

# TEST REPORT

of

## FCC Part 15 Subpart C AND CANADA RSS-247 Full Modular Approval

New Application;  Class I PC;  Class II PC

**Product :** Bluetooth 5.0 Module  
**Brand:** Fanstel  
**Model:** BT840X, BT840XE  
**Model Difference:** Please see page 7 model summaries table  
**FCC ID:** X8WBT840X  
**IC:** 4100A-BT840X  
**FCC Rule Part:** §15.247, Cat: DTS  
**IC Rule Part:** RSS-247 issue 2: 2017  
RSS-Gen issue 5: 2018+A1+A2  
**Applicant:** Fanstel Corporation, Taipei  
**Address:** 10F-10, No. 79, Sec. 1, Hsin Tai Wu Rd.,  
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Test Performed by:

**International Standards Laboratory Corp. LT Lab.**



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**Report No.: ISL-19LR022FC-R2**  
**Issue Date :2022/01/18**



Test results given in this report apply only to the specific sample(s) tested and are traceable to national or international standard through calibration of the equipment and evaluating measurement uncertainty herein.

The uncertainty of the measurement does not include in consideration of the test result unless the customer required the determination of uncertainty via the agreement, regulation or standard document specification.

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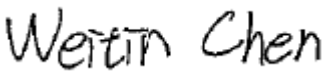
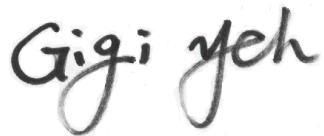
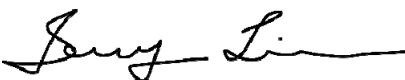
## VERIFICATION OF COMPLIANCE

**Applicant:** Fanstel Corporation, Taipei  
**Product Description:** Bluetooth 5.0 Module  
**Brand Name:** Fanstel  
**Model No.:** BT840X, BT840XE  
**Model Difference:** Please see page 7 model summaries table  
**FCC ID:** X8WBT840X  
**IC:** 4100A-BT840X  
**Date of test:** 2022/01/06 ~ 2022/01/17  
**Date of EUT Received:** 2022/01/06

### We hereby certify that:

All the tests in this report have been performed and recorded in accordance with the standards described above and performed by an independent electromagnetic compatibility consultant, International Standards Laboratory Corp.

The test results contained in this report accurately represent the measurements of the characteristics and the energy generated by sample equipment under test at the time of the test. The sample equipment tested as described in this report is in compliance with the limits of above standards.

<b>Test By:</b>		<b>Date:</b>	2022/01/18
	<hr/>		<hr/>
	<i>Weitin Chen / Senior Engineer</i>		
<b>Prepared By:</b>		<b>Date:</b>	2022/01/18
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<b>Approved By:</b>		<b>Date:</b>	2022/01/18
	<hr/>		<hr/>
	<i>Jerry Liu / Assistant Manager</i>		

## Version

Version No.	Date	Description
00	2019/05/13	Initial creation of document
00	2022/01/18	<p>This report is prepared for FCC class II permissive change of the original report no.: ISL-19LR022FC. The difference from the original report is to add two antennas.</p> <p>(HX-CUX005: PIFA Antennas; ANT060: Dipole Antenna)</p> <p>Therefore, test items for RF output power &amp; radiated emission are performed. Refer to original report for the other test data.</p>

## Measurement Uncertainty (K=2)

Description Of Test	Uncertainty
Conducted Emission (AC power line)	2.586 dB
Field Strength of Spurious Radiation	<=30MHz: 2.96dB 30-1GHz: 4.22 dB 1-40 GHz: 4.08 dB
Conducted Power	2.412 GHz: 1.30 dB 5.805 GHz: 1.55 dB
Power Density	2.412 GHz: 1.30 dB 5.805 GHz: 1.67 dB
Frequency	0.0032%

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## 1 General Information

### General:

Product Name:	Bluetooth 5.0 Module
Brand Name:	Fanstel
Model Name:	BT840X, BT840XE
Model Difference:	Please see page 7 model summaries table
Power Supply:	5Vdc

### IC RSS-Gen:

Product SW/HW version	BT840X
Radio SW/HW version	nrf52840 s140
PMN (Product Marketing Name)	BT840X
HVIN (Hardware Version Identification Number)	BT840X, BT840XE
FVIN (Firmware Version Identification Number)	nrf52840 s140
Test SoftWare Version	BT840X_Radio test
RF power setting:	0

### Bluetooth:

Frequency Range:	2402 – 2480MHz
Bluetooth Version:	V5.0
Channel number:	40 channels, 2MHz step
Modulation type	Digital Modulation
Modulation type:	GFSK
Tune-up power	20.96 dBm
Power Tolerance:	+/- 1.0 dBm
Dwell Time:	N/A
Antenna Designation:	HX-CUX005 : PIFA Antennas, 1.97 dBi ANT060 : Dipole Antenna, 6 dBi

**Remark:** The above DUT's information was declared by manufacturer. Please refer to the specifications or user's manual for more detailed description.

## Model Summaries

module	BT840X	BT840XE
SoC	nRF52840-QIAA	nRF52840-QIAA
Size	15x20.8x1.9mm	15x20.8x1.9mm
BT Antenna	PCB trace	PA + u.FL
32.768 sleep crystal	Integrated	Integrated
BT range, 1 Mbps, LMPI		
BT range, 1Mbps, 1.52m		
BT range, 125 Kbps, LMPI.		
BT range, 125 kBps, 1.52m		
Availability	Sample	Sample

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

This submittal(s) (test report) is intended for **FCC ID: X8WBT840X** filing to comply with Section 15.247 of the FCC Part 15, Subpart C Rules and **IC: 4100A-BT840X** filing to comply with Industry Canada RSS-247 issue 2.

### 1.2 Test Methodology

Both conducted and radiated testing were performed according to the procedures in ANSI C63.10: 2013. Radiated testing was performed at an antenna to EUT distance 3 meters.

KDB Document: 558074 D01 15.247 Meas Guidance v05r02

### 1.3 Test Facility

The measurement facilities used to collect the 3m Radiated Emission and AC power line conducted data are located on the address of **International Standards Laboratory Corp.**<LT Lab.> No. 120, Lane 180, Hsin Ho Rd., Lung-Tan Dist., Tao Yuan City 325, Taiwan which are constructed and calibrated to meet the FCC requirements in documents ANSI C63.10: 2013. FCC Registration Number is: 487532; Designation Number is: TW0997, Canada Registration Number: 4067B-4.

### 1.4 Special Accessories

Not available for this EUT intended for grant.

### 1.5 Equipment Modifications

Not available for this EUT intended for grant.

## 2 System Test Configuration

### 2.1 EUT Configuration

The EUT configuration for testing is installed on RF field strength measurement to meet the Commissions requirement and operating in a manner which intends to maximize its emission characteristics in a continuous normal application.

### 2.2 EUT Exercise

The EUT (Transmitter) was operated in the engineering mode to fix the Tx frequency that was for the purpose of the measurements.

### 2.3 Test Procedure

#### 2.3.1 Conducted Emissions

The EUT is a placed on as turn table which is 0.8 m above ground plane. According to the requirements in Section 6 and RSS-Gen issue 5: 2018+A1+A2. Con-ducted emissions from the EUT measured in the frequency range between 0.15 MHz and 30MHz using CISPR 16-1-1 Quasi-Peak and Average detector mode.

#### 2.3.2 Radiated Emissions

The EUT is a placed on as turn table which is 0.8/1.5 m above ground plane. The turn table shall rotate 360 degrees to determine the position of maximum emission level. EUT is set 3m away from the receiving antenna which varied from 1m to 4m to find out the highest emission. And also, each emission was to be maximized by changing the polarization of receiving antenna both horizontal and vertical. In order to find out the max. emission, the relative positions of this hand-held transmitter (EUT) was rotated through three orthogonal axes and measurement procedures for electric field radiated emissions above 1 GHz the EUT measurement is to be made “while keeping the antenna in the ‘cone of radiation’ from that area and pointed at the area both in azimuth and elevation, with polarization oriented for maximum response.” Is still within the 3dB illumination BW of the measurement antenna. According to the requirements in Section 8 and 13 and Subclause 8.3.1.2 of ANSI C63.10: 2013.



## 2.4 Configuration of Tested System

Fig. 2-1 Configuration



Table 2-1 Equipment Used in Tested System

Item	Equipment	Mfr/Brand	Model/ Type No.	Series No.	Data Cable	Power Cord
1	JIG	NA	NA	NA	Non-Shielded	Non-Shielded
2	NB	Lenove	X220i	NA	Non-Shielded	Non-Shielded

**Note:** All the above equipment/cables were placed in worse case positions to maximize emission signals during emission test.

**Grounding:** Grounding was in accordance with the manufacturer's requirements and conditions for the intended use.

### 3 Summary of Test Results

FCC Rules	Description Of Test	Result
§15.247(b) (3),(4) RSS-247 issue 2, §5.4(4)	Peak Output Power/ EIRP	Compliant
§15.247(d) RSS-247 issue 2, §5.5	100 kHz Bandwidth Of Frequency Band Edges	Compliant
§15.247(d) RSS-247 issue 2, §5.5	Spurious Emission	Compliant
§15.203 RSS-GEN 8.3	Antenna Requirement	Compliant

### 4 Description of Test Modes

The EUT has been tested under engineering operating condition.

Test program used to control the EUT for staying in continuous transmitting mode is programmed.

BT LE mode: Channel low (2402MHz), mid (2442MHz) and high (2480MHz) are chosen for full testing.

Note: Test item list below has been re-verify:

1. RF Output power
2. Transmitter spurious emissions below 1GHz
3. Transmitter spurious emissions above 1GHz
4. 100 kHz Bandwidth of Frequency Band Edges

## 5 Peak Output Power Measurement

### 5.1 Standard Applicable:

According to §15.247(b)(3),(4)(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.

(4) The conducted output power limit specified in paragraph (b) of this section is based on the use of antennas with directional gains that do not exceed 6 dBi. Except as shown in paragraph (c) of this section, if transmitting antennas of directional gain greater than 6 dBi are used, the conducted output power from the intentional radiator shall be reduced below the stated values in paragraphs (b)(1), (b)(2), and (b)(3) of this section, as appropriate, by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

(c) Operation with directional antenna gains greater than 6 dBi.

(1) Fixed point-to-point operation:

(i) Systems operating in the 2400-2483.5 MHz band that are used exclusively for fixed, point-to-point operations may employ transmitting antennas with directional gain greater than 6 dBi provided the maximum conducted output power of the intentional radiator is reduced by 1 dB for every 3 dB that the directional gain of the antenna exceeds 6 dBi.

(ii) Systems operating in the 5725-5850 MHz band that are used exclusively for fixed, point-to-point operations may employ transmitting antennas with directional gain greater than 6 dBi without any corresponding reduction in transmitter conducted output power.

According to RSS-247 issue 2,§5.4

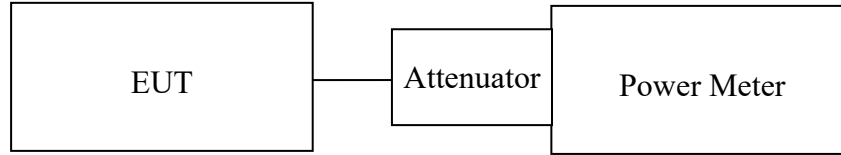
(4) For DTSs employing digital modulation techniques operating in the bands 902-928 MHz and 2400-2483.5 MHz, the maximum peak conducted output power shall not exceed 1W. Except as provided in Section 5.4(5), the e.i.r.p. shall not exceed 4 W.

As an alternative to a peak power measurement, compliance can be based on a measurement of the maximum conducted output power. The maximum conducted output power is the total transmit power delivered to all antennas and antenna elements, averaged across all symbols in the signalling 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 transmitting at a reduced power level. If multiple modes of operation are implemented, the maximum conducted output power is the highest total transmit power occurring in any mode.

## 5.2 Measurement Equipment Used:

Location Conducted	Equipment Name	Brand	Model	S/N	Last Cal. Date	Next Cal. Date
Conducted	Power Meter	Anritsu	ML2495A	1116010	09/30/2021	09/30/2022
Conducted	Power Sensor	Anritsu	MA2411B	34NKF50	09/30/2021	09/30/2022
Conducted	Power Sensor	DARE	RPR3006W	13I00030SNO33	01/07/2022	01/07/2023
Conducted	Power Sensor	DARE	RPR3006W	13I00030SNO34	01/07/2022	01/07/2023
Conducted	Power Sensor	DARE	RPR3006W	14I00889SNO35	06/23/2021	06/23/2022
Conducted	Power Sensor	DARE	RPR3006W	14I00889SNO36	06/23/2021	06/23/2022
Conducted	Temperature Chamber	KSON	THS-B4H100	2287	04/26/2021	04/26/2022
Conducted	DC Power supply	ABM	8185D	N/A	01/06/2022	01/06/2023
Conducted	AC Power supply	EXTECH	CFC105W	NA	N/A	N/A
Conducted	Spectrum analyzer	Keysight	N9010A	MY56070257	09/28/2021	09/28/2022
Conducted	Test Software	DARE	Radiation Ver:2013.1.23	NA	NA	NA
Conducted	Test Software	R&S	CMUGO Ver:2.0.0	N/A	N/A	N/A
Conducted	Universal Digital Radio Communication Tester	R&S	CMU200	111968	11/18/2021	11/18/2022
Conducted	Wideband Radio Communication Tester	R&S	CMW500	1201.002K50108793-JG	10/26/2021	10/26/2022
Conducted	BT Simulator	Agilent	N4010A	MY48100200	NA	NA
Conducted	GPS Simulator	Welnavigate	GS-50	701523	NA	NA
Conducted (TS8997)	Wideband Radio Communication Tester	R&S	CMW500	168811	09/09/2021	09/09/2022
Conducted (TS8997)	Signal Generator	R&S	SMB100B	101085	09/09/2021	09/09/2022
Conducted (TS8997)	Vector Signal Generator	R&S	SMBV100A	263246	09/09/2021	09/09/2022
Conducted (TS8997)	Signal analyzer 40GHz	R&S	FSV40	101884	09/07/2021	09/07/2022
Conducted (TS8997)	OSP150 extension unit CAM-BUS	R&S	OSP150	101107	09/10/2021	09/10/2022
Conducted (TS8997)	Test Software	R&S	EMC32	NA	NA	NA

### 5.3 Test Set-up:



### 5.4 Measurement Procedure:

1. Place the EUT on the table 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 the power meter
3. Record the max. reading.
4. Repeat above procedures until all frequency measured were complete.

### 5.5 Measurement Result:

Mode	Freq. (MHz)	Output Power (dBm)	Duty Factor (dB)	Total Output Power (dBm)	Output Power Limit (dBm)
BLE 5.0	2402	20.83	0.00	20.83	30.00
	2442	20.96	0.00	20.96	30.00
	2480	20.79	0.00	20.79	30.00

## **6 Spurious Emission Test**

### **6.1 Standard Applicable**

According to §15.247(c), all other emissions outside these bands shall not exceed the general radiated emission limits specified in §15.209(a). And according to §15.33(a)(1), for an intentional radiator operates below 10GHz, the frequency range of measurements: to the tenth harmonic of the highest fundamental frequency or to 40GHz, whichever is lower.

According to RSS-247 issue 2, §5.5

In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated device is operating, the RF power that is produced shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the de-sired power, based on either an RF conducted or a radiated measurement, provided that the transmitter demonstrates compliance with the peak conducted power limits. If the transmitter complies with the conducted power limits based on the use of root-mean-square averaging over a time interval, as permitted under Section 5.4(4), the attenuation required shall be 30 dB instead of 20 dB. Attenuation below the general field strength limits specified in RSS-Gen is not required.

### **6.2 Measurement Equipment Used:**

#### **6.2.1 Conducted Emission at antenna port:**

Refer to section 6.2 for details.

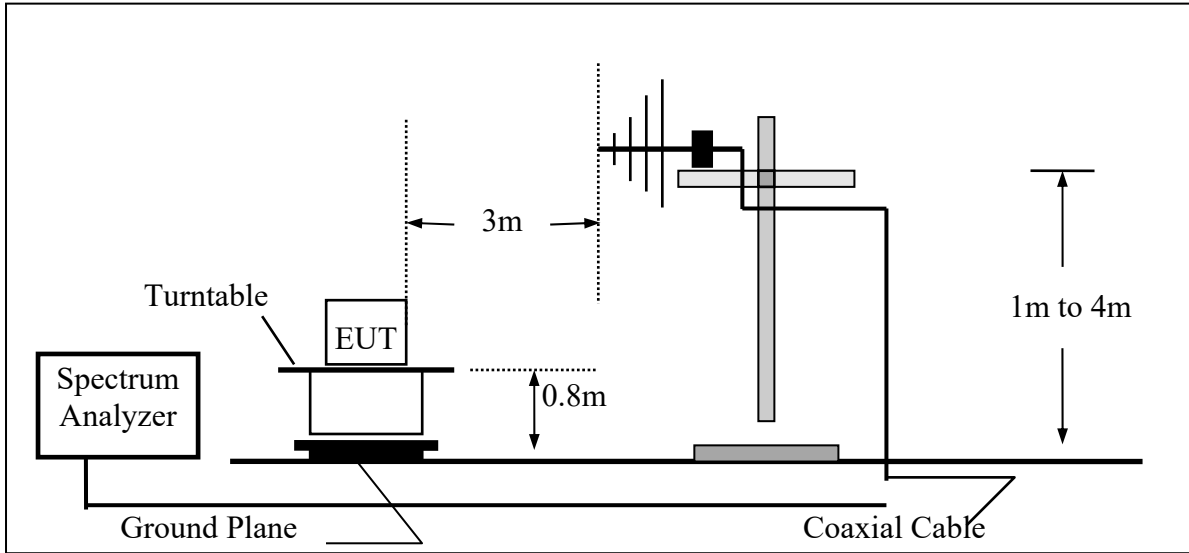
**6.2.2 Radiated emission:**

Location	Equipment Name	Brand	Model	S/N	Last Cal. Date	Next Cal. Date
Chamber 19	Spectrum analyzer	R&S	FSV40	101919	08/18/2021	08/18/2022
Chamber 19	EMI Receiver	R&S	ESR3	102461	05/05/2021	05/05/2022
Chamber 19	Loop Antenna	EM	EM-6879	271	09/29/2021	09/29/2022
Chamber 19	Bilog Antenna (30MHz-1GHz)	Schwarzbeck	VULB9168 w 6dB Att.	9168-736	02/22/2021	02/22/2022
Chamber 19	Horn antenna (1GHz-18GHz)	ETS	3117	00218718	10/12/2021	10/12/2022
Chamber 19	Horn antenna (18GHz-26GHz)	Com-power	AH-826	081001	11/30/2021	11/30/2022
Chamber 19	Horn antenna (26GHz-40GHz)	Com-power	AH-640	100A	03/11/2021	03/11/2022
Chamber 19	Preamplifier (9kHz-1GHz)	HP	8447F	3113A04621	06/22/2021	06/22/2022
Chamber 19	Preamplifier (1GHz-26GHz)	EM	EM01M26G	060681	05/07/2021	05/07/2022
Chamber 19	Preamplifier (26GHz-40GHz)	MITEQ	JS4-26004000- 27-5A	818471	05/07/2021	05/07/2022
Chamber 19	RF Cable (100kHz-26.5GHz)	HUBER HNER	SU- Sucoflex 104A	MY1394/4A & 50886/4A	08/30/2021	08/30/2022
Chamber 19	RF Cable (18GHz-40GHz)	HUBER HNER	SU- Sucoflex 102	27963/2&374 21/2	11/17/2021	11/17/2022
Chamber 19	Signal Generator	Anritsu	MG3692A	20311	12/28/2021	12/28/2022
Chamber 19	Test Software	Audix	E3 Ver:6.12023	N/A	N/A	N/A

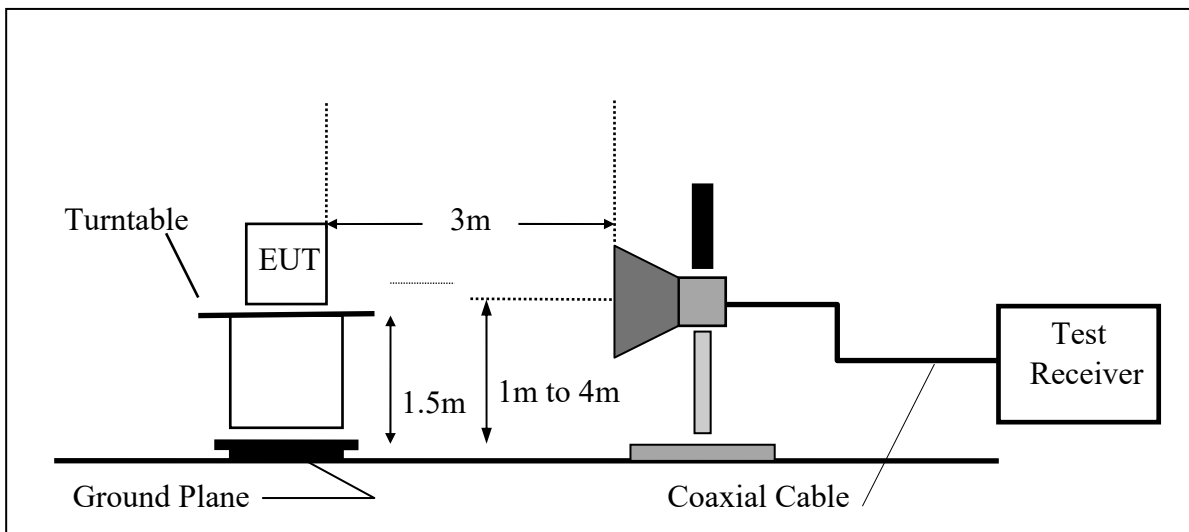
**6.3 Test SET-UP:**

The test item only performed radiated mode

(A) Radiated Emission Test Set-Up, Frequency Below 1000MHz



(B) Radiated Emission Test Set-UP Frequency Over 1 GHz





**6.4 Measurement Procedure:**

- 1 According 414788 section 2, Either OATS or chamber for radiated emission below 30MHz, the test was done at 966 chamber, the test site was evaluated with OATS and the Chamber has test signals level greater than OATS's .
- 2 The EUT was placed on a turn table which is 0.8m/1.5m above ground plane in 966 chamber.
- 3 The turn table shall rotate 360 degrees to determine the position of maximum emission level.
- 4 EUT is set 3m away from the receiving antenna which varied from 1m to 4m to find out the highest emissions.
- 5 When measurement procedures for electric field radiated emissions above 1 GHz the EUT measurement is to be made “while keeping the antenna in the ‘cone of radiation’ from that area and pointed at the area both in azimuth and elevation, with polarization oriented for maximum response.” is still within the 3dB illumination BW of the measurement antenna.
- 6 Maximum procedure was performed on the six highest emissions to ensure EUT compliance.
- 7 And also, each emission was to be maximized by changing the polarization of receiving antenna both horizontal and vertical.
- 8 Repeat above procedures until all frequency measured were complete.

Test receiver setting : Blew 1GHz  
 Detector : Average(9kHz – 90kHz, 110kHz – 90kHz), Quasi-Peak  
 Bandwidth : 200Hz, 120kHz  
 Test spectrum setting : Above 1GHz  
 Peak : RBW=1MHz, VBW=3MHz, Sweep=auto  
 Average (for BLE) : RBW=1MHz, VBW=10Hz, Sweep=auto

Mode	ON time (ms)	Total time (ms)	Duty Cycle	Duty Factor	1/Ton (kHz)	VBW for average detector (kHz)
BLE	10.000	10.000	100.000%	0.00	---	0.01

## 6.5 Field Strength Calculation

The field strength is calculated by adding the Antenna Factor and Cable Factor and subtracting the Amplifier Gain and Duty Cycle Correction Factor(if any) from the measured reading. The basic equation with a sample calculation is as follows:

$$FS = RA + AF + CL - AG$$

Where	FS = Field Strength	CL = Cable Attenuation Factor (Cable Loss)
	RA = Reading Amplitude	AG = Amplifier Gain
	AF = Antenna Factor	

## 6.6 Measurement Result:

Note: Refer to next page spectrum analyzer data chart and tabular data sheets.

**Radiated Spurious Emission Measurement Result (below 1GHz) (PIFA Antenna)**

Operation Mode	TX CH Low	Test Date	2022/01/13
Fundamental Frequency	2402MHz	Test By	Weitin
Temperature	25 °C	Pol	Ver./Hor
Humidity	60 %		

No	Freq MHz	Reading dBuV	Factor dB	Level dBuV/m	Limit dBuV/m	Margin dB	Remark	Pol V/H
1	164.83	31.60	-5.56	26.04	43.50	-17.46	Peak	VERTICAL
2	349.13	28.15	-3.86	24.29	46.00	-21.71	Peak	VERTICAL
3	466.50	28.93	-1.48	27.45	46.00	-18.55	Peak	VERTICAL
4	613.94	28.72	1.23	29.95	46.00	-16.05	Peak	VERTICAL
5	665.35	29.36	1.99	31.35	46.00	-14.65	Peak	VERTICAL
6	847.71	29.09	5.04	34.13	46.00	-11.87	Peak	VERTICAL
1	116.33	34.70	-8.41	26.29	43.50	-17.21	Peak	HORIZONTAL
2	207.51	37.64	-8.42	29.22	43.50	-14.28	Peak	HORIZONTAL
3	429.64	28.32	-2.09	26.23	46.00	-19.77	Peak	HORIZONTAL
4	550.89	29.53	-0.34	29.19	46.00	-16.81	Peak	HORIZONTAL
5	740.04	29.06	3.36	32.42	46.00	-13.58	Peak	HORIZONTAL
6	887.48	28.37	5.43	33.80	46.00	-12.20	Peak	HORIZONTAL

Remark:

- 1 No further spurious emissions detected from the lowest internal frequency and 30MHz.
- 2 Measuring frequencies from the lowest internal frequency to the 1GHz.
- 3 Radiated emissions measured in frequency range from 9MHz to 1000MHz were made with an instrument detector setting 9-90kHz/110-490kHz using PK/AV and other Frequency Band using PK/QP
- 4 Measurement result within this frequency range shown “ - ” in the table above means the reading of emissions are attenuated more than 20dB below the permissible limits or the field strength is too small to be measured.
- 5 The IF bandwidth of SPA between 9kHz to 30MHz was 10kHz, VBW= 30kHz; between 30MHz to 1GHz was 100kHz, VBW=300kHz.

**Radiated Spurious Emission Measurement Result (below 1GHz)**

Operation Mode	TX CH Mid	Test Date	2022/01/13
Fundamental Frequency	2442MHz	Test By	Weitin
Temperature	25 °C	Pol	Ver./Hor
Humidity	60 %		

No	Freq MHz	Reading dBuV	Factor dB	Level dBuV/m	Limit dBuV/m	Margin dB	Remark	Pol V/H
1	112.45	33.01	-8.76	24.25	43.50	-19.25	Peak	VERTICAL
2	162.89	31.58	-5.57	26.01	43.50	-17.49	Peak	VERTICAL
3	369.50	28.25	-3.46	24.79	46.00	-21.21	Peak	VERTICAL
4	514.03	29.53	-0.88	28.65	46.00	-17.35	Peak	VERTICAL
5	647.89	29.23	1.74	30.97	46.00	-15.03	Peak	VERTICAL
6	797.27	28.98	4.20	33.18	46.00	-12.82	Peak	VERTICAL
1	119.24	34.03	-8.04	25.99	43.50	-17.51	Peak	HORIZONTAL
2	200.72	38.02	-8.60	29.42	43.50	-14.08	Peak	HORIZONTAL
3	459.71	28.61	-1.57	27.04	46.00	-18.96	Peak	HORIZONTAL
4	615.88	29.38	1.26	30.64	46.00	-15.36	Peak	HORIZONTAL
5	812.79	28.60	4.37	32.97	46.00	-13.03	Peak	HORIZONTAL
6	886.51	28.63	5.42	34.05	46.00	-11.95	Peak	HORIZONTAL

Remark:

- 1 No further spurious emissions detected from the lowest internal frequency and 30MHz.
- 2 Measuring frequencies from the lowest internal frequency to the 1GHz.
- 3 Radiated emissions measured in frequency range from 9MHz to 1000MHz were made with an instrument detector setting 9-90kHz/110-490kHz using PK/AV and other Frequency Band using PK/QP
- 4 Measurement result within this frequency range shown “ - ” in the table above means the reading of emissions are attenuated more than 20dB below the permissible limits or the field strength is too small to be measured.
- 5 The IF bandwidth of SPA between 9kHz to 30MHz was 10kHz, VBW= 30kHz; between 30MHz to 1GHz was 100kHz, VBW=300kHz.

**Radiated Spurious Emission Measurement Result (below 1GHz)**

Operation Mode	TX CH High	Test Date	2022/01/13
Fundamental Frequency	2480MHz	Test By	Weitin
Temperature	25 °C	Pol	Ver./Hor
Humidity	60 %		

No	Freq MHz	Reading dBuV	Factor dB	Level dBuV/m	Limit dBuV/m	Margin dB	Remark	Pol V/H
1	113.42	33.52	-8.71	24.81	43.50	-18.69	Peak	VERTICAL
2	162.89	31.82	-5.57	26.25	43.50	-17.25	Peak	VERTICAL
3	275.41	28.31	-5.33	22.98	46.00	-23.02	Peak	VERTICAL
4	439.34	29.07	-1.82	27.25	46.00	-18.75	Peak	VERTICAL
5	542.16	28.67	-0.41	28.26	46.00	-17.74	Peak	VERTICAL
6	654.68	28.58	1.95	30.53	46.00	-15.47	Peak	VERTICAL
1	117.30	34.34	-8.21	26.13	43.50	-17.37	Peak	HORIZONTAL
2	198.78	38.08	-8.61	29.47	43.50	-14.03	Peak	HORIZONTAL
3	335.55	27.92	-3.86	24.06	46.00	-21.94	Peak	HORIZONTAL
4	509.18	28.93	-0.98	27.95	46.00	-18.05	Peak	HORIZONTAL
5	644.01	28.66	1.73	30.39	46.00	-15.61	Peak	HORIZONTAL
6	748.77	29.06	3.78	32.84	46.00	-13.16	Peak	HORIZONTAL

Remark:

- 1 No further spurious emissions detected from the lowest internal frequency and 30MHz.
- 2 Measuring frequencies from the lowest internal frequency to the 1GHz.
- 3 Radiated emissions measured in frequency range from 9MHz to 1000MHz were made with an instrument detector setting 9-90kHz/110-490kHz using PK/AV and other Frequency Band using PK/QP
- 4 Measurement result within this frequency range shown “ - ” in the table above means the reading of emissions are attenuated more than 20dB below the permissible limits or the field strength is too small to be measured.
- 5 The IF bandwidth of SPA between 9kHz to 30MHz was 10kHz, VBW= 30kHz; between 30MHz to 1GHz was 100kHz, VBW=300kHz.

**Radiated Spurious Emission Measurement Result (below 1GHz) (Dipole Antenna)**

Operation Mode	TX CH Low	Test Date	2022/01/13
Fundamental Frequency	2402MHz	Test By	Weitin
Temperature	25 °C	Pol	Ver./Hor
Humidity	60 %		

No	Freq MHz	Reading dBuV	Factor dB	Level dBuV/m	Limit dBuV/m	Margin dB	Remark	Pol V/H
1	163.86	31.15	-5.57	25.58	43.50	-17.92	Peak	VERTICAL
2	269.59	30.32	-5.70	24.62	46.00	-21.38	Peak	VERTICAL
3	450.01	28.60	-1.63	26.97	46.00	-19.03	Peak	VERTICAL
4	607.15	29.20	1.16	30.36	46.00	-15.64	Peak	VERTICAL
5	744.89	28.55	3.67	32.22	46.00	-13.78	Peak	VERTICAL
6	875.84	27.91	5.37	33.28	46.00	-12.72	Peak	VERTICAL
1	119.24	34.05	-8.04	26.01	43.50	-17.49	Peak	HORIZONTAL
2	201.69	38.15	-8.57	29.58	43.50	-13.92	Peak	HORIZONTAL
3	417.03	27.86	-2.57	25.29	46.00	-20.71	Peak	HORIZONTAL
4	540.22	30.44	-0.44	30.00	46.00	-16.00	Peak	HORIZONTAL
5	683.78	29.43	2.09	31.52	46.00	-14.48	Peak	HORIZONTAL
6	850.62	28.95	5.06	34.01	46.00	-11.99	Peak	HORIZONTAL

Remark:

- 1 No further spurious emissions detected from the lowest internal frequency and 30MHz.
- 2 Measuring frequencies from the lowest internal frequency to the 1GHz.
- 3 Radiated emissions measured in frequency range from 9MHz to 1000MHz were made with an instrument detector setting 9-90kHz/110-490kHz using PK/AV and other Frequency Band using PK/QP
- 4 Measurement result within this frequency range shown “ - ” in the table above means the reading of emissions are attenuated more than 20dB below the permissible limits or the field strength is too small to be measured.
- 5 The IF bandwidth of SPA between 9kHz to 30MHz was 10kHz, VBW= 30kHz; between 30MHz to 1GHz was 100kHz, VBW=300kHz.

**Radiated Spurious Emission Measurement Result (below 1GHz)**

Operation Mode	TX CH Mid	Test Date	2022/01/13
Fundamental Frequency	2442MHz	Test By	Weitin
Temperature	25 °C	Pol	Ver./Hor
Humidity	60 %		

No	Freq MHz	Reading dBuV	Factor dB	Level dBuV/m	Limit dBuV/m	Margin dB	Remark	Pol V/H
1	113.42	32.60	-8.71	23.89	43.50	-19.61	Peak	VERTICAL
2	163.86	31.53	-5.57	25.96	43.50	-17.54	Peak	VERTICAL
3	434.49	28.37	-1.91	26.46	46.00	-19.54	Peak	VERTICAL
4	601.33	29.26	1.02	30.28	46.00	-15.72	Peak	VERTICAL
5	741.98	28.49	3.49	31.98	46.00	-14.02	Peak	VERTICAL
6	924.34	28.32	6.39	34.71	46.00	-11.29	Peak	VERTICAL
1	118.27	33.58	-8.16	25.42	43.50	-18.08	Peak	HORIZONTAL
2	203.63	38.03	-8.52	29.51	43.50	-13.99	Peak	HORIZONTAL
3	336.52	28.39	-3.86	24.53	46.00	-21.47	Peak	HORIZONTAL
4	517.91	29.79	-0.80	28.99	46.00	-17.01	Peak	HORIZONTAL
5	674.08	28.78	1.94	30.72	46.00	-15.28	Peak	HORIZONTAL
6	769.14	28.61	3.99	32.60	46.00	-13.40	Peak	HORIZONTAL

Remark:

- 1 No further spurious emissions detected from the lowest internal frequency and 30MHz.
- 2 Measuring frequencies from the lowest internal frequency to the 1GHz.
- 3 Radiated emissions measured in frequency range from 9MHz to 1000MHz were made with an instrument detector setting 9-90kHz/110-490kHz using PK/AV and other Frequency Band using PK/QP
- 4 Measurement result within this frequency range shown “ - ” in the table above means the reading of emissions are attenuated more than 20dB below the permissible limits or the field strength is too small to be measured.
- 5 The IF bandwidth of SPA between 9kHz to 30MHz was 10kHz, VBW= 30kHz; between 30MHz to 1GHz was 100kHz, VBW=300kHz.

**Radiated Spurious Emission Measurement Result (below 1GHz)**

Operation Mode	TX CH High	Test Date	2022/01/13
Fundamental Frequency	2480MHz	Test By	Weitin
Temperature	25 °C	Pol	Ver./Hor
Humidity	60 %		

No	Freq MHz	Reading dBuV	Factor dB	Level dBuV/m	Limit dBuV/m	Margin dB	Remark	Pol V/H
1	113.42	32.77	-8.71	24.06	43.50	-19.44	Peak	VERTICAL
2	164.83	30.50	-5.56	24.94	43.50	-18.56	Peak	VERTICAL
3	395.69	28.72	-2.96	25.76	46.00	-20.24	Peak	VERTICAL
4	539.25	28.84	-0.45	28.39	46.00	-17.61	Peak	VERTICAL
5	727.43	29.23	2.96	32.19	46.00	-13.81	Peak	VERTICAL
6	793.39	29.17	4.19	33.36	46.00	-12.64	Peak	VERTICAL
1	121.18	33.78	-7.92	25.86	43.50	-17.64	Peak	HORIZONTAL
2	202.66	37.90	-8.55	29.35	43.50	-14.15	Peak	HORIZONTAL
3	442.25	28.60	-1.81	26.79	46.00	-19.21	Peak	HORIZONTAL
4	669.23	29.15	2.00	31.15	46.00	-14.85	Peak	HORIZONTAL
5	835.10	28.49	4.79	33.28	46.00	-12.72	Peak	HORIZONTAL
6	875.84	28.67	5.37	34.04	46.00	-11.96	Peak	HORIZONTAL

Remark:

- 1 No further spurious emissions detected from the lowest internal frequency and 30MHz.
- 2 Measuring frequencies from the lowest internal frequency to the 1GHz.
- 3 Radiated emissions measured in frequency range from 9MHz to 1000MHz were made with an instrument detector setting 9-90kHz/110-490kHz using PK/AV and other Frequency Band using PK/QP
- 4 Measurement result within this frequency range shown “ - ” in the table above means the reading of emissions are attenuated more than 20dB below the permissible limits or the field strength is too small to be measured.
- 5 The IF bandwidth of SPA between 9kHz to 30MHz was 10kHz, VBW= 30kHz; between 30MHz to 1GHz was 100kHz, VBW=300kHz.



**Radiated Spurious Emission Measurement Result (above 1GHz) (PIFA Antenna)**

Operation Mode	TX CH Low	Test Date	2022/01/13
Fundamental Frequency	2402MHz	Test By	Weitin
Temperature	25 °C	Pol	Ver./Hor
Humidity	60 %		

No	Freq MHz	Reading dBuV	Factor dB	Level dBuV/m	Limit dBuV/m	Margin dB	Remark	Pol V/H
1	4804.00	47.84	-5.83	42.01	74.00	-31.99	Peak	VERTICAL
2	5767.00	50.81	-3.33	47.48	74.00	-26.52	Peak	VERTICAL
1	4804.00	47.69	-5.83	41.86	74.00	-32.14	Peak	HORIZONTAL
2	5774.00	55.11	-3.31	51.80	74.00	-22.20	Peak	HORIZONTAL

Remark:

- 1 Measuring frequencies from the lowest internal frequency to the 10th of fundamental frequency
- 2 Field strength limits for frequency above 1000MHz are based on average limits. However, Peak mode field strength shall not exceed the average limits specified plus 20dB.
- 3 Measurement of data within this frequency range shown “ - ” in the table above means the reading of emissions are attenuated more than 20dB below the permissible limits or the field strength is too small to be measured.
- 4 Spectrum Peak mode IF bandwidth Setting : 1GHz- 26GHz, RBW= 1MHz, Sweep time= 200 ms., the VBW setting was 3 MHz.
- 5 Spectrum AV mode if bandwidth Setting : 1GHz- 26GHz, RBW= 1MHz, VBW= 10Hz, Sweep time= 200 ms.

**Radiated Spurious Emission Measurement Result (above 1GHz)**

Operation Mode	TX CH Mid	Test Date	2022/01/13
Fundamental Frequency	2442MHz	Test By	Weitin
Temperature	25 °C	Pol	Ver./Hor
Humidity	60 %		

No	Freq MHz	Reading dBuV	Factor dB	Level dBuV/m	Limit dBuV/m	Margin dB	Remark	Pol V/H
1	4884.00	47.11	-5.72	41.39	74.00	-32.61	Peak	VERTICAL
2	5767.00	50.81	-3.33	47.48	74.00	-26.52	Peak	VERTICAL
1	4884.00	47.45	-5.72	41.73	74.00	-32.27	Peak	HORIZONTAL
2	5774.00	55.11	-3.31	51.80	74.00	-22.20	Peak	HORIZONTAL
3	7447.00	54.66	-1.92	52.74	74.00	-21.26	Peak	HORIZONTAL

Remark:

- 1 Measuring frequencies from the lowest internal frequency to the 10th of fundamental frequency
- 2 Field strength limits for frequency above 1000MHz are based on average limits. However, Peak mode field strength shall not exceed the average limits specified plus 20dB.
- 3 Measurement of data within this frequency range shown “ - ” in the table above means the reading of emissions are attenuated more than 20dB below the permissible limits or the field strength is too small to be measured.
- 4 Spectrum Peak mode IF bandwidth Setting : 1GHz- 26GHz, RBW= 1MHz, Sweep time= 200 ms., the VBW setting was 3 MHz.
- 5 Spectrum AV mode if bandwidth Setting : 1GHz- 26GHz, RBW= 1MHz, VBW= 10Hz, Sweep time= 200 ms.

**Radiated Spurious Emission Measurement Result (above 1GHz)**

Operation Mode	TX CH High	Test Date	2022/01/13
Fundamental Frequency	2480MHz	Test By	Weitin
Temperature	25 °C	Pol	Ver./Hor
Humidity	60 %		

No	Freq MHz	Reading dBuV	Factor dB	Level dBuV/m	Limit dBuV/m	Margin dB	Remark	Pol V/H
1	4960.00	50.63	-5.51	45.12	74.00	-28.88	Peak	VERTICAL
2	5767.00	50.81	-3.33	47.48	74.00	-26.52	Peak	VERTICAL
1	4960.00	48.21	-5.51	42.70	74.00	-31.30	Peak	HORIZONTAL
2	5774.00	55.11	-3.31	51.80	74.00	-22.20	Peak	HORIZONTAL

Remark:

- 1 Measuring frequencies from the lowest internal frequency to the 10th of fundamental frequency
- 2 Field strength limits for frequency above 1000MHz are based on average limits. However, Peak mode field strength shall not exceed the average limits specified plus 20dB.
- 3 Measurement of data within this frequency range shown “ - ” in the table above means the reading of emissions are attenuated more than 20dB below the permissible limits or the field strength is too small to be measured.
- 4 Spectrum Peak mode IF bandwidth Setting : 1GHz- 26GHz, RBW= 1MHz, Sweep time= 200 ms., the VBW setting was 3 MHz.
- 5 Spectrum AV mode if bandwidth Setting : 1GHz- 26GHz, RBW= 1MHz, VBW= 10Hz, Sweep time= 200 ms.

**Radiated Spurious Emission Measurement Result (above 1GHz) (Dipole Antenna)**

Operation Mode	TX CH Low	Test Date	2022/01/13
Fundamental Frequency	2402MHz	Test By	Weitin
Temperature	25 °C	Pol	Ver./Hor
Humidity	60 %		

No	Freq MHz	Reading dBuV	Factor dB	Level dBuV/m	Limit dBuV/m	Margin dB	Remark	Pol V/H
1	4804.00	47.60	-5.83	41.77	74.00	-32.23	Peak	VERTICAL
2	5760.00	52.53	-3.34	49.19	74.00	-24.81	Peak	VERTICAL
1	4804.00	47.29	-5.83	41.46	74.00	-32.54	Peak	HORIZONTAL
2	5767.00	52.76	-3.33	49.43	74.00	-24.57	Peak	HORIZONTAL

Remark:

- 1 Measuring frequencies from the lowest internal frequency to the 10th of fundamental frequency
- 2 Field strength limits for frequency above 1000MHz are based on average limits. However, Peak mode field strength shall not exceed the average limits specified plus 20dB.
- 3 Measurement of data within this frequency range shown “ - ” in the table above means the reading of emissions are attenuated more than 20dB below the permissible limits or the field strength is too small to be measured.
- 4 Spectrum Peak mode IF bandwidth Setting : 1GHz- 26GHz, RBW= 1MHz, Sweep time= 200 ms., the VBW setting was 3 MHz.
- 5 Spectrum AV mode if bandwidth Setting : 1GHz- 26GHz, RBW= 1MHz, VBW= 10Hz, Sweep time= 200 ms.

**Radiated Spurious Emission Measurement Result (above 1GHz)**

Operation Mode	TX CH Mid	Test Date	2022/01/13
Fundamental Frequency	2442MHz	Test By	Weitin
Temperature	25 °C	Pol	Ver./Hor
Humidity	60 %		

No	Freq MHz	Reading dBuV	Factor dB	Level dBuV/m	Limit dBuV/m	Margin dB	Remark	Pol V/H
1	4884.00	47.11	-5.72	41.39	74.00	-32.61	Peak	VERTICAL
2	5760.00	52.53	-3.34	49.19	74.00	-24.81	Peak	VERTICAL
1	4884.00	47.28	-5.72	41.56	74.00	-32.44	Peak	HORIZONTAL
2	5767.00	52.76	-3.33	49.43	74.00	-24.57	Peak	HORIZONTAL

Remark:

- 1 Measuring frequencies from the lowest internal frequency to the 10th of fundamental frequency
- 2 Field strength limits for frequency above 1000MHz are based on average limits. However, Peak mode field strength shall not exceed the average limits specified plus 20dB.
- 3 Measurement of data within this frequency range shown “ - ” in the table above means the reading of emissions are attenuated more than 20dB below the permissible limits or the field strength is too small to be measured.
- 4 Spectrum Peak mode IF bandwidth Setting : 1GHz- 26GHz, RBW= 1MHz, Sweep time= 200 ms., the VBW setting was 3 MHz.
- 5 Spectrum AV mode if bandwidth Setting : 1GHz- 26GHz, RBW= 1MHz, VBW= 10Hz, Sweep time= 200 ms.

**Radiated Spurious Emission Measurement Result (above 1GHz)**

Operation Mode	TX CH High	Test Date	2022/01/13
Fundamental Frequency	2480MHz	Test By	Weitin
Temperature	25 °C	Pol	Ver./Hor
Humidity	60 %		

No	Freq MHz	Reading dBuV	Factor dB	Level dBuV/m	Limit dBuV/m	Margin dB	Remark	Pol V/H
1	4960.00	56.02	-5.51	50.51	74.00	-23.49	Peak	VERTICAL
2	5760.00	52.53	-3.34	49.19	74.00	-24.81	Peak	VERTICAL
1	4960.00	51.77	-5.51	46.26	74.00	-27.74	Peak	HORIZONTAL
2	5767.00	52.76	-3.33	49.43	74.00	-24.57	Peak	HORIZONTAL

Remark:

- 1 Measuring frequencies from the lowest internal frequency to the 10th of fundamental frequency
- 2 Field strength limits for frequency above 1000MHz are based on average limits. However, Peak mode field strength shall not exceed the average limits specified plus 20dB.
- 3 Measurement of data within this frequency range shown “ - ” in the table above means the reading of emissions are attenuated more than 20dB below the permissible limits or the field strength is too small to be measured.
- 4 Spectrum Peak mode IF bandwidth Setting : 1GHz- 26GHz, RBW= 1MHz, Sweep time= 200 ms., the VBW setting was 3 MHz.
- 5 Spectrum AV mode if bandwidth Setting : 1GHz- 26GHz, RBW= 1MHz, VBW= 10Hz, Sweep time= 200 ms.

## 7. 100kHz Bandwidth of Band Edges Measurement

### 7.1 Standard Applicable:

According to §15.247(c), in any 100 kHz bandwidth outside the frequency bands in which the spread spectrum intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20dB below that in the 100kHz bandwidth within the band that contains the highest level of the desired power, 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).

According to RSS-247 issue 2, §5.5

In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated device is operating, the RF power that is produced 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 that the transmitter demonstrates compliance with the peak conducted power limits. If the transmitter complies with the conducted power limits based on the use of root-mean-square averaging over a time interval, as permitted under Section 5.4(4), the attenuation required shall be 30 dB instead of 20 dB attenuation below the general field strength limits specified in RSS-Gen is not required.

**7.2 Measurement Equipment Used:**

**7.2.1 Conducted Emission at antenna port:**

Refer to section 6.2 for details.

**7.2.2 Radiated emission:**

Refer to section 6.2 for details.

**7.3 Test SET-UP:**

Refer to section 6.3 for details.

**7.4 Measurement Procedure:**

- 1 The EUT was placed on a turn table which is 0.8m above ground plane.
- 2 The turn table shall rotate 360 degrees to determine the position of maximum emission level.
- 3 EUT is set 3m away from the receiving antenna which varied from 1m to 4m to find out the highest emissions.
- 4 When measurement procedures for electric field radiated emissions above 1 GHz the EUT measurement is to be made “while keeping the antenna in the ‘cone of radiation’ from that area and pointed at the area both in azimuth and elevation, with polarization oriented for maximum response.” is still within the 3dB illumination BW of the measurement antenna.
- 5 Maximum procedure was performed on the six highest emissions to ensure EUT compliance.
- 6 And also, each emission was to be maximized by changing the polarization of receiving antenna both horizontal and vertical.
- 7 Repeat above procedures until all frequency measured were complete.

**7.5 Field Strength Calculation:**

The field strength is calculated by adding the Antenna Factor and Cable Factor and subtracting the Amplifier Gain and Duty Cycle Correction Factor (if any) from the measured reading. The basic equation with a sample calculation is as follows:

$$FS = RA + AF + CL - AG$$

Where	FS = Field Strength	CL = Cable Attenuation Factor (Cable Loss)
	RA = Reading Amplitude	AG = Amplifier Gain
	AF = Antenna Factor	

**7.6 Measurement Result:**

Note: Refer to next page spectrum analyzer data chart and tabular data sheets.

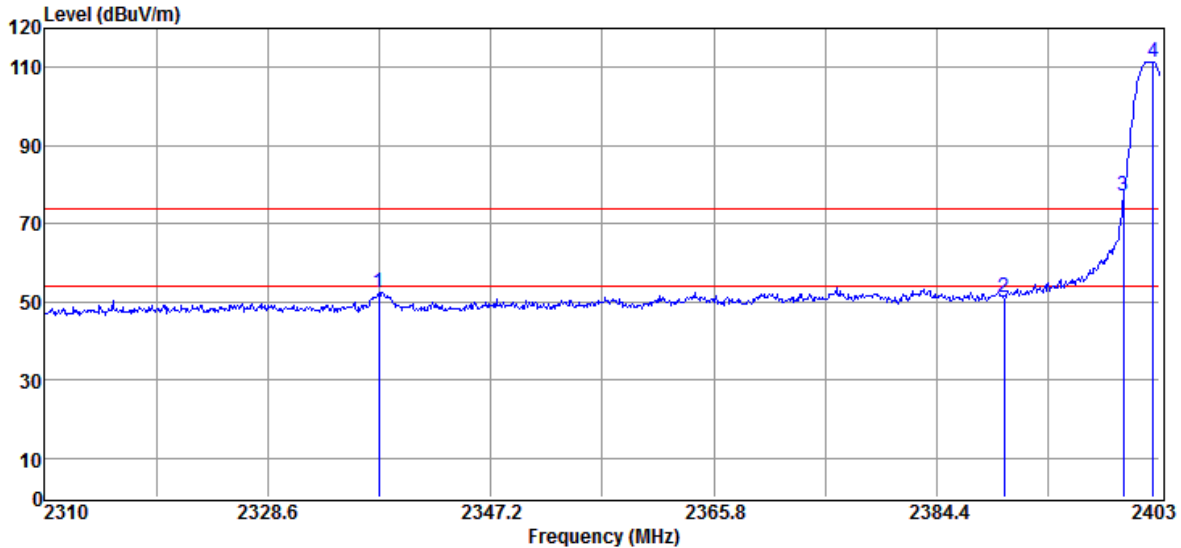


**Radiated Emission:**

**PIFA Antenna**

Operation Mode TX CH Low  
Fundamental Frequency 2402 MHz  
Temperature 25 °C

Test Date 2022/01/13  
Test By Weitin  
Humidity 60 %

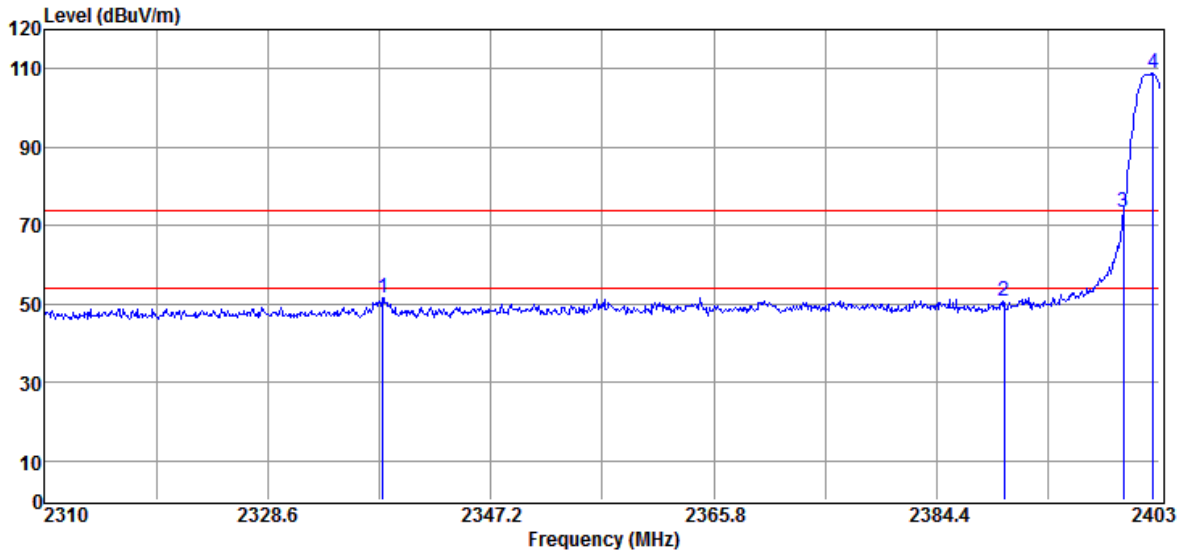


No	Freq MHz	Reading dBuV	Factor dB	Level dBuV/m	Limit dBuV/m	Margin dB	Remark	Pol V/H
1	2337.90	63.75	-11.25	52.50	74.00	-21.50	Peak	VERTICAL
2	2390.00	61.84	-10.86	50.98	74.00	-23.02	Peak	VERTICAL
3	2400.00	87.98	-10.77	77.21	91.32	-14.11	Peak	VERTICAL
4	2402.44	122.08	-10.76	111.32	F	--	Peak	VERTICAL

**Remark:**

- 1 Measuring frequencies from the lowest internal frequency to the 10th of fundamental frequency
- 2 Field strength limits for frequency above 1000MHz are based on average limits. However, Peak mode field strength shall not exceed the average limits specified plus 20dB.
- 3 Measurement of data within this frequency range shown “ - ” in the table above means the reading of emissions are attenuated more than 20dB below the permissible limits or the field strength is too small to be measured.
- 4 Spectrum Peak mode IF bandwidth Setting : 1GHz- 26GHz, RBW= 1MHz, Sweep time= 200 ms., the VBW setting was 3 MHz.
- 5 Spectrum AV mode if bandwidth Setting : 1GHz- 26GHz, RBW= 1MHz, VBW= 10Hz, Sweep time= 200 ms.

Note: “F” denotes fundamental frequency



No	Freq MHz	Reading dBuV	Factor dB	Level dBuV/m	Limit dBuV/m	Margin dB	Remark	Pol V/H
1	2338.18	62.90	-11.25	51.65	74.00	-22.35	Peak	HORIZONTAL
2	2390.00	61.42	-10.86	50.56	74.00	-23.44	Peak	HORIZONTAL
3	2400.00	84.04	-10.77	73.27	88.69	-15.42	Peak	HORIZONTAL
4	2402.44	119.45	-10.76	108.69	F	--	Peak	HORIZONTAL

Remark:

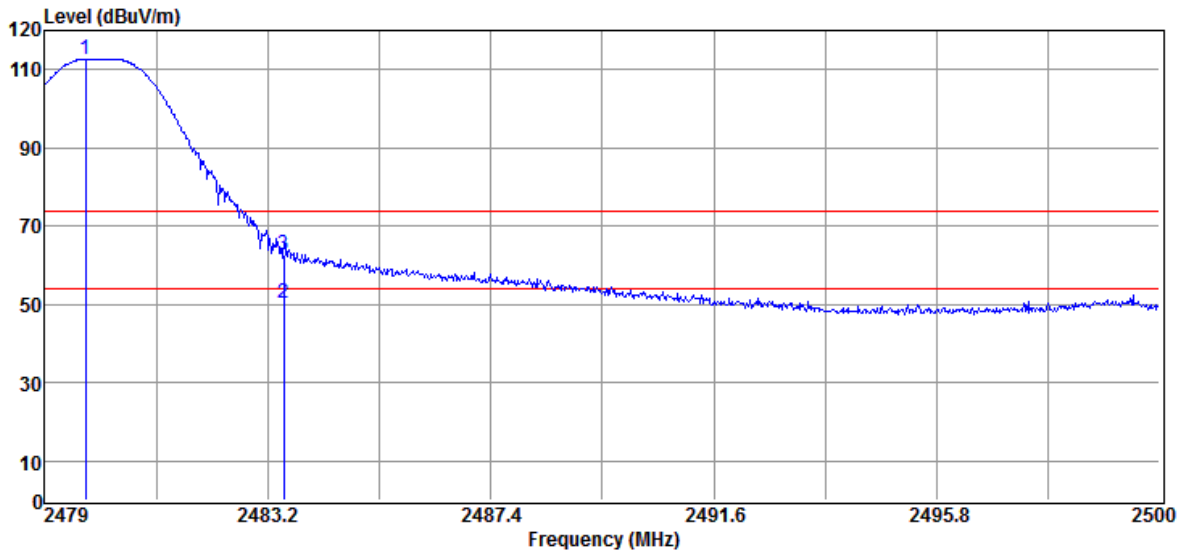
- 1 Measuring frequencies from the lowest internal frequency to the 10th of fundamental frequency
- 2 Field strength limits for frequency above 1000MHz are based on average limits. However, Peak mode field strength shall not exceed the average limits specified plus 20dB.
- 3 Measurement of data within this frequency range shown “ - ” in the table above means the reading of emissions are attenuated more than 20dB below the permissible limits or the field strength is too small to be measured.
- 4 Spectrum Peak mode IF bandwidth Setting : 1GHz- 26GHz, RBW= 1MHz, Sweep time= 200 ms., the VBW setting was 3 MHz.
- 5 Spectrum AV mode if bandwidth Setting : 1GHz- 26GHz, RBW= 1MHz, VBW= 10Hz, Sweep time= 200 ms.

Note: “F” denotes fundamental frequency

**PCB Antenna**

Operation Mode TX CH High  
 Fundamental Frequency 2480 MHz  
 Temperature 25 °C

Test Date 2018/11/16  
 Test By Weitin  
 Humidity 60 %

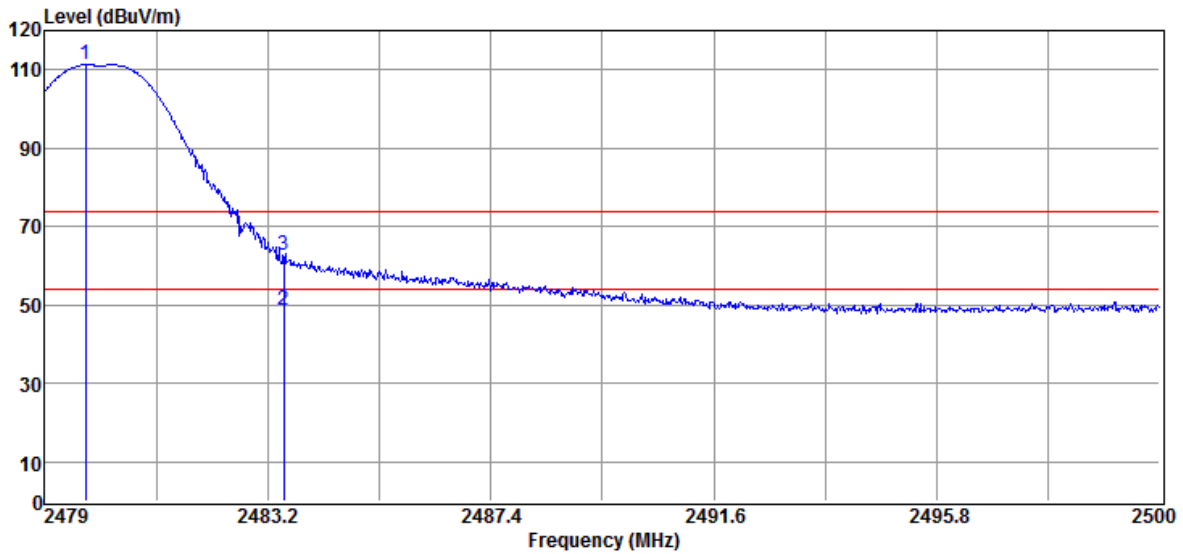


No	Freq MHz	Reading dBuV	Factor dB	Level dBuV/m	Limit dBuV/m	Margin dB	Remark	Pol V/H
1	2479.78	123.31	-10.64	112.67	F	--	Peak	VERTICAL
2	2483.50	60.76	-10.62	50.14	54.00	-3.86	Average	VERTICAL
3	2483.50	73.12	-10.62	62.50	74.00	-11.50	Peak	VERTICAL

Remark:

- 1 Measuring frequencies from the lowest internal frequency to the 10th of fundamental frequency
- 2 Field strength limits for frequency above 1000MHz are based on average limits. However, Peak mode field strength shall not exceed the average limits specified plus 20dB.
- 3 Measurement of data within this frequency range shown “ - ” in the table above means the reading of emissions are attenuated more than 20dB below the permissible limits or the field strength is too small to be measured.
- 4 Spectrum Peak mode IF bandwidth Setting : 1GHz- 26GHz, RBW= 1MHz, Sweep time= 200 ms., the VBW setting was 3 MHz.
- 5 Spectrum AV mode if bandwidth Setting : 1GHz- 26GHz, RBW= 1MHz, VBW= 10Hz, Sweep time= 200 ms.

Note: “F” denotes fundamental frequenc.



No	Freq MHz	Reading dBUV	Factor dB	Level dBUV/m	Limit dBUV/m	Margin dB	Remark	Pol V/H
1	2479.78	121.85	-10.64	111.21	F	--	Peak	HORIZONTAL
2	2483.50	59.44	-10.62	48.82	54.00	-5.18	Average	HORIZONTAL
3	2483.50	73.25	-10.62	62.63	74.00	-11.37	Peak	HORIZONTAL

Remark:

- 1 Measuring frequencies from the lowest internal frequency to the 10th of fundamental frequency
- 2 Field strength limits for frequency above 1000MHz are based on average limits. However, Peak mode field strength shall not exceed the average limits specified plus 20dB.
- 3 Measurement of data within this frequency range shown “ - ” in the table above means the reading of emissions are attenuated more than 20dB below the permissible limits or the field strength is too small to be measured.
- 4 Spectrum Peak mode IF bandwidth Setting : 1GHz- 26GHz, RBW= 1MHz, Sweep time= 200 ms., the VBW setting was 3 MHz.
- 5 Spectrum AV mode if bandwidth Setting : 1GHz- 26GHz, RBW= 1MHz, VBW= 10Hz, Sweep time= 200 ms.

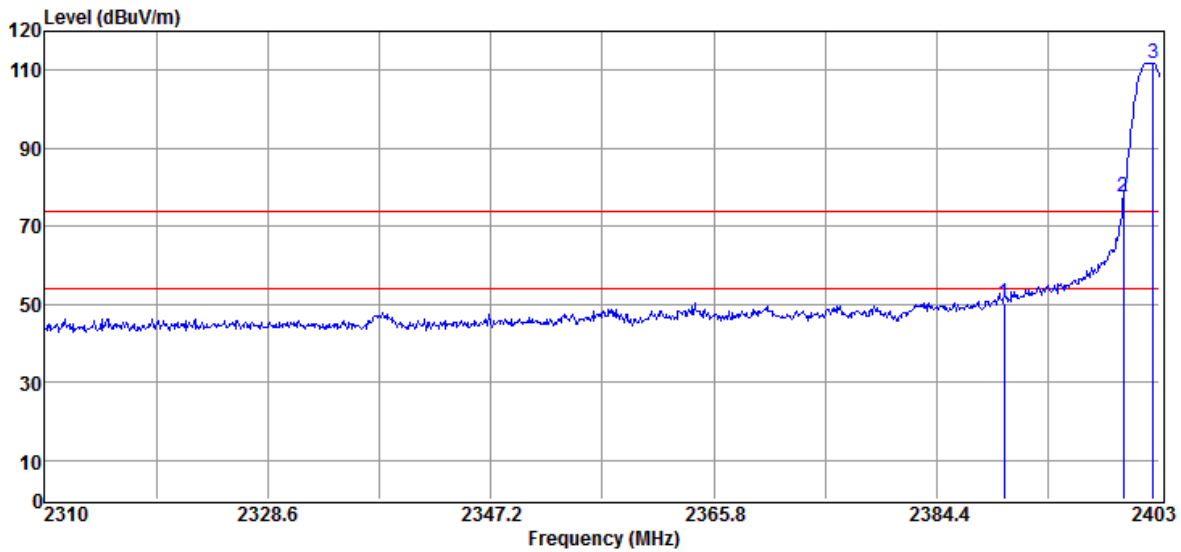
Note: “F” denotes fundamental frequency

**Radiated Emission:**

**Dipole Antenna**

Operation Mode TX CH Low  
 Fundamental Frequency 2402 MHz  
 Temperature 25 °C

Test Date 2022/01/13  
 Test By Weitin  
 Humidity 60 %

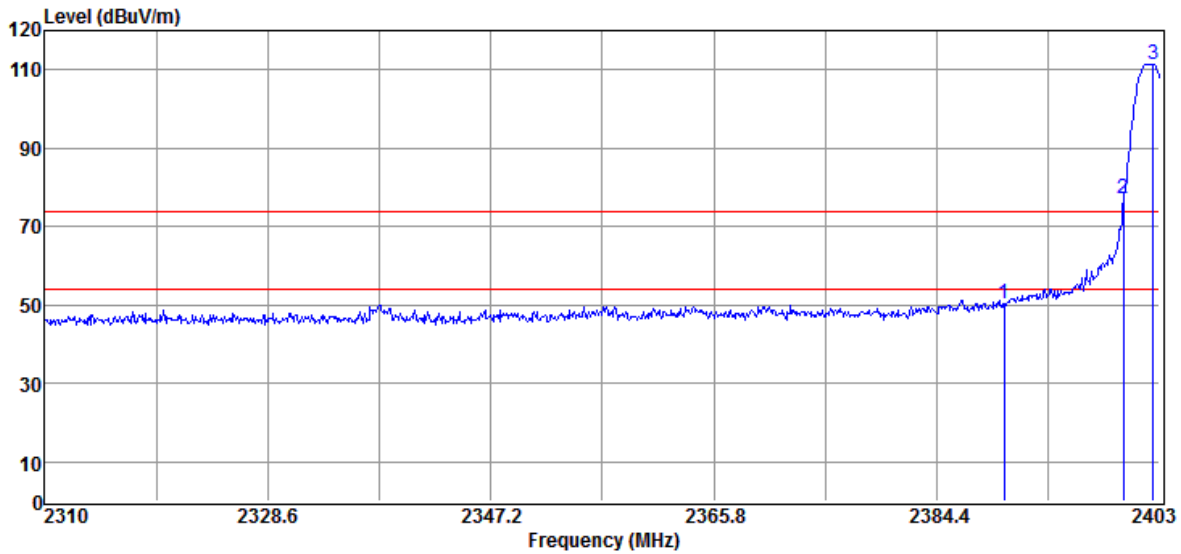


No	Freq MHz	Reading dBuV	Factor dB	Level dBuV/m	Limit dBuV/m	Margin dB	Remark	Pol V/H
1	2390.00	61.17	-10.86	50.31	74.00	-23.69	Peak	VERTICAL
2	2400.00	88.44	-10.77	77.67	91.75	-14.08	Peak	VERTICAL
3	2402.44	122.51	-10.76	111.75	F	--	Peak	VERTICAL

**Remark:**

- 1 Measuring frequencies from the lowest internal frequency to the 10th of fundamental frequency
- 2 Field strength limits for frequency above 1000MHz are based on average limits. However, Peak mode field strength shall not exceed the average limits specified plus 20dB.
- 3 Measurement of data within this frequency range shown “ - ” in the table above means the reading of emissions are attenuated more than 20dB below the permissible limits or the field strength is too small to be measured.
- 4 Spectrum Peak mode IF bandwidth Setting : 1GHz- 26GHz, RBW= 1MHz, Sweep time= 200 ms., the VBW setting was 3 MHz.
- 5 Spectrum AV mode if bandwidth Setting : 1GHz- 26GHz, RBW= 1MHz, VBW= 10Hz, Sweep time= 200 ms.

Note: “F” denotes fundamental frequency



No	Freq MHz	Reading dBuV	Factor dB	Level dBuV/m	Limit dBuV/m	Margin dB	Remark	Pol V/H
1	2390.00	61.33	-10.86	50.47	74.00	-23.53	Peak	HORIZONTAL
2	2400.00	87.93	-10.77	77.16	91.38	-14.22	Peak	HORIZONTAL
3	2402.44	122.14	-10.76	111.38	F	--	Peak	HORIZONTAL

Remark:

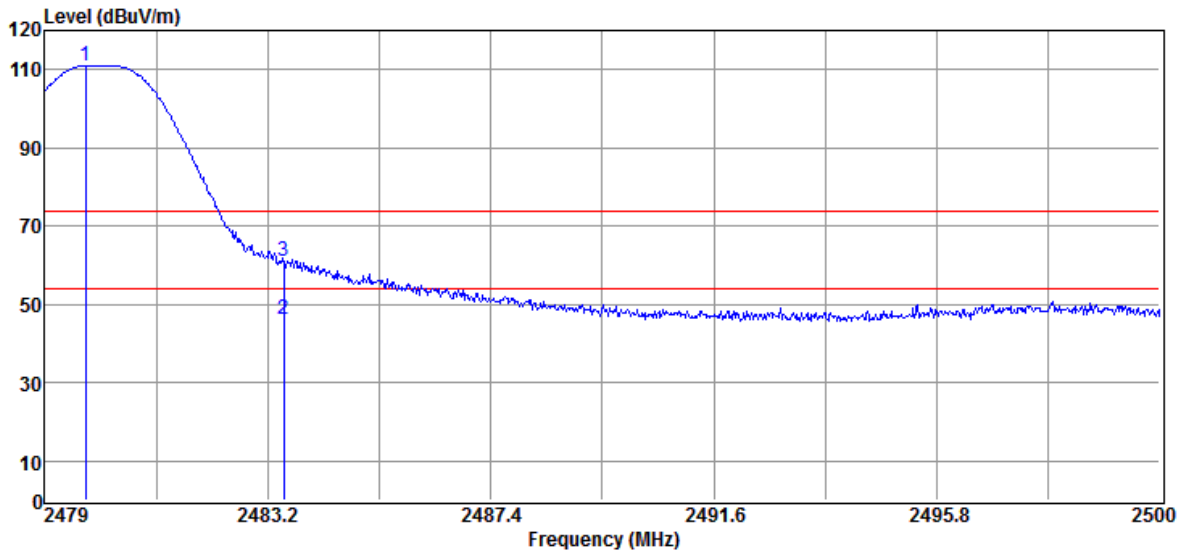
- 1 Measuring frequencies from the lowest internal frequency to the 10th of fundamental frequency
- 2 Field strength limits for frequency above 1000MHz are based on average limits. However, Peak mode field strength shall not exceed the average limits specified plus 20dB.
- 3 Measurement of data within this frequency range shown “ - ” in the table above means the reading of emissions are attenuated more than 20dB below the permissible limits or the field strength is too small to be measured.
- 4 Spectrum Peak mode IF bandwidth Setting : 1GHz- 26GHz, RBW= 1MHz, Sweep time= 200 ms., the VBW setting was 3 MHz.
- 5 Spectrum AV mode if bandwidth Setting : 1GHz- 26GHz, RBW= 1MHz, VBW= 10Hz, Sweep time= 200 ms.

Note: “F” denotes fundamental frequency

## Dipole Antenna

Operation Mode TX CH High  
Fundamental Frequency 2480 MHz  
Temperature 25 °C

Test Date 2018/03/16  
Test By Weitin  
Humidity 60 %

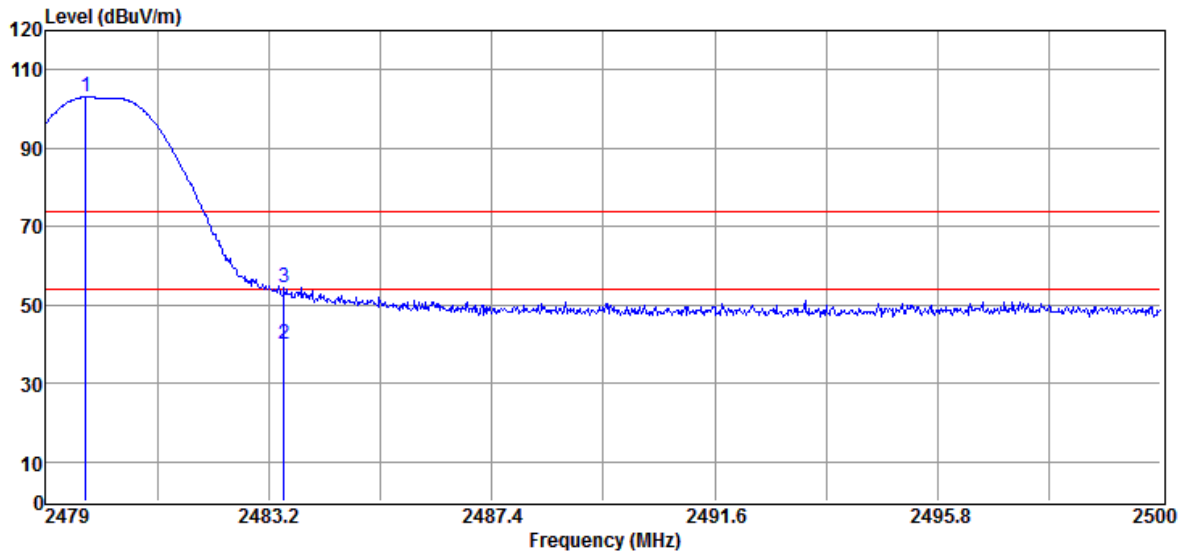


No	Freq MHz	Reading dBuV	Factor dB	Level dBuV/m	Limit dBuV/m	Margin dB	Remark	Pol V/H
1	2479.78	121.58	-10.64	110.94	F	--	Peak	VERTICAL
2	2483.50	56.92	-10.62	46.30	54.00	-7.70	Average	VERTICAL
3	2483.50	71.74	-10.62	61.12	74.00	-12.88	Peak	VERTICAL

### Remark:

- 1 Measuring frequencies from the lowest internal frequency to the 10th of fundamental frequency
- 2 Field strength limits for frequency above 1000MHz are based on average limits. However, Peak mode field strength shall not exceed the average limits specified plus 20dB.
- 3 Measurement of data within this frequency range shown “ - ” in the table above means the reading of emissions are attenuated more than 20dB below the permissible limits or the field strength is too small to be measured.
- 4 Spectrum Peak mode IF bandwidth Setting : 1GHz- 26GHz, RBW= 1MHz, Sweep time= 200 ms., the VBW setting was 3 MHz.
- 5 Spectrum AV mode if bandwidth Setting : 1GHz- 26GHz, RBW= 1MHz, VBW= 10Hz, Sweep time= 200 ms.

Note: “F” denotes fundamental frequency



No	Freq MHz	Reading dBuV	Factor dB	Level dBuV/m	Limit dBuV/m	Margin dB	Remark	Pol V/H
1	2479.76	113.63	-10.64	102.99	F	--	Peak	HORIZONTAL
2	2483.50	50.82	-10.62	40.20	54.00	-13.80	Average	HORIZONTAL
3	2483.50	64.87	-10.62	54.25	74.00	-19.75	Peak	HORIZONTAL

Remark:

- 1 Measuring frequencies from the lowest internal frequency to the 10th of fundamental frequency
- 2 Field strength limits for frequency above 1000MHz are based on average limits. However, Peak mode field strength shall not exceed the average limits specified plus 20dB.
- 3 Measurement of data within this frequency range shown “ - ” in the table above means the reading of emissions are attenuated more than 20dB below the permissible limits or the field strength is too small to be measured.
- 4 Spectrum Peak mode IF bandwidth Setting : 1GHz- 26GHz, RBW= 1MHz, Sweep time= 200 ms., the VBW setting was 3 MHz.
- 5 Spectrum AV mode if bandwidth Setting : 1GHz- 26GHz, RBW= 1MHz, VBW= 10Hz, Sweep time= 200 ms.

Note: “F” denotes fundamental frequency



## 8 Antenna Requirement

### 8.1 Standard Applicable:

According to §15.203, Antenna requirement.

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 use of a standard antenna jack or electrical connector is prohibited. This requirement does not apply to carrier current devices or to devices operated under the provisions of Sections 15.211, 15.213, 15.217, 15.219, or 15.221. Further, this requirement does not apply to intentional radiators that must be professionally installed, such as perimeter protection systems and some field disturbance sensors, or to other intentional radiators which, in accordance with Section 15.31(d), must be measured at the installation site. However, the installer shall be responsible for ensuring that the proper antenna is employed so that the limits in this Part are not exceeded.

According to RSS-GEN 6.8 antenna requirement: The applicant for equipment certification shall provide a list of all antenna types that may be used with the transmitter, where applicable (i.e. for transmitters with detachable antenna), indicating the maximum permissible antenna gain (in dBi) and the required impedance for each antenna.

The test report shall demonstrate the compliance of the transmitter with the limit for maximum equivalent isotropically radiated power (e.i.r.p.) specified in the applicable RSS, when the transmitter is equipped with any antenna type, selected from this list.

For expediting the testing, measurements may be performed using only the antenna with highest gain of each combination of transmitter and antenna type, with the transmitter output power set at the maximum level. However, the transmitter shall comply with the applicable requirements under all operational conditions and when in combination with any type of antenna from the list provided in the test report (and in the notice to be included in the user manual, provided below). When measurements at the antenna port are used to determine the RF output power, the effective gain of the device's antenna shall be stated, based on a measurement or on data from the antenna's manufacturer.

The test report shall state the RF power, output power setting and spurious emission measurements with each antenna type that is used with the transmitter being tested.

For licence-exempt equipment with detachable antennas, the user manual shall also contain the following notice in a conspicuous location:

<p>This radio transmitter [enter the device's ISED certification number] has been approved by Innovation, Science and Economic Development Canada to operate with the antenna types listed below, with the maximum permissible gain indicated. Antenna types not included in this list that have a gain greater than the maximum gain indicated for any type listed are strictly prohibited for use with this device.</p>
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Immediately following the above notice, the manufacturer shall provide a list of all antenna types which can be used with the transmitter, indicating the maximum permissible antenna gain (in dBi) and the required impedance for each antenna type.

### 8.2 Antenna Connected Construction:

The directional gains of antenna used for transmitting is 1.97dBi for HX-CUX005 and the antenna is and 6dBi for ANT060 and the antenna is Dipole antenna no consideration of replacement.

Please see EUT photo and antenna spec. for details