

TEST REPORT

Product : WIRELESS BATTERY DIAGNOSTICS
SYSTEM
Trade mark : AUTEL
Model/Type reference : MaxiBAS BT609
Serial Number : N/A
Report Number : EED32M00253903
FCC ID : WQ8MAXIBASBT609
Date of Issue : Jan. 04, 2021
Test Standards : 47 CFR Part 15Subpart C
Test result : PASS

Prepared for:

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Jan. 04, 2021

Check No.: 4762102967

2 Version

| Version No. | Date | Description |
|-------------|---------------|-------------|
| 00 | Jan. 04, 2021 | Original |
| | | |
| | | |

3 Test Summary

| Test Item | Test Requirement | Test method | Result |
|--|--|------------------|--------|
| Antenna Requirement | 47 CFR Part 15 Subpart C Section 15.203/15.247 (c) | ANSI C63.10-2013 | PASS |
| AC Power Line Conducted Emission | 47 CFR Part 15 Subpart C Section 15.207 | ANSI C63.10-2013 | PASS |
| Conducted Peak Output Power | 47 CFR Part 15 Subpart C Section 15.247 (b)(3) | ANSI C63.10-2013 | PASS |
| 6dB Occupied Bandwidth | 47 CFR Part 15 Subpart C Section 15.247 (a)(2) | ANSI C63.10-2013 | PASS |
| Power Spectral Density | 47 CFR Part 15 Subpart C Section 15.247 (e) | ANSI C63.10-2013 | PASS |
| Band-edge for RF Conducted Emissions | 47 CFR Part 15 Subpart C Section 15.247(d) | ANSI C63.10-2013 | PASS |
| RF Conducted Spurious Emissions | 47 CFR Part 15 Subpart C Section 15.247(d) | ANSI C63.10-2013 | PASS |
| Radiated Spurious Emissions | 47 CFR Part 15 Subpart C Section 15.205/15.209 | ANSI C63.10-2013 | PASS |
| Restricted bands around fundamental frequency (Radiated Emission) | 47 CFR Part 15 Subpart C Section 15.205/15.209 | ANSI C63.10-2013 | PASS |

Remark:

Test according to ANSI C63.4-2014 & ANSI C63.10-2013.

Company Name and Address shown on Report, the sample(s) and sample Information was/ were provided by the applicant who should be responsible for the authenticity which CTI hasn't verified.

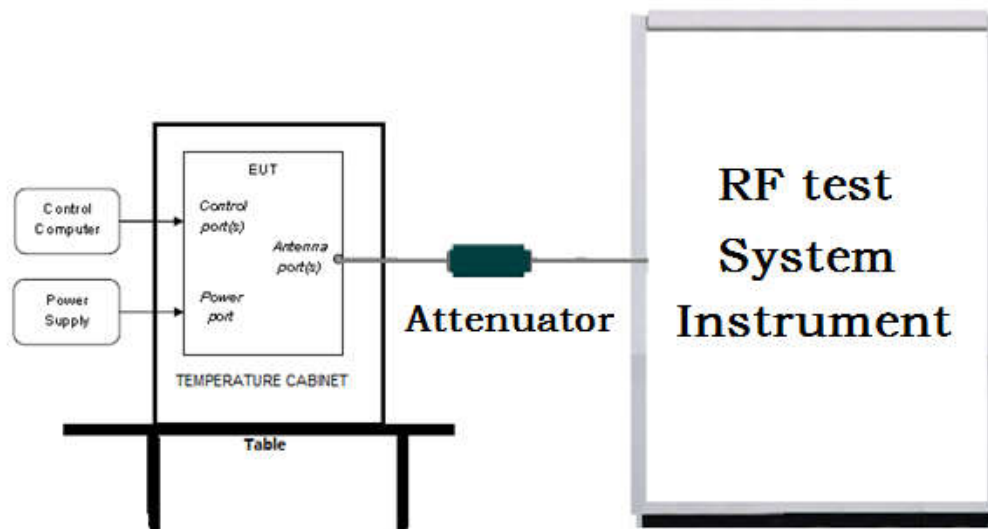
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5 Test Requirement

5.1 Test setup

5.1.1 For Conducted test setup



5.1.2 For Radiated Emissions test setup

Radiated Emissions setup:

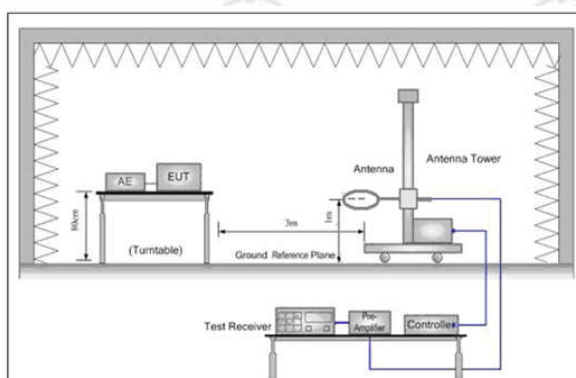


Figure 1. Below 30MHz

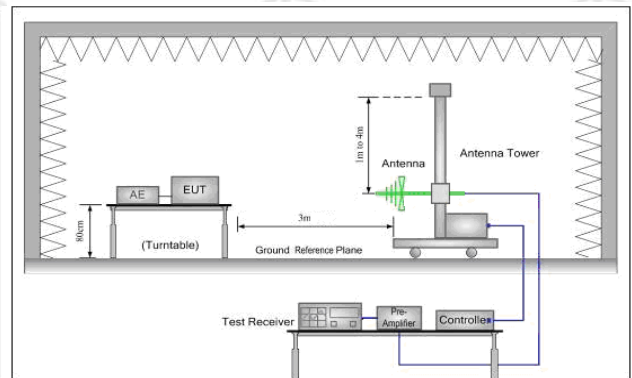


Figure 2. 30MHz to 1GHz

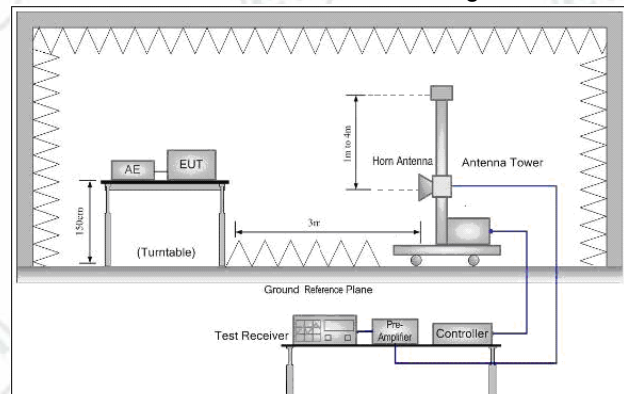
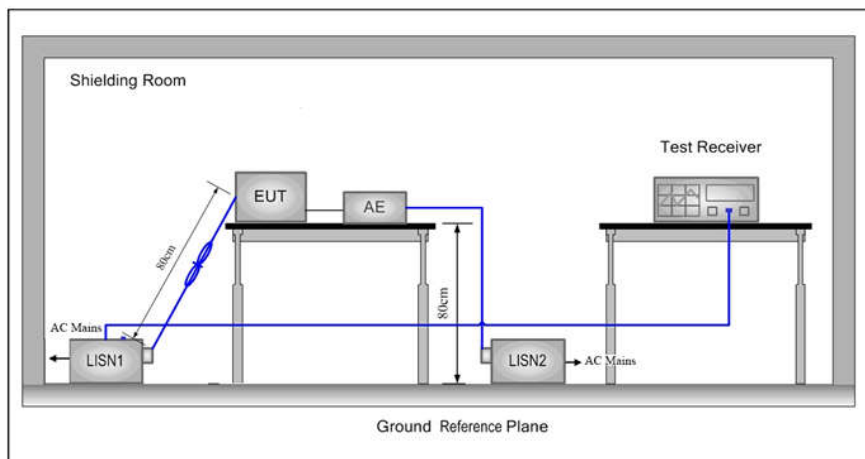


Figure 3. Above 1GHz

5.1.3 For Conducted Emissions test setup

Conducted Emissions setup



5.2 Test Environment

| Operating Environment: | |
|------------------------|----------|
| Temperature: | 24.0 °C |
| Humidity: | 54 % RH |
| Atmospheric Pressure: | 1010mbar |

5.3 Test Condition

Test channel:

| Test Mode | Tx/Rx | RF Channel | | |
|--------------------|--|------------|-----------|-----------|
| | | Low(L) | Middle(M) | High(H) |
| 802.11b/g/n(HT20) | 2412MHz ~2462 MHz | Channel 1 | Channel 6 | Channel11 |
| | | 2412MHz | 2437MHz | 2462MHz |
| 802.11n(HT40) | 2422MHz ~2452 MHz | Channel 1 | Channel 4 | Channel7 |
| | | 2422MHz | 2437MHz | 2452MHz |
| Transmitting mode: | Keep the EUT in transmitting mode with all kind of modulation and all kind of data rate. | | | |

Through Pre-scan, 1Mbps of rate is the worst case of 802.11b; 6Mbps of rate is the worst case of 802.11g; 6.5Mbps of rate is the worst case of 802.11n(HT20); 13.5Mbps of rate is the worst case of 802.11n(HT40).

6 General Information

6.1 Client Information

| | |
|--------------------------|--|
| Applicant: | Autel Intelligent Tech. Corp., Ltd. |
| Address of Applicant: | 7th-8th, 10th Floor, Bldg. B1, Zhiyuan, Xueyuan Rd. Xili, Nanshan, Shenzhen, 518055, China |
| Manufacturer: | Autel Intelligent Tech. Corp., Ltd. |
| Address of Manufacturer: | 7th-8th, 10th Floor, Bldg. B1, Zhiyuan, Xueyuan Rd. Xili, Nanshan, Shenzhen, 518055, China |
| Factory1: | Autel Intelligent Technology Corp., Ltd. Guangming Branch |
| Address of Factory1: | 7F&6F, East Wing, Building 2, and 6F of Electronical Building, Yanxiang Industrial Zone, Gaoxin Rd, Dongzhou Community of Guangming New District, Shenzhen |
| Factory2: | AUTEL VIETNAM COMPANY LIMITED |
| Address of Factory2: | 4th Floor, Factory#6, Land#CN1, An Duong Industrial Zone, Hong Phong Township, An Duong County, Hai Phong, VietNam |

6.2 General Description of EUT

| | | |
|------------------------|--|--|
| Product Name: | WIRELESS BATTERY DIAGNOSTICS SYSTEM | |
| Model No.(EUT): | MaxiBAS BT609 | |
| Trade mark: | AUTEL | |
| Power Supply: | SWITCHING AC/DC Power Adapter | MODEL: GME10C-050200FUu INPUT: 100-240V~, 50/60Hz, 0.28A OUTPUT: 5V --- 2A |
| | Battery | Model: TB2021 Capacity: 5800mAh/22.33Wh Nominal Voltage: 3.85V |
| Sample Received Date: | Aug. 20, 2020 | |
| Sample tested Date: | Aug. 20, 2020 to Oct. 13, 2020 | |
| Operation Frequency: | IEEE 802.11b/g/n(HT20): 2412MHz to 2462MHz IEEE 802.11n(HT40): 2422MHz to 2452MHz | |
| Channel Numbers: | IEEE 802.11b/g, IEEE 802.11n HT20: 11 Channels IEEE 802.11n HT40: 7 Channels | |
| Channel Separation: | 5MHz | |
| Type of Modulation: | IEEE for 802.11b: DSSS(CCK,DQPSK,DBPSK) IEEE for 802.11g :OFDM(64QAM, 16QAM, QPSK, BPSK) IEEE for 802.11n(HT20 and HT40) : OFDM (64QAM, 16QAM,QPSK,BPSK) | |
| Test Power Grade: | Default | |
| Test Software of EUT: | CMD | |
| Antenna Type and Gain: | Type: FPC antenna Gain:2.13dBi | |
| Test Voltage: | Battery 3.85V | |
| Sample Received Date: | Aug. 20, 2020 | |
| Sample tested Date: | Aug. 20, 2020 to Nov. 6, 2020 | |

| Operation Frequency each of channel(802.11b/g/n HT20) | | | | | | | |
|---|-----------|---------|-----------|---------|-----------|---------|-----------|
| Channel | Frequency | Channel | Frequency | Channel | Frequency | Channel | Frequency |
| 1 | 2412MHz | 4 | 2427MHz | 7 | 2442MHz | 10 | 2457MHz |
| 2 | 2417MHz | 5 | 2432MHz | 8 | 2447MHz | 11 | 2462MHz |
| 3 | 2422MHz | 6 | 2437MHz | 9 | 2452MHz | | |
| Operation Frequency each of channel(802.11n HT40) | | | | | | | |
| Channel | Frequency | Channel | Frequency | Channel | Frequency | | |
| 1 | 2422MHz | 4 | 2437MHz | 7 | 2452MHz | | |
| 2 | 2427MHz | 5 | 2442MHz | | | | |
| 3 | 2432MHz | 6 | 2447MHz | | | | |

6.3 Description of Support Units

The EUT has been tested with associated equipment below.

| Associated equipment name | | Manufacture | model | S/N serial number | Supplied by | Certification |
|---------------------------|----------|-------------|-----------|-------------------|-------------|---------------|
| AE | Notebook | DELL | DELL 3490 | D245DX2 | DELL | CE&FCC |

6.4 Test Location

All tests were performed at:

Centre Testing International Group Co., Ltd

Building C, Hongwei Industrial Park Block 70, Bao'an District, Shenzhen, China

Telephone: +86 (0) 755 33683668 Fax: +86 (0) 755 33683385

No tests were sub-contracted.

FCC Designation No.: CN1164

6.5 Deviation from Standards

None.

6.6 Abnormalities from Standard Conditions

None.

6.7 Other Information Requested by the Customer

None.

6.8 Measurement Uncertainty (95% confidence levels, k=2)

| No. | Item | Measurement Uncertainty |
|-----|---------------------------------|-------------------------|
| 1 | Radio Frequency | 7.9×10^{-8} |
| 2 | RF power, conducted | 0.46dB (30MHz-1GHz) |
| | | 0.55dB (1GHz-18GHz) |
| 3 | Radiated Spurious emission test | 4.3dB (30MHz-1GHz) |
| | | 4.5dB (1GHz-12.75GHz) |
| 4 | Conduction emission | 3.5dB (9kHz to 150kHz) |
| | | 3.1dB (150kHz to 30MHz) |
| 5 | Temperature test | 0.64°C |
| 6 | Humidity test | 3.8% |
| 7 | DC power voltages | 0.026% |

7 Equipment List

| RF test system | | | | | |
|--|-------------------|------------------------------|---------------|---------------------------|-------------------------------|
| Equipment | Manufacturer | Model No. | Serial Number | Cal. Date (mm-dd-yyyy) | Cal. Due date (mm-dd-yyyy) |
| Spectrum Analyzer | Keysight | N9010A | MY54510339 | 02-17-2020 | 02-16-2021 |
| Signal Generator | Keysight | N5182B | MY53051549 | 02-17-2020 | 02-16-2021 |
| Temperature/ Humidity Indicator | biaozhi | HM10 | 1804186 | 06-29-2020 | 06-28-2021 |
| High-pass filter | Sinoscite | FL3CX03WG18N M12-0398-002 | --- | --- | --- |
| High-pass filter | MICRO- TRONICS | SPA-F-63029-4 | --- | --- | --- |
| DC Power | Keysight | E3642A | MY56376072 | 02-17-2020 | 02-16-2021 |
| PC-1 | Lenovo | R4960d | --- | --- | --- |
| BT&WI-FI Automatic control | R&S | OSP120 | 101374 | 02-17-2020 | 02-16-2021 |
| RF control unit | JS Tonscend | JS0806-2 | 158060006 | 02-17-2020 | 02-16-2021 |
| BT&WI-FI Automatic test software | JS Tonscend | JS1120-3 | --- | --- | --- |

| Conducted disturbance Test | | | | | |
|------------------------------------|--------------|-----------|---------------|---------------------------|-------------------------------|
| Equipment | Manufacturer | Model No. | Serial Number | Cal. date (mm-dd-yyyy) | Cal. Due date (mm-dd-yyyy) |
| Receiver | R&S | ESCI | 100435 | 04-28-2020 | 04-27-2021 |
| Temperature/ Humidity Indicator | Defu | TH128 | / | --- | --- |
| LISN | R&S | ENV216 | 100098 | 03-05-2020 | 03-04-2021 |
| Barometer | changchun | DYM3 | 1188 | --- | --- |

| 3M full-anechoic Chamber | | | | | |
|--------------------------------|--------------|-------------------|---------------|------------------------|----------------------------|
| Equipment | Manufacturer | Model No. | Serial Number | Cal. date (mm-dd-yyyy) | Cal. Due date (mm-dd-yyyy) |
| RSE Automatic test software | JS Tonscend | JS36-RSE | 10166 | --- | --- |
| Receiver | Keysight | N9038A | MY57290136 | 03-05-2020 | 03-04-2021 |
| Spectrum Analyzer | Keysight | N9020B | MY57111112 | 03-05-2020 | 03-04-2021 |
| Spectrum Analyzer | Keysight | N9030B | MY57140871 | 03-05-2020 | 03-04-2021 |
| TRILOG Broadband Antenna | Schwarzbeck | VULB 9163 | 9163-1148 | 04-25-2018 | 04-24-2021 |
| Horn Antenna | Schwarzbeck | BBHA 9170 | 9170-832 | 04-25-2018 | 04-24-2021 |
| Horn Antenna | ETS-LINDGREN | 3117 | 00057407 | 07-10-2018 | 07-09-2021 |
| Preamplifier | EMCI | EMC184055SE | 980596 | 05-20-2020 | 05-19-2021 |
| Preamplifier | EMCI | EMC001330 | 980563 | 04-22-2020 | 04-21-2021 |
| Preamplifier | JS Tonscend | 980380 | EMC051845S E | 01-09-2020 | 01-08-2021 |
| Temperature/Humidity Indicator | biaozhi | GM1360 | EE1186631 | 04-27-2020 | 04-26-2021 |
| Fully Anechoic Chamber | TDK | FAC-3 | --- | 01-17-2018 | 01-16-2021 |
| Filter bank | JS Tonscend | JS0806-F | 188060094 | 04-10-2018 | 04-09-2021 |
| Cable line | Times | SFT205-NMSM-2.50M | 394812-0001 | --- | --- |
| Cable line | Times | SFT205-NMSM-2.50M | 394812-0002 | --- | --- |
| Cable line | Times | SFT205-NMSM-2.50M | 394812-0003 | --- | --- |
| Cable line | Times | SFT205-NMSM-2.50M | 393495-0001 | --- | --- |
| Cable line | Times | EMC104-NMNM-1000 | SN160710 | --- | --- |
| Cable line | Times | SFT205-NMSM-3.00M | 394813-0001 | --- | --- |
| Cable line | Times | SFT205-NMNM-1.50M | 381964-0001 | --- | --- |
| Cable line | Times | SFT205-NMSM-7.00M | 394815-0001 | --- | --- |
| Cable line | Times | HF160-KMKM-3.00M | 393493-0001 | --- | --- |

| 3M Semi/full-anechoic Chamber | | | | | |
|----------------------------------|------------------|------------------|---------------|------------------------|----------------------------|
| Equipment | Manufacturer | Model No. | Serial Number | Cal. date (mm-dd-yyyy) | Cal. Due date (mm-dd-yyyy) |
| 3M Chamber & Accessory Equipment | TDK | SAC-3 | --- | 05-24-2019 | 05-23-2022 |
| TRILOG Broadband Antenna | Schwarzbeck | VULB9163 | 9163-618 | 05-16-2020 | 05-15-2021 |
| Loop Antenna | Schwarzbeck | FMZB 1519B | 1519B-076 | 04-25-2018 | 04-24-2021 |
| Receiver | R&S | ESC17 | 100938-003 | 10-21-2019 | 10-20-2020 |
| Multi device Controller | matureo | NCD/070/10711112 | --- | --- | --- |
| Temperature/ Humidity Indicator | Shanghai qixiang | HM10 | 1804298 | 06-29-2020 | 06-28-2021 |
| Cable line | Fulai(7M) | SF106 | 5219/6A | --- | --- |
| Cable line | Fulai(6M) | SF106 | 5220/6A | --- | --- |
| Cable line | Fulai(3M) | SF106 | 5216/6A | --- | --- |
| Cable line | Fulai(3M) | SF106 | 5217/6A | --- | --- |

8 Radio Technical Requirements Specification

Reference documents for testing:

| No. | Identity | Document Title |
|-----|------------------|--|
| 1 | FCC Part15C | Subpart C-Intentional Radiators |
| 2 | ANSI C63.10-2013 | American National Standard for Testing Unlicensed Wireless Devices |

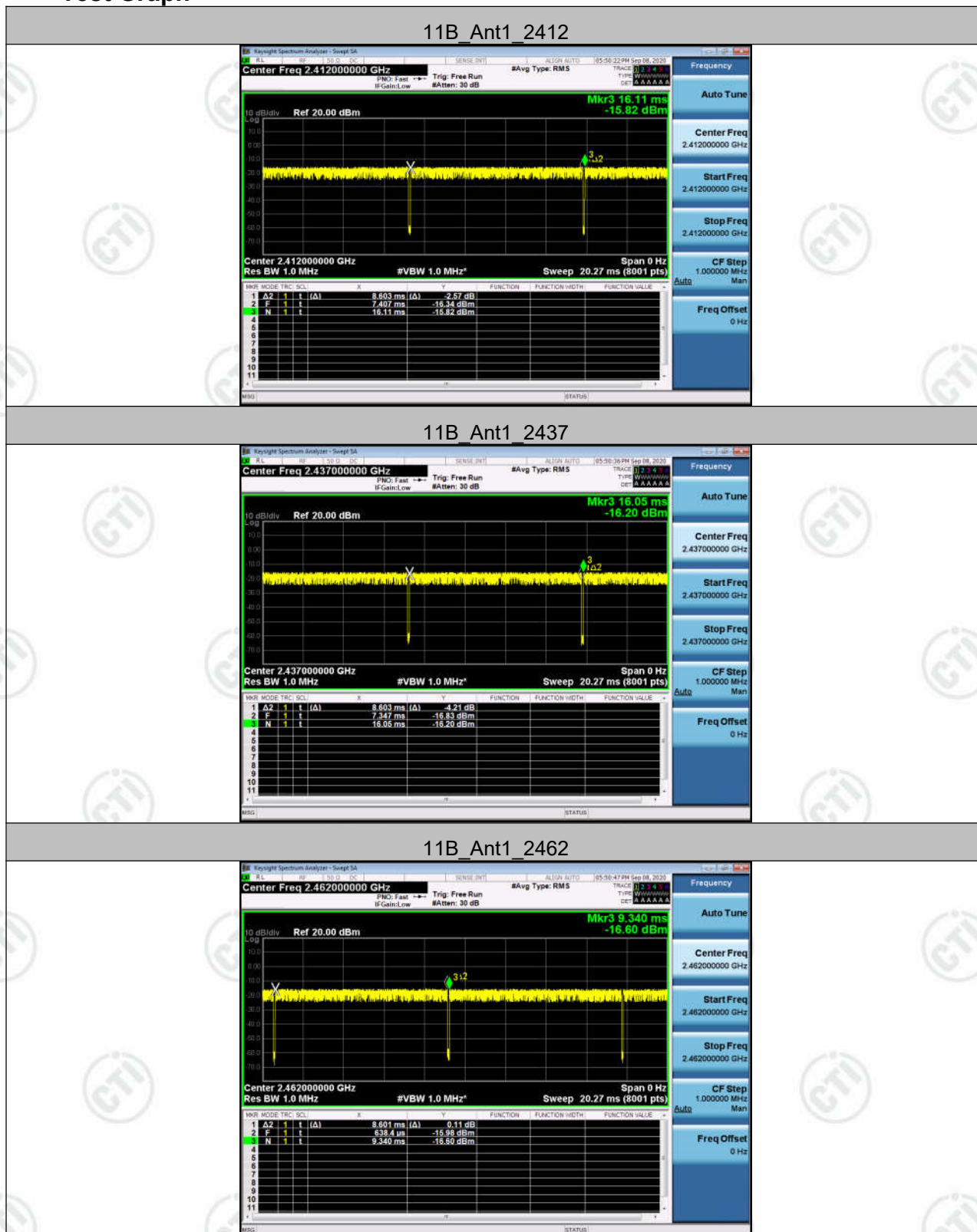
Test Results List:

| Test Requirement | Test method | Test item | Verdict | Note |
|-----------------------------------|-------------|---|---------|-------------|
| Part15C Section 15.247 (b)(3) | ANSI C63.10 | Conducted Peak Output Power | PASS | Appendix A) |
| Part15C Section 15.247 (a)(2) | ANSI C63.10 | 6dB Occupied Bandwidth | PASS | Appendix B) |
| Part15C Section 15.247(d) | ANSI C63.10 | Band-edge for RF Conducted Emissions | PASS | Appendix C) |
| Part15C Section 15.247(d) | ANSI C63.10 | RF Conducted Spurious Emissions | PASS | Appendix D) |
| Part15C Section 15.247 (e) | ANSI C63.10 | Power Spectral Density | PASS | Appendix E) |
| Part15C Section 15.203/15.247 (c) | ANSI C63.10 | Antenna Requirement | PASS | Appendix F) |
| Part15C Section 15.207 | ANSI C63.10 | AC Power Line Conducted Emission | PASS | Appendix G) |
| Part15C Section 15.205/15.209 | ANSI C63.10 | Restricted bands around fundamental frequency (Radiated Emission) | PASS | Appendix H) |
| Part15C Section 15.205/15.209 | ANSI C63.10 | Radiated Spurious Emissions | PASS | Appendix I) |

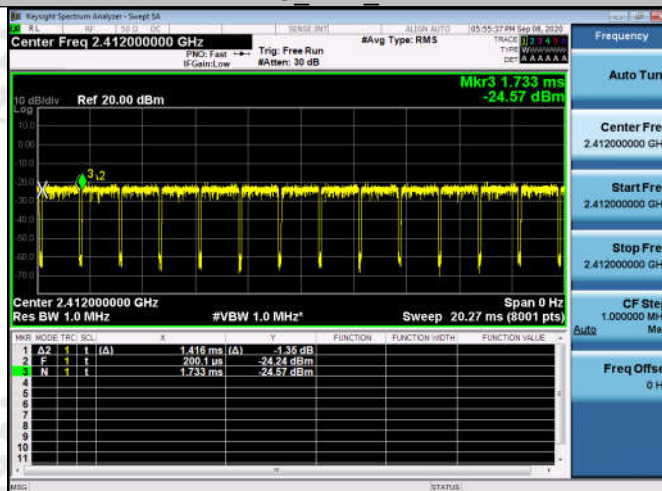
**Duty Cycle
Result Table**

| Test Mode | Antenna | Channel | Duty Cycle [%] | Limit | Verdict |
|-----------|---------|---------|----------------|-------|---------|
| 11B | Ant1 | 2412 | 98.84 | --- | PASS |
| | Ant1 | 2437 | 98.84 | --- | PASS |
| | Ant1 | 2462 | 98.84 | --- | PASS |
| 11G | Ant1 | 2412 | 92.40 | --- | PASS |
| | Ant1 | 2437 | 92.86 | --- | PASS |
| | Ant1 | 2462 | 92.86 | --- | PASS |
| 11N20SISO | Ant1 | 2412 | 92.97 | --- | PASS |
| | Ant1 | 2437 | 92.65 | --- | PASS |
| | Ant1 | 2462 | 92.77 | --- | PASS |
| 11N40SISO | Ant1 | 2422 | 84.28 | --- | PASS |
| | Ant1 | 2437 | 83.23 | --- | PASS |
| | Ant1 | 2452 | 82.83 | --- | PASS |

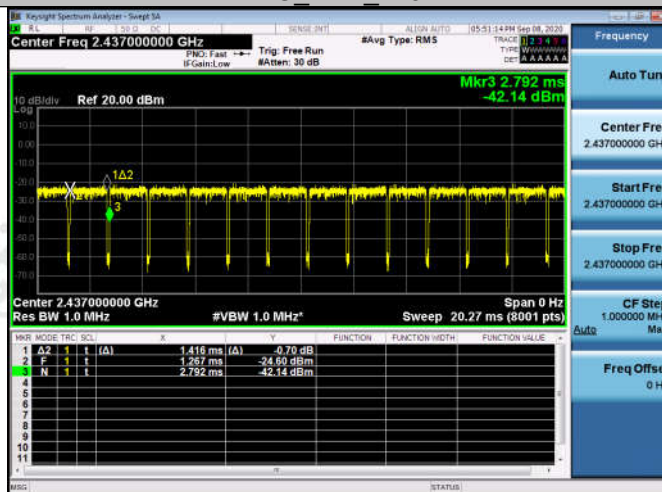
Test Graph



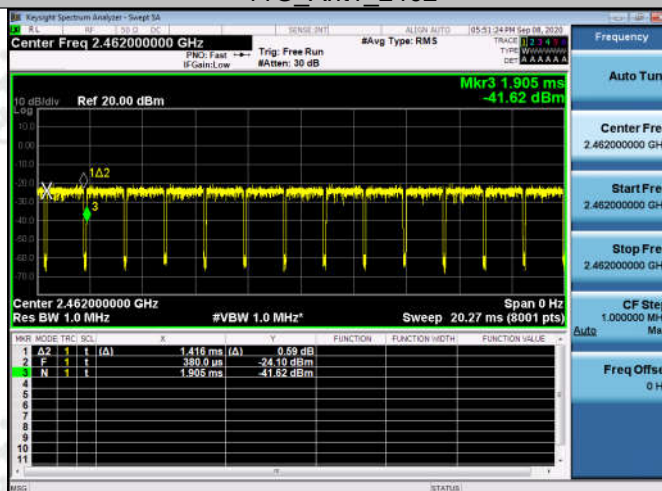
11G_Ant1_2412



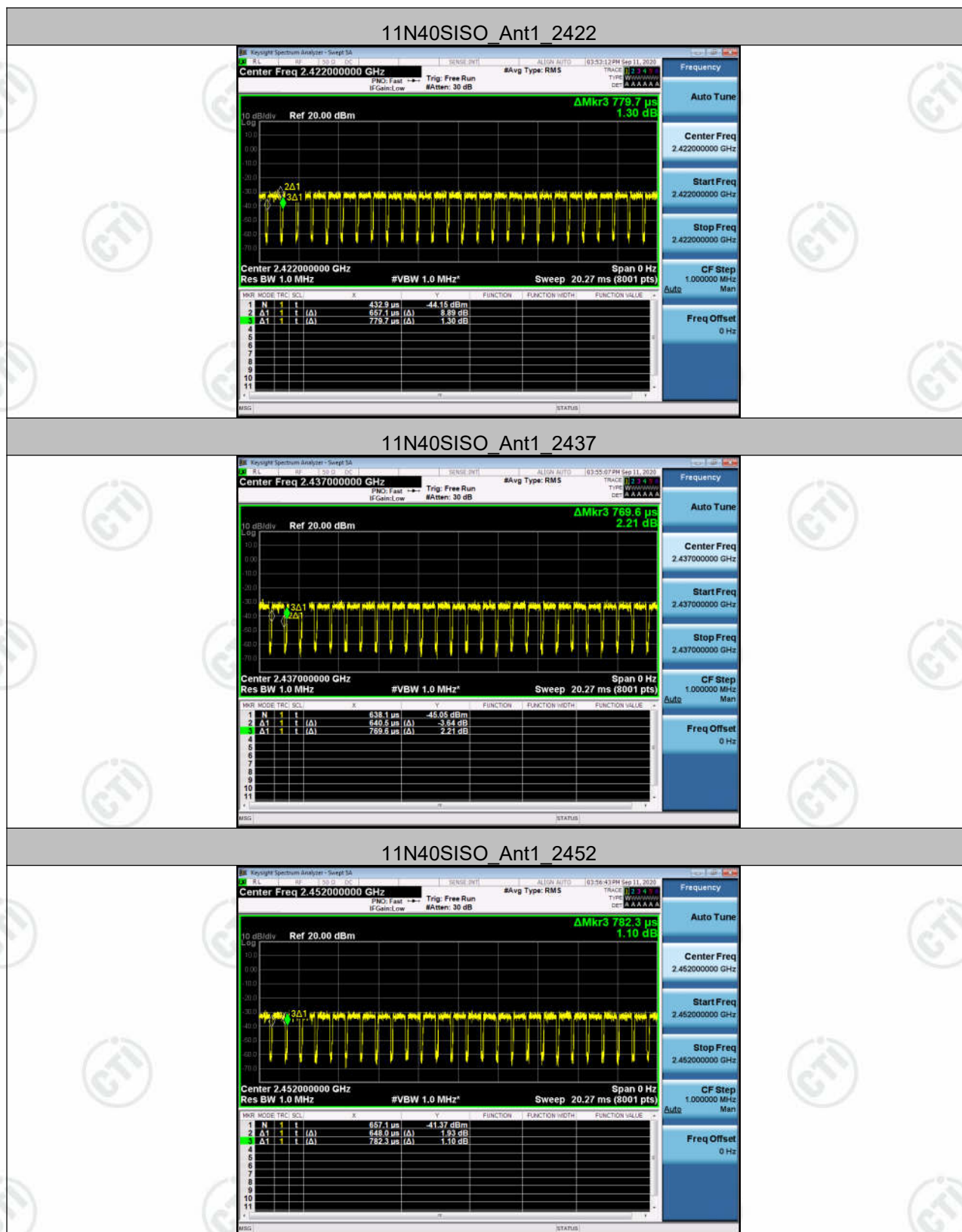
11G_Ant1_2437



11G_Ant1_2462







Appendix A): Conducted Peak Output Power

Test Limit

According to §15.247(b)(3),

Peak output power:

For systems using digital modulation in the 2400-2483.5 MHz: 1 Watt(30 dBm), base on the use of antennas with directional gain not exceed 6 dBi. If transmitting antennas of directional gain greater than 6dBi are used the peak output power the conducted output power from the intentional radiator shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi. In case of point-to-point operation, the limit has to be reduced by 1dB for every 3 dB that the directional gain of the antenna exceeds 6 dBi.

| | |
|-------|--|
| Limit | <input checked="" type="checkbox"/> Antenna not exceed 6 dBi: 30dBm <input type="checkbox"/> Antenna with DG greater than 6 dBi: [Limit = 30 – (DG – 6)] <input type="checkbox"/> Point-to-point operation: |
|-------|--|

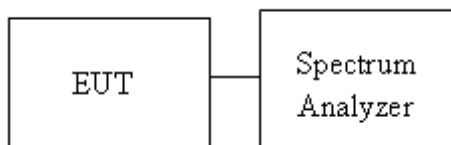
Average output power: For reporting purposes only.

Test Procedure

Test method Refer as KDB 558074 D01.

1. The EUT RF output connected to the power meter by RF cable.
2. Setting maximum power transmit of EUT.
3. The path loss was compensated to the results for each measurement.
4. Measure and record the result of Peak output power and Average output power. in the test report.

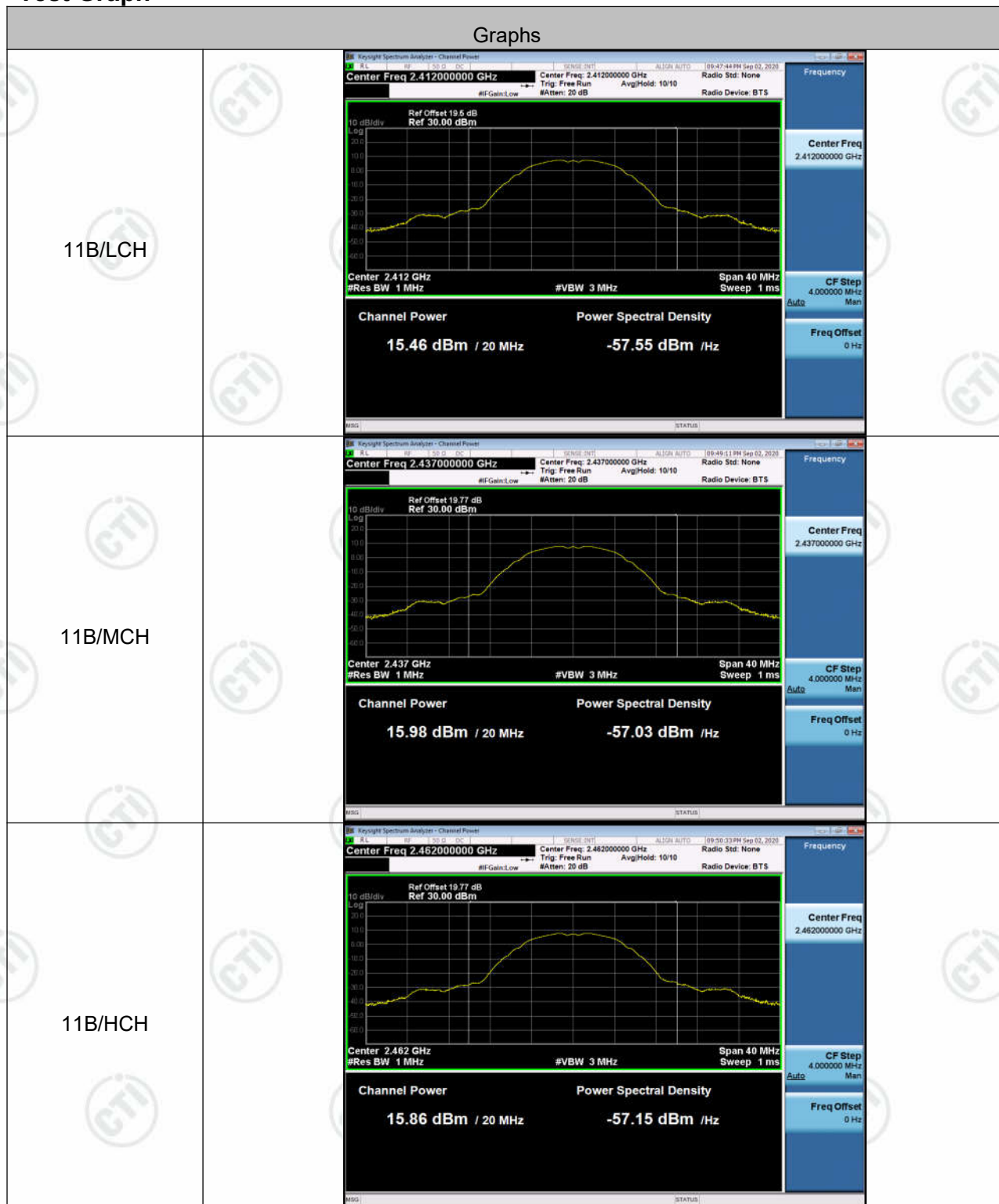
Test Setup



Result Table

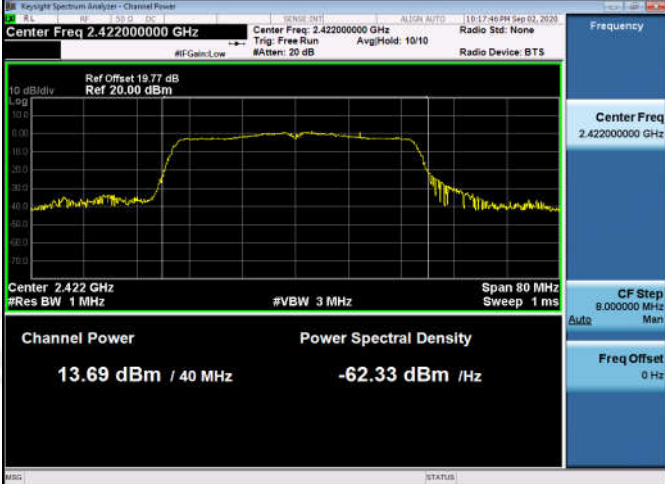
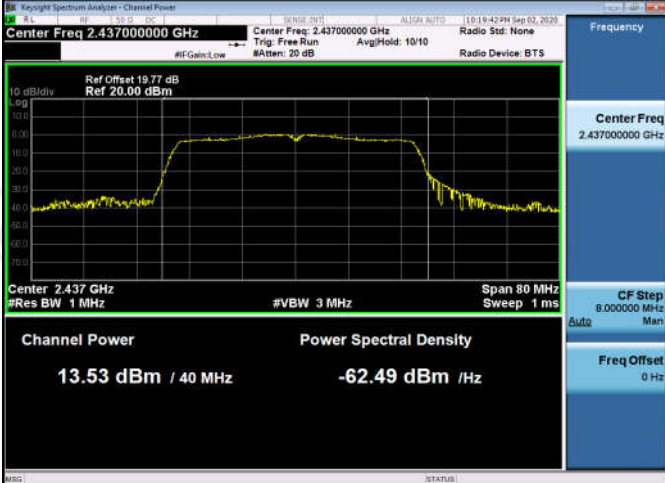
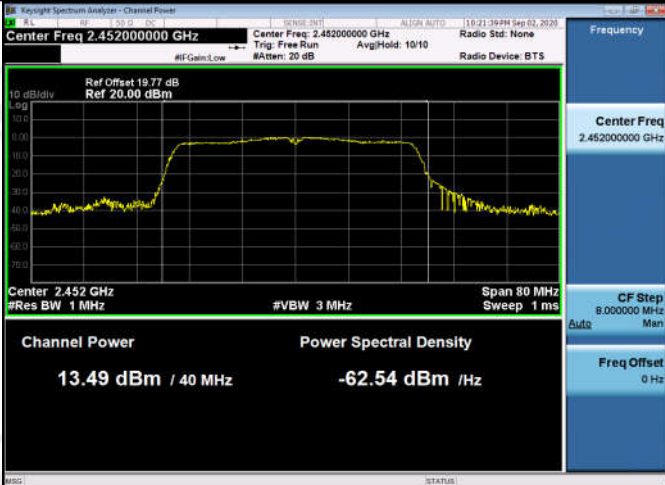
| Mode | Channel | Conducted Peak Output Power [dBm] | Verdict |
|-----------|---------|-----------------------------------|---------|
| 11B | LCH | 15.46 | PASS |
| 11B | MCH | 15.98 | PASS |
| 11B | HCH | 15.86 | PASS |
| 11G | LCH | 14.44 | PASS |
| 11G | MCH | 14.69 | PASS |
| 11G | HCH | 14.51 | PASS |
| 11N20SISO | LCH | 14.06 | PASS |
| 11N20SISO | MCH | 14.25 | PASS |
| 11N20SISO | HCH | 14.07 | PASS |
| 11N40SISO | LCH | 13.69 | PASS |
| 11N40SISO | MCH | 13.53 | PASS |
| 11N40SISO | HCH | 13.49 | PASS |

Test Graph



| | |
|---------|---|
| 11G/LCH |  <p>Center Freq 2.412000000 GHz</p> <p>Ref Offset 19.6 dB Ref 20.00 dBm</p> <p>Center 2.412 GHz #Res BW 1 MHz</p> <p>#VBW 3 MHz</p> <p>Span 40 MHz Sweep 1 ms</p> <p>Channel Power 14.44 dBm / 20 MHz</p> <p>Power Spectral Density -58.57 dBm / Hz</p> <p>Frequency Center Freq 2.412000000 GHz</p> <p>CF Step 4.000000 MHz</p> <p>Freq Offset 0 Hz</p> |
| 11G/MCH |  <p>Center Freq 2.437000000 GHz</p> <p>Ref Offset 19.77 dB Ref 20.00 dBm</p> <p>Center 2.437 GHz #Res BW 1 MHz</p> <p>#VBW 3 MHz</p> <p>Span 40 MHz Sweep 1 ms</p> <p>Channel Power 14.69 dBm / 20 MHz</p> <p>Power Spectral Density -58.32 dBm / Hz</p> <p>Frequency Center Freq 2.437000000 GHz</p> <p>CF Step 4.000000 MHz</p> <p>Freq Offset 0 Hz</p> |
| 11G/HCH |  <p>Center Freq 2.462000000 GHz</p> <p>Ref Offset 19.77 dB Ref 20.00 dBm</p> <p>Center 2.462 GHz #Res BW 1 MHz</p> <p>#VBW 3 MHz</p> <p>Span 40 MHz Sweep 1 ms</p> <p>Channel Power 14.51 dBm / 20 MHz</p> <p>Power Spectral Density -58.50 dBm / Hz</p> <p>Frequency Center Freq 2.462000000 GHz</p> <p>CF Step 4.000000 MHz</p> <p>Freq Offset 0 Hz</p> |

| | |
|---------------|--|
| 11N20SISO/LCH |  <p>Key parameters for 11N20SISO/LCH:</p> <ul style="list-style-type: none"> Center Freq: 2.412000000 GHz Channel Power: 14.06 dBm / 20 MHz Power Spectral Density: -58.95 dBm / Hz Ref Offset: 19.6 dB Ref: 20.00 dBm |
| 11N20SISO/MCH |  <p>Key parameters for 11N20SISO/MCH:</p> <ul style="list-style-type: none"> Center Freq: 2.437000000 GHz Channel Power: 14.25 dBm / 20 MHz Power Spectral Density: -58.76 dBm / Hz Ref Offset: 19.77 dB Ref: 20.00 dBm |
| 11N20SISO/HCH |  <p>Key parameters for 11N20SISO/HCH:</p> <ul style="list-style-type: none"> Center Freq: 2.462000000 GHz Channel Power: 14.07 dBm / 20 MHz Power Spectral Density: -58.94 dBm / Hz Ref Offset: 19.77 dB Ref: 20.00 dBm |

| | |
|---------------|--|
| 11N40SISO/LCH |  <p>Key parameters from the screenshot:</p> <ul style="list-style-type: none"> Center Freq: 2.422000000 GHz Channel Power: 13.69 dBm / 40 MHz Power Spectral Density: -62.33 dBm / Hz Span: 80 MHz Res BW: 1 MHz VBW: 3 MHz Sweep: 1 ms |
| 11N40SISO/MCH |  <p>Key parameters from the screenshot:</p> <ul style="list-style-type: none"> Center Freq: 2.437000000 GHz Channel Power: 13.53 dBm / 40 MHz Power Spectral Density: -62.49 dBm / Hz Span: 80 MHz Res BW: 1 MHz VBW: 3 MHz Sweep: 1 ms |
| 11N40SISO/HCH |  <p>Key parameters from the screenshot:</p> <ul style="list-style-type: none"> Center Freq: 2.452000000 GHz Channel Power: 13.49 dBm / 40 MHz Power Spectral Density: -62.54 dBm / Hz Span: 80 MHz Res BW: 1 MHz VBW: 3 MHz Sweep: 1 ms |

Appendix B): 6dB Occupied Bandwidth

Test Limit

According to §15.247(a)(2),

6 dB Bandwidth

| | |
|-------|--------------------------|
| Limit | Shall be at least 500kHz |
|-------|--------------------------|

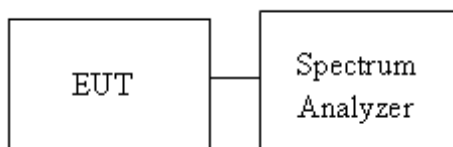
Occupied Bandwidth(99%) : For reporting purposes only.

Test Procedure

Test method Refer as KDB 558074 D01 and ANSI C63.10: 2013 clause 6.9.2,

1. The EUT RF output connected to the spectrum analyzer by RF cable.
2. Setting maximum power transmit of EUT
3. SA set RBW = 100KHz , VBW = 300KHz and Detector = Peak, to measurement 6dB Bandwidth
4. SA set RBW = 1% ~ 5% OBW, VBW = three times the RBW and Detector = Peak, to measurement 99% Bandwidth
5. Measure and record the result of 6 dB Bandwidth and 99% Bandwidth. in the test report.

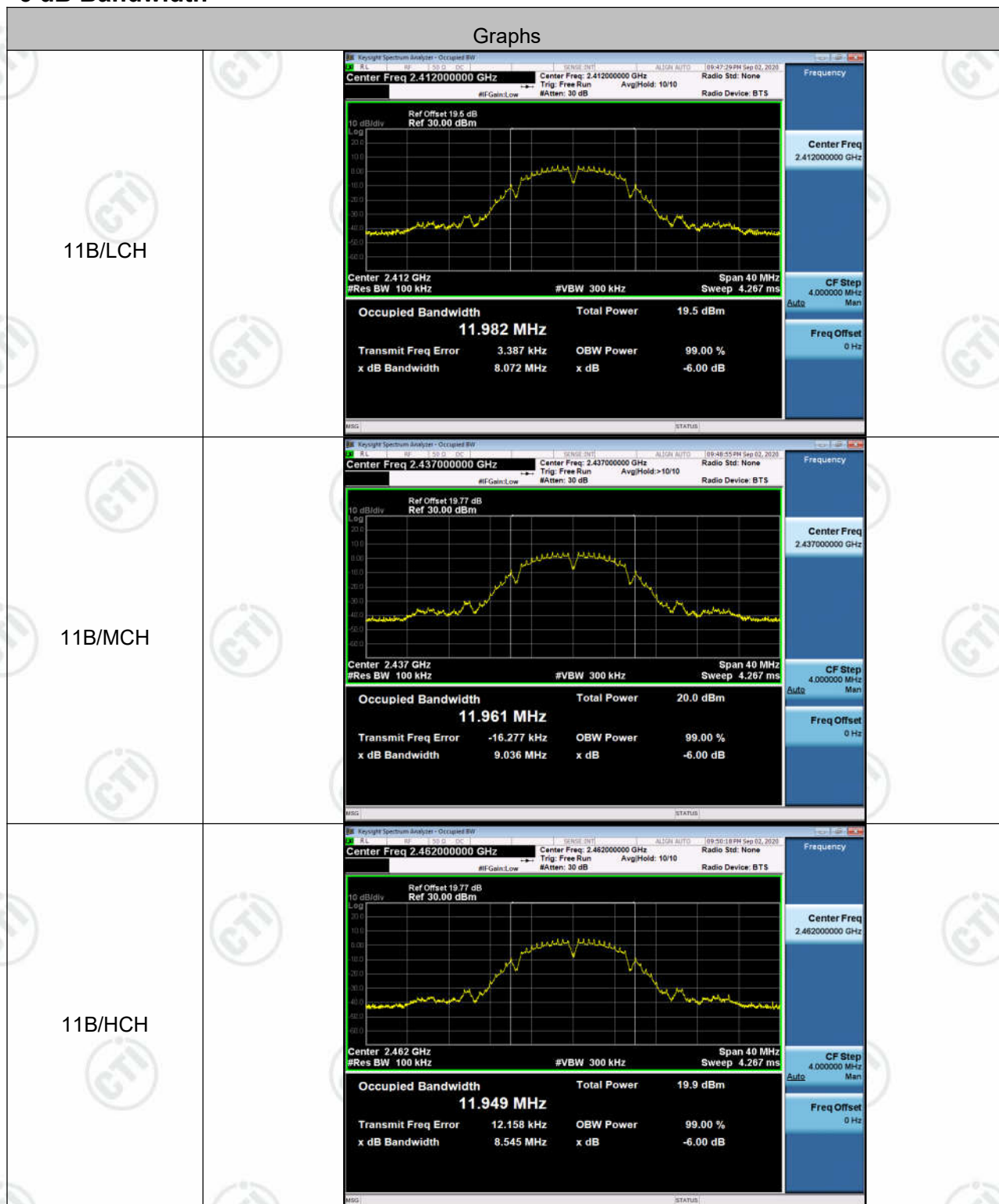
Test Setup

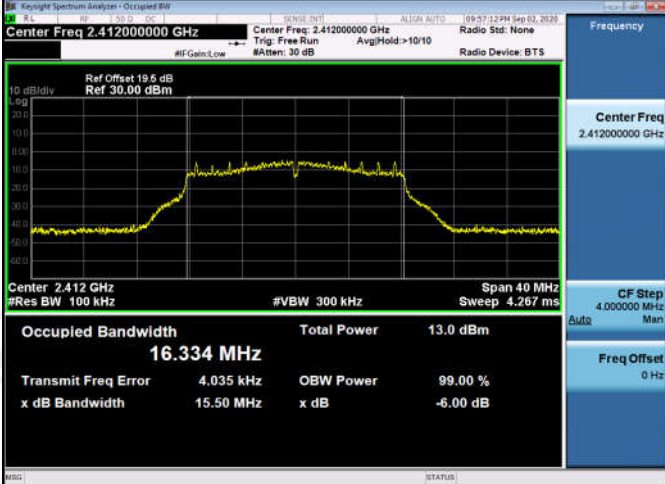
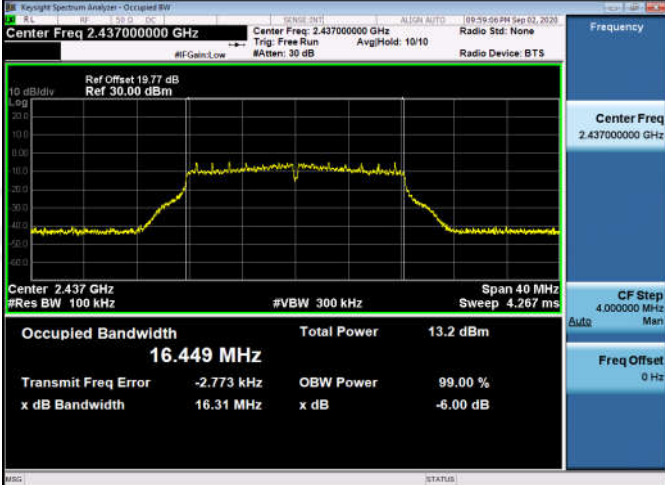



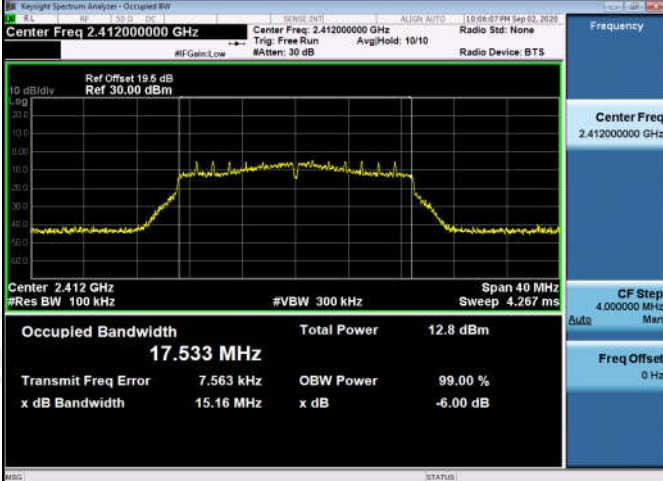
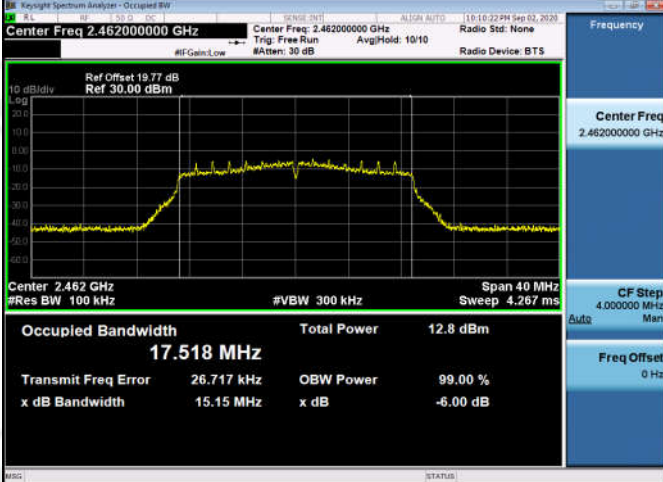
Result Table

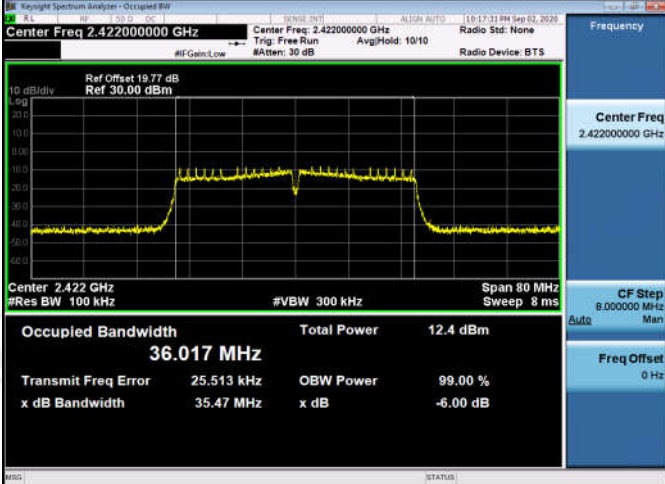
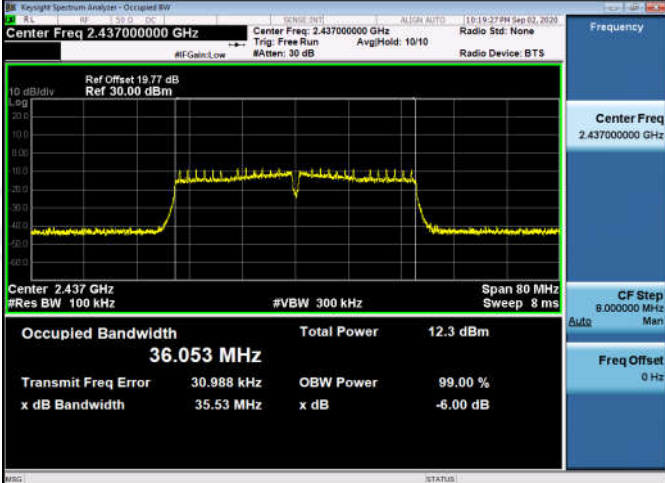
| Mode | Channel | 6dB Bandwidth [MHz] | 99% OBW [MHz] | Verdict |
|-----------|---------|---------------------|---------------|---------|
| 11B | LCH | 8.072 | 12.053 | PASS |
| 11B | MCH | 9.036 | 12.045 | PASS |
| 11B | HCH | 8.545 | 12.045 | PASS |
| 11G | LCH | 15.50 | 16.710 | PASS |
| 11G | MCH | 16.31 | 16.893 | PASS |
| 11G | HCH | 15.15 | 16.637 | PASS |
| 11N20SISO | LCH | 15.16 | 17.767 | PASS |
| 11N20SISO | MCH | 16.93 | 17.974 | PASS |
| 11N20SISO | HCH | 15.15 | 17.727 | PASS |
| 11N40SISO | LCH | 35.47 | 36.215 | PASS |
| 11N40SISO | MCH | 35.53 | 36.251 | PASS |
| 11N40SISO | HCH | 35.36 | 36.211 | PASS |

Test Graph
6 dB Bandwidth



| | |
|---------|---|
| 11G/LCH |  <p>Key Sight Spectrum Analyzer - Occupied BW</p> <p>Center Freq 2.412000000 GHz Center Freq: 2.412000000 GHz Radio Std: None</p> <p>Ref Offset 19.6 dB Ref 30.00 dBm</p> <p>Center 2.412 GHz #Res BW 100 kHz #VBW 300 kHz Span 40 MHz Sweep 4.267 ms</p> <p>Occupied Bandwidth 16.334 MHz Total Power 13.0 dBm</p> <p>Transmit Freq Error 4.035 kHz OBW Power 99.00 %</p> <p>x dB Bandwidth 15.50 MHz x dB -6.00 dB</p> <p>Frequency Center Freq 2.412000000 GHz</p> <p>CF Step 4.000000 MHz</p> <p>Freq Offset 0 Hz</p> |
| 11G/MCH |  <p>Key Sight Spectrum Analyzer - Occupied BW</p> <p>Center Freq 2.437000000 GHz Center Freq: 2.437000000 GHz Radio Std: None</p> <p>Ref Offset 19.77 dB Ref 30.00 dBm</p> <p>Center 2.437 GHz #Res BW 100 kHz #VBW 300 kHz Span 40 MHz Sweep 4.267 ms</p> <p>Occupied Bandwidth 16.449 MHz Total Power 13.2 dBm</p> <p>Transmit Freq Error -2.773 kHz OBW Power 99.00 %</p> <p>x dB Bandwidth 16.31 MHz x dB -6.00 dB</p> <p>Frequency Center Freq 2.437000000 GHz</p> <p>CF Step 4.000000 MHz</p> <p>Freq Offset 0 Hz</p> |
| 11G/HCH |  <p>Key Sight Spectrum Analyzer - Occupied BW</p> <p>Center Freq 2.462000000 GHz Center Freq: 2.462000000 GHz Radio Std: None</p> <p>Ref Offset 19.77 dB Ref 30.00 dBm</p> <p>Center 2.462 GHz #Res BW 100 kHz #VBW 300 kHz Span 40 MHz Sweep 4.267 ms</p> <p>Occupied Bandwidth 16.320 MHz Total Power 13.1 dBm</p> <p>Transmit Freq Error 17.108 kHz OBW Power 99.00 %</p> <p>x dB Bandwidth 15.15 MHz x dB -6.00 dB</p> <p>Frequency Center Freq 2.462000000 GHz</p> <p>CF Step 4.000000 MHz</p> <p>Freq Offset 0 Hz</p> |

| | |
|---------------|---|
| 11N20SISO/LCH |  <p>Keyight Spectrum Analyzer - Occupied BW</p> <p>Center Freq 2.412000000 GHz Center Freq: 2.412000000 GHz Radio Std: None</p> <p>Ref Offset 19.6 dB Ref 30.00 dBm</p> <p>Center 2.412 GHz Span 40 MHz</p> <p>#Res BW 100 kHz #VBW 300 kHz Sweep 4.267 ms</p> <p>Occupied Bandwidth 17.533 MHz Total Power 12.8 dBm</p> <p>Transmit Freq Error 7.563 kHz OBW Power 99.00 %</p> <p>x dB Bandwidth 15.16 MHz x dB -6.00 dB</p> <p>Frequency</p> <p>Center Freq 2.412000000 GHz</p> <p>CF Step 4.000000 MHz</p> <p>Freq Offset 0 Hz</p> |
| 11N20SISO/MCH |  <p>Keyight Spectrum Analyzer - Occupied BW</p> <p>Center Freq 2.437000000 GHz Center Freq: 2.437000000 GHz Radio Std: None</p> <p>Ref Offset 19.77 dB Ref 30.00 dBm</p> <p>Center 2.437 GHz Span 40 MHz</p> <p>#Res BW 100 kHz #VBW 300 kHz Sweep 4.267 ms</p> <p>Occupied Bandwidth 17.619 MHz Total Power 13.0 dBm</p> <p>Transmit Freq Error 6.264 kHz OBW Power 99.00 %</p> <p>x dB Bandwidth 16.93 MHz x dB -6.00 dB</p> <p>Frequency</p> <p>Center Freq 2.437000000 GHz</p> <p>CF Step 4.000000 MHz</p> <p>Freq Offset 0 Hz</p> |
| 11N20SISO/HCH |  <p>Keyight Spectrum Analyzer - Occupied BW</p> <p>Center Freq 2.462000000 GHz Center Freq: 2.462000000 GHz Radio Std: None</p> <p>Ref Offset 19.77 dB Ref 30.00 dBm</p> <p>Center 2.462 GHz Span 40 MHz</p> <p>#Res BW 100 kHz #VBW 300 kHz Sweep 4.267 ms</p> <p>Occupied Bandwidth 17.518 MHz Total Power 12.8 dBm</p> <p>Transmit Freq Error 26.717 kHz OBW Power 99.00 %</p> <p>x dB Bandwidth 15.15 MHz x dB -6.00 dB</p> <p>Frequency</p> <p>Center Freq 2.462000000 GHz</p> <p>CF Step 4.000000 MHz</p> <p>Freq Offset 0 Hz</p> |

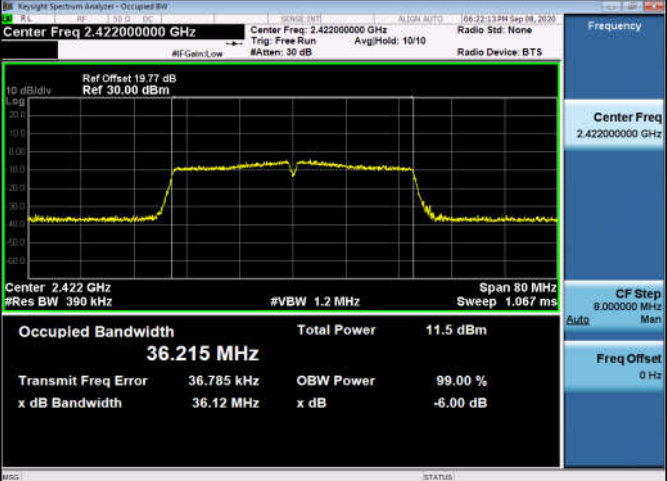
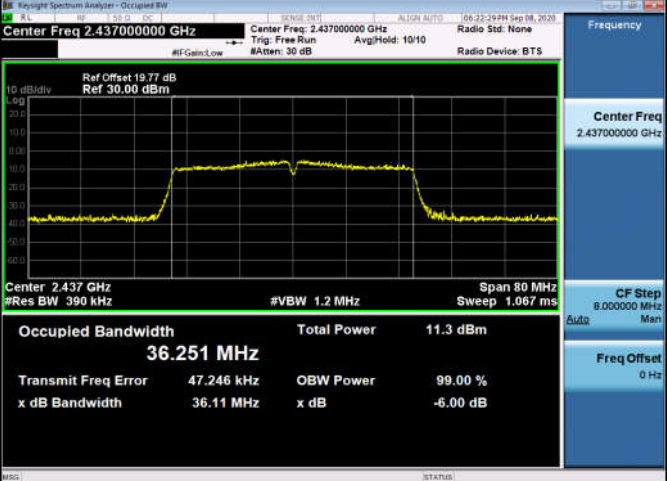
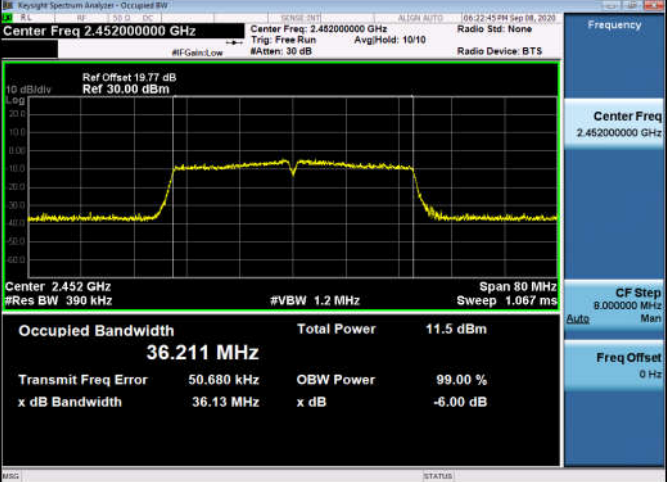
| | |
|---------------|---|
| 11N40SISO/LCH |  <p>Center Freq 2.422000000 GHz</p> <p>Center Freq 2.422000000 GHz</p> <p>Ref Offset 19.77 dB</p> <p>Ref 30.00 dBm</p> <p>Center 2.422 GHz</p> <p>#Res BW 100 kHz</p> <p>#VBW 300 kHz</p> <p>Span 80 MHz</p> <p>Sweep 8 ms</p> <p>Occupied Bandwidth 36.017 MHz</p> <p>Total Power 12.4 dBm</p> <p>Transmit Freq Error 25.513 kHz</p> <p>OBW Power 99.00 %</p> <p>x dB Bandwidth 35.47 MHz</p> <p>x dB -6.00 dB</p> <p>Frequency</p> <p>Center Freq 2.422000000 GHz</p> <p>CF Step 8.000000 MHz</p> <p>Freq Offset 0 Hz</p> |
| 11N40SISO/MCH |  <p>Center Freq 2.437000000 GHz</p> <p>Center Freq 2.437000000 GHz</p> <p>Ref Offset 19.77 dB</p> <p>Ref 30.00 dBm</p> <p>Center 2.437 GHz</p> <p>#Res BW 100 kHz</p> <p>#VBW 300 kHz</p> <p>Span 80 MHz</p> <p>Sweep 8 ms</p> <p>Occupied Bandwidth 36.053 MHz</p> <p>Total Power 12.3 dBm</p> <p>Transmit Freq Error 30.988 kHz</p> <p>OBW Power 99.00 %</p> <p>x dB Bandwidth 35.53 MHz</p> <p>x dB -6.00 dB</p> <p>Frequency</p> <p>Center Freq 2.437000000 GHz</p> <p>CF Step 8.000000 MHz</p> <p>Freq Offset 0 Hz</p> |
| 11N40SISO/HCH |  <p>Center Freq 2.452000000 GHz</p> <p>Center Freq 2.452000000 GHz</p> <p>Ref Offset 19.77 dB</p> <p>Ref 30.00 dBm</p> <p>Center 2.452 GHz</p> <p>#Res BW 100 kHz</p> <p>#VBW 300 kHz</p> <p>Span 80 MHz</p> <p>Sweep 8 ms</p> <p>Occupied Bandwidth 36.071 MHz</p> <p>Total Power 12.2 dBm</p> <p>Transmit Freq Error 28.437 kHz</p> <p>OBW Power 99.00 %</p> <p>x dB Bandwidth 35.36 MHz</p> <p>x dB -6.00 dB</p> <p>Frequency</p> <p>Center Freq 2.452000000 GHz</p> <p>CF Step 8.000000 MHz</p> <p>Freq Offset 0 Hz</p> |

Occupied Bandwidth(99%)





| | |
|---------------|--|
| 11N20SISO/LCH |  <p>KeySight Spectrum Analyzer - Occupied BW</p> <p>Center Freq 2.412000000 GHz</p> <p>Ref Offset 19.5 dB Ref 30.00 dBm</p> <p>Center 2.412 GHz #Res BW 300 kHz</p> <p>Occupied Bandwidth 17.767 MHz</p> <p>Total Power 11.9 dBm</p> <p>Transmit Freq Error 16.423 kHz</p> <p>x dB Bandwidth 15.88 MHz</p> |
| 11N20SISO/MCH |  <p>KeySight Spectrum Analyzer - Occupied BW</p> <p>Center Freq 2.437000000 GHz</p> <p>Ref Offset 19.77 dB Ref 30.00 dBm</p> <p>Center 2.437 GHz #Res BW 300 kHz</p> <p>Occupied Bandwidth 17.974 MHz</p> <p>Total Power 12.1 dBm</p> <p>Transmit Freq Error 18.072 kHz</p> <p>x dB Bandwidth 17.30 MHz</p> |
| 11N20SISO/HCH |  <p>KeySight Spectrum Analyzer - Occupied BW</p> <p>Center Freq 2.462000000 GHz</p> <p>Ref Offset 19.77 dB Ref 30.00 dBm</p> <p>Center 2.462 GHz #Res BW 300 kHz</p> <p>Occupied Bandwidth 17.727 MHz</p> <p>Total Power 12.0 dBm</p> <p>Transmit Freq Error 33.196 kHz</p> <p>x dB Bandwidth 15.47 MHz</p> |

| | |
|---------------|--|
| 11N40SISO/LCH |  <p>KeySight Spectrum Analyzer - Occupied BW</p> <p>Center Freq 2.422000000 GHz</p> <p>Ref Offset 19.77 dB Ref 30.00 dBm</p> <p>Center 2.422 GHz #Res BW 390 kHz</p> <p>Occupied Bandwidth 36.215 MHz</p> <p>Total Power 11.5 dBm</p> <p>Transmit Freq Error 36.785 kHz</p> <p>x dB Bandwidth 36.12 MHz</p> <p>OBW Power 99.00 %</p> <p>x dB -6.00 dB</p> |
| 11N40SISO/MCH |  <p>KeySight Spectrum Analyzer - Occupied BW</p> <p>Center Freq 2.437000000 GHz</p> <p>Ref Offset 19.77 dB Ref 30.00 dBm</p> <p>Center 2.437 GHz #Res BW 390 kHz</p> <p>Occupied Bandwidth 36.251 MHz</p> <p>Total Power 11.3 dBm</p> <p>Transmit Freq Error 47.246 kHz</p> <p>x dB Bandwidth 36.11 MHz</p> <p>OBW Power 99.00 %</p> <p>x dB -6.00 dB</p> |
| 11N40SISO/HCH |  <p>KeySight Spectrum Analyzer - Occupied BW</p> <p>Center Freq 2.452000000 GHz</p> <p>Ref Offset 19.77 dB Ref 30.00 dBm</p> <p>Center 2.452 GHz #Res BW 390 kHz</p> <p>Occupied Bandwidth 36.211 MHz</p> <p>Total Power 11.5 dBm</p> <p>Transmit Freq Error 50.680 kHz</p> <p>x dB Bandwidth 36.13 MHz</p> <p>OBW Power 99.00 %</p> <p>x dB -6.00 dB</p> |

Appendix C): Band-edge for RF Conducted Emissions

Test Limit

According to §15.247(d)

In any 100 kHz bandwidth outside the authorized frequency band,

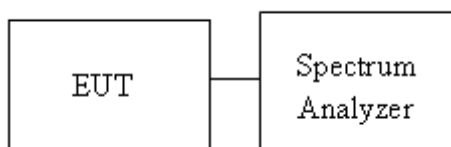
Non-restricted bands shall be attenuated at least 20 dB/30 dB relative to the maximum PSD level in 100 kHz by RF conducted or a radiated measurement which fall in the restricted bands, as defined in §15.205(a), must also comply with the radiated emission limits specified in §15.209(a).

Test Procedure

Test method Refer as KDB 558074 D01.

1. EUT RF output port connected to the SA by RF cable, and the path loss was compensated to result.
2. SA setting, RBW=100kHz, VBW=300kHz, Detector=Peak, Trace mode = max hold, SWT = Auto.
3. In any 100 kHz bandwidth outside the authorized frequency band, shall be attenuated at least 20 dB relative to the maximum in-band peak PSD level in 100 kHz when conducted power procedure is used. If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval, the attenuation required under this paragraph shall be 30 dB instead of 20 dB.

Test Setup

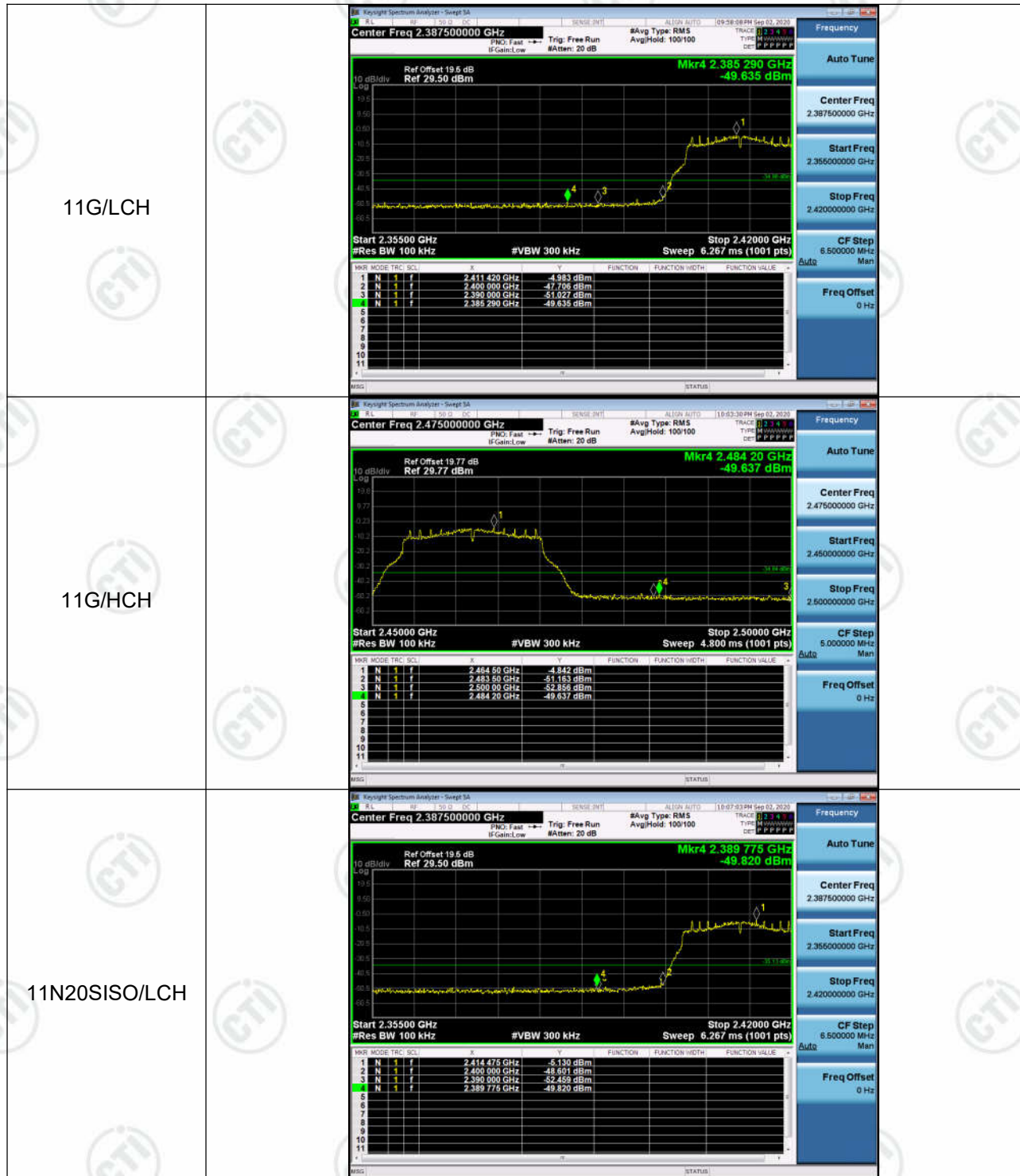


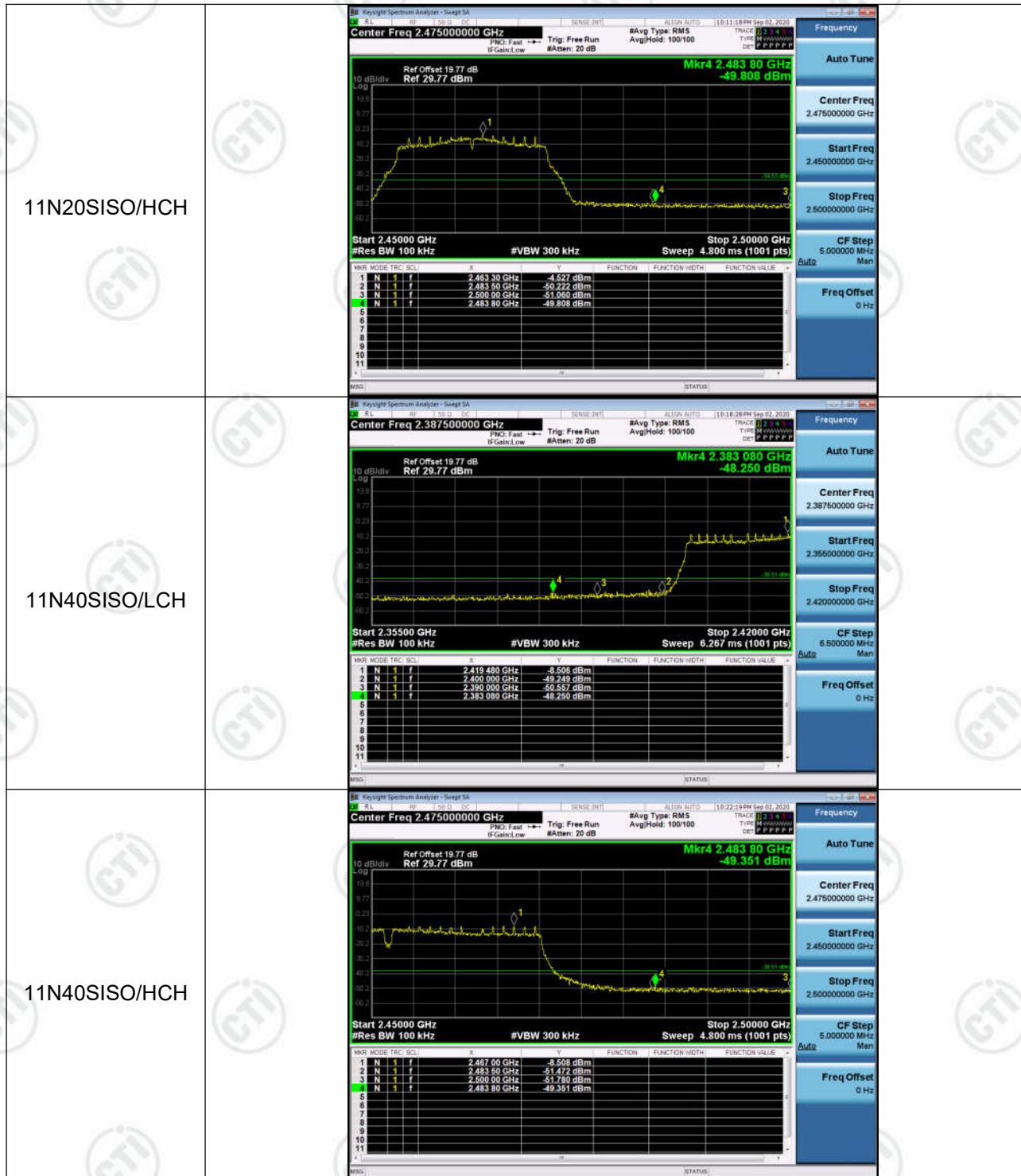
Result Table

| Mode | Channel | Carrier Power[dBm] | Max.Spurious Level [dBm] | Limit [dBm] | Verdict |
|-----------|---------|--------------------|--------------------------|-------------|---------|
| 11B | LCH | 4.097 | -49.831 | -25.9 | PASS |
| 11B | HCH | 4.355 | -48.646 | -25.65 | PASS |
| 11G | LCH | -4.983 | -49.635 | -34.98 | PASS |
| 11G | HCH | -4.842 | -49.637 | -34.84 | PASS |
| 11N20SISO | LCH | -5.130 | -49.820 | -35.13 | PASS |
| 11N20SISO | HCH | -4.527 | -49.808 | -34.53 | PASS |
| 11N40SISO | LCH | -8.506 | -48.250 | -38.51 | PASS |
| 11N40SISO | HCH | -8.508 | -49.351 | -38.51 | PASS |

Test Graph







Appendix D): RF Conducted Spurious Emissions

Test Limit

According to §15.247(d)

In any 100 kHz bandwidth outside the authorized frequency band,

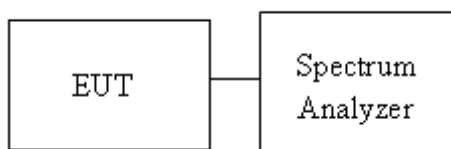
Non-restricted bands shall be attenuated at least 20 dB/30 dB relative to the maximum PSD level in 100 kHz by RF conducted or a radiated measurement which fall in the restricted bands, as defined in §15.205(a), must also comply with the radiated emission limits specified in §15.209(a).

Test Procedure

Test method Refer as KDB 558074 D01.

1. EUT RF output port connected to the SA by RF cable, and the path loss was compensated to result.
2. SA setting, RBW=100kHz, VBW=300kHz, Detector=Peak, Trace mode = max hold, SWT = Auto.
3. In any 100 kHz bandwidth outside the authorized frequency band, shall be attenuated at least 20 dB relative to the maximum in-band peak PSD level in 100 kHz when conducted power procedure is used. If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval, the attenuation required under this paragraph shall be 30 dB instead of 20 dB.

Test Setup

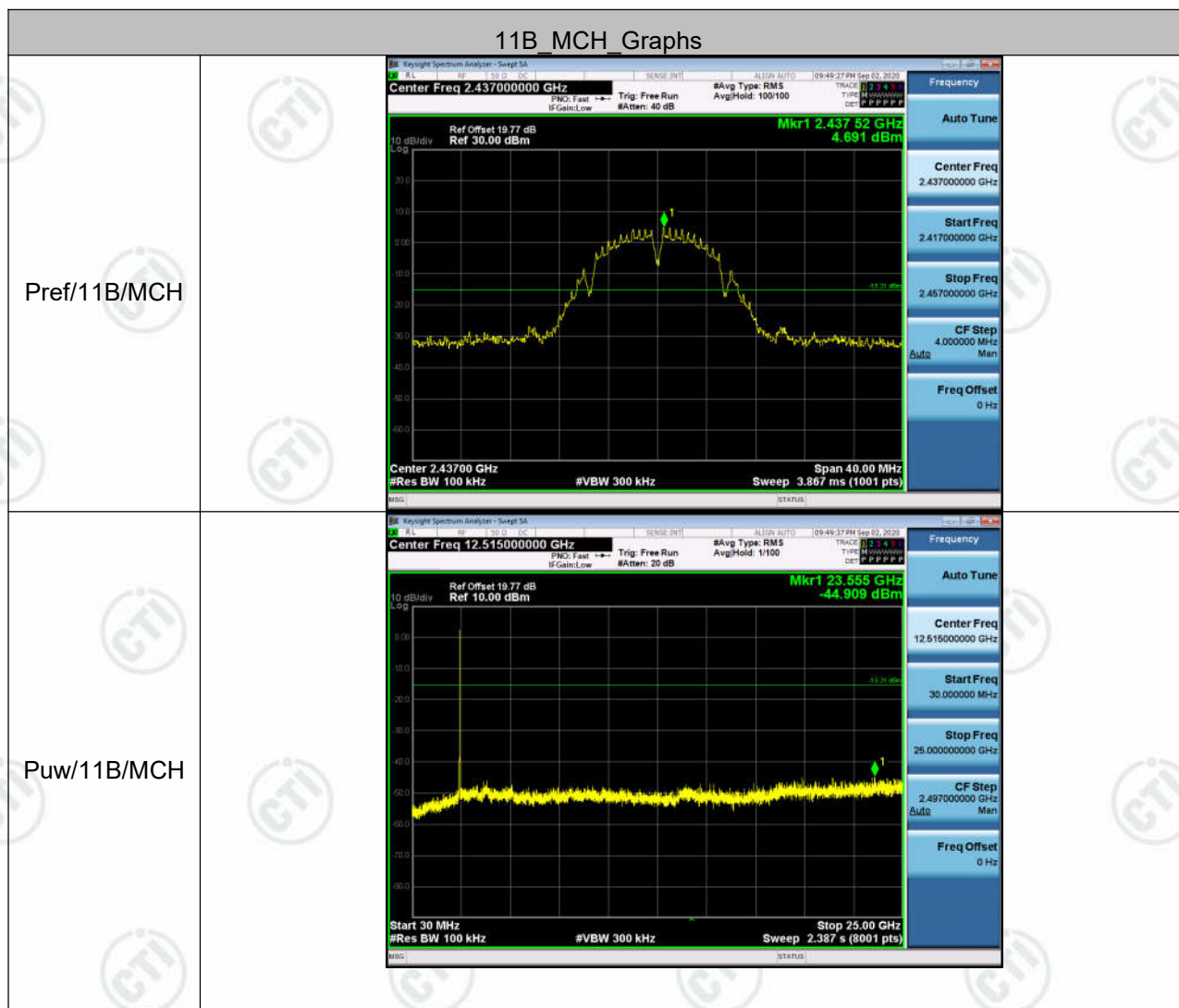


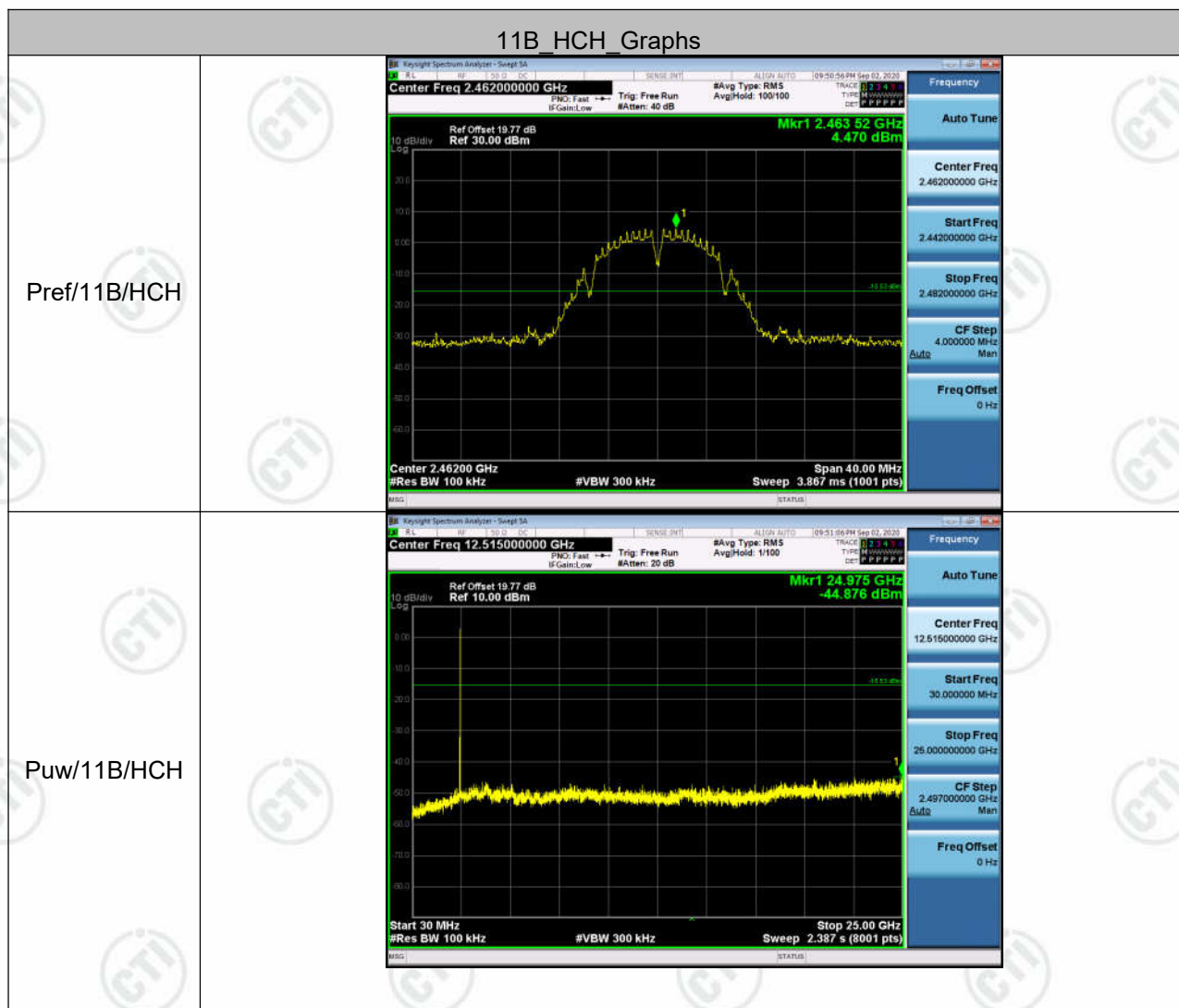
Result Table

| Mode | Channel | Pref [dBm] | Puw[dBm] | Verdict |
|-----------|---------|------------|----------|---------|
| 11B | LCH | 4.275 | <Limit | PASS |
| 11B | MCH | 4.691 | <Limit | PASS |
| 11B | HCH | 4.47 | <Limit | PASS |
| 11G | LCH | -4.721 | <Limit | PASS |
| 11G | MCH | -4.957 | <Limit | PASS |
| 11G | HCH | -5.053 | <Limit | PASS |
| 11N20SISO | LCH | -4.524 | <Limit | PASS |
| 11N20SISO | MCH | -4.526 | <Limit | PASS |
| 11N20SISO | HCH | -4.175 | <Limit | PASS |
| 11N40SISO | LCH | -8.011 | <Limit | PASS |
| 11N40SISO | MCH | -8.163 | <Limit | PASS |
| 11N40SISO | HCH | -8.291 | <Limit | PASS |

Test Graph



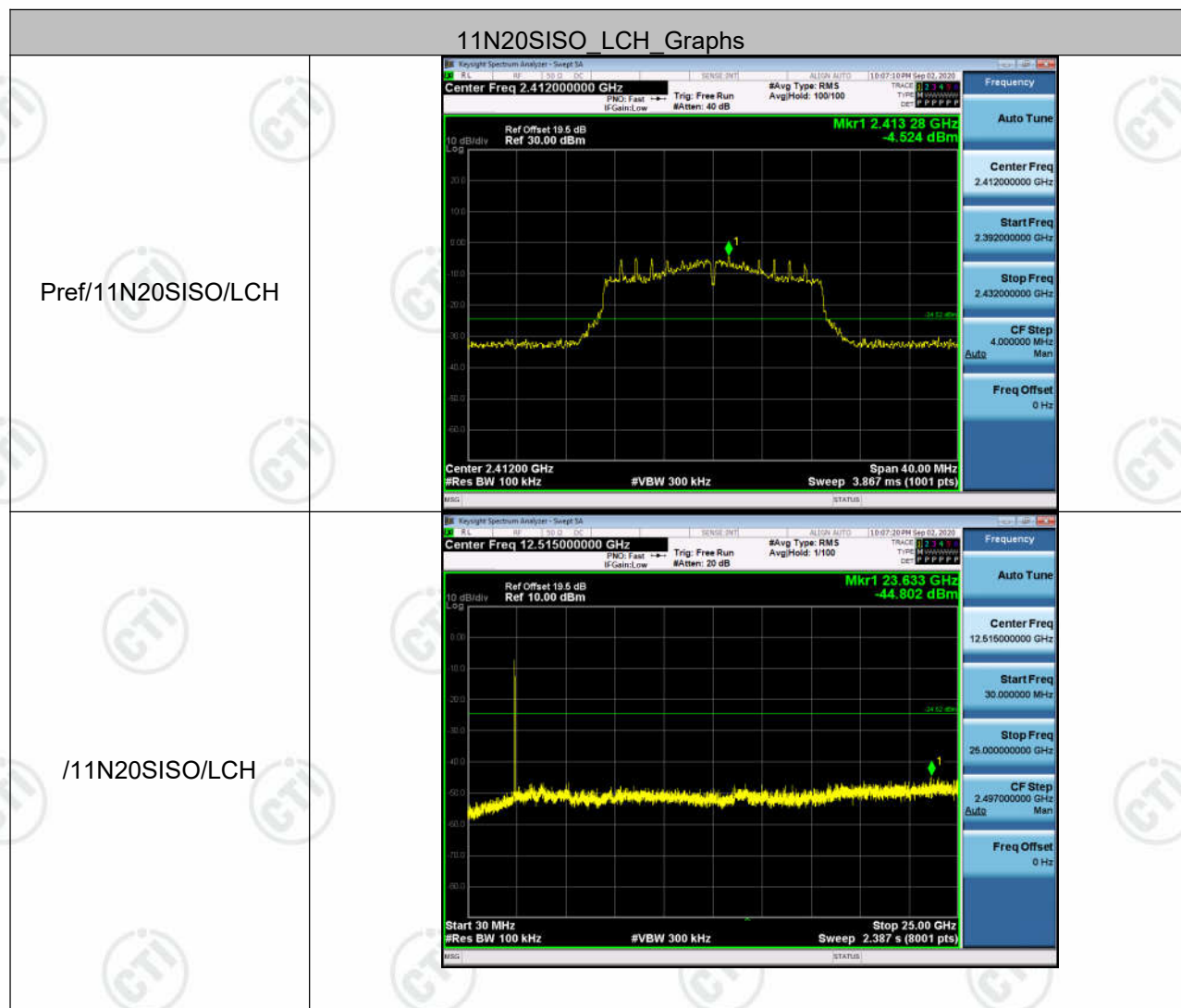


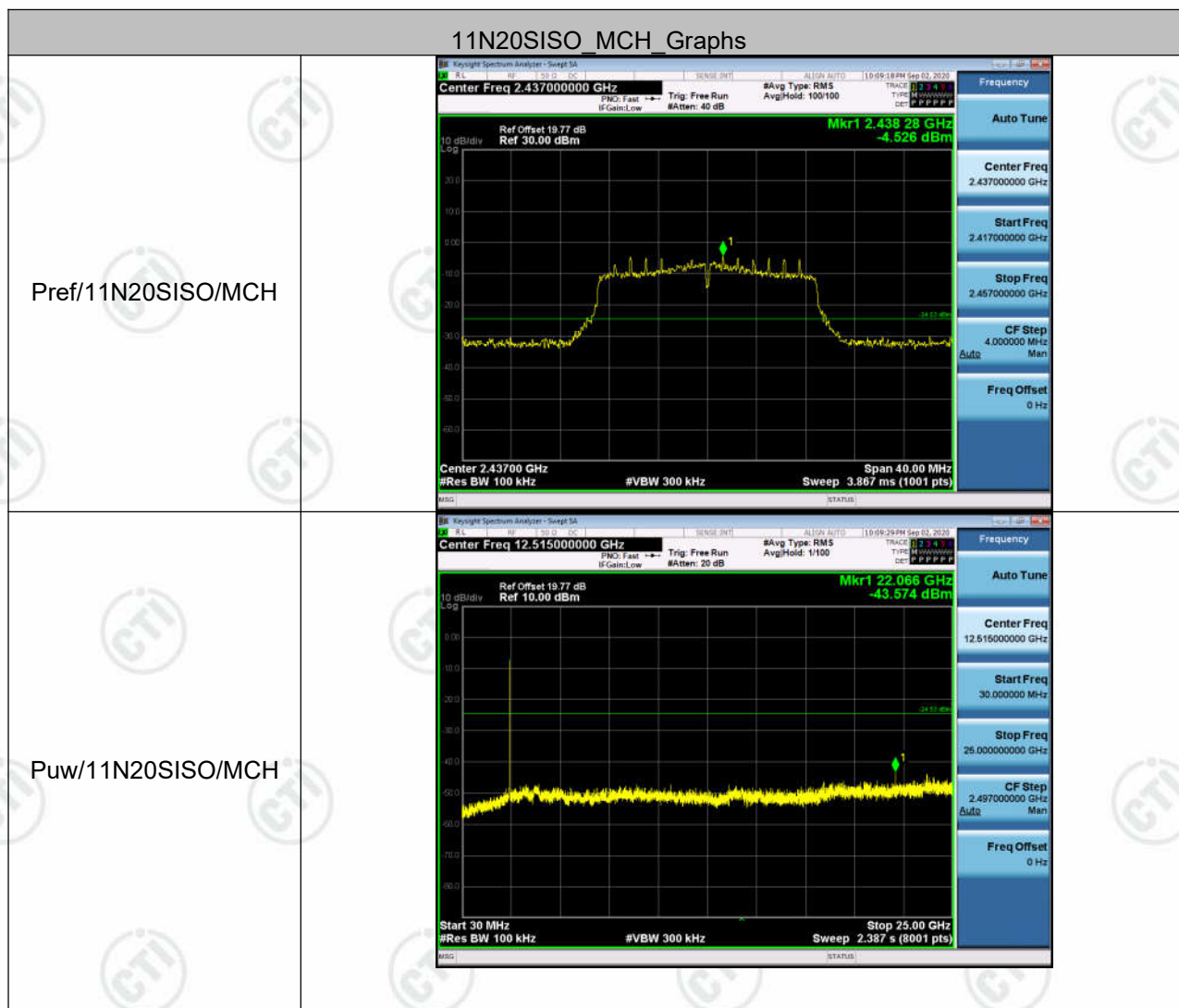


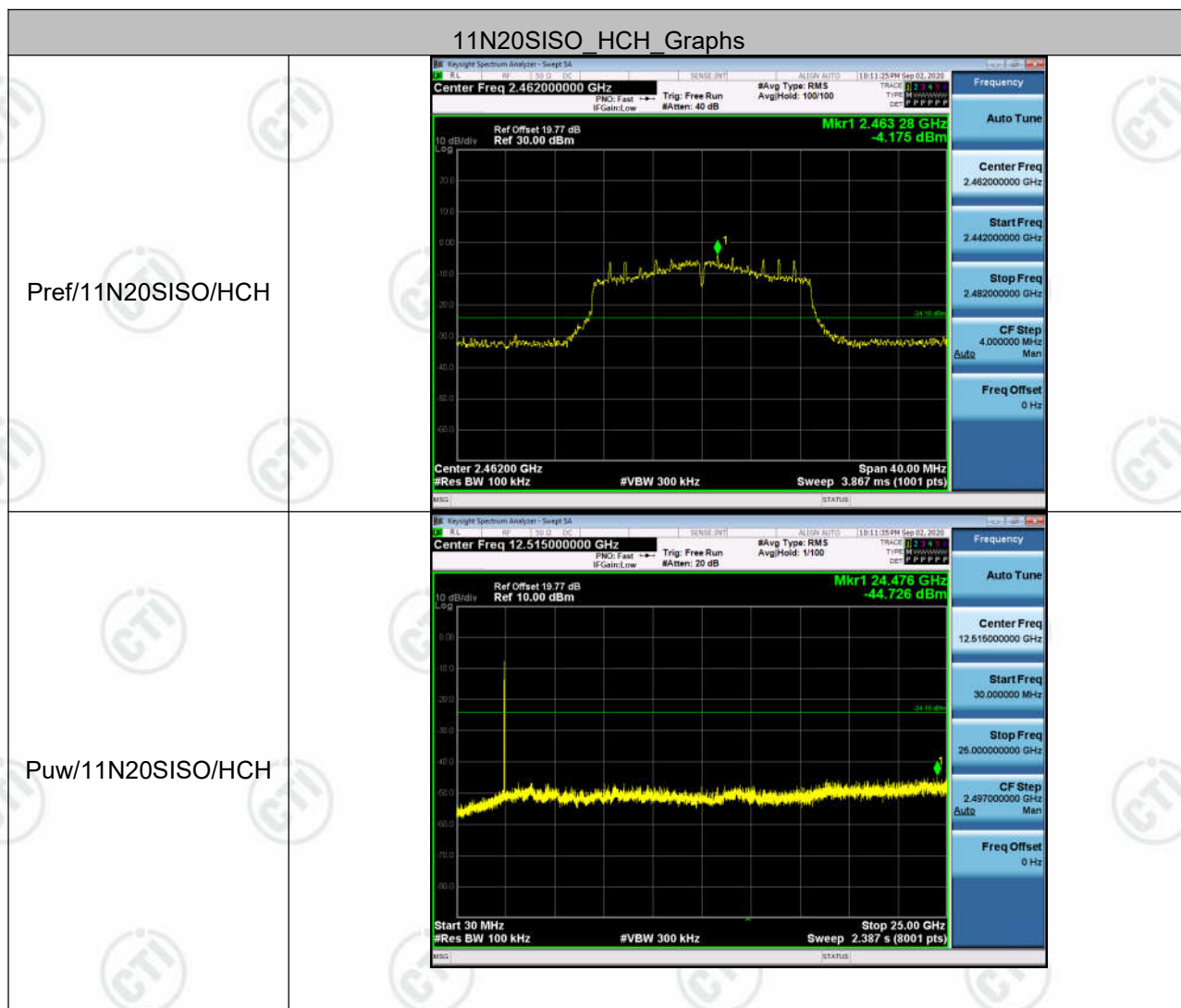


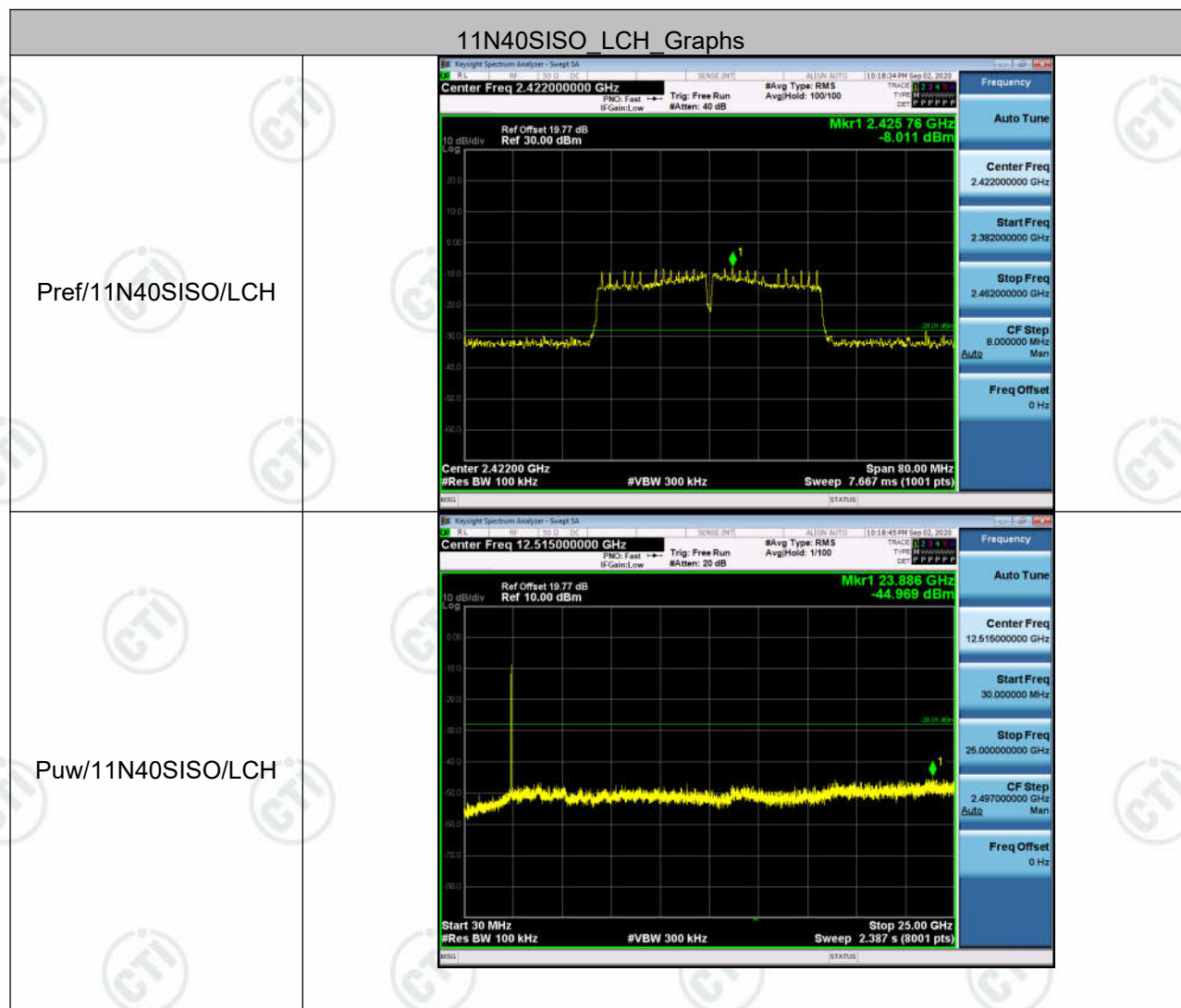


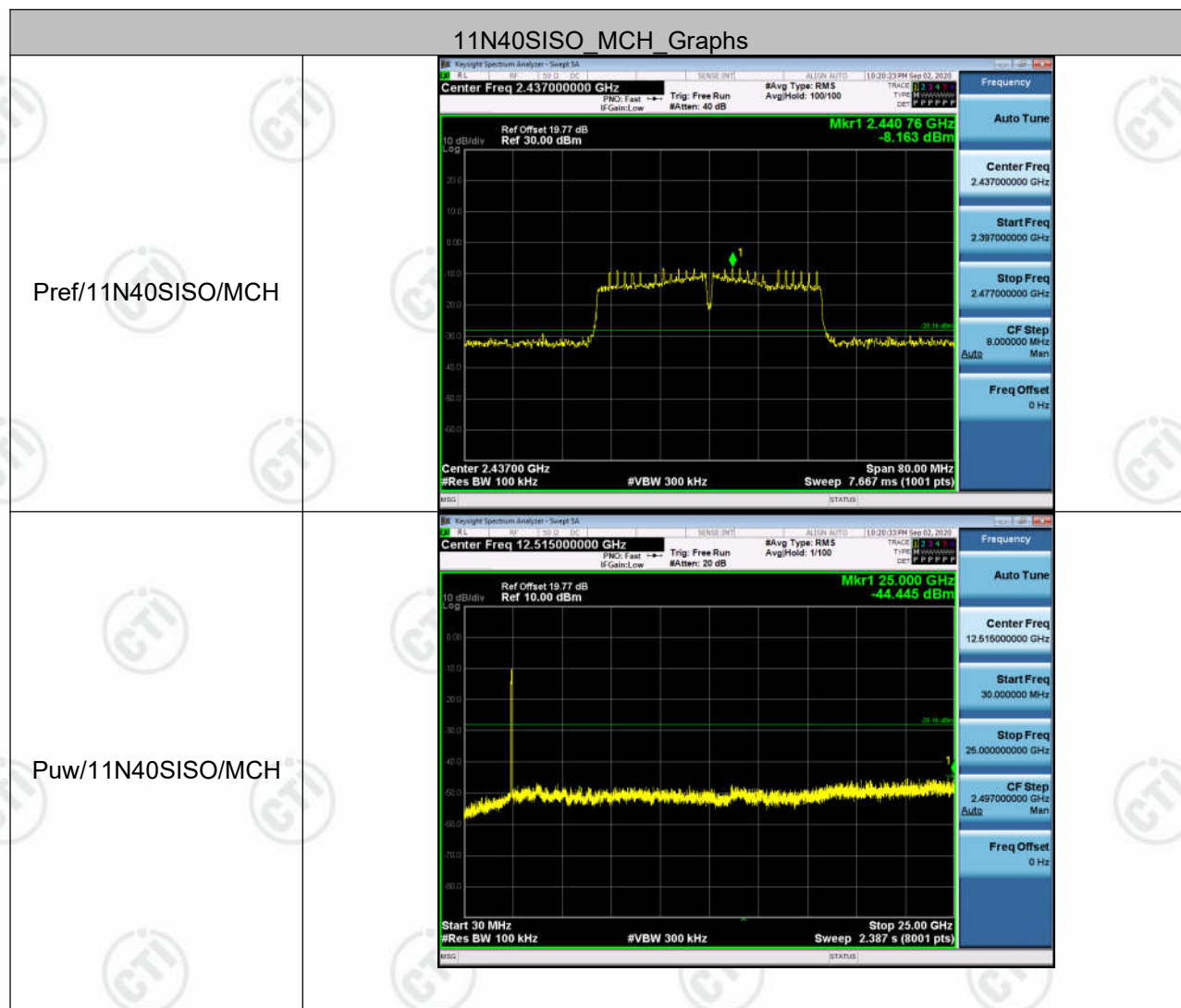


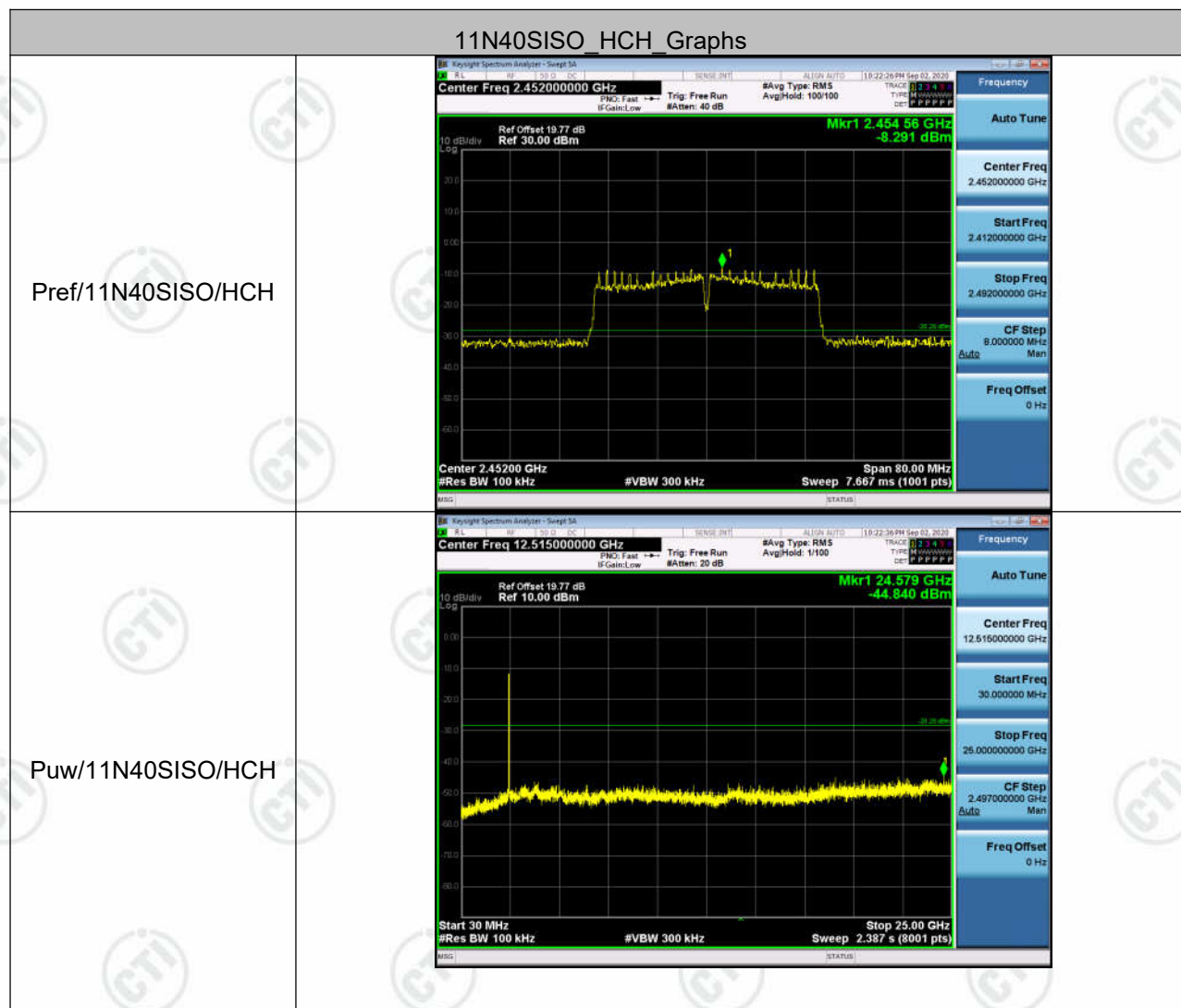












Appendix E): Power Spectral Density

Test Limit

According to §15.247(e),

For digitally modulated systems, the power spectral density conducted from the intentional radiator to the antenna shall not be greater than 8 dBm in any 3 kHz band during any time interval of continuous transmission.

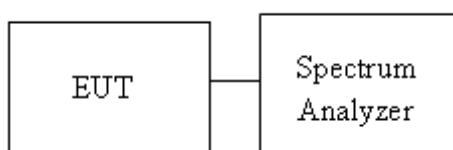
| | |
|-------|--|
| Limit | <input checked="" type="checkbox"/> Antenna not exceed 6 dBi: 8dBm <input type="checkbox"/> Antenna with DG greater than 6 dBi: [Limit = 8 – (DG – 6)] <input type="checkbox"/> Point-to-point operation: |
|-------|--|

Test Procedure

Test method Refer as KDB 558074 D01.

1. The EUT RF output connected to the spectrum analyzer by RF cable.
2. Setting maximum power transmit of EUT
3. SA set RBW = 3kHz, VBW = 30kHz, Span = 1.5 times DTS Bandwidth (6 dB BW), Detector = Peak, Sweep Time = Auto and Trace = Max hold.
4. The path loss was compensated to the results for each measurement by SA.
5. Mark the maximum level.
6. Measure and record the result of power spectral density. in the test report.

Test Setup



Result Table

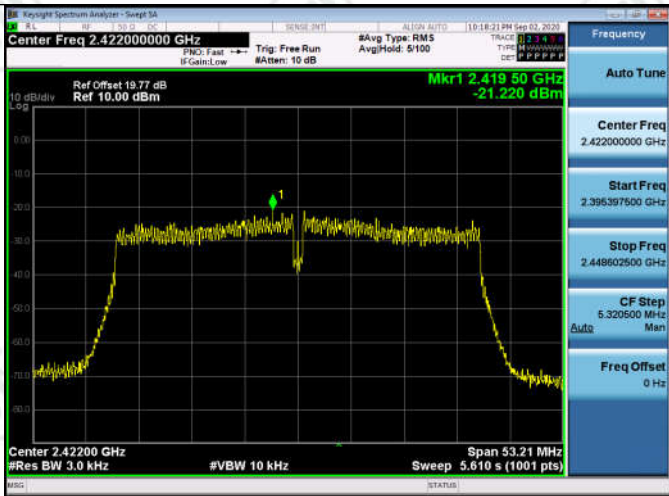
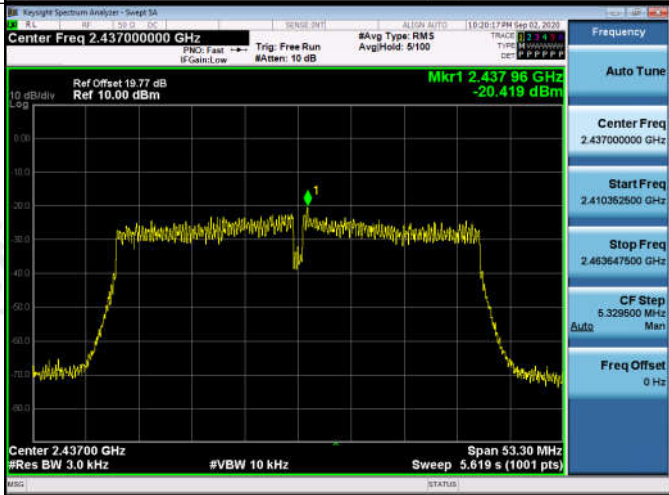
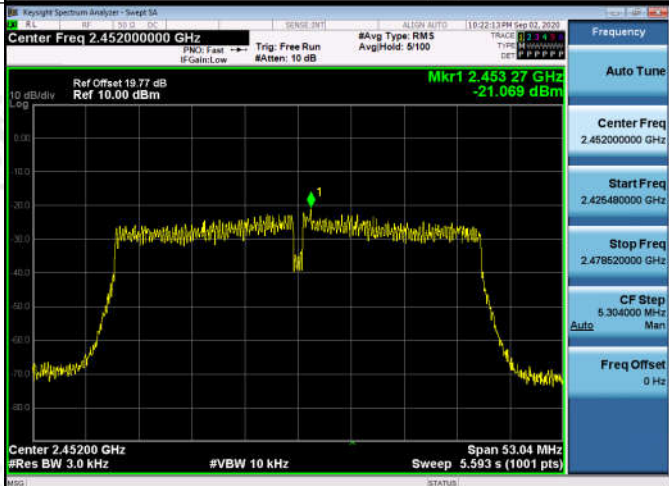
| Mode | Channel | Power Spectral Density [dBm] | Verdict |
|-----------|---------|------------------------------|---------|
| 11B | LCH | -10.253 | PASS |
| 11B | MCH | -10.023 | PASS |
| 11B | HCH | -8.931 | PASS |
| 11G | LCH | -16.027 | PASS |
| 11G | MCH | -16.429 | PASS |
| 11G | HCH | -16.176 | PASS |
| 11N20SISO | LCH | -16.155 | PASS |
| 11N20SISO | MCH | -17.625 | PASS |
| 11N20SISO | HCH | -17.406 | PASS |
| 11N40SISO | LCH | -21.220 | PASS |
| 11N40SISO | MCH | -20.419 | PASS |
| 11N40SISO | HCH | -21.069 | PASS |

Test Graph

| Graphs | |
|---------|--|
| 11B/LCH | <p>Key parameters for 11B/LCH:</p> <ul style="list-style-type: none"> Center Freq: 2.41200000 GHz Span: 12.11 MHz Mkr1: 2.411 298 GHz, -10.253 dBm Ref Offset: 19.5 dB, Ref: 10.00 dBm #Res BW: 3.0 kHz, #VBW: 10 kHz Sweep: 1.277 s (1001 pts) |
| 11B/MCH | <p>Key parameters for 11B/MCH:</p> <ul style="list-style-type: none"> Center Freq: 2.43700000 GHz Span: 13.55 MHz Mkr1: 2.437 691 GHz, -10.023 dBm Ref Offset: 19.77 dB, Ref: 10.00 dBm #Res BW: 3.0 kHz, #VBW: 10 kHz Sweep: 1.429 s (1001 pts) |
| 11B/HCH | <p>Key parameters for 11B/HCH:</p> <ul style="list-style-type: none"> Center Freq: 2.46200000 GHz Span: 12.82 MHz Mkr1: 2.461 308 GHz, -8.931 dBm Ref Offset: 19.77 dB, Ref: 10.00 dBm #Res BW: 3.0 kHz, #VBW: 10 kHz Sweep: 1.352 s (1001 pts) |

| | |
|---------|--|
| 11G/LCH |  |
| 11G/MCH |  |
| 11G/HCH |  |

| | |
|---------------|--|
| 11N20SISO/LCH |  |
| 11N20SISO/MCH |  |
| 11N20SISO/HCH |  |

| | |
|---------------|--|
| 11N40SISO/LCH |  |
| 11N40SISO/MCH |  |
| 11N40SISO/HCH |  |

Appendix F): Antenna Requirement

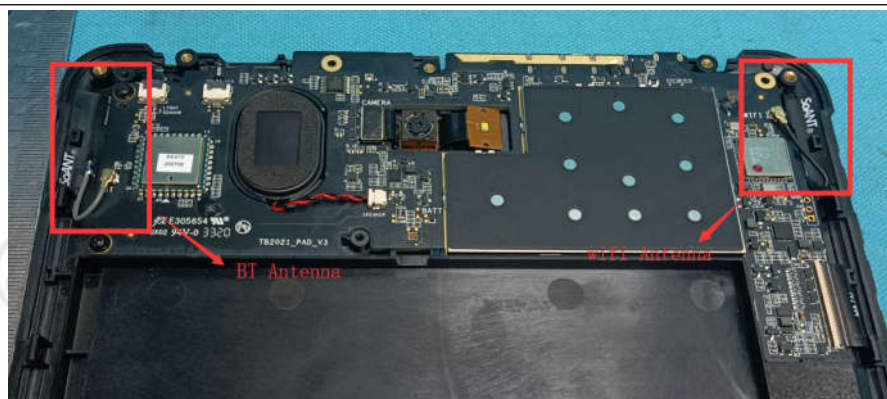
15.203 requirement:

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:

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.

EUT Antenna:



The antenna is integrated on the main PCB and no consideration of replacement. The best case gain of the antenna is 2.13dBi.

Appendix G): AC Power Line Conducted Emission

| Test Procedure: | <p>Test frequency range :150KHz-30MHz</p> <ol style="list-style-type: none">1) The mains terminal disturbance voltage test was conducted in a shielded room.2) The EUT was connected to AC power source through a LISN 1 (Line Impedance Stabilization Network) which provides a 50Ω/50μH + 5Ω linear impedance. The power cables of all other units of the EUT were connected to a second LISN 2, which was bonded to the ground reference plane in the same way as the LISN 1 for the unit being measured. A multiple socket outlet strip was used to connect multiple power cables to a single LISN provided the rating of the LISN was not exceeded.3) The tabletop EUT was placed upon a non-metallic table 0.8m above the ground reference plane. And for floor-standing arrangement, the EUT was placed on the horizontal ground reference plane,4) The test was performed with a vertical ground reference plane. The rear of the EUT shall be 0.4 m from the vertical ground reference plane. The vertical ground reference plane was bonded to the horizontal ground reference plane. The LISN 1 was placed 0.8 m from the boundary of the unit under test and bonded to a ground reference plane for LISNs mounted on top of the ground reference plane. This distance was between the closest points of the LISN 1 and the EUT. All other units of the EUT and associated equipment was at least 0.8 m from the LISN 2.5) In order to find the maximum emission, the relative positions of equipment and all of the interface cables must be changed according to ANSI C63.10 on conducted measurement. | | | | | | | | | | | | | | |
|-----------------------|---|-----------------------|--------------|--|------------|---------|----------|-----------|-----------|-------|----|----|------|----|----|
| Limit: | <table><tr><th rowspan="2">Frequency range (MHz)</th><th colspan="2">Limit (dBμV)</th></tr><tr><th>Quasi-peak</th><th>Average</th></tr><tr><td>0.15-0.5</td><td>66 to 56*</td><td>56 to 46*</td></tr><tr><td>0.5-5</td><td>56</td><td>46</td></tr><tr><td>5-30</td><td>60</td><td>50</td></tr></table> <p>* The limit decreases linearly with the logarithm of the frequency in the range 0.15 MHz to 0.50 MHz.</p> <p>NOTE : The lower limit is applicable at the transition frequency</p> | Frequency range (MHz) | Limit (dBμV) | | Quasi-peak | Average | 0.15-0.5 | 66 to 56* | 56 to 46* | 0.5-5 | 56 | 46 | 5-30 | 60 | 50 |
| Frequency range (MHz) | Limit (dBμV) | | | | | | | | | | | | | | |
| | Quasi-peak | Average | | | | | | | | | | | | | |
| 0.15-0.5 | 66 to 56* | 56 to 46* | | | | | | | | | | | | | |
| 0.5-5 | 56 | 46 | | | | | | | | | | | | | |
| 5-30 | 60 | 50 | | | | | | | | | | | | | |

Measurement Data

An initial pre-scan was performed on the live and neutral lines with peak detector.

Quasi-Peak and Average measurement were performed at the frequencies with maximized peak emission were detected.