TESTING LABORATORY
CERTIFICATE #4820.01

FCC PART 15.249

TEST REPORT

For

Shenzhen Rapoo Technology Co., Ltd

22, Jinxiu Road East, Pingshan District, Shenzhen, China

FCC ID: PP22944

Report Type:	Product Name:
Original Report	2.4 G receiver

Report Number:	RDG190315010-00
Report Date:	2019-04-28
Reviewed By:	Jerry Zhang EMC Manager
Test Laboratory:	Bay Area Compliance Laboratories Corp. (Dongguan) No.69 Pulongcun, Puxinhu Industry Area, Tangxia, Dongguan, Guangdong, China Tel: +86-769-86858888 Fax: +86-769-86858891 www.baclcorp.com.cn

Note: This test report is prepared for the customer shown above and for the device described herein. It may not be duplicated or used in part without prior written consent from Bay Area Compliance Laboratories Corp. (Dongguan). This report must not be used by the customer to claim product certification, approval, or endorsement by A2LA* or any agency of the Federal Government.
* 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)

EUT Name:	2.4 G receiver
EUT Model:	03058
Operation Frequency:	2402-2479 MHz
Modulation Type:	GFSK
Rated Input Voltage:	DC 5V from USB port
Serial Number:	190315010
EUT Received Date:	2019-03-28

Objective

This type approval report is prepared on behalf of ***Shenzhen Rapoo Technology 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)

Part of system submissions with FCC ID: PP2MT550.

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℃
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 lab has been recognized as the FCC accredited lab 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 lab has been recognized by Innovation, Science and Economic Development Canada to test to Canadian radio equipment requirements, the CAB identifier: CN0022.

SYSTEM TEST CONFIGURATION

Justification

The EUT was configured in operating mode for testing which was provided by the manufacturer.

The device employs total 16 channel as below:

Channel	Frequency (MHz)	Channel	Frequency (MHz)
1	2402	9	2437
2	2406	10	2441
3	2410	11	2455
4	2417	12	2452
5	2419	13	2462
6	2428	14	2459
7	2436	15	2477
8	2446	16	2479

2402 MHz, 2446 MHz, 2479 MHz was selected for test.

EUT Exercise Software

No software was used in test.

Equipment Modifications

No modifications were made to the EUT.

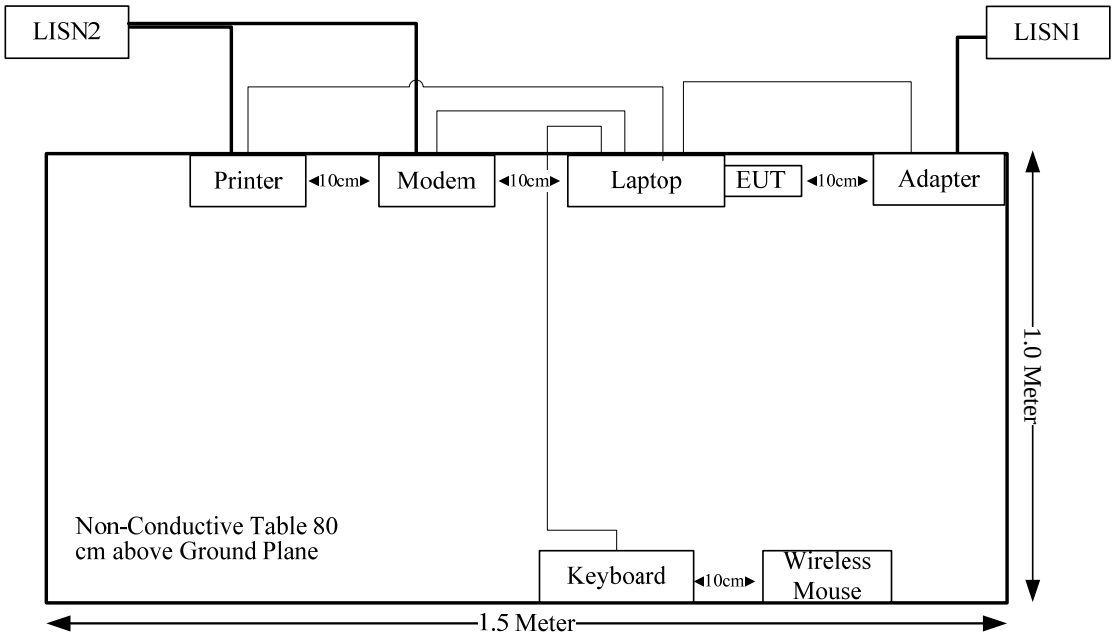
Local Support Equipment List and Details

Manufacturer	Description	Model	Serial Number
DELL	Laptop	PP11L	QDS-BRCM1017
HP	Printer	C3941A	JPTVOB2337
DELL	Keyboard	L100	CNORH656658907BL05DC
RAPOO	Mouse	6610M	Un-known
SAST	Modem	AEM-2100	293
Lenovo	Laptop	ThinkPad E450	PF-0MRADG

Support Cable List and Details

Cable Description	Shielding Type	Ferrite Core	Length (m)	From Port	To
Serial Cable	yes	No	1.2	Serial Port of Laptop	Modem
Parallel Cable	yes	No	1.2	Parallel Port of Laptop	Printer
Keyboard Cable	yes	No	1.8	USB Port of Laptop	Keyboard

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

FCC§15.203 - ANTENNA REQUIREMENT

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, and the antenna gain is -7.2 dBi, fulfill the requirement of this section. Please refer to the EUT photos.

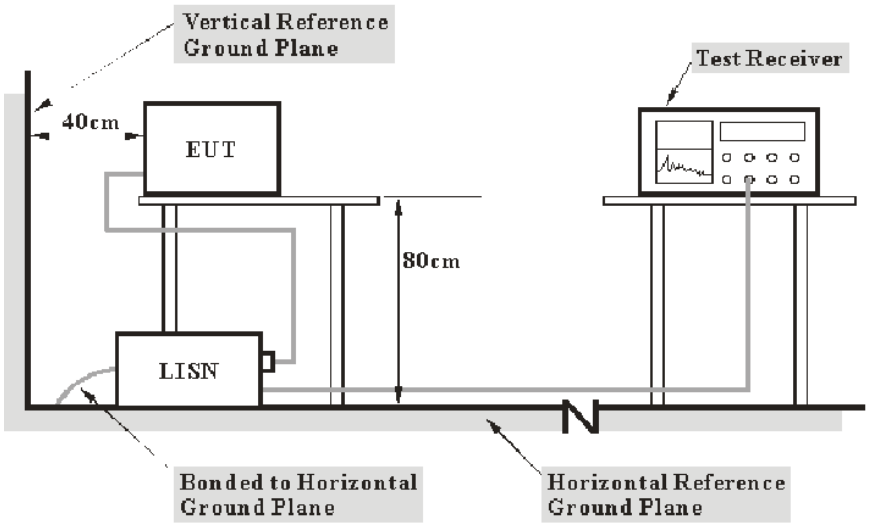
Result: Compliant.

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:

Margin = Limit – Corrected Amplitude

Test Equipment List and Details

Manufacturer	Description	Model	Serial Number	Calibration Date	Calibration Due Date
R&S	EMI Test Receiver	ESCI	101121	2019-03-23	2020-03-23
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	2018-12-10	2019-12-10

*** 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

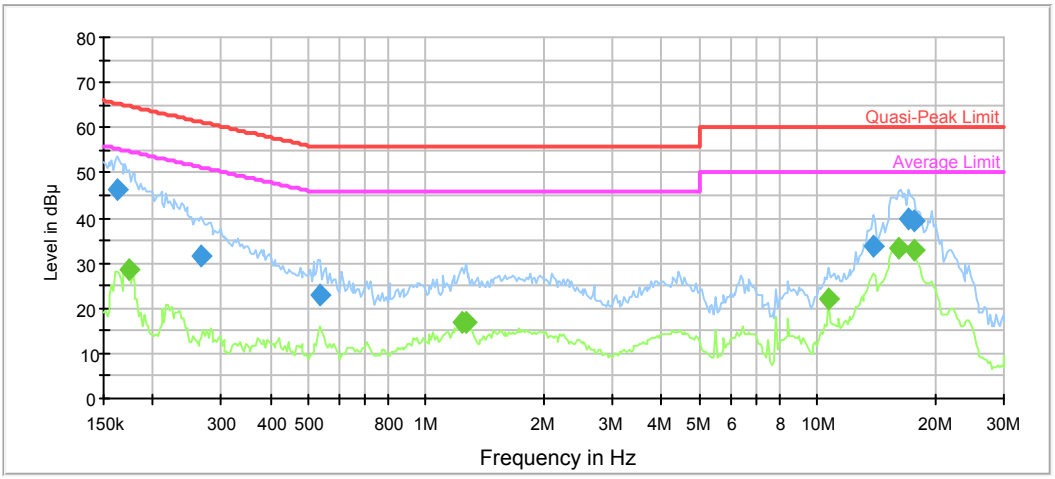
Environmental Conditions

Temperature:	25.3 °C
Relative Humidity:	50 %
ATM Pressure:	100.2 kPa

The testing was performed by Lily Xie on 2019-04-01

Test Mode: *Transmitting*

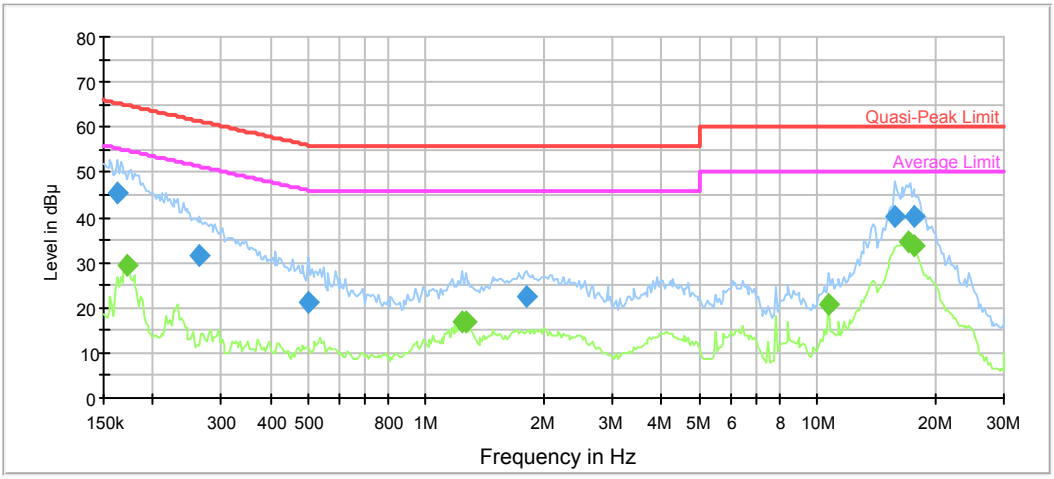
AC120V, 60 Hz, Line:



Frequency (MHz)	QuasiPeak (dBµV)	Bandwidth (kHz)	Line	Corr. (dB)	Margin (dB)	Limit (dBµV)	Comment
0.162429	46.4	9.000	L1	11.0	18.9	65.3	Compliance
0.267135	31.6	9.000	L1	10.3	29.6	61.2	Compliance
0.536077	23.1	9.000	L1	9.9	32.9	56.0	Compliance
13.877672	33.7	9.000	L1	9.9	26.3	60.0	Compliance
17.102731	39.7	9.000	L1	10.0	20.3	60.0	Compliance
17.797171	39.3	9.000	L1	10.0	20.7	60.0	Compliance

Frequency (MHz)	Average (dBµV)	Bandwidth (kHz)	Line	Corr. (dB)	Margin (dB)	Limit (dBµV)	Comment
0.174145	28.7	9.000	L1	10.9	26.1	54.8	Compliance
1.236582	16.9	9.000	L1	9.8	29.1	46.0	Compliance
1.261437	17.0	9.000	L1	9.8	29.0	46.0	Compliance
10.714228	22.1	9.000	L1	9.8	27.9	50.0	Compliance
16.111546	33.3	9.000	L1	10.0	16.7	50.0	Compliance
17.797171	32.8	9.000	L1	10.0	17.2	50.0	Compliance

AC120V, 60 Hz, Neutral:



Frequency (MHz)	QuasiPeak (dBµV)	Bandwidth (kHz)	Line	Corr. (dB)	Margin (dB)	Limit (dBµV)	Comment
0.162429	45.3	9.000	N	11.0	20.0	65.3	Compliance
0.264490	31.7	9.000	N	10.3	29.6	61.3	Compliance
0.500009	21.1	9.000	N	9.9	34.9	56.0	Compliance
1.804825	22.6	9.000	N	9.8	33.4	56.0	Compliance
15.794085	40.0	9.000	N	9.9	20.0	60.0	Compliance
17.797171	40.0	9.000	N	10.0	20.0	60.0	Compliance

Frequency (MHz)	Average (dBµV)	Bandwidth (kHz)	Line	Corr. (dB)	Margin (dB)	Limit (dBµV)	Comment
0.172421	29.5	9.000	N	10.9	25.3	54.8	Compliance
1.236582	17.0	9.000	N	9.8	29.0	46.0	Compliance
1.261437	16.7	9.000	N	9.8	29.3	46.0	Compliance
10.714228	20.8	9.000	N	9.8	29.2	50.0	Compliance
17.102731	34.8	9.000	N	10.0	15.2	50.0	Compliance
17.797171	33.6	9.000	N	10.0	16.4	50.0	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:

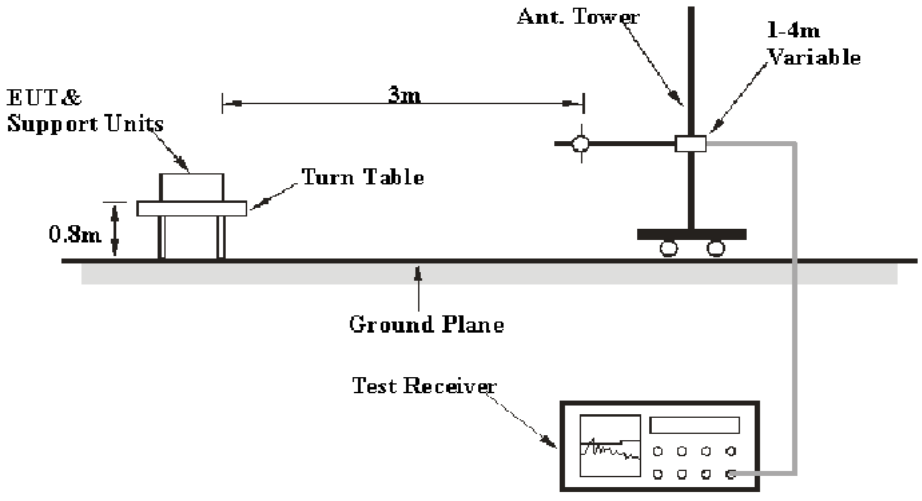
Fundamental frequency	Field strength of fundamental (millivolts/meter)	Field strength of harmonics (microvolts/meter)
902–928 MHz	50	500
2400–2483.5 MHz	50	500
5725–5875 MHz	50	500
24.0–24.25 GHz	250	2500

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

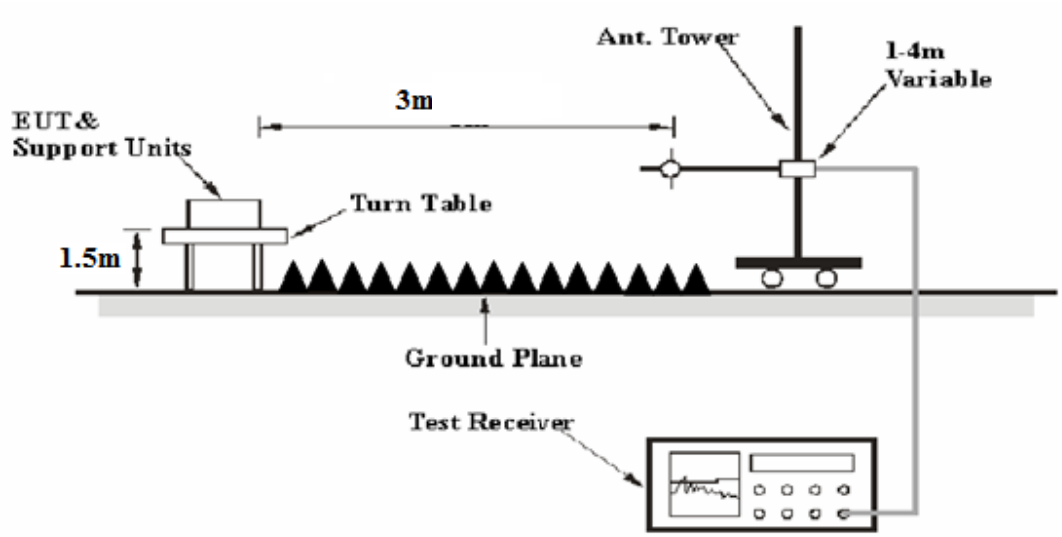
(d) Emissions radiated outside of the specified frequency bands, except for harmonics, shall be attenuated by at least 50 dB below the level of the fundamental or to the general radiated emission limits in §15.209, whichever is the lesser attenuation.

EUT Setup

Below 1 GHz:



Above 1 GHz:



The radiated emission below 1GHz tests were performed in the 3 meters chamber test site A, above 1GHz tests were performed in the 3 meters chamber test site B, using the setup accordance with the ANSI C63.10-2013. The specification used was the FCC 15.209, and FCC 15.249 limits.

Test Equipment 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:

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

If the maximized peak measured value complies with under the QP/Average limit more than 6dB, then it is unnecessary to perform an QP/Average measurement.

Test Procedure

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

All data was recorded in the Quasi-peak detection mode from 30 MHz to 1GHz, peak and average detection mode 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:

Corrected Amplitude = Meter Reading + Antenna Factor + Cable Loss - 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:

Margin = Limit –Corrected Amplitude

Test Equipment List and Details

Manufacturer	Description	Model	Serial Number	Calibration Date	Calibration Due Date
R&S	EMI Test Receiver	ESCI	100224	2018-12-10	2019-12-10
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-1400-01	2018-05-06	2019-05-06
HP	Amplifier	8447D	2727A05902	2018-09-05	2019-09-05
Agilent	Spectrum Analyzer	E4440A	SG43360054	2019-01-04	2020-01-04
ETS-Lindgren	Horn Antenna	3115	000 527 35	2018-10-12	2021-10-12
Ducommun Technolagies	Horn Antenna	ARH-4223-02	1007726-01 1304	2016-11-18	2019-11-18
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
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
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

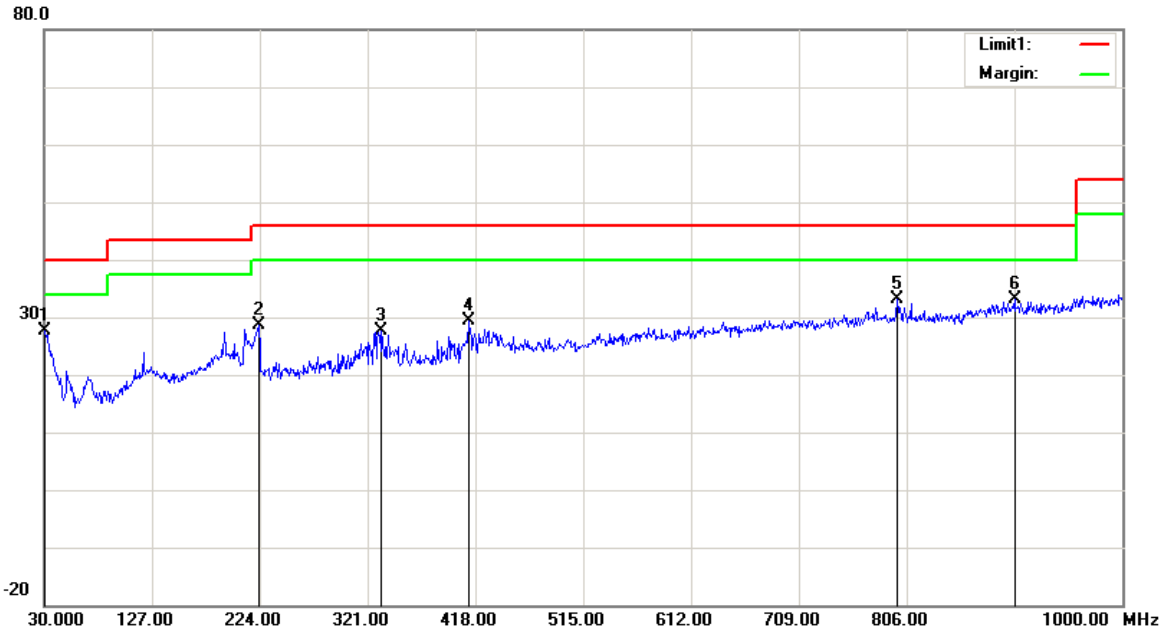
Temperature:	26.1~26.9 °C
Relative Humidity:	52~67%
ATM Pressure:	100.5~ 100.8kPa

The testing was performed by Neil Liao on 2019-04-25&2019-04-26.

Test Mode: Transmitting

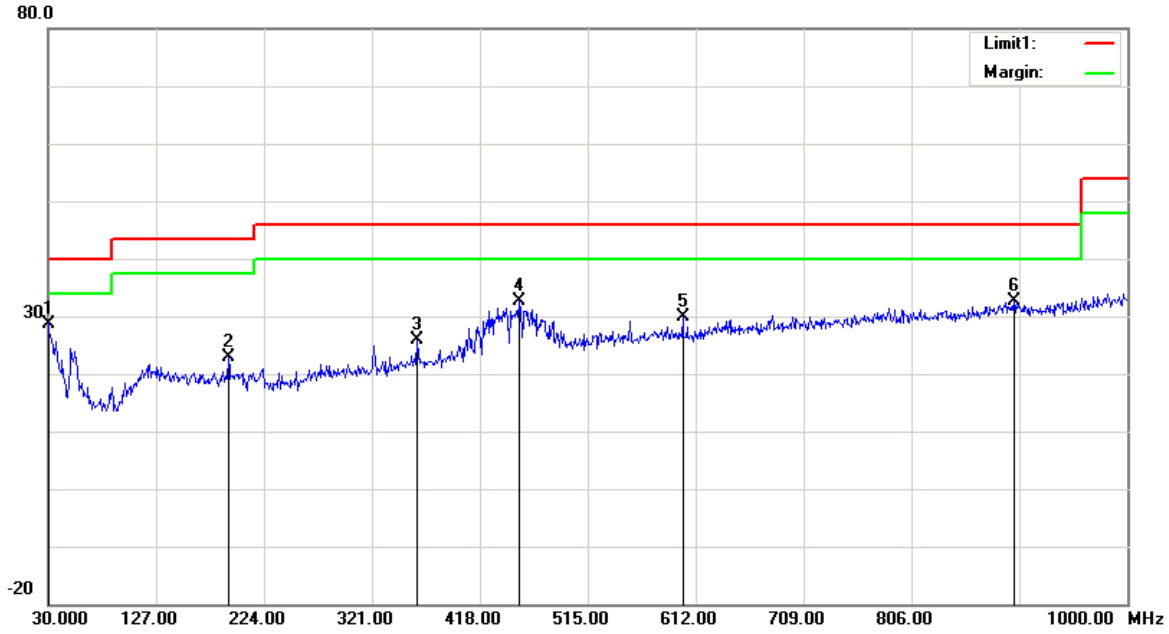
1) 30MHz-1GHz*(Middle channel is the worst)***:**

Horizontal:



Frequency (MHz)	Receiver Reading (dBuV)	Detector	Correction Factor (dB/m)	Cord. Amp. (dBuV/m)	Limit (dBuV/m)	Margin (dB)
30.0000	25.98	peak	1.72	27.70	40.00	12.30
223.0300	35.53	peak	-6.82	28.71	46.00	17.29
333.6100	30.94	peak	-3.35	27.59	46.00	18.41
412.1800	31.10	peak	-1.78	29.32	46.00	16.68
797.2700	28.80	peak	4.34	33.14	46.00	12.86
903.0000	36.90	peak	-3.80	33.10	46.00	12.90

Vertical:



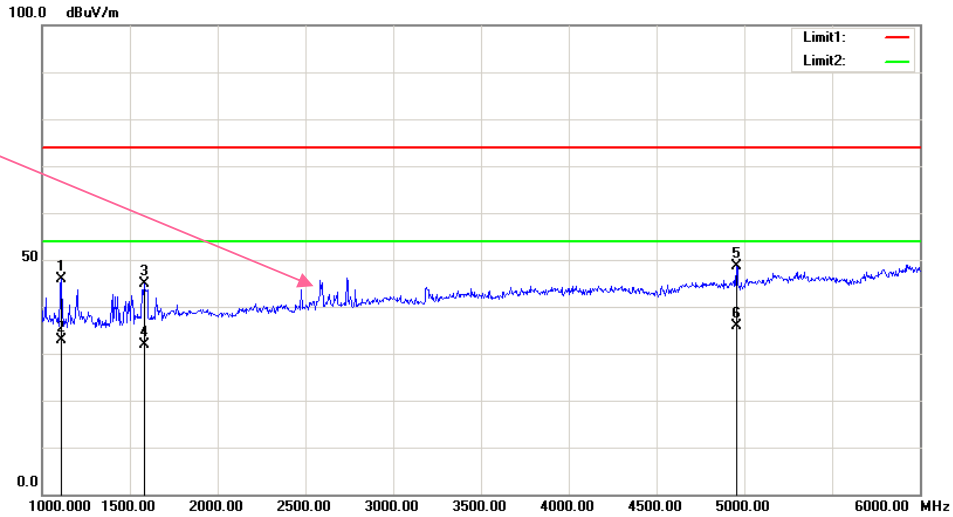
Frequency (MHz)	Receiver Reading (dBuV)	Detector	Correction Factor (dB/m)	Cord. Amp. (dBuV/m)	Limit (dBuV/m)	Margin (dB)
30.0000	27.03	peak	1.72	28.75	40.00	11.25
191.9900	29.87	peak	-7.01	22.86	43.50	20.64
361.7400	28.58	peak	-2.80	25.78	46.00	20.22
452.9200	33.70	peak	-1.07	32.63	46.00	13.37
600.3600	28.76	peak	1.03	29.79	46.00	16.21
898.1500	36.60	peak	-3.88	32.72	46.00	13.28

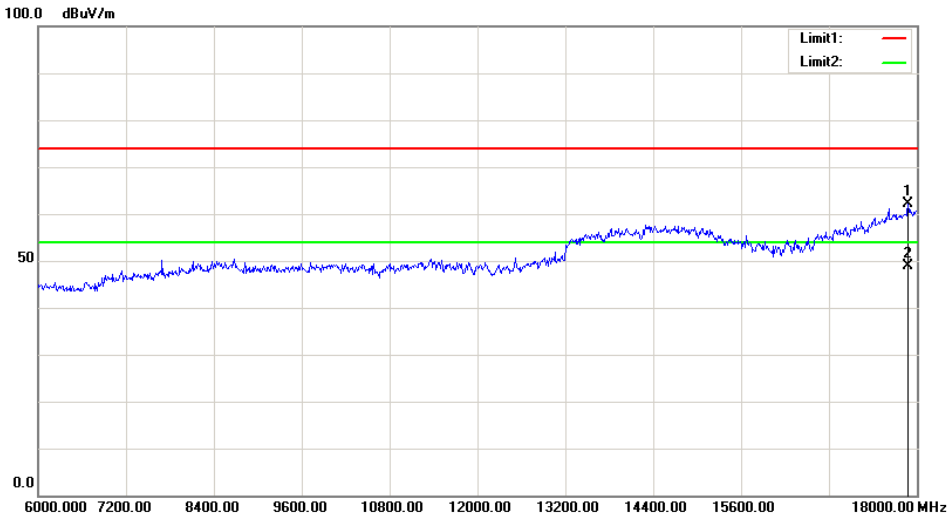
2) 1GHz-25GHz

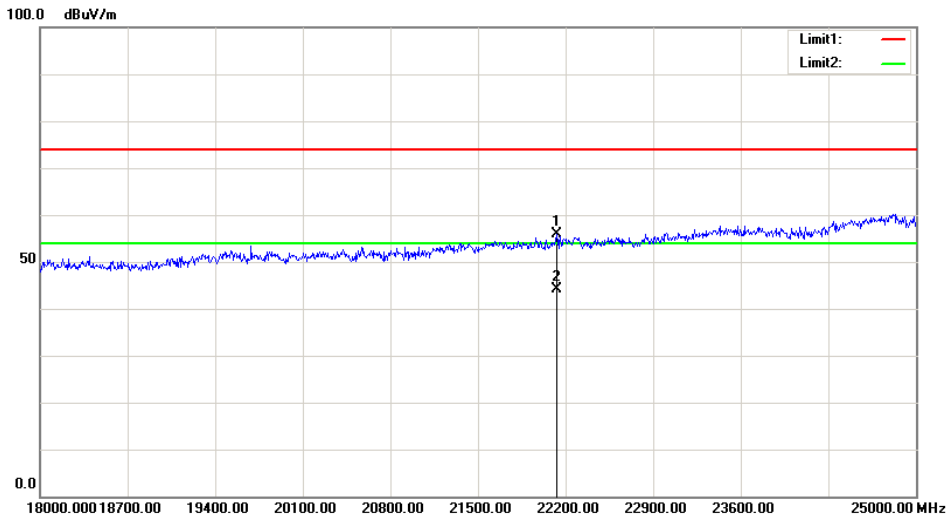
Frequency (MHz)	Receiver		Rx Antenna		Cable loss (dB)	Amplifier Gain (dB)	Corrected Amplitude (dBμV/m)	Limit (dBμV/m)	Margin (dB)
	Reading (dBμV)	Detector	Polar (H/V)	Factor (dB/m)					
Low Channel: 2402 MHz									
2402.00	51.33	PK	H	28.10	1.80	0.00	81.23	113.98	32.75
2402.00	48.39	AV	H	28.10	1.80	0.00	78.29	93.98	15.69
2402.00	49.77	PK	V	28.10	1.80	0.00	79.67	113.98	34.31
2402.00	47.63	AV	V	28.10	1.80	0.00	77.53	93.98	16.45
2400.00	33.48	PK	H	28.10	1.80	0.00	63.38	74.00	10.62
2400.00	19.55	AV	H	28.10	1.80	0.00	49.45	54.00	4.55
4804.00	50.06	PK	H	32.91	3.17	37.20	48.94	74.00	25.06
4804.00	39.48	AV	H	32.91	3.17	37.20	38.36	54.00	15.64
7206.00	46.29	PK	H	35.74	4.82	37.23	49.62	74.00	24.38
7206.00	34.29	AV	H	35.74	4.82	37.23	37.62	54.00	16.38
Middle Channel: 2446 MHz									
2446.00	49.88	PK	H	28.19	1.82	0.00	79.89	113.98	34.09
2446.00	46.59	AV	H	28.19	1.82	0.00	76.60	93.98	17.38
2446.00	45.77	PK	V	28.19	1.82	0.00	75.78	113.98	38.20
2446.00	43.92	AV	V	28.19	1.82	0.00	73.93	93.98	20.05
4892.00	51.44	PK	H	33.08	3.29	37.21	50.60	74.00	23.40
4892.00	39.67	AV	H	33.08	3.29	37.21	38.83	54.00	15.17
7338.00	45.98	PK	H	36.08	4.59	37.40	49.25	74.00	24.75
7338.00	33.16	AV	H	36.08	4.59	37.40	36.43	54.00	17.57
High Channel: 2479 MHz									
2479.00	50.39	PK	H	28.26	1.84	0.00	80.49	113.98	33.49
2479.00	48.49	AV	H	28.26	1.84	0.00	78.59	93.98	15.39
2479.00	46.50	PK	V	28.26	1.84	0.00	76.60	113.98	37.38
2479.00	44.16	AV	V	28.26	1.84	0.00	74.26	93.98	19.72
2483.50	28.79	PK	H	28.27	1.84	0.00	58.90	74.00	15.10
2483.50	14.70	AV	H	28.27	1.84	0.00	44.81	54.00	9.19
4958.00	52.19	PK	H	33.22	3.23	37.24	51.40	74.00	22.60
4958.00	40.77	AV	H	33.22	3.23	37.24	39.98	54.00	14.02
7437.00	45.90	PK	H	36.34	4.42	37.52	49.14	74.00	24.86
7437.00	33.14	AV	H	36.34	4.42	37.52	36.38	54.00	17.62

Test plots
Horizontal

Fundamental test with Filter

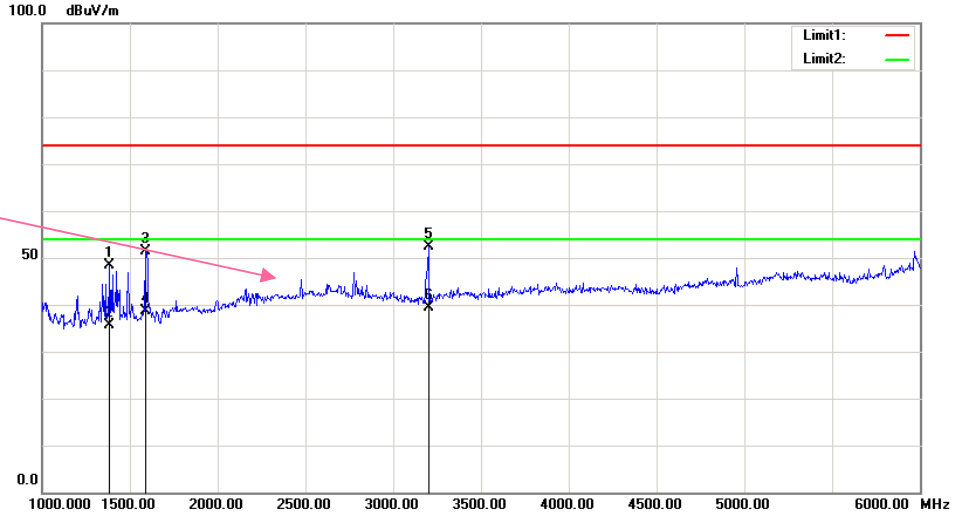


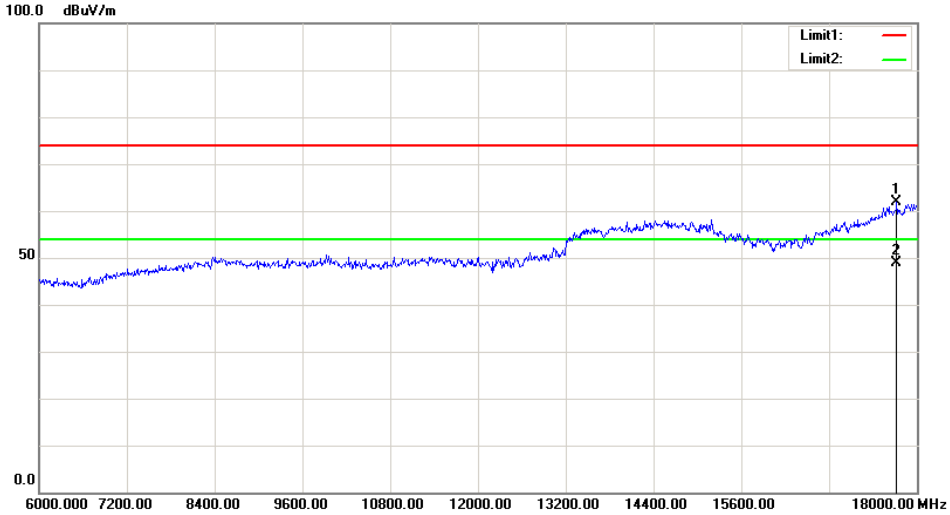


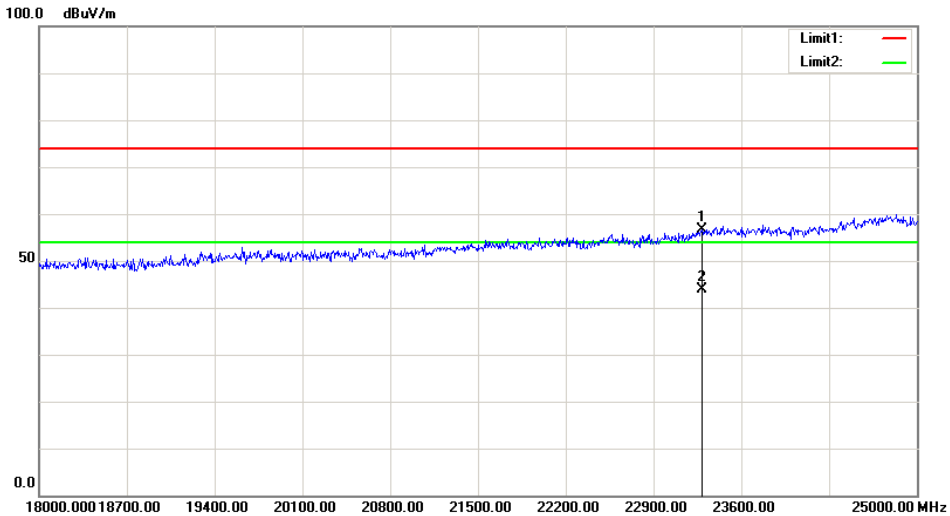


Vertical

Fundamental test with Filter







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	2019-01-04	2020-01-04
Unknown	Coaxial Cable	C-SJ00-0010	C0010/01	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:	26.1 °C
Relative Humidity:	52 %
ATM Pressure:	100.5 kPa

The testing was performed by Carrie He on 2019-04-09

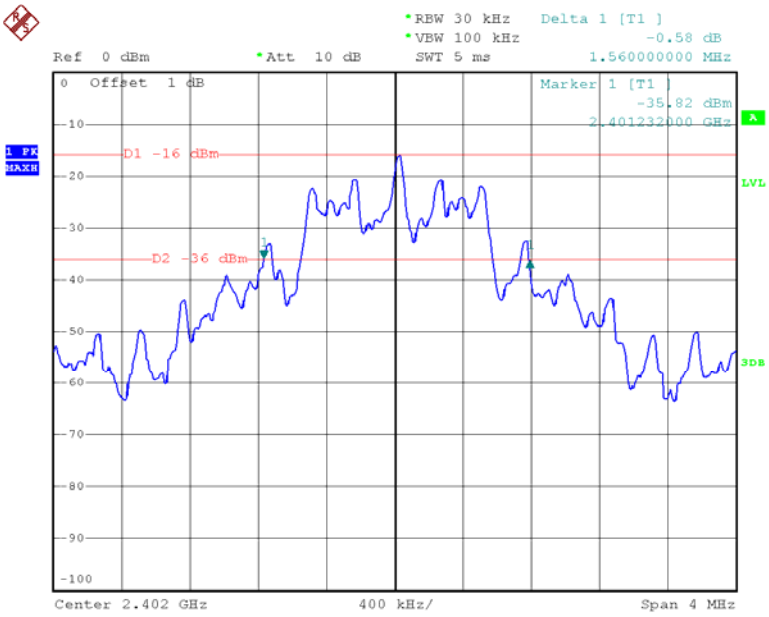
Test Result: Compliant.

Please refer to following tables and plots

Test Mode: Transmitting

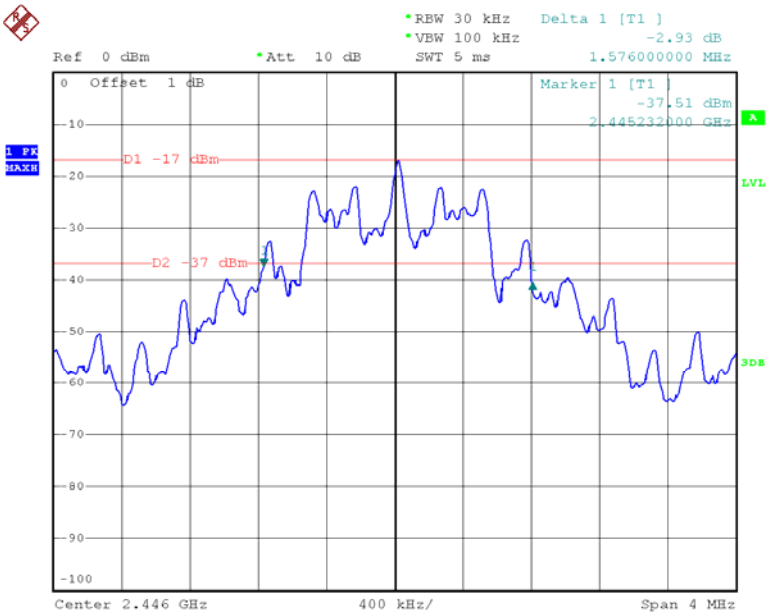
Channel	Frequency (MHz)	20 dB Bandwidth (MHz)
Low	2402	1.560
Middle	2446	1.576
High	2479	1.568

Low Channel



Date: 9.APR.2019 11:16:31

Middle Channel



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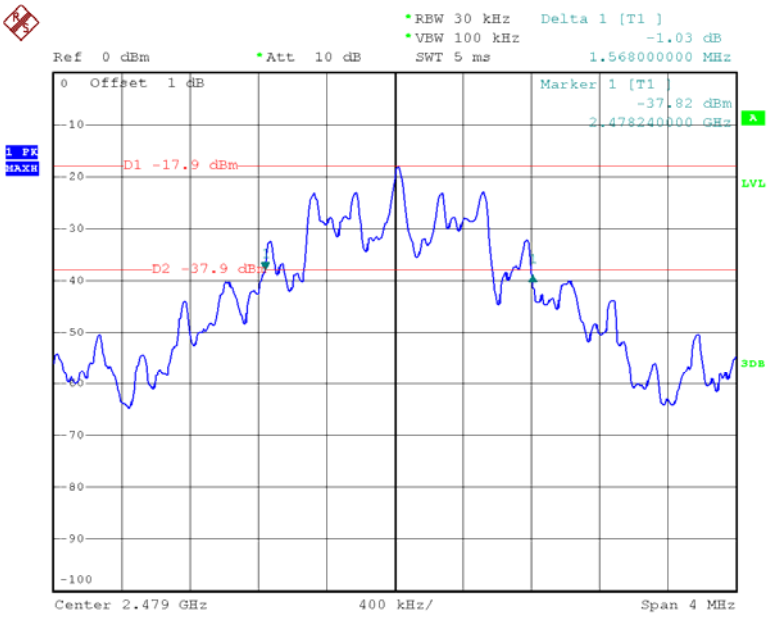
High Channel



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