04-C-Y-1

Type	Freq (Hz)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Raw (dBuV)	Dist (m)	Condition	Azimuth (*)	Height (m)	Comment	AF (dB)	CL (dB)	PA (dB)				
PK	4.96076G	47.20	74.00	-26.80	41.93	3	Vertical	97	1.69	-	32.70	5.79	33.22				
AV	4.9598G	35.06	54.00	-18.94	29.79	3	Vertical	97	1.69	-	32.70	5.79	33.22				
PK	7.43912G	55.02	74.00	-18.98	44.76	3	Vertical	171	2.09	-	37.20	7.21	34.15				
AV	7.43922G	44.69	54.00	-9.31	34.43	3	Vertical	171	2.09	-	37.20	7.21	34.15				



2.4-2.4835GHz_BT-LE(1Mbps)

2480MHz_TX



EUT X_1TX
Setting Default
04-C-Y-1

Type	Freq (Hz)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Raw (dBuV)	Dist (m)	Condition (*)	Azimuth	Height (m)	Comment	AF (dB)	CL (dB)	PA (dB)				
PK	4.95924G	46.74	74.00	-27.26	41.47	3	Horizontal	12	1.00	-	32.70	5.79	33.22				
AV	4.9596G	34.40	54.00	-19.60	29.13	3	Horizontal	12	1.00	-	32.70	5.79	33.22				
PK	7.43924G	54.39	74.00	-19.61	44.13	3	Horizontal	28	1.05	-	37.20	7.21	34.15				
AV	7.43936G	42.92	54.00	-11.08	32.66	3	Horizontal	28	1.05	-	37.20	7.21	34.15				