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TEL: +82-31-645-6300 **FAX: +82-31-645-6401**

FCC BT LE REPORT

Certification

Applicant Name:
SAMSUNG Electronics Co., Ltd.

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

Date of Issue:
March 11, 2020

Test Site/Location:
74, Seoicheon-ro 578beon-gil, Majang-myeon, Icheon-si, Gyeonggi-do, 17383 KOREA

Report No.: HCT-RF-2003-FC002-R2

FCC ID:	**A3LSMA415FN**
APPLICANT:	**SAMSUNG Electronics Co., Ltd.**

Model:	SM-A415F/DSN
EUT Type:	Mobile Phone
Average Output Power:	-2.54 dBm (0.557 mW)
Frequency Range:	2402 MHz -2480 MHz
Modulation type	GFSK
FCC Classification:	Digital Transmission System(DTS)
FCC Rule Part(s):	Part 15.247

Engineering Statement:

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

Report prepared by : Jeong Ho Kim
Engineer of Telecommunication testing center

Approved by : Jong Seok Lee
Manager of Telecommunication testing center

Version

TEST REPORT NO.	DATE	DESCRIPTION
HCT-RF-2003-FC002	March 03, 2020	- First Approval Report
HCT-RF-2003-FC002-R1	March 09, 2020	- 9.1.1 DUTY CYCLE Correction revised & related result revised. - On Page 36, 1M_37byte Low ch Peak Power Retest. - On Page 38, digit data align.
HCT-RF-2003-FC002-R2	March 11, 2020	- On Page 17~19, Test Procedure revised. - On Page 24, DCCF calculate delete. - On Page 60~73, Radiated B.E Re-test & revised.

This test results were applied only to the test methods required by the standard.

This laboratory is not accredited for the test results marked *.
The above Test Report is the accredited test result by KOLAS(Korea Laboratory Accreditation Scheme), which signed the ILAC-MRA. (HCT Accreditation No.: KT197)

Table of Contents

1. EUT DESCRIPTION

Model	SM-A415F/DSN	
Additional Model	-	
EUT Type	Mobile Phone	
Power Supply	DC 3.85 V	
Battery Information	Model: EB-BA415ABY Type: Li-ion Battery	
Travel Adapter Information	Model : EP-TA200 Manufacture: SOLUM	
Data Cable Information	Model : EP-DR140ABE Manufacture: KSD	
Ear-jack Information	Model : EHS61ASFBE Manufacture: FOSTER	
Frequency Range	2402 MHz ~ 2480 MHz	
Max. RF Output Power	Peak (For information only)	125k Bit/s : -2.532 dBm (0.558 mW) 500k Bit/s : -2.519 dBm (0.560 mW) 1M Bit/s : -2.462 dBm (0.567 mW) 2M Bit/s : -2.363 dBm (0.580 mW)
	Average	125k Bit/s : -2.62 dBm (0.546 mW) 500k Bit/s : -2.64 dBm (0.544 mW) 1M Bit/s : -2.59 dBm (0.551 mW) 2M Bit/s : -2.54 dBm (0.557 mW)
Modulation Type	GFSK	
Bluetooth Version	5.0	
Number of Channels	40 Channels	
Antenna Specification	Antenna type: MFA Peak Gain : -5.04 dBi	
Date(s) of Tests	February 01, 2020~ March 11, 2020	

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.

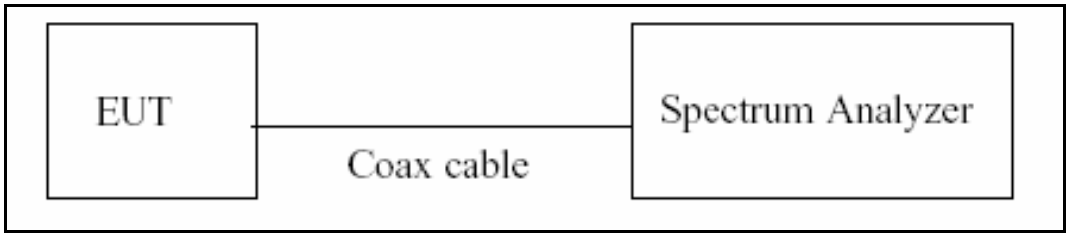
The measurement data shown herein meets or exceeds the U_{CISPR} measurement uncertainty values specified in CISPR 16-4-2 and, thus, can be compared directly to specified limits to determine compliance.

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*.

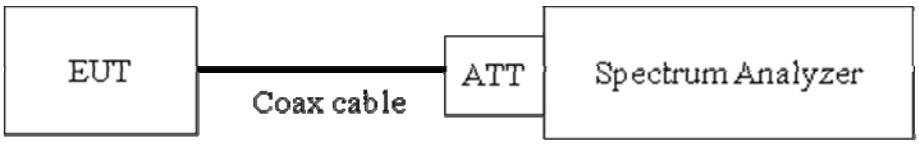
1. RBW = 8 MHz (the largest availble value)
2. VBW = 8 MHz (≥ RBW)
3. SPAN = 0 Hz
4. Detector = Peak
5. Number of points in sweep > 100
6. Trace mode = Clear write
7. Measure T_{total} and T_{on}
8. Calculate Duty Cycle = T_{on}/ T_{total} and Duty Cycle Factor = 10log(1/Duty Cycle)

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.

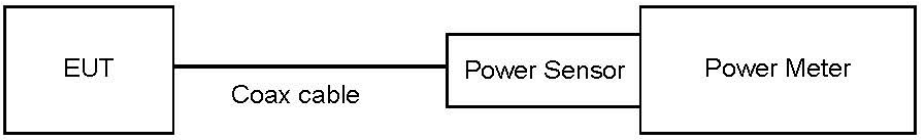
Note : We tested OBW using the automatic bandwidth measurement capability of a spectrum analyzer.

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

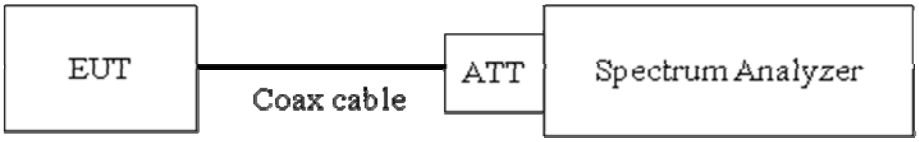
▪ Conducted Output Power(Average) = Reading Value + ATT loss + Cable loss + Duty Cycle Factor

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 = power averaging (rms) or sample detector (when rms not available).
7) Ensure that the number of measurement points in the sweep ≥[2 ×span / RBW].
8) Employ trace averaging (rms) modeover a minimum of 100 traces
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.
11) if then duty factor shall be added to adjust the result if the duty cycle is less than 98%

Sample Calculation

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

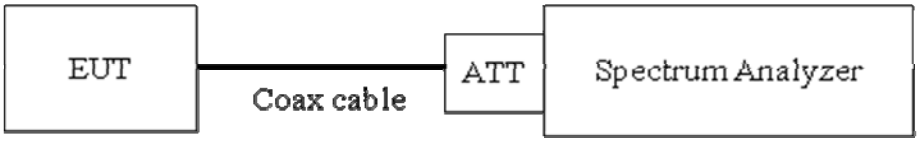
7.5. Conducted Band Edge(Out of Band Emissions) & Conducted Spurious Emissions

Limit

The maximum conducted (average) 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 ≥ 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	20.10
100	20.17
200	20.24
300	20.33
400	20.36
500	20.40
600	20.40
700	20.43
800	20.46
900	20.48
1000	20.51
2000	20.72
2400	20.79
2480	20.80
2500	20.81
3000	20.88
4000	21.01
5000	21.14
5150	21.16
5850	21.24
6000	21.26
7000	21.37
8000	21.49
9000	21.57
10000	21.66
11000	21.75
12000	21.84
13000	21.89
14000	21.92
15000	21.97
16000	22.03
17000	22.09
18000	22.13
19000	22.19
20000	22.25
21000	22.27
22000	22.29
23000	22.34
24000	22.47
25000	22.45
26000	22.58

Note : 1. 2 400 ~ 2 500 MHz is fundamental frequency range.
2. Factor = Attenuator loss(10 dB) + Cable loss(1ea)

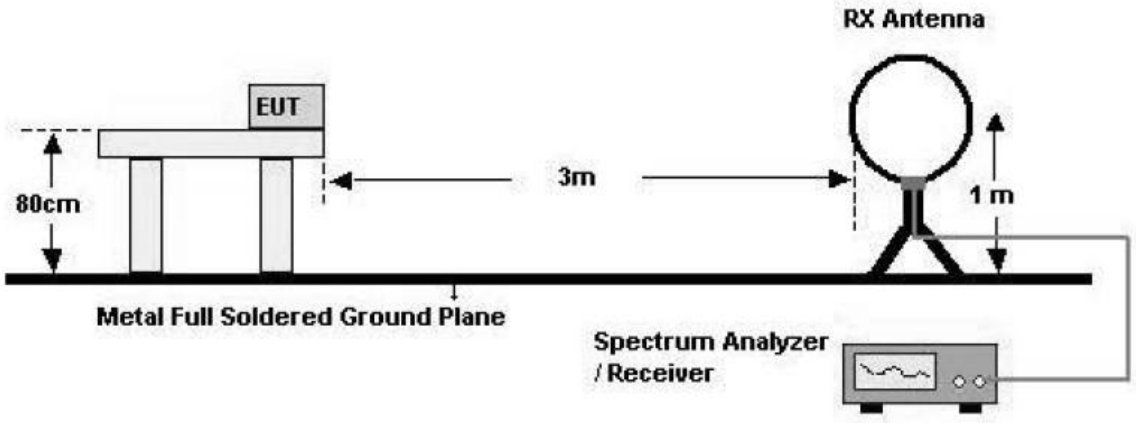
7.6. Radiated Test

Limit

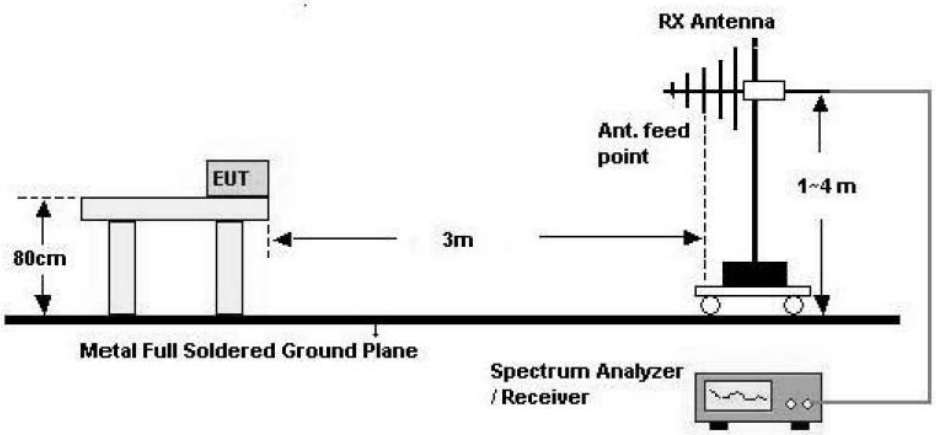
Frequency (MHz)	Field Strength (uV/m)	Measurement Distance (m)
0.009 – 0.490	2400/F(kHz)	300
0.490 – 1.705	24000/F(kHz)	30
1.705 – 30	30	30
30-88	100	3
88-216	150	3
216-960	200	3
Above 960	500	3

Test Configuration

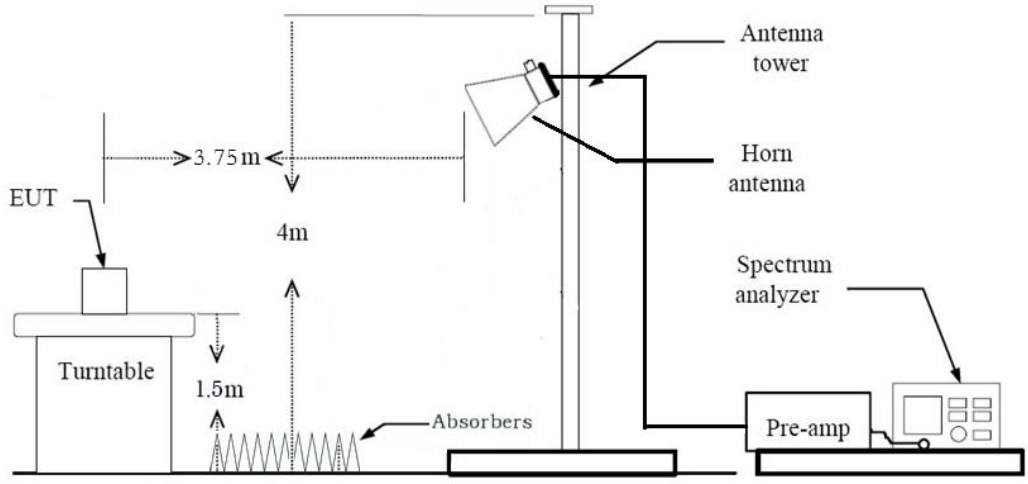
Below 30 MHz



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):
   - Duty cycle < 98%, duty cycle variations are less than ±2%
   - Measured Frequency Range : 1 GHz – 25 GHz
   - 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)
    = 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 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
    = Peak Reading Value + Antenna Factor(A.F) + Cable Loss(C.L) - Amp Gain(G)
    + Distance Factor(D.F) +Attenuator(ATT)

    Total(Measurement Type : Average)
    = Peak Reading Value + Antenna Factor(A.F) + Cable Loss(C.L) - Amp Gain(G)
    + Distance Factor(D.F) +Attenuator(ATT) + 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(Earphone, etc)
   - 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 : 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(Earphone, etc)+Travel Adapter
     Stand alone + Travel Adapter
   - Worstcase : Stand alone + Travel Adapter

Conducted test

1. The EUT was configured with packet length of highest power.
   (Worst case : 37 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 > 30 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

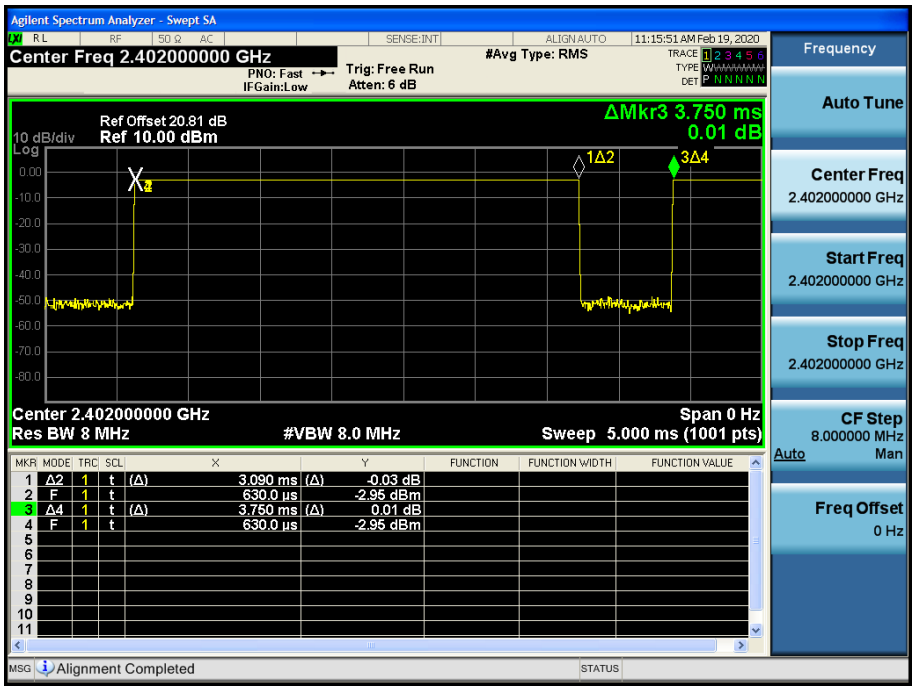
9. TEST RESULT

9.1 DUTY CYCLE

Data rate (Bit/s)	Packet length (Byte)	T_{on} (ms)	T_{total} (ms)	Duty Cycle	Duty Cycle Factor (dB)
125k	37	3.0900	3.7500	0.8240	0.84
	255	17.0500	17.5000	0.9743	0.11
500k	37	1.0633	1.8767	0.5666	2.47
	255	4.5450	4.9950	0.9099	0.41
1M	37	0.3825	0.6257	0.6113	2.14
	255	2.1300	2.5000	0.8520	0.70
2M	37	0.1989	0.6245	0.3185	4.97
	255	1.0700	1.8750	0.5707	2.44

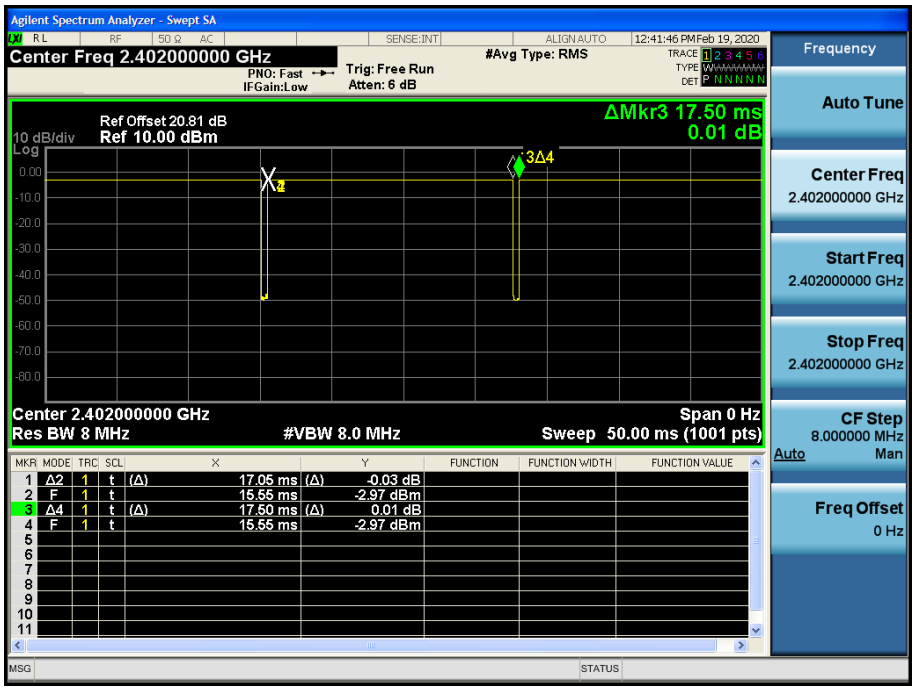
▣ 125k Bit/s(37 Byte) Test Plots

Duty Cycle (Low-CH 0)



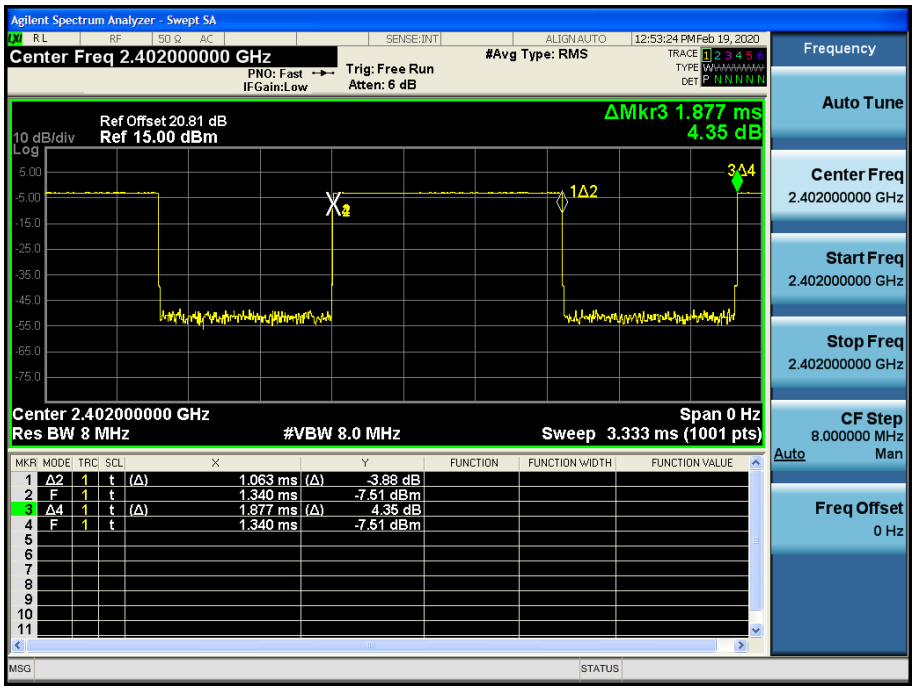
▣ 125k Bit/s(255 Byte) Test Plots

Duty Cycle (Low-CH 0)



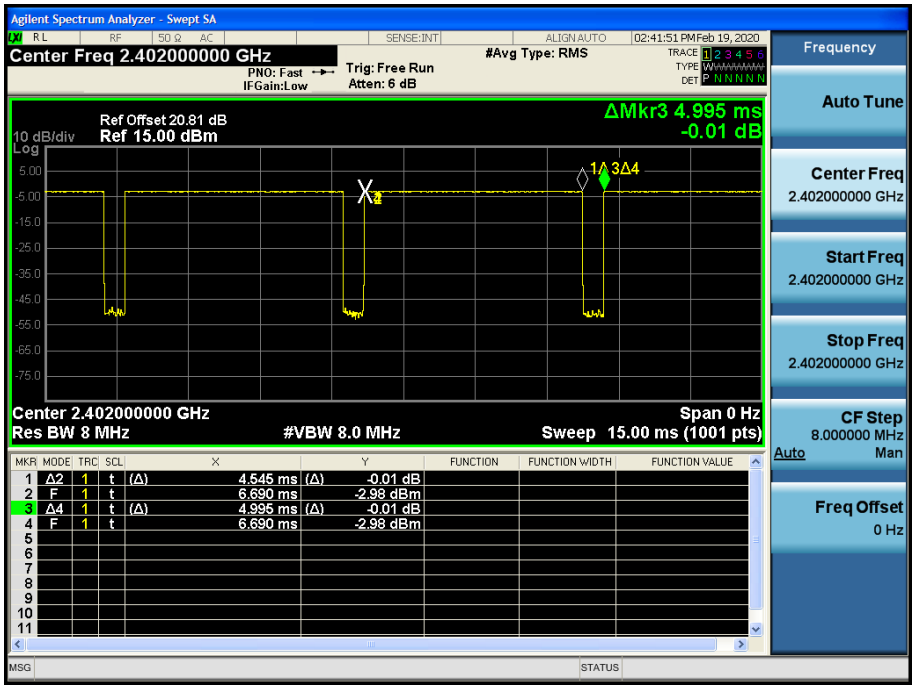
▣ 500k Bit/s(37 Byte) Test Plots

Duty Cycle (Low-CH 0)



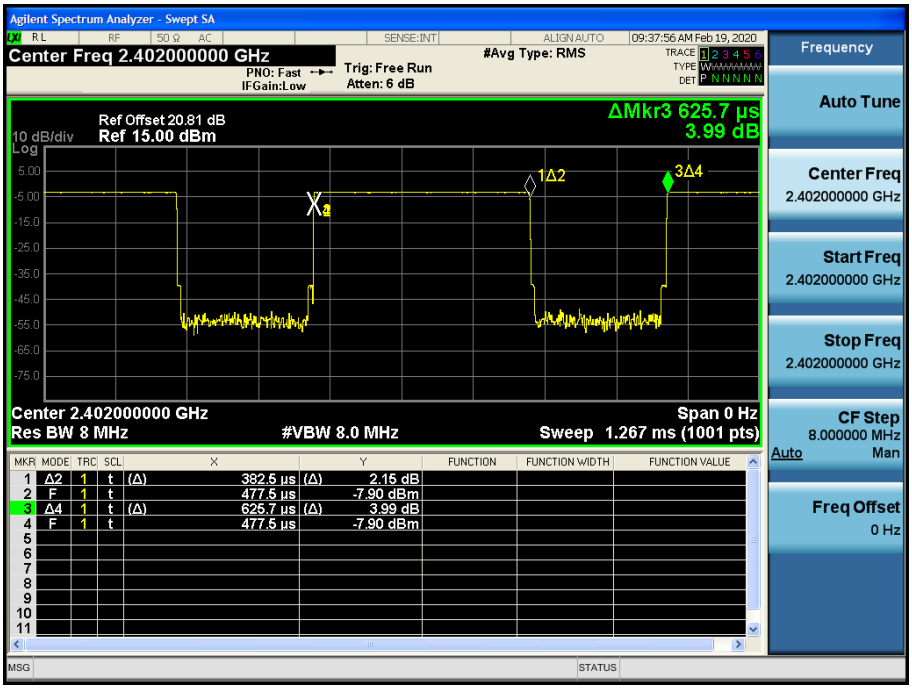
▣ 500k Bit/s(255 Byte) Test Plots

Duty Cycle (Low-CH 0)



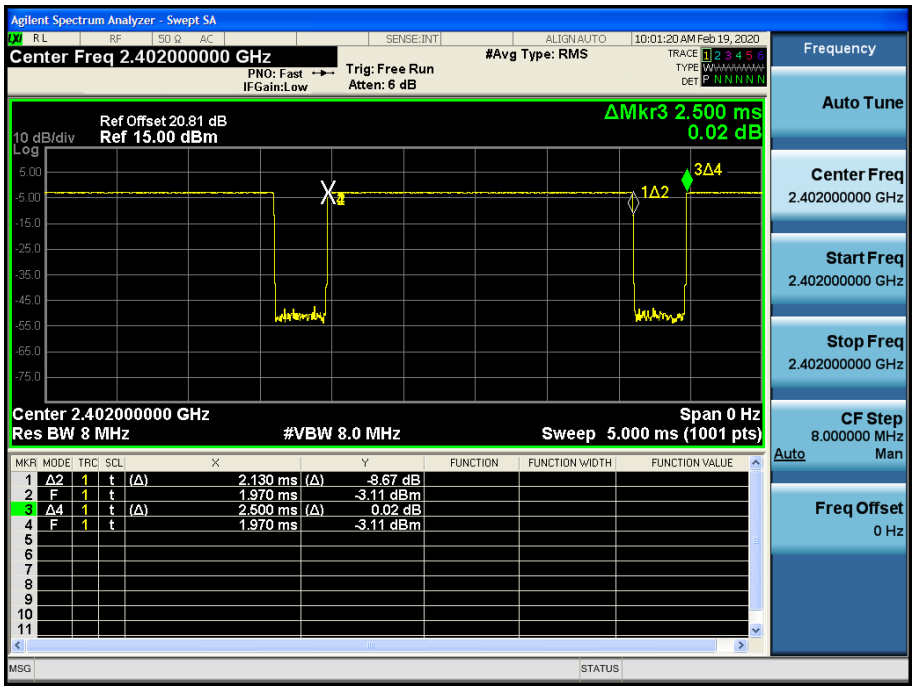
▣ 1M Bit/s (37 Byte) Test Plots

Duty Cycle (Low-CH 0)



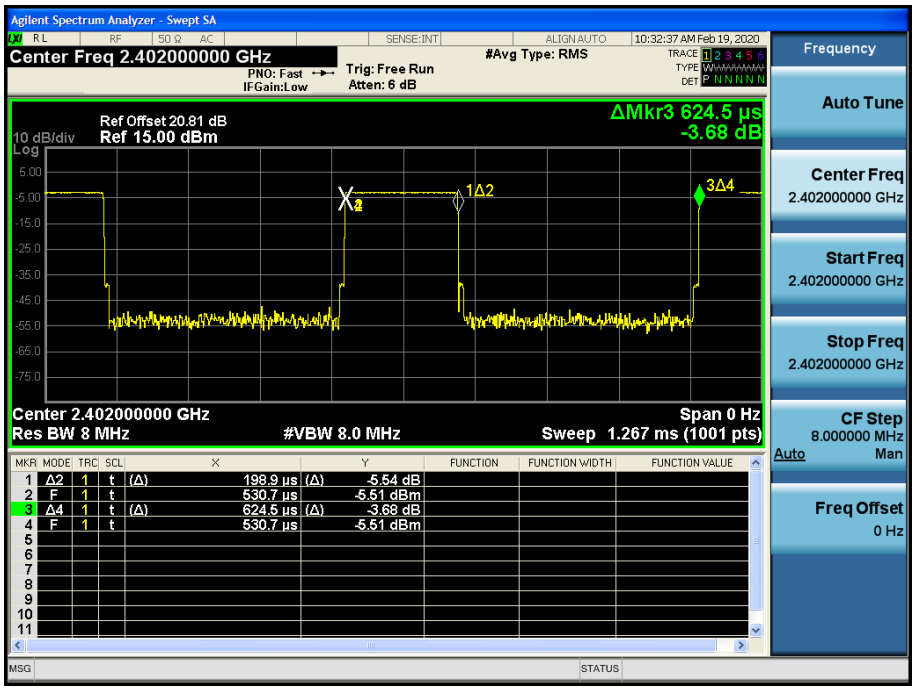
▣ 1M Bit/s (255 Byte) Test Plots

Duty Cycle (Low-CH 0)



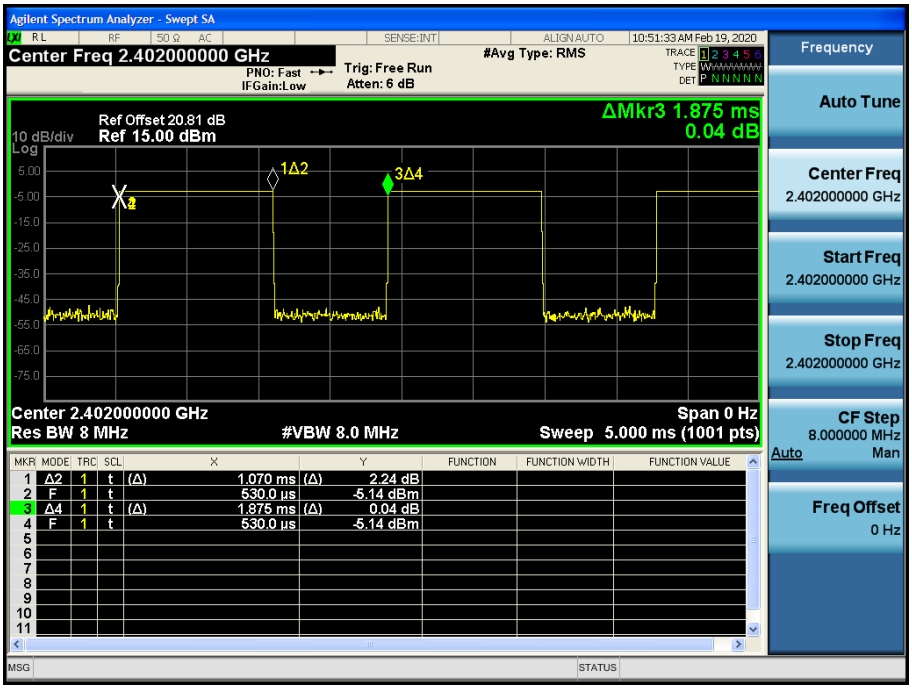
▣ 2M Bit/s (37 Byte) Test Plots

Duty Cycle (Low-CH 0)



▣ 2M Bit/s (255 Byte) Test Plots

Duty Cycle (Low-CH 0)

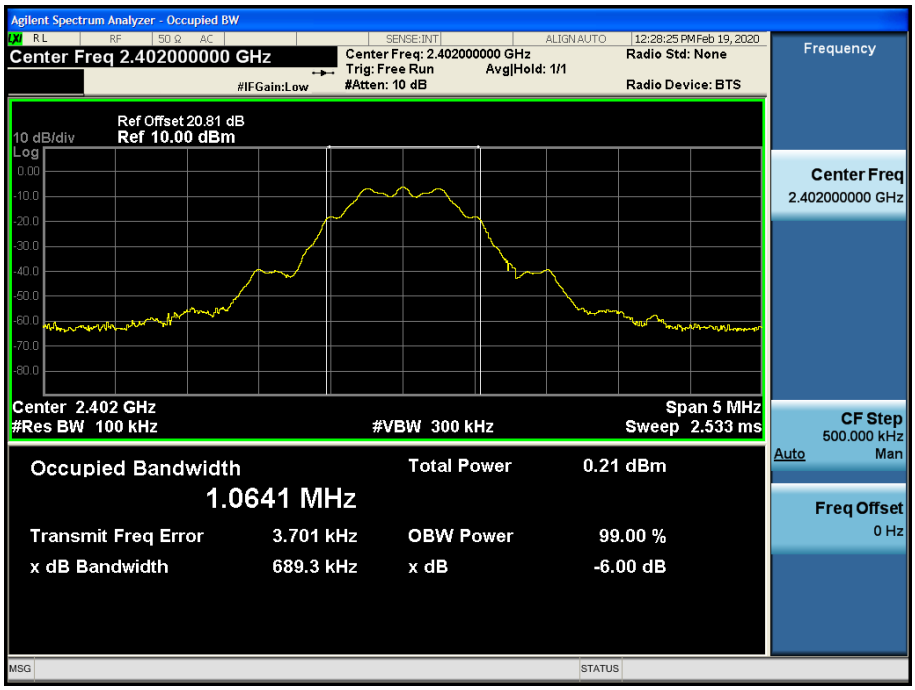


9.2 6dB BANDWIDTH

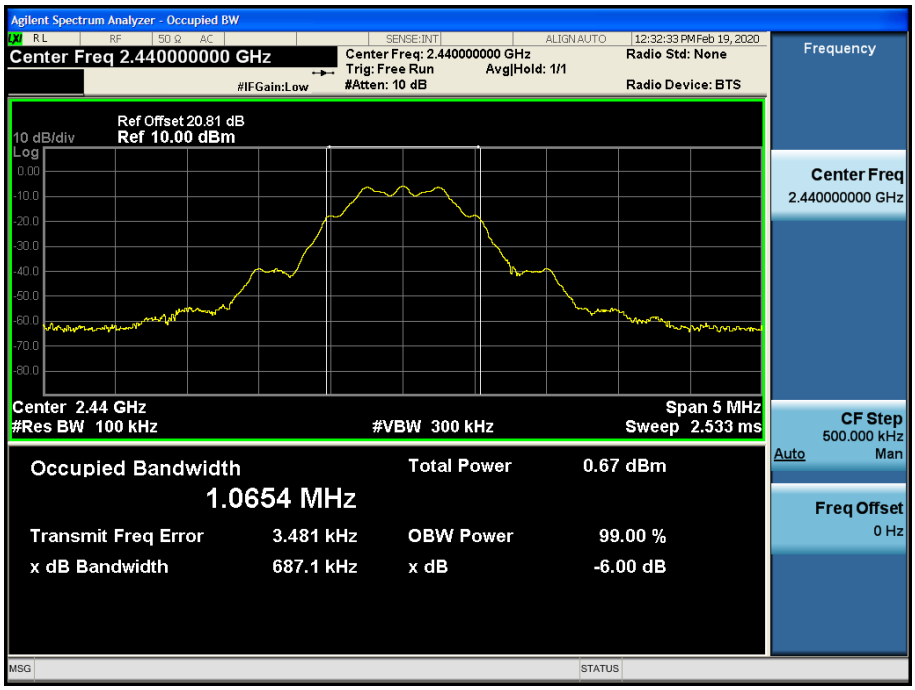
Mode (Bit/s)	Channel	6 dB Bandwidth (kHz)	Limit (kHz)
125k	0	689.3	> 500
	19	687.1	
	39	686.6	
500k	0	666.7	> 500
	19	667.5	
	39	664.3	
1M	0	667.7	> 500
	19	666.8	
	39	670.9	
2M	0	1163.0	> 500
	19	1164.0	
	39	1161.0	

▣ 125k Bit/s(37 Byte) Test Plots

6 dB Bandwidth plot (Low-CH 0)



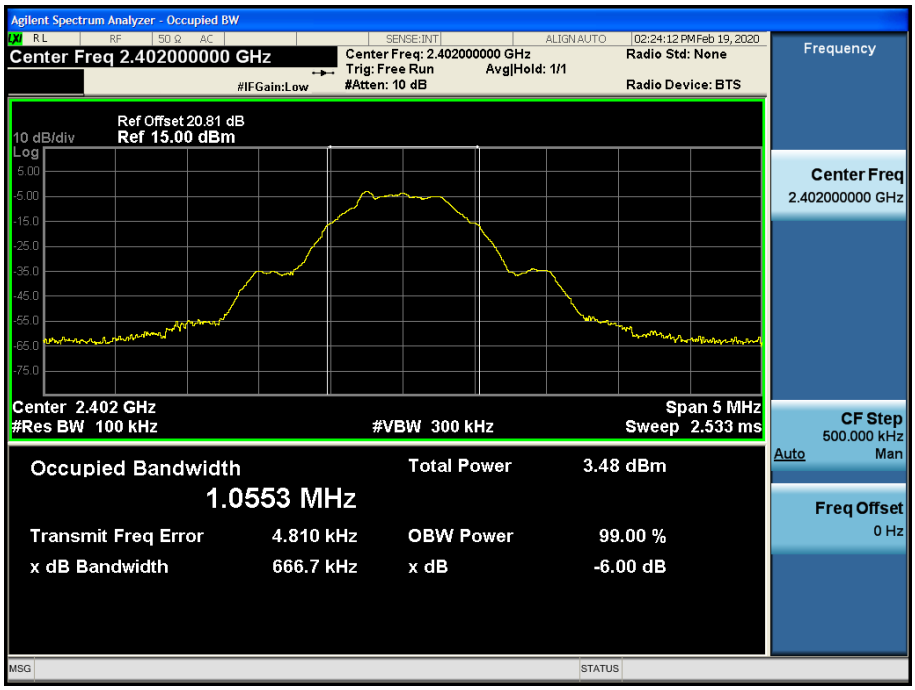
6 dB Bandwidth plot (Mid-CH 19)



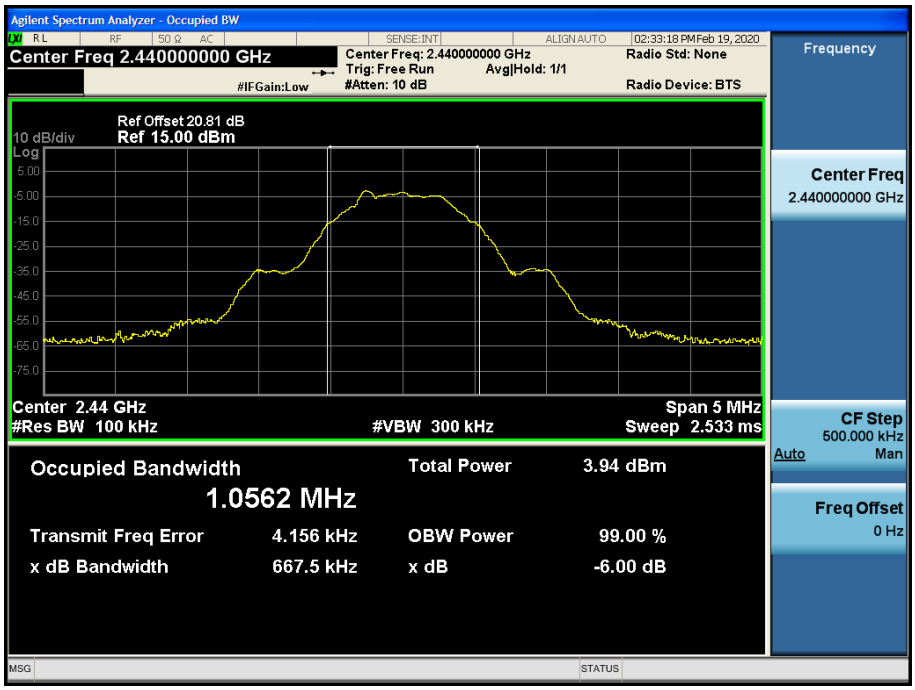
6 dB Bandwidth plot (High-CH 39)

▣ 500k Bit/s(37 Byte) Test Plots

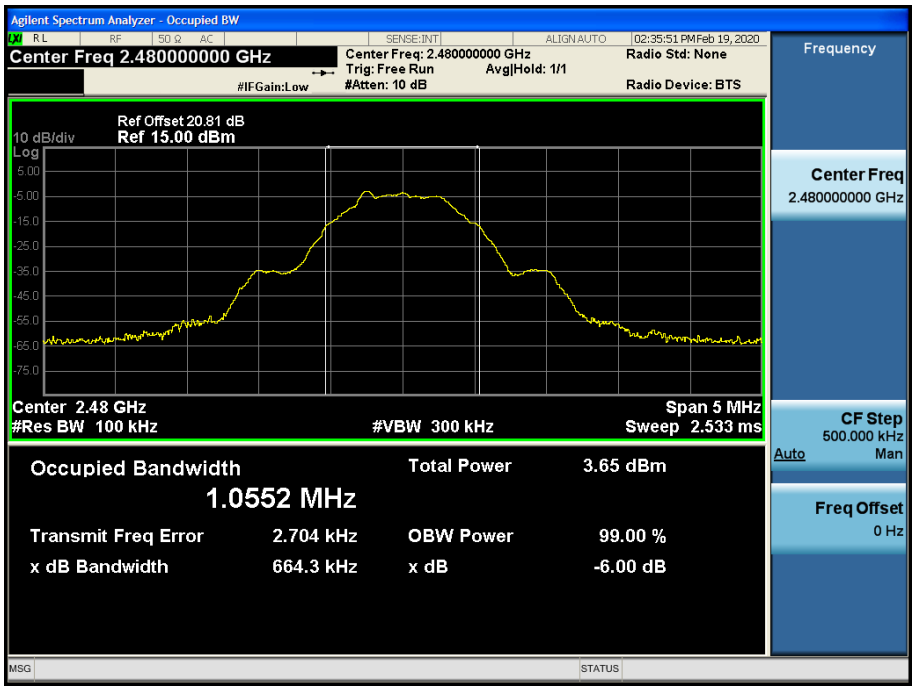
6 dB Bandwidth plot (Low-CH 0)



6 dB Bandwidth plot (Mid-CH 19)

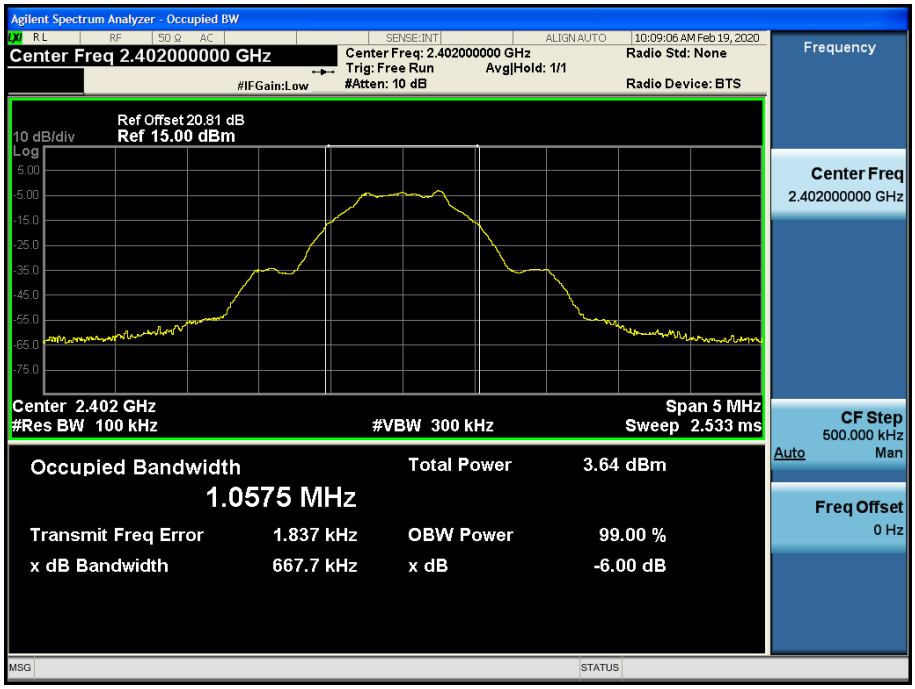


6 dB Bandwidth plot (High-CH 39)



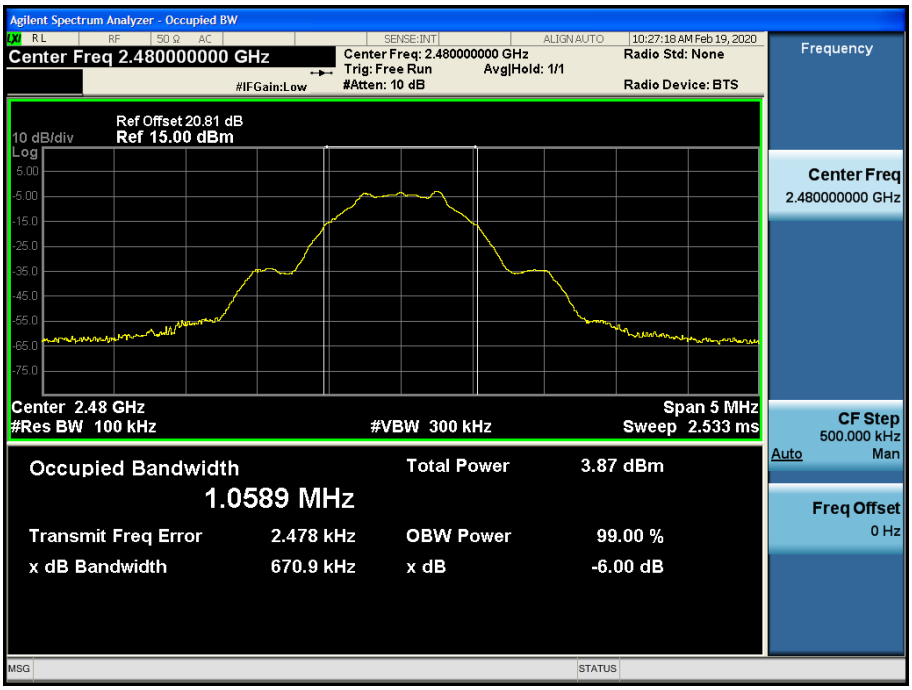
▣ 1M Bit/s (255 Byte) Test Plots

6 dB Bandwidth plot (Low-CH 0)



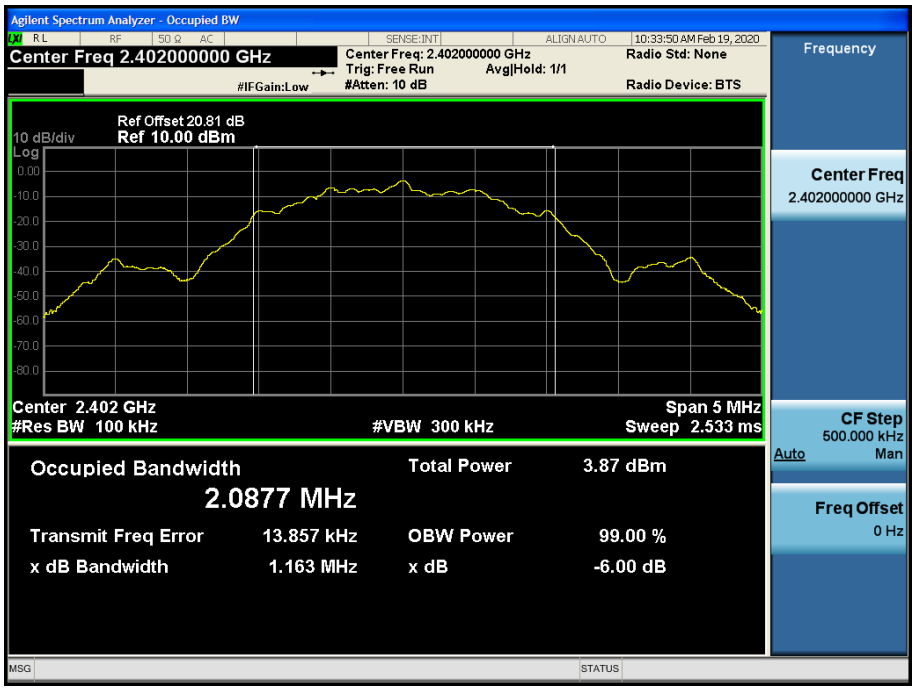
6 dB Bandwidth plot (Mid-CH 19)

6 dB Bandwidth plot (High-CH 39)



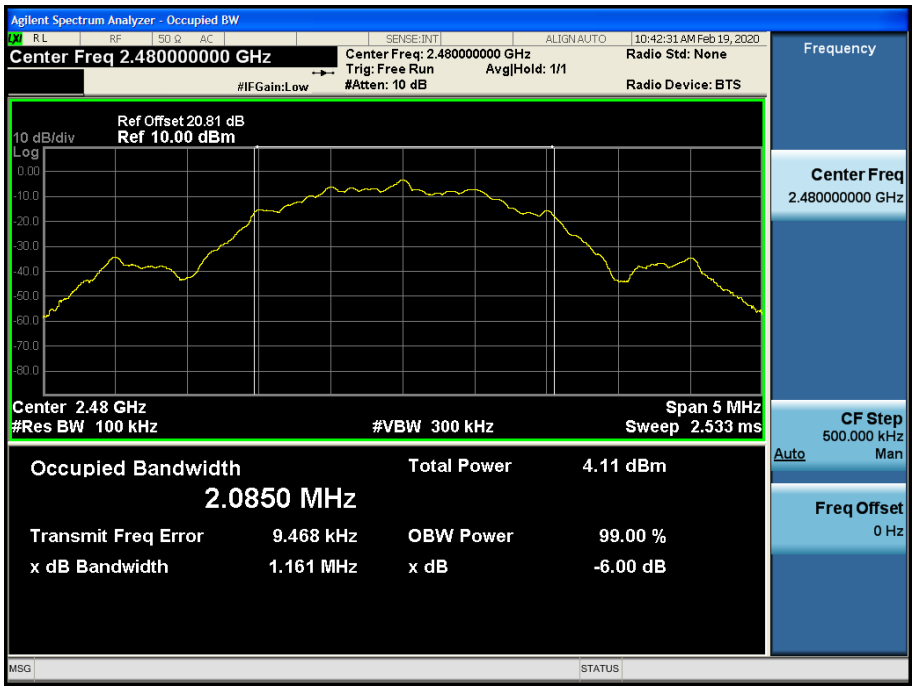
▣ 2M Bit/s (37 Byte) Test Plots

6 dB Bandwidth plot (Low-CH 0)



6 dB Bandwidth plot (Mid-CH 19)

6 dB Bandwidth plot (High-CH 39)



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	-2.996	30
		2440	19	-2.532	
		2480	39	-2.763	
	255	2402	0	-3.057	
		2440	19	-2.555	
		2480	39	-2.789	
500k	37	2402	0	-2.983	
		2440	19	-2.519	
		2480	39	-2.748	
	255	2402	0	-3.047	
		2440	19	-2.566	
		2480	39	-2.798	
1M	37	2402	0	-2.978	
		2440	19	-2.462	
		2480	39	-2.630	
	255	2402	0	-3.040	
		2440	19	-2.514	
		2480	39	-2.739	
2M	37	2402	0	-2.878	
		2440	19	-2.363	
		2480	39	-2.575	
	255	2402	0	-2.903	
		2440	19	-2.396	
		2480	39	-2.643	

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	-3.89	0.84	-3.05	30
		2440	19	-3.47	0.84	-2.62	
		2480	39	-3.62	0.84	-2.78	
	255	2402	0	-3.27	0.11	-3.16	
		2440	19	-2.76	0.11	-2.65	
		2480	39	-3.08	0.11	-2.97	
500k	37	2402	0	-5.59	2.47	-3.12	
		2440	19	-5.11	2.47	-2.64	
		2480	39	-5.41	2.47	-2.94	
	255	2402	0	-3.52	0.41	-3.11	
		2440	19	-3.09	0.41	-2.68	
		2480	39	-3.34	0.41	-2.93	
1M	37	2402	0	-5.26	2.14	-3.12	
		2440	19	-4.79	2.14	-2.65	
		2480	39	-5.01	2.14	-2.87	
	255	2402	0	-3.88	0.70	-3.18	
		2440	19	-3.29	0.70	-2.59	
		2480	39	-3.66	0.70	-2.96	
2M	37	2402	0	-7.97	4.97	-3.00	
		2440	19	-7.51	4.97	-2.54	
		2480	39	-7.89	4.97	-2.92	
	255	2402	0	-5.49	2.44	-3.05	
		2440	19	-5.10	2.44	-2.66	
		2480	39	-5.34	2.44	-2.91	

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, 20.81 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)	Duty Cycle Factor(dB)	Measured Power(dBm) + Duty Cycle Factor(dB)	Limit (dBm)
2402	0	125k 37 Byte	-9.715	0.84	-8.875	8.000
2440	19		-9.371	0.84	-8.531	
2480	39		-9.433	0.84	-8.593	
2402	0	125k 255 Byte	-9.241	0.11	-9.131	
2440	19		-8.687	0.11	-8.577	
2480	39		-8.860	0.11	-8.750	
2402	0	500k 37 Byte	-12.755	2.47	-10.285	
2440	19		-12.503	2.47	-10.033	
2480	39		-12.478	2.47	-10.008	
2402	0	500k 255 Byte	-10.502	0.41	-10.092	
2440	19		-10.041	0.41	-9.631	
2480	39		-10.549	0.41	-10.139	
2402	0	1M 37 Byte	-11.327	2.14	-9.187	
2440	19		-10.668	2.14	-8.528	
2480	39		-11.061	2.14	-8.921	
2402	0	1M 255 Byte	-10.292	0.70	-9.592	
2440	19		-9.772	0.70	-9.072	
2480	39		-10.153	0.70	-9.453	
2402	0	2M 37 Byte	-15.852	4.97	-10.882	
2440	19		-15.882	4.97	-10.912	
2480	39		-15.378	4.97	-10.408	
2402	0	2M 255 Byte	-14.977	2.44	-12.537	
2440	19		-13.755	2.44	-11.315	
2480	39		-14.838	2.44	-12.398	

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, 20.81 dB is offset for 2.4 GHz Band.
4. Worst case test Plot Only : 125k Bit/s(37 Byte)

▣ 125k Bit/s(37 Byte) Test Plots

Power Spectral Density (Low-CH 0)

Power Spectral Density (Mid-CH 19)

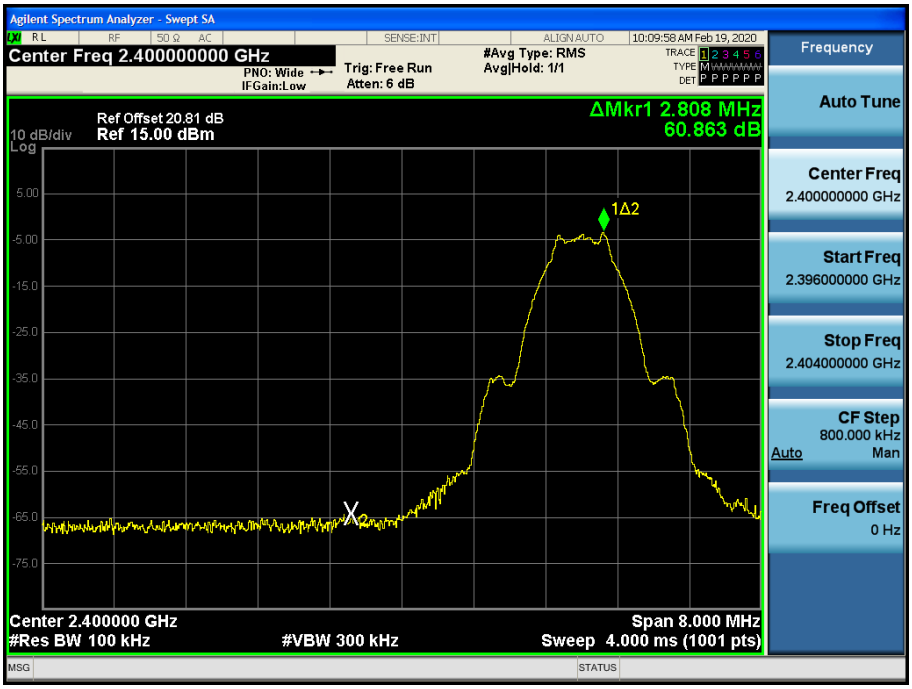
Power Spectral Density (High-CH 39)

9.5 BAND EDGE/ CONDUCTED SPURIOUS EMISSIONS

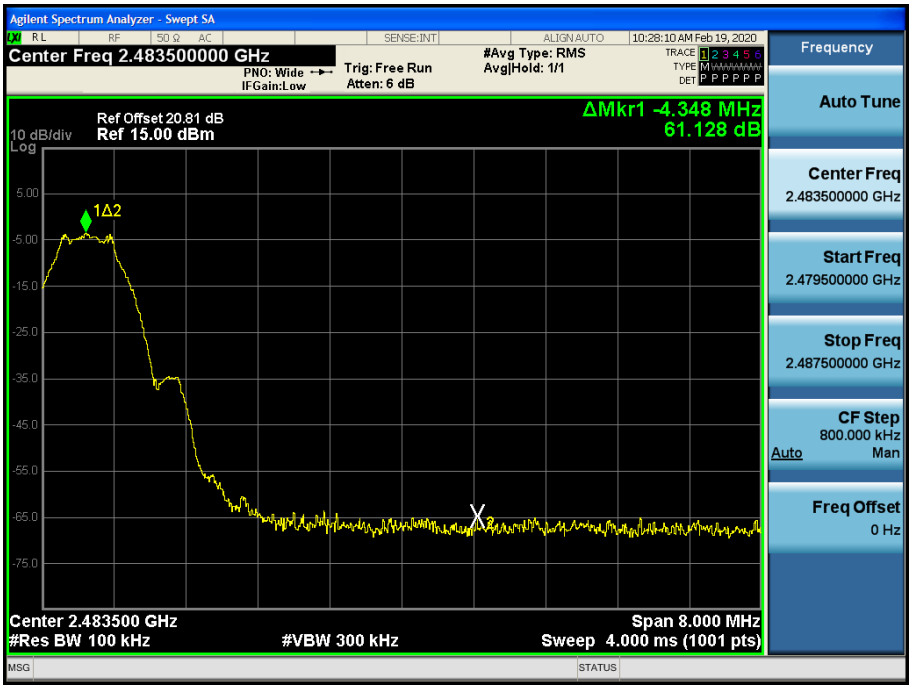
Test Result : please refer to the plot below.
In order to simplify the report, attached plots were only the worst case channel and data rate.

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

Low-CH 0



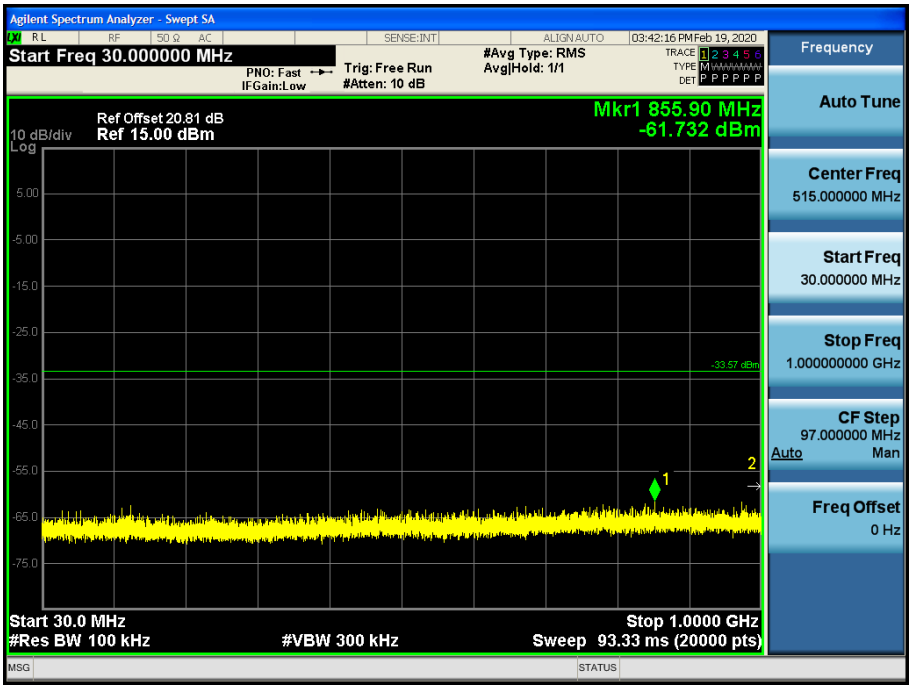
High-CH 39



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

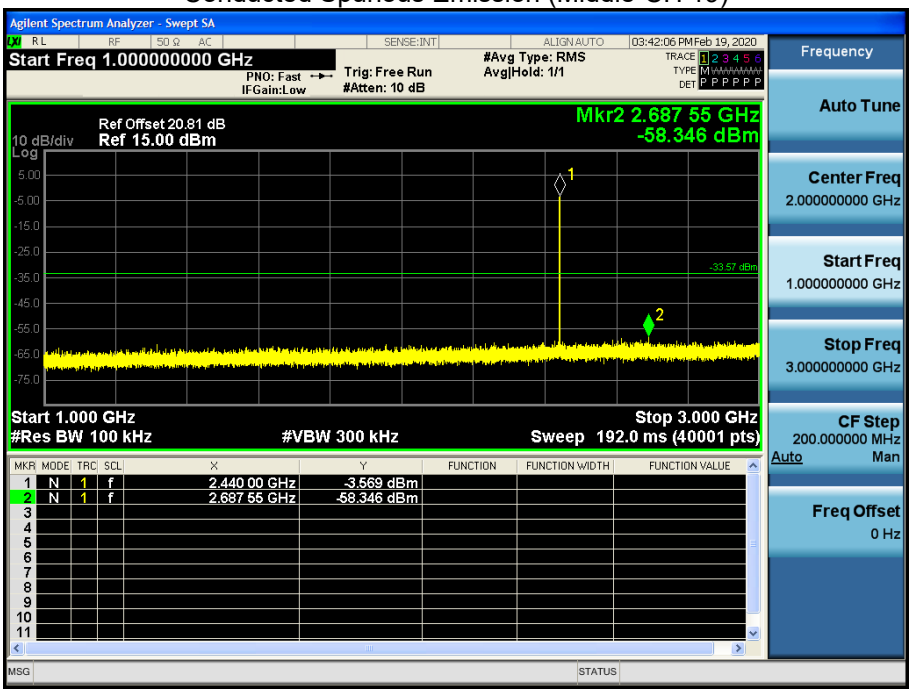
30 MHz ~ 1 GHz

Conducted Spurious Emission (Middle-CH 19)



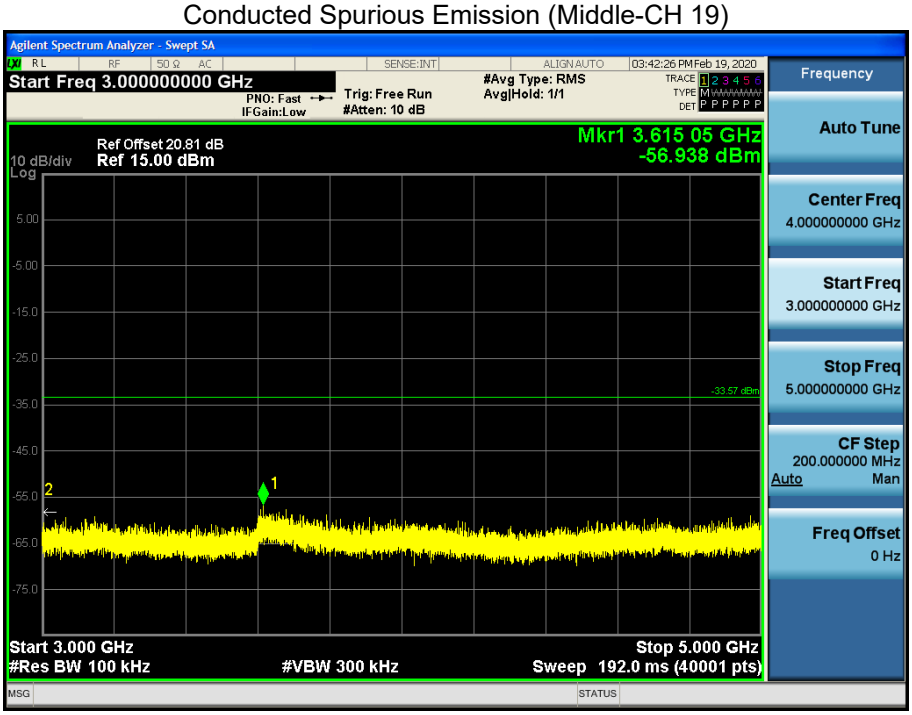
1 GHz ~ 3 GHz

Conducted Spurious Emission (Middle-CH 19)



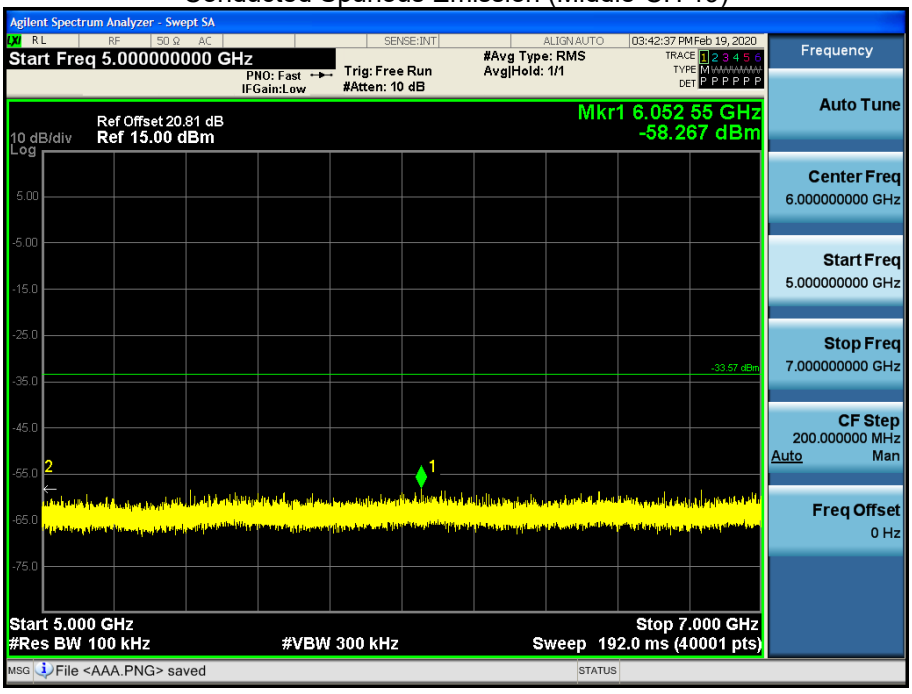
3 GHz ~ 5 GHz

Conducted Spurious Emission (Middle-CH 19)



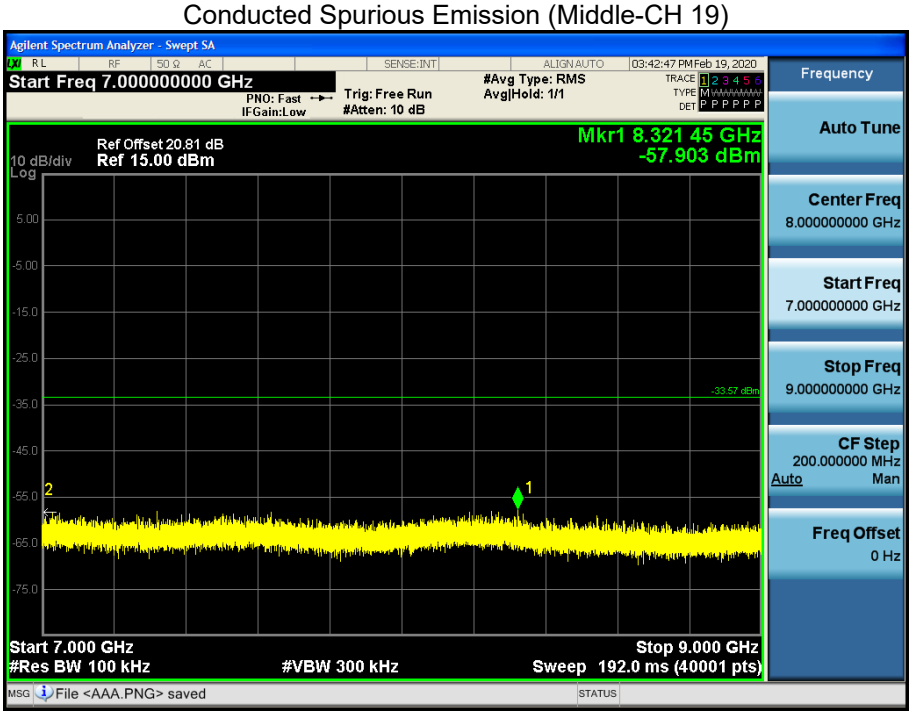
5 GHz ~ 7 GHz

Conducted Spurious Emission (Middle-CH 19)



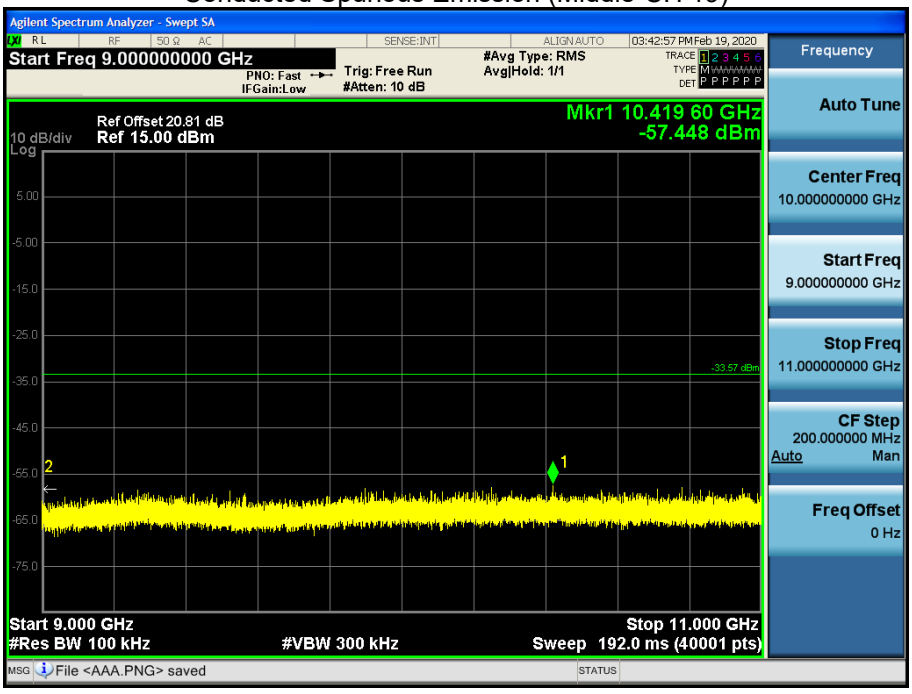
7 GHz ~ 9 GHz

Conducted Spurious Emission (Middle-CH 19)



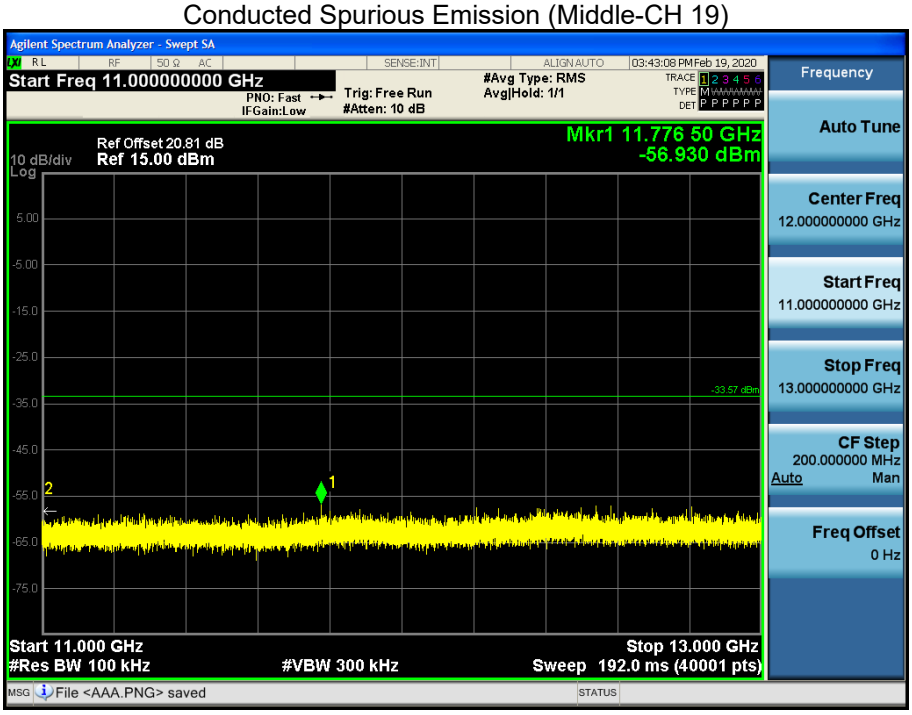
9 GHz ~ 11 GHz

Conducted Spurious Emission (Middle-CH 19)



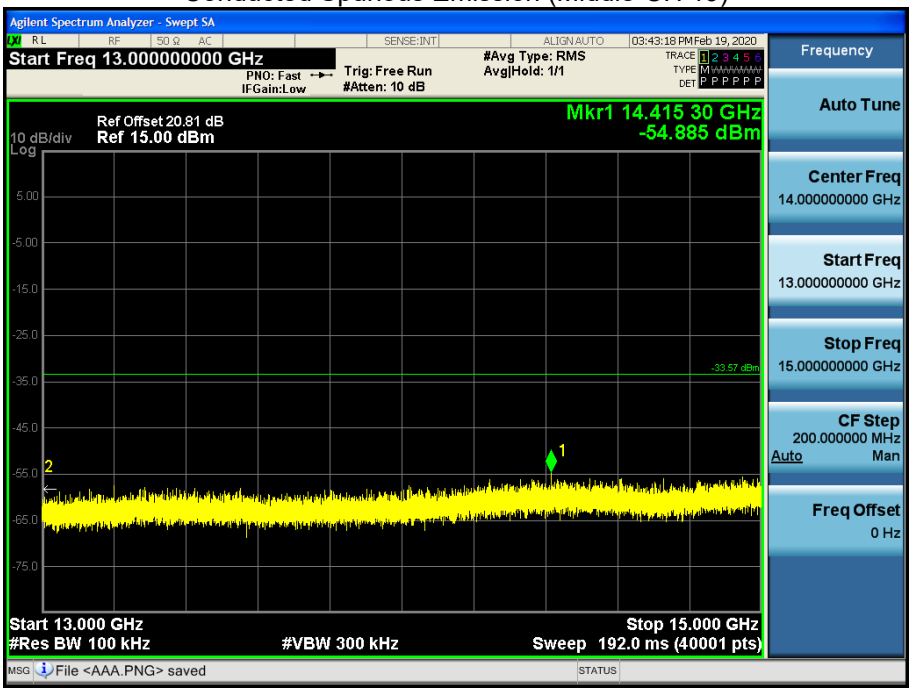
11 GHz ~ 13 GHz

Conducted Spurious Emission (Middle-CH 19)



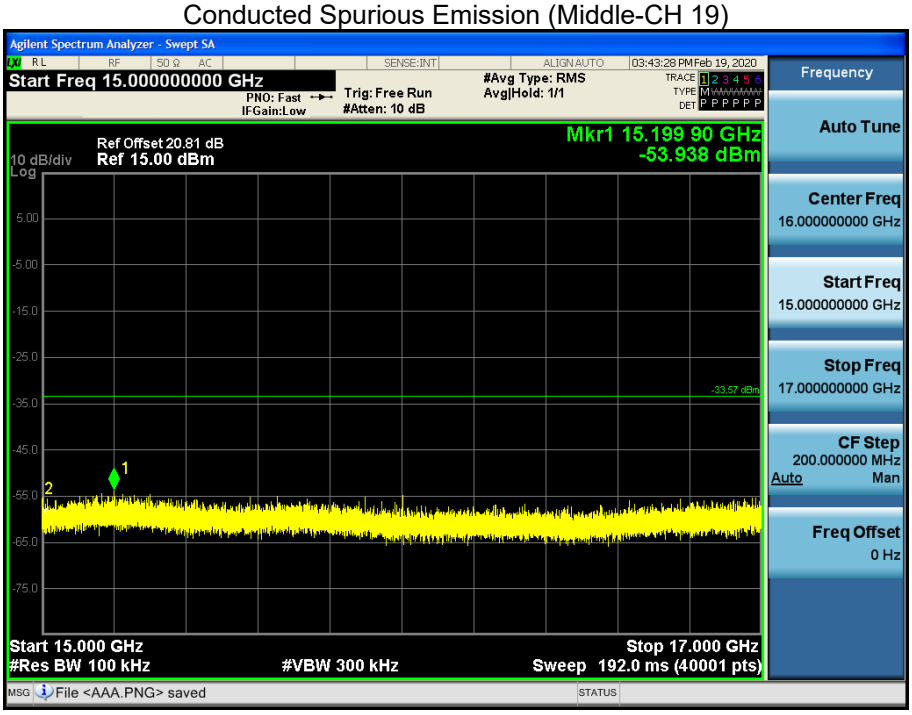
13 GHz ~ 15 GHz

Conducted Spurious Emission (Middle-CH 19)



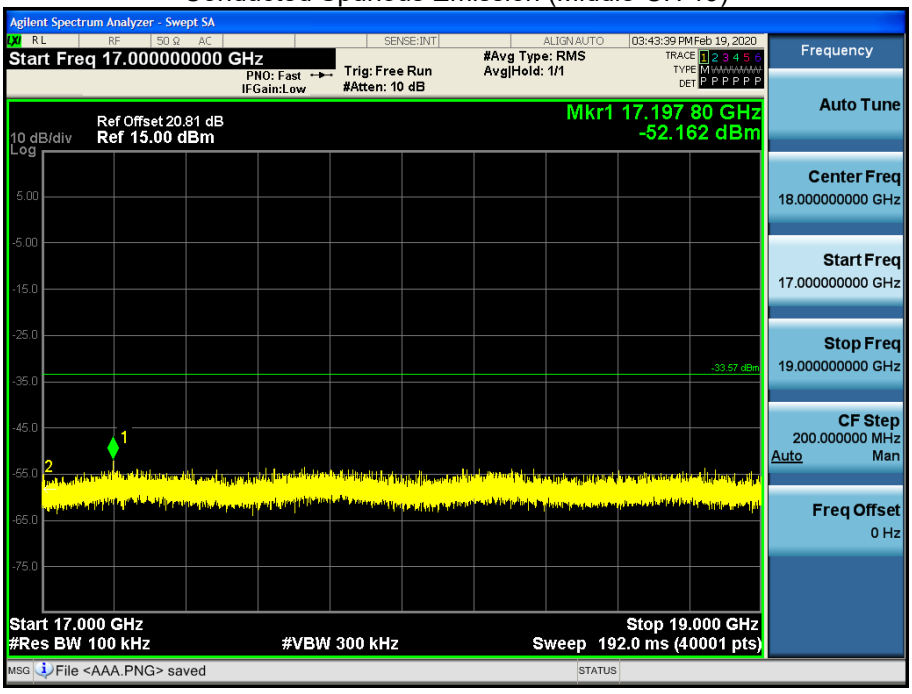
15 GHz ~ 17 GHz

Conducted Spurious Emission (Middle-CH 19)



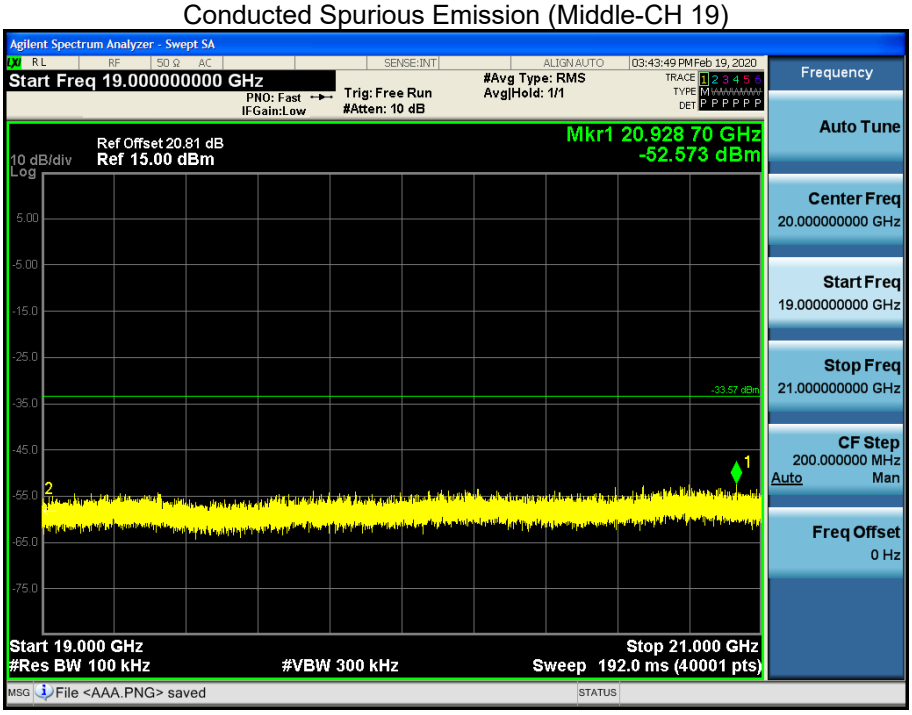
17 GHz ~ 19 GHz

Conducted Spurious Emission (Middle-CH 19)



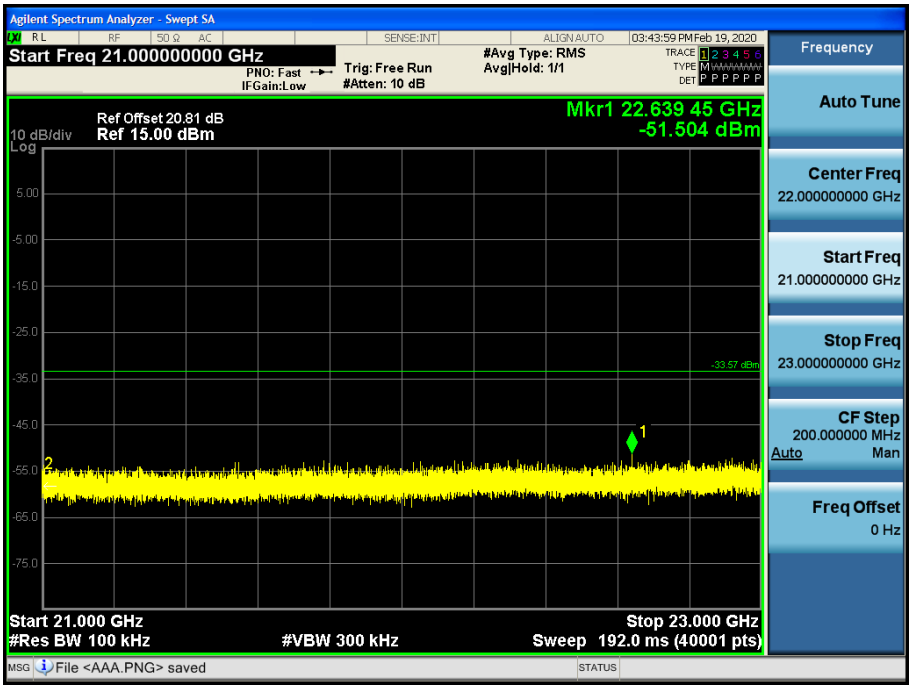
19 GHz ~ 21 GHz

Conducted Spurious Emission (Middle-CH 19)



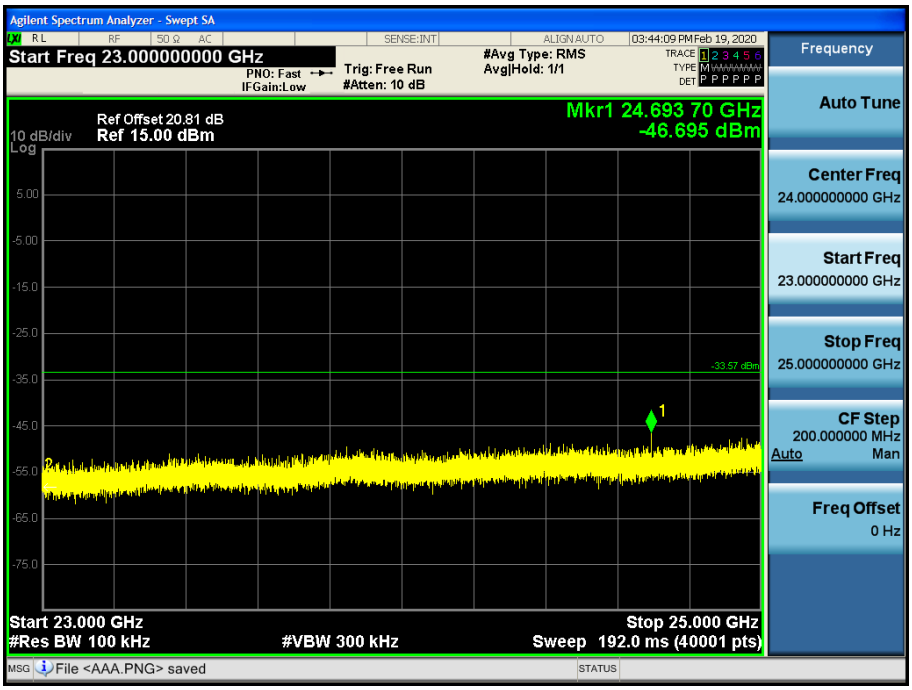
21 GHz ~ 23 GHz

Conducted Spurious Emission (Middle-CH 19)



23 GHz ~ 25 GHz

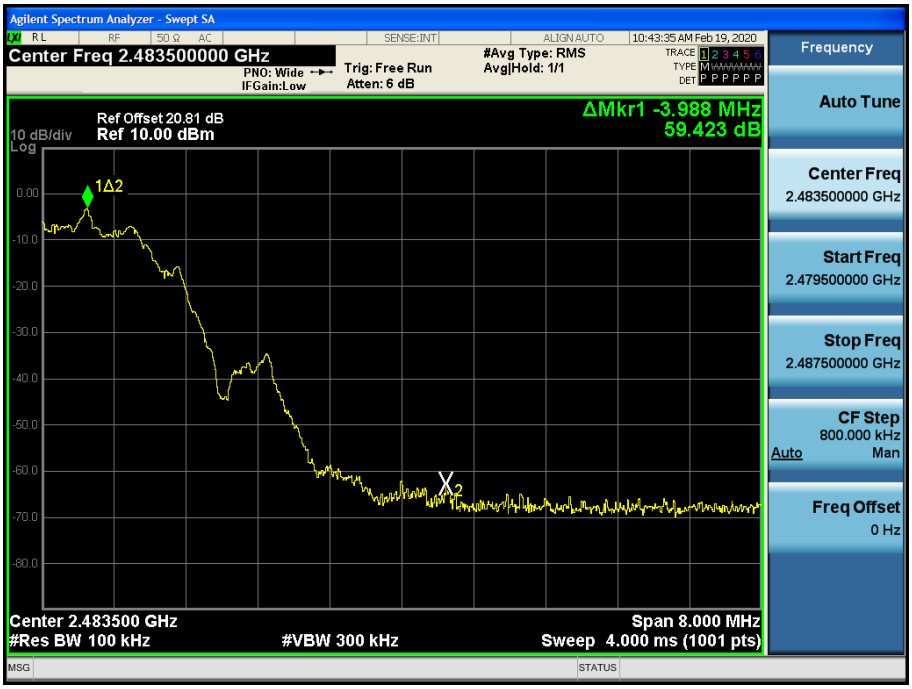
Conducted Spurious Emission (Middle-CH 19)



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

Low-CH 0

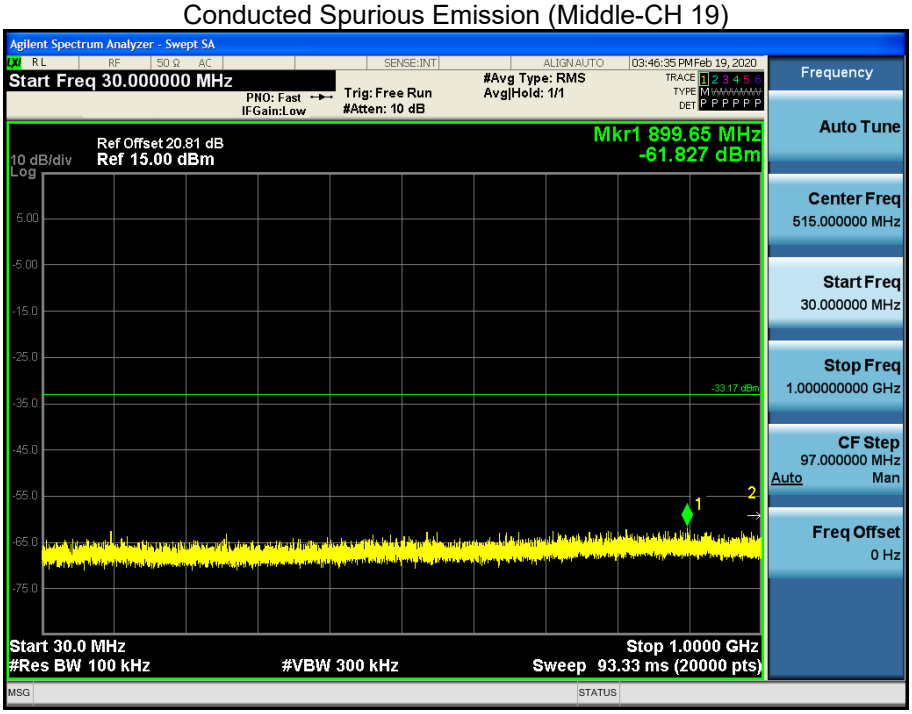
High-CH 39



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

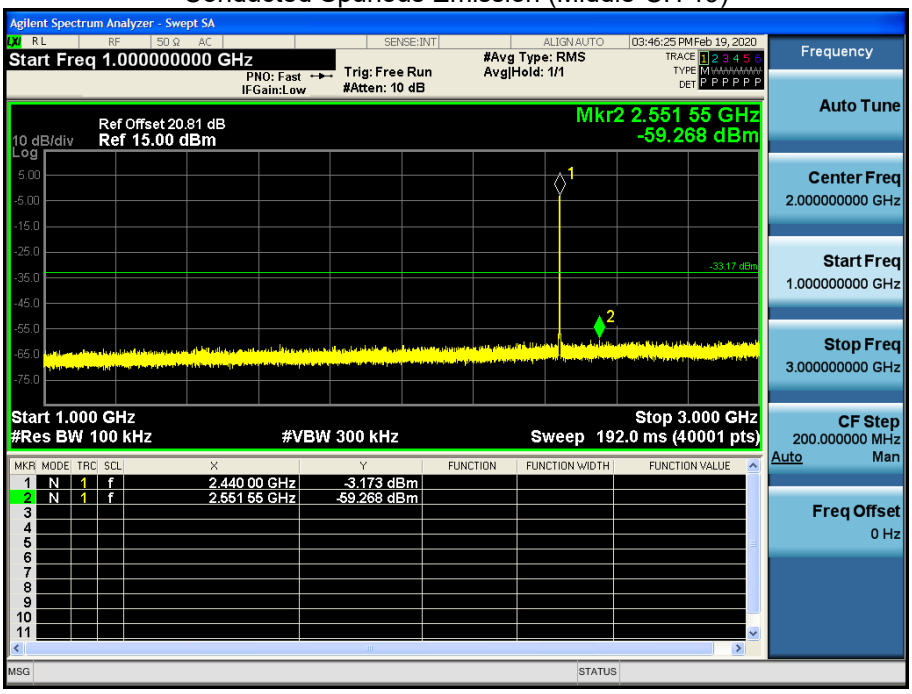
30 MHz ~ 1 GHz

Conducted Spurious Emission (Middle-CH 19)



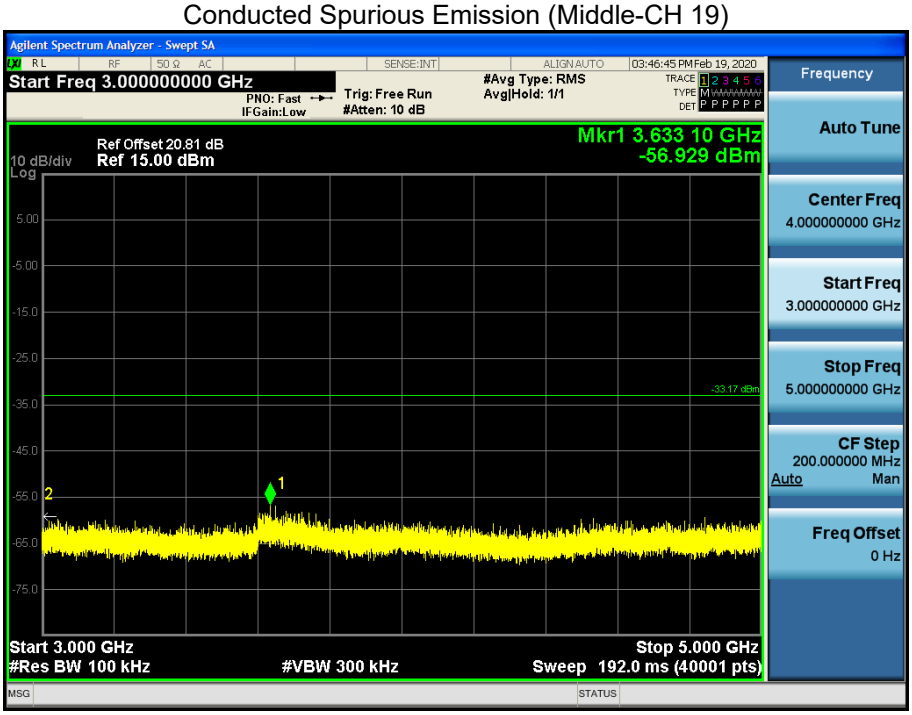
1 GHz ~ 3 GHz

Conducted Spurious Emission (Middle-CH 19)



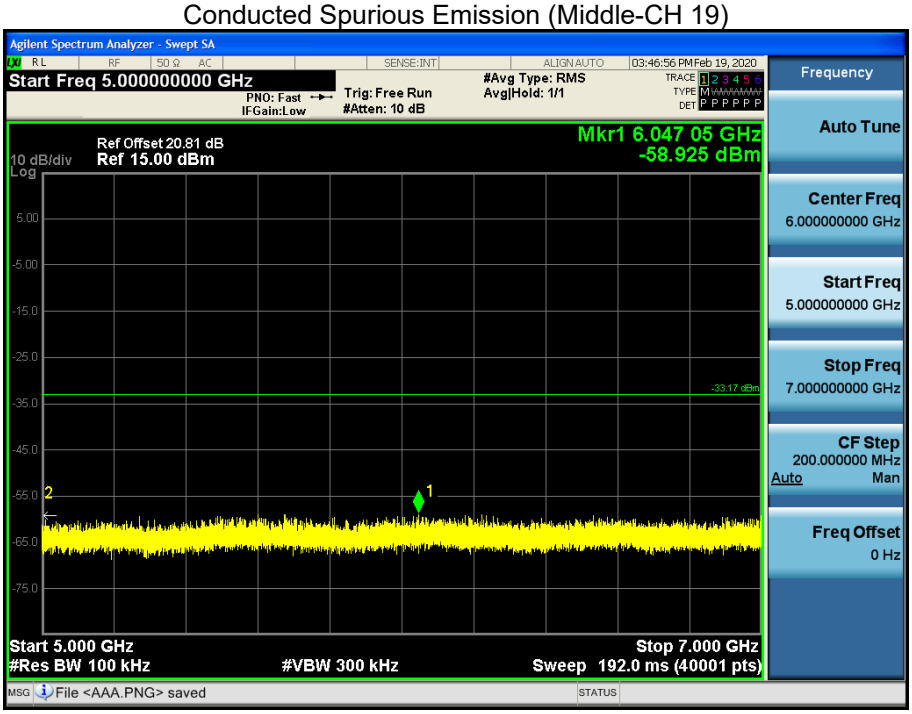
3 GHz ~ 5 GHz

Conducted Spurious Emission (Middle-CH 19)



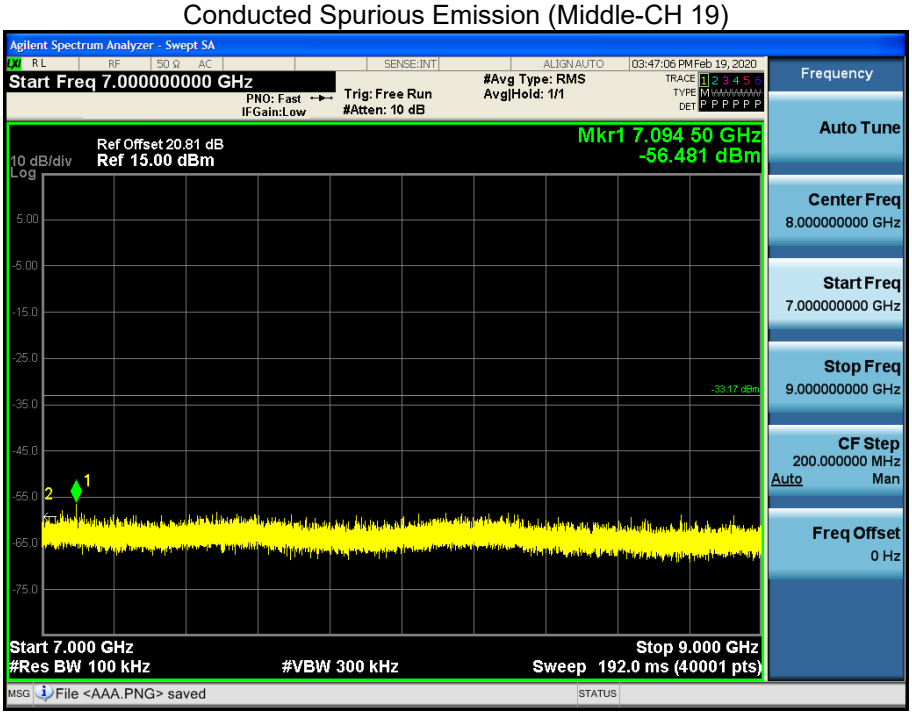
5 GHz ~ 7 GHz

Conducted Spurious Emission (Middle-CH 19)



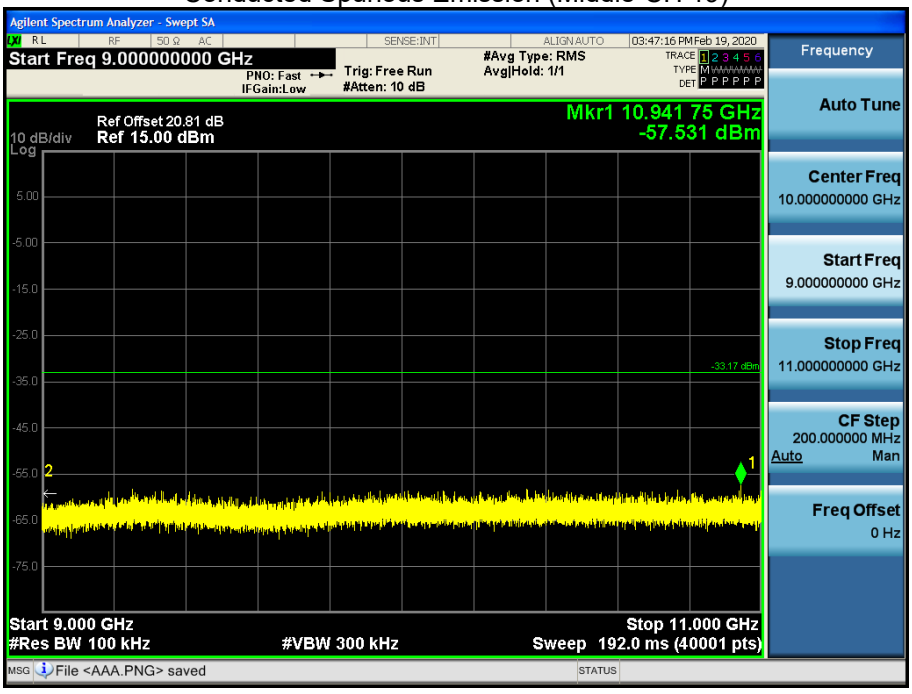
7 GHz ~ 9 GHz

Conducted Spurious Emission (Middle-CH 19)



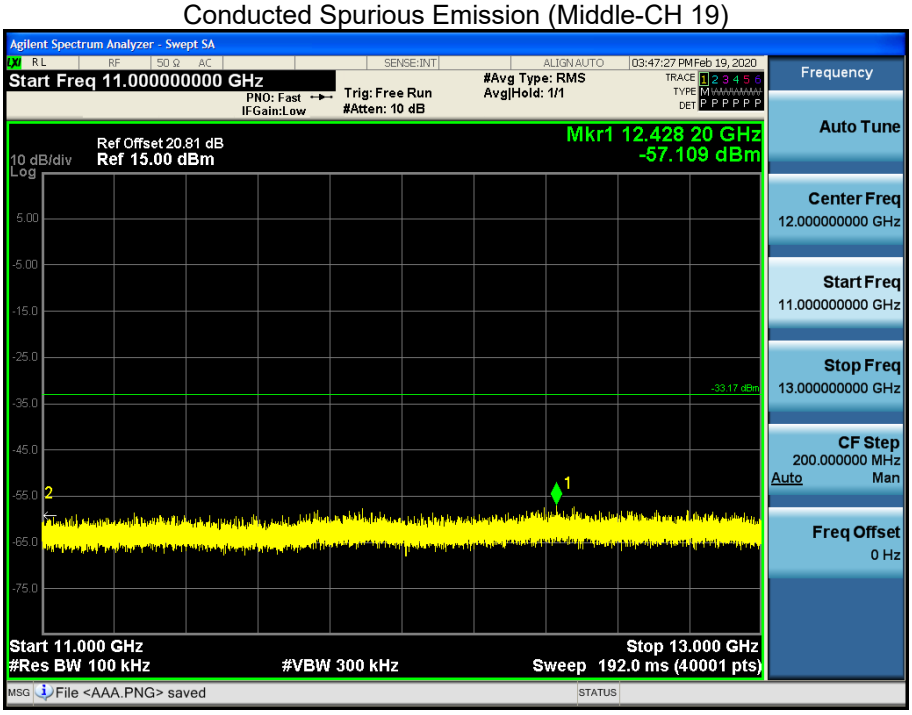
9 GHz ~ 11 GHz

Conducted Spurious Emission (Middle-CH 19)



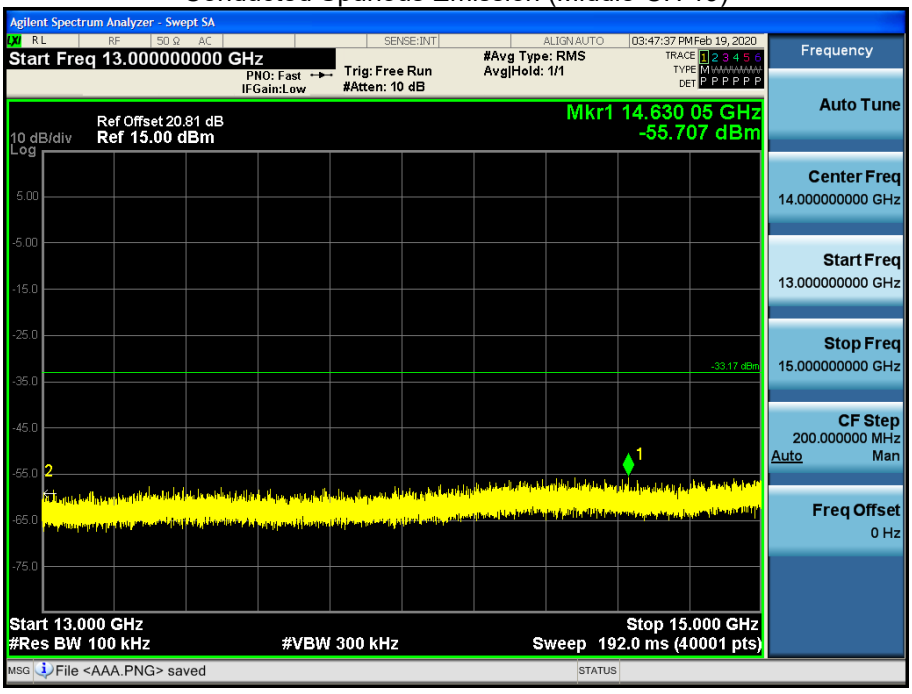
11 GHz ~ 13 GHz

Conducted Spurious Emission (Middle-CH 19)



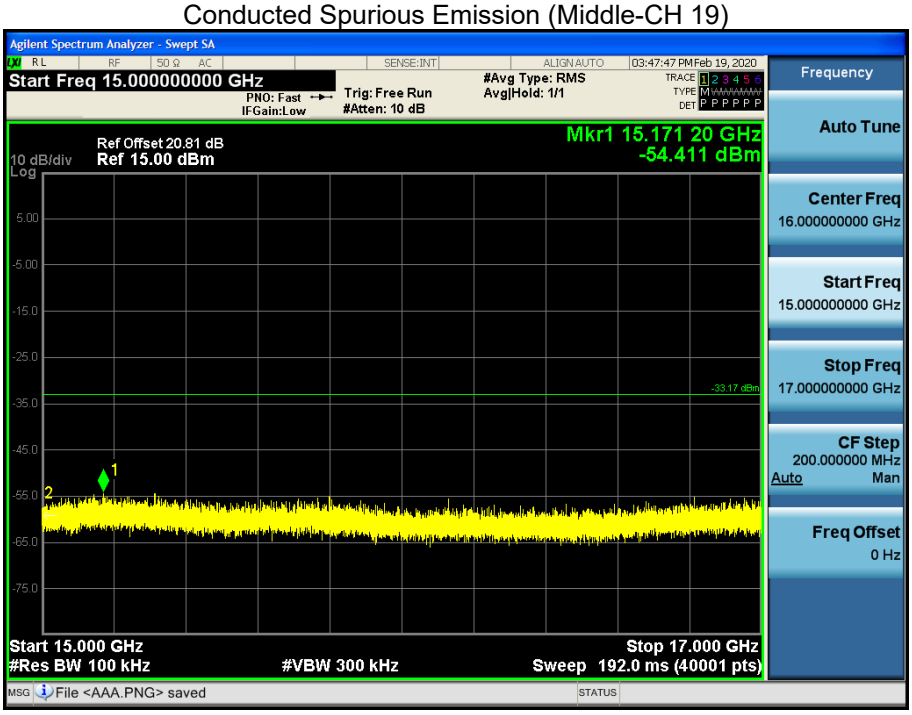
13 GHz ~ 15 GHz

Conducted Spurious Emission (Middle-CH 19)



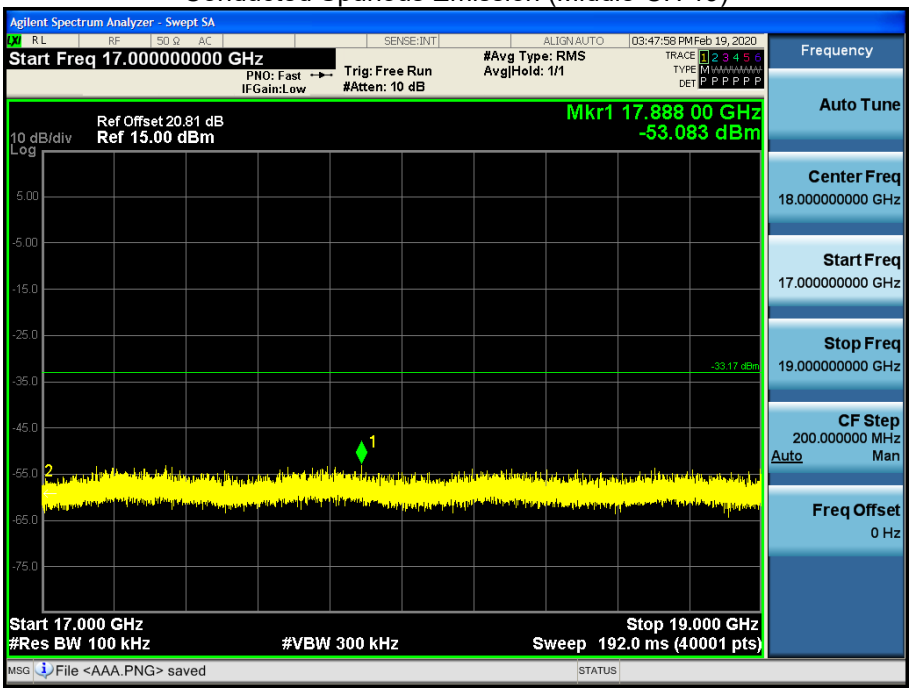
15 GHz ~ 17 GHz

Conducted Spurious Emission (Middle-CH 19)



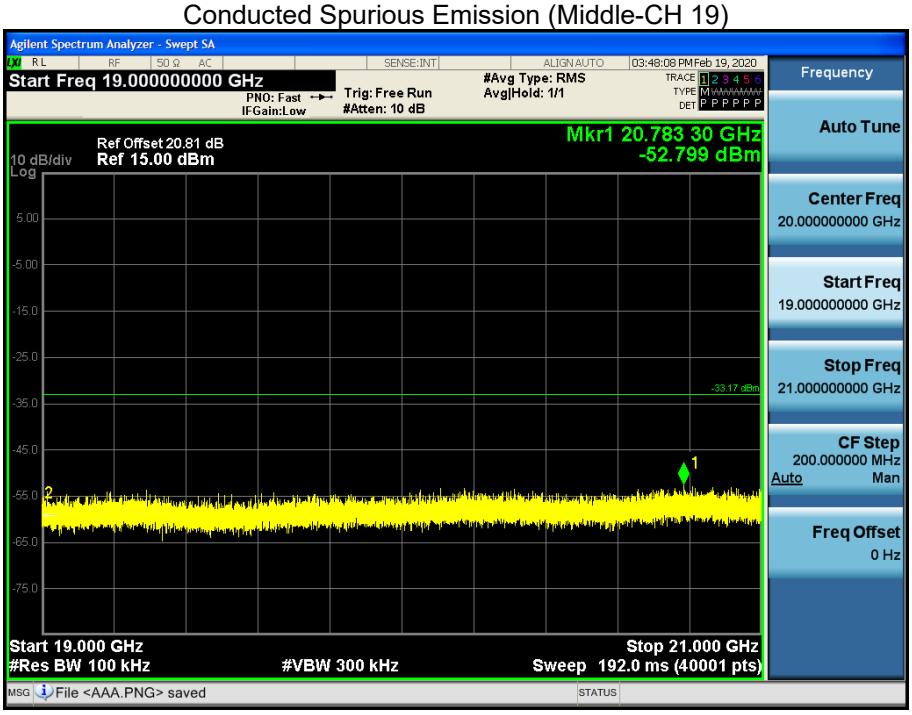
17 GHz ~ 19 GHz

Conducted Spurious Emission (Middle-CH 19)



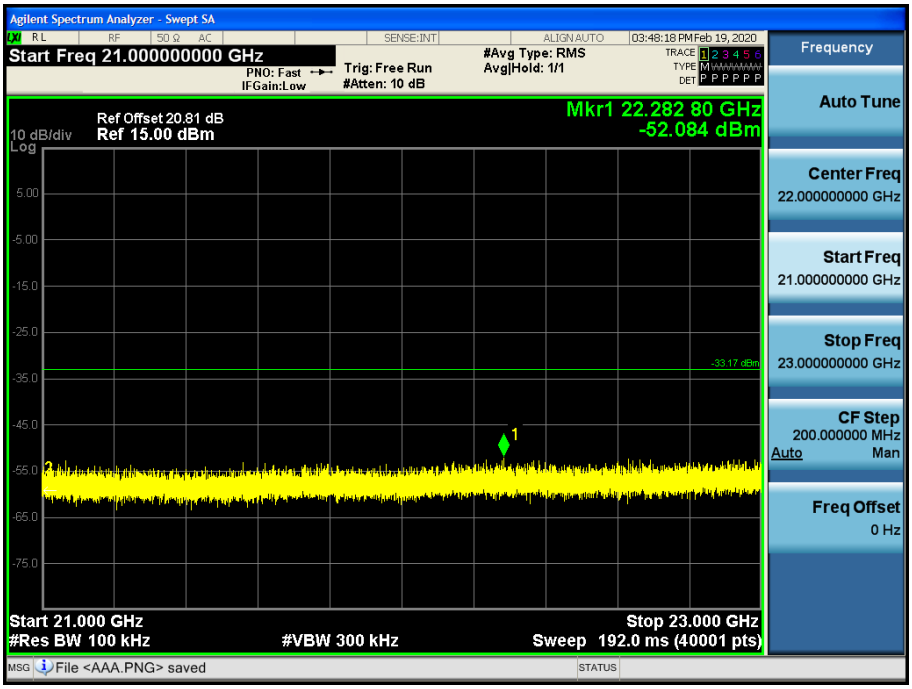
19 GHz ~ 21 GHz

Conducted Spurious Emission (Middle-CH 19)



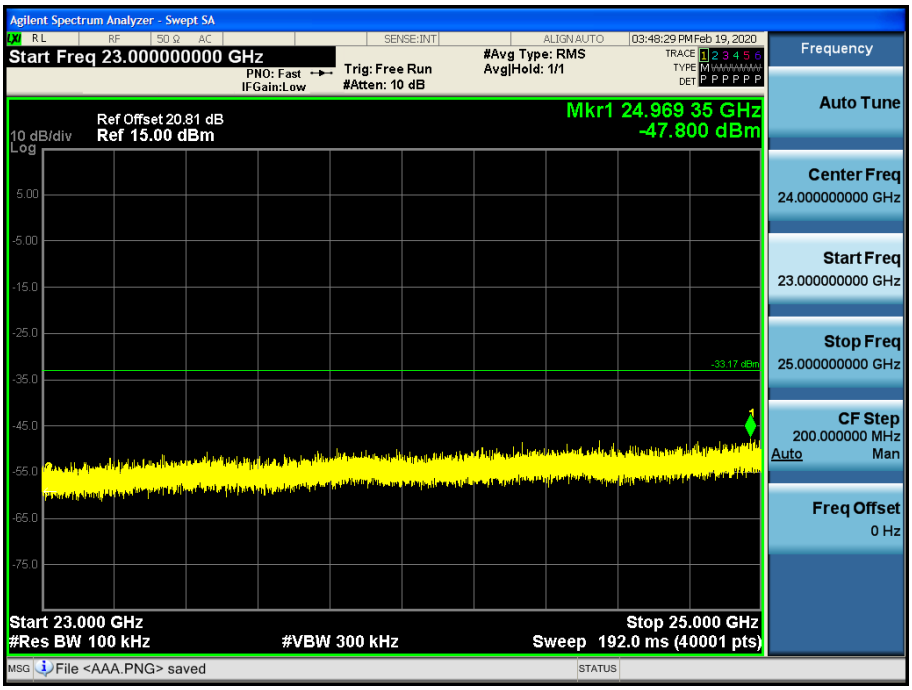
21 GHz ~ 23 GHz

Conducted Spurious Emission (Middle-CH 19)



23 GHz ~ 25 GHz

Conducted Spurious Emission (Middle-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 = 40log (specific distance / 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 : 125k Bit/s(37 Byte)

Operation Mode: CH Low

Frequency [MHz]	Reading [dBuV]	Duty Cycle Correction [dB]	A.F + C.L - A.G + D.F [dB]	Pol. [H/V]	Total [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Measurement Type
4804	41.25	0.00	1.83	V	43.08	73.98	30.90	PK
4804	-	0.84	1.83	V	-	53.98	-	AV
7206	40.44	0.00	9.65	V	50.09	73.98	23.89	PK
7206	-	0.84	9.65	V	-	53.98	-	AV
4804	42.07	0.00	1.83	H	43.90	73.98	30.08	PK
4804	-	0.84	1.83	H	-	53.98	-	AV
7206	40.75	0.00	9.65	H	50.40	73.98	23.58	PK
7206	-	0.84	9.65	H	-	53.98	-	AV

Operation Mode: CH Mid

Frequency [MHz]	Reading [dBuV]	Duty Cycle Correction [dB]	A.F + C.L - A.G + D.F [dB]	Pol. [H/V]	Total [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Measurement Type
4880	40.29	0.00	2.34	V	42.63	73.98	31.35	PK
4880	-	0.84	2.34	V	-	53.98	-	AV
7320	38.68	0.00	9.98	V	48.66	73.98	25.32	PK
7320	-	0.84	9.98	V	-	53.98	-	AV
4880	40.94	0.00	2.34	H	43.28	73.98	30.70	PK
4880	-	0.84	2.34	H	-	53.98	-	AV
7320	39.59	0.00	9.98	H	49.57	73.98	24.41	PK
7320	-	0.84	9.98	H	-	53.98	-	AV

Operation Mode: CH High

Frequency [MHz]	Reading [dBuV]	Duty Cycle Correction [dB]	A.F + C.L - A.G + D.F [dB]	Pol. [H/V]	Total [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Measurement Type
4960	40.89	0.00	2.26	V	43.15	73.98	30.83	PK
4960	-	0.84	2.26	V	-	53.98	-	AV
7440	38.43	0.00	9.78	V	48.21	73.98	25.77	PK
7440	-	0.84	9.78	V	-	53.98	-	AV
4960	41.04	0.00	2.26	H	43.30	73.98	30.68	PK
4960	-	0.84	2.26	H	-	53.98	-	AV
7440	39.20	0.00	9.78	H	48.98	73.98	25.00	PK
7440	-	0.84	9.78	H	-	53.98	-	AV

Note: As the peak measurement results satisfy the average limit, no average measurement is made.

Mode : 1M Bit/s (37 Byte)

Operation Mode: CH Low

Frequency [MHz]	Reading [dBuV]	Duty Cycle Correction [dB]	A.F + C.L - A.G + D.F [dB]	Pol. [H/V]	Total [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Measurement Type
4804	41.67	0.00	1.83	V	43.50	73.98	30.48	PK
4804	-	2.14	1.83	V	-	53.98	-	AV
7206	40.28	0.00	9.65	V	49.93	73.98	24.05	PK
7206	-	2.14	9.65	V	-	53.98	-	AV
4804	41.99	0.00	1.83	H	43.82	73.98	30.16	PK
4804	-	2.14	1.83	H	-	53.98	-	AV
7206	40.49	0.00	9.65	H	50.14	73.98	23.84	PK
7206	-	2.14	9.65	H	-	53.98	-	AV

Operation Mode: CH Mid

Frequency [MHz]	Reading [dBuV]	Duty Cycle Correction [dB]	A.F + C.L - A.G + D.F [dB]	Pol. [H/V]	Total [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Measurement Type
4880	40.60	0.00	2.34	V	42.94	73.98	31.04	PK
4880	-	2.14	2.34	V	-	53.98	-	AV
7320	38.32	0.00	9.98	V	48.30	73.98	25.68	PK
7320	-	2.14	9.98	V	-	53.98	-	AV
4880	40.93	0.00	2.34	H	43.27	73.98	30.71	PK
4880	-	2.14	2.34	H	-	53.98	-	AV
7320	39.10	0.00	9.98	H	49.08	73.98	24.90	PK
7320	-	2.14	9.98	H	-	53.98	-	AV

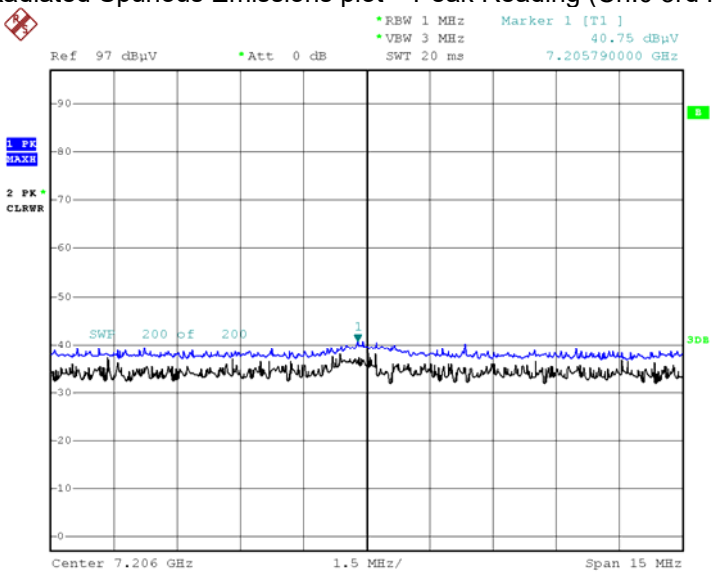
Operation Mode: CH High

Frequency [MHz]	Reading [dBuV]	Duty Cycle Correction [dB]	A.F + C.L - A.G + D.F [dB]	Pol. [H/V]	Total [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Measurement Type
4960	40.37	0.00	2.26	V	42.63	73.98	31.35	PK
4960	-	2.14	2.26	V	-	53.98	-	AV
7440	38.06	0.00	9.78	V	47.84	73.98	26.14	PK
7440	-	2.14	9.78	V	-	53.98	-	AV
4960	41.35	0.00	2.26	H	43.61	73.98	30.37	PK
4960	-	2.14	2.26	H	-	53.98	-	AV
7440	38.38	0.00	9.78	H	48.16	73.98	25.82	PK
7440	-	2.14	9.78	H	-	53.98	-	AV

Note: As the peak measurement results satisfy the average limit, no average measurement is made.

▣ 125k Bit/s 37 Byte Test Plots (Worst case : Y-H)

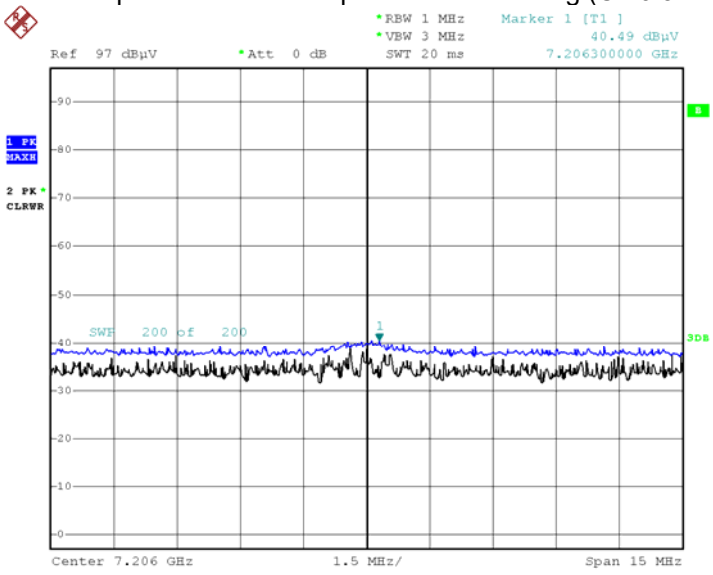
Radiated Spurious Emissions plot – Peak Reading (Ch.0 3rd Harmonic)



Date: 25.FEB.2020 14:17:45

▣ 1M Bit/s 37 Byte Test Plots (Worst case : Y-H)

Radiated Spurious Emissions plot – Peak Reading (Ch.0 3rd Harmonic)



Date: 25.FEB.2020 12:15:52

Note:

Plot of worst case are only reported.

9.7 RADIATED RESTRICTED BAND EDGES

Mode : 125k Bit/s(37 Byte)

Operating Frequency 2402 MHz

Channel No. 0

Frequency [MHz]	Reading [dBuV/m]	A.F.+C.L.+D.F -AMP+ATT [dB]	Ant. Pol. [H/V]	Duty Cycle Factor [dB]	Total [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Measurement Type
2390.0	45.24	2.00	H	0	47.24	73.98	26.74	PK
2390.0	34.71	2.00	H	0.84	37.55	53.98	16.43	AV
2390.0	45.06	2.00	V	0	47.06	73.98	26.92	PK
2390.0	34.56	2.00	V	0.84	37.40	53.98	16.58	AV

Operating Frequency 2480 MHz

Channel No. 39

Frequency [MHz]	Reading [dBuV/m]	A.F.+C.L.+D.F -AMP+ATT [dB]	Ant. Pol. [H/V]	Duty Cycle Factor [dB]	Total [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Measurement Type
2483.5	45.63	0.79	H	0	46.42	73.98	27.56	PK
2483.5	34.73	0.79	H	0.84	36.36	53.98	17.62	AV
2483.5	45.50	0.79	V	0	46.29	73.98	27.69	PK
2483.5	34.52	0.79	V	0.84	36.15	53.98	17.83	AV

Mode : 125k Bit/s(255 Byte)

Operating Frequency 2402 MHz

Channel No. 0

Frequency [MHz]	Reading [dBuV/m]	A.F.+C.L.+D.F -AMP+ATT [dB]	Ant. Pol. [H/V]	Duty Cycle Factor [dB]	Total [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Measurement Type
2390.0	45.54	2.00	H	0	47.54	73.98	26.44	PK
2390.0	34.55	2.00	H	0.11	36.66	53.98	17.32	AV
2390.0	44.40	2.00	V	0	46.40	73.98	27.58	PK
2390.0	34.12	2.00	V	0.11	36.23	53.98	17.75	AV

Operating Frequency 2480 MHz

Channel No. 39

Frequency [MHz]	Reading [dBuV/m]	A.F.+C.L.+D.F -AMP+ATT [dB]	Ant. Pol. [H/V]	Duty Cycle Factor [dB]	Total [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Measurement Type
2483.5	44.81	0.79	H	0	45.60	73.98	28.38	PK
2483.5	34.76	0.79	H	0.11	35.66	53.98	18.32	AV
2483.5	43.79	0.79	V	0	44.58	73.98	29.40	PK
2483.5	34.58	0.79	V	0.11	35.48	53.98	18.50	AV

Mode : 500k Bit/s(37 Byte)

Operating Frequency 2402 MHz

Channel No. 0

Frequency [MHz]	Reading [dBuV/m]	A.F.+C.L.+D.F -AMP+ATT [dB]	Ant. Pol. [H/V]	Duty Cycle Factor [dB]	Total [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Measurement Type
2390.0	47.24	2.00	H	0	49.24	73.98	24.74	PK
2390.0	34.46	2.00	H	2.47	38.93	53.98	15.05	AV
2390.0	45.59	2.00	V	0	47.59	73.98	26.39	PK
2390.0	34.40	2.00	V	2.47	38.87	53.98	15.11	AV

Operating Frequency 2480 MHz

Channel No. 39

Frequency [MHz]	Reading [dBuV/m]	A.F.+C.L.+D.F -AMP+ATT [dB]	Ant. Pol. [H/V]	Duty Cycle Factor [dB]	Total [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Measurement Type
2483.5	45.70	0.79	H	0	46.49	73.98	27.49	PK
2483.5	34.76	0.79	H	2.47	38.02	53.98	15.96	AV
2483.5	45.29	0.79	V	0	46.08	73.98	27.90	PK
2483.5	34.52	0.79	V	2.47	37.78	53.98	16.20	AV

Mode : 500k Bit/s(255 Byte)

Operating Frequency 2402 MHz

Channel No. 0

Frequency [MHz]	Reading [dBuV/m]	A.F.+C.L.+D.F -AMP+ATT [dB]	Ant. Pol. [H/V]	Duty Cycle Factor [dB]	Total [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Measurement Type
2390.0	45.96	2.00	H	0	47.96	73.98	26.02	PK
2390.0	34.54	2.00	H	0.41	36.95	53.98	17.03	AV
2390.0	43.92	2.00	V	0	45.92	73.98	28.06	PK
2390.0	34.44	2.00	V	0.41	36.85	53.98	17.13	AV

Operating Frequency 2480 MHz

Channel No. 39

Frequency [MHz]	Reading [dBuV/m]	A.F.+C.L.+D.F -AMP+ATT [dB]	Ant. Pol. [H/V]	Duty Cycle Factor [dB]	Total [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Measurement Type
2483.5	45.92	0.79	H	0	46.71	73.98	27.27	PK
2483.5	34.68	0.79	H	0.41	35.88	53.98	18.10	AV
2483.5	45.58	0.79	V	0	46.37	73.98	27.61	PK
2483.5	34.59	0.79	V	0.41	35.79	53.98	18.19	AV

Mode : 1M Bit/s (37 Byte)

Operating Frequency 2402 MHz

Channel No. 0

Frequency [MHz]	Reading [dBuV/m]	A.F.+C.L.+D.F -AMP+ATT [dB]	Ant. Pol. [H/V]	Duty Cycle Factor [dB]	Total [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Measurement Type
2390.0	46.14	2.00	H	0	48.14	73.98	25.84	PK
2390.0	34.43	2.00	H	2.14	38.57	53.98	15.41	AV
2390.0	45.90	2.00	V	0	47.90	73.98	26.08	PK
2390.0	34.21	2.00	V	2.14	38.35	53.98	15.63	AV

Operating Frequency 2480 MHz

Channel No. 39

Frequency [MHz]	Reading [dBuV/m]	A.F.+C.L.+D.F -AMP+ATT [dB]	Ant. Pol. [H/V]	Duty Cycle Factor [dB]	Total [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Measurement Type
2483.5	47.27	0.79	H	0	48.06	73.98	25.92	PK
2483.5	34.89	0.79	H	2.14	37.82	53.98	16.16	AV
2483.5	46.57	0.79	V	0	47.36	73.98	26.62	PK
2483.5	34.67	0.79	V	2.14	37.60	53.98	16.38	AV

Mode : 1M Bit/s (255 Byte)

Operating Frequency 2402 MHz

Channel No. 0

Frequency [MHz]	Reading [dBuV/m]	A.F.+C.L.+D.F -AMP+ATT [dB]	Ant. Pol. [H/V]	Duty Cycle Factor [dB]	Total [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Measurement Type
2390.0	45.21	2.00	H	0	47.21	73.98	26.77	PK
2390.0	34.56	2.00	H	0.70	37.26	53.98	16.72	AV
2390.0	44.39	2.00	V	0	46.39	73.98	27.59	PK
2390.0	34.51	2.00	V	0.70	37.21	53.98	16.77	AV

Operating Frequency 2480 MHz

Channel No. 39

Frequency [MHz]	Reading [dBuV/m]	A.F.+C.L.+D.F -AMP+ATT [dB]	Ant. Pol. [H/V]	Duty Cycle Factor [dB]	Total [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Measurement Type
2483.5	45.28	0.79	H	0	46.07	73.98	27.91	PK
2483.5	34.77	0.79	H	0.70	36.26	53.98	17.72	AV
2483.5	44.27	0.79	V	0	45.06	73.98	28.92	PK
2483.5	34.69	0.79	V	0.70	36.18	53.98	17.80	AV

Mode : 2M Bit/s (37 Byte)

Operating Frequency 2402 MHz

Channel No. 0

Frequency [MHz]	Reading [dBuV/m]	A.F.+C.L.+D.F -AMP+ATT [dB]	Ant. Pol. [H/V]	Duty Cycle Factor [dB]	Total [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Measurement Type
2390.0	46.26	2.00	H	0	48.26	73.98	25.72	PK
2390.0	34.77	2.00	H	4.97	41.74	53.98	12.24	AV
2390.0	45.74	2.00	V	0	47.74	73.98	26.24	PK
2390.0	34.36	2.00	V	4.97	41.33	53.98	12.65	AV

Operating Frequency 2480 MHz

Channel No. 39

Frequency [MHz]	Reading [dBuV/m]	A.F.+C.L.+D.F -AMP+ATT [dB]	Ant. Pol. [H/V]	Duty Cycle Factor [dB]	Total [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Measurement Type
2483.5	48.08	0.79	H	0	48.87	73.98	25.11	PK
2483.5	35.34	0.79	H	4.97	41.10	53.98	12.88	AV
2483.5	46.68	0.79	V	0	47.47	73.98	26.51	PK
2483.5	34.92	0.79	V	4.97	40.68	53.98	13.30	AV

Mode : 2M Bit/s (255 Byte)

Operating Frequency 2402 MHz

Channel No. 0

Frequency [MHz]	Reading [dBuV/m]	A.F.+C.L.+D.F -AMP+ATT [dB]	Ant. Pol. [H/V]	Duty Cycle Factor [dB]	Total [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Measurement Type
2390.0	46.66	2.00	H	0	48.66	73.98	25.32	PK
2390.0	34.57	2.00	H	2.44	39.01	53.98	14.97	AV
2390.0	45.10	2.00	V	0	47.10	73.98	26.88	PK
2390.0	34.37	2.00	V	2.44	38.81	53.98	15.17	AV

Operating Frequency 2480 MHz

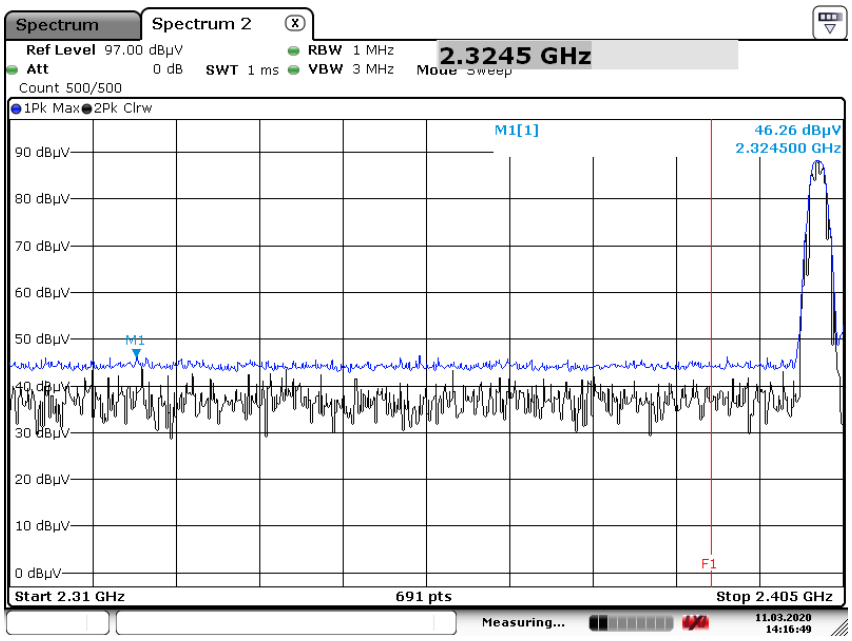
Channel No. 39

Frequency [MHz]	Reading [dBuV/m]	A.F.+C.L.+D.F -AMP+ATT [dB]	Ant. Pol. [H/V]	Duty Cycle Factor [dB]	Total [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Measurement Type
2483.5	46.27	0.79	H	0	47.06	73.98	26.92	PK
2483.5	35.37	0.79	H	2.44	38.60	53.98	15.38	AV
2483.5	45.57	0.79	V	0	46.36	73.98	27.62	PK
2483.5	35.10	0.79	V	2.44	38.33	53.98	15.65	AV

Note: All data Worst case Duty Cycle Correction Factor applied.

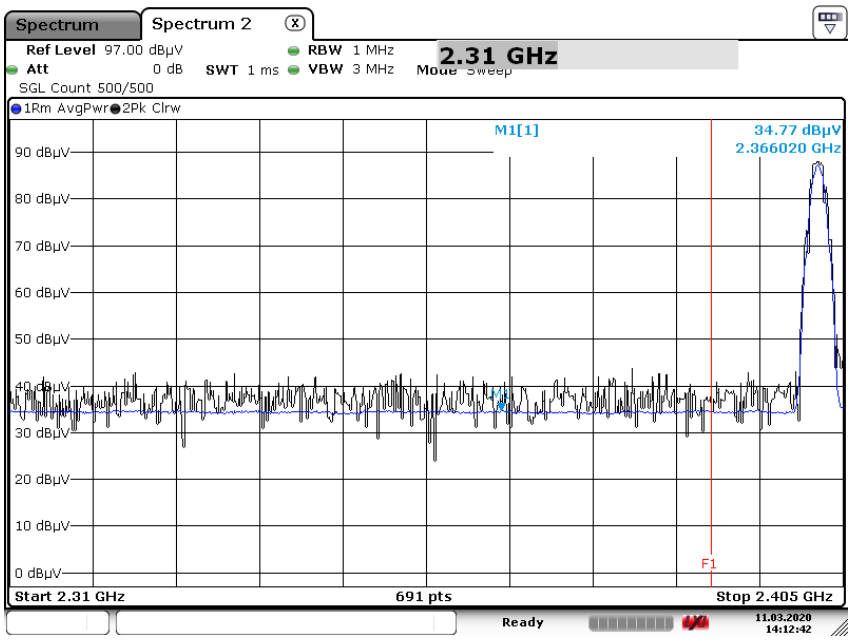
▣ Mode : 2M Bit/s (37 Byte) Test Plots (Worst case : X-H)

Radiated Restricted Band Edges plot – Peak Reading (Ch.0)



Date: 11.MAR.2020 14:16:49

Radiated Restricted Band Edges plot – Average Reading (Ch.0)



Date: 11.MAR.2020 14:12:42

Note:

Plot of worst case are only reported.

9.8 POWERLINE CONDUCTED EMISSIONS

Conducted Emissions (Line 1)

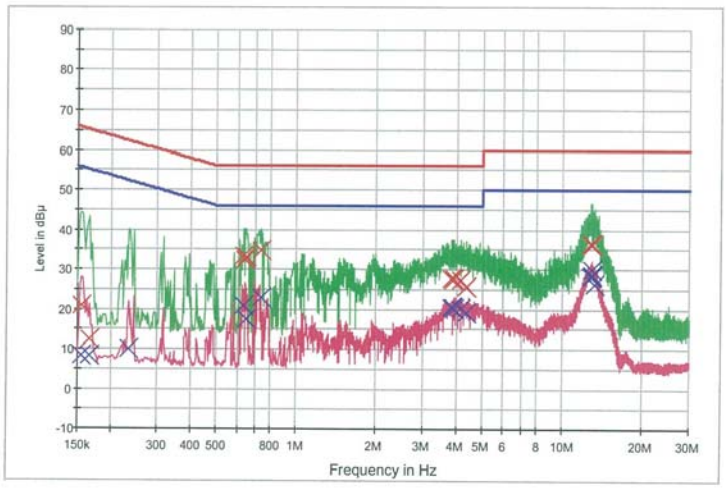
Test 1 / 2

HCT TEST Report

Common Information

EUT:	SM-A415F/DSN
Manufacturer:	SAMSUNG
Test Site:	SHIELD ROOM
Operating Conditions:	BTLE_L1

FCC CLASS B_Exten Cable



Final Result 1

Frequency (MHz)	QuasiPeak (dBuV)	Bandwidth (kHz)	Filter	Line	Corr. (dB)	Margin (dB)	Limit (dBuV)
0.156000	20.7	9.000	Off	L1	9.8	45.0	65.7
0.166000	12.5	9.000	Off	L1	9.8	52.6	65.2
0.634000	33.3	9.000	Off	L1	9.8	22.7	56.0
0.640000	32.3	9.000	Off	L1	9.8	23.7	56.0
0.644000	33.1	9.000	Off	L1	9.8	22.9	56.0
0.738000	34.9	9.000	Off	L1	9.8	21.1	56.0
3.848000	27.5	9.000	Off	L1	10.0	28.5	56.0
3.856000	27.3	9.000	Off	L1	10.0	28.7	56.0
3.902000	27.6	9.000	Off	L1	10.0	28.4	56.0
4.148000	27.4	9.000	Off	L1	10.0	28.6	56.0
4.152000	27.3	9.000	Off	L1	10.0	28.7	56.0
4.378000	25.7	9.000	Off	L1	10.0	30.3	56.0
12.814000	36.4	9.000	Off	L1	10.3	23.6	60.0
12.824000	36.4	9.000	Off	L1	10.3	23.6	60.0
12.840000	36.3	9.000	Off	L1	10.3	23.7	60.0
12.852000	36.2	9.000	Off	L1	10.3	23.8	60.0
12.862000	36.1	9.000	Off	L1	10.3	23.9	60.0
12.914000	36.5	9.000	Off	L1	10.3	23.5	60.0

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Test 2 / 2

Final Result 2

Frequency (MHz)	CAverage (dBuV)	Bandwidth (kHz)	Filter	Line	Corr. (dB)	Margin (dB)	Limit (dBuV)
0.156000	8.3	9.000	Off	L1	9.8	47.4	55.7
0.166000	8.4	9.000	Off	L1	9.8	46.8	55.2
0.234000	10.0	9.000	Off	L1	9.8	42.3	52.3
0.634000	20.7	9.000	Off	L1	9.8	25.3	46.0
0.648000	17.5	9.000	Off	L1	9.8	28.5	46.0
0.738000	22.9	9.000	Off	L1	9.8	23.1	46.0
3.822000	20.5	9.000	Off	L1	10.0	25.5	46.0
3.856000	20.4	9.000	Off	L1	10.0	25.6	46.0
3.902000	20.2	9.000	Off	L1	10.0	25.8	46.0
4.148000	20.3	9.000	Off	L1	10.0	25.7	46.0
4.152000	20.3	9.000	Off	L1	10.0	25.7	46.0
4.362000	19.0	9.000	Off	L1	10.0	27.0	46.0
12.840000	28.3	9.000	Off	L1	10.3	21.7	50.0
12.852000	28.4	9.000	Off	L1	10.3	21.6	50.0
12.898000	28.4	9.000	Off	L1	10.3	21.6	50.0
12.912000	29.9	9.000	Off	L1	10.3	20.1	50.0
12.970000	28.5	9.000	Off	L1	10.3	21.5	50.0
13.304000	26.3	9.000	Off	L1	10.3	23.7	50.0

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Conducted Emissions (Line 2)

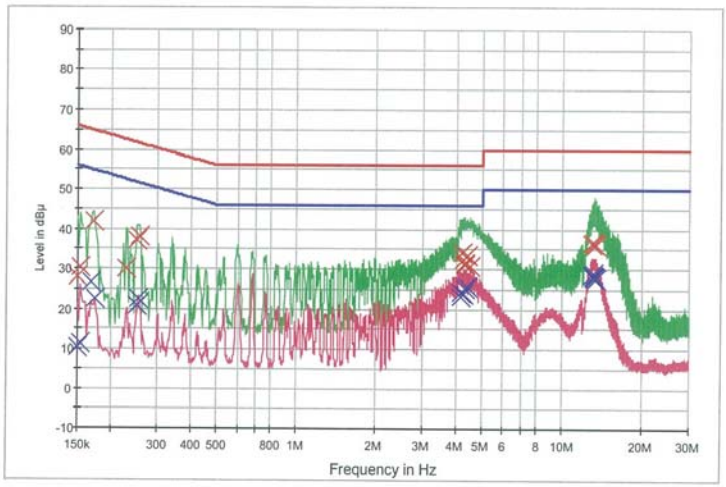
Test 1 / 2

HCT TEST Report

Common Information

EUT:	SM-A415F/DSN
Manufacturer:	SAMSUNG
Test Site:	SHIELD ROOM
Operating Conditions:	BTLE_N

FCC CLASS B_Exten Cable



Final Result 1

Frequency (MHz)	QuasiPeak (dBuV)	Bandwidth (kHz)	Filter	Line	Corr. (dB)	Margin (dB)	Limit (dBuV)
0.150000	28.1	9.000	Off	N	9.8	37.9	66.0
0.154000	30.2	9.000	Off	N	9.8	35.6	65.8
0.172000	42.0	9.000	Off	N	9.8	22.9	64.9
0.228000	30.0	9.000	Off	N	9.8	32.6	62.5
0.250000	37.1	9.000	Off	N	9.8	24.6	61.8
0.256000	38.0	9.000	Off	N	9.8	23.6	61.6
4.218000	34.2	9.000	Off	N	10.0	21.8	56.0
4.238000	32.5	9.000	Off	N	10.0	23.5	56.0
4.304000	31.3	9.000	Off	N	10.0	24.7	56.0
4.310000	31.1	9.000	Off	N	10.0	24.9	56.0
4.404000	33.4	9.000	Off	N	10.0	22.6	56.0
4.492000	30.6	9.000	Off	N	10.0	25.4	56.0
12.982000	36.3	9.000	Off	N	10.4	23.7	60.0
12.994000	36.5	9.000	Off	N	10.4	23.5	60.0
13.058000	36.8	9.000	Off	N	10.4	23.2	60.0
13.120000	36.9	9.000	Off	N	10.4	23.1	60.0
13.204000	36.4	9.000	Off	N	10.4	23.6	60.0
13.328000	36.2	9.000	Off	N	10.4	23.8	60.0

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Test 2 / 2

Final Result 2

Frequency (MHz)	CAverage (dBuV)	Bandwidth (kHz)	Filter	Line	Corr. (dB)	Margin (dB)	Limit (dBuV)
0.150000	10.2	9.000	Off	N	9.8	45.8	56.0
0.154000	11.2	9.000	Off	N	9.8	44.6	55.8
0.168000	26.5	9.000	Off	N	9.8	28.5	55.1
0.174000	22.6	9.000	Off	N	9.8	32.2	54.8
0.250000	20.9	9.000	Off	N	9.8	30.9	51.8
0.254000	22.6	9.000	Off	N	9.8	29.1	51.6
4.144000	23.1	9.000	Off	N	10.0	22.9	46.0
4.176000	24.3	9.000	Off	N	10.0	21.7	46.0
4.238000	24.0	9.000	Off	N	10.0	22.0	46.0
4.282000	25.4	9.000	Off	N	10.0	20.6	46.0
4.304000	25.2	9.000	Off	N	10.0	20.8	46.0
4.404000	25.6	9.000	Off	N	10.0	20.4	46.0
12.994000	28.6	9.000	Off	N	10.4	21.4	50.0
13.030000	29.0	9.000	Off	N	10.4	21.0	50.0
13.084000	28.1	9.000	Off	N	10.4	21.9	50.0
13.120000	28.2	9.000	Off	N	10.4	21.8	50.0
13.206000	27.8	9.000	Off	N	10.4	22.2	50.0
13.328000	27.8	9.000	Off	N	10.4	22.2	50.0

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10. LIST OF TEST EQUIPMENT

Conducted Test

Manufacturer	Model / Equipment	Calibration Date	Calibration Interval	Serial No.
Rohde & Schwarz	ENV216 / LISN	09/11/2019	Annual	102245
Rohde & Schwarz	ESCI / Test Receiver	06/18/2019	Annual	100584
ESPAC	SU-642 /Temperature Chamber	03/12/2019	Annual	0093008124
Agilent	N9020A / Signal Analyzer	05/23/2019	Annual	MY51110085
Agilent	N9030A / Signal Analyzer	05/09/2019	Annual	MY49432108
Agilent	N1911A / Power Meter	04/10/2019	Annual	MY45100523
Agilent	N1921A / Power Sensor	04/10/2019	Annual	MY52260025
Agilent	87300B / Directional Coupler	11/11/2019	Annual	3116A03621
Hewlett Packard	11667B / Power Splitter	05/24/2019	Annual	05001
Hewlett Packard	E3632A / DC Power Supply	06/18/2019	Annual	KR75303960
Agilent	8493C / Attenuator(10 dB)	07/02/2019	Annual	07560
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
Rohde & Schwarz	CBT / Bluetooth Tester	05/16/2019	Annual	100422

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
Audix	EM1000 / Controller	N/A	N/A	060520
Audix	Turn Table	N/A	N/A	N/A
TNM system	FBSM-01B / Amp & Filter Bank Switch Controller	N/A	N/A	N/A
Rohde & Schwarz	Loop Antenna	04/26/2019	Biennial	1513-175
Schwarzbeck	VULB 9168 / Hybrid Antenna	08/02/2019	Biennial	01039
Schwarzbeck	BBHA 9120D / Horn Antenna	06/28/2019	Biennial	1300
Schwarzbeck	BBHA9170 / Horn Antenna(15 GHz ~ 40 GHz)	04/29/2019	Biennial	BBHA9170342
Rohde & Schwarz	FSP(9 kHz ~ 40 GHz) / Spectrum Analyzer	07/16/2019	Annual	100843
Rohde & Schwarz	FSV40-N / Spectrum Analyzer	09/26/2019	Annual	101068-SZ
Wainwright Instruments	WRCJV2400/2483.5-2370/2520-60/12SS / Band Reject Filter	01/21/2020	Annual	2
Wainwright Instruments	WRCJV5100/5850-40/50-8EEK / Band Reject Filter	02/10/2020	Annual	1
CERNEX	CBL18265035 / Power Amplifier	12/26/2019	Annual	22966
CERNEX	CBL26405040 / Power Amplifier	06/18/2019	Annual	25956
TESCOM	TC-3000C / Bluetooth Tester	03/26/2019	Annual	3000C000276
TNM system	FBSM-05B / HPF(3~18GHz) + LNA1(1~18GHz)	01/21/2020	Annual	F6
TNM system	FBSM-05B / ATT(10dB) + LNA1(1~18GHz)	01/21/2020	Annual	None
TNM system	FBSM-05B / ATT(3dB) + LNA1(1~18GHz)	01/21/2020	Annual	None
TNM system	FBSM-05B / LNA1(1~18GHz)	01/21/2020	Annual	25540
TNM system	FBSM-05B / HPF(7~18GHz) + LNA2(6~18GHz)	01/21/2020	Annual	28550
TNM system	FBSM-05B / Thru(30MHz ~ 18GHz)	01/21/2020	Annual	None

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-2003-FC002-P