

# FCC Test Report

Report No.: AGC05877241202FR02

**FCC ID** : 2APA9-CMSXJ111A  
**APPLICATION PURPOSE** : Original Equipment  
**PRODUCT DESIGNATION** : IMILAB C30 Dual  
**BRAND NAME** : imilab,   
**MODEL NAME** : CMSXJ111A  
**APPLICANT** : Shanghai Imilab Technology Co., Ltd.  
**DATE OF ISSUE** : Feb. 12, 2025  
**STANDARD(S)** : FCC Part 15 Subpart C §15.247  
**REPORT VERSION** : V1.0

Attestation of Global Compliance (Shenzhen) Co., Ltd



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**Report Revise Record**

| Report Version | Revise Time | Issued Date   | Valid Version | Notes           |
|----------------|-------------|---------------|---------------|-----------------|
| V1.0           | /           | Feb. 12, 2025 | Valid         | Initial Release |

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## 1. General Information

|                              |                                                                                           |
|------------------------------|-------------------------------------------------------------------------------------------|
| Applicant                    | Shanghai Imilab Technology Co., Ltd.                                                      |
| Address                      | Room 001A, Floor 11, Block 1, No. 588 Zixing Road, Minhang District, Shanghai, China      |
| Manufacturer                 | Shanghai Imilab Technology Co., Ltd.                                                      |
| Address                      | Room 001A, Floor 11, Block 1, No. 588 Zixing Road, Minhang District, Shanghai, China      |
| Factory                      | N/A                                                                                       |
| Address                      | N/A                                                                                       |
| Product Designation          | IMILAB C30 Dual                                                                           |
| Brand Name                   | imilab,  |
| Test Model                   | CMSXJ111A                                                                                 |
| Series Model(s)              | N/A                                                                                       |
| Difference Description       | N/A                                                                                       |
| Date of receipt of test item | Dec. 11, 2024                                                                             |
| Date of Test                 | Dec. 11, 2024 - Feb. 12, 2025                                                             |
| Deviation from Standard      | No any deviation from the test method                                                     |
| Condition of Test Sample     | Normal                                                                                    |
| Test Result                  | Pass                                                                                      |
| Test Report Form No          | AGCER-FCC-2.4GWLAN-V1                                                                     |

Note: The test results of this report relate only to the tested sample identified in this report.

Prepared By



Jack Gui

(Project Engineer)

Feb. 12, 2025

Reviewed By



Calvin Liu

(Reviewer)

Feb. 12, 2025

Approved By



Angela Li

(Authorized Officer)

Feb. 12, 2025

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## 2. Product Information

### 2.1 Product Technical Description

|                        |                                                                                                                                                                                         |
|------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Equipment Type         | WLAN 2.4G                                                                                                                                                                               |
| Frequency Band         | 2400MHz ~ 2483.5MHz                                                                                                                                                                     |
| Operation Frequency    | 2412MHz ~ 2462MHz                                                                                                                                                                       |
| Output Power (Average) | IEEE 802.11b: <b>10.92dBm</b> ; IEEE 802.11g: 10.61dBm;<br>IEEE 802.11n(HT20): 10.45dBm; IEEE 802.11n(HT40): 10.45dBm<br>IEEE 802.11ax (HE20): 10.31dBm; IEEE 802.11ax (HE40): 10.37dBm |
| Output Power (Peak)    | IEEE 802.11b: 13.49dBm; IEEE 802.11g: 18.55dBm;<br>IEEE 802.11n(HT20): 17.98dBm; IEEE 802.11n(HT40): 18.65dBm<br>IEEE 802.11ax (HE20): 20.15dBm; IEEE 802.11ax (HE40): 20.27dBm         |
| Modulation             | 802.11b:(DQPSK, DBPSK, CCK) DSSS<br>802.11g/n:(64-QAM,16-QAM, QPSK, BPSK) OFDM<br>802.11ax:(1024-QAM,256-QAM,64-QAM,16QAM,QPSK,BPSK)OFDMA                                               |
| Data Rate              | 802.11b:1/2/5.5/11Mbps<br>802.11g: 6/9/12/18/24/36/48/54Mbps<br>802.11n: up to 150Mbps<br>802.11ax: up to 287Mbps                                                                       |
| Number of channels     | 11                                                                                                                                                                                      |
| Hardware Version       | LSAM124A1-1                                                                                                                                                                             |
| Software Version       | 5.3.1_0545                                                                                                                                                                              |
| Antenna Designation    | PIFA Antenna                                                                                                                                                                            |
| Antenna Gain           | 1.4dBi                                                                                                                                                                                  |
| Power Supply           | DC 5V by adapter                                                                                                                                                                        |

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## 2.2 Table of Carrier Frequency

For 2412-2462MHz:

11 channels are provided for 802.11b/g/n(HT20)/ax (HE20):

| Channel | Frequency | Channel | Frequency | Channel | Frequency |
|---------|-----------|---------|-----------|---------|-----------|
| 01      | 2412 MHz  | 02      | 2417 MHz  | 03      | 2422 MHz  |
| 04      | 2427 MHz  | 05      | 2432 MHz  | 06      | 2437 MHz  |
| 07      | 2442 MHz  | 08      | 2447 MHz  | 09      | 2452 MHz  |
| 10      | 2457 MHz  | 11      | 2462 MHz  |         |           |

7 channels are provided for 802.11n(HT40)/ax (HE40):

| Channel | Frequency | Channel | Frequency | Channel | Frequency |
|---------|-----------|---------|-----------|---------|-----------|
| 01      | --        | 02      | --        | 03      | 2422 MHz  |
| 04      | 2427 MHz  | 05      | 2432 MHz  | 06      | 2437 MHz  |
| 07      | 2442 MHz  | 08      | 2447 MHz  | 09      | 2452 MHz  |
| 10      | --        | 11      | --        |         |           |

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### 2.3 IEEE 802.11n Modulation Scheme

| MCS Index | N <sub>ss</sub> | Modulation | R   | N <sub>BPSC</sub> | N <sub>CBPS</sub> |       | N <sub>DBPS</sub> |       | Data Rate(Mbps) |       |
|-----------|-----------------|------------|-----|-------------------|-------------------|-------|-------------------|-------|-----------------|-------|
|           |                 |            |     |                   |                   |       |                   |       | 800nsGI         |       |
|           |                 |            |     |                   | 20MHz             | 40MHz | 20MHz             | 40MHz | 20MHz           | 40MHz |
| 0         | 1               | BPSK       | 1/2 | 1                 | 52                | 108   | 26                | 54    | 6.5             | 13.5  |
| 1         | 1               | QPSK       | 1/2 | 2                 | 104               | 216   | 52                | 108   | 13.0            | 27.0  |
| 2         | 1               | QPSK       | 3/4 | 2                 | 104               | 216   | 78                | 162   | 19.5            | 40.5  |
| 3         | 1               | 16-QAM     | 1/2 | 4                 | 208               | 432   | 104               | 216   | 26.0            | 54.0  |
| 4         | 1               | 16-QAM     | 3/4 | 4                 | 208               | 432   | 156               | 324   | 39.0            | 81.0  |
| 5         | 1               | 64-QAM     | 2/3 | 6                 | 312               | 648   | 208               | 432   | 52.0            | 108.0 |
| 6         | 1               | 64-QAM     | 3/4 | 6                 | 312               | 648   | 234               | 489   | 58.5            | 121.5 |
| 7         | 1               | 64-QAM     | 5/6 | 6                 | 312               | 648   | 260               | 540   | 65.0            | 135.0 |

| Symbol | Explanation                             |
|--------|-----------------------------------------|
| NSS    | Number of spatial streams               |
| R      | Code rate                               |
| NBPSC  | Number of coded bits per single carrier |
| NCBPS  | Number of coded bits per symbol         |
| NDBPS  | Number of data bits per symbol          |
| GI     | Guard interval                          |

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## 2.4 Related Submittal(S) / Grant (S)

This submittal(s) (test report) is intended for FCC ID: **2APA9-CMSXJ111A**, filing to comply with Part 2, Part 15 of the Federal Communication Commission rules.

## 2.5 Test Methodology

The tests were performed according to following standards:

| No. | Identity           | Document Title                                                                |
|-----|--------------------|-------------------------------------------------------------------------------|
| 1   | FCC 47 CFR Part 2  | Frequency allocations and radio treaty matters; general rules and regulations |
| 2   | FCC 47 CFR Part 15 | Radio Frequency Devices                                                       |
| 3   | ANSI C63.10-2013   | American National Standard for Testing Unlicensed Wireless Devices            |

## 2.6 Special Accessories

Refer to section 4.4.

## 2.7 Equipment Modifications

Not available for this EUT intended for grant.

## 2.8 Antenna Requirement

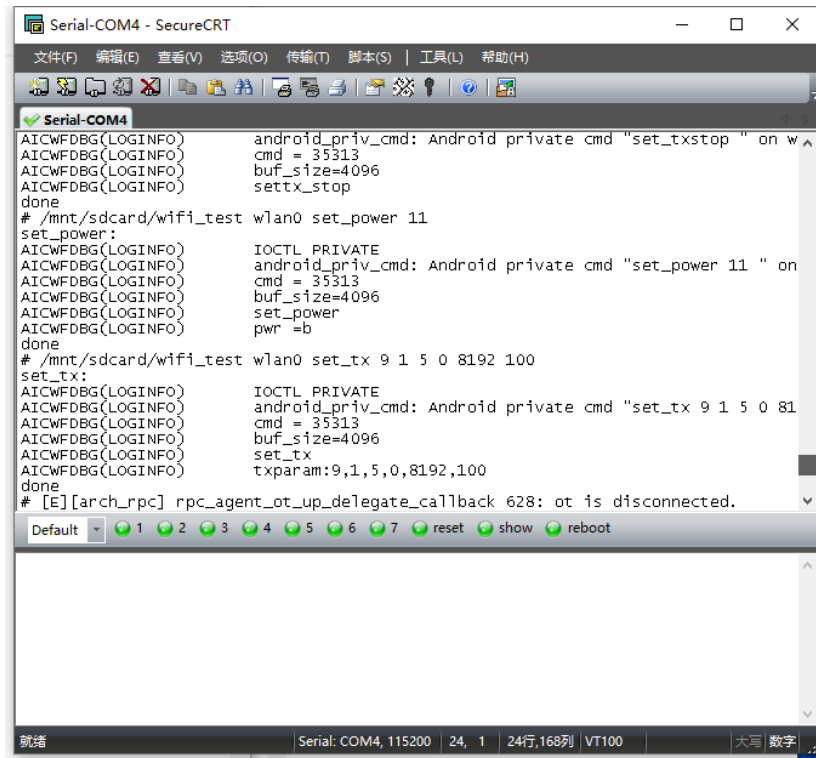
| Standard Requirement                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 15.203 requirement:<br>An intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device. The use of a permanently attached antenna or of an antenna that uses a unique coupling to the intentional radiator, the manufacturer may design the unit so that a broken antenna can be replaced by the user, but the use of a standard antenna jack or electrical connector is prohibited.                                                                                                     |
| 15.247(b) (4) requirement:<br>The conducted output power limit specified in paragraph (b) of this section is based on the use of antennas with directional gains that do not exceed 6 dBi. Except as shown in paragraph (c) of this section, if transmitting antennas of directional gain greater than 6 dBi are used, the conducted output power from the intentional radiator shall be reduced below the stated values in paragraphs (b)(1), (b)(2), and (b)(3) of this section, as appropriate, by the amount in dB that the directional gain of the antenna exceeds 6 dBi |
| <b>EUT Antenna:</b><br>The non-detachable antenna inside the device cannot be replaced by the user at will. The gain of the antenna is 1.4dBi.                                                                                                                                                                                                                                                                                                                                                                                                                                |

## 2.9 Description of Test Software

### For IEEE 802.11 mode:

The test utility software used during testing was “SecureCRT”.

Software Setting Diagram



```

Serial-COM4 - SecureCRT
文件(F) 编辑(E) 查看(V) 选项(O) 传输(T) 脚本(S) | 工具(L) 帮助(H)

Serial-COM4
AICWDBG(LOGINFO) android_priv_cmd: Android private cmd "set_txstop " on w
AICWDBG(LOGINFO) cmd = 35313
AICWDBG(LOGINFO) buf_size=4096
AICWDBG(LOGINFO) settx_stop
done
# /mnt/sdcard/wifi_test wlan0 set_power 11
set_power:
AICWDBG(LOGINFO) IOCTL_PRIVATE
AICWDBG(LOGINFO) android_priv_cmd: Android private cmd "set_power 11 " on
AICWDBG(LOGINFO) cmd = 35313
AICWDBG(LOGINFO) buf_size=4096
AICWDBG(LOGINFO) set_power
AICWDBG(LOGINFO) pwr =b
done
# /mnt/sdcard/wifi_test wlan0 set_tx 9 1 5 0 8192 100
set_tx:
AICWDBG(LOGINFO) IOCTL_PRIVATE
AICWDBG(LOGINFO) android_priv_cmd: Android private cmd "set_tx 9 1 5 0 81
AICWDBG(LOGINFO) cmd = 35313
AICWDBG(LOGINFO) buf_size=4096
AICWDBG(LOGINFO) set_tx
AICWDBG(LOGINFO) txparam:9,1,5,0,8192,100
done
# [E][arch_rpc] rpc_agent_ot_up_delegate_callback 628: ot is disconnected.

Default 1 2 3 4 5 6 7 reset show reboot
就绪 Serial: COM4, 115200 | 24, 1 | 24行,168列 | VT100 | 大写 数字
  
```

| Test Mode     | Channel | Power Index |
|---------------|---------|-------------|
| 802.11b       | L/M/H   | 11          |
| 802.11g       | L/M/H   | 9           |
| 802.11n-HT20  | L/M/H   | 9           |
| 802.11ax-HE20 | L/M/H   | 9           |
| 802.11n-HT40  | L/M/H   | 9           |
| 802.11ax-HE40 | L/M/H   | 9           |

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### 3. Test Environment

#### 3.1 Address of The Test Laboratory

Laboratory: Attestation of Global Compliance (Shenzhen) Co., Ltd.

Address: 1-2/F, Building 19, Junfeng Industrial Park, Chongqing Road, Heping Community, Fuhai Street, Bao'an District, Shenzhen, Guangdong, China

#### 3.2 Test Facility

The test facility is recognized, certified, or accredited by the following organizations:

##### **CNAS-Lab Code: L5488**

Attestation of Global Compliance (Shenzhen) Co., Ltd. has been assessed and proved to follow CNAS-CL01 Accreditation Criteria for Testing and Calibration Laboratories (identical to ISO/IEC17025: 2017 General Requirements for the Competence of Testing and Calibration Laboratories).

##### **A2LA-Lab Cert. No.: 5054.02**

Attestation of Global Compliance (Shenzhen) Co., Ltd. EMC Laboratory has been accredited by A2LA for technical competence in the field of electrical testing, and proved to follow ISO/IEC 17025: 2017 General Requirements for the Competence of Testing and Calibration Laboratories and any additional program requirements in the identified field of testing.

##### **FCC-Registration No.: 975832**

Attestation of Global Compliance (Shenzhen) Co., Ltd. EMC Laboratory has been registered and fully described in a report filed with the FCC (Federal Communications Commission). The acceptance letter from the FCC is maintained in our files with Registration 975832.

##### **IC-Registration No.: 24842 (CAB identifier: CN0063)**

Attestation of Global Compliance (Shenzhen) Co., Ltd. EMC Laboratory has been registered and fully described in a report filed with the Certification and Engineering Bureau of Industry Canada. The acceptance letter from the IC is maintained in our files with Registration 24842.

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### 3.3 Environmental Conditions

|                         | Normal Conditions |
|-------------------------|-------------------|
| Temperature range (°C)  | 15 - 35           |
| Relative humidity range | 20 % - 75 %       |
| Pressure range (kPa)    | 86 - 106          |

### 3.4 Measurement Uncertainty

The reported uncertainty of measurement  $y \pm U$ , where expanded uncertainty  $U$  is based on a standard uncertainty multiplied by a coverage factor of  $k=2$ , providing a level of confidence of approximately 95%.

| Item                                          | Measurement Uncertainty    |
|-----------------------------------------------|----------------------------|
| Uncertainty of Conducted Emission for AC Port | $U_c = \pm 2.9 \text{ dB}$ |
| Uncertainty of Radiated Emission below 1GHz   | $U_c = \pm 3.9 \text{ dB}$ |
| Uncertainty of Radiated Emission above 1GHz   | $U_c = \pm 4.9 \text{ dB}$ |
| Uncertainty of total RF power, conducted      | $U_c = \pm 0.8 \text{ dB}$ |
| Uncertainty of RF power density, conducted    | $U_c = \pm 2.6 \text{ dB}$ |
| Uncertainty of spurious emissions, conducted  | $U_c = \pm 2 \%$           |
| Uncertainty of Occupied Channel Bandwidth     | $U_c = \pm 2 \%$           |

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### 3.5 List of Equipment Used

| ● RF Conducted Test System          |               |                     |              |            |            |                           |                           |
|-------------------------------------|---------------|---------------------|--------------|------------|------------|---------------------------|---------------------------|
| Used                                | Equipment No. | Test Equipment      | Manufacturer | Model No.  | Serial No. | Last Cal. Date (YY-MM-DD) | Next Cal. Date (YY-MM-DD) |
| <input checked="" type="checkbox"/> | AGC-ER-E036   | Spectrum Analyzer   | Agilent      | N9020A     | MY49100060 | 2024-05-24                | 2025-05-23                |
| <input checked="" type="checkbox"/> | AGC-ER-E062   | Power Sensor        | Agilent      | U2021XA    | MY54110007 | 2024-02-01                | 2025-01-31                |
| <input checked="" type="checkbox"/> | AGC-ER-E062   | Power Sensor        | Agilent      | U2021XA    | MY54110007 | 2025-01-14                | 2026-01-13                |
| <input checked="" type="checkbox"/> | AGC-ER-E063   | Power Sensor        | Agilent      | U2021XA    | MY54110009 | 2024-02-01                | 2025-01-31                |
| <input checked="" type="checkbox"/> | AGC-ER-E063   | Power Sensor        | Agilent      | U2021XA    | MY54110009 | 2025-01-14                | 2026-01-13                |
| <input checked="" type="checkbox"/> | AGC-ER-A001   | 6dB Attenuator      | Eeatsheep    | LM-XX-6-5W | N/A        | 2023-09-21                | 2025-09-20                |
| <input checked="" type="checkbox"/> | AGC-ER-E083   | Signal Generator    | Agilent      | E4421B     | US39340815 | 2024-05-24                | 2025-05-23                |
| <input checked="" type="checkbox"/> | N/A           | RF Connection Cable | N/A          | 1#         | N/A        | Each time                 | N/A                       |
| <input checked="" type="checkbox"/> | N/A           | RF Connection Cable | N/A          | 2#         | N/A        | Each time                 | N/A                       |

| ● Radiated Spurious Emission        |               |                               |              |            |            |                           |                           |
|-------------------------------------|---------------|-------------------------------|--------------|------------|------------|---------------------------|---------------------------|
| Used                                | Equipment No. | Test Equipment                | Manufacturer | Model No.  | Serial No. | Last Cal. Date (YY-MM-DD) | Next Cal. Date (YY-MM-DD) |
| <input checked="" type="checkbox"/> | AGC-EM-E046   | EMI Test Receiver             | R&S          | ESCI       | 10096      | 2024-02-01                | 2025-01-31                |
| <input checked="" type="checkbox"/> | AGC-EM-E046   | EMI Test Receiver             | R&S          | ESCI       | 10096      | 2025-01-14                | 2026-01-13                |
| <input checked="" type="checkbox"/> | AGC-EM-E116   | EMI Test Receiver             | R&S          | ESCI       | 100034     | 2024-05-24                | 2025-05-23                |
| <input checked="" type="checkbox"/> | AGC-EM-E061   | Spectrum Analyzer             | Agilent      | N9010A     | MY53470504 | 2024-05-28                | 2025-05-27                |
| <input checked="" type="checkbox"/> | AGC-EM-E086   | Loop Antenna                  | ZHINAN       | ZN30900C   | 18051      | 2024-03-05                | 2026-03-04                |
| <input checked="" type="checkbox"/> | AGC-EM-E001   | Wideband Antenna              | SCHWARZBECK  | VULB9168   | D69250     | 2023-05-11                | 2025-05-10                |
| <input checked="" type="checkbox"/> | AGC-EM-E029   | Broadband Ridged Horn Antenna | ETS          | 3117       | 00034609   | 2024-03-31                | 2025-03-30                |
| <input checked="" type="checkbox"/> | AGC-EM-E082   | Horn Antenna                  | SCHWARZBECK  | BBHA 9170  | #768       | 2023-09-24                | 2025-09-23                |
| <input checked="" type="checkbox"/> | AGC-EM-E146   | Pre-amplifier                 | ETS          | 3117-PA    | 00246148   | 2024-07-24                | 2026-07-23                |
| <input checked="" type="checkbox"/> | AGC-EM-A119   | 2.4G Filter                   | SongYi       | N/A        | N/A        | 2024-05-23                | 2025-05-22                |
| <input checked="" type="checkbox"/> | AGC-EM-A138   | 6dB Attenuator                | Eeatsheep    | LM-XX-6-5W | N/A        | 2023-06-09                | 2025-06-08                |
| <input type="checkbox"/>            | AGC-EM-A139   | 6dB Attenuator                | Eeatsheep    | LM-XX-6-5W | N/A        | 2023-06-09                | 2025-06-08                |

| ● AC Power Line Conducted Emission  |               |                   |              |            |            |                           |                           |
|-------------------------------------|---------------|-------------------|--------------|------------|------------|---------------------------|---------------------------|
| Used                                | Equipment No. | Test Equipment    | Manufacturer | Model No.  | Serial No. | Last Cal. Date (YY-MM-DD) | Next Cal. Date (YY-MM-DD) |
| <input checked="" type="checkbox"/> | AGC-EM-E045   | EMI Test Receiver | R&S          | ESPI       | 101206     | 2024-05-28                | 2025-05-27                |
| <input checked="" type="checkbox"/> | AGC-EM-A130   | 6dB Attenuator    | Eeatsheep    | LM-XX-6-5W | DC-6GZ     | 2023-06-09                | 2025-06-08                |
| <input checked="" type="checkbox"/> | AGC-EM-E023   | AMN               | R&S          | 100086     | ESH2-Z5    | 2024-05-28                | 2025-05-27                |

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| ● Test Software                     |               |                     |              |                                 |                     |
|-------------------------------------|---------------|---------------------|--------------|---------------------------------|---------------------|
| Used                                | Equipment No. | Test Equipment      | Manufacturer | Model No.                       | Version Information |
| <input checked="" type="checkbox"/> | AGC-EM-S001   | CE Test System      | R&S          | ES-K1                           | V1.71               |
| <input checked="" type="checkbox"/> | AGC-EM-S003   | RE Test System      | FARA         | EZ-EMC                          | VRA-03A             |
| <input type="checkbox"/>            | AGC-EM-S004   | RE Test System      | Tonscend     | TS <sup>+</sup> Ver2.1(JS32-RE) | 4.0.0.0             |
| <input checked="" type="checkbox"/> | AGC-ER-S012   | BT/WIFI Test System | Tonscend     | JS1120-2                        | 2.6                 |
| <input checked="" type="checkbox"/> | AGC-EM-S011   | RSE Test System     | Tonscend     | TS+-Ver2.1(JS36-RSE)            | 4.0.0.0             |

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## 4. System Test Configuration

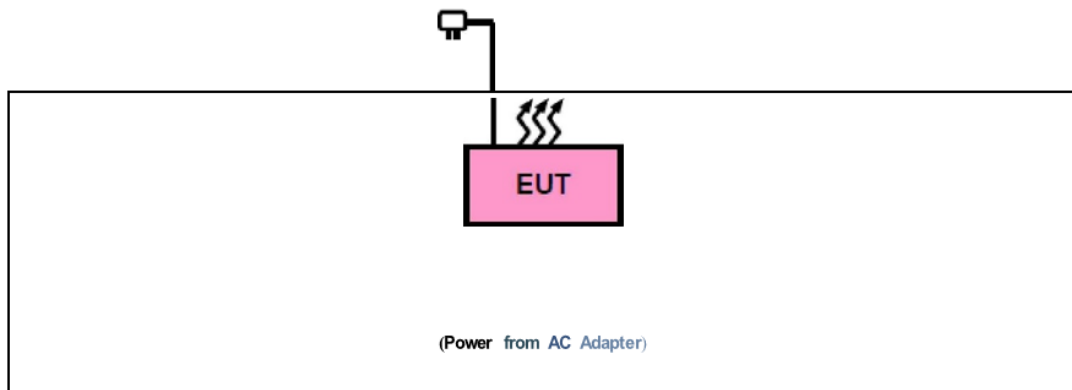
### 4.1 EUT Configuration

The EUT configuration for testing is installed on RF field strength measurement to meet the Commission's requirement and operating in a manner which intends to maximize its emission characteristics in a continuous normal application.

### 4.2 EUT Exercise

The Transmitter was operated in the normal operating mode. The TX frequency was fixed which was for the purpose of the measurements.

### 4.3 Configuration of Tested System



### 4.4 Equipment Used in Tested System

The following peripheral devices and interface cables were connected during the measurement:

☒ Test Accessories Come From The Laboratory

| No. | Equipment   | Manufacturer | Model No. | Specification Information | Cable |
|-----|-------------|--------------|-----------|---------------------------|-------|
| 1   | Control Box | --           | USB-TTL   | --                        | --    |

☒ Test Accessories Come From The Manufacturer

| No. | Equipment | Manufacturer                           | Model No.        | Specification Information                      | Cable           |
|-----|-----------|----------------------------------------|------------------|------------------------------------------------|-----------------|
| 1   | Adapter   | JiangxiJian Aohai Technology Co., Ltd. | A319-050200U-US2 | Input:100-240V~ 50/60Hz,<br>Output: 5V= 2000mA | 2.0m Unshielded |

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#### 4.5 Summary of Test Results

| Item | FCC Rules            | Description of Test                           | Result |
|------|----------------------|-----------------------------------------------|--------|
| 1    | §15.203&15.247(b)(4) | Antenna Equipment                             | Pass   |
| 2    | §15.247 (b)(1)       | RF Output Power                               | Pass   |
| 3    | §15.247 (a)(1)       | 6 dB Bandwidth                                | Pass   |
| 4    | §15.247 (e)          | Power Spectral Density                        | Pass   |
| 5    | §15.247 (d)          | Conducted Band Edge and Out-of-Band Emissions | Pass   |
| 6    | §15.247 (d)&15.209   | Radiated Spurious Emission                    | Pass   |
| 7    | §15.207              | AC Power Line Conducted Emission              | Pass   |

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## 5. Description of Test Modes

| Summary table of Test Cases                                                                                                                                                                                                                                          |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Test Item                                                                                                                                                                                                                                                            | Data Rate / Modulation                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |
|                                                                                                                                                                                                                                                                      | 2.4G WLAN – 802.11b/g/n/ax (DSSS/OFDM/OFDMA)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |
| Radiated & Conducted Test Cases                                                                                                                                                                                                                                      | Mode 1: 802.11b_TX CH01_2412 MHz_1 Mbps<br>Mode 2: 802.11b_TX CH06_2437 MHz_1 Mbps<br>Mode 3: 802.11b_TX CH11_2462 MHz_1 Mbps<br>Mode 4: 802.11g_TX CH01_2412 MHz_6 Mbps<br>Mode 5: 802.11g_TX CH06_2437 MHz_6 Mbps<br>Mode 6: 802.11g_TX CH11_2462 MHz_6 Mbps<br>Mode 7: 802.11n-HT20_TX CH01_2412 MHz_MCS0 Mbps<br>Mode 8: 802.11n-HT20_TX CH06_2437 MHz_MCS0 Mbps<br>Mode 9: 802.11n-HT20_TX CH11_2462 MHz_MCS0 Mbps<br>Mode 10: 802.11ax-HE20_TX CH01_2412 MHz_MCS0 Mbps<br>Mode 11: 802.11ax-HE20_TX CH06_2437 MHz_MCS0 Mbps<br>Mode 12: 802.11ax-HE20_TX CH11_2462 MHz_MCS0 Mbps<br>Mode 13: 802.11n-HT40_TX CH03_2422 MHz_MCS0 Mbps<br>Mode 14: 802.11n-HT40_TX CH06_2437 MHz_MCS0 Mbps<br>Mode 15: 802.11n-HT40_TX CH09_2452 MHz_MCS0 Mbps<br>Mode 16: 802.11ax-HE40_TX CH03_2422 MHz_MCS0 Mbps<br>Mode 17: 802.11ax-HE40_TX CH06_2437 MHz_MCS0 Mbps<br>Mode 18: 802.11ax-HE40_TX CH09_2452 MHz_MCS0 Mbps |
| AC Conducted Emission                                                                                                                                                                                                                                                | Mode 1: 2.4G WLAN Link + USB Cable (Charging from AC Adapter)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |
| Note:<br>1. The 802.11ax mode is only tested and evaluated at Full RU bandwidth.<br>2. For Radiated Emission, 3axis were chosen for testing for each applicable mode.<br>3. For Conducted Test method, a temporary antenna connector is provided by the manufacture. |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |

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## 6. Duty Cycle Measurement

2.4GHz WLAN (DTS) operation is possible in 20MHz, and 40MHz channel bandwidths. The maximum achievable duty cycles for all modes were determined based on measurements performed on a spectrum analyzer in zero-span mode with RBW = 8MHz, VBW = 50MHz, and detector = Average. The RBW and VBW were both greater than 50/T, where T is the minimum transmission duration, and the number of sweep points across T was greater than 100. The duty cycles are as follows:

| Operating mode     | Data rates (Mbps) | Duty Cycle (%) | Duty Cycle Factor (dB) |
|--------------------|-------------------|----------------|------------------------|
| IEEE 802.11b       | 1                 | 97.45          | 0.11                   |
| IEEE 802.11g       | 6                 | 88.34          | 0.54                   |
| IEEE 802.11n-HT20  | MCS0              | 96.93          | 0.14                   |
| IEEE 802.11n-HT40  | MCS0              | 96.80          | 0.14                   |
| IEEE 802.11ax-HE20 | MCS0              | 96.78          | 0.14                   |
| IEEE 802.11ax-HE40 | MCS0              | 96.92          | 0.14                   |

Remark:

1. Duty Cycle factor =  $10 * \log (1 / \text{Duty cycle})$
2. The duty cycle of each frequency band mode reflects the determination requirements of the Middle channel measurement value.

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- The test plots as follows:



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## 7. RF Output Power Measurement

### 7.1 Provisions Applicable

For DTSs employing digital modulation techniques operating in the bands 2400-2483.5 MHz, the maximum peak conducted output power shall not exceed 1 W.

### 7.2 Measurement Procedure

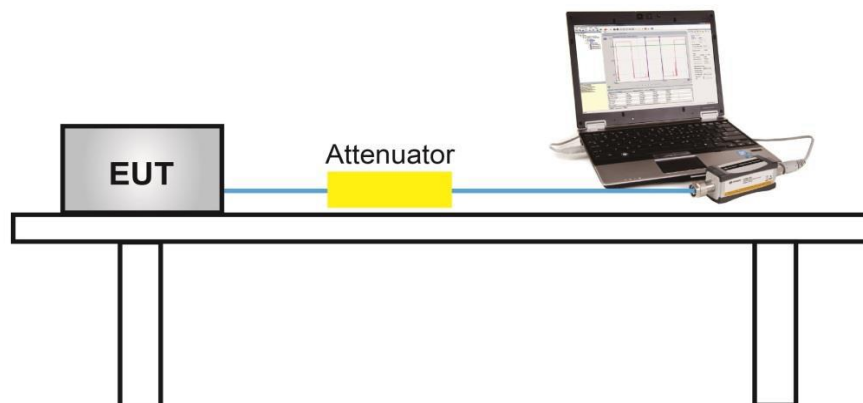
☒ Method PM is Measurement using an RF Peak power meter. The procedure for this method is as follows:

1. The testing follows the ANSI C63.10 Section 11.9.1.3
2. The maximum peak conducted output power may be measured using a broadband peak RF power meter. The power meter shall have a video bandwidth that is greater than or equal to the DTS bandwidth and shall use a fast-responding diode detector.

☒ Method PM is Measurement using an RF AV power meter. The procedure for this method is as follows:

1. The testing follows the ANSI C63.10 Section 11.9.2.3
2. Measurements may be performed using a wideband RF power meter with a thermocouple detector or equivalent if all of the following conditions are satisfied:
3. The EUT is configured to transmit continuously, or to transmit with a constant duty cycle.
4. At all times when the EUT is transmitting, it shall be transmitting at its maximum power control level.
5. The integration period of the power meter exceeds the repetition period of the transmitted signal by at least a factor of five.
6. Determine according to the duty cycle of the equipment: when it is less than 98%, follow the steps below.
7. Measure the average power of the transmitter. This measurement is an average over both the ON and OFF periods of the transmitter.
8. Adjust the measurement in dBm by adding  $[10 \log (1 / D)]$ , where D is the duty cycle {e.g.,  $[10 \log (1 / 0.25)]$ , if the duty cycle is 25%}.
9. Record the test results in the report.

### 7.3 Measurement Setup (Block Diagram of Configuration)



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#### 7.4 Measurement Result

| Test Data of Conducted Output Power |                      |                     |                  |              |              |
|-------------------------------------|----------------------|---------------------|------------------|--------------|--------------|
| Test Mode                           | Test Frequency (MHz) | Average Power (dBm) | Peak Power (dBm) | Limits (dBm) | Pass or Fail |
| 802.11b                             | 2412                 | <b>10.92</b>        | 13.49            | ≤30          | Pass         |
|                                     | 2437                 | 10.78               | 13.25            | ≤30          | Pass         |
|                                     | 2462                 | 10.38               | 12.91            | ≤30          | Pass         |
| 802.11g                             | 2412                 | 10.59               | 18.36            | ≤30          | Pass         |
|                                     | 2437                 | 10.61               | 18.55            | ≤30          | Pass         |
|                                     | 2462                 | 9.93                | 17.51            | ≤30          | Pass         |
| 802.11n20                           | 2412                 | 10.41               | 17.98            | ≤30          | Pass         |
|                                     | 2437                 | 10.45               | 17.95            | ≤30          | Pass         |
|                                     | 2462                 | 9.82                | 17.47            | ≤30          | Pass         |
| 802.11n40                           | 2422                 | 9.93                | 18.02            | ≤30          | Pass         |
|                                     | 2437                 | 10.45               | 18.65            | ≤30          | Pass         |
|                                     | 2452                 | 10.08               | 17.79            | ≤30          | Pass         |
| 802.11ax20                          | 2412                 | 9.96                | 18.67            | ≤30          | Pass         |
|                                     | 2437                 | 10.31               | 20.15            | ≤30          | Pass         |
|                                     | 2462                 | 9.64                | 19.40            | ≤30          | Pass         |
| 802.11ax40                          | 2422                 | 9.91                | 19.81            | ≤30          | Pass         |
|                                     | 2437                 | 10.37               | <b>20.27</b>     | ≤30          | Pass         |
|                                     | 2452                 | 9.96                | 19.94            | ≤30          | Pass         |

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## 8. 6dB Bandwidth Measurement

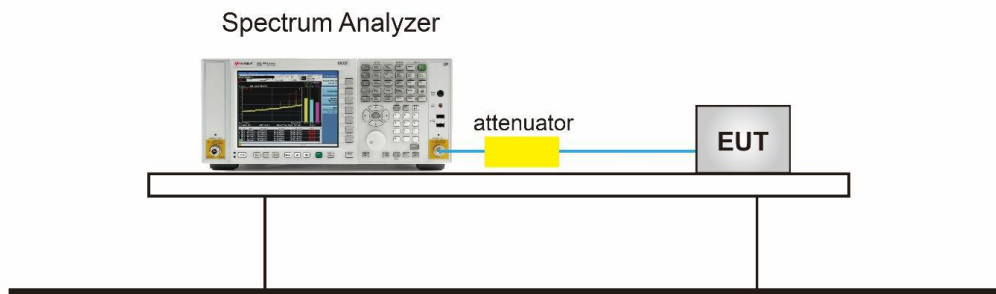
### 8.1 Provisions Applicable

The minimum 6dB bandwidth shall be 500 kHz.

### 8.2 Measurement Procedure

- The testing follows the ANSI C63.10 Section 6.9.3 (OBW) and 11.8.1 (6dB BW).
1. 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.
  2. Set to the maximum power setting and enable the EUT transmit continuously.
  3. For 6dB Bandwidth Measurement, the spectrum analyzer's resolution bandwidth (RBW) = 100 kHz. Set the Video bandwidth (VBW) = 300 kHz. In order to make an accurate measurement.
  4. For 99% Bandwidth Measurement, the spectrum analyzer's resolution bandwidth (RBW) is set 1-5% of the OBW and set the Video bandwidth (VBW)  $\geq 3 * \text{RBW}$ .
  5. Detector = peak
  6. Trace mode = max hold.
  7. Sweep = auto couple.
  8. Allow the trace to stabilize.
  9. Measure and record the results in the test report.

### 8.3 Measurement Setup (Block Diagram of Configuration)



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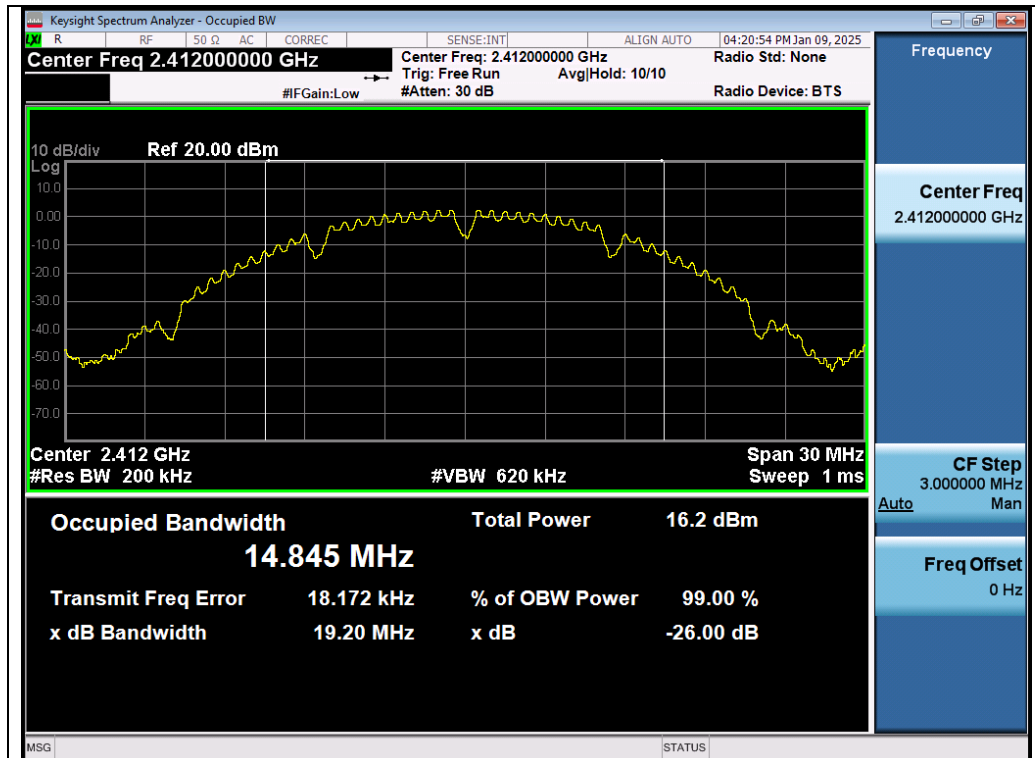


#### 8.4 Measurement Result

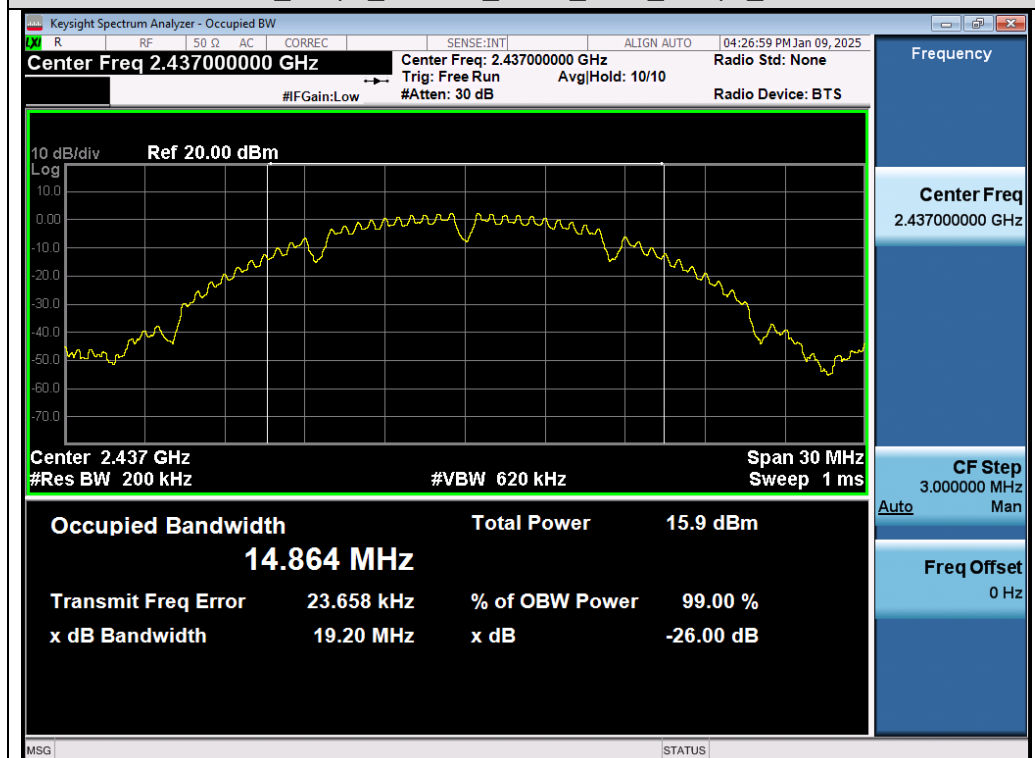
| Test Data of Occupied Bandwidth and DTS Bandwidth |                      |                              |                     |                            |        |
|---------------------------------------------------|----------------------|------------------------------|---------------------|----------------------------|--------|
| Test Mode                                         | Test Frequency (MHz) | 99% Occupied Bandwidth (MHz) | DTS Bandwidth (MHz) | DTS Bandwidth Limits (MHz) | Result |
| 802.11b                                           | 2412                 | 14.845                       | 9.555               | $\geq 0.5$                 | Pass   |
|                                                   | 2437                 | 14.864                       | 9.599               | $\geq 0.5$                 | Pass   |
|                                                   | 2462                 | 14.848                       | 10.072              | $\geq 0.5$                 | Pass   |
| 802.11g                                           | 2412                 | 16.573                       | 15.868              | $\geq 0.5$                 | Pass   |
|                                                   | 2437                 | 16.665                       | 16.030              | $\geq 0.5$                 | Pass   |
|                                                   | 2462                 | 16.659                       | 15.680              | $\geq 0.5$                 | Pass   |
| 802.11n20                                         | 2412                 | 17.818                       | 16.097              | $\geq 0.5$                 | Pass   |
|                                                   | 2437                 | 17.798                       | 15.725              | $\geq 0.5$                 | Pass   |
|                                                   | 2462                 | 17.759                       | 16.272              | $\geq 0.5$                 | Pass   |
| 802.11n40                                         | 2422                 | 36.166                       | 35.777              | $\geq 0.5$                 | Pass   |
|                                                   | 2437                 | 36.234                       | 35.731              | $\geq 0.5$                 | Pass   |
|                                                   | 2452                 | 36.213                       | 33.725              | $\geq 0.5$                 | Pass   |
| 802.11ax20                                        | 2412                 | 19.023                       | 17.418              | $\geq 0.5$                 | Pass   |
|                                                   | 2437                 | 19.012                       | 18.241              | $\geq 0.5$                 | Pass   |
|                                                   | 2462                 | 18.991                       | 17.811              | $\geq 0.5$                 | Pass   |
| 802.11ax40                                        | 2422                 | 37.722                       | 36.221              | $\geq 0.5$                 | Pass   |
|                                                   | 2437                 | 37.719                       | 37.071              | $\geq 0.5$                 | Pass   |
|                                                   | 2452                 | 37.753                       | 37.329              | $\geq 0.5$                 | Pass   |

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### Test Graphs of Occupied Bandwidth



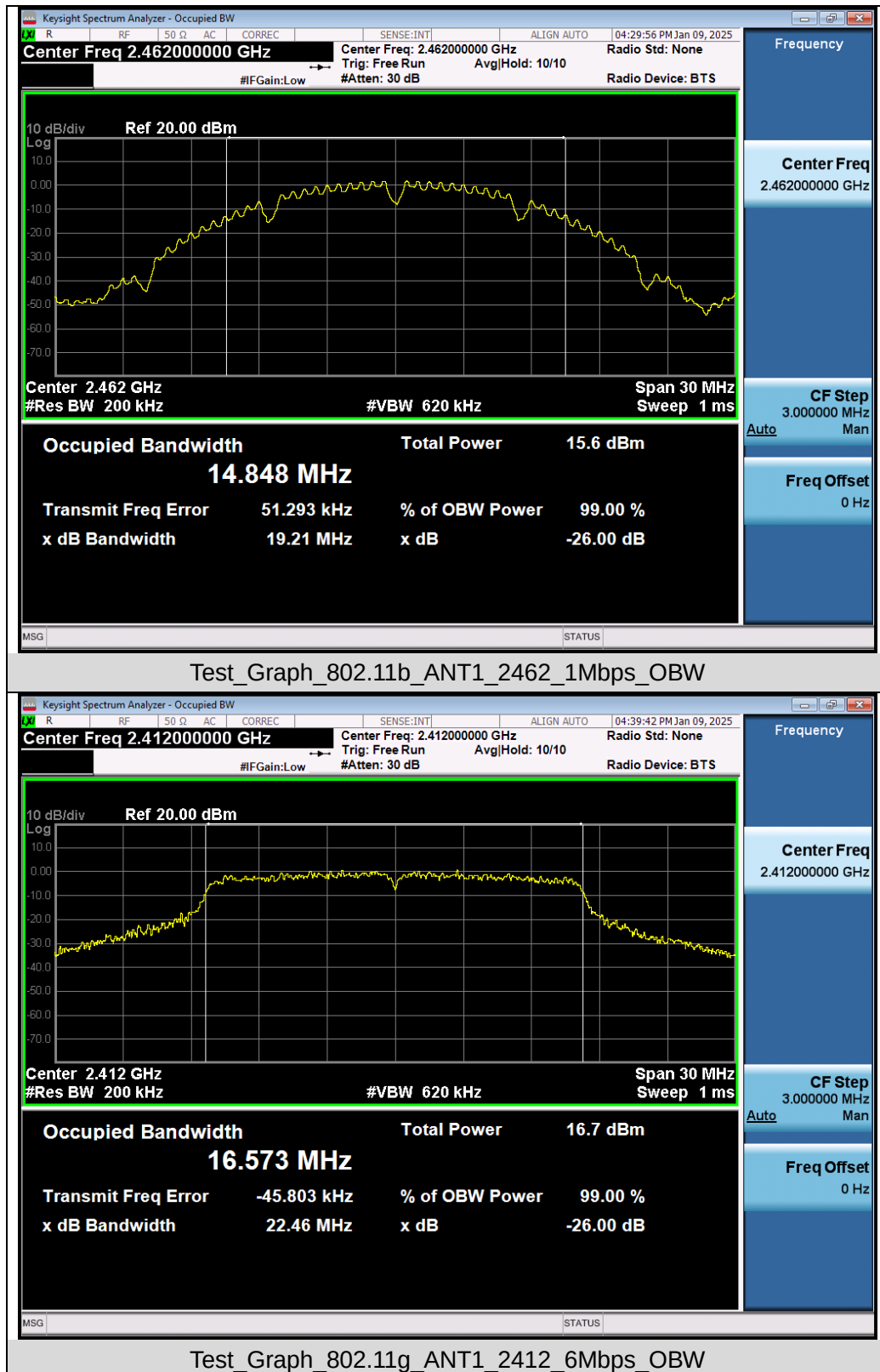
### Test\_Graph\_802.11b\_ANT1\_2412\_1Mbps\_OBW



### Test\_Graph\_802.11b\_ANT1\_2437\_1Mbps\_OBW

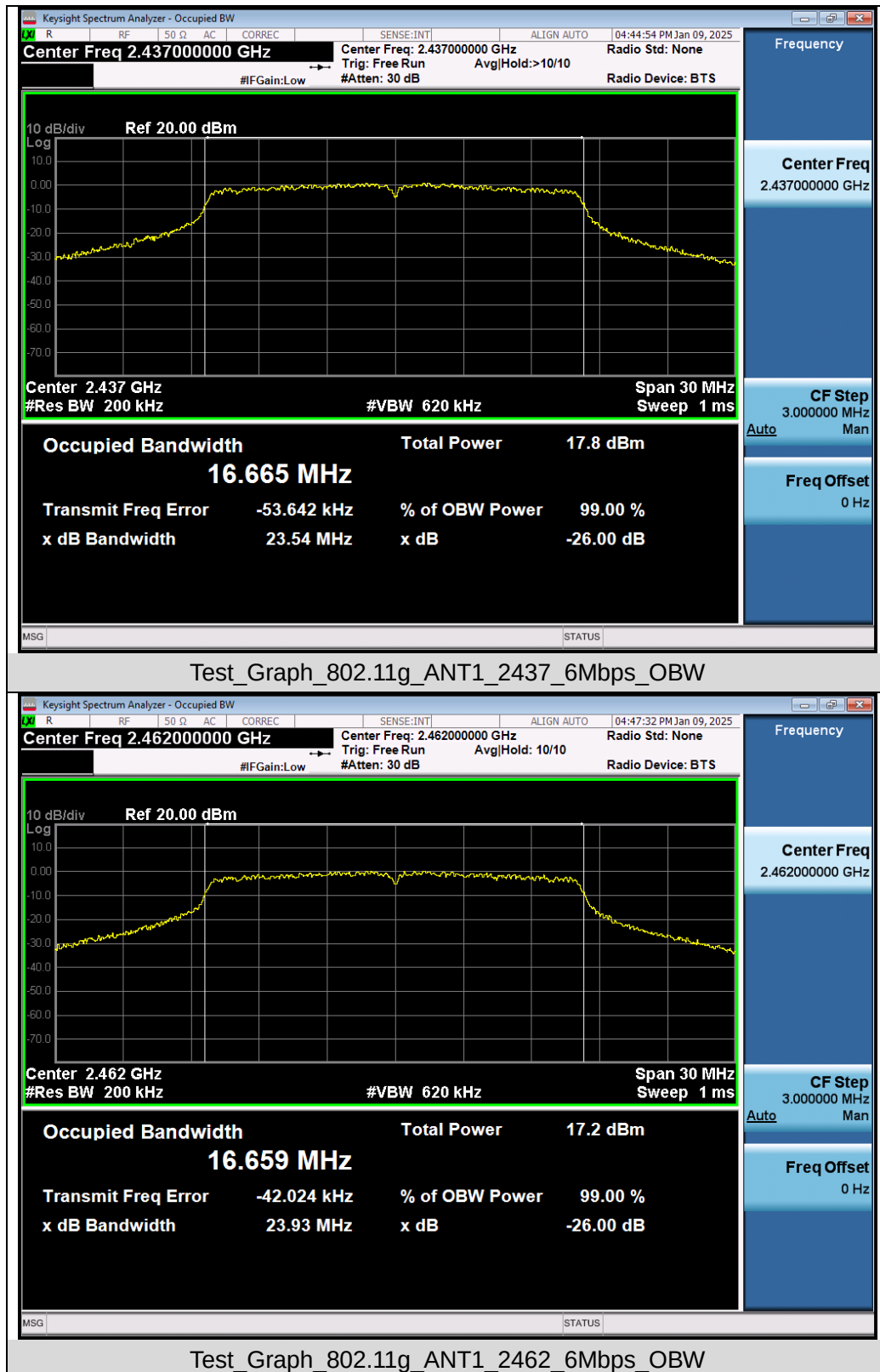
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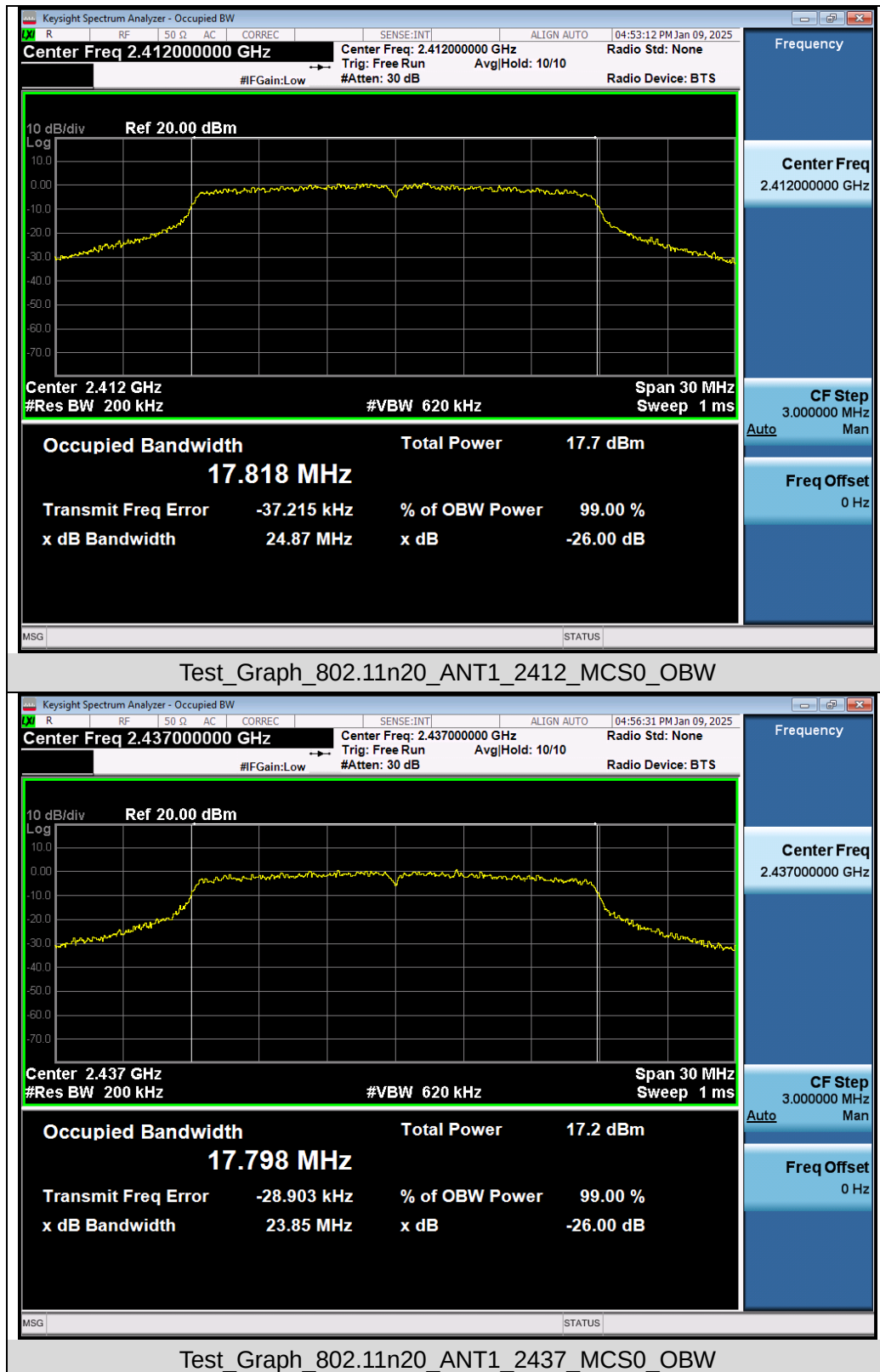


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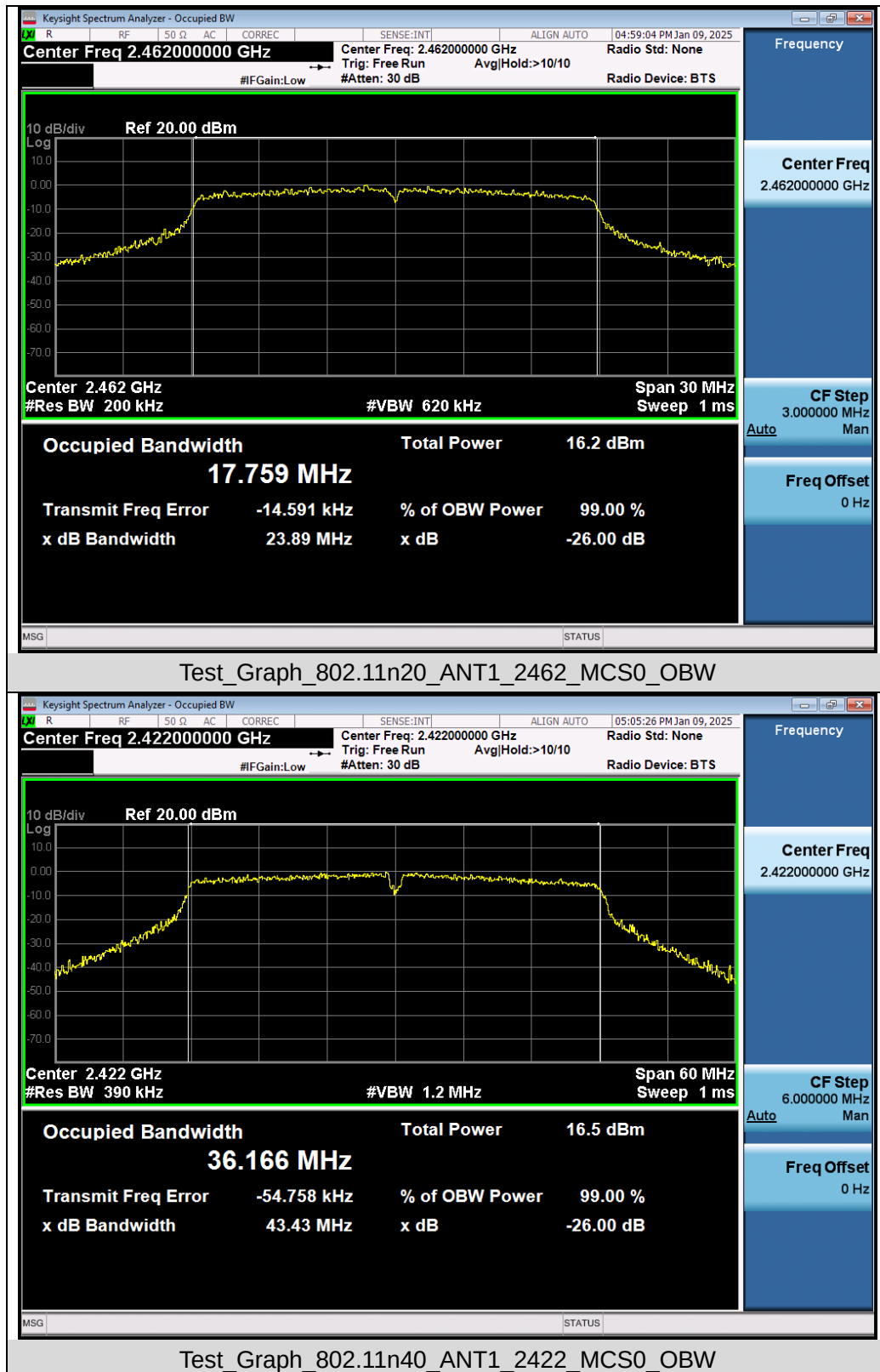


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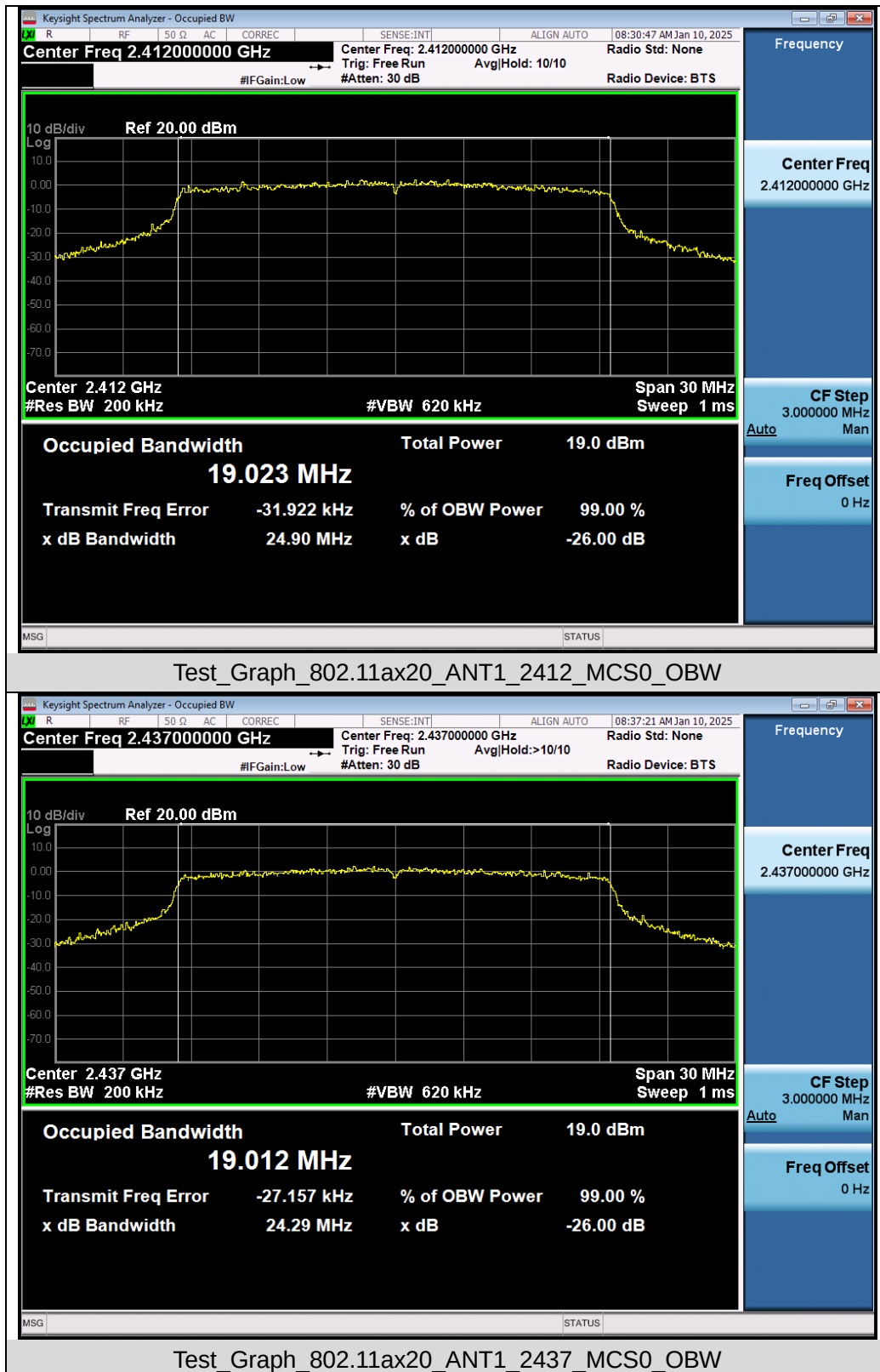


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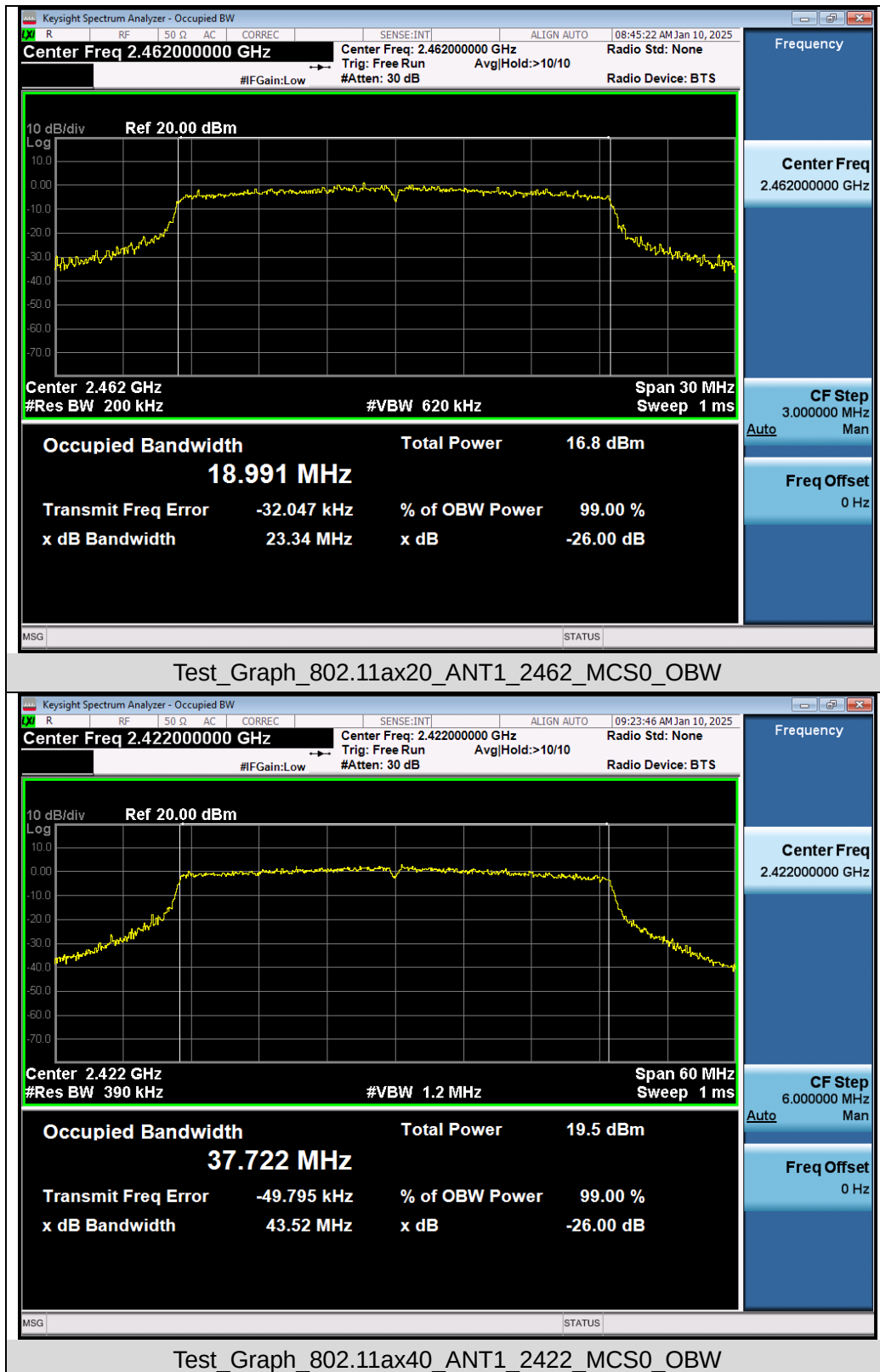
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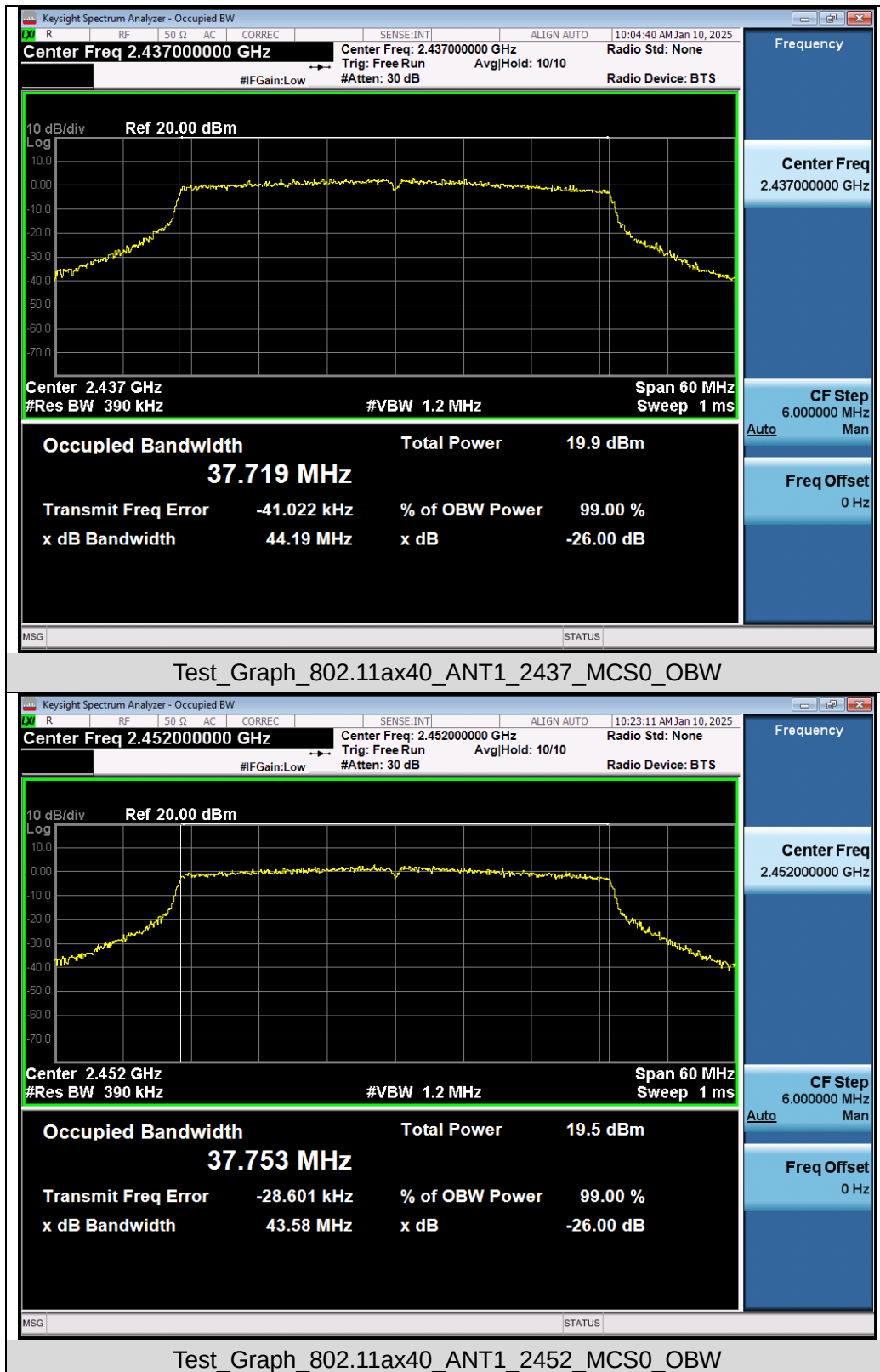
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### Test Graphs of DTS Bandwidth

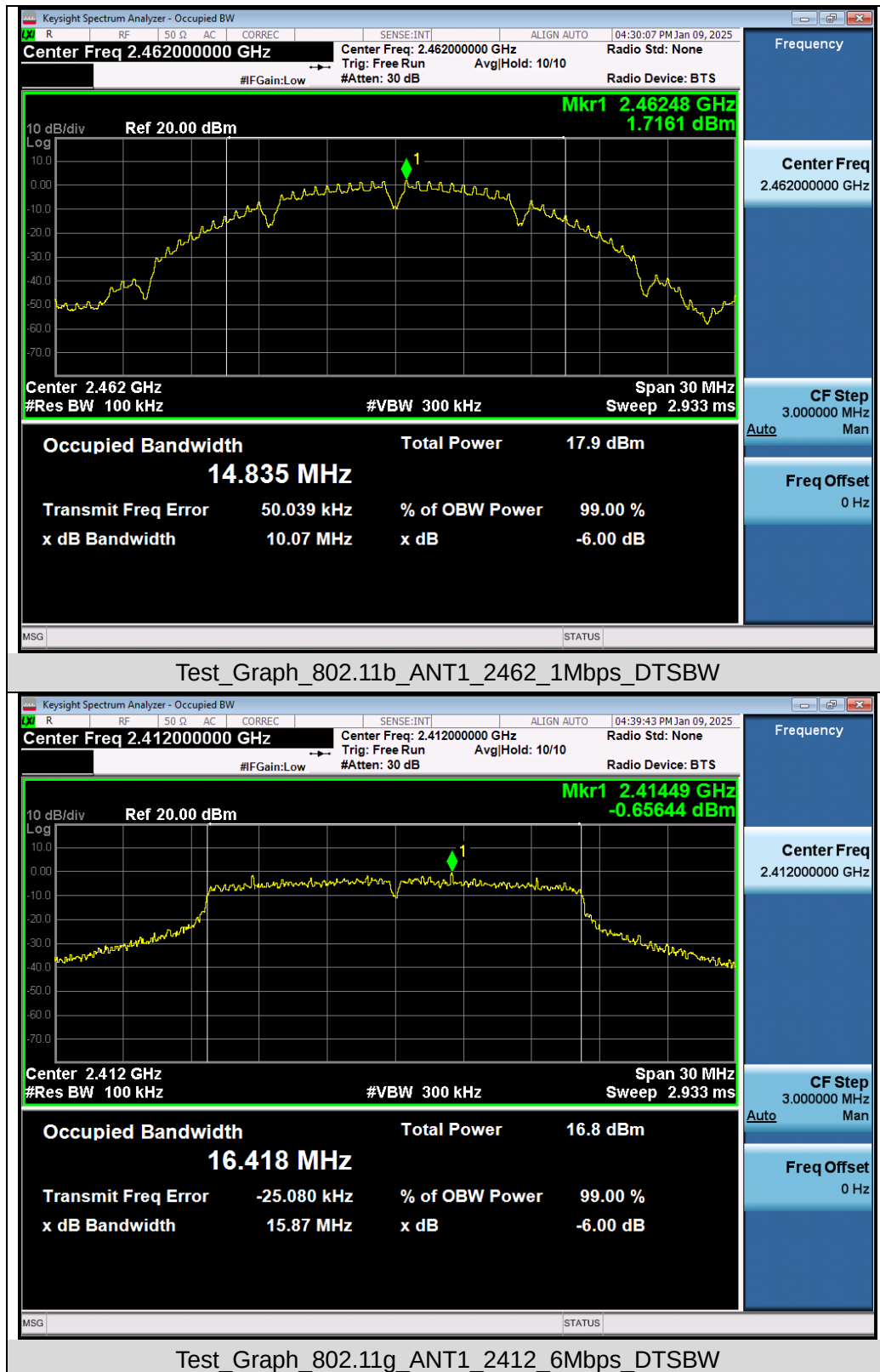


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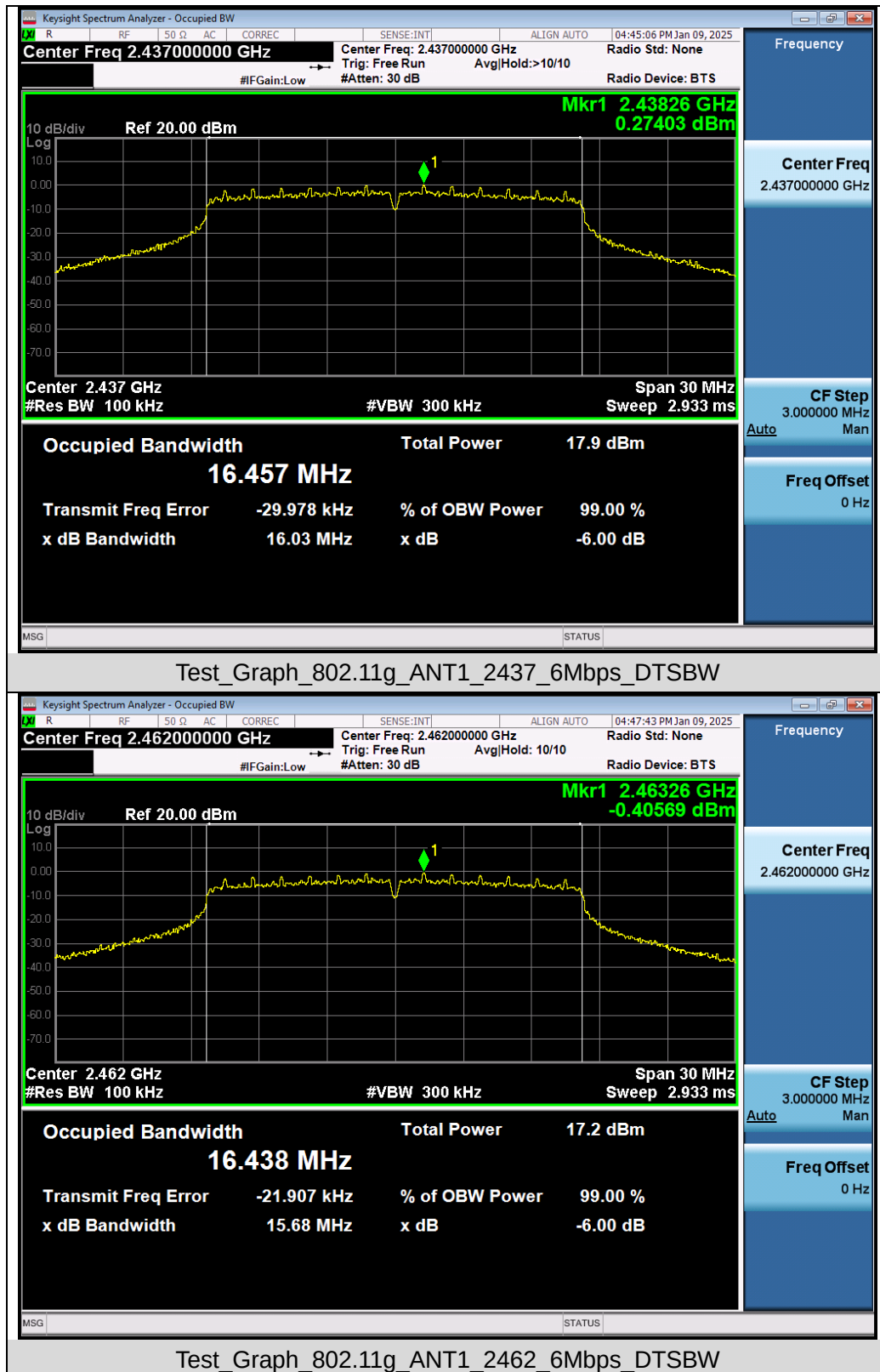
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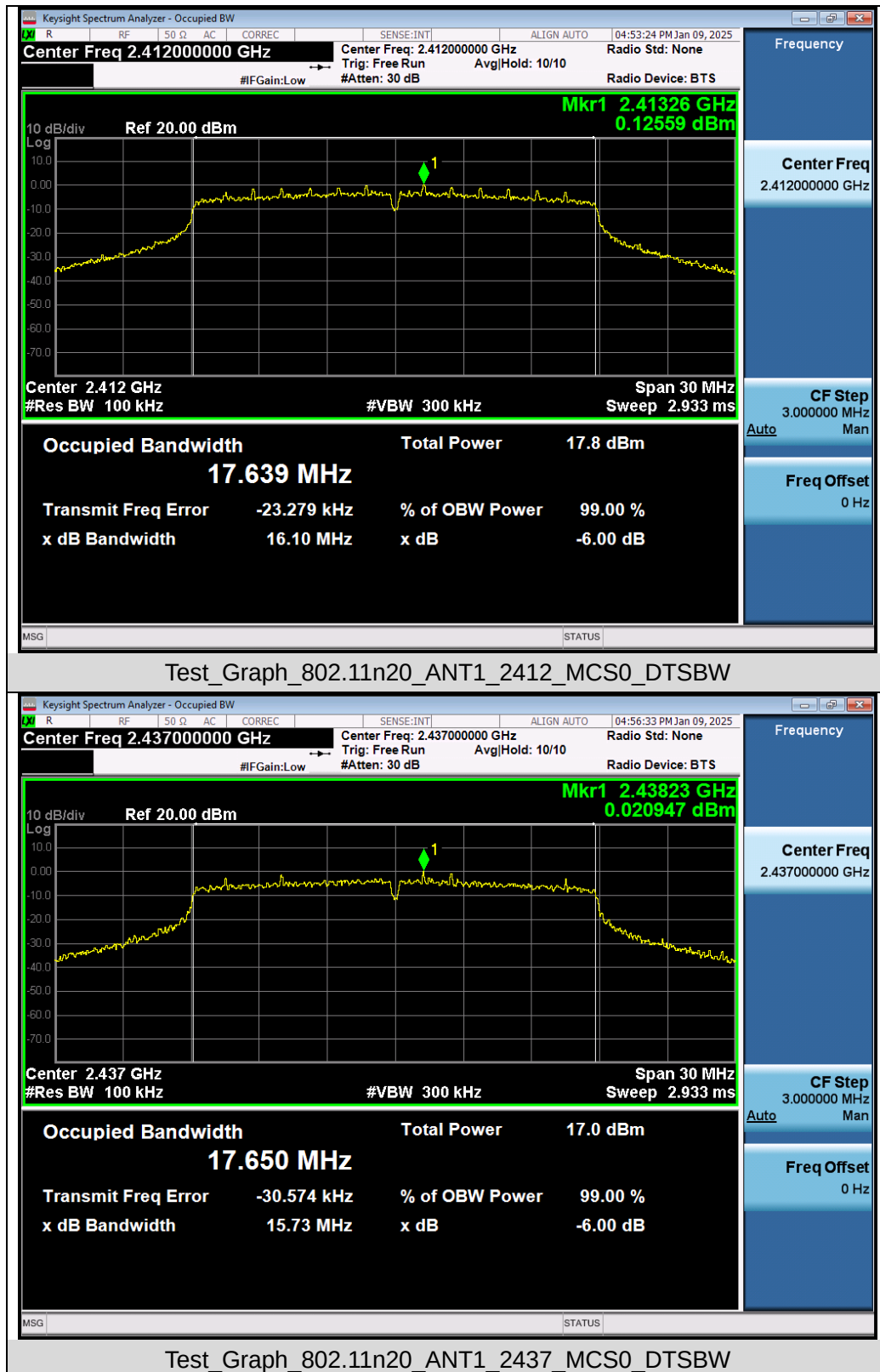
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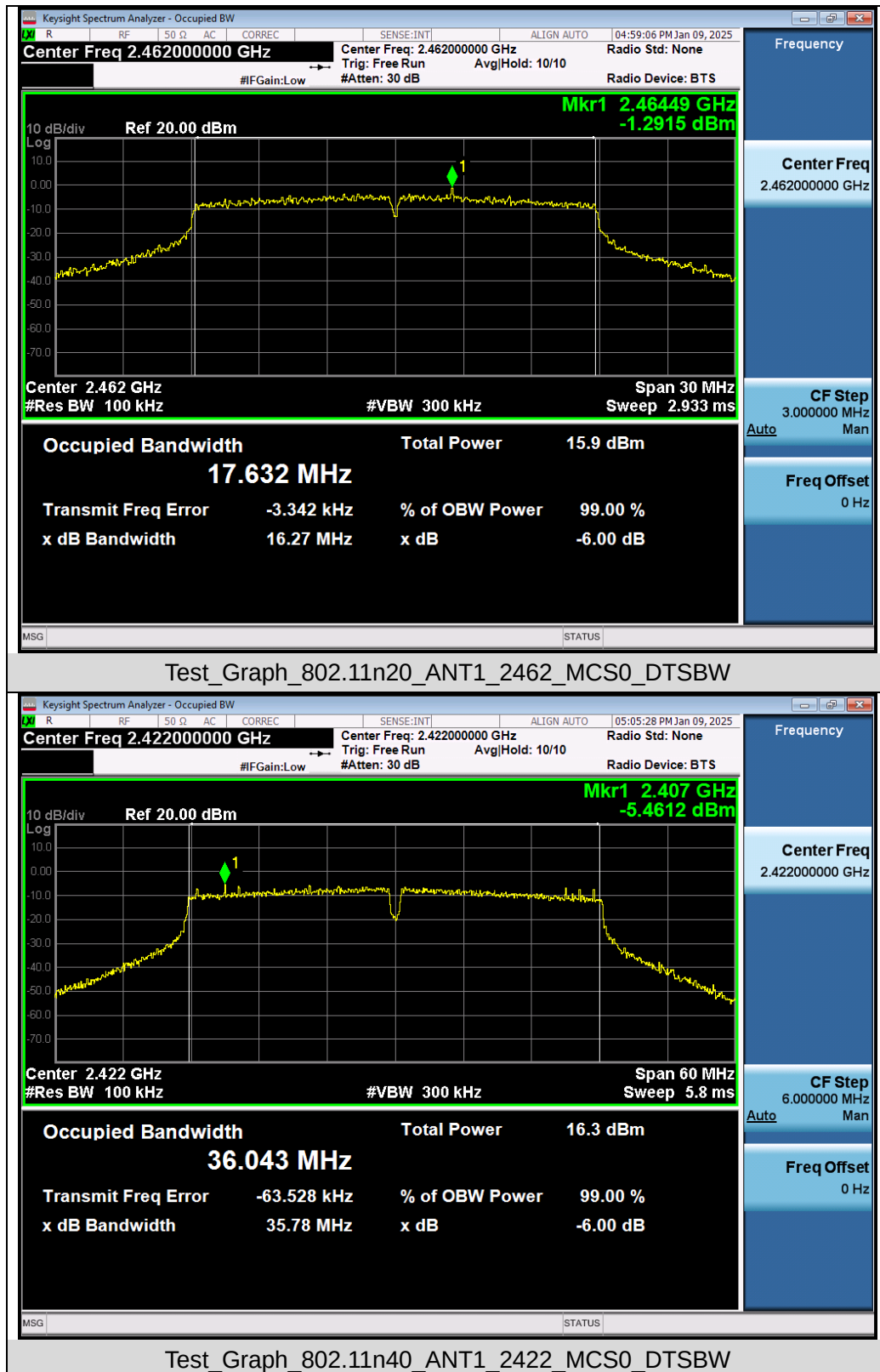
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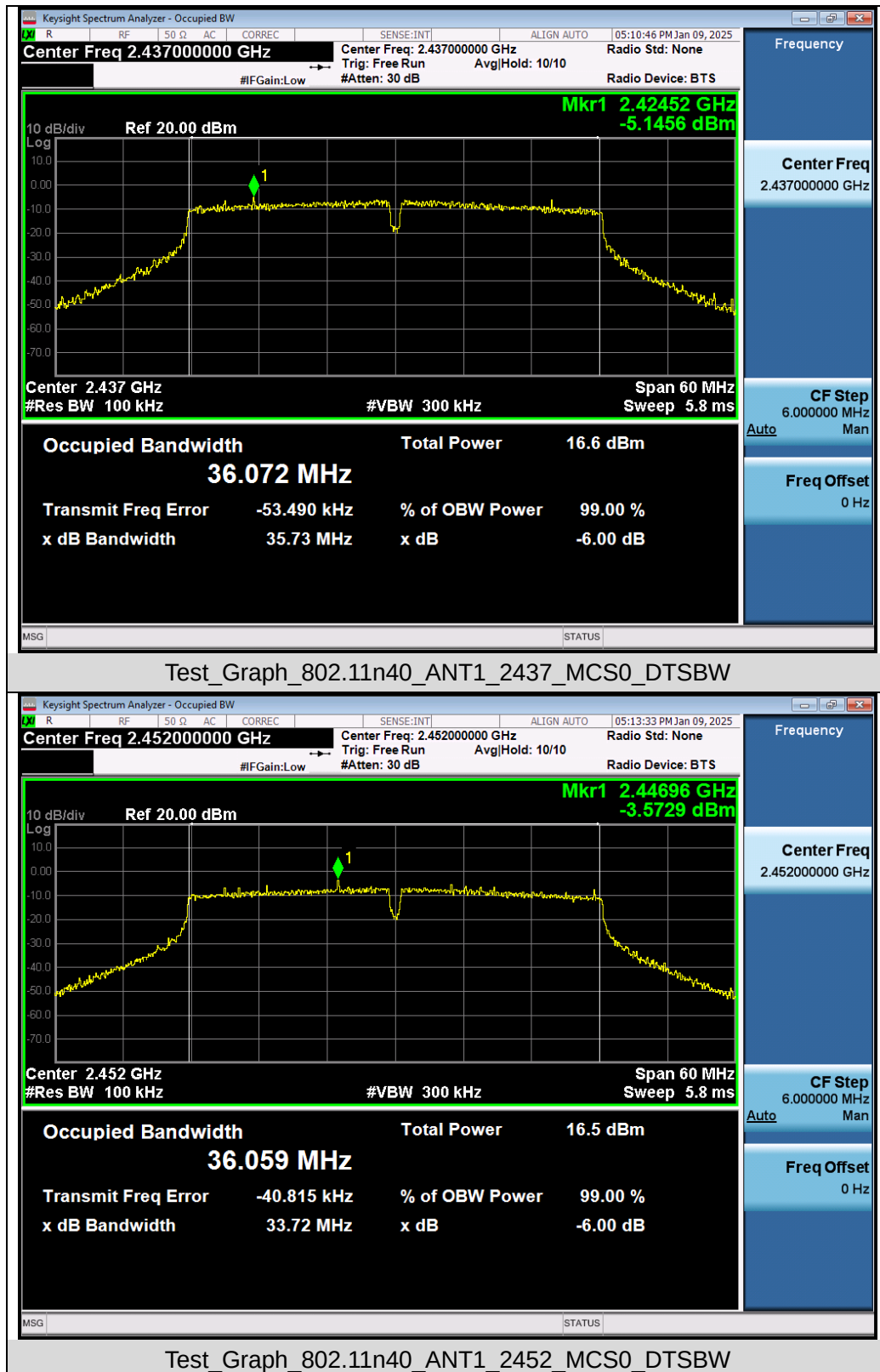
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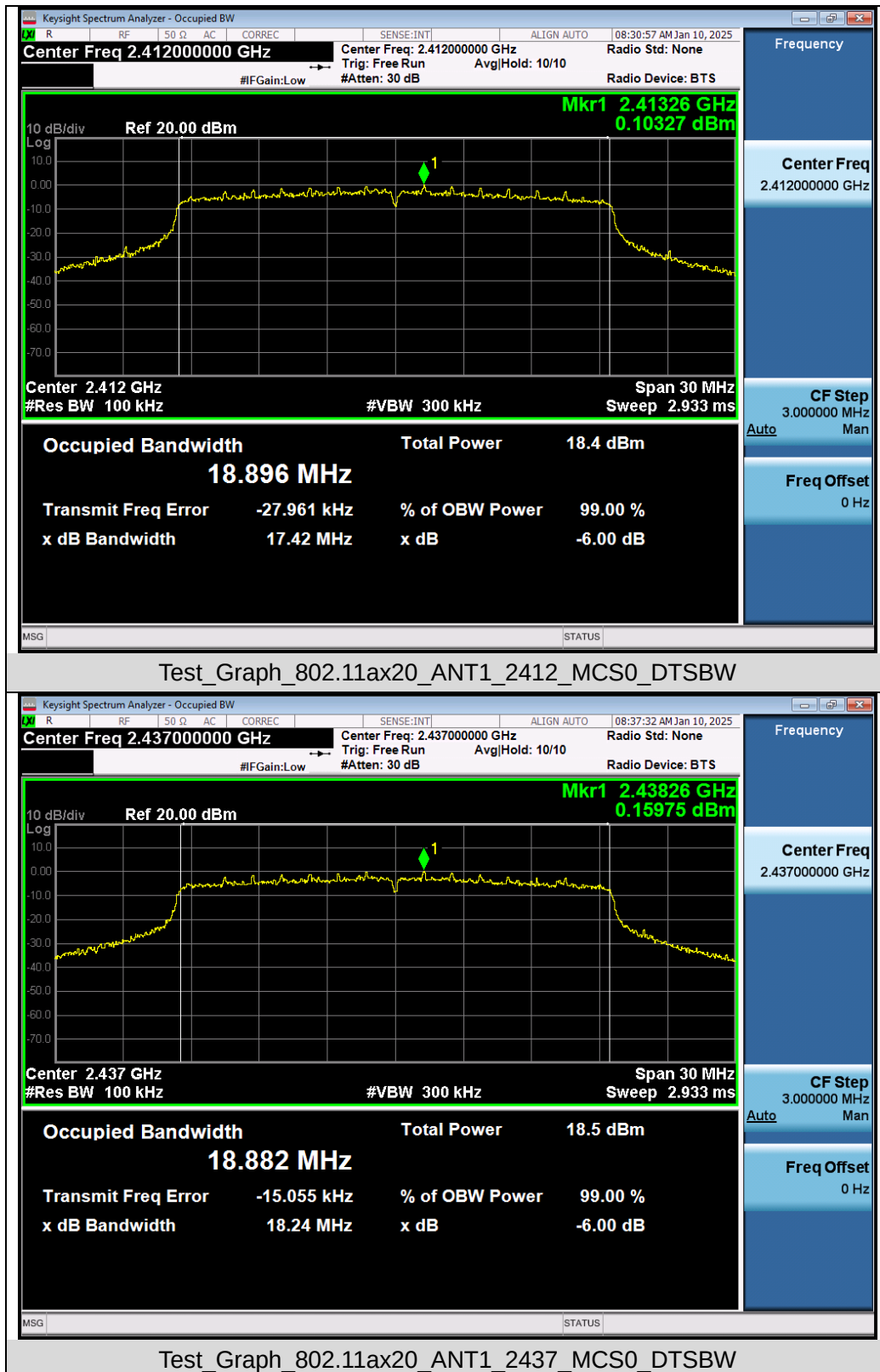
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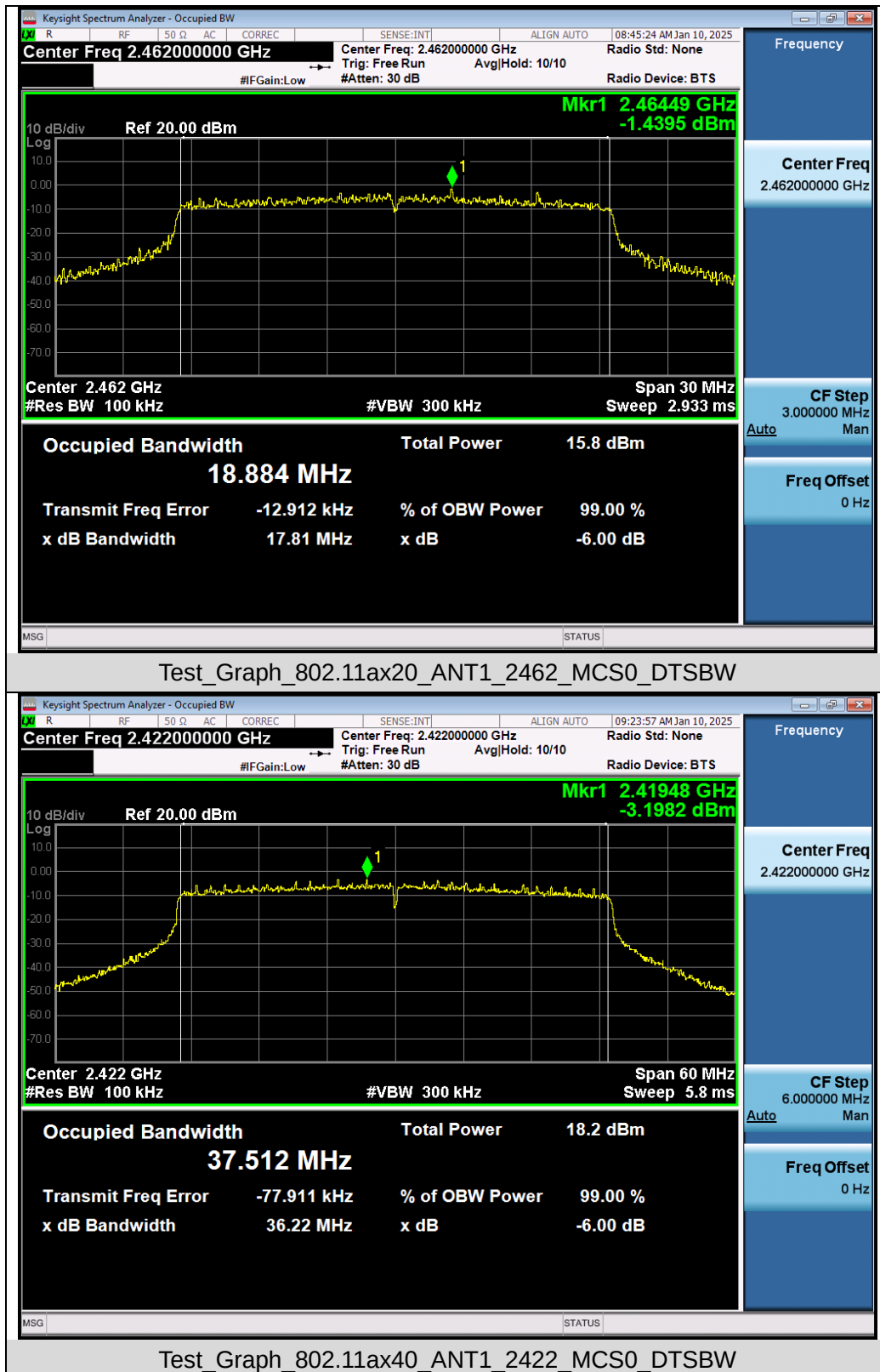
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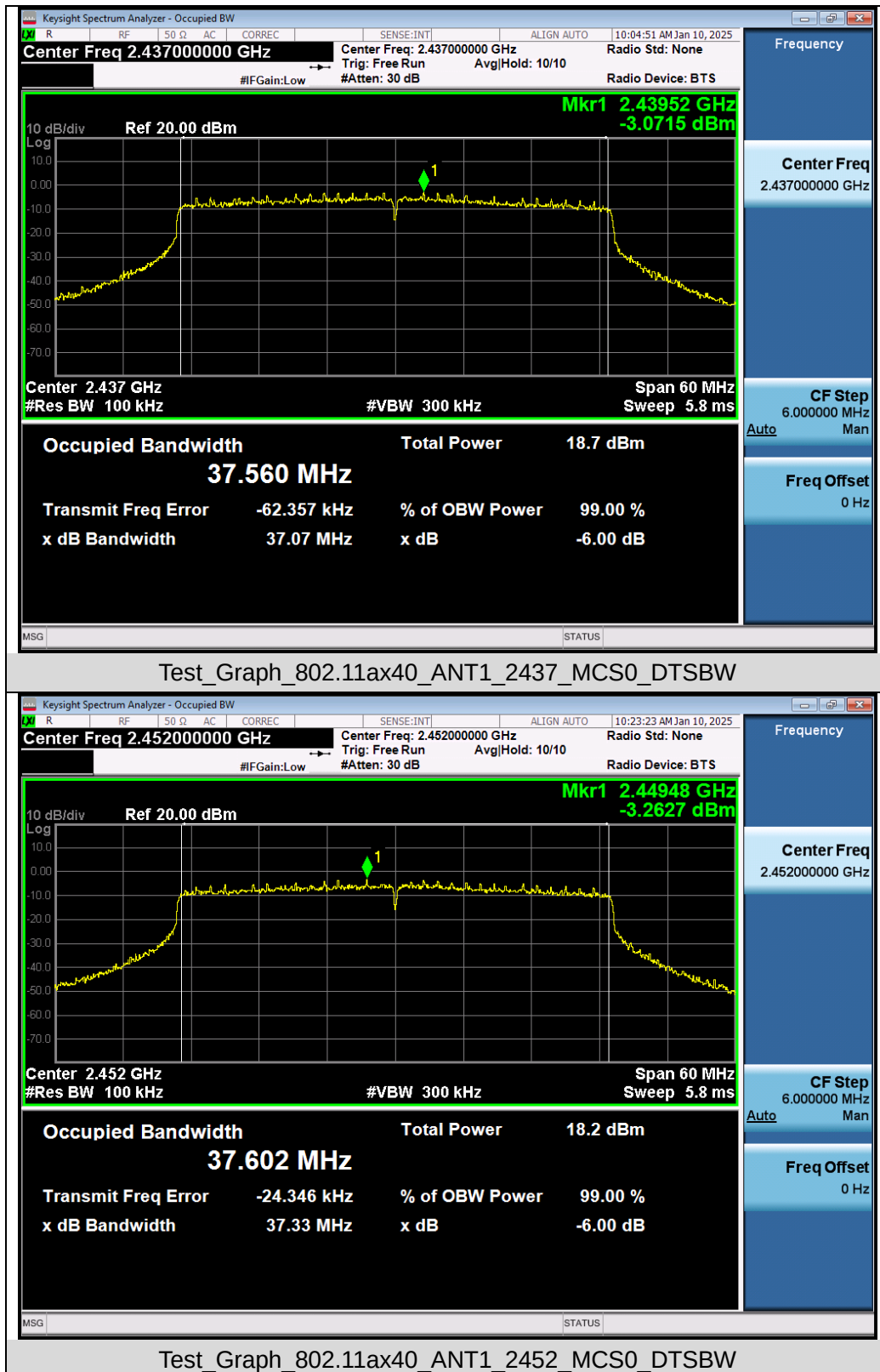
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## 9. Power Spectral Density Measurement

### 9.1 Provisions Applicable

The transmitter power spectral density conducted from the transmitter to the antenna shall not be greater than 8 dBm in any 3 kHz band during any time interval of continuous transmission.

### 9.2 Measurement Procedure

☒ For Peak power spectral density test:

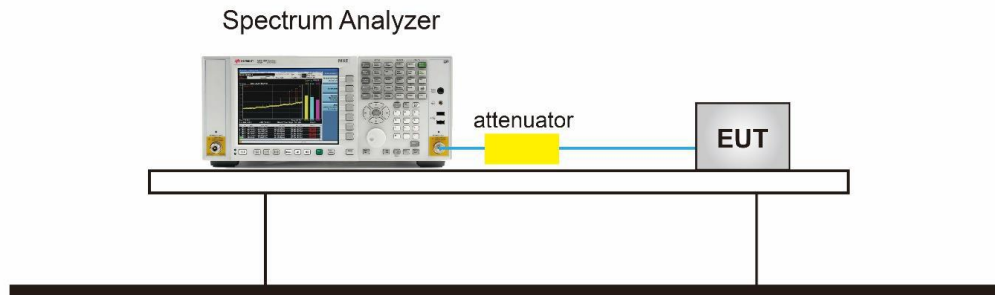
1. The testing follows the ANSI C63.10 Section 11.10.2 Method PKPSD.
2. Connect EUT RF output port to the Spectrum Analyzer through an RF attenuator
3. Set the RBW = 20 kHz.
4. Set the VBW  $\geq [3 \times \text{RBW}]$ .
5. Set the Span  $\geq [1.5 \times \text{DTS bandwidth}]$ .
6. Sweep time=Auto couple.
7. Detector function=Peak.
8. Trace Mode=Max hold.
9. When the measurement bandwidth of the maximum PSD is 3 kHz, a constant factor of  $10 \cdot \log(3\text{kHz}/20\text{kHz}) = -8.23 \text{ dB}$  is added to the measurement result.
10. Allow trace to stabilize. Use the marker-to-peak function to set the marker to the peak of the emission.
11. The indicated level is the peak output power, after any corrections for external attenuators and cables.

☐ For Average power spectral density test:

1. The testing follows the ANSI C63.10 Section 11.10.5 Method AVPSD.
2. Connect EUT RF output port to the Spectrum Analyzer through an RF attenuator.
3. Set Span to at least 1.5 times the OBW.
4. Set RBW to:  $3 \text{ kHz} \leq \text{RBW} \leq 100 \text{ kHz}$ .
5. Set VBW  $\geq [3 \times \text{RBW}]$ .
6. Sweep Time=Auto couple.
7. Detector function=RMS (i.e., power averaging).
8. Trace average at least 100 traces in power averaging (rms) mode.
9. When the measurement bandwidth of the maximum PSD is 3 kHz, a constant factor of  $10 \cdot \log(3\text{kHz}/20\text{kHz}) = -8.23 \text{ dB}$  is added to the measurement result.
10. Determine according to the duty cycle of the equipment: when it is less than 98%, follow the steps below.
11. Add  $[10 \log (1 / D)]$ , where D is the duty cycle, to the measured power to compute the average power during the actual transmission times (because the measurement represents an average over both the ON and OFF times of the transmission). For example, add  $[10 \log (1/0.25)] = 6 \text{ dB}$  if the duty cycle is 25%.
12. Record the test results in the report.

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### 9.3 Measurement Setup (Block Diagram of Configuration)



### 9.4 Measurement Result

| Test Data of Conducted Output Power Spectral Density |                      |                                    |                                   |                  |        |
|------------------------------------------------------|----------------------|------------------------------------|-----------------------------------|------------------|--------|
| Test Mode                                            | Test Frequency (MHz) | Power Spectral density (dBm/20kHz) | Power Spectral density (dBm/3kHz) | Limit (dBm/3kHz) | Result |
| 802.11b                                              | 2412                 | -2.131                             | -10.37                            | $\leq 8$         | Pass   |
|                                                      | 2437                 | -2.133                             | -10.372                           | $\leq 8$         | Pass   |
|                                                      | 2462                 | -2.904                             | -11.143                           | $\leq 8$         | Pass   |
| 802.11g                                              | 2412                 | -5.205                             | -13.444                           | $\leq 8$         | Pass   |
|                                                      | 2437                 | -6.091                             | -14.33                            | $\leq 8$         | Pass   |
|                                                      | 2462                 | -5.668                             | -13.907                           | $\leq 8$         | Pass   |
| 802.11n20                                            | 2412                 | -5.248                             | -13.487                           | $\leq 8$         | Pass   |
|                                                      | 2437                 | -5.973                             | -14.212                           | $\leq 8$         | Pass   |
|                                                      | 2462                 | -6.782                             | -15.021                           | $\leq 8$         | Pass   |
| 802.11n40                                            | 2422                 | -9.745                             | -17.984                           | $\leq 8$         | Pass   |
|                                                      | 2437                 | -9.613                             | -17.852                           | $\leq 8$         | Pass   |
|                                                      | 2452                 | -9.234                             | -17.473                           | $\leq 8$         | Pass   |
| 802.11ax20                                           | 2412                 | -6.159                             | -14.398                           | $\leq 8$         | Pass   |
|                                                      | 2437                 | -5.951                             | -14.19                            | $\leq 8$         | Pass   |
|                                                      | 2462                 | -6.907                             | -15.146                           | $\leq 8$         | Pass   |
| 802.11ax40                                           | 2422                 | -10.831                            | -19.07                            | $\leq 8$         | Pass   |
|                                                      | 2437                 | -10.077                            | -18.316                           | $\leq 8$         | Pass   |
|                                                      | 2452                 | -9.906                             | -18.145                           | $\leq 8$         | Pass   |

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### Test Graphs of Conducted Output Power Spectral Density



Test\_Graph\_802.11b\_ANT1\_2412\_1Mbps\_PSD



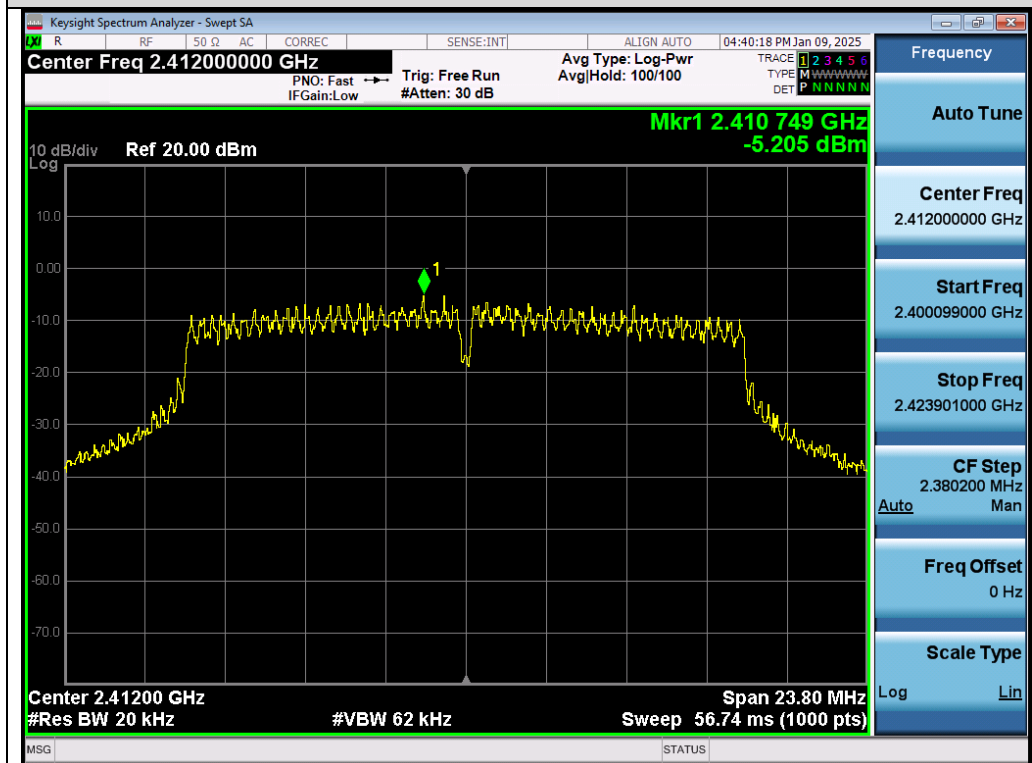
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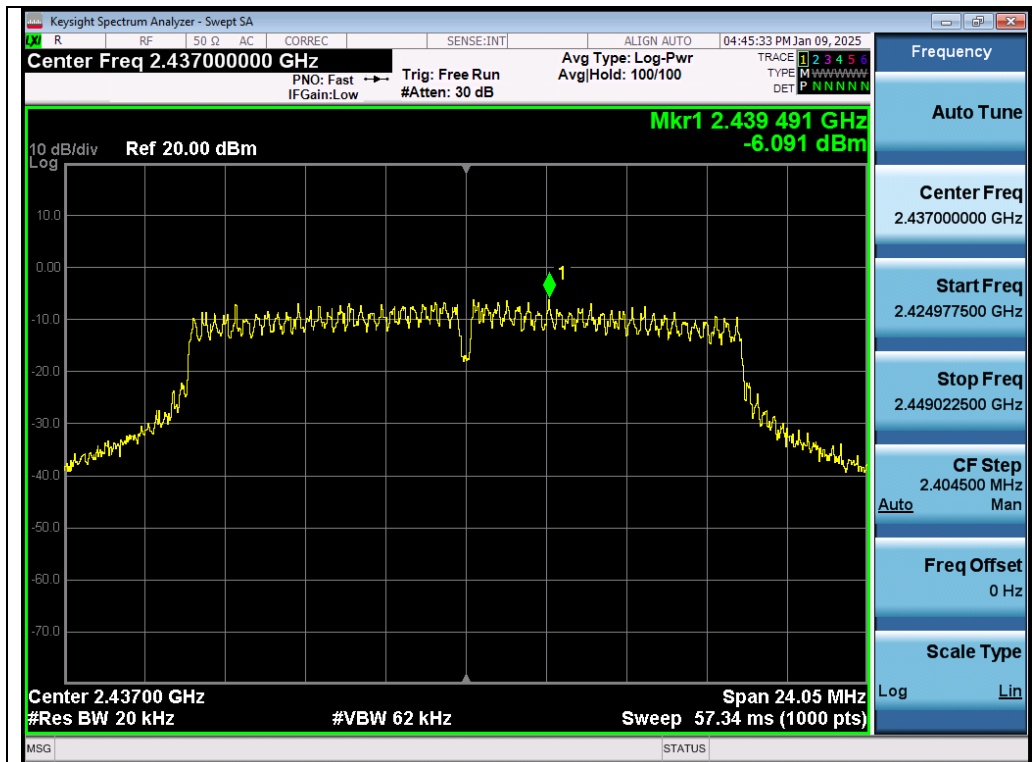
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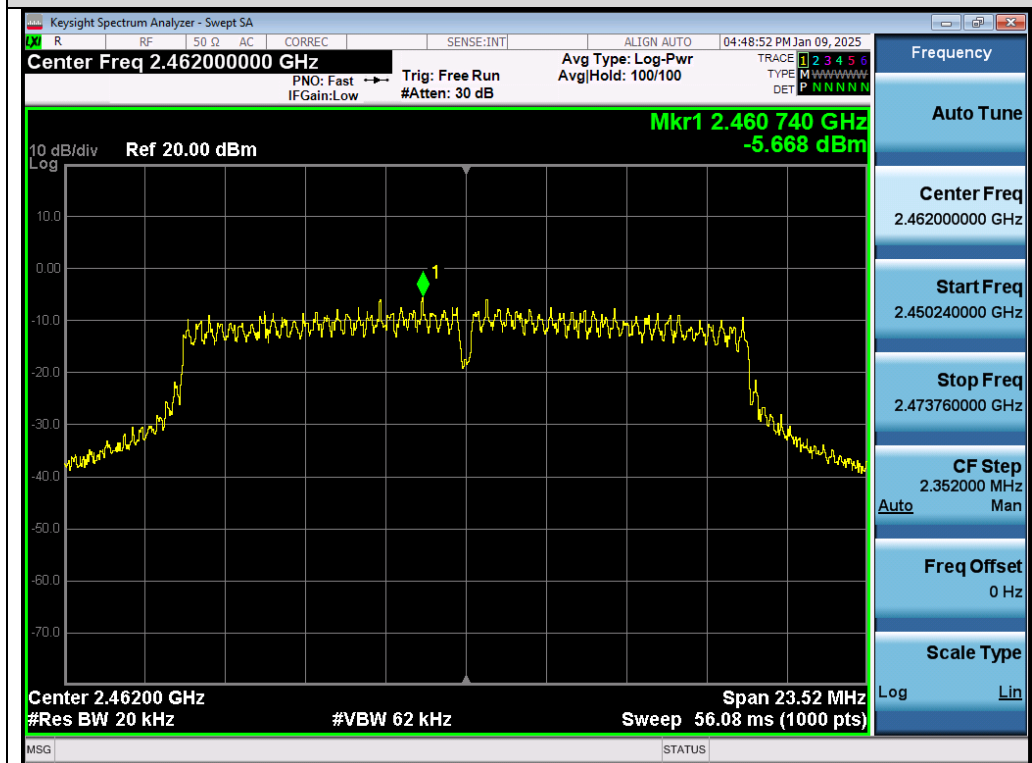
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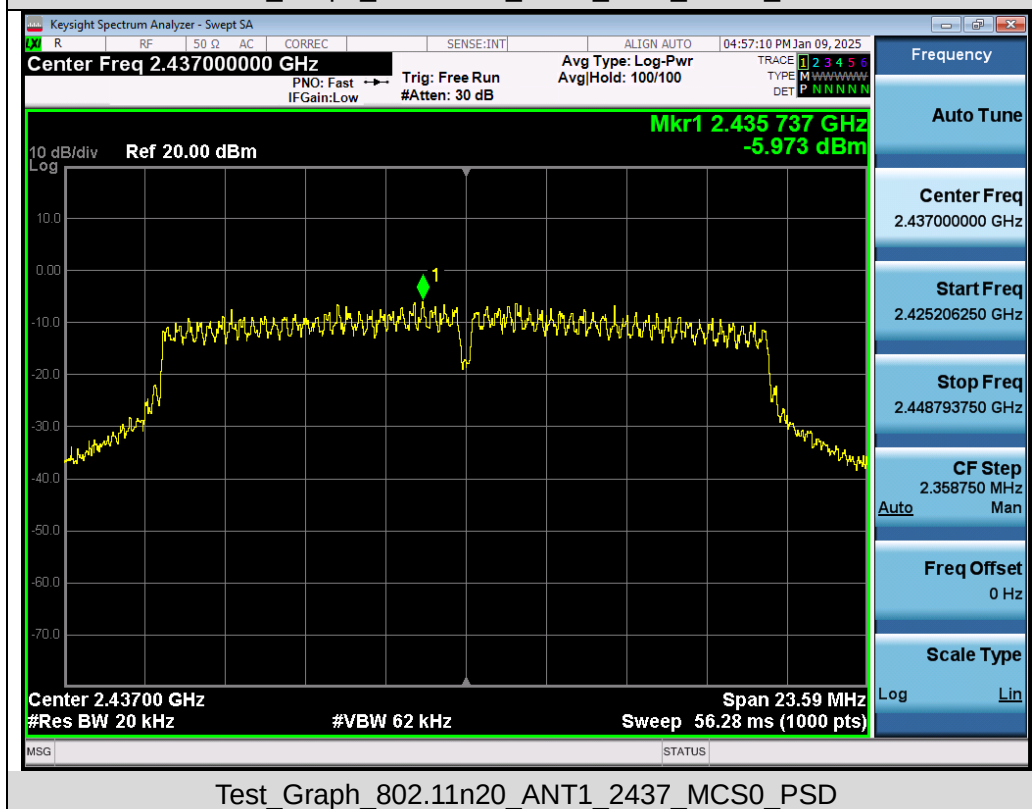
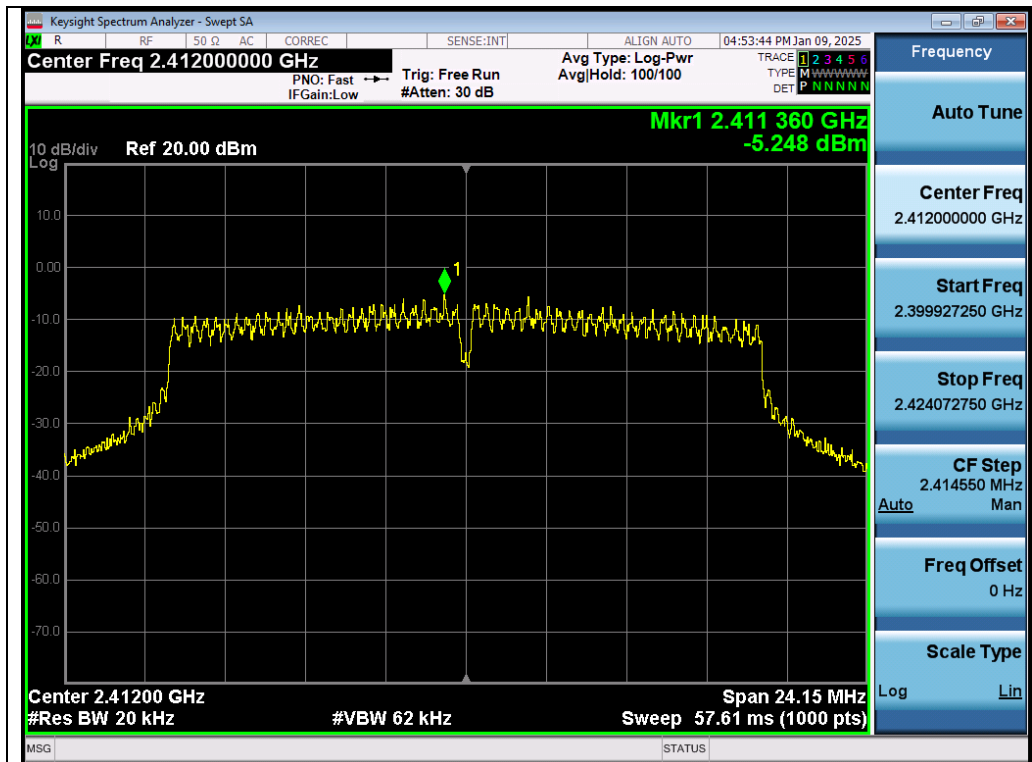
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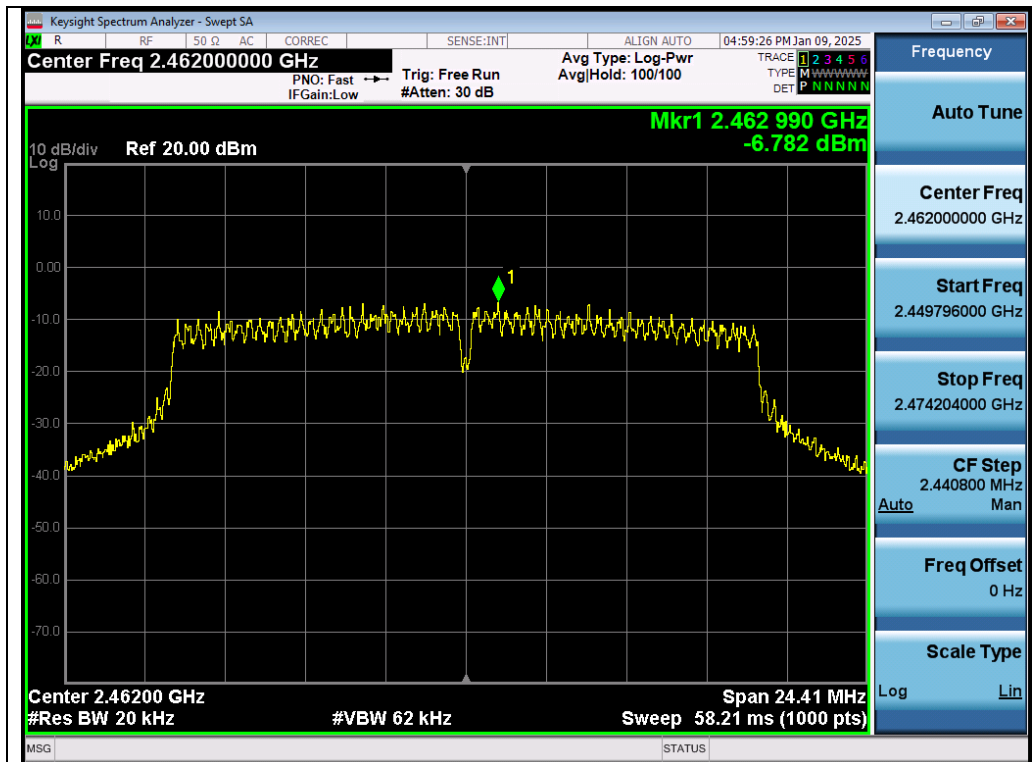
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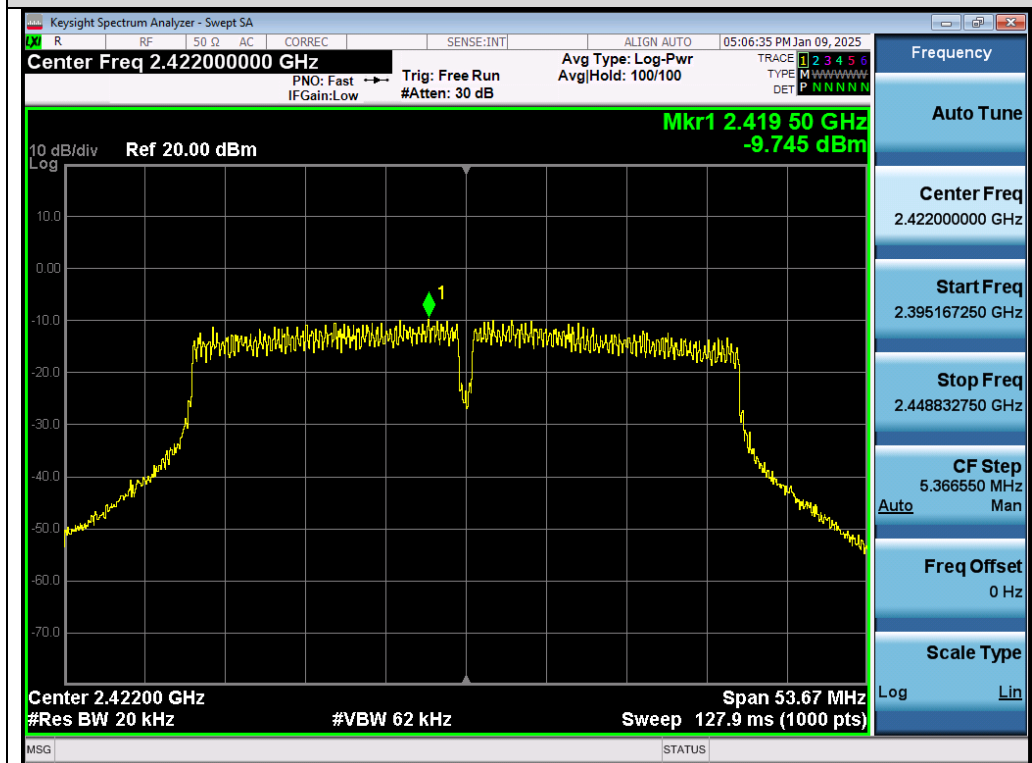


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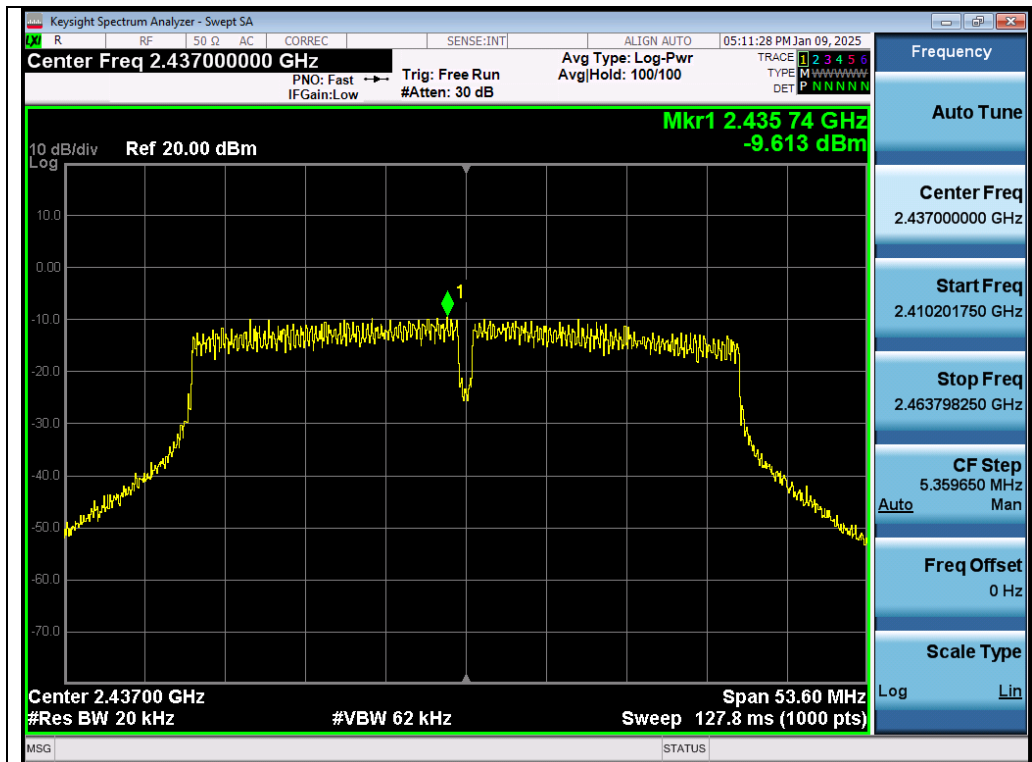
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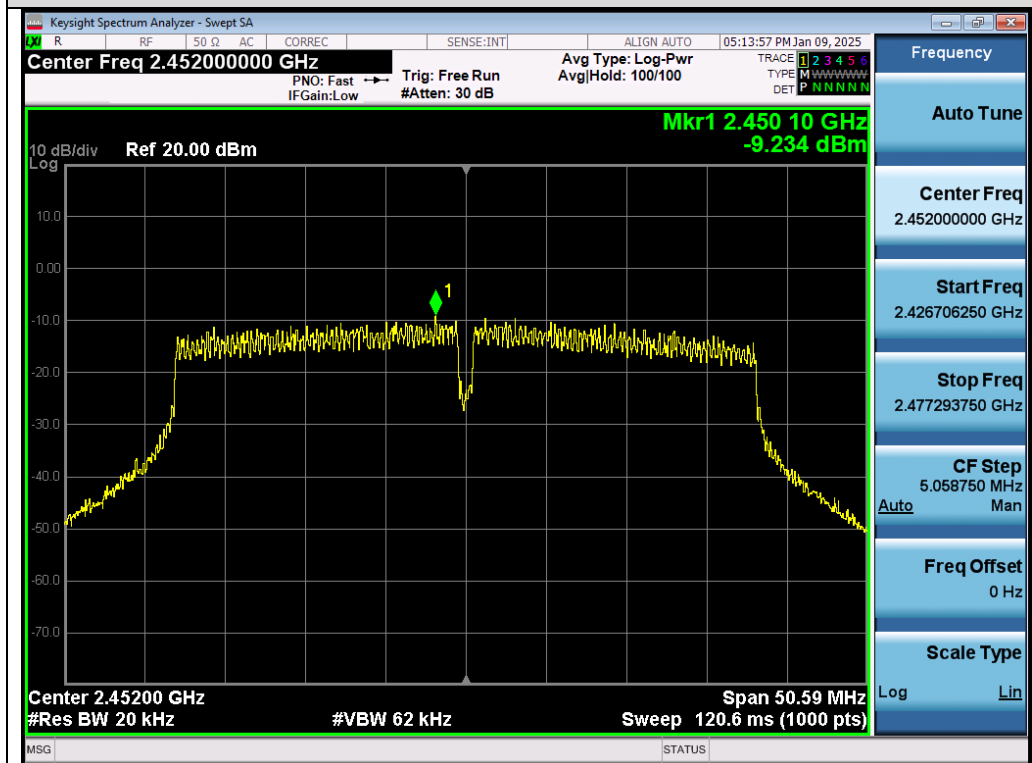
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Test\_Graph\_802.11n40\_ANT1\_2437\_MCS0\_PSD



Test\_Graph\_802.11n40\_ANT1\_2452\_MCS0\_PSD

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Test\_Graph\_802.11ax20\_ANT1\_2412\_MCS0\_PSD

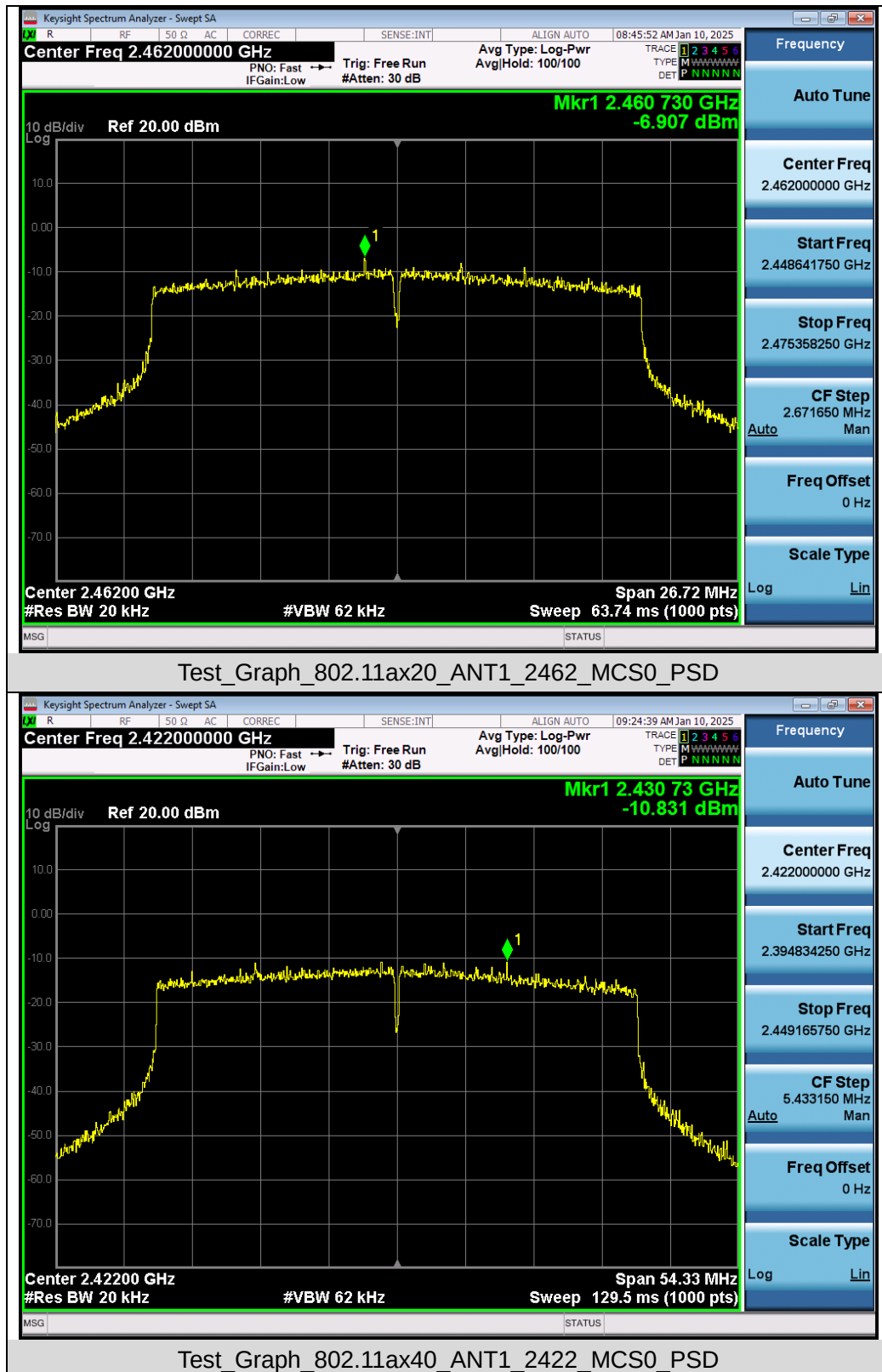


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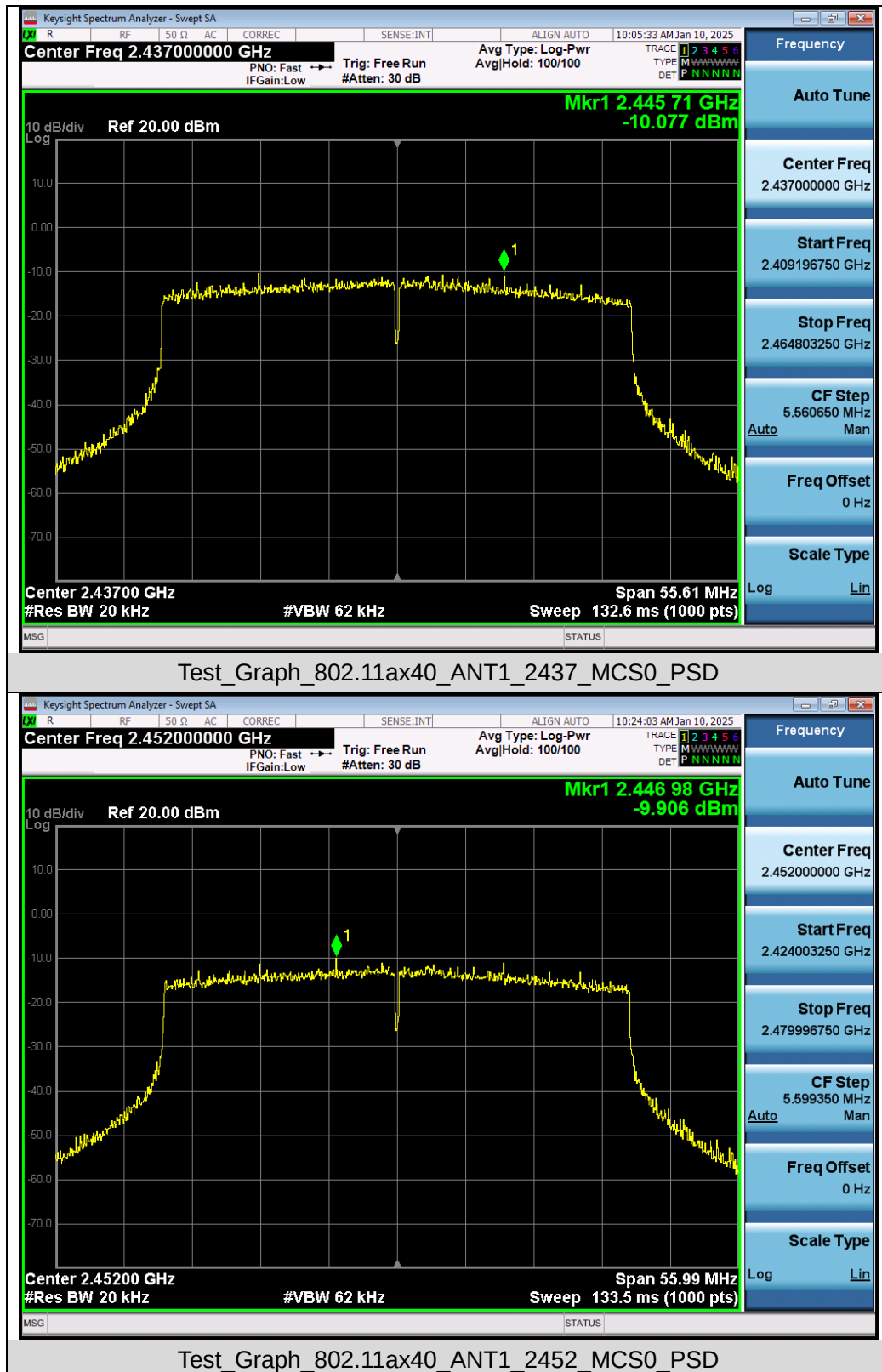
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## 10. Conducted Band Edge and Out-of-Band Emissions

### 10.1 Provisions Applicable

In any 100kHz bandwidth outside the frequency bands in which the spread spectrum intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20dB below that in the 100kHz bandwidth within the band that contains the highest level of the desired power.

### 10.2 Measurement Procedure

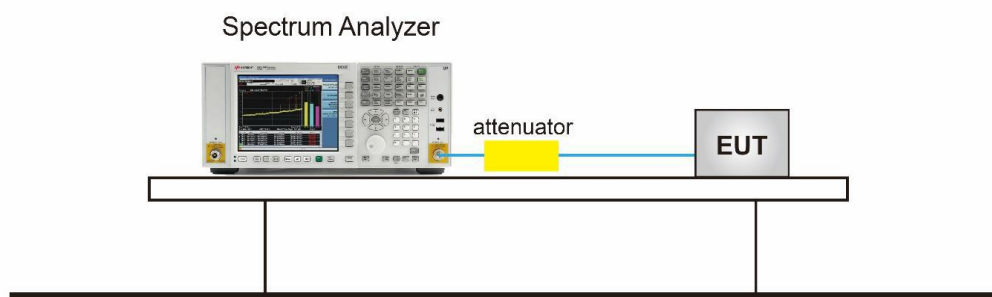
Remove the antenna from the EUT and then connect a low loss RF cable from the antenna port to the spectrum analyzer.

Use the following spectrum analyzer settings:

- Step 1: Measurement Procedure In-Band Reference Level
  1. Set instrument center frequency to DTS channel center frequency.
  2. Set the span to  $\geq 1.5$  times the DTS bandwidth.
  3. Set the RBW = 100 kHz.
  4. Set the VBW  $\geq 3 \times$  RBW.
  5. Detector = peak.
  6. Sweep time = auto couple.
  7. Trace mode = max hold.
  8. Allow trace to fully stabilize.
  9. Use the peak marker function to determine the maximum PSD level.
  10. Note that the channel found to contain the maximum PSD level can be used to establish the reference level.
  11. For reference level values, please refer to DTS bandwidth test.
- Step 2: Measurement Procedure Out of Band Emission
  1. Set RBW = 100 kHz.
  2. Set VBW  $\geq 300$  kHz.
  3. Detector = peak.
  4. Sweep = auto couple.
  5. Trace Mode = max hold.
  6. Allow trace to fully stabilize.
  7. Use the peak marker function to determine the maximum amplitude level.

Note: The cable loss and attenuator loss were offset into measure device as an amplitude offset.

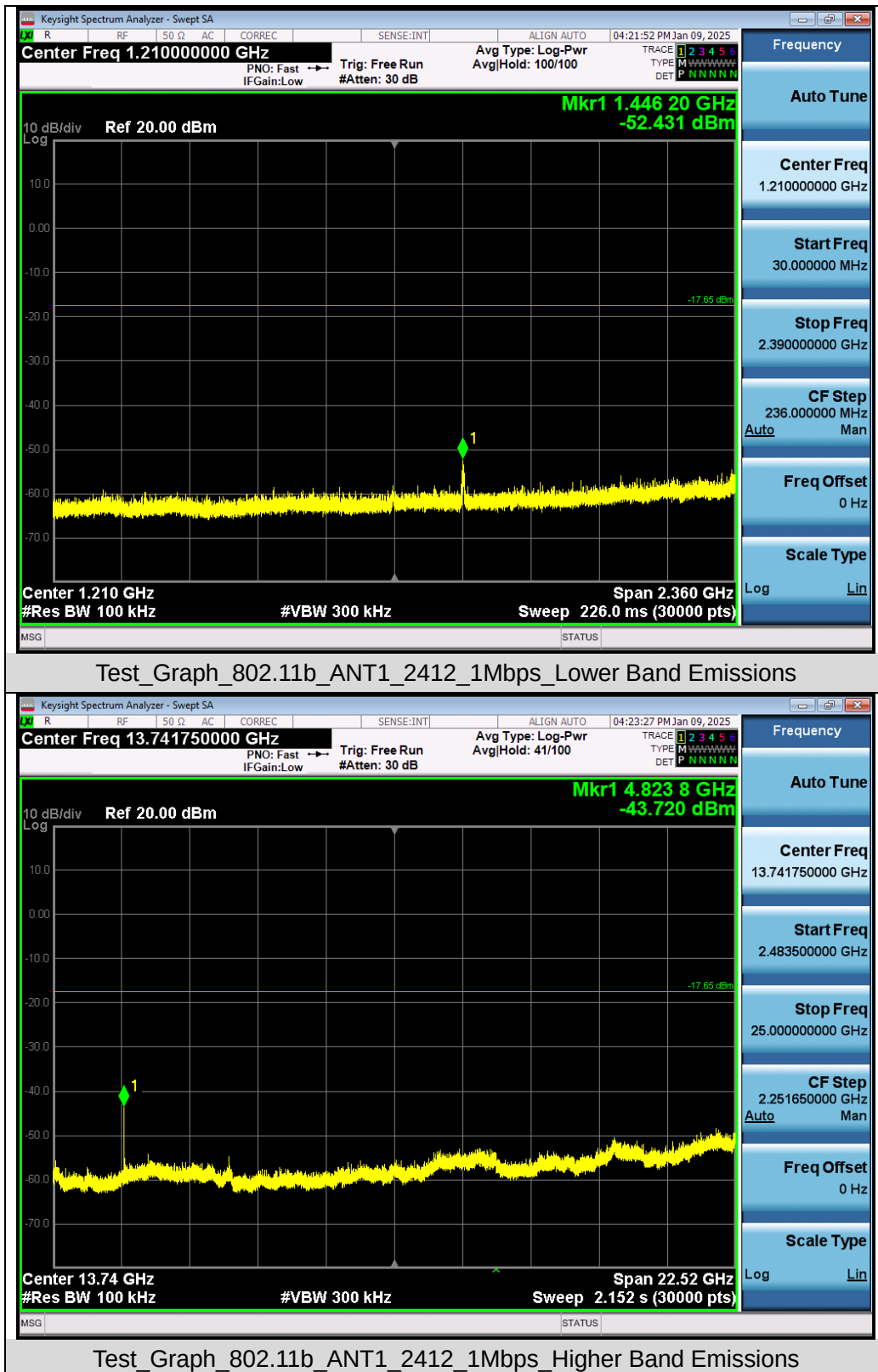
### 10.3 Measurement Setup (Block Diagram of Configuration)



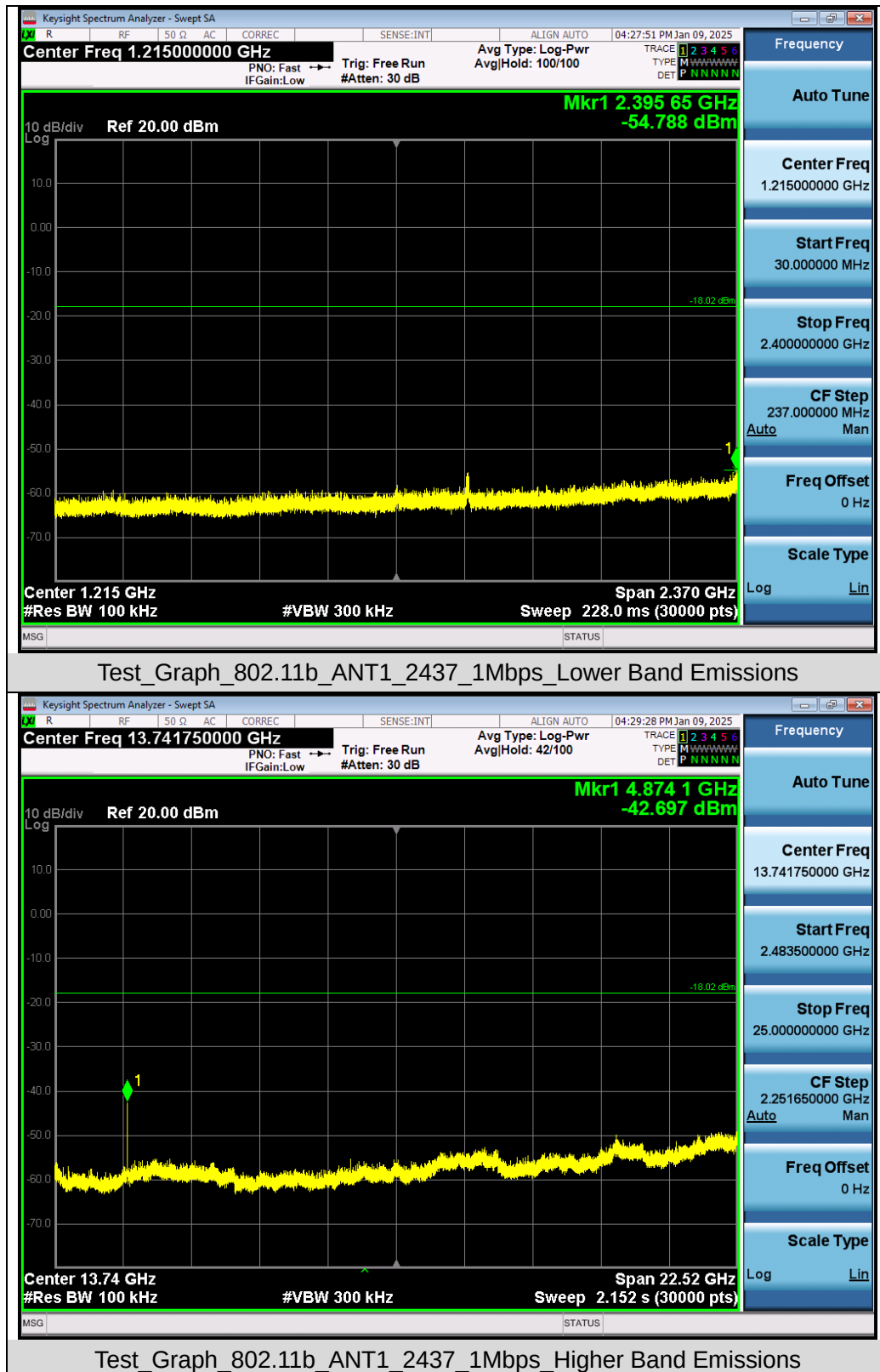
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## 10.4 Measurement Result

### Test Graphs of Spurious Emissions in Non-Restricted Frequency Bands



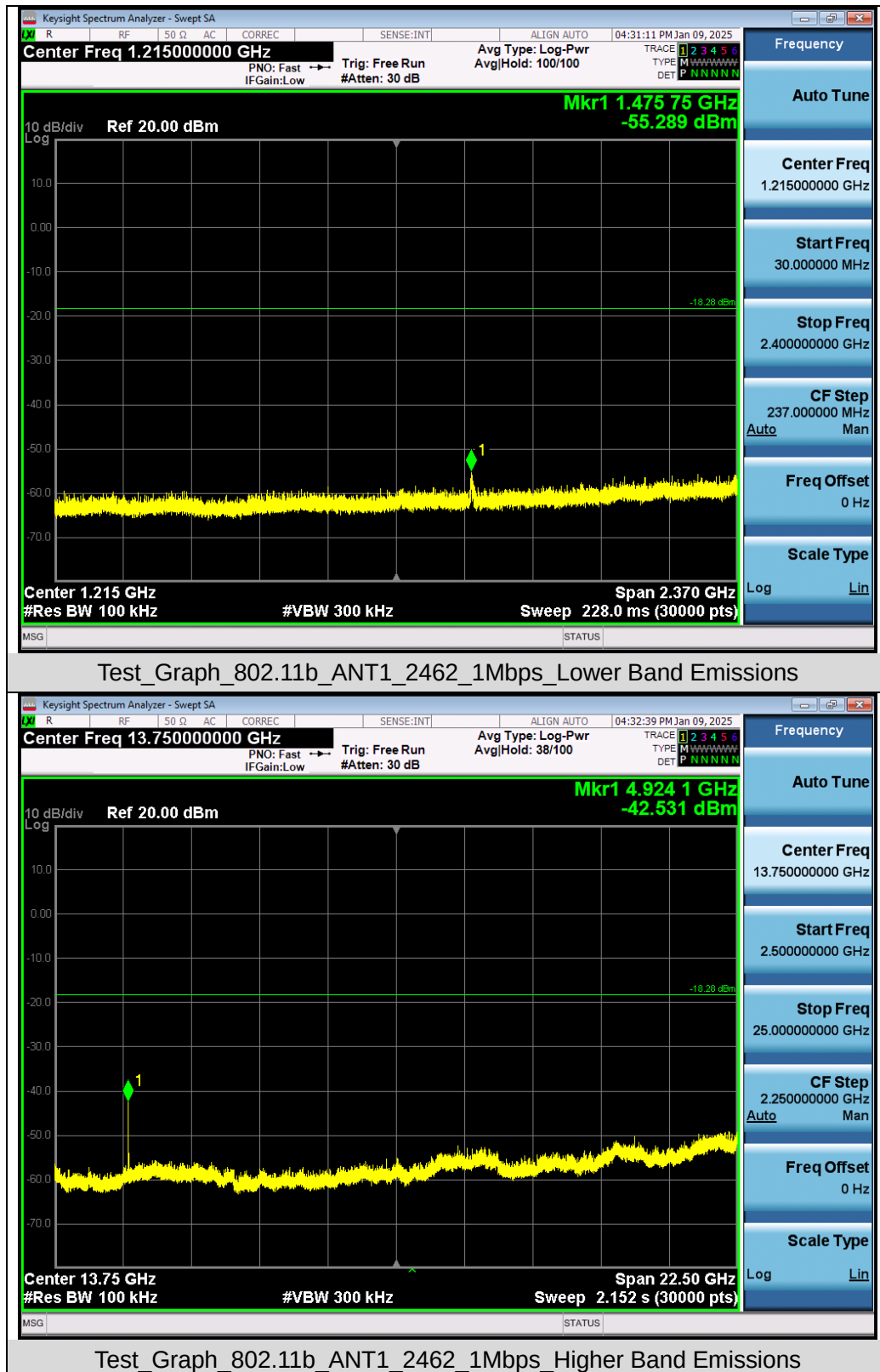
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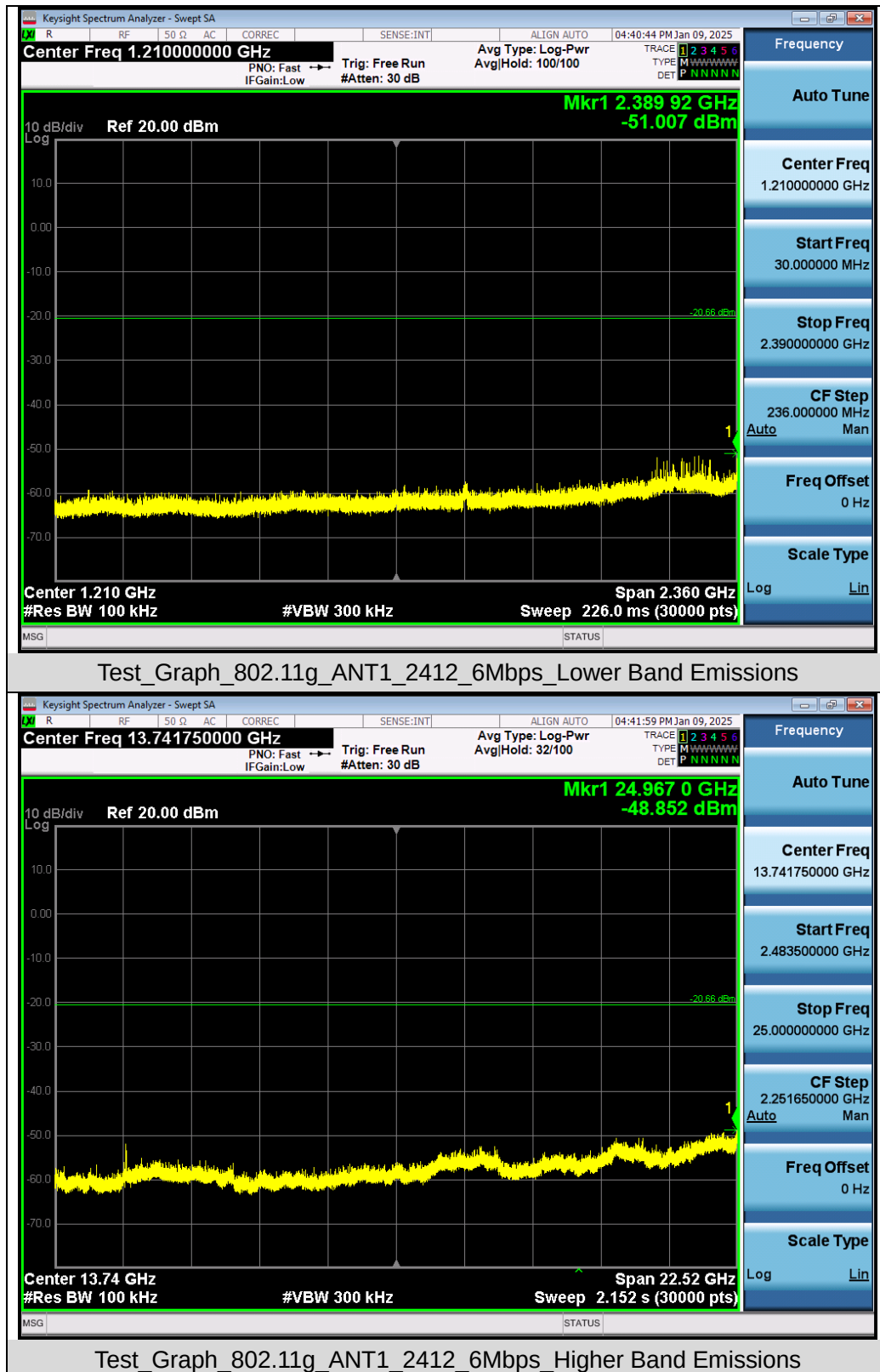
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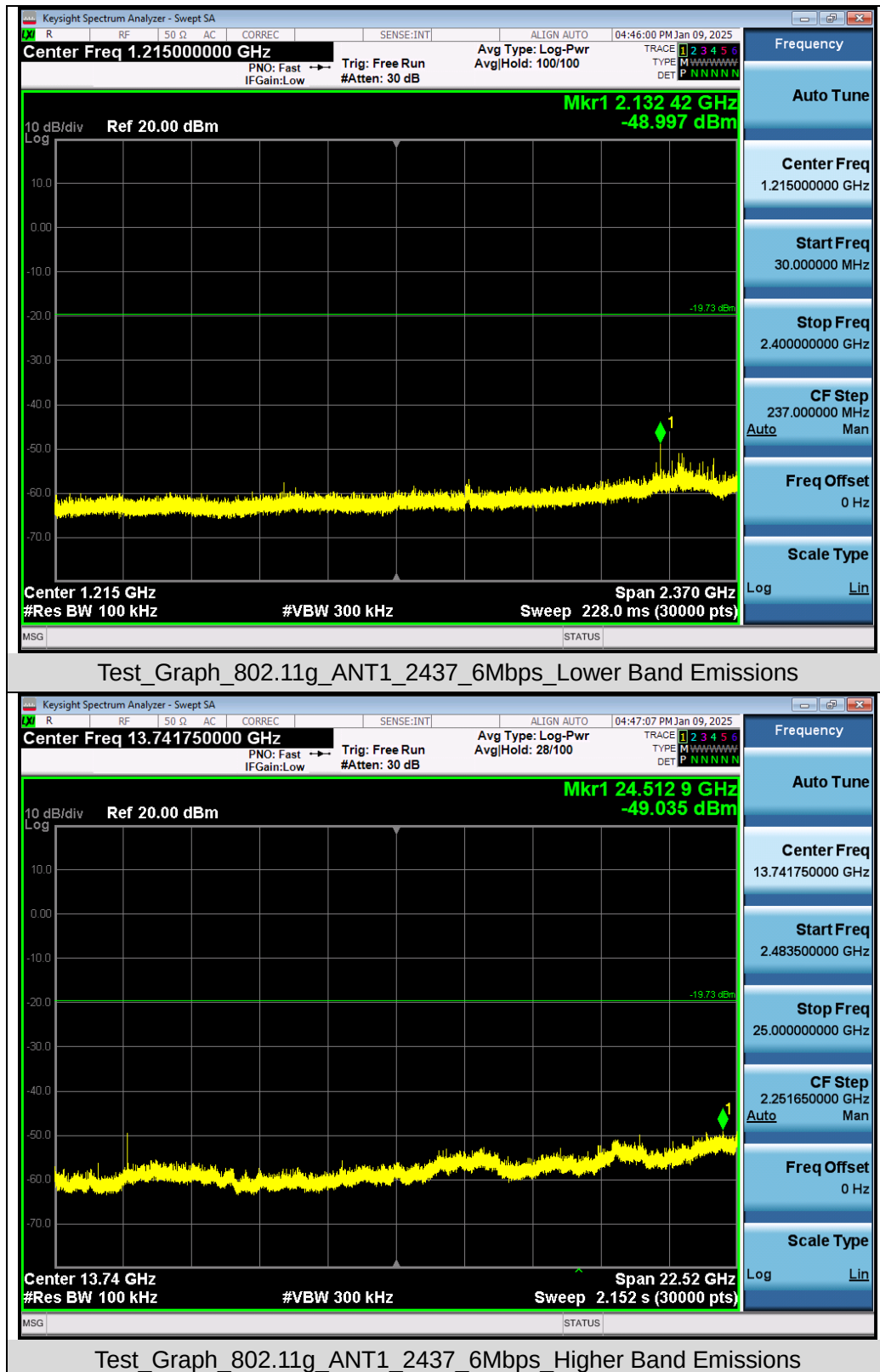
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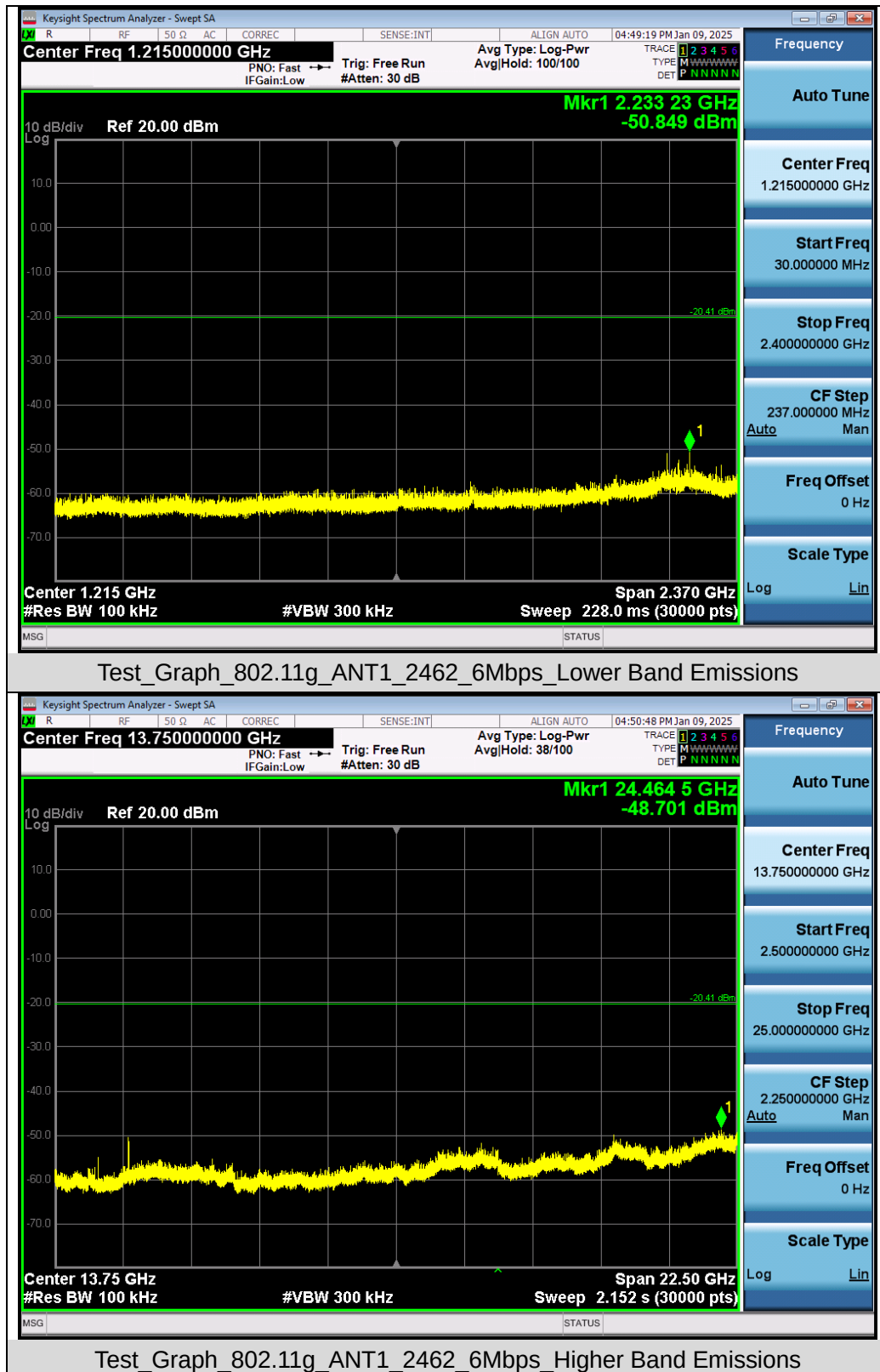


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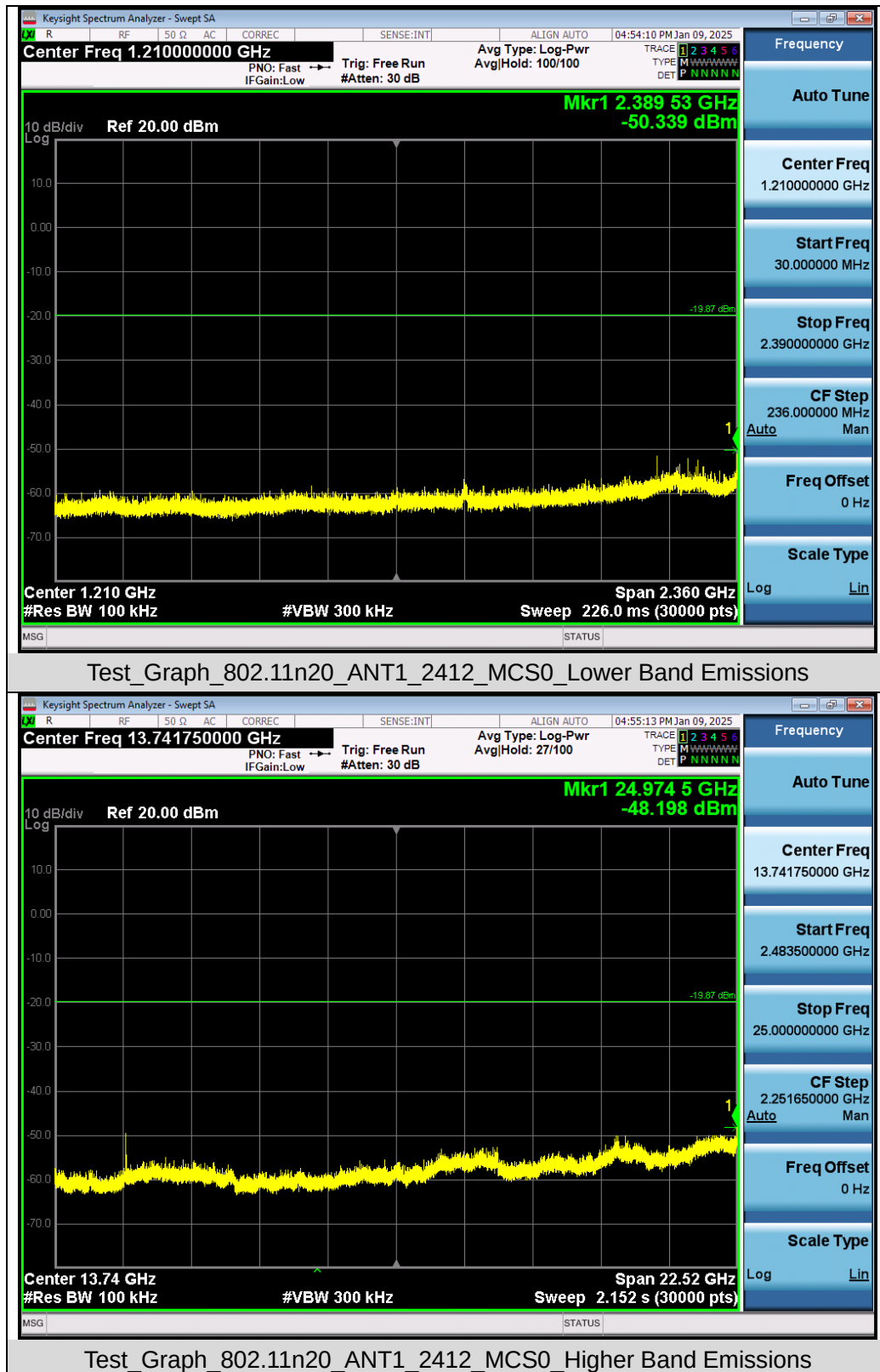


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