On your side

# TEST REPORT

## FCC BT LE Test for T7

**APPLICANT**
VC Inc.

**REPORT NO.**
HCT-RF-2002-FC019-R1

**DATE OF ISSUE**
March 10, 2020

**HCT Co., Ltd.**
74, Seoicheon-ro 578beon-gil, Majang-myeon, Icheon-si, Gyeonggi-do, 17383 KOREA
Tel. +82 31 634 6300 F ax. +82 31 645 6401

**HCT Co., Ltd.**
74, Seoicheon-ro 578beon-gil, Majang-myeon, Icheon-si, Gyeonggi-do, 17383 KOREA
Tel. +82 31 634 6300 Fax. +82 31 645 6401

# TEST REPORT

FCC BT LE Test for T7

REPORT NO.
HCT-RF-2002-FC019-R1

DATE OF ISSUE
March 10, 2020

Additional Model
-

| | |
|---|---|
| Applicant | VC Inc.<br>3F-4F, Hwawon Building, 417, Nonhyeon-ro, Gangnam-gu, Seoul, Republic of Korea |
| Eut Type<br>Model Name | Voice Caddie Hybrid Golf Watch<br>T7 |
| FCC ID: | 2ABTKT7 |
| RF Peak Output Power: | -0.313 dBm (0.930 mW) |
| Modulation type | GFSK |
| FCC Classification:<br>FCC Rule Part(s): | Digital Transmission System(DTS)<br>Part 15.247 |
| Frequency alignment range | 2 402 MHz ~ 2 480 MHz |

The result shown in this test report refer only to the sample(s) tested unless otherwise stated.
This test results were applied only to the test methods required by the standard.

Tested by
Jung Ki Lim (signature)

Technical Manager
Jong Seok Lee (signature)

HCT CO., LTD.
Soo Chan Lee
SooChan Lee / CEO

## REVISION HISTORY

The revision history for this test report is shown in table.

| Revision No. | Date of Issue | Description |
|---|---|---|
| 0 | February 26, 2020 | Initial Release |
| 1 | March 10, 2020 | Retest the 6dB BW for 1M**(Bit/s)** |

## CONTENTS

## 1. EUT DESCRIPTION

| | | |
|---|---|---|
| Model | T7 | |
| EUT Type | Voice Caddie Hybrid Golf Watch | |
| Power Supply | DC 3.7 V | |
| Frequency Range | 2402 MHz - 2480 MHz | |
| Max. RF Output Power | Peak | 1M Bit/s<br>- 37 byte : -0.383 dBm (0.916 mW)<br>- 255 byte : -0.380 dBm (0.916 mW)<br>2M Bit/s<br>- 37 byte: -0.324 dBm (0.928 mW)<br>- 255 byte : -0.313 dBm (0.930 mW) |
| | Average | 1M Bit/s<br>- 37 byte: -0.56 dBm (0.879 mW)<br>- 255 byte: -0.43 dBm (0.906 mW)<br>2M Bit/s<br>- 37 byte: -0.61 dBm (0.869 mW)<br>- 255 bytes: -0.42 dBm (0.908 mW) |
| Modulation Type | GFSK | |
| Bluetooth Version | 5.0 | |
| Number of Channels | 40 Channels | |
| Antenna Specification | Antenna type: Dielectric Chip Antenna<br>Peak Gain : 1.80 dBi | |
| Date(s) of Tests | February 18, 2020 ~ February 25, 2020<br>& March 10, 2020 (Rev1) | |

## 2. TEST METHODOLOGY

FCC KDB 558074 D01 15.247 Meas Guidance v05r02 dated April 02, 2019 entitled “guidance for compliance measurements on digital transmission system, frequency hopping spread spectrum system, and hybrid system devices and the measurement procedure described in ANSI C63.10(Version : 2013) ‘the American National Standard of Procedures for Compliance Testing of Unlicensed Wireless Devices’.

### 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.

### 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.

### 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 6.6.5 of ANSI C63.10. (Version: 2013)

### 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.

## 3. 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's, which is traceable to recognized national standards.
Especially, all antenna for measurement is calibrated in accordance with the requirements of C63.5 (Version : 2017).

## 4. FACILITIES AND ACCREDITATIONS

### 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, 17383, Rep. of 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 April 02, 2018 (Registration Number: KR0032).

### 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."

## 5. ANTENNA REQUIREMENTS

**According to FCC 47 CFR § 15.203 / RSS-Gen(Issue 5) Section 8:**

"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."

(1) The antennas of this E.U.T are permanently attached.

(2) The E.U.T Complies with the requirement of § 15.203

## 6. MEASUREMENT UNCERTAINTY

The measurement uncertainties shown below were calculated in accordance with the requirements of ANSI C63.10-2013.

All measurement uncertainty values are shown with a coverage factor of $k = 2$ to indicate a 95 % level of confidence.

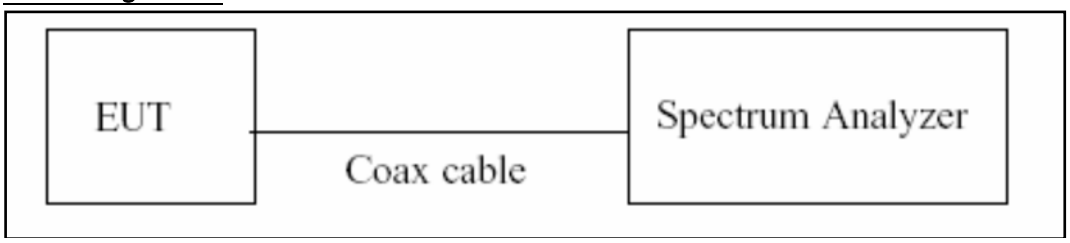
The measurement data shown herein meets or exceeds the $U_{CISPR}$ measurement uncertainty values specified in CISPR 16-4-2 and, thus, can be compared directly to specified limits to determine compliance.

| 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) | 5.05 |

# 7. DESCRIPTION OF TESTS

## 7.1. Duty Cycle

**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 v05r02.

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*.

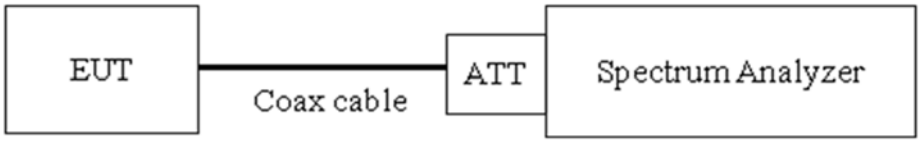
1. RBW = 8 MHz (the largest availble value)
2. VBW = 8 MHz (≥ RBW)
3. SPAN = 0 Hz
4. Detector = Peak
5. Number of points in sweep > 100
6. Trace mode = Clear write
7. Measure $T_{total}$ and $T_{on}$
8. Calculate Duty Cycle = $T_{on}$/ $T_{total}$ and Duty Cycle Factor = 10log(1/Duty Cycle)

## 7.2. 6dB Bandwidth

**Limit**

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 8.2 in KDB 558074 v05r02,
Procedure 11.8.1 in ANSI 63.10-2013)

1) RBW = 100 kHz
2) VBW ≥ 3 x RBW
3) Detector = Peak
4) Trace mode = max hold
5) Sweep = auto couple
6) Allow the trace to stabilize
7) We tested 6 dB bandwidth using the automatic bandwidth measurement capability of a spectrum analyzer. X dB is set 6 dB.

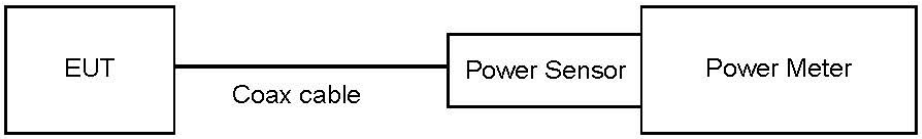
Note : We tested OBW using the automatic bandwidth measurement capability of a spectrum analyzer.

## 7.3. Output Power

### Limit

The maximum permissible conducted output power is 1 Watt.

### Test Configuration




### Test Procedure

The transmitter output is connected to the Power Meter.

- Peak Power (Procedure 11.9.1.3 in ANSI 63.10-2013)
  : Measure the peak power of the transmitter.

- Average Power (Procedure 8.3.2.3 in KDB 558074 v05r02, Procedure 11.9.2.3 in ANSI 63.10-2013)
  1) Measure the duty cycle.
  2) Measure the average power of the transmitter. This measurement is an average over both the on and off periods of the transmitter.
  3) 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

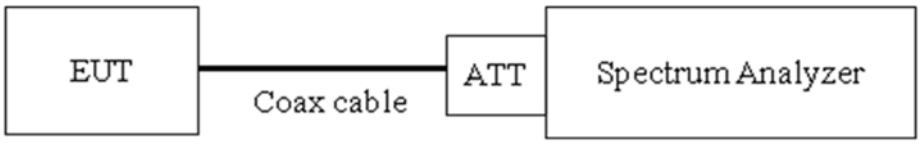
- Conducted Output Power(Peak) = Reading Value + ATT loss + Cable loss
- Conducted Output Power(Average) = Reading Value + ATT loss + Cable loss + Duty Cycle Factor

## 7.4. Power Spectral Density

### Limit

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

### Test Configuration




### Test Procedure

The transmitter output is connected to the Spectrum Analyzer.

We tested according to Procedure 8.4 in KDB 558074 v05r02, Procedure 11.10 in ANSI 63.10-2013.

The spectrum analyzer is set to :

1) Set analyzer center frequency to DTS channel center frequency.
2) Set span to at least 1.5 times the OBW.
3) RBW = 3 kHz ≤ RBW ≤ 100 kHz.
4) VBW ≥ 3 x RBW.
5) Sweep = auto couple
6) Detector = Peak
7) Trace mode = max hold
8) Allow trace to fully stablize.
9) Use the peak marker function to determine the maximum amplitude level.
10) 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

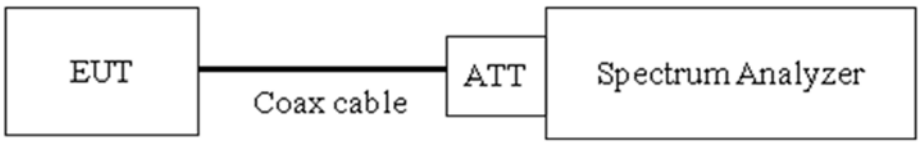
- Power Spectral Density = Reading Value + ATT loss + Cable loss

## 7.5. Conducted Band Edge(Out of Band Emissions) & Conducted Spurious Emissions

**Limit**

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.

**Test Configuration**




**Test Procedure**

The transmitter output is connected to the spectrum analyzer.

(Procedure 8.5 in KDB 558074 v05r02, Procedure 11.11 in ANSI 63.10-2013)

1) RBW = 100 kHz
2) VBW ≥ 3 x RBW
3) Set span to encompass the spectrum to be examined
4) Detector = Peak
5) Trace Mode = max hold
6) Sweep time = auto couple
7) Ensure that the number of measurement points ≥ 2 x Span/VBW
8) Allow trace to fully stabilize.
9) Use peak marker function to determine the maximum amplitude level.

Measurements are made over the 30 MHz to 25 GHz range with the transmitter set to the lowest, middle, and highest channels.

Factors for frequency

| Freq(MHz) | Factor(dB) |
|---|---|
| 30 | 10.04 |
| 100 | 10.07 |
| 200 | 10.12 |
| 300 | 10.17 |
| 400 | 10.20 |
| 500 | 10.21 |
| 600 | 10.21 |
| 700 | 10.23 |
| 800 | 10.24 |
| 900 | 10.26 |
| 1000 | 10.27 |
| 2000 | 10.41 |
| 2400 | 10.45 |
| 2500 | 10.47 |
| 3000 | 10.52 |
| 4000 | 10.60 |
| 5000 | 10.71 |
| 6000 | 10.73 |
| 7000 | 10.80 |
| 8000 | 10.85 |
| 9000 | 10.91 |
| 10000 | 10.97 |
| 11000 | 11.02 |
| 12000 | 11.10 |
| 13000 | 11.19 |
| 14000 | 11.16 |
| 15000 | 11.21 |
| 16000 | 11.22 |
| 17000 | 11.25 |
| 18000 | 11.30 |
| 19000 | 11.32 |
| 20000 | 11.36 |
| 21000 | 11.48 |
| 22000 | 11.55 |
| 23000 | 11.55 |
| 24000 | 11.59 |
| 25000 | 11.68 |
| 26000 | 11.69 |

Note : 1. 2 400 ~ 2 500 MHz is fundamental frequency range.

2. Factor = Attenuator loss + Cable loss

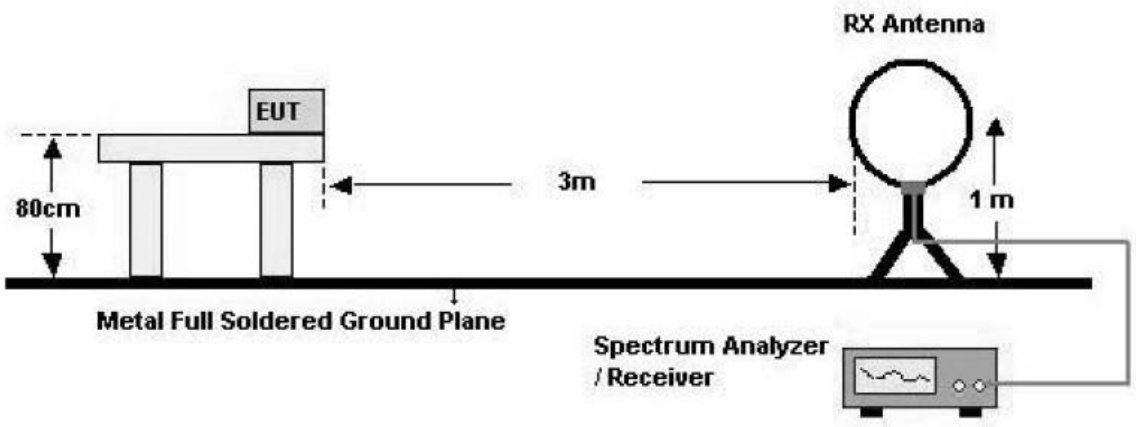
## 7.6. Radiated Test

**Limit**

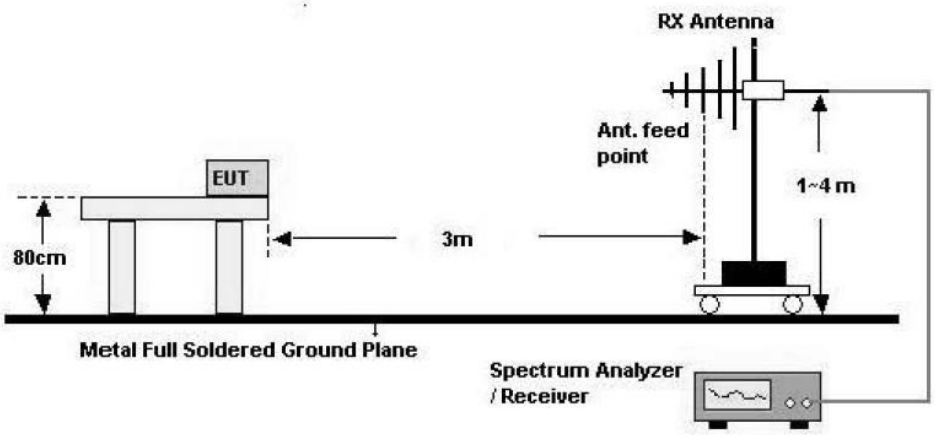
| Frequency (MHz) | Field Strength (uV/m) | Measurement Distance (m) |
|---|---|---|
| 0.009 – 0.490 | 2400/F(kHz) | 300 |
| 0.490 – 1.705 | 24000/F(kHz) | 30 |
| 1.705 – 30 | 30 | 30 |
| 30-88 | 100 | 3 |
| 88-216 | 150 | 3 |
| 216-960 | 200 | 3 |
| Above 960 | 500 | 3 |

**Test Configuration**

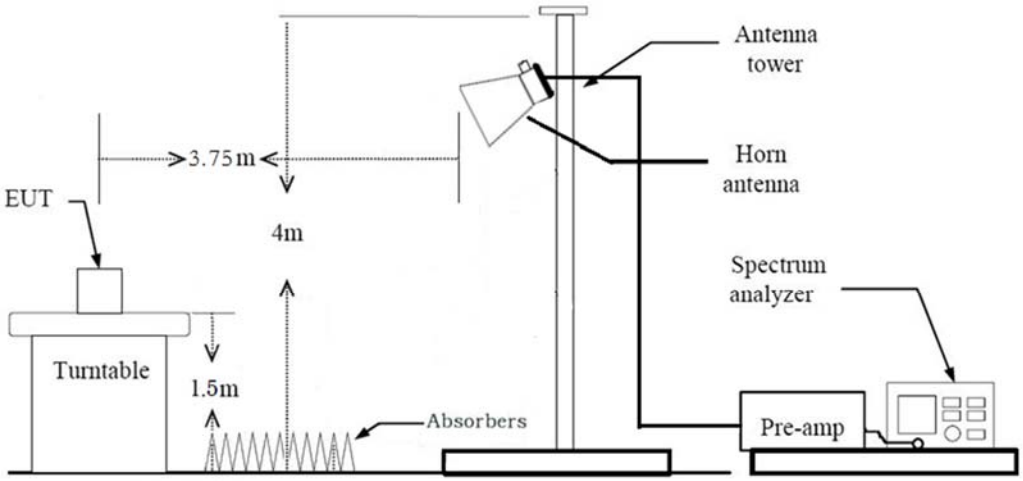
Below 30 MHz



30 MHz - 1 GHz




Above 1 GHz



## Test Procedure of Radiated spurious emissions(Below 30 MHz)

1. The EUT was placed on a non-conductive table located on semi-anechoic chamber.
2. The loop antenna was placed at a location 3m from the EUT
3. The EUT is placed on a turntable, which is 0.8m above ground plane.
4. We have done x, y, z planes in EUT and horizontal and vertical polarization and Parallel to the ground plane in detecting antenna.
5. The turntable shall be rotated for 360 degrees to determine the position of maximum emission level.
6. Distance Correction Factor(0.009 MHz – 0.490 MHz) = 40log(3 m/300 m) = - 80 dB
   Measurement Distance : 3 m
7. Distance Correction Factor(0.490 MHz – 30 MHz) = 40log(3 m/30 m) = - 40 dB
   Measurement Distance : 3 m
8. Spectrum Setting
   - Frequency Range = 9 kHz ~ 30 MHz
   - Detector = Peak
   - Trace = Maxhold
   - RBW = 9 kHz
   - VBW ≥ 3 x RBW
9. Total = Reading Value + Antenna Factor(A.F) + Cable Loss(C.L) + Distance Factor(D.F)
10. Measurement value only up to 6 maximum emissions noted, or would be lesser if no specific emissions from the EUT are recorded (ie: margin > 20 dB from the applicable limit) and considered that's already beyond the background noise floor.

## KDB 414788 OFS and Chamber Correlation Justification

Base on FCC 15.31 (f) (2): measurements may be performed at a distance closer than that specified in the regulations; however, an attempt should be made to avoid making measurements in the near field.

OFS and chamber correlation testing had been performed and chamber measured test result is the worst case test result.

**Test Procedure of Radiated spurious emissions(Below 1GHz)**

1. The EUT was placed on a non-conductive table located on semi-anechoic chamber.
2. The EUT is placed on a turntable, which is 0.8m above ground plane.
3. We have done x, y, z planes in EUT and horizontal and vertical polarization in detecting antenna.
4. The turntable shall be rotated for 360 degrees to determine the position of maximum emission level.
5. Spectrum Setting
   (1) Measurement Type(Peak):
      - Measured Frequency Range : 30 MHz – 1 GHz
      - Detector = Peak
      - Trace = Maxhold
      - RBW = 100 kHz
      - VBW ≥ 3 x RBW
   (2) Measurement Type(Quasi-peak):
      - Measured Frequency Range : 30 MHz – 1 GHz
      - Detector = Quasi-Peak
      - RBW = 120 kHz

   In general, (1) is used mainly
6. Total = Reading Value + Antenna Factor(A.F) + Cable Loss(C.L)
7. Measurement value only up to 6 maximum emissions noted, or would be lesser if no specific emissions from the EUT are recorded (ie: margin > 20 dB from the applicable limit) and considered that's already beyond the background noise floor.

**Test Procedure of Radiated spurious emissions (Above 1 GHz)**

1. The EUT is placed on a turntable, which is 1.5 m above ground plane.
2. We have done x, y, z planes in EUT and horizontal and vertical polarization in detecting antenna.
3. The turntable shall be rotated for 360 degrees to determine the position of maximum emission level.
4. EUT is set 3.75 m away from the receiving antenna, which is varied from 1m to 4m to find out the highest emissions.
5. According to SVSWR requirement in ANSI 63.4-2014, We performed the radiated test at 3.75 m distance from center of turn table. So, we applied the distance factor( reference distance : 3 m).
   - ◆ Distance extrapolation factor = 20log (test distance / specific distance) (dB)
6. Maximum procedure was performed on the six highest emissions to ensure EUT compliance.
7. Each emission was to be maximized by changing the polarization of receiving antenna both horizontal and vertical.
8. The unit was tested with its standard battery.
9. Spectrum Setting (Method 8.6 in KDB 558074 v05r02, Procedure 11.12 in ANSI 63.10-2013)
   (1) Measurement Type(Peak):
   - Measured Frequency Range : 1 GHz – 25 GHz
   - Detector = Peak
   - Trace = Maxhold
   - RBW = 1 MHz
   - VBW ≥ 3 x RBW

   (2) Measurement Type(Average):
   - Average value of pulsed emissions
   - Unless otherwise specified, when the radiated emission limits are expressed in terms of the average value of the emission and pulsed operation is employed, the average measurement shall determined from the peak field strength after correcting for the worst-case duty cycle as described in section 9.6
   - DCCF = $20\log_{10}$(Worst Case Dwell Time / 100ms)

10. Measurement value only up to 6 maximum emissions noted, or would be lesser if no specific emissions from the EUT are recorded (ie: margin > 20 dB from the applicable limit) and considered that's already beyond the background noise floor.

11. Total(Measurement Type : Peak)

= Peak Reading Value + Antenna Factor(A.F) + Cable Loss(C.L) - Amp Gain(G) + Distance Factor(D.F)

Total(Measurement Type : Average)

= Peak Reading Value + Antenna Factor(A.F) + Cable Loss(C.L) - Amp Gain(G) + Distance Factor(D.F)
+ Duty Cycle Correction Factor

**Test Procedure of Radiated Restricted Band Edge**

1. The EUT is placed on a turntable, which is 1.5 m above ground plane.
2. We have done x, y, z planes in EUT and horizontal and vertical polarization in detecting antenna.
3. The turntable shall be rotated for 360 degrees to determine the position of maximum emission level.
4. EUT is set 3.75 m away from the receiving antenna, which is varied from 1m to 4m to find out the highest emissions.
5. According to SVSWR requirement in ANSI 63.4-2014, We performed the radiated test at 3.75 m distance from center of turn table. So, we applied the distance factor( reference distance : 3 m).
   - ◆ Distance extrapolation factor = 20log (test distance / specific distance) (dB)
6. Maximum procedure was performed on the six highest emissions to ensure EUT compliance.
7. Each emission was to be maximized by changing the polarization of receiving antenna both horizontal and vertical.
8. The unit was tested with its standard battery.
9. Spectrum Setting
   (1) Measurement Type(Peak):
   - Measured Frequency Range : 2310 MHz ~ 2390 MHz/ 2483.5 MHz ~ 2500 MHz
   - Detector = Peak
   - Trace = Maxhold
   - RBW = 1 MHz
   - VBW ≥ 3 x RBW

   (2) Measurement Type(Average):
   - Duty cycle < 98%, duty cycle variations are less than ±2%
   - Measured Frequency Range : 2310 MHz ~ 2390 MHz/ 2483.5 MHz ~ 2500 MHz
   - Detector = RMS
   - Averaging type = power (*i.e.*, RMS)
   - RBW = 1 MHz
   - VBW ≥ 3 x RBW
   - Sweep time = auto.
   - Trace mode = average (at least 100 traces).
   - Correction factor shall be added to the measurement results prior to comparing to the emission limit in order to compute the emission level that would have been measured had the test been performed at 100 percent duty cycle.
   - Duty Cycle Factor (dB) : Please refer to the please refer to section 9.1.

10. Measurement value only up to 6 maximum emissions noted, or would be lesser if no specific emissions from the EUT are recorded (ie: margin > 20 dB from the applicable limit) and considered that's already beyond the background noise floor.
11. Total(Measurement Type : Peak
    = Reading Value + Antenna Factor(A.F) + Cable Loss(C.L) + Distance Factor(D.F)

    Total(Measurement Type : Average
    = Reading Value + Antenna Factor(A.F) + Cable Loss(C.L) + Distance Factor(D.F) + Duty Cycle Factor

## 7.7. AC Power line Conducted Emissions

### Limit

For an intentional radiator that is designed to be connected to the public utility (AC) power line, the radio frequency voltage that is conducted back onto the AC power line on any frequency or frequencies, within the band 150 kHz to 30 MHz, shall not exceed the limits in the following table, as measured using a 50 μH/50 ohms line impedance stabilization network (LISN).

| Frequency Range (MHz) | Limits (dBμV) | |
|---|---|---|
| | Quasi-peak | Average |
| 0.15 to 0.50 | 66 to 56[a] | 56 to 46[a] |
| 0.50 to 5 | 56 | 46 |
| 5 to 30 | 60 | 50 |

[a]Decreases with the logarithm of the frequency.

Compliance with this provision shall be based on the measurement of the radio frequency voltage between each power line (LINE and NEUTRAL) and ground at the power terminals.

### Test Configuration

See test photographs attached in Annex A for the actual connections between EUT and support equipment.

### Test Procedure

1. The EUT is placed on a wooden table 80 cm above the reference ground plane.
2. The EUT is connected via LISN to a test power supply.
3. The measurement results are obtained as described below:
4. Detectors : Quasi Peak and Average Detector.

### Sample Calculation

Quasi-peak(Final Result) = Reading Value + Correction Factor

### 7.8. Worst case configuration and mode

**Radiated Test**

1. All modes of operation were investigated and the worst case configuration results are reported.
   - Mode : Stand alone, Stand alone + External accessories(Craddle, et)
   - Worstcase : Stand alone

2. EUT Axis:
   - Radiated Spurious Emissions : Z
   - Radiated Restricted Band Edge : Z
3. All packet length of operation were investigated and the test results are worst case in lowest packet length.
   (Worst case : 255 Byte)
4. All position of loop antenna were investigated and the test result is a no critical peak found at all positions.
   - Position : Horizontal, Vertical, Parallel to the ground plane

**AC Power line Conducted Emissions**

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

**Conducted test**

1. The EUT was configured with packet length of highest power.
   (Worst case : 255 Byte)

## 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 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 > 20 dBc | | PASS |
| AC Power line Conducted Emissions | § 15.207 | cf. Section 7.7 | | PASS |
| Radiated Spurious Emissions | § 15.247(d), 15.205, 15.209 | cf. Section 7.6 | Radiated | PASS |
| Radiated Restricted Band Edge | § 15.247(d), 15.205, 15.209 | cf. Section 7.6 | | PASS |

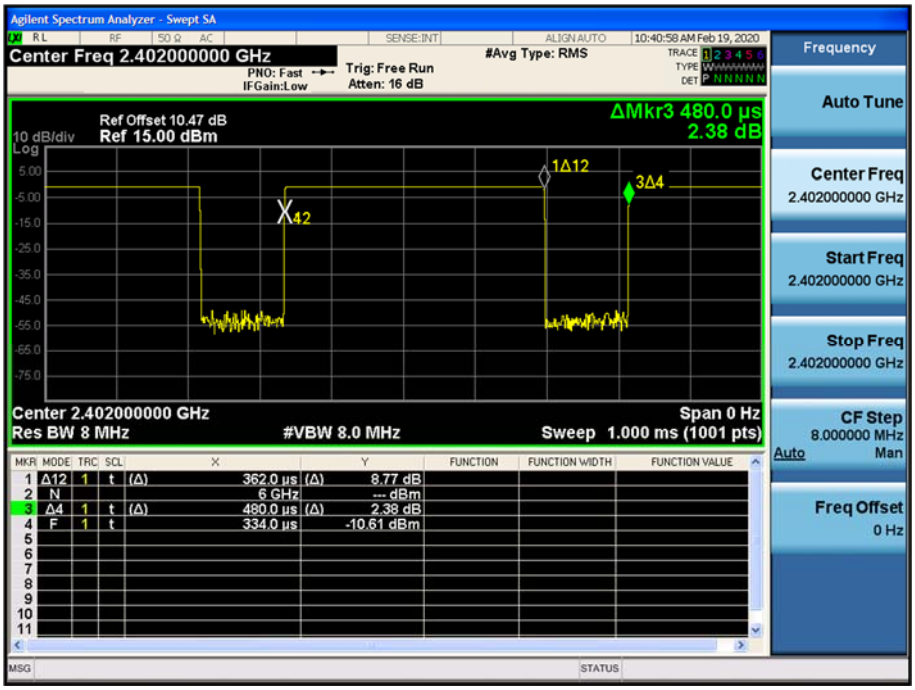
# 9. TEST RESULT

## 9.1 DUTY CYCLE

| Data rate (Bit/s) | Packet length (Byte) | $T_{on}$ (ms) | $T_{total}$ (ms) | Duty Cycle | Duty Cycle Factor (dB) |
|---|---|---|---|---|---|
| 1M | 37 | 0.3620 | 0.4800 | 0.7542 | 1.23 |
| | 255 | 2.1050 | 2.2250 | 0.9461 | 0.24 |
| 2M | 37 | 0.1881 | 0.3063 | 0.6143 | 2.12 |
| | 255 | 1.0600 | 1.1780 | 0.8998 | 0.46 |

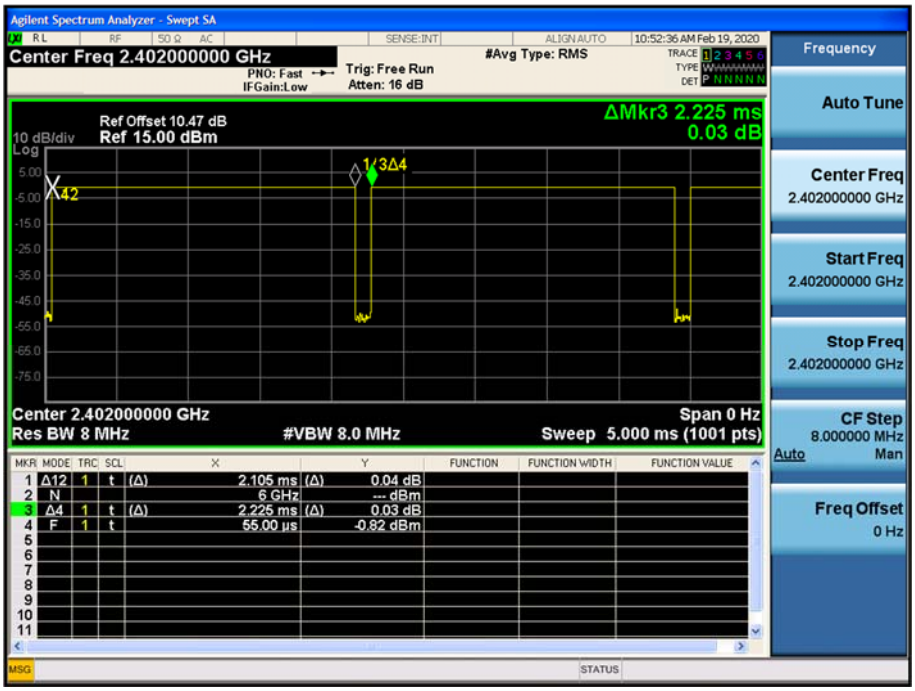
## ▣ 1M Bit/s (37 Byte) Test Plots

Duty Cycle (Low-CH 0)



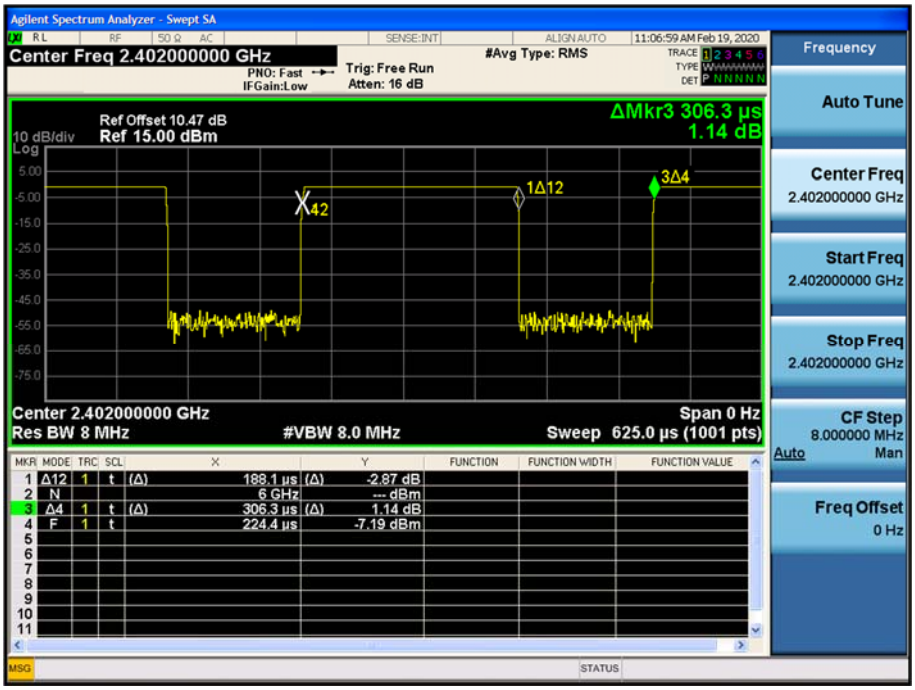

## ▣ 1M Bit/s (255 Byte) Test Plots

Duty Cycle (Low-CH 0)



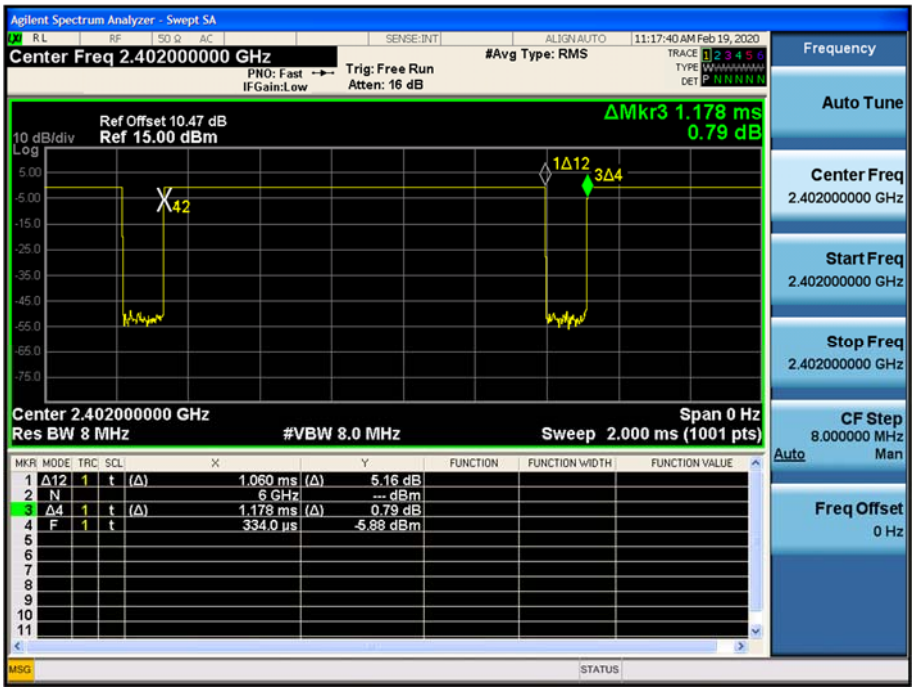
## ▣ 2M Bit/s (37 Byte) Test Plots

Duty Cycle (Low-CH 0)




## ▣ 2M Bit/s (255 Byte) Test Plots

Duty Cycle (Low-CH 0)

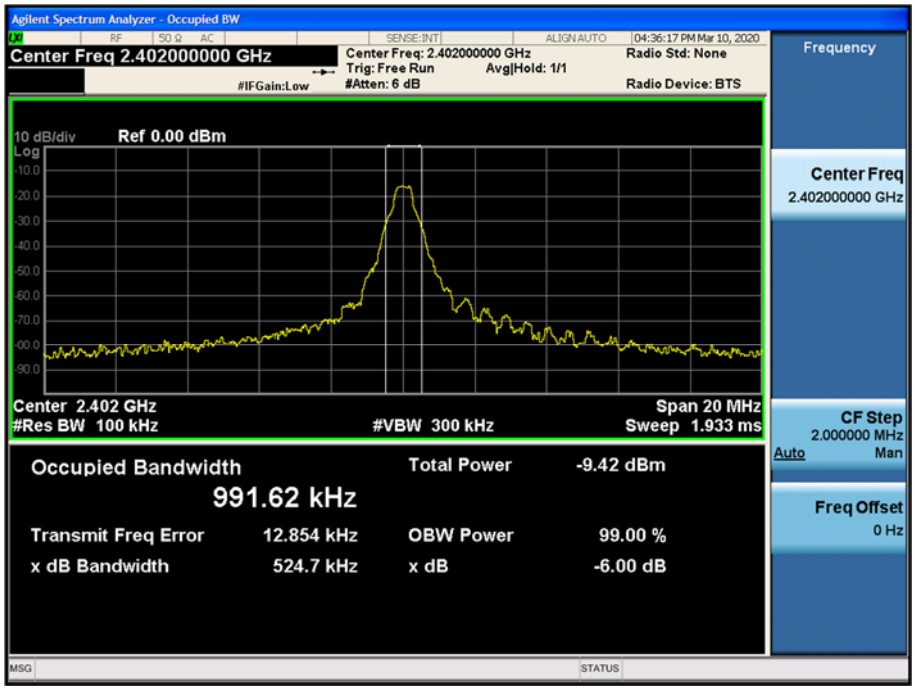


## 9.2 6dB BANDWIDTH

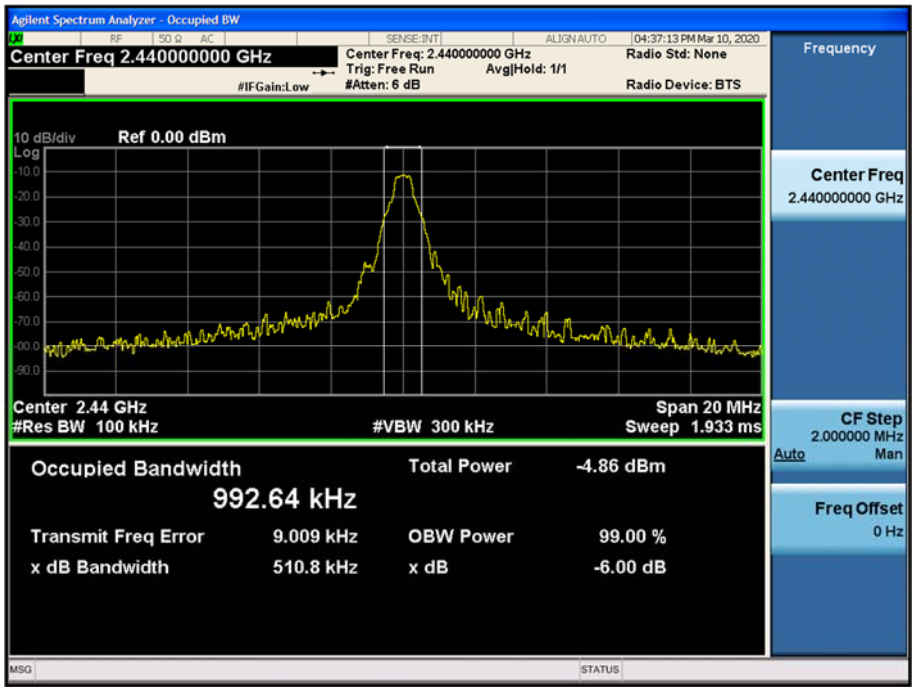
| Mode (Bit/s) | Channel | 6 dB Bandwidth (kHz) | Limit (kHz) |
|---|---|---|---|
| 1M | 0 | 524.7 | > 500 |
| | 19 | 510.8 | |
| | 39 | 519.7 | |
| 2M | 0 | 819.1 | > 500 |
| | 19 | 852.8 | |
| | 39 | 808.2 | |

## ▣ 1M Bit/s (255 Byte) Test Plots

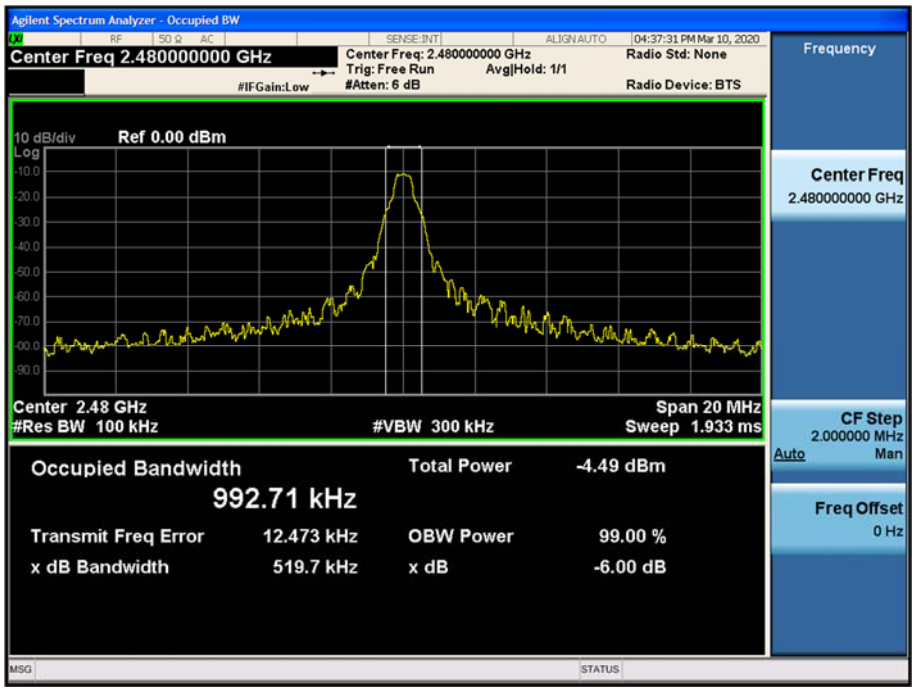
6 dB Bandwidth plot (Low-CH 0)




6 dB Bandwidth plot (Mid-CH 19)

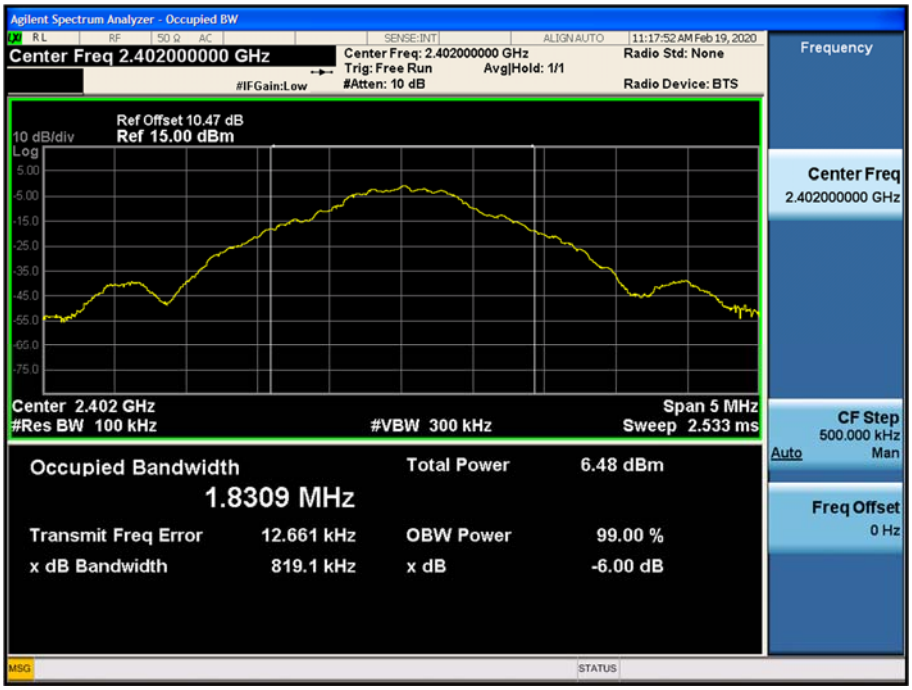


6 dB Bandwidth plot (High-CH 39)

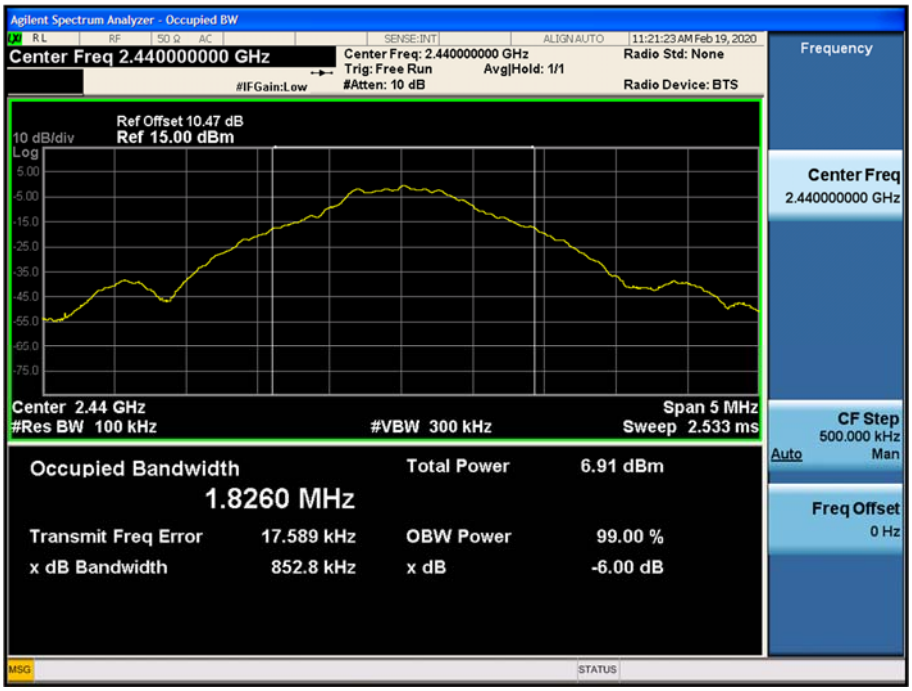


## ▣ 2M Bit/s (255 Byte) Test Plots

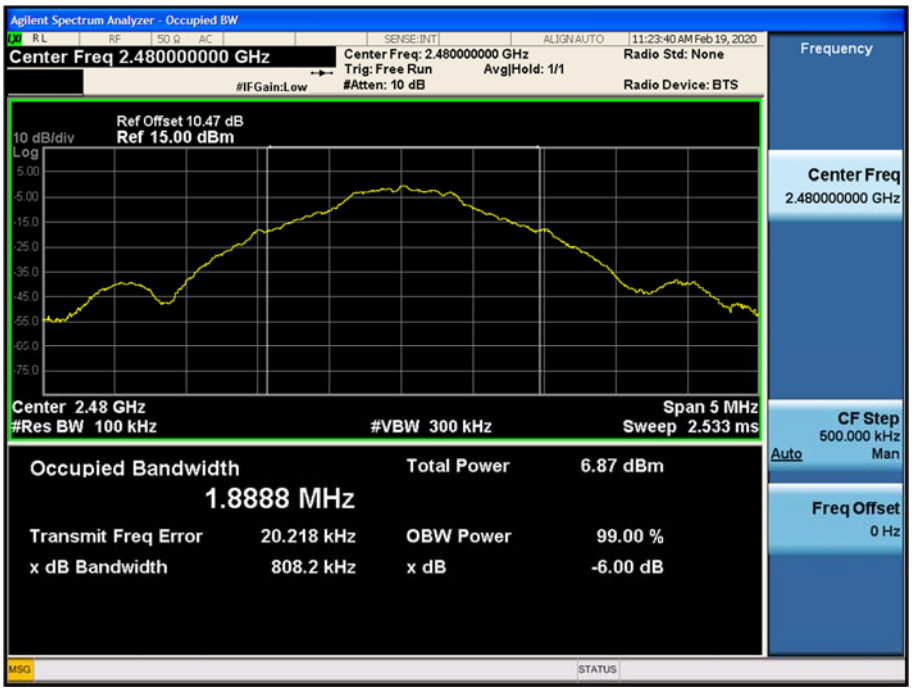
6 dB Bandwidth plot (Low-CH 0)




6 dB Bandwidth plot (Mid-CH 19)



6 dB Bandwidth plot (High-CH 39)



## 9.3 OUTPUT POWER

**Peak Power**

| Data rate (Bit/s) | Packet length (Byte) | LE Mode | | Measured Power(dBm) | Limit (dBm) |
|---|---|---|---|---|---|
| | | Frequency [MHz] | Channel | | |
| 1M | 37 | 2402 | 0 | -0.812 | 30 |
| | | 2440 | 19 | -0.568 | |
| | | 2480 | 39 | -0.383 | |
| | 255 | 2402 | 0 | -0.844 | |
| | | 2440 | 19 | -0.567 | |
| | | 2480 | 39 | -0.380 | |
| 2M | 37 | 2402 | 0 | -0.759 | |
| | | 2440 | 19 | -0.511 | |
| | | 2480 | 39 | -0.324 | |
| | 255 | 2402 | 0 | -0.752 | |
| | | 2440 | 19 | -0.505 | |
| | | 2480 | 39 | -0.313 | |

Average Power

| Data rate (Bit/s) | Packet length (Byte) | LE Mode | | Measured Power (dBm) | Duty Cycle Factor (dB) | Result (dBm) | Limit (dBm) |
|---|---|---|---|---|---|---|---|
| | | Frequency [MHz] | Channel | | | | |
| 1M | 37 | 2402 | 0 | -2.15 | 1.23 | -0.92 | 30 |
| | | 2440 | 19 | -1.87 | 1.23 | -0.64 | |
| | | 2480 | 39 | -1.78 | 1.23 | -0.56 | |
| | 255 | 2402 | 0 | -1.19 | 0.24 | -0.95 | |
| | | 2440 | 19 | -0.87 | 0.24 | -0.63 | |
| | | 2480 | 39 | -0.67 | 0.24 | -0.43 | |
| 2M | 37 | 2402 | 0 | -3.04 | 2.12 | -0.92 | |
| | | 2440 | 19 | -2.76 | 2.12 | -0.65 | |
| | | 2480 | 39 | -2.72 | 2.12 | -0.61 | |
| | 255 | 2402 | 0 | -1.40 | 0.46 | -0.94 | |
| | | 2440 | 19 | -1.13 | 0.46 | -0.67 | |
| | | 2480 | 39 | -0.88 | 0.46 | -0.42 | |

Note :

1. Power meter offset = Attenuator loss + Cable loss
2. We apply to the offset in the 2.4 GHz range that was rounded off to the closest tenth dB.
   So, 10.47 dB is offset for 2.4 GHz Band.

## 9.4 POWER SPECTRAL DENSITY

| Frequency (MHz) | Channel No. | Mode | Test Result | |
|---|---|---|---|---|
| | | | Measured Power(dBm) | Limit (dBm) |
| 2402 | 0 | 1M 255 Byte | -11.760 | 8 |
| 2440 | 19 | | -9.269 | |
| 2480 | 39 | | -11.484 | |
| 2402 | 0 | 2M 255 Byte | -14.423 | |
| 2440 | 19 | | -14.548 | |
| 2480 | 39 | | -13.779 | |

**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, 10.47 dB is offset for 2.4 GHz Band.

## ▣ 1M Bit/s (255 Byte) Test Plots

Power Spectral Density (Low-CH 0)

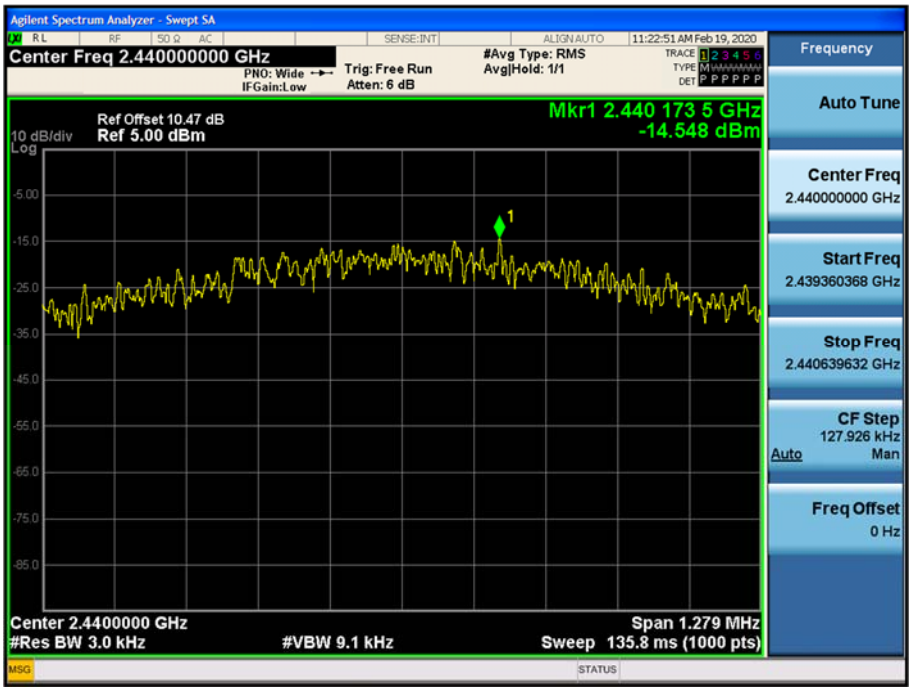

Power Spectral Density (Mid-CH 19)

Power Spectral Density (High-CH 39)

## ▣2M Bit/s (255 Byte) Test Plots

Power Spectral Density (Low-CH 0)


Power Spectral Density (Mid-CH 19)



Power Spectral Density (High-CH 39)

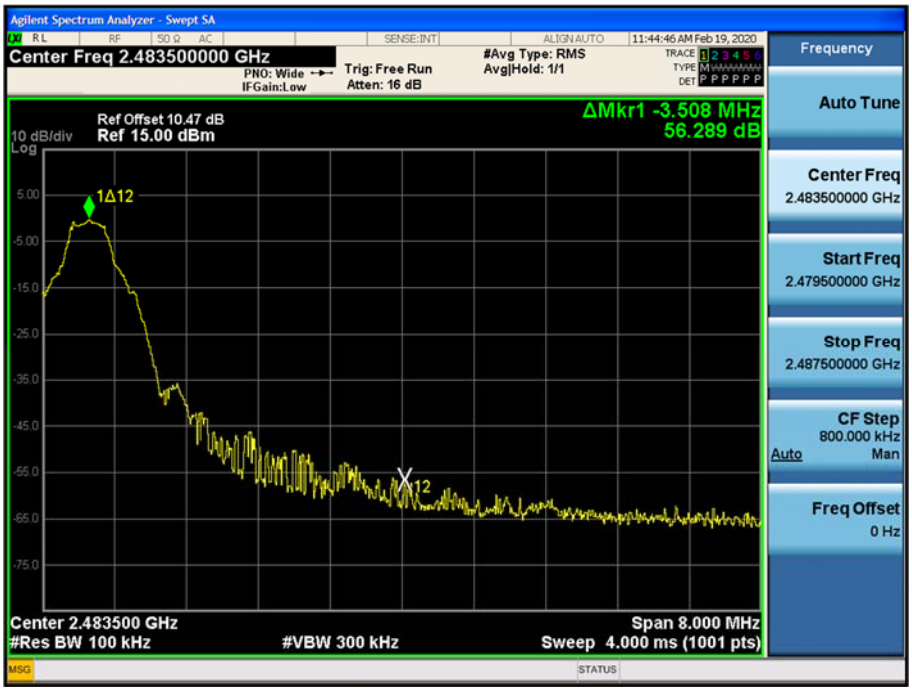
## 9.5 BAND EDGE/ CONDUCTED SPURIOUS EMISSIONS

Test Result : please refer to the plot below.
In order to simplify the report, attached plots were only the worst case channel and data rate.

## ▣ 1M Bit/s (255 Byte) Test Plots -BandEdge

Low-CH 0

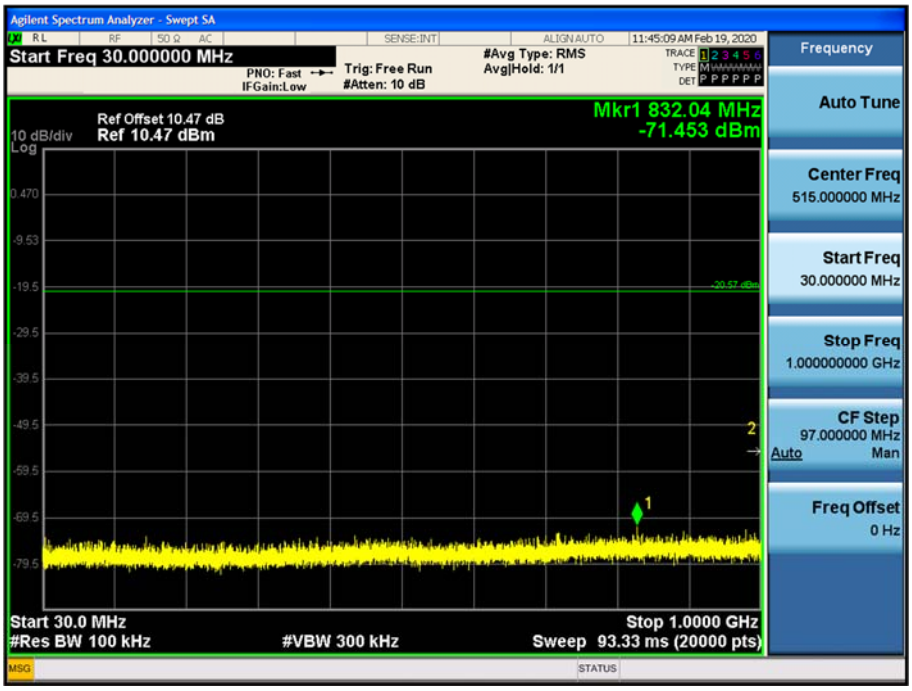

High-CH 39



## ▣ 1M Bit/s (255 Byte) Test Plots -Conducted Spurious Emission

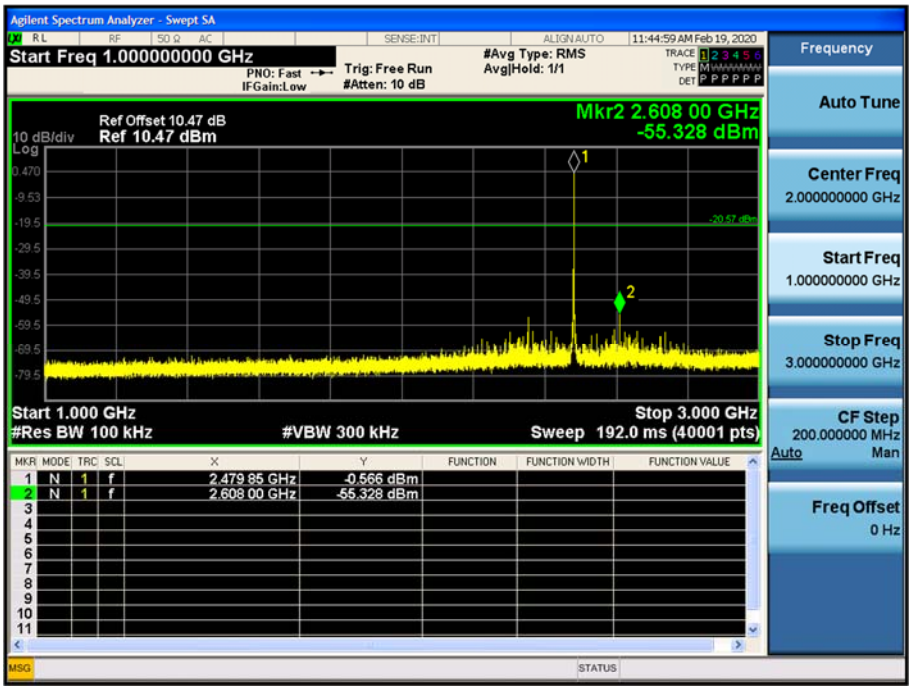
30 MHz ~ 1 GHz

Conducted Spurious Emission (High-CH 39)



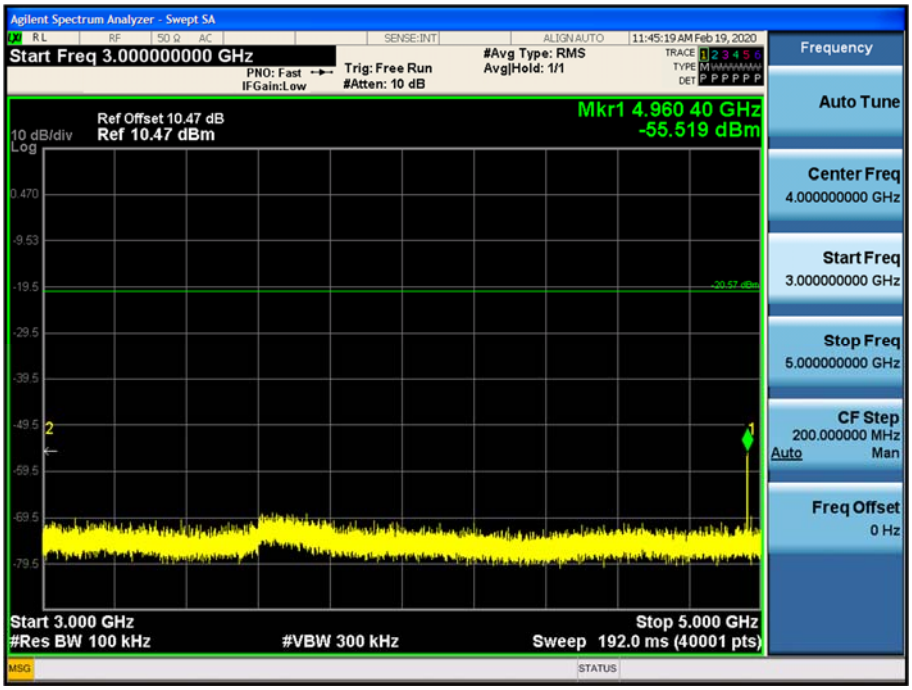

1 GHz ~ 3 GHz

Conducted Spurious Emission (High-CH 39)



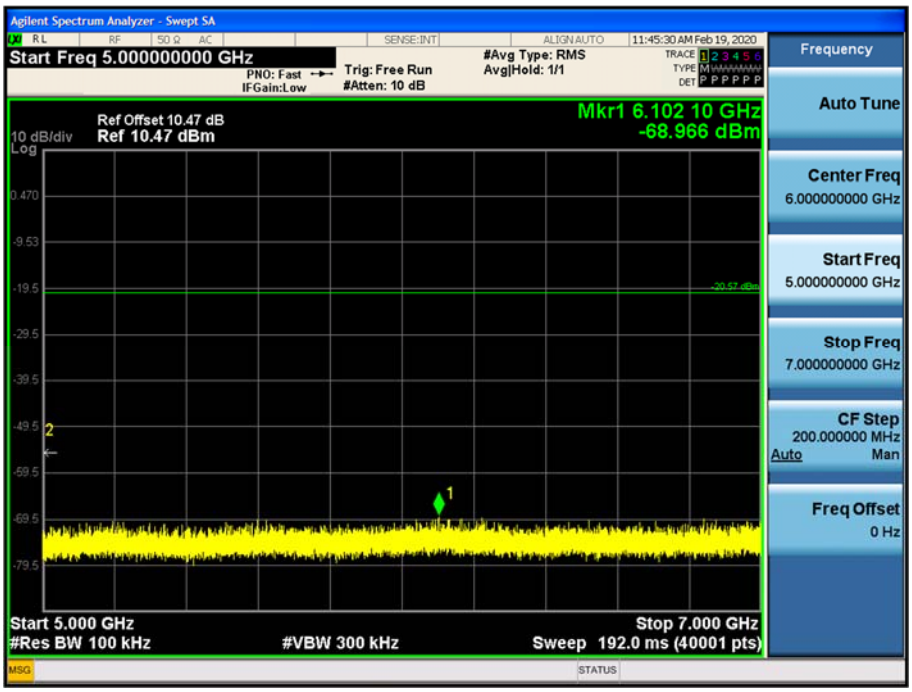
3 GHz ~ 5 GHz

Conducted Spurious Emission (High-CH 39)



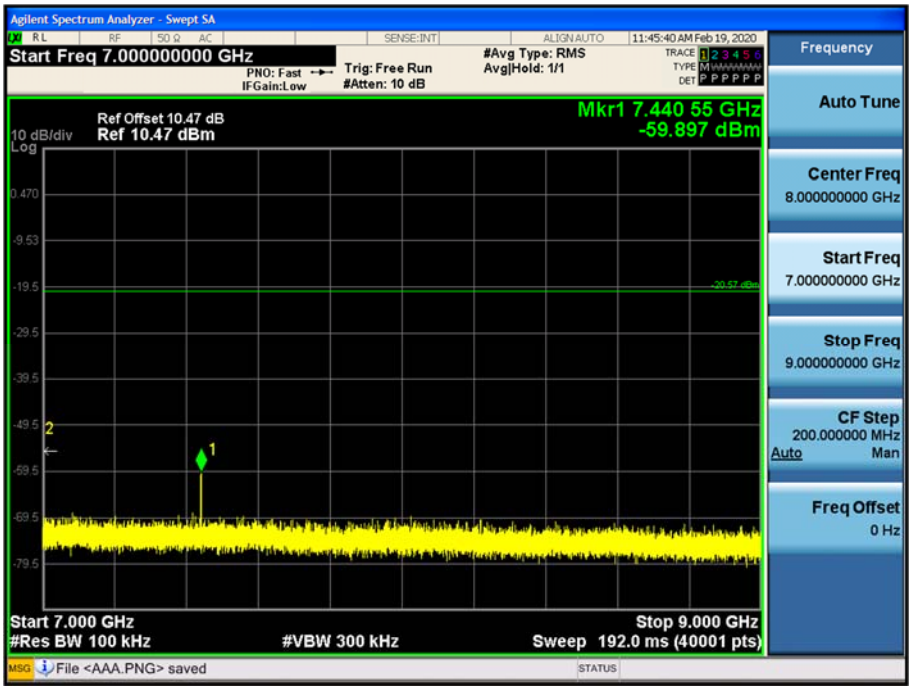

5 GHz ~ 7 GHz

Conducted Spurious Emission (High-CH 39)



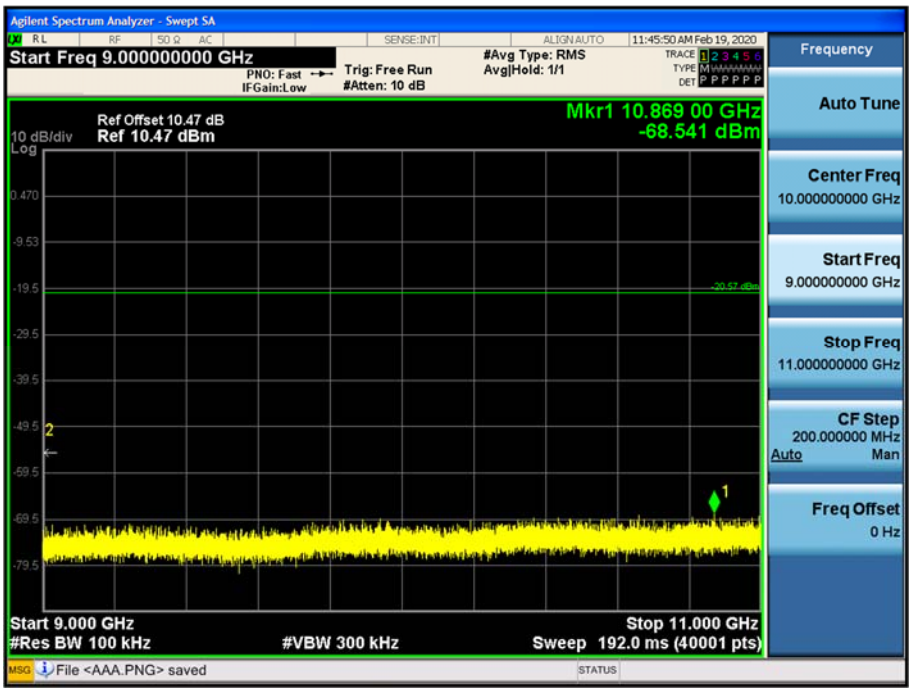
7 GHz ~ 9 GHz

Conducted Spurious Emission (High-CH 39)



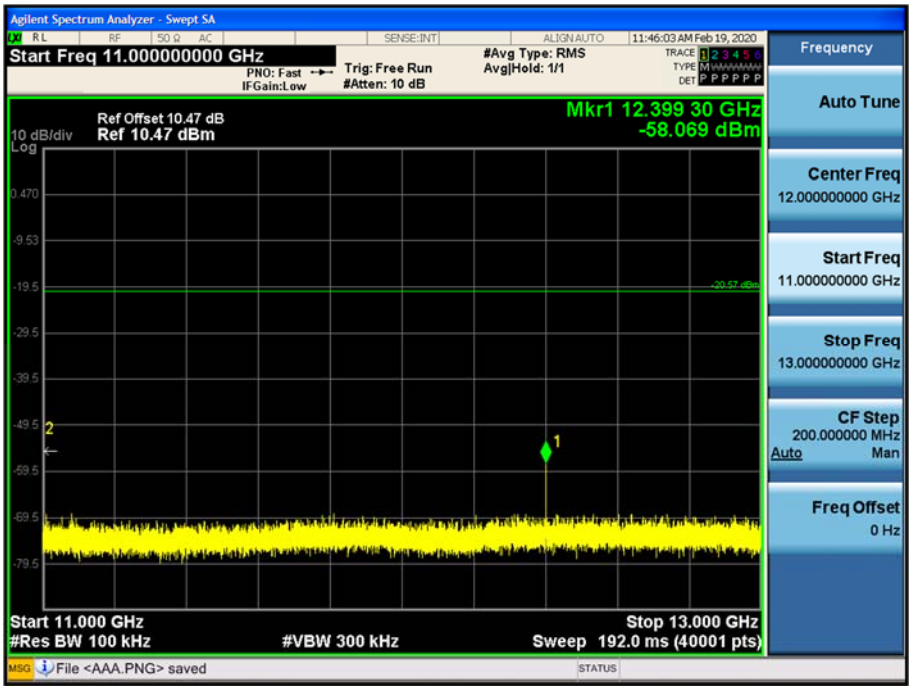

9 GHz ~ 11 GHz

Conducted Spurious Emission (High-CH 39)



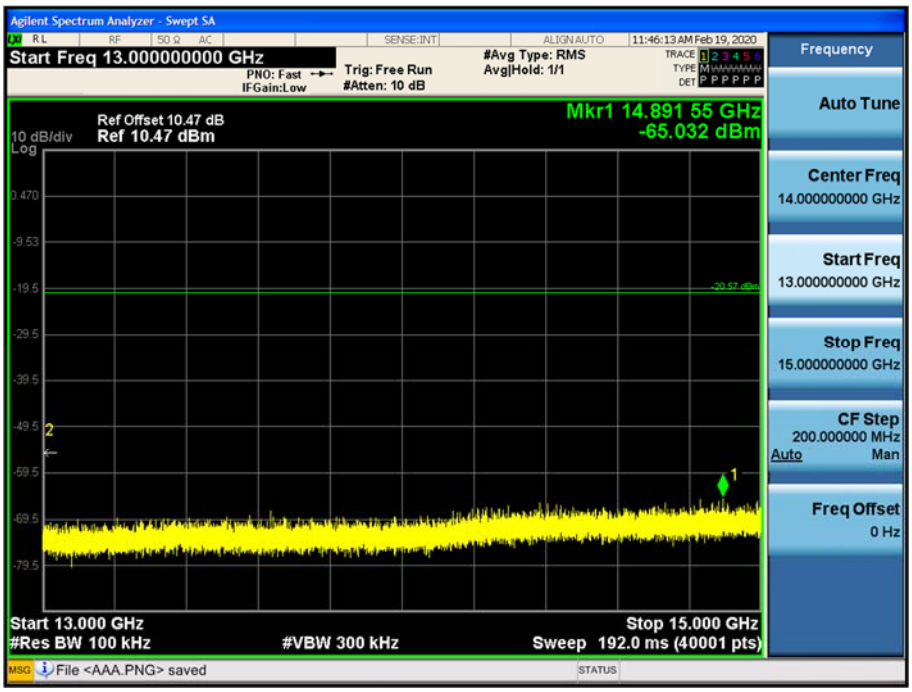
11 GHz ~ 13 GHz

Conducted Spurious Emission (High-CH 39)



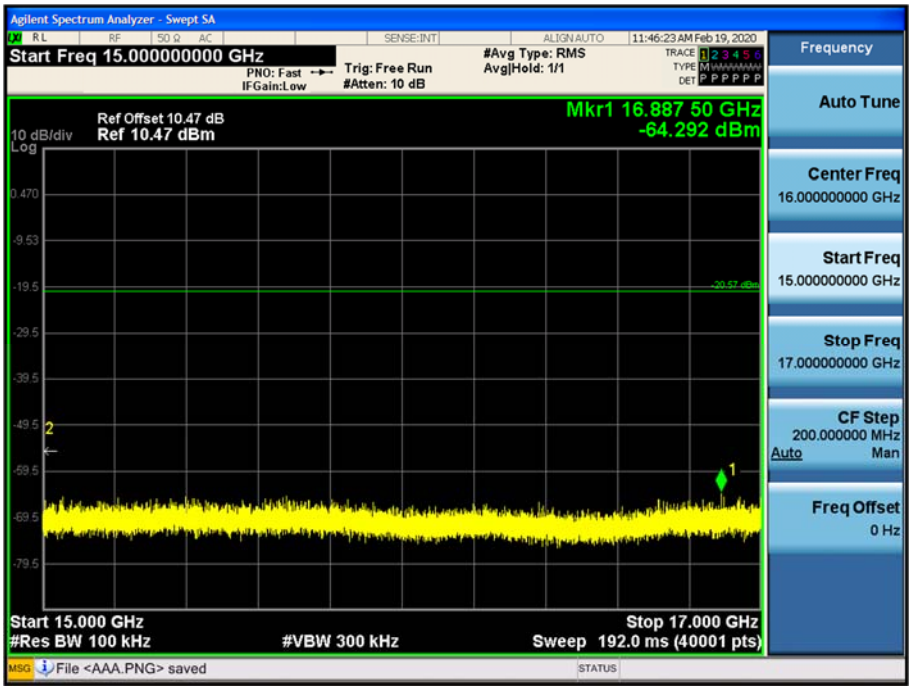

**13 GHz ~ 15 GHz**

Conducted Spurious Emission (High-CH 39)



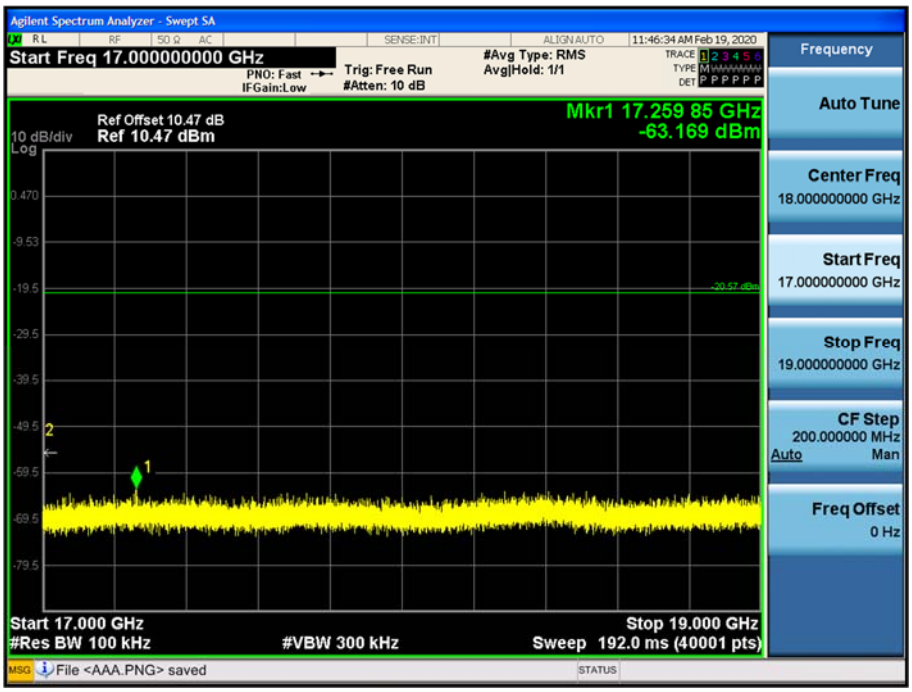
15 GHz ~ 17 GHz

Conducted Spurious Emission (High-CH 39)



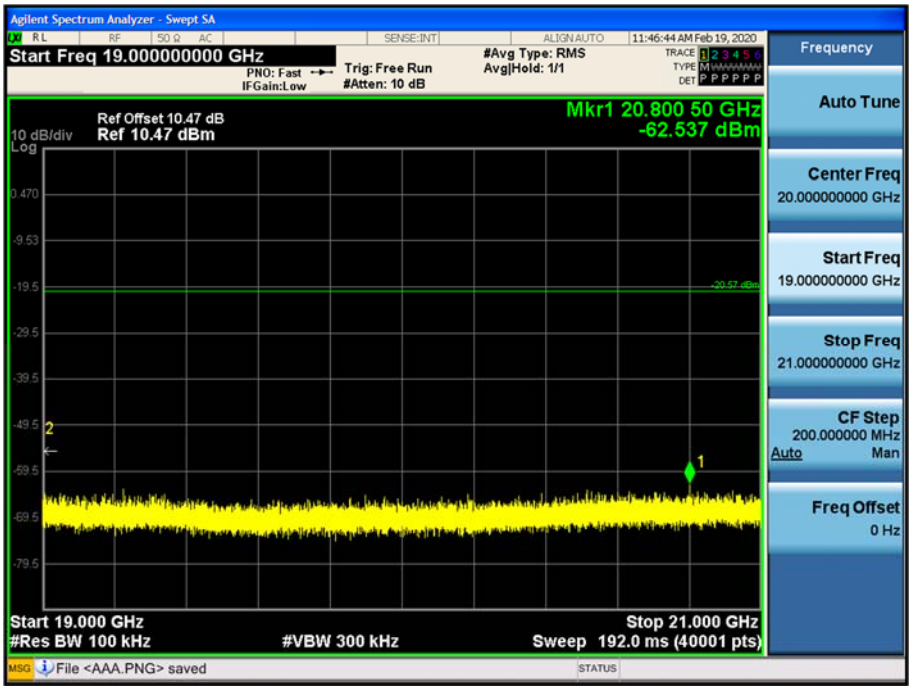

17 GHz ~ 19 GHz

Conducted Spurious Emission (High-CH 39)



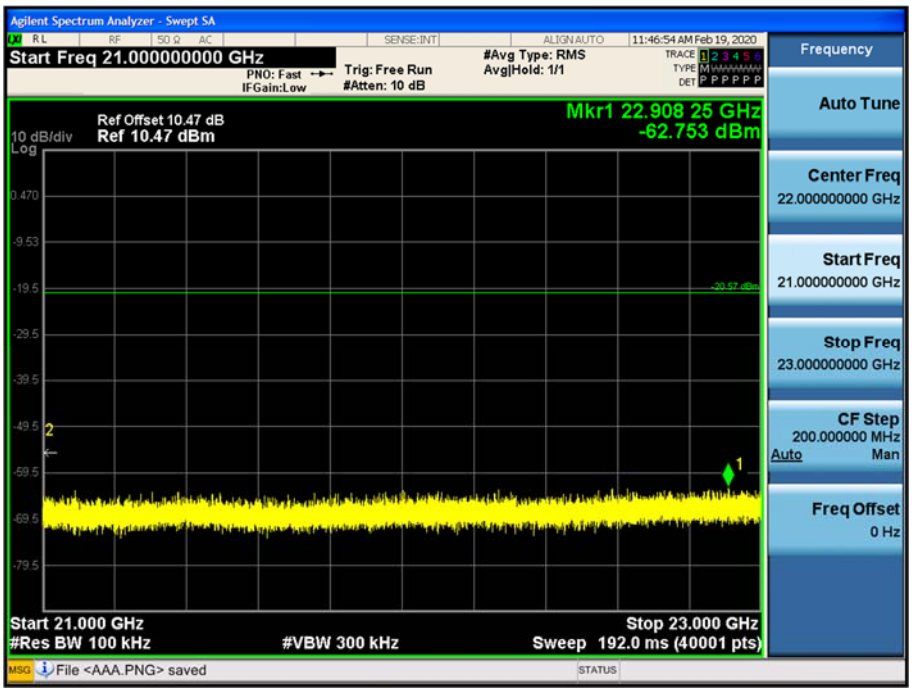
19 GHz ~ 21 GHz

Conducted Spurious Emission (High-CH 39)



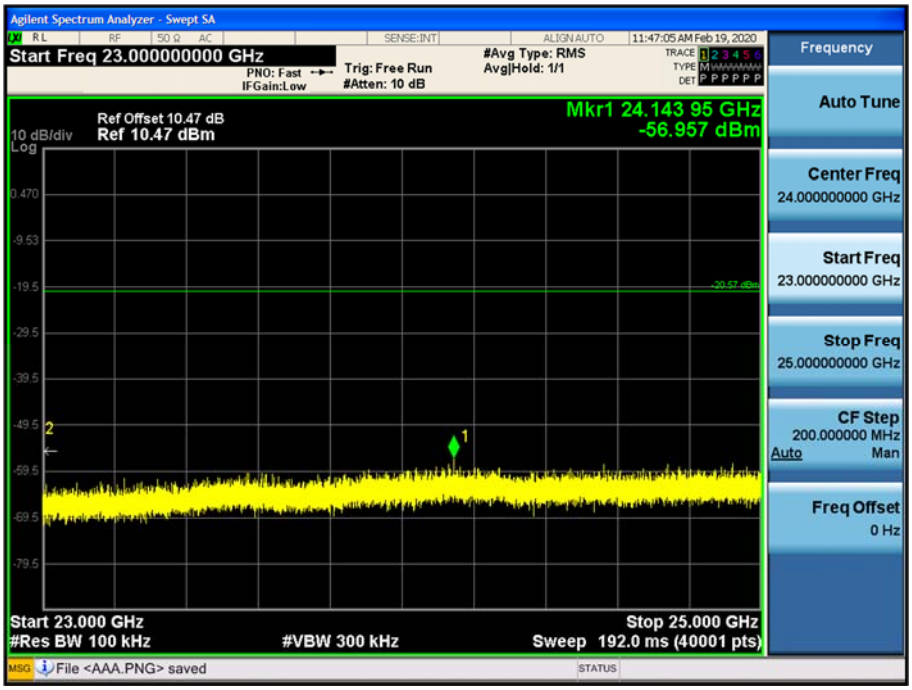

21 GHz ~ 23 GHz

Conducted Spurious Emission (High-CH 39)



23 GHz ~ 25 GHz

Conducted Spurious Emission (High-CH 39)



## ▣ 2M Bit/s (255 Byte) Test Plots -BandEdge

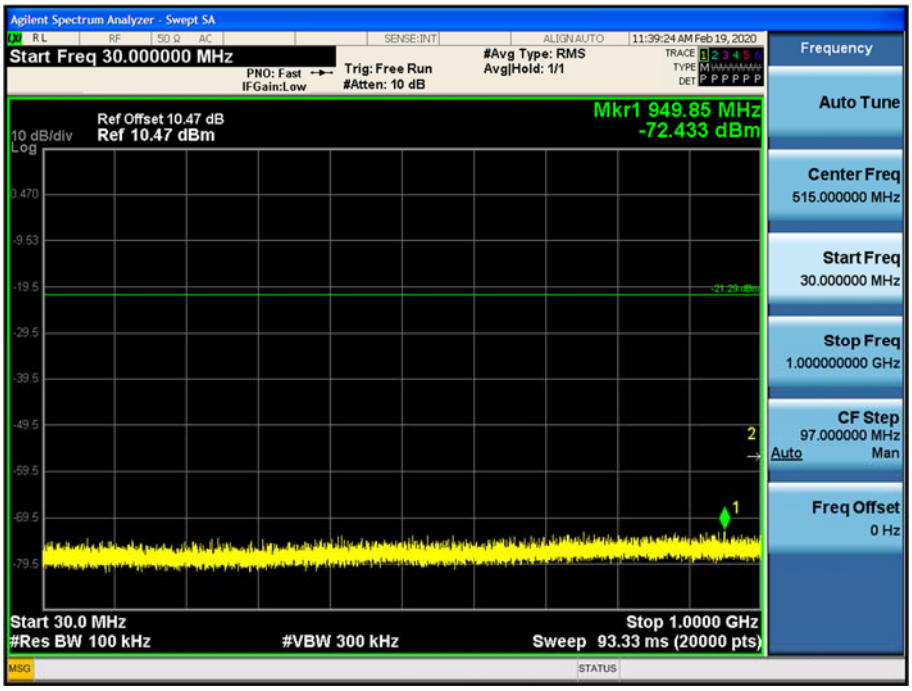
Low-CH 0


High-CH 39

## ▣ 2M Bit/s (255 Byte) Test Plots -Conducted Spurious Emission

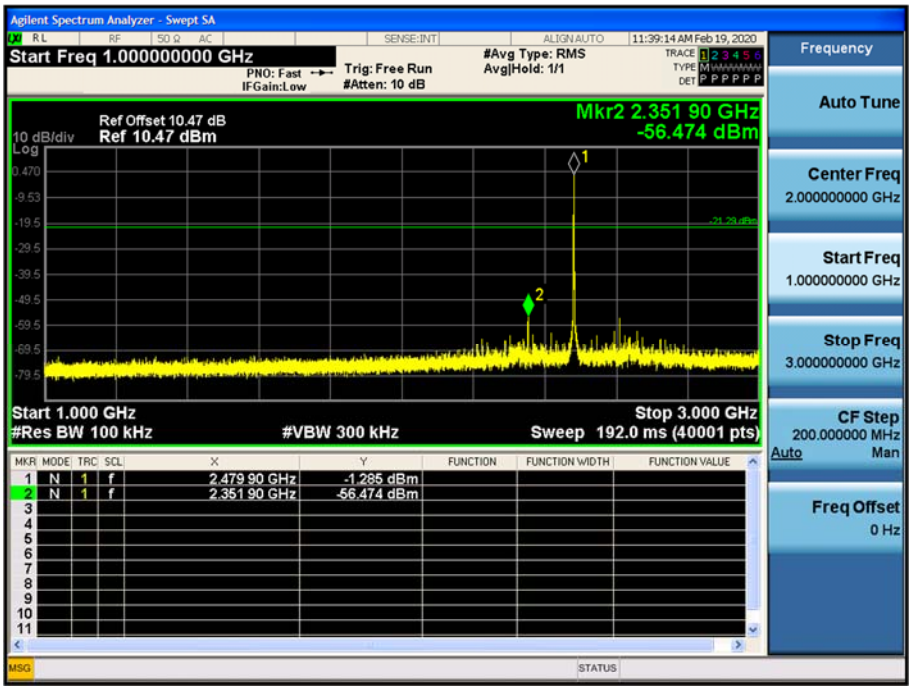
30 MHz ~ 1 GHz

Conducted Spurious Emission (High-CH 39)



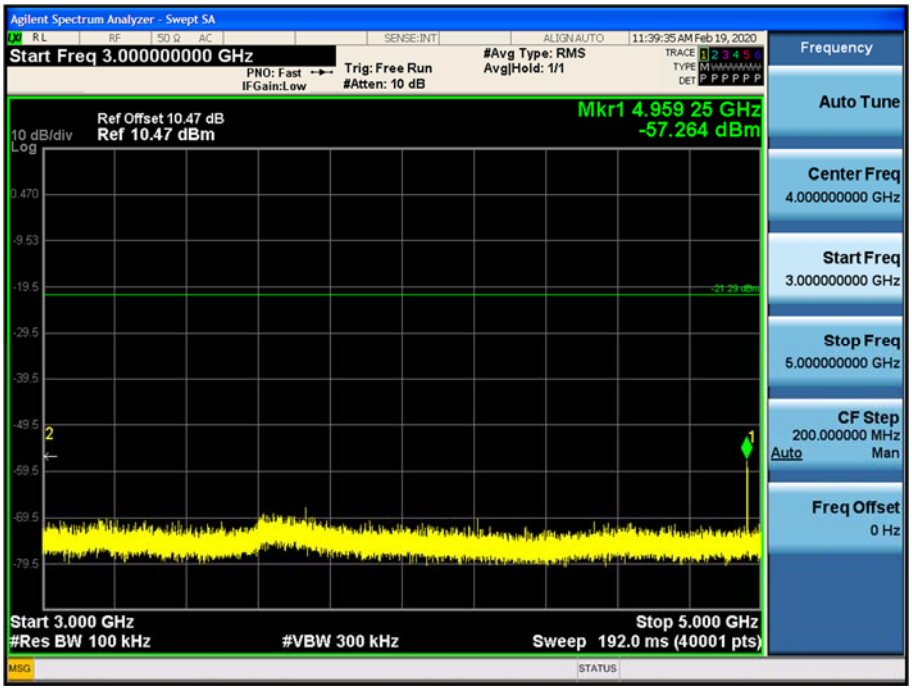

1 GHz ~ 3 GHz

Conducted Spurious Emission (High-CH 39)



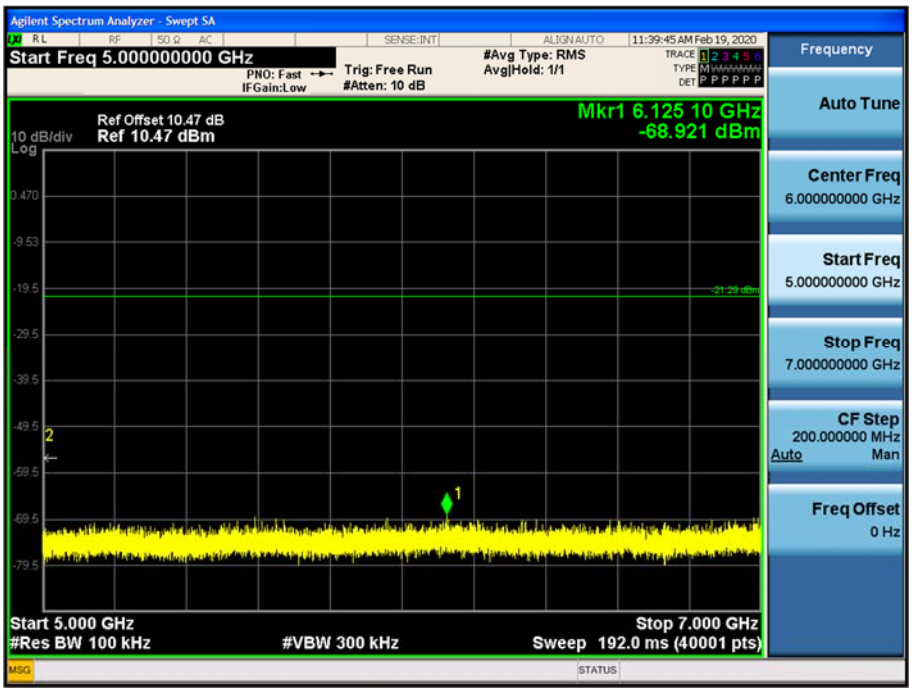
3 GHz ~ 5 GHz

Conducted Spurious Emission (High-CH 39)



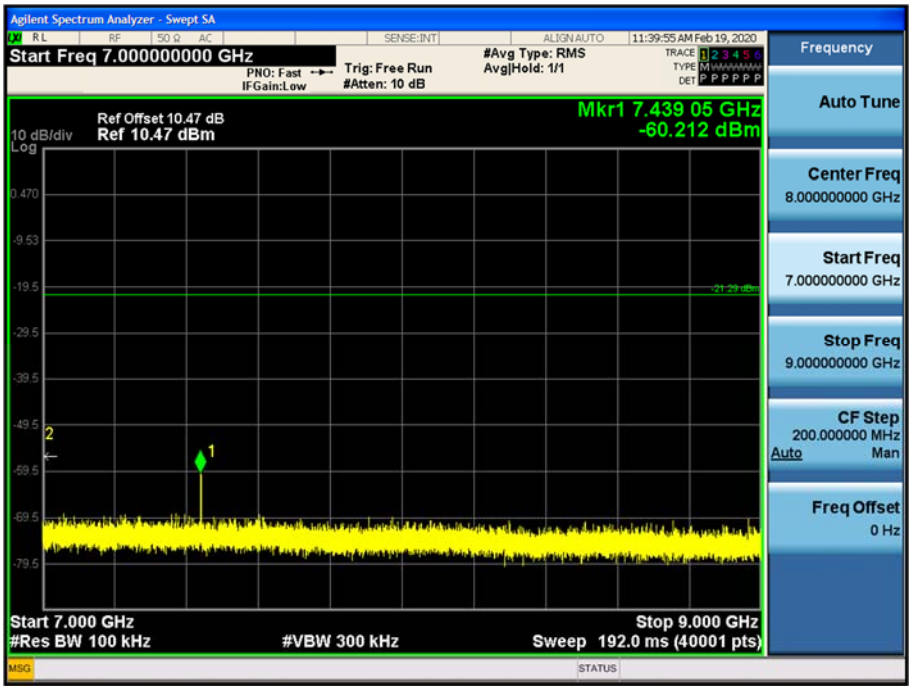

5 GHz ~ 7 GHz

Conducted Spurious Emission (High-CH 39)



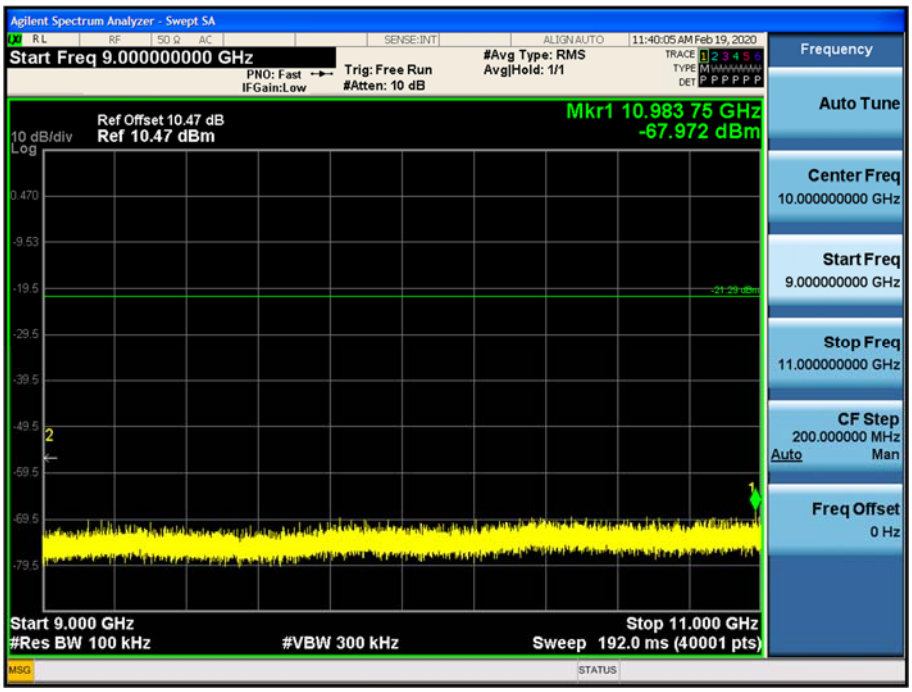
7 GHz ~ 9 GHz

Conducted Spurious Emission (High-CH 39)



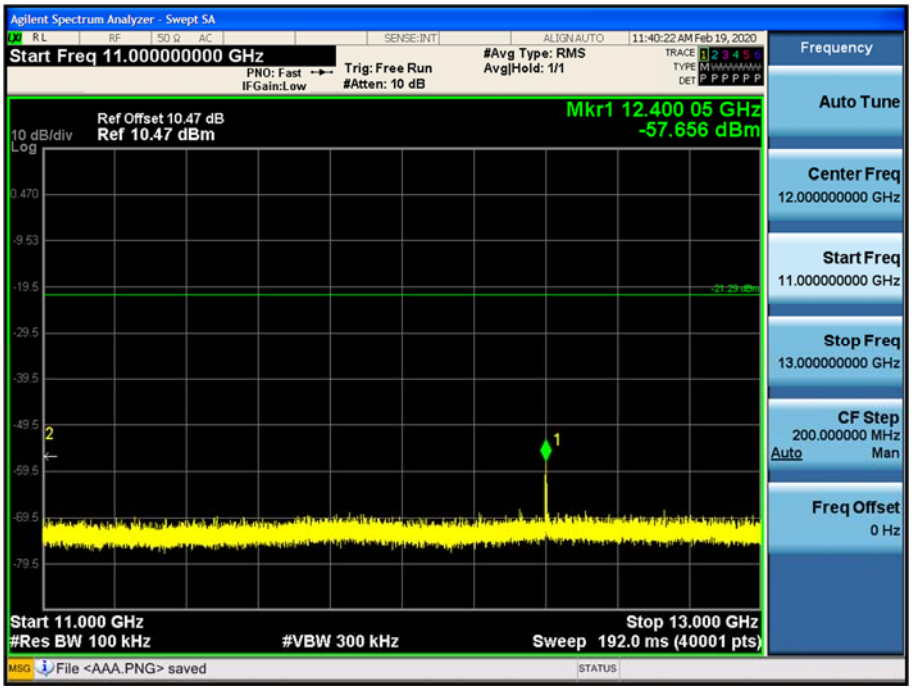

9 GHz ~ 11 GHz

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)