



FCC PART 15.247  
TEST REPORT

For

**SHENZHEN TOPFLYtech CO., LIMITED**

Rm409 Scientific Research Building Tsinghua Hi-tech Park Hi-tech Industrial  
Nanshan District Shenzhen China

**FCC ID: 2ASWY20TLP2SFB**

<b>Report Type:</b> Original Report	<b>Product Type:</b> SOLAR POWERED GPS TRACKER
<b>Report Number:</b>	RSZ200911007-00B
<b>Report Date:</b>	2020-09-24
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## TABLE OF CONTENTS

<b>GENERAL INFORMATION</b> .....	<b>4</b>
PRODUCT DESCRIPTION FOR EQUIPMENT UNDER TEST (EUT).....	4
OBJECTIVE.....	4
TEST METHODOLOGY.....	4
MEASUREMENT UNCERTAINTY.....	5
<b>SYSTEM TEST CONFIGURATION</b> .....	<b>6</b>
DESCRIPTION OF TEST CONFIGURATION.....	6
EQUIPMENT MODIFICATIONS.....	6
EUT EXERCISE SOFTWARE.....	6
DUTY CYCLE.....	7
SUPPORT EQUIPMENT LIST AND DETAILS.....	8
EXTERNAL I/O CABLE.....	8
BLOCK DIAGRAM OF TEST SETUP.....	8
<b>SUMMARY OF TEST RESULTS</b> .....	<b>9</b>
<b>TEST EQUIPMENT LIST</b> .....	<b>10</b>
<b>FCC §15.247 (i) &amp; §2.1091- MAXIMUM PERMISSIBLE EXPOSURE (MPE)</b> .....	<b>12</b>
APPLICABLE STANDARD.....	12
RESULT.....	12
<b>FCC §15.203 - ANTENNA REQUIREMENT</b> .....	<b>14</b>
APPLICABLE STANDARD.....	14
ANTENNA CONNECTOR CONSTRUCTION.....	14
<b>FCC §15.207 (a) – AC LINE CONDUCTED EMISSIONS</b> .....	<b>15</b>
APPLICABLE STANDARD.....	15
EUT SETUP.....	15
EMI TEST RECEIVER SETUP.....	15
TEST PROCEDURE.....	15
CORRECTED FACTOR & MARGIN CALCULATION.....	16
TEST DATA.....	17
<b>FCC §15.209, §15.205 &amp; §15.247(d) - SPURIOUS EMISSIONS</b> .....	<b>19</b>
APPLICABLE STANDARD.....	19
EUT SETUP.....	19
EMI TEST RECEIVER & SPECTRUM ANALYZER SETUP.....	20
TEST PROCEDURE.....	20
CORRECTED AMPLITUDE & MARGIN CALCULATION.....	20
TEST DATA.....	21
<b>FCC §15.247(a) (2) – 6 dB EMISSION BANDWIDTH</b> .....	<b>33</b>
APPLICABLE STANDARD.....	33
TEST PROCEDURE.....	33
TEST DATA.....	33
BLE_2M.....	36

**FCC §15.247(b) (3) - MAXIMUM CONDUCTED OUTPUT POWER.....38**  
    APPLICABLE STANDARD .....38  
    TEST PROCEDURE .....38  
    TEST DATA .....38  
    BLE\_2M.....41

**FCC §15.247(d) – 100 kHz BANDWIDTH OF FREQUENCY BAND EDGE.....43**  
    APPLICABLE STANDARD .....43  
    TEST PROCEDURE .....43  
    TEST DATA .....43

**FCC §15.247(e) - POWER SPECTRAL DENSITY .....46**  
    APPLICABLE STANDARD .....46  
    TEST PROCEDURE .....46  
    TEST DATA .....46  
    BLE\_2M.....49

## GENERAL INFORMATION

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

Product	SOLAR POWERED GPS TRACKER
Test Model	TLP2-SFB
Frequency Range	BLE_1M & BLE_2M: 2402-2480MHz
Maximum Conducted Output Peak Power	1.38dBm(BLE_1M) 1.05dBm(BLE_2M)
Modulation Technique	GFSK
Antenna Specification	1.11dBi
Voltage Range	DC 3.6V from Li-ion battery
Date of Test	2020-09-15 to 2020-09-24
Sample serial number	RSZ200911007-RF-S2 (Assigned by BAACL, Shenzhen)
Received date	2020-09-11
Sample/EUT Status	Good condition

### Objective

This test report is in accordance with Part 2-Subpart J, Part 15-Subparts A and C of the Federal Communication Commission's rules.

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

### 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 v05r02.

All emissions measurement was performed at Bay Area Compliance Laboratories Corp. (Shenzhen). The radiated testing was performed at an antenna-to-EUT distance of 3 meters.

**Measurement Uncertainty**

Parameter		Uncertainty
Occupied Channel Bandwidth		±5%
RF Output Power with Power meter		±0.73dB
RF conducted test with spectrum		±1.6dB
AC Power Lines Conducted Emissions		±1.95dB
Emissions, Radiated	Below 1GHz	±4.75dB
	Above 1GHz	±4.88dB
Temperature		±1°C
Humidity		±6%
Supply voltages		±0.4%

*Note: The extended uncertainty given in this report is obtained by combining the standard uncertainty times the coverage factor K with the 95% confidence interval. Otherwise required by the applicant or Product Regulations, Decision Rule in this report did not consider the uncertainty.*

**Test Facility**

The test site used by Bay Area Compliance Laboratories Corp. (Shenzhen) to collect test data is located on the 6/F., West Wing, Third Phase of Wanli Industrial Building, Shihua Road, Futian Free Trade Zone, Shenzhen, 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.: 342867, the FCC Designation No.: CN1221.

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

## SYSTEM TEST CONFIGURATION

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### Description of Test Configuration

For BLE mode, 40 channels are provided to testing:

Channel	Frequency (MHz)	Channel	Frequency (MHz)
0	2402	20	2442
1	2404	21	2444
2	2406	22	2446
3	2408	23	2448
4	2410	24	2450
5	2412	25	2452
6	2414	26	2454
7	2416	27	2456
8	2418	28	2458
9	2420	29	2460
10	2422	30	2462
11	2424	31	2464
12	2426	32	2466
13	2428	33	2468
14	2430	34	2470
15	2432	35	2472
16	2434	36	2474
17	2436	37	2476
18	2438	38	2478
19	2440	39	2480

EUT was tested with Channel 0, 19 and 39.

### Equipment Modifications

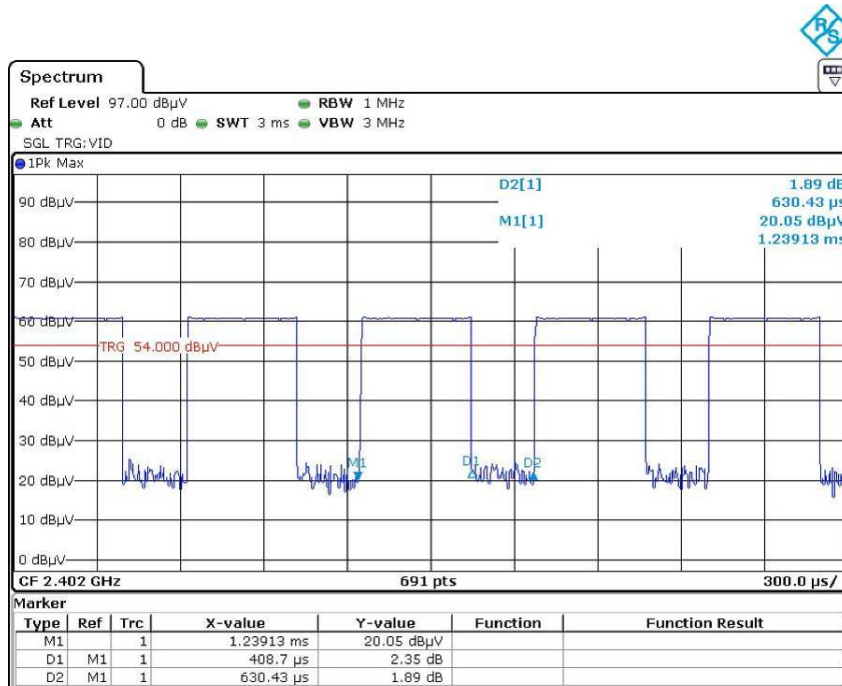
No modification was made to the EUT tested.

### EUT Exercise Software

“nrf” exercise software was used and power level is 4.

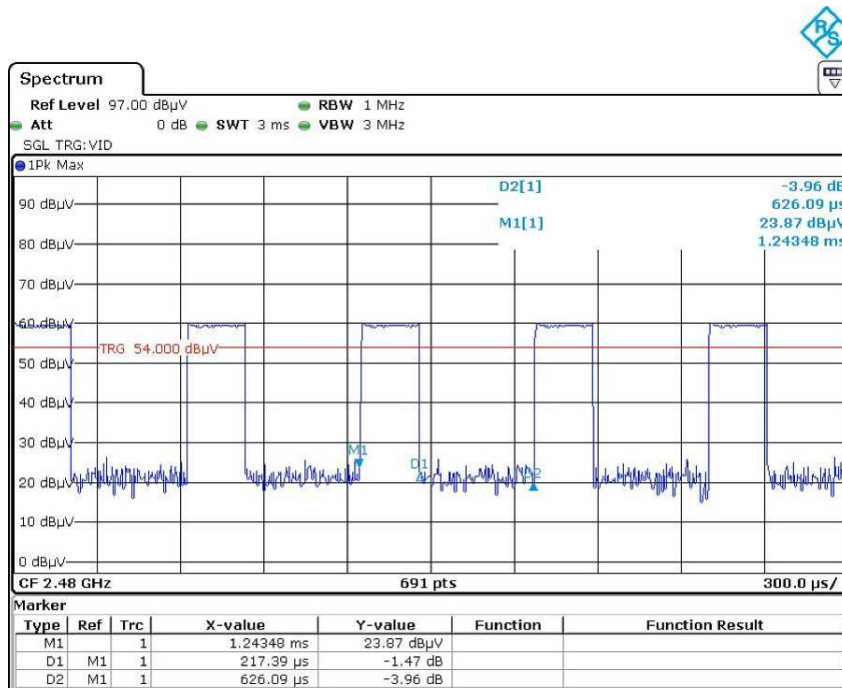
Duty cycle

BLE\_1M



Date: 15.SEP.2020 18:09:31

BLE\_2M



Date: 15.SEP.2020 19:28:21

Mode	T <sub>on</sub> (ms)	T <sub>on+off</sub> (ms)	Duty Cycle (%)
BLE_1M	0.408	0.630	64.76
BLE_2M	0.217	0.626	34.66

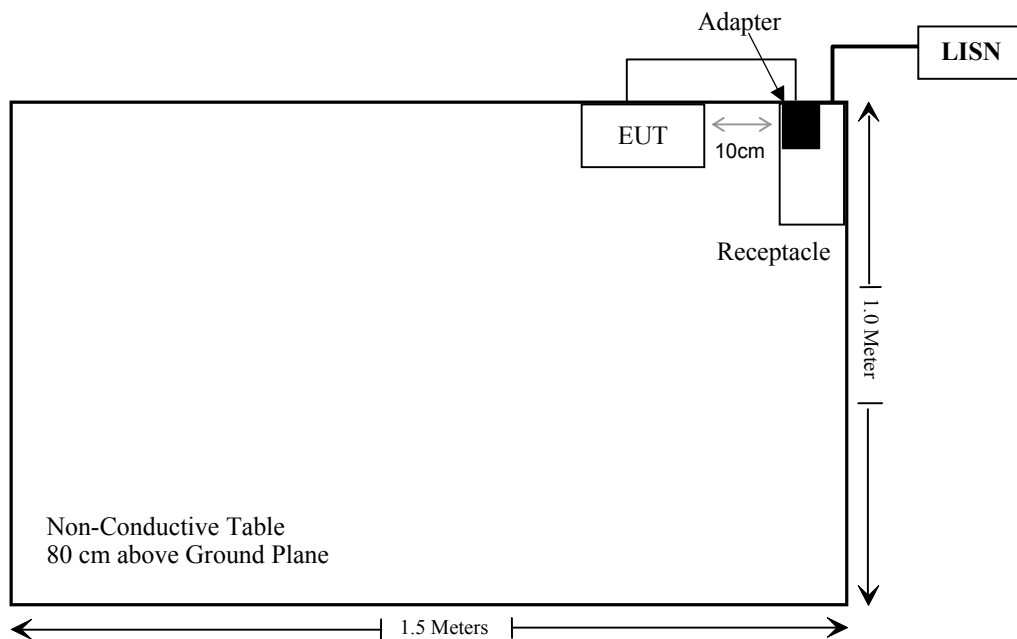
**Support Equipment List and Details**

Manufacturer	Description	Model	Serial Number
BLU	Adapter	TPA-46B050T00UU	US-WT-1000

**External I/O Cable**

Cable Description	Length (m)	From Port	To
Un-shielding Detachable USB Cable	0.6	EUT	Adapter

**Block Diagram of Test Setup**





**SUMMARY OF TEST RESULTS**

<b>FCC Rules</b>	<b>Description of Test</b>	<b>Result</b>
§15.247 (i), §2.1091	Maximum Permissible Exposure(MPE)	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 Emission 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

**TEST EQUIPMENT LIST**

Manufacturer	Description	Model	Serial Number	Calibration Date	Calibration Due Date
<b>Conducted Emissions Test</b>					
Rohde & Schwarz	EMI Test Receiver	ESCI	101120	2020/08/04	2021/08/03
Rohde & Schwarz	LISN	ENV216	101613	2020/08/04	2021/08/03
Rohde & Schwarz	Transient Limiter	ESH3Z2	DE25985	2019/11/29	2020/11/28
Unknown	CE Cable	CE Cable	UF A210B-1-0720-504504	2019/11/29	2020/11/28
Rohde & Schwarz	CE Test software	EMC 32	V8.53.0	NCR	NCR
<b>Radiated Emission Test</b>					
R&S	EMI Test Receiver	ESR3	102455	2020/08/04	2021/08/03
Sonoma instrument	Pre-amplifier	310 N	186238	2020/08/04	2021/08/03
Sunol Sciences	Broadband Antenna	JB1	A040904-1	2017/12/22	2020/12/21
Unknown	Cable 2	RF Cable 2	F-03-EM197	2019/11/29	2020/11/28
Unknown	Cable	Chamber Cable 1	F-03-EM236	2019/11/29	2020/11/28
Rohde & Schwarz	Auto test software	EMC 32	V9.10	NCR	NCR
Rohde & Schwarz	Spectrum Analyzer	FSV40-N	102259	2020/08/04	2021/08/03
COM-POWER	Pre-amplifier	PA-122	181919	2019/11/29	2020/11/28
Quinstar	Amplifier	QLW-18405536-J0	15964001002	2019/11/29	2020/11/28
Sunol Sciences	Horn Antenna	DRH-118	A052604	2017/12/22	2020/12/21
Insulted Wire Inc.	RF Cable	SPS-2503-3150	02222010	2019/11/29	2020/11/28
Unknown	RF Cable	W1101-EQ1 OUT	F-19-EM005	2019/11/29	2020/11/28
SNSD	Band Reject filter	BSF2402-2480MN-0898-001	2.4G filter	2020/04/20	2021/04/20
Ducommun Technologies	Horn antenna	ARH-4223-02	1007726-02 1304	2017/12/06	2020/12/05

Manufacturer	Description	Model	Serial Number	Calibration Date	Calibration Due Date
<b>RF Conducted Test</b>					
Rohde & Schwarz	SPECTRUM ANALYZER	FSU26	200120	2020/04/03	2021/04/02
WEINSCHTEL	3dB Attenuator	Unknown	Unknown	2019/11/29	2020/11/28
Unknown	RF Cable	Unknown	2301 276	2019/11/29	2020/11/28

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

**FCC §15.247 (i) & §2.1091- MAXIMUM PERMISSIBLE EXPOSURE (MPE)**

**Applicable Standard**

According to subpart 15.247 (i) and subpart 2.1091 systems operating under the provisions of this section shall be operated in a manner that ensures the public is not exposed to RF energy level in excess of the communication guidelines.

Limits for General Population/Uncontrolled Exposure

Limits for General Population/Uncontrolled Exposure				
Frequency Range (MHz)	Electric Field Strength (V/m)	Magnetic Field Strength (A/m)	Power Density (mW/cm <sup>2</sup> )	Averaging Time (Minutes)
0.3-1.34	614	1.63	*(100)	30
1.34-30	824/f	2.19/f	*(180/f <sup>2</sup> )	30
30-300	27.5	0.073	0.2	30
300-1500	/	/	f/1500	30
1500-100,000	/	/	1.0	30

f = frequency in MHz

\* = Plane-wave equivalent power density

**Result**

**Calculated Formulary:**

Predication of MPE limit at a given distance

$$S = \frac{PG}{4\pi R^2}$$

S = power density (in appropriate units, e.g. mW/cm<sup>2</sup>)

P = power input to the antenna (in appropriate units, e.g., mW).

G = power gain of the antenna in the direction of interest relative to an isotropic radiator, the power gain factor, is normally numeric gain.

R = distance to the center of radiation of the antenna (appropriate units, e.g., cm)

For simultaneously transmit system, the calculated power density should comply with:

$$\sum_i \frac{S_i}{S_{Limit,i}} \leq 1$$

Mode	Frequency (MHz)	Antenna Gain		Max Tune Up Conducted Power		Evaluation Distance (cm)	Power Density (mW/cm <sup>2</sup> )	MPE Limit (mW/cm <sup>2</sup> )
		(dBi)	(numeric)	(dBm)	(mW)			
BLE	2402-2480	1.11	1.29	1.5	1.41	20	0.0004	1.0
GSM850	824-849	-0.45	0.90	23.97	249.46	20	0.045	0.55
GSM1900	1850-1910	0.87	1.22	20.97	125.03	20	0.030	1.0
eMTC Band 2	1850-1910	0.87	1.22	24.0	251.19	20	0.061	1.0
eMTC Band 4	1710-1755	0.87	1.22	23.0	199.53	20	0.048	1.0
eMTC Band 5	824-849	-0.45	0.90	24.0	251.19	20	0.045	0.55
eMTC Band 12	699-716	-0.45	0.90	24.0	251.19	20	0.045	0.466
eMTC Band 13	777-787	-0.45	0.90	24.0	251.19	20	0.045	0.518
eMTC Band 26	814-824	-0.45	0.90	24.0	251.19	20	0.045	0.54
NB-IoT Band 2	1850-1910	0.87	1.22	25.0	316.23	20	0.077	1.0
NB-IoT Band 4	1710-1755	0.87	1.22	25.0	316.23	20	0.077	1.0
NB-IoT Band 5	824-849	-0.45	0.90	25.0	316.23	20	0.057	0.55
NB-IoT Band 12	699-716	-0.45	0.90	25.0	316.23	20	0.057	0.466
NB-IoT Band 13	777-787	-0.45	0.90	25.0	316.23	20	0.057	0.518

- Note: 1. The tune up conducted power was declared by the applicant  
2. The BLE function can transmit at the same time with the GSM/NB-IoT/eMTC.  
3. Please refer to the MPE report of the FCC ID: XMR201707BG96 for the GSM/NB-IoT/eMTC output power.

So the worst simultaneous transmitting consideration:

$$\text{The ratio} = \text{MPE}_{\text{BLE}}/\text{limit} + \text{MPE}_{\text{NB-IoT}}/\text{limit} = 0.0004/1.0 + 0.057/0.466 \\ = 0.1227 < 1.0$$

To maintain compliance with the FCC's RF exposure guidelines, place the equipment at least 20cm from nearby persons.

**Result: Compliance**

## **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.
- Unit must be professionally installed, and installer shall be responsible for verifying that the correct antenna is employed with the unit.

And according to FCC 47 CFR section 15.247 (b), if the transmitting antennas of directional gain greater than 6dBi are used, the power shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

### **Antenna Connector Construction**

The EUT has one internal antenna arrangement for BLE which was permanently attached and the antenna gain is 1.11 dBi, fulfill the requirement of this section. Please refer to the EUT photos.

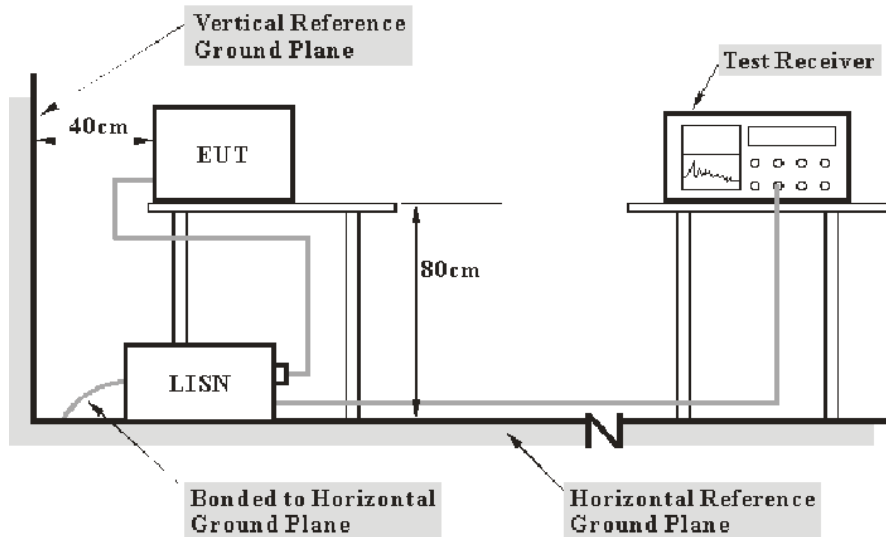
**Result: Pass**

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

**Applicable Standard**

FCC§15.207

**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 limits.

The spacing between the peripherals was 10 cm.

**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 outlet of the LISN.

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

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

### **Corrected Factor & Margin Calculation**

The Corrected factor is calculated by adding LISN VDF (Voltage Division Factor), Cable Loss and Transient Limiter Attenuation. The basic equation is as follows:

$$\text{Correction Factor} = \text{LISN VDF} + \text{Cable Loss} + \text{Transient Limiter Attenuation}$$

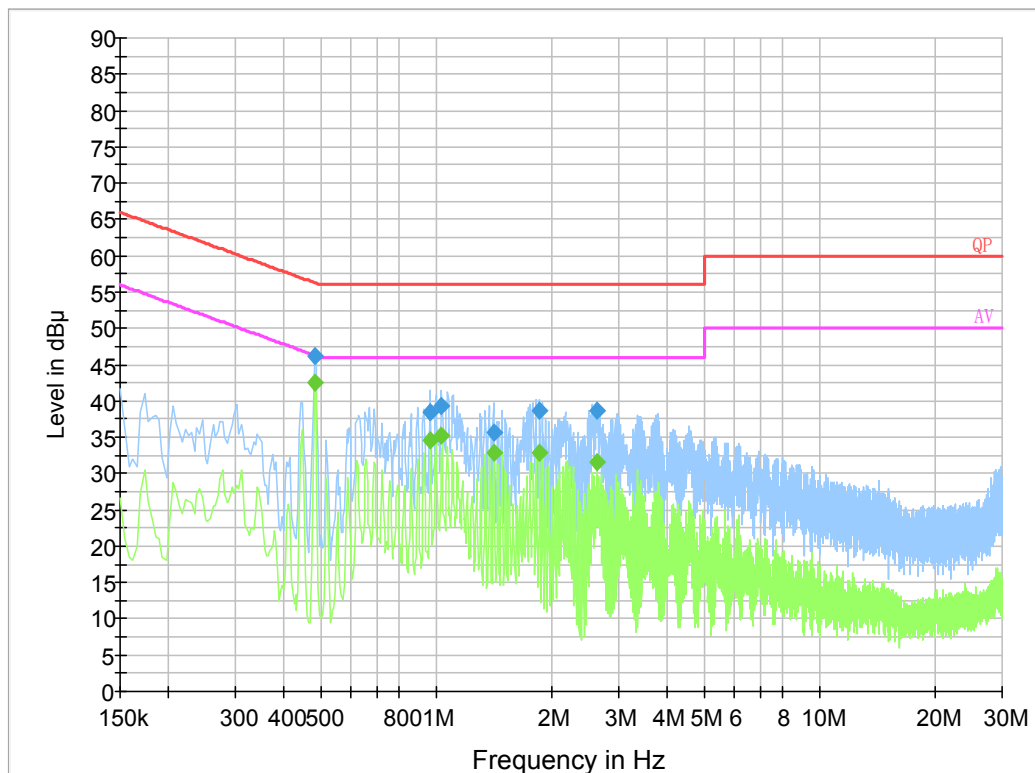
The “**Margin**” column of the following data tables indicates the degree of compliance with the applicable limit. For example, a margin of 7 dB means the emission is 7 dB below the limit. The equation for margin calculation is as follows:

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



**Test Data**

Project No: RSZ200911007-RF  
 Company Name: SHENZHEN TOPFLYtech CO., LIMITED  
 Model Number: TLP2-SFB EUT Number: RSZ200911007-RF-S1  
 Test Standard: FCC Part15.247  
 Climatic: 25°C 65%RH 101kPa  
 Test Date: 2020.09.15 Test Engineer: Haiguo Li  
 Power Source: AC 120V 60Hz Port: L  
 Test Mode: BLE transmitting & Charging



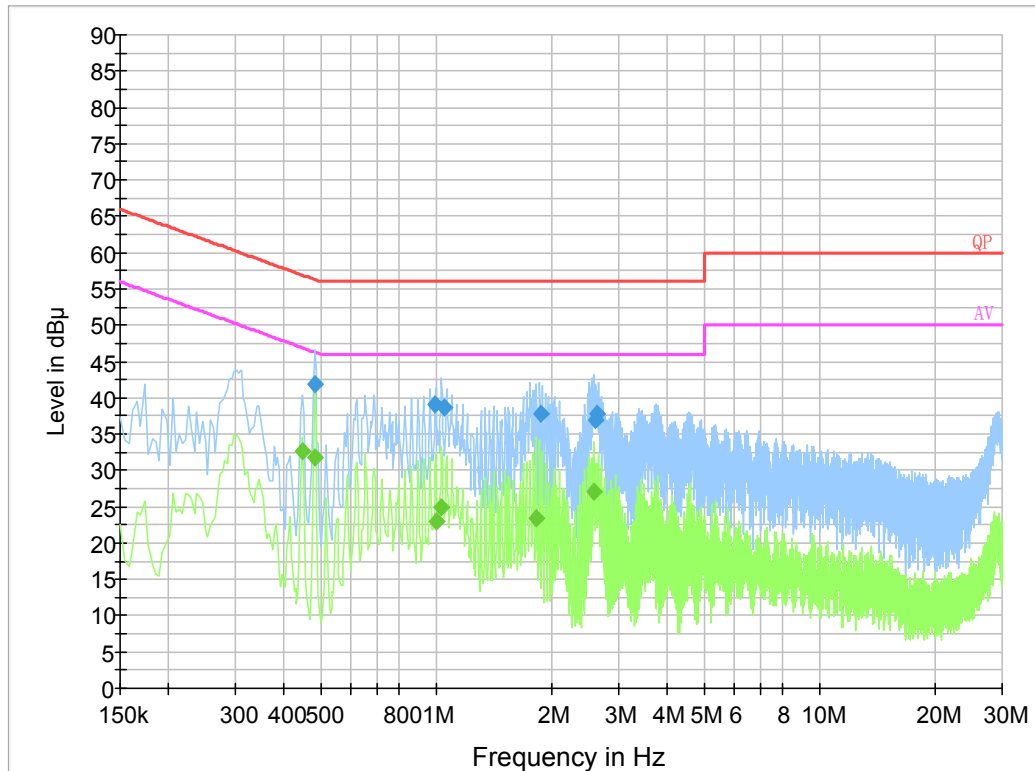
**Final Result 1**

Frequency (MHz)	QuasiPeak (dB μ V)	Bandwidth (kHz)	Line	Corr. (dB)	Margin (dB)	Limit (dB μ V)
0.482770	46.2	9.000	L1	19.8	10.1	56.3
0.967510	38.5	9.000	L1	19.9	17.5	56.0
1.034490	39.3	9.000	L1	19.9	16.7	56.0
1.416790	35.8	9.000	L1	19.8	20.2	56.0
1.862070	38.6	9.000	L1	19.9	17.4	56.0
2.622370	38.6	9.000	L1	19.9	17.4	56.0

**Final Result 2**

Frequency (MHz)	Average (dB μ V)	Bandwidth (kHz)	Line	Corr. (dB)	Margin (dB)	Limit (dB μ V)
0.482770	42.6	9.000	L1	19.8	3.7	46.3
0.967510	34.6	9.000	L1	19.9	11.4	46.0
1.034490	35.2	9.000	L1	19.9	10.8	46.0
1.416790	32.8	9.000	L1	19.8	13.2	46.0
1.862070	32.9	9.000	L1	19.9	13.1	46.0
2.622370	31.6	9.000	L1	19.9	14.4	46.0

Project No: RSZ200911007-RF  
 Company Name: SHENZHEN TOPFLYtech CO., LIMITED  
 Model Number: TLP2-SFB EUT Number: RSZ200911007-RF-S1  
 Test Standard: FCC Part15.247  
 Climatic: 25°C 65%RH 101kPa  
 Test Date: 2020.09.15 Test Engineer: Haiguo Li  
 Power Source: AC 120V 60Hz Port: N  
 Test Mode: BLE transmitting & Charging



**Final Result 1**

Frequency (MHz)	QuasiPeak (dB μ V)	Bandwidth (kHz)	Line	Corr. (dB)	Margin (dB)	Limit (dB μ V)
0.482770	42.0	9.000	N	19.8	14.3	56.3
0.994970	39.0	9.000	N	19.8	17.0	56.0
1.049510	38.6	9.000	N	19.8	17.4	56.0
1.870070	37.8	9.000	N	19.9	18.2	56.0
2.607210	37.0	9.000	N	19.8	19.0	56.0
2.622190	37.7	9.000	N	19.8	18.3	56.0

**Final Result 2**

Frequency (MHz)	Average (dB μ V)	Bandwidth (kHz)	Line	Corr. (dB)	Margin (dB)	Limit (dB μ V)
0.450000	32.8	9.000	N	19.8	14.1	46.9
0.482000	31.7	9.000	N	19.8	14.6	46.3
1.002000	23.1	9.000	N	19.8	22.9	46.0
1.034000	25.0	9.000	N	19.8	21.0	46.0
1.830000	23.3	9.000	N	19.8	22.7	46.0
2.586000	27.0	9.000	N	19.8	19.0	46.0

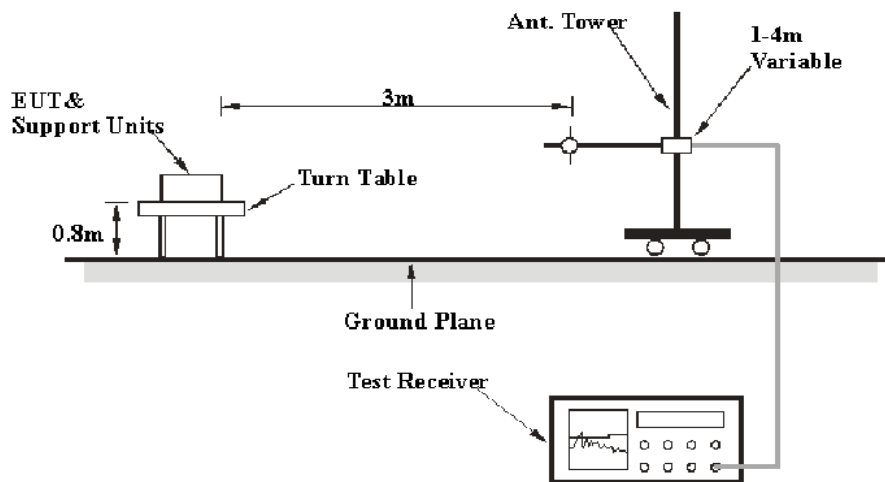
## FCC §15.209, §15.205 & §15.247(d) - SPURIOUS EMISSIONS

### Applicable Standard

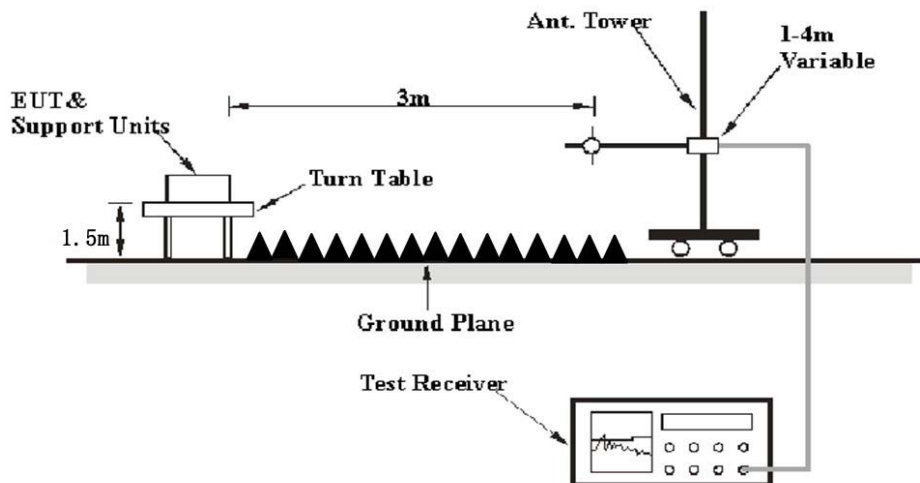
FCC §15.247 (d); §15.209; §15.205;

### EUT Setup

#### Below 1 GHz:



#### Above 1GHz:



The radiated emission tests were performed in the 3 meters test site, using the setup accordance with the ANSI C63.10-2013. The specification used was the FCC 15.209, and FCC 15.247 limits.

## EMI Test Receiver & Spectrum Analyzer Setup

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	100 kHz	300 kHz	120 kHz	QP
Above 1 GHz	1MHz	3 MHz	/	PK
	1MHz	10 Hz <sup>Note 1</sup>	/	Average
	1MHz	> 1/T <sup>Note 2</sup>	/	Average

Note 1: when duty cycle is no less than 98%

Note 2: when duty cycle is less than 98%

## 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:

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

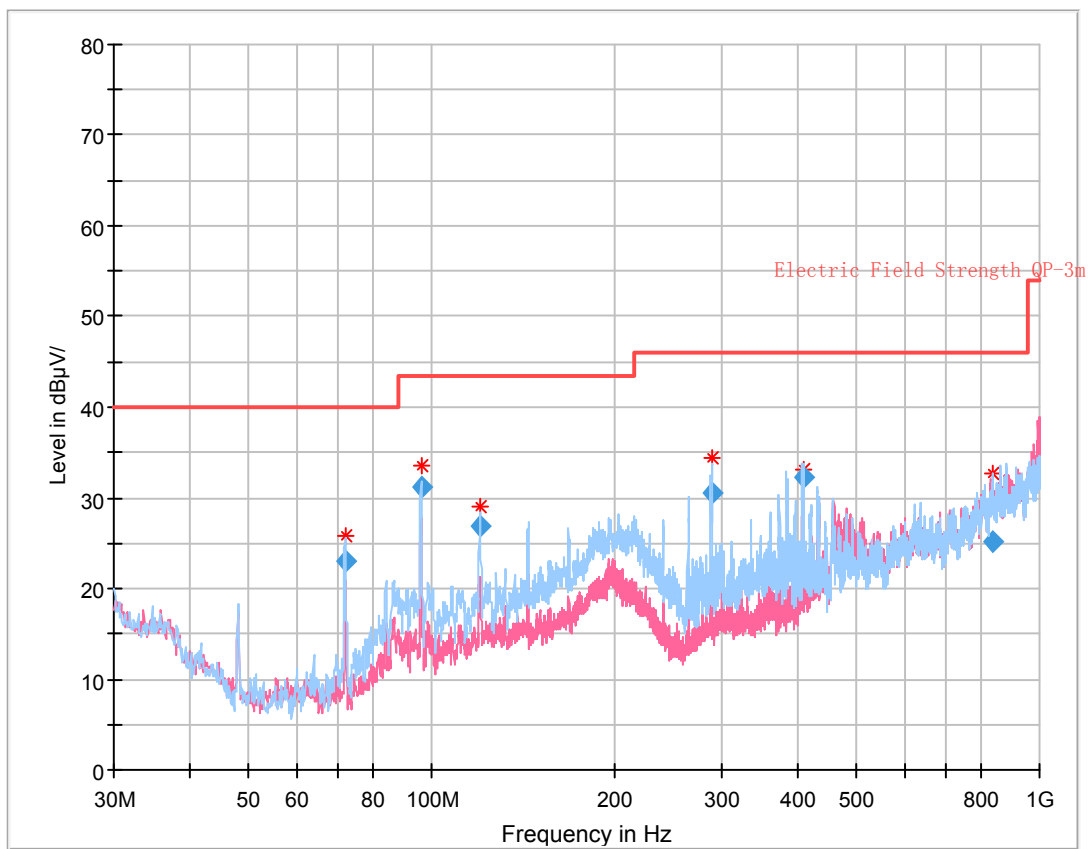
The “**Margin**” column of the following data tables indicates the degree of compliance with the applicable limit. For example, a margin of 7dB means the emission is 7dB below the limit. The equation for margin calculation is as follows:

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

**Test Data**

**30 MHz~1 GHz:**

Project No.: RSZ200911007-RF  
 Company: SHENZHEN TOPFLYtech CO., LIMITED  
 EUT Description: SOLAR POWERED GPS TRACKER  
 EUT Model: TLP2-SFB  
 EUT Number: RSZ200911007-RF-S1  
 Climatic: 30°C 51%RH 101kPa  
 Test Engineer: Charlie Cha Test Date:2020.09.16  
 Operating Mode: BLE transmitting & Charging  
 Voltage/Frequency: AC 120V 60Hz



**Final Result**

Frequency (MHz)	QuasiPeak (dB µ V/m)	Limit (dB µ V/m)	Margin (dB)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)
72.272000	22.97	40.00	17.03	400.0	H	331.0	-20.5
95.975000	31.27	43.50	12.23	199.0	H	158.0	-17.9
120.116500	26.80	43.50	16.70	296.0	H	0.0	-14.3
288.924250	30.58	46.00	15.42	109.0	H	23.0	-11.4
408.006125	32.30	46.00	13.70	101.0	H	20.0	-10.0
836.598625	25.11	46.00	20.89	180.0	H	54.0	2.7

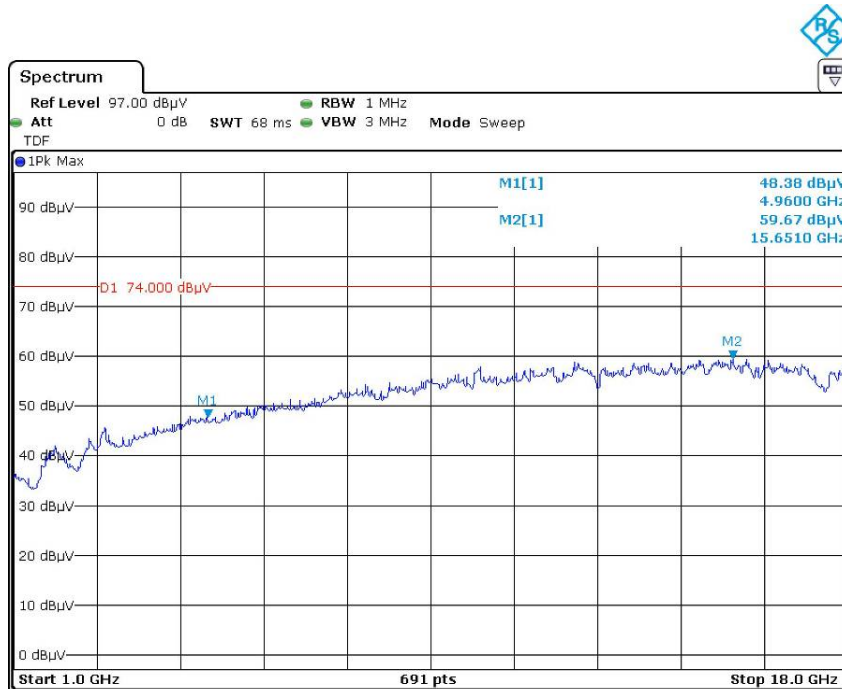
**1 GHz-25 GHz:**

**BLE\_1M mode:**

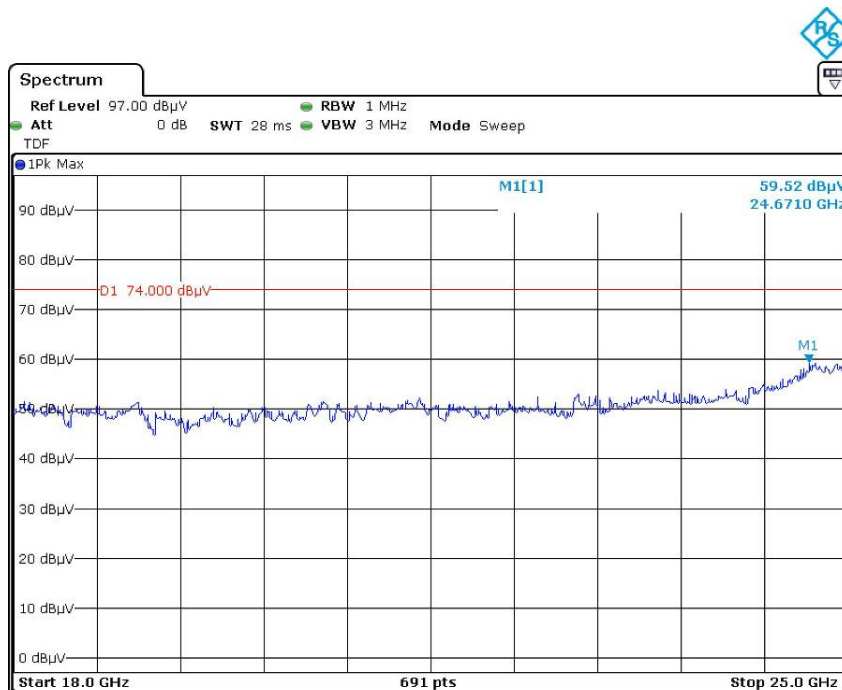
<b>Project No.:</b>	RSZ200911007-RF		
<b>Company:</b>	SHENZHEN TOPFLYtech CO., LIMITED		
<b>EUT model</b>	TLP2-SFB		
<b>EUT Number:</b>	RSZ200911007-RF-S1		
<b>Operating Mode:</b>	Transmitting		
<b>Test Conditions:</b>	Temperature: 29.8°C; Relative Humidity: 58%; ATM Pressure: 101.2 kPa		
<b>Test Engineer:</b>	Charlie Cha	<b>Test Date:</b>	2020-09-15

Frequency (MHz)	Receiver		Turntable Degree	Rx Antenna		Corrected Factor (dB/m)	Corrected Amplitude (dBµV/m)	Limit (dBµV/m)	Margin (dB)
	Reading (dBµV)	PK/QP/Ave.		Height (m)	Polar (H/V)				
<b>Low Channel (2402 MHz)</b>									
2388.46	28.39	PK	126	2.0	H	31.87	60.26	74	13.74
2388.46	14.22	Ave.	126	2.0	H	31.87	46.09	54	7.91
2484.59	28.10	PK	231	1.1	H	32.13	60.23	74	13.77
2484.59	14.13	Ave.	231	1.1	H	32.13	46.26	54	7.74
4804.00	44.25	PK	300	2.5	H	6.28	50.53	74	23.47
4804.00	31.53	Ave.	300	2.5	H	6.28	37.81	54	16.19
<b>Middle Channel (2440 MHz)</b>									
4880.00	44.29	PK	91	1.9	H	6.76	51.05	74	22.95
4880.00	31.60	Ave.	91	1.9	H	6.76	38.36	54	15.64
<b>High Channel (2480 MHz)</b>									
2387.94	28.35	PK	193	1.6	H	31.87	60.22	74	13.78
2387.94	14.21	Ave.	193	1.6	H	31.87	46.08	54	7.92
2483.85	28.57	PK	166	1.4	H	32.13	60.70	74	13.30
2483.85	14.36	Ave.	166	1.4	H	32.13	46.49	54	7.51
4960.00	44.36	PK	27	1.3	H	6.80	51.16	74	22.84
4960.00	31.75	Ave.	27	1.3	H	6.80	38.55	54	15.45

**Pre-scan with High channel  
Horizontal**

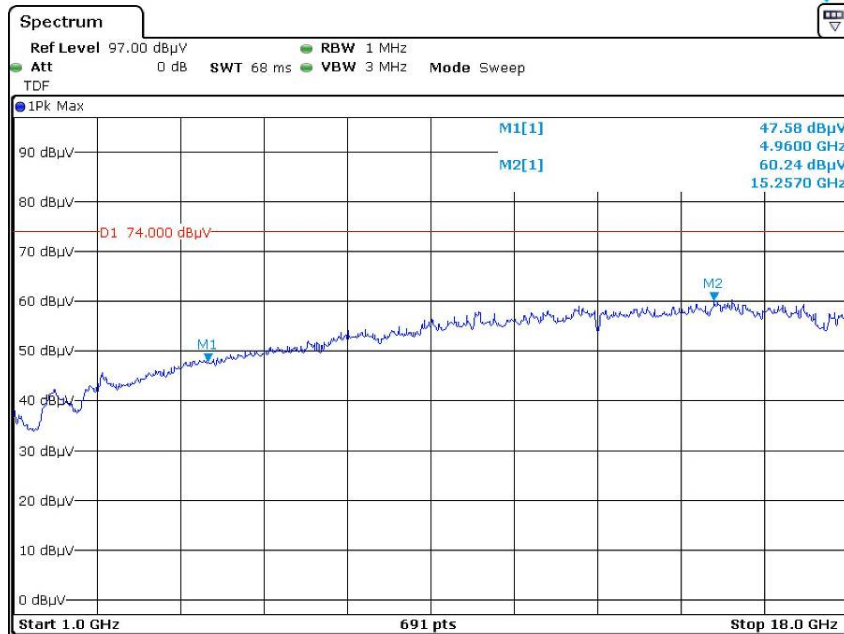


Date: 15.SEP.2020 18:24:53

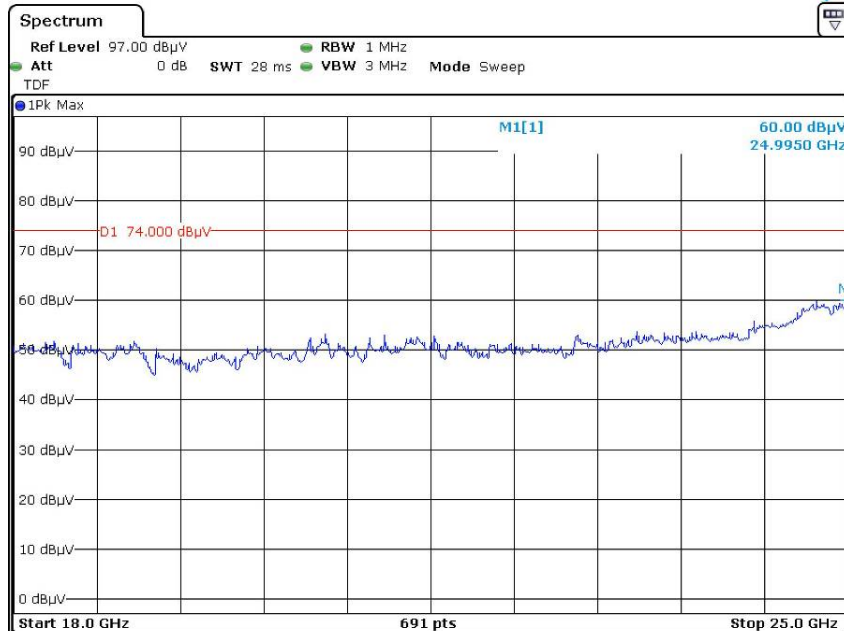


Date: 15.SEP.2020 18:41:48

Vertical



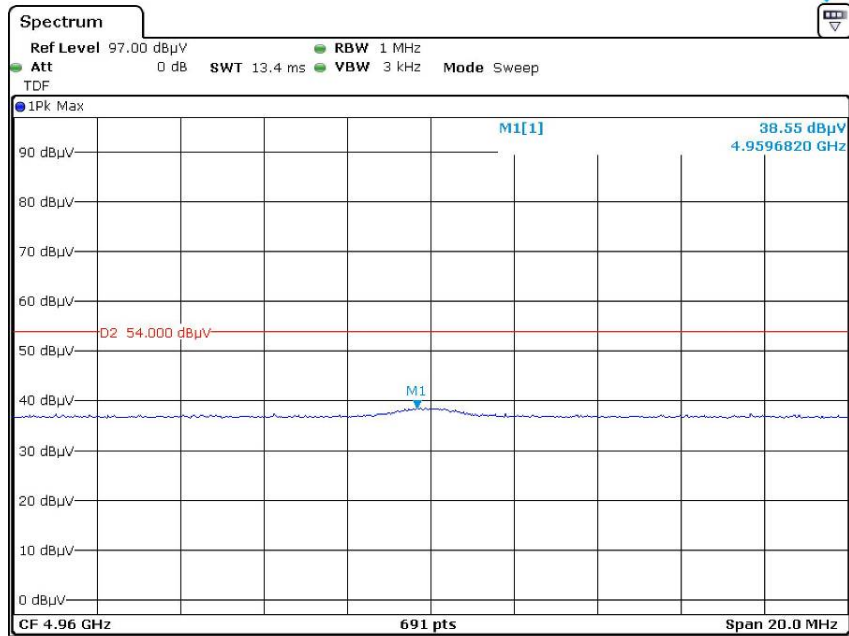
Date: 15.SEP.2020 18:34:30



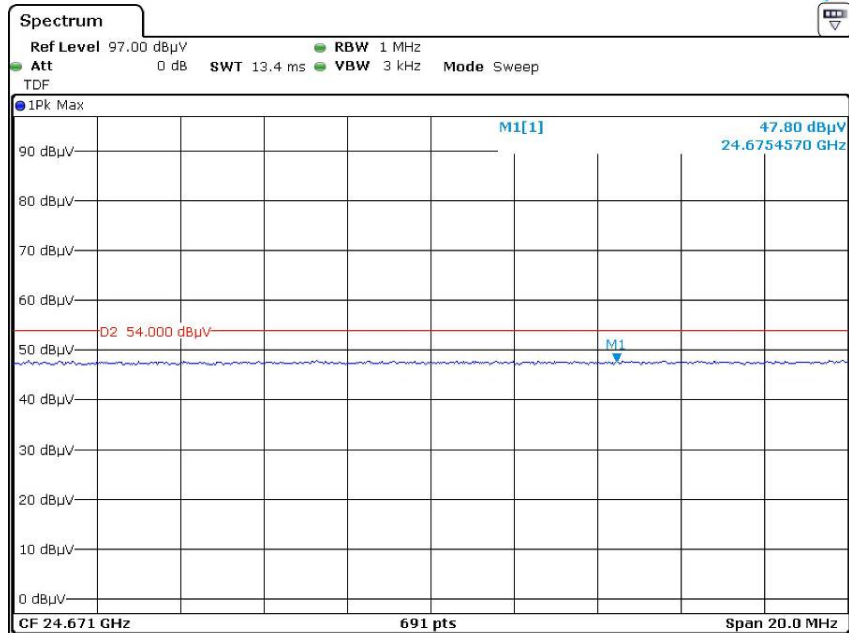
Date: 15.SEP.2020 19:16:22



### Average Horizontal

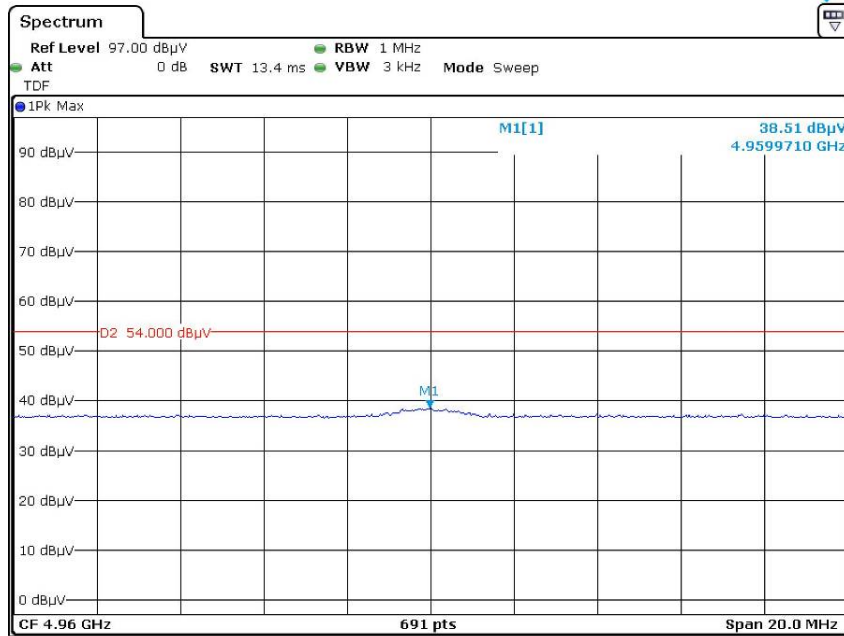


Date: 15.SEP.2020 18:29:47

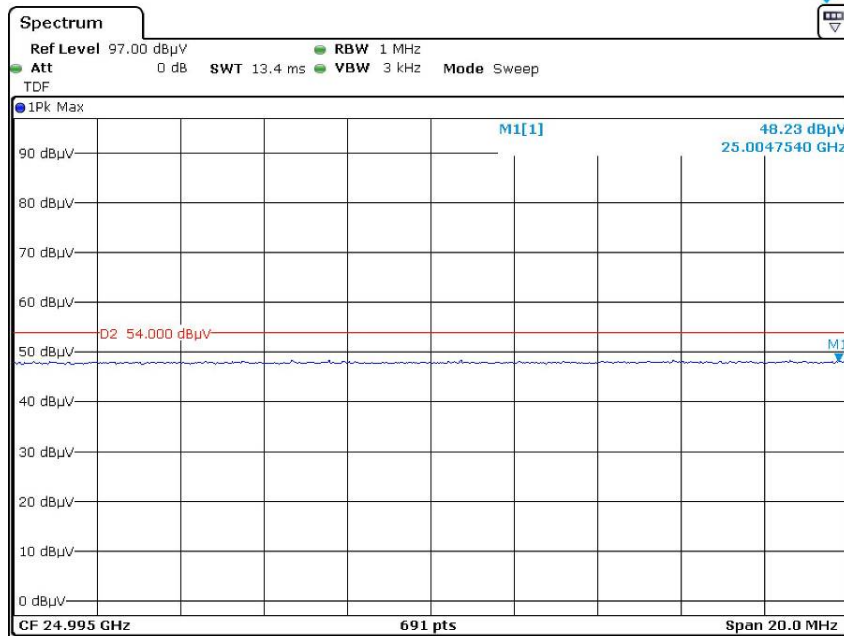


Date: 15.SEP.2020 19:12:25

### Vertical



Date: 15.SEP.2020 18:38:11



Date: 15.SEP.2020 19:21:33

**BLE\_2M mode:**

<b>Project No.:</b>	RSZ200911007-RF		
<b>Company:</b>	SHENZHEN TOPFLYtech CO., LIMITED		
<b>EUT model</b>	TLP2-SFB		
<b>EUT Number:</b>	RSZ200911007-RF-S1		
<b>Operating Mode:</b>	Transmitting		
<b>Test Conditions:</b>	Temperature: 29.8°C; Relative Humidity: 58%; ATM Pressure:101.2 kPa		
<b>Test Engineer:</b>	Charlie Cha	<b>Test Date:</b>	2020-09-15

Frequency (MHz)	Receiver		Turntable Degree	Rx Antenna		Corrected Factor (dB/m)	Corrected Amplitude (dBµV/m)	Limit (dBµV/m)	Margin (dB)
	Reading (dBµV)	PK/QP/Ave.		Height (m)	Polar (H/V)				
<b>Low Channel (2402 MHz)</b>									
2388.41	28.51	PK	267	1.6	H	31.87	60.38	74	13.62
2388.41	14.96	Ave.	267	1.6	H	31.87	46.83	54	7.17
2484.79	28.54	PK	204	1.6	H	32.13	60.67	74	13.33
2484.79	14.89	Ave.	204	1.6	H	32.13	47.02	54	6.98
4804.00	44.28	PK	278	2.4	H	6.28	50.56	74	23.44
4804.00	31.31	Ave.	278	2.4	H	6.28	37.59	54	16.41
<b>Middle Channel (2440 MHz)</b>									
4880.00	44.57	PK	44	1.3	H	6.76	51.33	74	22.67
4880.00	31.64	Ave.	44	1.3	H	6.76	38.40	54	15.60
<b>High Channel (2480 MHz)</b>									
2387.62	28.53	PK	151	1.9	H	31.87	60.40	74	13.60
2387.62	14.91	Ave.	151	1.9	H	31.87	46.78	54	7.22
2483.99	28.62	PK	136	1.4	H	32.13	60.75	74	13.25
2483.99	14.98	Ave.	136	1.4	H	32.13	47.11	54	6.89
4960.00	44.52	PK	120	1.4	H	6.80	51.32	74	22.68
4960.00	31.93	Ave.	120	1.4	H	6.80	38.73	54	15.27

**Note:**

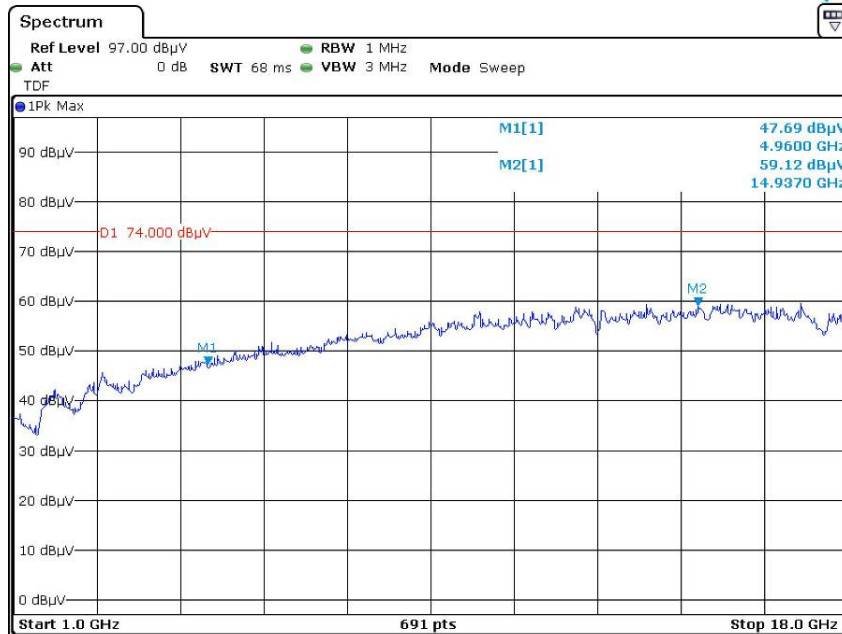
Corrected Factor = Antenna factor (RX) + Cable Loss – Amplifier Factor

Corrected Amplitude = Corrected Factor + Reading

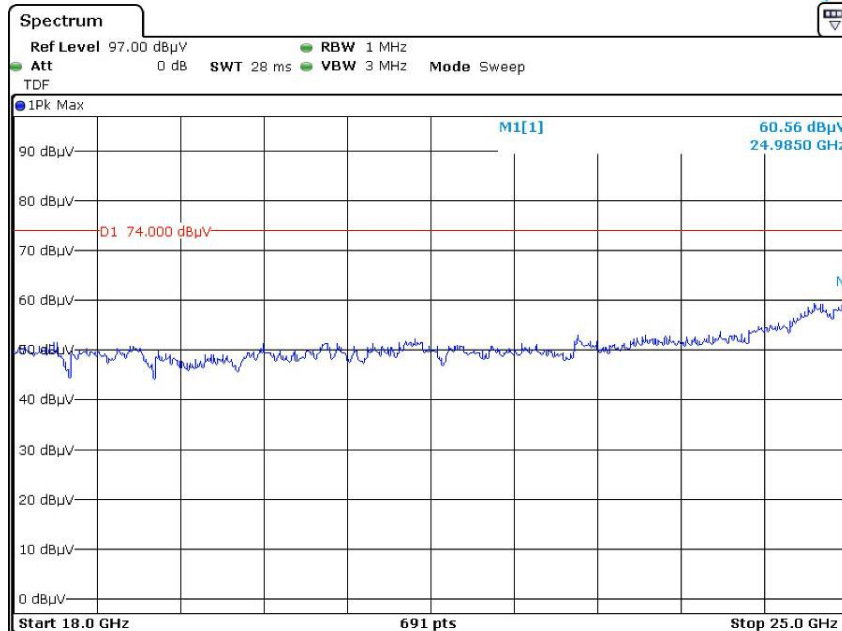
Margin = Limit - Corrected. Amplitude

The other spurious emission which is 20dB to the limit was not recorded.

**Pre-scan with High channel  
Horizontal**

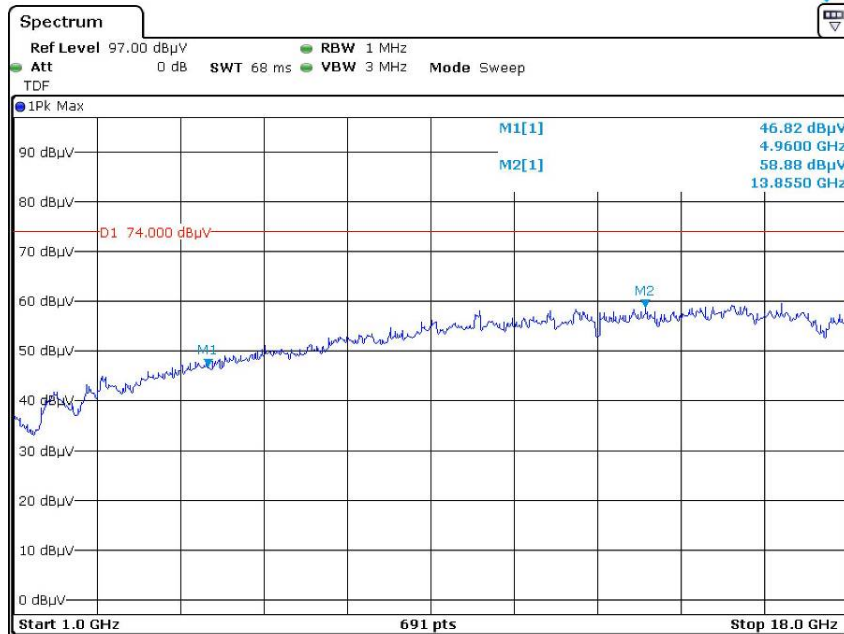


Date: 15.SEP.2020 19:41:16

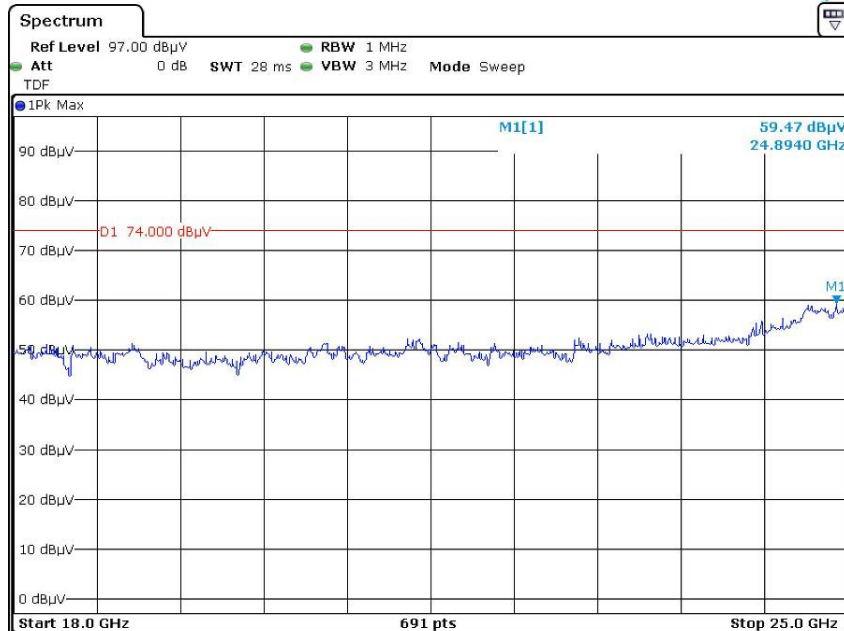


Date: 15.SEP.2020 20:24:25

Vertical

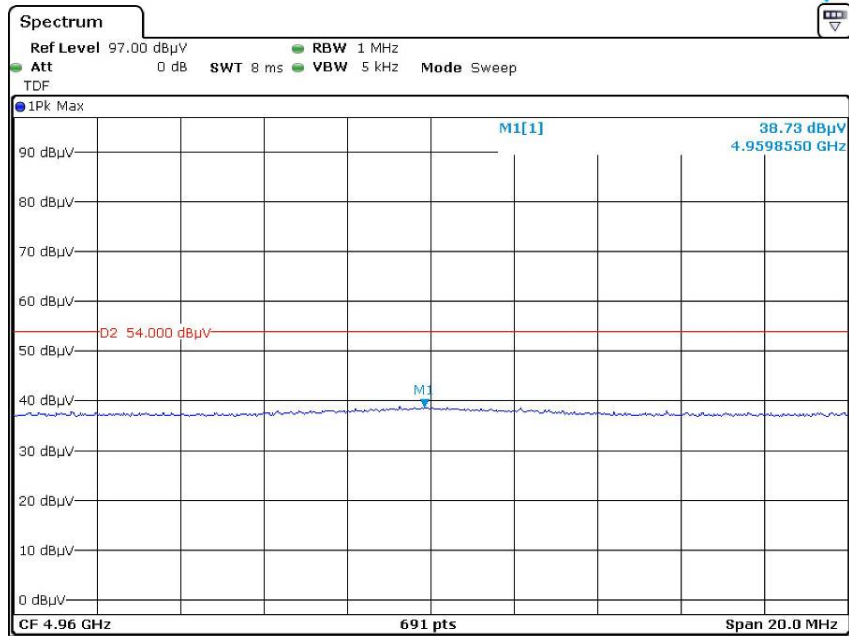


Date: 15.SEP.2020 19:50:25

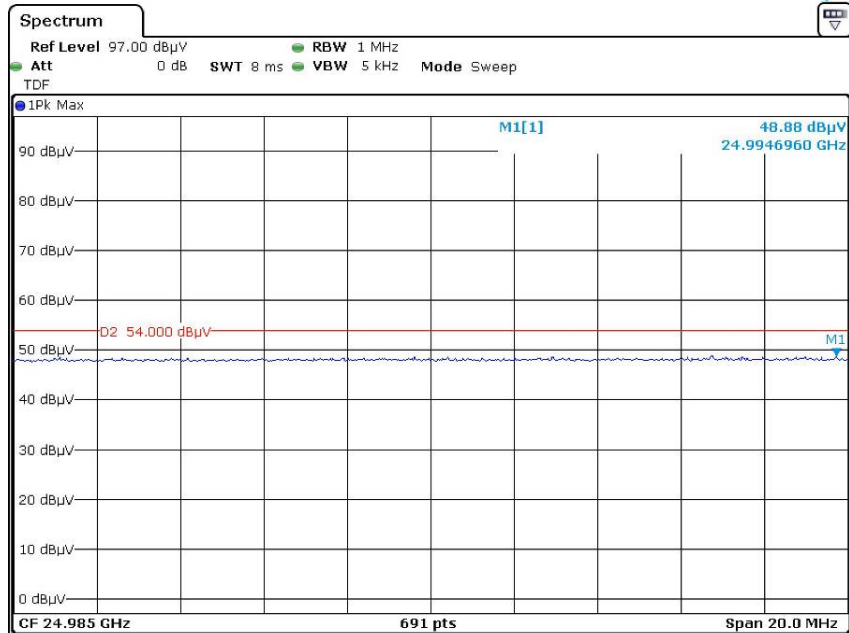


Date: 15.SEP.2020 20:32:05

### Average Horizontal

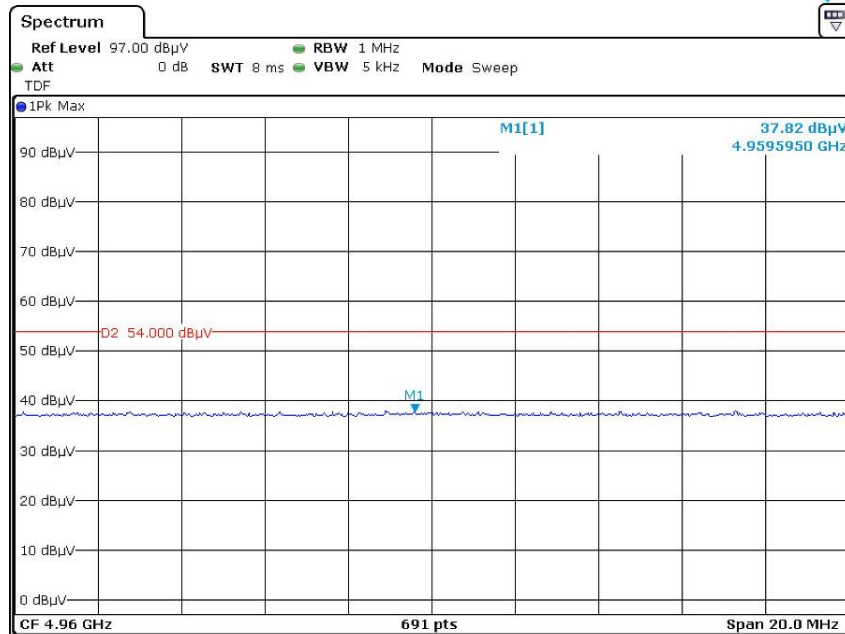


Date: 15.SEP.2020 19:45:42

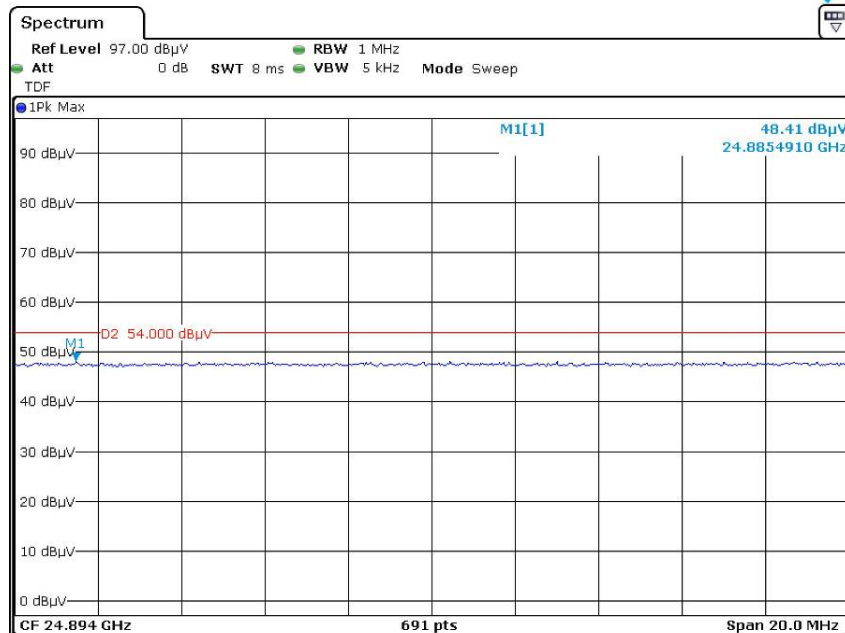


Date: 15.SEP.2020 20:27:43

### Vertical



Date: 15.SEP.2020 19:53:54



Date: 15.SEP.2020 20:36:26

**Co-location radiated emission:**

<b>Project No.:</b>	RSZ200911007-RF		
<b>Company:</b>	SHENZHEN TOPFLYtech CO., LIMITED		
<b>EUT model</b>	TLP2-SFB		
<b>EUT Number:</b>	RSZ200911007-RF-S1		
<b>Operating Mode:</b>	Worst case: BLE 2M High channel & GSM850 Middle channel		
<b>Test Conditions:</b>	Temperature: 29.8°C; Relative Humidity: 58%; ATM Pressure: 101.2 kPa		
<b>Test Engineer:</b>	Charlie Cha	<b>Test Date:</b>	2020-09-25

Frequency (MHz)	Receiver		Turn-Table Angle Degree	Rx Antenna		Corrected Factor (dB/m)	Corrected Amplitude (dBμV/m)	Limit (dBμV/m)	Margin (dB)
	Reading (dBμV)	Detector (PK/QP/Ave.)		Height (m)	Polar (H / V)				
815.09	28.35	QP	189	1.2	H	2.2	30.55	46	15.45
815.09	26.16	QP	189	1.2	V	2.2	28.36	46	17.64
3346.40	55.41	PK	354	1.2	H	3.21	58.62	74	15.38
3346.40	46.29	Ave.	354	1.2	H	3.21	49.50	54	4.50
4960.00	44.48	PK	283	2.3	H	6.80	51.28	74	22.72
4960.00	31.89	Ave.	283	2.3	H	6.80	38.69	54	15.31



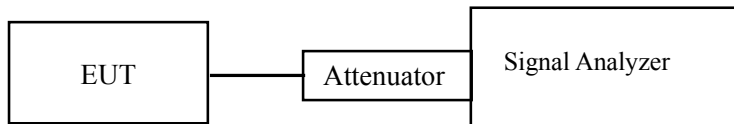
**FCC §15.247(a) (2) – 6 dB EMISSION BANDWIDTH**

**Applicable Standard**

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**

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 it to measurement instrument. Then set it to any one convenient frequency within its operating range. Set a reference level on the measuring instrument equal to the highest peak value.
3. Measure the frequency difference of two frequencies that were attenuated 6 dB from the reference level. Record the frequency difference as the emission bandwidth.
4. Repeat above procedures until all frequencies measured were complete.



**Test Data**

**Environmental Conditions**

<b>Temperature:</b>	24 °C
<b>Relative Humidity:</b>	50 %
<b>ATM Pressure:</b>	101.0 kPa

*The testing was performed by James Fu from 2020-09-15 to 2020-09-24.*

*EUT operation mode: Transmitting*

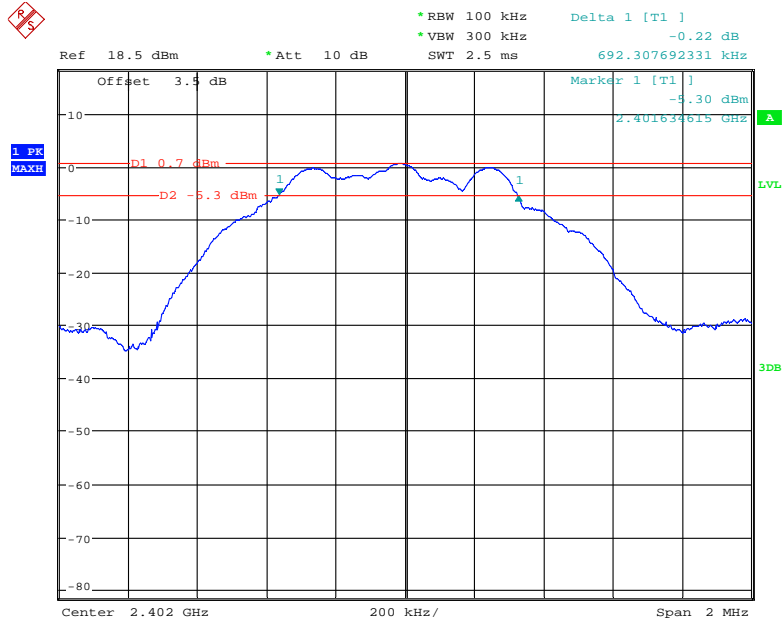
**Test Result: Pass**

Please refer to the following table and plots.

*EUT operation mode: Transmitting*

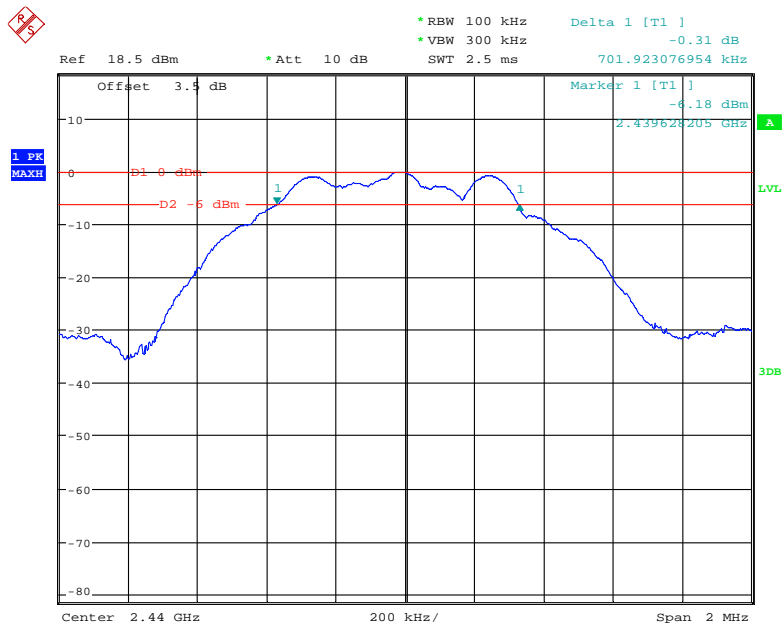
Channel	Frequency (MHz)	6 dB Emission Bandwidth (MHz)	Limit (kHz)
BLE_1M			
Low	2402	0.692	≥500
Middle	2440	0.702	≥500
High	2480	0.702	≥500
BLE_2M			
Low	2402	1.211	≥500
Middle	2440	1.205	≥500
High	2480	1.208	≥500

### BLE\_1M Low Channel



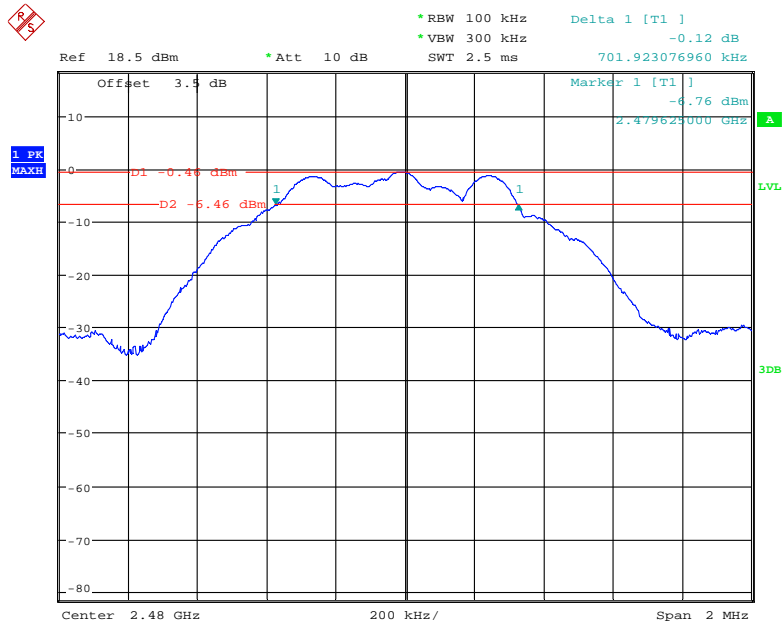
Date: 15.SEP.2020 09:22:17

### Middle Channel



Date: 15.SEP.2020 09:39:09

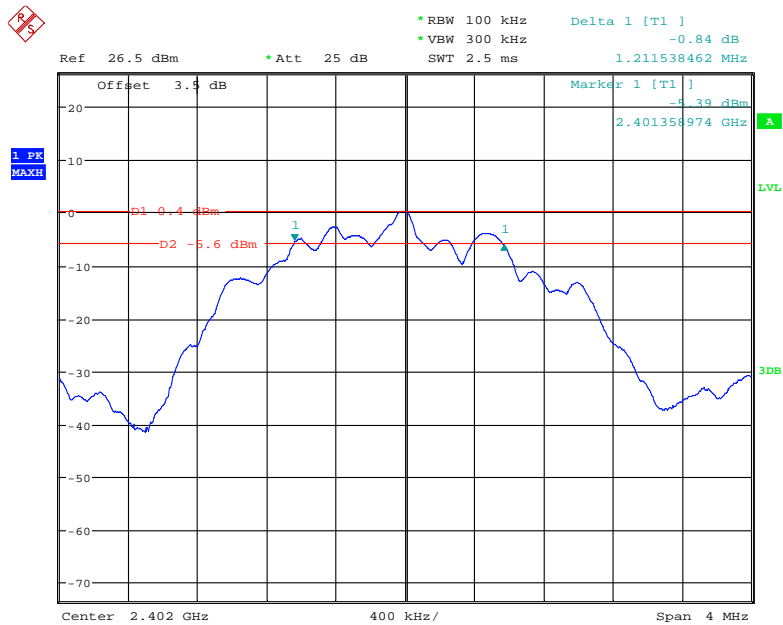
### High Channel



Date: 15.SEP.2020 09:45:57

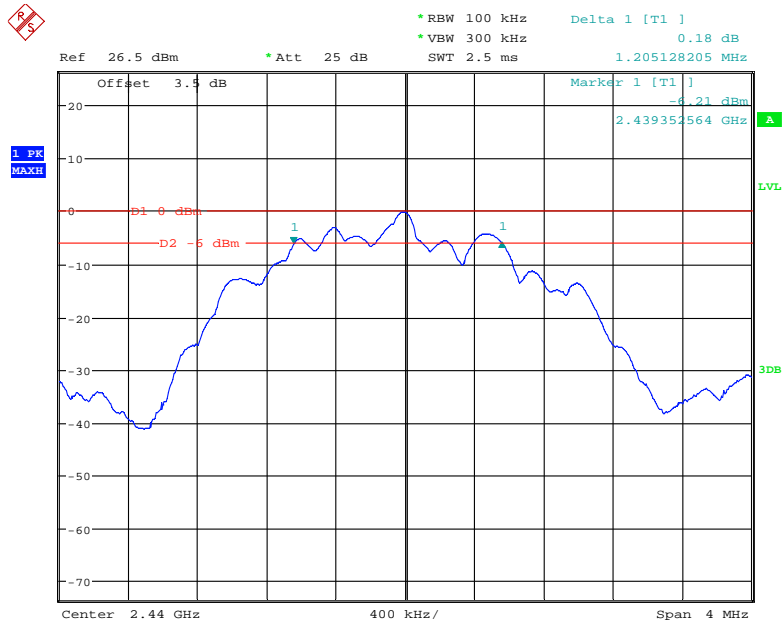
### BLE\_2M

#### Low Channel



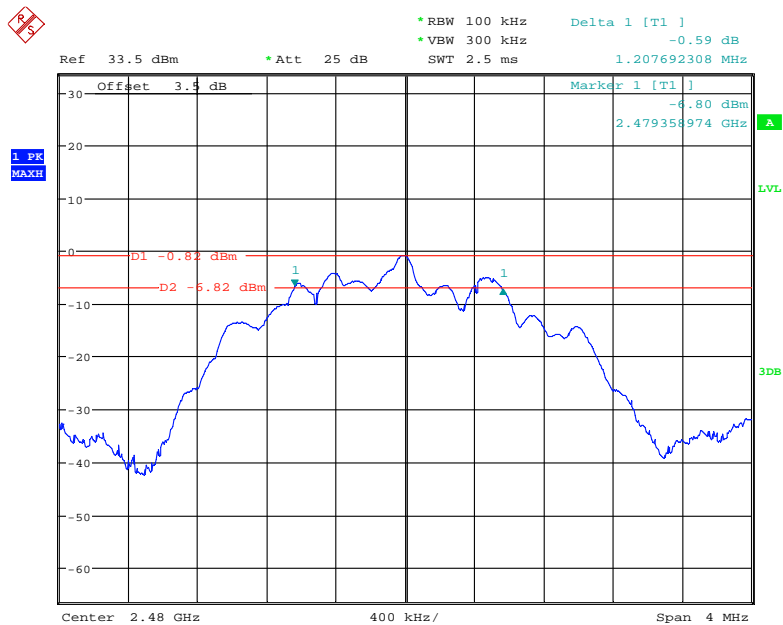
Date: 15.SEP.2020 11:10:52

### Middle Channel



Date: 15.SEP.2020 11:29:22

### High Channel



Date: 24.SEP.2020 20:31:19

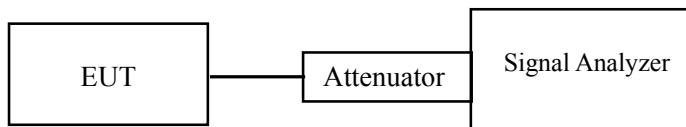
## FCC §15.247(b) (3) - MAXIMUM CONDUCTED OUTPUT POWER

### 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 one test equipment.
3. Add a correction factor to the display.



### Test Data

#### Environmental Conditions

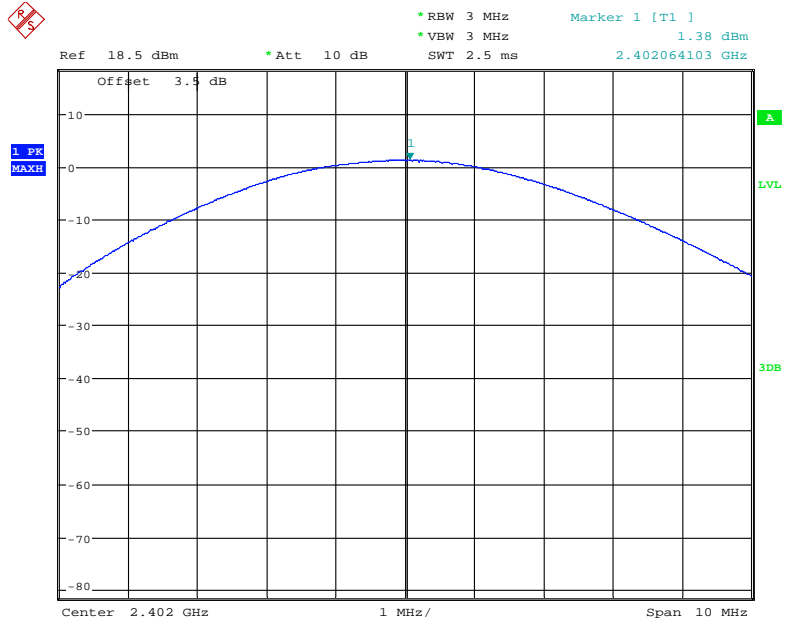
<b>Temperature:</b>	24 °C
<b>Relative Humidity:</b>	50 %
<b>ATM Pressure:</b>	101.0 kPa

*The testing was performed by James Fu on 2020-09-15.*

*EUT operation mode: Transmitting*

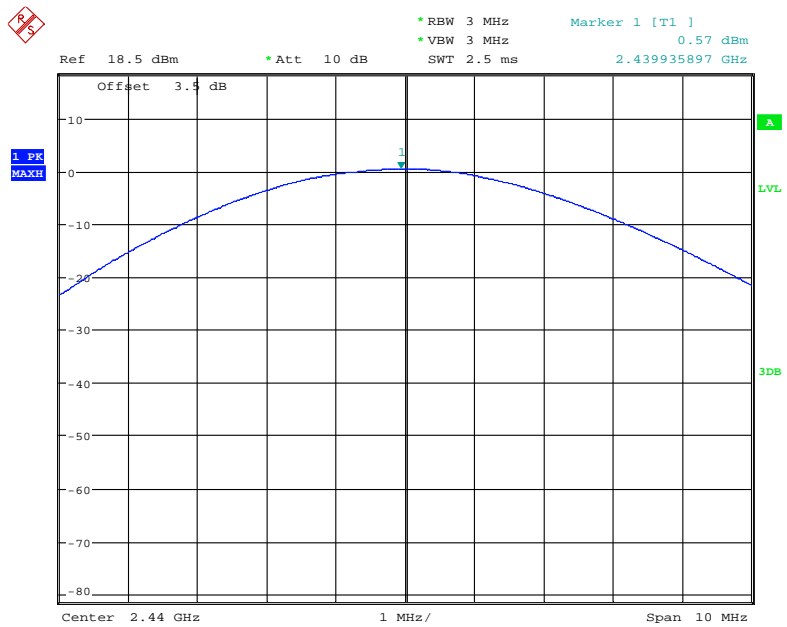
Channel	Frequency (MHz)	Maximum Conducted Peak Output Power (dBm)	Limit (dBm)	Result
BLE_1M				
Low	2402	1.38	30	Pass
Middle	2440	0.57	30	Pass
High	2480	0.19	30	Pass
BLE_2M				
Low	2402	1.05	30	Pass
Middle	2440	0.58	30	Pass
High	2480	0.22	30	Pass

### BLE\_1M Low Channel



Date: 15.SEP.2020 09:18:43

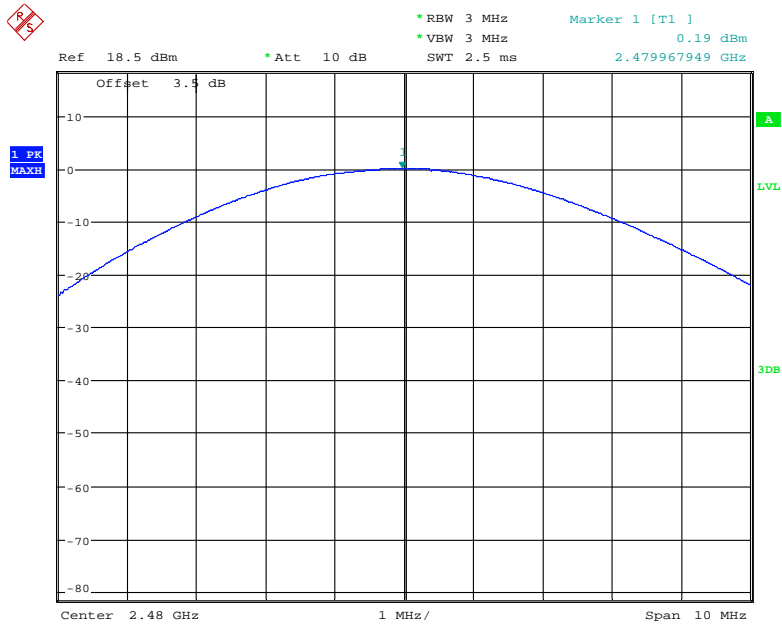
### Middle Channel



Date: 15.SEP.2020 09:54:38

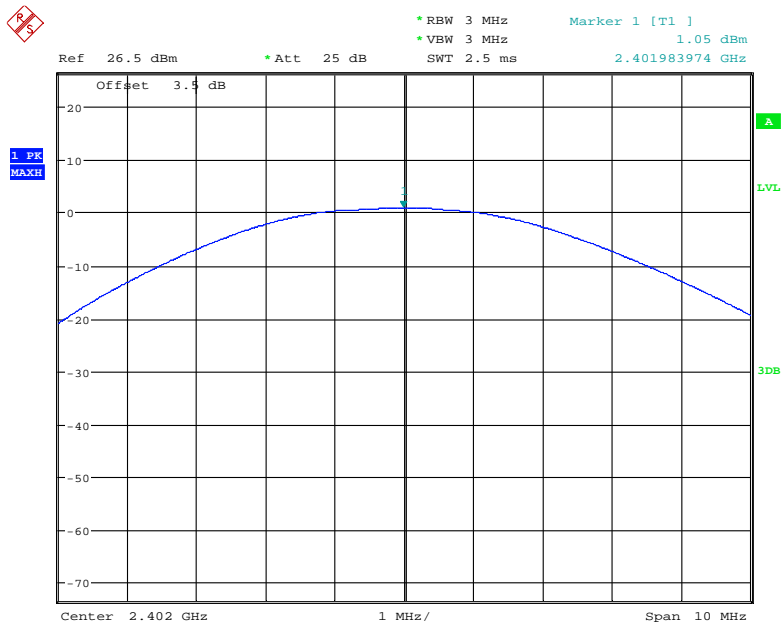


### High Channel



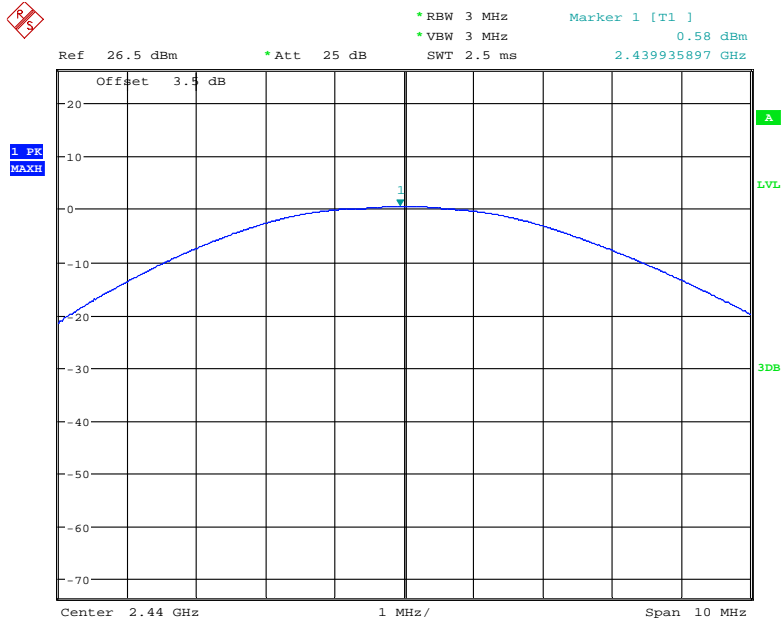
Date: 15.SEP.2020 09:55:25

### BLE\_2M Low Channel



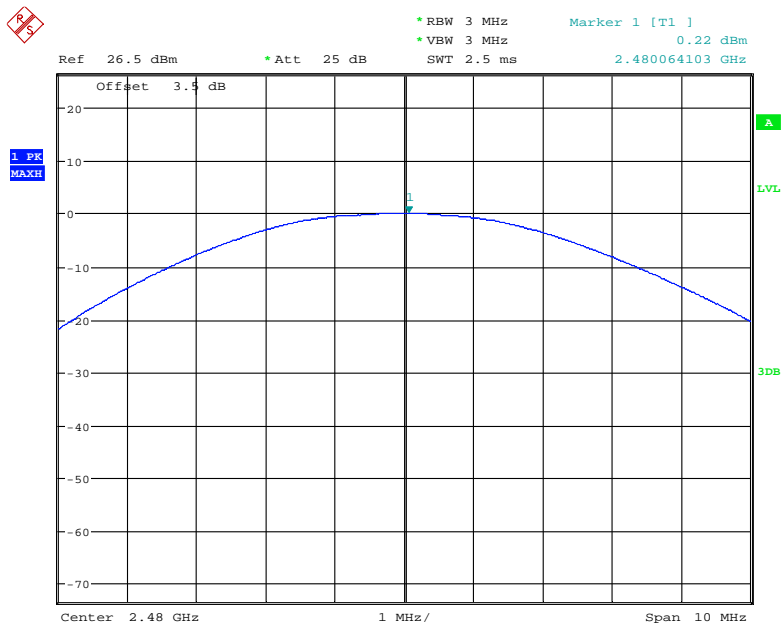
Date: 15.SEP.2020 11:00:48

### Middle Channel



Date: 15.SEP.2020 11:24:27

### High Channel



Date: 15.SEP.2020 11:25:56

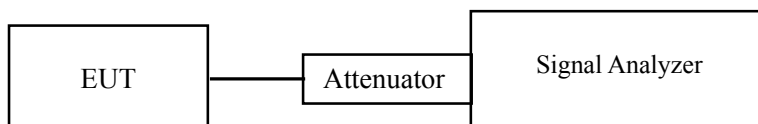
## **FCC §15.247(d) – 100 kHz BANDWIDTH OF FREQUENCY BAND EDGE**

### **Applicable Standard**

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 Data**

#### **Environmental Conditions**

<b>Temperature:</b>	24 °C
<b>Relative Humidity:</b>	50 %
<b>ATM Pressure:</b>	101.0 kPa

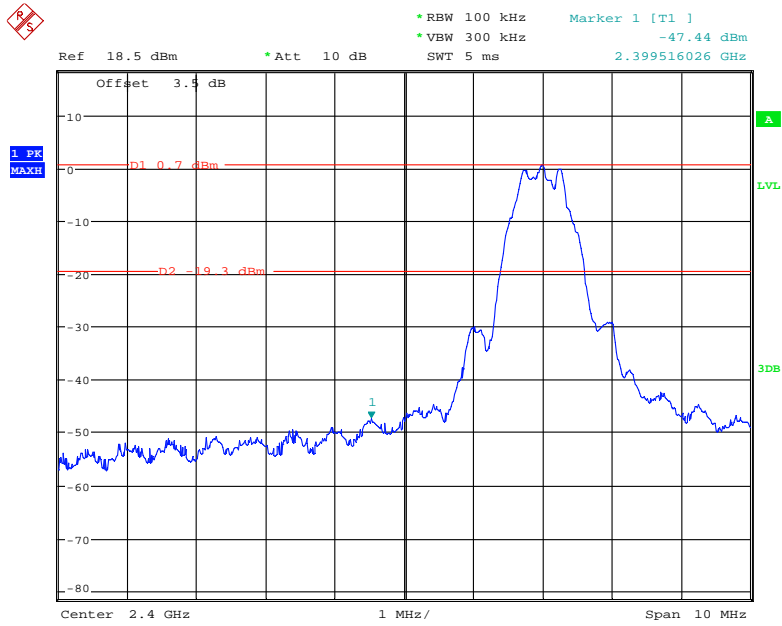
*The testing was performed by James Fu from 2020-09-15 to 2020-09-24.*

*EUT operation mode: Transmitting*

**Test Result: Pass**

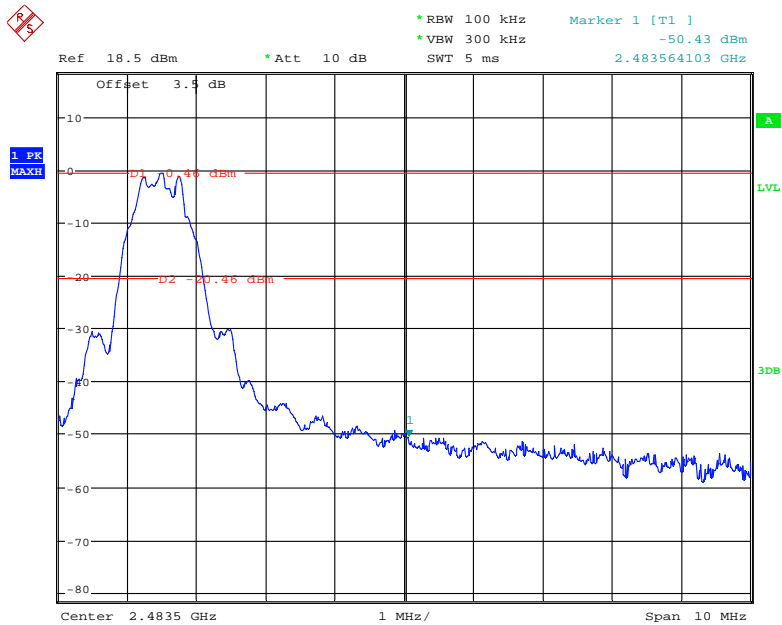
*Please refer to the following plots.*

### BLE\_1M Band Edge, Left Side



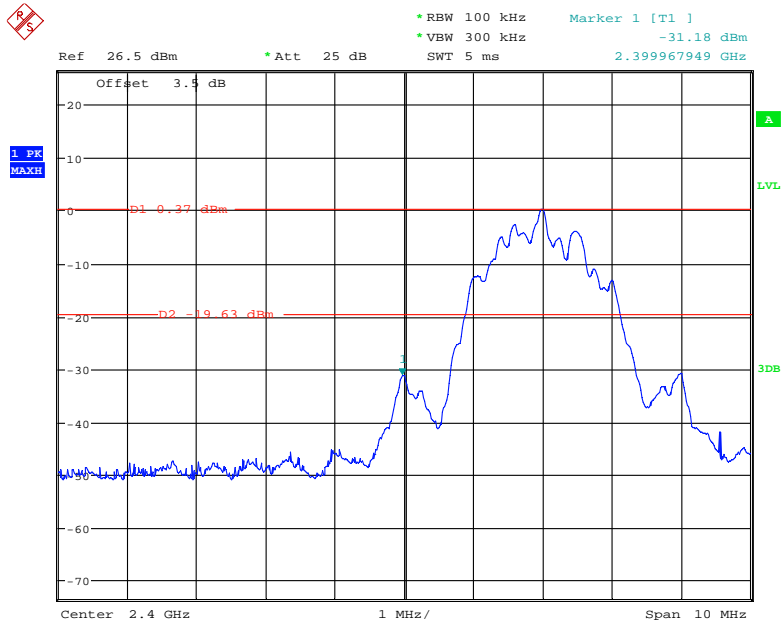
Date: 15.SEP.2020 09:24:19

### Band Edge, Right Side



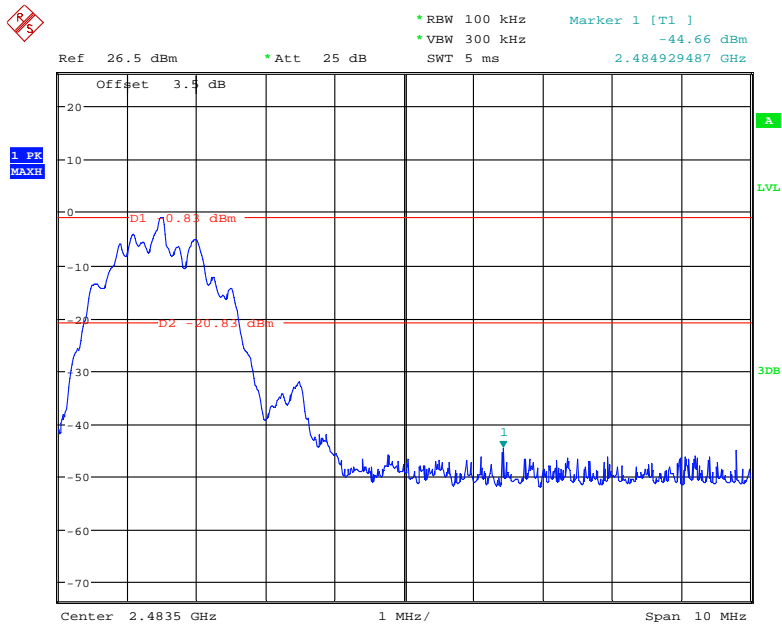
Date: 15.SEP.2020 09:51:07

### BLE\_2M Band Edge, Left Side



Date: 15.SEP.2020 11:15:42

### Band Edge, Right Side



Date: 24.SEP.2020 20:33:17

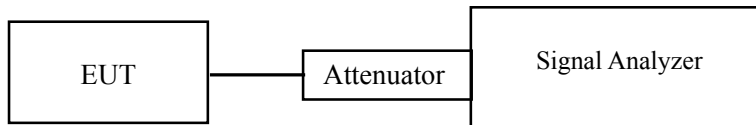
**FCC §15.247(e) - POWER SPECTRAL DENSITY**

**Applicable Standard**

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. Use this procedure when the maximum peak conducted output power in the fundamental emission is used to demonstrate compliance.
2. Set the RBW to: 3kHz
3. Set the VBW  $\geq 3 \times$ RBW.
4. Set the span to 1.5 times the DTS bandwidth.
5. Detector = peak.
6. Sweep time = auto couple.
7. Trace mode = max hold.
8. Allow trace to fully stabilize.
9. Use the peak marker function to determine the maximum amplitude level within the RBW.
10. If measured value exceeds limit, reduce RBW (no less than 3 kHz) and repeat.



**Test Data**

**Environmental Conditions**

<b>Temperature:</b>	24 °C
<b>Relative Humidity:</b>	50 %
<b>ATM Pressure:</b>	101.0 kPa

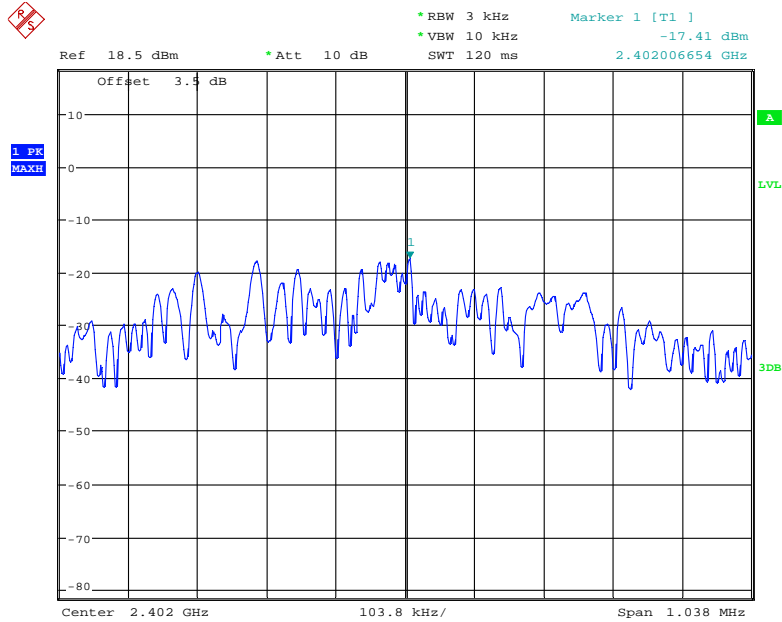
*The testing was performed by James Fu on 2020-09-15.*

*EUT operation mode: Transmitting*

**Test Result: Pass**

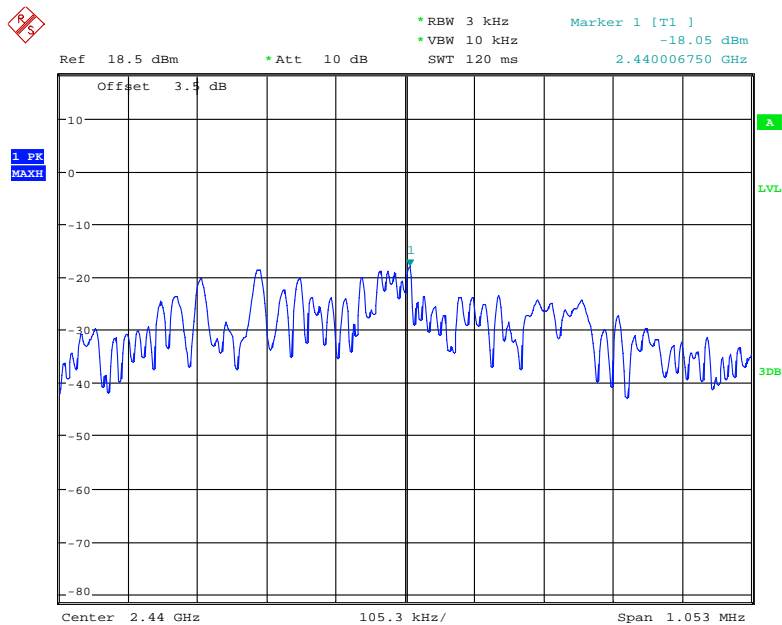
Channel	Frequency (MHz)	PSD (dBm/3kHz)	Limit (dBm/3kHz)
BLE_1M			
Low	2402	-17.41	≤8
Middle	2440	-18.05	≤8
High	2480	-18.29	≤8
BLE_2M			
Low	2402	-19.43	≤8
Middle	2440	-19.63	≤8
High	2480	-20.07	≤8

### BLE\_1M Low Channel



Date: 15.SEP.2020 09:27:11

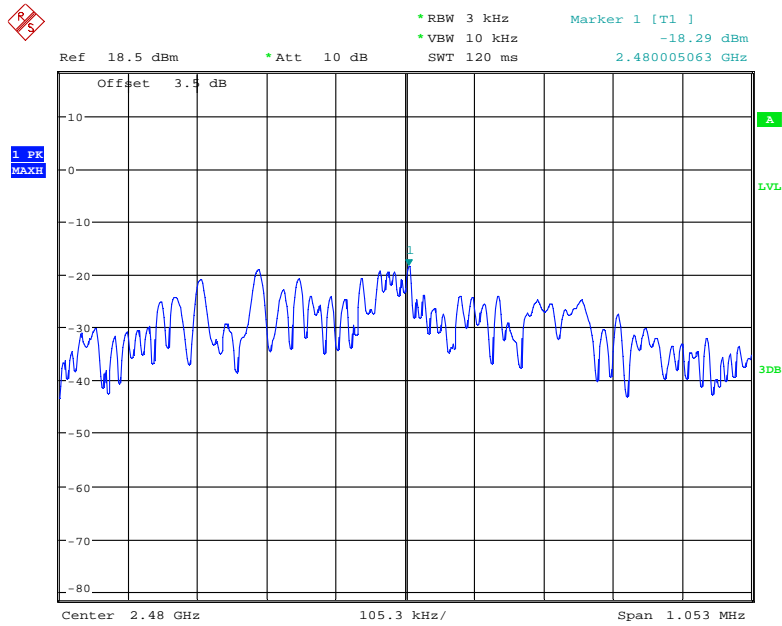
### Middle Channel



Date: 15.SEP.2020 10:08:03

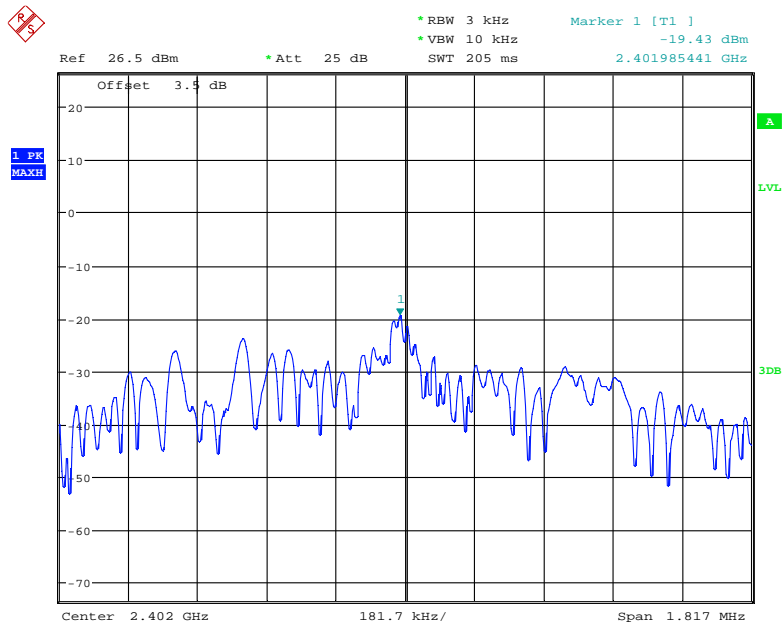


### High Channel



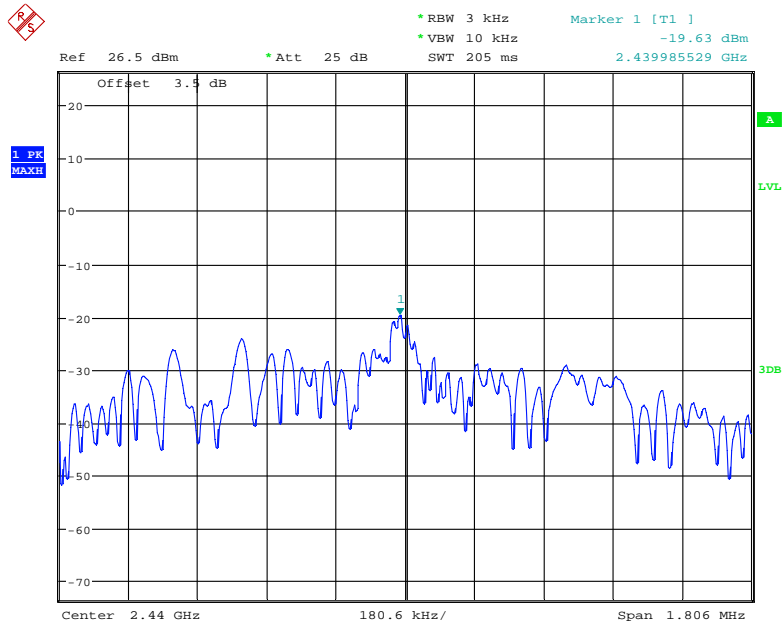
Date: 15.SEP.2020 10:03:17

### BLE\_2M Low Channel



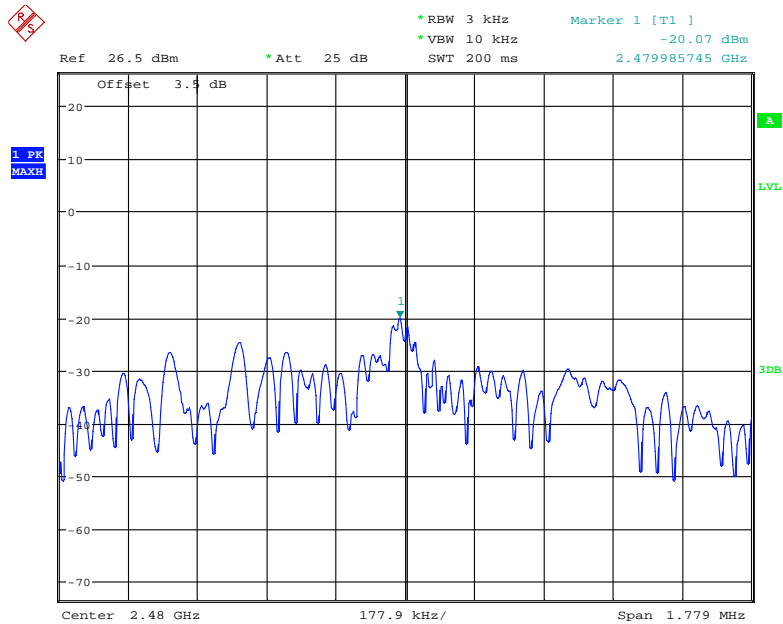
Date: 15.SEP.2020 11:43:26

### Middle Channel



Date: 15.SEP.2020 11:41:39

### High Channel



Date: 15.SEP.2020 11:39:05

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