TEST REPORT

of

FCC Part 15 Subpart C AND CANADA RSS-247

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

Product :	**Sensor AID DUO TPMS TOOL**
Brand:	**Cub**
Model:	**FCC: Please see page 7**
	IC:VS-60U029
Model Difference:	**FCC: Please see page 7**
	IC: N/A
FCC ID:	**ZPNVS60U029**
IC:	**9959A-VS60U029**
FCC Rule Part:	**§15.247, Cat: DSS**
IC Rule Part:	**RSS-247 issue 2: 2017**
	RSS-Gen issue 5: 2018
Applicant:	**CUB ELECPARTS INC.**
Address:	**No.6, Lane 546, Sec.6, Changlu Road, Fuhsin Township, Changhua County, Taiwan 506**

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.,
Lung-Tan Dist., Tao Yuan City 325, Taiwan
*Tel : 886-3-407-1718; Fax: 886-3-407-1738

Report No.: **ISL-18LR335FCDSS**
Issue Date : **2019/01/17**

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.
This report MUST not be used to claim product endorsement by TAF, NVLAP or any agency of the Government.
This test report shall not be reproduced except in full, without the written approval of International Standards Laboratory Corp.

VERIFICATION OF COMPLIANCE

Applicant:	CUB ELECPARTS INC.
Product Description:	Sensor AID DUO TPMS TOOL
Brand Name:	Cub
Model No.:	FCC: Please see page 7
	IC:VS-60U029
Model Difference:	FCC: Please see page 7
	IC: N/A
FCC ID:	ZPNVS60U029
IC:	9959A-VS60U029
Date of test:	2018/10/25 ~ 2019/01/16
Date of EUT Received:	2018/10/25

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:	Barry Lee	***Date:***	2019/01/17
	Barry Lee / Senior Engineer		
Prepared By:	Gigi yeh	***Date:***	2019/01/17
	Gigi Yeh / Senior Engineer		
Approved By:	Jerry Liu	***Date:***	2019/01/17
	Jerry Liu / Technical Manager		

Version

Version No.	Date	Description
00	2019/01/17	Initial creation of document

Uncertainty of Measurement

Description Of Test	Uncertainty
Conducted Emission (AC power line)	2.586 dB
Field Strength of Spurious Radiation	≤ 30MHz: 2.96dB 30-1GHz: 4.22 dB 1-40 GHz: 4.08 dB
Conducted Power	2.412 GHz: 1.30 dB 5.805 GHz: 1.55 dB
Power Density	2.412 GHz:1.30 dB 5.805 GHz: 1.67 dB
Frequency	0.0032%
Time	0.01%
DC Voltage	1%

Table of Contents

1. General Information 7
1.1. Product Description 7
1.2. Related Submittal(s) / Grant (s) 9
1.3. Test Methodology 9
1.4. Test Facility 9
1.5. Special Accessories 9
1.6. Equipment Modifications 9
2. System Test Configuration 10
2.1 EUT Configuration 10
2.2 EUT Exercise 10
2.3 Test Procedure 10
2.4 Configuration of Tested System 11
3. Summary of Test Results 12
4. Description of Test Modes 12
5. Conduced Emission Test 13
5.1 Standard Applicable: 13
5.2 Measurement Equipment Used: 13
5.3 EUT Setup: 13
5.4 Measurement Procedure: 14
5.5 Measurement Result: 14
6. Peak Output Power Measurement 17
6.1 Standard Applicable: 17
6.2 Measurement Equipment Used: 17
6.3 Test Set-up: 18
6.4 Measurement Procedure: 18
6.5 Measurement Result: 19
7. 100kHz Bandwidth of Band Edges Measurement 20
7.1 Standard Applicable: 20
7.2 Measurement Equipment Used: 21
7.3 Test SET-UP: 22
7.4 Measurement Procedure: 23
7.5 Field Strength Calculation 23
7.6 Measurement Result: 23
8. Spurious Emission Test 48
8.1 Standard Applicable: 48
8.2 Measurement Equipment Used: 48
8.3 Test SET-UP: 48
8.4 Measurement Procedure: 49
8.5 Field Strength Calculation 49
8.6 Measurement Result: 49
9. Frequency Separation 56
9.1 Standard Applicable: 56

9.2 Measurement Equipment Used: 56
9.3 Test Set-up: 56
9.4 Measurement Procedure: 56
9.5 Measurement Result: 56

10. Number of Hopping Frequency 59
10.1 Standard Applicable: 59
10.2 Measurement Equipment Used: 59
10.3 Test Set-up: 59
10.4 Measurement Procedure: 59
10.5 Measurement Result: 59

11. Time of Occupancy (Dwell Time) 61
11.1 Standard Applicable: 61
11.2 Measurement Equipment Used: 61
11.3 Test Set-up: 61
11.4 Measurement Procedure: 61
11.5 Measurement Result: 62

12. 20dB Bandwidth & 99% Bandwidth 68
12.1 Standard Applicable: 68
12.2 Measurement Equipment Used: 68
12.3 Test Set-up: 68
12.4 Measurement Procedure: 68
12.5 Measurement Result: 69

13. Antenna Requirement 80
13.1 Standard Applicable: 80
13.2 Antenna Connected Construction: 80

1. General Information

1.1. Product Description

General:

Product Name	Sensor AID DUO TPMS TOOL	
Brand Name	Cub	
FCC: Model Name	VS-60U029; VS-60U029XX; VS-60U029XX-XX; VS-60U029XX-XX-X; VS-60U024; VS-60U024XX; VS-60U024XX-XX; VS-60U024XX-XX-X; VS-60U029XXXXXXX; VS-60U024XXXXXXX; CT4; Sensor AID TOOL Gen4; Sensor AID DUO TPMS TOOL; SENSOR AID TOOL GEN4; SENSOR AID DUO TPMS TOOL	
IC: Model Name	VS-60U029	
FCC Model Difference	1. For the marketing purpose 2. Where X may be any alpha character “a”-“z”, ”A”-“Z”, or numeric character “0”-“9”,or -, (,) , or blank or combination of alpha and numeric characters	
IC Model Difference	N/A	
Power Supply	5 Vdc from AC/DC adapter or 3.7V from battery	
	Adapter:	Model: SK22G3-0500250U
	Battery:	Model : HTT-104

IC RSS-Gen:

PMN (Product Marketing Name)	VS-60U029
HVIN (Hardware Version Identification Number)	VS-60U029
Product SW version	1.0
Product HW version	1.0
Radio SW version	RS1.0
Radio HW version	1.0

2.4GHz WLAN: 1TX/1RX

Wi-Fi	Frequency Range (MHz)	Channels	Peak / Average Power	Modulation Technology
802.11b	2412 – 2462(DTS)	11	18.53 dBm (PK)/ 16.33 dBm (AV)	DSSS
802.11g	2412 – 2462(DTS)	11	23.14 dBm (PK) / 13.06 dBm (AV)	OFDM
802.11n	HT20 2412 – 2462(DTS)	11	22.42 dBm (PK) / 12.21 dBm (AV)	
802.11n	HT40 2422 – 2452(DTS)	7	21.32 dBm (PK) / 10.67 dBm (AV)	
Modulation type		CCK, DQPSK, DBPSK for DSSS 64QAM. 16QAM, QPSK, BPSK for OFDM		
Antenna Designation		Type: FPC, 2.80dBi		
Tune up power (Average)		16 dBm +/- 0.5 dBm		

Bluetooth:

Frequency Range:	2402 – 2480MHz	
Bluetooth Version:	V2.1 + EDR	V4.0
Channel number:	79 channels	40 channels, 2MHz step
Modulation type	GFSK +π / 4DQPSK + 8DPSK	Wide band Modulation (GFSK)
Transmit Power:	9.40 dBm Peak	-0.28 dBm Peak
Dwell Time:	≤ 0.4s	N/A
Antenna Designation:	Type: FPC, 2.80dBi	

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.

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

This submittal(s) (test report) is intended for **FCC ID: ZPNVS60U029** filing to comply with Section 15.247 of the FCC Part 15, Subpart C Rules and **IC: 9959A-VS60U029** 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.

KDB Document: 558074 D01 15.247 Meas Guidance v0.5

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.

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 4: 2014. 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)

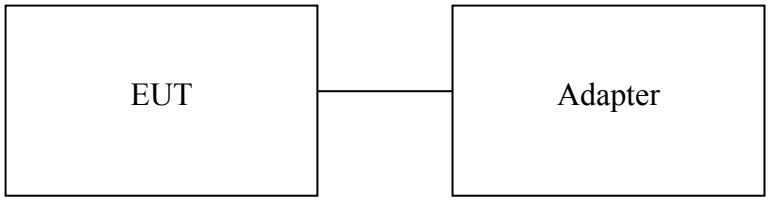


Table 1 Equipment Used in Tested System

Item	Equipment	Mfr/Brand	Model/ Type No.	Series No.	Data Cable	Power Cord
1	Adapter	Apple	A1385	N/A	Non-shield	Non-shield

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 8.3	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.

All mode has been pre-scanned, and only the cast of the worst is presented in the report.

The worst case EDR 2M mode was reported for Radiated Emission.

.

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:

Conducted Emission Test Site					
Equipment Type	**Manufacturer**	**Model Number**	**Serial Number**	**Last Cal.**	**Cal Due.**
Conduction 04-3 Cable	WOKEN	CFD 300-NL	Conduction 04 -3	09/11/2018	09/10/2019
EMI Receiver 16	Rohde & Schwarz	ESCI	101221	10/23/2018	10/22/2019
LISN 18	ROHDE & SCHWARZ	ENV216	101424	02/04/2018	02/03/2019
LISN 19	ROHDE & SCHWARZ	ENV216	101425	03/06/2018	03/05/2019
Test Software	Farad	EZEMC Ver:ISL-03A2	N/A	N/A	N/A

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:

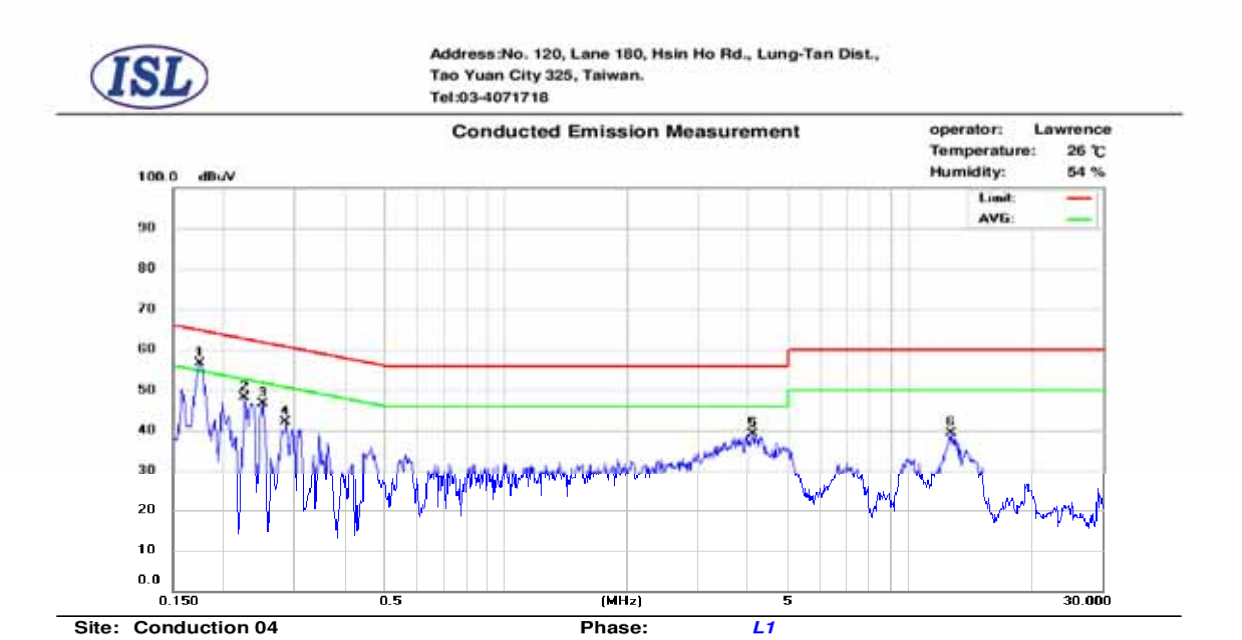
1. The EUT was placed on a table which is 0.8m above ground plane.
2. Maximum procedure was performed on the six highest emissions to ensure EUT compliance.
3. Repeat above procedures until all frequency measured were complete.

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:	Full mode	Test Date:	2018/12/26
Test By:	Barry		



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	0.174	45.44	32.87	9.69	55.13	64.77	-9.64	42.56	54.77	-12.21
2	0.226	35.37	21.08	9.69	45.06	62.60	-17.54	30.77	52.60	-21.83
3	0.250	29.46	6.66	9.69	39.15	61.76	-22.61	16.35	51.76	-35.41
4	0.286	30.14	13.82	9.70	39.84	60.64	-20.80	23.52	50.64	-27.12
5	4.086	24.06	16.50	9.81	33.87	56.00	-22.13	26.31	46.00	-19.69
6	12.630	23.22	16.96	9.98	33.20	60.00	-26.80	26.94	50.00	-23.06

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	46.03	32.47	9.68	55.71	65.36	-9.65	42.15	55.36	-13.21
2	0.170	44.57	30.64	9.68	54.25	64.96	-10.71	40.32	54.96	-14.64
3	0.226	31.60	14.79	9.68	41.28	62.60	-21.32	24.47	52.60	-28.13
4	0.278	27.07	12.35	9.69	36.76	60.88	-24.12	22.04	50.88	-28.84
5	4.050	23.89	16.88	9.80	33.69	56.00	-22.31	26.68	46.00	-19.32
6	12.602	15.91	8.48	10.01	25.92	60.00	-34.08	18.49	50.00	-31.51

6. Peak Output Power Measurement

6.1 Standard Applicable:

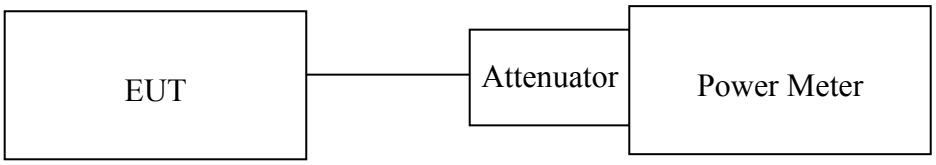
According to §15.247(b)(1), For frequency hopping systems operating in the 2400-2483.5 MHz band employing at least 75 hopping channels, and all frequency hopping systems in the 5725-5850MHz band: 1Watt. For all other frequency hopping systems in the 2400 – 2483.5MHz band: 0.125 Watts.

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:

Conducted Emission Test Site					
Equipment Type	**Manufacturer**	**Model Number**	**Serial Number**	**Last Cal.**	**Cal Due.**
Power Meter 05	Anritsu	ML2495A	1116010	10/28/2018	10/27/2019
Power Sensor 05	Anritsu	MA2411B	34NKF50	10/28/2018	10/27/2019
Power Sensor 06	DARE	RPR3006W	13I00030SNO33	12/12/2018	12/11/2019
Power Sensor 07	DARE	RPR3006W	13I00030SNO34	12/12/2018	12/11/2019
Temperature Chamber	KSON	THS-B4H100	2287	12/02/2018	12/01/2019
DC Power supply	ABM	8185D	N/A	11/16/2018	11/15/2019
AC Power supply	EXTECH	CFC105W	NA	12/25/2018	12/24/2019
Attenuator	Woken	Watt-65m3502	11051601	NA	NA
Splitter	MCLI	PS4-199	12465	12/26/2017	12/25/2019
Spectrum analyzer	keysight	N9010A	MY56070257	10/15/2018	10/14/2019
Spectrum analyzer	R&S	FSP40	100116	11/02/2018	11/01/2019
Test Sofware	DARE	Radimation Ver:2013.1.23	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:

BDR Mode

Frequency (MHz)	Peak Reading Power (dBm)	Cable Loss	Output Power (dBm)	Output Power (W)	Limit (W)
Low	9.40	0.00	9.40	0.00871	1
Mid	8.34	0.00	8.34	0.00682	1
High	8.48	0.00	8.48	0.00704	1

EDR 2M Mode

Frequency (MHz)	Peak Reading Power (dBm)	Cable Loss	Output Power (dBm)	Output Power (W)	Limit (W)
Low	9.16	0.00	9.16	0.00824	0.125
Mid	8.63	0.00	8.63	0.00729	0.125
High	8.71	0.00	8.71	0.00743	0.125

EDR 3M Mode

Frequency (MHz)	Peak Reading Power (dBm)	Cable Loss	Output Power (dBm)	Output Power (W)	Limit (W)
Low	8.89	0.00	8.89	0.00774	0.125
Mid	8.63	0.00	8.63	0.00730	0.125
High	8.83	0.00	8.83	0.00764	0.125

Offset: 1dB

7. 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.

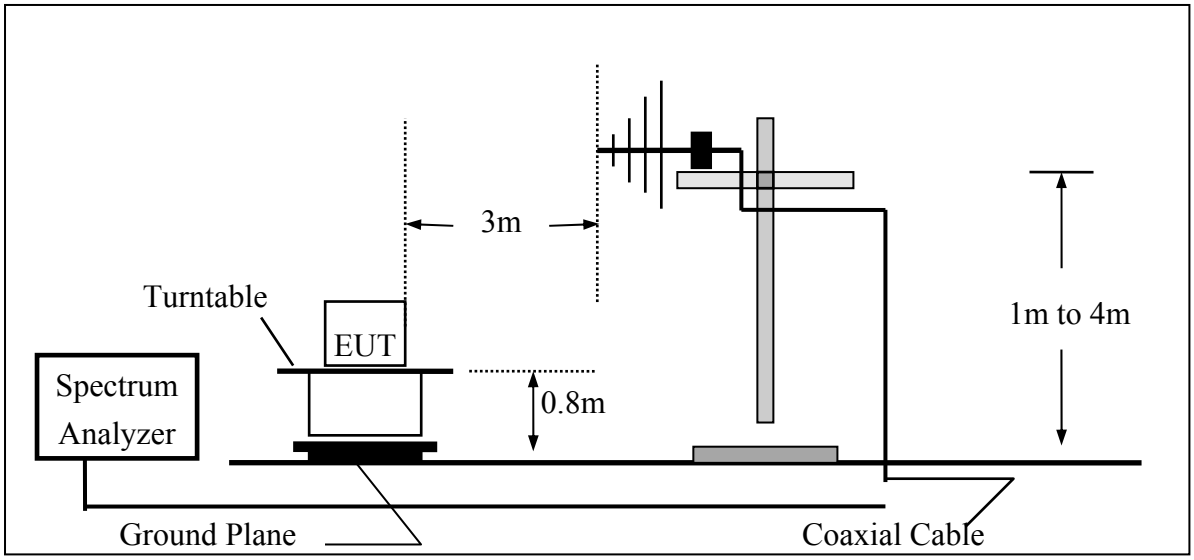
7.2.2. Radiated emission:

Chamber 14(966)					
Equipment Type	**Manufacturer**	**Model Number**	**Serial Number**	**Last Cal.**	**Cal Due.**
Spectrum Analyzer 21(26.5GHz)	Agilent	N9010A	MY52100117	06/30/2018	06/29/2019
EMI Receiver	SCHWARZ-BECK	FCVU1534	1534149	12/07/2018	12/06/2019
Dipole antenna	SCHWARZ-BECK	VHAP,30-300	919	12/28/2017	12/27/2019
Dipole antenna	SCHWARZ-BECK	UHAP,300-1000	1195	12/28/2017	12/27/2019
Loop Antenna9K-30M	EM	EM 6879	271	06/06/2018	06/05/2020
Bilog Antenna30-1G	SCHWARZ-BECK	VULB9168	736	07/21/2018	07/20/2019
Horn antenna1-18G	ETS	3117	00066665	11/29/2018	11/28/2019
Horn antenna18-26G(04)	Com-power	AH-826	081001	11/21/2017	11/20/2019
Horn antenna26-40G(05)	Com-power	AH-640	100A	02/22/2017	02/21/2019
Preamplifier9-1000M	HP	8447F	NA	12/08/2018	12/07/2019
Preamplifier1-18G	MITEQ	AFS44-00101800-25-10P-44	1329256	07/26/2018	07/25/2019
Preamplifier1-26G	EM	EM01M26G	NA	11/24/2018	11/23/2019
Preamplifier26-40G	MITEQ	JS-26004000-27-5A	818471	11/20/2017	11/19/2019
Cable1-18G	HUBER SU-HNER	Sucoflex 106	NA	11/12/2018	11/11/2019
Cable UP to 1G	HUBER SU-HNER	RG 214/U	NA	11/12/2018	11/11/2019
SUCOFLEX 1GHz~40GHz cable	HUBER SU-HNER	Sucoflex 102	27963/2&37421/2	11/02/2017	11/01/2019
Signal Generator	R&S	SMU200A	102330	03/14/2018	03/13/2019
Signal Generator	Anritsu	MG3692A	50405	12/07/2018	12/06/2019
2.4G Filter	Micro-Tronics	Brm50702	76	12/25/2018	12/24/2019
Test Software	Audix	E3 Ver:6.12023	N/A	N/A	N/A

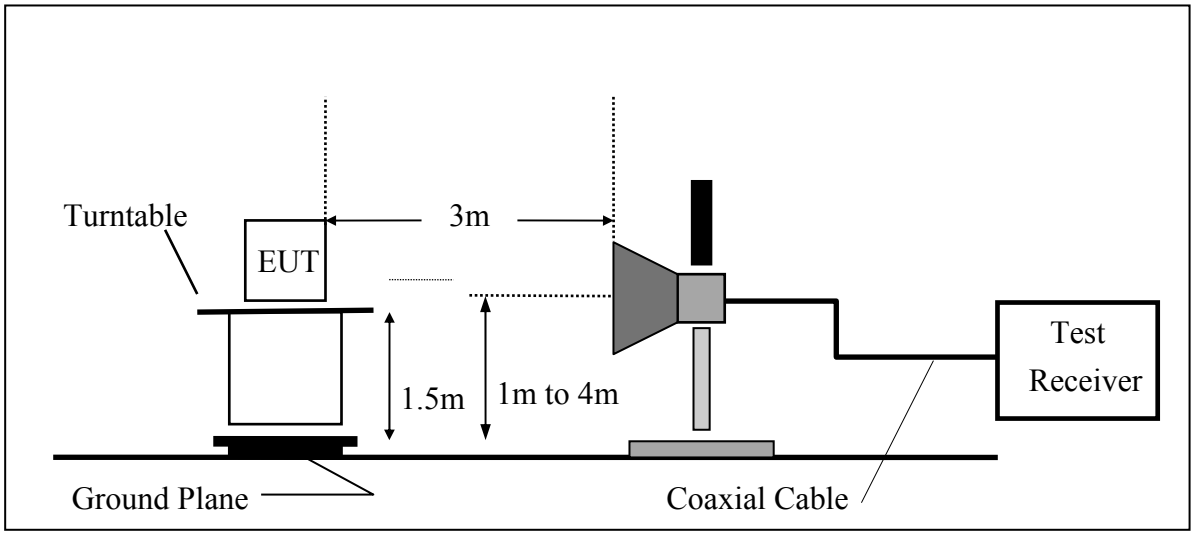
7.3 Test SET-UP:

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

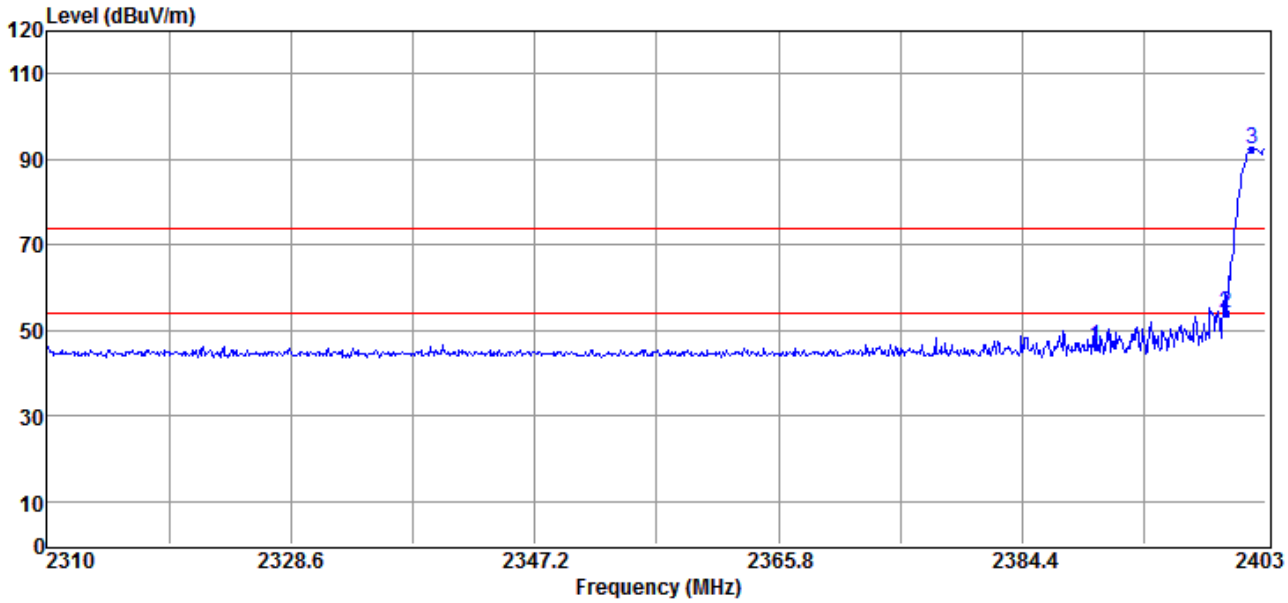
Where	FS = Field Strength	CL = Cable Attenuation Factor (Cable Loss)
	RA = Reading Amplitude	AG = Amplifier Gain
	AF = Antenna Factor	

7.6 Measurement Result:

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

Radiated Emission: (BDR Hopping mode)

Operation Mode	TX CH Low	Test Date	2018/12/26
Fundamental Frequency	2402 MHz	Test By	Barry
Temperature	25 ℃	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	61.86	-15.71	46.15	74.00	-27.85	Peak	VERTICAL
2	2400.00	69.95	-15.73	54.22	72.55	-18.33	Peak	VERTICAL
3	2401.88	108.28	-15.73	92.55	F	--	Peak	VERTICAL

Remark:

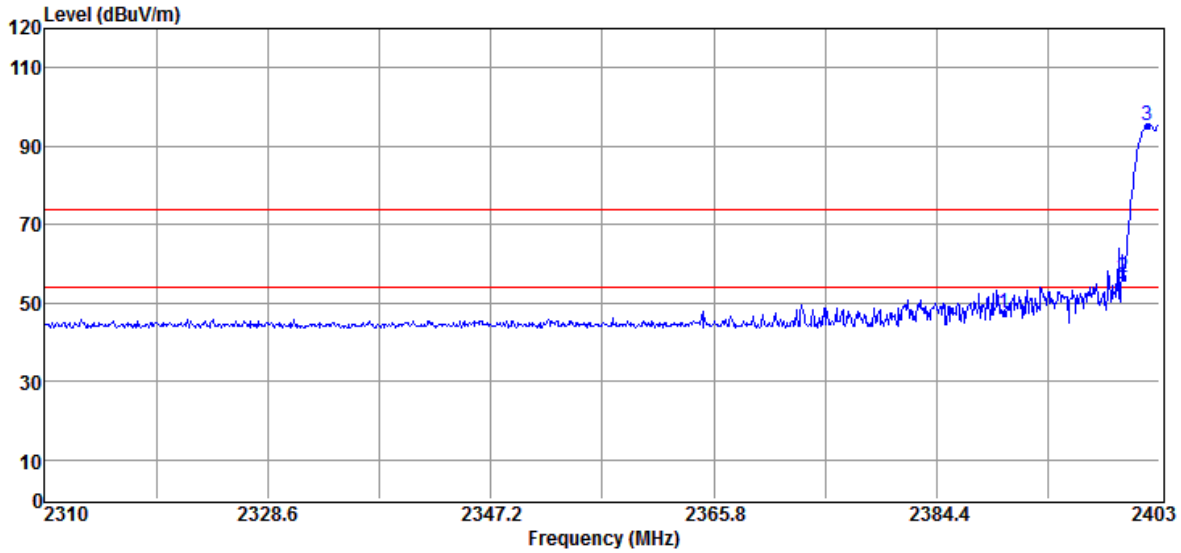
1 Field strength limits for frequency above 1000MHz are based on average limits. However, Peak mode field strength shall not exceed the average limits specified plus 20dB.

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	63.31	-15.71	47.60	74.00	-26.40	Peak	HORIZONTAL
2	2400.00	72.39	-15.73	56.66	75.33	-18.67	Peak	HORIZONTAL
3	2401.98	111.06	-15.73	95.33	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.

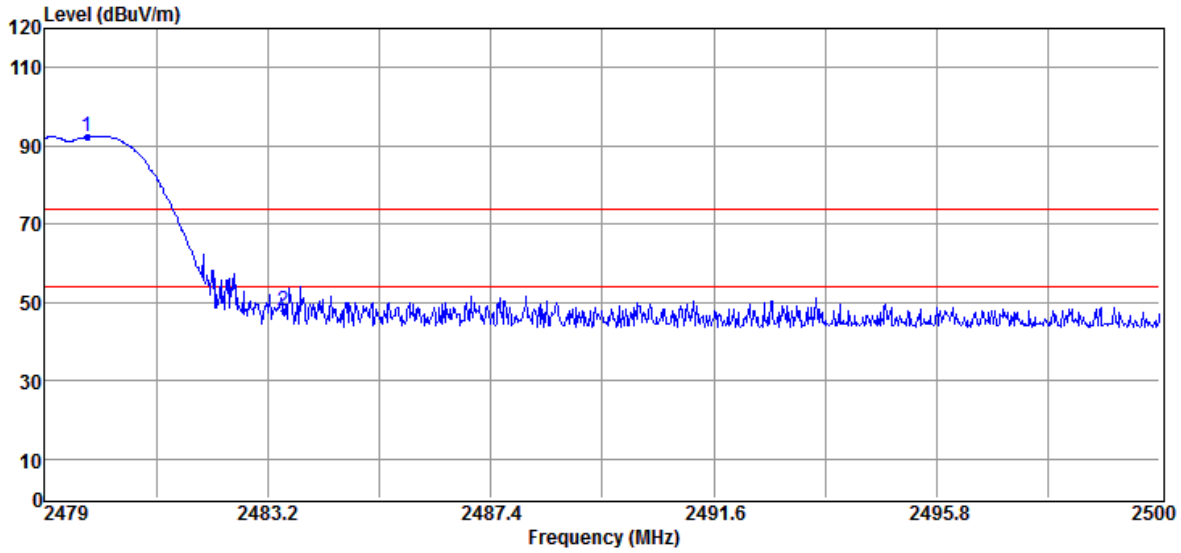
2 Measurement of data within this frequency range shown " - " in the table above means the reading of emissions are attenuated more than 20dB below the permissible limits or the field strength is too small to be measured.

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	2018/12/26
Fundamental Frequency	2480 MHz	Test By	Barry
Temperature	25 ℃	Humidity	60 %



No	Freq MHz	Reading dBuV	Factor dB/m	Level dBuV/m	Limit dBuV/m	Margin dB	Remark	Pol V/H
1	2479.80	108.11	-15.71	92.40	F	---	Peak	VERTICAL
2	2483.50	63.35	-15.71	47.64	74.00	-26.36	Peak	VERTICAL

Remark:

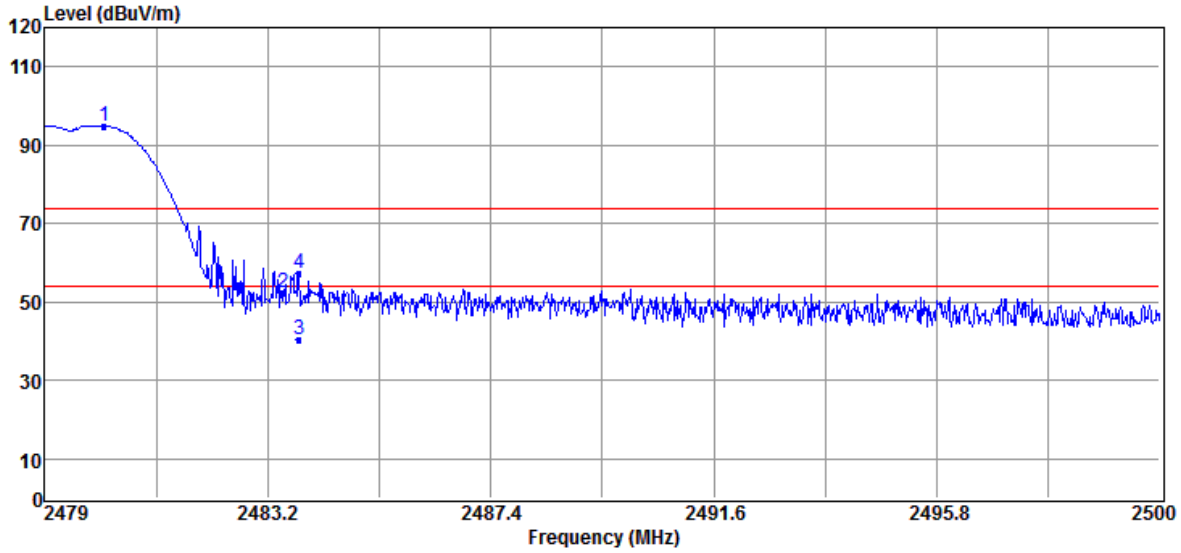
1 Field strength limits for frequency above 1000MHz are based on average limits. However, Peak mode field strength shall not exceed the average limits specified plus 20dB.

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	2480.11	110.62	-15.71	94.91	F	--	Peak	HORIZONTAL
2	2483.50	67.93	-15.71	52.22	74.00	-21.78	Peak	HORIZONTAL
3	2483.79	56.17	-15.71	40.46	54.00	-13.54	Average	HORIZONTAL
4	2483.79	72.89	-15.71	57.18	74.00	-16.82	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.

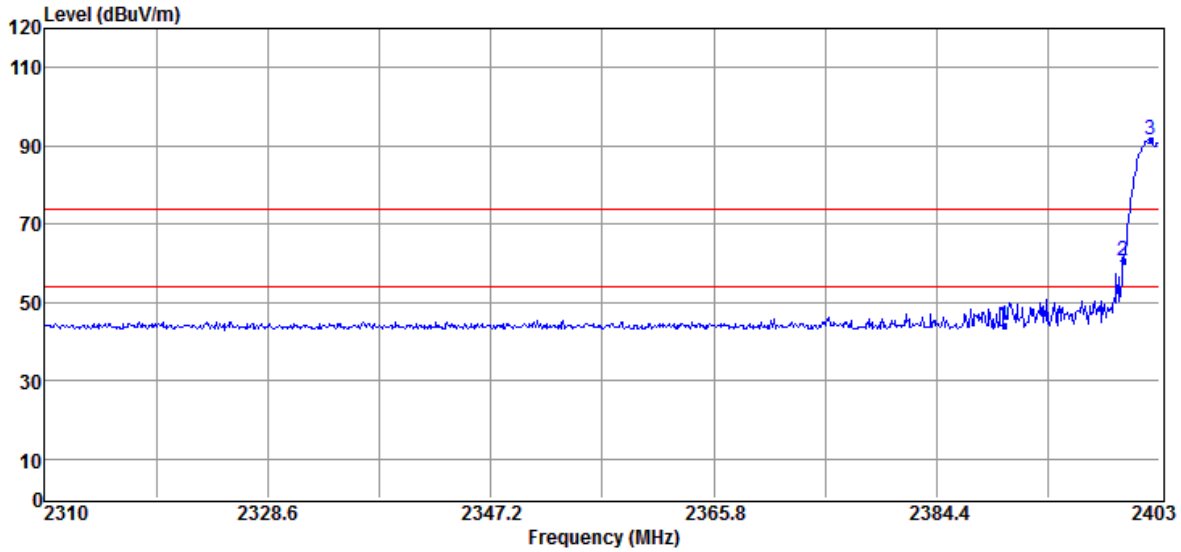
3 Spectrum Peak mode IF bandwidth Setting : 1GHz- 26GHz, RBW= 1MHz, Sweep time= 200 ms., the VBW setting was 3 MHz.

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

Note: "F" denotes fundamental frequency

Radiated Emission (EDR 2M Hopping mode):

Operation Mode	TX CH Low	Test Date	2018/12/26
Fundamental Frequency	2402 MHz	Test By	Barry
Temperature	25 ℃	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	59.97	-15.71	44.26	74.00	-29.74	Peak	VERTICAL
2	2400.00	76.28	-15.73	60.55	71.41	-10.86	Peak	VERTICAL
3	2402.26	107.14	-15.73	91.41	F	--	Peak	VERTICAL

Remark:

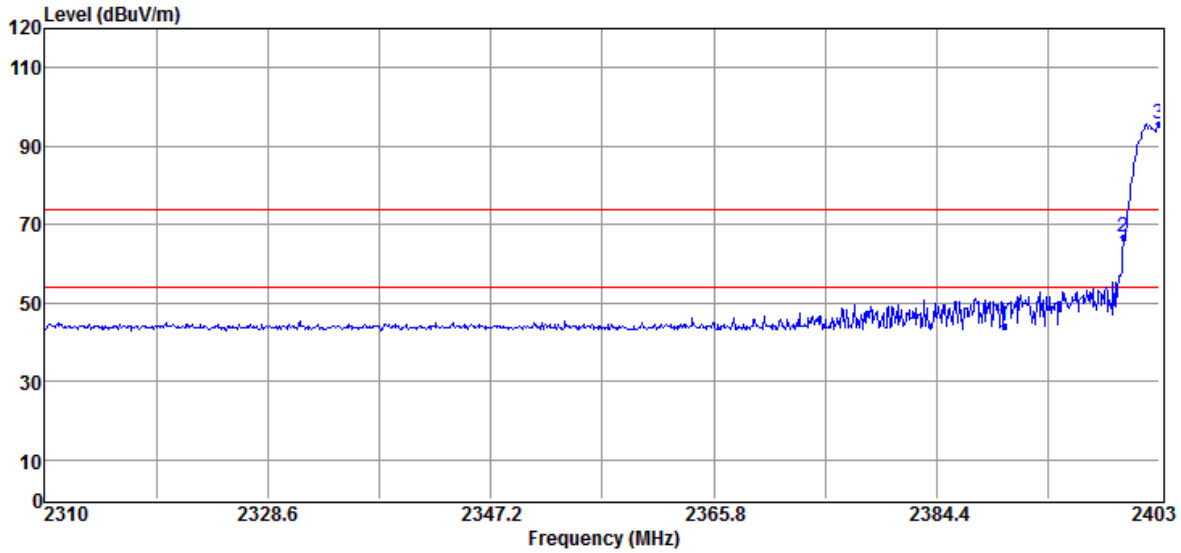
1 Field strength limits for frequency above 1000MHz are based on average limits. However, Peak mode field strength shall not exceed the average limits specified plus 20dB.

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	59.80	-15.71	44.09	74.00	-29.91	Peak	HORIZONTAL
2	2400.00	82.42	-15.73	66.69	75.52	-8.83	Peak	HORIZONTAL
3	2402.91	111.25	-15.73	95.52	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.

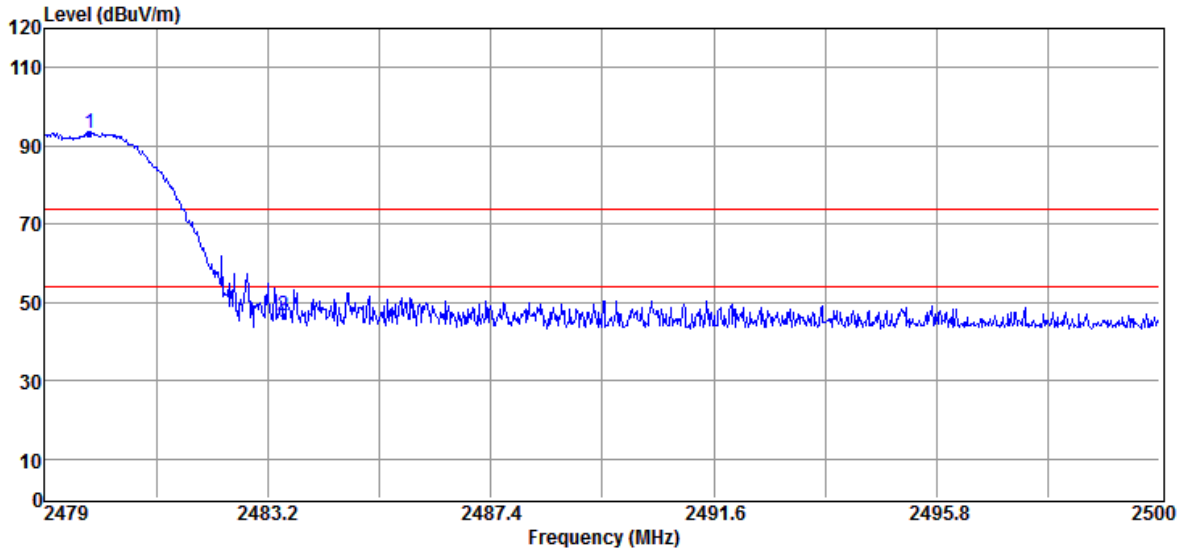
2 Measurement of data within this frequency range shown " - " in the table above means the reading of emissions are attenuated more than 20dB below the permissible limits or the field strength is too small to be measured.

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	2018/12/26
Fundamental Frequency	2480 MHz	Test By	Barry
Temperature	25 ℃	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	109.05	-15.71	93.34	F	---	Peak	VERTICAL
2	2483.50	62.50	-15.71	46.79	74.00	-27.21	Peak	VERTICAL

Remark:

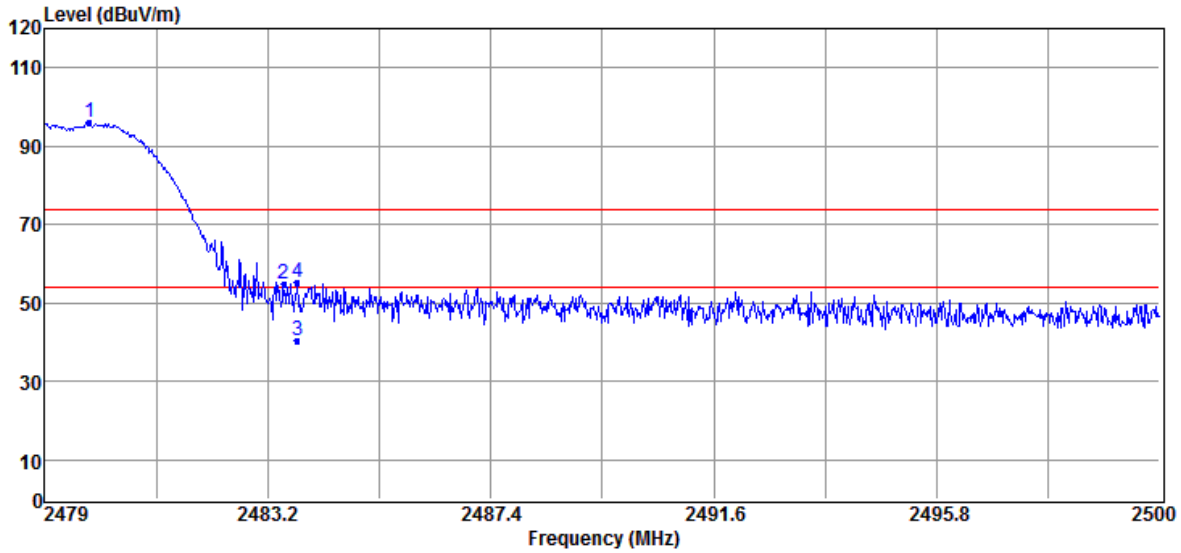
1 Field strength limits for frequency above 1000MHz are based on average limits. However, Peak mode field strength shall not exceed the average limits specified plus 20dB.

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	2479.84	111.65	-15.71	95.94	F	--	Peak	HORIZONTAL
2	2483.50	70.47	-15.71	54.76	74.00	-19.24	Peak	HORIZONTAL
3	2483.77	55.94	-15.71	40.23	54.00	-13.77	Average	HORIZONTAL
4	2483.77	70.87	-15.71	55.16	74.00	-18.84	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.

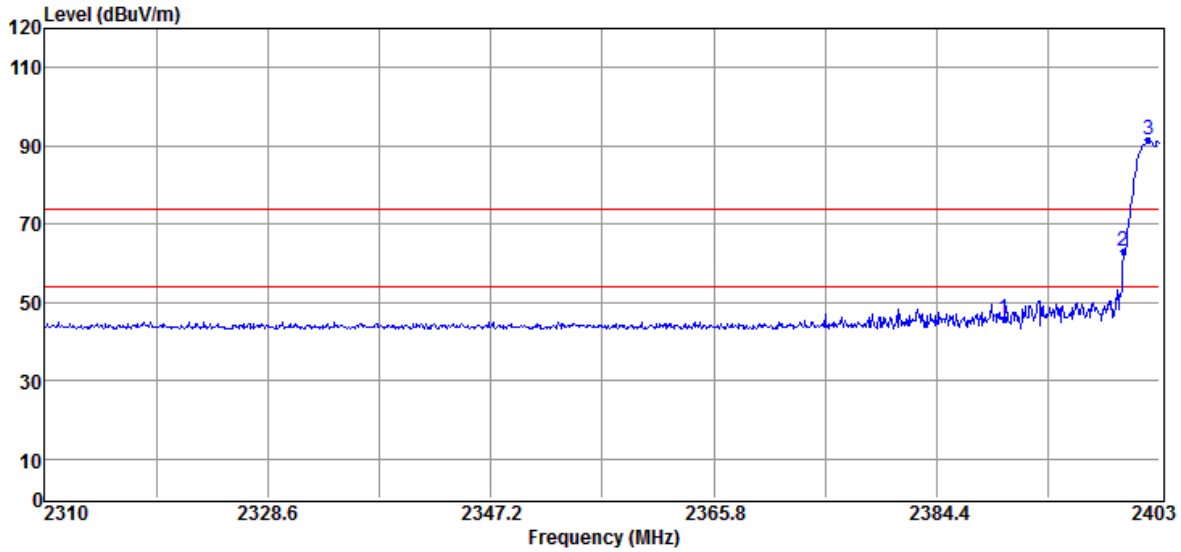
3 Spectrum Peak mode IF bandwidth Setting : 1GHz- 26GHz, RBW= 1MHz, Sweep time= 200 ms., the VBW setting was 3 MHz.

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

Note: "F" denotes fundamental frequency

Radiated Emission (EDR 3M Hopping mode):

Operation Mode	TX CH Low	Test Date	2018/12/26
Fundamental Frequency	2402 MHz	Test By	Barry
Temperature	25 ℃	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	61.47	-15.71	45.76	74.00	-28.24	Peak	VERTICAL
2	2400.00	78.77	-15.73	63.04	71.74	-8.70	Peak	VERTICAL
3	2402.07	107.47	-15.73	91.74	F	--	Peak	VERTICAL

Remark:

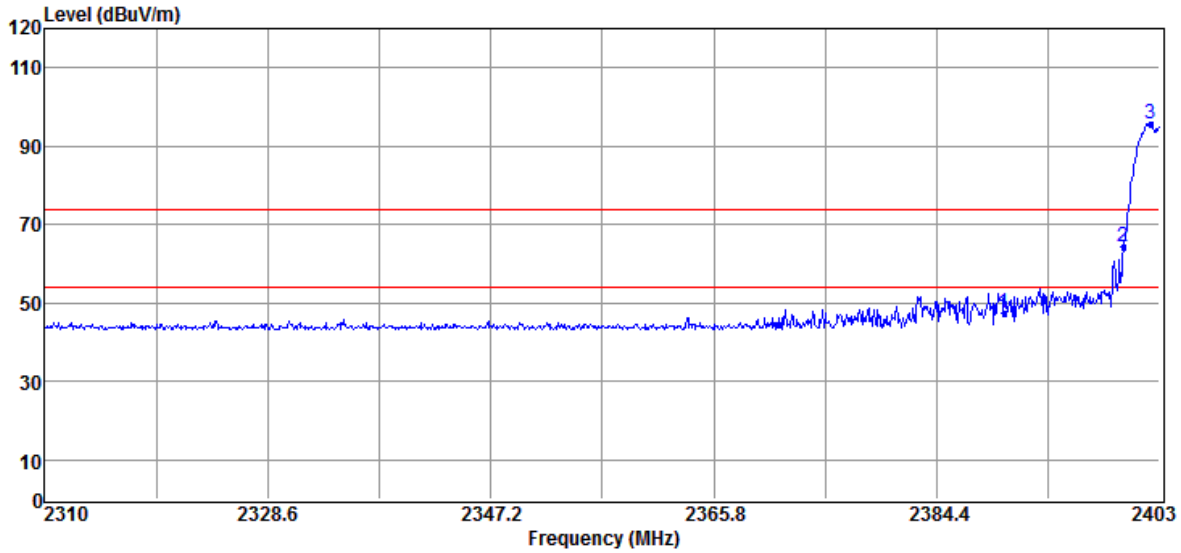
1 Field strength limits for frequency above 1000MHz are based on average limits. However, Peak mode field strength shall not exceed the average limits specified plus 20dB.

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	63.25	-15.71	47.54	74.00	-26.46	Peak	HORIZONTAL
2	2400.00	80.22	-15.73	64.49	75.53	-11.04	Peak	HORIZONTAL
3	2402.26	111.26	-15.73	95.53	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.

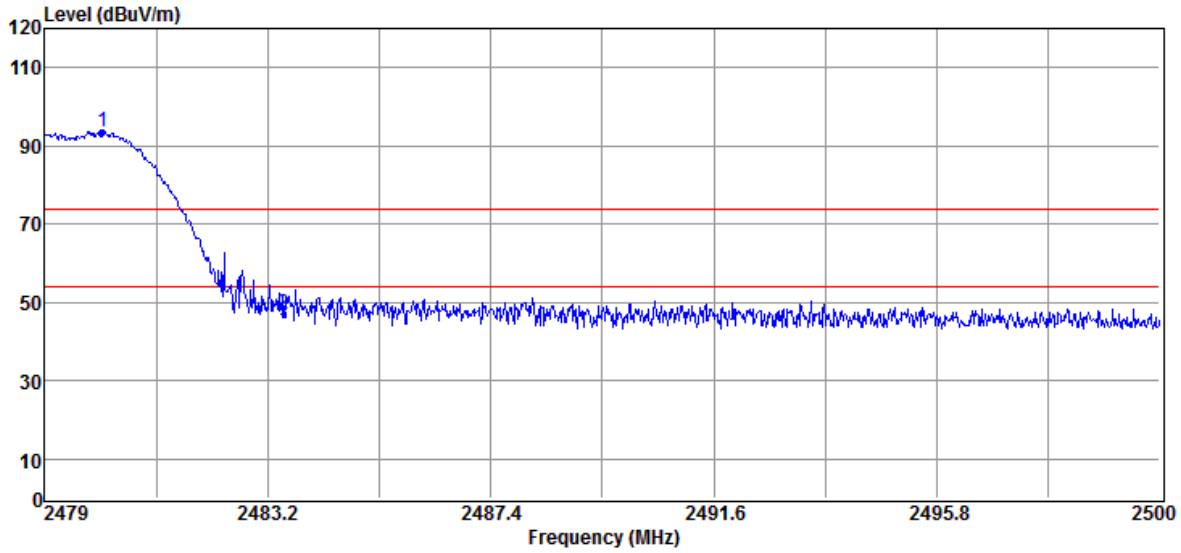
2 Measurement of data within this frequency range shown " - " in the table above means the reading of emissions are attenuated more than 20dB below the permissible limits or the field strength is too small to be measured.

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	2018/12/26
Fundamental Frequency	2480 MHz	Test By	Barry
Temperature	25 ℃	Humidity	60 %



No	Freq MHz	Reading dBuV	Factor dB/m	Level dBuV/m	Limit dBuV/m	Margin dB	Remark	Pol V/H
1	2480.09	109.38	-15.71	93.67	F	---	Peak	VERTICAL
2	2483.50	62.90	-15.71	47.19	74.00	-26.81	Peak	VERTICAL

Remark:

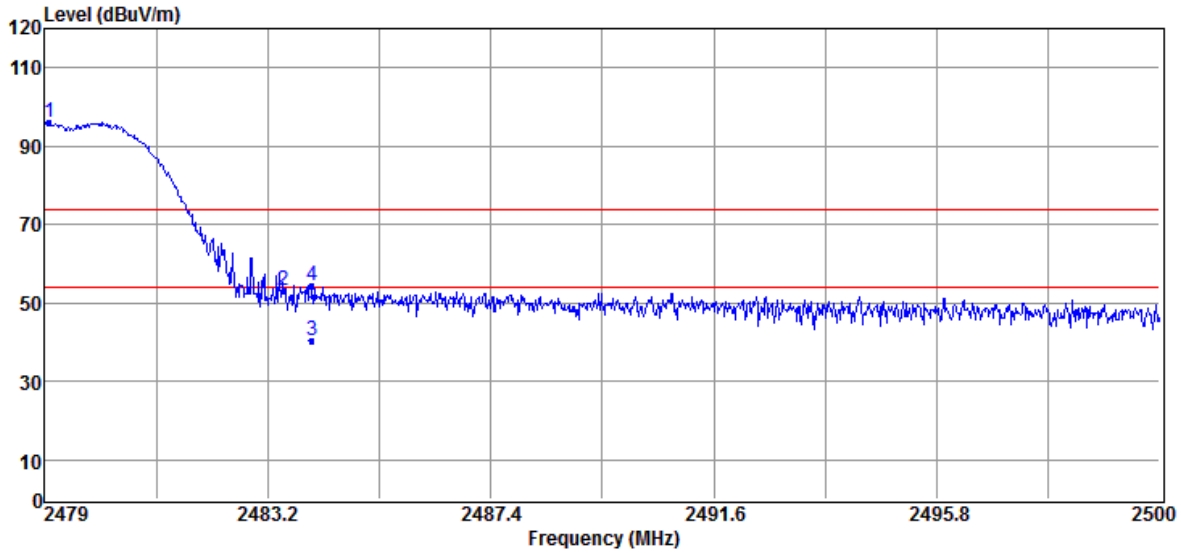
1 Field strength limits for frequency above 1000MHz are based on average limits. However, Peak mode field strength shall not exceed the average limits specified plus 20dB.

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	2479.08	111.70	-15.71	95.99	F	--	Peak	HORIZONTAL
2	2483.50	69.00	-15.71	53.29	74.00	-20.71	Peak	HORIZONTAL
3	2484.04	56.18	-15.71	40.47	54.00	-13.53	Average	HORIZONTAL
4	2484.04	70.24	-15.71	54.53	74.00	-19.47	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.

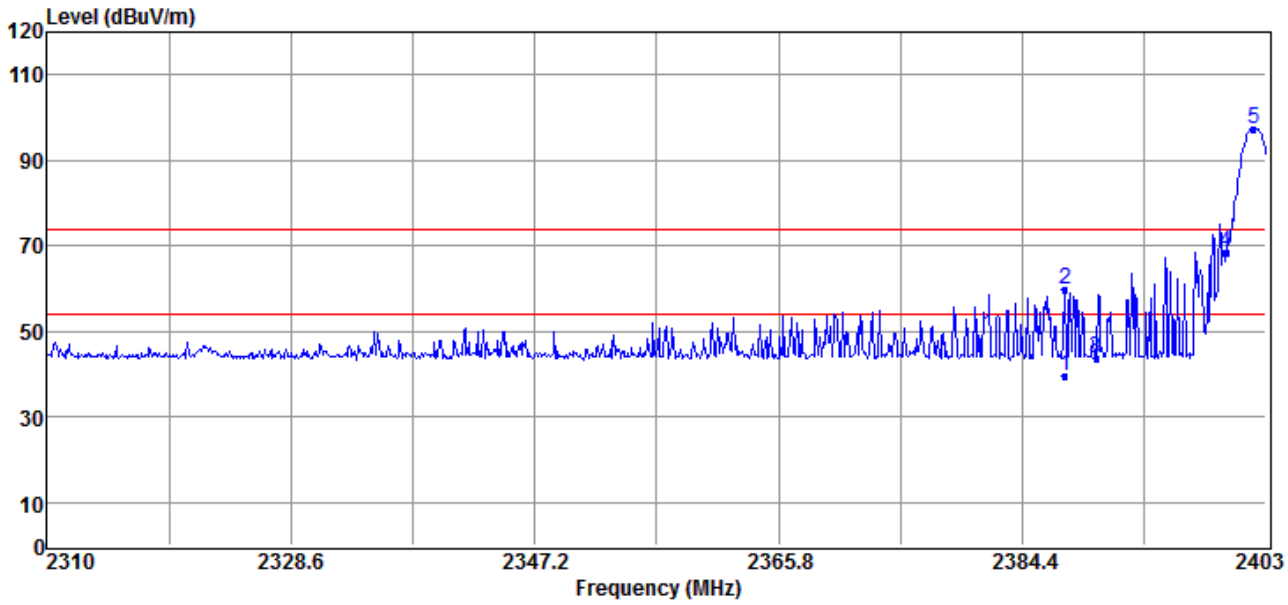
3 Spectrum Peak mode IF bandwidth Setting : 1GHz- 26GHz, RBW= 1MHz, Sweep time= 200 ms., the VBW setting was 3 MHz.

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

Note: "F" denotes fundamental frequency

Radiated Emission: (BDR Non-Hopping mode)

Operation Mode	TX CH Low	Test Date	2018/12/26
Fundamental Frequency	2402 MHz	Test By	Barry
Temperature	25 ℃	Humidity	60 %



No	Freq MHz	Reading dBuV	Factor dB/m	Level dBuV/m	Limit dBuV/m	Margin dB	Remark	Pol V/H
1	2387.66	55.31	-15.72	39.59	54.00	-14.41	Average	VERTICAL
2	2387.66	75.45	-15.72	59.73	74.00	-14.27	Peak	VERTICAL
3	2390.00	59.56	-15.71	43.85	74.00	-30.15	Peak	VERTICAL
4	2400.00	84.17	-15.73	68.44	77.42	-8.98	Peak	VERTICAL
5	2402.07	113.15	-15.73	97.42	F	--	Peak	VERTICAL

Remark:

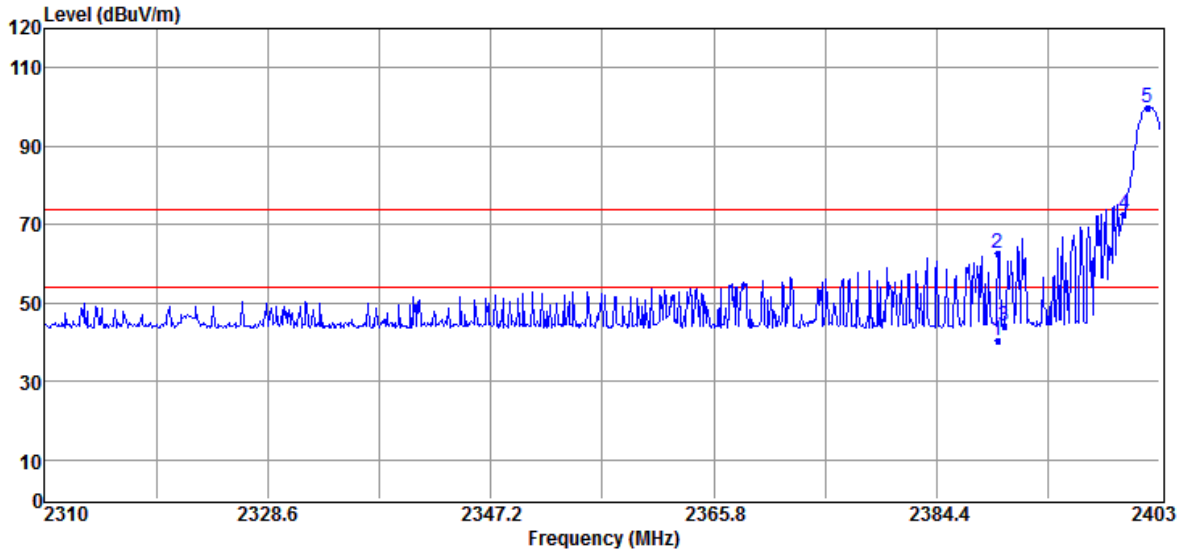
1 Field strength limits for frequency above 1000MHz are based on average limits. However, Peak mode field strength shall not exceed the average limits specified plus 20dB.

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	2389.52	56.17	-15.72	40.45	54.00	-13.55	Average	HORIZONTAL
2	2389.52	78.49	-15.72	62.77	74.00	-11.23	Peak	HORIZONTAL
3	2390.00	59.72	-15.71	44.01	74.00	-29.99	Peak	HORIZONTAL
4	2400.02	88.45	-15.73	72.72	79.98	-7.26	Peak	HORIZONTAL
5	2401.98	115.71	-15.73	99.98	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.

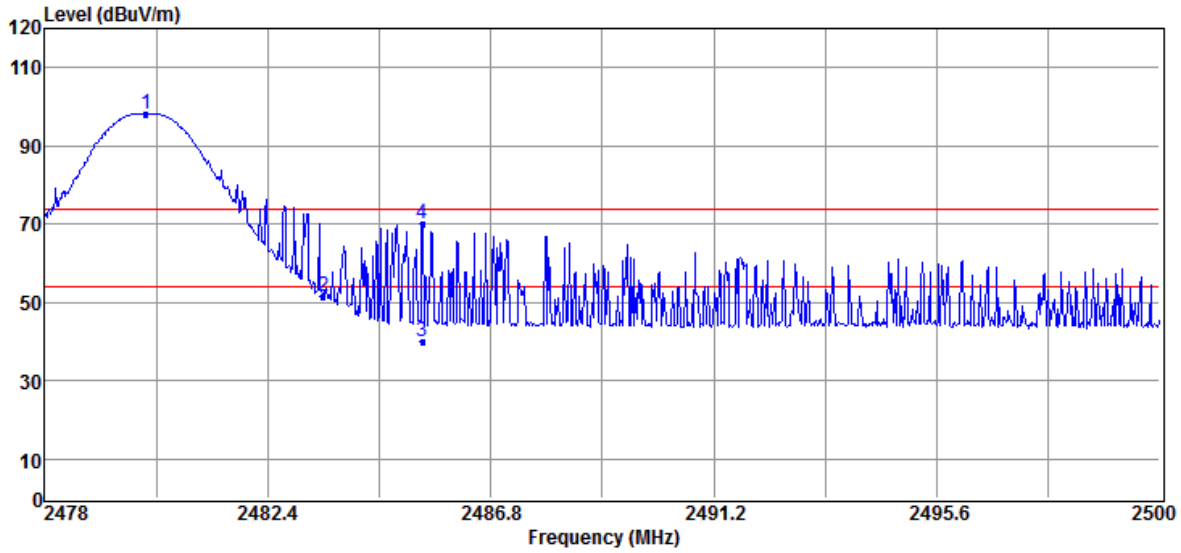
2 Measurement of data within this frequency range shown " - " in the table above means the reading of emissions are attenuated more than 20dB below the permissible limits or the field strength is too small to be measured.

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	2018/12/26
Fundamental Frequency	2480 MHz	Test By	Barry
Temperature	25 ℃	Humidity	60 %



No	Freq MHz	Reading dBuV	Factor dB/m	Level dBuV/m	Limit dBuV/m	Margin dB	Remark	Pol V/H
1	2480.00	114.03	-15.71	98.32	F	--	Peak	VERTICAL
2	2483.50	67.17	-15.71	51.46	74.00	-22.54	Peak	VERTICAL
3	2485.46	55.61	-15.70	39.91	54.00	-14.09	Average	VERTICAL
4	2485.46	85.81	-15.70	70.11	74.00	-3.89	Peak	VERTICAL

Remark:

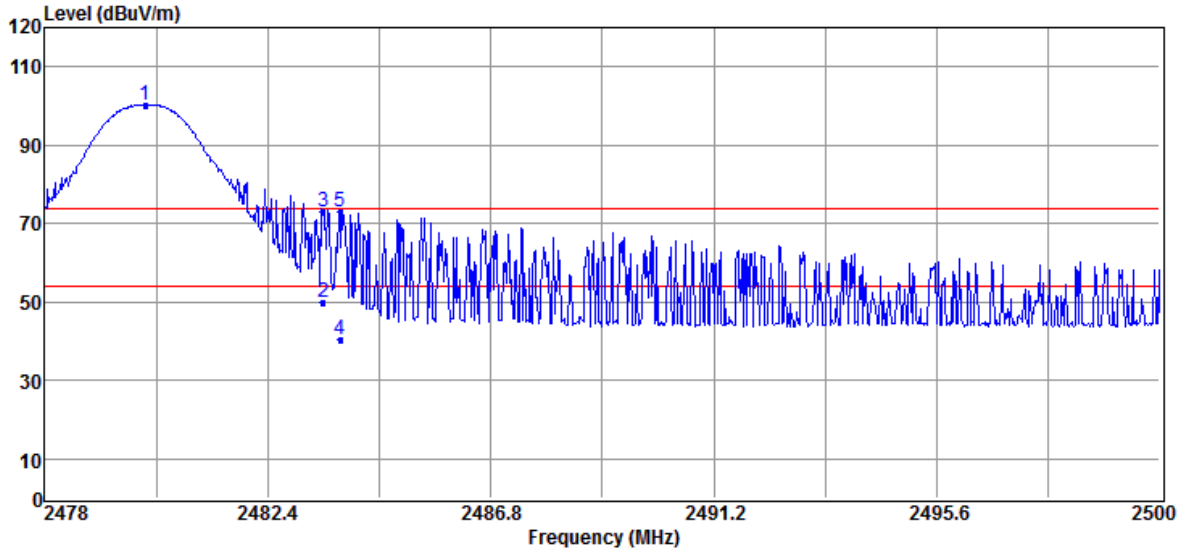
1 Field strength limits for frequency above 1000MHz are based on average limits. However, Peak mode field strength shall not exceed the average limits specified plus 20dB.

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	2479.98	116.04	-15.71	100.33	F	--	Peak	HORIZONTAL
2	2483.50	65.75	-15.71	50.04	54.00	-3.96	Average	HORIZONTAL
3	2483.50	88.59	-15.71	72.88	74.00	-1.12	Peak	HORIZONTAL
4	2483.83	56.02	-15.71	40.31	54.00	-13.69	Average	HORIZONTAL
5	2483.83	88.52	-15.71	72.81	74.00	-1.19	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.

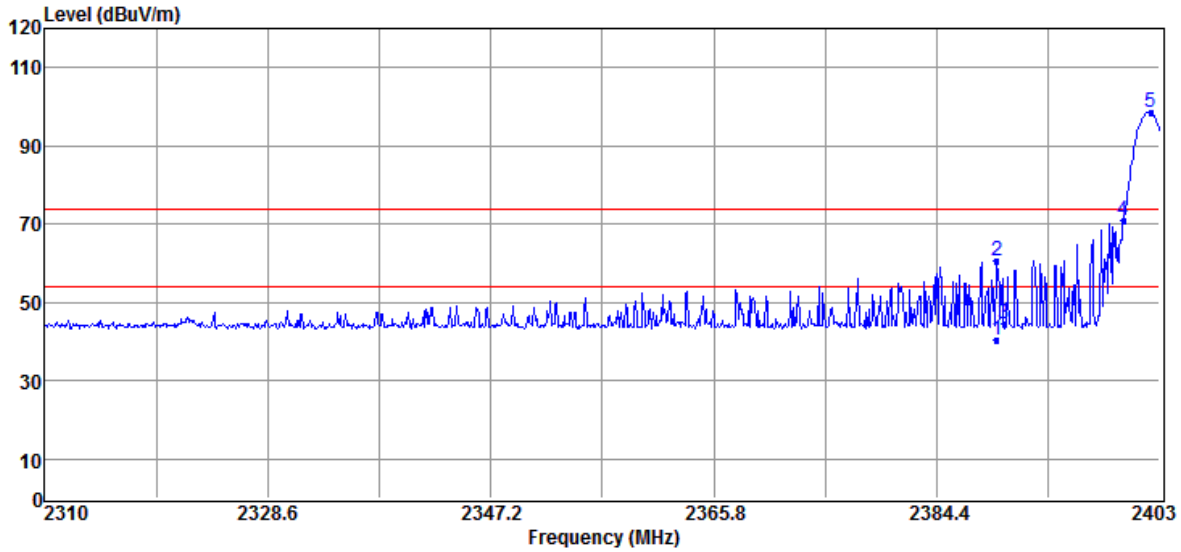
3 Spectrum Peak mode IF bandwidth Setting : 1GHz- 26GHz, RBW= 1MHz, Sweep time= 200 ms., the VBW setting was 3 MHz.

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

Note: "F" denotes fundamental frequency

Radiated Emission (EDR 2M Non-Hopping mode):

Operation Mode	TX CH Low	Test Date	2018/12/26
Fundamental Frequency	2402 MHz	Test By	Barry
Temperature	25 ℃	Humidity	60 %



No	Freq MHz	Reading dBuV	Factor dB/m	Level dBuV/m	Limit dBuV/m	Margin dB	Remark	Pol V/H
1	2389.42	56.22	-15.72	40.50	54.00	-13.50	Average	VERTICAL
2	2389.42	76.20	-15.72	60.48	74.00	-13.52	Peak	VERTICAL
3	2390.00	60.25	-15.71	44.54	74.00	-29.46	Peak	VERTICAL
4	2400.00	86.65	-15.73	70.92	78.49	-7.57	Peak	VERTICAL
5	2402.26	114.22	-15.73	98.49	F	--	Peak	VERTICAL

Remark:

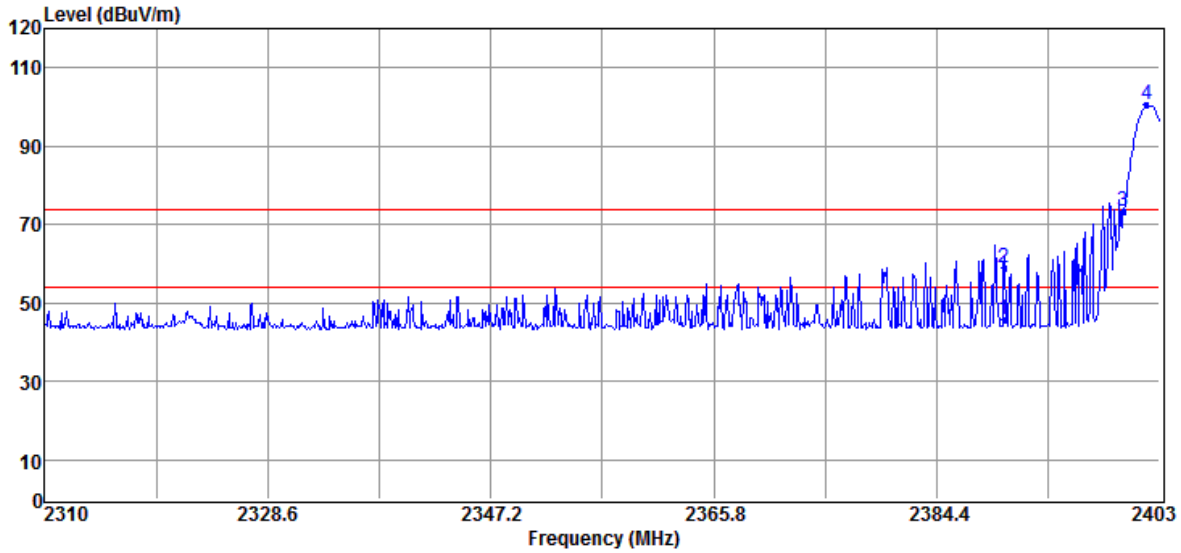
1 Field strength limits for frequency above 1000MHz are based on average limits. However, Peak mode field strength shall not exceed the average limits specified plus 20dB.

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	61.44	-15.71	45.73	54.00	-8.27	Average	HORIZONTAL
2	2390.00	74.67	-15.71	58.96	74.00	-15.04	Peak	HORIZONTAL
3	2400.00	89.05	-15.73	73.32	80.47	-7.15	Peak	HORIZONTAL
4	2401.88	116.20	-15.73	100.47	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.

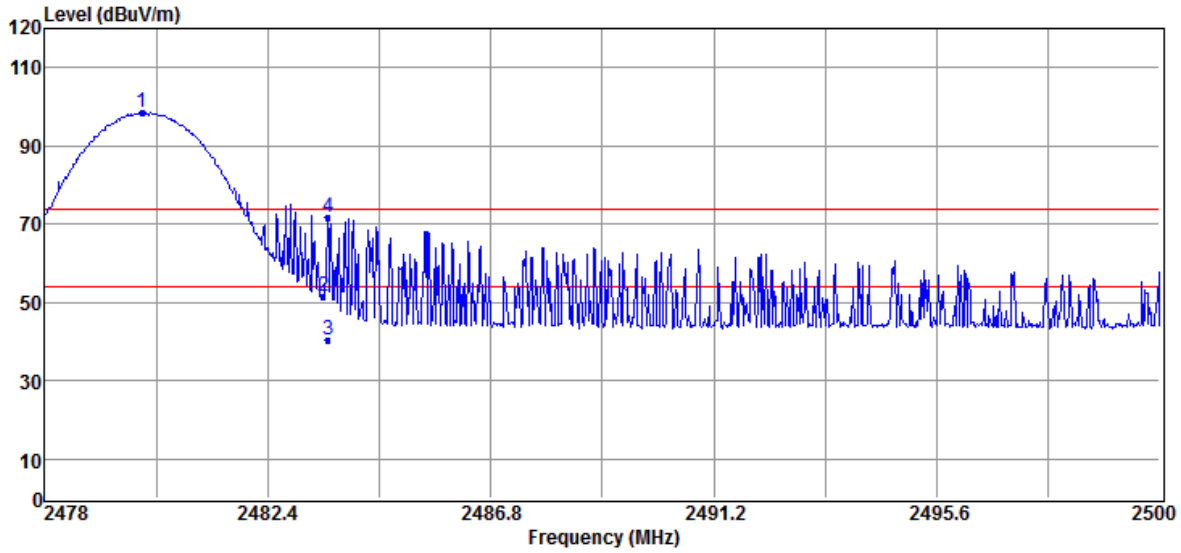
2 Measurement of data within this frequency range shown " - " in the table above means the reading of emissions are attenuated more than 20dB below the permissible limits or the field strength is too small to be measured.

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	2018/12/26
Fundamental Frequency	2480 MHz	Test By	Barry
Temperature	25 ℃	Humidity	60 %



No	Freq MHz	Reading dBuV	Factor dB/m	Level dBuV/m	Limit dBuV/m	Margin dB	Remark	Pol V/H
1	2479.91	114.20	-15.71	98.49	F	--	Peak	VERTICAL
2	2483.50	67.29	-15.71	51.58	74.00	-22.42	Peak	VERTICAL
3	2483.59	55.94	-15.71	40.23	54.00	-13.77	Average	VERTICAL
4	2483.59	87.51	-15.71	71.80	74.00	-2.20	Peak	VERTICAL

Remark:

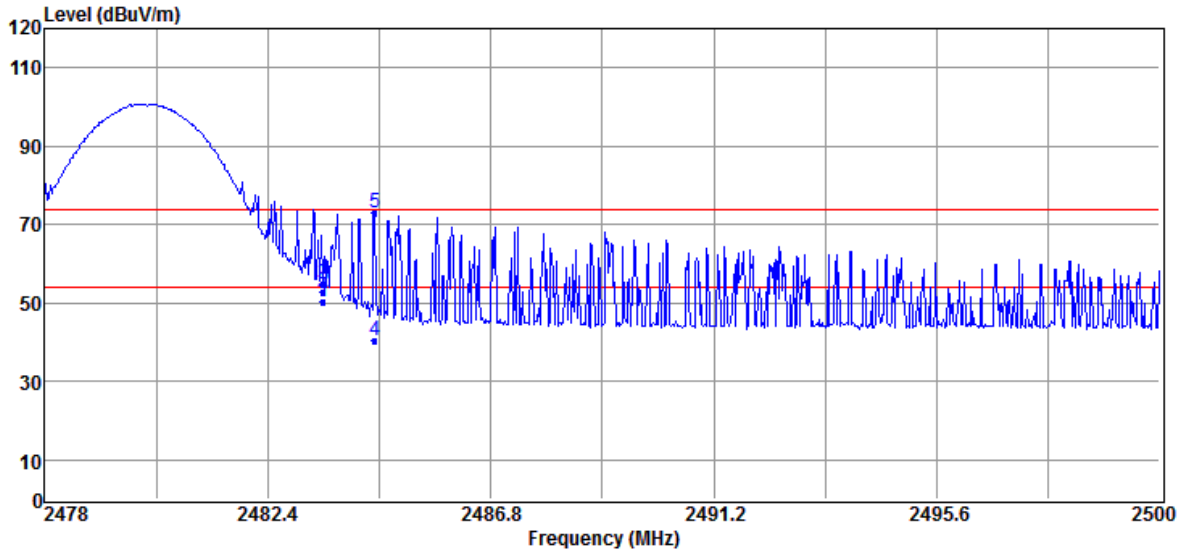
1 Field strength limits for frequency above 1000MHz are based on average limits. However, Peak mode field strength shall not exceed the average limits specified plus 20dB.

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	2483.50	66.17	-15.71	50.46	54.00	-3.54	Average	HORIZONTAL
2	2483.50	68.38	-15.71	52.67	54.00	-1.33	Average	HORIZONTAL
3	2483.50	70.65	-15.71	54.94	F	--	Peak	HORIZONTAL
4	2484.51	56.29	-15.71	40.58	54.00	-13.42	Average	HORIZONTAL
5	2484.51	88.51	-15.71	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.

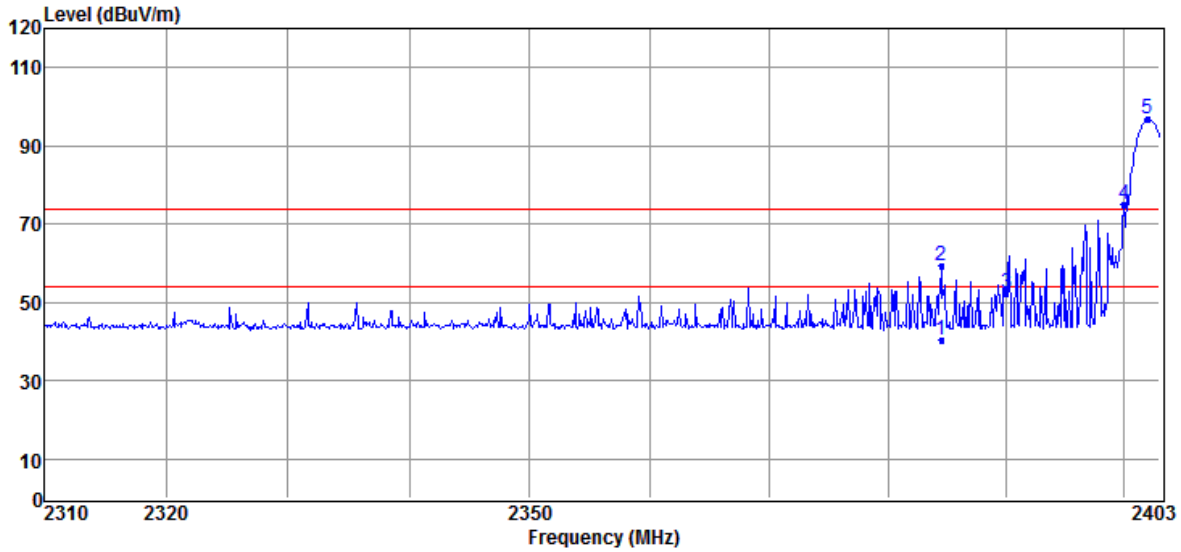
3 Spectrum Peak mode IF bandwidth Setting : 1GHz- 26GHz, RBW= 1MHz, Sweep time= 200 ms., the VBW setting was 3 MHz.

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

Note: "F" denotes fundamental frequency

Radiated Emission (EDR 3M Non-Hopping mode):

Operation Mode	TX CH Low	Test Date	2018/12/26
Fundamental Frequency	2402 MHz	Test By	Barry
Temperature	25 ℃	Humidity	60 %

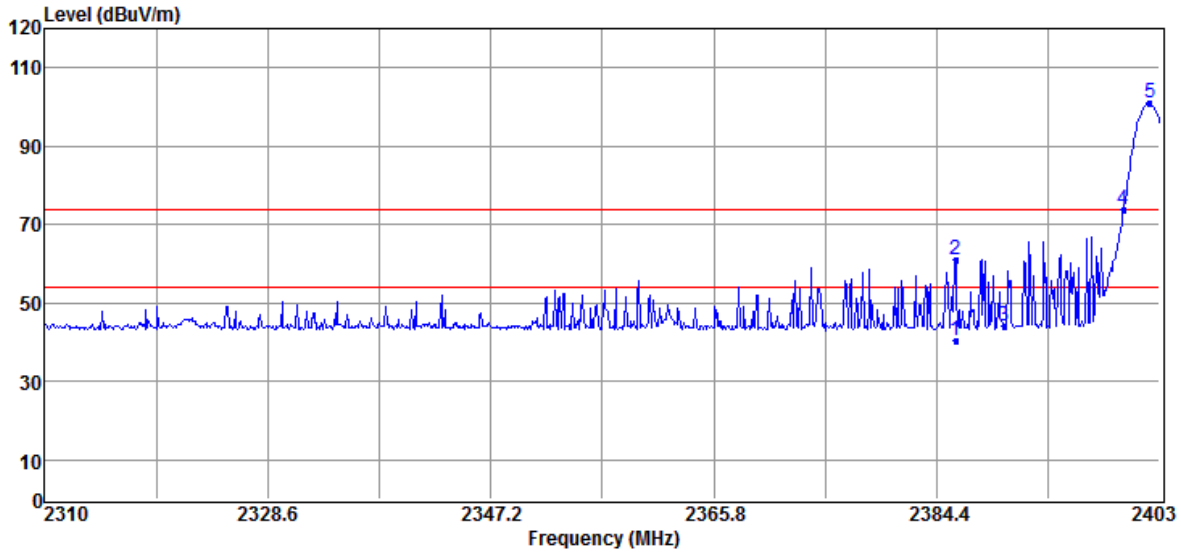


No	Freq MHz	Reading dBuV	Factor dB/m	Level dBuV/m	Limit dBuV/m	Margin dB	Remark	Pol V/H
1	2384.48	56.06	-15.71	40.35	54.00	-13.65	Average	VERTICAL
2	2384.48	74.92	-15.71	59.21	74.00	-14.79	Peak	VERTICAL
3	2390.00	67.98	-15.71	52.27	74.00	-21.73	Peak	VERTICAL
4	2400.00	90.80	-15.73	75.07	76.91	-1.84	Peak	VERTICAL
5	2401.96	112.64	-15.73	96.91	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	2385.98	56.11	-15.71	40.40	54.00	-13.60	Average	HORIZONTAL
2	2385.98	76.87	-15.71	61.16	74.00	-12.84	Peak	HORIZONTAL
3	2390.00	59.68	-15.71	43.97	74.00	-30.03	Peak	HORIZONTAL
4	2400.00	89.40	-15.73	73.67	80.90	-7.23	Peak	HORIZONTAL
5	2402.16	116.63	-15.73	100.90	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.

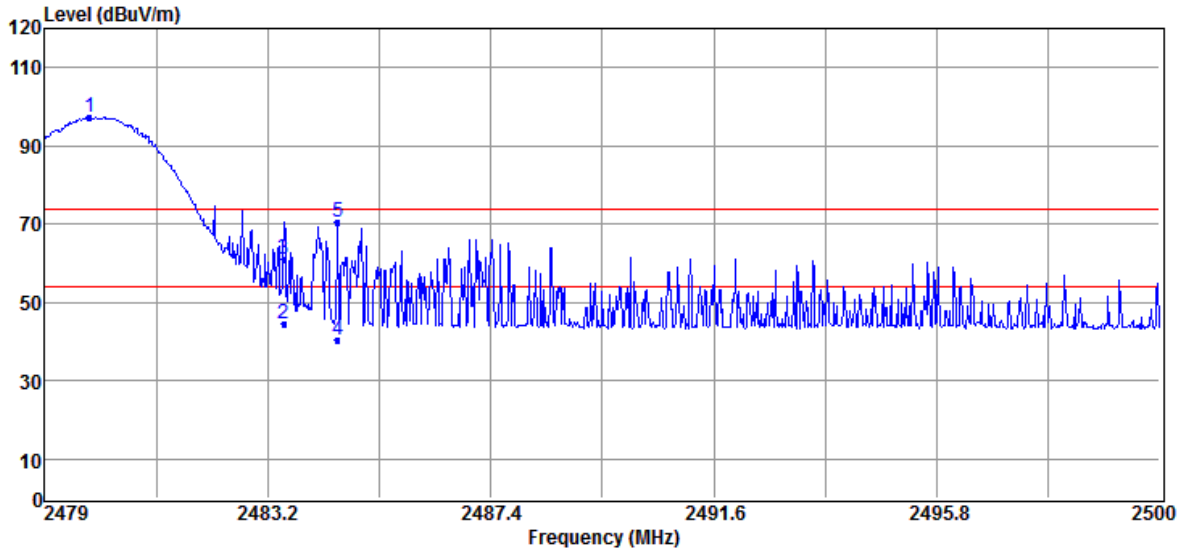
2 Measurement of data within this frequency range shown " - " in the table above means the reading of emissions are attenuated more than 20dB below the permissible limits or the field strength is too small to be measured.

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	2018/12/26
Fundamental Frequency	2480 MHz	Test By	Barry
Temperature	25 ℃	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	112.93	-15.71	97.22	F	--	Peak	VERTICAL
2	2483.50	60.12	-15.71	44.41	54.00	-9.59	Average	VERTICAL
3	2483.50	76.72	-15.71	61.01	74.00	-12.99	Peak	VERTICAL
4	2484.52	56.09	-15.71	40.38	54.00	-13.62	Average	VERTICAL
5	2484.52	86.15	-15.71	70.44	74.00	-3.56	Peak	VERTICAL

Remark:

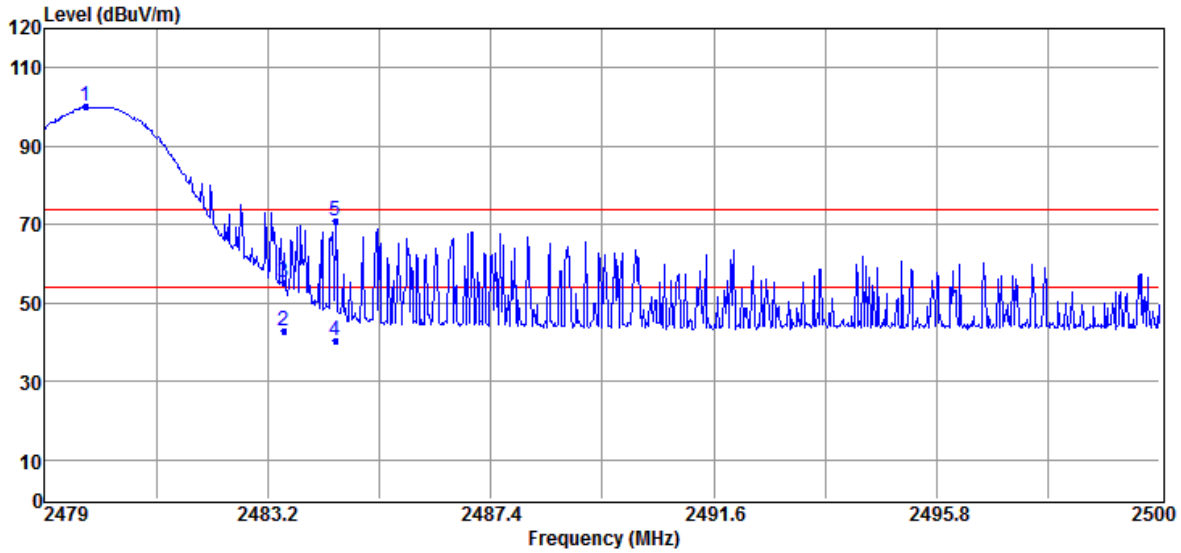
1 Field strength limits for frequency above 1000MHz are based on average limits. However, Peak mode field strength shall not exceed the average limits specified plus 20dB.

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	115.71	-15.71	100.00	F	--	Peak	HORIZONTAL
2	2483.50	58.44	-15.71	42.73	54.00	-11.27	Average	HORIZONTAL
3	2483.50	71.00	-15.71	55.29	74.00	-18.71	Peak	HORIZONTAL
4	2484.48	56.15	-15.71	40.44	54.00	-13.56	Average	HORIZONTAL
5	2484.48	86.72	-15.71	71.01	74.00	-2.99	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

8. Spurious Emission Test

8.1 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.

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:

The test item only performed radiated mode

Refer to section 7.3 for details.

8.4 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.

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.

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

Operation Mode	TX CH Low	Test Date	2019/01/07
Fundamental Frequency	2402MHz	Test By	Barry
Temperature	25 ℃	Humidity	60 %

No	Freq MHz	Reading dBuV	Factor dB	Level dBuV/m	Limit dBuV/m	Margin dB	Remark	Pol V/H
1	46.49	42.69	-6.24	36.45	40.00	-3.55	Peak	VERTICAL
2	68.80	39.22	-8.44	30.78	40.00	-9.22	Peak	VERTICAL
3	310.33	35.85	-4.66	31.19	46.00	-14.81	Peak	VERTICAL
4	442.25	38.48	-2.21	36.27	46.00	-9.73	Peak	VERTICAL
5	568.35	34.38	-0.36	34.02	46.00	-11.98	Peak	VERTICAL
6	779.81	30.77	3.40	34.17	46.00	-11.83	Peak	VERTICAL
1	47.46	36.77	-6.21	30.56	40.00	-9.44	Peak	HORIZONTAL
2	159.01	37.34	-5.90	31.44	43.50	-12.06	Peak	HORIZONTAL
3	232.73	39.57	-7.43	32.14	46.00	-13.86	Peak	HORIZONTAL
4	313.24	36.41	-4.61	31.80	46.00	-14.20	Peak	HORIZONTAL
5	442.25	38.92	-2.21	36.71	46.00	-9.29	Peak	HORIZONTAL
6	787.57	33.96	3.47	37.43	46.00	-8.57	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	2019/01/07
Fundamental Frequency	2441MHz	Test By	Barry
Temperature	25 ℃	Humidity	60 %

No	Freq MHz	Reading dBuV	Factor dB	Level dBuV/m	Limit dBuV/m	Margin dB	Remark	Pol V/H
1	47.46	44.29	-6.21	38.08	40.00	-1.92	Peak	VERTICAL
2	69.77	40.12	-8.63	31.49	40.00	-8.51	Peak	VERTICAL
3	217.21	34.12	-8.27	25.85	46.00	-20.15	Peak	VERTICAL
4	312.27	36.77	-4.62	32.15	46.00	-13.85	Peak	VERTICAL
5	450.98	39.17	-2.06	37.11	46.00	-8.89	Peak	VERTICAL
6	753.62	30.89	3.13	34.02	46.00	-11.98	Peak	VERTICAL
1	48.43	39.02	-6.19	32.83	40.00	-7.17	Peak	HORIZONTAL
2	159.01	36.81	-5.90	30.91	43.50	-12.59	Peak	HORIZONTAL
3	236.61	39.11	-7.17	31.94	46.00	-14.06	Peak	HORIZONTAL
4	312.27	36.33	-4.62	31.71	46.00	-14.29	Peak	HORIZONTAL
5	443.22	37.94	-2.20	35.74	46.00	-10.26	Peak	HORIZONTAL
6	777.87	33.31	3.37	36.68	46.00	-9.32	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	2019/01/07
Fundamental Frequency	2480MHz	Test By	Barry
Temperature	25 ℃	Humidity	60 %

No	Freq MHz	Reading dBuV	Factor dB	Level dBuV/m	Limit dBuV/m	Margin dB	Remark	Pol V/H
1	39.70	43.94	-6.73	37.21	40.00	-2.79	Peak	VERTICAL
2	69.77	41.47	-8.63	32.84	40.00	-7.16	Peak	VERTICAL
3	159.01	32.14	-5.90	26.24	43.50	-17.26	Peak	VERTICAL
4	311.30	36.60	-4.65	31.95	46.00	-14.05	Peak	VERTICAL
5	454.86	38.68	-2.03	36.65	46.00	-9.35	Peak	VERTICAL
6	571.26	35.30	-0.29	35.01	46.00	-10.99	Peak	VERTICAL
1	48.43	39.39	-6.19	33.20	40.00	-6.80	Peak	HORIZONTAL
2	157.07	36.98	-5.91	31.07	43.50	-12.43	Peak	HORIZONTAL
3	216.24	40.46	-8.31	32.15	46.00	-13.85	Peak	HORIZONTAL
4	312.27	35.91	-4.62	31.29	46.00	-14.71	Peak	HORIZONTAL
5	451.95	38.28	-2.06	36.22	46.00	-9.78	Peak	HORIZONTAL
6	739.07	34.33	2.82	37.15	46.00	-8.85	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	Test Date	2019/01/07
Fundamental Frequency	2402 MHz	Test By	Barry
Temperature	25 ℃	Humidity	60 %

No	Freq MHz	Reading dBuV	Factor dB	Level dBuV/m	Limit dBuV/m	Margin dB	Remark	Pol V/H
1	4804.00	44.58	-9.27	35.31	74.00	-38.69	Peak	VERTICAL
2	7307.00	46.55	-1.65	44.90	74.00	-29.10	Peak	VERTICAL
1	4804.00	44.84	-9.27	35.57	74.00	-38.43	Peak	HORIZONTAL
2	7230.00	46.55	-1.68	44.87	74.00	-29.13	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	2019/01/07
Fundamental Frequency	2441 MHz	Test By	Barry
Temperature	25 ℃	Humidity	60 %

No	Freq MHz	Reading dBuV	Factor dB	Level dBuV/m	Limit dBuV/m	Margin dB	Remark	Pol V/H
1	4882.00	44.95	-9.07	35.88	74.00	-38.12	Peak	VERTICAL
2	7335.00	46.69	-1.63	45.06	74.00	-28.94	Peak	VERTICAL
1	4882.00	44.94	-9.07	35.87	74.00	-38.13	Peak	HORIZONTAL
2	7258.00	46.45	-1.67	44.78	74.00	-29.22	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	2019/01/07
Fundamental Frequency	2480 MHz	Test By	Barry
Temperature	25 ℃	Humidity	60 %

No	Freq MHz	Reading dBuV	Factor dB	Level dBuV/m	Limit dBuV/m	Margin dB	Remark	Pol V/H
1	4960.00	44.37	-8.87	35.50	74.00	-38.50	Peak	VERTICAL
2	7356.00	47.38	-1.62	45.76	74.00	-28.24	Peak	VERTICAL
1	4960.00	44.32	-8.87	35.45	74.00	-38.55	Peak	HORIZONTAL
2	7335.00	47.49	-1.63	45.86	74.00	-28.14	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.

9. Frequency Separation

9.1 Standard Applicable:

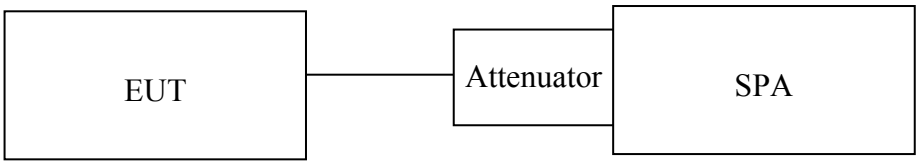
According to FCC 15.247 (a)(1) & RSS-247 5.1(b) requirement:

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.

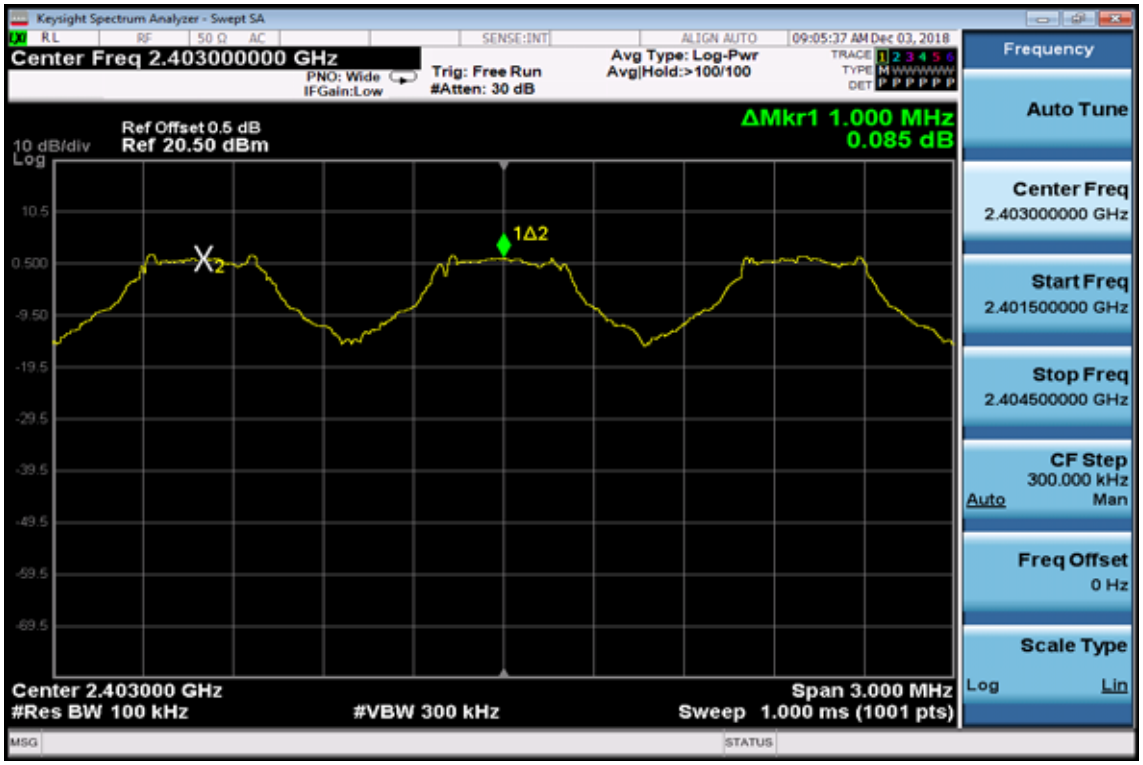
9.5 Measurement Result:

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

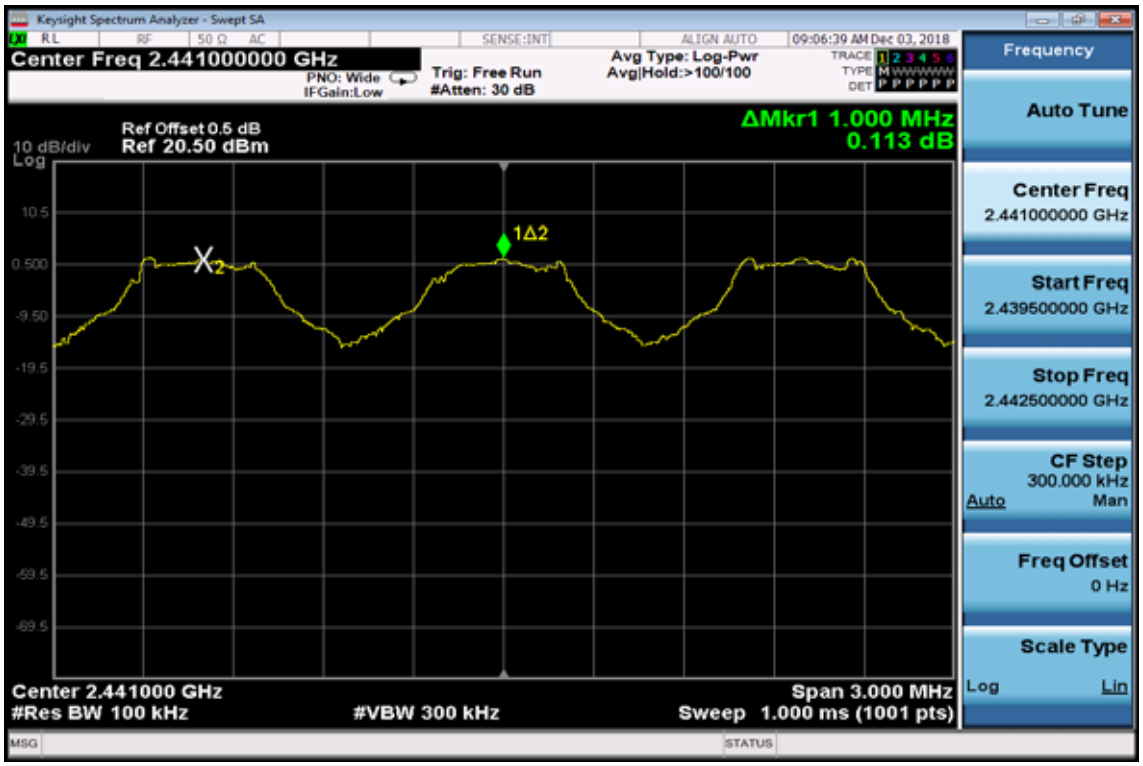
Note: Refer to next page for plots.

Frequency Separation Test Data

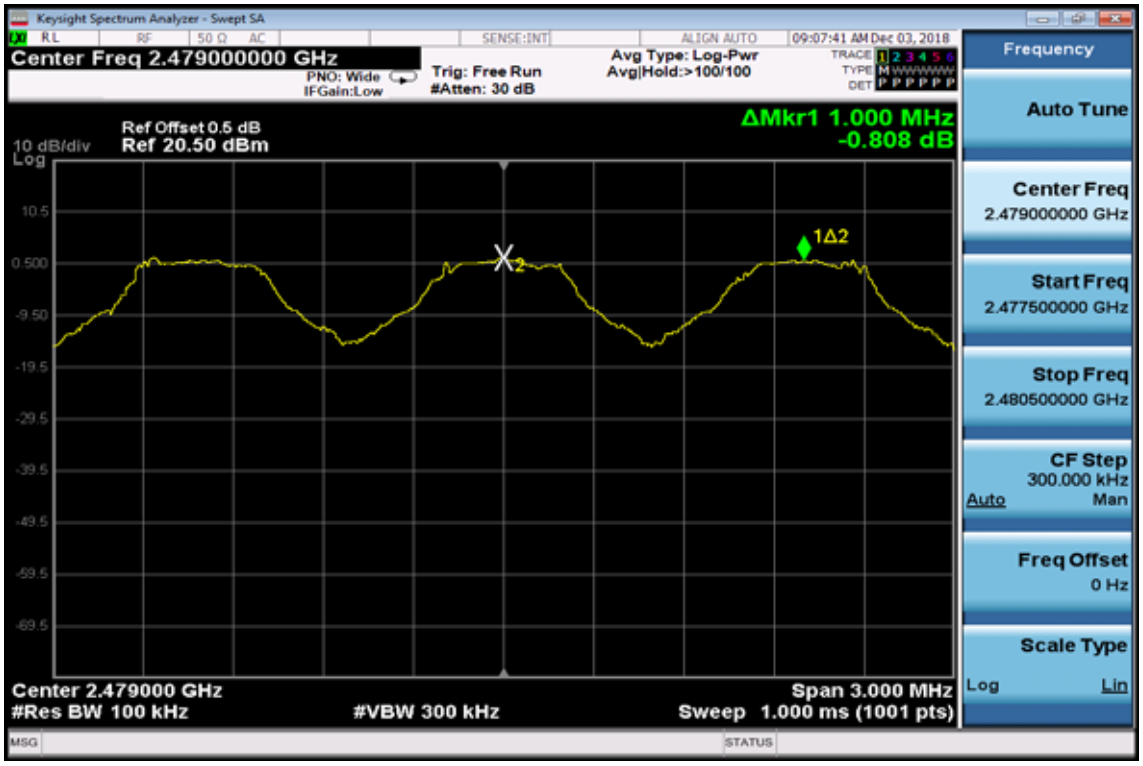
Low



Mid



High


Keysight 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
09:07:41 AM Dec 03, 2018
Ref Offset 0.5 dB
10 dB/div
Ref 20.50 dBm
Log
ΔMkr1 1.000 MHz
-0.808 dB
1Δ2
Center 2.479000 GHz
#Res BW 100 kHz
#VBW 300 kHz
Span 3.000 MHz
Sweep 1.000 ms (1001 pts)
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
Scale Type
Log
Lin

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.

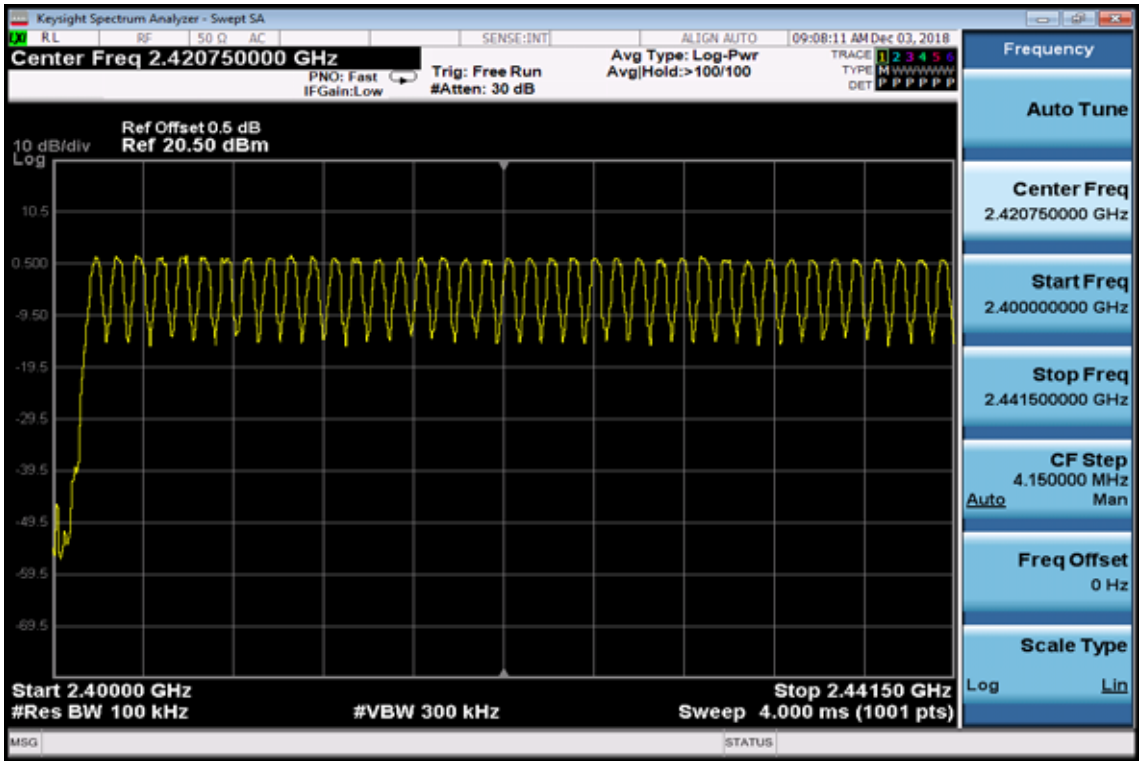
10.4 Measurement Procedure:

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.

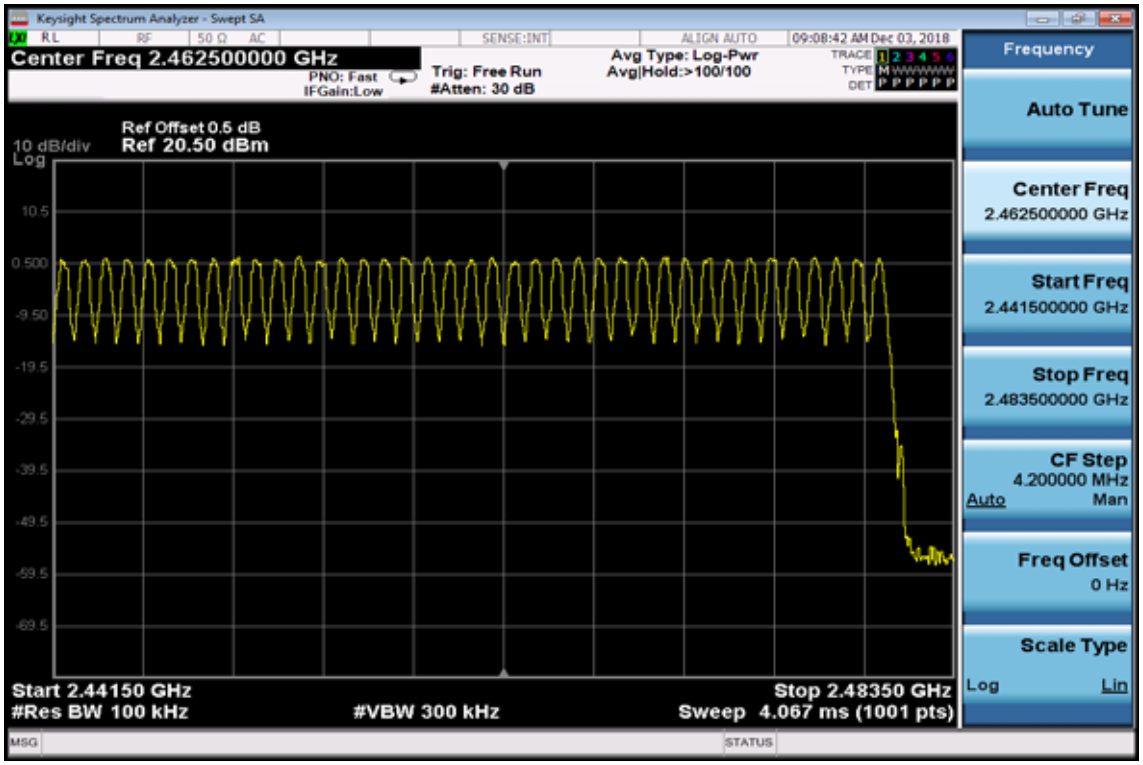
10.5 Measurement Result:

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	DH1 time slot	=	0.360 (ms)	*	(1600/2/79)	* 31.6 =	115.20	(ms)
	DH3 time slot	=	1.610 (ms)	*	(1600/4/79)	* 31.6 =	257.60	(ms)
	DH5 time slot	=	2.860 (ms)	*	(1600/6/79)	* 31.6 =	305.07	(ms)
CH Mid	DH1 time slot	=	0.360 (ms)	*	(1600/2/79)	* 31.6 =	115.20	(ms)
	DH3 time slot	=	1.590 (ms)	*	(1600/4/79)	* 31.6 =	254.40	(ms)
	DH5 time slot	=	2.840 (ms)	*	(1600/6/79)	* 31.6 =	302.93	(ms)
CH High	DH1 time slot	=	0.364 (ms)	*	(1600/2/79)	* 31.6 =	116.48	(ms)
	DH3 time slot	=	1.600 (ms)	*	(1600/4/79)	* 31.6 =	256.00	(ms)
	DH5 time slot	=	2.840 (ms)	*	(1600/6/79)	* 31.6 =	302.93	(ms)

AFH mode:

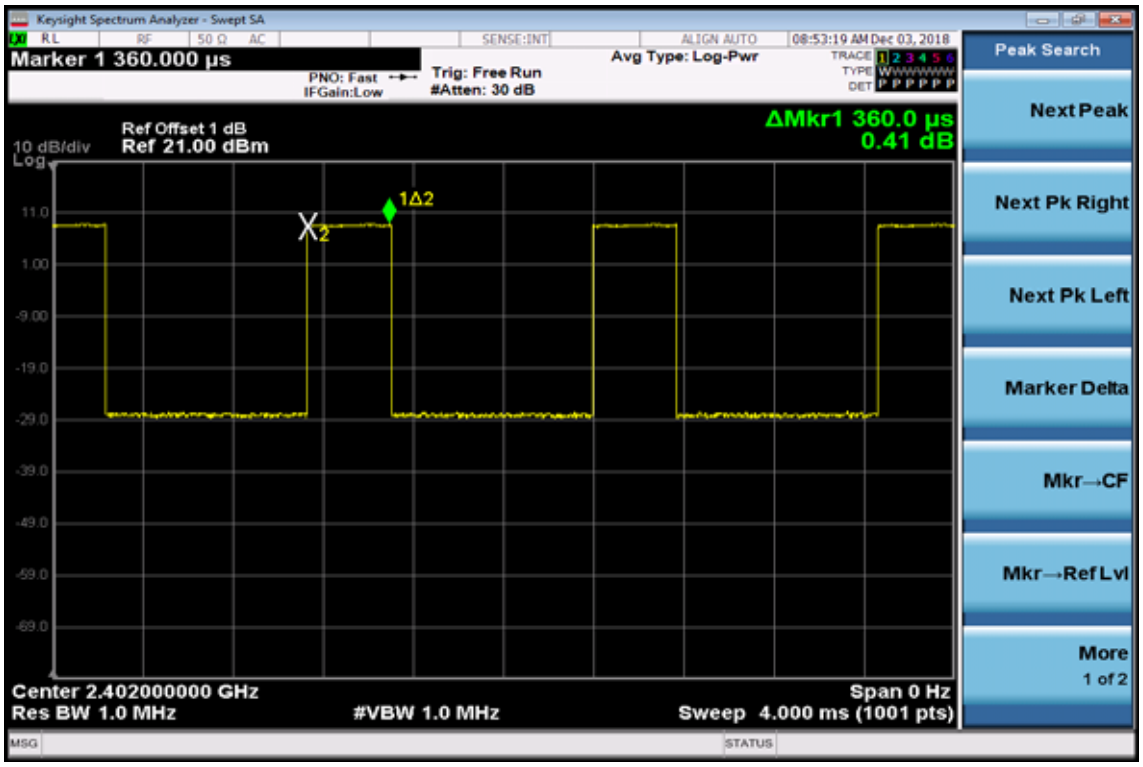
A period time = 0.4 (ms) * 79 = 31.6 (s)

CH Low	DH1 time slot	=	0.360 (ms)	*	(800/2/20)	* 8 =	57.60	(ms)
	DH3 time slot	=	1.610 (ms)	*	(800/4/20)	* 8 =	128.80	(ms)
	DH5 time slot	=	2.860 (ms)	*	(800/6/20)	* 8 =	152.53	(ms)
CH Mid	DH1 time slot	=	0.360 (ms)	*	(800/2/20)	* 8 =	57.60	(ms)
	DH3 time slot	=	1.590 (ms)	*	(800/4/20)	* 8 =	127.20	(ms)
	DH5 time slot	=	2.840 (ms)	*	(800/6/20)	* 8 =	151.47	(ms)
CH High	DH1 time slot	=	0.364 (ms)	*	(800/2/20)	* 8 =	58.24	(ms)
	DH3 time slot	=	1.600 (ms)	*	(800/4/20)	* 8 =	128.00	(ms)
	DH5 time slot	=	2.840 (ms)	*	(800/6/20)	* 8 =	151.47	(ms)

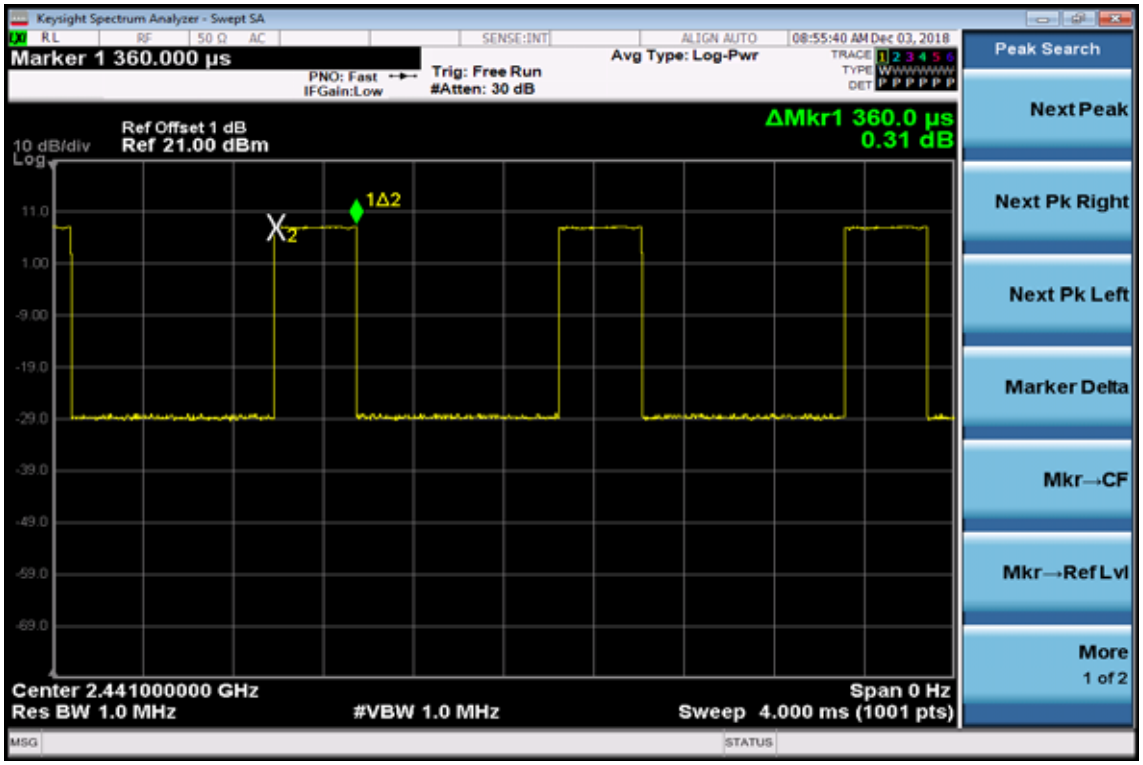
Note: Refer to next page for plots.

Low Channel

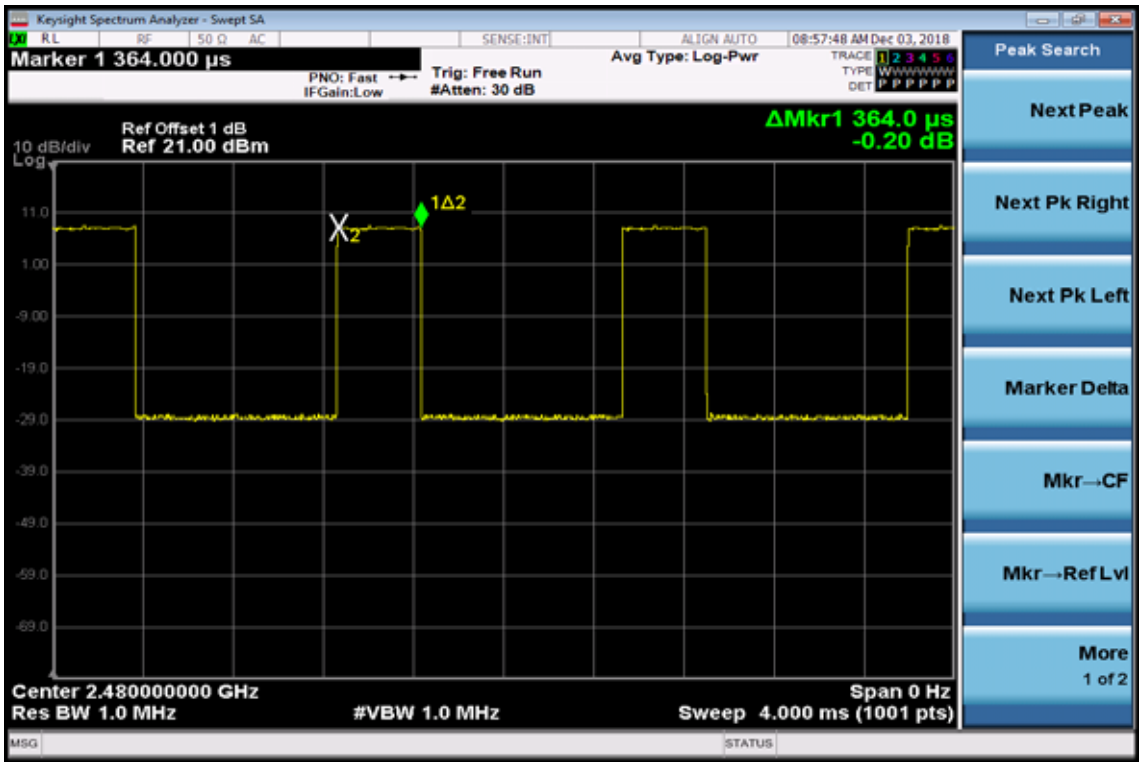
DH1



DH3

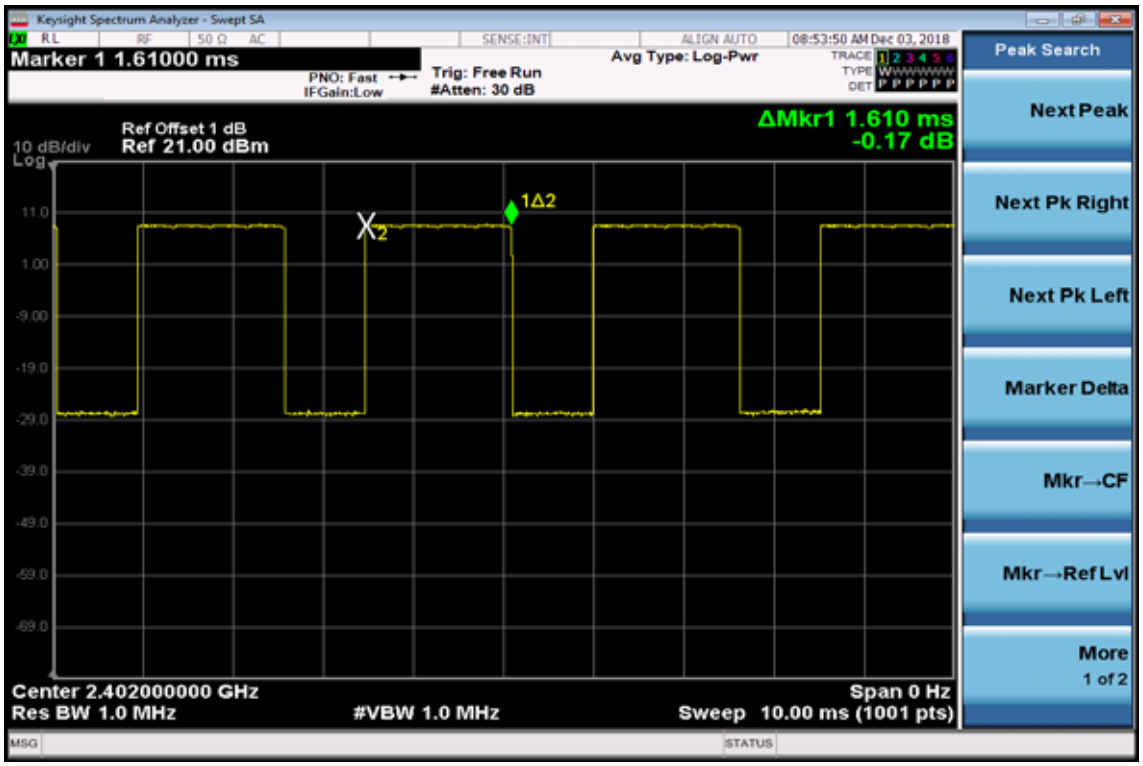


DH5

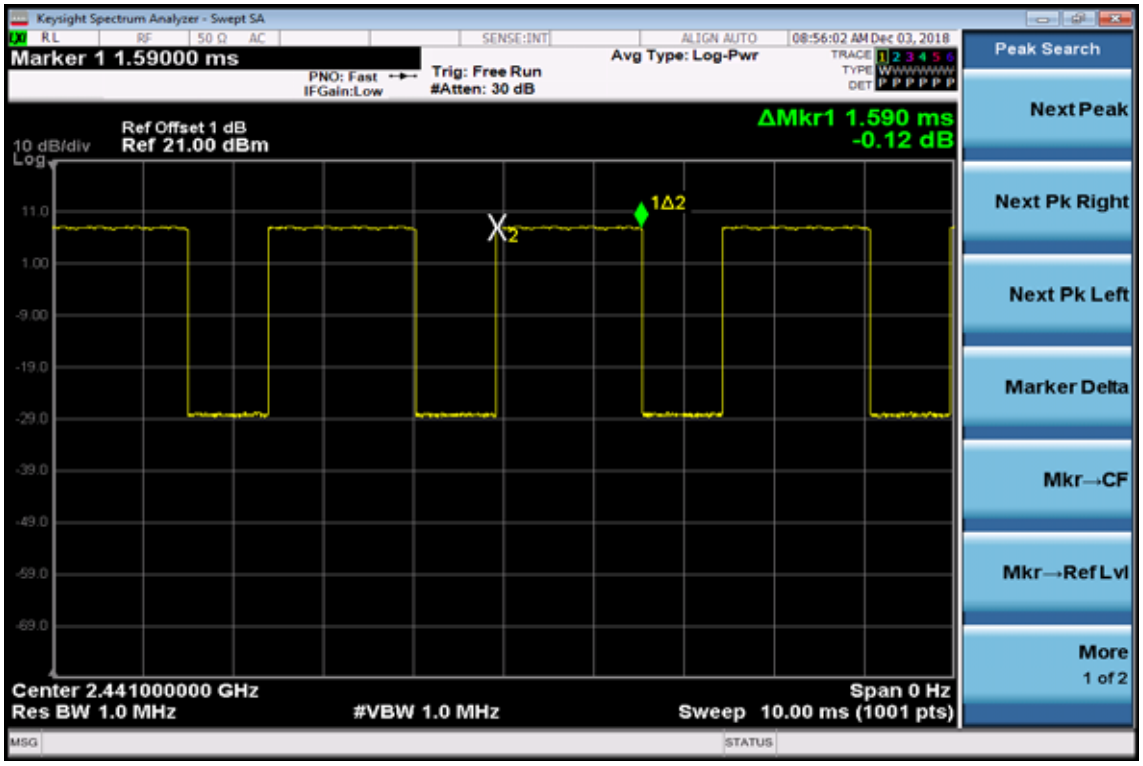


Mid Channel

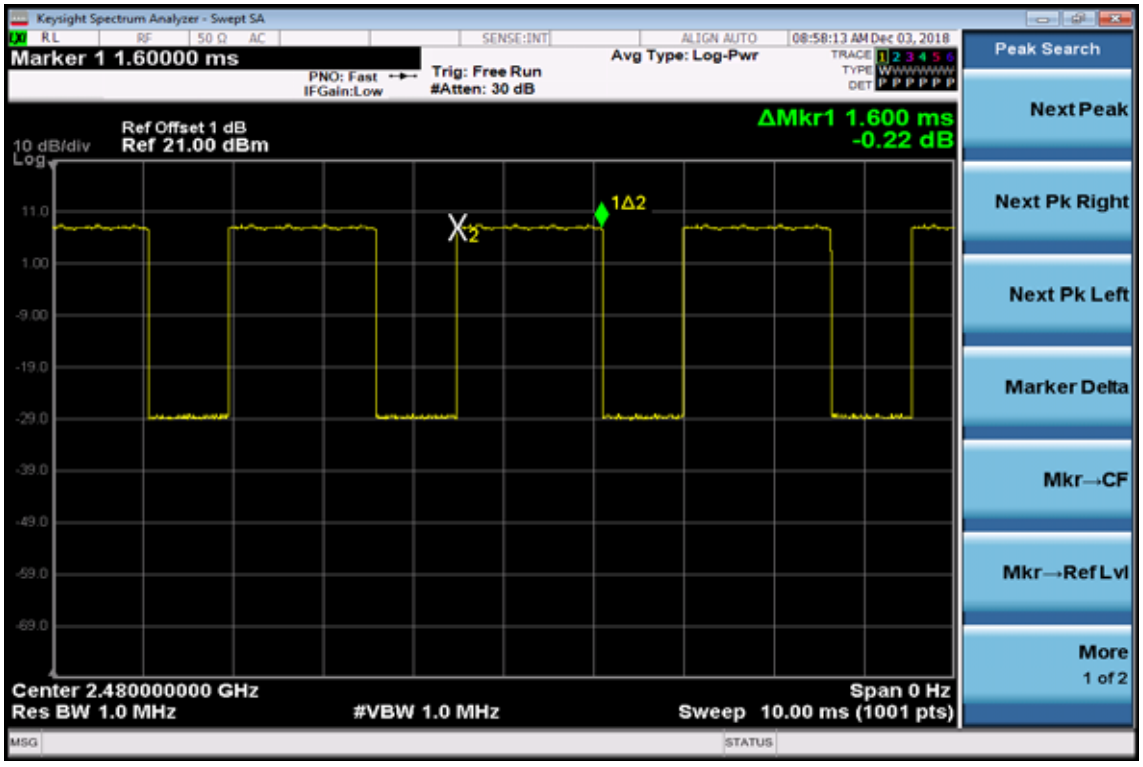
DH1



DH3

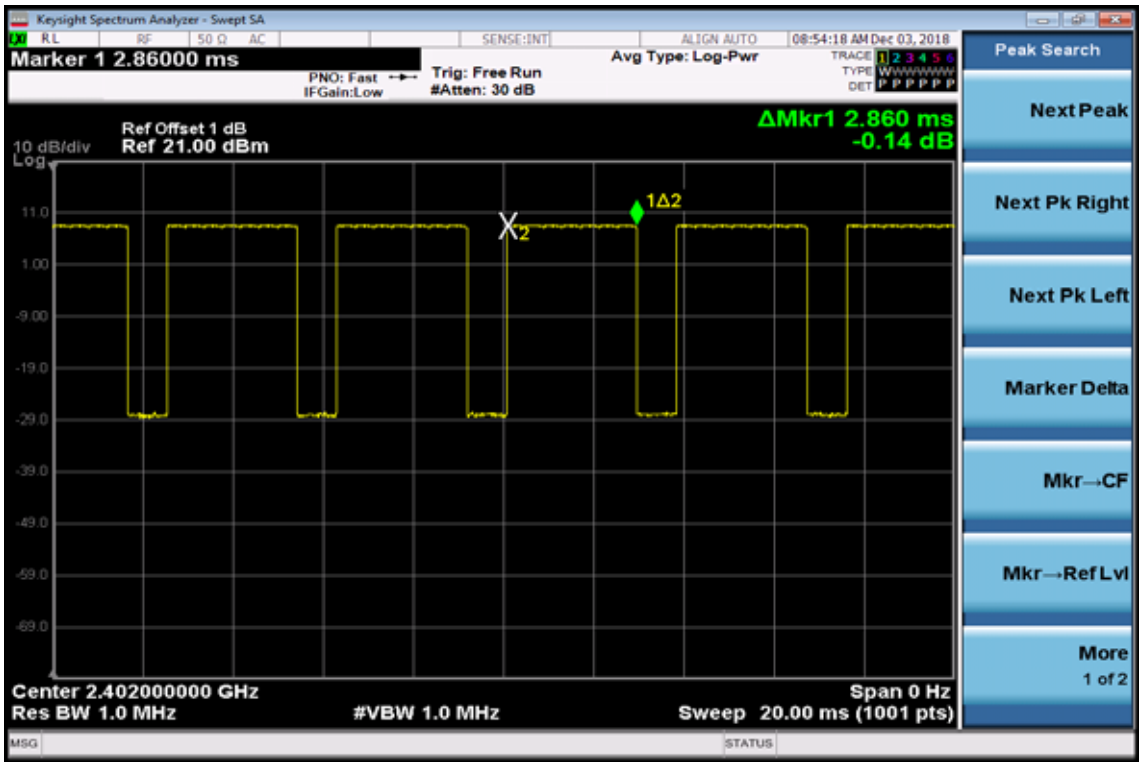

Keysight Spectrum Analyzer - Swept SA
Marker 1 1.59000 ms
PNO: Fast
IFGain:Low
Trig: Free Run
#Atten: 30 dB
Avg Type: Log-Pwr
08:56:02 AM Dec 03, 2018
Ref Offset 1 dB
10 dB/div
Ref 21.00 dBm
ΔMkr1 1.590 ms
-0.12 dB
Center 2.441000000 GHz
Res BW 1.0 MHz
#VBW 1.0 MHz
Span 0 Hz
Sweep 10.00 ms (1001 pts)
Peak Search
Next Peak
Next Pk Right
Next Pk Left
Marker Delta
Mkr→CF
Mkr→Ref Lvl
More
1 of 2

DH5

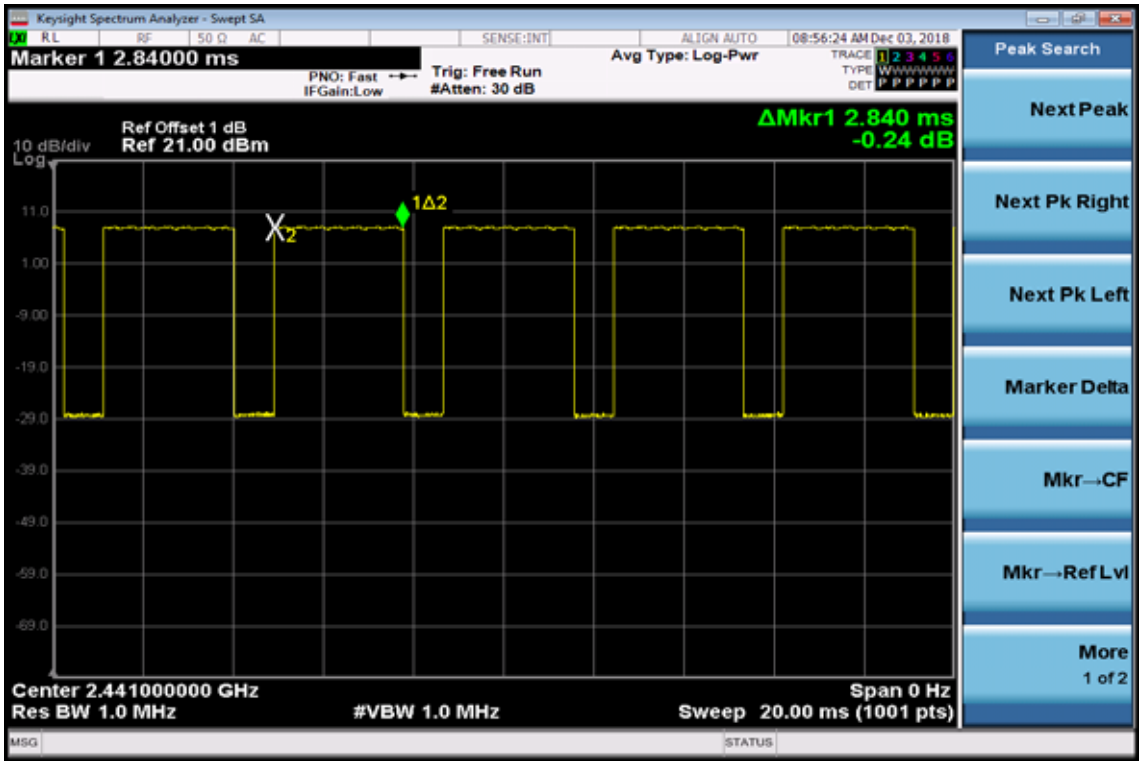

Keysight Spectrum Analyzer - Swept SA
Marker 1 1.60000 ms
PNO: Fast
IFGain:Low
Trig: Free Run
#Atten: 30 dB
Avg Type: Log-Pwr
08:58:13 AM Dec 03, 2018
Ref Offset 1 dB
10 dB/div
Ref 21.00 dBm
ΔMkr1 1.600 ms
-0.22 dB
Center 2.480000000 GHz
Res BW 1.0 MHz
#VBW 1.0 MHz
Span 0 Hz
Sweep 10.00 ms (1001 pts)
Peak Search
Next Peak
Next Pk Right
Next Pk Left
Marker Delta
Mkr→CF
Mkr→Ref Lvl
More
1 of 2

High Channel

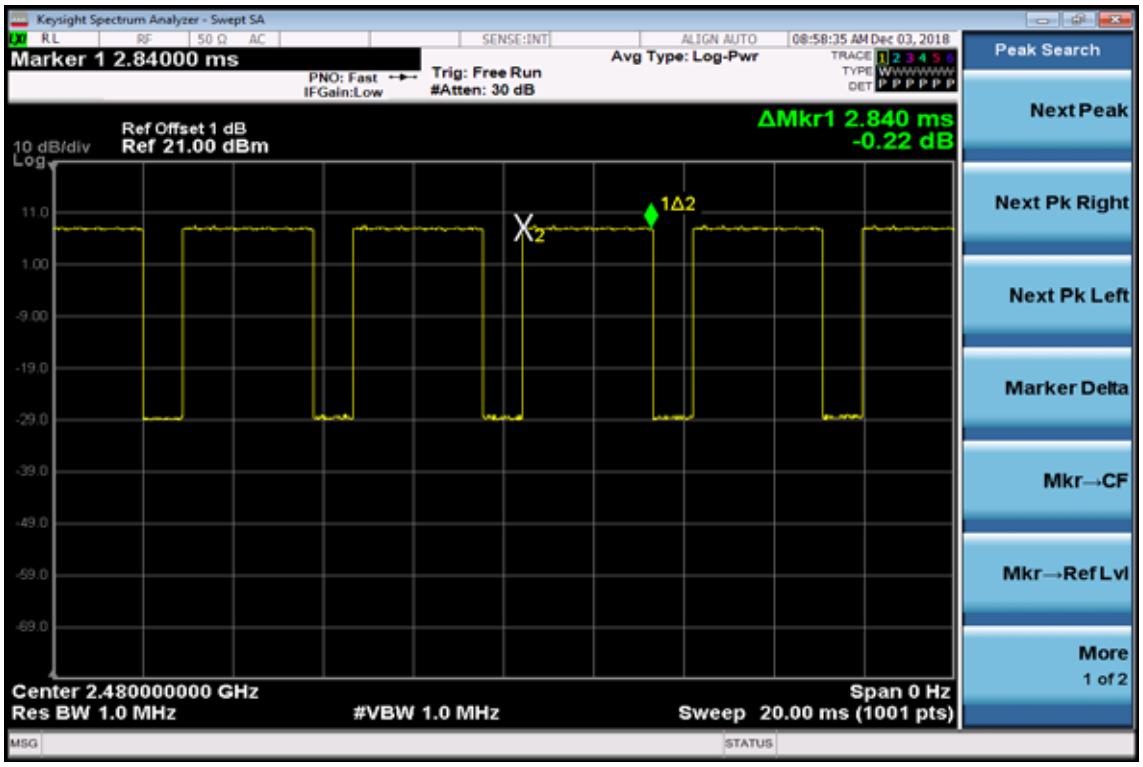
DH1



DH3



DH5


Keysight Spectrum Analyzer - Swept SA
Marker 1 2.84000 ms
PNO: Fast
IFGain:Low
Trig: Free Run
#Atten: 30 dB
Avg Type: Log-Pwr
08:58:35 AM Dec 03, 2018
Ref Offset 1 dB
10 dB/div
Ref 21.00 dBm
Log
ΔMkr1 2.840 ms
-0.22 dB
1Δ2
Center 2.480000000 GHz
Res BW 1.0 MHz
#VBW 1.0 MHz
Span 0 Hz
Sweep 20.00 ms (1001 pts)
Peak Search
Next Peak
Next Pk Right
Next Pk Left
Marker Delta
Mkr→CF
Mkr→Ref Lvl
More
1 of 2

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:

BDR Mode

CH	20dB Bandwidth (MHz)	99% Bandwidth (MHz)
Low	1.018	1.0039
Mid	1.017	1.0049
High	1.018	1.0047

EDR 2M Mode

CH	20dB Bandwidth	2/3* 20dB Bandwidth	99% Bandwidth
	(MHz)		
Lower	1.314	0.876	1.0868
Mid	1.133	0.843	1.0851
Higher	1.133	0.841	1.0859

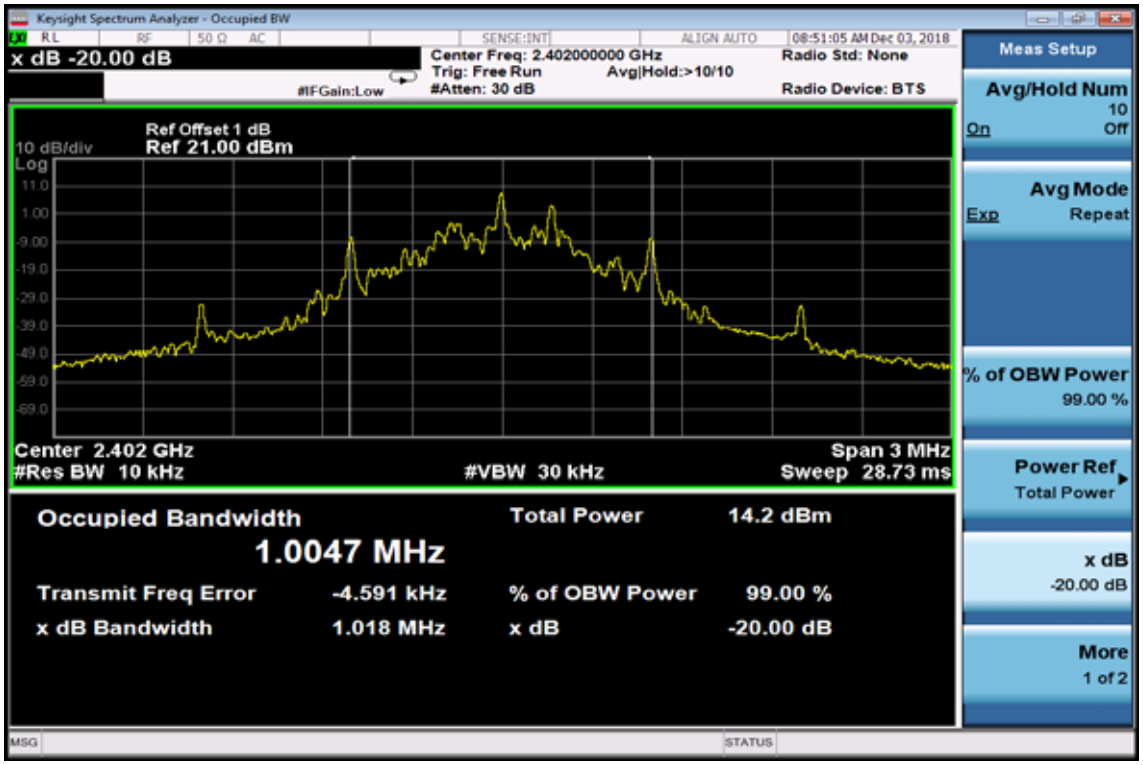
EDR 3M Mode

CH	20dB Bandwidth	2/3* 20dB Bandwidth	99% Bandwidth
	(MHz)		
Lower	1.188	0.792	1.1205
Mid	1.186	0.791	1.1199
Higher	1.184	0.790	1.1218

Note: Refer to next page for plots.

BDR Mode

20dB Bandwidth Test Data CH-Low

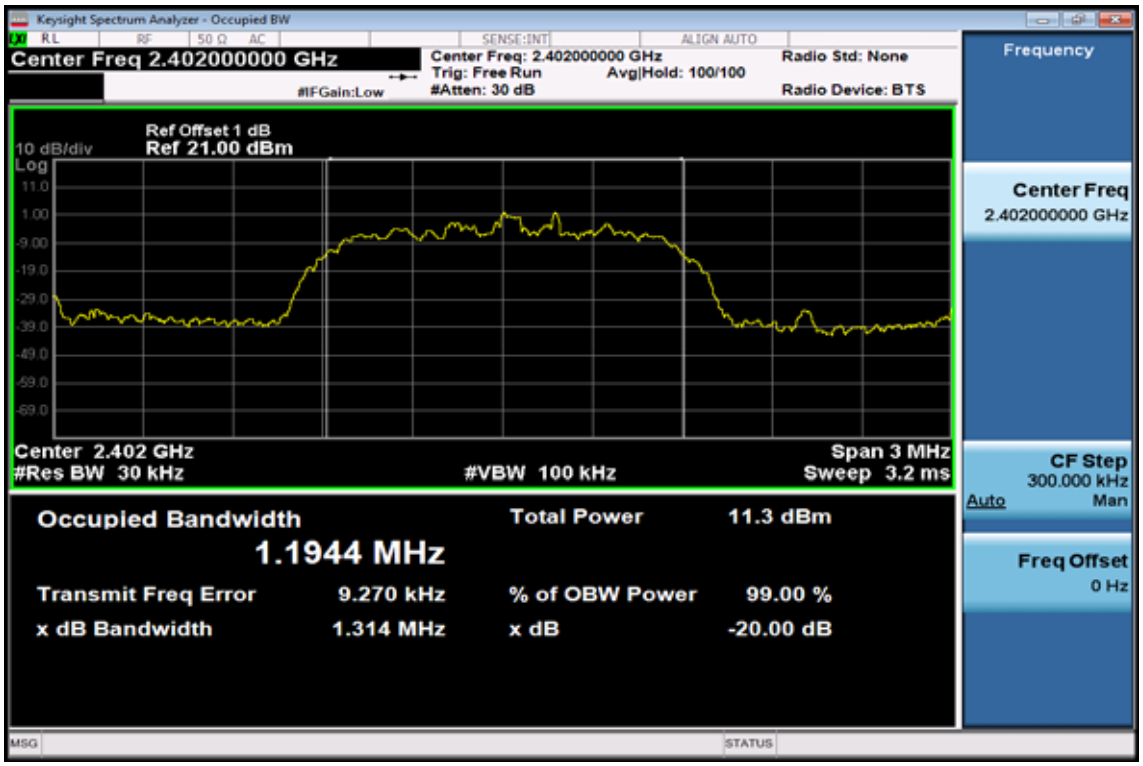


20dB Bandwidth Test Data CH-Mid

20dB Bandwidth Test Data CH-High

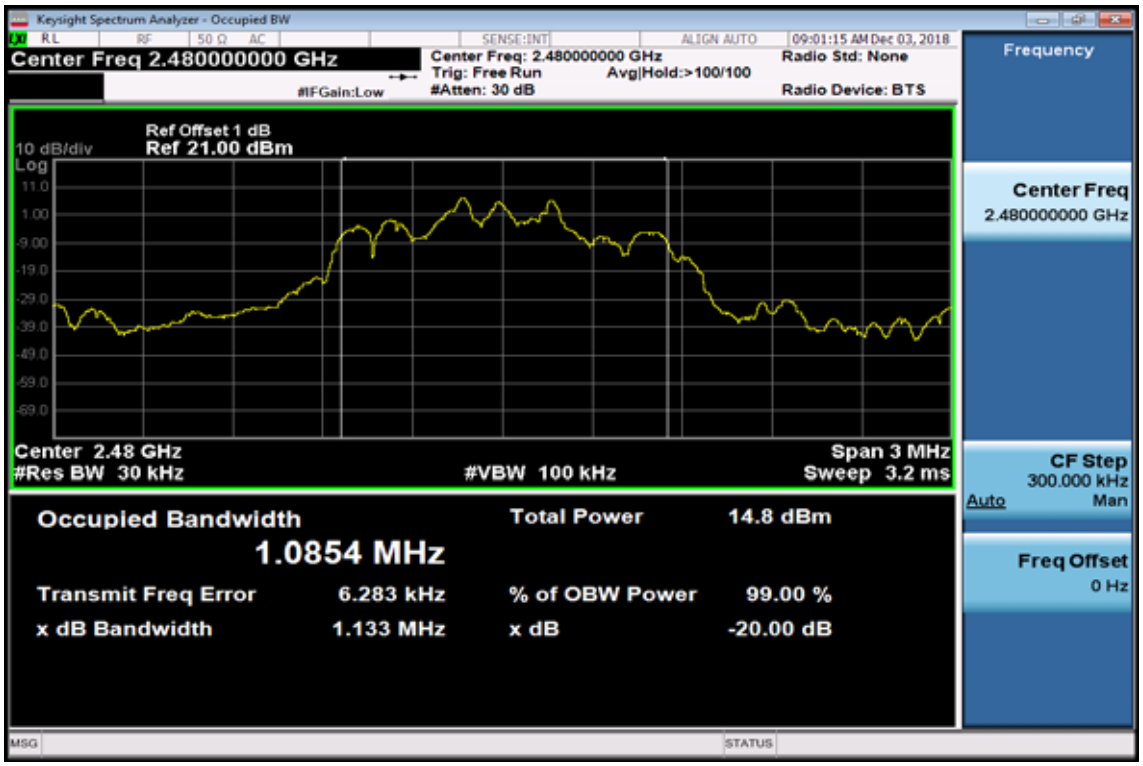
EDR 2M Mode

20dB Bandwidth Test Data CH-Low



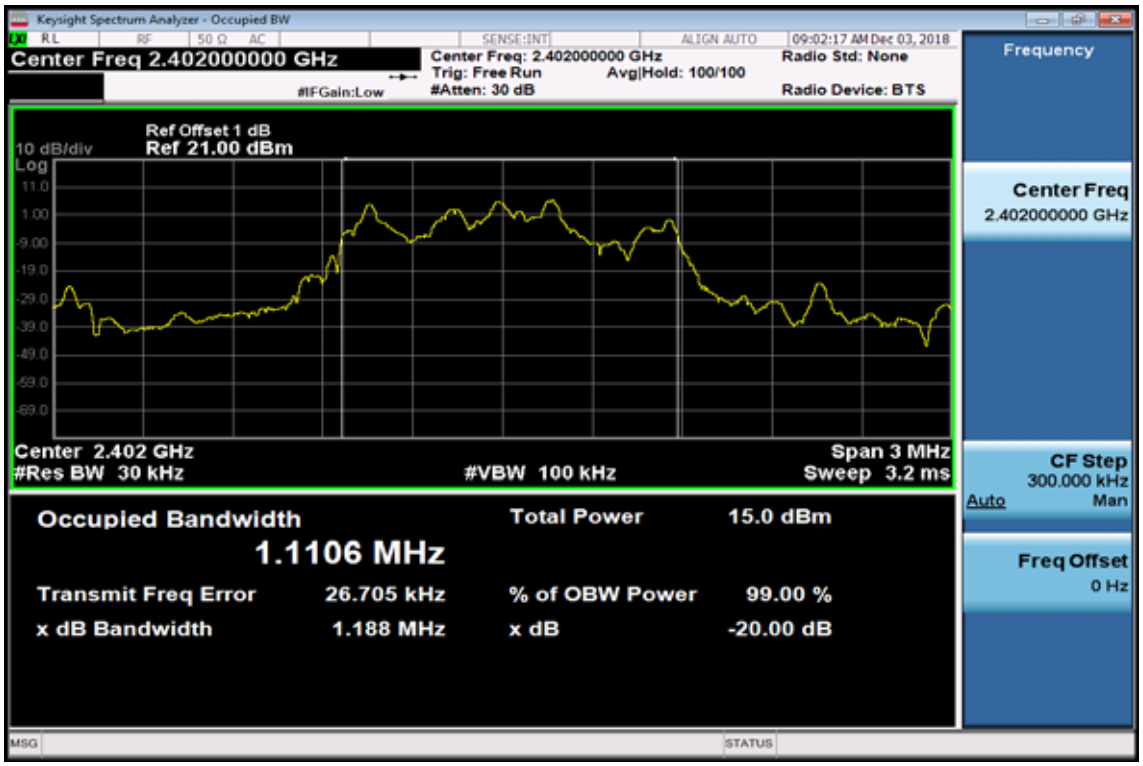
20dB Bandwidth Test Data CH-Mid

20dB Bandwidth Test Data CH-High

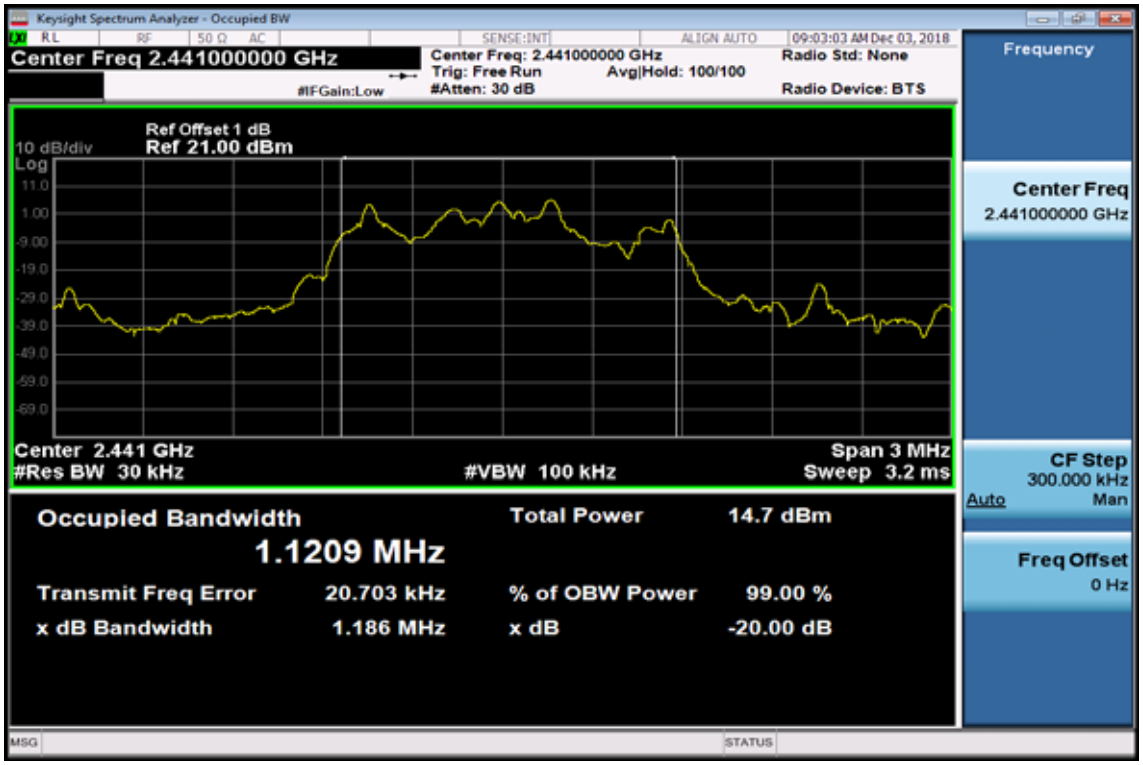


EDR 3M Mode

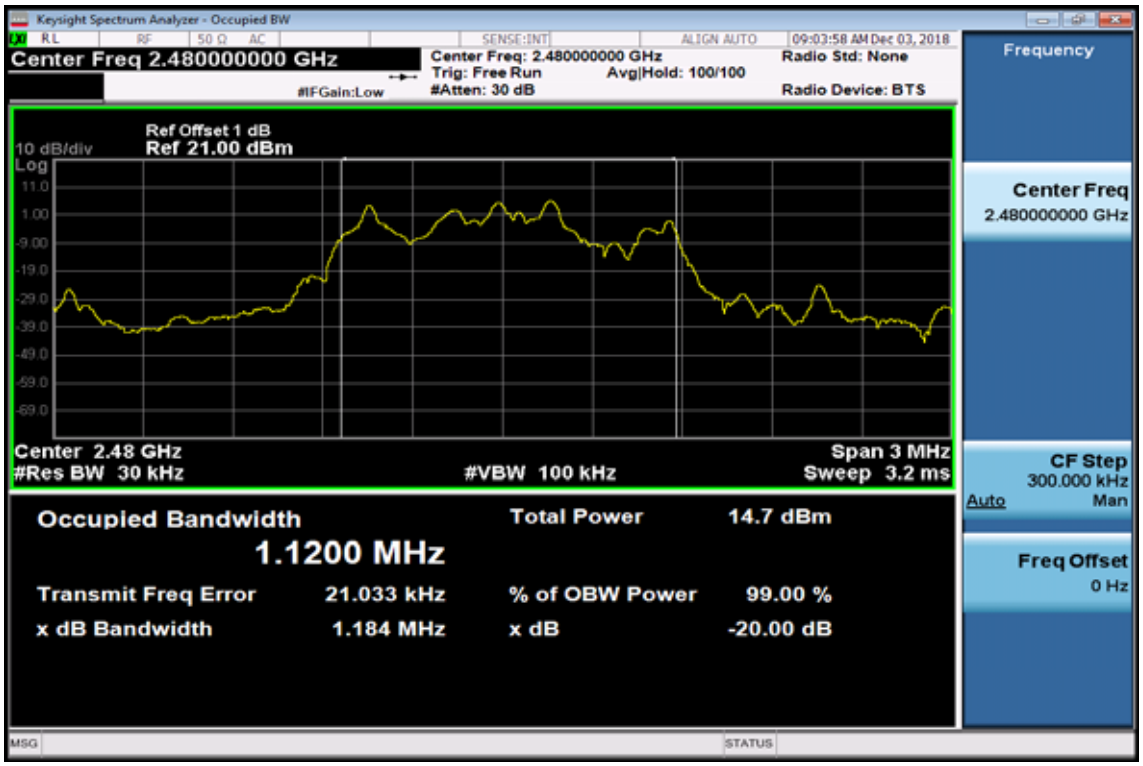
20dB Bandwidth Test Data CH-Low



20dB Bandwidth Test Data CH-Mid

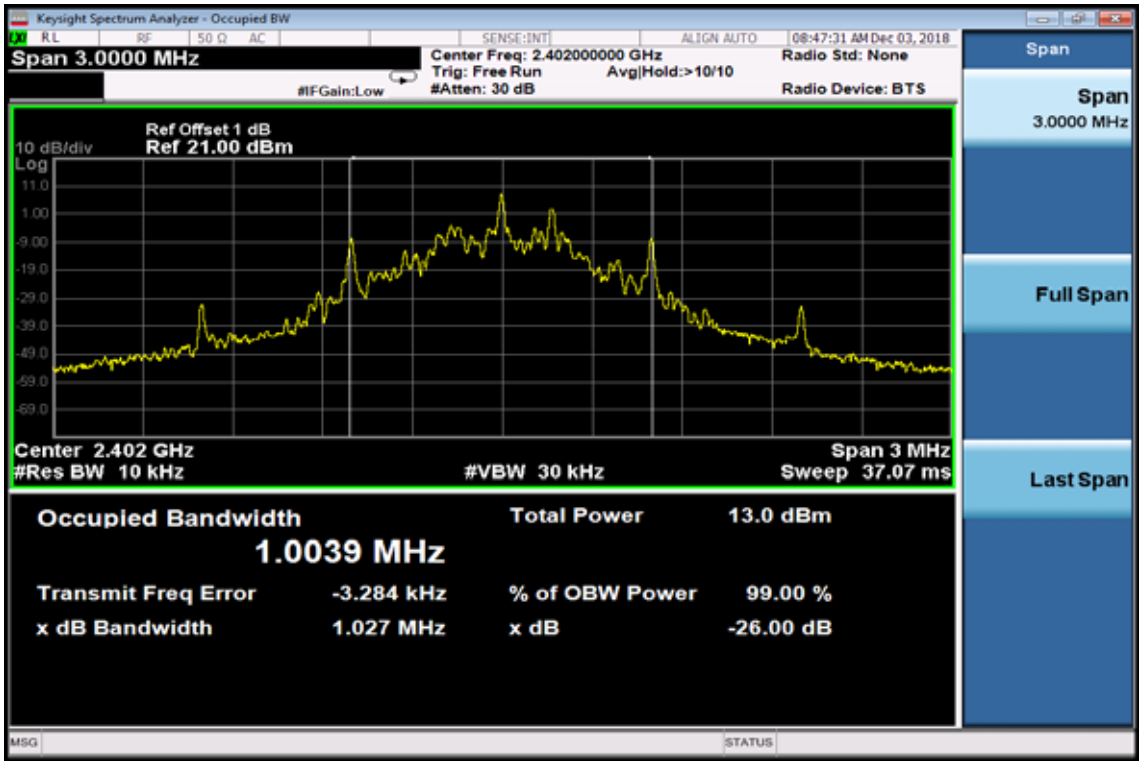


20dB Bandwidth Test Data CH-High



BDR Mode

99% Bandwidth Test Data CH-Low

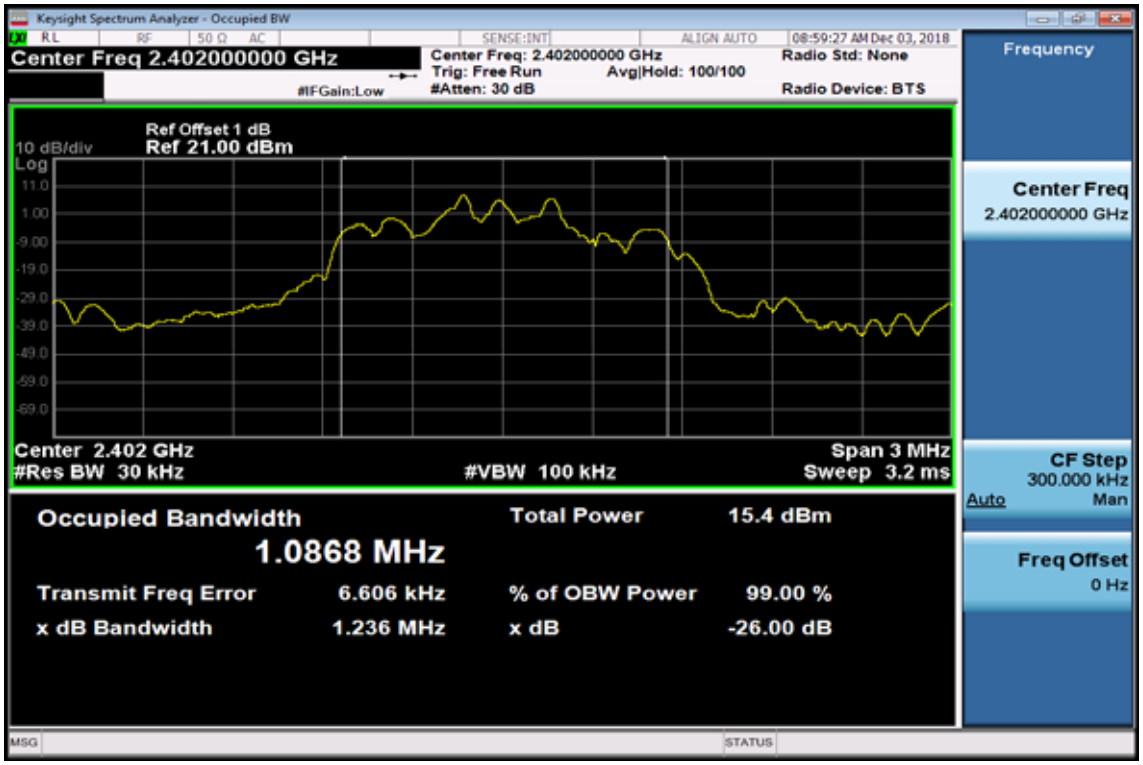


99% Bandwidth Test Data CH-Mid

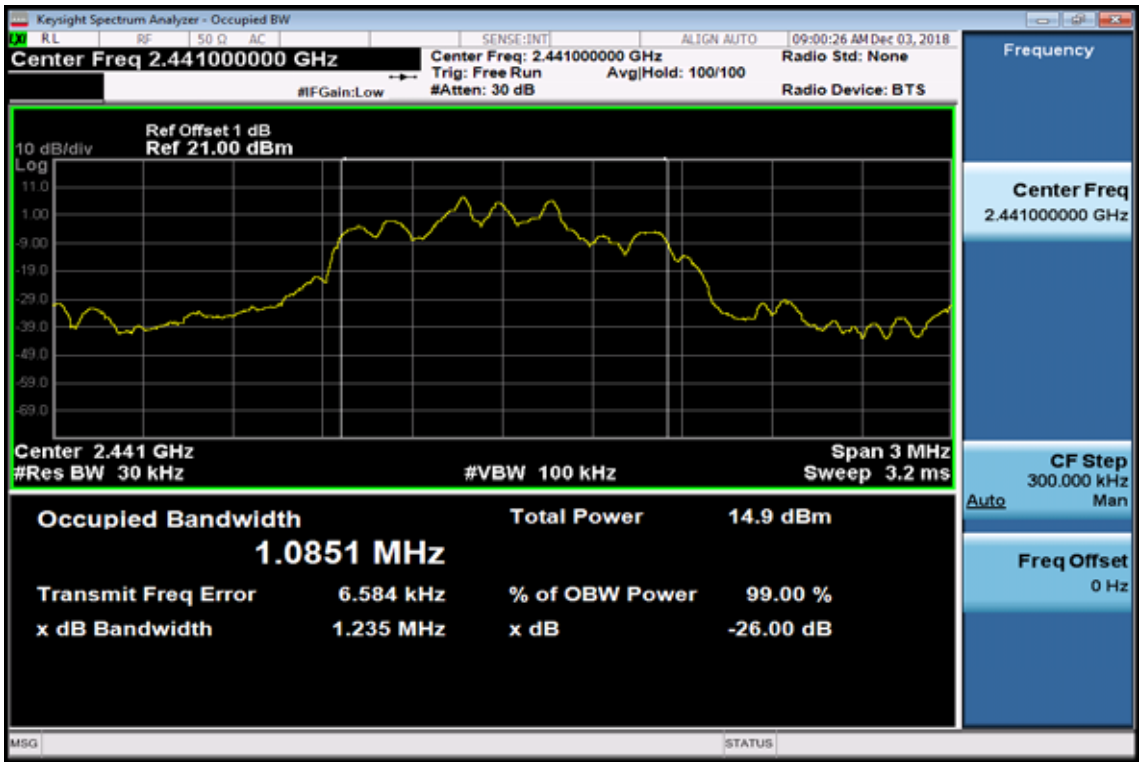
99% Bandwidth Test Data CH-High

EDR 2M Mode

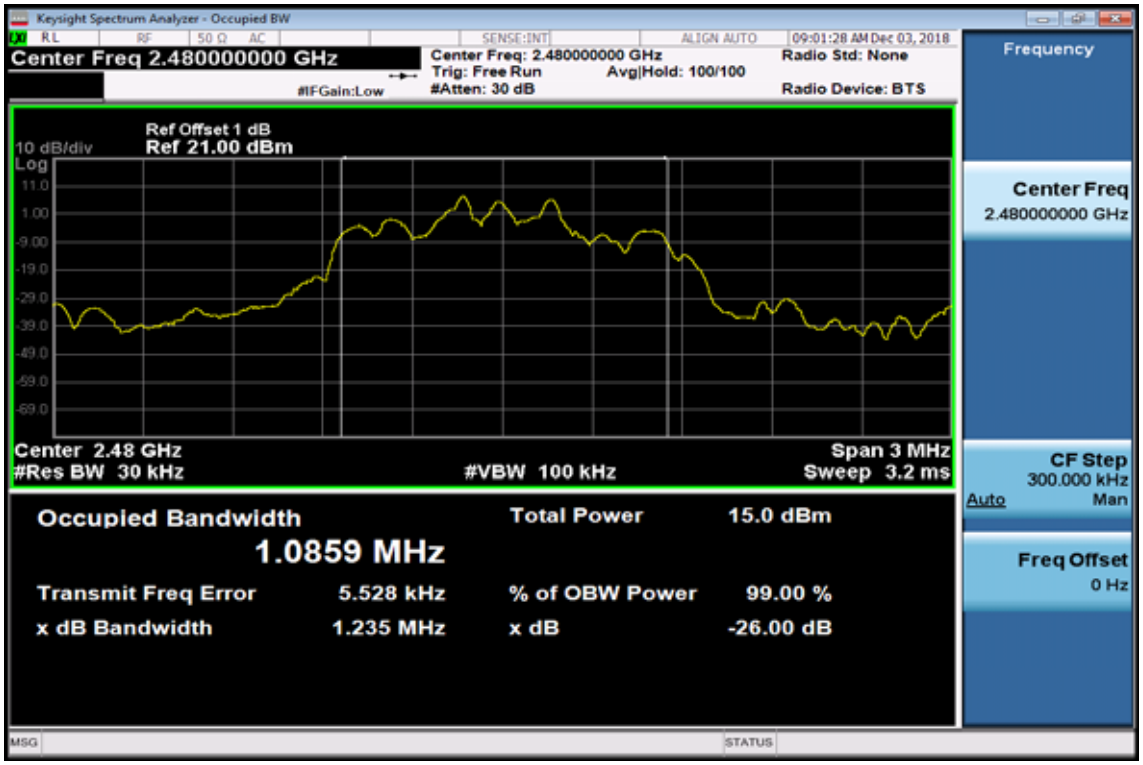
99% Bandwidth Test Data CH-Low



99% Bandwidth Test Data CH-Mid

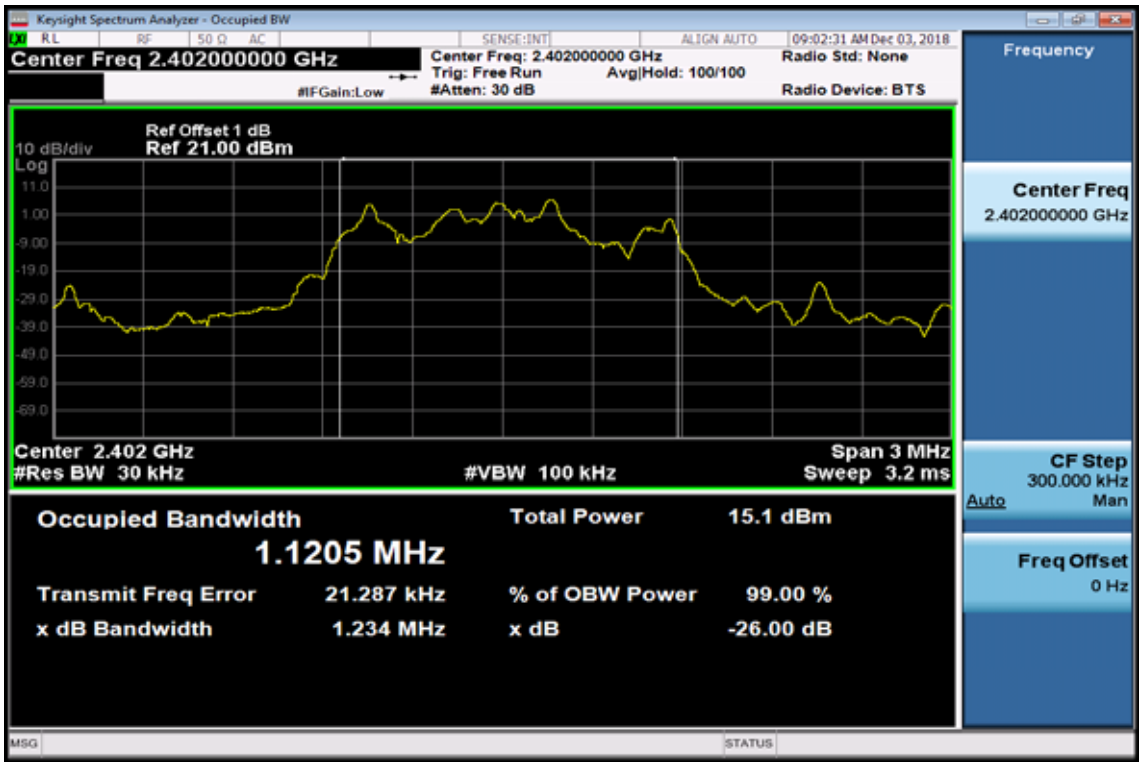


99% Bandwidth Test Data CH-High

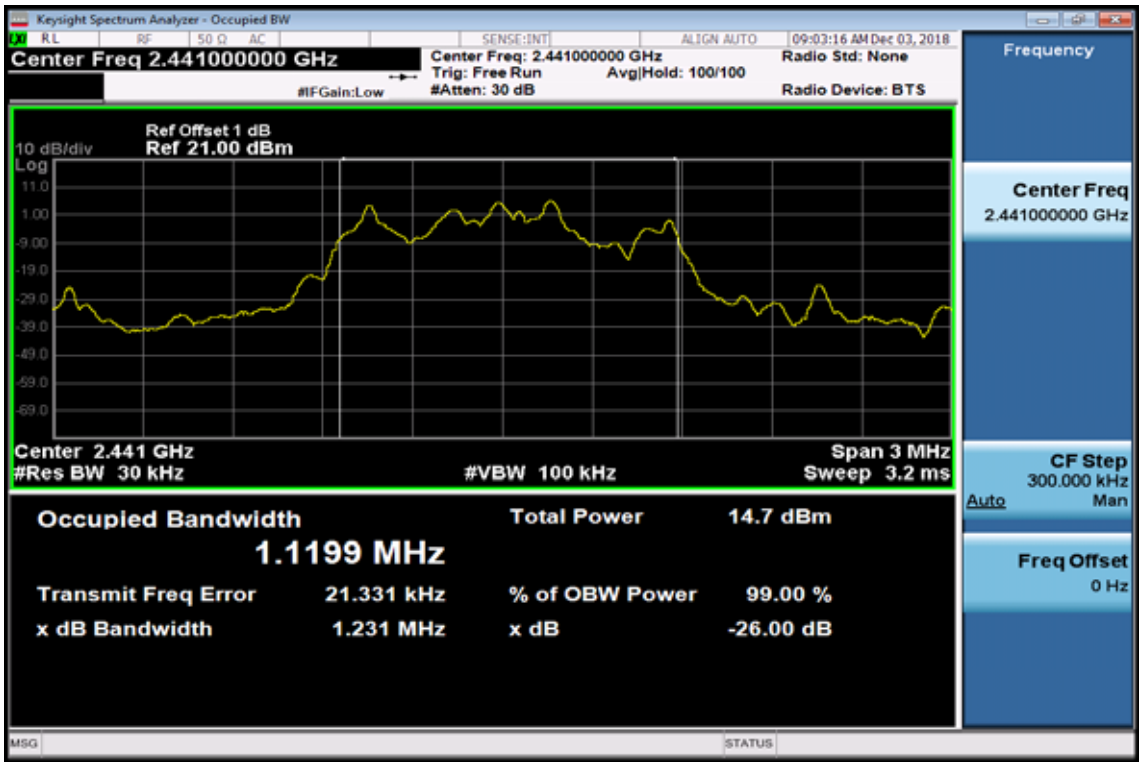


EDR 3M Mode

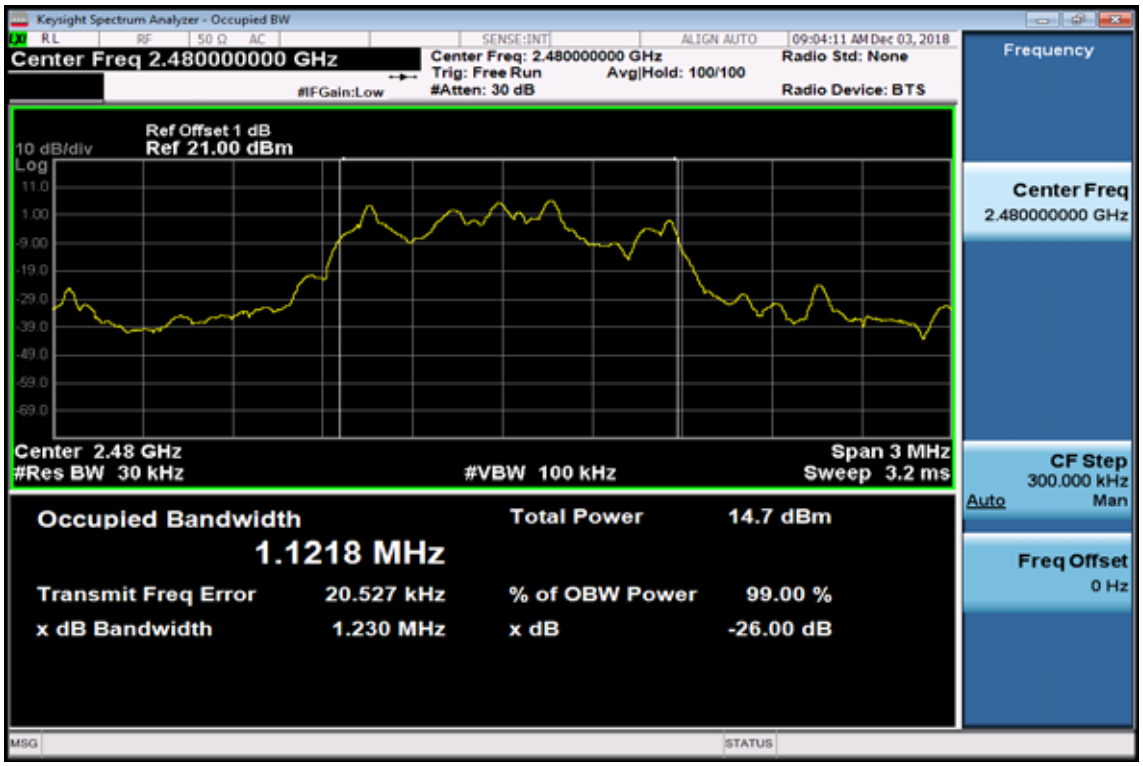
99% Bandwidth Test Data CH-Low



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 is 2.80 dBi and the antenna type is FPC antenna which is designed with permanent attachment and no consideration of replacement. Please see EUT photo for details.