

TEST REPORT

FCC BT LE Test for SC-51F
Certification

APPLICANT
SAMSUNG Electronics Co., Ltd.

REPORT NO.
HCT-RF-2412-FC014

DATE OF ISSUE
December 3, 2024

Tested by
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TEST REPORT

REPORT NO.

HCT-RF-2412-FC014

DATE OF ISSUE

December 03, 2024

Additional Model

SCG31

Applicant

SAMSUNG Electronics Co., Ltd.

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

Product Name

Mobile Phone

Model Name

SC-51F

FCC ID

A3LSMS931JPN

Date of Test

August 26, 2024 ~ December 3, 2024

FCC Classification

Digital Transmission System(DTS)

Test Standard Used

FCC Rule Part(s): Part 15.247

Test Results

PASS

Location of Test

☒ Permanent Testing Lab ☐ On Site Testing Lab

(Address: 74, Seoicheon-ro 578beon-gil, Majang-myeon, Icheon-si, Gyeonggi-do, Republic of Korea)

REVISION HISTORY

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

Revision No.	Date of Issue	Description
0	December 03, 2024	Initial Release

Notice

Content

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.

The results shown in this test report only apply to the sample(s), as received, provided by the applicant, unless otherwise stated.

The test results have only been applied with the test methods required by the standard(s).

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

Information provided by the applicant is marked **.

Test results provided by external providers are marked ***.

When confirmation of authenticity of this test report is required, please contact www.hct.co.kr

The test results in this test report are not associated with the ((KS Q) ISO/IEC 17025) accreditation by KOLAS (Korea Laboratory Accreditation Scheme) / A2LA (American Association for Laboratory Accreditation) that are under the ILAC (International Laboratory Accreditation Cooperation) Mutual Recognition Agreement (MRA).

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1. EUT DESCRIPTION

Model	SC-51F				
Additional Model	SCG31				
EUT Type	Mobile Phone				
Power Supply	DC 3.88 V				
Frequency Range	125k, 500k, 1M Bit/s : 2402 - 2480 MHz 2M Bit/s : 2404 - 2478 MHz (Except for 2426 MHz)				
Number of Channels	125k, 500k, 1M Bit/s : 40 Channels 2M Bit/s : 37 Channels				
Max. RF Output Power (Normal)	Ant.1	Peak (For information only)	1 M Bit/s: 2 M Bit/s: 125 k Bit/s : 500 k Bit/s :	9.697 dBm (9.33 mW) 9.865 dBm (9.69 mW) 10.083 dBm (10.19 mW) 10.172 dBm (10.40 mW)	
		Average	1 M Bit/s: 2 M Bit/s: 125 k Bit/s : 500 k Bit/s :	9.30 dBm (8.52 mW) 9.55 dBm (9.01 mW) 9.73 dBm (9.40 mW) 9.78 dBm (9.50 mW)	
		Ant.2	Peak (For information only)	1 M Bit/s: 2 M Bit/s: 125 k Bit/s : 500 k Bit/s :	8.859 dBm (7.69 mW) 9.615 dBm (9.15 mW) 8.946 dBm (7.85 mW) 8.914 dBm (7.79 mW)
			Average	1 M Bit/s: 2 M Bit/s: 125 k Bit/s : 500 k Bit/s :	8.60 dBm (7.25 mW) 9.17 dBm (8.26 mW) 8.62 dBm (7.28 mW) 8.70 dBm (7.40 mW)
	Modulation Type		GFSK		
	Bluetooth Version		5.4		
	Antenna Specification	Type: Metal ANT.1 Peak Gain: -1.05 dBi, ANT.2 Peak Gain: -4.74 dBi			
	Serial number	Conducted : R3CX9061L9A Radiated : R3CX90KCEPF			

ANTENNA CONFIGURATIONS

1. Below Tables are the possible configurations.

Configurations	SISO	
	Ant1(Core-0)	Ant2(Core-1)
Bluetooth Low Energy	O	O

Note:

- 1) O = Support, X = Not Support
- 2) SISO = Single Input Single Output

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.

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 30 MHz 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 1 GHz. Above 1 GHz with 1.5 m 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 March 11, 2024 (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

“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.

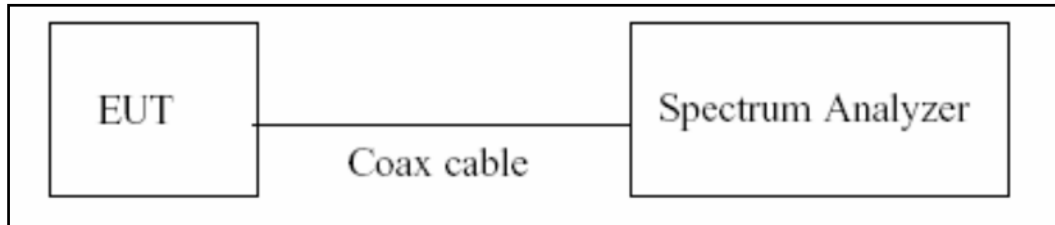
The measurement data shown herein meets or exceeds the U_{CISPR} measurement uncertainty values specified in CISPR 16-4-2 and, thus, can be compared directly to specified limits to determine compliance.

Parameter	Expanded Uncertainty (dB)
Conducted Disturbance (150 kHz ~ 30 MHz)	1.98 (Confidence level about 95 %, $k=2$)
Radiated Disturbance (9 kHz ~ 30 MHz)	4.36 (Confidence level about 95 %, $k=2$)
Radiated Disturbance (30 MHz ~ 1 GHz)	5.70 (Confidence level about 95 %, $k=2$)
Radiated Disturbance (1 GHz ~ 18 GHz)	5.52 (Confidence level about 95 %, $k=2$)
Radiated Disturbance (18 GHz ~ 40 GHz)	5.66 (Confidence level about 95 %, $k=2$)
Radiated Disturbance (Above 40 GHz)	5.58 (Confidence level about 95 %, $k=2$)

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 $> 50/T$.

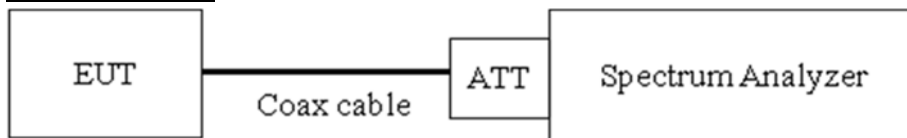
1. RBW = 8 MHz (the largest available value)
2. VBW = 8 MHz ($\geq$ RBW)
3. SPAN = 0 Hz
4. Detector = Peak
5. Number of points in sweep > 100
6. Trace mode = Clear write
7. Measure T_{total} and T_{on}
8. Calculate Duty Cycle = $T_{\text{on}}/T_{\text{total}}$ and Duty Cycle Factor = $10\log(1/\text{Duty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

7.2. 6 dB 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 $\geq 3 \times$ 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.

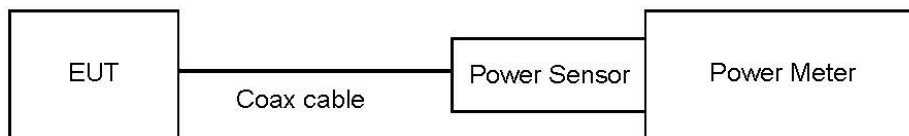
Note : We tested OBW using the automatic bandwidth measurement capability of a spectrum analyzer.

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

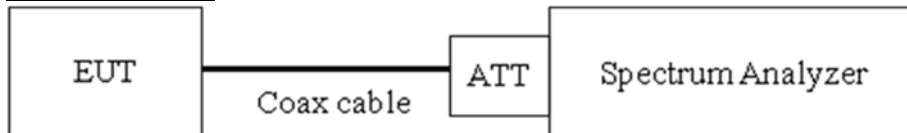
- Conducted Output Power(Peak) = Measured Value + ATT loss + Cable loss
- Conducted Output Power(Average) = Measured Value + ATT loss + Cable loss + Duty Cycle Factor

7.4. Power Spectral Density

Limit

The transmitter power density average over 1-second interval shall not be greater than 8 dBm 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 = power averaging (rms) or sample detector (when rms not available).
- 7) Ensure that the number of measurement points in the sweep $\geq [2 \times \text{span} / RBW]$.
- 8) Employ trace averaging (rms) mode over 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 = Measured Value + ATT loss + Cable loss + Duty Cycle Factor

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

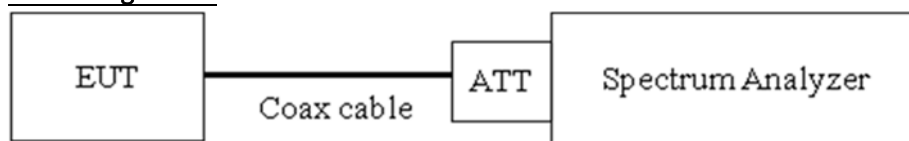
Limit

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 $\geq 3 \times$ 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) Allow trace to fully stabilize.
- 8) Use peak marker function to determine the maximum amplitude level.

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

Factors for frequency

Freq(MHz)	Factor(dB)
30	10.24
100	10.31
200	10.34
300	10.32
400	10.43
500	10.51
600	10.54
700	10.68
800	10.80
900	10.90
1 000	10.92
2 000	10.92
2 400	10.98
2 500	10.98
3 000	11.38
4 000	11.46
5 000	12.05
6 000	12.05
7 000	12.10
8 000	12.11
9 000	12.12
10 000	12.22
11 000	12.21
12 000	12.06
13 000	12.26
14 000	12.39
15 000	12.34
16 000	12.40
17 000	12.41
18 000	12.48
19 000	12.54
20 000	12.53
21 000	12.60
22 000	12.64
23 000	12.71
24 000	12.75
25 000	12.76
26 000	12.80

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

2. Factor = Attenuator loss + Cable loss

3. Total Port offset = Attenuator loss + Cable loss

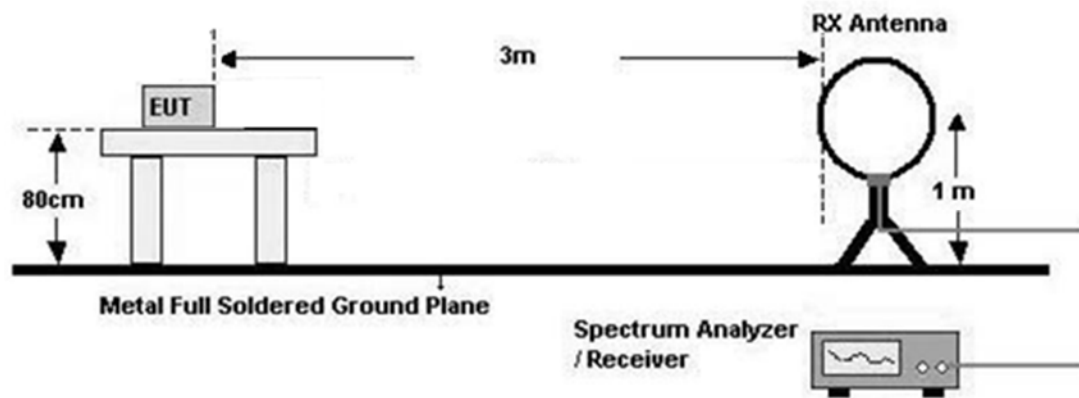
7.6. Radiated Test

Limit

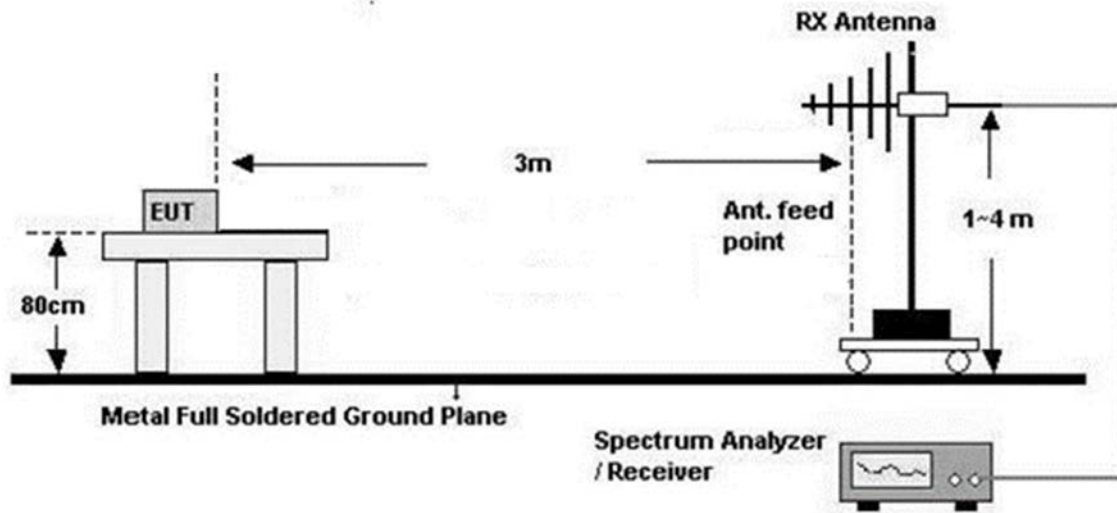
Frequency (MHz)	Field Strength ($\mu\text{V/m}$)	Measurement Distance (m)
0.009 – 0.490	$2400/F(\text{kHz})$	300
0.490 – 1.705	$24000/F(\text{kHz})$	30
1.705 – 30	30	30
30-88	100	3
88-216	150	3
216-960	200	3
Above 960	500	3

Test Configuration

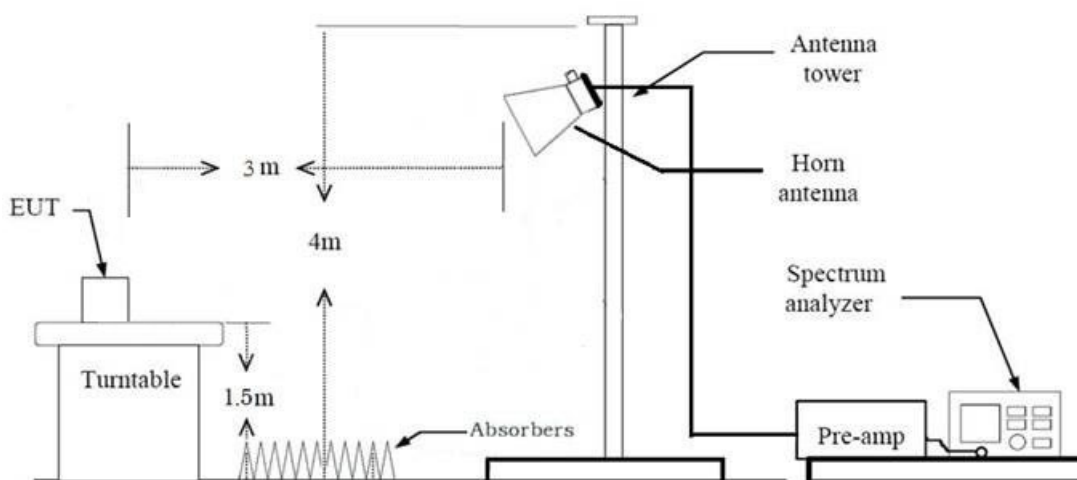
Below 30 MHz



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 3 m from the EUT
3. The EUT is placed on a turntable, which is 0.8 m 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 = Max hold
 - RBW = 9 kHz
 - VBW $\geq 3 \times$ RBW
9. Total = Measured 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 1 GHz)

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 0.8 m above ground plane.
3. The Hybrid antenna was placed at a location 3 m from the EUT, which is varied from 1m to 4 m 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 = Max hold
- RBW = 100 kHz
- VBW $\geq 3 \times$ 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

7. Total = Measured 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 1 m to 4 m 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 $\geq 3 \times$ 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 $\geq 3 \times$ 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 Measured Value + Antenna Factor(A.F) + Cable Loss(C.L) - Amp Gain(A.G)
 - + Distance Factor(D.F)

Total (Measurement Type : Average)

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

#Note : Used Average measurement method according to KDB 558074 Section11 Q3

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 1 m to 4 m 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 $\geq 3 \times$ 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 $\geq 3 \times$ 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

(1)Measurement(Peak)

= Measured Value(Peak)

(2)Measurement(Avg)

= Measured Value(Avg)

- We apply to the offset in range 1 GHz - 18 GHz

- The offset = Antenna Factor(A.F) + Cable Loss(C.L) + Distance Factor(D.F)

#Note : Used Average measurement method according to KDB 558074 Section11 Q3

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) = Measured 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
 - (1) Ant.1
 - Radiated Spurious Emissions : Y
 - Radiated Restricted Band Edge : X
 - (2) Ant.2
 - Radiated Spurious Emissions : Y
 - Radiated Restricted Band Edge : Y
3. All packet length of operation were investigated and the test results are worst case in lowest packet length.

(Worst case :1M Bit/s 37 Byte)

(125k, 500k, 1M Bit/s all have the same 1 MHz Band width and only Worst result is attached.)
4. All datarate of operation were investigated and the worst case configuration results are reported.
 - Worst case : 1 M, 2 M
5. 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
9. SC-51F, SCG31 were tested and the worst case results are reported.

(Worst case: SC-51F)

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
2. SC-51F, SCG31 were tested and the worst case results are reported.

(Worst case: SC-51F)

Conducted test

1. The EUT was configured with packet length of highest power.
 - ALL supported mode tested.
 - Worst Results refer to Notes for each test item
2. SC-51F, SCG31 were tested and the worst case results are reported.

(Worst case: SC-51F)

8. SUMMARY TEST OF RESULTS

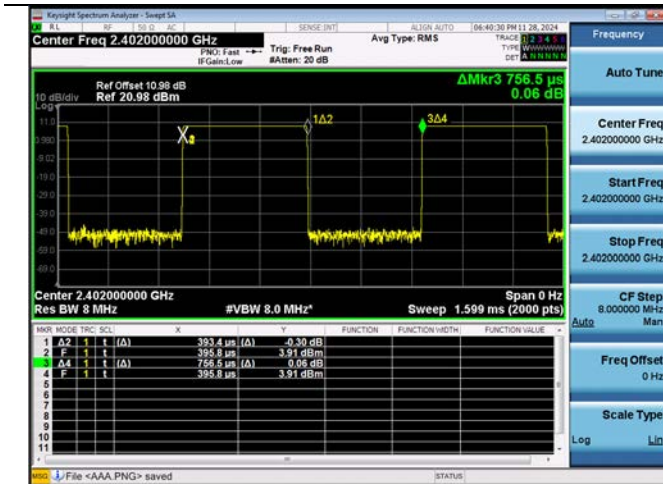
Test Description	FCC Part Section(s)	Test Limit	Test Condition	Test Result
6 dB Bandwidth	§ 15.247(a)(2)	> 500 kHz	Conducted	PASS
Conducted Maximum Output Power	§ 15.247(b)(3)	< 1 Watt		PASS
Power Spectral Density	§ 15.247(e)	< 8 dBm / 3 kHz Band		PASS
Band Edge (Out of Band Emissions)	§ 15.247(d)	Conducted > 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

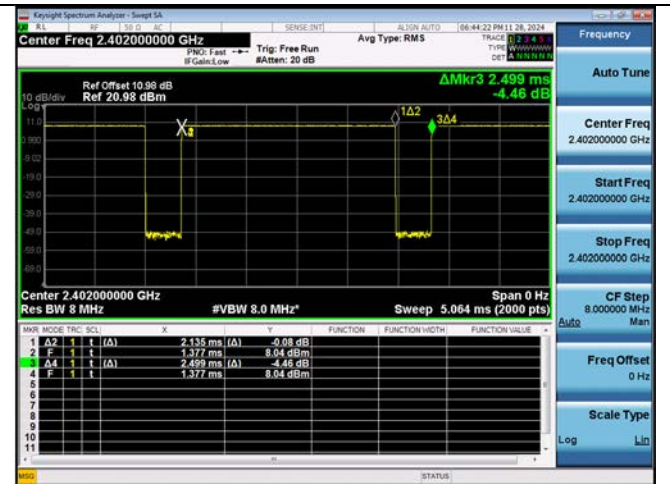
9.1 DUTY CYCLE

Data rate (Bit/s)	Packet length (Byte)	T _{on} (ms)	T _{total} (ms)	Duty Cycle	Duty Cycle Factor (dB)
1M	37	0.393	0.757	0.5200	2.840
	255	2.135	2.499	0.8543	0.684
2M	37	0.209	0.537	0.3889	4.101
	255	1.079	1.408	0.7663	1.156
125k	37	3.103	4.110	0.755	1.221
	255	17.060	18.060	0.945	0.247
500k	37	1.070	1.816	0.589	2.297
	255	4.555	5.309	0.858	0.665

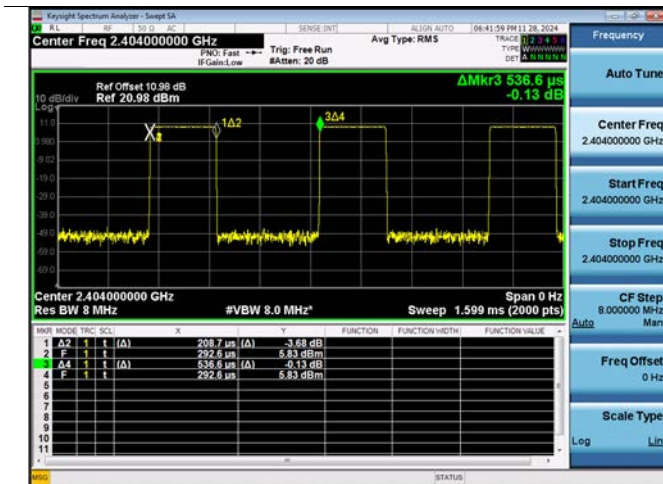
1 M Bit/s (37 Byte)



1 M Bit/s (255 Byte)



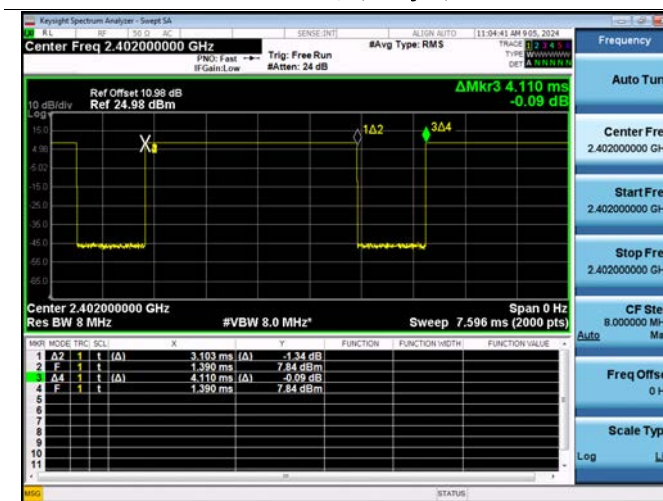
2 M Bit/s (37 Byte)



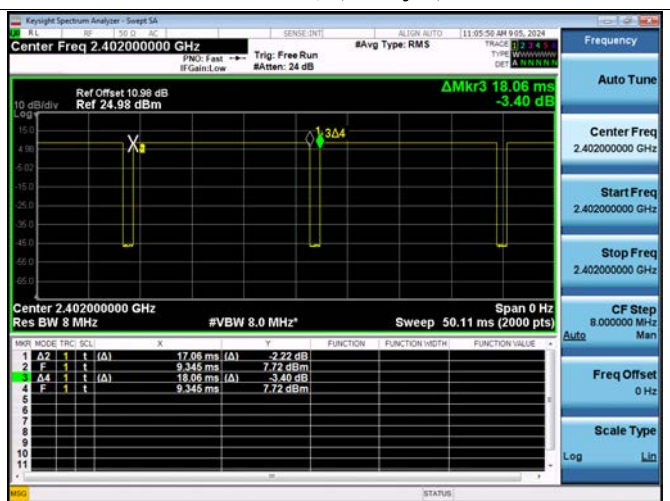
2 M Bit/s (255 Byte)



125 k Bit/s(37 Byte)

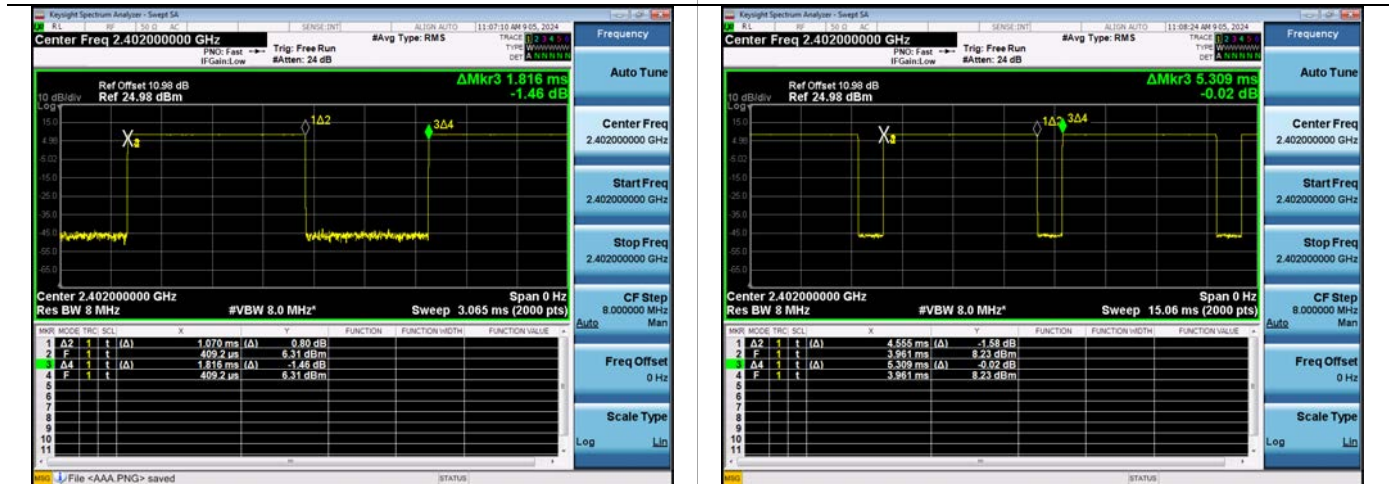


125 k Bit/s(255 Byte)



500 k Bit/s(37 Byte)

500 k Bit/s(255 Byte)



9.2 6 dB BANDWIDTH

[Ant. 1]

Mode (Bit/s)	Channel	6 dB Bandwidth (kHz)	Limit (kHz)
1M(37)	37	673.2	> 500
	17	676.5	
	39	678.2	
1M(255)	37	663.4	> 500
	17	669.6	
	39	666.4	
2M(37)	0	1149	> 500
	17	1141	
	36	1153	
2M(255)	0	1151	> 500
	17	1151	
	36	1151	
125k(37)	37	610.7	> 500
	17	611.4	
	39	614.8	
125k(255)	37	610.4	> 500
	17	609.7	
	39	607.9	
500k(37)	37	664.0	> 500
	17	666.6	
	39	660.2	
500k(255)	37	665.8	> 500
	17	670.6	
	39	664.2	

Note:

In order to simplify the report, attached plots were only the narrowest 6 dB BW Channel.

1M Bit/s: 255 Byte

2M Bit/s: 37 Byte

125k Bit/s: 255 Byte

500k Bit/s: 37 Byte

[Ant. 2]

Mode (Bit/s)	Channel	6 dB Bandwidth (kHz)	Limit (kHz)
1M(37)	37	673.3	> 500
	17	676.7	
	39	684.8	
1M(255)	37	665.9	> 500
	17	666.5	
	39	671.2	
2M(37)	0	1151	> 500
	17	1153	
	36	1146	
2M(255)	0	1157	> 500
	17	1152	
	36	1156	
125k(37)	37	611.1	> 500
	17	611.3	
	39	615.5	
125k(255)	37	610.0	> 500
	17	612.4	
	39	609.0	
500k(37)	37	664.8	> 500
	17	667.5	
	39	664.2	
500k(255)	37	666.6	> 500
	17	665.9	
	39	665.5	

Note:

In order to simplify the report, attached plots were only the narrowest 6 dB BW Channel.

1M Bit/s: 255 Byte

2M Bit/s: 37 Byte

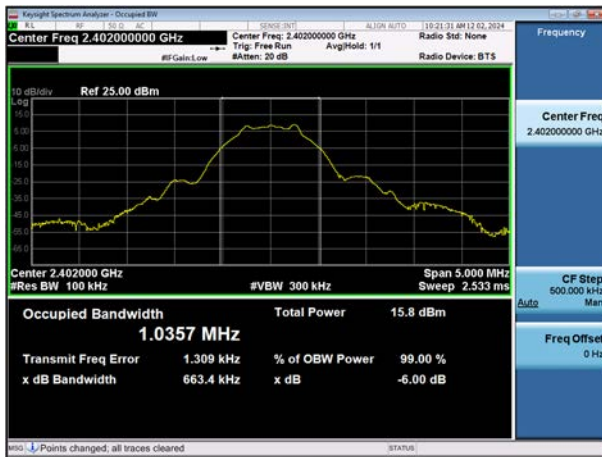
125k Bit/s: 255 Byte

500k Bit/s: 37 Byte

[Ant.1]

1 MBit/s (255 Byte) Test Plots

6 dB Bandwidth plot (Low-CH 37)

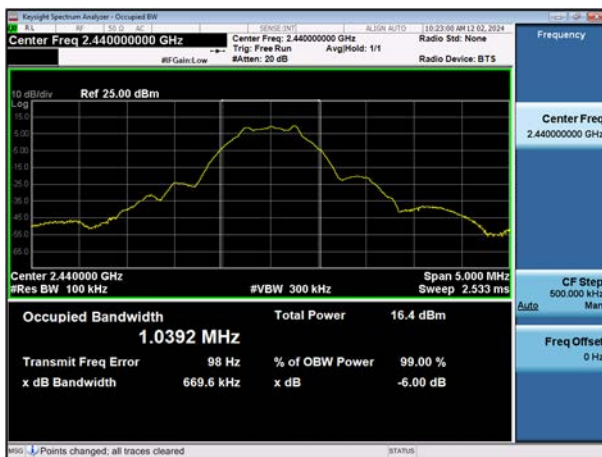


2 MBit/s (37 Byte) Test Plots

6 dB Bandwidth plot (Low-CH 0)



6 dB Bandwidth plot (Mid-CH 17)



6 dB Bandwidth plot (Mid-CH 17)



6 dB Bandwidth plot (High-CH 39)



6 dB Bandwidth plot (High-CH 36)



125k Bit/s(255 Byte) Test Plots

6 dB Bandwidth plot (Low-CH 37)



500k Bit/s(37 Byte) Test Plots

6 dB Bandwidth plot (Low-CH 37)



6 dB Bandwidth plot (Mid-CH 17)



6 dB Bandwidth plot (Mid-CH 17)



6 dB Bandwidth plot (High-CH 39)



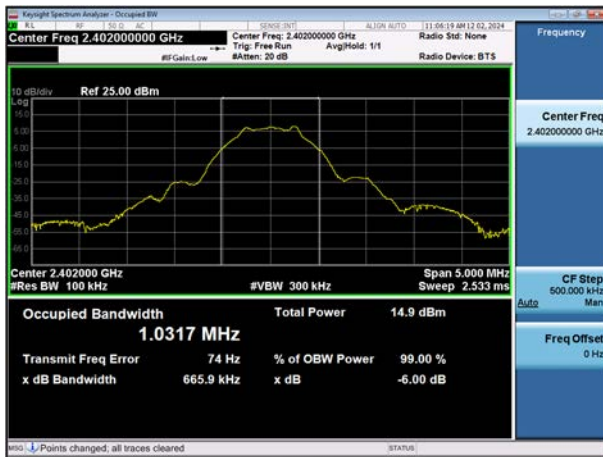
6 dB Bandwidth plot (High-CH 39)



[Ant.2]

1 MBit/s (255 Byte) Test Plots

6 dB Bandwidth plot (Low-CH 37)

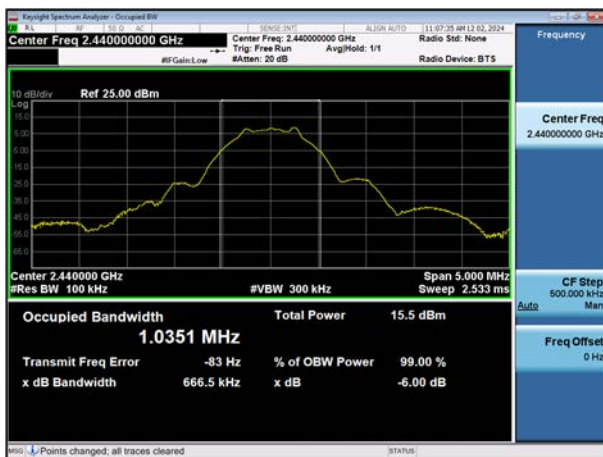


2 MBit/s (37 Byte) Test Plots

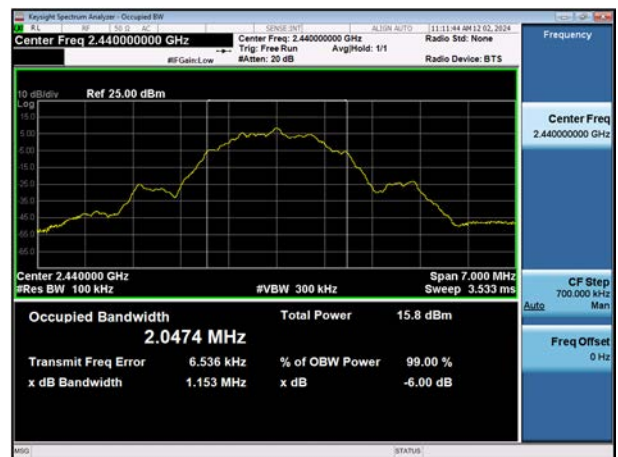
6 dB Bandwidth plot (Low-CH 0)



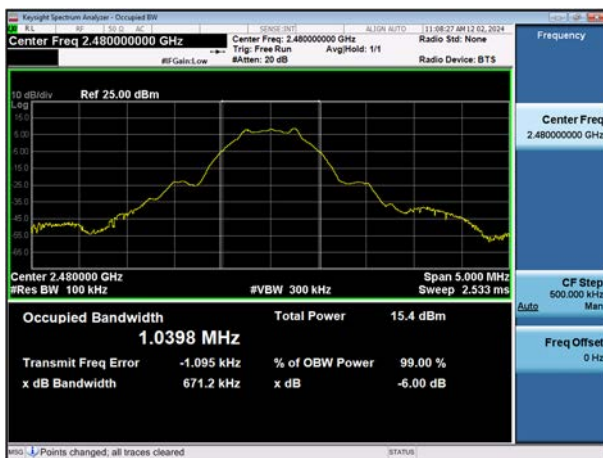
6 dB Bandwidth plot (Mid-CH 17)



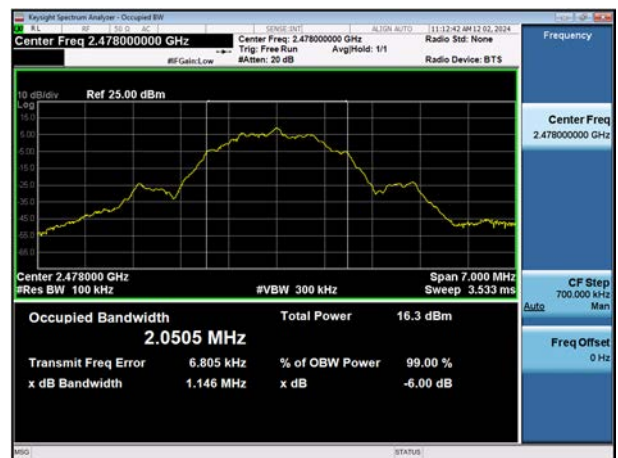
6 dB Bandwidth plot (Mid-CH 17)



6 dB Bandwidth plot (High-CH 39)



6 dB Bandwidth plot (High-CH 36)



125k Bit/s(255 Byte) Test Plots

6 dB Bandwidth plot (Low-CH 37)

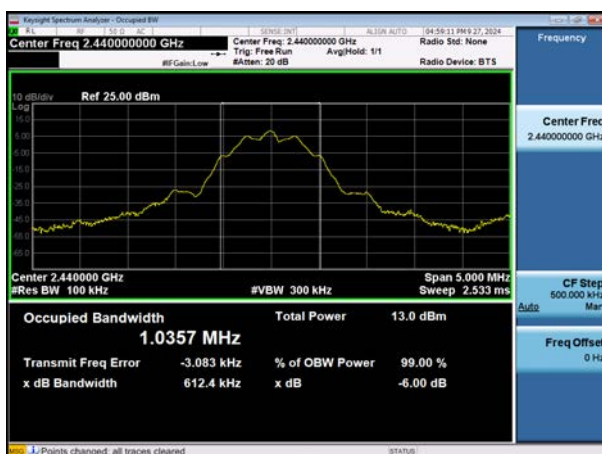


500k Bit/s(37 Byte) Test Plots

6 dB Bandwidth plot (Low-CH 37)



6 dB Bandwidth plot (Mid-CH 17)



6 dB Bandwidth plot (Mid-CH 17)



6 dB Bandwidth plot (High-CH 39)



6 dB Bandwidth plot (High-CH 39)



9.3 OUTPUT POWER

Peak Power

[Ant.1]

Data rate (Bit/s)	Packet length (Byte)	LE Mode		Peak Power (dBm)	Limit (dBm)
		Frequency [MHz]	Channel		
1M	37	2402	37	9.186	30
		2440	17	9.697	
		2480	39	9.164	
	255	2402	37	9.132	
		2440	17	9.618	
		2480	39	9.076	
2M	37	2404	0	9.491	
		2440	17	9.865	
		2478	36	9.458	
	255	2404	0	9.437	
		2440	17	9.767	
		2478	36	9.180	
125k	37	2402	37	9.774	
		2440	17	10.074	
		2480	39	9.628	
	255	2402	37	9.690	
		2440	17	10.083	
		2480	39	9.638	
500k	37	2402	37	9.865	
		2440	17	10.172	
		2480	39	9.753	
	255	2402	37	9.852	
		2440	17	10.167	
		2480	39	9.772	

[Ant.2]

Data rate	Packet length	LE Mode		Peak Power (dBm)	Limit (dBm)
(Bit/s)	(Byte)	Frequency [MHz]	Channel		
1M	37	2402	37	8.153	30
		2440	17	8.859	
		2480	39	8.717	
	255	2402	37	8.228	
		2440	17	8.835	
		2480	39	8.675	
2M	37	2404	0	8.538	
		2440	17	9.035	
		2478	36	9.615	
	255	2404	0	8.446	
		2440	17	8.846	
		2478	36	9.336	
125k	37	2402	37	8.946	
		2440	17	8.781	
		2480	39	8.175	
	255	2402	37	8.935	
		2440	17	8.794	
		2480	39	8.183	
500k	37	2402	37	8.754	
		2440	17	8.764	
		2480	39	8.159	
	255	2402	37	8.914	
		2440	17	8.829	
		2480	39	8.289	

Average Power

Note :

1. Total Power [dBm] = Measured Power [dBm] + Duty Cycle Factor [dB]

[Ant.1]

Data rate	Packet length	LE Mode		Measured Power (dBm)	Duty Cycle Factor	Result	Limit (dBm)
(Bit/s)	(Byte)	Frequency [MHz]	Channel		(dB)	(dBm)	
1M	37	2402	37	6.23	2.84	9.07	30
		2440	17	6.46	2.84	9.30	
		2480	39	6.17	2.84	9.01	
	255	2402	37	8.12	0.68	8.80	
		2440	17	8.62	0.68	9.30	
		2480	39	8.23	0.68	8.91	
2M	37	2404	0	5.14	4.10	9.24	
		2440	17	5.37	4.10	9.47	
		2478	36	5.17	4.10	9.27	
	255	2404	0	8.16	1.16	9.32	
		2440	17	8.39	1.16	9.55	
		2478	36	7.80	1.16	8.96	
125k	37	2402	37	8.50	1.22	9.72	
		2440	17	8.51	1.22	9.73	
		2480	39	8.12	1.22	9.34	
	255	2402	37	9.22	0.25	9.47	
		2440	17	9.38	0.25	9.63	
		2480	39	9.20	0.25	9.45	
500k	37	2402	37	7.21	2.30	9.51	
		2440	17	7.48	2.30	9.78	
		2480	39	7.23	2.30	9.53	
	255	2402	37	8.83	0.67	9.50	
		2440	17	9.01	0.67	9.68	
		2480	39	8.88	0.67	9.55	

[Ant.2]

Data rate	Packet length	LE Mode		Measured Power (dBm)	Duty Cycle Factor	Result	Limit (dBm)
(Bit/s)	(Byte)	Frequency [MHz]	Channel		(dB)	(dBm)	
1M	37	2402	37	5.05	2.84	7.89	30
		2440	17	5.68	2.84	8.52	
		2480	39	5.50	2.84	8.34	
	255	2402	37	7.22	0.68	7.90	
		2440	17	7.92	0.68	8.60	
		2480	39	7.68	0.68	8.36	
2M	37	2404	0	4.23	4.10	8.33	
		2440	17	4.56	4.10	8.66	
		2478	36	5.07	4.10	9.17	
	255	2404	0	7.18	1.16	8.34	
		2440	17	7.45	1.16	8.61	
		2478	36	7.60	1.16	8.76	
125k	37	2402	37	7.24	1.22	8.46	
		2440	17	7.40	1.22	8.62	
		2480	39	6.78	1.22	8.00	
	255	2402	37	8.04	0.25	8.29	
		2440	17	8.32	0.25	8.57	
		2480	39	7.80	0.25	8.05	
500k	37	2402	37	6.23	2.30	8.53	
		2440	17	6.31	2.30	8.61	
		2480	39	5.72	2.30	8.02	
	255	2402	37	7.66	0.67	8.33	
		2440	17	8.03	0.67	8.70	
		2480	39	7.46	0.67	8.13	

9.4 POWER SPECTRAL DENSITY

[Ant.1]

Frequency (MHz)	Channel No.	Mode	Test Result			
			Measured PSD (dBm)	Duty Cycle Factor(dB)	Total PSD (dBm)	Limit
2402	37	1 MBit/s 37 Byte	-0.111	2.84	2.729	8 dBm / 3 kHz
2440	17		0.836	2.84	3.676	
2480	39		0.042	2.84	2.882	
2402	37	1 MBit/s 255 Byte	1.829	0.68	2.513	
2440	17		2.386	0.68	3.070	
2480	39		1.409	0.68	2.093	
2404	0	2 MBit/s 37 Byte	-1.944	4.10	2.157	
2440	17		-1.176	4.10	2.925	
2478	36		-1.995	4.10	2.106	
2404	0	2 MBit/s 255 Byte	-1.152	1.16	0.004	
2440	17		-0.655	1.16	0.501	
2478	36		-0.913	1.16	0.243	
2402	37	125k 37 Byte	2.229	1.22	3.450	
2440	17		2.510	1.22	3.731	
2480	39		2.126	1.22	3.347	
2402	37	125k 255 Byte	3.163	0.25	3.410	
2440	17		3.726	0.25	3.973	
2480	39		2.892	0.25	3.139	
2402	37	500k 37 Byte	-3.258	2.30	-0.961	
2440	17		-2.213	2.30	0.084	
2480	39		-2.965	2.30	-0.668	
2402	37	500k 255 Byte	-6.468	0.67	-5.803	
2440	17		-5.390	0.67	-4.725	
2480	39		-5.957	0.67	-5.292	

Note :

1. Total PSD = Measured PSD + Duty Cycle Factor
2. In order to simplify the report, The plots were attached with the highest PSD Mode.
Worst case : 125k Bit/s (255 Byte)

[Ant.2]

Frequency (MHz)	Channel No.	Mode	Test Result			
			Measured PSD (dBm)	Duty Cycle Factor(dB)	Total PSD (dBm)	Limit
2402	37	1 MBit/s 37 Byte	-0.299	2.84	2.541	8 dBm / 3 kHz
2440	17		-0.276	2.84	2.564	
2480	39		0.637	2.84	3.477	
2402	37	1 MBit/s 255 Byte	1.159	0.68	1.843	
2440	17		1.315	0.68	1.999	
2480	39		1.144	0.68	1.828	
2404	0	2 MBit/s 37 Byte	-2.687	4.10	1.414	
2440	17		-1.975	4.10	2.126	
2478	36		-0.901	4.10	3.200	
2404	0	2 MBit/s 255 Byte	-2.038	1.16	-0.882	
2440	17		-1.299	1.16	-0.143	
2478	36		-0.777	1.16	0.379	
2402	37	125k 37 Byte	1.258	1.22	2.479	
2440	17		1.244	1.22	2.465	
2480	39		0.710	1.22	1.931	
2402	37	125k 255 Byte	2.242	0.25	2.489	
2440	17		2.197	0.25	2.444	
2480	39		1.698	0.25	1.945	
2402	37	500k 37 Byte	-3.748	2.30	-1.451	
2440	17		-4.490	2.30	-2.193	
2480	39		-6.730	2.30	-4.433	
2402	37	500k 255 Byte	-7.469	0.67	-6.804	
2440	17		-7.119	0.67	-6.454	
2480	39		-8.031	0.67	-7.366	

Note :

1. Total PSD = Measured PSD + Duty Cycle Factor
2. In order to simplify the report, The plots were attached with the highest PSD Mode.
Worst case : 1M Bit/s (37 Byte)

Test Plots

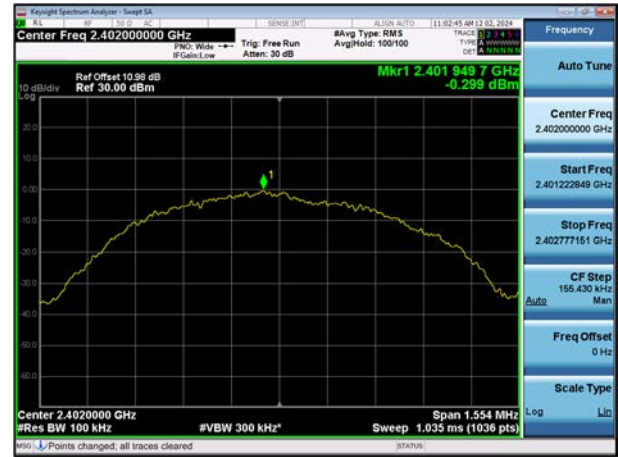
Ant.1 (125k Bit/s (255 Byte))

Power Spectral Density (Low-CH 37)



Ant.2 (1 MBit/s (37 Byte))

Power Spectral Density (Low-CH 37)



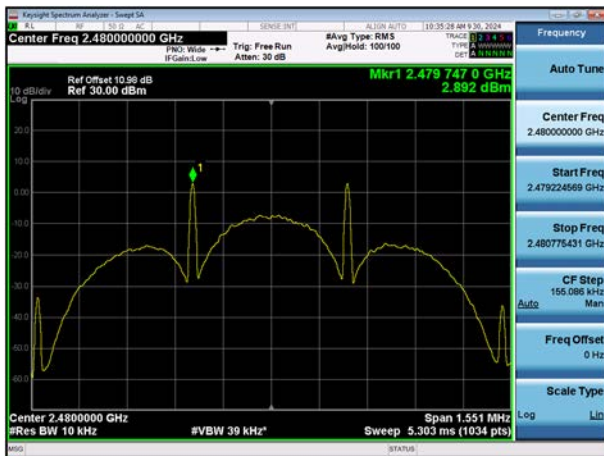
Power Spectral Density (Mid-CH 17)



Power Spectral Density (Mid-CH 17)



Power Spectral Density (High-CH 39)



Power Spectral Density (High-CH 39)



9.5 BAND EDGE/ CONDUCTED SPURIOUS EMISSIONS

[BAND EDGE]

[Ant. 1]

Frequency (MHz)	Mode	Channel No.	Position	Test Result	
				Measured Level (dB)	Limit (dBc)
2402	1M Bit/s 37 Byte	37	Lower	54.962	30
2480		39	Upper	60.758	30
2402	1M Bit/s 255 Byte	37	Lower	55.616	30
2480		39	Upper	60.601	30
2404	2M Bit/s 37 Byte	0	Lower	60.146	30
2478		36	Upper	60.282	30
2404	2M Bit/s 255 Byte	0	Lower	59.926	30
2478		36	Upper	61.164	30
2402	125k Bit/s 37 Byte	37	Lower	56.482	30
2480		39	Upper	59.786	30
2402	125k Bit/s 255 Byte	37	Lower	55.080	30
2480		39	Upper	61.280	30
2402	500k Bit/s 37 Byte	37	Lower	56.003	30
2480		39	Upper	61.092	30
2402	500k Bit/s 255 Byte	37	Lower	56.077	30
2480		39	Upper	60.918	30

Note :

In order to simplify the report, attached plots were only the worst case channel and data rate.

- Lower Band Edge: 1M Bit/s (37 Byte)
- Upper Band Edge: 125k Bit/s (37 Byte)

[Ant. 2]

Frequency (MHz)	Mode	Channel No.	Position	Test Result	
				Measured Level (dB)	Limit (dBc)
2402	1M Bit/s 37 Byte	37	Lower	54.993	30
2480		39	Upper	59.856	30
2402	1M Bit/s 255 Byte	37	Lower	54.948	30
2480		39	Upper	60.190	30
2404	2M Bit/s 37 Byte	0	Lower	59.572	30
2478		36	Upper	60.916	30
2404	2M Bit/s 255 Byte	0	Lower	60.082	30
2478		36	Upper	60.847	30
2402	125k Bit/s 37 Byte	37	Lower	55.958	30
2480		39	Upper	58.915	30
2402	125k Bit/s 255 Byte	37	Lower	56.317	30
2480		39	Upper	56.397	30
2402	500k Bit/s 37 Byte	37	Lower	55.998	30
2480		39	Upper	59.038	30
2402	500k Bit/s 255 Byte	37	Lower	57.142	30
2480		39	Upper	59.478	30

Note :

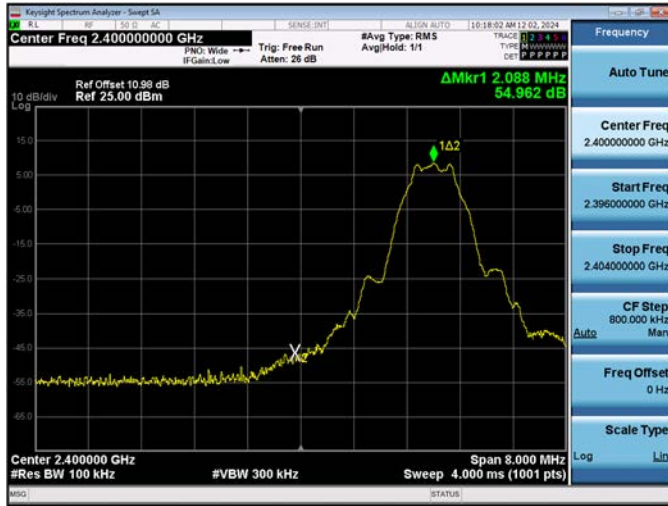
In order to simplify the report, attached plots were only the worst case channel and data rate.

- Lower Band Edge: 1M Bit/s (255 Byte)
- Upper Band Edge: 125k Bit/s (255 Byte)

Test Plot(Band Edge)

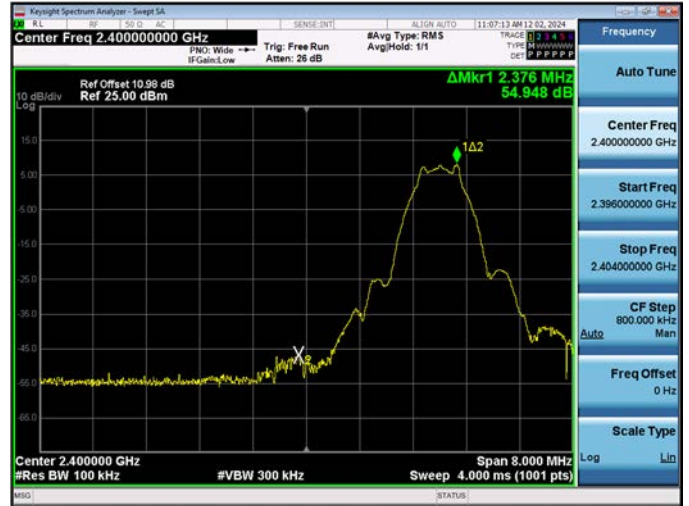
Ant. 1

1M Bit/s (37 Byte) Low-CH 37



Ant. 2

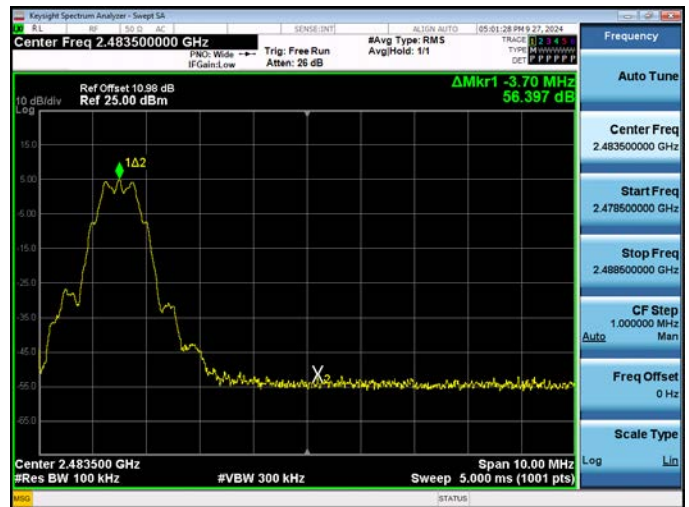
1M Bit/s (255 Byte) Low-CH 37



125k Bit/s (37 Byte) High-CH 39



125k Bit/s (255 Byte) High-CH 39



[CONDUCTED SPURIOUS EMISSIONS]

In order to simplify the report, attached plots were only the worst case channel and data rate.

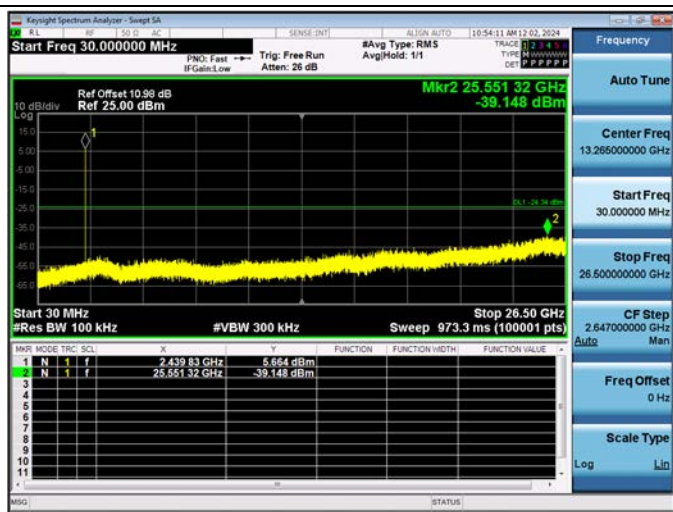
- Worst case

Ant. 1 : 2M Bit/s 255 Byte Ch. 17(2 440 MHz)

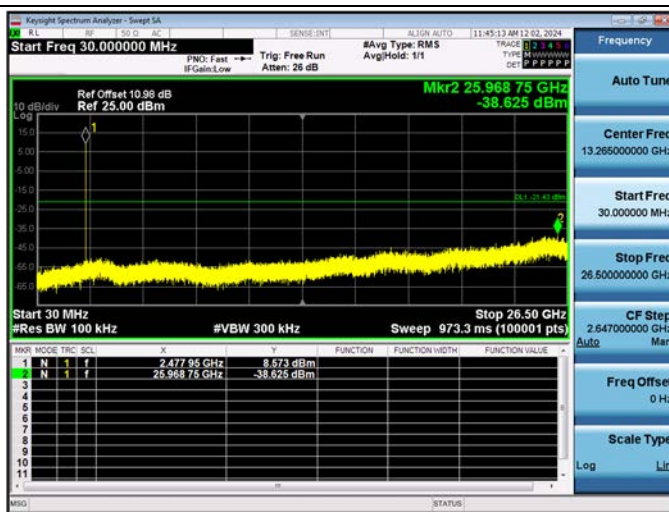
Ant. 2 : 2M Bit/s 37 Byte Ch. 36(2 478 MHz)

Test Plots(Conducted Spurious Emission (30 MHz – 26.5 GHz))

Ant. 1 Conducted Spurious Emission



Ant. 2 Conducted Spurious Emission



9.6 RADIATED SPURIOUS EMISSIONS

Frequency Range : 9 kHz – 30 MHz

Frequency	Measured Value	A.F+C.L+D.F	POL	Total	Limit	Margin
[MHz]	[dBμV]	[dB/m]	[H/V]	[dBμV/m]	[dBμV/m]	[dB]

No Critical peaks found

Note:

1. The Measured 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 (dBμV) + Distance extrapolation factor

Frequency Range : Below 1 GHz

Frequency	Measured Value	A.F+C.L	POL	Total	Limit	Margin
[MHz]	[dBμV]	[dB/m]	[H/V]	[dBμV/m]	[dBμV/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

[Ant.1]

CH 37	2402	MHz	Mode :		1 M Bit/s (37 Bytes)		
Frequency	Measured value	AF+CL-AG	Pol.	Total	Limit	Margin	Measurement
[MHz]	[dBμV]	[dB/m]	[H/V]	[dBμV/m]	[dBμV/m]	[dB]	Type
4804	51.01	-5.49	V	45.52	73.98	28.46	PK
4804	40.57	-5.49	V	35.08	53.98	18.90	AV
7206	47.45	1.86	V	49.31	73.98	24.67	PK
7206	35.49	1.86	V	37.35	53.98	16.63	AV
4804	51.28	-5.49	H	45.79	73.98	28.19	PK
4804	40.88	-5.49	H	35.39	53.98	18.59	AV
7206	47.39	1.86	H	49.25	73.98	24.73	PK
7206	35.44	1.86	H	37.30	53.98	16.68	AV

CH 17	2440	MHz	Mode :		1 M Bit/s (37 Bytes)		
Frequency	Measured value	AF+CL-AG	Pol.	Total	Limit	Margin	Measurement
[MHz]	[dBμV]	[dB/m]	[H/V]	[dBμV/m]	[dBμV/m]	[dB]	Type
4880	52.03	-5.18	V	46.85	73.98	27.13	PK
4880	41.92	-5.18	V	36.74	53.98	17.24	AV
7320	47.12	1.94	V	49.06	73.98	24.92	PK
7320	35.38	1.94	V	37.32	53.98	16.66	AV
4880	52.77	-5.18	H	47.59	73.98	26.39	PK
4880	42.07	-5.18	H	36.89	53.98	17.09	AV
7320	47.09	1.94	H	49.03	73.98	24.95	PK
7320	35.27	1.94	H	37.21	53.98	16.77	AV

CH 39	2480	MHz	Mode :		1 M Bit/s (37 Bytes)		
Frequency	Measured value	AF+CL-AG	Pol.	Total	Limit	Margin	Measurement
[MHz]	[dBμV]	[dB/m]	[H/V]	[dBμV/m]	[dBμV/m]	[dB]	Type
4960	54.62	-4.82	V	49.80	73.98	24.18	PK
4960	43.28	-4.82	V	38.46	53.98	15.52	AV
7440	47.66	2.13	V	49.79	73.98	24.19	PK
7440	35.43	2.13	V	37.56	53.98	16.42	AV
4960	54.86	-4.82	H	50.04	73.98	23.94	PK
4960	43.43	-4.82	H	38.61	53.98	15.37	AV
7440	47.57	2.13	H	49.70	73.98	24.28	PK
7440	35.44	2.13	H	37.57	53.98	16.41	AV

CH 0	2404	MHz	Mode :		2 M Bit/s (37 Bytes)		
Frequency	Measured value	AF+CL-AG	Pol.	Total	Limit	Margin	Measurement
[MHz]	[dBμV]	[dB/m]	[H/V]	[dBμV/m]	[dBμV/m]	[dB]	Type
4804	52.10	-5.49	V	46.61	73.98	27.37	PK
4804	39.32	-5.49	V	33.83	53.98	20.15	AV
7206	47.49	1.86	V	49.35	73.98	24.63	PK
7206	35.55	1.86	V	37.41	53.98	16.57	AV
4804	52.14	-5.49	H	46.65	73.98	27.33	PK
4804	39.57	-5.49	H	34.08	53.98	19.90	AV
7206	47.35	1.86	H	49.21	73.98	24.77	PK
7206	35.49	1.86	H	37.35	53.98	16.63	AV

CH 17	2440	MHz	Mode :		2 M Bit/s (37 Bytes)		
Frequency	Measured value	AF+CL-AG	Pol.	Total	Limit	Margin	Measurement
[MHz]	[dBμV]	[dB/m]	[H/V]	[dBμV/m]	[dBμV/m]	[dB]	Type
4880	52.82	-5.18	V	47.64	73.98	26.34	PK
4880	40.61	-5.18	V	35.43	53.98	18.55	AV
7320	47.06	1.94	V	49.00	73.98	24.98	PK
7320	35.33	1.94	V	37.27	53.98	16.71	AV
4880	53.14	-5.18	H	47.96	73.98	26.02	PK
4880	40.86	-5.18	H	35.68	53.98	18.30	AV
7320	46.93	1.94	H	48.87	73.98	25.11	PK
7320	35.29	1.94	H	37.23	53.98	16.75	AV

CH 36	2478	MHz	Mode :		2 M Bit/s (37 Bytes)		
Frequency	Measured value	AF+CL-AG	Pol.	Total	Limit	Margin	Measurement
[MHz]	[dBμV]	[dB/m]	[H/V]	[dBμV/m]	[dBμV/m]	[dB]	Type
4960	54.69	-4.82	V	49.87	73.98	24.11	PK
4960	41.63	-4.82	V	36.81	53.98	17.17	AV
7440	46.94	2.13	V	49.07	73.98	24.91	PK
7440	35.37	2.13	V	37.50	53.98	16.48	AV
4960	54.85	-4.82	H	50.03	73.98	23.95	PK
4960	41.87	-4.82	H	37.05	53.98	16.93	AV
7440	46.82	2.13	H	48.95	73.98	25.03	PK
7440	35.29	2.13	H	37.42	53.98	16.56	AV

[Ant.2]

CH 37	2402	MHz	Mode :		1 M Bit/s (37 Bytes)		
Frequency	Measured value	AF+CL-AG	Pol.	Total	Limit	Margin	Measurement
[MHz]	[dBμV]	[dB/m]	[H/V]	[dBμV/m]	[dBμV/m]	[dB]	Type
4804	51.34	-5.49	V	45.85	73.98	28.13	PK
4804	40.42	-5.49	V	34.93	53.98	19.05	AV
7206	47.04	1.86	V	48.90	73.98	25.08	PK
7206	35.62	1.86	V	37.48	53.98	16.50	AV
4804	51.32	-5.49	H	45.83	73.98	28.15	PK
4804	40.11	-5.49	H	34.62	53.98	19.36	AV
7206	46.92	1.86	H	48.78	73.98	25.20	PK
7206	35.57	1.86	H	37.43	53.98	16.55	AV

CH 17	2440	MHz	Mode :		1 M Bit/s (37 Bytes)		
Frequency	Measured value	AF+CL-AG	Pol.	Total	Limit	Margin	Measurement
[MHz]	[dBμV]	[dB/m]	[H/V]	[dBμV/m]	[dBμV/m]	[dB]	Type
4880	52.58	-5.18	V	47.40	73.98	26.58	PK
4880	42.34	-5.18	V	37.16	53.98	16.82	AV
7320	47.37	1.94	V	49.31	73.98	24.67	PK
7320	35.55	1.94	V	37.49	53.98	16.49	AV
4880	52.40	-5.18	H	47.22	73.98	26.76	PK
4880	42.22	-5.18	H	37.04	53.98	16.94	AV
7320	47.29	1.94	H	49.23	73.98	24.75	PK
7320	35.19	1.94	H	37.13	53.98	16.85	AV

CH 39	2480	MHz	Mode :		1 M Bit/s (37 Bytes)		
Frequency	Measured value	AF+CL-AG	Pol.	Total	Limit	Margin	Measurement
[MHz]	[dBμV]	[dB/m]	[H/V]	[dBμV/m]	[dBμV/m]	[dB]	Type
4960	54.03	-4.82	V	49.21	73.98	24.77	PK
4960	43.69	-4.82	V	38.87	53.98	15.11	AV
7440	46.94	2.13	V	49.07	73.98	24.91	PK
7440	35.46	2.13	V	37.59	53.98	16.39	AV
4960	53.91	-4.82	H	49.09	73.98	24.89	PK
4960	43.25	-4.82	H	38.43	53.98	15.55	AV
7440	46.73	2.13	H	48.86	73.98	25.12	PK
7440	35.39	2.13	H	37.52	53.98	16.46	AV

CH 0	2404	MHz	Mode :		2 M Bit/s (37 Bytes)		
Frequency	Measured value	AF+CL-AG	Pol.	Total	Limit	Margin	Measurement
[MHz]	[dBμV]	[dB/m]	[H/V]	[dBμV/m]	[dBμV/m]	[dB]	Type
4808	51.26	-5.49	V	45.77	73.98	28.21	PK
4808	39.71	-5.49	V	34.22	53.98	19.76	AV
7212	47.36	1.92	V	49.28	73.98	24.70	PK
7212	35.55	1.92	V	37.47	53.98	16.51	AV
4808	51.08	-5.49	H	45.59	73.98	28.39	PK
4808	39.68	-5.49	H	34.19	53.98	19.79	AV
7212	47.22	1.92	H	49.14	73.98	24.84	PK
7212	35.24	1.92	H	37.16	53.98	16.82	AV

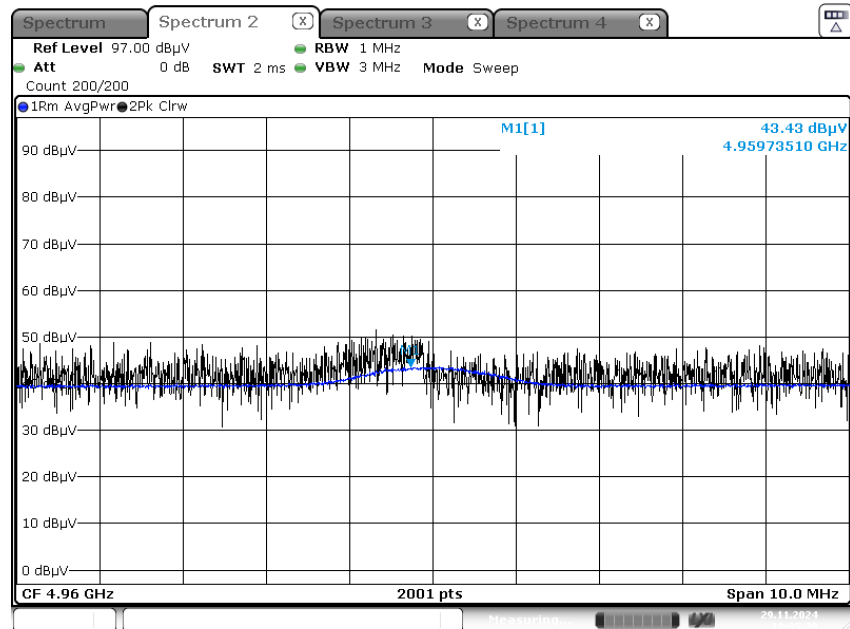
CH 17	2440	MHz	Mode :		2 M Bit/s (37 Bytes)		
Frequency	Measured value	AF+CL-AG	Pol.	Total	Limit	Margin	Measurement
[MHz]	[dBμV]	[dB/m]	[H/V]	[dBμV/m]	[dBμV/m]	[dB]	Type
4880	53.94	-5.18	V	48.76	73.98	25.22	PK
4880	41.05	-5.18	V	35.87	53.98	18.11	AV
7320	47.06	1.94	V	49.00	73.98	24.98	PK
7320	35.30	1.94	V	37.24	53.98	16.74	AV
4880	53.41	-5.18	H	48.23	73.98	25.75	PK
4880	40.93	-5.18	H	35.75	53.98	18.23	AV
7320	46.89	1.94	H	48.83	73.98	25.15	PK
7320	35.19	1.94	H	37.13	53.98	16.85	AV

CH 36	2478	MHz	Mode :		2 M Bit/s (37 Bytes)		
Frequency	Measured value	AF+CL-AG	Pol.	Total	Limit	Margin	Measurement
[MHz]	[dBμV]	[dB/m]	[H/V]	[dBμV/m]	[dBμV/m]	[dB]	Type
4956	53.84	-4.93	V	48.91	73.98	25.07	PK
4956	42.19	-4.93	V	37.26	53.98	16.72	AV
7434	46.87	2.11	V	48.98	73.98	25.00	PK
7434	35.23	2.11	V	37.34	53.98	16.64	AV
4956	53.63	-4.93	H	48.70	73.98	25.28	PK
4956	41.92	-4.93	H	36.99	53.98	16.99	AV
7434	46.69	2.11	H	48.80	73.98	25.18	PK
7434	35.21	2.11	H	37.32	53.98	16.66	AV

[Ant.1]

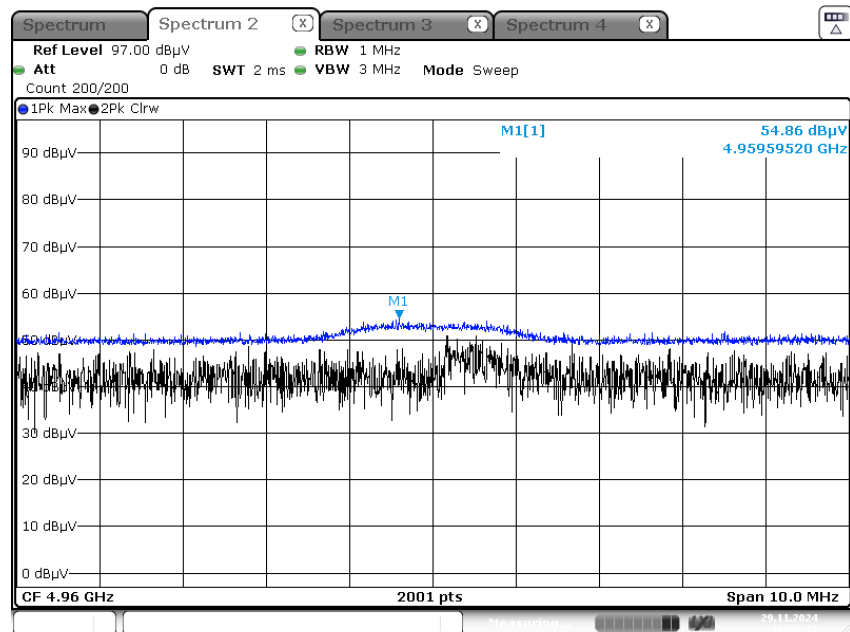
1 M Bit/s 37 Bytes Test Plots (Worst case : Y-H)

Radiated Spurious Emissions plot – Average Result (Ch.39 2nd Harmonic)



Date: 29.NOV.2024 12:35:29

Radiated Spurious Emissions plot – Peak Result (Ch.39 2nd Harmonic)



Date: 29.NOV.2024 12:36:42

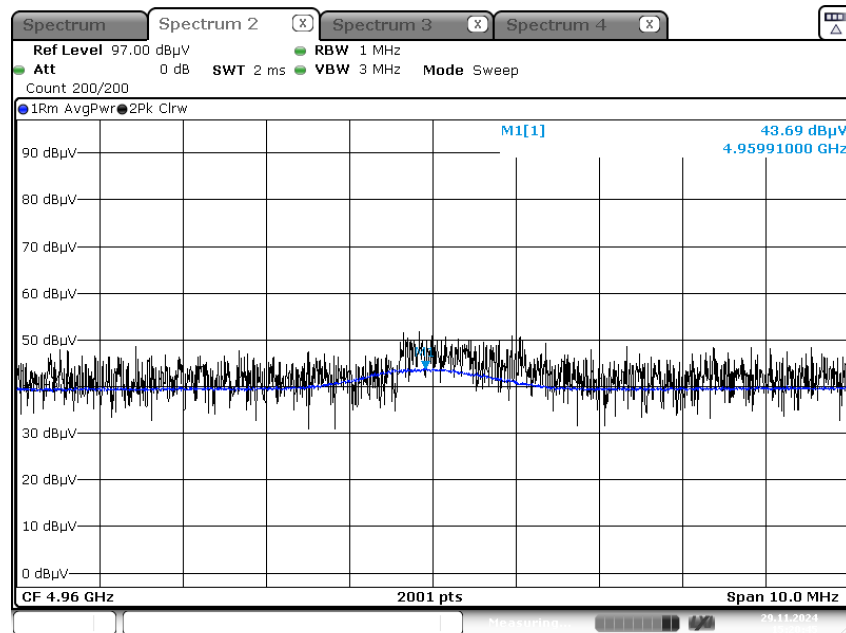
Note:

Plots of worst case are only reported.

[Ant.2]

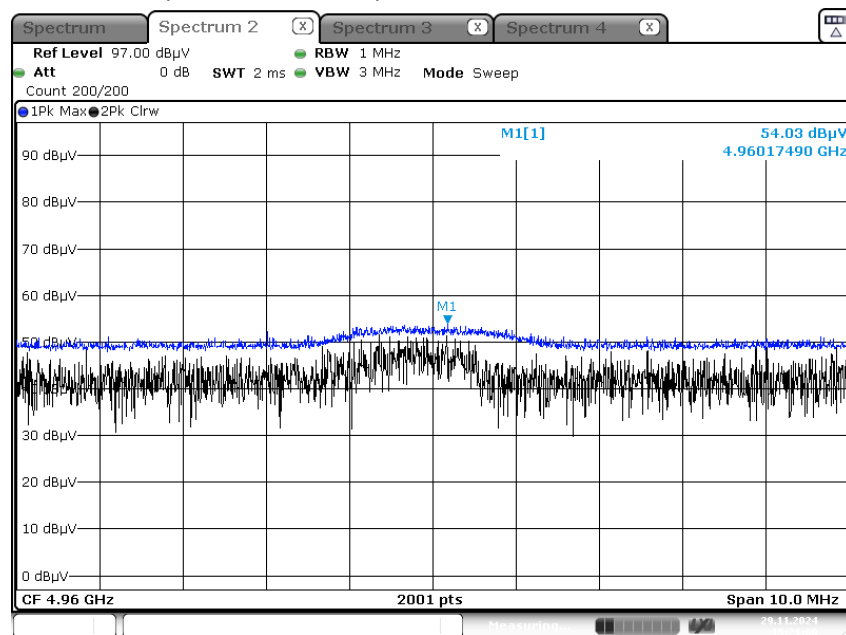
▣ 1 M Bit/s 37 Bytes Test Plots (Worst case : Y-V)

Radiated Spurious Emissions plot – Average Result (Ch.39 2nd Harmonic)



Date: 29.NOV.2024 15:20:46

Radiated Spurious Emissions plot – Peak Result (Ch.39 2nd Harmonic)



Date: 29.NOV.2024 15:21:09

Note:

Plots of worst case are only reported.

9.7 RADIATED RESTRICTED BAND EDGES

[Ant.1]

1 M Bit/s (37 Bytes)							
Channel	37 CH, 39 CH	Channel No	2402 MHz, 2480 MHz				
Frequency	Measured Value	AF+CL+DF	Ant. Pol.	Total	Limit	Margin	Measurement
[MHz]	[dBμV]	[dB/m]	[H/V]	[dBμV/m]	[dBμV/m]	[dB]	Type
2390.0	52.12	-	H	52.12	73.98	21.86	PK
2390.0	40.04	-	H	40.04	53.98	13.94	AV
2483.5	65.59	-	H	65.59	73.98	8.39	PK
2483.5	43.68	-	H	43.68	53.98	10.30	AV

2 M Bit/s (37 Bytes)							
Channel	0 CH, 36 CH	Channel No	2404 MHz, 2478 MHz				
Frequency	Measured Value	AF+CL+DF	Ant. Pol.	Total	Limit	Margin	Measurement
[MHz]	[dBμV]	[dB/m]	[H/V]	[dBμV/m]	[dBμV/m]	[dB]	Type
2390.0	52.46	-	H	52.46	73.98	21.52	PK
2390.0	40.12	-	H	40.12	53.98	13.86	AV
2483.5	60.04	-	H	60.04	73.98	13.94	PK
2483.5	41.70	-	H	41.70	53.98	12.28	AV

[Ant.2]

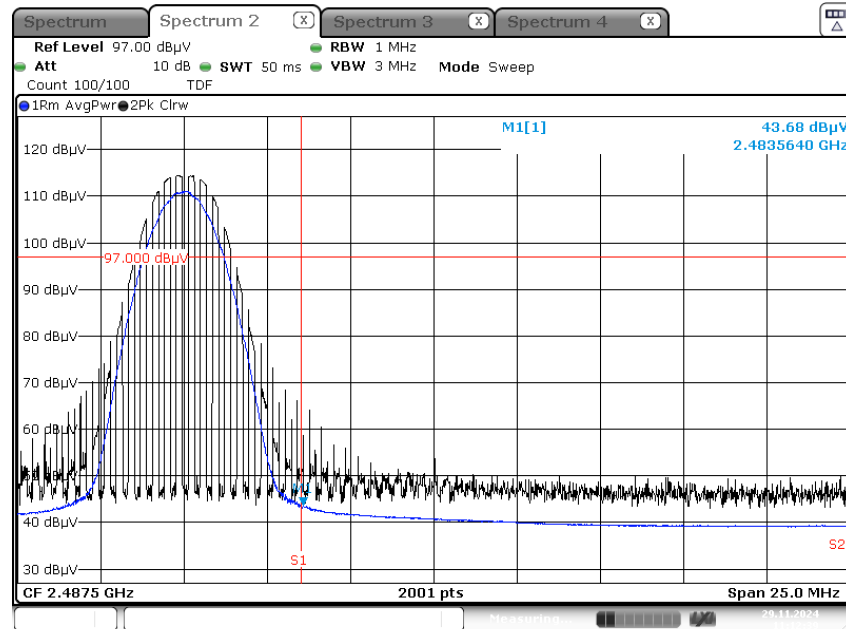
1 M Bit/s (37 Bytes)							
Channel	37 CH, 39 CH	Channel No	2402 MHz, 2480 MHz				
Frequency	Measured Value	AF+CL+DF	Ant. Pol.	Total	Limit	Margin	Measurement
[MHz]	[dBμV]	[dB/m]	[H/V]	[dBμV/m]	[dBμV/m]	[dB]	Type
2390.0	52.81	-	V	52.81	73.98	21.17	PK
2390.0	40.13	-	V	40.13	53.98	13.85	AV
2483.5	64.14	-	H	64.14	73.98	9.84	PK
2483.5	42.47	-	H	42.47	53.98	11.51	AV

2 M Bit/s (37 Bytes)							
Channel	0 CH, 36 CH	Channel No	2404 MHz, 2478 MHz				
Frequency	Measured Value	AF+CL+DF	Ant. Pol.	Total	Limit	Margin	Measurement
[MHz]	[dBμV]	[dB/m]	[H/V]	[dBμV/m]	[dBμV/m]	[dB]	Type
2390.0	52.23	-	V	52.23	73.98	21.75	PK
2390.0	40.20	-	V	40.20	53.98	13.78	AV
2483.5	57.94	-	H	57.94	73.98	16.04	PK
2483.5	40.71	-	H	40.71	53.98	13.27	AV

[Ant.1]

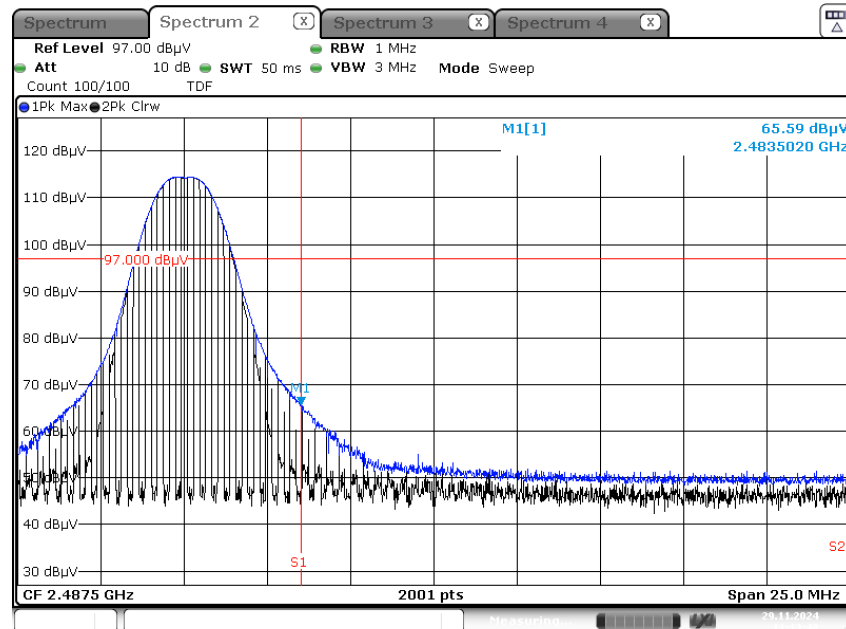
■ Mode : 1 M Bit/s (37 Bytes) Test Plots

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



Date: 29.NOV.2024 11:12:39

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



Date: 29.NOV.2024 11:13:49

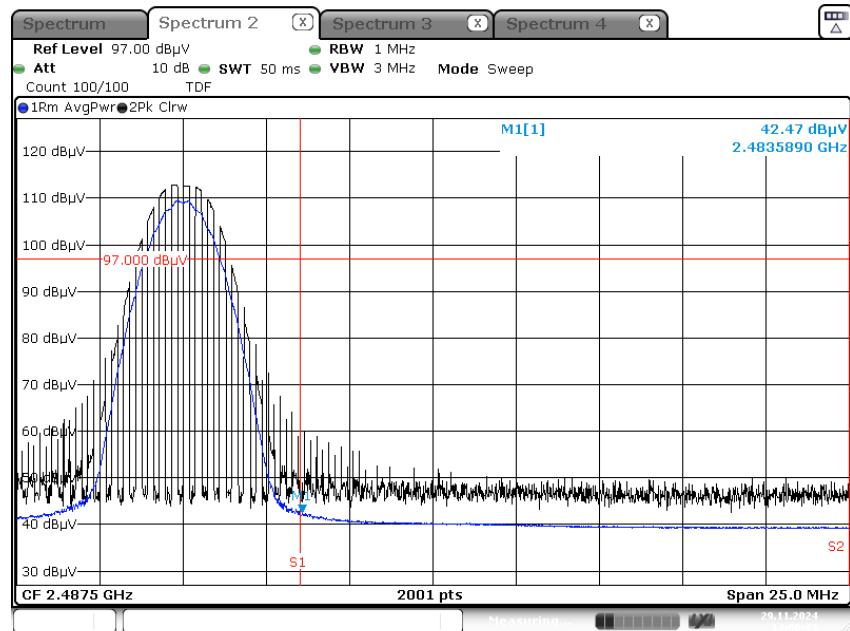
Note:

In order to simplify the report, Plot of worst case are only reported.

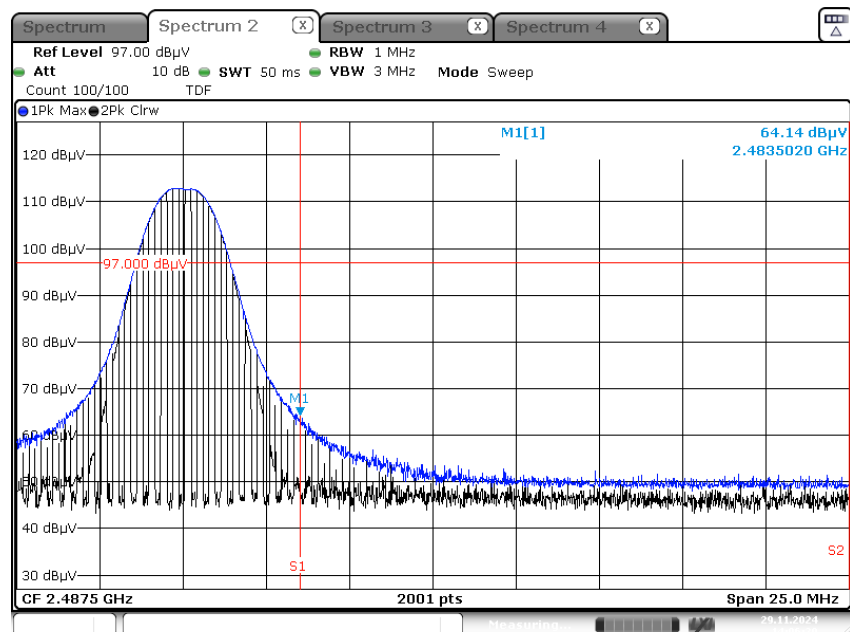
[Ant.2]

Mode : 1 M Bit/s (37 Bytes) Test Plots

Radiated Restricted Band Edges plot – Average Result (Ch.39, Y-H)



Radiated Restricted Band Edges plot – Peak Result (Ch.39, Y-H)



Note:

In order to simplify the report, Plot of worst case are only reported.

9.8 POWERLINE CONDUCTED EMISSIONS

Conducted Emissions

Test

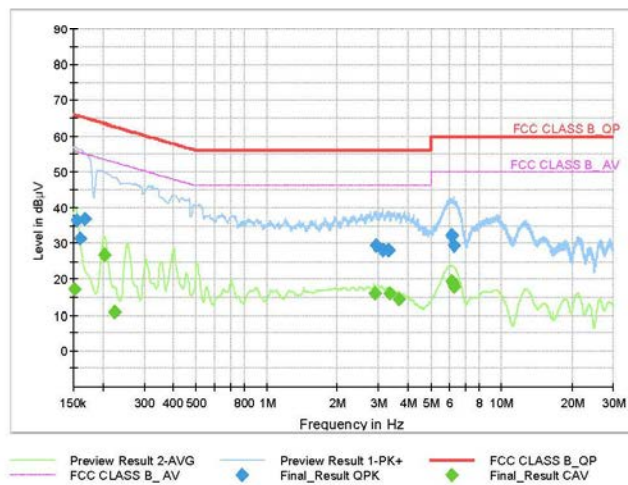
1 / 1

Test Report

Common Information

EUT : SM-S931U
Operating Conditions : BLE Mode
Comment :

Full Spectrum



Final Result QPK

Frequency (MHz)	QuasiPeak (dBµV)	Limit (dBµV)	Margin (dB)	Bandwidth (kHz)	Line	Corr. (dB)
0.1545	36.53	65.75	29.22	9.000	L1	9.6
0.1613	31.40	65.40	34.00	9.000	L1	9.6
0.1680	36.85	65.06	28.21	9.000	L1	9.6
2.9188	29.56	56.00	26.44	9.000	L1	9.8
3.1258	28.09	56.00	27.91	9.000	L1	9.8
3.3103	28.14	56.00	27.86	9.000	L1	9.8
6.1160	32.10	60.00	27.90	9.000	L1	9.9
6.1250	32.44	60.00	27.56	9.000	L1	9.9
6.2533	29.35	60.00	30.65	9.000	L1	9.9

Final Result CAV

Frequency (MHz)	CAverage (dBµV)	Limit (dBµV)	Margin (dB)	Bandwidth (kHz)	Line	Corr. (dB)
0.1523	17.14	55.88	38.74	9.000	L1	9.6
0.2040	26.81	53.45	26.63	9.000	L1	9.6
0.2243	10.82	52.66	41.84	9.000	L1	9.6
2.8940	15.81	46.00	30.19	9.000	L1	9.8
3.3328	15.86	46.00	30.14	9.000	L1	9.8
3.6478	14.30	46.00	31.70	9.000	L1	9.8
6.1183	19.45	50.00	30.55	9.000	L1	9.9
6.1880	18.70	50.00	31.30	9.000	L1	9.9
6.2578	17.84	50.00	32.16	9.000	L1	9.9

2024-08-30

오전 9:56:51

10. LIST OF TEST EQUIPMENT

Conducted Test

Equipment	Model	Manufacturer	Serial No.	Due to Calibration	Calibration Interval
LISN	ENV216	Rohde & Schwarz	102245	07/17/2025	Annual
EMI Test Receiver	ESR	Rohde & Schwarz	101910	07/02/2025	Annual
Temperature Chamber	SU-642	ESPEC	93008124	02/19/2025	Annual
Signal Analyzer	N9030A	Keysight	MY55410508	08/23/2025	Annual
Power Meter	N1911A	Agilent	MY45100523	02/28/2025	Annual
Power Sensor	N1921A	Agilent	MY57820067	02/22/2025	Annual
Directional Coupler	87300B	Agilent	3116A03621	10/21/2025	Annual
Power Splitter	11667B	Hewlett Packard	10545	02/06/2025	Annual
DC Power Supply	E3632A	Agilent	KR01009150	04/18/2025	Annual
Attenuator(10 dB)(DC-26.5 GHz)	8493C-010	Agilent	08285	05/28/2025	Annual
Attenuator(20 dB)	18N-20dB	Rohde & Schwarz	8	02/20/2025	Annual
Software	EMC32	Rohde & Schwarz	N/A	N/A	N/A
FCC WLAN&BT&BLE Conducted Test Software v3.0	N/A	HCT CO., LTD.	N/A	N/A	N/A
Bluetooth Tester	CBT	Rohde & Schwarz	100808	02/15/2025	Annual

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

Equipment	Model	Manufacturer	Serial No.	Due to Calibration	Calibration Interval
Controller (Antenna mast & Turn Table)	CO3000	Innco system	CO3000/ 15421/57580623/G	N/A	N/A
Antenna Position Tower	MA4640	Innco system	9320422	04/05/2025	Biennial
Turn Table	N/A	Innco system	5930623	N/A	N/A
Loop Antenna	FMZB 1513	Schwarzbeck	1513-175	01/16/2025	Biennial
Hybrid Antenna	VULB 9168	Schwarzbeck	9168-1135	08/19/2026	Biennial
Horn Antenna	BBHA 9120D	Schwarzbeck	9120D-1151	07/14/2025	Biennial
Horn Antenna (15 GHz ~ 40 GHz)	BBHA9170	Schwarzbeck	BBHA9170124	03/28/2025	Biennial
Amp & Filter Bank Switch Controller	FBSM-01B	T&M system	TM2009001	N/A	N/A
Band Reject Filter	WRCJV2400/2483.5- 2370/2520-60/12SS	Wainwright Instruments	2	01/02/2025	Annual
Band Reject Filter	WRCJV12-4900-5100-5900- 6100-50SS	Wainwright Instruments	5	06/04/2025	Annual
Band Reject Filter	WRCJV12-4900-5100-5900- 6100-50SS	Wainwright Instruments	6	06/04/2025	Annual
Band Reject Filter	WRCJV5100/5850-40/50- 8EEK	Wainwright Instruments	1	02/14/2025	Annual
RF Switching System	FMSR-05B (HPF(3~18GHz) + LNA1(1~18GHz))	T&M system	S5L1	03/12/2025	Annual
RF Switching System	FMSR -05B (ATT(10dB) + LNA1(1~18GHz))	T&M system	S5L2	03/12/2025	Annual
RF Switching System	FMSR -05B (ATT(3dB) + LNA1(1~18GHz))	T&M system	S5L3	03/12/2025	Annual
RF Switching System	FMSR -05B (LNA1(1~18GHz))	T&M system	S5L4	03/12/2025	Annual
RF Switching System	FMSR -05B (HPF(7~18GHz) + LNA2(6~18GHz))	T&M system	S5L5	03/12/2025	Annual
RF Switching System	FMSR -05B (Thru(30MHz ~ 18GHz))	T&M system	S5L6	03/12/2025	Annual
Power Amplifier	CBL18265035	CERNEX	22966	11/07/2025	Annual
Power Amplifier	CBL26405040	CERNEX	25956	02/26/2025	Annual
Bluetooth Tester	TC-3000C	TESCOM	3000C000175	03/19/2025	Annual
Spectrum Analyzer	FSW (2 Hz ~ 67 GHz)	Rohde & Schwarz	101736	05/23/2025	Annual
Spectrum Analyzer	FSV40 (9 kHz ~ 40 GHz)	Rohde & Schwarz	101510	03/28/2025	Annual

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-2412-FC014-P