FCC Test Report

Equipment	:	Wireless Genie Mini
Brand Name	:	AT&T
Model No.	:	C61W-400, C61WBP-400, C61WNC-400
FCC ID	:	NKR-ATTC61W
Standard	:	47 CFR FCC Part 15.247
Operating Band	:	2400 MHz – 2483.5 MHz
Function	:	☐ Point-to-multipoint; ☒ Point-to-point
Applicant	:	Wistron NeWeb Corporation 20 Park Avenue II Hsinchu Science Park Hsinchu, 308 Taiwan
Manufacturer	:	Wistron NeWeb Corporation 20 Park Avenue II Hsinchu Science Park Hsinchu, 308 Taiwan

The product sample received on Feb. 11, 2017 and completely tested on Mar. 22, 2017. We, SPORTON, would like to declare that the tested sample has been evaluated in accordance with the procedures given in ANSI C63.10-2013 and shown compliance with the applicable technical standards.

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

Cliff Chang
SPORTON INTERNATIONAL INC.

Testing Laboratory
1190

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Summary of Test Result

Conformance Test Specifications				
Report Clause	**Ref. Std. Clause**	**Description**	**Limit**	**Result**
1.1.2	15.203	Antenna Requirement	FCC 15.203	Complied
3.1	15.207	AC Power-line Conducted Emissions	FCC 15.207	Complied
3.2	15.247(a)	DTS Bandwidth	≥500kHz	Complied
3.3	15.247(b)	Maximum Conducted Output Power	Power [dBm]:30	Complied
3.4	15.247(e)	Power Spectral Density	PSD [dBm/3kHz]:8	Complied
3.5	15.247(d)	Emissions in Non-restricted Frequency Bands	Non-Restricted Bands: > 30 dBc	Complied
3.6	15.247(d)	Emissions in Restricted Frequency Bands	Restricted Bands: FCC 15.209	Complied

Revision History

Report No.	Version	Description	Issued Date
FR730747AA	Rev. 01	Initial issue of report	Apr. 17, 2017

1 General Description

1.1 Information

1.1.1 RF General Information

Frequency Range (MHz)	IEEE Std.	Ch. Frequency (MHz)	Channel Number
2400-2483.5	802.15.4	2425-2475	15-25 [11]

Band	Mode	BWch (MHz)	Nant
2.4G	RF4CE	5	1

Note:
- 2.4G is the 2.4GHz Band (2.4-2.4835GHz).
- RF4CE uses a O-QPSK (250kbps) modulation for DSSS.
- 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.	Brand	Model Name	Antenna Type	Connector
1	-	-	Printing Antenna	N/A
2	-	-	Printing Antenna	N/A
3	Airgain	N5X35BCMY	PIFA Antenna	I-PEX
4	Airgain	N5X35BCHY	PIFA Antenna	I-PEX
5	Airgain	N5X35BC2MY	PIFA Antenna	I-PEX
6	Airgain	N5X35BC2MY	PIFA Antenna	I-PEX

Frequency Band	Gain (dBi)	
	Ant. 1	Ant. 2
2425MHz~2475MHz	3	3

Frequency Band	Gain (dBi)			
	Ant. 3	Ant. 4	Ant. 5	Ant. 6
UNII-1	2.58	2.60	3.16	3.25
UNII-2A	2.46	2.41	2.71	2.89
UNII-2C	3.12	3.31	2.29	3.21
UNII-3	2.61	3.53	3.25	3.33
Frequency Band	**Max Directional Gain (dBi)**			
	4T1S	**4T2S**	**4T3S**	**4T4S**
UNII-1	7.20	4.23	2.72	1.22
UNII-2A	6.79	3.85	2.39	0.84
UNII-2C	6.43	3.43	2.29	0.50
UNII-3	7.03	4.03	2.94	1.09

Note: The EUT has six antennas.

For RF4CE mode (1TX/1RX):

Ant. 1 Connect to port 1, Ant. 2 Connect to port 2

The EUT supports the antenna with TX and RX diversity functions.

Both Ant. 1 and Ant. 2 support transmit and receive functions, but only one of them will be used at one time.

The Ant. 1 generated the worst case, so it was selected to test and record in the report.

For IEEE 802.11a/n/ac mode (4TX/4RX):

Ant. 3 ~ Ant. 6 Connect to port 1~port 4

Ant. 3, Ant. 4, Ant. 5 and Ant. 6 could transmit/receive simultaneously.

1.1.3 Mode Test Duty Cycle

Mode	DC	DCF(dB)
RF4CE	1	0

1.1.4 EUT Operational Condition

EUT Power Type	From Power Adapter			
Beamforming Function	☒	With beamforming for IEEE 802.11n/ac in 5GHz	☐	Without beamforming

1.1.5 Table for Multiple Listing

The model names in the following table are all refer to the identical product.

Model Name	Description
C61W-400	All the models are identical, the different model names served as package different.
C61WBP-400	
C61WNC-400	

Note: Assessed as above, there is only model: C61W-400 selected to test and recorded in the report as a result.

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
- FCC KDB 558074 D01 v04
- FCC KDB 662911 D01 v02r01
- FCC KDB 644545 D01 v01r02

1.3 Testing Location Information

Testing Location			
☐	HWA YA	ADD :	No. 52, Hwa Ya 1st Rd., Kwei-Shan Hsiang, Tao Yuan Hsien, Taiwan, R.O.C.
		TEL :	886-3-327-3456 FAX : 886-3-318-0055
☒	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	TH01-CB	Ron Huang & Peter Wu	24°C / 59%	Feb. 14, 2017 ~ Mar. 16, 2017
Radiated	03CH01-CB	Joy Luo & Justin Lin & Steven Liang	24°C / 59%	Feb. 22, 2017 ~ Mar. 15, 2017
AC Conduction	CO01-CB	Da Deng	21°C / 55%	Mar. 22, 2017

Test site Designation No. TW0006 with FCC.
Test site registered number IC 4086D 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)	3.2 dB	Confidence levels of 95%
Radiated Emission (30MHz ~ 1,000MHz)	3.6 dB	Confidence levels of 95%
Radiated Emission (1GHz ~ 18GHz)	3.7 dB	Confidence levels of 95%
Radiated Emission (18GHz ~ 40GHz)	3.5 dB	Confidence levels of 95%
Conducted Emission	1.7 dB	Confidence levels of 95%
Output Power Measurement	1.33 dB	Confidence levels of 95%
Power Density Measurement	1.27 dB	Confidence levels of 95%
Bandwidth Measurement	9.74×10^{-8}	Confidence levels of 95%

2 Test Configuration of EUT

2.1 Test Channel Mode

Mode	Power Setting
RF4CE	-
2425MHz	3
2450MHz	3
2475MHz	3

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
1	EUT in Z axis_RF4CE

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	EUT in Z axis_RF4CE
Operating Mode > 1GHz	CTX
1	EUT in Z axis_RF4CE

The Worst Case Mode for Following Conformance Tests	
Tests Item	Simultaneous Transmission Analysis - Co-location RF Exposure Evaluation
Operating Mode	
1	WLAN 5GHz function + RF4CE
Refer to Sporton Test Report No.: FA730747 for Co-location RF Exposure Evaluation.	

Note: 1. The EUT can only be used in Z-axis position.

2. The test configuration, test mode and test software were written in this test report are designated by the applicant.

3. Adapter information as below:

The Adapter is for measurement only, would not be marketed.

Support Unit	Brand	Model
AC adapter	DIRECTV	EPS10R4-08

2.3 EUT Operation during Test

The EUT was programmed to be in continuously transmitting mode.

2.4 Accessories

N/A

2.5 Support Equipment

For Test Site No: CO01-CB

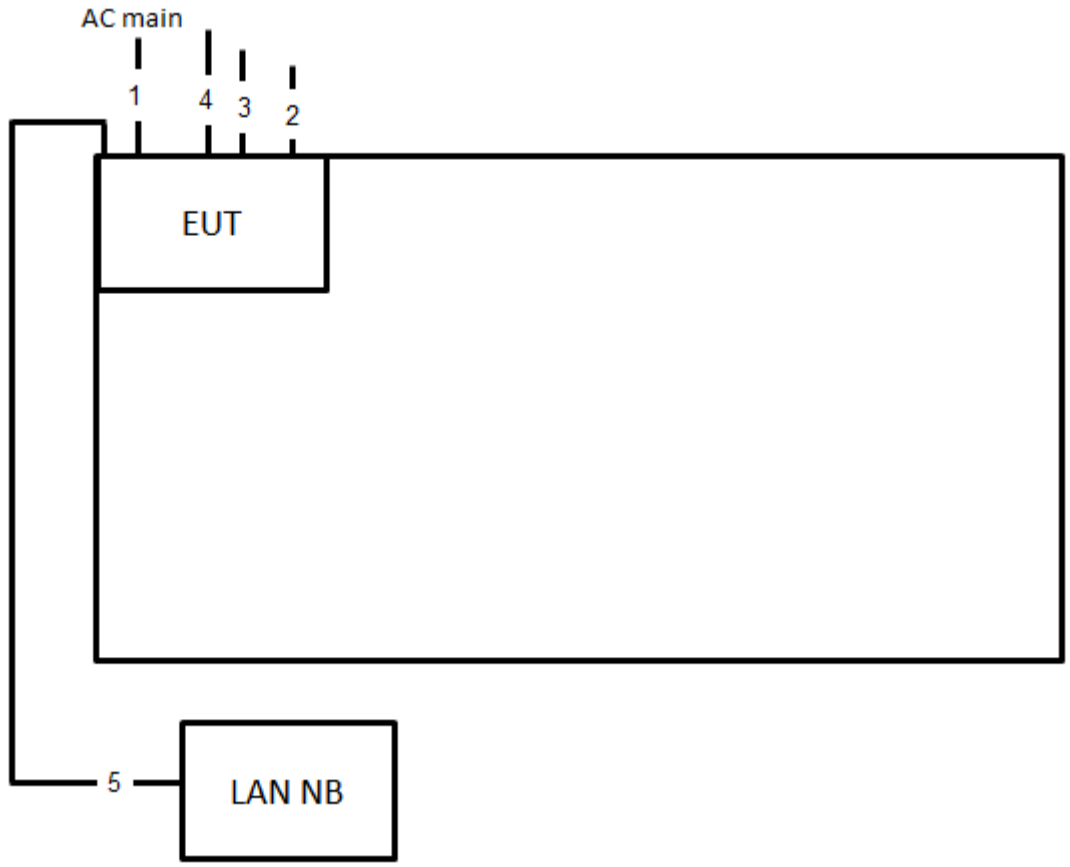
Support Equipment				
No.	**Equipment**	**Brand Name**	**Model Name**	**FCC ID**
1	NB	DELL	E6430	DoC
2	AC adapter	DIRECTV	EPS10R4-08	N/A

For Test Site No: 03CH01-CB and TH01-CB

Support Equipment				
No.	**Equipment**	**Brand Name**	**Model Name**	**FCC ID**
1	NB	DELL	E4300	DoC
2	AC adapter	DIRECTV	EPS10R4-08	N/A
3	Test Fixture	N/A	N/A	N/A

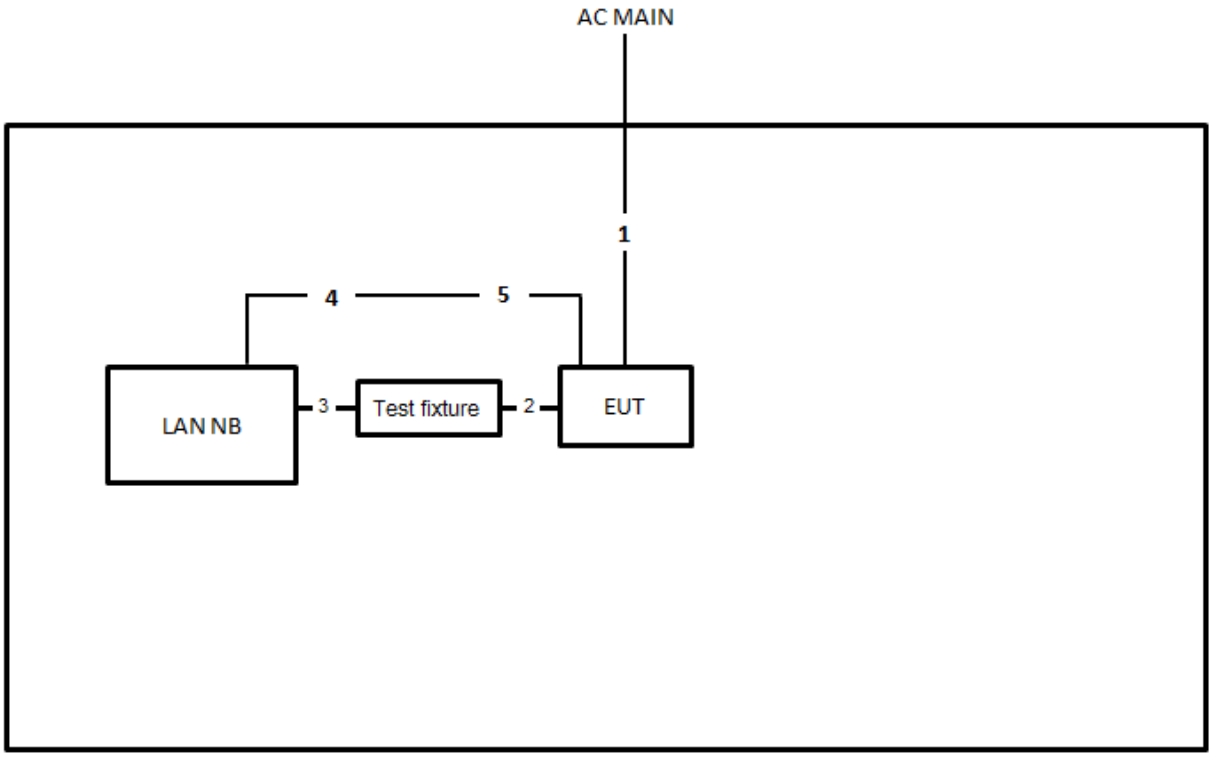
2.6 Test Setup Diagram

Test Setup Diagram – AC Line Conducted Emission Test



Item	Connection	Shielded	Length
1	Power cable	No	2.8m
2	Audio cable	No	2m
3	HDMI cable	Yes	1.8m
4	Ypbpr cable	No	1.8m
5	RJ-45 cable	No	10m

Test Setup Diagram - Radiated Test



Item	Connection	Shielded	Length
1	Power cable	No	2.8
2	Console cable	No	0.15
3	USB cable	Yes	0.3
4	USB to RJ-45 cable	No	0.3
5	RJ-45 cable	No	0.3

3 Transmitter Test Result

3.1 AC Power-line Conducted Emissions

3.1.1 AC Power-line Conducted Emissions Limit

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

3.1.2 Measuring Instruments

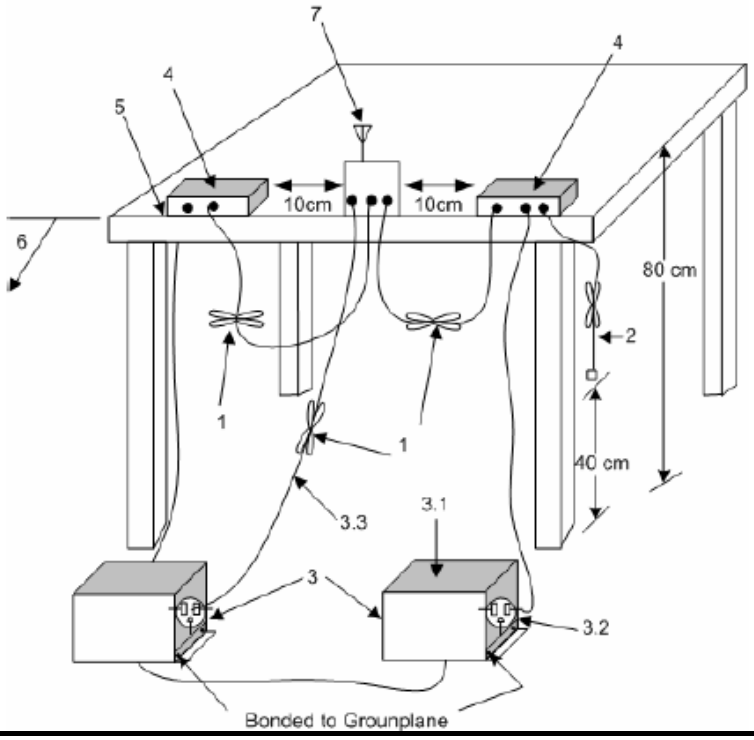
Refer a test equipment and calibration data table in this test report.

3.1.3 Test Procedures

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

3.1.4 Test Setup

AC Power-line Conducted Emissions



3.1.5 Test Result of AC Power-line Conducted Emissions

Refer as Appendix A

3.2 DTS Bandwidth

3.2.1 6dB Bandwidth Limit

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

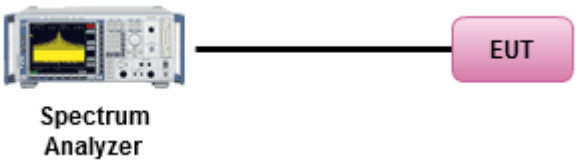
3.2.2 Measuring Instruments

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

3.2.3 Test Procedures

Test Method	
▪ For the emission bandwidth shall be measured using one of the options below:	
	☒ Refer as FCC KDB 558074, clause 8.1 Option 1 for 6 dB bandwidth measurement.
	☐ Refer as FCC KDB 558074, clause 8.2 Option 2 for 6 dB bandwidth measurement.
	☐ Refer as ANSI C63.10, clause 6.9.1 for occupied bandwidth testing.

3.2.4 Test Setup

Emission Bandwidth


3.2.5 Test Result of Emission Bandwidth

Refer as Appendix B

3.3 Maximum Conducted Output Power

3.3.1 Maximum Conducted Output Power Limit

Maximum Conducted Output Power Limit		
	▪ If $G_{TX} \leq 6$ dBi, then $P_{Out} \leq 30$ dBm (1 W)	
	▪ Point-to-multipoint systems (P2M): If $G_{TX} > 6$ dBi, then $P_{Out} = 30 – (G_{TX} – 6)$ dBm	
	▪ Point-to-point systems (P2P): If $G_{TX} > 6$ dBi, then $P_{Out} = 30 – (G_{TX} – 6)/3$ dBm	
	▪ Smart antenna system (SAS):	
		- Single beam: If $G_{TX} > 6$ dBi, then $P_{Out} = 30 – (G_{TX} – 6)/3$ dBm
		- Overlap beam: If $G_{TX} > 6$ dBi, then $P_{Out} = 30 – (G_{TX} – 6)/3$ dBm
		- Aggregate power on all beams: If $G_{TX} > 6$ dBi, then $P_{Out} = 30 – (G_{TX} – 6)/3 + 8$dB dBm
P_{Out} = maximum peak conducted output power or maximum conducted output power in dBm, **G_{TX}** = the maximum transmitting antenna directional gain in dBi.		

3.3.2 Measuring Instruments

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

3.3.3 Test Procedures

Test Method	
▪ Maximum Peak Conducted Output Power	
	☐ Refer as FCC KDB 558074, clause 9.1.1 Option 1 (RBW ≥ EBW method).
	☐ Refer as FCC KDB 558074, clause 9.1.2 Option 2 (peak power meter for VBW ≥ DTS BW)
▪ Maximum Conducted Output Power	
	[duty cycle ≥ 98% or external video / power trigger]
	☐ Refer as FCC KDB 558074, clause 9.2.2.2 Method AVGSA-1 (spectral trace averaging).
	☐ Refer as FCC KDB 558074, clause 9.2.2.3 Method AVGSA-1 Alt. (slow sweep speed)
	duty cycle < 98% and average over on/off periods with duty factor
	☐ Refer as FCC KDB 558074, clause 9.2.2.4 Method AVGSA-2 (spectral trace averaging).
	☐ Refer as FCC KDB 558074, clause 9.2.2.5 Method AVGSA-2 Alt. (slow sweep speed)
	RF power meter and average over on/off periods with duty factor or gated trigger
	☒ Refer as FCC KDB 558074, clause 9.2.3 Method AVGPM-G (using an RF average power meter).
▪ For conducted measurement.	
	▪ If the EUT supports multiple transmit chains using options given below: Refer as FCC KDB 662911, In-band power measurements. Using the measure-and-sum approach, measured all transmit ports individually. Sum the power (in linear power units e.g., mW) of all ports for each individual sample and save them.
	▪ If multiple transmit chains, EIRP calculation could be following as methods: $P_{total} = P_1 + P_2 + \ldots + P_n$ (calculated in linear unit [mW] and transfer to log unit [dBm]) $EIRP_{total} = P_{total} + DG$

3.3.4 Test Setup

Maximum Conducted Output Power (Power Meter)


3.3.5 Test Result of Maximum Conducted Output Power

Refer as Appendix C

3.4 Power Spectral Density

3.4.1 Power Spectral Density Limit

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

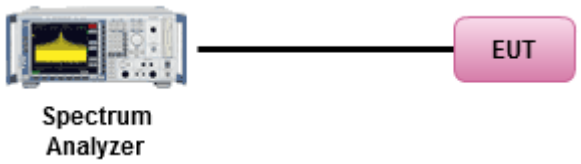
3.4.2 Measuring Instruments

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

3.4.3 Test Procedures

Test Method		
▪ Peak power spectral density procedures that the same method as used to determine the conducted output power. If maximum peak conducted output power was measured to demonstrate compliance to the output power limit, then the peak PSD procedure below (Method PKPSD) shall be used. If maximum conducted output power was measured to demonstrate compliance to the output power limit, then one of the average PSD procedures shall be used, as applicable based on the following criteria (the peak PSD procedure is also an acceptable option).		
	☒ Refer as FCC KDB 558074, clause 10.2 Method PKPSD (RBW=3-100kHz; Detector=peak).	
	[duty cycle ≥ 98% or external video / power trigger]	
	☐ Refer as FCC KDB 558074, clause 10.3 Method AVGPSD-1 (spectral trace averaging).	
	☐ Refer as FCC KDB 558074, clause 10.4 Method AVGPSD-2 (slow sweep speed)	
	duty cycle < 98% and average over on/off periods with duty factor	
	☐ Refer as FCC KDB 558074, clause 10.5 Method AVGPSD-1 Alt (spectral trace averaging).	
	☐ Refer as FCC KDB 558074, clause 10.6 Method AVGPSD-2 Alt. (slow sweep speed)	
▪ For conducted measurement.		
	▪ If The EUT supports multiple transmit chains using options given below:	
		☒ Option 1: Measure and sum the spectra across the outputs. Refer as FCC KDB 662911, In-band power spectral density (PSD). Sample all transmit ports simultaneously using a spectrum analyzer for each transmit port. Where the trace bin-by-bin of each transmit port summing can be performed. (i.e., in the first spectral bin of output 1 is summed with that in the first spectral bin of output 2 and that from the first spectral bin of output 3, and so on up to the NTX output to obtain the value for the first frequency bin of the summed spectrum.). Add up the amplitude (power) values for the different transmit chains and use this as the new data trace.
		☐ Option 2: Measure and sum spectral maxima across the outputs. With this technique, spectra are measured at each output of the device at the required resolution bandwidth. The maximum value (peak) of each spectrum is determined. These maximum values are then summed mathematically in linear power units across the outputs. These operations shall be performed separately over frequency spans that have different out-of-band or spurious emission limits,
		☐ Option 3: Measure and add 10 log(N) dB, where N is the number of transmit chains. Refer as FCC KDB 662911, In-band power spectral density (PSD). Performed at each transmit chains and each transmit chains shall be compared with the limit have been reduced with 10 log(N). Or each transmit chains shall be add 10 log(N) to compared with the limit.

3.4.4 Test Setup

Power Spectral Density
 Spectrum Analyzer

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 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.	

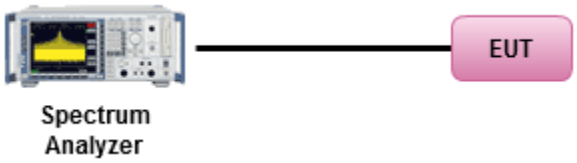
3.5.2 Measuring Instruments

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 11 for unwanted emissions into non-restricted bands.

3.5.4 Test Setup

Emissions in Non-restricted Frequency Bands


3.5.5 Test Result of Emissions in Non-restricted Frequency Bands

Refer as Appendix E

3.6 Emissions in Restricted Frequency Bands

3.6.1 Emissions in Restricted Frequency Bands Limit

Restricted Band Emissions Limit			
Frequency Range (MHz)	**Field Strength (uV/m)**	**Field Strength (dBuV/m)**	**Measure Distance (m)**
0.009~0.490	2400/F(kHz)	48.5 - 13.8	300
0.490~1.705	24000/F(kHz)	33.8 - 23	30
1.705~30.0	30	29	30
30~88	100	40	3
88~216	150	43.5	3
216~960	200	46	3
Above 960	500	54	3

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

Note 2: Test distance for frequencies at below 30 MHz, measurements may be performed at a distance closer than the EUT limit distance; however, an attempt should be made to avoid making measurements in the near field. When performing measurements 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.

3.6.2 Measuring Instruments

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

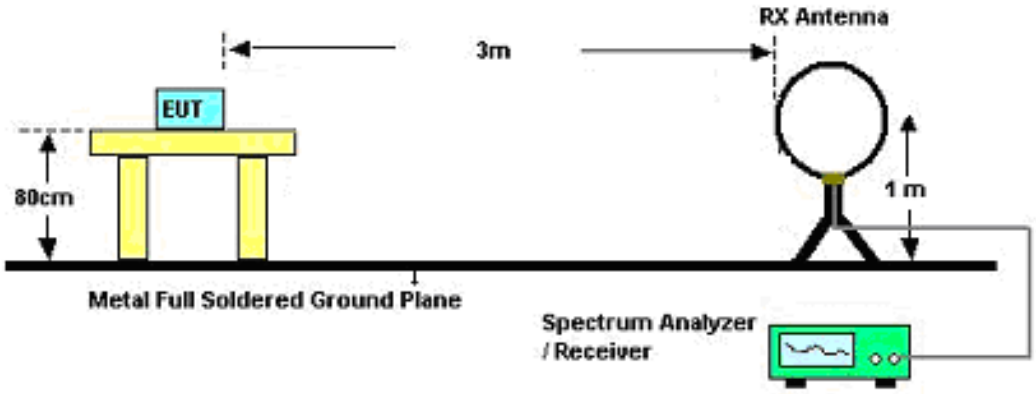
3.6.3 Test Procedures

Test Method		
▪ The average emission levels shall be measured in [duty cycle ≥ 98 or duty factor].		
▪ Refer as ANSI C63.10, clause 6.9.2.2 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 12 for unwanted emissions into restricted bands.	
		☐ Refer as FCC KDB 558074, clause 12.2.5.1 Option 1 (trace averaging for duty cycle ≥98%)
		☐ Refer as FCC KDB 558074, clause 12.2.5.2 Option 2 (trace averaging + duty factor).
		☒ Refer as FCC KDB 558074, clause 12.2.5.3 Option 3 (Reduced VBW≥1/T).
		☐ Refer as ANSI C63.10, clause 4.2.3.2.3 (Reduced VBW). VBW ≥ 1/T, where T is pulse time.
		☐ Refer as ANSI C63.10, clause 4.2.3.2.4 average value of pulsed emissions.
		☒ Refer as FCC KDB 558074, clause 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 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 13.2 (ANSI C63.10, clause 6.9.3) for marker-delta method for band-edge measurements.	
	▪ Refer as FCC KDB 558074, clause 13.3 for narrower resolution bandwidth (100kHz) using the band power and summing the spectral levels (i.e., 1 MHz).	
▪ For conducted and cabinet radiation measurement, refer as FCC KDB 558074, clause 12.2.2.		
	▪ 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.	

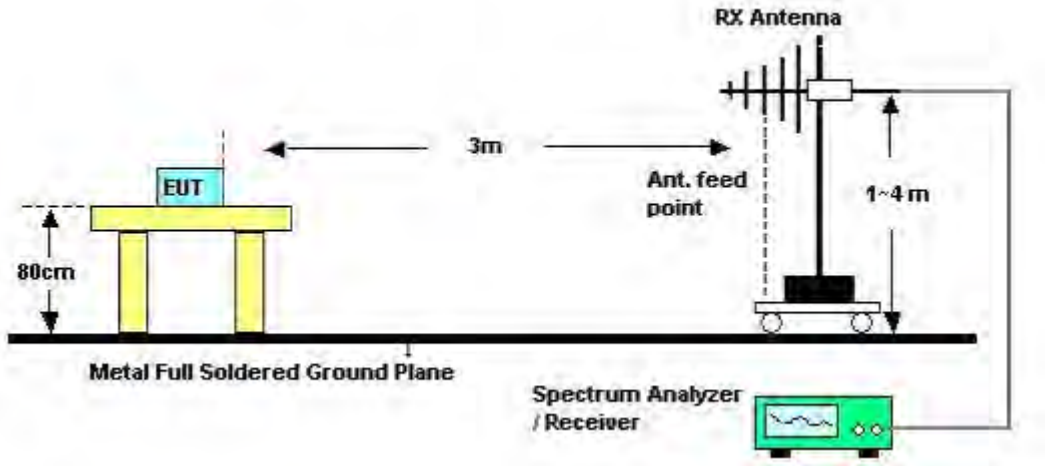
3.6.4 Test Setup

Transmitter Radiated Emissions

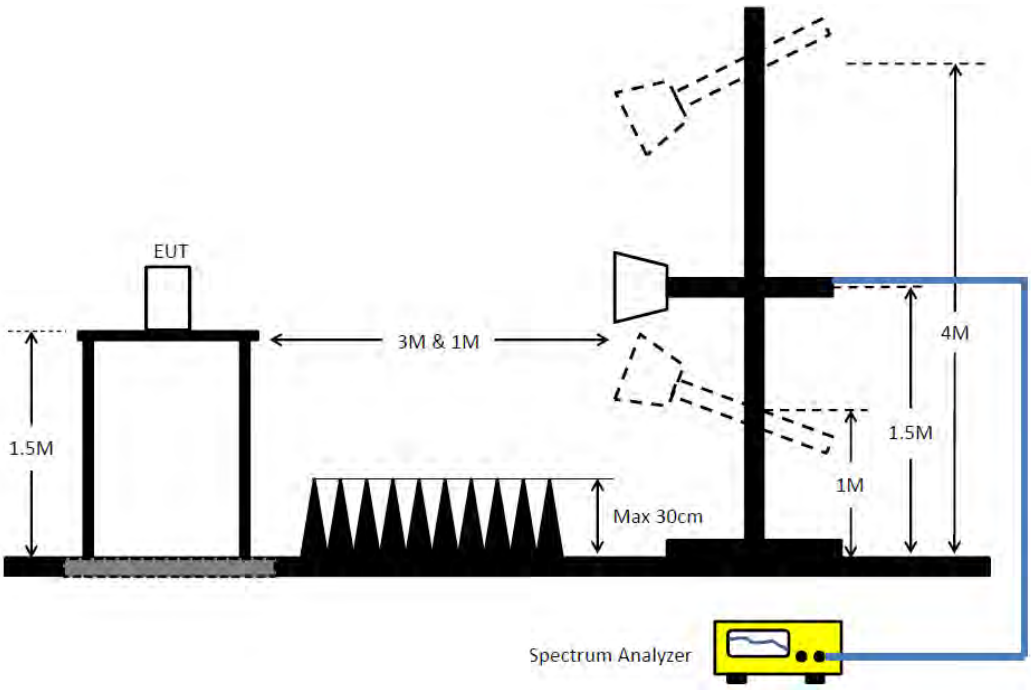
9kHz ~30MHz



30MHz~1GHz



Above 1GHz



3.6.5 Transmitter Radiated Unwanted Emissions (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.

3.6.6 Test Result of Transmitter Radiated Unwanted Emissions

Refer as Appendix F

4 Test Equipment and Calibration Data

Instrument	Manufacturer	Model No.	Serial No.	Characteristics	Calibration Date	Remark
EMI Receiver	Agilent	N9038A	My52260123	9kHz ~ 8.45GHz	Jan. 23, 2017	Conduction (CO01-CB)
LISN	F.C.C.	FCC-LISN-50-16-2	04083	150kHz ~ 100MHz	Dec. 14, 2016	Conduction (CO01-CB)
LISN	Schwarzbeck	NSLK 8127	8127647	9kHz ~ 30MHz	Dec. 21, 2016	Conduction (CO01-CB)
COND Cable	Woken	Cable	01	150kHz ~ 30MHz	May 24, 2016	Conduction (CO01-CB)
Software	Audix	E3	6.120210n	-	N.C.R.	Conduction (CO01-CB)
BILOG ANTENNA with 6dB Attenator	TESEQ & EMCI	CBL6112D & N-6-06	37880 & AT-N0609	20MHz ~ 2GHz	Aug. 30, 2016	Radiation (03CH01-CB)
Loop Antenna	Teseq	HLA 6120	24155	9kHz - 30 MHz	Mar. 16, 2016*	Radiation (03CH01-CB)
Horn Antenna	EMCO	3115	00075790	750MHz ~ 18GHz	Nov. 10, 2016	Radiation (03CH01-CB)
Horn Antenna	Schwarzbeck	BBHA 9170	BBHA9170252	15GHz ~ 40GHz	Jul. 25, 2016	Radiation (03CH01-CB)
Horn Antenna	Schwarzbeck	BBHA 9170	BBHA9170252	15GHz ~ 40GHz	Jul. 25, 2016	Radiation (03CH01-CB)
Pre-Amplifier	Agilent	8447D	2944A10940	0.1MHz ~ 1.3GHz	Jan. 24, 2017	Radiation (03CH01-CB)
Pre-Amplifier	Agilent	8449B	3008A02310	1GHz ~ 26.5GHz	Jan. 16, 2017	Radiation (03CH01-CB)
Spectrum Analyzer	R&S	FSP40	100056	9kHz ~ 40GHz	Nov. 21, 2016	Radiation (03CH01-CB)
EMI Test	R&S	ESCS	100355	9kHz ~ 2.75GHz	May 16, 2016	Radiation (03CH01-CB)
RF Cable-low	Woken	Low Cable-16+17	N/A	30 MHz ~ 1 GHz	Oct. 24, 2016	Radiation (03CH01-CB)
RF Cable-high	Woken	High Cable-16	N/A	1 GHz ~ 18 GHz	Oct. 24, 2016	Radiation (03CH01-CB)
RF Cable-high	Woken	High Cable-16+17	N/A	1 GHz ~ 18 GHz	Oct. 24, 2016	Radiation (03CH01-CB)
RF Cable-high	Woken	High Cable-40G#1	N/A	18GHz ~ 40 GHz	Oct. 24, 2016	Radiation (03CH01-CB)
RF Cable-high	Woken	High Cable-40G#2	N/A	18GHz ~ 40 GHz	Oct. 24, 2016	Radiation (03CH01-CB)

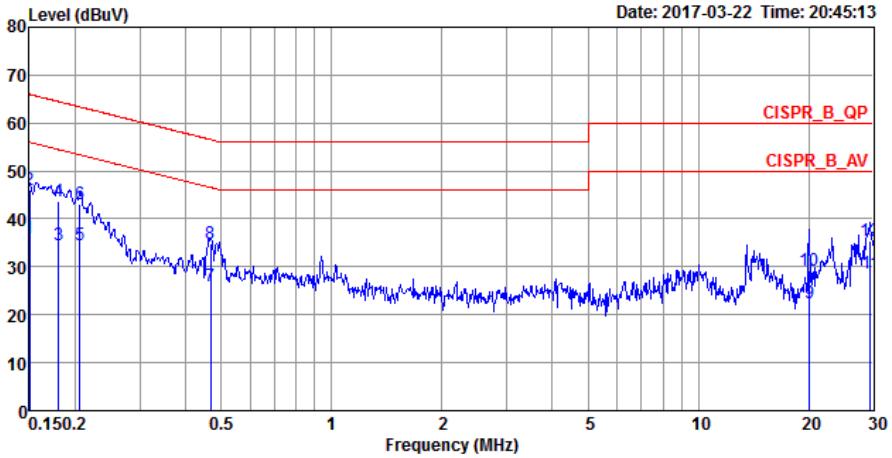
Instrument	Manufacturer	Model No.	Serial No.	Characteristics	Calibration Date	Remark
Test Software	Audix	E3	6.2009-l0-7	N/A	N/A	Radiation (03CH01-CB)
Spectrum analyzer	R&S	FSV40	100979	9kHz~40GHz	Dec. 26, 2016	Conducted (TH01-CB)
Temp. and Humidity Chamber	Ten Billion	TTH-D3SP	TBN-931011	-30~100 degree	Jun. 03, 2016	Conducted (TH01-CB)
RF Cable-high	Woken	RG402	High Cable-6	1 GHz – 26.5 GHz	Oct. 24, 2016	Conducted (TH01-CB)
RF Cable-high	Woken	RG402	High Cable-7	1 GHz –26.5 GHz	Oct. 24, 2016	Conducted (TH01-CB)
RF Cable-high	Woken	RG402	High Cable-8	1 GHz –26.5 GHz	Oct. 24, 2016	Conducted (TH01-CB)
RF Cable-high	Woken	RG402	High Cable-9	1 GHz –26.5 GHz	Oct. 24, 2016	Conducted (TH01-CB)
RF Cable-high	Woken	RG402	High Cable-10	1 GHz –26.5 GHz	Oct. 24, 2016	Conducted (TH01-CB)
Power Sensor	Agilent	U2021XA	MY53410001	50MHz~18GHz	Nov. 22, 2016	Conducted (TH01-CB)

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

"*" Calibration Interval of instruments listed above is two years.

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

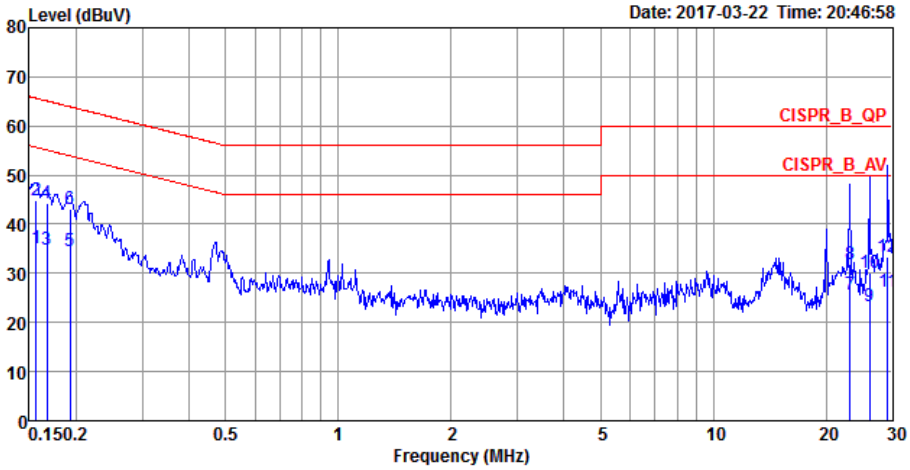
AC Power-line Conducted Emissions Result			
Operating Mode	1	**Power Phase**	Neutral
Operating Function	CTX		



	Freq	Level	Over Limit	Limit Line	Read Level	LISN Factor	Cable Loss	Remark	Pol/Phase
	MHz	dBuV	dB	dBuV	dBuV	dB	dB		
1	0.1500	35.93	-20.07	56.00	25.67	10.10	0.16	Average	NEUTRAL
2	0.1500	45.94	-20.06	66.00	35.68	10.10	0.16	QP	NEUTRAL
3	0.1806	34.42	-20.04	54.46	24.23	10.01	0.18	Average	NEUTRAL
4	0.1806	43.83	-20.63	64.46	33.64	10.01	0.18	QP	NEUTRAL
5	0.2061	34.47	-18.89	53.36	24.24	10.05	0.18	Average	NEUTRAL
6	0.2061	43.12	-20.24	63.36	32.89	10.05	0.18	QP	NEUTRAL
7	0.4686	26.11	-20.43	46.54	15.74	10.24	0.13	Average	NEUTRAL
8	0.4686	34.83	-21.71	56.54	24.46	10.24	0.13	QP	NEUTRAL
9	20.0559	22.31	-27.69	50.00	11.73	10.34	0.24	Average	NEUTRAL
10	20.0559	29.13	-30.87	60.00	18.55	10.34	0.24	QP	NEUTRAL
11	29.3709	28.75	-21.25	50.00	17.88	10.56	0.31	Average	NEUTRAL
12	29.3709	35.32	-24.68	60.00	24.45	10.56	0.31	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.)

AC Power-line Conducted Emissions Result			
Operating Mode	1	**Power Phase**	Line
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	0.1565	35.05	-20.60	55.65	24.88	10.00	0.17	Average	LINE
2	0.1565	44.82	-20.83	65.65	34.65	10.00	0.17	QP	LINE
3	0.1668	34.87	-20.25	55.12	24.70	10.00	0.17	Average	LINE
4	0.1668	44.40	-20.72	65.12	34.23	10.00	0.17	QP	LINE
5	0.1924	34.47	-19.46	53.93	24.37	9.91	0.19	Average	LINE
6	0.1924	43.16	-20.77	63.93	33.06	9.91	0.19	QP	LINE
7	23.1404	25.63	-24.37	50.00	14.97	10.40	0.26	Average	LINE
8	23.1404	31.97	-28.03	60.00	21.31	10.40	0.26	QP	LINE
9	26.1393	23.30	-26.70	50.00	12.57	10.45	0.28	Average	LINE
10	26.1393	30.05	-29.95	60.00	19.32	10.45	0.28	QP	LINE
11	29.2157	26.21	-23.79	50.00	15.39	10.51	0.31	Average	LINE
12	29.2157	33.31	-26.69	60.00	22.49	10.51	0.31	QP	LINE

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)
RF4CE	-	-	-	-	-
2.4-2.4835GHz	1.563M	2.368M	2M37G1D	1.538M	2.336M

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;

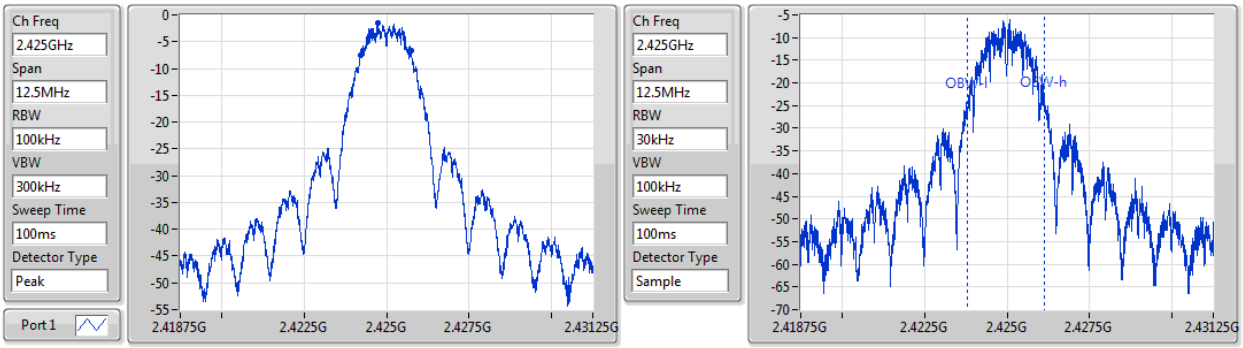
Result

Mode	Result	Limit (Hz)	Port 1-N dB (Hz)	Port 1-OBW (Hz)
RF4CE	-	-	-	-
2425MHz	Pass	500k	1.538M	2.336M
2450MHz	Pass	500k	1.556M	2.355M
2475MHz	Pass	500k	1.563M	2.368M

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

RF4CE
2425MHz

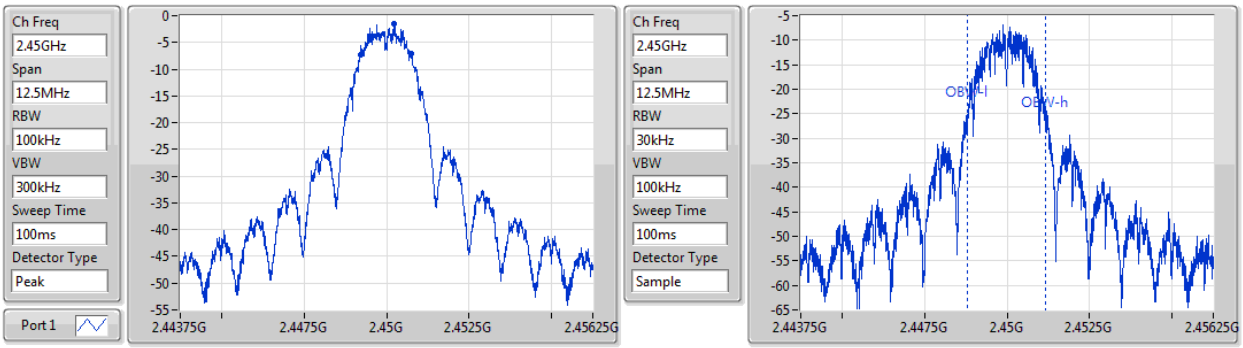
EBW



6dB(Hz)	Fl-6dB(Hz)	Fh-6dB(Hz)	OBW(Hz)	Fl-OBW(Hz)	Fh-OBW(Hz)	Limit(Hz)	Port
1.538M	2.424219G	2.425756G	2.336M	2.423807G	2.426143G	500k	1

RF4CE
2450MHz

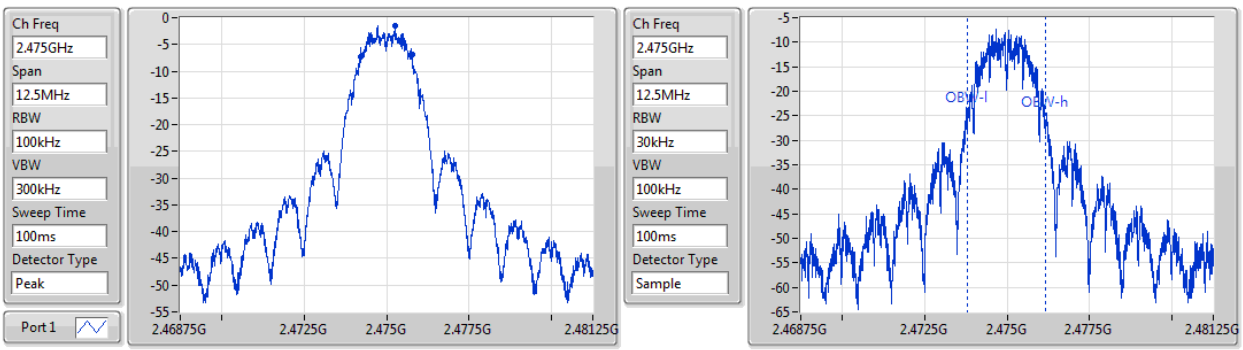
EBW



6dB(Hz)	Fl-6dB(Hz)	Fh-6dB(Hz)	OBW(Hz)	Fl-OBW(Hz)	Fh-OBW(Hz)	Limit(Hz)	Port
1.556M	2.4492G	2.450756G	2.355M	2.448813G	2.451168G	500k	1

RF4CE
2475MHz

EBW



6dB(Hz)	Fl-6dB(Hz)	Fh-6dB(Hz)	OBW(Hz)	Fl-OBW(Hz)	Fh-OBW(Hz)	Limit(Hz)	Port
1.563M	2.474213G	2.475775G	2.368M	2.473794G	2.476162G	500k	1

Summary

Mode	Total Power (dBm)	Total Power (W)
RF4CE	-	-
2.4-2.4835GHz	2.66	0.00185

Result

Mode	Result	DG (dBi)	Port 1 (dBm)	Total Power (dBm)	Power Limit (dBm)
RF4CE	-	-	-	-	-
2425MHz	Pass	3.00	2.65	2.65	30.00
2450MHz	Pass	3.00	2.66	2.66	30.00
2475MHz	Pass	3.00	2.58	2.58	30.00

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

Summary

Mode	PD (dBm/RBW)
RF4CE	-
2.4-2.4835GHz	-14.13

RBW=3kHz.

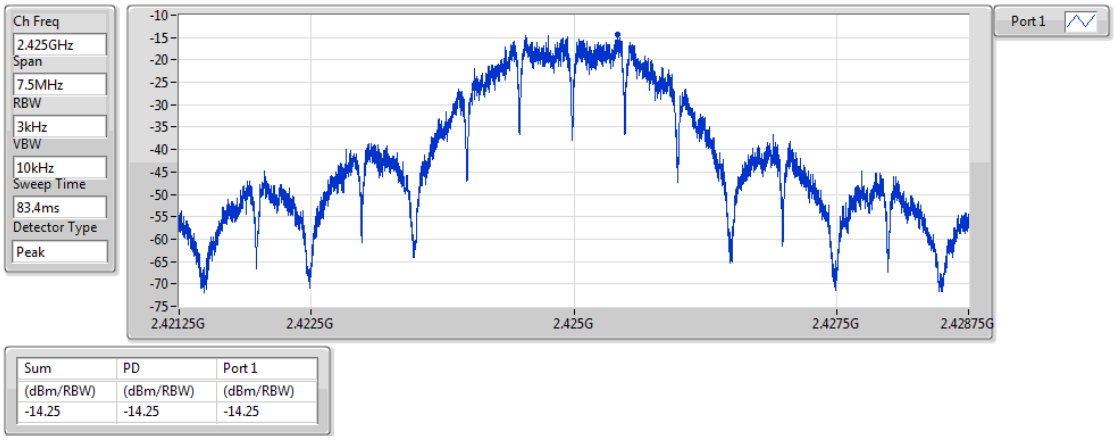
Result

Mode	Result	DG (dBi)	Port 1 (dBm/RBW)	PD (dBm/RBW)	PD Limit (dBm/RBW)
RF4CE	-	-	-	-	-
2425MHz	Pass	3.00	-14.25	-14.25	8.00
2450MHz	Pass	3.00	-14.69	-14.69	8.00
2475MHz	Pass	3.00	-14.13	-14.13	8.00

DG = Directional Gain; RBW=3kHz;
PD = trace bin-by-bin of each transmits port summing can be performed maximum power density; **Port X** = Port X power density;

RF4CE **PSD**

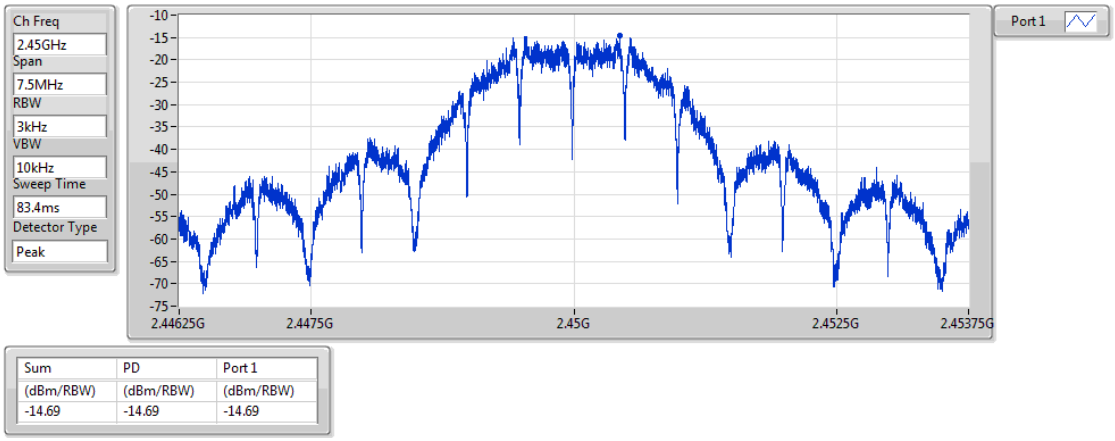
2425MHz



Sum	PD	Port 1
(dBm/RBW)	(dBm/RBW)	(dBm/RBW)
-14.25	-14.25	-14.25

RF4CE **PSD**

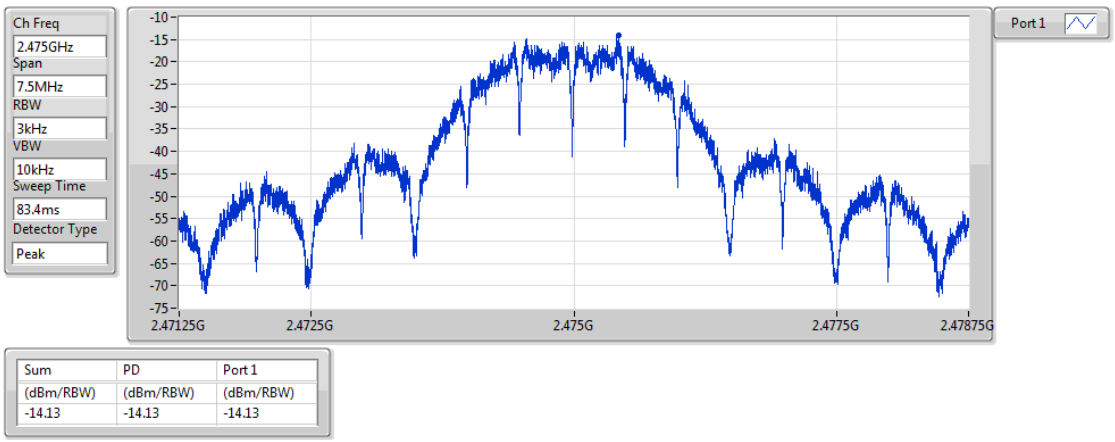
2450MHz



Sum	PD	Port 1
(dBm/RBW)	(dBm/RBW)	(dBm/RBW)
-14.69	-14.69	-14.69

RF4CE **PSD**

2475MHz



Sum	PD	Port 1
(dBm/RBW)	(dBm/RBW)	(dBm/RBW)
-14.13	-14.13	-14.13

Summary

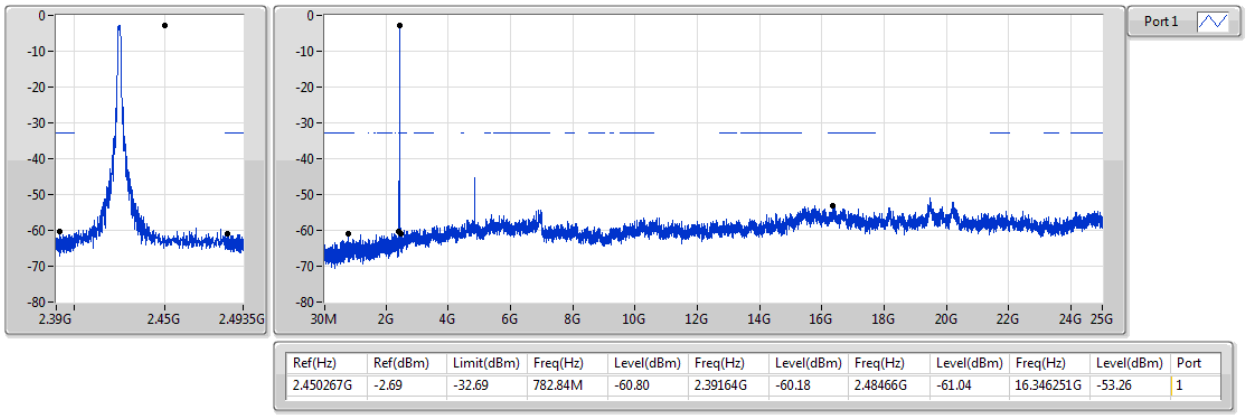
Mode	Result	Ref (Hz)	Ref (dBm)	Limit (dBm)	Freq (Hz)	Level (dBm)	Freq (Hz)	Level (dBm)	Freq (Hz)	Level (dBm)	Freq (Hz)	Level (dBm)	Port
RF4CE	-	-	-	-	-	-	-	-	-	-	-	-	-
2.4-2.4835GHz	Pass	2.450267G	-2.69	-32.69	813.52M	-60.37	2.39858G	-61.10	2.48386G	-51.07	16.683848G	-53.53	1

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
RF4CE	-	-	-	-	-	-	-	-	-	-	-	-	-
2425MHz	Pass	2.450267G	-2.69	-32.69	782.84M	-60.80	2.39164G	-60.18	2.48466G	-61.04	16.346251G	-53.26	1
2450MHz	Pass	2.450267G	-2.69	-32.69	2.30504G	-61.47	2.3944G	-60.77	2.49186G	-60.86	16.723235G	-52.00	1
2475MHz	Pass	2.450267G	-2.69	-32.69	813.52M	-60.37	2.39858G	-61.10	2.48386G	-51.07	16.683848G	-53.53	1

RF4CE **CSE NdB**

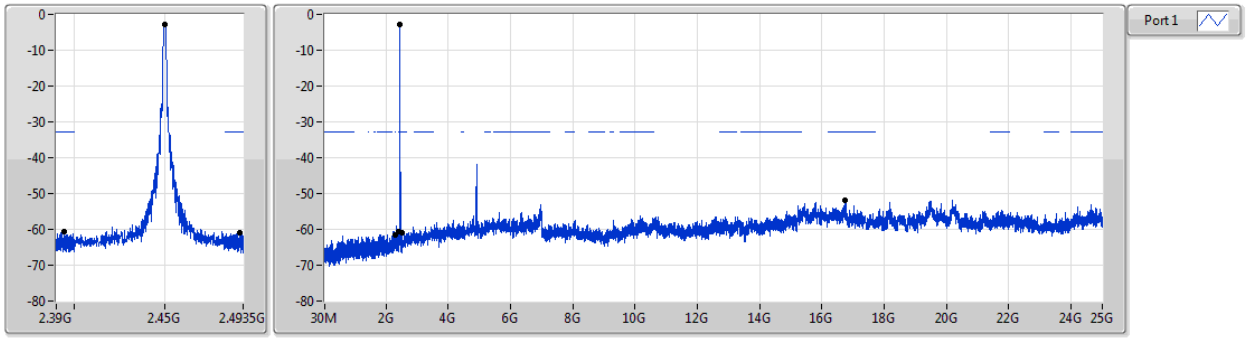
2425MHz



Ref(Hz)	Ref(dBm)	Limit(dBm)	Freq(Hz)	Level(dBm)	Freq(Hz)	Level(dBm)	Freq(Hz)	Level(dBm)	Freq(Hz)	Level(dBm)	Port
2.450267G	-2.69	-32.69	782.84M	-60.80	2.39164G	-60.18	2.48466G	-61.04	16.346251G	-53.26	1

RF4CE **CSE NdB**

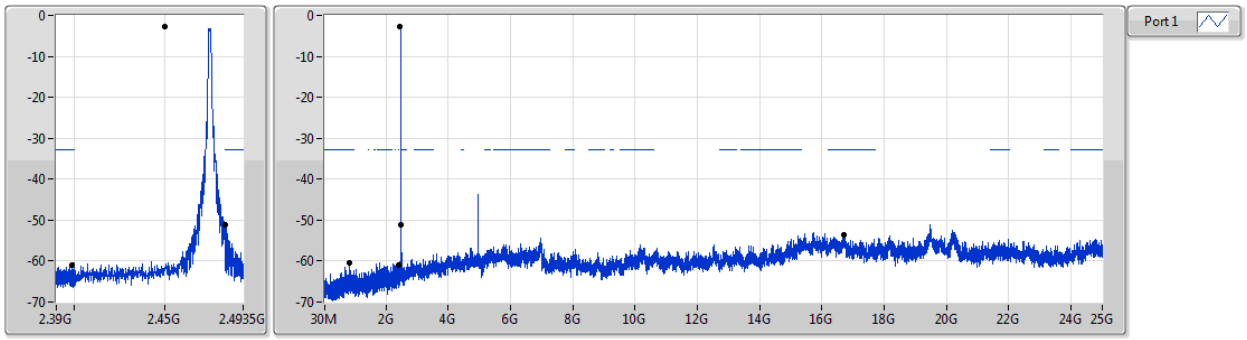
2450MHz



Ref(Hz)	Ref(dBm)	Limit(dBm)	Freq(Hz)	Level(dBm)	Freq(Hz)	Level(dBm)	Freq(Hz)	Level(dBm)	Freq(Hz)	Level(dBm)	Port
2.450267G	-2.69	-32.69	2.30504G	-61.47	2.3944G	-60.77	2.49186G	-60.86	16.723235G	-52.00	1

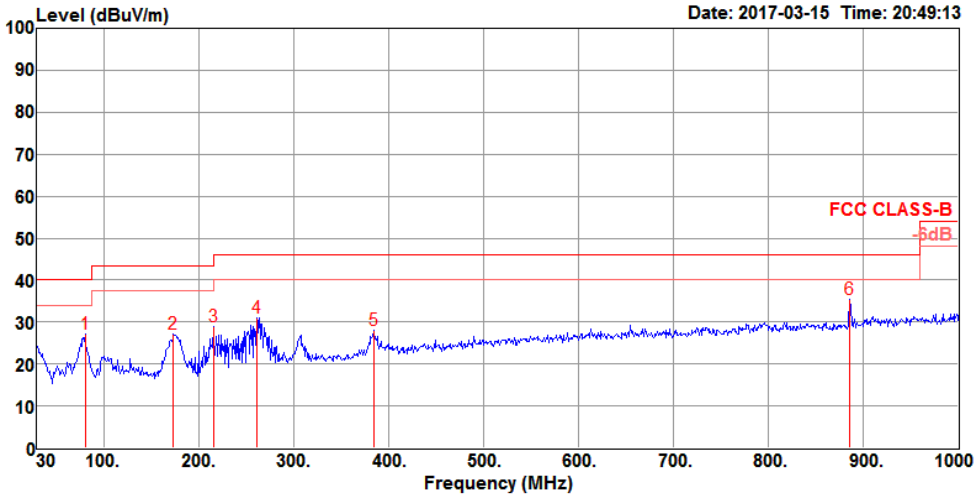
RF4CE **CSE NdB**

2475MHz



Ref(Hz)	Ref(dBm)	Limit(dBm)	Freq(Hz)	Level(dBm)	Freq(Hz)	Level(dBm)	Freq(Hz)	Level(dBm)	Freq(Hz)	Level(dBm)	Port
2.450267G	-2.69	-32.69	813.52M	-60.37	2.39858G	-61.10	2.48386G	-51.07	16.683848G	-53.53	1

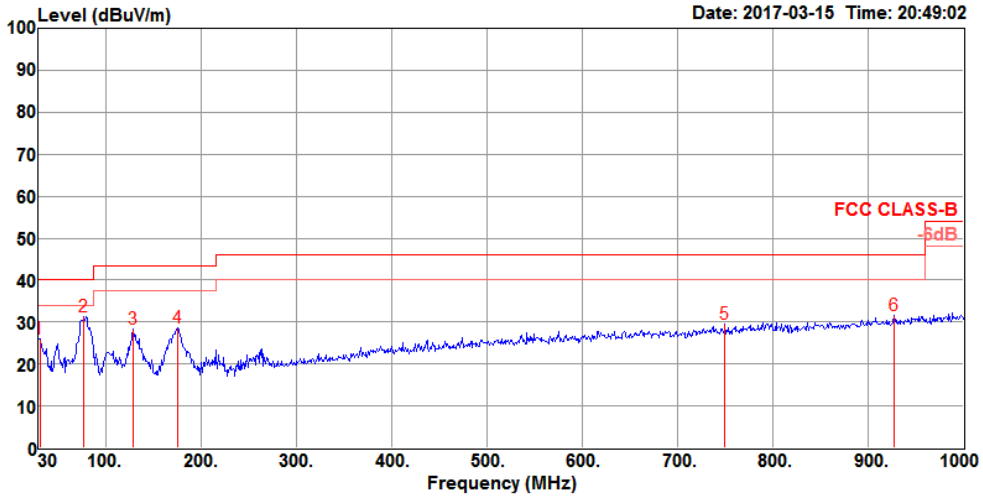
RSE below 1GHz Result			
Operating Mode	1	**Polarization**	Horizontal
Operating Function	CTX		



	Freq	Level	Limit Line	Over Limit	Read Level	Cable Loss	Antenna Factor	Preamp Factor	A/Pos	T/Pos	Remark	Pol/Phase
	MHz	dBuV/m	dBuV/m	dB	dBuV	dB	dB/m	dB	cm	deg		
1	80.44	27.13	40.00	-12.87	45.03	0.87	13.66	32.43	200	142	Peak	HORIZONTAL
2	173.56	27.03	43.50	-16.47	41.70	1.27	16.41	32.35	150	112	Peak	HORIZONTAL
3	215.27	28.96	43.50	-14.54	43.08	1.40	16.81	32.33	150	300	Peak	HORIZONTAL
4	260.86	31.08	46.00	-14.92	42.00	1.54	19.87	32.33	100	230	Peak	HORIZONTAL
5	384.05	28.15	46.00	-17.85	36.25	1.91	22.29	32.30	100	358	Peak	HORIZONTAL
6	885.54	35.47	46.00	-10.53	36.71	2.90	27.61	31.75	300	322	Peak	HORIZONTAL

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.)

RSE below 1GHz Result			
Operating Mode	1	**Polarization**	Vertical
Operating Function	CTX		



	Freq	Level	Limit Line	Over Limit	Read Level	Cable Loss	Antenna Factor	Preamp Factor	A/Pos	T/Pos	Remark	Pol/Phase
	MHz	dBuV/m	dBuV/m	dB	dBuV	dB	dB/m	dB	cm	deg		
1	30.97	26.00	40.00	-14.00	33.35	0.51	25.13	32.99	150	201	Peak	VERTICAL
2	77.53	31.29	40.00	-8.71	49.44	0.84	13.43	32.42	200	228	Peak	VERTICAL
3	128.94	28.35	43.50	-15.15	40.84	1.09	18.83	32.41	100	220	Peak	VERTICAL
4	175.50	28.56	43.50	-14.94	43.31	1.28	16.32	32.35	100	109	Peak	VERTICAL
5	749.74	29.55	46.00	-16.45	32.70	2.73	26.40	32.28	300	0	Peak	VERTICAL
6	927.25	31.44	46.00	-14.56	32.00	2.94	27.91	31.41	200	359	Peak	VERTICAL

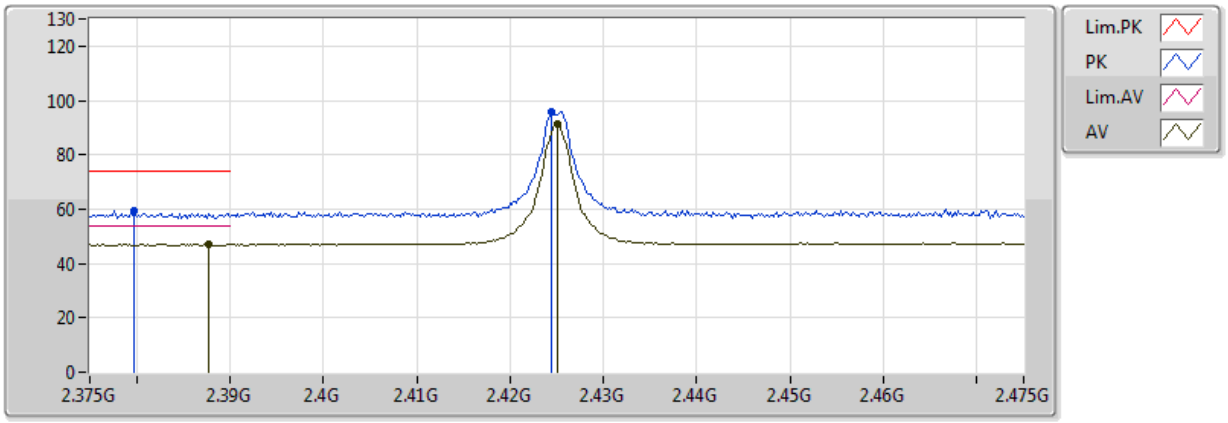
Note 1: “>20dB” means emission levels that exceed the level of 20 dB below the applicable limit.
Note 2: “N/F” means Nothing Found emissions (No emissions were detected.)

Summary

Mode	Result	Type	Freq (Hz)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Factor (dB)	Dist (m)	Pol. (H/V)	Azimuth (°)	Height (m)	Comments
RF4CE	-	-	-	-	-	-	-	-	-	-	-	-
2.4-2.4835GHz	Pass	AV	4.849G	51.23	54.00	-2.77	4.77	3	H	135	1.00	-

RF4CE

2425MHz_TX

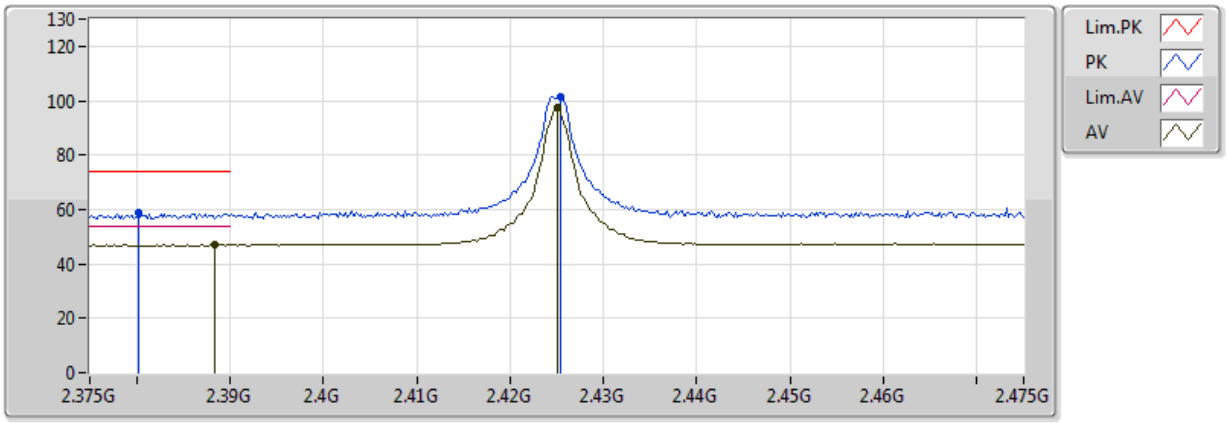


20170315
EUT Z_1TX(ANT1)
Setting 3
03-L-2
FSU

Type	Freq(Hz)	Level(dBuV/m)	Limit(dBuV/m)	Margin(dB)	Factor(dB)	Dist(m)	Pol.(H/V)	Azimuth(°)	Height(m)	Comments
AV	2.3878G	47.02	54.00	-6.98	31.91	3	V	224	1.00	-
AV	2.425G	91.61	Inf	-Inf	32.00	3	V	224	1.00	-
PK	2.3798G	59.29	74.00	-14.71	31.89	3	V	224	1.00	-
PK	2.4244G	95.77	Inf	-Inf	32.00	3	V	224	1.00	-

RF4CE

2425MHz_TX

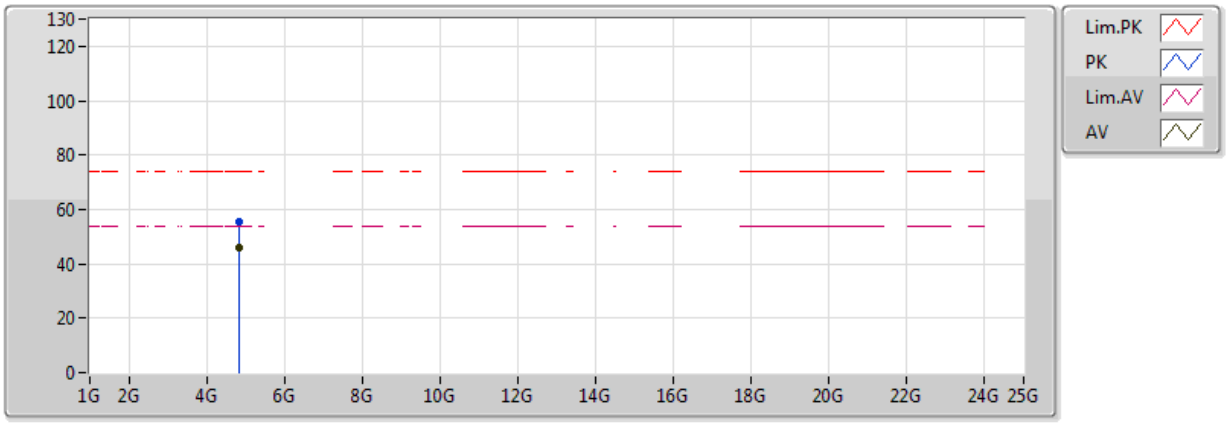


20170315
EUT Z_1TX(ANT1)
Setting 3
03-L-2
FSU

Type	Freq(Hz)	Level(dBuV/m)	Limit(dBuV/m)	Margin(dB)	Factor(dB)	Dist(m)	Pol.(H/V)	Azimuth(°)	Height(m)	Comments
AV	2.3884G	47.17	54.00	-6.83	31.91	3	H	96	1.00	-
AV	2.425G	97.35	Inf	-Inf	32.00	3	H	96	1.00	-
PK	2.3802G	58.58	74.00	-15.42	31.89	3	H	96	1.00	-
PK	2.4254G	101.58	Inf	-Inf	32.00	3	H	96	1.00	-

RF4CE

2425MHz_TX

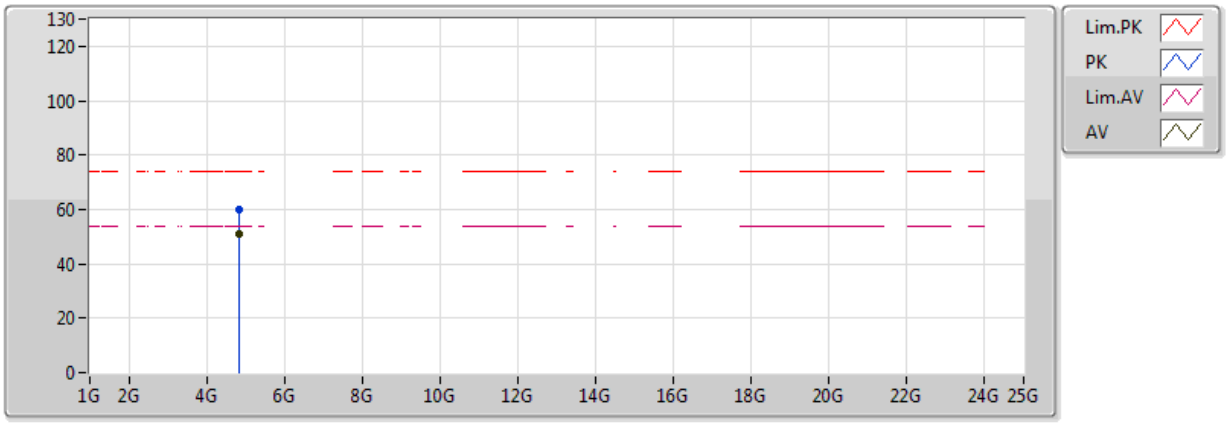


20170315
EUT Z_1TX(ANT1)
Setting 3
03-L-2
FSU

Type	Freq(Hz)	Level(dBuV/m)	Limit(dBuV/m)	Margin(dB)	Factor(dB)	Dist(m)	Pol.(H/V)	Azimuth(°)	Height(m)	Comments
AV	4.8489G	45.83	54.00	-8.17	4.77	3	V	144	2.55	-
PK	4.85098G	55.35	74.00	-18.65	4.77	3	V	144	2.55	-

RF4CE

2425MHz_TX

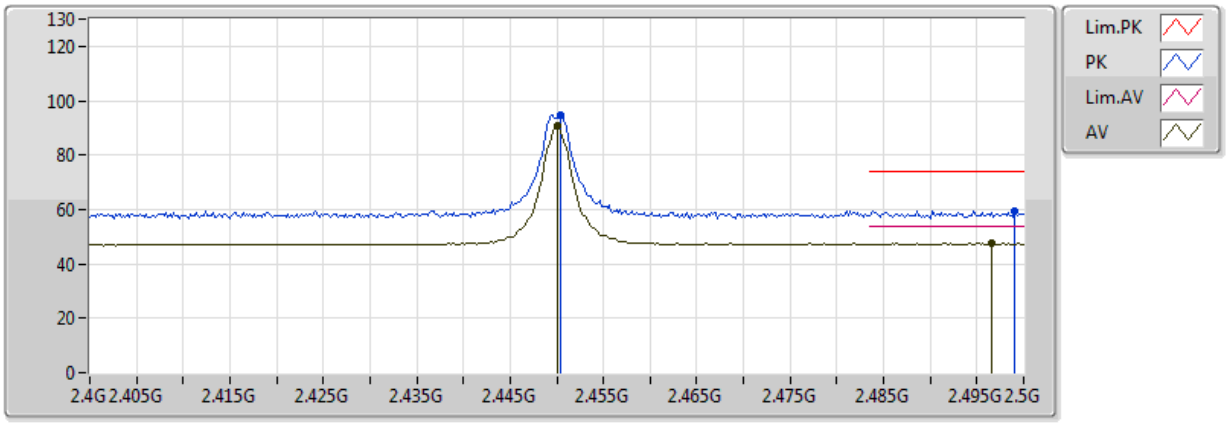


20170315
EUT Z_1TX(ANT1)
Setting 3
03-L-2
FSU

Type	Freq(Hz)	Level(dBuV/m)	Limit(dBuV/m)	Margin(dB)	Factor(dB)	Dist(m)	Pol.(H/V)	Azimuth(°)	Height(m)	Comments
AV	4.849G	51.23	54.00	-2.77	4.77	3	H	135	1.00	-
PK	4.84892G	59.75	74.00	-14.25	4.77	3	H	135	1.00	-

RF4CE

2450MHz_TX

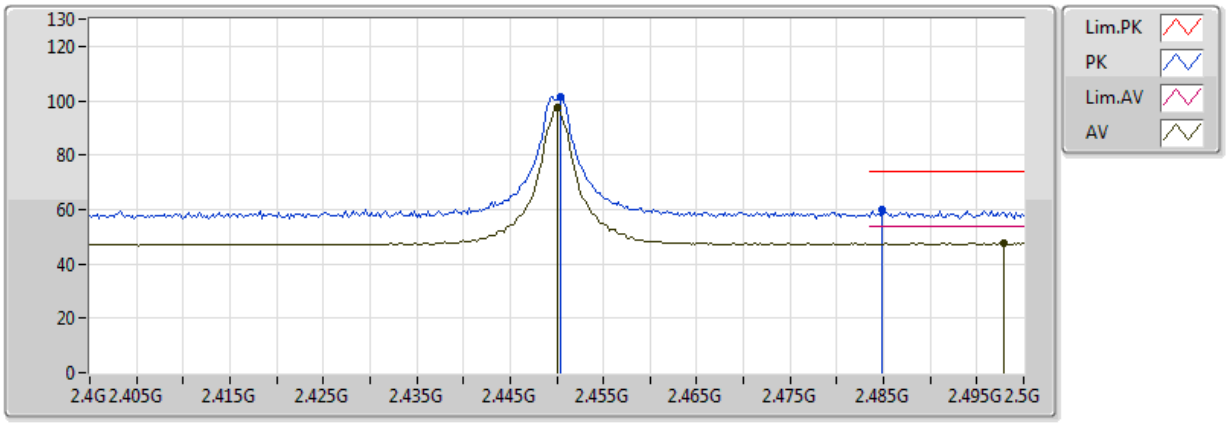


20170315
EUT Z_1TX(ANT1)
Setting 3
03-L-2
FSU

Type	Freq(Hz)	Level(dBuV/m)	Limit(dBuV/m)	Margin(dB)	Factor(dB)	Dist(m)	Pol.(H/V)	Azimuth(°)	Height(m)	Comments
AV	2.45G	90.61	Inf	-Inf	32.06	3	V	219	1.01	-
AV	2.4966G	47.59	54.00	-6.41	32.17	3	V	219	1.01	-
PK	2.4504G	94.69	Inf	-Inf	32.06	3	V	219	1.01	-
PK	2.499G	59.47	74.00	-14.53	32.18	3	V	219	1.01	-

RF4CE

2450MHz_TX

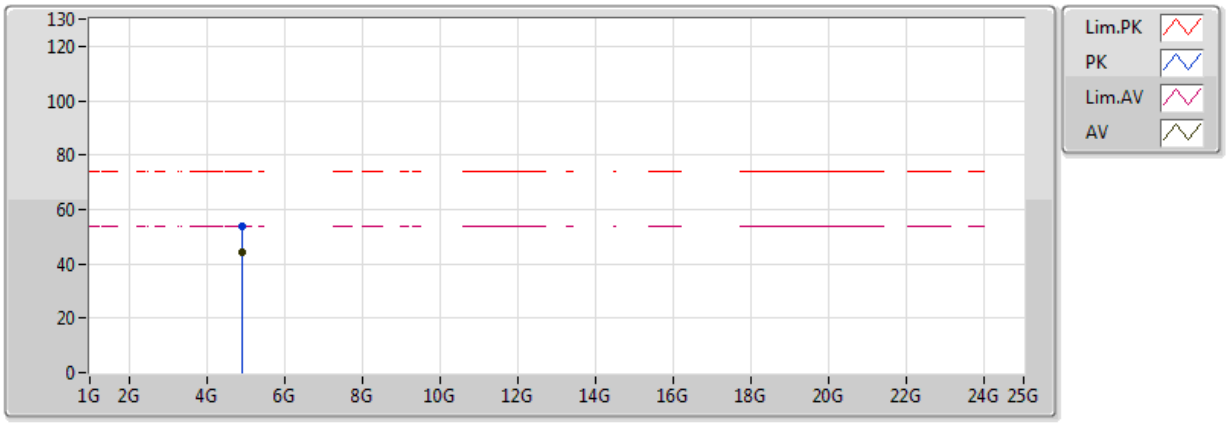


20170315
EUT Z_1TX(ANT1)
Setting 3
03-L-2
FSU

Type	Freq(Hz)	Level(dBuV/m)	Limit(dBuV/m)	Margin(dB)	Factor(dB)	Dist(m)	Pol.(H/V)	Azimuth(°)	Height(m)	Comments
AV	2.45G	97.22	Inf	-Inf	32.06	3	H	99	1.01	-
AV	2.4978G	47.61	54.00	-6.39	32.17	3	H	99	1.01	-
PK	2.4504G	101.36	Inf	-Inf	32.06	3	H	99	1.01	-
PK	2.4848G	59.75	74.00	-14.25	32.14	3	H	99	1.01	-

RF4CE

2450MHz_TX

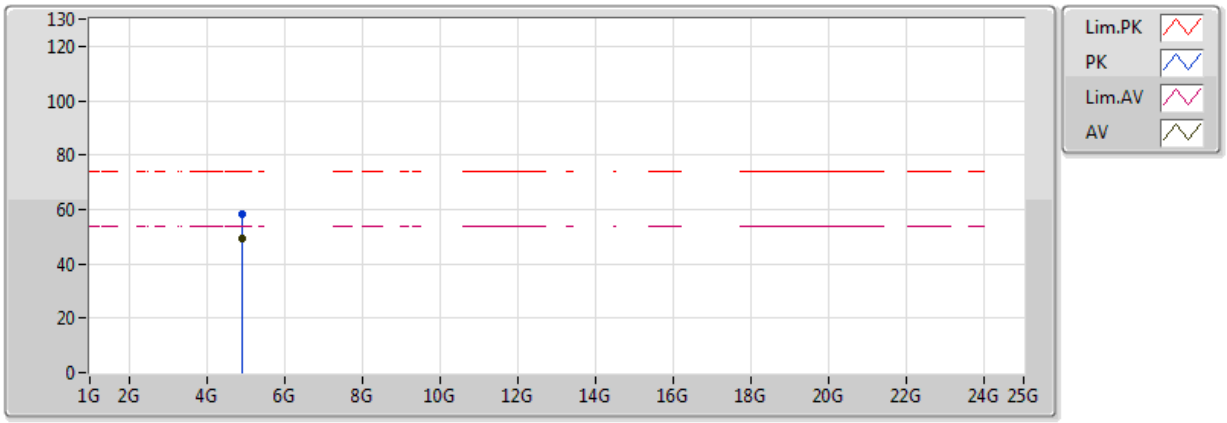


20170315
EUT Z_1TX(ANT1)
Setting 3
03-L-2
FSU

Type	Freq(Hz)	Level(dBuV/m)	Limit(dBuV/m)	Margin(dB)	Factor(dB)	Dist(m)	Pol.(H/V)	Azimuth(°)	Height(m)	Comments
AV	4.901G	44.18	54.00	-9.82	4.87	3	V	149	2.67	-
PK	4.90104G	53.83	74.00	-20.17	4.87	3	V	149	2.67	-

RF4CE

2450MHz_TX

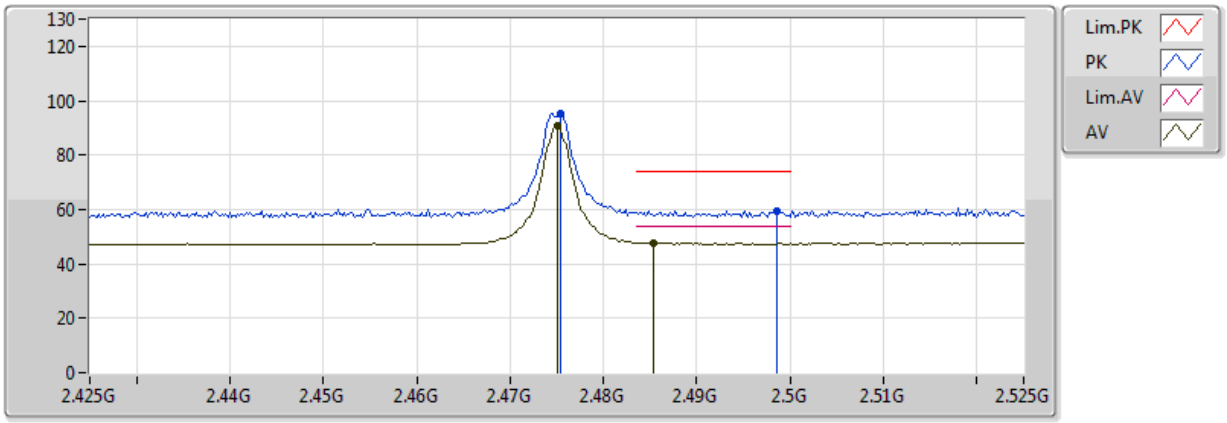


20170315
EUT Z_1TX(ANT1)
Setting 3
03-L-2
FSU

Type	Freq(Hz)	Level(dBuV/m)	Limit(dBuV/m)	Margin(dB)	Factor(dB)	Dist(m)	Pol.(H/V)	Azimuth(°)	Height(m)	Comments
AV	4.90104G	49.24	54.00	-4.76	4.87	3	H	142	1.01	-
PK	4.90102G	58.32	74.00	-15.68	4.87	3	H	142	1.01	-

RF4CE

2475MHz_TX

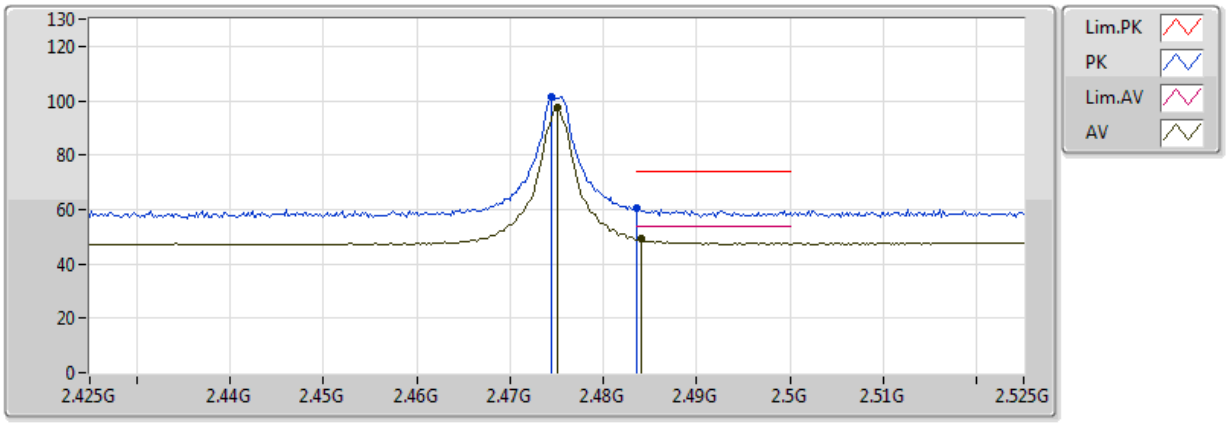


20170315
EUT Z_1TX(ANT1)
Setting 3
03-L-2
FSU

Type	Freq(Hz)	Level(dBuV/m)	Limit(dBuV/m)	Margin(dB)	Factor(dB)	Dist(m)	Pol.(H/V)	Azimuth(°)	Height(m)	Comments
AV	2.475G	90.99	Inf	-Inf	32.12	3	V	359	2.99	-
AV	2.4854G	47.89	54.00	-6.11	32.14	3	V	359	2.99	-
PK	2.4754G	95.18	Inf	-Inf	32.12	3	V	359	2.99	-
PK	2.4986G	59.50	74.00	-14.50	32.18	3	V	359	2.99	-

RF4CE

2475MHz_TX

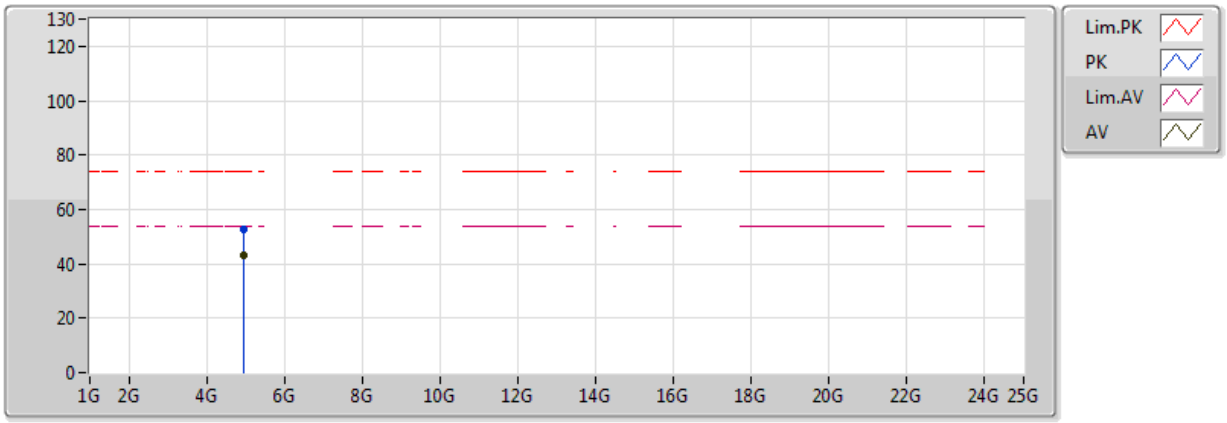


20170315
EUT Z_1TX(ANT1)
Setting 3
03-L-2
FSU

Type	Freq(Hz)	Level(dBuV/m)	Limit(dBuV/m)	Margin(dB)	Factor(dB)	Dist(m)	Pol.(H/V)	Azimuth(°)	Height(m)	Comments
AV	2.475G	97.35	Inf	-Inf	32.12	3	H	104	1.57	-
AV	2.484G	49.14	54.00	-4.86	32.14	3	H	104	1.57	-
PK	2.4744G	101.55	Inf	-Inf	32.12	3	H	104	1.57	-
PK	2.4836G	60.37	74.00	-13.63	32.14	3	H	104	1.57	-

RF4CE

2475MHz_TX

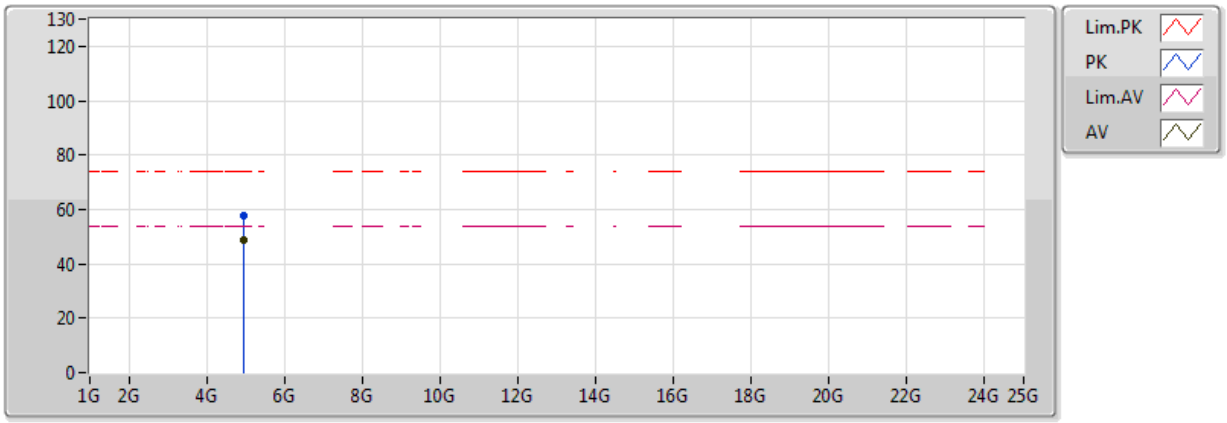


20170315
EUT Z_1TX(ANT1)
Setting 3
03-L-2
FSU

Type	Freq(Hz)	Level(dBuV/m)	Limit(dBuV/m)	Margin(dB)	Factor(dB)	Dist(m)	Pol.(H/V)	Azimuth(°)	Height(m)	Comments
AV	4.95094G	42.87	54.00	-11.13	4.98	3	V	144	2.78	-
PK	4.95088G	52.51	74.00	-21.49	4.98	3	V	144	2.78	-

RF4CE

2475MHz_TX



20170315
EUT Z_1TX(ANT1)
Setting 3
03-L-2
FSU

Type	Freq(Hz)	Level(dBuV/m)	Limit(dBuV/m)	Margin(dB)	Factor(dB)	Dist(m)	Pol.(H/V)	Azimuth(°)	Height(m)	Comments
AV	4.95102G	48.90	54.00	-5.10	4.98	3	H	133	1.03	-
PK	4.94898G	57.94	74.00	-16.06	4.98	3	H	133	1.03	-