

FCC - TEST REPORT

Report Number : **60.790.19.003.01R01** Date of Issue : April 16, 2019

Model : Connect Hub

Product Type : Connect Hub Gateway

Applicant : Mobile Technologies Inc.

Address : 1050 NE 67th Ave, Hillsboro, OR 97124

Production Facility : Hualun Technology Co., LTD

Address : 3F No. 82-4 Dongshun St. Shulin Dist. New Taipei City, Taiwan

Test Result : ☒ **Positive** ☐ **Negative**

Total pages including Appendices : 35

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2 Description of Equipment Under Test

Description of the Equipment Under Test

| | |
|-----------------------------|--|
| Product: | Connect Hub Gateway |
| Model no.: | Connect Hub |
| FCC ID: | 2AA2X-16500361 |
| Rating: | Adapter input: 100-240V DC 1.0A, 50-60Hz, output:5.2V DC 3.0A Connect Hub input: Max 5.2V DC, Max 5A. Internal Rechargeable Battery:3.7V DC Internal Backup Battery:3V DC |
| Frequency: | 2405MHz-2480MHz (Tx and Rx) |
| Antenna gain: | Internal Chip Antenna: -1.5 dBi External Whip Antenna:2 dBi |
| Number of operated channel: | 16 |
| Modulation: | O-QPSK |

3 Summary of Test Standards

| Test Standards |
|---|
| FCC Part 15 Subpart C 10-1-17 Edition Federal Communications Commission, PART 15 — Radio Frequency Devices, Subpart C — Unintentional Radiators |

All the tests were performed using the procedures from ANSI C63.4(2014) and ANSI C63.10 (2013).

4 Details about the Test Laboratory

Site 1

Company name: TÜV SÜD Hong Kong Ltd.
3/F, West Wing, Lakeside 2,
10 Science Park West Avenue,
Science Park, Shatin, Hong Kong

Site 2

Company name: TÜV SÜD Certification and Testing (China) Co., Ltd. Shenzhen Branch
Building 12&13 Zhiheng Wisdomland Business Park,
Nantou Checkpoint Road 2,
Shenzhen 518052, P.R.China
FCC Registration Number: 502708

| Emission Tests | |
|--|-----------|
| Test Item | Test Site |
| FCC Part 15 Subpart C | |
| FCC Title 47 Part 15.205, 15.209 & 15.247(d) Spurious Radiated Emission | Site 2 |
| FCC Title 47 Part 15.207 Conduct Emission | Site 2 |
| FCC Title 47 Part 15.247(a)(1) 6dB & 99% Bandwidth | Site 2 |
| FCC Title 47 Part 15.247(b) Peak Output Power | Site 2 |
| FCC Title 47 Part 2.1051 & 15.247(d) Spurious Emissions at Antenna Terminals | Site 2 |
| FCC Title 47 Part 15.247(d) 100kHz Bandwidth of band edges | Site 2 |
| FCC Title 47 Part 15.247(e) Power Spectral Density | Site 2 |
| FCC Title 47 Part 15.203 & 15.247(b) Antenna Requirement | Site 2 |

4.1 Test Equipment Site List

Radiated emission Test – Site 1

| DESCRIPTION | MANUFACTURER | MODEL NO. | SERIAL NO. | CAL. DUE DATE |
|-------------------------------------|-----------------|-------------------|-----------------|---------------|
| EMI Test Receiver | Rohde & Schwarz | ESR 26 | 101269 | 2019-7-6 |
| Signal Analyzer | Rohde & Schwarz | FSV40 | 101031 | 2019-7-6 |
| Loop Antenna | Rohde & Schwarz | HFH2-Z2 | 100398 | 2019-7-6 |
| Trilog Super Broadband Test Antenna | Schwarzbeck | VULB 9163 | 707 | 2019-6-28 |
| Horn Antenna | Rohde & Schwarz | HF907 | 102294 | 2019-6-28 |
| Wideband Horn Antenna | Q-PAR | QWH-SL-18-40-K-SG | 12827 | 2019-7-12 |
| Pre-amplifier | Rohde & Schwarz | SCU 18 | 102230 | 2019-7-6 |
| Pre-amplifier | Rohde & Schwarz | SCU 40A | 100432 | 2019-7-6 |
| Attenuator | Agilent | 8491A | MY39264334 | 2019-7-6 |
| 3m Semi-anechoic chamber | TDK | 9X6X6 | ---- | 2020-7-7 |
| Test software | Rohde & Schwarz | EMC32 | Version 9.15.00 | N/A |

Conducted Emission Test – Site 1

| DESCRIPTION | MANUFACTURER | MODEL NO. | SERIAL NO. | CAL. DUE DATE |
|--------------------|-------------------|----------------|----------------|---------------|
| EMI Test Receiver | Rohde & Schwarz | ESR 3 | 101782 | 2019-7-6 |
| LISN | Rohde & Schwarz | ENV4200 | 100249 | 2019-7-6 |
| LISN | Rohde & Schwarz | ENV432 | 101318 | 2019-7-6 |
| LISN | Rohde & Schwarz | ENV216 | 100326 | 2019-7-6 |
| ISN | Rohde & Schwarz | ENY81 | 100177 | 2019-7-6 |
| ISN | Rohde & Schwarz | ENY81-CA6 | 101664 | 2019-7-6 |
| High Voltage Probe | Rohde & Schwarz | TK9420(VT9420) | 9420-584 | 2019-6-30 |
| RF Current Probe | Rohde & Schwarz | EZ-17 | 100816 | 2019-6-30 |
| Attenuator | Shanghai Huaxiang | TS2-26-3 | 080928189 | 2019-7-6 |
| Test software | Rohde & Schwarz | EMC32 | Version9.15.00 | N/A |

20dB & 99% Bandwidth, Peak Output Power, Spurious Emissions at Antenna Terminals, 100kHz Bandwidth of band edges, Power Spectral Density – Site 1

| DESCRIPTION | MANUFACTURER | MODEL NO. | SERIAL NO. | CAL. DUE DATE |
|-------------------------|-----------------|-----------------|---------------|---------------|
| Signal Analyzer | Rohde & Schwarz | FSV40 | 101030 | 2019-7-6 |
| Vector Signal Generator | Rohde & Schwarz | SMU 200A | 105324 | 2019-7-6 |
| RF Switch Module | Rohde & Schwarz | OSP120/OSP-B157 | 101226/100851 | 2019-7-6 |

4.2 Measurement System Uncertainty

Measurement System Uncertainty Emissions

| System Measurement Uncertainty | |
|---|--|
| Items | Extended Uncertainty |
| Uncertainty for Radiated Emission in 3m chamber 9kHz-30MHz | 4.46dB |
| Uncertainty for Radiated Emission in 3m chamber 30MHz-1000MHz | Horizontal: 4.91dB; Vertical: 4.89dB; |
| Uncertainty for Radiated Emission in 3m chamber 1000MHz-25000MHz | Horizontal: 4.80dB; Vertical: 4.79dB; |
| Uncertainty for Conducted Emission at AC Power Line 150kHz-30MHz | 3.21dB |
| Uncertainty for Conducted RF Power | 2.13dB |
| Uncertainty for frequency test | 0.6×10^{-7} |

5 Summary of Test Results

| Emission Tests | | | | |
|--|-------|-------------------------------------|--------------------------|--------------------------|
| FCC Part 15 Subpart C | | | | |
| Test Condition | Pages | Test Result | | |
| | | Pass | Fail | N/A |
| FCC Title 47 Part 15.205, 15.209 & 15.247(d) Spurious Radiated Emission | 10-13 | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| FCC Title 47 Part 15.207 Conduct Emission | 14-15 | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| FCC Title 47 Part 15.247(a)(2) 6dB & 99% Bandwidth | 16-18 | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| FCC Title 47 Part 15.247(b) Peak Output Power | 19-21 | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| FCC Title 47 Part 2.1051 & 15.247(d) Spurious Emissions at Antenna Terminals | 22-27 | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| FCC Title 47 Part 15.247(d) 100kHz Bandwidth of band edges | 28-30 | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| FCC Title 47 Part 15.247(e) Power Spectral Density | 31-33 | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| FCC Title 47 Part 15.203 & 15.247(b) Antenna Requirement | 34 | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |

6 General Remarks

Remarks

This submittal(s) (test report) is intended for **FCC ID: 2AA2X-16500361**, complies with Section 15.203, 15.205, 15.207, 15.209, 15.247 of the FCC Part 15, Subpart C rules for the DTS grant

The TX and RX range is 2405MHz-2480MHz.

EUT has an internal antenna and an external, as manufacture declared, there is an RF switch that selects the internal antenna or the external antenna. Never both at the same time. And actually the internal antenna is not used under normal operation.

Testing was performed on both setting of using external antenna and internal antenna to make sure both could comply with standard's requirement. While this report final only shows the data of testing on external antenna, which we found it is the worst case.

SUMMARY:

- All tests according to the regulations cited on page 8 were

■ - Performed

□ - **Not** Performed

- The Equipment Under Test

■ - **Fulfills** the general approval requirements.

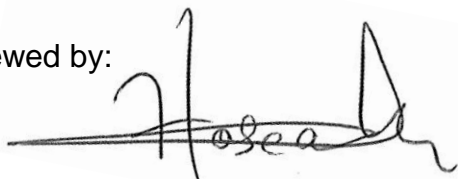
□ - **Does not** fulfill the general approval requirements.

Sample Received Date: January 30, 2019

Testing Start Date: February 26, 2019

Testing End Date: March 6, 2019

Reviewed by:



Hosea CHAN
EMC Project Engineer

Prepared by:



Eric LI
EMC Senior Project Engineer

7 Emission Test Results

7.1 Spurious Radiated Emission

EUT: Connect Hub
 Op Condition: Operated, TX Mode
 (Worst case lies on 2480MHz channel)
 Test Specification: FCC15.205, 15.209 & 15.247(d)
 Comment: 120V AC
 Remark: 9kHz to 1GHz

Test Result

☒ Passed

☐ Not Passed

| Frequency MHz | Result dBμV/m | Limit dBμV/m | Margin dB | Detector PK/QP/AV | Ant. Polarity H/V | Corr. (dB) |
|------------------|------------------|-----------------|--------------|----------------------|----------------------|---------------|
| 108.623889 | 17.98 | 43.50 | -25.52 | Peak | H | -27.6 |
| 541.675000 | 30.73 | 46.00 | -15.27 | Peak | H | -21.1 |
| 583.385000 | 32.40 | 46.00 | -13.60 | Peak | H | -20.1 |
| 50.639444 | 24.99 | 40.00 | -15.01 | Peak | V | -24.7 |
| 64.542778 | 23.94 | 40.00 | -16.06 | Peak | V | -29.1 |
| 874.654444 | 31.78 | 46.00 | -14.22 | Peak | V | -15.9 |

Remark:

- As the measured peak value not exceeded the Quasi peak limit, Quasi peak value no need to be measured.

Spurious Radiated Emission

EUT: Connect Hub
 Op Condition: Operated, TX Mode (2405MHz)
 Test Specification: FCC15.205, 15.209 & 15.247(d)
 Comment: 120V AC
 Remark: 1GHz to 25GHz

| | |
|-------------------------------------|------------|
| Test Result | |
| <input checked="" type="checkbox"/> | Passed |
| <input type="checkbox"/> | Not Passed |

| Frequency MHz | Result dBμV/m | Limit dBμV/m | Margin dB | Detector PK/QP/AV | Ant. Polarity H/V | Corr. (dB) |
|------------------|------------------|-----------------|--------------|----------------------|-------------------------|---------------|
| 1200.250000 | 38.37 | 54.00 | -15.63 | Peak | H | -12.3 |
| 1253.250000 | 35.23 | 54.00 | -18.77 | Peak | H | -12.0 |
| 4809.906250 | 38.74 | 54.00 | -15.26 | Peak | H | 2.8 |
| 7061.718750 | 38.90 | 54.00 | -15.10 | Peak | H | 5.8 |
| 9482.343750 | 40.15 | 54.00 | -13.85 | Peak | H | 9.1 |
| 1200.000000 | 40.35 | 54.00 | -13.65 | Peak | V | -12.3 |
| 1786.312500 | 25.96 | 54.00 | -28.04 | Peak | V | -10.1 |
| 4808.906250 | 37.20 | 54.00 | -16.80 | Peak | V | 2.8 |
| 8257.968750 | 38.25 | 54.00 | -15.75 | Peak | V | 6.0 |
| 11404.687500 | 40.61 | 54.00 | -13.39 | Peak | V | 8.7 |

Remark:

1.As the measured peak value not exceeded the average limit, average value no need to be measured.

Spurious Radiated Emission

EUT: Connect Hub
 Op Condition: Operated, TX Mode (2445MHz)
 Test Specification: FCC15.205, 15.209 & 15.247(d)
 Comment: 120V AC
 Remark: 1GHz to 25GHz

| | |
|-------------------------------------|------------|
| Test Result | |
| <input checked="" type="checkbox"/> | Passed |
| <input type="checkbox"/> | Not Passed |

| Frequency MHz | Result dBμV/m | Limit dBμV/m | Margin dB | Detector PK/QP/AV | Ant. Polarity H/V | Corr. (dB) |
|------------------|------------------|-----------------|--------------|----------------------|-------------------------|---------------|
| 1200.250000 | 37.49 | 54.00 | -16.51 | Peak | H | -12.3 |
| 1253.437500 | 34.41 | 54.00 | -19.59 | Peak | H | -12.0 |
| 4890.062500 | 40.38 | 54.00 | -13.62 | Peak | H | 2.9 |
| 7456.406250 | 38.67 | 54.00 | -15.33 | Peak | H | 6.1 |
| 11874.843750 | 41.03 | 54.00 | -12.97 | Peak | H | 10.4 |
| 1200.250000 | 40.13 | 54.00 | -13.87 | Peak | V | -12.3 |
| 1598.625000 | 29.03 | 54.00 | -24.97 | Peak | V | -10.8 |
| 4890.937500 | 40.62 | 54.00 | -13.38 | Peak | V | 2.9 |
| 7227.656250 | 38.91 | 54.00 | -15.09 | Peak | V | 4.9 |
| 9513.750000 | 41.62 | 54.00 | -12.38 | Peak | V | 9.1 |

Remark:

1.As the measured peak value not exceeded the average limit, average value no need to be measured.

Spurious Radiated Emission

EUT: Connect Hub
 Op Condition: Operated, TX Mode (2480MHz)
 Test Specification: FCC15.205, 15.209 & 15.247(d)
 Comment: 120V AC
 Remark: 1GHz to 25GHz

| Test Result | |
|-------------------------------------|------------|
| <input checked="" type="checkbox"/> | Passed |
| <input type="checkbox"/> | Not Passed |

| Frequency MHz | Result dBμV/m | Limit dBμV/m | Margin dB | Detector PK/QP/AV | Ant. Polarity H/V | Corr. (dB) |
|------------------|------------------|-----------------|--------------|----------------------|-------------------------|---------------|
| 1255.937500 | 34.52 | 54.00 | -19.48 | Peak | H | -12.0 |
| 1596.437500 | 29.22 | 54.00 | -24.78 | Peak | H | -10.8 |
| 4959.906250 | 40.48 | 54.00 | -13.52 | Peak | H | 3.3 |
| 9340.312500 | 41.03 | 54.00 | -12.97 | Peak | H | 8.4 |
| 13112.343750 | 43.86 | 54.00 | -10.14 | Peak | H | 13.8 |
| 1200.250000 | 39.74 | 54.00 | -14.26 | Peak | V | -12.3 |
| 2399.500000 | 37.05 | 54.00 | -16.95 | Peak | V | -6.0 |
| 4960.781250 | 40.73 | 54.00 | -13.27 | Peak | V | 3.3 |
| 8193.281250 | 39.29 | 54.00 | -14.71 | Peak | V | 5.6 |
| 13095.937500 | 43.75 | 54.00 | -10.25 | Peak | V | 13.8 |

Remark:

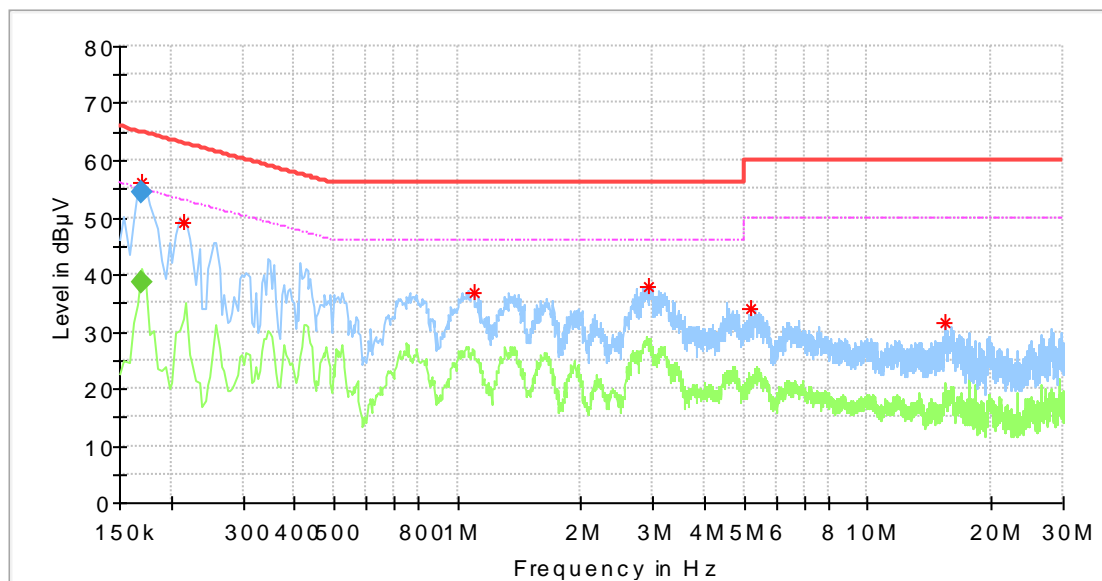
- 1.As the measured peak value not exceeded the average limit, average value no need to be measured.

7.2 Conducted Emission at AC Power line

EUT: Connect Hub
 Op Condition: Operated, TX Mode
 Test Specification: FCC15.207
 Comment: 120V AC
 Remark: L Line

Test Result

☒ Passed
☐ Not Passed



Critical_Freqs

| Frequency (MHz) | MaxPeak (dBμV) | Average (dBμV) | Limit (dBμV) | Margin (dB) |
|-----------------|----------------|----------------|--------------|-------------|
| 0.169500 | 56.19 | --- | 64.96 | -8.77 |
| 0.214000 | 49.02 | --- | 63.05 | -14.03 |
| 1.098000 | 36.88 | --- | 56.00 | -19.12 |
| 2.914000 | 37.98 | --- | 56.00 | -18.02 |
| 5.198000 | 34.18 | --- | 60.00 | -25.82 |
| 15.434000 | 31.48 | --- | 60.00 | -28.52 |

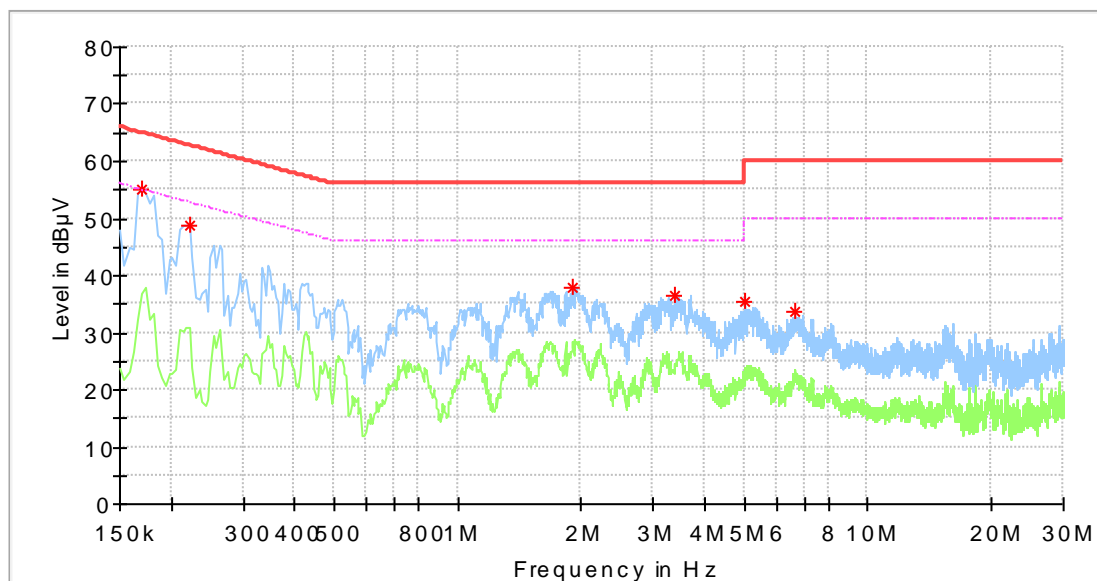
Final_Result

| Frequency (MHz) | QuasiPeak (dBμV) | Average (dBμV) | Limit (dBμV) | Margin (dB) |
|-----------------|------------------|----------------|--------------|-------------|
| 0.169500 | --- | 38.61 | 54.98 | -16.37 |
| 0.169500 | 54.43 | --- | 64.98 | -10.55 |

Conducted Emission at AC Power line

EUT: Connect Hub
 Op Condition: Operated, TX Mode
 Test Specification: FCC15.207
 Comment: 120V AC
 Remark: N Line

Test Result
☒ Passed
☐ Not Passed



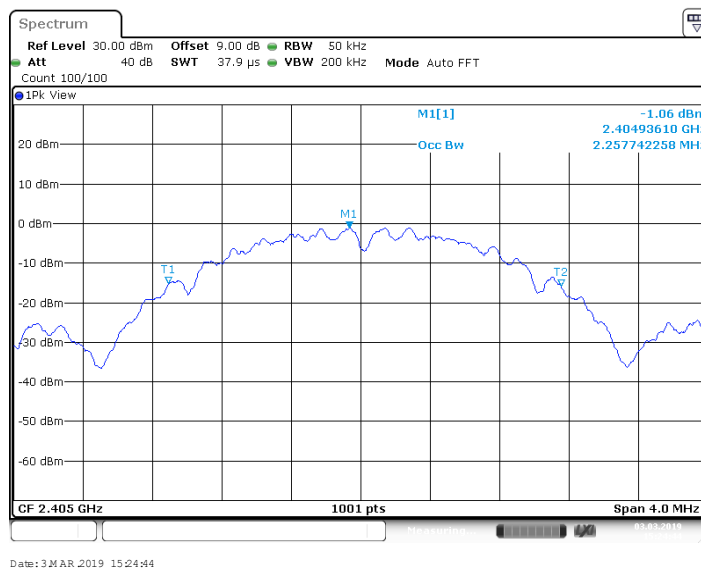
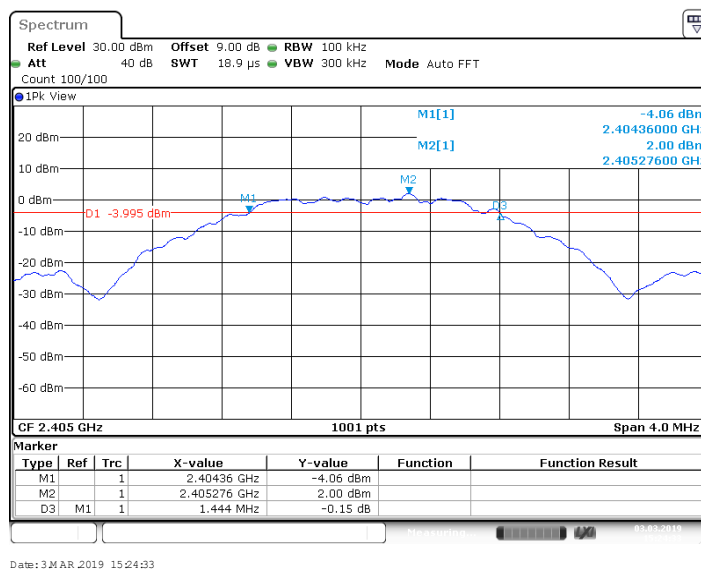
Final Result

| Frequency (MHz) | MaxPeak (dBμV) | Average (dBμV) | Limit (dBμV) | Margin (dB) |
|-----------------|----------------|----------------|--------------|-------------|
| 0.170000 | 55.22 | --- | 64.96 | -9.74 |
| 0.222000 | 48.93 | --- | 62.74 | -13.82 |
| 1.906000 | 37.95 | --- | 56.00 | -18.05 |
| 3.398000 | 36.57 | --- | 56.00 | -19.43 |
| 5.014000 | 35.36 | --- | 60.00 | -24.64 |
| 6.614000 | 33.65 | --- | 60.00 | -26.35 |

7.3 6dB & 99% Bandwidth

EUT: Connect Hub
 Op Condition: Operated, TX Mode (2405MHz)
 Test Specification: FCC15.247(a)(2), 6dB Bandwidth & 99% Bandwidth
 Comment: 120V AC

Test Result

☒ Passed☐ Not Passed

| Bandwidth | Measured Value | Limit |
|---------------|----------------|----------|
| 6dB bandwidth | 1.444MHz | > 0.5MHz |
| 99% OCB | 2.258MHz | NA |

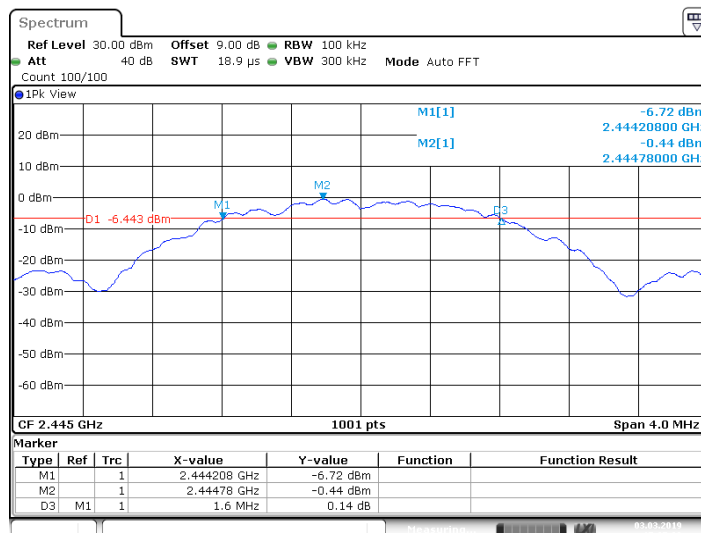
6dB & 99% Bandwidth

EUT: Connect Hub
 Op Condition: Operated, TX Mode (2445MHz)
 Test Specification: FCC15.247(a)(2), 6dB Bandwidth & 99% Bandwidth
 Comment: 120V AC

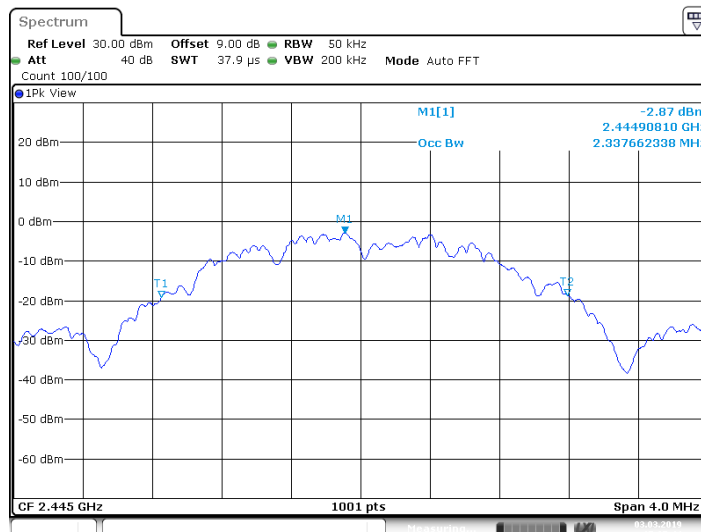
Test Result

☒ Passed

☐ Not Passed



Date: 3 MAR 2019 15:27:33



Date: 3 MAR 2019 15:27:44

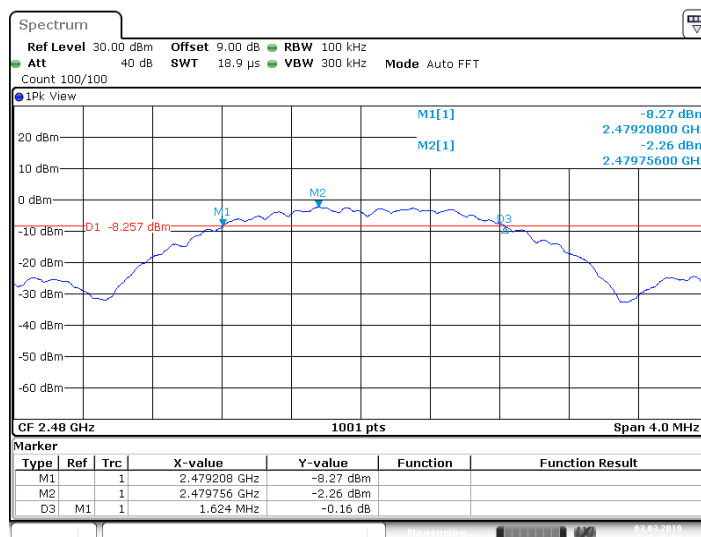
| Bandwidth | Measured Value | Limit |
|---------------|----------------|-----------|
| 6dB bandwidth | 1.600 MHz | > 0.5 MHz |
| 99% OCB | 2.338 MHz | NA |

6dB & 99% Bandwidth

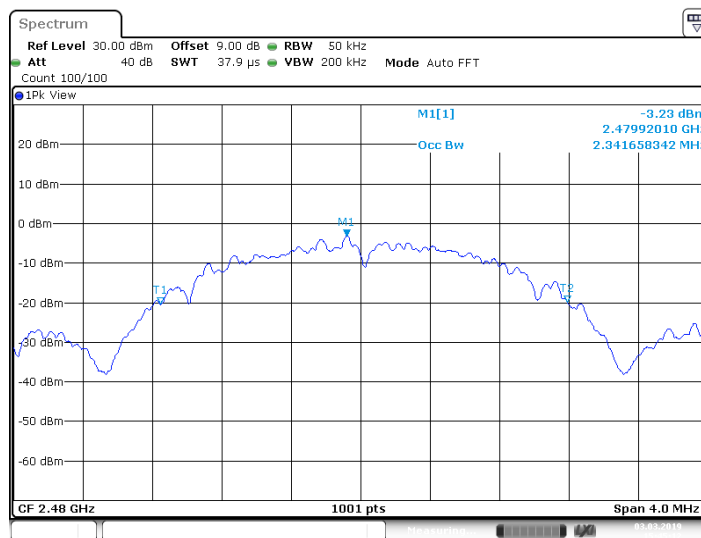
EUT: Connect Hub
 Op Condition: Operated, TX Mode (2480MHz)
 Test Specification: FCC15.247(a)(2), 6dB Bandwidth & 99% Bandwidth
 Comment: 120V AC

Test Result

☒ Passed
☐ Not Passed



Date: 3 MAR 2019 15:45:01



Date: 3 MAR 2019 15:45:12

| Bandwidth | Measured Value | Limit |
|---------------|----------------|-----------|
| 6dB bandwidth | 1.624 MHz | > 0.5 MHz |
| 99% OCB | 2.342 MHz | NA |

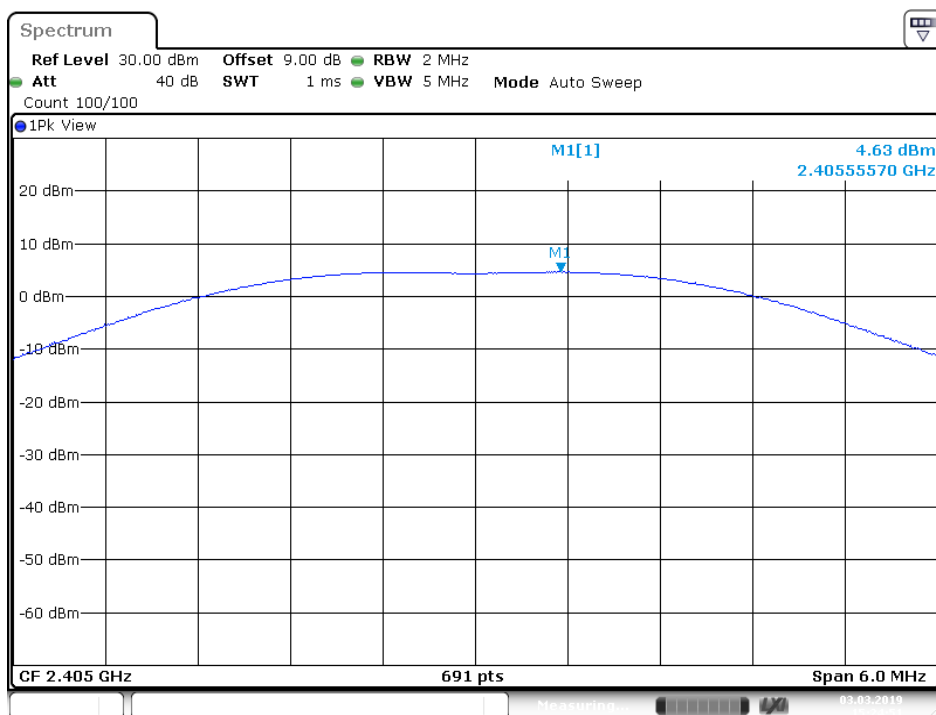
7.4 Peak Output Power

EUT: Connect Hub
 Op Condition: Operated, TX Mode (2405MHz)
 Test Specification: FCC15.247(b)
 Comment: 120V AC

Test Result

☒ Passed

☐ Not Passed



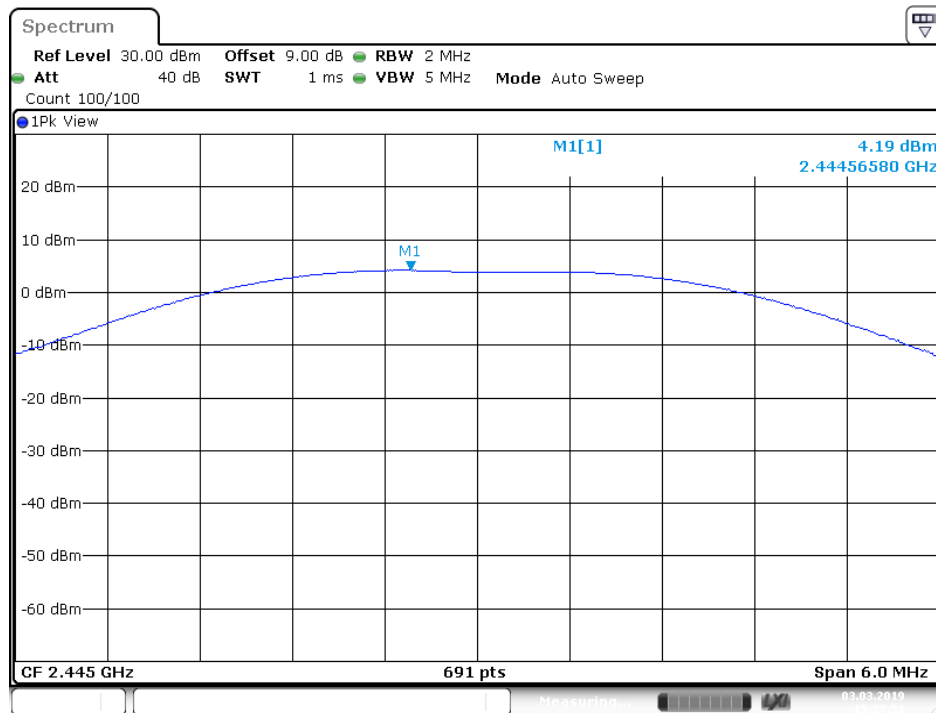
Date: 3 MAR 2019 15:24:51

| Conducted Output Power | Limit |
|------------------------|---------|
| 4.63 dBm | < 30dBm |

Peak Output Power

EUT: Connect Hub
Op Condition: Operated, TX Mode (2445MHz)
Test Specification: FCC15.247(b)
Comment: 120V AC

Test Result
☒ Passed
☐ Not Passed



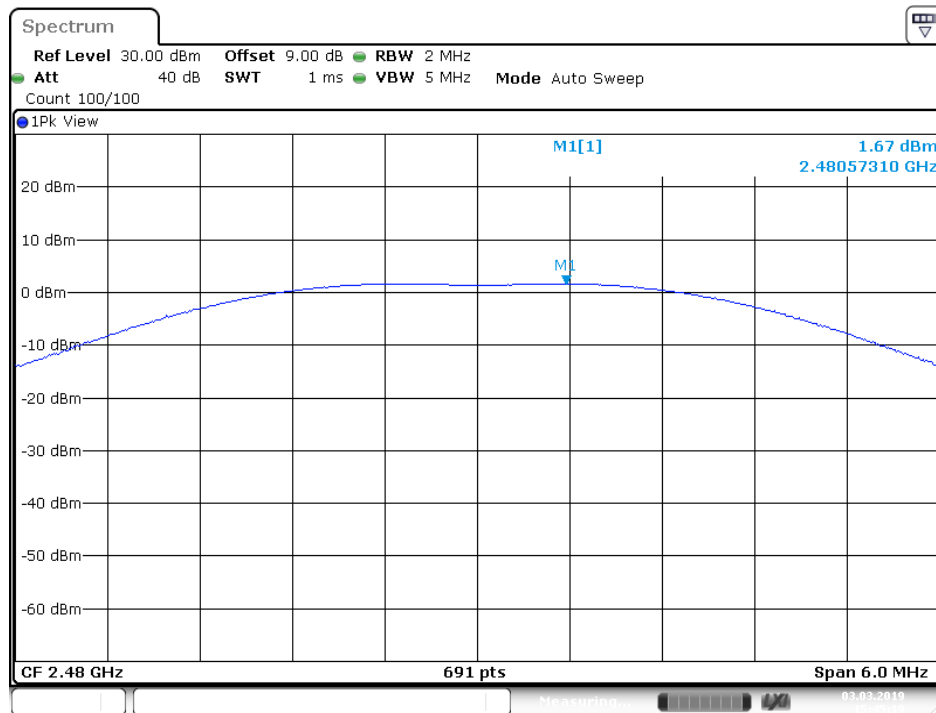
Date: 3 MAR 2019 15:27:51

| Conducted Output Power | Limit |
|------------------------|---------|
| 4.19 dBm | < 30dBm |

Peak Output Power

EUT: Connect Hub
Op Condition: Operated, TX Mode (2480MHz)
Test Specification: FCC15.247(b)
Comment: 120V AC

Test Result
☒ Passed
☐ Not Passed



Date: 3 MAR 2019 15:45:20

| Conducted Output Power | Limit |
|------------------------|---------|
| 1.67 dBm | < 30dBm |

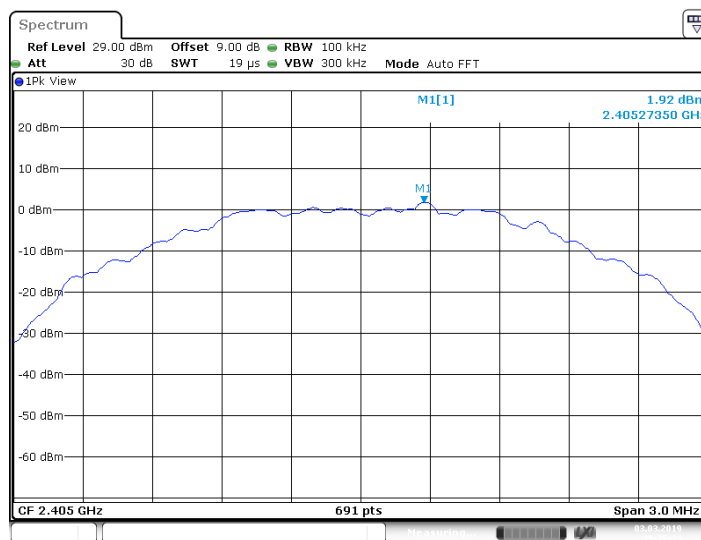
7.5 Spurious Emissions at Antenna Terminals

EUT: Connect Hub
 Op Condition: Operated, TX Mode (2405MHz)
 Test Specification: FCC2.1051 & 15.247(d)
 Comment: 120V AC

Test Result

☒ Passed☐ Not Passed

| Channel | FreqRange | RefLevel | Result | Limit | Verdict |
|---------|------------|----------|--------|--------|---------|
| 2405 | Reference | 1.92 | 1.92 | --- | PASS |
| 2405 | 30~1000 | 1.92 | -61.07 | -18.08 | PASS |
| 2405 | 1000~26500 | 1.92 | -44.67 | -18.08 | PASS |



Date: 3 MAR 2019 15:25:14

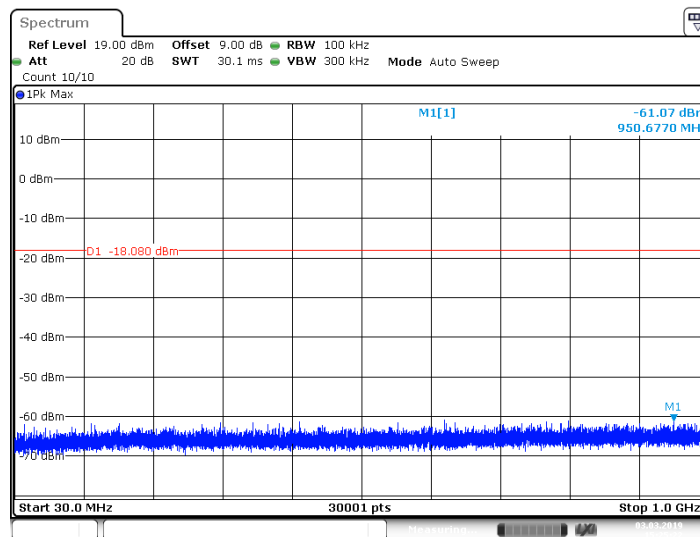
Spurious Emissions at Antenna Terminals

EUT: Connect Hub
Op Condition: Operated, TX Mode (2405MHz)
Test Specification: FCC2.1051 & 15.247(d)
Comment: 120V AC

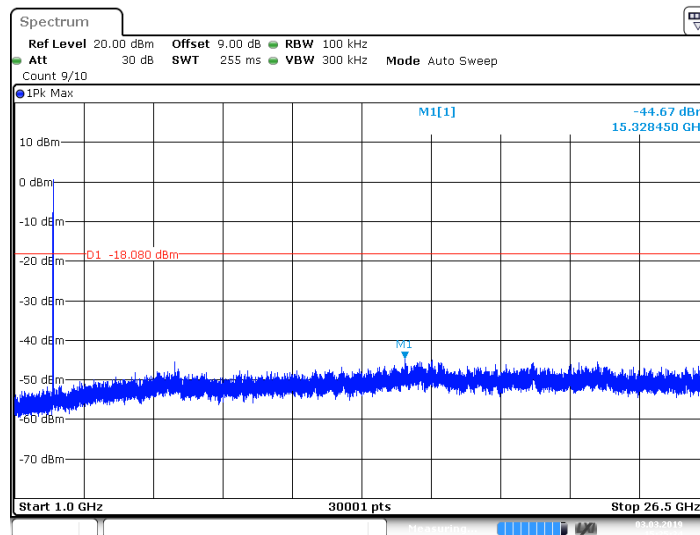
Test Result

☒ Passed

☐ Not Passed



Date: 3 MAR 2019 15:25:22



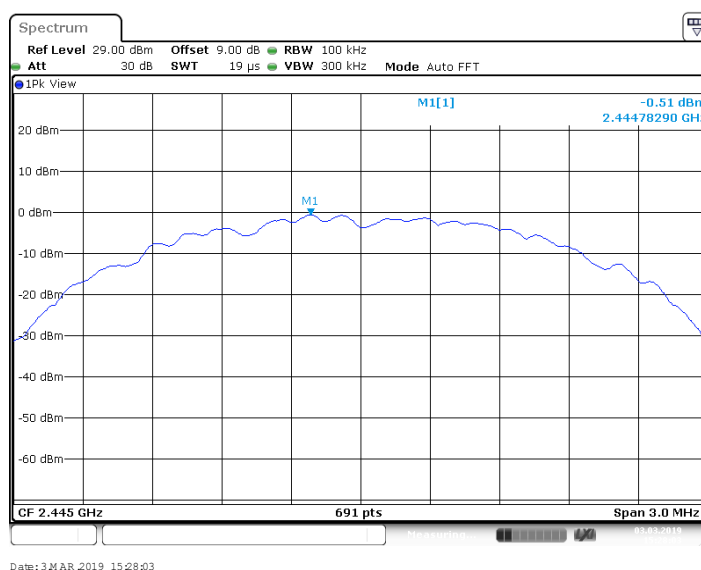
Date: 3 MAR 2019 15:25:34

Spurious Emissions at Antenna Terminals

EUT: Connect Hub
 Op Condition: Operated, TX Mode (2445MHz)
 Test Specification: FCC2.1051 & 15.247(d)
 Comment: 120V AC

Test Result
☒ Passed
☐ Not Passed

| Channel | FreqRange | RefLevel | Result | Limit | Verdict |
|---------|------------|----------|--------|--------|---------|
| 2445 | Reference | -0.51 | -0.51 | --- | PASS |
| 2445 | 30~1000 | -0.51 | -60.91 | -20.51 | PASS |
| 2445 | 1000~26500 | -0.51 | -45.15 | -20.51 | PASS |



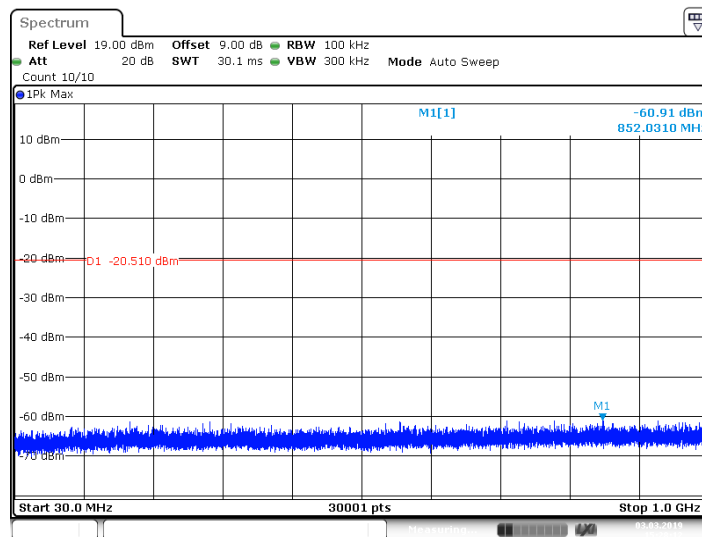
Spurious Emissions at Antenna Terminals

EUT: Connect Hub
Op Condition: Operated, TX Mode (2445MHz)
Test Specification: FCC2.1051 & 15.247(d)
Comment: 120V AC

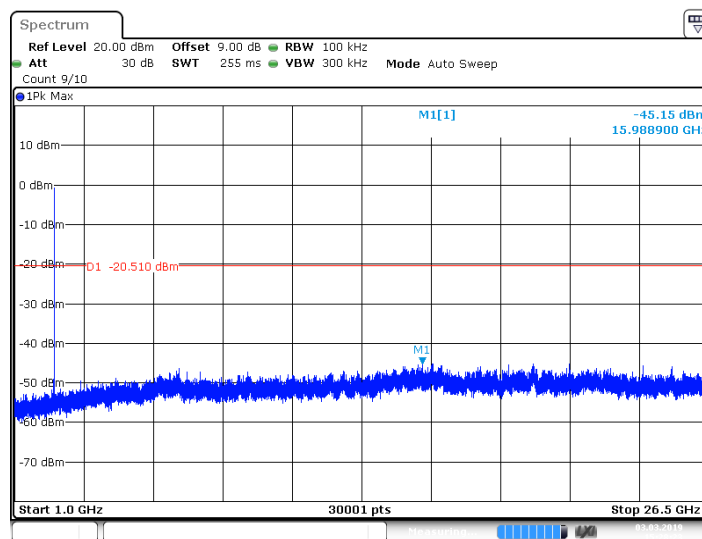
Test Result

☒ Passed

☐ Not Passed



Date: 3 MAR 2019 15:28:12



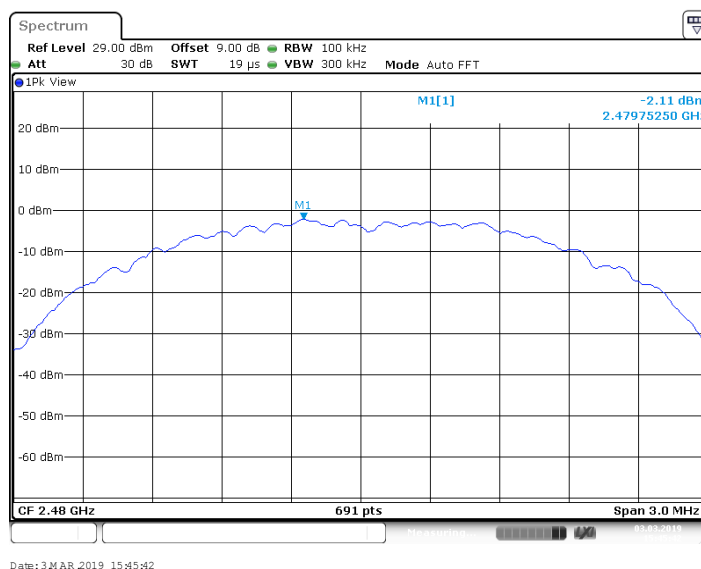
Date: 3 MAR 2019 15:28:24

Spurious Emissions at Antenna Terminals

EUT: Connect Hub
 Op Condition: Operated, TX Mode (2480MHz)
 Test Specification: FCC2.1051 & 15.247(d)
 Comment: 120V AC

| | |
|-------------------------------------|------------|
| Test Result | |
| <input checked="" type="checkbox"/> | Passed |
| <input type="checkbox"/> | Not Passed |

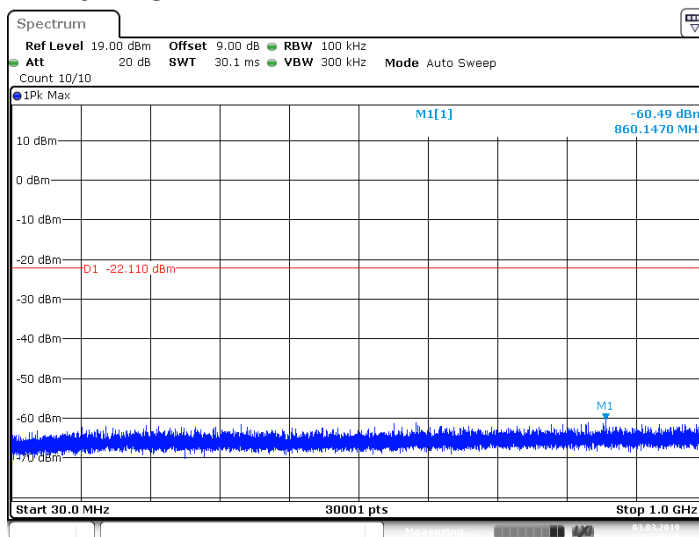
| Channel | FreqRange | RefLevel | Result | Limit | Verdict |
|---------|------------|----------|--------|--------|---------|
| 2480 | Reference | -2.11 | -2.11 | --- | PASS |
| 2480 | 30~1000 | -2.11 | -60.49 | -22.11 | PASS |
| 2480 | 1000~26500 | -2.11 | -45.26 | -22.11 | PASS |



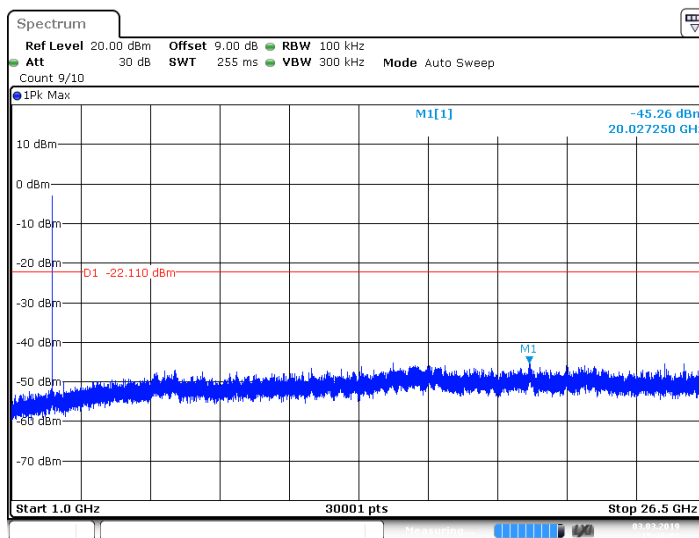
Spurious Emissions at Antenna Terminals

EUT: Connect Hub
Op Condition: Operated, TX Mode (2480MHz)
Test Specification: FCC2.1051 & 15.247(d)
Comment: 120V AC

Test Result

☒ Passed☐ Not Passed

Date: 3 MAR 2019 15:45:50



Date: 3 MAR 2019 15:46:02

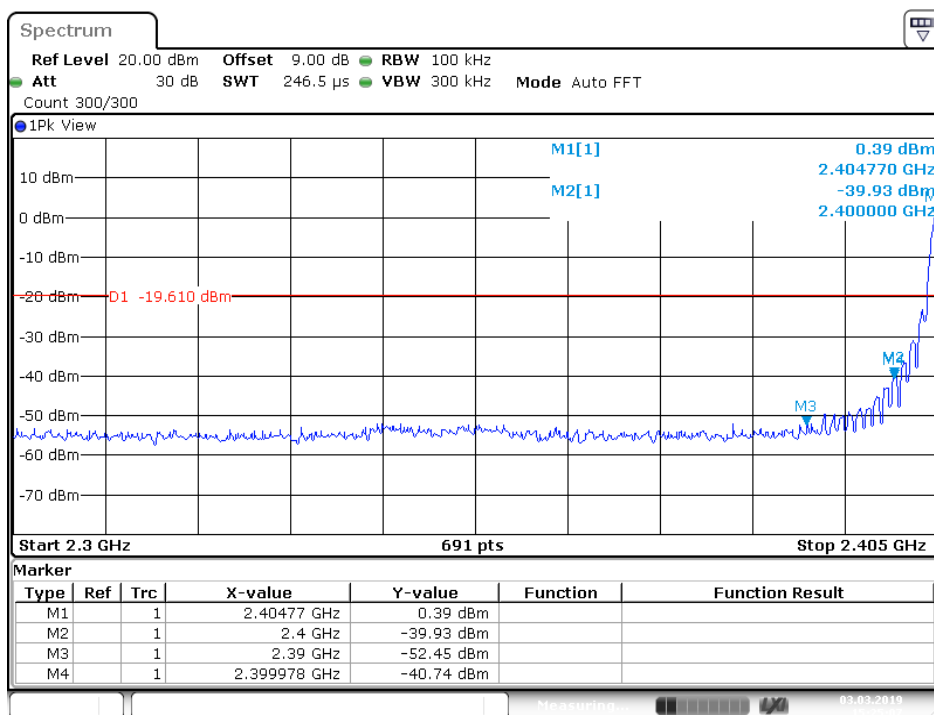
7.6 100kHz Bandwidth of band edges

EUT: Connect Hub
 Op Condition: Operated, TX Mode (2405MHz)
 Test Specification: FCC15.247(d), Conducted
 Comment: 120V AC

Test Result

☒ Passed

☐ Not Passed



Date: 3 MAR 2019 15:25:07

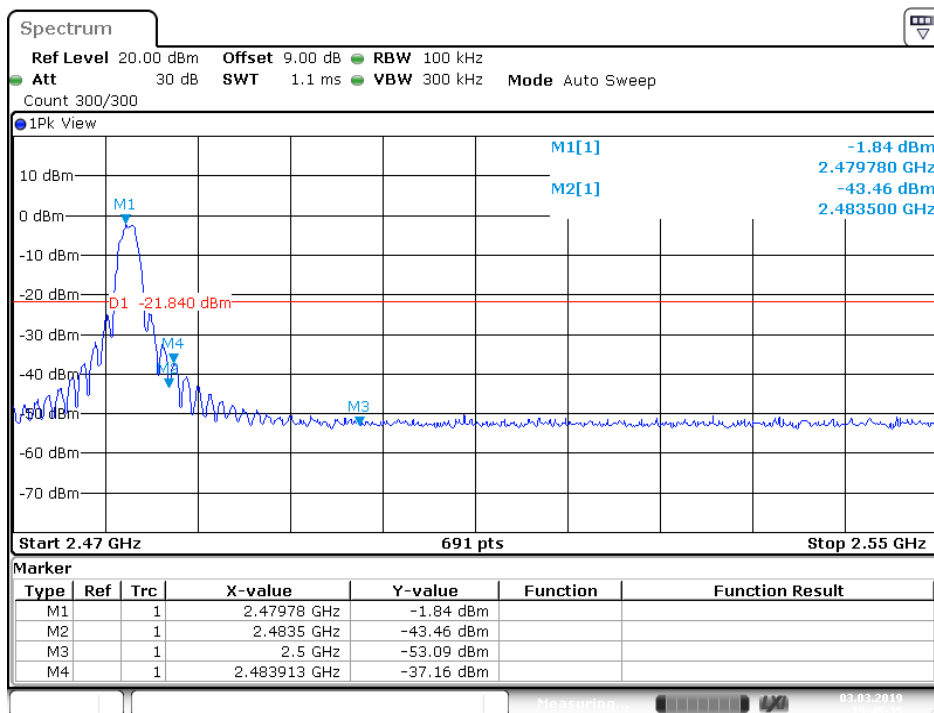
| Band edges | Limit |
|------------|--------|
| 40.32 dB | > 20dB |

100kHz Bandwidth of band edges

EUT: Connect Hub
 Op Condition: Operated, TX Mode (2480MHz)
 Test Specification: FCC15.247(d), Conducted
 Comment: 120V AC

Test Result

☒ Passed
☐ Not Passed



Date: 3 MAR 2019 15:45:35

| Band edges | Limit |
|------------|--------|
| 41.62 dB | > 20dB |

100kHz Bandwidth of band edges

EUT: Connect Hub
 Op Condition: Operated, TX Mode (2405MHz & 2480MHz)
 Test Specification: FCC15.247(d), Radiated
 Comment: 120V AC

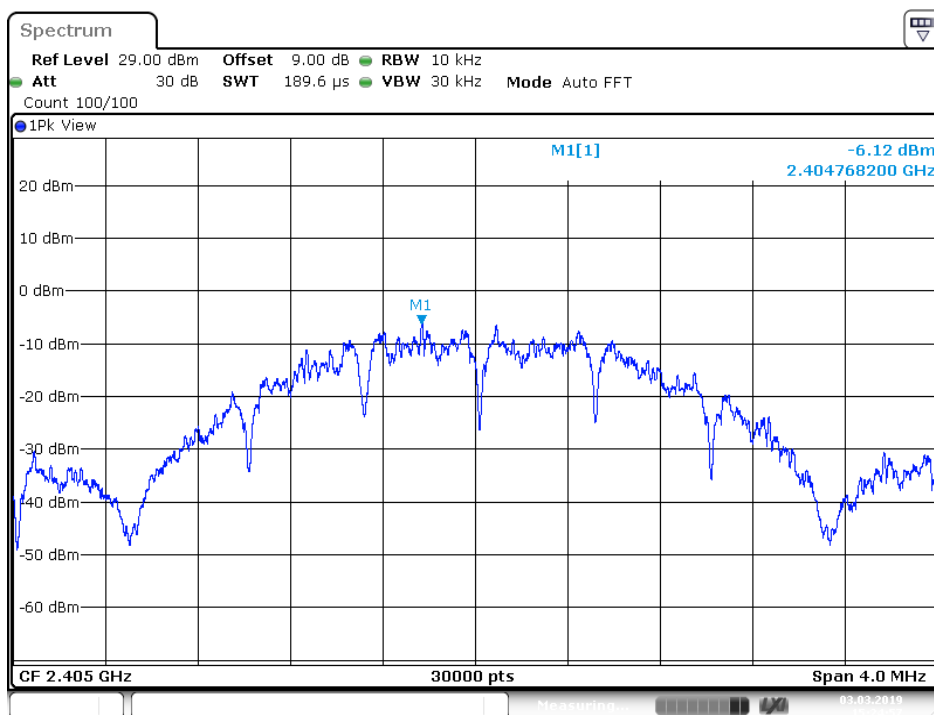
| Test Result | |
|-------------------------------------|------------|
| <input checked="" type="checkbox"/> | Passed |
| <input type="checkbox"/> | Not Passed |

| Channel | Frequency MHz | Result dBμV/m | Limit dBμV/m | Margin dB | Detector PK /AV | Ant. Polarity H/V | Corr. (dB) |
|---------|------------------|------------------|-----------------|--------------|--------------------|----------------------|---------------|
| 2405 | 2400.00 | 43.62 | 74.00 | -30.38 | Peak | H | -5.5 |
| 2405 | 2400.00 | 35.81 | 54.00 | -18.19 | Average | H | -5.5 |
| 2405 | 2400.00 | 42.47 | 74.00 | -31.53 | Peak | V | -5.5 |
| 2405 | 2400.00 | 33.48 | 54.00 | -20.52 | Average | V | -5.5 |
| 2480 | 2483.50 | 46.23 | 74.00 | -27.77 | Peak | H | -4.8 |
| 2480 | 2483.50 | 36.77 | 54.00 | -17.23 | Average | H | -4.8 |
| 2480 | 2483.50 | 48.13 | 74.00 | -25.87 | Peak | V | -4.8 |
| 2480 | 2483.50 | 37.25 | 54.00 | -16.75 | Average | V | -4.8 |

7.7 Power Spectral Density

EUT: Connect Hub
Op Condition: Operated, TX Mode (2405MHz)
Test Specification: FCC15.247(e)
Comment: 120V AC

Test Result

☒ Passed☐ Not Passed

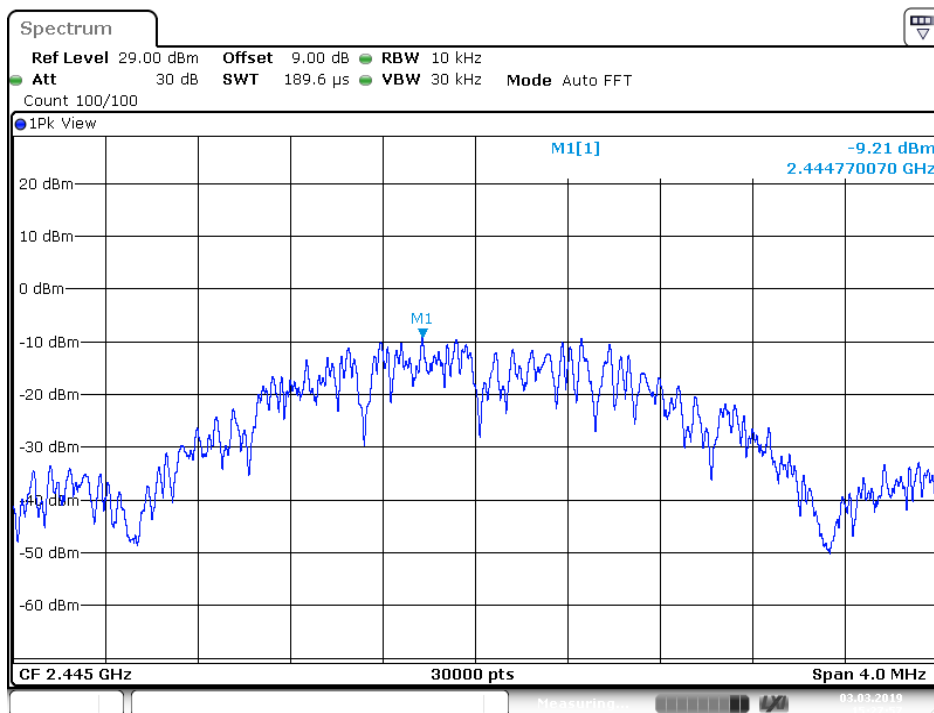
Date: 3 MAR 2019 15:24:58

| PSD | Limit |
|-----------|---------|
| -6.12 dBm | < 8 dBm |

Power Spectral Density

EUT: Connect Hub
 Op Condition: Operated, TX Mode (2445MHz)
 Test Specification: FCC15.247(e)
 Comment: 120V AC

Test Result
☒ Passed
☐ Not Passed



Date: 3 MAR 2019 15:27:57

| PSD | Limit |
|-----------|---------|
| -9.21 dBm | < 8 dBm |

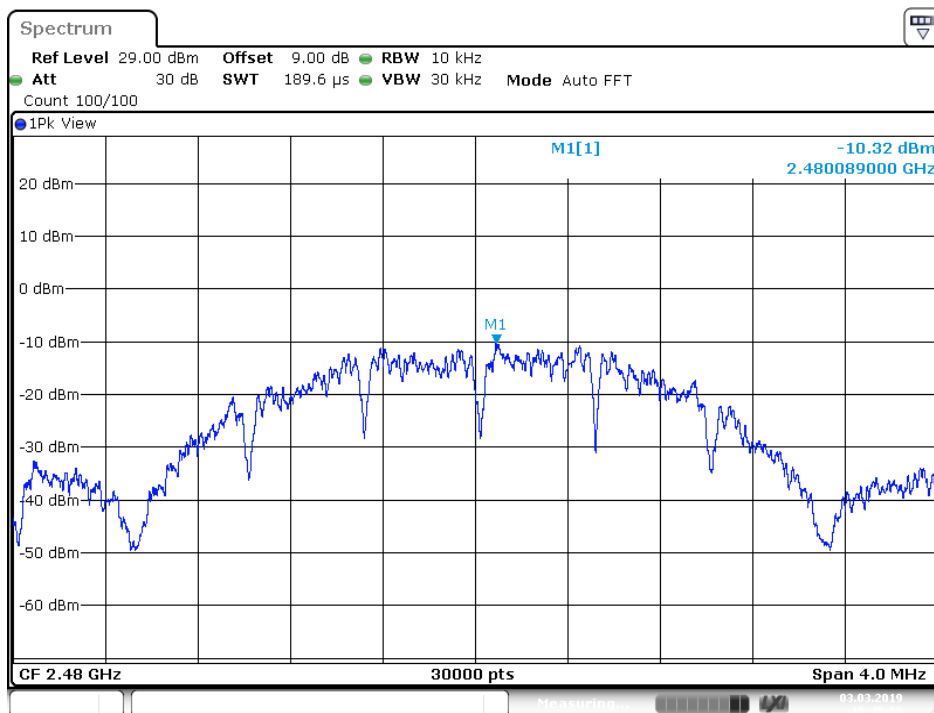
Power Spectral Density

EUT: Connect Hub
 Op Condition: Operated, TX Mode (2480MHz)
 Test Specification: FCC15.247(e)
 Comment: 120V AC

Test Result

☒ Passed

☐ Not Passed



Date: 3 MAR 2019 15:45:26

| PSD | Limit |
|------------|---------|
| -10.32 dBm | < 8 dBm |

7.8 Antenna Requirement

EUT: Connect Hub
Op Condition: Operated, TX Mode
Test Specification: FCC15.203 & 15.247(b)
Comment: 120V AC

| Test Result | |
|--|------------|
| <input checked="checked" type="checkbox"/> | Passed |
| <input type="checkbox"/> | Not Passed |

Limit

For intentional device, according to FCC Title 47 Part 15.203, 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. And according to FCC Title 47 Part 15.247(b), if transmitting antennas of directional gain greater than 6 dBi are used, the power shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

Antenna Connector Construction

EUT has two antennas, one is on-board chip antenna, another is external whip antenna with SMA connector. Chip antenna maximum gain is -1.5 dBi, Whip antenna maximum gain is 2dBi. So EUT fulfill with 15.203 requirements.

8 Appendix A - General Product Information

Radiofrequency radiation exposure evaluation

This exposure evaluation is intended for **FCC ID: 2AA2X-16500361**.

According to KDB 447498 D01v06 section 4.3.1, For frequencies between 100 MHz to 6GHz and test separation distances ≤ 50 mm, the Numeric threshold is determined as:

Step a)

$[(\text{max. power of channel, including tune-up tolerance, mW}) / (\text{min. test separation distance, mm})] \cdot [\sqrt{f(\text{GHz})}] \leq 3.0$ for 1-g SAR

>> The fundamental frequency of the EUT is 2405-2480MHz,
the test separation distance is ≤ 50 mm.
(Manufacturer specified the separation distance is: 20mm)

Step a)

>> Numeric threshold (2405MHz), $\text{mW} / 20\text{mm} \cdot \sqrt{2.402\text{GHz}} \leq 3.0$
Numeric threshold (2405MHz) $\leq 38.713\text{mW}$

>> Numeric threshold (2445MHz), $\text{mW} / 20\text{mm} \cdot \sqrt{2.440\text{GHz}} \leq 3.0$
Numeric threshold (2445MHz) $\leq 38.411\text{mW}$

>> Numeric threshold (2480MHz), $\text{mW} / 20\text{mm} \cdot \sqrt{2.480\text{GHz}} \leq 3.0$
Numeric threshold (2480MHz) $\leq 38.100\text{mW}$

>> The power of EUT measured (2405MHz) is: $4.63\text{dBm} = 2.904\text{mW}$
The power of EUT measured (2445MHz) is: $4.19\text{dBm} = 2.624\text{mW}$
The power of EUT measured (2480MHz) is: $1.67\text{dBm} = 1.469\text{mW}$

Which is smaller than the Numeric threshold.

Therefore, the device is exempt from stand-alone SAR test requirements.