TEST REPORT

of

FCC Part 15 Subpart C AND CANADA RSS-247

☒ New Application; ☐ Class I PC; ☐ Class II PC

Product :	**Bluetooth 5Module**
Brand:	**Fanstel**
Main Model:	**FCC: BT832X, IC: BT832XH**
Series Model:	**FCC: BT832XE, IC: BT832XHE**
Model Difference:	**Antenna difference**
FCC ID:	**X8WBT832XH**
IC:	**4100A-BT832XH**
FCC Rule Part:	**§15.247, Cat: DSS**
IC Rule Part:	**RSS-247 issue 2: 2017** **RSS-Gen issue 5: 2018+A1(2019)+A2(2021)**
Applicant:	**Fanstel Corporation, Taipei**
Address:	**10F-10, No. 79, Sec. 1, Hsin Tai Wu Rd., Hsi-Chih, New Taipei City 221 Taiwan**

Test Performed by:

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Report No.: **ISL-22LR0101FCDSS**
Issue Date :**2022/05/27**

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 5Module
Brand Name:	Fanstel
Main Model:	FCC: BT832X, IC: BT832XH
Series Model:	FCC: BT832XE, IC: BT832XHE
Model Difference:	Antenna difference
FCC ID:	X8WBT832XH
IC:	4100A-BT832XH
Date of test:	2025/05/05 ~ 2022/05/26
Date of EUT Received:	2022/05/05

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.

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Prepared By:	Gigi yeh	***Date:***	2022/05/27
	Gigi Yeh / Senior Engineer		
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	Jerry Liu / Assistant Manager		

Version

Version No.	Date	Description
00	2022/05/27	Initial creation of document

Uncertainty of Measurement

ISO/IEC 17025 requires that an estimate of measurement uncertainties associated with the emissions test results be included in the report. The measurement uncertainties given below are based on a 95% confidence level (based on a coverage factor (k=2)).

Parameter	Uncertainty (k=2)
Conducted Emission (AC power line)	±0.852 dB
Spurious emissions, radiated	±3.46 dB
RF power, conducted	±1.386 dB
Power Density	±1.432 dB
RF Frequency	±0.00298%
Time	±0.01%
DC Voltage	±0.808%

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1. General Information

1.1. Product Description

General Information	
Product Name:	Bluetooth 5Module
Brand Name:	Fanstel
Main Model:	FCC: BT832X, IC: BT832XH
Series Model:	FCC: BT832XE, IC: BT832XHE
Model Difference:	Antenna difference
Temperature Range	-40°C to +85°C
Power Supply:	3.3V
Information	
Frequency Range:	2402 – 2480MHz
Max Output Power:	19.87dBm
Channel number:	79 channels
Modulation type:	FHSS
PMN (Product Marketing Name)	BT832XH
HVIN (Hardware Version Identification Number)	BT832XH; BT832XHE
FVIN (Firmware Version Identification Number)	radio_test-nrf52832-bare_TX_12_RX_11-ok
Test SW Version:	Putty 0.60.0.0
RFpower setting:	Slotop set power 150

Model Summaries:

Module	FCC: BT832X, IC: BT832XH	FCC: BT832XE, IC: BT832XHE
SoC	nRF52832-QFAA	nRF52832-QFAA
Flash/RAM	512KB/64KB	512KB/64KB
BT Antenna	PCB trace	Dipole
Antenna gain	2.34dBi	6.15dBi

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

1.2. Related Submittal(s) / Grant (s)

This submittal(s) (test report) is intended for **FCC ID: X8WBT832XH** filing to comply with Section 15.247 of the FCC Part 15, Subpart C Rules and **IC: 4100A-BT832XH** filing to comply with Industry Canada RSS-247 issue 2.

1.3. 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.

1.4. 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.

1.5. Special Accessories

Not available for this EUT intended for grant.

1.6. Equipment Modifications

Not available for this EUT intended for grant.

1.7. Reference

KDB Document: 558074 D01 15.247 Meas Guidance v05r02.

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 tested with a test program to fix the TX/RX frequency that was for the purpose of the measurements. For more information please see test data and APPENDIX 1 for set-up photographs.

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 of ANSI C63.10: 2013 and RSS-Gen issue 5: 2018+A1(2019) +A2(2021). 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 Sub-clause 8.3.1.2 of ANSI C63.10: 2013.

2.4 Configuration of Tested System

Fig. 2-1 Configuration of Tested System (Fixed channel)

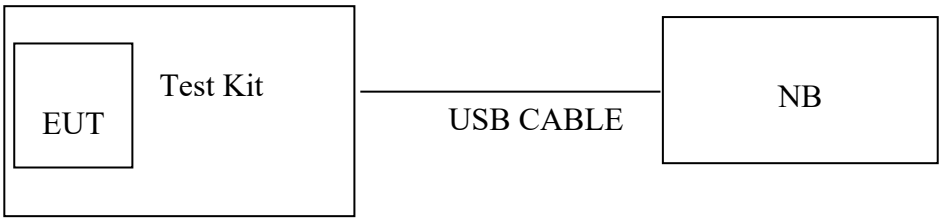


Table 1 Equipment Used in Tested System

Item	Equipment	Mfr/Brand	Model/ Type No.	Series No.	Data Cable	Power Cord
1	Notebook	Lenovo	X220i	N/A	N/A	Non-shielded
2	Test Kit	N/A	N/A	N/A	N/A	N/A

3. Summary of Test Results

FCC Rules	Description Of Test	Result
§15.207(a)/ RSS-Gen §8.8	AC Power line Conducted Emission	Compliant
§15.247(b)(1)/ RSS-247 issue 2,§A5.4(b)	Peak Output Power	Compliant
§15.247(d) RSS-247 issue 2, §5.5	100 kHz Bandwidth of Frequency Band Edges	Compliant
§15.247(c) RSS-247 issue 2, §5.5	Spurious Emission	Compliant
§15.247(a)(1)/ RSS-247 issue 2,§A5.1(b)	Frequency Separation	Compliant
§15.247(a)(1)(iii)/ RSS-247 issue 2,§A5.1(d)	Number of hopping frequency	Compliant
§15.247(a)(1)(ii)/ RSS-247 issue 2,§A5.1(d)	Time of Occupancy	Compliant
§15.247(a)(1) RSS-Gen §6.6 RSS-247 issue 2, §5.1(a)	20dB Bandwidth & 99% Power Bandwidth	Compliant
§15.203, §15.247(c) RSS-GEN 6.8	Antenna Requirement	Compliant

4. Description of Test Modes

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

Channel low (2402MHz)、mid (2441MHz) and high (2480MHz) with each modulation were chosen for full testing.

5. Conduced Emission Test

5.1 Standard Applicable:

According to §15.207 and RSS-Gen §8.8, frequency range within 150kHz to 30MHz shall not exceed the Limit table as below.

Frequency range MHz	Limits dB(uV)	
	Quasi-peak	Average
0.15 to 0.50	66 to 56	56 to 46
0.50 to 5	56	46
5 to 30	60	50

Note
1.The lower limit shall apply at the transition frequencies
2.The limit decreases linearly with the logarithm of the frequency in the range 0.15 MHz to 0.50 MHz.

5.2 Measurement Equipment Used:

Location	Equipment Name	Brand	Model	S/N	Last Cal. Date	Next Cal. Date
Conduction 04	EMI Receiver 18	ROHDE&SCHWARZ	ESCI	101392	06/08/2021	06/08/2022
Conduction 04	Conduction 04-03 Cable	WOKEN	CFD 300-NL	Conduction 04-03	10/13/2021	10/13/2022
Conduction 04	LISN 18	ROHDE & SCHWARZ	ENV216	101424	06/27/2021	06/27/2022
Conduction 04	LISN 03	R&S	ESH3-Z5	828874/010	11/11/2021	11/11/2022
Conduction 04	ISN T8 07	Teseq GmbH	ISN T800	30834	09/02/2021	09/02/2022
Conduction 04	ISN T4 06	Teseq GmbH	ISN T400A	28574	10/29/2021	10/29/2022
Conduction 04	ISN T8 CAT6A_01	SCHWARZ-BECK	NTFM 8158	8158 0123	01/25/2022	01/25/2023
Conduction 04	CDN ISN ST08A_1	Teseq GmbH	CDN ISN ST08A	43352	10/07/2021	10/07/2022
Conduction 04	Capacitive Voltage Probe 01	SCHAFFNER	CVP 2200A	18711	02/23/2022	02/23/2023
Conduction 04	Current Probe	SCHAFFNER	SMZ 11	18030	02/23/2022	02/23/2023

5.3 EUT Setup:

1. The conducted emission tests were performed in the test site, using the setup in accordance with the ANSI C63.10-2013.
2. The AC/DC Power adaptor of EUT was plug-in LISN. The EUT was placed flushed with the rear of the table.
3. The LISN was connected with 120Vac/60Hz power source.

5.4 Measurement Procedure:

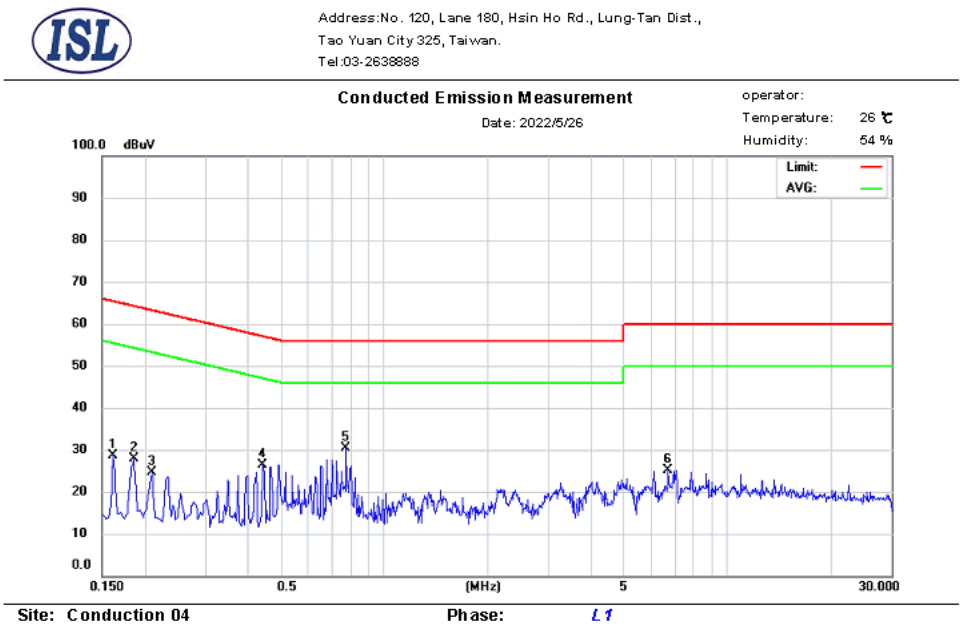
1. The EUT was placed on a table which is 0.8m above ground plane.
2. Maximum procedure was performed on the six highest emissions to ensure EUT compliance.
3. Repeat above procedures until all frequency measured were complete.

5.5 Measurement Result:

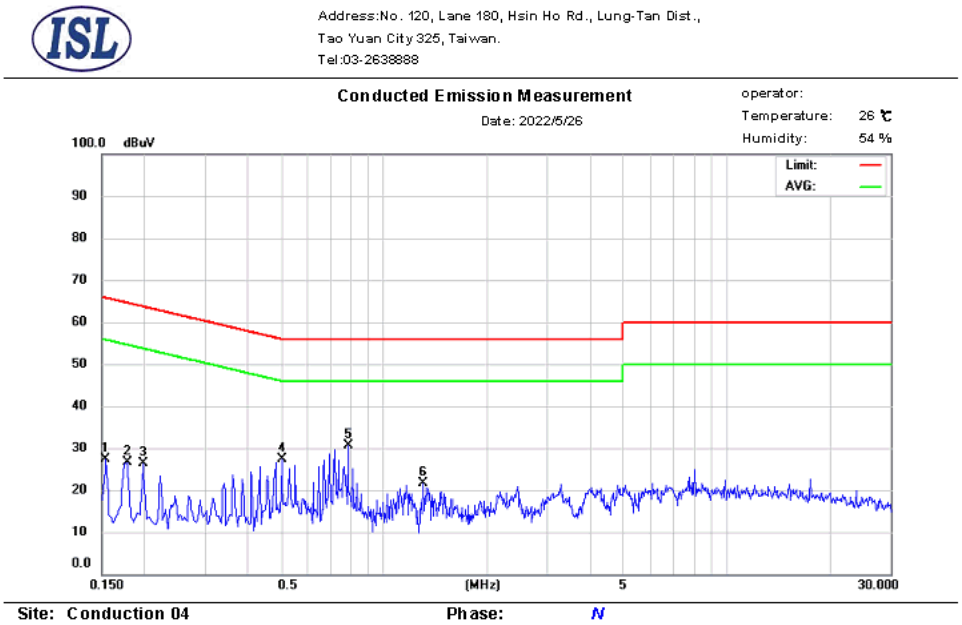
The initial step in collecting conducted data is a spectrum analyzer peak scan of the measurement range. Significant peaks are then marked as shown on the following data page, and these signals are then quasi-peaked.

AC POWER LINE CONDUCTED EMISSION TEST DATA

Operation Mode:	Normal Operation	Test Date:	2022/05/26



No.	Frequency (MHz)	QP_R (dBuV)	AVG_R (dBuV)	Correct Factor (dB)	QP Emission (dBuV)	QP Limit (dBuV)	QP Margin (dB)	AVG Emission (dBuV)	AVG Limit (dBuV)	AVG Margin (dB)
1	0.162	13.69	0.36	9.64	23.33	65.36	-42.03	10.00	55.36	-45.36
2	0.186	11.61	-0.47	9.64	21.25	64.21	-42.96	9.17	54.21	-45.04
3	0.210	9.31	-1.32	9.64	18.95	63.21	-44.26	8.32	53.21	-44.89
4	0.442	9.90	-1.28	9.66	19.56	57.02	-37.46	8.38	47.02	-38.64
5	0.774	15.12	7.02	9.67	24.79	56.00	-31.21	16.69	46.00	-29.31
6	6.726	6.40	2.74	9.80	16.20	60.00	-43.80	12.54	50.00	-37.46



No.	Frequency (MHz)	QP_R (dBuV)	AVG_R (dBuV)	Correct Factor (dB)	QP Emission (dBuV)	QP Limit (dBuV)	QP Margin (dB)	AVG Emission (dBuV)	AVG Limit (dBuV)	AVG Margin (dB)
1	0.154	14.42	0.71	9.63	24.05	65.78	-41.73	10.34	55.78	-45.44
2	0.178	12.19	-0.17	9.63	21.82	64.58	-42.76	9.46	54.58	-45.12
3	0.198	10.27	-0.85	9.63	19.90	63.69	-43.79	8.78	53.69	-44.91
4	0.502	10.80	0.41	9.64	20.44	56.00	-35.56	10.05	46.00	-35.95
5	0.786	14.72	5.39	9.66	24.38	56.00	-31.62	15.05	46.00	-30.95
6	1.302	3.44	-0.80	9.67	13.11	56.00	-42.89	8.87	46.00	-37.13

6. Peak Output Power Measurement

6.1 Standard Applicable:

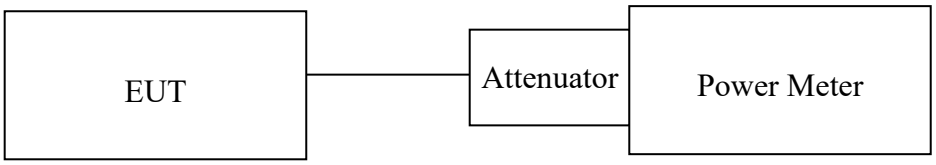
According to §15.247(b)(1), For frequency hopping systems operating in the 2400-2483.5 MHz band employing at least 75 hopping channels, and all frequency hopping systems in the 5725-5850MHz band: 1Watt. For all other frequency hopping systems in the 2400 – 2483.5MHz band: 0.125 Watts.

According to RSS-247 issue 2,§A5.4(b), For FHSs operating in the band 2400-2483.5 MHz, the maximum peak conducted output power shall not exceed 1.0 W if the hopset uses 75 or more hopping channels; the maximum peak conducted output power shall not exceed 0.125 W if the hopset uses less than 75 hopping channels. The e.i.r.p. shall not exceed 4 W, except as provided in section 5.4(e).

6.2 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	04/26/2022	04/26/2023
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 (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 Ver:11.10.00	NA	NA	NA

6.3 Test Set-up:



6.4 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.

6.5 Measurement Result:

Dipole Ant.

Frequency (MHz)	Output Power (dBm)	Output Power (W)	Limit (W)
Low	15.66	0.03685	29.85
Mid	19.87	0.09705	29.85
High	17.26	0.05320	29.85

PCB Ant.

Frequency (MHz)	Output Power (dBm)	Output Power (W)	Limit (W)
Low	15.66	0.03685	30
Mid	19.87	0.09705	30
High	17.26	0.05320	30

7. Spurious Emission Test

7.1 Standard Applicable:

According to §15.247(d), 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 digi-tally modulated device is operating, the RF power that is produced shall be at least 20 dB be-low 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(d), 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 7.2 for details.

7.3 Test SET-UP:

The test item only performed radiated mode

Refer to section 7.3 for details.

7.4 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.

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.

Model: FCC: BT832X, IC: BT832XH

Radiated Spurious Emission Measurement Result: (below 1GHz)

Operation Mode	TX CH Low	Test Date	2022/05/24
Fundamental Frequency	2402MHz		
Temperature	24°C	Humidity	64%

No	Freq MHz	Reading dBuV	Factor dB	Level dBuV/m	Limit dBuV/m	Margin dB	Remark	Pol V/H
1	95.96	41.14	-11.14	30.00	43.50	-13.50	Peak	VERTICAL
2	151.25	43.15	-5.28	37.87	43.50	-5.63	Peak	VERTICAL
3	296.75	39.05	-4.49	34.56	46.00	-11.44	Peak	VERTICAL
4	370.47	37.72	-3.42	34.30	46.00	-11.70	Peak	VERTICAL
5	668.26	33.37	2.17	35.54	46.00	-10.46	Peak	VERTICAL
6	817.64	31.39	4.64	36.03	46.00	-9.97	Peak	VERTICAL
1	212.36	49.46	-8.09	41.37	43.50	-2.13	Peak	HORIZONTAL
2	288.02	40.11	-4.69	35.42	46.00	-10.58	Peak	HORIZONTAL
3	359.80	36.48	-3.69	32.79	46.00	-13.21	Peak	HORIZONTAL
4	445.16	31.34	-1.42	29.92	46.00	-16.08	Peak	HORIZONTAL
5	591.63	32.94	1.15	34.09	46.00	-11.91	Peak	HORIZONTAL
6	813.76	30.54	4.58	35.12	46.00	-10.88	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	2022/05/24
Fundamental Frequency	2441MHz		
Temperature	24℃	Humidity	64%

No	Freq MHz	Reading dBuV	Factor dB	Level dBuV/m	Limit dBuV/m	Margin dB	Remark	Pol V/H
1	149.31	43.68	-5.74	37.94	43.50	-5.56	Peak	VERTICAL
2	215.27	44.25	-8.03	36.22	43.50	-7.28	Peak	VERTICAL
3	295.78	37.28	-4.53	32.75	46.00	-13.25	Peak	VERTICAL
4	371.44	38.09	-3.39	34.70	46.00	-11.30	Peak	VERTICAL
5	668.26	33.09	2.17	35.26	46.00	-10.74	Peak	VERTICAL
6	814.73	30.74	4.58	35.32	46.00	-10.68	Peak	VERTICAL
1	107.60	47.10	-9.32	37.78	43.50	-5.72	Peak	HORIZONTAL
2	215.27	49.43	-8.03	41.40	43.50	-2.10	Peak	HORIZONTAL
3	263.77	45.16	-5.56	39.60	46.00	-6.40	Peak	HORIZONTAL
4	359.80	35.12	-3.69	31.43	46.00	-14.57	Peak	HORIZONTAL
5	504.33	33.70	-0.88	32.82	46.00	-13.18	Peak	HORIZONTAL
6	591.63	34.26	1.15	35.41	46.00	-10.59	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	2022/05/24
Fundamental Frequency	2480MHz		
Temperature	24℃	Humidity	64%

No	Freq MHz	Reading dBuV	Factor dB	Level dBuV/m	Limit dBuV/m	Margin dB	Remark	Pol V/H
1	149.31	43.79	-5.74	38.05	43.50	-5.45	Peak	VERTICAL
2	295.78	38.82	-4.53	34.29	46.00	-11.71	Peak	VERTICAL
3	370.47	35.37	-3.42	31.95	46.00	-14.05	Peak	VERTICAL
4	591.63	32.88	1.15	34.03	46.00	-11.97	Peak	VERTICAL
5	668.26	33.74	2.17	35.91	46.00	-10.09	Peak	VERTICAL
6	815.70	32.11	4.60	36.71	46.00	-9.29	Peak	VERTICAL
1	107.60	47.49	-9.32	38.17	43.50	-5.33	Peak	HORIZONTAL
2	216.24	49.53	-8.04	41.49	46.00	-4.51	Peak	HORIZONTAL
3	295.78	41.52	-4.53	36.99	46.00	-9.01	Peak	HORIZONTAL
4	355.92	34.94	-3.67	31.27	46.00	-14.73	Peak	HORIZONTAL
5	591.63	33.52	1.15	34.67	46.00	-11.33	Peak	HORIZONTAL
6	817.64	31.58	4.64	36.22	46.00	-9.78	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.

Model: FCC: BT832X, IC: BT832XHE

Radiated Spurious Emission Measurement Result: (below 1GHz)

Operation Mode	TX CH Low	Test Date	2022/05/24
Fundamental Frequency	2402MHz		
Temperature	24°C	Humidity	64%

No	Freq MHz	Reading dBuV	Factor dB	Level dBuV/m	Limit dBuV/m	Margin dB	Remark	Pol V/H
1	150.43	40.22	-5.28	34.94	43.50	-8.56	Peak	VERTICAL
2	203.39	38.24	-8.26	29.98	43.50	-13.52	Peak	VERTICAL
3	296.36	38.12	-4.49	33.63	46.00	-12.37	Peak	VERTICAL
4	370.08	37.39	-3.42	33.97	46.00	-12.03	Peak	VERTICAL
5	455.58	30.64	-1.25	29.39	46.00	-16.61	Peak	VERTICAL
6	667.86	33.47	2.17	35.64	46.00	-10.36	Peak	VERTICAL
1	148.77	43.76	-5.74	38.02	43.50	-5.48	Peak	HORIZONTAL
2	214.50	50.01	-8.03	41.98	43.50	-1.52	Peak	HORIZONTAL
3	288.51	39.92	-4.69	35.23	46.00	-10.77	Peak	HORIZONTAL
4	359.75	36.70	-3.69	33.01	46.00	-12.99	Peak	HORIZONTAL
5	503.45	32.62	-0.88	31.74	46.00	-14.26	Peak	HORIZONTAL
6	612.44	28.59	1.47	30.06	46.00	-15.94	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	2022/05/24
Fundamental Frequency	2441MHz		
Temperature	24℃	Humidity	64%

No	Freq MHz	Reading dBuV	Factor dB	Level dBuV/m	Limit dBuV/m	Margin dB	Remark	Pol V/H
1	118.58	46.35	-8.27	38.08	43.50	-5.42	Peak	VERTICAL
2	215.75	44.36	-8.03	36.33	43.50	-7.17	Peak	VERTICAL
3	296.53	38.07	-4.53	33.54	46.00	-12.46	Peak	VERTICAL
4	371.20	38.60	-3.39	35.21	46.00	-10.79	Peak	VERTICAL
5	591.12	30.71	1.15	31.86	46.00	-14.14	Peak	VERTICAL
6	668.44	32.84	2.17	35.01	46.00	-10.99	Peak	VERTICAL
1	108.19	47.97	-9.32	38.65	43.50	-4.85	Peak	HORIZONTAL
2	215.80	48.50	-8.03	40.47	43.50	-3.03	Peak	HORIZONTAL
3	264.16	44.90	-5.56	39.34	46.00	-6.66	Peak	HORIZONTAL
4	297.08	42.62	-4.49	38.13	46.00	-7.87	Peak	HORIZONTAL
5	359.44	35.26	-3.69	31.57	46.00	-14.43	Peak	HORIZONTAL
6	480.95	33.05	-1.02	32.03	46.00	-13.97	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	2022/05/24
Fundamental Frequency	2480MHz		
Temperature	24℃	Humidity	64%

No	Freq MHz	Reading dBuV	Factor dB	Level dBuV/m	Limit dBuV/m	Margin dB	Remark	Pol V/H
1	148.56	40.71	-5.74	34.97	43.50	-8.53	Peak	VERTICAL
2	204.30	37.03	-8.26	28.77	43.50	-14.73	Peak	VERTICAL
3	296.36	39.71	-4.53	35.18	46.00	-10.82	Peak	VERTICAL
4	370.02	35.92	-3.42	32.50	46.00	-13.50	Peak	VERTICAL
5	503.52	30.53	-0.88	29.65	46.00	-16.35	Peak	VERTICAL
6	591.37	32.34	1.15	33.49	46.00	-12.51	Peak	VERTICAL
1	107.81	47.41	-9.32	38.09	43.50	-5.41	Peak	HORIZONTAL
2	149.23	46.32	-5.74	40.58	43.50	-2.92	Peak	HORIZONTAL
3	216.34	49.03	-8.04	40.99	46.00	-5.01	Peak	HORIZONTAL
4	295.33	42.06	-4.53	37.53	46.00	-8.47	Peak	HORIZONTAL
5	355.65	35.90	-3.67	32.23	46.00	-13.77	Peak	HORIZONTAL
6	444.88	33.00	-1.42	31.58	46.00	-14.42	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.

Model: FCC: BT832X, IC: BT832XH

Radiated Spurious Emission Measurement Result (above 1GHz)

Operation Mode	TX CH Low	Test Date	2022/05/24
Fundamental Frequency	2402 MHz		
Temperature	24℃	Humidity	64%

No	Freq MHz	Reading dBuV	Factor dB	Level dBuV/m	Limit dBuV/m	Margin dB	Remark	Pol V/H
1	4804.00	46.77	-6.92	39.85	74.00	-34.15	Peak	VERTICAL
2	6642.00	47.38	-3.24	44.14	74.00	-29.86	Peak	VERTICAL
1	4804.00	49.48	-6.92	42.56	74.00	-31.44	Peak	HORIZONTAL
2	6383.00	47.61	-3.17	44.44	74.00	-29.56	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	2022/05/24
Fundamental Frequency	2441 MHz		
Temperature	24℃	Humidity	64%

No	Freq MHz	Reading dBuV	Factor dB	Level dBuV/m	Limit dBuV/m	Margin dB	Remark	Pol V/H
1	4882.00	47.09	-6.83	40.26	74.00	-33.74	Peak	VERTICAL
2	6264.00	47.24	-3.16	44.08	74.00	-29.92	Peak	VERTICAL
1	4882.00	47.19	-6.83	40.36	74.00	-33.64	Peak	HORIZONTAL
2	6404.00	47.13	-3.19	43.94	74.00	-30.06	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	2022/05/24
Fundamental Frequency	2480 MHz		
Temperature	24℃	Humidity	64%

No	Freq MHz	Reading dBuV	Factor dB	Level dBuV/m	Limit dBuV/m	Margin dB	Remark	Pol V/H
1	4960.00	49.95	-6.62	43.33	74.00	-30.67	Peak	VERTICAL
2	6614.00	47.95	-3.22	44.73	74.00	-29.27	Peak	VERTICAL
1	4960.00	46.78	-6.62	40.16	74.00	-33.84	Peak	HORIZONTAL
2	7237.00	47.84	-3.17	44.67	74.00	-29.33	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.

Model: FCC: BT832XE, IC: BT832XHE

Radiated Spurious Emission Measurement Result (above 1GHz)

Operation Mode	TX CH Low	Test Date	2022/05/24
Fundamental Frequency	2402 MHz		
Temperature	24°C	Humidity	64%

No	Freq MHz	Reading dBuV	Factor dB	Level dBuV/m	Limit dBuV/m	Margin dB	Remark	Pol V/H
1	4804.00	46.16	-6.92	39.24	74.00	-34.76	Peak	VERTICAL
2	6894.00	46.91	-3.17	43.74	74.00	-30.26	Peak	VERTICAL
1	4804.00	46.47	-6.92	39.55	74.00	-34.45	Peak	HORIZONTAL
2	6586.00	47.08	-3.19	43.89	74.00	-30.11	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	2022/05/24
Fundamental Frequency	2441 MHz		
Temperature	24℃	Humidity	64%

No	Freq MHz	Reading dBuV	Factor dB	Level dBuV/m	Limit dBuV/m	Margin dB	Remark	Pol V/H
1	4884.00	46.32	-6.82	39.50	74.00	-34.50	Peak	VERTICAL
2	6530.00	47.02	-3.16	43.86	74.00	-30.14	Peak	VERTICAL
1	4884.00	47.51	-6.82	40.69	74.00	-33.31	Peak	HORIZONTAL
2	6740.00	47.43	-3.34	44.09	74.00	-29.91	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	2022/05/24
Fundamental Frequency	2480 MHz		
Temperature	24℃	Humidity	64%

No	Freq MHz	Reading dBuV	Factor dB	Level dBuV/m	Limit dBuV/m	Margin dB	Remark	Pol V/H
1	4960.00	51.41	-6.62	44.79	74.00	-29.21	Peak	VERTICAL
2	6614.00	47.01	-3.22	43.79	74.00	-30.21	Peak	VERTICAL
1	4960.00	47.02	-6.62	40.40	74.00	-33.60	Peak	HORIZONTAL
2	6642.00	47.60	-3.24	44.36	74.00	-29.64	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.

8. 100kHz Bandwidth of Band Edges Measurement

7.1 Standard Applicable:

According to §15.247(d), in any 100 kHz bandwidth outside the frequency bands in which the spread spectrum intentional radiator in 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 in15.209(a).

According to RSS-247 issue 2, §5.5

In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digi-tally modulated device is operating, the RF power that is produced shall be at least 20 dB be-low 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(d), 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.

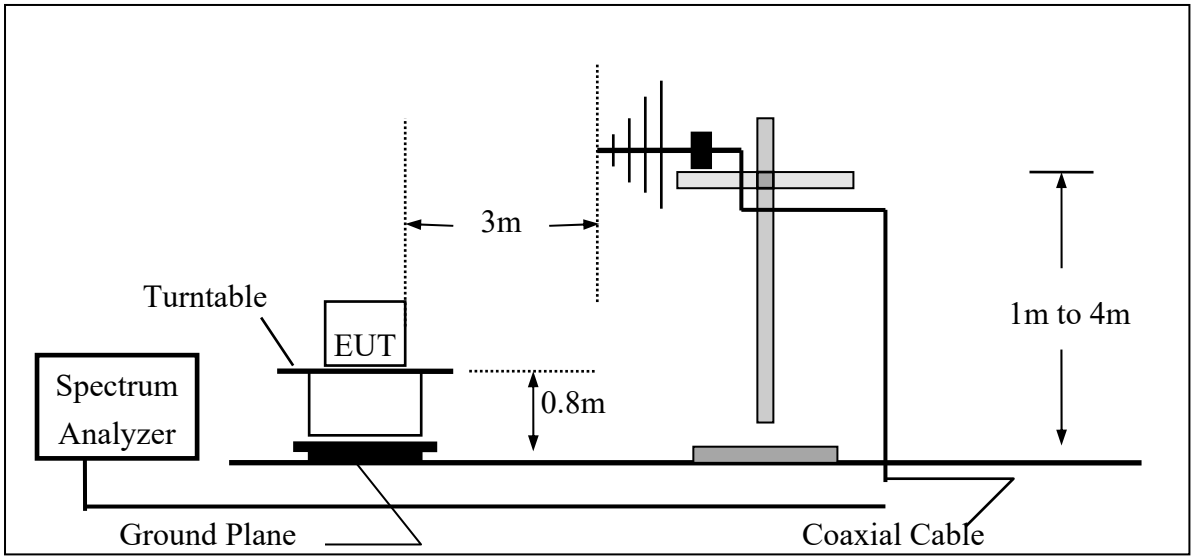
7.2.2. Radiated emission:

Location Conducted	Equipment Name	Brand	Model	S/N	Last Cal. Date	Next Cal. Date
Chamber 19	Signal analyzer	R&S	FSV40	101919	8/18/2021	8/18/2022
Chamber 19	EMI Receiver	R&S	ESR3	102461	05/10/2022	05/10/2023
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	03/09/2022	03/09/2023
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	03/18/2022	03/18/2023
Chamber 19	Preamplifier (9kHz-1GHz)	HP	8447F	3113A04621	06/22/2021	06/22/2022
Chamber 19	Preamplifier (1GHz - 26GHz)	EM	EM01M26G	060681	05/12/2022	05/12/2023
Chamber 19	Preamplifier (26GHz-40GHz)	MITEQ	JS4-26004000-27-5A	818471	05/12/2022	05/12/2023
Chamber 19	RF Cable (100kHz-26.5GHz)	Huber Suhner	Sucoflex 104A	MY1394/4A & 50886/4A	08/30/2021	08/30/2022
Chamber 19	RF Cable (18GHz-40GHz)	HUBER SUHNER	Sucoflex 102	27963/2&37421/2	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

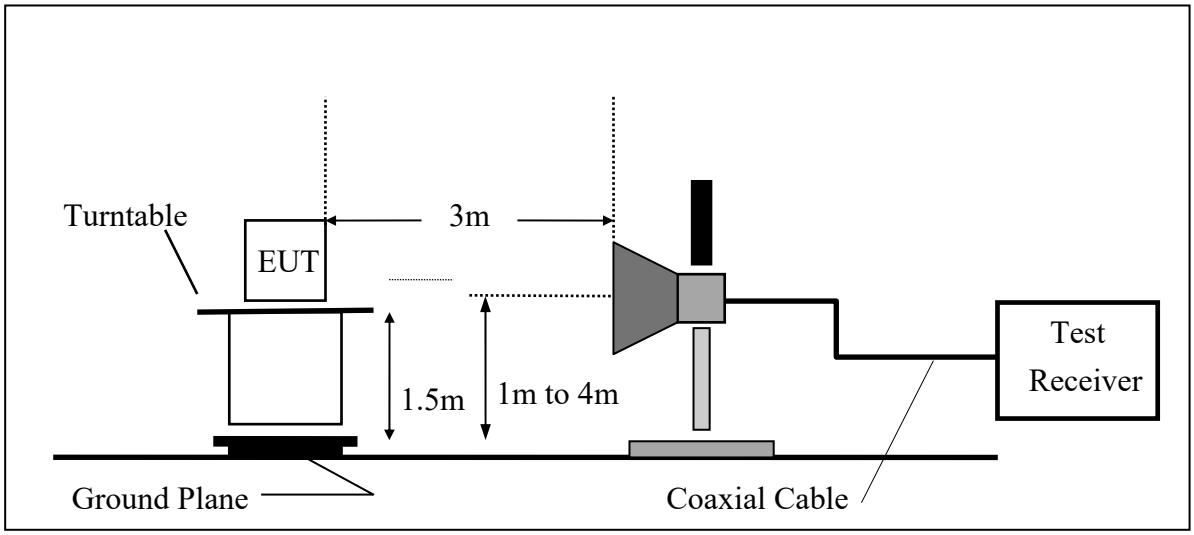
7.3 Test SET-UP:

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



7.4 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 spectrum analyzer.
3. Set center frequency of spectrum analyzer = operating frequency.
4. Set the spectrum analyzer as RBW, VBW=100kHz, Span=25MHz, Sweep = auto
5. Mark Peak, 2.390GHz and 2.4835GHz and record the max. level.
6. 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	

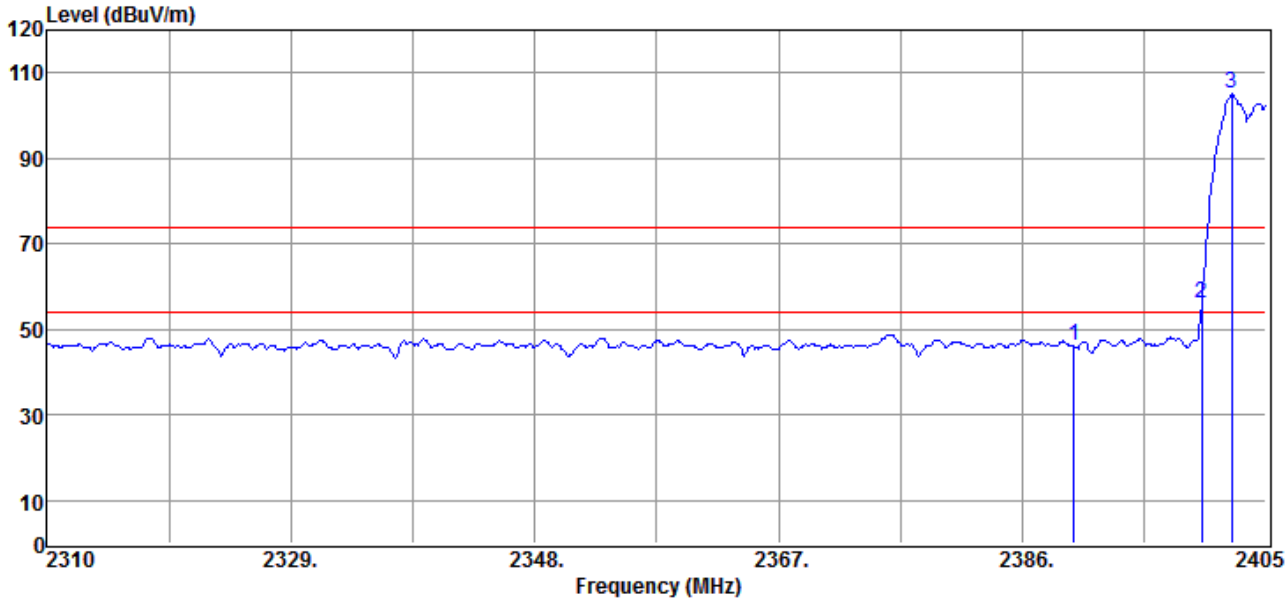
7.6 Measurement Result:

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

Model: FCC: BT832X, IC: BT832XH

Radiated Emission: Non-Hopping mode

Operation Mode	TX CH Low	Test Date	2022/05/24
Fundamental Frequency	2402 MHz		
Temperature	24°C	Humidity	64%

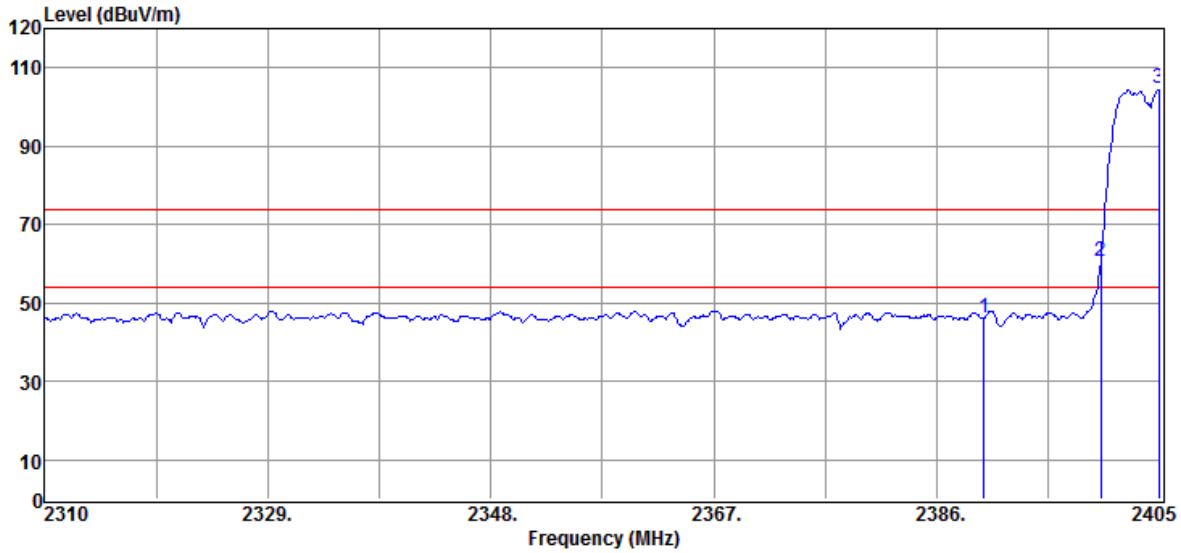


No	Freq MHz	Reading dBuV	Factor dB/m	Level dBuV/m	Limit dBuV/m	Margin dB	Remark	Pol V/H
1	2390.00	57.81	-11.64	46.17	74.00	-27.83	Peak	VERTICAL
2	2400.00	67.54	-11.55	55.99	84.96	-28.97	Peak	VERTICAL
3	2402.34	116.51	-11.55	104.96	F	--	Peak	VERTICAL

Remark:

1. 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.
2. 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.
3. Spectrum Peak mode IF bandwidth Setting : 1GHz- 26GHz, RBW= 1MHz, Sweep time= 200 ms., the VBW setting was 3 MHz.
4. 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/m	Level dBuV/m	Limit dBuV/m	Margin dB	Remark	Pol V/H
1	2390.00	57.75	-11.64	46.11	74.00	-27.89	Peak	HORIZONTAL
2	2400.00	72.35	-11.55	60.80	84.65	-23.85	Peak	HORIZONTAL
3	2404.91	116.20	-11.55	104.65	F	--	Peak	HORIZONTAL

Remark:

1 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.

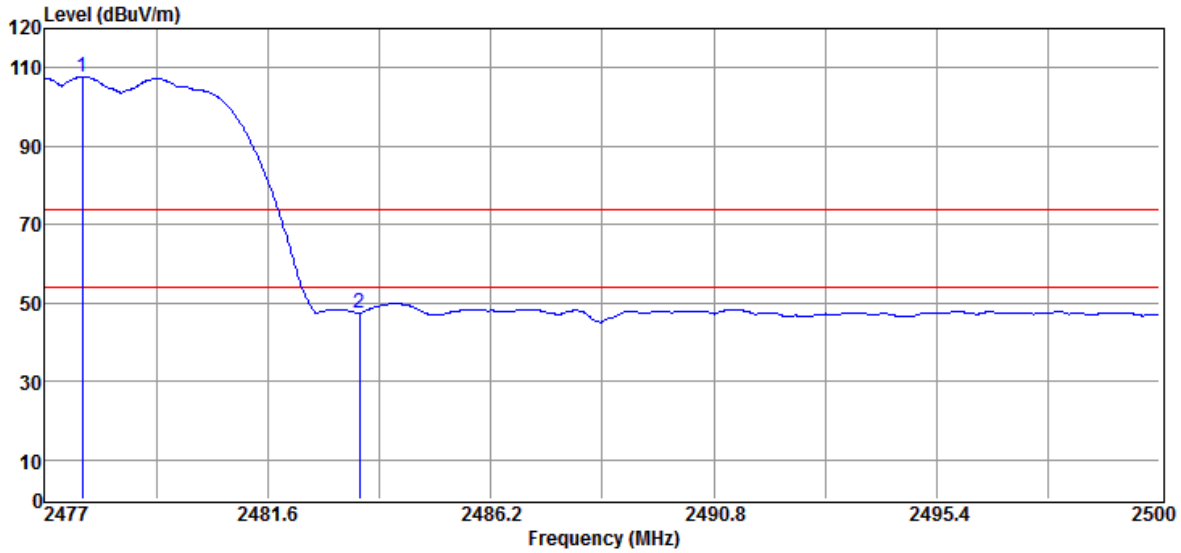
2 Measurement of data within this frequency range shown " - " in the table above means the reading of emissions are attenuated more than 20dB below the permissible limits or the field strength is too small to be measured.

3 Spectrum Peak mode IF bandwidth Setting : 1GHz- 26GHz, RBW= 1MHz, Sweep time= 200 ms., the VBW setting was 3 MHz.

4 Spectrum AV mode if bandwidth Setting : 1GHz- 26GHz, RBW= 1MHz, VBW= 10Hz, Sweep time= 200 ms.

Note: "F" denotes fundamental frequency

Operation Mode	TX CH High	Test Date	2022/05/24
Fundamental Frequency	2480 MHz		
Temperature	24°C	Humidity	64%



No	Freq MHz	Reading dBuV	Factor dB/m	Level dBuV/m	Limit dBuV/m	Margin dB	Remark	Pol V/H
1	2477.78	119.11	-11.44	107.67	F	--	Peak	VERTICAL
2	2483.50	58.91	-11.43	47.48	74.00	-26.52	Peak	VERTICAL

Remark:

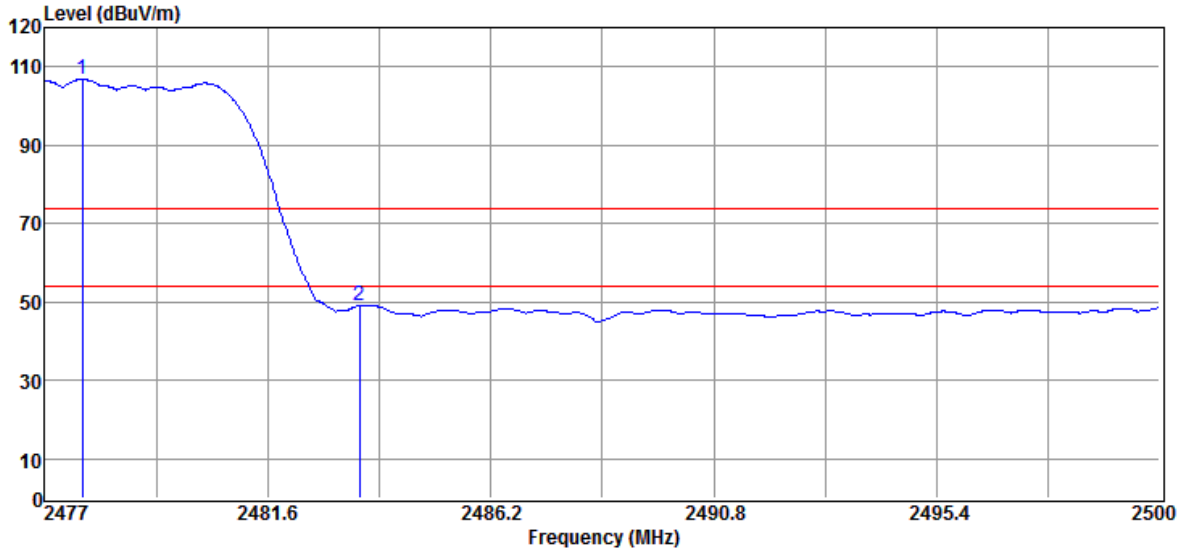
1 Field strength limits for frequency above 1000MHz are based on average limits. However, Peak mode field strength shall not exceed the average limits specified plus 20dB.

2 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.

3 Spectrum Peak mode IF bandwidth Setting : 1GHz- 26GHz, RBW= 1MHz, Sweep time= 200 ms., the VBW setting was 3 MHz.

4 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/m	Level dBuV/m	Limit dBuV/m	Margin dB	Remark	Pol V/H
1	2477.78	118.19	-11.44	106.75	F	--	Peak	HORIZONTAL
2	2483.50	60.54	-11.43	49.11	74.00	-24.89	Peak	HORIZONTAL

Remark:

1 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.

2 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.

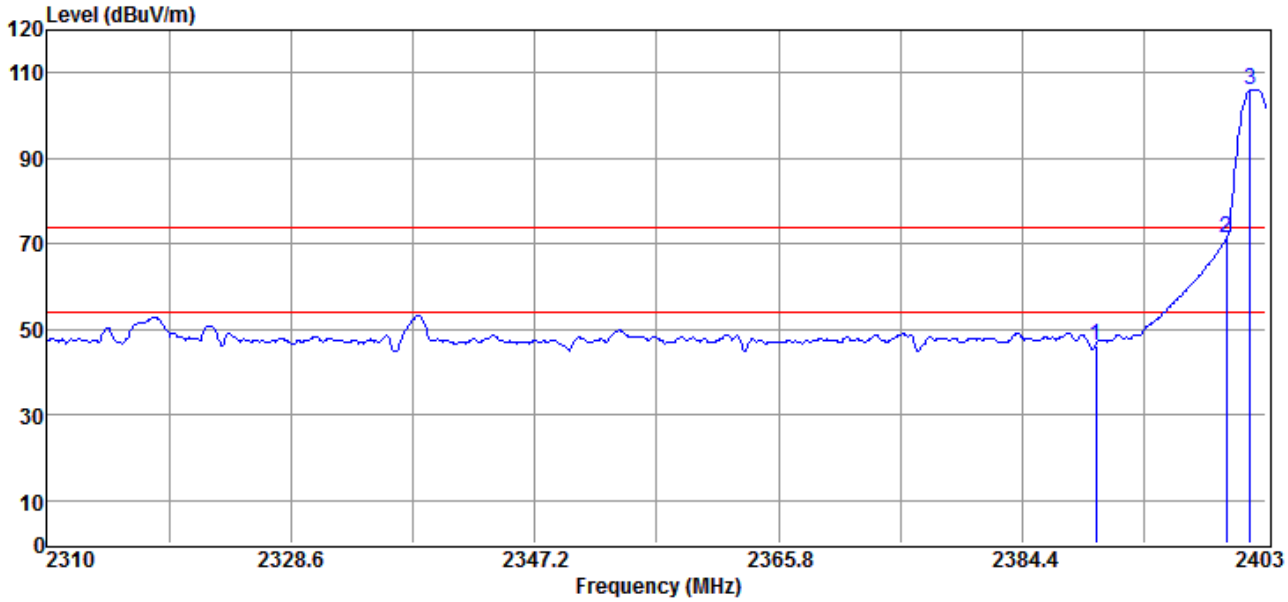
3 Spectrum Peak mode IF bandwidth Setting : 1GHz- 26GHz, RBW= 1MHz, Sweep time= 200 ms., the VBW setting was 3 MHz.

4 Spectrum AV mode if bandwidth Setting : 1GHz- 26GHz, RBW= 1MHz, VBW= 10Hz, Sweep time= 200 ms.

Note: "F" denotes fundamental frequency

Radiated Emission: Hopping mode

Operation Mode	TX CH Low	Test Date	2022/05/24
Fundamental Frequency	2402 MHz		
Temperature	24℃	Humidity	64%



No	Freq MHz	Reading dBuV	Factor dB/m	Level dBuV/m	Limit dBuV/m	Margin dB	Remark	Pol V/H
1	2390.00	57.84	-11.64	46.20	74.00	-27.80	Peak	VERTICAL
2	2400.00	83.06	-11.55	71.51	86.11	-14.60	Peak	VERTICAL
3	2401.79	117.66	-11.55	106.11	F	--	Peak	VERTICAL

Remark:

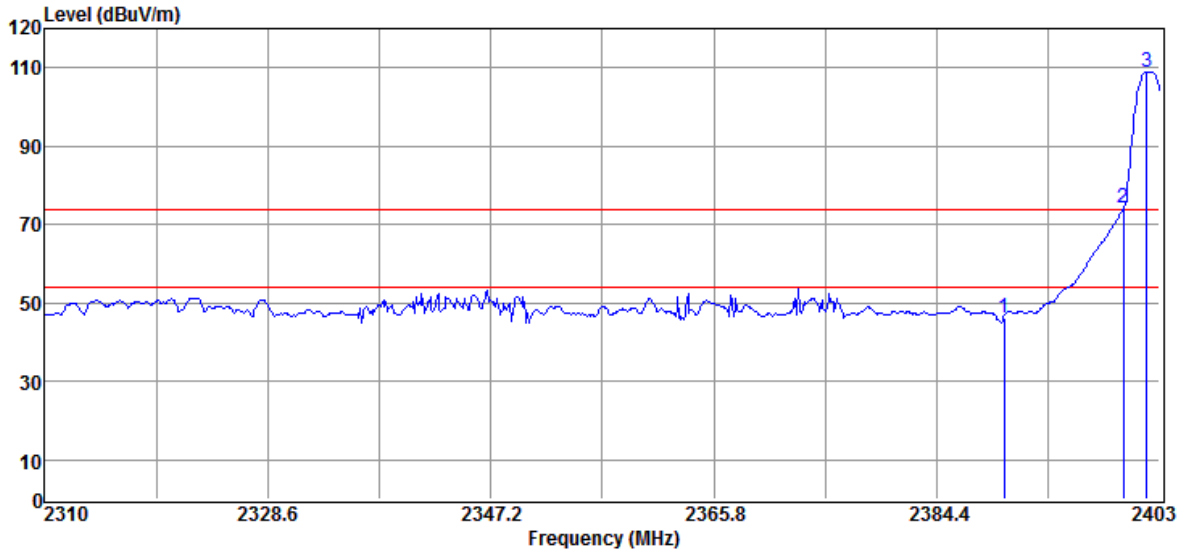
1 Field strength limits for frequency above 1000MHz are based on average limits. However, Peak mode field strength shall not exceed the average limits specified plus 20dB.

2 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.

3 Spectrum Peak mode IF bandwidth Setting : 1GHz- 26GHz, RBW= 1MHz, Sweep time= 200 ms., the VBW setting was 3 MHz.

4 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/m	Level dBuV/m	Limit dBuV/m	Margin dB	Remark	Pol V/H
1	2390.00	57.94	-11.64	46.30	74.00	-27.70	Peak	HORIZONTAL
2	2400.00	85.89	-11.55	74.34	89.01	-14.67	Peak	HORIZONTAL
3	2401.88	120.56	-11.55	109.01	F	--	Peak	HORIZONTAL

Remark:

1 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.

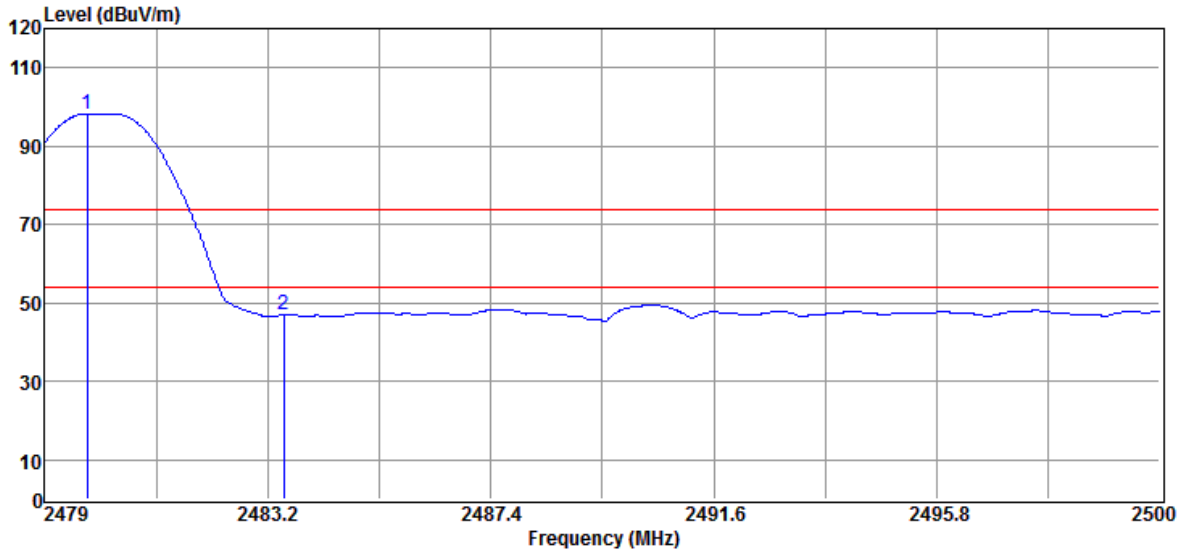
2 Measurement of data within this frequency range shown " - " in the table above means the reading of emissions are attenuated more than 20dB below the permissible limits or the field strength is too small to be measured.

3 Spectrum Peak mode IF bandwidth Setting : 1GHz- 26GHz, RBW= 1MHz, Sweep time= 200 ms., the VBW setting was 3 MHz.

4 Spectrum AV mode if bandwidth Setting : 1GHz- 26GHz, RBW= 1MHz, VBW= 10Hz, Sweep time= 200 ms.

Note: "F" denotes fundamental frequency

Operation Mode	TX CH High	Test Date	2022/05/24
Fundamental Frequency	2480 MHz		
Temperature	24°C	Humidity	64%



No	Freq MHz	Reading dBuV	Factor dB/m	Level dBuV/m	Limit dBuV/m	Margin dB	Remark	Pol V/H
1	2479.80	109.76	-11.44	98.32	F	--	Peak	VERTICAL
2	2483.50	58.51	-11.43	47.08	74.00	-26.92	Peak	VERTICAL

Remark:

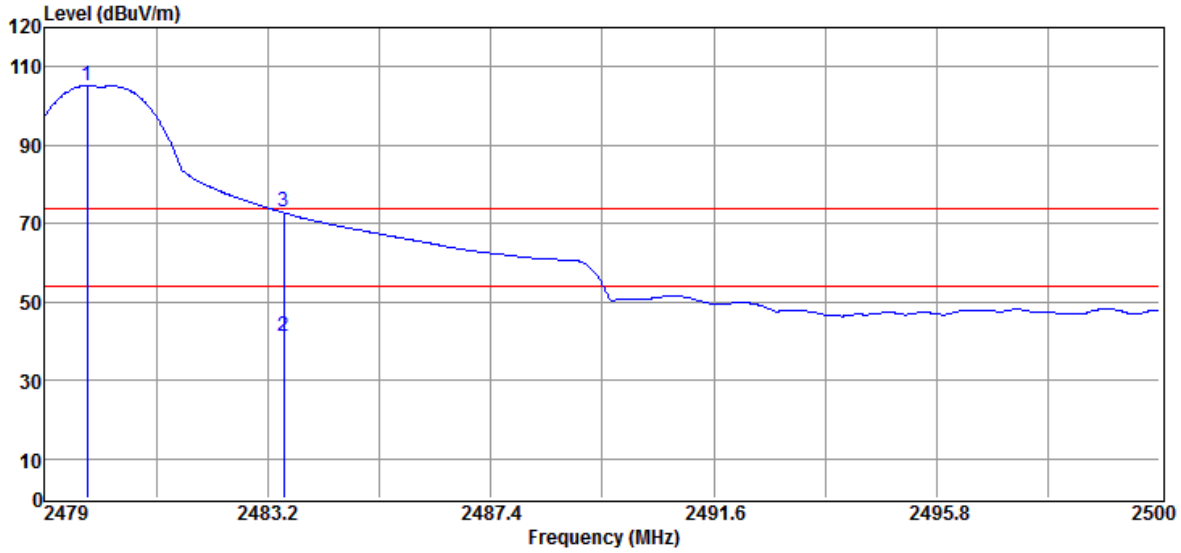
1 Field strength limits for frequency above 1000MHz are based on average limits. However, Peak mode field strength shall not exceed the average limits specified plus 20dB.

2 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.

3 Spectrum Peak mode IF bandwidth Setting : 1GHz- 26GHz, RBW= 1MHz, Sweep time= 200 ms., the VBW setting was 3 MHz.

4 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/m	Level dBuV/m	Limit dBuV/m	Margin dB	Remark	Pol V/H
1	2479.80	116.58	-11.44	105.14	F	--	Peak	HORIZONTAL
2	2483.50	52.82	-11.43	41.39	54.00	-12.61	Average	HORIZONTAL
3	2483.50	84.23	-11.43	72.80	74.00	-1.20	Peak	HORIZONTAL

Remark:

1 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.

2 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.

3 Spectrum Peak mode IF bandwidth Setting : 1GHz- 26GHz, RBW= 1MHz, Sweep time= 200 ms., the VBW setting was 3 MHz.

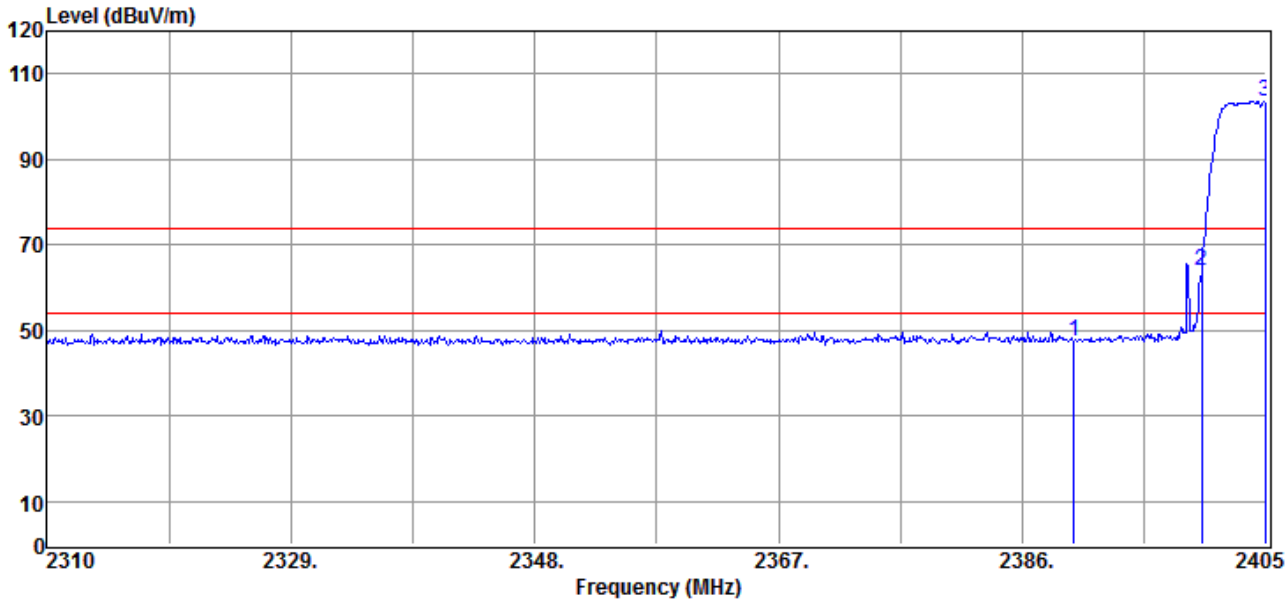
4 Spectrum AV mode if bandwidth Setting : 1GHz- 26GHz, RBW= 1MHz, VBW= 10Hz, Sweep time= 200 ms.

Note: "F" denotes fundamental frequency

Model: FCC: BT832XE, IC: BT832XHE

Radiated Emission: Non-Hopping mode

Operation Mode	TX CH Low	Test Date	2022/05/24
Fundamental Frequency	2402 MHz		
Temperature	24°C	Humidity	64%



No	Freq MHz	Reading dBuV	Factor dB/m	Level dBuV/m	Limit dBuV/m	Margin dB	Remark	Pol V/H
1	2390.00	59.15	-11.64	47.51	74.00	-26.49	Peak	VERTICAL
2	2400.00	75.43	-11.55	63.88	83.61	-19.73	Peak	VERTICAL
3	2404.91	115.16	-11.55	103.61	F	--	Peak	VERTICAL

Remark:

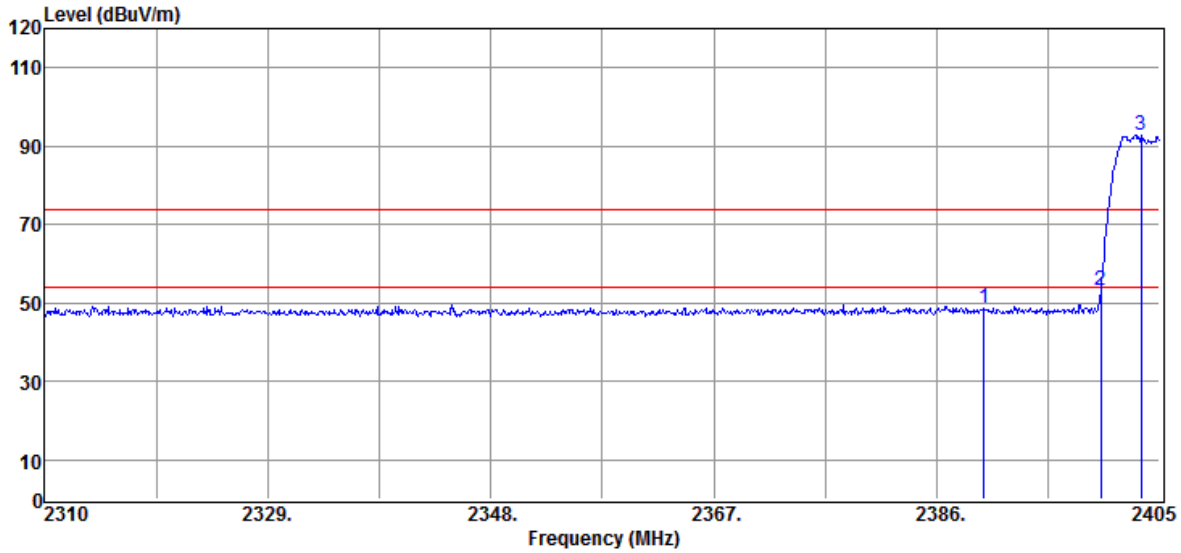
1 Field strength limits for frequency above 1000MHz are based on average limits. However, Peak mode field strength shall not exceed the average limits specified plus 20dB.

2 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.

3 Spectrum Peak mode IF bandwidth Setting : 1GHz- 26GHz, RBW= 1MHz, Sweep time= 200 ms., the VBW setting was 3 MHz.

4 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/m	Level dBuV/m	Limit dBuV/m	Margin dB	Remark	Pol V/H
1	2390.00	60.49	-11.64	48.85	74.00	-25.15	Peak	HORIZONTAL
2	2400.00	64.79	-11.55	53.24	72.67	-19.43	Peak	HORIZONTAL
3	2403.39	104.22	-11.55	92.67	F	--	Peak	HORIZONTAL

Remark:

1 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.

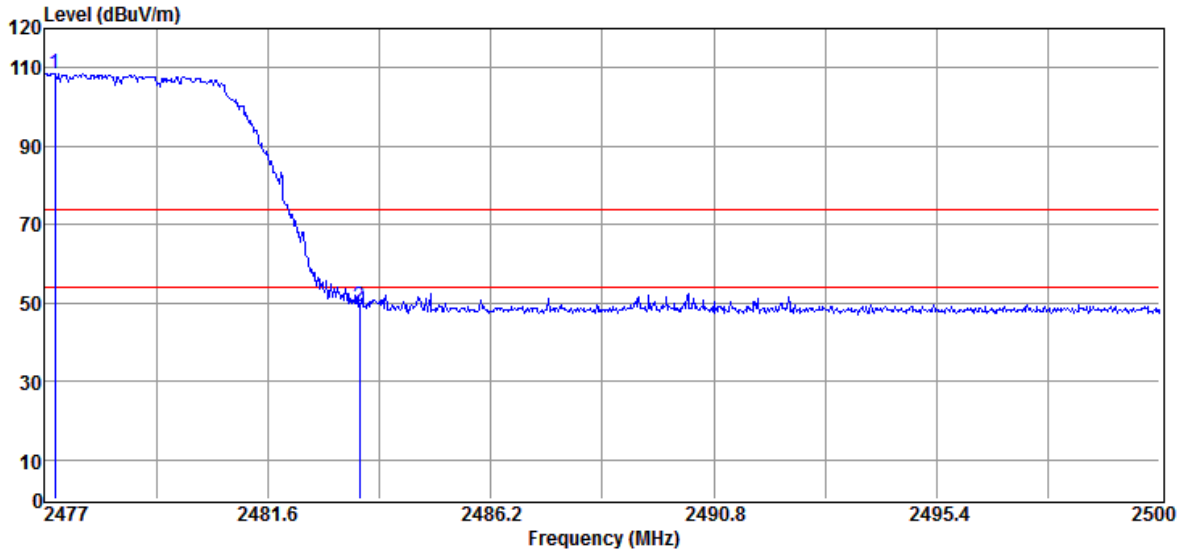
2 Measurement of data within this frequency range shown " - " in the table above means the reading of emissions are attenuated more than 20dB below the permissible limits or the field strength is too small to be measured.

3 Spectrum Peak mode IF bandwidth Setting : 1GHz- 26GHz, RBW= 1MHz, Sweep time= 200 ms., the VBW setting was 3 MHz.

4 Spectrum AV mode if bandwidth Setting : 1GHz- 26GHz, RBW= 1MHz, VBW= 10Hz, Sweep time= 200 ms.

Note: "F" denotes fundamental frequency

Operation Mode	TX CH High	Test Date	2022/05/24
Fundamental Frequency	2480 MHz		
Temperature	24°C	Humidity	64%



No	Freq MHz	Reading dBuV	Factor dB/m	Level dBuV/m	Limit dBuV/m	Margin dB	Remark	Pol V/H
1	2477.21	119.78	-11.45	108.33	F	--	Peak	VERTICAL
2	2483.50	60.60	-11.43	49.17	74.00	-24.83	Peak	VERTICAL

Remark:

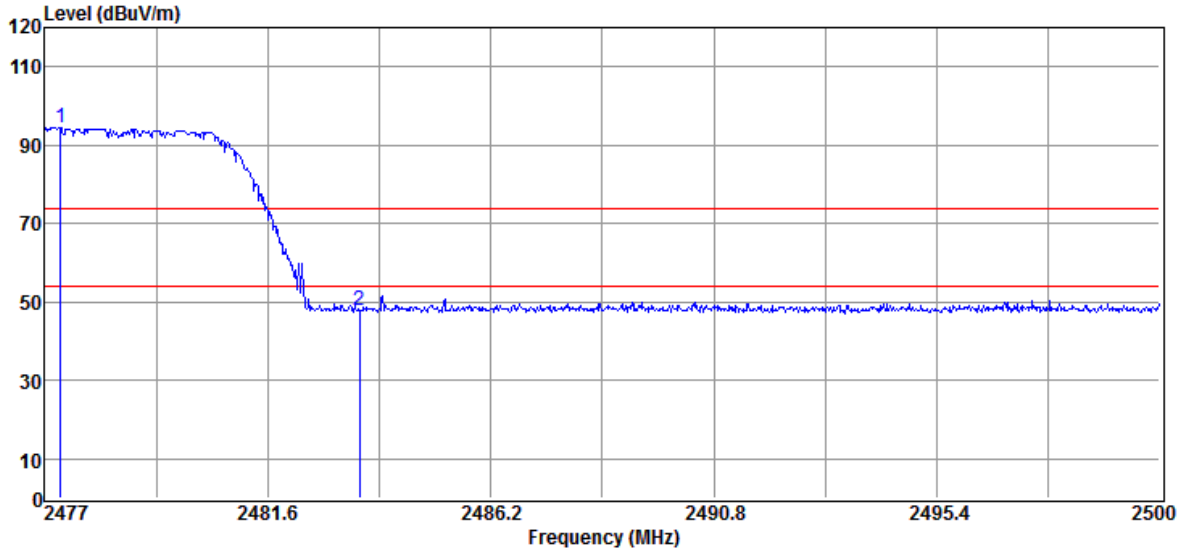
1 Field strength limits for frequency above 1000MHz are based on average limits. However, Peak mode field strength shall not exceed the average limits specified plus 20dB.

2 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.

3 Spectrum Peak mode IF bandwidth Setting : 1GHz- 26GHz, RBW= 1MHz, Sweep time= 200 ms., the VBW setting was 3 MHz.

4 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/m	Level dBuV/m	Limit dBuV/m	Margin dB	Remark	Pol V/H
1	2477.32	105.89	-11.45	94.44	F	--	Peak	HORIZONTAL
2	2483.50	59.09	-11.43	47.66	74.00	-26.34	Peak	HORIZONTAL

Remark:

1 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.

2 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.

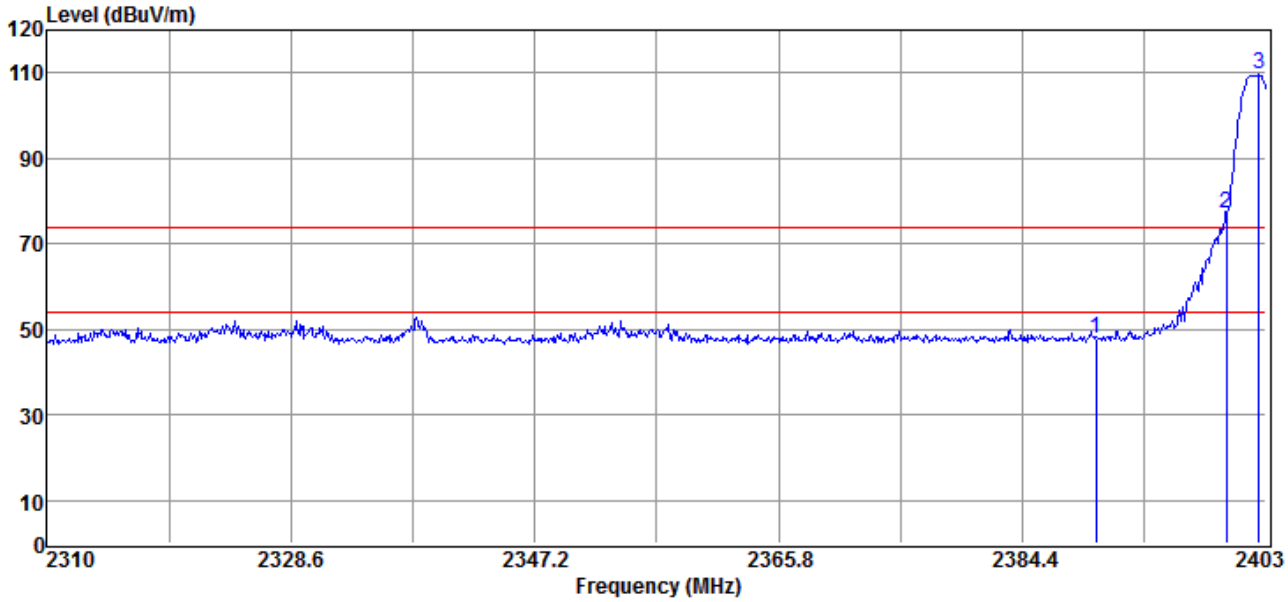
3 Spectrum Peak mode IF bandwidth Setting : 1GHz- 26GHz, RBW= 1MHz, Sweep time= 200 ms., the VBW setting was 3 MHz.

4 Spectrum AV mode if bandwidth Setting : 1GHz- 26GHz, RBW= 1MHz, VBW= 10Hz, Sweep time= 200 ms.

Note: "F" denotes fundamental frequency

Radiated Emission: Hopping mode

Operation Mode	TX CH Low	Test Date	2022/05/24
Fundamental Frequency	2402 MHz		
Temperature	24℃	Humidity	64%

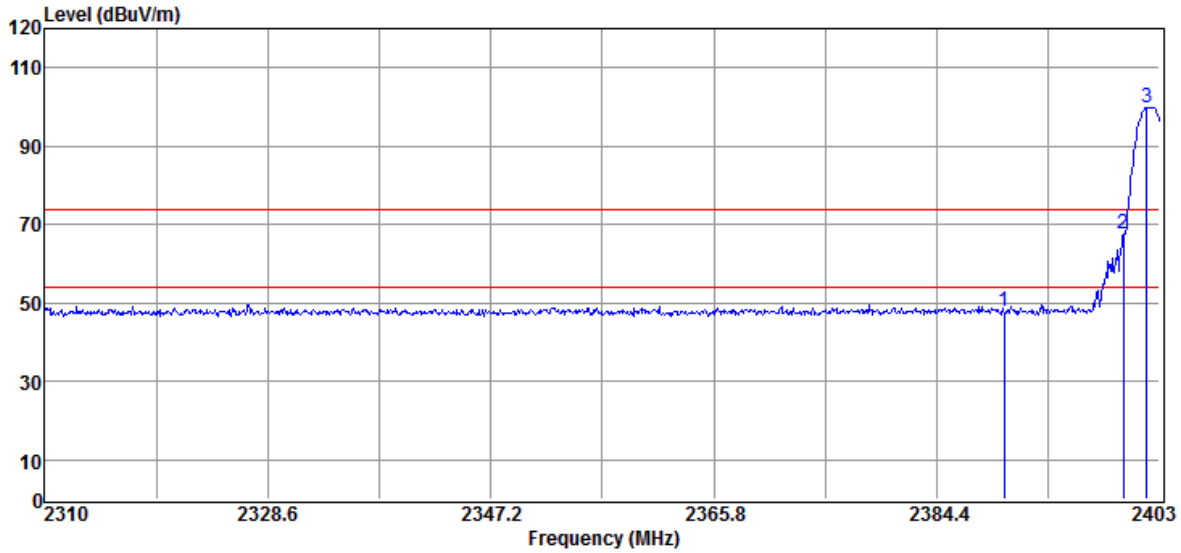


No	Freq MHz	Reading dBuV	Factor dB/m	Level dBuV/m	Limit dBuV/m	Margin dB	Remark	Pol V/H
1	2390.00	59.37	-11.64	47.73	74.00	-26.27	Peak	VERTICAL
2	2400.00	88.54	-11.55	76.99	89.49	-12.50	Peak	VERTICAL
3	2402.44	121.04	-11.55	109.49	F	--	Peak	VERTICAL

Remark:

1. 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.
2. 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.
3. Spectrum Peak mode IF bandwidth Setting : 1GHz- 26GHz, RBW= 1MHz, Sweep time= 200 ms., the VBW setting was 3 MHz.
4. 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/m	Level dBuV/m	Limit dBuV/m	Margin dB	Remark	Pol V/H
1	2390.00	59.28	-11.64	47.64	74.00	-26.36	Peak	HORIZONTAL
2	2400.00	79.09	-11.55	67.54	79.77	-12.23	Peak	HORIZONTAL
3	2401.88	111.32	-11.55	99.77	F	--	Peak	HORIZONTAL

Remark:

1 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.

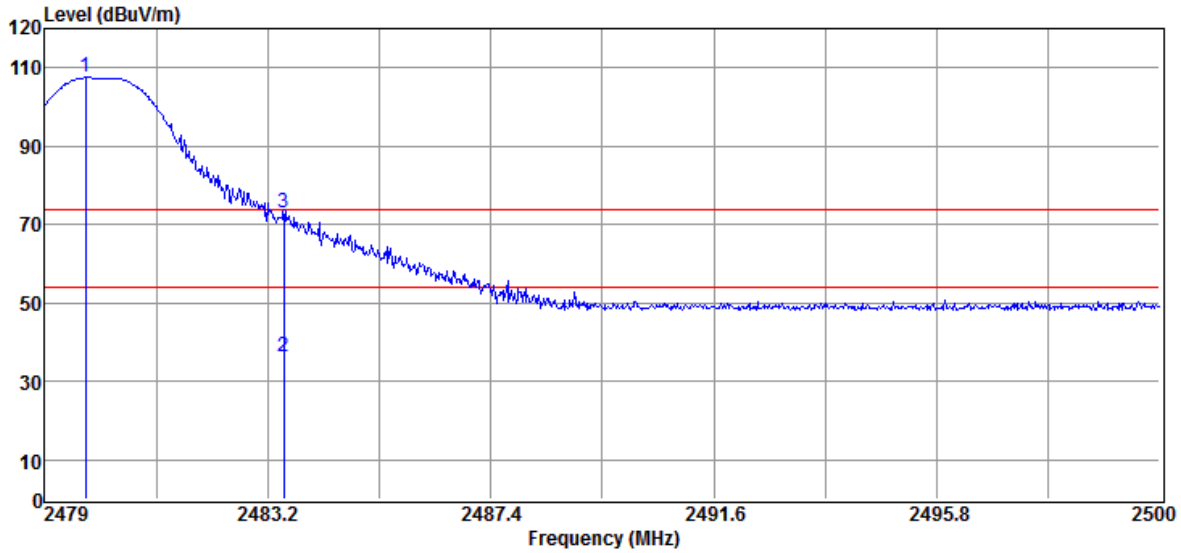
2 Measurement of data within this frequency range shown " - " in the table above means the reading of emissions are attenuated more than 20dB below the permissible limits or the field strength is too small to be measured.

3 Spectrum Peak mode IF bandwidth Setting : 1GHz- 26GHz, RBW= 1MHz, Sweep time= 200 ms., the VBW setting was 3 MHz.

4 Spectrum AV mode if bandwidth Setting : 1GHz- 26GHz, RBW= 1MHz, VBW= 10Hz, Sweep time= 200 ms.

Note: "F" denotes fundamental frequency

Operation Mode	TX CH High	Test Date	2022/05/24
Fundamental Frequency	2480 MHz		
Temperature	24°C	Humidity	64%



No	Freq MHz	Reading dBuV	Factor dB/m	Level dBuV/m	Limit dBuV/m	Margin dB	Remark	Pol V/H
1	2479.78	118.94	-11.44	107.50	F	--	Peak	VERTICAL
2	2483.50	47.84	-11.43	36.41	54.00	-17.59	Average	VERTICAL
3	2483.50	84.37	-11.43	72.94	74.00	-1.06	Peak	VERTICAL

Remark:

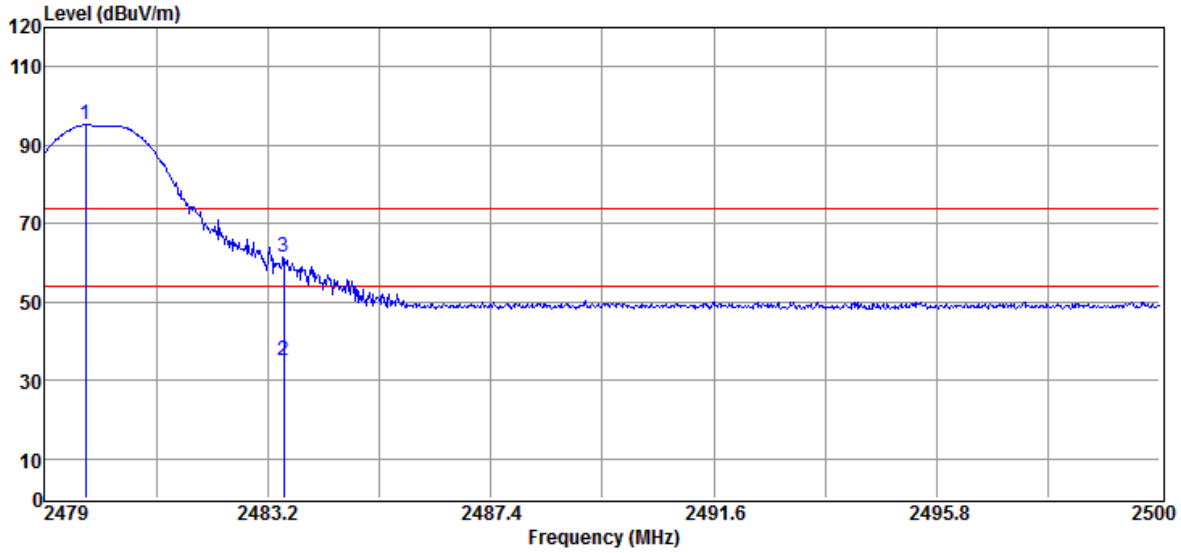
1 Field strength limits for frequency above 1000MHz are based on average limits. However, Peak mode field strength shall not exceed the average limits specified plus 20dB.

2 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.

3 Spectrum Peak mode IF bandwidth Setting : 1GHz- 26GHz, RBW= 1MHz, Sweep time= 200 ms., the VBW setting was 3 MHz.

4 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/m	Level dBuV/m	Limit dBuV/m	Margin dB	Remark	Pol V/H
1	2479.78	106.55	-11.44	95.11	F	--	Peak	HORIZONTAL
2	2483.50	46.45	-11.43	35.02	54.00	-18.98	Average	HORIZONTAL
3	2483.50	72.74	-11.43	61.31	74.00	-12.69	Peak	HORIZONTAL

Remark:

1 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.

2 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.

3 Spectrum Peak mode IF bandwidth Setting : 1GHz- 26GHz, RBW= 1MHz, Sweep time= 200 ms., the VBW setting was 3 MHz.

4 Spectrum AV mode if bandwidth Setting : 1GHz- 26GHz, RBW= 1MHz, VBW= 10Hz, Sweep time= 200 ms.

Note: "F" denotes fundamental frequency

9. Frequency Separation

9.1 Standard Applicable:

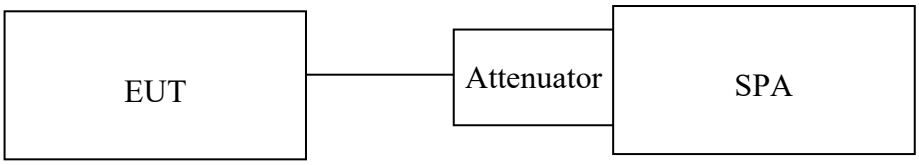
According to FCC 15.247 (a)(1) & RSS-247 5.1(b) requirement:

Frequency hopping systems shall have hopping channel carrier frequencies separated by a minimum of 25 kHz or the 20 dB bandwidth of the hopping channel, whichever is greater. Alternatively, frequency hopping systems operating in the 2400-2483.5 MHz band may have hopping channel carrier frequencies that are separated by 25 kHz or two-thirds of the 20 dB bandwidth of the hopping channel, whichever is greater, provided the systems operate with an output power no greater than 125 mW.

9.2 Measurement Equipment Used:

Refer to section 6.2 for details.

9.3 Test Set-up:



9.4 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 spectrum analyzer.
3. Set center frequency of spectrum analyzer = middle of hopping channel .
4. Set the spectrum analyzer as RBW,VBW=100kHz, Adjust Span to 3 MHz, Sweep = auto.
5. Max hold. Mark 3 Peaks of hopping channel and record the 3 peaks frequency.

9.5 Measurement Result:

Channel separation (MHz)	Limit	Result
1	≥ 25kHz or 2/3 of the 20dB bandwidth (whichever is greater)	PASS

Note: Refer to next page for plots.

Frequency Separation Test Data
Low

Mid

High

Agilent Spectrum Analyzer - Swept SA
Center Freq 2.479000000 GHz
PNO: Wide
IFGain:Low
Trig: Free Run
#Atten: 30 dB
Avg Type: Log-Pwr
Avg|Hold:>100/100
12:03:13 PM May 27, 2022
Ref Offset 0.5 dB
10 dB/div
Ref 20.50 dBm
Log
ΔMkr1 1.000 MHz
-1.012 dB
1Δ2
Center 2.479000 GHz
#Res BW 100 kHz
#VBW 300 kHz
Span 3.000 MHz
Sweep 1.00 ms (1001 pts)
Alignment Completed
Frequency
Auto Tune
Center Freq
2.479000000 GHz
Start Freq
2.477500000 GHz
Stop Freq
2.480500000 GHz
CF Step
300.000 kHz
Auto
Man
Freq Offset
0 Hz

10. Number of Hopping Frequency

10.1 Standard Applicable:

According to §15.247(a)(1)(iii), Frequency hopping systems operating in the 2400MHz-2483.5 MHz bands shall use at least 15 hopping frequencies.

According to RSS 247 issue 2,§5.4(b), For FHSs operating in the band 2400-2483.5 MHz, the maximum peak conducted output power shall not exceed 1.0 W if the hopset uses 75 or more hopping channels; the maximum peak conducted output power shall not exceed 0.125 W if the hopset uses less than 75 hopping channels.

10.2 Measurement Equipment Used:

Refer to section 6.2 for details.

10.3 Test Set-up:

Refer to section 9.3 for details.

10.4 Measurement Procedure:

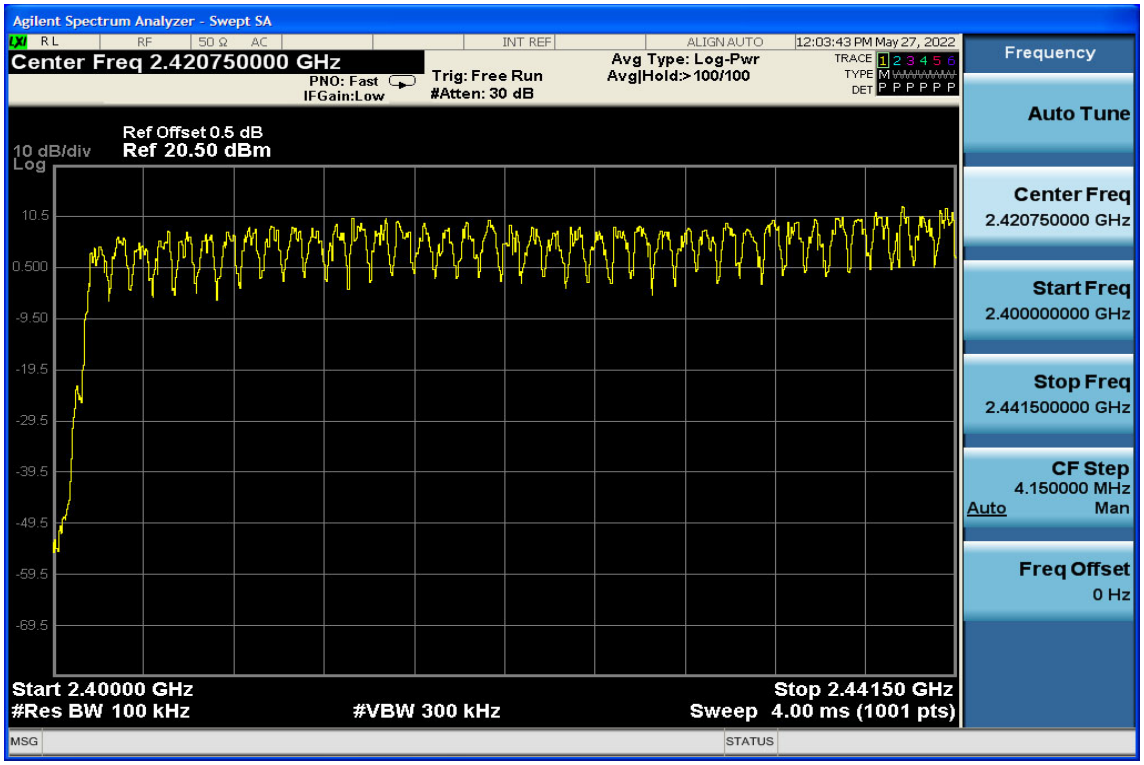
1. Place the EUT on the table and set it in transmitting mode.
2. Remove the antenna from the EUT and then connect a low loss RF cable from the antenna port to the spectrum analyzer.
3. Set spectrum analyzer Start=2400MHz, Stop = 2441.5MHz and Start=2441.5MHz, Stop = 2483.5MHz, Sweep = auto.
4. Set the spectrum analyzer as RBW=100kHz, VBW=300kHz
5. Max hold, view and count how many channel in the band.

10.5 Measurement Result:

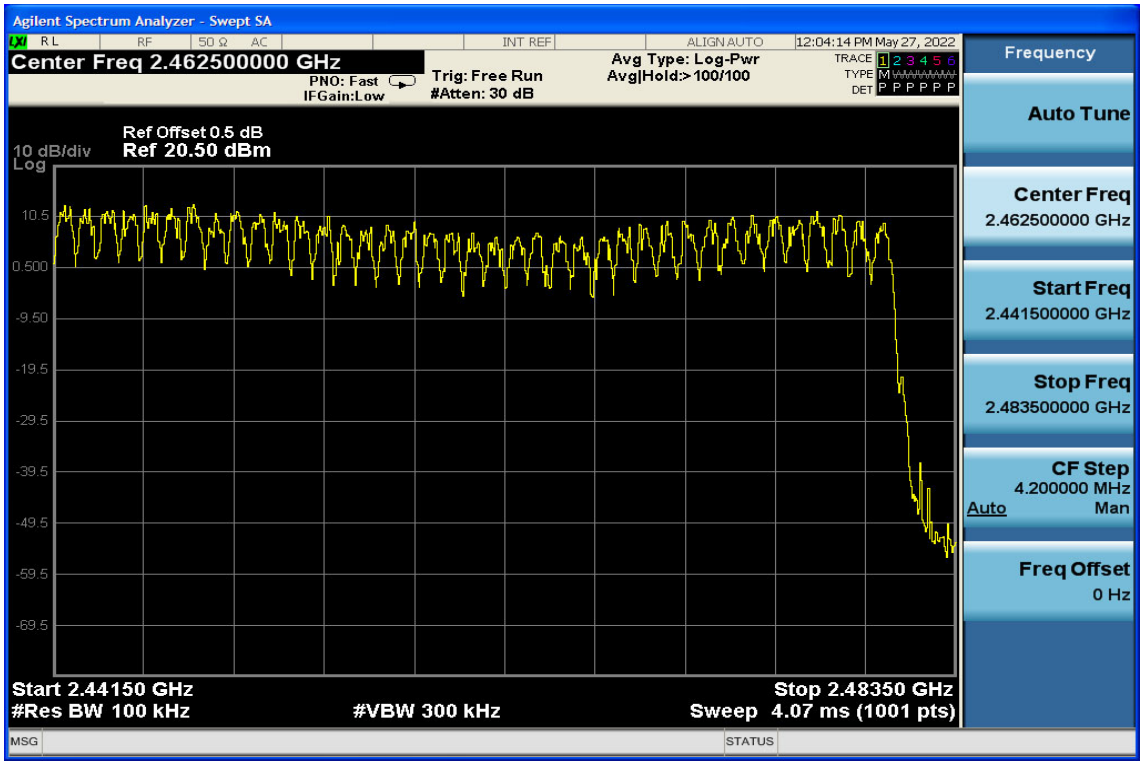
Channel Number: 79 Channel

Note: Refer to next page for plots.

Channel Number
2.4 GHz – 2.441.5GHz



2.441.5 GHz – 2.4835GHz



11. Time of Occupancy (Dwell Time)

11.1 Standard Applicable:

According to §15.247(a)(1)(iii), Frequency hopping systems operating in the 2400MHz-2483.5 MHz. The average time of occupancy on any frequency shall not greater than 0.4 s within period of 0.4 seconds multiplied by the number of hopping channel employed.

According to RSS 247 issue 2, §5.1(d), FHSs operating in the band 2400-2483.5 MHz shall use at least 15 hopping channels. The average time of occupancy on any channel shall not be greater than 0.4 seconds within a period of 0.4 seconds, multiplied by the number of hopping channels employed. Transmissions on particular hopping frequencies may be avoided or suppressed provided that at least 15 hopping channels are used.

11.2 Measurement Equipment Used:

Refer to section 6.2 for details.

11.3 Test Set-up:

Refer to section 9.3 for details.

11.4 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 spectrum analyzer.
3. Set center frequency of spectrum analyzer = operating frequency.
4. Set the spectrum analyzer as RBW / VBW =1MHz, Span = 0Hz , Adjust Sweep = 2.5ms.
5. Repeat above procedures until all frequency measured were complete.

11.5 Measurement Result:

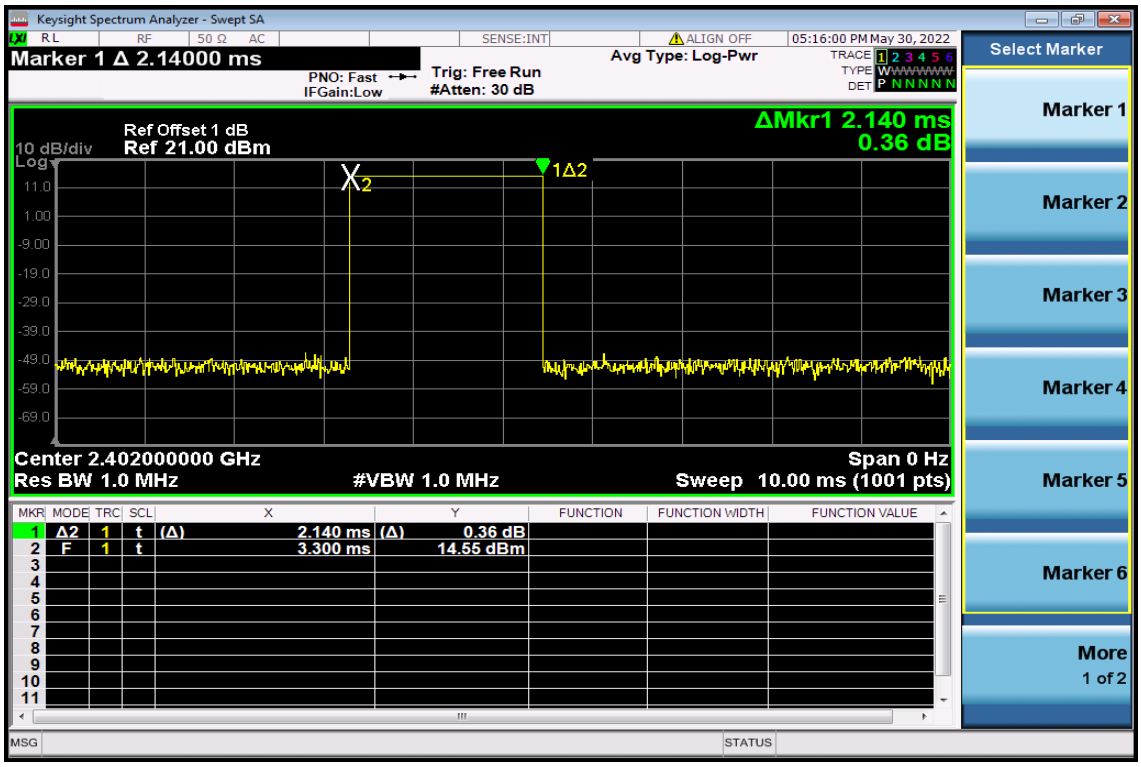
A period time = 0.4 (ms) * 79 = 31.6 (s)

CH Low	Dwell time	=	2.140 (ms)	*	40	=	85.60	(ms)
CH Mid	Dwell time	=	2.140 (ms)	*	40	=	85.60	(ms)
CH High	Dwell time	=	2.140 (ms)	*	40	=	85.60	(ms)

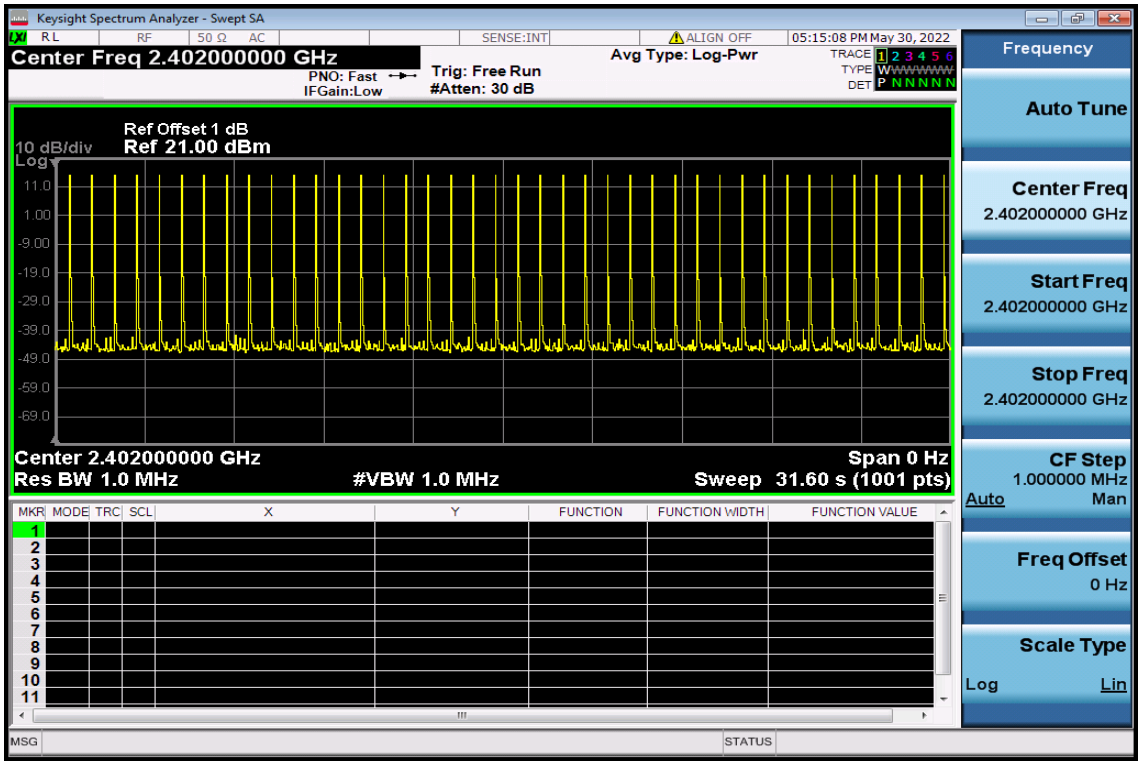
Note: Refer to next page for plots.

Low Channel

02 singal

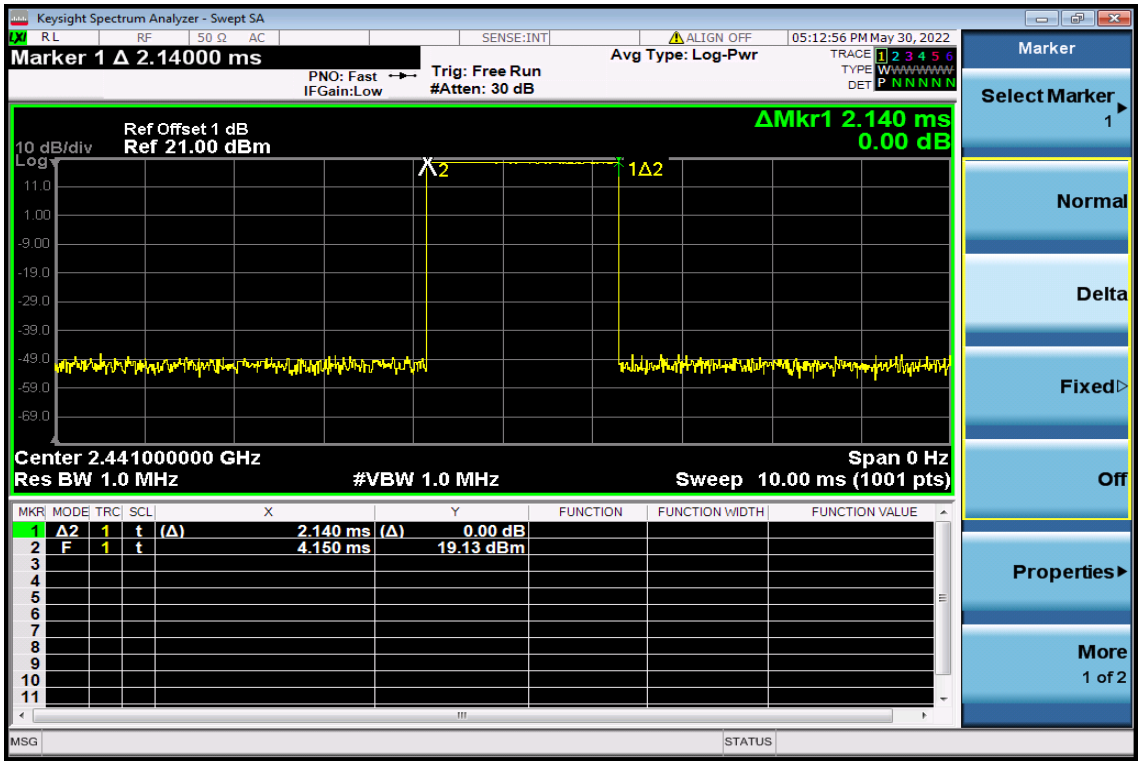


02 total

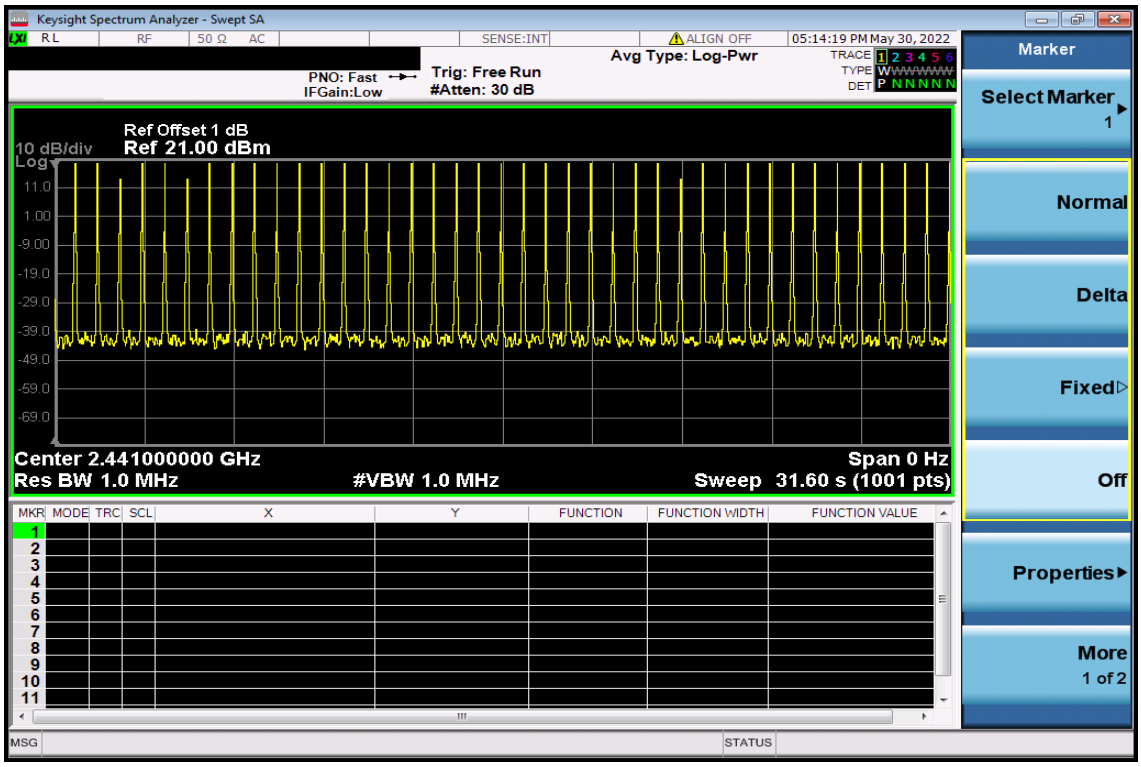


Mid Channel

41 singal

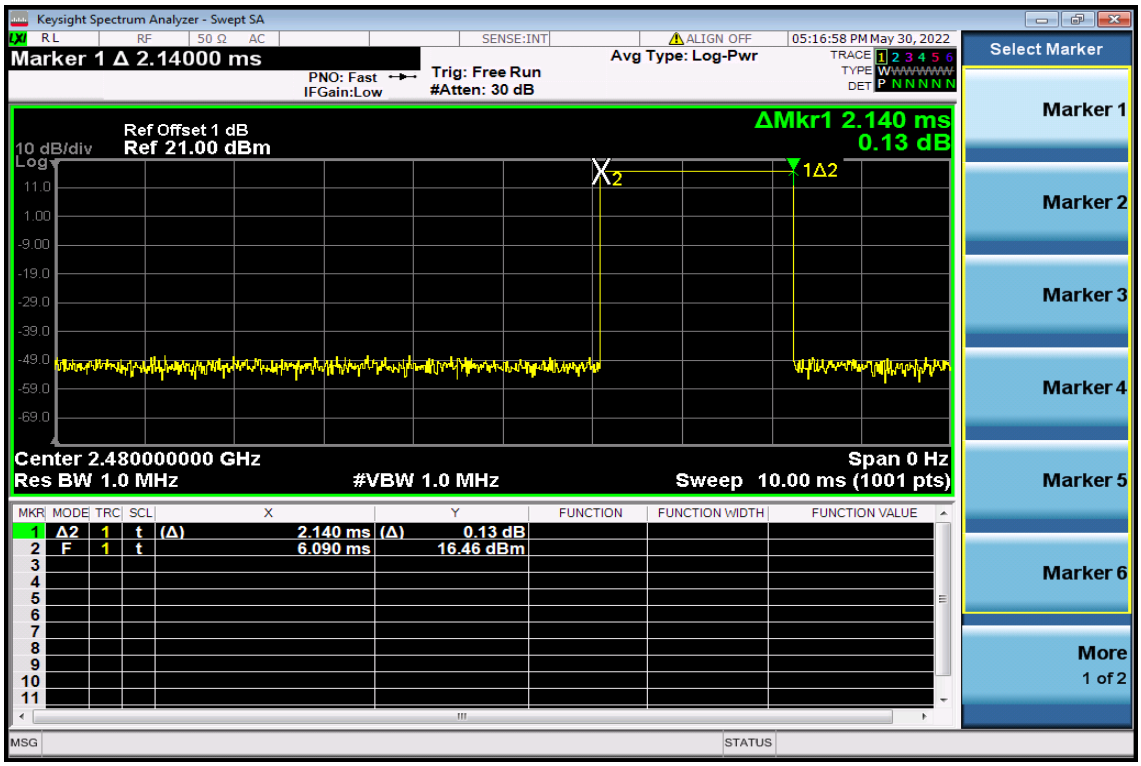


41 total

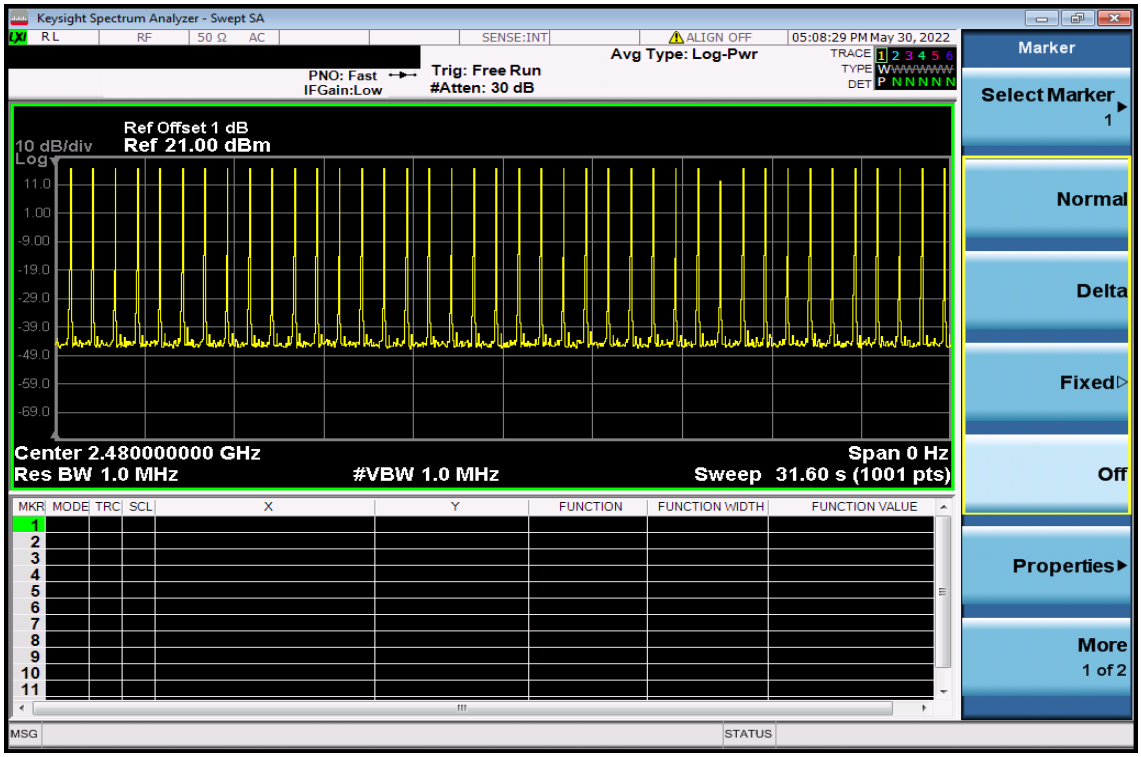


High Channel

80 singal



80 total



12. 20dB Bandwidth & 99% Bandwidth

12.1 Standard Applicable:

According to §15.247(a)(1),and RSS210 A8.1(b) for frequency hopping systems operating in the 2400MHz-2483.5 MHz no limit for 20dB bandwidth.

According to RSS-247 issue 2, §5.1 (a), the bandwidth of a frequency hopping channel is the 20 dB emission bandwidth.

12.2 Measurement Equipment Used:

Refer to section 6.2 for details.

12.3 Test Set-up:

Refer to section 9.3 for details.

12.4 Measurement Procedure:

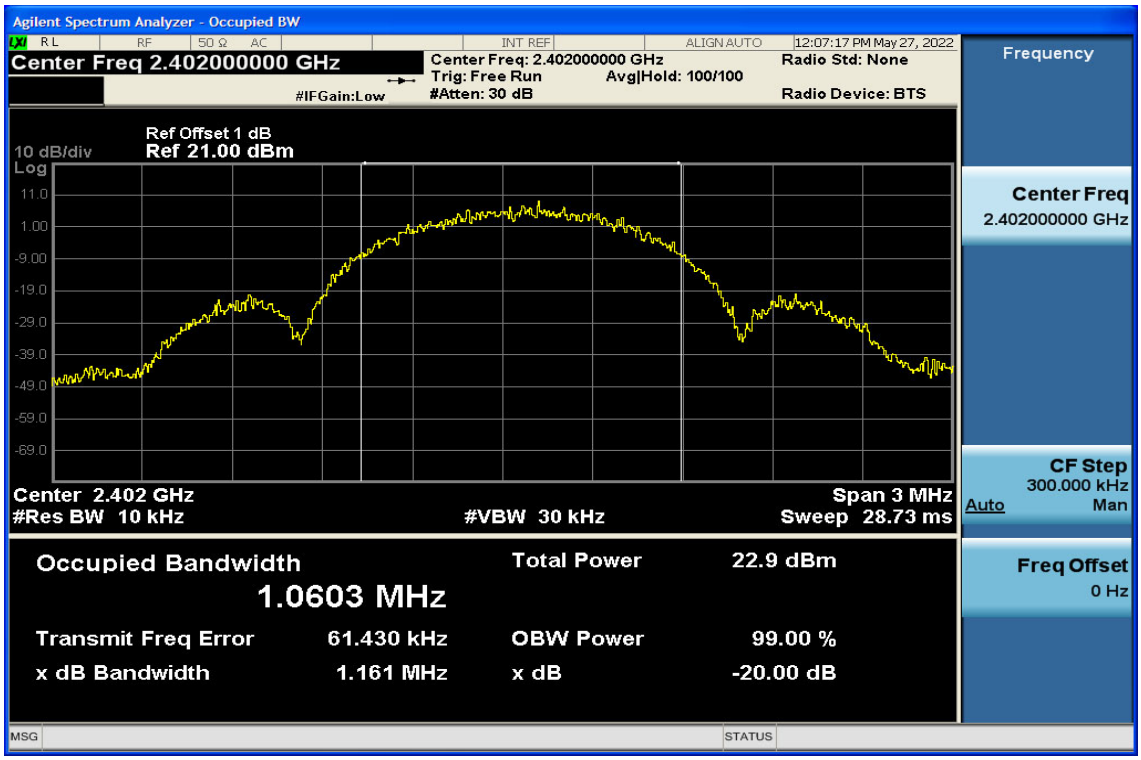
1. Place the EUT on the table and set it in transmitting mode.
2. Remove the antenna from the EUT and then connect a low loss RF cable from the antenna port to the spectrum analyzer.
3. Set the spectrum analyzer as RBW= 1 % - 5% of Bandwidth., Span= 3MHz, Sweep=auto
4. Mark the peak frequency and –20dB (upper and lower) frequency and 99%.
5. Repeat above procedures until all frequency measured were complete.

12.5 Measurement Result:

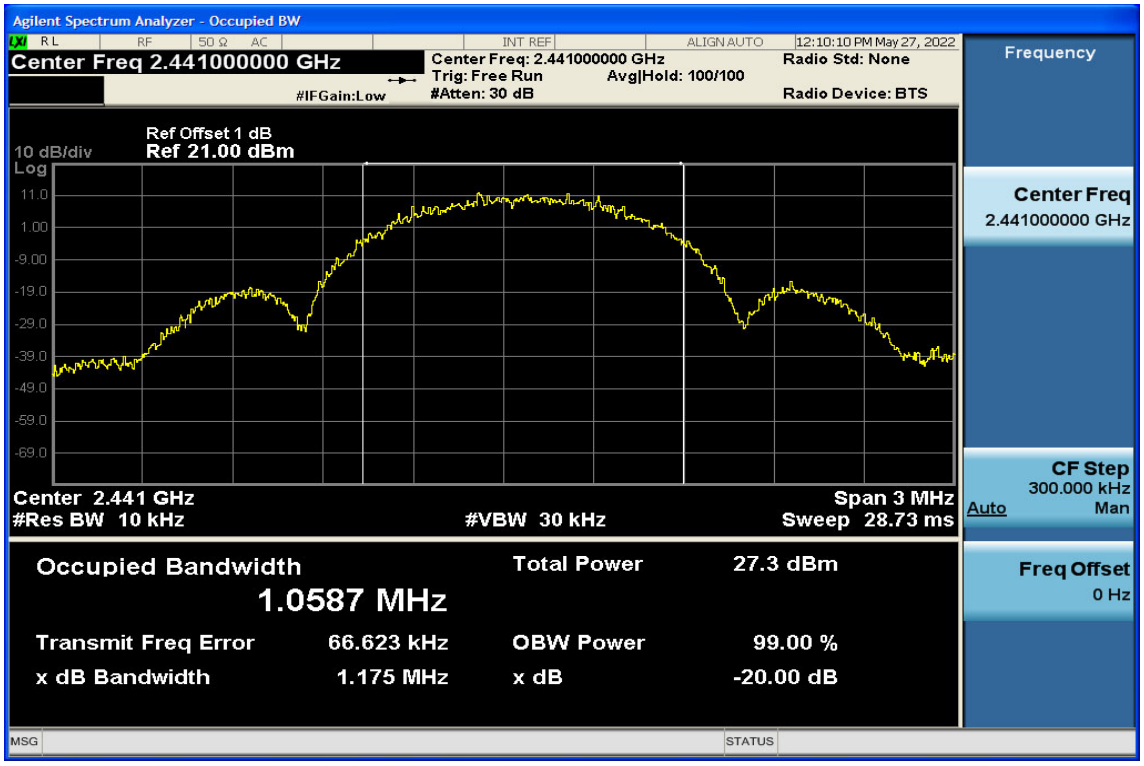
CH	20dB Bandwidth	99% Bandwidth
	(MHz)	
Low	1.161	1.061
Mid	1.175	1.061
High	1.207	1.062

Note: Refer to next page for plots.

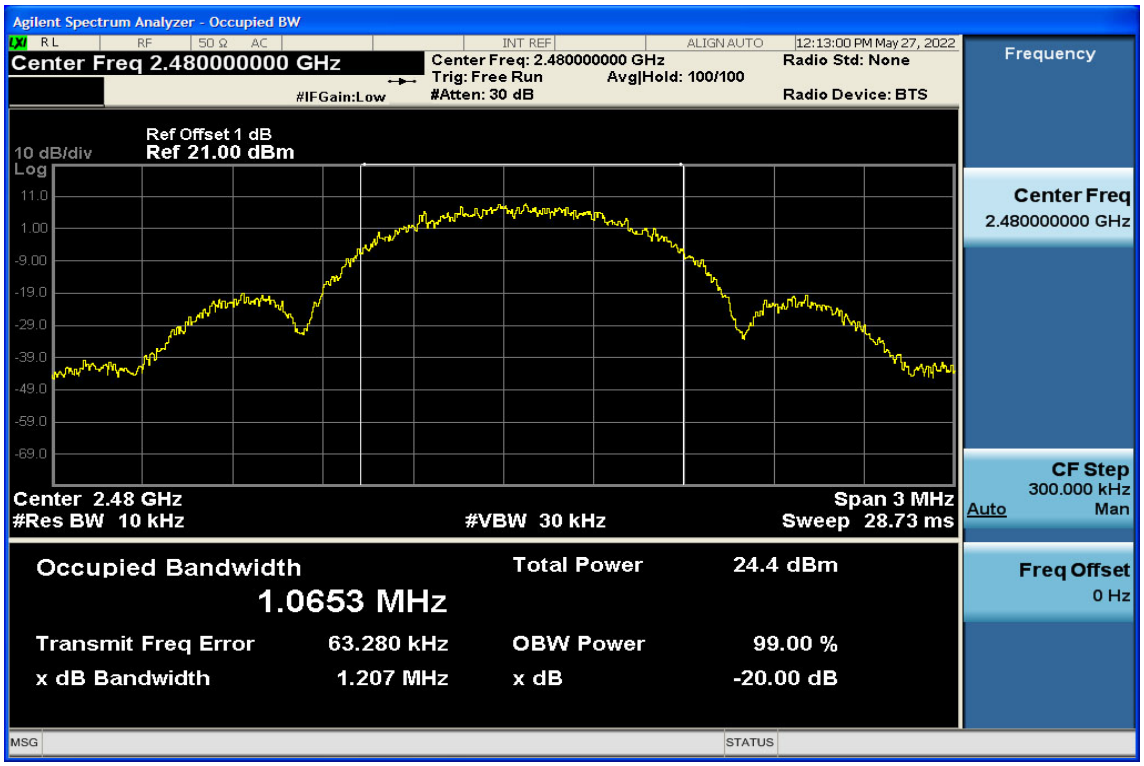
20dB Bandwidth Test Data CH-Low



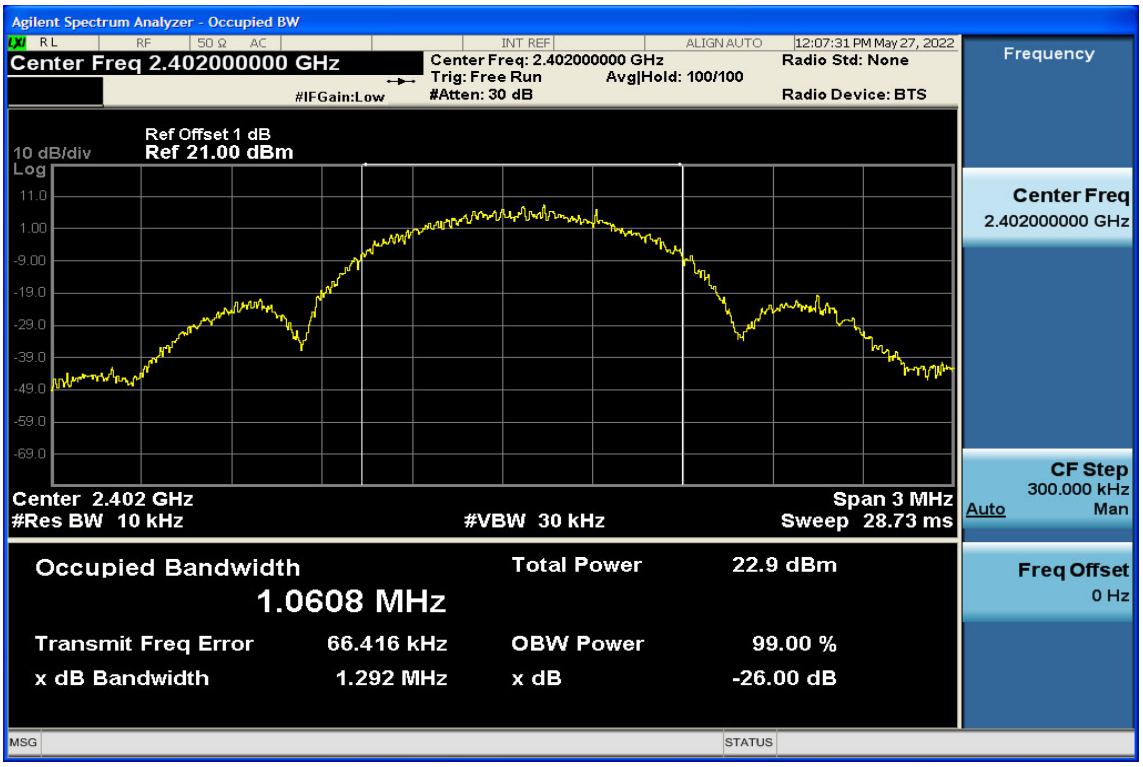
20dB Bandwidth Test Data CH-Mid



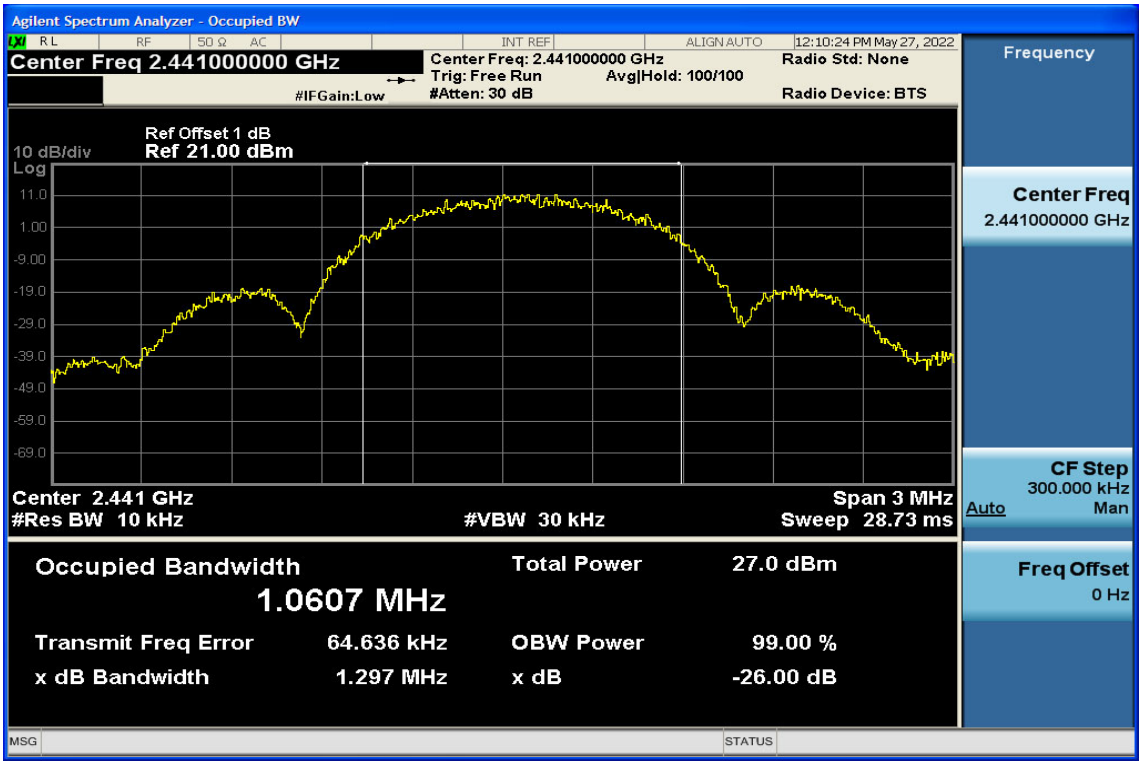
20dB Bandwidth Test Data CH-High



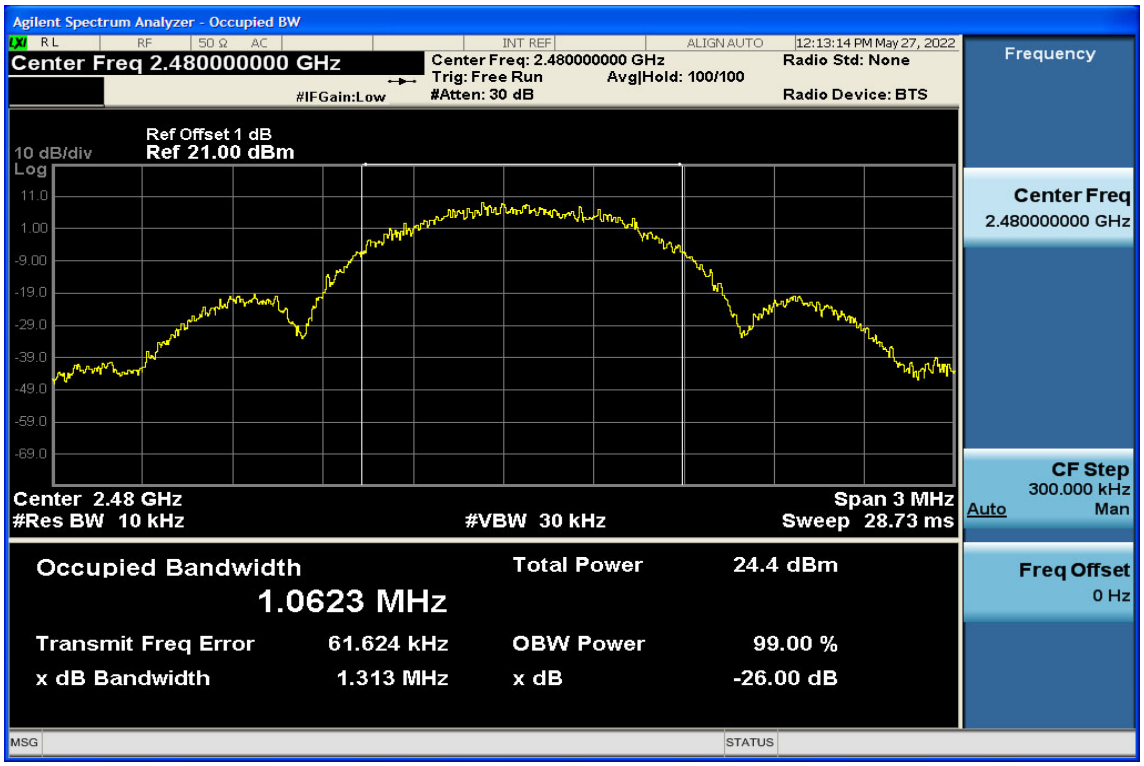
99% Bandwidth Test Data CH-Low



99% Bandwidth Test Data CH-Mid



99% Bandwidth Test Data CH-High



13. Antenna Requirement

13.1 Standard Applicable:

According to §15.203, an intentional radiator shall be designed to ensure that no antenna other than furnished by the responsible party shall be used with the device.

And according to §15.247(c), if 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.

According to RSS-GEN 8.3, the applicant for equipment certification, as per RSP-100, must provide a list of all antenna types that may be used with the licence-exempt transmitter, indicating the maximum permissible antenna gain (in dBi) and the required impedance for each antenna.

Licence-exempt transmitters that have received equipment certification may operate with different types of antennas. However, it is not permissible to exceed the maximum equivalent isotropically radiated power (e.i.r.p.) limits specified in the applicable standard (RSS) for the licence-exempt apparatus.

Testing shall be performed using the highest gain antenna of each combination of licence-exempt transmitter and antenna type, with the transmitter output power set at the maximum level.9 When a measurement at the antenna connector is used to determine RF output power, the effective gain of the device's antenna shall be stated, based on a measurement or on data from the antenna manufacturer.

User manuals for transmitters equipped with detachable antennas shall also contain the following notice in a conspicuous location:

This radio transmitter (identify the device by certification number or model number if Category II) has been approved by Industry Canada to operate with the antenna types listed below with the maximum permissible gain indicated. Antenna types not included in this list, having a gain greater than the maximum gain indicated for that type, are strictly prohibited for use with this device.

Immediately following the above notice, the manufacturer shall provide a list of all antenna types approved for use with the transmitter, indicating the maximum permissible antenna gain (in dBi).

13.2 Antenna Connected Construction:

The directional gains of antenna used for transmitting as follow. Please see EUT photo and antenna spec. for details

Module	FCC: BT832X, IC: BT832XH	FCC: BT832XE, IC: BT832XHE
SoC	nRF52832-QFAA	nRF52832-QFAA
Flash/RAM	512KB/64KB	512KB/64KB
BT Antenna	PCB trace	Dipole
Antenna gain	2.34dBi	6.15dBi