

TEST REPORT

of

FCC Part 15 Subpart C

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

Product : Digital Signage / POS System
Brand: Zunidata
Model: 7NX-RM; 7FX-RM; 7XXX-XXX (X=0~9 or A-Z or Blank or -)
Model Difference: Metal and plastic case. with, and without POE
FCC ID: Z28-7N-7F-RM
FCC Rule Part: §15.247, Cat: DSS
Applicant: Zunidata Systems, Inc.
Address: 6F, No. 945, Boai Street, Jubei City, Hsinchu, Taiwan 302

Test Performed by:
International Standards Laboratory Corp.

<LT Lab.>

*Site Registration No.

BSMI: SL2-IN-E-0013; MRA TW0997; TAF: 0997; IC: IC4067B-4;

*Address:

No. 120, Lane 180, Hsin Ho Rd.,
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Report No.: ISL-20LR343FCDSS

Issue Date : 2020/11/12



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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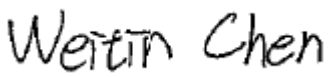
VERIFICATION OF COMPLIANCE

Applicant: Zunidata Systems, Inc.
Product Description: Digital Signage / POS System
Brand Name: Zunidata
Model No.: 7NX-RM; 7FX-RM; 7XXX-XXX (X=0~9 or A-Z or Blank or -)
Model Difference: Metal and plastic case. with, and without POE
FCC ID: Z28-7N-7F-RM
Date of test: 2020/10/15 ~ 2020/11/11
Date of EUT Received: 2020/10/15

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.

Test By:	 _____ Weitin Chen / Senior Engineer	Date:	2020/11/12 _____
Prepared By:	 _____ Gigi Yeh / Senior Engineer	Date:	2020/11/12 _____
Approved By:	 _____ Jerry Liu / Technical Manager	Date:	2020/11/12 _____

Version

Version No.	Date	Description
00	2020/11/12	Initial creation of document

Uncertainty of Measurement

Description Of Test	Uncertainty
Conducted Emission (AC power line)	2.586 dB
Field Strength of Spurious Radiation	$\leq 30\text{MHz}$: 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%
Time	0.01%
DC Voltage	1%

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1. General Information

1.1. Product Description

General:

Product Name	Digital Signage / Digital Signage / POS System System	
Brand Name	Zunidata	
Model Name	7NX-RM; 7FX-RM; 7XXX-XXX (X = 0~9 or A-Z or Blank or -)	
Model Difference	Metal and plastic case. with, and without POE	
Power Supply	12Vdc by AC Adapter, Model No.: 2ABL024F US	
AC In Power Port	One provided	
USB 2.0 Port	Two provided	
COM 2 (RS232)Port	One provided	
COM 1 (RS232)Port	One provided	
Micro USB Port	One provided	
LAN Port	One provided	
Power Supply	12Vdc from AC/DC adapter	
	Adapter:	1. Model : SOY-1200200; Supplier: Shenzhen SOY Technology Co., Ltd. 2. Model : 2ABL024F US; Supplier: CWT 3. Model : 2AAJ024FC ; Supplier: CWT

Bluetooth:

Frequency Range:	2402 – 2480MHz
Bluetooth Version:	V2.1 + EDR
Channel number:	79 channels
Tune up power (Peak):	GFSK : 0.82 dBm +/- 1 dB π / 4DQPSK: -2.96 dBm +/- 1 dB 8DPSK: -2.56 dBm +/- 1 dB
Antenna Designation:	PCB Antenna: -1.89 dBi

This report applies for BT V2.1 + EDR

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

BT Power setting

Mode	Freq(MHz)	Power Setting (dBm)	Software value
BDR	2402	0dBm	0dBm
	2441	0dBm	0dBm
	2480	0dBm	0dBm
EDR (1M)	2402	0dBm	0dBm
	2441	0dBm	0dBm
	2480	0dBm	0dBm
EDR (2M)	2402	0dBm	0dBm
	2441	0dBm	0dBm
	2480	0dBm	0dBm

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

This submittal(s) (test report) is intended for **FCC ID: Z28-7N-7F-RM** filing to comply with Section 15.247 of the FCC Part 15, Subpart C Rules.

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.

KDB Document: 558074 D01 15.247 Meas Guidance v05r02

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 . 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.

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 placed on a turn table which is 0.8 m above ground plane. According to the requirements in Section 6 of ANSI C63.10: 2013. Conducted 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 placed on a turn table which is 0.8 m/1.5m (frequency above 1GHz) 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 according to the requirements in Section 6 and 11 of ANSI C63.10: 2013.

2.4 Configuration of Tested System

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

Radiated Emission

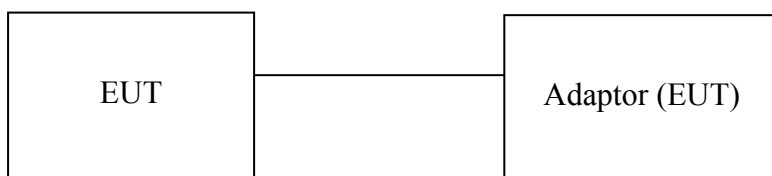


Table 1 Equipment Used in Tested System

Item	Equipment	Mfr/Brand	Model/ Type No.	Series No.	Data Cable	Power Cord
1	EUT (adaptor)	CWT	2ABL024F US	NA	NA	Non-shielding
2	EUT (adaptor)	Shenzhen SOY Technology Co., Ltd.	SOY-1200200	NA	NA	Non-shielding
3	EUT (adaptor)	CWT	2AAJ024FC	NA	NA	Non-shielding

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
§15.207(a)	AC Power line Conducted Emission	Compliant
§15.247(b)(1)	Peak Output Power	Compliant
§15.247(d)	100 kHz Bandwidth Of Frequency Band Edges	Compliant
§15.247(c)	Spurious Emission	Compliant
§15.247(a)(1)	Frequency Separation	Compliant
§15.247(a)(1)(iii)	Number of hopping frequency	Compliant
§15.247(a)(1)(ii)	Time of Occupancy	Compliant
§15.247(a)(1)	20dB Bandwidth	Compliant
§ 15.203, §15.247(c)	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.

The worst case BDR mode was reported for Radiated Emission.

5. Conducted Emission Test

5.1 Standard Applicable:

According to §15.207 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 02	LISN 26	R&S	ENV216	102378	11/21/2019	11/21/2020
Conduction 02	LISN 21	R&S	ENV216	101476	07/21/2020	07/21/2021
Conduction 02	Conduction 02-1 Cable	WOKEN	CFD 300-NL	Conduction 02 -1	09/11/2020	09/11/2021
Conduction 02	EMI Receiver 14	ROHDE&SCHWARZ	ESCI	101034	05/22/2020	05/22/2021
Conduction 02	ISN T4 07	Teseq GmbH	ISN T400A	49913	08/02/2020	08/02/2021
Conduction 02	ISN T8 10	Teseq GmbH	ISN T800	42773	08/02/2020	08/02/2021

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.
4. Both 120V & 240V have been verified, and 120V/60Hz was defined as the worst-case and record in the report.

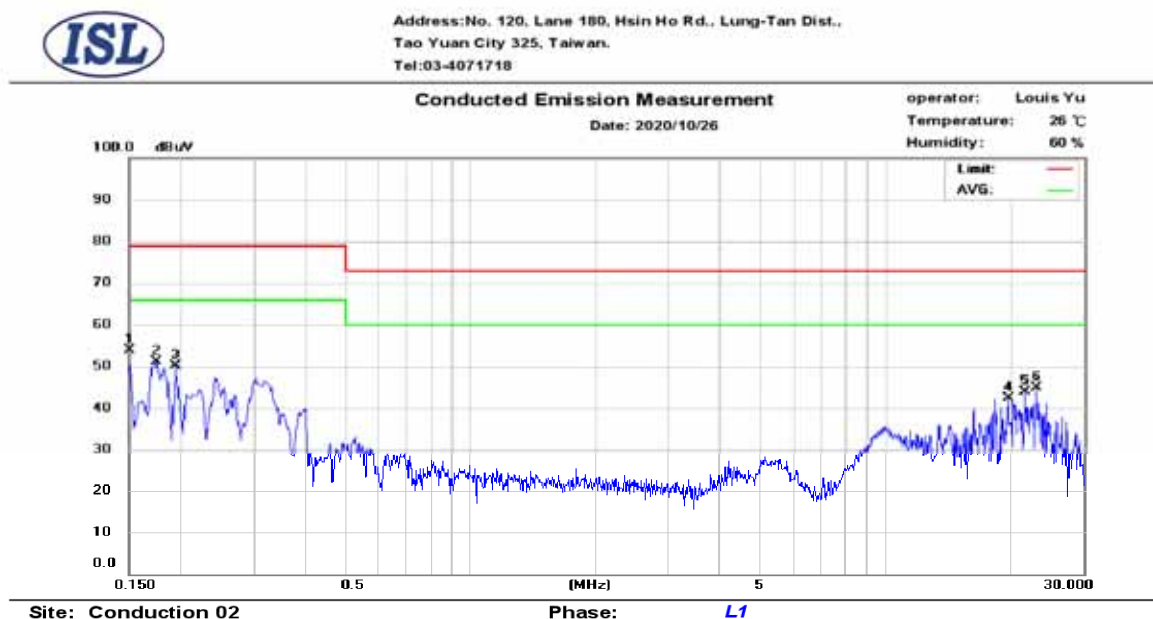
5.5 Measurement Result:

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.

Note: Refer to next page for measurement data and plots.

AC POWER LINE CONDUCTED EMISSION TEST DATA

Operation Mode:	Normal Operation	Worst Case	Adapter module : 2ABL024F
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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	0.150	43.88	26.32	9.69	53.57	79.00	-25.43	36.01	66.00	-29.99
2	0.174	39.05	24.07	9.69	48.74	79.00	-30.26	33.76	66.00	-32.24
3	0.194	36.74	22.02	9.68	46.42	79.00	-32.58	31.70	66.00	-34.30
4	19.710	31.63	28.96	9.98	41.61	73.00	-31.39	38.94	60.00	-21.06
5	21.662	32.76	30.30	9.98	42.74	73.00	-30.26	40.28	60.00	-19.72
6	23.130	33.94	32.36	9.97	43.91	73.00	-29.09	42.33	60.00	-17.67



Address: No. 120, Lane 180, Hsin Ho Rd., Lung-Tan Dist.,
Tao Yuan City 325, Taiwan.
Tel: 03-4071718

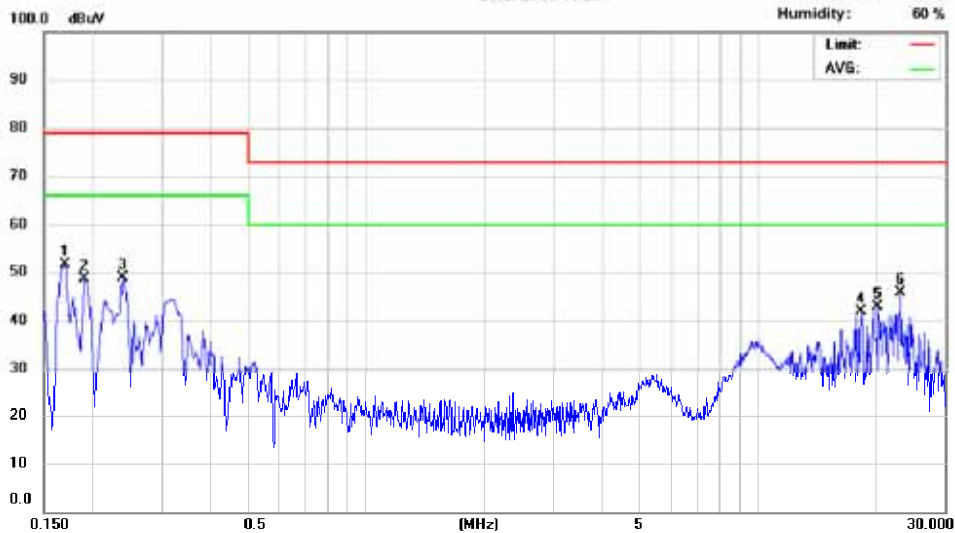
Conducted Emission Measurement

Date: 2020/10/26

operator: Louis Yu

Temperature: 26 °C

Humidity: 60 %



Site: Conduction 02

Phase: N

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	0.170	38.37	24.45	9.68	48.05	79.00	-30.95	34.13	66.00	-31.87
2	0.190	35.91	19.87	9.68	45.59	79.00	-33.41	29.55	66.00	-36.45
3	0.238	34.19	22.66	9.68	43.87	79.00	-35.13	32.34	66.00	-33.66
4	18.242	31.32	28.55	10.06	41.38	73.00	-31.62	38.61	60.00	-21.39
5	20.258	31.78	29.16	10.08	41.86	73.00	-31.14	39.24	60.00	-20.76
6	23.130	34.40	31.88	10.10	44.50	73.00	-28.50	41.98	60.00	-18.02

6. Peak Output Power Measurement

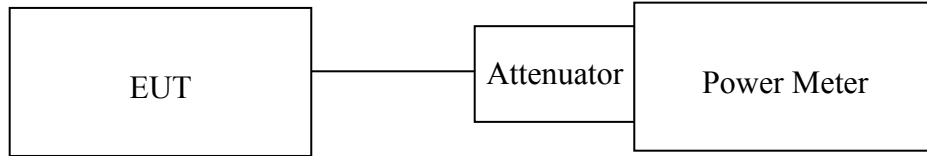
6.1 Standard Applicable:

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.

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	09/25/2020	09/25/2021
Conducted	Power Sensor	Anritsu	MA2411B	34NKF50	09/25/2020	09/25/2021
Conducted	Power Sensor	DARE	RPR3006W	13I00030SNO33	01/03/2020	01/03/2021
Conducted	Power Sensor	DARE	RPR3006W	13I00030SNO34	01/09/2020	01/09/2021
Conducted	Power Sensor	DARE	RPR3006W	14I00889SNO35	06/29/2020	06/29/2021
Conducted	Power Sensor	DARE	RPR3006W	14I00889SNO36	06/29/2020	06/29/2021
Conducted	Temperature Chamber	KSON	THS-B4H100	2287	03/11/2020	03/11/2021
Conducted	DC Power supply	ABM	8185D	N/A	01/03/2020	01/03/2021
Conducted	AC Power supply	EXTECH	CFC105W	NA	N/A	N/A
Conducted	Spectrum analyzer	Keysight	N9010A	MY56070257	09/23/2020	09/23/2021
Conducted	Spectrum analyzer	R&S	FSP40	100116	01/10/2020	01/10/2021
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	Radio Communication Analyzer	R&S	CMU200	111968	11/29/2019	11/29/2020
Conducted	Wideband Radio Communication Tester	R&S	CMW500	1201.002K50108 793-JG	10/28/2020	10/28/2021
Conducted	BT Simulator	Agilent	N4010A	MY48100200	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:

BDR Mode

Frequency (MHz)	Output Power (dBm)	Output Power (W)	Limit (W)
Low	0.55	0.00114	1
Mid	0.70	0.00118	1
High	0.82	0.00121	1

EDR 2M Mode

Frequency (MHz)	Output Power (dBm)	Output Power (W)	Limit (W)
Low	-3.26	0.00047	0.125
Mid	-2.96	0.00051	0.125
High	-3.32	0.00047	0.125

EDR 3M Mode

Frequency (MHz)	Output Power (dBm)	Output Power (W)	Limit (W)
Low	-2.84	0.00052	0.125
Mid	-2.56	0.00056	0.125
High	-2.89	0.00051	0.125

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.

7.2 Measurement Equipment Used:

7.2.1. Conducted Emission at antenna port:

Refer to section 6.2 for details.

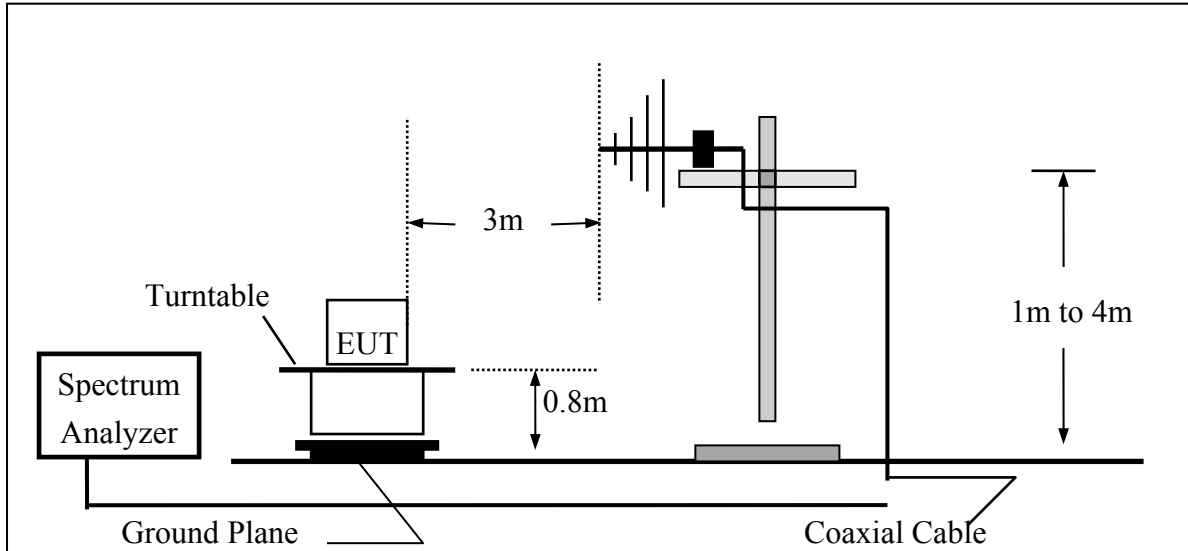
7.2.2. Radiated emission:

Location	Equipment Name	Brand	Model	S/N	Last Cal. Date	Next Cal. Date
Chamber 19	Signal analyzer	R&S	FSV40	101919	08/13/2020	08/13/2021
Chamber 19	EMI Receiver	R&S	ESR3	102461	05/05/2020	05/05/2021
Chamber 19	Loop Antenna	EM	EM-6879	271	05/21/2020	05/21/2021
Chamber 19	Bilog Antenna (30MHz-1GHz)	Schwarzbeck	VULB9168 w 6dB Att.	736	02/11/2020	02/11/2021
Chamber 19	Horn antenna (1GHz-18GHz)	ETS LINDGREN	3117	00218718	09/25/2020	09/25/2021
Chamber 19	Horn antenna (18GHz-26GHz)	Com-power	AH-826	081001	11/25/2019	11/25/2020
Chamber 19	Horn antenna (26GHz-40GHz)	Com-power	AH-640	100A	03/13/2020	03/13/2021
Chamber 19	Preamplifier (9kHz-1GHz)	HP	8447F	3113A04621	06/19/2020	06/19/2021
Chamber 19	Preamplifier (1GHz - 26GHz)	EM	EM01M26G	060681	05/04/2020	05/04/2021
Chamber 19	Preamplifier (26GHz-40GHz)	MITEQ	JS4-26004000-27-5A	818471	05/04/2020	05/04/2021
Chamber 19	RF Cable (9kHz-18GHz)	HUBER SU-HNER	Sucoflex 104A	MY1397/4A	01/10/2020	01/10/2021
Chamber 19	RF Cable (18GHz-40GHz)	HUBER SU-HNER	Sucoflex 102	27963/2&374 21/2	11/21/2019	11/21/2020
Chamber 19	Signal Generator	Anritsu	MG3692A	20311	01/06/2020	01/06/2021
Chamber 19	Test Software	Audix	E3 Ver:6.12023	N/A	N/A	N/A

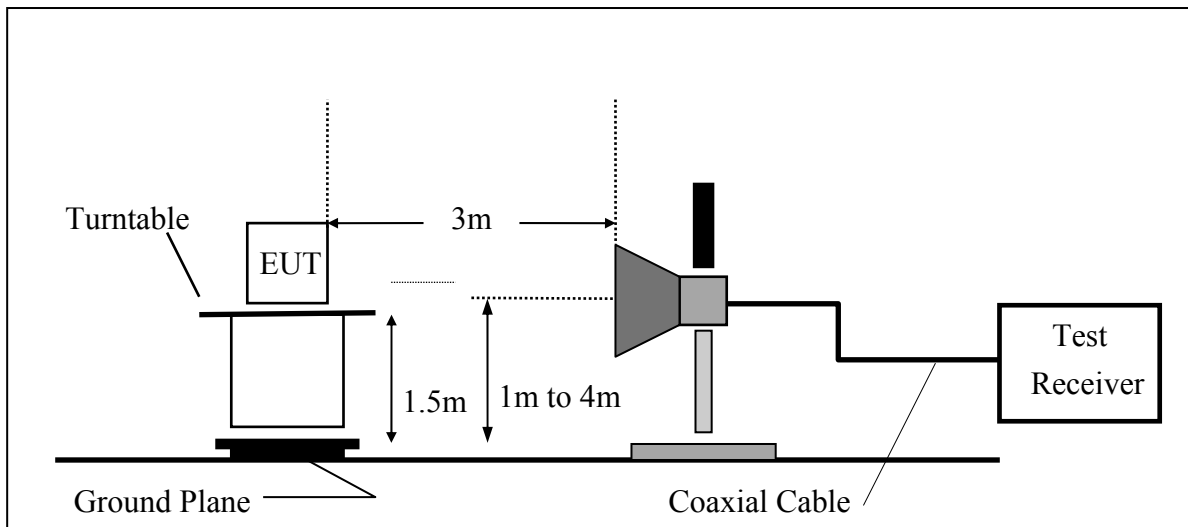
7.3 Test SET-UP:

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. 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 : 9kHz, 120kHz
 Test spectrum setting : Above 1GHz
 Peak : RBW=1MHz, VBW=3MHz, Sweep=auto
 Average (for BT) : RBW=1MHz, VBW=0.5KHz, Sweep=auto

Average Measurement Setting (VBW)

Mode	ON time (ms)	Total time (ms)	Duty Cycle	Duty Factor	1/Ton	VBW (kHz)
1M	2.850	3.750	76.000%	1.19	0.351	0.5
2M	2.880	3.750	76.800%	1.15	0.347	0.5
3M	2.895	3.780	76.587%	1.16	0.345	0.5

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 Spurious Emission Measurement Result: (below 1GHz) (Worst case: BDR)

Operation Mode	TX CH Low	Test Date	2020/11/09
Fundamental Frequency	2402MHz	Test By	Weitin
Temperature	25 °C	Humidity	60 %

No	Freq MHz	Reading dBuV	Factor dB	Level dBuV/m	Limit dBuV/m	Over Limit dB	Remark	Pol V/H
1	74.62	39.99	-8.65	31.34	40.00	-8.66	Peak	VERTICAL
2	120.21	33.81	-7.68	26.13	43.50	-17.37	Peak	VERTICAL
3	307.42	30.71	-3.75	26.96	46.00	-19.04	Peak	VERTICAL
4	395.69	37.98	-2.11	35.87	46.00	-10.13	Peak	VERTICAL
5	520.82	33.05	-0.08	32.97	46.00	-13.03	Peak	VERTICAL
6	712.88	29.35	3.14	32.49	46.00	-13.51	Peak	VERTICAL
1	124.09	33.98	-7.33	26.65	43.50	-16.85	Peak	HORIZONTAL
2	205.57	34.15	-7.37	26.78	43.50	-16.72	Peak	HORIZONTAL
3	395.69	30.71	-2.11	28.60	46.00	-17.40	Peak	HORIZONTAL
4	520.82	31.85	-0.08	31.77	46.00	-14.23	Peak	HORIZONTAL
5	723.55	29.68	3.35	33.03	46.00	-12.97	Peak	HORIZONTAL
6	763.32	29.41	4.36	33.77	46.00	-12.23	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
Fundamental Frequency 2441MHz
Temperature 25 °C

Test Date 2020/11/09
Test By Weitin
Humidity 60 %

No	Freq MHz	Reading dBuV	Factor dB	Level dBuV/m	Limit dBuV/m	Over Limit dB	Remark	Pol V/H
1	75.59	38.88	-8.79	30.09	40.00	-9.91	Peak	VERTICAL
2	122.15	33.42	-7.54	25.88	43.50	-17.62	Peak	VERTICAL
3	266.68	29.79	-5.01	24.78	46.00	-21.22	Peak	VERTICAL
4	395.69	38.19	-2.11	36.08	46.00	-9.92	Peak	VERTICAL
5	522.76	36.00	0.00	36.00	46.00	-10.00	Peak	VERTICAL
6	745.86	29.05	3.89	32.94	46.00	-13.06	Peak	VERTICAL
1	122.15	35.00	-7.54	27.46	43.50	-16.04	Peak	HORIZONTAL
2	185.20	32.91	-6.74	26.17	43.50	-17.33	Peak	HORIZONTAL
3	231.76	32.13	-6.51	25.62	46.00	-20.38	Peak	HORIZONTAL
4	369.50	27.82	-2.53	25.29	46.00	-20.71	Peak	HORIZONTAL
5	515.97	31.47	-0.27	31.20	46.00	-14.80	Peak	HORIZONTAL
6	720.64	29.32	3.27	32.59	46.00	-13.41	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
Fundamental Frequency 2480MHz
Temperature 25 °C

Test Date 2020/11/09
Test By Weitin
Humidity 60 %

No	Freq MHz	Reading dBuV	Factor dB	Level dBuV/m	Limit dBuV/m	Over Limit dB	Remark	Pol V/H
1	74.62	39.61	-8.65	30.96	40.00	-9.04	Peak	VERTICAL
2	131.85	32.29	-6.46	25.83	43.50	-17.67	Peak	VERTICAL
3	247.28	30.99	-5.72	25.27	46.00	-20.73	Peak	VERTICAL
4	307.42	29.68	-3.75	25.93	46.00	-20.07	Peak	VERTICAL
5	395.69	37.98	-2.11	35.87	46.00	-10.13	Peak	VERTICAL
6	520.82	31.74	-0.08	31.66	46.00	-14.34	Peak	VERTICAL
1	77.53	33.16	-9.17	23.99	40.00	-16.01	Peak	HORIZONTAL
2	121.18	33.56	-7.64	25.92	43.50	-17.58	Peak	HORIZONTAL
3	184.23	32.81	-6.65	26.16	43.50	-17.34	Peak	HORIZONTAL
4	395.69	30.12	-2.11	28.01	46.00	-17.99	Peak	HORIZONTAL
5	513.06	29.99	-0.36	29.63	46.00	-16.37	Peak	HORIZONTAL
6	622.67	28.51	1.75	30.26	46.00	-15.74	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)

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

Test Date 2020/11/09
Test By Weitin
Humidity 60 %

No	Freq MHz	Reading dBuV	Factor dB	Level dBuV/m	Limit dBuV/m	Over Limit dB	Remark	Pol V/H
1	4804.00	46.76	-7.42	39.34	74.00	-34.66	Peak	VERTICAL
2	7222.00	48.12	-1.08	47.04	74.00	-26.96	Peak	VERTICAL
1	4804.00	47.39	-7.42	39.97	74.00	-34.03	Peak	HORIZONTAL
2	7171.00	47.58	-1.18	46.40	74.00	-27.60	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.

Radiated Spurious Emission Measurement Result (above 1GHz)

Operation Mode	TX CH Mid	Test Date	2020/11/09
Fundamental Frequency	2441 MHz	Test By	Weitin
Temperature	25 °C	Humidity	60 %

No	Freq MHz	Reading dBuV	Factor dB	Level dBuV/m	Limit dBuV/m	Over Limit dB	Remark	Pol V/H
1	4882.00	46.92	-7.02	39.90	74.00	-34.10	Peak	VERTICAL
2	7001.00	47.24	-1.26	45.98	74.00	-28.02	Peak	VERTICAL
1	4882.00	46.90	-7.02	39.88	74.00	-34.12	Peak	HORIZONTAL
2	7171.00	47.30	-1.18	46.12	74.00	-27.88	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.

Radiated Spurious Emission Measurement Result (above 1GHz)

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

Test Date 2020/11/09
Test By Weitin
Humidity 60 %

No	Freq MHz	Reading dBuV	Factor dB	Level dBuV/m	Limit dBuV/m	Over Limit dB	Remark	Pol V/H
1	4960.00	47.12	-7.05	40.07	74.00	-33.93	Peak	VERTICAL
2	7409.00	46.99	-0.96	46.03	74.00	-27.97	Peak	VERTICAL
1	4960.00	48.75	-7.05	41.70	74.00	-32.30	Peak	HORIZONTAL
2	7001.00	47.84	-1.26	46.58	74.00	-27.42	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.

8. 100kHz Bandwidth of Band Edges Measurement

8.1 Standard Applicable:

According to §15.247(d), 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).

8.2 Measurement Equipment Used:

8.2.1. Conducted Emission at antenna port:

Refer to section 6.2 for details.

8.2.2. Radiated emission:

Refer to section 7.2 for details.

8.3 Test SET-UP:

Refer to section 7.3 for details.

8.4 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.

8.5 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	

8.6 Measurement Result:

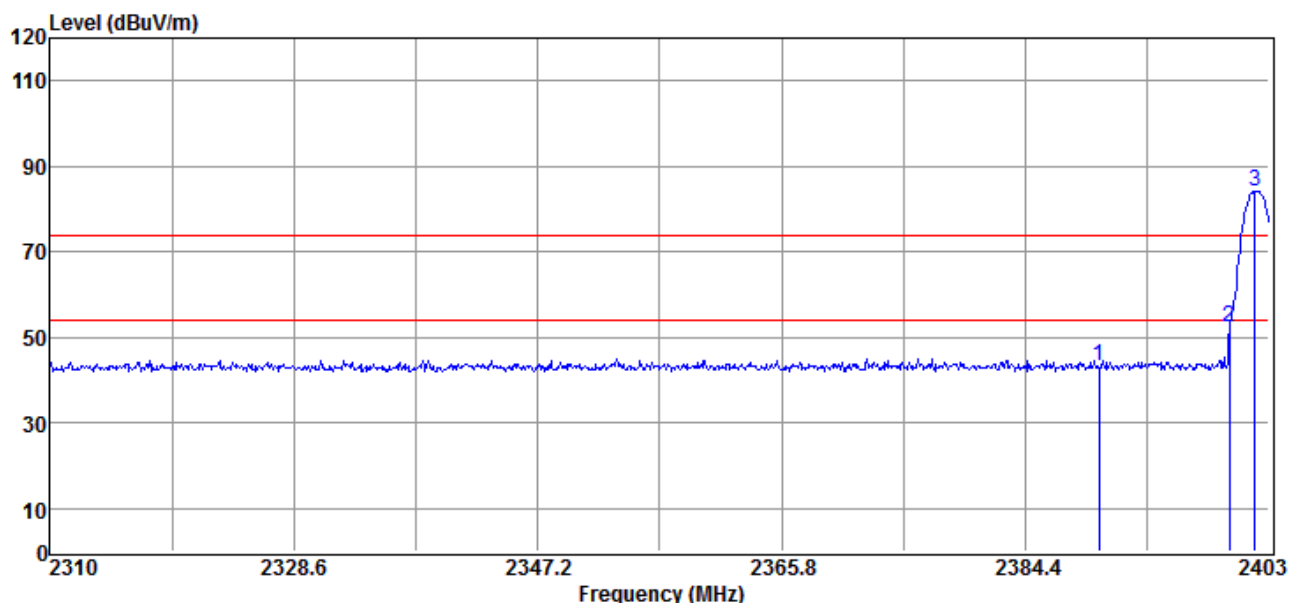
Note: Refer to next page spectrum analyzer data chart and tabular data sheets.

Non-hopping mode:

Radiated Emission: (BDR mode)

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

Test Date 2020/11/09
Test By Weitin
Humidity 60 %

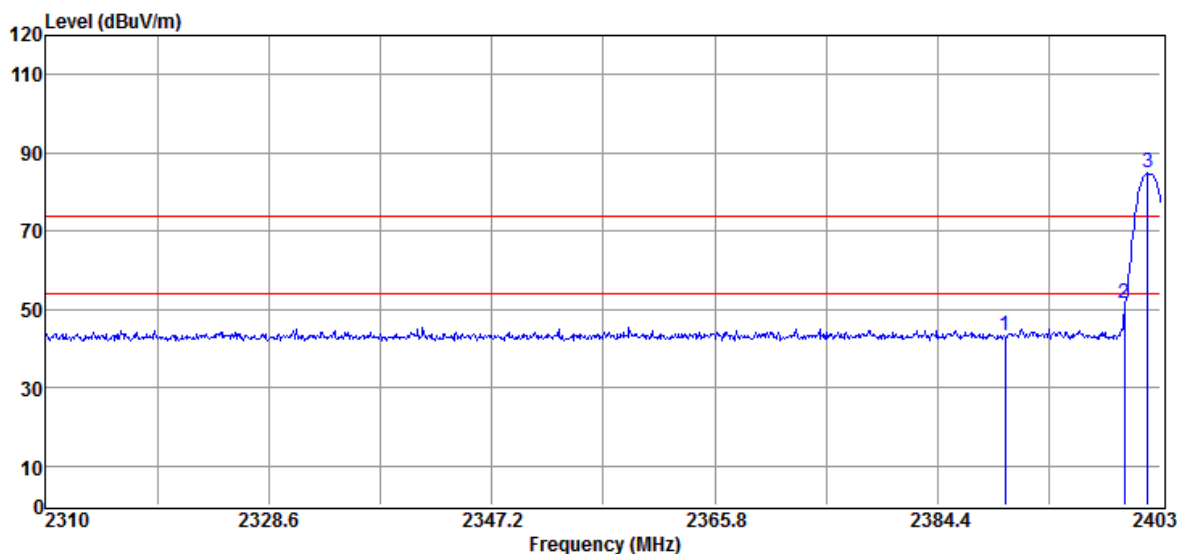


No	Freq MHz	Reading dBuV	Factor dB/m	Level dBuV/m	Limit dBuV/m	Margin dB	Remark	Pol V/H
1	2390.00	59.25	-16.15	43.10	74.00	-30.90	Peak	VERTICAL
2	2400.00	68.65	-16.12	52.53	64.04	-11.51	Peak	VERTICAL
3	2401.88	100.15	-16.11	84.04	F	--	Peak	VERTICAL

Remark:

- 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.
- 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.
- Spectrum Peak mode IF bandwidth Setting : 1GHz- 26GHz, RBW= 1MHz, Sweep time= 200 ms., the VBW setting was 3 MHz.
- Spectrum AV mode if bandwidth Setting : 1GHz- 26GHz, RBW= 1MHz, VBW $\geq$ 1/Ton, 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	59.54	-16.15	43.39	74.00	-30.61	Peak	HORIZONTAL
2	2400.00	67.83	-16.12	51.71	64.76	-13.05	Peak	HORIZONTAL
3	2401.88	100.87	-16.11	84.76	F	--	Peak	HORIZONTAL

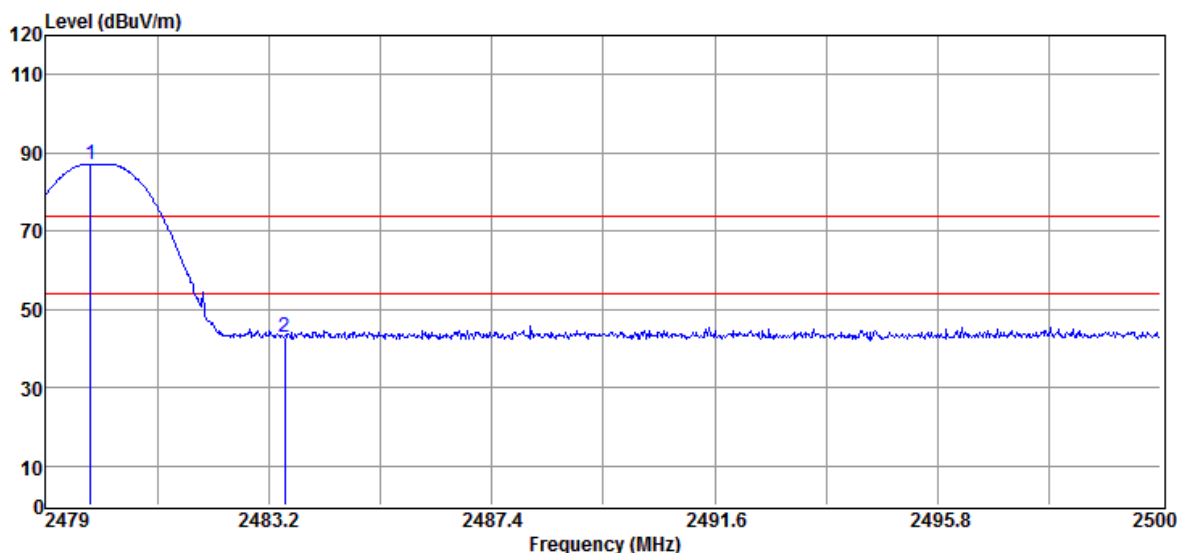
Remark:

- 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 $\geq 1/\text{Ton}$, Sweep time= 200 ms.

Note: “F” denotes fundamental frequency

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

Test Date 2020/11/09
Test By Weitin
Humidity 60 %

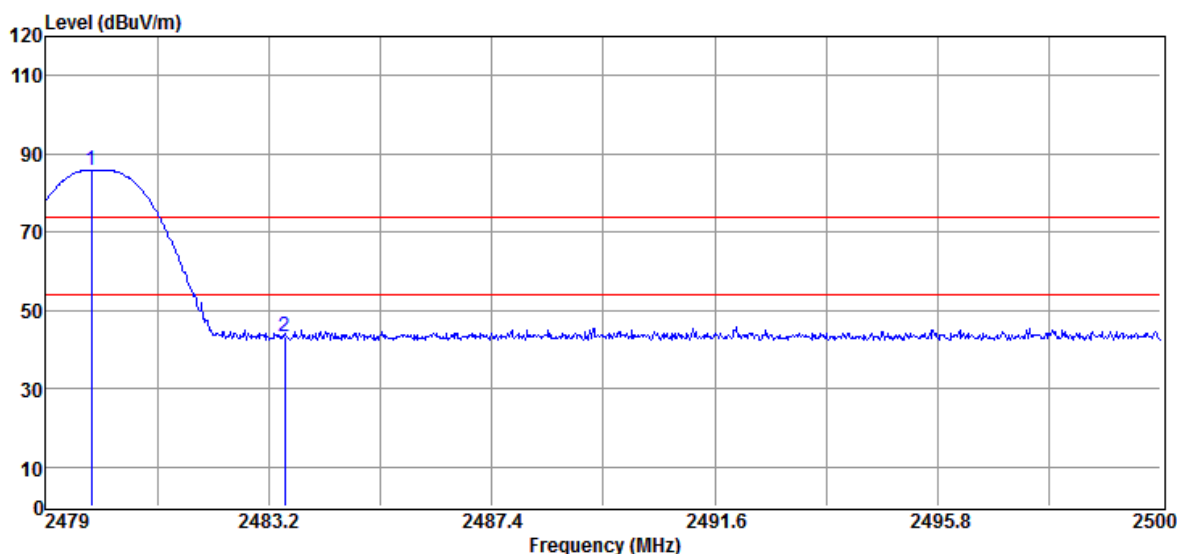


No	Freq MHz	Reading dBUV	Factor dB/m	Level dBUV/m	Limit dBUV/m	Margin dB	Remark	Pol V/H
1	2479.84	103.19	-16.00	87.19	F	--	Peak	VERTICAL
2	2483.50	58.73	-15.99	42.74	74.00	-31.26	Peak	VERTICAL

Remark:

- 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.
- 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.
- Spectrum Peak mode IF bandwidth Setting : 1GHz- 26GHz, RBW= 1MHz, Sweep time= 200 ms., the VBW setting was 3 MHz.
- Spectrum AV mode if bandwidth Setting : 1GHz- 26GHz, RBW= 1MHz, VBW $\geq 1/\text{Ton}$, 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	2479.86	101.95	-16.00	85.95	F	--	Peak	HORIZONTAL
2	2483.50	59.48	-15.99	43.49	74.00	-30.51	Peak	HORIZONTAL

Remark:

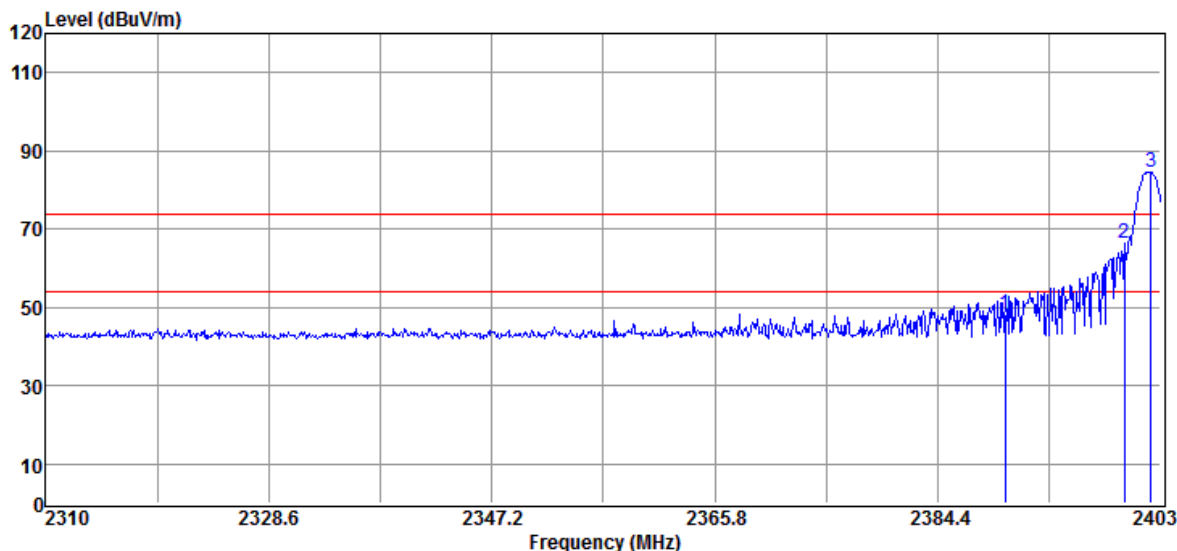
- 1 Field strength limits for frequency above 1000MHz are based on average limits. However, Peak mode field strength shall not exceed the average limits specified plus 20dB.
- 2 Measurement of data within this frequency range shown “ - ” in the table above means the reading of emissions are attenuated 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 $\geq 1/\text{Ton}$, Sweep time= 200 ms.

Note: “F” denotes fundamental frequency

Radiated Emission (EDR 2M mode):

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

Test Date 2020/11/09
Test By Weitin
Humidity 60 %

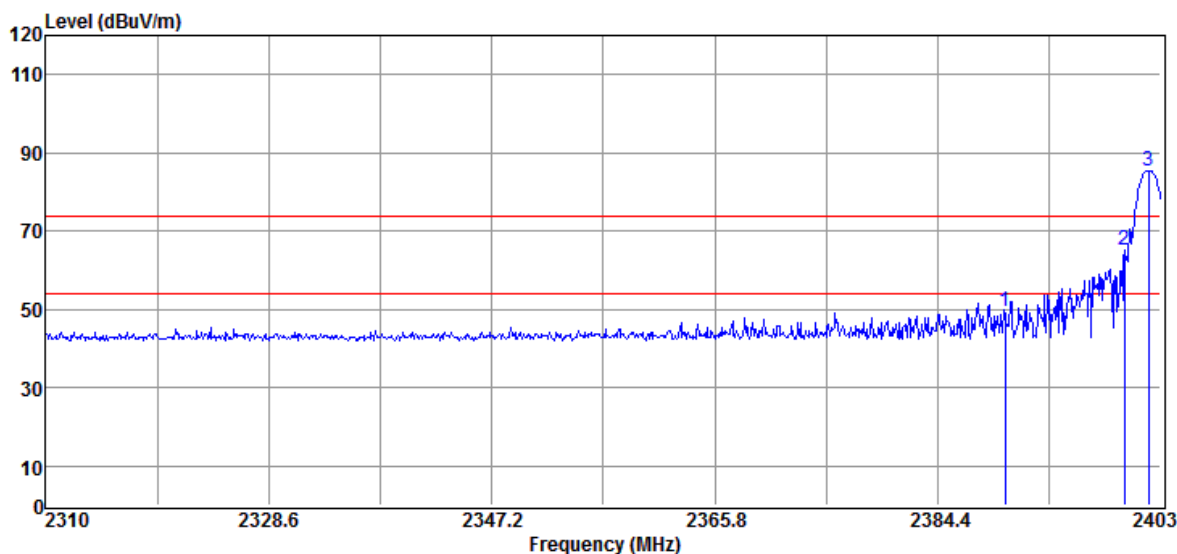


No	Freq MHz	Reading dBuV	Factor dB/m	Level dBuV/m	Limit dBuV/m	Margin dB	Remark	Pol V/H
1	2390.00	64.39	-16.15	48.24	74.00	-25.76	Peak	VERTICAL
2	2400.00	80.19	-16.12	64.07	64.44	-0.37	Peak	VERTICAL
3	2402.16	100.55	-16.11	84.44	F	--	Peak	VERTICAL

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 $\geq 1/\text{Ton}$, 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	65.60	-16.15	49.45	74.00	-24.55	Peak	HORIZONTAL
2	2400.00	81.36	-16.12	65.24	65.40	-0.16	Peak	HORIZONTAL
3	2401.98	101.51	-16.11	85.40	F	--	Peak	HORIZONTAL

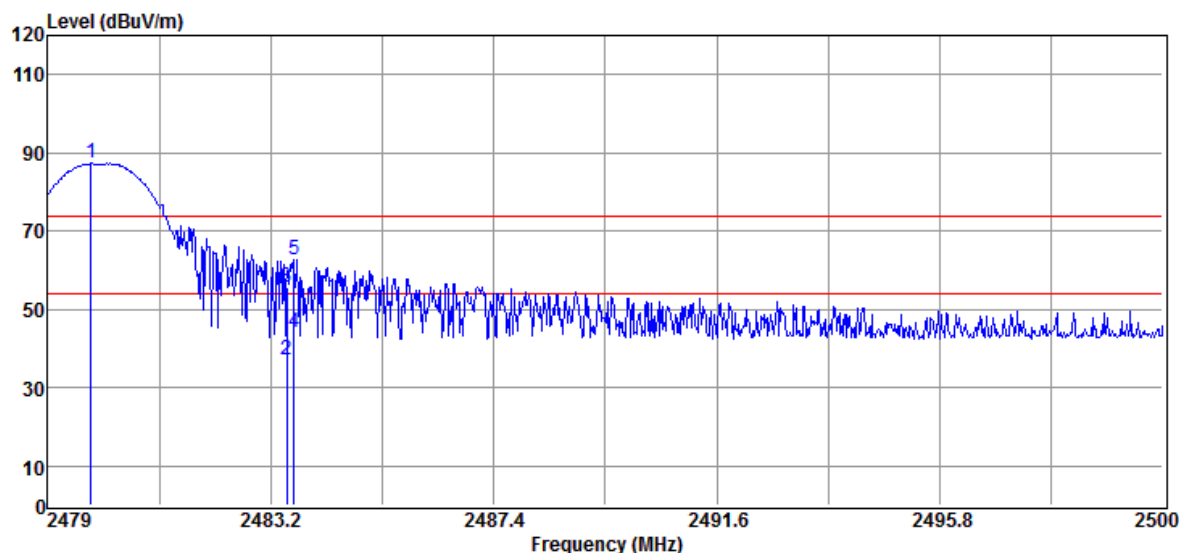
Remark:

- 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 $\geq$ 1/Ton, Sweep time= 200 ms.

Note: “F” denotes fundamental frequency

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

Test Date 2020/11/09
Test By Weitin
Humidity 60 %

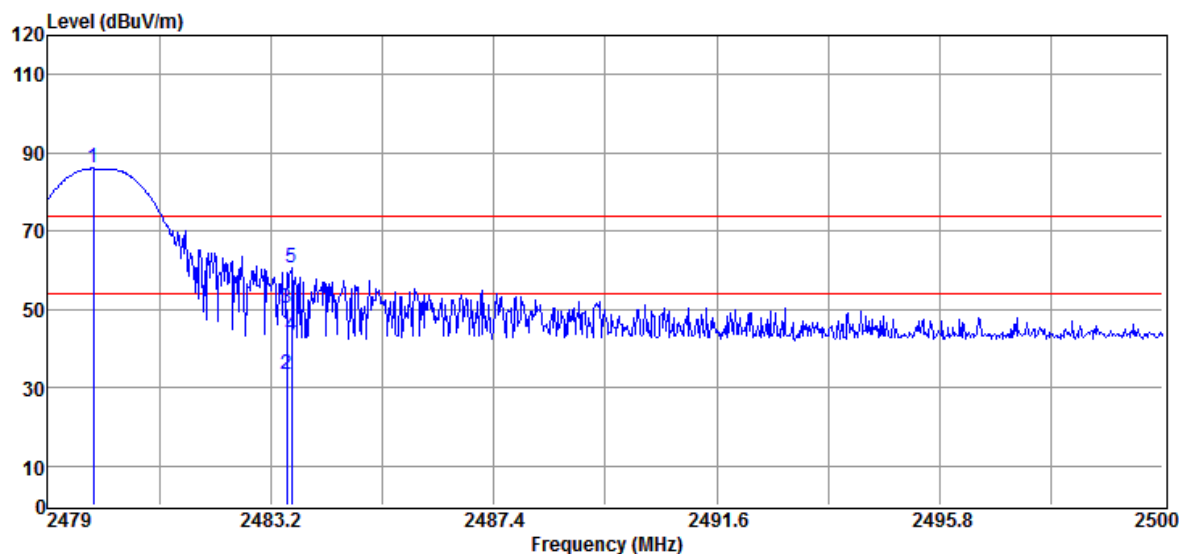


No	Freq MHz	Reading dBuV	Factor dB/m	Level dBuV/m	Limit dBuV/m	Margin dB	Remark	Pol V/H
1	2479.82	103.25	-16.00	87.25	F	--	Peak	VERTICAL
2	2483.50	53.24	-15.99	37.25	54.00	-16.75	Average	VERTICAL
3	2483.50	71.60	-15.99	55.61	74.00	-18.39	Peak	VERTICAL
4	2483.64	60.25	-15.99	44.26	54.00	-9.74	Average	VERTICAL
5	2483.64	78.59	-15.99	62.60	74.00	-11.40	Peak	VERTICAL

Remark:

- 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.
- 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.
- Spectrum Peak mode IF bandwidth Setting : 1GHz- 26GHz, RBW= 1MHz, Sweep time= 200 ms., the VBW setting was 3 MHz.
- Spectrum AV mode if bandwidth Setting : 1GHz- 26GHz, RBW= 1MHz, VBW $\geq 1/\text{Ton}$, 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	2479.86	102.01	-16.00	86.01	F	--	Peak	HORIZONTAL
2	2483.50	49.35	-15.99	33.36	54.00	-20.64	Average	HORIZONTAL
3	2483.50	66.21	-15.99	50.22	74.00	-23.78	Peak	HORIZONTAL
4	2483.60	59.24	-15.99	43.25	54.00	-10.75	Average	HORIZONTAL
5	2483.60	76.61	-15.99	60.62	74.00	-13.38	Peak	HORIZONTAL

Remark:

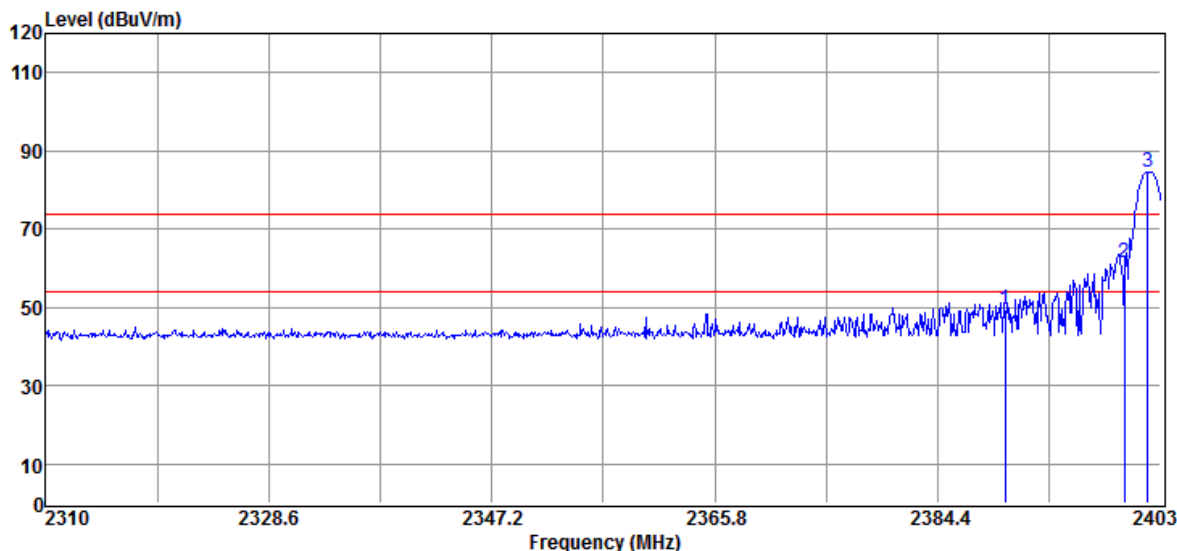
- 1 Field strength limits for frequency above 1000MHz are based on average limits. However, Peak mode field strength shall not exceed the average limits specified plus 20dB.
- 2 Measurement of data within this frequency range shown “ - ” in the table above means the reading of emissions are attenuated 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 $\geq$ 1/Ton, Sweep time= 200 ms.

Note: “F” denotes fundamental frequency

Radiated Emission (EDR 3M mode):

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

Test Date 2020/11/09
Test By Weitin
Humidity 60 %

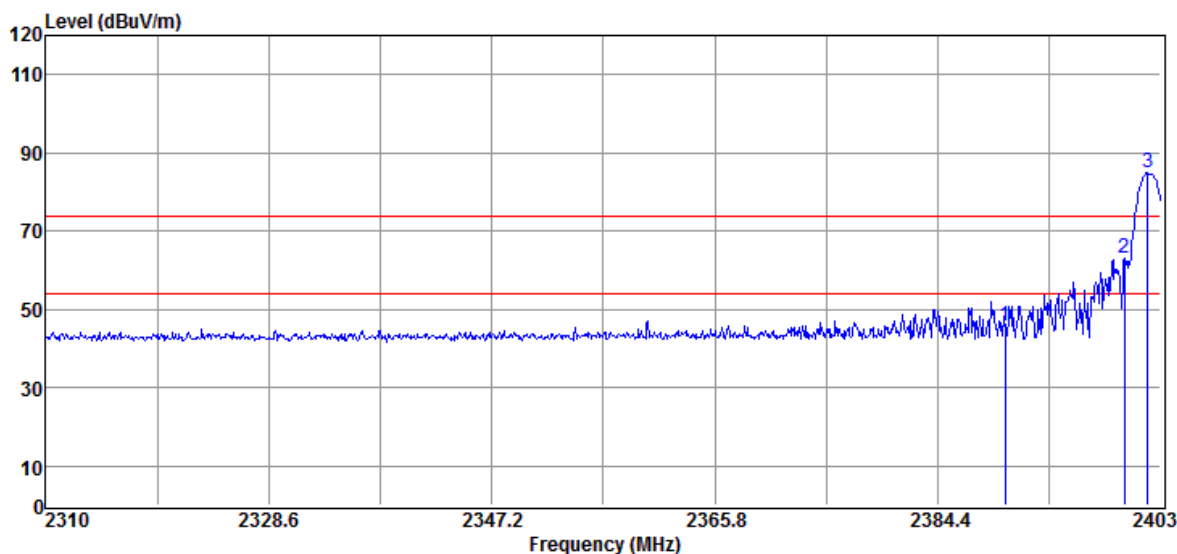


No	Freq MHz	Reading dBuV	Factor dB/m	Level dBuV/m	Limit dBuV/m	Margin dB	Remark	Pol V/H
1	2390.00	65.71	-16.15	49.56	74.00	-24.44	Peak	VERTICAL
2	2400.00	77.74	-16.12	61.62	64.62	-3.00	Peak	VERTICAL
3	2401.88	100.73	-16.11	84.62	F	--	Peak	VERTICAL

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 $\geq$ 1/Ton, 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	62.02	-16.15	45.87	74.00	-28.13	Peak	HORIZONTAL
2	2400.00	79.02	-16.12	62.90	64.81	-1.91	Peak	HORIZONTAL
3	2401.88	100.92	-16.11	84.81	F	--	Peak	HORIZONTAL

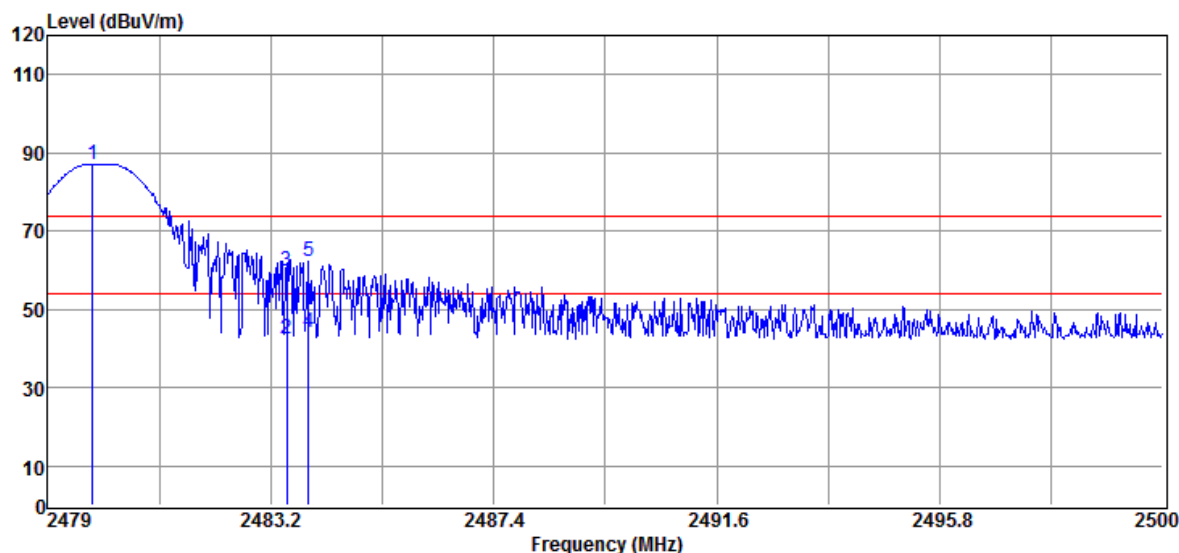
Remark:

- 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 $\geq 1/\text{Ton}$, Sweep time= 200 ms.

Note: “F” denotes fundamental frequency

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

Test Date 2020/11/09
Test By Weitin
Humidity 60 %

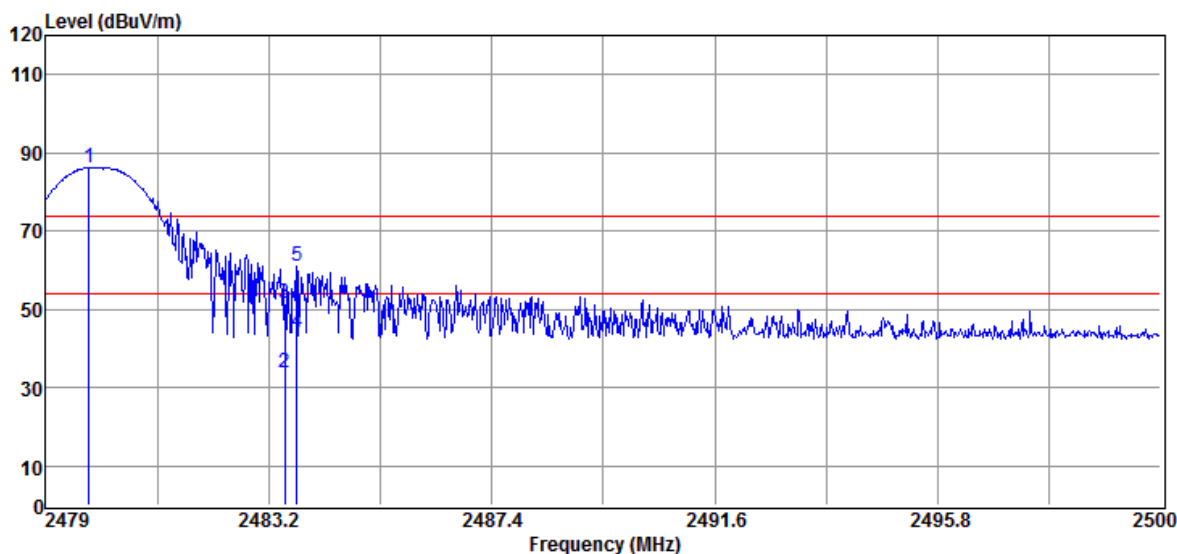


No	Freq MHz	Reading dBUV	Factor dB/m	Level dBUV/m	Limit dBUV/m	Margin dB	Remark	Pol V/H
1	2479.84	103.21	-16.00	87.21	F	--	Peak	VERTICAL
2	2483.50	58.45	-15.99	42.46	54.00	-11.54	Average	VERTICAL
3	2483.50	75.94	-15.99	59.95	74.00	-14.05	Peak	VERTICAL
4	2483.91	60.26	-15.99	44.27	54.00	-9.73	Average	VERTICAL
5	2483.91	78.15	-15.99	62.16	74.00	-11.84	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 $\geq 1/\text{Ton}$, 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	2479.82	102.10	-16.00	86.10	F	--	Peak	HORIZONTAL
2	2483.50	49.85	-15.99	33.86	54.00	-20.14	Average	HORIZONTAL
3	2483.50	67.45	-15.99	51.46	74.00	-22.54	Peak	HORIZONTAL
4	2483.73	60.29	-15.99	44.30	54.00	-9.70	Average	HORIZONTAL
5	2483.73	77.15	-15.99	61.16	74.00	-12.84	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 $\geq 1/\text{Ton}$, Sweep time= 200 ms.

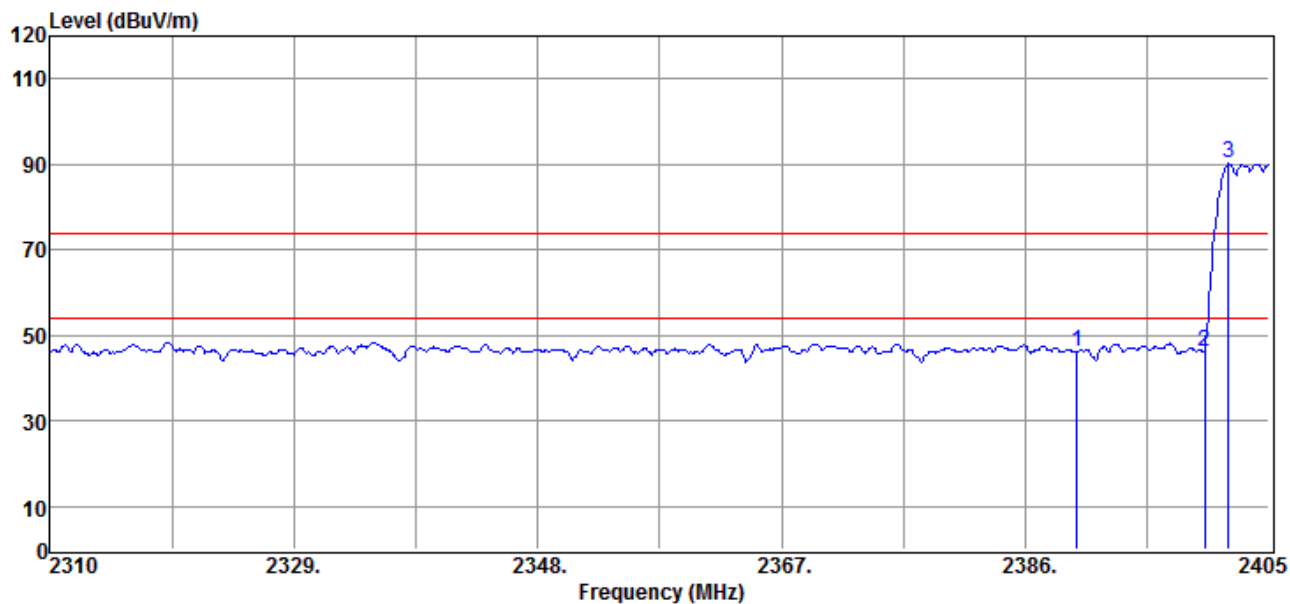
Note: “F” denotes fundamental frequency

Hopping mode:

Radiated Emission: (BDR mode)

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

Test Date 2020/11/12
Test By Weitin
Humidity 60 %

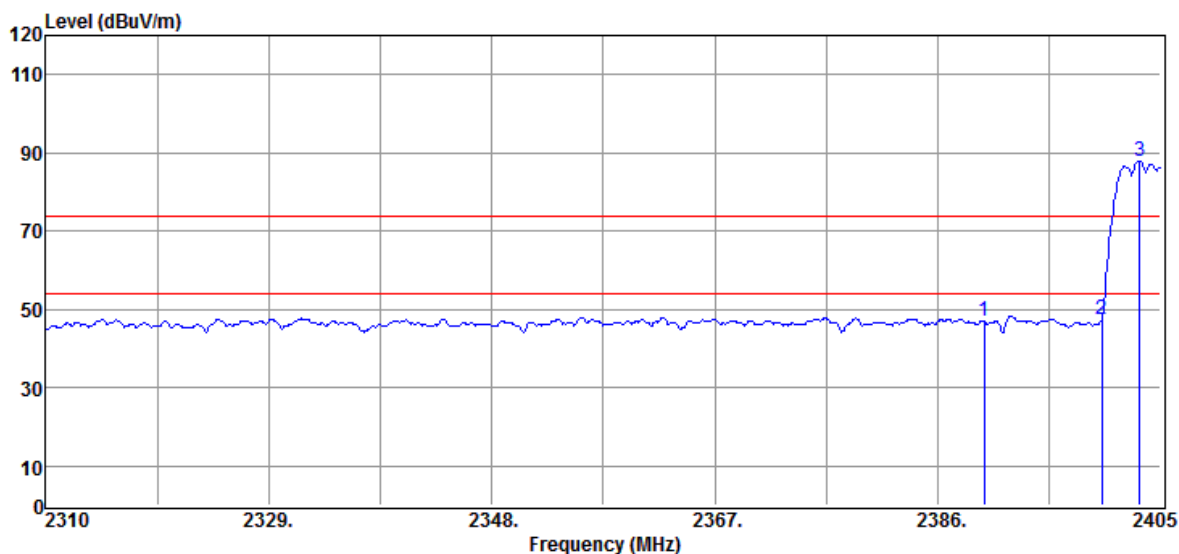


No	Freq MHz	Reading dBuV	Factor dB/m	Level dBuV/m	Limit dBuV/m	Margin dB	Remark	Pol V/H
1	2390.00	57.44	-11.43	46.01	74.00	-27.99	Peak	VERTICAL
2	2400.00	57.53	-11.42	46.11	74.00	-27.89	Peak	VERTICAL
3	2401.87	101.52	-11.41	90.11	F	--	Peak	VERTICAL

Remark:

- 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.
- 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.
- Spectrum Peak mode IF bandwidth Setting : 1GHz- 26GHz, RBW= 1MHz, Sweep time= 200 ms., the VBW setting was 3 MHz.
- Spectrum AV mode if bandwidth Setting : 1GHz- 26GHz, RBW= 1MHz, VBW $\geq 1/\text{Ton}$, 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	2389.99	58.29	-11.43	46.86	74.00	-27.14	Peak	HORIZONTAL
2	2400.00	58.66	-11.42	47.24	74.00	-26.76	Peak	HORIZONTAL
3	2403.20	99.38	-11.41	87.97	F	--	Peak	HORIZONTAL

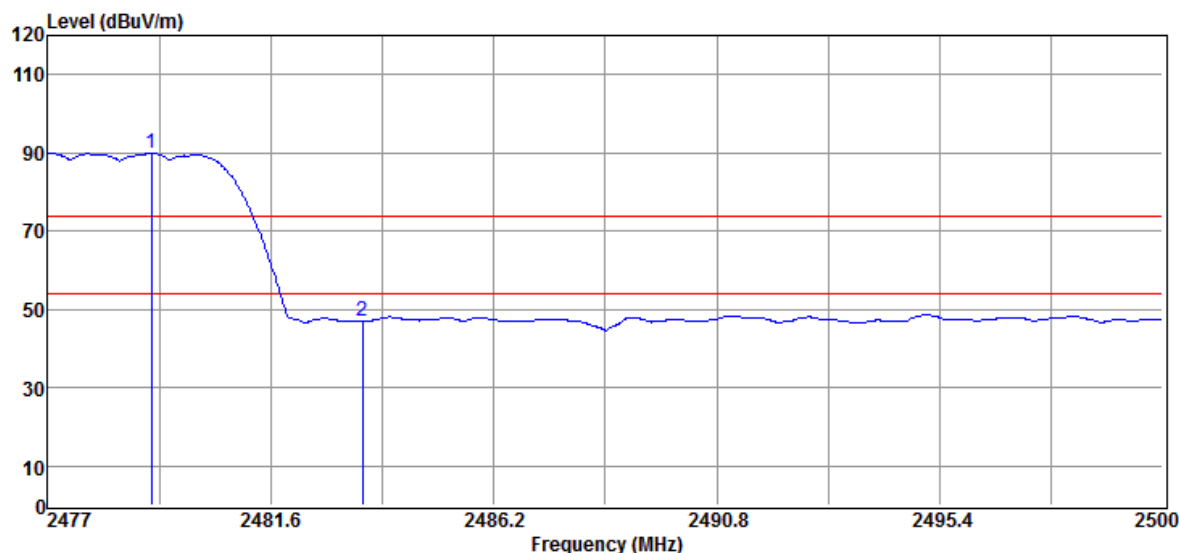
Remark:

- 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 $\geq 1/\text{Ton}$, Sweep time= 200 ms.

Note: “F” denotes fundamental frequency

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

Test Date 2020/11/12
Test By Weitin
Humidity 60 %

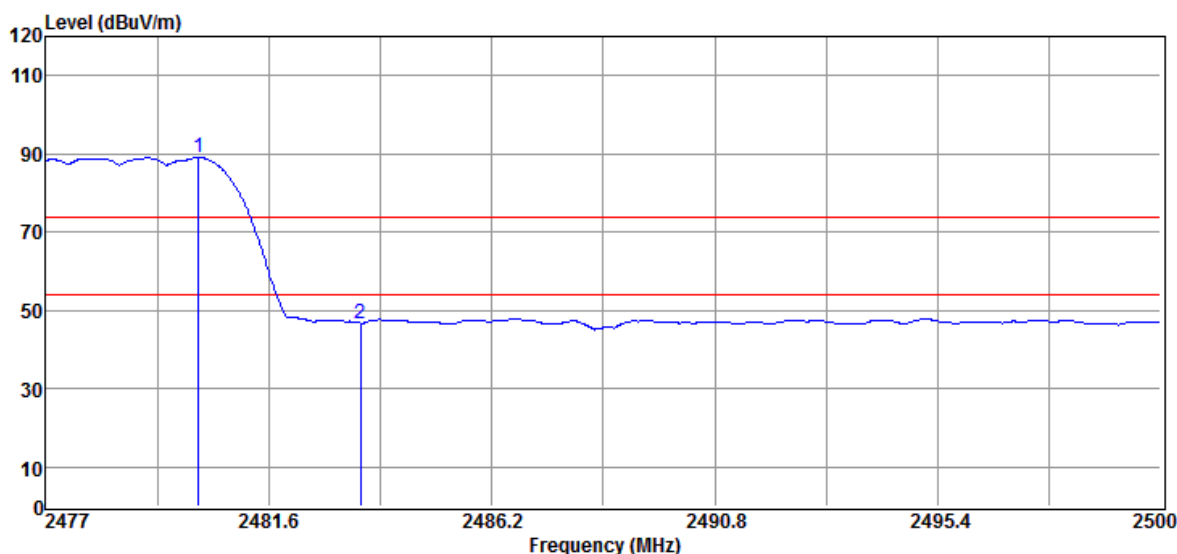


No	Freq MHz	Reading dBUV	Factor dB/m	Level dBUV/m	Limit dBUV/m	Margin dB	Remark	Pol V/H
1	2479.14	101.17	-11.30	89.87	F	--	Peak	VERTICAL
2	2483.50	58.14	-11.29	46.85	74.00	-27.15	Peak	VERTICAL

Remark:

- 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.
- 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.
- Spectrum Peak mode IF bandwidth Setting : 1GHz- 26GHz, RBW= 1MHz, Sweep time= 200 ms., the VBW setting was 3 MHz.
- Spectrum AV mode if bandwidth Setting : 1GHz- 26GHz, RBW= 1MHz, VBW $\geq 1/\text{Ton}$, 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	2480.15	100.38	-11.30	89.08	F	--	Peak	HORIZONTAL
2	2483.50	58.04	-11.29	46.75	74.00	-27.25	Peak	HORIZONTAL

Remark:

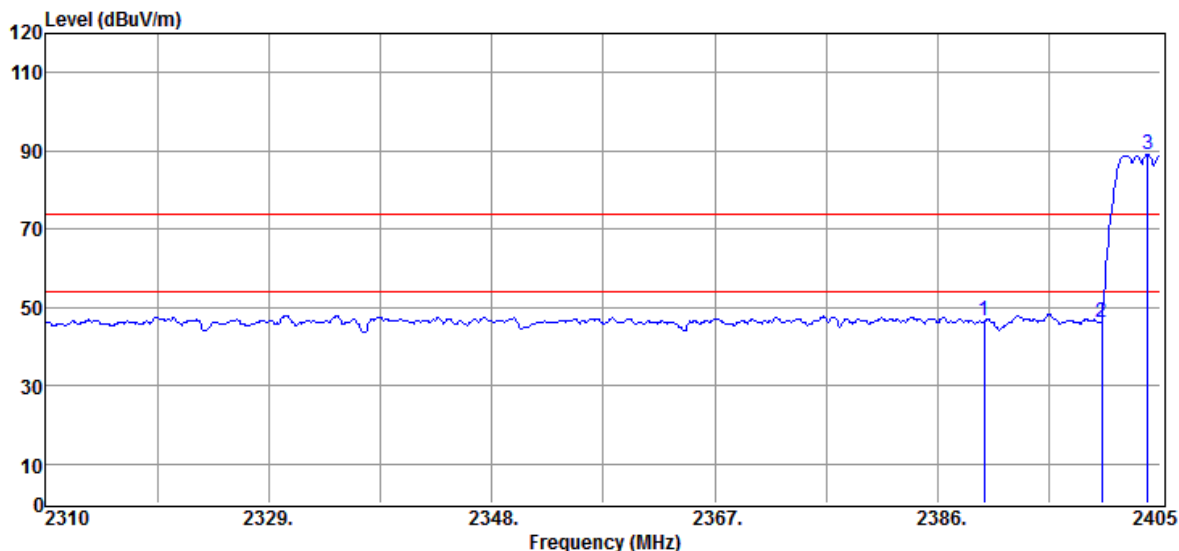
- 1 Field strength limits for frequency above 1000MHz are based on average limits. However, Peak mode field strength shall not exceed the average limits specified plus 20dB.
- 2 Measurement of data within this frequency range shown “ - ” in the table above means the reading of emissions are attenuated 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 $\geq 1/\text{Ton}$, Sweep time= 200 ms.

Note: “F” denotes fundamental frequency

Radiated Emission (EDR 2M mode):

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

Test Date 2020/11/12
Test By Weitin
Humidity 60 %

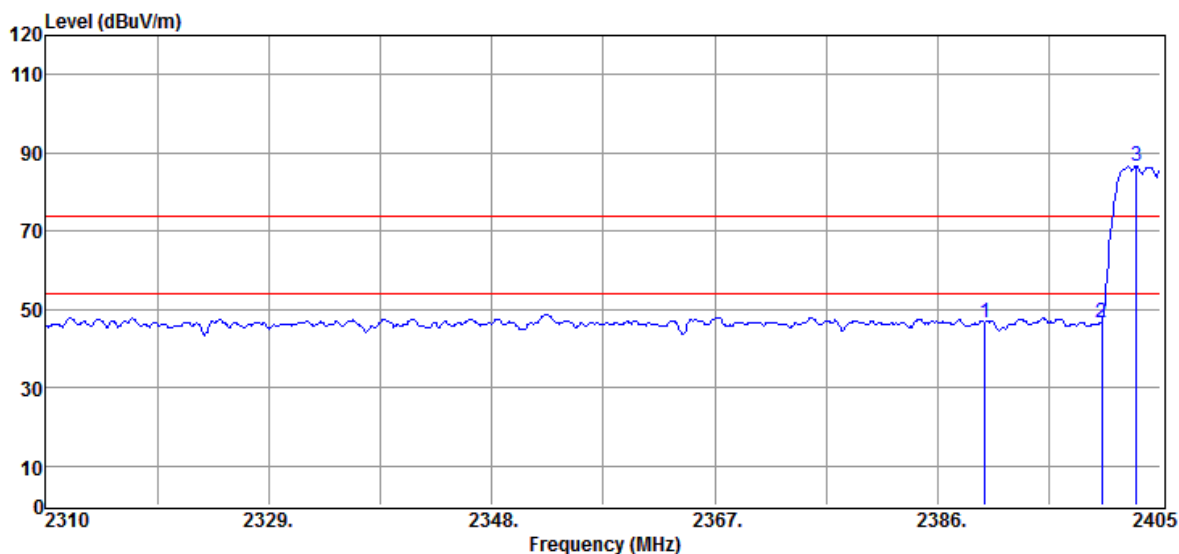


No	Freq MHz	Reading dBuV	Factor dB/m	Level dBuV/m	Limit dBuV/m	Margin dB	Remark	Pol V/H
1	2389.99	57.97	-11.43	46.54	74.00	-27.46	Peak	VERTICAL
2	2400.00	57.60	-11.42	46.18	74.00	-27.82	Peak	VERTICAL
3	2403.86	100.66	-11.41	89.25	F	--	Peak	VERTICAL

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 $\geq$ 1/Ton, 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	58.19	-11.43	46.76	74.00	-27.24	Peak	HORIZONTAL
2	2400.00	58.21	-11.42	46.79	74.00	-27.21	Peak	HORIZONTAL
3	2402.91	97.96	-11.41	86.55	F	--	Peak	HORIZONTAL

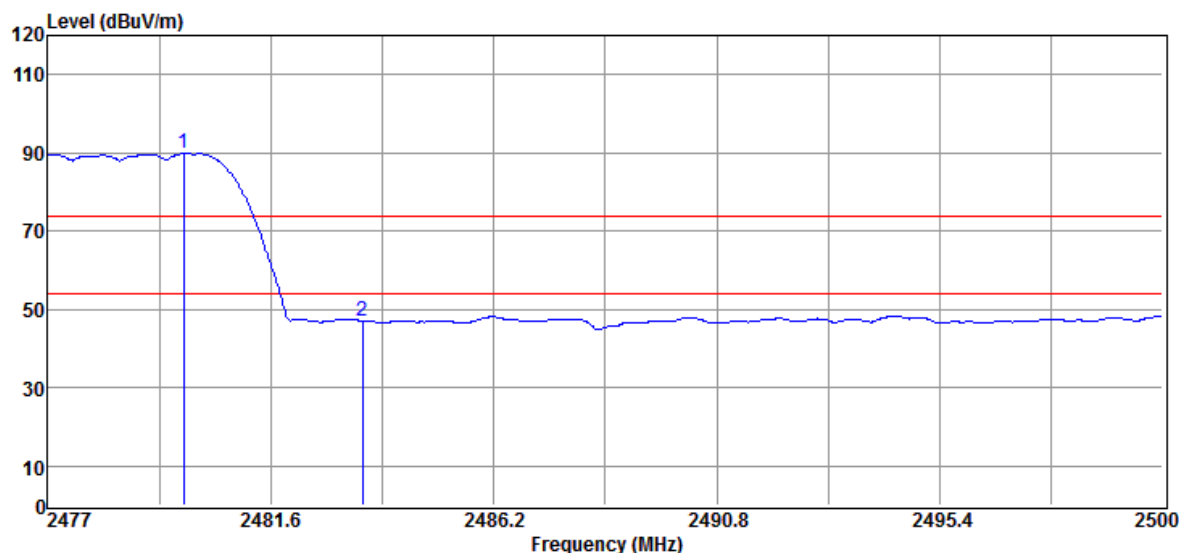
Remark:

- 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 $\geq 1/\text{Ton}$, Sweep time= 200 ms.

Note: “F” denotes fundamental frequency

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

Test Date 2020/11/12
Test By Weitin
Humidity 60 %

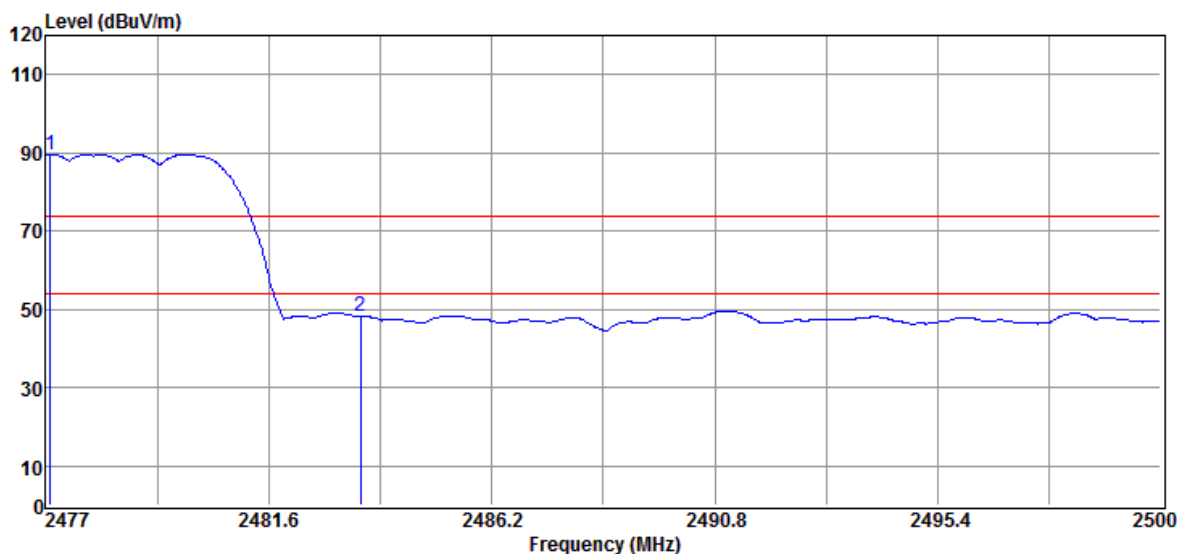


No	Freq MHz	Reading dBUV	Factor dB/m	Level dBUV/m	Limit dBUV/m	Margin dB	Remark	Pol V/H
1	2479.81	101.09	-11.30	89.79	F	--	Peak	VERTICAL
2	2483.50	58.25	-11.29	46.96	74.00	-27.04	Peak	VERTICAL

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 $\geq 1/\text{Ton}$, 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	2477.09	100.90	-11.31	89.59	F	--	Peak	HORIZONTAL
2	2483.50	59.49	-11.29	48.20	74.00	-25.80	Peak	HORIZONTAL

Remark:

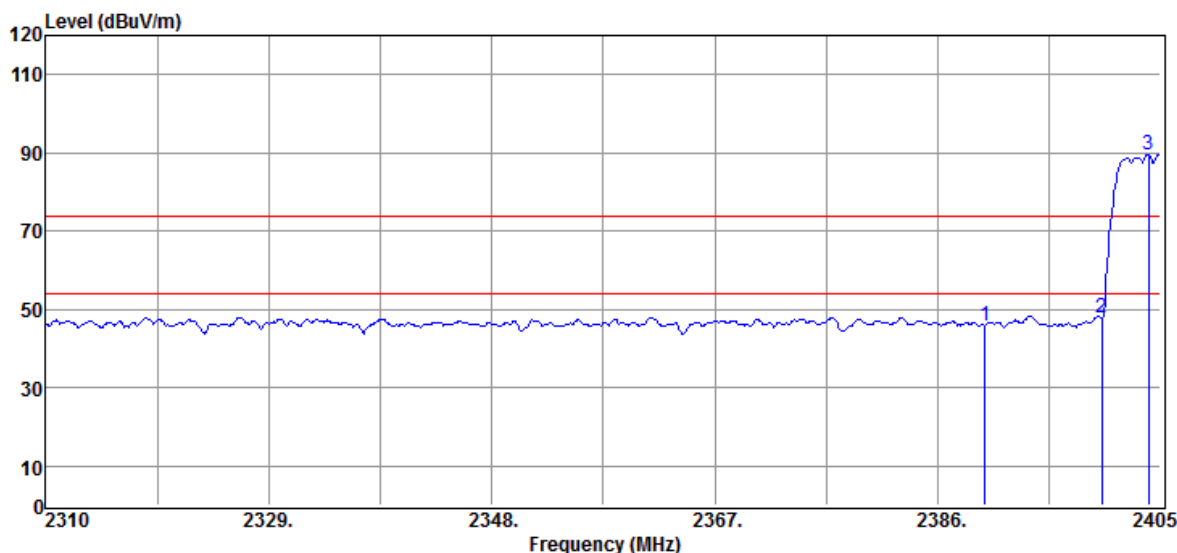
- 1 Field strength limits for frequency above 1000MHz are based on average limits. However, Peak mode field strength shall not exceed the average limits specified plus 20dB.
- 2 Measurement of data within this frequency range shown “ - ” in the table above means the reading of emissions are attenuated 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 $\geq 1/\text{Ton}$, Sweep time= 200 ms.

Note: “F” denotes fundamental frequency

Radiated Emission (EDR 3M mode):

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

Test Date 2020/11/12
Test By Weitin
Humidity 60 %

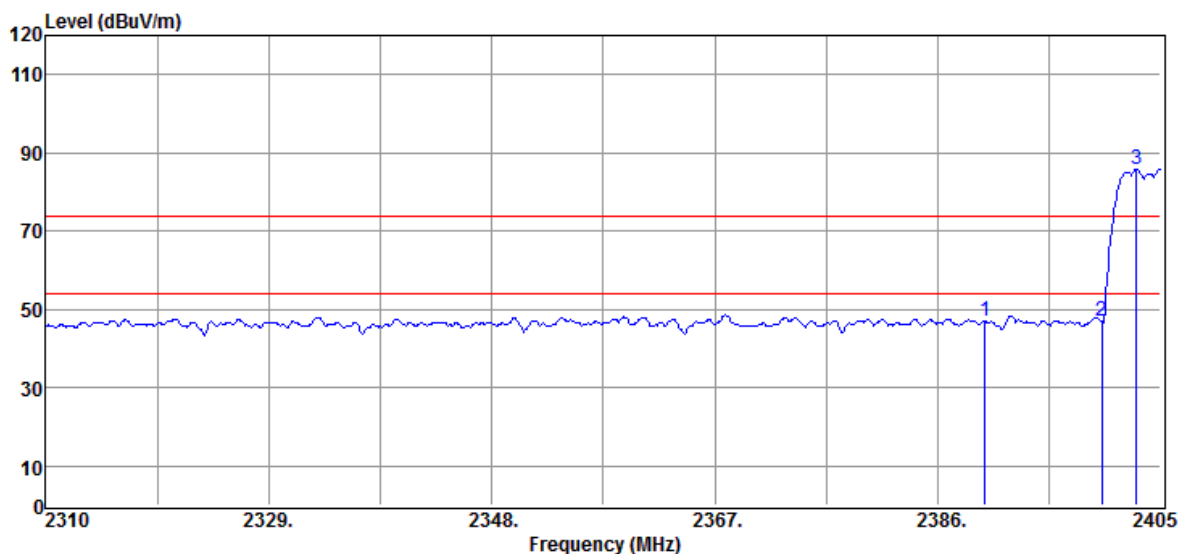


No	Freq MHz	Reading dBuV	Factor dB/m	Level dBuV/m	Limit dBuV/m	Margin dB	Remark	Pol V/H
1	2390.00	57.24	-11.43	45.81	74.00	-28.19	Peak	VERTICAL
2	2400.00	59.15	-11.42	47.73	74.00	-26.27	Peak	VERTICAL
3	2403.96	101.01	-11.41	89.60	F	--	Peak	VERTICAL

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 $\geq$ 1/Ton, 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	58.37	-11.43	46.94	74.00	-27.06	Peak	HORIZONTAL
2	2400.00	58.32	-11.42	46.90	74.00	-27.10	Peak	HORIZONTAL
3	2402.91	97.38	-11.41	85.97	F	--	Peak	HORIZONTAL

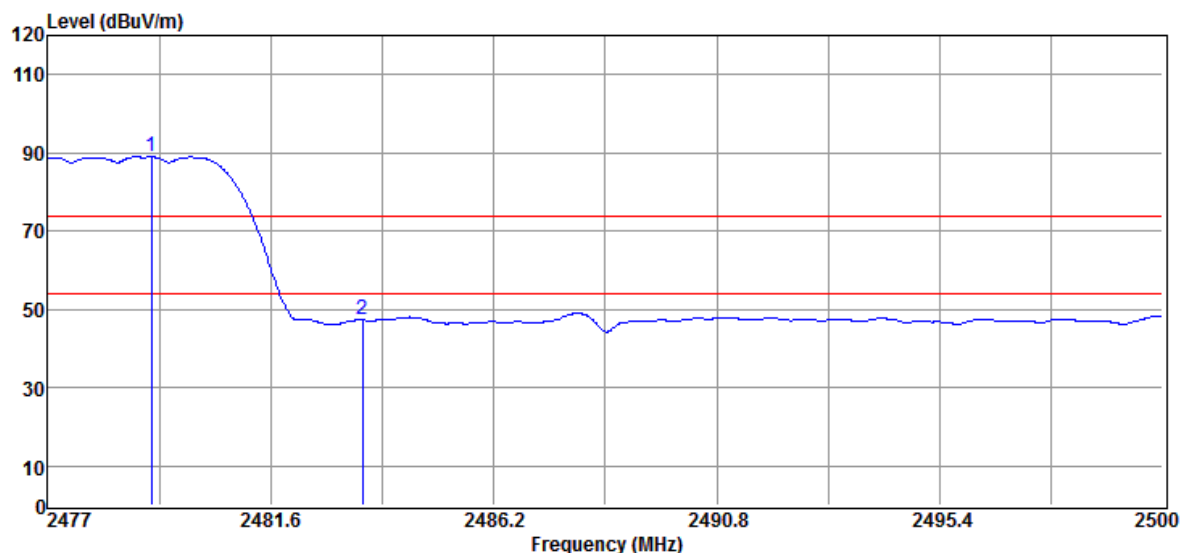
Remark:

- 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 $\geq 1/\text{Ton}$, Sweep time= 200 ms.

Note: “F” denotes fundamental frequency

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

Test Date 2020/11/12
Test By Weitin
Humidity 60 %

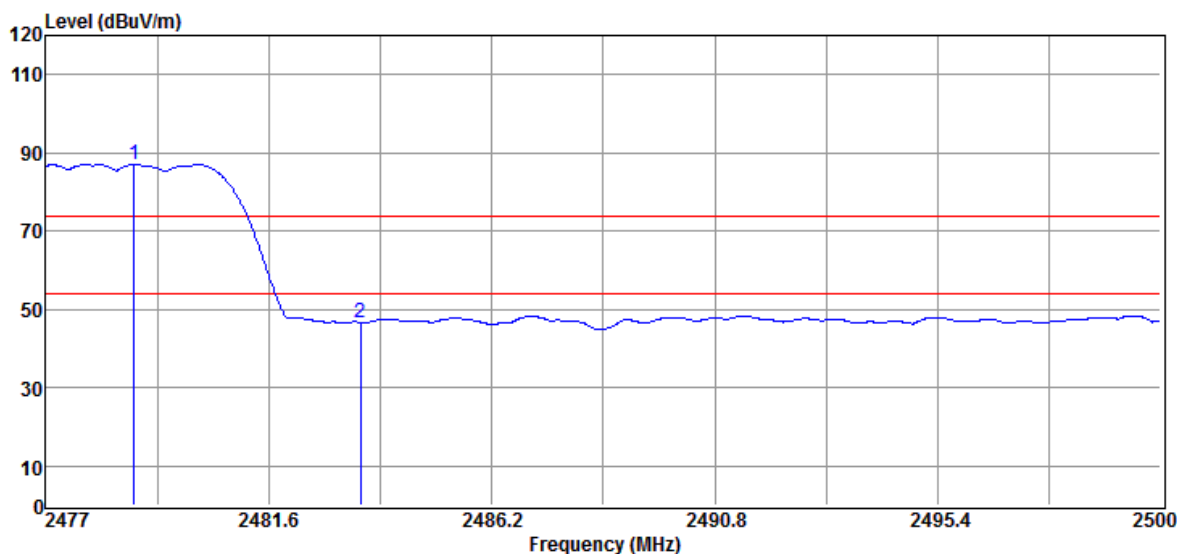


No	Freq MHz	Reading dBUV	Factor dB/m	Level dBUV/m	Limit dBUV/m	Margin dB	Remark	Pol V/H
1	2479.14	100.27	-11.30	88.97	F	--	Peak	VERTICAL
2	2483.50	58.54	-11.29	47.25	74.00	-26.75	Peak	VERTICAL

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 $\geq 1/\text{Ton}$, 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	2478.82	98.33	-11.30	87.03	F	--	Peak	HORIZONTAL
2	2483.50	58.01	-11.29	46.72	74.00	-27.28	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 $\geq 1/\text{Ton}$, Sweep time= 200 ms.

Note: “F” denotes fundamental frequency

9. FREQUENCY SEPARATION

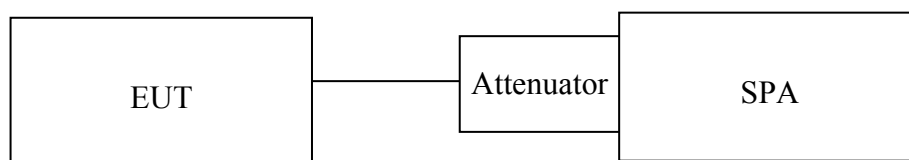
9.1 Standard Applicable:

According to §15.247(a)(1), Frequency hopping systems shall have hopping channel carrier frequencies separated by minimum of 25kHz or the 20dB bandwidth of the hopping channel, whichever is greater.

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 3.0 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	$\geq 25\text{kHz}$ or 2/3 times 20dB bandwidth	PASS

Note: Refer to next page for plots.

Frequency Separation Test Data Low



Mid



High



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.

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:

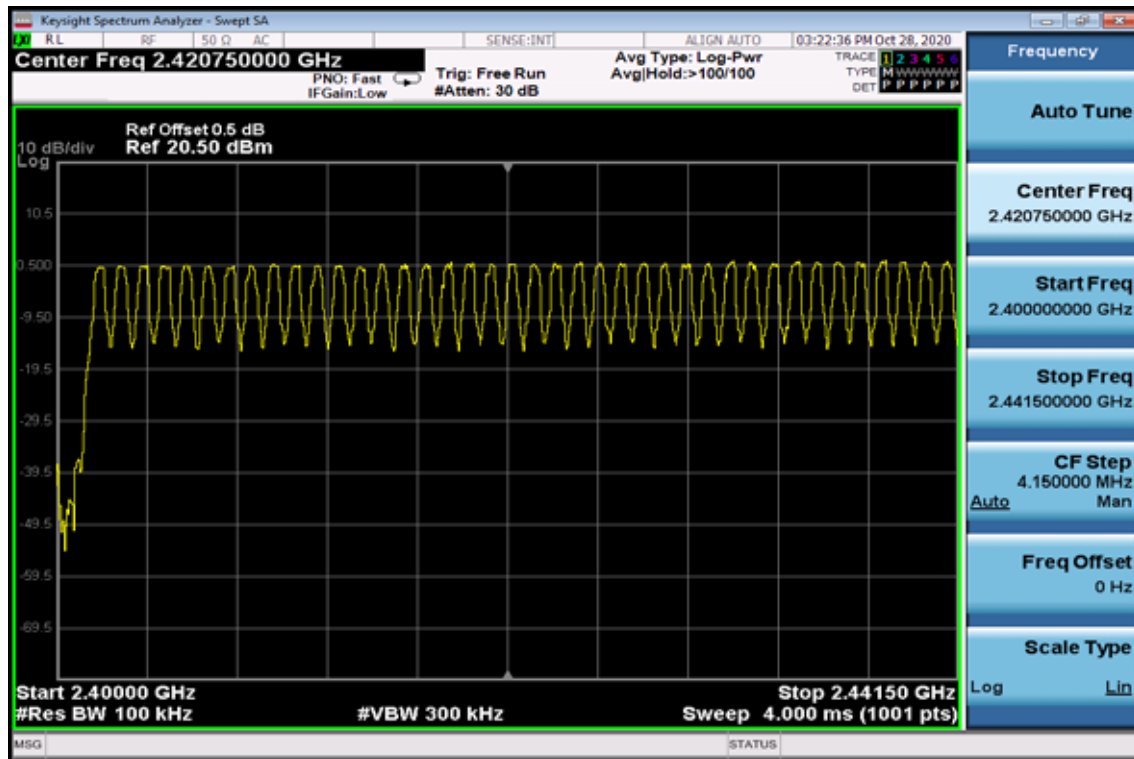
1. Place the EUT on the table and set it in transmitting mode.
2. Remove the antenna from the EUT and then connect a low loss RF cable from the antenna port to the spectrum analyzer.
3. Set spectrum analyzer Start=2400MHz, Stop = 2441.5MHz and Start=2441.5MHz, Stop = 2483.5MHz, Sweep = auto.
4. Set the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

10.5 Measurement Result:

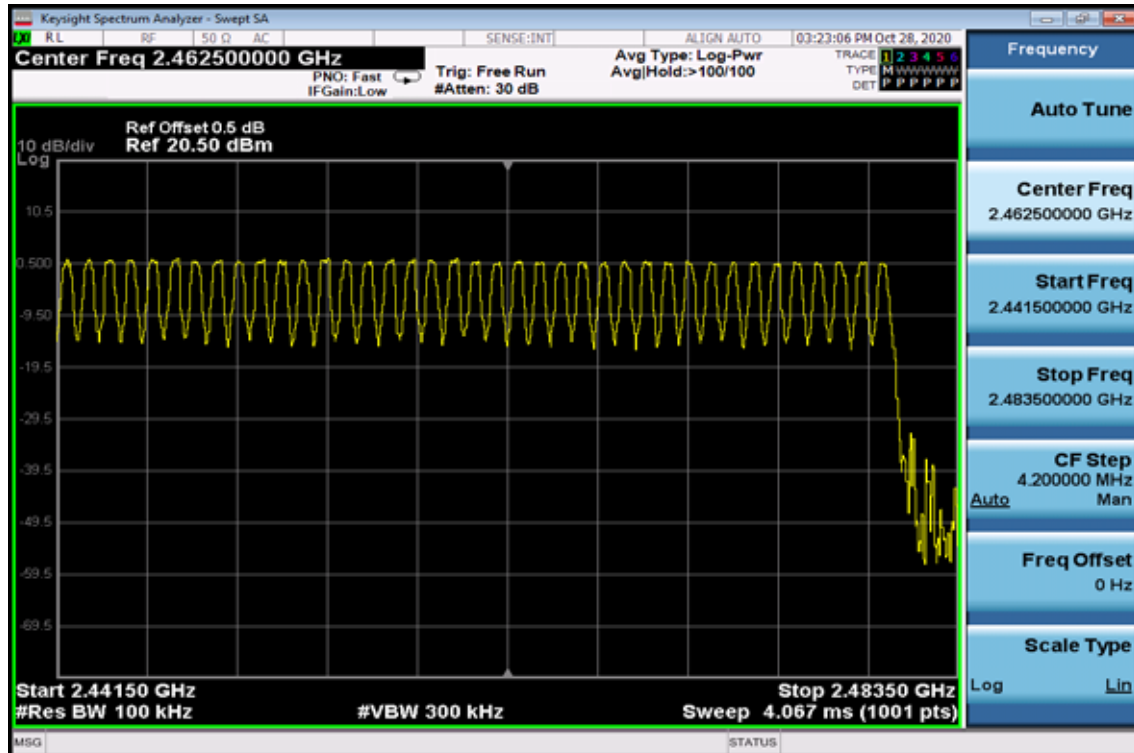
Note: Refer to next page for plots.

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.

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 ,
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	DH1 time slot	=	0.380 (ms)	*	(1600/2/79)	*	31.6 =	121.60	(ms)
	DH3 time slot	=	1.630 (ms)	*	(1600/4/79)	*	31.6 =	260.80	(ms)
	DH5 time slot	=	2.880 (ms)	*	(1600/6/79)	*	31.6 =	307.20	(ms)

CH Mid	DH1 time slot	=	0.380 (ms)	*	(1600/2/79)	*	31.6 =	121.60	(ms)
	DH3 time slot	=	1.640 (ms)	*	(1600/4/79)	*	31.6 =	262.40	(ms)
	DH5 time slot	=	2.880 (ms)	*	(1600/6/79)	*	31.6 =	307.20	(ms)

CH High	DH1 time slot	=	0.380 (ms)	*	(1600/2/79)	*	31.6 =	121.60	(ms)
	DH3 time slot	=	1.640 (ms)	*	(1600/4/79)	*	31.6 =	262.40	(ms)
	DH5 time slot	=	2.900 (ms)	*	(1600/6/79)	*	31.6 =	309.33	(ms)

AFH Mode

A period time = 0.4 (ms) * 20 = 8 (s)

CH Low	DH1 time slot	=	0.380 (ms)	*	(800/2/20)	*	8 =	60.80	(ms)
	DH3 time slot	=	1.630 (ms)	*	(800/4/20)	*	8 =	130.40	(ms)
	DH5 time slot	=	2.880 (ms)	*	(800/6/20)	*	8 =	153.60	(ms)

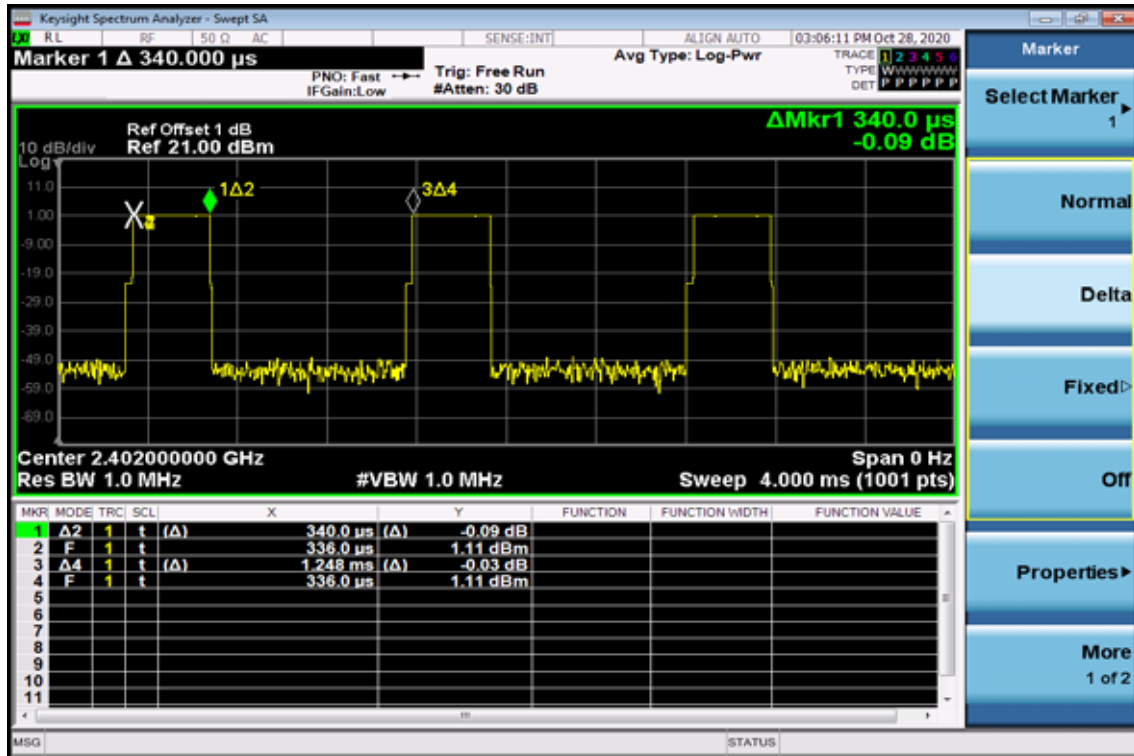
CH Mid	DH1 time slot	=	0.380 (ms)	*	(800/2/20)	*	8 =	60.80	(ms)
	DH3 time slot	=	1.640 (ms)	*	(800/4/20)	*	8 =	131.20	(ms)
	DH5 time slot	=	2.880 (ms)	*	(800/6/20)	*	8 =	153.60	(ms)

CH High	DH1 time slot	=	0.380 (ms)	*	(800/2/20)	*	8 =	60.80	(ms)
	DH3 time slot	=	1.640 (ms)	*	(800/4/20)	*	8 =	131.20	(ms)
	DH5 time slot	=	2.900 (ms)	*	(800/6/20)	*	8 =	154.67	(ms)

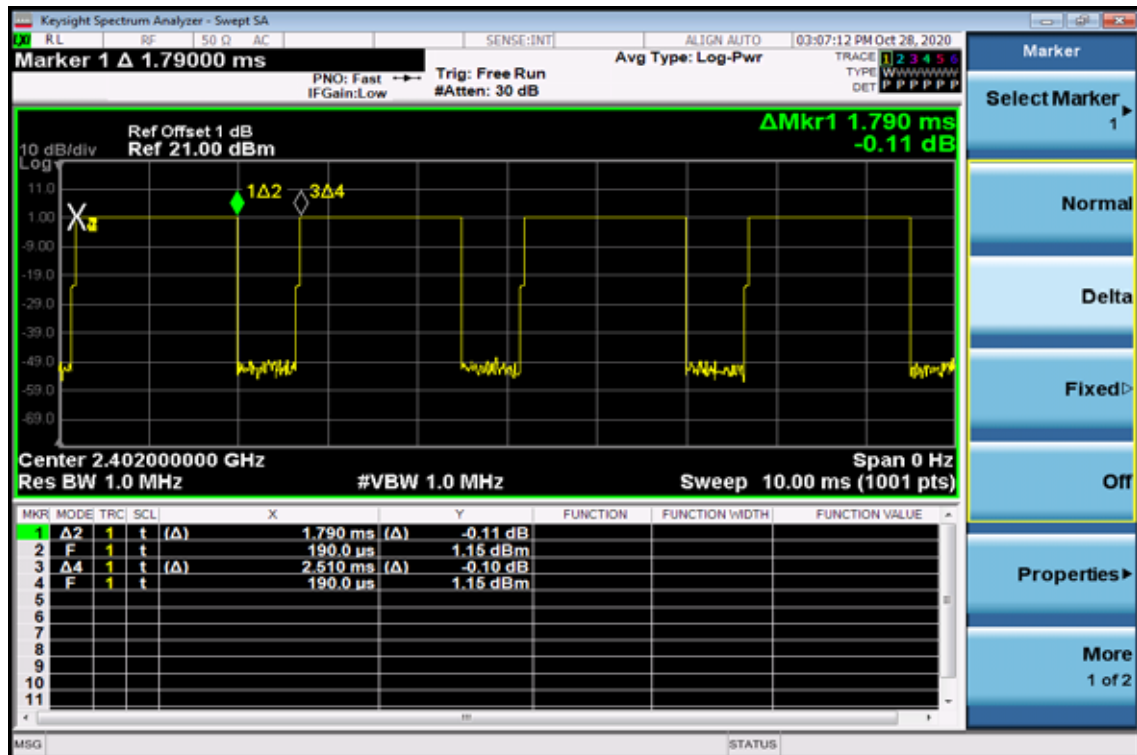
Note: Refer to next page for plots.

Low Channel

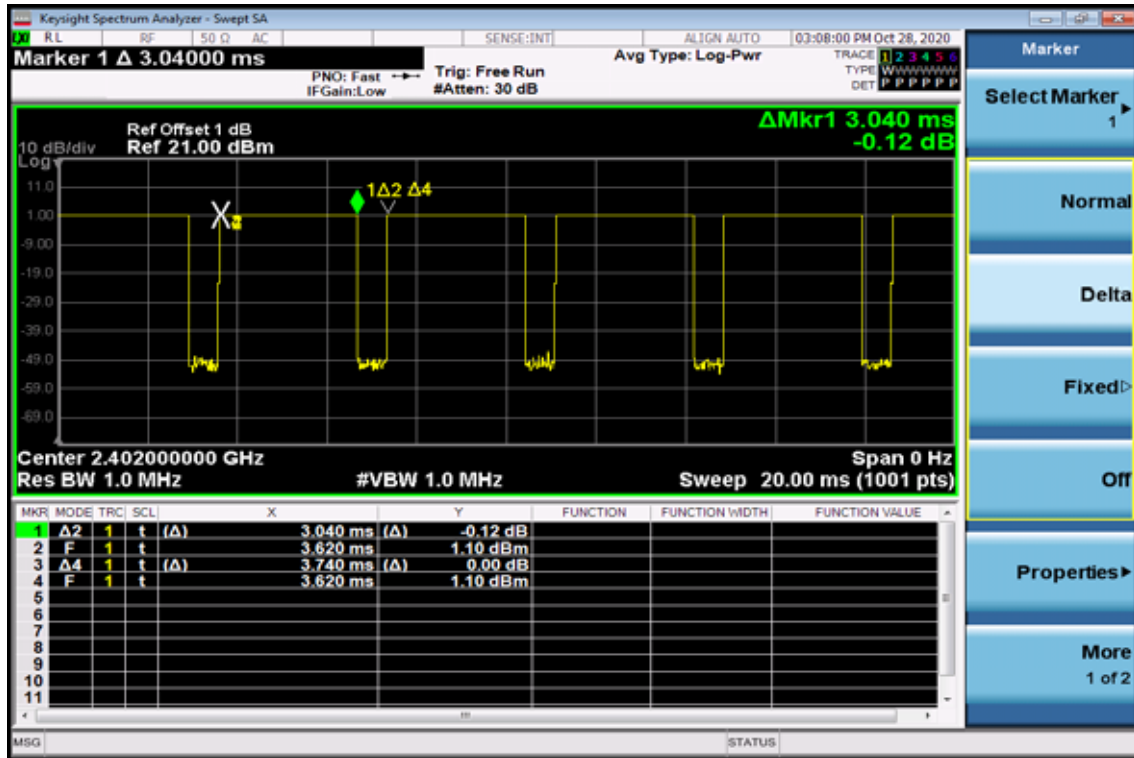
DH1



DH3

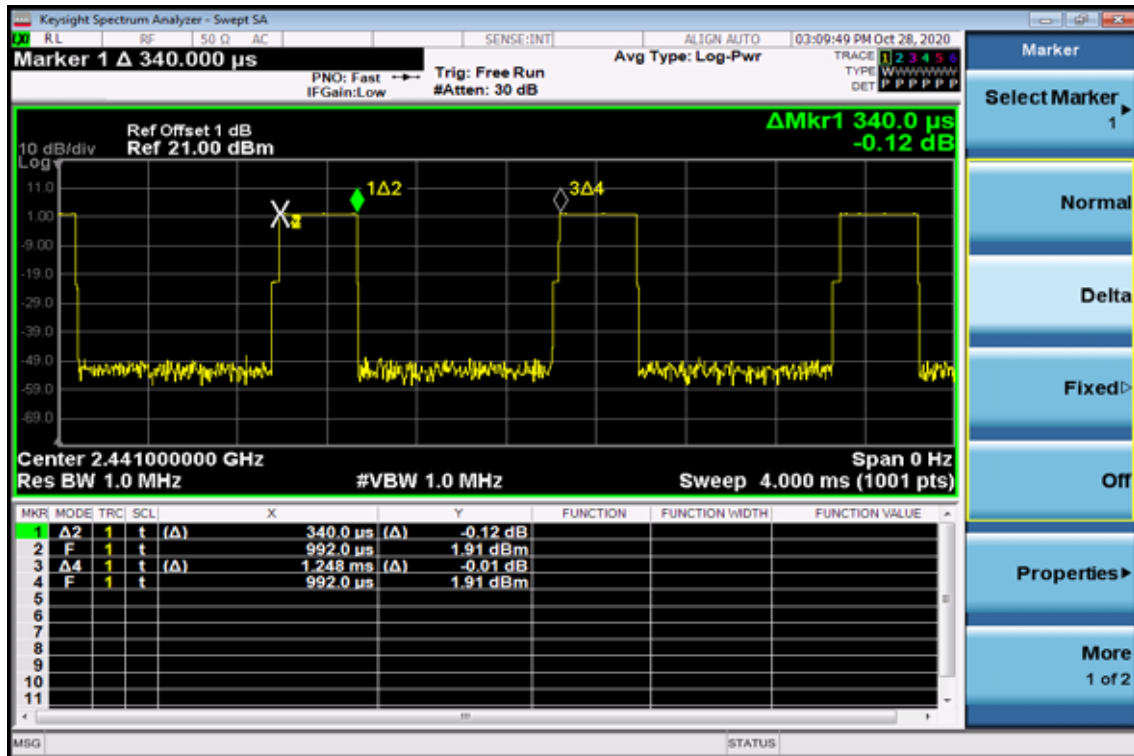


DH5

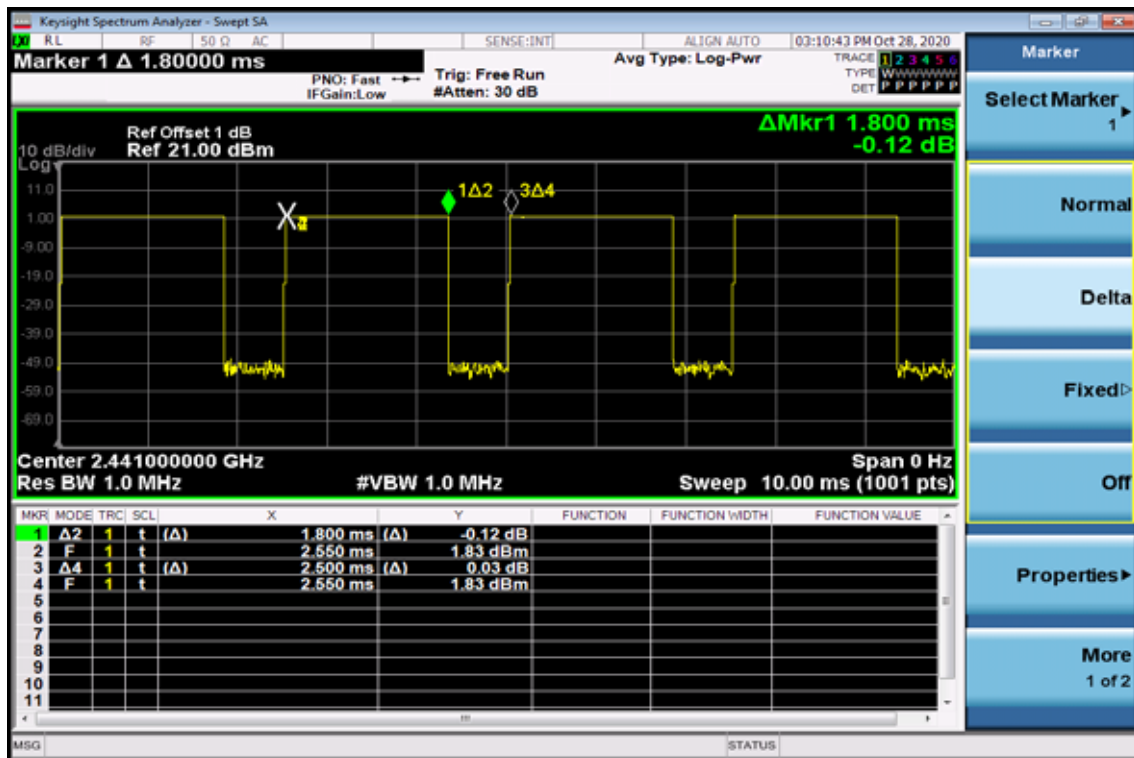


Mid Channel

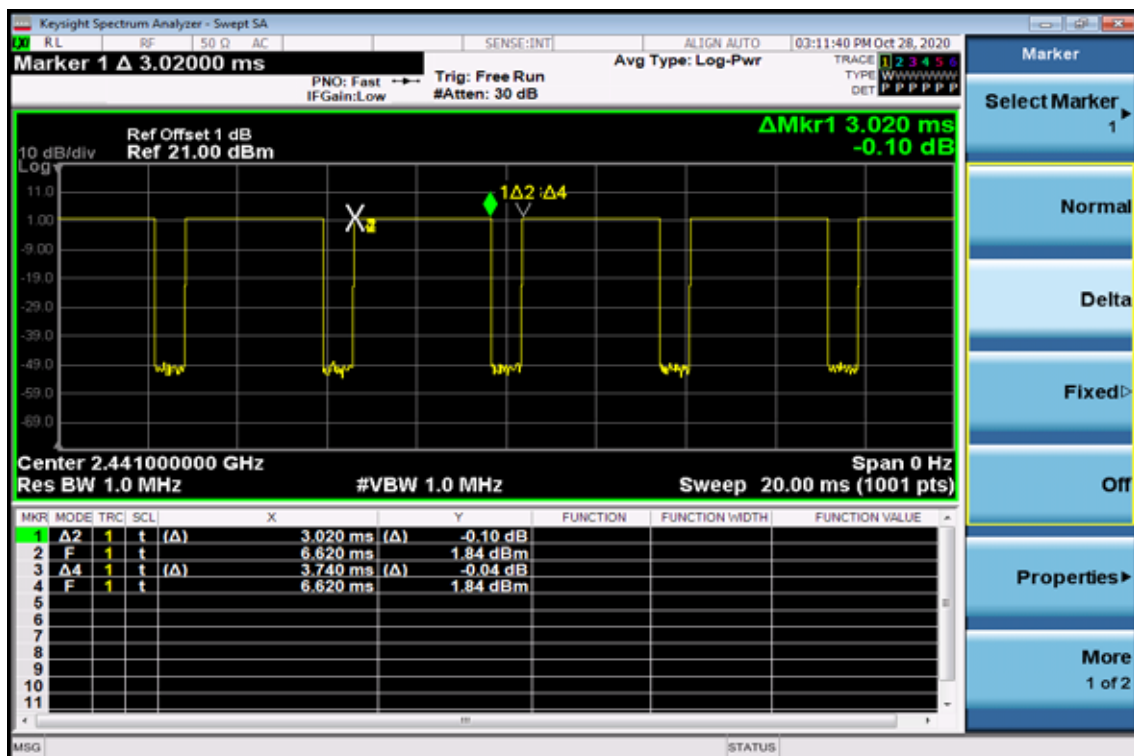
DH1



DH3

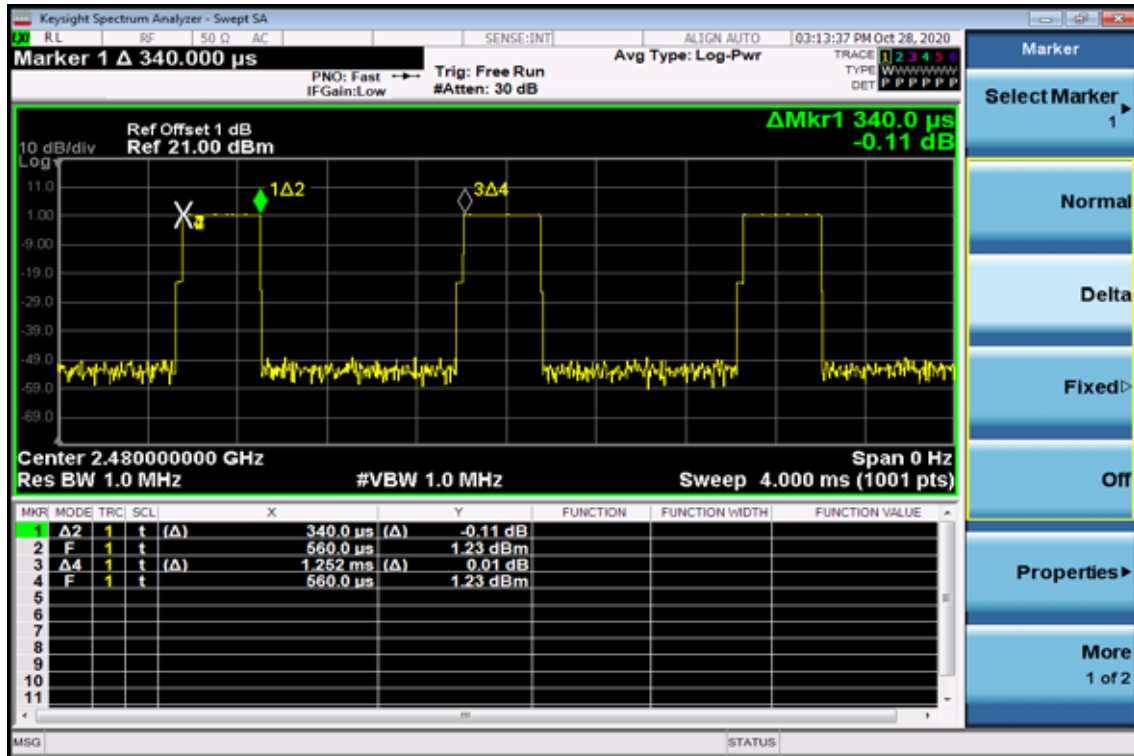


DH5

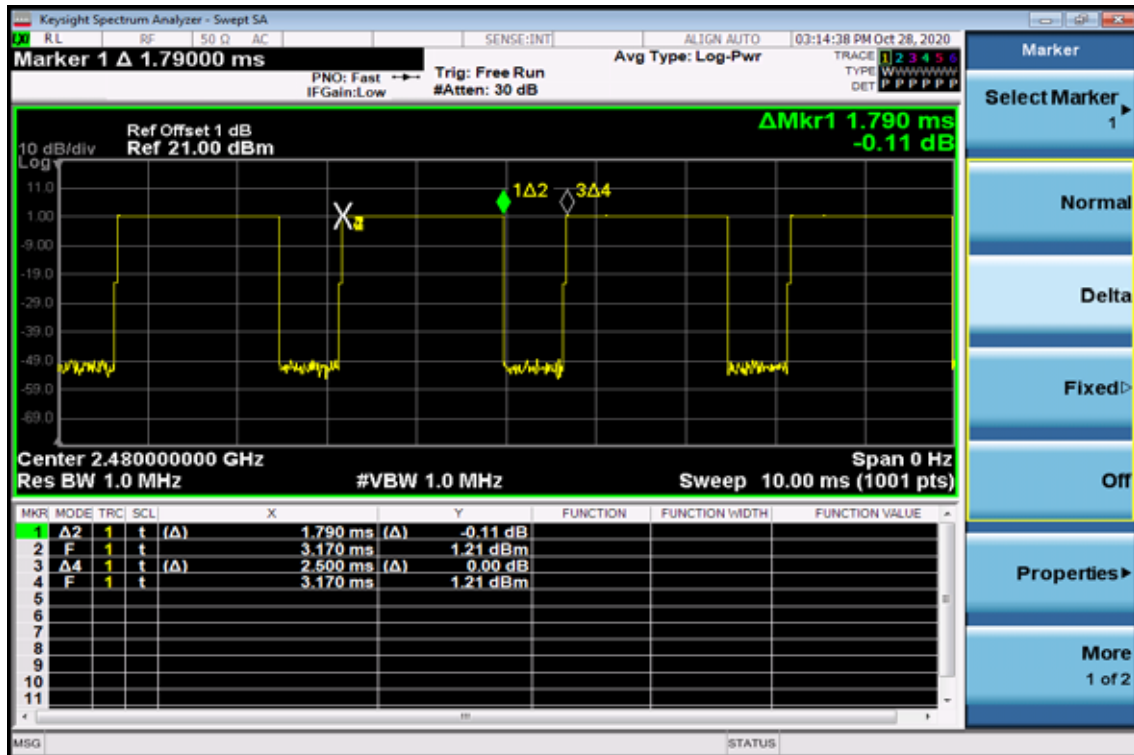


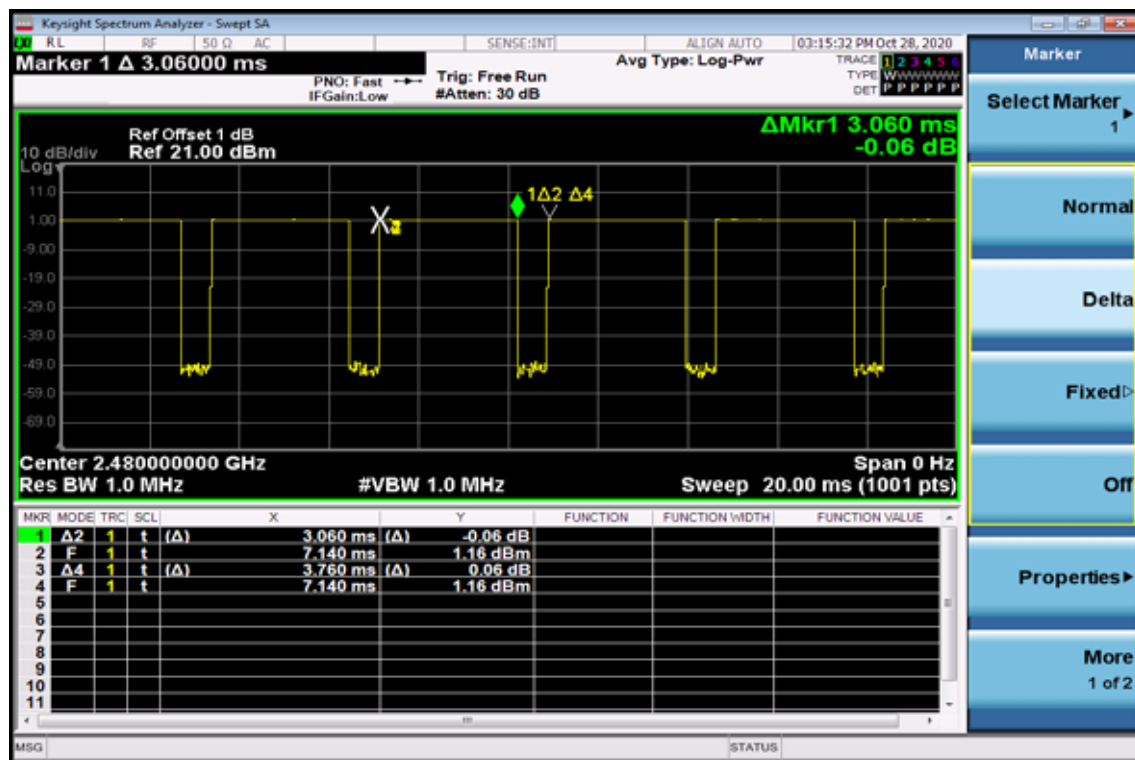
High Channel

DH1



DH3





12. 20dB 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.

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.
5. Repeat above procedures until all frequency measured were complete.

12.5 Measurement Result:

BDR Mode

CH	20dB Bandwidth (MHz)
Low	0.924
Mid	0.924
High	0.924

EDR 2M Mode

CH	20dB Bandwidth (MHz)	2/3* 20dB Bandwidth (MHz)
Lower	1.009	0.673
Mid	1.026	0.684
Higher	1.023	0.682

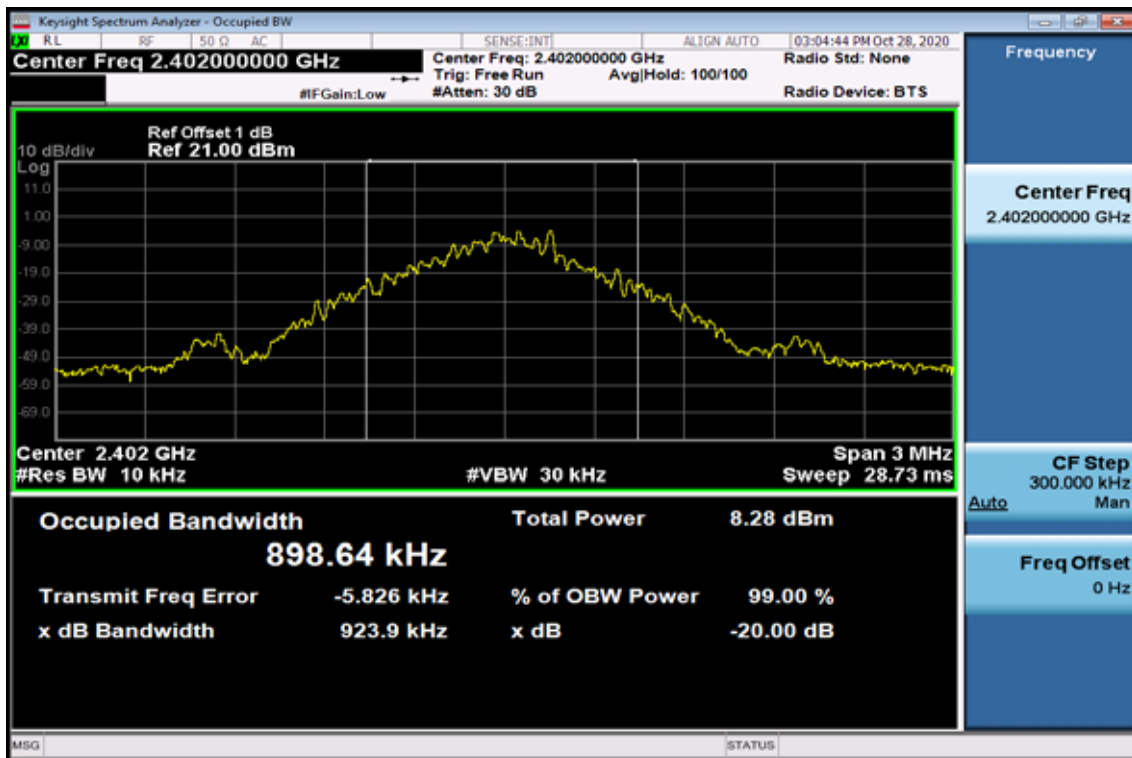
EDR 3M Mode

CH	20dB Bandwidth (MHz)	2/3* 20dB Bandwidth (MHz)
Lower	1.013	0.675
Mid	1.013	0.675
Higher	1.011	0.674

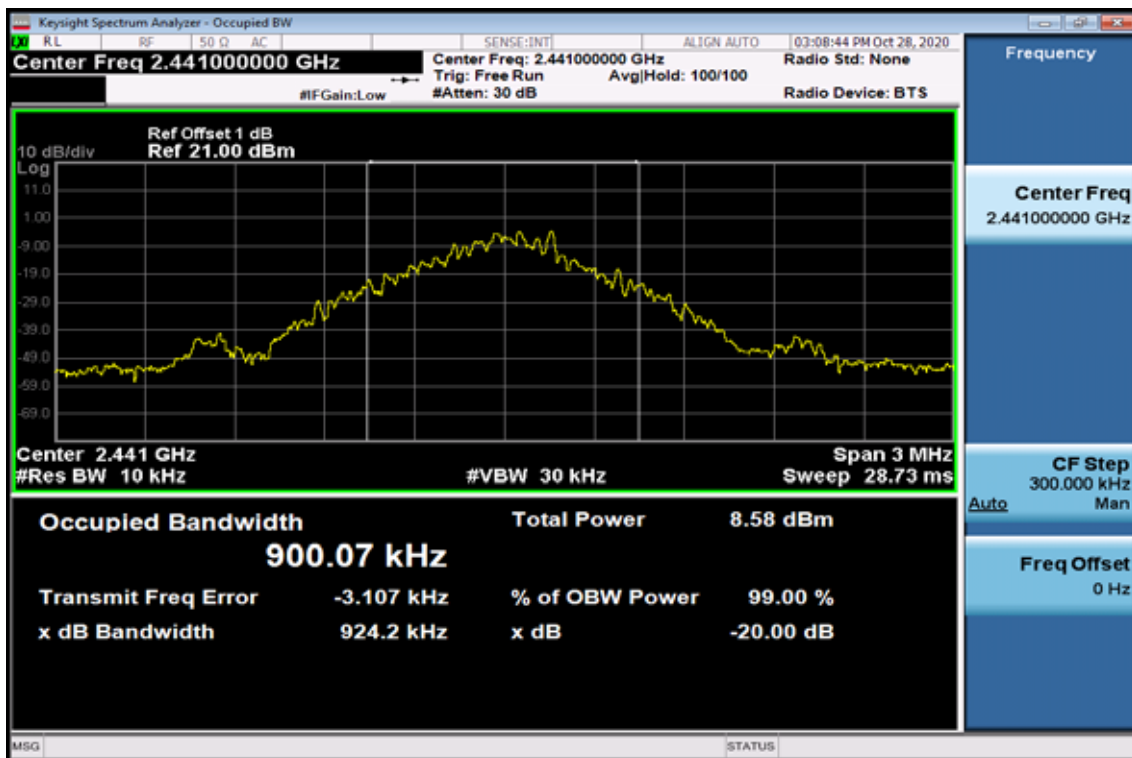
Note: Refer to next page for plots.

BDR Mode

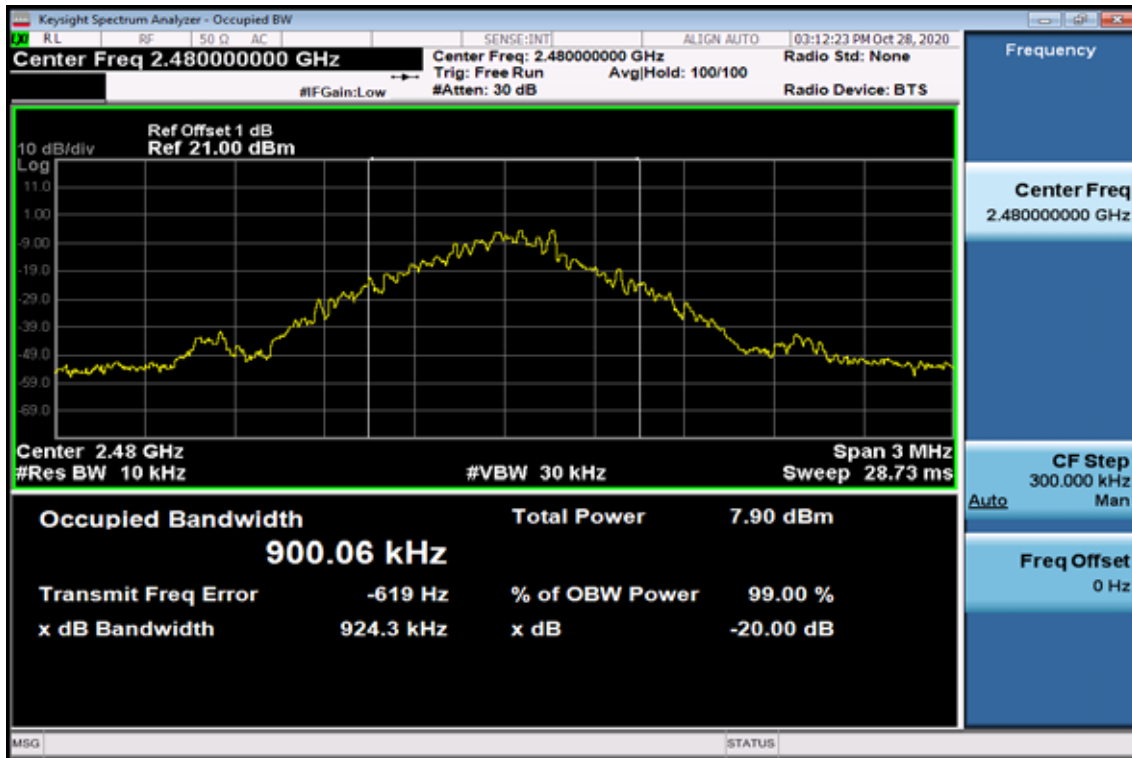
20dB Bandwidth Test Data CH-Low



20dB Bandwidth Test Data CH-Mid

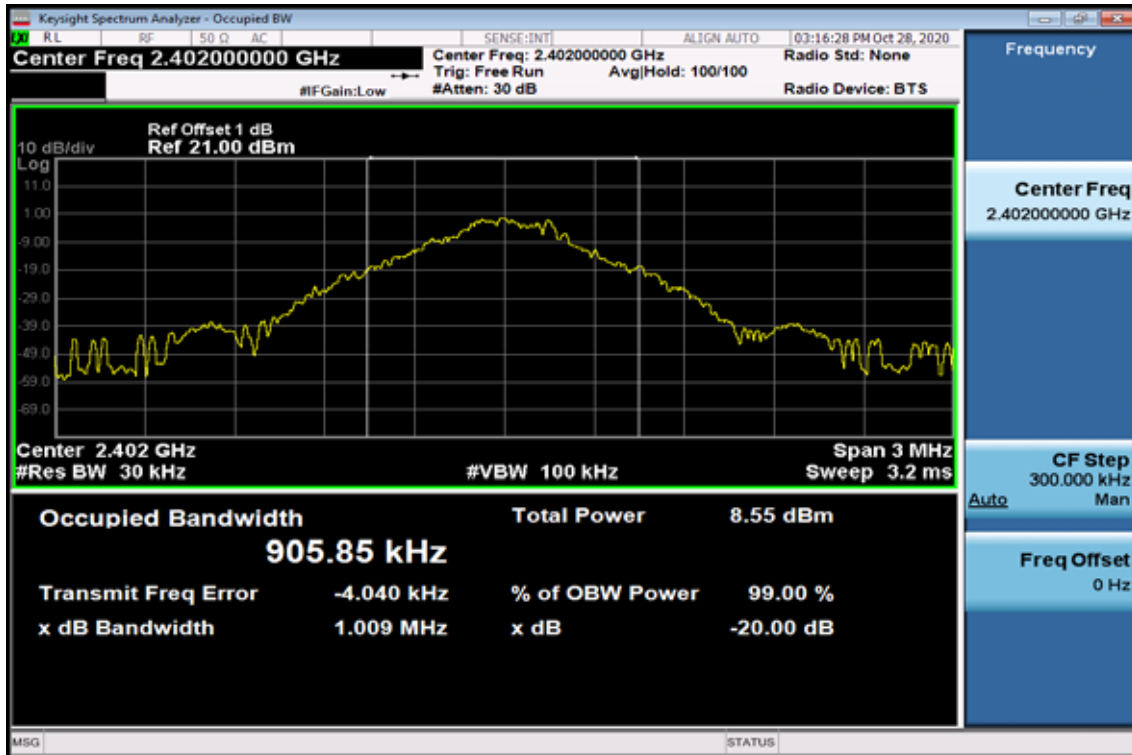


20dB Bandwidth Test Data CH-High

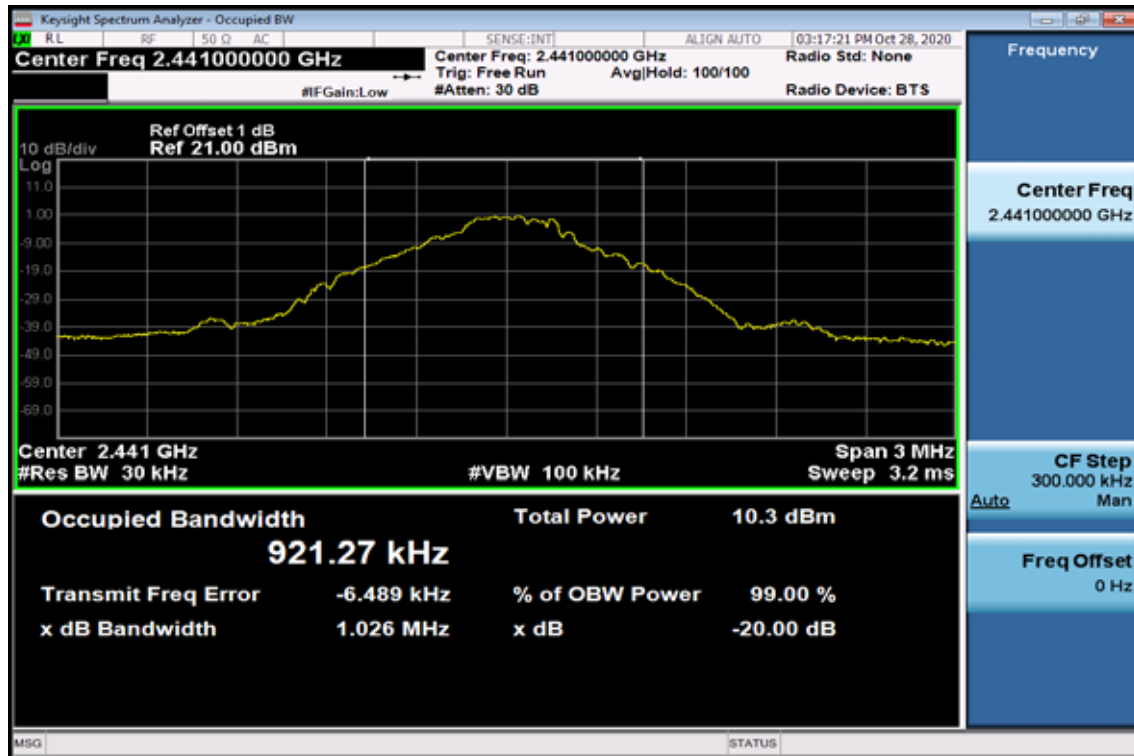


EDR 2M Mode

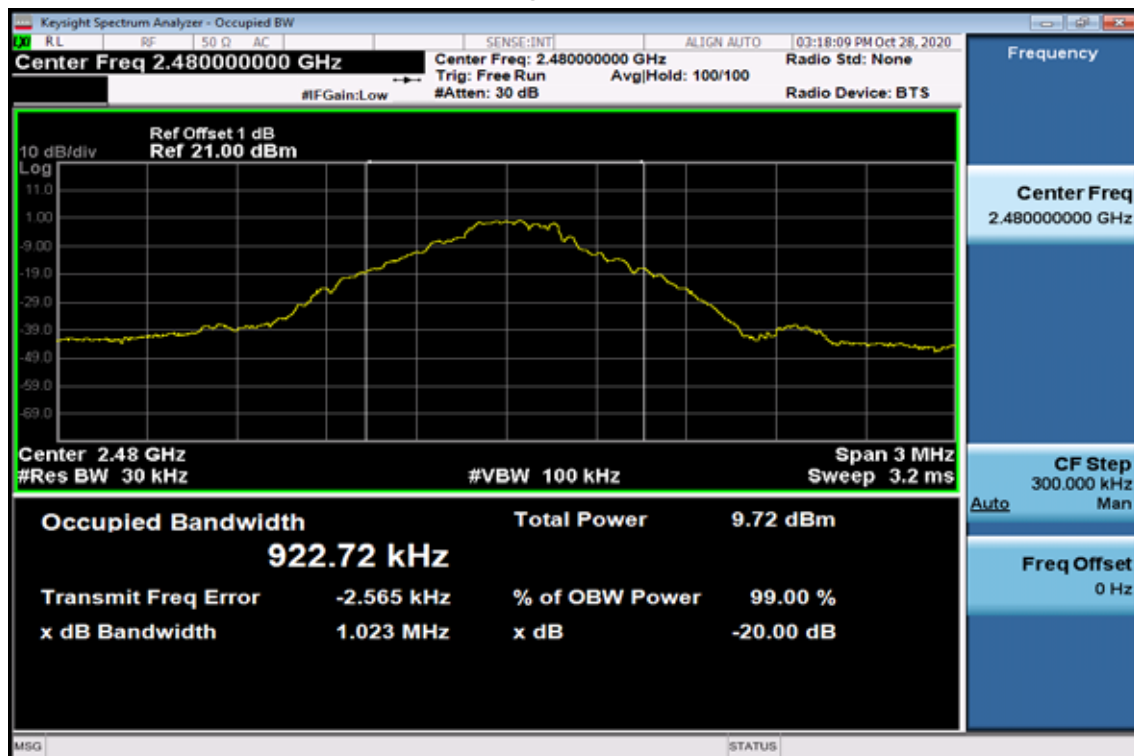
20dB Bandwidth Test Data CH-Low



20dB Bandwidth Test Data CH-Mid

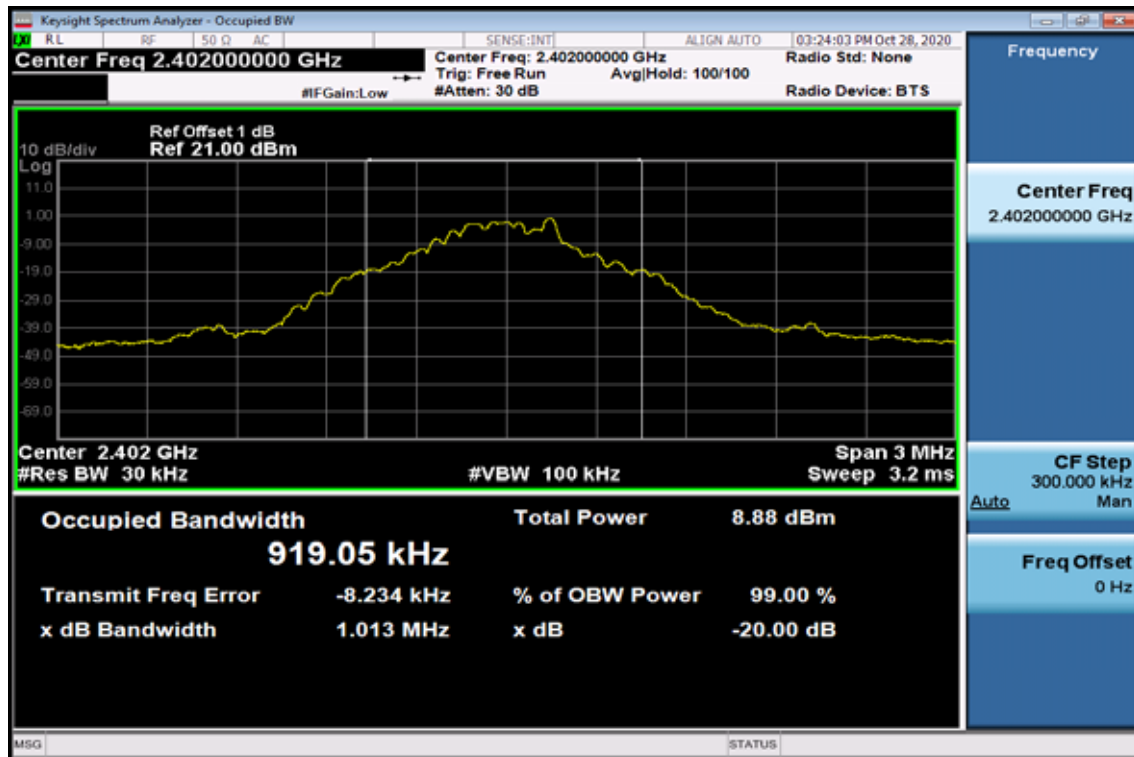


20dB Bandwidth Test Data CH-High

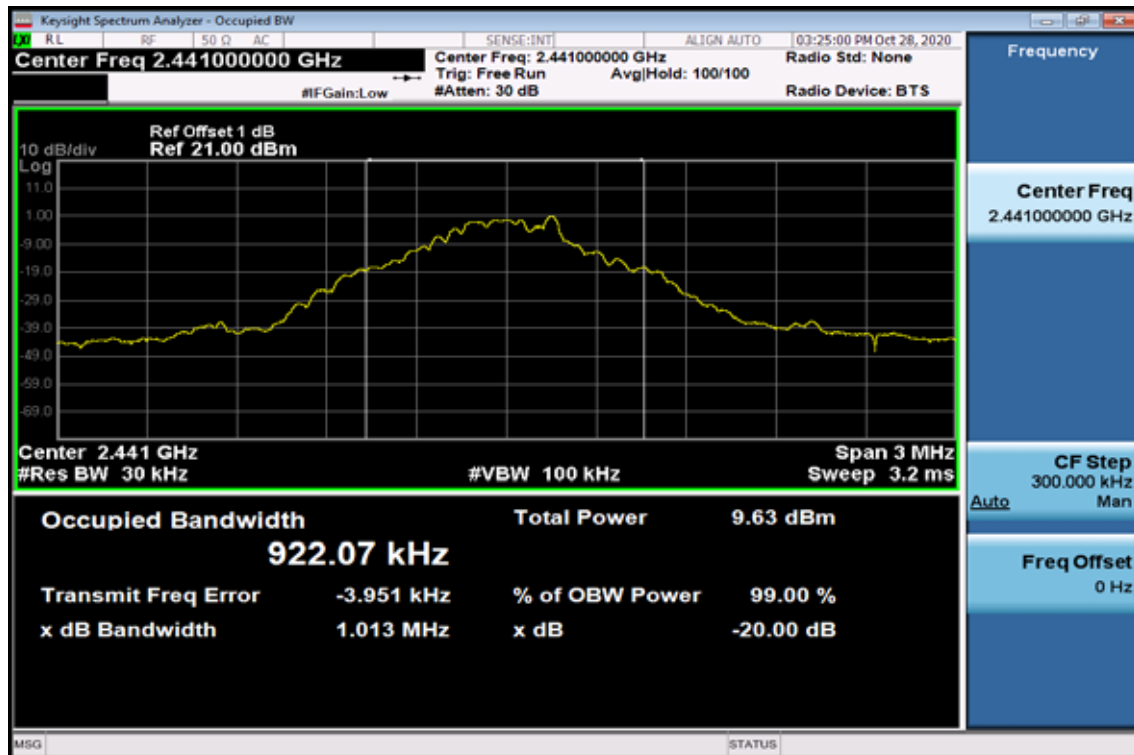


EDR 3M Mode

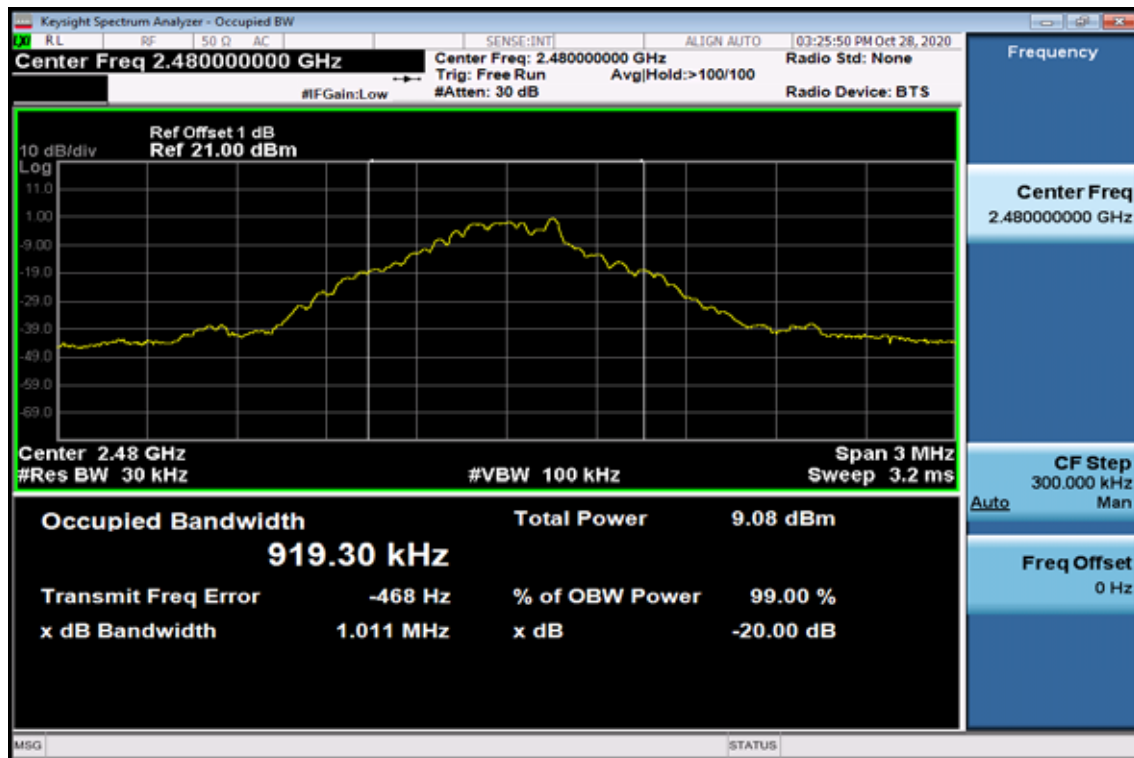
20dB Bandwidth Test Data CH-Low



20dB Bandwidth Test Data CH-Mid



20dB 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.

13.2 Antenna Connected Construction:

The directional gains of antenna used for transmitting is below table, and the antenna connector is designed with unique type RF connector and no consideration of replacement. Please see EUT photo and antenna spec. for details.

Antenna Designation:

	PCB Antenna	Gain
1	BT Antenna: -1.89 dBi	-1.89dBi