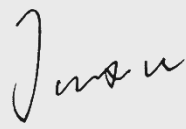
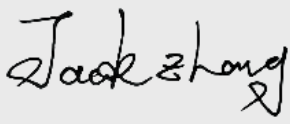


Test report No:
2390387R-RF-US-DFS-P09V04



FCC & ISED TEST REPORT

| | |
|--|---|
| Product Name | POS |
| Trademark | Elo |
| Model and /or type reference | EMC-M100 |
| FCC ID | RBWEMCM100 |
| IC | 10757B-EMCM100 |
| Applicant's name / address | Elo Touch Solutions, Inc 670 N. McCarthy Blvd., Suite 100, Milpitas, CA 95035, USA. |
| Test method requested, standard | 47 CFR FCC Part 15 (Section 15.407) RSS-Gen Issue 5 RSS-247 Issue 3 |
| Verdict Summary | IN COMPLIANCE |
| Tested By (name / position & signature) | Jun Xu/ Project Engineer  |
| Approved by (name / position & signature) | Jack Zhang/ Manager  |
| Date of issue | 2024-05-23 |
| Report Version | V1.0 |
| Report template No | Template_Part 15E-DFS-RF-V1.0 |

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COMPETENCES AND GUARANTEES

DEKRA is a testing laboratory competent to carry out the tests described in this report.

In order to assure the traceability to other national and international laboratories, DEKRA has a calibration and maintenance program for its measurement equipment.

DEKRA guarantees the reliability of the data presented in this report, which is the result of the measurements and the tests performed to the item under test on the date and under the conditions stated in the report and it is based on the knowledge and technical facilities available at DEKRA at the time of performance of the test.

DEKRA is liable to the client for the maintenance of the confidentiality of all information related to the item under test and the results of the test.

The results presented in this Test Report apply only to the particular item under test established in this document.

IMPORTANT: No parts of this report may be reproduced or quoted out of context, in any form or by any means, except in full, without the previous written permission of DEKRA.

GENERAL CONDITIONS

| | |
|----------------------|--|
| Test Location | No. 99, Hongye Road, Suzhou Industrial Park Suzhou, 215006, P.R. China |
| Date(receive sample) | Dec. 26, 2023 |
| Date (start test) | Dec. 29, 2023 |
| Date (finish test) | Feb. 22, 2024 |

1. This report is only referred to the item that has undergone the test.
2. This report does not constitute or imply on its own an approval of the product by the Certification Bodies or Competent Authorities.
3. This document is only valid if complete; no partial reproduction can be made without previous written permission of DEKRA.
4. This test report cannot be used partially or in full for publicity and/or promotional purposes without previous written permission of DEKRA.

ENVIRONMENTAL CONDITIONS

The climatic conditions during the tests are within the limits specified by the manufacturer for the operation of the EUT and the test equipment. The climatic conditions during the tests were within the following limits:

| | |
|-----------------------|---------------|
| Ambient temperature | 15 °C – 35 °C |
| Relative Humidity air | 30% - 60% |

If explicitly required in the basic standard or applied product / product family standard the climatic values are recorded and documented separately in this test report.

POSSIBLE TEST CASE VERDICTS

| | |
|---|-----------------|
| Test case does not apply to test object | N/A |
| Test object does meet requirement | P (Pass) / PASS |
| Test object does not meet requirement | F (Fail) / FAIL |
| Not measured | N/M |

ABBREVIATIONS

For the purposes of the present document, the following abbreviations apply:

| | |
|-------|-------------------------------|
| EUT | : Equipment Under Test |
| QP | : Quasi-Peak |
| CAV | : CISPR Average |
| AV | : Average |
| CDN | : Coupling Decoupling Network |
| SAC | : Semi-Anechoic Chamber |
| OATS | : Open Area Test Site |
| BW | : Bandwidth |
| AM | : Amplitude Modulation |
| PM | : Pulse Modulation |
| HCP | : Horizontal Coupling Plane |
| VCP | : Vertical Coupling Plane |
| U_N | : Nominal voltage |
| Tx | : Transmitter |
| Rx | : Receiver |
| N/A | : Not Applicable |
| N/M | : Not Measured |

DOCUMENT HISTORY

| Report No. | Version | Description | Issued Date |
|---------------------------|---------|--------------------------|-------------|
| 2390387R-RF-US-DFS-P09V04 | V1.0 | Initial issue of report. | 2024-05-23 |
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |

REMARKS AND COMMENTS

1. The equipment under test (EUT) does meet the essential requirements of the stated standard(s)/test(s).
2. These test results on a sample of the device are for the purpose of demonstrating Compliance with 47 CFR FCC Part 15 (Section 15.407 Clauses (h)), RSS-247 Issue 3 Clauses 6.3.
3. The measurement result is considered in conformance with the requirement if it is within the prescribed limit, It is not necessary to account the uncertainty associated with the measurement result.
4. The test results presented in this report relate only to the object tested.
5. The test report shall not be reproduced without the written approval of DEKRA Testing and Certification (Suzhou) Co., Ltd.
6. This report will not be used for social proof function in China market.
7. DEKRA declines any responsibility with the following test data provided by customer that may affect the validity of result:
 - Chapter 1.1 General Description of the Item(s);
 - Chapter 1.2 Antenna Informaion.
 - Chapter 1.3 Channel List.
 - Chapter 1.4 Data Rate.

USED EQUIPMENT

Dynamic Frequency Selection (DFS) / TR-8

| Instrument | Manufacturer | Model No. | Serial No. | Cal. Date | Next Cal. Date | Firmware Version | Software version |
|---|--------------|---------------|------------|------------|----------------|------------------|------------------|
| Wireless Connectivity Tester | R&S | CMW 270 | 102593 | 2023.05.20 | 2024.05.19 | V 4.0.60 | N/A |
| Coaxial Cable | N/A | N/A | 2477 | 2023.06.08 | 2024.06.07 | N/A | N/A |
| Coaxial Cable | N/A | N/A | 2478 | 2023.06.08 | 2024.06.07 | N/A | N/A |
| High and low temperature and fast temperature change test box | ASTUOD | ASTD-FBT-225K | N/A | 2023.05.20 | 2024.05.19 | N/A | N/A |
| Temperature/Humidity Meter | RTS | RTS-8S | RF08 | 2023.08.25 | 2024.08.24 | N/A | N/A |
| Test system | | | | | | | |
| Instrument | Manufacturer | Model No. | Serial No. | Cal. Date | Next Cal. Date | Firmware Version | Software version |
| MAX Signal Analyzer | Keysight | N9010A | MY48030494 | 2023.11.08 | 2024.11.07 | A.14.03 | N/A |
| RF Control Unit | Tonscend | JS0806-2 | 22G8060594 | 2023.02.04 | 2024.02.03 | N/A | N/A |
| RF Control Unit | Tonscend | JS0806-2 | 22G8060594 | 2024.01.31 | 2025.01.30 | N/A | N/A |
| MXG-B RF Vector Signal Generator | Keysight | N5182B | MY61252529 | 2023.05.20 | 2024.05.19 | B.01.96 | N/A |
| Frequency extender for EXG or MXG | Keysight | N5182BX07 | MY59362500 | 2023.05.20 | 2024.05.19 | N/A | N/A |
| EXG-B MW Analog Signal Generator | Keysight | N5173B | MY61252566 | 2023.08.26 | 2024.08.25 | B.01.95 | N/A |
| Test Software | Tonscend | TS1120 | JS1120-3 | N/A | N/A | N/A | V3.0.22 |

UNCERTAINTY

Uncertainties have been calculated according to the DEKRA internal document. The reported expanded uncertainties are based on a standard uncertainty multiplied by a coverage factor of $k=2$, providing a level of confidence of approximately 95%.

| Test item | Uncertainty |
|------------------------------------|---------------|
| Time | ± 1 ms |
| RF Antenna Port Conducted Emission | ± 1.13 dB |
| Occupied Bandwidth | ± 279 Hz |
| Power Spectral Density | ± 1.13 dB |
| Frequency Stability | ± 100 Hz |

1 GENERAL INFORMATION

1.1 General Description of the Item(s)

| | |
|----------------------------|--|
| Product Name | POS |
| Model No. | EMC-M100 |
| Trademark. | Elo |
| FCC ID..... | RBWEMCM100 |
| IC | 10757B-EMCM100 |
| Hardware Version..... | V1.00 |
| Software Version | T14 |
| Manufacturer | Elo Touch Solutions, Inc |
| Manufacturer Address | 670 N. McCarthy Blvd., Suite 100, Milpitas, CA 95035, USA. |
| Factory..... | ShuoGe Intelligent Technology Co.,Ltd. |
| Factory address..... | Room 308-310, Building 1, No.2 8th Road, Baiyang Street, Qiantang New Area, Hangzhou City, Zhejiang Province, P.R. China(310018) |
| Test Sample SN | #1 |

Note: This report is based on 2390387R-RF-US-DFS-P09V02. The customer stated that the new EUT has removed the WCDMA and LTE modules and the rest are identical. We verified the worst channel test on the new EUT and the test results did not get worse. Therefore, this report reuses the test data of 2390387R-RF-US-DFS-P09V02.

| | | | | | | |
|--------------------------------------|--|--|-------------------------------------|-----------------|-------------------------------------|-----------------|
| Wireless specification | WIFI For FCC | | | | | |
| Transmit modes..... | <input checked="" type="checkbox"/> | 802.11a | <input checked="" type="checkbox"/> | 802.11n(20MHz) | <input checked="" type="checkbox"/> | 802.11n(40MHz) |
| | <input checked="" type="checkbox"/> | 802.11ac(20MHz) | <input checked="" type="checkbox"/> | 802.11ac(40MHz) | <input checked="" type="checkbox"/> | 802.11ac(80MHz) |
| Frequency Range | 802.11a/n/ac(20MHz):5180MHz~5240Mz 802.11n/ac(40MHz):5190MHz~5230Mz 802.11ac(80MHz):5210Mz | | | | | |
| | <input checked="" type="checkbox"/> | <input type="checkbox"/> Outdoor access point | | | | |
| | | <input type="checkbox"/> RF Module | | | | |
| | | <input type="checkbox"/> Fixed point-to-point AP | | | | |
| | | <input checked="" type="checkbox"/> Mobile and Portable Client | | | | |
| | <input checked="" type="checkbox"/> | 802.11a/n/ac(20MHz):5260MHz~5320Mz 802.11n/ac(40MHz):5270MHz~5310Mz 802.11ac(80MHz):5290Mz | | | | |
| <input checked="" type="checkbox"/> | 802.11a/n/ac(20MHz):5500MHz~5700MHz 802.11n/ac(40MHz):5510MHz~5670Mz 802.11ac(80MHz):5530~5610Mz | | | | | |
| <input checked="" type="checkbox"/> | 802.11a/n/ac(20MHz):5745MHz~5825MHz 802.11n/ac(40MHz):5755MHz~5805Mz 802.11ac(80MHz):5775Mz | | | | | |
| DFS | <input type="checkbox"/> Master | | | | | |
| | <input checked="" type="checkbox"/> Slave | | | | | |
| Type of Modulation & Data Rate | Refer to Clause 1.4 | | | | | |

| | | | | | | |
|---------------------------------------|---|--|-------------------------------------|-----------------|-------------------------------------|-----------------|
| Number of channels | 802.11a/n/ac(20MHz): 24 802.11n/ac(40MHz): 11 802.11ac(80MHz): 5 | | | | | |
| Wireless specification | WIFI For ISED | | | | | |
| Transmit modes | <input checked="" type="checkbox"/> | 802.11a | <input checked="" type="checkbox"/> | 802.11n(20MHz) | <input checked="" type="checkbox"/> | 802.11n(40MHz) |
| | <input checked="" type="checkbox"/> | 802.11ac(20MHz) | <input checked="" type="checkbox"/> | 802.11ac(40MHz) | <input checked="" type="checkbox"/> | 802.11ac(80MHz) |
| Frequency Range | 802.11a/n/ac(20MHz):5180MHz~5240Mz 802.11n/ac(40MHz):5190MHz~5230Mz 802.11ac(80MHz):5210Mz | | | | | |
| | <input checked="" type="checkbox"/> | <input type="checkbox"/> | Outdoor access point | | | |
| | | <input type="checkbox"/> | RF Module | | | |
| | | <input type="checkbox"/> | Fixed point-to-point AP | | | |
| | | <input checked="" type="checkbox"/> | Mobile and Portable Client | | | |
| | <input checked="" type="checkbox"/> | 802.11a/n/ac(20MHz):5260MHz~5320Mz 802.11n/ac(40MHz):5270MHz~5310Mz 802.11ac(80MHz):5290Mz | | | | |
| <input checked="" type="checkbox"/> | 802.11a/n/ac(20MHz):5500MHz~5580MHz, 5660MHz~5700MHz 802.11n/ac(40MHz):5510MHz~5550MHz, 5670Mz 802.11ac(80MHz):5530, 5610Mz | | | | | |
| <input checked="" type="checkbox"/> | 802.11a/n/ac(20MHz):5745MHz~5825MHz 802.11n/ac(40MHz):5755MHz~5805Mz 802.11ac(80MHz):5775Mz | | | | | |
| DFS | <input type="checkbox"/> Master | | | | | |
| | <input checked="" type="checkbox"/> Slave | | | | | |
| Type of Modulation & Data Rate : | Refer to Clause 1.4 | | | | | |
| Number of channels | 802.11a/n/ac(20MHz): 21 802.11n/ac(40MHz): 11 802.11ac(80MHz): 4 | | | | | |

| | | | | | | |
|--------------------------|---|--------------------------------|--|--|--|--|
| Rated power supply | Voltage and Frequency | | | | | |
| | <input type="checkbox"/> | AC: 220 - 240 V, 50/60 Hz | | | | |
| | <input type="checkbox"/> | AC: 100 - 240 V, 50/60 Hz | | | | |
| | <input type="checkbox"/> | DC: 24 Vdc | | | | |
| | <input type="checkbox"/> | Poe: | | | | |
| | <input checked="" type="checkbox"/> | Adapter: | | | | |
| Adapter Model | UES45LCP-SPC | | | | | |
| | Input: 100-240V ~ 50/60Hz,1.3A Output: 5.0V/3.0A,15.0W; 9.0V/3.0A, 27.0W; 12.0V/3.0A,36.0W; 15V/3.0A,45W; 20V/2.25A,45W Max | | | | | |
| Mounting position | <input type="checkbox"/> | Tabletop equipment | | | | |
| | <input type="checkbox"/> | Wall/Ceiling mounted equipment | | | | |
| | <input checked="" type="checkbox"/> | Hand-held/Portable equipment | | | | |
| | <input type="checkbox"/> | Other: | | | | |

1.2 Antenna Information

| | | | |
|-----------------------------------|-------------------------------------|---|--|
| Antenna model / type number | N/A | | |
| Antenna serial number | N/A | | |
| Antenna Delivery | <input checked="" type="checkbox"/> | 1TX + 1RX | |
| | <input checked="" type="checkbox"/> | 2TX + 2RX | |
| Antenna technology..... | <input checked="" type="checkbox"/> | SISO | |
| | <input checked="" type="checkbox"/> | MIMO | <input checked="" type="checkbox"/> CDD <input type="checkbox"/> Beam-forming |
| Antenna Type | <input type="checkbox"/> | External | <input type="checkbox"/> Dipole |
| | | | <input type="checkbox"/> Sectorized |
| | <input checked="" type="checkbox"/> | Internal | <input type="checkbox"/> PIFA |
| | | | <input checked="" type="checkbox"/> FPC |
| | | | <input type="checkbox"/> Others..... |
| SISO Antenna Gain..... | Antenna1: | 5150-5250: -0.05 dBi 5250-5350: 1.37 dBi 5470-5725: 2.58 dBi 5725-5850: 1.30 dBi | |
| | Antenna2: | 5150-5250: 2.81 dBi 5250-5350: 2.59 dBi 5470-5725: 2.67 dBi 5725-5850: 2.89 dBi | |
| CDD directional gain | For Power: | 5150-5250: 2.81 dBi 5250-5350: 2.59 dBi 5470-5725: 2.67 dBi 5725-5850: 2.89 dBi | |
| | For PSD: | 5150-5250: 5.82 dBi 5250-5350: 5.60 dBi 5470-5725: 5.68 dBi 5725-5850: 5.90 dBi | |

1.3 Channel List

For FCC:

| 802.11a/n/ac(20MHz) Working Frequency of Each Channel: | | | | | | | |
|--|-----------|---------|-----------|---------|-----------|---------|-----------|
| Channel | Frequency | Channel | Frequency | Channel | Frequency | Channel | Frequency |
| 36 | 5180 MHz | 40 | 5200 MHz | 44 | 5220 MHz | 48 | 5240 MHz |
| 52 | 5260 MHz | 56 | 5280 MHz | 60 | 5300 MHz | 64 | 5320 MHz |
| 100 | 5500 MHz | 104 | 5520 MHz | 108 | 5540 MHz | 112 | 5550 MHz |
| 116 | 5580 MHz | 120 | 5600 MHz | 124 | 5620 MHz | 128 | 5640 MHz |
| 132 | 5660 MHz | 136 | 5680 MHz | 140 | 5700 MHz | N/A | N/A |
| 149 | 5745 MHz | 153 | 5765 MHz | 157 | 5785 MHz | 161 | 5805 MHz |
| 165 | 5825 MHz | N/A | N/A | N/A | N/A | N/A | N/A |
| 802.11n/ac(40MHz) Working Frequency of Each Channel: | | | | | | | |
| Channel | Frequency | Channel | Frequency | Channel | Frequency | Channel | Frequency |
| 38 | 5190 MHz | 46 | 5230 MHz | 54 | 5270 MHz | 62 | 5310 MHz |
| 102 | 5510 MHz | 110 | 5550 MHz | 118 | 5590 MHz | 126 | 5630 MHz |
| 134 | 5670 MHz | 151 | 5755 MHz | 159 | 5795 MHz | N/A | N/A |
| 802.11ac(80MHz) Working Frequency of Each Channel: | | | | | | | |
| Channel | Frequency | Channel | Frequency | Channel | Frequency | Channel | Frequency |
| 42 | 5210 MHz | 58 | 5290 MHz | 106 | 5530MHz | 122 | 5610 MHz |
| 138 | 5690 MHz | 155 | 5775 MHz | N/A | N/A | N/A | N/A |

For IC:

| IEEE 802.11a/n/ac(20MHz) Working Frequency of Each Channel: | | | | | | | |
|---|-----------|---------|-----------|---------|-----------|---------|-----------|
| Channel | Frequency | Channel | Frequency | Channel | Frequency | Channel | Frequency |
| 36 | 5180 MHz | 40 | 5200 MHz | 44 | 5220 MHz | 48 | 5240 MHz |
| 52 | 5260 MHz | 56 | 5280 MHz | 60 | 5300 MHz | 64 | 5320 MHz |
| 100 | 5500 MHz | 104 | 5520 MHz | 108 | 5540 MHz | 112 | 5560 MHz |
| 116 | 5580 MHz | 132 | 5660 MHz | 136 | 5680 MHz | 140 | 5700 MHz |
| 149 | 5745 MHz | 153 | 5765 MHz | 157 | 5785 MHz | 161 | 5805 MHz |
| 165 | 5825 MHz | N/A | N/A | N/A | N/A | N/A | N/A |
| IEEE 802.11n/ac(40MHz)Working Frequency of Each Channel: | | | | | | | |
| Channel | Frequency | Channel | Frequency | Channel | Frequency | Channel | Frequency |
| 38 | 5190 MHz | 46 | 5230 MHz | 54 | 5270 MHz | 62 | 5310 MHz |
| 102 | 5510 MHz | 110 | 5550 MHz | 134 | 5670 MHz | 151 | 5755 MHz |
| 159 | 5795 MHz | N/A | N/A | N/A | N/A | N/A | N/A |
| IEEE 802.11ac(80MHz)Working Frequency of Each Channel: | | | | | | | |
| Channel | Frequency | Channel | Frequency | Channel | Frequency | Channel | Frequency |
| 42 | 5210 MHz | 58 | 5290 MHz | 106 | 5530 MHz | 155 | 5775 MHz |

1.4 Data Rate

IEEE 802.11a

| Modulation | R | Data Rate(Mb/s) |
|------------|-----|-----------------|
| BPSK | 1/2 | 6 |
| BPSK | 3/4 | 9 |
| QPSK | 1/2 | 12 |
| QPSK | 3/4 | 18 |
| 16-QAM | 1/2 | 24 |
| 16-QAM | 3/4 | 36 |
| 64-QAM | 2/3 | 48 |
| 64-QAM | 3/4 | 54 |

Note : We have evaluated low/mid/high data rate, the blue font is the highest power data rate.

IEEE 802.11n/ac

| Spatial streames | MCS Index | Modulation | R | Data Rate(Mb/s) | | | | | |
|------------------|-----------|------------|-----|-----------------|-------|-------|----------|-------|-------|
| | | | | 400ns GI | | | 800ns GI | | |
| | | | | 20MHz | 40MHz | 80MHz | 20MHz | 40MHz | 80MHz |
| 1 | 0 | BPSK | 1/2 | 7.2 | 15 | 32.5 | 6.5 | 13.5 | 29.3 |
| 1 | 1 | QPSK | 1/2 | 14.4 | 30 | 65 | 13 | 27 | 58.5 |
| 1 | 2 | QPSK | 3/4 | 21.7 | 45 | 97.5 | 19.5 | 40.5 | 87.8 |
| 1 | 3 | 16-QAM | 1/2 | 28.9 | 60 | 130 | 26 | 54 | 117 |
| 1 | 4 | 16-QAM | 3/4 | 43.3 | 90 | 195 | 39 | 81 | 175.5 |
| 1 | 5 | 64-QAM | 2/3 | 57.8 | 120 | 260 | 52 | 108 | 234 |
| 1 | 6 | 64-QAM | 3/4 | 65 | 135 | 292.5 | 58.5 | 121.5 | 263.3 |
| 1 | 7 | 64-QAM | 5/6 | 72.2 | 150 | 325 | 65 | 135 | 292.5 |
| 1 | 8 | 256QAM | 3/4 | 86.7 | 180 | 390 | 78 | 162 | 351 |
| 1 | 9 | 256QAM | 5/6 | N/A | 200 | 433.3 | N/A | 180 | 390 |
| 2 | 0 | BPSK | 1/2 | 14.4 | 30 | 65 | 13 | 27 | 58.6 |
| 2 | 1 | QPSK | 1/2 | 28.8 | 60 | 130 | 26 | 54 | 117 |
| 2 | 2 | QPSK | 3/4 | 43.4 | 90 | 195 | 39 | 81 | 175.6 |
| 2 | 3 | 16-QAM | 1/2 | 57.8 | 120 | 260 | 52 | 108 | 234 |
| 2 | 4 | 16-QAM | 3/4 | 86.6 | 180 | 390 | 78 | 162 | 351 |
| 2 | 5 | 64-QAM | 2/3 | 115.6 | 240 | 520 | 104 | 216 | 468 |
| 2 | 6 | 64-QAM | 3/4 | 130 | 270 | 585 | 117 | 243 | 526.6 |
| 2 | 7 | 64-QAM | 5/6 | 144.4 | 300 | 650 | 130 | 270 | 585 |
| 2 | 8 | 256QAM | 3/4 | 173.4 | 360 | 780 | 156 | 324 | 702 |
| 2 | 9 | 256QAM | 5/6 | N/A | 400 | 866.6 | N/A | 360 | 780 |

Note : We have evaluated low/mid/high data rate, the blue font is the highest power data rate.

Note: The general description of the Item(s), antenna information, data rate and channel list in clause 1 are provided and confirmed by the client.

2 UNII DEVICE DESCRIPTION

The UUT operates in the following band:

1. 5250-5350 MHz
2. 5470-5725 MHz for FCC, 5470-5600 MHz and 5650-5725 MHz for ISSED

The UUT is a Client Device that does not have radar detection capability and ad-hoc function. The highest gain antenna assembly utilized with the EUT has a maximum gain refer to clause 1.2. The 50-ohm Tx/Rx antenna port is connected to the test system to perform conducted tests. TPC is not required since the maximum EIRP is less than 500mW (27dBm).

The UUT utilizes 802.11a/n/ac/ax IP based architecture. Three nominal channel bandwidths, 20 MHz, 40MHz and 80MHz are implemented.

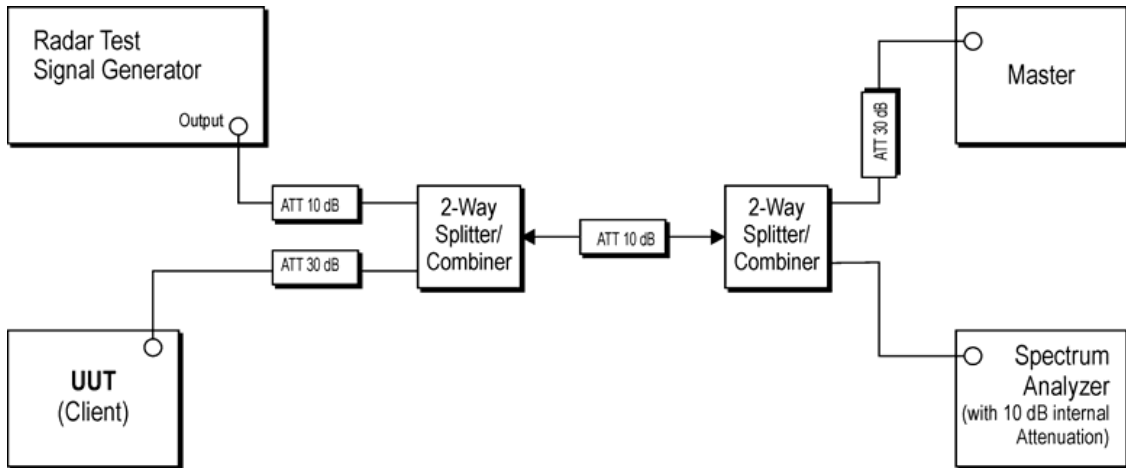
The master device is an ASUS 802.11a/b/g/n/ac/ax Access Point. The ASUS Access Point FCC ID: MSQ-RTAXHP00

The UUT is a client device without radar detection therefore the interference threshold level is not required.

Statement: Information regarding the parameters of the detected Radar Waveforms is not available to the end user.

3 TEST DESCRIPTION

3.1 Test Setup



DFS Set-up Photo: Slave and Spectrum Analyzer



3.2 Limits

According to §15.407(h), 905462 D02 UNII DFS Compliance Procedures New Rules v01, 905462 D03 UNII Clients Without Radar Detection New Rules v01r02 and FCC 14-30 APPENDIX “COMPLIANCE MEASUREMENT PROCEDURES FOR UNLICENSED NATIONAL INFORMATION INFRASTRUCTURE DEVICES OPERATING IN THE 5250-5350 MHz AND 5470-5725MHz BANDS INCORPORATING DYNAMIC FREQUENCY SELECTION”.

Applicability of DFS requirements prior to use of a channel

| Requirement | Operational Mode | | |
|---------------------------------|------------------|----------------------------------|-------------------------------|
| | Master | Client (without radar detection) | Client (with radar detection) |
| Non-Occupancy Period | Yes | Not Required | Yes |
| DFS Detection Threshold | Yes | Not Required | Yes |
| Channel Availability Check Time | Yes | Not Required | Not Required |
| U-NII Detection Bandwidth | Yes | Not Required | Yes |

Applicability of DFS requirements during normal operation

| Requirement | Operational Mode | |
|-----------------------------------|---|----------------------------------|
| | Master or Client (with radar detection) | Client (without radar detection) |
| DFS Detection Threshold | Yes | Not Required |
| Channel Closing Transmission Time | Yes | Yes |
| Channel Move Time | Yes | Yes |
| U-NII Detection Bandwidth | Yes | Not required |

| Additional requirements for devices with multiple bandwidth modes | Master Device or Client with Radar Detection | Client (without radar detection) |
|--|--|---|
| U-NII Detection Bandwidth and Statistical Performance Check | All BW modes must be tested | Not required |
| Channel Move Time and Channel Closing Transmission Time | Test using widest BW mode available | Test using the widest BW mode available for the link |
| All other tests | Any single BW mode | Not required |
| <p>Note: Frequencies selected for statistical performance check (Section 7.8.4) should include several frequencies within the radar detection bandwidth and frequencies near the edge of the radar detection bandwidth. For 802.11 devices it is suggested to select frequencies in all 20 MHz channel blocks and a null frequencies between the bonded 20 MHz channel blocks.</p> | | |

DFS Detection Thresholds for Master Devices and Client Devices With Radar Detection

| Maximum Transmit Power | Value (see note) |
|--|------------------|
| EIRP ≥ 200 milliwatt | -64 dBm |
| EIRP < 200 milliwatt and power spectral density < 10 dBm/MHz | -62 dBm |
| EIRP < 200 milliwatt that do not meet the power spectral density requirement | -62 dBm |
| <p>Note 1: This is the level at the input of the receiver assuming a 0 dBi receive antenna.</p> <p>Note 2: Throughout these test procedures an additional 1 dB has been added to the amplitude of the test transmission waveforms to account for variations in measurement equipment. This will ensure that the test signal is at or above the detection threshold level to trigger a DFS response.</p> <p>Note3: EIRP is based on the highest antenna gain. For MIMO devices refer to KDB Publication 662911 D01.</p> | |

DFS Response requirement values

| Parameter | Value |
|---|--|
| Non-Occupancy Period | Minimum 30 minutes |
| Channel Availability Check Time | 60 Seconds |
| Channel Move Time | 10 Seconds (See Note1) |
| Channel Closing Transmission Time | 200 milliseconds + an aggregate of 60 milliseconds over remaining 10 second period. (See Notes 1 and 2) |
| U-NII Detection Bandwidth | Minimum 100% of the U-NII 99% transmission power bandwidth. See Note 3. |
| <p>Note 1: Channel Move Time and the Channel Closing Transmission Time should be performed with Radar Type 0. The measurement timing begins at the end of the Radar Type 0 burst.</p> <p>Note 2: The Channel Closing Transmission Time is comprised of 200 milliseconds starting at the beginning of the Channel Move Time plus any additional intermittent control signals required to facilitate a Channel move (an aggregate of 60 milliseconds) during the remainder of the 10 second period. The aggregate duration of control signals will not count quiet periods in between transmissions.</p> <p>Note 3: During the U-NII Detection Bandwidth detection test, radar type 0 should be used. For each frequency step the minimum percentage of detection is 90 percent. Measurements are performed with no data traffic.</p> | |

Short Pulse Radar Test Waveforms

Table 5 – Short Pulse Radar Test Waveforms

| Radar Type | Pulse Width (μsec) | PRI (μsec) | Number of Pulses | Minimum Percentage of Successful Detection | Minimum Number of Trials |
|---|--------------------|---|--|--|--------------------------|
| 0 | 1 | 1428 | 18 | See Note 1 | See Note 1 |
| 1 | 1 | Test A: 15 unique PRI values randomly selected from the list of 23 PRI values in Table 5a | Roundup $\left\{ \left(\frac{1}{360} \right) \cdot \left(\frac{19 \cdot 10^6}{PRI_{\mu sec}} \right) \right\}$ | 60% | 30 |
| | | Test B: 15 unique PRI values randomly selected within the range of 518-3066 μ sec, with a minimum increment of 1 μ sec, excluding PRI values selected in Test A | | | |
| 2 | 1-5 | 150-230 | 23-29 | 60% | 30 |
| 3 | 6-10 | 200-500 | 16-18 | 60% | 30 |
| 4 | 11-20 | 200-500 | 12-16 | 60% | 30 |
| Aggregate (Radar Types 1-4) | | | | 80% | 120 |
| Note 1: Short Pulse Radar Type 0 should be used for the detection bandwidth test, channel move time, and channel closing time tests. | | | | | |

A minimum of 30 unique waveforms are required for each of the Short Pulse Radar Types 2 through 4. If more than 30 waveforms are used for Short Pulse Radar Types 2 through 4, then each additional waveform must also be unique and not repeated from the previous waveforms. If more than 30 waveforms are used for Short Pulse Radar Type 1, then each additional waveform is generated with Test B and must also be unique and not repeated from the previous waveforms in Tests A or B.

For example if in Short Pulse Radar Type 1 Test B a PRI of 3066 usec is selected, the number of

pulses would be = Roundup $\left\{ \left(\frac{1}{360} \right) \cdot \left(\frac{19 \cdot 10^6}{3066} \right) \right\} = \text{Roundup}\{17.2\} = 18.$

Table 5a - Pulse Repetition Intervals Values for Test A

| Pulse Repetition Frequency Number | Pulse Repetition Frequency (Pulses Per Second) | Pulse Repetition Interval (Microseconds) |
|-----------------------------------|--|--|
| 1 | 1930.5 | 518 |
| 2 | 1858.7 | 538 |
| 3 | 1792.1 | 558 |
| 4 | 1730.1 | 578 |
| 5 | 1672.2 | 598 |
| 6 | 1618.1 | 618 |
| 7 | 1567.4 | 638 |
| 8 | 1519.8 | 658 |
| 9 | 1474.9 | 678 |
| 10 | 1432.7 | 698 |
| 11 | 1392.8 | 718 |
| 12 | 1355 | 738 |
| 13 | 1319.3 | 758 |
| 14 | 1285.3 | 778 |
| 15 | 1253.1 | 798 |
| 16 | 1222.5 | 818 |
| 17 | 1193.3 | 838 |
| 18 | 1165.6 | 858 |
| 19 | 1139 | 878 |
| 20 | 1113.6 | 898 |
| 21 | 1089.3 | 918 |
| 22 | 1066.1 | 938 |
| 23 | 326.2 | 3066 |

The aggregate is the average of the percentage of successful detections of Short Pulse Radar Types 1-4.

Long Pulse Radar Test Signal

| Radar Waveform | Bursts | Pulses Per Burst | Pulse Width (μsec) | Chirp Width (MHz) | PRI (μsec) | Minimum Percentage of Successful Detection | Minimum Trials |
|----------------|--------|------------------|---------------------------|-------------------|-------------------|--|----------------|
| 5 | 8-20 | 1-3 | 50-100 | 5-20 | 1000-2000 | 80% | 30 |

The parameters for this waveform are randomly chosen. Thirty unique waveforms are required for the long pulse radar test signal. If more than 30 waveforms are used for the long pulse radar test signal, then each additional waveform must also be unique and not repeated from the previous waveforms.

Frequency Hopping Radar Test Signal

| Radar Waveform | Pulse Width (μsec) | PRI (μsec) | Hopping Sequence Length (msec) | Pulses Per Hop | Hopping Rate (kHz) | Minimum Percentage of Successful Detection | Minimum Trials |
|----------------|---------------------------------|-------------------------|--------------------------------|----------------|--------------------|--|----------------|
| 6 | 1 | 333 | 300 | 9 | 0.333 | 70% | 30 |

For the Frequency Hopping Radar Type, the same *Burst* parameters are used for each waveform. The hopping sequence is different for each waveform and a 100-length segment is selected from the hopping sequence defined by the following algorithm:

The first frequency in a hopping sequence is selected randomly from the group of 475 integer frequencies from 5250 – 5724 MHz. Next, the frequency that was just chosen is removed from the group and a frequency is randomly selected from the remaining 474 frequencies in the group. This process continues until all 475 frequencies are chosen for the set. For selection of a random frequency, the frequencies remaining within the group are always treated as equally likely.

3.3 Client Device requirement

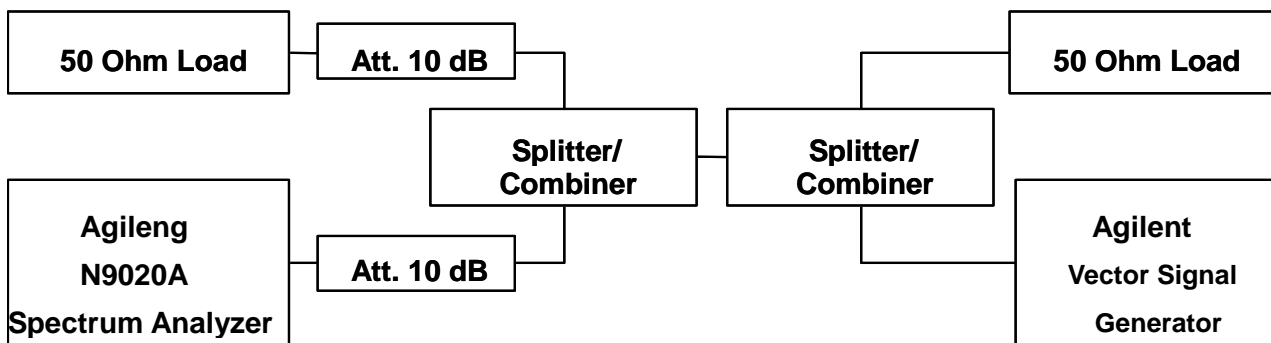
- a) A Client Device will not transmit before having received appropriate control signals from a Master Device.
- b) A Client Device will stop all its transmissions whenever instructed by a Master Device to which it is associated and will meet the Channel Move Time and Channel Closing Transmission Time requirements. The Client Device will not resume any transmissions until it has again received control signals from a Master Device.
- c) If a Client Device is performing In-Service Monitoring and detects a Radar Waveform above the DFS Detection Threshold, it will inform the Master Device. This is equivalent to the Master Device detecting the Radar Waveform and d) through f) of section 5.1.1 apply.
- d) Irrespective of Client Device or Master Device detection the Channel Move Time and Channel Closing Transmission Time requirements remain the same.
- e) The client test frequency must be monitored to ensure no transmission of any type has occurred for 30 minutes. Note: If the client moves with the master, the device is considered compliant if nothing appears in the client non-occupancy period test. For devices that shut down (rather than moving channels), no beacons should appear.

3.4 Radar Waveform Calibration

The following equipment setup was used to calibrate the conducted radar waveform. A spectrum analyzer was used to establish the test signal level for each radar type. During this process there were replace 50ohm terminal from master and client device and no transmissions by either the master or client device. The spectrum analyzer was switched to the zero span (time domain) at the frequency of the radar waveform generator. Peak detection was utilized. The spectrum analyzer resolution bandwidth (RBW) and video bandwidth (VBW) were set to 3MHz and 3 MHz.

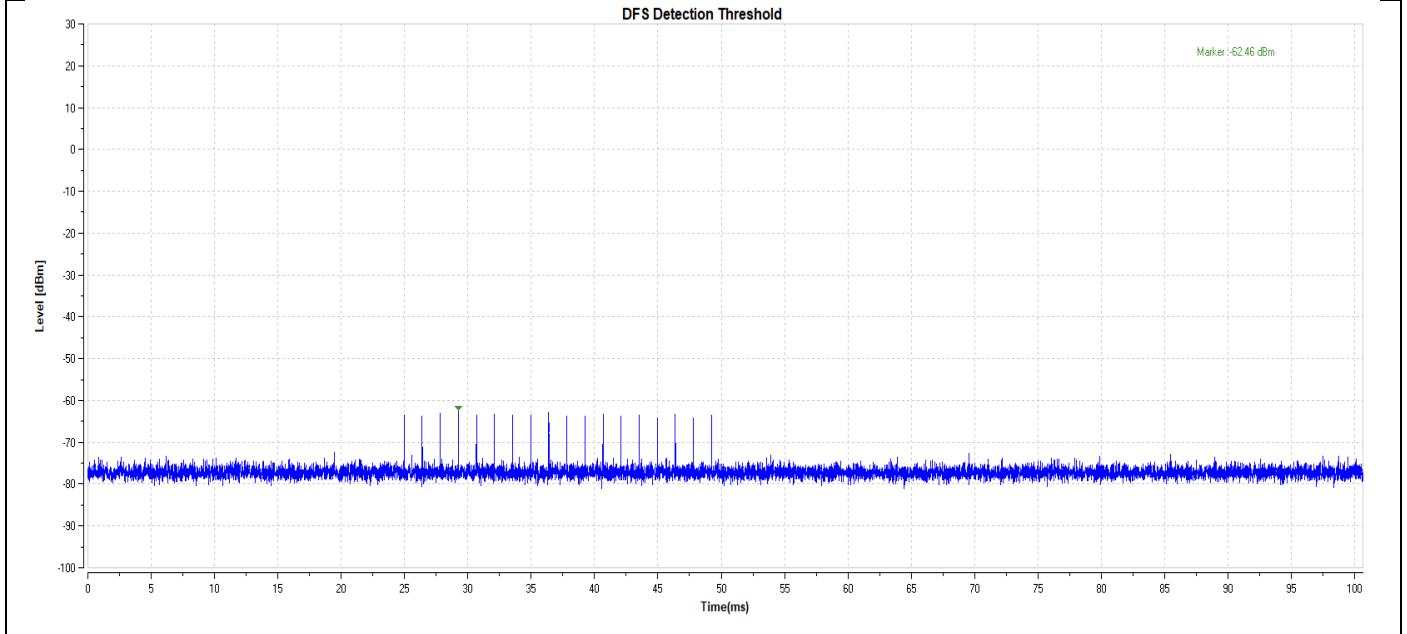
The signal generator amplitude was set so that the power level measured at the spectrum analyzer was -61dBm due to the interference threshold level is not required.

Conducted Calibration Setup

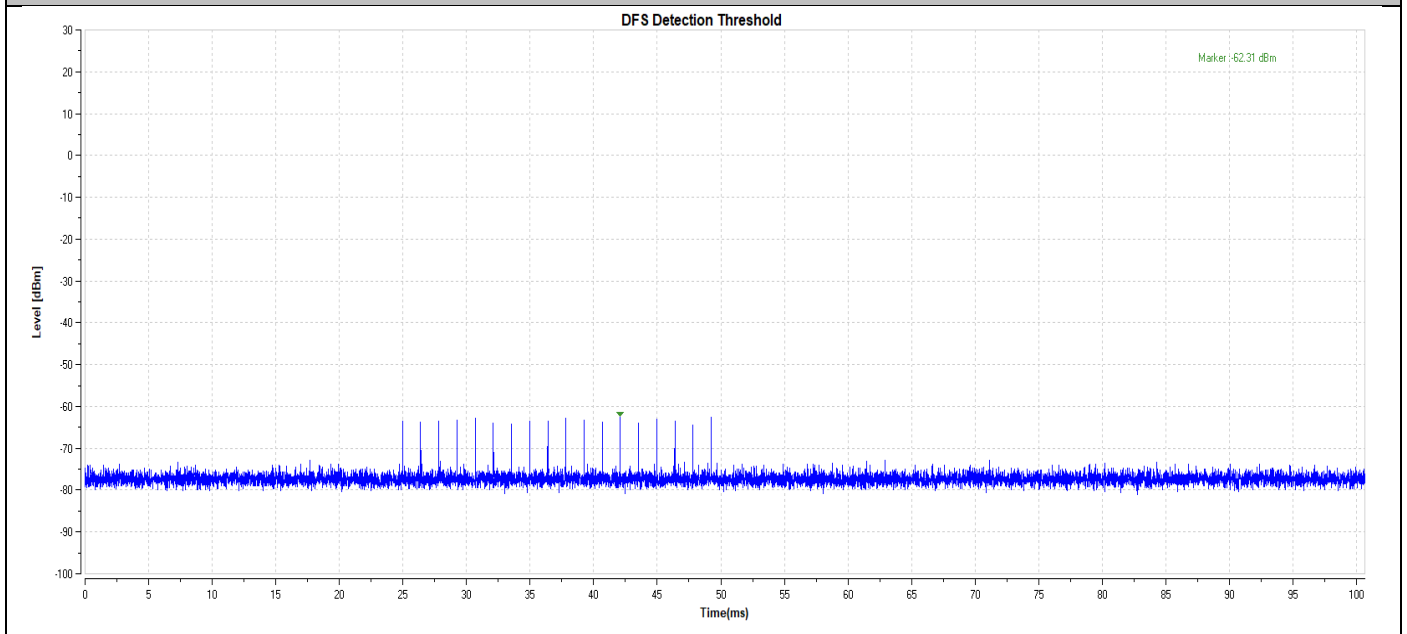


3.5 Radar Waveform Calibration Result

| TestMode | Frequency[dbm] | Radar Type | Result | Limit[dbm] | Verdict |
|------------|----------------|------------|--------|------------|---------|
| 11AC80SISO | 5290 | Type0 | -62.46 | -62.00 | PASS |
| 11AC80SISO | 5530 | Type0 | -62.31 | -62.00 | PASS |



11AC80SISO-5290-Type0-PASS



11AC80SISO-5530-Type0-PASS

4 CHANNEL MOVE TIME ,CHANNEL CLOSING TRANSMISSION TIME AND NON-OCCUPANCY PERIOD

4.1 Test Procedure

These tests define how the following DFS parameters are verified during In-Service Monitoring; Channel Closing Transmission Time and Channel Move Time.

The steps below define the procedure to determine the above mentioned parameters when a radar burst with a level -61dBm is generated on the operating channel of the U-NII device.

A U-NII device operating as a Client device will associate with the Master device at 5500MHz.

During the in-service monitoring detection probability and channel moving tests the system was configured with a streaming video file from the master device (sourced by the PC connected to the master device via an Ethernet interface) to the client device. The streamed file was the "FCC" test file and the client device was using Media Player Classic as required by FCC Part 15 Subpart E.

Observe the transmissions of the EUT at the end of the radar burst on the operating channel for duration greater than 10 seconds. Measure and record the transmissions from the spectrum analyzer during the observation time (Channel Move Time). Compare the channel move time and channel closing transmission time results to the limits defined in the DFS Response requirement values table.

The client and DFS-certified master device are associated, and a movie can be streamed as specified in the DFS Order for a non-occupancy period test

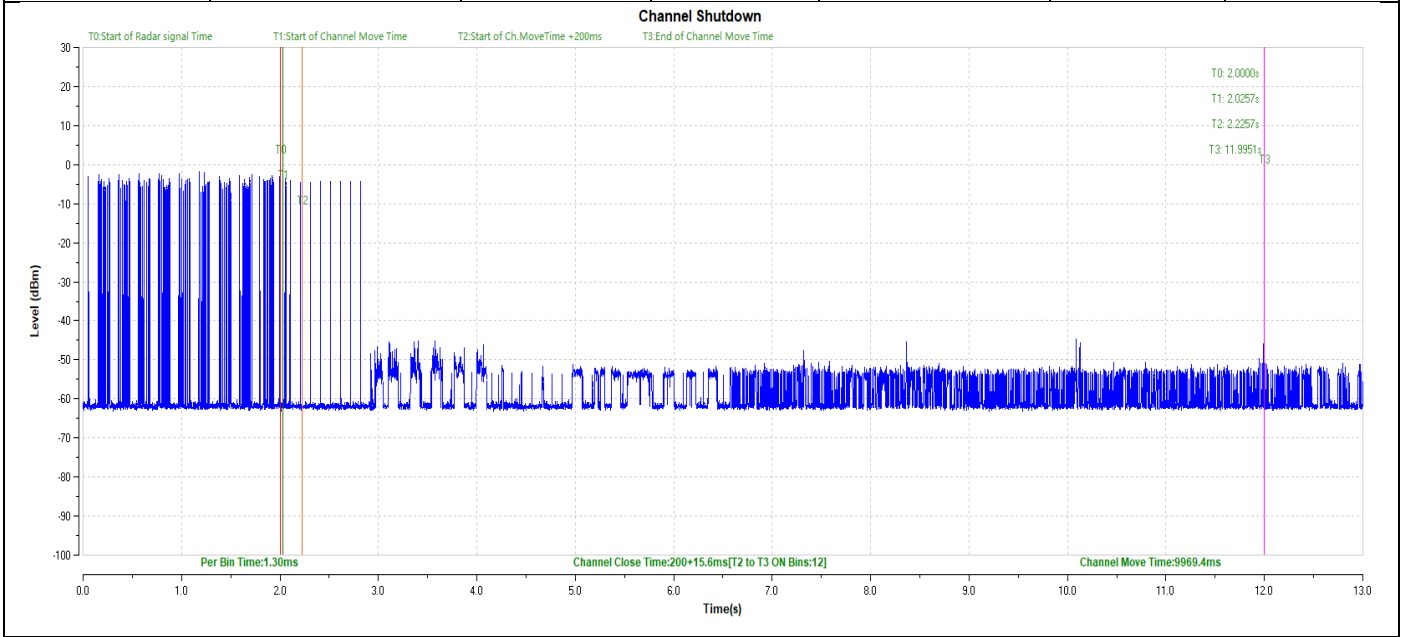
The test frequency has been monitored to ensure no transmission of any type has occurred for 30 minutes. Note: If the client moves with the master, the device is considered compliant if nothing appears in the client non-occupancy period test. For devices that shut down (rather than moving channels), no beacons should appear.

4.2 Test Requirement

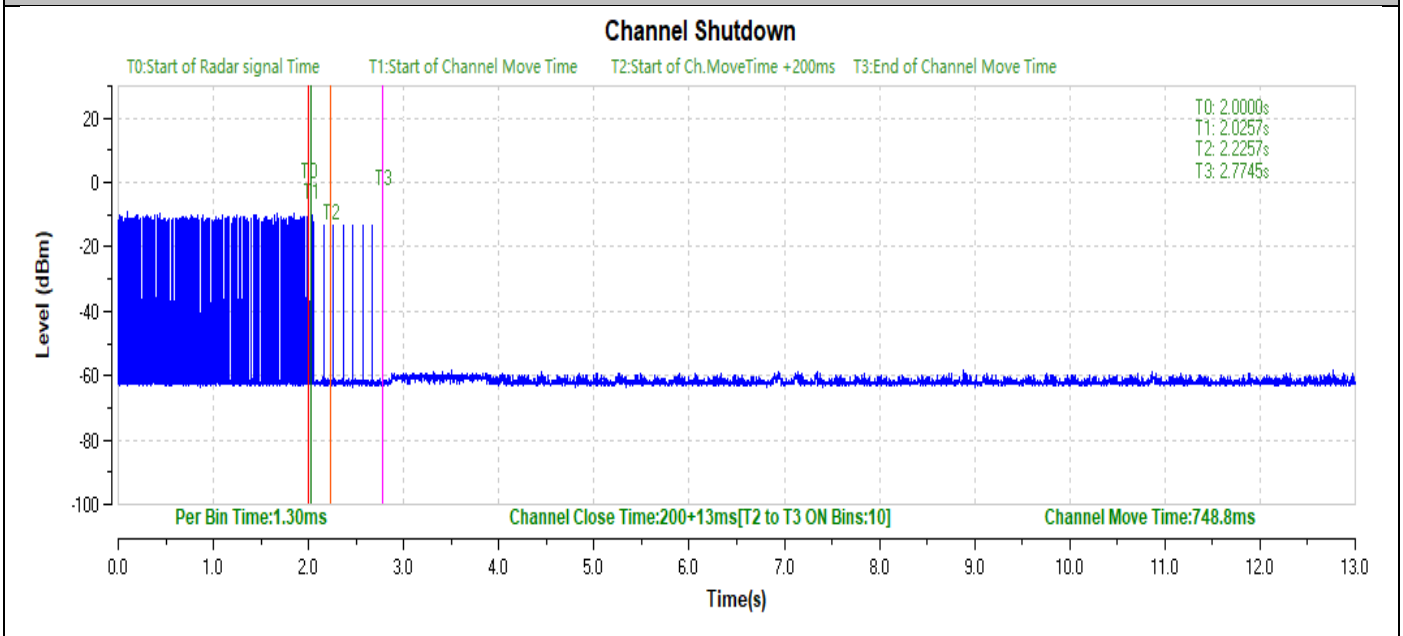
| Parameter | Value |
|-----------------------------------|---|
| Channel Move Time | 10 Seconds |
| Channel Closing Transmission Time | 200 milliseconds + approx. 60 milliseconds over remaining 10 seconds period |
| Non-Occupancy | the device is considered compliant if nothing appears in the client non-occupancy period test |

4.3 Test Result of Channel Move Time , Channel Closing Transmission Time and Non-Occupancy Period

| TestMode | Frequency[MHz] | CCTT[ms] | Limit[ms] | CMT[ms] | Limit[ms] | Verdict |
|------------|----------------|----------|-----------|---------|-----------|---------|
| 11AC80SISO | 5530 | 200+15.6 | 200+60 | 9969.4 | 10000 | PASS |
| 11AC80SISO | 5290 | 200+13 | 200+60 | 748.8 | 10000 | PASS |



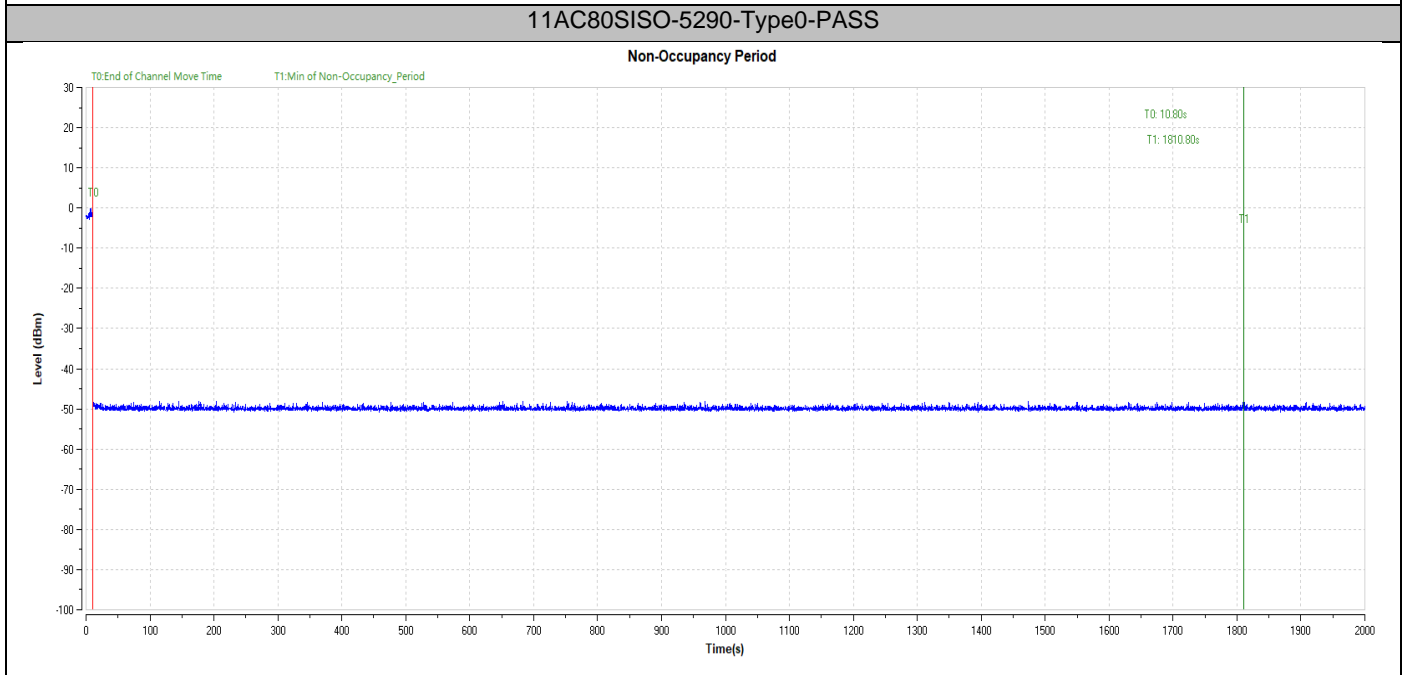
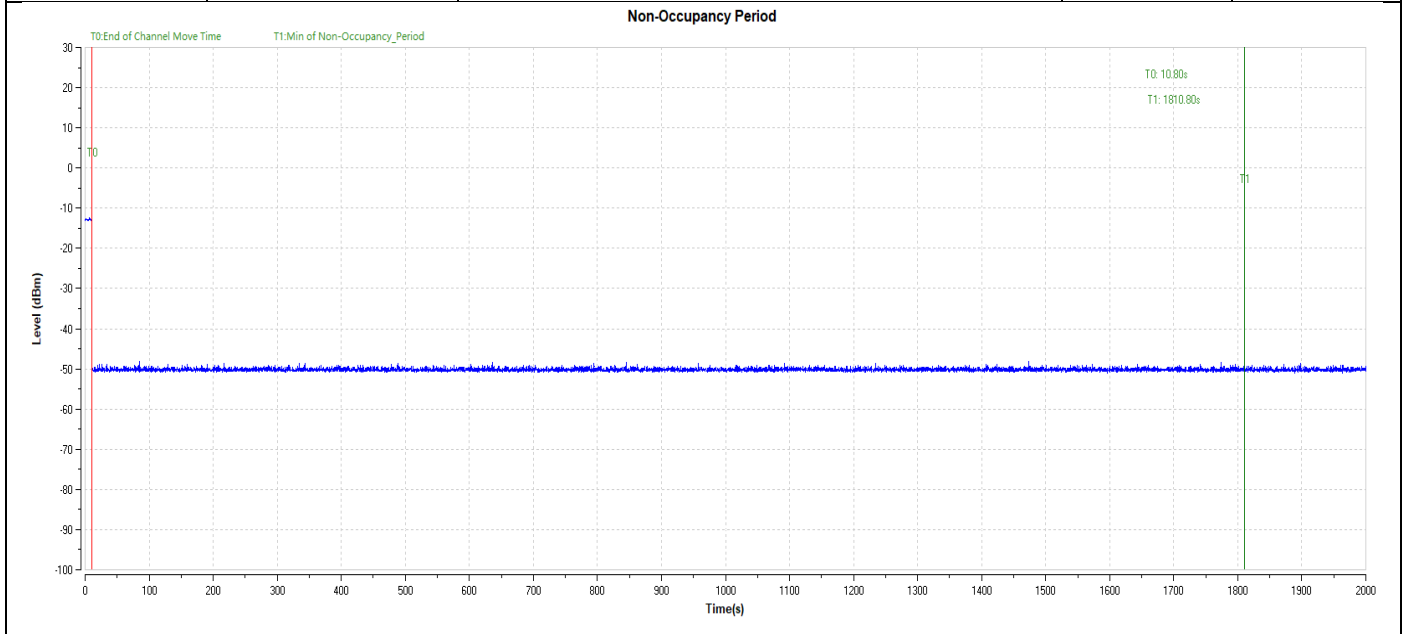
11AC80SISO-5530-Type0-PASS



11AC80SISO-5290-Type0-PASS

Non-Occupancy Period :

| TestMode | Frequency[MHz] | Result | Limit[s] | Verdict |
|------------|----------------|----------------|----------|---------|
| 11AC80SISO | 5530 | see test graph | ≥1800 | PASS |
| 11AC80SISO | 5290 | see test graph | ≥1800 | PASS |



The End