



# FCC PART 15C TEST REPORT No.I23Z60483-IOT12 for

**Client name: OnePlus Technology (Shenzhen) Co., Ltd.**

**Product name: Mobile Phone**

**Model name: CPH2551**

**With**

**FCC ID: 2ABZ2-AA541**

**Hardware Version: 11**

**Software Version: OxygenOS 13.2**

**Issued Date: 2023-07-19**

**Note:**

The test results in this test report relate only to the devices specified in this report. This report shall not be reproduced except in full without the written approval of CTTL.

The report must not be used by the client to claim product certification, approval, or endorsement by NVLAP, NIST, or any agency of the U.S.Government.

**Test Laboratory:**

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## **REPORT HISTORY**

| <b>Report Number</b> | <b>Revision</b> | <b>Description</b>                                                                                                    | <b>Issue Date</b> |
|----------------------|-----------------|-----------------------------------------------------------------------------------------------------------------------|-------------------|
| I23Z60483-IOT12      | Rev.0           | 1st edition                                                                                                           | 2023-07-05        |
| I23Z60483-IOT12      | Rev.1           | Update statement about antenna gain and testing strategy on page 10 to 11;<br>Update ant1/2 and ant7/10 relationship. | 2023-07-19        |

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## **1. Test Laboratory**

### **1.1.Introduction & Accreditation**

**Telecommunication Technology Labs, CAICT** is an ISO/IEC 17025:2017 accredited test laboratory under NATIONAL VOLUNTARY LABORATORY ACCREDITATION PROGRAM (NVLAP) with lab code 600118-0, and is also an FCC accredited test laboratory (CN5017), and ISED accredited test laboratory (ISED#: 24849). The detail accreditation scope can be found on NVLAP website.

### **1.2.Testing Location**

Conducted testing Location 1:CTTL(Huayuan North Road)

Address: No. 52, Huayuan North Road, Haidian District, Beijing,  
P. R. China100191

Radiated testing Location 2:CTTL(huayuan North Road)

Address: No. 52, Huayuan North Road, Haidian District, Beijing,  
P. R. China100191

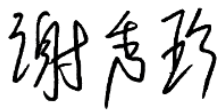
### 1.3. Testing Environment

Normal Temperature: 15-35℃  
Relative Humidity: 20-75%

### 1.4. Project date

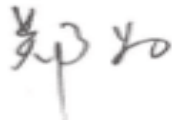
Testing Start Date: 2023-03-17  
Testing End Date: 2023-07-05

### 1.5. Signature



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Xie Xiuzhen  
(Prepared this test report)



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Zheng Wei  
(Reviewed this test report)



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Pang Shuai  
(Approved this test report)

## **2. Client Information**

### **2.1.Applicant Information**

Company Name: OnePlus Technology (Shenzhen) Co., Ltd.  
Address: 18C02, 18C03, 18C04 and 18C05, Shum Yip Terra Building,  
Binhe Avenue North, Futian District, Shenzhen  
City: Shenzhen  
Postal Code: /  
Country: China  
Telephone: (86)76986076999  
Fax: /

### **2.2.Manufacturer Information**

Company Name: OnePlus Technology (Shenzhen) Co., Ltd.  
Address: 18C02, 18C03, 18C04 and 18C05, Shum Yip Terra Building,  
Binhe Avenue North, Futian District, Shenzhen  
City: Shenzhen  
Postal Code: /  
Country: China  
Telephone: (86)76986076999  
Fax: /

### 3. Equipment Under Test (EUT) and Ancillary Equipment (AE)

#### 3.1. About EUT

|                     |                       |
|---------------------|-----------------------|
| Description         | Mobile Phone          |
| Model name          | CPH2551               |
| FCC ID              | 2ABZ2-AA541           |
| With WLAN Function  | Yes                   |
| Frequency Band      | ISM 2400MHz~2483.5MHz |
| Type of Modulation  | DSSS/CCK/OFDM         |
| Number of Channels  | 11                    |
| Antenna             | Integral Antenna      |
| MAX Conducted Power | 27.95dBm              |
| Power Supply        | 3.91V                 |

#### 3.2. Internal Identification of EUT

| EUT ID* | SN or IMEI                          | HW Version | SW Version    |
|---------|-------------------------------------|------------|---------------|
| UT35a   | 868147060030673/<br>868147060030665 | 11         | OxygenOS 13.2 |
| UT15a   | 868147060020070/<br>868147060020062 | 11         | OxygenOS 13.2 |

\*EUT ID: is used to identify the test sample in the lab internally.

UT35a is used for Conduction test, UT15a is used for Radiation test.

#### 3.3. Internal Identification of AE

| AE ID* | Description | SN |
|--------|-------------|----|
| AE1    | Battery     | /  |
| AE2    | Battery     | /  |
| AE3    | Charger     | /  |
| AE4    | USB Cable   | /  |

##### AE1

|                 |                             |
|-----------------|-----------------------------|
| Model           | BLPA01                      |
| Manufacturer    | Sunwoda Electronic Co., Ltd |
| Capacity        | 1470mAh                     |
| Nominal Voltage |                             |

##### AE2

|                 |                             |
|-----------------|-----------------------------|
| Model           | BLPA03                      |
| Manufacturer    | Sunwoda Electronic Co., Ltd |
| Capacity        | 3210mAh                     |
| Nominal Voltage |                             |

##### AE3

|              |                                              |
|--------------|----------------------------------------------|
| Model        | VCB8JAUH                                     |
| Manufacturer | Huizhou Jinhu Industrial Development Co.,Ltd |

|                 |                                       |
|-----------------|---------------------------------------|
| Length of cable | /                                     |
| AE4             |                                       |
| Model           | DL129                                 |
| Manufacturer    | OnePlus Technology(Shenzhen) Co.,Ltd. |
| Length of cable | /                                     |

\*AE ID: is used to identify the test sample in the lab internally.

### 3.4. General Description

The Equipment under Test (EUT) is a model of Mobile Phone with integrated antenna and inbuilt battery.

It consists of normal options: travel charger, USB cable.

Manual and specifications of the EUT were provided to fulfil the test.

Samples undergoing test were selected by the client.

### 3.5. Interpretation of the Test Environment

For the test methods, the test environment uncertainty figures correspond to an expansion factor k=2.

Measurement Uncertainty

| Parameter   | Uncertainty |
|-------------|-------------|
| temperature | 0.48°C      |
| humidity    | 2 %         |
| DC voltages | 0.003V      |

## 4. Reference Documents

### 4.1. Documents supplied by applicant

EUT feature information is supplied by the applicant or manufacturer, which is the basis of testing.

### 4.2. Reference Documents for testing

The following documents listed in this section are referred for testing.

| Reference      | Title                                                                                                                     | Version |
|----------------|---------------------------------------------------------------------------------------------------------------------------|---------|
| FCC Part15     | FCC CFR 47, Part 15, Subpart C:                                                                                           | 2021    |
|                | 15.205 Restricted bands of operation;                                                                                     |         |
|                | 15.209 Radiated emission limits, general requirements;                                                                    |         |
| ANSI C63.10    | 15.247 Operation within the bands 902-928MHz, 2400-2483.5 MHz, and 5725-5850 MHz.                                         | 2013    |
|                | American National Standard of Procedures for Compliance Testing of Unlicensed Wireless Devices                            |         |
| KDB 558074 D01 | Federal Communications Commission Office of Engineering and Technology Laboratory Division                                | 2019    |
|                | GUIDANCE FOR COMPLIANCE MEASUREMENTS ON DIGITAL TRANSMISSION SYSTEM, FREQUENCY HOPPING SPREAD SPECTRUM SYSTEM, AND HYBRID |         |
|                |                                                                                                                           |         |

SYSTEM DEVICES OPERATING UNDER SECTION  
15.247 OF THE FCC RULES

KDB 662911 D01 Emissions Testing of Transmitters with Multiple Outputs in  
the Same Band(e.g., MIMO, Smart Antenna, etc) 2013-10

## 5. Test Results

### 5.1. Summary of Test Results

| SUMMARY OF MEASUREMENT RESULTS            | Sub-clause of Part15C  | Sub-clause of IC | Verdict |
|-------------------------------------------|------------------------|------------------|---------|
| Maximum Peak Output Power                 | 15.247 (b)             | /                | P       |
| Peak Power Spectral Density               | 15.247 (e)             | /                | P       |
| Occupied 6dB Bandwidth                    | 15.247 (a)             | /                | P       |
| Band Edges Compliance                     | 15.247 (d)             | /                | P       |
| Transmitter Spurious Emission - Conducted | 15.247 (d)             | /                | P       |
| Transmitter Spurious Emission - Radiated  | 15.247, 15.205, 15.209 | /                | P       |
| AC Powerline Conducted Emission           | 15.107, 15.207         | /                | P       |

Please refer to **ANNEX A** for detail.

Terms used in Verdict column

|    |                                                                               |
|----|-------------------------------------------------------------------------------|
| P  | Pass, The EUT complies with the essential requirements in the standard.       |
| NP | Not Perform, The test was not performed by CTTL                               |
| NA | Not Applicable, The test was not applicable                                   |
| F  | Fail, The EUT does not comply with the essential requirements in the standard |

### 5.2. For conducted result :

1. EUT support 802.11b/g/n/ax/be modes on 2.4G, and can't transmit simultaneously in 2.4G.
  2. As WLAN SISO(1x1) & MIMO(2x2) mode have the same power setting, the whole testing has assessed only MIMO mode.
  3. 802.11ax support full RU and single RU modes.
  4. 802.11be support full RU, single RU, small MRU, large MRU and puncturing modes.
  5. For 802.11b/g/n/ax full RU/be full RU, the whole testing (PSD/6dB bandwidth/band edges/ Transmitter Spurious Emission-Conducted) has reported only 802.11b/g/be-EHT20/40MHz by referring to the higher output power.
  6. For 802.11ax single RU and 802.11be single RU modes, the whole testing (PSD/band edges/ Transmitter Spurious Emission-Conducted) has reported only 802.11be- EHT20-single RU by referring to the higher output power.
  7. For 802.11be-EHT20/40MHz small MRU mode, the whole testing (PSD/band edges/ Transmitter Spurious Emission-Conducted) has reported only 802.11be- EHT20 by referring to the higher output power.
- 52 Tone,index38 + 26Tone,index1, 52 Tone,index39 + 26Tone,index7  
106 Tone,index53 + 26Tone,index4, 106 Tone,index54 + 26Tone,index4.

### 5.3. Antenna Gain

| Mode | Ant5(dBi) | Ant6(dBi) | Power(dBi) | PSD(dBi) |
|------|-----------|-----------|------------|----------|
| CDD  | -3        | -0.5      | -0.5       | 1.35     |
| BF   | -3        | -0.5      | 1.35       | 1.35     |

1. For BF transmissions, power and PSD directional gain is calculated as:

Directional gain =  $10 \log [(10^{G1/20} + 10^{G2/20} + \dots + 10^{Gn/20})^2 / \text{NANT}]$  dBi, as following table for PSD. NANT = number of transmit antennas NSS = number of spatial streams. (The worst case directional gain will occur when NSS = 1)

2. For CDD transmissions, directional gain is calculated as:

a. For power, the directional gain GANT is set equal to the antenna having the highest gain, i.e., Directional gain = GANT MAX (Ant.1 Gain, Ant.2 Gain, ...) + Array Gain, where Array Gain = 0 dB (i.e., no array gain) for NANT ≤ 4.

b. For PSD, the directional gain calculation is following:

Directional gain =  $10 \log [(10^{G1/20} + 10^{G2/20} + \dots + 10^{Gn/20})^2 / \text{NANT}]$  dBi. NANT = number of transmit antennas NSS = number of spatial streams. (The worst case directional gain will occur when NSS = 1).

3. 802.11g support CDD mode ;
4. 802.11n support CDD and STBC mode, as they use the same power setting, only eirp results of CDD have been reported.
5. 802.11ax/be support CDD, BF and STBC mode, as they use the same power setting, only eirp results of BF have been reported.
6. The device what use a permanently attached antenna were considered sufficient to comply with the provisions of 15.203.

### 5.4. Statements

The test cases as listed in section 5.1 of this report for the EUT specified in section 3 was performed by CTTL and according to the standards or reference documents listed in section 4.2

The EUT met all requirements of the standards or reference documents, and only the WLAN function was tested in this report.

### 5.5. Test Conditions

|       |                    |
|-------|--------------------|
| T nom | Normal Temperature |
| T min | Low Temperature    |
| T max | High Temperature   |
| V nom | Normal Voltage     |

For this report, if the test cases listed above are tested under normal temperature and normal voltage, and also under norm humidity, the specific condition is shown as follows:

|             |       |                   |
|-------------|-------|-------------------|
| Temperature | T nom | 26°C              |
| Voltage     | V nom | 3.91V(By battery) |
| Humidity    | H nom | 20-75%            |

## 6. Test Facilities Utilized

### Conducted test system

| No. | Equipment              | Model  | Serial Number | Manufacturer    | Calibration Period | Calibration Due date |
|-----|------------------------|--------|---------------|-----------------|--------------------|----------------------|
| 1   | Vector Signal Analyzer | FSQ40  | 200089        | Rohde & Schwarz | 1 year             | 2024-06-15           |
| 2   | LISN                   | ENV216 | 101459        | R&S             | 1 year             | 2024-04-29           |
| 3   | Test Receiver          | ESCI 3 | 100766        | R&S             | 1 year             | 2024-04-30           |
| 4   | Shielding Room         | S81    | /             | ETS-Lindgren    | /                  | /                    |

### Radiated emission test system

| No. | Equipment                         | Model     | Serial Number | Manufacturer    | Calibration Period | Calibration Due date |
|-----|-----------------------------------|-----------|---------------|-----------------|--------------------|----------------------|
| 1   | Test Receiver                     | ESW44     | 103144        | Rohde & Schwarz | 1 year             | 2023-10-25           |
| 2   | Dual-Ridge Waveguide Horn Antenna | VULB 9163 | 01223         | Schwarzbeck     | 1 year             | 2023-07-25           |
| 3   | Dual-Ridge Waveguide Horn Antenna | 3115      | 00167250      | ETS-Lindgren    | 1 year             | 2023-06-20           |

**Note:** The Dual-Ridge Waveguide Horn Antenna with series number of 00167250 did not exceed the CAL.DUE.DATE when used.

## 7. Measurement Uncertainty

### 7.1. Maximum Output Power

Measurement Uncertainty: 0.387dB,k=1.96

### 7.2. Peak Power Spectral Density

Measurement Uncertainty: 0.705dB,k=1.96

### 7.3. DTS 6-dB Signal Bandwidth

Measurement Uncertainty: 60.80Hz,k=1.96

### 7.4. Band Edges Compliance

Measurement Uncertainty : 0.62dB,k=1.96

### 7.5. Transmitter Spurious Emission

#### Conducted (k=1.96)

| Frequency Range                            | Uncertainty(dB) |
|--------------------------------------------|-----------------|
| $30\text{MHz} \leq f \leq 2\text{GHz}$     | 1.22            |
| $2\text{GHz} \leq f \leq 3.6\text{GHz}$    | 1.22            |
| $3.6\text{GHz} \leq f \leq 8\text{GHz}$    | 1.22            |
| $8\text{GHz} \leq f \leq 12.75\text{GHz}$  | 1.51            |
| $12.75\text{GHz} \leq f \leq 26\text{GHz}$ | 1.51            |
| $26\text{GHz} \leq f \leq 40\text{GHz}$    | 1.59            |

#### Radiated (k=2)

| Frequency Range                         | Uncertainty(dB) |
|-----------------------------------------|-----------------|
| 9kHz-30MHz                              | /               |
| $30\text{MHz} \leq f \leq 1\text{GHz}$  | 4.92            |
| $1\text{GHz} \leq f \leq 18\text{GHz}$  | 5.15            |
| $18\text{GHz} \leq f \leq 40\text{GHz}$ | 5.54            |

### 7.6. AC Power-line Conducted Emission

Measurement Uncertainty : 3.08dB,k=2

## **ANNEX A: Detailed Test Results**

### **A.1. Measurement Method**

#### **A.1.1. Conducted Measurements**

Connect the EUT to the test system as Fig.A.1.1.1 shows.

Set the EUT to the required work mode.

Set the EUT to the required channel.

Set the Vector Signal Analyzer and start measurement.

Record the values. Vector Signal Analyzer

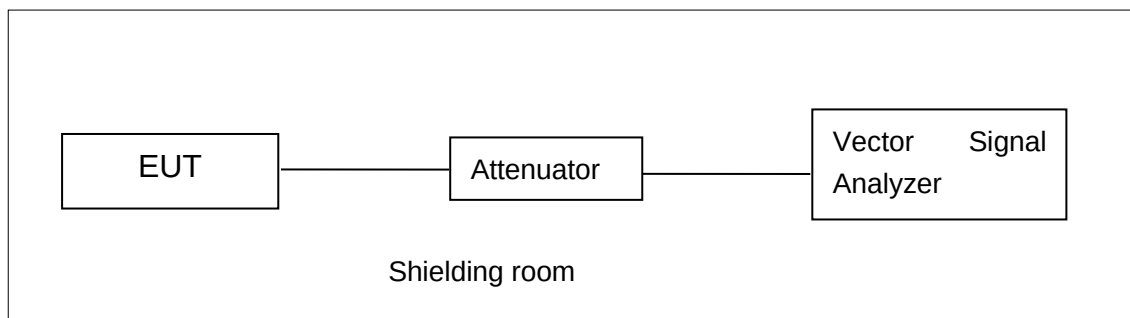


**Fig.A.1.1.1: Test Setup Diagram for Conducted Measurements**

#### **A.1.2. Radiated Emission Measurements**

In the case of radiated emission, the used settings are as follows,

Sweep frequency from 30 MHz to 1GHz, RBW = 100 kHz, VBW = 300 kHz;

Sweep frequency from 1 GHz to 26GHz, RBW = 1MHz, VBW = 10Hz;

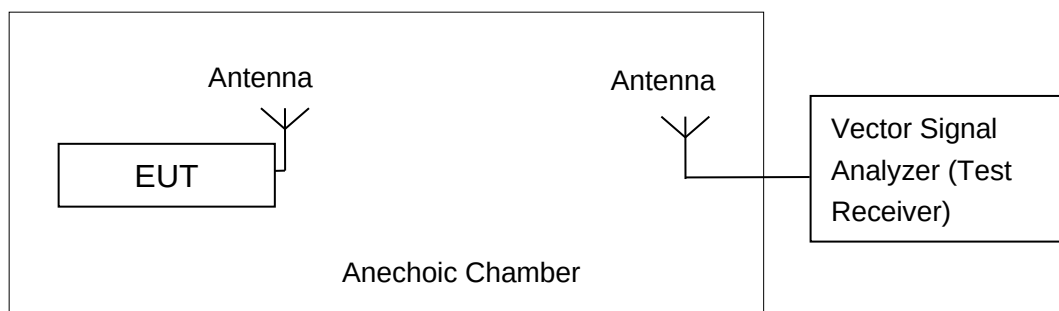


**Fig.A.1.2.1: Test Setup Diagram for Radiated Measurements**

## A.2. Maximum Output Power

**Method of Measurement:** See ANSI C63.10-2013-clause 11.9.1.1

- Set the RBW  $\geq$  DTS bandwidth.
- Set VBW  $\geq [3 \times \text{RBW}]$ .
- Set span  $\geq [3 \times \text{RBW}]$ .
- Sweep time = auto couple.
- Detector = peak.
- Trace mode = max hold.
- Allow trace to fully stabilize.
- Use peak marker function to determine the peak amplitude level.

**Measurement Limit:**

| Standard               | Limit (dBm) |
|------------------------|-------------|
| FCC CRF Part 15.247(b) | < 30        |

EUT ID: UT35a

### A.2.1. Peak Output Power-conducted

**Measurement Results:**

**MIMO**

**802.11b/g mode**

| Mode    | Data Rate (Mbps) | Test Result (dBm) |               |                 |               |               |                 |               |               |                 |
|---------|------------------|-------------------|---------------|-----------------|---------------|---------------|-----------------|---------------|---------------|-----------------|
|         |                  | ANT5              |               |                 | ANT6          |               |                 | MIMO          |               |                 |
|         |                  | 2412MHz (Ch1)     | 2437MHz (Ch6) | 2462 MHz (Ch11) | 2412MHz (Ch1) | 2437MHz (Ch6) | 2462 MHz (Ch11) | 2412MHz (Ch1) | 2437MHz (Ch6) | 2462 MHz (Ch11) |
| 802.11g | 6                | 22.88             | 23.72         | 22.51           | 23.59         | 24.55         | 23.44           | 26.26         | 27.17         | 26.01           |

The data rate 6Mbps is selected as worst condition, and the following cases are performed with this condition.

**802.11n-HT20 mode**

| Mode            | Data Rate (Index) | Test Result (dBm) |               |                 |               |               |                 |               |               |                 |
|-----------------|-------------------|-------------------|---------------|-----------------|---------------|---------------|-----------------|---------------|---------------|-----------------|
|                 |                   | ANT5              |               |                 | ANT6          |               |                 | MIMO          |               |                 |
|                 |                   | 2412MHz (Ch1)     | 2437MHz (Ch6) | 2462 MHz (Ch11) | 2412MHz (Ch1) | 2437MHz (Ch6) | 2462 MHz (Ch11) | 2412MHz (Ch1) | 2437MHz (Ch6) | 2462 MHz (Ch11) |
| 802.11n (20MHz) | MCS0              | 22.86             | 23.73         | 23.46           | 23.74         | 24.69         | 24.52           | 26.33         | 27.25         | 27.03           |

The data rate MSC0 is selected as worst condition, and the following cases are performed with this condition.

### 802.11n-HT40 mode

| Mode            | Data Rate (Index) | Test Result (dBm) |               |                |               |               |                |               |               |                |
|-----------------|-------------------|-------------------|---------------|----------------|---------------|---------------|----------------|---------------|---------------|----------------|
|                 |                   | ANT5              |               |                | ANT6          |               |                | MIMO          |               |                |
|                 |                   | 2422MHz (Ch3)     | 2437MHz (Ch6) | 2452 MHz (Ch9) | 2422MHz (Ch3) | 2437MHz (Ch6) | 2452 MHz (Ch9) | 2422MHz (Ch3) | 2437MHz (Ch6) | 2452 MHz (Ch9) |
| 802.11n (40MHz) | MCS0              | 21.62             | 23.87         | 19.54          | 22.97         | 24.79         | 20.73          | 25.36         | 27.36         | 23.19          |

The data rate MCS0 is selected as worst condition, and the following cases are performed with this condition.

### 802.11ax-HT20 mode

| Mode             | Data Rate (Index) | Test Result (dBm) |               |                 |               |               |                 |               |               |                 |
|------------------|-------------------|-------------------|---------------|-----------------|---------------|---------------|-----------------|---------------|---------------|-----------------|
|                  |                   | ANT5              |               |                 | ANT6          |               |                 | MIMO          |               |                 |
|                  |                   | 2412MHz (Ch1)     | 2437MHz (Ch6) | 2462 MHz (Ch11) | 2412MHz (Ch1) | 2437MHz (Ch6) | 2462 MHz (Ch11) | 2412MHz (Ch1) | 2437MHz (Ch6) | 2462 MHz (Ch11) |
| 802.11ax (20MHz) | MCS0              | 23.94             | 24.75         | 23.57           | 24.83         | 25.78         | 24.70           | 27.42         | 28.31         | 27.18           |

The data rate MCS0 is selected as worst condition, and the following cases are performed with this condition.

### 802.11ax-HT40 mode

| Mode             | Data Rate (Index) | Test Result (dBm) |               |                |               |               |                |               |               |                |
|------------------|-------------------|-------------------|---------------|----------------|---------------|---------------|----------------|---------------|---------------|----------------|
|                  |                   | ANT5              |               |                | ANT6          |               |                | MIMO          |               |                |
|                  |                   | 2422MHz (Ch3)     | 2437MHz (Ch6) | 2452 MHz (Ch9) | 2422MHz (Ch3) | 2437MHz (Ch6) | 2452 MHz (Ch9) | 2422MHz (Ch3) | 2437MHz (Ch6) | 2452 MHz (Ch9) |
| 802.11ax (40MHz) | MCS0              | 22.16             | 24.38         | 19.09          | 23.51         | 25.31         | 20.29          | 25.90         | 27.88         | 22.74          |

The data rate MCS0 is selected as worst condition, and the following cases are performed with this condition.

### 802.11be-HT20 mode

| Mode             | Data Rate (Index) | Test Result (dBm) |               |                 |               |               |                 |               |               |                 |
|------------------|-------------------|-------------------|---------------|-----------------|---------------|---------------|-----------------|---------------|---------------|-----------------|
|                  |                   | ANT5              |               |                 | ANT6          |               |                 | MIMO          |               |                 |
|                  |                   | 2412MHz (Ch1)     | 2437MHz (Ch6) | 2462 MHz (Ch11) | 2412MHz (Ch1) | 2437MHz (Ch6) | 2462 MHz (Ch11) | 2412MHz (Ch1) | 2437MHz (Ch6) | 2462 MHz (Ch11) |
| 802.11be (20MHz) | MCS0              | 24.43             | 24.33         | 24.07           | 25.40         | 25.34         | 25.18           | 27.95         | 27.87         | 27.67           |

The data rate MCS0 is selected as worst condition, and the following cases are performed with this condition.

this condition.

#### 802.11be-HT40 mode

| Mode             | Data Rate (Index) | Test Result (dBm) |               |                |               |               |                |               |               |                |
|------------------|-------------------|-------------------|---------------|----------------|---------------|---------------|----------------|---------------|---------------|----------------|
|                  |                   | ANT5              |               |                | ANT6          |               |                | MIMO          |               |                |
|                  |                   | 2422MHz (Ch3)     | 2437MHz (Ch6) | 2452 MHz (Ch9) | 2422MHz (Ch3) | 2437MHz (Ch6) | 2452 MHz (Ch9) | 2422MHz (Ch3) | 2437MHz (Ch6) | 2452 MHz (Ch9) |
| 802.11be (40MHz) | MCS0              | 21.94             | 24.14         | 19.82          | 23.32         | 25.15         | 21.08          | 25.69         | 27.68         | 23.51          |

The data rate MCS0 is selected as worst condition, and the following cases are performed with this condition.

#### RU MIMO

#### 802.11ax20-RU26 mode

| Mode                  | Data Rate (Mbps) | Test Result (dBm) |               |                 |               |               |                 |               |               |                 |
|-----------------------|------------------|-------------------|---------------|-----------------|---------------|---------------|-----------------|---------------|---------------|-----------------|
|                       |                  | ANT5              |               |                 | ANT6          |               |                 | MIMO          |               |                 |
|                       |                  | 2412MHz (Ch1)     | 2437MHz (Ch6) | 2462 MHz (Ch11) | 2412MHz (Ch1) | 2437MHz (Ch6) | 2462 MHz (Ch11) | 2412MHz (Ch1) | 2437MHz (Ch6) | 2462 MHz (Ch11) |
| 802.11ax20-RU26-left  | MCS0             | 17.68             | 17.48         | 17.17           | 18.19         | 17.78         | 17.95           | 20.95         | 20.64         | 20.59           |
| 802.11ax20-RU26-right | MCS0             | 17.11             | 17.09         | 17.55           | 17.43         | 17.45         | 18.08           | 20.28         | 20.28         | 20.83           |

The data rate MCS0 are selected as worst condition, and the following cases are performed with this condition.

#### 802.11ax20-RU52 mode

| Mode                  | Data Rate (Mbps) | Test Result (dBm) |               |                 |               |               |                 |               |               |                 |
|-----------------------|------------------|-------------------|---------------|-----------------|---------------|---------------|-----------------|---------------|---------------|-----------------|
|                       |                  | ANT5              |               |                 | ANT6          |               |                 | MIMO          |               |                 |
|                       |                  | 2412MHz (Ch1)     | 2437MHz (Ch6) | 2462 MHz (Ch11) | 2412MHz (Ch1) | 2437MHz (Ch6) | 2462 MHz (Ch11) | 2412MHz (Ch1) | 2437MHz (Ch6) | 2462 MHz (Ch11) |
| 802.11ax20-RU52-left  | MCS0             | 19.82             | 20.45         | 20.16           | 20.38         | 20.82         | 21.02           | 23.12         | 23.65         | 23.62           |
| 802.11ax20-RU52-right | MCS0             | 20.09             | 20.11         | 20.19           | 20.46         | 20.57         | 20.66           | 23.29         | 23.36         | 23.44           |

The data rate MCS0 are selected as worst condition, and the following cases are performed with this condition.

**802.11ax20-RU106 mode**

| Mode                   | Data Rate (Mbps) | Test Result (dBm) |               |                 |               |               |                 |               |               |                 |
|------------------------|------------------|-------------------|---------------|-----------------|---------------|---------------|-----------------|---------------|---------------|-----------------|
|                        |                  | ANT5              |               |                 | ANT6          |               |                 | MIMO          |               |                 |
|                        |                  | 2412MHz (Ch1)     | 2437MHz (Ch6) | 2462 MHz (Ch11) | 2412MHz (Ch1) | 2437MHz (Ch6) | 2462 MHz (Ch11) | 2412MHz (Ch1) | 2437MHz (Ch6) | 2462 MHz (Ch11) |
| 802.11ax20-RU106-left  | MCS0             | 23.17             | 23.09         | 22.77           | 23.87         | 23.7          | 23.87           | 26.54         | 26.42         | 26.27           |
| 802.11ax20-RU106-right | MCS0             | 23.10             | 23.33         | 23.46           | 23.81         | 23.80         | 23.81           | 26.48         | 26.58         | 26.77           |

The data rate MCS0 are selected as worst condition, and the following cases are performed with this condition.

**802.11be20-RU26 mode**

| Mode                  | Data Rate (Mbps) | Test Result (dBm) |               |                 |               |               |                 |               |               |                 |
|-----------------------|------------------|-------------------|---------------|-----------------|---------------|---------------|-----------------|---------------|---------------|-----------------|
|                       |                  | ANT5              |               |                 | ANT6          |               |                 | MIMO          |               |                 |
|                       |                  | 2412MHz (Ch1)     | 2437MHz (Ch6) | 2462 MHz (Ch11) | 2412MHz (Ch1) | 2437MHz (Ch6) | 2462 MHz (Ch11) | 2412MHz (Ch1) | 2437MHz (Ch6) | 2462 MHz (Ch11) |
| 802.11be20-RU26-left  | MCS0             | 17.28             | 17.70         | 17.45           | 17.92         | 17.90         | 18.12           | 20.62         | 20.81         | 20.81           |
| 802.11be20-RU26-right | MCS0             | 17.10             | 17.21         | 17.02           | 17.32         | 17.64         | 17.46           | 20.22         | 20.44         | 20.26           |

The data rate MCS0 are selected as worst condition, and the following cases are performed with this condition.

**802.11be20-RU52 mode**

| Mode                  | Data Rate (Mbps) | Test Result (dBm) |               |                 |               |               |                 |               |               |                 |
|-----------------------|------------------|-------------------|---------------|-----------------|---------------|---------------|-----------------|---------------|---------------|-----------------|
|                       |                  | ANT5              |               |                 | ANT6          |               |                 | MIMO          |               |                 |
|                       |                  | 2412MHz (Ch1)     | 2437MHz (Ch6) | 2462 MHz (Ch11) | 2412MHz (Ch1) | 2437MHz (Ch6) | 2462 MHz (Ch11) | 2412MHz (Ch1) | 2437MHz (Ch6) | 2462 MHz (Ch11) |
| 802.11be20-RU52-left  | MCS0             | 19.95             | 20.69         | 20.32           | 20.48         | 21.01         | 21.11           | 23.23         | 23.86         | 23.74           |
| 802.11be20-RU52-right | MCS0             | 20.16             | 20.29         | 20.31           | 20.51         | 20.72         | 20.72           | 23.35         | 23.52         | 23.53           |

The data rate MCS0 are selected as worst condition, and the following cases are performed with this condition.

**802.11be20-RU106 mode**

| Mode                   | Data Rate (Mbps) | Test Result (dBm) |               |                 |               |               |                 |               |               |                 |
|------------------------|------------------|-------------------|---------------|-----------------|---------------|---------------|-----------------|---------------|---------------|-----------------|
|                        |                  | ANT5              |               |                 | ANT6          |               |                 | MIMO          |               |                 |
|                        |                  | 2412MHz (Ch1)     | 2437MHz (Ch6) | 2462 MHz (Ch11) | 2412MHz (Ch1) | 2437MHz (Ch6) | 2462 MHz (Ch11) | 2412MHz (Ch1) | 2437MHz (Ch6) | 2462 MHz (Ch11) |
| 802.11be20-RU106-left  | MCS0             | 23.14             | 23.09         | 22.81           | 23.85         | 23.67         | 23.65           | 26.52         | 26.40         | 26.26           |
| 802.11be20-RU106-right | MCS0             | 23.34             | 22.88         | 23.03           | 23.89         | 23.52         | 23.53           | 26.63         | 26.22         | 26.30           |

The data rate MCS0 are selected as worst condition, and the following cases are performed with this condition.

**Small MRU MIMO**
**802.11be20 mode**

| Mode                             | Data Rate (Mbps) | Test Result (dBm) |                |                 |                |                |                 |                |                |                 |
|----------------------------------|------------------|-------------------|----------------|-----------------|----------------|----------------|-----------------|----------------|----------------|-----------------|
|                                  |                  | ANT5              |                |                 | ANT6           |                |                 | MIMO           |                |                 |
|                                  |                  | 2412 MHz (Ch1)    | 2437 MHz (Ch6) | 2462 MHz (Ch11) | 2412 MHz (Ch1) | 2437 MHz (Ch6) | 2462 MHz (Ch11) | 2412 MHz (Ch1) | 2437 MHz (Ch6) | 2462 MHz (Ch11) |
| 52 Tone,index38 + 26Tone,index1  | MCS0             | 17.71             | 17.97          | 17.68           | 18.16          | 18.34          | 18.33           | 20.95          | 21.17          | 21.03           |
| 52 Tone,index39 + 26Tone,index7  | MCS0             | 18.14             | 17.74          | 17.41           | 18.44          | 18.16          | 18.08           | 21.30          | 20.97          | 20.77           |
| Mode                             | Data Rate (Mbps) | Test Result (dBm) |                |                 |                |                |                 |                |                |                 |
|                                  |                  | ANT5              |                |                 | ANT6           |                |                 | MIMO           |                |                 |
|                                  |                  | 2412 MHz (Ch1)    | 2437 MHz (Ch6) | 2462 MHz (Ch11) | 2412 MHz (Ch1) | 2437 MHz (Ch6) | 2462 MHz (Ch11) | 2412 MHz (Ch1) | 2437 MHz (Ch6) | 2462 MHz (Ch11) |
| 106 Tone,index53 + 26Tone,index4 | MCS0             | 17.04             | 17.14          | 17.07           | 17.56          | 17.61          | 17.82           | 20.32          | 20.39          | 20.47           |
| 106 Tone,index54 + 26Tone,index4 | MCS0             | 17.67             | 17.34          | 16.88           | 17.98          | 17.78          | 17.45           | 20.84          | 20.58          | 20.18           |

The data rate MCS0 are selected as worst condition, and the following cases are performed with this condition.

### Duty Cycle

| Mode       | 802.11b | 802.11g | 802.11n20 | 802.11n40 | 802.11ax-20 | 802.11ax-20<br>RU | 802.11ax-40 | 802.11ax-40<br>RU |
|------------|---------|---------|-----------|-----------|-------------|-------------------|-------------|-------------------|
| Duty Cycle | 95%     | 99%     | 99%       | 99%       | 90%         | 94%               | 90%         | 94%               |

| Mode       | 802.11BE-20 | 802.11BE-20 RU | 802.11BE-40 | 802.11BE-40<br>RU |
|------------|-------------|----------------|-------------|-------------------|
| Duty Cycle | 89%         | 94%            | 89%         | 94%               |

| Mode       | 802.11BE-20<br>52-index38+26-index1<br>MRU1 | 802.11BE-20<br>52-index39+26-index7<br>MRU3 | 802.11BE-20<br>106-index53+26-index4<br>MRU1 | 802.11BE-20<br>106-index54+26-index4<br>MRU2 |
|------------|---------------------------------------------|---------------------------------------------|----------------------------------------------|----------------------------------------------|
| Duty Cycle | 94%                                         | 94%                                         | 93%                                          | 93%                                          |

**Conclusion: Pass**

### A.3. Peak Power Spectral Density

**Method of Measurement: See ANSI C63.10-2013-clause 11.10.2**

- Set analyzer center frequency to DTS channel center frequency.
- Set the span to 1.5 times the DTS bandwidth.
- Set the RBW to RBW = 3 kHz.
- Set the VBW = 10 kHz.
- Detector = peak.
- Sweep time = auto couple.
- Trace mode = max hold.
- Allow trace to fully stabilize.
- Use the peak marker function to determine the maximum amplitude level within the RBW.

#### Measurement Limit:

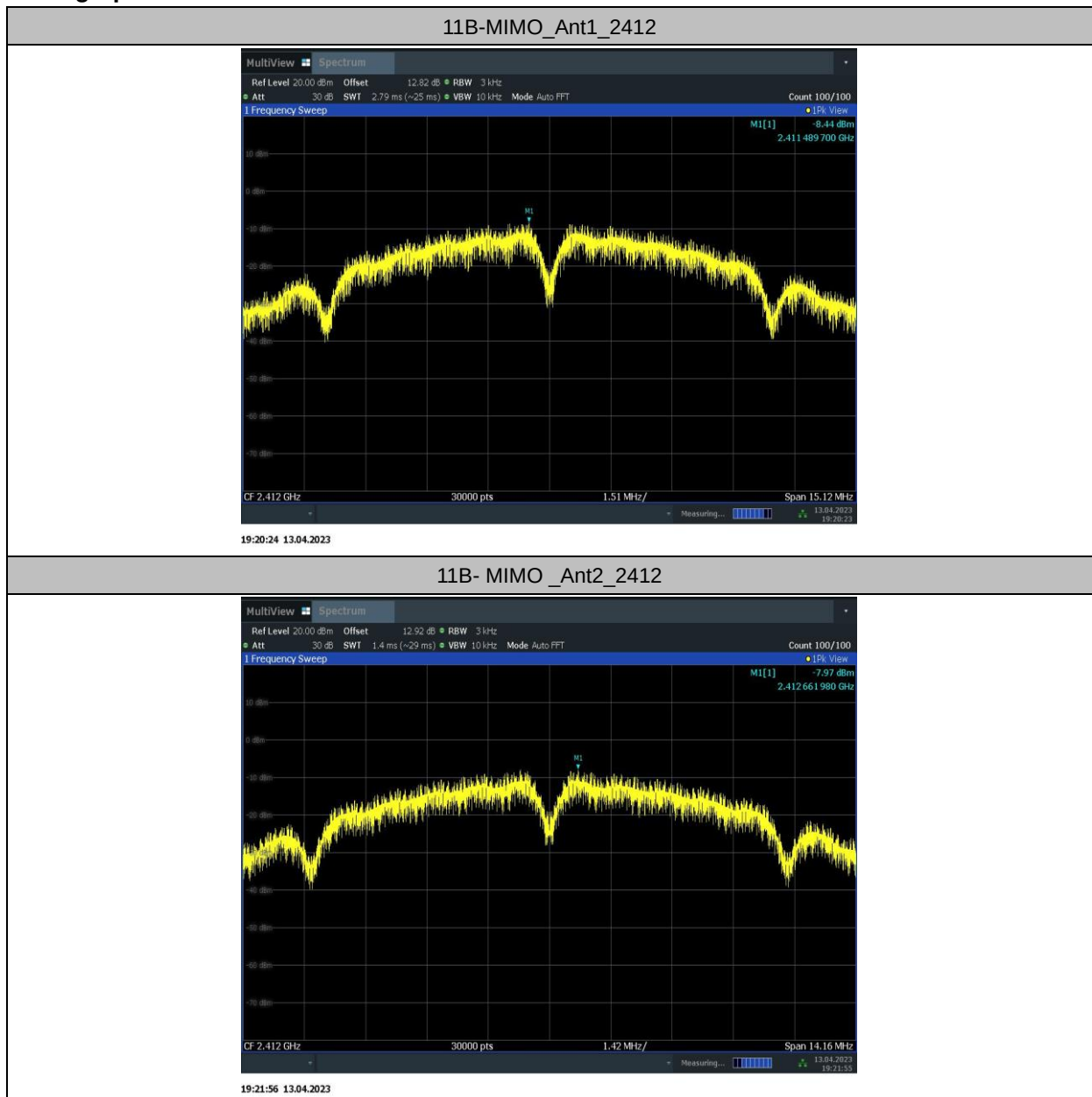
| Standard               | Limit         |
|------------------------|---------------|
| FCC CRF Part 15.247(e) | < 8 dBm/3 kHz |

#### Measurement Results:

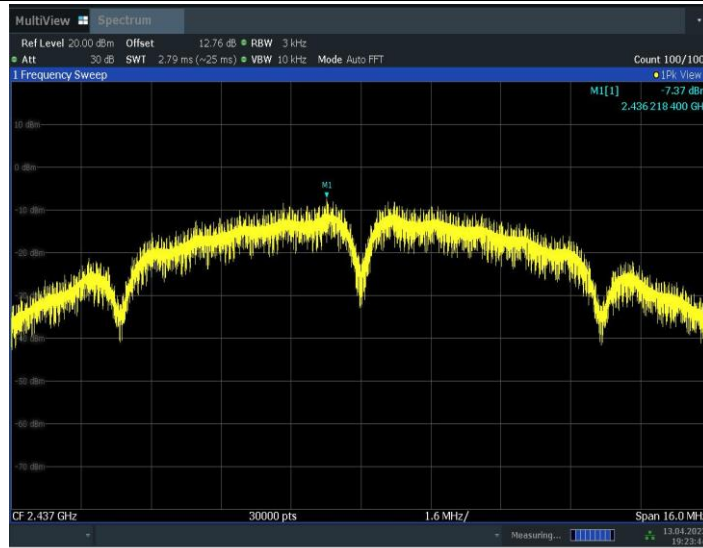
| Test Mode  | Antenna | Fre [MHz] | Result[dBm/3-100kHz] | Limit[dBm/3kHz] | Verdict |
|------------|---------|-----------|----------------------|-----------------|---------|
| 11B-MIMO   | Ant5    | 2412      | -8.44                | ≤8.00           | PASS    |
|            | Ant6    | 2412      | -7.97                | ≤8.00           | PASS    |
|            | total   | 2412      | -5.19                | ≤8.00           | PASS    |
|            | Ant5    | 2437      | -7.37                | ≤8.00           | PASS    |
|            | Ant6    | 2437      | -7.65                | ≤8.00           | PASS    |
|            | total   | 2437      | -4.50                | ≤8.00           | PASS    |
|            | Ant5    | 2462      | -8.4                 | ≤8.00           | PASS    |
|            | Ant6    | 2462      | -8.12                | ≤8.00           | PASS    |
|            | total   | 2462      | -5.25                | ≤8.00           | PASS    |
| 11G-MIMO   | Ant5    | 2412      | -11.18               | ≤8.00           | PASS    |
|            | Ant6    | 2412      | -10.6                | ≤8.00           | PASS    |
|            | total   | 2412      | -7.87                | ≤8.00           | PASS    |
|            | Ant5    | 2437      | -10.52               | ≤8.00           | PASS    |
|            | Ant6    | 2437      | -10.71               | ≤8.00           | PASS    |
|            | total   | 2437      | -7.60                | ≤8.00           | PASS    |
|            | Ant5    | 2462      | -10.62               | ≤8.00           | PASS    |
|            | Ant6    | 2462      | -11.81               | ≤8.00           | PASS    |
|            | total   | 2462      | -8.16                | ≤8.00           | PASS    |
| 11BE20MIMO | Ant5    | 2412      | -9.54                | ≤8.00           | PASS    |
|            | Ant6    | 2412      | -10.08               | ≤8.00           | PASS    |
|            | total   | 2412      | -6.79                | ≤8.00           | PASS    |
|            | Ant5    | 2437      | -10.27               | ≤8.00           | PASS    |
|            | Ant6    | 2437      | -9.69                | ≤8.00           | PASS    |
|            | total   | 2437      | -6.96                | ≤8.00           | PASS    |
|            | Ant5    | 2462      | -9.11                | ≤8.00           | PASS    |

|            |       |      |        |       |      |
|------------|-------|------|--------|-------|------|
|            | Ant6  | 2462 | -10.1  | ≤8.00 | PASS |
|            | total | 2462 | -6.57  | ≤8.00 | PASS |
| 11BE40MIMO | Ant5  | 2422 | -15.97 | ≤8.00 | PASS |
|            | Ant6  | 2422 | -15.99 | ≤8.00 | PASS |
|            | total | 2422 | -12.97 | ≤8.00 | PASS |
|            | Ant5  | 2437 | -13.81 | ≤8.00 | PASS |
|            | Ant6  | 2437 | -13.76 | ≤8.00 | PASS |
|            | total | 2437 | -10.77 | ≤8.00 | PASS |
|            | Ant5  | 2452 | -17.83 | ≤8.00 | PASS |
|            | Ant6  | 2452 | -17.74 | ≤8.00 | PASS |
|            | total | 2452 | -14.77 | ≤8.00 | PASS |

Test graphs as below:

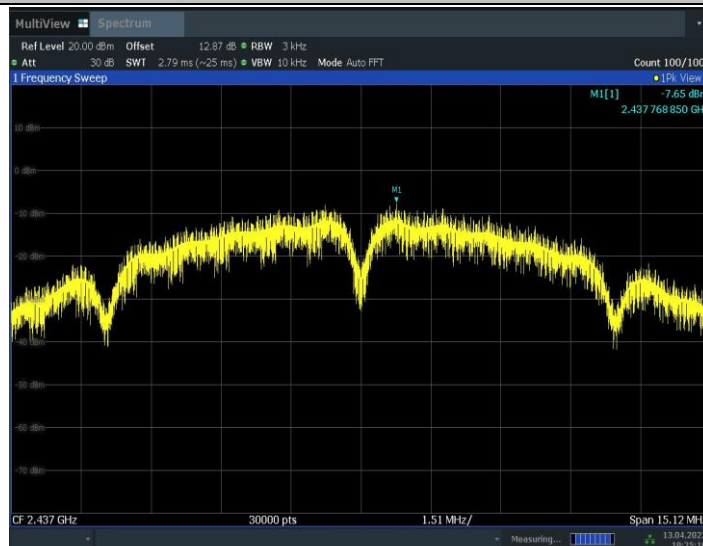


11B- MIMO\_Ant1\_2437



19:23:44 13.04.2023

11B- MIMO\_Ant2\_2437



19:25:11 13.04.2023

11B- MIMO\_Ant1\_2462



11B- MIMO\_Ant2\_2462



11G- MIMO\_Ant1\_2412



11G- MIMO\_Ant2\_2412



11G- MIMO\_Ant1\_2437



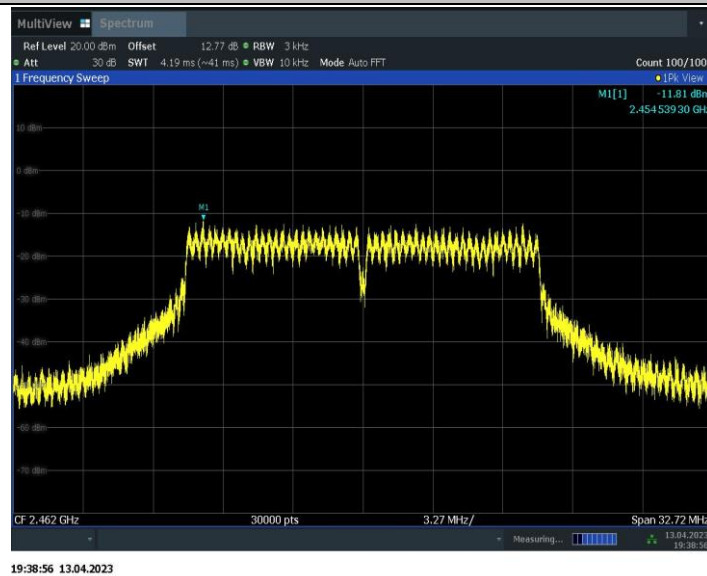
11G- MIMO\_Ant2\_2437



11G- MIMO\_Ant1\_2462



11G- MIMO\_Ant2\_2462



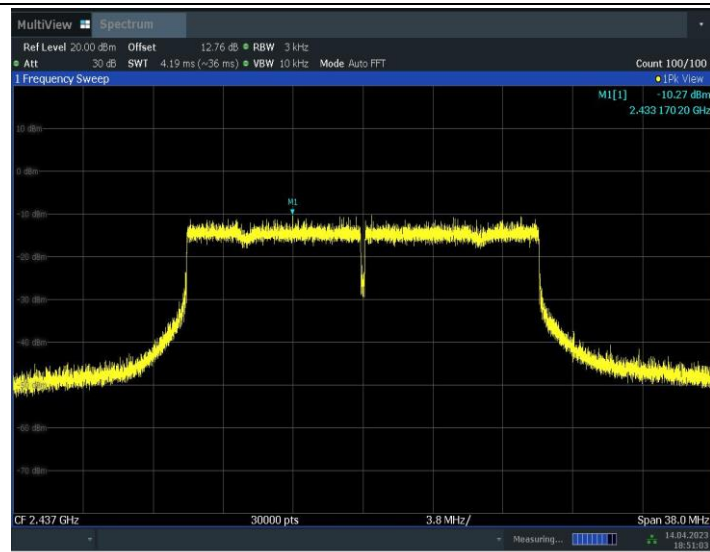
11BE20MIMO\_Ant1\_2412



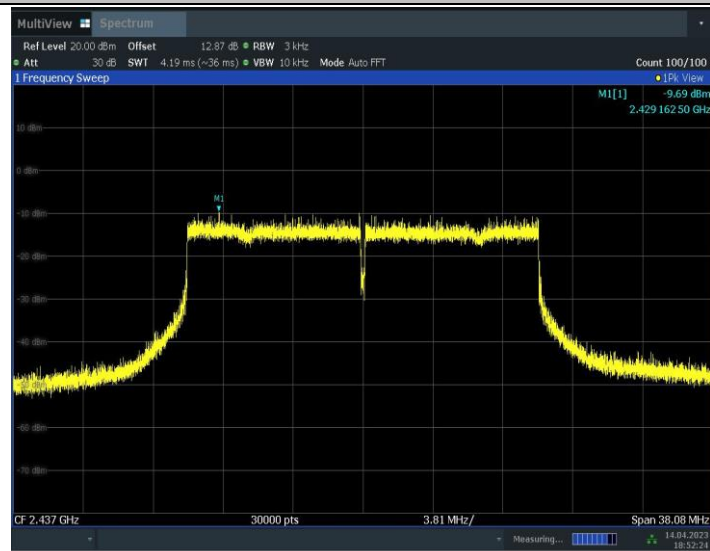
11BE20MIMO\_Ant2\_2412



11BE20MIMO\_Ant1\_2437



11BE20MIMO\_Ant2\_2437



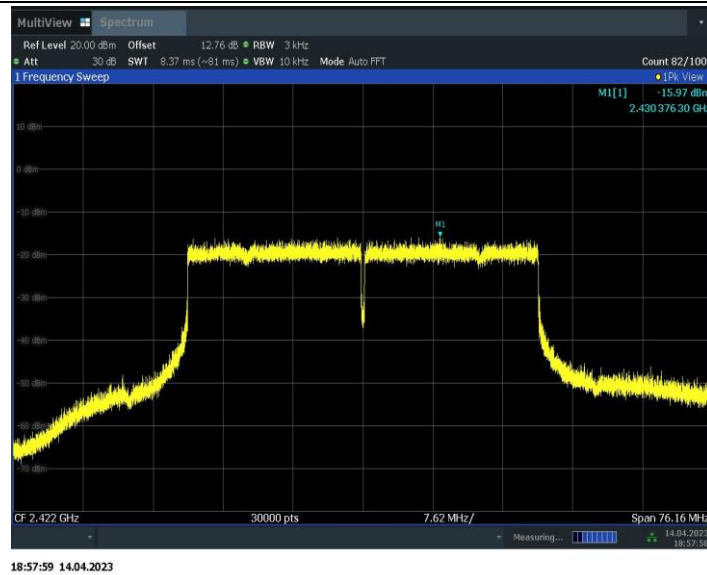
11BE20MIMO\_Ant1\_2462



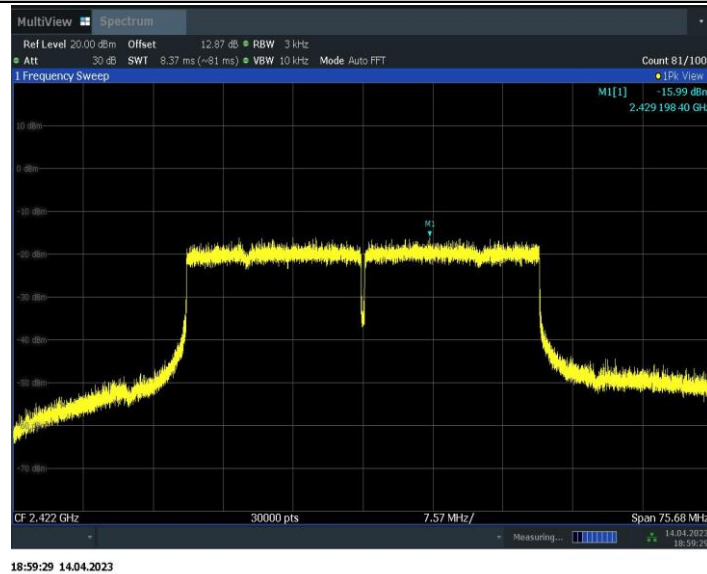
11BE20MIMO\_Ant2\_2462



11BE40MIMO\_Ant1\_2422



11BE40MIMO\_Ant2\_2422



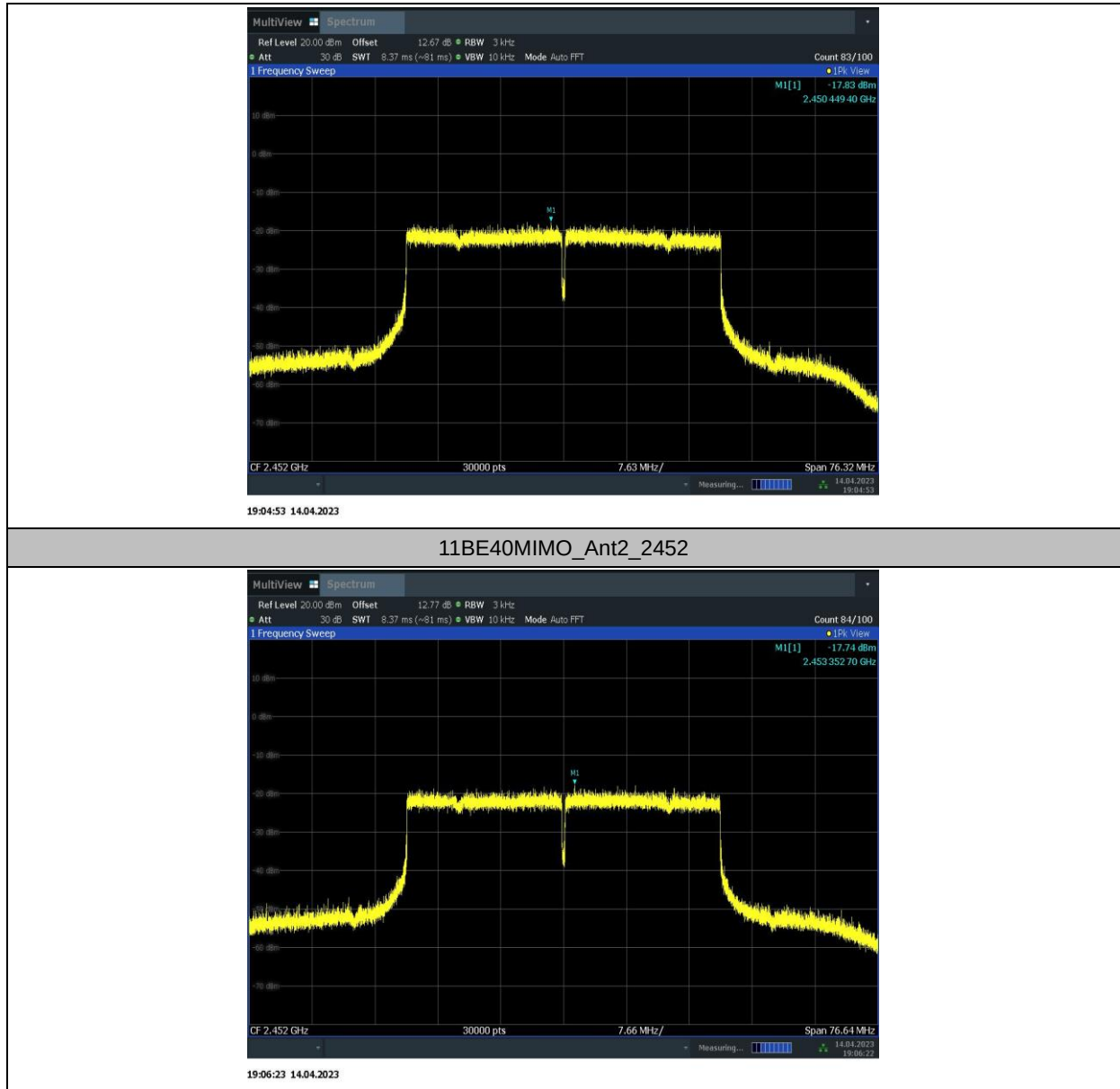
11BE40MIMO\_Ant1\_2437



11BE40MIMO\_Ant2\_2437



11BE40MIMO\_Ant1\_2452



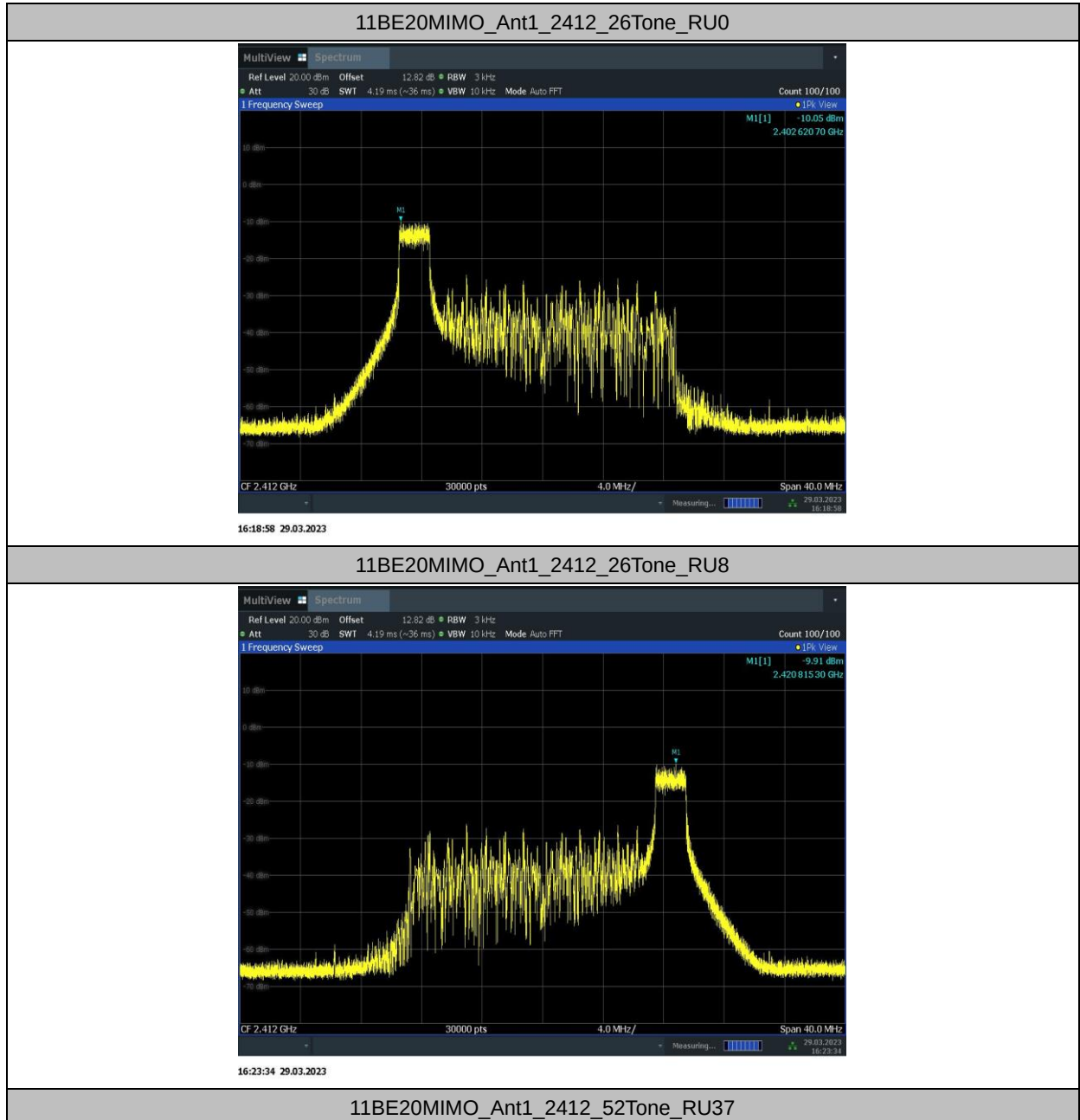
### RU mode

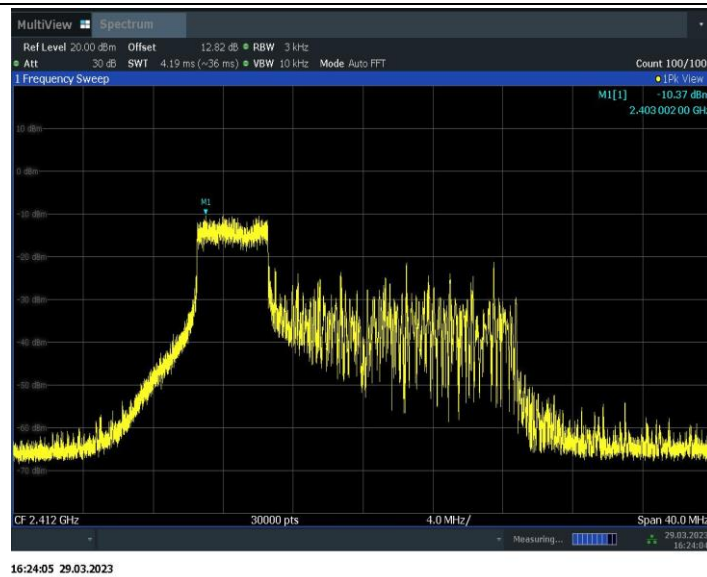
| Test Mode  | Antenna | Frequency[MHz] | RuSize  | RuIndex | Result [dBm/3kHz] | Limit [dBm/3kHz] | Verdict |
|------------|---------|----------------|---------|---------|-------------------|------------------|---------|
| 11BE20MIMO | Ant1    | 2412           | 26Tone  | RU0     | -10.05            | ≤8.00            | PASS    |
|            |         |                |         | RU8     | -9.91             | ≤8.00            | PASS    |
|            |         |                | 52Tone  | RU37    | -10.37            | ≤8.00            | PASS    |
|            |         |                |         | RU40    | -10.26            | ≤8.00            | PASS    |
|            |         |                | 106Tone | RU53    | -8.7              | ≤8.00            | PASS    |
|            |         |                |         | RU54    | -9.03             | ≤8.00            | PASS    |
|            | Ant2    | 2412           | 26Tone  | RU0     | -10.6             | ≤8.00            | PASS    |
|            |         |                |         | RU8     | -10.55            | ≤8.00            | PASS    |
|            |         |                | 52Tone  | RU37    | -10.33            | ≤8.00            | PASS    |

|  |       |      |         |      |        |             |      |
|--|-------|------|---------|------|--------|-------------|------|
|  |       |      | 106Tone | RU40 | -10.26 | $\leq 8.00$ | PASS |
|  |       |      |         | RU53 | -9.65  | $\leq 8.00$ | PASS |
|  |       |      |         | RU54 | -9.55  | $\leq 8.00$ | PASS |
|  | total | 2412 | 26Tone  | RU0  | -7.31  | $\leq 8.00$ | PASS |
|  |       |      |         | RU8  | -7.21  | $\leq 8.00$ | PASS |
|  |       |      | 52Tone  | RU37 | -7.34  | $\leq 8.00$ | PASS |
|  |       |      |         | RU40 | -7.25  | $\leq 8.00$ | PASS |
|  |       |      | 106Tone | RU53 | -6.14  | $\leq 8.00$ | PASS |
|  |       |      |         | RU54 | -6.27  | $\leq 8.00$ | PASS |
|  | Ant1  | 2437 | 26Tone  | RU0  | -9.95  | $\leq 8.00$ | PASS |
|  |       |      |         | RU8  | -9.99  | $\leq 8.00$ | PASS |
|  |       |      | 52Tone  | RU37 | -9.22  | $\leq 8.00$ | PASS |
|  |       |      |         | RU40 | -9.65  | $\leq 8.00$ | PASS |
|  |       |      | 106Tone | RU53 | -8.87  | $\leq 8.00$ | PASS |
|  |       |      |         | RU54 | -9.81  | $\leq 8.00$ | PASS |
|  | Ant2  | 2437 | 26Tone  | RU0  | -10.47 | $\leq 8.00$ | PASS |
|  |       |      |         | RU8  | -10.41 | $\leq 8.00$ | PASS |
|  |       |      | 52Tone  | RU37 | -9.56  | $\leq 8.00$ | PASS |
|  |       |      |         | RU40 | -10.22 | $\leq 8.00$ | PASS |
|  |       |      | 106Tone | RU53 | -9.85  | $\leq 8.00$ | PASS |
|  |       |      |         | RU54 | -10.35 | $\leq 8.00$ | PASS |
|  | total | 2437 | 26Tone  | RU0  | -7.19  | $\leq 8.00$ | PASS |
|  |       |      |         | RU8  | -7.18  | $\leq 8.00$ | PASS |
|  |       |      | 52Tone  | RU37 | -6.38  | $\leq 8.00$ | PASS |
|  |       |      |         | RU40 | -6.92  | $\leq 8.00$ | PASS |
|  |       |      | 106Tone | RU53 | -6.32  | $\leq 8.00$ | PASS |
|  |       |      |         | RU54 | -7.06  | $\leq 8.00$ | PASS |
|  | Ant1  | 2462 | 26Tone  | RU0  | -9.52  | $\leq 8.00$ | PASS |
|  |       |      |         | RU8  | -10.28 | $\leq 8.00$ | PASS |
|  |       |      | 52Tone  | RU37 | -9.67  | $\leq 8.00$ | PASS |
|  |       |      |         | RU40 | -9.86  | $\leq 8.00$ | PASS |
|  |       |      | 106Tone | RU53 | -8.68  | $\leq 8.00$ | PASS |
|  |       |      |         | RU54 | -9.91  | $\leq 8.00$ | PASS |
|  | Ant2  | 2462 | 26Tone  | RU0  | -10.57 | $\leq 8.00$ | PASS |
|  |       |      |         | RU8  | -10.62 | $\leq 8.00$ | PASS |
|  |       |      | 52Tone  | RU37 | -10.19 | $\leq 8.00$ | PASS |
|  |       |      |         | RU40 | -10.19 | $\leq 8.00$ | PASS |
|  |       |      | 106Tone | RU53 | -9.61  | $\leq 8.00$ | PASS |
|  |       |      |         | RU54 | -10.39 | $\leq 8.00$ | PASS |
|  | total | 2462 | 26Tone  | RU0  | -7.00  | $\leq 8.00$ | PASS |
|  |       |      |         | RU8  | -7.44  | $\leq 8.00$ | PASS |
|  |       |      | 52Tone  | RU37 | -6.91  | $\leq 8.00$ | PASS |

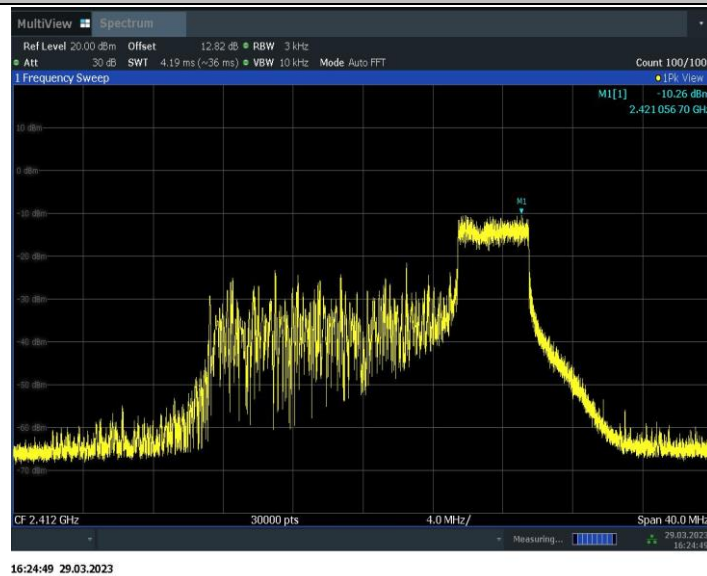
|  |  |  |         |      |       |             |      |
|--|--|--|---------|------|-------|-------------|------|
|  |  |  |         | RU40 | -7.01 | $\leq 8.00$ | PASS |
|  |  |  | 106Tone | RU53 | -6.11 | $\leq 8.00$ | PASS |
|  |  |  |         | RU54 | -7.13 | $\leq 8.00$ | PASS |

Test graphs as below:

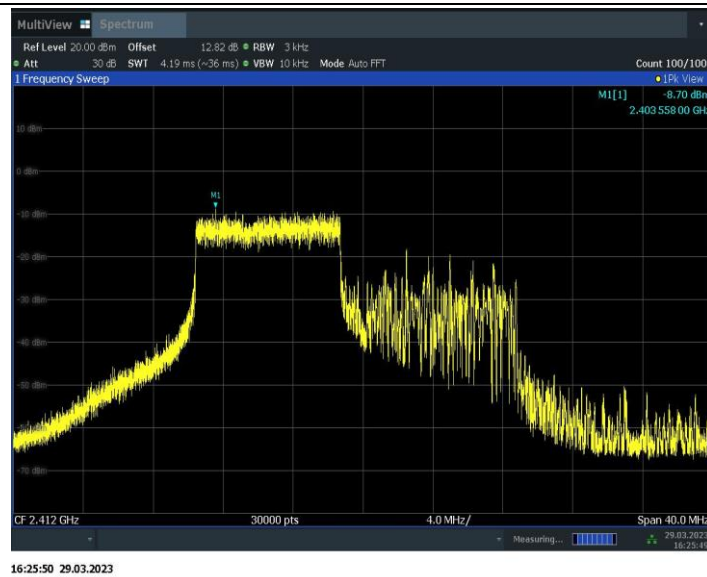




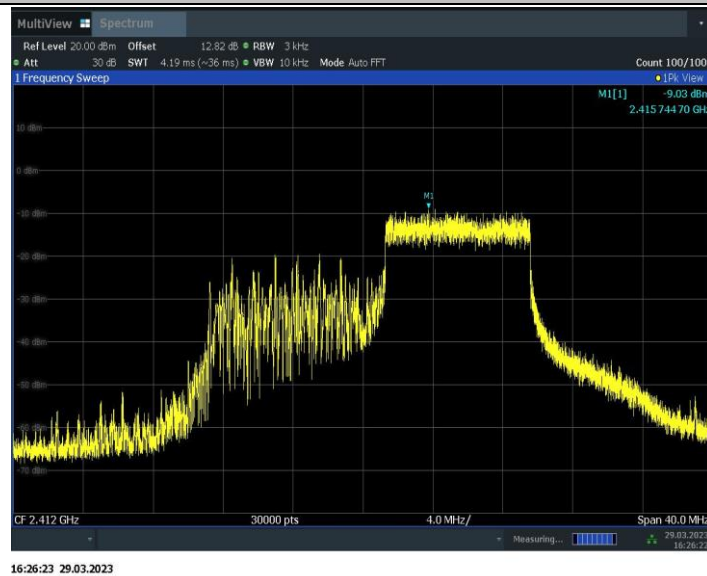
11BE20MIMO\_Ant1\_2412\_52Tone\_RU40



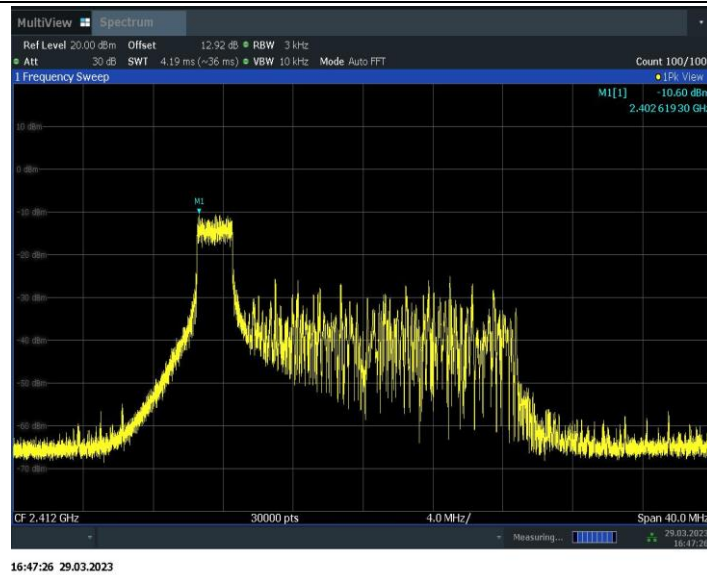
11BE20MIMO\_Ant1\_2412\_106Tone\_RU53



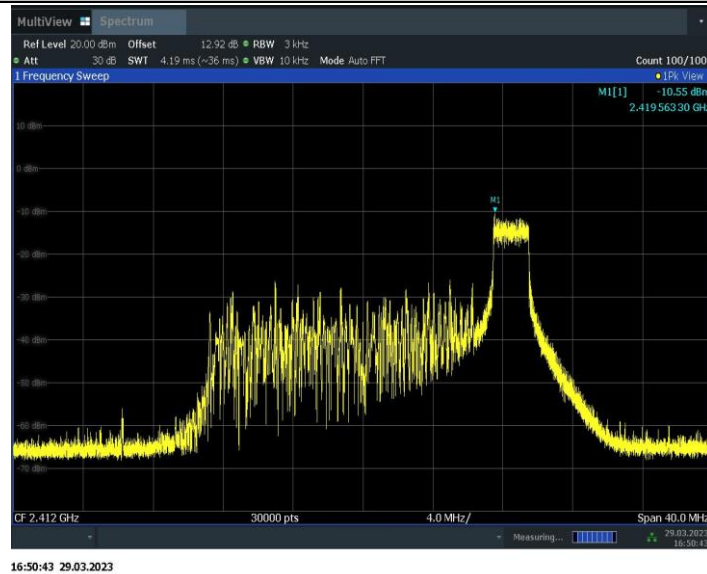
11BE20MIMO\_Ant1\_2412\_106Tone\_RU54



11BE20MIMO\_Ant2\_2412\_26Tone\_RU0



11BE20MIMO\_Ant2\_2412\_26Tone\_RU8



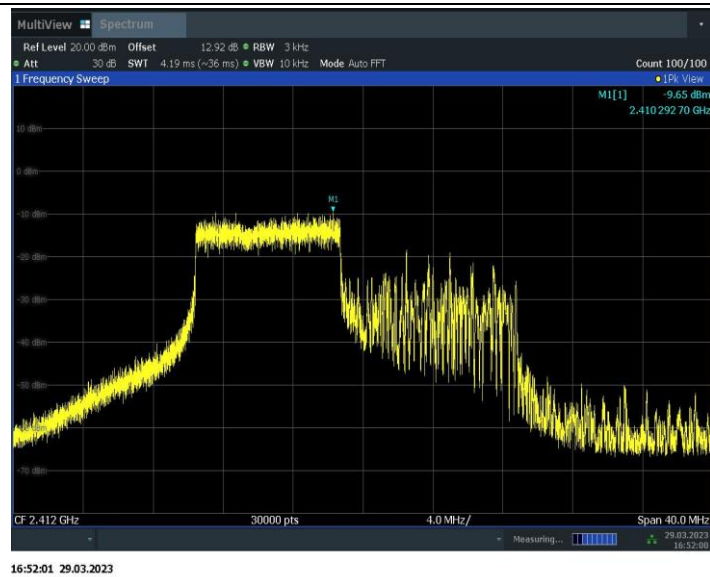
11BE20MIMO\_Ant2\_2412\_52Tone\_RU37



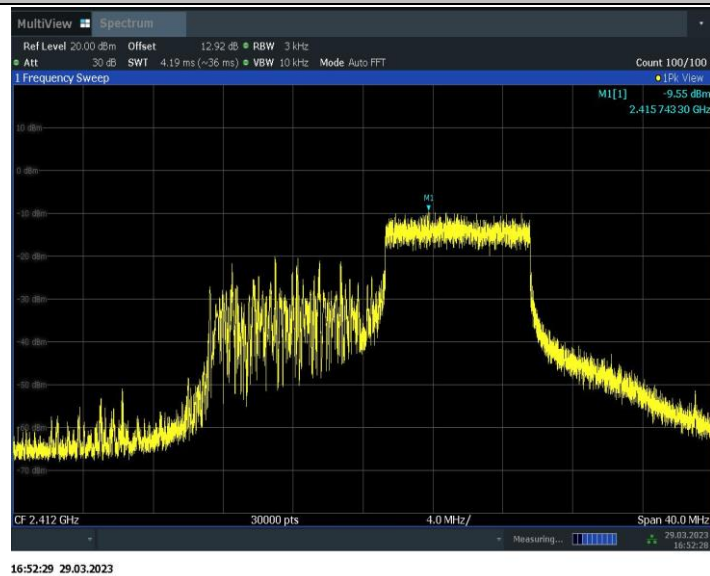
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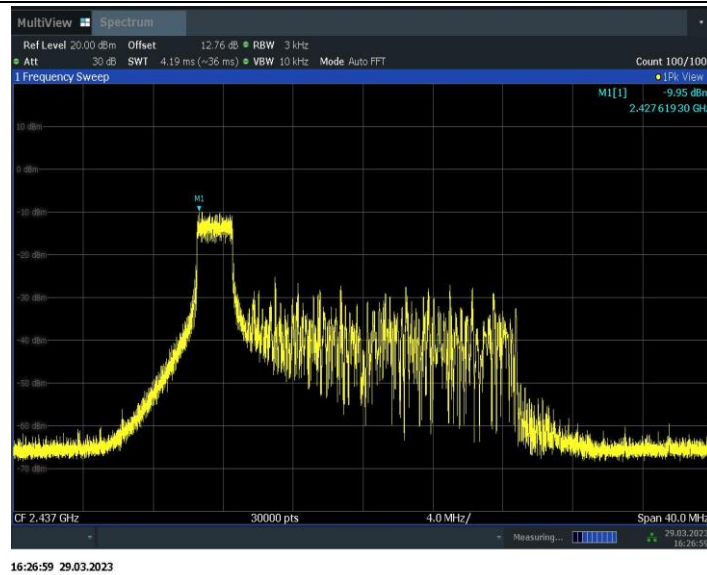
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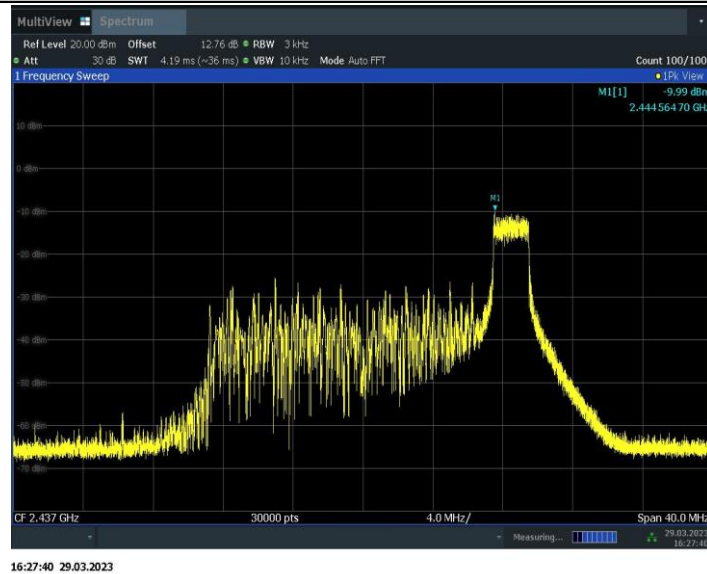
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11BE20MIMO\_Ant1\_2437\_26Tone\_RU0



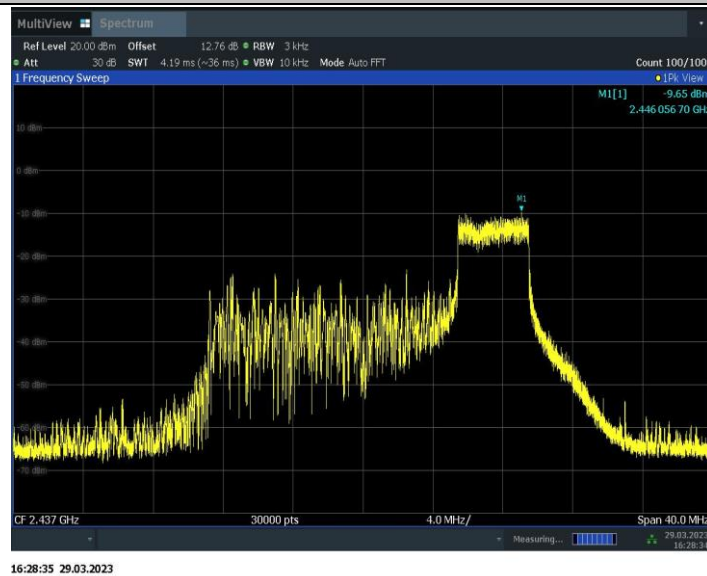
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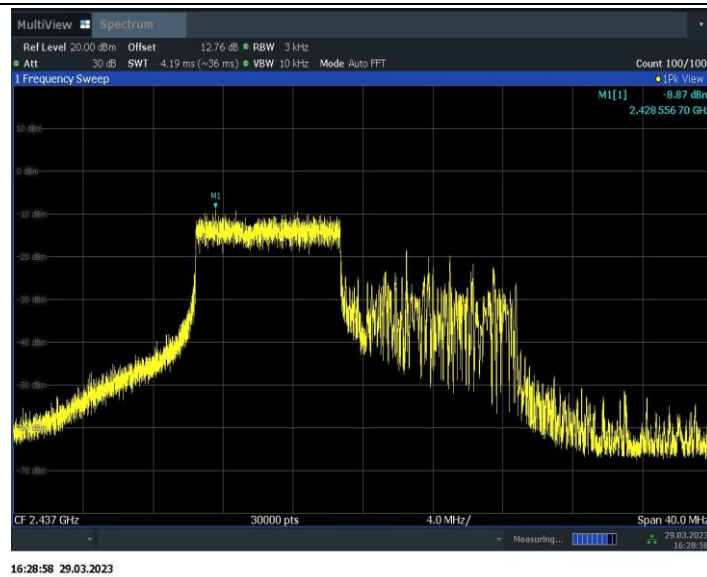
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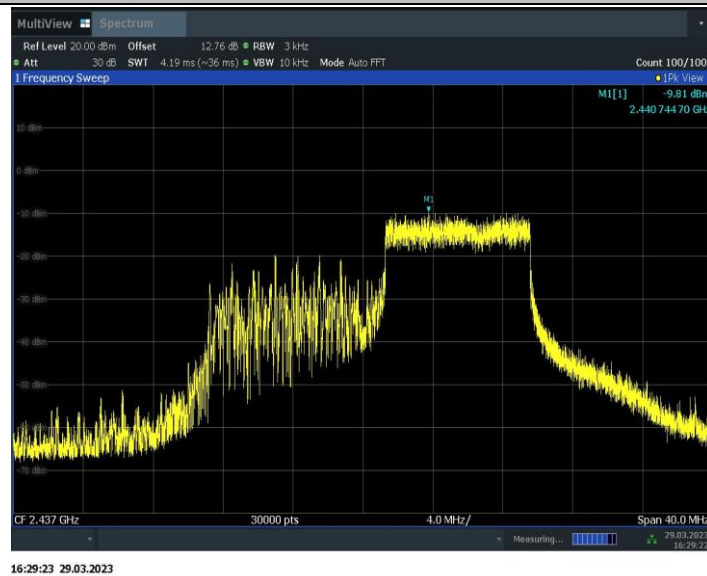
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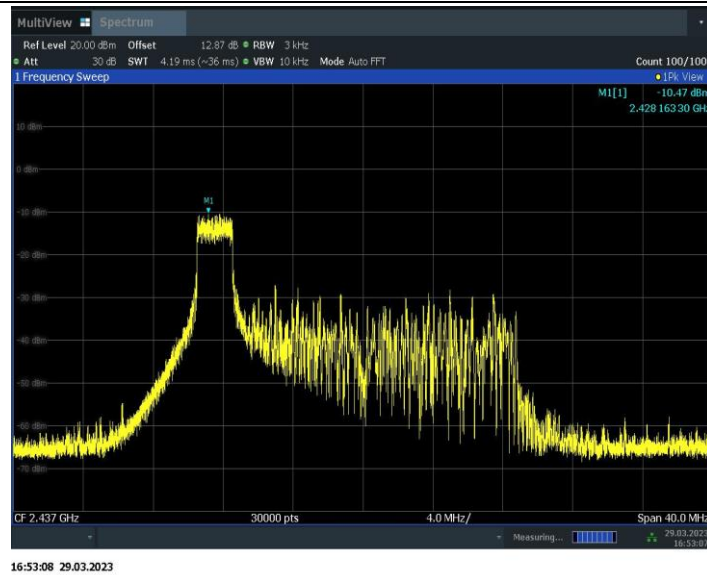
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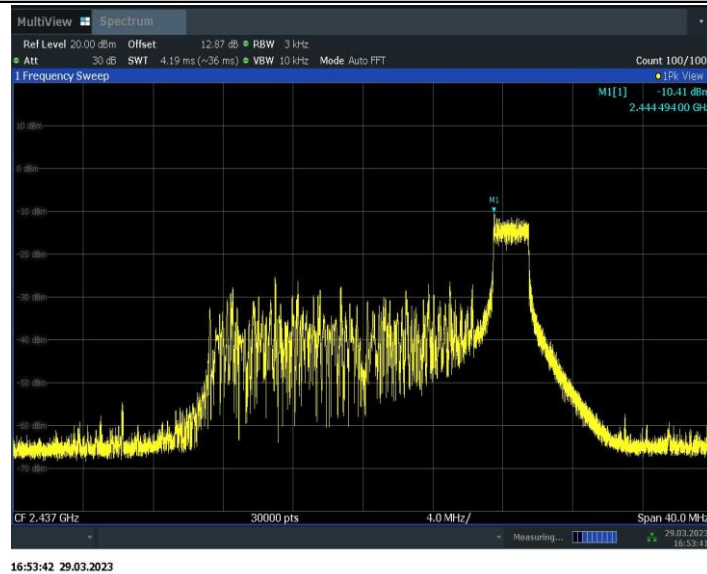
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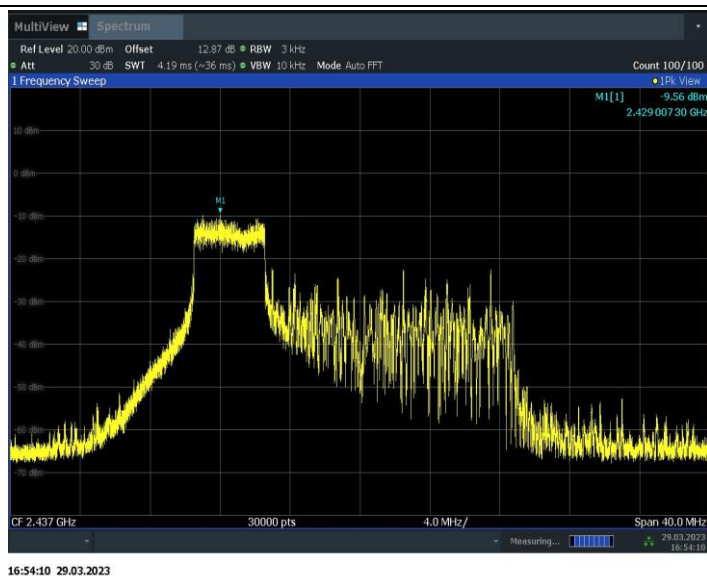
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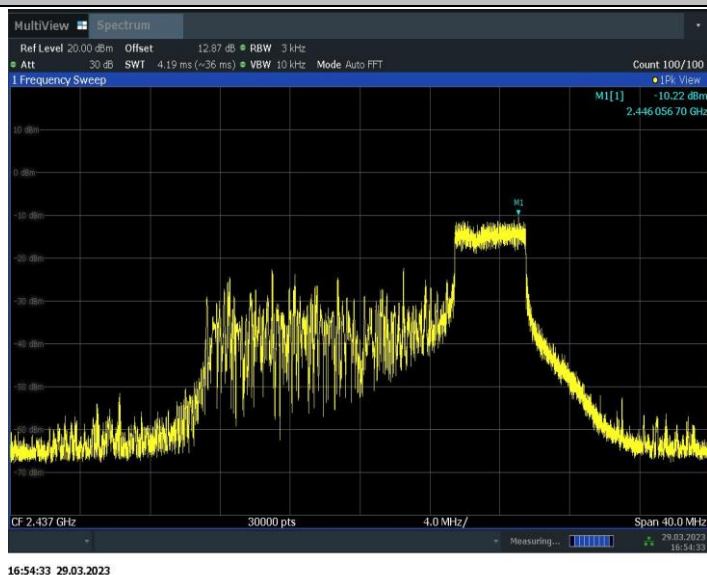
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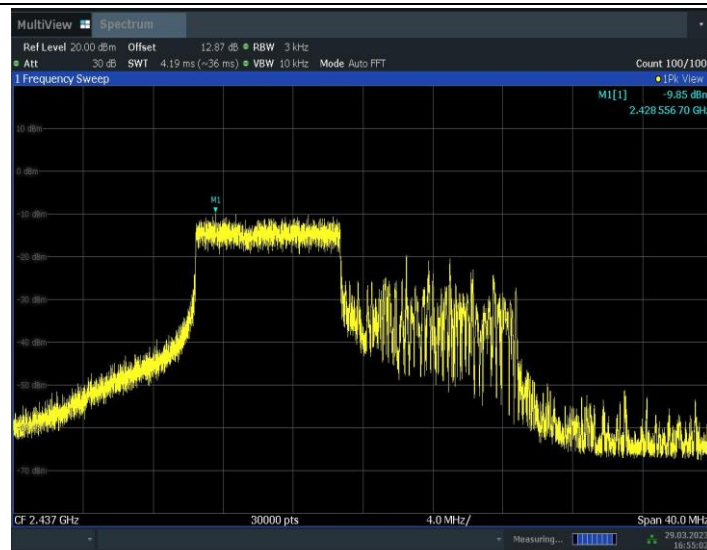
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11BE20MIMO Ant2 2437 52Tone RU40

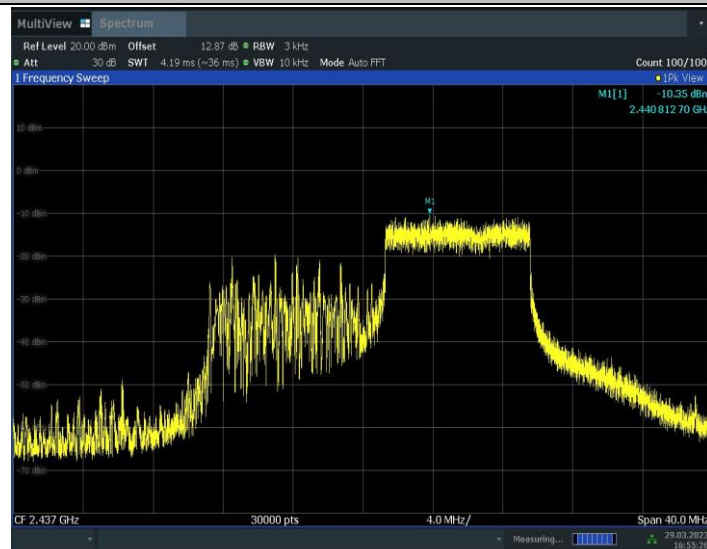


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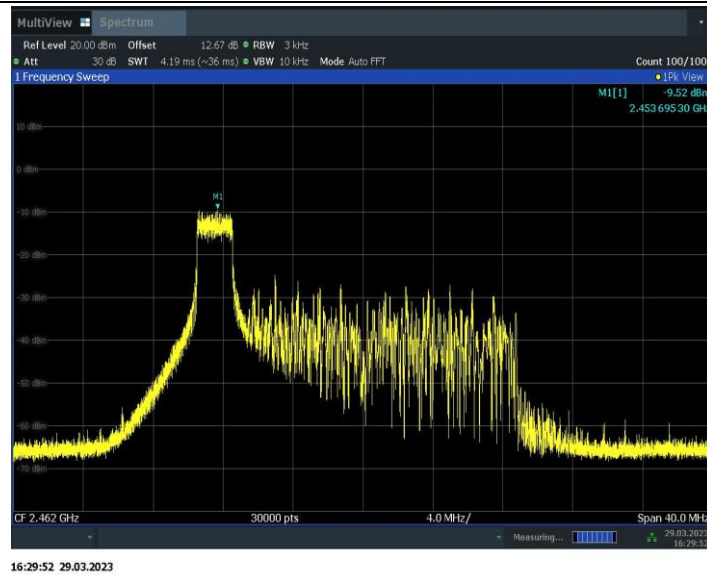
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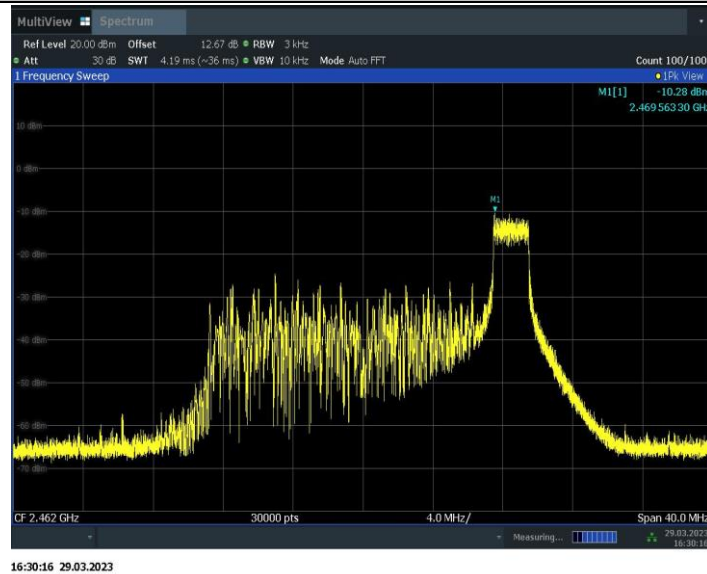


16:55:27 29.03.2023

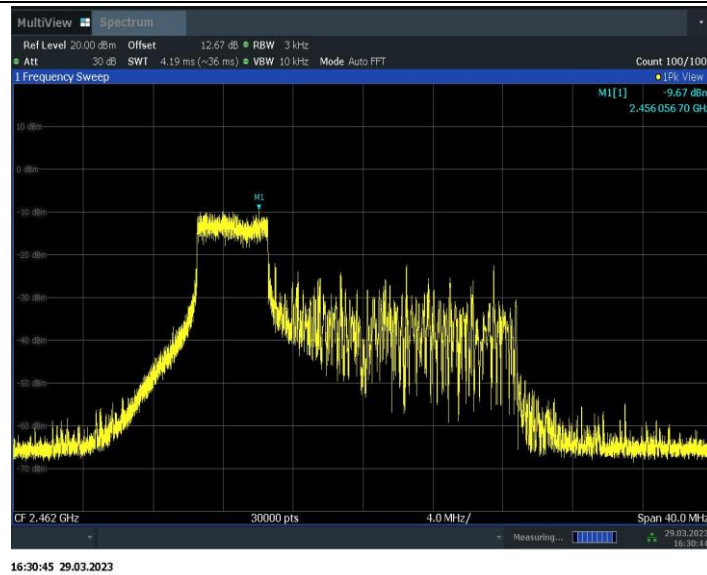
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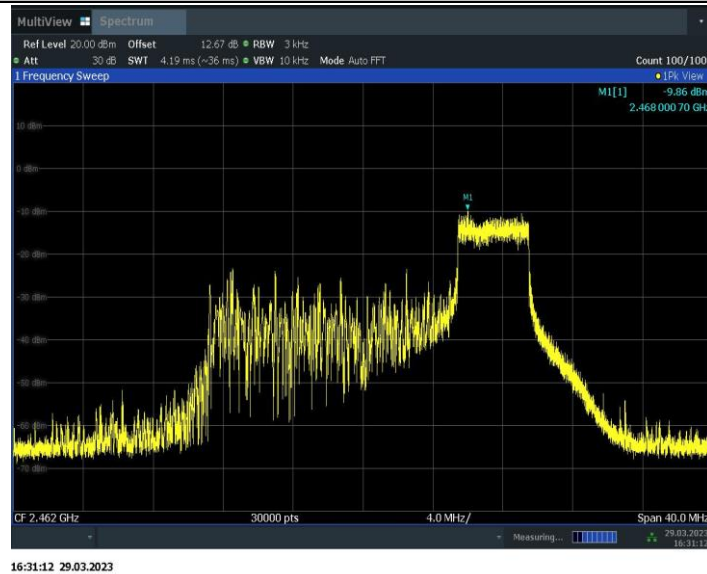
11BE20MIMO\_Ant1\_2462\_26Tone\_RU8



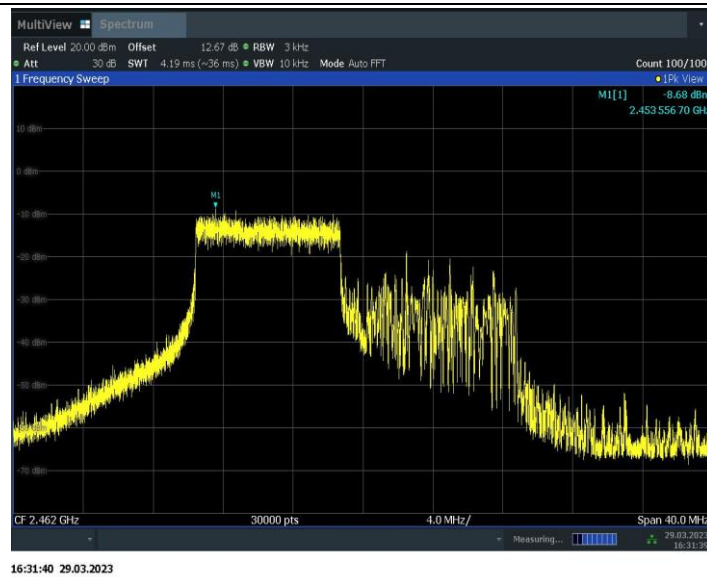
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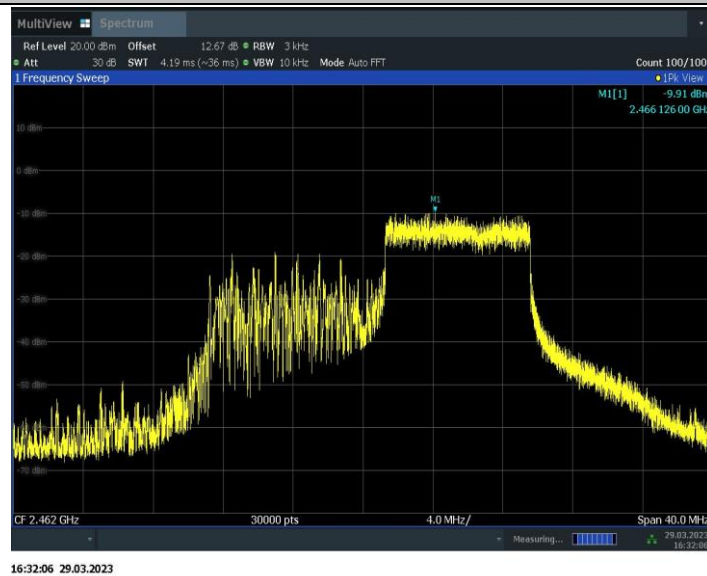
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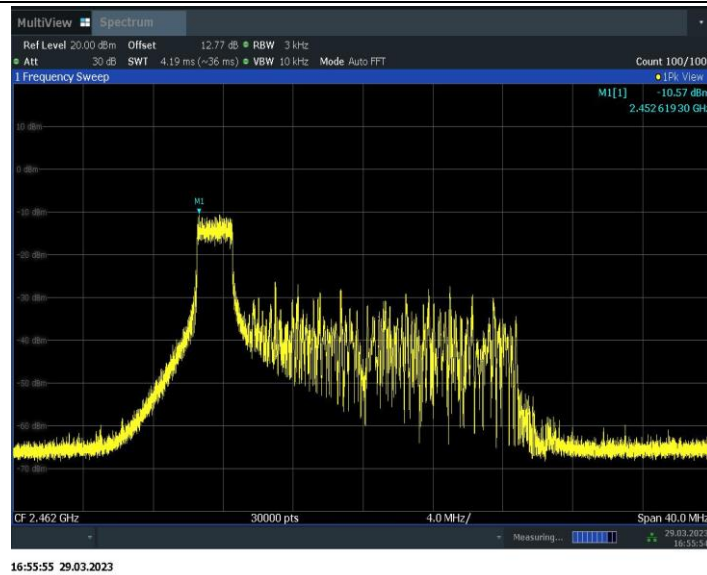
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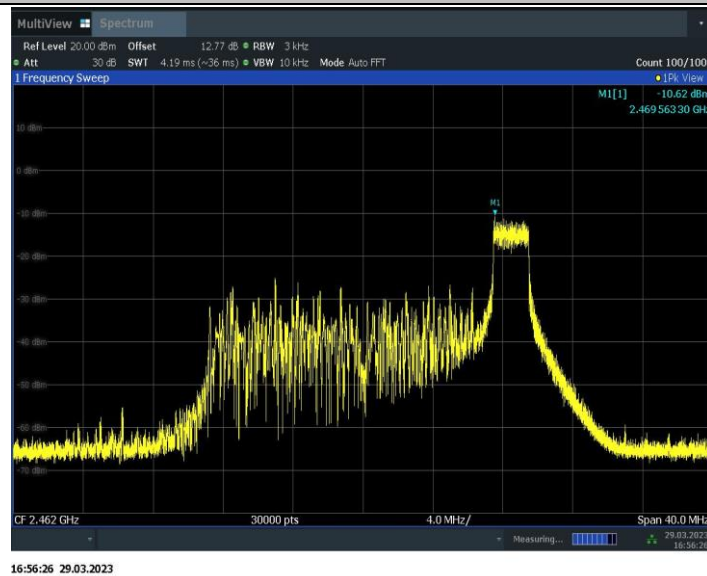
11BE20MIMO\_Ant1\_2462\_106Tone\_RU54



11BE20MIMO\_Ant2\_2462\_26Tone\_RU0



11BE20MIMO\_Ant2\_2462\_26Tone\_RU8



11BE20MIMO\_Ant2\_2462\_52Tone\_RU37