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FCC BT LE REPORT

Certification

Applicant Name:
SAMSUNG Electronics Co., Ltd.

Address:
129, Samsung-ro, Yeongtong-gu, Suwon-si, Gyeonggi-do, 16677, Rep. of Korea

Date of Issue:
May 24, 2018
Test Site/Location:
HCT CO., LTD., 74,Seoicheon-ro 578beon-gil,Majang-myeo,Icheon-si, Gyeonggi-do, 17383, Rep. of KOREA
Report No.: HCT-RF-1805-FC035

FCC ID:	**A3LSMG885S**
APPLICANT:	**SAMSUNG Electronics Co., Ltd.**

According to the Evaluation report, all of the data contained herein is reused from the reference FCC ID : A3LSMG885F report.

Model:	SM-G885S
EUT Type:	Mobile Phone
Average Output Power:	4.2 LE: 37 Byte: 0.26 dBm (1.062 mW) 4.2 LE: 255 Byte: 0.13 dBm (1.030 mW) 5.0 LE 1M: 37 Byte: 0.18 dBm (1.042 mW) 5.0 LE 1M: 255 Byte: 0.09 dBm (1.021 mW) 5.0 LE 2M: 37 Byte: 0.48 dBm (1.117 mW) 5.0 LE 2M: 255 Byte: -0.04 dBm (0.991 mW)
Frequency Range:	2402 MHz -2480 MHz
Modulation type	GFSK
FCC Classification:	Digital Transmission System(DTS)
FCC Rule Part(s):	Part 15.247

Engineering Statement:

The measurements shown in this report were made in accordance with the procedures indicated, and the emissions from this equipment were found to be within the limits applicable. I assume full responsibility for the accuracy and completeness of these measurements, and for the qualifications of all persons taking them.

HCT CO., LTD. Certifies that no party to this application has subject to a denial of Federal benefits that includes FCC benefits pursuant to section 5301 of the Anti-Drug Abuse Act of 1998,21 U.S. C.853(a)

Report prepared by : Jung Ki Lim
Engineer of Telecommunication testing center

Approved by : Jong Seok Lee
Manager of Telecommunication testing center

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Version

TEST REPORT NO.	DATE	DESCRIPTION
HCT-RF-1805-FC035	May 24, 2018	- First Approval Report

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1. GENERAL INFORMATION

Applicant:	SAMSUNG Electronics Co., Ltd.
Address:	129, Samsung-ro, Yeongtong-gu, Suwon-si, Gyeonggi-do, 16677, Rep. of Korea
FCC ID:	A3LSMG885S
EUT Type:	Mobile Phone
Model:	SM-G885S
Date(s) of Tests:	April 02, 2018 ~ April 19, 2018
Place of Tests:	HCT Co., Ltd. 74, Seoicheon-ro 578beon-gil, Majang-myeon, Icheon-si, Gyeonggi-do, Korea

2. EUT DESCRIPTION

Model	SM-G885S	
EUT Type	Mobile Phone	
Power Supply	DC 3.85 V	
Battery Information	Model: EB-BG885ABU Type: Li-ion Battery	
Travel Adapter Information	Model: EP-TA20EWE Input: 100 - 240V Output: 9.0V, 1.66A or 5.0V, 2.0A Manufacture: SAMSUNG	
Frequency Range	TX: 2402 MHz ~ 2480 MHz RX: 2402 MHz ~ 2480 MHz	
Max. RF Output Power	Peak	4.2 LE: 37 Byte: 0.547dBm (1.134 mW) 4.2 LE: 255 Byte: 0.476 dBm (1.116 mW) 5.0 LE 1M: 37 Byte: 0.426 dBm (1.103 mW) 5.0 LE 1M: 255 Byte: 0.374 dBm (1.090 mW) 5.0 LE 2M: 37 Byte: 0.858 dBm (1.218 mW) 5.0 LE 2M: 255 Byte: 0.432 dBm (1.105 mW)
	Average	4.2 LE: 37 Byte: 0.26 dBm (1.062 mW) 4.2 LE: 255 Byte: 0.13 dBm (1.030 mW) 5.0 LE 1M: 37 Byte: 0.18 dBm (1.042 mW) 5.0 LE 1M: 255 Byte: 0.09 dBm (1.021 mW) 5.0 LE 2M: 37 Byte: 0.48 dBm (1.117 mW) 5.0 LE 2M: 255 Byte: -0.04 dBm (0.991 mW)
BT Operating Mode	BT _Low Energy Mode	
Modulation Type	GFSK	
Number of Channels	40 Channels	
Antenna Specification	Antenna type: METAL + TFA Peak Gain : -2.12 dBi	

3. TEST METHODOLOGY

FCC KDB 558074 D01 DTS Meas Guidance v04 dated April 5, 2017 entitled “Guidance for Performing Compliance Measurements on Digital Transmission Systems(DTS) and the measurement procedure described in ANSI C63.10(Version : 2013) ‘the American National Standard of Procedures for Compliance Testing of Unlicensed Wireless Devices’.

3.1 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.

3.2 EUT EXERCISE

The EUT was operated in the engineering mode to fix the Tx frequency that was for the purpse 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.

3.3 GENERAL TEST PROCEDURES

Conducted Emissions

The EUT is placed on the turntable, which is 0.8 m above ground plane. According to the requirements in Section 6.2 of ANSI C63.10. (Version :2013) Conducted emissions from the EUT measured in the frequency range between 0.15 MHz and 30MHz using CISPR Quasi-peak and average detector modes.

Radiated Emissions

The EUT is placed on a turn table, which is 0.8 m above ground plane below 1GHz. Above 1GHz with 1.5m using absorbers between the EUT and receive antenna. The turntable shall rotate 360 degrees to determine the position of maximum emission level. EUT is set 3.75 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 max. emission, the relative positions of this hand-held transmitter (EUT) was rotated through three orthogonal axes according to the requirements in Section 8 of ANSI C63.10. (Version: 2013)

Conducted Antenna Terminal

See Section from 9.1 to 9.2.(KDB 558074 v04)

3.4 DESCRIPTION OF TEST MODES

The EUT has been tested under operating condition. Test program used to control the EUT for staying in continuous transmitting and receiving mode is programmed.

Channel low, mid and high with highest data rate (worst case) is chosen for full testing.

3.5 WORSTCASE OF TEST MODES

All modes of operation were investigated and the worst case configuration results are reported.

[RADIATED EMISSIONS]

- Mode : Stand alone, Stand alone+ external accessories(earphone, etc)
- Worstcase : Stand alone

[POWERLINE CONDUCTED EMISSION]

- Mode : Stand alone+Earphone+Travel Adapter, Stand alone+Travel Adapter
- Worstcase : Stand alone+Travel Adapter

4. 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 equipments, which is traceable to recognized national standards.
Especially, all antenna for measurement is calibrated in accordance with the requirements of C63.5 (Version : 2006).

5. FACILITIES AND ACCREDITATIONS

5.1 FACILITIES

The SAC(Semi-Anechoic Chamber) and conducted measurement facility used to collect the radiated data are located at the 74, Seoicheon-ro 578beon-gil, Majang-myeon, Icheon-si, Gyeonggi-do, Korea. The site is constructed in conformance with the requirements of ANSI C63.4. (Version :2014) and CISPR Publication 22. Detailed description of test facility was submitted to the Commission and accepted dated July 07, 2015 (Registration Number: 90661)

5.2 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, horn. Spectrum analyzers with pre-selectors and 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.”

6. ANTENNA REQUIREMENTS

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 antennas of this E.U.T are permanently attached.
*The E.U.T Complies with the requirement of §15.203

7. MEASUREMENT UNCERTAINTY

The measurement uncertainties shown below were calculated in accordance with the requirements of ANSI C63.4:2014.

All measurement uncertainty values are shown with a coverage factor of k = 2 to indicate a 95 % level of confidence. The measurement data shown herein meets or exceeds the U_{CISPR} measurement uncertainty values specified in CISPR 16-4-2 and, thus, can be compared directly to specified limits to determine compliance.

Parameter	Expanded Uncertainty (±dB)
Conducted Disturbance (150 kHz ~ 30 MHz)	1.82
Radiated Disturbance (9 kHz ~ 30 MHz)	3.40
Radiated Disturbance (30 MHz ~ 1 GHz)	4.80
Radiated Disturbance (1 GHz ~ 18 GHz)	5.70
Radiated Disturbance (18 GHz ~ 40 GHz)	5.71

8. SUMMARY TEST OF RESULTS

Test Description	FCC Part Section(s)	Test Limit	Test Condition	Test Result
6 dB Bandwidth	§15.247(a)(2)	> 500 kHz	CONDUCTED	PASS
Conducted Maximum Peak Output Power	§15.247(b)(3)	< 1 Watt		PASS
Power Spectral Density	§15.247(e)	< 8 dBm / 3 kHz Band		PASS
Band Edge(Out of Band Emissions)	§15.247(d)	Conducted > 30 dBc		PASS
AC Power line Conducted Emissions	§15.207	cf. Section 9.7		PASS
Radiated Spurious Emissions	§15.205, 15.209	cf. Section 9.6.1	RADIATED	PASS
Radiated Restricted Band Edge	§15.247(d), 15.205, 15.209	cf. Section 9.6.2		PASS

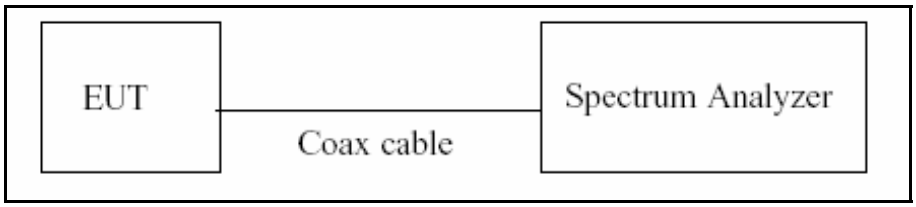
9. TEST RESULT

9.1 DUTY CYCLE

▣ TEST PROCEDURE

The zero-span mode on a spectrum analyzer or EMI receiver if the response time and spacing between bins on the sweep are sufficient to permit accurate measurements of the on and off times of the transmitted signal. Set the center frequency of the instrument to the center frequency of the transmission. Set RBW ≥ OBW if possible; otherwise, set RBW to the largest available value. Set VBW ≥ RBW. Set detector = peak or average. The zero-span measurement method shall not be used unless both RBW and VBW are > 50/T and the number of sweep points across duration T exceeds 100. (For example, if VBW and/or RBW are limited to 3 MHz, then the zero-span method of measuring duty cycle shall not be used if T ≤ 16.7 microseconds.)

▣ TEST CONFIGURATION



▣ TEST PROCEDURE

The transmitter output is connected to the Spectrum Analyzer. We tested according to the zero-span measurement method, 6.0)b) in KDB 558074 v04.

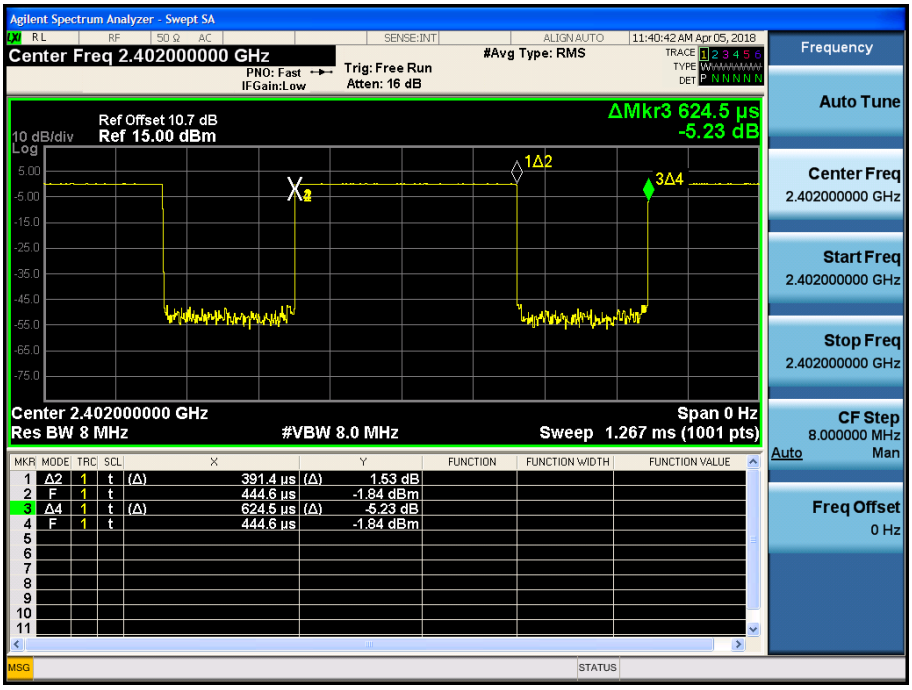
The largest availble value of RBW is 8 MHz and VBW is 50 MHz. The zero-span method of measuring duty cycle shall not be used if T ≤ 6.25 microseconds. (50/6.25 = 8)

The zero-span method was used because all measured T data are > 6.25 microseconds and both RBW and VBW are > 50/*T*.

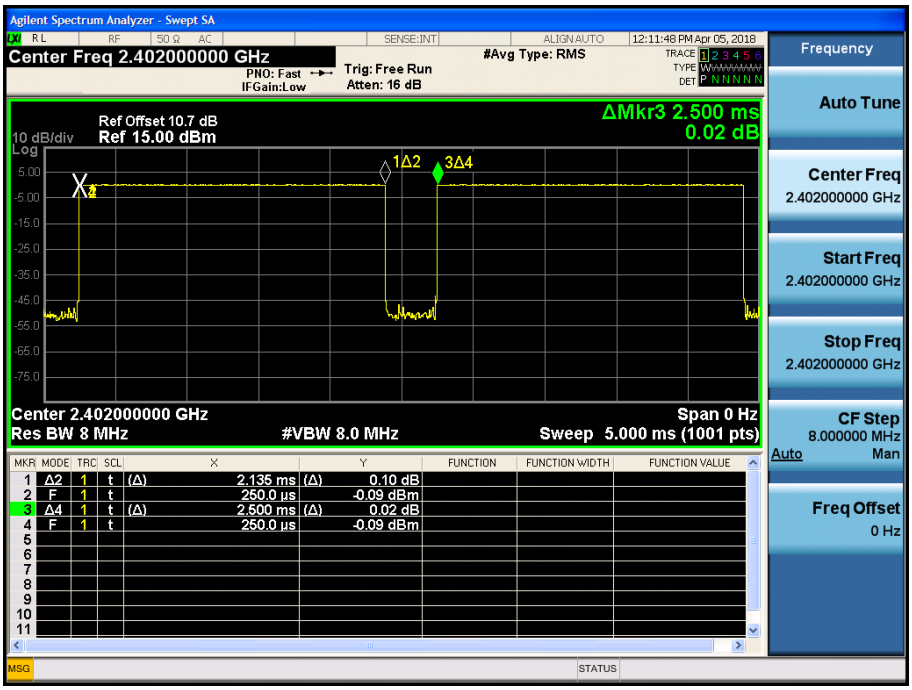
1. RBW = 8 MHz (the largest availble value)
2. VBW = 8 MHz (≥ RBW)
3. SPAN = 0 Hz
4. Detector = Peak
5. Number of points in sweep > 100
6. Trace mode = Clear write
7. Measure T_{total} and T_{on}
8. Calculate Duty Cycle = T_{on}/ T_{total} and Duty Cycle Factor = 10*log(1/Duty Cycle)

LE Mode	T_{on} (ms)	T_{total} (ms)	Duty Cycle	Duty Cycle Factor (dB)
Bluetooth Version : 4.2 LE: 37 Byte	0.3914	0.6245	0.6268	2.03
Bluetooth Version : 4.2 LE: 255 Byte	2.1350	2.5000	0.8540	0.69
Bluetooth Version : 5.0 LE 1M: 37 Byte	0.3914	0.6245	0.6268	2.03
Bluetooth Version : 5.0 LE 1M: 255 Byte	2.1350	2.5000	0.8540	0.69
Bluetooth Version : 5.0 LE 2M: 37 Byte	0.2052	0.6245	0.3286	4.83
Bluetooth Version : 5.0 LE 2M: 255 Byte	1.0800	1.8750	0.5760	2.40

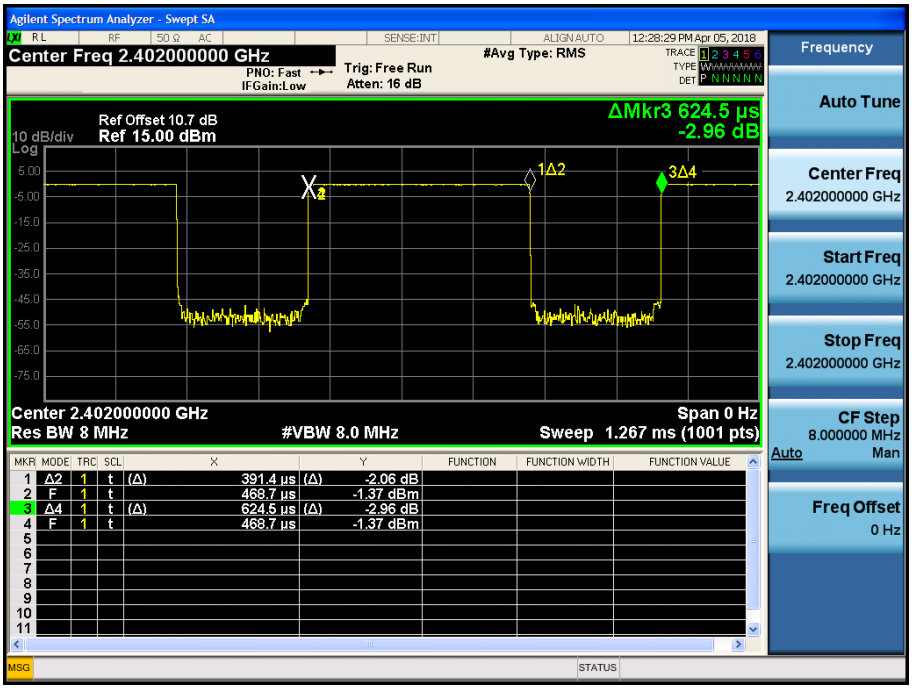
▣ 4.2 LE: 37 Byte Duty Cycle RESULT PLOTS



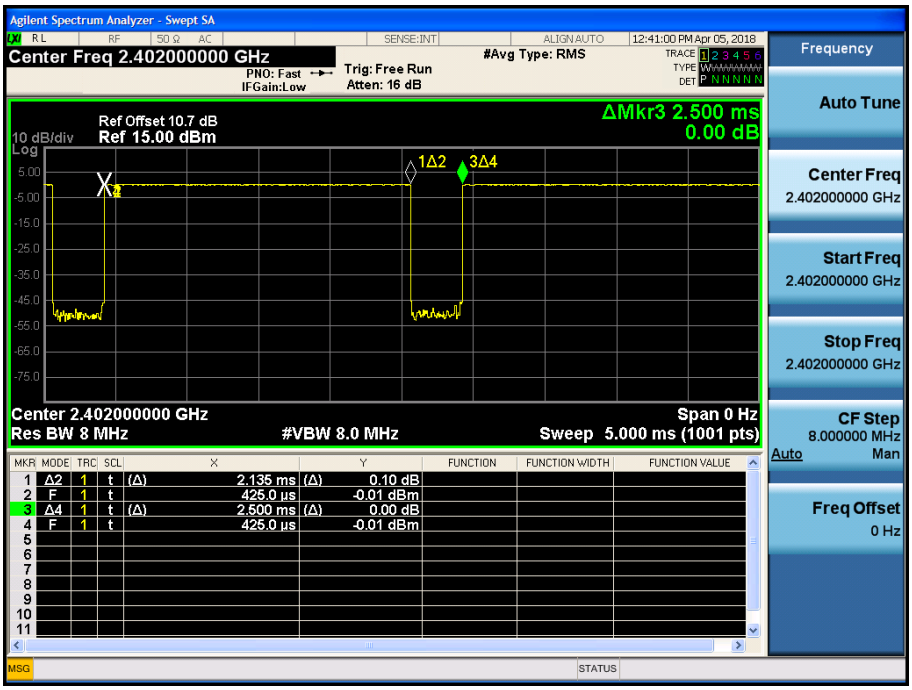
▣ 4.2 LE: 255 Byte Duty Cycle RESULT PLOTS



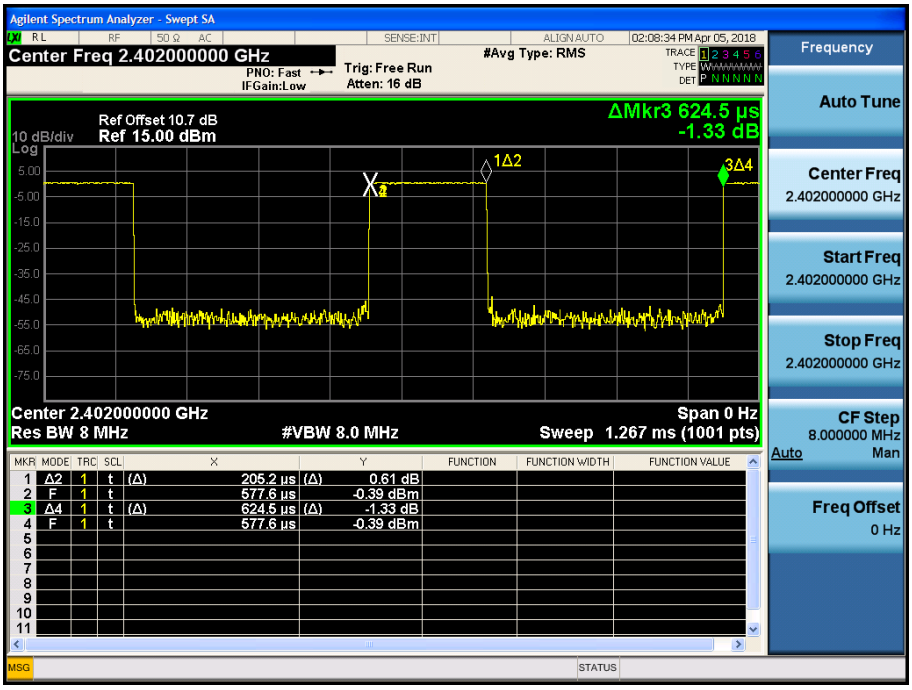
▣ 5.0 LE 1M: 37 Byte Duty Cycle RESULT PLOTS



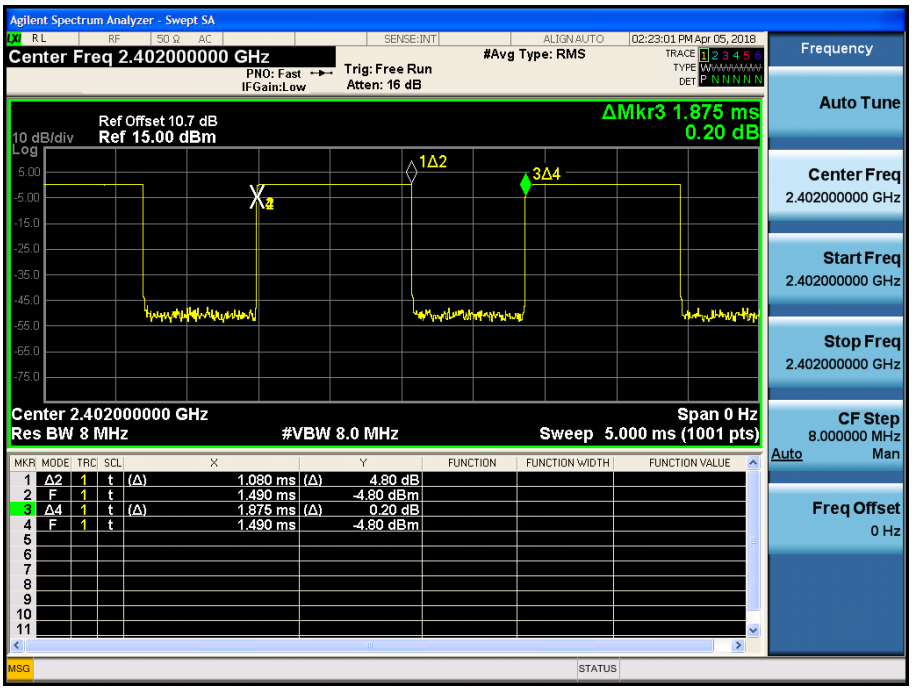
▣ 5.0 LE 1M: 255 Byte Duty Cycle RESULT PLOTS



▣ 5.0 LE 2M: 37 Byte Duty Cycle RESULT PLOTS



▣ 5.0 LE 2M: 255 Byte Duty Cycle RESULT PLOTS



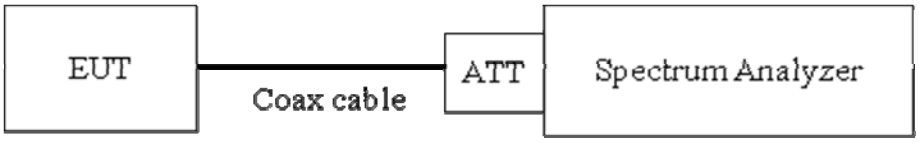
9.2 6 dB BANDWIDTH MEASUREMENT

Test Requirements and limit, §15.247(a)(2)

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



▣ TEST PROCEDURE

The transmitter output is connected to the Spectrum Analyzer.

The Spectrum Analyzer is set to (Procedure 8.1 in KDB 558074 v04)

RBW = 100 kHz

VBW ≥ 3 x RBW

Detector = Peak

Trace mode = max hold

Sweep = auto couple

Allow the trace to stabilize

Note : We tested 6 dB bandwidth using the automatic bandwidth measurement capability of a spectrum analyzer. X dB is set 6 dB.

▣ TEST RESULT

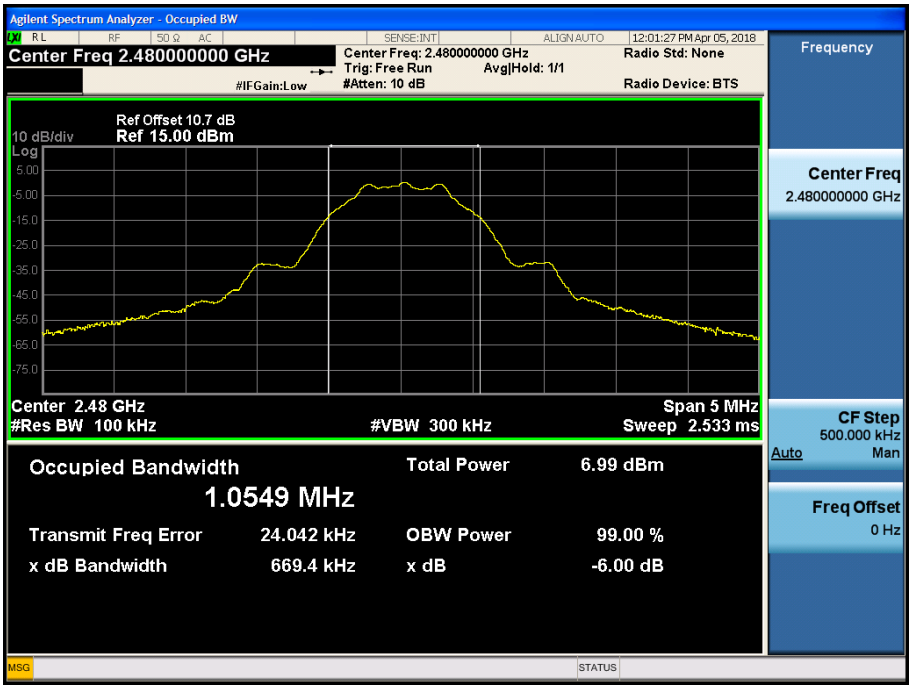
Mode	Channel	6 dB Bandwidth (kHz)	Limit (kHz)	Pass/Fail
4.2 LE: 37 Byte	0	665.4	> 500	Pass
	19	672.1		Pass
	39	669.4		Pass
4.2 LE: 255 Byte	0	668.3	> 500	Pass
	19	668.8		Pass
	39	671.3		Pass
5.0 LE 1M: 37 Byte	0	668.0	> 500	Pass
	19	670.9		Pass
	39	667.3		Pass
5.0 LE 1M: 255 Byte	0	665.3	> 500	Pass
	19	667.9		Pass
	39	670.4		Pass
5.0 LE 2M: 37 Byte	0	1135	> 500	Pass
	19	1149		Pass
	39	1142		Pass
5.0 LE 2M: 255 Byte	0	1146	> 500	Pass
	19	1154		Pass
	39	1142		Pass

▣ 4.2 LE: 37 Byte RESULT PLOTS

6 dB Bandwidth plot (Low-CH 0)

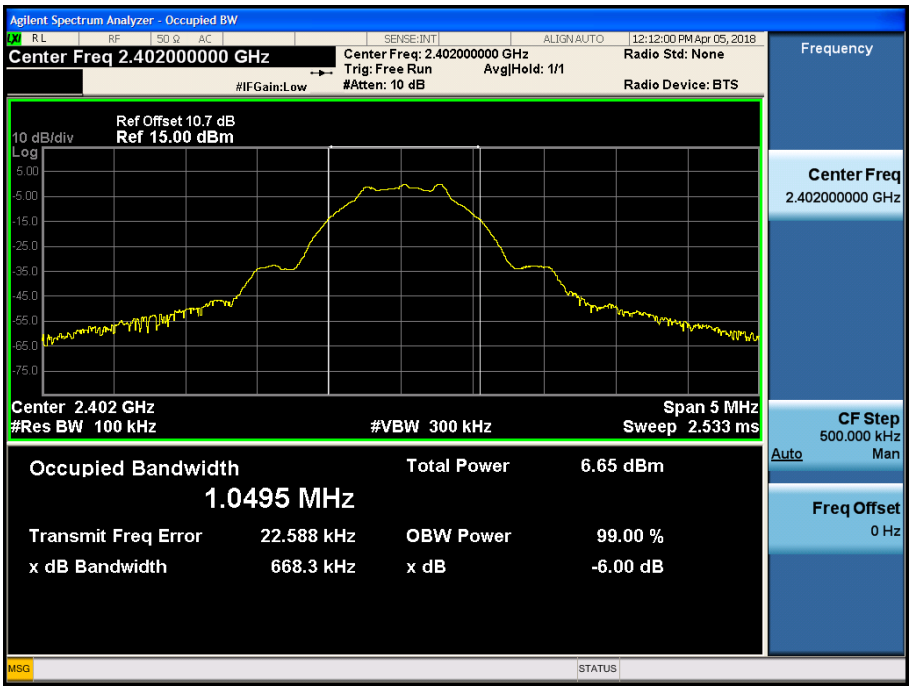
6 dB Bandwidth plot (Mid-CH 19)

6 dB Bandwidth plot (High-CH 39)

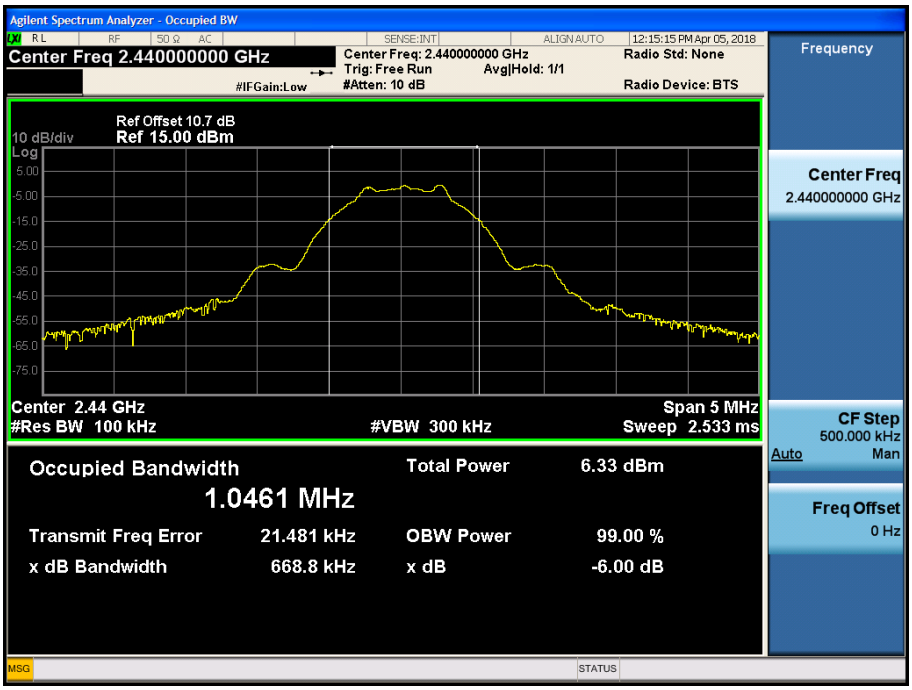


▣ 4.2 LE: 255 Byte RESULT PLOTS

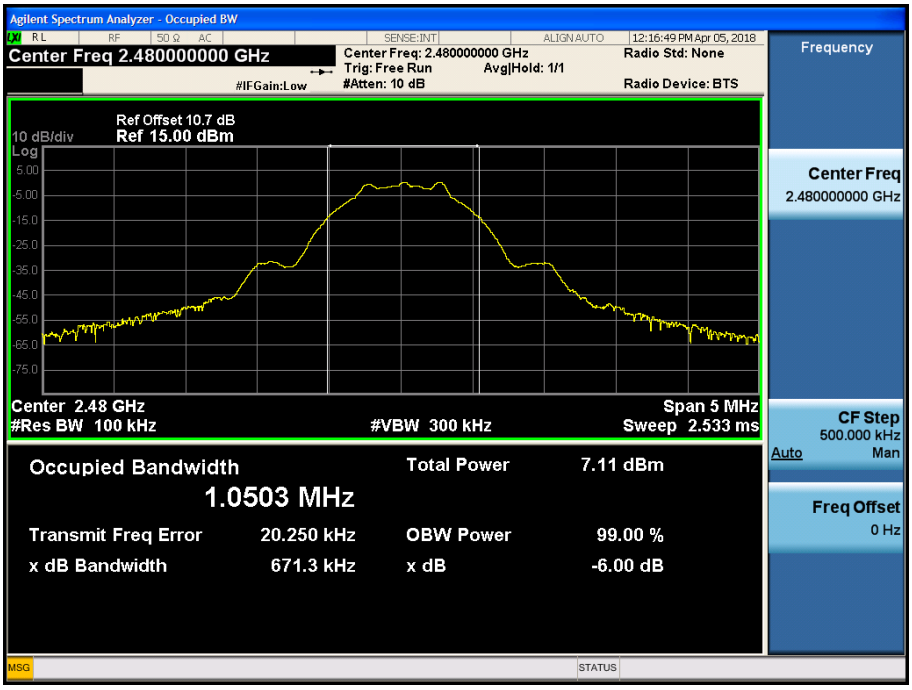
6 dB Bandwidth plot (Low-CH 0)



6 dB Bandwidth plot (Mid-CH 19)



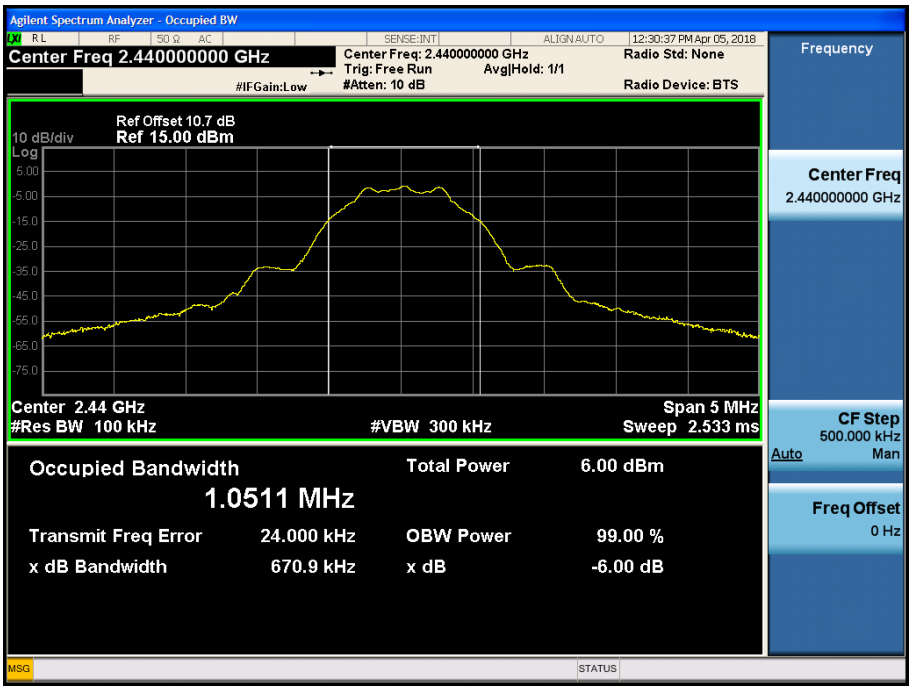
6 dB Bandwidth plot (High-CH 39)



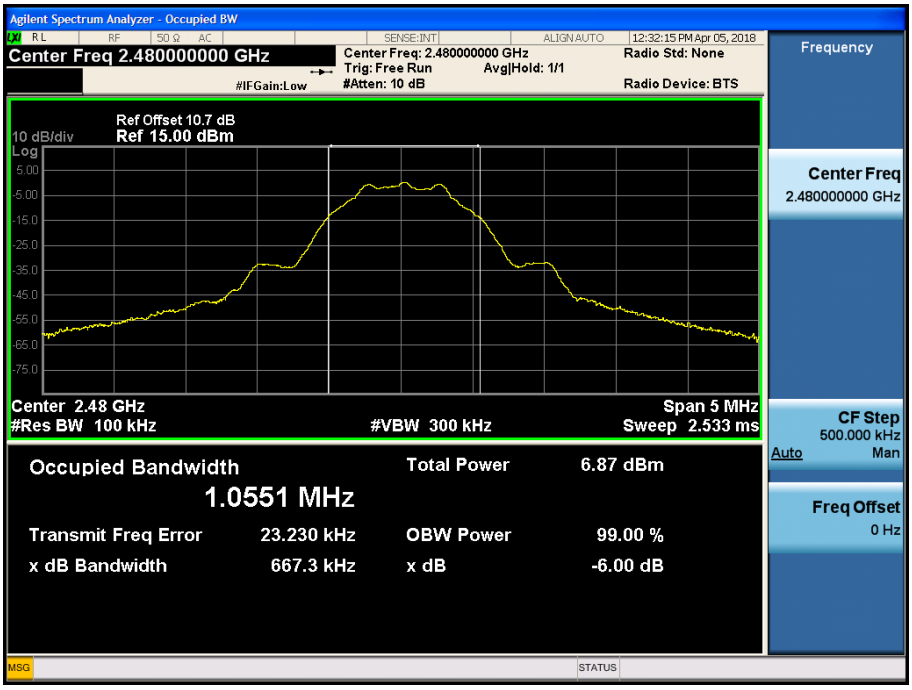
▣ 5.0 LE 1M: 37 Byte RESULT PLOTS

6 dB Bandwidth plot (Low-CH 0)

6 dB Bandwidth plot (Mid-CH 19)



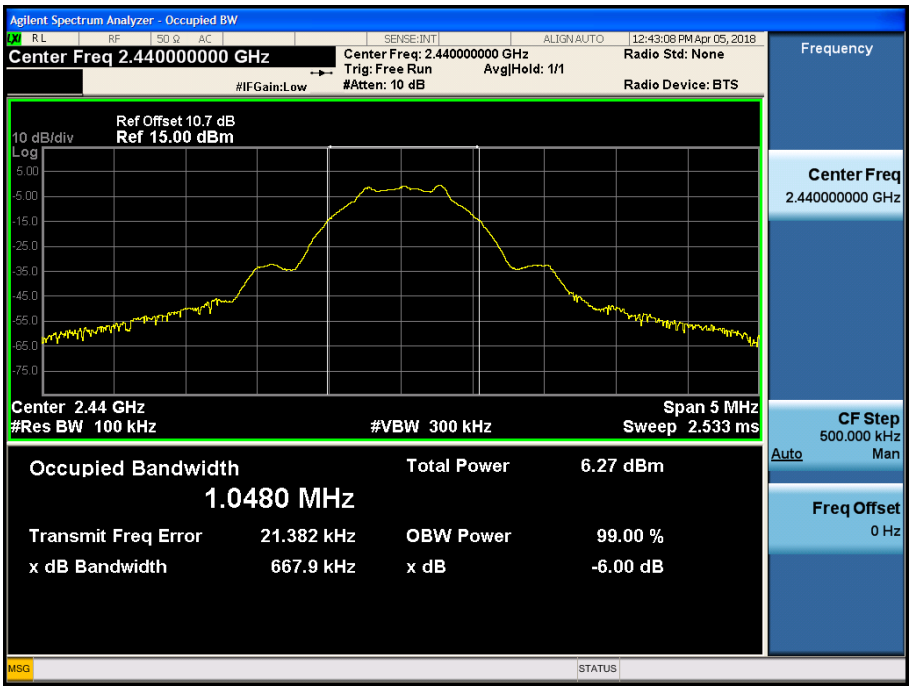
6 dB Bandwidth plot (High-CH 39)



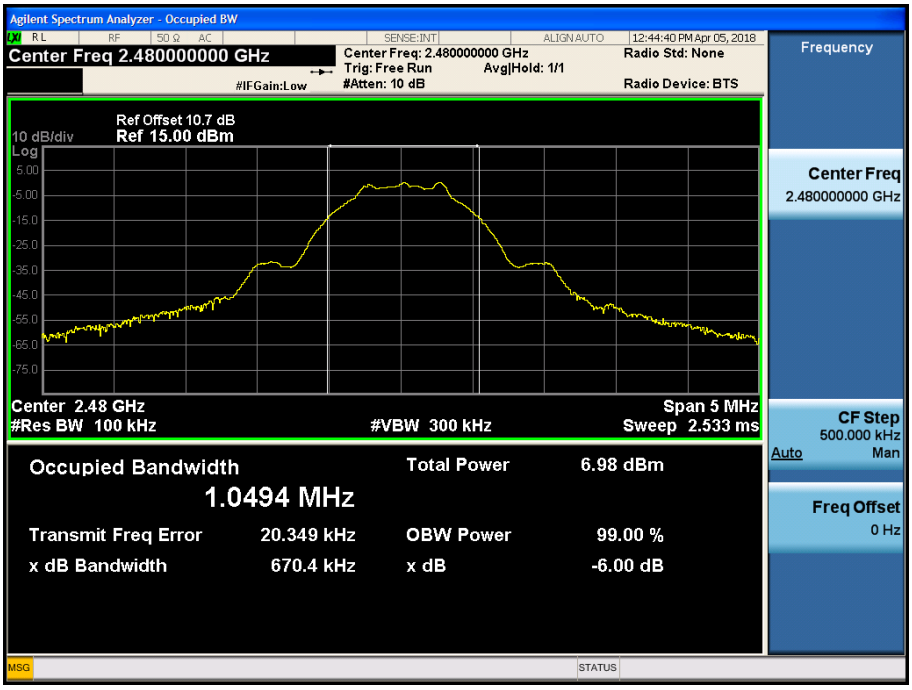
▣ 5.0 LE 1M: 255 Byte RESULT PLOTS

6 dB Bandwidth plot (Low-CH 0)

6 dB Bandwidth plot (Mid-CH 19)

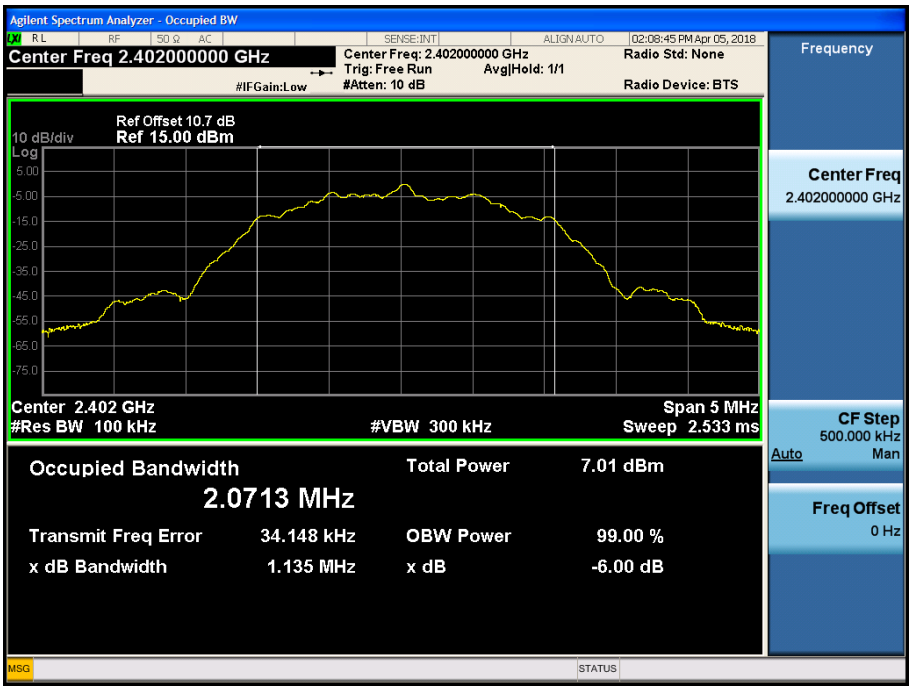


6 dB Bandwidth plot (High-CH 39)



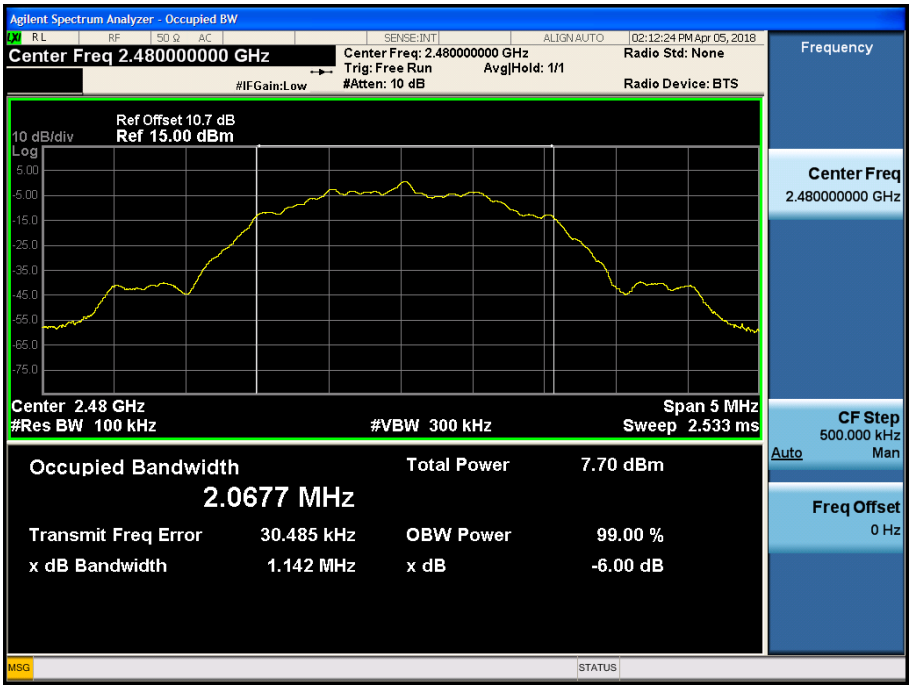
▣ 5.0 LE 2M: 37 Byte RESULT PLOTS

6 dB Bandwidth plot (Low-CH 0)



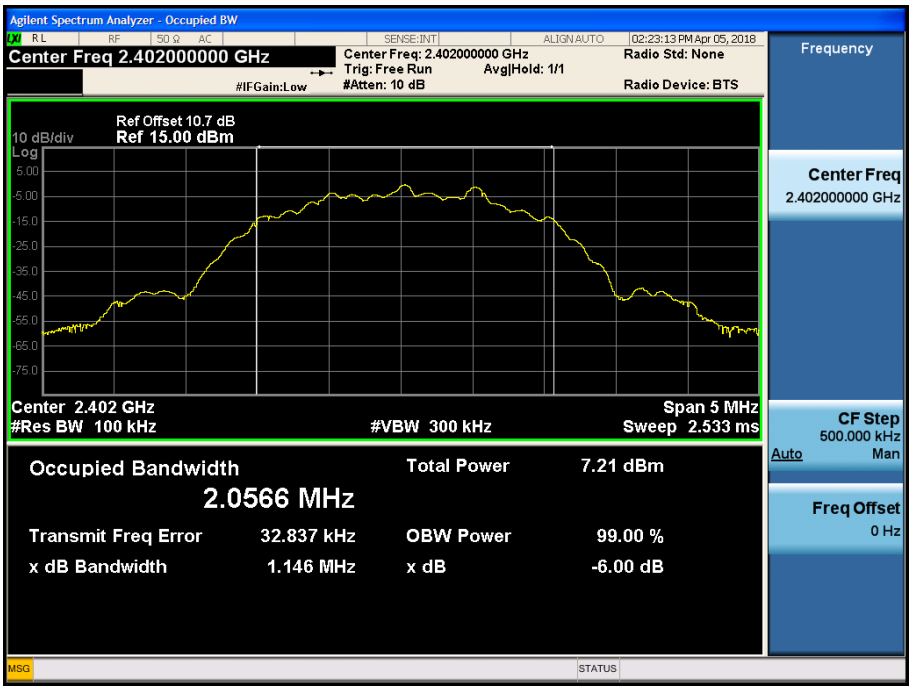
6 dB Bandwidth plot (Mid-CH 19)

6 dB Bandwidth plot (High-CH 39)



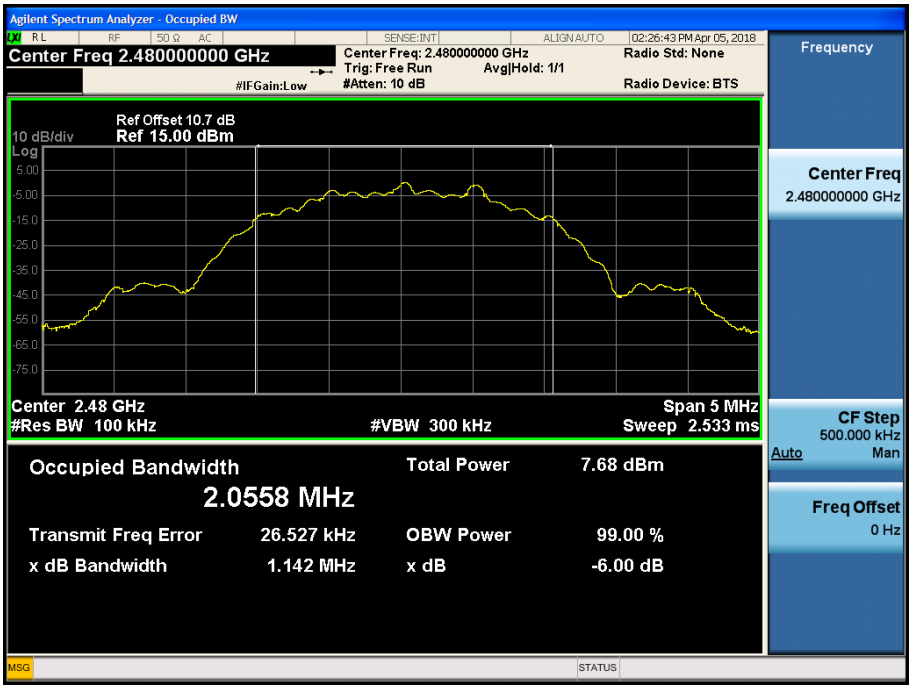
▣ 5.0 LE 2M: 255 Byte RESULT PLOTS

6 dB Bandwidth plot (Low-CH 0)



6 dB Bandwidth plot (Mid-CH 19)

6 dB Bandwidth plot (High-CH 39)



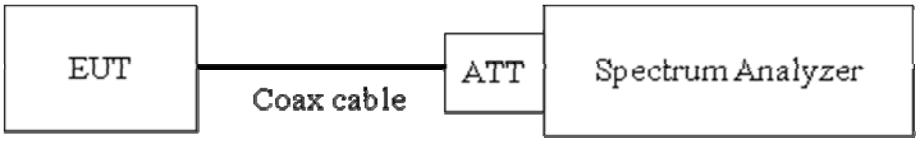
9.3 OUTPUT POWER MEASUREMENT

Test Requirements and limit, §15.247(b)(3)

A transmitter antenna terminal of EUT is connected to the input of a Spectrum Analyzer. Measurement is made while the EUT is operating in transmission mode at the appropriate frequencies.

The maximum permissible conducted output power is 1 Watt.

▣ TEST CONFIGURATION



▣ TEST PROCEDURE

The transmitter output is connected to the Spectrum Analyzer. We use the spectrum analyzer's integrated band power measurement function.

This EUT TX condition is actual operating mode by BT LE mode test program.

The Spectrum Analyzer is set to

- Peak Power (Procedure 9.1.1 in KDB 558074 v04)

  RBW ≥ DTS Bandwidth

  VBW ≥ 3 x RBW

  SPAN ≥ 3 x RBW

  Detector Mode = Peak

  Sweep = auto couple

  Trace Mode = max hold

  Allow trace to fully stabilize.

  Use peak marker function to determine the peak amplitude level

- Average Power (Procedure 9.2.2.4 in KDB 558074 v04)

  Measure the duty cycle

  Set span to at least 1.5 times the OBW

  RBW = 1-5 % of the OBW, not to exceed 1 MHz.

  VBW ≥ 3 x RBW.

  Number of points in sweep ≥ 2 x span / RBW. (This gives bin-to-bin spacing ≤ RBW/2, so that narrowband signals are not lost between frequency bins.)

  Sweep time = auto.

  Detector = RMS(i.e., power averaging)

  Do not use sweep triggering. Allow the sweep to "free run".

  Trace average at least 100 traces in power averaging(RMS) mode.

  Compute power by integrating the spectrum across the OBW of the signal using the instrument's band

power measurement function with band limits set equal to the OBW band edges.
Add 10 log (1/x), where x is the duty cycle, to the measured power in order to compute the average power during the actual transmission times.

▣ Sample Calculation

Output Power = Reading Value + ATT loss + Cable loss(1 ea) + Duty Cycle Factor
Output Power = 10 dBm + 10 dB + 0.8 dB + 0.2 dB = 21.0 dBm

Note :

1. Spectrum reading values are not plot data. The power results in plot is already including the actual values of loss for the attenuator and cable combination.
2. Spectrum offset = Attenuator loss + Cable loss
3. We apply to the offset in the 2.4 GHz range that was rounded off to the closest tenth dB. So, 10.7 dB is offset for 2.4 GHz Band.

▣ 4.2 LE: 37 Byte TEST RESULTS-Peak

Conducted Output Power Measurements

LE Mode		Measured Power(dBm)	Limit (dBm)
Frequency[MHz]	Channel No.		
2402	0	0.048	30
2440	19	-0.359	30
2480	39	0.547	30

▣ 4.2 LE: 37 Byte TEST RESULTS-Average

Conducted Output Power Measurements

LE Mode		Measured Power(dBm)	Duty Cycle Factor (dB)	Measured Power(dBm) + Duty Cycle Factor(dB)	Limit (dBm)
Frequency[MHz]	Channel No.				
2402	0	-2.29	2.03	-0.26	30
2440	19	-2.73	2.03	-0.70	30
2480	39	-1.77	2.03	0.26	30

▣ 4.2 LE: 255 Byte TEST RESULTS-Peak

Conducted Output Power Measurements

LE Mode		Measured Power(dBm)	Limit (dBm)
Frequency[MHz]	Channel No.		
2402	0	0.034	30
2440	19	-0.296	30
2480	39	0.476	30

▣ 4.2 LE: 255 Byte TEST RESULTS-Average

Conducted Output Power Measurements

LE Mode		Measured Power(dBm)	Duty Cycle Factor (dB)	Measured Power(dBm) + Duty Cycle Factor(dB)	Limit (dBm)
Frequency[MHz]	Channel No.				
2402	0	-0.86	0.69	-0.17	30
2440	19	-1.27	0.69	-0.59	30
2480	39	-0.56	0.69	0.13	30

▣ 5.0 LE 1M: 37 Byte TEST RESULTS-Peak

Conducted Output Power Measurements

LE Mode		Measured Power(dBm)	Limit (dBm)
Frequency[MHz]	Channel No.		
2402	0	-0.136	30
2440	19	-0.417	30
2480	39	0.426	30

▣ 5.0 LE 1M: 37 Byte TEST RESULTS-Average

Conducted Output Power Measurements

LE Mode		Measured Power(dBm)	Duty Cycle Factor (dB)	Measured Power(dBm) + Duty Cycle Factor(dB)	Limit (dBm)
Frequency[MHz]	Channel No.				
2402	0	-2.41	2.03	-0.39	30
2440	19	-2.64	2.03	-0.61	30
2480	39	-1.85	2.03	0.18	30

▣ 5.0 LE 1M: 255 Byte TEST RESULTS-Peak

Conducted Output Power Measurements

LE Mode		Measured Power(dBm)	Limit (dBm)
Frequency[MHz]	Channel No.		
2402	0	0.098	30
2440	19	-0.285	30
2480	39	0.374	30

▣ 5.0 LE 1M: 255 Byte TEST RESULTS-Average

Conducted Output Power Measurements

LE Mode		Measured Power(dBm)	Duty Cycle Factor (dB)	Measured Power(dBm) + Duty Cycle Factor(dB)	Limit (dBm)
Frequency[MHz]	Channel No.				
2402	0	-0.83	0.69	-0.14	30
2440	19	-1.27	0.69	-0.59	30
2480	39	-0.60	0.69	0.09	30

▣ 5.0 LE 2M: 37 Byte TEST RESULTS-Peak

Conducted Output Power Measurements

LE Mode		Measured Power(dBm)	Limit (dBm)
Frequency[MHz]	Channel No.		
2402	0	0.229	30
2440	19	-0.089	30
2480	39	0.858	30

▣ 5.0 LE 2M: 37 Byte TEST RESULTS-Average

Conducted Output Power Measurements

LE Mode		Measured Power(dBm)	Duty Cycle Factor (dB)	Measured Power(dBm) + Duty Cycle Factor(dB)	Limit (dBm)
Frequency[MHz]	Channel No.				
2402	0	-4.82	4.83	0.01	30
2440	19	-4.52	4.83	0.31	30
2480	39	-4.35	4.83	0.48	30

▣ 5.0 LE 2M: 255 Byte TEST RESULTS-Peak

Conducted Output Power Measurements

LE Mode		Measured Power(dBm)	Limit (dBm)
Frequency[MHz]	Channel No.		
2402	0	-0.026	30
2440	19	-0.402	30
2480	39	0.432	30

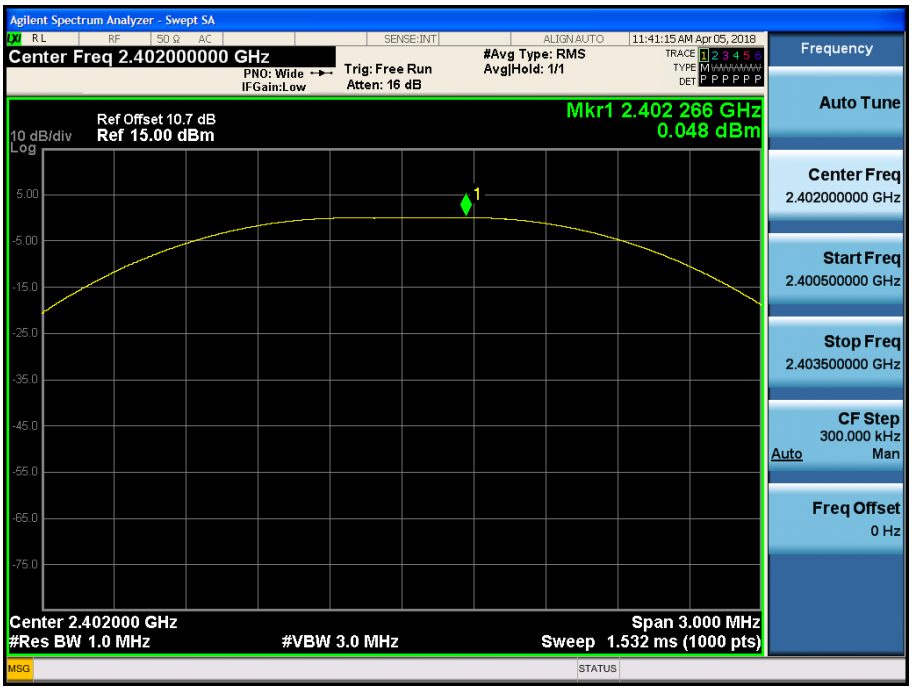
▣ 5.0 LE 2M: 255 Byte TEST RESULTS-Average

Conducted Output Power Measurements

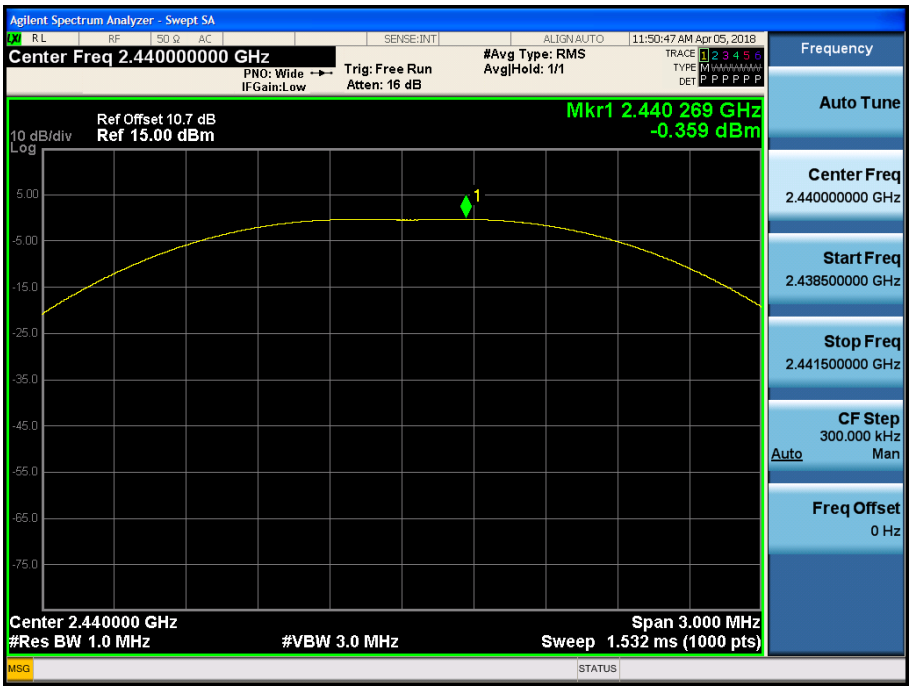
LE Mode		Measured Power(dBm)	Duty Cycle Factor (dB)	Measured Power(dBm) + Duty Cycle Factor(dB)	Limit (dBm)
Frequency[MHz]	Channel No.				
2402	0	-2.76	2.40	-0.37	30
2440	19	-3.15	2.40	-0.76	30
2480	39	-2.44	2.40	-0.04	30

▣ 4.2 LE: 37 Byte RESULT PLOTS-Peak

Conducted Output Power (Low-CH 0)



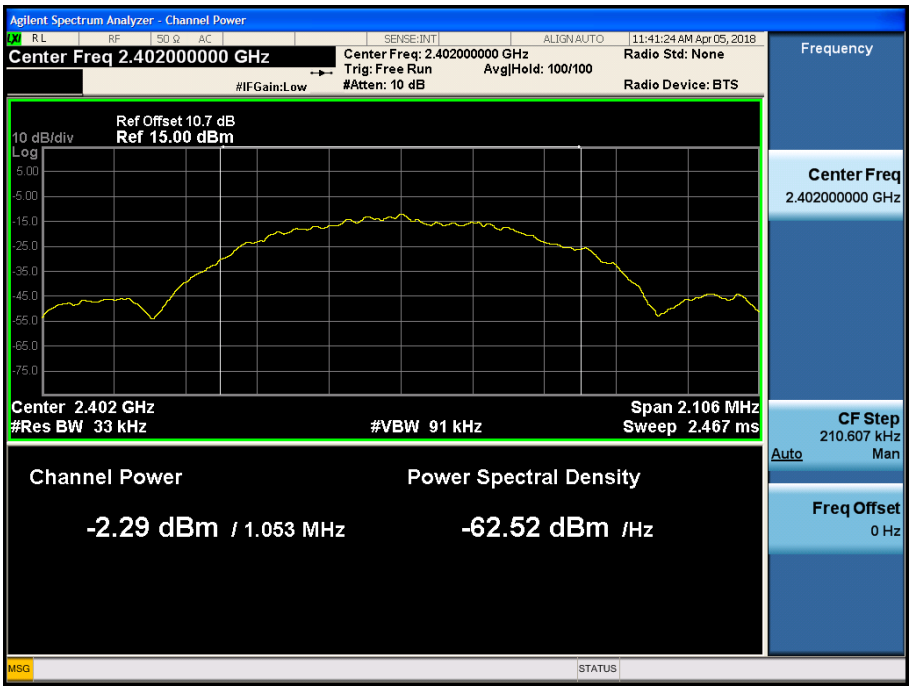
Conducted Output Power (Mid-CH 19)



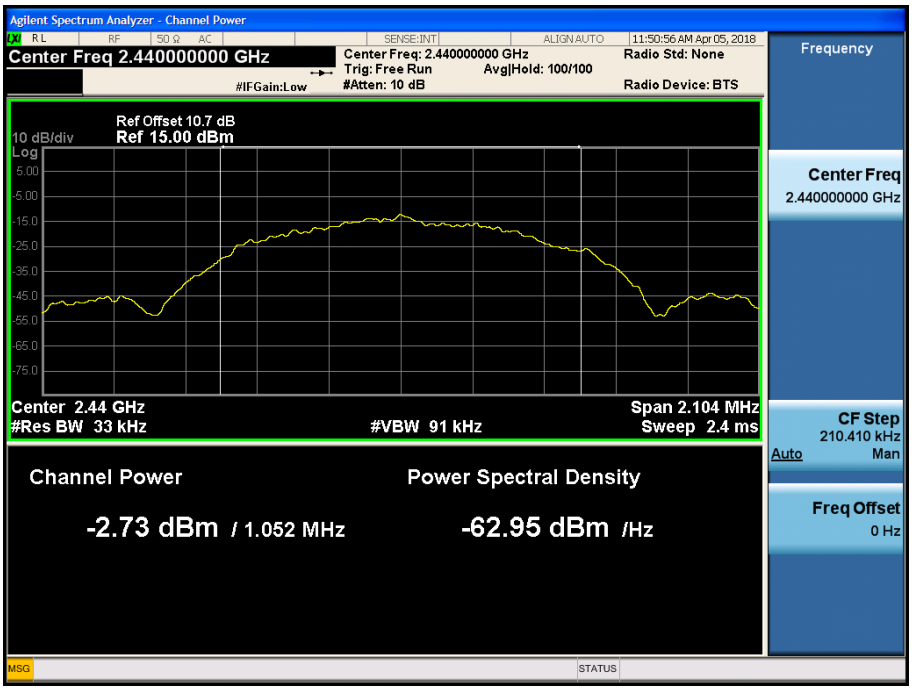
Conducted Output Power (High-CH 39)

▣ 4.2 LE: 37 Byte RESULT PLOTS-Average

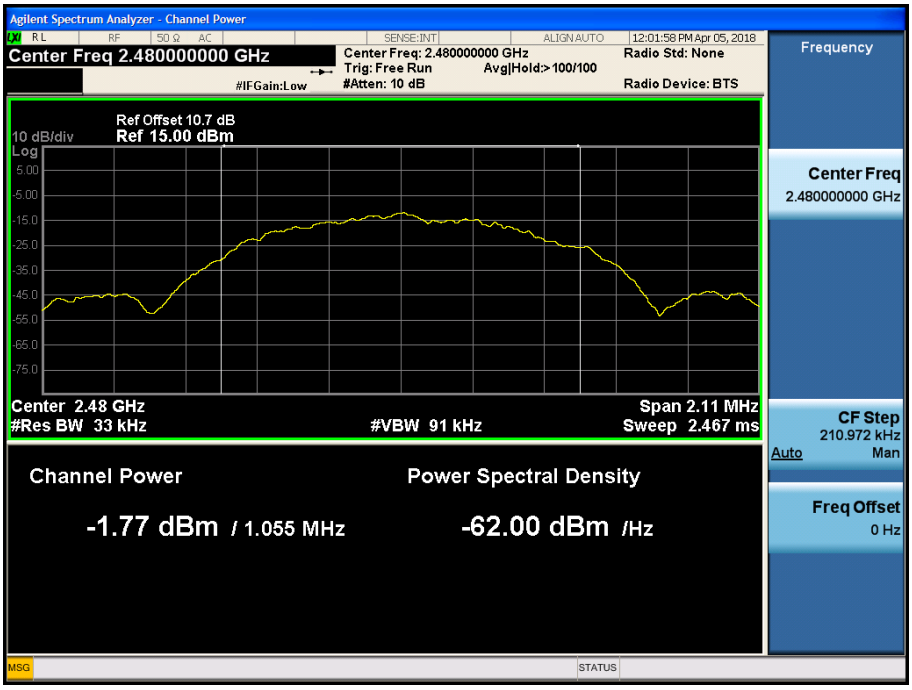
Conducted Output Power (Low-CH 0)



Conducted Output Power (Mid-CH 19)



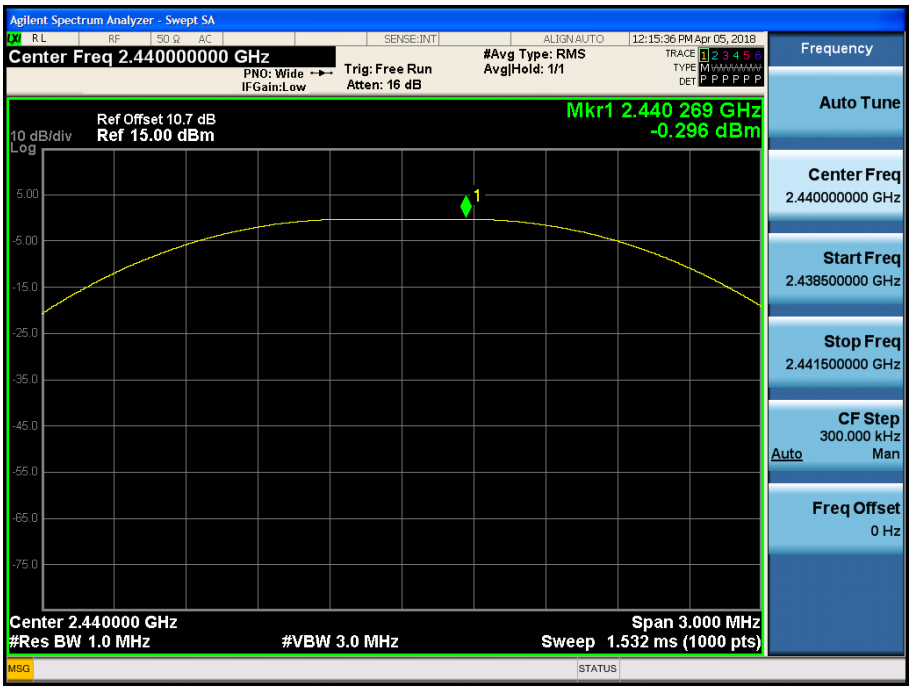
Conducted Output Power (High-CH 39)



▣ 4.2 LE: 255 Byte RESULT PLOTS-Peak

Conducted Output Power (Low-CH 0)

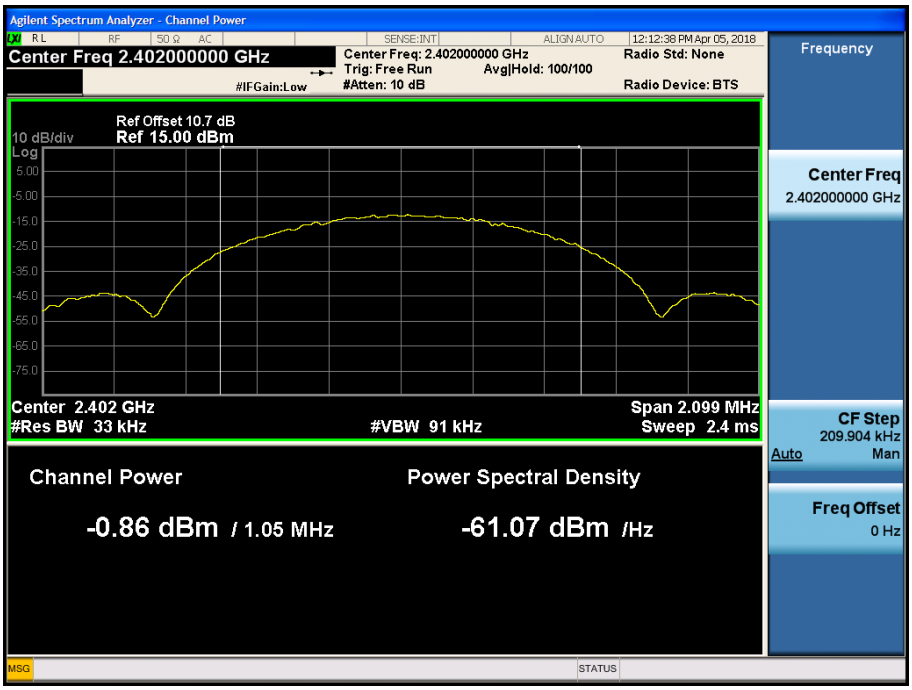
Conducted Output Power (Mid-CH 19)



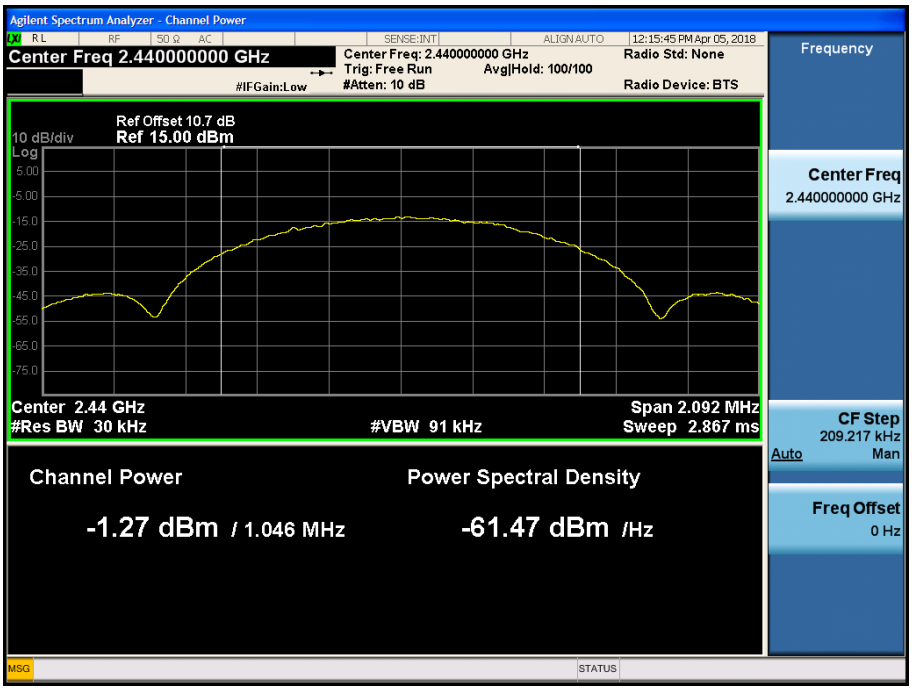
Conducted Output Power (High-CH 39)

▣ 4.2 LE: 255 Byte RESULT PLOTS-Average

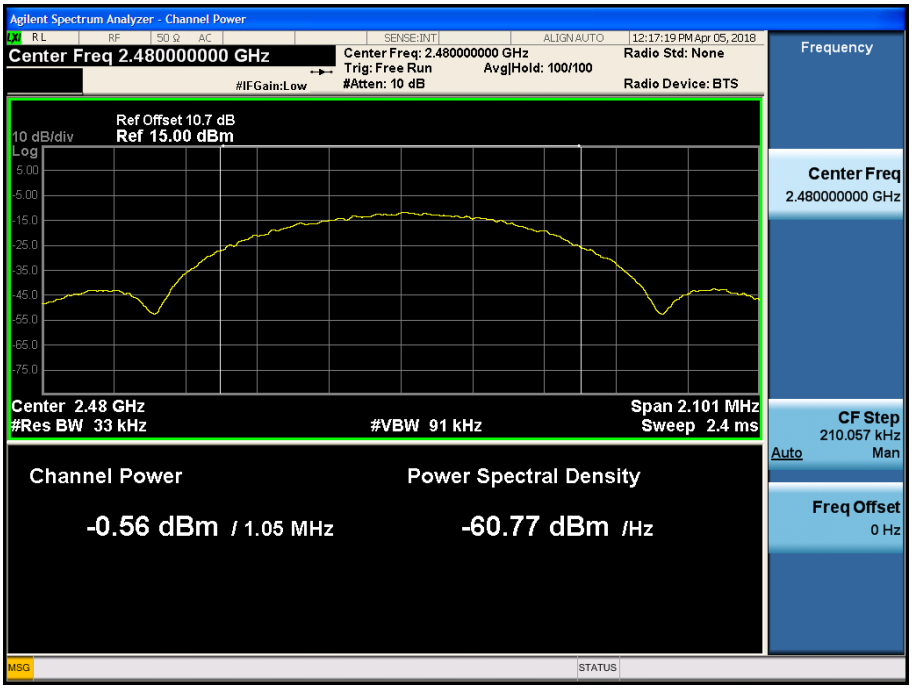
Conducted Output Power (Low-CH 0)



Conducted Output Power (Mid-CH 19)

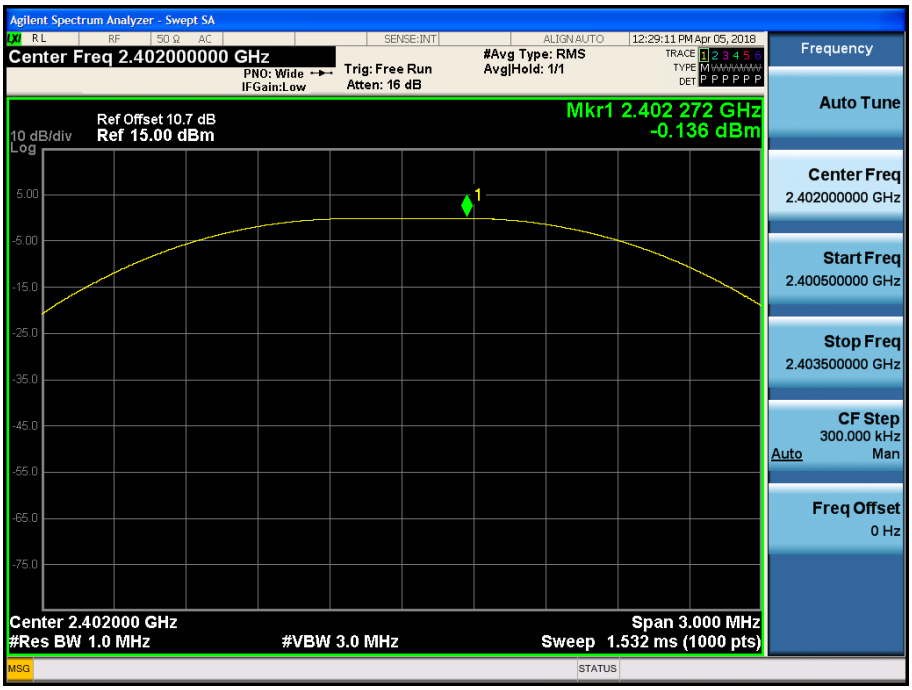


Conducted Output Power (High-CH 39)



▣ 5.0 LE 1M: 37 Byte RESULT PLOTS-Peak

Conducted Output Power (Low-CH 0)

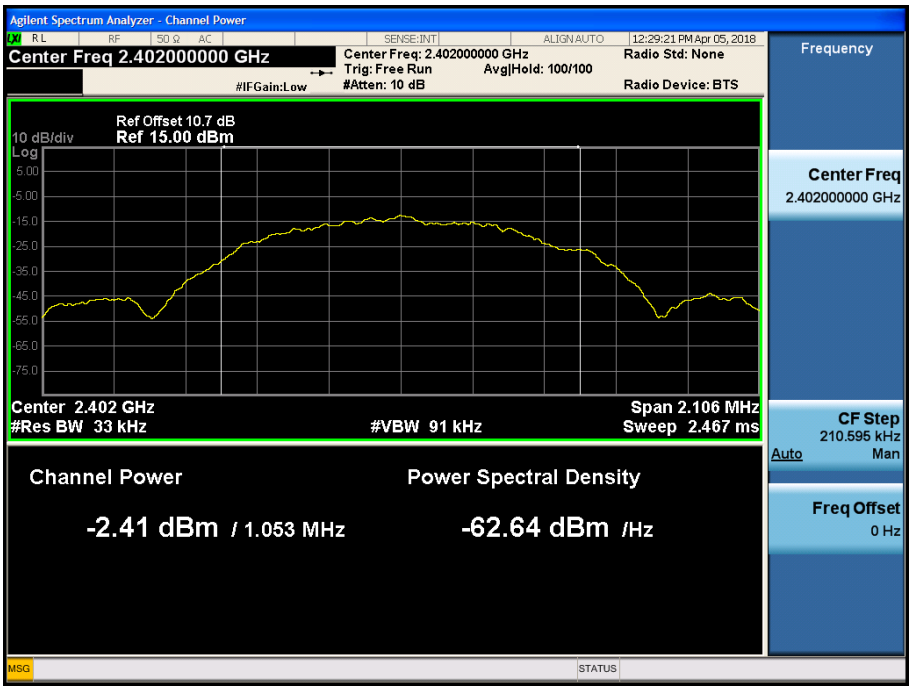


Conducted Output Power (Mid-CH 19)

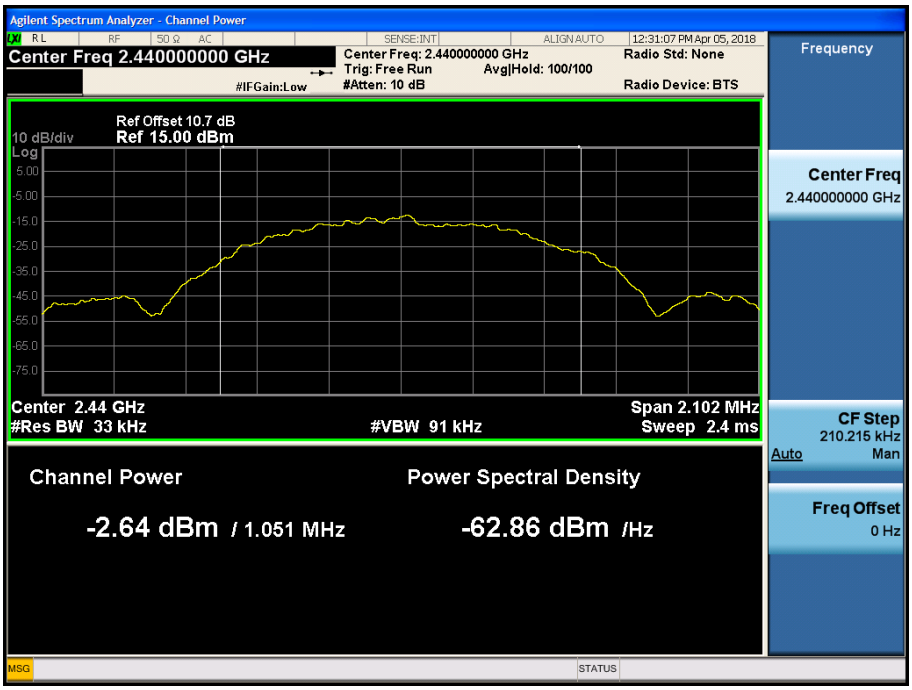
Conducted Output Power (High-CH 39)

▣ 5.0 LE 1M: 37 Byte RESULT PLOTS-Average

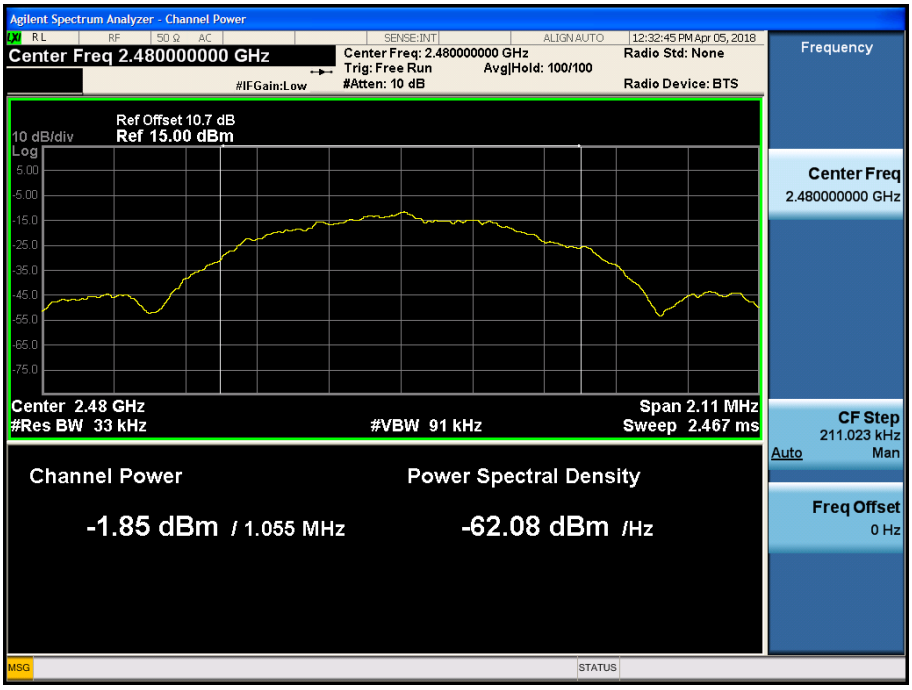
Conducted Output Power (Low-CH 0)



Conducted Output Power (Mid-CH 19)

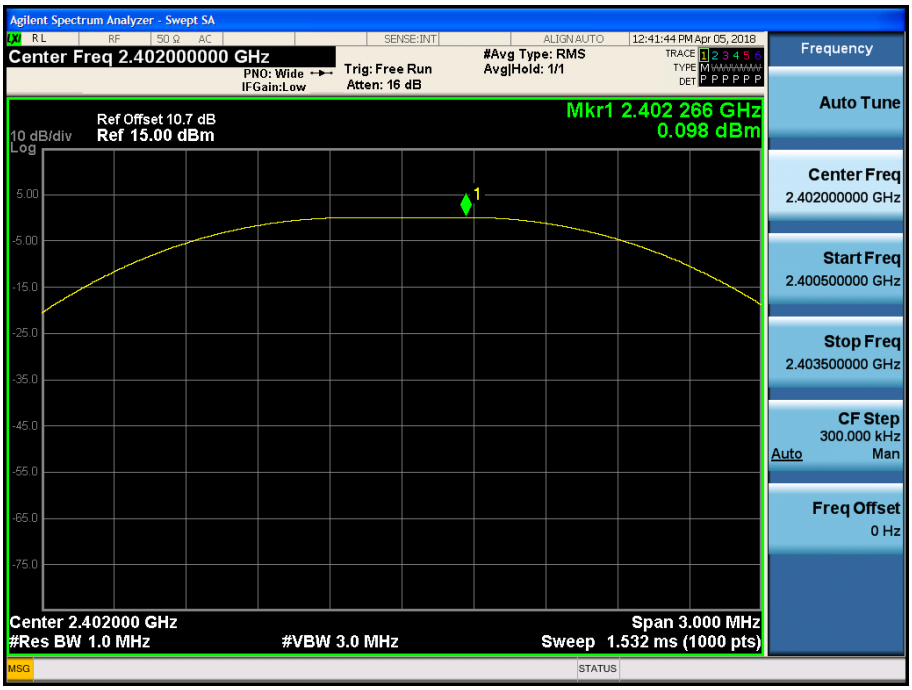


Conducted Output Power (High-CH 39)

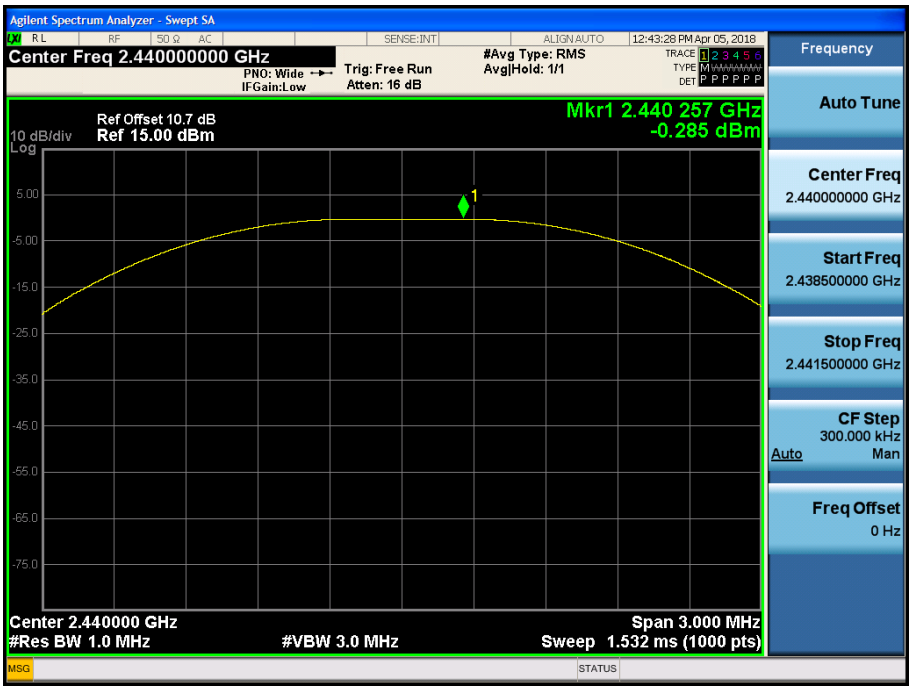


▣ 5.0 LE 1M: 255 Byte RESULT PLOTS-Peak

Conducted Output Power (Low-CH 0)



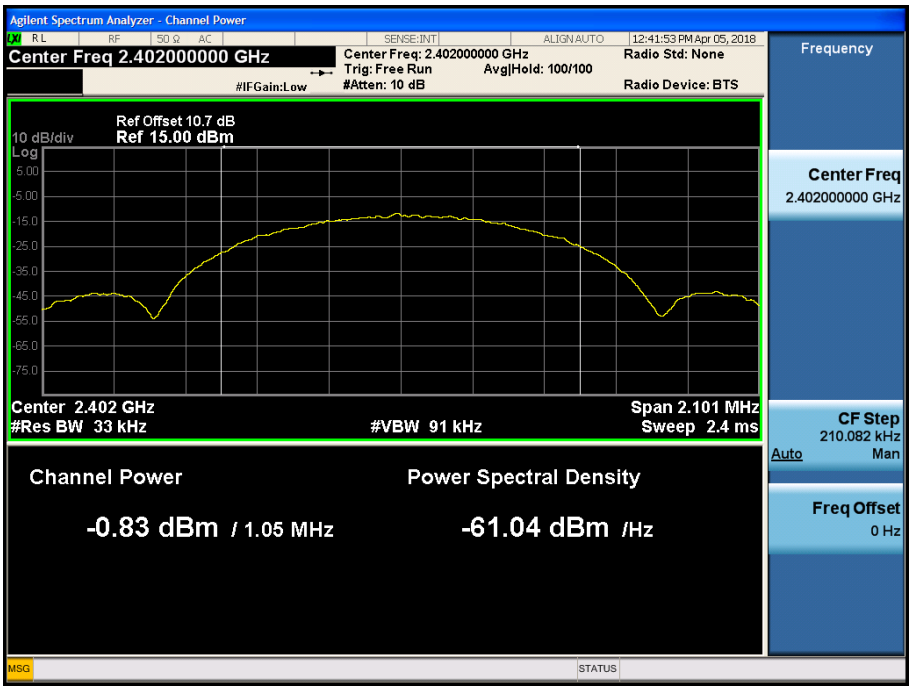
Conducted Output Power (Mid-CH 19)



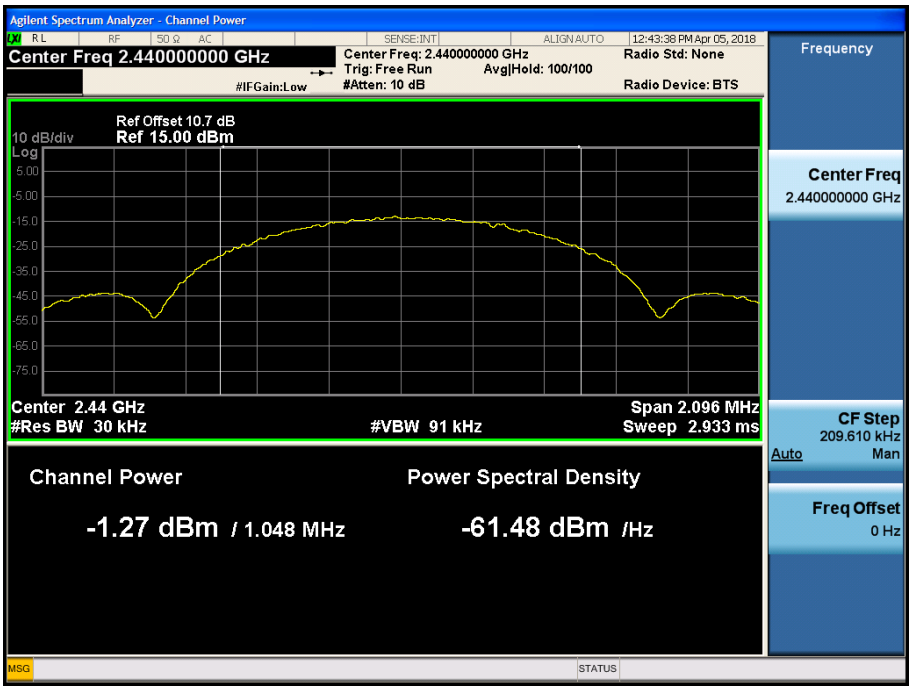
Conducted Output Power (High-CH 39)

▣ 5.0 LE 1M: 255 Byte RESULT PLOTS-Average

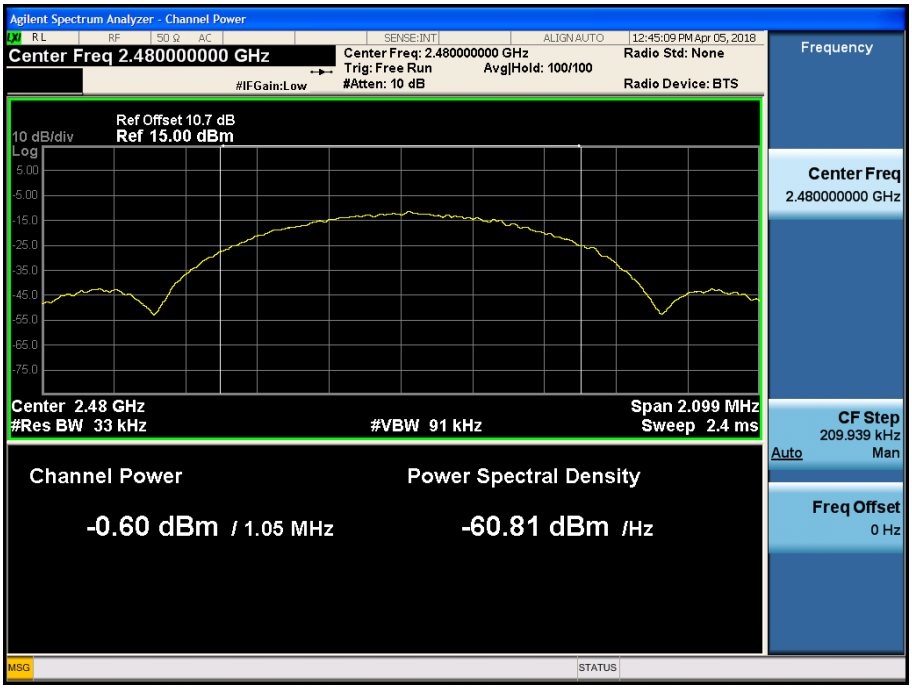
Conducted Output Power (Low-CH 0)



Conducted Output Power (Mid-CH 19)



Conducted Output Power (High-CH 39)



▣ 5.0 LE 2M: 37 Byte RESULT PLOTS-Peak

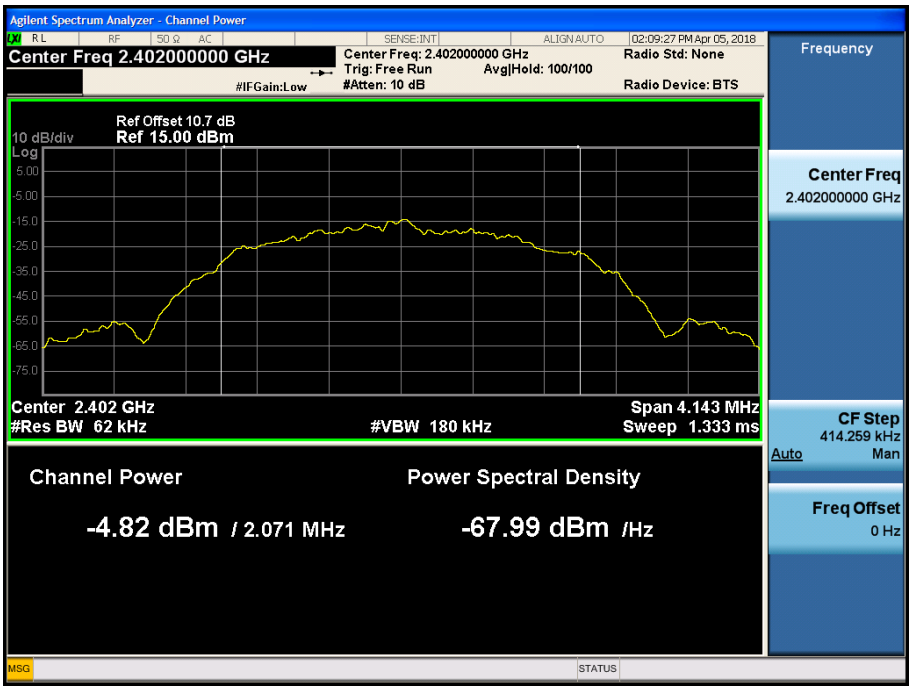
Conducted Output Power (Low-CH 0)

Conducted Output Power (Mid-CH 19)

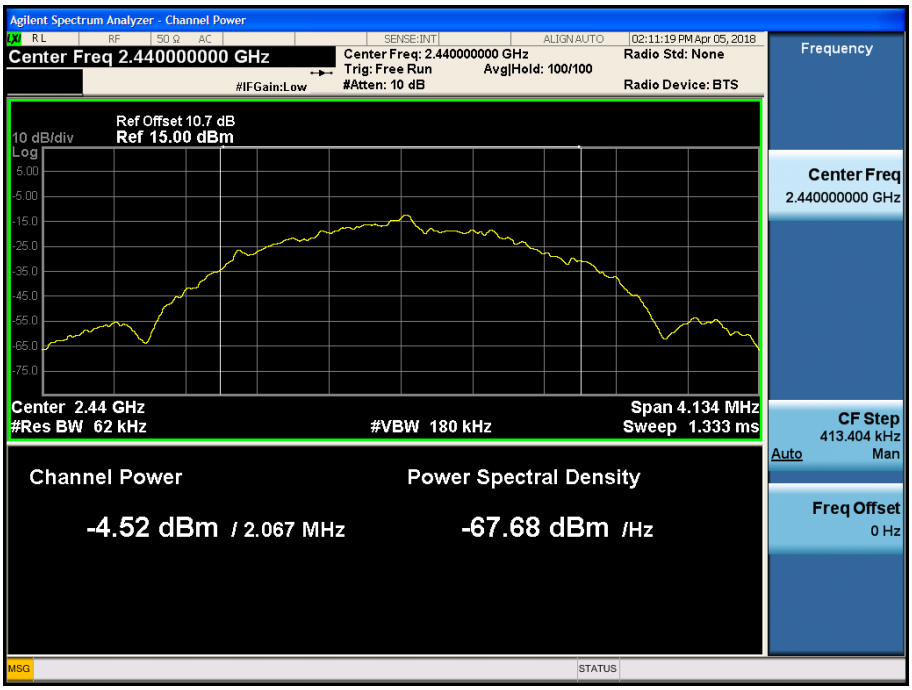
Conducted Output Power (High-CH 39)

▣ 5.0 LE 2M: 37 Byte RESULT PLOTS-Average

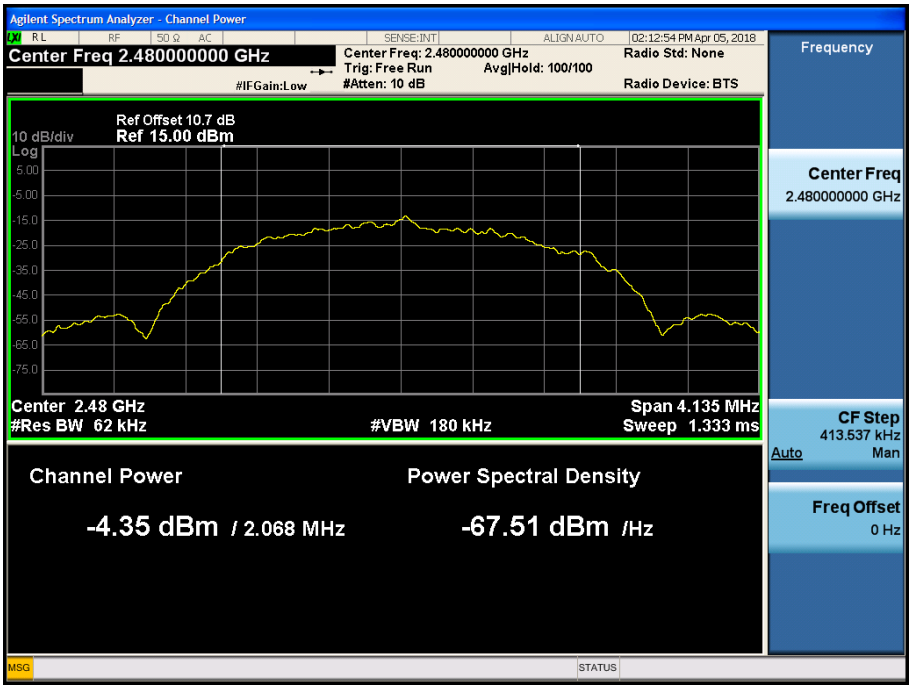
Conducted Output Power (Low-CH 0)



Conducted Output Power (Mid-CH 19)



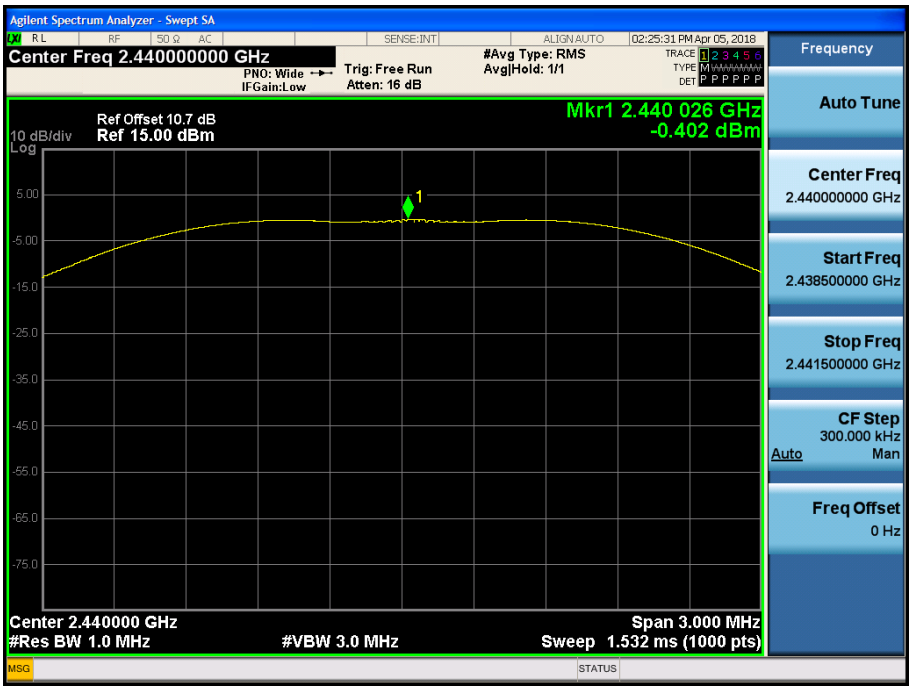
Conducted Output Power (High-CH 39)



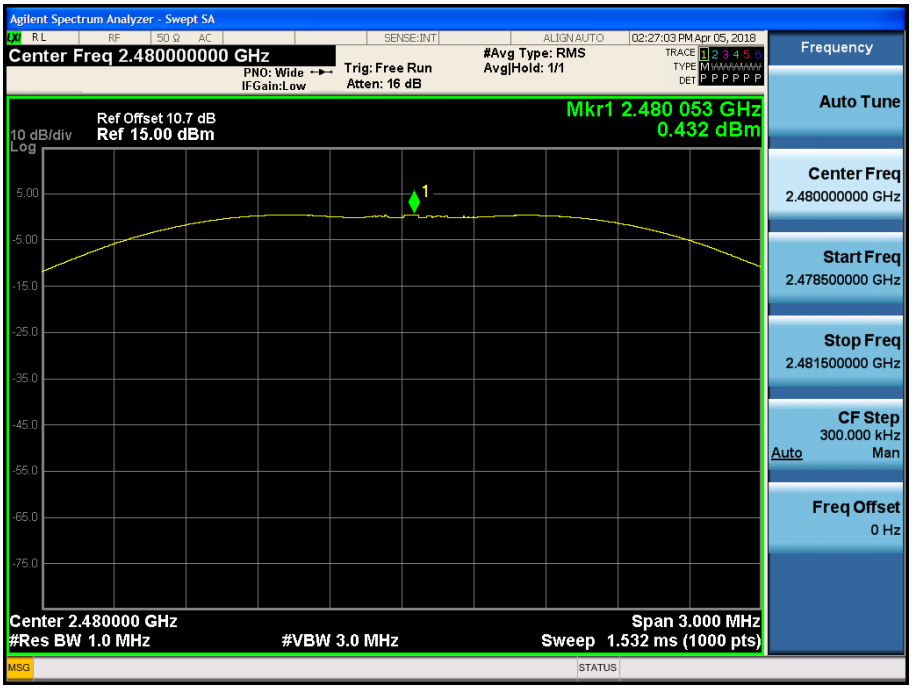
▣ 5.0 LE 2M: 255 Byte RESULT PLOTS-Peak

Conducted Output Power (Low-CH 0)

Conducted Output Power (Mid-CH 19)

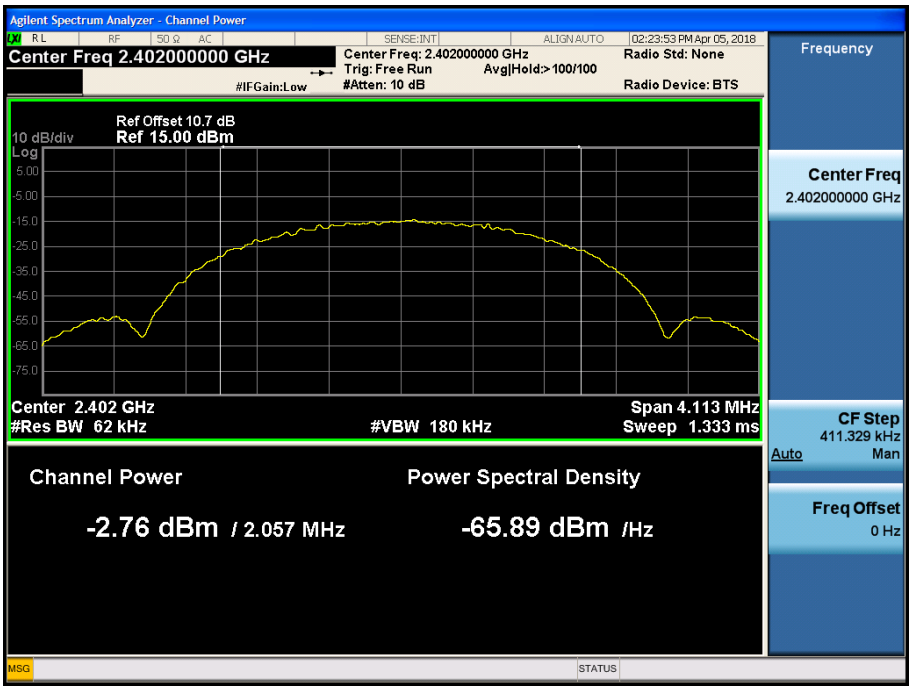


Conducted Output Power (High-CH 39)

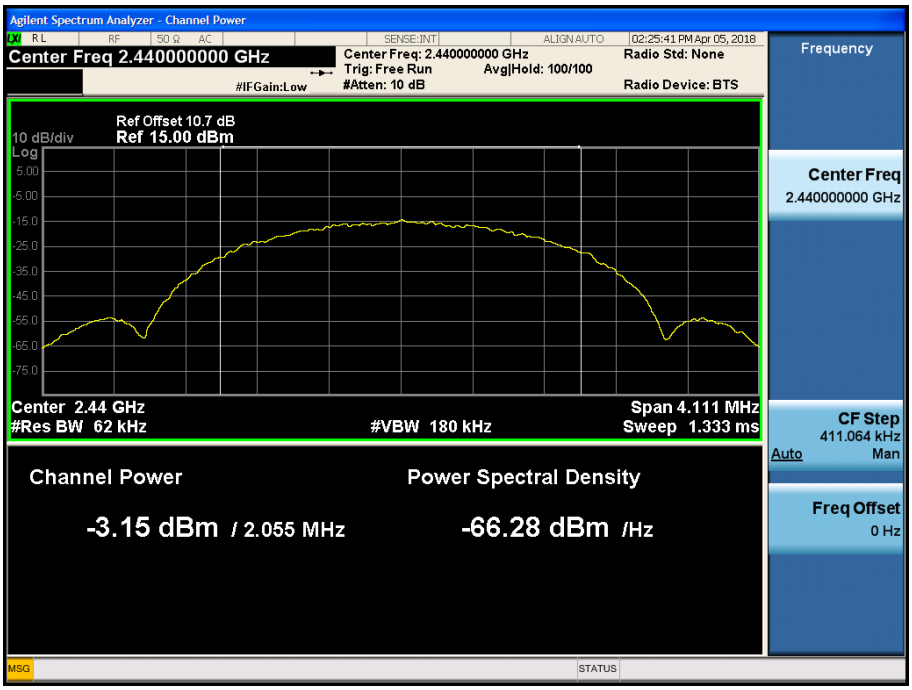


▣ 5.0 LE 2M: 255 Byte RESULT PLOTS-Average

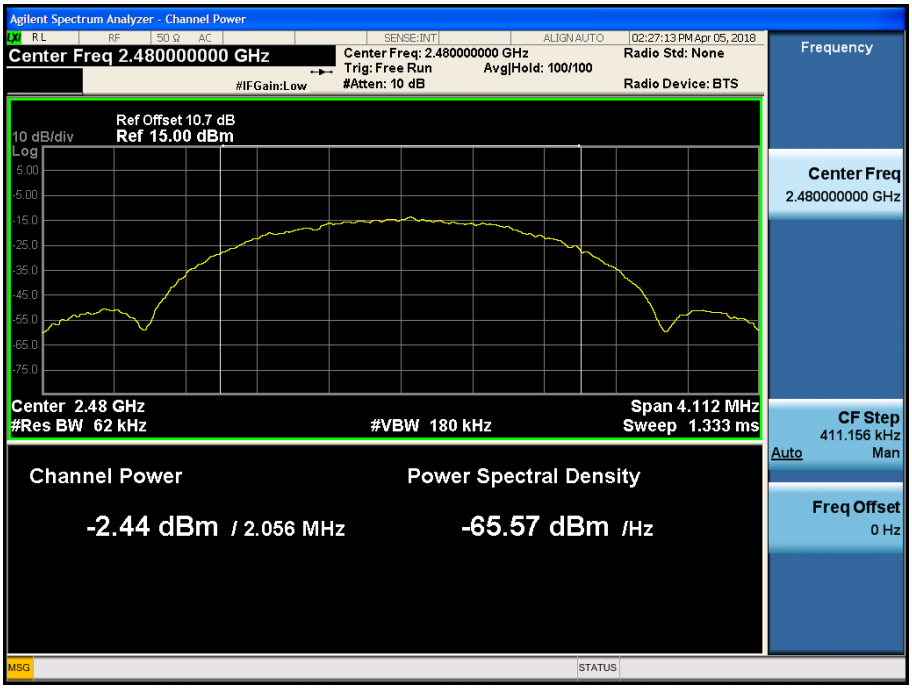
Conducted Output Power (Low-CH 0)



Conducted Output Power (Mid-CH 19)



Conducted Output Power (High-CH 39)



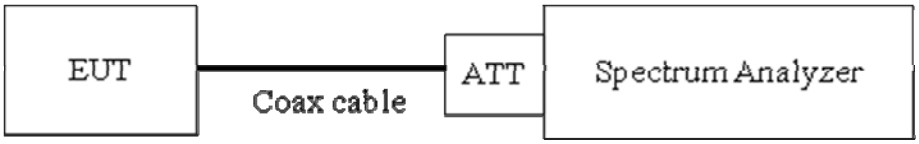
9.4 POWER SPECTRAL DENSITY

Test Requirements and limit, §15.247(e)

The peak power density is measured with a spectrum analyzer connected to the antenna terminal while the EUT is operating in transmission mode at the appropriate frequencies.

Minimum Standard – The transmitter power density average over 1-second interval shall not be greater than 8dBm in any 3kHz BW.

▣ TEST CONFIGURATION



▣ TEST PROCEDURE

We tested according to Procedure 10.2 in KDB 558074, issued 04/05/2017

The spectrum analyzer is set to :

Set analyzer center frequency to DTS channel center frequency.

Span = 1.5 times the DTS channel bandwidth.

RBW = 3 kHz ≤ RBW ≤ 100 kHz.

VBW ≥ 3 x RBW.

Sweep = auto couple

Detector = peak

Trace Mode = max hold

Allow trace to fully stabilize.

Use the peak marker function to determine the maximum amplitude level within the RBW.

If measured value exceeds limit, reduce RBW (no less than 3 kHz) and repeat.

▣ Sample Calculation

PSD = Reading Value + ATT loss + Cable loss(1 ea)

Output Power = -5 dBm + 10 dB + 0.8 dB = 5.8 dBm

Note :

1. Spectrum reading values are not plot data. The PSD results in plot is already including the actual values of loss for the attenuator and cable combination.
2. Spectrum offset = Attenuator loss + Cable loss
3. We apply to the offset in the 2.4 GHz range that was rounded off to the closest tenth dB. So,10.7 dB is offset for 2.4 GHz Band.

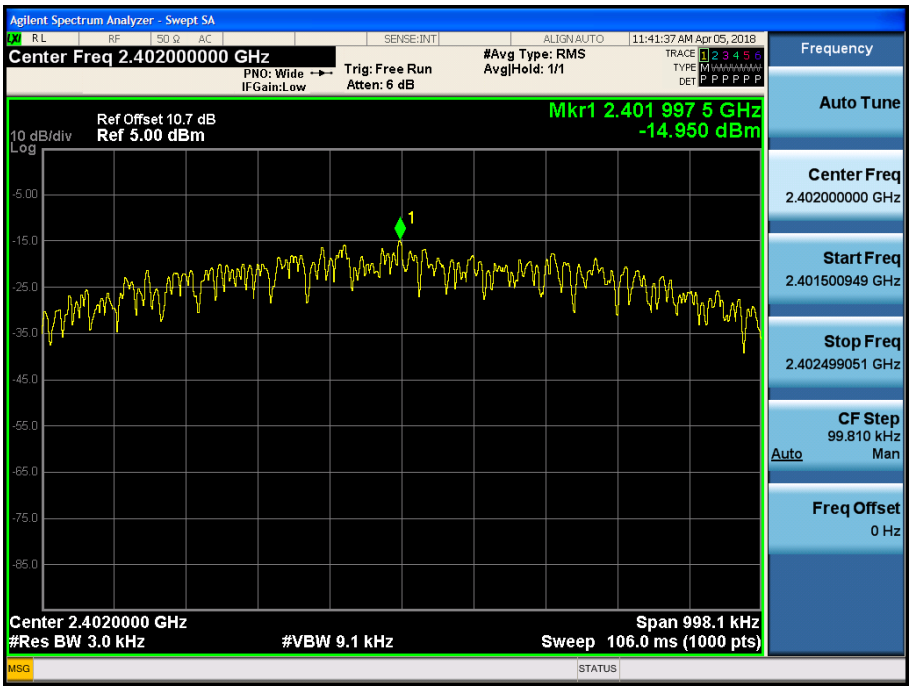
▣ TEST RESULTS

Conducted Power Density Measurements

Frequency (MHz)	Channel No.	Mode	Test Result		
			PSD (dBm)	Limit (dBm)	Pass/ Fail
2402	0	4.2 LE: 37 Byte	-14.950	8	Pass
2440	19		-15.347	8	Pass
2480	39		-14.337	8	Pass
2402	0	4.2 LE: 255 Byte	-16.284	8	Pass
2440	19		-16.563	8	Pass
2480	39		-15.652	8	Pass
2402	0	5.0 LE 1M: 37 Byte	-15.066	8	Pass
2440	19		-15.382	8	Pass
2480	39		-14.486	8	Pass
2402	0	5.0 LE 1M: 255 Byte	-16.219	8	Pass
2440	19		-16.894	8	Pass
2480	39		-15.845	8	Pass
2402	0	5.0 LE 2M: 37 Byte	-18.325	8	Pass
2440	19		-18.502	8	Pass
2480	39		-17.570	8	Pass
2402	0	5.0 LE 2M: 255 Byte	-19.074	8	Pass
2440	19		-19.215	8	Pass
2480	39		-18.301	8	Pass

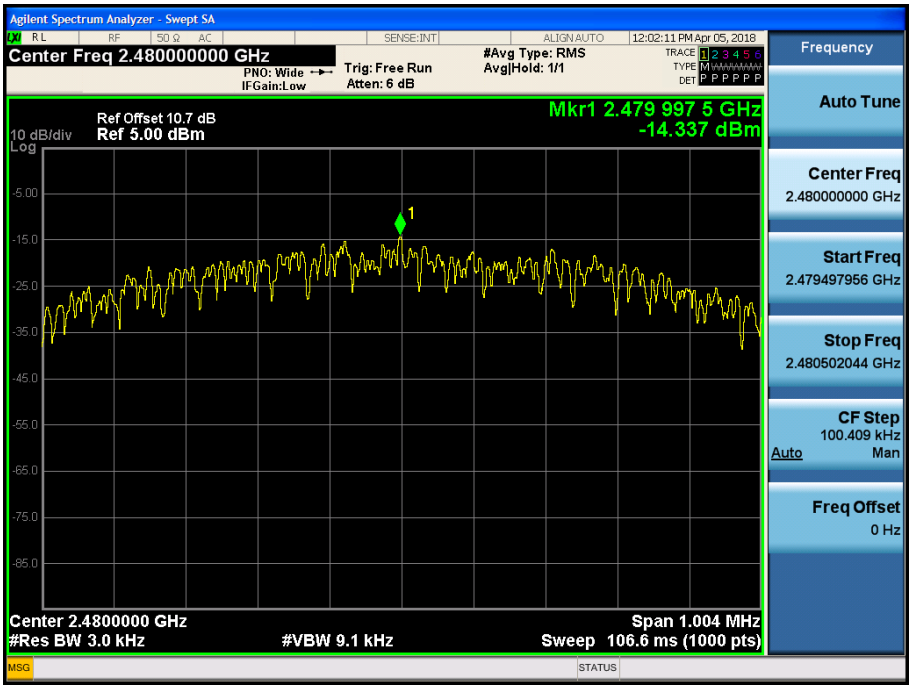
▣ 4.2 LE: 37 Byte RESULT PLOTS

Power Spectral Density (Low-CH 0)



Power Spectral Density (Mid-CH 19)

Power Spectral Density (High-CH 39)



▣ 4.2 LE: 255 Byte RESULT PLOTS

Power Spectral Density (Low-CH 0)

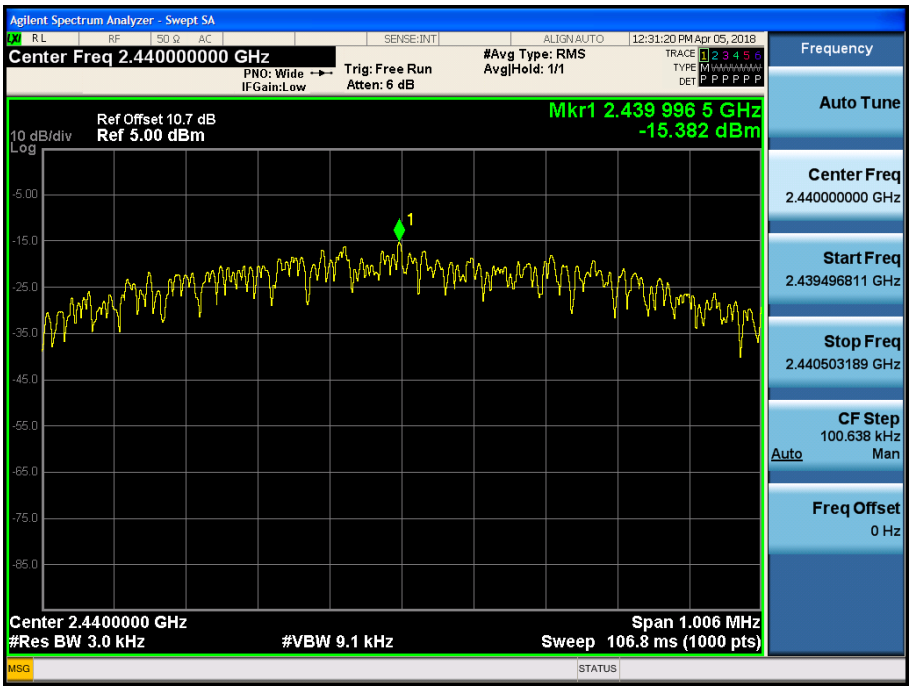
Power Spectral Density (Mid-CH 19)

Power Spectral Density (High-CH 39)

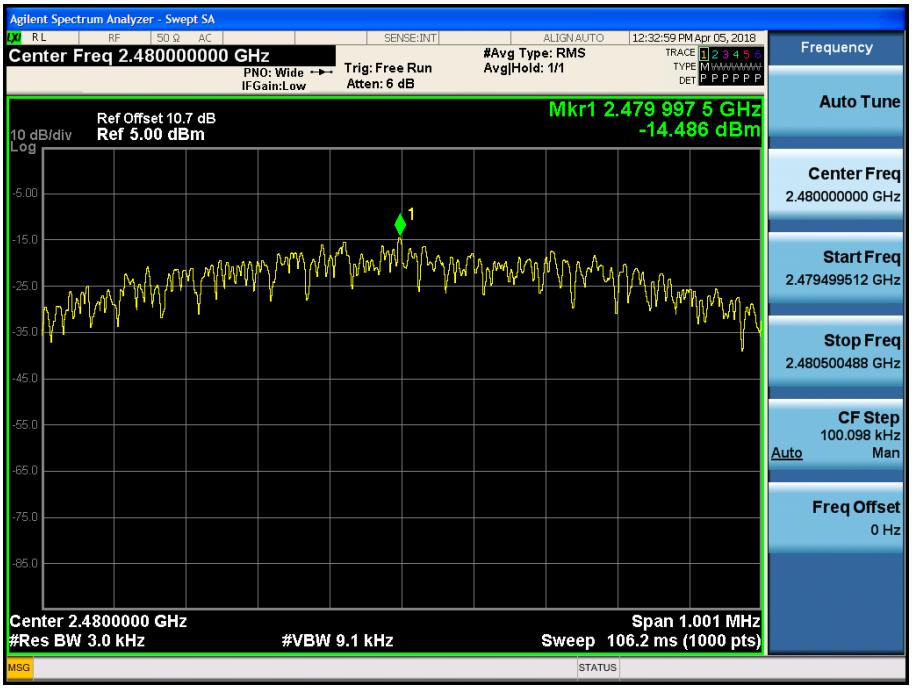
▣ 5.0 LE 1M: 37 Byte RESULT PLOTS

Power Spectral Density (Low-CH 0)

Power Spectral Density (Mid-CH 19)



Power Spectral Density (High-CH 39)



▣ 5.0 LE 1M: 255 Byte RESULT PLOTS

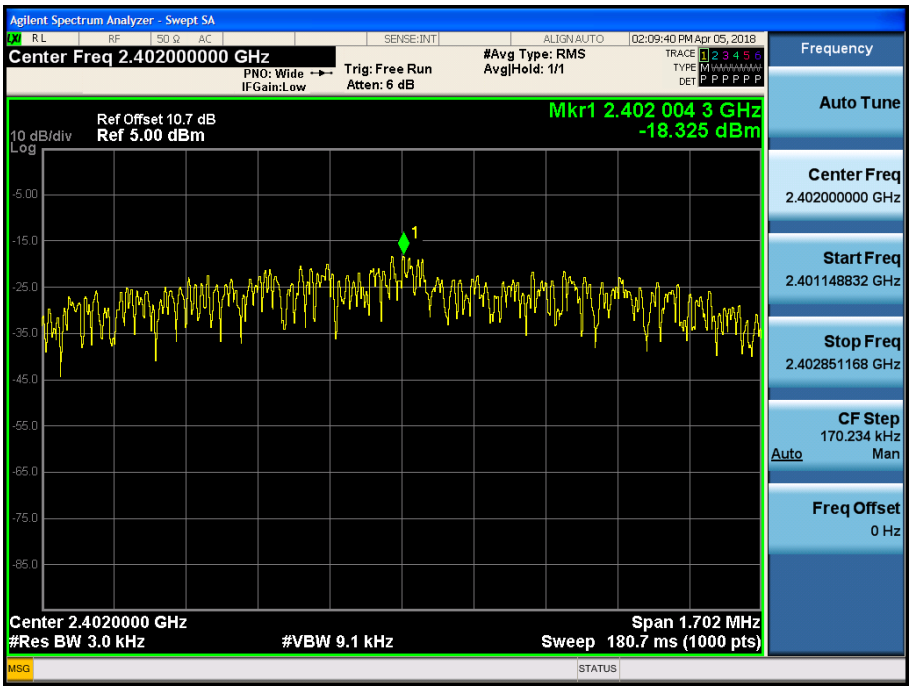
Power Spectral Density (Low-CH 0)

Power Spectral Density (Mid-CH 19)

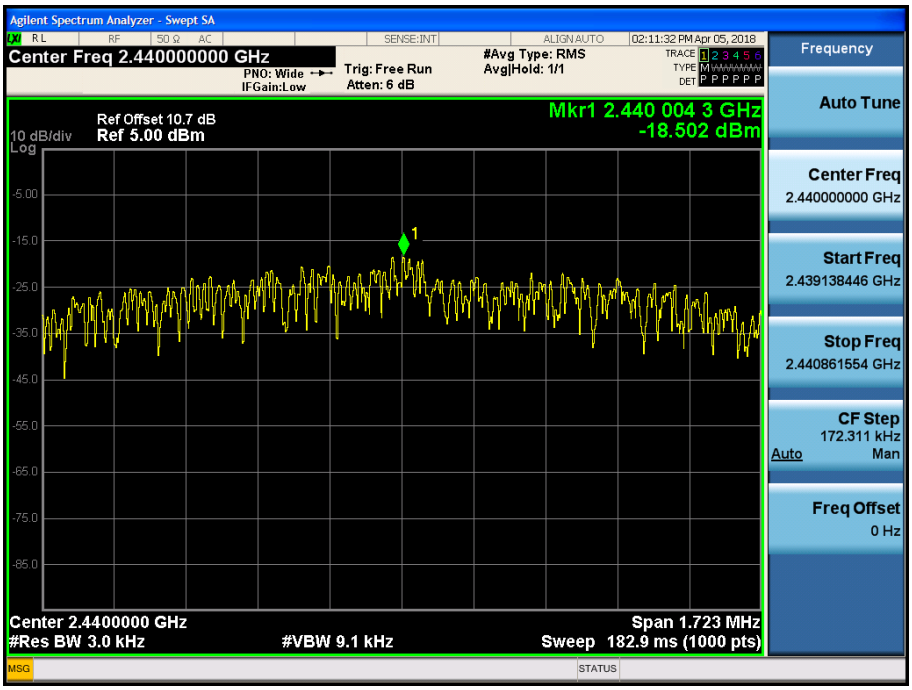
Power Spectral Density (High-CH 39)

▣ 5.0 LE 2M: 37 Byte RESULT PLOTS

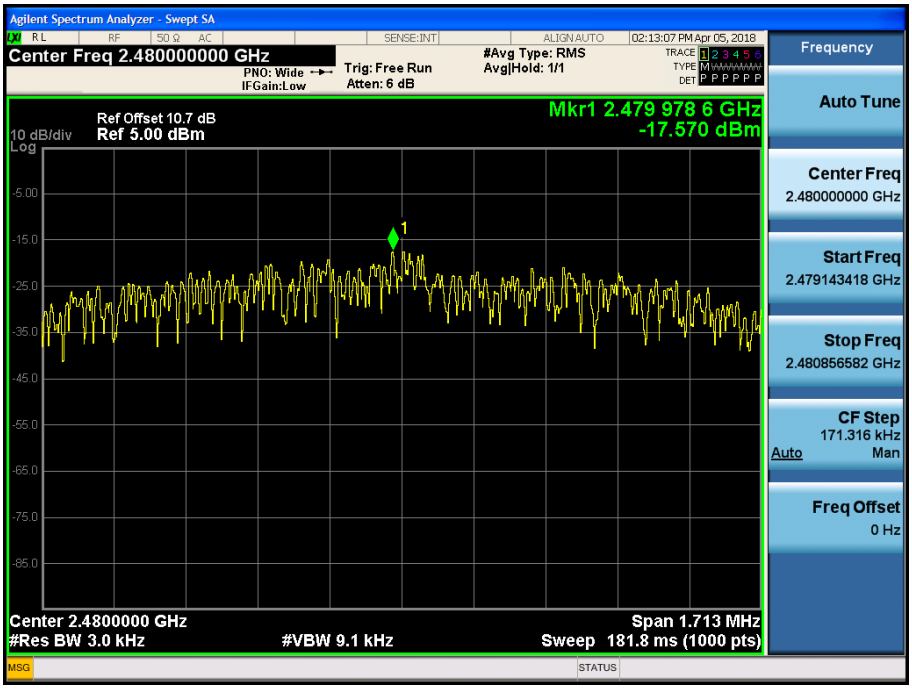
Power Spectral Density (Low-CH 0)



Power Spectral Density (Mid-CH 19)



Power Spectral Density (High-CH 39)



▣ 5.0 LE 2M: 255 Byte RESULT PLOTS

Power Spectral Density (Low-CH 0)

Power Spectral Density (Mid-CH 19)

Power Spectral Density (High-CH 39)

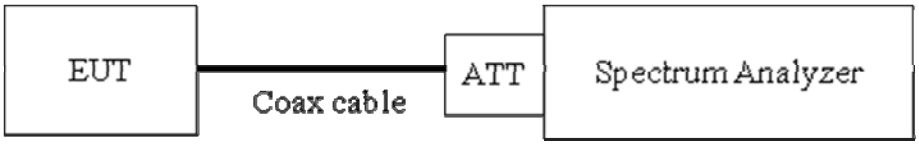
9.5 OUT OF BAND EMISSIONS AT THE BAND EDGE/ CONDUCTED SPURIOUS EMISSIONS

Test Requirements and limit, §15.247(d)

In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement, provided the transmitter demonstrates compliance with the peak conducted power limits. If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval, as permitted under paragraph (b)(3) of this section, the attenuation required under this paragraph shall be 30 dB instead of 20 dB. Attenuation below the general limits specified in § 15.209(a) is not required. In addition, radiated emissions which fall in the restricted bands, as defined in § 15.205(a), must also comply with the radiated emission limits specified in § 15.209(a) (see § 15.205(c)).

Limit : 30 dBc

▣ TEST CONFIGURATION



▣ TEST PROCEDURE

The transmitter output is connected to the spectrum analyzer. (Procedure 11.0 in KDB 558074 v04)

RBW = 100 kHz

VBW ≥ 3 x RBW

Set span to encompass the spectrum to be examined

Detector = Peak

Trace Mode = max hold

Sweep time = auto couple

Ensure that the number of measurement points ≥ 2*Span/RBW

Allow trace to fully stabilize.

Use peak marker function to determine the maximum amplitude level.

Measurements are made over the 30 MHz to 10th harmonic range with the transmitter set to the lowest, middle, and highest channels.

Note :

1. The maximum conducted (average) output power was used to demonstrate compliance as described in 9.2, then the peak power in any 100 kHz bandwidth outside of the authorized frequency band shall be attenuated by at least 30 dB relative to the maximum in-band peak PSD level in 100 kHz (i.e., 30 dBc).

2. The band edge results in plot is already including the actual values of loss for the attenuator and cable combination.
3. Spectrum offset = Attenuator loss + Cable loss
4. We apply to the offset in the 2.4 GHz range that was rounded off to the closest tenth dB. So, 10.7 dB is offset for 2.4 GHz Band.
5. In case of conducted spurious emissions test, please check factors blow table.
6. In order to simplify the report, attached plots were only the worst case channel and data rate.

▣ FACTORS FOR FREQUENCY

Freq(MHz)	Factor(dB)
30	11.30
100	9.83
200	10.19
300	10.13
400	10.23
500	10.25
600	10.32
700	10.35
800	10.35
900	10.34
1000	10.39
2000	10.64
2400*	10.65
2500*	10.67
3000	10.68
4000	10.89
5000	11.07
6000	11.06
7000	11.35
8000	11.32
9000	11.48
10000	11.56
11000	11.56
12000	11.68
13000	11.83
14000	11.90
15000	11.98
16000	12.04

17000	12.02
18000	12.08
19000	12.07
20000	12.14
21000	12.17
22000	12.31
23000	12.60
24000	12.34
25000	12.53

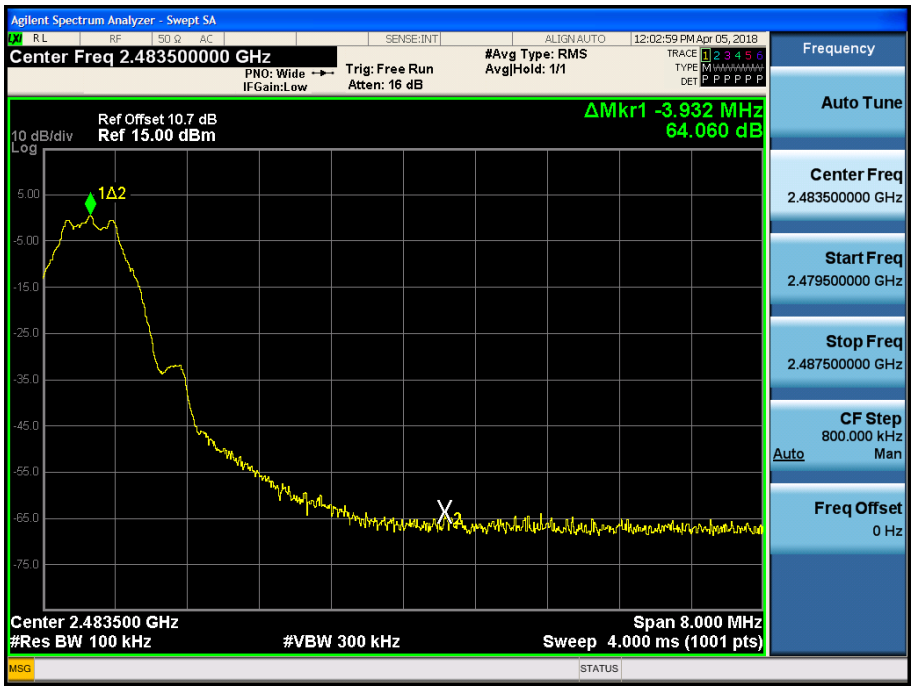
Note : 1. '*' is fundamental frequency range.

2. Factor = Cable loss + Attenuator loss

▣ 4.2 LE: 37 Byte RESULT PLOTS

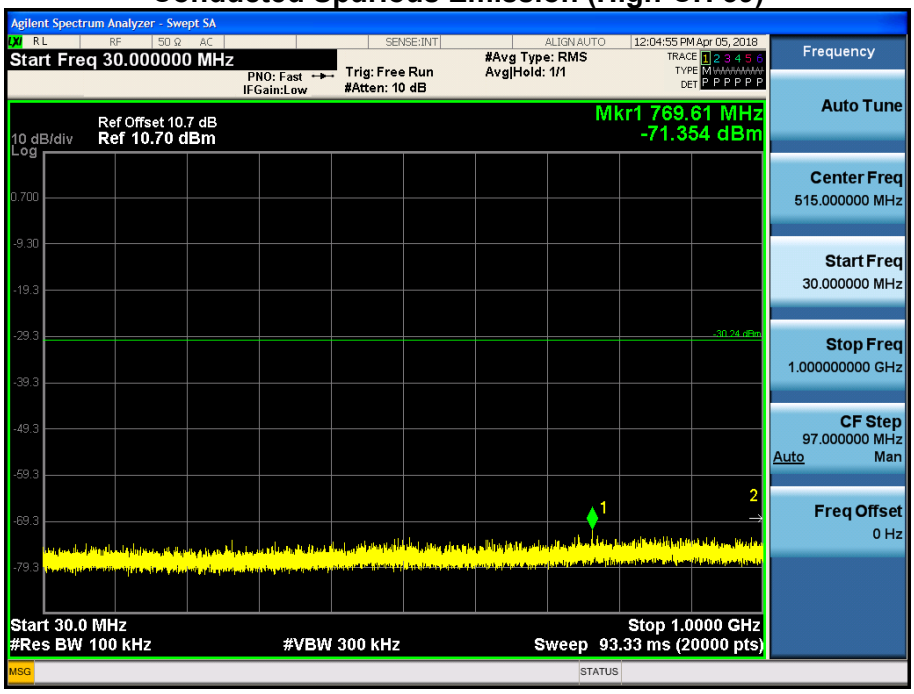
BandEdge (Low-CH 0)

BandEdge (High-CH 39)



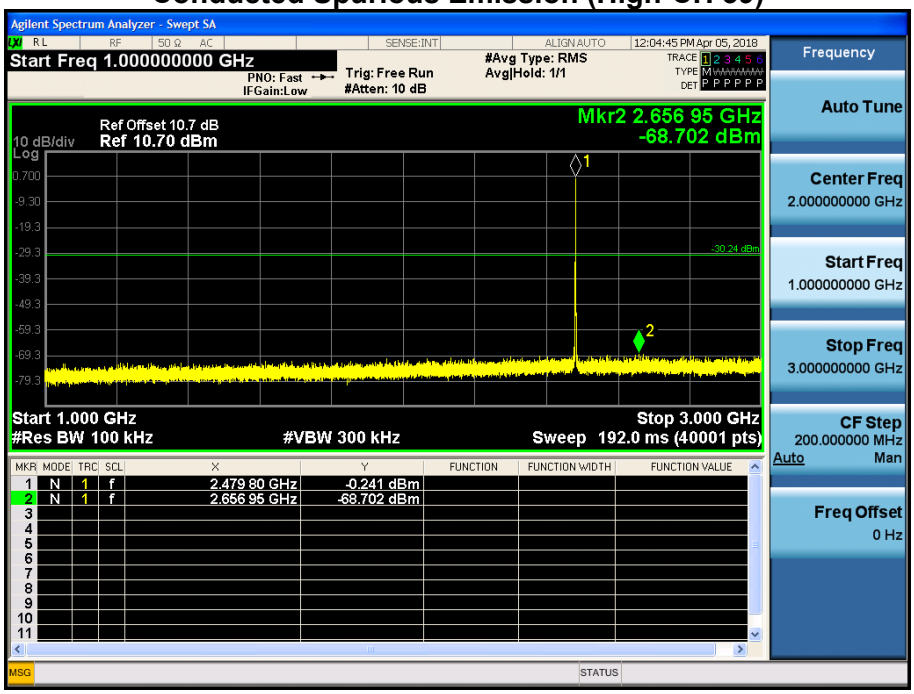
30 MHz ~ 1 GHz

Conducted Spurious Emission (High-CH 39)



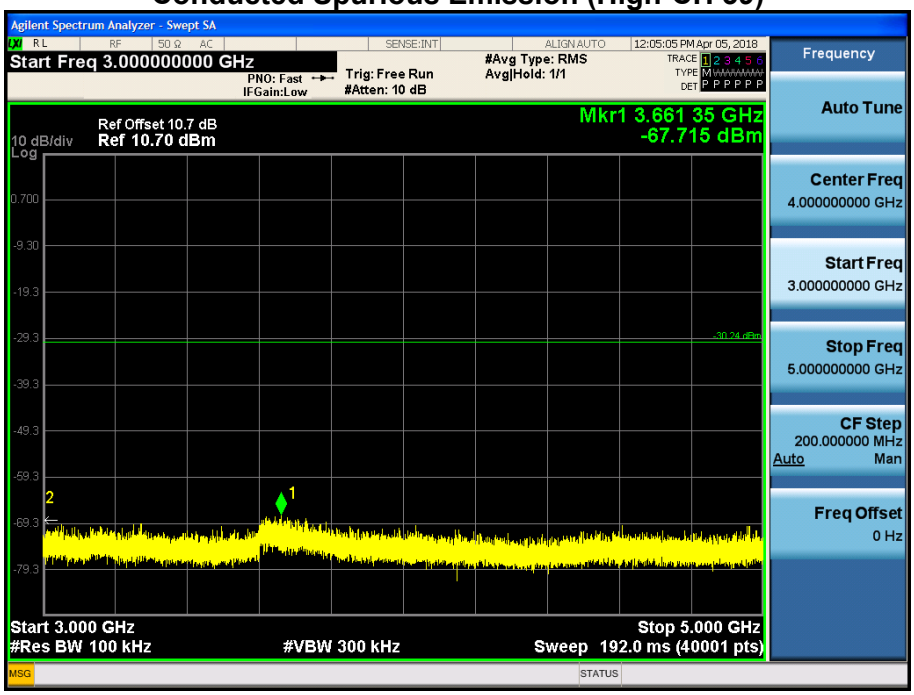
1 GHz ~ 3 GHz

Conducted Spurious Emission (High-CH 39)



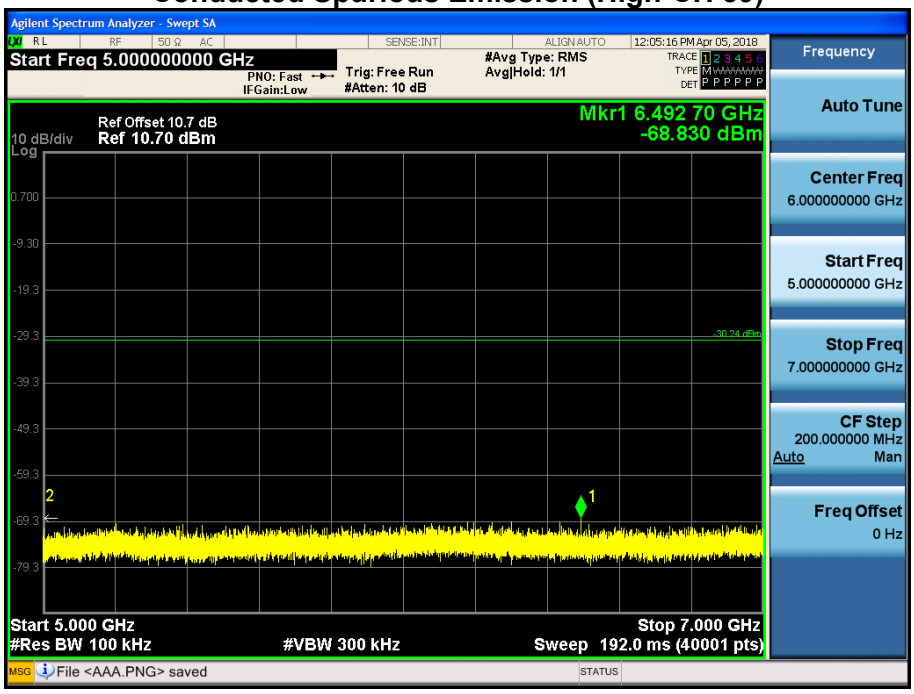
3 GHz ~ 5 GHz

Conducted Spurious Emission (High-CH 39)



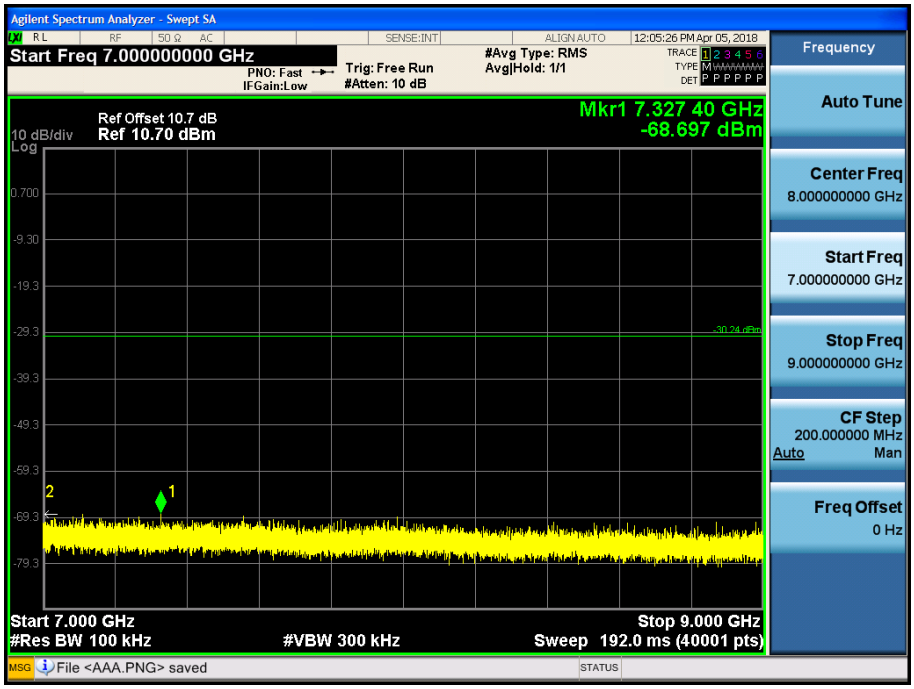
5 GHz ~ 7 GHz

Conducted Spurious Emission (High-CH 39)



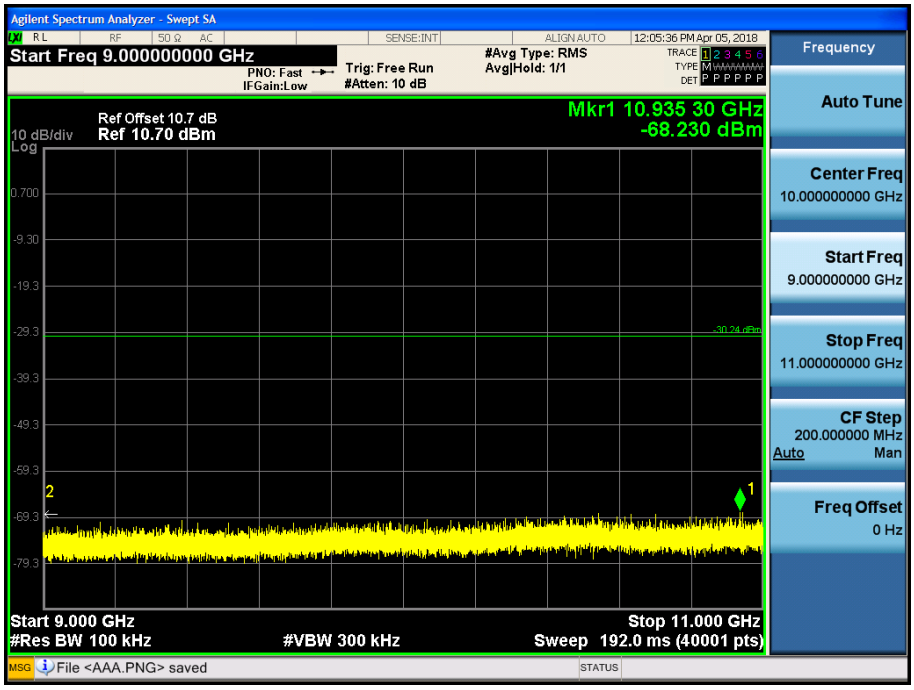
7 GHz ~ 9 GHz

Conducted Spurious Emission (High-CH 39)



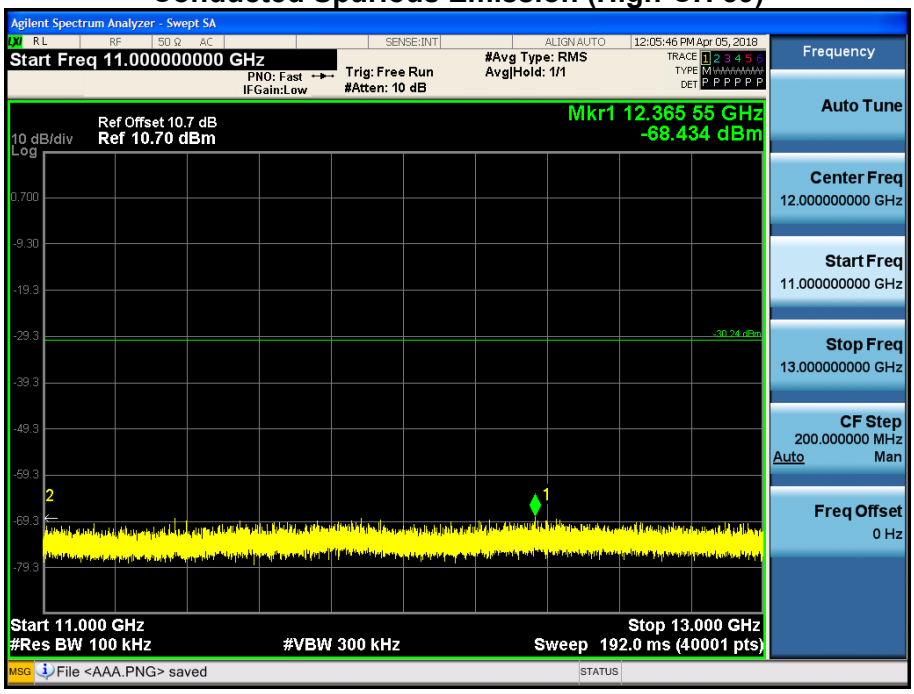
9 GHz ~ 11 GHz

Conducted Spurious Emission (High-CH 39)



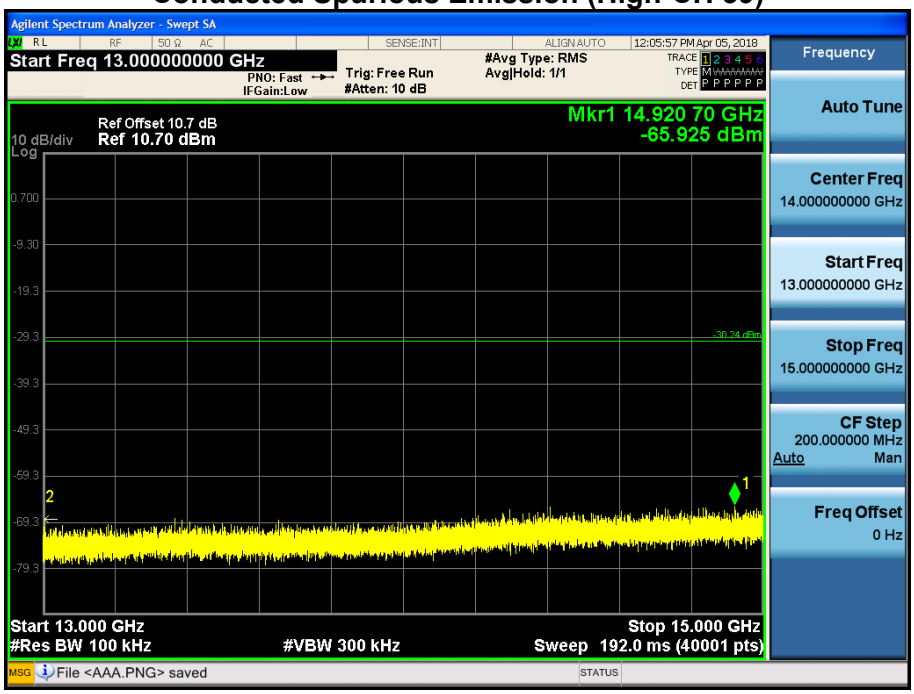
11 GHz ~ 13 GHz

Conducted Spurious Emission (High-CH 39)



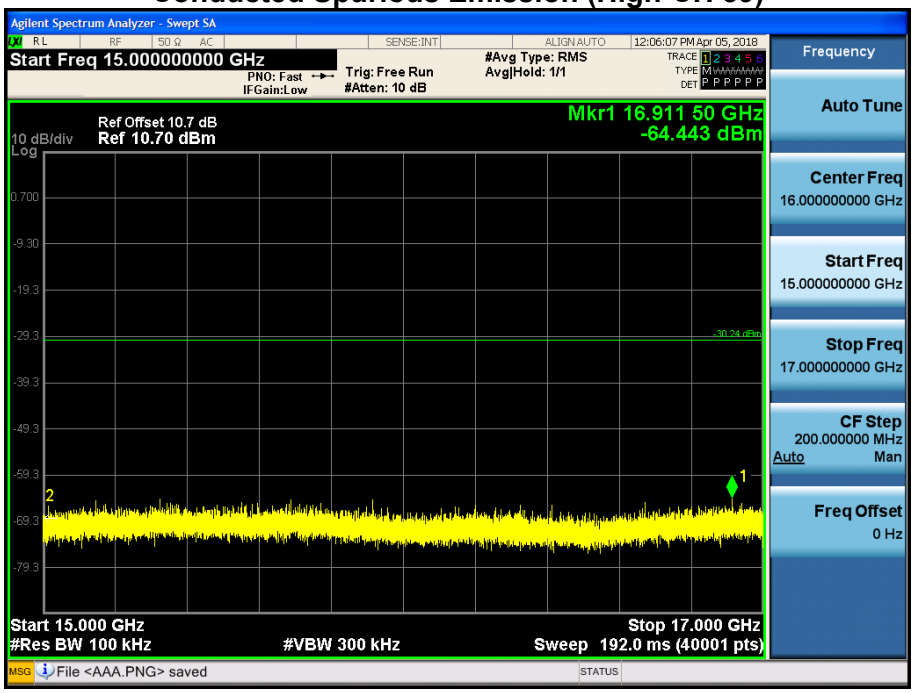
13 GHz ~ 15 GHz

Conducted Spurious Emission (High-CH 39)



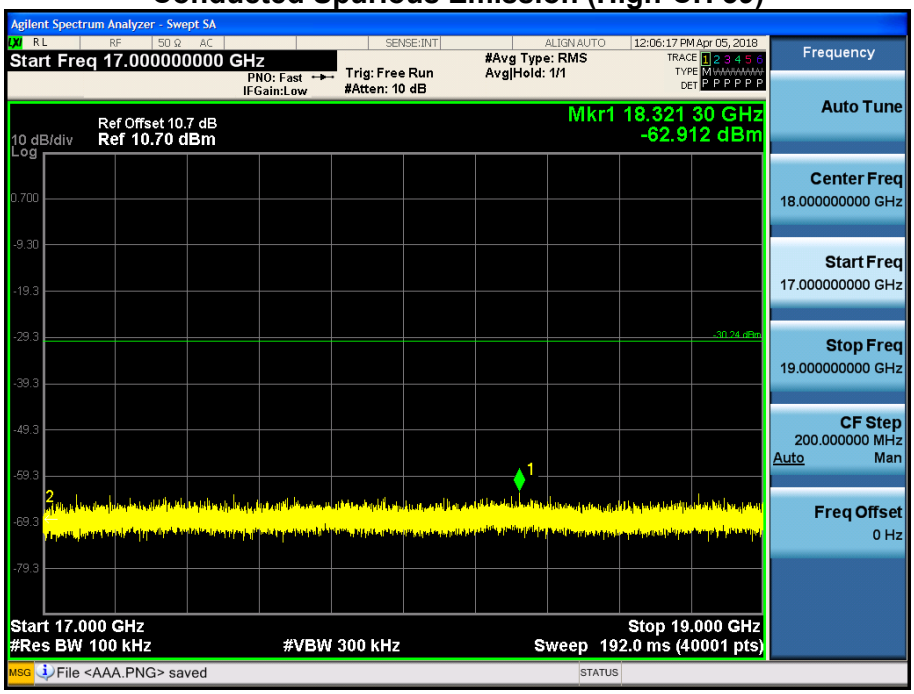
15 GHz ~ 17 GHz

Conducted Spurious Emission (High-CH 39)



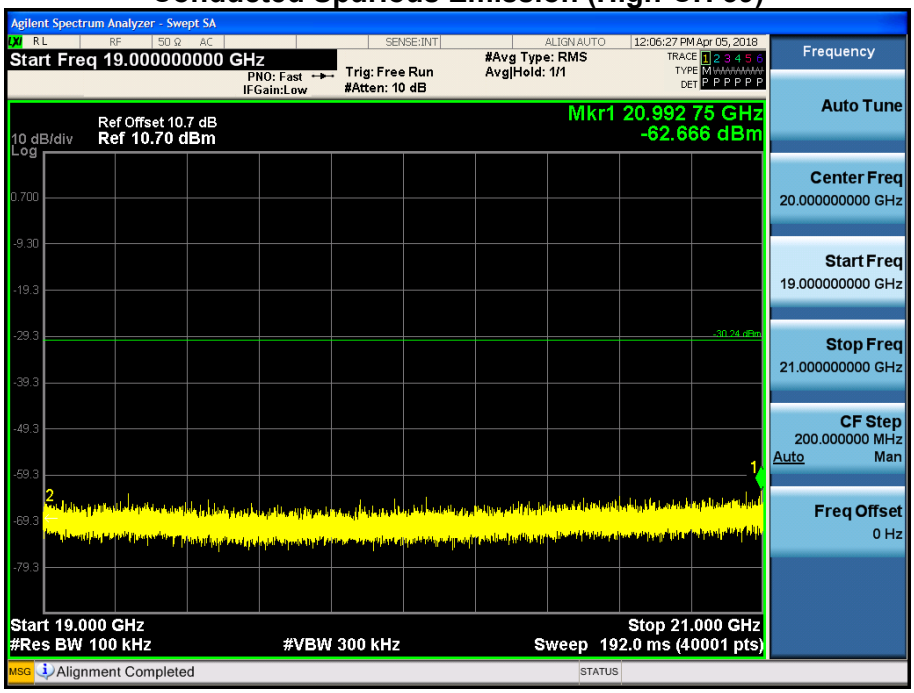
17 GHz ~ 19 GHz

Conducted Spurious Emission (High-CH 39)



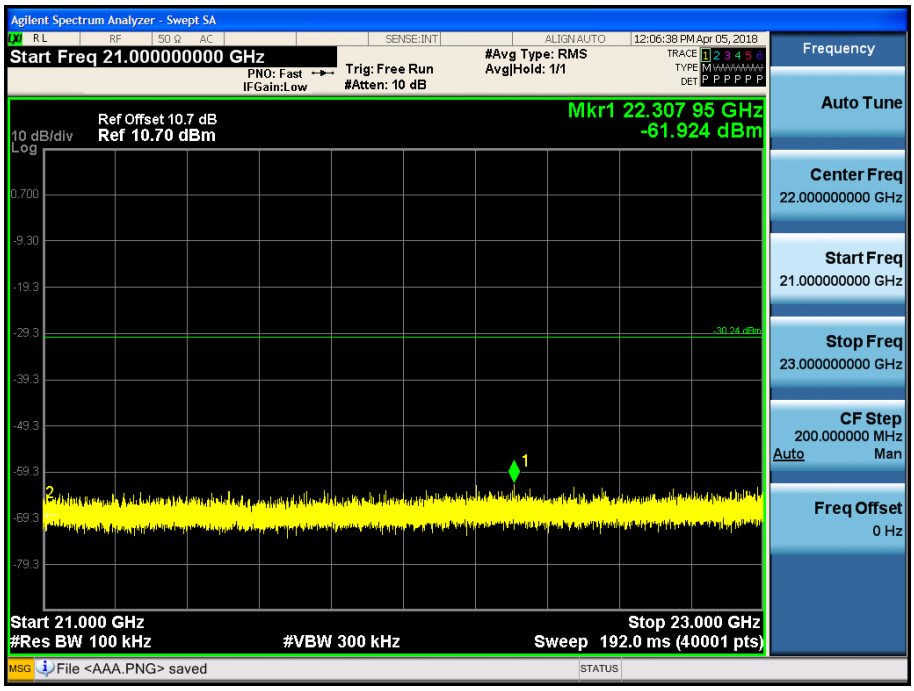
19 GHz ~ 21 GHz

Conducted Spurious Emission (High-CH 39)



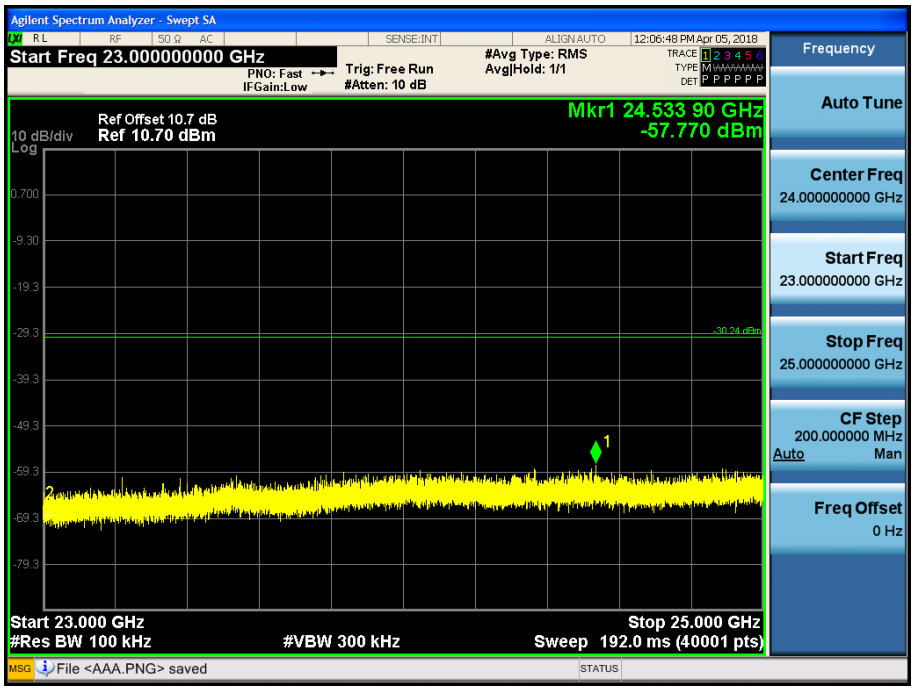
21 GHz ~ 23 GHz

Conducted Spurious Emission (High-CH 39)



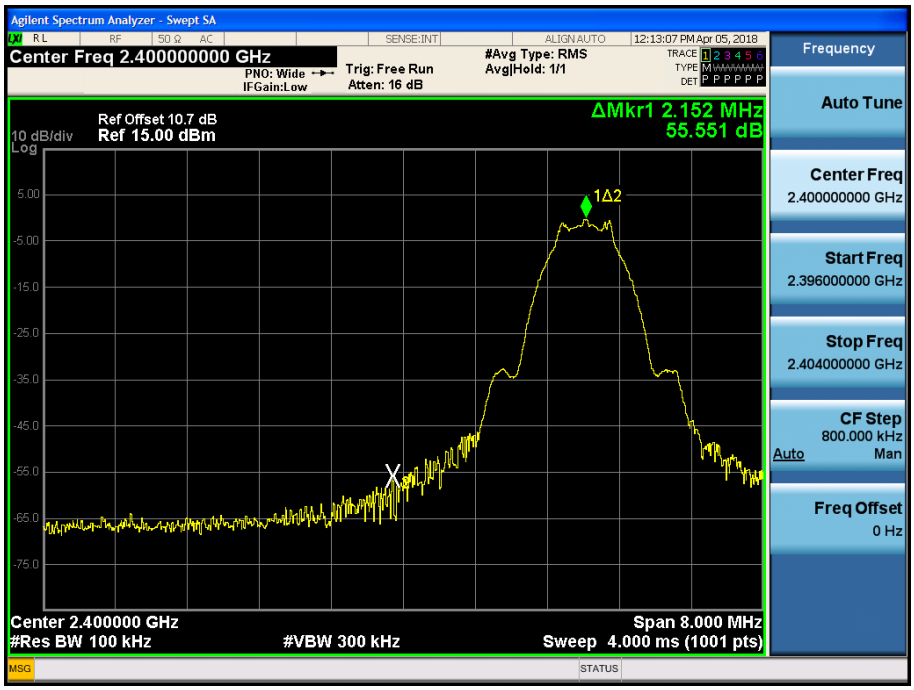
23 GHz ~ 25 GHz

Conducted Spurious Emission (High-CH 39)

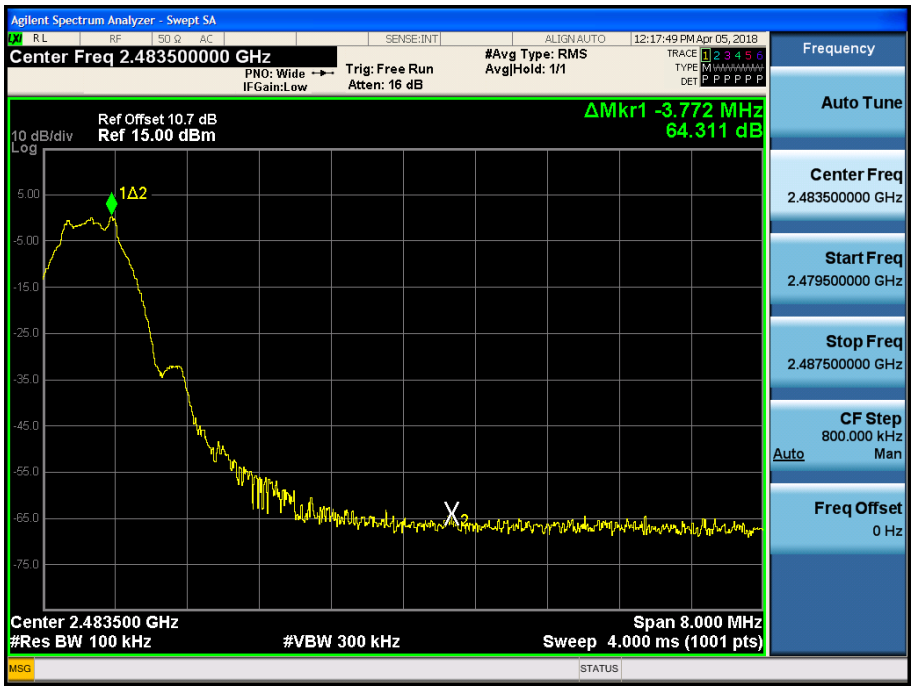


▣ 4.2 LE: 255 Byte RESULT PLOTS

BandEdge (Low-CH 0)

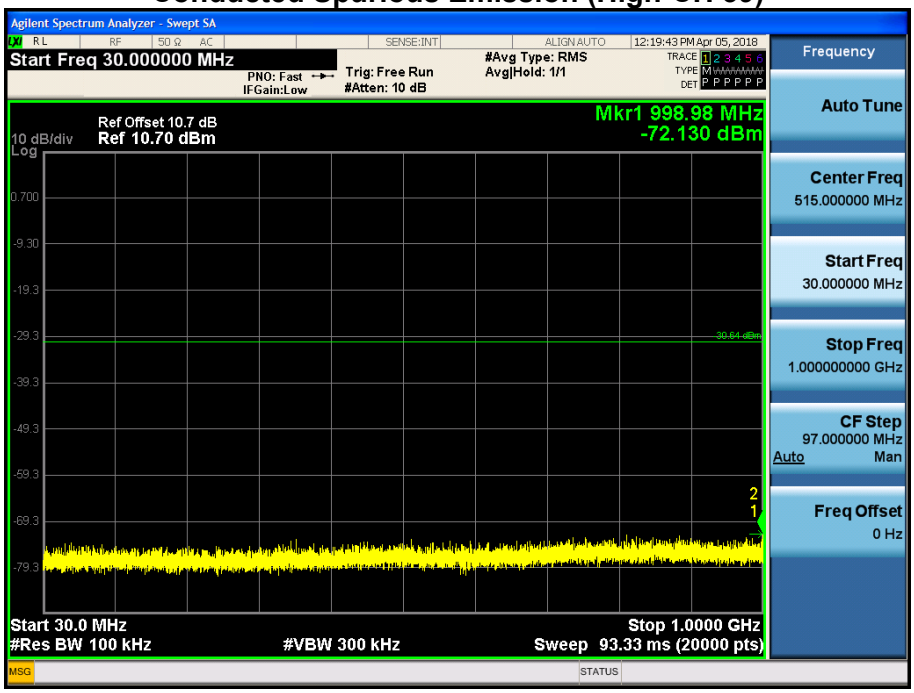


BandEdge (High-CH 39)



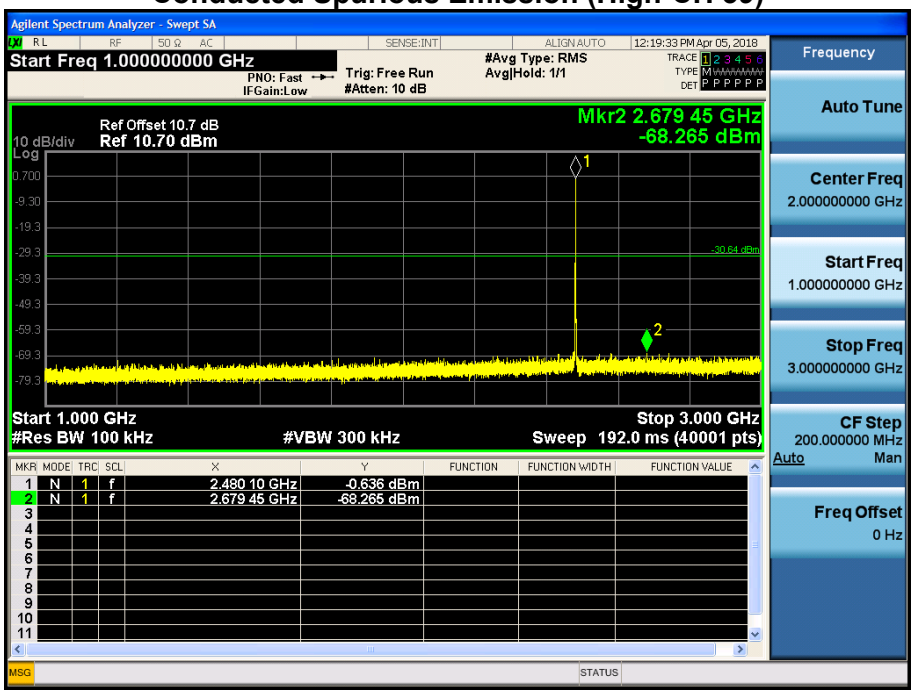
30 MHz ~ 1 GHz

Conducted Spurious Emission (High-CH 39)



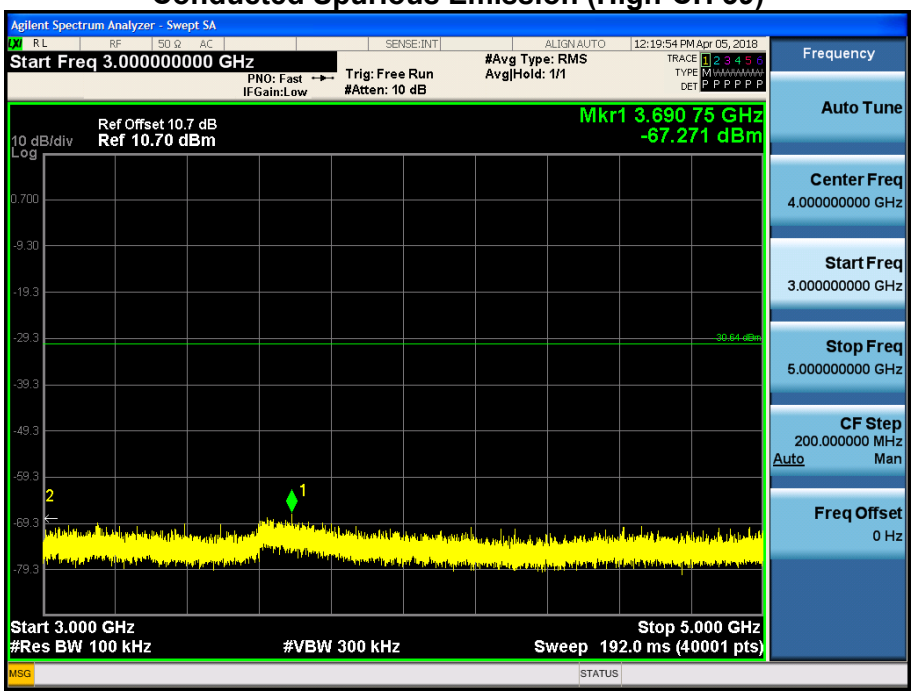
1 GHz ~ 3 GHz

Conducted Spurious Emission (High-CH 39)



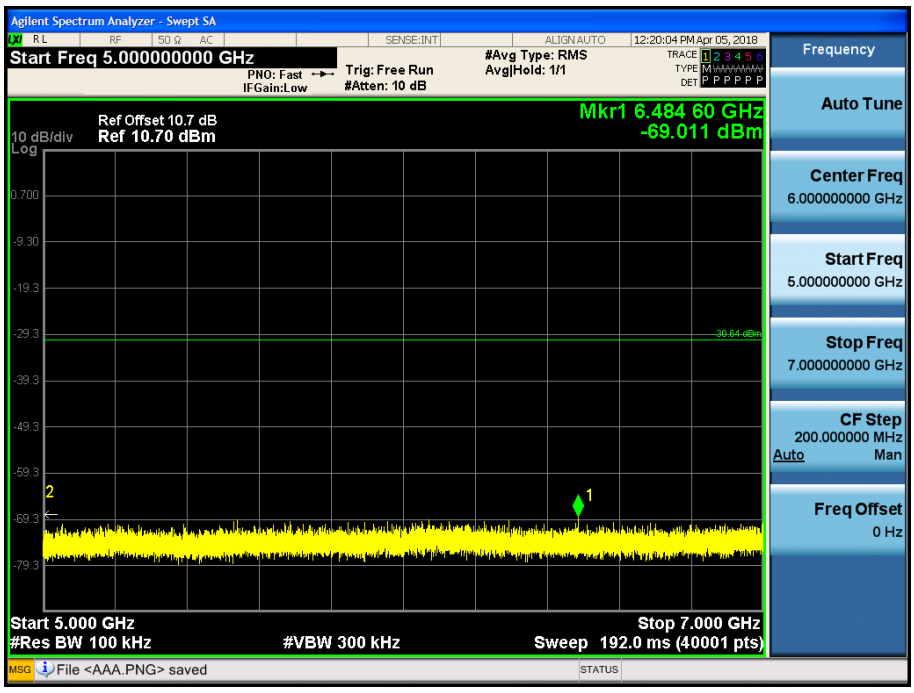
3 GHz ~ 5 GHz

Conducted Spurious Emission (High-CH 39)



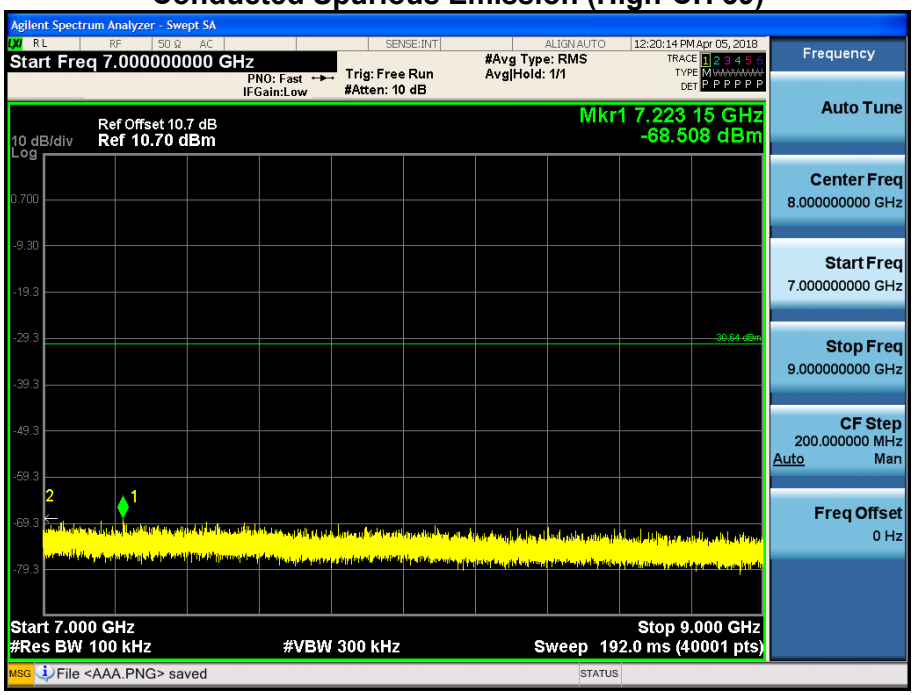
5 GHz ~ 7 GHz

Conducted Spurious Emission (High-CH 39)



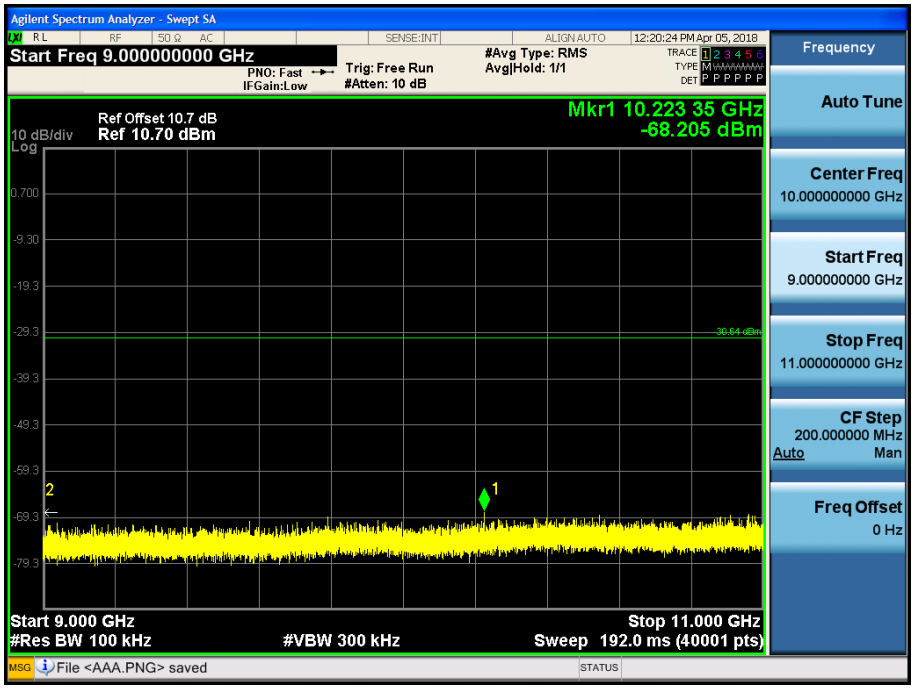
7 GHz ~ 9 GHz

Conducted Spurious Emission (High-CH 39)



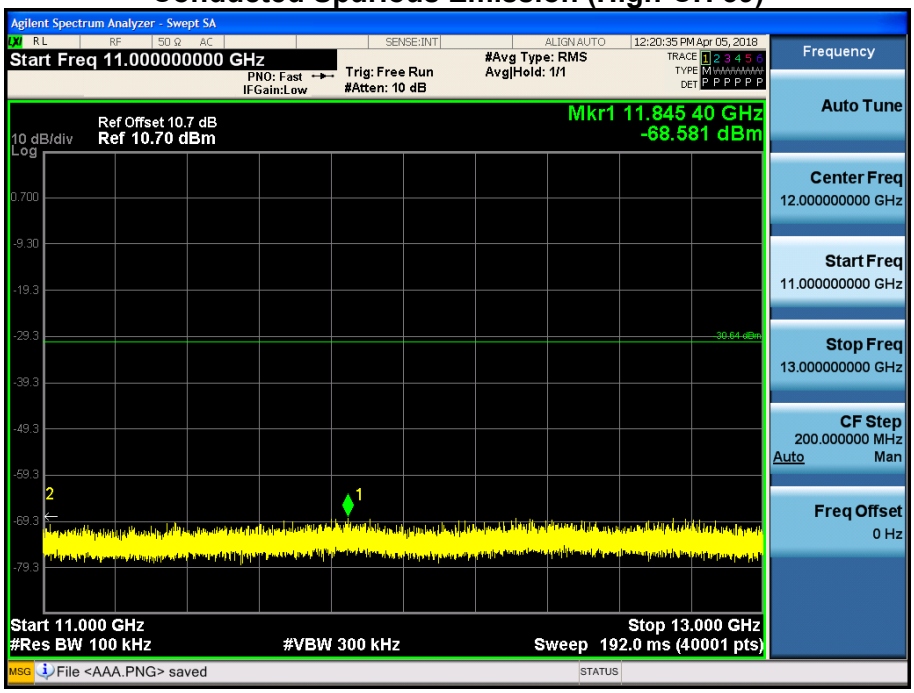
9 GHz ~ 11 GHz

Conducted Spurious Emission (High-CH 39)



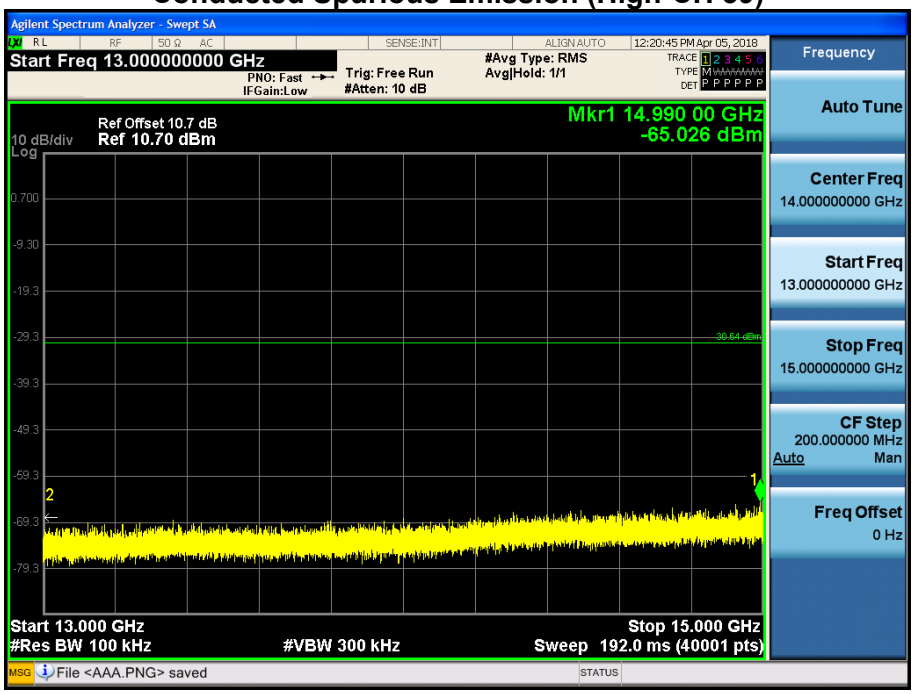
11 GHz ~ 13 GHz

Conducted Spurious Emission (High-CH 39)



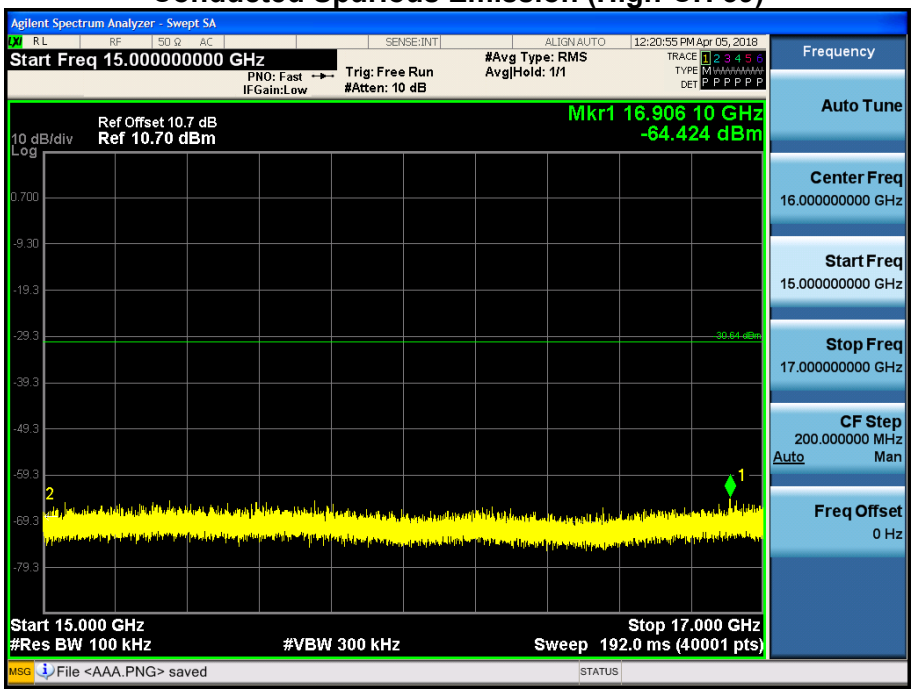
13 GHz ~ 15 GHz

Conducted Spurious Emission (High-CH 39)



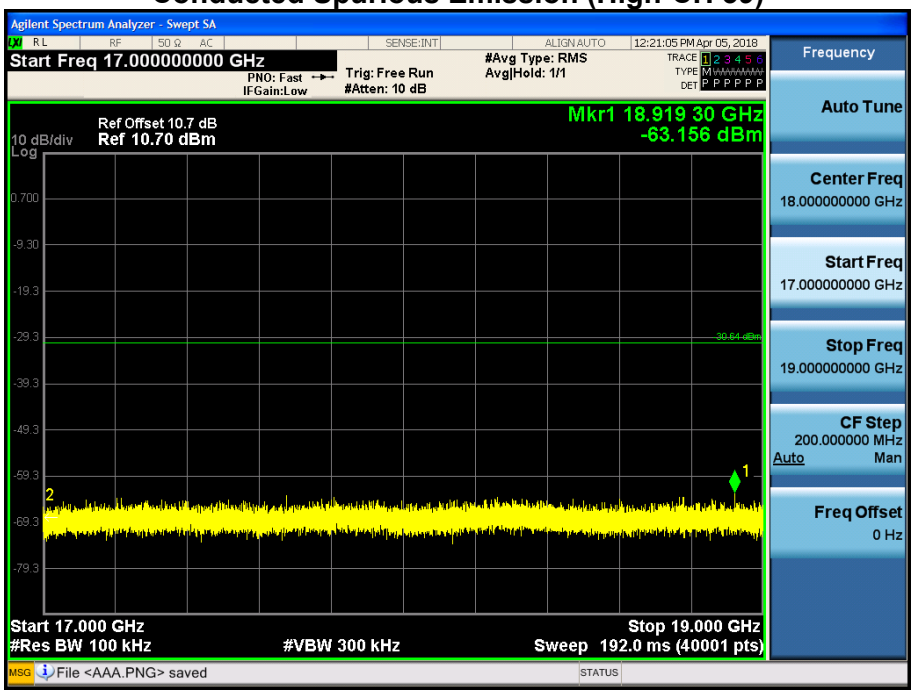
15 GHz ~ 17 GHz

Conducted Spurious Emission (High-CH 39)



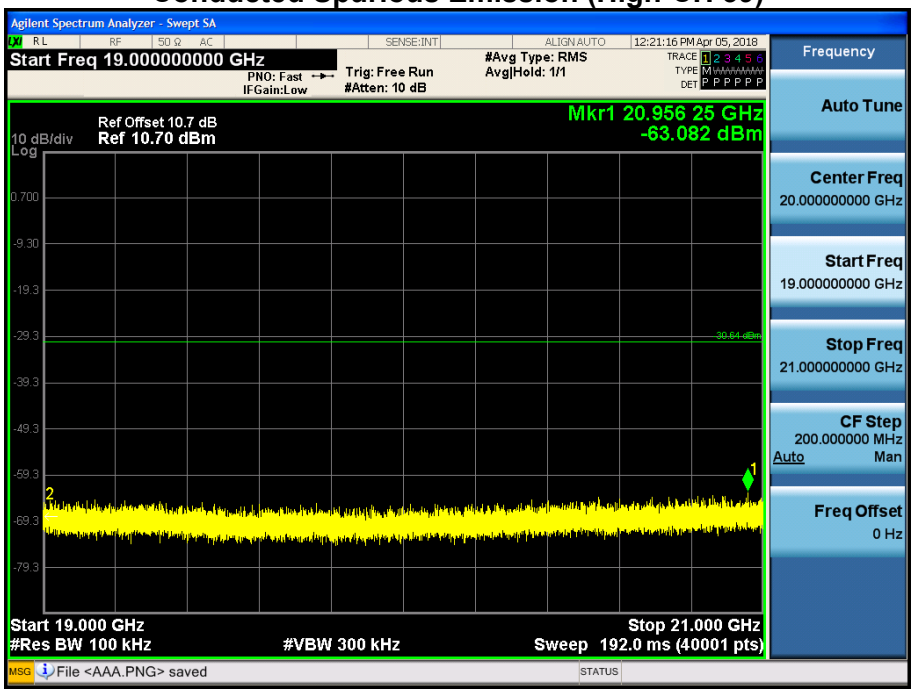
17 GHz ~ 19 GHz

Conducted Spurious Emission (High-CH 39)



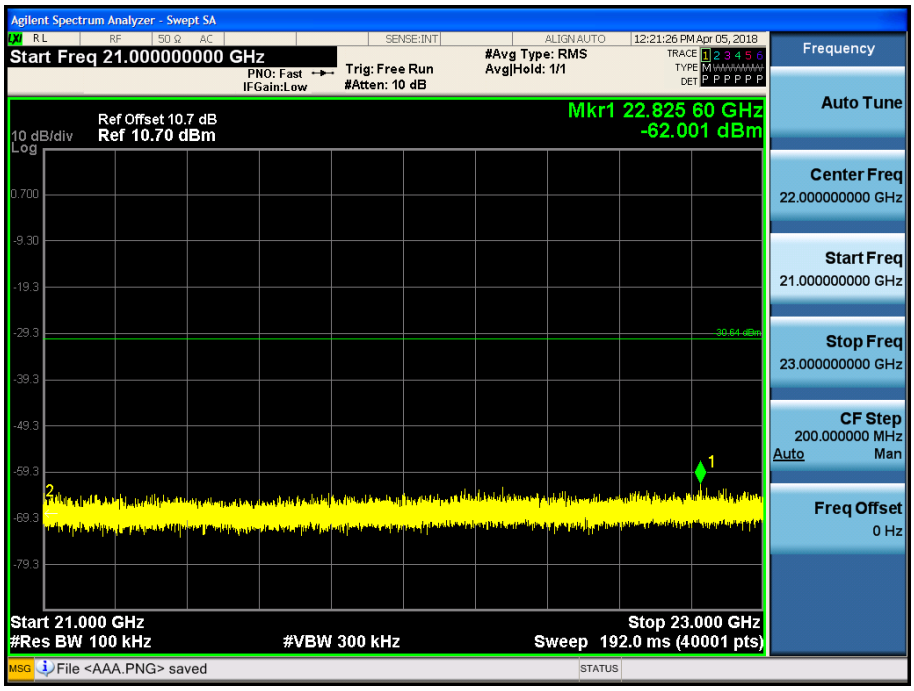
19 GHz ~ 21 GHz

Conducted Spurious Emission (High-CH 39)



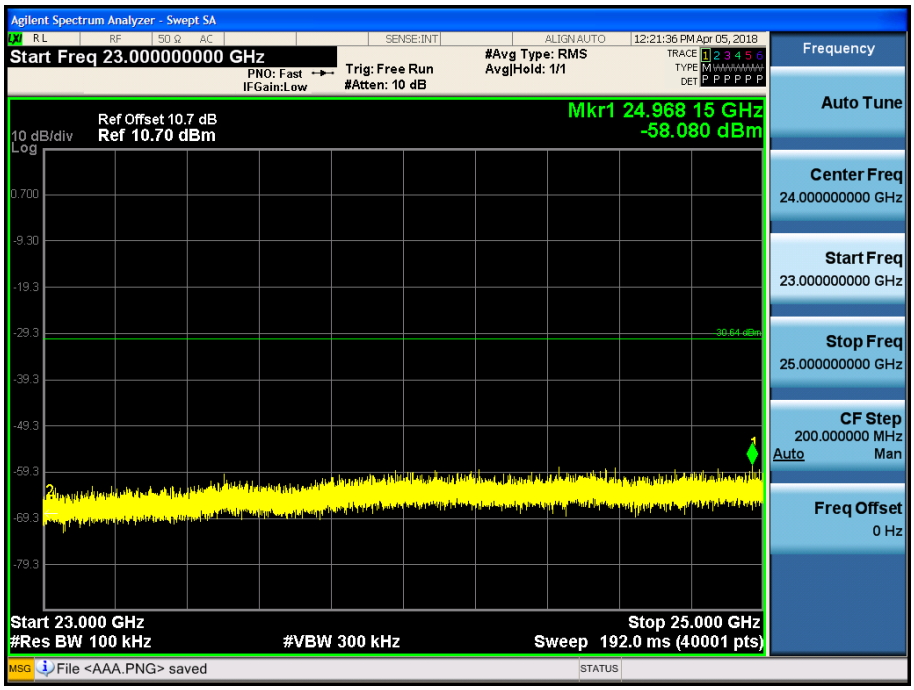
21 GHz ~ 23 GHz

Conducted Spurious Emission (High-CH 39)



23 GHz ~ 25 GHz

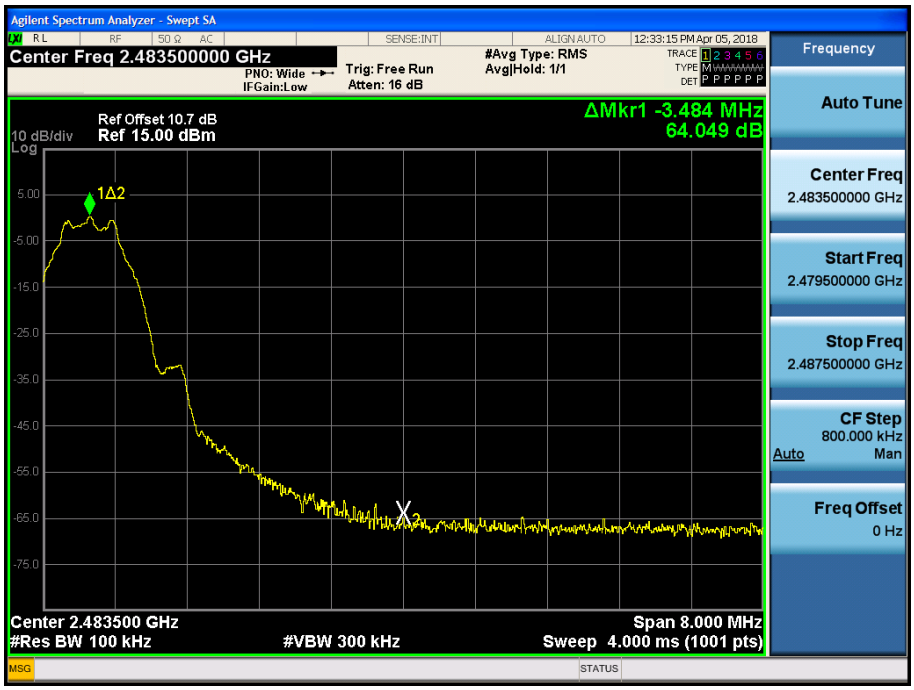
Conducted Spurious Emission (High-CH 39)



▣ 5.0 LE 1M: 37 Byte RESULT PLOTS

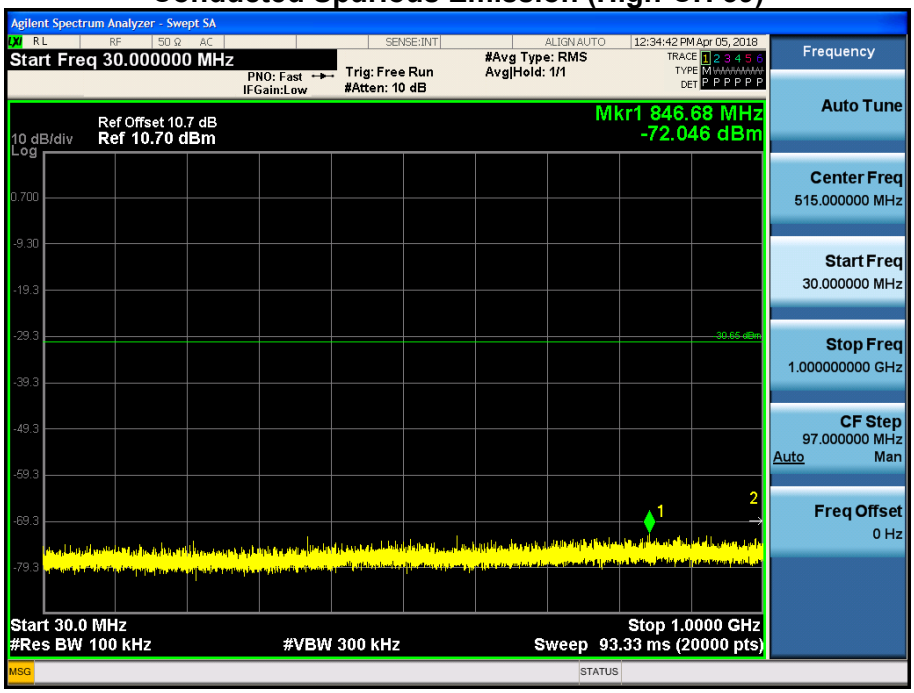
BandEdge (Low-CH 0)

BandEdge (High-CH 39)



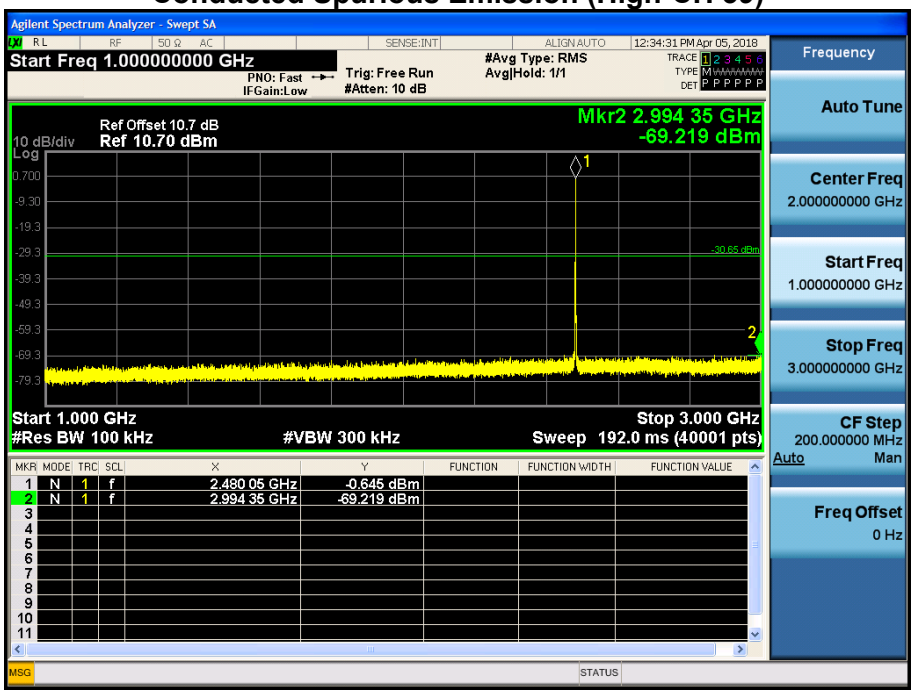
30 MHz ~ 1 GHz

Conducted Spurious Emission (High-CH 39)



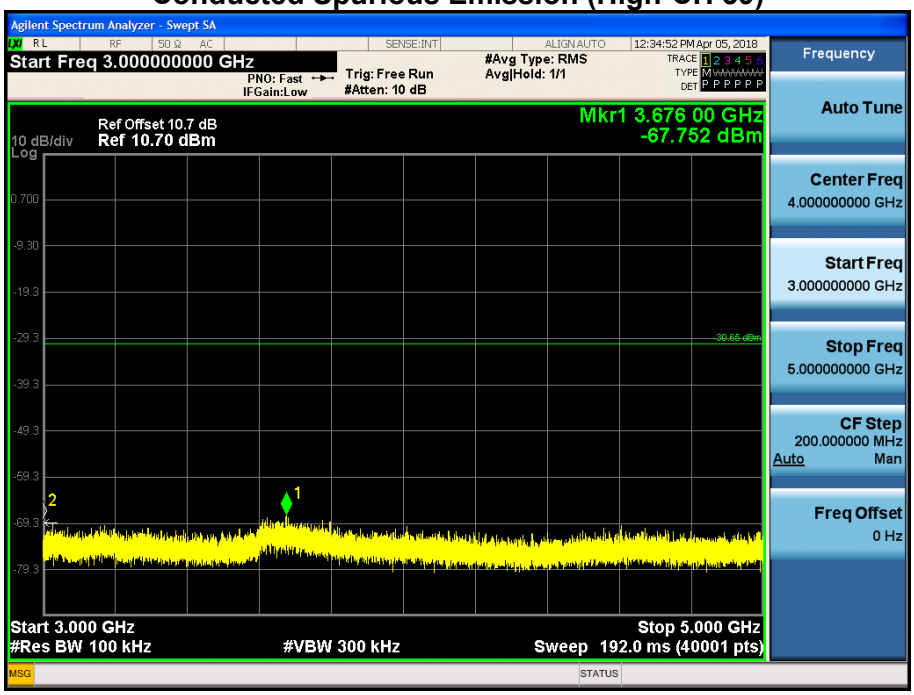
1 GHz ~ 3 GHz

Conducted Spurious Emission (High-CH 39)



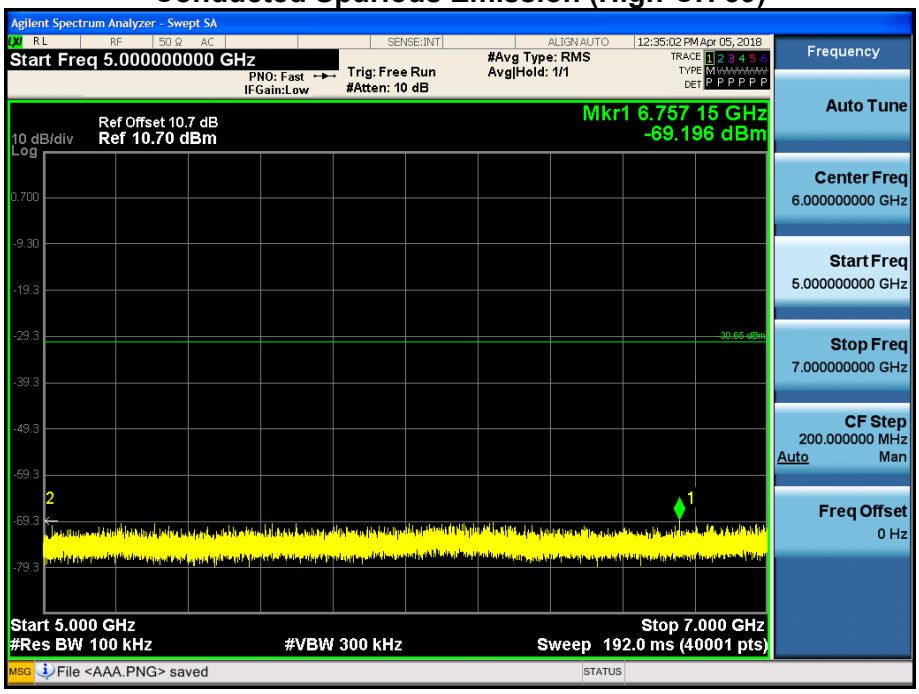
3 GHz ~ 5 GHz

Conducted Spurious Emission (High-CH 39)



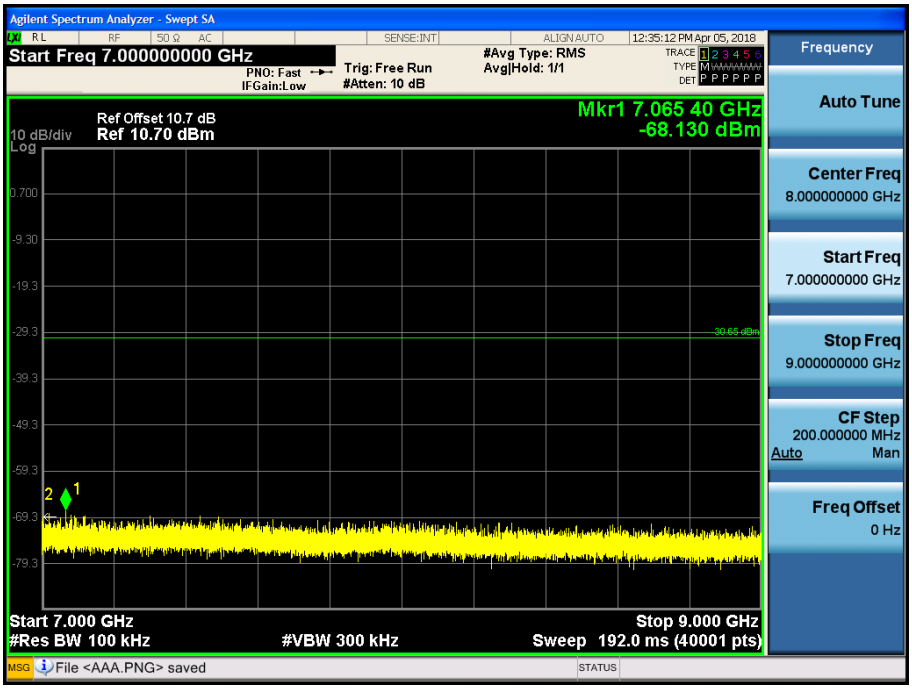
5 GHz ~ 7 GHz

Conducted Spurious Emission (High-CH 39)



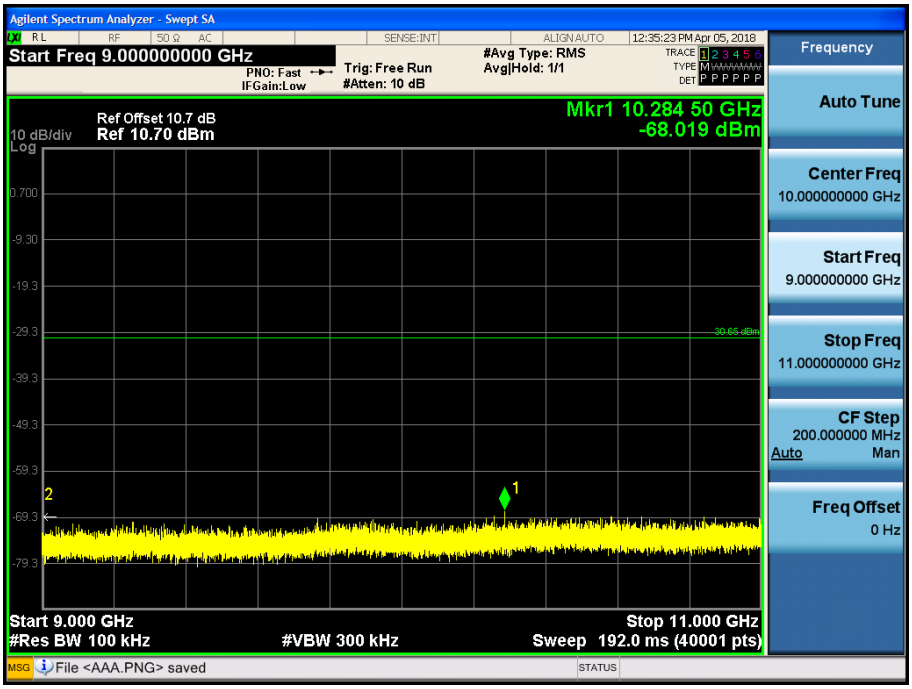
7 GHz ~ 9 GHz

Conducted Spurious Emission (High-CH 39)



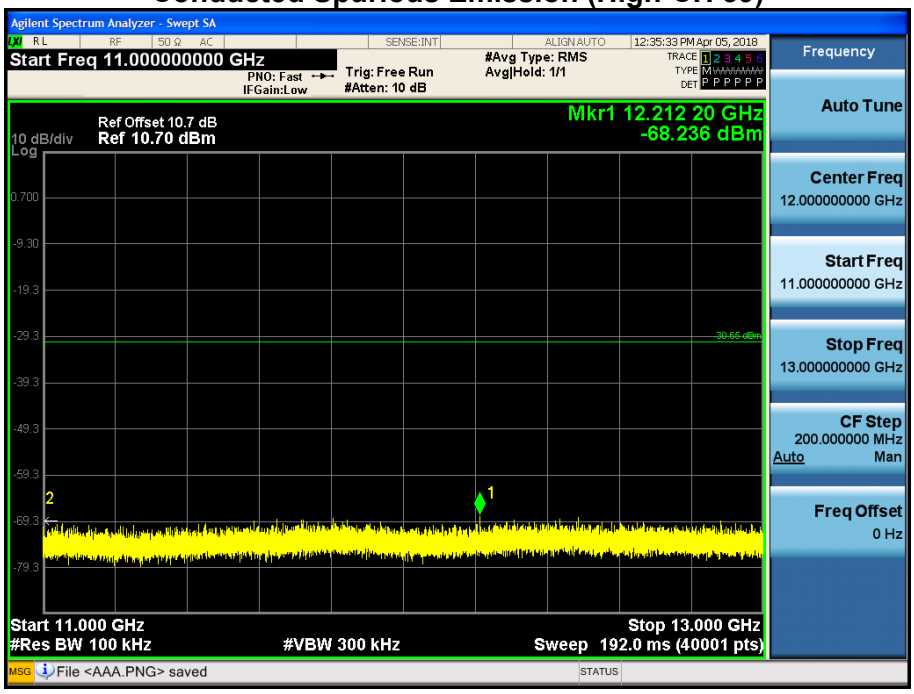
9 GHz ~ 11 GHz

Conducted Spurious Emission (High-CH 39)



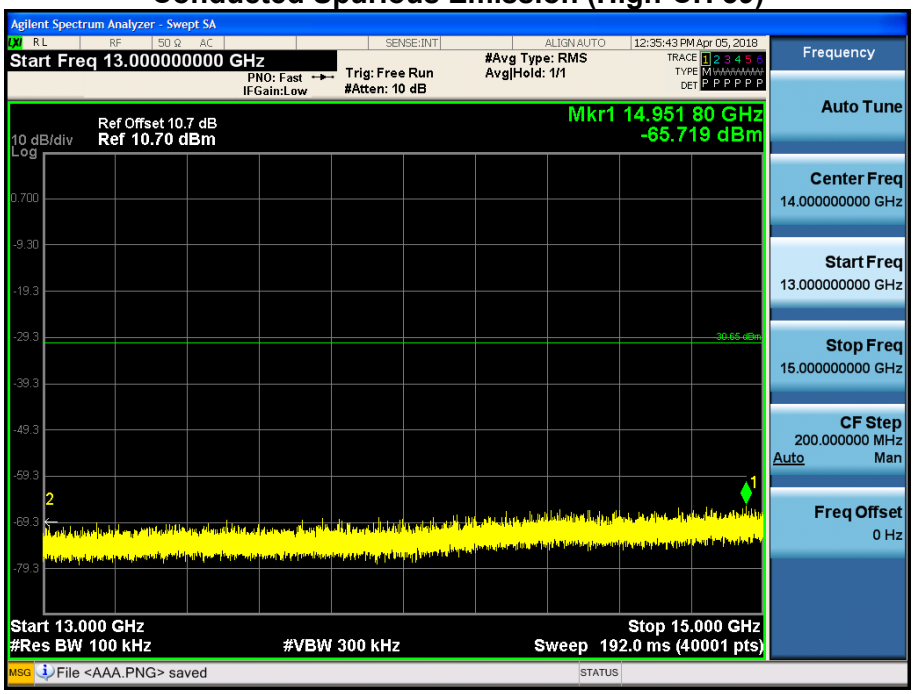
11 GHz ~ 13 GHz

Conducted Spurious Emission (High-CH 39)



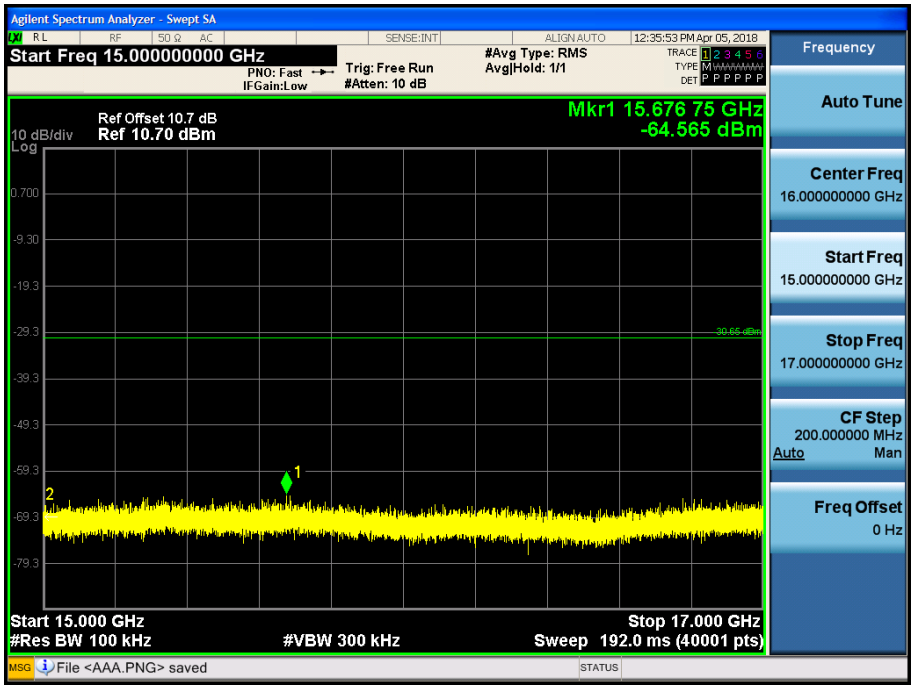
13 GHz ~ 15 GHz

Conducted Spurious Emission (High-CH 39)



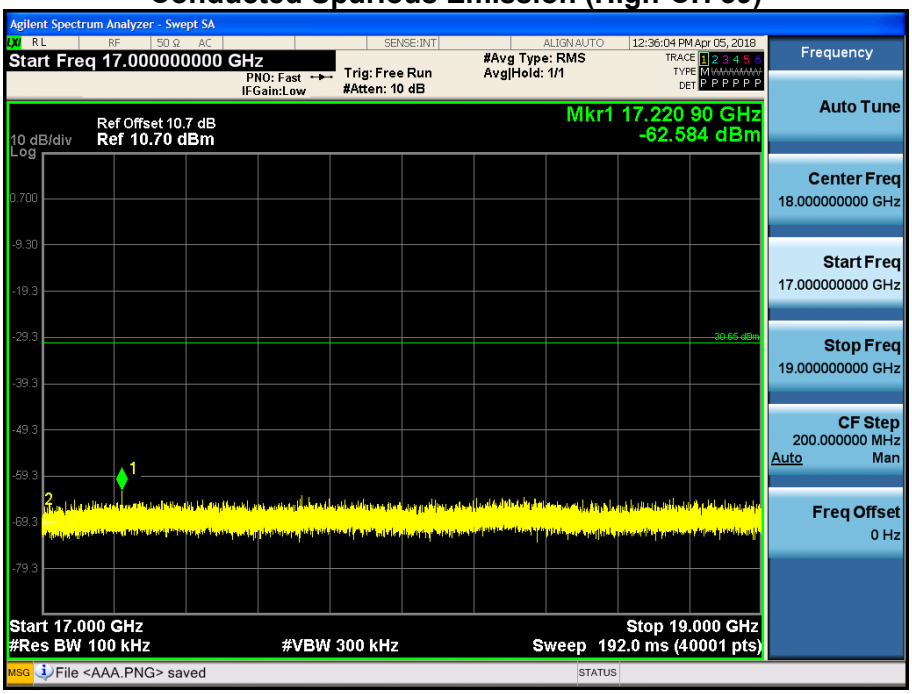
15 GHz ~ 17 GHz

Conducted Spurious Emission (High-CH 39)



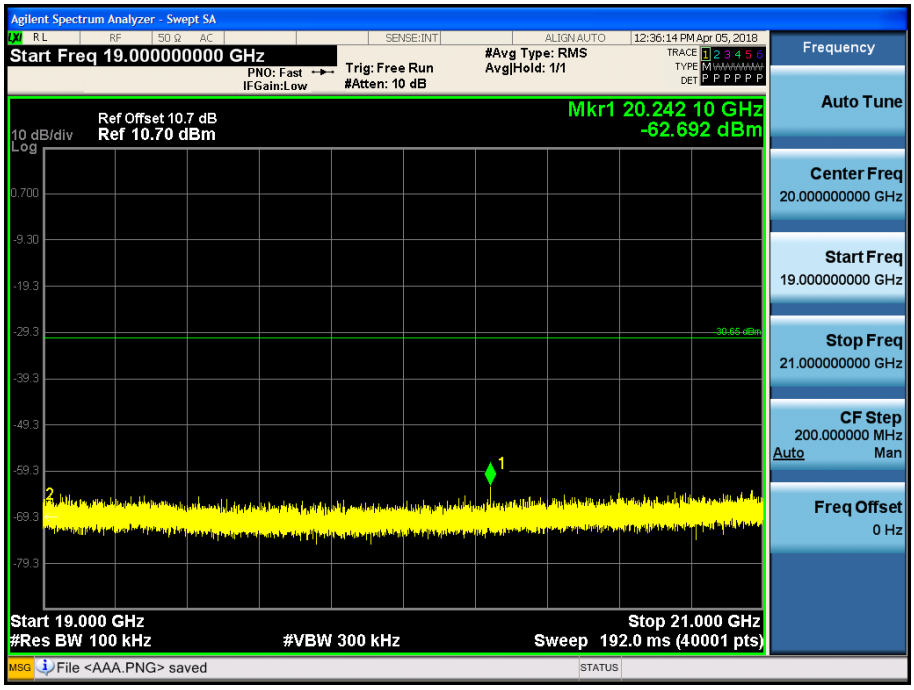
17 GHz ~ 19 GHz

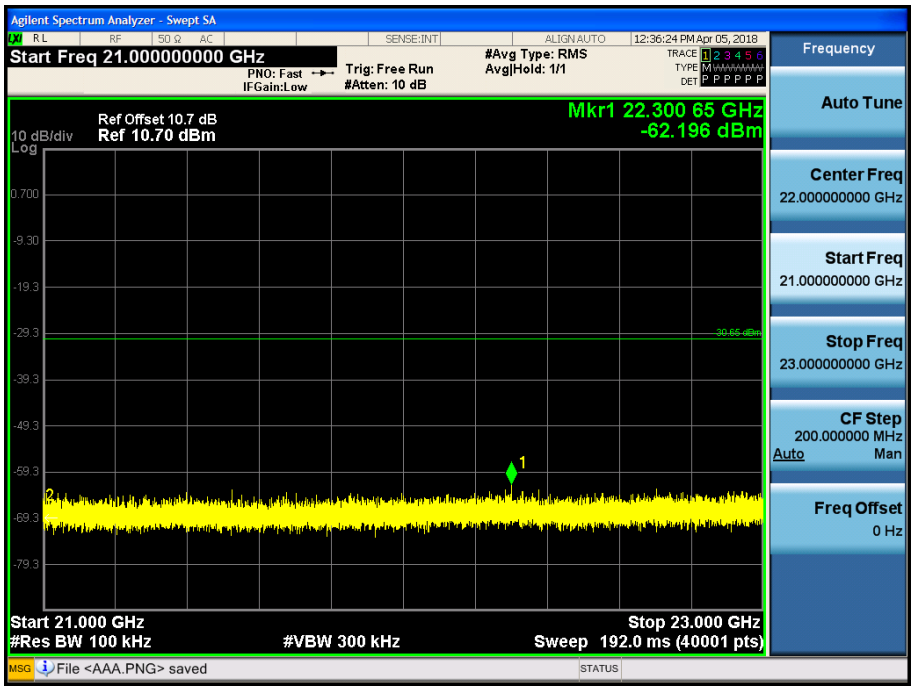
Conducted Spurious Emission (High-CH 39)



19 GHz ~ 21 GHz

Conducted Spurious Emission (High-CH 39)



21 GHz ~ 23 GHz

Conducted Spurious Emission (High-CH 39)