



TEST REPORT

FCC/ISED BT LE Test for MTWBE01GLX
Certification

APPLICANT
LG Electronics Inc.

REPORT NO.
HCT-RF-2103-FI004

DATE OF ISSUE
March 15, 2021

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<h1 style="margin: 0;">TEST REPORT</h1> <p style="margin: 0;">FCC/ISED BT LE Test for MTVWBE01GLX</p>	<p>REPORT NO. HCT-RF-2103-FI004</p> <p>DATE OF ISSUE March 15, 2021</p> <p>Additional Model -</p>
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Applicant **LG Electronics Inc.**
222, LG-ro, Jinwi-myeon, Pyeongtaek-si, Gyeonggi-do, 451-713, Korea

Eut Type	RF Module
Model Name	MTVWBE01GLX
FCC ID	BEJMTVWBE01GLX
IC	2703H-MTVWBE01GLX
Max. RF Output Power	8.181 dBm (6.58 mW)
Modulation type	GFSK
FCC Classification	Digital Transmission System(DTS)
FCC Rule Part(s)	Part 15.247
ISED Rule Part(s)	RSS-247 Issue 2 (February 2017) RSS-Gen Issue 5_Amendment 1 (March 2019)

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.

REVISION HISTORY

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

Revision No.	Date of Issue	Description
0	March 15, 2021	Initial Release

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. It is further stated that upon the basis of the measurements made, the equipment tested is capable of operation in accordance with the requirements of the FCC / ISED Rules under normal use and maintenance.

This laboratory is not accredited for the test results marked *.

The above Test Report is the accredited test result by (KS Q) ISO/IEC 17025 AND KOLAS(Korea Laboratory Accreditation Scheme), which signed the ILAC-MRA.(HCT Accreditation No.: KT197)

* The report shall not be reproduced except in full(only partly) without approval of the laboratory.

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1. EUT DESCRIPTION

Model	MTVWBE01GLX	
Additional Model	-	
EUT Type	RF Module	
Power Supply	DC 3.30 V	
Frequency Range	2 402 MHz – 2 480 MHz	
Max. RF Output Power	Peak	125k Bit/s : 7.879 dBm (6.14 mW) 500k Bit/s : 7.878 dBm (6.13 mW) 1M Bit/s : 7.884 dBm (6.14 mW) 2M Bit/s : 8.181 dBm (6.58 mW)
	Average	125k Bit/s : 7.66 dBm (5.83 mW) 500k Bit/s : 7.72 dBm (5.92 mW) 1M Bit/s : 7.70 dBm (5.89 mW) 2M Bit/s : 8.18 dBm (6.58 mW)
Modulation Type	GFSK	
Bluetooth Version	5.0	
Number of Channels	40 Channels	
Antenna Specification	Antenna type: PIFA (Planar Inverted F Antenna) Peak Gain : 1.51 dBi	
Date(s) of Tests	February 19, 2021 ~ March 15, 2021	
PMN (Product Marketing Number)	RF Module	
HVIN (Hardware Version Identification Number)	MTVWBE01GLX	
FVIN (Firmware Version Identification Number)	ver 1.0	
HMN (Host Marketing Name)	N/A	
EUT serial numbers	Radiated : MTVWBE01GLX-1 Conducted : MTVWBE01GLX-2	
Manufacturer	Markone-Technology A 2401, 606, Seobusaet-gil, Geumcheon-gu, Seoul, Korea, 08504	

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 purpose of the measurements. According to its specifications, the EUT must comply with the requirements of the Section 15.207, 15.209 and 15.247 under the FCC Rules Part 15 Subpart C. / RSS-Gen issue 5, RSS-247 issue 2.

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 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).

For ISED, test facility was accepted dated February 14, 2019 (CAB identifier: 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.

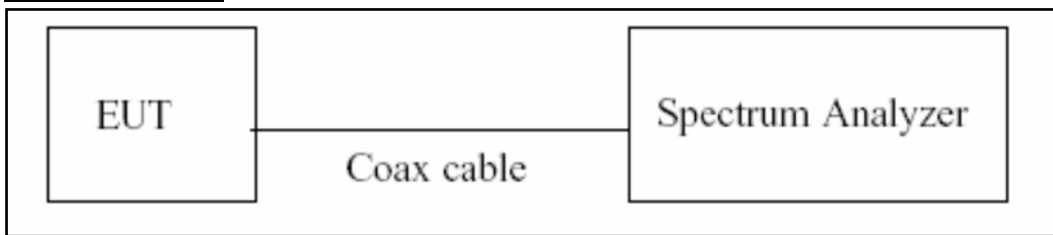
The measurement data shown herein meets or exceeds the U_{CISPR} measurement uncertainty values specified in CISPR 16-4-2 and, thus, can be compared directly to specified limits to determine compliance.

Parameter	Expanded Uncertainty (\pm 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 available value of RBW is 8 MHz and VBW is 50 MHz.

The zero-span method of measuring duty cycle shall not be used if $T \leq 6.25$ 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 $> 50/T$.

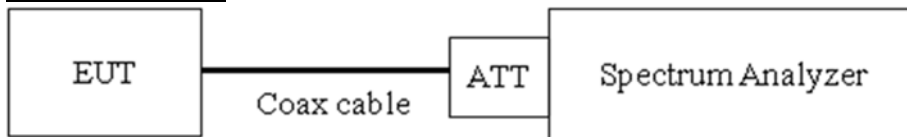
1. RBW = 8 MHz (the largest available value)
2. VBW = 8 MHz (\geq RBW)
3. SPAN = 0 Hz
4. Detector = Peak
5. Number of points in sweep > 100
6. Trace mode = Clear write
7. Measure T_{total} and T_{on}
8. Calculate Duty Cycle = T_{on}/T_{total} and Duty Cycle Factor = $10\log(1/Duty\ Cycle)$

7.2. 6dB Bandwidth & 99 % Bandwidth(ISED)

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 \geq 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.

Test Procedure (99 % Bandwidth for ISED)

The transmitter output is connected to the spectrum analyzer.

RBW = 1% ~ 5% of the occupied bandwidth

VBW \approx 3 x RBW

Detector = Peak

Trace mode = max hold

Sweep = auto couple

Allow the trace to stabilize

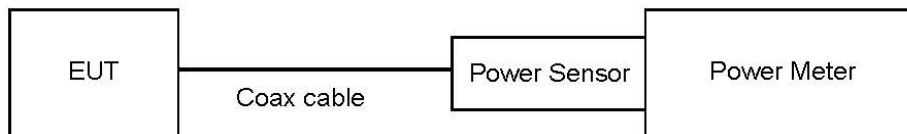
Note : We tested OBW using the automatic bandwidth measurement capability of a spectrum analyzer.

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

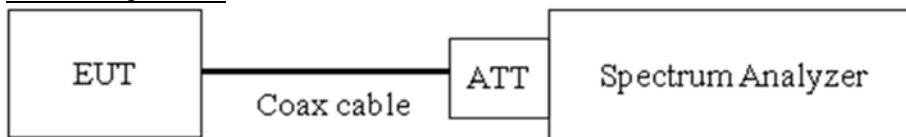
- Conducted Output Power(Peak) = Reading Value + ATT loss + Cable loss
- Conducted Output Power(Average) = Reading Value + ATT loss + Cable loss + Duty Cycle Factor

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) $RBW = 3 \text{ kHz} \leq RBW \leq 100 \text{ kHz}$.
- 4) $VBW \geq 3 \times RBW$.
- 5) Sweep = auto couple
- 6) Detector = Peak
- 7) Trace mode = max hold
- 8) Allow trace to fully stabilize.
- 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

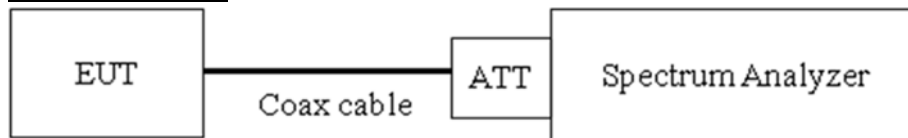
7.5. Conducted Band Edge(Out of Band Emissions) & Conducted Spurious Emissions

Limit

The maximum conducted (Peak) output power was used to demonstrate compliance, 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.

[Conducted > 30 dBc]

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 \geq 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 \geq 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	20.05
100	20.10
200	20.14
300	20.19
400	20.25
500	20.25
600	20.26
700	20.27
800	20.28
900	20.30
1000	20.35
2000	20.50
2400	20.55
2412	20.55
2437	20.55
2462	20.54
2500	20.54
3000	20.64
4000	20.72
5000	20.79
5700	20.80
5800	20.87
6000	20.88
7000	21.01
8000	21.01
9000	21.09
10000	21.19
11000	21.28
12000	21.37
13000	21.38
14000	21.41
15000	21.51
16000	21.59
17000	21.80
18000	21.93
19000	21.85
20000	21.52
21000	21.65
22000	21.64
23000	21.65
24000	21.66
25000	21.76

Note : 1. 2400 ~ 2500 MHz is fundamental frequency range.

2. Factor = Attenuator loss(20dB) + Cable loss

7.6. Radiated Test

FCC

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

ISED

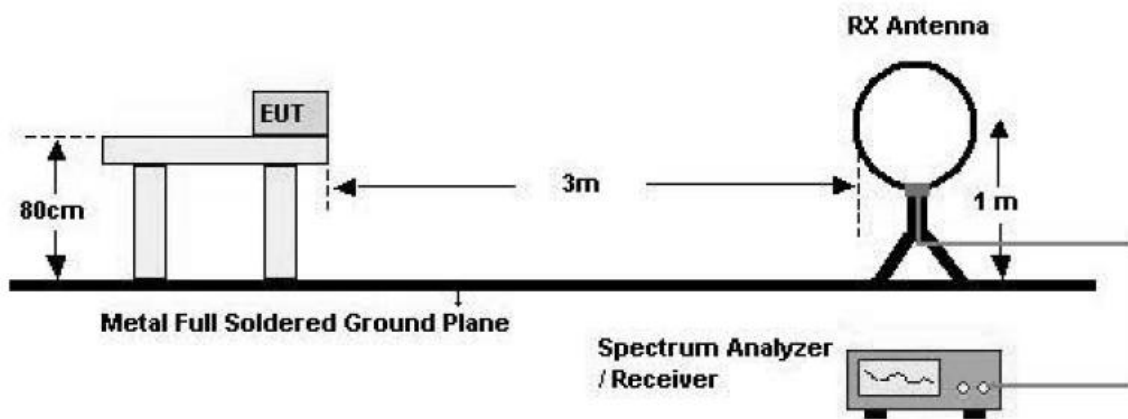
Frequency (MHz)	Field Strength (uA/m)	Measurement Distance (m)
0.009 – 0.490	6.37/F(kHz)	300
0.490 – 1.705	63.7/F(kHz)	30
1.705 – 30	0.08	30

FCC&ISED

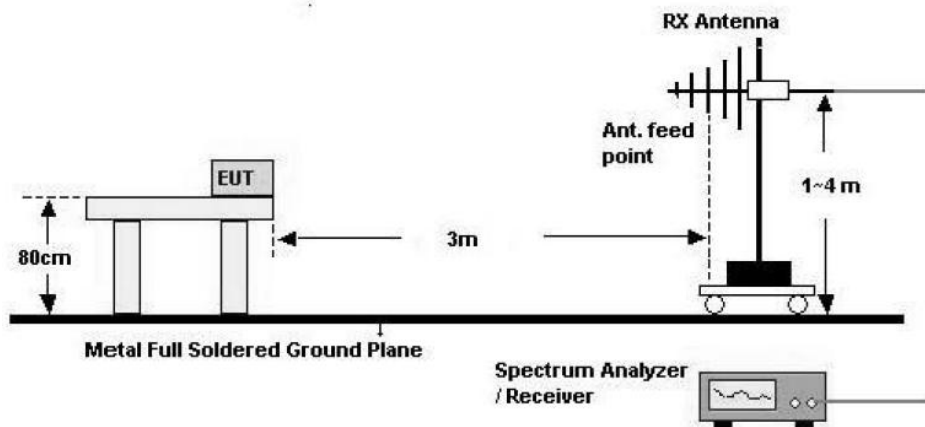
Frequency (MHz)	Field Strength (uV/m)	Measurement Distance (m)
30-88	100	3
88-216	150	3
216-960	200	3
Above 960	500	3

Test Configuration

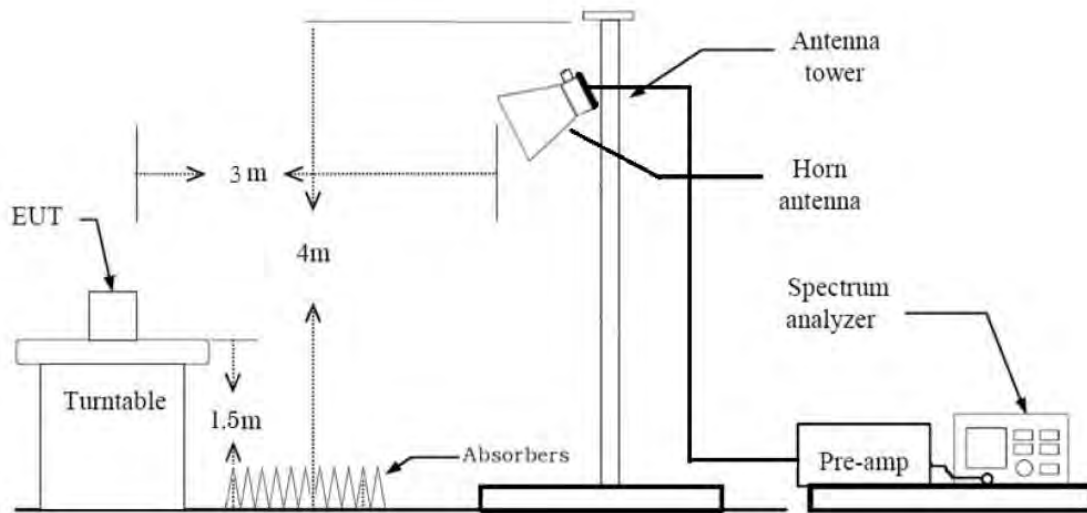
Below 30 MHz



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) = $40\log(3\text{ m}/300\text{ m}) = -80\text{ dB}$
Measurement Distance : 3 m
7. Distance Correction Factor(0.490 MHz – 30 MHz) = $40\log(3\text{ m}/30\text{ m}) = -40\text{ dB}$
Measurement Distance : 3 m
8. Spectrum Setting
 - Frequency Range = 9 kHz ~ 30 MHz
 - Detector = Peak
 - Trace = Maxhold
 - RBW = 9 kHz
 - VBW $\geq 3 \times$ 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. The Hybrid antenna was placed at a location 3m from the EUT, which is varied from 1m to 4m to find out the highest emissions.
4. We have done x, y, z planes in EUT and horizontal and vertical polarization in detecting antenna.
5. The turntable shall be rotated for 360 degrees to determine the position of maximum emission level.
6. Spectrum Setting
 - (1) Measurement Type(Peak):
 - Measured Frequency Range : 30 MHz – 1 GHz
 - Detector = Peak
 - Trace = Maxhold
 - RBW = 100 kHz
 - VBW \geq 3 x RBW
 - (2) Measurement Type(Quasi-peak):
 - Measured Frequency Range : 30 MHz – 1 GHz
 - Detector = Quasi-Peak
 - RBW = 120 kHzIn general, (1) is used mainly
7. Total = Reading Value + Antenna Factor(A.F) + Cable Loss(C.L)
8. 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 m away from the receiving antenna, which is varied from 1m to 4m to find out the highest emissions.
5. Maximum procedure was performed on the six highest emissions to ensure EUT compliance.
6. Each emission was to be maximized by changing the polarization of receiving antenna both horizontal and vertical.
7. The unit was tested with its standard battery.
8. 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 = Max hold
 - RBW = 1 MHz
 - VBW \geq 3 x RBW
 - (2) Measurement Type(Average):
 - Duty cycle < 98%, duty cycle variations are less than $\pm 2\%$
 - Measured Frequency Range : 1 GHz – 25 GHz
 - Detector = RMS
 - Averaging type = power (*i.e.*, RMS)
 - RBW = 1 MHz
 - VBW \geq 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
9. 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.
10. Distance extrapolation factor = $20\log(\text{test distance} / \text{specific distance})$ (dB)

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)

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

+ Distance Factor(D.F) + Duty Cycle 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 m away from the receiving antenna, which is varied from 1m to 4m to find out the highest emissions.
5. Maximum procedure was performed on the six highest emissions to ensure EUT compliance.
6. Each emission was to be maximized by changing the polarization of receiving antenna both horizontal and vertical.
7. The unit was tested with its standard battery.

8. Spectrum Setting

(1) Measurement Type(Peak):

- Measured Frequency Range : 2310 MHz ~ 2390 MHz/ 2483.5 MHz ~ 2500 MHz
- Detector = Peak
- Trace = Max hold
- RBW = 1 MHz
- VBW \geq 3 x RBW

(2) Measurement Type(Average):

- Duty cycle < 98%, duty cycle variations are less than $\pm 2\%$
- Measured Frequency Range : 2310 MHz ~ 2390 MHz/ 2483.5 MHz ~ 2500 MHz
- Detector = RMS
- Averaging type = power (*i.e.*, RMS)
- RBW = 1 MHz
- VBW \geq 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.

9. 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.

10. Distance extrapolation factor = $20\log(\text{test distance} / \text{specific distance})$ (dB)

11. Total(Measurement Type : Peak

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

Total(Measurement Type : Average)

= 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 μ H/50 ohms line impedance stabilization network (LISN).

Frequency Range (MHz)	Limits (dB μ V)	
	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. Receiver Spurious Emissions

Limit

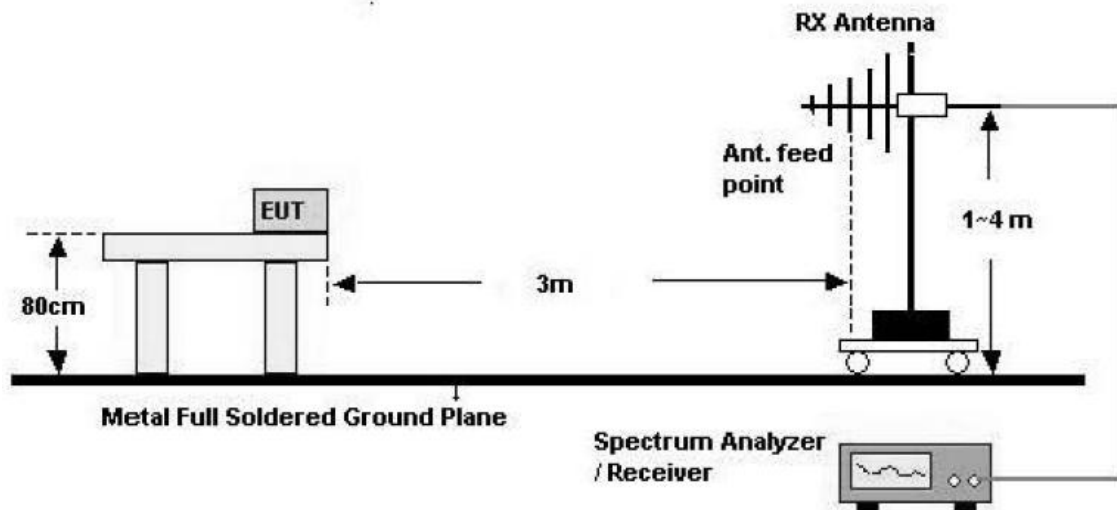
Frequency (MHz)	Field Strength (uV/m)	Measurement Distance (m)
30-88	100	3
88-216	150	3
216-960	200	3
Above 960	500	3

Note:

Measurements for compliance with the limits in table may be performed at distances other than 3 metres.

Test Configuration

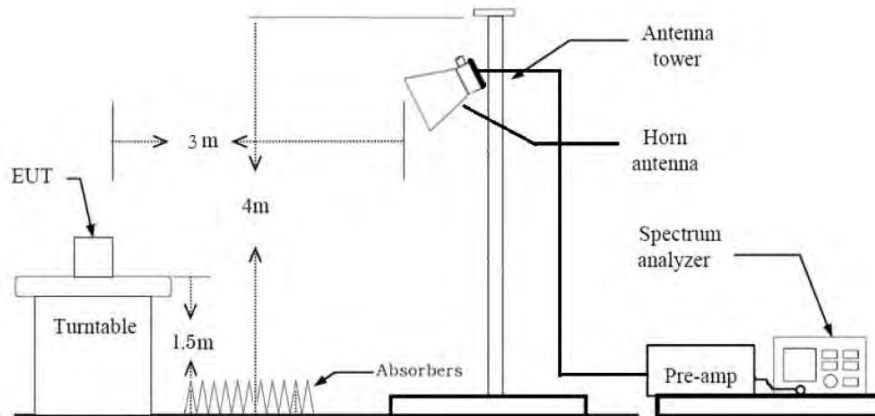
30 MHz - 1 GHz



Test Procedure of Receiver 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. The Hybrid antenna was placed at a location 3m from the EUT, which is varied from 1m to 4m to find out the highest emissions.
4. We have done x, y, z planes in EUT and horizontal and vertical polarization in detecting antenna.
5. The turntable shall be rotated for 360 degrees to determine the position of maximum emission level.
6. Spectrum Setting
 - (1) Measurement Type(Peak):
 - Measured Frequency Range : 30 MHz – 1 GHz
 - Detector = Peak
 - Trace = Maxhold
 - RBW = 100 kHz
 - VBW \geq 3 x RBW
 - (2) Measurement Type(Quasi-peak):
 - Measured Frequency Range : 30 MHz – 1 GHz
 - Detector = Quasi-Peak
 - RBW = 120 kHz
7. Total = Reading Value + Antenna Factor(A.F) + Cable Loss(C.L)

Above 1 GHz



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 m away from the receiving antenna, which is varied from 1m to 4m to find out the highest emissions.
5. Maximum procedure was performed on the six highest emissions to ensure EUT compliance.
6. Each emission was to be maximized by changing the polarization of receiving antenna both horizontal and vertical.
7. The unit was tested with its standard battery.

8. Spectrum Setting

(1) Measurement Type(Peak):

- Measured Frequency Range : 1 GHz – 25 GHz
- Detector = Peak
- Trace = Maxhold
- RBW = 1 MHz
- VBW \geq 3 x RBW

(2) Measurement Type(Average):

- We performed using a reduced video BW method was done with the analyzer in linear mode
- Measured Frequency Range : 1 GHz – 25 GHz
- Detector = Peak

- Trace = Maxhold
- RBW = 1 MHz
- VBW $\geq 1/\tau$ Hz, where τ = pulse width in seconds

The actual setting value of VBW = 1 kHz

9. 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.
10. Distance extrapolation factor = $20\log(\text{test distance} / \text{specific distance})$ (dB)
11. Total = Reading Value + Antenna Factor(A.F) + Cable Loss(C.L) - Amp Gain(G) + Distance Factor(D.F)

7.9. 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
 - Worstcase : Stand alone
2. EUT Axis:
 - Radiated Spurious Emissions : Y
 - Radiated Restricted Band Edge : X
3. All packet length of operation were investigated and the test results are worst case in lowest packet length.
(Worst case : 1M 255 Bytes, 2M 37 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.
 - Mode : Stand alone + External accessories (Notebook)

Conducted test

1. The EUT was configured with packet length of highest power.
 - ALL Mode Test
 (Worst case : 1M 255 Bytes, 2M 37 Byte)



8. SUMMARY TEST OF RESULTS

FCC Part

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

ISED Part

Test Description	ISED Part Section(s)	Test Limit	Test Condition	Test Result
6 dB Bandwidth	RSS-247, 5.2	> 500 kHz	Conducted	PASS
99% Bandwidth	RSS-GEN, 6.7	NA		PASS
Conducted Maximum Peak Output Power And e.i.r.p.	RSS-247, 5.4.4	< 1 Watt <4 Watt(e.i.r.p.)		PASS
Power Spectral Density	RSS-247, 5.2	< 8 dBm / 3 kHz Band		PASS
Band Edge(Out of Band Emissions)	RSS-247, 5.5	Conducted > 20 dBc		PASS
AC Power line Conducted Emissions	RSS-GEN, 8.8	RSS-GEN section 8.8 table 4		PASS
Radiated Spurious Emissions	RSS-GEN, 8.9	RSS-GEN section 8.9 table 5, 6	Radiated	PASS
Receiver Spurious Emissions	RSS-GEN, 5 RSS-GEN, 7.3	RSS-GEN section 7.3 table 3		PASS
Radiated Restricted Band Edge	RSS-GEN, 8.10	RSS-GEN section 8.10 table 7		PASS

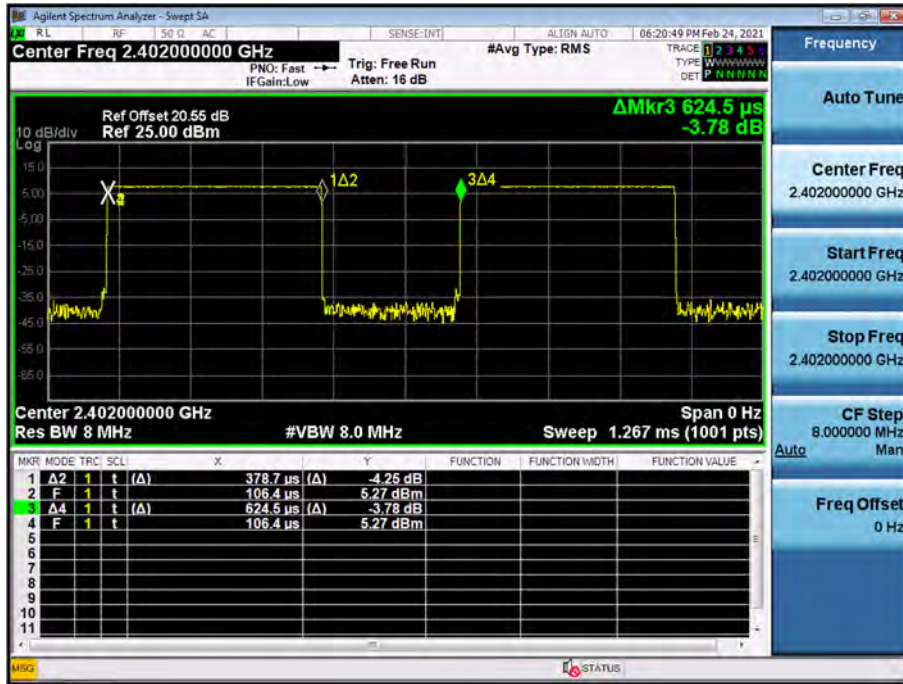
9. TEST RESULT

9.1 DUTY CYCLE

Data rate (Bit/s)	Packet length (Byte)	T _{on} (ms)	T _{total} (ms)	Duty Cycle	Duty Cycle Factor (dB)
125k	37	0.379	0.624	0.606	2.17
	255	2.125	2.500	0.850	0.71
500k	37	0.379	0.624	0.606	2.17
	255	2.125	2.500	0.850	0.71
1M	37	0.379	0.624	0.606	2.17
	255	2.120	2.500	0.848	0.72
2M	37	0.195	0.626	0.312	5.06
	255	1.067	1.877	0.568	2.45

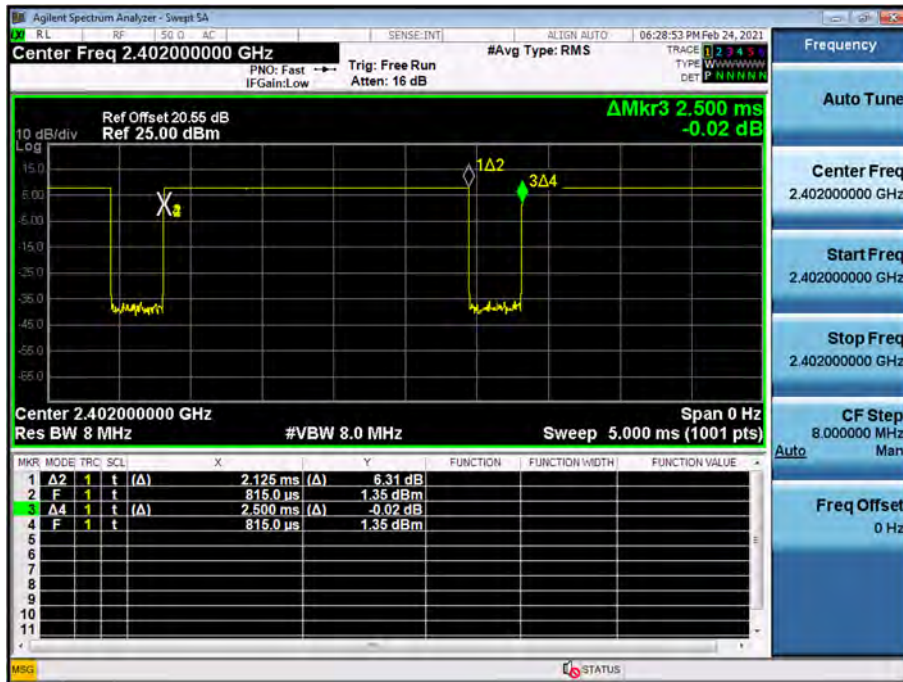
125k Bit/s(37 Byte) Test Plots

Duty Cycle (Low-CH 0)



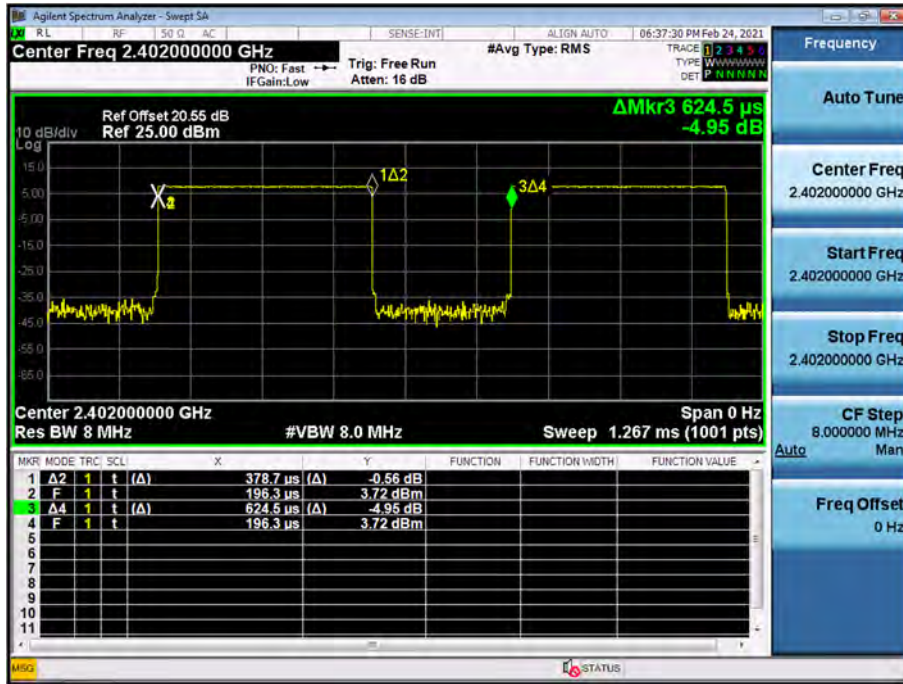
125k Bit/s(255 Byte) Test Plots

Duty Cycle (Low-CH 0)



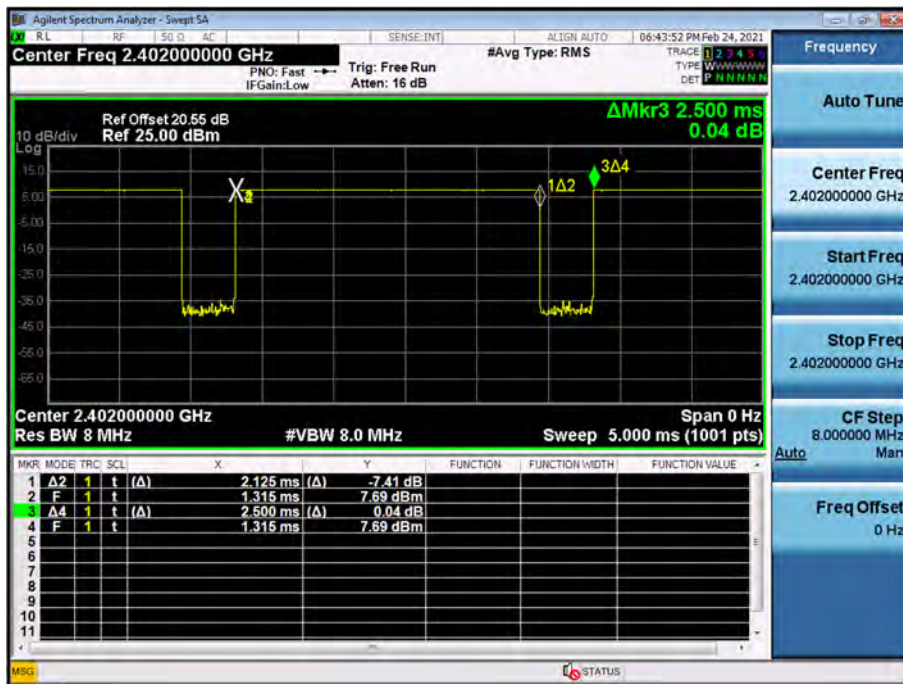
500k Bit/s(37 Byte) Test Plots

Duty Cycle (Low-CH 0)



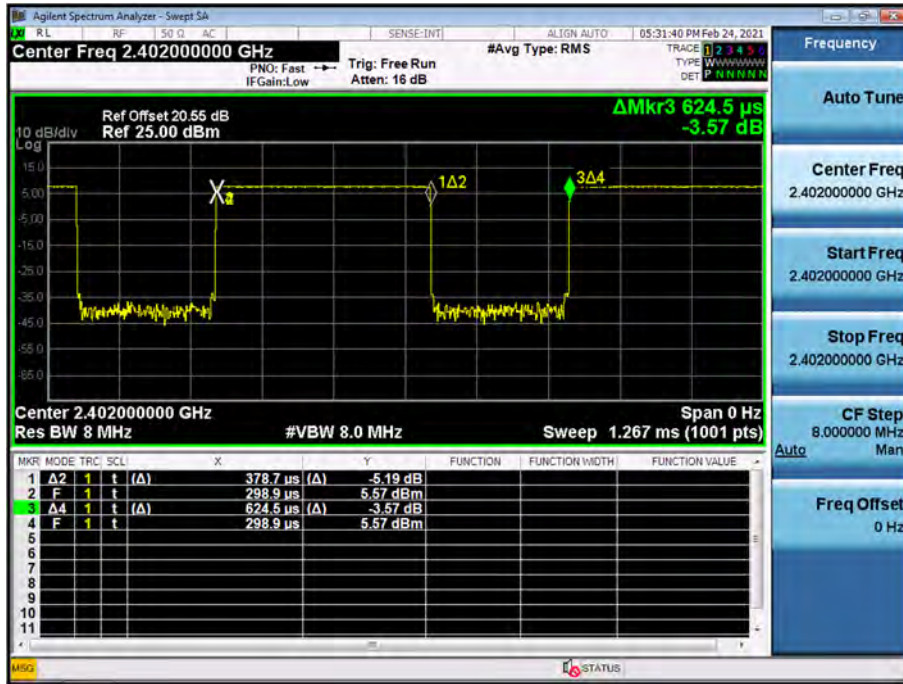
500k Bit/s(255 Byte) Test Plots

Duty Cycle (Low-CH 0)



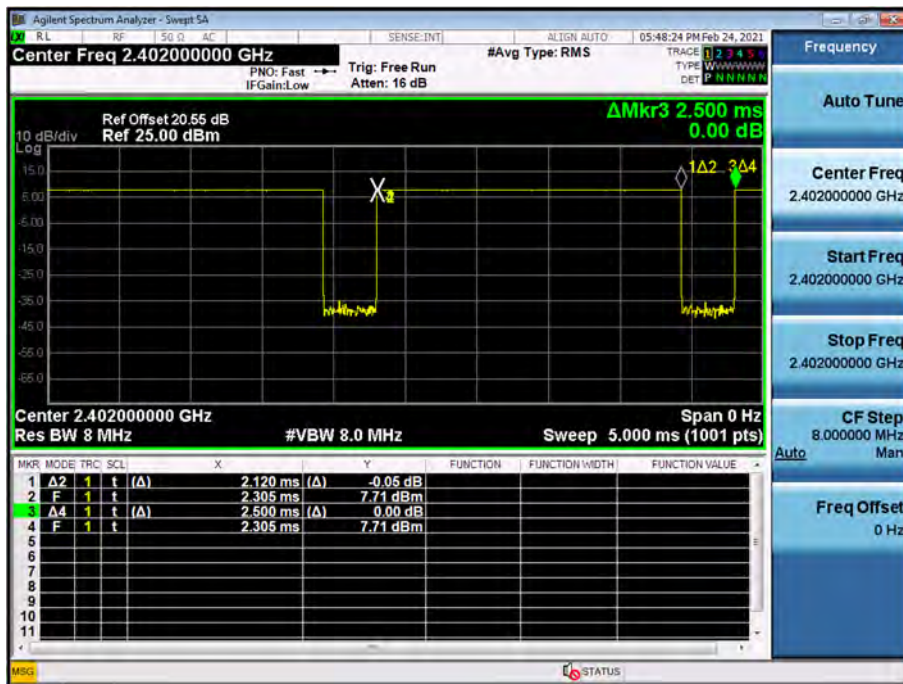
1M Bit/s (37 Byte) Test Plots

Duty Cycle (Low-CH 0)



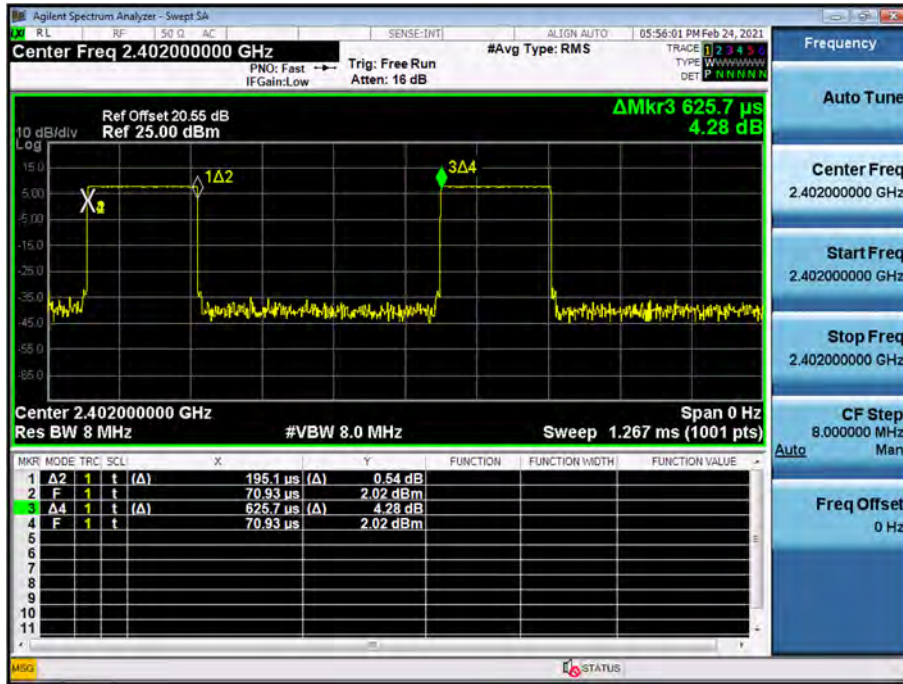
1M Bit/s (255 Byte) Test Plots

Duty Cycle (Low-CH 0)



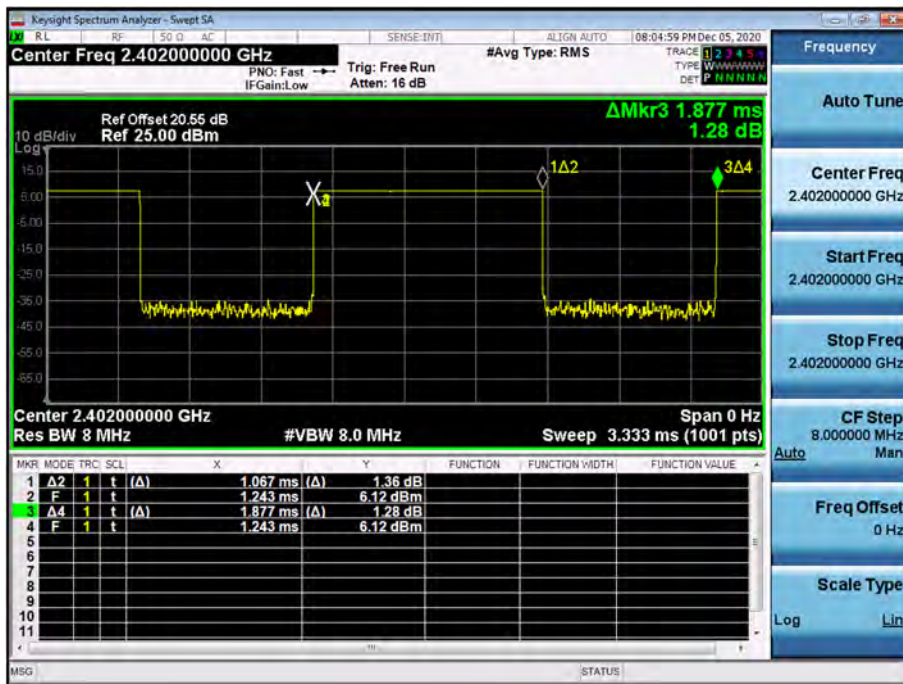
2M Bit/s (37 Byte) Test Plots

Duty Cycle (Low-CH 0)



2M Bit/s (255 Byte) Test Plots

Duty Cycle (Low-CH 0)





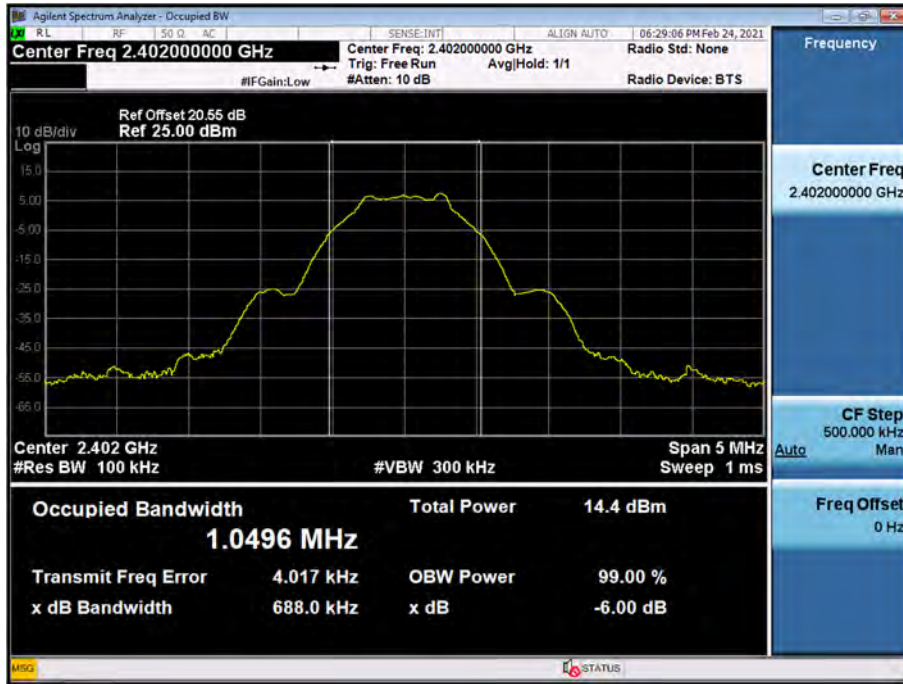
9.2 6dB BANDWIDTH & 99 % BANDWIDTH

FCC

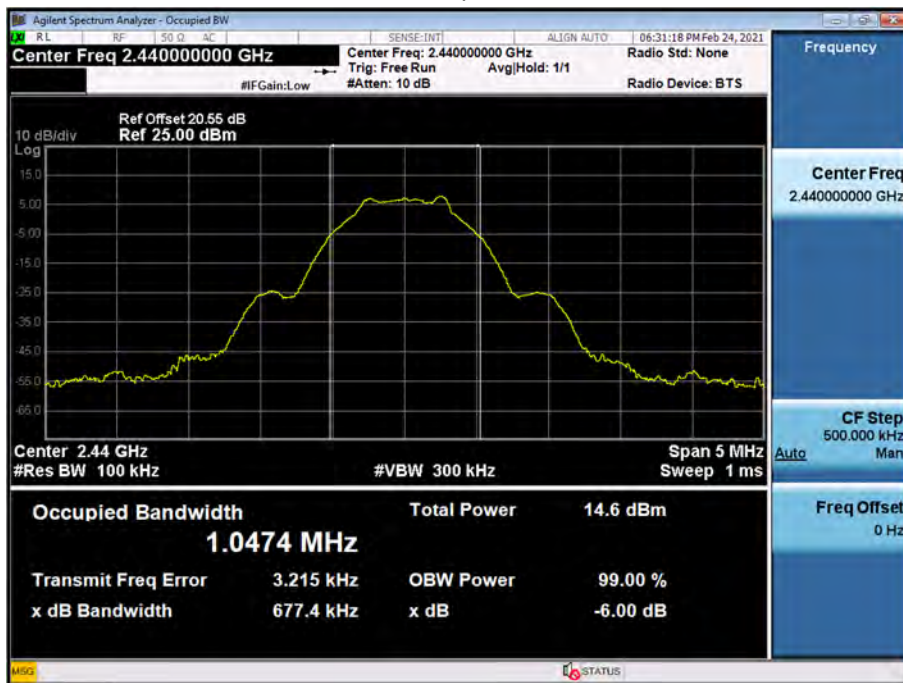
Mode (Bit/s)	Channel	6 dB Bandwidth (kHz)	Limit (kHz)
125k 255 Byte	0	688.0	> 500
	19	677.4	
	39	682.0	
500k 37 Byte	0	706.5	> 500
	19	708.7	
	39	707.4	
1M 255 Byte	0	682.4	> 500
	19	682.0	
	39	684.7	
2M 37 Byte	0	1259	> 500
	19	1259	
	39	1244	

125k Bit/s(255 Byte) Test Plots

6 dB Bandwidth plot (Low-CH 0)

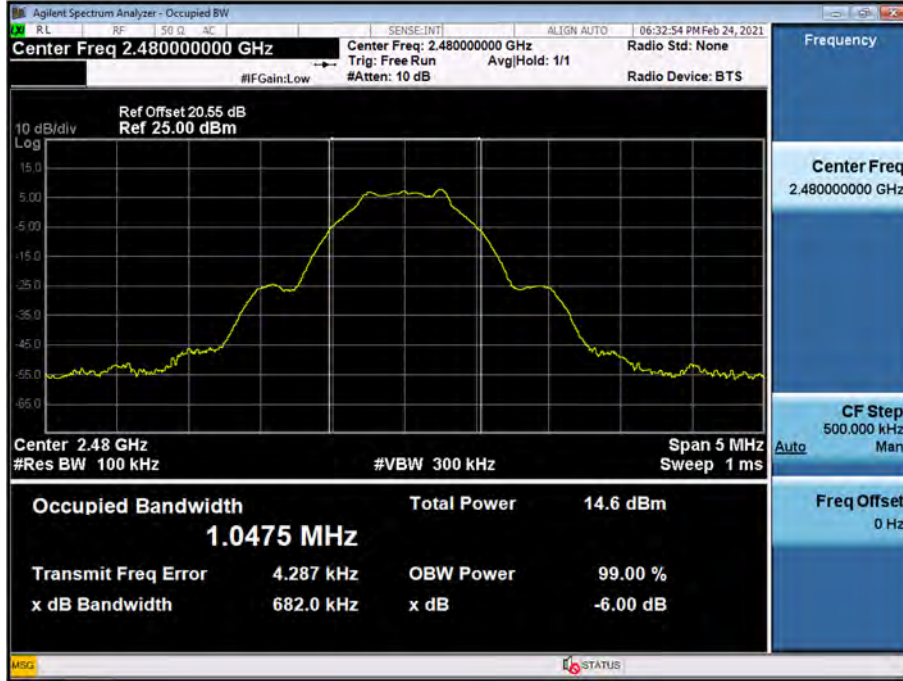


6 dB Bandwidth plot (Mid-CH 19)



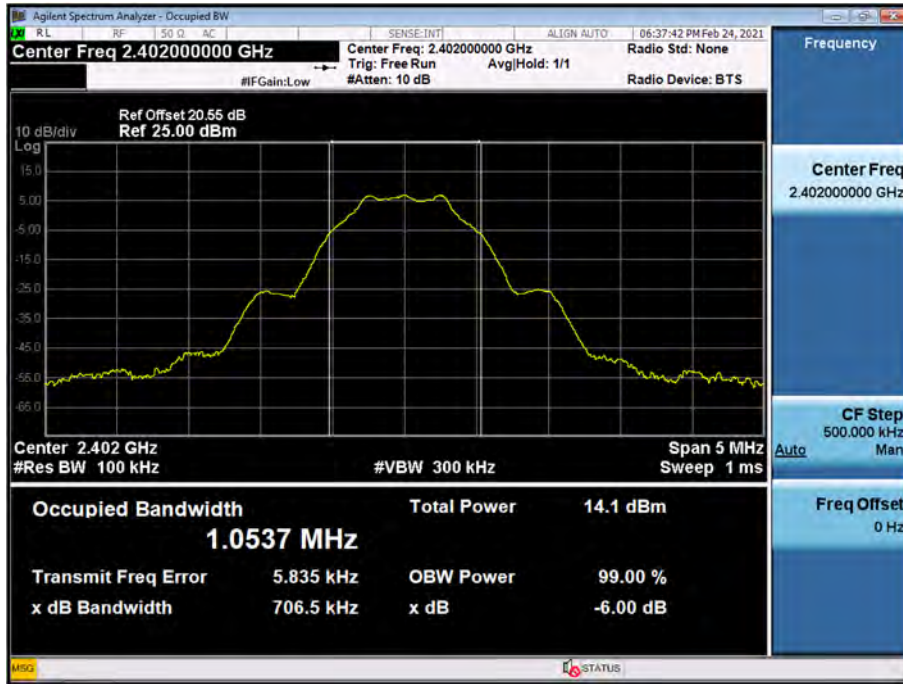


6 dB Bandwidth plot (High-CH 39)

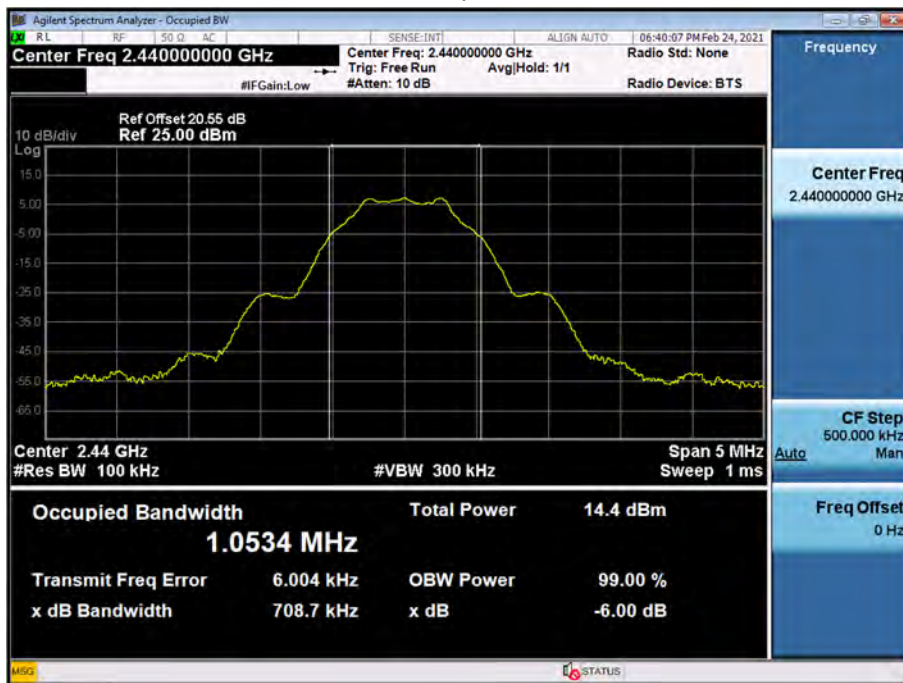


500k Bit/s(37 Byte) Test Plots

6 dB Bandwidth plot (Low-CH 0)

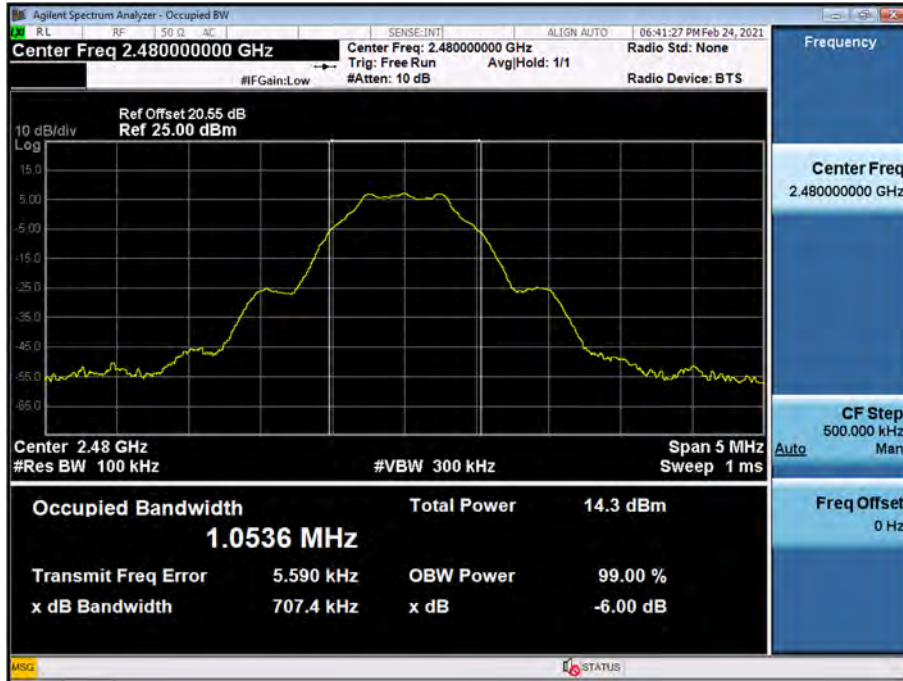


6 dB Bandwidth plot (Mid-CH 19)



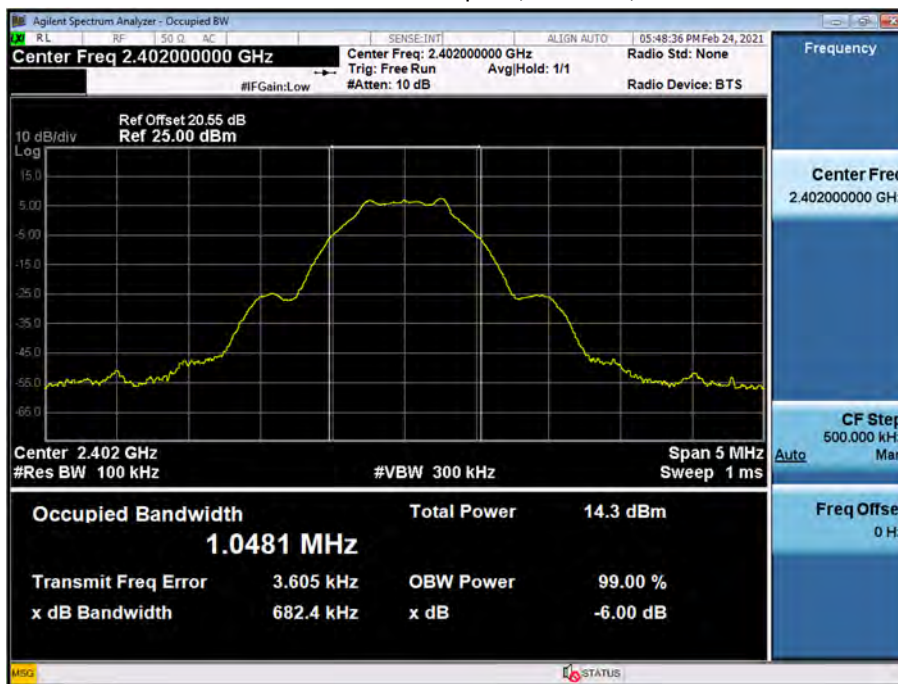


6 dB Bandwidth plot (High-CH 39)

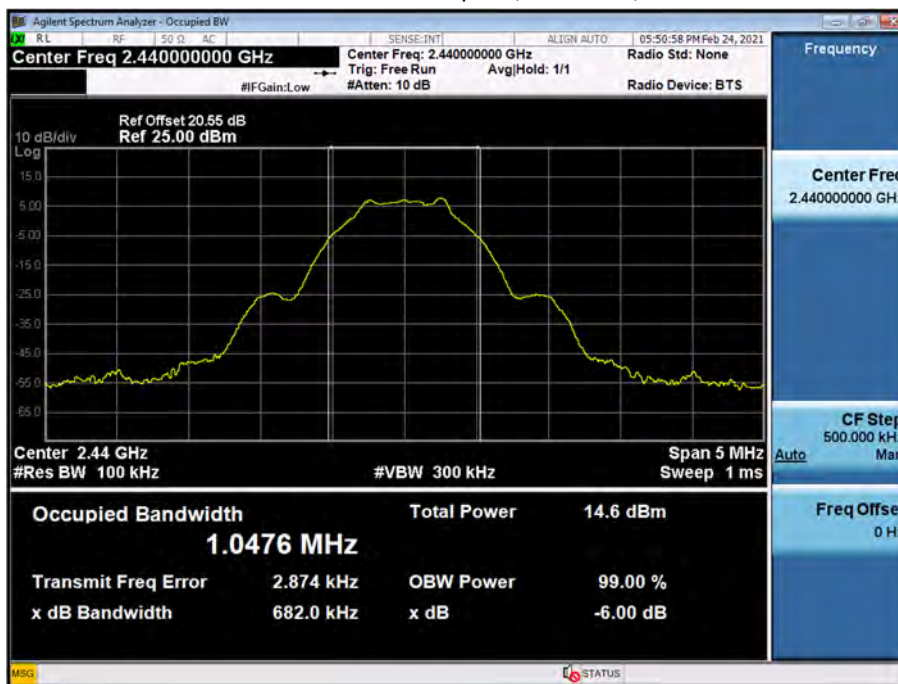


1M Bit/s (255 Byte) Test Plots

6 dB Bandwidth plot (Low-CH 0)

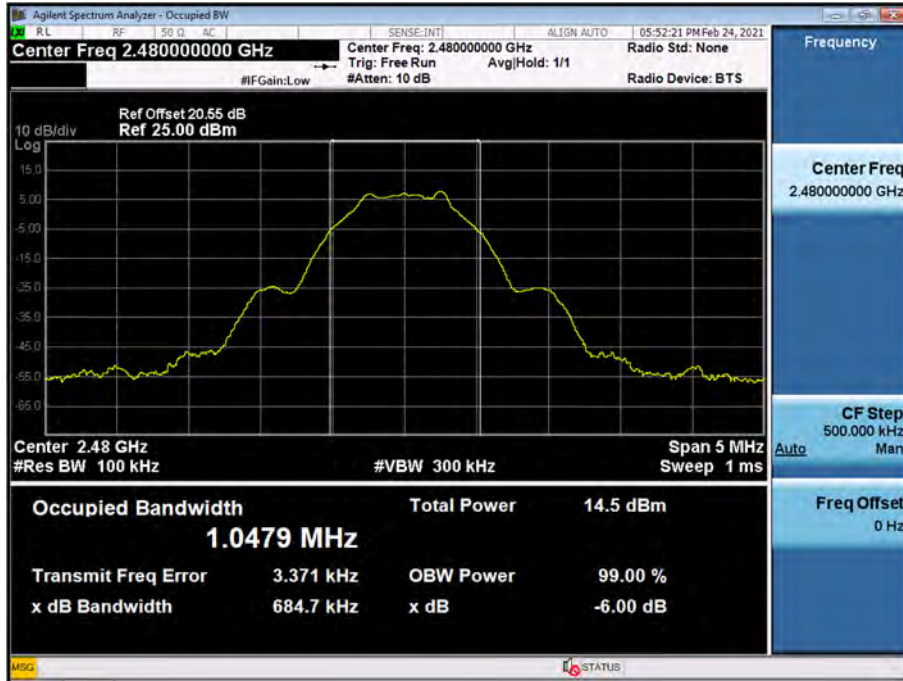


6 dB Bandwidth plot (Mid-CH 19)



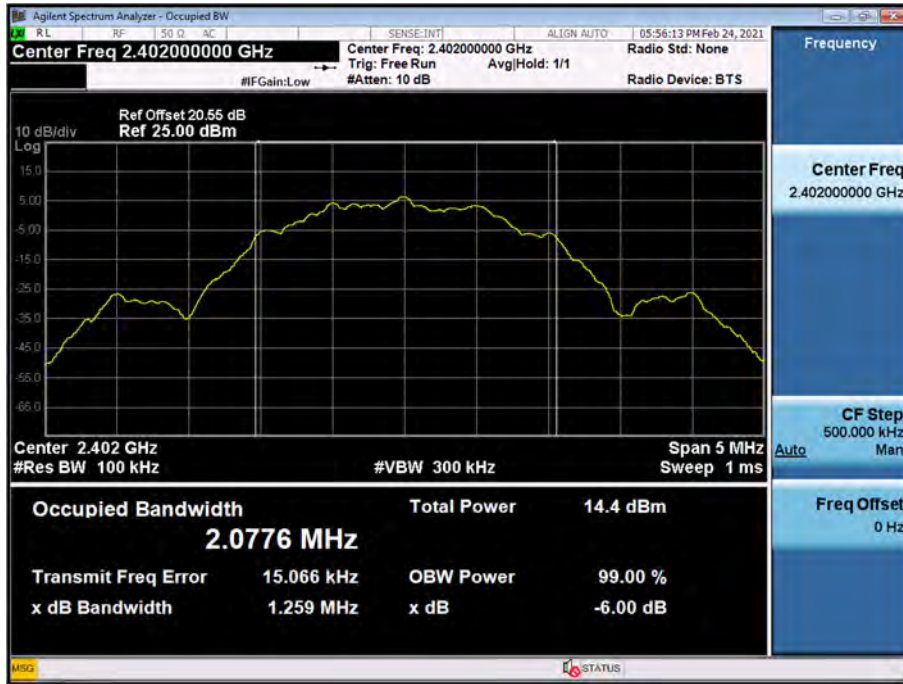


6 dB Bandwidth plot (High-CH 39)

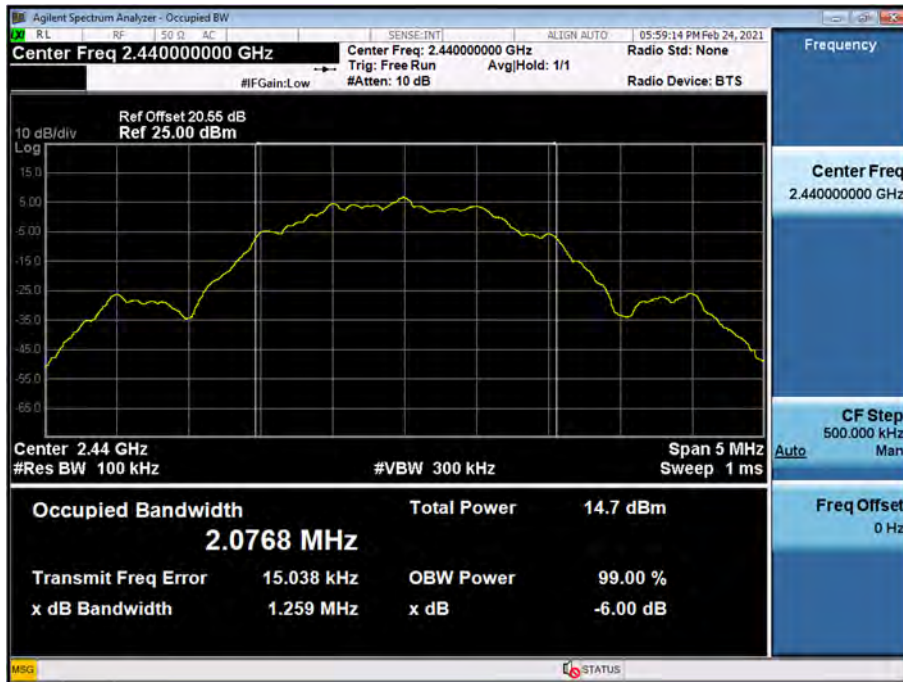


2M Bit/s (37 Byte) Test Plots

6 dB Bandwidth plot (Low-CH 0)



6 dB Bandwidth plot (Mid-CH 19)





6 dB Bandwidth plot (High-CH 39)

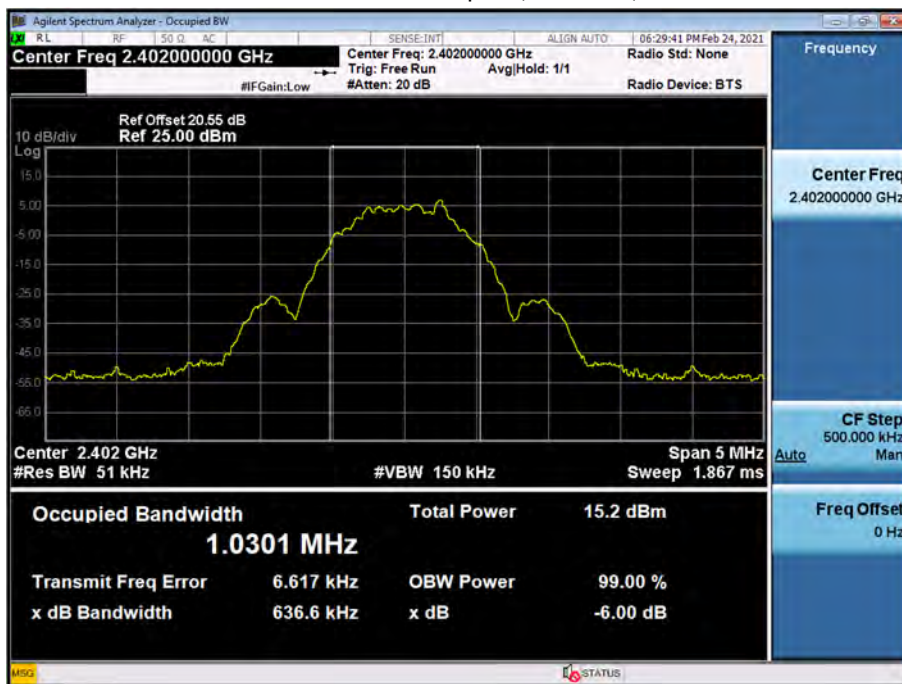


99 % Bandwidth(ISED)

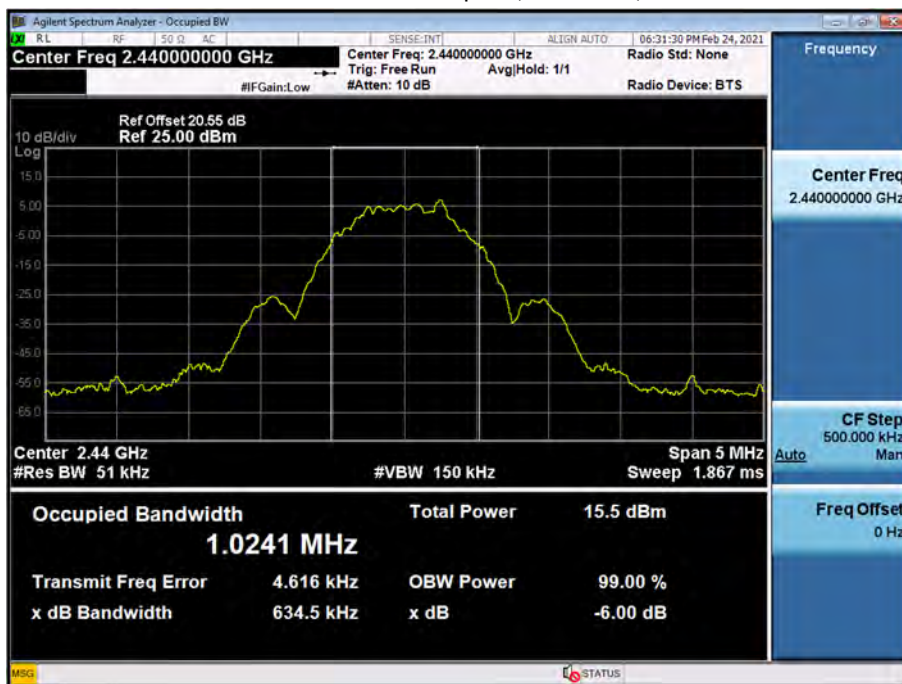
Mode (Bit/s)	Packet length (Byte)	Channel	99 % Bandwidth (MHz)
125k 255 Byte	255	0	1.0301
		19	1.0241
		39	1.0290
500k 37 Byte	255	0	1.0407
		19	1.0398
		39	1.0399
1M 255 Byte	37	0	1.0287
		19	1.0278
		39	1.0273
2M 37 Byte	255	0	2.0787
		19	2.0783
		39	2.0773

125k Bit/s(255 Byte) Test Plots

99 % Bandwidth plot (Low-CH 0)

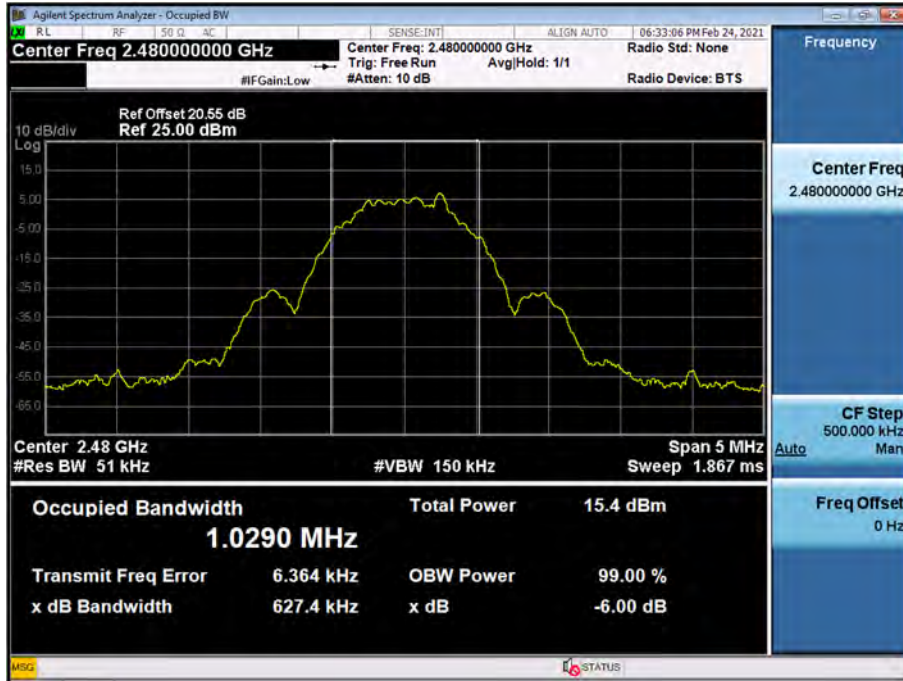


99 % Bandwidth plot (Mid-CH 19)



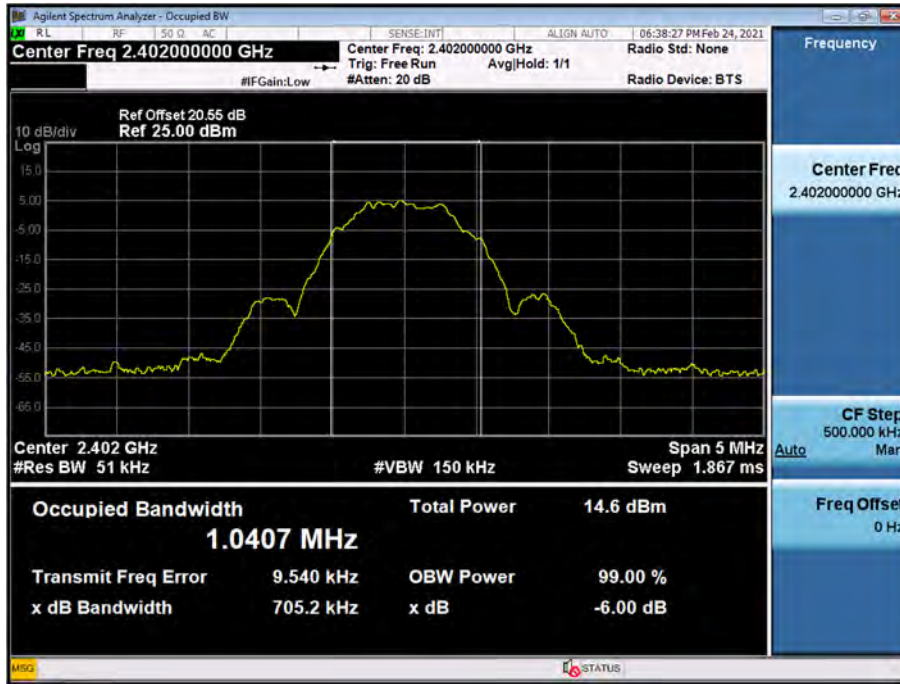


99 % Bandwidth plot (High-CH 39)

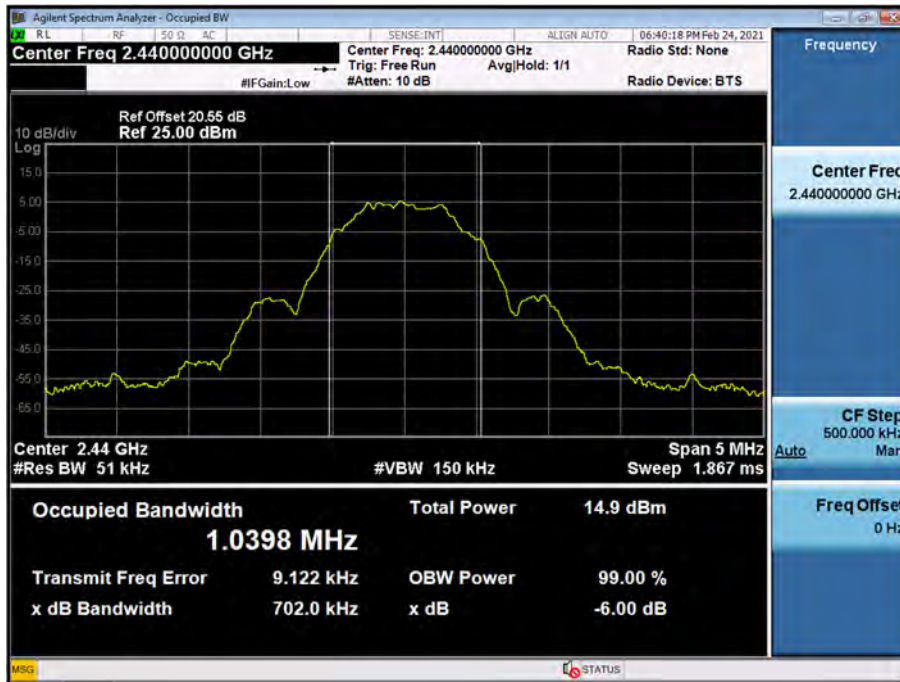


500k Bit/s(37 Byte) Test Plots

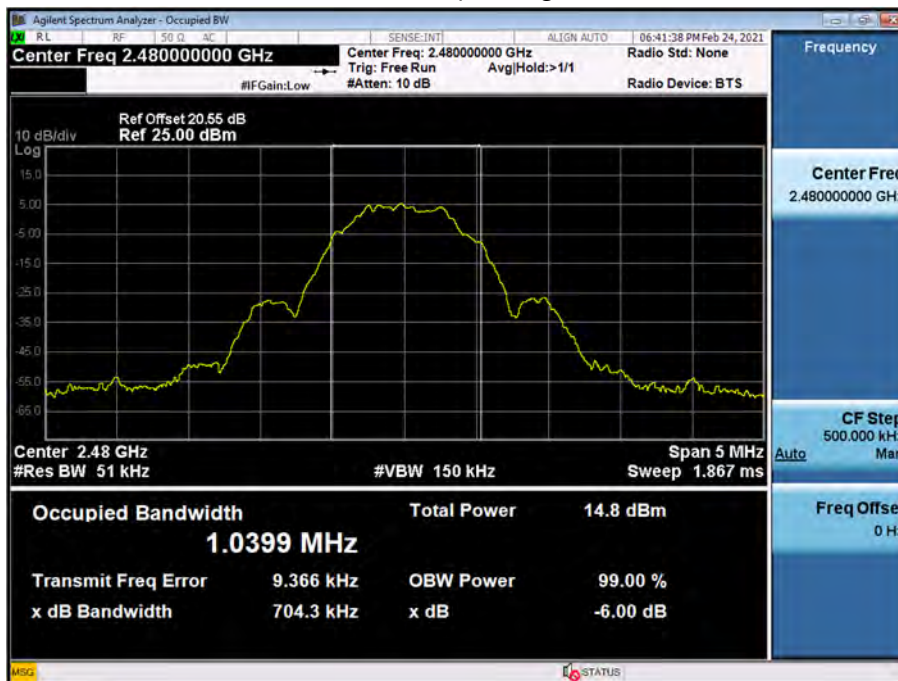
99 % Bandwidth plot (Low-CH 0)



99 % Bandwidth plot (Mid-CH 19)

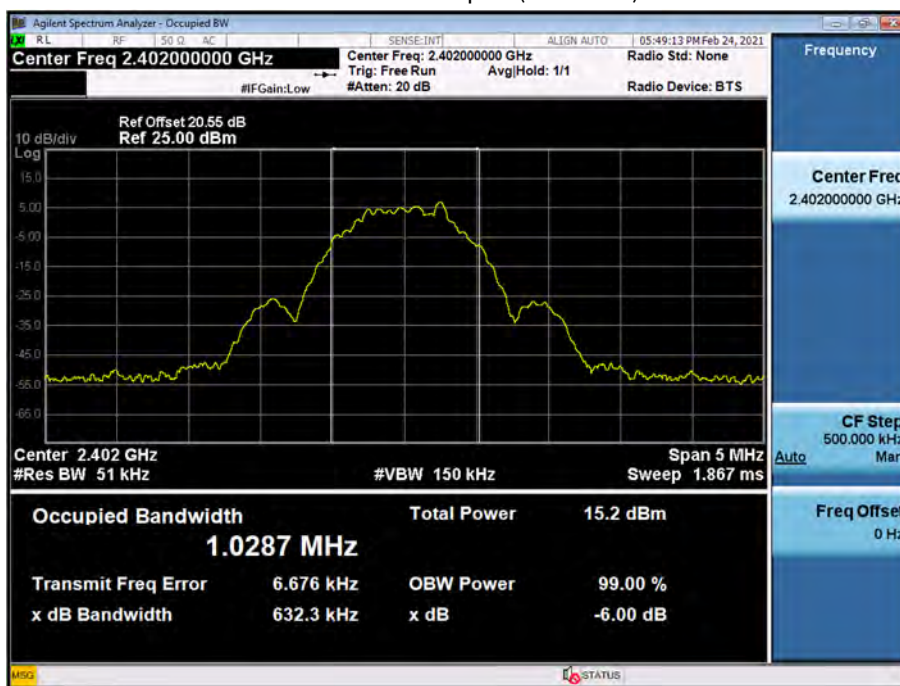


99 % Bandwidth plot (High-CH 39)

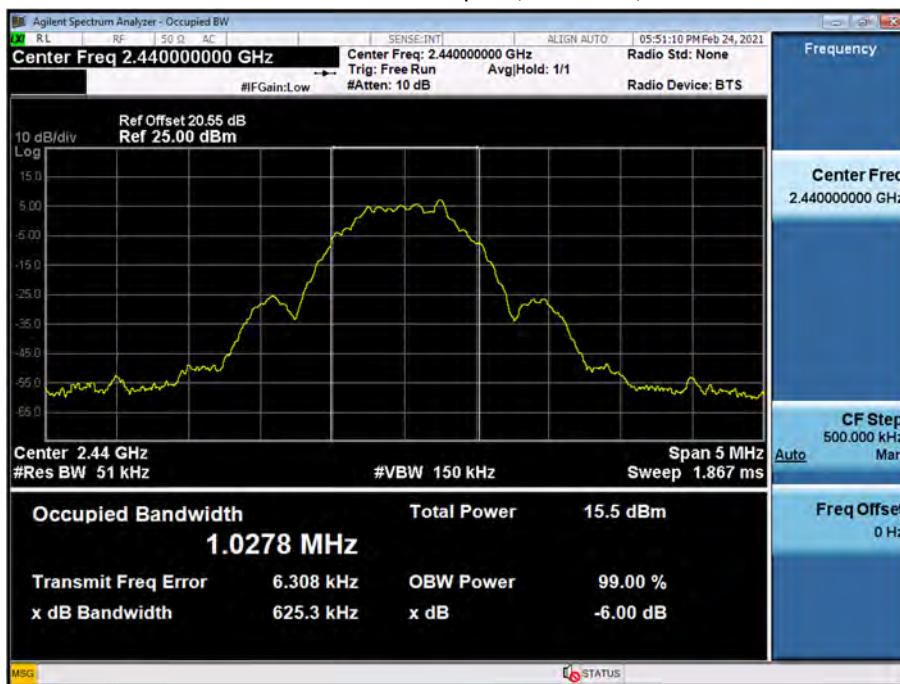


▣ 1M Bit/s (255 Byte) Test Plots

99 % Bandwidth plot (Low-CH 0)

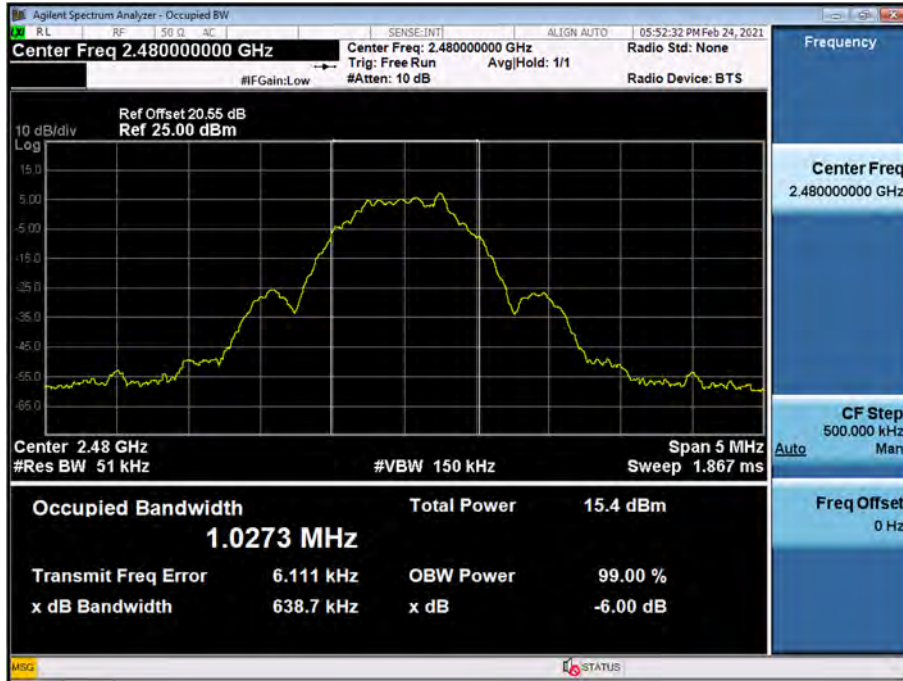


99 % Bandwidth plot (Mid-CH 19)



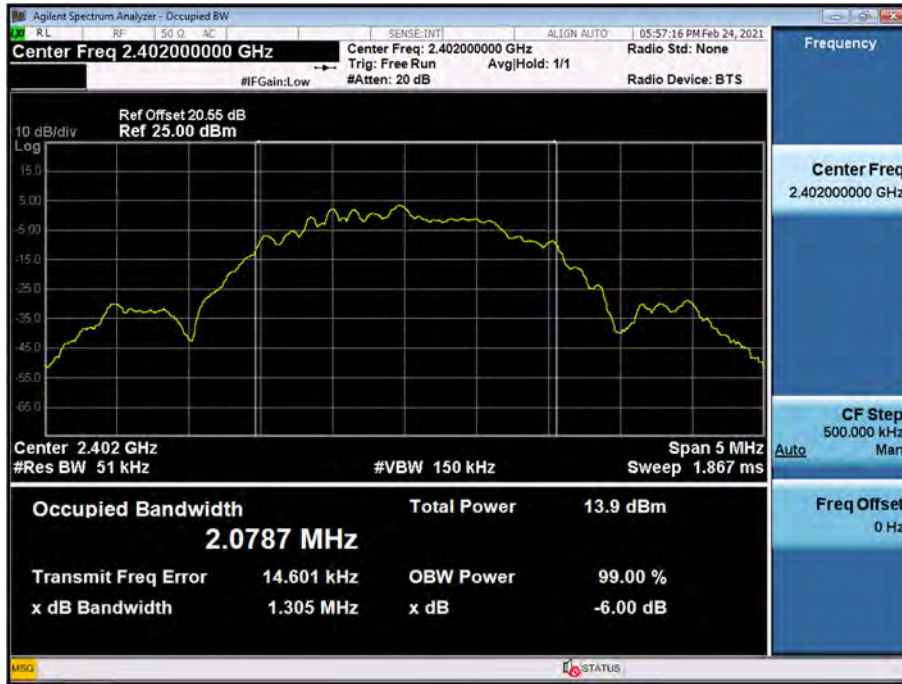


99 % Bandwidth plot (High-CH 39)



▣ 2M Bit/s (37 Byte) Test Plots

99 % Bandwidth plot (Low-CH 0)



99 % Bandwidth plot (Mid-CH 19)



99 % 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		
125k	37	2402	0	7.593	30
		2440	19	7.874	
		2480	39	7.822	
	255	2402	0	7.604	
		2440	19	7.879	
		2480	39	7.823	
500k	37	2402	0	7.588	
		2440	19	7.878	
		2480	39	7.817	
	255	2402	0	7.592	
		2440	19	7.862	
		2480	39	7.809	
1M	37	2402	0	7.579	
		2440	19	7.874	
		2480	39	7.801	
	255	2402	0	7.591	
		2440	19	7.884	
		2480	39	7.816	
2M	37	2402	0	7.529	
		2440	19	8.181	
		2480	39	7.701	
	255	2402	0	7.267	
		2440	19	8.097	
		2480	39	7.346	

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				
125k	37	2402	0	5.21	2.17	7.38	30
		2440	19	5.48	2.17	7.66	
		2480	39	5.43	2.17	7.60	
	255	2402	0	6.65	0.71	7.36	
		2440	19	6.91	0.71	7.61	
		2480	39	6.90	0.71	7.61	
500k	37	2402	0	5.24	2.17	7.41	
		2440	19	5.55	2.17	7.72	
		2480	39	5.42	2.17	7.59	
	255	2402	0	6.67	0.71	7.38	
		2440	19	6.92	0.71	7.62	
		2480	39	6.91	0.71	7.62	
1M	37	2402	0	5.22	2.17	7.39	
		2440	19	5.43	2.17	7.60	
		2480	39	5.39	2.17	7.56	
	255	2402	0	6.75	0.72	7.46	
		2440	19	6.98	0.72	7.70	
		2480	39	6.89	0.72	7.61	
2M	37	2402	0	2.46	5.06	7.52	
		2440	19	3.11	5.06	8.18	
		2480	39	2.48	5.06	7.54	
	255	2402	0	4.73	2.45	7.18	
		2440	19	5.61	2.45	8.07	
		2480	39	4.70	2.45	7.15	

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, 20.55 dB is offset for 2.4 GHz Band.

9.4 POWER SPECTRAL DENSITY

Frequency (MHz)	Channel No.	Mode (Bit/s)	Test Result	
			Measured Power(dBm)	Limit (dBm)
2402	0	125k 255 Byte	-8.425	8
2440	19		-8.184	
2480	39		-8.245	
2402	0	500k 37 Byte	-7.571	
2440	19		-7.386	
2480	39		-7.423	
2402	0	1M 255 Byte	-8.542	
2440	19		-8.410	
2480	39		-8.264	
2402	0	2M 37 Byte	-9.951	
2440	19		-9.723	
2480	39		-9.692	

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, 20.55 dB is offset for 2.4 GHz Band.
4. The plot included is the worst mode (500k Bit/s (37 Byte)) of peak output power.

500k Bit/s (37 Byte) Test Plots

Power Spectral Density (Low-CH 0)



Power Spectral Density (Mid-CH 19)





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



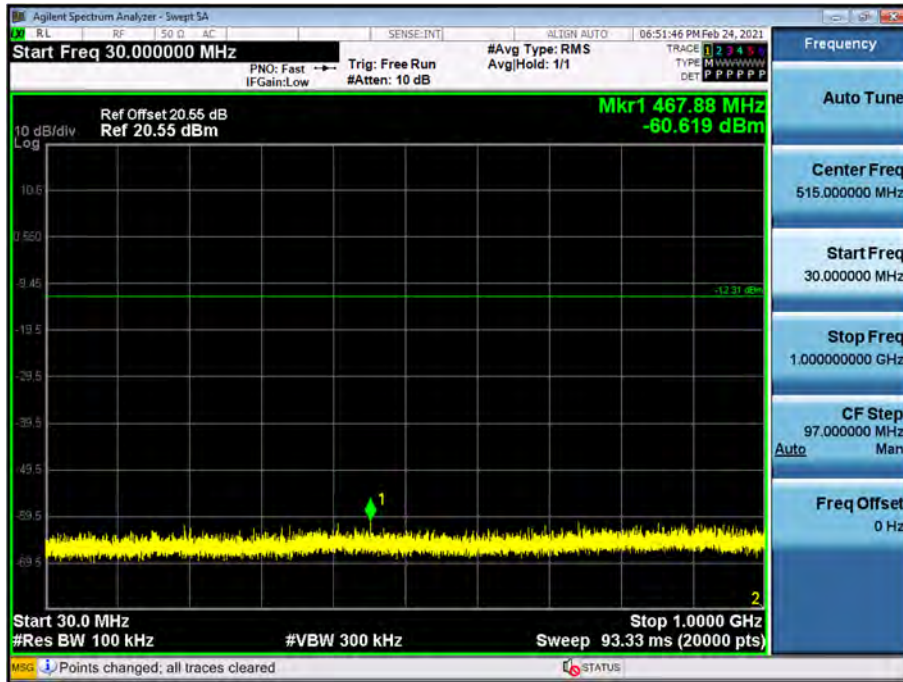
High-CH 39



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

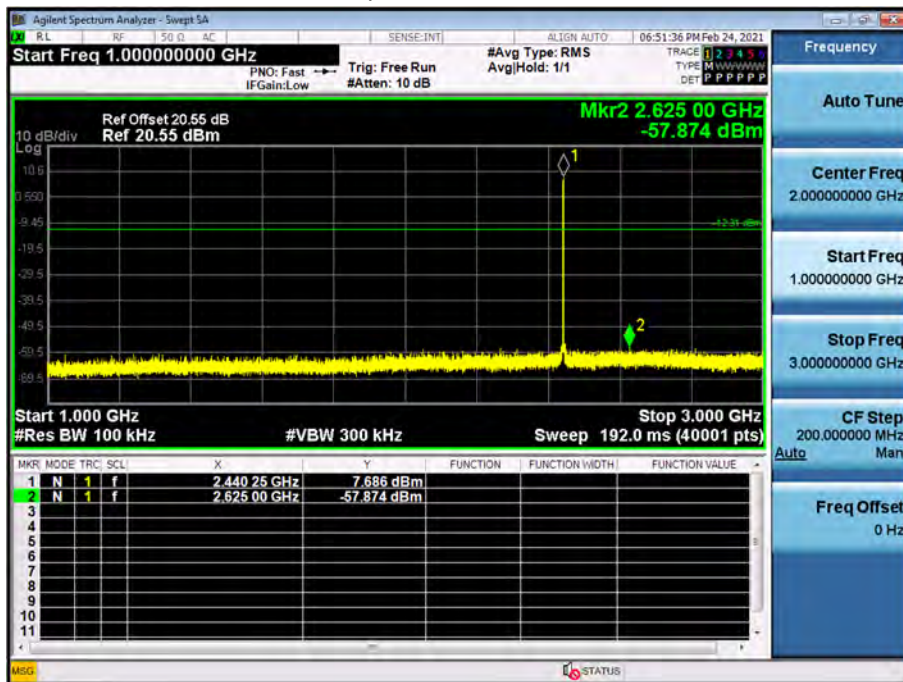
30 MHz ~ 1 GHz

Conducted Spurious Emission (Mid-CH 19)



1 GHz ~ 3 GHz

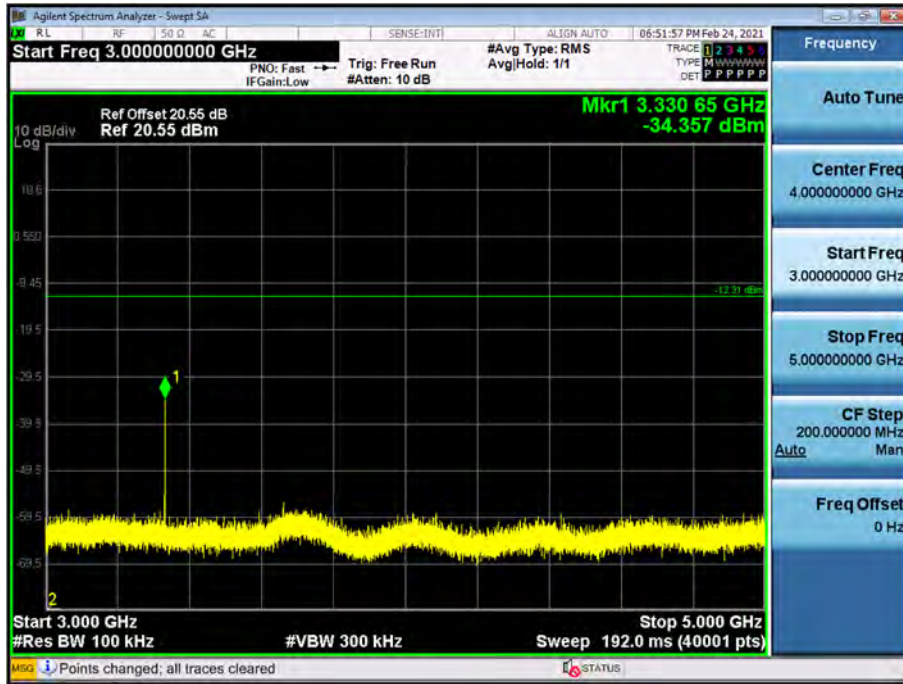
Conducted Spurious Emission (Mid-CH 19)





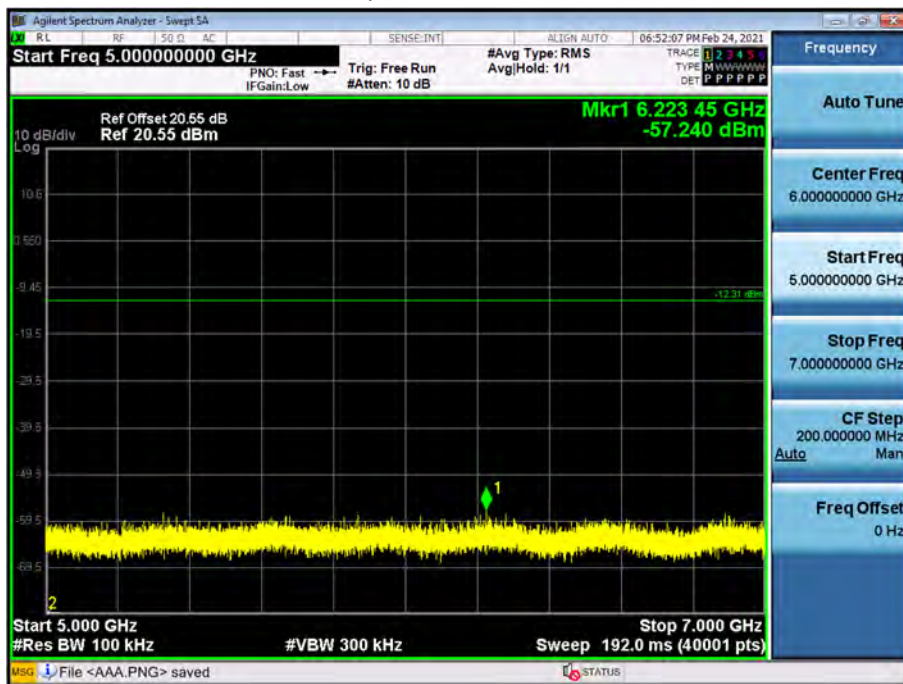
3 GHz ~ 5 GHz

Conducted Spurious Emission (Mid-CH 19)



5 GHz ~ 7 GHz

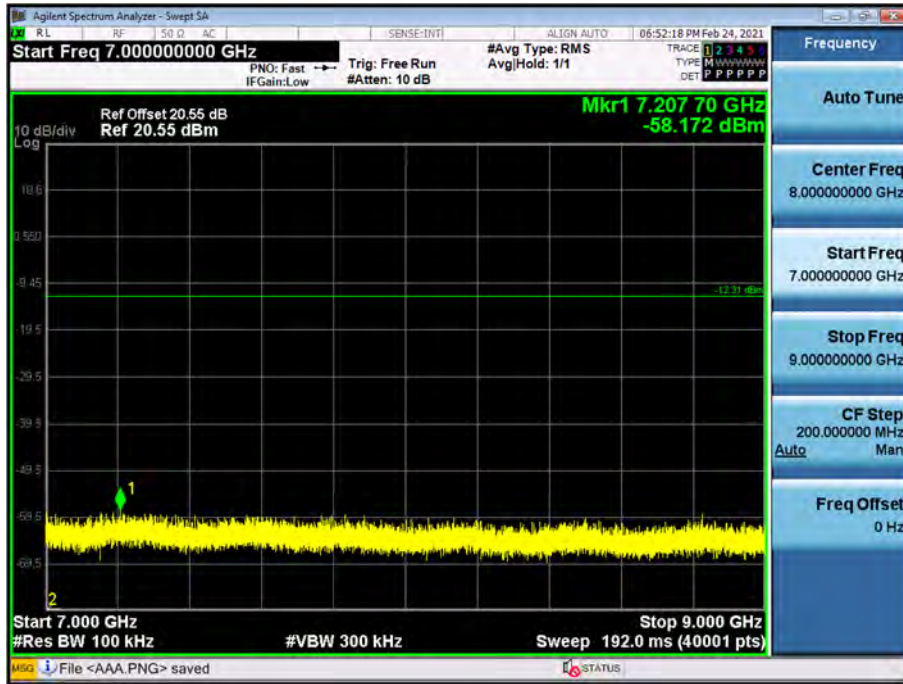
Conducted Spurious Emission (Mid-CH 19)





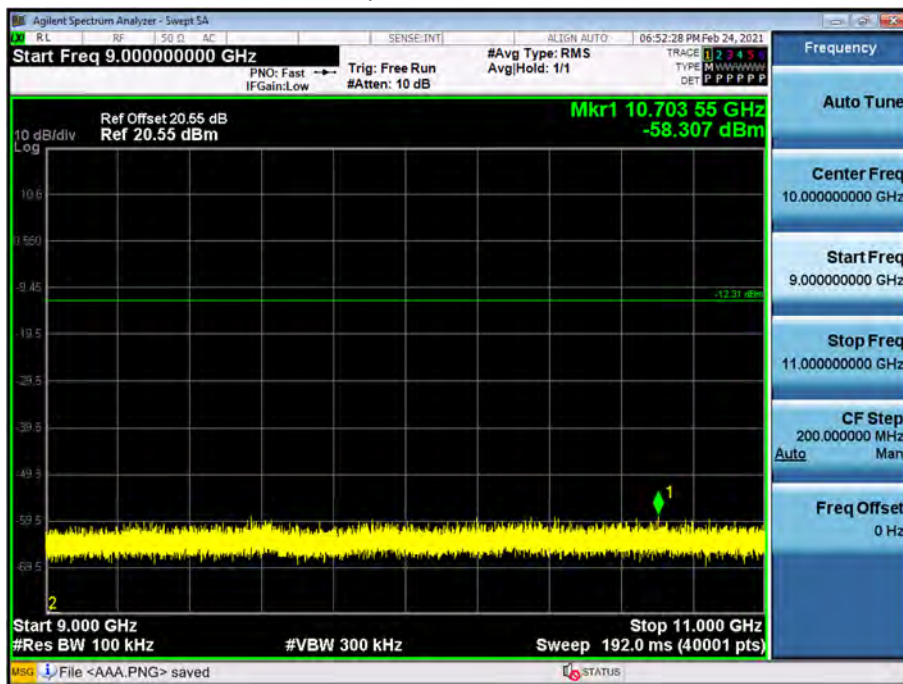
7 GHz ~ 9 GHz

Conducted Spurious Emission (Mid-CH 19)



9 GHz ~ 11 GHz

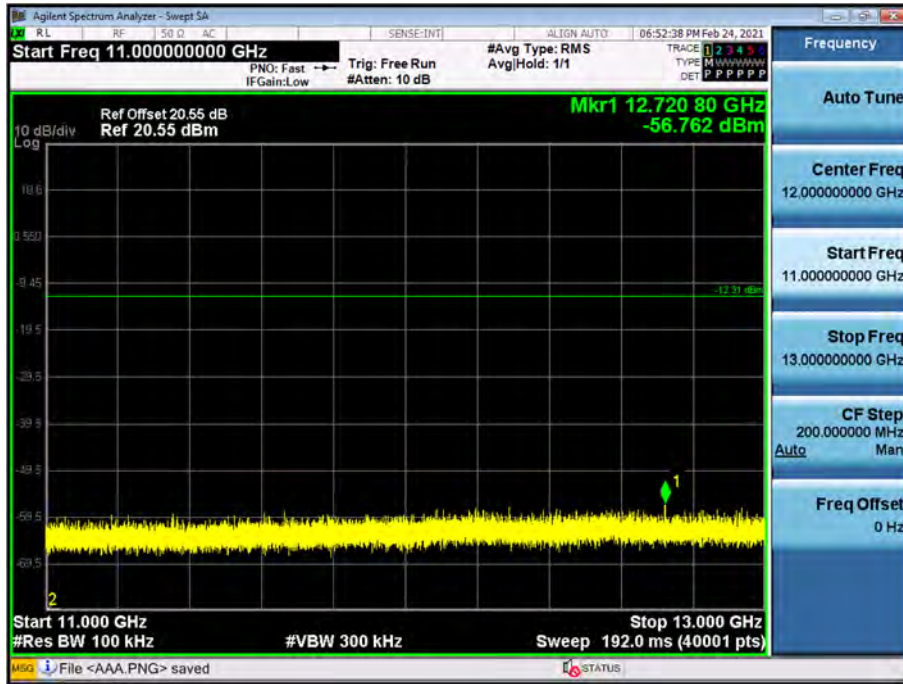
Conducted Spurious Emission (Mid-CH 19)





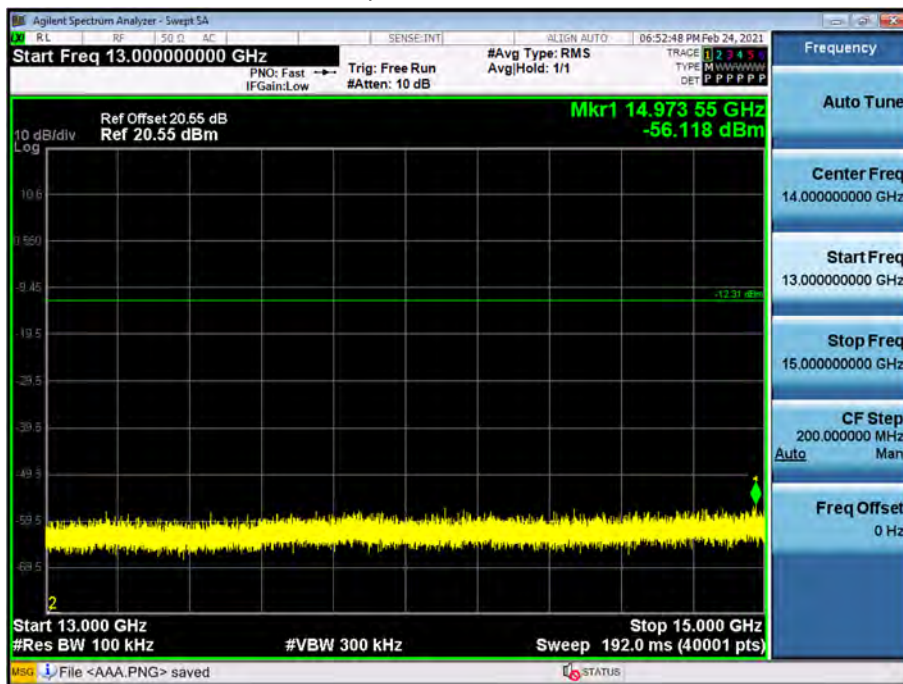
11 GHz ~ 13 GHz

Conducted Spurious Emission (Mid-CH 19)



13 GHz ~ 15 GHz

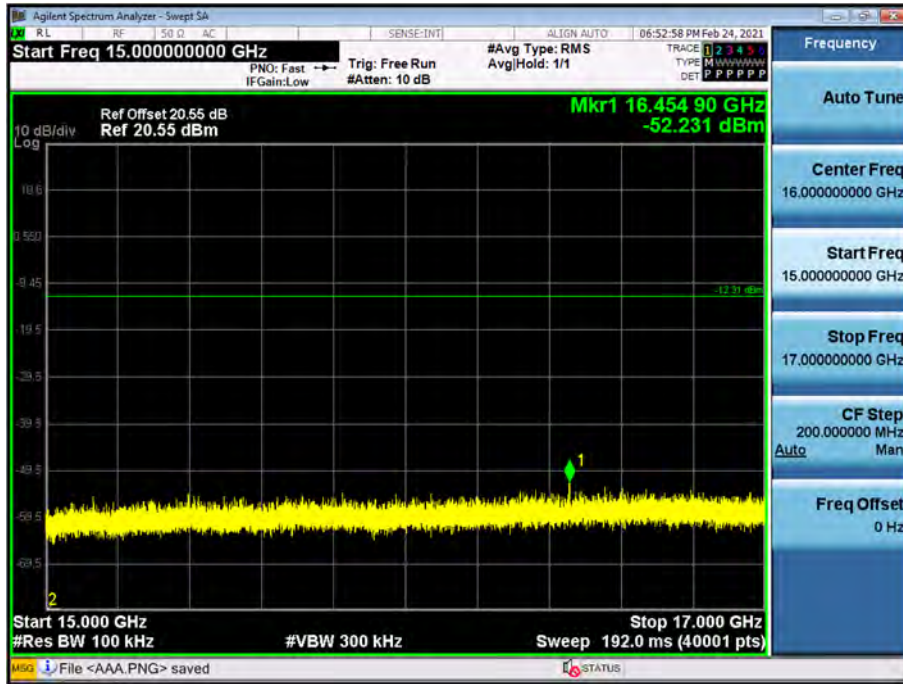
Conducted Spurious Emission (Mid-CH 19)





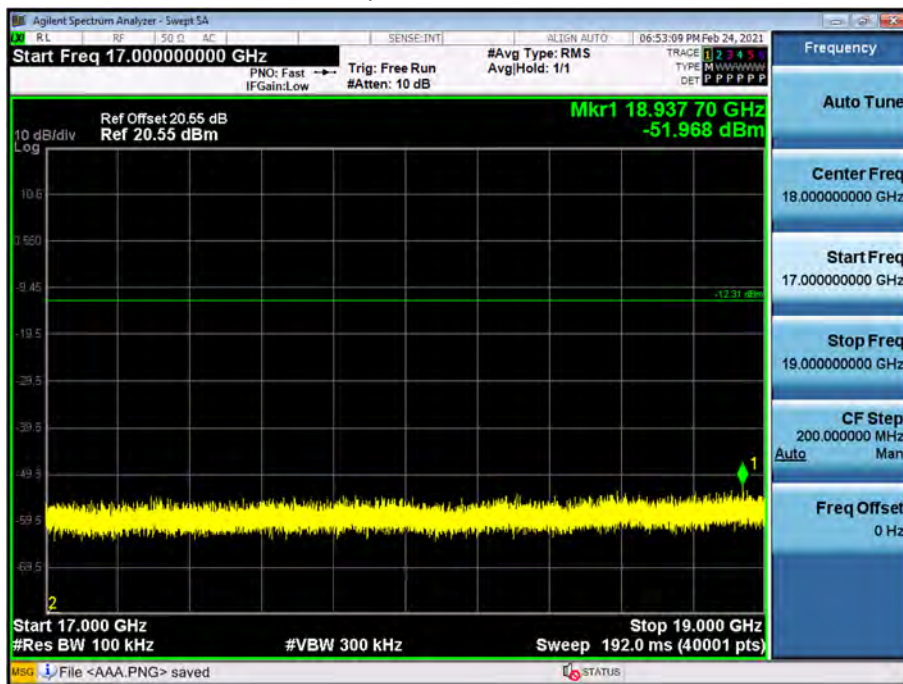
15 GHz ~ 17 GHz

Conducted Spurious Emission (Mid-CH 19)



17 GHz ~ 19 GHz

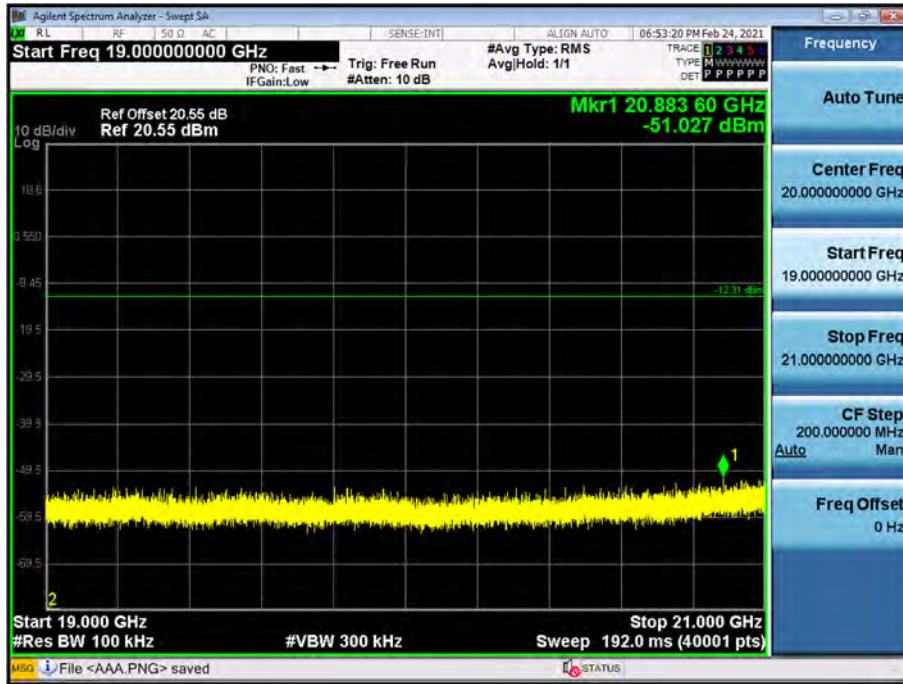
Conducted Spurious Emission (Mid-CH 19)





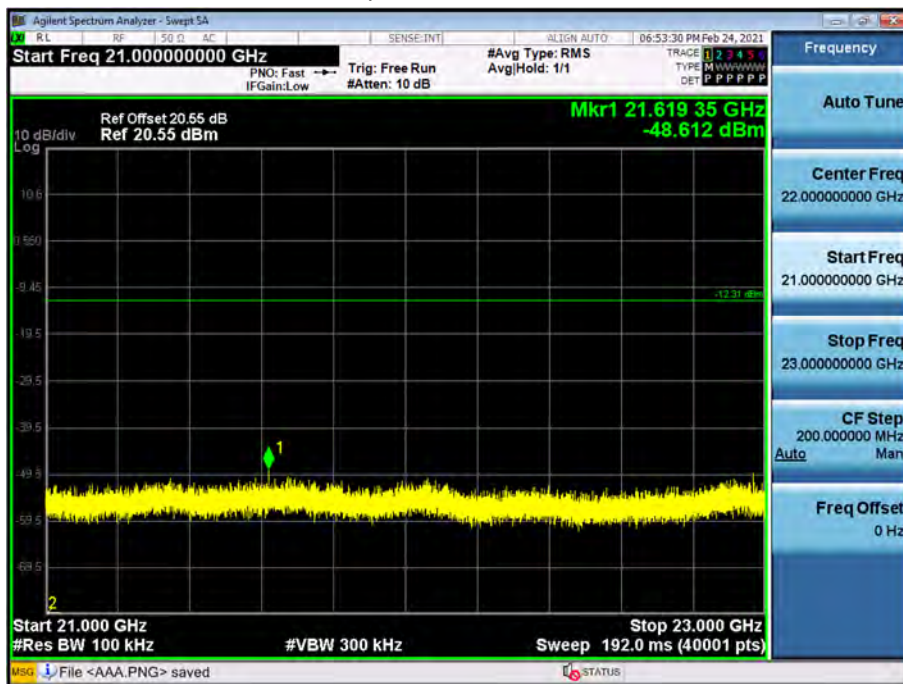
19 GHz ~ 21 GHz

Conducted Spurious Emission (Mid-CH 19)



21 GHz ~ 23 GHz

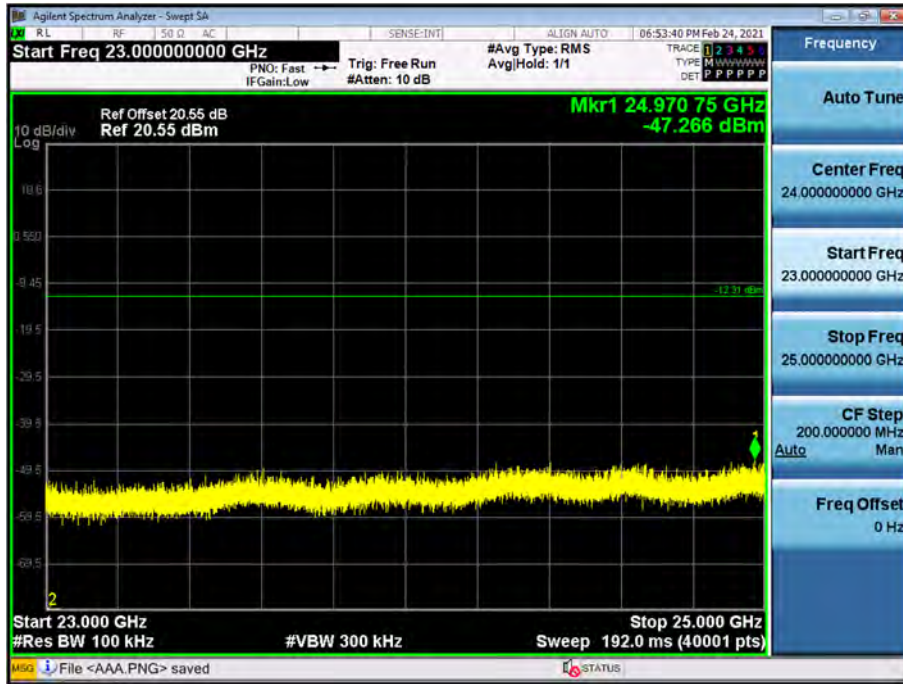
Conducted Spurious Emission (Mid-CH 19)





23 GHz ~ 25 GHz

Conducted Spurious Emission (Mid-CH 19)



2M Bit/s (37 Byte) Test Plots -BandEdge

Low-CH 0



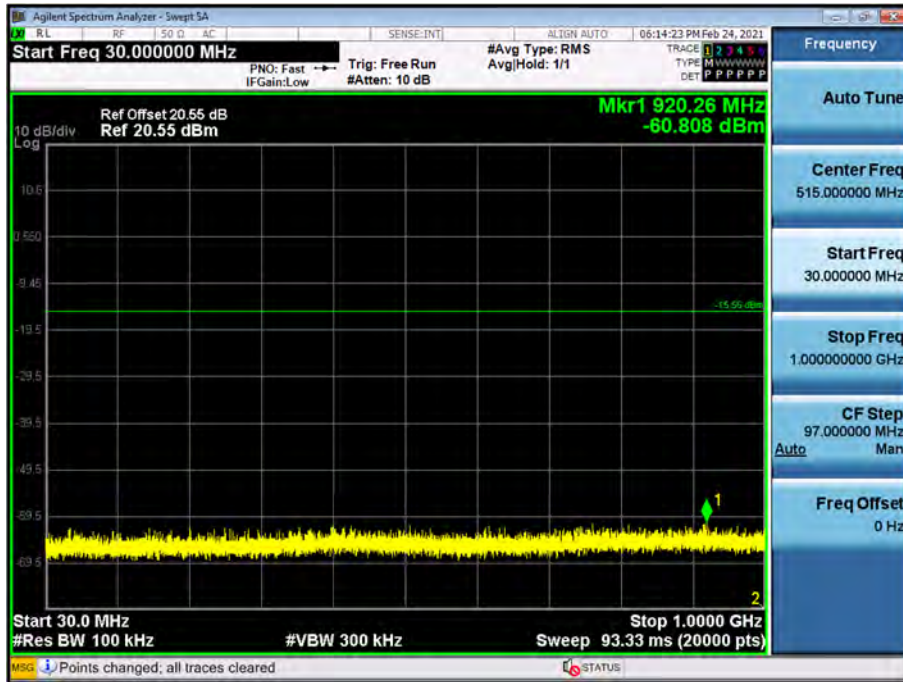
High-CH 39



2M Bit/s (37 Byte) Test Plots -Conducted Spurious Emission

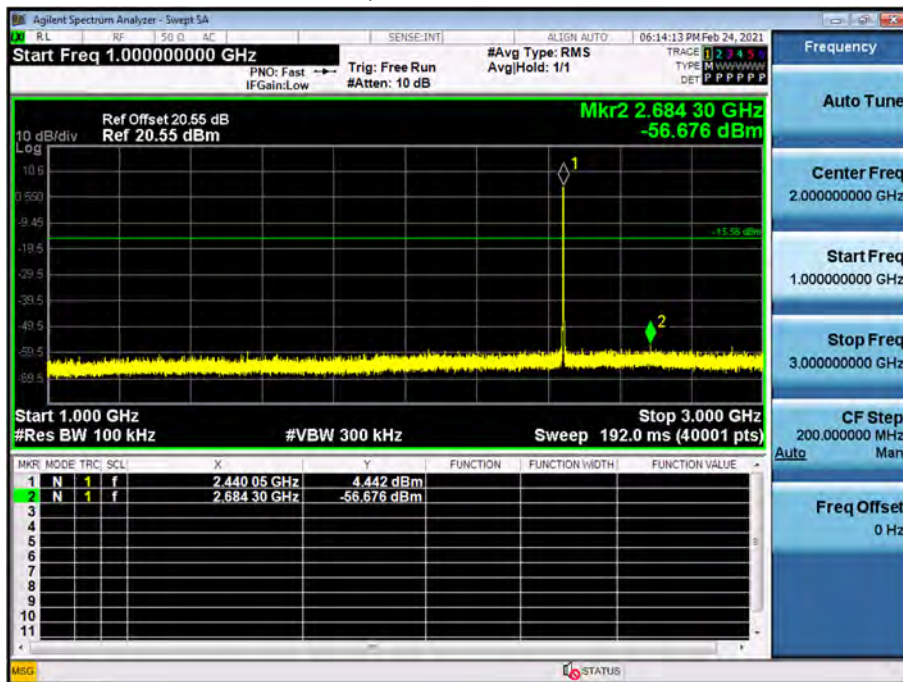
30 MHz ~ 1 GHz

Conducted Spurious Emission (Mid-CH 19)



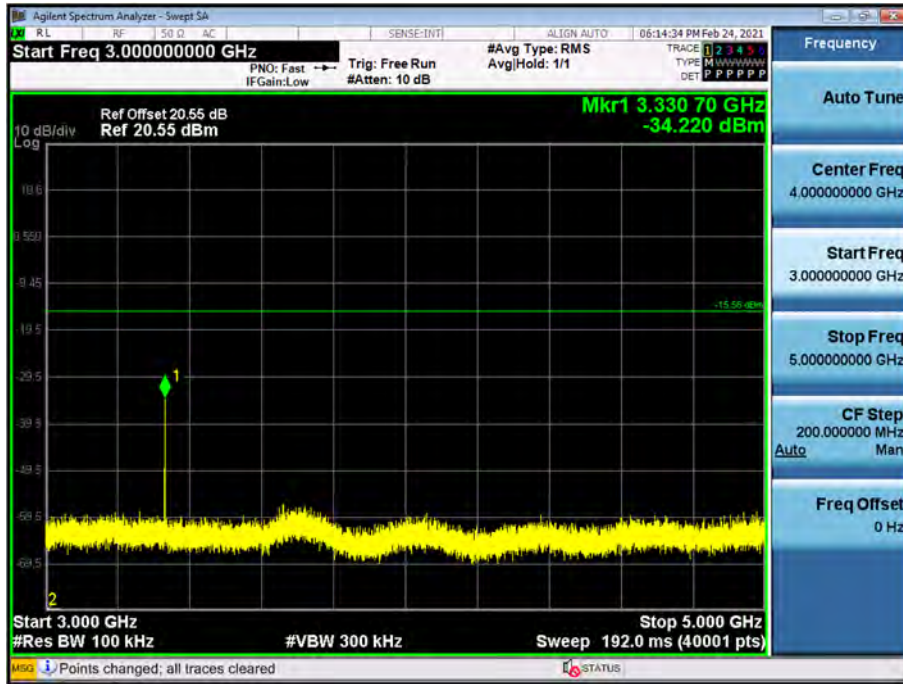
1 GHz ~ 3 GHz

Conducted Spurious Emission (Mid-CH 19)



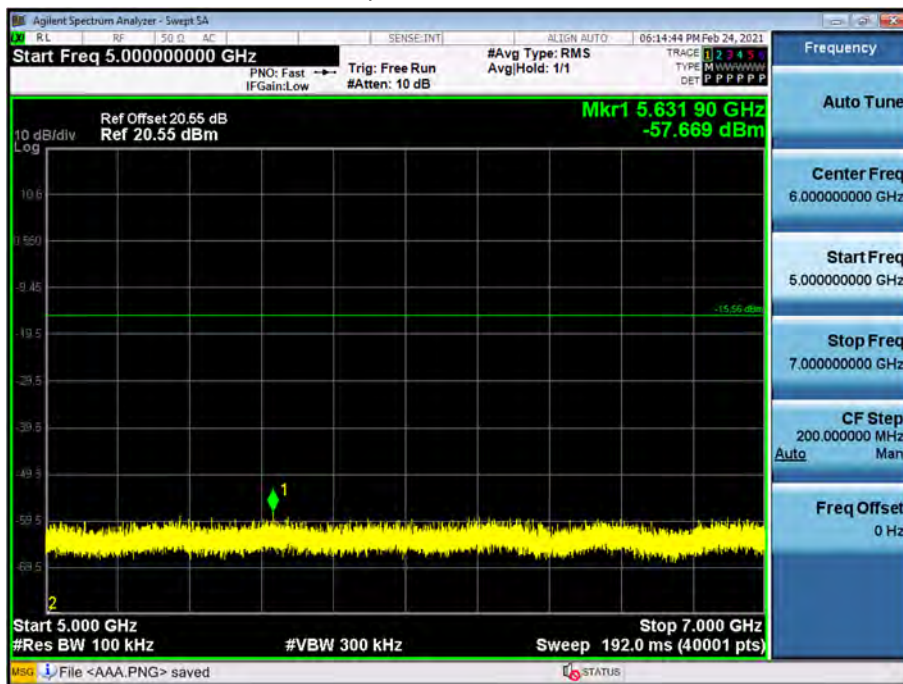
3 GHz ~ 5 GHz

Conducted Spurious Emission (Mid-CH 19)



5 GHz ~ 7 GHz

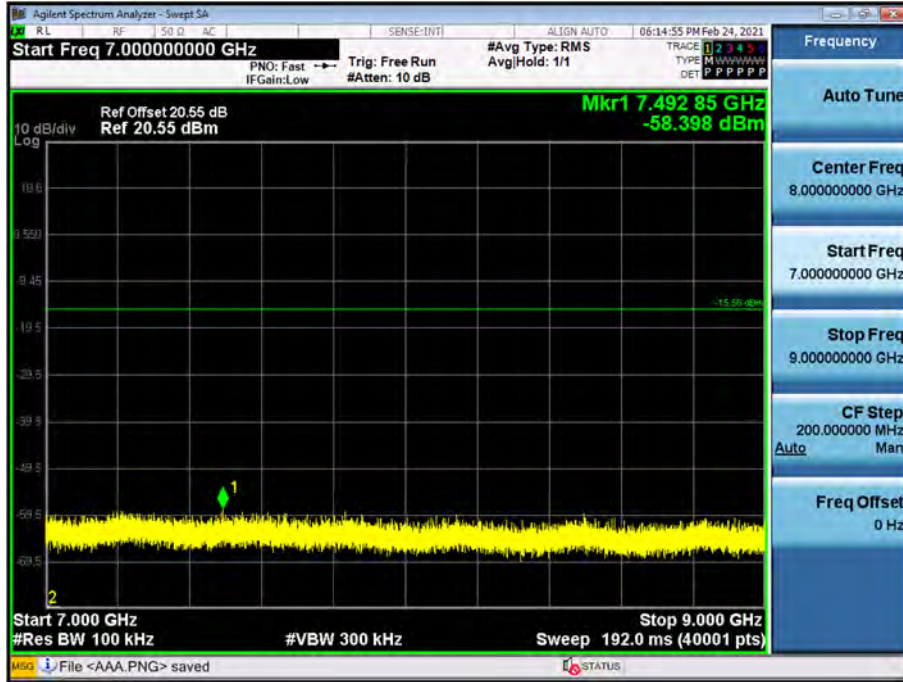
Conducted Spurious Emission (Mid-CH 19)





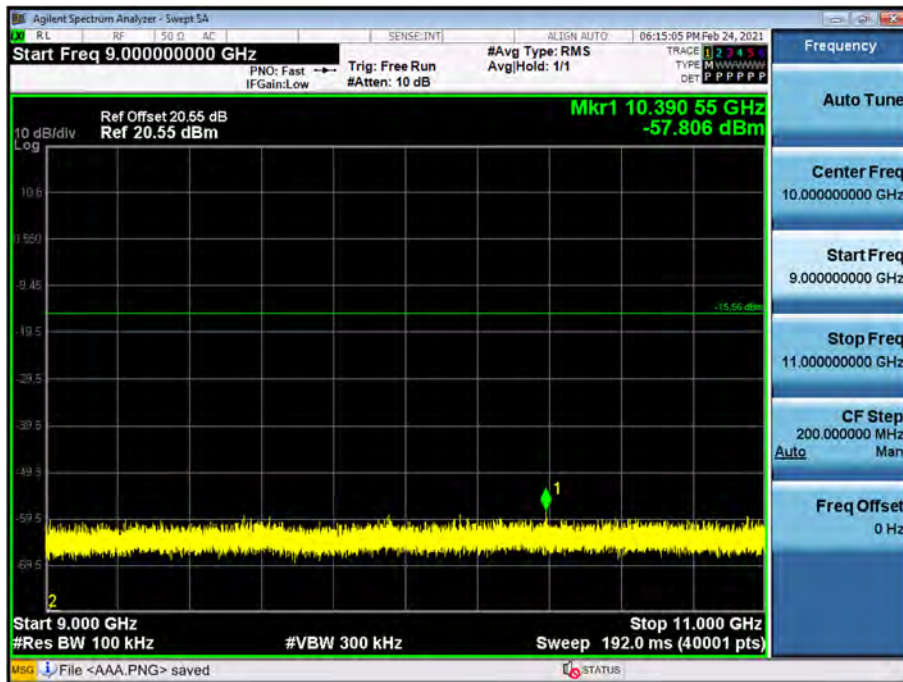
7 GHz ~ 9 GHz

Conducted Spurious Emission (Mid-CH 19)



9 GHz ~ 11 GHz

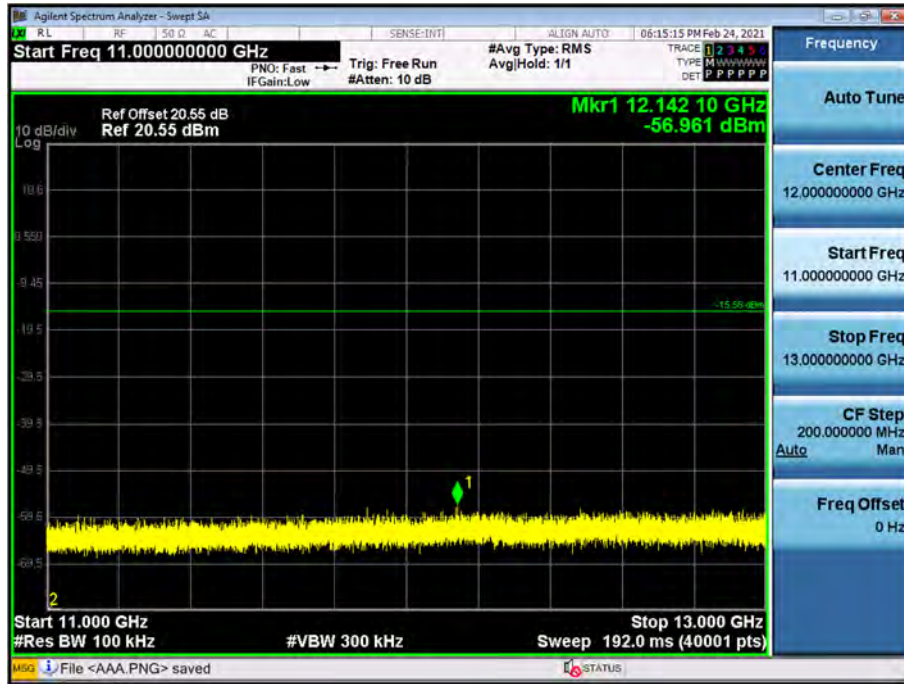
Conducted Spurious Emission (Mid-CH 19)





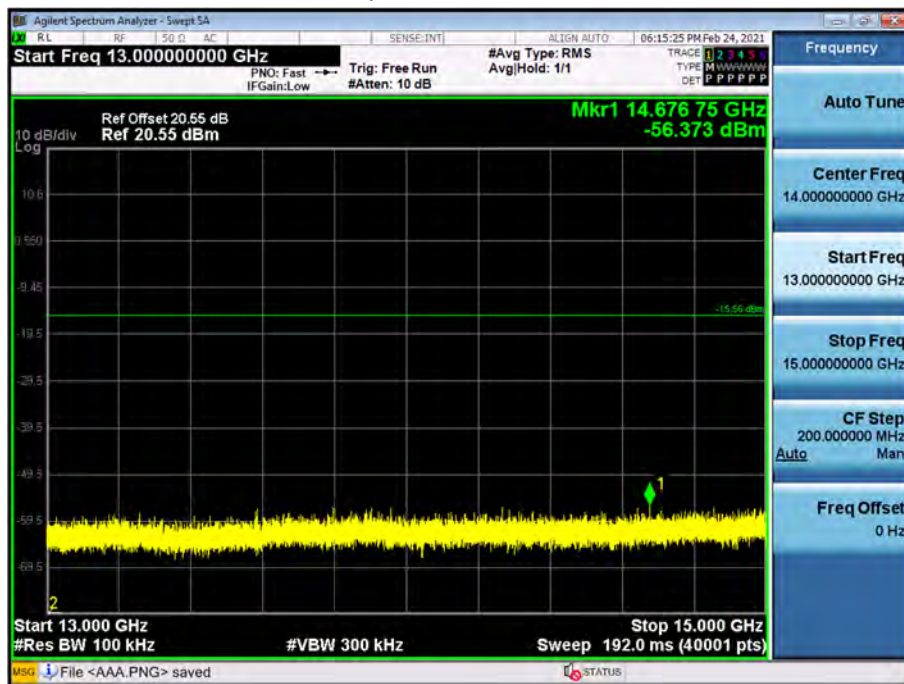
11 GHz ~ 13 GHz

Conducted Spurious Emission (Mid-CH 19)



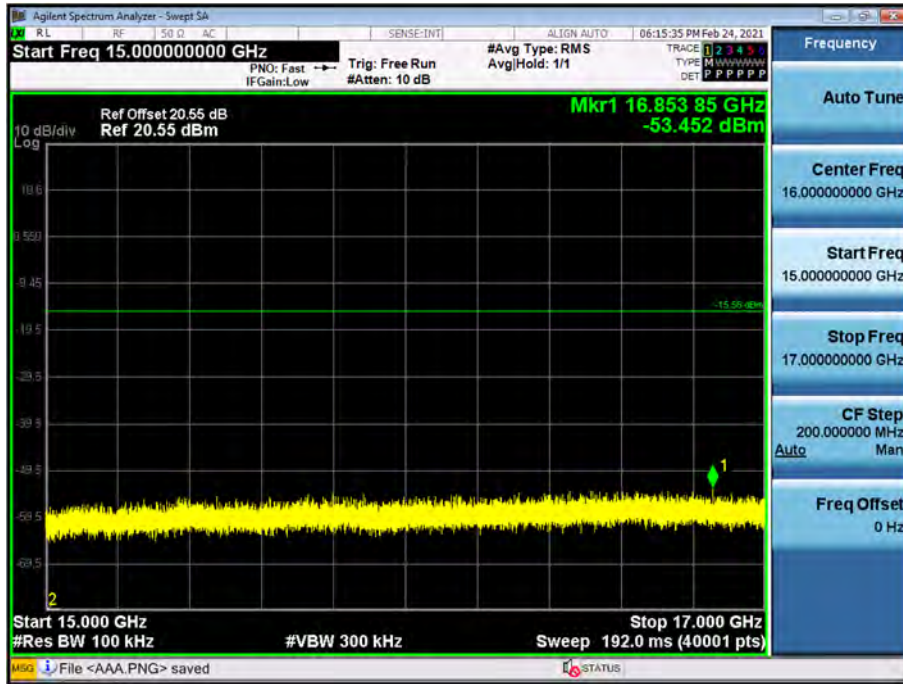
13 GHz ~ 15 GHz

Conducted Spurious Emission (Mid-CH 19)



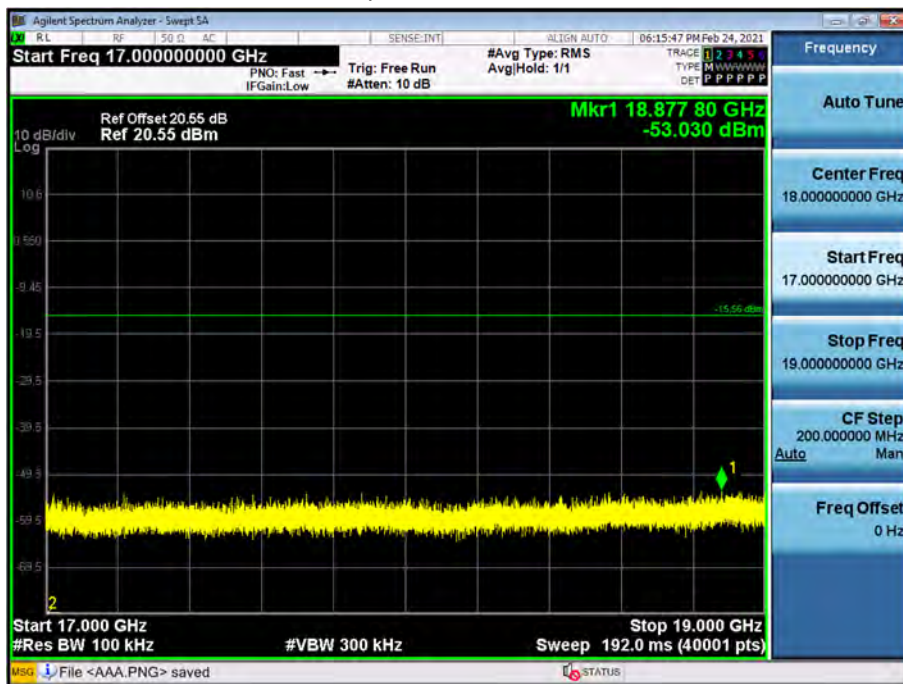
15 GHz ~ 17 GHz

Conducted Spurious Emission (Mid-CH 19)



17 GHz ~ 19 GHz

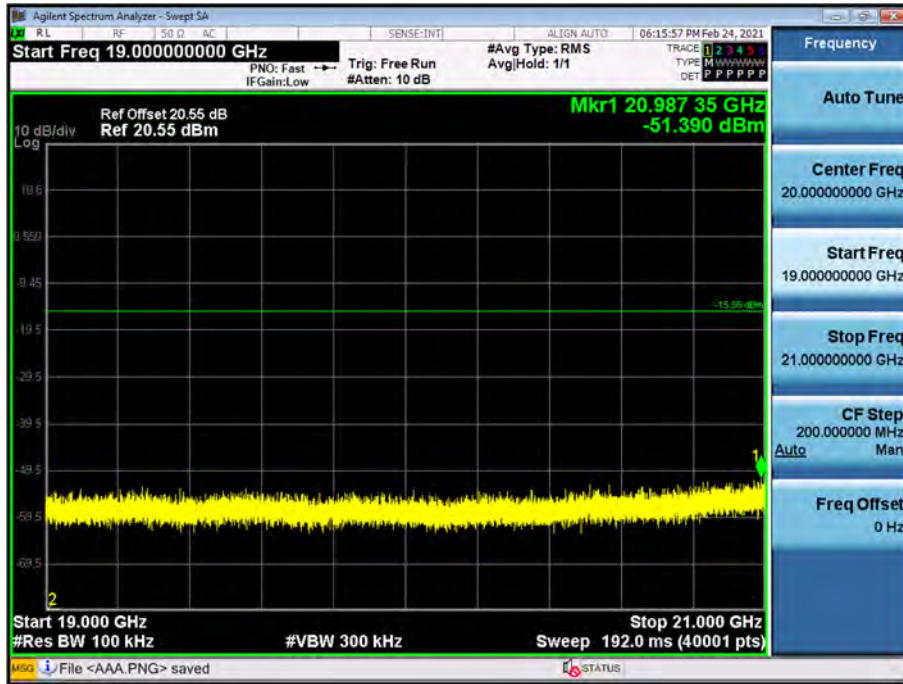
Conducted Spurious Emission (Mid-CH 19)





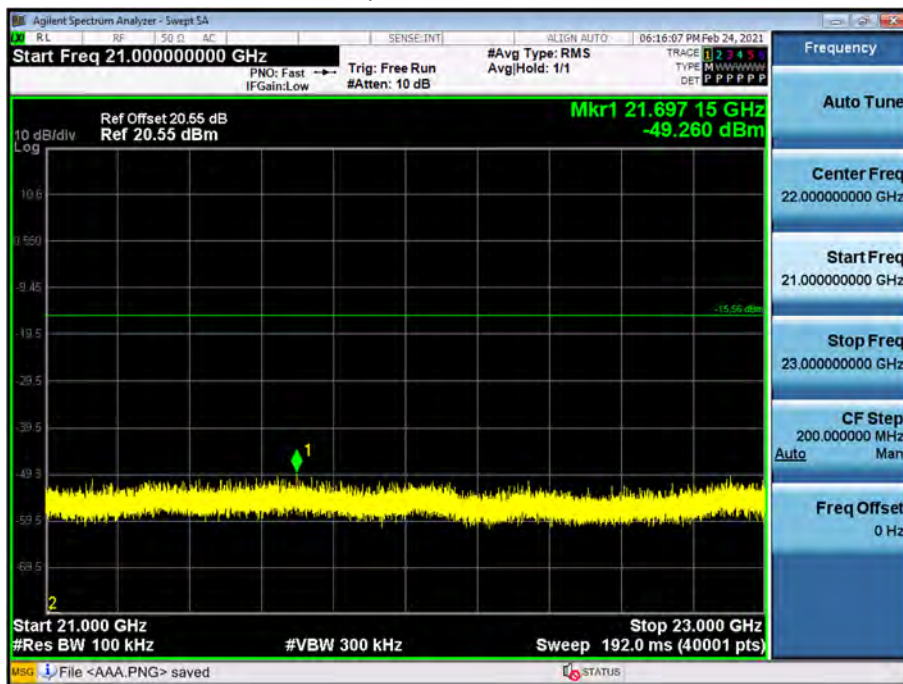
19 GHz ~ 21 GHz

Conducted Spurious Emission (Mid-CH 19)



21 GHz ~ 23 GHz

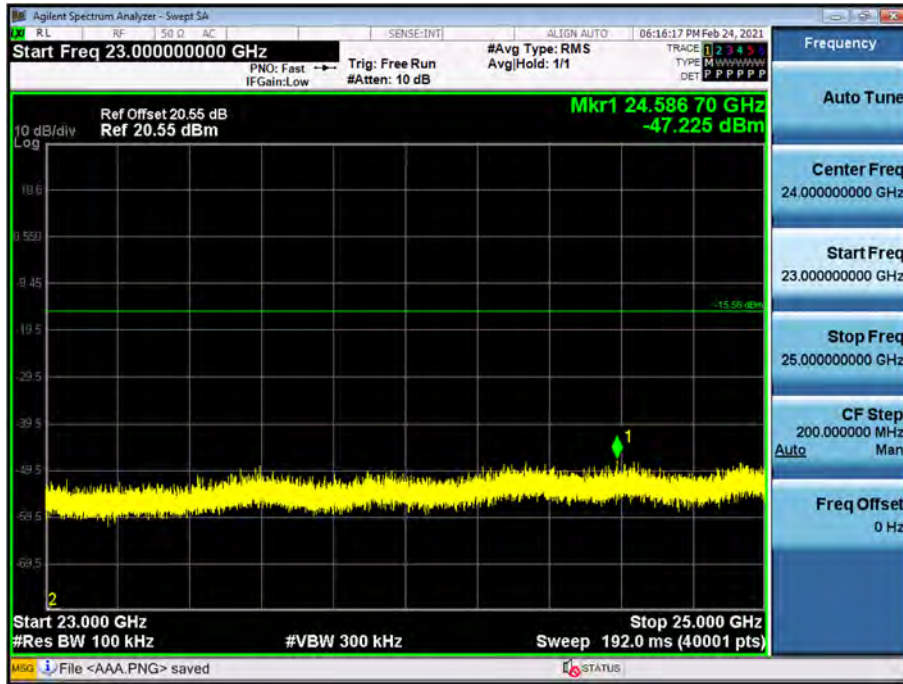
Conducted Spurious Emission (Mid-CH 19)





23 GHz ~ 25 GHz

Conducted Spurious Emission (Mid-CH 19)



9.6 RADIATED SPURIOUS EMISSIONS

Frequency Range : 9 kHz – 30MHz

Frequency	Reading	Ant. factor	Cable loss	Ant. POL	Total	Limit	Margin
MHz	dBuV/m	dBm/m	dBm	(H/V)	dBuV/m	dBuV/m	dB

No Critical peaks found

Note:

1. The reading of emissions are attenuated more than 20 dB below the permissible limits or the field strength is too small to be measured.
2. Distance extrapolation factor = $40\log(\text{specific distance} / \text{test distance})$ (dB)
3. Limit line = specific Limits (dBuV) + Distance extrapolation factor
4. Radiated test is performed with hopping off.

Frequency Range : Below 1 GHz

Frequency	Reading	Ant. factor	Cable loss	Ant. POL	Total	Limit	Margin
MHz	dBuV/m	dBm/m	dBm	(H/V)	dBuV/m	dBuV/m	dB

No Critical peaks found

Note:

1. Radiated emissions measured in frequency range from 30 MHz to 1000 MHz were made with an instrument using Quasi peak detector mode.

Frequency Range : Above 1 GHz

Mode : 1M Bit/s (255 Byte)

Operation Mode: CH Low

Frequency	Reading	Duty Cycle Correction	AN.+CL-AMP G	Ant. Pol.	Total	Limit	Margin	Measurement Type
[MHz]	[dBuV]	[dB]	[dB]	[H/V]	[dBuV/m]	[dBuV/m]	[dB]	
4804	42.99	0.00	2.98	V	45.97	73.98	28.01	PK
4804	30.24	0.72	2.98	V	33.94	53.98	20.04	AV
7206	38.34	0.00	9.57	V	47.91	73.98	26.07	PK
7206	26.78	0.72	9.57	V	37.07	53.98	16.91	AV
4804	39.77	0.00	2.98	H	42.75	73.98	31.23	PK
4804	28.16	0.72	2.98	H	31.86	53.98	22.12	AV
7206	35.08	0.00	9.57	H	44.65	73.98	29.33	PK
7206	23.69	0.72	9.57	H	33.98	53.98	20.00	AV

Operation Mode: CH Mid

Frequency	Reading	Duty Cycle Correction	AN.+CL-AMP G	Ant. Pol.	Total	Limit	Margin	Measurement Type
[MHz]	[dBuV]	[dB]	[dB]	[H/V]	[dBuV/m]	[dBuV/m]	[dB]	
4880	41.07	0.00	3.33	V	44.40	73.98	29.58	PK
4880	29.10	0.72	3.33	V	33.15	53.98	20.83	AV
7320	39.69	0.00	10.20	V	49.89	73.98	24.09	PK
7320	27.44	0.72	10.20	V	38.35	53.98	15.63	AV
4880	39.00	0.00	3.33	H	42.33	73.98	31.65	PK
4880	27.15	0.72	3.33	H	31.20	53.98	22.78	AV
7320	35.66	0.00	10.20	H	45.86	73.98	28.12	PK
7320	24.18	0.72	10.20	H	35.09	53.98	18.89	AV



Operation Mode: CH High

Frequency	Reading	Duty Cycle Correction	AN.+CL-AMP G	Ant. Pol.	Total	Limit	Margin	Measurement Type
[MHz]	[dBuV]	[dB]	[dB]	[H/V]	[dBuV/m]	[dBuV/m]	[dB]	
4960	41.09	0.00	2.36	V	43.45	73.98	30.53	PK
4960	28.72	0.72	2.36	V	31.80	53.98	22.18	AV
7440	39.23	0.00	10.72	V	49.95	73.98	24.03	PK
7440	27.14	0.72	10.72	V	38.58	53.98	15.40	AV
4960	37.58	0.00	2.36	H	39.94	73.98	34.04	PK
4960	25.61	0.72	2.36	H	28.69	53.98	25.29	AV
7440	35.44	0.00	10.72	H	46.16	73.98	27.82	PK
7440	24.36	0.72	10.72	H	35.80	53.98	18.18	AV

Mode : 2M Bit/s (37 Byte)

Operation Mode: CH Low

Frequency	Reading	Duty Cycle Correction	AN.+CL-AMP G	Ant. Pol.	Total	Limit	Margin	Measurement Type
[MHz]	[dBuV]	[dB]	[dB]	[H/V]	[dBuV/m]	[dBuV/m]	[dB]	
4804	42.55	0.00	2.98	V	45.53	73.98	28.45	PK
4804	30.34	5.06	2.98	V	38.38	53.98	15.60	AV
7206	38.29	0.00	9.57	V	47.86	73.98	26.12	PK
7206	26.53	5.06	9.57	V	41.17	53.98	12.81	AV
4804	39.86	0.00	2.98	H	42.84	73.98	31.14	PK
4804	28.53	5.06	2.98	H	36.57	53.98	17.41	AV
7206	35.69	0.00	9.57	H	45.26	73.98	28.72	PK
7206	24.25	5.06	9.57	H	38.89	53.98	15.09	AV

Operation Mode: CH Mid

Frequency	Reading	Duty Cycle Correction	AN.+CL-AMP G	Ant. Pol.	Total	Limit	Margin	Measurement Type
[MHz]	[dBuV]	[dB]	[dB]	[H/V]	[dBuV/m]	[dBuV/m]	[dB]	
4880	41.47	0.00	3.33	V	44.80	73.98	29.18	PK
4880	29.10	5.06	3.33	V	37.49	53.98	16.49	AV
7320	39.28	0.00	10.20	V	49.48	73.98	24.50	PK
7320	27.26	5.06	10.20	V	42.52	53.98	11.46	AV
4880	39.24	0.00	3.33	H	42.57	73.98	31.41	PK
4880	27.06	5.06	3.33	H	35.45	53.98	18.53	AV
7320	38.10	0.00	10.20	H	48.30	73.98	25.68	PK
7320	25.14	5.06	10.20	H	40.40	53.98	13.58	AV



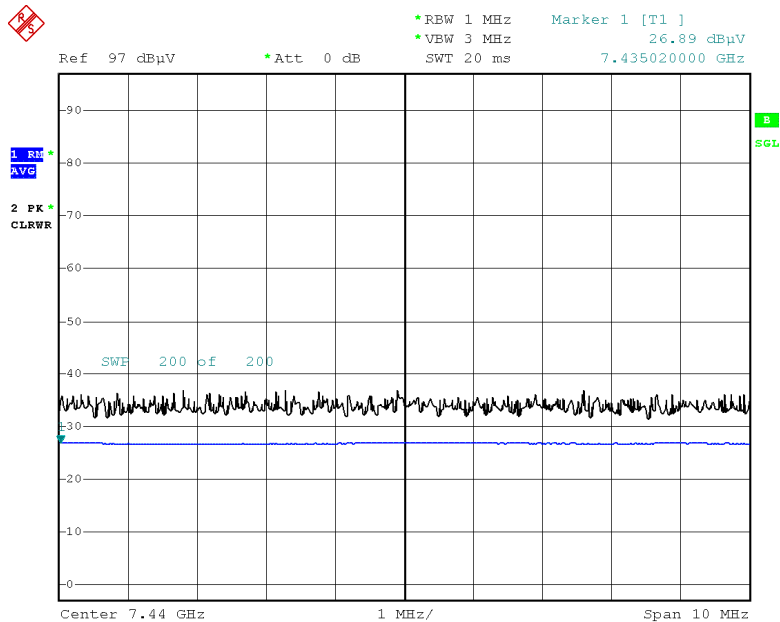
Operation Mode: CH High

Frequency	Reading	Duty Cycle Correction	AN.+CL-AMP G	Ant. Pol.	Total	Limit	Margin	Measurement Type
[MHz]	[dBuV]	[dB]	[dB]	[H/V]	[dBuV/m]	[dBuV/m]	[dB]	
4960	41.24	0.00	2.36	V	43.60	73.98	30.38	PK
4960	28.75	5.06	2.36	V	36.18	53.98	17.80	AV
7440	40.34	0.00	10.72	V	51.06	73.98	22.92	PK
7440	26.89	5.06	10.72	V	42.67	53.98	11.31	AV
4960	39.55	0.00	2.36	H	41.91	73.98	32.07	PK
4960	26.63	5.06	2.36	H	34.06	53.98	19.92	AV
7440	36.87	0.00	10.72	H	47.59	73.98	26.39	PK
7440	23.18	5.06	10.72	H	38.96	53.98	15.02	AV



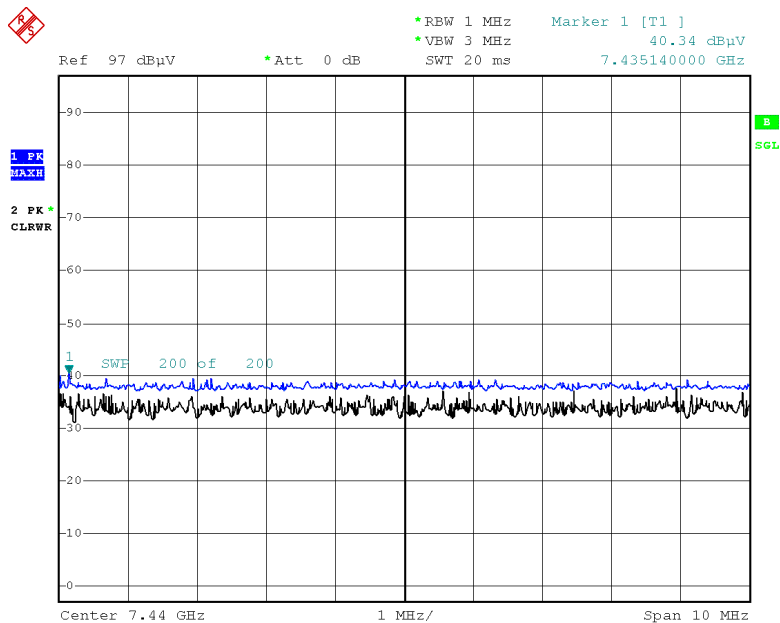
2M Bit/s (37 Byte) Test Plots (Worst case : Y-V)

Radiated Spurious Emissions plot – Average Reading (Ch.39 3rd Harmonic)



Date: 25.FEB.2021 15:28:18

Radiated Spurious Emissions plot – Peak Reading (Ch.39 3rd Harmonic)



Date: 25.FEB.2021 15:29:19

Note:

Plot of worst case are only reported.

9.7 RADIATED RESTRICTED BAND EDGES

Mode : 1M Bit/s (255 Byte)

Operating Frequency 2402 MHz & 2480 MHz

Channel No. 0 & 39

Frequency	Reading	Duty Cycle Correction	※ A.F.+CL	Ant. Pol.	Total	Limit	Margin	Measurement Type
[MHz]	[dBuV]	[dB]	[dB]	[H/V]	[dBuV/m]	[dBuV/m]	[dB]	
2390.0	19.49	0.000	35.16	H	54.65	73.98	19.33	PK
2390.0	6.94	0.716	35.16	H	42.82	53.98	11.16	AV
2390.0	19.37	0.000	35.16	V	54.53	73.98	19.45	PK
2390.0	6.91	0.716	35.16	V	42.78	53.98	11.20	AV
2483.5	22.36	0.000	35.36	H	57.71	73.98	16.27	PK
2483.5	9.70	0.716	35.36	H	45.77	53.98	8.21	AV
2483.5	21.69	0.000	35.36	V	57.04	73.98	16.94	PK
2483.5	9.61	0.716	35.36	V	45.69	53.98	8.29	AV

Mode : 2M Bit/s (37 Byte)

Operating Frequency 2402 MHz & 2480 MHz

Channel No. 0 & 39

Frequency	Reading	Duty Cycle Correction	※ A.F.+CL	Ant. Pol.	Total	Limit	Margin	Measurement Type
[MHz]	[dBuV]	[dB]	[dB]	[H/V]	[dBuV/m]	[dBuV/m]	[dB]	
2390.0	21.25	0.000	35.16	H	56.41	73.98	17.57	PK
2390.0	7.00	5.062	35.16	H	47.22	53.98	6.76	AV
2390.0	21.17	0.000	35.16	V	56.33	73.98	17.65	PK
2390.0	6.98	5.062	35.16	V	47.20	53.98	6.78	AV
#2483.5	54.28	0.000	1.20	H	55.48	73.98	18.50	PK
#2483.5	40.98	5.062	1.20	H	47.24	53.98	6.74	AV
#2483.5	54.12	0.000	1.20	V	55.32	73.98	18.66	PK
#2483.5	40.58	5.062	1.20	V	46.84	53.98	7.14	AV

Note :



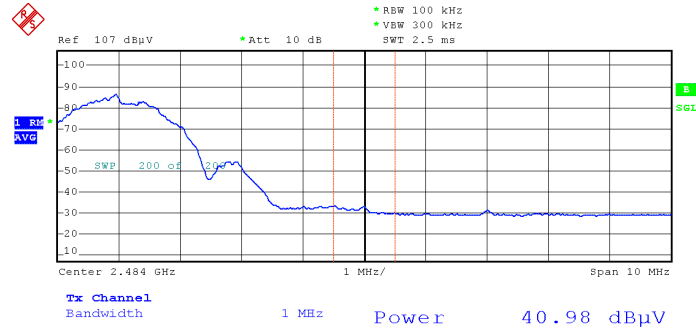
1. # integration method Used (ANSI C63.10 Section11.13.3
2. All data Worst case Duty Cycle Correction Factor applied.



Mode : 2M Bit/s (37 Byte) Test Plots

Radiated Restricted Band Edges plot – Average Reading (Ch.39, X-H)

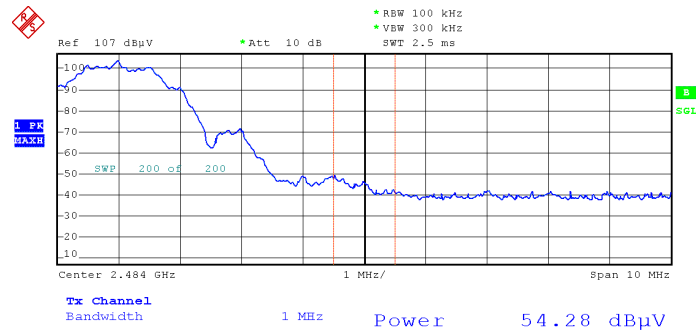
integration method Used_2 483.5 MHz



Date: 25.FEB.2021 15:49:17

Radiated Restricted Band Edges plot – Peak Reading (Ch.39, X-H)

integration method Used_2 483.5 MHz



Date: 25.FEB.2021 15:49:47

Note:

Plot of worst case are only reported.

9.8 RECEIVER SPURIOUS EMISSIONS

Frequency Range : Below 1 GHz

Frequency	Reading	Ant. factor	Cable loss	Ant. POL	Total	Limit	Margin
MHz	dBuV/m	dBm/m	dBm	(H/V)	dBuV/m	dBuV/m	dB

No Critical peaks found

Note:

1. Radiated emissions measured in frequency range from 30 MHz to 1000 MHz were made with an instrument using Quasi peak detector mode.

Frequency Range : Above 1 GHz

Frequency	Reading	Ant. factor	Cable loss	Ant. POL	Total	Limit	Margin
MHz	dBuV/m	dBm/m	dBm	(H/V)	dBuV/m	dBuV/m	dB

No Critical peaks found



9.9 POWERLINE CONDUCTED EMISSIONS

Conducted Emissions (Line 1)

BLE L1

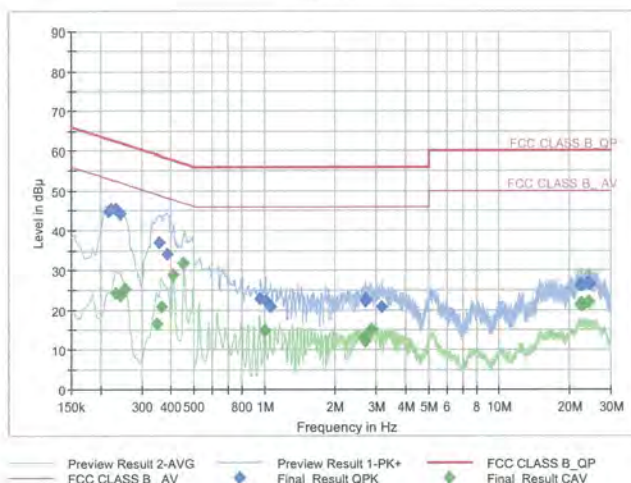
1 / 2

Test Report

Common Information

EUT : MTVWBE01GLX
 Manufacturer : LG
 Test Site: SHIELD ROOM
 Operating Conditions : BLE L1

Full Spectrum



Final Result QPK

Frequency (MHz)	QuasiPeak	Limit (dBuV)	Margin	Bandwidth (Hz)	Line	Filter	Corr. (dB)
0.217500	44.62	62.91	18.29	9.000	L1	OFF	9.6
0.222000	45.15	62.74	17.59	9.000	L1	OFF	9.6
0.233250	45.15	62.33	17.19	9.000	L1	OFF	9.6
0.244500	44.01	61.94	17.93	9.000	L1	OFF	9.6
0.357000	36.94	58.80	21.85	9.000	L1	OFF	9.6
0.384000	34.18	58.19	24.01	9.000	L1	OFF	9.6
0.961250	22.76	56.00	33.24	9.000	L1	OFF	9.6
1.013000	22.19	56.00	33.81	9.000	L1	OFF	9.6
1.064750	20.72	56.00	35.28	9.000	L1	OFF	9.6
2.691500	22.80	56.00	33.20	9.000	L1	OFF	9.7
2.700500	22.35	56.00	33.65	9.000	L1	OFF	9.7
3.170750	20.86	56.00	35.14	9.000	L1	OFF	9.7
22.176500	26.27	60.00	33.73	9.000	L1	OFF	10.0
22.248500	26.22	60.00	33.78	9.000	L1	OFF	10.0
22.552250	26.30	60.00	33.70	9.000	L1	OFF	10.0
23.951750	26.85	60.00	33.15	9.000	L1	OFF	10.0
24.131750	26.87	60.00	33.13	9.000	L1	OFF	10.0
24.392750	26.54	60.00	33.46	9.000	L1	OFF	10.0

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BLE L1

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Final Result CAV

Frequency (MHz)	CAverage (dBuV)	Limit (dBuV)	Margin (dB)	Bandwidth (kHz)	Line	Filter	Corr. (dB)
0.233250	24.29	52.33	28.04	9.000	L1	OFF	9.6
0.242250	23.63	52.02	28.39	9.000	L1	OFF	9.6
0.253500	25.27	51.64	26.37	9.000	L1	OFF	9.6
0.348000	16.32	49.01	32.69	9.000	L1	OFF	9.6
0.363750	20.64	48.64	28.01	9.000	L1	OFF	9.6
0.408750	28.70	47.67	18.97	9.000	L1	OFF	9.6
0.453750	31.84	46.81	14.97	9.000	L1	OFF	9.6
1.004000	14.64	46.00	31.36	9.000	L1	OFF	9.6
2.639750	12.98	46.00	33.02	9.000	L1	OFF	9.7
2.693750	11.99	46.00	34.01	9.000	L1	OFF	9.7
2.799500	14.51	46.00	31.49	9.000	L1	OFF	9.7
2.851250	15.12	46.00	30.88	9.000	L1	OFF	9.7
22.124750	21.28	50.00	28.72	9.000	L1	OFF	10.0
22.318250	21.53	50.00	28.47	9.000	L1	OFF	10.0
22.554500	21.74	50.00	28.26	9.000	L1	OFF	10.0
22.606250	21.08	50.00	28.92	9.000	L1	OFF	10.0
23.949500	21.98	50.00	28.02	9.000	L1	OFF	10.0
24.131750	21.93	50.00	28.07	9.000	L1	OFF	10.0

2021-01-07

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Conducted Emissions (Line 2)

BLE N

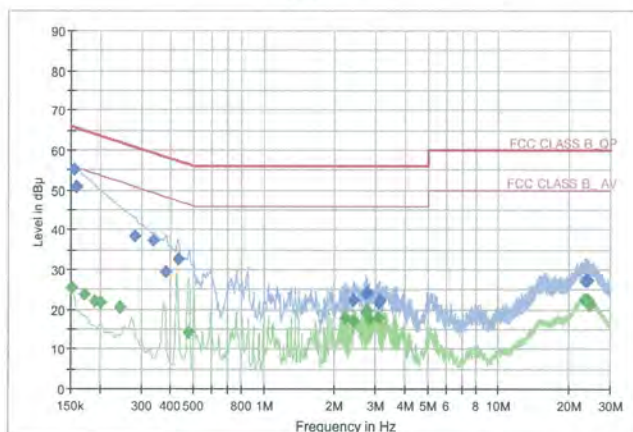
1 / 2

Test Report

Common Information

EUT : MTVWBE01GLX
 Manufacturer : LG
 Test Site: SHIELD ROOM
 Operating Conditions : BLE N

Full Spectrum



Preview Result 2-AVG FCC CLASS B_AV Preview Result 1-PK+ Final_Result QPK FCC CLASS B_QP Final_Result CAV

Final Result QPK

Frequency (MHz)	QuasiPeak	Limit (dBuV)	Margin	Bandwidth	Line	Filter	Corr. (dB)
0.154500	54.97	65.75	10.79	9.000	N	OFF	9.6
0.159000	50.85	65.52	14.67	9.000	N	OFF	9.6
0.280500	38.48	60.80	22.32	9.000	N	OFF	9.6
0.339000	37.10	59.23	22.13	9.000	N	OFF	9.6
0.381750	29.31	58.24	28.93	9.000	N	OFF	9.6
0.431250	32.66	57.23	24.56	9.000	N	OFF	9.6
2.408000	22.18	56.00	33.82	9.000	N	OFF	9.6
2.723000	23.86	56.00	32.14	9.000	N	OFF	9.7
2.763500	24.06	56.00	31.94	9.000	N	OFF	9.7
2.770250	24.31	56.00	31.69	9.000	N	OFF	9.7
3.076250	21.68	56.00	34.33	9.000	N	OFF	9.7
3.130250	22.23	56.00	33.77	9.000	N	OFF	9.7
23.411750	27.01	60.00	32.99	9.000	N	OFF	10.0
23.542250	27.04	60.00	32.96	9.000	N	OFF	10.0
23.591750	27.36	60.00	32.64	9.000	N	OFF	10.0
23.832500	27.16	60.00	32.84	9.000	N	OFF	10.0
23.922500	27.03	60.00	32.97	9.000	N	OFF	10.0
24.089000	27.36	60.00	32.64	9.000	N	OFF	10.0

2021-01-07

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BLE N

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Final Result CAV

Frequency (MHz)	CAverage (dBuV)	Limit (dBuV)	Margin (dB)	Bandwidth (kHz)	Line	Filter	Corr. (dB)
0.152250	25.36	55.88	30.51	9.000	N	OFF	9.6
0.172500	23.57	54.84	31.27	9.000	N	OFF	9.6
0.190500	21.94	54.02	32.07	9.000	N	OFF	9.6
0.201750	21.62	53.54	31.92	9.000	N	OFF	9.6
0.242250	20.47	52.02	31.55	9.000	N	OFF	9.6
0.476250	14.07	46.40	32.33	9.000	N	OFF	9.6
2.219000	17.92	46.00	28.08	9.000	N	OFF	9.6
2.408000	17.13	46.00	28.87	9.000	N	OFF	9.6
2.720750	19.46	46.00	26.54	9.000	N	OFF	9.7
2.768000	19.61	46.00	26.39	9.000	N	OFF	9.7
2.815250	17.58	46.00	28.42	9.000	N	OFF	9.7
3.078500	17.98	46.00	28.02	9.000	N	OFF	9.7
23.321750	22.27	50.00	27.73	9.000	N	OFF	10.0
23.335250	22.07	50.00	27.93	9.000	N	OFF	10.0
23.411750	22.53	50.00	27.47	9.000	N	OFF	10.0
23.832500	22.19	50.00	27.81	9.000	N	OFF	10.0
23.992250	22.42	50.00	27.58	9.000	N	OFF	10.0
24.595250	21.09	50.00	28.91	9.000	N	OFF	10.0

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10. LIST OF TEST EQUIPMENT

Conducted Test

Manufacturer	Model / Equipment	Calibration Date	Calibration Interval	Serial No.
Rohde & Schwarz	ENV216 / LISN	09/04/2020	Annual	102245
Rohde & Schwarz	ESCI / Test Receiver	06/05/2020	Annual	100033
ESPAC	SU-642 /Temperature Chamber	03/18/2020	Annual	0093008124
Agilent	N9020A / Signal Analyzer	05/11/2020	Annual	MY51110085
Agilent	N9030A / Signal Analyzer	01/11/2021	Annual	MY49431210
Agilent	N1911A / Power Meter	04/07/2020	Annual	MY45100523
Agilent	N1921A / Power Sensor	06/08/2020	Annual	MY57820067
Agilent	87300B / Directional Coupler	11/10/2020	Annual	3116A03621
Hewlett Packard	11667B / Power Splitter	05/25/2020	Annual	05001
Hewlett Packard	E3632A / DC Power Supply	06/12/2020	Annual	KR75303960
Weinschel	2-20 / Attenuator(20 dB)	10/07/2020	Annual	BR0592
Rohde & Schwarz	EMC32 / Software	N/A	N/A	N/A
HCT CO., LTD.	FCC WLAN&BT&BLE Conducted Test Software v3.0	N/A	N/A	N/A

Note:

1. Equipment listed above that calibrated during the testing period was set for test after the calibration.
2. Equipment listed above that has a calibration due date during the testing period, the testing is completed before equipment expiration date.

Radiated Test

Manufacturer	Model / Equipment	Calibration Date	Calibration Interval	Serial No.
Innco system	CO3000 / Controller(Antenna mast)	N/A	N/A	CO3000-4p
Innco system	MA4640/800-XP-EP / Antenna Position Tower	N/A	N/A	N/A
Emco	2090 / Controller	N/A	N/A	060520
Ets	Turn Table	N/A	N/A	N/A
Rohde & Schwarz	Loop Antenna	05/18/2020	Biennial	1513-175
Schwarzbeck	VULB 9160 / Hybrid Antenna	08/19/2020	Biennial	9160-3368
Schwarzbeck	VULB 9168 / Hybrid Antenna	09/04/2020	Biennial	9168-0895
Schwarzbeck	BBHA 9120D / Horn Antenna	11/18/2019	Biennial	9120D-1191
Schwarzbeck	BBHA9170 / Horn Antenna(15 GHz ~ 40 GHz)	11/29/2019	Biennial	BBHA9170541
Rohde & Schwarz	FSP(9 kHz ~ 30 GHz) / Spectrum Analyzer	09/14/2020	Annual	836650/016
Rohde & Schwarz	FSV40-N / Spectrum Analyzer	09/22/2020	Annual	101068-SZ
Wainwright Instruments	WRCJV2400/2483.5-2370/2520-60/12SS / Band Reject Filter	01/06/2021	Annual	2
Wainwright Instruments	WRCJV5100/5850-40/50-8EEK / Band Reject Filter	02/08/2021	Annual	1
CERNEX	CBLU1183540B-01/Broadband Bench Top LNA	12/23/2020	Annual	N/A
WEINSCHTEL	56-10 / Attenuator(10 dB)			
CERNEX	CBL06185030 / Broadband Low Noise Amplifier	12/23/2020	Annual	N/A
Api tech.	18B-03 / Attenuator (3 dB)			
Wainwright Instruments	WHKX10-2700-3000-18000-40SS / High Pass Filter	12/23/2020	Annual	N/A
Wainwright Instruments	WHKX8-6090-7000-18000-40SS / High Pass Filter	12/23/2020	Annual	N/A
T&M SYSTEM	COAXIAL ATTENUATOR / Thru	12/23/2020	Annual	N/A
CERNEX	CBL18265035 / Power Amplifier	12/04/2020	Annual	22966
CERNEX	CBL26405040 / Power Amplifier	03/23/2020	Annual	25956

Note:

1. Equipment listed above that calibrated during the testing period was set for test after the calibration.
2. Equipment listed above that has a calibration due date during the testing period, the testing is completed before equipment expiration date.
3. Especially, all antenna for measurement is calibrated in accordance with the requirements of C63.5(Version : 2017).



11. ANNEX A_ TEST SETUP PHOTO

Please refer to test setup photo file no. as follows;

No.	Description
1	HCT-RF-2103-FI004-P