



# FCC RF Test Report

**APPLICANT** : Quectel Wireless Solutions Co., Ltd.  
**EQUIPMENT** : Wi-Fi & Bluetooth Module  
**BRAND NAME** : Quectel  
**MODEL NAME** : SC66-MW  
**FCC ID** : XMR201905SC66MW  
**STANDARD** : FCC Part 15 Subpart C §15.247  
**CLASSIFICATION** : (DTS) Digital Transmission System

The product was received on Mar. 13, 2019 and testing was completed on Apr. 25, 2019. We, Sporton International (Kunshan) Inc., would like to declare that the tested sample has been evaluated in accordance with the test procedures and has been in compliance with the applicable technical standards.

The test results in this report apply exclusively to the tested model / sample. Without written approval of Sporton International (Kunshan) Inc., the test report shall not be reproduced except in full.

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Approved by: James Huang / Manager



***Sporton International (Kunshan) Inc.***  
***No. 1098, Pengxi North Road, Kunshan Economic Development Zone,***  
***Jiangsu Province 215335, China***



## TABLE OF CONTENTS

|                                                                  |           |
|------------------------------------------------------------------|-----------|
| <b>REVISION HISTORY.....</b>                                     | <b>3</b>  |
| <b>SUMMARY OF TEST RESULT .....</b>                              | <b>4</b>  |
| <b>1 GENERAL DESCRIPTION .....</b>                               | <b>5</b>  |
| 1.1 Applicant .....                                              | 5         |
| 1.2 Manufacturer .....                                           | 5         |
| 1.3 Product Feature of Equipment Under Test.....                 | 5         |
| 1.4 Product Specification of Equipment Under Test.....           | 6         |
| 1.5 Modification of EUT .....                                    | 6         |
| 1.6 Testing Location .....                                       | 7         |
| 1.7 Applicable Standards.....                                    | 7         |
| <b>2 TEST CONFIGURATION OF EQUIPMENT UNDER TEST .....</b>        | <b>8</b>  |
| 2.1 Carrier Frequency and Channel .....                          | 8         |
| 2.2 Test Mode.....                                               | 9         |
| 2.3 Connection Diagram of Test System.....                       | 10        |
| 2.4 Support Unit used in test configuration and system .....     | 10        |
| 2.5 EUT Operation Test Setup .....                               | 11        |
| 2.6 Measurement Results Explanation Example.....                 | 11        |
| <b>3 TEST RESULT .....</b>                                       | <b>12</b> |
| 3.1 6dB and 99% Bandwidth Measurement .....                      | 12        |
| 3.2 Output Power Measurement.....                                | 14        |
| 3.3 Power Spectral Density Measurement .....                     | 15        |
| 3.4 Conducted Band Edges and Spurious Emission Measurement ..... | 17        |
| 3.5 Radiated Band Edges and Spurious Emission Measurement .....  | 42        |
| 3.6 AC Conducted Emission Measurement.....                       | 46        |
| 3.7 Antenna Requirements.....                                    | 48        |
| <b>4 LIST OF MEASURING EQUIPMENT .....</b>                       | <b>49</b> |
| <b>5 UNCERTAINTY OF EVALUATION .....</b>                         | <b>50</b> |
| <b>APPENDIX A. CONDUCTED TEST RESULTS</b>                        |           |
| <b>APPENDIX B. AC CONDUCTED EMISSION TEST RESULT</b>             |           |
| <b>APPENDIX C. RADIATED SPURIOUS EMISSION</b>                    |           |
| <b>APPENDIX D. DUTY CYCLE PLOTS</b>                              |           |
| <b>APPENDIX E. SETUP PHOTOGRAPHS</b>                             |           |



## REVISION HISTORY

| REPORT NO. | VERSION | DESCRIPTION             | ISSUED DATE   |
|------------|---------|-------------------------|---------------|
| FR931313C  | Rev. 01 | Initial issue of report | Apr. 28, 2019 |
|            |         |                         |               |
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|            |         |                         |               |

## SUMMARY OF TEST RESULT

| Report Section | FCC Rule           | Description                                        | Limit                          | Result | Remark                             |
|----------------|--------------------|----------------------------------------------------|--------------------------------|--------|------------------------------------|
| 3.1            | 15.247(a)(2)       | 6dB Bandwidth                                      | $\geq 0.5\text{MHz}$           | Pass   | -                                  |
| 3.1            | -                  | 99% Bandwidth                                      | -                              | Pass   | -                                  |
| 3.2            | 15.247(b)          | Power Output Measurement                           | $\leq 30\text{dBm}$            | Pass   | -                                  |
| 3.3            | 15.247(e)          | Power Spectral Density                             | $\leq 8\text{dBm}/3\text{kHz}$ | Pass   | -                                  |
| 3.4            | 15.247(d)          | Conducted Band Edges                               | $\leq 20\text{dBc}$            | Pass   | -                                  |
|                |                    | Conducted Spurious Emission                        |                                | Pass   | -                                  |
| 3.5            | 15.247(d)          | Radiated Band Edges and Radiated Spurious Emission | 15.209(a) & 15.247(d)          | Pass   | Under limit 3.03 dB at 2483.50 MHz |
| 3.6            | 15.207             | AC Conducted Emission                              | 15.207(a)                      | Pass   | Under limit 17.39 dB at 0.513 MHz  |
| 3.7            | 15.203 & 15.247(b) | Antenna Requirement                                | N/A                            | Pass   | -                                  |



# 1 General Description

## 1.1 Applicant

**Quectel Wireless Solutions Co., Ltd.**

7th Floor, Hongye Building, No.1801 Hongmei Road, Xuhui District, Shanghai 200233, China

## 1.2 Manufacturer

**Quectel Wireless Solutions Co., Ltd.**

7th Floor, Hongye Building, No.1801 Hongmei Road, Xuhui District, Shanghai 200233, China

## 1.3 Product Feature of Equipment Under Test

| Product Feature                 |                                                                                                                                   |
|---------------------------------|-----------------------------------------------------------------------------------------------------------------------------------|
| Equipment                       | Wi-Fi & Bluetooth Module                                                                                                          |
| Brand Name                      | Quectel                                                                                                                           |
| Model Name                      | SC66-MW                                                                                                                           |
| FCC ID                          | XMR201905SC66MW                                                                                                                   |
| EUT supports Radios application | WLAN 2.4GHz 802.11b/g/n HT20/HT40<br>WLAN 5GHz 802.11a/n HT20/HT40<br>WLAN 5GHz 802.11ac VHT20/VHT40/VHT80<br>Bluetooth BR/EDR/LE |
| HW Version                      | R1.0                                                                                                                              |
| SW Version                      | SC66MWNAR01A02                                                                                                                    |
| EUT Stage                       | Identical Prototype                                                                                                               |

**Remark:** The above EUT's information was declared by manufacturer. Please refer to the specifications or user's manual for more detailed description.

## 1.4 Product Specification of Equipment Under Test

| Standards-related Product Specification       |                                                                                                                                                                                                                                                              |               |               |
|-----------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------|---------------|
| <b>Tx/Rx Channel Frequency Range</b>          | 2412 MHz ~ 2462 MHz                                                                                                                                                                                                                                          |               |               |
| <b>Maximum (Peak) Output Power to antenna</b> | <b>MIMO &lt;Ant. 1 + 2&gt;</b><br>802.11b : 20.31 dBm (0.1074 W)<br>802.11g : 19.45 dBm (0.0881 W)<br>802.11n HT20 : 18.27 dBm (0.0671 W)<br>802.11n HT40 : 19.68 dBm (0.0929 W)                                                                             |               |               |
| <b>99% Occupied Bandwidth</b>                 | <b>MIMO &lt;Ant. 1&gt;</b><br>802.11b : 13.29MHz<br>802.11g : 18.23MHz<br>802.11n HT20 : 19.23MHz<br>802.11n HT40 : 36.86MHz<br><b>MIMO &lt;Ant. 2&gt;</b><br>802.11b : 12.84MHz<br>802.11g : 17.98MHz<br>802.11n HT20 : 19.18MHz<br>802.11n HT40 : 36.56MHz |               |               |
| <b>Antenna Type / Gain</b>                    | Ant. 1: Fixed External Antenna with gain 5.38 dBi<br>Ant. 2: Fixed External Antenna with gain 5.38 dBi                                                                                                                                                       |               |               |
| <b>Type of Modulation</b>                     | 802.11b : DSSS (DBPSK / DQPSK / CCK)<br>802.11g/n : OFDM (BPSK / QPSK / 16QAM / 64QAM)                                                                                                                                                                       |               |               |
| <b>Antenna Function</b>                       |                                                                                                                                                                                                                                                              | <b>Ant. 1</b> | <b>Ant. 2</b> |
|                                               | 802.11b/g/n (MIMO)                                                                                                                                                                                                                                           | V             | V             |

**Note:** MIMO Ant. 1+2 is a calculated result from sum of the power MIMO Ant. 1 and MIMO Ant. 2.

## 1.5 Modification of EUT

No modifications are made to the EUT during all test items.



## 1.6 Testing Location

Sporton Lab is accredited to ISO 17025 by National Voluntary Laboratory Accreditation Program (NVLAP code: 600155-0).

|                           |                                                                                                                                                     |                            |                                       |
|---------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------|---------------------------------------|
| <b>Test Site</b>          | Sporton International (Kunshan) Inc.                                                                                                                |                            |                                       |
| <b>Test Site Location</b> | No. 1098, Pengxi North Road, Kunshan Economic Development Zone,<br>Jiangsu Province 215335, China<br>TEL : 86-512-57900158<br>FAX : 86-512-57900958 |                            |                                       |
| <b>Test Site No.</b>      | <b>Sporton Site No.</b>                                                                                                                             | <b>FCC designation No.</b> | <b>FCC Test Firm Registration No.</b> |
|                           | TH01-KS<br>CO01-KS<br>03CH06-KS                                                                                                                     | CN5013                     | 630927                                |

## 1.7 Applicable Standards

According to the specifications of the manufacturer, the EUT must comply with the requirements of the following standards:

- ♦ 47 CFR Part 15 Subpart C §15.247
- ♦ FCC KDB 558074 D01 15.247 Meas Guidance v05r01
- ♦ FCC KDB 662911 D01 Multiple Transmitter Output v02r01.
- ♦ ANSI C63.10-2013

### Remark:

1. All test items were verified and recorded according to the standards and without any deviation during the test.
2. This EUT has also been tested and complied with the requirements of FCC Part 15, Subpart B, recorded in a separate test report.

## 2 Test Configuration of Equipment Under Test

- a. The EUT has been associated with peripherals and configuration operated in a manner tended to maximize its emission characteristics in a typical application. Frequency range investigated: conduction emission (150 kHz to 30 MHz), radiation emission (9 kHz to the 10th harmonic of the highest fundamental frequency or to 40 GHz, whichever is lower).
- b. AC power line Conducted Emission was tested under maximum output power.

### 2.1 Carrier Frequency and Channel

| Frequency Band  | Channel | Freq.<br>(MHz) | Channel | Freq.<br>(MHz) |
|-----------------|---------|----------------|---------|----------------|
| 2400-2483.5 MHz | 1       | 2412           | 7       | 2442           |
|                 | 2       | 2417           | 8       | 2447           |
|                 | 3       | 2422           | 9       | 2452           |
|                 | 4       | 2427           | 10      | 2457           |
|                 | 5       | 2432           | 11      | 2462           |
|                 | 6       | 2437           |         |                |

## 2.2 Test Mode

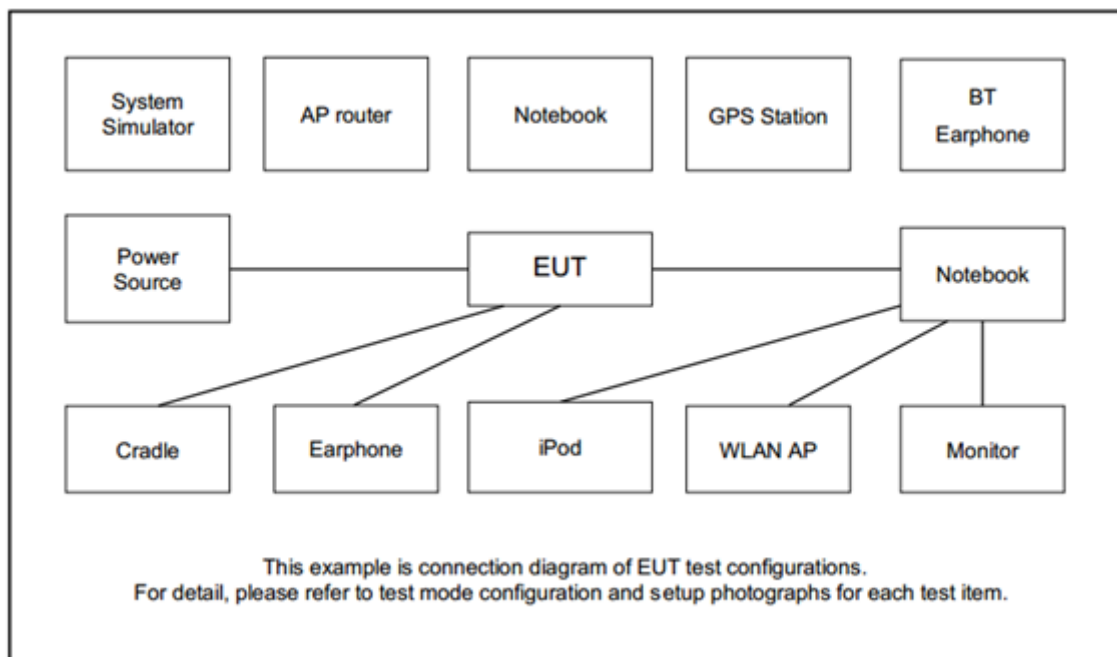
Final test modes are considering the modulation and worse data rates as below table.

### MIMO Antenna

| Modulation   | Data Rate |
|--------------|-----------|
| 802.11b      | 1 Mbps    |
| 802.11g      | 6 Mbps    |
| 802.11n HT20 | MCS0      |
| 802.11n HT40 | MCS0      |

| Test Cases                                                                       |                                                                |
|----------------------------------------------------------------------------------|----------------------------------------------------------------|
| AC<br>Conducted<br>Emission                                                      | Mode 1 :Bluetooth Link + WLAN Link (2.4G) + Adapter + Earphone |
| <b>Remark:</b> For Radiated Test Cases, The tests were performance with Adapter. |                                                                |

## 2.3 Connection Diagram of Test System



## 2.4 Support Unit used in test configuration and system

| Item | Equipment          | Trade Name | Model Name | FCC ID         | Data Cable | Power Cord        |
|------|--------------------|------------|------------|----------------|------------|-------------------|
| 1.   | WLAN AP            | LINKSYS    | WRT600N    | Q87-WRT600NV11 | N/A        | Unshielded, 1.8 m |
| 2.   | Bluetooth Earphone | Lenovo     | LBH308     | N/A            | N/A        | N/A               |
| 3.   | Earphone           | Lenovo     | LH102      | N/A            | N/A        | Unshielded, 1.2m  |



## 2.5 EUT Operation Test Setup

For WLAN RF test items, an engineering test program was provided and enabled to make EUT continuous transmit/receive.

For AC power line conducted emissions, the EUT was set to connect with the Notebook under large package sizes transmission.

## 2.6 Measurement Results Explanation Example

### **For all conducted test items:**

The offset level is set in the spectrum analyzer to compensate the RF cable loss between EUT conducted output port and spectrum analyzer. With the offset compensation, the spectrum analyzer reading level is exactly the EUT RF output level.

Example:

The spectrum analyzer offset is derived from RF cable loss.

*Offset = RF cable loss.*

Following shows an offset computation example with cable loss 4.8 dB.

$$\begin{aligned}\text{Offset(dB)} &= \text{RF cable loss(dB)} . \\ &= 4.8 \text{ (dB)}\end{aligned}$$

### 3 Test Result

#### 3.1 6dB and 99% Bandwidth Measurement

##### 3.1.1 Limit of 6dB and 99% Bandwidth

The minimum 6 dB bandwidth shall be at least 500 kHz.

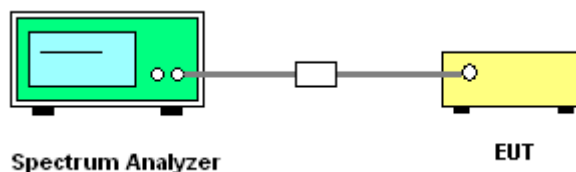
##### 3.1.2 Measuring Instruments

The measuring equipment is listed in the section 4 of this test report.

##### 3.1.3 Test Procedures

1. The testing follows ANSI C63.10-2013 clause 11.8
2. The RF output of EUT was connected to the spectrum analyzer by RF cable and attenuator. The path loss was compensated to the results for each measurement.
3. Set to the maximum power setting and enable the EUT transmit continuously.
4. Make the measurement with the spectrum analyzer's resolution bandwidth (RBW) = 100 kHz. Set the Video bandwidth (VBW) = 300 kHz. In order to make an accurate measurement. The 6 dB bandwidth must be greater than 500 kHz.
5. For 99% Bandwidth Measurement, the spectrum analyzer's resolution bandwidth (RBW) = 1MHz and set the Video bandwidth (VBW) = 3MHz.
6. Measure and record the results in the test report.

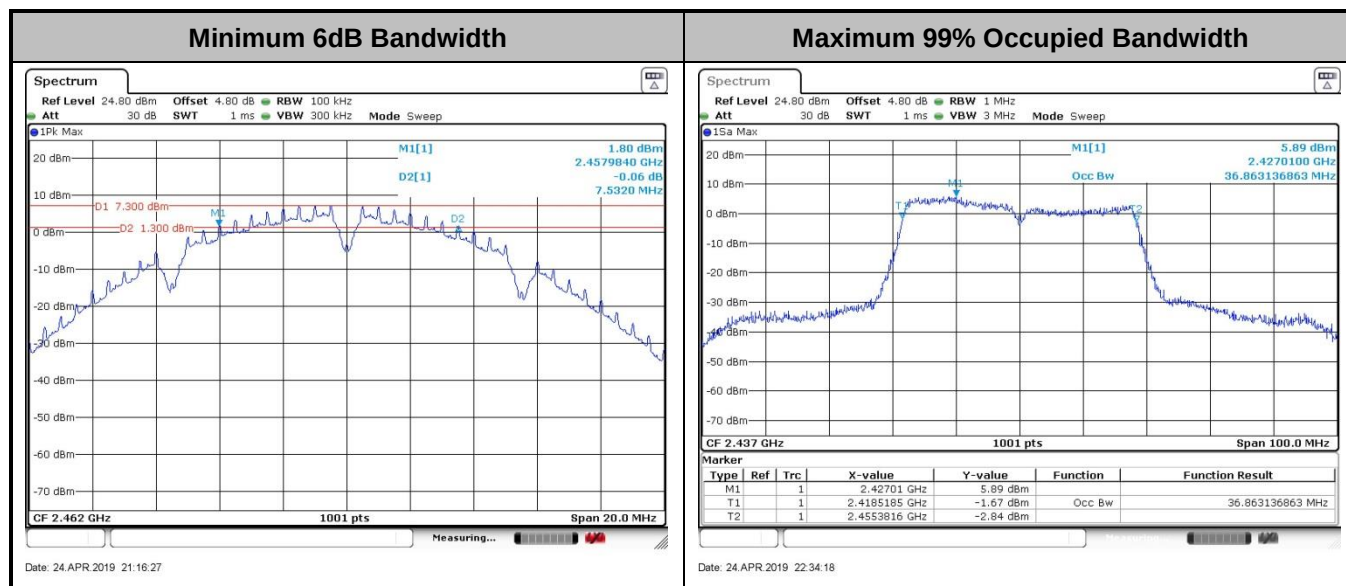
##### 3.1.4 Test Setup





### 3.1.5 Test Result of 6dB and 99% Occupied Bandwidth

Please refer to Appendix A.



Note : The occupied channel bandwidth is maintained within the band of operation for all of the modulations.

## 3.2 Output Power Measurement

### 3.2.1 Limit of Output Power

For systems using digital modulation in the 2400-2483.5MHz, the limit for peak output power is 30dBm. If transmitting antenna with directional gain greater than 6dBi is used, the peak output power from the intentional radiator shall be reduced below the above stated value by the amount in dB that the directional gain of the antenna exceeds 6 dBi. In case of point-to-point operation, the limit has to be reduced by 1dB for every 3dB that the directional gain of the antenna exceeds 6dBi.

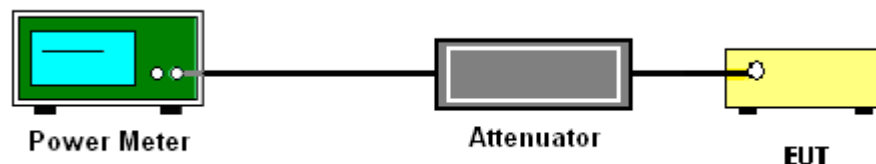
### 3.2.2 Measuring Instruments

The measuring equipment is listed in the section 4 of this test report.

### 3.2.3 Test Procedures

1. The testing follows the Measurement Procedure of ANSI C63.10-2013 clause 11.9.1.3 PKPM1 Peak power meter method.
2. The RF output of EUT was connected to the power meter by RF cable and attenuator. The path loss was compensated to the results for each measurement.
3. Set to the maximum power setting and enable the EUT transmit continuously.
4. Measure the conducted output power and record the results in the test report.
5. For MIMO mode, calculation method follows FCC KDB 662911 D01 Multiple Transmitter Output v02r01.

### 3.2.4 Test Setup



### 3.2.5 Test Result of Peak Output Power

Please refer to Appendix A.

### 3.2.6 Test Result of Average output Power (Reporting Only)

Please refer to Appendix A.

### 3.3 Power Spectral Density Measurement

#### 3.3.1 Limit of Power Spectral Density

The peak power spectral density shall not be greater than 8dBm in any 3kHz band at any time interval of continuous transmission.

#### 3.3.2 Measuring Instruments

The measuring equipment is listed in the section 4 of this test report.

#### 3.3.3 Test Procedures

1. The testing follows Measurement Procedure of ANSI C63.10-2013 clause 11.10.2 Method PKPSD.
2. The RF output of EUT was connected to the spectrum analyzer by RF cable and attenuator. The path loss was compensated to the results for each measurement.
3. Set to the maximum power setting and enable the EUT transmit continuously.
4. Make the measurement with the spectrum analyzer's resolution bandwidth (RBW) = 3 kHz. Video bandwidth VBW = 10 kHz In order to make an accurate measurement, set the span to 1.5 times DTS Channel Bandwidth. (6dB BW)
5. Detector = peak, Sweep time = auto couple, Trace mode = max hold, Allow trace to fully stabilize. Use the peak marker function to determine the maximum power level.
6. Measure and record the results in the test report.
7. For MIMO mode, calculation method follows FCC KDB 662911 D01 Multiple Transmitter Output v02r01.

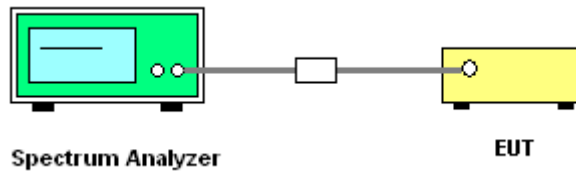
If measurements performed using method (2) plus  $10 \log(N)$  exceeds the emission limit, the test should choose method (1) before declaring that the device fails the emission limit.

Method (1): Measure and sum the spectra across the outputs.

The total final Power Spectral Density is from a device with 2 transmitter outputs. The spectrum measurements of the individual outputs are all performed with the same span and number of points, the spectrum value in the first spectral bin of output 1 is summed with that in the first spectral bin of output 2 to obtain the value for the first frequency bin of the summed spectrum.

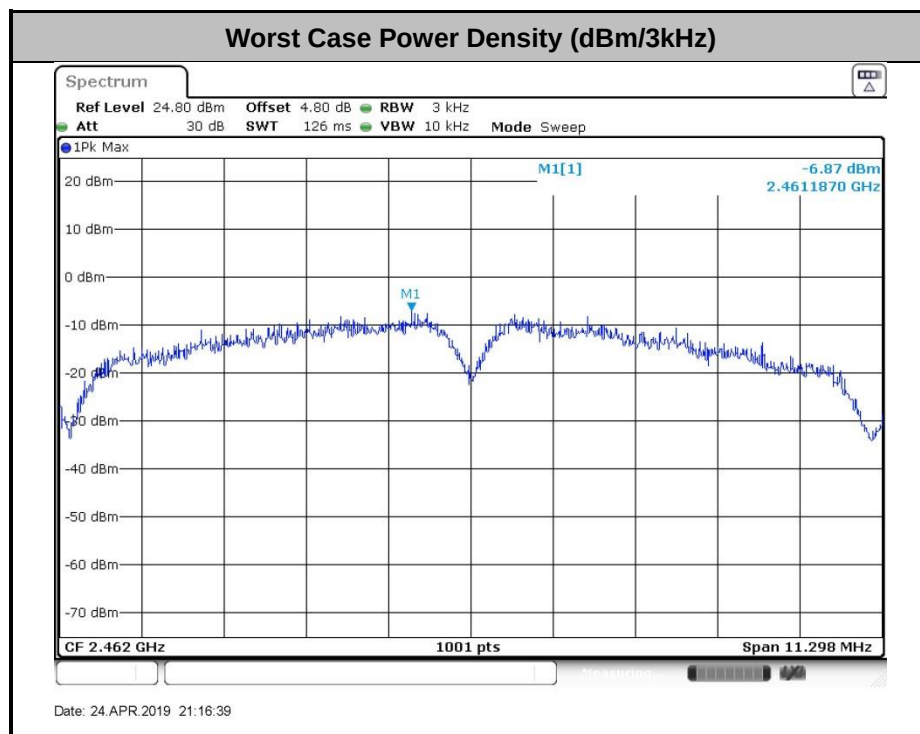
Method (2): Measure and add  $10 \log(N)$  dB, where N is the number of outputs. (N=2)

### 3.3.4 Test Setup



### 3.3.5 Test Result of Power Spectral Density

Please refer to Appendix A.



## 3.4 Conducted Band Edges and Spurious Emission Measurement

### 3.4.1 Limit of Conducted Band Edges and Spurious Emission Measurement

In any 100 kHz bandwidth outside of the authorized frequency band, the emissions which fall in the non-restricted bands shall be attenuated at least 20 dB / 30dB relative to the maximum PSD level in 100 kHz by RF conducted measurement.

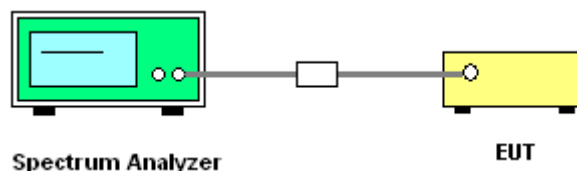
### 3.4.2 Measuring Instruments

The measuring equipment is listed in the section 4 of this test report.

### 3.4.3 Test Procedures

1. The testing follows ANSI C63.10-2013 clause 11.13
2. The RF output of EUT was connected to the spectrum analyzer by RF cable and attenuator. The path loss was compensated to the results for each measurement.
3. Set to the maximum power setting and enable the EUT transmit continuously.
4. Set RBW = 100 kHz, VBW=300 kHz, Peak Detector. Unwanted Emissions measured in any 100 kHz bandwidth outside of the authorized frequency band shall be attenuated by at least 20 dB relative to the maximum in-band peak PSD level in 100 kHz when maximum peak conducted output power procedure is used. If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval, the attenuation required under this paragraph shall be 30 dB instead of 20 dB per 15.247(d).
5. Measure and record the results in the test report.
6. The RF fundamental frequency should be excluded against the limit line in the operating frequency band.

### 3.4.4 Test Setup



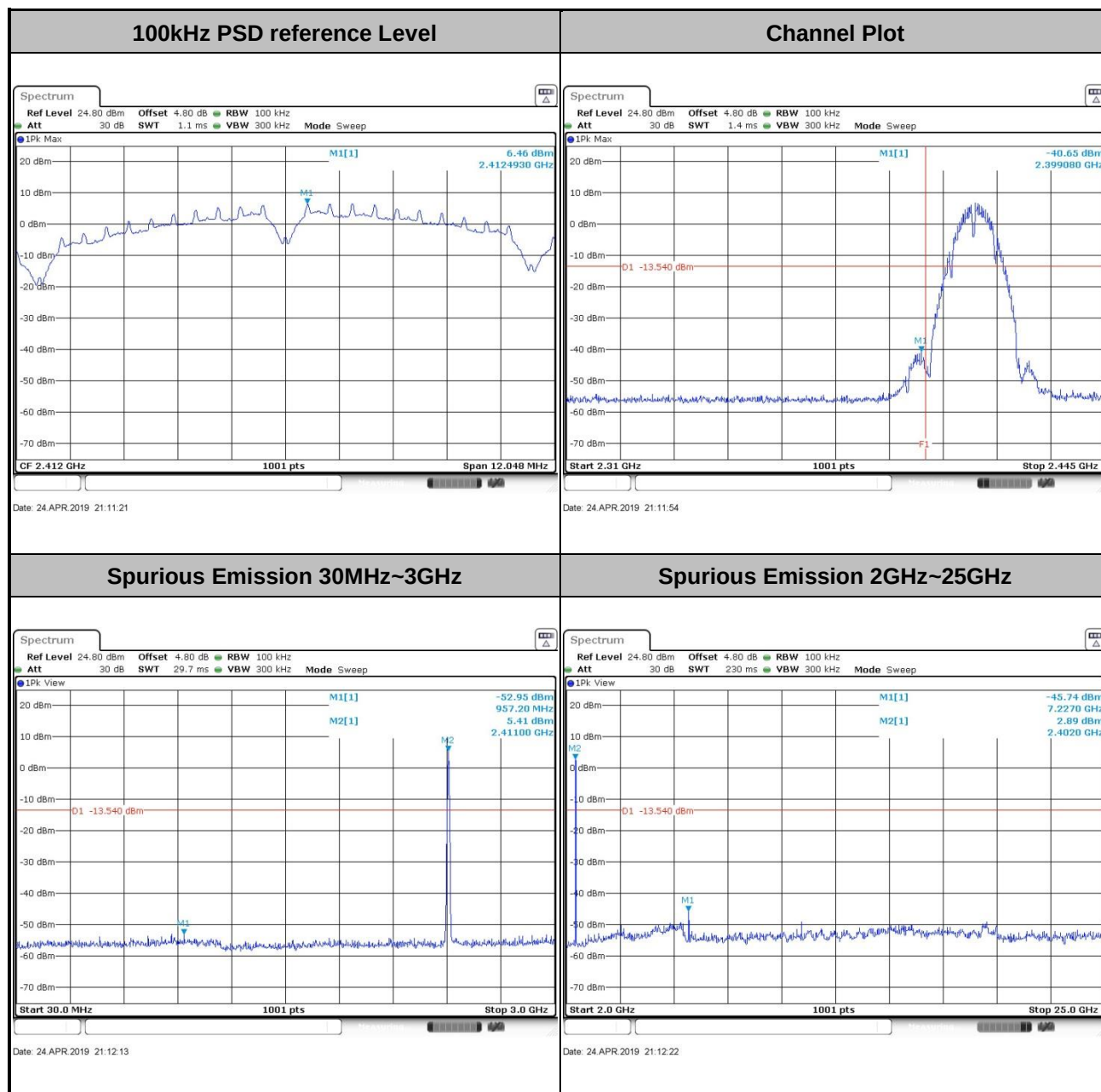


## 3.4.5 Test Result of Conducted Band Edges and Spurious Emission

|                 |            |                     |         |
|-----------------|------------|---------------------|---------|
| Test Engineer : | Weller Liu | Temperature :       | 21~25°C |
|                 |            | Relative Humidity : | 51~55%  |

Number of TX = 2, Ant. 1 (Measured)

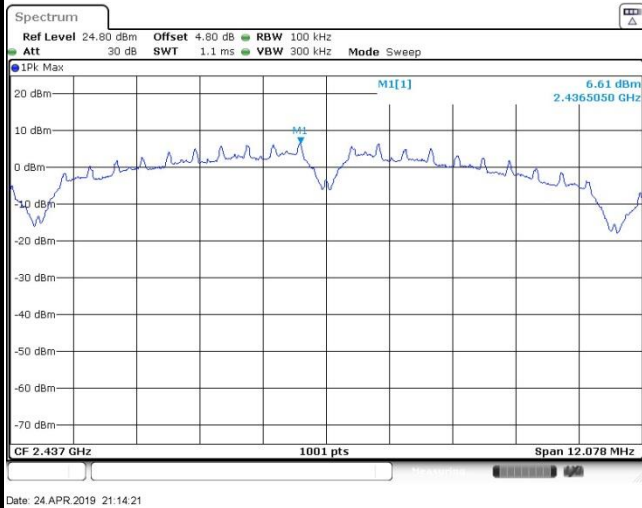
|             |         |                |    |
|-------------|---------|----------------|----|
| Test Mode : | 802.11b | Test Channel : | 01 |
|-------------|---------|----------------|----|



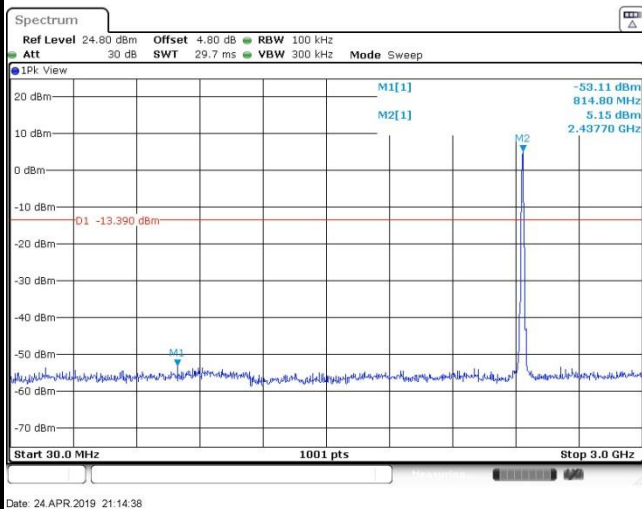


|             |         |                |    |
|-------------|---------|----------------|----|
| Test Mode : | 802.11b | Test Channel : | 06 |
|-------------|---------|----------------|----|

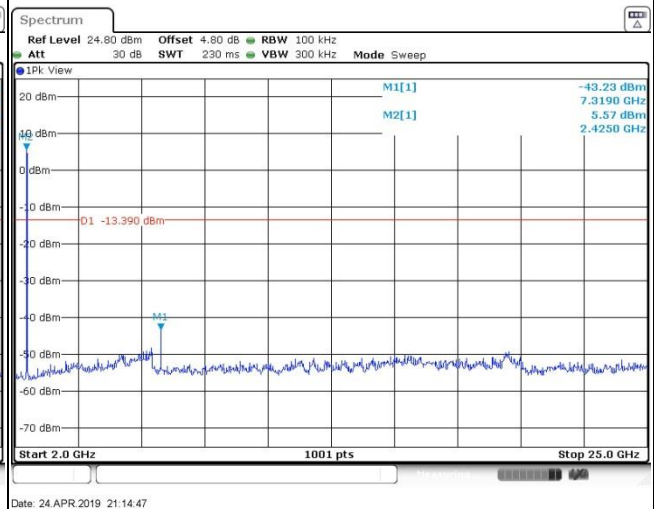
## 100kHz PSD reference Level



## Spurious Emission 30MHz~3GHz

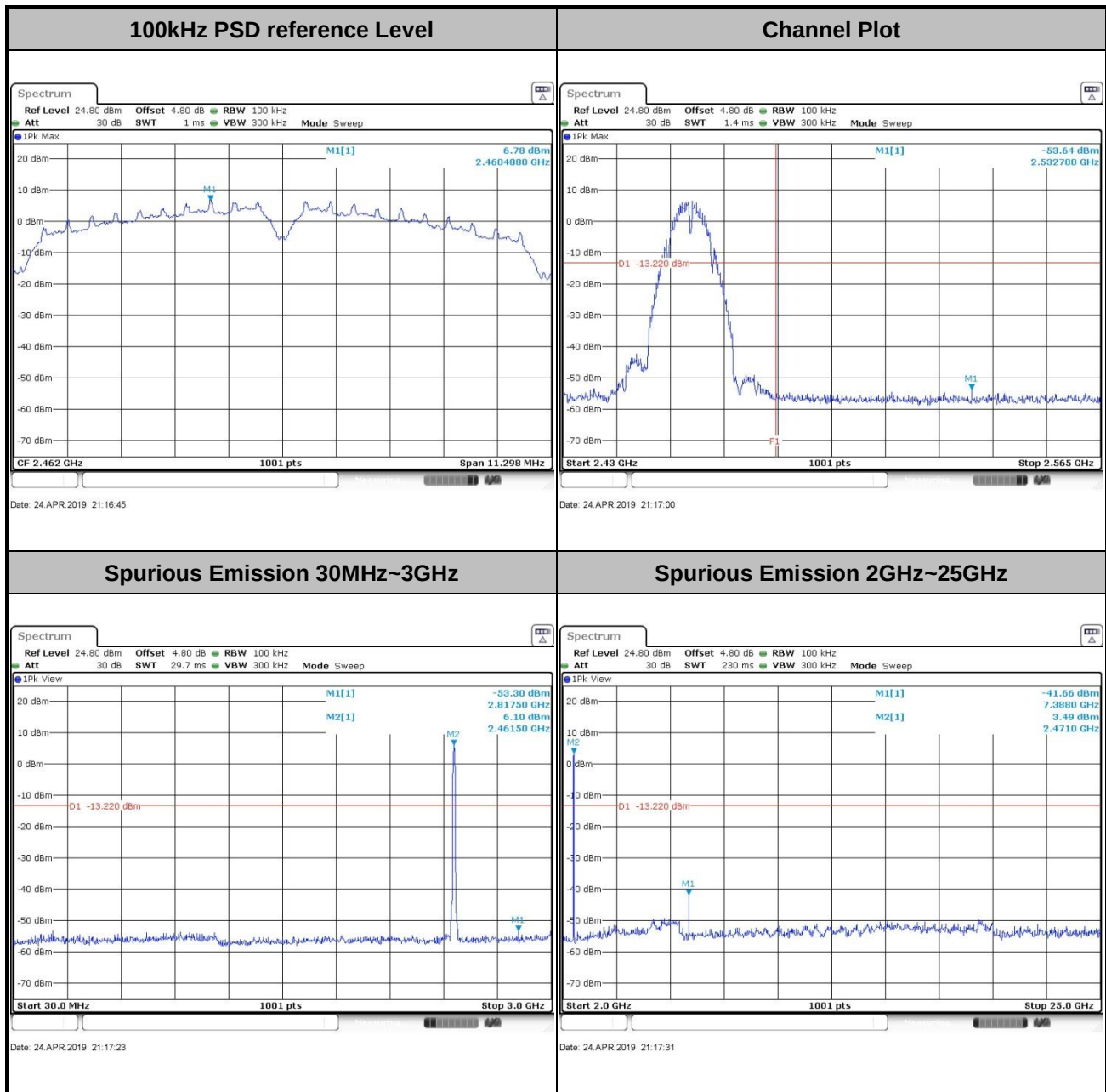


## Spurious Emission 2GHz~25GHz



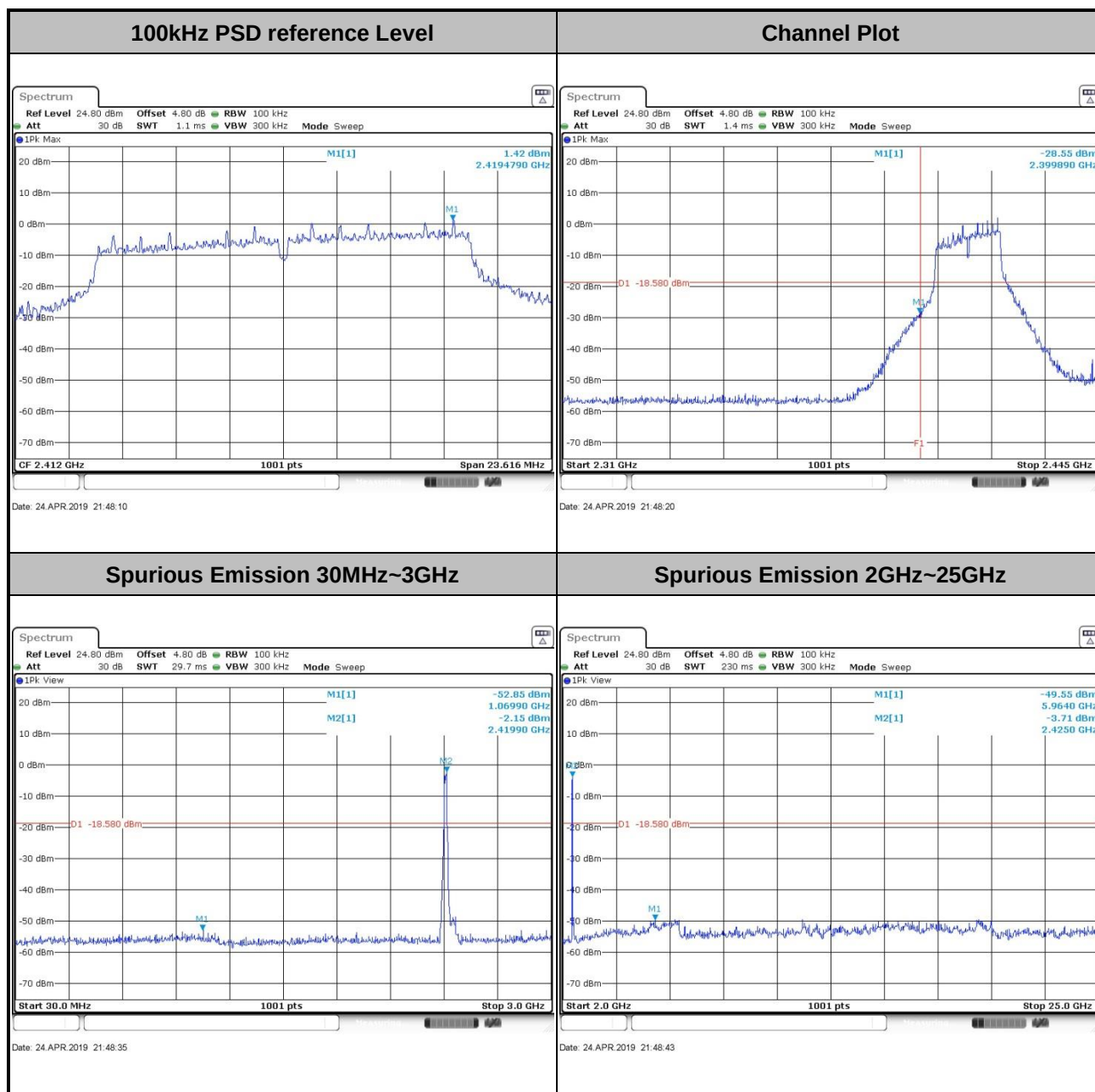


|             |         |                |    |
|-------------|---------|----------------|----|
| Test Mode : | 802.11b | Test Channel : | 11 |
|-------------|---------|----------------|----|





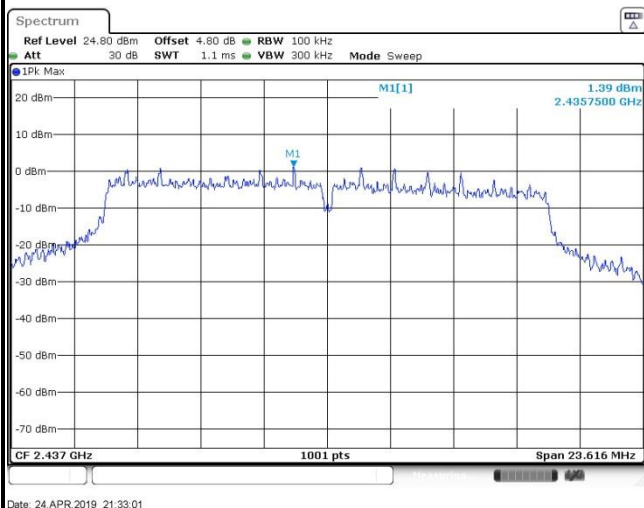
|             |         |                |    |
|-------------|---------|----------------|----|
| Test Mode : | 802.11g | Test Channel : | 01 |
|-------------|---------|----------------|----|



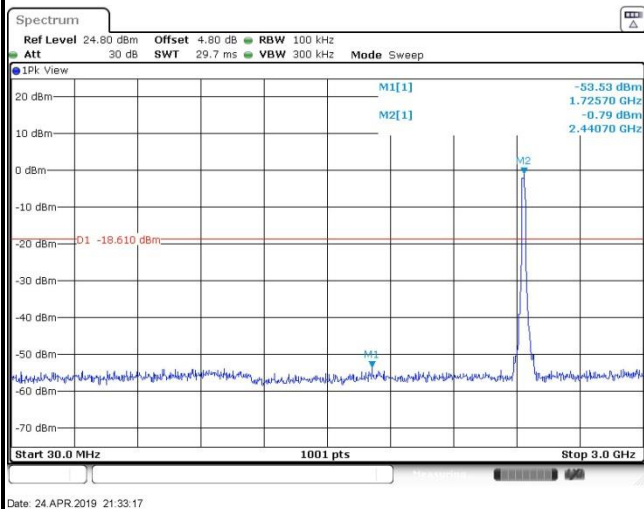


|             |         |                |    |
|-------------|---------|----------------|----|
| Test Mode : | 802.11g | Test Channel : | 06 |
|-------------|---------|----------------|----|

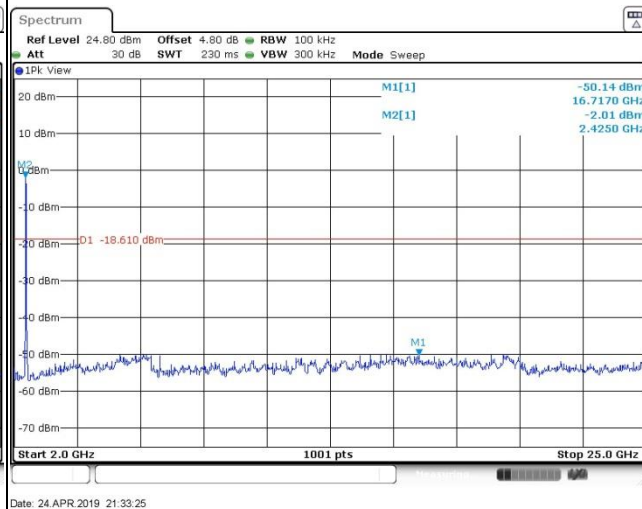
## 100kHz PSD reference Level



## Spurious Emission 30MHz~3GHz

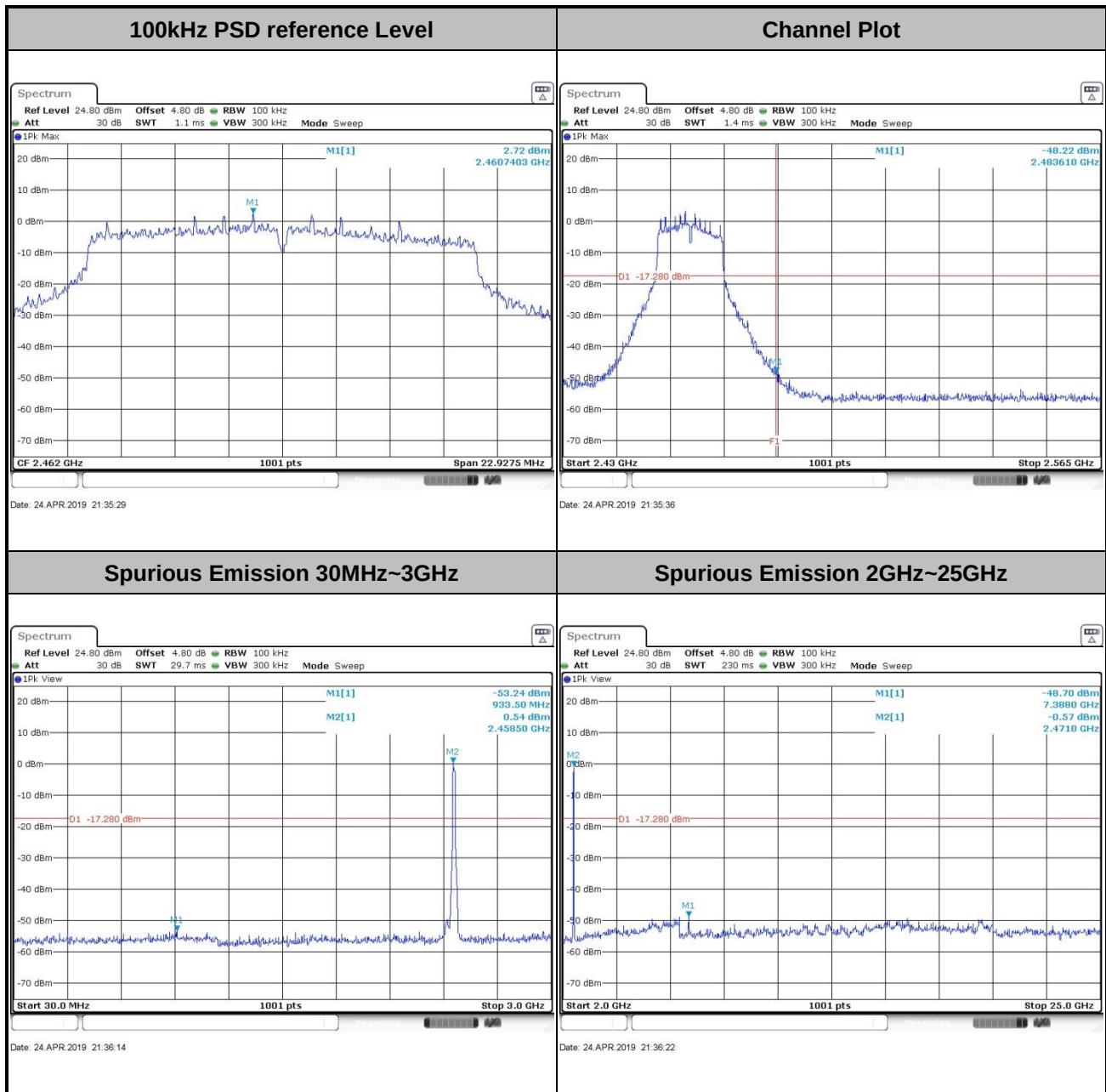


## Spurious Emission 2GHz~25GHz





|             |         |                |    |
|-------------|---------|----------------|----|
| Test Mode : | 802.11g | Test Channel : | 11 |
|-------------|---------|----------------|----|

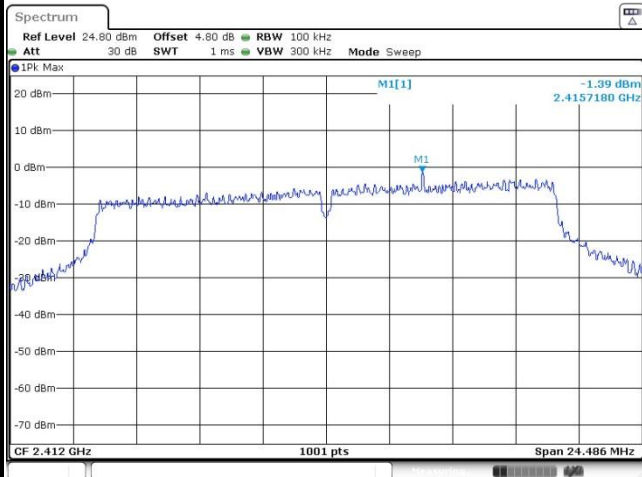




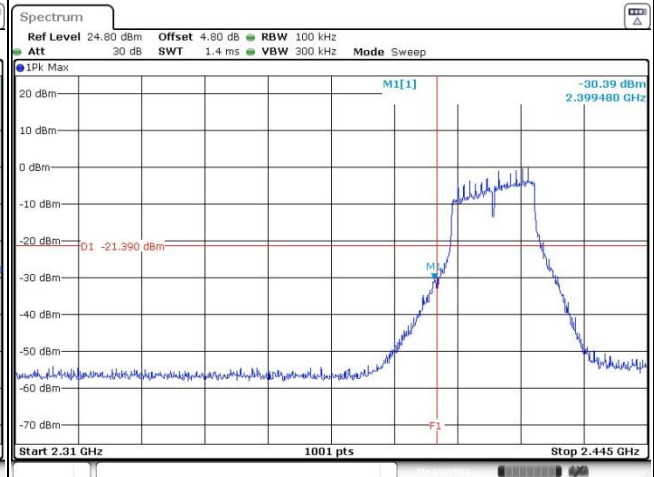
Test Mode : 802.11n HT20

Test Channel : 01

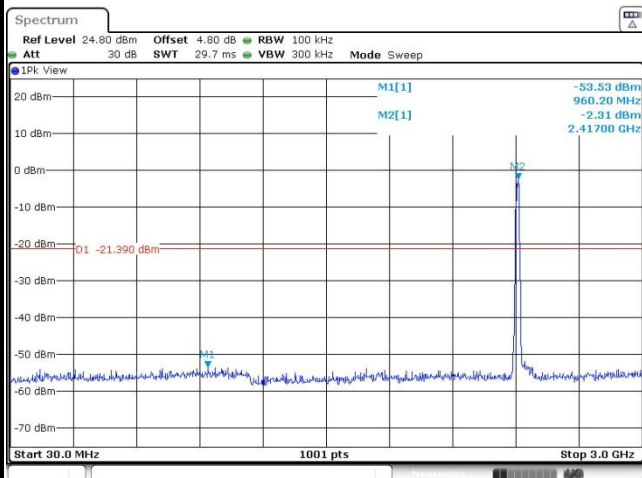
## 100kHz PSD reference Level



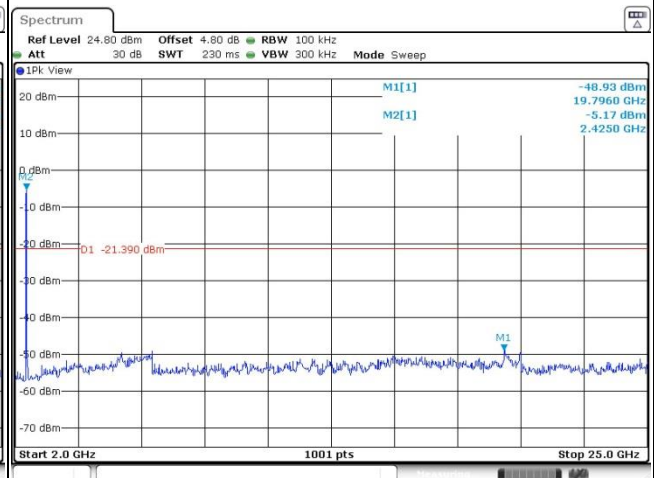
## Channel Plot



## Spurious Emission 30MHz~3GHz



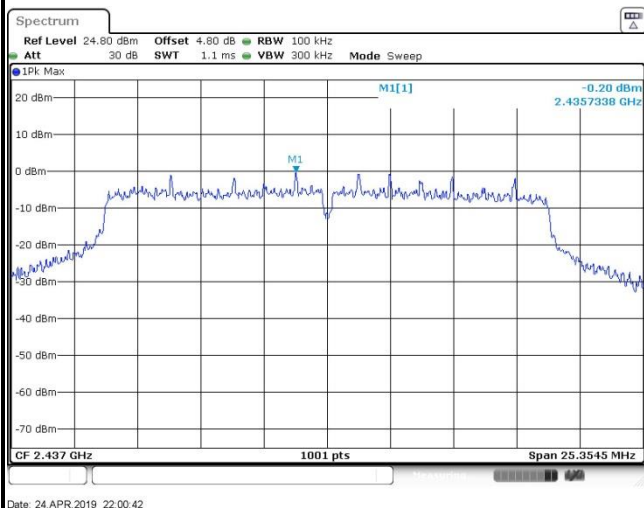
## Spurious Emission 2GHz~25GHz



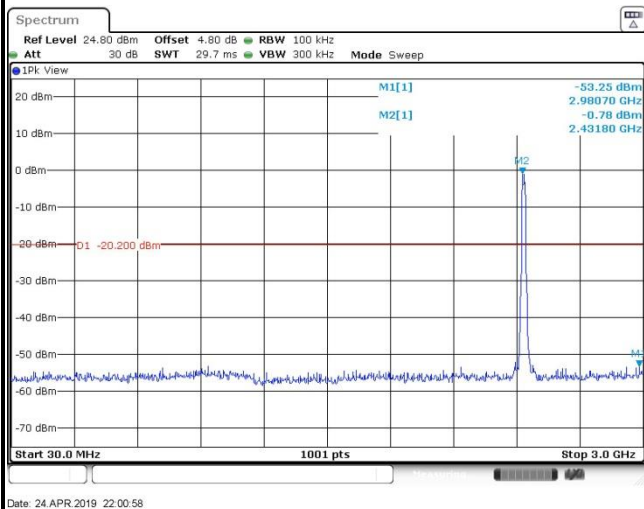


|             |              |                |    |
|-------------|--------------|----------------|----|
| Test Mode : | 802.11n HT20 | Test Channel : | 06 |
|-------------|--------------|----------------|----|

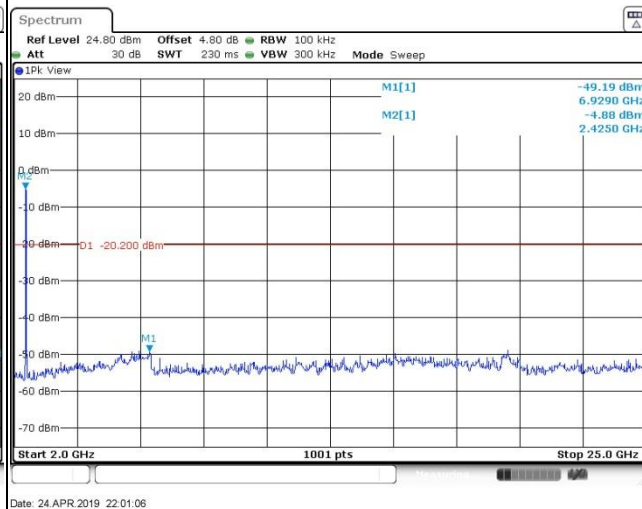
## 100kHz PSD reference Level



## Spurious Emission 30MHz~3GHz



## Spurious Emission 2GHz~25GHz

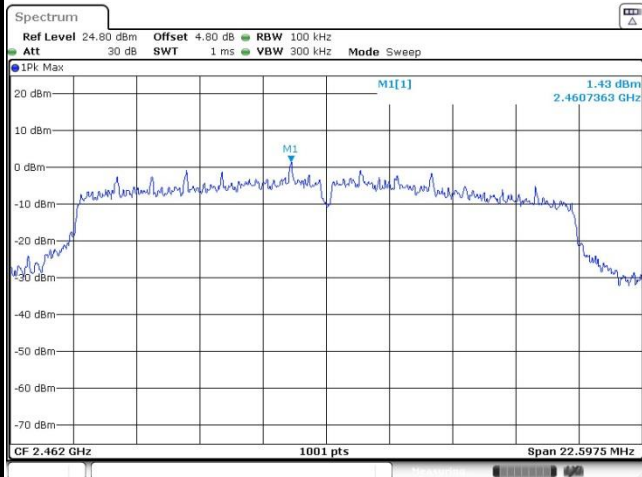




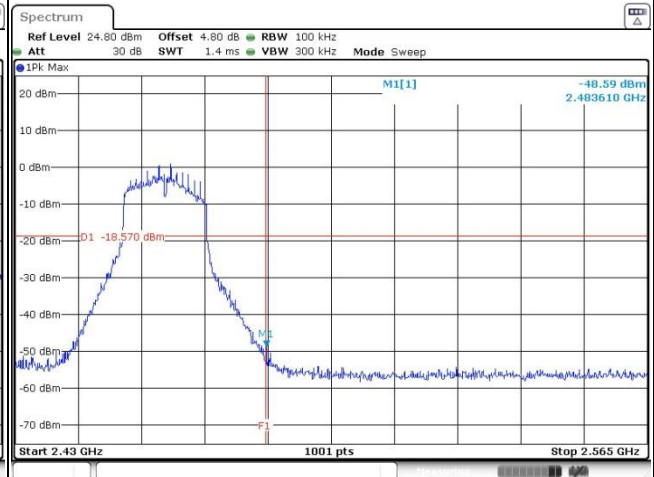
Test Mode : 802.11n HT20

Test Channel : 11

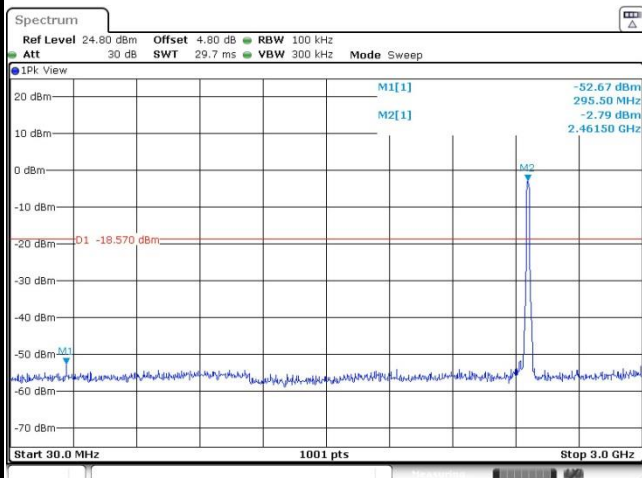
## 100kHz PSD reference Level



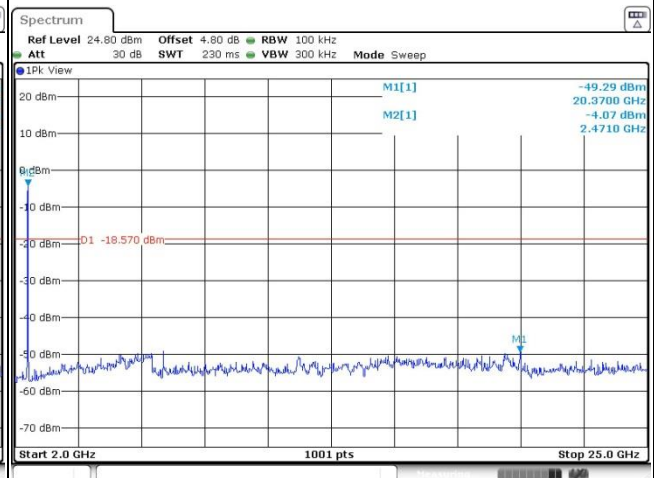
## Channel Plot



## Spurious Emission 30MHz~3GHz



## Spurious Emission 2GHz~25GHz

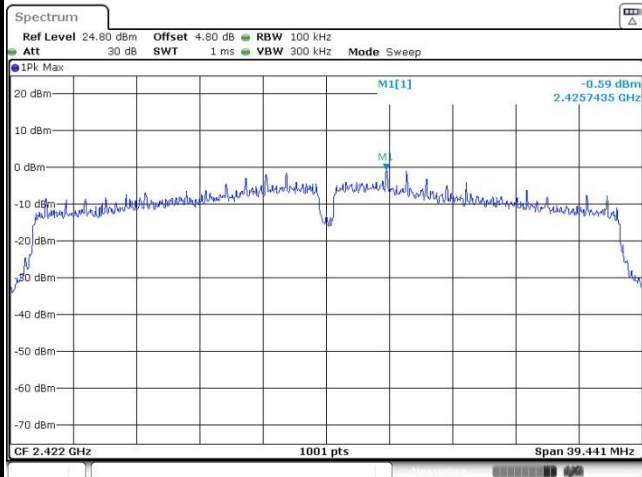




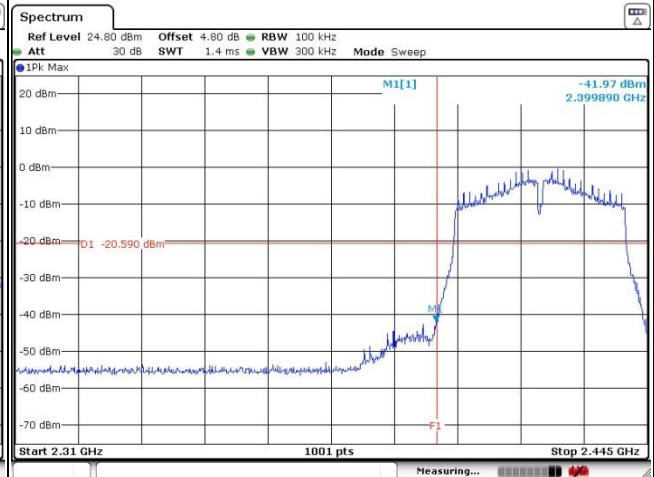
Test Mode : 802.11n HT40

Test Channel : 03

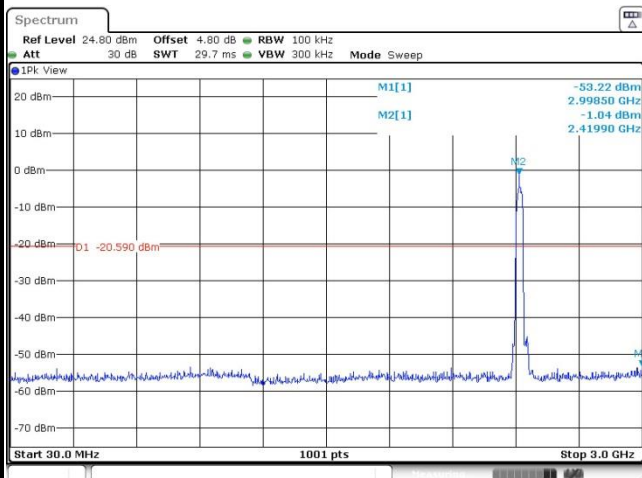
## 100kHz PSD reference Level



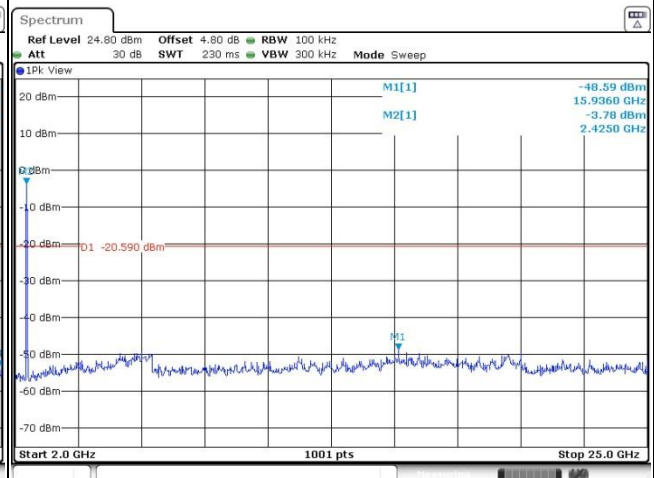
## Channel Plot



## Spurious Emission 30MHz~3GHz



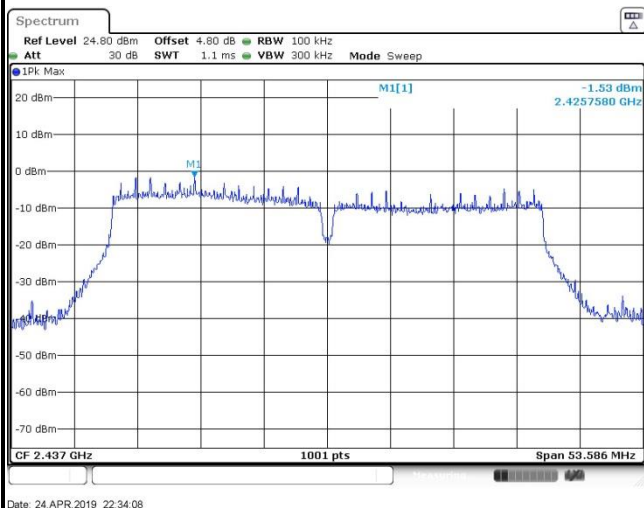
## Spurious Emission 2GHz~25GHz



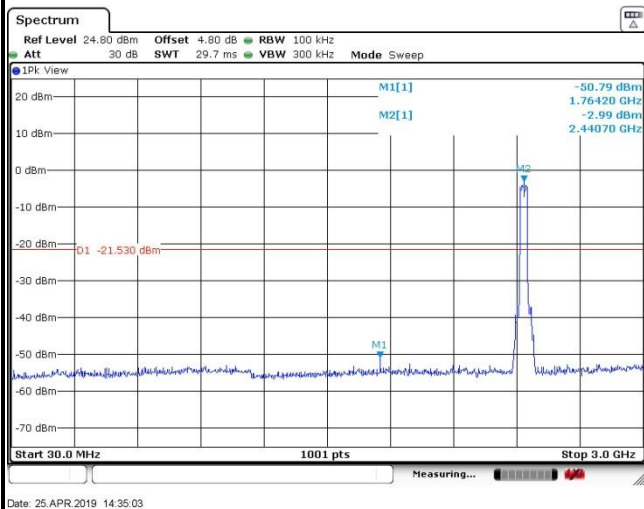


|             |              |                |    |
|-------------|--------------|----------------|----|
| Test Mode : | 802.11n HT40 | Test Channel : | 06 |
|-------------|--------------|----------------|----|

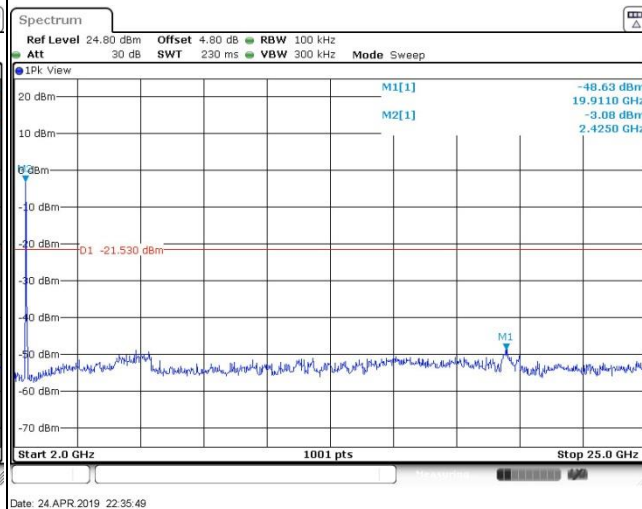
## 100kHz PSD reference Level



## Spurious Emission 30MHz~3GHz

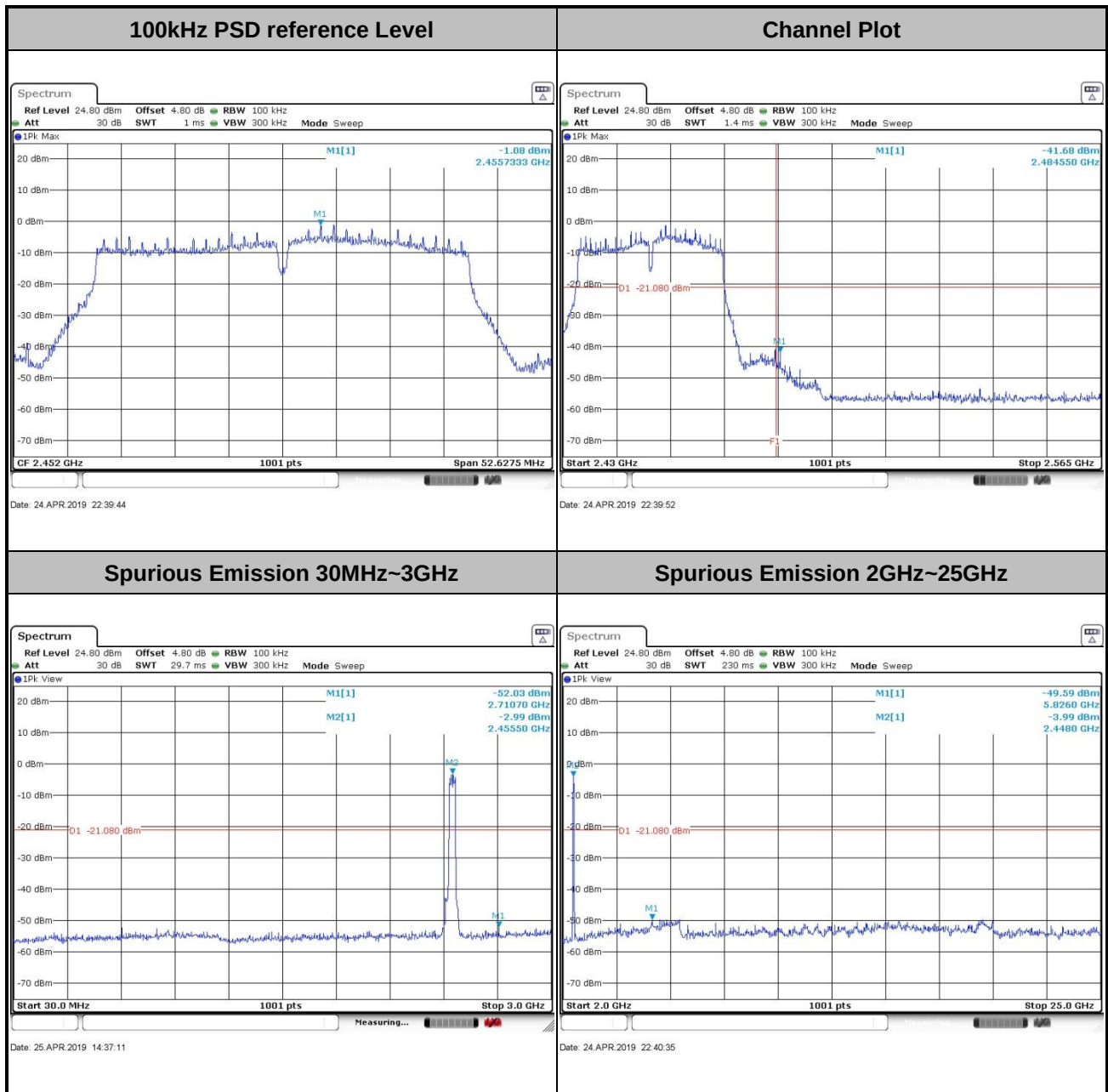


## Spurious Emission 2GHz~25GHz





|             |              |                |    |
|-------------|--------------|----------------|----|
| Test Mode : | 802.11n HT40 | Test Channel : | 09 |
|-------------|--------------|----------------|----|





Number of TX = 2, Ant. 2 (Measured)

|             |         |                |    |
|-------------|---------|----------------|----|
| Test Mode : | 802.11b | Test Channel : | 01 |
|-------------|---------|----------------|----|

