TEST REPORT

Dt&C

DT&C Co., Ltd.

42, Yurim-ro, 154Beon-gil, Cheoin-gu, Yongin-si, Gyeonggi-do, Korea, 17042
Tel : 031-321-2664, Fax : 031-321-1664

1. Report No : DRTFCC1802-0044

2. Customer

- Name (FCC): MOTREX CO., LTD.
- Name (IC): Motrex Co,. Ltd.
- Address (FCC) : (Mullae-dong 3(sam)-ga, Ace High-Tech City B/D), 1-1103, 775, Gyeongin-ro, Yeongdeungpo-gu, Seoul, South Korea
- Address (IC) : 21, Daewangpangyo-ro 644beon-gil,Bundang-gu Seongnam-si 13494 Korea (Republic Of)

3. Use of Report : FCC & IC Original Grant

4. Product Name / Model Name : Rear Seat Entertainment / MTXRSE100YPPE
FCC ID : BP9-MTXRSE100YPPE / IC : 23638-MTXRSE100YP

5. Test Method Used : KDB558074 D01v04
Test Specification : FCC Part 15.247
RSS-247 Issue 2 (2017-02), RSS-GEN Issue 4 (2014-11)

6. Date of Test : 2018.01.29 ~ 2018.02.26

7. Testing Environment : See appended test report.

8. Test Result : Refer to the attached test result.

Affirmation	Tested by Name : Inhee Bae (Signature)	Reviewed by Name : GeunKi Son (Signature)

2018 . 02 . 27 .

DT&C Co., Ltd.

If this report is required to confirmation of authenticity, please contact to report@dtnc.net

Test Report Version

Test Report No.	Date	Description
DRTFCC1802-0044	Feb. 27, 2018	Initial issue

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1. EUT DESCRIPTION

FCC Equipment Class	Digital Transmission System(DTS)
Product	Rear Seat Entertainment
Model Name	MTXRSE100YPPE
Add Model Name	NA
Hardware Version	1.0.0
Software Version	1.0
Power Supply	DC 12 V
Frequency Range	▪ 802.11b/g/n(20/40 MHz) : 2412 MHz ~ 2462 MHz
Max. RF Output Power	2.4GHz Band ▪ 802.11b : 18.23 dBm ▪ 802.11g : 20.67 dBm ▪ 802.11n (HT20) : 20.56 dBm ▪ 802.11n (HT40) : 19.83 dBm
Modulation Type	▪ 802.11b: CCK, DSSS ▪ 802.11g/n: OFDM
Antenna Specification	**Antenna type**: Internal Antenna **Antenna gain**: 3.190 dBi

2. INFORMATION ABOUT TESTING

2.1 Test mode

Test mode	Worst case data rate	Tested Frequency(MHz)		
		Lowest	Middle	Highest
TM 1	802.11b 11 Mbps	2412	2437	2462
TM 2	802.11g 6 Mbps	2412	2437	2462
TM 3	802.11n(HT20) MCS 0	2412	2437	2462
TM 4	802.11n(HT40) MCS 0	2422	2437	2452

Note 1: The worst case data rate is determined as above test mode according to the power measurements.
Note 2: The power measurement results for all modes and data rate were reported.

2.2 Auxiliary equipment

Equipment	Model No.	Serial No.	Manufacturer	Note
-	-	-	-	-
-	-	-	-	-

2.3 Tested environment

Temperature	:	20 ~ 24 °C
Relative humidity content	:	39 ~ 44 % R.H..
Details of power supply	:	DC 12 V

2.4 EMI suppression Device(s) / Modifications

EMI suppression device(s) added and/or modifications made during testing
→ None

2.5 Measurement Uncertainty

The measurement uncertainties shown below were calculated in accordance with requirements of ANSI C 63.4-2014 and ANSI C 63.10-2013. All measurement uncertainty values are shown with a coverage factor of k = 2 to indicate a 95 % level of confidence.

Test items	Measurement uncertainty
Transmitter Output Power	0.7 dB (The confidence level is about 95 %, k = 2)
Conducted spurious emission	1.0 dB (The confidence level is about 95 %, k = 2)
Radiated spurious emission (1 GHz Below)	5.1 dB (The confidence level is about 95 %, k = 2)
Radiated spurious emission (1 GHz ~ 18 GHz)	5.4 dB (The confidence level is about 95 %, k = 2)
Radiated spurious emission (18 GHz Above)	5.3 dB (The confidence level is about 95 %, k = 2)

3. SUMMARY OF TESTS

FCC Part Section(s)	Parameter	Limit	Test Condition	Status Note 1
15.247(a)	6 dB Bandwidth	> 500 kHz	Conducted	C
15.247(b)	Transmitter Output Power	< 1 Watt		C
15.247(d)	Out of Band Emissions / Band Edge	20 dBc in any 100 kHz BW		C
15.247(e)	Transmitter Power Spectral Density	< 8 dBm/3 kHz		C
-	RSS-Gen [6.6]	Occupied Bandwidth (99 %)		C
15.247(d) 15.205 15.209	General Field Strength Limits (Restricted Bands and Radiated Emission Limits)	FCC 15.209 limits	Radiated	C
15.207	AC Line Conducted Emissions	FCC 15.207 limits	AC Line Conducted	NA Note 2
15.203	Antenna Requirements	FCC 15.203	-	C

Note 1: **C**=Comply **NC**=Not Comply **NT**=Not Tested **NA**=Not Applicable
Note 2: This device is installed in a car. Therefore the power source is a battery of car.

4. TEST METHODOLOGY

Generally the tests were performed according to the KDB558074 D01v04. And ANSI C63.10-2013 was used to reference appropriate EUT setup and maximizing procedures of radiated spurious emission and AC line conducted emission testing

4.1 EUT configuration

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

4.2 EUT exercise

The EUT was operated in the test mode to fix the Tx frequency that was for the purpose of the measurements. According to its specifications, the EUT must comply with the requirements of the Section 15.207, 15.209 and 15.247 under the FCC Rules Part 15 Subpart C.

4.3 General test procedures

Conducted Emissions

The power-line conducted emission test procedure is not described on the KDB558074 D01v04.
So this test was fulfilled with the requirements in Section 6.2 of ANSI C63.10-2013.
The EUT is placed on the wooden table, which is 0.8 m above ground plane and the conducted emissions from the EUT measured in the frequency range between 0.15 MHz and 30 MHz using CISPR Quasi-peak and Average detector

Radiated Emissions

Basically the radiated tests were performed with KDB558074 D01v04. But some requirements and procedures like test site requirements, EUT setup and maximizing procedure were fulfilled with the requirements in Section 5 and 6 of the ANSI C63.10 as stated on section 12.1 of the KDB558074 D01V04.
The EUT is placed on a non-conductive table. For emission measurements at or below 1 GHz, the table height is 80 cm. For emission measurements above 1 GHz, the table height is 1.5 m. The turntable shall rotate 360 degrees to determine the position of maximum emission level. EUT is set 3 m away from the receiving antenna, which varied from 1 m to 4 m 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 highest emission, the relative positions of the EUT were rotated through three orthogonal axes.

4.4 Description of test modes

The EUT has been tested with all modes of operating conditions to determine the worst case emission characteristics.
A test program is used to control the EUT for staying in continuous transmitting mode.

5. INSTRUMENT CALIBRATION

The measuring equipment, which was utilized in performing the tests documented herein, has been calibrated in accordance with the manufacturer's recommendations for utilizing calibration equipment, which is traceable to recognized national standards.

6. FACILITIES AND ACCREDITATIONS

6.1 Facilities

DT&C Co., Ltd.		
The 3 m test site and conducted measurement facility used to collect the radiated data are located at the 42, Yurim-ro, 154beon-gil, Cheoin-gu, Yongin-si, Gyeonggi-do, Korea 17042. The site is constructed in conformance with the requirements. **- FCC MRA Accredited Test Firm No. : KR0034**		
www.dtnc.net		
Telephone	:	+ 82-31-321-2664
FAX	:	+ 82-31-321-1664

6.2 Equipment

Radiated emissions are measured with one or more of the following types of linearly polarized antennas: tuned dipole, bi-conical, log periodic, bi-log, and/or ridged waveguide, loop, horn. Spectrum analyzers with pre-selectors and peak, quasi-peak detectors are used to perform radiated measurements.
Conducted emissions are measured with Line Impedance Stabilization Networks and EMI Test Receivers. Calibrated wideband preamplifiers, coaxial cables, and coaxial attenuators are also used for making measurements.
All receiving equipment conforms to CISPR Publication 16-1, “Radio Interference Measuring Apparatus and Measurement Methods.”

7. ANTENNA REQUIREMENTS

7.1 According to FCC 47 CFR §15.203

An intentional radiator antenna shall be designed to ensure that no antenna other than that furnished by the responsible party can be used with the device. The use of a permanently attached antenna or of an antenna that uses a unique coupling to the intentional radiator shall be considered sufficient to comply with the provisions of this section.

The internal antenna is permanently attached on the PCB.
Therefore this E.U.T Complies with the requirement of §15.203

8. TEST RESULT

8.1 6dB bandwidth

▣ Test Requirements and limit, §15.247(a)

The bandwidth at 6 dB down from the highest in-band spectral density is measured with a spectrum analyzer connected to the receive antenna while the EUT is operating in transmission mode at the appropriate frequencies.

The minimum permissible 6 dB bandwidth is 500 kHz.

▣ Test Configuration:

Refer to the APPENDIX I.

▣ Test Procedure:

The transmitter output is connected to the Spectrum Analyzer and used following test procedure of **KDB558074 D01V04**

1. Set resolution bandwidth (RBW) = 100 kHz.
2. Set the video bandwidth (VBW) ≥ 3 x RBW.
   (RBW : 100 kHz / VBW : 300 kHz)
3. Detector = **Peak**.
4. Trace mode = **Max hold**.
5. Sweep = **Auto couple**.
6. Allow the trace to stabilize.
7. Measure the maximum width of the emission that is constrained by the frequencies associated with the two outermost amplitude points (upper and lower) that are attenuated by 6 dB relative to the maximum level measured in the fundamental emission.

▣ Test Results: Comply

Test Mode	Frequency	Test Results[MHz]
TM 1	Lowest	7.758
	Middle	7.578
	Highest	7.673
TM 2	Lowest	15.380
	Middle	15.260
	Highest	15.810
TM 3	Lowest	16.910
	Middle	16.930
	Highest	17.050
TM 4	Lowest	35.170
	Middle	35.200
	Highest	35.080

▣ RESULT PLOTS

6 dB Bandwidth

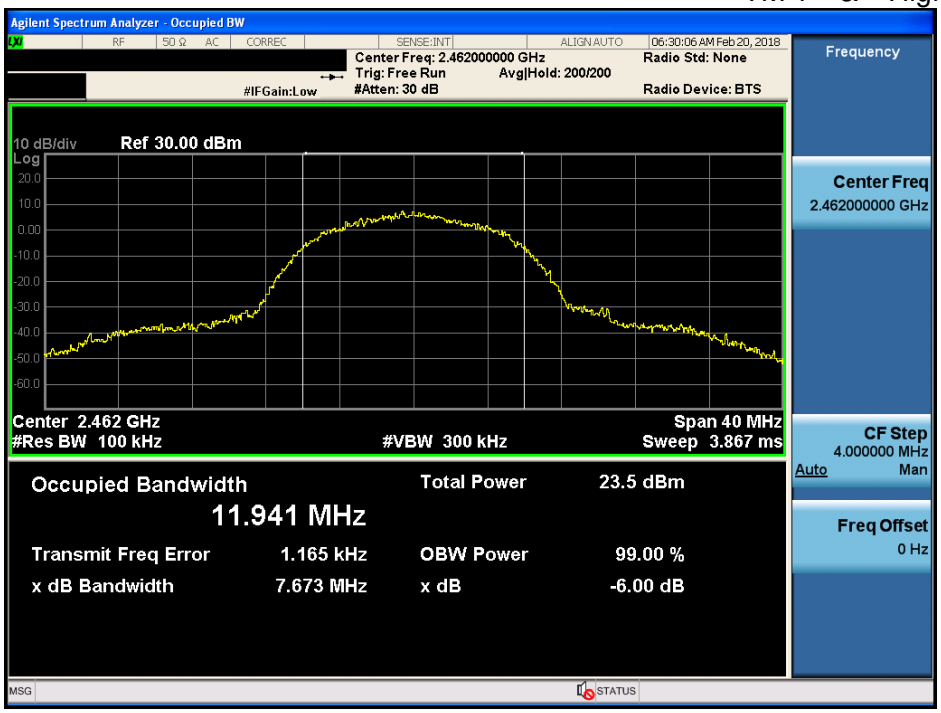
TM 1 & Lowest

6 dB Bandwidth

TM 1 & Middle

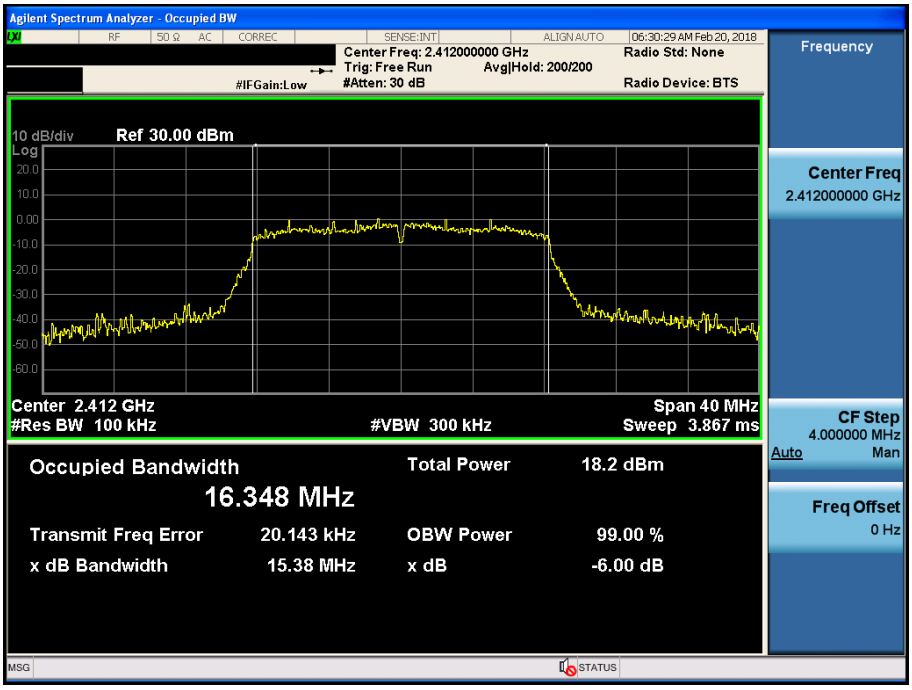
6 dB Bandwidth

TM 1 & Highest



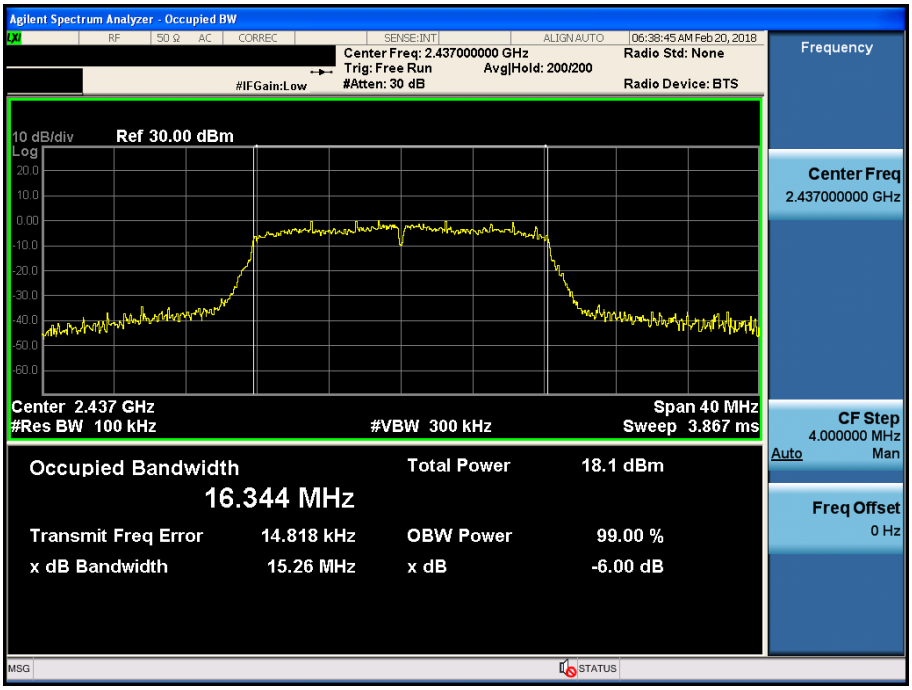
6 dB Bandwidth

TM 2 & Lowest



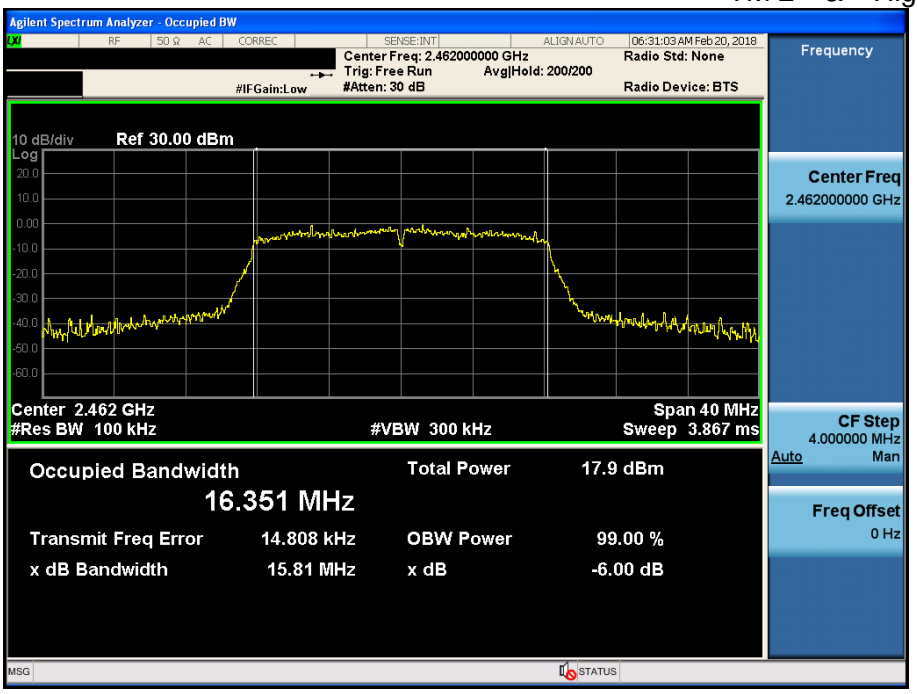
6 dB Bandwidth

TM 2 & Middle



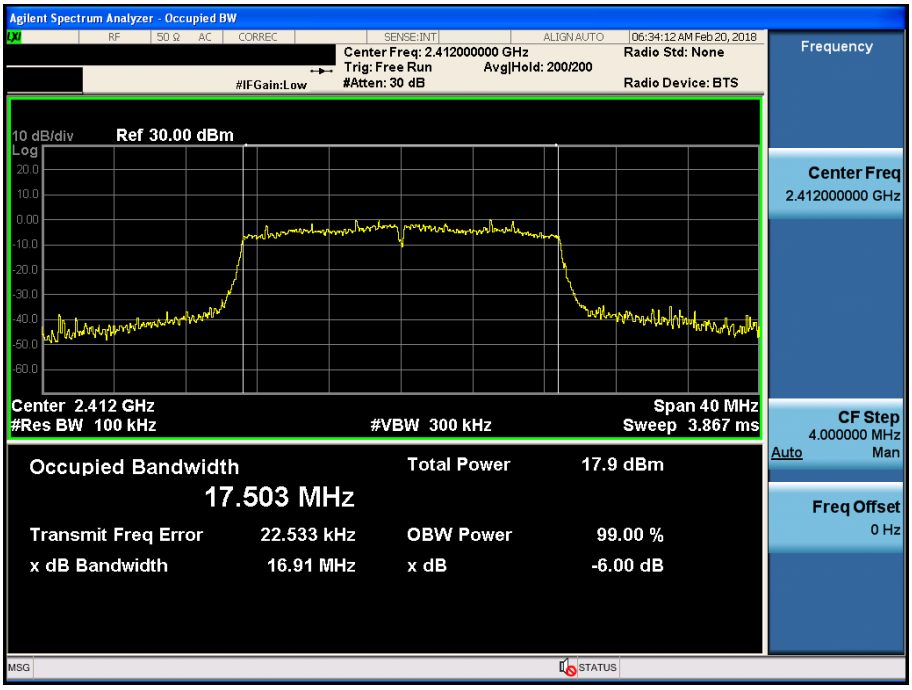
6 dB Bandwidth

TM 2 & Highest



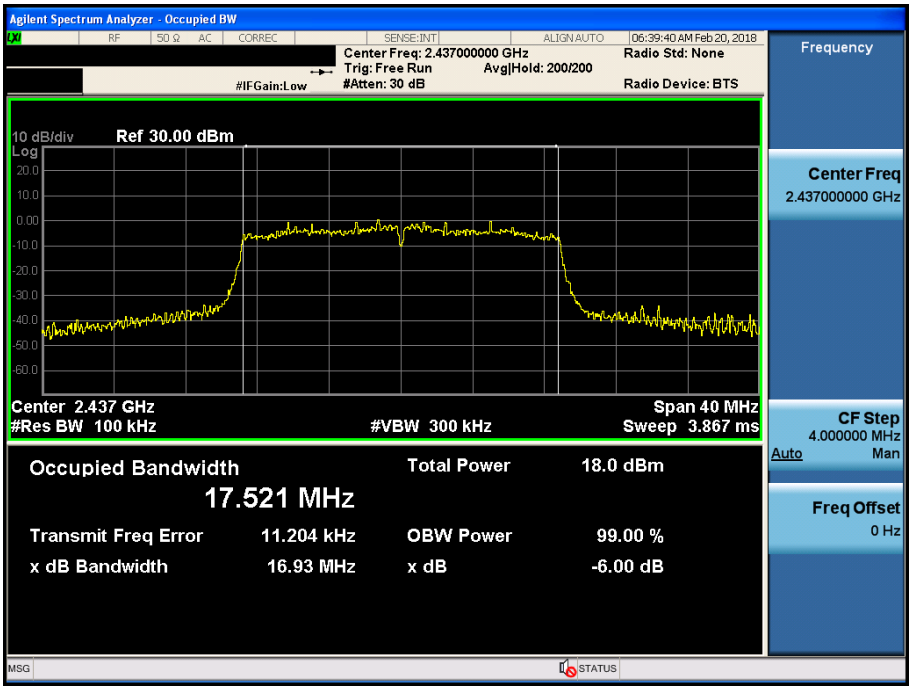
6 dB Bandwidth

TM 3 & Lowest



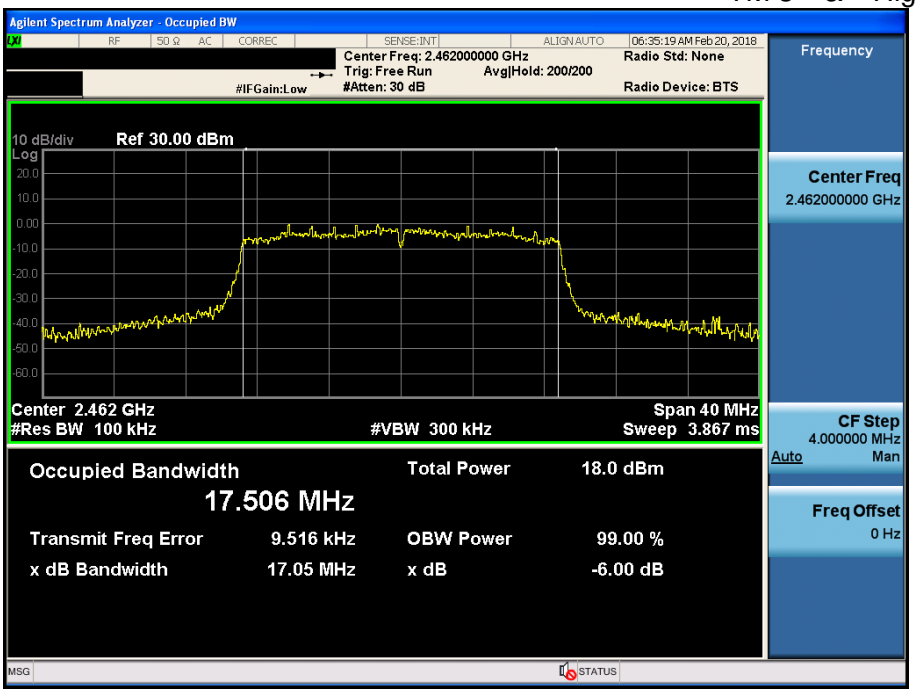
6 dB Bandwidth

TM 3 & Middle



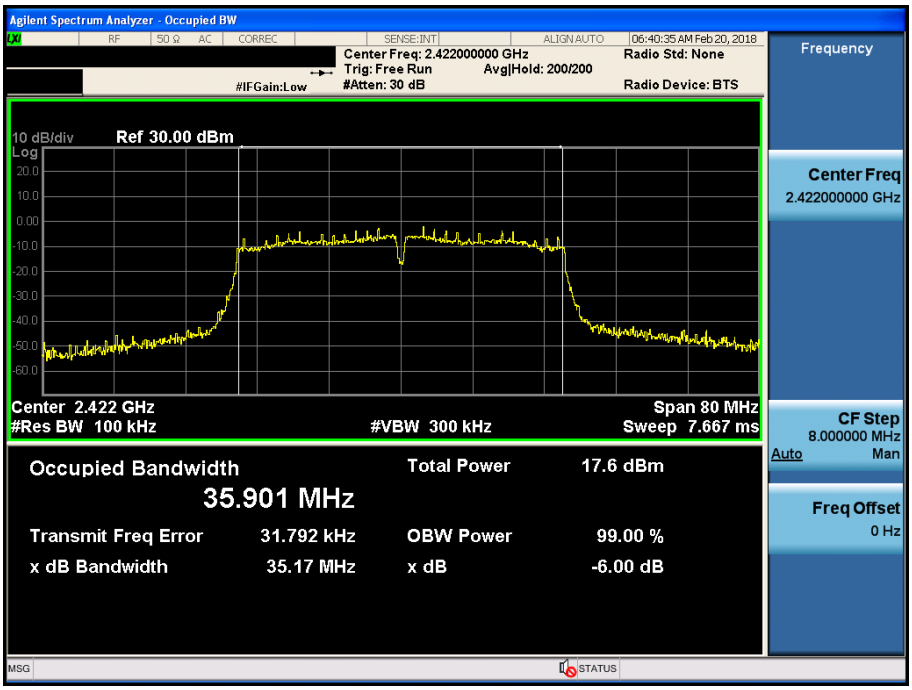
6 dB Bandwidth

TM 3 & Highest



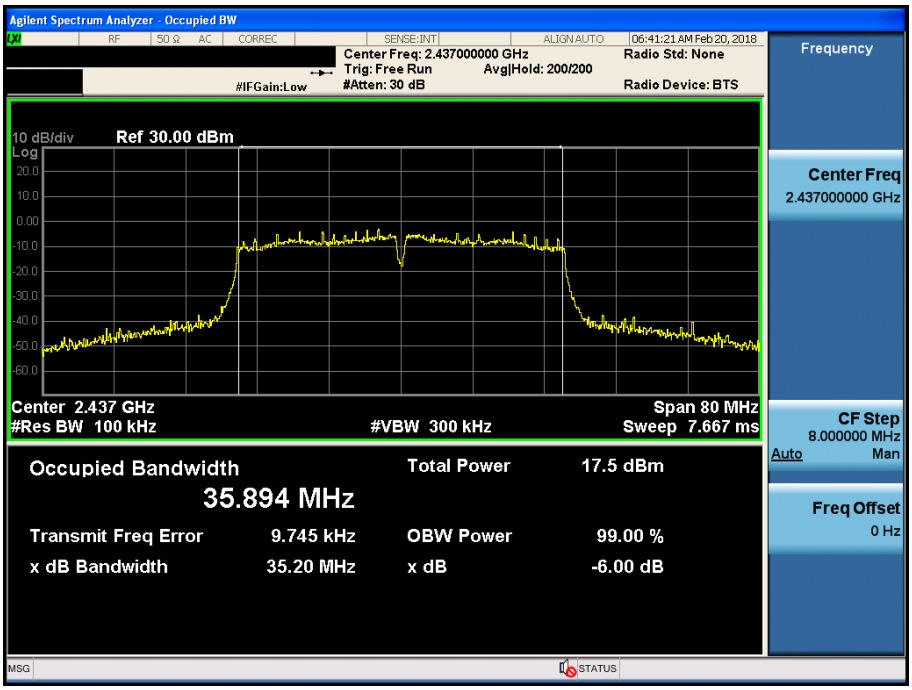
6 dB Bandwidth

TM 4 & Lowest



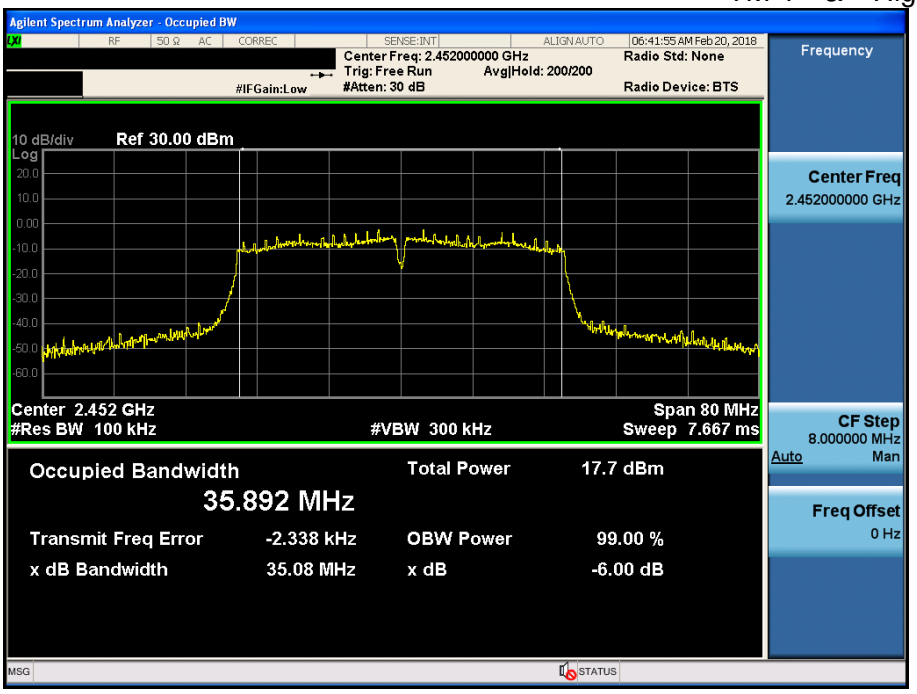
6 dB Bandwidth

TM 4 & Middle



6 dB Bandwidth

TM 4 & Highest

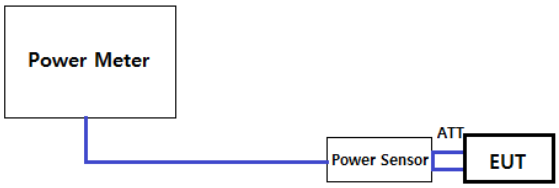


8.2 Maximum peak conducted output power

▣ Test Requirements and limit, §15.247(b)

The maximum permissible conducted output power is **1 Watt**.

▣ Test Configuration



▣ Test Procedure

1. **PKPM1 Peak power meter method of KDB558074 D01V04**
   The maximum conducted output powers were measured using a broadband peak RF power meter which has greater video bandwidth than DUT's DTS bandwidth and utilize a fast-responding diode detector.

2. **Method AVGPM-G (Measurement using a gated RF average power meter) of KDB558074 D01V04**
   The average conducted output powers were measured using a wideband gated RF power meter provided that the gate parameters are adjusted such that the power is measured only when the EUT is transmitting at its maximum power control level. Since this measurement is made only during the ON time of the transmitter, no duty cycle correction is required.

▣ Test Results: Comply

Freq. (MHz)	Det.	Maximum Peak Conducted Output Power (dBm) for 802.11b							
		Data Rate [Mbps]							
		1	2	5.5	11	-	-	-	-
2412	PK	17.66	17.70	17.75	17.83	-	-	-	-
	AV	14.21	14.28	14.36	14.41	-	-	-	-
2437	PK	18.05	18.12	18.17	**18.23**	-	-	-	-
	AV	14.71	14.79	14.84	14.91	-	-	-	-
2462	PK	17.89	17.94	17.96	18.05	-	-	-	-
	AV	14.55	14.63	14.68	14.72	-	-	-	-

Freq. (MHz)	Det.	Maximum Peak Conducted Output Power (dBm) for 802.11g							
		Data Rate [Mbps]							
		6	9	12	18	24	36	48	54
2412	PK	20.43	20.39	20.33	20.27	20.23	20.18	20.14	20.11
	AV	11.32	11.26	11.23	11.19	11.15	11.13	11.07	11.03
2437	PK	**20.67**	20.62	20.59	20.53	20.47	20.43	20.36	20.31
	AV	11.62	11.57	11.53	11.48	11.44	11.39	11.31	11.25
2462	PK	20.28	20.25	20.20	20.15	20.11	20.07	20.04	19.96
	AV	10.83	10.77	10.72	10.66	10.63	10.54	10.50	10.48

Freq. (MHz)	Det.	Maximum Peak Conducted Output Power (dBm) for 802.11n(HT20)							
		Data Rate [MCS]							
		0	1	2	3	4	5	6	7
2412	PK	**20.56**	20.51	20.47	20.43	20.38	20.35	20.31	20.29
	AV	11.02	10.98	10.95	10.90	10.86	10.83	10.77	10.74
2437	PK	20.46	20.42	20.37	20.33	20.29	20.21	20.16	20.11
	AV	11.31	11.27	11.22	11.16	11.13	11.08	11.06	11.02
2462	PK	20.12	20.08	20.02	19.95	19.91	19.86	19.82	19.77
	AV	10.56	10.52	10.46	10.42	10.39	10.33	10.28	10.24

Freq. (MHz)	Det.	Maximum Peak Conducted Output Power (dBm) for 802.11n(HT40)							
		Data Rate [MCS]							
		0	1	2	3	4	5	6	7
2422	PK	**19.83**	19.78	19.71	19.66	19.62	19.59	19.57	19.53
	AV	10.12	10.08	10.05	10.01	9.97	9.92	9.87	9.85
2437	PK	19.63	19.55	19.52	19.47	19.43	19.39	19.34	19.31
	AV	10.15	10.11	10.07	10.03	9.98	9.95	9.91	9.89
2452	PK	19.62	19.57	19.52	19.49	19.44	19.41	19.37	19.33
	AV	10.15	10.14	10.11	10.09	10.04	9.97	9.90	9.84

8.3 Maximum power spectral density

▣ Test requirements and limit, §15.247(e)

The power spectral density conducted from the intentional radiator to the antenna shall not be greater than 8 dBm in any 3 kHz band during any time interval of continuous transmission.

▣ Test Configuration:

Refer to the APPENDIX I.

▣ Test Procedure

Method PKPSD of KDB558074 D01V04 is used.

1. Set analyzer center frequency to DTS channel center frequency.
2. Set the span to **1.5 times** the DTS bandwidth.
3. Set the RBW to : **3 kHz** ≤ RBW ≤ **100 kHz**
4. Set the VBW ≥ **3 x RBW**
5. Detector = **Peak**
6. Sweep time = **Auto couple**
7. Trace mode = **Max hold.**
8. Allow trace to fully stabilize.
9. Use the **peak marker function** to determine the maximum amplitude level within the RBW.
10. If measured value exceeds limit, reduce RBW (no less than 3 kHz) and repeat.

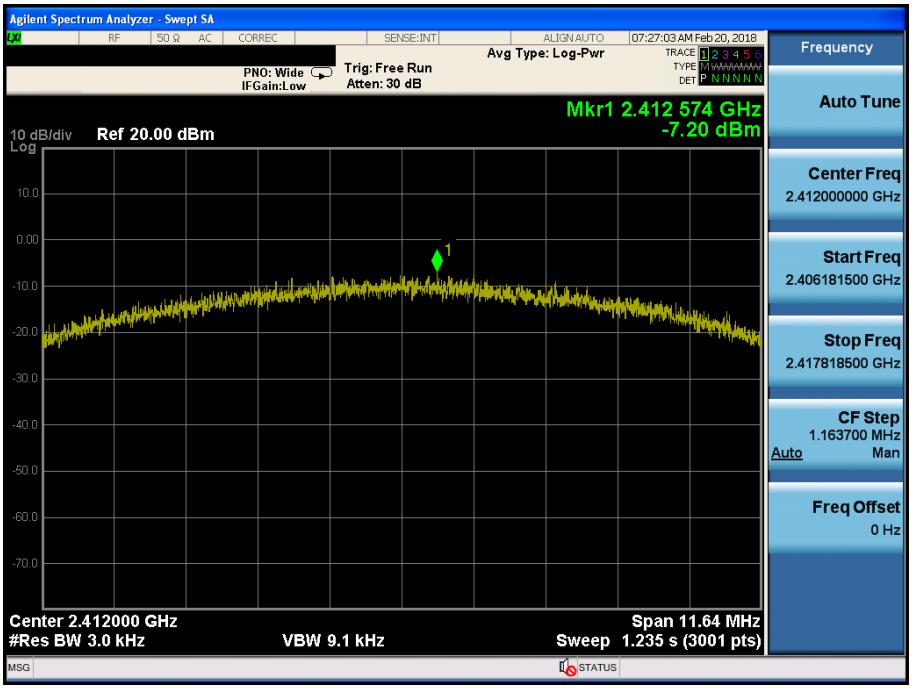
▣ Test Results: Comply

Test Mode	Frequency	RBW	PKPSD [dBm]
TM 1	Lowest	3 kHz	-7.20
	Middle	3 kHz	-7.25
	Highest	3 kHz	-7.13
TM 2	Lowest	3 kHz	-12.47
	Middle	3 kHz	-12.48
	Highest	3 kHz	-12.56
TM 3	Lowest	3 kHz	-12.75
	Middle	3 kHz	-12.43
	Highest	3 kHz	-12.43
TM 4	Lowest	3 kHz	-16.79
	Middle	3 kHz	-16.25
	Highest	3 kHz	-15.81

▣ RESULT PLOTS

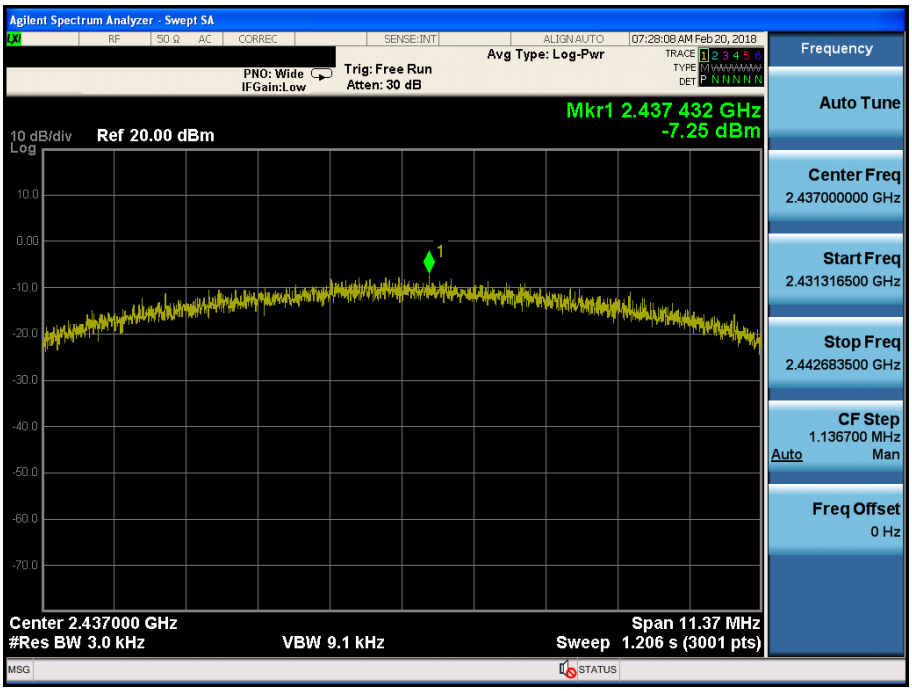
Maximum PPSD

TM1 & Lowest



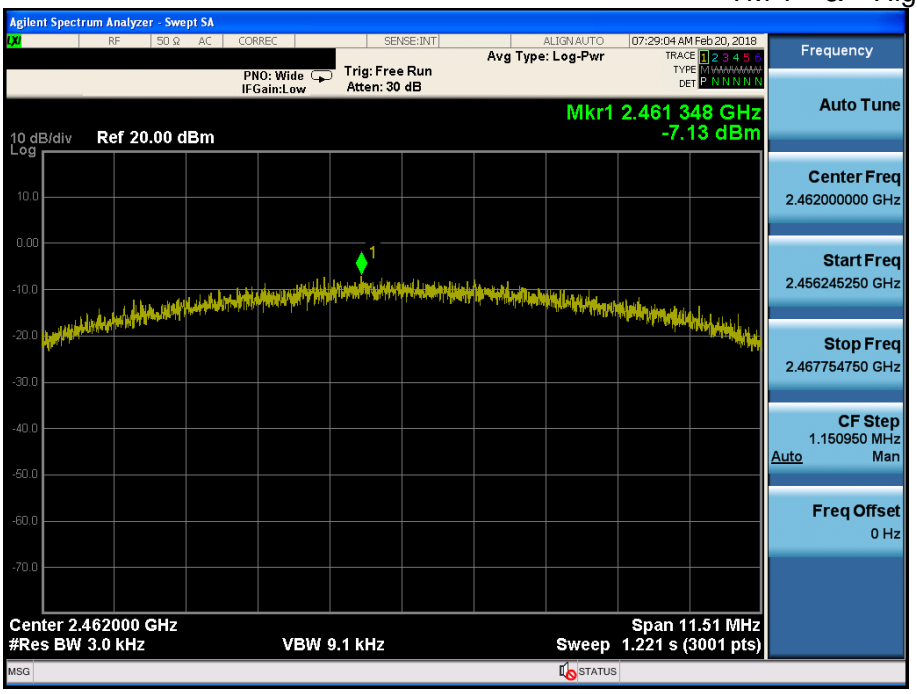
Maximum PPSD

TM 1 & Middle



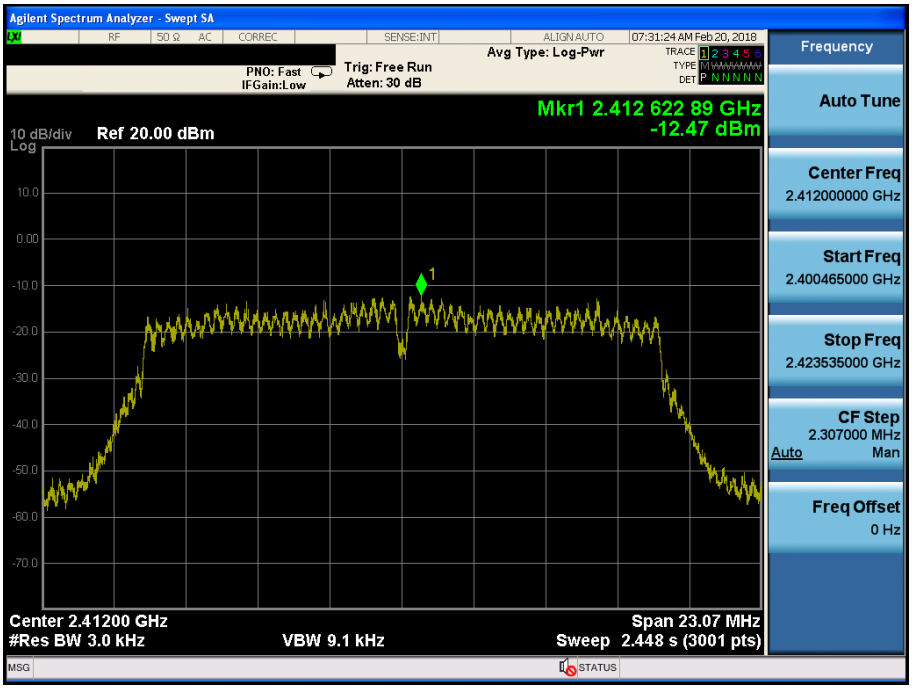
Maximum PPSD

TM 1 & Highest



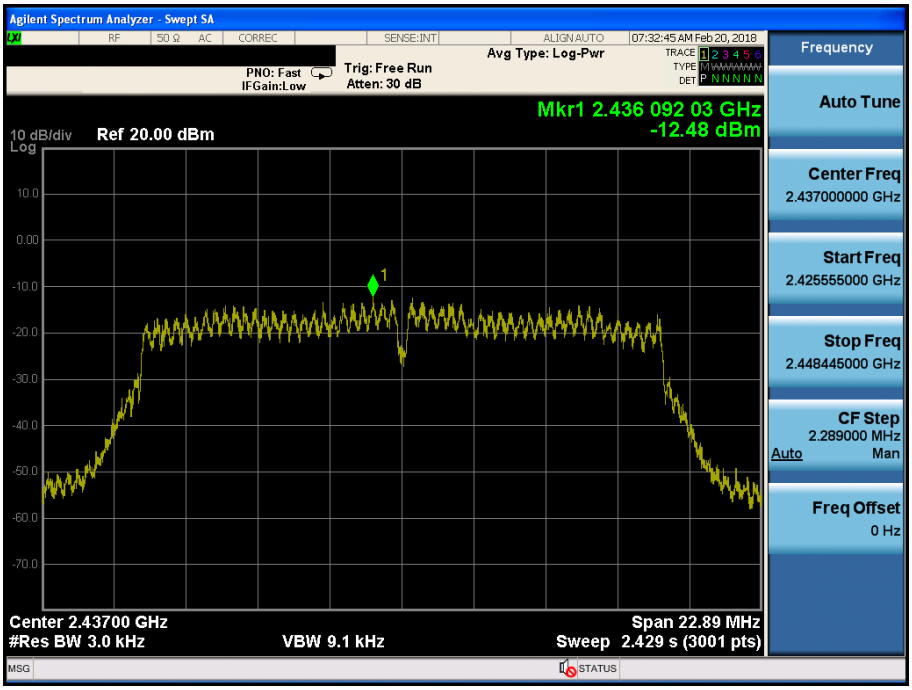
Maximum PPSD

TM 2 & Lowest



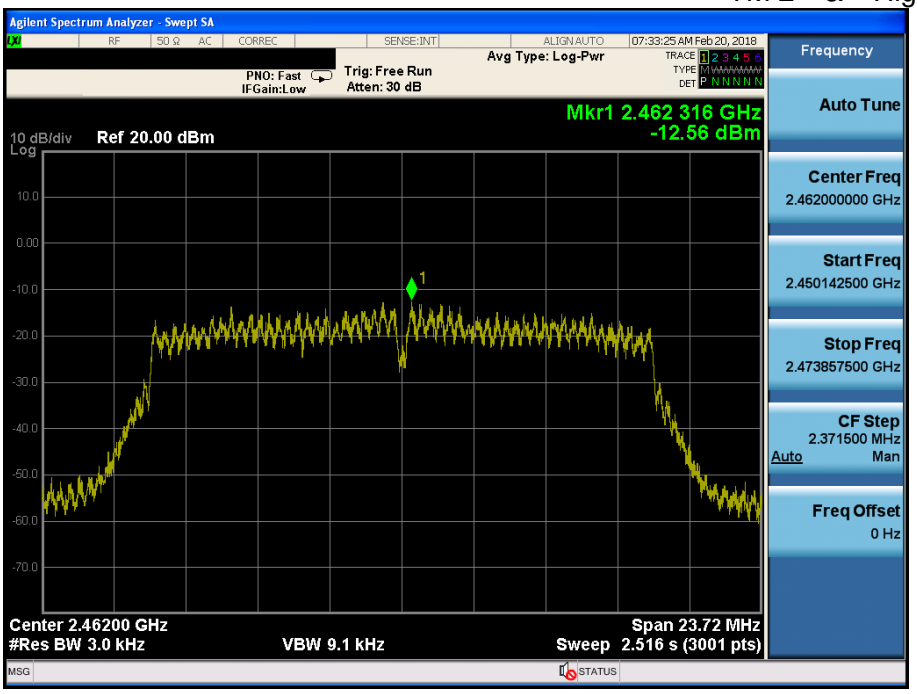
Maximum PPSD

TM2 & Middle



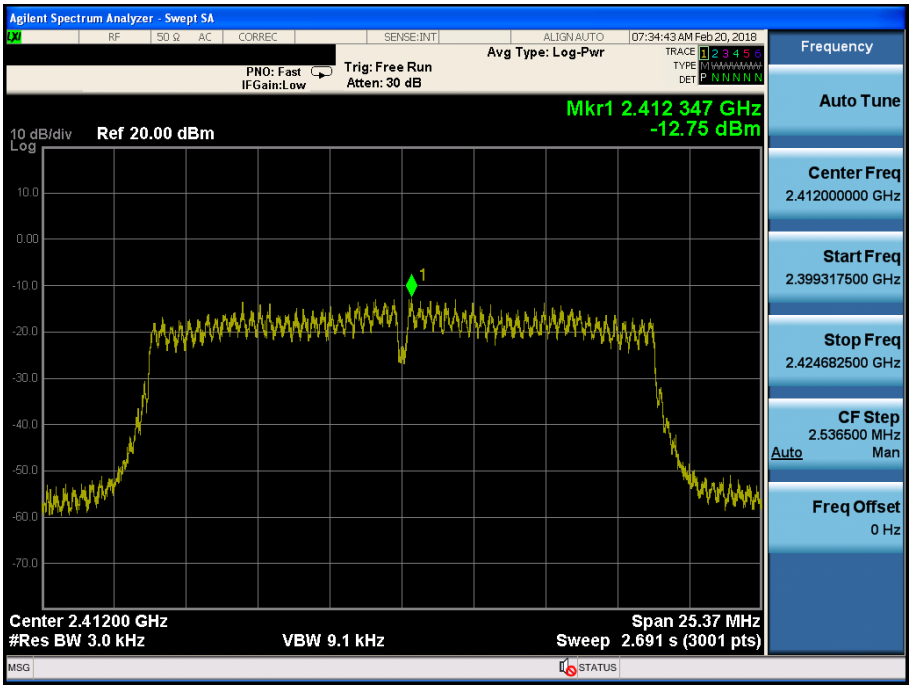
Maximum PPSD

TM 2 & Highest



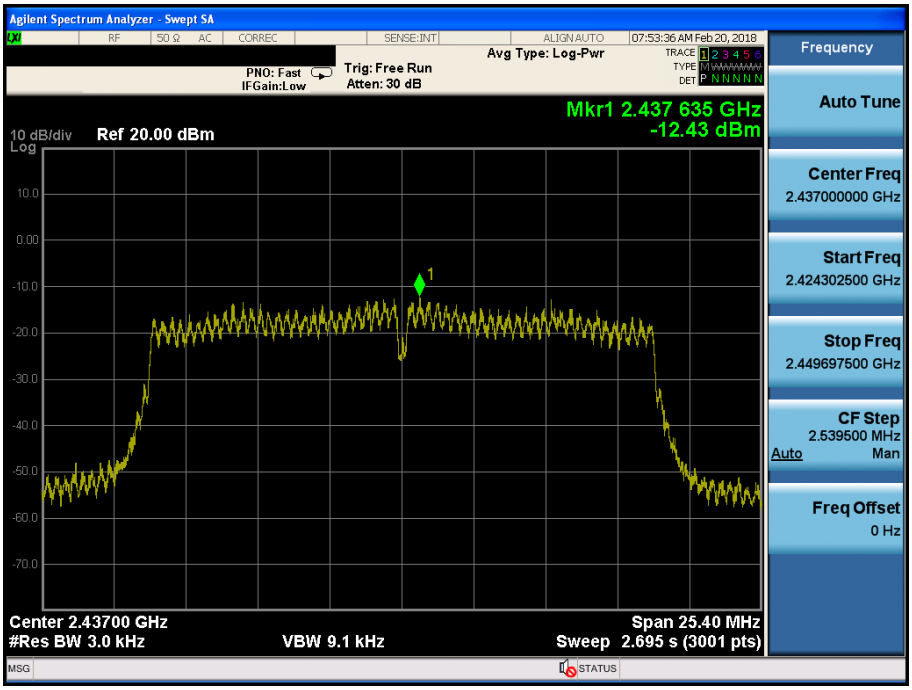
Maximum PPSD

TM 3 & Lowest



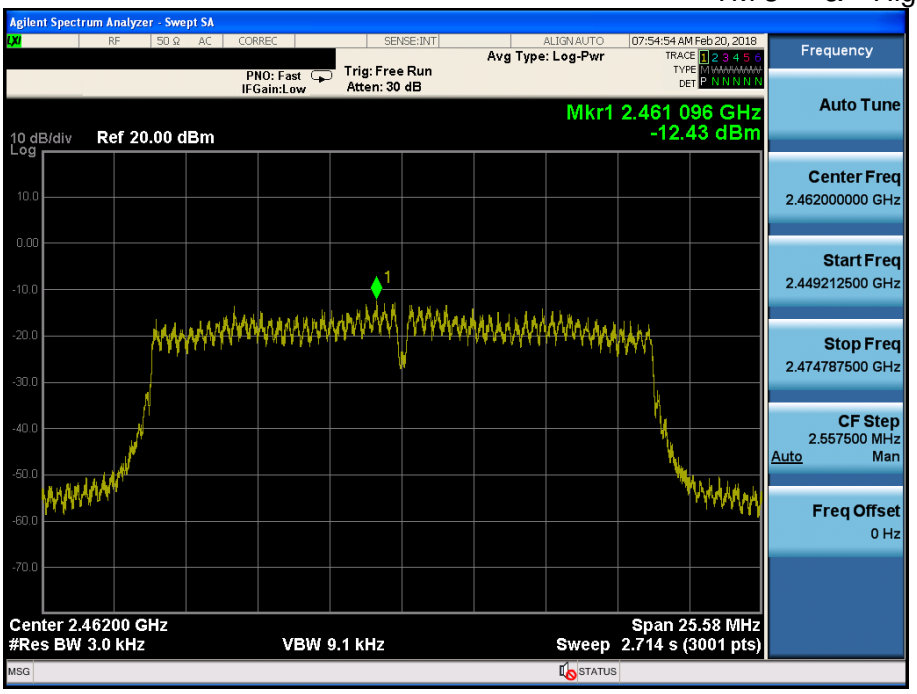
Maximum PPSD

TM3 & Middle



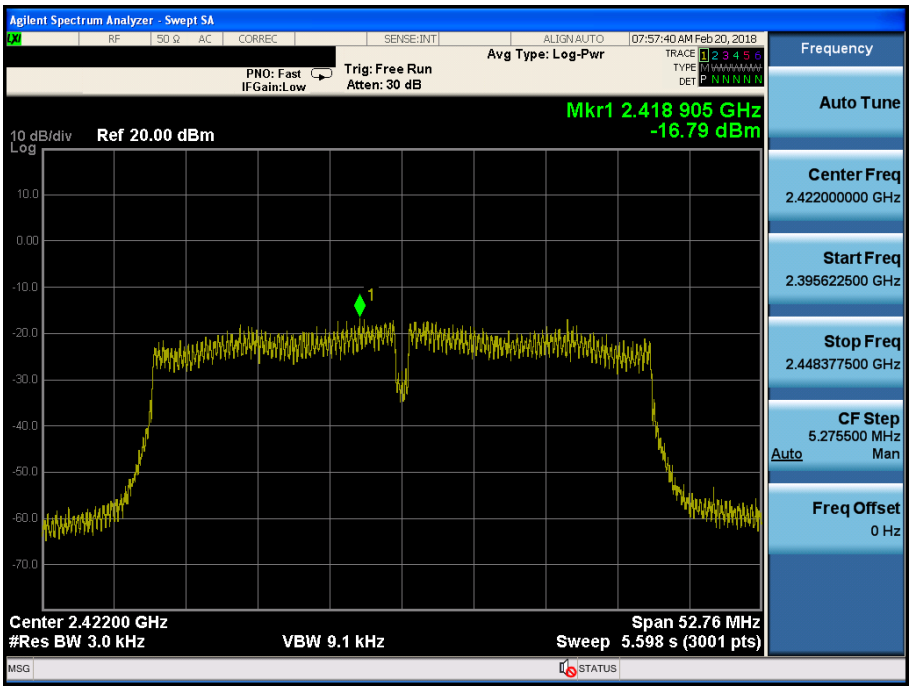
Maximum PPSD

TM 3 & Highest



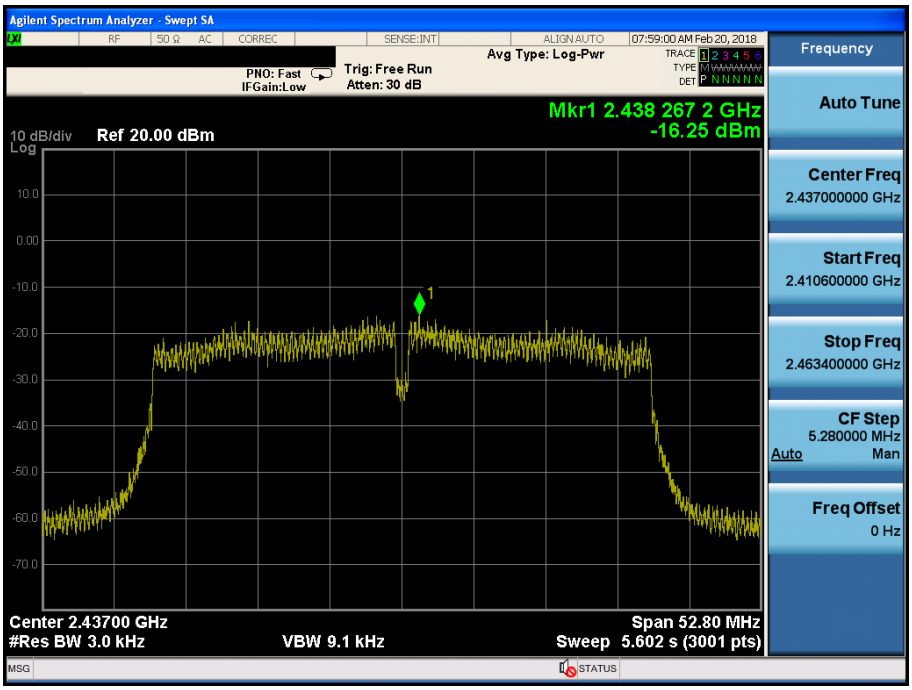
Maximum PPSD

TM 4 & Lowest



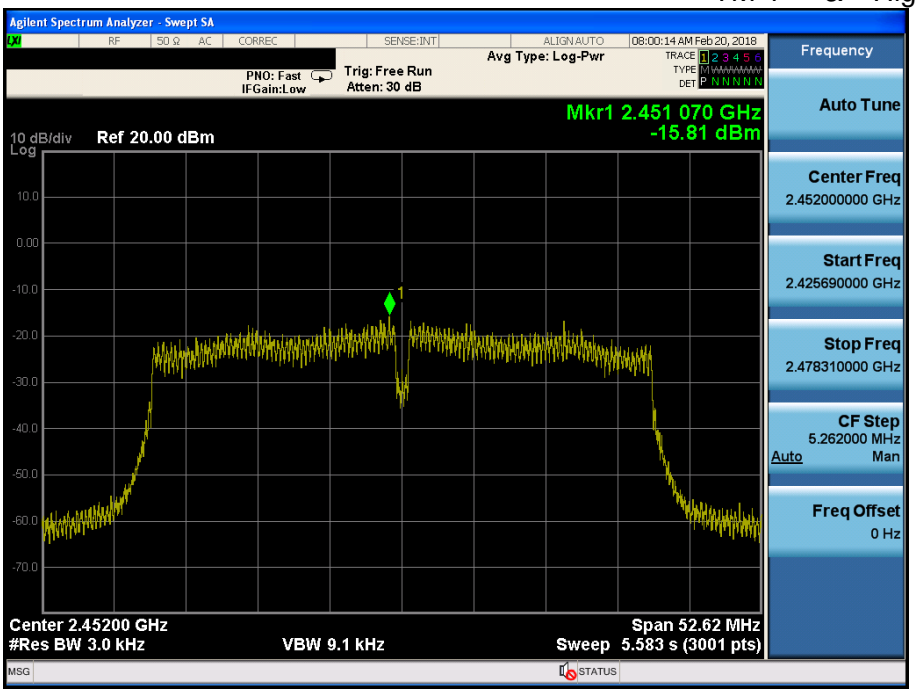
Maximum PPSD

TM4 & Middle



Maximum PPSD

TM 4 & Highest



8.4 Out of band emissions at the band edge / conducted spurious emissions

▣ Test requirements and limit, §15.247(d)

§15.247(d) specifies that in any 100 kHz bandwidth outside of the authorized frequency band, the power shall be attenuated according to the following conditions:

If **the peak output power procedure** is used to measure the fundamental emission power to demonstrate compliance to **15.247(b)(3)** requirements, then the peak conducted output power measured within any 100 kHz outside the authorized frequency band shall be attenuated **by at least 20 dB** relative to the maximum measured in-band peak PSD level.

If the average output power procedure is used to measure the fundamental emission power to demonstrate compliance to **15.247(b)(3)** requirements, then the power in any 100 kHz outside of the authorized frequency band shall be attenuated by at least 30 dB relative to the maximum measured in band average PSD level.
In either case, attenuation to levels below the general emission limits specified in **§15.209(a)** is not required.

▣ Test Configuration:

Refer to the APPENDIX I.

▣ Test Procedure

The transmitter output is connected to a spectrum analyzer.

- Measurement Procedure 1 – Reference Level of KDB558074 D01v04

1. Set instrument center frequency to DTS channel center frequency.
2. Set the span to ≥ 1.5 times the DTS bandwidth.
3. Set the RBW = **100 kHz.**
4. Set the VBW ≥ **3 x RBW.**
5. Detector = **Peak.**
6. Sweep time = **Auto couple.**
7. Trace mode = **Max hold.**
8. **Allow trace to fully stabilize.**
9. Use the peak marker function to determine the maximum PSD level.

- Measurement Procedure 2 - Unwanted Emissions of KDB558074 D01v04

1. Set the center frequency and span to encompass frequency range to be measured.
2. Set the RBW = **100 kHz. (Actual 1 MHz , See below note)**
3. Set the VBW ≥ **3 x RBW. (Actual 3 MHz, See below note)**
4. Detector = **Peak**.
5. Ensure that the number of measurement points ≥ Span / RBW.
6. Sweep time = **Auto couple.**
7. Trace mode = **Max hold.**
8. **Allow the trace to stabilize.** (this may take some time, depending on the extent of the span)
9. Use the peak marker function to determine the maximum amplitude level.

Note : The conducted spurious emission was tested with below settings.
Frequency range: 9 kHz ~ 30 MHz
RBW = 100 kHz, VBW = 300 kHz, SWEEP TIME = AUTO, DETECTOR = PEAK, TRACE = MAX HOLD, SWEEP POINT : 40001

Frequency range: 30 MHz ~ 10 GHz, 10 GHz ~25 GHz
RBW = 1 MHz, VBW = 3 MHz, SWEEP TIME = AUTO, DETECTOR = PEAK, TRACE = MAX HOLD, SWEEP POINT : 40001

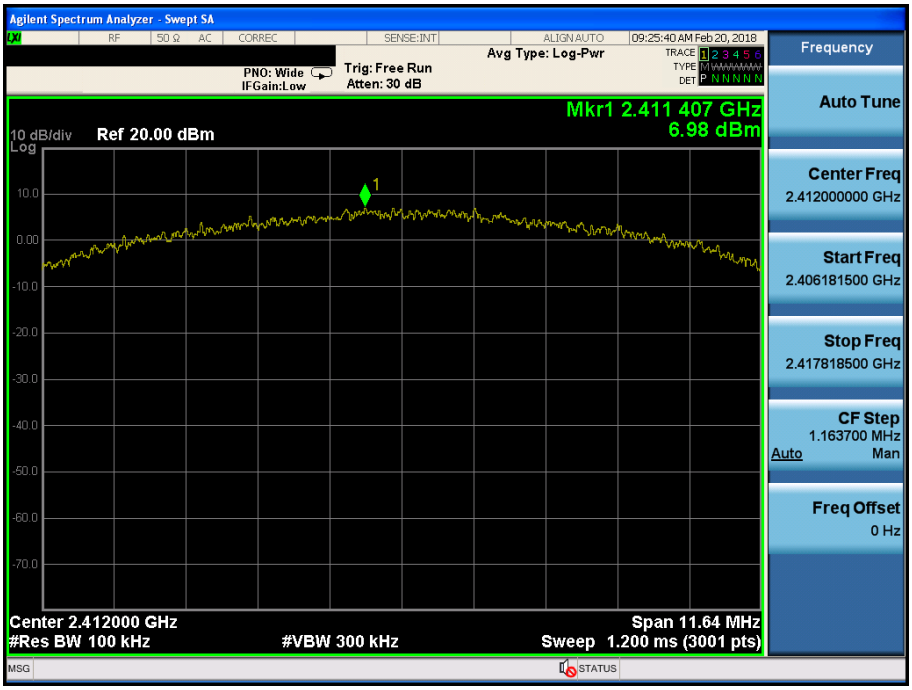
LIMIT LINE = 20 dB below of the reference level of above measurement procedure Step 2. (RBW = 100 kHz, VBW = 300 kHz)

If the emission level with above setting was close to the limit (ie, less than 3 dB margin) then zoom scan is required using RBW = 100 kHz, VBW = 300 kHz, SPAN = 100 MHz and BINS = 2001 to get accurate emission level within 100 kHz BW.

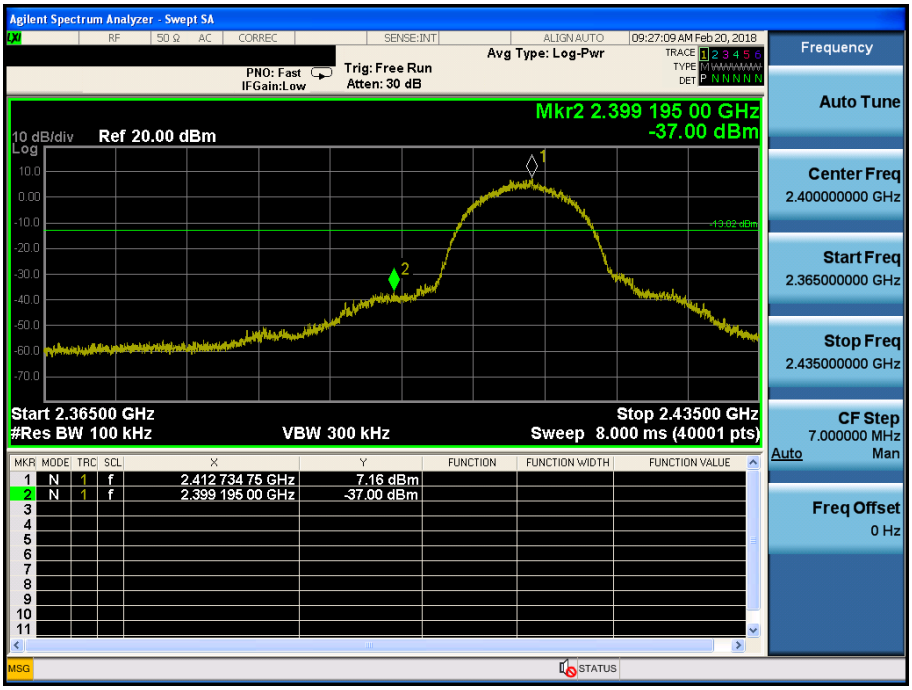
▣ RESULT PLOTS

TM 1 & Lowest

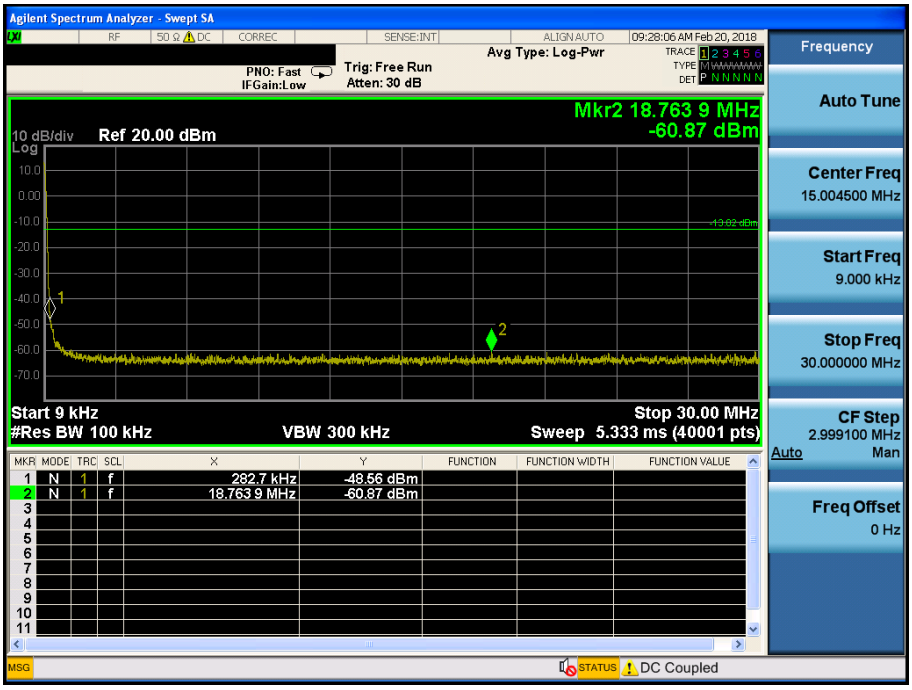
Reference

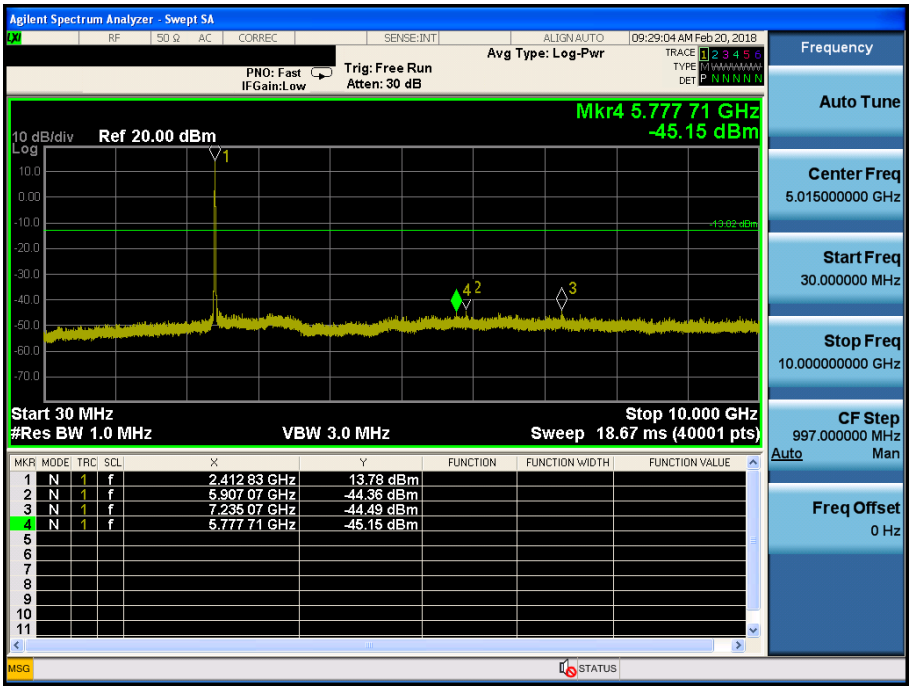


Low Band-edge



Conducted Spurious Emissions





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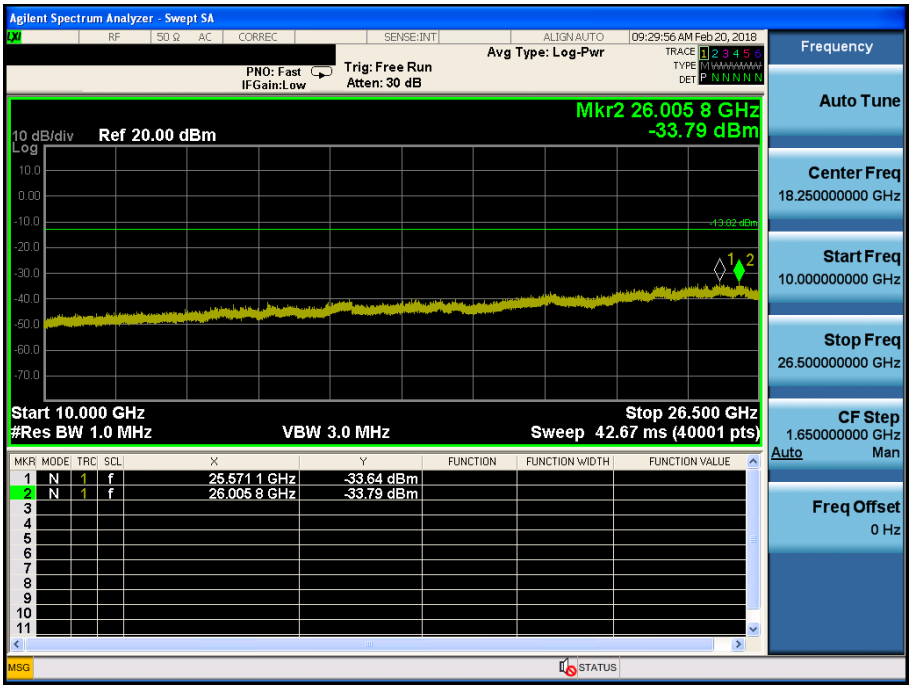
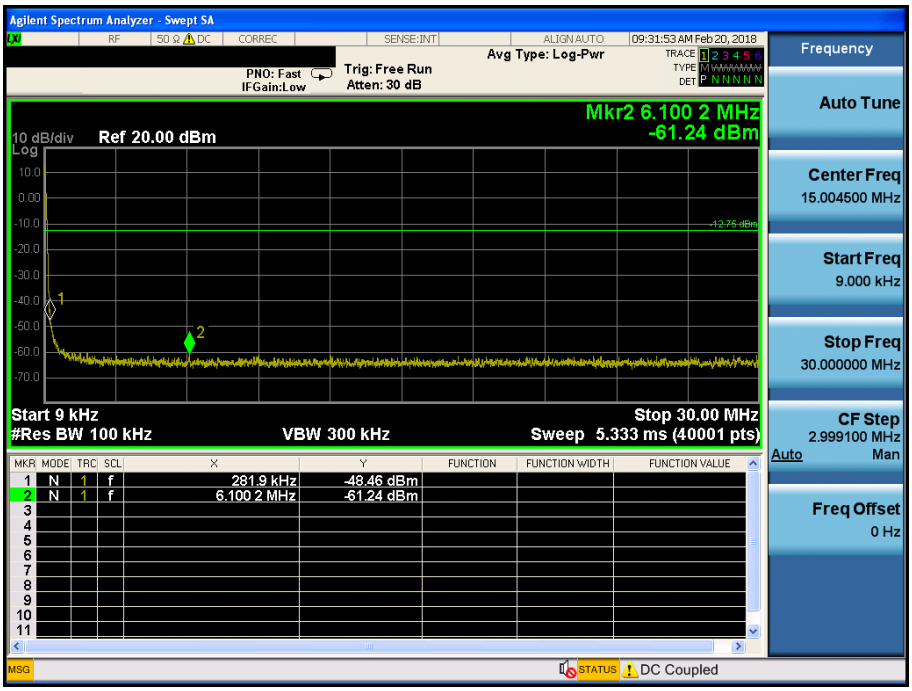


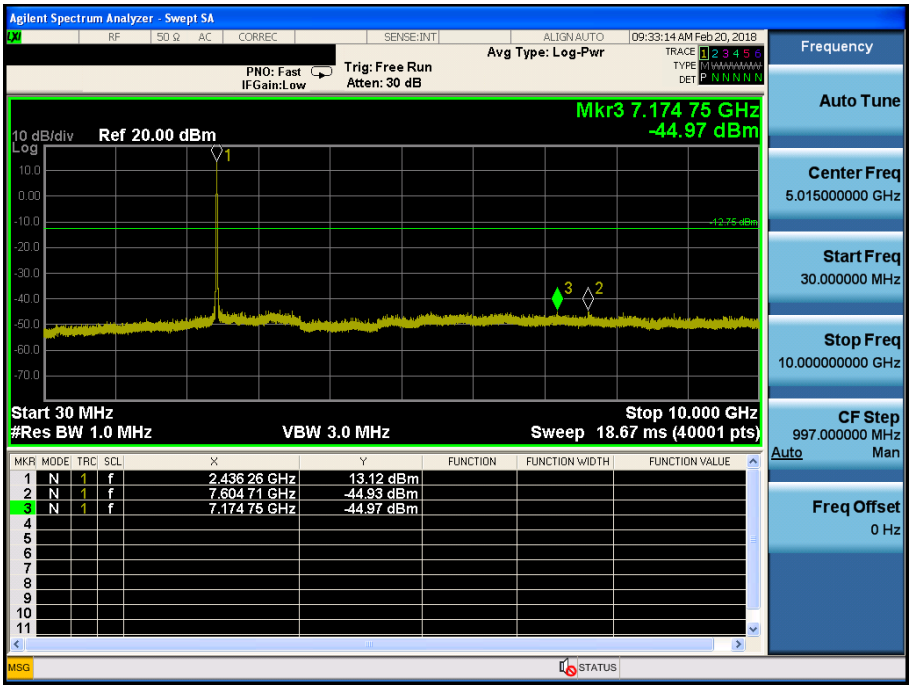
TM 1 & Middle

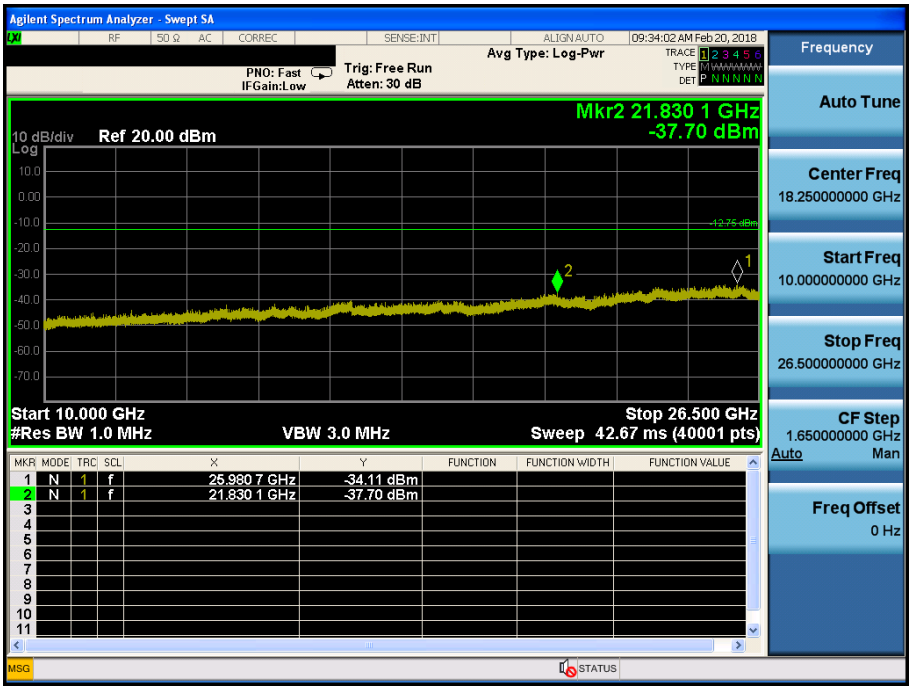
Reference

Conducted Spurious Emissions



Conducted Spurious Emissions

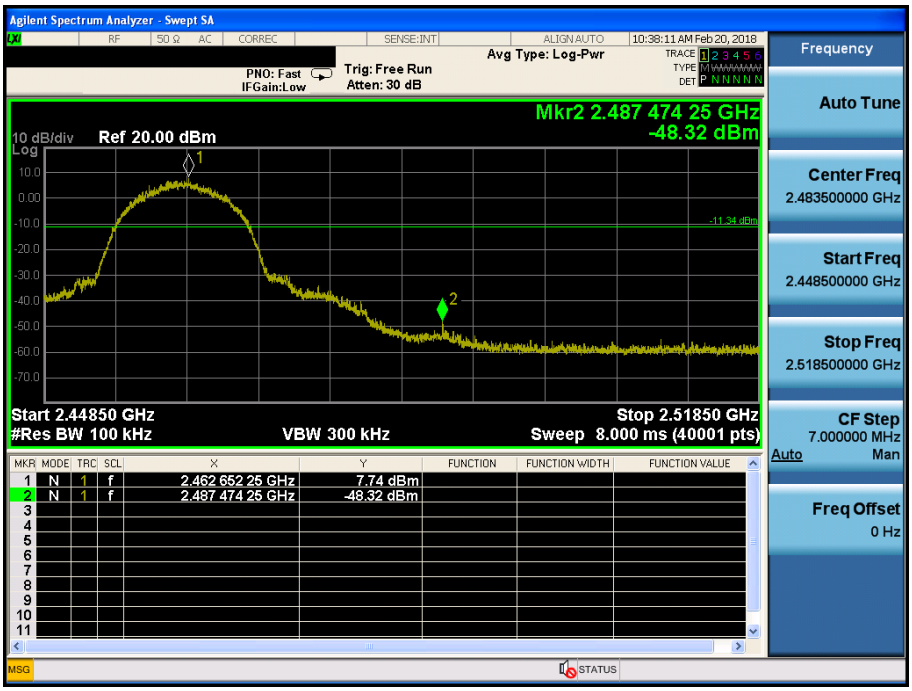




TM 1 & Highest

Reference

High Band-edge



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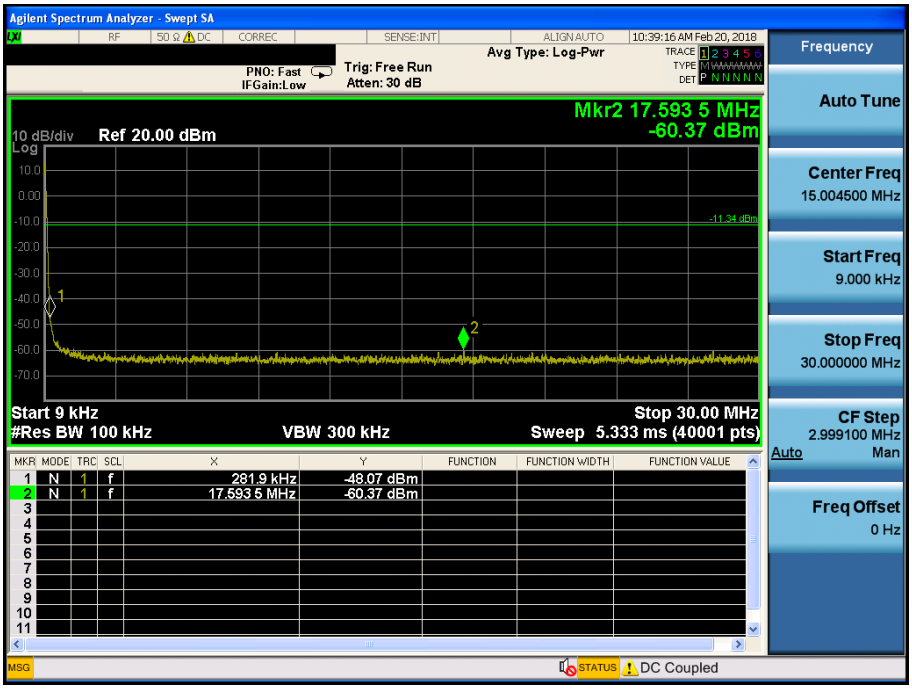

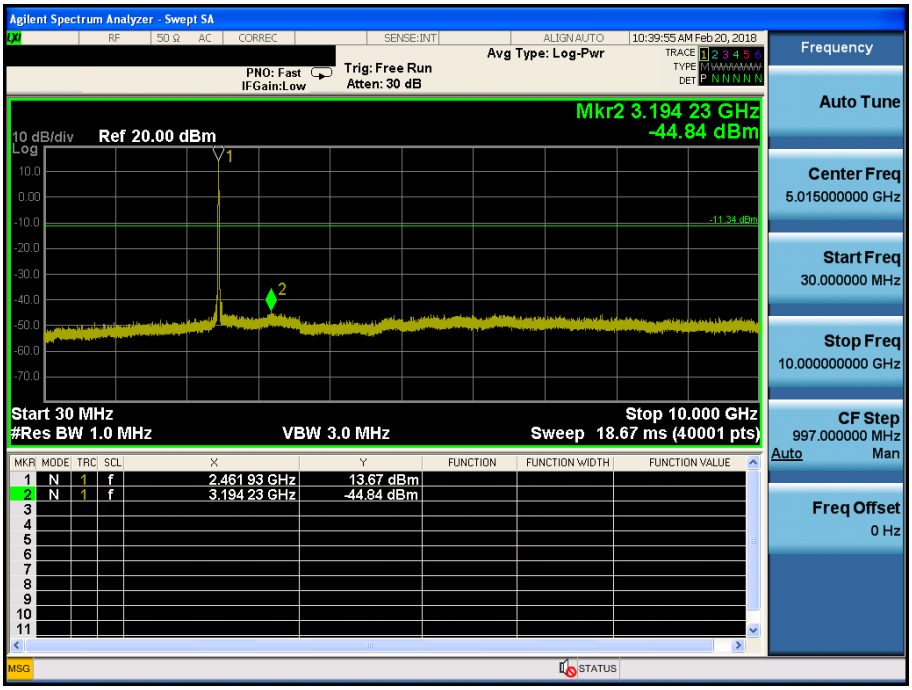

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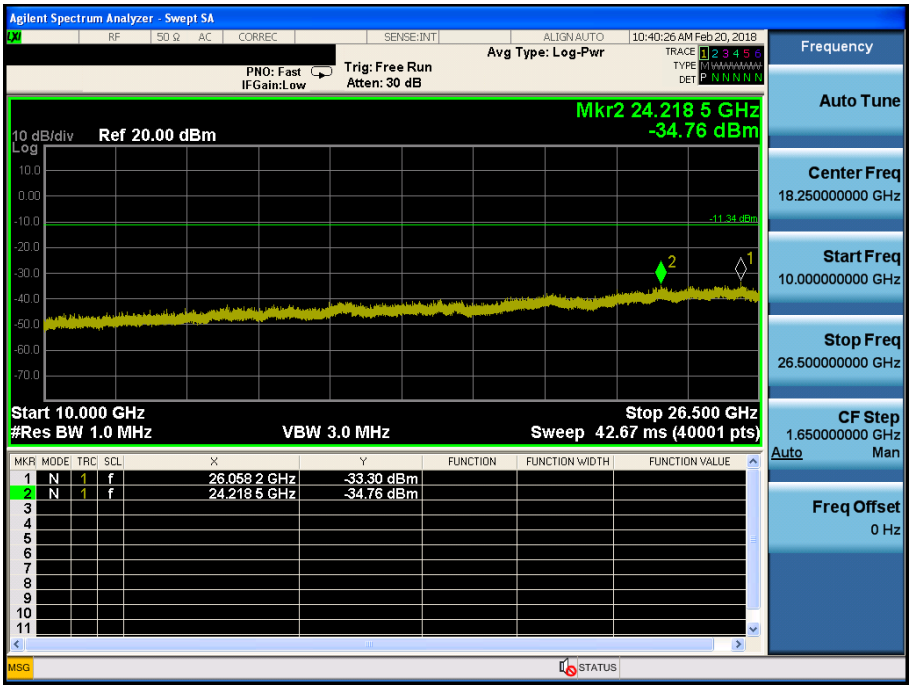

TM 2 & Lowest

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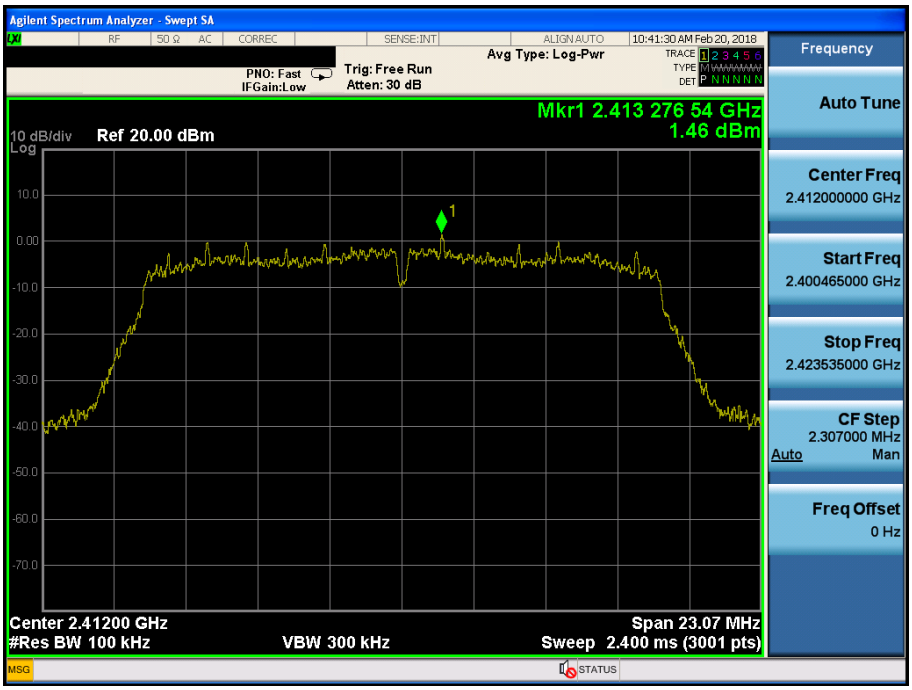
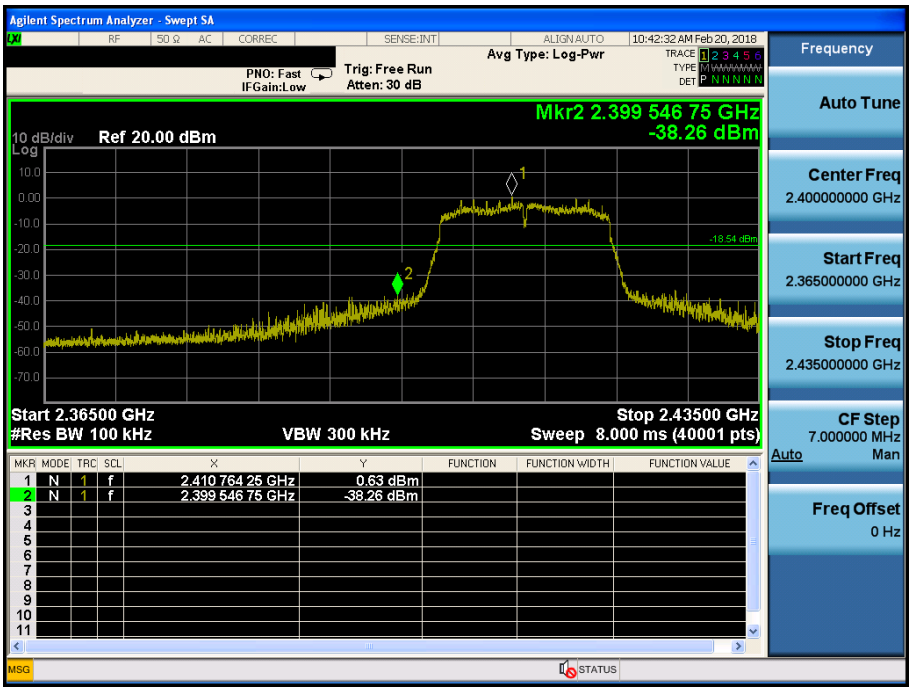


Low Band-edge



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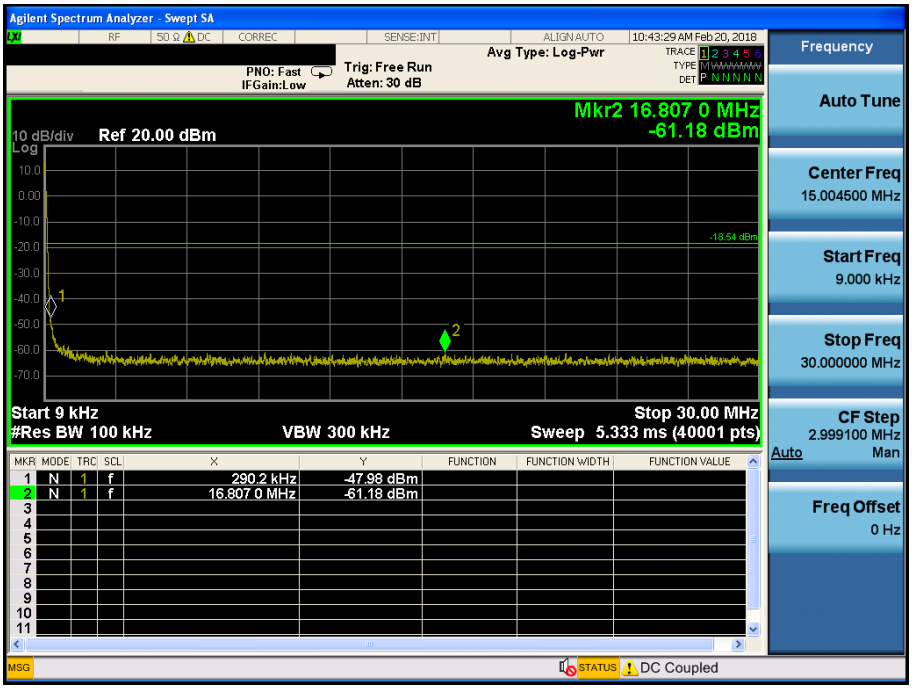

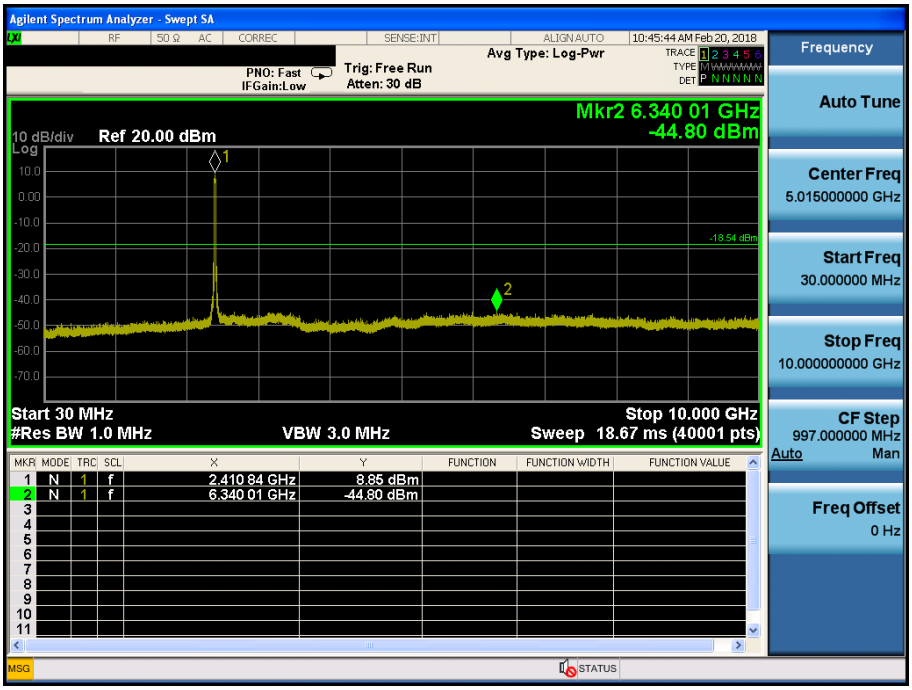

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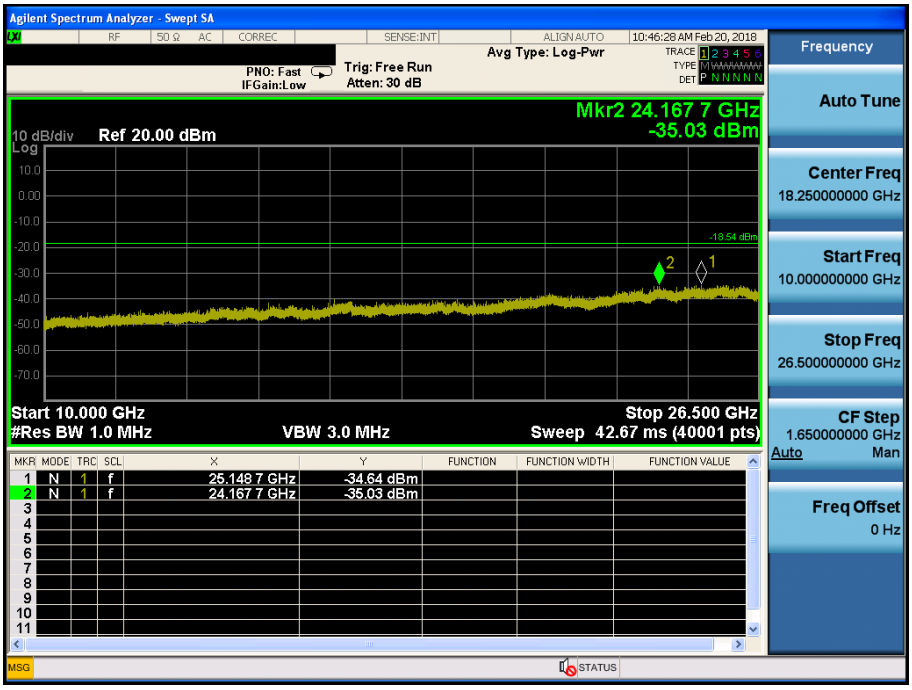

TM 2 & Middle

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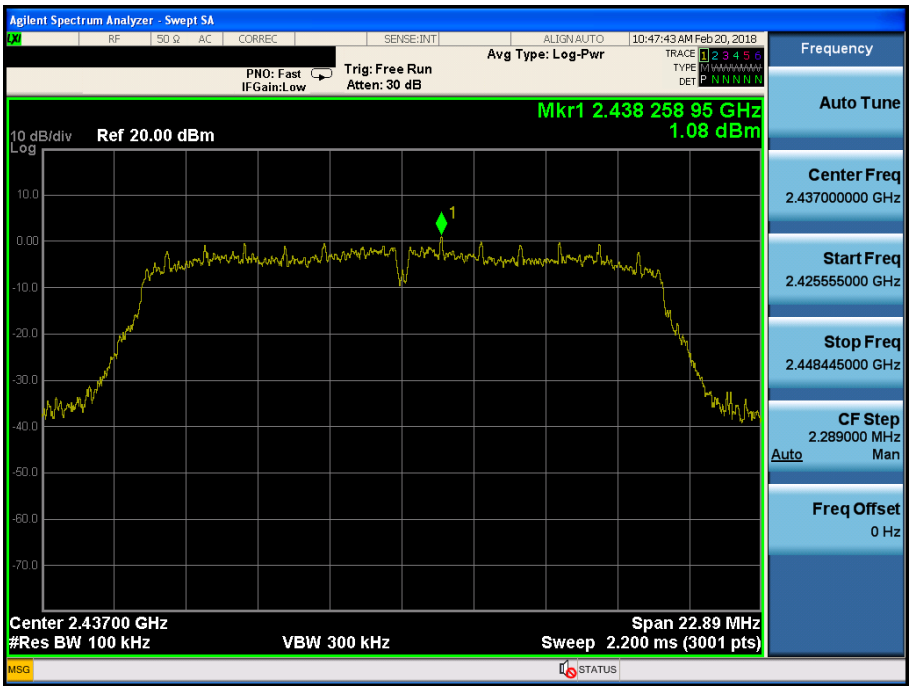

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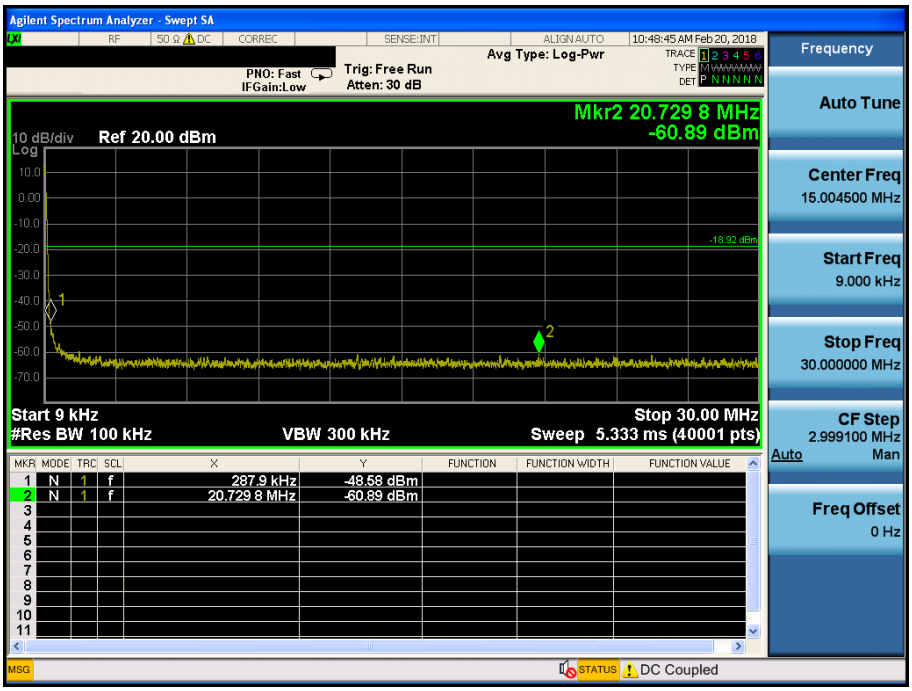
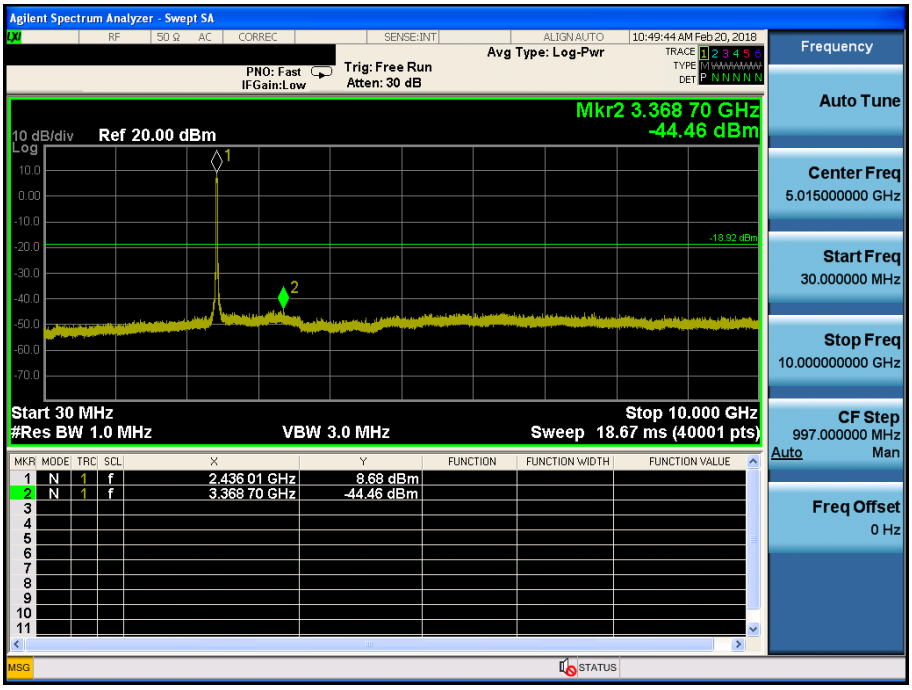
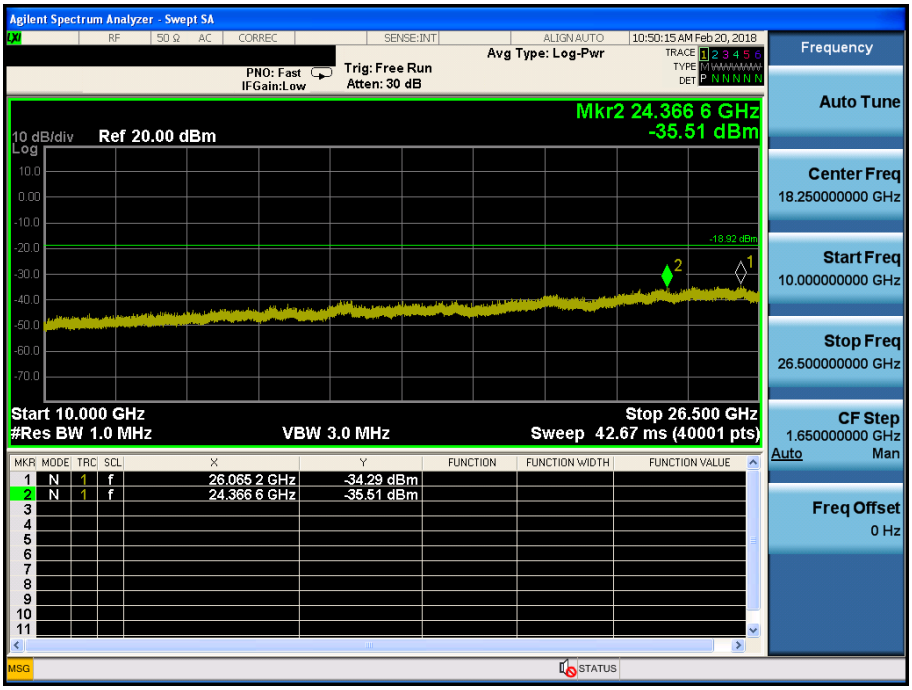


Conducted Spurious Emissions





TM 2 & Highest

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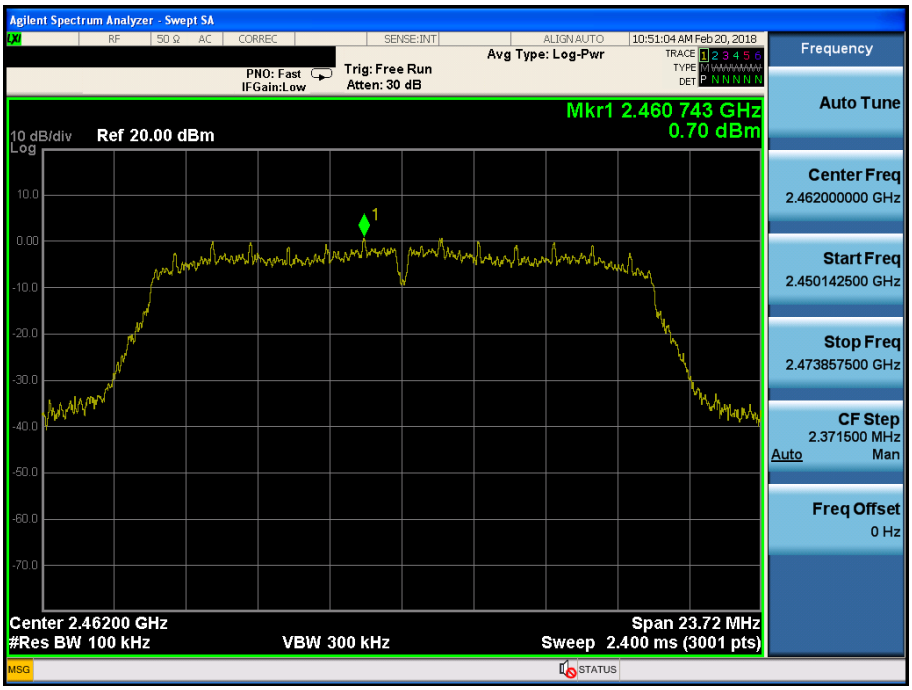
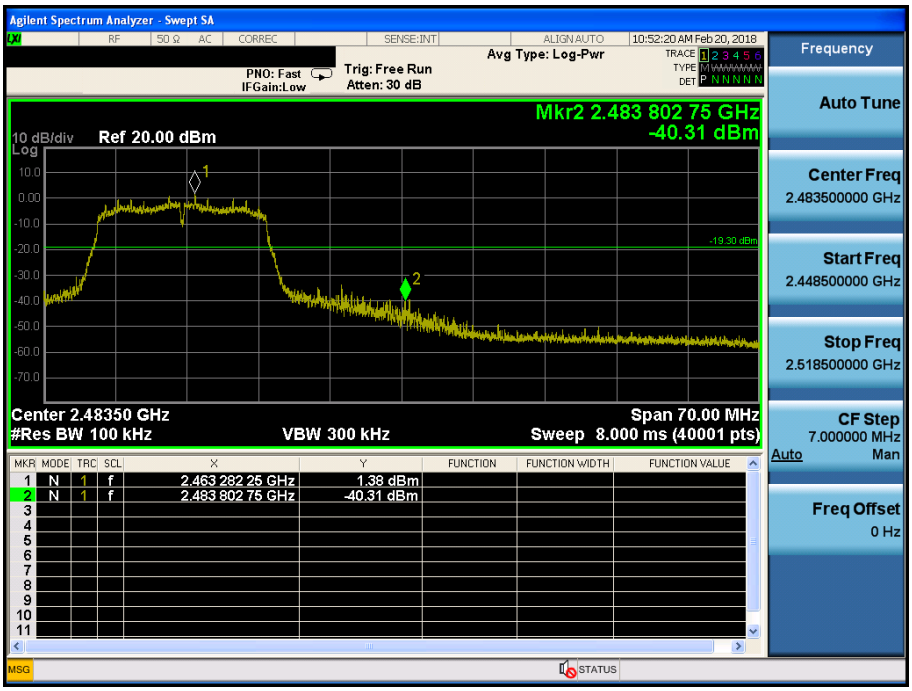


High Band-edge



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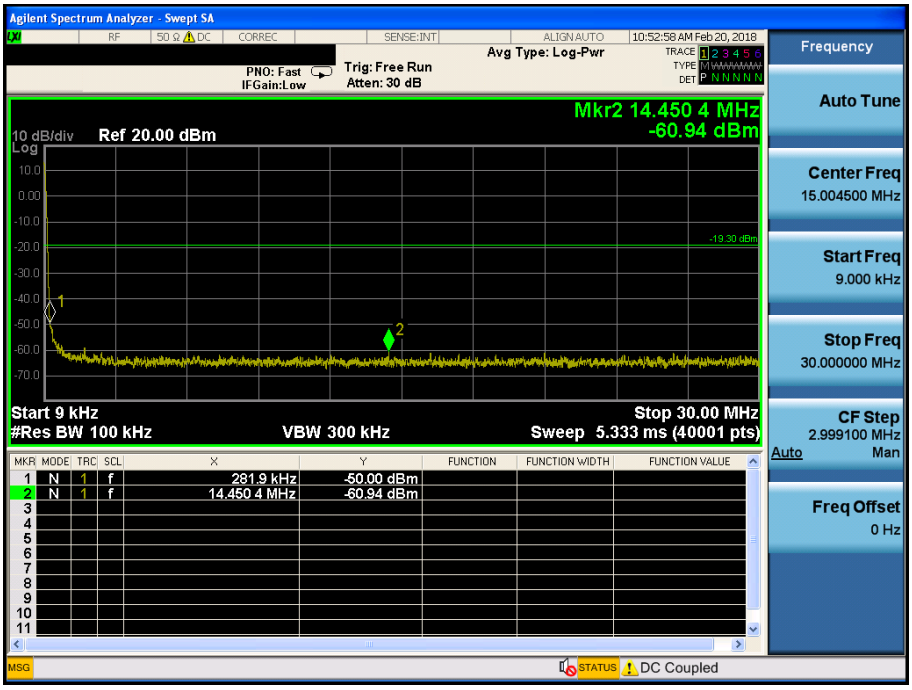
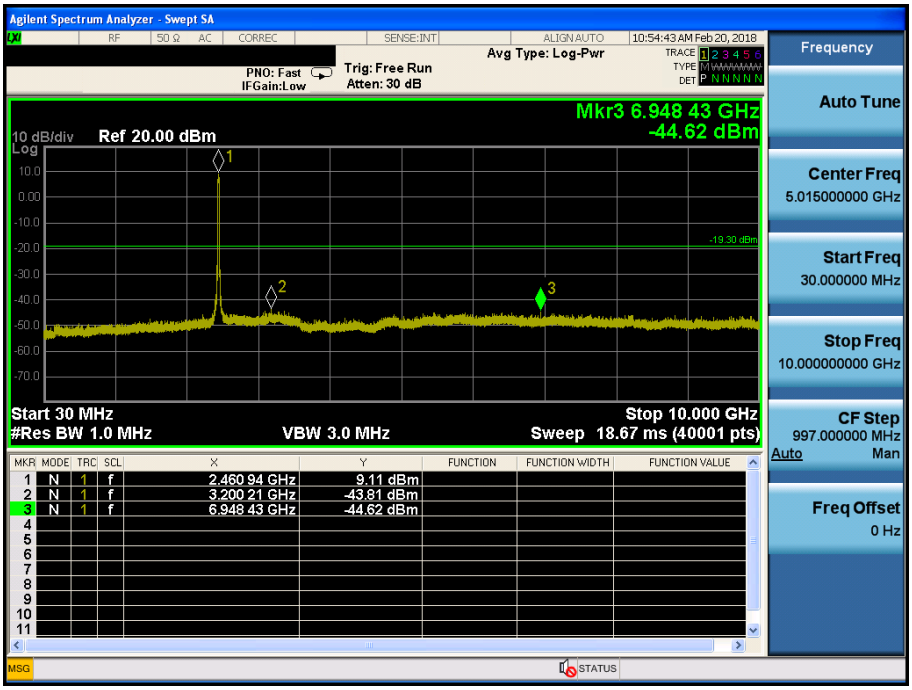
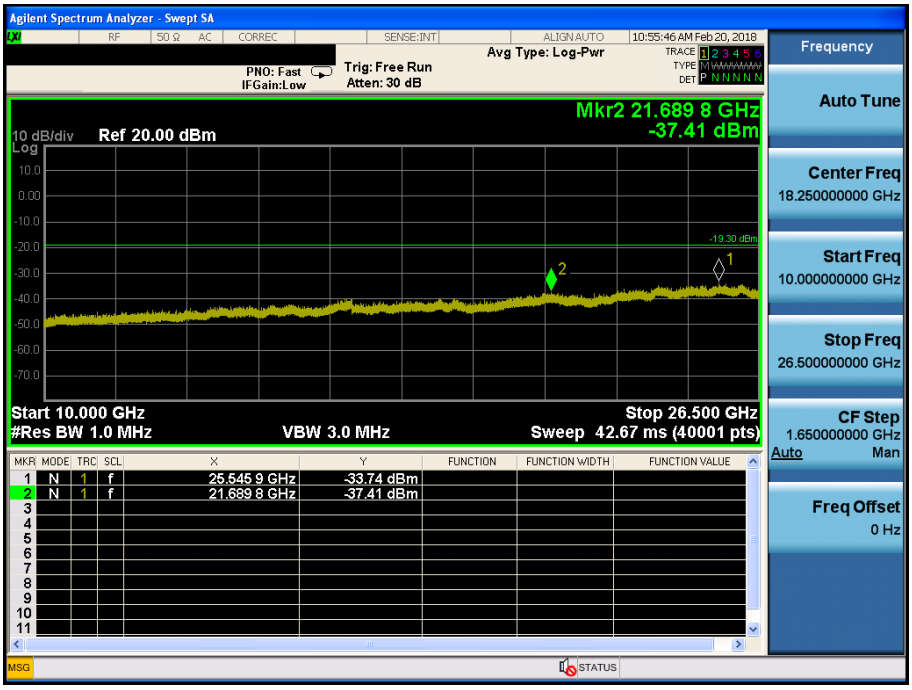


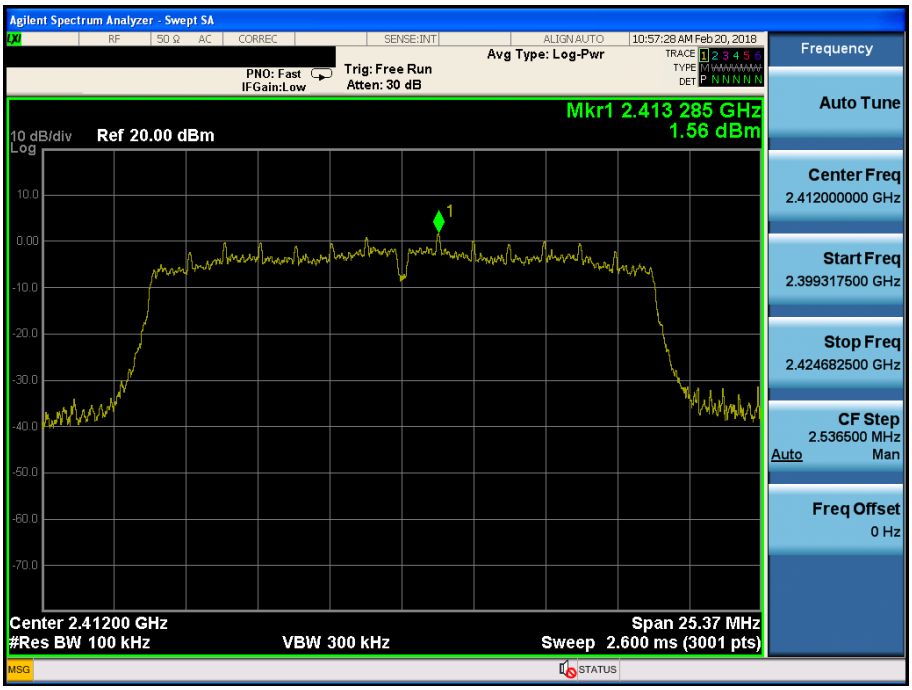


Conducted Spurious Emissions



TM 3 & Lowest

Reference



Low Band-edge