



TESTING LABORATORY  
CERTIFICATE #4820.01



# FCC PART 15.249

## TEST REPORT

For

### SHENZHEN LOFREE CULTURE CO., LTD

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**FCC ID: 2AC59EP115**

<b>Report Type:</b> Original Report	<b>Product Name:</b> Maus Bluetooth Mouse
<b>Report Number:</b>	RDG181026007-00A
<b>Report Date:</b>	2018-11-14
<b>Reviewed By:</b>	Allen Qiao RF Supervisor
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\* This report may contain data that are not covered by the A2LA accreditation and are marked with an asterisk “\*”.

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## GENERAL INFORMATION

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

<b>EUT Name:</b>	Maus Bluetooth Mouse
<b>EUT Model:</b>	EP115
<b>Multiple Models:</b>	EP116, EP118, EP119, EP120, EP121, EP122
<b>FCC ID:</b>	2AC59EP115
<b>Rated Input Voltage:</b>	DC3.6V from battery or DC 5V from USB port
<b>External Dimension:</b>	108mm(L)*63mm(W)*34mm(H)
<b>Serial Number:</b>	181026007
<b>EUT Received Date:</b>	2018.10.26

*Note: The series product model EP116, EP118, EP119, EP120, EP121, EP122 are electrically identical with the tested model EP115, we selected EP115 for fully testing. The differences between them were explained in the attached declaration letter.*

### Objective

This type approval report is prepared on behalf of *SHENZHEN LOFREE CULTURE CO., LTD* in accordance with Part 2-Subpart J, and Part 15-Subparts A and C of the Federal Communication Commissions rules.

The tests were performed in order to determine compliance with FCC Rules Part 15, Subpart C, and section 15.203, 15.205, 15.207, 15.209 and 15.249 rules.

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

FCC Part 15C DTS submissions with FCC ID: 2AC59EP115.  
Part of system submissions with FCC ID: OO9RG50.

### 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.

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

**Measurement Uncertainty**

Parameter	Measurement Uncertainty
Occupied Channel Bandwidth	±5 %
Unwanted Emissions, radiated	30M~200MHz: 4.58 dB for Horizontal, 4.59 dB for Vertical 200M~1GHz: 4.83 dB for Horizontal, 5.85 dB for Vertical 1G~6GHz: 4.45 dB, 6G~26.5GHz: 5.23 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

### Justification

The system was configured for testing in engineering mode, which was provided by the manufacturer.

16 channels are provided and channel 1, 9, 16 were selected to testing:

Channel	Frequency (MHz)	Channel	Frequency (MHz)
1	2403	9	2441
2	2407	10	2445
3	2414	11	2453
4	2419	12	2459
5	2422	13	2463
6	2426	14	2466
7	2436	15	2473
8	2439	16	2480

### EUT Exercise Software

No software was used in test, the device was configured to engineer mode by manufacturer.

### Equipment Modifications

No modifications were made to the EUT.

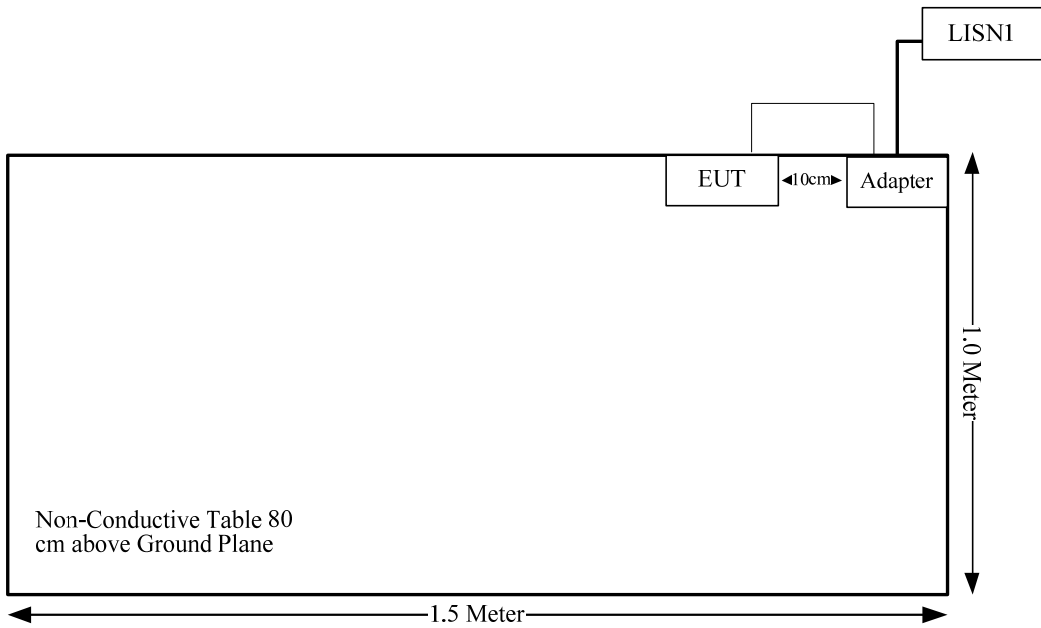
### Support Equipment List and Details

Manufacturer	Description	Model	Serial Number
CFOMAX	Adapter	ACC07C02	V043660704256144

### Support Cable List and Details

Cable Description	Shielding Type	Ferrite Core	Length (m)	From Port	To
USB Cable	No	No	1.2	EUT	Adapter

**Block Diagram of Test Setup**



**SUMMARY OF TEST RESULTS**

FCC Rules	Description of Test	Result
§15.203	Antenna Requirement	Compliance
§15.207(a)	Conduction Emissions	Compliance
15.205, §15.209, §15.249	Radiated Emissions	Compliance
§15.215 (c)	20 dB Bandwidth	Compliance

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

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### **Applicable Standard**

For intentional device, 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.

### **Antenna Connector Construction**

The EUT has one internal antenna arrangement for 2.4G transmission, and the antenna gain is -1dBi, fulfill the requirement of this section. Please refer to the EUT photos.

**Result:** Compliant.

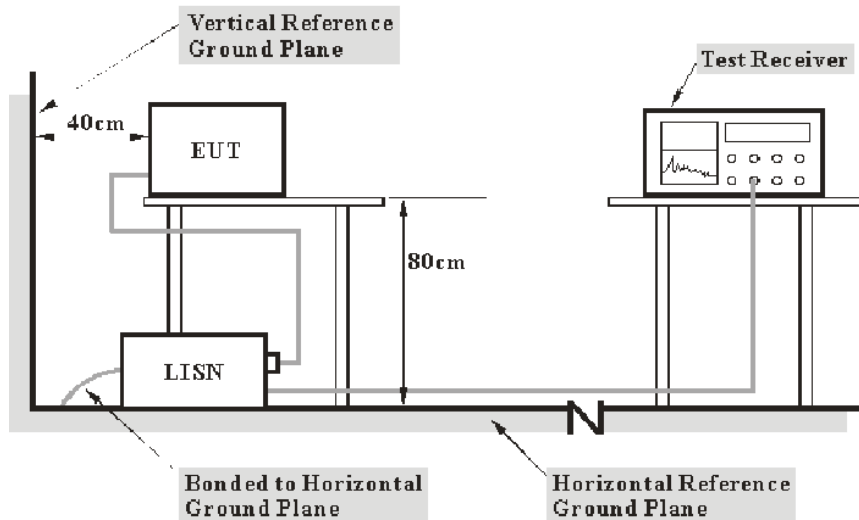


**FCC §15.207 (a)– AC LINE CONDUCTED EMISSIONS**

**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**

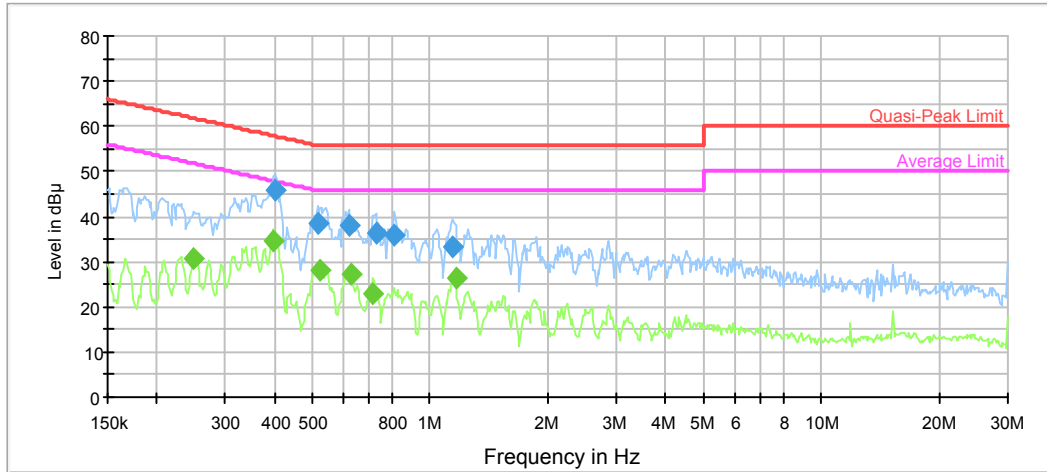
**Environmental Conditions**

<b>Temperature:</b>	26.5 °C
<b>Relative Humidity:</b>	43 %
<b>ATM Pressure:</b>	100 kPa

*The testing was performed by Lily Xie on 2018-11-10.*

Test Mode: Charging & Transmitting

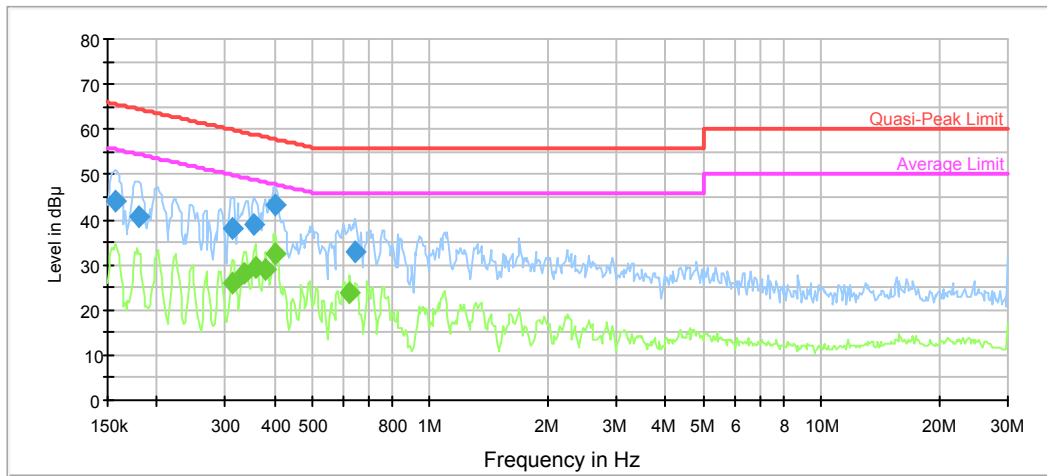
AC120 V, 60 Hz, Line:



Frequency (MHz)	QuasiPeak (dBµV)	Bandwidth (kHz)	Line	Corr. (dB)	Margin (dB)	Limit (dBµV)	Comment
0.402900	45.8	9.000	L1	10.0	12.0	57.8	Compliance
0.515791	38.6	9.000	L1	9.9	17.4	56.0	Compliance
0.619536	38.1	9.000	L1	9.8	17.9	56.0	Compliance
0.726569	36.5	9.000	L1	9.8	19.5	56.0	Compliance
0.812315	36.0	9.000	L1	9.8	20.0	56.0	Compliance
1.144267	33.3	9.000	L1	9.8	22.7	56.0	Compliance

Frequency (MHz)	Average (dBµV)	Bandwidth (kHz)	Line	Corr. (dB)	Margin (dB)	Limit (dBµV)	Comment
0.249785	30.6	9.000	L1	10.3	21.2	51.8	Compliance
0.399703	34.6	9.000	L1	10.0	13.3	47.9	Compliance
0.524077	28.1	9.000	L1	9.9	17.9	46.0	Compliance
0.629488	27.5	9.000	L1	9.8	18.6	46.0	Compliance
0.715082	23.0	9.000	L1	9.8	23.0	46.0	Compliance
1.162648	26.2	9.000	L1	9.8	19.8	46.0	Compliance

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



Frequency (MHz)	QuasiPeak (dB $\mu$ V)	Bandwidth (kHz)	Line	Corr. (dB)	Margin (dB)	Limit (dB $\mu$ V)	Comment
0.157346	44.0	9.000	N	11.1	21.6	65.6	Compliance
0.180171	40.5	9.000	N	10.8	24.0	64.5	Compliance
0.312220	38.1	9.000	N	10.1	21.8	59.9	Compliance
0.354674	39.1	9.000	N	10.0	19.7	58.9	Compliance
0.402900	43.4	9.000	N	10.0	14.4	57.8	Compliance
0.644717	32.8	9.000	N	9.8	23.2	56.0	Compliance

Frequency (MHz)	Average (dB $\mu$ V)	Bandwidth (kHz)	Line	Corr. (dB)	Margin (dB)	Limit (dB $\mu$ V)	Comment
0.312220	26.0	9.000	N	10.1	23.9	49.9	Compliance
0.335433	28.0	9.000	N	10.1	21.3	49.3	Compliance
0.357511	29.5	9.000	N	10.0	19.2	48.8	Compliance
0.381043	29.0	9.000	N	10.0	19.2	48.3	Compliance
0.402900	32.3	9.000	N	10.0	15.5	47.8	Compliance
0.624492	23.8	9.000	N	9.8	22.2	46.0	Compliance

## FCC§15.205, §15.209&§15.249- RADIATED EMISSIONS

### Applicable Standard

As per FCC§15.249 (a), except as provided in paragraph (b) of this section, the field strength of emissions from intentional radiators operated within these frequency bands shall comply with the following:

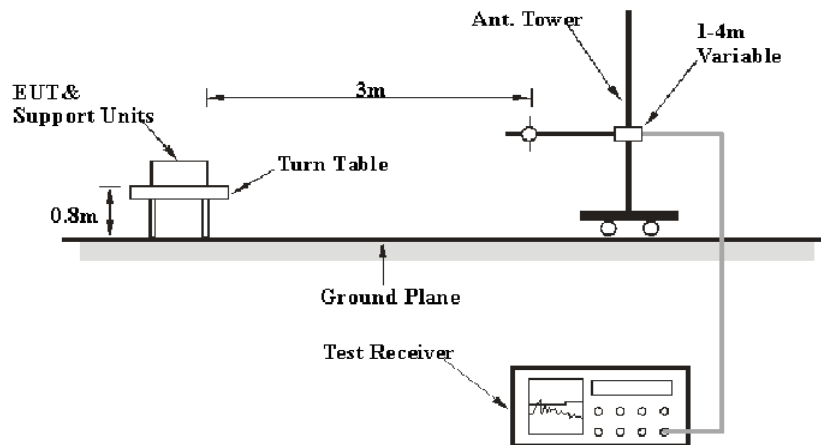
Fundamental frequency	Field strength of fundamental (millivolts/meter)	Field strength of harmonics (microvolts/meter)
902–928 MHz	50	500
2400–2483.5 MHz	50	500
5725–5875 MHz	50	500
24.0–24.25 GHz	250	2500

As per FCC§15.249 (c), Field strength limits are specified at a distance of 3 meters.

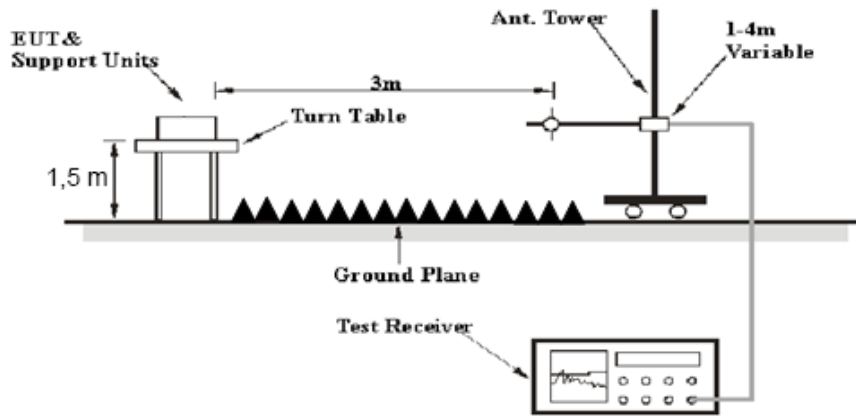
(d) Emissions radiated outside of the specified frequency bands, except for harmonics, shall be attenuated by at least 50 dB below the level of the fundamental or to the general radiated emission limits in §15.209, whichever is the lesser attenuation.

### EUT Setup

Below 1 GHz:



**1-26.5 GHz:**



The radiated emission tests were performed in the 3 meters chamber test site, using the setup accordance with the ANSI C63.10-2013. The specification used was the FCC 15.209, FCC 15.249 limits.

**Test Equipment Setup**

The system was investigated from 30 MHz to 26.5 GHz.

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

Frequency Range	RBW	Video B/W	IF B/W	Measurement
30 MHz – 1000 MHz	120 kHz	300 kHz	120 kHz	QP
Above 1 GHz	1MHz	3 MHz	/	PK
	1MHz	10 Hz	/	AV

**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-1GHz, peak and Average detection modes for frequencies above 1GHz.

All emissions under the average limit and under the noise floor have not recorded in the report.

**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	100224	2017-12-11	2018-12-11
Farad	Test Software	EZ-EMC	V1.1.4.2	N/A	N/A
Sunol Sciences	Antenna	JB3	A060611-1	2017-11-10	2020-11-10
Unknown	Coaxial Cable	C-NJNJ-50	C-0400-01	2018-09-05	2019-09-05
Unknown	Coaxial Cable	C-NJNJ-50	C-0075-01	2018-09-05	2019-09-05
Unknown	Coaxial Cable	C-NJNJ-50	C-1000-01	2018-09-05	2019-09-05
HP	Amplifier	8447D	2727A05902	2018-09-05	2019-09-05
R&S	Spectrum Analyzer	FSP 38	100478	2017-12-08	2018-12-08
Ducommun Technologies	Horn Antenna	ARH-4223-02	1007726-01 1304	2016-11-18	2019-11-18
MICRO-COAX	Coaxial Cable	UFA147-1-2362- 100100	64639 231029- 001	2018-02-24	2019-02-28
Mini	Pre-amplifier	ZVA-183-S+	5969001149	2018-09-05	2019-09-05
Quinstar	Amplifier	QLW-18405536-JO	15964001001	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

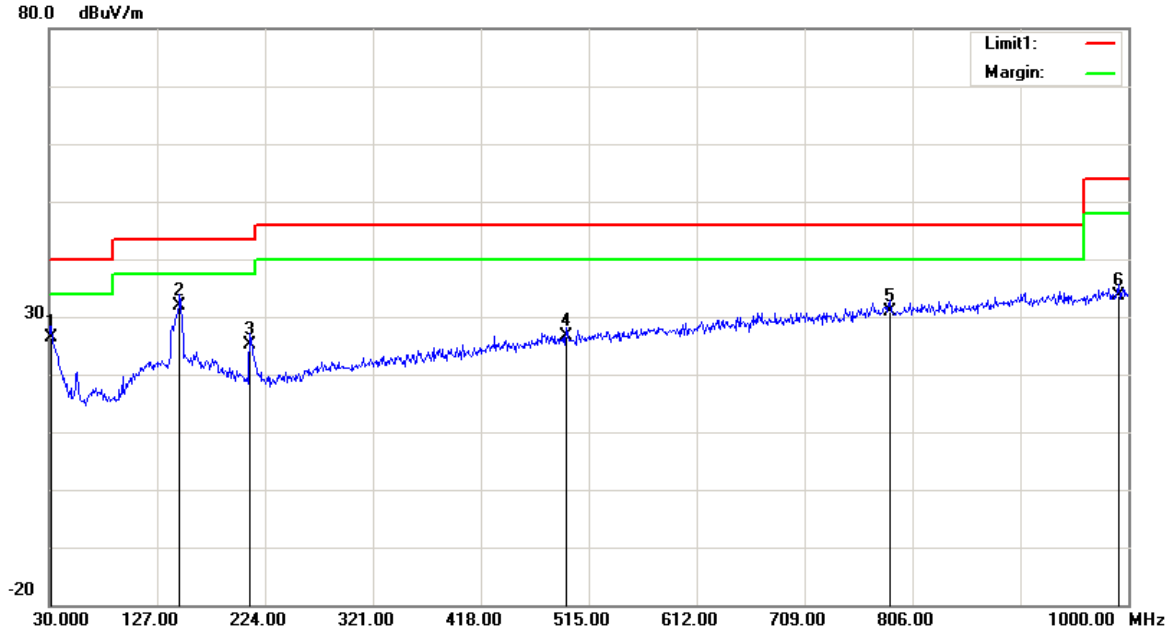
<b>Temperature:</b>	25.6~26.5 °C
<b>Relative Humidity:</b>	32~35 %
<b>ATM Pressure:</b>	100~100.8 kPa

\* The testing was performed by Neil Liao & Vern Shen on 2018-11-09 & 2018-11-11.

Test Mode: Transmitting

1) 30MHz-1GHz (Worst Case at Low Channel)

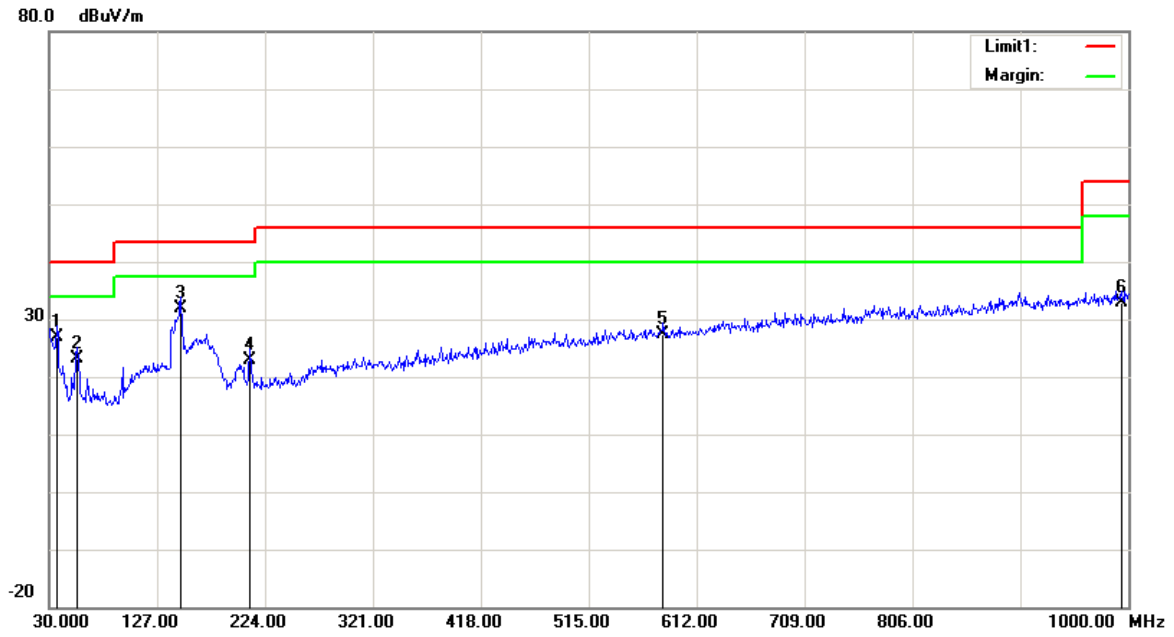
Horizontal:



Frequency (MHz)	Receiver Reading (dBuV)	Detector	Correction Factor (dB/m)	Cord. Amp. (dBuV/m)	Limit (dBuV/m)	Margin (dB)
31.9400	26.24	QP	0.24	26.48	40.00	13.52
147.3700	37.99	QP	-6.03	31.96	43.50	11.54
210.4200	32.49	QP	-7.36	25.13	43.50	18.37
494.6300	26.81	QP	-0.26	26.55	46.00	19.45
785.6300	26.48	QP	4.48	30.96	46.00	15.04
991.2700	10.37	QP	23.20	33.57	54.00	20.43



**Vertical:**



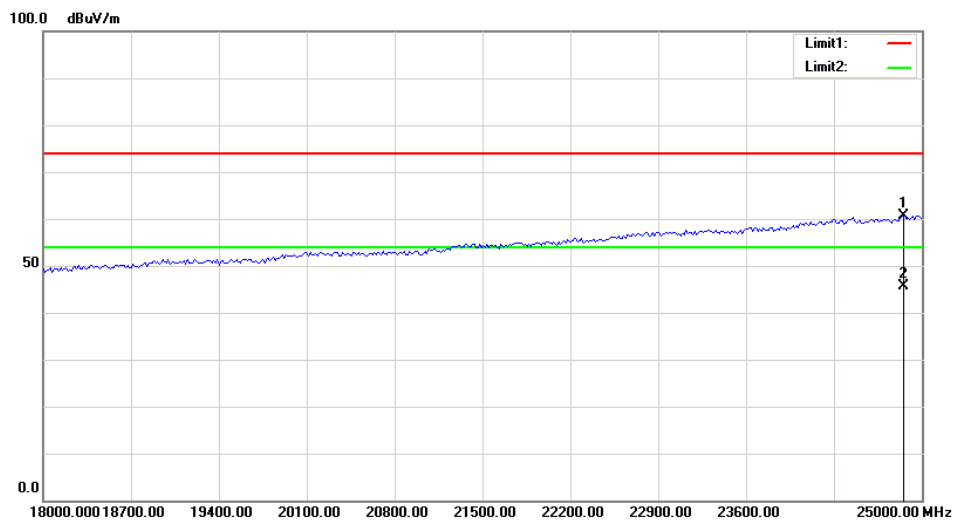
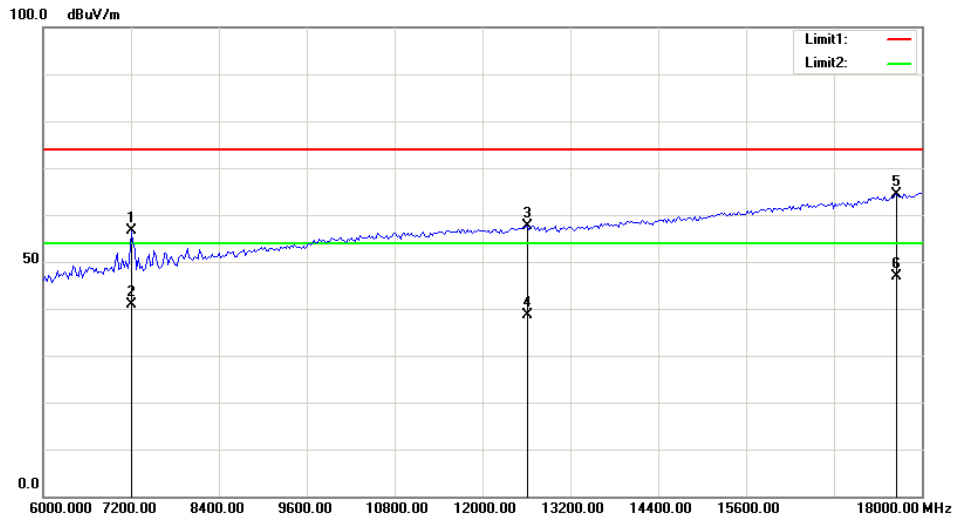
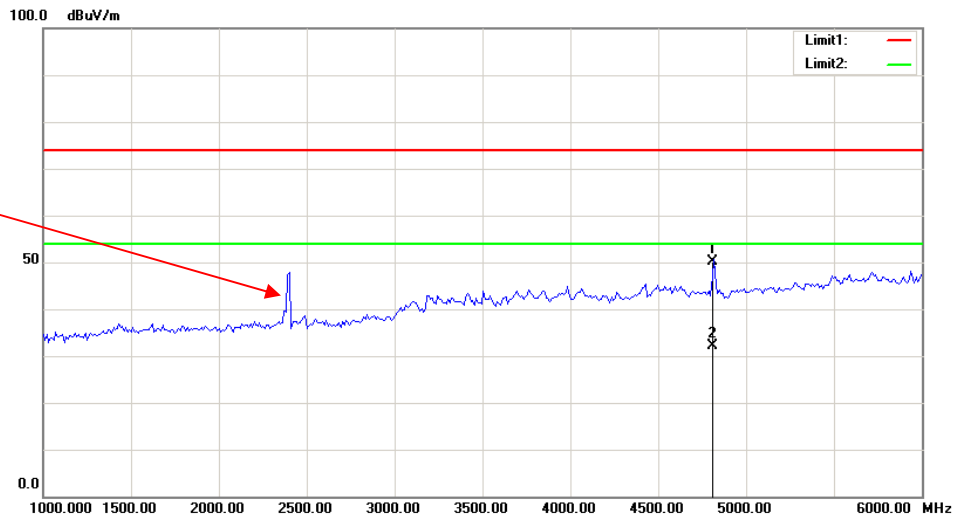
Frequency (MHz)	Receiver Reading (dBuV)	Detector	Correction Factor (dB/m)	Cord. Amp. (dBuV/m)	Limit (dBuV/m)	Margin (dB)
36.7900	30.30	QP	-3.33	26.97	40.00	13.03
55.2200	35.22	QP	-12.08	23.14	40.00	16.86
148.3400	37.93	QP	-6.03	31.90	43.50	11.60
210.4200	30.29	QP	-7.36	22.93	43.50	20.57
581.9300	26.32	QP	1.04	27.36	46.00	18.64
994.1800	9.77	QP	23.20	32.97	54.00	21.03

2) 1GHz-25GHz

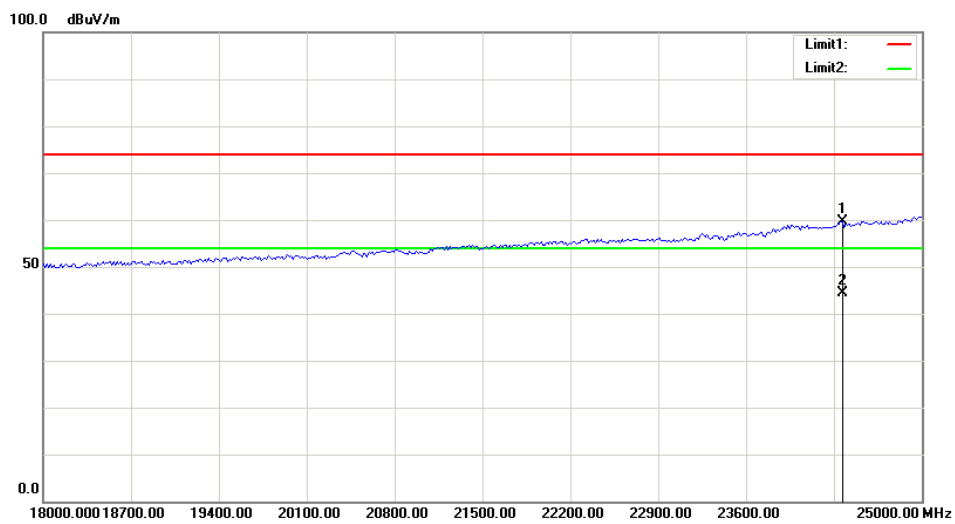
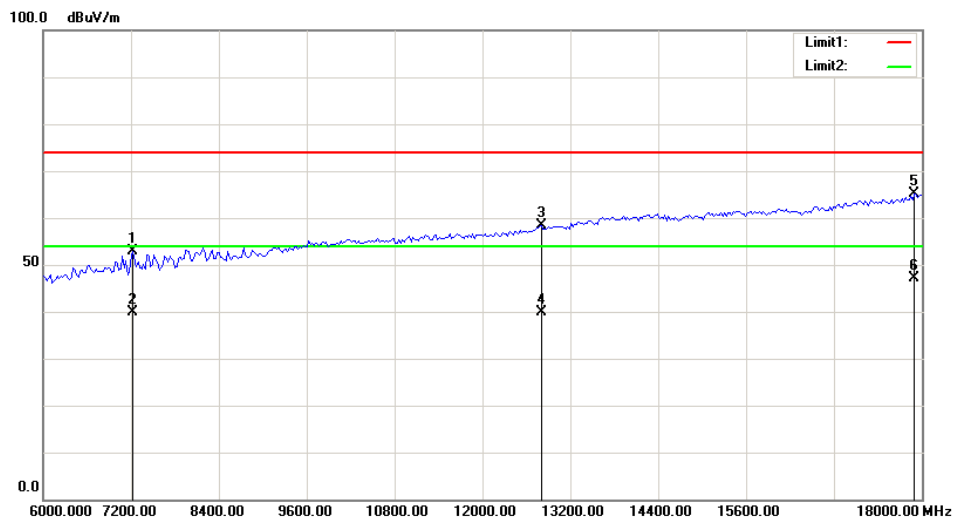
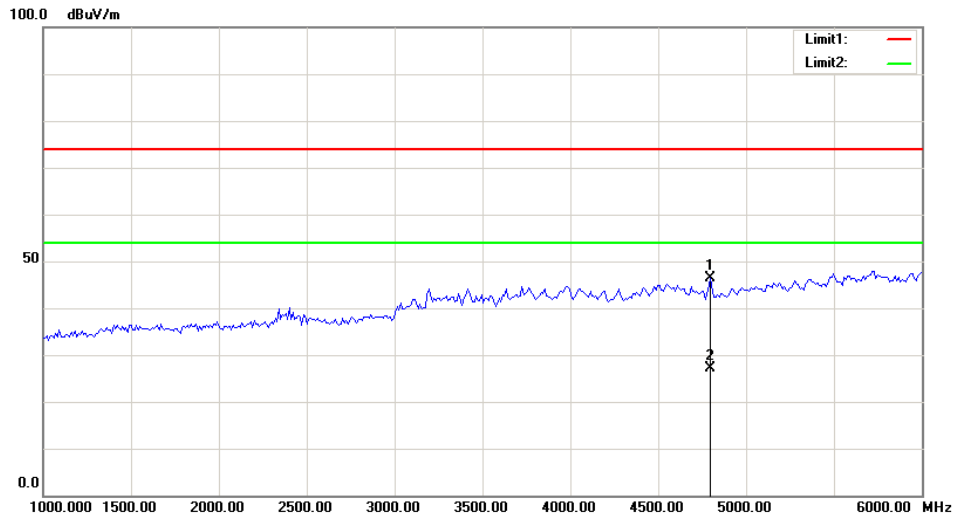
Frequency (MHz)	Receiver		Rx Antenna		Cable loss (dB)	Amplifier Gain (dB)	Corrected Amplitude (dBµV/m)	Limit (dBµV/m)	Margin (dB)
	Reading (dBµV)	Detector	Polar (H/V)	Factor (dB(1/m))					
Low Channel, Test Frequency: 2403 MHz									
2403.00	62.48	PK	H	24.83	3.34	0.00	90.65	113.98	23.33
2403.00	27.04	AV	H	24.83	3.34	0.00	55.21	93.98	38.77
2403.00	52.29	PK	V	24.83	3.34	0.00	80.46	113.98	33.52
2403.00	19.26	AV	V	24.83	3.34	0.00	47.43	93.98	46.55
2400.00	25.15	PK	H	24.82	3.34	0.00	53.31	74.00	20.69
2400.00	13.02	AV	H	24.82	3.34	0.00	41.18	54.00	12.82
4806.00	43.20	PK	H	29.71	4.58	27.37	50.12	74.00	23.88
4806.00	25.16	AV	H	29.71	4.58	27.37	32.08	54.00	21.92
7209.00	44.22	PK	H	33.93	5.60	27.19	56.56	74.00	17.44
7209.00	28.53	AV	H	33.93	5.60	27.19	40.87	54.00	13.13
Middle Channel, Test Frequency: 2441 MHz									
2441.00	61.76	PK	H	24.89	3.36	0.00	90.01	113.98	23.97
2441.00	26.64	AV	H	24.89	3.36	0.00	54.89	93.98	39.09
2441.00	51.44	PK	V	24.89	3.36	0.00	79.69	113.98	34.29
2441.00	18.79	AV	V	24.89	3.36	0.00	47.04	93.98	46.94
4882.00	42.15	PK	H	29.86	4.56	27.56	49.01	74.00	24.99
4882.00	25.12	AV	H	29.86	4.56	27.56	31.98	54.00	22.02
7323.00	42.21	PK	H	34.12	5.69	27.26	54.76	74.00	19.24
7323.00	26.21	AV	H	34.12	5.69	27.26	38.76	54.00	15.24
High Channel, Test Frequency: 2480 MHz									
2480.00	61.40	PK	H	24.96	3.38	0.00	89.74	113.98	24.24
2480.00	26.26	AV	H	24.96	3.38	0.00	54.60	93.98	39.38
2480.00	51.21	PK	V	24.96	3.38	0.00	79.55	113.98	34.43
2480.00	18.37	AV	V	24.96	3.38	0.00	46.71	93.98	47.27
2483.50	23.78	PK	H	24.97	3.38	0.00	52.13	74.00	21.87
2483.50	10.64	AV	H	24.97	3.38	0.00	38.99	54.00	15.01
4960.00	42.93	PK	H	30.02	4.58	27.37	50.16	74.00	23.84
4960.00	25.04	AV	H	30.02	4.58	27.37	32.27	54.00	21.73
7440.00	40.59	PK	H	34.30	5.79	27.22	53.46	74.00	20.54
7440.00	24.60	AV	H	34.30	5.79	27.22	37.47	54.00	16.53

### Test plots at Low Channel Horizontal

Fundamental  
Test with Band  
Rejection Filter



Vertical



## FCC §15.215(c) – 20 dB BANDWIDTH TESTING

### Applicable Standard

Intentional radiators operating under the alternative provisions to the general emission limits, as contained in §§ 15.217 through 15.257 and in Subpart E of this part, must be designed to ensure that the 20 dB bandwidth of the emission, or whatever bandwidth may otherwise be specified in the specific rule section under which the equipment operates, is contained within the frequency band designated in the rule section under which the equipment is operated.

### Test Procedure

1. Check the calibration of the measuring instrument using either an internal calibrator or a known signal from an external generator.
2. Measure the frequency difference of two frequencies that were attenuated 20 dB from the reference level. Record the frequency difference as the emission bandwidth.
3. Repeat above procedures until all frequencies measured were complete.

### Test Equipment List and Details

Manufacturer	Description	Model	Serial Number	Calibration Date	Calibration Due Date
R&S	Spectrum Analyzer	FSU 26	200256	2018-01-04	2019-01-04
Unknown	Coaxial Cable	C-SJ00-0010	C0010/03	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:	27.9 °C
Relative Humidity:	41 %
ATM Pressure:	101.1 kPa

*The testing was performed by Andy Huang on 2018-11-10.*

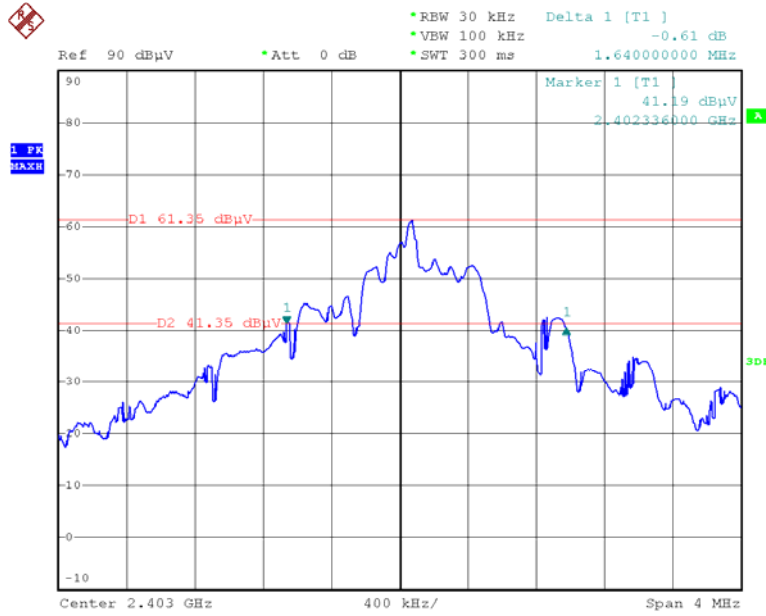
**Test Result:** Compliant.

Please refer to following tables and plots

Test Mode: Transmitting

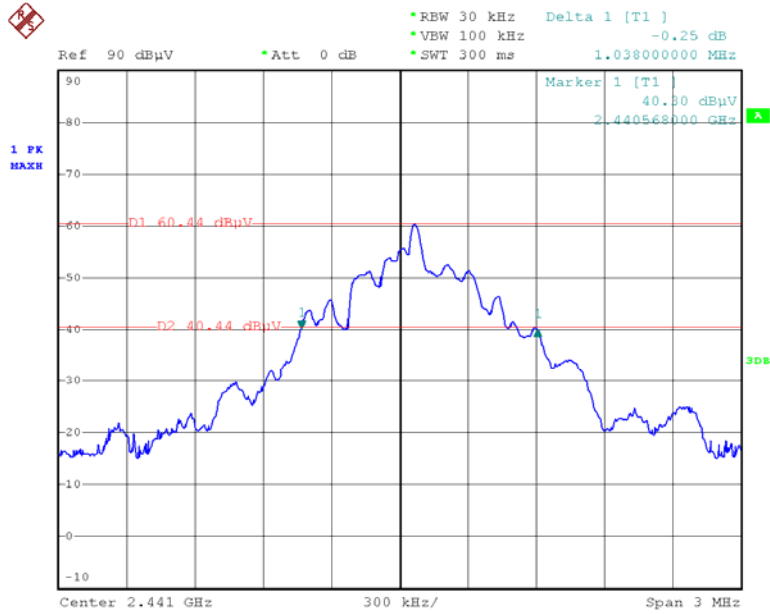
Channel	Frequency (MHz)	20 dB Bandwidth (MHz)
Low	2403	1.640
Middle	2441	1.038
High	2480	1.038

Low Channel



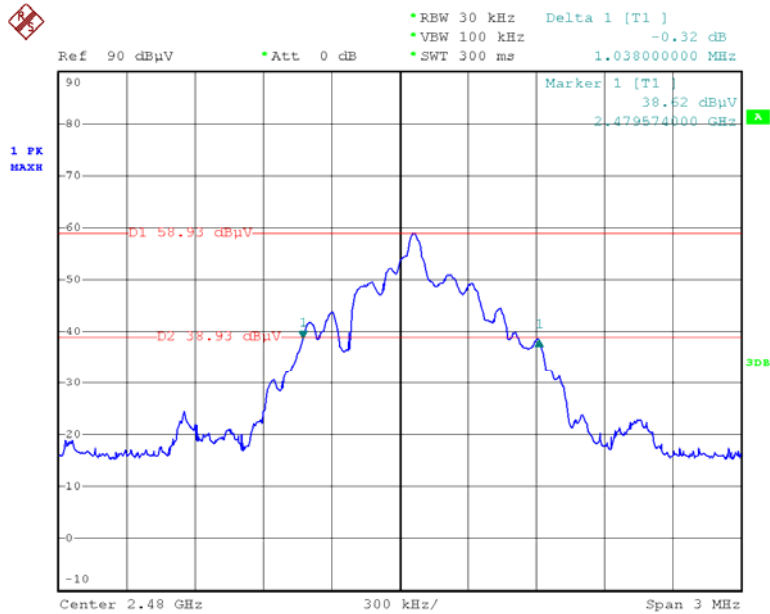
Date: 10.NOV.2018 17:52:46

### Middle Channel



Date: 10.NOV.2018 17:26:03

### High Channel



Date: 10.NOV.2018 17:38:23

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