



TESTING LABORATORY  
CERTIFICATE #4820.01



## FCC PART 15.247


### TEST REPORT

For

## Shenzhen Soundsoul Information Technology Co., Ltd.

Room 1308-1309, Building B, Huihai Square, Chuangye Road, Longhua District, Shenzhen China.

**FCC ID: 2AFTUYL001**

<b>Report Type:</b> Original Report	<b>Product Name:</b> Bluetooth Headset
<b>Report Number:</b> RDG181011001-00B	
<b>Report Date:</b> 2018-11-05	
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## GENERAL INFORMATION

### Product Description for Equipment under Test (EUT)

<b>EUT Name:</b>	Bluetooth Headset
<b>EUT Model:</b>	TrueFree
<b>Multiple Model(s):</b>	Q32, TrueFree+, TrueFree <sup>2</sup> , Truebuds, True, TrueFree mini, TrueFree Pro, TrueFree Air, TrueFree Max
<b>FCC ID:</b>	2AFTUYL001
<b>Rated Input Voltage:</b>	DC 3.7V from battery or DC 5V from charger box
<b>External Dimension:</b>	24mm(L)*21.9mm(W)*16mm(H)
<b>Serial Number:</b>	181011001
<b>EUT Received Date:</b>	2018-10-11

*Note: The series product, model Q32, TrueFree+, TrueFree<sup>2</sup>, Truebuds, True, TrueFree mini, TrueFree Pro, TrueFree Air, TrueFree Max are electrically identical with TrueFree, we selected TrueFree for fully testing. The difference between them was explained in the attached declaration letter. The left ear headset and right ear headset is electorally identical, we select left ear for fully testing*

### Objective

This report is prepared on behalf of *Shenzhen Soundsoul Information Technology Co., Ltd.* in accordance with Part 2, Subpart J, Part 15, Subparts A, and C of the Federal Communications Commission's rules.

The tests were performed in order to determine the compliance of the EUT with FCC Rules Part 15-Subpart C, section 15.203, 15.205, 15.207, 15.209, 15.247 rules.

### Related Submittal(s)/Grant(s)

FCC Part 15C DSS submissions with FCC ID: 2AFTUYL001.

### Test Methodology

All measurements contained in this report were conducted with ANSI C63.10-2013, American National Standard of Procedures for Compliance Testing of Unlicensed Wireless Devices and KDB 558074 D01 15.247 Meas Guidance v05.

All emissions measurement was performed and Bay Area Compliance Laboratories Corp. (Dongguan).

**Measurement Uncertainty**

Parameter	Measurement Uncertainty
Occupied Channel Bandwidth	±5 %
RF output power, conducted	±0.61dB
Power Spectral Density, conducted	±0.61 dB
Unwanted Emissions, radiated	30M~200MHz: 4.55 dB, 200M~1GHz: 5.92 dB, 1G~6GHz: 4.98 dB, 6G~18GHz: 5.89 dB, 18G~26.5G: 5.47 dB, 26.5G~40G: 5.63 dB
Unwanted Emissions, conducted	±1.5 dB
Temperature	±1 °C
Humidity	±5%
DC and low frequency voltages	±0.4%
Duty Cycle	1%
AC Power Lines Conducted Emission	3.12 dB (150 kHz to 30 MHz)

**Test Facility**

The Test site used by Bay Area Compliance Laboratories Corp. (Dongguan) to collect test data is located on the No.69 Pulongcun, Puxinhu Industry Area, Tangxia, Dongguan, Guangdong, China.

The test site has been approved by the FCC under the KDB 974614 D01 and is listed in the FCC Public Access Link (PAL) database, FCC Registration No. : 897218, the FCC Designation No. : CN1220.

The test site has been registered with ISED Canada under ISED Canada Registration Number 3062D.

## SYSTEM TEST CONFIGURATION

### Description of Test Configuration

The system was configured for testing in engineering mode.

For Bluetooth LE mode, 40 channels are provided for testing:

Channel	Frequency (MHz)	Channel	Frequency (MHz)
0	2402	20	2442
1	2404	...	...
...	...	...	...
...	...	...	...
..	...	38	2478
19	2440	39	2480

EUT was tested with channel 0, 19 and 39.

### Equipment Modifications

No modification was made to the EUT tested.

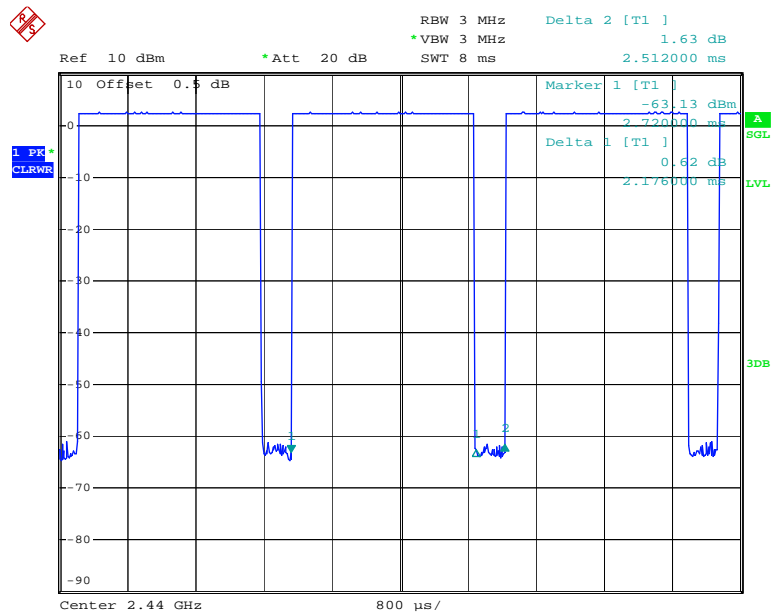
### EUT Exercise Software

Test software: 'RTLBTAPP.exe' was used in test, the system configured maximum power level as default setting.

The duty cycle as below:

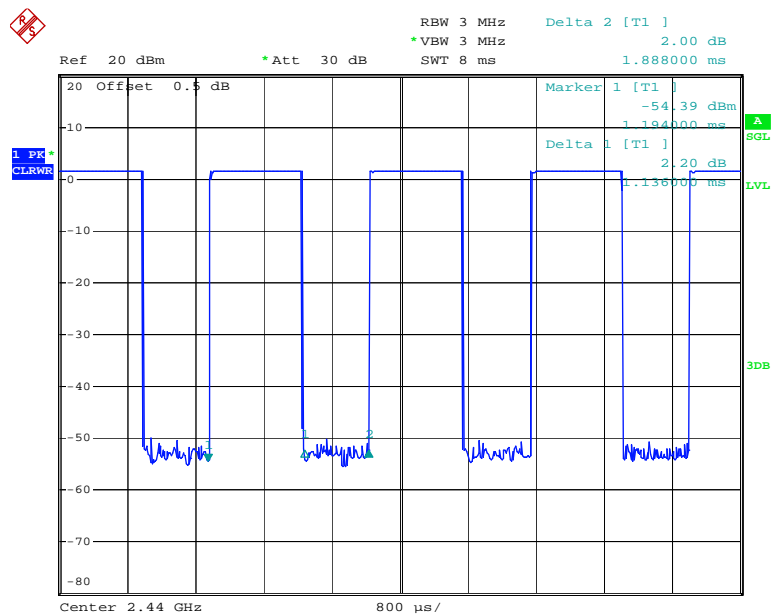
Test mode	T <sub>on</sub> (ms)	T <sub>on+off</sub> (ms)	Duty Cycle (%)
1 Mbps	2.176	2.512	86.62
2 Mbps	1.136	1.888	60.17

### 1 Mbps



Date: 1.NOV.2018 20:04:13

### 2 Mbps



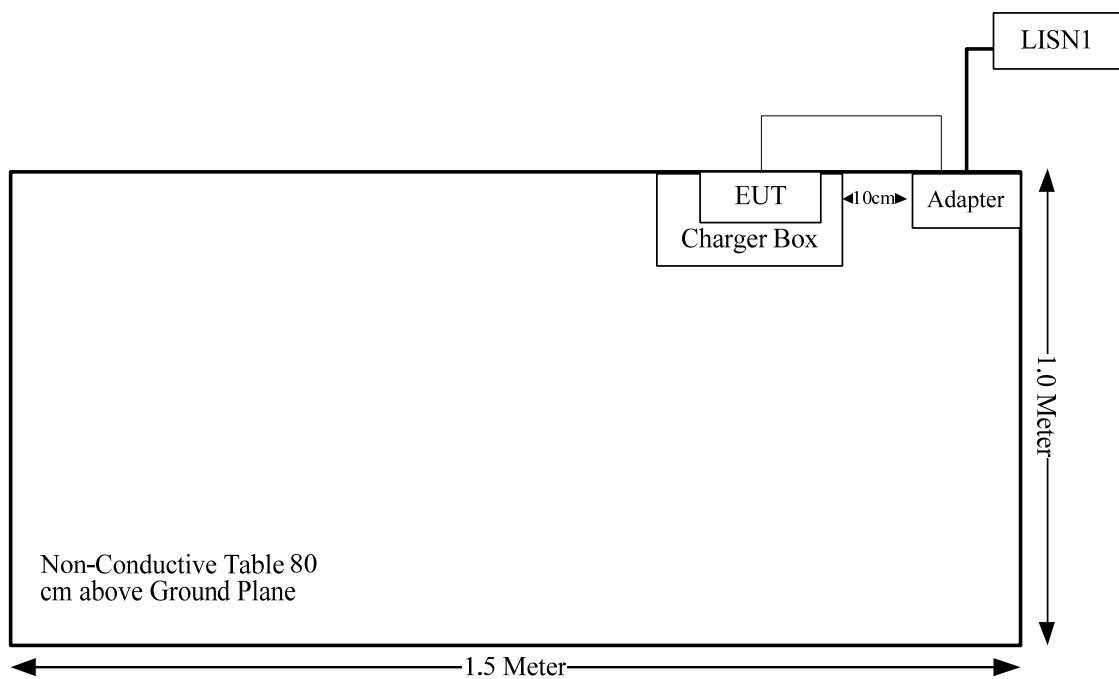
Date: 1.NOV.2018 22:42:53

**Support Equipment List and Details**

Manufacturer	Description	Model	Serial Number
unknown	adapter	HJ-0502000W2-US	/

**Support Cable List and Details**

Cable Description	Shielding Type	Ferrite Core	Length (m)	From Port	To
USB cable	No	No	1	adapter	charger box

**Block Diagram of Test Setup**



**SUMMARY OF TEST RESULTS**

FCC Rules	Description of Test	Result
FCC §15.247 (i) & §1.1310 & §2.1093	RF Exposure	Compliance
§15.203	Antenna Requirement	Compliance
§15.207 (a)	AC Line Conducted Emissions	Compliance
§15.205, §15.209, §15.247(d)	Spurious Emissions	Compliance
§15.247 (a)(2)	6 dB Bandwidth	Compliance
§15.247(b)(3)	Maximum Conducted Output Power	Compliance
§15.247(d)	100 kHz Bandwidth of Frequency Band Edge	Compliance
§15.247(e)	Power Spectral Density	Compliance

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**FCC §15.247 (i) & §1.1310 & §2.1093- RF EXPOSURE**

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**Applicable Standard**

According to §15.247(i) and §1.1310, systems operating under the provisions of this section shall be operated in a manner that ensure that the public is not exposed to radio frequency energy level in excess of the Commission's guideline.

According to KDB447498 D01 General RF Exposure Guidance v06:

The 1-g and 10-g SAR test exclusion thresholds for 100 MHz to 6 GHz at test separation distances  $\leq 50$  mm are determined by:

$[(\text{max. power of channel, including tune-up tolerance, mW}) / (\text{min. test separation distance, mm})] \cdot [\sqrt{f(\text{GHz})}] \leq 3.0$  for 1-g SAR and  $\leq 7.5$  for 10-g extremity SAR, where

- $f(\text{GHz})$  is the RF channel transmit frequency in GHz
- Power and distance are rounded to the nearest mW and mm before calculation
- The result is rounded to one decimal place for comparison
- 3.0 and 7.5 are referred to as the numeric thresholds in the step 2 below

The test exclusions are applicable only when the minimum test separation distance is  $\leq 50$  mm and for transmission frequencies between 100 MHz and 6 GHz. When the minimum test separation distance is  $< 5$  mm, a distance of 5 mm according to 5) in section 4.1 is applied to determine SAR test exclusion.

When an antenna qualifies for the standalone SAR test exclusion of 4.3.1 and also transmits simultaneously with other antennas, the standalone SAR value must be estimated according to the following to determine the simultaneous transmission SAR test exclusion criteria:  $[(\text{max. power of channel, including tune-up tolerance, mW}) / (\text{min. test separation distance, mm})] \cdot [\sqrt{f(\text{GHz})}/x]$  W/kg, for test separation distances  $\leq 50$  mm; where  $x = 7.5$  for 1-g SAR and  $x = 18.75$  for 10-g SAR.

**Measurement Result**

The max conducted power including tune-up tolerance is 3.0 dBm (2.0 mW).

$[(\text{max. power of channel, mW}) / (\text{min. test separation distance, mm})] \cdot [\sqrt{f(\text{GHz})}]$   
 $= 2.0/5 \cdot (\sqrt{2.480}) = 0.6 < 3.0$

**So the SAR test is not necessary.**

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## **FCC §15.203 - ANTENNA REQUIREMENT**

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### **Applicable Standard**

According to § 15.203, an intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device. The use of a permanently attached antenna or of an antenna that uses a unique coupling to the intentional radiator shall be considered sufficient to comply with the provisions of this section. The manufacturer may design the unit so that a broken antenna can be replaced by the user, but the user of a standard antenna jack or electrical connector is prohibited. The structure and application of the EUT were analyzed to determine compliance with section §15.203 of the rules. §15.203 state that the subject device must meet the following criteria:

- a. Antenna must be permanently attached to the unit.
- b. Antenna must use a unique type of connector to attach to the EUT.
- c. Unit must be professionally installed, and installer shall be responsible for verifying that the correct antenna is employed with the unit.

### **Antenna Information And Connector Construction**

The EUT has one internal antenna arrangement for BT, and the antenna gain is 2.5 dBi, fulfill the requirement of this section. Please refer to the EUT photos.

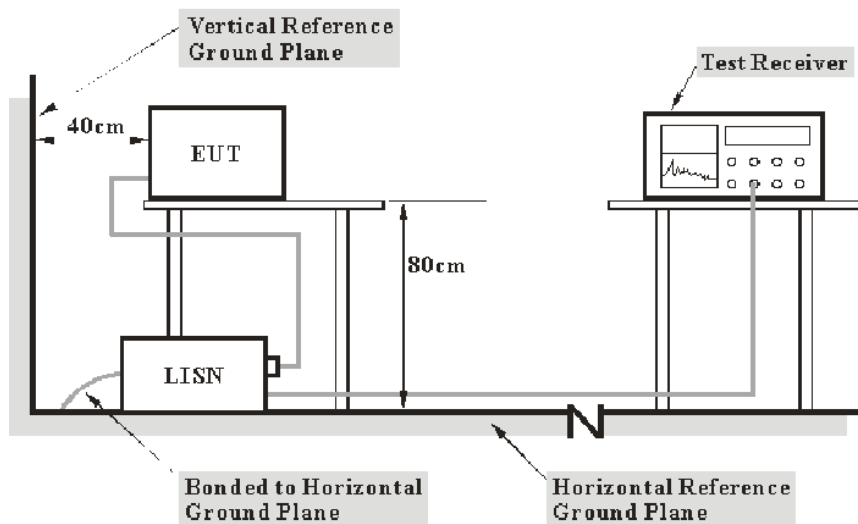
**Result:** Compliance.

## FCC §15.207 (a)– AC LINE CONDUCTED EMISSIONS

### Applicable Standard

FCC§15.207(a)

### EUT Setup



Note: 1. Support units were connected to second LISN.  
2. Both of LISNs (AMN) 80 cm from EUT and at the least 80 cm from other units and other metal planes support units.

The setup of EUT is according with per ANSI C63.10-2013 measurement procedure. The specification used was with the FCC Part 15.207.

The spacing between the peripherals was 10 cm.

The adapter was connected to the main lisn with a 120 V/60 Hz AC power source.

### EMI Test Receiver Setup

The EMI test receiver was set to investigate the spectrum from 150 kHz to 30 MHz.

During the conducted emission test, the EMI test receiver was set with the following configurations:

Frequency Range	IF B/W
150 kHz – 30 MHz	9 kHz

### Test Procedure

During the conducted emission test, the adapter was connected to the first LISN.

Maximizing procedure was performed on the six (6) highest emissions of the EUT.

All data was recorded in the Quasi-peak and average detection mode.

## Corrected Amplitude & Margin Calculation

The basic equation is as follows:

$$V_C = V_R + A_C + VDF$$

$$C_f = A_C + VDF$$

Herein,

$V_C$  (cord. Reading): corrected voltage amplitude

$V_R$ : reading voltage amplitude

$A_C$ : attenuation caused by cable loss

$VDF$ : voltage division factor of AMN

$C_f$ : Correction Factor

The “**Margin**” column of the following data tables indicates the degree of compliance within the applicable limit. For example, a margin of 7dB means the emission is 7dB below the limit. The equation for margin calculation is as follows:

$$\text{Margin} = \text{Limit} - \text{Corrected Amplitude}$$

## Test Equipment List and Details

Manufacturer	Description	Model	Serial Number	Calibration Date	Calibration Due Date
R&S	EMI Test Receiver	ESCS 30	830245/006	2017-12-11	2018-12-11
Unknown	Coaxial Cable	C-NJNJ-50	C-0200-01	2018-09-05	2019-09-05
R&S	Test Software	EMC32	Version8.53.0	N/A	N/A
R&S	Two-line V-network	ENV 216	101614	2017-12-08	2018-12-08

\* **Statement of Traceability:** Bay Area Compliance Laboratories Corp. (Dongguan) attests that all calibrations have been performed, traceable to National Primary Standards and International System of Units (SI).

## Test Data

### Environmental Conditions

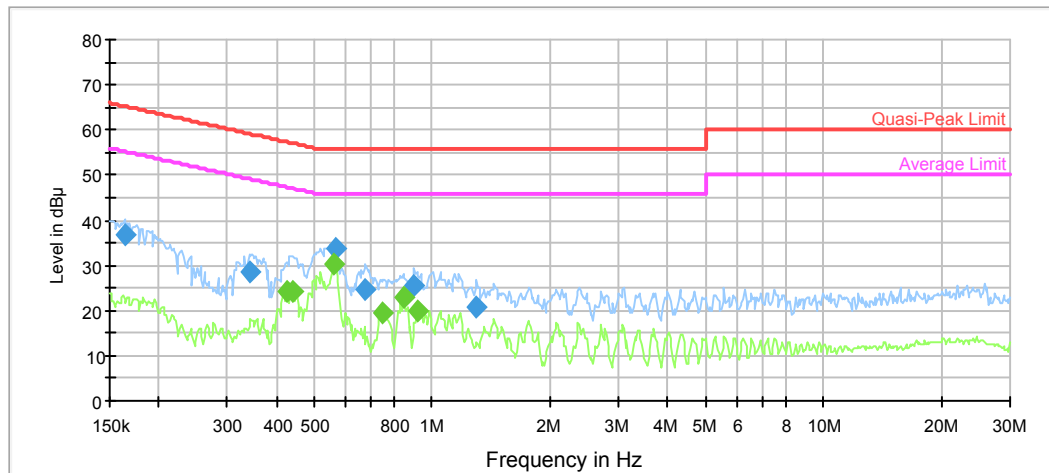
Temperature:	28.1 °C
Relative Humidity:	53 %
ATM Pressure:	100.4 kPa

*The testing was performed by Lily Xie on 2018-10-27.*

Test Mode: Transmitting (2Mbps low channel was the worst)

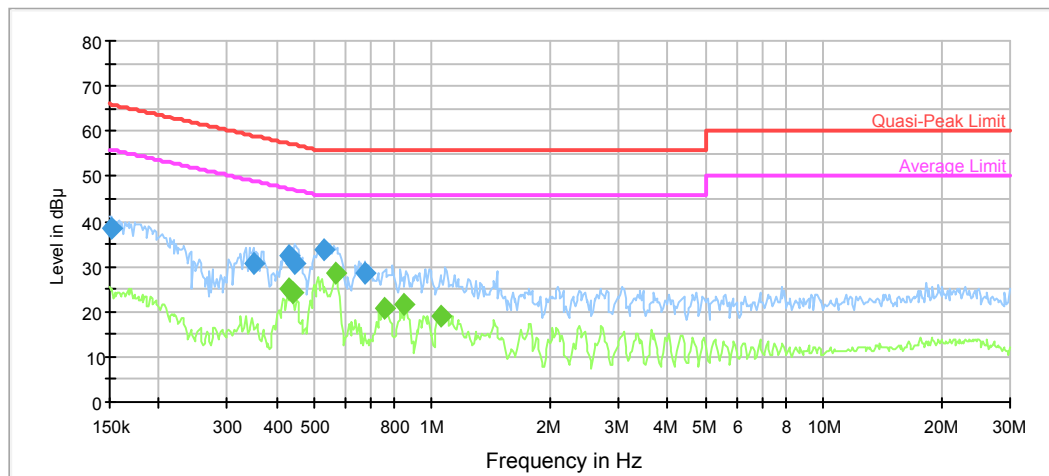
For Charging Box#1

AC120 V, 60 Hz, Line:



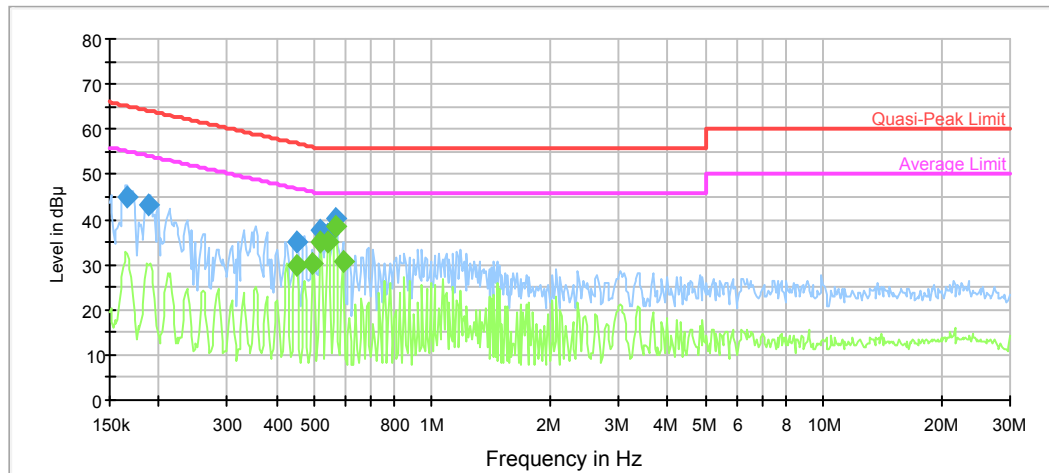
Frequency (MHz)	QuasiPeak (dBμV)	Bandwidth (kHz)	Line	Corr. (dB)	Margin (dB)	Limit (dBμV)	Comment
0.163741	36.9	9.000	L1	11.0	28.4	65.3	Compliance
0.340821	28.7	9.000	L1	10.1	30.5	59.2	Compliance
0.567545	33.9	9.000	L1	9.8	22.1	56.0	Compliance
0.676289	24.8	9.000	L1	9.8	31.2	56.0	Compliance
0.900972	25.6	9.000	L1	9.8	30.4	56.0	Compliance
1.299858	20.8	9.000	L1	9.8	35.2	56.0	Compliance

Frequency (MHz)	Average (dBμV)	Bandwidth (kHz)	Line	Corr. (dB)	Margin (dB)	Limit (dBμV)	Comment
0.426011	24.0	9.000	L1	9.9	23.3	47.3	Compliance
0.439808	24.3	9.000	L1	9.9	22.8	47.1	Compliance
0.563041	30.4	9.000	L1	9.8	15.6	46.0	Compliance
0.750100	19.6	9.000	L1	9.8	26.4	46.0	Compliance
0.845331	23.1	9.000	L1	9.8	22.9	46.0	Compliance
0.922769	20.0	9.000	L1	9.8	26.0	46.0	Compliance

**AC120 V, 60 Hz, Neutral:**

Frequency (MHz)	QuasiPeak (dBμV)	Bandwidth (kHz)	Line	Corr. (dB)	Margin (dB)	Limit (dBμV)	Comment
0.151200	38.5	9.000	N	11.1	27.4	65.9	Compliance
0.349066	30.5	9.000	N	10.0	28.5	59.0	Compliance
0.429420	32.3	9.000	N	9.9	25.0	57.3	Compliance
0.446873	30.8	9.000	N	9.9	26.1	56.9	Compliance
0.532496	33.6	9.000	N	9.9	22.4	56.0	Compliance
0.670921	28.3	9.000	N	9.8	27.7	56.0	Compliance

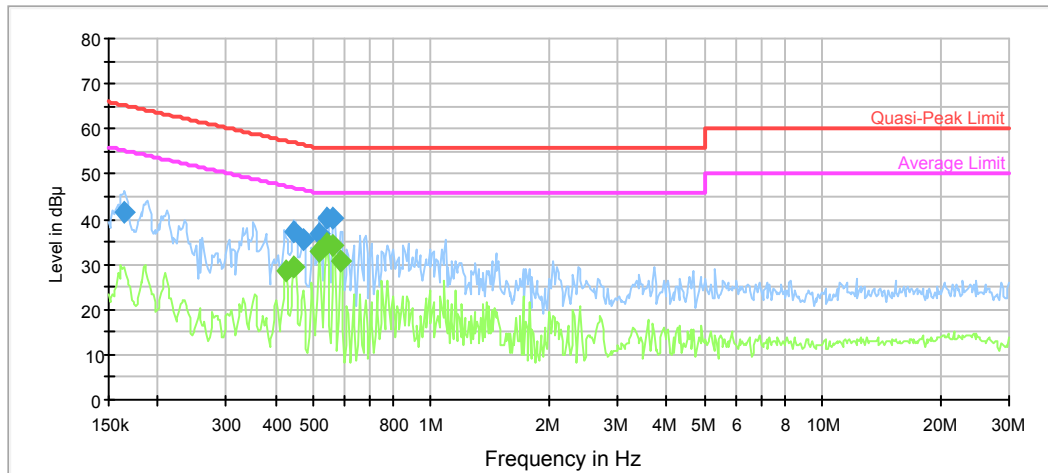
Frequency (MHz)	Average (dBμV)	Bandwidth (kHz)	Line	Corr. (dB)	Margin (dB)	Limit (dBμV)	Comment
0.429420	25.1	9.000	N	9.9	22.2	47.3	Compliance
0.439808	24.2	9.000	N	9.9	22.9	47.1	Compliance
0.567545	28.4	9.000	N	9.8	17.6	46.0	Compliance
0.756101	20.8	9.000	N	9.8	25.2	46.0	Compliance
0.845331	21.5	9.000	N	9.8	24.5	46.0	Compliance
1.056628	19.0	9.000	N	9.8	27.0	46.0	Compliance

**For Charging Box#2****AC120V, 60 Hz, Line:**

Frequency (MHz)	QuasiPeak (dBμV)	Bandwidth (kHz)	Line	Corr. (dB)	Margin (dB)	Limit (dBμV)	Comment
0.166371	44.9	9.000	L1	11.0	20.2	65.1	Compliance
0.188994	43.4	9.000	L1	10.7	20.7	64.1	Compliance
0.450448	35.0	9.000	L1	9.9	21.9	56.9	Compliance
0.519918	37.4	9.000	L1	9.9	18.6	56.0	Compliance
0.541050	36.9	9.000	L1	9.9	19.1	56.0	Compliance
0.567545	40.2	9.000	L1	9.8	15.8	56.0	Compliance

Frequency (MHz)	Average (dBμV)	Bandwidth (kHz)	Line	Corr. (dB)	Margin (dB)	Limit (dBμV)	Comment
0.450448	29.9	9.000	L1	9.9	16.9	46.8	Compliance
0.495646	30.2	9.000	L1	9.9	15.9	46.1	Compliance
0.519918	34.9	9.000	L1	9.9	11.1	46.0	Compliance
0.541050	35.0	9.000	L1	9.9	11.0	46.0	Compliance
0.567545	38.6	9.000	L1	9.8	7.4	46.0	Compliance
0.590613	30.7	9.000	L1	9.8	15.3	46.0	Compliance



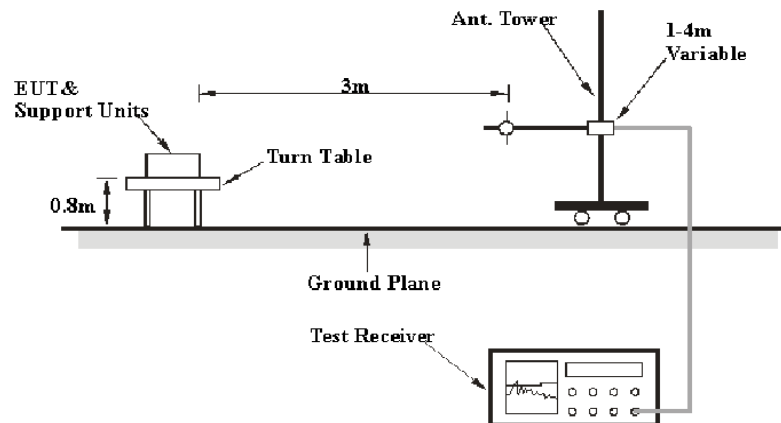
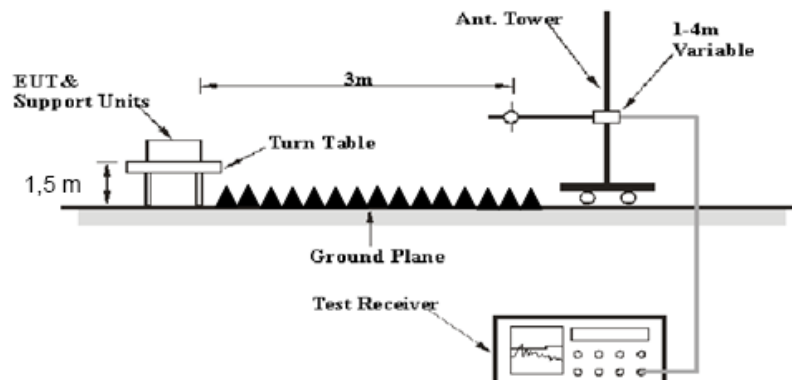
**AC120V, 60 Hz, Neutral:**

Frequency (MHz)	QuasiPeak (dBμV)	Bandwidth (kHz)	Line	Corr. (dB)	Margin (dB)	Limit (dBμV)	Comment
0.165051	41.7	9.000	N	11.0	23.5	65.2	Compliance
0.446873	37.2	9.000	N	9.9	19.7	56.9	Compliance
0.472507	35.6	9.000	N	9.9	20.9	56.5	Compliance
0.519918	36.7	9.000	N	9.9	19.3	56.0	Compliance
0.541050	40.3	9.000	N	9.8	15.7	56.0	Compliance
0.563041	40.2	9.000	N	9.8	15.8	56.0	Compliance

Frequency (MHz)	Average (dBμV)	Bandwidth (kHz)	Line	Corr. (dB)	Margin (dB)	Limit (dBμV)	Comment
0.426011	28.4	9.000	N	9.9	19.0	47.4	Compliance
0.446873	29.2	9.000	N	9.9	17.7	46.9	Compliance
0.519918	32.7	9.000	N	9.9	13.3	46.0	Compliance
0.541050	34.8	9.000	N	9.8	11.2	46.0	Compliance
0.563041	34.3	9.000	N	9.8	11.7	46.0	Compliance
0.585926	30.5	9.000	N	9.8	15.5	46.0	Compliance

**FCC §15.209, §15.205, §15.247(d) - SPURIOUS EMISSIONS****Applicable Standard**

FCC §15.247 (d); §15.209; §15.205

**EUT Setup****Below 1GHz:****Above 1GHz:**

The radiated emission tests were performed in the 10 meters chamber test site for the range 30MHz to 1GHz and the 3 meters chamber B test site for above 1GHz, using the setup accordance with the ANSI C63.10-2013. The specification used was the FCC 15.209, and FCC 15.247 limits.

The spacing between the peripherals was 10 cm.

## EMI Test Receiver & Spectrum Analyzer Setup

The system was investigated from 30 MHz to 25 GHz.

During the radiated emission test, the EMI test receiver & Spectrum Analyzer Setup were set with the following configurations:

30MHz-1000MHz:

Measurement	RBW	Video B/W	IF B/W
QP	120 kHz	300 kHz	120kHz

1GHz- 25GHz:

Measurement	Duty cycle	RBW	Video B/W
PK	Any	1MHz	3 MHz
Ave.	>98%	1MHz	10 Hz
	<98%	1MHz	1/T

Note: T is minimum transmission duration

## Test Procedure

Maximizing procedure was performed on the highest emissions to ensure that the EUT complied with all installation combinations.

Data was recorded in Quasi-peak detection mode for frequency range of 30 MHz-1 GHz, peak and Average detection modes for frequencies above 1 GHz.

## Corrected Amplitude & Margin Calculation

The Corrected Amplitude is calculated by adding the Antenna Factor and Cable Loss, and subtracting the Amplifier Gain from the Meter Reading. The basic equation is as follows:

$$\text{Corrected Amplitude} = \text{Meter Reading} + \text{Antenna Factor} + \text{Cable Loss} - \text{Amplifier Gain}$$

The “**Margin**” column of the following data tables indicates the degree of compliance with the applicable limit. For example, a margin of 7dB means the emission is 7dB below the limit. The equation for margin calculation is as follows:

$$\text{Margin} = \text{Limit} - \text{Corrected Amplitude}$$

**Test Equipment List and Details**

Manufacturer	Description	Model	Serial Number	Calibration Date	Calibration Due Date
R&S	EMI Test Receiver	ESCI	100035	2018-08-03	2019-08-03
Farad	Test Software	EZ-EMC	V1.1.4.2	N/A	N/A
Sunol Sciences	Antenna	JB3	A060611-3	2017-07-21	2019-07-21
Unknown	Coaxial Cable	C-NJNJ-50	C-0400-02	2018-09-05	2019-09-05
Unknown	Coaxial Cable	C-NJNJ-50	C-0075-02	2018-09-05	2019-09-05
Unknown	Coaxial Cable	C-NJNJ-50	C-2200-01	2018-09-05	2019-09-05
HP	Amplifier	8447F	2443A01912	2018-09-05	2019-09-05
Agilent	Spectrum Analyzer	E4440A	SG43360054	2018-01-04	2019-01-04
ETS-Lindgren	Horn Antenna	3115	000 527 35	2016-01-05	2019-01-04
Ducommun Technologies	Horn Antenna	ARH-4223-02	1007726-01 1304	2016-11-18	2019-11-18
MITEQ	Amplifier	AFS42-00101800- 25-S-42	2001271	2018-09-05	2019-09-05
Quinstar	Amplifier	QLW-18405536-JO	15964001001	2018-06-27	2019-06-27
Unknown	Coaxial Cable	C-SJSJ-50	C-0800-01	2018-09-05	2019-09-05
Unknown	Coaxial Cable	C-2.4J2.4J-50	C-0700-02	2018-06-27	2019-06-27
E-Microwave	Band-stop Filters	OBSF-2400-2483.5-S	OE01601525	2018-06-16	2019-06-16
Micro-tronics	High Pass Filter	HPM50111	S/N-G217	2018-06-16	2019-06-16

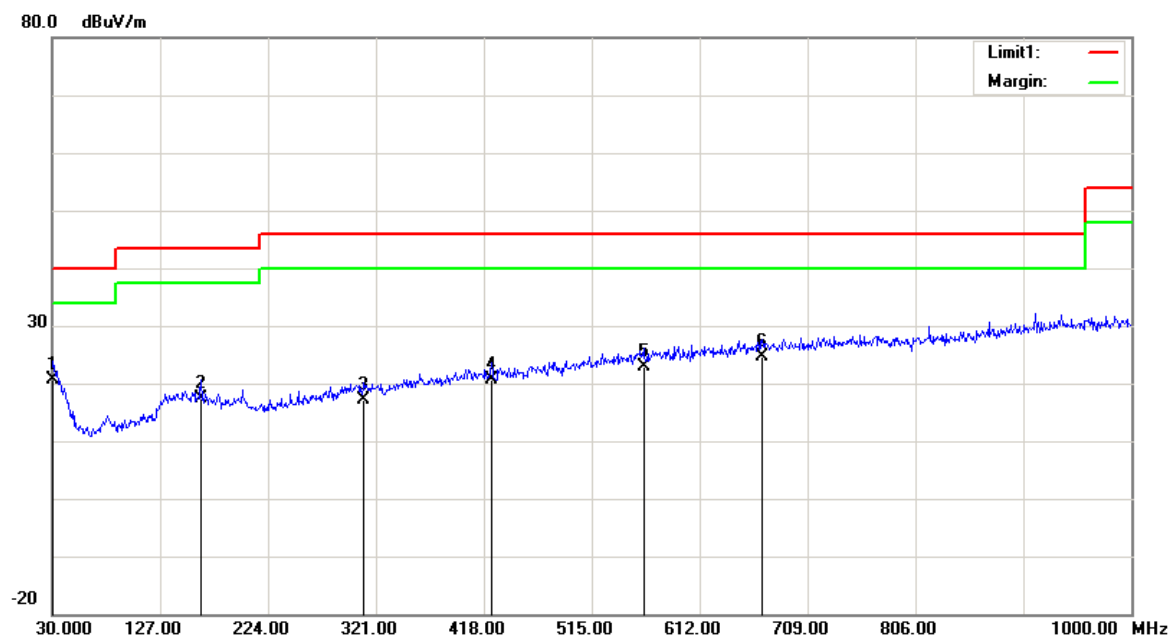
\* **Statement of Traceability:** Bay Area Compliance Laboratories Corp. (Dongguan) attests that all calibrations have been performed, traceable to National Primary Standards and International System of Units (SI).

**Test Data****Environmental Conditions**

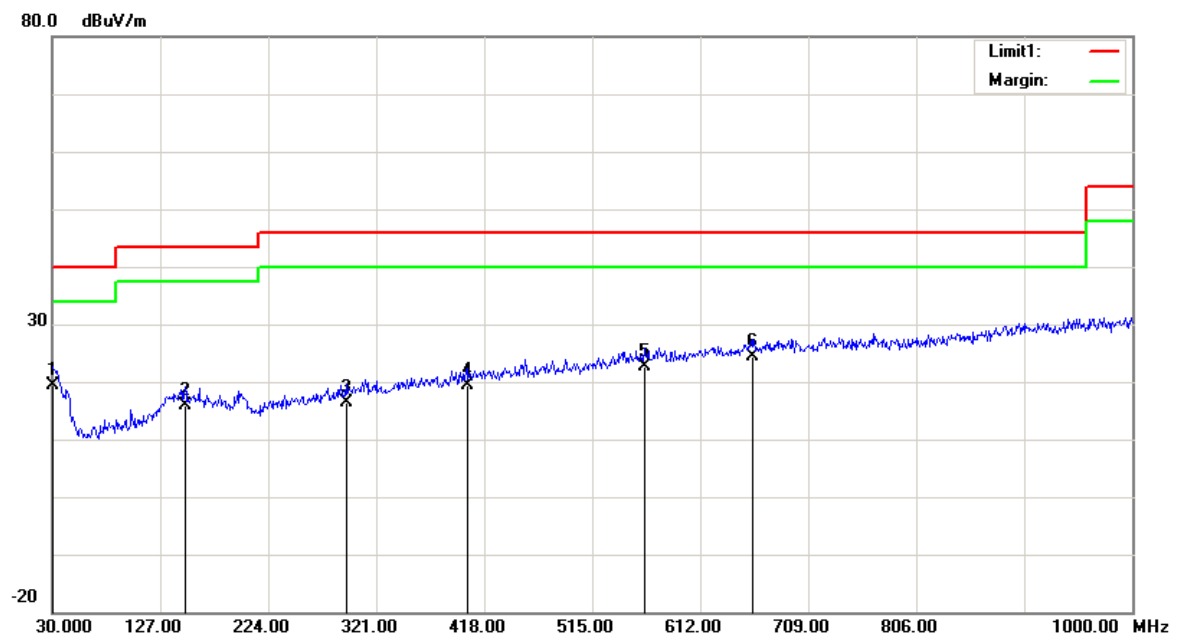
<b>Temperature:</b>	24.8~26.8°C
<b>Relative Humidity:</b>	36~48 %
<b>ATM Pressure:</b>	100.6~101 kPa

\* The testing was performed by Alex You & Kami Zhou from 2018-10-29 to 2018-11-02.

Test Mode: Transmitting (left ear headset was the worst)

**1) 30MHz-1GHz (2Mbps Low Channel was the worst):****Horizontal:**

Frequency (MHz)	Receiver Reading (dBuV)	Detector	Correction Factor (dB/m)	Cord. Amp. (dBuV/m)	Limit (dBuV/m)	Margin (dB)
30.9700	25.58	QP	-4.88	20.70	40.00	19.30
163.8600	27.04	QP	-9.54	17.50	43.50	26.00
310.3300	24.13	QP	-7.03	17.10	46.00	28.90
424.7900	25.47	QP	-4.77	20.70	46.00	25.30
561.5600	24.52	QP	-1.52	23.00	46.00	23.00
668.2600	24.58	QP	0.12	24.70	46.00	21.30

**Vertical:**

Frequency (MHz)	Receiver Reading (dBuV)	Detector	Correction Factor (dB/m)	Cord. Amp. (dBuV/m)	Limit (dBuV/m)	Margin (dB)
30.0000	23.83	QP	-4.33	19.50	40.00	20.50
149.3100	25.56	QP	-9.56	16.00	43.50	27.50
293.8400	24.20	QP	-7.70	16.50	46.00	29.50
402.4800	24.46	QP	-5.16	19.30	46.00	26.70
561.5600	24.22	QP	-1.52	22.70	46.00	23.30
659.5300	24.49	QP	-0.09	24.40	46.00	21.60

**2) 1-25GHz:****1 Mbps Mode:**

Frequency (MHz)	Receiver		Rx Antenna		Cable loss (dB)	Amplifier Gain (dB)	Corrected Amplitude (dBμV/m)	Limit (dBμV/m)	Margin (dB)
	Reading (dBμV)	Remark	Polar (H/V)	Factor (dB/m)					
Low Channel: 2402 MHz									
2402.00	56.14	PK	H	28.10	1.80	0.00	86.04	N/A	N/A
2402.00	48.71	AV	H	28.10	1.80	0.00	78.61	N/A	N/A
2402.00	54.90	PK	V	28.10	1.80	0.00	84.80	N/A	N/A
2402.00	47.24	AV	V	28.10	1.80	0.00	77.14	N/A	N/A
2390.00	24.51	PK	H	28.08	1.80	0.00	54.39	74.00	19.61
2390.00	12.34	AV	H	28.08	1.80	0.00	42.22	54.00	11.78
4804.00	59.36	PK	H	32.91	3.17	37.20	58.24	74.00	15.76
4804.00	53.90	AV	H	32.91	3.17	37.20	52.78	54.00	1.22
7206.00	52.96	PK	H	35.74	4.82	37.23	56.29	74.00	17.71
7206.00	45.40	AV	H	35.74	4.82	37.23	48.73	54.00	5.27
Middle Channel: 2440 MHz									
2440.00	57.83	PK	H	28.18	1.82	0.00	87.83	N/A	N/A
2440.00	49.90	AV	H	28.18	1.82	0.00	79.90	N/A	N/A
2440.00	56.85	PK	V	28.18	1.82	0.00	86.85	N/A	N/A
2440.00	49.17	AV	V	28.18	1.82	0.00	79.17	N/A	N/A
4880.00	53.41	PK	H	33.06	3.27	37.21	52.53	74.00	21.47
4880.00	45.58	AV	H	33.06	3.27	37.21	44.70	54.00	9.30
7320.00	47.51	PK	H	36.03	4.62	37.37	50.79	74.00	23.21
7320.00	35.15	AV	H	36.03	4.62	37.37	38.43	54.00	15.57
High Channel: 2480 MHz									
2480.00	59.78	PK	H	28.26	1.84	0.00	89.88	N/A	N/A
2480.00	52.38	AV	H	28.26	1.84	0.00	82.48	N/A	N/A
2480.00	58.92	PK	V	28.26	1.84	0.00	89.02	N/A	N/A
2480.00	51.96	AV	V	28.26	1.84	0.00	82.06	N/A	N/A
2483.50	25.48	PK	H	28.27	1.84	0.00	55.59	74.00	18.41
2483.50	13.27	AV	H	28.27	1.84	0.00	43.38	54.00	10.62
4960.00	58.62	PK	H	33.22	3.23	37.25	57.82	74.00	16.18
4960.00	50.56	AV	H	33.22	3.23	37.25	49.76	54.00	4.24
7440.00	47.79	PK	H	36.34	4.41	37.52	51.02	74.00	22.98
7440.00	32.29	AV	H	36.34	4.41	37.52	35.52	54.00	18.48

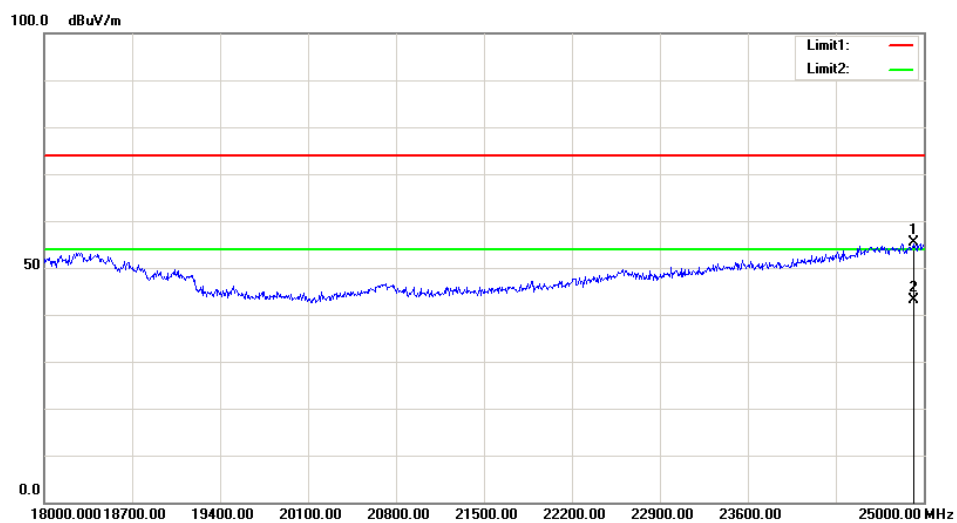
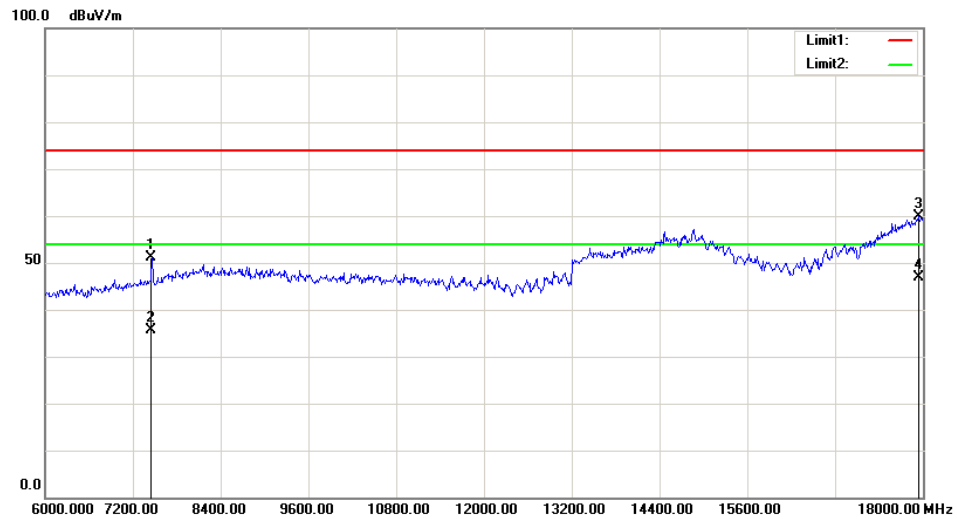
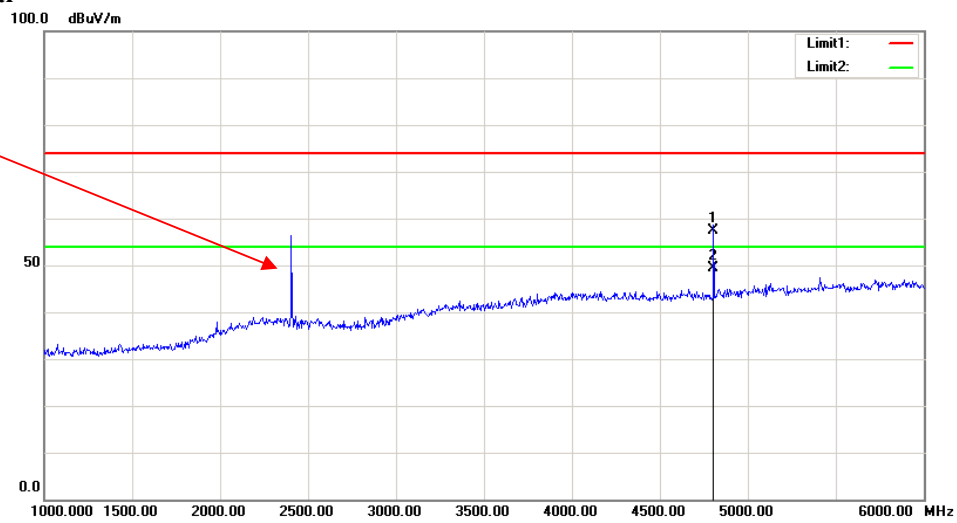
**2 Mbps Mode:**

Frequency (MHz)	Receiver		Rx Antenna		Cable loss (dB)	Amplifier Gain (dB)	Corrected Amplitude (dBμV/m)	Limit (dBμV/m)	Margin (dB)
	Reading (dBμV)	Remark	Polar (H/V)	Factor (dB/m)					
Low Channel: 2402 MHz									
2402.00	57.80	PK	H	28.10	1.80	0.00	87.70	N/A	N/A
2402.00	51.75	AV	H	28.10	1.80	0.00	81.65	N/A	N/A
2402.00	56.93	PK	V	28.10	1.80	0.00	86.83	N/A	N/A
2402.00	50.86	AV	V	28.10	1.80	0.00	80.76	N/A	N/A
2390.00	24.49	PK	H	28.08	1.80	0.00	54.37	74.00	19.63
2390.00	13.86	AV	H	28.08	1.80	0.00	43.74	54.00	10.26
4804.00	58.61	PK	H	32.91	3.17	37.20	57.49	74.00	16.51
4804.00	48.11	AV	H	32.91	3.17	37.20	46.99	54.00	7.01
7206.00	52.15	PK	H	35.74	4.82	37.23	55.48	74.00	18.52
7206.00	42.24	AV	H	35.74	4.82	37.23	45.57	54.00	8.43
Middle Channel: 2440 MHz									
2440.00	59.63	PK	H	28.18	1.82	0.00	89.63	N/A	N/A
2440.00	53.44	AV	H	28.18	1.82	0.00	83.44	N/A	N/A
2440.00	58.27	PK	V	28.18	1.82	0.00	88.27	N/A	N/A
2440.00	52.18	AV	V	28.18	1.82	0.00	82.18	N/A	N/A
4880.00	59.39	PK	H	33.06	3.27	37.21	58.51	74.00	15.49
4880.00	49.23	AV	H	33.06	3.27	37.21	48.35	54.00	5.65
7320.00	50.63	PK	H	36.03	4.62	37.37	53.91	74.00	20.09
7320.00	40.00	AV	H	36.03	4.62	37.37	43.28	54.00	10.72
High Channel: 2480 MHz									
2480.00	61.57	PK	H	28.26	1.84	0.00	91.67	N/A	N/A
2480.00	55.63	AV	H	28.26	1.84	0.00	85.73	N/A	N/A
2480.00	60.62	PK	V	28.26	1.84	0.00	90.72	N/A	N/A
2480.00	54.45	AV	V	28.26	1.84	0.00	84.55	N/A	N/A
2483.50	25.78	PK	H	28.27	1.84	0.00	55.89	74.00	18.11
2483.50	14.73	AV	H	28.27	1.84	0.00	44.84	54.00	9.16
4960.00	60.98	PK	H	33.22	3.23	37.25	60.18	74.00	13.82
4960.00	50.76	AV	H	33.22	3.23	37.25	49.96	54.00	4.04
7440.00	47.21	PK	H	36.34	4.41	37.52	50.44	74.00	23.56
7440.00	37.52	AV	H	36.34	4.41	37.52	40.75	54.00	13.25



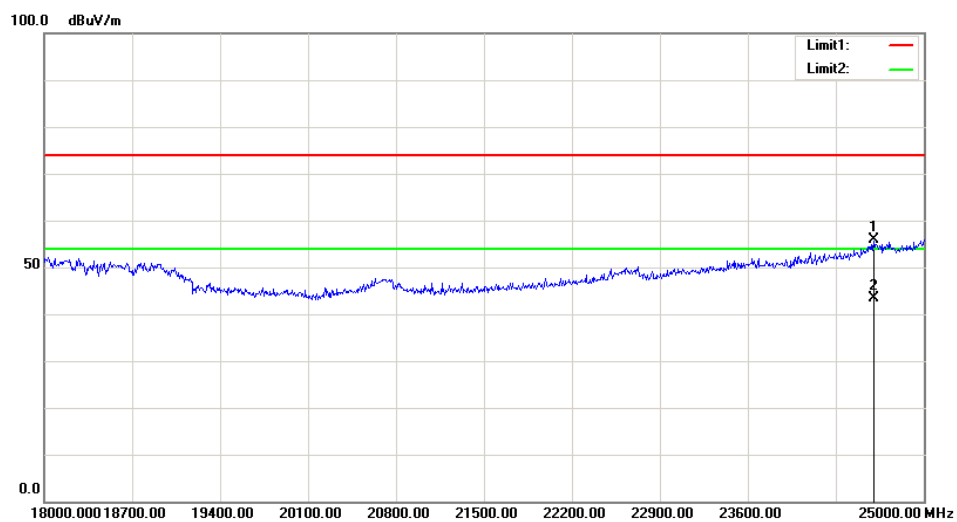
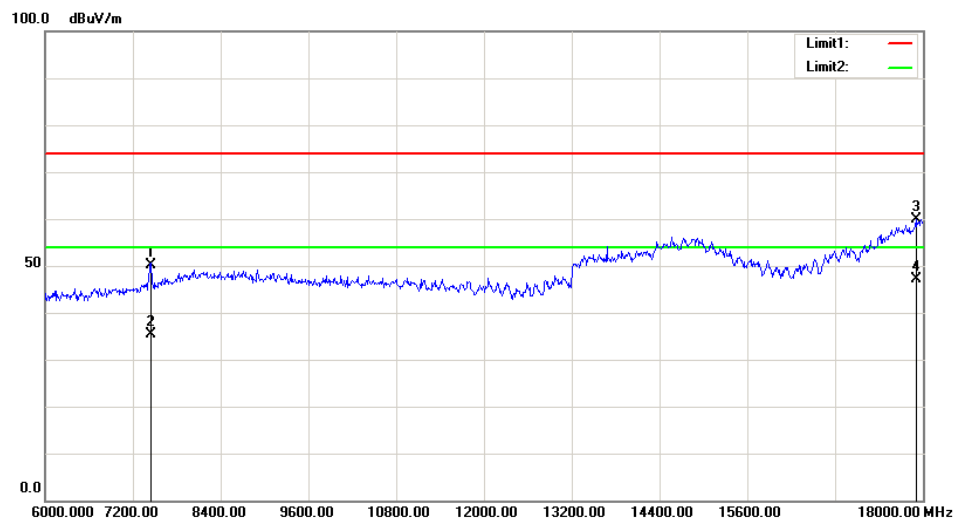
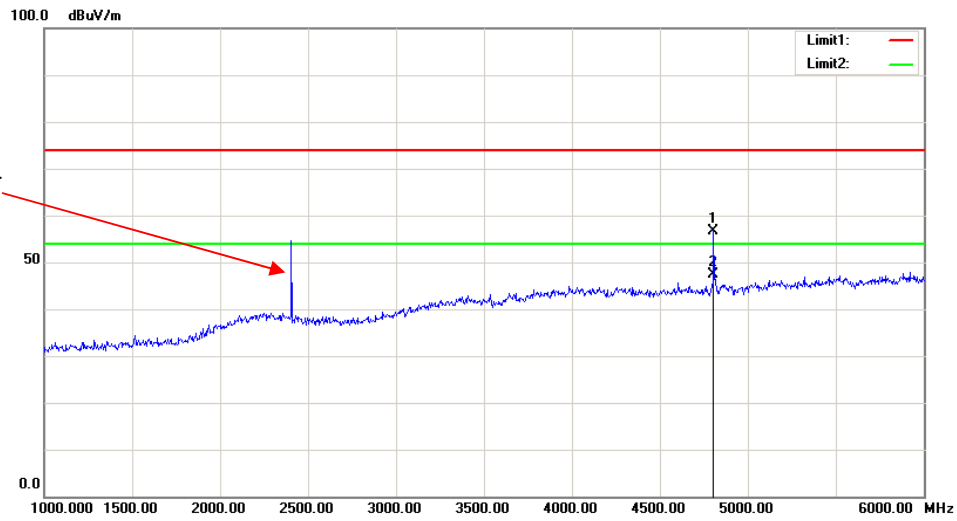
# Test plots (1 Mbps Low Channel) Horizontal

Fundamental  
Test with Band  
Rejection Filter



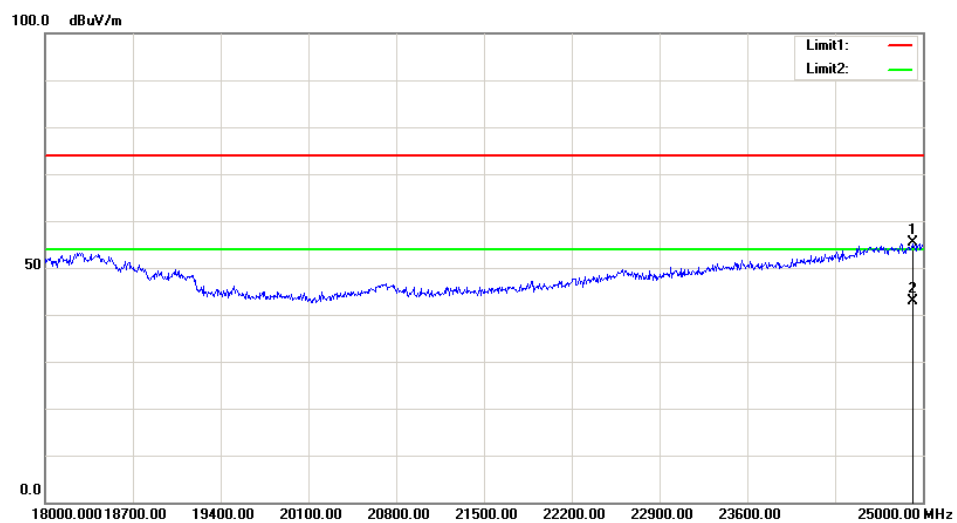
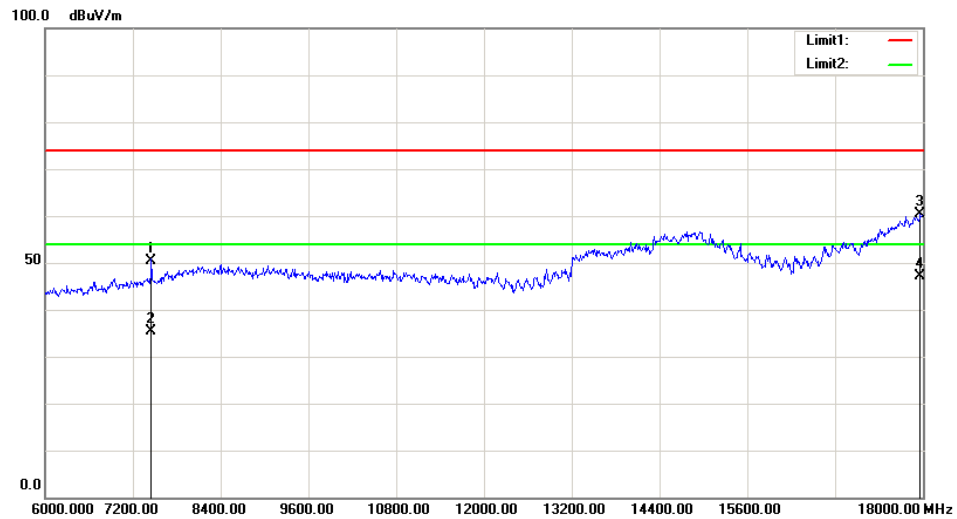
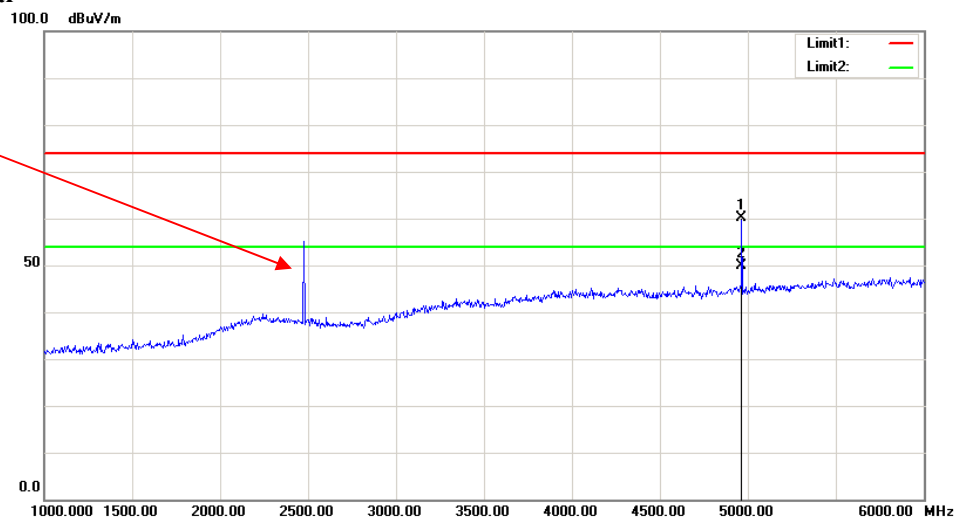
# Vertical

Fundamental  
Test with Band  
Rejection Filter



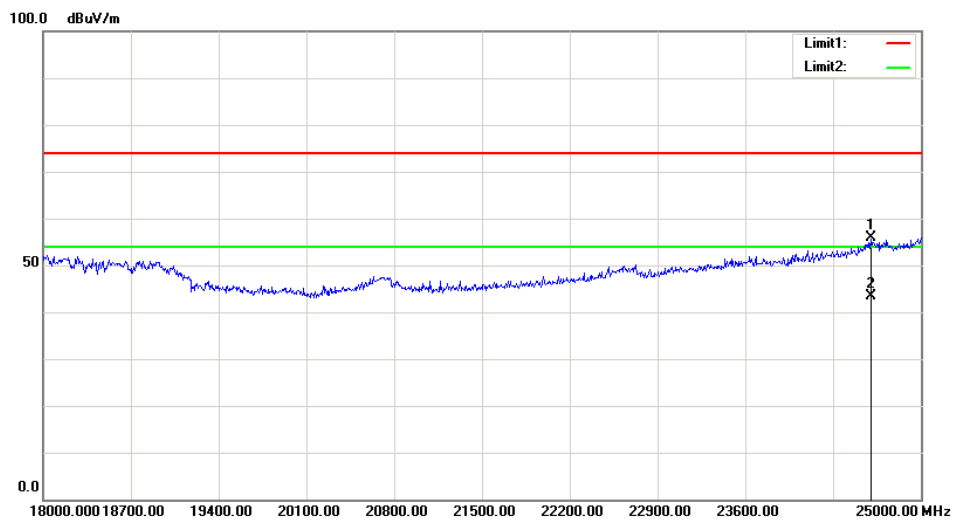
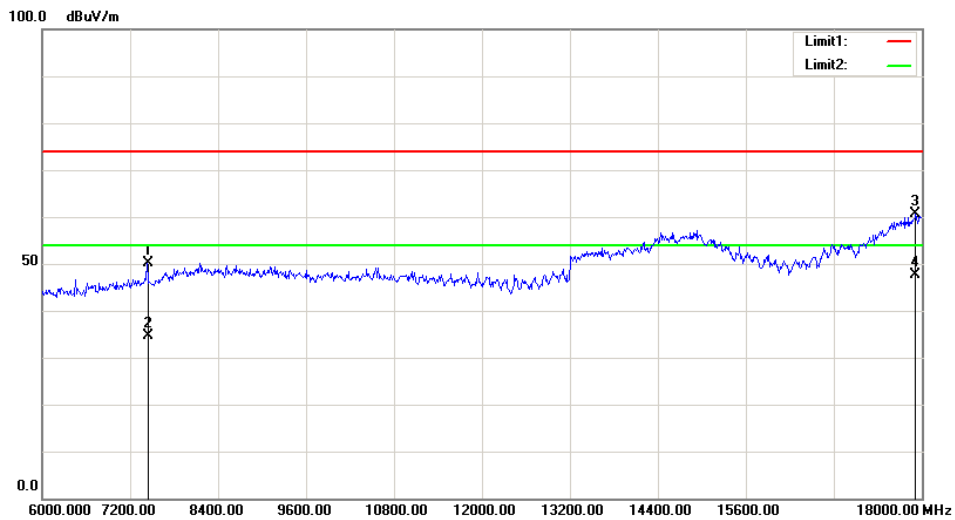
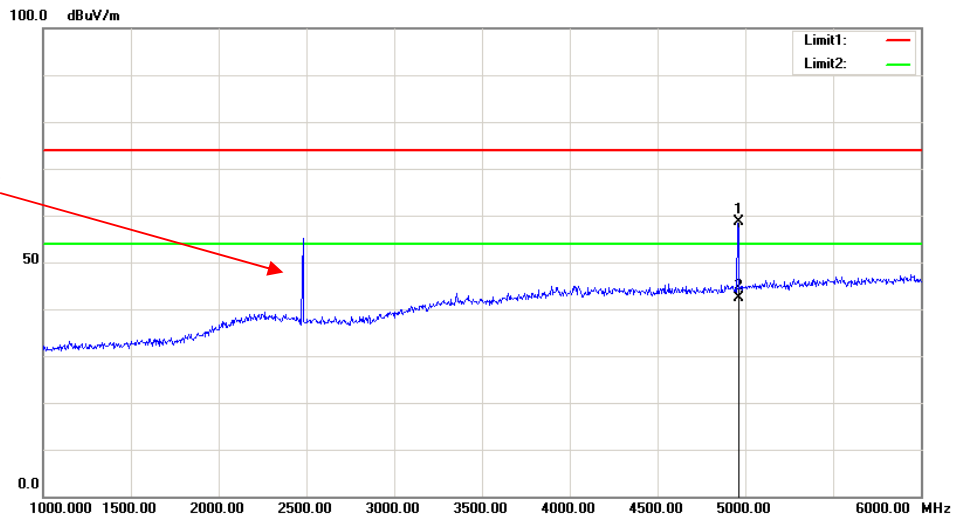
# **Worst plots ( 2 Mbps High Channel)** **Horizontal**

Fundamental  
Test with Band  
Rejection Filter



Vertical

Fundamental  
Test with Band  
Rejection Filter



## FCC §15.247(a) (2) –6 dB EMISSION BANDWIDTH

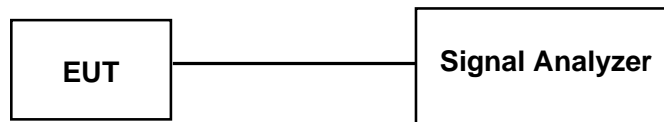
### Applicable Standard

According to FCC §15.247(a) (2)

Systems using digital modulation techniques may operate in the 902–928 MHz, 2400–2483.5 MHz, and 5725–5850 MHz bands. The minimum 6 dB bandwidth shall be at least 500 kHz.

### Test Procedure

- Set RBW = 100 kHz.
- Set the video bandwidth (VBW)  $\geq 3 \times$  RBW.
- Detector = Peak.
- Trace mode = max hold.
- Sweep = auto couple.
- Allow the trace to stabilize.
- Measure the maximum width of the emission that is constrained by the frequencies associated with the two outermost amplitude points (upper and lower frequencies) that are attenuated by 6 dB relative to the maximum level measured in the fundamental emission.



### Test Equipment List and Details

Manufacturer	Description	Model	Serial Number	Calibration Date	Calibration Due Date
R&S	Spectrum Analyzer	FSP 38	100478	2017-12-08	2018-12-08
Unknown	Coaxial Cable	C-SJ00-0010	C0010/02	Each time	N/A

\* **Statement of Traceability:** Bay Area Compliance Laboratories Corp. (Dongguan) attests that all calibrations have been performed, traceable to National Primary Standards and International System of Units (SI).

### Test Data

#### Environmental Conditions

Temperature:	28.7 °C
Relative Humidity:	27 %
ATM Pressure:	100.6 kPa

\* The testing was performed by Tiago Huang on 2018-11-01.

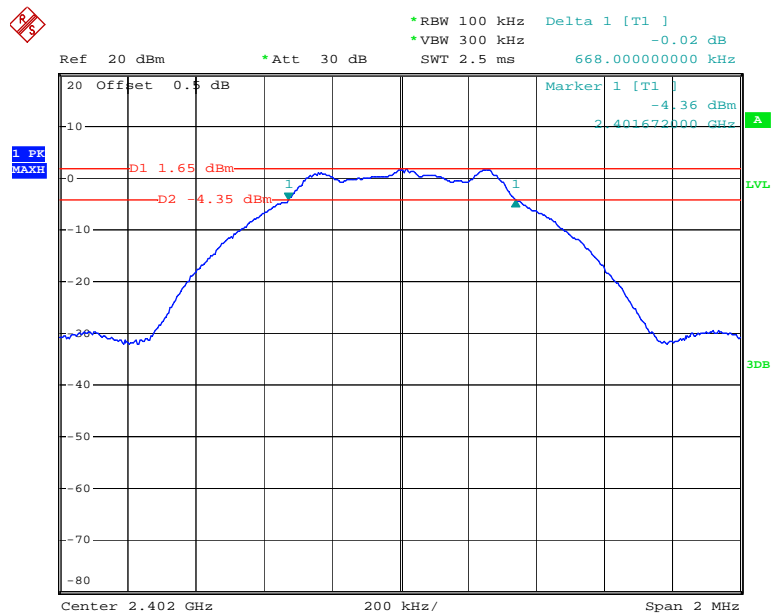
Test Mode: Transmitting

Test Result: Compliance. Please refer to the following table and plots.

Test mode	Channel	Frequency (MHz)	6 dB Bandwidth (MHz)	Limit (MHz)
1 Mbps	Low	2402	0.668	$\geq 0.5$
	Middle	2440	0.664	$\geq 0.5$
	High	2480	0.664	$\geq 0.5$
2 Mbps	Low	2402	1.152	$\geq 0.5$
	Middle	2440	1.160	$\geq 0.5$
	High	2480	1.144	$\geq 0.5$

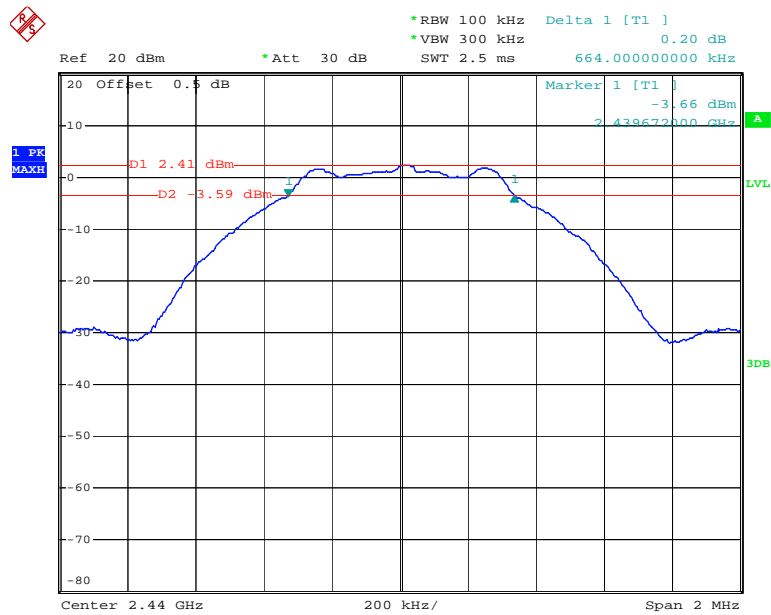
### 1 Mbps Mode:

#### Low Channel



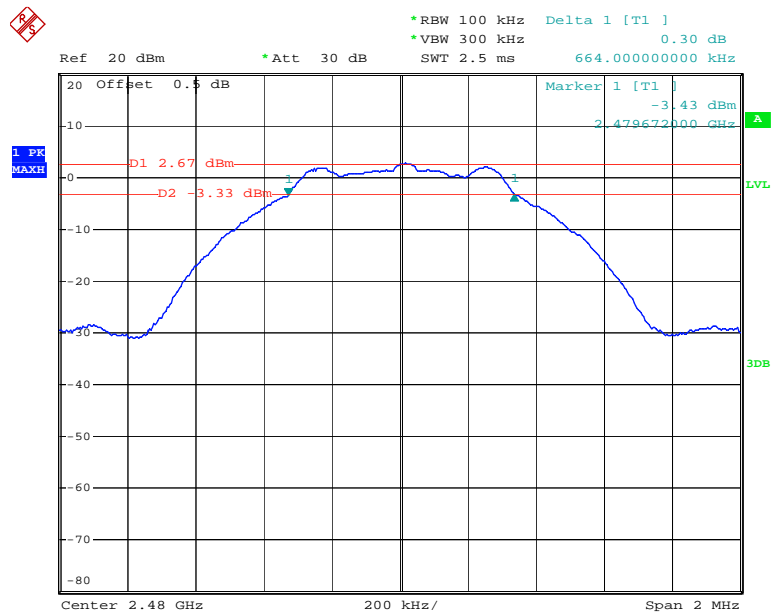
Date: 1.NOV.2018 18:36:03

### Middle Channel

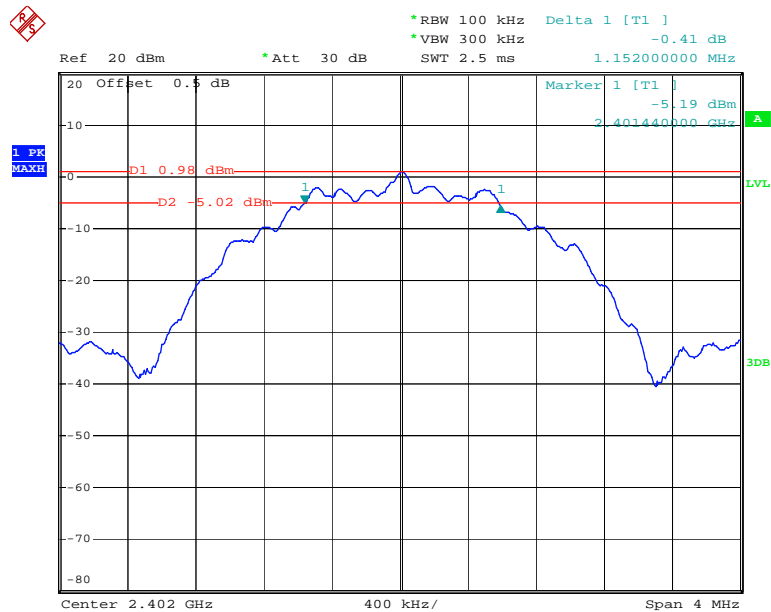


Date: 1.NOV.2018 18:38:51

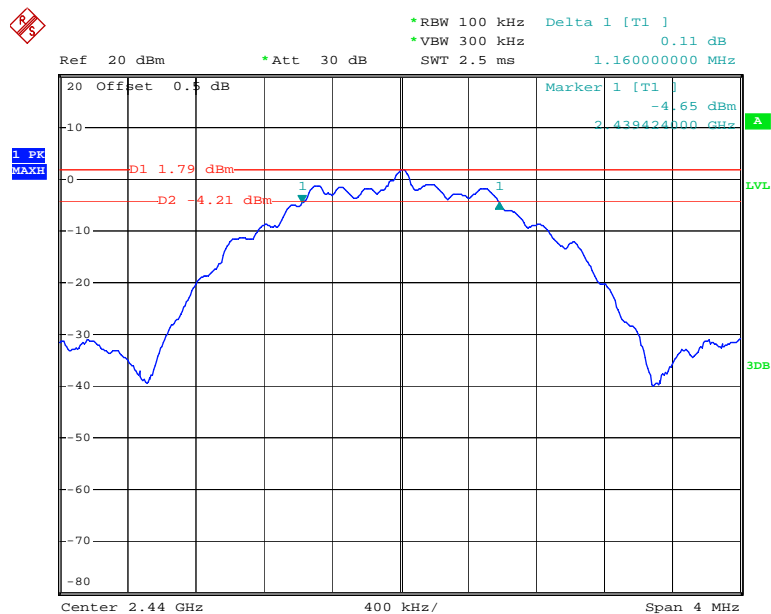
### High Channel



Date: 1.NOV.2018 18:39:59

**2 Mbps Mode:****Low Channel**

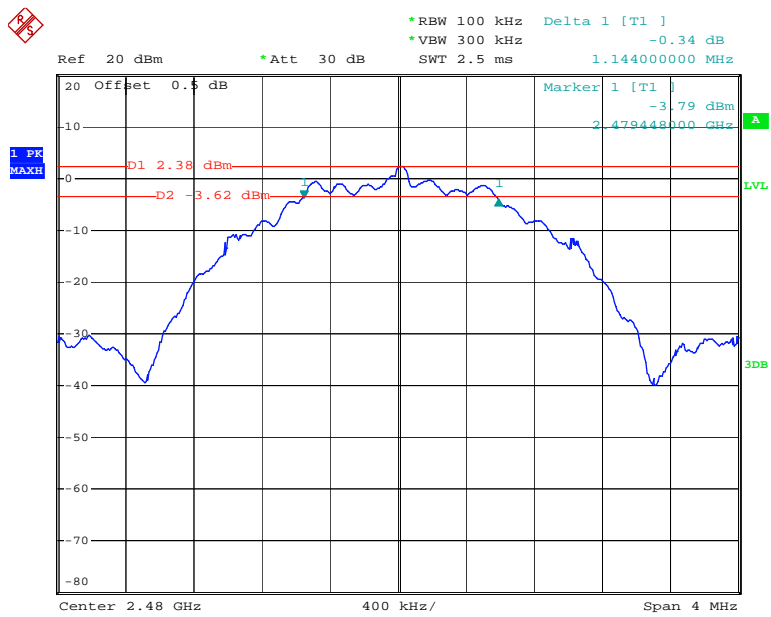
Date: 1.NOV.2018 22:23:04

**Middle Channel**

Date: 1.NOV.2018 22:25:35



### High Channel



Date: 1.NOV.2018 22:26:42

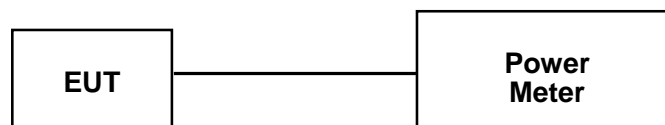
## FCC §15.247(b) (3) - MAXIMUM PEAK CONDUCTED OUTPUT POWER

### Applicable Standard

According to FCC §15.247(b) (3), for systems using digital modulation in the 902-928 MHz, 2400-2483.5 MHz, and 5725-5850 MHz bands: 1 Watt. As an alternative to a peak power measurement, compliance with the one Watt limit can be based on a measurement of the maximum conducted output power. Maximum Conducted Output Power is defined as the total transmit power delivered to all antennas and antenna elements averaged across all symbols in the signaling alphabet when the transmitter is operating at its maximum power control level. Power must be summed across all antennas and antenna elements. The average must not include any time intervals during which the transmitter is off or is transmitting at a reduced power level. If multiple modes of operation are possible (e.g., alternative modulation methods), the maximum conducted output power is the highest total transmit power occurring in any mode.

### Test Procedure

1. Place the EUT on a bench and set it in transmitting mode.
2. Remove the antenna from the EUT and then connect a low loss RF cable from the antenna port to test equipment.
3. Add a correction factor to the display.
4. Set the power Meter to test Peak output power, record the result as peak power.
5. Set the power meter to test average output power, record the result as average power.



### Test Equipment List and Details

Manufacturer	Description	Model	Serial Number	Calibration Date	Calibration Due Date
Agilent	USB Wideband Power Sensor	U2021XA	MY5425009	2018-3-21	2019-3-21
Unknown	Coaxial Cable	C-SJ00-0010	C0010/02	Each time	N/A

\* **Statement of Traceability:** Bay Area Compliance Laboratories Corp. (Dongguan) attests that all calibrations have been performed, traceable to National Primary Standards and International System of Units (SI).

### Test Data

#### Environmental Conditions

Temperature:	28.7 °C
Relative Humidity:	27 %
ATM Pressure:	100.6 kPa

\* The testing was performed by Tiago Huang on 2018-11-01.

*Test Mode: Transmitting*

*Test Result: Compliance. Please refer to the following table.*

Test mode	Channel	Frequency (MHz)	Max Peak Conducted Output Power (dBm)	Limit (dBm)
1 Mbps	Low	2402	1.72	30
	Middle	2440	2.48	30
	High	2480	2.73	30
2 Mbps	Low	2402	1.02	30
	Middle	2440	1.78	30
	High	2480	2.12	30

## **FCC §15.247(d) – 100 kHz BANDWIDTH OF FREQUENCY BAND EDGE**

### **Applicable Standard**

According to FCC§15.247(d): In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement, provided the transmitter demonstrates compliance with the peak conducted power limits. If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval, as permitted under paragraph (b)(3) of this section, the attenuation required under this paragraph shall be 30 dB instead of 20 dB. Attenuation below the general limits specified in §15.209(a) is not required. In addition, radiated emissions which fall in the restricted bands, as defined in §15.205(a), must also comply with the radiated emission limits specified in §15.209(a) (see §15.205(c)).

### **Test Procedure**

1. Check the calibration of the measuring instrument using either an internal calibrator or a known signal from an external generator.
2. Position the EUT without connection to measurement instrument. Turn on the EUT and connect its antenna terminal to measurement instrument via a low loss cable. Then set it to any one measured frequency within its operating range, and make sure the instrument is operated in its linear range.
3. Set RBW to 100 kHz and VBW of spectrum analyzer to 300 kHz with a convenient frequency span including 100 kHz bandwidth from band edge.
4. Measure the highest amplitude appearing on spectral display and set it as a reference level. Plot the graph with marking the highest point and edge frequency.
5. Repeat above procedures until all measured frequencies were complete.

### **Test Equipment List and Details**

Manufacturer	Description	Model	Serial Number	Calibration Date	Calibration Due Date
R&S	Spectrum Analyzer	FSP 38	100478	2017-12-08	2018-12-08
Unknown	Coaxial Cable	C-SJ00-0010	C0010/02	Each time	N/A

\* **Statement of Traceability:** Bay Area Compliance Laboratories Corp. (Dongguan) attests that all calibrations have been performed, traceable to National Primary Standards and International System of Units (SI).

### **Test Data**

#### **Environmental Conditions**

Temperature:	28.7 °C
Relative Humidity:	27 %
ATM Pressure:	100.6 kPa

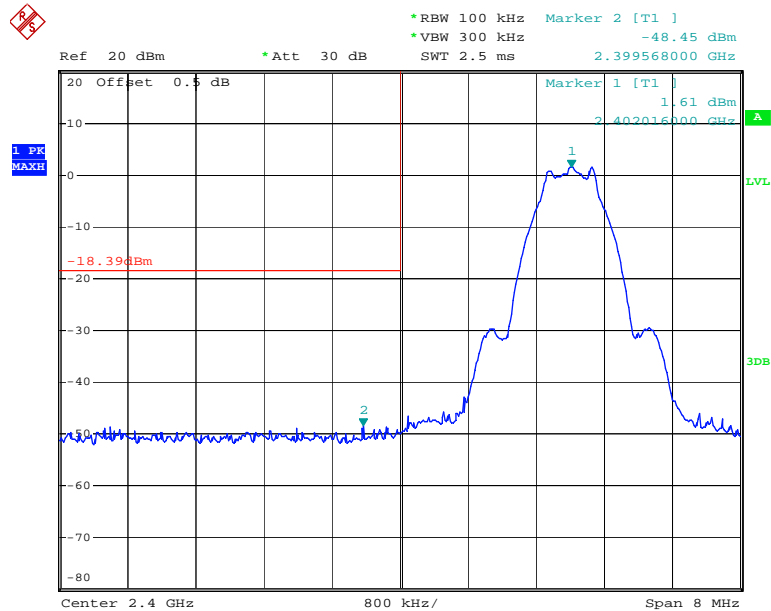
\* The testing was performed by Tiago Huang on 2018-11-01.

Test mode: Transmitting

Test Result: Compliance. Please refer to following plots.

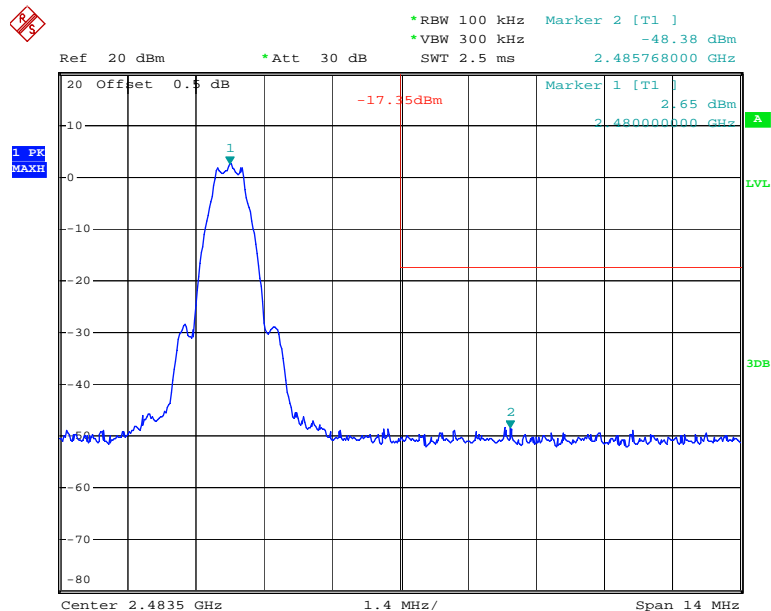
1Mbps Mode:

### Band Edge, Left Side



Date: 1.NOV.2018 18:37:16

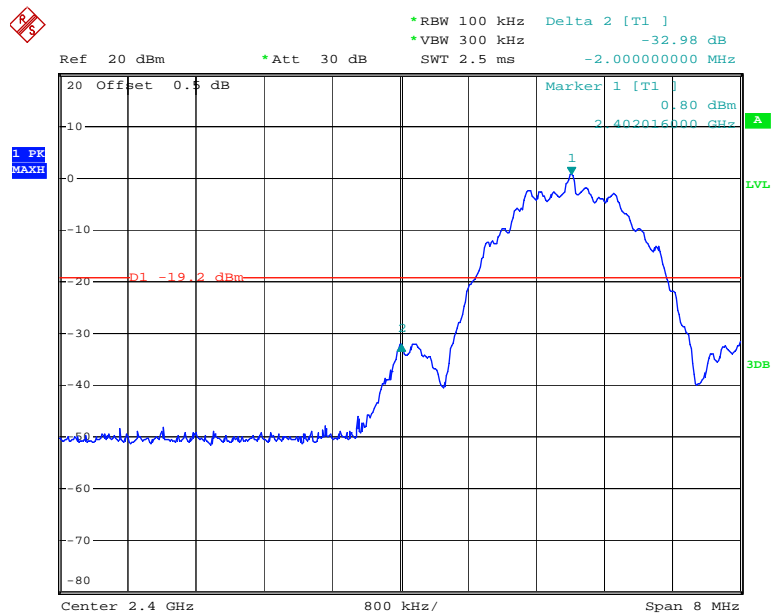
### Band Edge, Right Side



Date: 1.NOV.2018 18:41:10

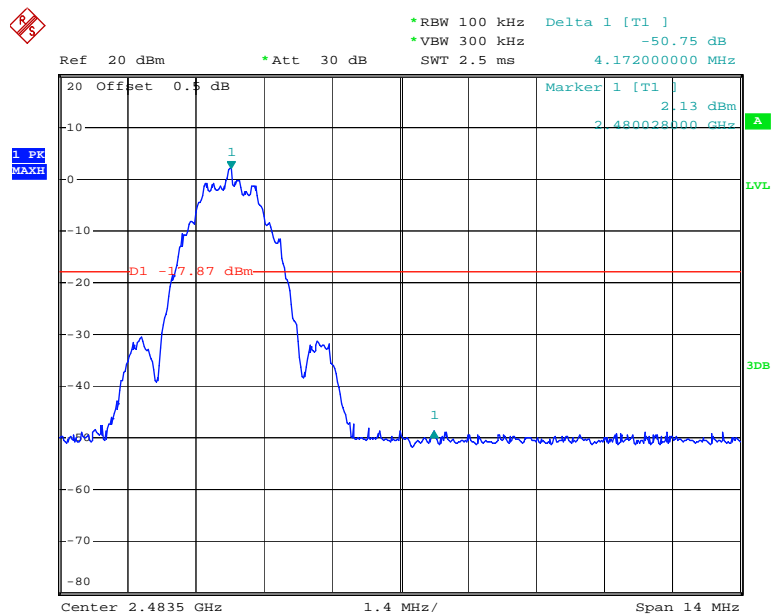
**2Mbps Mode:**

**Band Edge, Left Side**



Date: 1.NOV.2018 22:30:20

**Band Edge, Right Side**



Date: 1.NOV.2018 22:28:27

## FCC §15.247(e) - POWER SPECTRAL DENSITY

### Applicable Standard

According to FCC§15.247(e):For digitally modulated systems, the power spectral density conducted from the intentional radiator to the antenna shall not be greater than 8 dBm in any 3 kHz band during any time interval of continuous transmission. This power spectral density shall be determined in accordance with the provisions of paragraph (b) of this section. The same method of determining the conducted output power shall be used to determine the power spectral density.

### Test Procedure

1. Check the calibration of the measuring instrument using either an internal calibrator or a known signal from an external generator.
2. Position the EUT was set without connection to measurement instrument. Turn on the EUT and connect its antenna terminal to measurement instrument via a low loss cable. Then set it to any one measured frequency within its operating range, and make sure the instrument is operated in its linear range.
3. Set the RBW = 3 kHz, VBW = 10 kHz, Set the span to 1.5 times the DTS bandwidth.
4. Use the peak marker function to determine the maximum amplitude level.

### Test Equipment List and Details

Manufacturer	Description	Model	Serial Number	Calibration Date	Calibration Due Date
R&S	Spectrum Analyzer	FSP 38	100478	2017-12-08	2018-12-08
Unknown	Coaxial Cable	C-SJ00-0010	C0010/02	Each time	N/A

\* **Statement of Traceability:** Bay Area Compliance Laboratories Corp. (Dongguan) attests that all calibrations have been performed, traceable to National Primary Standards and International System of Units (SI).

### Test Data

#### Environmental Conditions

Temperature:	28.7 °C
Relative Humidity:	27 %
ATM Pressure:	100.6 kPa

\* The testing was performed by Tiago Huang on 2018-11-01.

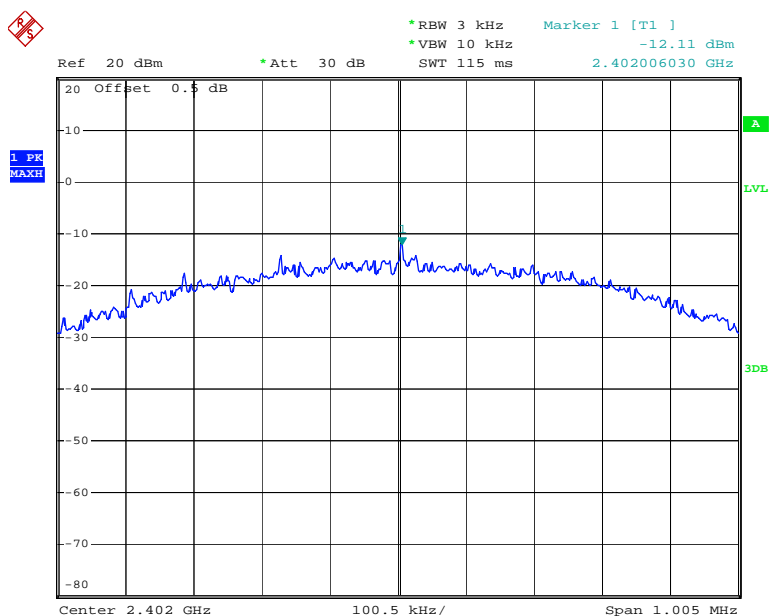
Test Mode: Transmitting

Test Result: Compliance. Please refer to the following table and plots

Test mode	Channel	Frequency (MHz)	PSD (dBm/3kHz)	Limit (dBm/3kHz)
1 Mbps	Low	2402	-12.11	≤8
	Middle	2440	-13.68	≤8
	High	2480	-13.35	≤8
2 Mbps	Low	2402	-16.64	≤8
	Middle	2440	-16.68	≤8
	High	2480	-15.47	≤8

1Mbps Mode:

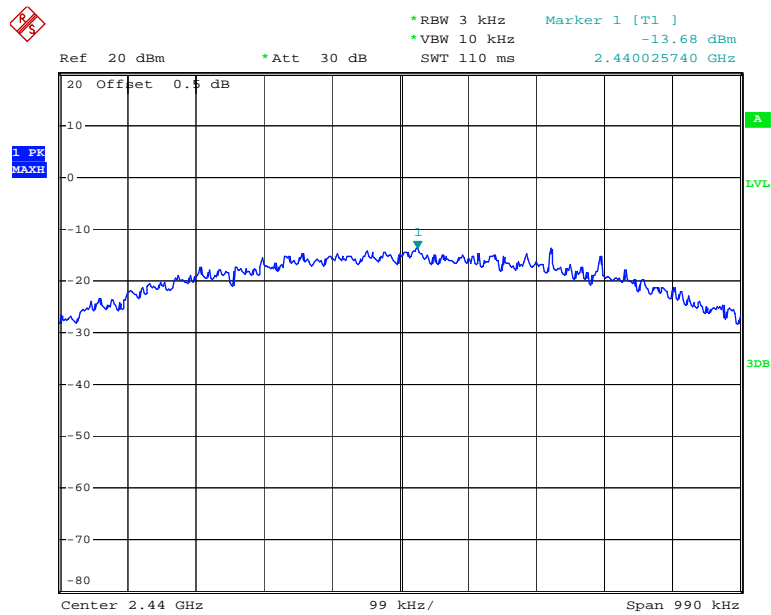
### Power Spectral Density, Low Channel



Date: 1.NOV.2018 18:36:46

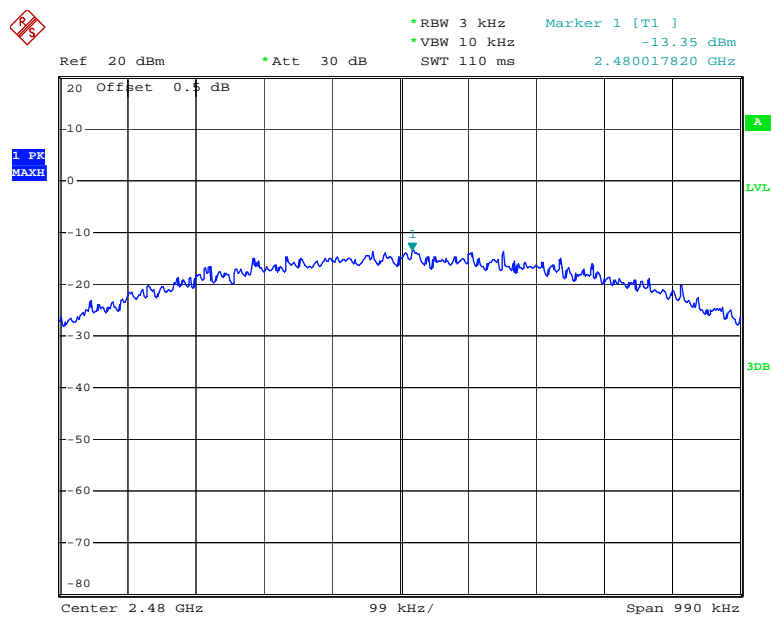


### Power Spectral Density, Middle Channel



Date: 1.NOV.2018 18:39:34

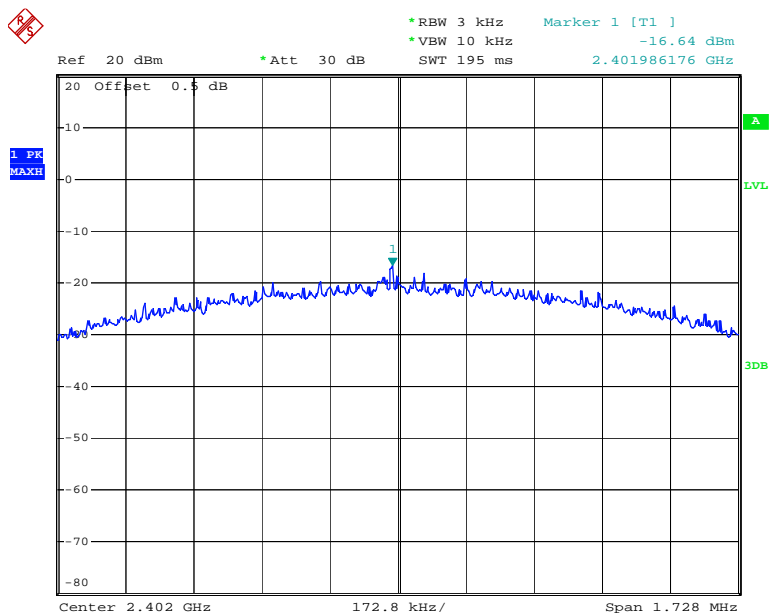
### Power Spectral Density, High Channel



Date: 1.NOV.2018 18:40:44

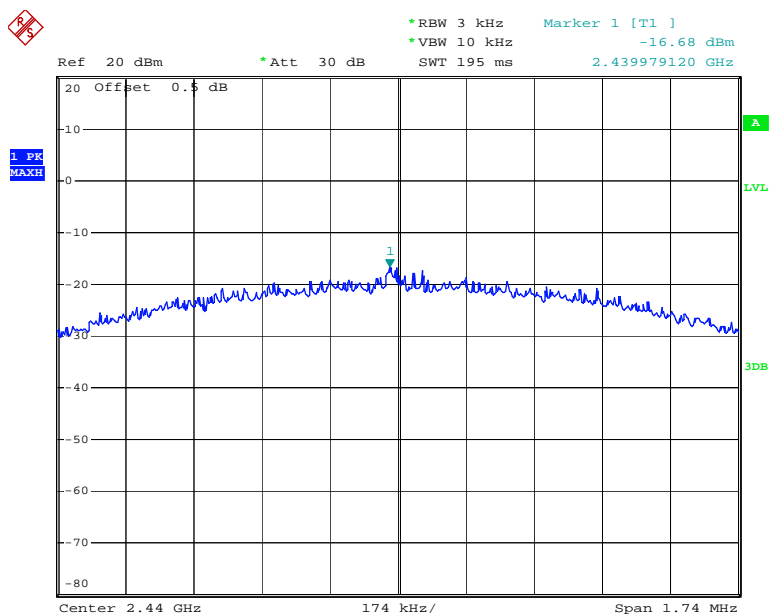
**2Mbps Mode:**

**Power Spectral Density, Low Channel**



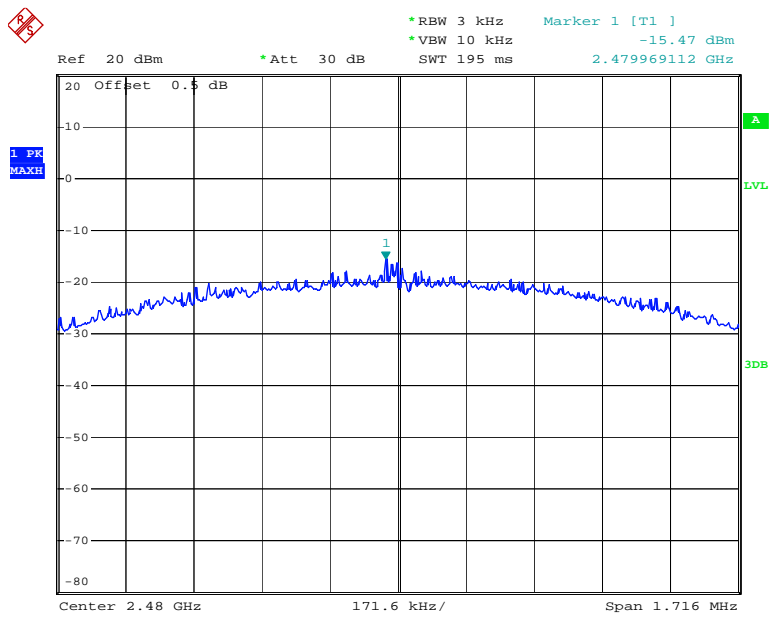
Date: 1.NOV.2018 22:39:01

**Power Spectral Density, Middle Channel**



Date: 1.NOV.2018 22:38:14

### Power Spectral Density, High Channel



Date: 1.NOV.2018 22:41:16

\*\*\*\*\* END OF REPORT \*\*\*\*\*