

## FCC - TEST REPORT

Report Number : **709502102910-00** Date of Issue: February 26, 2021Model : CR2SProduct Type : Wi-Fi and Bluetooth ModuleApplicant : Hangzhou Tuya Information Technology Co.,LtdAddress : Room701,Building3,More Center,No.87 GuDun  
Road,Hangzhou,Zhejiang ChinaManufacturer : Hangzhou Tuya Information Technology Co.,LtdAddress : Room701,Building3,More Center,No.87 GuDun  
Road,Hangzhou,Zhejiang ChinaTest Result : ☒ **Positive** ☐ **Negative**Total pages including  
Appendices : 35

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## 2 Details about the Test Laboratory

### Details about the Test Laboratory

#### Test Site 1

Company name: TÜV SÜD Certification and Testing (China) Co., Ltd. Shanghai Branch  
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Registration  
Number: 820234

Test Firm IC  
Registration  
Number: 25988

Telephone: +86 21 6141 0123  
Fax: +86 21 6140 8600

### 3 Description of the Equipment under Test

#### Description of the Equipment Under Test

Product:	Wi-Fi and Bluetooth Module
Model no.:	CR2S
FCC ID:	2ANDL-CR2S
Options and accessories:	NA
Rating:	3V-3.6V DC
RF Transmission Frequency:	For 802.11b/g/n-HT20: 2412~2462 MHz (Wi-Fi) For 802.15.1:2402~2480 MHz (BLE4.2)
No. of Operated Channel:	2.4GHz WIFI: 11 for 802.11b/802.11g/802.11(H20) 2.4GHz BLE: 40
Modulation:	Direct Sequence Spread Spectrum (DSSS) for 802.11b Orthogonal Frequency Division Multiplexing (OFDM) for 802.11g/n For 2.4GHz BLE: GFSK
Antenna Type:	On board PCB antenna
Antenna Gain:	1.7dBi
Description of the EUT:	The Equipment Under Test (EUT) is a Wi-Fi and Bluetooth module which support 2.4GHz Wi-Fi and BLE 4.2. We tested it and listed the worst data in this report.
Test sample no.:	SHA-551542-1

The sample's mentioned in this report is/are submitted/ supplied/ manufactured by client. The laboratory therefore assumes no responsibility for accuracy of information on the brand name, model number, origin of manufacture, consignment, antenna gain or any information supplied.



China

## 4 Summary of Test Standards

Test Standards	
FCC Part 15 Subpart C	PART 15 - RADIO FREQUENCY DEVICES Subpart C - Intentional Radiators

All the test methods were according to KDB 558074 D01 15.247 Meas Guidance v05r02 and ANSI C63.10 (2013).

## 5 Summary of Test Results

Technical Requirements						
FCC Part 15 Subpart C						
Test Condition		Pages	Test Site	Test Result		
				Pass	Fail	N/A
§15.207	Conducted emission AC power port	12-14	Site 1	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
§15.247 (b) (1)	Conducted peak output power	15	Site 1	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
§15.247(a)(1)	20dB bandwidth	---	---	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
§15.247(a)(1)	Carrier frequency separation	---	---	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
§15.247(a)(1)(iii)	Number of hopping frequencies	---	---	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
§15.247(a)(1)(iii)	Dwell Time	---	---	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
§15.247(a)(2)	6dB bandwidth	16-19	Site 1	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
§15.247(e)	Power spectral density	20-23	Site 1	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
§15.247(d)	Spurious RF conducted emissions	24-33	Site 1	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
§15.247(d)	Band edge	34-37	Site 1	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
§15.247(d) & §15.209	Spurious radiated emissions for transmitter	38-44	Site 1	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
§15.203	Antenna requirement	See note 1		<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Remark 1: N/A – Not Applicable.

Note 1: The EUT uses a on board PCB antenna, which gain is 1.7dBi. In accordance to §15.203, It is considered sufficiently to comply with the provisions of this section.

## 6 General Remarks

### Remarks

This submittal(s) (test report) is intended for FCC ID: 2ANDL-CR2S, complies with Section 15.207, 15.209, 15.247 of the FCC Part 15, Subpart C Rules.

This report is only for the 2.4GHz BLE test report, for the 2.4GHz Wi-Fi test report please refer to 709502102908-00.

### SUMMARY:

All tests according to the regulations cited on page 5 were

■ - Performed

□ - **Not** Performed

The Equipment under Test

■ - **Fulfills** the general approval requirements.

□ - **Does not** fulfill the general approval requirements.

Sample Received Date: February 17, 2021

Testing Start Date: February 17, 2021


Testing End Date: February 24, 2021

-TÜV SÜD Certification and Testing (China) Co., Ltd. Shanghai Branch

Reviewed by:

Prepared by:

Tested by:



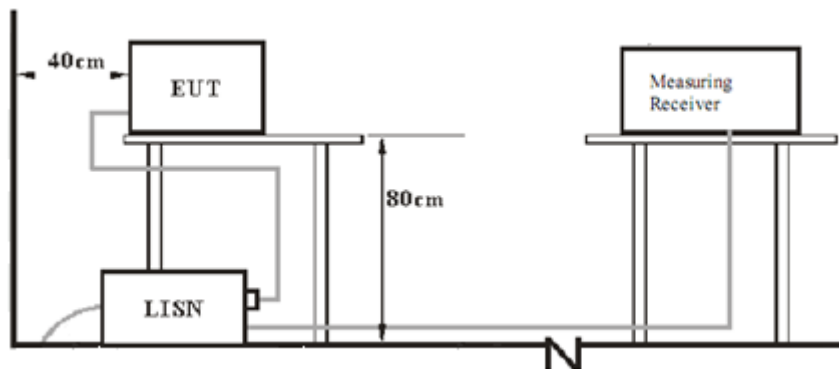
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Test Engineer

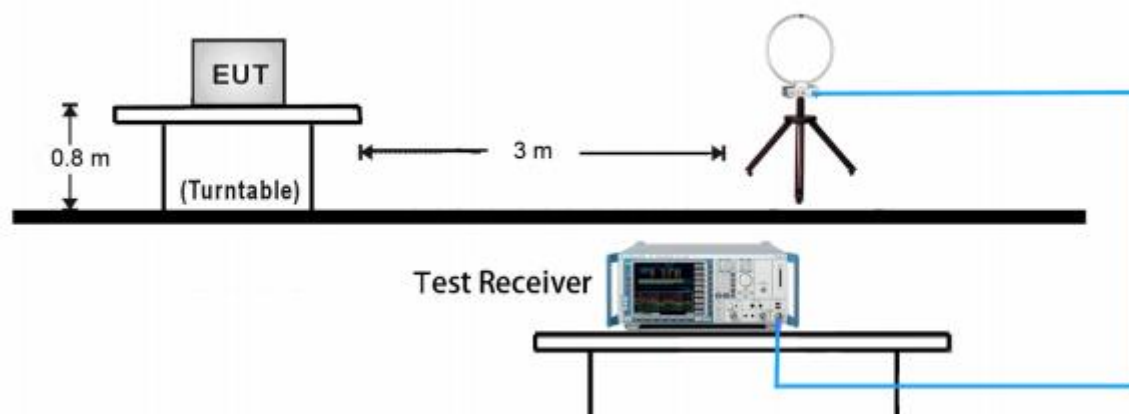
## 7 Test Setups

### 7.1 AC Power Line Conducted Emission test setups



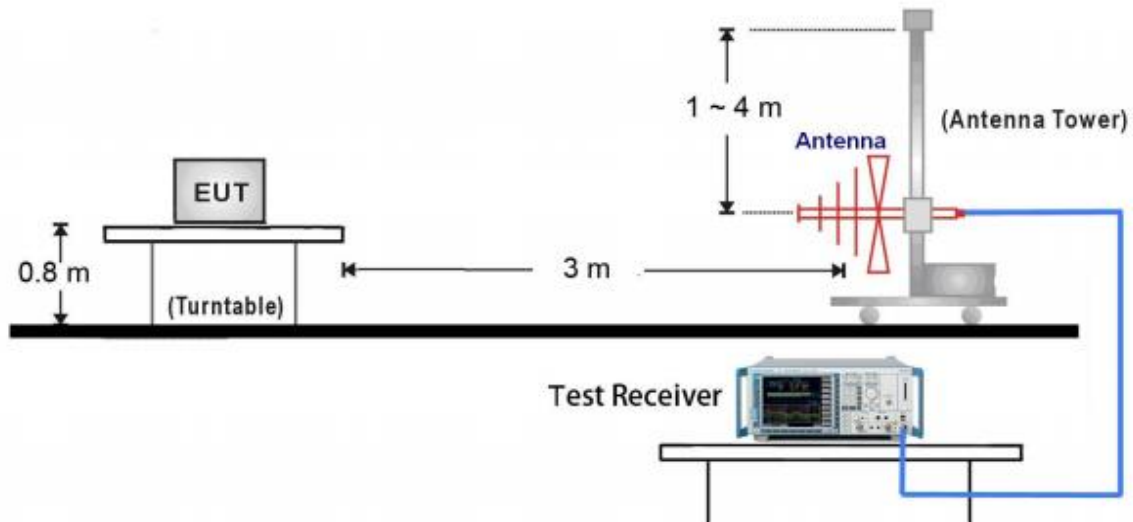
### 7.2 Radiated test setups

#### 9kHz ~ 30MHz Test Setup:

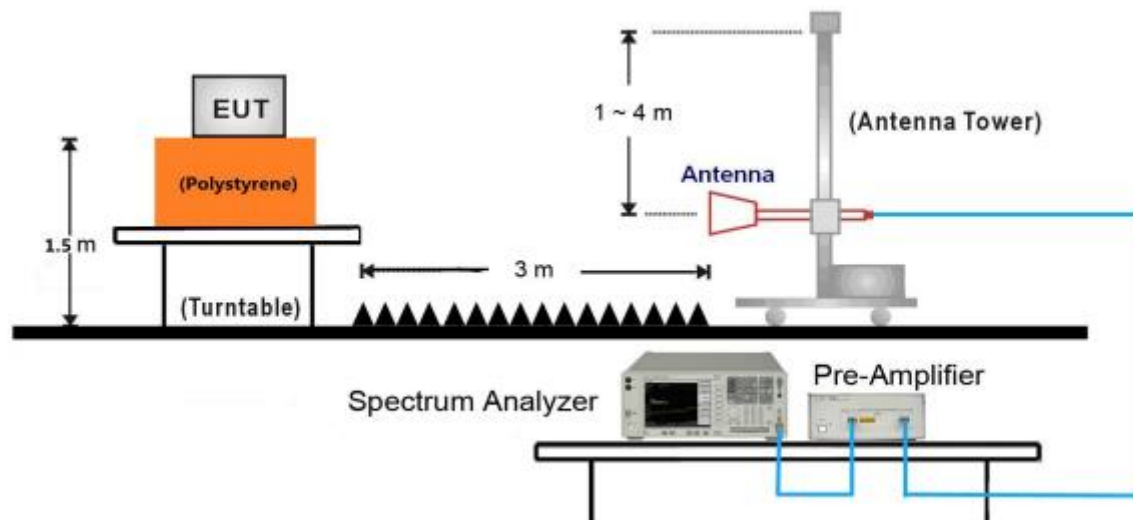




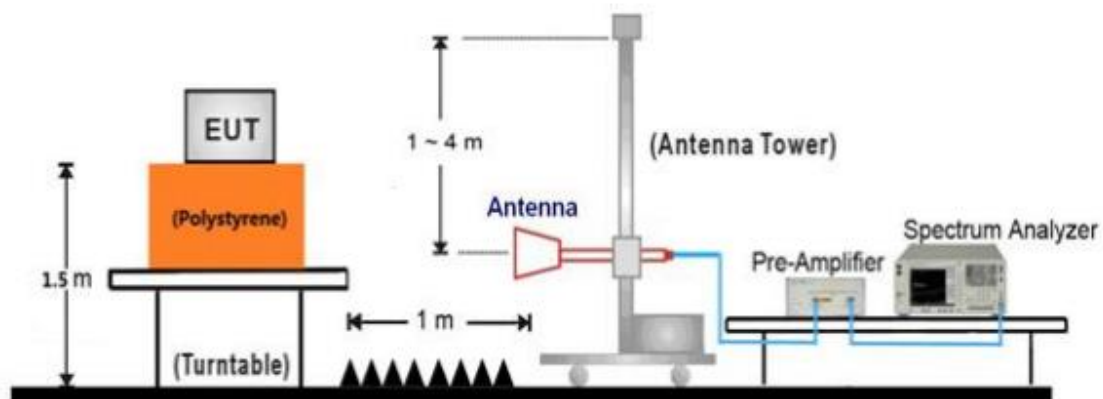
### 30MHz ~ 1GHz Test Setup:



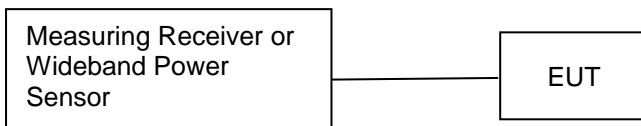
### 1GHz ~ 18GHz Test Setup:



### 18GHz ~ 40GHz Test Setup:



### 7.3 Conducted RF test setups



## 8 Systems test configuration

Auxiliary Equipment Used during Test:

DESCRIPTION	MANUFACTURER	MODEL NO.(SHIELD)	S/N(LENGTH)
Notebook	Lenove	E470	PF-OU5TS7 17/09

Test software: AmebaD\_mptool\_1V3 for Wi-Fi  
Bluetooth RF Test Tool (REALTEK) for BLE

The system was configured to channel 0, 19, and 39 for the test.

Non-hopping mode: The system was configured to operate at a signal channel transmitting. The test software allows the configuration and operation at the worst-case duty and the highest transmit power.

## 9 Technical Requirement

### 9.1 Conducted Emission

#### Test Method

1. The EUT was placed on a table, which is 0.8m above ground plane
2. The power line of the EUT is connected to the AC mains through a Artificial Mains Network (A.M.N.).
3. Maximum procedure was performed to ensure EUT compliance
4. A EMI test receiver is used to test the emissions from both sides of AC line

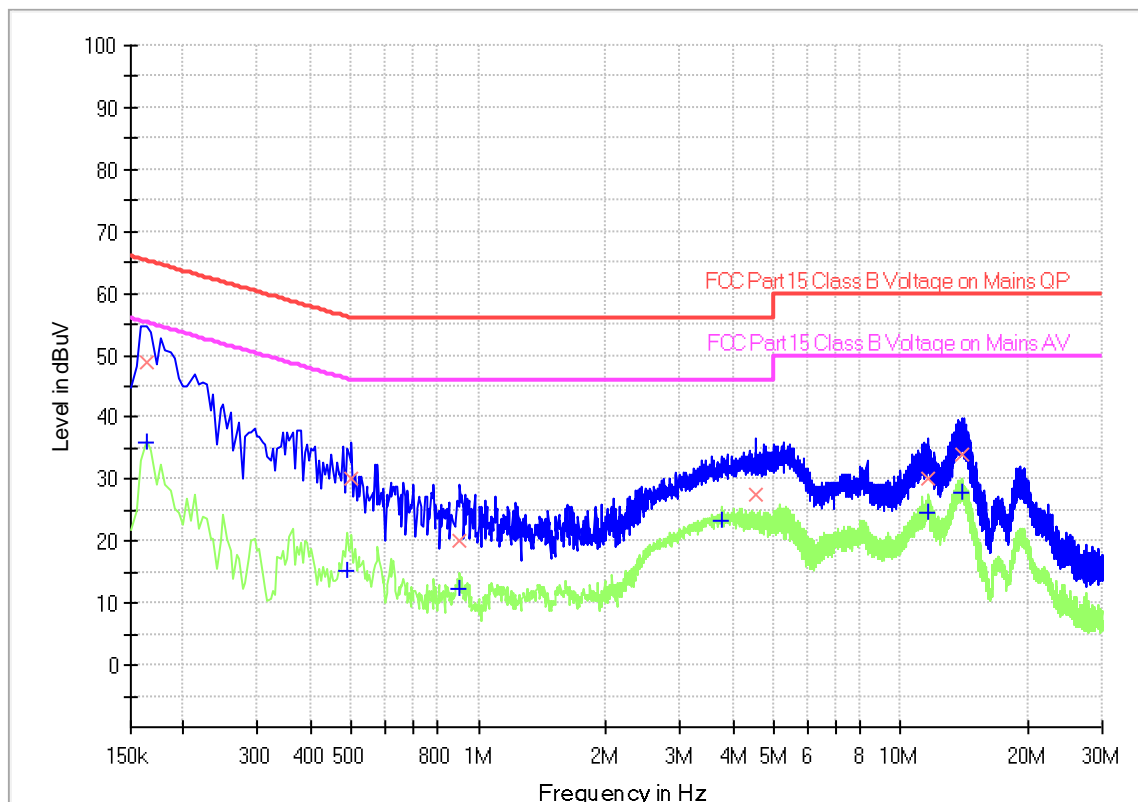
#### Limit

Frequency MHz	QP Limit dB $\mu$ V	AV Limit dB $\mu$ V
0.150-0.500	66-56*	56-46*
0.500-5	56	46
5-30	60	50

Decreasing linearly with logarithm of the frequency

## Conducted Emission

Product Type : Wi-Fi and Bluetooth module  
 M/N : CR2S  
 Operating Condition : Mode 1: Tx\_2480MHz for BLE  
 Test Specification : L-line  
 Comment : AC 120V/60Hz (powered by notebook)



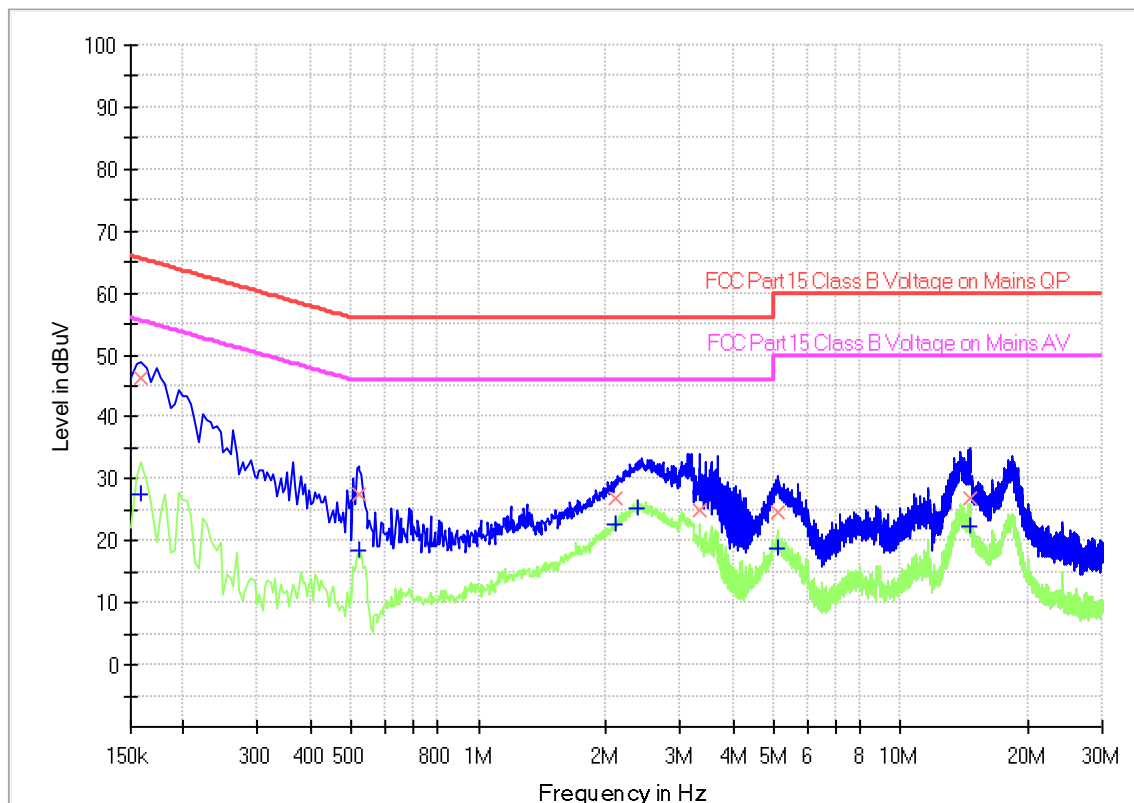
## Final Result

Frequency (MHz)	QuasiPeak (dBuV)	CAverage (dBuV)	Limit (dBuV)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Line	Corr. (dB)
0.163500	---	35.85	55.28	19.43	1000.0	9.000	L1	19.5
0.163500	48.94	---	65.28	16.34	1000.0	9.000	L1	19.5
0.487500	---	15.29	46.21	30.92	1000.0	9.000	L1	19.5
0.501000	30.12	---	56.00	25.88	1000.0	9.000	L1	19.5
0.901500	---	12.37	46.00	33.63	1000.0	9.000	L1	19.5
0.901500	19.98	---	56.00	36.02	1000.0	9.000	L1	19.5
3.754500	---	23.38	46.00	22.62	1000.0	9.000	L1	19.5
4.515000	27.42	---	56.00	28.58	1000.0	9.000	L1	19.5
11.571000	30.01	---	60.00	29.99	1000.0	9.000	L1	19.7
11.571000	---	24.51	50.00	25.49	1000.0	9.000	L1	19.7
13.915500	---	28.01	50.00	21.99	1000.0	9.000	L1	19.7
13.938000	33.96	---	60.00	26.04	1000.0	9.000	L1	19.7

Note 1: Measure Level (dBuV/m) = Reading Level (dBuV) + Factor (dB)

Factor (dB) = Cable Loss (dB) + LISN Factor (dB) + 10dB Attenuator

Product Type : Wi-Fi and Bluetooth module  
 M/N : CR2S  
 Operating Condition : Mode 1: Tx\_2480MHz for BLE  
 Test Specification : N-line  
 Comment : AC 120V/60Hz (powered by notebook)



## Final\_Result

Frequency (MHz)	QuasiPeak (dBuV)	CAverage (dBuV)	Limit (dBuV)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Line	Corr. (dB)
0.159000	---	27.59	55.52	27.93	1000.0	9.000	N	19.5
0.159000	46.40	---	65.52	19.12	1000.0	9.000	N	19.5
0.519000	---	18.38	46.00	27.62	1000.0	9.000	N	19.5
0.519000	27.66	---	56.00	28.34	1000.0	9.000	N	19.5
2.103000	26.78	---	56.00	29.22	1000.0	9.000	N	19.5
2.121000	---	22.68	46.00	23.32	1000.0	9.000	N	19.5
2.391000	---	25.30	46.00	20.70	1000.0	9.000	N	19.6
3.340500	25.07	---	56.00	30.93	1000.0	9.000	N	19.6
5.136000	24.53	---	60.00	35.47	1000.0	9.000	N	19.6
5.136000	---	18.73	50.00	31.27	1000.0	9.000	N	19.6
14.532000	---	22.22	50.00	27.78	1000.0	9.000	N	19.8
14.586000	27.04	---	60.00	32.96	1000.0	9.000	N	19.8

Note 1: Measure Level (dBuV/m) = Reading Level (dBuV) + Factor (dB)  
 Factor (dB) = Cable Loss (dB) + LISN Factor (dB) + 10dB Attenuator

## 9.2 Conducted peak output power

### Test Method

1. Use the following spectrum analyzer settings:  
RBW > the 6 dB bandwidth of the emission being measured, VBW $\geq$ 3RBW, Span $\geq$ 3RBW  
Sweep = auto, Detector function = peak, Trace = max hold.
2. Add a correction factor to the display.
3. Use a power meter to measure the conducted peak output power.

### Limits

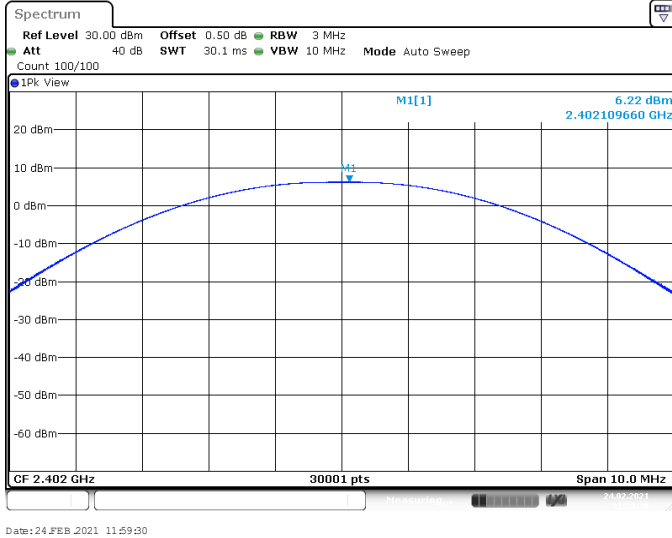
Frequency Range MHz	Limit W	Limit dBm
2400-2483.5	$\leq 1$	$\leq 30$

Test result as below table

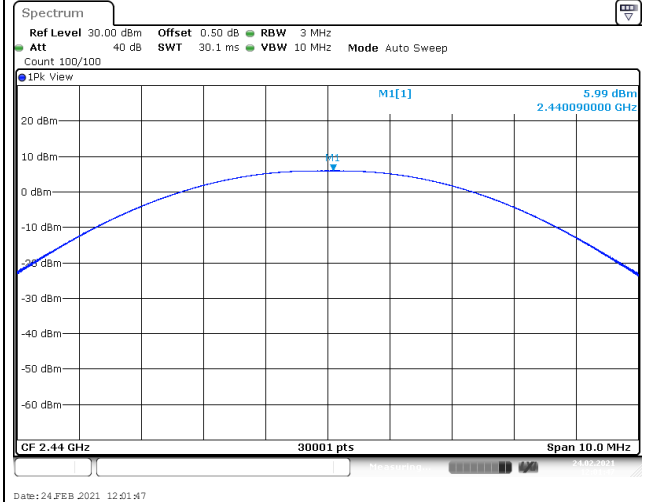
Frequency MHz	Conducted Peak Output Power dBm	Data transmission rate	Result
Low channel 2402MHz	6.22	1Mbps	Pass
Middle channel 2440MHz	5.99	1Mbps	Pass
High channel 2480MHz	6.30	1Mbps	Pass

## Peak output power

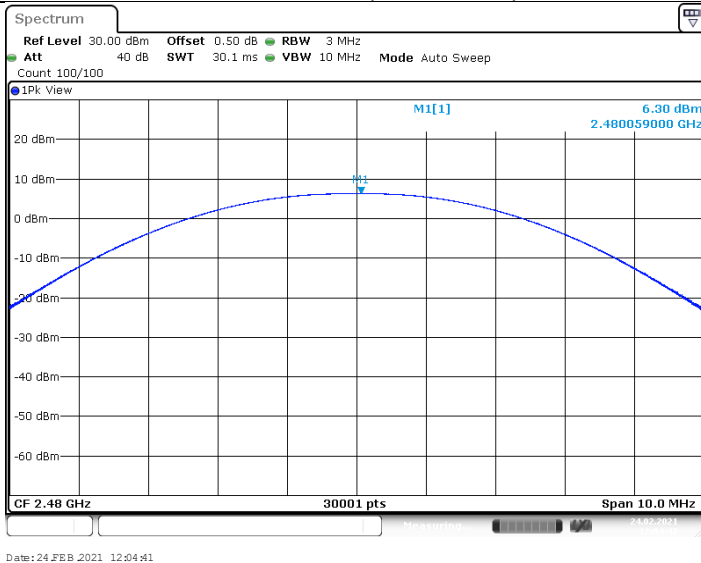
## Channel 0 (2402MHz)



## Channel 19 (2440MHz)



## Channel 39 (2480MHz)



Note 1: Measure Level (dBuV/m) = Reading Level (dBuV) + Factor (dB)  
Factor (dB) = Cable Loss (dB)





9.3 6dB bandwidth

Test Method

- 1. Use the following spectrum analyzer settings:  
RBW=100K, VBW≥3RBW, Sweep = auto, Detector function = peak, Trace = max hold
- 2. Use the automatic bandwidth measurement capability of an instrument, may be employed using the X dB bandwidth mode with X set to 6 dB, care shall be taken so that the bandwidth measurement is not influenced by any intermediate power nulls in the fundamental emission that might be ≥ 6 dB.
- 3. Allow the trace to stabilize, record the X dB Bandwidth value.

Limit

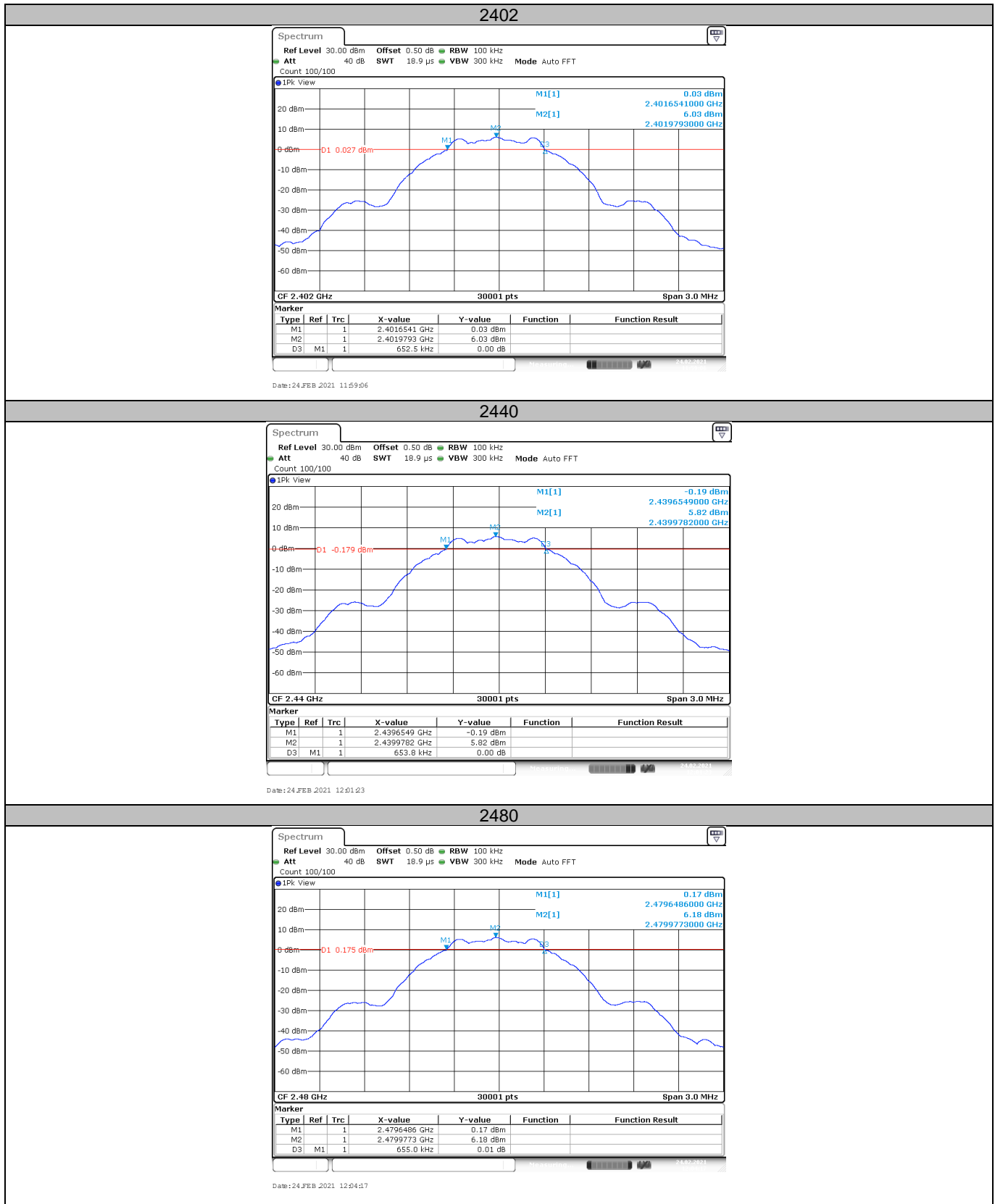
Limit [kHz]

\_\_\_\_\_

≥500

Test result

Frequency	6dB bandwidth	Data transmission rate	Result
MHz	kHz		
Top channel 2402MHz	0.652	1Mbps	Pass
Middle channel 2440MHz	0.654	1Mbps	Pass
Bottom channel 2480MHz	0.655	1Mbps	Pass

**6dB Bandwidth**

9.4 Power spectral density

Test Method

This procedure shall be used if maximum peak conducted output power was used to demonstrate compliance:

- 1. Set analyzer center frequency to DTS channel center frequency.  
RBW=3kHz,VBW≥3RBW,Span=1.5 times DTS bandwidth, Detector=Peak, Sweep=auto, Trace= max hold.
- 2. Allow trace to fully stabilize, use the peak marker function to determine the maximum amplitude level within the RBW.
- 3. Repeat above procedures until other frequencies measured were completed.

Limit

Limit [dBm/3kHz]

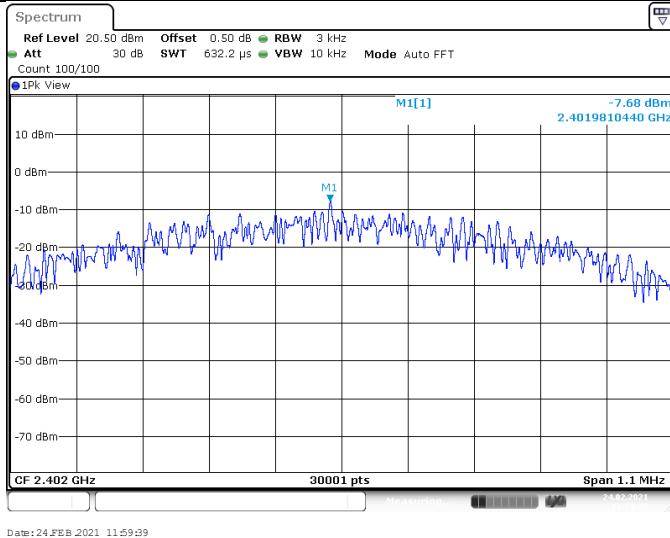
≤8

Test result

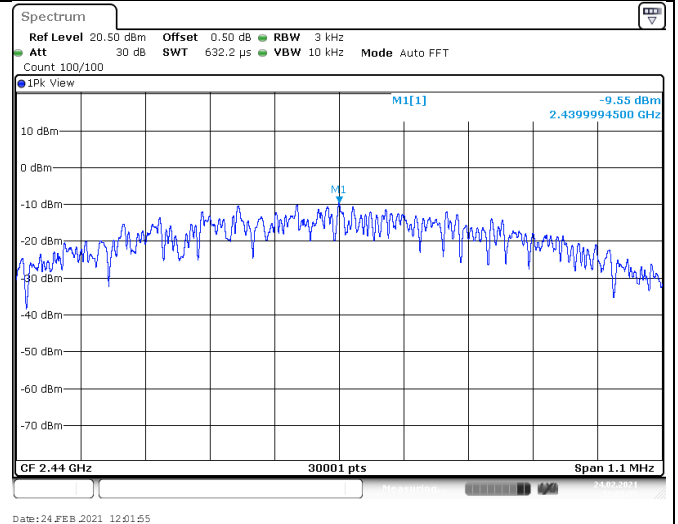
Frequency MHz	Power spectral density dBm/3kHz	Result
Top channel 2402MHz	-7.68	Pass
Middle channel 2440MHz	-9.55	Pass
Bottom channel 2480MHz	-10.57	Pass

## PK PSD

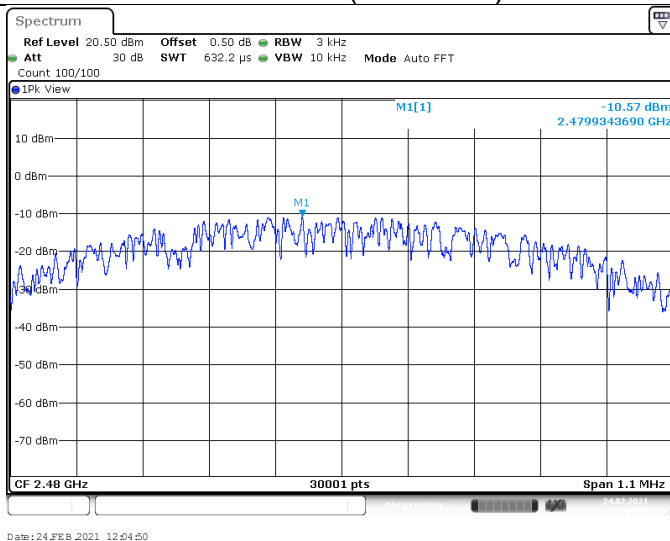
## Channel 0 (2402MHz)



## Channel 19 (2440MHz)



## Channel 39 (2480MHz)



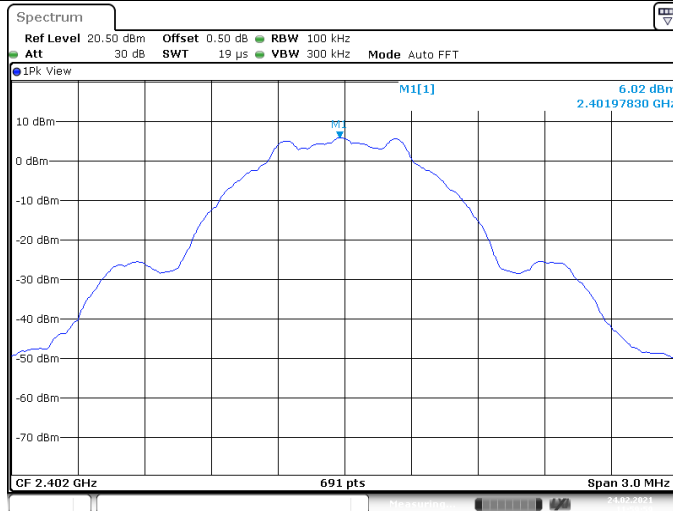
## 9.5 Spurious RF conducted emissions

### Test Method

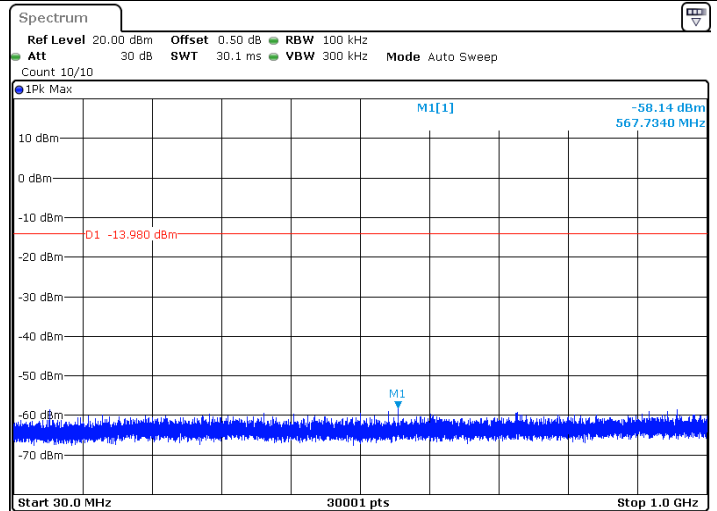
1. Establish a reference level by using the following procedure:
  - a. Set RBW=100 kHz. VBW $\geq$ 3RBW. Detector =peak, Sweep time = auto couple, Trace mode = max hold.
  - b. Allow trace to fully stabilize, use the peak marker function to determine the maximum PSD level.
2. Use the maximum PSD level to establish the reference level.
  - a. Set the center frequency and span to encompass frequency range to be measured.
  - b. Use the peak marker function to determine the maximum amplitude level. Ensure that the amplitude of all unwanted emissions outside of the authorized frequency band (excluding restricted frequency bands) are attenuated by at least the minimum requirements, report the three highest emissions relative to the limit.
3. Repeat above procedures until other frequencies measured were completed.

### Limit

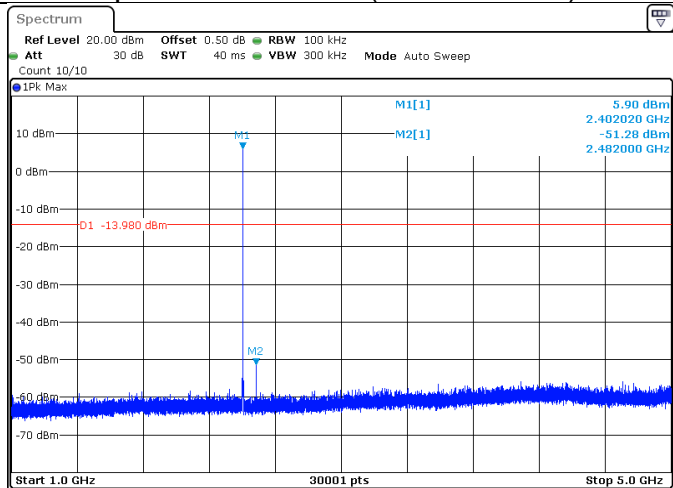
Frequency Range MHz	Limit (dBc)
30-25000	-20

**Spurious RF conducted emissions****Out-of-Band Emissions  
Channel 0 (2402MHz)****Reference point**

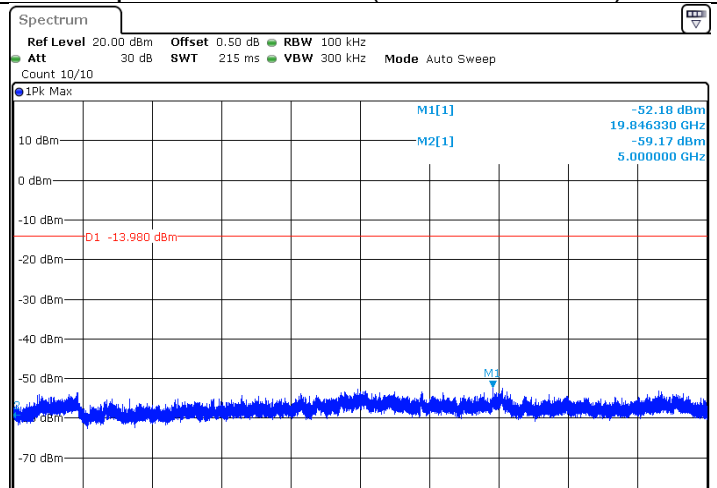
Date: 24 FEB 2021 11:59:59

**Spurious Emission (30MHz – 1GHz)**

Date: 24 FEB 2021 12:00:06

**Spurious Emission (1GHz –5GHz)**

Date: 24 FEB 2021 12:00:21

**Spurious Emission (5GHz –26.5GHz)**

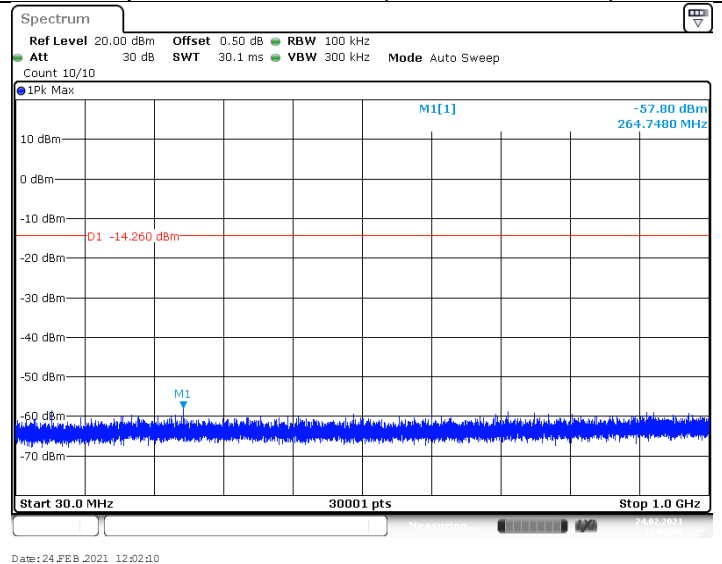
Date: 24 FEB 2021 12:00:55

## Out-of-Band Emissions Channel 19 (2440MHz)

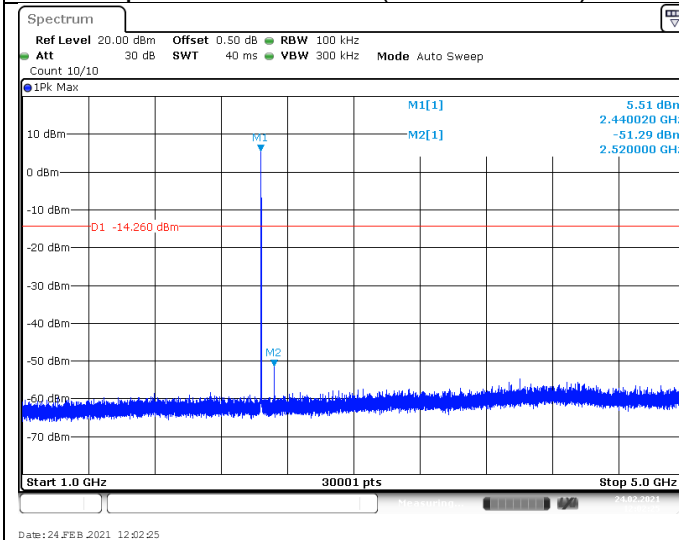
### Reference point



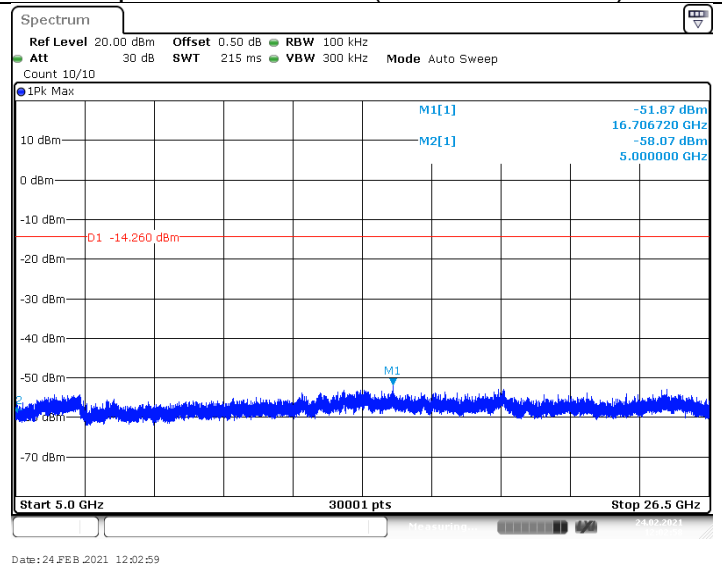
### Spurious Emission (30MHz – 1GHz)



### Spurious Emission (1GHz – 5GHz)



### Spurious Emission (5GHz – 26.5GHz)

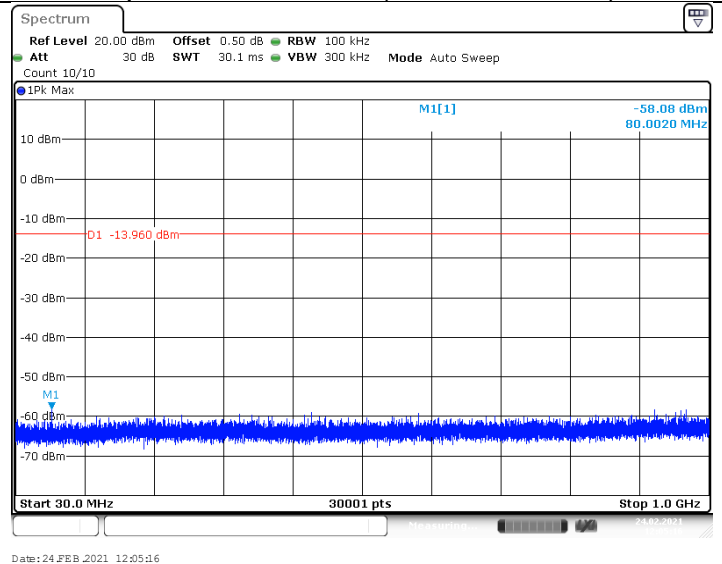
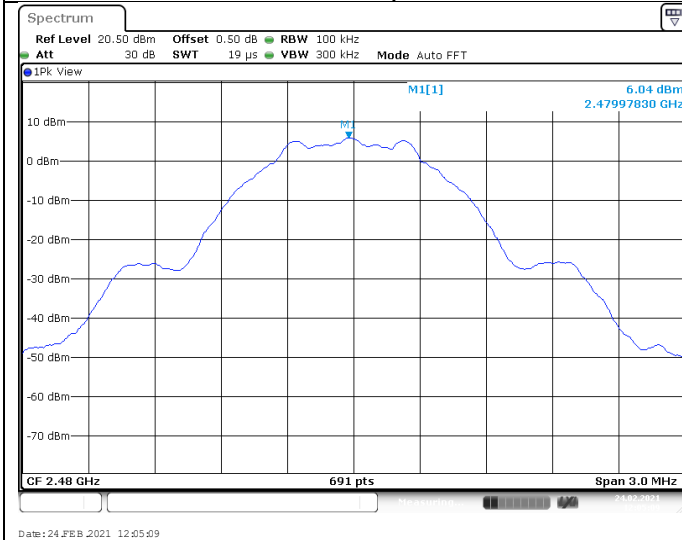


## Out-of-Band Emissions

## Channel 39 (2480MHz)

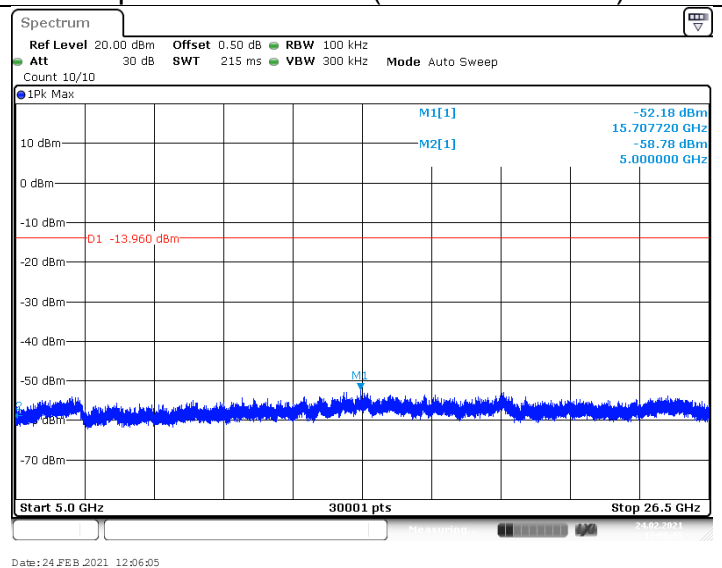
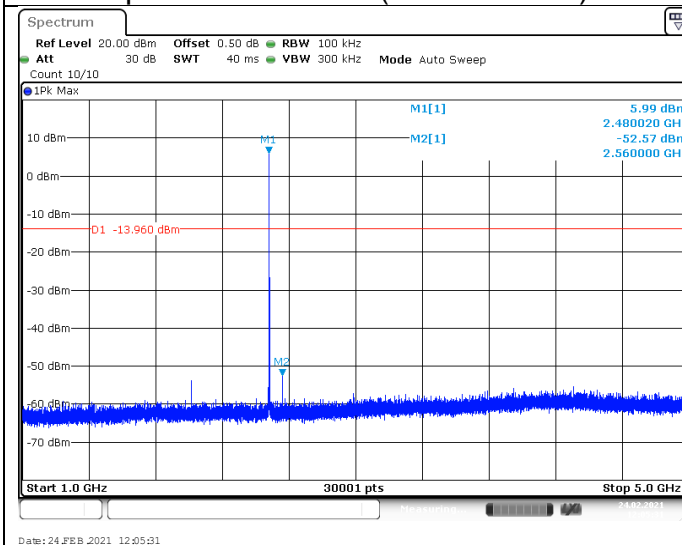
## Reference point

## Spurious Emission (30MHz – 1GHz)



## Spurious Emission (1GHz – 5GHz)

## Spurious Emission (5GHz – 26.5GHz)



Note 1: Measure Level (dBuV/m) = Reading Level (dBuV) + Factor (dB)  
Factor (dB) = Cable Loss (dB)



## 9.6 Band edge

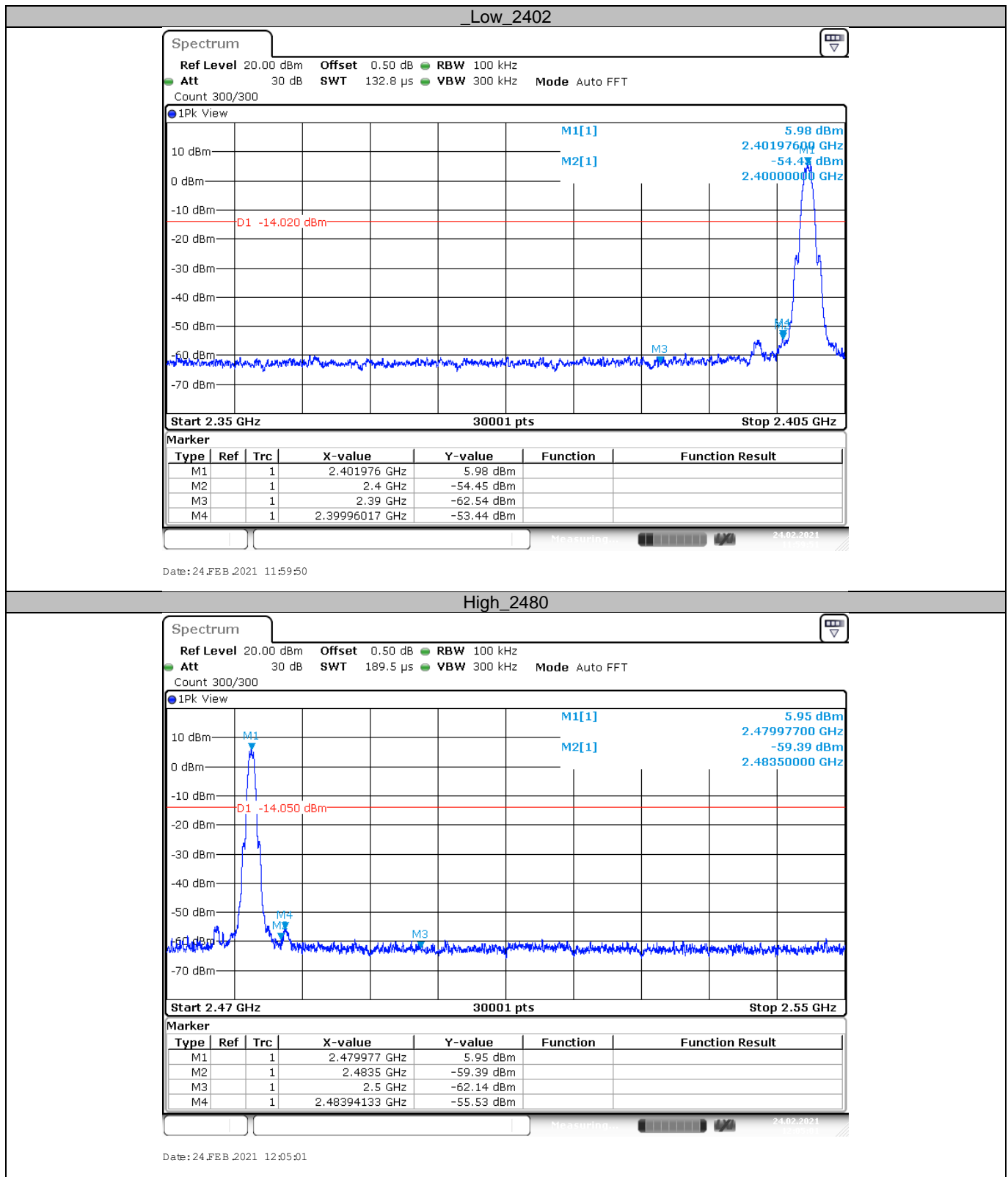
### Test Method

- 1 Use the following spectrum analyzer settings:  
Span = wide enough to capture the peak level of the in-band emission and all spurious  
RBW = 100 kHz, VBW $\geq$ RBW, Sweep = auto, Detector function = peak, Trace = max hold.
- 2 Allow the trace to stabilize, use the peak and delta measurement to record the result.
- 3 The level displayed must comply with the limit specified in this Section.

### Limit

According to §15.247(d) and RSS-247 5.5, in any 100 kHz bandwidth outside the frequency bands in which the spread spectrum intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement, provided the transmitter demonstrates compliance with the peak conducted power limits. In addition, radiated emissions which fall in the restricted bands, as defined in §15.205(a) and RSS-Gen 8.10, must also comply with the radiated emission limits specified in 15.209(a) (see Section 15.205(c)) and RSS-Gen.

## Test result



## 9.7 Spurious radiated emissions for transmitter

### Test Method

1. The EUT was placed on a turn table which is 1.5m above ground plane for above 1GHz and 0.8m above ground for below 1GHz at 3 meter chamber room for test. The table was rotated 360 degrees to determine the position of the highest radiation.
2. The EUT was set 3 meters away from the interference – receiving antenna, which was mounted on the top of a variable – height antenna tower.
3. The height of antenna is varied from one meter to four meters above the ground to determine the maximum value of the field strength. Both horizontal and vertical polarizations of the antenna are set to make the measurement.
4. For each suspected emission, the EUT was arranged to its worst case and then the antenna was tuned to heights from 1 meter to 4 meters and the rotatable table was turned from 0 degrees to 360 degrees to find the maximum reading.
5. Use the following spectrum analyzer settings According to C63.10:

#### For Below 1GHz

Use the following spectrum analyzer settings:

Span = wide enough to capture the peak level of the in-band emission and all spurious  
RBW = 100 kHz to 120 kHz, VBW ≥ RBW for peak measurement, Sweep = auto, Detector function = peak, Trace = max hold.

#### For Peak unwanted emissions Above 1GHz:

Span = wide enough to capture the peak level of the in-band emission and all spurious  
RBW = 1MHz, VBW ≥ RBW for peak measurement, Sweep = auto, Detector function = peak, Trace = max hold.

#### Procedures for average unwanted emissions measurements above 1000 MHz

- a) RBW = 1MHz.
- b)  $VBW \geq [3 \times RBW]$ .
- c) Detector = RMS (power averaging), if  $[\text{span} / (\# \text{ of points in sweep})] \leq RBW / 2$ .  
Satisfying this condition can require increasing the number of points in the sweep or reducing the span. If the condition is not satisfied, then the detector mode shall be set to peak.
- d) Averaging type = power (i.e., rms) (As an alternative, the detector and averaging type may be set for linear voltage averaging. Some instruments require linear display mode to use linear voltage averaging. Log or dB averaging shall not be used.)
- e) Sweep time = auto.
- f) Perform a trace average of at least 100 traces if the transmission is continuous. If the transmission is not continuous, then the number of traces shall be increased by a factor of  $1 / D$ , where  $D$  is the duty cycle. For example, with 50% duty cycle, at least 200 traces shall be averaged. (If a specific emission is demonstrated to be continuous—i.e., 100% duty cycle—then rather than turning ON and OFF with the transmit cycle, at least 100 traces shall be averaged.)
- g) If tests are performed with the EUT transmitting at a duty cycle less than 98%, then a correction factor shall be added to the measurement results prior to comparing with the emission limit, to compute the emission level that would have been measured had the test been performed at 100% duty cycle. The correction factor is computed as follows:

- 1) If power averaging (rms) mode was used in the preceding step e), then the correction factor is  $[10 \log (1 / D)]$ , where D is the duty cycle. For example, if the transmit duty cycle was 50%, then 3 dB shall be added to the measured emission levels.
- 2) If linear voltage averaging mode was used in the preceding step e), then the correction factor is  $[20 \log (1 / D)]$ , where D is the duty cycle. For example, if the transmit duty cycle was 50%, then 6 dB shall be added to the measured emission levels.
- 3) If a specific emission is demonstrated to be continuous (100% duty cycle) rather than turning ON and OFF with the transmit cycle, then no duty cycle correction is required for that emission.

## Limit

The radio emission outside the operating frequency band shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power. Radiated emissions which fall in the restricted bands, as defined in section 15.205 and RSS-GEN 8.10 must comply with the radiated emission limits specified in section 15.209.

Frequency MHz	Field Strength uV/m	Measured Distance Meters
0.009~0.490	2400/F (kHz)	300
0.490~1.705	24000/F (kHz)	30
1.705~30	30	30

Frequency MHz	Field Strength uV/m	Field Strength dBuV/m	Detector
30-88	100	40	QP
88-216	150	43.5	QP
216-960	200	46	QP
960-1000	500	54	QP
Above 1000	500	54	AV
Above 1000	5000	74	PK

### Spurious radiated emissions for transmitter

According to C63.10, if the peak (or quasi-peak) measured value complies with the average limit, it is unnecessary to perform an average measurement, so AV emission value did not show in below table if the peak value complies with average limit.

Pre-scan with three orthogonal axis and worst case as X axis. The only worse case test result is listed in the report.

### Test result

Test mode: GFSK					
Channel 0 (2402MHz)					
Frequency (MHz)	Measure Level (dBuV/m)	Limit (dBuV/M)	Margin (dB)	Detector	Polarization
2383.3	45.01	74.0	28.99	Peak	Horizontal
4805.4	44.31	74.0	29.69	Peak	Horizontal
2385.5	44.60	74.0	29.40	Peak	Vertical
4804.0	44.08	74.0	29.92	Peak	Vertical

Test mode: GFSK					
Channel 19 (2440MHz)					
Frequency (MHz)	Measure Level (dBuV/m)	Limit (dBuV/M)	Margin (dB)	Detector	Polarization
4879.4	46.76	74.0	27.24	Peak	Horizontal
4879.4	45.81	74.0	28.19	Peak	Vertical

Test mode: GFSK					
Channel 39 (2480MHz)					
Frequency (MHz)	Measure Level (dBuV/m)	Limit (dBuV/M)	Margin (dB)	Detector	Polarization
2483.5	47.05	74.0	26.95	Peak	Horizontal
4959.4	45.99	74.0	28.01	Peak	Horizontal
2483.5	46.15	74.0	27.85	Peak	Vertical
4959.4	46.26	74.0	27.74	Peak	Vertical

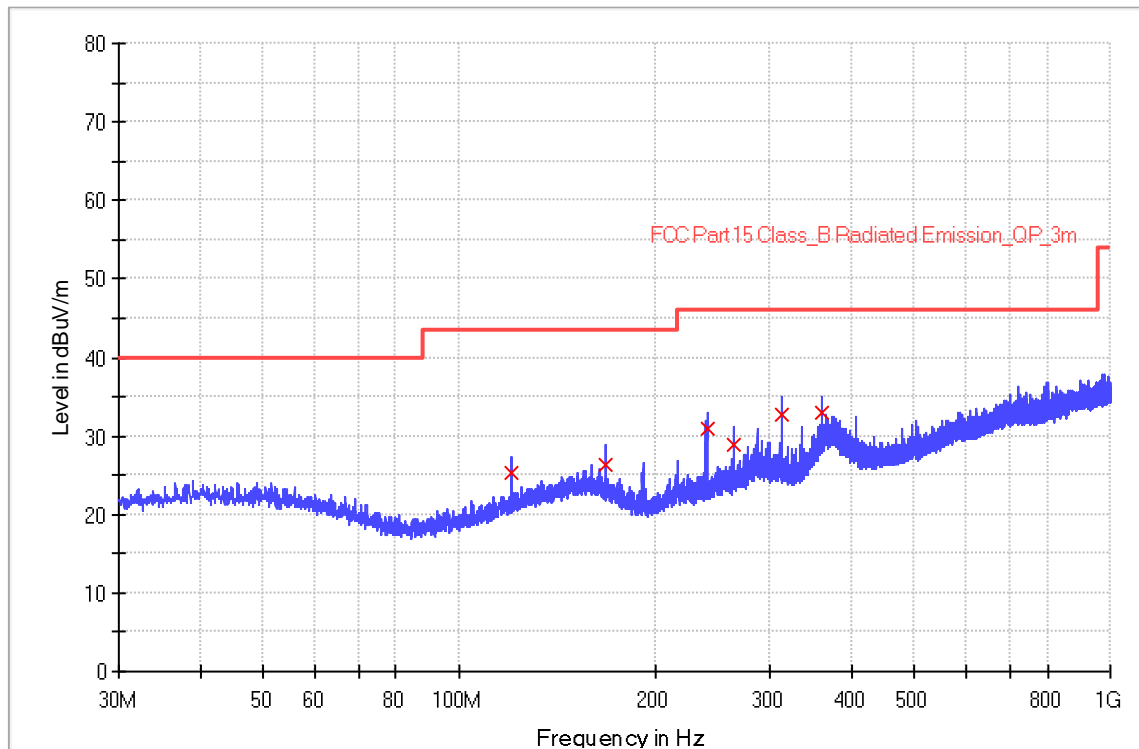
### Remark:

- (1) Emission level= Original Receiver Reading + Correct Factor
- (2) Correct Factor = Antenna Factor + Cable Loss -Amplifier gain
- (3) Margin = limit – Corrected Reading

## The worst case of Radiated Emission below 1GHz:

Site: 3 meter chamber	Time: 2021/02/23 - 12:09
Limit: FCC_Part15.209_RE(3m)_ClassB	Engineer: Jiaxi XU
Probe: VULB9168	Polarity: Horizontal
EUT: Wi-Fi and Bluetooth Module, Model no: CR2S	Power: DC 3.3V by debug board for EUT, AC 120V,60Hz for notebook
Note: Transmit by at channel 2480MHz.	
Note: Pre-scan with three orthogonal axis and worst case as X axis	

RE\_VULB9168\_pre\_Cont\_30-1000



## Limit and Margin

Frequency (MHz)	QuasiPeak (dBuV/m)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)	Margin - QPK (dB)	Limit - QPK (dBuV/m)
120.000000	25.3	1000.0	120.000	100.2	H	153.0	13.5	18.2	43.5
168.040000	26.3	1000.0	120.000	100.2	H	326.0	14.9	17.2	43.5
240.000000	30.9	1000.0	120.000	100.2	H	61.0	13.4	15.1	46.0
263.960000	28.9	1000.0	120.000	100.2	H	174.0	13.9	17.1	46.0
312.040000	32.8	1000.0	120.000	100.2	H	198.0	15.3	13.3	46.0
359.960000	33.0	1000.0	120.000	100.2	H	125.0	16.5	13.0	46.0

Note 1: Measure Level (dBuV/m) = Reading Level (dBuV) + Factor (dB)

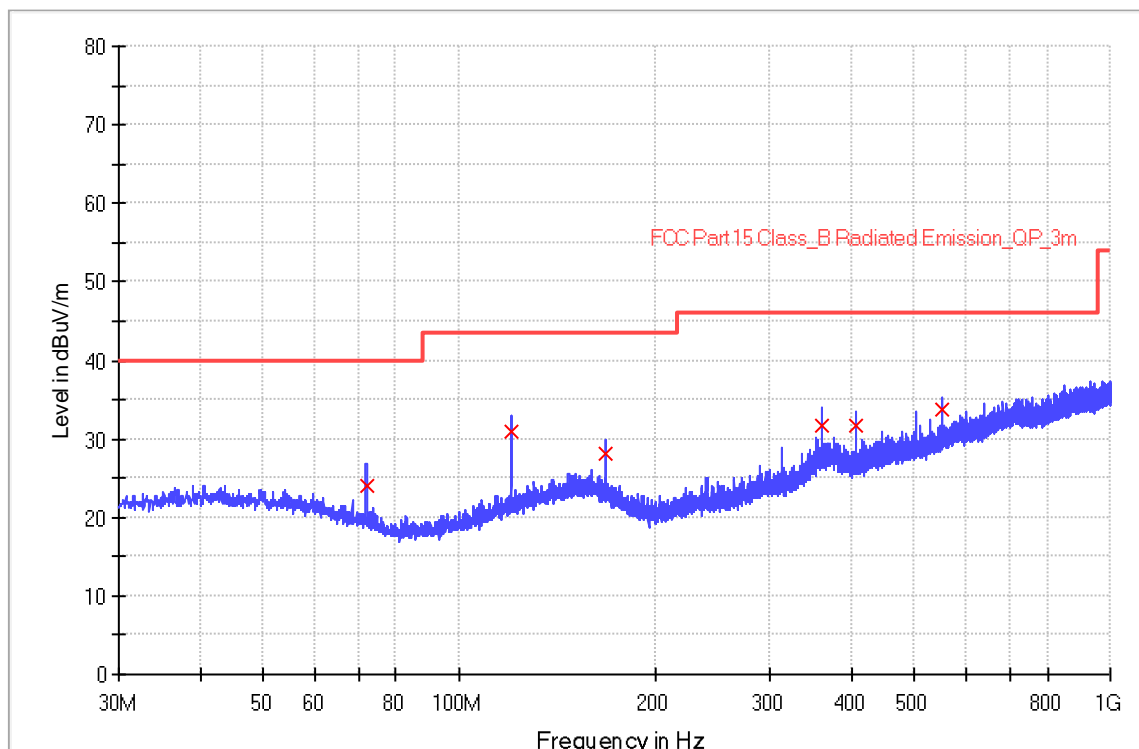
Factor (dB) = Cable Loss (dB) + Antenna Factor (dB/m)

Note 2: The test trace is same as the ambient noise and the amplitude of the emissions are attenuated more than 20dB below the permissible (the test frequency range: 9kHz ~ 30MHz, 18GHz ~ 25GHz), therefore no data appear in the report.

## The worst case of Radiated Emission below 1GHz:

Site: 3 meter chamber	Time: 2021/02/23 - 12:45
Limit: FCC_Part15.209_RE(3m)_ClassB	Engineer: Jiaxi XU
Probe: VULB9168	Polarity: Vertical
EUT: Wi-Fi and Bluetooth Module, Model no: CR2S	Power: DC 3.3V by debug board for EUT, AC 120V,60Hz for notebook
Note: Transmit by at channel 2480MHz.	
Note: Pre-scan with three orthogonal axis and worst case as X axis	

RE\_VULB9168\_pre\_Cont\_30-1000



## Limit and Margin

Frequency (MHz)	QuasiPeak (dBuV/m)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)	Margin - QPK (dB)	Limit - QPK (dBuV/m)
71.960000	24.0	1000.0	120.000	100.2	V	125.0	11.5	16.0	40.0
120.000000	31.0	1000.0	120.000	100.2	V	84.0	13.5	12.5	43.5
168.040000	28.1	1000.0	120.000	100.2	V	174.0	14.9	15.4	43.5
359.960000	31.7	1000.0	120.000	100.2	V	236.0	16.5	14.3	46.0
407.960000	31.6	1000.0	120.000	100.2	V	314.0	17.5	14.4	46.0
551.960000	33.7	1000.0	120.000	100.2	V	110.0	20.6	12.3	46.0

Note 1: Measure Level (dBuV/m) = Reading Level (dBuV) + Factor (dB)

Factor (dB) = Cable Loss (dB) + Antenna Factor (dB/m)

Note 2: The test trace is same as the ambient noise and the amplitude of the emissions are attenuated more than 20dB below the permissible (the test frequency range: 9kHz ~ 30MHz, 18GHz ~ 25GHz), therefore no data appear in the report.

## 10 Test Equipment List

List of Test Instruments  
Test Site1

	DESCRIPTION	MANUFACTURER	MODEL NO.	SERIAL NO.	CAL. DATE	CAL. DUE DATE
C	Signal Analyzer	Rohde & Schwarz	FSV40	101091	2020-8-4	2021-8-3
RE	EMI Test Receiver	Rohde & Schwarz	ESR3	101906	2020-8-4	2021-8-3
	Signal Analyzer	Rohde & Schwarz	FSV40	101091	2020-8-4	2021-8-3
	Trilog Super Broadband Test Antenna	Schwarzbeck	VULB 9168	961	2019-3-16	2022-3-15
	Horn Antenna	Rohde & Schwarz	HF907	102393	2018-6-11	2021-4-1
	Pre-amplifier	Rohde & Schwarz	SCU-18D	19006451	2020-8-4	2021-8-3
	Loop antenna	Rohde & Schwarz	HFH2-Z2	100443	2020-3-14	2021-3-13
	DOUBLE-RIDGED WAVEGUIDE HORN WITH PRE-AMPLIFIER (18 GHZ - 40 GHZ)	ETS-Lindgren	3116C-PA	002222727	2020-9-23	2021-9-22
	3m Semi-anechoic chamber	TDK	9X6X6	----	2018-5-11	2021-5-10
CE	EMI Test Receiver	Rohde & Schwarz	ESR3	101907	2020-8-4	2021-8-3
	LISN	Rohde & Schwarz	ENV216	101924	2020-8-4	2021-8-3

Measurement Software Information			
Test Item	Software	Manufacturer	Version
C	Bluetooth and WiFi Test System	Shenzhen JS tonscond co.,ltd	2.6.77.0518
RE	EMC 32	Rohde & Schwarz	V9.15.00
CE	EMC 32	Rohde & Schwarz	V9.15.03

### C - Conducted RF tests

- Conducted peak output power
- 6dB bandwidth and 99% Occupied Bandwidth
- Power spectral density\*
- Spurious RF conducted emissions
- Band edge



## 11 System Measurement Uncertainty

For a 95% confidence level, the measurement expanded uncertainties for defined systems, in accordance with the recommendations of ISO 17025 were:

Items	Extended Uncertainty
Conducted Disturbance at Mains Terminals	150kHz to 30MHz, LISN, $\pm 3.16\text{dB}$
Radiated Disturbance	30MHz to 1GHz, $\pm 5.03\text{dB}$ (Horizontal) $\pm 5.12\text{dB}$ (Vertical) 1GHz to 18GHz, $\pm 5.49\text{dB}$ 18GHz to 40GHz, $\pm 5.63\text{dB}$
Carrier power conducted measurement	50MHz~18GHz, $\pm 1.238\text{dB}$
Spurious Emission Conducted Measurement	9kHz ~40GHz, $\pm 1.224\text{dB}$



## 12 Photographs of Test Set-ups

Refer to the < Test Setup photos >.



## **13 Photographs of EUT**

Refer to the < External Photos > & < Internal Photos >.

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THE END