# RADIO TEST REPORT
# MIC Public Notice 88

**Test report**
**On Behalf of**
**Igloohome Pte Ltd**
**For**
**Mortise 2**
**Model No.: IGM3**

| | |
|---|---|
| **Prepared for :** | **Igloohome Pte Ltd**<br>**67 Ayer Rajah Crescent #03-25/26 Singapore 139950** |
| **Prepared By :** | **Shenzhen HUAK Testing Technology Co., Ltd.**<br>**1F, B2 Building, Junfeng Zhongcheng Zhizao Innovation Park,**<br>**Heping Community, Fuhai Street, Bao'an District, Shenzhen, China** |
| **Date of Test:** | **Nov. 06, 2019 ~ Nov. 13, 2019** |
| **Date of Report:** | **Nov. 13, 2019** |
| **Report Number:** | **HK1911082829-E** |

# TEST RESULT CERTIFICATION

| | | |
|---|---|---|
| **Applicant's name** | : | Igloohome Pte Ltd |
| Address | : | 67 Ayer Rajah Crescent #03-25/26 Singapore 139950 |
| **Manufacture's Name** | : | Igloohome Pte Ltd |
| Address | : | 67 Ayer Rajah Crescent #03-25/26 Singapore 139950 |

**Product description**

| | | |
|---|---|---|
| Trade Mark: | | Igloohome |
| Product name | : | Mortise 2 |
| Model and/or type reference | : | IGM3 |
| **Standards** | : | MIC Public Notice 88:2004, annex 1 and annex 43<br>ARIB STD-T66 V3.7 |



| | | |
|---|---|---|
| **Date of Test** | : | |
| Date (s) of performance of tests | : | Nov. 06, 2019 ~ Nov. 13, 2019 |
| Date of Issue | : | Nov. 13, 2019 |
| Test Result | : | **Pass** |

Prepared by: Gary Qian
Project Engineer

Reviewed by: Leo Zhang
Project Supervisor

Approved by: James Zhou
Technical Director

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**APPENDIX-PHOTOGRAPHS OF EUT CONSTRUCTIONAL DETAILS**

## 1. SUMMARY OF TEST RESULTS

Test procedures according to the technical standards:

| Part | Rule Section | Description of Test | Result |
|---|---|---|---|
| 4.1 | 3.2 | Frequency Error | Complies |
| 4.2 | 3.2 | Antenna Power<br>Antenna Power Error | Complies |
| 4.3 | 3.2 | Occupied Bandwidth (99%) and<br>Spread-spectrum<br>Bandwidth (90%) | Complies |
| 4.4 | 3.2 | Unwanted Emission Intensity | Complies |
| 4.5 | 3.2 | Limitation of Collateral Emission of Receiver | Complies |
| 4.6 | 3.2 | Transmission Antenna Gain (EIRP Antenna Power) | N/A |
| 4.7 | 3.2 | Transmission Radiation Angle Width (3dB Beamwidth) | N/A |
| 4.8 | 3.2 | Radio Interference Prevention Capability | Complies |
| 4.9 | / | Carrier Sense Capability | N/A |

NOTE:

(1)” N/A” denotes test is not applicable in this Test Report

(2) MIC Public Notice 88:2004, annex 1 and annex 43

(3) MIC Ordinance Regulating Radio Equipment Section 4.17 of Article 49.20

(4) Referenced in the standard ARIB STD-T66

## 1.1 TEST FACILITY

Test Firm : Shenzhen HUAK Testing Technology Co., Ltd.

Address : 1F, B2 Building, Junfeng Zhongcheng Zhizao Innovation Park, Heping Community, Fuhai Street, Bao'an District, Shenzhen, China

## 1.2 MEASUREMENT UNCERTAINTY

The reported uncertainty of measurement **y ± U**，where expended uncertainty **U** is based on a standard uncertainty multiplied by a coverage factor of **k=2**，providing a level of confidence of approximately **95** %。

| No. | Item | Uncertainty |
|---|---|---|
| 1 | Conducted Emission Test | ±3.2dB |
| 2 | Radiated Emission Test | ±4.7dB |
| 3 | RF power,conducted | ±0.16dB |
| 4 | Spurious emissions,conducted | ±0.21dB |
| 5 | All emissions,radiated(<1G) | ±4.68dB |
| 6 | All emissions,radiated(>1G) | ±5.0dB |

# 2. GENERAL INFORMATION

## 2.1 GENERAL DESCRIPTION OF EUT

| | |
|---|---|
| Equipment | Mortise 2 |
| Model Name | IGM3 |
| Serial No | / |
| Trade Mark | Igloohome |
| Antenna Type | PCB Antenna |
| Antenna Gain | 0 dBi |
| Operation frequency | 2402-2480MHz |
| Number of Channels | 40CH |
| Modulation Type | GFSK |
| Power Source | DC 6V By Battery |
| Power Rating | DC 6V By Battery |
| Firmware Version | V2.0 |
| Hardware Version | V2.0 |

Note:

1. For a more detailed features description, please refer to the manufacturer's specifications or the User's Manual.

2.

| Channel List | | | | | | | |
|---|---|---|---|---|---|---|---|
| Channel | Frequency (MHz) | Channel | Frequency (MHz) | Channel | Frequency (MHz) | Channel | Frequency (MHz) |
| 01 | 2402 | 11 | 2422 | 21 | 2442 | 31 | 2462 |
| 02 | 2404 | 12 | 2424 | 22 | 2444 | 32 | 2464 |
| 03 | 2406 | 13 | 2426 | 23 | 2446 | 33 | 2466 |
| 04 | 2408 | 14 | 2428 | 24 | 2448 | 34 | 2468 |
| 05 | 2410 | 15 | 2430 | 25 | 2450 | 35 | 2470 |
| 06 | 2412 | 16 | 2432 | 26 | 2452 | 36 | 2472 |
| 07 | 2414 | 17 | 2434 | 27 | 2454 | 37 | 2474 |
| 08 | 2416 | 18 | 2436 | 28 | 2456 | 38 | 2476 |
| 09 | 2418 | 19 | 2438 | 29 | 2458 | 39 | 2478 |
| 10 | 2420 | 20 | 2440 | 30 | 2460 | 40 | 2480 |

3.

Table for Filed Antenna

| Ant. | Brand | Model Name | Antenna Type | Connector | Gain (dBi) | NOTE |
|---|---|---|---|---|---|---|
| 1 | N/A | PIFA antenna | PCB antenna | N/A | 0 | |

## 2.2 DESCRIPTION OF TEST MODES

To investigate the maximum EMI emission characteristics generates from EUT, the test system was pre-scanning tested base on the consideration of following EUT operation mode or test configuration mode which possible have effect on EMI emission level. Each of these EUT operation mode(s) or test configuration mode(s) mentioned above was evaluated respectively.

| Pretest Mode | Description |
|---|---|
| Mode 1 | CH01:2402MHz |
| Mode 2 | CH20:2440MHz |
| Mode 3 | CH40:2480MHz |

## 2.3 TEST CONDITIONS

The RF module was tested while in a continuous transmitter/receiver mode.
The EUT was tuned to a low, middle, and high channel for all tests. For all test case pre/scans were completed in all Modes to determine worst case levels.

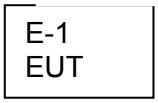
**Power Supply Voltage Fluctuation Test**

| Voltage mode | Input Voltage |
|---|---|
| DC Input | DC 5.40V |
| | DC 6.00V |
| | DC 6.60V |
| Note: 1 The radio unit Voltage with the module regulator IC regulator.<br>2 The radio unit less than 1%, so the test only rated voltage (Normal voltage) with the battery. | |

During the input supply voltage to the EUT from the external power source is varied by +/- 10%, if utput voltage had been confirmed that the fluctuation of power supply to the RF circuit of EUT (excluding power source) is equal to or less than +/-1%. Exempt extremely high and low supply voltage condition test, EUT only operated in normal voltage to test all regulations.

## 2.4 BLOCK DIGRAM SHOWING THE CONFIGURATION OF SYSTEM TESTED

Mode 1:



## 2.5 DESCRIPTION OF SUPPORT UNITS(CONDUCTED MODE)

The EUT has been tested as an independent unit together with other necessary accessories or support units. The following support units or accessories were used to form a representative test configuration during the tests.

| Item | Equipment | Trade Mark | Model/Type No. | Series No. | Note |
|---|---|---|---|---|---|
| E-1 | Mortise 2 | Igloohome | Mortise 2 | N/A | EUT |
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |

| Item | Shielded Type | Ferrite Core | Length | Note |
|---|---|---|---|---|
| | | | | |
| | | | | |
| | | | | |
| | | | | |
| | | | | |

Note:

(1) The support equipment was authorized by Declaration of Confirmation.

(2) For detachable type I/O cable should be specified the length in cm in『Length』column.

(3) “YES” is means “shielded” “with core”; “NO” is means “unshielded” “without core”.

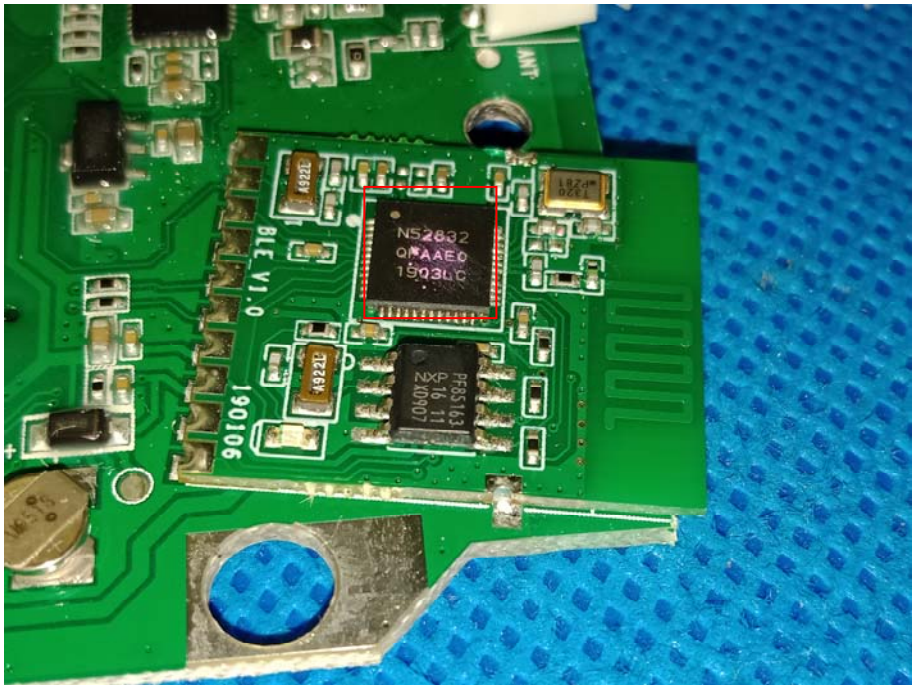
## 2.6 EQUIPMENTS LIST FOR ALL TEST ITEMS

| Item | Equipment | Manufacturer | Model No. | Serial No. | Last Cal. | Cal. Interval |
|---|---|---|---|---|---|---|
| 1. | EMI Receiver | Rohde & Schwarz | ESCI | 100627 | Dec. 27, 2018 | 1 Year |
| 2. | LISN | SchwarzBeck | NSLK 8126 | 8126377 | Dec. 27, 2018 | 1 Year |
| 3. | RF Switching Unit | Compliance Direction | RSU-M2 | 38303 | Dec. 27, 2018 | 1 Year |
| 4. | EMI Test Software ES-K1 | Rohde & Schwarz | N/A | N/A | N/A | N/A |
| 5. | EMI Test Receiver | Rohde & Schwarz | ESCI | 100627 | Dec. 27, 2018 | 1 Year |
| 6. | Trilog Broadband Antenna | Schwarzbeck | VULB9163 | VULB 9163-289 | Dec. 27, 2018 | 1 Year |
| 7. | Pre-amplifier | Compliance Direction | PAP-0203 | 22008 | Dec. 27, 2018 | 1 Year |
| 8. | EMI Test Software EZ-EMC | SHURPLE | N/A | N/A | N/A | N/A |
| 9. | EMI Receiver | Rohde & Schwarz | ESCI | 100627 | Dec. 27, 2018 | 1 Year |
| 10. | LISN | SchwarzBeck | NSLK 8126 | 8126377 | Dec. 27, 2018 | 1 Year |
| 11. | RF Switching Unit | Compliance Direction | RSU-M2 | 38303 | Dec. 27, 2018 | 1 Year |
| 12. | EMI Test Software ES-K1 | Rohde & Schwarz | N/A | N/A | N/A | N/A |
| 13. | EMI Receiver | Rohde & Schwarz | ESCI | 100627 | Dec. 27, 2018 | 1 Year |
| 14. | EMI Receiver | Rohde & Schwarz | ESCI | 100627 | Dec. 27, 2018 | 1 Year |
| 15. | LISN | SchwarzBeck | NSLK 8126 | 8126377 | Dec. 27, 2018 | 1 Year |
| 16. | RF Switching Unit | Compliance Direction | RSU-M2 | 38303 | Dec. 27, 2018 | 1 Year |
| 17. | EMI Test Software ES-K1 | Rohde & Schwarz | N/A | N/A | N/A | N/A |
| 18. | Power Meter | R&S | NRVD | SEL0069 | Dec. 27, 2018 | 1 Year |
| 19. | Power Sensor | R&S | URV5-Z2 | SEL0071 | Dec. 27, 2018 | 1 Year |
| 20. | Power Sensor | R&S | URV5-Z2 | SEL0072 | Dec. 27, 2018 | 1 Year |
| 21. | Software EMC32 | R&S | EMC32-S | SEL0082 | N/A | N/A |
| 22. | Log-periodic Antenna | Amplifier Reasearch | AIFS-IP780 | SEL0073 | N/A | N/A |
| 23. | Antenna Tripod | Amplifier Reasearch | TP1000A | SEL0074 | N/A | N/A |
| 24. | High Gain Horn Antenna(0.8-5GHz) | Amplifier Reasearch | AT4002A | SEL0075 | N/A | N/A |
| 25. | Spectrum analyzer | Agilent | N9020A | MY49911048 | Dec. 27, 2018 | 1 Year |
| 26. | Spectrum analyzer | Agilent | E4407B | MY46184326 | Dec. 27, 2018 | 1 Year |
| 27. | DC power supply | Agilent | E3646A | N/A | Dec. 27, 2018 | 1 Year |
| 28. | frequency meter | Agilent | 53131A | N/A | Dec. 27, 2018 | 1 Year |

## 3. RF SHIELDING METHOD

We apply the product for Japan RF certification. Number of terminals is48,Terminal pitch is 1 mm.. It is not easily removed. Please refer to following for photo for details.

Red circle part of the RF module soldered on the PCB.



# 4. TEST RESULT

## 4.1 FREQUENCY ERROR

### 4.1.1 LIMIT

| Item | Limits |
|---|---|
| Frequency Error | +/-50ppm |

### 4.1.2 MEASURING INSTRUMENTS AND SETTING

The following table is the setting of Spectrum Analyzer.

| Spectrum Parameter | Setting |
|---|---|
| Attenuation | Auto |
| RB / VB | 10KHz |
| Detector | Peak |
| Trace | Max Hold |
| Sweep Time | Auto |

### 4.1.3 TEST PROCEDURES

(1)In the case of unmodulated signal (continuous or continuous burst), measure the frequency directly by a frequency meter.

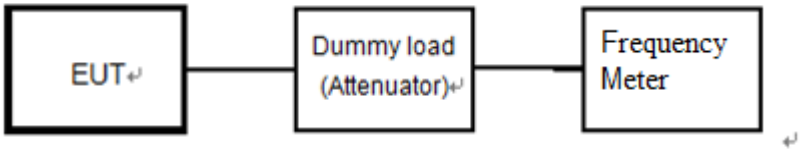
(2)In the case of burst waves, the measurement shall be done for enough time in order to obtain the enough measuring accuracy, and the average of the measured values becomes the final value.

(3)In the case of a test mode with a specific frequency spectrum, measure the frequency of the specific spectrum by a spectrum analyzer.

(4)In the cases above, if the frequency equivalent to the test frequency is not directly measured in principle, it shall be obtained by necessary calculation.

In the case of modulated signal, if there is no specific spectrum measurable by a spectrum analyzer but a specific dip is observed, it is allowed to measure the frequency with the signal generator (synthesized). That is, observe a signal of the signal generator concurrently (or alternately) with the tested signal using the spectrum analyzer while setting the frequency of the signal generator to the position of the dip on the screen of the spectrum analyzer, and determine the frequency of the signal generator at the time as a measured value.

### 4.1.4 TEST SETUP LAYOUT




### 4.1.5 EUT OPERATION DURING TEST

The EUT was placed on the test table and programmed in un-modulation function.

### 4.1.6 TEST RESULT

| EUT： | Mortise 2 | Test Date: | Nov. 12, 2019 |
|---|---|---|---|
| Temperature: | 25$^0$C | Tested by: | Gary Qian |
| Humidity: | 55 % RH | Test Voltage | Normal Voltage |
| Operation Mode: | Normal Voltage- Carrier Tx Mode | | |

| Mode | CH | Measured | Tolerance | Result | Limit |
|---|---|---|---|---|---|
| | | MHz | MHz | ppm | ppm |
| Carrier | CH01:2402MHz | 2402.019 | 0.019 | 7.91 | +/-50 |
| | CH20:2440MHz | 2441.046 | 0.046 | 18.84 | +/-50 |
| | CH40:2480MHz | 2479.953 | -0.047 | -18.95 | +/-50 |
| **Conclusion：PASS** | | | | | |

## 4.2. ANTENNA POWER

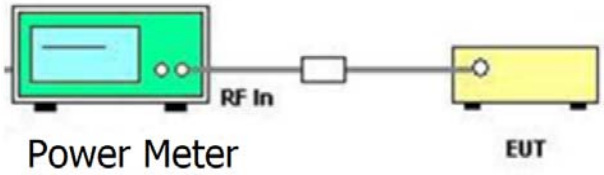
### 4.2.1 LIMIT

| Item | Limits |
|---|---|
| Antenna Power Density | ≦3mW/MHz (FH form 2427 - 2470.75 MHz)<br>≦10mW/MHz (OFDM,DS from2400~2483.5MHz)<br>≦10mW (Other from 2400~2483.5MHz) |
| Antenna Power Error | +20%, -80% (Base on manufacturer declare antenna power density) |

### 4.2.2 MEASURING INSTRUMENTS AND SETTING

1. The EUT was placed on a table which is 0.8m above ground plane.
2. The EUT was directly connected to the Power meter.

### 4.2.3 TEST SETUP LAYOUT




### 4.2.4 EST DEVIATION

There is no deviation with the original standard.

### 4.2.5 TEST RESULT

| EUT： | Mortise 2 | Test Date: | Nov. 12, 2019 |
|---|---|---|---|
| Temperature: | 25$^0$C | Tested by: | Gary Qian |
| Humidity: | 55 % RH | Test Voltage | Normal Voltage |
| Operation Mode: | Normal Voltage | | |

| Test Frequency | Antenna Power (dBm) | Result (mW) | Antenna Power Limit (mW) |
|---|---|---|---|
| 2402MHz | -5.056 | 0.312 | 10 |
| 2440MHz | -6.139 | 0.243 | 10 |
| 2480MHz | -5.148 | 0.306 | 10 |

| Test Frequency | Conducted RF output power density (mW) | Rated power density (mW) | Antenna Power Error (%) |
|---|---|---|---|
| 2402MHz | 0.312 | 0.6 | -48.00% |
| 2440MHz | 0.243 | 0.6 | -59.50% |
| 2480MHz | 0.306 | 0.6 | -49.00% |
| **Limit :** +20%, -80% (Base on manufacturer declare antenna power density) | | | |

## 4.3. OCCUPIED BANDWITH

### 4.3.1 LIMIT

| Item | Limits |
|---|---|
| Occupied Band Width: | FH 83.5MHz; OFDM,DS ≦26MHz;Others≦26MHz |
| Spreading Bandwidth: | ≧500 kHz (FH, DS) |

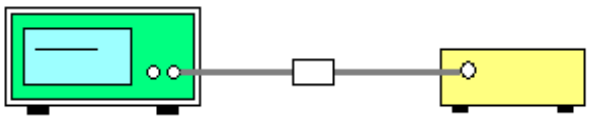
### 4.3.2 MEASURING INSTRUMENTS AND SETTING

| Spectrum Parameter | Setting |
|---|---|
| Attenuation | Auto |
| RB / VB | 300kHz |
| Detector | Peak |
| Trace | Max Hold |
| Sweep Time | Auto |

### 4.3.3 TEST PROCEDURES

1. Setting of SA is following as: RB: 300kHz / VB:300kHz / SPAN: 3MHz / AT: 30dB Ref: 20dBm / Sweep time: Auto / Sweep Mode: Continuous sweep / Detect mode: Positive peak / Trace mode: Max hold
2. EUT have transmitted the maximum modulation signal and fixed channelize ( For DSSS or OFDM Device) or continuous maximum power of hopping mode(For FHSS Device). SA set to 99% of occupied bandwidth to measure occupied bandwidth. The limit is less than 26MHz(For DSSS or OFDM Device) or 83.5MHz(For FHSS Device).
3. SA set to 90% of occupied bandwidth to measure Spread Spectrum Bandwidth and must greater than 500kHz.
4. Spread Spectrum Factor = Spread Spectrum Bandwidth / modulation rate of EUT.
5. Spread Spectrum Factor limit is greater than 5

### 4.3.4 TEST SETUP LAYOUT




### 4.3.5 TEST DEVIATION

There is no deviation with the original standard.

### 4.3.6 EUT OPERATION DURING TEST

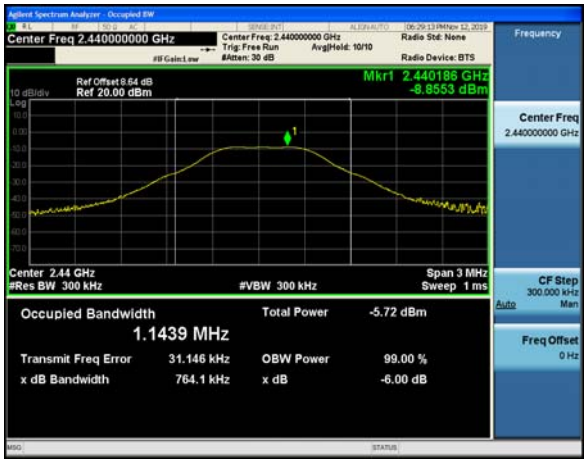
The EUT was programmed to be in continuously transmitting mode.

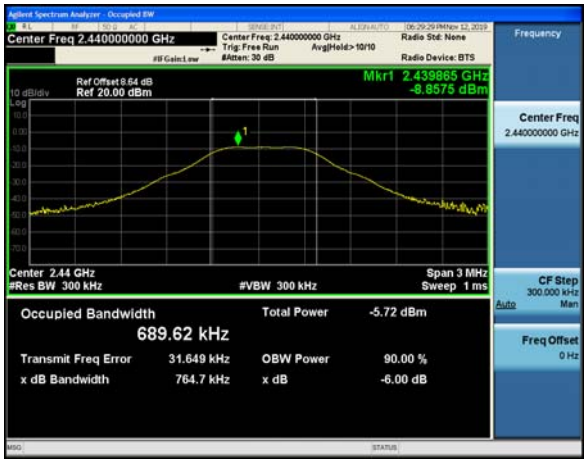
### 4.3.7 TEST RESULT

| EUT： | Mortise 2 | Test Date: | Nov. 12, 2019 |
|---|---|---|---|
| Temperature: | 25$^0$C | Tested by: | Gary Qian |
| Humidity: | 55 % RH | Test Voltage | Normal Voltage |
| Operation Mode: | Normal Voltage | | |

| Test Voltage | Test Frequency (MHz) | Occupied Bandwidth (MHz) | Spread Bandwidth (MHz) |
|---|---|---|---|
| Normal Voltage | 2402 | 1.1414 | 0.6890 |
| | 2440 | 1.1439 | 0.6896 |
| | 2480 | 1.1496 | 0.6920 |






Agilent Spectrum Analyzer - Occupied BW
Center Freq 2.480000000 GHz
Center Freq: 2.480000000 GHz
Trig: Free Run
Avg|Hold:>10/10
#Atten: 30 dB
Radio Std: None
Radio Device: BTS
Frequency
Ref Offset 8.64 dB
10 dB/div
Ref 20.00 dBm
Mkr1 2.480195 GHz
-9.3465 dBm
Center Freq
2.480000000 GHz
Center 2.48 GHz
#Res BW 300 kHz
#VBW 300 kHz
Span 3 MHz
Sweep 1 ms
CF Step
300.000 kHz
Auto
Man
Occupied Bandwidth
1.1496 MHz
Total Power
-6.21 dBm
Transmit Freq Error
30.990 kHz
OBW Power
99.00 %
x dB Bandwidth
764.0 kHz
x dB
-6.00 dB
Freq Offset
0 Hz
MSG
STATUS


Agilent Spectrum Analyzer - Occupied BW
Center Freq 2.480000000 GHz
Center Freq: 2.480000000 GHz
Trig: Free Run
Avg|Hold: 10/10
#Atten: 30 dB
Radio Std: None
Radio Device: BTS
Frequency
Ref Offset 8.64 dB
10 dB/div
Ref 20.00 dBm
Mkr1 2.48021 GHz
-9.3529 dBm
Center Freq
2.480000000 GHz
Center 2.48 GHz
#Res BW 300 kHz
#VBW 300 kHz
Span 3 MHz
Sweep 1 ms
CF Step
300.000 kHz
Auto
Man
Occupied Bandwidth
691.95 kHz
Total Power
-6.20 dBm
Transmit Freq Error
32.507 kHz
OBW Power
90.00 %
x dB Bandwidth
764.4 kHz
x dB
-6.00 dB
Freq Offset
0 Hz
MSG
STATUS

## 4.4. UNWANTED EMISSION INTENSITY MEASUREMENT

### 4.4.1 LIMIT

| Item | Limits |
|---|---|
| TX Spurious Emission | ≦0.25 μW (30MHz≦f≦1000MHz) |
| | ≦2.5 μW (1000MHz<f≦2387MHz) |
| | ≦25 μW (2387MHz<f≦2400MHz) |
| | ≦25 μW (2483.5MHz≦f<2496.5MHz) |
| | ≦2.5 μW (2496.5MHz≦f<12500MHz) |

### 4.4.2. MEASURING INSTRUMENTS AND SETTING

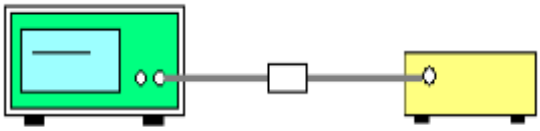
Please refer to section 5 in this report. The following table is the setting of Spectrum Analyzer.

| Spectrum Parameter | Setting |
|---|---|
| Attenuation | Auto |
| RB / VB | 100 kHz (below 1GHz emissions)<br>1 MHz (above 1GHz emissions) |
| Detector | Peak |
| Trace | Max Hold |
| Sweep Time | Auto |

### 4.4.3. TEST PROCEDURES

1. EUT have transmitted the maximum modulation signal and fixed channelize.
2. Setting of SA is following as: Below 1GHz RB:100KHz / VB:100KHz
   Above 1GHz RB:1MHz / VB:1MHz / AT: 20dB Ref: 0dBm / Sweep time: Auto
   Sweep Mode: Continuous sweep / Detect mode: Positive peak
   Trace mode: Max hold
3. Setting of SA is following as 30MHz and stop frequency 1000MHz Then to mark peak reading value + cable loss shall be less than 0.25μW.
4. Setting of SA is following as 1000MHz and stop frequency 2387MHz Then to mark peak reading value + cable loss shall be less than 2.5μW.
5. SA adjusted to start frequency 2387MHz and stop frequency 2400MHz. Then to mark peak reading value + cable loss shall be less than 25μW.
6. SA adjusted to start frequency 2483.5MHz and stop frequency 2496.5MHz Then to mark peak reading value + cable loss shall be less than 25μW
7. SA adjusted to start frequency 2496.5MHz and stop frequency 12500MHz Then to mark peak reading value + cable loss shall be less than 2.5μW
8. Measure side band spurious as follows: For 2.4GHz band: 2374MHz~2400MHz and 2483.5MHz~2509.5MHz RBW = VBW = 1MHz, Result_Value = Meaured_ Value + 15.2 [dBm]
9. If the Result_Value is over the requirement, take total sum of 1MHz band centered at the spur frequency like ACLP measurement as Result_Value.

### 4.4.4. TEST SETUP LAYOUT




### 4.4.5. TEST DEVIATION

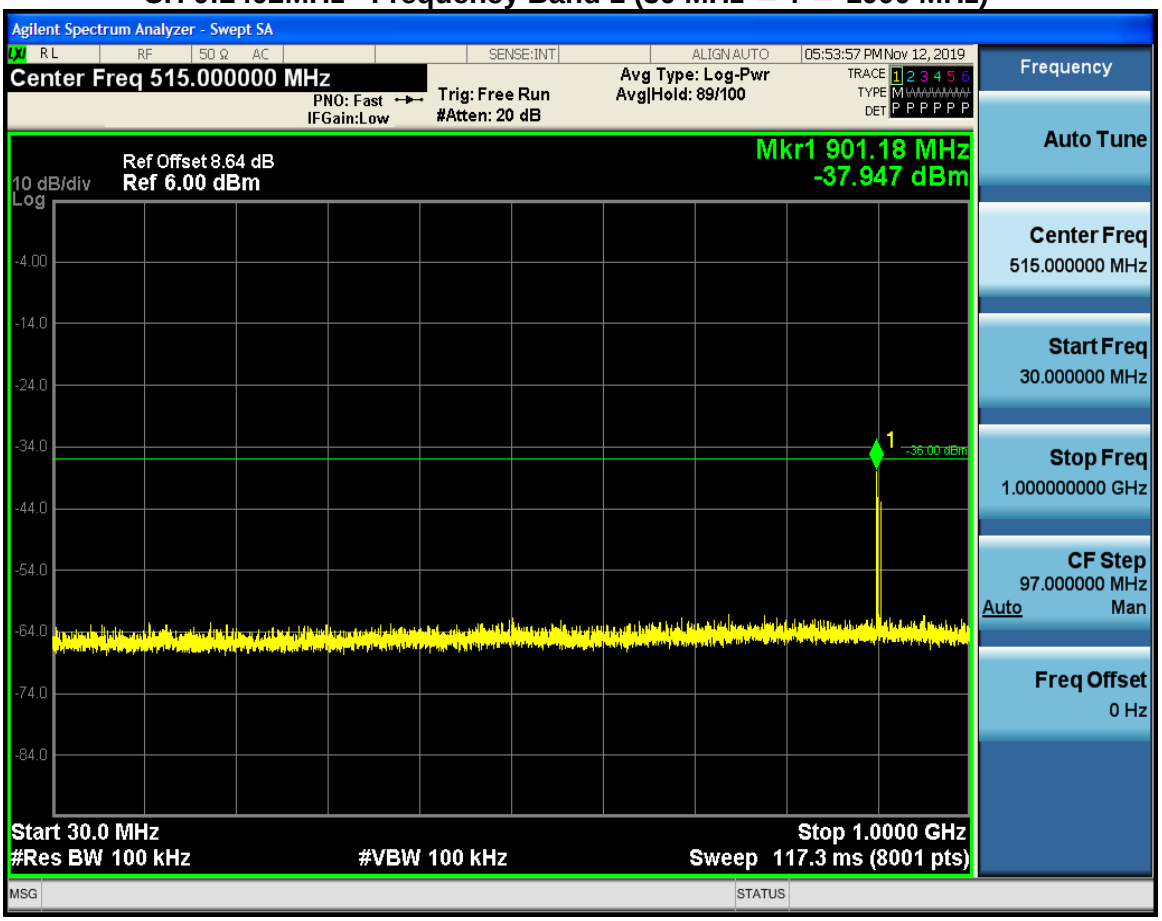
There is no deviation with the original standard.

### 4.4.6. TEST RESULT

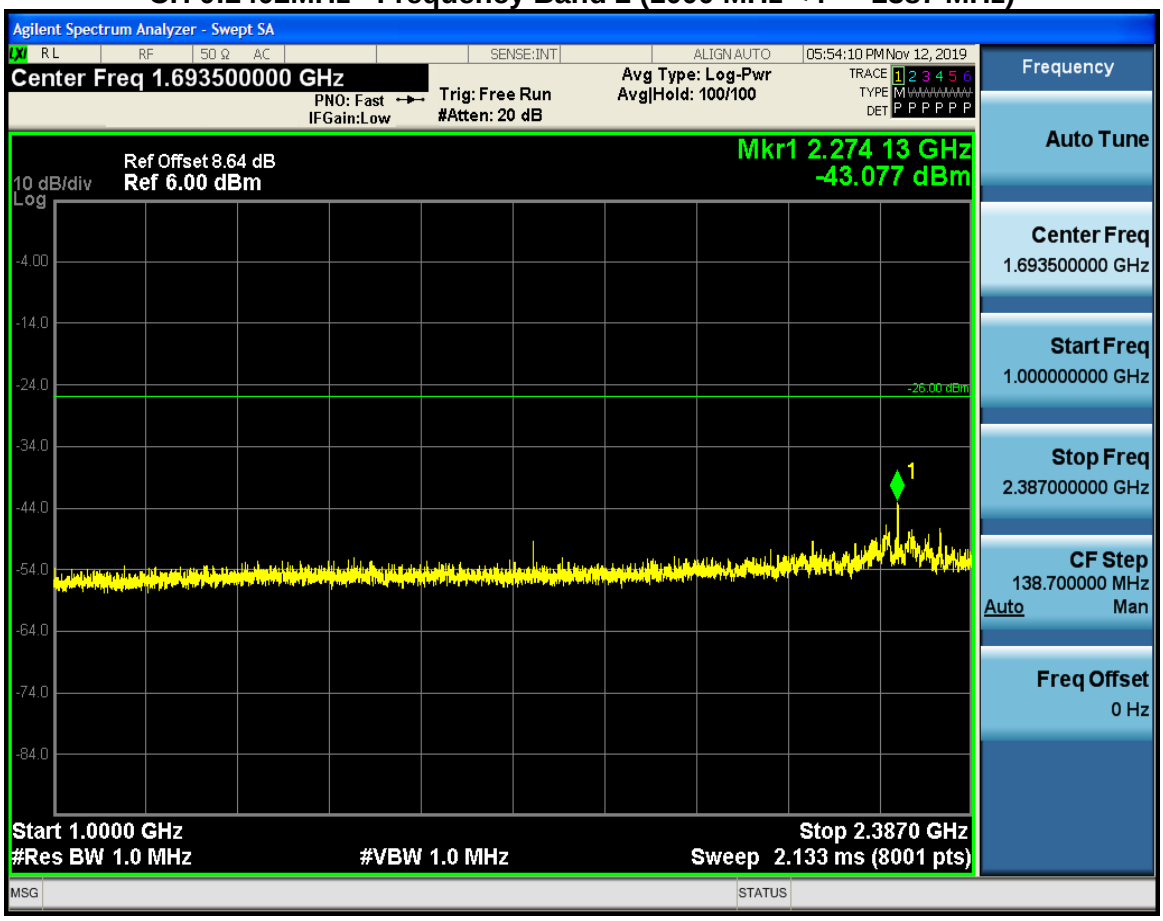
| EUT： | Mortise 2 | Test Date: | Nov. 12, 2019 |
|---|---|---|---|
| Temperature: | 25$^0$C | Tested by: | Gary Qian |
| Humidity: | 55 % RH | Test Voltage | Normal Voltage |
| Operation Mode: | Normal Voltage | | |

| Test Channel | StartFre[MHz] | StopFre[MHz] | Max.Fre[MHz] | Max.Level[μW] | Limit[μW] | Verdict |
|---|---|---|---|---|---|---|
| 2402 | 30 | 1000 | 901.181 | 0.1207 | <0.3 | PASS |
| 2402 | 1000 | 2387 | 2274.133 | 0.0492 | <2.5 | PASS |
| 2402 | 2387 | 2400 | 2388.300 | 0.0073 | <25 | PASS |
| 2402 | 2483.5 | 2496.5 | 2491.593 | 0.0082 | <25 | PASS |
| 2402 | 2496.5 | 13000 | 12645.489 | 0.0200 | <2.5 | PASS |
| 2480 | 30 | 1000 | 96.081 | 0.0012 | <0.3 | PASS |
| 2480 | 1000 | 2387 | 1711.531 | 0.1616 | <2.5 | PASS |
| 2480 | 2387 | 2400 | 2398.733 | 0.0145 | <25 | PASS |
| 2480 | 2483.5 | 2496.5 | 2483.546 | 0.0386 | <25 | PASS |
| 2480 | 2496.5 | 13000 | 2607.843 | 0.0217 | <2.5 | PASS |

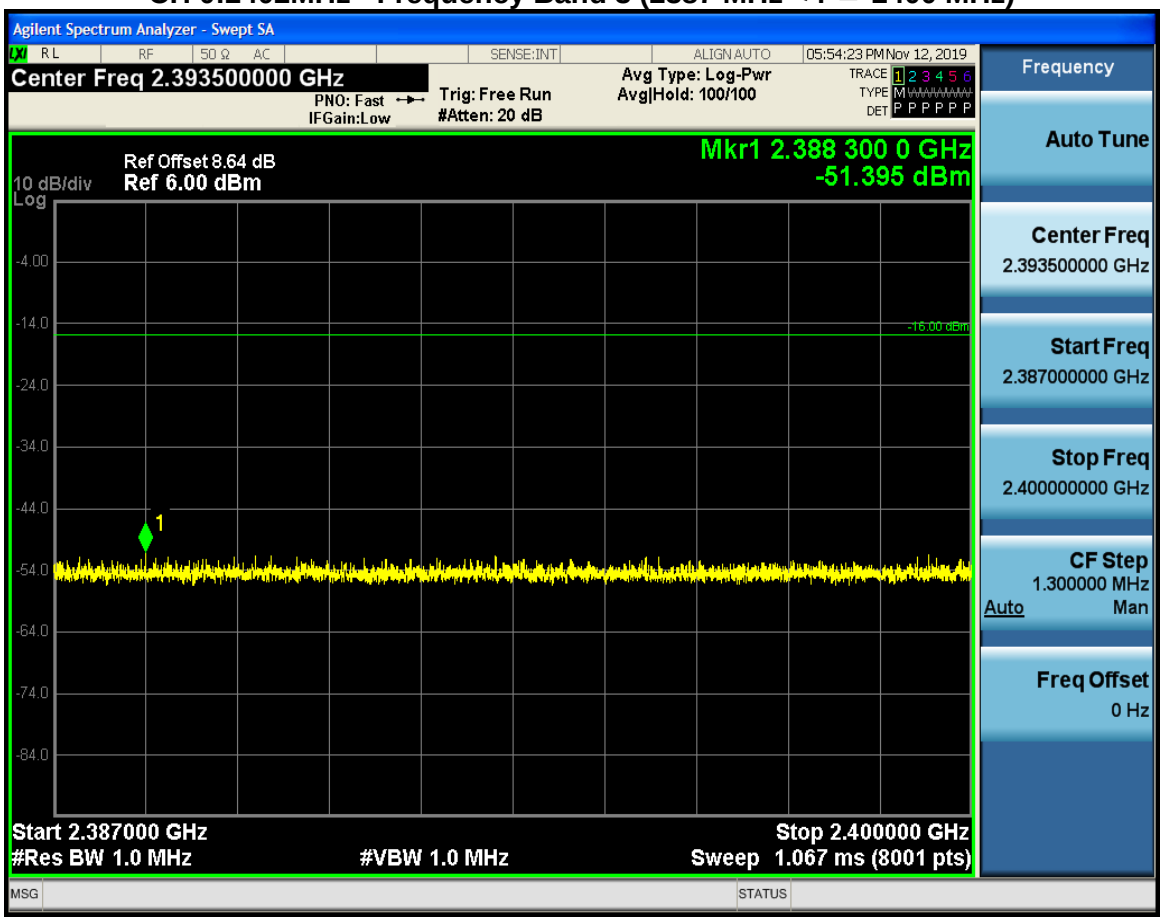
**CH 0:2402MHz - Frequency Band 1 (30 MHz ≦ f ≦ 1000 MHz)**



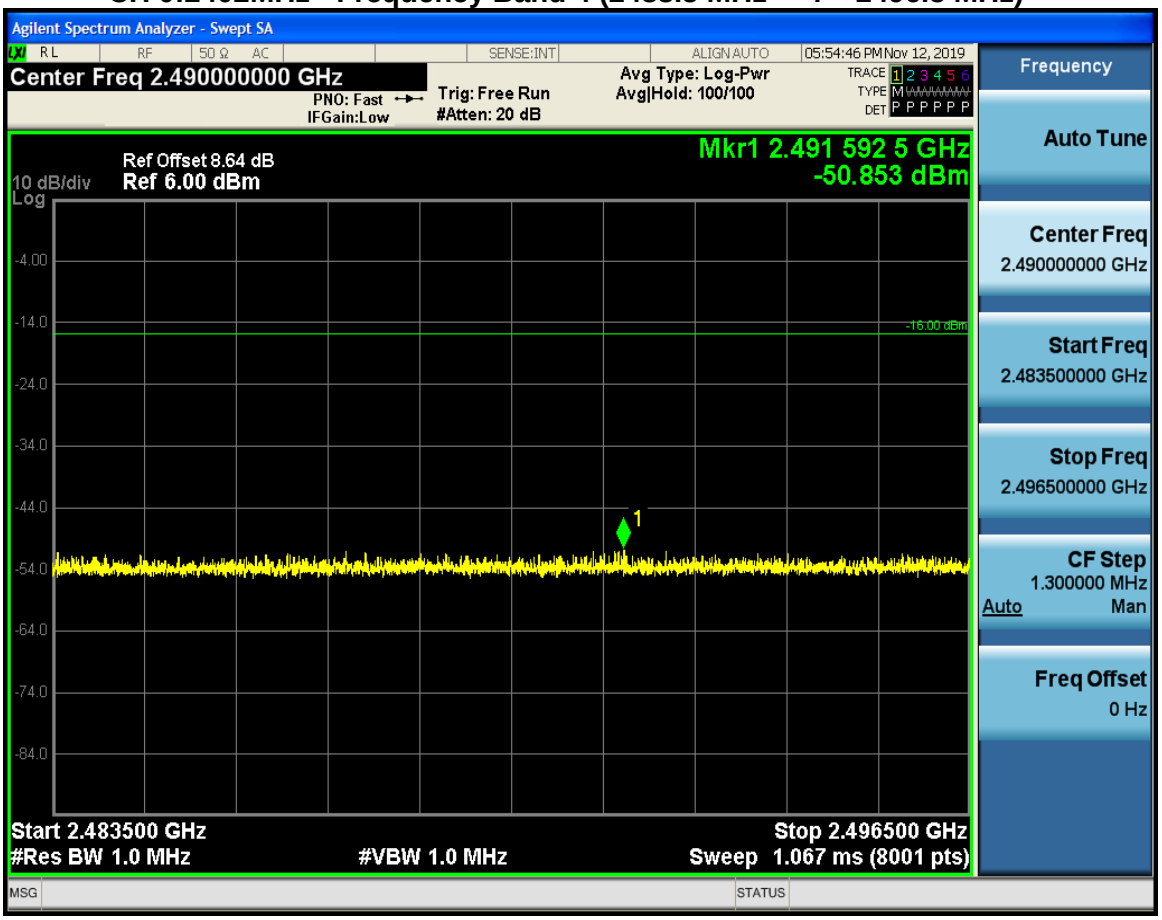

**CH 0:2402MHz - Frequency Band 2 (1000 MHz < f ≦ 2387 MHz)**



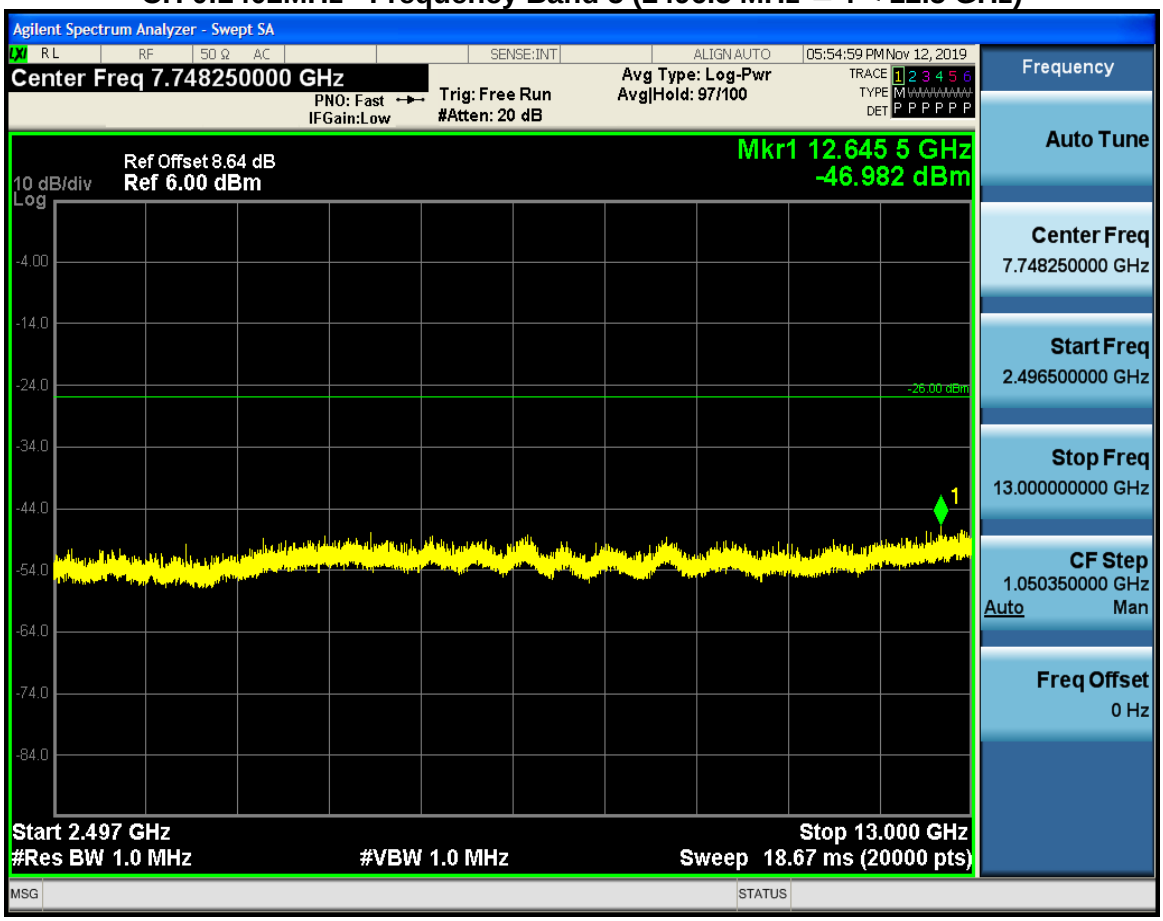
**CH 0:2402MHz - Frequency Band 3 (2387 MHz < f ≦ 2400 MHz)**



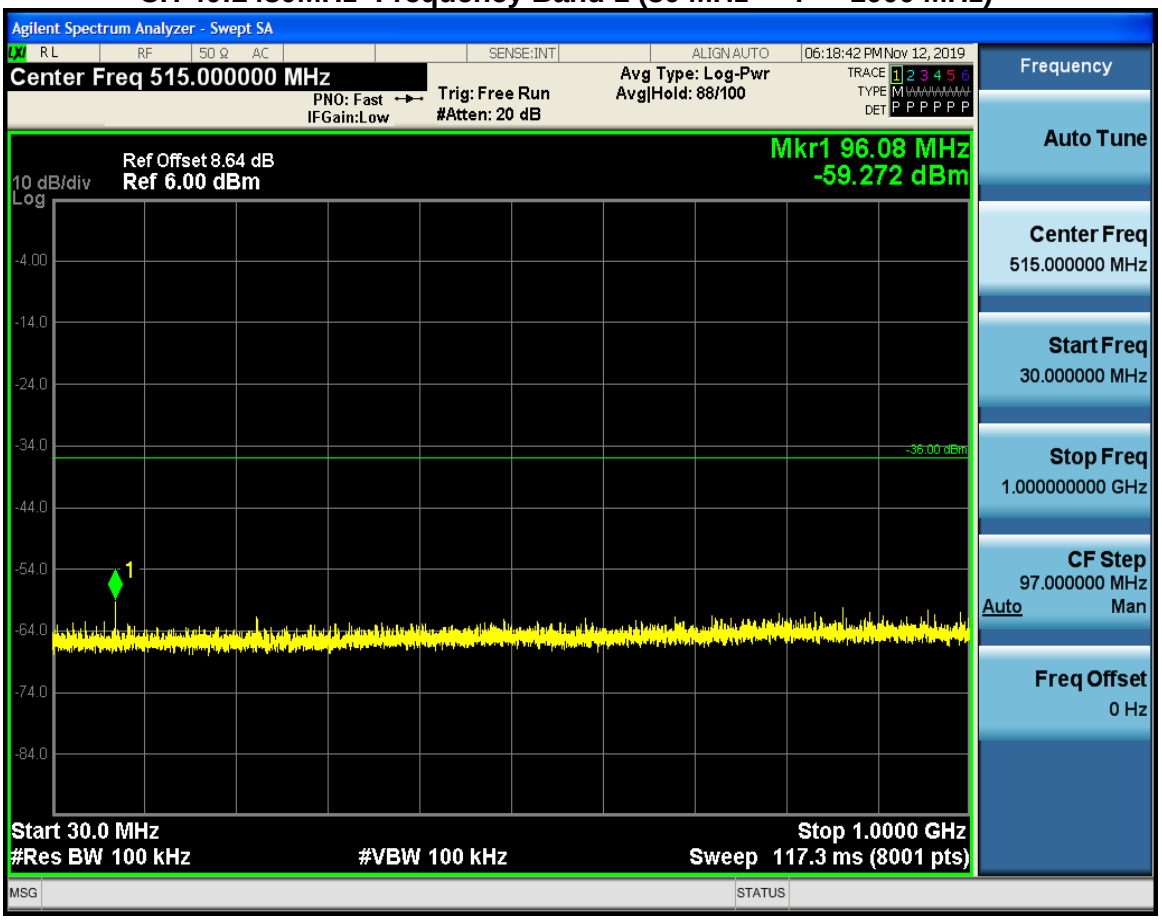

**CH 0:2402MHz - Frequency Band 4 (2483.5 MHz ≦ f < 2496.5 MHz)**



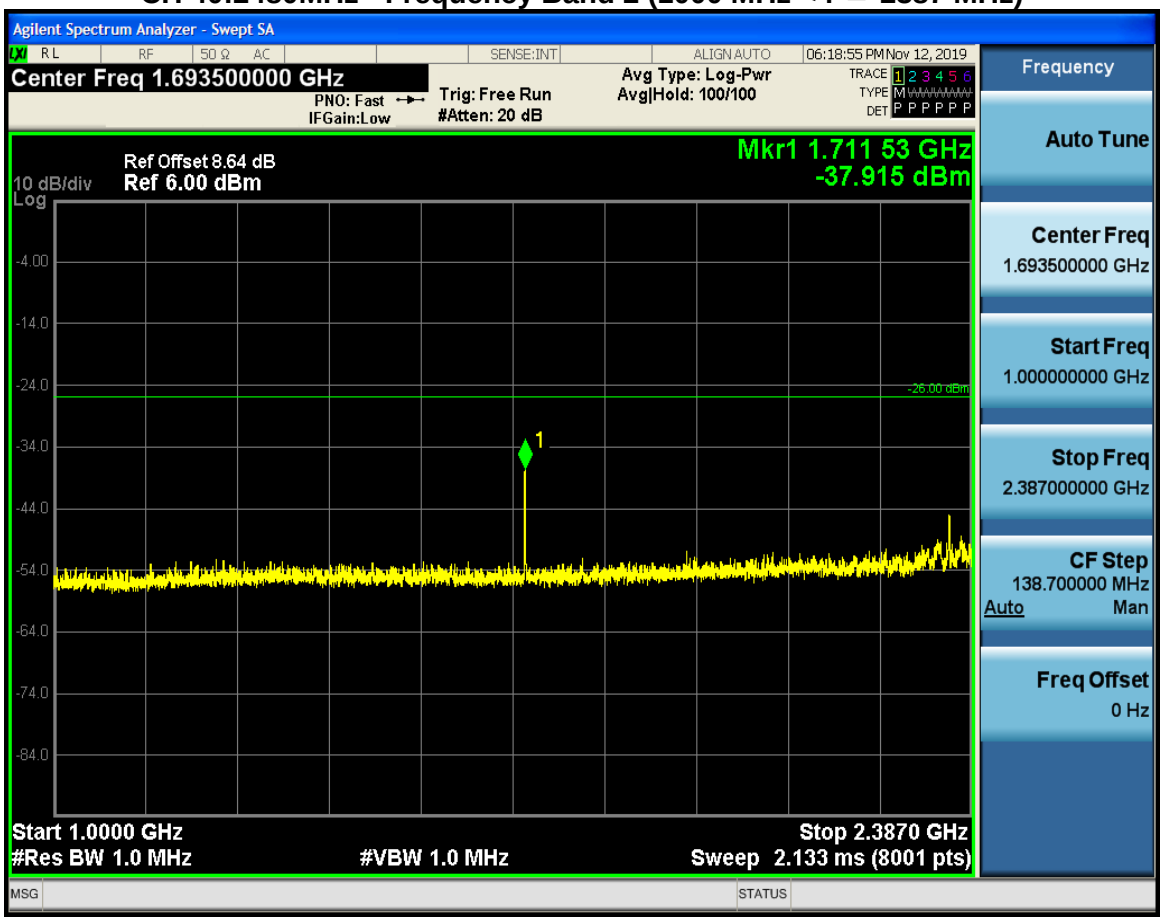
**CH 0:2402MHz - Frequency Band 5 (2496.5 MHz ≦ f < 12.5 GHz)**




**CH 40:2480MHz- Frequency Band 1 (30 MHz ≦ f ≦ 1000 MHz)**

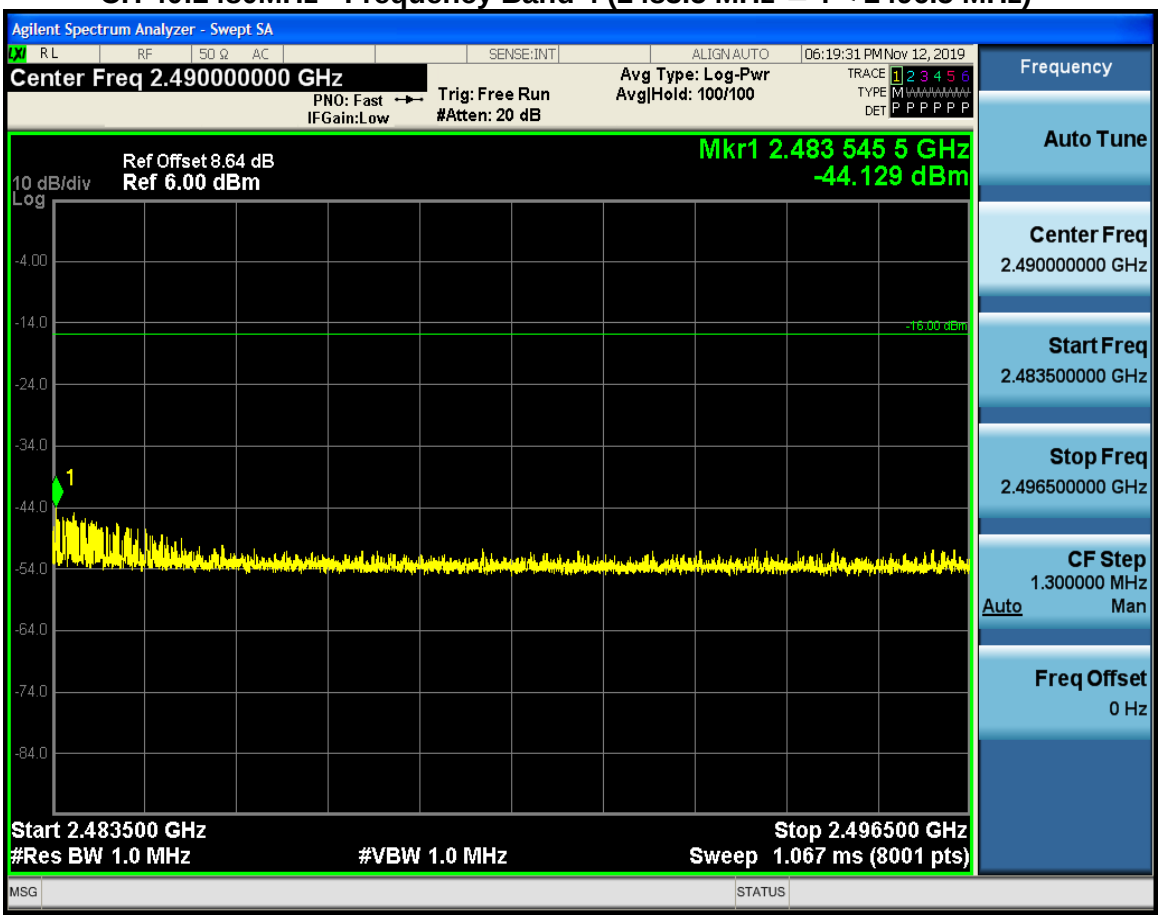


## CH 40:2480MHz - Frequency Band 2 (1000 MHz < f ≦ 2387 MHz)

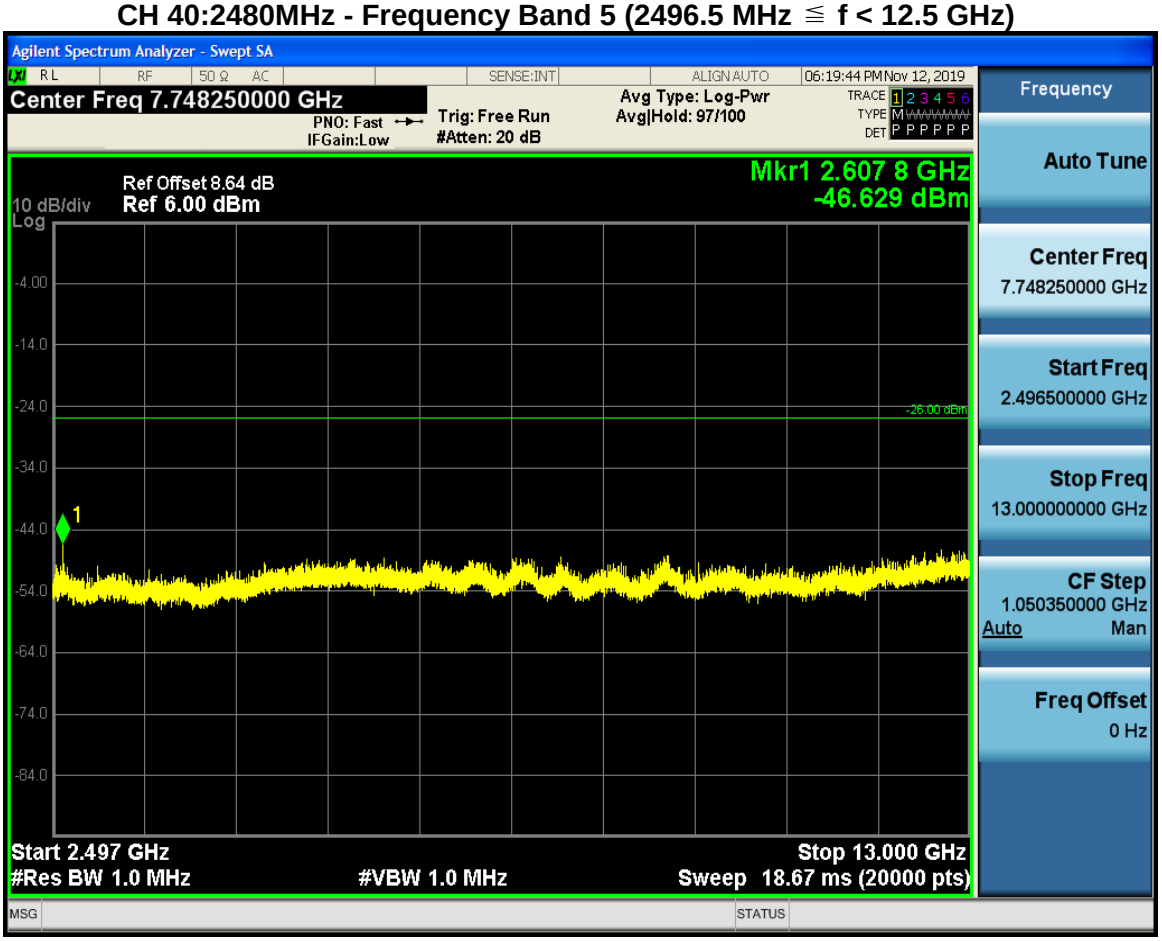



## CH 40:2480MHz - Frequency Band 3 (2387 MHz < f ≦ 2400 MHz)

## CH 40:2480MHz - Frequency Band 4 (2483.5 MHz ≦ f < 2496.5 MHz)




## CH 40:2480MHz - Frequency Band 5 (2496.5 MHz ≦ f < 12.5 GHz)



## 4.5. IMITATION OF COLLATERAL EMISSION OF RECEIVER MEASUREMENT

### 4.5.1 LIMIT

| Item | Limits |
|---|---|
| RX Spurious Emission: | ≦4nW (f<1GHz) |
| | ≦20nW (1GHz≦f) |

### 4.5.2 MEASURING INSTRUMENTS AND SETTING

Please refer to section 5 in this report. The following table is the setting of Spectrum Analyzer.

| Spectrum Parameter | Setting |
|---|---|
| Attenuation | Auto |
| RB | 100 kHz (below 1GHz emissions)<br>1 MHz (above 1GHz emissions) |
| VB | 100 kHz (below 1GHz emissions)<br>1 MHz (above 1GHz emissions) |
| Detector | Peak |
| Trace | Max Hold |
| Sweep Time | Auto |

### 4.5.3 TEST PROCEDURES

1. EUT have the continuous reception mode and fixed only one channelize.
2. Setting of SA is following as RB / VB: 100 kHz (below 1GHz emissions) / 1 MHz (above 1GHz emissions) /
   AT: 10dB / Ref: 0dBm / Sweep time: Auto / Sweep Mode: Continuous sweep / Detect mode: Positive peak / Trace mode: Max hold
3. SA set RB: 100kHz and VB: 100kHz. Then adjust to start frequency 30MHz and stop frequency 1000MHz. Search to mark peak reading value + cable loss shall be less than 4nW
4. SA set RB: 1MHz and VB: 1MHz. Then adjust to start frequency 1000MHz and stop frequency 12500MHz. Search to mark peak reading value + cable loss shall be less than 20nW
5. If power level of lower emissions are more than 1/10 of limit (.0.4nW for f < 1GHz, 2nW for f >= 1GHz), all those are to be indicated in the 2nd and 3rd lines. If others are 1/10 or less more of the limit, no necessary to be indicated.

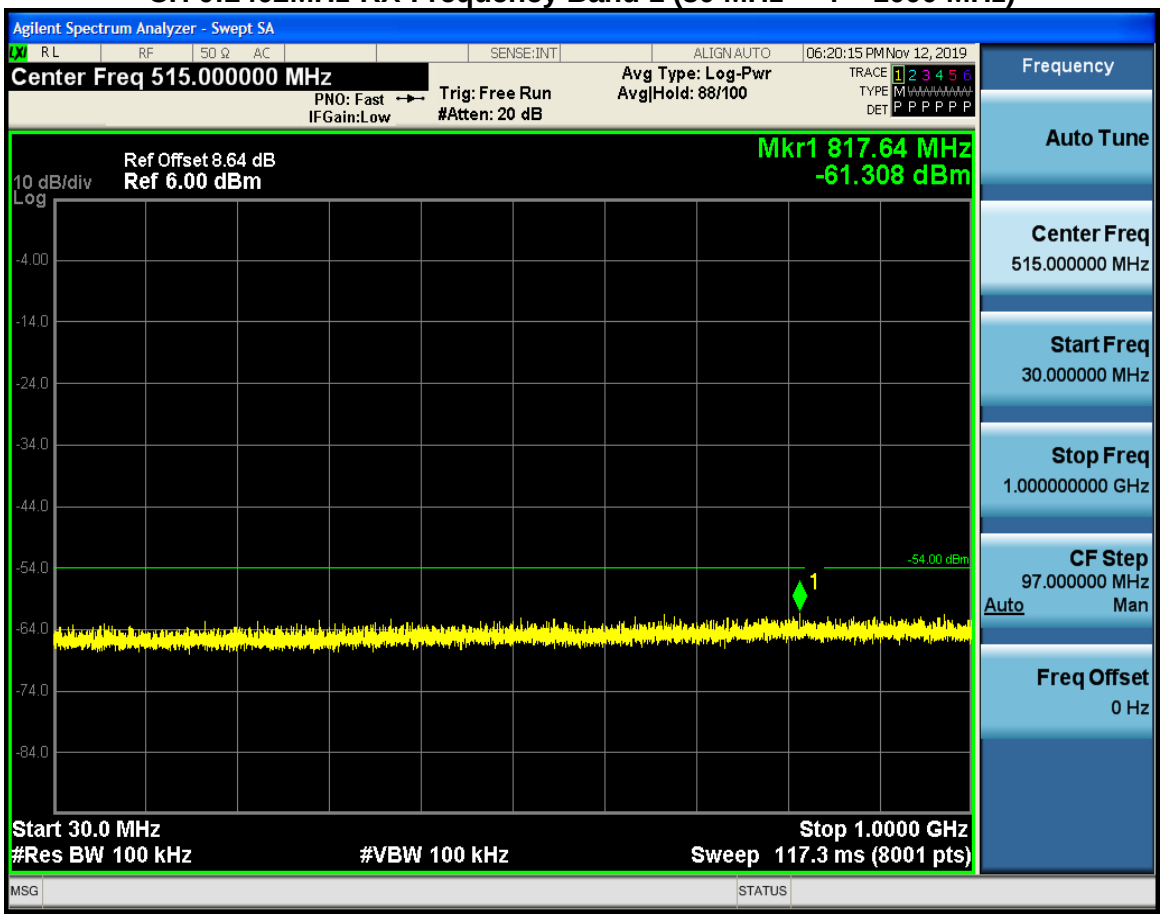
### 4.5.4 TEST RESULT

| EUT： | Mortise 2 | Test Date: | Nov. 12, 2019 |
|---|---|---|---|
| Temperature: | 25$^0$C | Tested by: | Gary Qian |
| Humidity: | 55 % RH | Test Voltage | Normal Voltage |
| Operation Mode: | Normal Voltage | | |

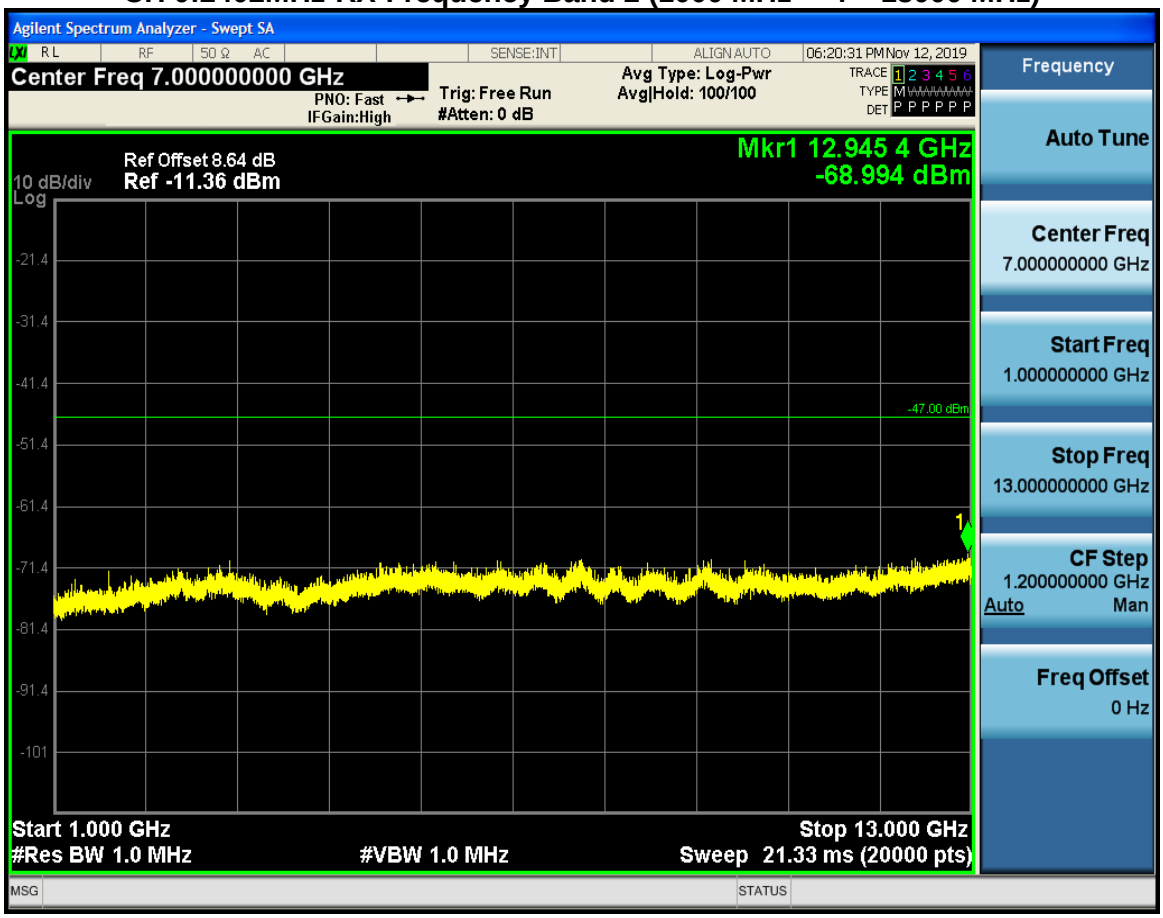
The worst test channel of all channels was showed as the follow:

| Test Channel | StartFre[MHz] | StopFre[MHz] | Max.Fre[MHz] | Max.Level[nW] | Limit[nW] | Verdict |
|---|---|---|---|---|---|---|
| 2402 | 30 | 1000 | 817.640 | 0.740 | <4 | PASS |
| 2402 | 1000 | 13000 | 12945.397 | 0.126 | <20 | PASS |
| 2480 | 30 | 1000 | 843.951 | 0.747 | <4 | PASS |
| 2480 | 1000 | 13000 | 12927.396 | 0.130 | <20 | PASS |

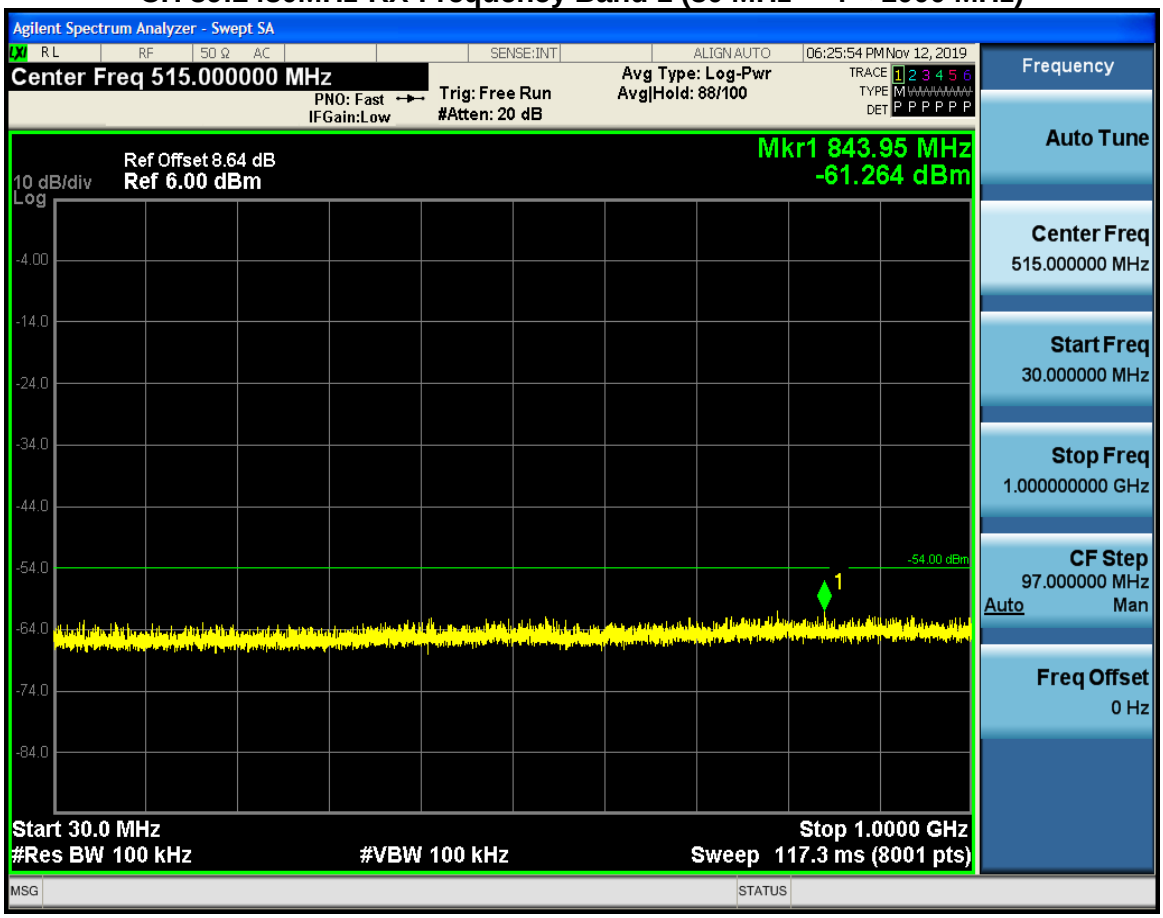
**CH 0:2402MHz-RX-Frequency Band 1 (30 MHz ≦ f < 1000 MHz)**



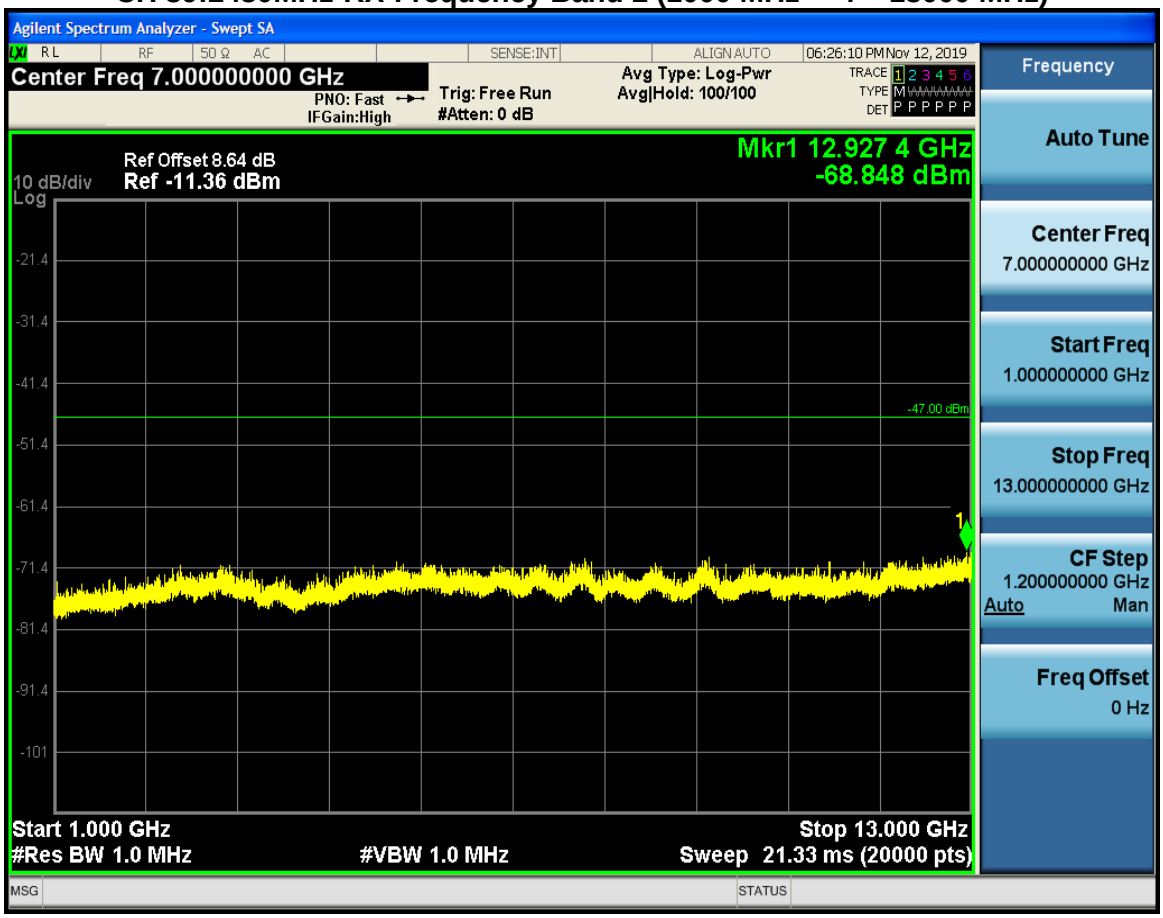
**CH 0:2402MHz-RX-Frequency Band 2 (1000 MHz ≦ f < 13000 MHz)**




**CH 39:2480MHz-RX-Frequency Band 1 (30 MHz ≦ f < 1000 MHz)**



**CH 39:2480MHz-RX-Frequency Band 2 (1000 MHz ≦ f < 13000 MHz)**



## 4.6. TRANSMISSION ANTENNA GAIN (EIRP ANTENNA POWER) MEASUREMENT

### 4.6.1 LIMIT

| Item | Limits |
|---|---|
| EIRP Power Density | ≦16.91dBm/MHz (FH form 2427 - 2470.75 MHz)<br>≦22.14dBm/MHz (OFDM,DS from 2400~2483.5MHz)<br>≦22.14dBm (Other from 2400~2483.5MHz) |
| Note: This test item is not applied for radio equipment with equivalent isotropic radiation power lower than 12.14dBm/MHz, but Antenna Power(Conducted) limit is 10 mW/MHz (10 dBm/MHz), So the test item will not be applied to the transmission antenna which has a gain of 2.14dBi or less | |

### 4.6.2 MEASURING INSTRUMENTS AND SETTING

Please refer to section 5 in this report. The following table is the setting of spectrum analyzer.

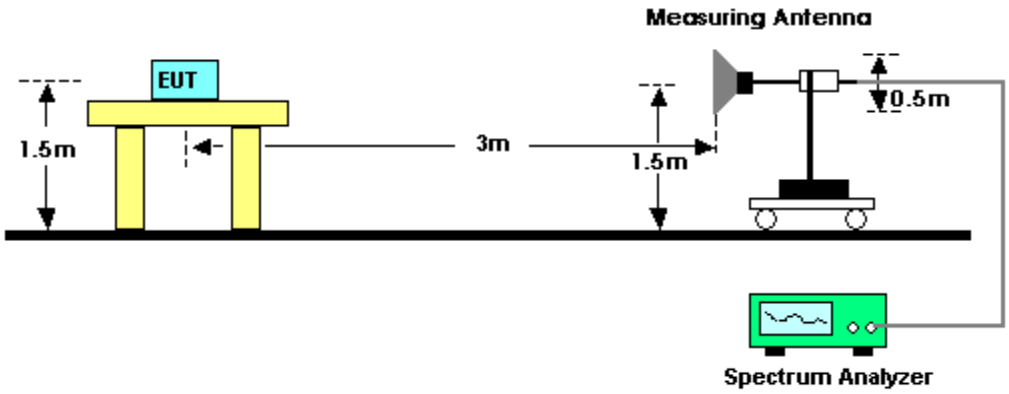
| Spectrum Parameter | Setting |
|---|---|
| Attenuation | Auto |
| RB/VB | 1 MHz |
| Detector | Peak |
| Trace | Max Hold |
| Sweep Time | Auto |

### 4.6.3 TEST PROCEDURES

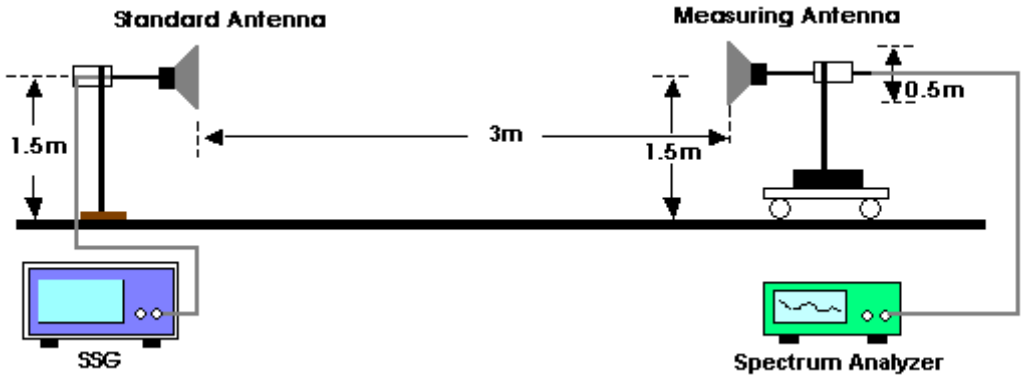
1. Set EUT ad measuring antenna at the same height and roughly facing each other.
2. Move the measuring antenna height up and down within ± 50cm of EUT height and swing it to find the maximum output of the measuring antenna. The output level at the spectrum analyzer is read sa “E“.
3. Remove the EUT from the turn table and put the replacing antenna facing to measuring antenna at same height. Set the standard signal generator (SSG) at same frequency and transmit on then receive the signal
4. Swing the replacing antenna give a maximum receiving level.
5. Move the measuring antenna height up and down within ± 50cm of replacing antenna height and swing it to find the maximum receiving level.
6. Set SSG output power at Pt to give the equivalent output level of “E” or caluate Pt with SSG output which gives the nearest of “E” and difference (± 1dB). Record the Pt.
7. Calculate EIRP by the formula below EIRP = Gt – L + Pt.
   Gt: gain of replacing antenna (dBi)
   L: feeder loss between SSG and replacing antenna
   Pt: Output power of the SSG
8. If the antenna for the EUT has circular polarization, sum of V-field and H-field will be result if measuring antenna is linear polarization.

### 4.6.4 TEST SETUP LAYOUT

**For EUT radiation measurement**




**For standard antenna measurement**




### 4.6.5 TEST DEVIATION

There is no deviation with the original standard.

### 4.6.6 EUT OPERATION DURING TEST

The EUT was programmed to be in continuously transmitting mode.

### 4.6.7 RESULTS OF TRANSMISSION ANTENNA GAIN

**Note:** This test item will not be applied to the transmission antenna which has a gain of 2.14 dBi or less

## 4.7. TRANSMISSION RADIATION ANGLE WIDTH (3DB BEAMWIDTH) MEASUREMENT

### 4.7.1 LIMIT

| Item | Limits |
|---|---|
| 3dB antenna beam width | 360/A (If A<1; then A=1)<br>A = {EIRP Power [mW] / 16.36 for DS, OFDM} or<br>A = {EIRP Power [mW] / 4.9 for FH} |
| Note: This test item is not applied for radio equipment with equivalent isotropic radiation power lower than 12.14dBm/MHz, but Antenna Power(Conducted) limit is 10 mW/MHz (10 dBm/MHz), So the test item will not be applied to the transmission antenna which has a gain of 2.14dBi or less | |

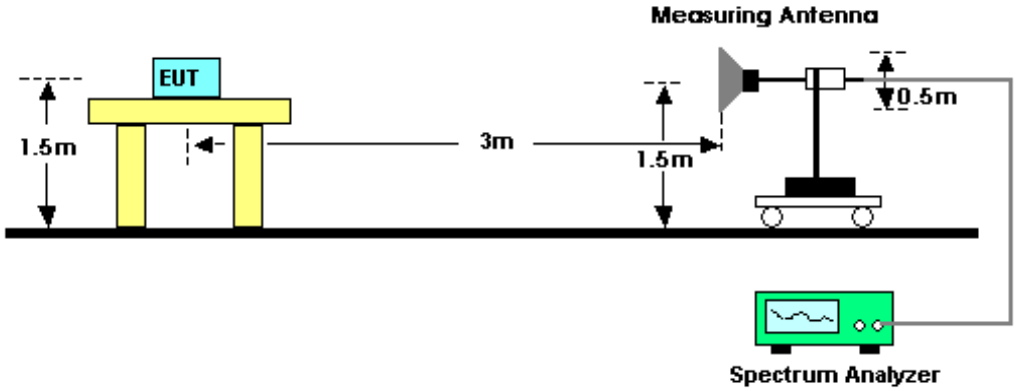
### 4.7.2 MEASURING INSTRUMENTS AND SETTING

| Spectrum Parameter | Setting |
|---|---|
| Attenuation | Auto |
| Span Frequency | 0 MHz |
| RB | 1 MHz |
| VB | 1 kHz |
| Detector | Peak |
| Trace | Max Hold |
| Sweep Time | Auto |

### 4.7.3 TEST PROCEDURES

1. Set EUT and measuring antenna at the same height and roughly facing each other.
2. Set spectrum analyzer with condition in section 4.7.2 and tune reference level to observe receving signal position.
3. Rotate directions of the EUT horizontally and ertically to find the maximum receiving power.
4. Move the measuring antenna height up and down within ± 50cm of EUT height and swing it to find the maximum output of measuing antenna. The output level at the spectrum analyzer is read as “E”
5. Caluate permitted radiation angle in horizontal and vertical using EIRP measured in another test method.
6. Calculate 3dB antenna beam width by the formula below 360/A (If A<1; then A=1).
   A = {EIRP Power [mW] / 16.36 for DS, OFDM} or
   A = {EIRP Power [mW] / 4.9 for FH}

### 4.7.4 TEST SETUP LAYOUT




### 4.7.5 TEST DEVIATION

There is no deviation with the original standard.

### 4.7.6 EUT OPERATION DURING TEST

The EUT was programmed to be in continuously transmitting mode.

### 4.7.7 TEST RESULT OF TRANSMISSION RADIATION ANGLE WIDTH (3DB BEAMWIDTH)

The test item will not be applied to the transmission antenna which has a gain of 2.14dBi or less

## 4.8. RADIO INTERFERENCE PREVENTION CAPABILITY MEASUREMENT

### 4.8.1 LIMIT

| Item | Limits |
|---|---|
| Identification code | ≧48 bits |

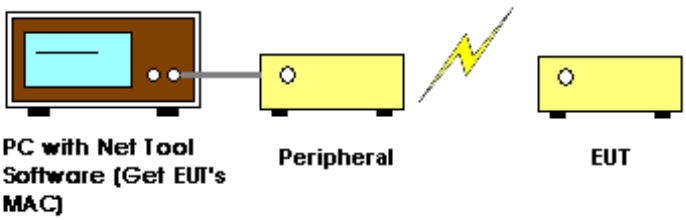
### 4.8.2 MEASURING ID CODE SOFTWARE

| Item | Limits |
|---|---|
| MAC IP List | MAC Scan |

### 4.8.3 TEST PROCEDURES

1. In the case that the EUT has the function of automatically transmitting the identification code: a. Transmit the predetermined identification codes form EUT. b. Check the transmitted identification codes with the demodulator.
2. In the case of receiving the identification ocde: a. Transmit the predetermined identification codes form the counterpart. b . Check if communication is normal. c. Transmit the signals other than predetermined ID codes form the counterpart. d. check if the EUT stops the transmission, or if it displays that idnetification codes are different from the predetermined ones.

### 4.8.4 TEST SETUP LAYOUT




### 4.8.5 TEST DEVIATION

There is no deviation with the original standard.

### 4.8.6 EUT OPERATION DURING TEST

The EUT was programmed to be in normal transmitting mode.

### 4.8.7 TEST RESULT OF RADIO INTERFERENCE PREVENTION CAPABILIT

| | | | |
|---|---|---|---|
| EUT： | Mortise 2 | Test Date: | Nov. 12, 2019 |
| Temperature: | 25$^0$C | Tested by: | Gary Qian |
| Humidity: | 55 % RH | | |
| Test result: | CONFORM | | |

## 4.9. CARRIER SENSING FUNCTION

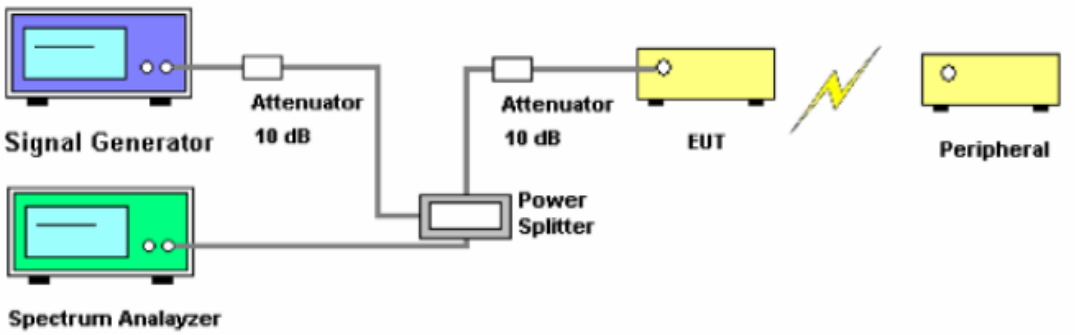
### 4.9.1 TEST REQUIREMENT

MIC Notice No.88 Appendix No.43

Article 2, Paragraph 1, Item 19 Rules Section 10

### 4.9.2 BLOCK DIAGRAM OF TEST SETUP

❖ Measurement System Diagram




❖ Conditions of Application Equipment (EUT)

- The EUT state shall be "normal mode link with wireless router".

### 4.9.3 TEST PRECEDURE

1 SG adjusted the frequency as same as the EUT transmitted signal and emitted the absence of modulation from SG and power level is (on 22.79+G-20*log(f)dBm)(G is the antenna gain,f is the test frequency).

2. turn off the RF signal of the SG.
3. EUT have transmitted the maximum modulation signal and fixed channelize.
4. Setting of SA :RBW/VBW=1MHz/1MHz,Span=50MHz,Sweep time=auto,Sweep mode=continuous, Detect mode=positive peak
5. SG RF signal on.
6. EUT shall be stop the transmitted any signal and SG RF signal off, the EUT will be continuous

### 4.9.4 TEST RESULT

| | | | |
|---|---|---|---|
| EUT: | Mortise 2 | Test Date: | / |
| Temperature: | 25$^0$C | Tested by: | / |
| Humidity: | 55 % RH | | |
| Test result: | Not applicable other than OFDM modulation. | | |

## 5. EUT TEST PHOTO

**Measurement Photos**