



FCC RADIO TEST REPORT

FCC ID : 2AKBCGRODT2019
Equipment : Mighty Audio Device
Brand Name : Mighty
Model Name : M2
Applicant : Mighty Audio, Inc.
707 Coeur d'Alene Ave, Venice, CA 90291 USA
Manufacturer : Dongguanhung Fu Electronic Technology Co., LTD
ChuTang ChinXiaoTang Industrial
Zone,FengGang,DongGuang, GuangDong,China
Postcode 523682
Standard : 47 CFR FCC Part 15.247

The product was received on Apr. 08, 2019, and testing was started from Jun. 14, 2019 and completed on Jul. 04, 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: Cliff Chang

SPORTON INTERNATIONAL INC. EMC & Wireless Communications Laboratory
No. 52, Huaya 1st Rd., Guishan Dist., Taoyuan City, Taiwan (R.O.C.)



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Photographs of EUT v01



TEL : 886-3-656-9065
FAX : 886-3-656-9085
Report Template No.: CB Ver1.0



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:

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: Sandy Chuang



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
2.4G	BT-LE	1	1

Note:

- ♦ 2.4G is the 2.4GHz Band (2.4-2.4835GHz).
- ♦ Bluetooth LE uses a GFSK modulation.
- ♦ BWch is the nominal channel bandwidth.
- ♦ Nss-Min is the minimum number of spatial streams.
- ♦ Nant is the number of outputs. e.g., 2(2, 3) means have 2 outputs for port 2 and port 3. 2 means have 2 outputs for port 1 and port 2.

1.1.2 Antenna Information

Ant.	Port	Brand	Model Name	Antenna Type	Connector	Gain (dBi)
1	1	M-A	AntEffic	PCB antenna	N/A	2.6

Note: The above information was declared by manufacturer.

1.1.3 Mode Test Duty Cycle

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

1.1.4 EUT Operational Condition

EUT Power Type	From Host System or Battery			
Function	☒	Point-to-multipoint	☐	Point-to-point
Test Software Version	Tera Term 4.75、Spotify、Mighty Audio			
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.



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
- ♦ ANSI C63.10-2013
- ♦ FCC 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
☒	JHUBEI	ADD : No.8, Lane 724, Bo-ai St., Jhubei City, HsinChu County 302, Taiwan, R.O.C.	TEL : 886-3-656-9065	FAX : 886-3-656-9085

Test Condition	Test Site No.	Test Engineer	Test Environment	Test Date
RF Conducted	TH02-CB	Owen Hsu	21~24°C / 50~53%	Jun. 14, 2019~ Jun. 15, 2019
Radiated (Below 1GHz)	03CH04-CB	Justin Lin	23~25°C / 58~62%	Jun. 14, 2019~ Jul. 04, 2019
Radiated (Above 1GHz)	03CH03-CB	Justin Lin	22~27°C / 55~60%	Jun. 14, 2019~ Jul. 04, 2019
AC Conduction	CO01-CB	Max Lin	22.1~23.2°C / 56~58%	Jul. 01, 2019

Test site Designation No. TW0006 with FCC.

Test site registered number IC 4086B with Industry Canada.

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 (30MHz ~ 1,000MHz)	4.3 dB	Confidence levels of 95%
Radiated Emission (1GHz ~ 18GHz)	4.3 dB	Confidence levels of 95%
Radiated Emission (18GHz ~ 40GHz)	5.1 dB	Confidence levels of 95%
Conducted Emission	2.4 dB	Confidence levels of 95%
Output Power Measurement	1.5 dB	Confidence levels of 95%
Power Density Measurement	2.4 dB	Confidence levels of 95%
Bandwidth Measurement	2%	Confidence levels of 95%



2 Test Configuration of EUT

2.1 Test Channel Mode

Mode	PowerSetting
BT-LE_Nss1_1TX	-
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
Operating Mode	CTX
Test Mode	EUT with host system

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
Test Mode	The EUT can be placed in X axis, Y-axis and Z-axis. EUT X axis has been evaluated to be the worst case at Emissions in Restricted Frequency Bands <Above 1GHz>; thus, the measurement will follow this same test configuration.
	Place EUT in X axis - EUT with host system
Operating Mode > 1GHz	CTX
Test Mode	The EUT was performed at X axis, Y axis and Z axis position. The worst case was found at X axis, thus the measurement will follow this same test configuration.
	Place EUT in X axis



The Worst Case Mode for Following Conformance Tests	
Tests Item	Simultaneous Transmission Analysis - Radiated Emission Co-location
Test Condition	Radiated measurement
Operating Mode	Normal Link
Test Mode	The EUT can be placed in X axis, Y-axis and Z-axis. EUT X axis has been evaluated to be the worst case at Emissions in Restricted Frequency Bands <Above 1GHz>; thus, the measurement will follow this same test configuration.
	Place EUT in X axis - WLAN 2.4GHz + Bluetooth
Refer to Appendix G for Radiated Emission Co-location.	

2.3 EUT Operation during Test

The EUT was programmed to be in continuously transmitting mode.

2.4 Accessories

Accessories			
Equipment Name	Brand Name	Model Name	Rating
Battery	PATL	402431	3.8Vdc, 320mAh
Other			
USB Cable*1: Non-Shielded, 0.26m			



2.5 Support Equipment

For AC Conduction:

Support Equipment				
No.	Equipment	Brand Name	Model Name	FCC ID
A	NB	DELL	E6430	N/A
B	Earphone	e-Power	S90W	N/A
C	Mouse	Logitech	M-U0026	N/A
D	iPad	Apple	A1421	N/A
E	AP Router	ASUS	RP-N53	MSQ-RPN53

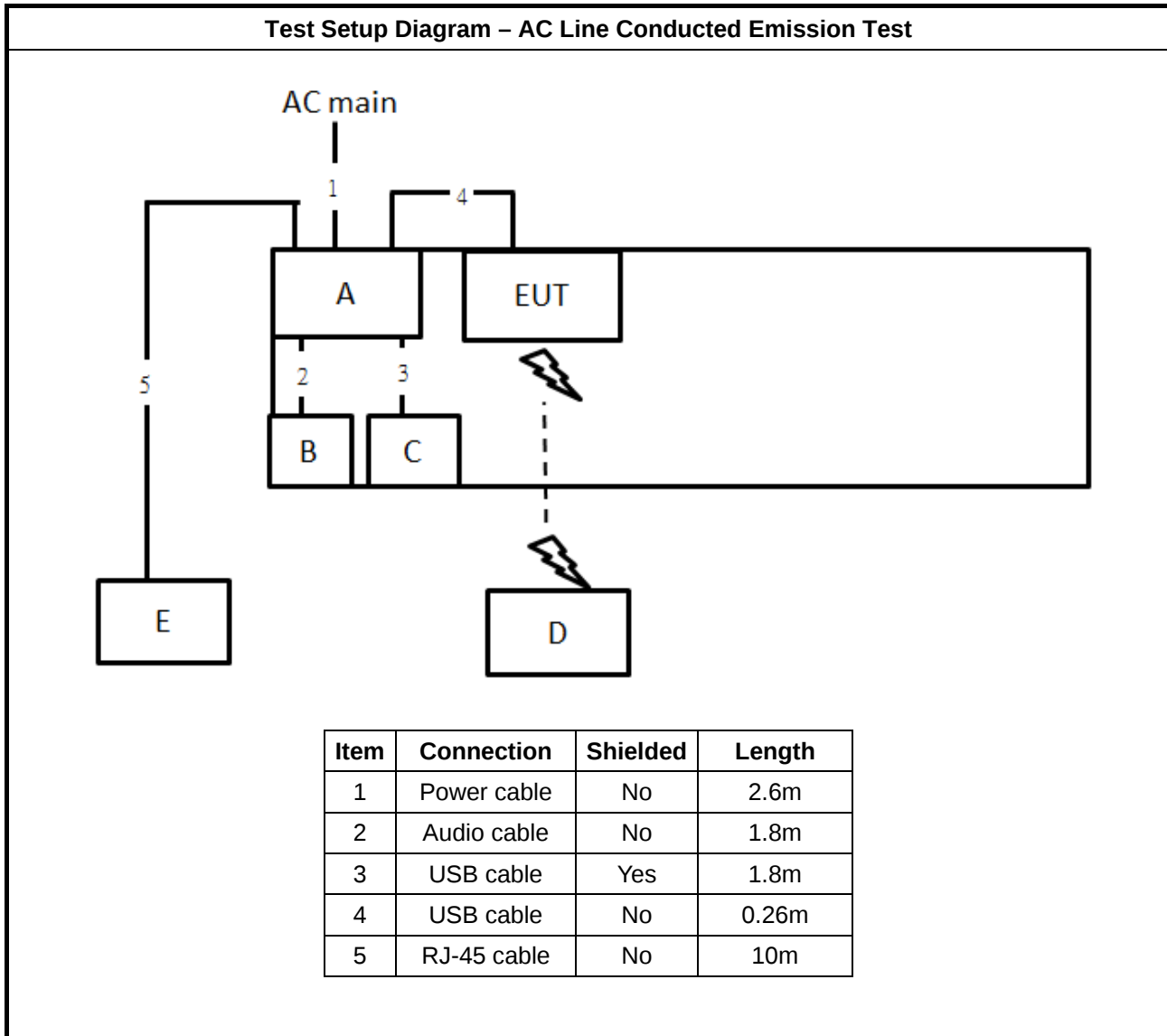
For Radiated:

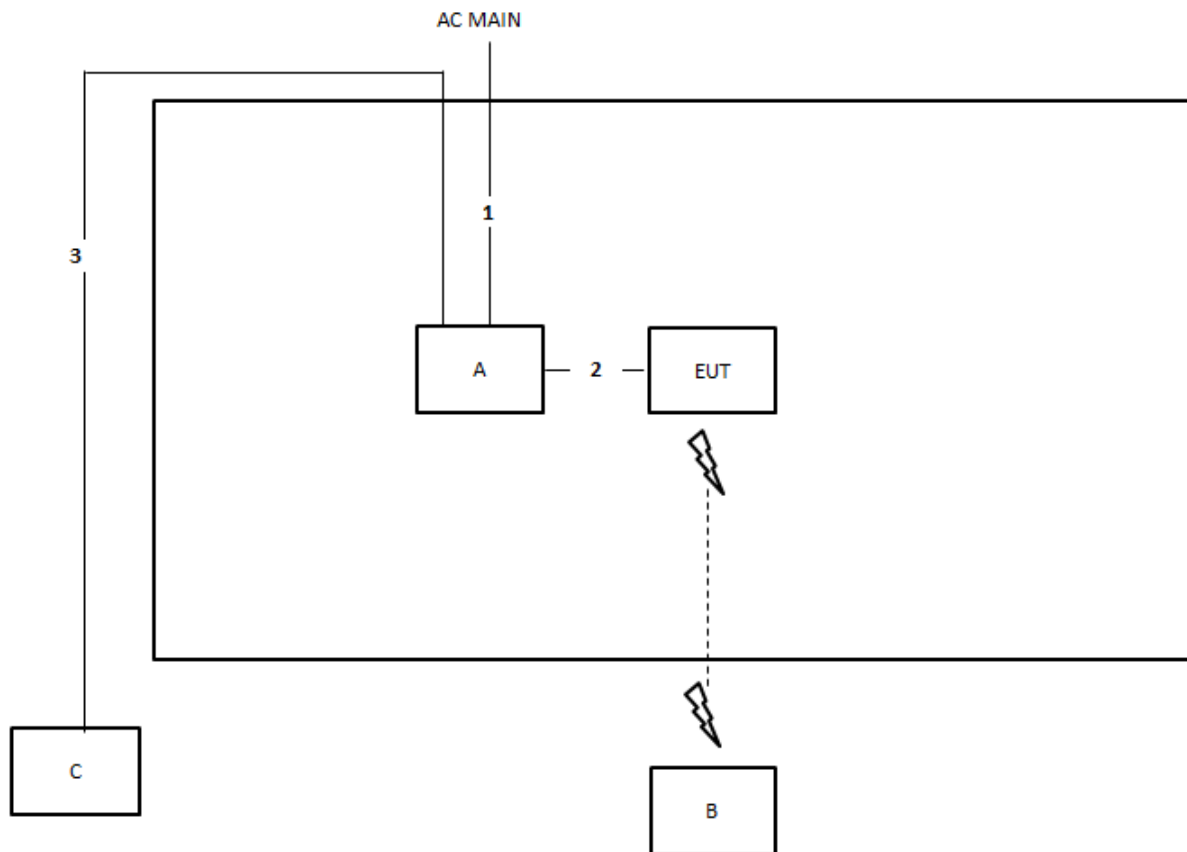
Support Equipment				
No.	Equipment	Brand Name	Model Name	FCC ID
A	Notebook	DELL	E4300	N/A
B	iPad	Apple	A1489	N/A
C	WLAN AP	Netgear	R7500	PY314300288

For RF Conducted:

Support Equipment				
No.	Equipment	Brand Name	Model Name	FCC ID
A	Notebook	DELL	E4300	N/A
B	WLAN AP	Netgear	R7500	PY314300288
C	iPad	Apple	A1458	DMRK42SCF185

2.6 Test Setup Diagram



Test Setup Diagram - Radiated Test


Item	Connection	Shielded	Length
1	Power cable	No	2.6m
2	USB cable	No	0.26m
3	RJ-45 cable	No	10m



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.		

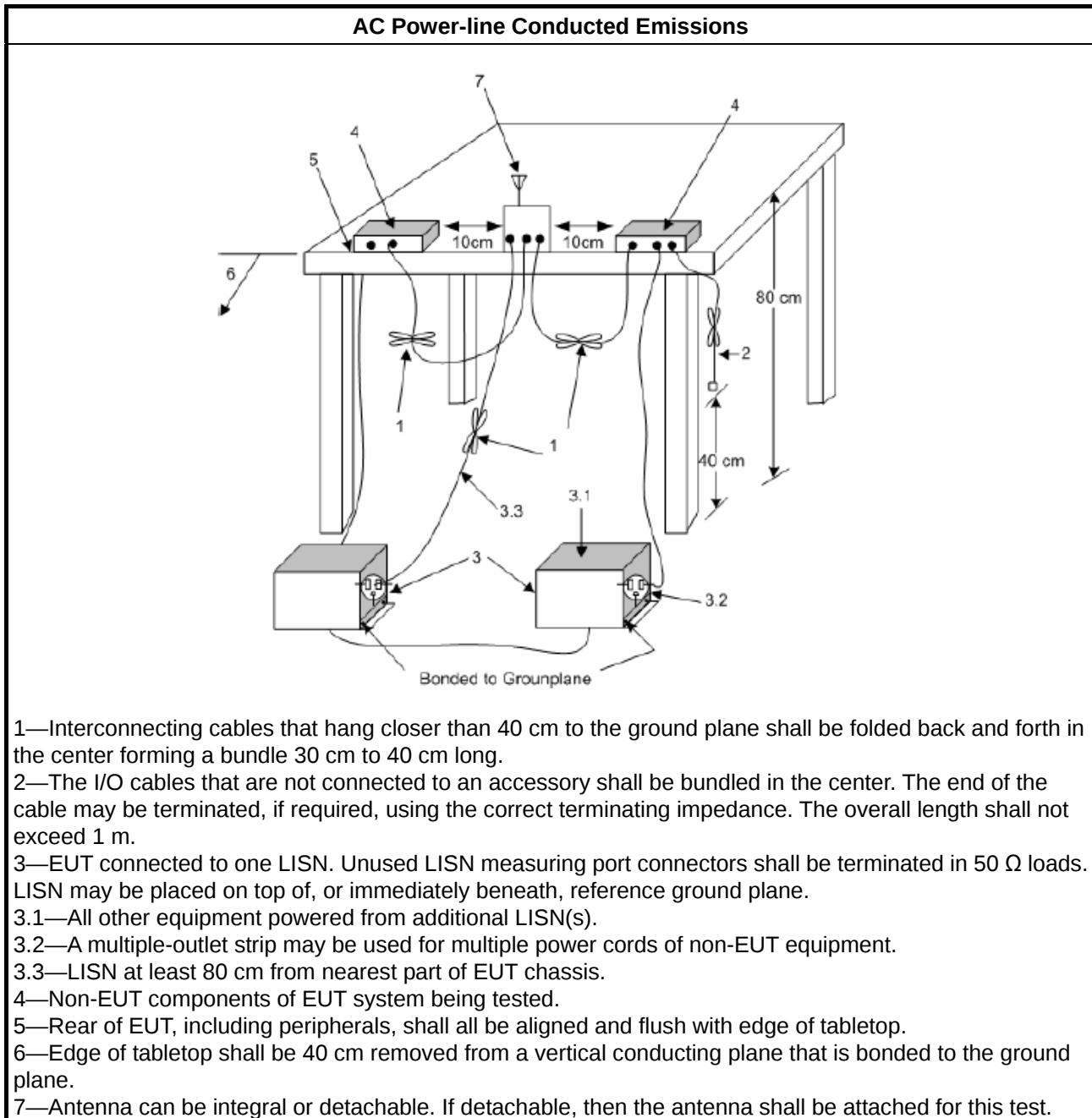
3.1.2 Measuring Instruments

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



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 $\geq$ 500 kHz.

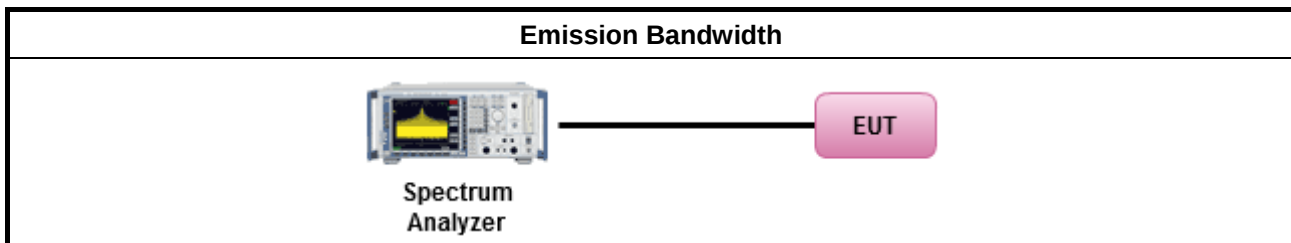
3.2.2 Measuring Instruments

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



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.	

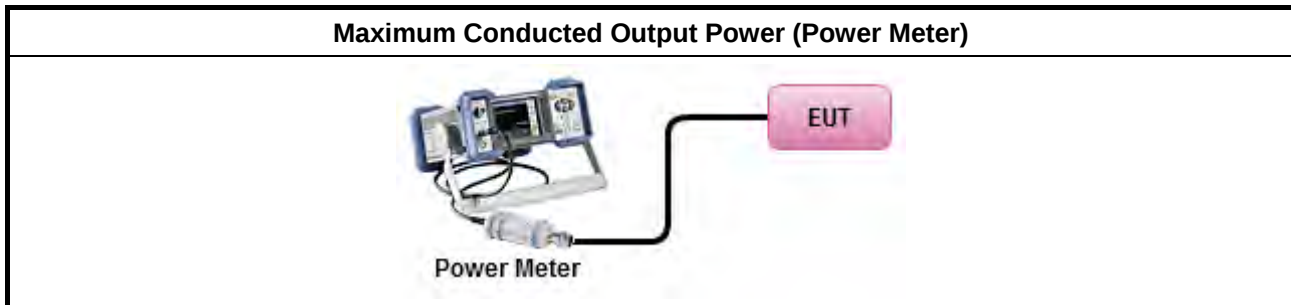
3.3.2 Measuring Instruments

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: $P_{total} = P_1 + P_2 + \dots + P_n$ (calculated in linear unit [mW] and transfer to log unit [dBm]) $EIRP_{total} = P_{total} + DG$	

3.3.4 Test Setup



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.

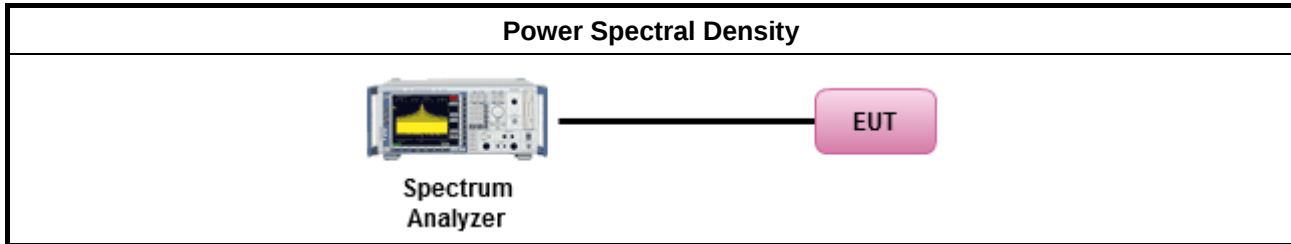
3.4.3 Test Procedures

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 11.10.2 Method PKPSD. [duty cycle $\geq 98\%$ or external video / power trigger]
☐	Refer as FCC KDB 558074, clause 8.4 & C63.10 clause 11.10.3 Method AVGPS-1.
☐	Refer as FCC KDB 558074, clause 8.4 & C63.10 clause 11.10.5 Method AVGPS-2.
☐	Refer as FCC KDB 558074, clause 8.4 & C63.10 clause 11.10.7 Method AVGPS-3.
duty cycle $< 98\%$ and average over on/off periods with duty factor	
☐	Refer as FCC KDB 558074, clause 8.4 & C63.10 clause 11.10.4 Method AVGPS-1A. (alternative).
☐	Refer as FCC KDB 558074, clause 8.4 & C63.10 clause 11.10.6 Method AVGPS-2A. (alternative)
☐	Refer as FCC KDB 558074, clause 8.4 & C63.10 clause 11.10.8 Method AVGPS-3A. (alternative)
▪ 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



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.	

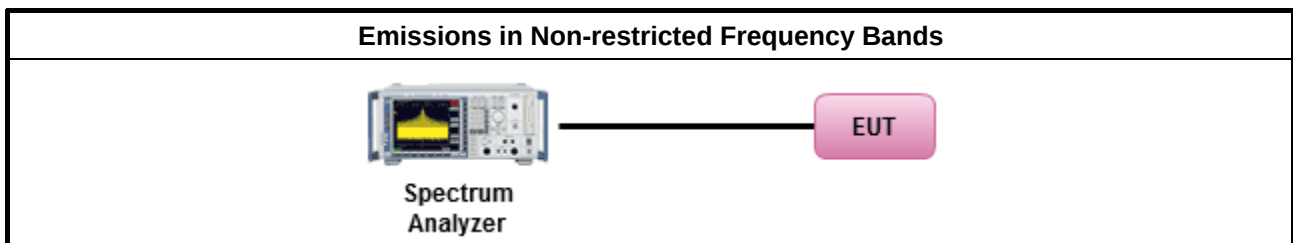
3.5.2 Measuring Instruments

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



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 below 30 MHz at a closer distance than the limit distance, the results shall be extrapolated to the specified distance by either making measurements at a minimum of two or more distances on at least one radial to determine the proper extrapolation factor or by using the square of an inverse linear distance extrapolation factor (40 dB / decade). The test report shall specify the extrapolation method used to determine compliance of the EUT.

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

3.6.2 Measuring Instruments

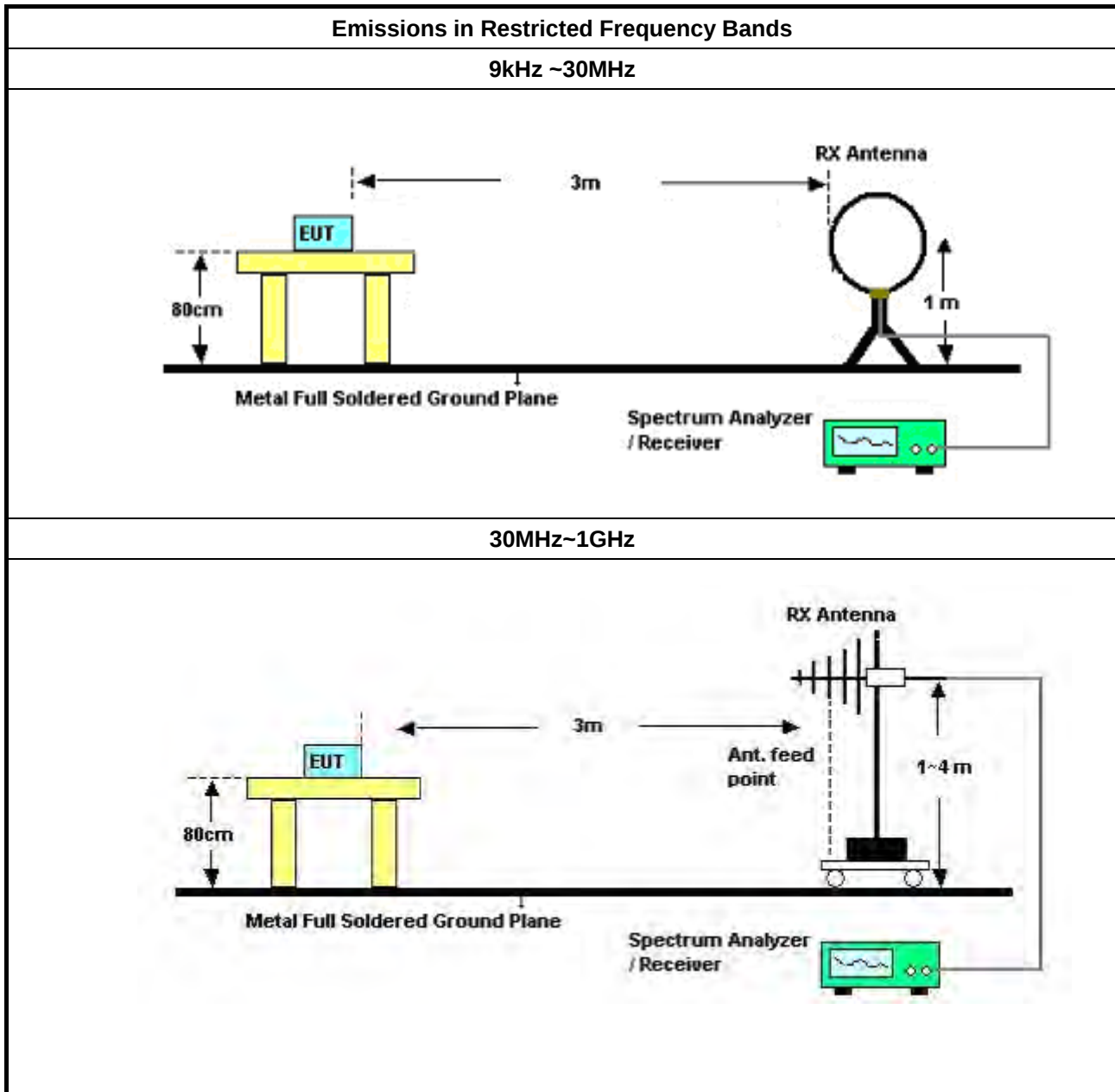
Refer a test equipment and calibration data table in this test report.

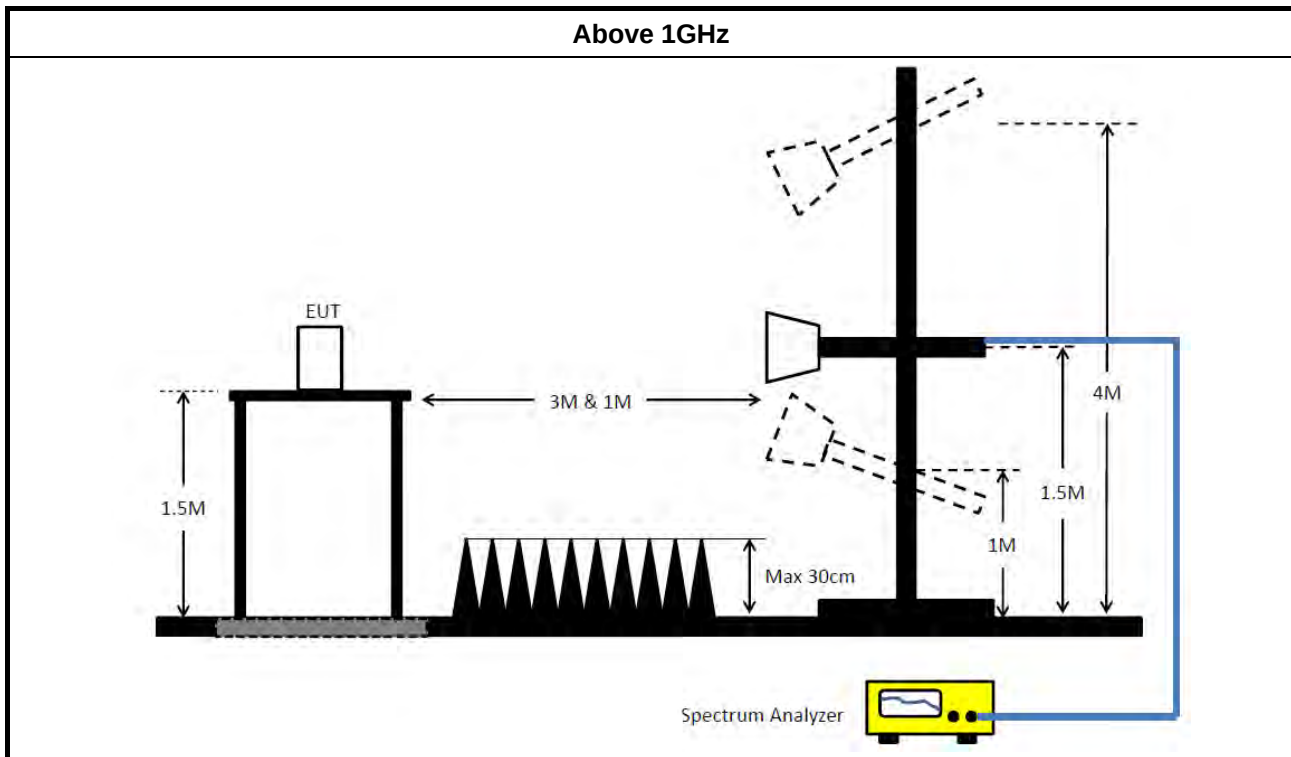


3.6.3 Test Procedures

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 $\geq 98\%$).
☐	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 $\geq 1/T$).
☐	Refer as ANSI C63.10, clause 11.12.2.5.3 (Reduced VBW). VBW $\geq 1/T$, 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





3.6.5 Measurement Results Calculation

The measured Level is calculated using:

Corrected Reading: Antenna Factor + Cable Loss + Read Level - Preamp Factor = Level.

3.6.6 Emissions in Restricted Frequency Bands (Below 30MHz)

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 10 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

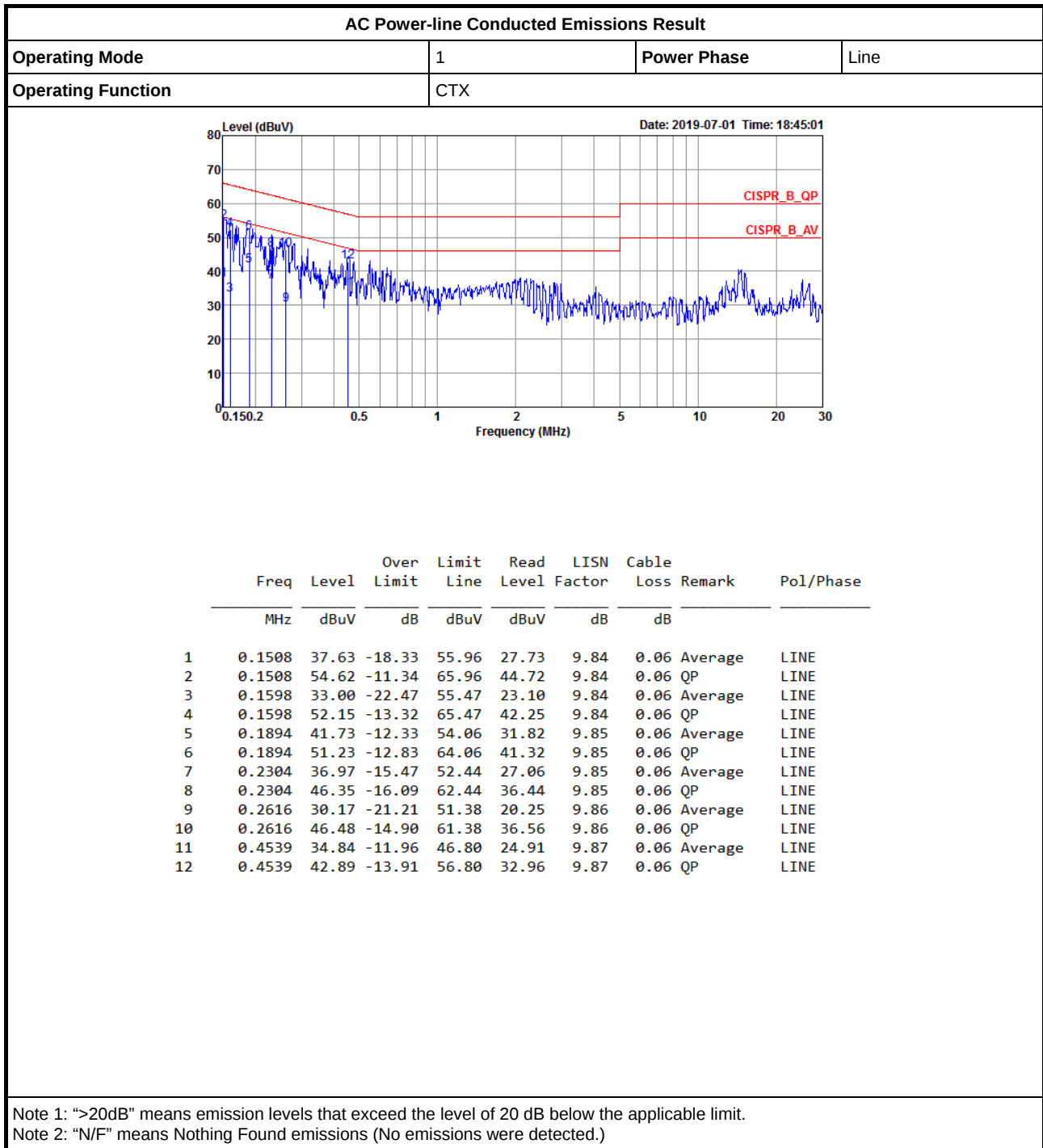
Instrument	Manufacturer	Model No.	Serial No.	Characteristics	Calibration Date	Calibration Due Date	Remark
EMI Receiver	Agilent	N9038A	My52260123	9kHz ~ 8.45GHz	Jan. 28, 2019	Jan. 29, 2020	Conduction (CO01-CB)
LISN	F.C.C.	FCC-LISN-50-16-2	04083	150kHz ~ 100MHz	Dec. 24, 2018	Dec. 23, 2019	Conduction (CO01-CB)
LISN	Schwarzbeck	NSLK 8127	8127647	9kHz ~ 30MHz	Jan. 11, 2019	Jan. 10, 2020	Conduction (CO01-CB)
COND Cable	Woken	Cable	Low cable-CO01	9kHz ~ 30MHz	May 21, 2019	May 20, 2020	Conduction (CO01-CB)
Software	Audix	E3	6.120210n	-	N.C.R.	N.C.R.	Conduction (CO01-CB)
Loop Antenna	Teseq	HLA 6120	24155	9kHz - 30 MHz	Mar. 29, 2019	Mar. 28, 2020	Radiation (03CH04-CB)
BILOG ANTENNA with 6 dB attenuator	Schaffner & Woken	CBL6112B & N-6-06	22021&AT-N06 07	30MHz ~ 1GHz	Oct. 12, 2018	Oct. 11, 2019	Radiation (03CH04-CB)
Pre-Amplifier	Agilent	310N	187291	0.1MHz ~ 1GHz	Mar. 19, 2019	Mar. 18, 2020	Radiation (03CH04-CB)
Spectrum Analyzer	R&S	FSP40	100142	9kHz~40GHz	Dec. 26, 2018	Dec. 25, 2019	Radiation (03CH04-CB)
EMI Test Receiver	R&S	ESCS	100359	9kHz ~ 2.75GHz	Jul. 03, 2018	Jul. 02, 2019	Radiation (03CH04-CB)
EMI Test Receiver	R&S	ESCS	100359	9kHz ~ 2.75GHz	Jun. 26, 2019	Jun. 25, 2020	Radiation (03CH04-CB)
RF Cable-low	Woken	RG402	Low Cable-03+22	30MHz ~ 1GHz	Oct. 08, 2018	Oct. 07, 2019	Radiation (03CH04-CB)
Horn Antenna	ETS • Lindgren	3115	6821	750MHz~18GHz	Jan. 24, 2019	Jan. 23, 2020	Radiation (03CH03-CB)
Horn Antenna	Schwarzbeck	BBHA 9170	BBHA9170252	15GHz ~ 40GHz	Jun. 27, 2019	Jun. 26, 2020	Radiation (03CH03-CB)
Pre-Amplifier	Agilent	8449B	3008A02097	1GHz ~ 26.5GHz	Dec. 20, 2018	Dec. 19, 2019	Radiation (03CH03-CB)
Pre-Amplifier	MITEQ	TTA1840-35-H G	1864479	18GHz ~ 40GHz	Jul. 04, 2018	Jul. 03, 2019	Radiation (03CH03-CB)
Pre-Amplifier	MITEQ	TTA1840-35-H G	1864479	18GHz ~ 40GHz	Jul. 03, 2019	Jul. 02, 2020	Radiation (03CH03-CB)
Spectrum Analyzer	R&S	FSP-40	100019	9kHz ~ 40GHz	Jun. 19, 2019	Jun. 18, 2020	Radiation (03CH03-CB)



Instrument	Manufacturer	Model No.	Serial No.	Characteristics	Calibration Date	Calibration Due Date	Remark
RF Cable-high	Woken	RG402	High Cable-20+27	1GHz ~ 18GHz	Oct. 08, 2018	Oct. 07, 2019	Radiation (03CH03-CB)
RF Cable-high	Woken	RG402	High Cable-27	1GHz ~ 18GHz	Oct. 08, 2018	Oct. 07, 2019	Radiation (03CH03-CB)
RF Cable-high	Woken	RG402	High Cable-40G#1	18GHz ~ 40 GHz	Jul. 27, 2018	Jul. 26, 2019	Radiation (03CH03-CB)
RF Cable-high	Woken	RG402	High Cable-40G#2	18GHz ~ 40 GHz	Jul. 27, 2018	Jul. 26, 2019	Radiation (03CH03-CB)
Spectrum analyzer	R&S	FSV40	101027	9kHz~40GHz	Jun. 22, 2018	Jun. 21, 2019	Conducted (TH02-CB)
Power Sensor	Anritsu	MA2411B	1126203	300MHz~40GHz	Sep. 03, 2018	Sep. 02, 2019	Conducted (TH02-CB)
Power Meter	Anritsu	ML2495A	1210004	300MHz~40GHz	Sep. 03, 2018	Sep. 02, 2019	Conducted (TH02-CB)
RF Cable-high	Woken	RG402	High Cable-01	1 GHz – 26.5 GHz	Oct. 08, 2018	Oct. 07, 2019	Conducted (TH02-CB)
RF Cable-high	Woken	RG402	High Cable-02	1 GHz – 26.5 GHz	Oct. 08, 2018	Oct. 07, 2019	Conducted (TH02-CB)
RF Cable-high	Woken	RG402	High Cable-3	1 GHz – 26.5 GHz	Oct. 24, 2018	Oct. 23, 2019	Conducted (TH02-CB)
RF Cable-high	Woken	RG402	High Cable-04	1 GHz – 26.5 GHz	Oct. 08, 2018	Oct. 07, 2019	Conducted (TH02-CB)
RF Cable-high	Woken	RG402	High Cable-05	1 GHz – 26.5 GHz	Oct. 08, 2018	Oct. 07, 2019	Conducted (TH02-CB)

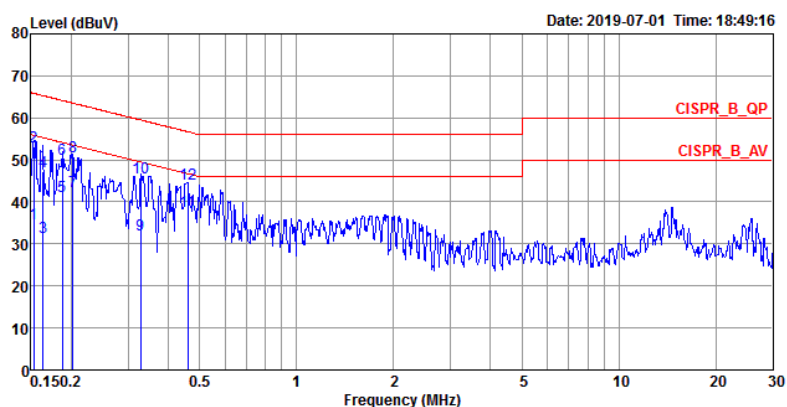
Note: Calibration Interval of instruments listed above is one year.

NCR means Non-Calibration required.



AC Power-line Conducted Emissions Result

Operating Mode	1	Power Phase	Neutral
Operating Function	CTX		



	Freq	Level	Over Limit	Limit Line	Read Level	LISN Factor	Cable Loss	Remark	Pol/Phase
	MHz	dBuV	dB	dBuV	dBuV	dB	dB		
1	0.1532	34.93	-20.89	55.82	25.04	9.83	0.06	Average	NEUTRAL
2	0.1532	53.09	-12.73	65.82	43.20	9.83	0.06	QP	NEUTRAL
3	0.1633	31.62	-23.68	55.30	21.73	9.83	0.06	Average	NEUTRAL
4	0.1633	47.19	-18.11	65.30	37.30	9.83	0.06	QP	NEUTRAL
5	0.1874	41.35	-12.80	54.15	31.46	9.83	0.06	Average	NEUTRAL
6	0.1874	50.31	-13.84	64.15	40.42	9.83	0.06	QP	NEUTRAL
7	0.2018	42.51	-11.03	53.54	32.62	9.83	0.06	Average	NEUTRAL
8	0.2018	50.80	-12.74	63.54	40.91	9.83	0.06	QP	NEUTRAL
9	0.3286	32.25	-17.24	49.49	22.35	9.84	0.06	Average	NEUTRAL
10	0.3286	45.63	-13.86	59.49	35.73	9.84	0.06	QP	NEUTRAL
11	0.4588	37.74	-8.97	46.71	27.83	9.85	0.06	Average	NEUTRAL
12	0.4588	44.14	-12.57	56.71	34.23	9.85	0.06	QP	NEUTRAL

Note 1: ">20dB" means emission levels that exceed the level of 20 dB below the applicable limit.

Note 2: "N/F" means Nothing Found emissions (No emissions were detected.)

**Summary**

Mode	Max-N dB (Hz)	Max-OBW (Hz)	ITU-Code	Min-N dB (Hz)	Min-OBW (Hz)
2.4-2.4835GHz	-	-	-	-	-
BT-LE_Nss1_1TX	721.25k	1.053M	1M05F1D	708.75k	1.051M

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;

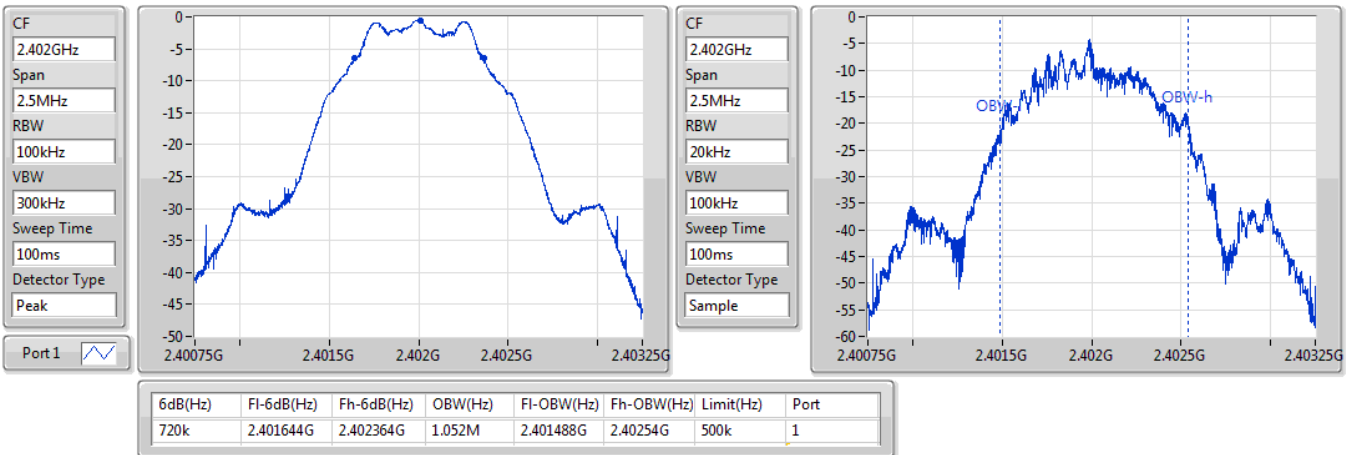
**Result**

Mode	Result	Limit (Hz)	Port 1-N dB (Hz)	Port 1-OBW (Hz)
BT-LE_Nss1_1TX	-	-	-	-
2402MHz	Pass	500k	720k	1.052M
2440MHz	Pass	500k	721.25k	1.051M
2480MHz	Pass	500k	708.75k	1.053M

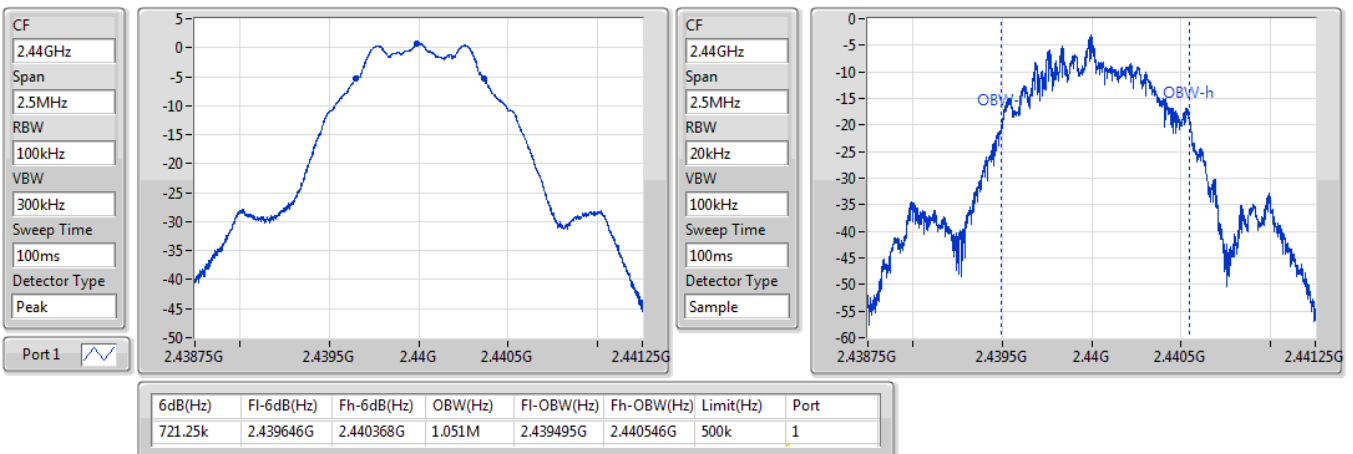
Port X-N dB = Port X 6dB down bandwidth; **Port X-OBW** = Port X 99% occupied bandwidth;

BT-LE_Nss1_1TX
2402MHz

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BT-LE_Nss1_1TX
2440MHz

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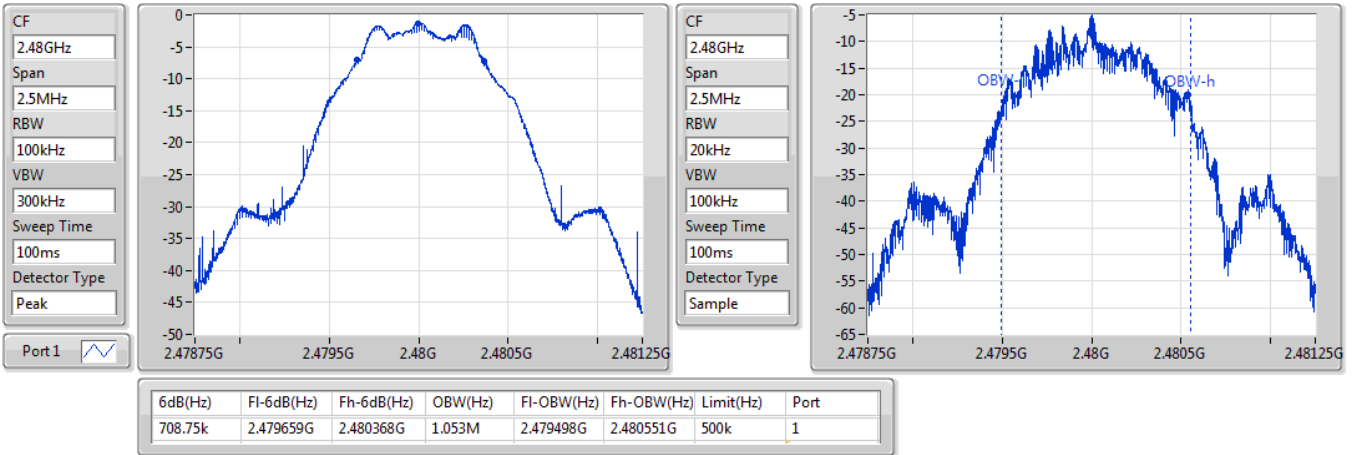


BT-LE_Nss1_1TX

2480MHz

EBW

17/06/2019





Average Power Results

Appendix C

Summary

Mode	Total Power (dBm)	Total Power (W)
2.4-2.4835GHz	-	-
BT-LE_Nss1_1TX	0.69	0.00117



Average Power Results

Appendix C

Result

Mode	Result	DG (dBi)	Port 1 (dBm)	Total Power (dBm)	Power Limit (dBm)
BT-LE_Nss1_1TX	-	-	-	-	-
2402MHz	Pass	2.60	0.69	0.69	30.00
2440MHz	Pass	2.60	0.41	0.41	30.00
2480MHz	Pass	2.60	0.01	0.01	30.00

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



Summary

Mode	PD (dBm/RBW)
2.4-2.4835GHz	-
BT-LE_Nss1_1TX	-11.77

RBW=3 kHz.



Result

Mode	Result	DG (dBi)	Port 1 (dBm/RBW)	PD (dBm/RBW)	PD Limit (dBm/RBW)
BT-LE_Nss1_1TX	-	-	-	-	-
2402MHz	Pass	2.60	-11.77	-11.77	8.00
2440MHz	Pass	2.60	-12.84	-12.84	8.00
2480MHz	Pass	2.60	-12.63	-12.63	8.00

DG = Directional Gain; RBW=3 kHz;

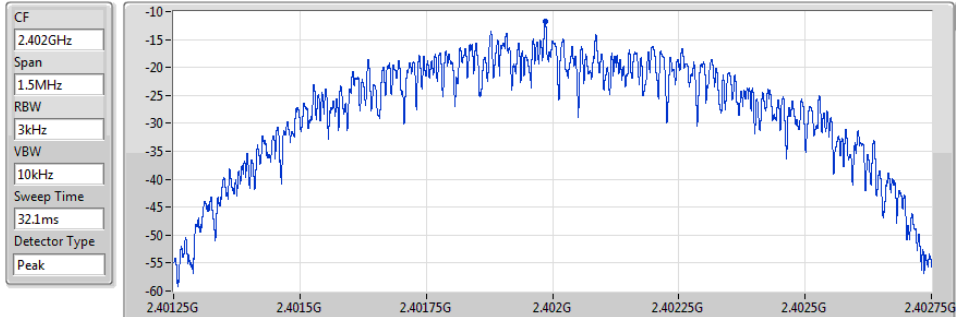
PD = trace bin-by-bin of each transmits port summing can be performed maximum power density; **Port X** = Port X power density;

BT-LE_Nss1_1TX

PSD

2402MHz

17/06/2019



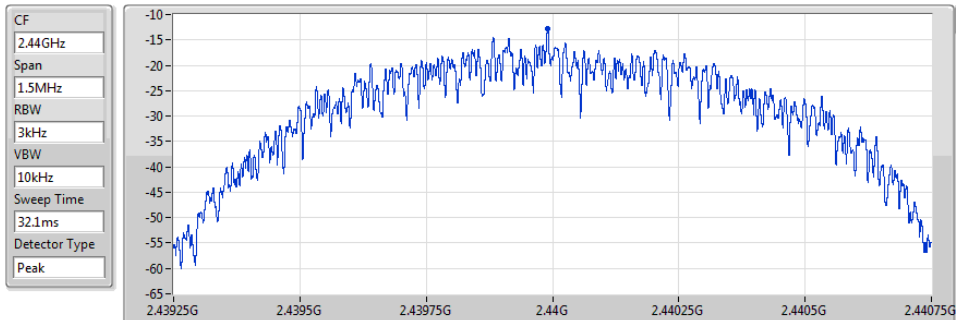
Sum	PD	Port 1
(dBm/RBW)	(dBm/RBW)	(dBm/RBW)
-11.77	-11.77	-11.77

BT-LE_Nss1_1TX

PSD

2440MHz

15/06/2019



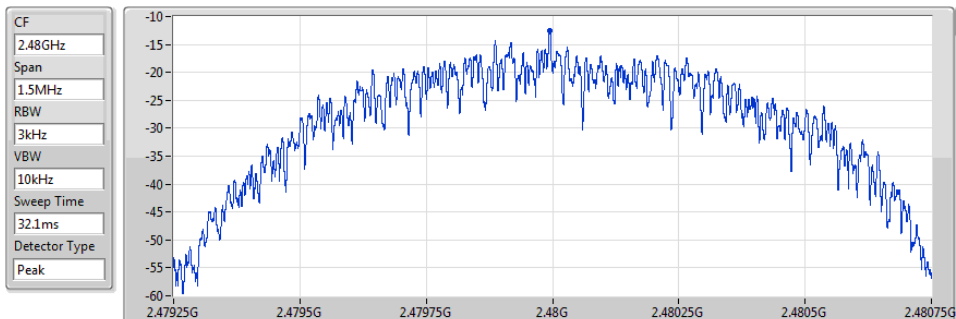
Sum	PD	Port 1
(dBm/RBW)	(dBm/RBW)	(dBm/RBW)
-12.84	-12.84	-12.84

BT-LE_Nss1_1TX

PSD

2480MHz

17/06/2019



Sum	PD	Port 1
(dBm/RBW)	(dBm/RBW)	(dBm/RBW)
-12.63	-12.63	-12.63



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_Nss1_1TX	Pass	2.402G	-1.55	-31.55	95.71M	-50.98	2.39902G	-41.96	2.48426G	-53.24	15.25966G	-47.35	1



CSE(Non-restricted Band) Results

Appendix E

Result

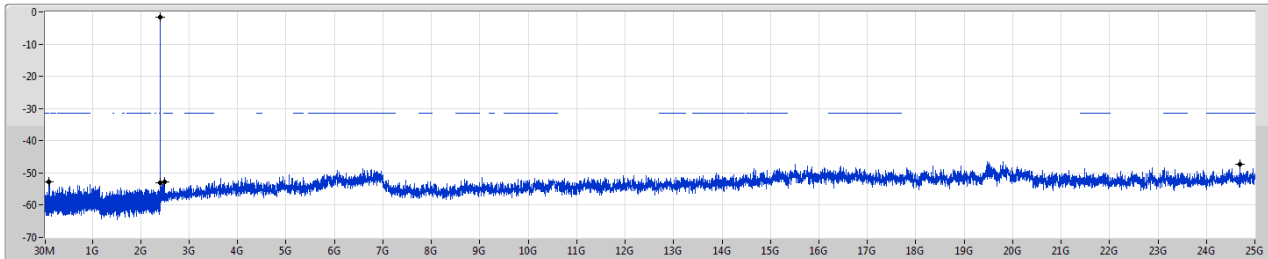
Mode	Result	Ref (Hz)	Ref (dBm)	Limit (dBm)	Freq (Hz)	Level (dBm)	Freq (Hz)	Level (dBm)	Freq (Hz)	Level (dBm)	Freq (Hz)	Level (dBm)	Port
BT-LE_Nss1_1TX	-	-	-	-	-	-	-	-	-	-	-	-	-
2402MHz	Pass	2.402G	-1.55	-31.55	95.71M	-52.83	2.39847G	-53.15	2.48434G	-52.74	24.69887G	-47.37	1
2440MHz	Pass	2.402G	-1.55	-31.55	95.71M	-50.98	2.39902G	-41.96	2.48426G	-53.24	15.25966G	-47.35	1
2480MHz	Pass	2.402G	-1.55	-31.55	96.01M	-50.18	2.39812G	-53.36	2.48439G	-42.69	16.73436G	-47.25	1

BT-LE_Nss1_1TX

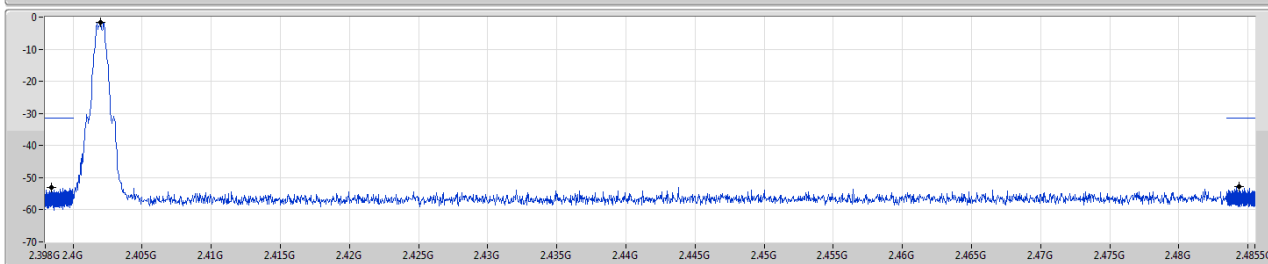
CSE NdB

2402MHz

17/06/2019



Port1



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

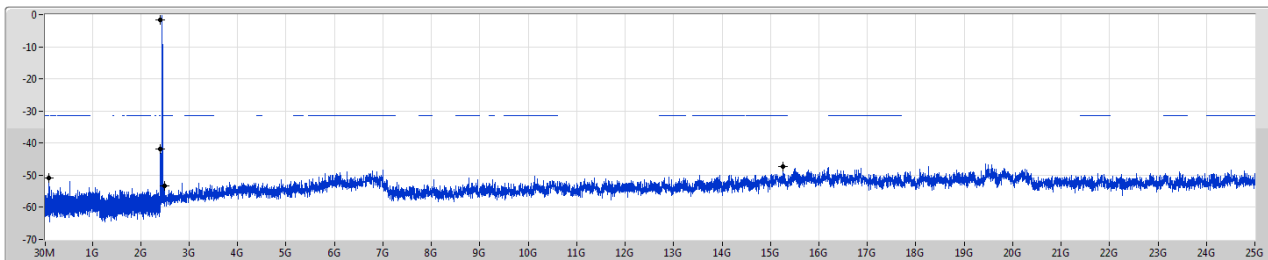
Ref(Hz)	Ref(dBm)	Limit(dBm)	Freq(Hz)	Level(dBm)	Freq(Hz)	Level(dBm)	Freq(Hz)	Level(dBm)	Freq(Hz)	Level(dBm)	Port
2402G	-1.55	-31.55	95.71M	-52.83	2.39847G	-53.15	2.48434G	-52.74	2.469887G	-47.37	1

BT-LE_Nss1_1TX

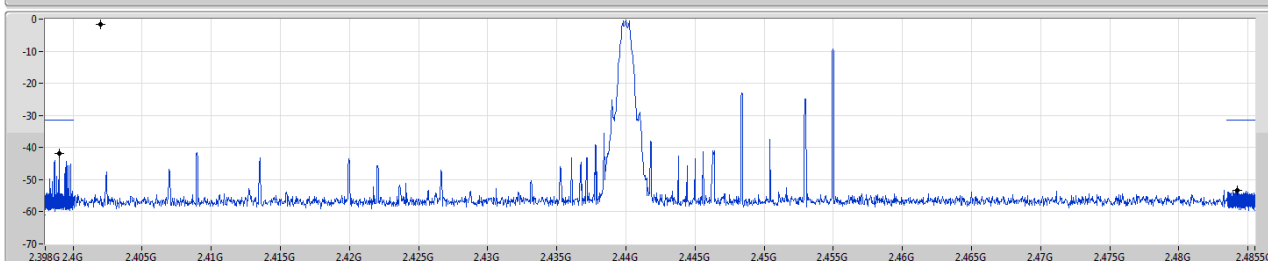
CSE NdB

2440MHz

17/06/2019



Port1



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

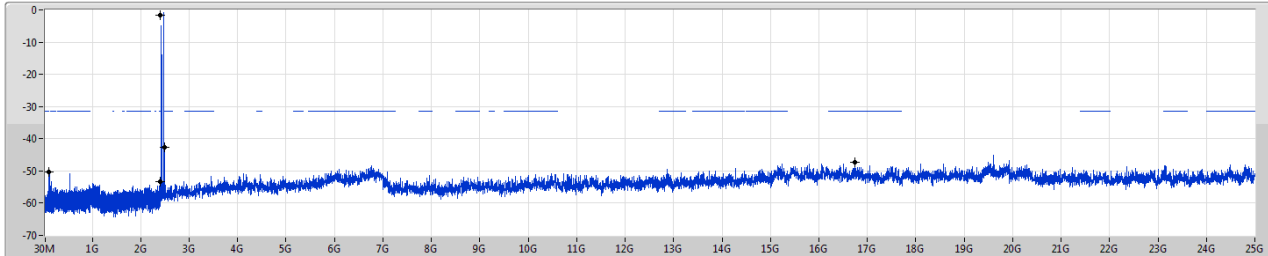
Ref(Hz)	Ref(dBm)	Limit(dBm)	Freq(Hz)	Level(dBm)	Freq(Hz)	Level(dBm)	Freq(Hz)	Level(dBm)	Freq(Hz)	Level(dBm)	Port
2402G	-1.55	-31.55	95.71M	-50.98	2.39902G	-41.96	2.48426G	-53.24	15.25966G	-47.35	1

BT-LE_Nss1_1TX

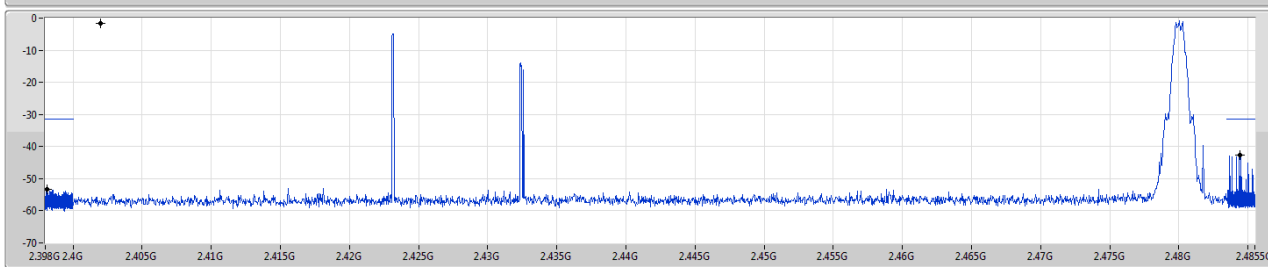
CSE NdB

2480MHz

17/06/2019

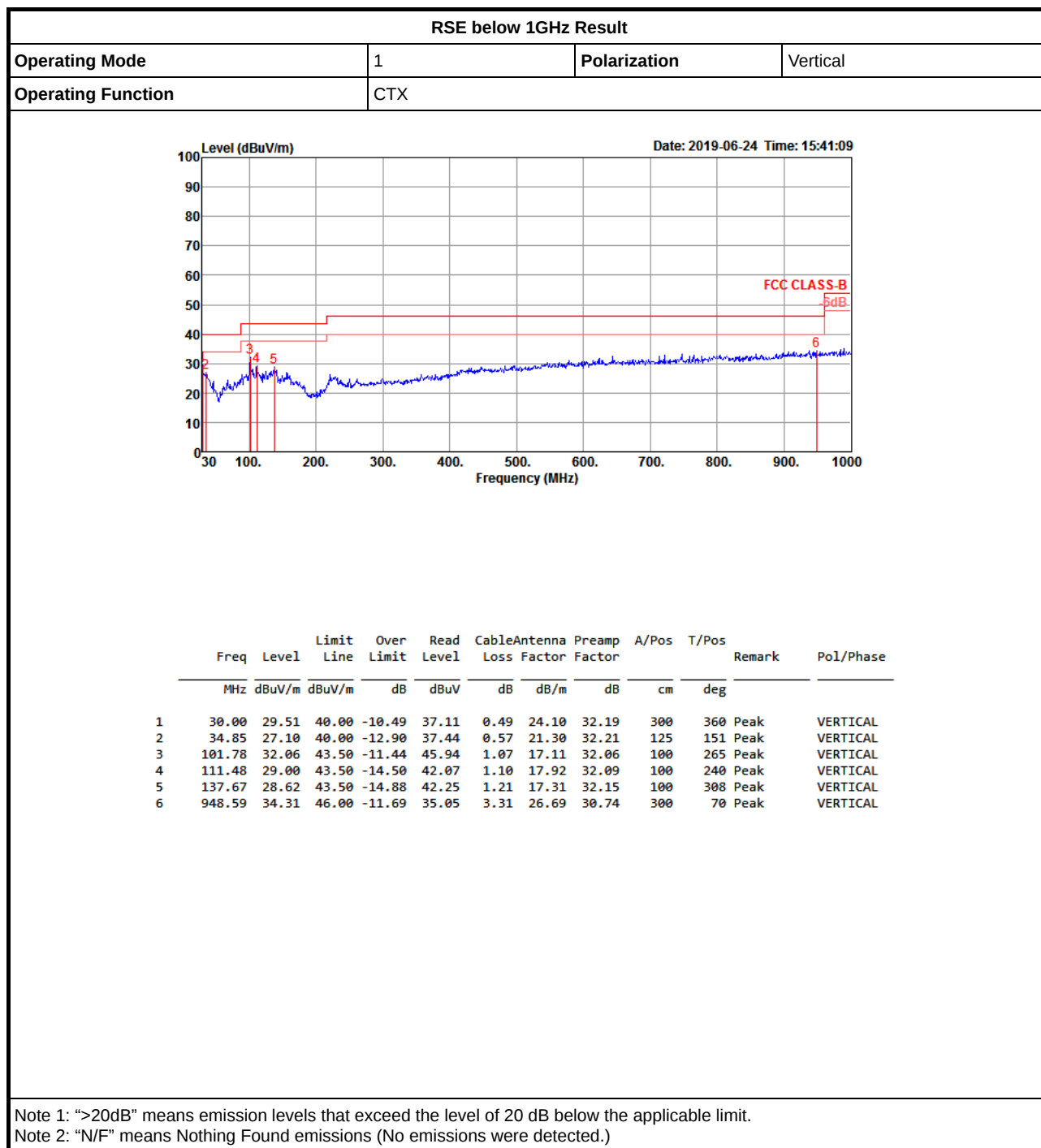


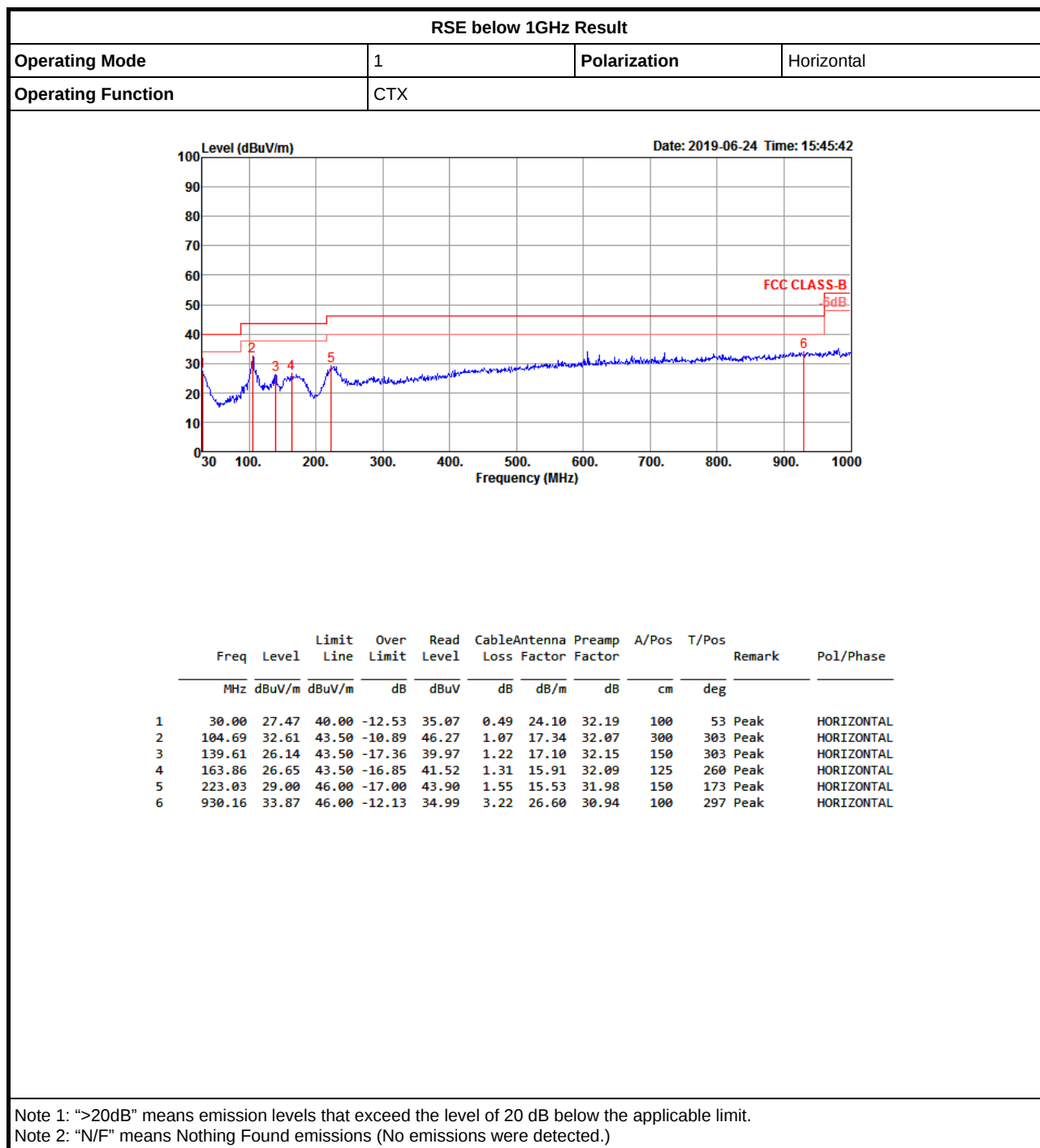
Port1



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

Ref(Hz)	Ref(dBm)	Limit(dBm)	Freq(Hz)	Level(dBm)	Freq(Hz)	Level(dBm)	Freq(Hz)	Level(dBm)	Freq(Hz)	Level(dBm)	Port
2.402G	-1.55	-31.55	96.01M	-50.18	2.39812G	-53.36	2.48439G	-42.69	16.73436G	-47.25	1







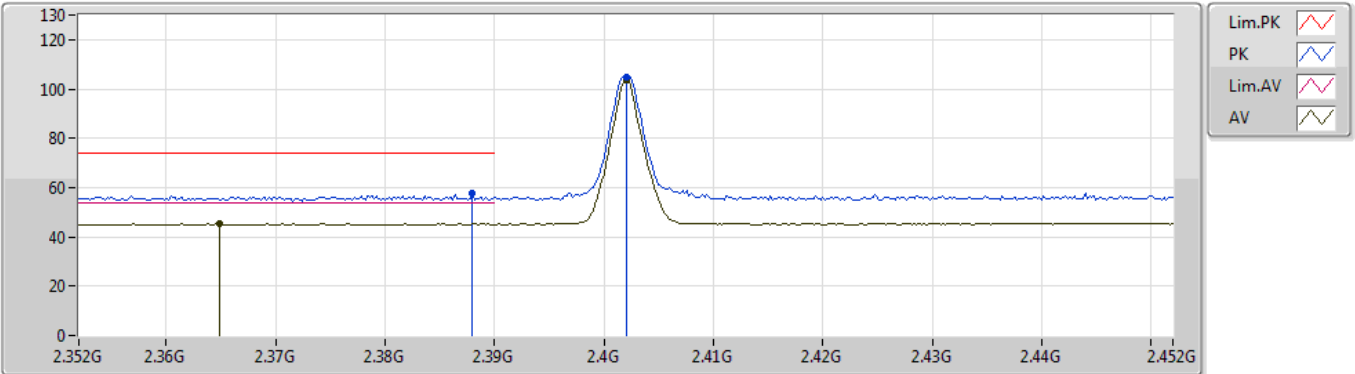
Summary

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_Nss1_1TX	Pass	AV	2.4835G	48.65	54.00	-5.35	32.41	3	Vertical	1	1.05	-

BT-LE_Nss1_1TX

14/06/2019

2402MHz_TX



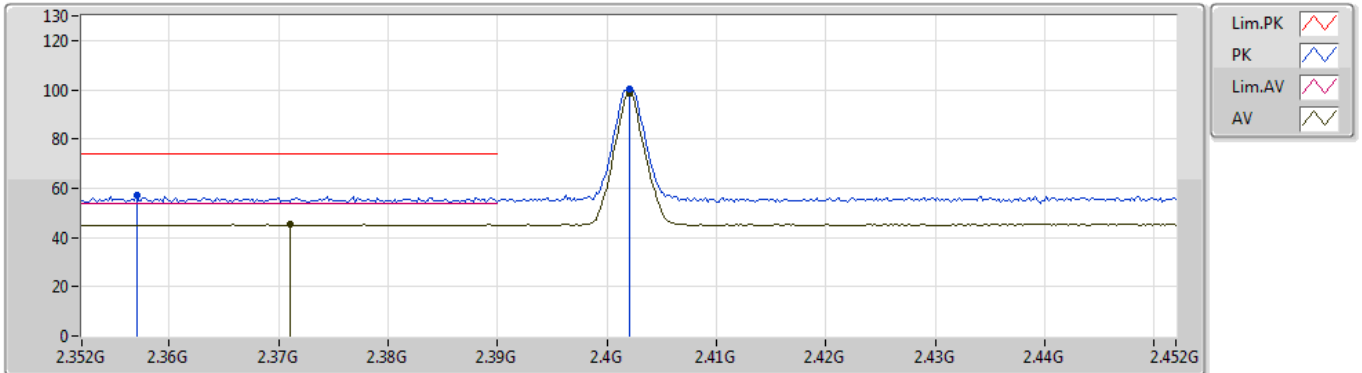
EUT X_1TX
Setting Default
03-J-5
FSP(100080)

Type	Freq (Hz)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Factor (dB)	Dist (m)	Condition	Azimuth (°)	Height (m)	Comment				
PK	2.388G	57.46	74.00	-16.54	32.06	3	Vertical	13	1.11	-				
AV	2.3648G	45.27	54.00	-8.73	31.99	3	Vertical	13	1.11	-				
PK	2.402G	104.98	Inf	-Inf	32.10	3	Vertical	13	1.11	-				
AV	2.402G	103.40	Inf	-Inf	32.10	3	Vertical	13	1.11	-				

BT-LE_Nss1_1TX

14/06/2019

2402MHz_TX



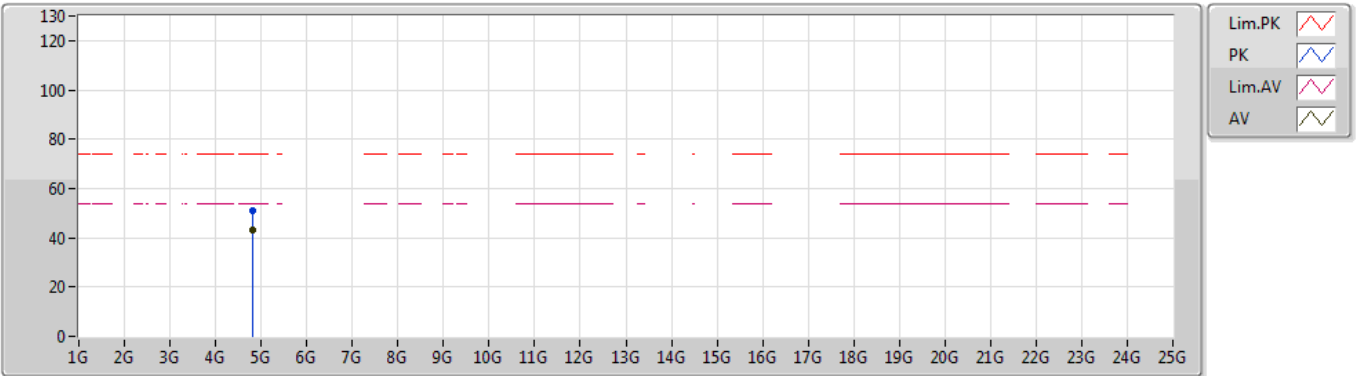
EUT X_1TX
Setting Default
03-J-5
FSP(100080)

Type	Freq (Hz)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Factor (dB)	Dist (m)	Condition	Azimuth (°)	Height (m)	Comment				
PK	2.357G	57.11	74.00	-16.89	31.96	3	Horizontal	213	1.00	-				
AV	2.371G	45.22	54.00	-8.78	32.00	3	Horizontal	213	1.00	-				
PK	2.402G	100.10	Inf	-Inf	32.10	3	Horizontal	213	1.00	-				
AV	2.402G	98.50	Inf	-Inf	32.10	3	Horizontal	213	1.00	-				

BT-LE_Nss1_1TX

14/06/2019

2402MHz_TX



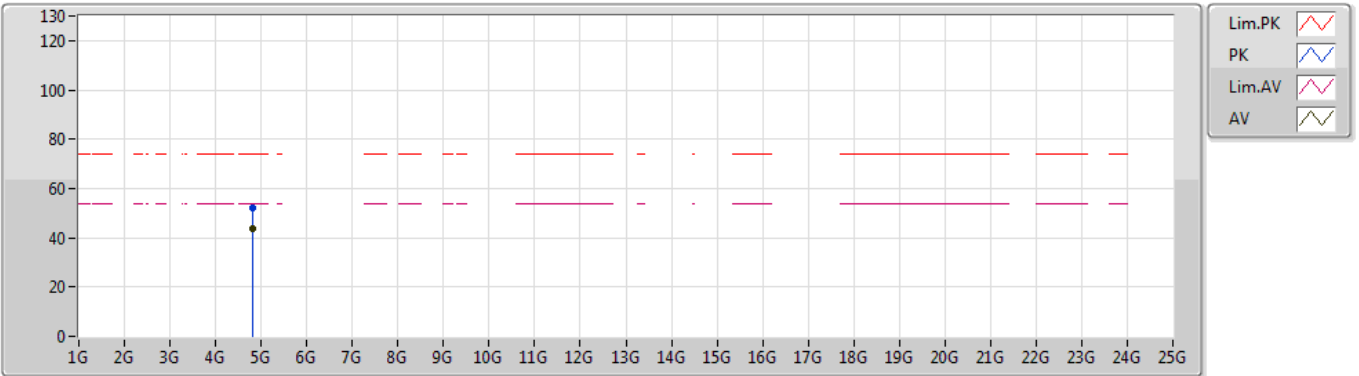
EUT X_1TX
Setting Default
03-J-5
FSP(100080)

Type	Freq (Hz)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Factor (dB)	Dist (m)	Condition	Azimuth (°)	Height (m)	Comment				
PK	4.80426G	51.24	74.00	-22.76	5.06	3	Vertical	99	1.17	-				
AV	4.804G	43.20	54.00	-10.80	5.06	3	Vertical	99	1.17	-				

BT-LE_Nss1_1TX

14/06/2019

2402MHz_TX



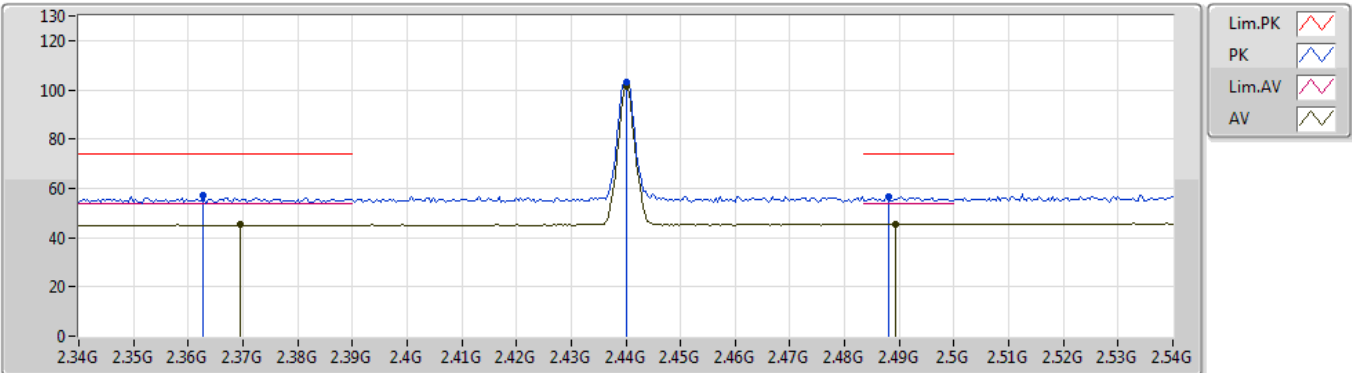
EUT X_1TX
Setting Default
03-J-5
FSP(100080)

Type	Freq (Hz)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Factor (dB)	Dist (m)	Condition	Azimuth (°)	Height (m)	Comment				
PK	4.80456G	51.88	74.00	-22.12	5.06	3	Horizontal	178	2.54	-				
AV	4.8039G	43.74	54.00	-10.26	5.06	3	Horizontal	178	2.54	-				

BT-LE_Nss1_1TX

14/06/2019

2440MHz_TX



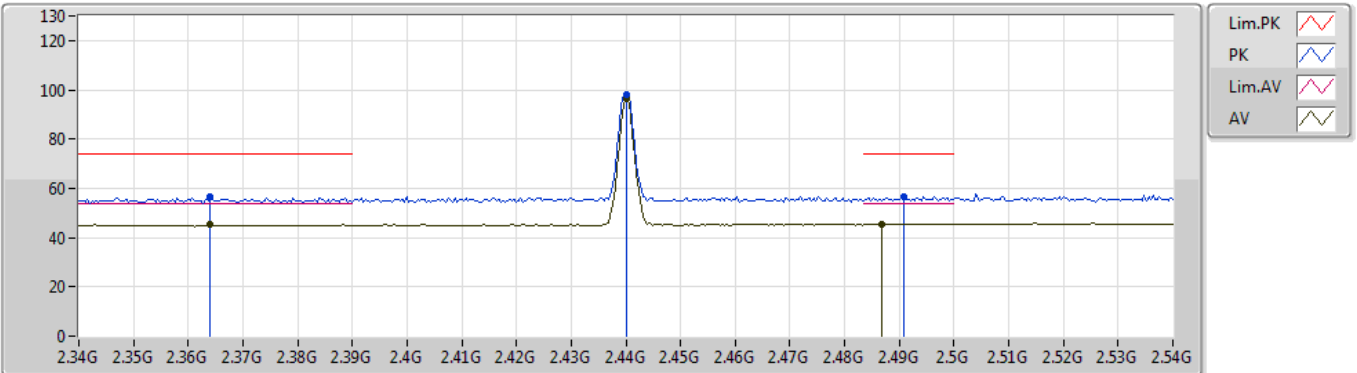
EUT X_1TX
Setting Default
03-J-5
FSP(100080)

Type	Freq (Hz)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Factor (dB)	Dist (m)	Condition	Azimuth (°)	Height (m)	Comment				
PK	2.3628G	56.89	74.00	-17.11	31.99	3	Vertical	6	1.46	-				
AV	2.3696G	45.16	54.00	-8.84	32.00	3	Vertical	6	1.46	-				
PK	2.44G	103.11	Inf	-Inf	32.24	3	Vertical	6	1.46	-				
AV	2.44G	101.45	Inf	-Inf	32.24	3	Vertical	6	1.46	-				
PK	2.488G	56.52	74.00	-17.48	32.42	3	Vertical	6	1.46	-				
AV	2.4892G	45.57	54.00	-8.43	32.43	3	Vertical	6	1.46	-				

BT-LE_Nss1_1TX

14/06/2019

2440MHz_TX



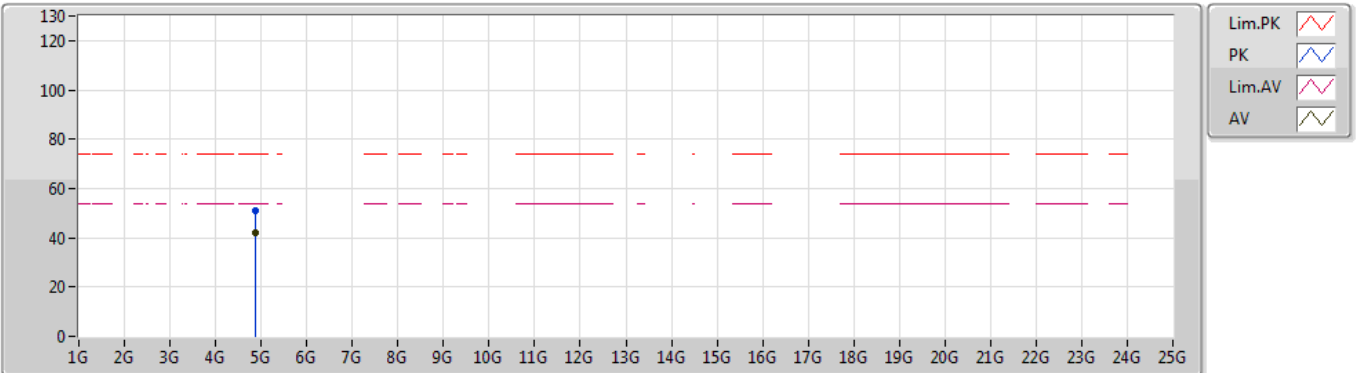
EUT X_1TX
Setting Default
03-J-5
FSP(100080)

Type	Freq (Hz)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Factor (dB)	Dist (m)	Condition	Azimuth (°)	Height (m)	Comment			
PK	2.364G	56.33	74.00	-17.67	31.99	3	Horizontal	225	1.57	-			
AV	2.364G	45.15	54.00	-8.85	31.99	3	Horizontal	225	1.57	-			
PK	2.44G	98.20	Inf	-Inf	32.24	3	Horizontal	225	1.57	-			
AV	2.44G	96.55	Inf	-Inf	32.24	3	Horizontal	225	1.57	-			
PK	2.4908G	56.67	74.00	-17.33	32.43	3	Horizontal	225	1.57	-			
AV	2.4868G	45.47	54.00	-8.53	32.42	3	Horizontal	225	1.57	-			

BT-LE_Nss1_1TX

14/06/2019

2440MHz_TX



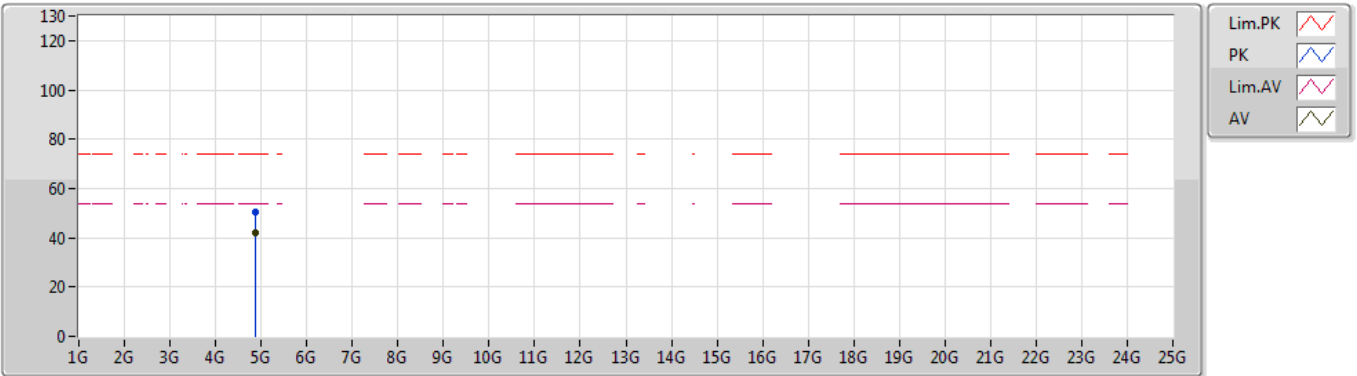
EUT X_1TX
Setting Default
03-J-5
FSP(100080)

Type	Freq (Hz)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Factor (dB)	Dist (m)	Condition	Azimuth (°)	Height (m)	Comment				
PK	4.88018G	51.06	74.00	-22.94	5.25	3	Vertical	108	1.09	-				
AV	4.87986G	42.10	54.00	-11.90	5.25	3	Vertical	108	1.09	-				

BT-LE_Nss1_1TX

14/06/2019

2440MHz_TX



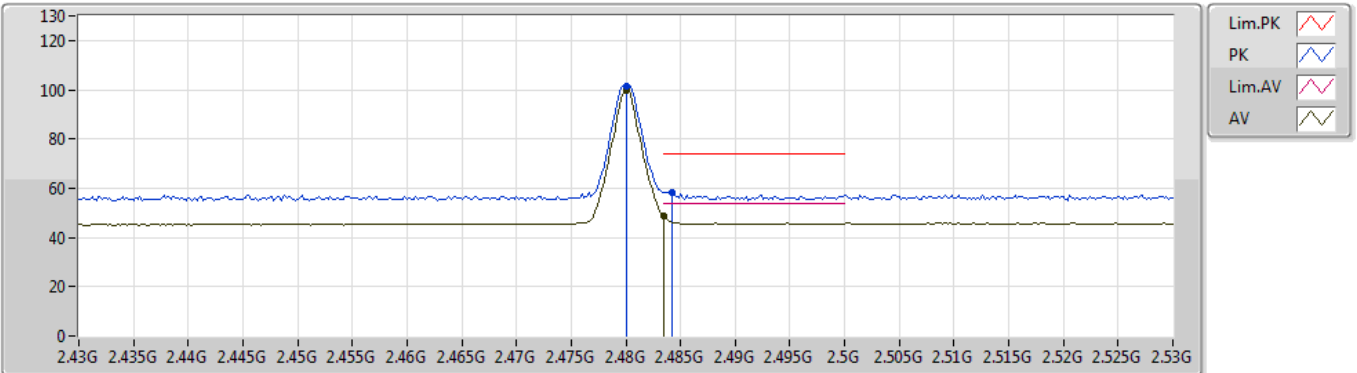
EUT X_1TX
Setting Default
03-J-5
FSP(100080)

Type	Freq (Hz)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Factor (dB)	Dist (m)	Condition	Azimuth (°)	Height (m)	Comment				
PK	4.87942G	50.57	74.00	-23.43	5.25	3	Horizontal	178	1.01	-				
AV	4.87982G	41.79	54.00	-12.21	5.25	3	Horizontal	178	1.01	-				

BT-LE_Nss1_1TX

14/06/2019

2480MHz_TX



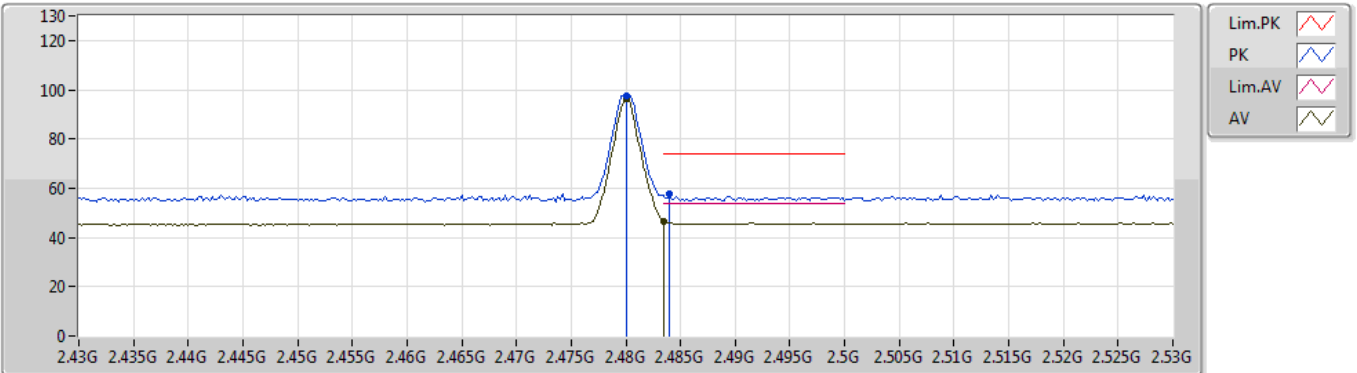
EUT X_1TX
Setting Default
03-J-5
FSP(100080)

Type	Freq (Hz)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Factor (dB)	Dist (m)	Condition	Azimuth (°)	Height (m)	Comment			
PK	2.48G	101.51	Inf	-Inf	32.39	3	Vertical	1	1.05	-			
AV	2.48G	99.83	Inf	-Inf	32.39	3	Vertical	1	1.05	-			
PK	2.4842G	58.25	74.00	-15.75	32.41	3	Vertical	1	1.05	-			
AV	2.4835G	48.65	54.00	-5.35	32.41	3	Vertical	1	1.05	-			

BT-LE_Nss1_1TX

14/06/2019

2480MHz_TX



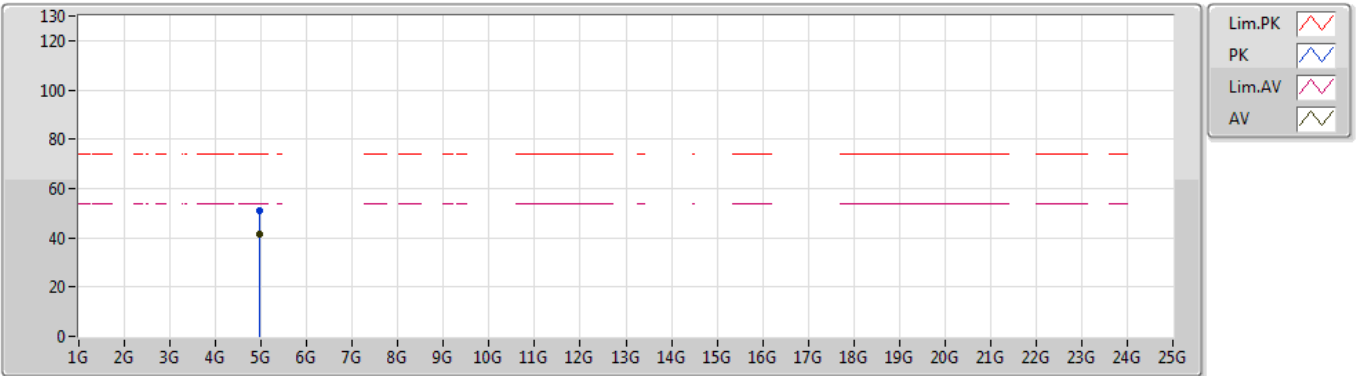
EUT X_1TX
Setting Default
03-J-5
FSP(100080)

Type	Freq (Hz)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Factor (dB)	Dist (m)	Condition	Azimuth (°)	Height (m)	Comment				
PK	2.48G	97.70	Inf	-Inf	32.39	3	Horizontal	221	1.19	-				
AV	2.48G	96.10	Inf	-Inf	32.39	3	Horizontal	221	1.19	-				
PK	2.484G	57.71	74.00	-16.29	32.41	3	Horizontal	221	1.19	-				
AV	2.4835G	46.77	54.00	-7.23	32.41	3	Horizontal	221	1.19	-				

BT-LE_Nss1_1TX

14/06/2019

2480MHz_TX



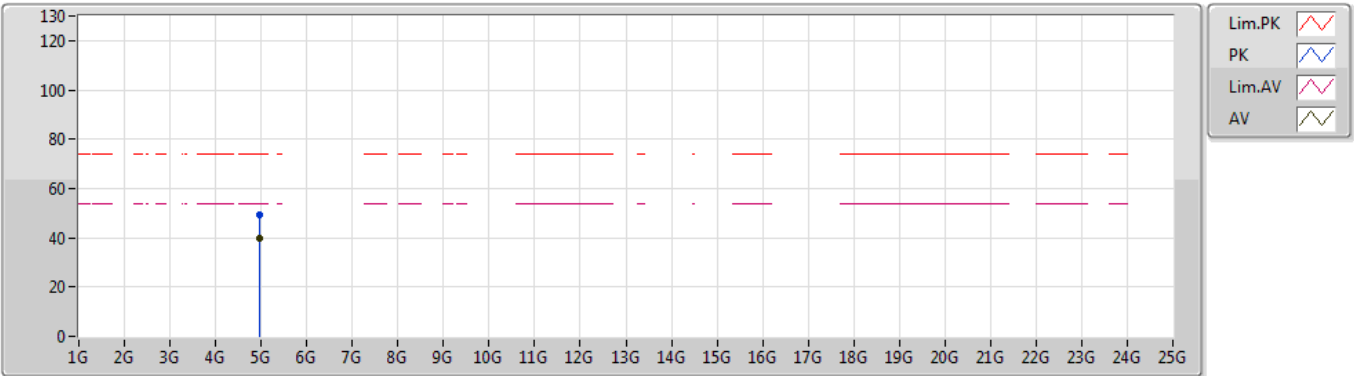
EUT X_1TX
Setting Default
03-J-5
FSP(100080)

Type	Freq (Hz)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Factor (dB)	Dist (m)	Condition	Azimuth (°)	Height (m)	Comment				
PK	4.96038G	51.12	74.00	-22.88	5.44	3	Vertical	158	1.24	-				
AV	4.95984G	41.73	54.00	-12.27	5.44	3	Vertical	158	1.24	-				

BT-LE_Nss1_1TX

14/06/2019

2480MHz_TX



EUT X_1TX
Setting Default
03-J-5
FSP(100080)

Type	Freq (Hz)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Factor (dB)	Dist (m)	Condition	Azimuth (°)	Height (m)	Comment				
PK	4.95954G	49.40	74.00	-24.60	5.44	3	Horizontal	178	1.01	-				
AV	4.96012G	39.66	54.00	-14.34	5.44	3	Horizontal	178	1.01	-				



RSE Co-location Result

Appendix G

