FCC Test Report

FCC ID	:	**2ACIX-PI4**
Equipment	:	**Wireless Neckband**
Brand Name	:	**Bowers & Wilkins**
Model Name	:	**PI4**
Applicant	:	**B&W Group Ltd Dale Road, Worthing, West Sussex. BN11 2BH, United Kingdom**
Manufacturer	:	**B&W Group Ltd Dale Road, Worthing, West Sussex. BN11 2BH, United Kingdom**
Standard	:	**47 CFR FCC Part 15.247**

The product was received on Jun. 12, 2019, and testing was started from Jun. 20, 2019 and completed on Jul. 10, 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
FR961113AL	01	Initial issue of report	Jul. 29, 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	PASS	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: Sam Tsai

Report Producer: Debby Hung

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
2.4-2.4835GHz	BT-LE(2Mbps)	2.0	1TX

Note:
- Bluetooth LE uses a GFSK (1Mbps/2Mbps) modulation for DSSS.
- BWch is the nominal channel bandwidth.

1.1.2 Antenna Information

Ant.	Brand	Model Name	Antenna Type	Connector	Gain (dBi)
1	ADVANCED-CONNECTEK INC.	AML00-000001	Dipole Antenna	Mini I-Pex	-0.91

For Bluetooth function:

For Bluetooth mode (1TX/1RX)

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

1.1.3 EUT Information

Operational Condition				
EUT Power Type	From Host System			
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)	0.635	1.97	396.875u	3k
BT-LE(2Mbps)	0.345	4.62	215.625u	10k

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
AC Conduction	CO04-HY	Jeff	21.2~23.9°C / 56.2~59.1%	20/Jun/2019
RF Conducted	TH01-HY	Andy	23.3~24.9°C / 63~65.5%	01/Jul/2019
Radiated	03CH01-HY	Edward	24.8~26.9°C / 56.1~63.4%	20/Jun/2019~10/Jul/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	120V

2.2 Test Channel Mode

Test Software Version	Blue Test 3

Mode	PowerSetting
BT-LE(1Mbps)	-
2402MHz	default
2440MHz	default
2480MHz	default
BT-LE(2Mbps)	-
2402MHz	default
2440MHz	default
2480MHz	default

2.3 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
Operating Mode	CTX
1	USB Mode

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	USB 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	VDL	Model Name	451034
	Manufacturer	VDL Electronics Co., LTD		
	Power Rating	3.8 Vdc,150 mAh		
USB Cable	Brand Name	Liang Gang	Model Name	TG-D10128-0002
	Signal Line	0.2 meter, D-shielded cable, w/o ferrite core		

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

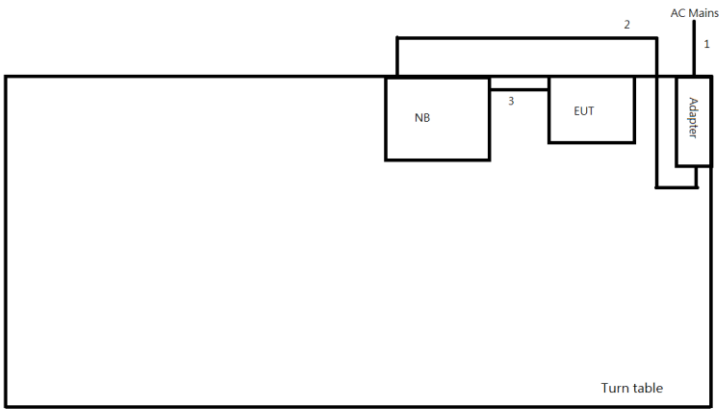
Support Equipment – AC Conduction				
No.	**Equipment**	**Brand Name**	**Model Name**	**FCC ID**
1	Notebook	DELL	E5570	-
2	AC Adapter for NB	DELL	LA90PS1-00	-

Support Equipment – RF Conducted				
No.	**Equipment**	**Brand Name**	**Model Name**	**FCC ID**
1	Notebook	DELL	E5410	R33002 / DOC
2	Adapter for NB	DELL	HA65NM130	R35737 / DOC
3	DC Power Supply	GW	GPS-3030DD	-

Support Equipment – Radiated Emission				
No.	**Equipment**	**Brand Name**	**Model Name**	**FCC ID**
1	Adapter	Dell	AA65NM121	-

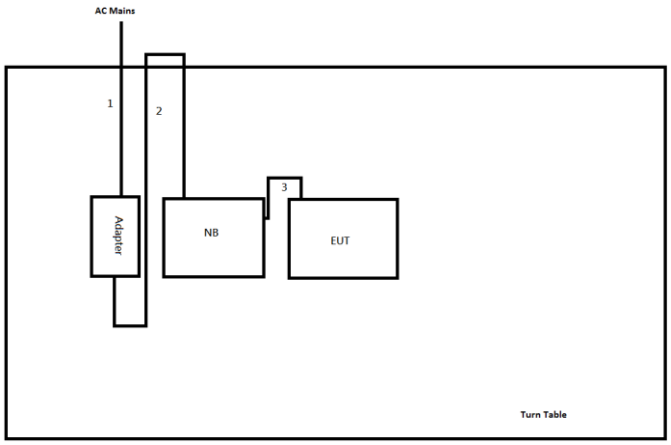
2.5 Test Setup Diagram

Test Setup Diagram – AC Line Conducted Emission Test



Item	Connection	Shielded	Length(m)	Remark
1	AC Power line	No	1.5	-
2	DC Power line	No	1.5	-
3	USB Cable	No	0.2	-

Test Setup Diagram - Radiated Test



Item	Connection	Shielded	Length(m)	Remark
1	AC Power line	No	1.5	-
2	DC Power line	No	1.5	-
3	Type C USB Cable	No	0.2	-

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

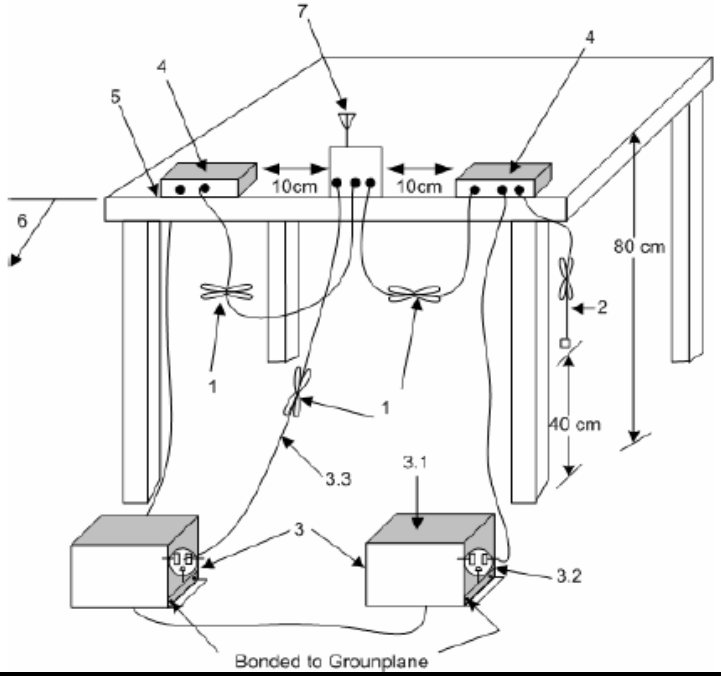
Refer a test equipment and calibration data table in this test report.

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

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.

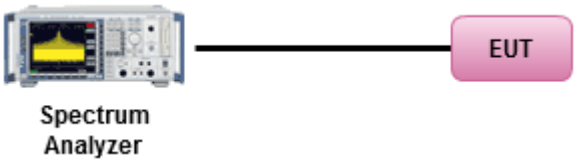
3.2.2 Measuring Instruments

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

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 C

3.4 Power Spectral Density

3.4.1 Power Spectral Density Limit

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

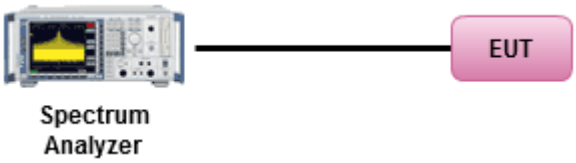
3.4.2 Measuring Instruments

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 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 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 (dB)**
Peak output power procedure	20
Average output power procedure	30
Note 1: If the peak output power procedure is used to measure the fundamental emission power to demonstrate compliance to requirements, then the peak conducted output power measured within any 100 kHz outside the authorized frequency band shall be attenuated by at least 20 dB relative to the maximum measured in-band peak level. Note 2: If the average output power procedure is used to measure the fundamental emission power to demonstrate compliance to requirements, then the power in any 100 kHz outside of the authorized frequency band shall be attenuated by at least 30 dB relative to the maximum measured in-band average level.	

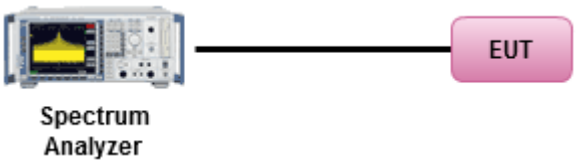
3.5.2 Measuring Instruments

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 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.

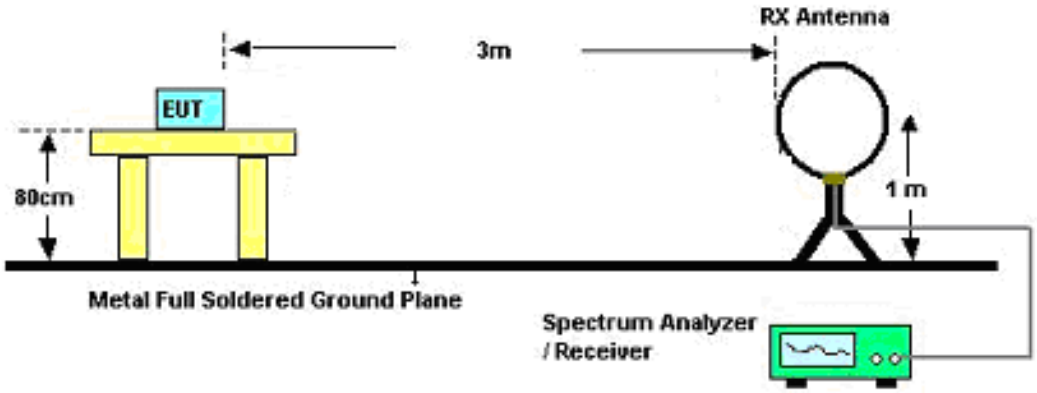
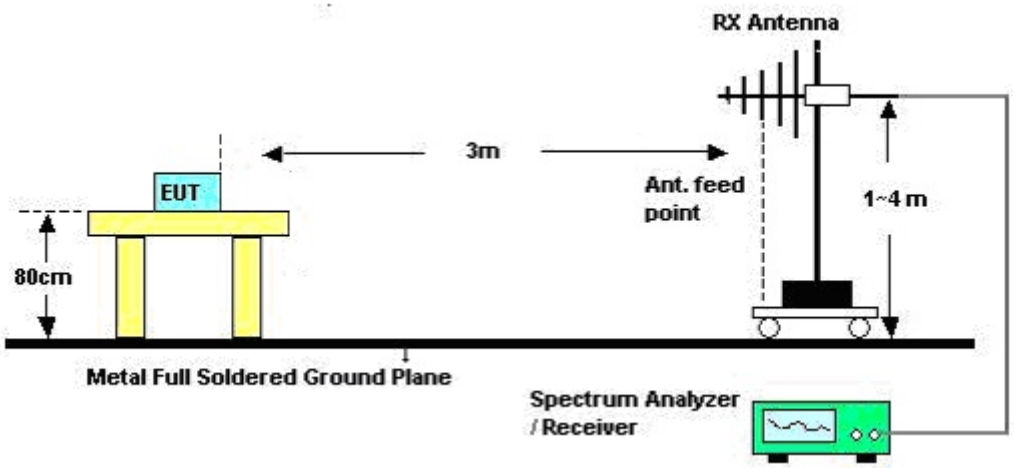
3.6.2 Measuring Instruments

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

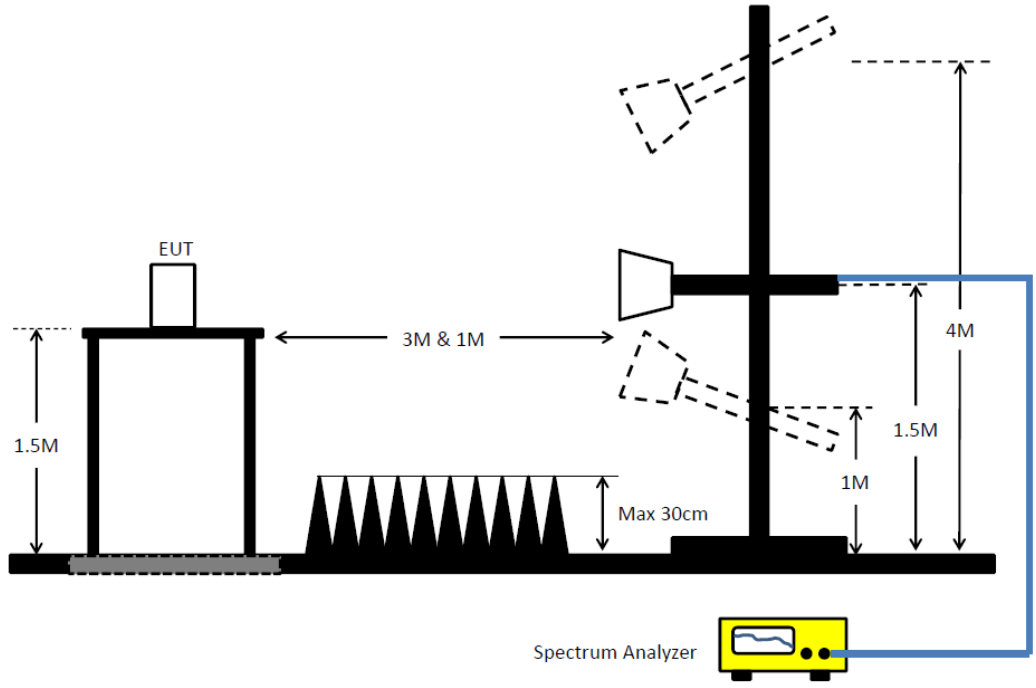
3.6.3 Test Procedures

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

4 Test Equipment and Calibration Data

Instrument for AC Conduction

Instrument	Manufacturer	Model No.	Serial No.	Spec.	Calibration Date	Calibration Due Date
EMC Receiver	R&S	ESR3	102052	9kHz ~ 3.6GHz	09/Apr/2019	08/Apr/2020
LISN	R&S	ENV216	101295	9kHz ~ 30MHz	08/Nov/2018	07/Nov/2019
RF Cable-CON	MTJ	RG142	CB002-CO	9kHz ~ 200MHz	17/Sep/2018	16/Sep/2019
AC POWER	APC	AFC-11005G	F310050055	47Hz~63Hz 5~300V	NCR	NCR
Impuls Begrenzer Puls e Limiter	SCHWARZBECK	VTSD 9561-F	9561-F041	9 kHz ~ 30 MHz	12/Oct/2018	11/Oct/2019

NCR : Non-Calibration Require

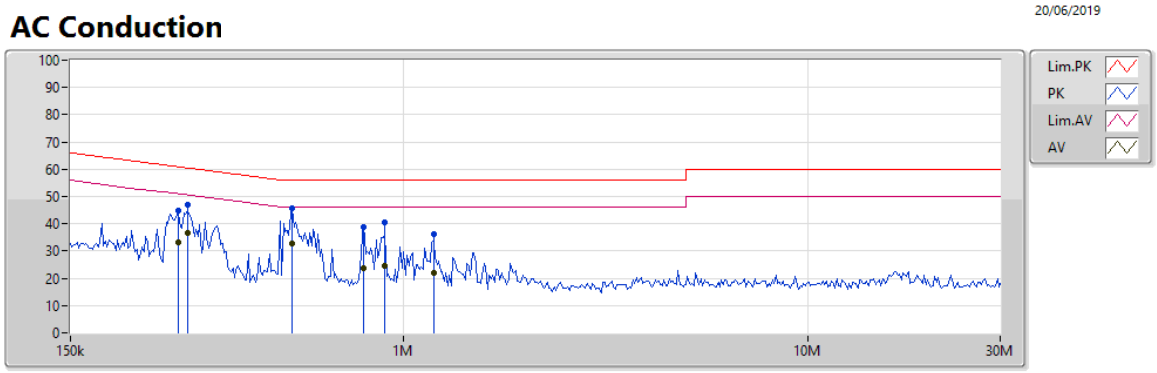
Instrument for Conducted Test

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
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	Riken	SAC-3M	03CH01-HY	30MHz ~ 1GHz 3m	11/Jan/2019	10/Jan/2020
3m Semi Anechoic Chamber	Riken	SAC-3M	03CH01-HY	1GHz ~ 18GHz 3m	09/Jan/2019	08/Jan/2020
PreAmplifier	COM-POWER	PA-103	161050	1 MHz ~ 1.0GHz	24/Jul/2018	23/Jul/2019
Microwave Preamplifier	Agilent	8449B	3008A02602	1GHz ~ 26.5GHz	27/Mar/2019	26/Mar/2020
Spectrum Analyzer	R&S	FSV40	101407	10Hz ~ 40GHz	16/Aug/2018	15/Aug/2019
RF Cable-R03m	Jye Bao	RG142	CB019	9kHz ~ 1GHz	14/Dec/2018	13/Dec/2019
RF Cable-HIGH	SUHNER	SUCOFLEX 104	SN805196/4+MY39495	1 GHz ~ 18 GHz	13/Mar/2019	12/Mar/2020
Bilog Antenna & 5db Attenuator	SCHAFFNER/MTJ	CBL6112D / MTJ6102-05	2678 / 001	30MHz ~ 2GHz	13/Mar/2019	12/Mar/2020
EMI Test Receiver	R&S	ESU-26	100422	20Hz ~ 26.5GHz	25/Oct/2018	24/Oct/2019
Loop Antenna	TESEQ	HLA 6120	31244	9k-30MHz	15/Mar/2019	14/Mar/2020
Broadband Horn Antenna	SCHWARZBECK	BBHA 9170	BBHA9170339	18GHz ~ 40GHz	19/Apr/2019	18/Apr/2020
Horn Antenna	SCHWARZBECK	BBHA 9120 D	BBHA 9120 D-1130	1GHz ~ 18GHz	26/Oct/2018	25/Oct/2019

AC Power-line Conducted Emissions Result			
Operating Mode	1	**Power Phase**	Neutral
Operating Function	USB mode		

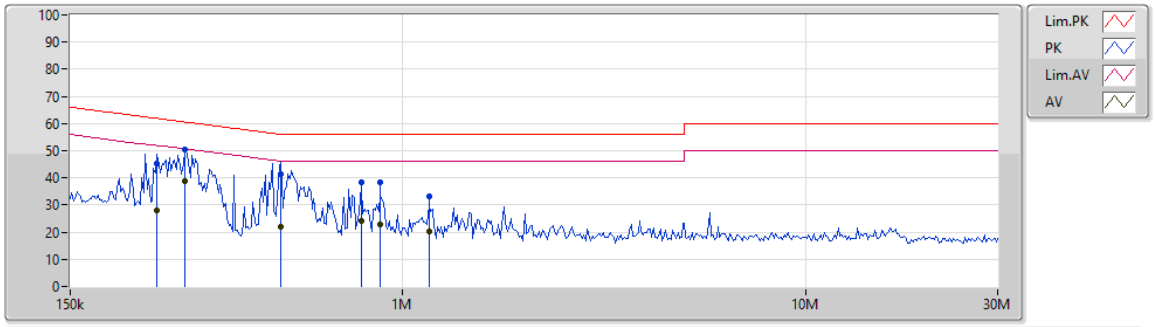


Type	Freq	Level	Limit	Margin	Factor	Condition	Comment	Raw	LISN	CL	AT
	(Hz)	(dBuV)	(dBuV)	(dB)	(dB)			(dBuV)	(dB)	(dB)	(dB)
QP	277.982k	44.81	60.88	-16.07	19.47	Neutral	-	25.34	9.59	0.01	9.87
AV	277.982k	33.03	50.88	-17.85	19.47	Neutral	-	13.56	9.59	0.01	9.87
QP	292.162k	46.98	60.46	-13.48	19.48	Neutral	-	27.50	9.59	0.01	9.88
AV	292.162k	36.55	50.46	-13.91	19.48	Neutral	-	17.07	9.59	0.01	9.88
QP	530.769k	45.61	56.00	-10.39	19.48	Neutral	"Worst"	26.13	9.59	0.01	9.88
AV	530.769k	32.95	46.00	-13.05	19.48	Neutral	-	13.47	9.59	0.01	9.88
QP	798.145k	38.82	56.00	-17.18	19.49	Neutral	-	19.33	9.59	0.02	9.88
AV	798.145k	23.89	46.00	-22.11	19.49	Neutral	-	4.40	9.59	0.02	9.88
QP	899.37k	40.64	56.00	-15.36	19.49	Neutral	-	21.15	9.59	0.02	9.88
AV	899.37k	24.49	46.00	-21.51	19.49	Neutral	-	5.00	9.59	0.02	9.88
QP	1.188M	36.40	56.00	-19.60	19.50	Neutral	-	16.90	9.60	0.02	9.88
AV	1.188M	21.94	46.00	-24.06	19.50	Neutral	-	2.44	9.60	0.02	9.88

AC Power-line Conducted Emissions Result			
Operating Mode	1	**Power Phase**	Line
Operating Function	USB mode		

AC Conduction

20/06/2019



Type	Freq	Level	Limit	Margin	Factor	Condition	Comment	Raw	LISN	CL	AT
	(Hz)	(dBuV)	(dBuV)	(dB)	(dB)			(dBuV)	(dB)	(dB)	(dB)
QP	246.695k	45.41	61.87	-16.46	19.48	Line	-	25.93	9.60	0.01	9.87
AV	246.695k	28.14	51.87	-23.73	19.48	Line	-	8.66	9.60	0.01	9.87
QP	289.269k	50.23	60.55	-10.32	19.48	Line	"Worst"	30.75	9.59	0.01	9.88
AV	289.269k	38.65	50.55	-11.90	19.48	Line	-	19.17	9.59	0.01	9.88
QP	500k	41.58	56.00	-14.42	19.48	Line	-	22.10	9.59	0.01	9.88
AV	500k	21.94	46.00	-24.06	19.48	Line	-	2.46	9.59	0.01	9.88
QP	790.243k	38.40	56.00	-17.60	19.50	Line	-	18.90	9.60	0.02	9.88
AV	790.243k	23.99	46.00	-22.01	19.50	Line	-	4.49	9.60	0.02	9.88
QP	881.649k	38.23	56.00	-17.77	19.50	Line	-	18.73	9.60	0.02	9.88
AV	881.649k	22.68	46.00	-23.32	19.50	Line	-	3.18	9.60	0.02	9.88
QP	1.165M	33.10	56.00	-22.90	19.51	Line	-	13.59	9.61	0.02	9.88
AV	1.165M	20.38	46.00	-25.62	19.51	Line	-	0.87	9.61	0.02	9.88

Summary

Mode	OBW (Hz)	ITU-Code
2.4-2.4835GHz	-	-
BT-LE(1Mbps)	1.041M	1M04F1D
BT-LE(2Mbps)	2.075M	2M08F1D

OBW = 99% occupied bandwidth;

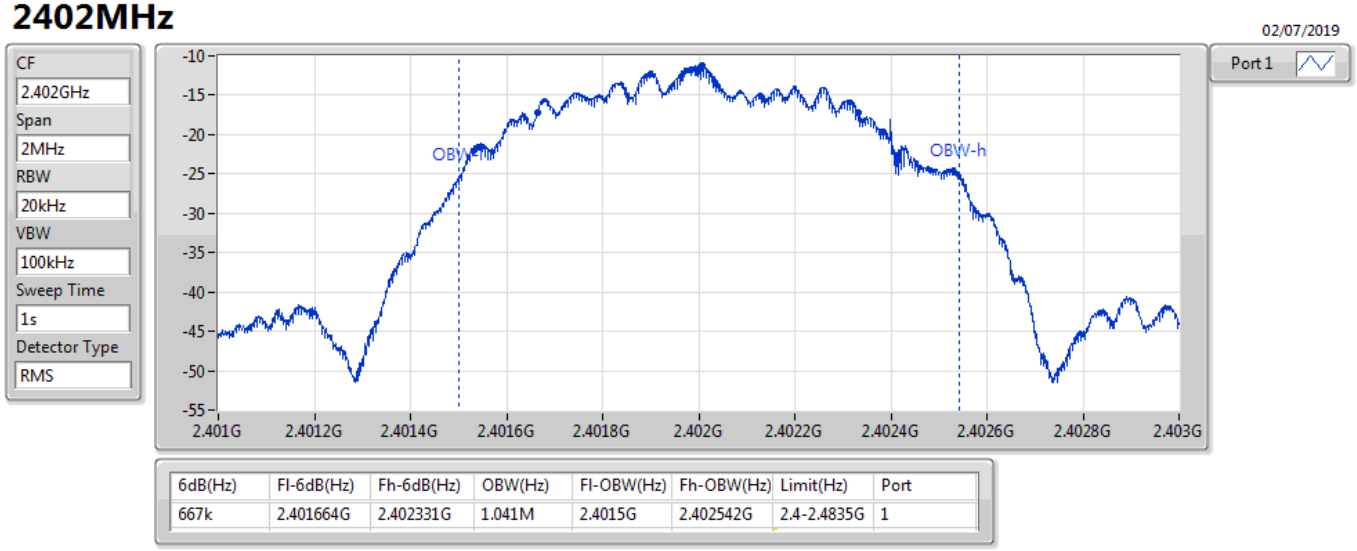
Result

Mode	Result	Limit (Hz)	fl-OBW (Hz)	fh-OBW (Hz)	OBW (Hz)	N dB (Hz)
BT-LE(1Mbps)	-	-	-	-	-	-
2402MHz_TnomVnom	Pass	2.4-2.4835G	2.4015G	2.402542G	1.041M	667k
2480MHz_TnomVnom	Pass	2.4-2.4835G	2.479501G	2.480541G	1.039M	666k
BT-LE(2Mbps)	-	-	-	-	-	-
2402MHz_TnomVnom	Pass	2.4-2.4835G	2.400993G	2.403067G	2.075M	1.082M
2480MHz_TnomVnom	Pass	2.4-2.4835G	2.478997G	2.481067G	2.071M	1.08M

fl-OBW = fl lower edge 99% occupied bandwidth; **fh-OBW** = fh higher edge 99% occupied bandwidth; **OBW** = 99% occupied bandwidth;
N dB = 6dB down bandwidth;

BT-LE(1Mbps) EBW

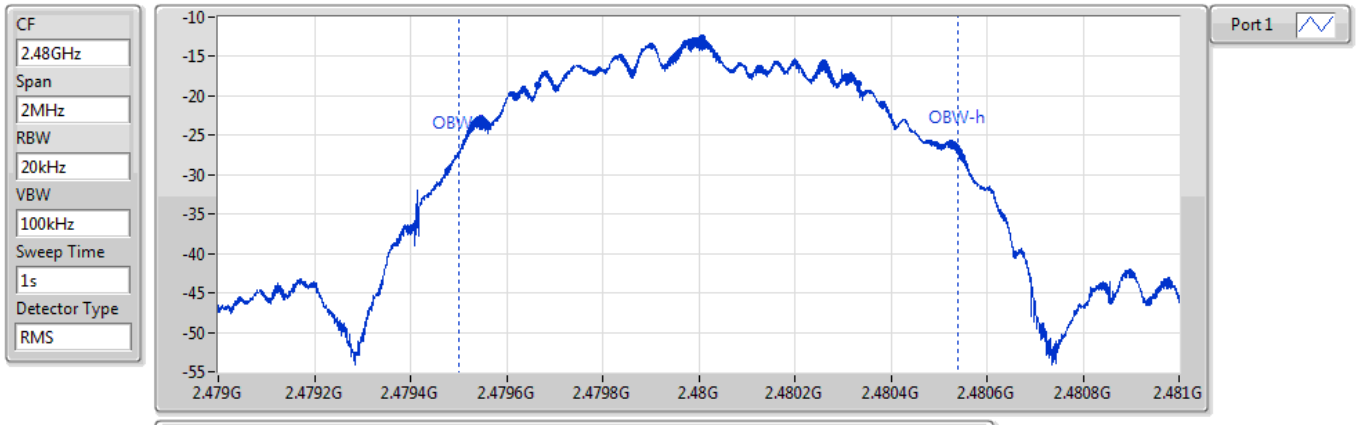
2402MHz



6dB(Hz)	Fl-6dB(Hz)	Fh-6dB(Hz)	OBW(Hz)	Fl-OBW(Hz)	Fh-OBW(Hz)	Limit(Hz)	Port
667k	2.401664G	2.402331G	1.041M	2.4015G	2.402542G	2.4-2.4835G	1

BT-LE(1Mbps) EBW

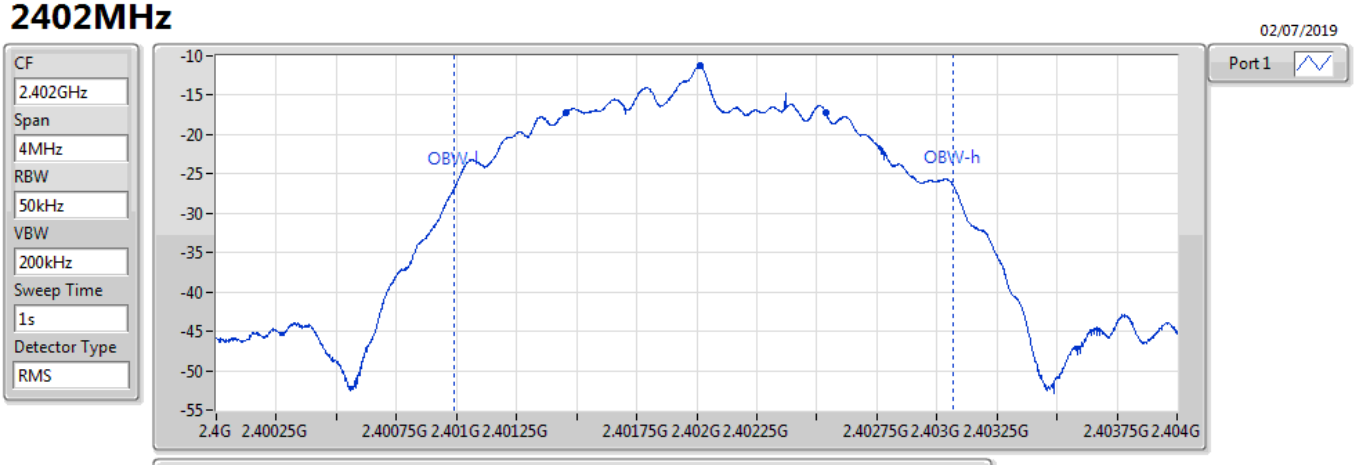
2480MHz



6dB(Hz)	Fl-6dB(Hz)	Fh-6dB(Hz)	OBW(Hz)	Fl-OBW(Hz)	Fh-OBW(Hz)	Limit(Hz)	Port
666k	2.479665G	2.480331G	1.039M	2.479501G	2.480541G	2.4-2.4835G	1

BT-LE(2Mbps) EBW

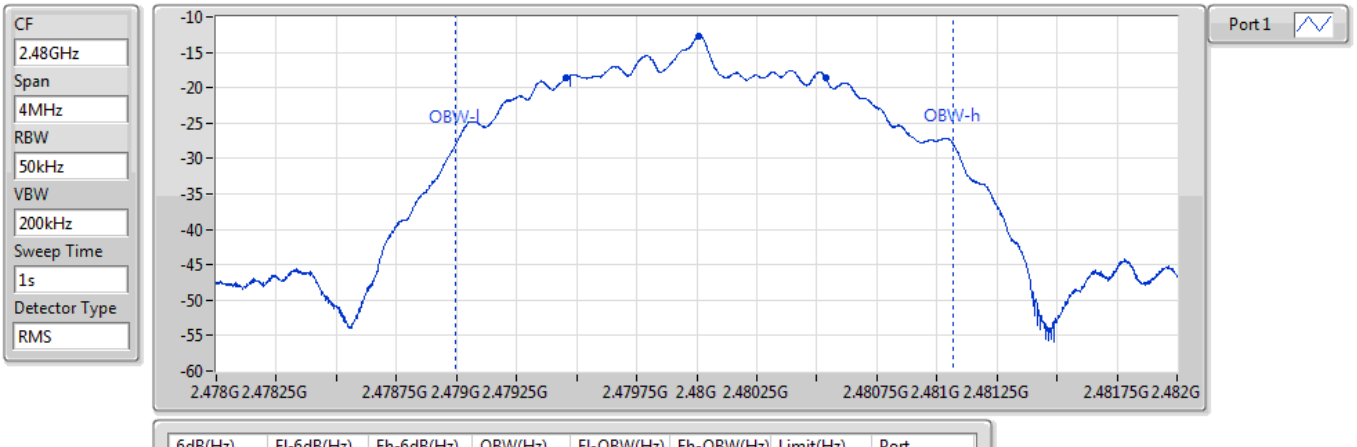
2402MHz



6dB(Hz)	Fl-6dB(Hz)	Fh-6dB(Hz)	OBW(Hz)	Fl-OBW(Hz)	Fh-OBW(Hz)	Limit(Hz)	Port
1.082M	2.401454G	2.402536G	2.075M	2.400993G	2.403067G	2.4-2.4835G	1

BT-LE(2Mbps) EBW

2480MHz



6dB(Hz)	Fl-6dB(Hz)	Fh-6dB(Hz)	OBW(Hz)	Fl-OBW(Hz)	Fh-OBW(Hz)	Limit(Hz)	Port
1.08M	2.479456G	2.480536G	2.071M	2.478997G	2.481067G	2.4-2.4835G	1

Summary

Mode	EIRP (dBm)	EIRP (W)
2.4-2.4835GHz	-	-
BT-LE(1Mbps)	1.10	0.00129
BT-LE(2Mbps)	1.01	0.00126

Result

Mode	Result	Gain (dBi)	Sum (dBm)	EIRP (dBm)	EIRP Lim. (dBm)
BT-LE(1Mbps)	-	-	-	-	-
2402MHz_TnomVnom	Pass	-0.91	2.01	1.10	20.00
2402MHz_TminVnom	Pass	-0.91	1.73	0.82	20.00
2402MHz_TmaxVnom	Pass	-0.91	1.67	0.76	20.00
2440MHz_TnomVnom	Pass	-0.91	1.53	0.62	20.00
2440MHz_TminVnom	Pass	-0.91	1.27	0.36	20.00
2440MHz_TmaxVnom	Pass	-0.91	1.30	0.39	20.00
2480MHz_TnomVnom	Pass	-0.91	0.70	-0.21	20.00
2480MHz_TminVnom	Pass	-0.91	0.35	-0.56	20.00
2480MHz_TmaxVnom	Pass	-0.91	0.97	0.06	20.00
BT-LE(2Mbps)	-	-	-	-	-
2402MHz_TnomVnom	Pass	-0.91	1.92	1.01	20.00
2402MHz_TminVnom	Pass	-0.91	1.64	0.73	20.00
2402MHz_TmaxVnom	Pass	-0.91	1.65	0.74	20.00
2440MHz_TnomVnom	Pass	-0.91	1.45	0.54	20.00
2440MHz_TminVnom	Pass	-0.91	1.24	0.33	20.00
2440MHz_TmaxVnom	Pass	-0.91	1.25	0.34	20.00
2480MHz_TnomVnom	Pass	-0.91	0.64	-0.27	20.00
2480MHz_TminVnom	Pass	-0.91	0.97	0.06	20.00
2480MHz_TmaxVnom	Pass	-0.91	0.58	-0.33	20.00

Port X = Port X output power; **Total Power** = Total power measure all transmit ports simultaneously.

Summary

Mode	EIRP PD (dBm/MHz)
2.4-2.4835GHz	-
BT-LE(1Mbps)	0.78
BT-LE(2Mbps)	-0.35

RBW=1MHz.

Result

Mode	Result	Gain (dBi)	PD (dBm/MHz)	EIRP PD (dBm/MHz)	EIRP PD Limit (dBm/MHz)
BT-LE(1Mbps)	-	-	-	-	-
2402MHz_TnomVnom	Pass	-0.91	1.69	0.78	10.00
2440MHz_TnomVnom	Pass	-0.91	1.25	0.34	10.00
2480MHz_TnomVnom	Pass	-0.91	0.27	-0.64	10.00
BT-LE(2Mbps)	-	-	-	-	-
2402MHz_TnomVnom	Pass	-0.91	0.56	-0.35	10.00
2440MHz_TnomVnom	Pass	-0.91	-0.22	-1.13	10.00
2480MHz_TnomVnom	Pass	-0.91	-1.10	-2.01	10.00

RBW=1MHz;
Port X = Port X power density;

Summary

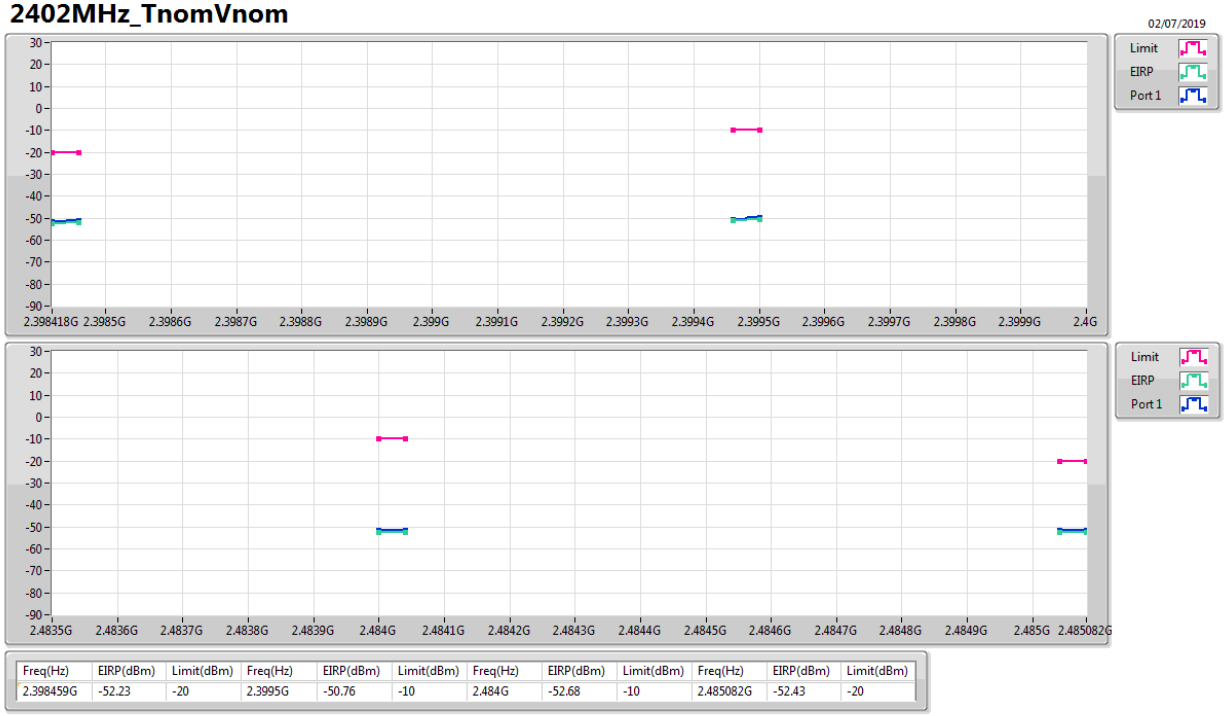
Mode	EIRP-A (dBm)	Limit-A (dBm)	EIRP-B (dBm)	Limit-B (dBm)
2.4-2.4835GHz	-	-	-	-
BT-LE(1Mbps)	-50.76	-10	-51.97	-20
BT-LE(2Mbps)	-34.86	-10	-48.63	-20

Result

Mode	Result	Freq (Hz)	EIRP (dBm)	Limit (dBm)	Freq (Hz)	EIRP (dBm)	Limit (dBm)
BT-LE(1Mbps)	-	-	-	-	-	-	-
2402MHz_TnomVnom	Pass	2.398459G	-52.23	-20	2.3995G	-50.76	-10
2402MHz_TnomVnom	Pass	2.485082G	-52.43	-20	2.484G	-52.68	-10
2480MHz_TnomVnom	Pass	2.398461G	-53.00	-20	2.3995G	-53.43	-10
2480MHz_TnomVnom	Pass	2.485039G	-51.97	-20	2.484039G	-52.04	-10
BT-LE(2Mbps)	-	-	-	-	-	-	-
2402MHz_TnomVnom	Pass	2.397439G	-48.63	-20	2.3995G	-34.86	-10
2402MHz_TnomVnom	Pass	2.486061G	-49.77	-20	2.484G	-49.76	-10
2480MHz_TnomVnom	Pass	2.396764G	-50.39	-20	2.3995G	-50.21	-10
2480MHz_TnomVnom	Pass	2.486736G	-49.85	-20	2.484G	-49.05	-10

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

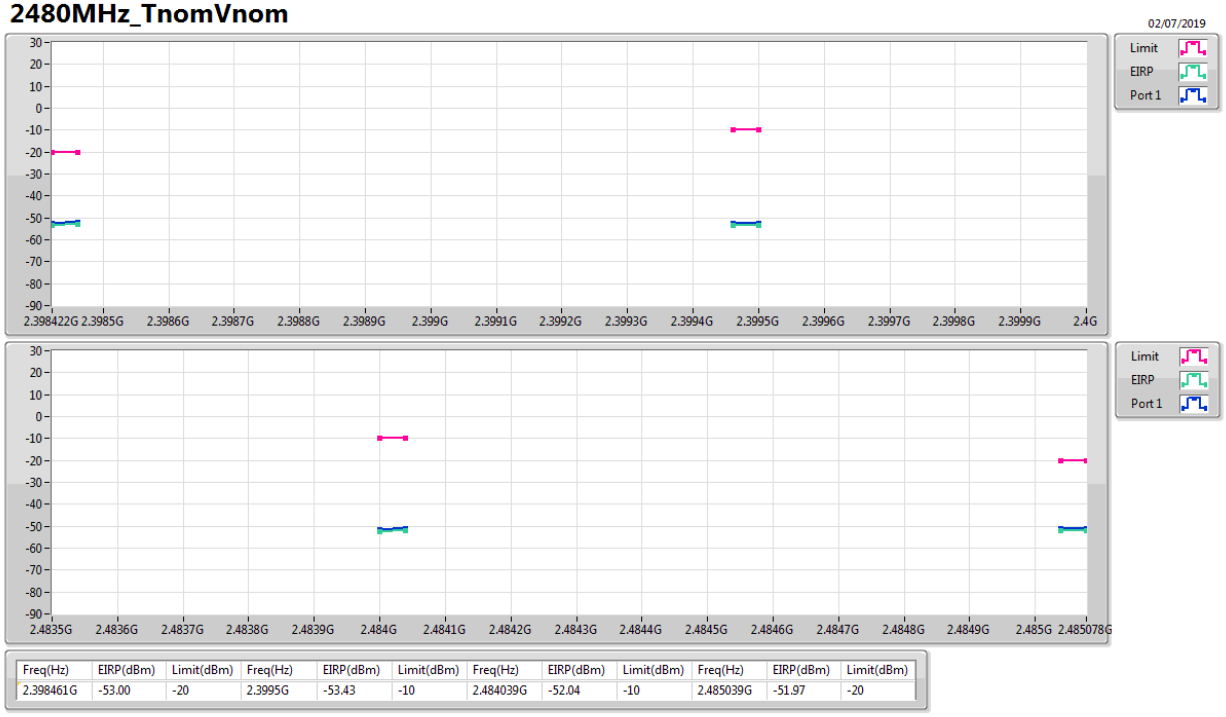
2402MHz_TnomVnom



Freq(Hz)	EIRP(dBm)	Limit(dBm)	Freq(Hz)	EIRP(dBm)	Limit(dBm)	Freq(Hz)	EIRP(dBm)	Limit(dBm)	Freq(Hz)	EIRP(dBm)	Limit(dBm)
2.398459G	-52.23	-20	2.3995G	-50.76	-10	2.484G	-52.68	-10	2.485082G	-52.43	-20

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

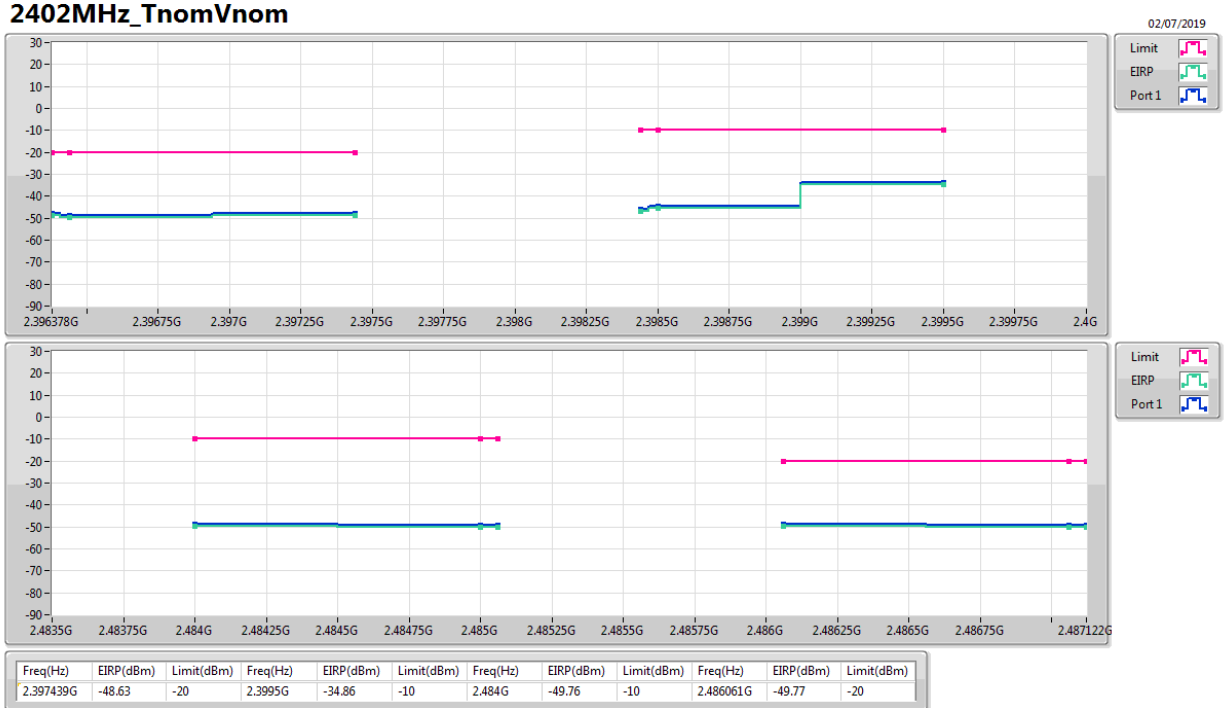
2480MHz_TnomVnom



Freq(Hz)	EIRP(dBm)	Limit(dBm)	Freq(Hz)	EIRP(dBm)	Limit(dBm)	Freq(Hz)	EIRP(dBm)	Limit(dBm)	Freq(Hz)	EIRP(dBm)	Limit(dBm)
2.398461G	-53.00	-20	2.3995G	-53.43	-10	2.484039G	-52.04	-10	2.485039G	-51.97	-20

BT-LE(2Mbps) **Mask**

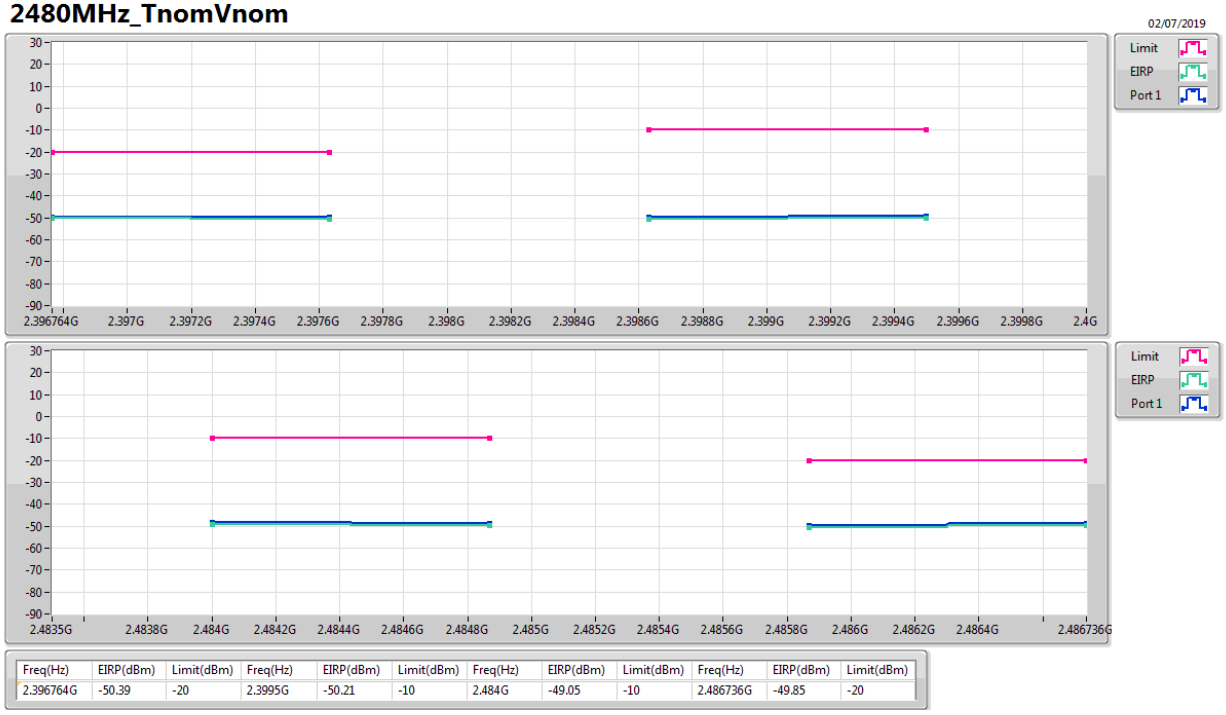
2402MHz_TnomVnom



Freq(Hz)	EIRP(dBm)	Limit(dBm)	Freq(Hz)	EIRP(dBm)	Limit(dBm)	Freq(Hz)	EIRP(dBm)	Limit(dBm)	Freq(Hz)	EIRP(dBm)	Limit(dBm)
2.397439G	-48.63	-20	2.3995G	-34.86	-10	2.484G	-49.76	-10	2.486061G	-49.77	-20

BT-LE(2Mbps) **Mask**

2480MHz_TnomVnom



Freq(Hz)	EIRP(dBm)	Limit(dBm)	Freq(Hz)	EIRP(dBm)	Limit(dBm)	Freq(Hz)	EIRP(dBm)	Limit(dBm)	Freq(Hz)	EIRP(dBm)	Limit(dBm)
2.396764G	-50.39	-20	2.3995G	-50.21	-10	2.484G	-49.05	-10	2.486736G	-49.85	-20

Summary

Mode	Result	Type	Freq (Hz)	Level (dBm)	Limit (dBm)	Margin (dB)	Factor (dB)	Dist (m)	Condition	Azimuth (°)	Height (m)	Comments
2.4-2.4835GHz	-	-	-	-	-	-	-	-	-	-	-	-
BT-LE(2Mbps)	Pass	AV	100.4M	-62.09	-54.00	-8.09	-1.79	3	Horizontal	360	1.5	-

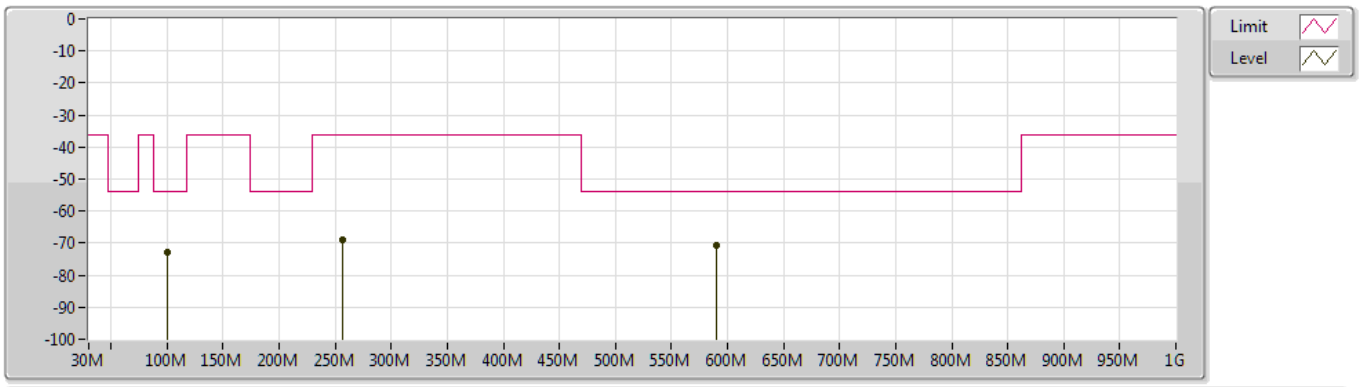
Result

Mode	Result	Type	Freq (Hz)	Level (dBm)	Limit (dBm)	Margin (dB)	Factor (dB)	Dist (m)	Condition	Azimuth (°)	Height (m)	Comments
BT-LE(2Mbps)	-	-	-	-	-	-	-	-	-	-	-	-
2480MHz_TX	Pass	AV	100.4M	-62.09	-54.00	-8.09	-1.79	3	Horizontal	360	1.5	-
2480MHz_TX	Pass	AV	224.01M	-73.47	-54.00	-19.47	-0.25	3	Horizontal	360	1.5	-
2480MHz_TX	Pass	AV	672.03M	-64.38	-54.00	-10.38	9.45	3	Horizontal	360	1.5	-
2480MHz_TX	Pass	AV	99.9M	-72.80	-54.00	-18.80	2.41	3	Vertical	0	1.5	-
2480MHz_TX	Pass	AV	256.01M	-68.80	-36.00	-32.80	-0.13	3	Vertical	0	1.5	-
2480MHz_TX	Pass	AV	589.83M	-70.53	-54.00	-16.53	8.25	3	Vertical	0	1.5	-

BT-LE(2Mbps)

19/06/2019

2480MHz_TX

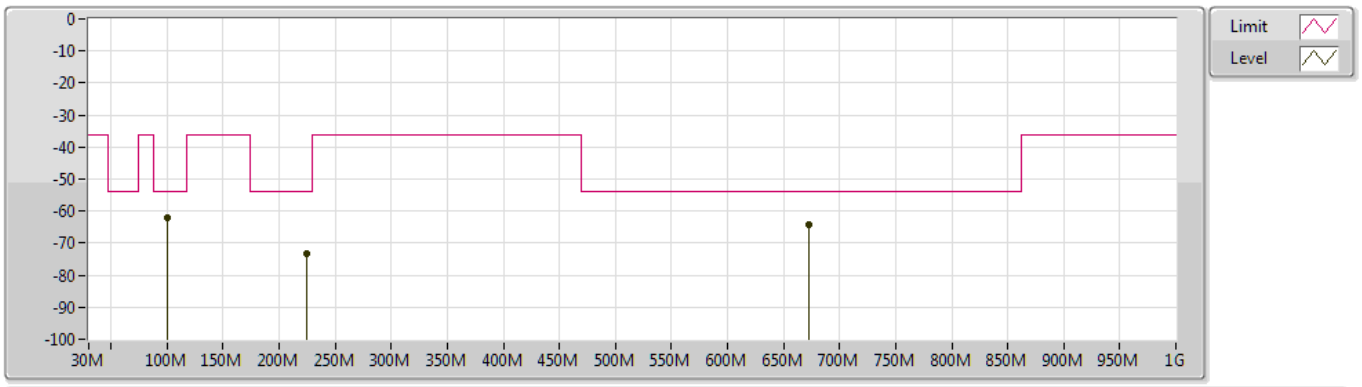


Type	Freq	Level	Limit	Margin	Factor	Dist	Condition	Azimuth	Height	Comment
	(Hz)	(dBm)	(dBm)	(dB)	(dB)	(m)		(°)	(m)	
AV	99.9M	-72.80	-54.00	-18.80	2.41	3	Vertical	0	1.5	-
AV	256.01M	-68.80	-36.00	-32.80	-0.13	3	Vertical	0	1.5	-
AV	589.83M	-70.53	-54.00	-16.53	8.25	3	Vertical	0	1.5	-

BT-LE(2Mbps)

19/06/2019

2480MHz_TX



Type	Freq	Level	Limit	Margin	Factor	Dist	Condition	Azimuth	Height	Comment
	(Hz)	(dBm)	(dBm)	(dB)	(dB)	(m)		(°)	(m)	
AV	100.4M	-62.09	-54.00	-8.09	-1.79	3	Horizontal	360	1.5	-
AV	224.01M	-73.47	-54.00	-19.47	-0.25	3	Horizontal	360	1.5	-
AV	672.03M	-64.38	-54.00	-10.38	9.45	3	Horizontal	360	1.5	-

Summary

Mode	Result	Type	Freq (Hz)	Level (dBm)	Limit (dBm)	Margin (dB)	Factor (dB)	Dist (m)	Condition	Azimuth (°)	Height (m)	Comments
2.4-2.4835GHz	-	-	-	-	-	-	-	-	-	-	-	-
BT-LE(1Mbps)	Pass	AV	4.80445G	-41.05	-30.00	-11.05	1.04	3	Vertical	0	1.5	-
BT-LE(2Mbps)	Pass	AV	4.80403G	-43.17	-30.00	-13.17	1.04	3	Vertical	360	1.5	-

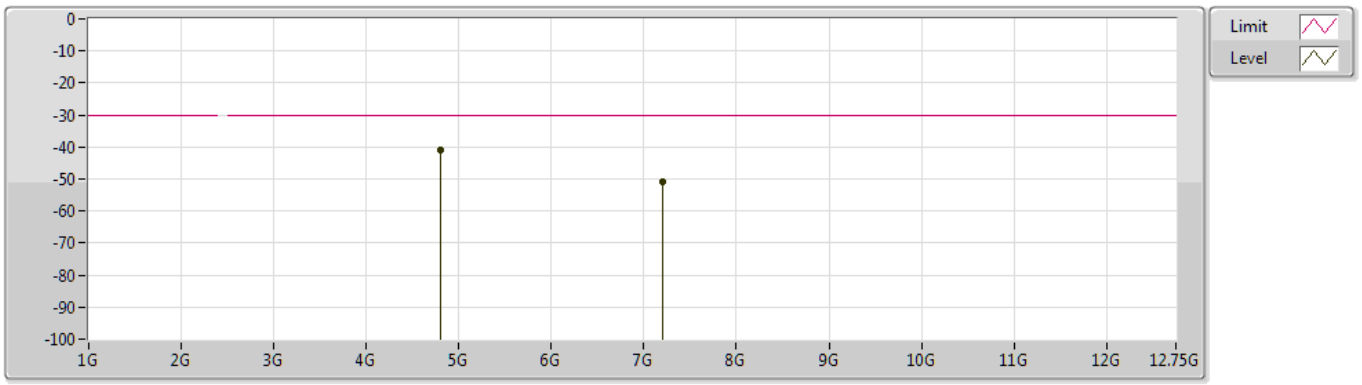
Result

Mode	Result	Type	Freq (Hz)	Level (dBm)	Limit (dBm)	Margin (dB)	Factor (dB)	Dist (m)	Condition	Azimuth (°)	Height (m)	Comments
BT-LE(1Mbps)	-	-	-	-	-	-	-	-	-	-	-	-
2402MHz_TX	Pass	AV	4.80445G	-41.05	-30.00	-11.05	1.04	3	Vertical	0	1.5	-
2402MHz_TX	Pass	AV	7.20596G	-50.68	-30.00	-20.68	4.55	3	Vertical	0	1.5	-
2402MHz_TX	Pass	AV	4.80445G	-41.18	-30.00	-11.18	1.09	3	Horizontal	360	1.5	-
2402MHz_TX	Pass	AV	7.20554G	-54.17	-30.00	-24.17	4.68	3	Horizontal	360	1.5	-
2480MHz_TX	Pass	AV	4.95963G	-43.18	-30.00	-13.18	0.91	3	Horizontal	0	1.5	-
2480MHz_TX	Pass	AV	7.43955G	-56.30	-30.00	-26.30	2.94	3	Horizontal	0	1.5	-
2480MHz_TX	Pass	AV	4.96004G	-42.28	-30.00	-12.28	1.04	3	Vertical	360	1.5	-
2480MHz_TX	Pass	AV	7.43955G	-55.27	-30.00	-25.27	2.84	3	Vertical	360	1.5	-
BT-LE(2Mbps)	-	-	-	-	-	-	-	-	-	-	-	-
2402MHz_TX	Pass	AV	4.80486G	-44.05	-30.00	-14.05	1.09	3	Horizontal	0	1.5	-
2402MHz_TX	Pass	AV	7.20596G	-54.12	-30.00	-24.12	4.68	3	Horizontal	0	1.5	-
2402MHz_TX	Pass	AV	4.80403G	-43.17	-30.00	-13.17	1.04	3	Vertical	360	1.5	-
2402MHz_TX	Pass	AV	7.20637G	-53.04	-30.00	-23.04	4.54	3	Vertical	360	1.5	-
2480MHz_TX	Pass	AV	4.95921G	-45.01	-30.00	-15.01	0.91	3	Horizontal	360	1.5	-
2480MHz_TX	Pass	AV	7.4408G	-57.74	-30.00	-27.74	2.95	3	Horizontal	360	1.5	-
2480MHz_TX	Pass	AV	4.95963G	-43.33	-30.00	-13.33	1.04	3	Vertical	0	1.5	-
2480MHz_TX	Pass	AV	7.43997G	-55.91	-30.00	-25.91	2.84	3	Vertical	0	1.5	-

BT-LE(1Mbps)

2402MHz_TX

19/06/2019

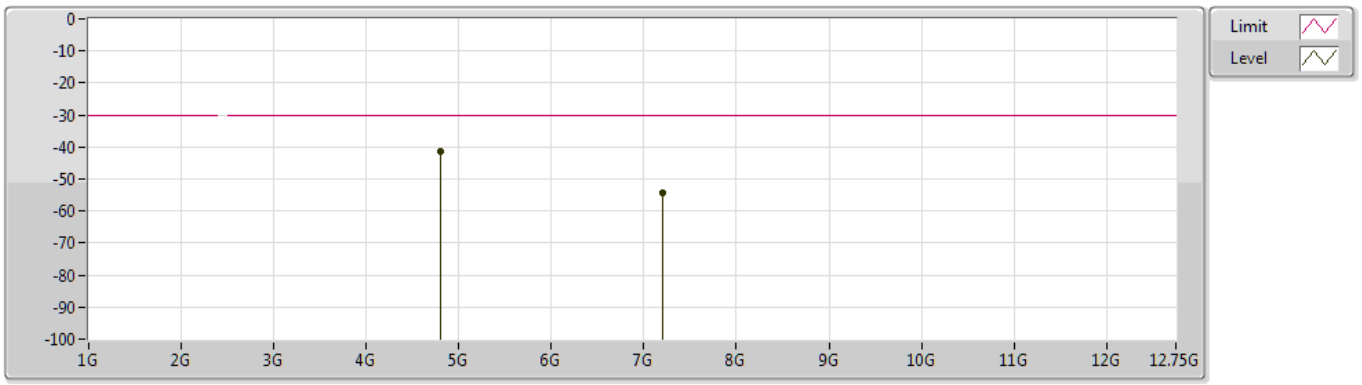


Type	Freq	Level	Limit	Margin	Factor	Dist	Condition	Azimuth	Height	Comment
	(Hz)	(dBm)	(dBm)	(dB)	(dB)	(m)		(°)	(m)	
AV	4.80445G	-41.05	-30.00	-11.05	1.04	3	Vertical	0	1.5	-
AV	7.20596G	-50.68	-30.00	-20.68	4.55	3	Vertical	0	1.5	-

BT-LE(1Mbps)

2402MHz_TX

19/06/2019

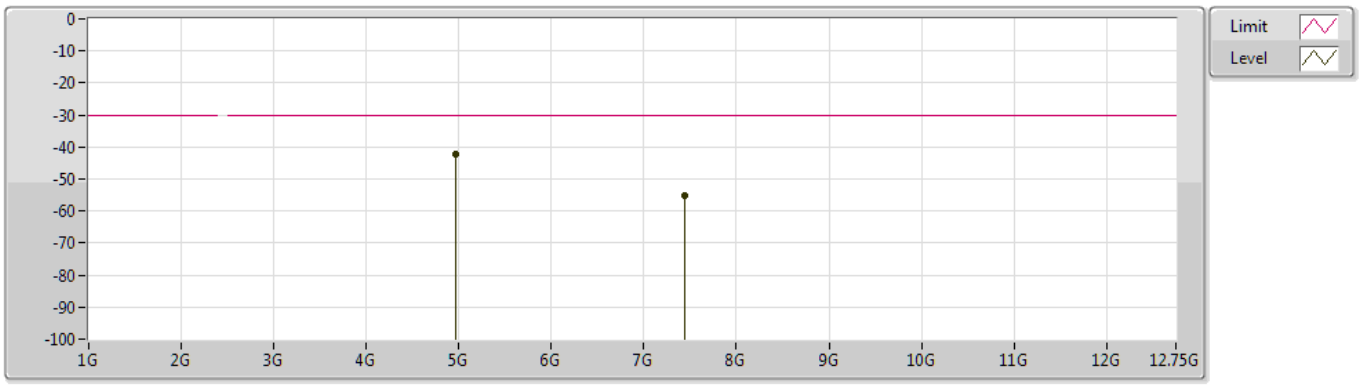


Type	Freq	Level	Limit	Margin	Factor	Dist	Condition	Azimuth	Height	Comment
	(Hz)	(dBm)	(dBm)	(dB)	(dB)	(m)		(°)	(m)	
AV	4.80445G	-41.18	-30.00	-11.18	1.09	3	Horizontal	360	1.5	-
AV	7.20554G	-54.17	-30.00	-24.17	4.68	3	Horizontal	360	1.5	-

BT-LE(1Mbps)

2480MHz_TX

19/06/2019

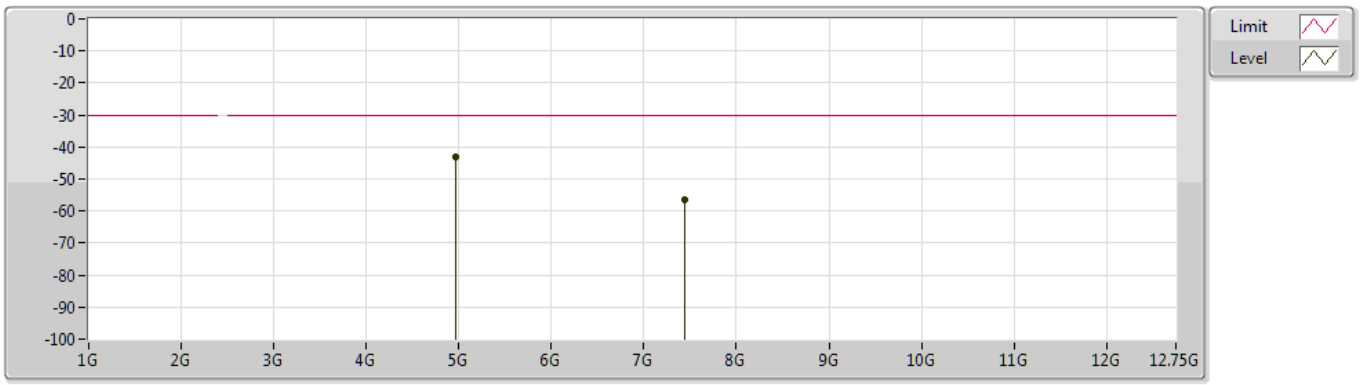


Type	Freq	Level	Limit	Margin	Factor	Dist	Condition	Azimuth	Height	Comment
	(Hz)	(dBm)	(dBm)	(dB)	(dB)	(m)		(°)	(m)	
AV	4.96004G	-42.28	-30.00	-12.28	1.04	3	Vertical	360	1.5	-
AV	7.43955G	-55.27	-30.00	-25.27	2.84	3	Vertical	360	1.5	-

BT-LE(1Mbps)

2480MHz_TX

19/06/2019

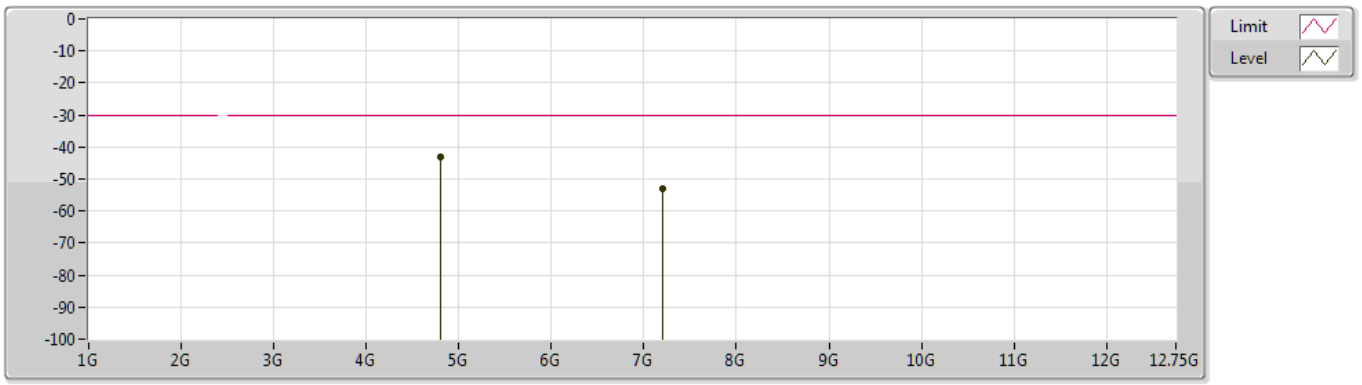


Type	Freq	Level	Limit	Margin	Factor	Dist	Condition	Azimuth	Height	Comment
	(Hz)	(dBm)	(dBm)	(dB)	(dB)	(m)		(°)	(m)	
AV	4.95963G	-43.18	-30.00	-13.18	0.91	3	Horizontal	0	1.5	-
AV	7.43955G	-56.30	-30.00	-26.30	2.94	3	Horizontal	0	1.5	-

BT-LE(2Mbps)

2402MHz_TX

19/06/2019

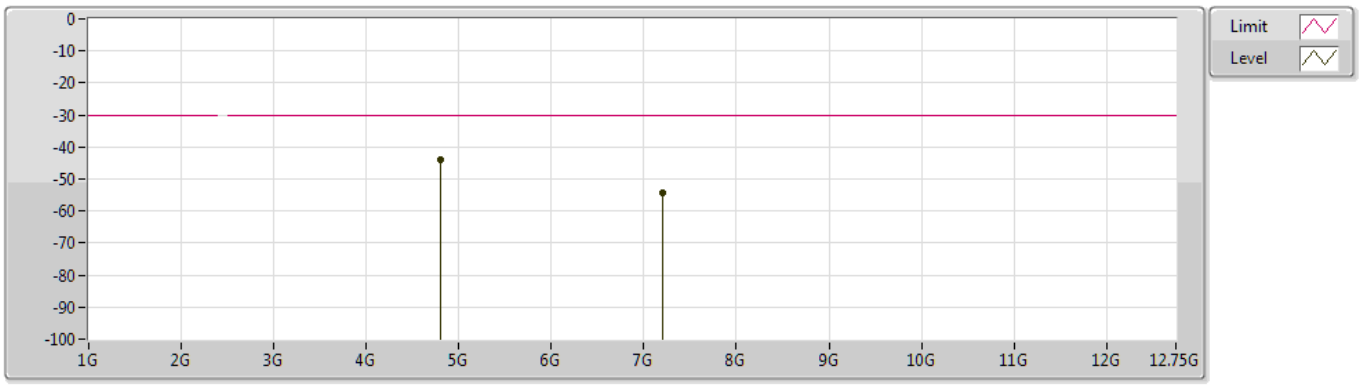


Type	Freq	Level	Limit	Margin	Factor	Dist	Condition	Azimuth	Height	Comment
	(Hz)	(dBm)	(dBm)	(dB)	(dB)	(m)		(°)	(m)	
AV	4.80403G	-43.17	-30.00	-13.17	1.04	3	Vertical	360	1.5	-
AV	7.20637G	-53.04	-30.00	-23.04	4.54	3	Vertical	360	1.5	-

BT-LE(2Mbps)

2402MHz_TX

19/06/2019

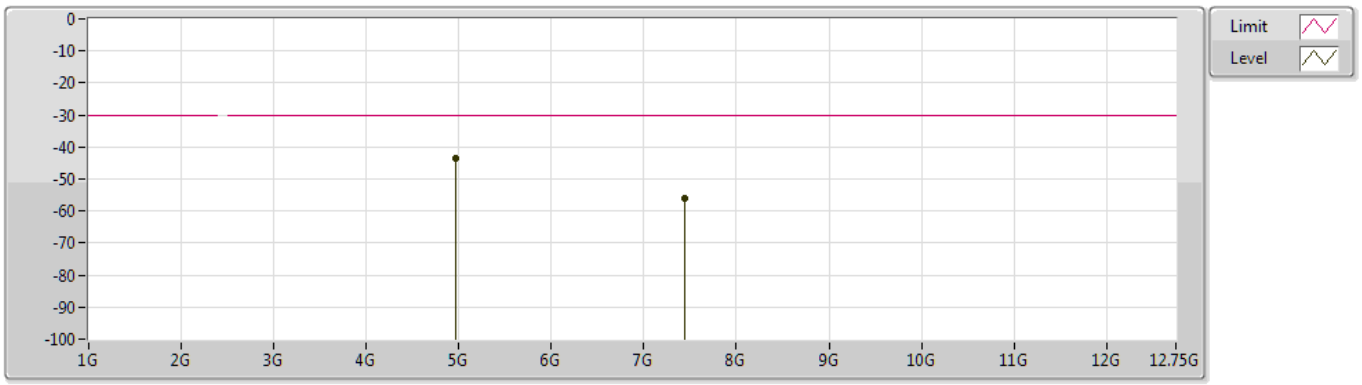


Type	Freq	Level	Limit	Margin	Factor	Dist	Condition	Azimuth	Height	Comment
	(Hz)	(dBm)	(dBm)	(dB)	(dB)	(m)		(°)	(m)	
AV	4.80486G	-44.05	-30.00	-14.05	1.09	3	Horizontal	0	1.5	-
AV	7.20596G	-54.12	-30.00	-24.12	4.68	3	Horizontal	0	1.5	-

BT-LE(2Mbps)

2480MHz_TX

19/06/2019

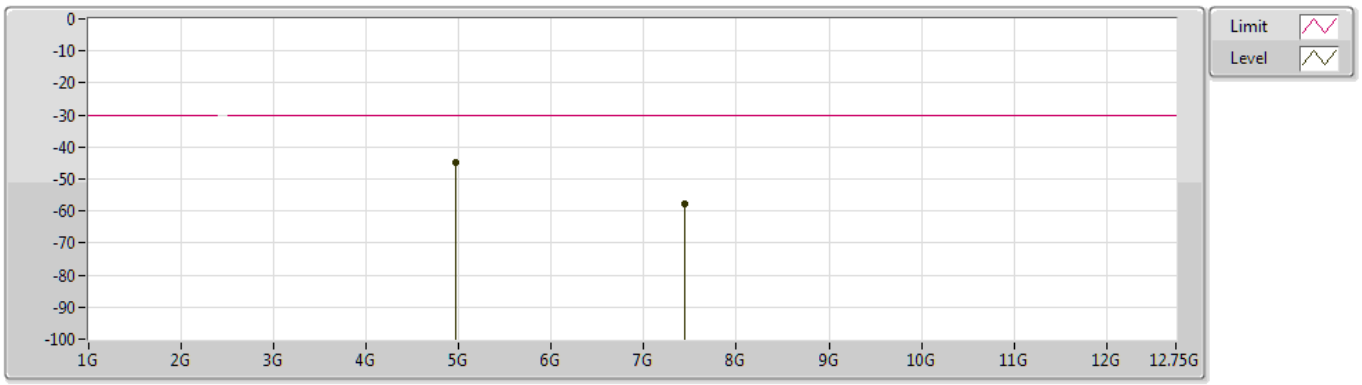


Type	Freq	Level	Limit	Margin	Factor	Dist	Condition	Azimuth	Height	Comment
	(Hz)	(dBm)	(dBm)	(dB)	(dB)	(m)		(°)	(m)	
AV	4.95963G	-43.33	-30.00	-13.33	1.04	3	Vertical	0	1.5	-
AV	7.43997G	-55.91	-30.00	-25.91	2.84	3	Vertical	0	1.5	-

BT-LE(2Mbps)

2480MHz_TX

19/06/2019



Type	Freq	Level	Limit	Margin	Factor	Dist	Condition	Azimuth	Height	Comment
	(Hz)	(dBm)	(dBm)	(dB)	(dB)	(m)		(°)	(m)	
AV	4.95921G	-45.01	-30.00	-15.01	0.91	3	Horizontal	360	1.5	-
AV	7.4408G	-57.74	-30.00	-27.74	2.95	3	Horizontal	360	1.5	-