Testing Laboratory 3787

RADIO TEST REPORT

FCC ID	:	TVE-111M01A
Equipment	:	Secured Network Extension Device
Brand Name	:	FORTINET
Model Name	:	FortiExtender 312Fxxxxxx, FORTIEXTENDER-312Fxxxxxx, FEX-312Fxxxxxx, FortiExtender 311Fxxxxxx, FORTIEXTENDER-311Fxxxxxx, FEX-311Fxxxxxx (Refer to section 1.1.6 for detail information)
Applicant	:	Fortinet, Inc. 899 Kifer Road, Sunnyvale, CA 94086 USA
Manufacturer	:	Fortinet, Inc. 899 Kifer Road, Sunnyvale, CA 94086 USA
Standard	:	47 CFR FCC Part 15.247

The product was received on Jun. 28, 2021, and testing was started from Jul. 08, 2021 and completed on Jul. 19, 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

Report No.	Version	Description	Issued Date
FR162527AB	01	Initial issue of report	Dec. 28, 2021

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	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:

1. The test configuration, test mode and test software were written in this test report are declared by the manufacturer.
2. 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: Viola Huang

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	1
2.4-2.4835GHz	BT-LE(2Mbps)	2	1

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

1.1.2 Antenna Information

For Bluetooth antenna

Ant.	Port	Brand	Model Name	Antenna Type	Connector	Gain (dBi)
1	1	WIESON	102700000021A	Chip Antenna	N/A	1.08

Note: The above information was declared by manufacturer.

For bluetooth mode (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)	0.609	2.15	380.313u	3k
BT-LE(2Mbps)	0.314	5.03	196.25u	10k

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

1.1.4 EUT Operational Condition

EUT Power Type	From power adapter or PoE			
Function	☒	Point-to-multipoint	☐	Point-to-point
Test Software Version	WCN_Comb (version 2.1749.00)			
Support Mode	☒	LE 1M PHY: 1 Mb/s		
	☐	LE Coded PHY (S=2): 500 Kb/s		
	☐	LE Coded PHY (S=8): 125 Kb/s		
	☒	LE 2M PHY: 2 Mb/s		

Note: The above information was declared by manufacturer.

The device has been installed with two certified WWAN modules. (FCC ID: XMR2020EM160RGL)

1.1.5 Table for Multiple Listing

Equipment Name	EUT No.	Model Name	Description
Secured Network Extension Device	EUT 1	FortiExtender 312Fxxxxxx, FORTIEXTENDER-312Fxxxxxx, FEX-312Fxxxxxx (where “x” can be “0-9”, or “A-Z”, or “-“, or blank for marketing purposes or software changes only and no Safety or EMC related changes)	Contain two certified WWAN Modules
Secured Network Extension Device	EUT 2	FortiExtender 311Fxxxxxx, FORTIEXTENDER-311Fxxxxxx, FEX-311Fxxxxxx (where “x” can be “0-9”, or “A-Z”, or “-“, or blank for marketing purposes or software changes only and no Safety or EMC related changes)	Contain one certified WWAN Module

Note 1: From the above models, model: FEX-312F (EUT 1) was selected as representative model for the test and its data was recorded in this report.

Note 2: The above information was declared by manufacturer.

1.2 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	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	TH02-CB	Paul Chen	24.7-26.4 / 54-57	Jul. 09, 2021
Radiated below 1GHz	10CH01-CB	Zack KUo	24-26 / 48-50	Jul. 15, 2021
Radiated above 1GHz	03CH05-CB	Stim Sung	26.2-27.7 / 65-69	Jul. 08, 2021~Jul. 09, 2021
AC Conduction	CO01-CB	Peter Wu	24-25 / 58-59	Jul. 19, 2021

1.4 Measurement Uncertainty

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

Test Items	Uncertainty	Remark
Conducted Emission (150kHz ~ 30MHz)	2.0 dB	Confidence levels of 95%
Radiated Emission (9kHz ~ 30MHz)	1.6 dB	Confidence levels of 95%
Radiated Emission (30MHz ~ 1,000MHz)	4.2 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%

2 Test Configuration of EUT

2.1 Test Channel Mode

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

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	GPS + Bluetooth + Sim 1 (Left) LTE Band 2 link + Sim 1 (Right) WCDMA Band 2 link + Adapter
2	GPS + Bluetooth + Sim 2 (Left) WCDMA Band 2 link + Sim 2 (Right) LTE Band 2 link + Adapter
Mode 1 has been evaluated to be the worst case among Mode 1~2, thus the measurement for Mode 3 will follow this same test mode.	
3	GPS + Bluetooth + Sim 1 (Left) LTE Band 2 link + Sim 1 (Right) WCDMA Band 2 link + PoE
For operating mode 3 is the worst case and it was record in this test report.	

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	Normal Link
1	EUT in Z axis-GPS + Bluetooth + Sim 1 (Left) LTE Band 2 link + Sim 1 (Right) WCDMA Band 2 link + Adapter
2	EUT in Y axis-GPS + Bluetooth + Sim 1 (Left) LTE Band 2 link + Sim 1 (Right) WCDMA Band 2 link + Adapter
Mode 1 has been evaluated to be the worst case among Mode 1~2, thus the measurement for Mode 3 will follow this same test mode.	
3	EUT in Z axis-GPS + Bluetooth + Sim 2 (Left) WCDMA Band 2 link + Sim 2 (Right) LTE Band 2 link + Adapter
Mode 1 has been evaluated to be the worst case among Mode 1~3, thus the measurement for Mode 4 will follow this same test mode.	
4	EUT in Z axis-GPS + Bluetooth + Sim 1 (Left) LTE Band 2 link + Sim 1 (Right) WCDMA Band 2 link + PoE
For operating mode 4 is the worst case and it was record in this test report.	
Operating Mode > 1GHz	CTX
	The EUT was performed at Y axis and Z axis position for Radiated emission above 1GHz test, and the worst case was found at Y axis. So the measurement will follow this same test configuration.
1	EUT in Y axis

Note: The Adapter and PoE are for measurement only, would not be marketed.

Adapter and PoE information as below:

Power	Brand	Model
Adapter	APD	WA-36A12R
PoE	Fortinet	FortiSwitch 108F-FPOE

2.3 EUT Operation during Test

For CTX Mode:

The EUT was programmed to be in continuously transmitting mode.

For Normal Link:

During the test, the EUT operation to normal function.

2.4 Accessories

N/A

2.5 Support Equipment

For AC Conduction:

Support Equipment				
No.	**Equipment**	**Brand Name**	**Model Name**	**FCC ID**
A	SIM card	N/A	N/A	N/A
B	SIM card	N/A	N/A	N/A
C	Flash disk3.0	Transcend	JetFlash-700	N/A
D	PoE switch	Fortinet	FortiSwitch 108F-FPOE	N/A
E	WAN NB	DELL	E6430	N/A
F	PoE NB	DELL	E6430	N/A
G	GPS Simulator	WELNAVIGATE	GS-100	N/A
H	3G base station	R&S	CMU200	N/A
I	LTE Base station	Anritsu	MT8820C	N/A
J	Smart phone	Samsung	Galaxy J2	N/A
K	SFP NB	DELL	E6430	N/A
L	LAN NB	DELL	E6430	N/A

For Radiated (below 1GHz):

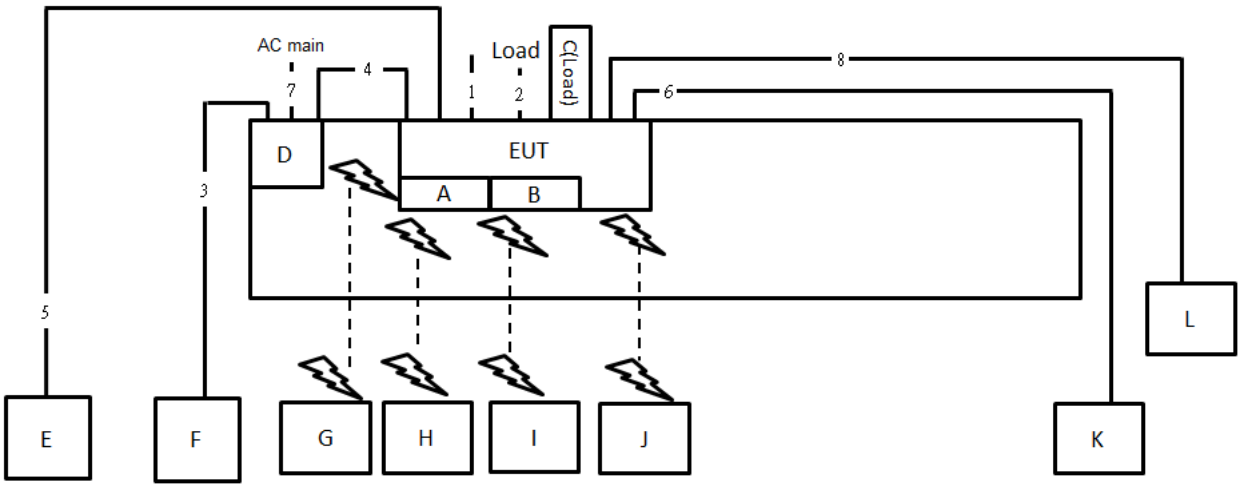
Support Equipment				
No.	**Equipment**	**Brand Name**	**Model Name**	**FCC ID**
A	SIM card	N/A	N/A	N/A
B	SIM card	N/A	N/A	N/A
C	Flash disk3.0	Transcend	JetFlash-700	N/A
D	PoE switch	Fortinet	FortiSwitch 108F-FPOE	N/A
E	WAN NB	DELL	E6430	N/A
F	PoE NB	DELL	E6430	N/A
G	GPS Simulator	WELNAVIGATE	GS-100	N/A
H	3G base station	R&S	CMU200	N/A
I	LTE Base station	Anritsu	MT8820C	N/A
J	Smart phone	Samsung	Galaxy J2	N/A
K	SFP NB	DELL	E6430	N/A
L	LAN NB	DELL	E6430	N/A

For Radiated (above 1GHz) and RF Conducted:

Support Equipment				
No.	**Equipment**	**Brand Name**	**Model Name**	**FCC ID**
A	NB	DELL	E4300	N/A
B	Adapter	APD	WA-36A12R	N/A

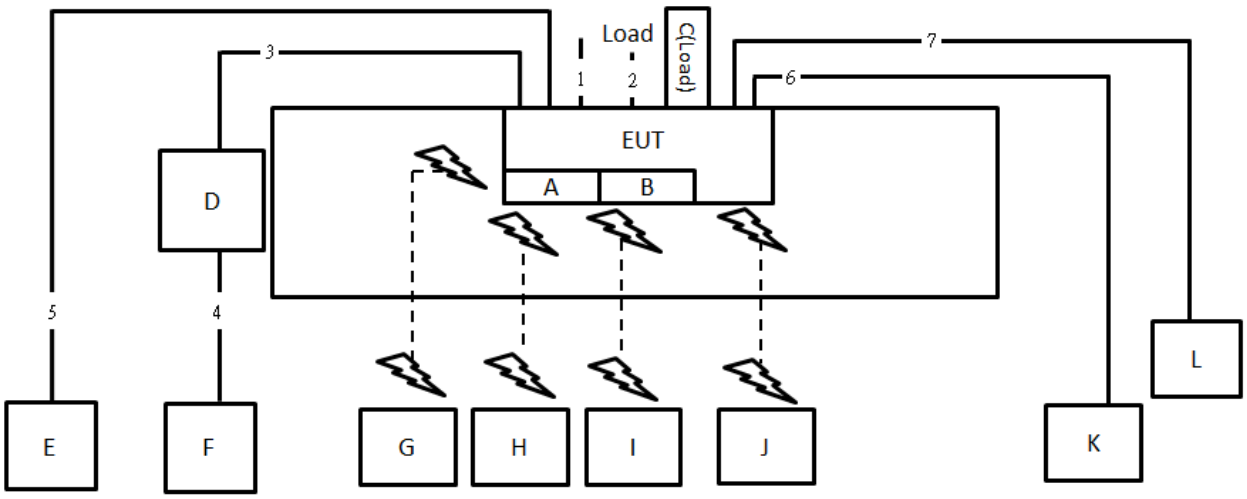
2.6 Test Setup Diagram

Test Setup Diagram – AC Line Conducted Emission Test



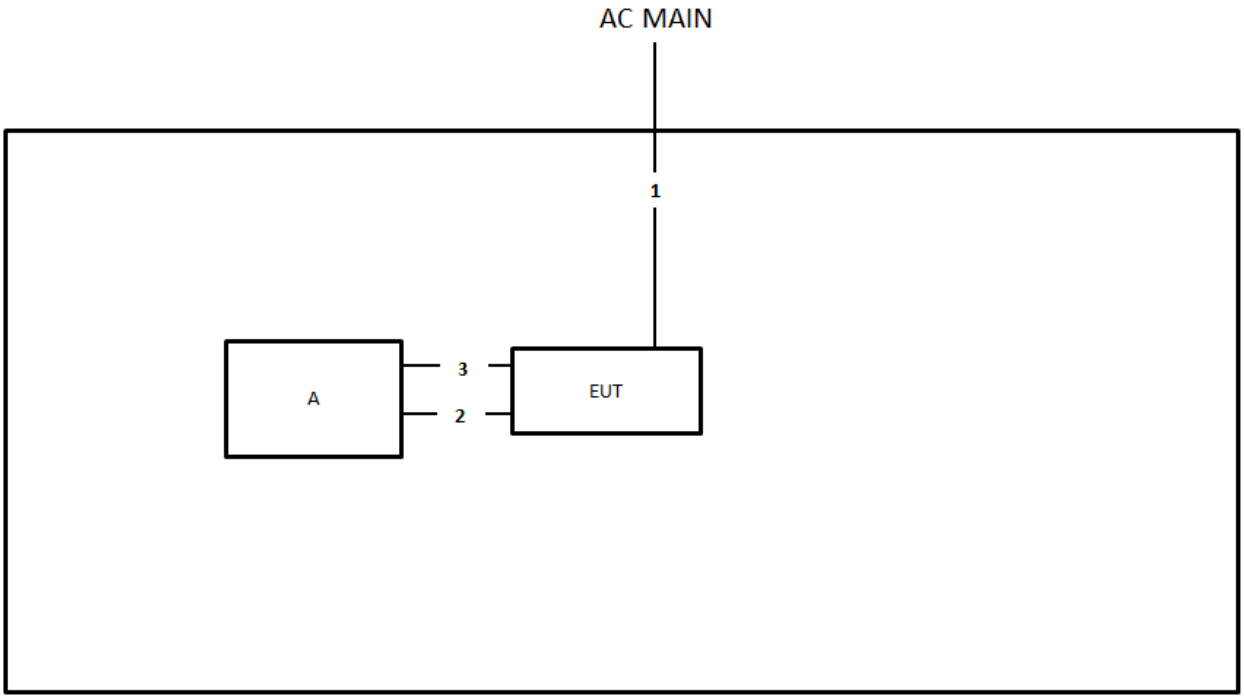
Item	Connection	Shielded	Length
1	Console cable	No	1.8m
2	RJ-45 cable*2	No	1.5m
3	RJ-45 cable	No	10m
4	RJ-45 cable	No	1.5m
5	RJ-45 cable	No	10m
6	RJ-45 cable	No	10m
7	Power cable	No	1.8m
8	RJ-45 cable	No	10m

Test Setup Diagram - Radiated Test < 1GHz



Item	Connection	Shielded	Length
1	Console cable	No	1.8m
2	RJ-45 cable*2	No	1.5m
3	RJ-45 cable	No	10m
4	RJ-45 cable	No	1.5m
5	RJ-45 cable	No	10m
6	RJ-45 cable	No	10m
7	RJ-45 cable	No	10m

Test Setup Diagram - Radiated Test > 1GHz



Item	Connection	Shielded	Length
1	Power cable	No	1.8m
2	RJ-45 cable	No	1.5m
3	Console cable	Yes	1.9m

3 Transmitter Test Result

3.1 AC Power-line Conducted Emissions

3.1.1 AC Power-line Conducted Emissions Limit

AC Power-line Conducted Emissions Limit		
Frequency Emission (MHz)	**Quasi-Peak**	**Average**
0.15-0.5	66 - 56 *	56 - 46 *
0.5-5	56	46
5-30	60	50
Note 1: * Decreases with the logarithm of the frequency.		

3.1.2 Measuring Instruments

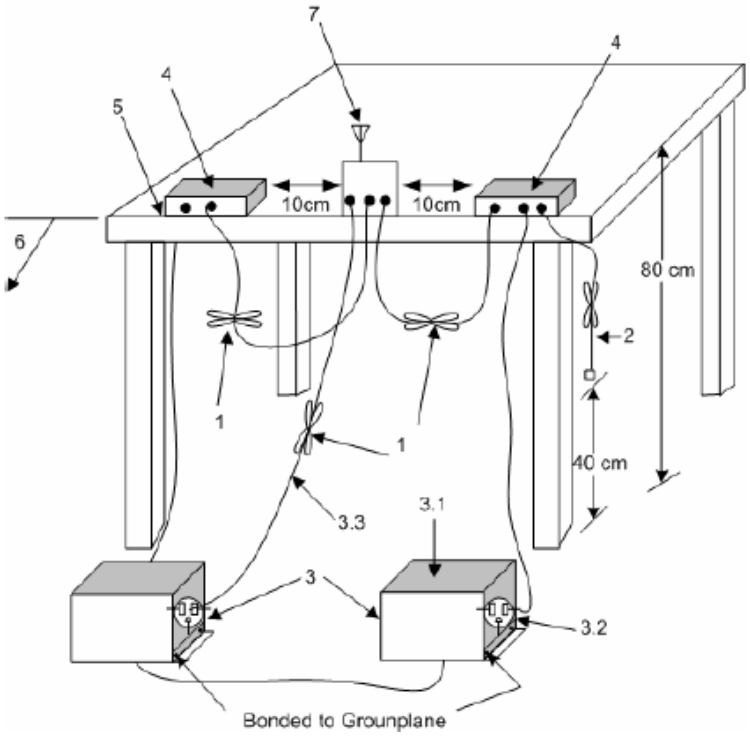
Refer a test equipment and calibration data table in this test report.

3.1.3 Test Procedures

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

3.1.4 Test Setup

AC Power-line Conducted Emissions



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

1.1.1. Measurement Results Calculation

The measured Level is calculated using:

a. Corrected Reading: LISN Factor (LISN) + Attenuator (AT/AUX) + Cable Loss (CL) + Read Level (Raw) = Level

b. Margin = -Limit + Level

3.1.5 Test Result of AC Power-line Conducted Emissions

Refer as Appendix A

3.2 DTS Bandwidth

3.2.1 6dB Bandwidth Limit

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

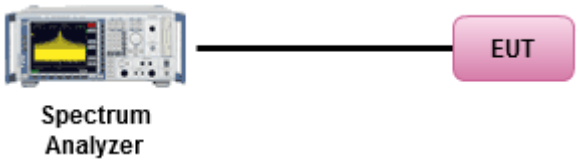
3.2.2 Measuring Instruments

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

3.2.3 Test Procedures

Test Method	
▪ For the emission bandwidth shall be measured using one of the options below:	
	☒ Refer as FCC KDB 558074, clause 8.2 & C63.10 clause 11.8.1 Option 1 for 6 dB bandwidth measurement.
	☐ Refer as FCC KDB 558074, clause 8.2 & C63.10 clause 11.8.2 Option 2 for 6 dB bandwidth measurement.
	☐ Refer as ANSI C63.10, clause 6.9.1 for occupied bandwidth testing.

3.2.4 Test Setup

Emission Bandwidth


3.2.5 Test Result of Emission Bandwidth

Refer as Appendix B

3.3 Maximum Conducted Output Power

3.3.1 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
P_{Out} = maximum peak conducted output power or maximum conducted output power in dBm, **G_{TX}** = the maximum transmitting antenna directional gain in dBi.		

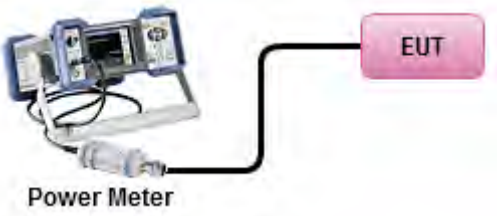
3.3.2 Measuring Instruments

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

3.3.3 Test Procedures

Test Method	
▪ Maximum Peak Conducted Output Power	
	☐ Refer as FCC KDB 558074, clause 8.3.1.1 & C63.10 clause 11.9.1.1 (RBW ≥ EBW method).
	☐ Refer as FCC KDB 558074, clause 8.3.1.3 & C63.10 clause 11.9.1.3 (peak power meter).
▪ Maximum Conducted Output Power	
	[duty cycle ≥ 98% or external video / power trigger]
	☐ Refer as FCC KDB 558074, clause 8.3.2.2 & C63.10 clause 11.9.2.2.2 Method AVGSA-1.
	☐ Refer as FCC KDB 558074, clause 8.3.2.2 & C63.10 clause 11.9.2.2.3 Method 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)
	Measurement using a power meter (PM)
	☐ Refer as FCC KDB 558074, clause 8.3.2.3 & C63.10 clause 11.9.2.3.1 Method AVGPM (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: $P_{total} = P_1 + P_2 + \ldots + P_n$ (calculated in linear unit [mW] and transfer to log unit [dBm]) $EIRP_{total} = P_{total} + DG$

3.3.4 Test Setup

Maximum Conducted Output Power (Power Meter)


3.3.5 Test Result of Maximum Conducted Output Power

Refer as Appendix C

3.4 Power Spectral Density

3.4.1 Power Spectral Density Limit

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

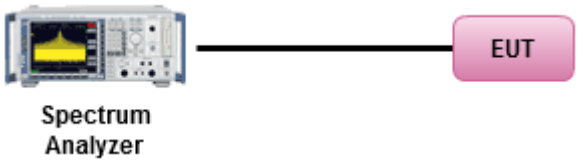
3.4.2 Measuring Instruments

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

3.4.3 Test Procedures

Test Method			
▪ Peak power spectral density procedures that the same method as used to determine the conducted output power. If maximum peak conducted output power was measured to demonstrate compliance to the output power limit, then the peak PSD procedure below (Method PKPSD) shall be used. If maximum conducted output power was measured to demonstrate compliance to the output power limit, then one of the average PSD procedures shall be used, as applicable based on the following criteria (the peak PSD procedure is also an acceptable option).			
	☒ Refer as FCC KDB 558074, clause 8.4 & C63.10 clause 11.10 Method Max. PSD.		
	[duty cycle ≥ 98% or external video / power trigger]		
▪ For conducted measurement.			
	▪ If The EUT supports multiple transmit chains using options given below:		
		☐	Option 1: Measure and sum the spectra across the outputs. Refer as FCC KDB 662911, In-band power spectral density (PSD). Sample all transmit ports simultaneously using a spectrum analyzer for each transmit port. Where the trace bin-by-bin of each transmit port summing can be performed. (i.e., in the first spectral bin of output 1 is summed with that in the first spectral bin of output 2 and that from the first spectral bin of output 3, and so on up to the NTX output to obtain the value for the first frequency bin of the summed spectrum.). Add up the amplitude (power) values for the different transmit chains and use this as the new data trace.
		☐	Option 2: Measure and sum spectral maxima across the outputs. With this 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.

3.4.4 Test Setup

Power Spectral Density


3.4.5 Test Result of Power Spectral Density

Refer as Appendix D

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
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.	

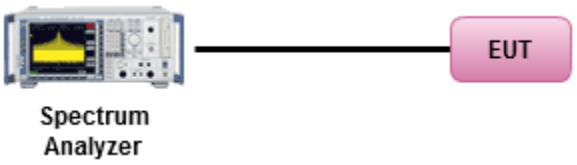
3.5.2 Measuring Instruments

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

Emissions in Non-restricted Frequency Bands


3.5.5 Test Result of Emissions in Non-restricted Frequency Bands

Refer as Appendix E

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

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

Note 2: Test distance for frequencies at below 30 MHz, measurements may be performed at a distance closer than the EUT limit distance; however, an attempt should be made to avoid making measurements in the near field. When performing measurements below30 MHz at a closer distance than the limit distance, the results shall be extrapolated to the specified distance by either making measurements at a minimum of two or more distances on at least one radial to determine the proper extrapolation factor or by using the square of an inverse linear distance extrapolation factor (40 dB / decade). The test report shall specify the extrapolation method used to determine compliance of the EUT.

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

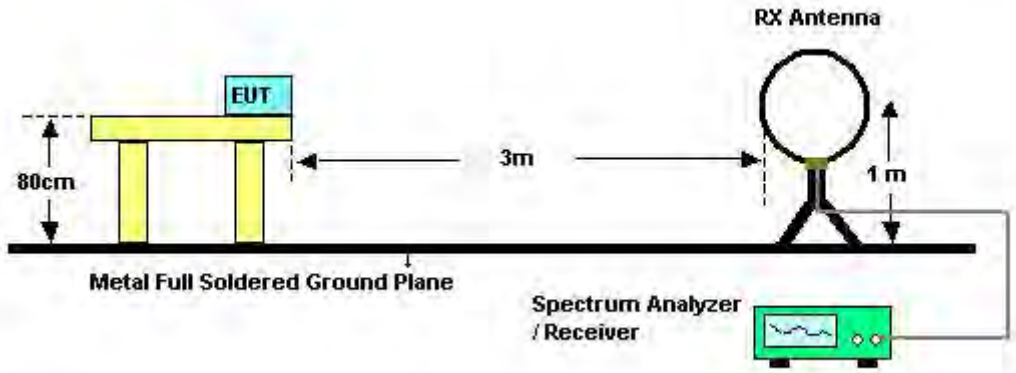
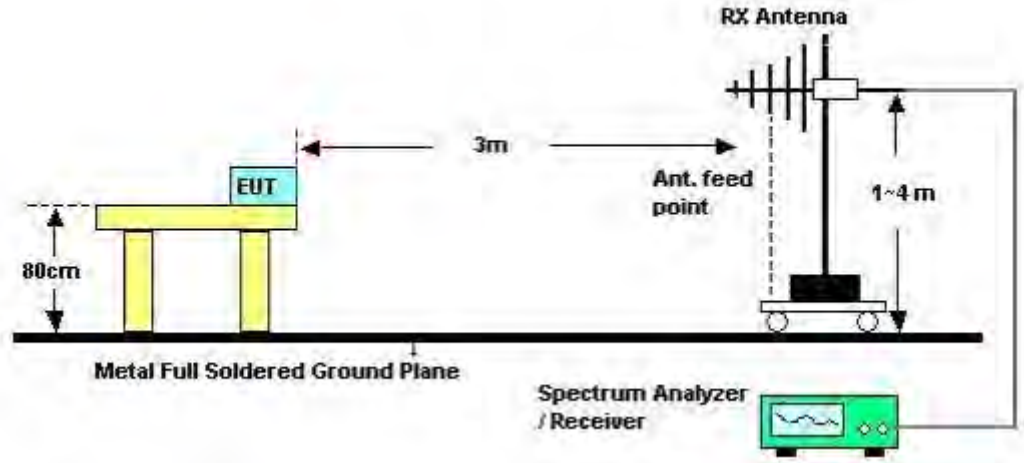
3.6.2 Measuring Instruments

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

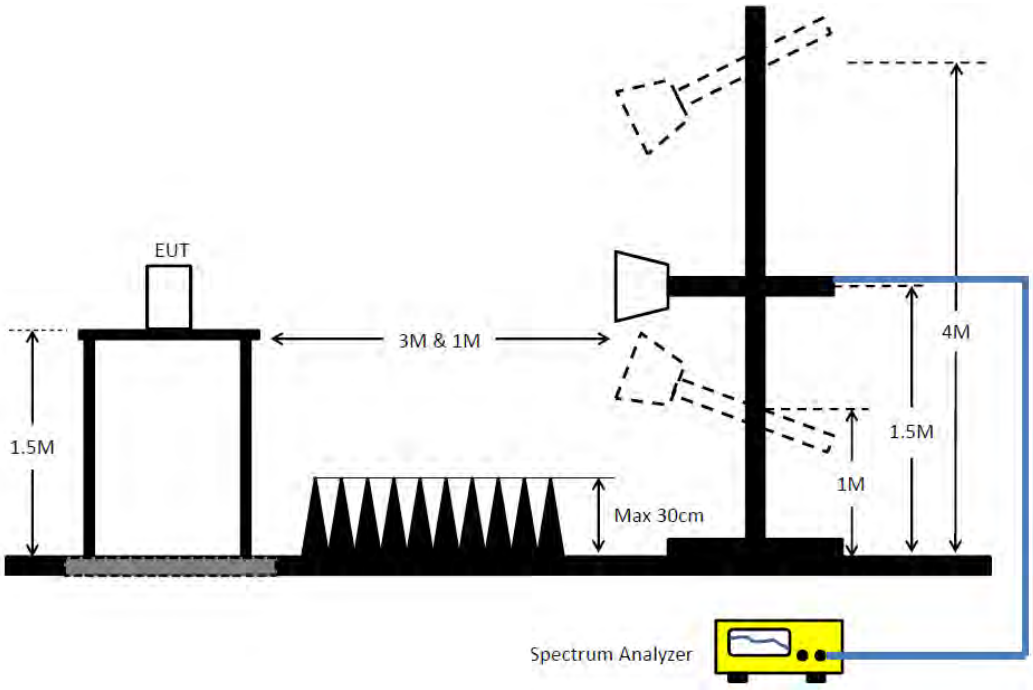
3.6.3 Test Procedures

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.

3.6.4 Test Setup

Emissions in Restricted Frequency Bands
9kHz ~30MHz

30MHz~1GHz


Above 1GHz



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

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& Schwarz	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)
10m Semi Anechoic Chamber NSA	TDK	SAC-10M	10CH01-CB	30MHz~1GHz 10m,3m	Jan. 28, 2021	Jan. 27, 2022	Radiation (10CH01-CB)
Loop Antenna	Teseq	HLA 6120	24155	9kHz - 30 MHz	Apr. 14, 2021	Apr. 13, 2022	Radiation (10CH01-CB)
Pre-Amplifier	Agilent	8447D	2944A10783	9kHz ~ 1.3GHz	Mar. 11, 2021	Mar. 10, 2022	Radiation (10CH01-CB)
Pre-Amplifier	Agilent	8447D	2944A10784	9kHz ~ 1.3GHz	Mar. 11, 2021	Mar. 10, 2022	Radiation (10CH01-CB)
Low Cable	Woken	SUCOFLEX 104	low cable-01	25MHz ~ 1GHz	Oct. 20, 2020	Oct. 19, 2021	Radiation (10CH01-CB)
High Cable	Woken	SUCOFLEX 104	low cable-02	25MHz ~ 1GHz	Oct. 20, 2020	Oct. 19, 2021	Radiation (10CH01-CB)
Bilog Antenna with 6dB Attenator	Chase & EMCI	CBL6111A &N-6-06	1543 &AT-N0609	30MHz ~ 1GHz	Jul. 01, 2021	Jun. 30, 2022	Radiation (10CH01-CB)
EMI Test Receiver	Rohde& Schwarz	ESCI	100186	9kHz ~ 3GHz	Jul. 12, 2021	Jul. 11, 2022	Radiation (10CH01-CB)
Spectrum Analyzer	Rohde& Schwarz	FSV30	101026	9kHz ~ 30GHz	Mar. 08, 2021	Mar. 07, 2022	Radiation (10CH01-CB)
3m Semi Anechoic Chamber VSWR	TDK	SAC-3M	03CH05-CB	1GHz ~18GHz 3m	Nov. 08, 2020	Nov. 07, 2021	Radiation (03CH05-CB)
Horn Antenna	SCHWARZBECK	BBHA9120D	BBHA 9120 D-1291	1GHz~18GHz	Sep. 05, 2020	Sep. 04, 2021	Radiation (03CH05-CB)
Horn Antenna	Schwarzbeck	BBHA 9170	BBHA9170252	15GHz ~ 40GHz	Jul. 21, 2020	Jul. 20, 2021	Radiation (03CH05-CB)
Pre-Amplifier	EMCI	EMC12630SE	980287	1GHz – 26.5GHz	Jul. 02, 2021	Jul. 01, 2022	Radiation (03CH05-CB)
Amplifier	-	-	TF-130N-R1	18GHz ~ 40GHz	Jun.15, 2021	Jun. 14, 2022	Radiation (03CH05-CB)

Instrument	Brand	Model No.	Serial No.	Characteristics	Calibration Date	Calibration Due Date	Remark
Spectrum Analyzer	R&S	FSP40	100304	9kHz ~ 40GHz	Nov. 10, 2020	Nov. 09, 2021	Radiation (03CH05-CB)
RF Cable-high	Woken	RG402	High Cable-28	1GHz~18GHz	Oct. 05, 2020	Oct. 04, 2021	Radiation (03CH05-CB)
RF Cable-high	Woken	RG402	High Cable-04+28	1GHz~18GHz	Oct. 05, 2020	Oct. 04, 2021	Radiation (03CH05-CB)
RF Cable-high	Woken	RG402	High Cable-40G#1	18GHz ~ 40 GHz	Jul. 16, 2020	Jul. 15, 2021	Radiation (03CH05-CB)
RF Cable-high	Woken	RG402	High Cable-40G#2	18GHz ~ 40 GHz	Jul. 16, 2020	Jul. 15, 2021	Radiation (03CH05-CB)
Test Software	SPORTON	SENSE	V5.10	-	N.C.R.	N.C.R.	Radiation (03CH05-CB)
Spectrum analyzer	R&S	FSV40	101027	9kHz~40GHz	Jul. 27, 2020	Jul. 26, 2021	Conducted (TH02-CB)
Power Sensor	Agilent	U2021XA	MY53410001	50MHz~18GHz	Nov. 13, 2020	Nov. 12, 2021	Conducted (TH02-CB)
RF Cable-high	Woken	RG402	High Cable-01	1 GHz – 18 GHz	Oct. 05, 2020	Oct. 04, 2021	Conducted (TH02-CB)
RF Cable-high	Woken	RG402	High Cable-02	1 GHz – 18 GHz	Oct. 05, 2020	Oct. 04, 2021	Conducted (TH02-CB)
RF Cable-high	Woken	RG402	High Cable-03	1 GHz – 18 GHz	Oct. 05, 2020	Oct. 04, 2021	Conducted (TH02-CB)
RF Cable-high	Woken	RG402	High Cable-04	1 GHz – 18 GHz	Oct. 05, 2020	Oct. 04, 2021	Conducted (TH02-CB)
RF Cable-high	Woken	RG402	High Cable-05	1 GHz – 18 GHz	Oct. 05, 2020	Oct. 04, 2021	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.

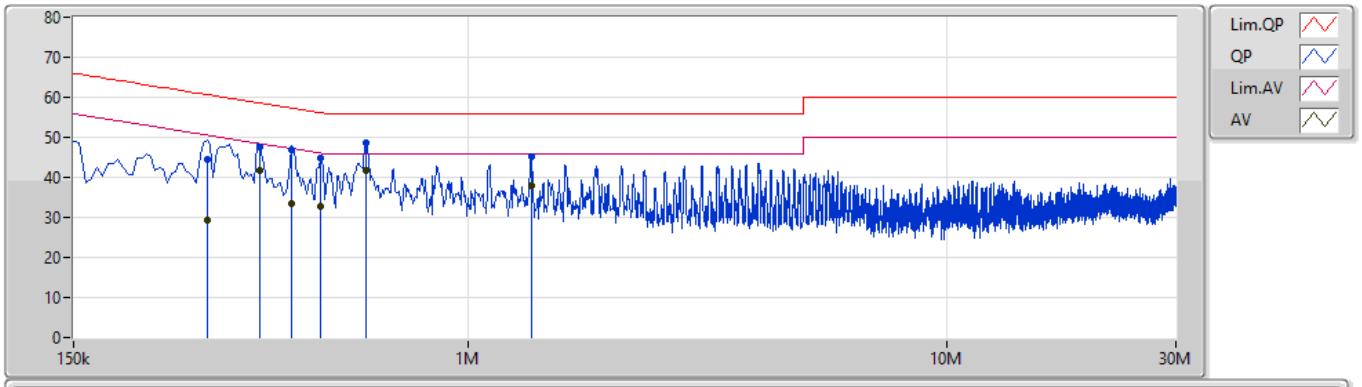
N.C.R. means Non-Calibration required.

Summary

Mode	Result	Type	Freq (Hz)	Level (dBuV)	Limit (dBuV)	Margin (dB)	Condition
Mode 3	Pass	AV	613.5k	41.87	46.00	-4.13	Line

Mode 3

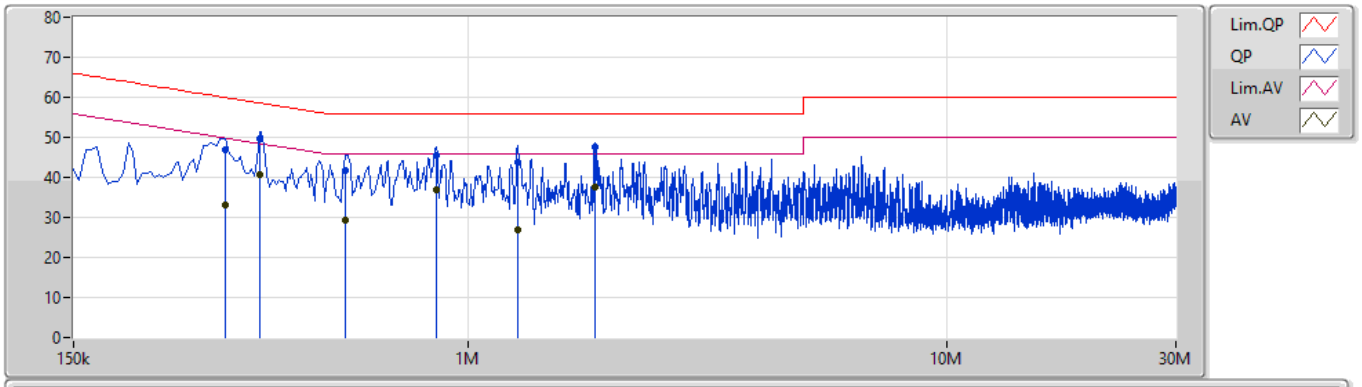
19/07/2021



Type	Freq	Level	Limit	Margin	Factor	Condition	Comment	Raw	LISN	CL	AT
	(Hz)	(dBuV)	(dBuV)	(dB)	(dB)			(dBuV)	(dB)	(dB)	(dB)
QP	285k	44.41	60.67	-16.26	9.90	Line	-	34.51	0.04	0.04	9.82
AV	285k	29.16	50.67	-21.51	9.90	Line	-	19.26	0.04	0.04	9.82
QP	366k	47.50	58.60	-11.10	9.90	Line	-	37.60	0.04	0.04	9.82
AV	366k	41.84	48.60	-6.76	9.90	Line	-	31.94	0.04	0.04	9.82
QP	429k	46.85	57.28	-10.43	9.90	Line	-	36.95	0.04	0.04	9.82
AV	429k	33.48	47.28	-13.80	9.90	Line	-	23.58	0.04	0.04	9.82
QP	492k	44.72	56.13	-11.41	9.90	Line	-	34.82	0.04	0.04	9.82
AV	492k	32.70	46.13	-13.43	9.90	Line	-	22.80	0.04	0.04	9.82
QP	613.5k	48.64	56.00	-7.36	9.91	Line	-	38.73	0.05	0.04	9.82
AV	613.5k	41.87	46.00	-4.13	9.91	Line	"Worst"	31.96	0.05	0.04	9.82
QP	1.352M	45.21	56.00	-10.79	9.95	Line	-	35.26	0.07	0.05	9.83
AV	1.352M	37.89	46.00	-8.11	9.95	Line	-	27.94	0.07	0.05	9.83

Mode 3

19/07/2021



Type	Freq	Level	Limit	Margin	Factor	Condition	Comment	Raw	LISN	CL	AT
	(Hz)	(dBuV)	(dBuV)	(dB)	(dB)			(dBuV)	(dB)	(dB)	(dB)
QP	312k	46.85	59.92	-13.07	9.89	Neutral	-	36.96	0.03	0.04	9.82
AV	312k	33.02	49.92	-16.90	9.89	Neutral	-	23.13	0.03	0.04	9.82
QP	366k	49.75	58.60	-8.85	9.89	Neutral	-	39.86	0.03	0.04	9.82
AV	366k	40.70	48.60	-7.90	9.89	Neutral	"Worst"	30.81	0.03	0.04	9.82
QP	555k	41.88	56.00	-14.12	9.90	Neutral	-	31.98	0.04	0.04	9.82
AV	555k	29.33	46.00	-16.67	9.90	Neutral	-	19.43	0.04	0.04	9.82
QP	856.5k	45.48	56.00	-10.52	9.92	Neutral	-	35.56	0.05	0.04	9.83
AV	856.5k	36.75	46.00	-9.25	9.92	Neutral	-	26.83	0.05	0.04	9.83
QP	1.266M	43.64	56.00	-12.36	9.94	Neutral	-	33.70	0.06	0.05	9.83
AV	1.266M	27.03	46.00	-18.97	9.94	Neutral	-	17.09	0.06	0.05	9.83
QP	1.842M	47.52	56.00	-8.48	9.96	Neutral	-	37.56	0.07	0.07	9.82
AV	1.842M	37.42	46.00	-8.58	9.96	Neutral	-	27.46	0.07	0.07	9.82

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)	690k	1.028M	1M03F1D	685k	1.019M
BT-LE(2Mbps)	1.238M	2.054M	2M05F1D	1.175M	2.039M

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

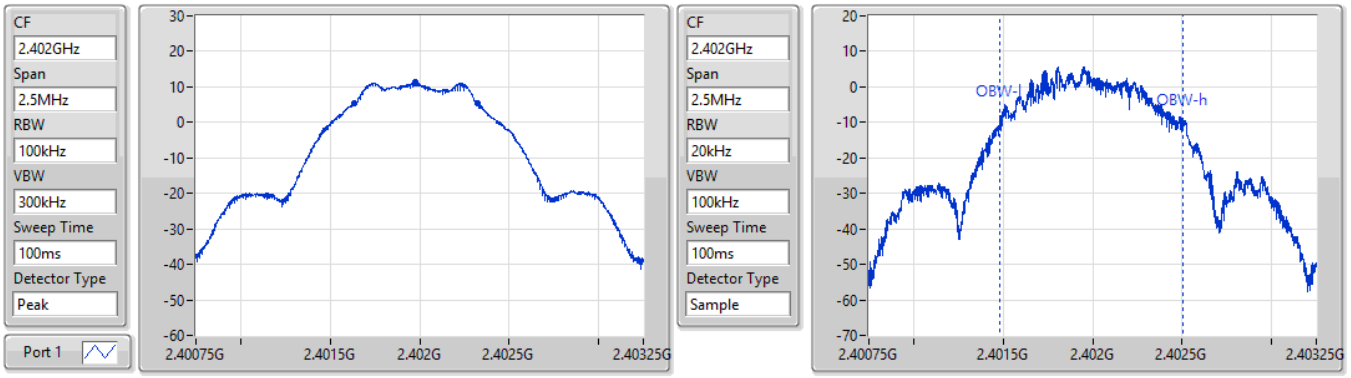
Mode	Result	Limit (Hz)	Port 1-N dB (Hz)	Port 1-OBW (Hz)
BT-LE(1Mbps)	-	-	-	-
2402MHz	Pass	500k	687.5k	1.019M
2440MHz	Pass	500k	690k	1.024M
2480MHz	Pass	500k	685k	1.028M
BT-LE(2Mbps)	-	-	-	-
2402MHz	Pass	500k	1.238M	2.039M
2440MHz	Pass	500k	1.238M	2.039M
2480MHz	Pass	500k	1.175M	2.054M

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

BT-LE(1Mbps) **EBW-DTS**

2402MHz

09/07/2021

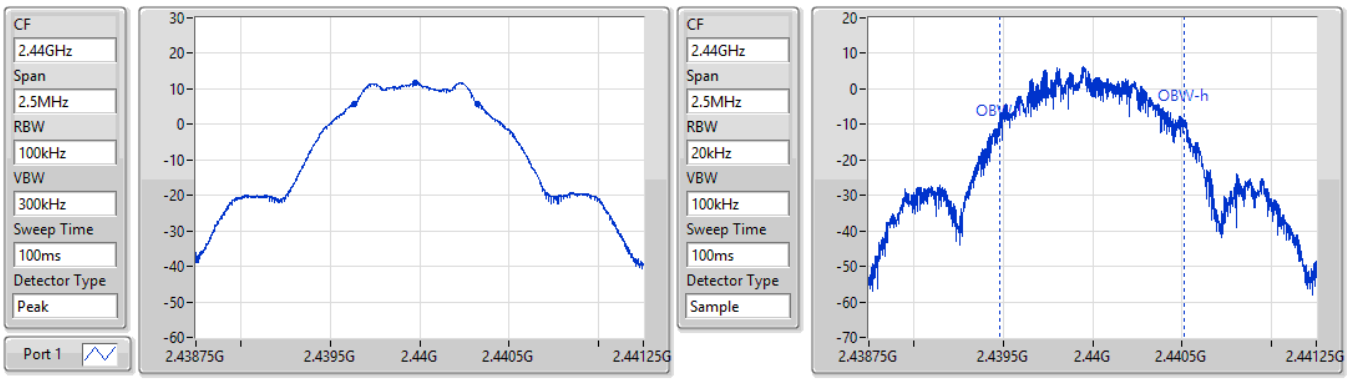


6dB(Hz)	Fl-6dB(Hz)	Fh-6dB(Hz)	OBW(Hz)	Fl-OBW(Hz)	Fh-OBW(Hz)	Limit(Hz)	Port
687.5k	2.401635G	2.402323G	1.019M	2.401484G	2.402503G	500k	1

BT-LE(1Mbps) **EBW-DTS**

2440MHz

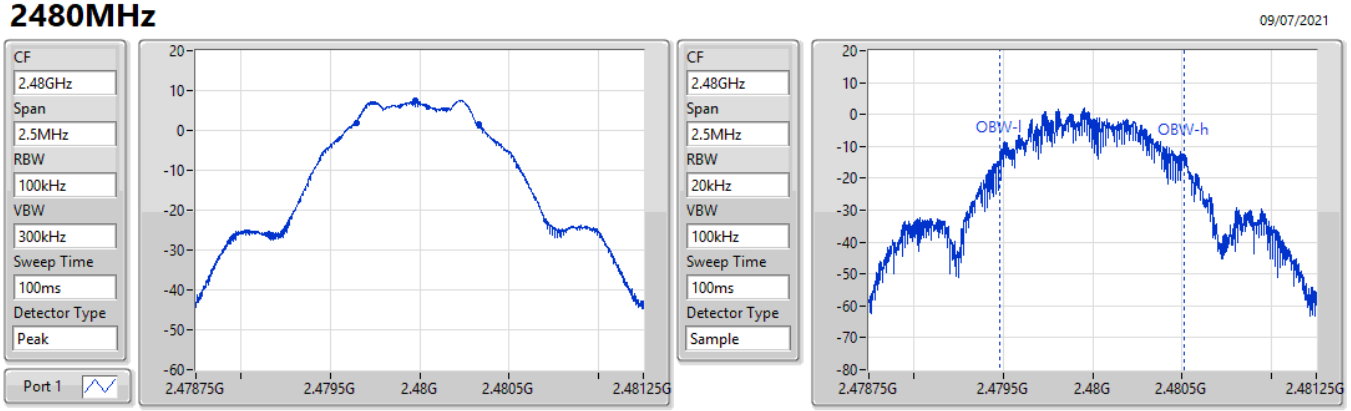
09/07/2021



6dB(Hz)	Fl-6dB(Hz)	Fh-6dB(Hz)	OBW(Hz)	Fl-OBW(Hz)	Fh-OBW(Hz)	Limit(Hz)	Port
690k	2.439634G	2.440324G	1.024M	2.439484G	2.440508G	500k	1

BT-LE(1Mbps) **EBW-DTS**

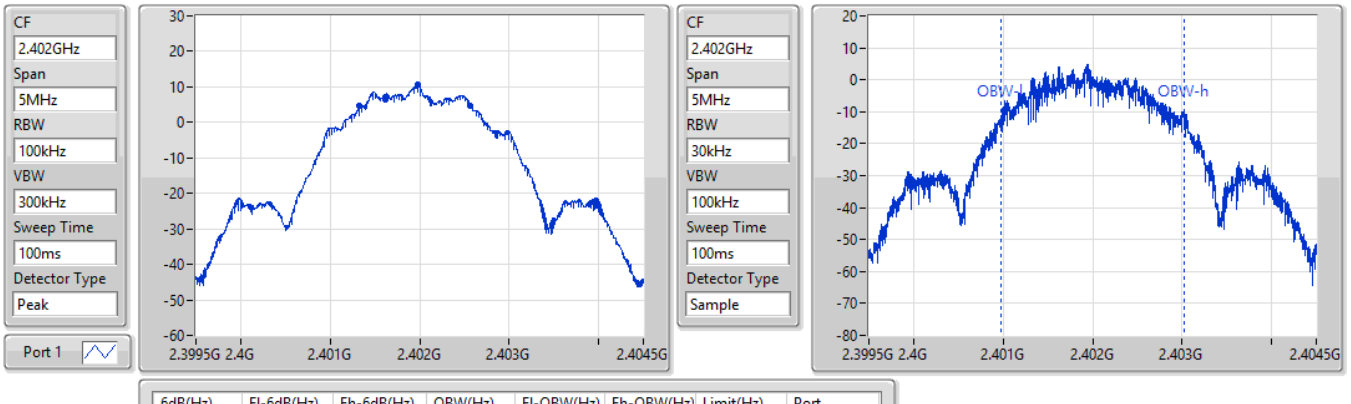
2480MHz



6dB(Hz)	Fl-6dB(Hz)	Fh-6dB(Hz)	OBW(Hz)	Fl-OBW(Hz)	Fh-OBW(Hz)	Limit(Hz)	Port
685k	2.479645G	2.48033G	1.028M	2.479483G	2.480511G	500k	1

BT-LE(2Mbps) **EBW-DTS**

2402MHz

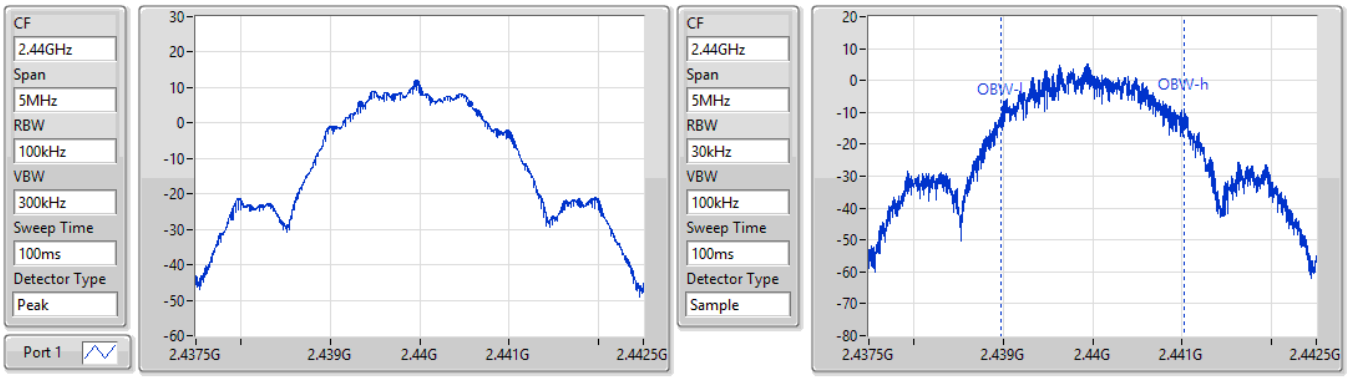


6dB(Hz)	Fl-6dB(Hz)	Fh-6dB(Hz)	OBW(Hz)	Fl-OBW(Hz)	Fh-OBW(Hz)	Limit(Hz)	Port
1.238M	2.40133G	2.402568G	2.039M	2.400978G	2.403017G	500k	1

BT-LE(2Mbps) **EBW-DTS**

2440MHz

09/07/2021

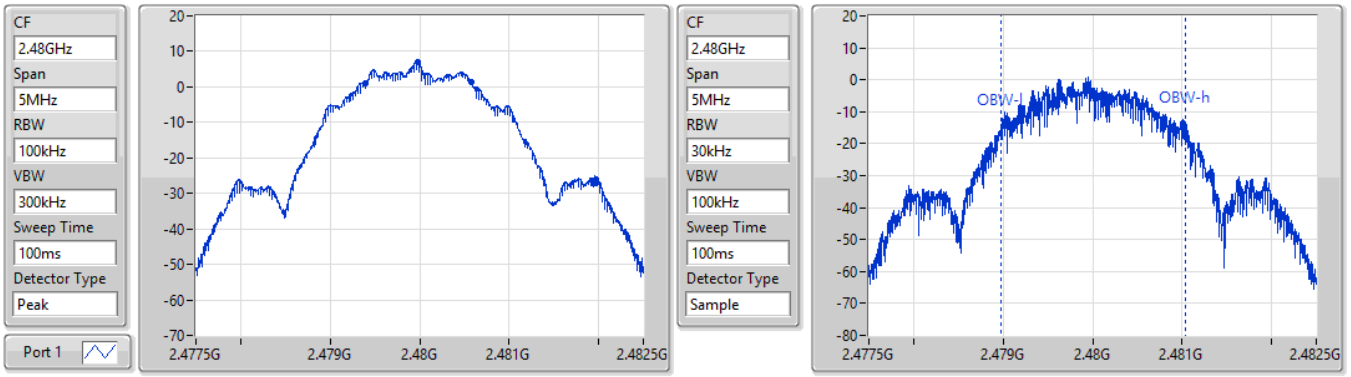


6dB(Hz)	Fl-6dB(Hz)	Fh-6dB(Hz)	OBW(Hz)	Fl-OBW(Hz)	Fh-OBW(Hz)	Limit(Hz)	Port
1.238M	2.439333G	2.44057G	2.039M	2.438981G	2.441019G	500k	1

BT-LE(2Mbps) **EBW-DTS**

2480MHz

09/07/2021



6dB(Hz)	Fl-6dB(Hz)	Fh-6dB(Hz)	OBW(Hz)	Fl-OBW(Hz)	Fh-OBW(Hz)	Limit(Hz)	Port
1.175M	2.479398G	2.480573G	2.054M	2.478981G	2.481034G	500k	1

Summary

Mode	Power (dBm)	Power (W)
2.4-2.4835GHz	-	-
BT-LE(1Mbps)	11.99	0.01581
BT-LE(2Mbps)	11.82	0.01521

Result

Mode	Result	Gain (dBi)	Power (dBm)	Power Limit (dBm)
BT-LE(1Mbps)	-	-	-	-
2402MHz	Pass	1.08	11.59	30.00
2440MHz	Pass	1.08	11.99	30.00
2480MHz	Pass	1.08	7.88	30.00
BT-LE(2Mbps)	-	-	-	-
2402MHz	Pass	1.08	11.37	30.00
2440MHz	Pass	1.08	11.82	30.00
2480MHz	Pass	1.08	7.57	30.00

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

Summary

Mode	PD (dBm/RBW)
2.4-2.4835GHz	-
BT-LE(1Mbps)	-4.02
BT-LE(2Mbps)	-6.12

RBW = 3kHz;

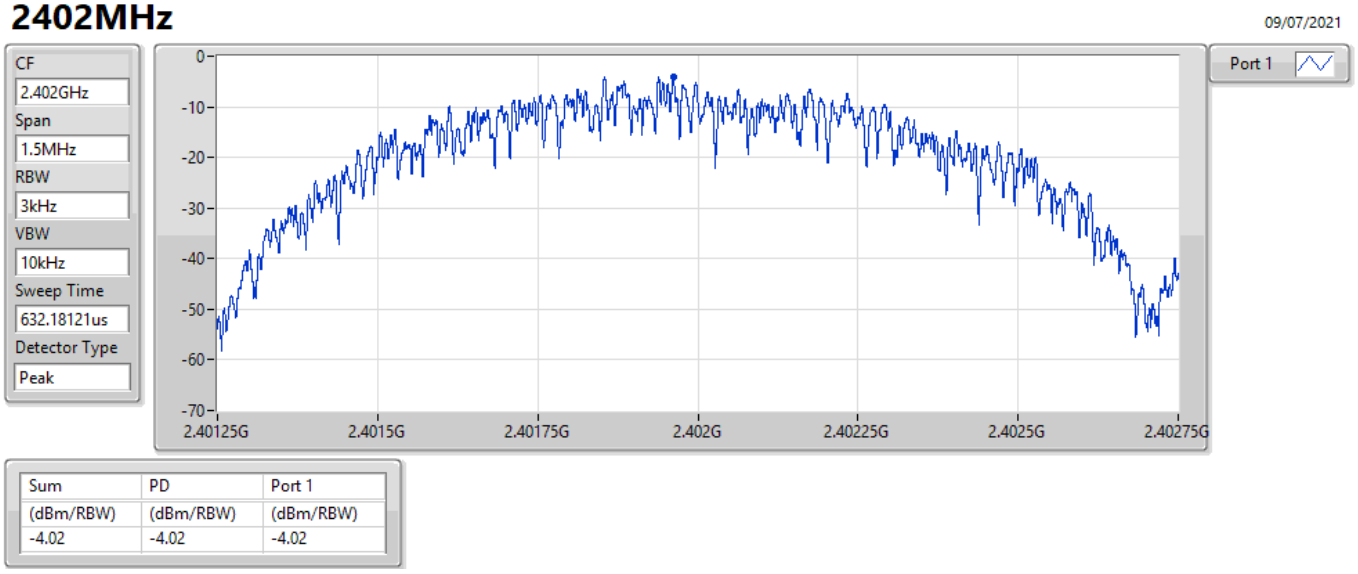
Result

Mode	Result	Gain (dBi)	PD (dBm/RBW)	PD Limit (dBm/RBW)
BT-LE(1Mbps)	-	-	-	-
2402MHz	Pass	1.08	-4.02	8.00
2440MHz	Pass	1.08	-4.49	8.00
2480MHz	Pass	1.08	-7.89	8.00
BT-LE(2Mbps)	-	-	-	-
2402MHz	Pass	1.08	-6.13	8.00
2440MHz	Pass	1.08	-6.12	8.00
2480MHz	Pass	1.08	-9.71	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;

BT-LE(1Mbps) PSD

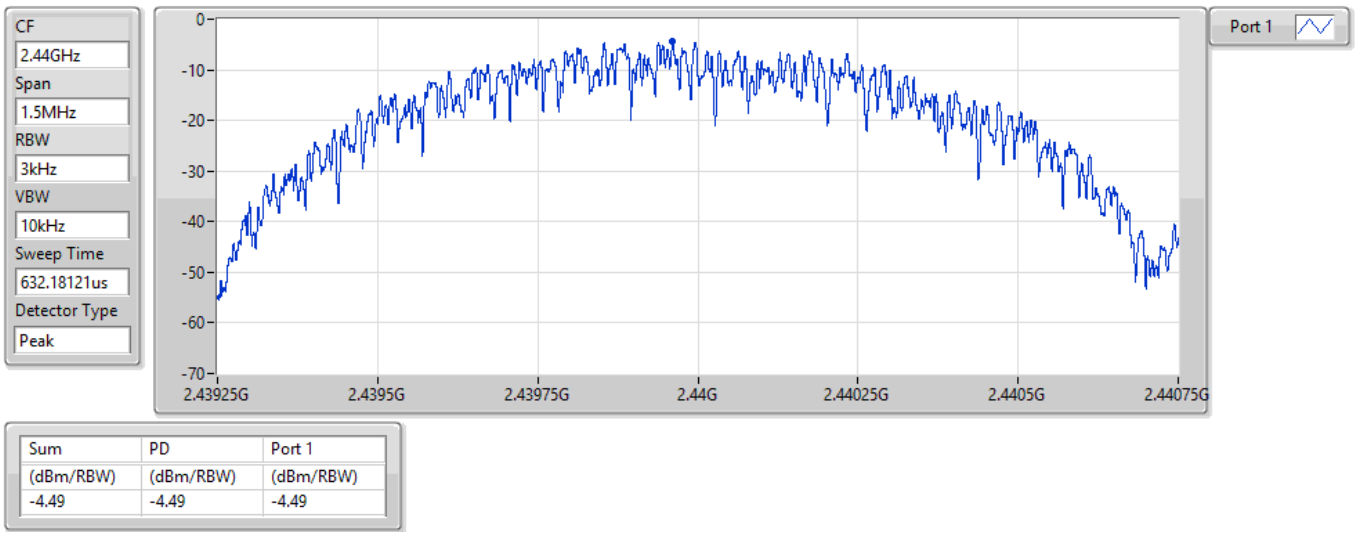
2402MHz



Sum	PD	Port 1
(dBm/RBW)	(dBm/RBW)	(dBm/RBW)
-4.02	-4.02	-4.02

BT-LE(1Mbps) PSD

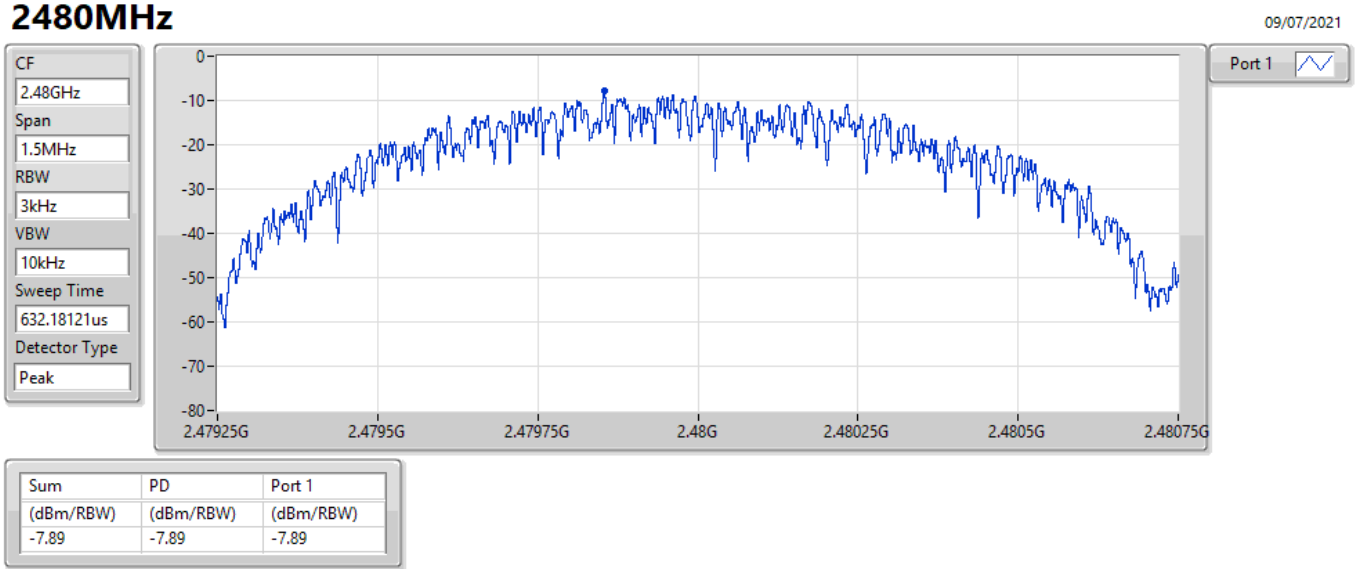
2440MHz



Sum	PD	Port 1
(dBm/RBW)	(dBm/RBW)	(dBm/RBW)
-4.49	-4.49	-4.49

BT-LE(1Mbps) PSD

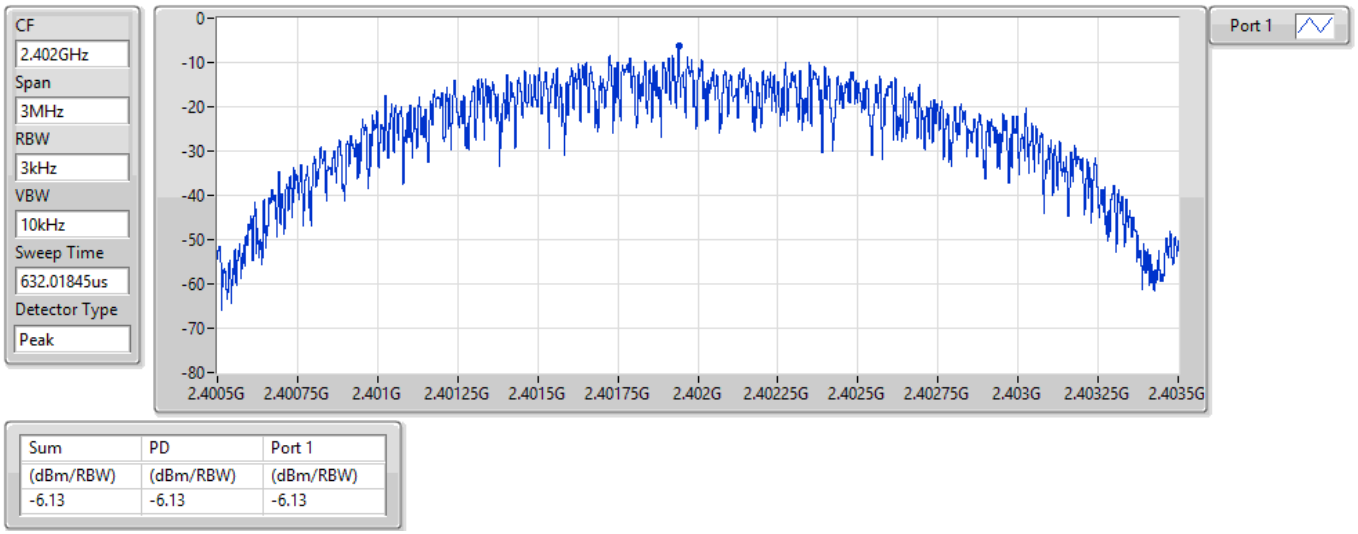
2480MHz



Sum	PD	Port 1
(dBm/RBW)	(dBm/RBW)	(dBm/RBW)
-7.89	-7.89	-7.89

BT-LE(2Mbps) PSD

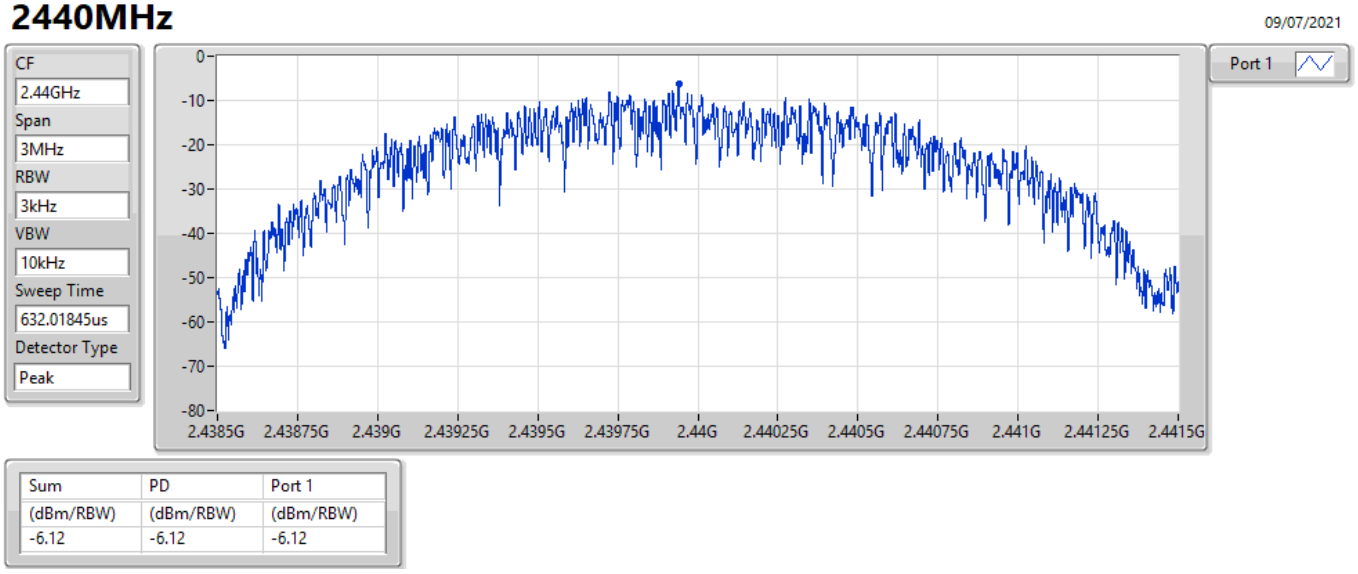
2402MHz



Sum	PD	Port 1
(dBm/RBW)	(dBm/RBW)	(dBm/RBW)
-6.13	-6.13	-6.13

BT-LE(2Mbps) PSD

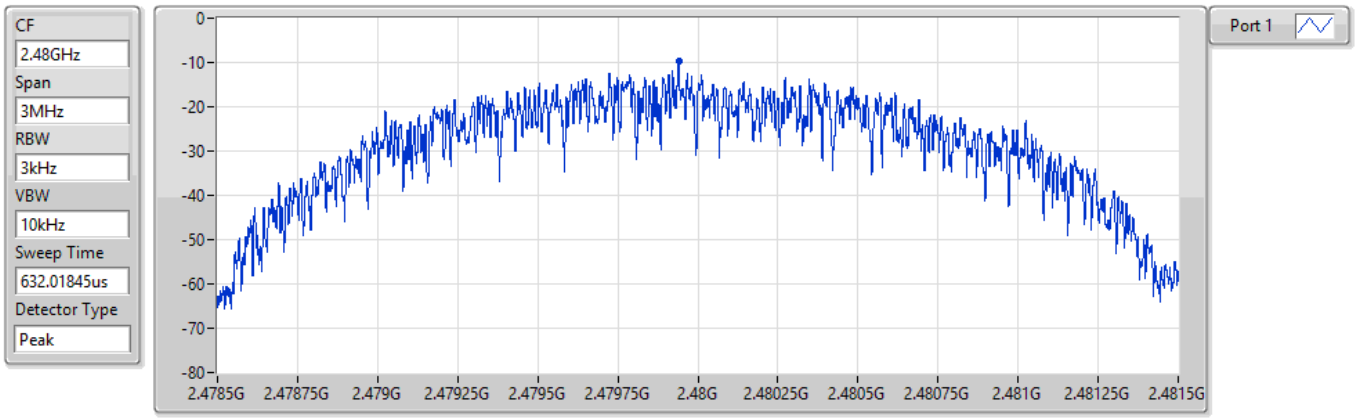
2440MHz



Sum	PD	Port 1
(dBm/RBW)	(dBm/RBW)	(dBm/RBW)
-6.12	-6.12	-6.12

BT-LE(2Mbps) PSD

2480MHz



Sum	PD	Port 1
(dBm/RBW)	(dBm/RBW)	(dBm/RBW)
-9.71	-9.71	-9.71

Summary

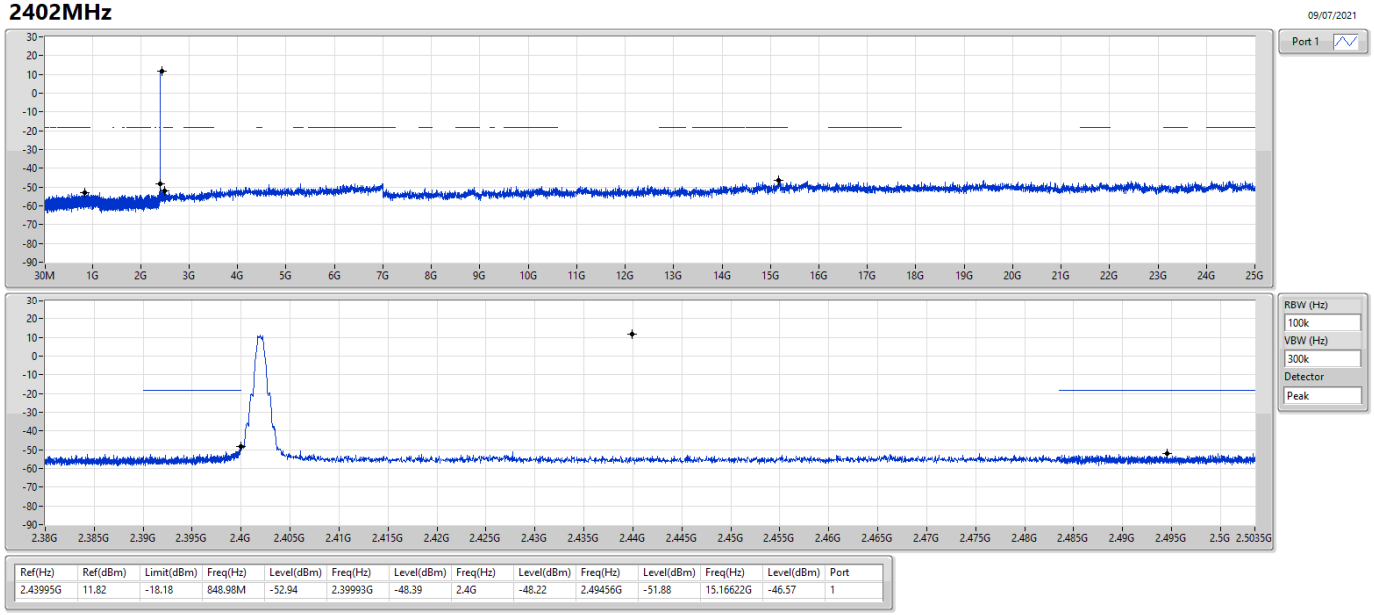
Mode	Result	Ref (Hz)	Ref (dBm)	Limit (dBm)	Freq (Hz)	Level (dBm)	Freq (Hz)	Level (dBm)	Freq (Hz)	Level (dBm)	Freq (Hz)	Level (dBm)	Freq (Hz)	Level (dBm)	Port
2.4-2.4835GHz	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
BT-LE(1Mbps)	Pass	2.43995G	11.82	-18.18	848.98M	-52.94	2.39993G	-48.39	2.4G	-48.22	2.49456G	-51.88	15.16622G	-46.57	1
BT-LE(2Mbps)	Pass	2.43995G	11.33	-18.67	855.73M	-53.16	2.39998G	-21.45	2.4G	-22.02	2.49271G	-52.05	6.97187G	-46.82	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	2.43995G	11.82	-18.18	848.98M	-52.94	2.39993G	-48.39	2.4G	-48.22	2.49456G	-51.88	15.16622G	-46.57	1
2440MHz	Pass	2.43995G	11.82	-18.18	888.34M	-52.63	2.39748G	-52.97	2.4835G	-54.04	2.49557G	-52.04	24.49383G	-46.05	1
2480MHz	Pass	2.43995G	11.82	-18.18	708.56M	-53.27	2.3972G	-52.76	2.4835G	-53.64	2.4889G	-51.26	24.53882G	-46.67	1
BT-LE(2Mbps)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2402MHz	Pass	2.43995G	11.33	-18.67	855.73M	-53.16	2.39998G	-21.45	2.4G	-22.02	2.49271G	-52.05	6.97187G	-46.82	1
2440MHz	Pass	2.43995G	11.33	-18.67	898.62M	-53.22	2.39163G	-52.46	2.4G	-54.34	2.48614G	-52.29	24.8369G	-45.91	1
2480MHz	Pass	2.43995G	11.33	-18.67	2.09888G	-52.81	2.39196G	-52.60	2.4835G	-54.98	2.49601G	-51.95	6.93531G	-46.33	1

BT-LE(1Mbps) **CSENdB-DTS**

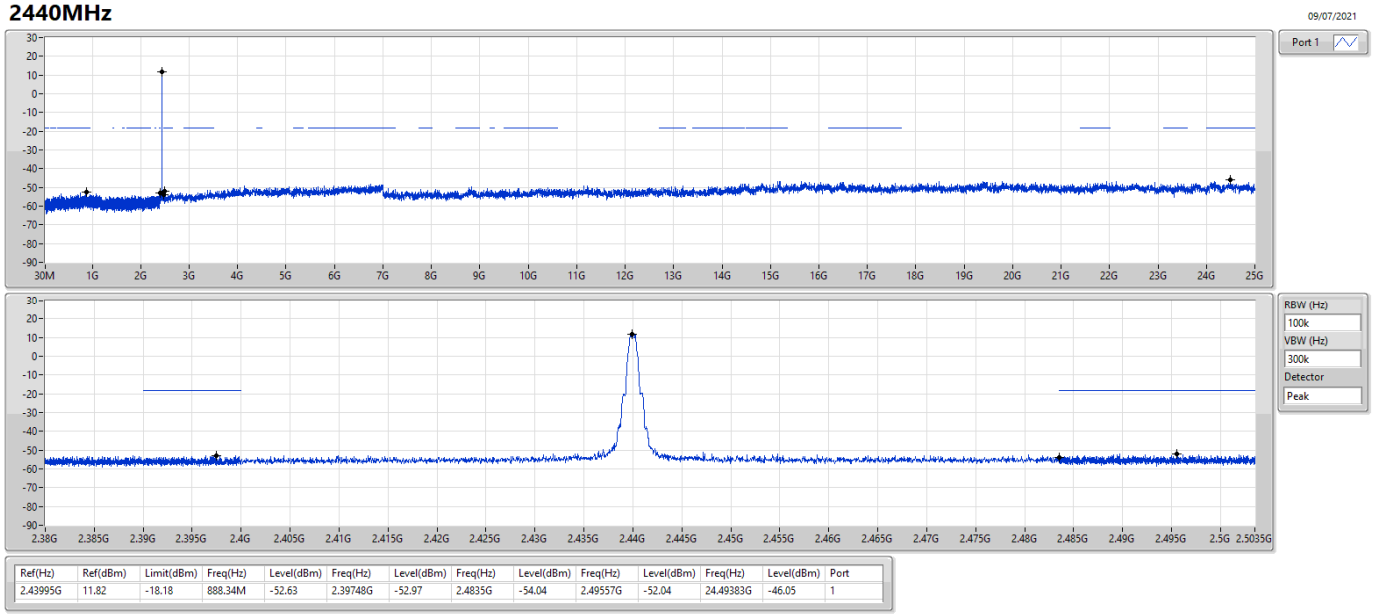
2402MHz



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
2.43995G	11.82	-18.18	848.98M	-52.94	2.39993G	-48.39	2.4G	-48.22	2.49456G	-51.88	15.16622G	-46.57	1

BT-LE(1Mbps) **CSENdB-DTS**

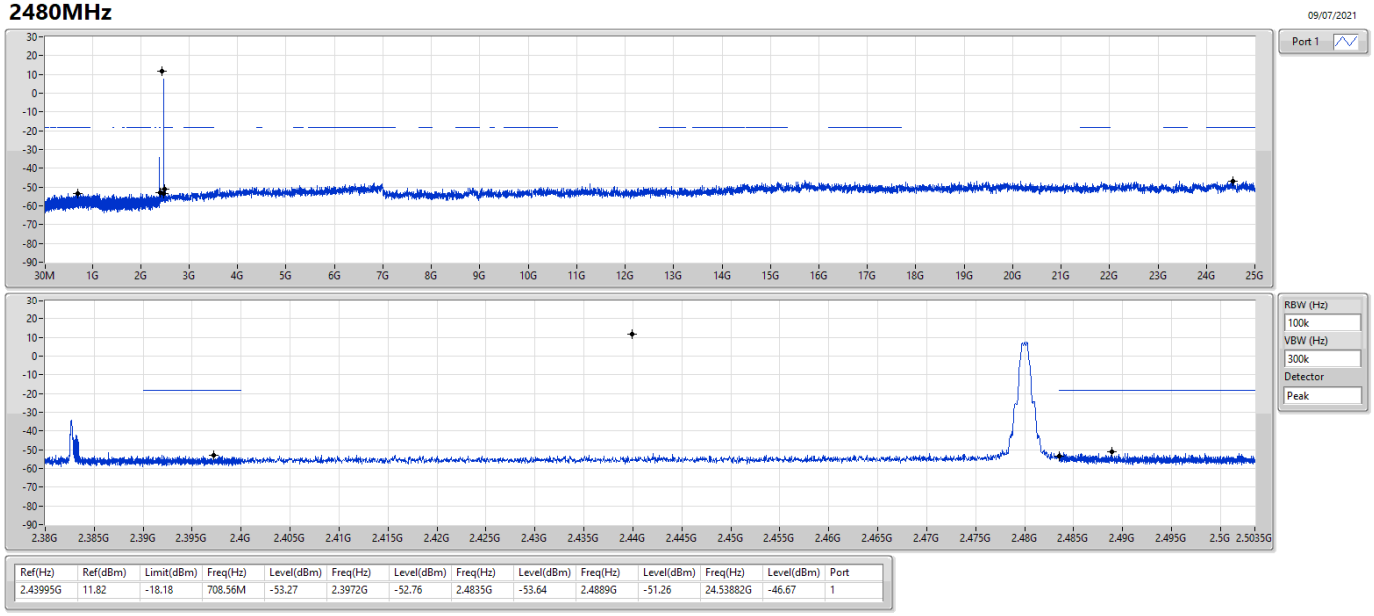
2440MHz



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
2.43995G	11.82	-18.18	888.34M	-52.63	2.39748G	-52.97	2.4835G	-54.04	2.49557G	-52.04	24.49383G	-46.05	1

BT-LE(1Mbps) **CSENdB-DTS**

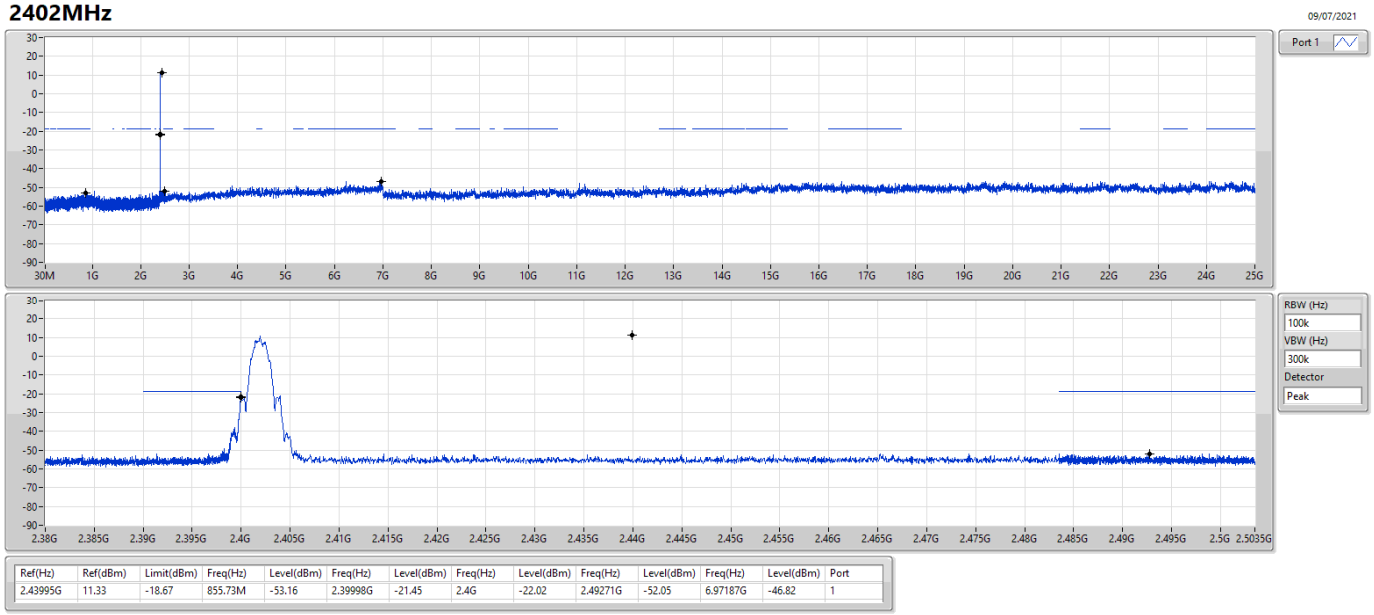
2480MHz



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
2.43995G	11.82	-18.18	708.56M	-53.27	2.3972G	-52.76	2.4835G	-53.64	2.4889G	-51.26	24.53882G	-46.67	1

BT-LE(2Mbps) **CSENdB-DTS**

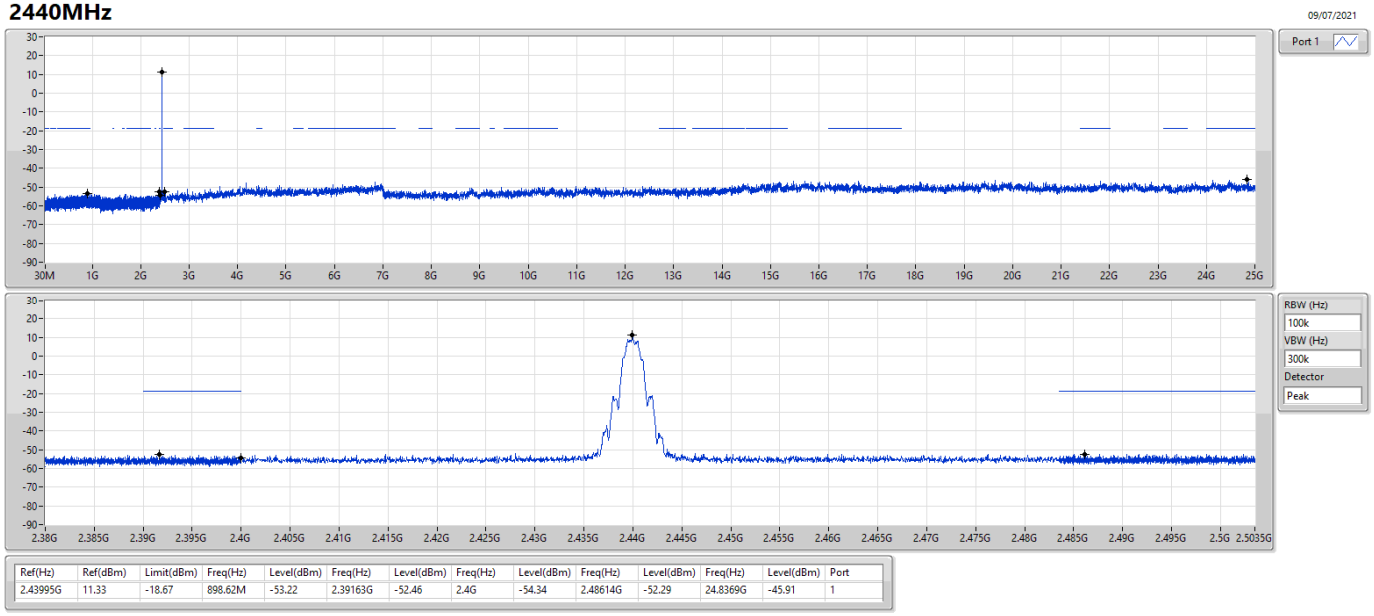
2402MHz



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
2.43995G	11.33	-18.67	855.73M	-53.16	2.39998G	-21.45	2.4G	-22.02	2.49271G	-52.05	6.97187G	-46.82	1

BT-LE(2Mbps) **CSENdB-DTS**

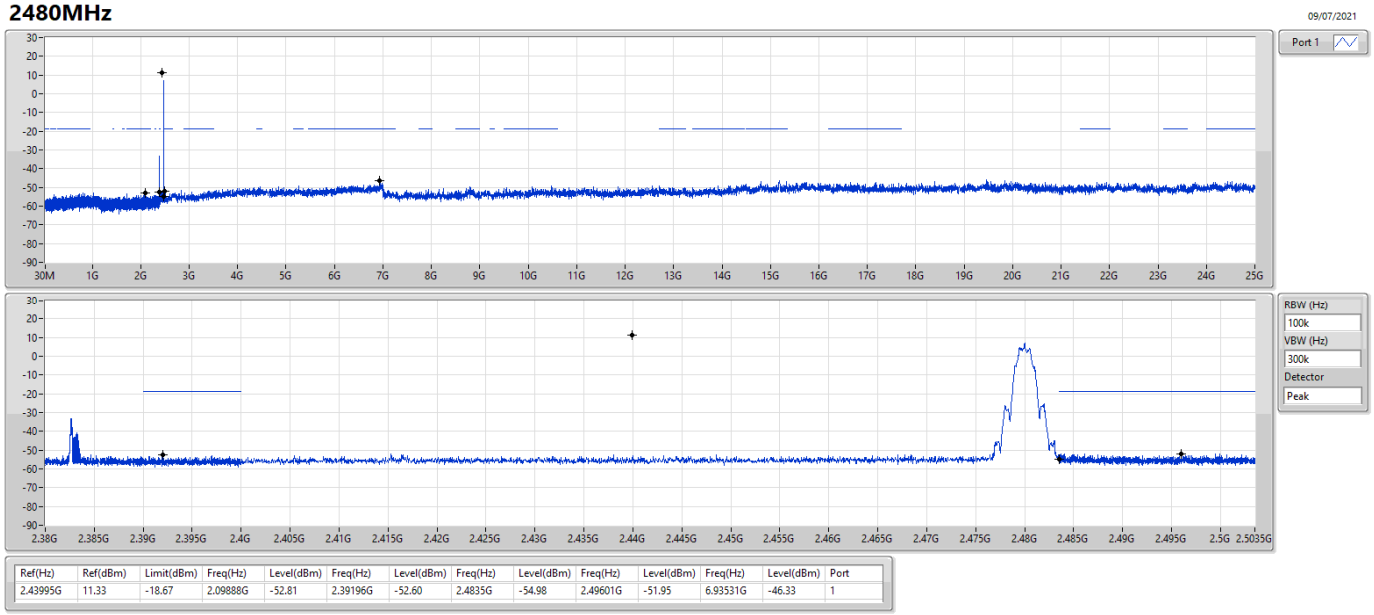
2440MHz



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
2.43995G	11.33	-18.67	898.62M	-53.22	2.39163G	-52.46	2.4G	-54.34	2.48614G	-52.29	24.8369G	-45.91	1

BT-LE(2Mbps) **CSENdB-DTS**

2480MHz



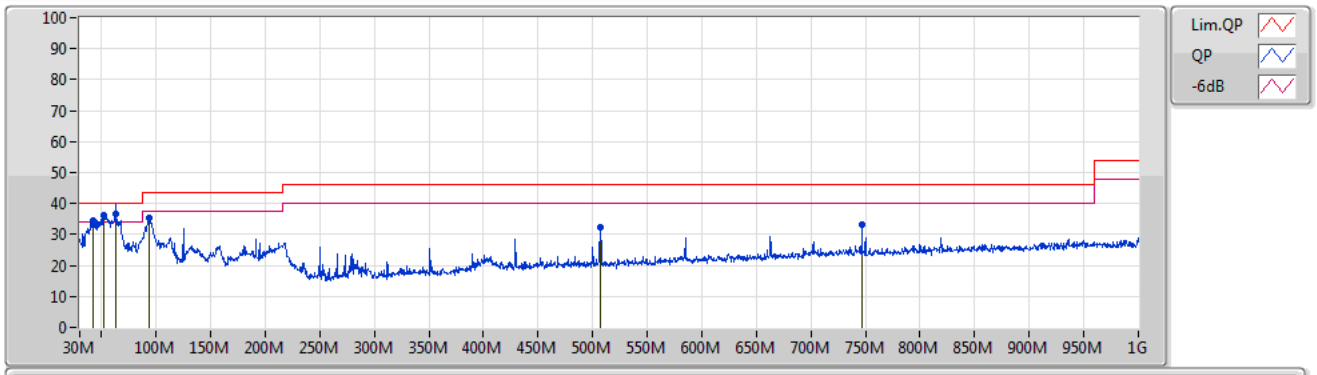
Ref(Hz)	Ref(dBm)	Limit(dBm)	Freq(Hz)	Level(dBm)	Freq(Hz)	Level(dBm)	Freq(Hz)	Level(dBm)	Freq(Hz)	Level(dBm)	Freq(Hz)	Level(dBm)	Port
2.43995G	11.33	-18.67	2.09888G	-52.81	2.39196G	-52.60	2.4835G	-54.98	2.49601G	-51.95	6.93531G	-46.33	1

Summary

Mode	Result	Type	Freq (Hz)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Condition
Mode 4	Pass	QP	62.5M	36.79	40.00	-3.21	Vertical

Mode 4

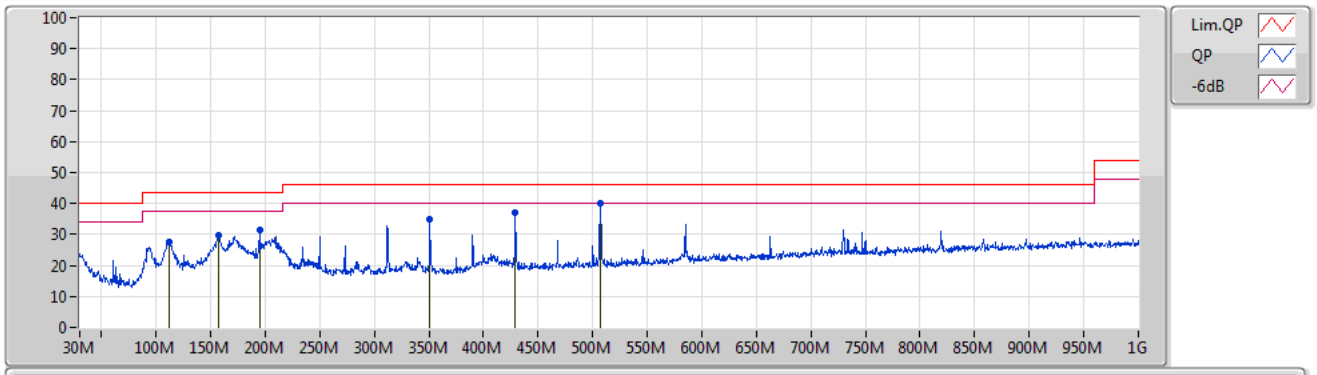
15/07/2021



Type	Freq	Level	Limit	Margin	Factor	Dist	Condition	Azimuth	Height	Comment	Raw	AF	CL	PA
	(Hz)	(dBuV/m)	(dBuV/m)	(dB)	(dB)	(m)		(°)	(m)		(dBuV)	(dB)	(dB)	(dB)
PK	41.64M	34.37	40.00	-5.63	-9.18	3	Vertical	27	1.00	-	43.55	17.47	1.33	27.98
PK	51.83M	36.14	40.00	-3.86	-13.13	3	Vertical	0	1.00	-	49.27	13.29	1.54	27.96
QP	62.5M	36.79	40.00	-3.21	-13.62	3	Vertical	93	2.00	"Worst"	50.41	12.46	1.75	27.83
PK	94.02M	35.42	43.50	-8.08	-9.79	3	Vertical	141	3.00	-	45.21	15.76	2.28	27.83
PK	506.76M	32.39	46.00	-13.61	-5.33	3	Vertical	73	4.00	-	37.72	17.73	4.84	27.90
PK	746.83M	33.20	46.00	-12.80	-1.19	3	Vertical	255	1.00	-	34.39	20.41	5.99	27.59

Mode 4

15/07/2021



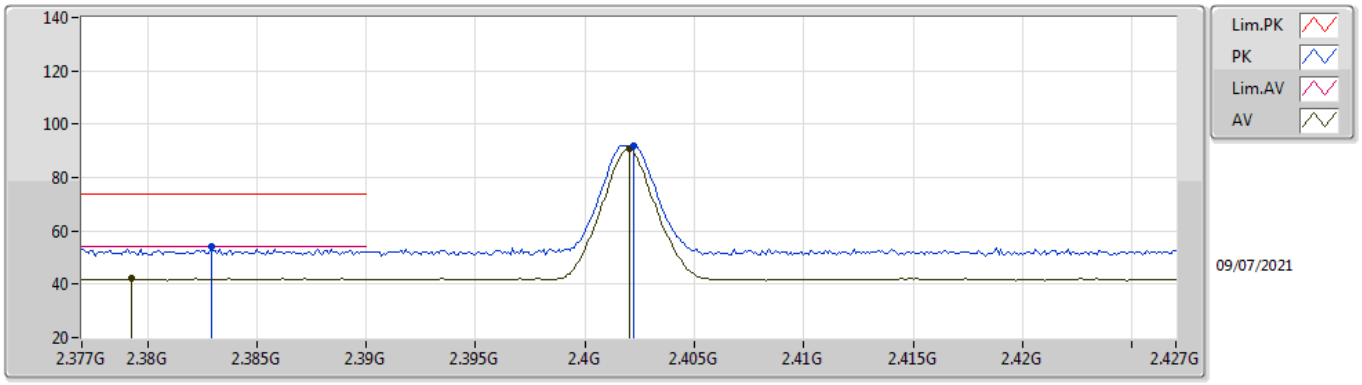
Type	Freq	Level	Limit	Margin	Factor	Dist	Condition	Azimuth	Height	Comment	Raw	AF	CL	PA
	(Hz)	(dBuV/m)	(dBuV/m)	(dB)	(dB)	(m)		(°)	(m)		(dBuV)	(dB)	(dB)	(dB)
PK	111.48M	27.70	43.50	-15.80	-7.16	3	Horizontal	54	1.00	-	34.86	17.98	2.57	27.71
PK	157.07M	29.54	43.50	-13.96	-8.23	3	Horizontal	197	2.00	-	37.77	16.12	3.17	27.52
PK	194.9M	31.40	43.50	-12.10	-8.59	3	Horizontal	36	1.00	-	39.99	15.06	3.65	27.30
PK	351.07M	35.06	46.00	-10.94	-7.42	3	Horizontal	201	3.00	-	42.48	15.39	4.10	26.91
PK	429.16M	37.04	46.00	-8.96	-6.53	3	Horizontal	123	4.00	-	43.57	16.55	4.47	27.55
PK	507.24M	39.90	46.00	-6.10	-5.34	3	Horizontal	288	2.00	"Worst"	45.24	17.72	4.84	27.90

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	45.19	54.00	-8.81	3	Horizontal	307	1.48	-

BT-LE(1Mbps)

2402MHz_TX

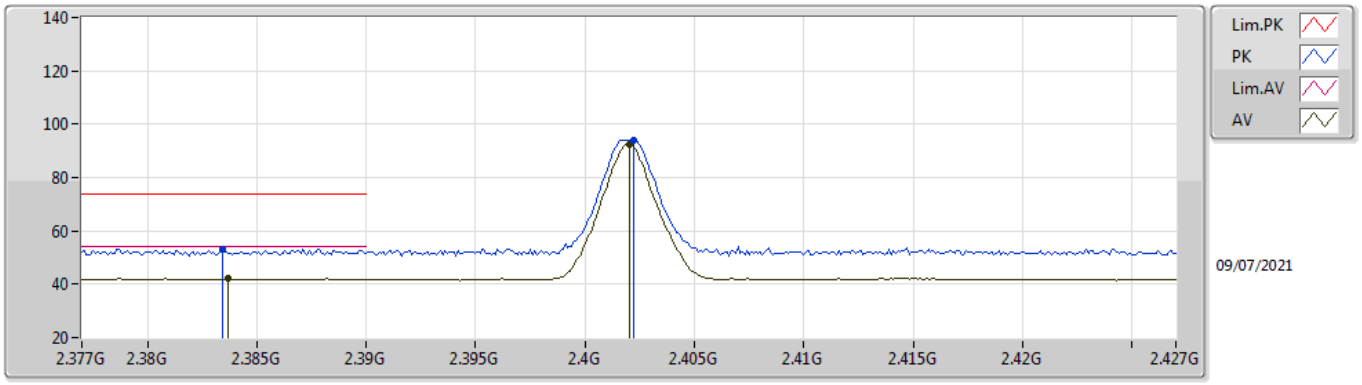


EUT Y_1TX
Setting Default
05-A-S-5

Type	Freq	Level	Limit	Margin	Raw	Dist	Condition	Azimuth	Height	Comment	AF	CL	PA
	(Hz)	(dBuV/m)	(dBuV/m)	(dB)	(dBuV)	(m)		(°)	(m)		(dB)	(dB)	(dB)
PK	2.3829G	54.07	74.00	-19.93	23.89	3	Vertical	266	1.77	-	27.60	2.58	-
AV	2.3793G	42.09	54.00	-11.91	11.89	3	Vertical	266	1.77	-	27.62	2.58	-
PK	2.4022G	92.10	Inf	-Inf	62.00	3	Vertical	266	1.77	-	27.50	2.60	-
AV	2.402G	90.65	Inf	-Inf	60.55	3	Vertical	266	1.77	-	27.50	2.60	-

BT-LE(1Mbps)

2402MHz_TX

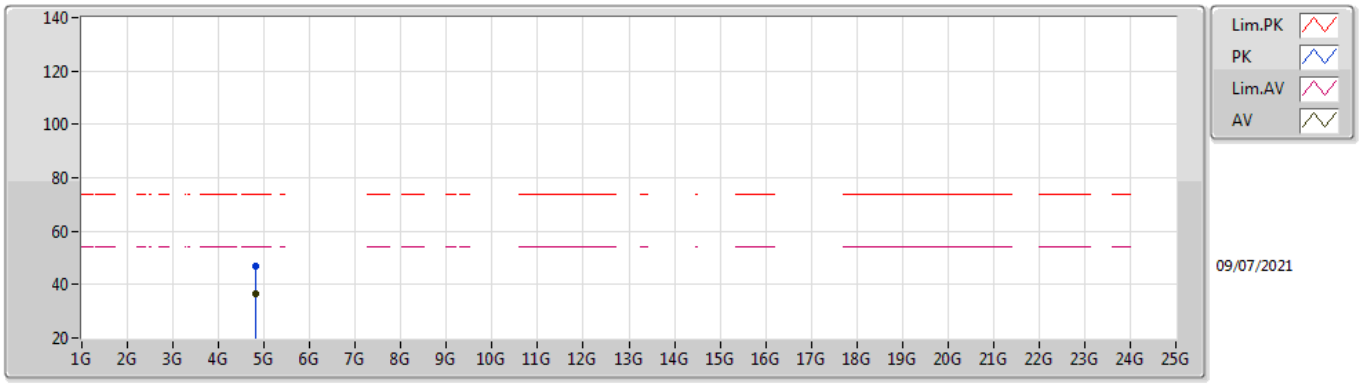


EUT Y_1TX
Setting Default
05-A-S-5

Type	Freq	Level	Limit	Margin	Raw	Dist	Condition	Azimuth	Height	Comment	AF	CL	PA
	(Hz)	(dBuV/m)	(dBuV/m)	(dB)	(dBuV)	(m)		(°)	(m)		(dB)	(dB)	(dB)
PK	2.3834G	53.19	74.00	-20.81	23.01	3	Horizontal	226	1.80	-	27.60	2.58	-
AV	2.3837G	42.15	54.00	-11.85	11.97	3	Horizontal	226	1.80	-	27.60	2.58	-
PK	2.4022G	94.12	Inf	-Inf	64.02	3	Horizontal	226	1.80	-	27.50	2.60	-
AV	2.402G	92.64	Inf	-Inf	62.54	3	Horizontal	226	1.80	-	27.50	2.60	-

BT-LE(1Mbps)

2402MHz_TX

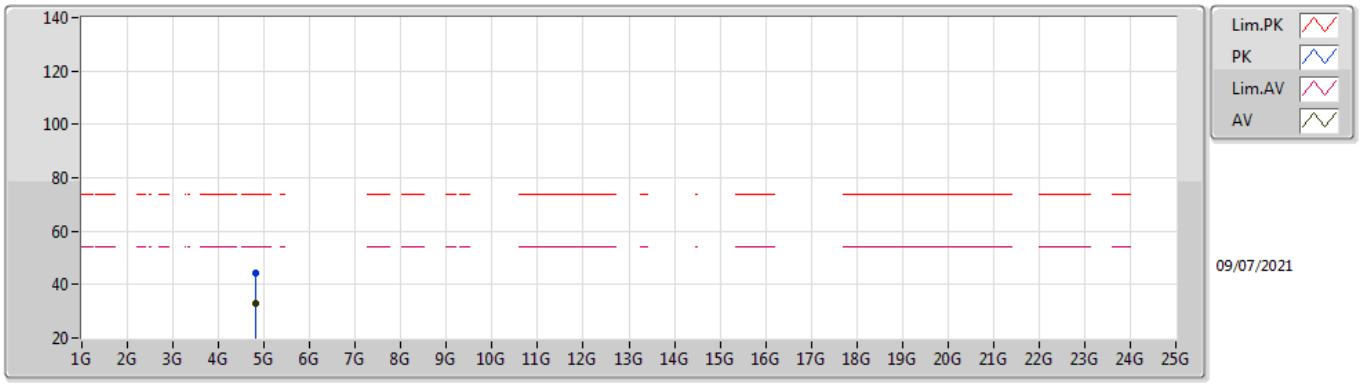


EUT Y_1TX
Setting Default
05-A-S-5

Type	Freq	Level	Limit	Margin	Raw	Dist	Condition	Azimuth	Height	Comment	AF	CL	PA
	(Hz)	(dBuV/m)	(dBuV/m)	(dB)	(dBuV)	(m)		(°)	(m)		(dB)	(dB)	(dB)
PK	4.80374G	46.79	74.00	-27.21	45.36	3	Vertical	205	1.82	-	31.31	6.01	35.89
AV	4.80404G	36.52	54.00	-17.48	35.09	3	Vertical	205	1.82	-	31.31	6.01	35.89

BT-LE(1Mbps)

2402MHz_TX

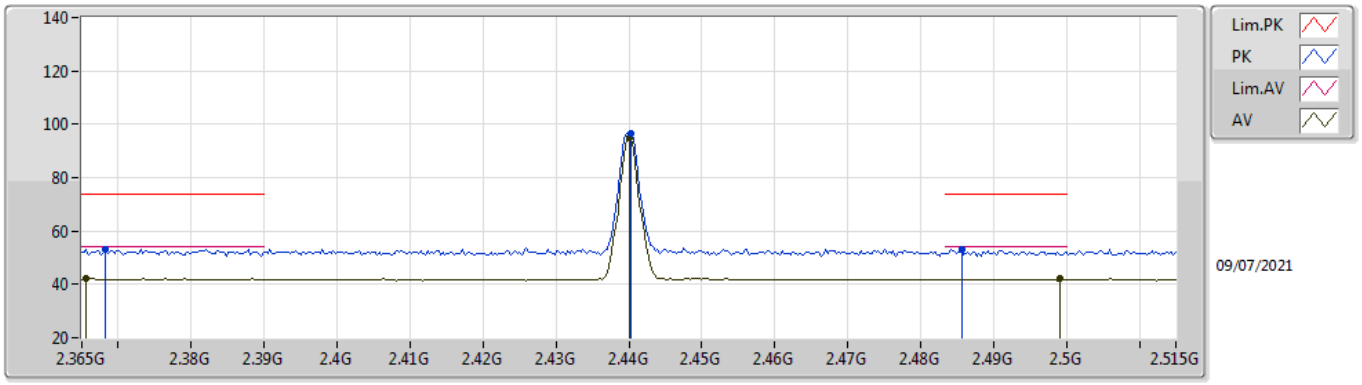


EUT Y_1TX
Setting Default
05-A-S-5

Type	Freq	Level	Limit	Margin	Raw	Dist	Condition	Azimuth	Height	Comment	AF	CL	PA
	(Hz)	(dBuV/m)	(dBuV/m)	(dB)	(dBuV)	(m)		(°)	(m)		(dB)	(dB)	(dB)
PK	4.80446G	44.35	74.00	-29.65	42.92	3	Horizontal	188	1.80	-	31.31	6.01	35.89
AV	4.804G	33.17	54.00	-20.83	31.74	3	Horizontal	188	1.80	-	31.31	6.01	35.89

BT-LE(1Mbps)

2440MHz_TX

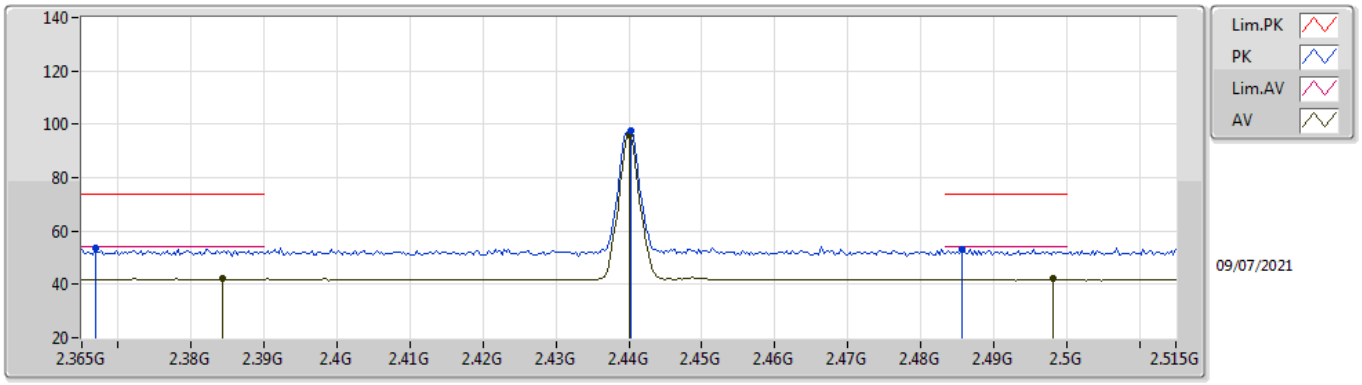


EUT Y_1TX
Setting Default
05-A-S-5

Type	Freq	Level	Limit	Margin	Raw	Dist	Condition	Azimuth	Height	Comment	AF	CL	PA
	(Hz)	(dBuV/m)	(dBuV/m)	(dB)	(dBuV)	(m)		(°)	(m)		(dB)	(dB)	(dB)
PK	2.3683G	53.00	74.00	-21.00	22.74	3	Vertical	258	1.96	-	27.69	2.57	-
AV	2.3656G	42.19	54.00	-11.81	11.91	3	Vertical	258	1.96	-	27.71	2.57	-
PK	2.4403G	96.58	Inf	-Inf	66.52	3	Vertical	258	1.96	-	27.42	2.64	-
AV	2.44G	95.11	Inf	-Inf	65.05	3	Vertical	258	1.96	-	27.42	2.64	-
PK	2.4856G	53.28	74.00	-20.72	23.26	3	Vertical	258	1.96	-	27.33	2.69	-
AV	2.4991G	42.01	54.00	-11.99	12.01	3	Vertical	258	1.96	-	27.30	2.70	-

BT-LE(1Mbps)

2440MHz_TX

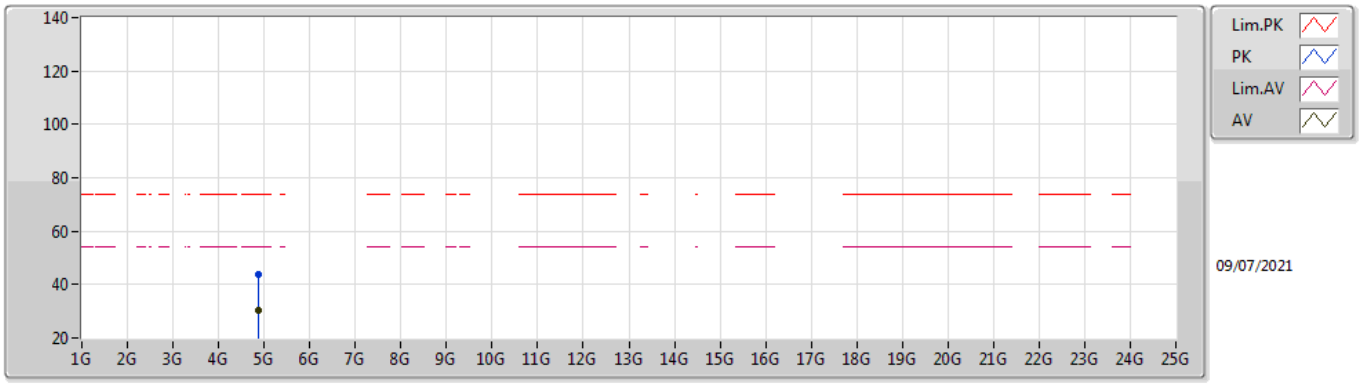


EUT Y_1TX
Setting Default
05-A-S-5

Type	Freq	Level	Limit	Margin	Raw	Dist	Condition	Azimuth	Height	Comment	AF	CL	PA
	(Hz)	(dBuV/m)	(dBuV/m)	(dB)	(dBuV)	(m)		(°)	(m)		(dB)	(dB)	(dB)
PK	2.3668G	53.48	74.00	-20.52	23.21	3	Horizontal	238	1.80	-	27.70	2.57	-
AV	2.3842G	42.12	54.00	-11.88	11.95	3	Horizontal	238	1.80	-	27.59	2.58	-
PK	2.4403G	97.49	Inf	-Inf	67.43	3	Horizontal	238	1.80	-	27.42	2.64	-
AV	2.44G	96.00	Inf	-Inf	65.94	3	Horizontal	238	1.80	-	27.42	2.64	-
PK	2.4856G	53.20	74.00	-20.80	23.18	3	Horizontal	238	1.80	-	27.33	2.69	-
AV	2.4982G	42.00	54.00	-12.00	12.00	3	Horizontal	238	1.80	-	27.30	2.70	-

BT-LE(1Mbps)

2440MHz_TX

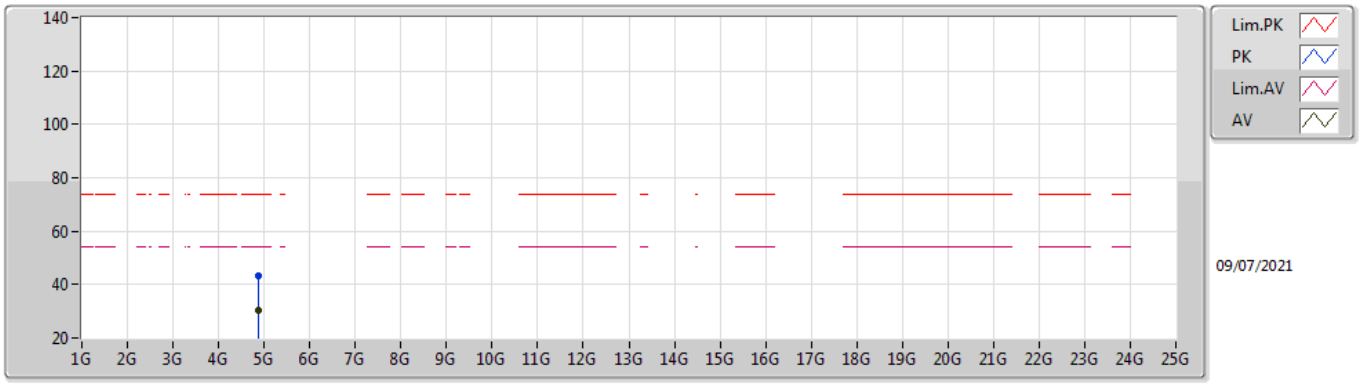


EUT Y_1TX
Setting Default
05-A-S-5

Type	Freq	Level	Limit	Margin	Raw	Dist	Condition	Azimuth	Height	Comment	AF	CL	PA
	(Hz)	(dBuV/m)	(dBuV/m)	(dB)	(dBuV)	(m)		(°)	(m)		(dB)	(dB)	(dB)
PK	4.88128G	43.64	74.00	-30.36	42.11	3	Vertical	200	2.07	-	31.27	6.12	35.86
AV	4.88132G	30.49	54.00	-23.51	28.96	3	Vertical	200	2.07	-	31.27	6.12	35.86

BT-LE(1Mbps)

2440MHz_TX

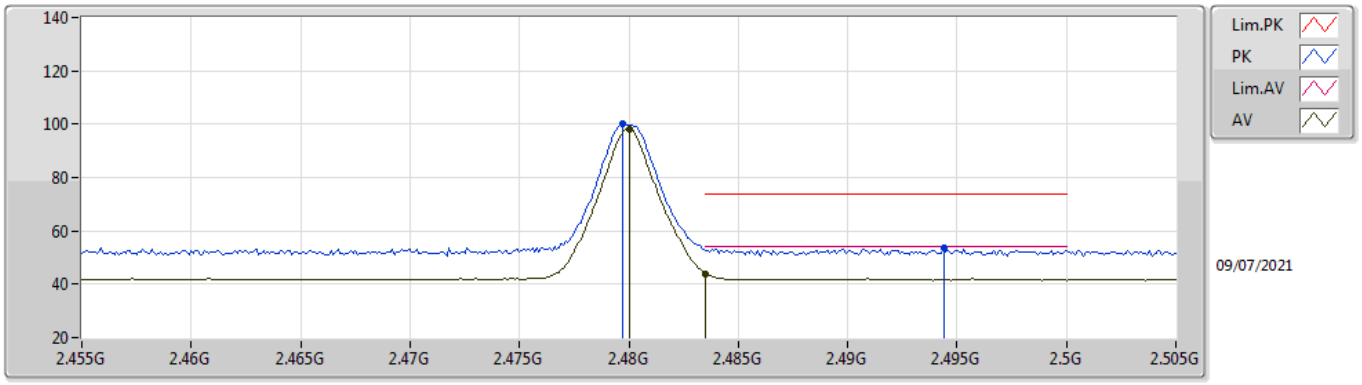


EUT Y_1TX
Setting Default
05-A-S-5

Type	Freq	Level	Limit	Margin	Raw	Dist	Condition	Azimuth	Height	Comment	AF	CL	PA
	(Hz)	(dBuV/m)	(dBuV/m)	(dB)	(dBuV)	(m)		(°)	(m)		(dB)	(dB)	(dB)
PK	4.87812G	43.28	74.00	-30.72	41.73	3	Horizontal	212	2.28	-	31.29	6.12	35.86
AV	4.8778G	30.34	54.00	-23.66	28.79	3	Horizontal	212	2.28	-	31.29	6.12	35.86

BT-LE(1Mbps)

2480MHz_TX

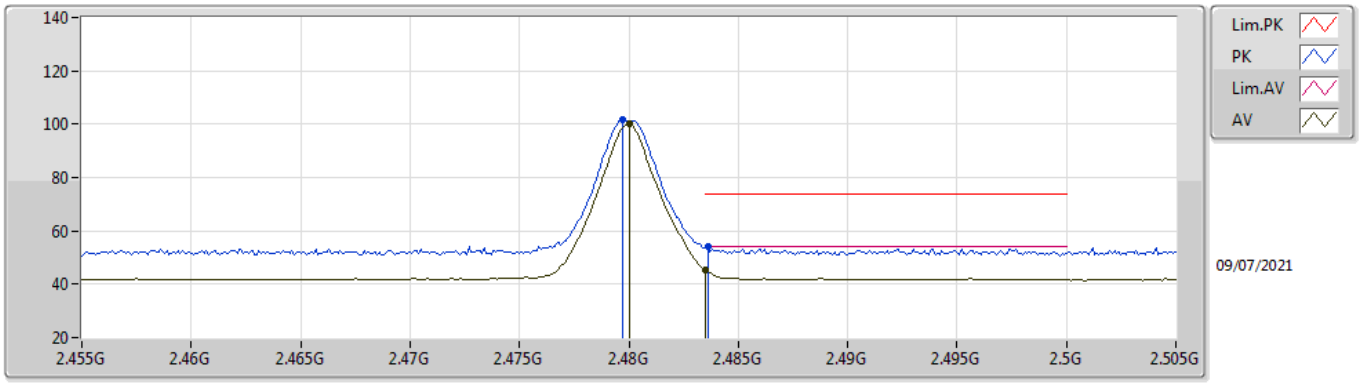


EUT Y_1TX
Setting Default
05-A-S-5

Type	Freq	Level	Limit	Margin	Raw	Dist	Condition	Azimuth	Height	Comment	AF	CL	PA
	(Hz)	(dBuV/m)	(dBuV/m)	(dB)	(dBuV)	(m)		(°)	(m)		(dB)	(dB)	(dB)
PK	2.4797G	99.92	Inf	-Inf	69.90	3	Vertical	129	1.99	-	27.34	2.68	-
AV	2.48G	98.13	Inf	-Inf	68.11	3	Vertical	129	1.99	-	27.34	2.68	-
PK	2.4944G	53.78	74.00	-20.22	23.78	3	Vertical	129	1.99	-	27.31	2.69	-
AV	2.4835G	44.02	54.00	-9.98	14.01	3	Vertical	129	1.99	-	27.33	2.68	-

BT-LE(1Mbps)

2480MHz_TX

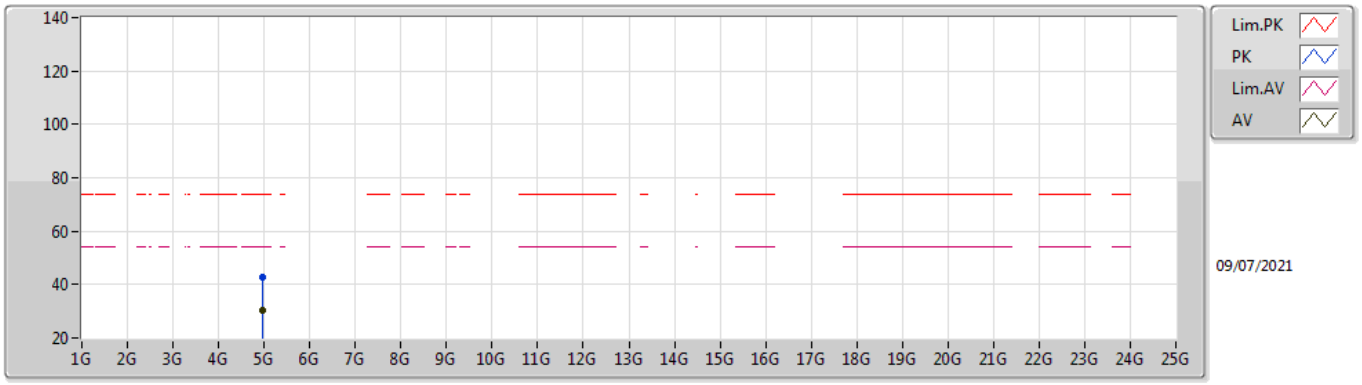


EUT Y_1TX
Setting Default
05-A-S-5

Type	Freq	Level	Limit	Margin	Raw	Dist	Condition	Azimuth	Height	Comment	AF	CL	PA
	(Hz)	(dBuV/m)	(dBuV/m)	(dB)	(dBuV)	(m)		(°)	(m)		(dB)	(dB)	(dB)
PK	2.4797G	101.75	Inf	-Inf	71.73	3	Horizontal	307	1.48	-	27.34	2.68	-
AV	2.48G	99.94	Inf	-Inf	69.92	3	Horizontal	307	1.48	-	27.34	2.68	-
PK	2.4836G	54.23	74.00	-19.77	24.22	3	Horizontal	307	1.48	-	27.33	2.68	-
AV	2.4835G	45.19	54.00	-8.81	15.18	3	Horizontal	307	1.48	-	27.33	2.68	-

BT-LE(1Mbps)

2480MHz_TX

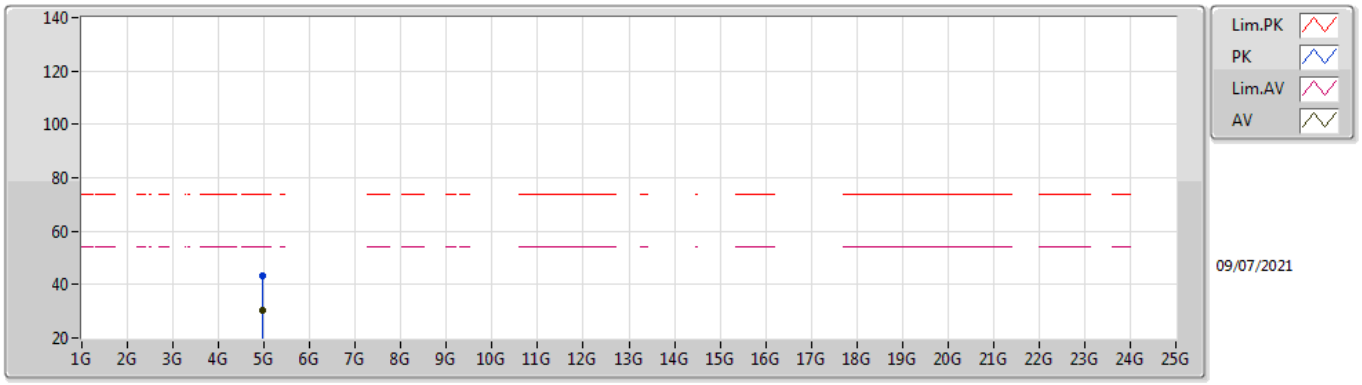


EUT Y_1TX
Setting Default
05-A-S-5

Type	Freq	Level	Limit	Margin	Raw	Dist	Condition	Azimuth	Height	Comment	AF	CL	PA
	(Hz)	(dBuV/m)	(dBuV/m)	(dB)	(dBuV)	(m)		(°)	(m)		(dB)	(dB)	(dB)
PK	4.95732G	42.54	74.00	-31.46	40.71	3	Vertical	215	1.59	-	31.43	6.24	35.84
AV	4.96148G	30.57	54.00	-23.43	28.71	3	Vertical	215	1.59	-	31.45	6.24	35.83

BT-LE(1Mbps)

2480MHz_TX



EUT Y_1TX
Setting Default
05-A-S-5

Type	Freq	Level	Limit	Margin	Raw	Dist	Condition	Azimuth	Height	Comment	AF	CL	PA
	(Hz)	(dBuV/m)	(dBuV/m)	(dB)	(dBuV)	(m)		(°)	(m)		(dB)	(dB)	(dB)
PK	4.95982G	43.35	74.00	-30.65	41.50	3	Horizontal	350	2.76	-	31.44	6.24	35.83
AV	4.95716G	30.41	54.00	-23.59	28.58	3	Horizontal	350	2.76	-	31.43	6.24	35.84