FCC Test Report

Equipment	:	Cloud Access Camera
Brand Name	:	ZYXEL
Model No.	:	CAM3115
FCC ID	:	I88CAM3115
Standard	:	47 CFR FCC Part 15.247
Frequency	:	2400 MHz – 2483.5 MHz
Function	:	☒Point-to-multipoint; ☐Point-to-point
Applicant	:	Zyxel Communications Corporation No.2 Industry East RD. IX, Science Park, Hsinchu 30075, Taiwan(R.O.C)
Manufacturer	:	Zyxel Communications Corporation No.2 Industry East RD. IX, Science Park, Hsinchu 30075, Taiwan(R.O.C)

The product sample received on Oct. 03, 2016 and completely tested on Jan. 10, 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 INTERNATIONALINC., the test report shall not be reproduced except in full.

Cliff Chang
SPORTON INTERNATIONAL INC.

Testing Laboratory
1190

Table of Contents

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
FR691206AC	Rev. 01	Initial issue of report	Apr. 12, 2017

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	2	1

Note:
- 2.4G is the 2.4GHz Band (2.4-2.4835GHz).
- Bluetooth LE uses a GFSK (1Mbps) modulation for DSSS.
- BWch is the channel separation
- 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	Gain (dBi)
1	LYNwave	ALA150-052027-000001	PIFA Antenna	I-PEX	2.43

Note: The EUT has an antenna only.

For 2.4GHz WLAN function:

For IEEE 802.11b/g/n mode <1TX/1RX>:

Only Ant. 1(Port1) can be used as transmitting antenna and receiving antenna.

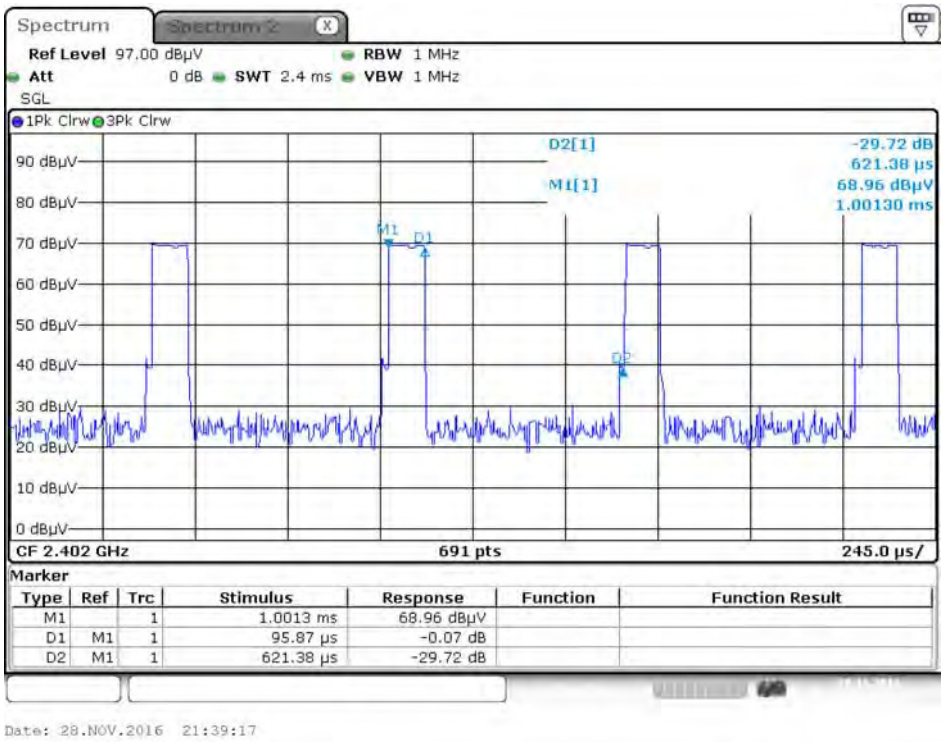
For Bluetooth function:

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

1.1.3 Mode Test Duty Cycle

Mode	DC	T(s)	VBW(Hz) ≥ 1/T
BT-LE	0.15	0.096	30k

BT-LE



1.1.4 EUT Operational Condition

EUT Power Type	From Power Adapter
RF Chip Model No.	BCM43438
Firmware Version	V1.00(ABEQ.1)C0

1.1.5 Table for micro SD card list

Micro SD card	Brand Name
Main source micro SD card	ADATA
Second source micro SD card	Phison

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 v03r05
- FCC KDB 412172 D01 v01

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	Gary Chu	25°C / 65%	Nov. 28, 2016
Radiated	03CH01-CB	Peter Wu/Zero Chen/ Stim Sung/Mason Chen/ Nyle Chang	22°C / 54%	Nov. 02, 2016~Jan. 10, 2017
AC Conduction	CO01-CB	GN Hou/Edison	21°C / 59%	Jan. 10, 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

Band	Mode	BWch (MHz)	Nss-Min	Nant	Ch. (MHz)	Range	Power Setting
2.4G	BT-LE	2	1	1	2402	L	Default
2.4G	BT-LE	2	1	1	2440	M	Default
2.4G	BT-LE	2	1	1	2480	H	Default

Note:
- Test range channel consist of L (Low Ch.), M (Middle Ch.), H (High Ch.), S (Single Ch.) and C (Straddle Band Ch.).

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	CTX - 2.4GHz WLAN
2	CTX - BT / RF test tool: BlueTool
For operating mode 2 is the worst case and it was record in this test report.	

The Worst Case Mode for Following Conformance Tests	
Tests Item	DTS Bandwidth Maximum Conducted Output Power Power Spectral Density Emissions in Non-restricted Frequency Bands
Test Condition	Conducted measurement at transmit chains

The Worst Case Mode for Following Conformance Tests	
Tests Item	Emissions in Restricted Frequency Bands
Test Condition	Radiated measurement If EUT consist of multiple antenna assembly (multiple antenna are used in EUT regardless of spatial multiplexing MIMO configuration), the radiated test should be performed with highest antenna gain of each antenna type.
Operating Mode < 1GHz	CTX
1	CTX - 2.4GHz WLAN at Z-axis
2	CTX - 2.4GHz WLAN at Y-axis
3	CTX - BT at Z-axis / RF test tool: BlueTool
4	CTX - BT at Y-axis / RF test tool: BlueTool
For operating mode 2 is the worst case and it was record in this test report.	
Operating Mode > 1GHz	The EUT can be placed in Y-axis and Z-axis. After evaluating, The worst case was found at Y-axis, so it's recorded in this report.
	CTX
1	EUT at Y-axis

2.3 EUT Operation during Test

The EUT was programmed to be in continuously transmitting mode.

2.4 Accessories

Accessories				
No.	**Equipment Name**	**Brand Name**	**Model Name**	**Rating**
1	Adapter	APD	WB-10E05R	Input: 100-240V~50-60Hz, 0.4A Max Output: 5V, 2A
Others				
2	USB cable, Shielded, 3m			
3	Pedestal*1			
4	Plug*1			
5	Main source micro SD card*1 (Brand Name.: ADATA)			
6	Second source micro SD card*1 (Brand Name.: Phison)			

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	Test fixture	Abocom	RS232 Console Cable	N/A

For Test Site No: 03CH01-CB

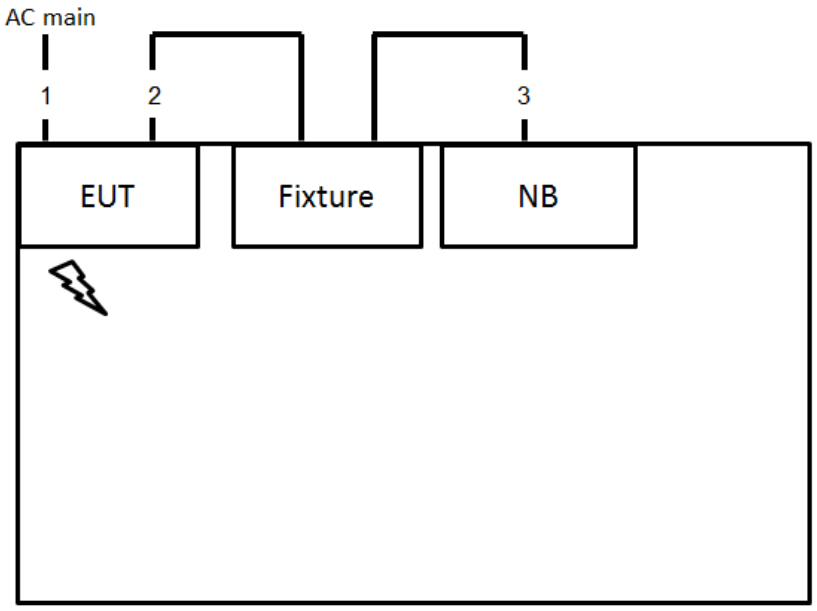
Support Equipment				
No.	**Equipment**	**Brand Name**	**Model Name**	**FCC ID**
1	NB	DELL	E4300	DoC
2	Test fixture	Abocom	RS232 Console Cable	N/A

For Test Site No: TH01-CB

Support Equipment				
No.	**Equipment**	**Brand Name**	**Model Name**	**FCC ID**
1	NB	DELL	E4300	DoC
2	Test fixture	Abocom	RS232 Console Cable	N/A

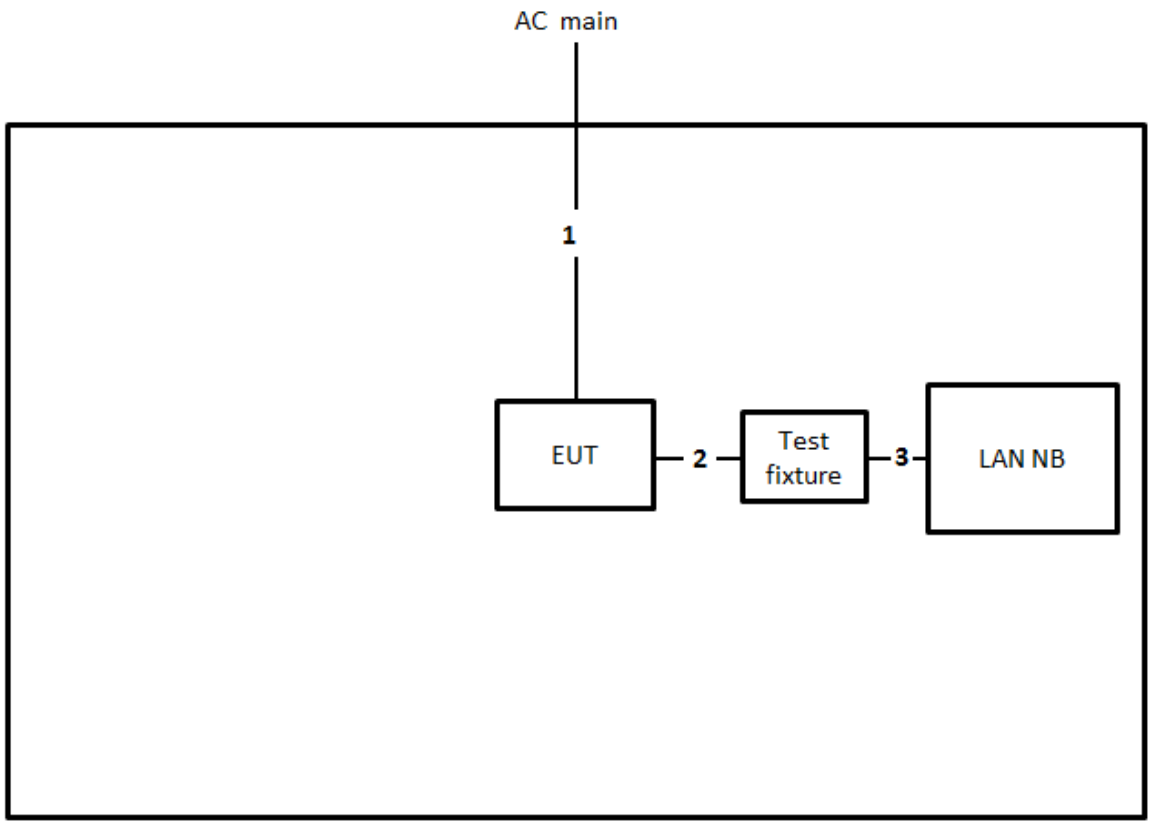
2.6 Test Setup Diagram

Test Setup Diagram – AC Line Conducted Emission Test



Item	Connection	Shielded	Length
1	USB cable	Yes	3m
2	Console cable	No	0.2m
3	USB cable	Yes	0.4m

Test Setup Diagram - Radiated Test



Item	Connection	Shielded	Length
1	USB cable	Yes	3m
2	Console cable	No	0.2m
3	USB cable	Yes	0.4m

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

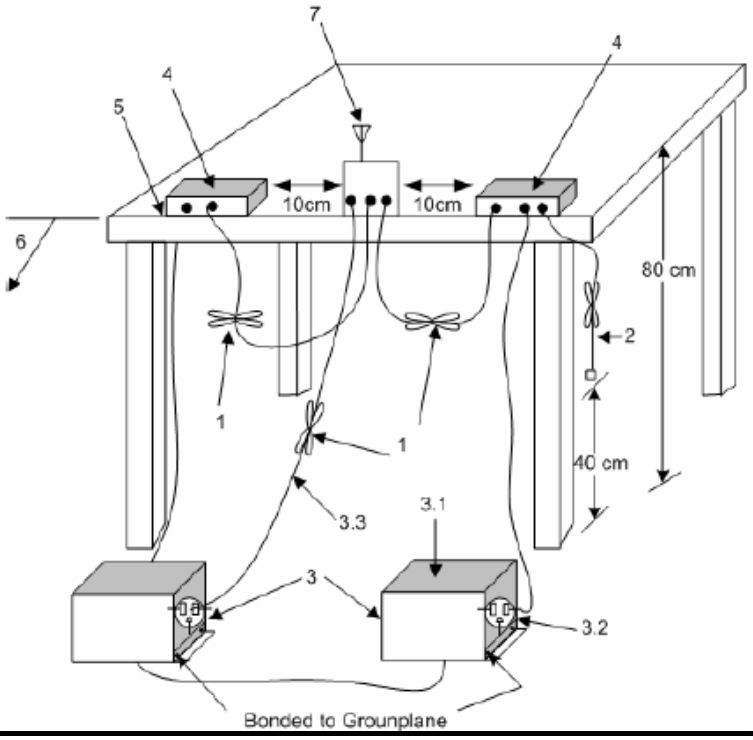
Refer a test equipment and calibration data table in this test report.

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.

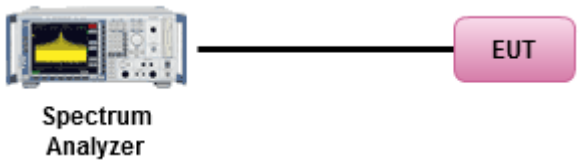
3.2.2 Measuring Instruments

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 FCC KDB 558074, clause 8.1 Option 1 for6 dB bandwidth measurement.
	☐ Refer as FCC KDB 558074, clause 8.2 Option 2 for6 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

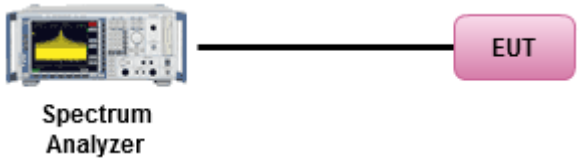
3.4.2 Measuring Instruments

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


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.	

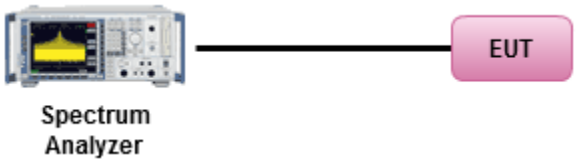
3.5.2 Measuring Instruments

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 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.

3.6.2 Measuring Instruments

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

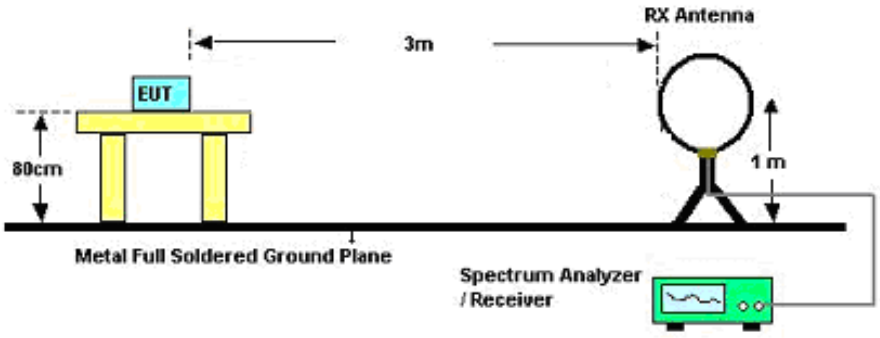
3.6.3 Test Procedures

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.	

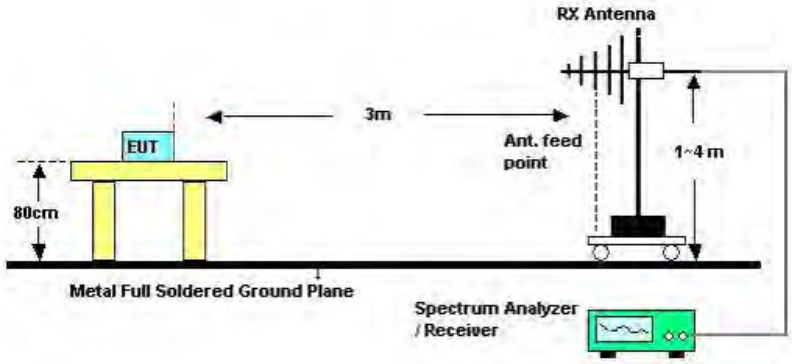
3.6.4 Test Setup

Transmitter Radiated Emissions

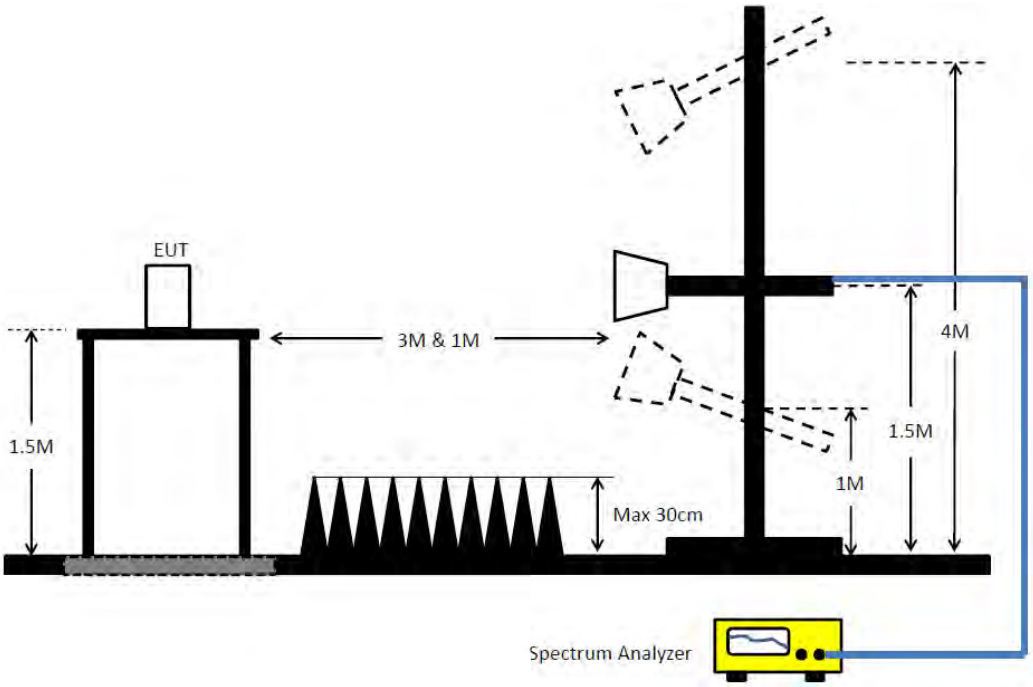
9kHz ~30MHz



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 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. 27, 2016	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)
Loop Antenna	Teseq	HLA 6120	24155	9kHz - 30 MHz	Mar. 16, 2016*	Radiation (03CH01-CB)
BILOG ANTENNA	TESEQ	CBL6112D	37880	20MHz ~ 2GHz	Aug. 30, 2016	Radiation (03CH01-CB)
Horn Antenna	EMCO	3115	9610-4976	1GHz ~ 18GHz	Apr. 25, 2016	Radiation (03CH01-CB)
Horn Antenna	Schwarzbeck	BBHA 9170	BBHA9170252	15GHz ~ 40GHz	Jul. 25, 2016	Radiation (03CH01-CB)
Pre-Amplifier	Agilent	8447D	2944A10991	0.1MHz ~ 1.3GHz	Mar. 15, 2016	Radiation (03CH01-CB)
Pre-Amplifier	Agilent	8449B	3008A02310	1GHz ~ 26.5GHz	Jan. 18, 2016	Radiation (03CH01-CB)
Spectrum Analyzer	R&S	FSP-40	100019	9kHz ~ 40GHz	Apr. 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-1	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-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)
Test Software	Audix	E3	6.2009-l0-7	N/A	N/A	Radiation (03CH01-CB)
Spectrum analyzer	R&S	FSV40	100979	9kHz~40GHz	Dec. 09, 2015	Conducted (TH01-CB)

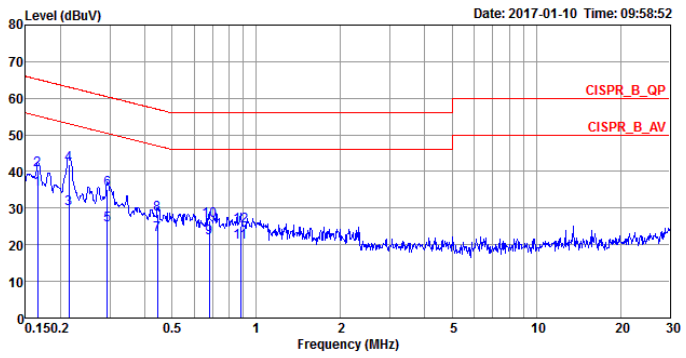
Instrument	Manufacturer	Model No.	Serial No.	Characteristics	Calibration Date	Remark
RF Cable-high	Woken	RG402	High Cable-6	1 GHz – 26.5 GHz	Oct. 24, 2016	Conducted (TH01-CB)
RF Cable-high	Woken	RG402	High Cable-7	1 GHz – 26.5 GHz	Oct. 24, 2016	Conducted (TH01-CB)
RF Cable-high	Woken	RG402	High Cable-8	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	MY54320014	50MHz~18GHz	Apr. 20, 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.

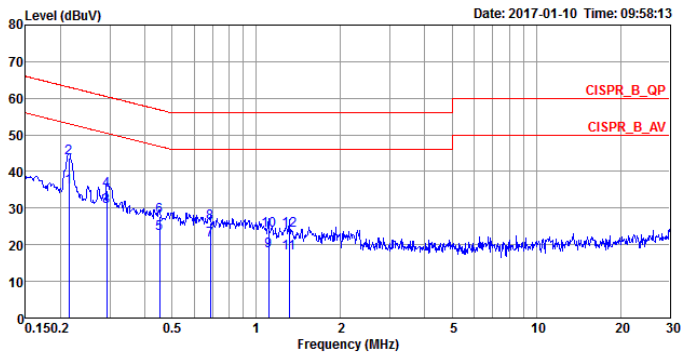
AC Power-line Conducted Emissions Result			
Operating Mode	2	**Power Phase**	Neutral
Operating Function	CTX		



	Freq	Level	Over Limit	Limit Line	Read Level	LISN Factor	Cable Loss	Pol/Phase	Remark
	MHz	dBuV	dB	dBuV	dBuV	dB	dB		
1	0.1659	34.99	-20.17	55.16	24.80	10.02	0.17	NEUTRAL	Average
2	0.1659	40.44	-24.72	65.16	30.25	10.02	0.17	NEUTRAL	QP
3	0.2139	29.93	-23.12	53.05	19.84	9.92	0.17	NEUTRAL	Average
4	0.2139	41.81	-21.24	63.05	31.72	9.92	0.17	NEUTRAL	QP
5	0.2940	25.25	-25.16	50.41	15.24	9.92	0.09	NEUTRAL	Average
6	0.2940	35.01	-25.40	60.41	25.00	9.92	0.09	NEUTRAL	QP
7	0.4444	22.61	-24.37	46.98	12.60	9.92	0.09	NEUTRAL	Average
8	0.4444	28.32	-28.66	56.98	18.31	9.92	0.09	NEUTRAL	QP
9	0.6790	21.73	-24.27	46.00	11.37	9.93	0.43	NEUTRAL	Average
10	0.6790	26.58	-29.42	56.00	16.22	9.93	0.43	NEUTRAL	QP
11	0.8803	20.65	-25.35	46.00	10.07	9.94	0.64	NEUTRAL	Average
12	0.8803	25.22	-30.78	56.00	14.64	9.94	0.64	NEUTRAL	QP

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	2	**Power Phase**	Line
Operating Function	CTX		



	Freq	Level	Over Limit	Limit Line	Read Level	LISN Factor	Cable Loss	Pol/Phase	Remark
	MHz	dBuV	dB	dBuV	dBuV	dB	dB		
1	0.2139	35.70	-17.35	53.05	25.61	9.92	0.17	LINE	Average
2	0.2139	43.81	-19.24	63.05	33.72	9.92	0.17	LINE	QP
3	0.2924	30.32	-20.14	50.46	20.31	9.92	0.09	LINE	Average
4	0.2924	34.95	-25.51	60.46	24.94	9.92	0.09	LINE	QP
5	0.4516	23.16	-23.69	46.85	13.13	9.92	0.11	LINE	Average
6	0.4516	27.87	-28.98	56.85	17.84	9.92	0.11	LINE	QP
7	0.6863	21.23	-24.77	46.00	10.86	9.93	0.44	LINE	Average
8	0.6863	25.90	-30.10	56.00	15.53	9.93	0.44	LINE	QP
9	1.1056	18.17	-27.83	46.00	7.59	9.94	0.64	LINE	Average
10	1.1056	23.92	-32.08	56.00	13.34	9.94	0.64	LINE	QP
11	1.3098	17.80	-28.20	46.00	7.37	9.95	0.48	LINE	Average
12	1.3098	24.01	-31.99	56.00	13.58	9.95	0.48	LINE	QP

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.)

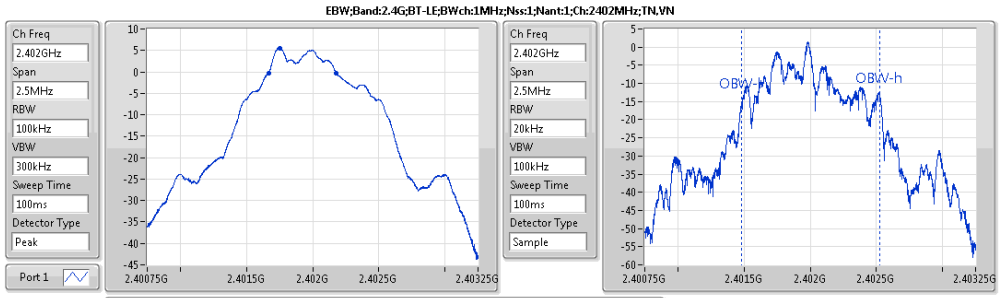
Summary

Mode	Max-N dB (Hz)	Max-OBW (Hz)	ITU-Code	Min-N dB (Hz)	Min-OBW (Hz)
2.4G;BT-LE;Nss1;Ntx1	517.5k	1.044M	1M04F1D	503.75k	1.044M

Result

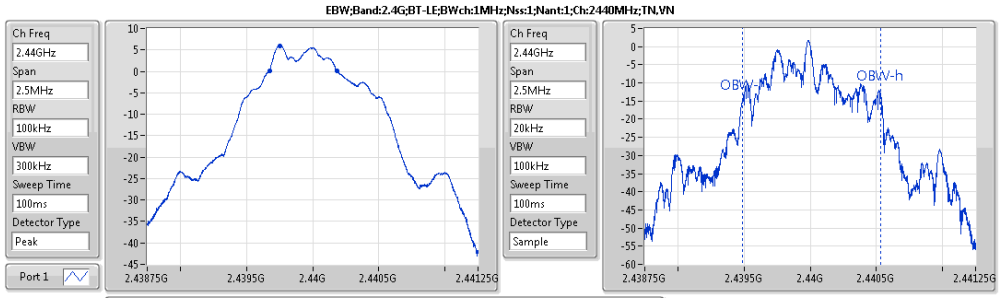
Mode	Result	Limit (Hz)	P1-N dB (Hz)	P1-OBW (Hz)
2.4G;BT-LE;Nss1;Ntx1;2402	Pass	500k	503.75k	1.044M
2.4G;BT-LE;Nss1;Ntx1;2440	Pass	500k	505k	1.044M
2.4G;BT-LE;Nss1;Ntx1;2480	Pass	500k	517.5k	1.044M

EBW;Band:2.4G;BT-LE;BWch:1MHz;Nss:1;Nant:1;Ch:2402MHz;TN,VN



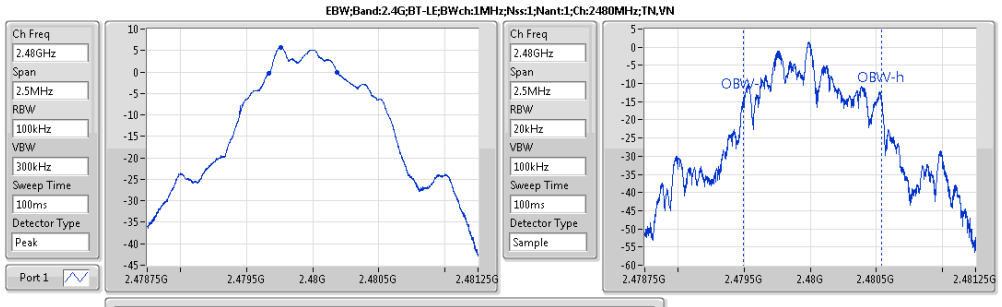
6dB(Hz)	Fl-6dB(Hz)	Fh-6dB(Hz)	OBW(Hz)	Fl-OBW(Hz)	Fh-OBW(Hz)	Limit(Hz)	Port
503.75k	2.401673G	2.402176G	1.044M	2.401484G	2.402528G	500k	1

EBW;Band:2.4G;BT-LE;BWch:1MHz;Nss:1;Nant:1;Ch:2440MHz;TN,VN



6dB(Hz)	Fl-6dB(Hz)	Fh-6dB(Hz)	OBW(Hz)	Fl-OBW(Hz)	Fh-OBW(Hz)	Limit(Hz)	Port
505k	2.439676G	2.440181G	1.044M	2.439488G	2.440532G	500k	1

EBW;Band:2.4G;BT-LE;BWch:1MHz;Nss:1;Nant:1;Ch:2480MHz;TN,VN



6dB(Hz)	Fl-6dB(Hz)	Fh-6dB(Hz)	OBW(Hz)	Fl-OBW(Hz)	Fh-OBW(Hz)	Limit(Hz)	Port
517.5k	2.479669G	2.480186G	1.044M	2.479493G	2.480537G	500k	1

Summary

Mode	Sum (dBm)	Sum (W)	EIRP (dBm)	EIRP (W)
2.4G;BT-LE;Nss1;Ntx1	6.05	0.00403	8.48	0.00705

Result

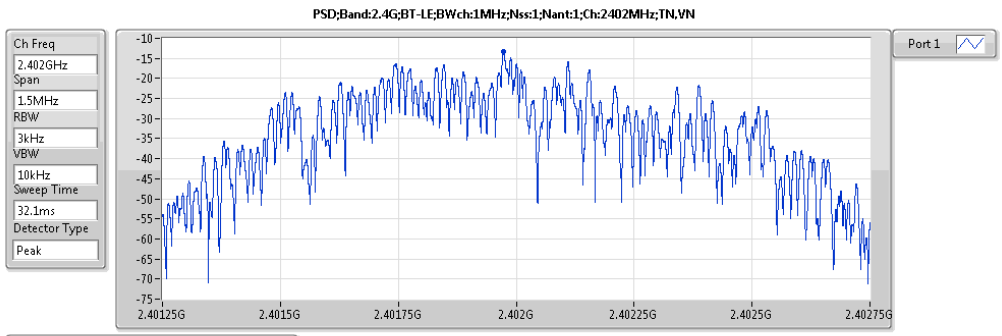
Mode	Result	DG (dBi)	Sum (dBm)	Sum Lim. (dBm)	EIRP (dBm)	P1 (dBm)
2.4G;BT-LE;Nss1;Ntx1;2402	Pass	2.43	5.89	30.00	8.32	5.89
2.4G;BT-LE;Nss1;Ntx1;2440	Pass	2.43	6.05	30.00	8.48	6.05
2.4G;BT-LE;Nss1;Ntx1;2480	Pass	2.43	5.91	30.00	8.34	5.91

Summary

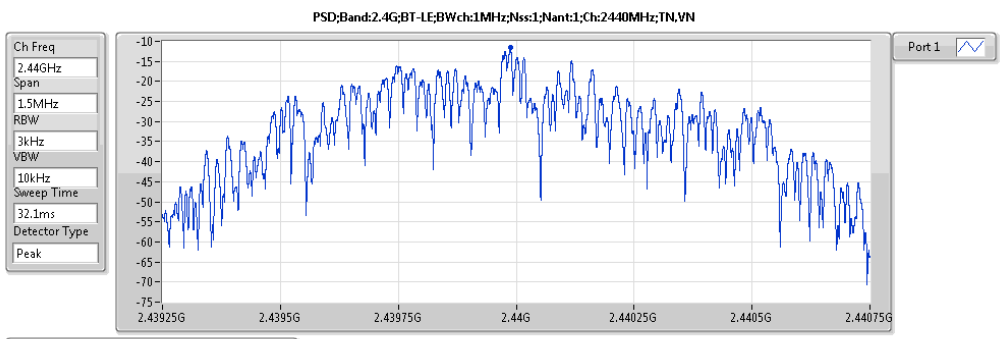
Mode	PD (dBm/RBW)	EIRP.PD (dBm/RBW)
2.4G;BT-LE;Nss1;Ntx1	-11.54	-9.11

Result

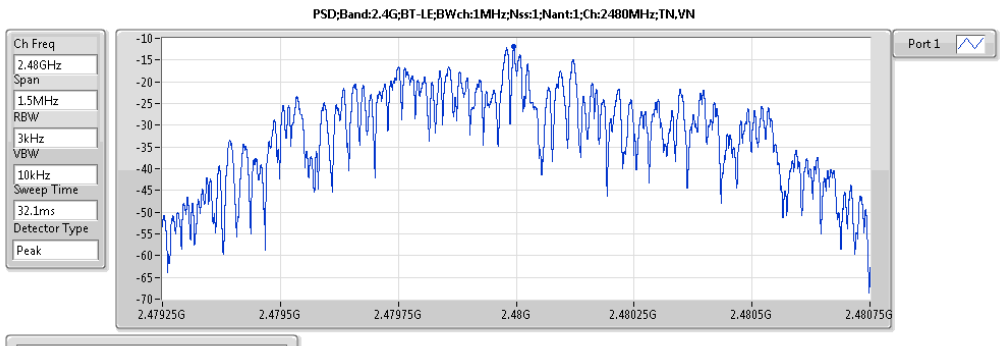
Mode	Result	DG (dBi)	PD (dBm/RBW)	P1 (dBm/RBW)	PD limit (dBm/RBW)
2.4G;BT-LE;Nss1;Ntx1;2402	Pass	2.43	-13.28	-13.28	8
2.4G;BT-LE;Nss1;Ntx1;2440	Pass	2.43	-11.54	-11.54	8
2.4G;BT-LE;Nss1;Ntx1;2480	Pass	2.43	-11.93	-11.93	8



Sum.Max	PD	P1
(dBm/RBW)	(dBm/RBW)	(dBm/RBW)
-13.28	-13.28	-13.28



Sum.Max	PD	P1
(dBm/RBW)	(dBm/RBW)	(dBm/RBW)
-11.54	-11.54	-11.54



Sum.Max	PD	P1
(dBm/RBW)	(dBm/RBW)	(dBm/RBW)
-11.93	-11.93	-11.93

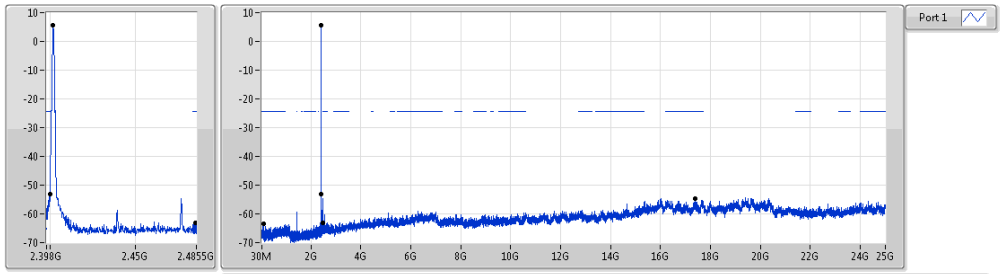
Summary

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
2.4G;BT-LE;Nss1;Ntx1;2402	Pass	2.40167G	5.60	-24.40	99.856M	-63.40	2.399968G	-53.27	2.484808G	-63.08	17.381656G	-54.76	1

Result

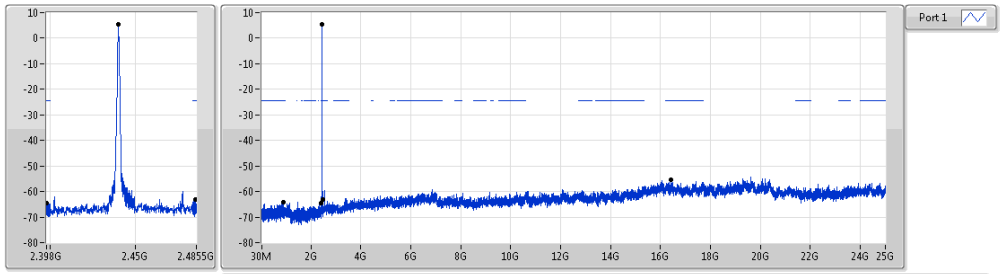
Mode	Result	Ref (Hz)	Ref (dBm)	Limit (dBm)	Freq (Hz)	Level (dBm)	Freq (Hz)	Level (dBm)	Freq (Hz)	Level (dBm)	Freq (Hz)	Level (dBm)	Port
2.4G;BT-LE;Nss1;Ntx1;2402	Pass	2.40167G	5.60	-24.40	99.856M	-63.40	2.399968G	-53.27	2.484808G	-63.08	17.381656G	-54.76	1
2.4G;BT-LE;Nss1;Ntx1;2440	Pass	2.439746G	5.53	-24.40	897.872M	-64.25	2.39812G	-64.49	2.484924G	-63.14	16.413533G	-55.22	1
2.4G;BT-LE;Nss1;Ntx1;2480	Pass	2.479826G	4.92	-24.40	48.944M	-63.02	2.399612G	-64.35	2.483612G	-55.33	16.250302G	-56.13	1

CSE in non-restricted band;PK;Band:2.4G;BT-LE;BWch:1MHz;Nss:1;Nant:1;Ch:2402MHz;TN,VN



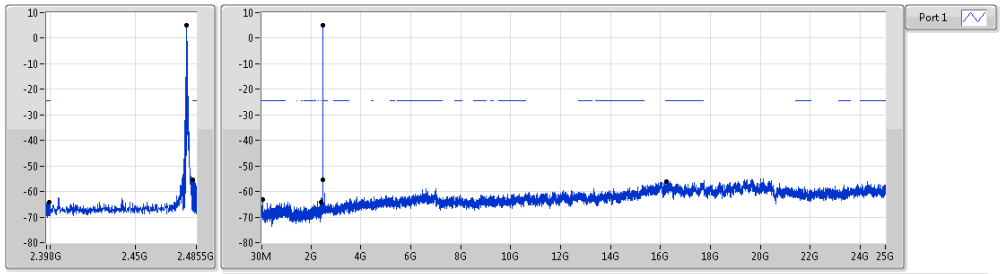
Ref(Hz)	Ref(dBm)	Limit(dBm)	Freq(Hz)	Level(dBm)	Freq(Hz)	Level(dBm)	Freq(Hz)	Level(dBm)	Freq(Hz)	Level(dBm)	Port
2.40167G	5.60	-24.40	99.856M	-63.40	2.399968G	-53.27	2.484808G	-63.08	17.381656G	-54.76	1

CSE in non-restricted band;PK;Band:2.4G;BT-LE;BWch:1MHz;Nss:1;Nant:1;Ch:2440MHz;TN,VN



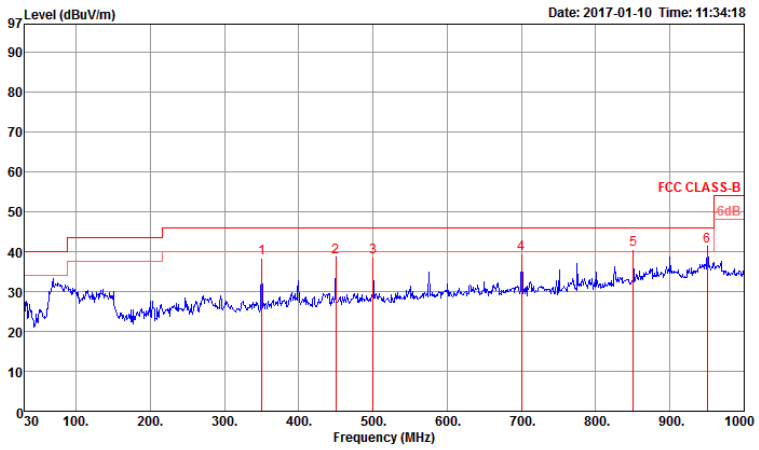
Ref(Hz)	Ref(dBm)	Limit(dBm)	Freq(Hz)	Level(dBm)	Freq(Hz)	Level(dBm)	Freq(Hz)	Level(dBm)	Freq(Hz)	Level(dBm)	Port
2.439746G	5.53	-24.40	897.872M	-64.25	2.39812G	-64.49	2.484924G	-63.14	16.413533G	-55.22	1

CSE in non-restricted band;PK;Band:2.4G;BT-LE;BWch:1MHz;Nss:1;Nant:1;Ch:2480MHz;TN,VN



Ref(Hz)	Ref(dBm)	Limit(dBm)	Freq(Hz)	Level(dBm)	Freq(Hz)	Level(dBm)	Freq(Hz)	Level(dBm)	Freq(Hz)	Level(dBm)	Port
2.479826G	4.92	-24.40	48.944M	-63.02	2.399612G	-64.35	2.483612G	-55.33	16.250302G	-56.13	1

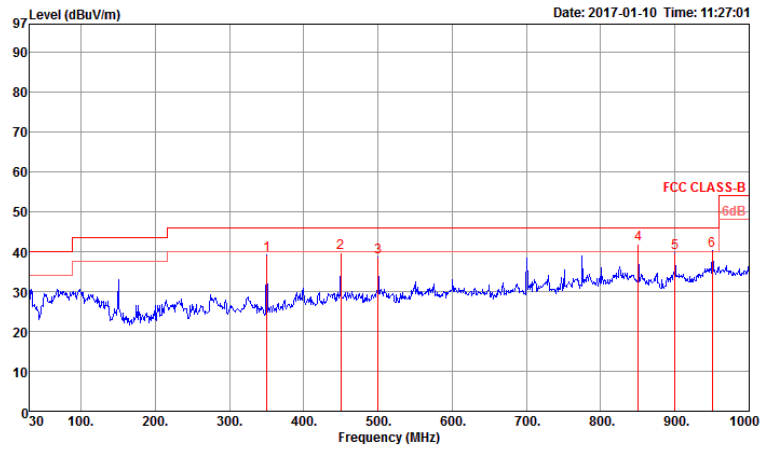
RSE below 1GHz Result			
Operating Mode	2	**Polarization**	Horizontal
Operating Function	CTX		



	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	350.10	38.35	46.00	-7.65	43.06	2.25	21.00	27.96	150	236	Peak	HORIZONTAL
2	450.01	38.75	46.00	-7.25	41.91	2.48	22.90	28.54	125	198	Peak	HORIZONTAL
3	500.45	38.76	46.00	-7.24	41.30	2.58	23.64	28.76	125	328	Peak	HORIZONTAL
4	700.27	39.38	46.00	-6.62	39.26	3.16	25.60	28.64	100	291	Peak	HORIZONTAL
5	850.62	40.53	46.00	-5.47	38.15	3.37	27.20	28.19	100	82	Peak	HORIZONTAL
6	950.53	41.32	46.00	-4.68	37.41	3.62	28.11	27.82	150	247	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	2	**Power Phase**	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	350.10	39.18	46.00	-6.82	43.89	2.25	21.00	27.96	100	143	Peak	VERTICAL
2	450.01	39.67	46.00	-6.33	42.83	2.48	22.90	28.54	125	225	Peak	VERTICAL
3	500.45	38.64	46.00	-7.36	41.18	2.58	23.64	28.76	100	138	Peak	VERTICAL
4	850.62	41.81	46.00	-4.19	39.43	3.37	27.20	28.19	150	304	Peak	VERTICAL
5	900.09	39.61	46.00	-6.39	36.58	3.45	27.60	28.02	100	125	Peak	VERTICAL
6	950.53	40.33	46.00	-5.67	36.42	3.62	28.11	27.82	100	159	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.)

Radiated Emissions (1GHz~10th Harmonic)

Configurations	GFSK CH 0 / Ant. 1

Horizontal

	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	4953.89	37.98	54.00	-16.02	31.19	6.30	33.41	32.92	140	257	Average	HORIZONTAL
2	4962.08	48.11	74.00	-25.89	41.31	6.30	33.41	32.91	140	257	Peak	HORIZONTAL

Vertical

	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	4951.00	38.49	54.00	-15.51	31.73	6.30	33.38	32.92	154	201	Average	VERTICAL
2	4951.95	47.18	74.00	-26.82	40.42	6.30	33.38	32.92	154	201	Peak	VERTICAL

Configurations	GFSK CH 19 / Ant. 1

Horizontal

	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	4882.36	47.16	74.00	-26.84	40.55	6.28	33.26	32.93	152	222	Peak	HORIZONTAL
2	4886.37	38.06	54.00	-15.94	31.45	6.28	33.26	32.93	152	222	Average	HORIZONTAL

Vertical

	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	4877.80	38.83	54.00	-15.17	32.25	6.28	33.23	32.93	170	277	Average	VERTICAL
2	4879.56	47.89	74.00	-26.11	41.31	6.28	33.23	32.93	170	277	Peak	VERTICAL

Configurations	GFSK CH 39 / Ant. 1

Horizontal

	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	4952.07	47.28	74.00	-26.72	40.52	6.30	33.38	32.92	180	242	Peak	HORIZONTAL
2	4962.08	38.24	54.00	-15.76	31.44	6.30	33.41	32.91	180	242	Average	HORIZONTAL

Vertical

	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	4955.00	37.59	54.00	-16.41	30.80	6.30	33.41	32.92	150	168	Average	VERTICAL
2	4955.00	45.72	74.00	-28.28	38.93	6.30	33.41	32.92	150	168	Peak	VERTICAL

Note:

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

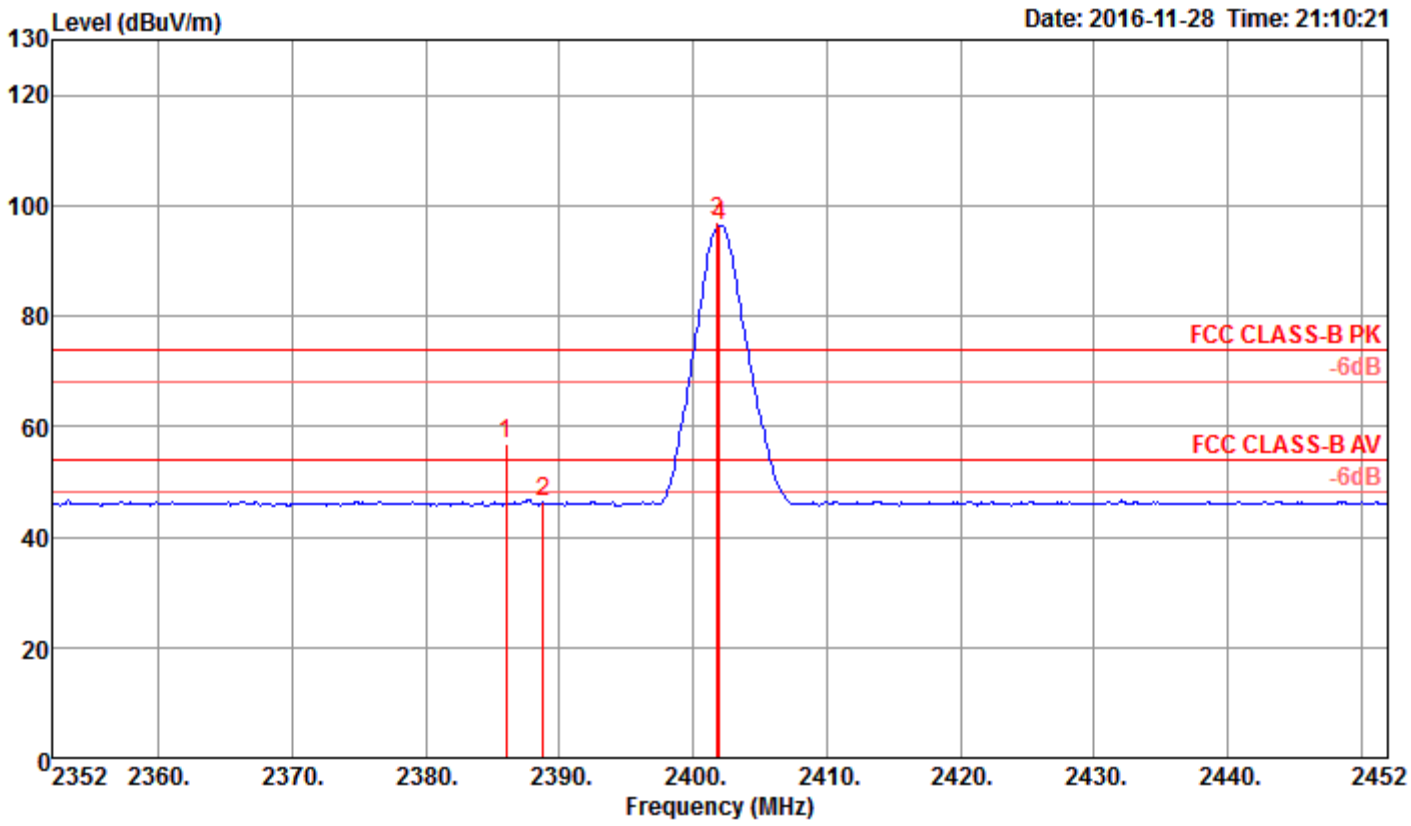
Emission level (dBuV/m) = 20 log Emission level (uV/m).

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

Band Edge Emissions

Configurations	GFSK CH 0, 19, 39 / Ant. 1

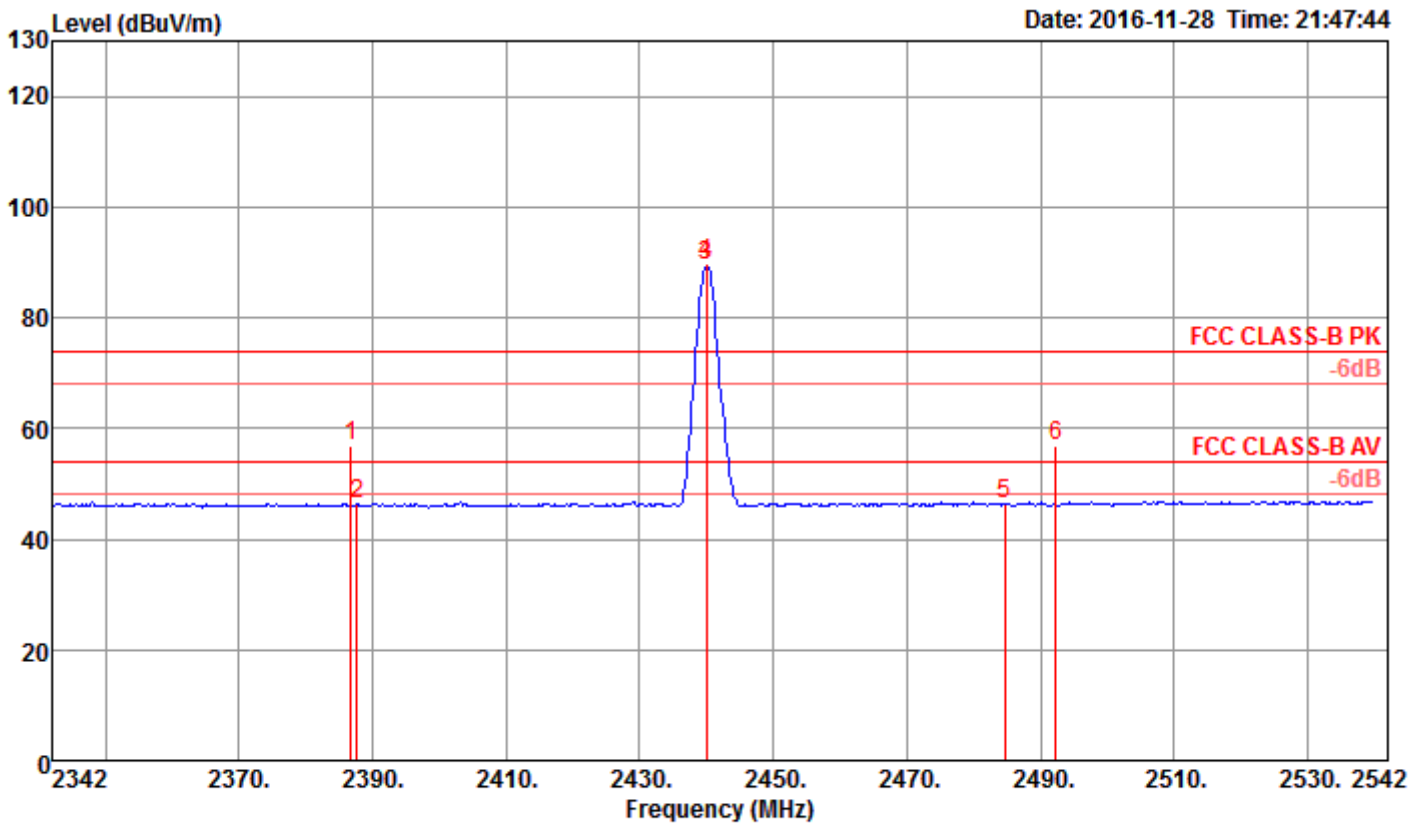
Channel 0



	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	2386.00	57.00	74.00	-17.00	25.09	3.60	28.31	0.00	149	334	Peak	VERTICAL
2	2388.80	46.28	54.00	-7.72	14.37	3.60	28.31	0.00	149	334	Average	VERTICAL
3 @	2401.80	96.95			65.00	3.61	28.34	0.00	149	334	Peak	VERTICAL
4 @	2402.00	96.34			64.39	3.61	28.34	0.00	149	334	Average	VERTICAL

Item 3, 4 are the fundamental frequency at 2402 MHz.

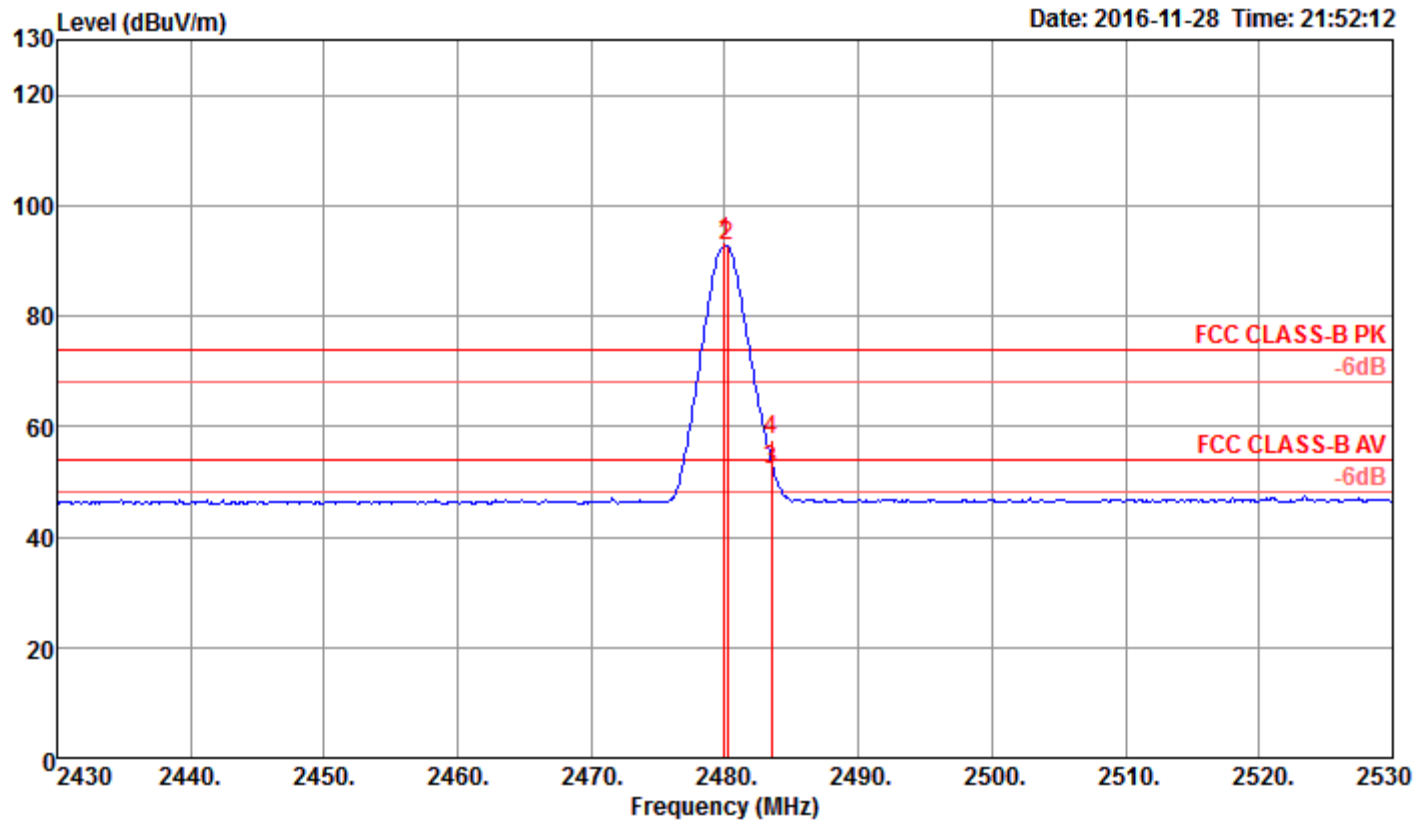
Channel 19



	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	2386.80	57.00	74.00	-17.00	25.09	3.60	28.31	0.00	179	333	Peak	HORIZONTAL
2	2387.60	46.32	54.00	-7.68	14.41	3.60	28.31	0.00	179	333	Average	HORIZONTAL
3 @	2440.00	89.29			57.24	3.64	28.41	0.00	179	333	Average	HORIZONTAL
4 @	2440.00	89.91			57.86	3.64	28.41	0.00	179	333	Peak	HORIZONTAL
5	2484.70	46.43	54.00	-7.57	14.27	3.68	28.48	0.00	179	333	Average	HORIZONTAL
6	2492.30	56.79	74.00	-17.21	24.62	3.68	28.49	0.00	179	333	Peak	HORIZONTAL

Item 3, 4 are the fundamental frequency at 2440 MHz.

Channel 39



	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 @	2480.00	93.32			61.19	3.67	28.46	0.00	198	294	Peak	HORIZONTAL
2 @	2480.20	92.71			60.58	3.67	28.46	0.00	198	294	Average	HORIZONTAL
3	2483.50	52.29	54.00	-1.71	20.13	3.68	28.48	0.00	198	294	Average	HORIZONTAL
4	2483.50	57.74	74.00	-16.26	25.58	3.68	28.48	0.00	198	294	Peak	HORIZONTAL

Item 1, 2 are the fundamental frequency at 2480 MHz.

Note:

Emission level (dBuV/m) = 20 log Emission level (uV/m).

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