FCC Test Report

FCC ID	:	**2ABXLT1101**
Equipment	:	**Wireless Transceiver**
Brand Name	:	**Tile**
Model Name	:	**T1101**
Applicant	:	**Tile, Inc. 2121 S. El Camino Real Suite 900 San Mateo, CA 94403 USA**
Manufacturer	:	**Tile, Inc. 2121 S. El Camino Real Suite 900 San Mateo, CA 94403 USA**
Standard	:	**47 CFR FCC Part 15.247**

The product was received on May 29, 2019, and testing was started from Jun. 04, 2019 and completed on Jun. 05, 2019. We, SPORTON INTERNATIONAL INC. EMC & Wireless Communications 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 report must not be used by the client to claim product certification, approval, or endorsement by TAF or any agency of government.

The test results in this report apply exclusively to the tested model / sample. Without written approval of SPORTON INTERNATIONAL INC. EMC & Wireless Communications Laboratory, the test report shall not be reproduced except in full.

Approved by: Allen Lin

SPORTON INTERNATIONAL INC. EMC & Wireless Communications Laboratory

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

Table of Contents

History of this test report

Report No.	Version	Description	Issued Date
FR952858AL	01	Initial issue of report	Jun. 20, 2019

Summary of Test Result

Report Clause	Ref. Std. Clause	Test Items	Result (PASS/FAIL)	Remark
1.1.2	15.203	Antenna Requirement	PASS	FCC 15.203
3.1	15.207	AC Power-line Conducted Emissions	Not Required	FCC 15.207
3.2	15.247(a)	DTS Bandwidth	PASS	≥500kHz
3.3	15.247(b)	Maximum Conducted Output Power	PASS	Power [dBm]:30
3.4	15.247(e)	Power Spectral Density	PASS	PSD [dBm/3kHz]:8
3.5	15.247(d)	Emissions in Non-restricted Frequency Bands	PASS	Non-Restricted Bands: >30 dBc
3.6	15.247(d)	Emissions in Restricted Frequency Bands	PASS	Restricted Bands: FCC 15.209

Declaration of Conformity:
The test results with all measurement uncertainty excluded are presented in accordance with the regulation limits or requirements declared by manufacturers.
Comments and explanations:
None

Reviewed by: Jackson Tsai

Report Producer: Jenny Yang

1 General Description

1.1 Information

1.1.1 RF General Information

Frequency Range (MHz)	Bluetooth Mode	Ch. Frequency (MHz)	Channel Number
2400-2483.5	LE	2402-2480	0-39 [40]

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

Note:
- Bluetooth LE uses a GFSK (1Mbps) modulation for DSSS.
- BWch is the nominal channel bandwidth.

1.1.2 Antenna Information

Ant.	Brand	Model Name	Antenna Type	Connector	Gain (dBi)
1	-	-	Integral	N/A	1.83

Note 1: The EUT has one antenna.

For BT function:

For IEEE 802.15.1 Bluetooth mode (1TX/1RX)

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

1.1.3 EUT Information

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

1.1.4 Mode Test Duty Cycle

Mode	DC	DCF(dB)	T(s)	VBW(Hz) ≥ 1/T
BT-LE(1Mbps)	0.632	1.99	395u	3k

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

1.2 Testing Applied Standards

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

- 47 CFR FCC Part 15
- ANSI C63.10-2013
- KDB 558074 D01 v05r02

1.3 Testing Location Information

Testing Location			
☒	HWA YA	ADD : No. 52, Huaya 1st Rd., Guishan Dist., Taoyuan City, Taiwan (R.O.C.)	
		TEL : 886-3-327-3456	FAX : 886-3-327-0973
Test site Designation No. TW1190 with FCC.			
☐	JHUBEI	ADD : No.8, Ln. 724, Bo'ai St., Zhubei City, Hsinchu County, Taiwan (R.O.C.)	
		TEL : 886-3-656-9065	FAX : 886-3-656-9085
Test site Designation No. TW0006 with FCC.			

Test Condition	Test Site No.	Test Engineer	Test Environment	Test Date
RF Conducted	TH06-HY	Bunny	23.2~23.8°C / 62~69%	04/Jun/2019
Radiated	03CH09-HY	Ryan	24.2~27.3°C / 55.8~62.8%	04/Jun/2019~ 05/Jun/2019

1.4 Measurement Uncertainty

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

Test Items	Uncertainty	Remark
Conducted Emission (150kHz ~ 30MHz)	3.54 dB	Confidence levels of 95%
Radiated Emission (9kHz ~ 30MHz)	1.6 dB	Confidence levels of 95%
Radiated Emission (30MHz ~ 1,000MHz)	4.3 dB	Confidence levels of 95%
Radiated Emission (1GHz ~ 18GHz)	3.9 dB	Confidence levels of 95%
Radiated Emission (18GHz ~ 40GHz)	3.5 dB	Confidence levels of 95%
Conducted Emission	1.3 dB	Confidence levels of 95%
Temperature	0.7 °C	Confidence levels of 95%
Humidity	4 %	Confidence levels of 95%

2 Test Configuration of EUT

2.1 Test Condition

RF Conducted	Abbreviation	Remark
TnomVnom	Tnom	20°C
-	Vnom	3V

2.2 Test Channel Mode

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

2.3 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		
1	Battery Mode		
Operating Mode > 1GHz	CTX		
Orthogonal Planes of EUT	**X Plane**	**Y Plane**	**Z Plane**
			
Worst Planes of EUT		V	

2.4 Accessories and Support Equipment

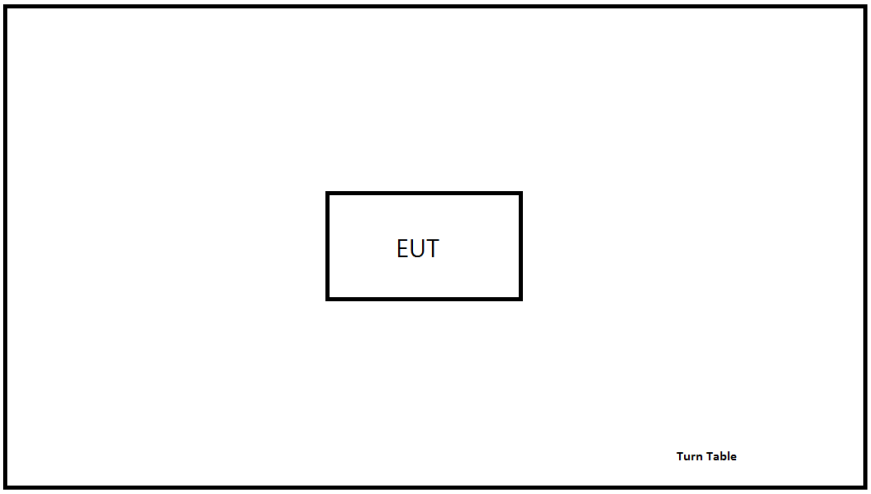
Accessories				
Battery	**Brand Name**	Sony	**Model Name**	CR2032
	Power Rating	3Vdc, 225mAh	Type	Coin Cell

Reminder: Regarding to more detail and other information, please refer to user manual.

Support Equipment – RF Conducted				
No.	**Equipment**	**Brand Name**	**Model Name**	**FCC ID**
1	DC Power Supply	GW	PSS-2005	-

2.5 Test Setup Diagram

Test Setup Diagram - Radiated Test



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

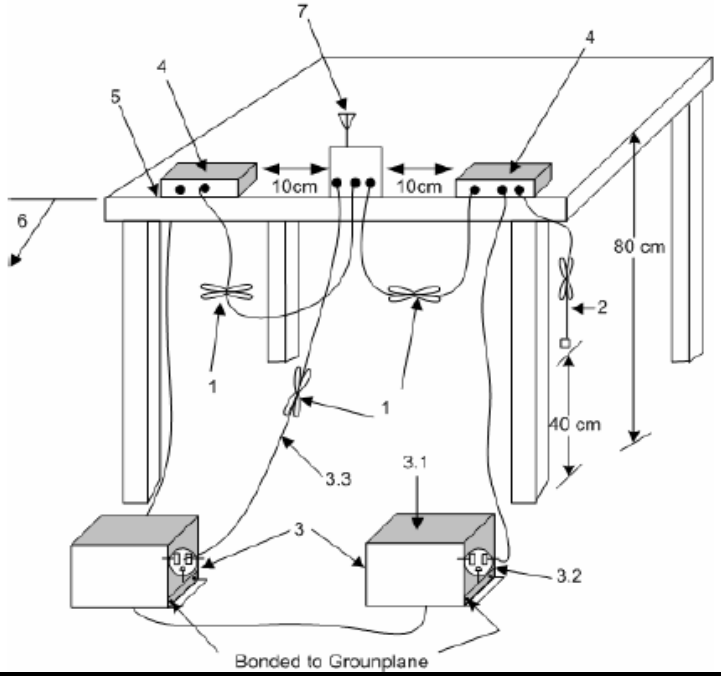
Refer a test equipment and calibration data table in this test report.

3.1.3 Test Procedures

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

3.1.4 Test Setup

AC Power-line Conducted Emissions



3.1.5 Test Result of AC Power-line Conducted Emissions

Please refer to FCC 15.207 which states, “Measurements to demonstrate compliance with the conducted limits are not required for devices employ Battery for operation and which do not operate from the AC power lines or contain provisions for operation while connected to the AC power lines”.
Therefore, for this device, AC Power Line Conducted Emissions investigation is not required.

3.2 DTS Bandwidth

3.2.1 6dB Bandwidth Limit

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

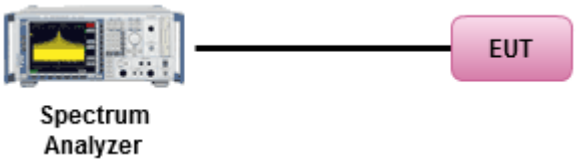
3.2.2 Measuring Instruments

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 KDB 558074, clause 8.2 (11.8 of ANSI C63.10) DTS bandwidth measurement.
	☐ Refer as RSS-Gen, clause 6.7 for occupied bandwidth testing.
	☐ Refer as ANSI C63.10, clause 6.9.3 for occupied bandwidth testing.

3.2.4 Test Setup

Emission Bandwidth


3.2.5 Test Result of Emission Bandwidth

Refer as Appendix A

3.3 Maximum Conducted Output Power

3.3.1 Maximum Conducted Output Power Limit

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

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

3.4 Power Spectral Density

3.4.1 Power Spectral Density Limit

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

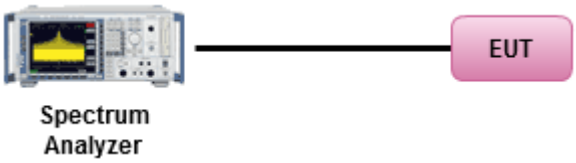
3.4.2 Measuring Instruments

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 KDB 558074, clause 8.4 (11.10 of ANSI C63.10) Method PKPSD.	
▪ For conducted measurement.		
	▪ If The EUT supports multiple transmit chains using options given below:	
		▪ Measure and sum the spectra across the outputs. Refer as KDB 662911, In-band power spectral density (PSD). Sample all transmit ports simultaneously using a spectrum analyzer for each transmit port. Where the trace bin-by-bin of each transmit port summing can be performed. (i.e., in the first spectral bin of output 1 is summed with that in the first spectral bin of output 2 and that from the first spectral bin of output 3, and so on up to the NTX output to obtain the value for the first frequency bin of the summed spectrum.). Add up the amplitude (power) values for the different transmit chains and use this as the new data trace.

3.4.4 Test Setup

Power Spectral Density


3.4.5 Test Result of Power Spectral Density

Refer as Appendix C

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

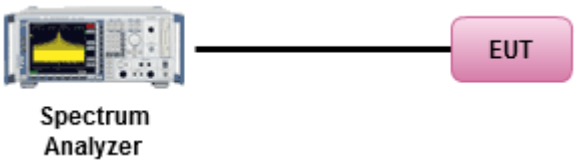
3.5.2 Measuring Instruments

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

3.5.3 Test Procedures

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

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.

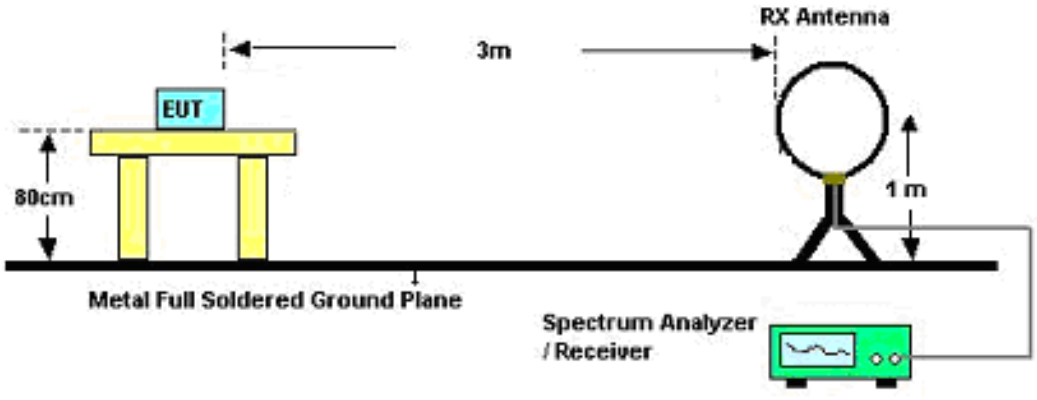
3.6.2 Measuring Instruments

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

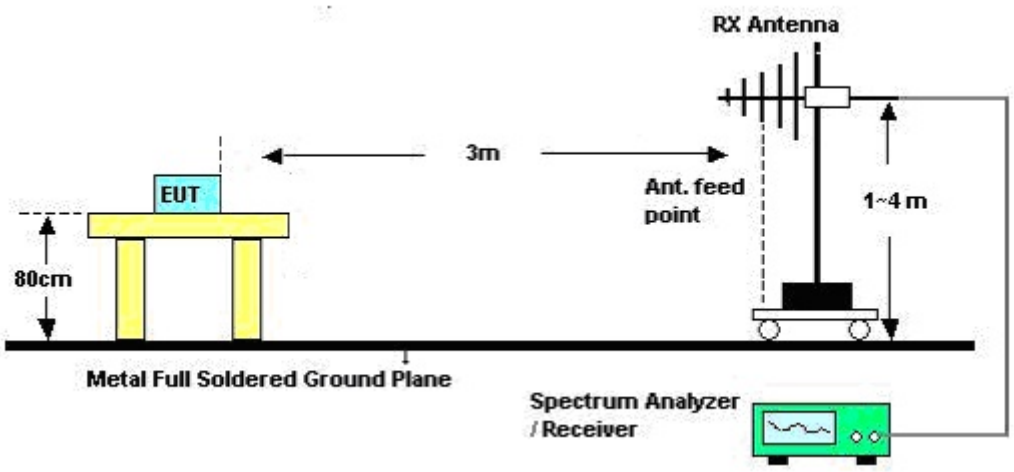
3.6.3 Test Procedures

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 KDB 558074, clause 8.6 (11.12 of ANSI C63.10) for restricted frequency bands.
▪ For the transmitter band-edge emissions shall be measured using following options below:	
	▪ Refer as KDB 558074 clause 8.7.1, When the performing peak or average radiated measurements, emissions within 2 MHz of the authorized band edge may be measured using the marker-delta method described below.
	▪ Refer as KDB 558074, clause 8.7.2 (6.10.6 of ANSI C63.10) for marker-delta method for band-edge measurements.
	▪ Refer as KDB 558074, clause 8.7.3 for narrower resolution bandwidth (100kHz) using the band power and summing the spectral levels (i.e., 1 MHz).
▪ Use the following spectrum analyzer settings:	
	▪ Set RBW=100 kHz for f < 1 GHz; VBW=3 * RBW; Sweep = auto; Detector function = peak; Trace = max hold.
	▪ Set RBW = 1 MHz, VBW= 3MHz for f ≥ 1 GHz for peak measurement. For average measurement, refer as 1.1.4.

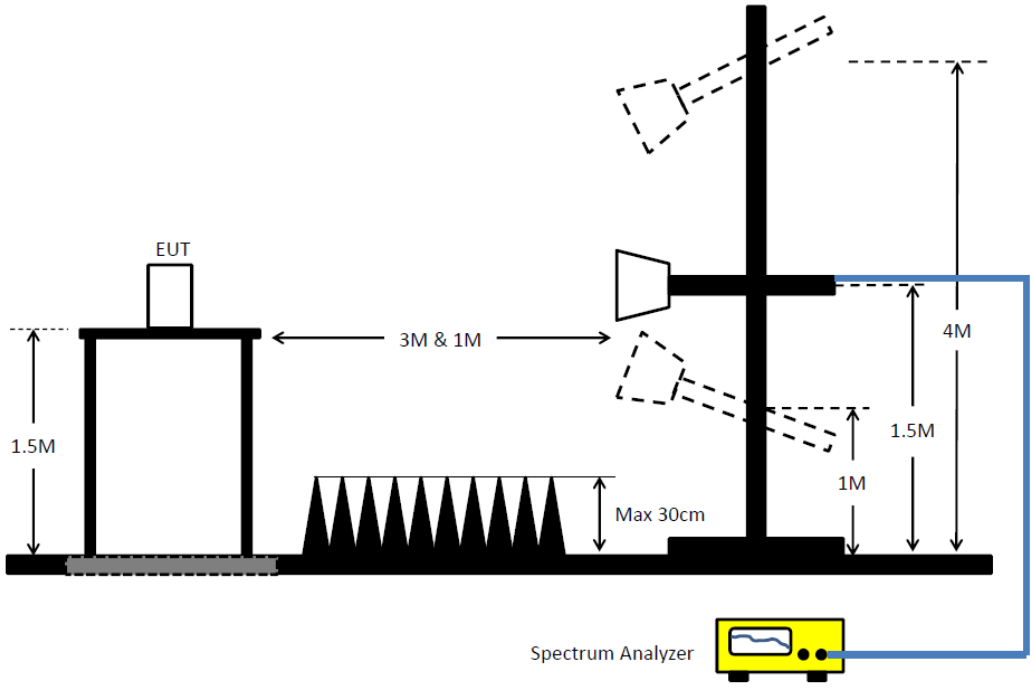
3.6.4 Test Setup

Emissions in Restricted Frequency Bands
9kHz ~30MHz


30MHz~1GHz



Above 1GHz



3.6.5 Test Result of Emissions in Restricted Frequency Bands (Below 30MHz)

The amplitude of spurious emissions which are attenuated by more than 20dB below the permissible value has no need to be reported.

3.6.6 Test Result of Emissions in Restricted Frequency Bands

Refer as Appendix E

4 Test Equipment and Calibration Data

Instrument for Conducted Test

Instrument	Manufacturer	Model No.	Serial No.	Spec.	Calibration Date	Calibration Due Date
Spectrum Analyzer	R&S	FSV 40	101013	10Hz~40GHz	13/Mar/2019	12/Mar/2020
Power Sensor	Anritsu	MA2411B	1339407	300MHz ~ 40GHz	17/Nov/2018	16/Nov/2019
Power Meter	Anritsu	ML2495A	1517010	300MHz ~ 40GHz	17/Nov/2018	16/Nov/2019
Cable 0.2m	HUBER	MY10710/4	RF Cable - 01	30MHz ~18G	10/Jan/2019	09/Jan/2020
Cable 0.2m	HUBER	MY10711/4	RF Cable - 02	30MHz ~18G	10/Jan/2019	09/Jan/2020
Cable 0.5m	HUBER	MY39470/4	RF Cable - 29	30MHz ~18G	10/Jan/2019	09/Jan/2020
CABLE 1.5m	HUBER	MY33066/4	RF Cable - 30	1 to 18GHz	10/Jan/2019	09/Jan/2020
SMB100A Signal Generator	R&S	SMB100A03	181147	100kHz~40GHz	12/Nov/2018	10/Nov/2020

Instrument for Radiated Test

Instrument	Manufacturer	Model No.	Serial No.	Spec.	Calibration Date	Calibration Due Date
3m Semi Anechoic Chamber	TDK	SAC-3M	03CH09-HY	30MHz ~ 1GHz	30/Mar/2019	29/Mar/2020
3m Semi Anechoic Chamber	TDK	SAC-3M	03CH09-HY	1GHz ~ 18GHz	30/Mar/2019	29/Mar/2020
Microwave Preamplifier	Agilent	8449B	3008A02326	1GHz ~ 26.5GHz	03/Jul/2018	02/Jul/2019
Amplifier	EMC	EMC9135	980209	9kHz ~ 1.0GHz	11/Jan/2019	10/Jan/2020
EMI Test Receiver	R&S	ESR3	102052	9kHz ~ 3.6GHz	09/Apr/2019	08/Apr/2020
EXA Signal Analyzer	KEYSIGHT	N9010A	MY54200885	10Hz ~ 44GHz	31/Jul/2018	30/Jul/2019
Bilog Antenna & 5dB Attenuator	TESEQ & MTJ	CBL6111D & MTJ6102-05	35418 / 3	30MHz~1GHz	02/Oct/2018	03/Oct/2019
Double ridged Guide Horn Antenna	COM-POWER	AH-118	10094	1GHz~18GHz	13/Jul/2018	12/Jul/2019
Broadband Horn Antenna	SCHWARZBECK	BBHA 9170	BBHA9170614	18GHz~40GHz	22/May/2019	21/May/2020
Loop Antenna	TESEQ	HLA 6120	31244	9k-30MHz	15/Mar/2019	14/Mar/2020
LF-CABLE-20190218	Jye Bao	RG142	CB028	9kHz ~ 1GHz	18/Feb/2019	17/Feb/2020
RF Cable-high	HUBER+ SUHNER	SUCOFLEX104	SN 556626/4 + 556627	1GHz ~ 40GHz	14/Mar/2019	13/Mar/2020

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)	716.25k	1.048M	1M05F1D	703.75k	1.042M

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

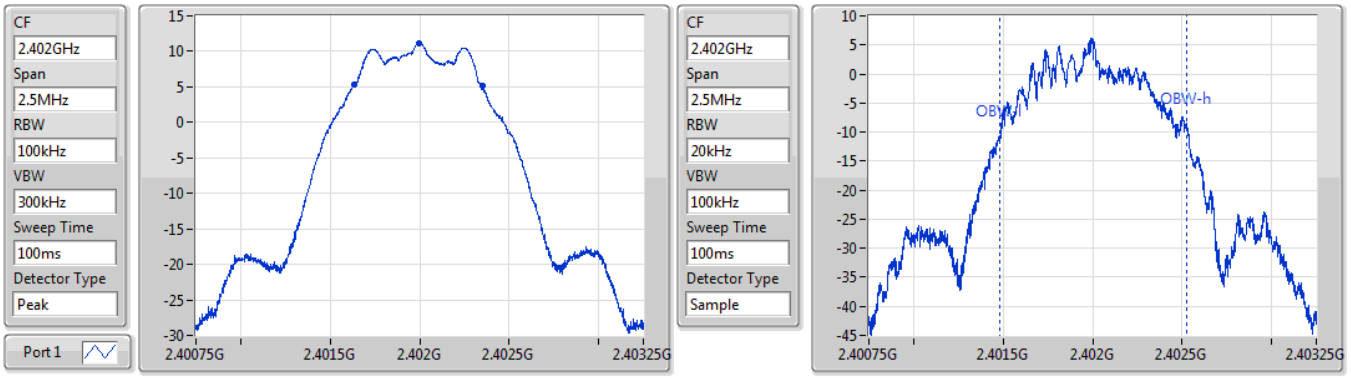
Mode	Result	Limit (Hz)	Port 1-N dB (Hz)	Port 1-OBW (Hz)
BT-LE(1Mbps)	-	-	-	-
2402MHz	Pass	500k	712.5k	1.042M
2440MHz	Pass	500k	716.25k	1.046M
2480MHz	Pass	500k	703.75k	1.048M

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

BT-LE(1Mbps) EBW

2402MHz

04/06/2019

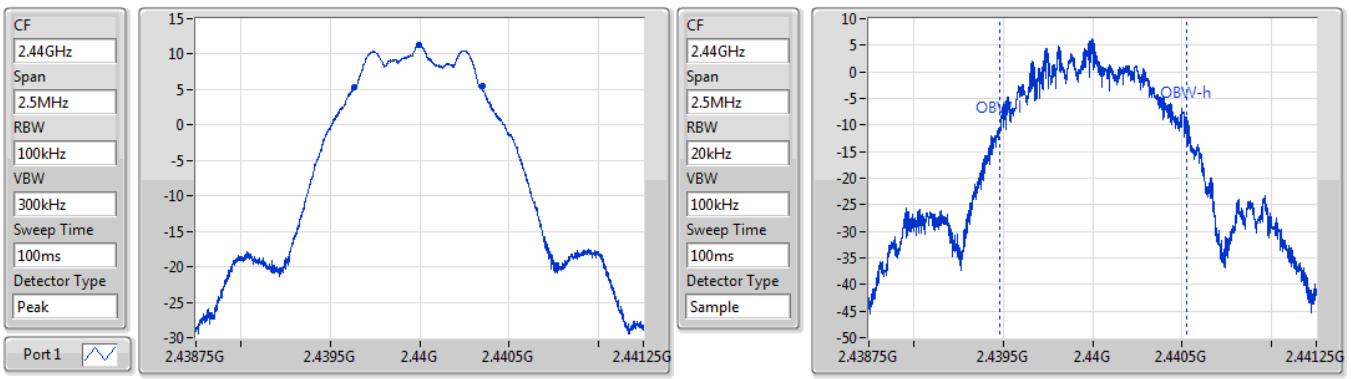


6dB(Hz)	Fl-6dB(Hz)	Fh-6dB(Hz)	OBW(Hz)	Fl-OBW(Hz)	Fh-OBW(Hz)	Limit(Hz)	Port
712.5k	2.401636G	2.402349G	1.042M	2.401483G	2.402525G	500k	1

BT-LE(1Mbps) EBW

2440MHz

04/06/2019

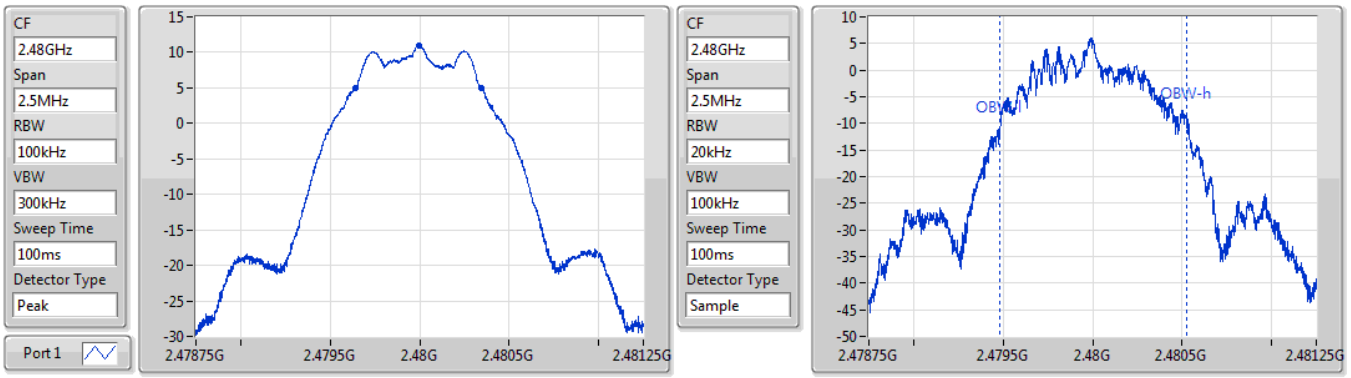


6dB(Hz)	Fl-6dB(Hz)	Fh-6dB(Hz)	OBW(Hz)	Fl-OBW(Hz)	Fh-OBW(Hz)	Limit(Hz)	Port
716.25k	2.439635G	2.440351G	1.046M	2.43948G	2.440526G	500k	1

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

2480MHz

04/06/2019



6dB(Hz)	Fl-6dB(Hz)	Fh-6dB(Hz)	OBW(Hz)	Fl-OBW(Hz)	Fh-OBW(Hz)	Limit(Hz)	Port
703.75k	2.479639G	2.480343G	1.048M	2.479478G	2.480526G	500k	1

Summary

Mode	Power (dBm)	Power (W)
2.4-2.4835GHz	-	-
BT-LE(1Mbps)	9.90	0.00977

Result

Mode	Result	Gain (dBi)	Power (dBm)	Power Limit (dBm)
BT-LE(1Mbps)	-	-	-	-
2402MHz	Pass	1.83	9.90	30.00
2440MHz	Pass	1.83	9.85	30.00
2480MHz	Pass	1.83	9.61	30.00

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

Summary

Mode	PD (dBm/RBW)
2.4-2.4835GHz	-
BT-LE(1Mbps)	-4.34

RBW=3 kHz.

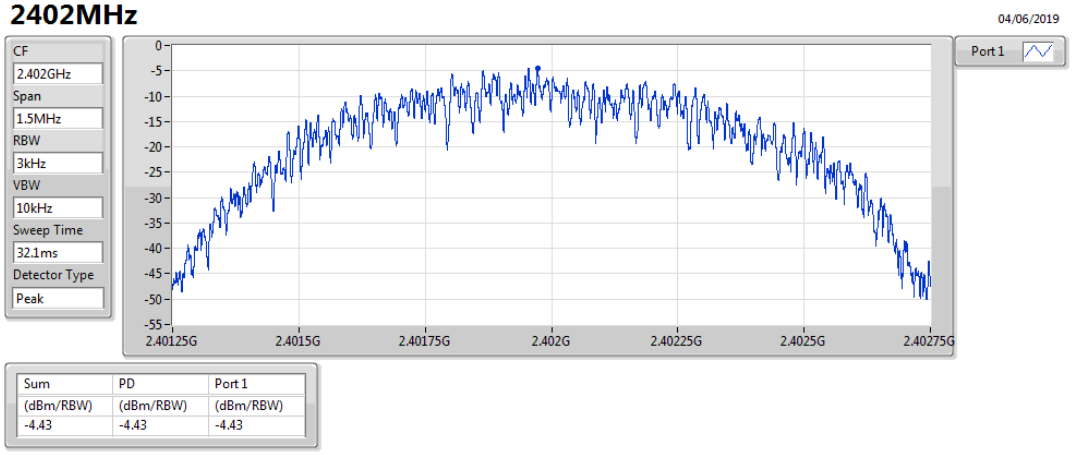
Result

Mode	Result	Gain (dBi)	PD (dBm/RBW)	PD Limit (dBm/RBW)
BT-LE(1Mbps)	-	-	-	-
2402MHz	Pass	1.83	-4.43	8.00
2440MHz	Pass	1.83	-4.34	8.00
2480MHz	Pass	1.83	-4.67	8.00

DG = Directional Gain; RBW=3 kHz;
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**

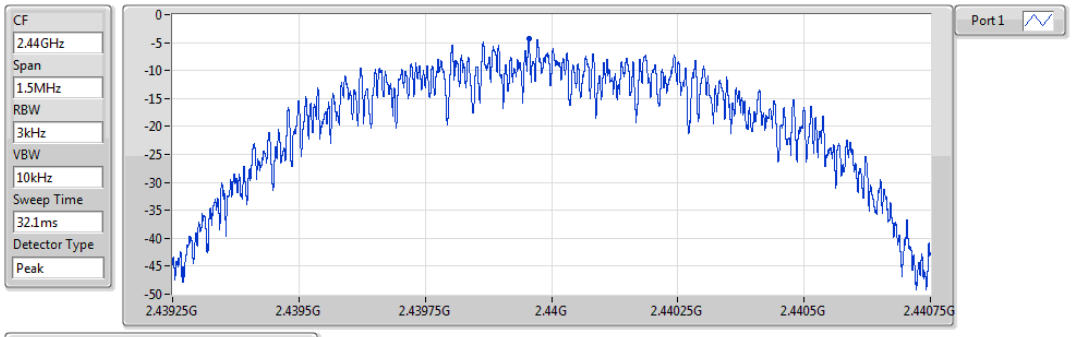
2402MHz



Sum	PD	Port 1
(dBm/RBW)	(dBm/RBW)	(dBm/RBW)
-4.43	-4.43	-4.43

BT-LE(1Mbps) **PSD**

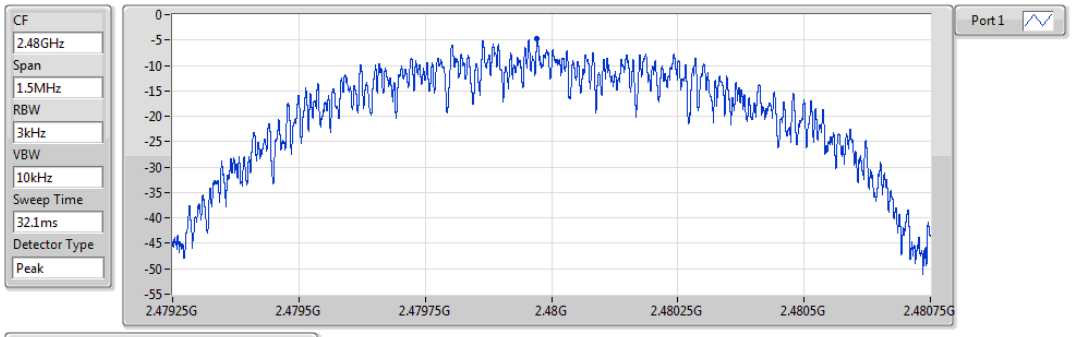
2440MHz



Sum	PD	Port 1
(dBm/RBW)	(dBm/RBW)	(dBm/RBW)
-4.34	-4.34	-4.34

BT-LE(1Mbps) **PSD**

2480MHz



Sum	PD	Port 1
(dBm/RBW)	(dBm/RBW)	(dBm/RBW)
-4.67	-4.67	-4.67

Summary

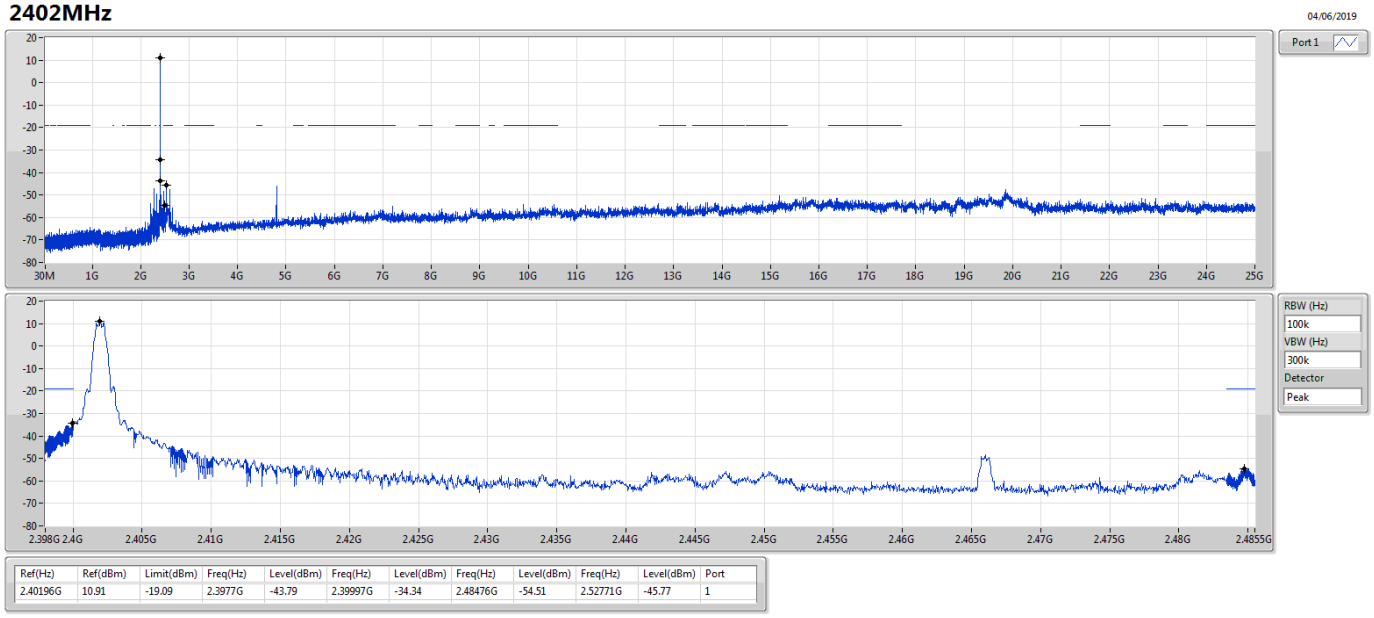
Mode	Result	Ref (Hz)	Ref (dBm)	Limit (dBm)	Freq (Hz)	Level (dBm)	Freq (Hz)	Level (dBm)	Freq (Hz)	Level (dBm)	Freq (Hz)	Level (dBm)	Port
2.4-2.4835GHz	-	-	-	-	-	-	-	-	-	-	-	-	-
BT-LE(1Mbps)	Pass	2.40196G	10.91	-19.09	2.3977G	-43.79	2.39997G	-34.34	2.48476G	-54.51	2.52771G	-45.77	1

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)	Port
BT-LE(1Mbps)	-	-	-	-	-	-	-	-	-	-	-	-	-
2402MHz	Pass	2.40196G	10.91	-19.09	2.3977G	-43.79	2.39997G	-34.34	2.48476G	-54.51	2.52771G	-45.77	1
2440MHz	Pass	2.40196G	10.91	-19.09	2.39178G	-56.42	2.3992G	-56.17	2.48533G	-54.66	2.56712G	-48.21	1
2480MHz	Pass	2.40196G	10.91	-19.09	2.3095G	-57.11	2.39957G	-55.12	2.4835G	-39.70	2.60652G	-43.11	1

BT-LE(1Mbps) **CSE NdB**

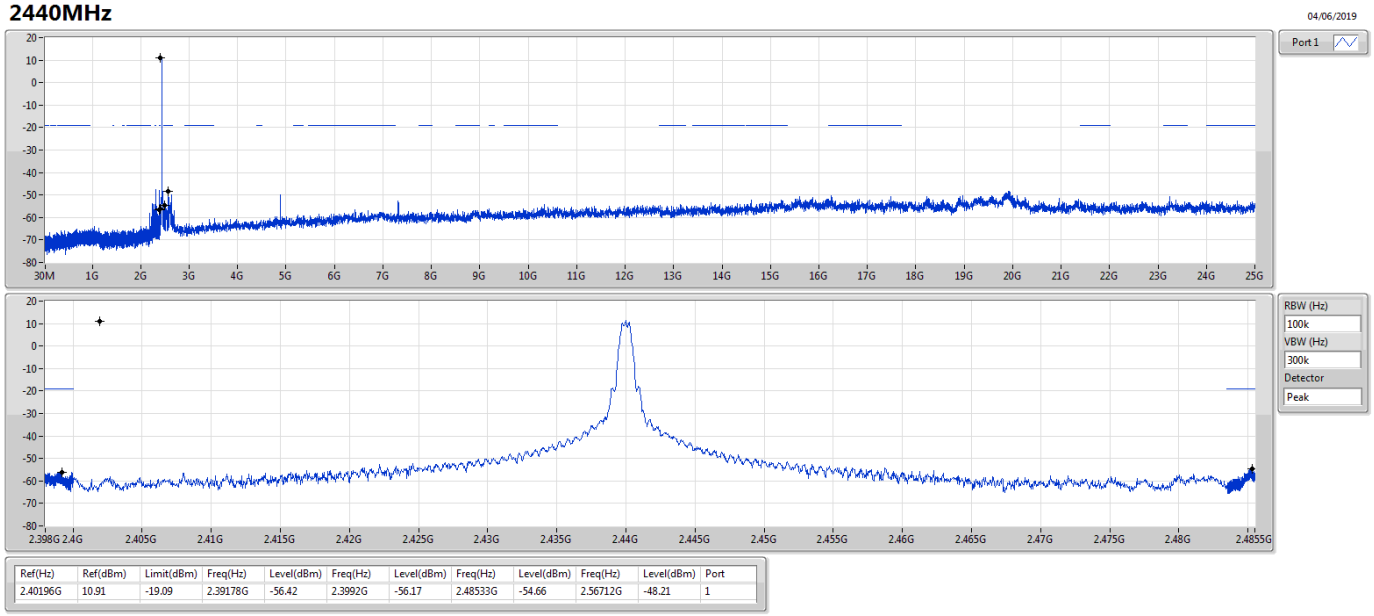
2402MHz



Ref(Hz)	Ref(dBm)	Limit(dBm)	Freq(Hz)	Level(dBm)	Freq(Hz)	Level(dBm)	Freq(Hz)	Level(dBm)	Freq(Hz)	Level(dBm)	Port
2.40196G	10.91	-19.09	2.3977G	-43.79	2.39997G	-34.34	2.48476G	-54.51	2.52771G	-45.77	1

BT-LE(1Mbps) **CSE NdB**

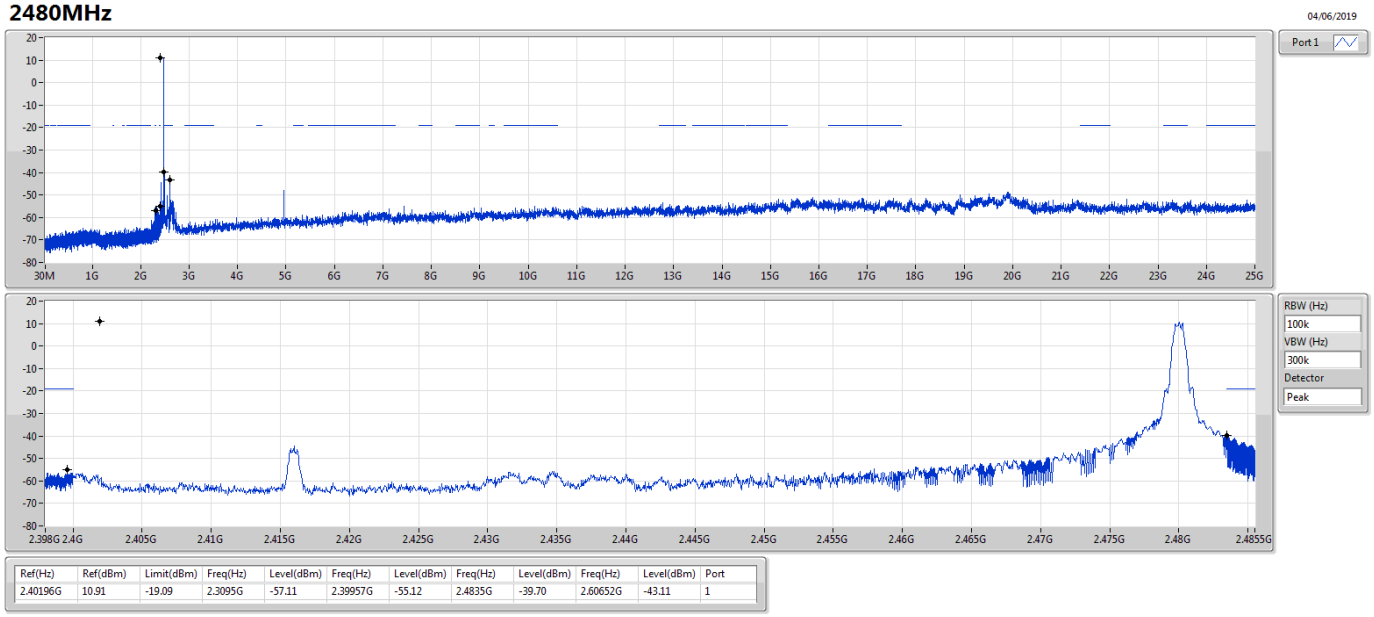
2440MHz



Ref(Hz)	Ref(dBm)	Limit(dBm)	Freq(Hz)	Level(dBm)	Freq(Hz)	Level(dBm)	Freq(Hz)	Level(dBm)	Freq(Hz)	Level(dBm)	Port
2.40196G	10.91	-19.09	2.39178G	-56.42	2.3992G	-56.17	2.48533G	-54.66	2.56712G	-48.21	1

BT-LE(1Mbps) **CSE NdB**

2480MHz



Ref(Hz)	Ref(dBm)	Limit(dBm)	Freq(Hz)	Level(dBm)	Freq(Hz)	Level(dBm)	Freq(Hz)	Level(dBm)	Freq(Hz)	Level(dBm)	Port
2.40196G	10.91	-19.09	2.3095G	-57.11	2.39957G	-55.12	2.4835G	-39.70	2.60652G	-43.11	1

Summary

Mode	Result	Type	Freq (Hz)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Factor (dB)	Dist (m)	Condition	Azimuth (°)	Height (m)	Comments
2.4-2.4835GHz	-	-	-	-	-	-	-	-	-	-	-	-
BT-LE(1Mbps)	Pass	PK	30M	25.37	40.00	-14.63	-8.16	3	Horizontal	0	1.00	-

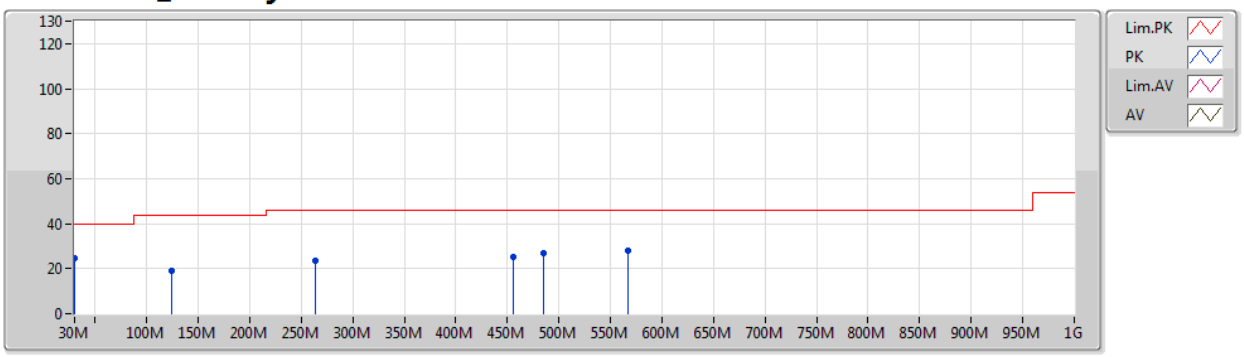
Result

Mode	Result	Type	Freq (Hz)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Factor (dB)	Dist (m)	Condition	Azimuth (°)	Height (m)	Comments
BT-LE(1Mbps)	-	-	-	-	-	-	-	-	-	-	-	-
2440MHz_Battery	Pass	PK	30M	24.65	40.00	-15.35	-8.16	3	Vertical	360	1.00	-
2440MHz_Battery	Pass	PK	124.19M	19.17	43.50	-24.33	-13.79	3	Vertical	360	1.00	-
2440MHz_Battery	Pass	PK	263.36M	23.50	46.00	-22.50	-11.28	3	Vertical	360	1.00	-
2440MHz_Battery	Pass	PK	455.96M	25.45	46.00	-20.55	-7.03	3	Vertical	360	1.00	-
2440MHz_Battery	Pass	PK	485.48M	26.64	46.00	-19.36	-6.34	3	Vertical	360	1.00	-
2440MHz_Battery	Pass	PK	567.01M	28.11	46.00	-17.89	-4.80	3	Vertical	360	1.00	-
2440MHz_Battery	Pass	PK	30M	25.37	40.00	-14.63	-8.16	3	Horizontal	0	1.00	-
2440MHz_Battery	Pass	PK	88M	24.17	40.00	-15.83	-17.47	3	Horizontal	0	1.00	-
2440MHz_Battery	Pass	PK	184.64M	19.51	43.50	-23.99	-16.46	3	Horizontal	0	1.00	-
2440MHz_Battery	Pass	PK	333.65M	22.99	46.00	-23.01	-10.82	3	Horizontal	0	1.00	-
2440MHz_Battery	Pass	PK	447.52M	25.69	46.00	-20.31	-7.26	3	Horizontal	0	1.00	-
2440MHz_Battery	Pass	PK	489.7M	26.92	46.00	-19.08	-6.31	3	Horizontal	0	1.00	-

BT-LE(1Mbps)

04/06/2019

2440MHz_Battery

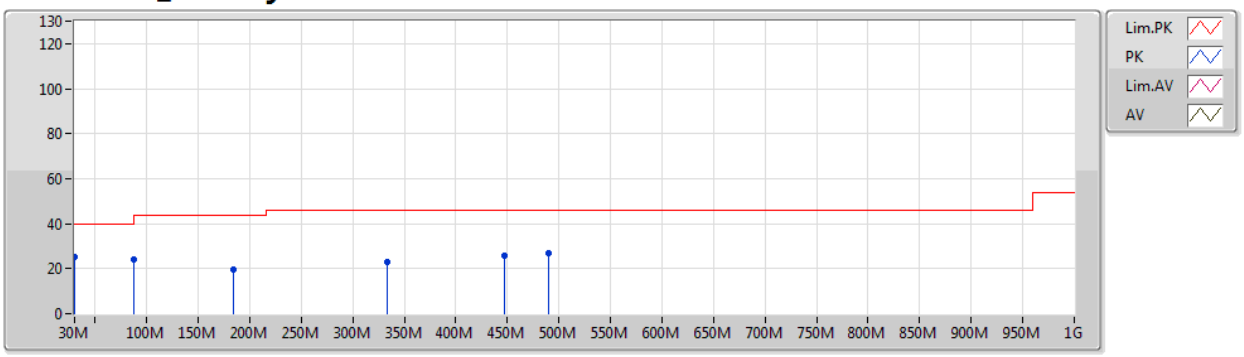


Type	Freq	Level	Limit	Margin	Factor	Dist	Condition	Azimuth	Height	Comment
	(Hz)	(dBuV/m)	(dBuV/m)	(dB)	(dB)	(m)		(°)	(m)	
PK	30M	24.65	40.00	-15.35	-8.16	3	Vertical	360	1.00	-
PK	124.19M	19.17	43.50	-24.33	-13.79	3	Vertical	360	1.00	-
PK	263.36M	23.50	46.00	-22.50	-11.28	3	Vertical	360	1.00	-
PK	455.96M	25.45	46.00	-20.55	-7.03	3	Vertical	360	1.00	-
PK	485.48M	26.64	46.00	-19.36	-6.34	3	Vertical	360	1.00	-
PK	567.01M	28.11	46.00	-17.89	-4.80	3	Vertical	360	1.00	-

BT-LE(1Mbps)

04/06/2019

2440MHz_Battery



Type	Freq	Level	Limit	Margin	Factor	Dist	Condition	Azimuth	Height	Comment
	(Hz)	(dBuV/m)	(dBuV/m)	(dB)	(dB)	(m)		(°)	(m)	
PK	30M	25.37	40.00	-14.63	-8.16	3	Horizontal	0	1.00	-
PK	88M	24.17	40.00	-15.83	-17.47	3	Horizontal	0	1.00	-
PK	184.64M	19.51	43.50	-23.99	-16.46	3	Horizontal	0	1.00	-
PK	333.65M	22.99	46.00	-23.01	-10.82	3	Horizontal	0	1.00	-
PK	447.52M	25.69	46.00	-20.31	-7.26	3	Horizontal	0	1.00	-
PK	489.7M	26.92	46.00	-19.08	-6.31	3	Horizontal	0	1.00	-

Summary

Mode	Result	Type	Freq (Hz)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Factor (dB)	Dist (m)	Condition	Azimuth (°)	Height (m)	Comments
2.4-2.4835GHz	-	-	-	-	-	-	-	-	-	-	-	-
BT-LE(1Mbps)	Pass	AV	2.4835G	53.70	54.00	-0.30	32.28	3	Horizontal	9	2.31	-

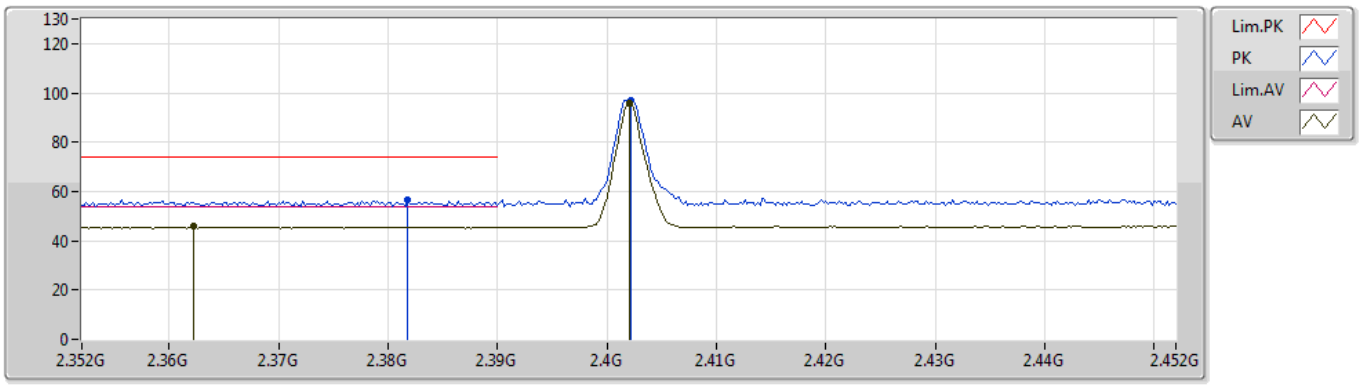
Result

Mode	Result	Type	Freq (Hz)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Factor (dB)	Dist (m)	Condition	Azimuth (°)	Height (m)	Comments
BT-LE(1Mbps)	-	-	-	-	-	-	-	-	-	-	-	-
2402MHz	Pass	AV	2.3622G	45.71	54.00	-8.29	31.80	3	Vertical	5	1.05	-
2402MHz	Pass	AV	2.402G	95.67	Inf	-Inf	31.96	3	Vertical	5	1.05	-
2402MHz	Pass	PK	2.3818G	56.55	74.00	-17.45	31.88	3	Vertical	5	1.05	-
2402MHz	Pass	PK	2.4022G	97.11	Inf	-Inf	31.96	3	Vertical	5	1.05	-
2402MHz	Pass	AV	2.3736G	45.66	54.00	-8.34	31.85	3	Horizontal	0	2.23	-
2402MHz	Pass	AV	2.402G	102.21	Inf	-Inf	31.96	3	Horizontal	0	2.23	-
2402MHz	Pass	PK	2.3706G	57.09	74.00	-16.91	31.84	3	Horizontal	0	2.23	-
2402MHz	Pass	PK	2.402G	103.68	Inf	-Inf	31.96	3	Horizontal	0	2.23	-
2402MHz	Pass	PK	4.80454G	46.44	74.00	-27.56	3.48	3	Vertical	185	2.44	-
2402MHz	Pass	AV	4.80394G	37.57	54.00	-16.43	3.48	3	Vertical	185	2.44	-
2402MHz	Pass	AV	4.80406G	40.44	54.00	-13.56	3.48	3	Horizontal	179	1.98	-
2402MHz	Pass	PK	4.80352G	48.30	74.00	-25.70	3.48	3	Horizontal	179	1.98	-
2440MHz	Pass	AV	2.376G	45.65	54.00	-8.35	31.85	3	Vertical	188	1.67	-
2440MHz	Pass	AV	2.44G	98.70	Inf	-Inf	32.11	3	Vertical	188	1.67	-
2440MHz	Pass	AV	2.4908G	45.96	54.00	-8.04	32.31	3	Vertical	188	1.67	-
2440MHz	Pass	PK	2.3576G	57.07	74.00	-16.93	31.78	3	Vertical	188	1.67	-
2440MHz	Pass	PK	2.4396G	100.29	Inf	-Inf	32.11	3	Vertical	188	1.67	-
2440MHz	Pass	PK	2.4864G	56.54	74.00	-17.46	32.29	3	Vertical	188	1.67	-
2440MHz	Pass	AV	2.376G	47.54	54.00	-6.46	31.85	3	Horizontal	0	2.70	-
2440MHz	Pass	AV	2.44G	103.54	Inf	-Inf	32.11	3	Horizontal	0	2.70	-
2440MHz	Pass	AV	2.4876G	46.21	54.00	-7.79	32.30	3	Horizontal	0	2.70	-
2440MHz	Pass	PK	2.376G	57.17	74.00	-16.83	31.85	3	Horizontal	0	2.70	-
2440MHz	Pass	PK	2.4396G	105.00	Inf	-Inf	32.11	3	Horizontal	0	2.70	-
2440MHz	Pass	PK	2.4924G	56.88	74.00	-17.12	32.32	3	Horizontal	0	2.70	-
2440MHz	Pass	AV	7.31934G	41.84	54.00	-12.16	9.90	3	Vertical	200	1.98	-
2440MHz	Pass	PK	7.32078G	52.04	74.00	-21.96	9.90	3	Vertical	200	1.98	-
2440MHz	Pass	AV	7.31934G	37.45	54.00	-16.55	9.90	3	Horizontal	13	1.32	-
2440MHz	Pass	PK	7.3236G	49.39	74.00	-24.61	9.91	3	Horizontal	13	1.32	-
2480MHz	Pass	AV	2.48G	96.72	Inf	-Inf	32.26	3	Vertical	7	1.18	-
2480MHz	Pass	AV	2.4835G	49.17	54.00	-4.83	32.28	3	Vertical	7	1.18	-
2480MHz	Pass	PK	2.48G	98.22	Inf	-Inf	32.26	3	Vertical	7	1.18	-
2480MHz	Pass	PK	2.4835G	62.81	74.00	-11.19	32.28	3	Vertical	7	1.18	-
2480MHz	Pass	AV	2.48G	102.75	Inf	-Inf	32.26	3	Horizontal	9	2.31	-
2480MHz	Pass	AV	2.4835G	53.70	54.00	-0.30	32.28	3	Horizontal	9	2.31	-
2480MHz	Pass	PK	2.48G	104.19	Inf	-Inf	32.26	3	Horizontal	9	2.31	-
2480MHz	Pass	PK	2.4836G	67.53	74.00	-6.47	32.28	3	Horizontal	9	2.31	-
2480MHz	Pass	AV	4.95986G	37.35	54.00	-16.65	3.83	3	Vertical	179	2.08	-
2480MHz	Pass	AV	7.43934G	47.13	54.00	-6.87	10.24	3	Vertical	188	1.92	-
2480MHz	Pass	PK	4.9596G	46.69	74.00	-27.31	3.83	3	Vertical	179	2.08	-
2480MHz	Pass	PK	7.43922G	55.95	74.00	-18.05	10.24	3	Vertical	188	1.92	-
2480MHz	Pass	AV	4.96G	42.38	54.00	-11.62	3.83	3	Horizontal	175	2.02	-
2480MHz	Pass	AV	7.43934G	42.75	54.00	-11.25	10.24	3	Horizontal	199	2.00	-
2480MHz	Pass	PK	4.95952G	49.89	74.00	-24.11	3.83	3	Horizontal	175	2.02	-
2480MHz	Pass	PK	7.43904G	52.67	74.00	-21.33	10.24	3	Horizontal	199	2.00	-

BT-LE(1Mbps)

2402MHz_TX

05/06/2019

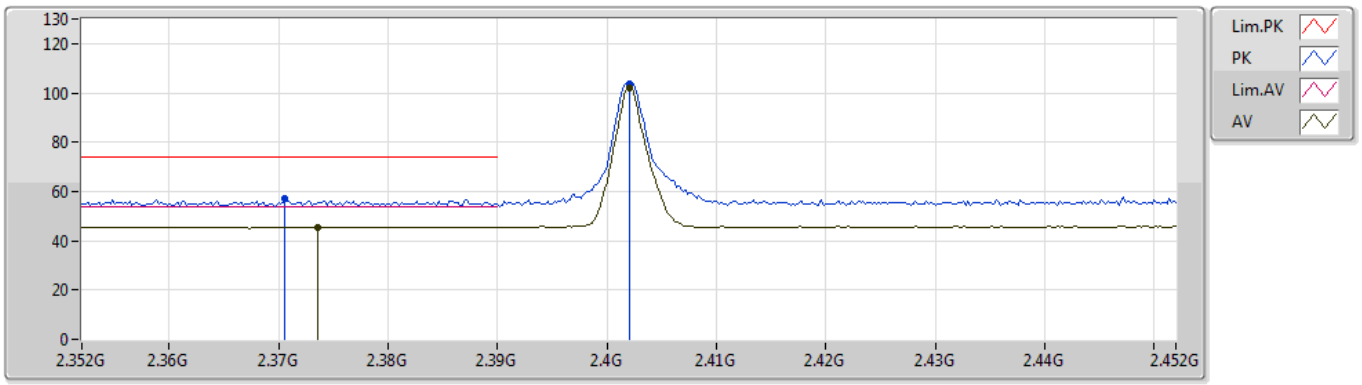


Type	Freq	Level	Limit	Margin	Factor	Dist	Condition	Azimuth	Height	Comment
	(Hz)	(dBuV/m)	(dBuV/m)	(dB)	(dB)	(m)		(°)	(m)	
AV	2.3622G	45.71	54.00	-8.29	31.80	3	Vertical	5	1.05	-
AV	2.402G	95.67	Inf	-Inf	31.96	3	Vertical	5	1.05	-
PK	2.3818G	56.55	74.00	-17.45	31.88	3	Vertical	5	1.05	-
PK	2.4022G	97.11	Inf	-Inf	31.96	3	Vertical	5	1.05	-

BT-LE(1Mbps)

2402MHz_TX

05/06/2019

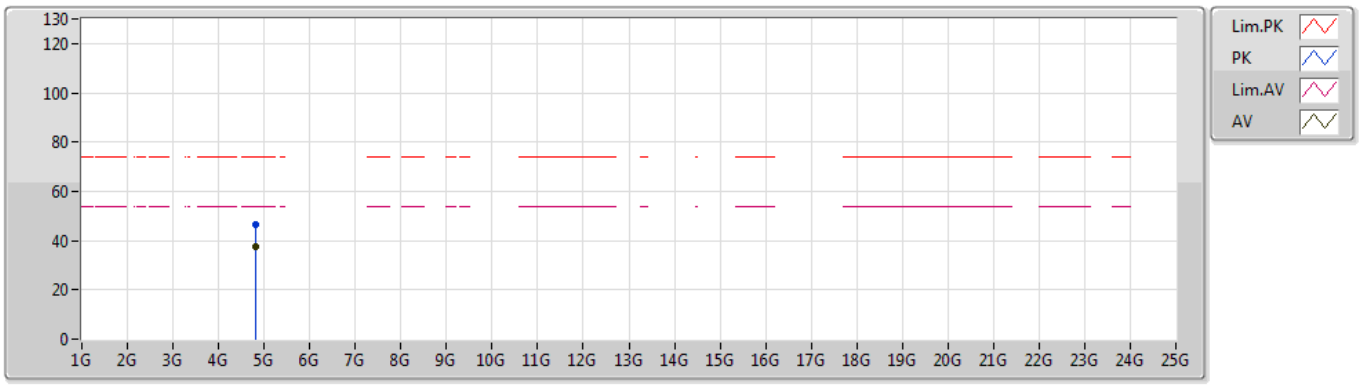


Type	Freq	Level	Limit	Margin	Factor	Dist	Condition	Azimuth	Height	Comment
	(Hz)	(dBuV/m)	(dBuV/m)	(dB)	(dB)	(m)		(°)	(m)	
AV	2.3736G	45.66	54.00	-8.34	31.85	3	Horizontal	0	2.23	-
AV	2.402G	102.21	Inf	-Inf	31.96	3	Horizontal	0	2.23	-
PK	2.3706G	57.09	74.00	-16.91	31.84	3	Horizontal	0	2.23	-
PK	2.402G	103.68	Inf	-Inf	31.96	3	Horizontal	0	2.23	-

BT-LE(1Mbps)

05/06/2019

2402MHz_TX

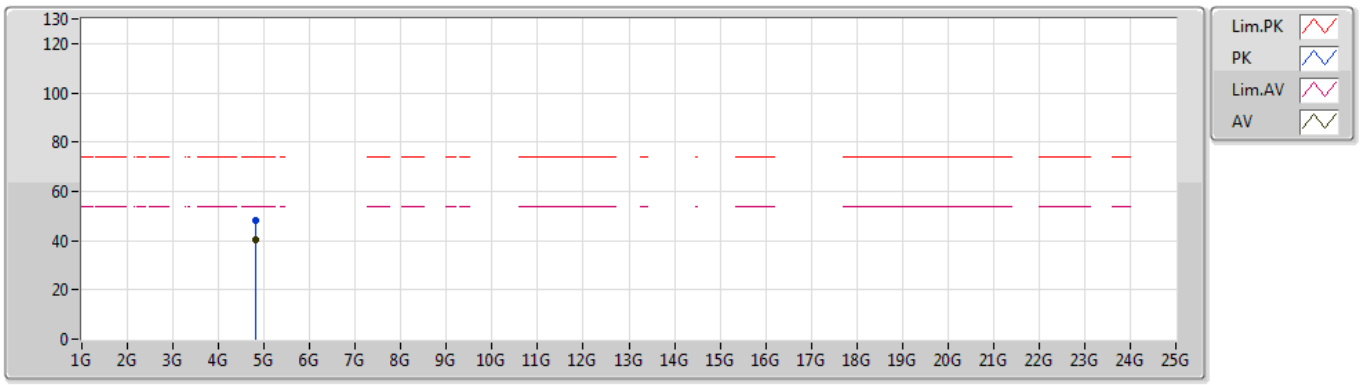


Type	Freq	Level	Limit	Margin	Factor	Dist	Condition	Azimuth	Height	Comment
	(Hz)	(dBuV/m)	(dBuV/m)	(dB)	(dB)	(m)		(°)	(m)	
PK	4.80454G	46.44	74.00	-27.56	3.48	3	Vertical	185	2.44	-
AV	4.80394G	37.57	54.00	-16.43	3.48	3	Vertical	185	2.44	-

BT-LE(1Mbps)

2402MHz_TX

05/06/2019

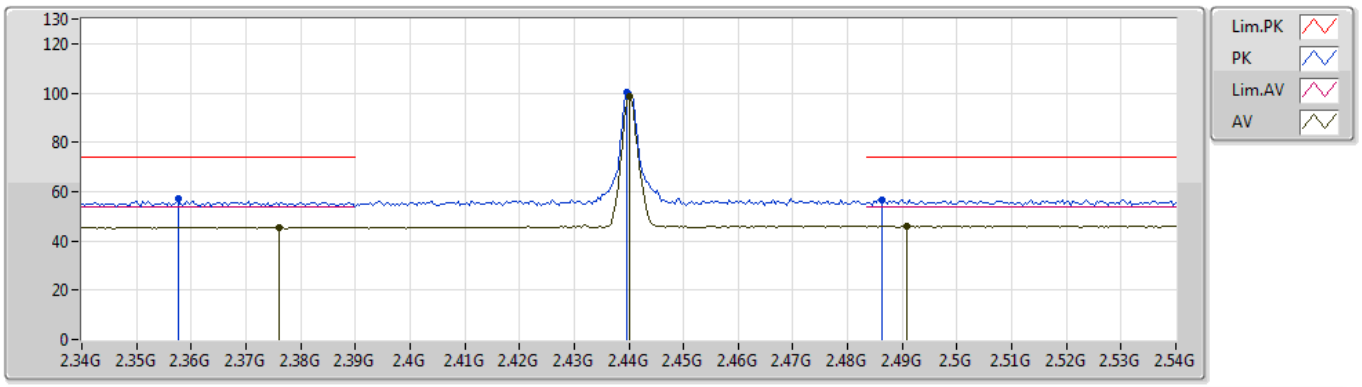


Type	Freq	Level	Limit	Margin	Factor	Dist	Condition	Azimuth	Height	Comment
	(Hz)	(dBuV/m)	(dBuV/m)	(dB)	(dB)	(m)		(°)	(m)	
AV	4.80406G	40.44	54.00	-13.56	3.48	3	Horizontal	179	1.98	-
PK	4.80352G	48.30	74.00	-25.70	3.48	3	Horizontal	179	1.98	-

BT-LE(1Mbps)

2440MHz_TX

05/06/2019

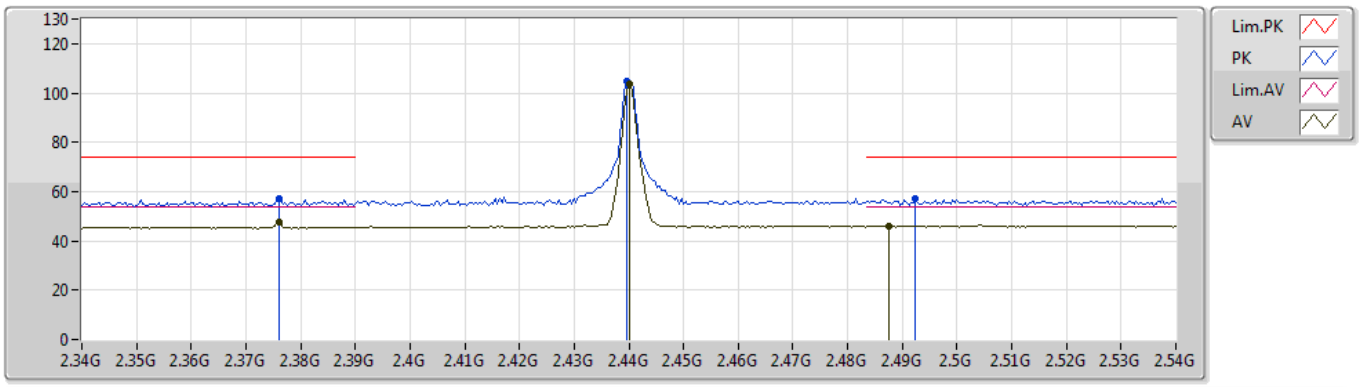


Type	Freq	Level	Limit	Margin	Factor	Dist	Condition	Azimuth	Height	Comment
	(Hz)	(dBuV/m)	(dBuV/m)	(dB)	(dB)	(m)		(°)	(m)	
AV	2.376G	45.65	54.00	-8.35	31.85	3	Vertical	188	1.67	-
AV	2.44G	98.70	Inf	-Inf	32.11	3	Vertical	188	1.67	-
AV	2.4908G	45.96	54.00	-8.04	32.31	3	Vertical	188	1.67	-
PK	2.3576G	57.07	74.00	-16.93	31.78	3	Vertical	188	1.67	-
PK	2.4396G	100.29	Inf	-Inf	32.11	3	Vertical	188	1.67	-
PK	2.4864G	56.54	74.00	-17.46	32.29	3	Vertical	188	1.67	-

BT-LE(1Mbps)

2440MHz_TX

05/06/2019

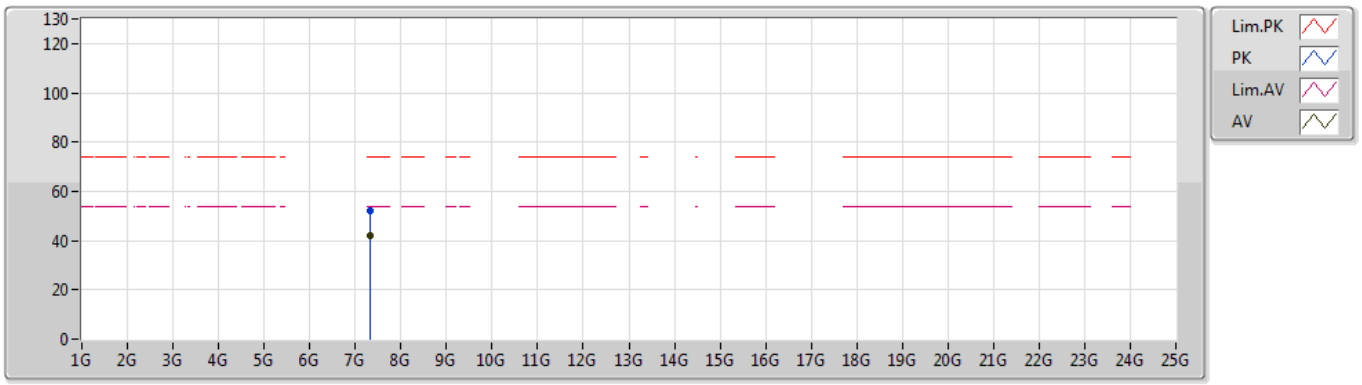


Type	Freq	Level	Limit	Margin	Factor	Dist	Condition	Azimuth	Height	Comment
	(Hz)	(dBuV/m)	(dBuV/m)	(dB)	(dB)	(m)		(°)	(m)	
AV	2.376G	47.54	54.00	-6.46	31.85	3	Horizontal	0	2.70	-
AV	2.44G	103.54	Inf	-Inf	32.11	3	Horizontal	0	2.70	-
AV	2.4876G	46.21	54.00	-7.79	32.30	3	Horizontal	0	2.70	-
PK	2.376G	57.17	74.00	-16.83	31.85	3	Horizontal	0	2.70	-
PK	2.4396G	105.00	Inf	-Inf	32.11	3	Horizontal	0	2.70	-
PK	2.4924G	56.88	74.00	-17.12	32.32	3	Horizontal	0	2.70	-

BT-LE(1Mbps)

2440MHz_TX

05/06/2019

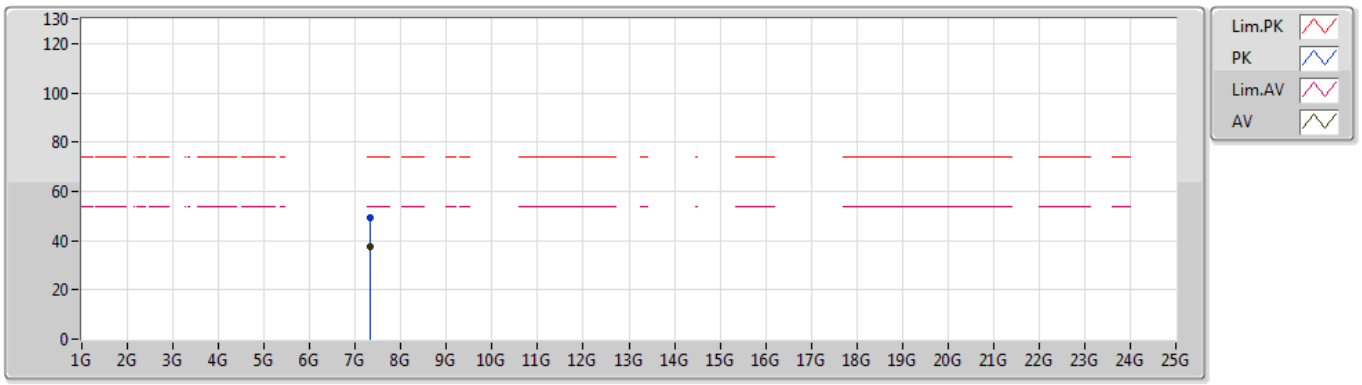


Type	Freq	Level	Limit	Margin	Factor	Dist	Condition	Azimuth	Height	Comment
	(Hz)	(dBuV/m)	(dBuV/m)	(dB)	(dB)	(m)		(°)	(m)	
AV	7.31934G	41.84	54.00	-12.16	9.90	3	Vertical	200	1.98	-
PK	7.32078G	52.04	74.00	-21.96	9.90	3	Vertical	200	1.98	-

BT-LE(1Mbps)

2440MHz_TX

05/06/2019

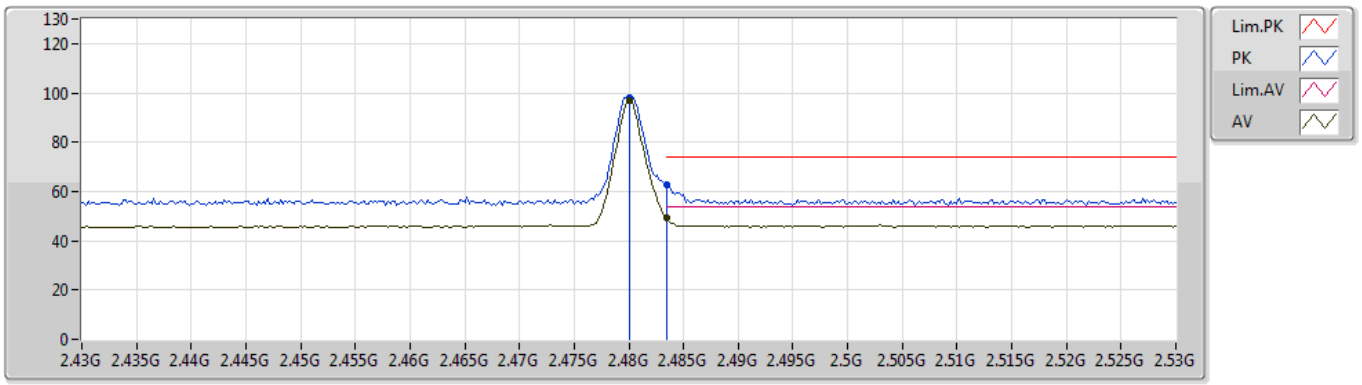


Type	Freq	Level	Limit	Margin	Factor	Dist	Condition	Azimuth	Height	Comment
	(Hz)	(dBuV/m)	(dBuV/m)	(dB)	(dB)	(m)		(°)	(m)	
AV	7.31934G	37.45	54.00	-16.55	9.90	3	Horizontal	13	1.32	-
PK	7.3236G	49.39	74.00	-24.61	9.91	3	Horizontal	13	1.32	-

BT-LE(1Mbps)

2480MHz_TX

05/06/2019

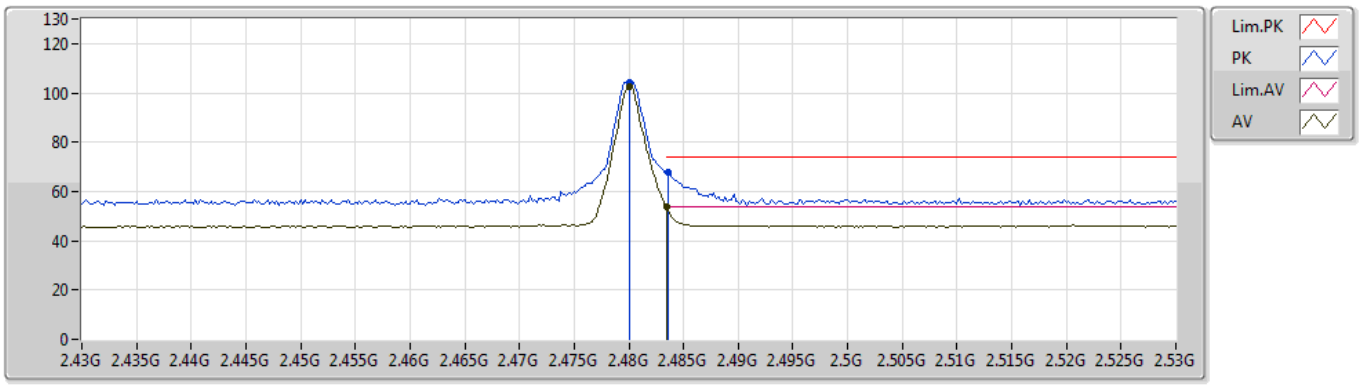


Type	Freq	Level	Limit	Margin	Factor	Dist	Condition	Azimuth	Height	Comment
	(Hz)	(dBuV/m)	(dBuV/m)	(dB)	(dB)	(m)		(°)	(m)	
AV	2.48G	96.72	Inf	-Inf	32.26	3	Vertical	7	1.18	-
AV	2.4835G	49.17	54.00	-4.83	32.28	3	Vertical	7	1.18	-
PK	2.48G	98.22	Inf	-Inf	32.26	3	Vertical	7	1.18	-
PK	2.4835G	62.81	74.00	-11.19	32.28	3	Vertical	7	1.18	-

BT-LE(1Mbps)

2480MHz_TX

05/06/2019

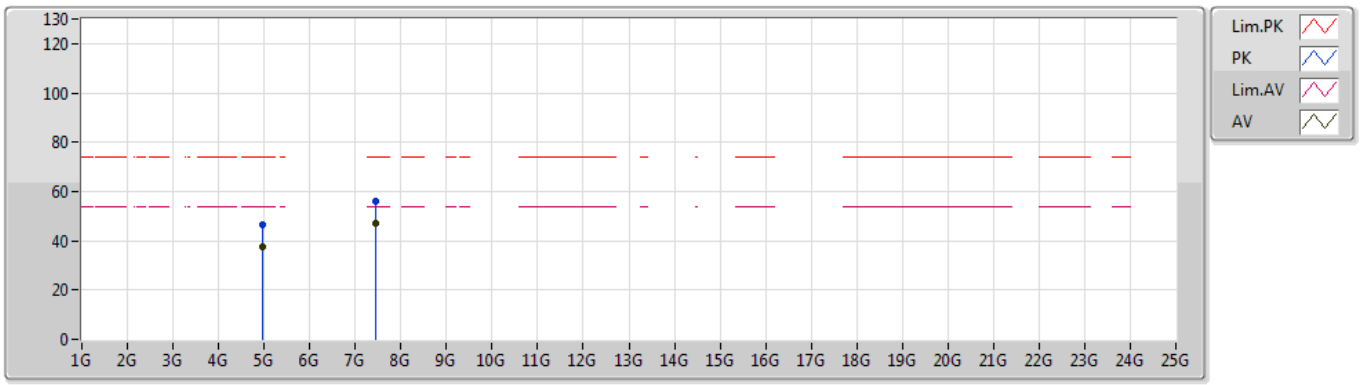


Type	Freq	Level	Limit	Margin	Factor	Dist	Condition	Azimuth	Height	Comment
	(Hz)	(dBuV/m)	(dBuV/m)	(dB)	(dB)	(m)		(°)	(m)	
AV	2.48G	102.75	Inf	-Inf	32.26	3	Horizontal	9	2.31	-
AV	2.4835G	53.70	54.00	-0.30	32.28	3	Horizontal	9	2.31	-
PK	2.48G	104.19	Inf	-Inf	32.26	3	Horizontal	9	2.31	-
PK	2.4836G	67.53	74.00	-6.47	32.28	3	Horizontal	9	2.31	-

BT-LE(1Mbps)

2480MHz_TX

05/06/2019

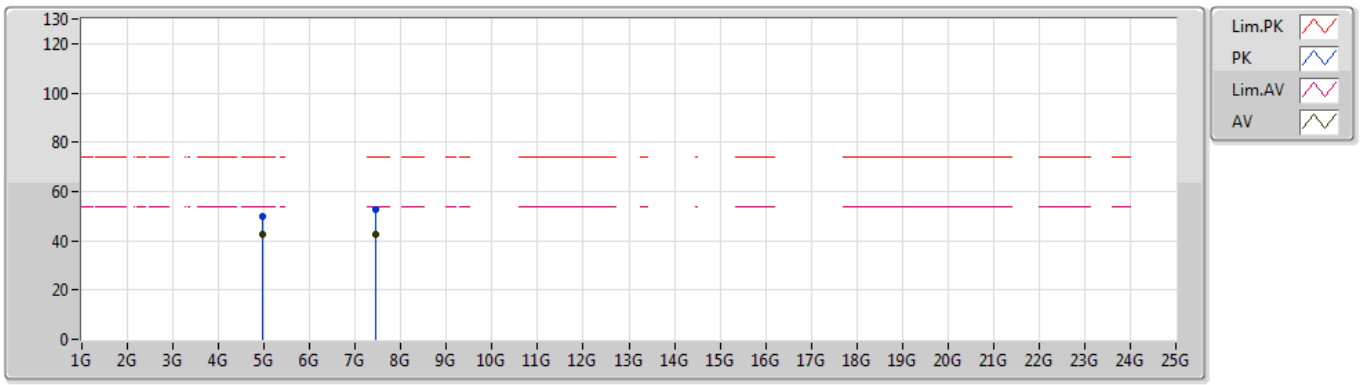


Type	Freq	Level	Limit	Margin	Factor	Dist	Condition	Azimuth	Height	Comment
	(Hz)	(dBuV/m)	(dBuV/m)	(dB)	(dB)	(m)		(°)	(m)	
AV	4.95986G	37.35	54.00	-16.65	3.83	3	Vertical	179	2.08	-
AV	7.43934G	47.13	54.00	-6.87	10.24	3	Vertical	188	1.92	-
PK	4.9596G	46.69	74.00	-27.31	3.83	3	Vertical	179	2.08	-
PK	7.43922G	55.95	74.00	-18.05	10.24	3	Vertical	188	1.92	-

BT-LE(1Mbps)

2480MHz_TX

05/06/2019



Type	Freq	Level	Limit	Margin	Factor	Dist	Condition	Azimuth	Height	Comment
	(Hz)	(dBuV/m)	(dBuV/m)	(dB)	(dB)	(m)		(°)	(m)	
AV	4.96G	42.38	54.00	-11.62	3.83	3	Horizontal	175	2.02	-
AV	7.43934G	42.75	54.00	-11.25	10.24	3	Horizontal	199	2.00	-
PK	4.95952G	49.89	74.00	-24.11	3.83	3	Horizontal	175	2.02	-
PK	7.43904G	52.67	74.00	-21.33	10.24	3	Horizontal	199	2.00	-