TEST REPORT

of

FCC Part 15 Subpart C

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

Product :	**Display Unit**
Brand:	**Aulisa**
Model:	**GA-DU0003, GA-DU0003HDMI**
Model Difference:	**For market segmentation**
FCC ID:	**2AI5QGA-DU0003**
FCC Rule Part:	**§15.247, Cat: DSS**
Applicant:	**Taiwan Aulisa Medical Devices Technologies Inc**
Address:	**10F., No.3-2, YuanQu St., Nangang Dist., Taipei City, Taiwan 115**

Test Performed by:
International Standards Laboratory
<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-18LR287FCDSS**
Issue Date : **2018/11/01**

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.
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VERIFICATION OF COMPLIANCE

Applicant:	Taiwan Aulisa Medical Devices Technologies Inc
Product Description:	Display Unit
Brand Name:	Aulisa
Model No.:	GA-DU0003, GA-DU0003HDMI
Model Difference:	For market segmentation
FCC ID:	2AI5QGA-DU0003
Date of test:	2018/09/13 ~ 2018/10/30
Date of EUT Received:	2018/09/13

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.

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:***	2018/11/01
	Barry Lee / Senior Engineer		
Prepared By:	Gigi yeh	***Date:***	2018/11/01
	Gigi Yeh / Senior Engineer		
Approved By:	Dino Chen	***Date:***	2018/11/01
	Dino Chen / Senior Engineer		

Version

Version No.	Date	Description
00	2018/11/01	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%

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1. General Information

1.1. Product Description

Product Name	Display Unit	
Brand Name	Aulisa	
Model Name	GA-DU0003, GA-DU0003HDMI	
Model Difference	For market segmentation	
Power Supply	12Vdc from AC/DC adapter	
	Adapter:	1. Model : MPU12A-102

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)
Tune up power:	7.07 dBm Peak, +/- 1 dB	7.37 dBm (Peak), +/- 1 dB
Dwell Time:	≤ 0.4s	N/A
Antenna Designation:	Detachable Revised SMA Type. Antenna Type: PIFA, 0.5Bi	

2.4GHz WLAN: 1TX/1RX SM-MIM; 5GHz WLAN: 1TX/1RX SM-MIMO

Wi-Fi	Frequency Range (MHz)	Channels	Peak / Average Rated Power	Modulation Technology
802.11b	2412 – 2462(DTS)	11	22.75dBm (PK)	DSSS
802.11g	2412 – 2462(DTS)	11	25.20dBm (PK)	OFDM
802.11n (2.4G)	HT20 2412 – 2462(DTS)	11	25.01dBm (PK)	
	HT40 2422 – 2452(DTS)	7	25.12dBm (PK)	
802.11a	5150 – 5350(NII)	8	12.01dBm (AV)	
	5470 – 5725(NII)	8	11.63dBm (AV)	
	5725 – 5850(NII)	5	9.15dBm (AV)	
802.11n(5G)	HT20 5150 – 5350(NII)	8	11.69dBm (AV)	
	HT20 5470 – 5725(NII)	8	11.30dBm (AV)	
	HT20 5725 – 5850(NII)	5	8.95dBm (AV)	
	HT40 5150 – 5350(NII)	7	12.15dBm (AV)	
	HT40 5470 – 5725(NII)	6	12.09dBm (AV)	
	HT40 5725 – 5850(NII)	2	9.24dBm (AV)	
Modulation type		CCK, DQPSK, DBPSK for DSSS 256QAM.64QAM. 16QAM, QPSK, BPSK for OFDM		
Antenna Designation		Fixed PIFA Antenna WiFi 2.4G Antenna 1 : 0.5dBi WiFi 5G Antenna : 0.5 dBi According to KDB662911 D01 SM-MIMO signals could be considered uncorrelated for purposes of directional gain computation. Directional gain = GANT		

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: 2AI5QGA-DU0003** 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 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 <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 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. 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 m/1.5m (Frequency above 1GHz) above ground plane. The turn table shall rotate 360 degrees to determine the position of maxi-mum 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 max-imized 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 transmit-ter(EUT) was rotated through three orthogonal axes according to the requirements in Sec-tion 6 and 11 of ANSI C63.10: 2013.

2.4 Configuration of Tested System

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

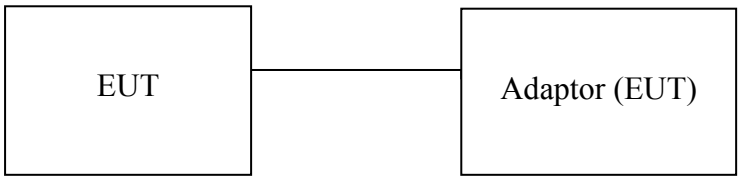


Table 1 Equipment Used in Tested System

Item	Equipment	Mfr/Brand	Model/ Type No.	Series No.	Data Cable	Power Cord
1	N/A					

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. Conduced 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:

Conducted Emission Test Site					
Equipment Type	**MFR**	**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:

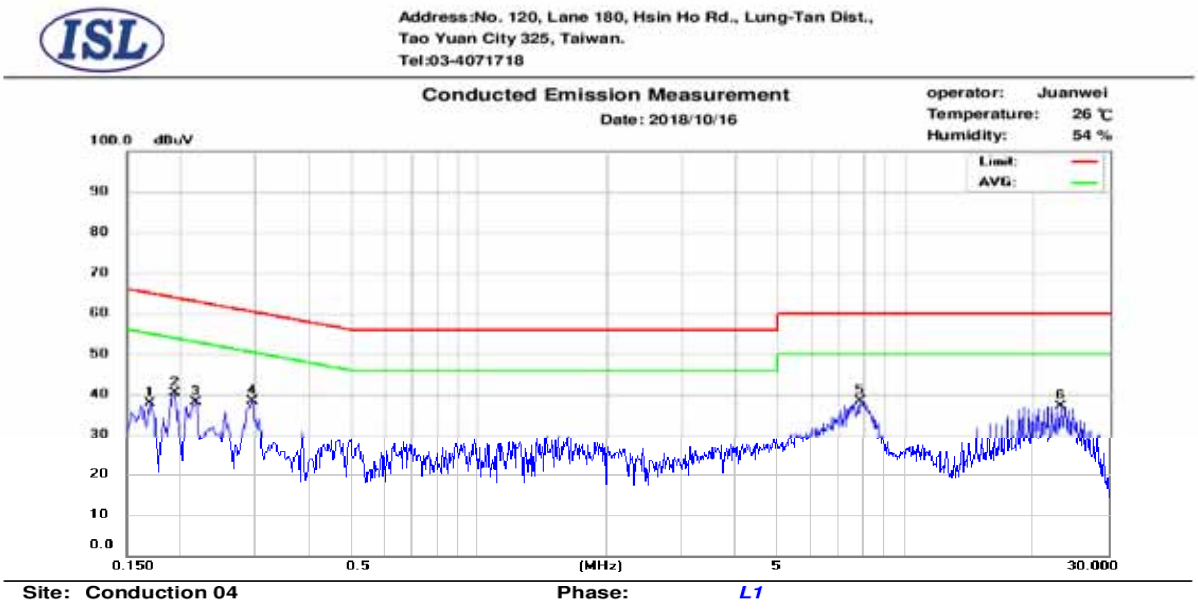
1. The EUT was placed on a table which is 0.8m above ground plane.
2. Maximum procedure was performed on the six highest emissions to ensure EUT compliance.
3. Repeat above procedures until all frequency measured were complete.

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.

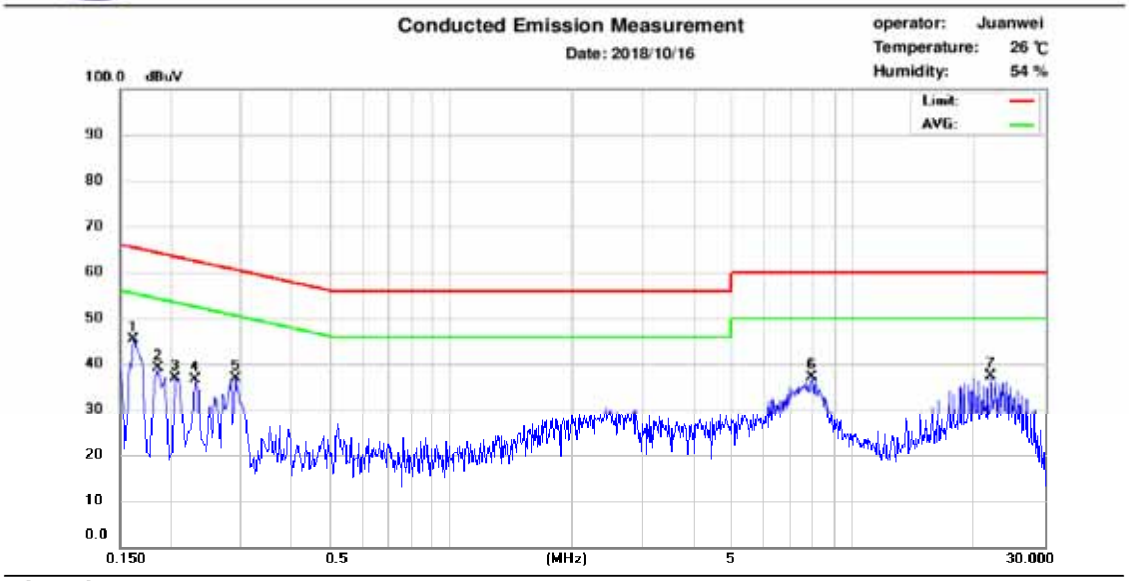
AC POWER LINE CONDUCTED EMISSION TEST DATA

Operation Mode:	Normal Operation	Test Date:	2018/10/16
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	0.170	31.22	13.07	9.70	40.92	64.96	-24.04	22.77	54.96	-32.19
2	0.194	27.01	9.64	9.69	36.70	63.86	-27.16	19.33	53.86	-34.53
3	0.218	24.14	9.92	9.69	33.83	62.89	-29.06	19.61	52.89	-33.28
4	0.294	27.71	18.82	9.70	37.41	60.41	-23.00	28.52	50.41	-21.89
5	7.830	24.69	17.67	9.90	34.59	60.00	-25.41	27.57	50.00	-22.43
6	23.066	25.08	19.10	10.13	35.21	60.00	-24.79	29.23	50.00	-20.77

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



Site: Conduction 04 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	0.162	32.31	13.71	9.70	42.01	65.36	-23.35	23.41	55.36	-31.95
2	0.186	28.15	11.05	9.69	37.84	64.20	-26.36	20.74	54.20	-33.46
3	0.206	24.85	9.67	9.69	34.54	63.37	-28.83	19.36	53.37	-34.01
4	0.230	22.56	10.80	9.69	32.25	62.45	-30.20	20.49	52.45	-31.96
5	0.290	26.62	18.49	9.70	36.32	60.52	-24.20	28.19	50.52	-22.33
6	7.854	24.49	17.46	9.91	34.40	60.00	-25.60	27.37	50.00	-22.63
7	22.010	23.40	16.64	10.22	33.62	60.00	-26.38	26.86	50.00	-23.14

6. Peak Output Power Measurement

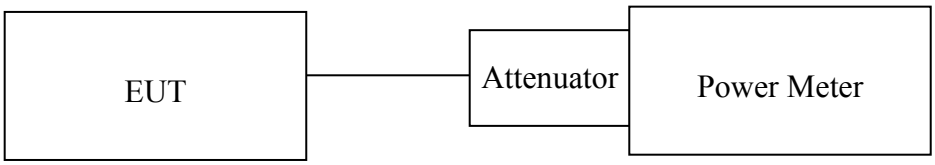
6.1. Standard Applicable:

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:

Conducted Emission Test Site					
Equipment Type	**MFR**	**Model Number**	**Serial Num-ber**	**Last Cal.**	**Cal Due.**
Power Meter 05	Anritsu	ML2495A	1116010	09/07/2018	09/06/2019
Power Sensor 05	Anritsu	MA2411B	34NKF50	09/07/2018	09/06/2019
Power Sensor 06	DARE	RPR3006W	13I00030SNO33	12/12/2017	12/11/2018
Power Sensor 07	DARE	RPR3006W	13I00030SNO34	12/12/2017	12/11/2018
Temperature Chamber	KSON	THS-B4H100	2287	12/02/2017	12/01/2018
DC Power supply	ABM	8185D	N/A	11/06/2017	11/05/2018
AC Power supply	EXTECH	CFC105W	NA	12/25/2017	12/24/2018
Attenuator	Woken	Watt-65m3502	11051601	NA	NA
Splitter	MCLI	PS4-199	12465	12/26/2017	12/25/2019
Spectrum analyzer	keysight	N9010A	MY56070257	07/07/2018	07/06/2019
Spectrum analyzer	R&S	FSP40	100143	11/02/2017	11/01/2018
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	6.77	0.00	6.77	0.00476	1
Mid	6.85	0.00	6.85	0.00484	1
High	7.07	0.00	7.07	0.00509	1

EDR 2M Mode

Frequency (MHz)	Peak Reading Power (dBm)	Cable Loss	Output Power (dBm)	Output Power (W)	Limit (W)
Low	5.14	0.00	5.14	0.00327	0.125
Mid	6.21	0.00	6.21	0.00418	0.125
High	6.41	0.00	6.41	0.00437	0.125

EDR 3M Mode

Frequency (MHz)	Peak Reading Power (dBm)	Cable Loss	Output Power (dBm)	Output Power (W)	Limit (W)
Low	6.41	0.00	6.41	0.00438	0.125
Mid	6.47	0.00	6.47	0.00443	0.125
High	5.86	0.00	5.86	0.00385	0.125

Offset: 0.5dB

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).

7.2 Measurement Equipment Used:

7.2.1. Conducted Emission at antenna port:

Refer to section 6.2 for details.

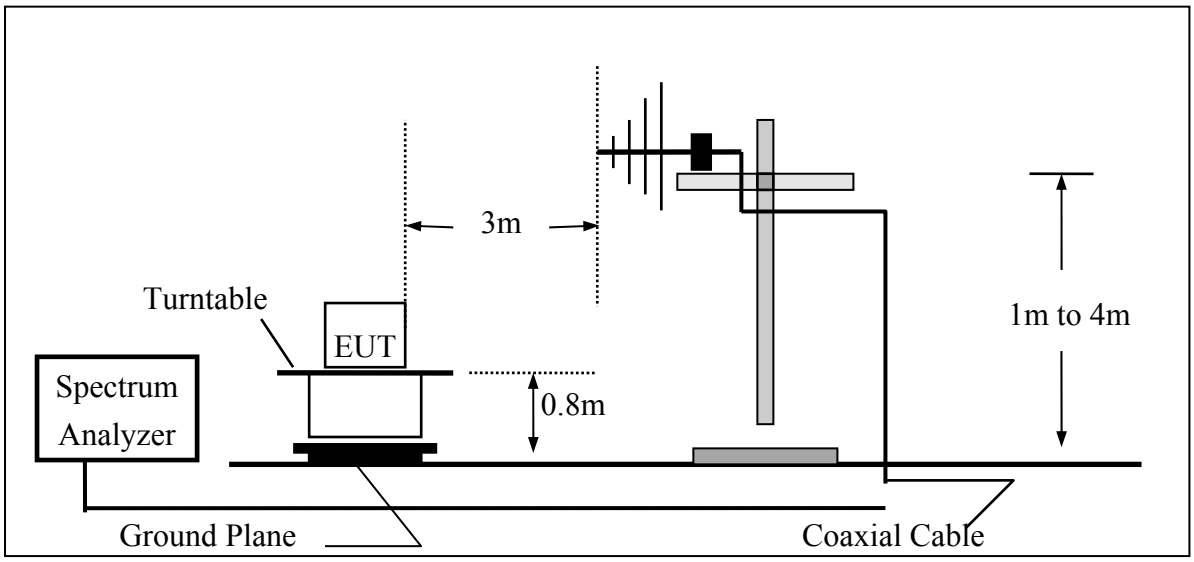
7.2.2. Radiated emission:

Chamber 19(966)					
Equipment Type	**MFR**	**Model Number**	**Serial Number**	**Last Cal.**	**Cal Due.**
966 Chamber	Chance Most	Chamber 19	N/A	08/13/2018	08/12/2019
Spectrum Analyzer 21(3Hz-44GHz)	Agilent	N9030A	MY51360021	11/20/2017	11/19/2018
EMI Receiver	SCHWARZBECK	FCVU1534	1534149	12/07/2017	12/06/2018
Loop Antenna(9K-30M)	EM	EM-6879	271	06/06/2018	06/05/2020
Bilog Antenna (30M-1G)	SCHWARZBECK	VULB9168 w 5dB Att	736	11/16/2017	11/25/2018
Horn antenna (1G-18G)	SCHWARZBECK	9120D	9120D-1627	11/27/2017	11/26/2019
Horn antenna (18G-26G)	Com-power	AH-826	081001	11/21/2017	11/20/2019
Horn antenna (26G-40G)	Com-power	AH-640	100A	02/22/2017	02/21/2019
Preamplifier (9k-1000M)	HP	8447F	3113A04621	12/08/2017	12/07/2018
Preamplifier(1G-26G)	Agilent	8449B	3008A02471	08/23/2018	08/22/2019
Preamplifier (26G-40G)	MITEQ	JS4-26004000-27-5A	818471	11/20/2017	07/21/2019
RF Cable (9k-18G)	HUBER SUHNER	SUCOFLEX 104A	MY1397/4A	11/02/2018	11/01/2019
RF cable (18G~40G)	HUBER SUHNER	Sucoflex 102	27963/2&37421/2	11/02/2018	11/01/2019
Turn Table	MF	Turn Table-19	Turn Table-19	N/A	N/A
Mast Tower	MF	JSDES-15A	1308283	N/A	N/A
Controller	MF	MF-7802BS	MF780208460	N/A	N/A
AC power source	T-Power	TFC-1005	40006471	N/A	N/A
Signal Generator	R&S	SMU200A	102330	03/14/2018	03/13/2019
Signal Generator	Anritsu	MG3692A	20311	12/07/2017	12/06/2018
2.4G Filter	Micro-Tronics	Brm50702	76	12/25/2017	12/24/2018
Test Software	Audix	E3 Ver:6.12023	N/A	N/A	N/A

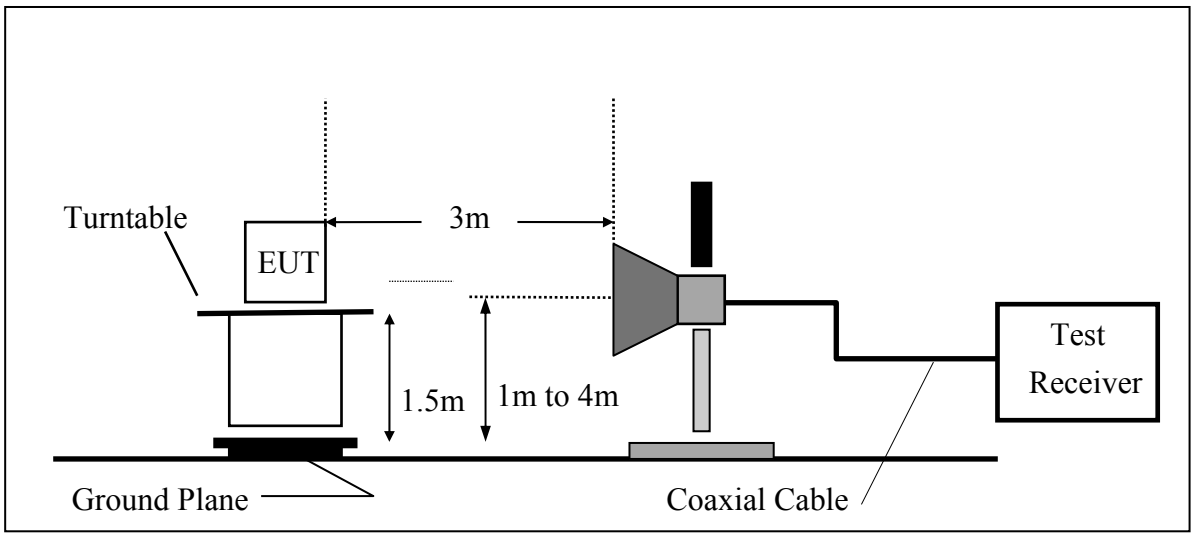
7.3 Test SET-UP:

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

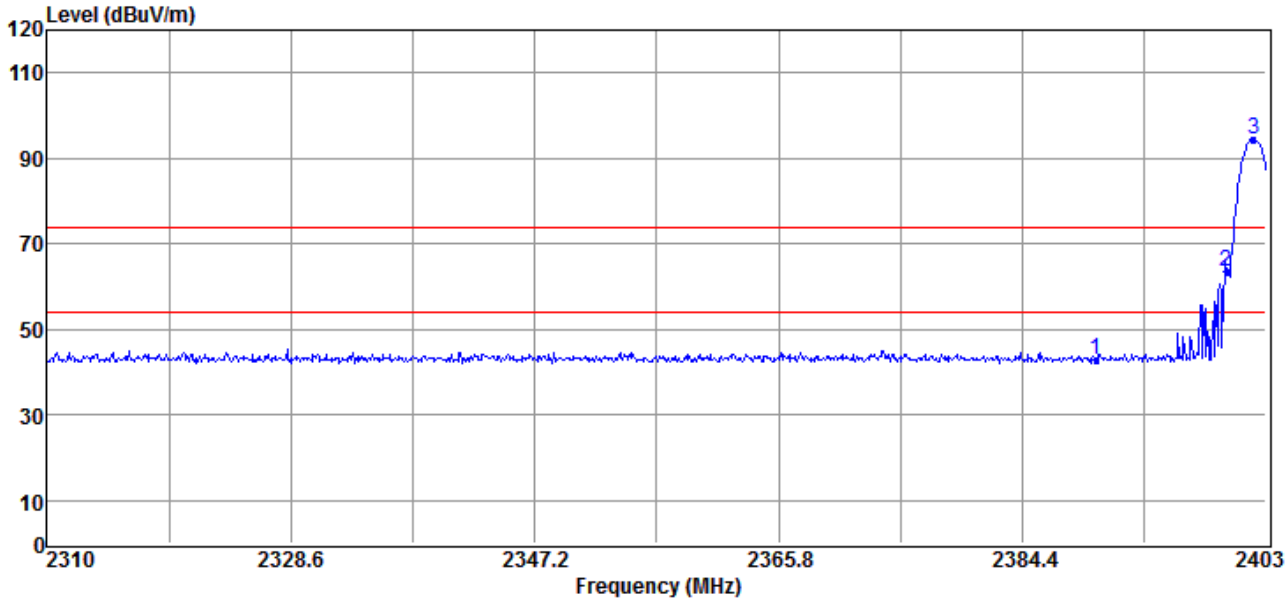
Where	FS = Field Strength	CL = Cable Attenuation Factor (Cable Loss)
	RA = Reading Amplitude	AG = Amplifier Gain
	AF = Antenna Factor	

7.6 Measurement Result:

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

Radiated Emission: (BDR mode)

Operation Mode	TX CH Low	Test Date	2018/10/01
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	58.68	-15.71	42.97	74.00	-31.03	Peak	VERTICAL
2	2400.00	79.19	-15.73	63.46	74.32	-10.86	Peak	VERTICAL
3	2402.07	110.05	-15.73	94.32	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.

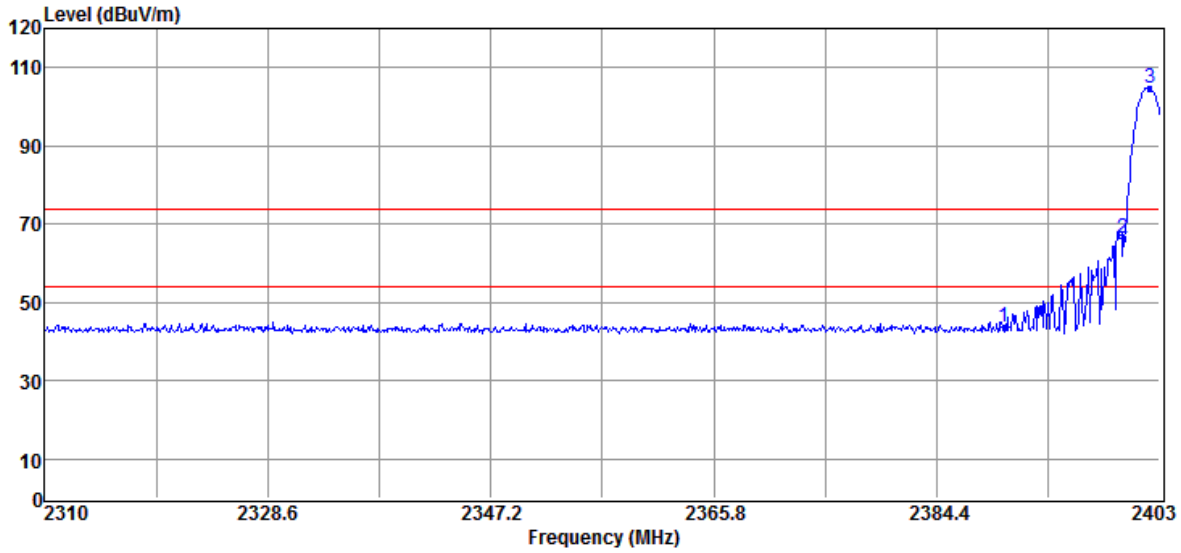
2 Measurement of data within this frequency range shown " - " in the table above means the reading of emissions are attenuated more than 20dB below the permissible limits or the field strength is too small to be measured.

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

v



No	Freq MHz	Reading dBuV	Factor dB/m	Level dBuV/m	Limit dBuV/m	Margin dB	Remark	Pol V/H
1	2390.00	59.38	-15.71	43.67	74.00	-30.33	Peak	HORIZONTAL
2	2400.00	81.98	-15.73	66.25	84.62	-18.37	Peak	HORIZONTAL
3	2402.16	120.35	-15.73	104.62	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.

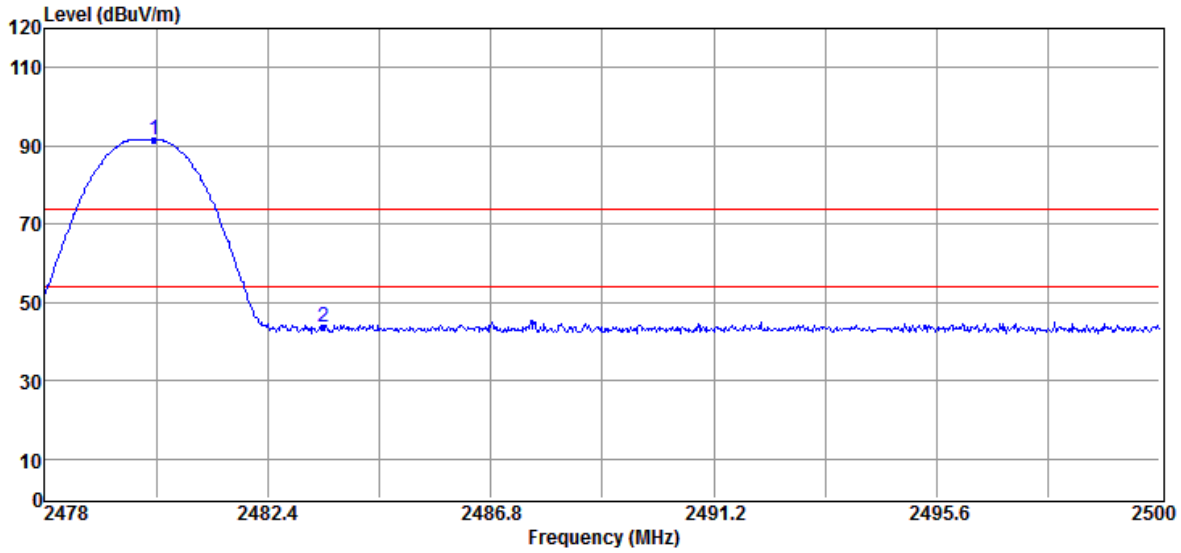
2 Measurement of data within this frequency range shown " - " in the table above means the reading of emissions are attenuated more than 20dB below the permissible limits or the field strength is too small to be measured.

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	2018/10/01
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	2480.16	107.45	-15.71	91.74	F	--	Peak	VERTICAL
2	2483.50	59.33	-15.71	43.62	74.00	-30.38	Peak	VERTICAL

Remark:

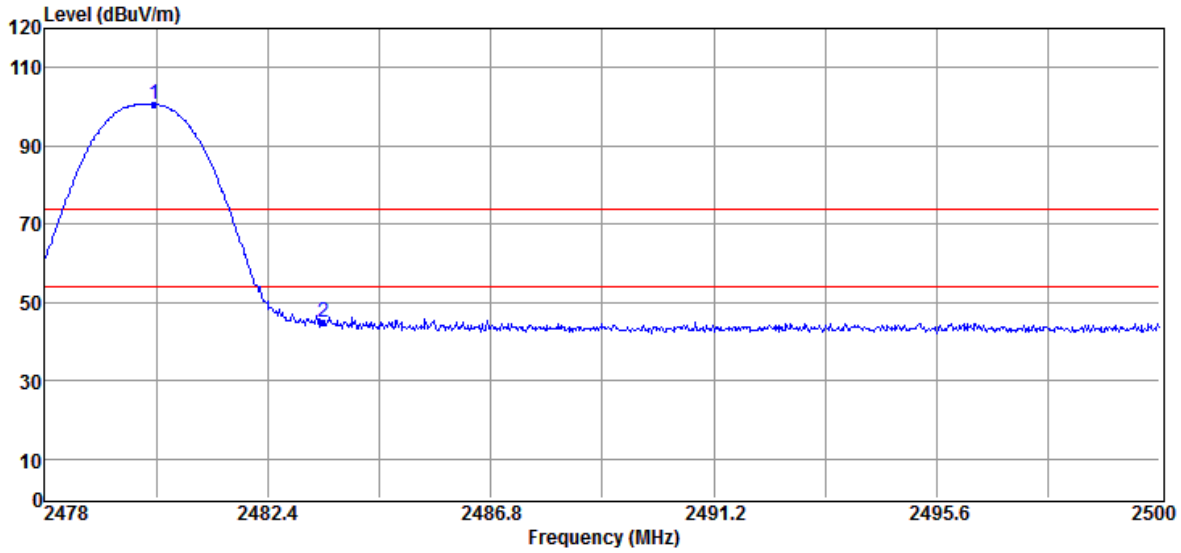
1 Field strength limits for frequency above 1000MHz are based on average limits. However, Peak mode field strength shall not exceed the average limits specified plus 20dB.

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	2480.16	116.24	-15.71	100.53	F	--	Peak	HORIZONTAL
2	2483.50	60.76	-15.71	45.05	74.00	-28.95	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.

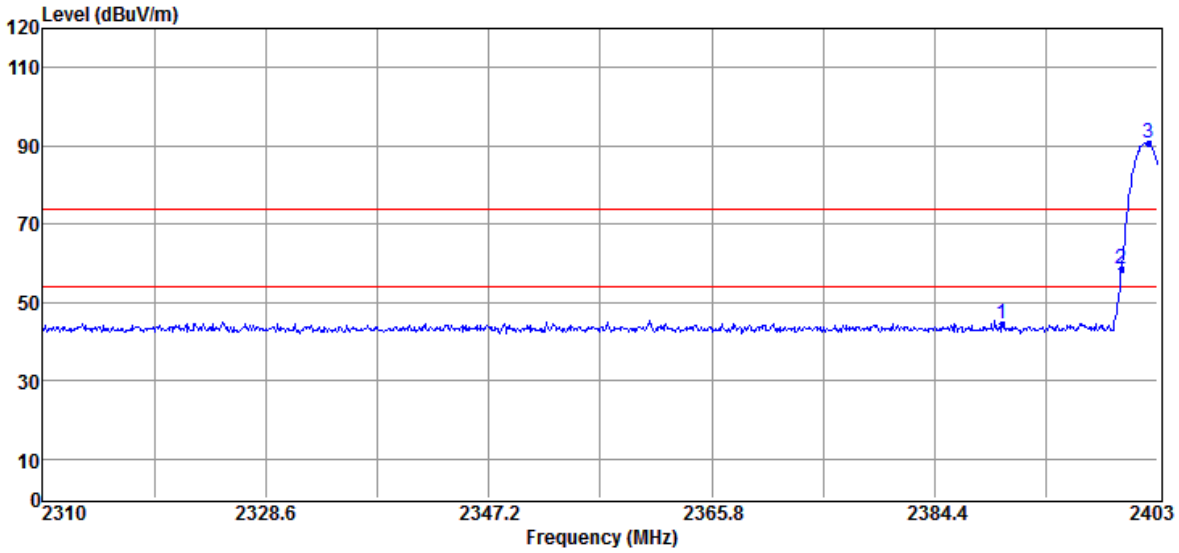
3 Spectrum Peak mode IF bandwidth Setting : 1GHz- 26GHz, RBW= 1MHz, Sweep time= 200 ms., the VBW setting was 3 MHz.

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 mode):

Operation Mode	TX CH Low	Test Date	2018/10/01
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	60.23	-15.71	44.52	74.00	-29.48	Peak	VERTICAL
2	2400.00	74.43	-15.73	58.70	70.87	-12.17	Peak	VERTICAL
3	2402.26	106.60	-15.73	90.87	F	--	Peak	VERTICAL

Remark:

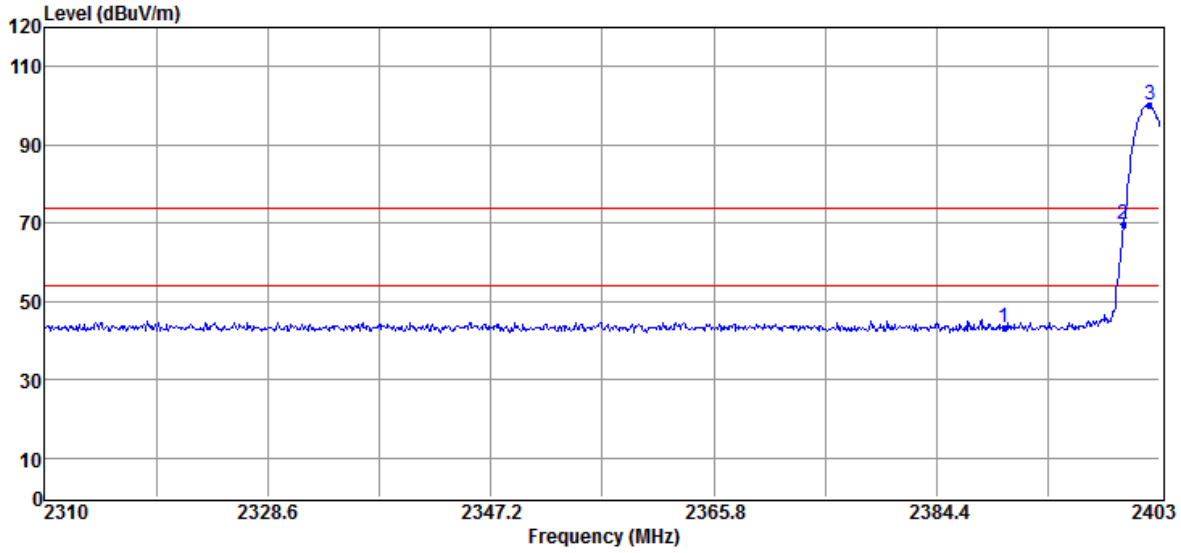
1 Field strength limits for frequency above 1000MHz are based on average limits. However, Peak mode field strength shall not exceed the average limits specified plus 20dB.

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	59.21	-15.71	43.50	74.00	-30.50	Peak	HORIZONTAL
2	2400.00	85.59	-15.73	69.86	80.09	-10.23	Peak	HORIZONTAL
3	2402.16	115.82	-15.73	100.09	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.

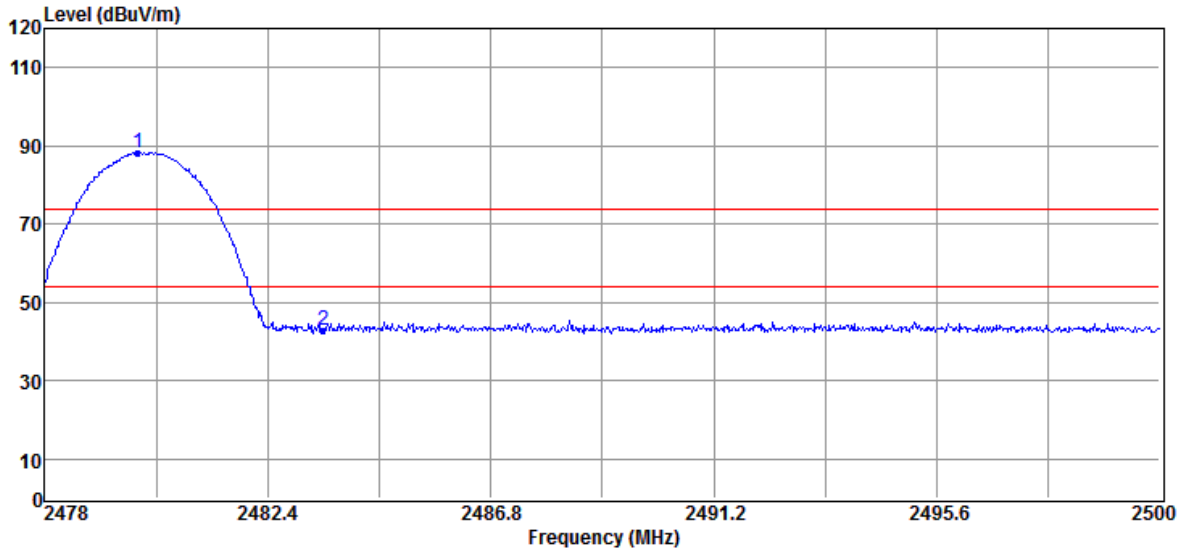
2 Measurement of data within this frequency range shown " - " in the table above means the reading of emissions are attenuated more than 20dB below the permissible limits or the field strength is too small to be measured.

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	2018/10/01
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	2479.85	103.98	-15.71	88.27	F	--	Peak	VERTICAL
2	2483.50	58.57	-15.71	42.86	74.00	-31.14	Peak	VERTICAL

Remark:

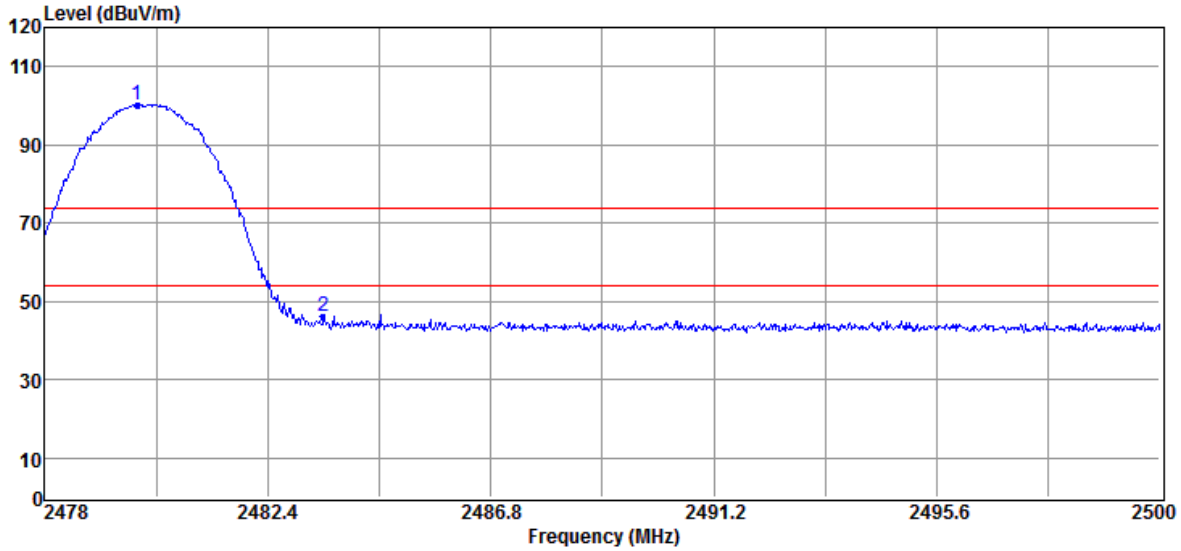
1 Field strength limits for frequency above 1000MHz are based on average limits. However, Peak mode field strength shall not exceed the average limits specified plus 20dB.

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	2479.83	115.86	-15.71	100.15	F	--	Peak	HORIZONTAL
2	2483.50	61.77	-15.71	46.06	74.00	-27.94	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.

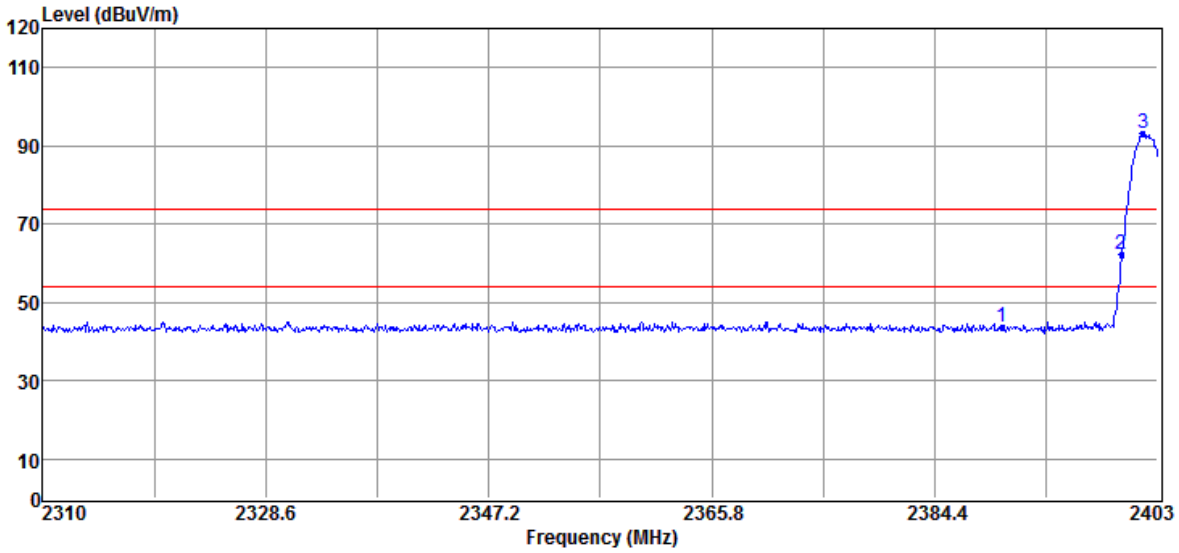
3 Spectrum Peak mode IF bandwidth Setting : 1GHz- 26GHz, RBW= 1MHz, Sweep time= 200 ms., the VBW setting was 3 MHz.

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 mode):

Operation Mode	TX CH Low	Test Date	2018/10/01
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	59.22	-15.71	43.51	74.00	-30.49	Peak	VERTICAL
2	2400.00	77.89	-15.73	62.16	73.01	-10.85	Peak	VERTICAL
3	2401.79	108.74	-15.73	93.01	F	--	Peak	VERTICAL

Remark:

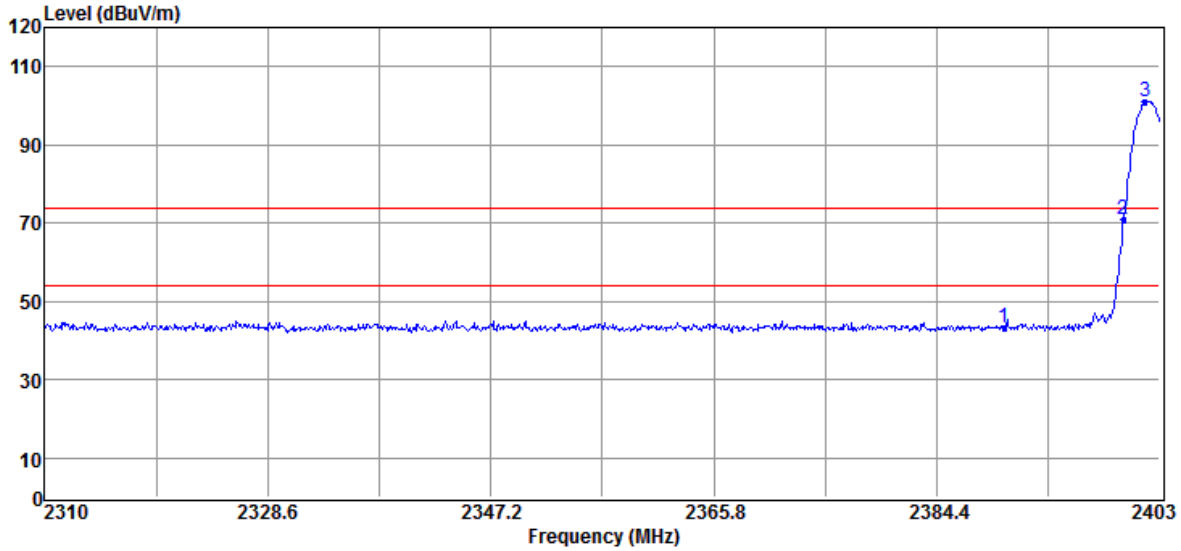
1 Field strength limits for frequency above 1000MHz are based on average limits. However, Peak mode field strength shall not exceed the average limits specified plus 20dB.

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	58.83	-15.71	43.12	74.00	-30.88	Peak	HORIZONTAL
2	2400.00	86.73	-15.73	71.00	81.11	-10.11	Peak	HORIZONTAL
3	2401.79	116.84	-15.73	101.11	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.

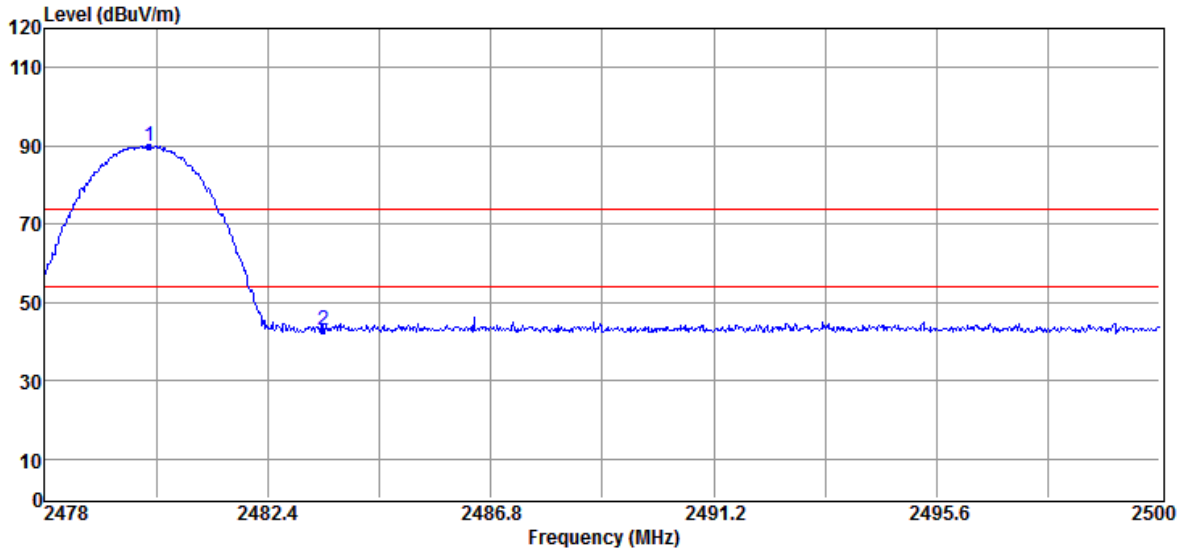
2 Measurement of data within this frequency range shown " - " in the table above means the reading of emissions are attenuated more than 20dB below the permissible limits or the field strength is too small to be measured.

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	2018/10/01
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	2480.07	105.68	-15.71	89.97	F	--	Peak	VERTICAL
2	2483.50	58.80	-15.71	43.09	74.00	-30.91	Peak	VERTICAL

Remark:

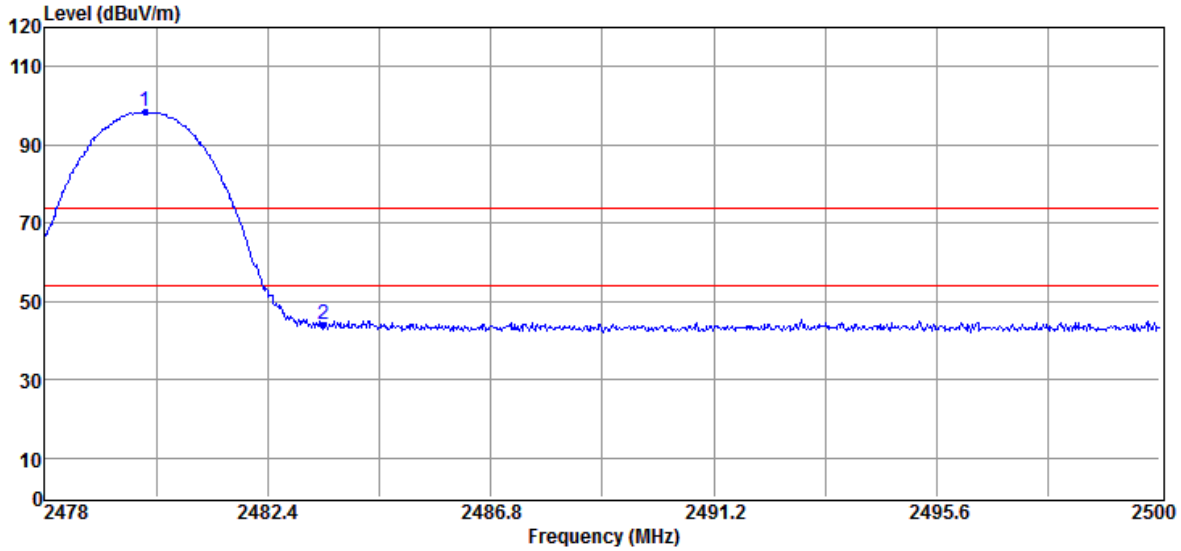
1 Field strength limits for frequency above 1000MHz are based on average limits. However, Peak mode field strength shall not exceed the average limits specified plus 20dB.

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	114.13	-15.71	98.42	F	--	Peak	HORIZONTAL
2	2483.50	59.81	-15.71	44.10	74.00	-29.90	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.

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	2018/10/01
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	380.17	28.31	-3.40	24.91	46.00	-21.09	Peak	VERTICAL
2	491.72	29.93	-1.72	28.21	46.00	-17.79	Peak	VERTICAL
3	499.48	42.97	-1.66	41.31	46.00	-4.69	Peak	VERTICAL
4	521.79	39.02	-1.28	37.74	46.00	-8.26	Peak	VERTICAL
5	780.78	28.25	3.40	31.65	46.00	-14.35	Peak	VERTICAL
6	858.38	28.18	4.52	32.70	46.00	-13.30	Peak	VERTICAL
1	345.25	29.09	-4.09	25.00	46.00	-21.00	Peak	HORIZONTAL
2	415.09	28.96	-2.70	26.26	46.00	-19.74	Peak	HORIZONTAL
3	495.60	42.94	-1.69	41.25	46.00	-4.75	Peak	HORIZONTAL
4	514.03	39.19	-1.42	37.77	46.00	-8.23	Peak	HORIZONTAL
5	648.86	28.33	0.99	29.32	46.00	-16.68	Peak	HORIZONTAL
6	769.14	28.63	3.28	31.91	46.00	-14.09	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	2018/10/01
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	431.58	27.95	-2.41	25.54	46.00	-20.46	Peak	VERTICAL
2	498.51	45.64	-1.66	43.98	46.00	-2.02	Peak	VERTICAL
3	513.06	40.19	-1.43	38.76	46.00	-7.24	Peak	VERTICAL
4	522.76	41.78	-1.27	40.51	46.00	-5.49	Peak	VERTICAL
5	709.97	28.11	2.12	30.23	46.00	-15.77	Peak	VERTICAL
6	874.87	27.46	4.84	32.30	46.00	-13.70	Peak	VERTICAL
1	494.63	41.42	-1.69	39.73	46.00	-6.27	Peak	HORIZONTAL
2	499.48	42.49	-1.66	40.83	46.00	-5.17	Peak	HORIZONTAL
3	513.06	36.70	-1.43	35.27	46.00	-10.73	Peak	HORIZONTAL
4	522.76	42.13	-1.27	40.86	46.00	-5.14	Peak	HORIZONTAL
5	810.85	27.77	3.76	31.53	46.00	-14.47	Peak	HORIZONTAL
6	872.93	27.80	4.79	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	Test Date	2018/10/01
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	494.63	35.46	-1.69	33.77	46.00	-12.23	Peak	VERTICAL
2	499.48	39.52	-1.66	37.86	46.00	-8.14	Peak	VERTICAL
3	513.06	41.00	-1.43	39.57	46.00	-6.43	Peak	VERTICAL
4	516.94	38.80	-1.37	37.43	46.00	-8.57	Peak	VERTICAL
5	730.34	27.84	2.62	30.46	46.00	-15.54	Peak	VERTICAL
6	784.66	28.23	3.44	31.67	46.00	-14.33	Peak	VERTICAL
1	493.66	42.64	-1.70	40.94	46.00	-5.06	Peak	HORIZONTAL
2	500.45	39.13	-1.64	37.49	46.00	-8.51	Peak	HORIZONTAL
3	515.00	31.98	-1.40	30.58	46.00	-15.42	Peak	HORIZONTAL
4	522.76	31.61	-1.27	30.34	46.00	-15.66	Peak	HORIZONTAL
5	648.86	28.22	0.99	29.21	46.00	-16.79	Peak	HORIZONTAL
6	868.08	28.26	4.70	32.96	46.00	-13.04	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	2018/10/01
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	1868.00	58.92	-18.48	40.44	74.00	-33.56	Peak	VERTICAL
2	5242.00	54.76	-8.19	46.57	74.00	-27.43	Peak	VERTICAL
1	1602.00	59.21	-19.02	40.19	74.00	-33.81	Peak	HORIZONTAL
2	4157.00	55.71	-11.47	44.24	74.00	-29.76	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	2018/10/01
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	1595.00	52.24	-19.03	33.21	74.00	-40.79	Peak	VERTICAL
2	5088.00	50.47	-8.55	41.92	74.00	-32.08	Peak	VERTICAL
1	1595.00	53.05	-19.03	34.02	74.00	-39.98	Peak	HORIZONTAL
2	4346.00	49.42	-10.87	38.55	74.00	-35.45	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	2018/10/01
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	2190.00	50.47	-15.73	34.74	74.00	-39.26	Peak	VERTICAL
2	4983.00	48.38	-8.80	39.58	74.00	-34.42	Peak	VERTICAL
1	1063.00	54.75	-20.21	34.54	74.00	-39.46	Peak	HORIZONTAL
2	4451.00	49.80	-10.49	39.31	74.00	-34.69	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

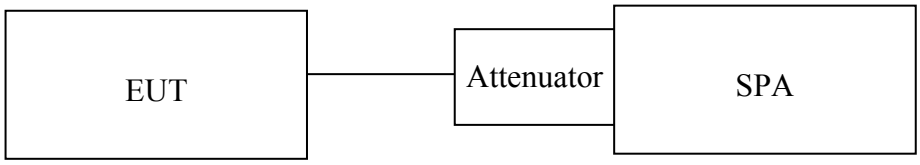
9.1 Standard Applicable:

According to §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.

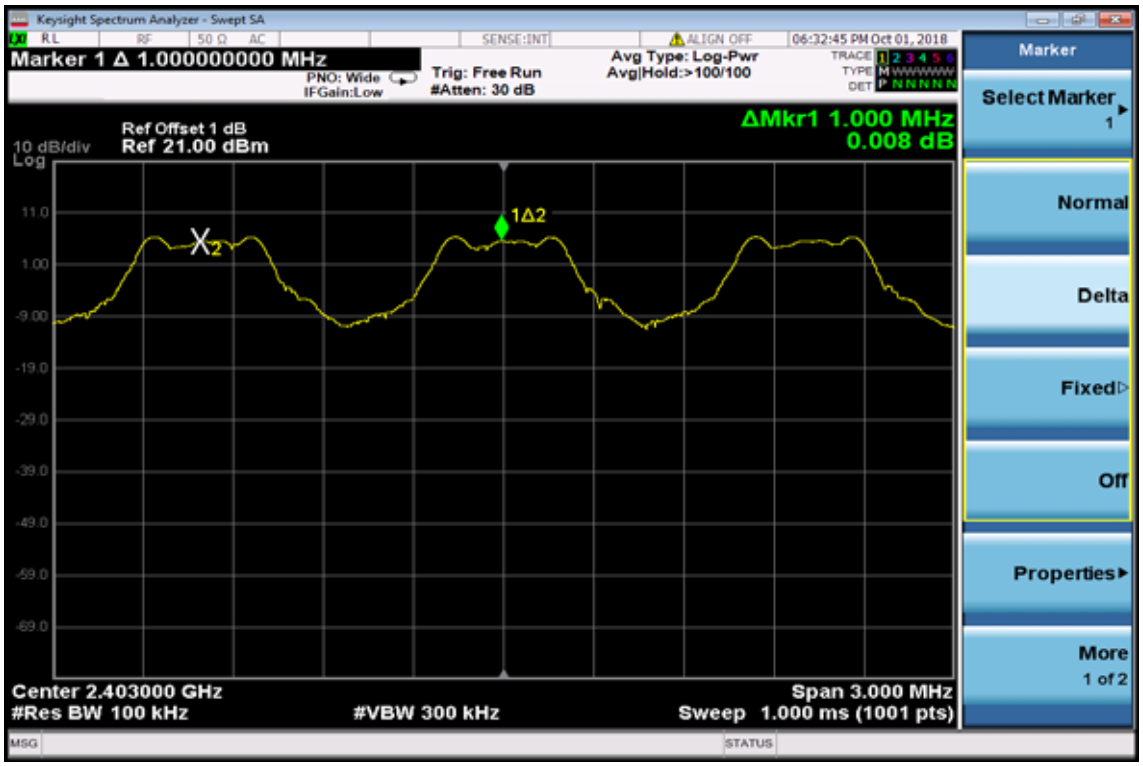
9.5 Measurement Result:

Channel separation (MHz)	Limit	Result
1	≥25kHz or 2/3 times 20dB bandwidth	PASS

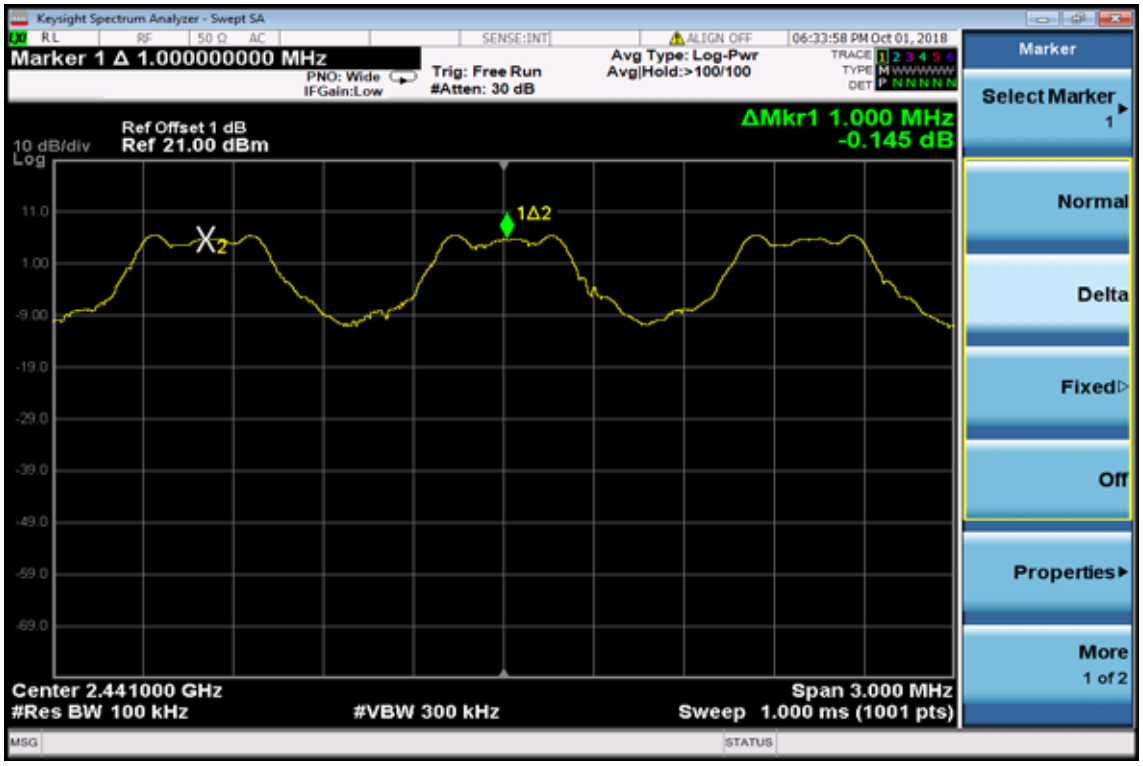
Note: Refer to next page for plots.

Frequency Separation Test Data

Low



Mid



High


Keysight Spectrum Analyzer - Swept SA
Marker 1 Δ 1.000000000 MHz
PNO: Wide
IFGain:Low
Trig: Free Run
#Atten: 30 dB
Avg Type: Log-Pwr
Avg|Hold:>100/100
06:35:25 PM Oct 01, 2018
Ref Offset 1 dB
10 dB/div
Log
Ref 21.00 dBm
ΔMkr1 1.000 MHz
0.000 dB
1Δ2
Center 2.479000 GHz
#Res BW 100 kHz
#VBW 300 kHz
Span 3.000 MHz
Sweep 1.000 ms (1001 pts)
Marker
Select Marker
Normal
Delta
Fixed
Off
Properties
More
1 of 2
Align Now All required

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.

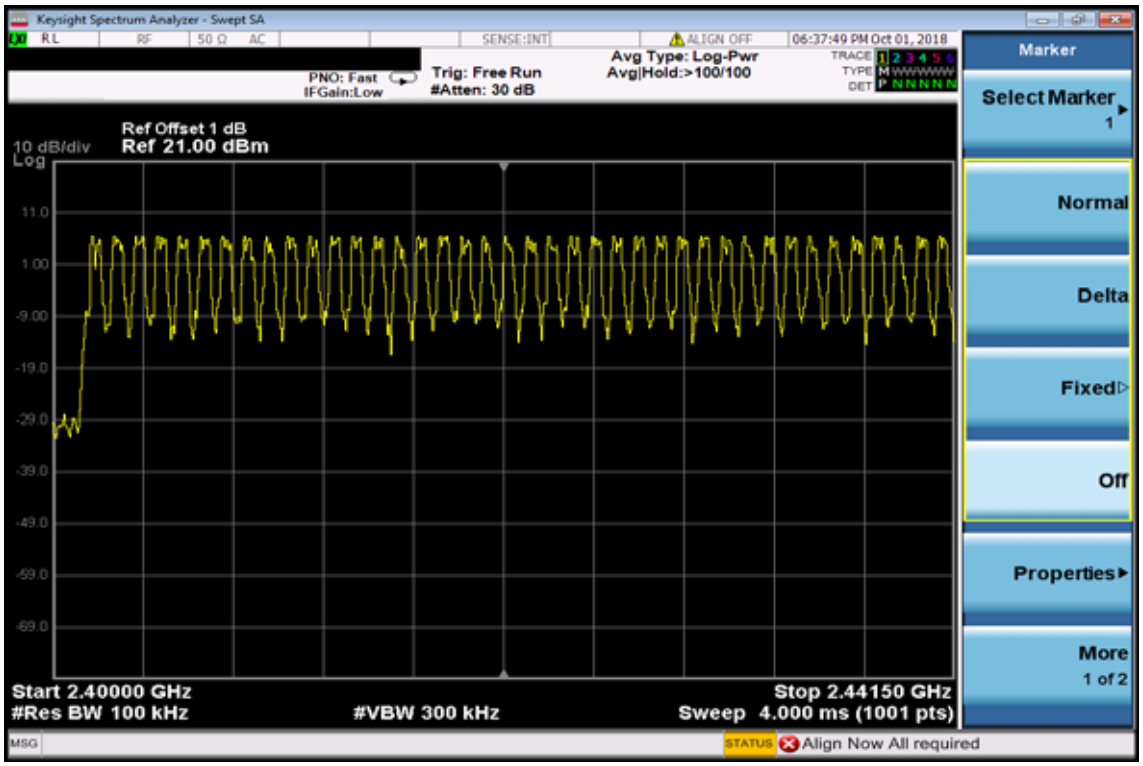
10.4 Measurement Procedure:

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.

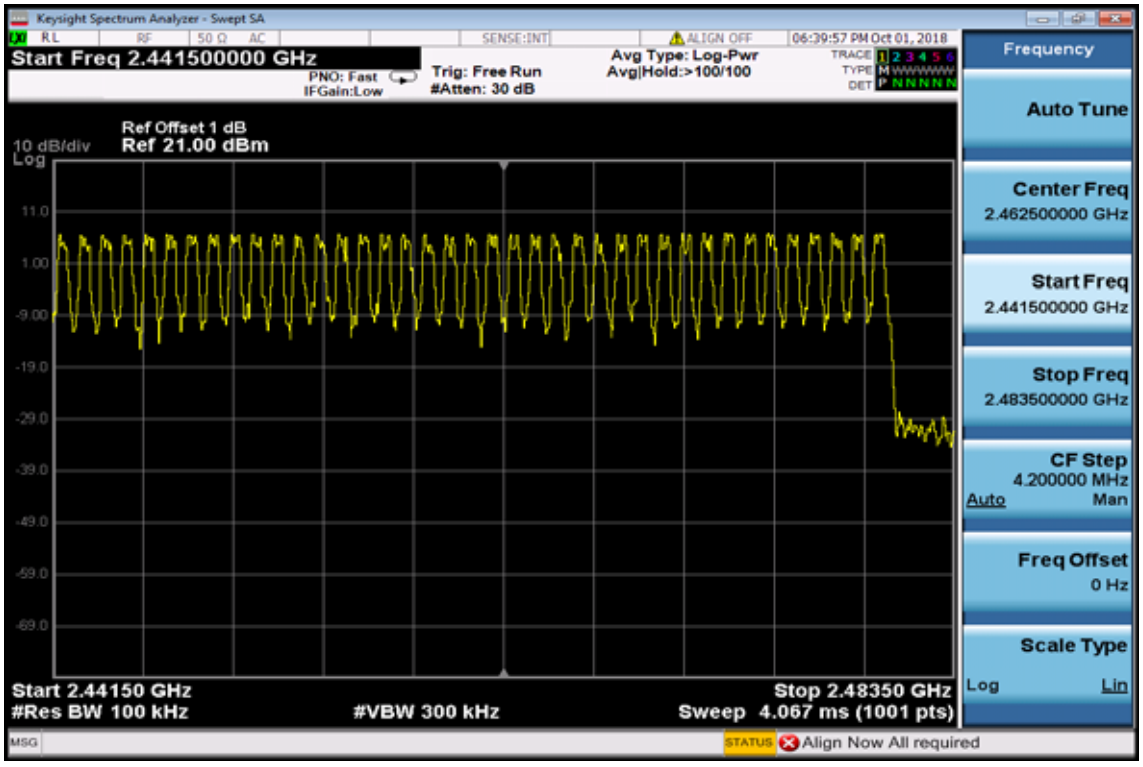
10.5 Measurement Result:

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:

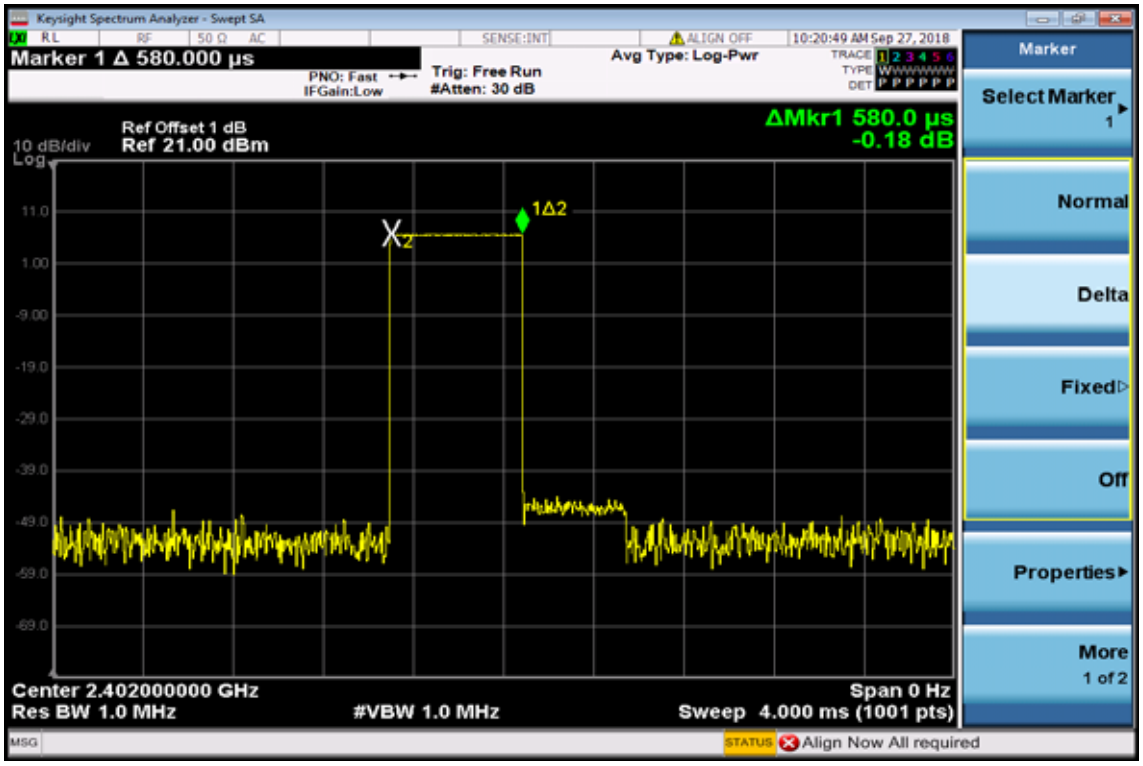
A period time = 0.4 (ms) * 79 = 31.6 (s)

CH Low	DH1 time slot	=	0.580	(ms) *	(1600/2/79) * 31.6 =	185.60	(ms)
	DH3 time slot	=	1.830	(ms) *	(1600/4/79) * 31.6 =	292.80	(ms)
	DH5 time slot	=	3.060	(ms) *	(1600/6/79) * 31.6 =	326.40	(ms)
CH Mid	DH1 time slot	=	0.572	(ms) *	(1600/2/79) * 31.6 =	183.04	(ms)
	DH3 time slot	=	1.830	(ms) *	(1600/4/79) * 31.6 =	292.80	(ms)
	DH5 time slot	=	3.080	(ms) *	(1600/6/79) * 31.6 =	328.53	(ms)
CH High	DH1 time slot	=	0.580	(ms) *	(1600/2/79) * 31.6 =	185.60	(ms)
	DH3 time slot	=	1.830	(ms) *	(1600/4/79) * 31.6 =	292.80	(ms)
	DH5 time slot	=	3.020	(ms) *	(1600/6/79) * 31.6 =	322.13	(ms)

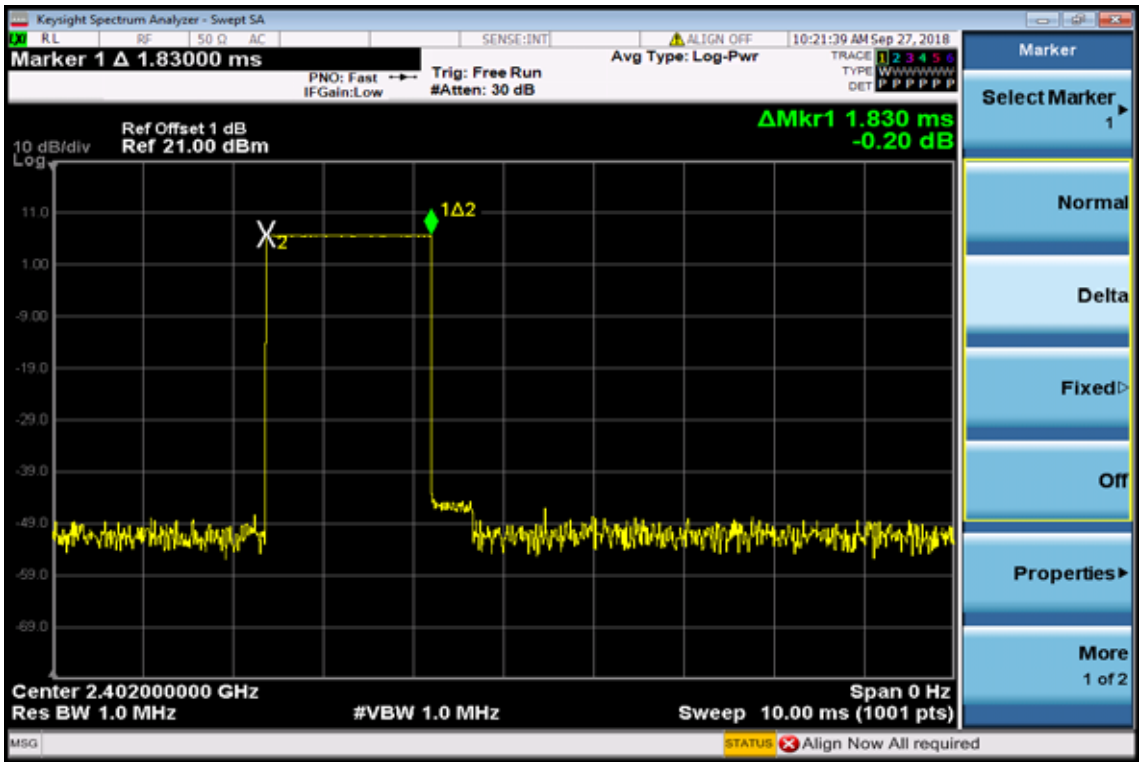
Note: Refer to next page for plots.

Low Channel

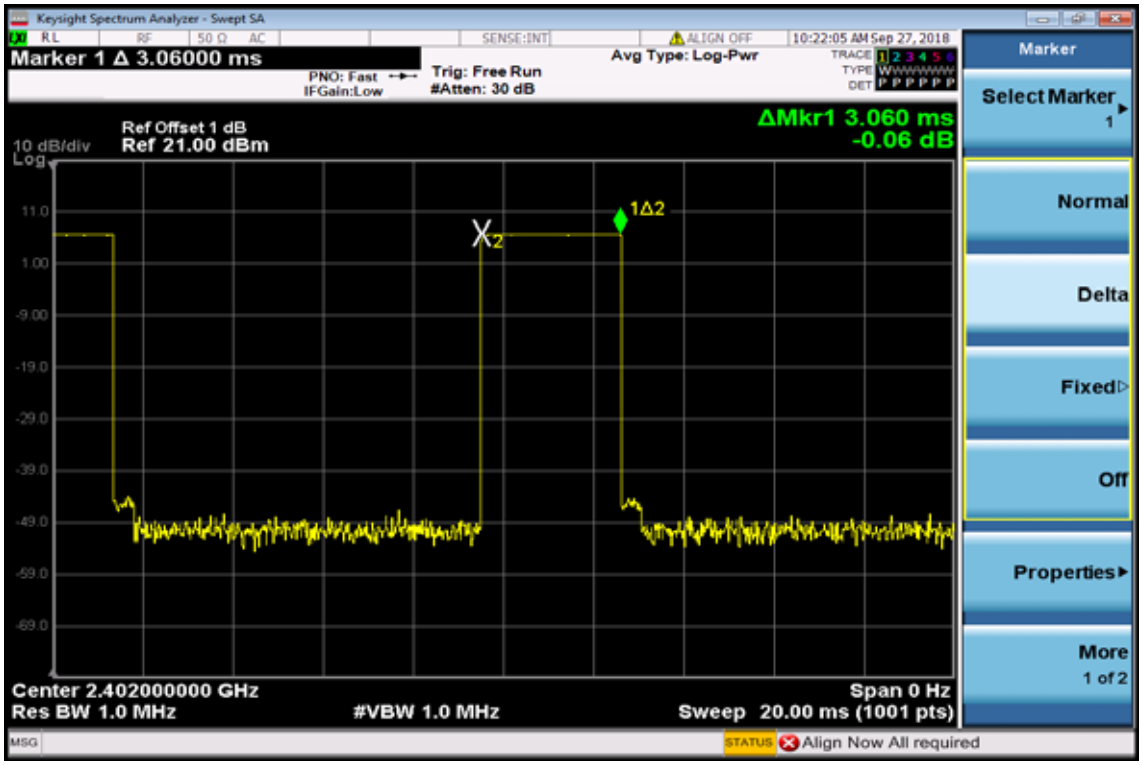
DH1



DH3

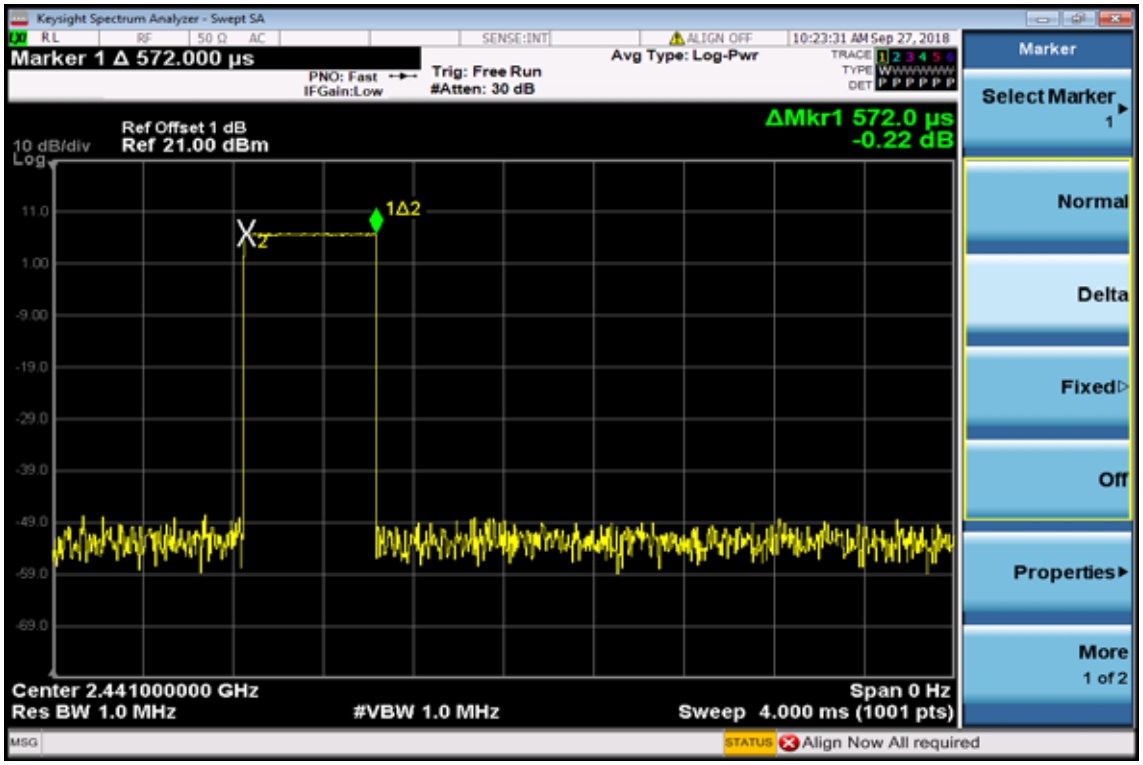


DH5

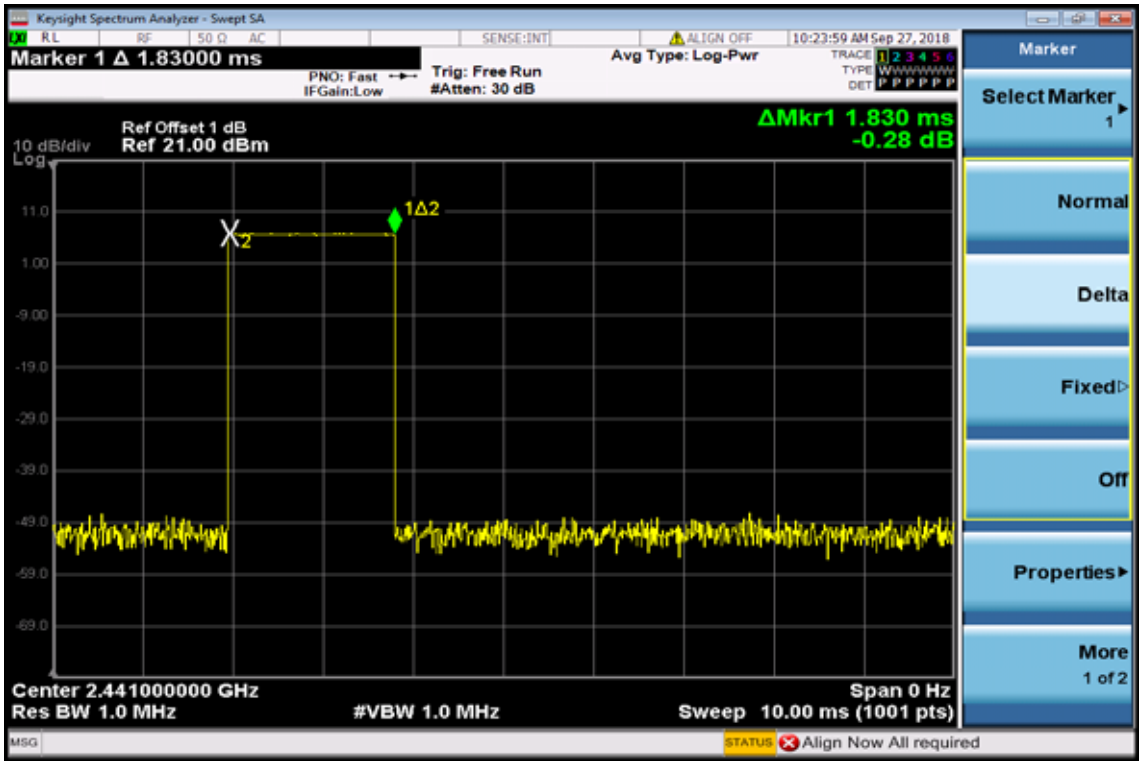


Mid Channel

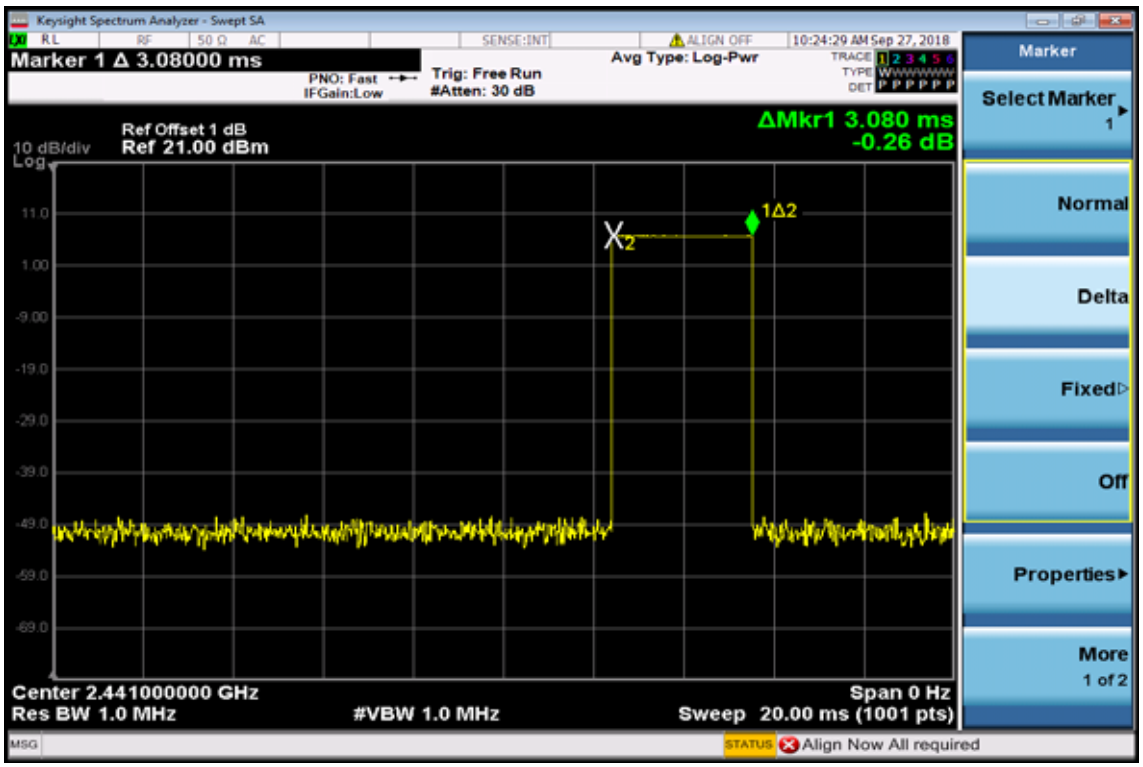
DH1



DH3

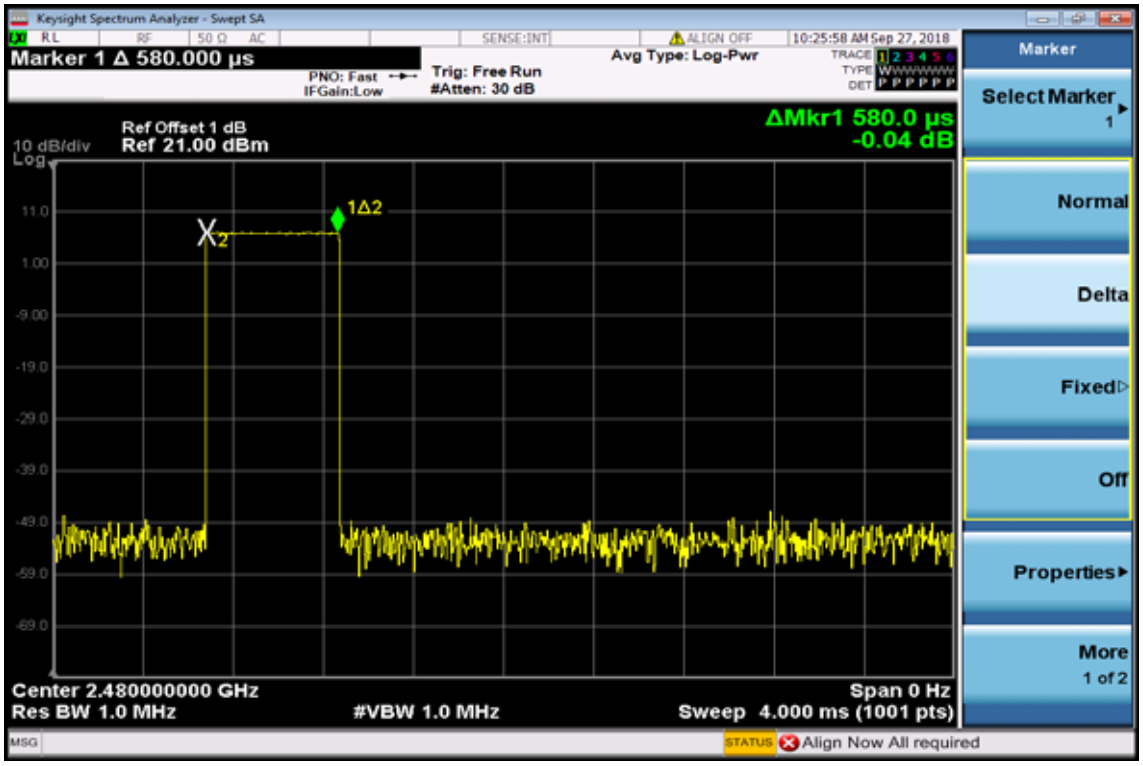

Keysight Spectrum Analyzer - Swept SA
Marker 1 Δ 1.83000 ms
PNO: Fast
IFGain:Low
Trig: Free Run
#Atten: 30 dB
Avg Type: Log-Pwr
10:23:59 AM Sep 27, 2018
Ref Offset 1 dB
10 dB/div
Ref 21.00 dBm
ΔMkr1 1.830 ms
-0.28 dB
1Δ2
Center 2.441000000 GHz
Res BW 1.0 MHz
#VBW 1.0 MHz
Span 0 Hz
Sweep 10.00 ms (1001 pts)
Marker
Select Marker
Normal
Delta
Fixed
Off
Properties
More
1 of 2
Align Now All required

DH5

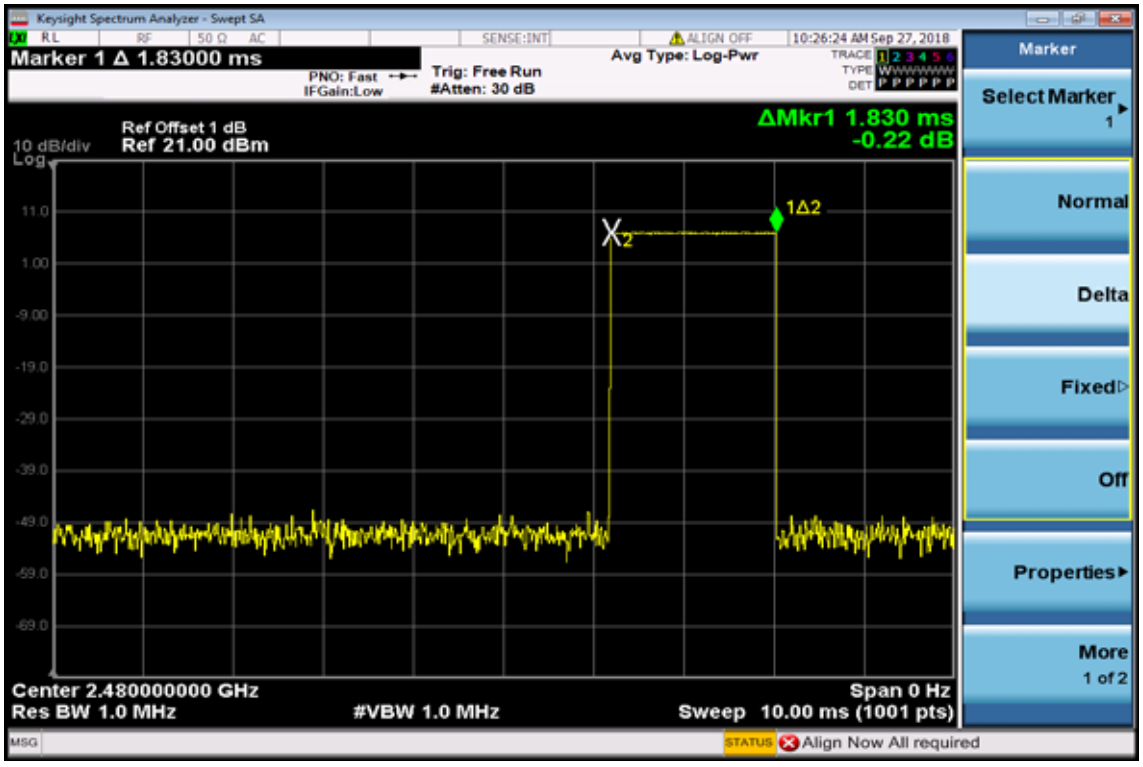

Keysight Spectrum Analyzer - Swept SA
Marker 1 Δ 3.08000 ms
PNO: Fast
IFGain:Low
Trig: Free Run
#Atten: 30 dB
Avg Type: Log-Pwr
10:24:29 AM Sep 27, 2018
Ref Offset 1 dB
10 dB/div
Ref 21.00 dBm
ΔMkr1 3.080 ms
-0.26 dB
1Δ2
Center 2.441000000 GHz
Res BW 1.0 MHz
#VBW 1.0 MHz
Span 0 Hz
Sweep 20.00 ms (1001 pts)
Marker
Select Marker
Normal
Delta
Fixed
Off
Properties
More
1 of 2
Align Now All required

High Channel

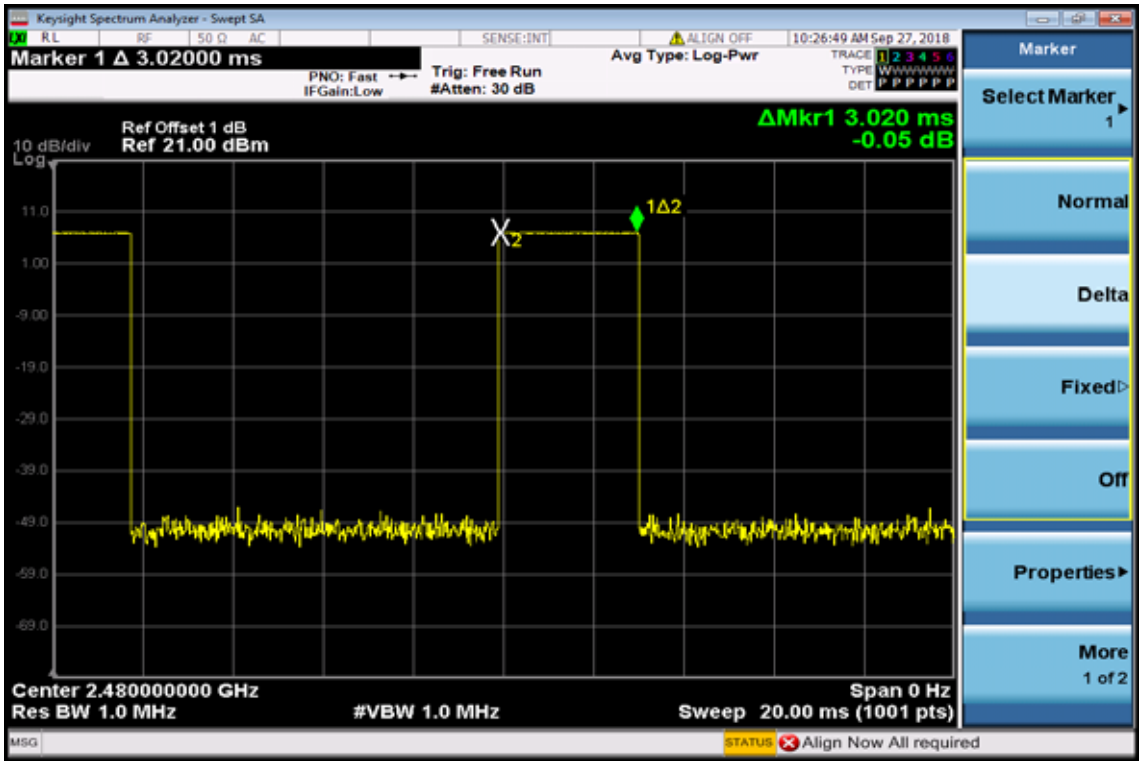
DH1



DH3



DH5


Keysight Spectrum Analyzer - Swept SA
RL
RF
50 Ω AC
SENSE:INT
ALIGN OFF
10:26:49 AM Sep 27, 2018
Marker 1 Δ 3.02000 ms
PNO: Fast
IFGain:Low
Trig: Free Run
#Atten: 30 dB
Avg Type: Log-Pwr
TRACE 1 2 3 4 5 6
TYPE
DET P P P P P P
Ref Offset 1 dB
10 dB/div
Log
Ref 21.00 dBm
ΔMkr1 3.020 ms
-0.05 dB
11.0
1.00
-9.00
-19.0
-29.0
-39.0
-49.0
-59.0
-69.0
1Δ2
Center 2.480000000 GHz
Res BW 1.0 MHz
#VBW 1.0 MHz
Span 0 Hz
Sweep 20.00 ms (1001 pts)
Marker
Select Marker
1
Normal
Delta
Fixed
Off
Properties
More
1 of 2
MSG
STATUS
Align Now All required

12. 20dB Bandwidth

12.1 Standard Applicable:

According to §15.247(a)(1), 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	0.928
Mid	0.929
High	0.928

EDR 2M Mode

CH	20dB Bandwidth (MHz)	2/3* 20dB Bandwidth (MHz)
Lower	1.311	0.874
Mid	1.290	0.860
Higher	1.294	0.862

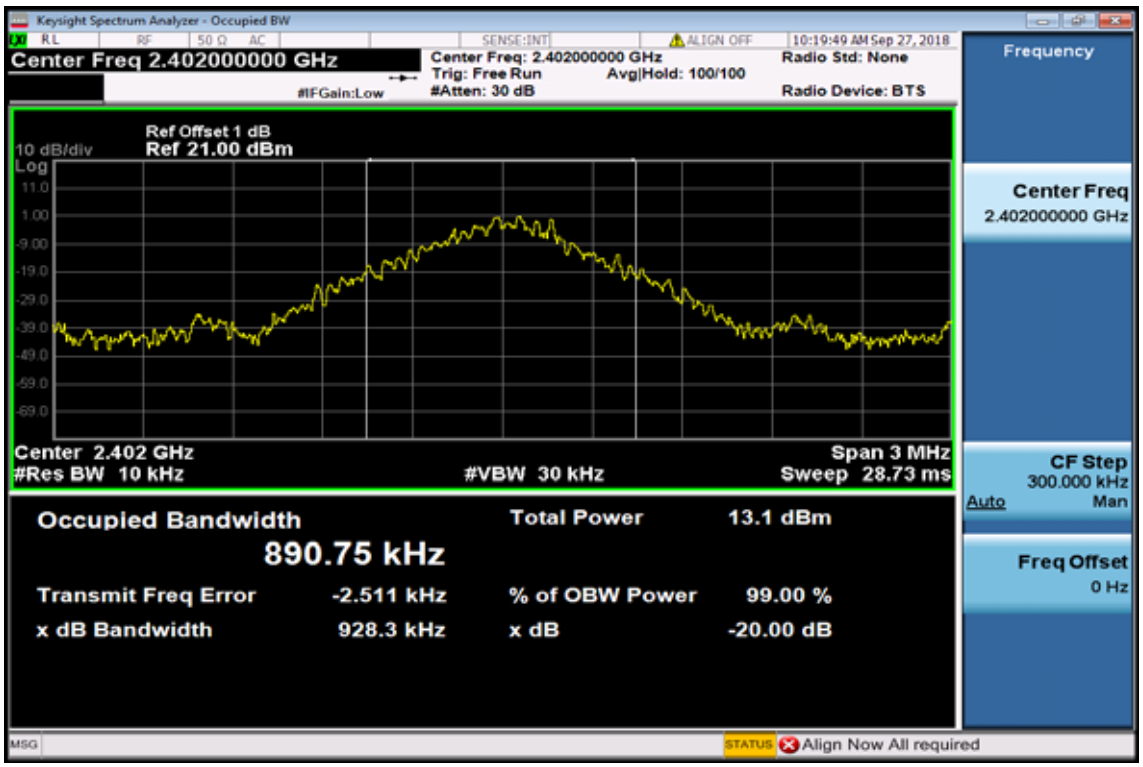
EDR 3M Mode

CH	20dB Bandwidth (MHz)	2/3* 20dB Bandwidth (MHz)
Lower	1.300	0.867
Mid	1.300	0.867
Higher	1.300	0.867

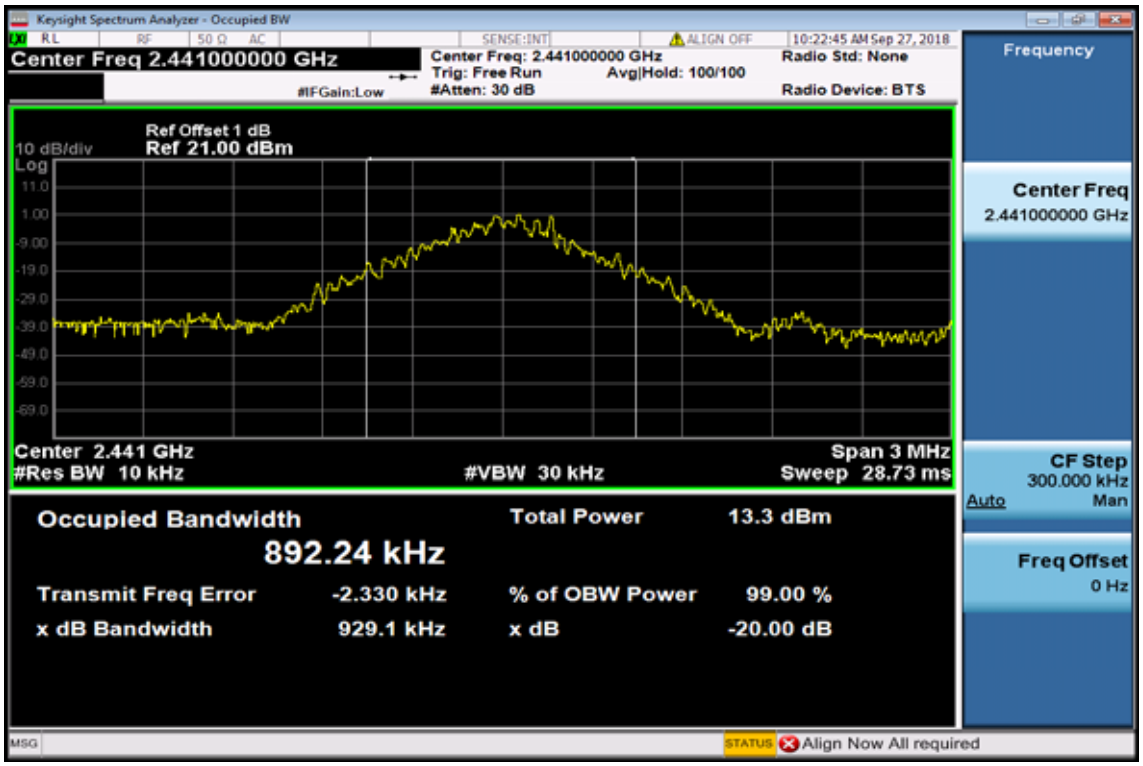
Note: Refer to next page for plots.

BDR Mode

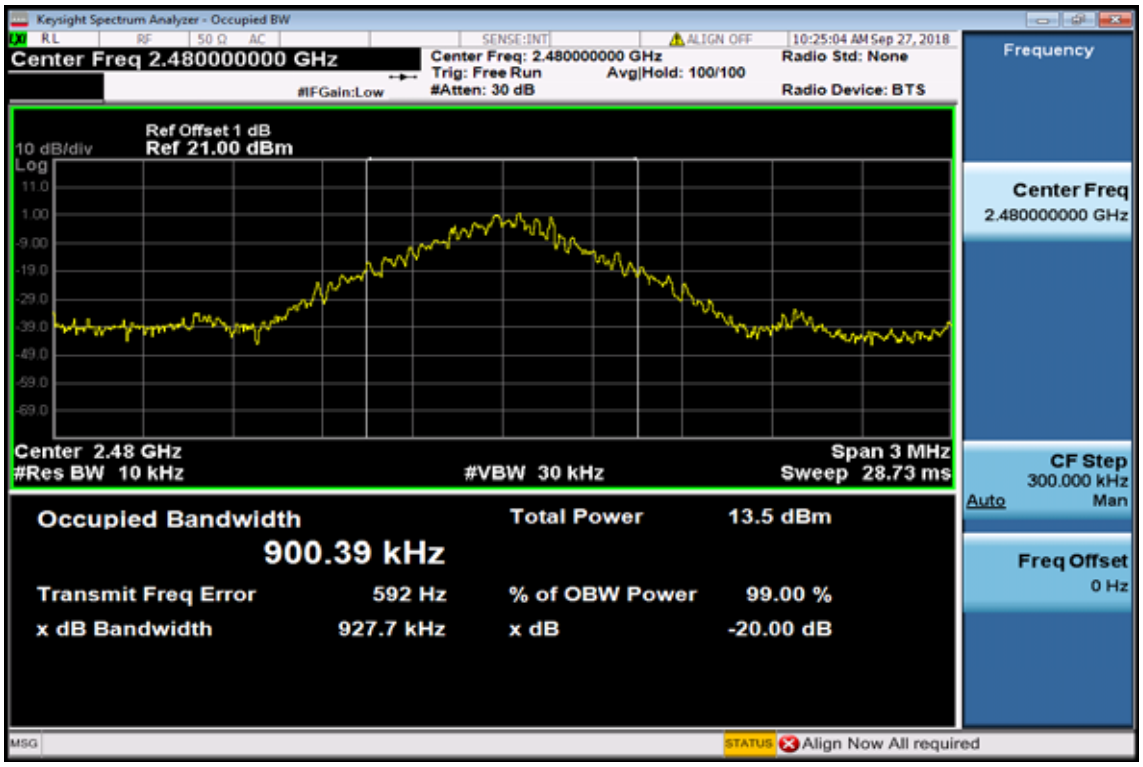
20dB Bandwidth Test Data CH-Low



20dB Bandwidth Test Data CH-Mid

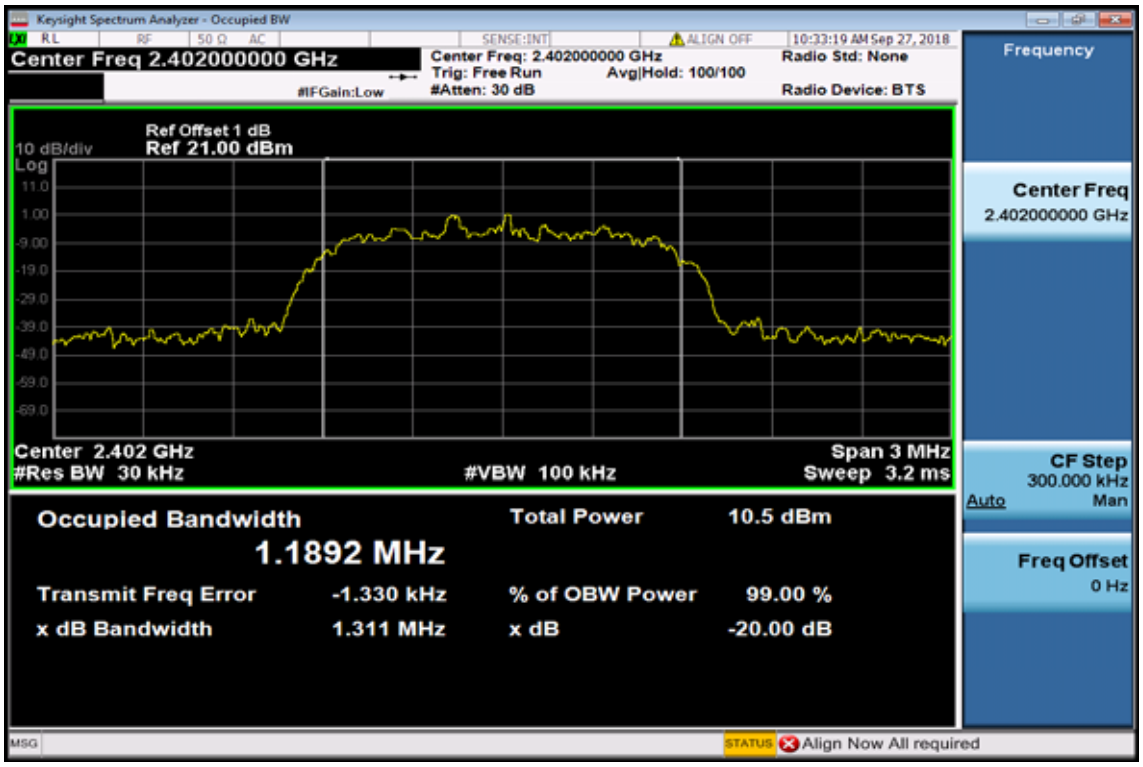


20dB Bandwidth Test Data CH-High

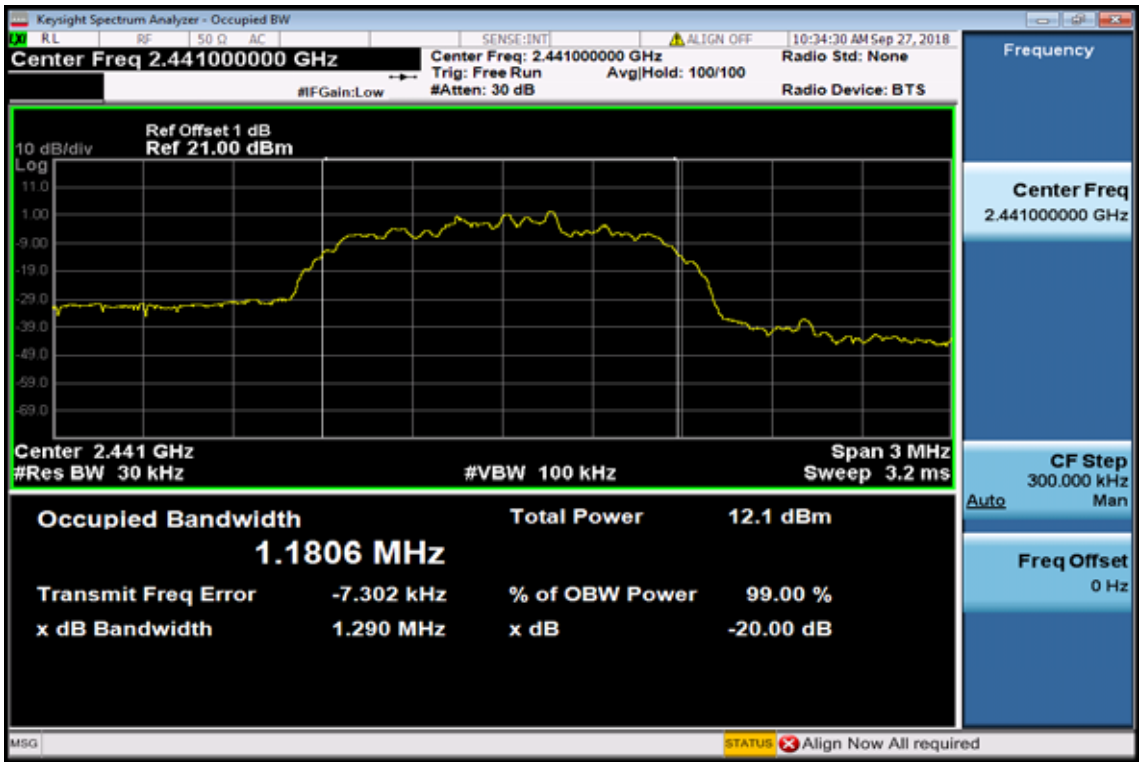


EDR 2M Mode

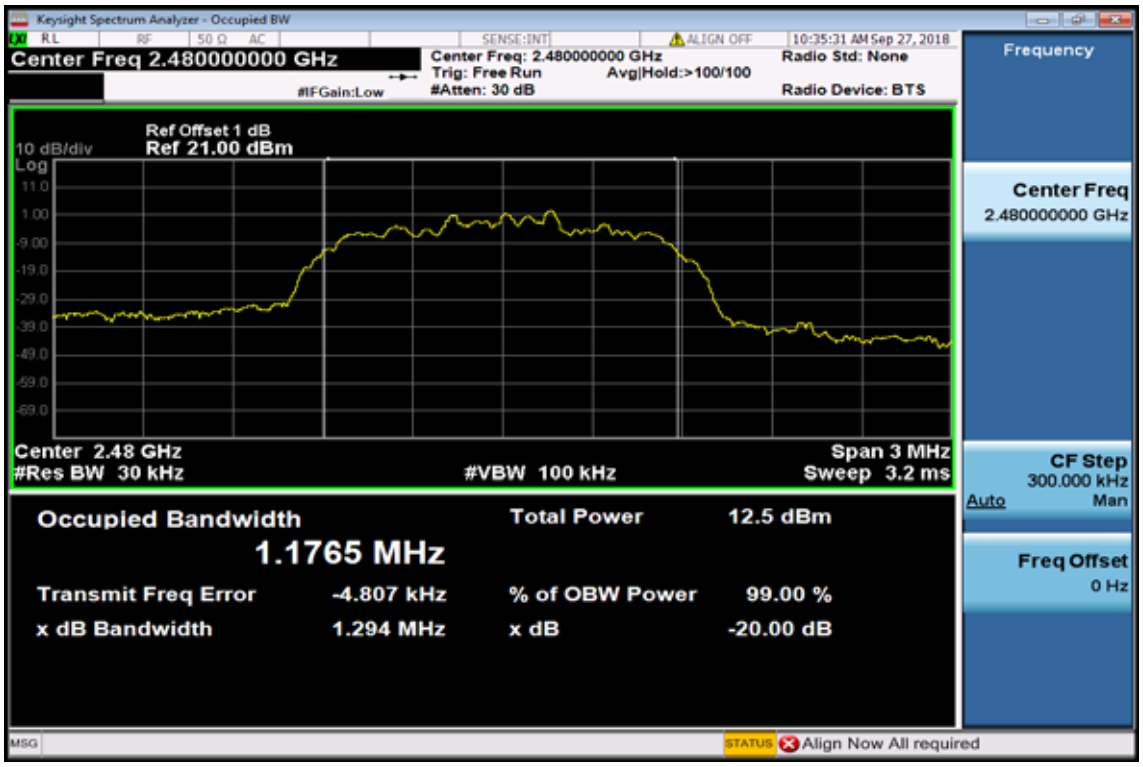
20dB Bandwidth Test Data CH-Low



20dB Bandwidth Test Data CH-Mid

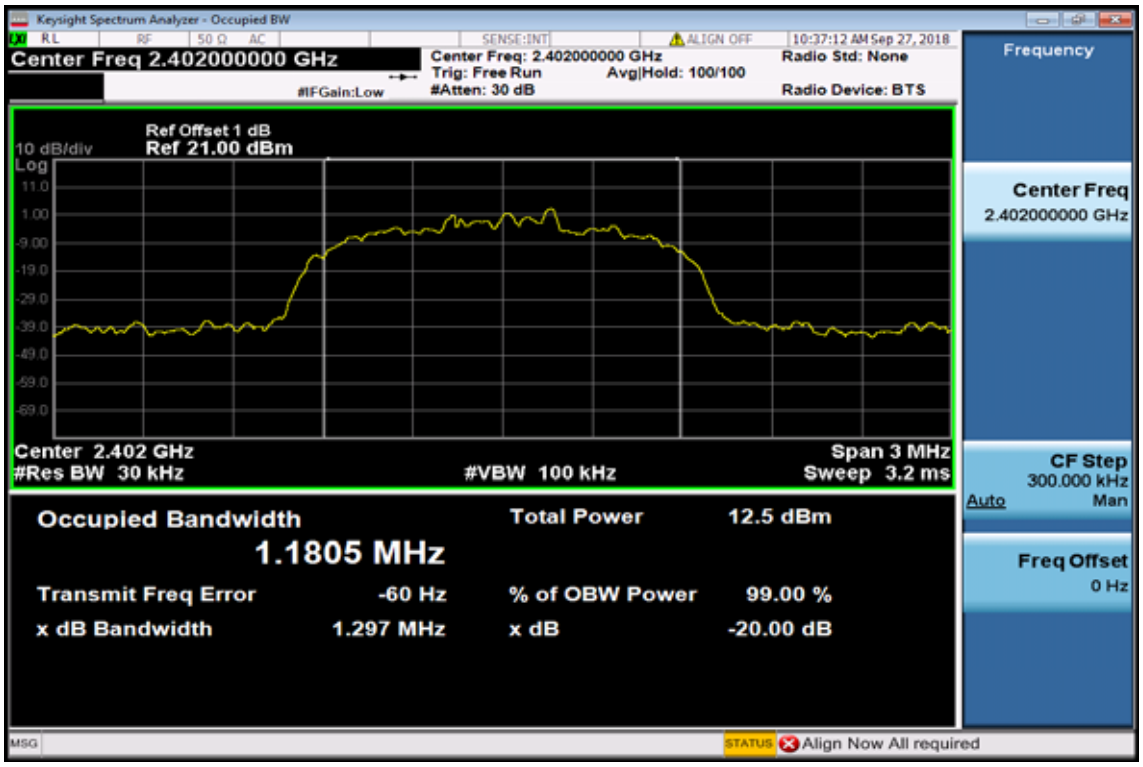


20dB Bandwidth Test Data CH-High

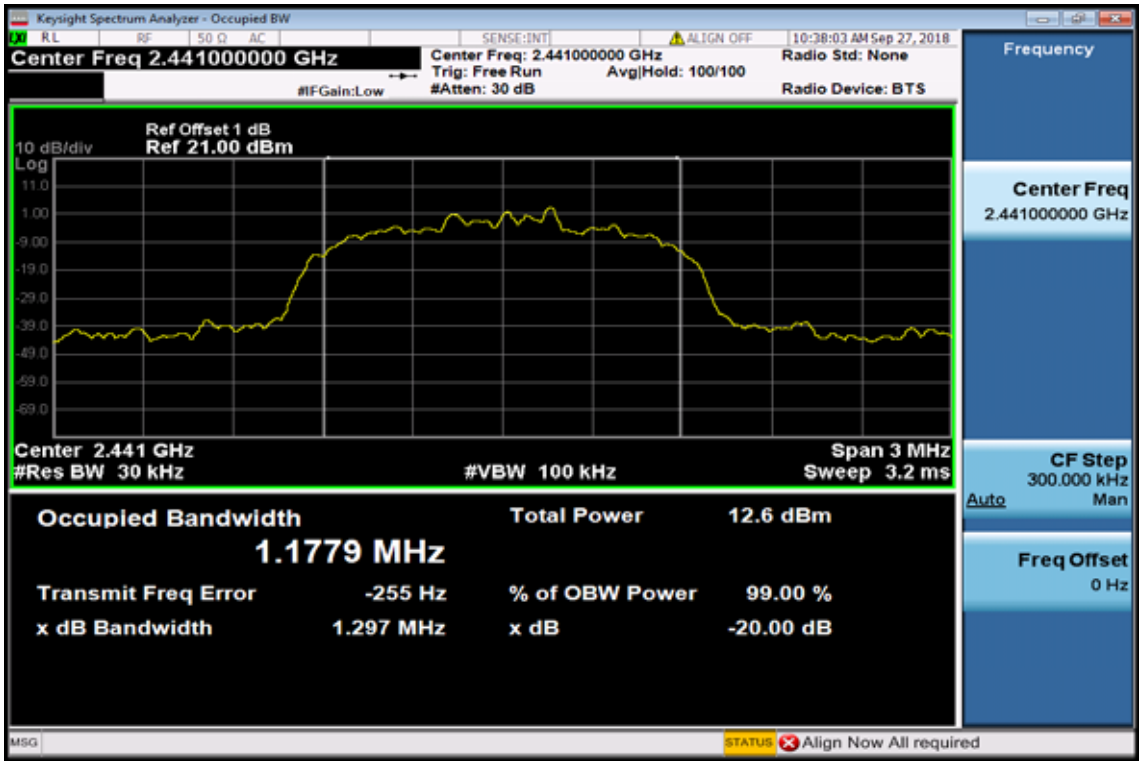


EDR 3M Mode

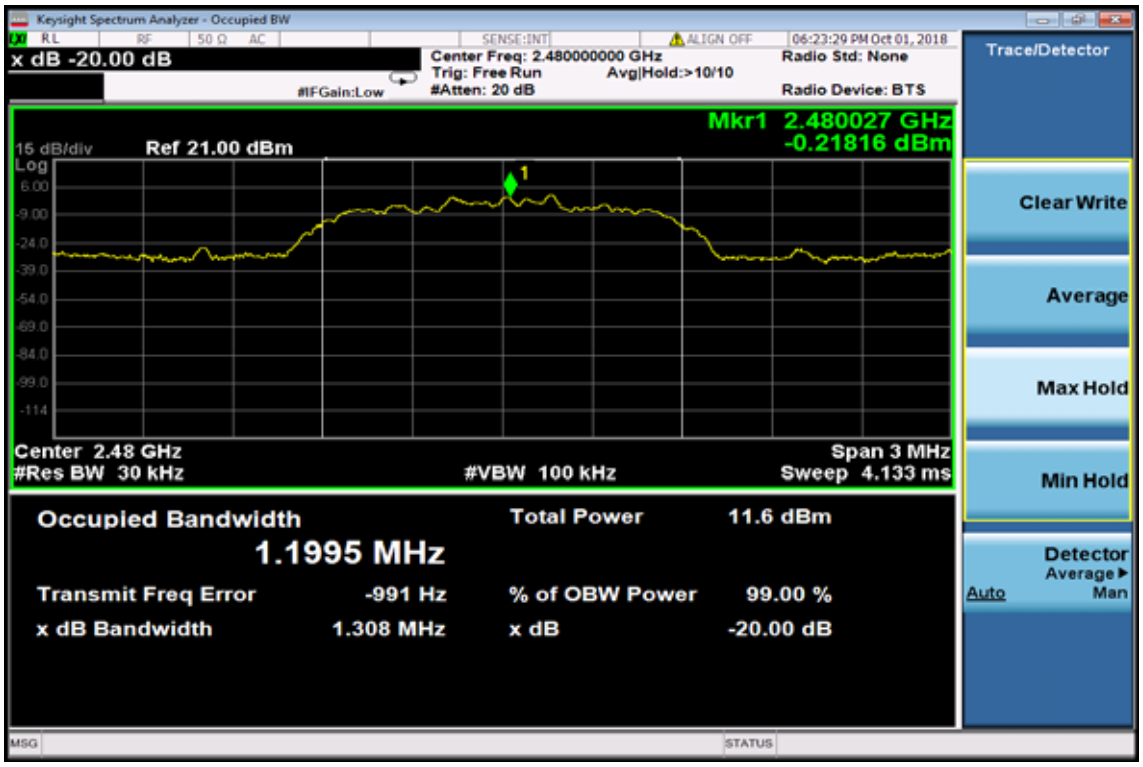
20dB Bandwidth Test Data CH-Low



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