



**Emerson, Rosemount Inc.**

**Model: 781SA**

**FCC 15.247:2024, RSS-247 Issue 3:2023  
RSS-Gen Issue 5:2018+A1:2019+A2:2021**

**2400 - 2483.5 MHz Hybrid (US/ISED only) transceiver**

**Report: EMPM0165.0 Rev. 0, Issue Date: December 22, 2024**



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# CERTIFICATE OF TEST



Last Date of Test: August 2, 2024

Emerson  
EUT: 781SA

## Radio Equipment Testing

### Standards

| Specification                        | Method           |
|--------------------------------------|------------------|
| FCC 15.247:2024                      | ANSI C63.10:2013 |
| RSS-247 Issue 3:2023                 | ANSI C63.10:2013 |
| RSS-Gen Issue 5:2018+A1:2019+A2:2021 | ANSI C63.10:2013 |

### Guidance

|                            |
|----------------------------|
| FCC KDB 558074 v05r02:2019 |
|----------------------------|

### Results

| Test Description                           | Result | FCC Section(s) | RSS Section(s) | ANSI C63.10 Section(s) | Comments                                                                                                                                   |
|--------------------------------------------|--------|----------------|----------------|------------------------|--------------------------------------------------------------------------------------------------------------------------------------------|
| Powerline Conducted Emissions              | N/A    | 15.207         | RSS-Gen 8.8    | 6.2                    | Not required to add a new antenna.                                                                                                         |
| Spurious Radiated Emissions                | Pass   | 15.247(d)      | RSS-247 5.5    | 6.5, 6.6               |                                                                                                                                            |
| Duty Cycle                                 | N/A    | 15.247         | RSS-Gen 3.2    | 7.5                    | EUT operates at 100% Duty Cycle in test mode. Client states that Operational Duty Cycle will not exceed 20.706% in 100ms and 19.09% in 1s. |
| Carrier Frequency Separation               | N/A    | 15.247(a)(1)   | RSS-247 5.1(b) | 7.8.2                  | Not required to add a new antenna.                                                                                                         |
| Number of Hopping Frequencies              | N/A    | 15.247(a)(1)   | RSS-247 5.1(d) | 7.8.3                  | Not required to add a new antenna.                                                                                                         |
| Dwell Time                                 | N/A    | 15.247(a)(1)   | RSS-247 5.1(d) | 7.8.4                  | Not required to add a new antenna.                                                                                                         |
| Output Power                               | Pass   | 15.247(b)      | RSS-247 5.4(d) | 7.8.5                  |                                                                                                                                            |
| Equivalent Isotropic Radiated Power (EIRP) | Pass   | 15.247(b)      | RSS-247 5.4(d) | 7.8.5                  |                                                                                                                                            |
| Band Edge Compliance                       | N/A    | 15.247(d)      | RSS-247 5.5    | 7.8.6                  | Not required to add a new antenna.                                                                                                         |
| Band Edge Compliance - Hopping Mode        | N/A    | 15.247(d)      | RSS-247 5.5    | 7.8.6                  | Not required to add a new antenna.                                                                                                         |
| Emissions Bandwidth (dB)                   | N/A    | 15.247(a)      | RSS-247 5.2(a) | 7.8.7                  | Not required to add a new antenna.                                                                                                         |
| Occupied Bandwidth (99%)                   | N/A    | 15.247(a)      | RSS-Gen 6.7    | 7.8.7                  | Not required to add a new antenna.                                                                                                         |
| Spurious Conducted Emissions               | N/A    | 15.247(d)      | RSS-247 5.5    | 7.8.8                  | Not required to add a new antenna.                                                                                                         |
| Power Spectral Density                     | N/A    | 15.247(e)      | RSS-247 5.2(b) | 11.10.2                | Not required to add a new antenna.                                                                                                         |

**Product compliance is the responsibility of the client; therefore, the tests and equipment modes of operation represented in this report were agreed upon by the client, prior to testing. The results of this test pertain only to the sample(s) tested. The specific description is noted in each of the individual sections of the test report supporting this certificate of test. This report reflects only those tests from the referenced standards shown in the certificate of test. It does not include inspection or verification of labels, identification, marking or user information. As indicated in the Statement of Work sent with the quotation, Element's standard process is to always use the latest published version of the test methods even when earlier versions are cited in the test specification. Issuance of a purchase order was de facto acceptance of this approach. Otherwise, the client would have advised Element in writing of the specific version of the test methods they wanted applied to the subject testing.**

# CERTIFICATE OF TEST



## Deviations From Test Standards

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None

### Approved By:

Jeff Alcock, Senior EMC Test Engineer

*Product compliance is the responsibility of the client; therefore, the tests and equipment modes of operation represented in this report were agreed upon by the client, prior to testing. The results of this test pertain only to the sample(s) tested. The specific description is noted in each of the individual sections of the test report supporting this certificate of test. This report reflects only those tests from the referenced standards shown in the certificate of test. It does not include inspection or verification of labels, identification, marking or user information. As indicated in the Statement of Work sent with the quotation, Element's standard process is to always use the latest published version of the test methods even when earlier versions are cited in the test specification. Issuance of a purchase order was de facto acceptance of this approach. Otherwise, the client would have advised Element in writing of the specific version of the test methods they wanted applied to the subject testing.*

# REVISION HISTORY



| Revision Number | Description | Date<br>(yyyy-mm-dd) | Page Number |
|-----------------|-------------|----------------------|-------------|
| 00              | None        |                      |             |

# ACCREDITATIONS AND AUTHORIZATIONS



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## United States

**FCC** - Designated by the FCC as a Telecommunications Certification Body (TCB). Certification chambers, Open Area Test Sites, and conducted measurement facilities are listed with the FCC.

**A2LA** - Each laboratory is accredited by A2LA to ISO / IEC 17025, and as a product certifier to ISO / IEC 17065 which allows Element to certify transmitters to FCC and IC specifications.

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## Canada

**ISED** - Recognized by Innovation, Science and Economic Development Canada as a Certification Body (CB) and as a CAB for the acceptance of test data.

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## European Union

**European Commission** – Recognized as an EU Notified Body validated for the EMCD and RED Directives.

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## United Kingdom

**BEIS** – Recognized by the UK as an Approved Body under the UK Radio Equipment and UK EMC Regulations.

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## Australia/New Zealand

**ACMA** - Recognized by ACMA as a CAB for the acceptance of test data.

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## Korea

**MSIT / RRA** - Recognized by KCC's RRA as a CAB for the acceptance of test data.

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## Japan

**VCCI** - Associate Member of the VCCI. Conducted and radiated measurement facilities are registered.

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## Taiwan

**BSMI** – Recognized by BSMI as a CAB for the acceptance of test data.

**NCC** - Recognized by NCC as a CAB for the acceptance of test data.

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## Singapore

**IDA** – Recognized by IDA as a CAB for the acceptance of test data.

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## Israel

**MOC** – Recognized by MOC as a CAB for the acceptance of test data.

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## Hong Kong

**OFCA** – Recognized by OFCA as a CAB for the acceptance of test data.

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## Vietnam

**MIC** – Recognized by MIC as a CAB for the acceptance of test data.

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## SCOPE

For details on the Scopes of our Accreditations, please visit:

[California](#)

[Minnesota](#)

[Oregon](#)

[Texas](#)

[Washington](#)

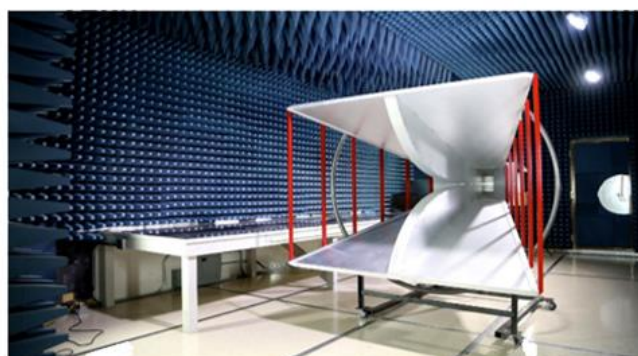
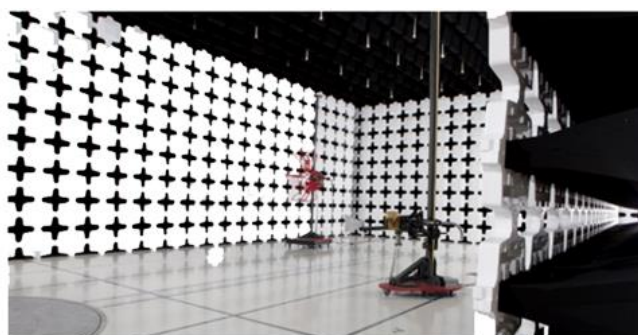
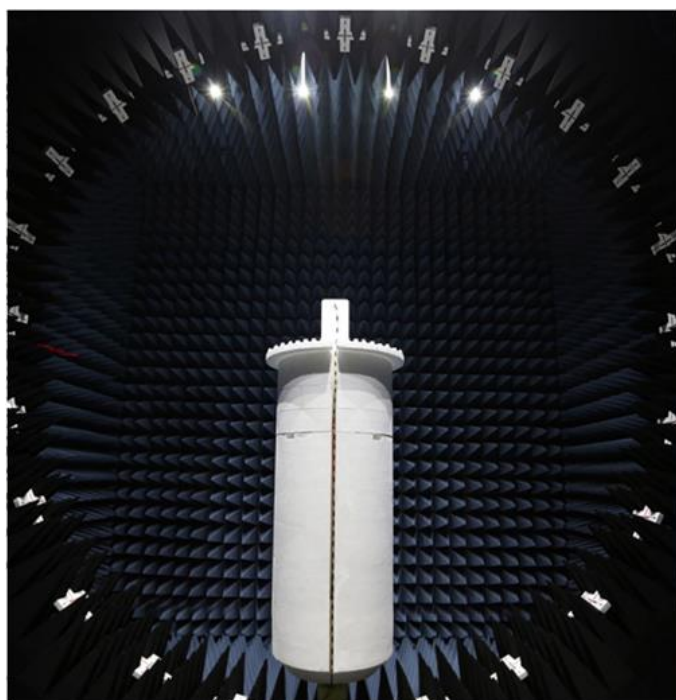
# FACILITIES

Testing was performed at the following location(s)

|                                     | Location   | Labs <sup>(1)</sup> | Address                                                              | A2LA <sup>(2)</sup> | ISED <sup>(3)</sup> | BSMI <sup>(4)</sup> | VCCI <sup>(5)</sup> | CAB <sup>(6)</sup> | FDA <sup>(7)</sup> |
|-------------------------------------|------------|---------------------|----------------------------------------------------------------------|---------------------|---------------------|---------------------|---------------------|--------------------|--------------------|
| <input type="checkbox"/>            | California | OC01-17             | 41 Tesla<br>Irvine, CA 92618<br>(949) 861-8918                       | 3310.04             | 2834B               | SL2-IN-E-1154R      | A-0029              | US0158             | TL-55              |
| <input checked="" type="checkbox"/> | Minnesota  | MN01-11             | 9349 W Broadway Ave.<br>Brooklyn Park, MN 55445<br>(612) 638-5136    | 3310.05             | 2834E               | SL2-IN-E-1152R      | A-0109              | US0175             | TL-57              |
| <input type="checkbox"/>            | Oregon     | EV01-12             | 6775 NE Evergreen Pkwy #400<br>Hillsboro, OR 97124<br>(503) 844-4066 | 3310.02             | 2834D               | SL2-IN-E-1017       | A-0108              | US0017             | TL-56              |
| <input type="checkbox"/>            | Texas      | TX01-09             | 3801 E Plano Pkwy<br>Plano, TX 75074<br>(469) 304-5255               | 3310.03             | 2834G               | SL2-IN-E-1158R      | A-0201              | US0191             | TL-54              |
| <input type="checkbox"/>            | Washington | NC01-05             | 19201 120th Ave NE<br>Bothell, WA 98011<br>(425) 984-6600            | 3310.06             | 2834F               | SL2-IN-E-1153R      | A-0110              | US0157             | TL-67              |
| <input type="checkbox"/>            | Offsite    | N/A                 | See Product Description                                              | N/A                 | N/A                 | N/A                 | N/A                 | N/A                | N/A                |

See data sheets for specific labs

- (1) The lab designations denote individual rooms within each location. (OC01, OC02, OC03, etc.)
- (2) A2LA Certificate No.
- (3) ISED Company No.
- (4) BSMI No.
- (5) VCCI Site Filing No.
- (6) CAB Identifier. Recognized Phase I CAB for ISED, ACMA, BSMI, IDA, KCC/RRA, MIC, MOC, NCC, OFCA
- (7) FDA ASCA No.



# MEASUREMENT UNCERTAINTY

## Measurement Uncertainty

When a measurement is made, the result will be different from the true or theoretically correct value. The difference is the result of tolerances in the measurement system that cannot be completely eliminated. To the extent that technology allows us, it has been our aim to minimize this error. Measurement uncertainty is a statistical expression of measurement error qualified by a probability distribution.

A measurement uncertainty estimation has been performed for each test per our internal quality document QM205.4.6. The estimation is used to compare the measured result with its "true" or theoretically correct value. The expanded measurement uncertainty (K=2) can be found in the table below. A lab specific value may also be found in the applicable test description section. Our measurement data meets or exceeds the measurement uncertainty requirements of the applicable specification; therefore, the test data can be compared directly to the specification limit to determine compliance. The calculations for estimating measurement uncertainty are based upon ETSI TR 100 028 (or CISPR 16-4-2 as applicable), and are available upon request.

The following table represents the Measurement Uncertainty (MU) budgets for each of the tests that may be contained in this report.

| Test                                  | + MU    | - MU     |
|---------------------------------------|---------|----------|
| Frequency Accuracy                    | 0.0007% | -0.0007% |
| Amplitude Accuracy (dB)               | 1.2 dB  | -1.2 dB  |
| Conducted Power (dB)                  | 1.2 dB  | -1.2 dB  |
| Radiated Power via Substitution (dB)  | 0.7 dB  | -0.7 dB  |
| Temperature (degrees C)               | 0.7°C   | -0.7°C   |
| Humidity (% RH)                       | 2.5% RH | -2.5% RH |
| Voltage (AC)                          | 1.0%    | -1.0%    |
| Voltage (DC)                          | 0.7%    | -0.7%    |
| Field Strength (dB)                   | 5.2 dB  | -5.2 dB  |
| AC Powerline Conducted Emissions (dB) | 3.2 dB  | -3.2 dB  |



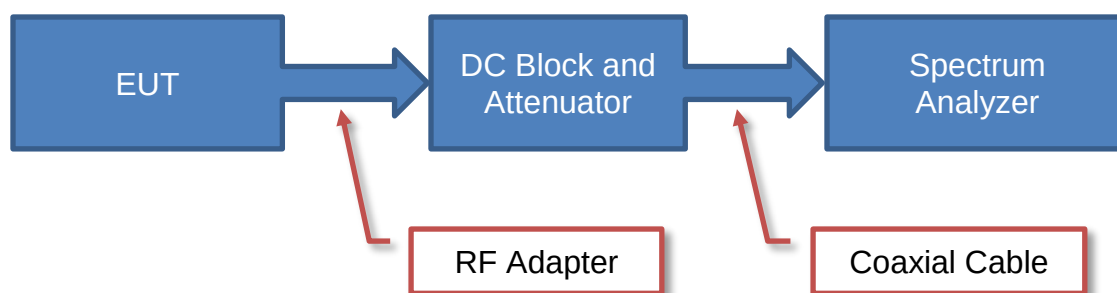
# TEST SETUP BLOCK DIAGRAMS

## Measurement Bandwidths

| Frequency Range (MHz) | Peak Data (kHz) | Quasi-Peak Data (kHz) | Average Data (kHz) |
|-----------------------|-----------------|-----------------------|--------------------|
| 0.01 - 0.15           | 1.0             | 0.2                   | 0.2                |
| 0.15 - 30.0           | 10.0            | 9.0                   | 9.0                |
| 30.0 - 1000           | 100.0           | 120.0                 | 120.0              |
| Above 1000            | 1000.0          | N/A                   | 1000.0             |

Unless otherwise stated, measurements were made using the bandwidths and detectors specified. No video filter was used.

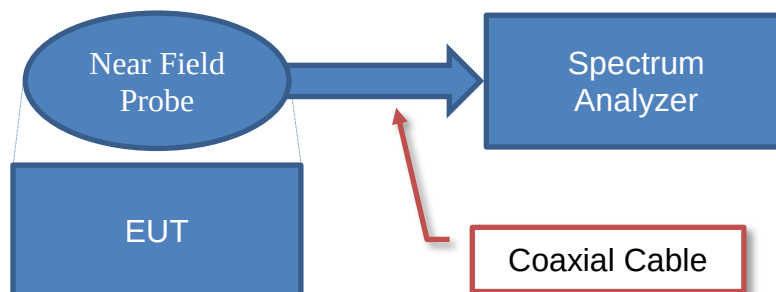
## Antenna Port Conducted Measurements



### Sample Calculation (logarithmic units)

|                |   |                |   |                        |
|----------------|---|----------------|---|------------------------|
| Measured Value |   | Measured Level |   | Reference Level Offset |
| 71.2           | = | 42.6           | + | 28.6                   |

## Near Field Test Fixture Measurements

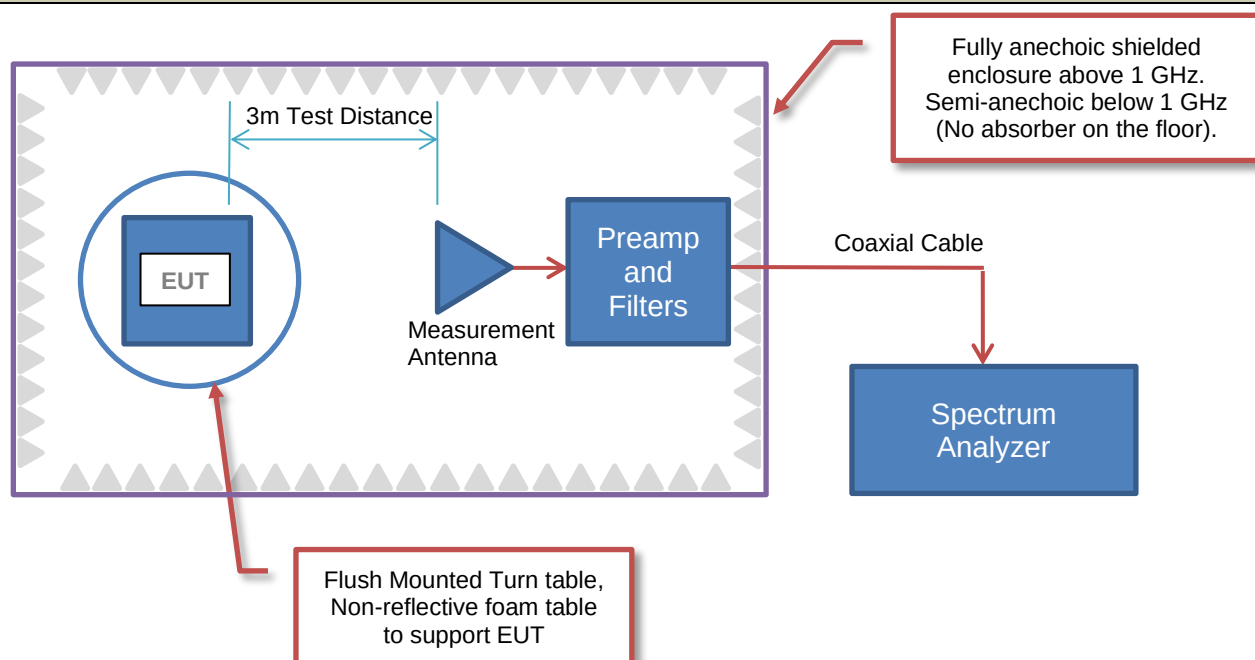


### Sample Calculation (logarithmic units)

|                |   |                |   |                        |
|----------------|---|----------------|---|------------------------|
| Measured Value |   | Measured Level |   | Reference Level Offset |
| 71.2           | = | 42.6           | + | 28.6                   |

# TEST SETUP BLOCK DIAGRAMS

## Emissions Measurements



## Sample Calculation (logarithmic units)

### Radiated Emissions:

| Measured Level (Amplitude) | Factor         |              |                | Distance Adjustment Factor | External Attenuation | Field Strength |
|----------------------------|----------------|--------------|----------------|----------------------------|----------------------|----------------|
|                            | Antenna Factor | Cable Factor | Amplifier Gain |                            |                      |                |
| 42.6                       | 28.6           | 3.1          | 40.8           | 0.0                        | 0.0                  | 33.5           |

### Conducted Emissions:

| Measured Level (Amplitude) | Factor            |              | External Attenuation | Adjusted Level |
|----------------------------|-------------------|--------------|----------------------|----------------|
|                            | Transducer Factor | Cable Factor |                      |                |
| 26.7                       | 0.3               | 0.1          | 20.0                 | 47.1           |

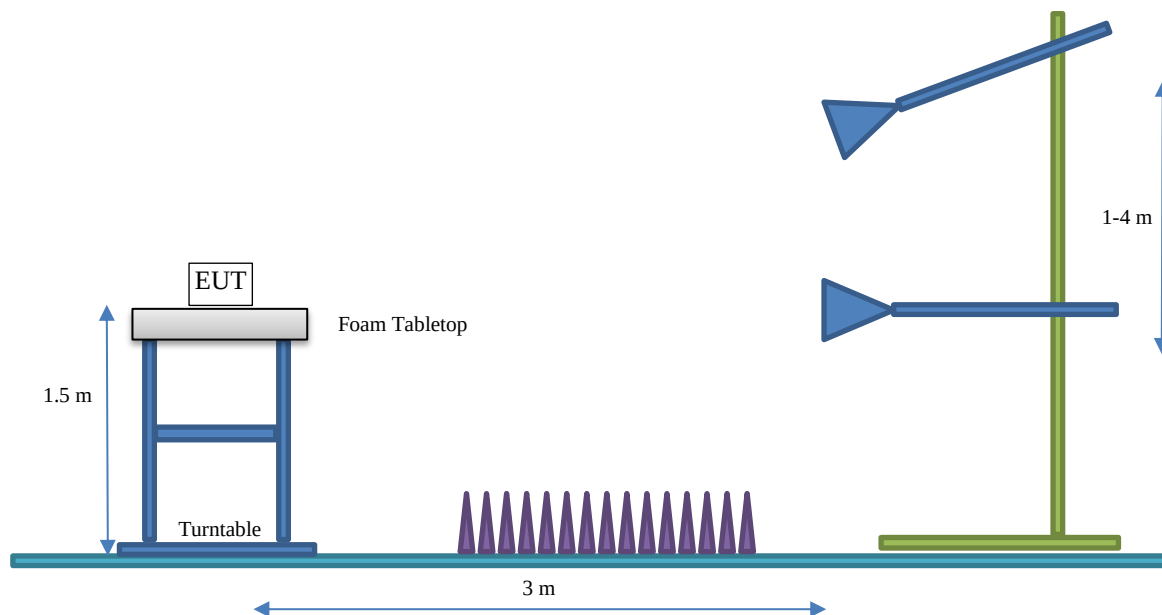
### Radiated Power (ERP/EIRP) – Substitution Method:

| Measured Level into Substitution Antenna (Amplitude dBm) | Substitution Antenna Factor (dBi) | EIRP to ERP (if applicable) | Measured power (dBm ERP/EIRP) |
|----------------------------------------------------------|-----------------------------------|-----------------------------|-------------------------------|
| 10.0                                                     | 6.0                               | 2.15                        | 13.9/16.0                     |

# TEST SETUP BLOCK DIAGRAMS

## Bore Sighting (>1GHz)

The diameter of the illumination area is the dimension of the line tangent to the EUT formed by 3 dB beamwidth of the measurement antenna at the measurement distance. At a 3 meter test distance, the diameter of the illumination area was 3.8 meters at 1 GHz and greater than 2.1 meters up to 6 GHz. Above 1 GHz, when required by the measurement standard, the antenna is pointed for both azimuth and elevation to maintain the receive antenna within the cone of radiation from the EUT. The specified measurement detectors were used for comparison of the emissions to the peak and average specification limits.



# PRODUCT DESCRIPTION

## Client and Equipment under Test (EUT) Information

|                          |                           |
|--------------------------|---------------------------|
| Company Name:            | Emerson                   |
| Address:                 | 6021 Innovation Boulevard |
| City, State, Zip:        | Shakopee, MN 55379        |
| Test Requested By:       | Elizabeth Reiersen        |
| EUT:                     | 781SA                     |
| First Date of Test:      | March 5, 2024             |
| Last Date of Test:       | August 2, 2024            |
| Receipt Date of Samples: | March 5, 2024             |
| Equipment Design Stage:  | Production                |
| Equipment Condition:     | No Damage                 |
| Purchase Authorization:  | Verified                  |

## Information Provided by the Party Requesting the Test

### Functional Description of the EUT:

The Emerson 781SA uses WirelessHART communication protocol to wirelessly receive and send information between a wireless sensor and to the wired Emerson Wireless 1410S Gateway. This is revision 3 of the 781SA hardware.

### Testing Objective:

To demonstrate compliance of additional antennas not included in the original grant with KDB 178919 for the 2.4 GHz hybrid radio to FCC 15.247 requirements and to RSS-247 requirements.

# POWER SETTINGS AND ANTENNAS



The power settings, antenna gain value(s) and cable loss (if applicable) used for the testing contained in this report were provided by the customer and will affect the validity of the results. Element assumes no responsibility for the accuracy of this information. The power settings below reflect the maximum power that the EUT is allowed to transmit at during normal operation.

## ANTENNA GAIN (dBi)

| Type              | Provided by:      | Frequency Range (MHz) | Gain (dBi) |
|-------------------|-------------------|-----------------------|------------|
| Sector Antenna    | L-Com HG2420P-120 | 2400-2500             | 20         |
| Panel Antenna     | L-Com HG2418P     | 2400-2500             | 18         |
| Dipole            | L-Com HG2415U-PRO | 2400-2500             | 15         |
| Yagi              | L-Com HG2415Y     | 2400-2500             | 14.5       |
| Dipole            | BOA24008NF        | 2400-2500             | 8          |
| Integral Monopole | Emerson           | 2400-2483.5           | 2          |

The EUT was tested using the power settings provided by the manufacturer which were based upon:

- ☐ Test software settings      Software/firmware used for testing: Hart Talk Ver 1.1.43.0A / C56095-0003  
☒ Rated power settings

## SETTINGS FOR ALL TESTS IN THIS REPORT

| Modulation Types | Position<br>(if multiple channels) | Power Setting (dBm) |
|------------------|------------------------------------|---------------------|
| OQPSK            | Low Channel, 2405 MHz              | 14                  |
|                  | Mid Channel, 2440 MHz              | 14                  |
|                  | High Channel, 2475 MHz             | 14                  |

# CONFIGURATIONS

## Configuration EMPM0165-1

| EUT                      |              |                   |               |
|--------------------------|--------------|-------------------|---------------|
| Description              | Manufacturer | Model/Part Number | Serial Number |
| 781SA (internal antenna) | Emerson      | 781SA             | 015           |

| Remote Equipment Outside of Test Setup Boundary |              |                   |               |
|-------------------------------------------------|--------------|-------------------|---------------|
| Description                                     | Manufacturer | Model/Part Number | Serial Number |
| Gateway                                         | Emerson      | 1410S             | None          |
| Power Supply                                    | Triad        | WS2U240-0500      | None          |

| Cables             |        |            |         |              |              |
|--------------------|--------|------------|---------|--------------|--------------|
| Cable Type         | Shield | Length (m) | Ferrite | Connection 1 | Connection 2 |
| Belden Cable 3084A | Yes    | 9.0m       | No      | Gateway      | 781SA        |
| Power Cable        | No     | 1.5m       | No      | Power Supply | AC Mains     |

## Configuration EMPM0165-4

| EUT                      |              |                   |               |
|--------------------------|--------------|-------------------|---------------|
| Description              | Manufacturer | Model/Part Number | Serial Number |
| Dipole Antenna 8dBi      | PCTEL        | BOA24008NF        | None          |
| 781SA (external antenna) | Emerson      | 781SA             | 018           |

| Remote Equipment Outside of Test Setup Boundary |              |                   |               |
|-------------------------------------------------|--------------|-------------------|---------------|
| Description                                     | Manufacturer | Model/Part Number | Serial Number |
| Gateway                                         | Emerson      | 1410S             | None          |
| Power Supply                                    | Triad        | WS2U240-0500      | None          |

| Cables             |        |            |         |              |              |
|--------------------|--------|------------|---------|--------------|--------------|
| Cable Type         | Shield | Length (m) | Ferrite | Connection 1 | Connection 2 |
| Belden Cable 3084A | Yes    | 9.0m       | No      | Gateway      | 781SA        |
| Antenna Cable      | Yes    | >3m        | No      | 781SA        | Antenna      |
| Power Cable        | No     | 1.5m       | No      | Power Supply | AC Mains     |

# CONFIGURATIONS

## Configuration EMPM0165-5

| EUT                      |              |                   |               |
|--------------------------|--------------|-------------------|---------------|
| Description              | Manufacturer | Model/Part Number | Serial Number |
| Dipole Antenna 15dBi     | L-COM        | HG2415U-PRO       | None          |
| 781SA (external antenna) | Emerson      | 781SA             | 018           |

| Remote Equipment Outside of Test Setup Boundary |              |                   |               |
|-------------------------------------------------|--------------|-------------------|---------------|
| Description                                     | Manufacturer | Model/Part Number | Serial Number |
| Gateway                                         | Emerson      | 1410S             | None          |
| Power Supply                                    | Triad        | WS2U240-0500      | None          |

| Cables             |        |            |         |              |              |
|--------------------|--------|------------|---------|--------------|--------------|
| Cable Type         | Shield | Length (m) | Ferrite | Connection 1 | Connection 2 |
| Belden Cable 3084A | Yes    | 9.0m       | No      | Gateway      | 781SA        |
| Antenna Cable      | Yes    | >3m        | No      | 781SA        | Antenna      |
| Power Cable        | No     | 1.5m       | No      | Power Supply | AC Mains     |

## Configuration EMPM0165-6

| EUT                      |              |                   |               |
|--------------------------|--------------|-------------------|---------------|
| Description              | Manufacturer | Model/Part Number | Serial Number |
| Sector Antenna 20dBi     | L-COM        | HG2420P-120       | None          |
| 781SA (external antenna) | Emerson      | 781SA             | 018           |

| Remote Equipment Outside of Test Setup Boundary |              |                   |               |
|-------------------------------------------------|--------------|-------------------|---------------|
| Description                                     | Manufacturer | Model/Part Number | Serial Number |
| Gateway                                         | Emerson      | 1410S             | None          |
| Power Supply                                    | Triad        | WS2U240-0500      | None          |

| Cables             |        |            |         |              |              |
|--------------------|--------|------------|---------|--------------|--------------|
| Cable Type         | Shield | Length (m) | Ferrite | Connection 1 | Connection 2 |
| Belden Cable 3084A | Yes    | 9.0m       | No      | Gateway      | 781SA        |
| Antenna Cable      | Yes    | >3m        | No      | 781SA        | Antenna      |
| Power Cable        | No     | 1.5m       | No      | Power Supply | AC Mains     |

# CONFIGURATIONS

## Configuration EMPM0165-7

| EUT                      |              |                   |               |
|--------------------------|--------------|-------------------|---------------|
| Description              | Manufacturer | Model/Part Number | Serial Number |
| 781SA (external antenna) | Emerson      | 781SA             | 018           |
| YAGI Antenna 14.5dBi     | L-COM        | HG2415Y           | None          |

| Remote Equipment Outside of Test Setup Boundary |              |                   |               |
|-------------------------------------------------|--------------|-------------------|---------------|
| Description                                     | Manufacturer | Model/Part Number | Serial Number |
| Gateway                                         | Emerson      | 1410S             | None          |
| Power Supply                                    | Triad        | WS2U240-0500      | None          |

| Cables             |        |            |         |              |              |
|--------------------|--------|------------|---------|--------------|--------------|
| Cable Type         | Shield | Length (m) | Ferrite | Connection 1 | Connection 2 |
| Belden Cable 3084A | Yes    | 9.0m       | No      | Gateway      | 781SA        |
| Antenna Cable      | Yes    | >3m        | No      | 781SA        | Antenna      |
| Power Cable        | No     | 1.5m       | No      | Power Supply | AC Mains     |

## Configuration EMPM0165-9

| EUT                      |              |                   |               |
|--------------------------|--------------|-------------------|---------------|
| Description              | Manufacturer | Model/Part Number | Serial Number |
| 781SA (external antenna) | Emerson      | 781SA             | 018           |
| Panel 18dBi Antenna      | L-COM        | HG2418P           | None          |

| Remote Equipment Outside of Test Setup Boundary |              |                   |               |
|-------------------------------------------------|--------------|-------------------|---------------|
| Description                                     | Manufacturer | Model/Part Number | Serial Number |
| Gateway                                         | Emerson      | 1410S             | None          |
| Power Supply                                    | Triad        | WS2U240-0500      | None          |

| Cables             |        |            |         |              |              |
|--------------------|--------|------------|---------|--------------|--------------|
| Cable Type         | Shield | Length (m) | Ferrite | Connection 1 | Connection 2 |
| Belden Cable 3084A | Yes    | 9.0m       | No      | Gateway      | 781SA        |
| Antenna Cable      | Yes    | >3m        | No      | 781SA        | Antenna      |
| Power Cable        | No     | 1.5m       | No      | Power Supply | AC Mains     |



# CONFIGURATIONS

## Configuration EMPM0165-10

| EUT                      |              |                   |               |
|--------------------------|--------------|-------------------|---------------|
| Description              | Manufacturer | Model/Part Number | Serial Number |
| 781SA (external antenna) | Emerson      | 781SA             | 018           |

| Peripherals in Test Setup Boundary |              |                   |               |
|------------------------------------|--------------|-------------------|---------------|
| Description                        | Manufacturer | Model/Part Number | Serial Number |
| Gateway                            | Emerson      | 1410S             | None          |
| Power Supply                       | Triad        | WS2U240-0500      | None          |

| Cables             |        |            |         |              |              |
|--------------------|--------|------------|---------|--------------|--------------|
| Cable Type         | Shield | Length (m) | Ferrite | Connection 1 | Connection 2 |
| Belden Cable 3084A | Yes    | 9.0m       | No      | Gateway      | 781SA        |
| Power Cable        | No     | 1.5m       | No      | Power Supply | AC Mains     |

# CONFIGURATIONS

## Configuration EMPM0182-1

| EUT                      |              |                   |               |
|--------------------------|--------------|-------------------|---------------|
| Description              | Manufacturer | Model/Part Number | Serial Number |
| Dipole Antenna 8dBi      | PCTEL        | BOA24008NF        | None          |
| 781SA (external antenna) | Emerson      | 781SA             | 018           |

| Peripherals in Test Setup Boundary |              |                   |               |
|------------------------------------|--------------|-------------------|---------------|
| Description                        | Manufacturer | Model/Part Number | Serial Number |
| Gateway                            | Emerson      | 1410S             | None          |
| Power Supply                       | Triad        | WS2U240-0500      | None          |

| Cables             |        |            |         |              |              |
|--------------------|--------|------------|---------|--------------|--------------|
| Cable Type         | Shield | Length (m) | Ferrite | Connection 1 | Connection 2 |
| Antenna Cable      | Yes    | 6.1m       | No      | Antenna      | 781SA        |
| Belden Cable 3084A | Yes    | 9.0m       | No      | Gateway      | 781SA        |
| Power Cable        | No     | 1.5m       | No      | Power Supply | AC Mains     |

## Configuration EMPM0182-2

| EUT                      |              |                   |               |
|--------------------------|--------------|-------------------|---------------|
| Description              | Manufacturer | Model/Part Number | Serial Number |
| Dipole Antenna 15dBi     | L-COM        | HG2415U-PRO       | None          |
| 781SA (external antenna) | Emerson      | 781SA             | 018           |

| Peripherals in Test Setup Boundary |              |                   |               |
|------------------------------------|--------------|-------------------|---------------|
| Description                        | Manufacturer | Model/Part Number | Serial Number |
| Gateway                            | Emerson      | 1410S             | None          |
| Power Supply                       | Triad        | WS2U240-0500      | None          |

| Cables             |        |            |         |              |              |
|--------------------|--------|------------|---------|--------------|--------------|
| Cable Type         | Shield | Length (m) | Ferrite | Connection 1 | Connection 2 |
| Antenna Cable      | Yes    | 6.1m       | No      | Antenna      | 781SA        |
| Belden Cable 3084A | Yes    | 9.0m       | No      | Gateway      | 781SA        |
| Power Cable        | No     | 1.5m       | No      | Power Supply | AC Mains     |

# CONFIGURATIONS



## Configuration EMPM0182-3

| EUT                      |              |                   |               |
|--------------------------|--------------|-------------------|---------------|
| Description              | Manufacturer | Model/Part Number | Serial Number |
| 781SA (external antenna) | Emerson      | 781SA             | 018           |
| YAGI Antenna 14.5dBi     | L-COM        | HG2415Y           | None          |

| Peripherals in Test Setup Boundary |              |                   |               |
|------------------------------------|--------------|-------------------|---------------|
| Description                        | Manufacturer | Model/Part Number | Serial Number |
| Gateway                            | Emerson      | 1410S             | None          |
| Power Supply                       | Triad        | WS2U240-0500      | None          |

| Cables             |        |            |         |              |              |
|--------------------|--------|------------|---------|--------------|--------------|
| Cable Type         | Shield | Length (m) | Ferrite | Connection 1 | Connection 2 |
| Antenna Cable      | Yes    | 6.1m       | No      | Antenna      | 781SA        |
| Belden Cable 3084A | Yes    | 9.0m       | No      | Gateway      | 781SA        |
| Power Cable        | No     | 1.5m       | No      | Power Supply | AC Mains     |

## Configuration EMPM0182-4

| EUT                      |              |                   |               |
|--------------------------|--------------|-------------------|---------------|
| Description              | Manufacturer | Model/Part Number | Serial Number |
| Panel 18dBi Antenna      | L-COM        | HG2418P           | None          |
| 781SA (external antenna) | Emerson      | 781SA             | 018           |

| Peripherals in Test Setup Boundary |              |                   |               |
|------------------------------------|--------------|-------------------|---------------|
| Description                        | Manufacturer | Model/Part Number | Serial Number |
| Gateway                            | Emerson      | 1410S             | None          |
| Power Supply                       | Triad        | WS2U240-0500      | None          |

| Cables             |        |            |         |              |              |
|--------------------|--------|------------|---------|--------------|--------------|
| Cable Type         | Shield | Length (m) | Ferrite | Connection 1 | Connection 2 |
| Antenna Cable      | Yes    | 6.1m       | No      | Antenna      | 781SA        |
| Belden Cable 3084A | Yes    | 9.0m       | No      | Gateway      | 781SA        |
| Power Cable        | No     | 1.5m       | No      | Power Supply | AC Mains     |

# CONFIGURATIONS

## Configuration EMPM0182-5

| EUT                      |              |                   |               |
|--------------------------|--------------|-------------------|---------------|
| Description              | Manufacturer | Model/Part Number | Serial Number |
| Sector Antenna 20dB      | L-COM        | HG2420P-120       | None          |
| 781SA (external antenna) | Emerson      | 781SA             | 018           |

| Peripherals in Test Setup Boundary |              |                   |               |
|------------------------------------|--------------|-------------------|---------------|
| Description                        | Manufacturer | Model/Part Number | Serial Number |
| Gateway                            | Emerson      | 1410S             | None          |
| Power Supply                       | Triad        | WS2U240-0500      | None          |

| Cables             |        |            |         |              |              |
|--------------------|--------|------------|---------|--------------|--------------|
| Cable Type         | Shield | Length (m) | Ferrite | Connection 1 | Connection 2 |
| Antenna Cable      | Yes    | 6.1m       | No      | Antenna      | 781SA        |
| Belden Cable 3084A | Yes    | 9.0m       | No      | Gateway      | 781SA        |
| Power Cable        | No     | 1.5m       | No      | Power Supply | AC Mains     |

# MODIFICATIONS

## Equipment Modifications

| Item | Date       | Test                                       | Modification                         | Note                                                                | Disposition of EUT                          |
|------|------------|--------------------------------------------|--------------------------------------|---------------------------------------------------------------------|---------------------------------------------|
| 1    | 2024-03-05 | Spurious Radiated Emissions                | Tested as delivered to Test Station. | No EMI suppression devices were added or modified during this test. | EUT remained at Element following the test. |
| 2    | 2024-03-12 | Output Power                               | Tested as delivered to Test Station. | No EMI suppression devices were added or modified during this test. | EUT remained at Element following the test. |
| 3    | 2024-03-12 | Equivalent Isotropic Radiated Power (EIRP) | Tested as delivered to Test Station. | No EMI suppression devices were added or modified during this test. | EUT remained at Element following the test. |
| 4    | 2024-08-02 | Spurious Radiated Emissions                | Tested as delivered to Test Station. | No EMI suppression devices were added or modified during this test. | Scheduled testing was completed.            |

# DUTY CYCLE



## TEST DESCRIPTION

---

The Duty Cycle (x) were measured for each of the EUT operating modes. The measurements were made using a zero span on the spectrum analyzer to see the pulses in the time domain. The transmit power was set to its default maximum.

The duty cycle was calculated by dividing the transmission pulse duration (T) by the total period of a single on and total off time.

The EUT operates at 100% Duty Cycle in test mode. The client states that the Operational Duty Cycle will not exceed 20.706% in 100ms and 19.09% in 1s.

# OUTPUT POWER

## TEST DESCRIPTION

Testing was performed using the mode(s) of operation and configuration(s) noted within the report. The individuals and/or the organization requesting the test provided the modes, configurations and settings used to complete the evaluation. The actual test parameters are specified in the test data, this includes items such as investigated frequency range (scanned) and test levels. The testing methods and performance specifications, as well as the test site used for the evaluation are indicated in the test data.

The measurement was made using a direct connection between the RF output of the EUT and a spectrum analyzer.

The transmit frequency was set to the required channels in each band. The transmit power was set to its default maximum.

Prior to measuring peak transmit power the DTS bandwidth (B) was measured.

The method found in ANSI C63.10:2013 Section 11.9.1.1 was used because the RBW on the analyzer was greater than the DTS Bandwidth of the radio.

## TEST EQUIPMENT

| Description                  | Manufacturer       | Model                 | ID  | Last Cal.  | Cal. Due   |
|------------------------------|--------------------|-----------------------|-----|------------|------------|
| Analyzer - Spectrum Analyzer | Keysight           | N9010A                | AFM | 2023-05-01 | 2024-05-01 |
| Generator - Signal           | Agilent            | N5183A                | TIK | 2022-01-24 | 2025-01-24 |
| Cable                        | Micro-Coax         | UFD150A-1-0720-200200 | MNL | 2023-09-05 | 2024-09-05 |
| Block - DC                   | Fairview Microwave | SD3379                | ANH | 2023-09-05 | 2024-09-05 |
| Attenuator                   | S.M. Electronics   | SA26B-20              | RFW | 2024-01-31 | 2025-01-31 |

# OUTPUT POWER

|                   |                                          |                       |             |
|-------------------|------------------------------------------|-----------------------|-------------|
| EUT:              | 781SA                                    | Work Order:           | EMPM0165    |
| Serial Number:    | 018                                      | Date:                 | 2024-03-12  |
| Customer:         | Emerson                                  | Temperature:          | 23.7°C      |
| Attendees:        | Daniel Wolf, Elizabeth Reiersen          | Relative Humidity:    | 25.8%       |
| Customer Project: | None                                     | Bar. Pressure (PMSL): | 1007 mbar   |
| Tested By:        | Christopher Heintzeman                   | Job Site:             | MN11        |
| Power:            | 15VDC (provided from peripheral Gateway) | Configuration:        | EMPM0165-10 |

## TEST SPECIFICATIONS

|                      |                  |
|----------------------|------------------|
| Specification:       | Method:          |
| FCC 15.247:2024      | ANSI C63.10:2013 |
| RSS-247 Issue 3:2023 | ANSI C63.10:2013 |

## COMMENTS

Reference level offset includes measurement cable, attenuator, and DC block.  
The maximum antenna gain is 20 dBi. Per FCC 15.247(b)(4), 20 dBi exceeds the specified 6 dBi directional gain by 14 dB, so the output power limit stated was reduced by 14 dB.  $30 \text{ dBm} - (20 \text{ dBi} - 6 \text{ dBi}) = 16 \text{ dBm}$ . This is tighter than the specified 30 dBm (1 Watt) limit specified by RSS-247 section 5.4 d. EIRP limits have also been applied for both FCC and ISSED requirements as shown separately in this report.

## DEVIATIONS FROM TEST STANDARD

None

## CONCLUSION

Pass



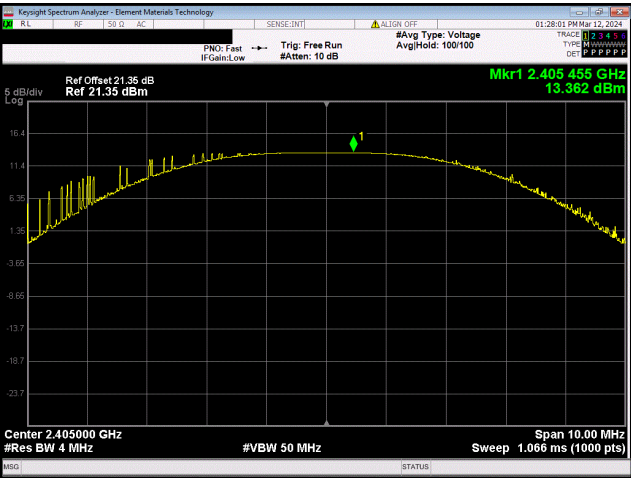
Tested By

## TEST RESULTS

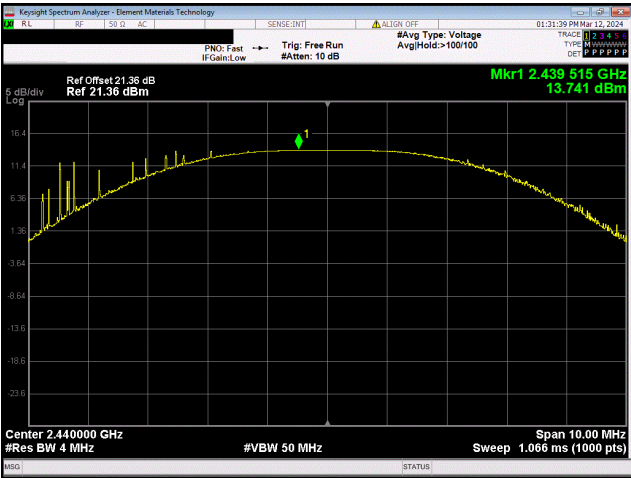
|                        | Out Pwr<br>(dBm) | Limit<br>(dBm) | Result |
|------------------------|------------------|----------------|--------|
| 2.4 GHz Radio, OQPSK   |                  |                |        |
| Low Channel, 2405 MHz  | 13.362           | 16             | Pass   |
| Mid Channel, 2440 MHz  | 13.741           | 16             | Pass   |
| High Channel, 2475 MHz | 14.271           | 16             | Pass   |



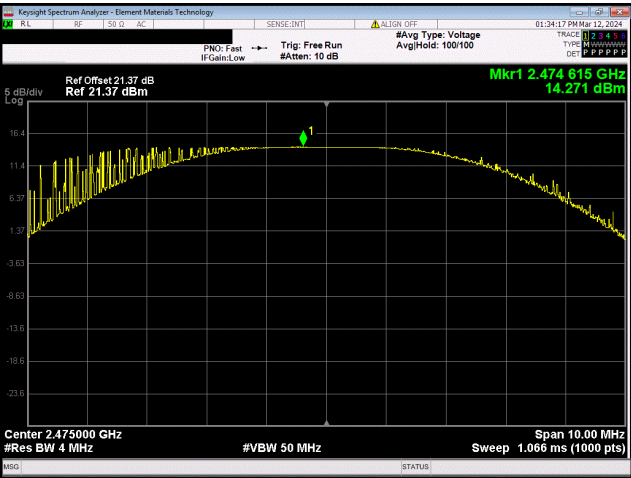
# OUTPUT POWER



2.4 GHz Radio, OQPSK  
Low Channel, 2405 MHz



2.4 GHz Radio, OQPSK  
Mid Channel, 2440 MHz



2.4 GHz Radio, OQPSK  
High Channel, 2475 MHz

# EQUIVALENT ISOTROPIC RADIATED POWER (EIRP)



## TEST DESCRIPTION

Testing was performed using the mode(s) of operation and configuration(s) noted within the report. The individuals and/or the organization requesting the test provided the modes, configurations and settings used to complete the evaluation. The actual test parameters are specified in the test data, this includes items such as investigated frequency range (scanned) and test levels. The testing methods and performance specifications, as well as the test site used for the evaluation are indicated in the test data.

The measurement was made using a direct connection between the RF output of the EUT and a spectrum analyzer.

The transmit frequency was set to the required channels in each band. The transmit power was set to its default maximum.

Prior to measuring peak transmit power the DTS bandwidth (B) was measured.

The method found in ANSI C63.10:2013 Section 11.9.1.1 was used because the RBW on the analyzer was greater than the DTS Bandwidth of the radio.

Equivalent Isotropic Radiated Power (EIRP) = Max Measured Power + Antenna gain (dBi)

## TEST EQUIPMENT

| Description                  | Manufacturer       | Model                 | ID  | Last Cal.  | Cal. Due   |
|------------------------------|--------------------|-----------------------|-----|------------|------------|
| Analyzer - Spectrum Analyzer | Keysight           | N9010A                | AFM | 2023-05-01 | 2024-05-01 |
| Generator - Signal           | Agilent            | N5183A                | TIK | 2022-01-24 | 2025-01-24 |
| Cable                        | Micro-Coax         | UFD150A-1-0720-200200 | MNL | 2023-09-05 | 2024-09-05 |
| Block - DC                   | Fairview Microwave | SD3379                | ANH | 2023-09-05 | 2024-09-05 |
| Attenuator                   | S.M. Electronics   | SA26B-20              | RFW | 2024-01-31 | 2025-01-31 |

# EQUIVALENT ISOTROPIC RADIATED POWER (EIRP)



|                   |                                          |                       |             |
|-------------------|------------------------------------------|-----------------------|-------------|
| EUT:              | 781SA                                    | Work Order:           | EMPM0165    |
| Serial Number:    | 018                                      | Date:                 | 2024-03-12  |
| Customer:         | Emerson                                  | Temperature:          | 23.7°C      |
| Attendees:        | Daniel Wolf, Elizabeth Reiersen          | Relative Humidity:    | 26.1%       |
| Customer Project: | None                                     | Bar. Pressure (PMSL): | 1007 mbar   |
| Tested By:        | Christopher Heintzelman                  | Job Site:             | MN11        |
| Power:            | 15VDC (provided from peripheral Gateway) | Configuration:        | EMPM0165-10 |

## TEST SPECIFICATIONS

|                      |                  |
|----------------------|------------------|
| Specification:       | Method:          |
| FCC 15.247:2024      | ANSI C63.10:2013 |
| RSS-247 Issue 3:2023 | ANSI C63.10:2013 |

## COMMENTS

Reference level offset includes measurement cable, attenuator, and DC block.  
The highest antenna gain (worst case) from the tested antennas in this test report was used to calculate the EIRP.

## DEVIATIONS FROM TEST STANDARD

None

## CONCLUSION

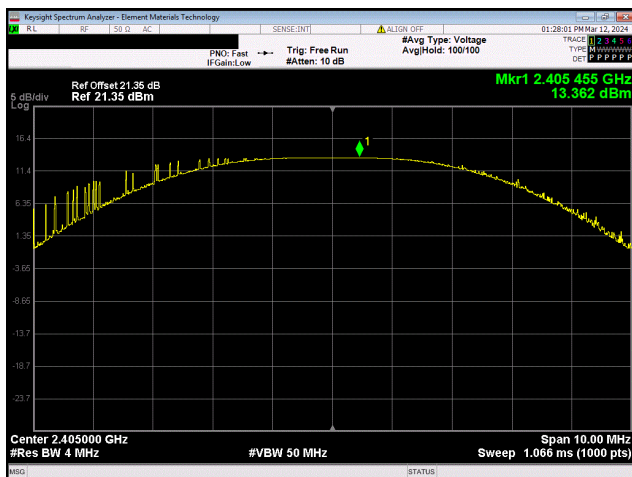
Pass

Tested By

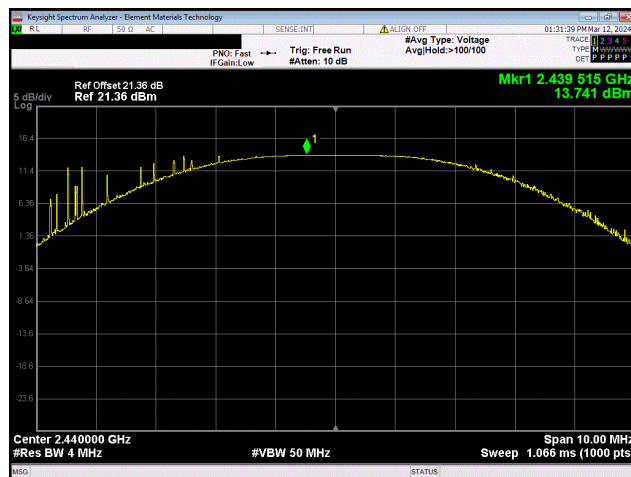
## TEST RESULTS

|                        | Out Pwr<br>(dBm) | Antenna<br>Gain (dBi) | EIRP<br>(dBm) | EIRP Limit<br>(dBm) | Result |
|------------------------|------------------|-----------------------|---------------|---------------------|--------|
| 2.4 GHz Radio, OQPSK   |                  |                       |               |                     |        |
| Low Channel, 2405 MHz  | 13.362           | 20                    | 33.362        | 36                  | Pass   |
| Mid Channel, 2440 MHz  | 13.741           | 20                    | 33.741        | 36                  | Pass   |
| High Channel, 2475 MHz | 14.271           | 20                    | 34.271        | 36                  | Pass   |

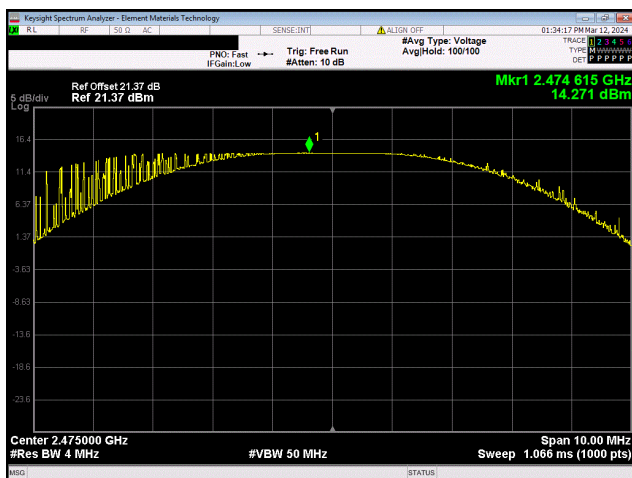
# EQUIVALENT ISOTROPIC RADIATED POWER (EIRP)



2.4 GHz Radio, OQPSK  
Low Channel, 2405 MHz



2.4 GHz Radio, OQPSK  
Mid Channel, 2440 MHz



2.4 GHz Radio, OQPSK  
High Channel, 2475 MHz

# SPURIOUS RADIATED EMISSIONS – INTERNAL ANTENNA – SPOT CHECKS

## TEST DESCRIPTION

The highest gain antenna of each type to be used with the EUT was tested. The EUT was configured for the required transmit frequencies and the modes as showed in the data sheets.

For each configuration, the spectrum was scanned throughout the specified range as part of the exploratory investigation of the emissions. These “pre-scans” are not included in the report. Final measurements on individual emissions were then made and included in this test report.

The individual emissions from the EUT were maximized by rotating the EUT on a turntable, adjusting the position of the EUT and EUT antenna in three orthogonal axis if required, and adjusting the measurement antenna height and polarization (per ANSI C63.10). A preamp and high pass filter (and notch filter) were used for this test in order to provide sufficient measurement sensitivity.

Measurements were made with the required detectors and annotated on the data for each individual point using the following annotation:

QP = Quasi-Peak Detector  
PK = Peak Detector  
AV = RMS Detector

Measurements were made to satisfy the specific requirements of the test specification for out of band emissions as well as the restricted band requirements.

If there are no detectable emissions above the noise floor, the data included may show noise floor measurements for reference only.

Measurements within 2 MHz of the allowable band may have been taken using the integration method from ANSI C63.10 clause 11.13.3. This procedure uses the channel power feature of the spectrum analyzer to integrate the power of the emission within a 1 MHz bandwidth.

Where the radio test software does not provide for a duty cycle at continuous transmit conditions (> 98%) and the RMS (power average) measurements were made across the on and off times of the EUT transmissions, a duty cycle correction is added to the measurements using the formula of  $10 \cdot \log(1/dc)$ .

## TEST EQUIPMENT

| Description                  | Manufacturer       | Model                          | ID  | Last Cal.  | Cal. Due   |
|------------------------------|--------------------|--------------------------------|-----|------------|------------|
| Antenna - Double Ridge       | ETS Lindgren       | 3115                           | AIP | 2022-07-20 | 2024-07-20 |
| Cable                        | ESM Cable Corp.    | Double Ridge Guide Horn Cables | MNI | 2024-01-08 | 2025-01-08 |
| Amplifier - Pre-Amplifier    | Miteq              | AMF-3D-00100800-32-13P         | AVT | 2024-01-08 | 2025-01-08 |
| Attenuator                   | Fairview Microwave | SA18H-20                       | VAF | 2023-09-11 | 2024-09-11 |
| Analyzer - Spectrum Analyzer | Keysight           | N9010A                         | AFN | 2024-02-29 | 2025-02-28 |
| Filter - High Pass           | Micro-Tronics      | HPM50111                       | LFN | 2023-08-23 | 2024-08-23 |
| Antenna - Standard Gain      | ETS Lindgren       | 3160-07                        | AXP | NCR        | NCR        |
| Cable                        | ESM Cable Corp.    | Standard Gain Horn Cables      | MNJ | 2024-01-28 | 2025-01-28 |
| Amplifier - Pre-Amplifier    | Miteq              | AMF-6F-08001200-30-10P         | AVV | 2024-01-08 | 2025-01-08 |
| Antenna - Standard Gain      | ETS Lindgren       | 3160-08                        | AIQ | NCR        | NCR        |
| Amplifier - Pre-Amplifier    | Miteq              | AMF-6F-12001800-30-10P         | AVW | 2024-01-08 | 2025-01-08 |

## MEASUREMENT UNCERTAINTY

| Description  |        |         |
|--------------|--------|---------|
| Expanded k=2 | 5.2 dB | -5.2 dB |

# SPURIOUS RADIATED EMISSIONS – INTERNAL ANTENNA – SPOT CHECKS

## FREQUENCY RANGE INVESTIGATED

1 GHz TO 18 GHz

## POWER INVESTIGATED

15VDC (provided from peripheral Gateway)

## CONFIGURATIONS INVESTIGATED

EMPM0165-1

## MODES INVESTIGATED

Transmitting 2.4 GHz Antenna Low, Mid and High Chs (2405, 2440 and 2475 MHz) OQPSK 250 kbps

Transmitting 2.4 GHz Antenna Low and High Chs (2405 and 2475 MHz) OQPSK 250 kbps

All channels tested independently.

# SPURIOUS RADIATED EMISSIONS – INTERNAL ANTENNA – SPOT CHECKS

|                   |                                             |                       |            |
|-------------------|---------------------------------------------|-----------------------|------------|
| EUT:              | 781SA                                       | Work Order:           | EMPM0165   |
| Serial Number:    | 015                                         | Date:                 | 2024-03-05 |
| Customer:         | Emerson                                     | Temperature:          | 21.3°C     |
| Attendees:        | Erin Snell, Mark Nelson, Elizabeth Reiersen | Relative Humidity:    | 25%        |
| Customer Project: | None                                        | Bar. Pressure (PMSL): | 1021 mb    |
| Tested By:        | Arnauld Dedry, Marcelo Aguayo               | Job Site:             | MN05       |
| Power:            | 15VDC (provided from peripheral Gateway)    | Configuration:        | EMPM0165-1 |

## TEST SPECIFICATIONS

|                                      |                  |
|--------------------------------------|------------------|
| Specification:                       | Method:          |
| FCC 15.247:2024                      | ANSI C63.10:2013 |
| RSS-247 Issue 3:2023                 | ANSI C63.10:2013 |
| RSS-Gen Issue 5:2018+A1:2019+A2:2021 |                  |

## TEST PARAMETERS

|        |    |                    |   |                     |           |
|--------|----|--------------------|---|---------------------|-----------|
| Run #: | 21 | Test Distance (m): | 3 | Ant. Height(s) (m): | 1 to 4(m) |
|--------|----|--------------------|---|---------------------|-----------|

## COMMENTS

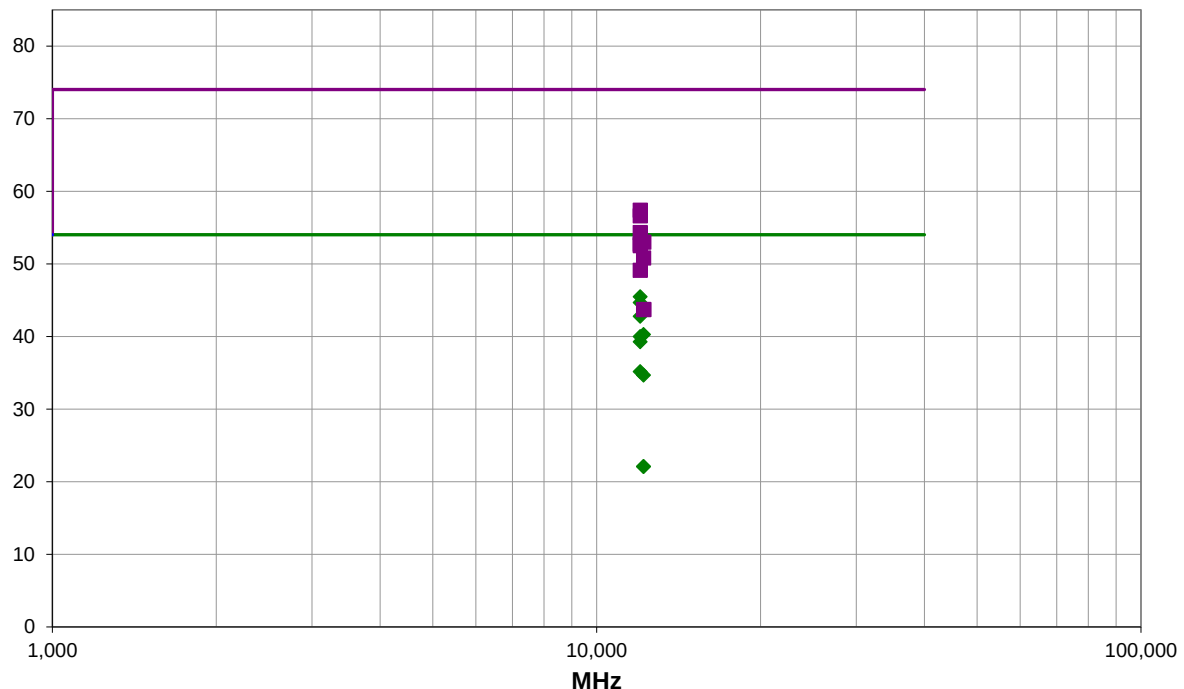
This model has an internal antenna. The test mode was 100% duty cycle. In frequency hopping mode, the worst case on time in 100ms is 20.706ms. This value was provided by the customer. Therefore, a duty cycle correction factor (DCCF) was applied using  $10 \cdot \log(\text{on time} / 100\text{ms}) = -6.8 \text{ dB}$

## EUT OPERATING MODES

Transmitting 2.4 GHz Antenna Low, Mid and High Ch (2405, 2440 and 2475 MHz) OQPSK 250 kbps, Channels tested independently.

## DEVIATIONS FROM TEST STANDARD

None



Run #: 21

■ PK ◆ AV ● QP

# SPURIOUS RADIATED EMISSIONS – INTERNAL ANTENNA – SPOT CHECKS

## RESULTS - Run #21

| Freq (MHz) | Amplitude (dBuV) | Factor (dB/m) | Antenna Height (meters) | Azimuth (degrees) | Duty Cycle Correction Factor (dB) | External Attenuation (dB) | Polarity/Transducer Type | Detector | Distance Adjustment (dB) | Adjusted (dBuV/m) | Spec. Limit (dBuV/m) | Compared to Spec. (dB) | Comments             |
|------------|------------------|---------------|-------------------------|-------------------|-----------------------------------|---------------------------|--------------------------|----------|--------------------------|-------------------|----------------------|------------------------|----------------------|
| 12022.360  | 54.1             | -1.8          | 1.4                     | 328.0             | -6.8                              | 0.0                       | Horz                     | AV       | 0.0                      | 45.5              | 54.0                 | -8.5                   | EUT On Side, Low Ch  |
| 12022.380  | 53.3             | -1.8          | 1.5                     | 339.0             | -6.8                              | 0.0                       | Horz                     | AV       | 0.0                      | 44.7              | 54.0                 | -9.3                   | EUT Horz, Low Ch     |
| 12022.310  | 51.4             | -1.8          | 3.1                     | 340.9             | -6.8                              | 0.0                       | Vert                     | AV       | 0.0                      | 42.8              | 54.0                 | -11.2                  | EUT Horz, Low Ch     |
| 12197.510  | 47.9             | -0.8          | 1.6                     | 325.9             | -6.8                              | 0.0                       | Horz                     | AV       | 0.0                      | 40.3              | 54.0                 | -13.7                  | EUT On Side, Mid Ch  |
| 12022.330  | 48.6             | -1.8          | 1.5                     | 6.9               | -6.8                              | 0.0                       | Vert                     | AV       | 0.0                      | 40.0              | 54.0                 | -14.0                  | EUT On Side, Low Ch  |
| 12022.330  | 47.9             | -1.8          | 1.5                     | 311.9             | -6.8                              | 0.0                       | Vert                     | AV       | 0.0                      | 39.3              | 54.0                 | -14.7                  | EUT Vert, Low Ch     |
| 12022.480  | 59.2             | -1.8          | 1.4                     | 328.0             | 0.0                               | 0.0                       | Horz                     | PK       | 0.0                      | 57.4              | 74.0                 | -16.6                  | EUT On Side, Low Ch  |
| 12022.430  | 58.4             | -1.8          | 1.4                     | 339.0             | 0.0                               | 0.0                       | Horz                     | PK       | 0.0                      | 56.6              | 74.0                 | -17.4                  | EUT Horz, Low Ch     |
| 12022.340  | 43.8             | -1.8          | 2.3                     | 297.0             | -6.8                              | 0.0                       | Horz                     | AV       | 0.0                      | 35.2              | 54.0                 | -18.8                  | EUT Vert, Low Ch     |
| 12197.500  | 42.3             | -0.8          | 3.9                     | 19.0              | -6.8                              | 0.0                       | Vert                     | AV       | 0.0                      | 34.7              | 54.0                 | -19.3                  | EUT Horz, Mid Ch     |
| 12022.210  | 56.1             | -1.8          | 1.5                     | 333.0             | 0.0                               | 0.0                       | Vert                     | PK       | 0.0                      | 54.3              | 74.0                 | -19.7                  | EUT Horz, Low Ch     |
| 12202.250  | 53.8             | -0.8          | 1.6                     | 325.9             | 0.0                               | 0.0                       | Horz                     | PK       | 0.0                      | 53.0              | 74.0                 | -21.0                  | EUT On Side, Mid Ch  |
| 12022.290  | 54.5             | -1.8          | 1.5                     | 6.9               | 0.0                               | 0.0                       | Vert                     | PK       | 0.0                      | 52.7              | 74.0                 | -21.3                  | EUT On Side, Low Ch  |
| 12022.480  | 54.3             | -1.8          | 1.5                     | 318.0             | 0.0                               | 0.0                       | Vert                     | PK       | 0.0                      | 52.5              | 74.0                 | -21.5                  | EUT Vert, Low Ch     |
| 12197.520  | 51.6             | -0.8          | 3.9                     | 19.0              | 0.0                               | 0.0                       | Vert                     | PK       | 0.0                      | 50.8              | 74.0                 | -23.2                  | EUT Horz, Mid Ch     |
| 12022.400  | 50.9             | -1.8          | 2.3                     | 297.0             | 0.0                               | 0.0                       | Horz                     | PK       | 0.0                      | 49.1              | 74.0                 | -24.9                  | EUT Vert, Low Ch     |
| 12201.780  | 44.5             | -0.8          | 1.5                     | 47.0              | 0.0                               | 0.0                       | Vert                     | PK       | 0.0                      | 43.7              | 74.0                 | -30.3                  | EUT Horz, High Ch    |
| 12199.740  | 44.5             | -0.8          | 1.5                     | 175.9             | 0.0                               | 0.0                       | Horz                     | PK       | 0.0                      | 43.7              | 74.0                 | -30.3                  | EUT On Side, High Ch |
| 12197.730  | 29.7             | -0.8          | 1.5                     | 47.0              | -6.8                              | 0.0                       | Vert                     | AV       | 0.0                      | 22.1              | 54.0                 | -31.9                  | EUT Horz, High Ch    |
| 12197.680  | 29.7             | -0.8          | 1.5                     | 175.9             | -6.8                              | 0.0                       | Horz                     | AV       | 0.0                      | 22.1              | 54.0                 | -31.9                  | EUT On Side, High Ch |

## CONCLUSION

Pass



Tested By



# SPURIOUS RADIATED EMISSIONS – INTERNAL ANTENNA – SPOT CHECKS

|                   |                                             |                       |            |
|-------------------|---------------------------------------------|-----------------------|------------|
| EUT:              | 781SA                                       | Work Order:           | EMPM0165   |
| Serial Number:    | 015                                         | Date:                 | 2024-03-05 |
| Customer:         | Emerson                                     | Temperature:          | 21.3°C     |
| Attendees:        | Erin Snell, Mark Nelson, Elizabeth Reiersen | Relative Humidity:    | 25%        |
| Customer Project: | None                                        | Bar. Pressure (PMSL): | 1021 mb    |
| Tested By:        | Arnauld Dedry, Marcelo Aguayo               | Job Site:             | MN05       |
| Power:            | 15VDC (provided from peripheral Gateway)    | Configuration:        | EMPM0165-1 |

## TEST SPECIFICATIONS

|                                      |                  |
|--------------------------------------|------------------|
| Specification:                       | Method:          |
| FCC 15.247:2024                      | ANSI C63.10:2013 |
| RSS-247 Issue 3:2023                 | ANSI C63.10:2013 |
| RSS-Gen Issue 5:2018+A1:2019+A2:2021 |                  |

## TEST PARAMETERS

|        |    |                    |   |                     |           |
|--------|----|--------------------|---|---------------------|-----------|
| Run #: | 25 | Test Distance (m): | 3 | Ant. Height(s) (m): | 1 to 4(m) |
|--------|----|--------------------|---|---------------------|-----------|

## COMMENTS

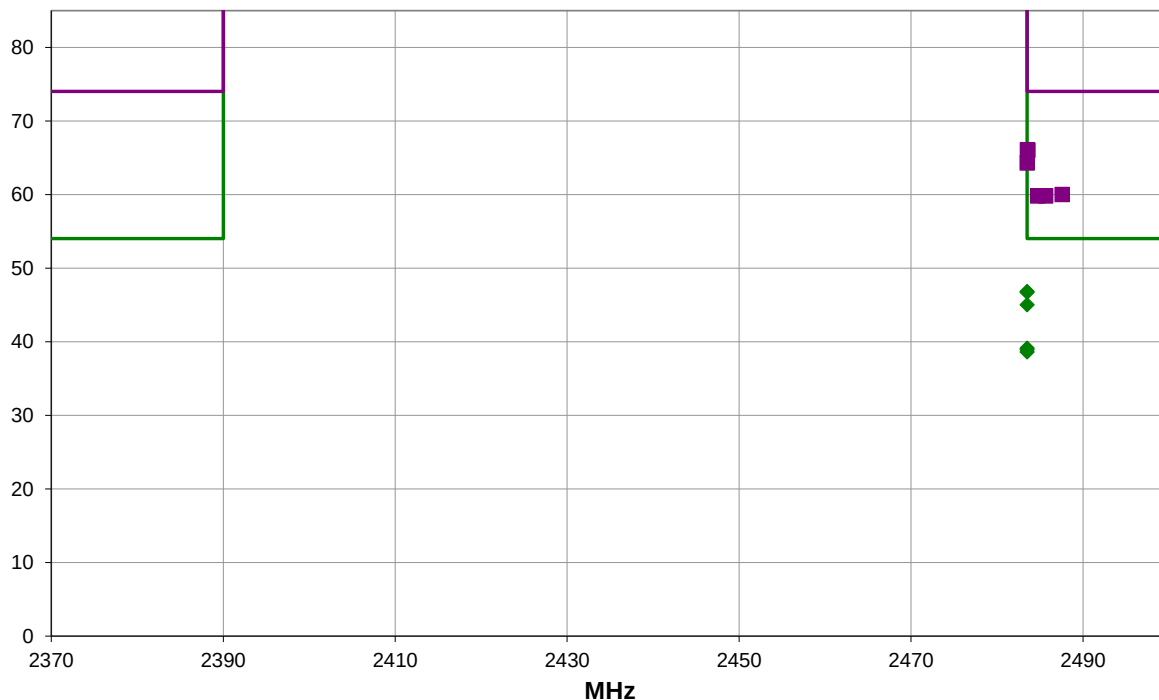
This model has an internal antenna. The test mode was 100% duty cycle. In frequency hopping mode, the worst case on time in 100ms is 20.706ms. This value was provided by the customer. Therefore, a duty cycle correction factor (DCCF) was applied using  $10 \cdot \log(\text{on time} / 100\text{ms}) = -6.8 \text{ dB}$

## EUT OPERATING MODES

Transmitting 2.4 GHz Antenna Low and High Chs (2405 and 2475 MHz) OQPSK 250 kbps, Channels tested independently.

## DEVIATIONS FROM TEST STANDARD

None



Run #: 25

PK AV QP

# SPURIOUS RADIATED EMISSIONS – INTERNAL ANTENNA – SPOT CHECKS

## RESULTS - Run #25

| Freq (MHz) | Amplitude (dBuV) | Factor (dB/m) | Antenna Height (meters) | Azimuth (degrees) | Duty Cycle Correction Factor (dB) | External Attenuation (dB) | Polarity/Transducer Type | Detector | Distance Adjustment (dB) | Adjusted (dBuV/m) | Spec. Limit (dBuV/m) | Compared to Spec. (dB) | Comments             |
|------------|------------------|---------------|-------------------------|-------------------|-----------------------------------|---------------------------|--------------------------|----------|--------------------------|-------------------|----------------------|------------------------|----------------------|
| 2483.500   | 37.1             | -3.5          | 2.1                     | 77.9              | -6.8                              | 20.0                      | Horz                     | AV       | 0.0                      | 46.8              | 54.0                 | -7.2                   | EUT On Side, High Ch |
| 2483.500   | 37.0             | -3.5          | 3.3                     | 52.0              | -6.8                              | 20.0                      | Horz                     | AV       | 0.0                      | 46.7              | 54.0                 | -7.3                   | EUT Horz, High Ch    |
| 2483.525   | 49.6             | -3.5          | 3.3                     | 52.0              | 0.0                               | 20.0                      | Horz                     | PK       | 0.0                      | 66.1              | 74.0                 | -7.9                   | EUT Horz, High Ch    |
| 2483.592   | 49.5             | -3.5          | 2.1                     | 77.9              | 0.0                               | 20.0                      | Horz                     | PK       | 0.0                      | 66.0              | 74.0                 | -8.0                   | EUT On Side, High Ch |
| 2483.500   | 35.3             | -3.5          | 2.0                     | 293.9             | -6.8                              | 20.0                      | Vert                     | AV       | 0.0                      | 45.0              | 54.0                 | -9.0                   | EUT Vert, High Ch    |
| 2483.517   | 47.8             | -3.5          | 2.0                     | 293.9             | 0.0                               | 20.0                      | Vert                     | PK       | 0.0                      | 64.3              | 74.0                 | -9.7                   | EUT Vert, High Ch    |
| 2487.583   | 43.5             | -3.5          | 1.5                     | 91.0              | 0.0                               | 20.0                      | Vert                     | PK       | 0.0                      | 60.0              | 74.0                 | -14.0                  | EUT Horz, High Ch    |
| 2485.667   | 43.3             | -3.5          | 1.5                     | 48.9              | 0.0                               | 20.0                      | Vert                     | PK       | 0.0                      | 59.8              | 74.0                 | -14.2                  | EUT On Side, High Ch |
| 2484.717   | 43.3             | -3.5          | 1.5                     | 174.0             | 0.0                               | 20.0                      | Horz                     | PK       | 0.0                      | 59.8              | 74.0                 | -14.2                  | EUT Vert, High Ch    |
| 2483.500   | 29.4             | -3.5          | 1.5                     | 174.0             | -6.8                              | 20.0                      | Horz                     | AV       | 0.0                      | 39.1              | 54.0                 | -14.9                  | EUT Vert, High Ch    |
| 2483.500   | 29.2             | -3.5          | 1.5                     | 48.9              | -6.8                              | 20.0                      | Vert                     | AV       | 0.0                      | 38.9              | 54.0                 | -15.1                  | EUT On Side, High Ch |
| 2483.500   | 28.9             | -3.5          | 1.5                     | 91.0              | -6.8                              | 20.0                      | Vert                     | AV       | 0.0                      | 38.6              | 54.0                 | -15.4                  | EUT Horz, High Ch    |

## CONCLUSION

Pass



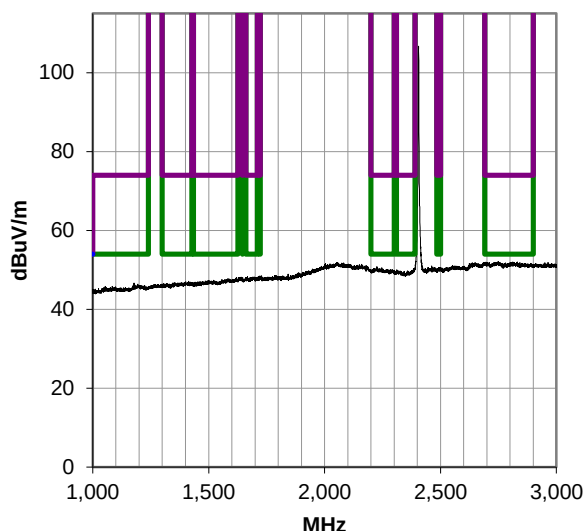
Tested By

# SPURIOUS RADIATED EMISSIONS – INTERNAL ANTENNA – SPOT CHECKS

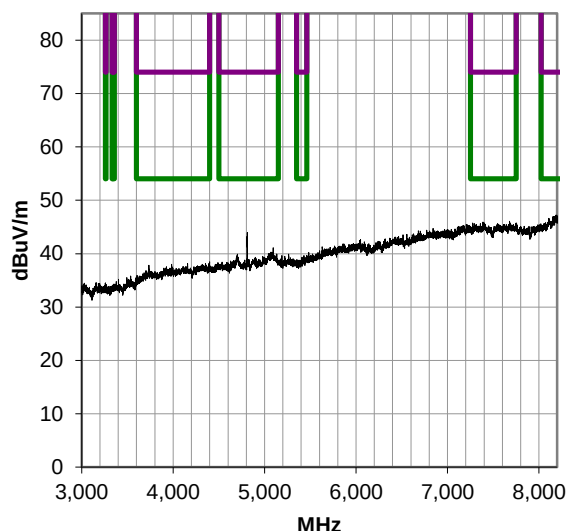
## PRESCAN DATA

Radiated spurious emissions from the EUT are initially reviewed with Pre-scans (Preview scans). Pre-scans are performed, with the EUT transmitting on the lowest applicable data rate, for both vertical and horizontal polarizations. The Pre-scan plots below are shown with a peak detector and RBW for the following frequency ranges: 9 kHz RBW (< 30 MHz); 120 kHz RBW (30 - 1000 MHz); 1 MHz RBW (> 1 GHz). In the case where unintentional emissions are observed, an ambient or idle pre-scan with the radio off, will be shown for comparison.

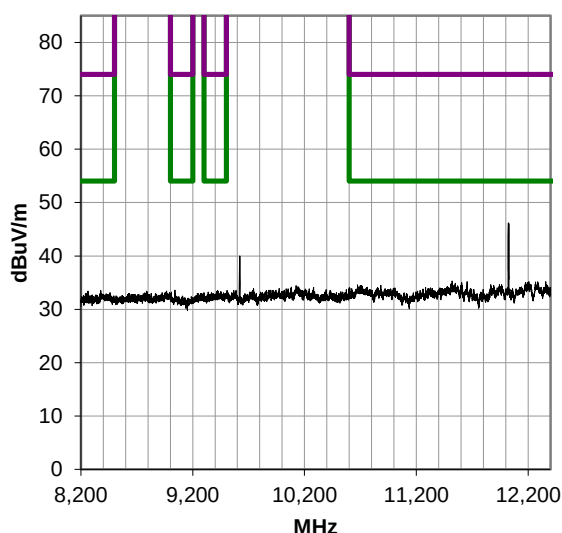
1000-3000 MHz, Run 10



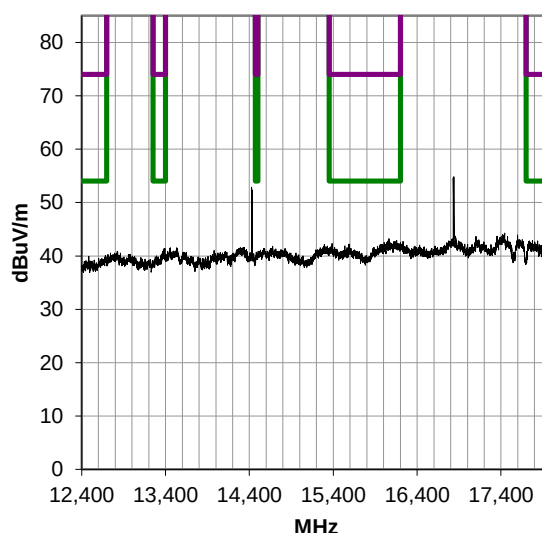
3000-8200 MHz, Run 11



8200-12400 MHz, Run 12



12400-18000 MHz, Run 13



# SPURIOUS RADIATED EMISSIONS – 8dBi Dipole Antenna

## TEST DESCRIPTION

The highest gain antenna of each type to be used with the EUT was tested. The EUT was configured for the required transmit frequencies and the modes as showed in the data sheets.

For each configuration, the spectrum was scanned throughout the specified range as part of the exploratory investigation of the emissions. These “pre-scans” are not included in the report. Final measurements on individual emissions were then made and included in this test report.

The individual emissions from the EUT were maximized by rotating the EUT on a turntable, adjusting the position of the EUT and EUT antenna in three orthogonal axis if required, and adjusting the measurement antenna height and polarization (per ANSI C63.10). A preamp and high pass filter (and notch filter) were used for this test in order to provide sufficient measurement sensitivity.

Measurements were made with the required detectors and annotated on the data for each individual point using the following annotation:

QP = Quasi-Peak Detector  
PK = Peak Detector  
AV = RMS Detector

Measurements were made to satisfy the specific requirements of the test specification for out of band emissions as well as the restricted band requirements.

If there are no detectable emissions above the noise floor, the data included may show noise floor measurements for reference only.

Measurements within 2 MHz of the allowable band may have been taken using the integration method from ANSI C63.10 clause 11.13.3. This procedure uses the channel power feature of the spectrum analyzer to integrate the power of the emission within a 1 MHz bandwidth.

Where the radio test software does not provide for a duty cycle at continuous transmit conditions (> 98%) and the RMS (power average) measurements were made across the on and off times of the EUT transmissions, a duty cycle correction is added to the measurements using the formula of  $10 \cdot \log(1/dc)$ .

## TEST EQUIPMENT (EMPM0165)

| Description                  | Manufacturer       | Model                          | ID  | Last Cal.  | Cal. Due   |
|------------------------------|--------------------|--------------------------------|-----|------------|------------|
| Antenna - Double Ridge       | ETS Lindgren       | 3115                           | AIP | 2022-07-20 | 2024-07-20 |
| Cable                        | ESM Cable Corp.    | Double Ridge Guide Horn Cables | MNI | 2024-01-08 | 2025-01-08 |
| Amplifier - Pre-Amplifier    | Miteq              | AMF-3D-00100800-32-13P         | AVT | 2024-01-08 | 2025-01-08 |
| Attenuator                   | Fairview Microwave | SA18H-20                       | VAF | 2023-09-11 | 2024-09-11 |
| Analyzer - Spectrum Analyzer | Keysight           | N9010A                         | AFN | 2024-02-29 | 2025-02-28 |
| Filter - High Pass           | Micro-Tronics      | HPM50111                       | LFN | 2023-08-23 | 2024-08-23 |
| Antenna - Standard Gain      | ETS Lindgren       | 3160-07                        | AXP | NCR        | NCR        |
| Cable                        | ESM Cable Corp.    | Standard Gain Horn Cables      | MNJ | 2024-01-28 | 2025-01-28 |
| Amplifier - Pre-Amplifier    | Miteq              | AMF-6F-08001200-30-10P         | AVV | 2024-01-08 | 2025-01-08 |
| Antenna - Standard Gain      | ETS Lindgren       | 3160-08                        | AIQ | NCR        | NCR        |
| Amplifier - Pre-Amplifier    | Miteq              | AMF-6F-12001800-30-10P         | AVW | 2024-01-08 | 2025-01-08 |
| Antenna - Biconilog          | ETS Lindgren       | 3142D                          | AXO | 2023-10-02 | 2025-10-02 |
| Antenna - Standard Gain      | ETS Lindgren       | 3160-09                        | AHG | NCR        | NCR        |
| Cable                        | ESM Cable Corp.    | TTBJ141 KMKM-72                | MNP | 2023-09-05 | 2024-09-05 |
| Amplifier - Pre-Amplifier    | Miteq              | JSD4-18002600-26-8P            | APU | 2023-09-05 | 2024-09-05 |
| Antenna - Loop               | ETS Lindgren       | 6502                           | AOB | 2023-06-12 | 2025-06-12 |
| Cable                        | ESM Cable Corp.    | Bilog Cables                   | MNH | 2023-10-08 | 2024-10-08 |
| Amplifier - Pre-Amplifier    | Miteq              | AM-1616-1000                   | AVO | 2023-10-08 | 2024-10-08 |

# SPURIOUS RADIATED EMISSIONS – 8dBi Dipole Antenna

| Description       | Manufacturer  | Model    | ID  | Last Cal.  | Cal. Due   |
|-------------------|---------------|----------|-----|------------|------------|
| Filter - Low Pass | Micro-Tronics | LPM50004 | LFK | 2023-08-23 | 2024-08-23 |

## TEST EQUIPMENT (EMPM0182)

| Description                  | Manufacturer       | Model                          | ID   | Last Cal.  | Cal. Due   |
|------------------------------|--------------------|--------------------------------|------|------------|------------|
| Antenna - Double Ridge       | ETS Lindgren       | 3115                           | AJA  | 2023-09-06 | 2025-09-06 |
| Cable                        | ESM Cable Corp.    | Double Ridge Guide Horn Cables | MNI  | 2024-01-08 | 2025-01-08 |
| Amplifier - Pre-Amplifier    | Miteq              | AMF-3D-00100800-32-13P         | AVT  | 2024-01-08 | 2025-01-08 |
| Attenuator                   | Fairview Microwave | SA18H-20                       | VAF  | 2023-09-11 | 2024-09-11 |
| Analyzer - Spectrum Analyzer | Agilent            | E4446A                         | AAQ  | 2024-03-13 | 2025-03-13 |
| Antenna - Biconilog          | ETS Lindgren       | 3142D                          | AXO  | 2023-10-02 | 2025-10-02 |
| Cable                        | ESM Cable Corp.    | Bilog Cables                   | MN H | 2024-10-09 | 2025-10-09 |
| Amplifier - Pre-Amplifier    | Miteq              | AM-1616-1000                   | AVO  | 2024-10-09 | 2025-10-09 |
| Filter - Low Pass            | Micro-Tronics      | LPM50004                       | LFK  | 2023-08-23 | 2024-08-23 |
| Filter - High Pass           | Micro-Tronics      | HPM50111                       | LFN  | 2023-08-23 | 2024-08-23 |
| Antenna - Standard Gain      | ETS Lindgren       | 3160-09                        | AHG  | NCR        | NCR        |
| Cable                        | ESM Cable Corp.    | TTBJ141 KMKM-72                | MNP  | 2024-09-05 | 2025-09-05 |
| Amplifier - Pre-Amplifier    | Miteq              | JSD4-18002600-26-8P            | APU  | 2024-09-05 | 2025-09-05 |
| Antenna - Loop               | ETS Lindgren       | 6502                           | AOB  | 2023-06-12 | 2025-06-12 |

## MEASUREMENT UNCERTAINTY

| Description  |        |         |
|--------------|--------|---------|
| Expanded k=2 | 5.2 dB | -5.2 dB |

## FREQUENCY RANGE INVESTIGATED

|                 |
|-----------------|
| 9 kHz TO 25 GHz |
|-----------------|

## CONFIGURATIONS INVESTIGATED

|            |
|------------|
| EMPM0165-4 |
| EMPM0182-1 |

# SPURIOUS RADIATED EMISSIONS – 8dBi Dipole Antenna



|                   |                                          |                       |            |
|-------------------|------------------------------------------|-----------------------|------------|
| EUT:              | 781SA                                    | Work Order:           | EMPM0182   |
| Serial Number:    | 018                                      | Date:                 | 2024-08-02 |
| Customer:         | Emerson                                  | Temperature:          | 22°C       |
| Attendees:        | Stacy Lukas, Daniel Wolf                 | Relative Humidity:    | 59.6%      |
| Customer Project: | None                                     | Bar. Pressure (PMSL): | 1018 mb    |
| Tested By:        | Arnauld Dedry                            | Job Site:             | MN05       |
| Power:            | 15VDC (provided from peripheral Gateway) | Configuration:        | EMPM0182-1 |

### TEST SPECIFICATIONS

|                                      |                  |
|--------------------------------------|------------------|
| Specification:                       | Method:          |
| FCC 15.247:2024                      | ANSI C63.10:2013 |
| RSS-247 Issue 3:2023                 | ANSI C63.10:2013 |
| RSS-Gen Issue 5:2018+A1:2019+A2:2021 |                  |

### TEST PARAMETERS

|        |   |                    |   |                     |           |
|--------|---|--------------------|---|---------------------|-----------|
| Run #: | 3 | Test Distance (m): | 3 | Ant. Height(s) (m): | 1 to 4(m) |
|--------|---|--------------------|---|---------------------|-----------|

### COMMENTS

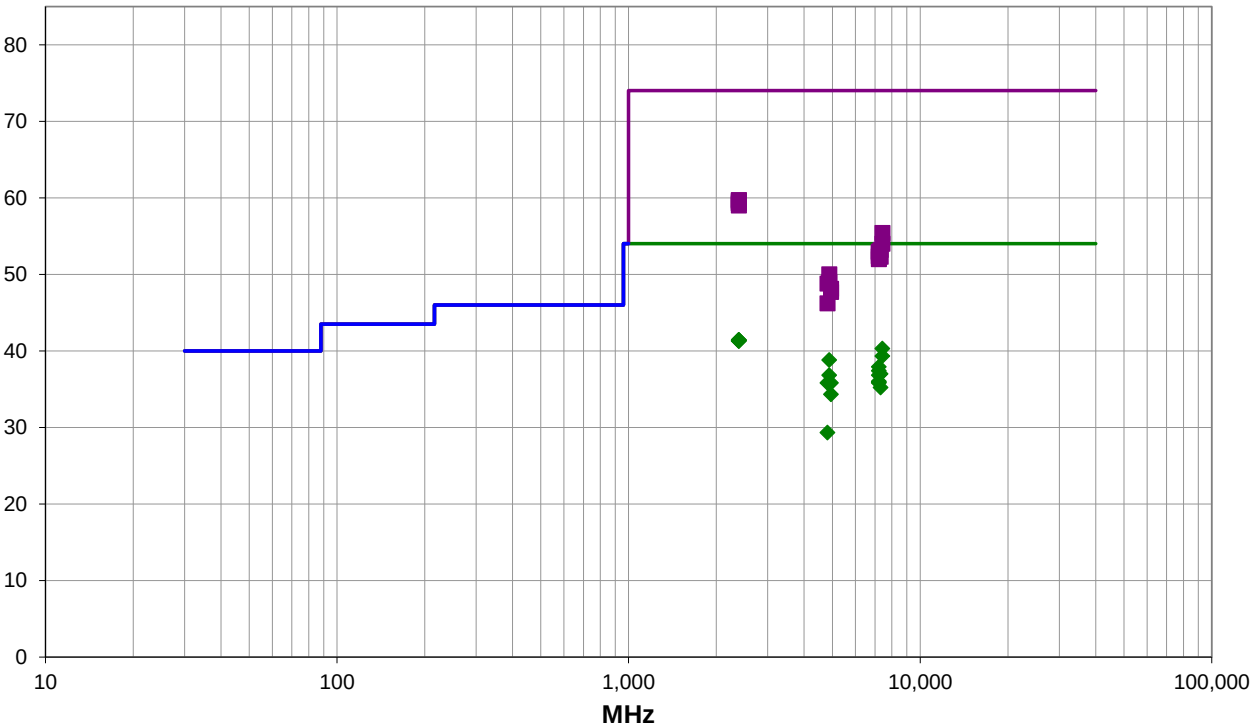
8dBi dipole antenna. Test mode is 100% Duty Cycle. The client states that in frequency hopping mode, the worst case on time in 100ms is 20.706ms. This value was provided by the customer. Therefore, a duty cycle correction factor (DCCF) was applied using  $10 \cdot \log(\text{dwell time}/100\text{ms}) = -6.8\text{dB}$

### EUT OPERATING MODES

Transmitting 2.4 GHz Antenna Low, Mid and High Chs (2405, 2440 and 2475 MHz) OQPSK 250 kbps, Channels tested independently.

### DEVIATIONS FROM TEST STANDARD

None



Run #: 3

PK AV QP

# SPURIOUS RADIATED EMISSIONS – 8dBi Dipole Antenna

## RESULTS - Run #3

| Freq (MHz) | Amplitude (dBuV) | Factor (dB/m) | Antenna Height (meters) | Azimuth (degrees) | Duty Cycle Correction Factor | External Attenuation (dB) | Polarity/ Transducer | Detector | Distance Adjustment (dB) | Adjusted (dBuV/m) | Spec. Limit (dBuV/m) | Compared to Spec. (dB) | Comments             |
|------------|------------------|---------------|-------------------------|-------------------|------------------------------|---------------------------|----------------------|----------|--------------------------|-------------------|----------------------|------------------------|----------------------|
| 2389.622   | 32.1             | -3.9          | 3.4                     | 189.0             | -6.8                         | 20.0                      | Vert                 | AV       | 0.0                      | 41.4              | 54.0                 | -12.6                  | EUT Vert, Low Ch     |
| 2389.342   | 32.1             | -3.9          | 1.1                     | 224.0             | -6.8                         | 20.0                      | Vert                 | AV       | 0.0                      | 41.4              | 54.0                 | -12.6                  | EUT Horz, Low Ch     |
| 2389.010   | 32.1             | -3.9          | 1.2                     | 211.9             | -6.8                         | 20.0                      | Horz                 | AV       | 0.0                      | 41.4              | 54.0                 | -12.6                  | EUT On Side, Low Ch  |
| 2389.912   | 32.0             | -3.9          | 1.5                     | 254.9             | -6.8                         | 20.0                      | Horz                 | AV       | 0.0                      | 41.3              | 54.0                 | -12.7                  | EUT Vert, Low Ch     |
| 2389.135   | 32.0             | -3.9          | 1.5                     | 168.9             | -6.8                         | 20.0                      | Horz                 | AV       | 0.0                      | 41.3              | 54.0                 | -12.7                  | EUT Horz, Low Ch     |
| 2389.063   | 32.0             | -3.9          | 1.5                     | 124.0             | -6.8                         | 20.0                      | Vert                 | AV       | 0.0                      | 41.3              | 54.0                 | -12.7                  | EUT On Side, Low Ch  |
| 7425.050   | 34.5             | 12.6          | 3.9                     | 332.0             | -6.8                         | 0.0                       | Vert                 | AV       | 0.0                      | 40.3              | 54.0                 | -13.7                  | EUT Horz, High Ch    |
| 2389.105   | 43.6             | -3.9          | 1.2                     | 211.9             | 0.0                          | 20.0                      | Horz                 | PK       | 0.0                      | 59.7              | 74.0                 | -14.3                  | EUT On Side, Low Ch  |
| 2389.873   | 43.6             | -3.9          | 1.5                     | 124.0             | 0.0                          | 20.0                      | Vert                 | PK       | 0.0                      | 59.7              | 74.0                 | -14.3                  | EUT On Side, Low Ch  |
| 2389.667   | 43.4             | -3.9          | 1.5                     | 254.9             | 0.0                          | 20.0                      | Horz                 | PK       | 0.0                      | 59.5              | 74.0                 | -14.5                  | EUT Vert, Low Ch     |
| 7424.883   | 33.5             | 12.6          | 4.0                     | 217.0             | -6.8                         | 0.0                       | Horz                 | AV       | 0.0                      | 39.3              | 54.0                 | -14.7                  | EUT On Side, High Ch |
| 2389.402   | 43.2             | -3.9          | 3.4                     | 189.0             | 0.0                          | 20.0                      | Vert                 | PK       | 0.0                      | 59.3              | 74.0                 | -14.7                  | EUT Vert, Low Ch     |
| 2389.188   | 43.2             | -3.9          | 1.1                     | 224.0             | 0.0                          | 20.0                      | Vert                 | PK       | 0.0                      | 59.3              | 74.0                 | -14.7                  | EUT Horz, Low Ch     |
| 2389.167   | 42.9             | -3.9          | 1.5                     | 168.9             | 0.0                          | 20.0                      | Horz                 | PK       | 0.0                      | 59.0              | 74.0                 | -15.0                  | EUT Horz, Low Ch     |
| 4879.950   | 40.5             | 5.1           | 3.5                     | 257.9             | -6.8                         | 0.0                       | Horz                 | AV       | 0.0                      | 38.8              | 54.0                 | -15.2                  | EUT On Side, Mid Ch  |
| 7214.908   | 32.1             | 12.6          | 2.6                     | 307.9             | -6.8                         | 0.0                       | Horz                 | AV       | 0.0                      | 37.9              | 54.0                 | -16.1                  | EUT On Side, Low Ch  |
| 7214.925   | 31.6             | 12.6          | 1.2                     | 322.9             | -6.8                         | 0.0                       | Vert                 | AV       | 0.0                      | 37.4              | 54.0                 | -16.6                  | EUT Horz, Low Ch     |
| 7320.067   | 31.2             | 12.6          | 2.1                     | 301.9             | -6.8                         | 0.0                       | Horz                 | AV       | 0.0                      | 37.0              | 54.0                 | -17.0                  | EUT On Side, Mid Ch  |
| 7215.025   | 31.0             | 12.6          | 1.5                     | 52.9              | -6.8                         | 0.0                       | Horz                 | AV       | 0.0                      | 36.8              | 54.0                 | -17.2                  | EUT Horz, Low Ch     |
| 4879.967   | 38.5             | 5.1           | 3.9                     | 317.0             | -6.8                         | 0.0                       | Vert                 | AV       | 0.0                      | 36.8              | 54.0                 | -17.2                  | EUT Horz, Mid Ch     |
| 7214.825   | 30.2             | 12.6          | 1.5                     | 120.9             | -6.8                         | 0.0                       | Vert                 | AV       | 0.0                      | 36.0              | 54.0                 | -18.0                  | EUT On Side, Low Ch  |
| 7214.908   | 30.1             | 12.6          | 1.5                     | 317.0             | -6.8                         | 0.0                       | Vert                 | AV       | 0.0                      | 35.9              | 54.0                 | -18.1                  | EUT Vert, Low Ch     |
| 7214.867   | 30.0             | 12.6          | 1.5                     | 55.0              | -6.8                         | 0.0                       | Horz                 | AV       | 0.0                      | 35.8              | 54.0                 | -18.2                  | EUT Vert, Low Ch     |
| 4809.975   | 37.3             | 5.3           | 2.6                     | 250.0             | -6.8                         | 0.0                       | Horz                 | AV       | 0.0                      | 35.8              | 54.0                 | -18.2                  | EUT On Side, Low Ch  |
| 4949.992   | 37.4             | 5.2           | 2.3                     | 199.9             | -6.8                         | 0.0                       | Horz                 | AV       | 0.0                      | 35.8              | 54.0                 | -18.2                  | EUT On Side, High Ch |
| 7425.050   | 42.8             | 12.6          | 3.9                     | 332.0             | 0.0                          | 0.0                       | Vert                 | PK       | 0.0                      | 55.4              | 74.0                 | -18.6                  | EUT Horz, High Ch    |
| 7320.067   | 29.4             | 12.6          | 1.5                     | 185.9             | -6.8                         | 0.0                       | Vert                 | AV       | 0.0                      | 35.2              | 54.0                 | -18.8                  | EUT Horz, Mid Ch     |
| 4950.033   | 35.9             | 5.2           | 2.3                     | 142.0             | -6.8                         | 0.0                       | Vert                 | AV       | 0.0                      | 34.3              | 54.0                 | -19.7                  | EUT Horz, High Ch    |
| 7424.992   | 41.4             | 12.6          | 4.0                     | 217.0             | 0.0                          | 0.0                       | Horz                 | PK       | 0.0                      | 54.0              | 74.0                 | -20.0                  | EUT On Side, High Ch |
| 7319.667   | 40.6             | 12.6          | 2.1                     | 301.9             | 0.0                          | 0.0                       | Horz                 | PK       | 0.0                      | 53.2              | 74.0                 | -20.8                  | EUT On Side, Mid Ch  |
| 7214.400   | 40.4             | 12.6          | 1.5                     | 52.9              | 0.0                          | 0.0                       | Horz                 | PK       | 0.0                      | 53.0              | 74.0                 | -21.0                  | EUT Horz, Low Ch     |
| 7215.325   | 40.3             | 12.6          | 2.6                     | 307.9             | 0.0                          | 0.0                       | Horz                 | PK       | 0.0                      | 52.9              | 74.0                 | -21.1                  | EUT On Side, Low Ch  |
| 7214.708   | 40.2             | 12.6          | 1.2                     | 322.9             | 0.0                          | 0.0                       | Vert                 | PK       | 0.0                      | 52.8              | 74.0                 | -21.2                  | EUT Horz, Low Ch     |
| 7213.958   | 39.8             | 12.6          | 1.5                     | 120.9             | 0.0                          | 0.0                       | Vert                 | PK       | 0.0                      | 52.4              | 74.0                 | -21.6                  | EUT On Side, Low Ch  |
| 7214.450   | 39.7             | 12.6          | 1.5                     | 317.0             | 0.0                          | 0.0                       | Vert                 | PK       | 0.0                      | 52.3              | 74.0                 | -21.7                  | EUT Vert, Low Ch     |
| 7319.150   | 39.7             | 12.6          | 1.5                     | 185.9             | 0.0                          | 0.0                       | Vert                 | PK       | 0.0                      | 52.3              | 74.0                 | -21.7                  | EUT Horz, Mid Ch     |
| 7214.225   | 39.4             | 12.6          | 1.5                     | 55.0              | 0.0                          | 0.0                       | Horz                 | PK       | 0.0                      | 52.0              | 74.0                 | -22.0                  | EUT Vert, Low Ch     |
| 4879.858   | 44.9             | 5.1           | 3.5                     | 257.9             | 0.0                          | 0.0                       | Horz                 | PK       | 0.0                      | 50.0              | 74.0                 | -24.0                  | EUT On Side, Mid Ch  |
| 4809.925   | 30.8             | 5.3           | 2.8                     | 258.9             | -6.8                         | 0.0                       | Vert                 | AV       | 0.0                      | 29.3              | 54.0                 | -24.7                  | EUT Horz, Low Ch     |
| 4879.808   | 43.9             | 5.1           | 3.9                     | 317.0             | 0.0                          | 0.0                       | Vert                 | PK       | 0.0                      | 49.0              | 74.0                 | -25.0                  | EUT Horz, Mid Ch     |

# SPURIOUS RADIATED EMISSIONS – 8dBi Dipole Antenna



| Freq (MHz) | Amplitude (dBuV) | Factor (dB/m) | Antenna Height (meters) | Azimuth (degrees) | Duty Cycle Correction Factor | External Attenuation (dB) | Polarity/ Transducer | Detector | Distance Adjustment (dB) | Adjusted (dBuV/m) | Spec. Limit (dBuV/m) | Compared to Spec. (dB) | Comments             |
|------------|------------------|---------------|-------------------------|-------------------|------------------------------|---------------------------|----------------------|----------|--------------------------|-------------------|----------------------|------------------------|----------------------|
| 4809.942   | 43.5             | 5.3           | 2.6                     | 250.0             | 0.0                          | 0.0                       | Horz                 | PK       | 0.0                      | 48.8              | 74.0                 | -25.2                  | EUT On Side, Low Ch  |
| 4949.792   | 42.9             | 5.2           | 2.3                     | 199.9             | 0.0                          | 0.0                       | Horz                 | PK       | 0.0                      | 48.1              | 74.0                 | -25.9                  | EUT On Side, High Ch |
| 4949.950   | 42.5             | 5.2           | 2.3                     | 142.0             | 0.0                          | 0.0                       | Vert                 | PK       | 0.0                      | 47.7              | 74.0                 | -26.3                  | EUT Horz, High Ch    |
| 4809.642   | 40.9             | 5.3           | 2.8                     | 258.9             | 0.0                          | 0.0                       | Vert                 | PK       | 0.0                      | 46.2              | 74.0                 | -27.8                  | EUT Horz, Low Ch     |

CONCLUSION  
Pass

Tested By



# SPURIOUS RADIATED EMISSIONS – 8dBi Dipole Antenna



|                   |                                          |                       |            |
|-------------------|------------------------------------------|-----------------------|------------|
| EUT:              | 781SA                                    | Work Order:           | EMPM0165   |
| Serial Number:    | 018                                      | Date:                 | 2024-03-07 |
| Customer:         | Emerson                                  | Temperature:          | 22.3°C     |
| Attendees:        | Erin Snell                               | Relative Humidity:    | 25.3%      |
| Customer Project: | None                                     | Bar. Pressure (PMSL): | 1017 mb    |
| Tested By:        | Marcelo Aguayo                           | Job Site:             | MN05       |
| Power:            | 15VDC (provided from peripheral Gateway) | Configuration:        | EMPM0165-4 |

## TEST SPECIFICATIONS

|                                      |                  |
|--------------------------------------|------------------|
| Specification:                       | Method:          |
| FCC 15.247:2024                      | ANSI C63.10:2013 |
| RSS-247 Issue 3:2023                 | ANSI C63.10:2013 |
| RSS-Gen Issue 5:2018+A1:2019+A2:2021 |                  |

## TEST PARAMETERS

|        |     |                    |   |                     |           |
|--------|-----|--------------------|---|---------------------|-----------|
| Run #: | 108 | Test Distance (m): | 3 | Ant. Height(s) (m): | 1 to 4(m) |
|--------|-----|--------------------|---|---------------------|-----------|

## COMMENTS

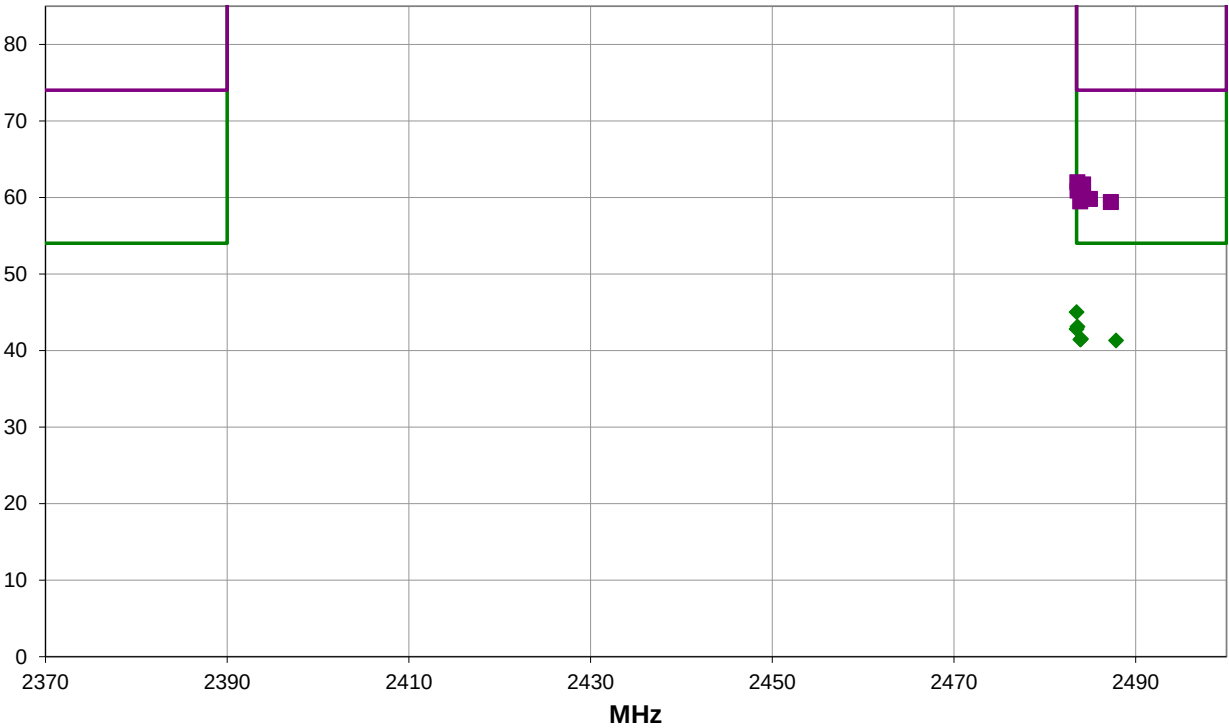
8dBi dipole antenna. Test mode is 100% Duty Cycle. The client states that in frequency hopping mode, the worst case on time in 100ms is 20.706ms. This value was provided by the customer. Therefore, a duty cycle correction factor (DCCF) was applied using  $10 \cdot \log(\text{dwell time}/100\text{ms}) = -6.8\text{dB}$

## EUT OPERATING MODES

Transmitting 2.4 GHz Antenna High Ch (2475 MHz) OQPSK 250 kbps, Channels tested independently.

## DEVIATIONS FROM TEST STANDARD

None



Run #: 108

■ PK ◆ AV ● QP

# SPURIOUS RADIATED EMISSIONS – 8dBi Dipole Antenna

## RESULTS - Run #108

| Freq (MHz) | Amplitude (dBuV) | Factor (dB/m) | Antenna Height (meters) | Azimuth (degrees) | Duty Cycle Correction Factor | External Attenuation (dB) | Polarity/ Transducer | Detector | Distance Adjustment (dB) | Adjusted (dBuV/m) | Spec. Limit (dBuV/m) | Compared to Spec. (dB) | Comments             |
|------------|------------------|---------------|-------------------------|-------------------|------------------------------|---------------------------|----------------------|----------|--------------------------|-------------------|----------------------|------------------------|----------------------|
| 2483.508   | 35.3             | -3.5          | 1.8                     | 30.0              | -6.8                         | 20.0                      | Horz                 | AV       | 0.0                      | 45.0              | 54.0                 | -9.0                   | EUT Horz, High Ch    |
| 2483.608   | 33.4             | -3.5          | 2.5                     | 33.0              | -6.8                         | 20.0                      | Horz                 | AV       | 0.0                      | 43.1              | 54.0                 | -10.9                  | EUT On Side, High Ch |
| 2483.508   | 33.1             | -3.5          | 2.1                     | 315.9             | -6.8                         | 20.0                      | Vert                 | AV       | 0.0                      | 42.8              | 54.0                 | -11.2                  | EUT Vert, High Ch    |
| 2483.600   | 45.5             | -3.5          | 1.8                     | 30.0              | 0.0                          | 20.0                      | Horz                 | PK       | 0.0                      | 62.0              | 74.0                 | -12.0                  | EUT Horz, High Ch    |
| 2484.233   | 45.2             | -3.5          | 2.5                     | 33.0              | 0.0                          | 20.0                      | Horz                 | PK       | 0.0                      | 61.7              | 74.0                 | -12.3                  | EUT On Side, High Ch |
| 2483.992   | 31.8             | -3.5          | 2.4                     | 30.0              | -6.8                         | 20.0                      | Vert                 | AV       | 0.0                      | 41.5              | 54.0                 | -12.5                  | EUT Horz, High Ch    |
| 2483.933   | 31.7             | -3.5          | 3.7                     | 342.0             | -6.8                         | 20.0                      | Horz                 | AV       | 0.0                      | 41.4              | 54.0                 | -12.6                  | EUT Vert, High Ch    |
| 2487.858   | 31.6             | -3.5          | 1.5                     | 227.0             | -6.8                         | 20.0                      | Vert                 | AV       | 0.0                      | 41.3              | 54.0                 | -12.7                  | EUT On Side, High Ch |
| 2483.625   | 44.4             | -3.5          | 2.1                     | 315.9             | 0.0                          | 20.0                      | Vert                 | PK       | 0.0                      | 60.9              | 74.0                 | -13.1                  | EUT Vert, High Ch    |
| 2484.983   | 43.3             | -3.5          | 2.4                     | 30.0              | 0.0                          | 20.0                      | Vert                 | PK       | 0.0                      | 59.8              | 74.0                 | -14.2                  | EUT Horz, High Ch    |
| 2483.900   | 43.0             | -3.5          | 3.7                     | 342.0             | 0.0                          | 20.0                      | Horz                 | PK       | 0.0                      | 59.5              | 74.0                 | -14.5                  | EUT Vert, High Ch    |
| 2487.283   | 42.9             | -3.5          | 1.5                     | 227.0             | 0.0                          | 20.0                      | Vert                 | PK       | 0.0                      | 59.4              | 74.0                 | -14.6                  | EUT On Side, High Ch |

## CONCLUSION

Pass



Tested By

# SPURIOUS RADIATED EMISSIONS – 8dBi Dipole Antenna



|                   |                                          |                       |            |
|-------------------|------------------------------------------|-----------------------|------------|
| EUT:              | 781SA                                    | Work Order:           | EMPM0165   |
| Serial Number:    | 018                                      | Date:                 | 2024-03-07 |
| Customer:         | Emerson                                  | Temperature:          | 22.3°C     |
| Attendees:        | Erin Snell                               | Relative Humidity:    | 25.3%      |
| Customer Project: | None                                     | Bar. Pressure (PMSL): | 1017 mb    |
| Tested By:        | Marcelo Aguayo                           | Job Site:             | MN05       |
| Power:            | 15VDC (provided from peripheral Gateway) | Configuration:        | EMPM0165-4 |

## TEST SPECIFICATIONS

|                                      |                  |
|--------------------------------------|------------------|
| Specification:                       | Method:          |
| FCC 15.247:2024                      | ANSI C63.10:2013 |
| RSS-247 Issue 3:2023                 | ANSI C63.10:2013 |
| RSS-Gen Issue 5:2018+A1:2019+A2:2021 |                  |

## TEST PARAMETERS

|        |     |                    |   |                     |           |
|--------|-----|--------------------|---|---------------------|-----------|
| Run #: | 109 | Test Distance (m): | 3 | Ant. Height(s) (m): | 1 to 4(m) |
|--------|-----|--------------------|---|---------------------|-----------|

## COMMENTS

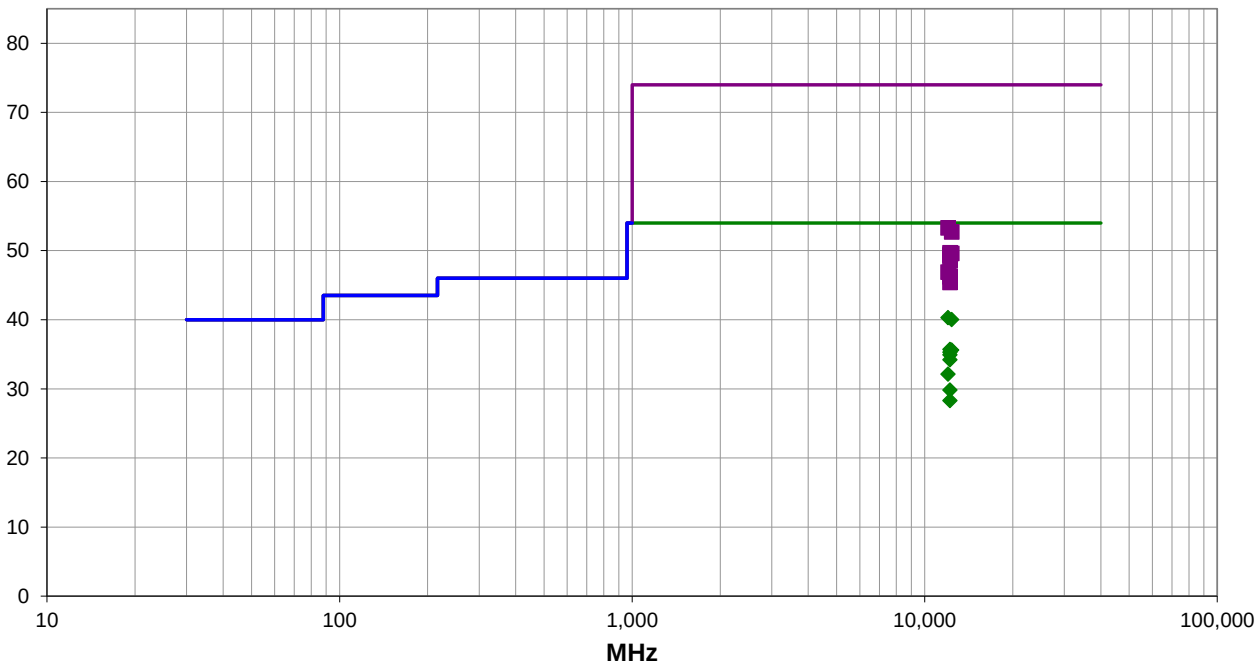
8dBi dipole antenna. Test mode is 100% Duty Cycle. The client states that in frequency hopping mode, the worst case on time in 100ms is 20.706ms. This value was provided by the customer. Therefore, a duty cycle correction factor (DCCF) was applied using  $10 \cdot \log(\text{dwell time}/100\text{ms}) = -6.8\text{dB}$

## EUT OPERATING MODES

Transmitting 2.4 GHz Antenna Low, Mid and High Chs (2405, 2440 and 2475 MHz) OQPSK 250 kbps, Channels tested independently.

## DEVIATIONS FROM TEST STANDARD

None



Run #: 109

PK AV QP

# SPURIOUS RADIATED EMISSIONS – 8dBi Dipole Antenna

## RESULTS - Run #109

| Freq (MHz) | Amplitude (dBuV) | Factor (dB/m) | Antenna Height (meters) | Azimuth (degrees) | Duty Cycle Correction Factor | External Attenuation (dB) | Polarity/ Transducer | Detector | Distance Adjustment (dB) | Adjusted (dBuV/m) | Spec. Limit (dBuV/m) | Compared to Spec. (dB) | Comments             |
|------------|------------------|---------------|-------------------------|-------------------|------------------------------|---------------------------|----------------------|----------|--------------------------|-------------------|----------------------|------------------------|----------------------|
| 12027.390  | 48.9             | -1.8          | 4.0                     | 267.0             | -6.8                         | 0.0                       | Vert                 | AV       | 0.0                      | 40.3              | 54.0                 | -13.7                  | EUT Vert, Low Ch     |
| 12377.370  | 47.6             | -0.8          | 3.8                     | 250.0             | -6.8                         | 0.0                       | Vert                 | AV       | 0.0                      | 40.0              | 54.0                 | -14.0                  | EUT Vert, High Ch    |
| 12202.330  | 43.3             | -0.8          | 3.9                     | 250.0             | -6.8                         | 0.0                       | Vert                 | AV       | 0.0                      | 35.7              | 54.0                 | -18.3                  | EUT Vert, Mid Ch     |
| 12377.380  | 43.2             | -0.8          | 3.2                     | 355.9             | -6.8                         | 0.0                       | Horz                 | AV       | 0.0                      | 35.6              | 54.0                 | -18.4                  | EUT On Side, High Ch |
| 12202.380  | 42.9             | -0.8          | 3.5                     | 33.0              | -6.8                         | 0.0                       | Vert                 | AV       | 0.0                      | 35.3              | 54.0                 | -18.7                  | EUT Horz, Mid Ch     |
| 12202.380  | 42.5             | -0.8          | 3.9                     | 300.0             | -6.8                         | 0.0                       | Horz                 | AV       | 0.0                      | 34.9              | 54.0                 | -19.1                  | EUT On Side, Mid Ch  |
| 12202.420  | 41.8             | -0.8          | 1.9                     | 73.0              | -6.8                         | 0.0                       | Horz                 | AV       | 0.0                      | 34.2              | 54.0                 | -19.8                  | EUT Horz, Mid Ch     |
| 12022.580  | 55.1             | -1.8          | 4.0                     | 267.0             | 0.0                          | 0.0                       | Vert                 | PK       | 0.0                      | 53.3              | 74.0                 | -20.7                  | EUT Vert, Low Ch     |
| 12377.050  | 53.5             | -0.8          | 3.8                     | 250.0             | 0.0                          | 0.0                       | Vert                 | PK       | 0.0                      | 52.7              | 74.0                 | -21.3                  | EUT Vert, High Ch    |
| 12027.380  | 40.7             | -1.8          | 3.0                     | 4.0               | -6.8                         | 0.0                       | Horz                 | AV       | 0.0                      | 32.1              | 54.0                 | -21.9                  | EUT On Side, Low Ch  |
| 12202.440  | 37.4             | -0.8          | 2.6                     | 278.0             | -6.8                         | 0.0                       | Horz                 | AV       | 0.0                      | 29.8              | 54.0                 | -24.2                  | EUT Vert, Mid Ch     |
| 12202.420  | 50.5             | -0.8          | 3.9                     | 250.0             | 0.0                          | 0.0                       | Vert                 | PK       | 0.0                      | 49.7              | 74.0                 | -24.3                  | EUT Vert, Mid Ch     |
| 12377.380  | 50.4             | -0.8          | 3.2                     | 355.9             | 0.0                          | 0.0                       | Horz                 | PK       | 0.0                      | 49.6              | 74.0                 | -24.4                  | EUT On Side, High Ch |
| 12202.100  | 50.2             | -0.8          | 3.5                     | 33.0              | 0.0                          | 0.0                       | Vert                 | PK       | 0.0                      | 49.4              | 74.0                 | -24.6                  | EUT Horz, Mid Ch     |
| 12202.190  | 50.1             | -0.8          | 3.9                     | 300.0             | 0.0                          | 0.0                       | Horz                 | PK       | 0.0                      | 49.3              | 74.0                 | -24.7                  | EUT On Side, Mid Ch  |
| 12202.290  | 49.3             | -0.8          | 1.9                     | 73.0              | 0.0                          | 0.0                       | Horz                 | PK       | 0.0                      | 48.5              | 74.0                 | -25.5                  | EUT Horz, Mid Ch     |
| 12202.380  | 35.9             | -0.8          | 1.5                     | 234.0             | -6.8                         | 0.0                       | Vert                 | AV       | 0.0                      | 28.3              | 54.0                 | -25.7                  | EUT On Side, Mid Ch  |
| 12027.280  | 48.7             | -1.8          | 3.0                     | 4.0               | 0.0                          | 0.0                       | Horz                 | PK       | 0.0                      | 46.9              | 74.0                 | -27.1                  | EUT On Side, Low Ch  |
| 12197.560  | 47.0             | -0.8          | 2.6                     | 278.0             | 0.0                          | 0.0                       | Horz                 | PK       | 0.0                      | 46.2              | 74.0                 | -27.8                  | EUT Vert, Mid Ch     |
| 12202.130  | 46.2             | -0.8          | 1.5                     | 234.0             | 0.0                          | 0.0                       | Vert                 | PK       | 0.0                      | 45.4              | 74.0                 | -28.6                  | EUT On Side, Mid Ch  |

## CONCLUSION

Pass



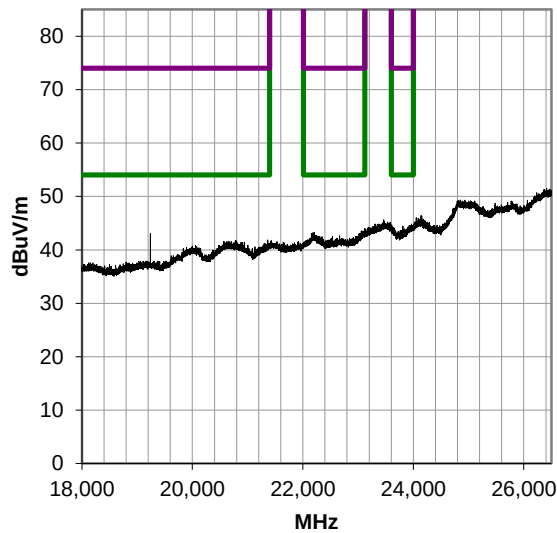
Tested By

# SPURIOUS RADIATED EMISSIONS – 8dBi Dipole Antenna

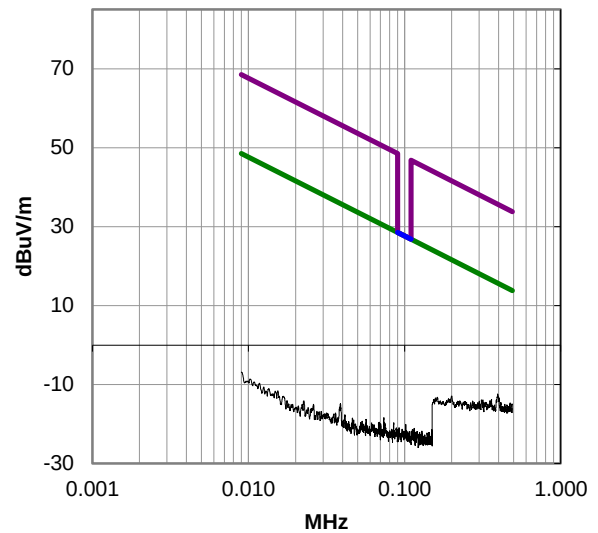
## PRESCAN DATA

Radiated spurious emissions from the EUT are initially reviewed with Pre-scans (Preview scans). Pre-scans are performed, with the EUT transmitting on the lowest applicable data rate, for both vertical and horizontal polarizations. The Pre-scan plots below are shown with a peak detector and RBW for the following frequency ranges: 9 kHz RBW (< 30 MHz); 120 kHz RBW (30 - 1000 MHz); 1 MHz RBW (> 1 GHz). In the case where unintentional emissions are observed, an ambient or idle pre-scan with the radio off, will be shown for comparison.

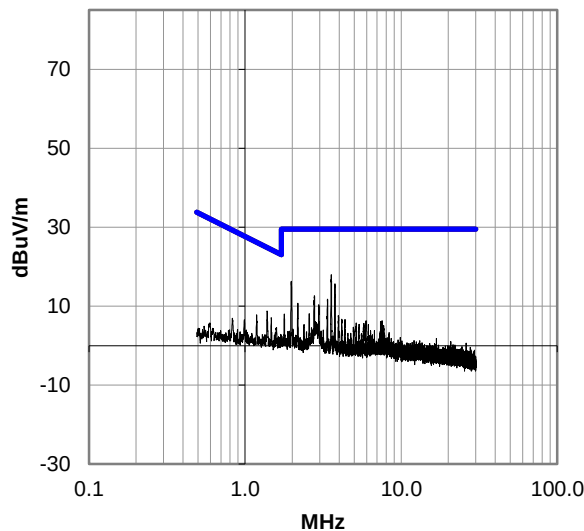
18000-26500 MHz, Run 39



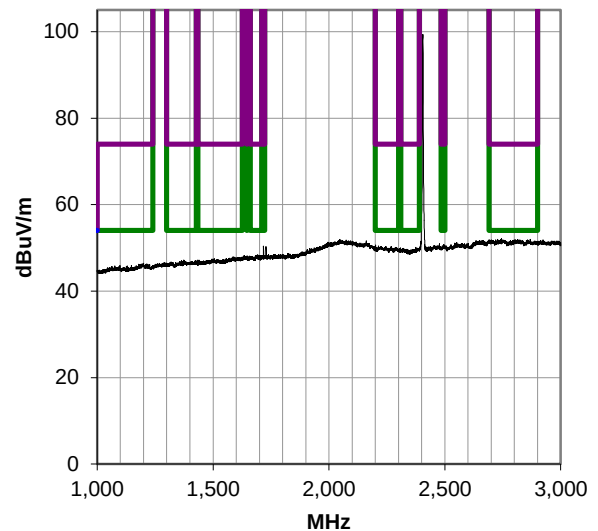
0.009-0.49 MHz, Run 43



0.49-30 MHz, Run 44

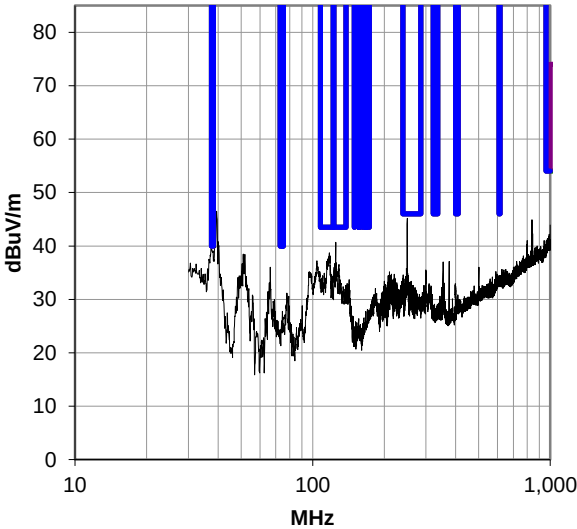


1000-3000 MHz, Run 97

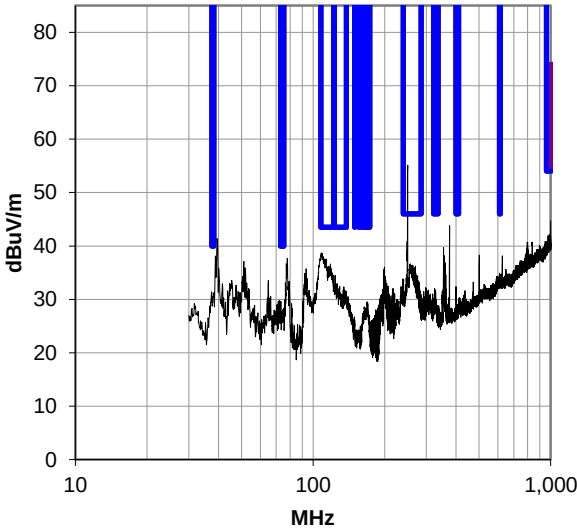


# SPURIOUS RADIATED EMISSIONS – 8dBi Dipole Antenna

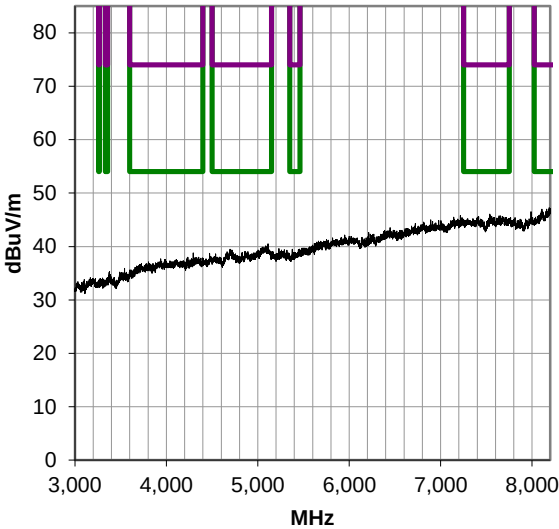
30-1000 MHz, Run 77 (transmitter on)



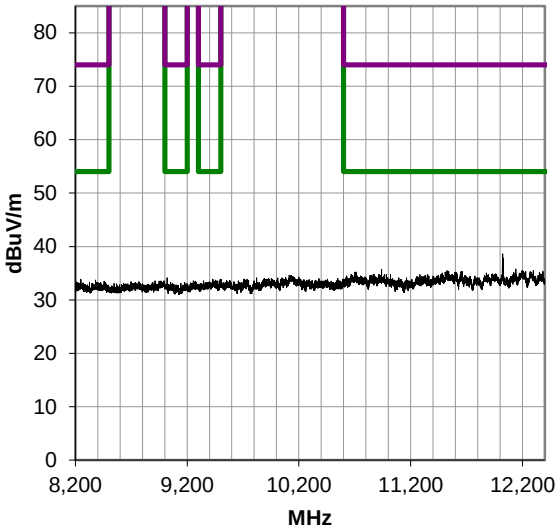
30-1000 MHz, Run 78 (transmitter off)



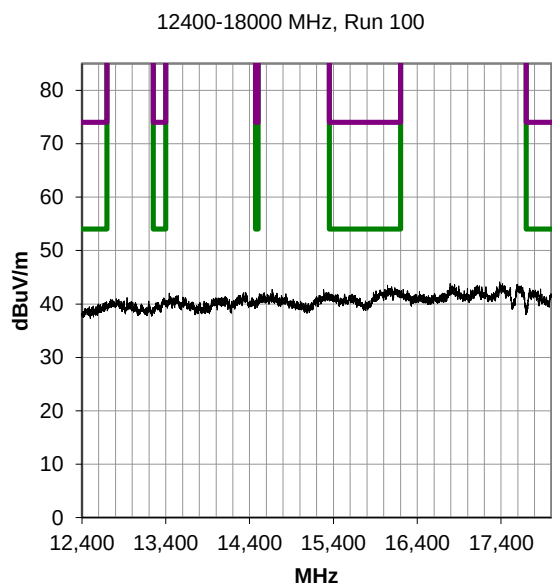
3000-8200 MHz, Run 98



8200-12400 MHz, Run 99



# SPURIOUS RADIATED EMISSIONS – 8dBi Dipole Antenna



# SPURIOUS RADIATED EMISSIONS – 14.5dBi Yagi Antenna

## TEST DESCRIPTION

The highest gain antenna of each type to be used with the EUT was tested. The EUT was configured for the required transmit frequencies and the modes as showed in the data sheets.

For each configuration, the spectrum was scanned throughout the specified range as part of the exploratory investigation of the emissions. These “pre-scans” are not included in the report. Final measurements on individual emissions were then made and included in this test report.

The individual emissions from the EUT were maximized by rotating the EUT on a turntable, adjusting the position of the EUT and EUT antenna in three orthogonal axis if required, and adjusting the measurement antenna height and polarization (per ANSI C63.10). A preamp and high pass filter (and notch filter) were used for this test in order to provide sufficient measurement sensitivity.

Measurements were made with the required detectors and annotated on the data for each individual point using the following annotation:

QP = Quasi-Peak Detector  
PK = Peak Detector  
AV = RMS Detector

Measurements were made to satisfy the specific requirements of the test specification for out of band emissions as well as the restricted band requirements.

If there are no detectable emissions above the noise floor, the data included may show noise floor measurements for reference only.

Measurements within 2 MHz of the allowable band may have been taken using the integration method from ANSI C63.10 clause 11.13.3. This procedure uses the channel power feature of the spectrum analyzer to integrate the power of the emission within a 1 MHz bandwidth.

Where the radio test software does not provide for a duty cycle at continuous transmit conditions (> 98%) and the RMS (power average) measurements were made across the on and off times of the EUT transmissions, a duty cycle correction is added to the measurements using the formula of  $10 \cdot \log(1/dc)$ .

## TEST EQUIPMENT (EMPM0165)

| Description                  | Manufacturer       | Model                          | ID  | Last Cal.  | Cal. Due   |
|------------------------------|--------------------|--------------------------------|-----|------------|------------|
| Antenna - Double Ridge       | ETS Lindgren       | 3115                           | AIP | 2022-07-20 | 2024-07-20 |
| Cable                        | ESM Cable Corp.    | Double Ridge Guide Horn Cables | MNI | 2024-01-08 | 2025-01-08 |
| Amplifier - Pre-Amplifier    | Miteq              | AMF-3D-00100800-32-13P         | AVT | 2024-01-08 | 2025-01-08 |
| Attenuator                   | Fairview Microwave | SA18H-20                       | VAF | 2023-09-11 | 2024-09-11 |
| Analyzer - Spectrum Analyzer | Keysight           | N9010A                         | AFN | 2024-02-29 | 2025-02-28 |
| Filter - High Pass           | Micro-Tronics      | HPM50111                       | LFN | 2023-08-23 | 2024-08-23 |
| Antenna - Standard Gain      | ETS Lindgren       | 3160-07                        | AXP | NCR        | NCR        |
| Cable                        | ESM Cable Corp.    | Standard Gain Horn Cables      | MNJ | 2024-01-28 | 2025-01-28 |
| Amplifier - Pre-Amplifier    | Miteq              | AMF-6F-08001200-30-10P         | AVV | 2024-01-08 | 2025-01-08 |
| Antenna - Standard Gain      | ETS Lindgren       | 3160-08                        | AIQ | NCR        | NCR        |
| Amplifier - Pre-Amplifier    | Miteq              | AMF-6F-12001800-30-10P         | AVW | 2024-01-08 | 2025-01-08 |
| Antenna - Biconilog          | ETS Lindgren       | 3142D                          | AXO | 2023-10-02 | 2025-10-02 |
| Antenna - Standard Gain      | ETS Lindgren       | 3160-09                        | AHG | NCR        | NCR        |
| Cable                        | ESM Cable Corp.    | TTBJ141 KMKM-72                | MNP | 2023-09-05 | 2024-09-05 |
| Amplifier - Pre-Amplifier    | Miteq              | JSD4-18002600-26-8P            | APU | 2023-09-05 | 2024-09-05 |
| Antenna - Loop               | ETS Lindgren       | 6502                           | AOB | 2023-06-12 | 2025-06-12 |
| Cable                        | ESM Cable Corp.    | Bilog Cables                   | MNH | 2023-10-08 | 2024-10-08 |
| Amplifier - Pre-Amplifier    | Miteq              | AM-1616-1000                   | AVO | 2023-10-08 | 2024-10-08 |



# SPURIOUS RADIATED EMISSIONS – 14.5dBi Yagi Antenna

| Description       | Manufacturer  | Model    | ID  | Last Cal.  | Cal. Due   |
|-------------------|---------------|----------|-----|------------|------------|
| Filter - Low Pass | Micro-Tronics | LPM50004 | LFK | 2023-08-23 | 2024-08-23 |

## TEST EQUIPMENT (EMPM0182)

| Description                  | Manufacturer       | Model                          | ID      | Last Cal.  | Cal. Due   |
|------------------------------|--------------------|--------------------------------|---------|------------|------------|
| Antenna - Double Ridge       | ETS Lindgren       | 3115                           | AJA     | 2023-09-06 | 2025-09-06 |
| Cable                        | ESM Cable Corp.    | Double Ridge Guide Horn Cables | MNI     | 2024-01-08 | 2025-01-08 |
| Amplifier - Pre-Amplifier    | Miteq              | AMF-3D-00100800-32-13P         | AVT     | 2024-01-08 | 2025-01-08 |
| Attenuator                   | Fairview Microwave | SA18H-20                       | VAF     | 2023-09-11 | 2024-09-11 |
| Analyzer - Spectrum Analyzer | Agilent            | E4446A                         | AAQ     | 2024-03-13 | 2025-03-13 |
| Antenna - Biconilog          | ETS Lindgren       | 3142D                          | AXO     | 2023-10-02 | 2025-10-02 |
| Cable                        | ESM Cable Corp.    | Bilog Cables                   | MN<br>H | 2024-10-09 | 2025-10-09 |
| Amplifier - Pre-Amplifier    | Miteq              | AM-1616-1000                   | AVO     | 2024-10-09 | 2025-10-09 |
| Filter - Low Pass            | Micro-Tronics      | LPM50004                       | LFK     | 2023-08-23 | 2024-08-23 |
| Filter - High Pass           | Micro-Tronics      | HPM50111                       | LFN     | 2023-08-23 | 2024-08-23 |
| Antenna - Standard Gain      | ETS Lindgren       | 3160-09                        | AHG     | NCR        | NCR        |
| Cable                        | ESM Cable Corp.    | TTBJ141 KMKM-72                | MNP     | 2024-09-05 | 2025-09-05 |
| Amplifier - Pre-Amplifier    | Miteq              | JSD4-18002600-26-8P            | APU     | 2024-09-05 | 2025-09-05 |
| Antenna - Loop               | ETS Lindgren       | 6502                           | AOB     | 2023-06-12 | 2025-06-12 |

## MEASUREMENT UNCERTAINTY

| Description  |        |         |
|--------------|--------|---------|
| Expanded k=2 | 5.2 dB | -5.2 dB |

## FREQUENCY RANGE INVESTIGATED

|                 |
|-----------------|
| 9 kHz TO 25 GHz |
|-----------------|

## CONFIGURATIONS INVESTIGATED

|            |
|------------|
| EMPM0165-7 |
| EMPM0182-3 |

# SPURIOUS RADIATED EMISSIONS – 14.5dBi Yagi Antenna



|                   |                                          |                       |            |
|-------------------|------------------------------------------|-----------------------|------------|
| EUT:              | 781SA                                    | Work Order:           | EMPM0182   |
| Serial Number:    | 018                                      | Date:                 | 2024-08-02 |
| Customer:         | Emerson                                  | Temperature:          | 21.8°C     |
| Attendees:        | Stacy Lukas, Daniel Wolf                 | Relative Humidity:    | 60.1%      |
| Customer Project: | None                                     | Bar. Pressure (PMSL): | 1017 mb    |
| Tested By:        | Arnauld Dedry                            | Job Site:             | MN05       |
| Power:            | 15VDC (provided from peripheral Gateway) | Configuration:        | EMPM0182-3 |

## TEST SPECIFICATIONS

|                                      |                  |
|--------------------------------------|------------------|
| Specification:                       | Method:          |
| FCC 15.247:2024                      | ANSI C63.10:2013 |
| RSS-247 Issue 3:2023                 | ANSI C63.10:2013 |
| RSS-Gen Issue 5:2018+A1:2019+A2:2021 |                  |

## TEST PARAMETERS

|        |    |                    |   |                     |           |
|--------|----|--------------------|---|---------------------|-----------|
| Run #: | 16 | Test Distance (m): | 3 | Ant. Height(s) (m): | 1 to 4(m) |
|--------|----|--------------------|---|---------------------|-----------|

## COMMENTS

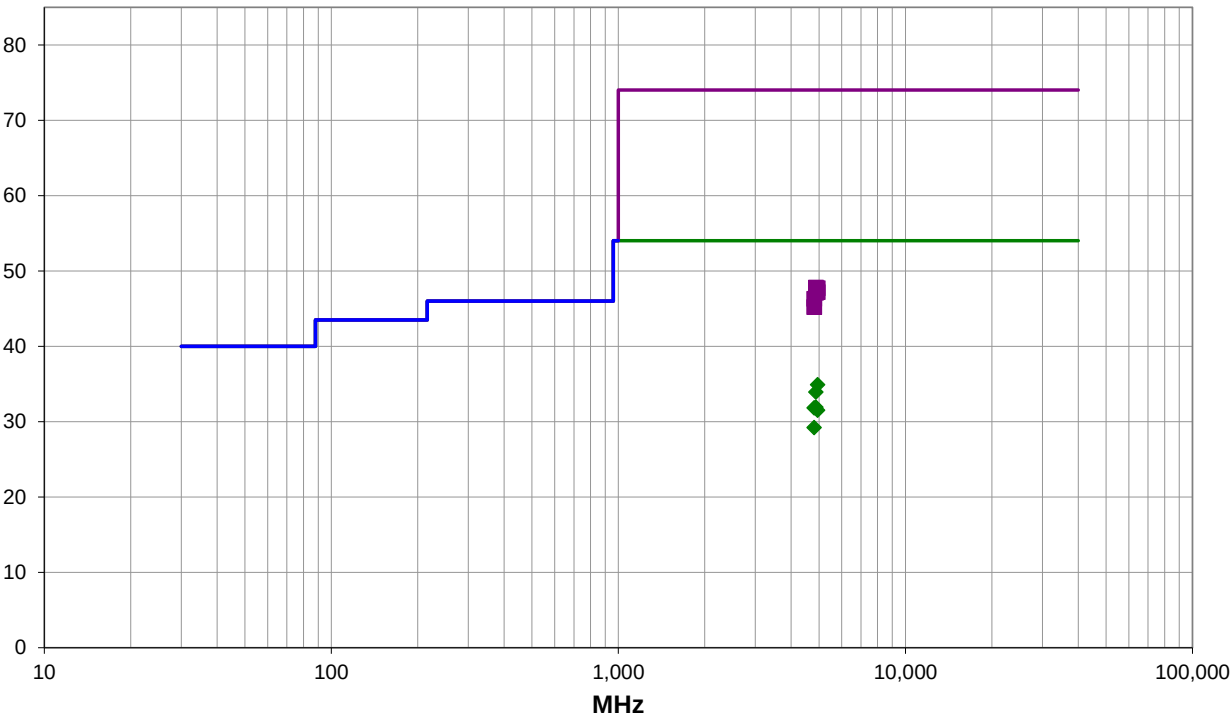
14.5 dBi Yagi Antenna. The test mode is 100% Duty Cycle. In hopping mode, the customer states that the worst case on time in 100 ms is 20.706 ms. Therefore, a duty cycle correction factor (DCCF) was applied using  $10 \cdot \log(\text{dwell time}/100\text{ms}) = -6.8\text{dB}$ .

## EUT OPERATING MODES

Transmitting Low, Mid & High Ch (2405, 2440,2475). Channels tested independently.

## DEVIATIONS FROM TEST STANDARD

None



Run #: 16

■ PK ◆ AV ● QP

# SPURIOUS RADIATED EMISSIONS – 14.5dBi Yagi Antenna

## RESULTS - Run #16

| Freq (MHz) | Amplitude (dBuV) | Factor (dB/m) | Antenna Height (meters) | Azimuth (degrees) | Duty Cycle Correction Factor | External Attenuation (dB) | Polarity/Transducer | Detector | Distance Adjustment (dB) | Adjusted (dBuV/m) | Spec. Limit (dBuV/m) | Compared to Spec. (dB) | Comments          |
|------------|------------------|---------------|-------------------------|-------------------|------------------------------|---------------------------|---------------------|----------|--------------------------|-------------------|----------------------|------------------------|-------------------|
| 4949.975   | 36.5             | 5.2           | 3.3                     | 186.9             | -6.8                         | 0.0                       | Horz                | AV       | 0.0                      | 34.9              | 54.0                 | -19.1                  | EUT Horz, High Ch |
| 4880.008   | 35.6             | 5.1           | 3.8                     | 198.0             | -6.8                         | 0.0                       | Horz                | AV       | 0.0                      | 33.9              | 54.0                 | -20.1                  | EUT Horz, Mid Ch  |
| 4879.967   | 33.6             | 5.1           | 1.2                     | 214.9             | -6.8                         | 0.0                       | Vert                | AV       | 0.0                      | 31.9              | 54.0                 | -22.1                  | EUT Horz, Mid Ch  |
| 4809.983   | 33.3             | 5.3           | 2.4                     | 196.9             | -6.8                         | 0.0                       | Horz                | AV       | 0.0                      | 31.8              | 54.0                 | -22.2                  | EUT Horz, Low Ch  |
| 4949.908   | 33.1             | 5.2           | 1.3                     | 84.0              | -6.8                         | 0.0                       | Vert                | AV       | 0.0                      | 31.5              | 54.0                 | -22.5                  | EUT Horz, High Ch |
| 4809.958   | 30.7             | 5.3           | 1.4                     | 196.9             | -6.8                         | 0.0                       | Vert                | AV       | 0.0                      | 29.2              | 54.0                 | -24.8                  | EUT Horz, Low Ch  |
| 4879.958   | 42.7             | 5.1           | 3.8                     | 198.0             | 0.0                          | 0.0                       | Horz                | PK       | 0.0                      | 47.8              | 74.0                 | -26.2                  | EUT Horz, Mid Ch  |
| 4949.992   | 42.5             | 5.2           | 3.3                     | 186.9             | 0.0                          | 0.0                       | Horz                | PK       | 0.0                      | 47.7              | 74.0                 | -26.3                  | EUT Horz, High Ch |
| 4949.983   | 42.0             | 5.2           | 1.3                     | 84.0              | 0.0                          | 0.0                       | Vert                | PK       | 0.0                      | 47.2              | 74.0                 | -26.8                  | EUT Horz, High Ch |
| 4880.233   | 42.0             | 5.1           | 1.2                     | 214.9             | 0.0                          | 0.0                       | Vert                | PK       | 0.0                      | 47.1              | 74.0                 | -26.9                  | EUT Horz, Mid Ch  |
| 4809.950   | 41.0             | 5.3           | 2.4                     | 196.9             | 0.0                          | 0.0                       | Horz                | PK       | 0.0                      | 46.3              | 74.0                 | -27.7                  | EUT Horz, Low Ch  |
| 4809.458   | 39.9             | 5.3           | 1.4                     | 196.9             | 0.0                          | 0.0                       | Vert                | PK       | 0.0                      | 45.2              | 74.0                 | -28.8                  | EUT Horz, Low Ch  |

## CONCLUSION

Pass



Tested By

# SPURIOUS RADIATED EMISSIONS – 14.5dBi Yagi Antenna

|                   |                                          |                       |            |
|-------------------|------------------------------------------|-----------------------|------------|
| EUT:              | 781SA                                    | Work Order:           | EMPM0165   |
| Serial Number:    | 018                                      | Date:                 | 2024-03-08 |
| Customer:         | Emerson                                  | Temperature:          | 21.2°C     |
| Attendees:        | Erin Snell                               | Relative Humidity:    | 23.6%      |
| Customer Project: | None                                     | Bar. Pressure (PMSL): | 1021 mb    |
| Tested By:        | Marcelo Aguayo                           | Job Site:             | MN05       |
| Power:            | 15VDC (provided from peripheral Gateway) | Configuration:        | EMPM0165-7 |

## TEST SPECIFICATIONS

|                                      |                  |
|--------------------------------------|------------------|
| Specification:                       | Method:          |
| FCC 15.247:2024                      | ANSI C63.10:2013 |
| RSS-247 Issue 3:2023                 | ANSI C63.10:2013 |
| RSS-Gen Issue 5:2018+A1:2019+A2:2021 |                  |

## TEST PARAMETERS

|        |     |                    |   |                     |           |
|--------|-----|--------------------|---|---------------------|-----------|
| Run #: | 148 | Test Distance (m): | 3 | Ant. Height(s) (m): | 1 to 4(m) |
|--------|-----|--------------------|---|---------------------|-----------|

## COMMENTS

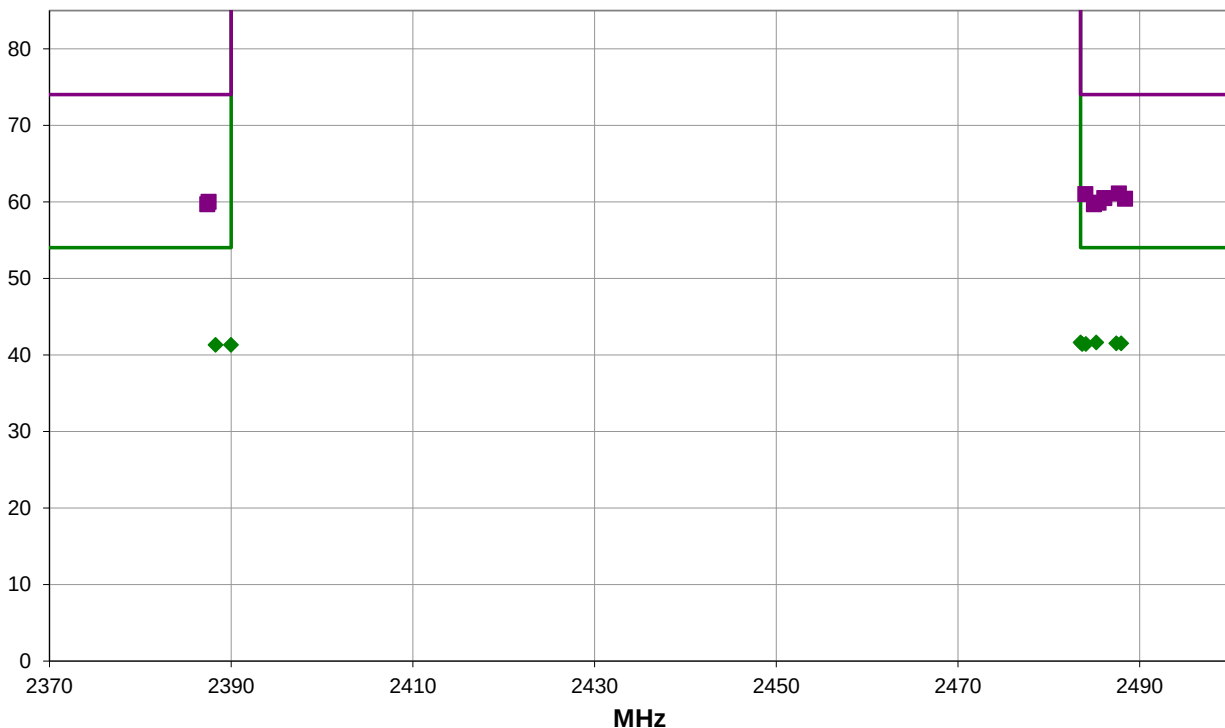
14.5 dBi Yagi antenna. Test mode is 100% Duty Cycle. The client states that during hopping operation, the highest on time in 100ms is 20.706ms. Therefore, a duty cycle correction factor (DCCF) was added using  $10 \cdot \log(\text{dwell time}/100\text{ms}) = -6.8 \text{ dB}$ .

## EUT OPERATING MODES

Transmitting 2.4 GHz Antenna Low and High Chs (2405 and 2475 MHz), OQPSK 250 kbps. Channels tested independently.

## DEVIATIONS FROM TEST STANDARD

None



Run #: 148

■ PK ◆ AV ● QP

# SPURIOUS RADIATED EMISSIONS – 14.5dBi Yagi Antenna

## RESULTS - Run #148

| Freq (MHz) | Amplitude (dBuV) | Factor (dB/m) | Antenna Height (meters) | Azimuth (degrees) | Duty Cycle Correction Factor | External Attenuation (dB) | Polarity/ Transducer | Detector | Distance Adjustment (dB) | Adjusted (dBuV/m) | Spec. Limit (dBuV/m) | Compared to Spec. (dB) | Comments             |
|------------|------------------|---------------|-------------------------|-------------------|------------------------------|---------------------------|----------------------|----------|--------------------------|-------------------|----------------------|------------------------|----------------------|
| 2483.517   | 31.9             | -3.5          | 1.5                     | 276.9             | -6.8                         | 20.0                      | Horz                 | AV       | 0.0                      | 41.6              | 54.0                 | -12.4                  | EUT Horz, High Ch    |
| 2485.233   | 31.9             | -3.5          | 3.2                     | 235.0             | -6.8                         | 20.0                      | Vert                 | AV       | 0.0                      | 41.6              | 54.0                 | -12.4                  | EUT Horz, High Ch    |
| 2487.450   | 31.8             | -3.5          | 1.0                     | 152.0             | -6.8                         | 20.0                      | Horz                 | AV       | 0.0                      | 41.5              | 54.0                 | -12.5                  | EUT On Side, High Ch |
| 2487.992   | 31.8             | -3.5          | 1.5                     | 40.0              | -6.8                         | 20.0                      | Vert                 | AV       | 0.0                      | 41.5              | 54.0                 | -12.5                  | EUT On Side, High Ch |
| 2483.692   | 31.7             | -3.5          | 1.5                     | 336.0             | -6.8                         | 20.0                      | Horz                 | AV       | 0.0                      | 41.4              | 54.0                 | -12.6                  | EUT Vert, High Ch    |
| 2484.108   | 31.7             | -3.5          | 1.5                     | 329.0             | -6.8                         | 20.0                      | Vert                 | AV       | 0.0                      | 41.4              | 54.0                 | -12.6                  | EUT Vert, High Ch    |
| 2388.300   | 32.2             | -4.1          | 1.5                     | 247.9             | -6.8                         | 20.0                      | Horz                 | AV       | 0.0                      | 41.3              | 54.0                 | -12.7                  | EUT Horz, Low Ch     |
| 2390.000   | 32.2             | -4.1          | 1.5                     | 228.9             | -6.8                         | 20.0                      | Vert                 | AV       | 0.0                      | 41.3              | 54.0                 | -12.7                  | EUT Horz, Low Ch     |
| 2487.725   | 44.6             | -3.5          | 1.5                     | 276.9             | 0.0                          | 20.0                      | Horz                 | PK       | 0.0                      | 61.1              | 74.0                 | -12.9                  | EUT Horz, High Ch    |
| 2484.033   | 44.5             | -3.5          | 1.0                     | 152.0             | 0.0                          | 20.0                      | Horz                 | PK       | 0.0                      | 61.0              | 74.0                 | -13.0                  | EUT On Side, High Ch |
| 2486.117   | 44.0             | -3.5          | 1.5                     | 40.0              | 0.0                          | 20.0                      | Vert                 | PK       | 0.0                      | 60.5              | 74.0                 | -13.5                  | EUT On Side, High Ch |
| 2488.400   | 43.8             | -3.4          | 1.5                     | 336.0             | 0.0                          | 20.0                      | Horz                 | PK       | 0.0                      | 60.4              | 74.0                 | -13.6                  | EUT Vert, High Ch    |
| 2387.525   | 44.1             | -4.1          | 1.5                     | 228.9             | 0.0                          | 20.0                      | Vert                 | PK       | 0.0                      | 60.0              | 74.0                 | -14.0                  | EUT Horz, Low Ch     |
| 2485.492   | 43.4             | -3.5          | 1.5                     | 329.0             | 0.0                          | 20.0                      | Vert                 | PK       | 0.0                      | 59.9              | 74.0                 | -14.1                  | EUT Vert, High Ch    |
| 2484.967   | 43.2             | -3.5          | 3.2                     | 235.0             | 0.0                          | 20.0                      | Vert                 | PK       | 0.0                      | 59.7              | 74.0                 | -14.3                  | EUT Horz, High Ch    |
| 2387.367   | 43.8             | -4.1          | 1.5                     | 247.9             | 0.0                          | 20.0                      | Horz                 | PK       | 0.0                      | 59.7              | 74.0                 | -14.3                  | EUT Horz, Low Ch     |

## CONCLUSION

Pass



Tested By

# SPURIOUS RADIATED EMISSIONS – 14.5dBi Yagi Antenna



|                   |                                          |                       |            |
|-------------------|------------------------------------------|-----------------------|------------|
| EUT:              | 781SA                                    | Work Order:           | EMPM0165   |
| Serial Number:    | 018                                      | Date:                 | 2024-03-08 |
| Customer:         | Emerson                                  | Temperature:          | 21.2°C     |
| Attendees:        | Erin Snell                               | Relative Humidity:    | 23.6%      |
| Customer Project: | None                                     | Bar. Pressure (PMSL): | 1021 mb    |
| Tested By:        | Marcelo Aguayo                           | Job Site:             | MN05       |
| Power:            | 15VDC (provided from peripheral Gateway) | Configuration:        | EMPM0165-7 |

## TEST SPECIFICATIONS

|                                      |                  |
|--------------------------------------|------------------|
| Specification:                       | Method:          |
| FCC 15.247:2024                      | ANSI C63.10:2013 |
| RSS-247 Issue 3:2023                 | ANSI C63.10:2013 |
| RSS-Gen Issue 5:2018+A1:2019+A2:2021 |                  |

## TEST PARAMETERS

|        |     |                    |   |                     |           |
|--------|-----|--------------------|---|---------------------|-----------|
| Run #: | 149 | Test Distance (m): | 3 | Ant. Height(s) (m): | 1 to 4(m) |
|--------|-----|--------------------|---|---------------------|-----------|

## COMMENTS

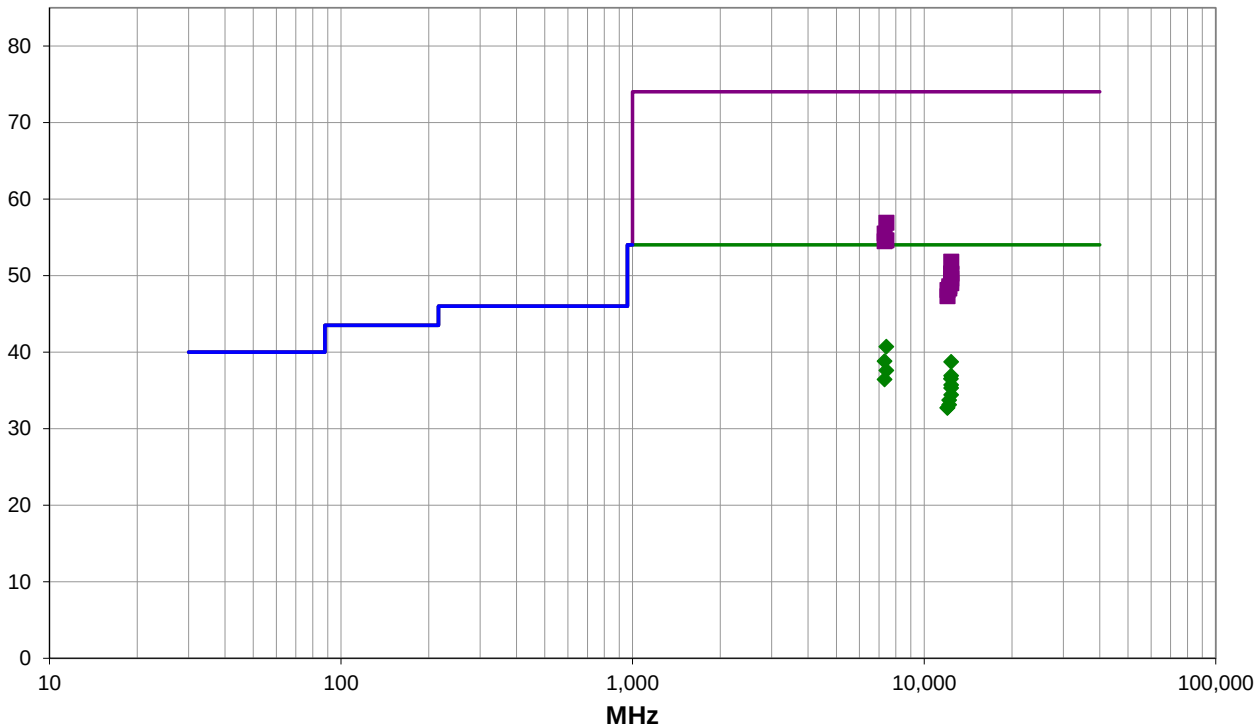
14.5 dBi Yagi antenna. Test mode is 100% Duty Cycle. The client states that during hopping operation, the highest on time in 100ms is 20.706ms. Therefore, a duty cycle correction factor (DCCF) was added using  $10 \cdot \log(\text{dwell time}/100\text{ms}) = -6.8 \text{ dB}$ .

## EUT OPERATING MODES

Transmitting 2.4 GHz Antenna Low, Mid and High Chs (2405, 2440 and 2475 MHz), OQPSK 250 kbps. Channels tested independently.

## DEVIATIONS FROM TEST STANDARD

None



Run #: 149

■ PK ◆ AV ● QP

# SPURIOUS RADIATED EMISSIONS – 14.5dBi Yagi Antenna

## RESULTS - Run #149

| Freq (MHz) | Amplitude (dBuV) | Factor (dB/m) | Antenna Height (meters) | Azimuth (degrees) | Duty Cycle Correction Factor | External Attenuation (dB) | Polarity/Transducer | Detector | Distance Adjustment (dB) | Adjusted (dBuV/m) | Spec. Limit (dBuV/m) | Compared to Spec. (dB) | Comments             |
|------------|------------------|---------------|-------------------------|-------------------|------------------------------|---------------------------|---------------------|----------|--------------------------|-------------------|----------------------|------------------------|----------------------|
| 7426.342   | 35.0             | 12.5          | 2.6                     | 322.0             | -6.8                         | 0.0                       | Horz                | AV       | 0.0                      | 40.7              | 54.0                 | -13.3                  | EUT Horz, High Ch    |
| 7318.608   | 33.1             | 12.5          | 3.1                     | 62.0              | -6.8                         | 0.0                       | Vert                | AV       | 0.0                      | 38.8              | 54.0                 | -15.2                  | EUT Horz, Mid Ch     |
| 12377.380  | 46.3             | -0.8          | 2.3                     | 80.0              | -6.8                         | 0.0                       | Horz                | AV       | 0.0                      | 38.7              | 54.0                 | -15.3                  | EUT Horz, High Ch    |
| 7426.442   | 31.9             | 12.5          | 2.4                     | 22.0              | -6.8                         | 0.0                       | Vert                | AV       | 0.0                      | 37.6              | 54.0                 | -16.4                  | EUT Horz, High Ch    |
| 12377.350  | 44.5             | -0.8          | 2.1                     | 12.9              | -6.8                         | 0.0                       | Vert                | AV       | 0.0                      | 36.9              | 54.0                 | -17.1                  | EUT Horz, High Ch    |
| 7426.667   | 44.4             | 12.5          | 2.6                     | 322.0             | 0.0                          | 0.0                       | Horz                | PK       | 0.0                      | 56.9              | 74.0                 | -17.1                  | EUT Horz, High Ch    |
| 12372.530  | 44.1             | -0.8          | 3.7                     | 76.0              | -6.8                         | 0.0                       | Horz                | AV       | 0.0                      | 36.5              | 54.0                 | -17.5                  | EUT Vert, High Ch    |
| 7321.392   | 30.7             | 12.5          | 1.5                     | 5.9               | -6.8                         | 0.0                       | Horz                | AV       | 0.0                      | 36.4              | 54.0                 | -17.6                  | EUT Horz, Mid Ch     |
| 12377.350  | 43.3             | -0.8          | 2.1                     | 307.9             | -6.8                         | 0.0                       | Horz                | AV       | 0.0                      | 35.7              | 54.0                 | -18.3                  | EUT On Side, High Ch |
| 7318.417   | 43.0             | 12.5          | 3.1                     | 62.0              | 0.0                          | 0.0                       | Vert                | PK       | 0.0                      | 55.5              | 74.0                 | -18.5                  | EUT Horz, Mid Ch     |
| 12377.440  | 42.9             | -0.8          | 2.0                     | 18.0              | -6.8                         | 0.0                       | Vert                | AV       | 0.0                      | 35.3              | 54.0                 | -18.7                  | EUT On Side, High Ch |
| 7426.267   | 42.1             | 12.5          | 2.4                     | 22.0              | 0.0                          | 0.0                       | Vert                | PK       | 0.0                      | 54.6              | 74.0                 | -19.4                  | EUT Horz, High Ch    |
| 7318.350   | 42.0             | 12.5          | 1.5                     | 5.9               | 0.0                          | 0.0                       | Horz                | PK       | 0.0                      | 54.5              | 74.0                 | -19.5                  | EUT Horz, Mid Ch     |
| 12377.370  | 42.0             | -0.8          | 2.0                     | 336.0             | -6.8                         | 0.0                       | Vert                | AV       | 0.0                      | 34.4              | 54.0                 | -19.6                  | EUT Vert, High Ch    |
| 12197.520  | 41.3             | -0.8          | 1.6                     | 189.0             | -6.8                         | 0.0                       | Horz                | AV       | 0.0                      | 33.7              | 54.0                 | -20.3                  | EUT Horz, Mid Ch     |
| 12202.390  | 40.7             | -0.8          | 2.8                     | 31.9              | -6.8                         | 0.0                       | Vert                | AV       | 0.0                      | 33.1              | 54.0                 | -20.9                  | EUT Horz, Mid Ch     |
| 12027.320  | 41.3             | -1.8          | 1.9                     | 73.9              | -6.8                         | 0.0                       | Horz                | AV       | 0.0                      | 32.7              | 54.0                 | -21.3                  | EUT Horz, Low Ch     |
| 12027.350  | 41.3             | -1.8          | 4.0                     | 30.0              | -6.8                         | 0.0                       | Vert                | AV       | 0.0                      | 32.7              | 54.0                 | -21.3                  | EUT Horz, Low Ch     |
| 12377.320  | 52.6             | -0.8          | 2.3                     | 80.0              | 0.0                          | 0.0                       | Horz                | PK       | 0.0                      | 51.8              | 74.0                 | -22.2                  | EUT On Side, High Ch |
| 12377.330  | 51.1             | -0.8          | 2.1                     | 12.9              | 0.0                          | 0.0                       | Vert                | PK       | 0.0                      | 50.3              | 74.0                 | -23.7                  | EUT Horz, High Ch    |
| 12377.230  | 51.0             | -0.8          | 3.7                     | 76.0              | 0.0                          | 0.0                       | Horz                | PK       | 0.0                      | 50.2              | 74.0                 | -23.8                  | EUT Vert, High Ch    |
| 12377.310  | 50.4             | -0.8          | 2.1                     | 307.9             | 0.0                          | 0.0                       | Horz                | PK       | 0.0                      | 49.6              | 74.0                 | -24.4                  | EUT Horz, High Ch    |
| 12372.580  | 50.1             | -0.8          | 2.0                     | 18.0              | 0.0                          | 0.0                       | Vert                | PK       | 0.0                      | 49.3              | 74.0                 | -24.7                  | EUT On Side, High Ch |
| 12377.320  | 49.8             | -0.8          | 2.0                     | 336.0             | 0.0                          | 0.0                       | Vert                | PK       | 0.0                      | 49.0              | 74.0                 | -25.0                  | EUT Vert, High Ch    |
| 12197.890  | 49.4             | -0.8          | 1.6                     | 189.0             | 0.0                          | 0.0                       | Horz                | PK       | 0.0                      | 48.6              | 74.0                 | -25.4                  | EUT Horz, Mid Ch     |
| 12202.320  | 49.1             | -0.8          | 2.8                     | 31.9              | 0.0                          | 0.0                       | Vert                | PK       | 0.0                      | 48.3              | 74.0                 | -25.7                  | EUT Horz, Mid Ch     |
| 12022.510  | 49.9             | -1.8          | 1.9                     | 73.9              | 0.0                          | 0.0                       | Horz                | PK       | 0.0                      | 48.1              | 74.0                 | -25.9                  | EUT Horz, Low Ch     |
| 12027.280  | 49.1             | -1.8          | 4.0                     | 30.0              | 0.0                          | 0.0                       | Vert                | PK       | 0.0                      | 47.3              | 74.0                 | -26.7                  | EUT Horz, Low Ch     |

## CONCLUSION

Pass



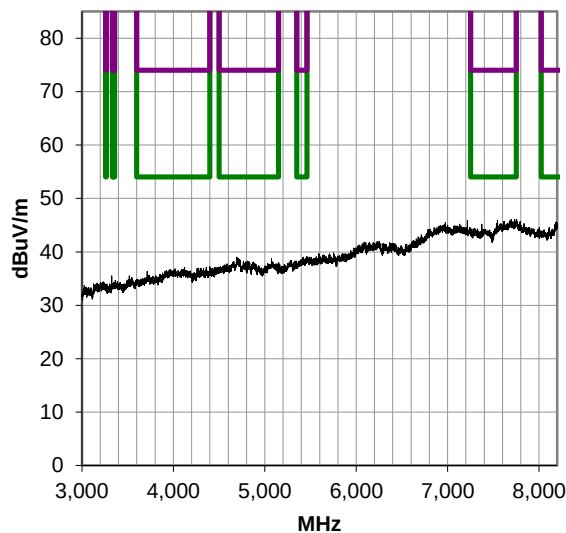
Tested By

# SPURIOUS RADIATED EMISSIONS – 14.5dBi Yagi Antenna

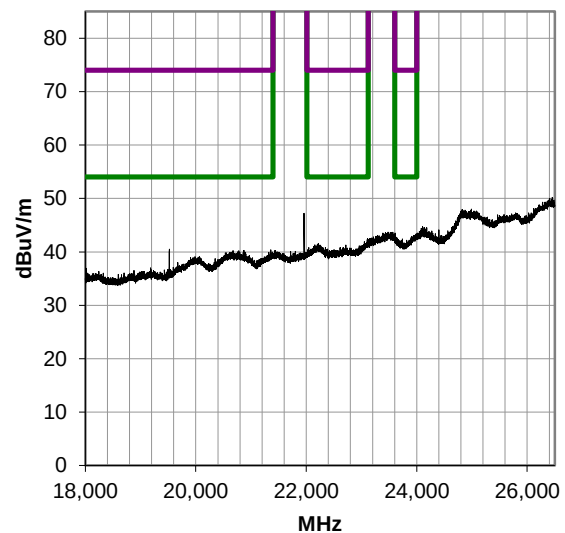
## PRESCAN DATA

Radiated spurious emissions from the EUT are initially reviewed with Pre-scans (Preview scans). Pre-scans are performed, with the EUT transmitting on the lowest applicable data rate, for both vertical and horizontal polarizations. The Pre-scan plots below are shown with a peak detector and RBW for the following frequency ranges: 9 kHz RBW (< 30 MHz); 120 kHz RBW (30 - 1000 MHz); 1 MHz RBW (> 1 GHz). In the case where unintentional emissions are observed, an ambient or idle pre-scan with the radio off, will be shown for comparison.

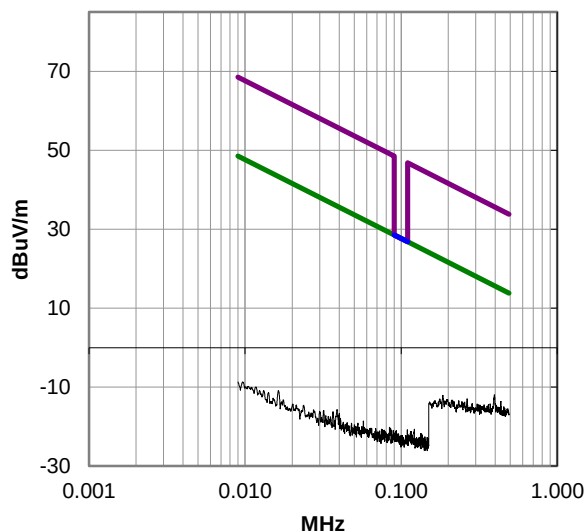
3000-8200 MHz, Run 16



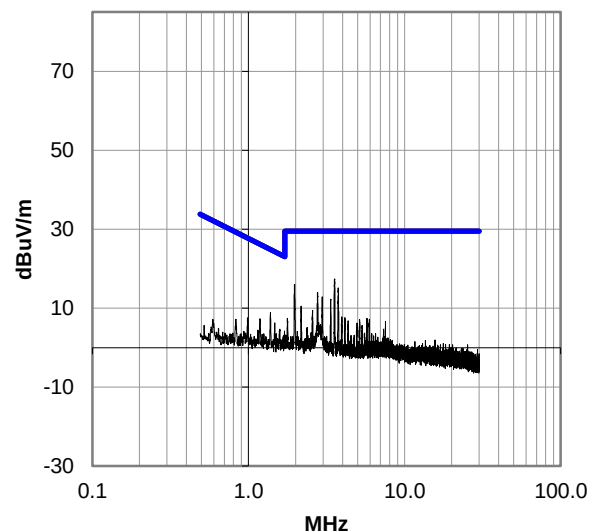
18000-26500 MHz, Run 37



0.009-0.49 MHz, Run 49



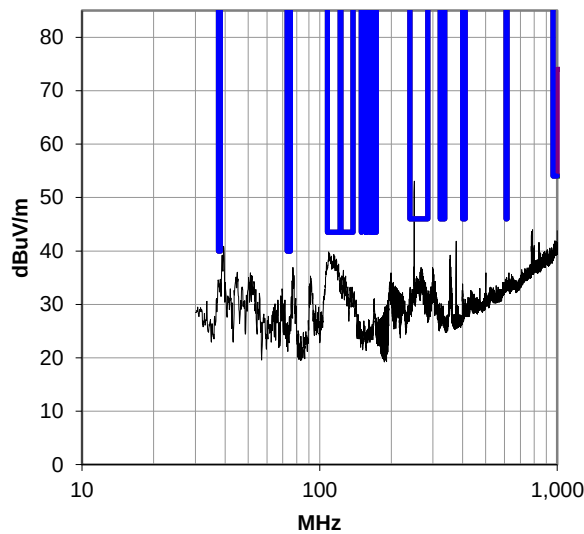
0.49-30 MHz, Run 50



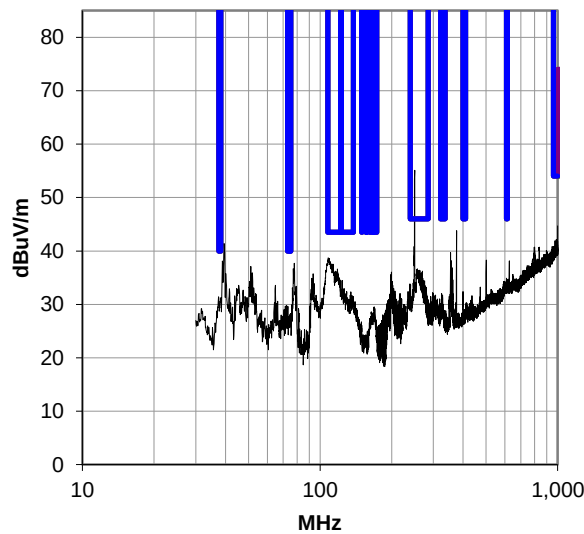


# SPURIOUS RADIATED EMISSIONS – 14.5dBi Yagi Antenna

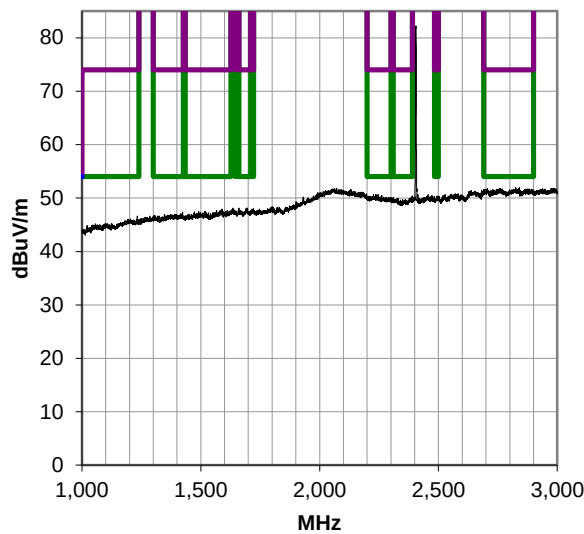
30-1000 MHz, Run 83



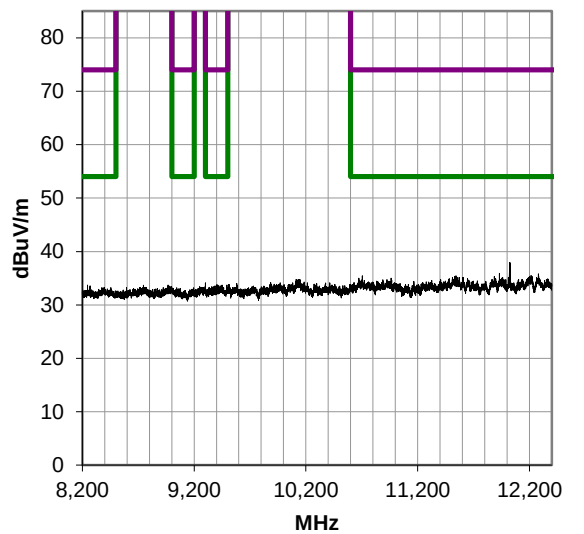
30-1000 MHz, Run 78 (transmitter off)



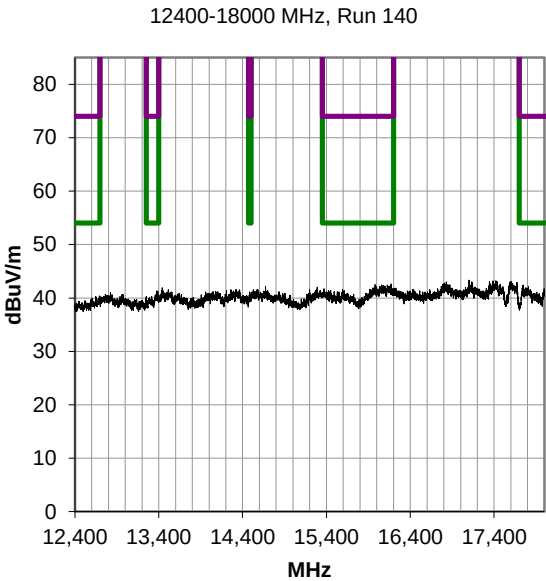
1000-3000 MHz, Run 137



8200-12400 MHz, Run 139



# SPURIOUS RADIATED EMISSIONS – 14.5dBi Yagi Antenna



# SPURIOUS RADIATED EMISSIONS – 15dBi Dipole Antenna

## TEST DESCRIPTION

The highest gain antenna of each type to be used with the EUT was tested. The EUT was configured for the required transmit frequencies and the modes as showed in the data sheets.

For each configuration, the spectrum was scanned throughout the specified range as part of the exploratory investigation of the emissions. These “pre-scans” are not included in the report. Final measurements on individual emissions were then made and included in this test report.

The individual emissions from the EUT were maximized by rotating the EUT on a turntable, adjusting the position of the EUT and EUT antenna in three orthogonal axis if required, and adjusting the measurement antenna height and polarization (per ANSI C63.10). A preamp and high pass filter (and notch filter) were used for this test in order to provide sufficient measurement sensitivity.

Measurements were made with the required detectors and annotated on the data for each individual point using the following annotation:

QP = Quasi-Peak Detector  
PK = Peak Detector  
AV = RMS Detector

Measurements were made to satisfy the specific requirements of the test specification for out of band emissions as well as the restricted band requirements.

If there are no detectable emissions above the noise floor, the data included may show noise floor measurements for reference only.

Measurements within 2 MHz of the allowable band may have been taken using the integration method from ANSI C63.10 clause 11.13.3. This procedure uses the channel power feature of the spectrum analyzer to integrate the power of the emission within a 1 MHz bandwidth.

Where the radio test software does not provide for a duty cycle at continuous transmit conditions (> 98%) and the RMS (power average) measurements were made across the on and off times of the EUT transmissions, a duty cycle correction is added to the measurements using the formula of  $10 \cdot \log(1/dc)$ .

## TEST EQUIPMENT (EMPM0165)

| Description                  | Manufacturer       | Model                          | ID  | Last Cal.  | Cal. Due   |
|------------------------------|--------------------|--------------------------------|-----|------------|------------|
| Antenna - Double Ridge       | ETS Lindgren       | 3115                           | AIP | 2022-07-20 | 2024-07-20 |
| Cable                        | ESM Cable Corp.    | Double Ridge Guide Horn Cables | MNI | 2024-01-08 | 2025-01-08 |
| Amplifier - Pre-Amplifier    | Miteq              | AMF-3D-00100800-32-13P         | AVT | 2024-01-08 | 2025-01-08 |
| Attenuator                   | Fairview Microwave | SA18H-20                       | VAF | 2023-09-11 | 2024-09-11 |
| Analyzer - Spectrum Analyzer | Keysight           | N9010A                         | AFN | 2024-02-29 | 2025-02-28 |
| Filter - High Pass           | Micro-Tronics      | HPM50111                       | LFN | 2023-08-23 | 2024-08-23 |
| Antenna - Standard Gain      | ETS Lindgren       | 3160-07                        | AXP | NCR        | NCR        |
| Cable                        | ESM Cable Corp.    | Standard Gain Horn Cables      | MNJ | 2024-01-28 | 2025-01-28 |
| Amplifier - Pre-Amplifier    | Miteq              | AMF-6F-08001200-30-10P         | AVV | 2024-01-08 | 2025-01-08 |
| Antenna - Standard Gain      | ETS Lindgren       | 3160-08                        | AIQ | NCR        | NCR        |
| Amplifier - Pre-Amplifier    | Miteq              | AMF-6F-12001800-30-10P         | AVW | 2024-01-08 | 2025-01-08 |
| Antenna - Biconilog          | ETS Lindgren       | 3142D                          | AXO | 2023-10-02 | 2025-10-02 |
| Antenna - Standard Gain      | ETS Lindgren       | 3160-09                        | AHG | NCR        | NCR        |
| Cable                        | ESM Cable Corp.    | TTBJ141 KMKM-72                | MNP | 2023-09-05 | 2024-09-05 |
| Amplifier - Pre-Amplifier    | Miteq              | JSD4-18002600-26-8P            | APU | 2023-09-05 | 2024-09-05 |
| Antenna - Loop               | ETS Lindgren       | 6502                           | AOB | 2023-06-12 | 2025-06-12 |
| Cable                        | ESM Cable Corp.    | Bilog Cables                   | MNH | 2023-10-08 | 2024-10-08 |
| Amplifier - Pre-Amplifier    | Miteq              | AM-1616-1000                   | AVO | 2023-10-08 | 2024-10-08 |

# SPURIOUS RADIATED EMISSIONS – 15dBi Dipole Antenna

| Description       | Manufacturer  | Model    | ID  | Last Cal.  | Cal. Due   |
|-------------------|---------------|----------|-----|------------|------------|
| Filter - Low Pass | Micro-Tronics | LPM50004 | LFK | 2023-08-23 | 2024-08-23 |

## TEST EQUIPMENT (EMPM0182)

| Description                  | Manufacturer       | Model                          | ID   | Last Cal.  | Cal. Due   |
|------------------------------|--------------------|--------------------------------|------|------------|------------|
| Antenna - Double Ridge       | ETS Lindgren       | 3115                           | AJA  | 2023-09-06 | 2025-09-06 |
| Cable                        | ESM Cable Corp.    | Double Ridge Guide Horn Cables | MNI  | 2024-01-08 | 2025-01-08 |
| Amplifier - Pre-Amplifier    | Miteq              | AMF-3D-00100800-32-13P         | AVT  | 2024-01-08 | 2025-01-08 |
| Attenuator                   | Fairview Microwave | SA18H-20                       | VAF  | 2023-09-11 | 2024-09-11 |
| Analyzer - Spectrum Analyzer | Agilent            | E4446A                         | AAQ  | 2024-03-13 | 2025-03-13 |
| Antenna - Biconilog          | ETS Lindgren       | 3142D                          | AXO  | 2023-10-02 | 2025-10-02 |
| Cable                        | ESM Cable Corp.    | Bilog Cables                   | MN H | 2024-10-09 | 2025-10-09 |
| Amplifier - Pre-Amplifier    | Miteq              | AM-1616-1000                   | AVO  | 2024-10-09 | 2025-10-09 |
| Filter - Low Pass            | Micro-Tronics      | LPM50004                       | LFK  | 2023-08-23 | 2024-08-23 |
| Filter - High Pass           | Micro-Tronics      | HPM50111                       | LFN  | 2023-08-23 | 2024-08-23 |
| Antenna - Standard Gain      | ETS Lindgren       | 3160-09                        | AHG  | NCR        | NCR        |
| Cable                        | ESM Cable Corp.    | TTBJ141 KMKM-72                | MNP  | 2024-09-05 | 2025-09-05 |
| Amplifier - Pre-Amplifier    | Miteq              | JSD4-18002600-26-8P            | APU  | 2024-09-05 | 2025-09-05 |
| Antenna - Loop               | ETS Lindgren       | 6502                           | AOB  | 2023-06-12 | 2025-06-12 |

## MEASUREMENT UNCERTAINTY

| Description  |        |         |
|--------------|--------|---------|
| Expanded k=2 | 5.2 dB | -5.2 dB |

## FREQUENCY RANGE INVESTIGATED

|                 |
|-----------------|
| 9 kHz TO 25 GHz |
|-----------------|

## CONFIGURATIONS INVESTIGATED

|            |
|------------|
| EMPM0165-5 |
| EMPM0182-2 |

# SPURIOUS RADIATED EMISSIONS – 15dBi Dipole Antenna



|                   |                                          |                       |            |
|-------------------|------------------------------------------|-----------------------|------------|
| EUT:              | 781SA                                    | Work Order:           | EMPM0182   |
| Serial Number:    | 018                                      | Date:                 | 2024-08-02 |
| Customer:         | Emerson                                  | Temperature:          | 21.6°C     |
| Attendees:        | Stacy Lukas, Daniel Wolf                 | Relative Humidity:    | 59.8%      |
| Customer Project: | None                                     | Bar. Pressure (PMSL): | 1018 mb    |
| Tested By:        | Arnauld Dedry                            | Job Site:             | MN05       |
| Power:            | 15VDC (provided from peripheral Gateway) | Configuration:        | EMPM0182-2 |

## TEST SPECIFICATIONS

|                                      |                  |
|--------------------------------------|------------------|
| Specification:                       | Method:          |
| FCC 15.247:2024                      | ANSI C63.10:2013 |
| RSS-247 Issue 3:2023                 | ANSI C63.10:2013 |
| RSS-Gen Issue 5:2018+A1:2019+A2:2021 |                  |

## TEST PARAMETERS

|        |    |                    |   |                     |           |
|--------|----|--------------------|---|---------------------|-----------|
| Run #: | 13 | Test Distance (m): | 3 | Ant. Height(s) (m): | 1 to 4(m) |
|--------|----|--------------------|---|---------------------|-----------|

## COMMENTS

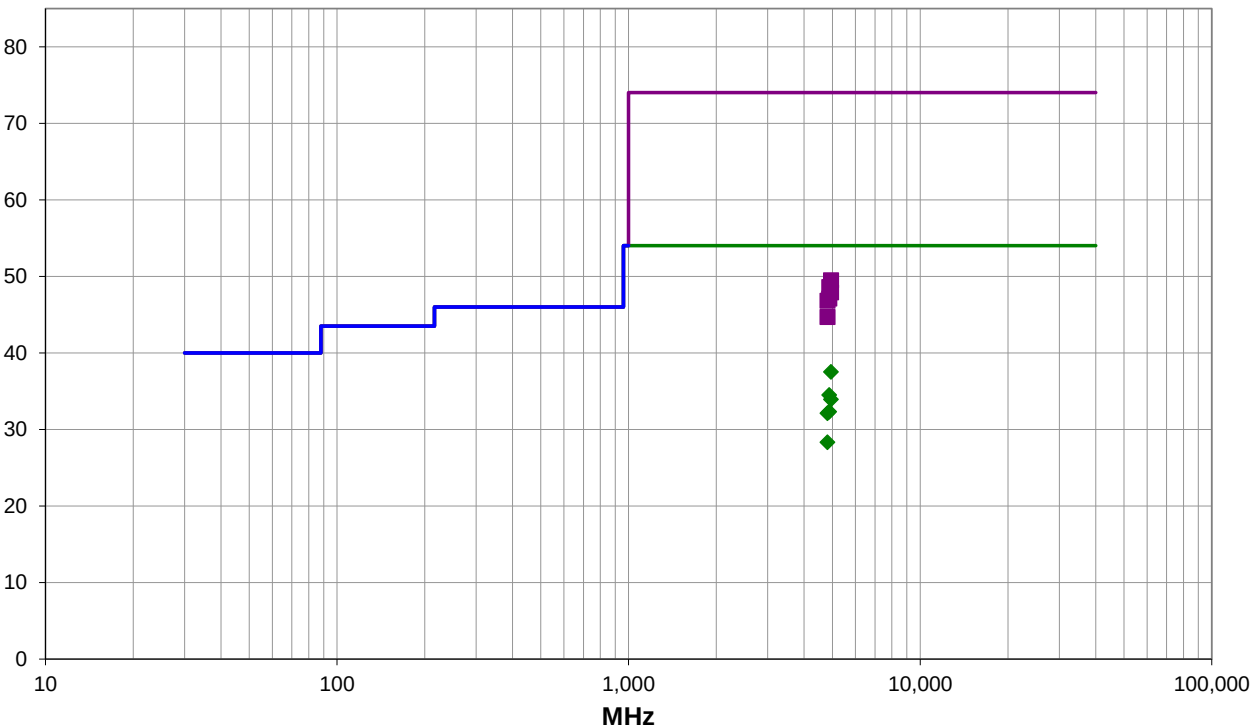
15 dBi Dipole Antenna. Test mode is 100% Duty Cycle. In frequency hopping mode, the highest on time in 100 ms is 20.706 ms (as provided by the customer). Therefore, a duty cycle correction factor was applied using  $10 \cdot \log(\text{dwell time}/100\text{ms}) = -6.8\text{dB}$ .

## EUT OPERATING MODES

Transmitting 2.4 GHz Antenna Low, Mid and High Chs (2405, 2440 and 2475 MHz), OQPSK 250 kbps. Channels tested independently.

## DEVIATIONS FROM TEST STANDARD

None



Run #: 13

■ PK ◆ AV ● QP

# SPURIOUS RADIATED EMISSIONS – 15dBi Dipole Antenna

## RESULTS - Run #13

| Freq (MHz) | Amplitude (dBuV) | Factor (dB/m) | Antenna Height (meters) | Azimuth (degrees) | Duty Cycle Correction Factor | External Attenuation (dB) | Polarity/ Transducer | Detector | Distance Adjustment (dB) | Adjusted (dBuV/m) | Spec. Limit (dBuV/m) | Compared to Spec. (dB) | Comments             |
|------------|------------------|---------------|-------------------------|-------------------|------------------------------|---------------------------|----------------------|----------|--------------------------|-------------------|----------------------|------------------------|----------------------|
| 4950.000   | 39.1             | 5.2           | 2.7                     | 160.9             | -6.8                         | 0.0                       | Horz                 | AV       | 0.0                      | 37.5              | 54.0                 | -16.5                  | EUT On Side, High Ch |
| 4879.983   | 36.2             | 5.1           | 2.4                     | 213.0             | -6.8                         | 0.0                       | Horz                 | AV       | 0.0                      | 34.5              | 54.0                 | -19.5                  | EUT On Side, Mid Ch  |
| 4949.983   | 35.5             | 5.2           | 1.3                     | 207.9             | -6.8                         | 0.0                       | Vert                 | AV       | 0.0                      | 33.9              | 54.0                 | -20.1                  | EUT Horz, High Ch    |
| 4879.983   | 34.0             | 5.1           | 1.1                     | 207.9             | -6.8                         | 0.0                       | Vert                 | AV       | 0.0                      | 32.3              | 54.0                 | -21.7                  | EUT Horz, Mid Ch     |
| 4810.000   | 33.6             | 5.3           | 3.5                     | 180.0             | -6.8                         | 0.0                       | Horz                 | AV       | 0.0                      | 32.1              | 54.0                 | -21.9                  | EUT On Side, Low Ch  |
| 4950.000   | 44.3             | 5.2           | 2.7                     | 160.9             | 0.0                          | 0.0                       | Horz                 | PK       | 0.0                      | 49.5              | 74.0                 | -24.5                  | EUT On Side, High Ch |
| 4879.783   | 43.5             | 5.1           | 2.4                     | 213.0             | 0.0                          | 0.0                       | Horz                 | PK       | 0.0                      | 48.6              | 74.0                 | -25.4                  | EUT On Side, Mid Ch  |
| 4809.900   | 29.8             | 5.3           | 1.5                     | 146.9             | -6.8                         | 0.0                       | Vert                 | AV       | 0.0                      | 28.3              | 54.0                 | -25.7                  | EUT Horz, Low Ch     |
| 4949.892   | 42.7             | 5.2           | 1.3                     | 207.9             | 0.0                          | 0.0                       | Vert                 | PK       | 0.0                      | 47.9              | 74.0                 | -26.1                  | EUT Horz, High Ch    |
| 4879.758   | 42.0             | 5.1           | 1.1                     | 207.9             | 0.0                          | 0.0                       | Vert                 | PK       | 0.0                      | 47.1              | 74.0                 | -26.9                  | EUT Horz, Mid Ch     |
| 4809.717   | 41.5             | 5.3           | 3.5                     | 180.0             | 0.0                          | 0.0                       | Horz                 | PK       | 0.0                      | 46.8              | 74.0                 | -27.2                  | EUT On Side, Low Ch  |
| 4810.192   | 39.4             | 5.3           | 1.5                     | 146.9             | 0.0                          | 0.0                       | Vert                 | PK       | 0.0                      | 44.7              | 74.0                 | -29.3                  | EUT Horz, Low Ch     |

## CONCLUSION

Pass



Tested By

# SPURIOUS RADIATED EMISSIONS – 15dBi Dipole Antenna



|                   |                                          |                       |            |
|-------------------|------------------------------------------|-----------------------|------------|
| EUT:              | 781SA                                    | Work Order:           | EMPM0165   |
| Serial Number:    | 018                                      | Date:                 | 2024-03-08 |
| Customer:         | Emerson                                  | Temperature:          | 21.5°C     |
| Attendees:        | Erin Snell                               | Relative Humidity:    | 23.6%      |
| Customer Project: | None                                     | Bar. Pressure (PMSL): | 1021 mb    |
| Tested By:        | Marcelo Aguayo                           | Job Site:             | MN05       |
| Power:            | 15VDC (provided from peripheral Gateway) | Configuration:        | EMPM0165-5 |

## TEST SPECIFICATIONS

|                                      |                  |
|--------------------------------------|------------------|
| Specification:                       | Method:          |
| FCC 15.247:2024                      | ANSI C63.10:2013 |
| RSS-247 Issue 3:2023                 | ANSI C63.10:2013 |
| RSS-Gen Issue 5:2018+A1:2019+A2:2021 |                  |

## TEST PARAMETERS

|        |     |                    |   |                     |           |
|--------|-----|--------------------|---|---------------------|-----------|
| Run #: | 127 | Test Distance (m): | 3 | Ant. Height(s) (m): | 1 to 4(m) |
|--------|-----|--------------------|---|---------------------|-----------|

## COMMENTS

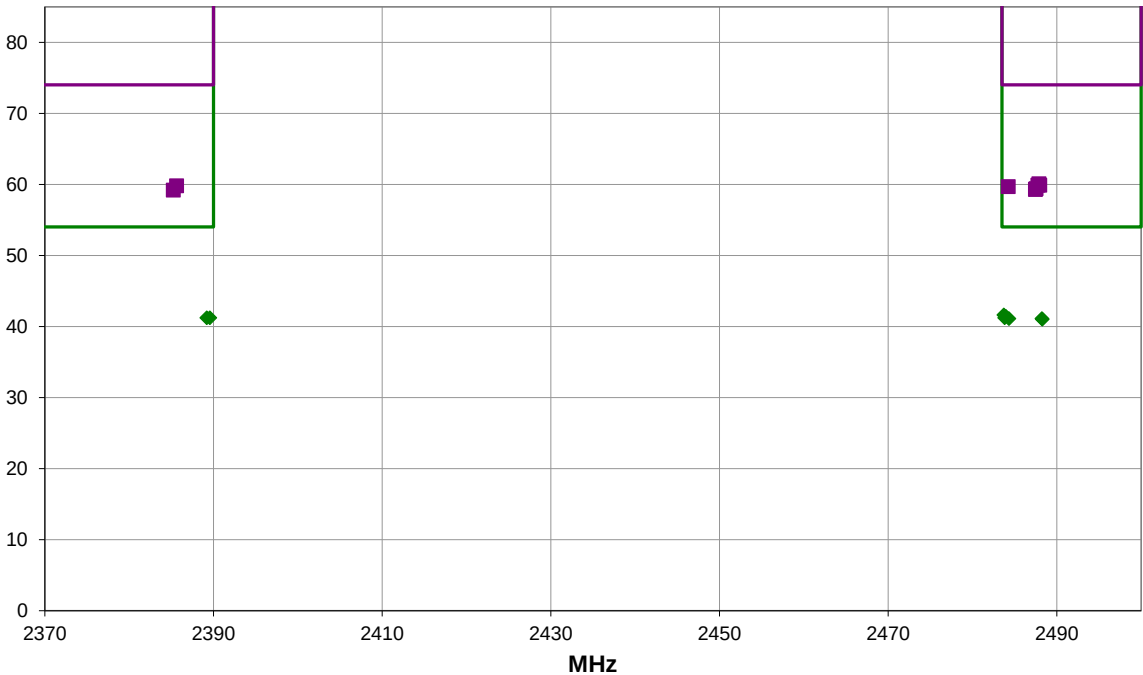
15dBi dipole antenna. Test mode is 100% Duty Cycle. The client states that during hopping operation, the highest on time in 100ms is 20.706ms. Therefore, a duty cycle correction factor (DCCF) was added using  $10 \cdot \log(\text{dwell time}/100\text{ms}) = -6.8 \text{ dB}$ .

## EUT OPERATING MODES

Transmitting 2.4 GHz Antenna Low and High Chs (2405 and 2475 MHz), OQPSK 250 kbps. Channels tested independently.

## DEVIATIONS FROM TEST STANDARD

None



Run #: 127

PK AV QP

# SPURIOUS RADIATED EMISSIONS – 15dBi Dipole Antenna

## RESULTS - Run #127

| Freq (MHz) | Amplitude (dBuV) | Factor (dB/m) | Antenna Height (meters) | Azimuth (degrees) | Duty Cycle Correction Factor | External Attenuation (dB) | Polarity/Transducer | Detector | Distance Adjustment (dB) | Adjusted (dBuV/m) | Spec. Limit (dBuV/m) | Compared to Spec. (dB) | Comments             |
|------------|------------------|---------------|-------------------------|-------------------|------------------------------|---------------------------|---------------------|----------|--------------------------|-------------------|----------------------|------------------------|----------------------|
| 2483.725   | 31.9             | -3.5          | 1.5                     | 98.0              | -6.8                         | 20.0                      | Vert                | AV       | 0.0                      | 41.6              | 54.0                 | -12.4                  | EUT Vert, High Ch    |
| 2483.983   | 31.7             | -3.5          | 4.0                     | 5.9               | -6.8                         | 20.0                      | Horz                | AV       | 0.0                      | 41.4              | 54.0                 | -12.6                  | EUT Vert, High Ch    |
| 2483.825   | 31.5             | -3.5          | 2.4                     | 63.9              | -6.8                         | 20.0                      | Horz                | AV       | 0.0                      | 41.2              | 54.0                 | -12.8                  | EUT Horz, High Ch    |
| 2389.225   | 32.1             | -4.1          | 3.0                     | 9.0               | -6.8                         | 20.0                      | Horz                | AV       | 0.0                      | 41.2              | 54.0                 | -12.8                  | EUT Vert, Low Ch     |
| 2389.592   | 32.1             | -4.1          | 3.5                     | 138.9             | -6.8                         | 20.0                      | Vert                | AV       | 0.0                      | 41.2              | 54.0                 | -12.8                  | EUT Vert, Low Ch     |
| 2484.333   | 31.4             | -3.5          | 2.3                     | 141.0             | -6.8                         | 20.0                      | Vert                | AV       | 0.0                      | 41.1              | 54.0                 | -12.9                  | EUT Horz, High Ch    |
| 2488.250   | 31.4             | -3.5          | 1.5                     | 168.9             | -6.8                         | 20.0                      | Horz                | AV       | 0.0                      | 41.1              | 54.0                 | -12.9                  | EUT On Side, High Ch |
| 2488.292   | 31.3             | -3.5          | 1.5                     | 218.9             | -6.8                         | 20.0                      | Vert                | AV       | 0.0                      | 41.0              | 54.0                 | -13.0                  | EUT On Side, High Ch |
| 2487.892   | 43.6             | -3.5          | 1.5                     | 218.9             | 0.0                          | 20.0                      | Vert                | PK       | 0.0                      | 60.1              | 74.0                 | -13.9                  | EUT On Side, High Ch |
| 2487.758   | 43.4             | -3.5          | 2.3                     | 141.0             | 0.0                          | 20.0                      | Vert                | PK       | 0.0                      | 59.9              | 74.0                 | -14.1                  | EUT Horz, High Ch    |
| 2487.992   | 43.4             | -3.5          | 2.4                     | 63.9              | 0.0                          | 20.0                      | Horz                | PK       | 0.0                      | 59.9              | 74.0                 | -14.1                  | EUT Vert, High Ch    |
| 2385.633   | 43.9             | -4.1          | 3.0                     | 9.0               | 0.0                          | 20.0                      | Horz                | PK       | 0.0                      | 59.8              | 74.0                 | -14.2                  | EUT Vert, Low Ch     |
| 2484.242   | 43.2             | -3.5          | 4.0                     | 5.9               | 0.0                          | 20.0                      | Horz                | PK       | 0.0                      | 59.7              | 74.0                 | -14.3                  | EUT Horz, High Ch    |
| 2487.550   | 42.9             | -3.5          | 1.5                     | 98.0              | 0.0                          | 20.0                      | Vert                | PK       | 0.0                      | 59.4              | 74.0                 | -14.6                  | EUT Vert, High Ch    |
| 2487.475   | 42.8             | -3.5          | 1.5                     | 168.9             | 0.0                          | 20.0                      | Horz                | PK       | 0.0                      | 59.3              | 74.0                 | -14.7                  | EUT On Side, High Ch |
| 2385.242   | 43.3             | -4.1          | 3.5                     | 138.9             | 0.0                          | 20.0                      | Vert                | PK       | 0.0                      | 59.2              | 74.0                 | -14.8                  | EUT Vert, Low Ch     |

## CONCLUSION

Pass



Tested By



# SPURIOUS RADIATED EMISSIONS – 15dBi Dipole Antenna



|                   |                                          |                       |            |
|-------------------|------------------------------------------|-----------------------|------------|
| EUT:              | 781SA                                    | Work Order:           | EMPM0165   |
| Serial Number:    | 018                                      | Date:                 | 2024-03-08 |
| Customer:         | Emerson                                  | Temperature:          | 21.2°C     |
| Attendees:        | Erin Snell                               | Relative Humidity:    | 23.6%      |
| Customer Project: | None                                     | Bar. Pressure (PMSL): | 1021 mb    |
| Tested By:        | Marcelo Aguayo                           | Job Site:             | MN05       |
| Power:            | 15VDC (provided from peripheral Gateway) | Configuration:        | EMPM0165-5 |

## TEST SPECIFICATIONS

|                                      |                  |
|--------------------------------------|------------------|
| Specification:                       | Method:          |
| FCC 15.247:2024                      | ANSI C63.10:2013 |
| RSS-247 Issue 3:2023                 | ANSI C63.10:2013 |
| RSS-Gen Issue 5:2018+A1:2019+A2:2021 |                  |

## TEST PARAMETERS

|        |     |                    |   |                     |           |
|--------|-----|--------------------|---|---------------------|-----------|
| Run #: | 131 | Test Distance (m): | 3 | Ant. Height(s) (m): | 1 to 4(m) |
|--------|-----|--------------------|---|---------------------|-----------|

## COMMENTS

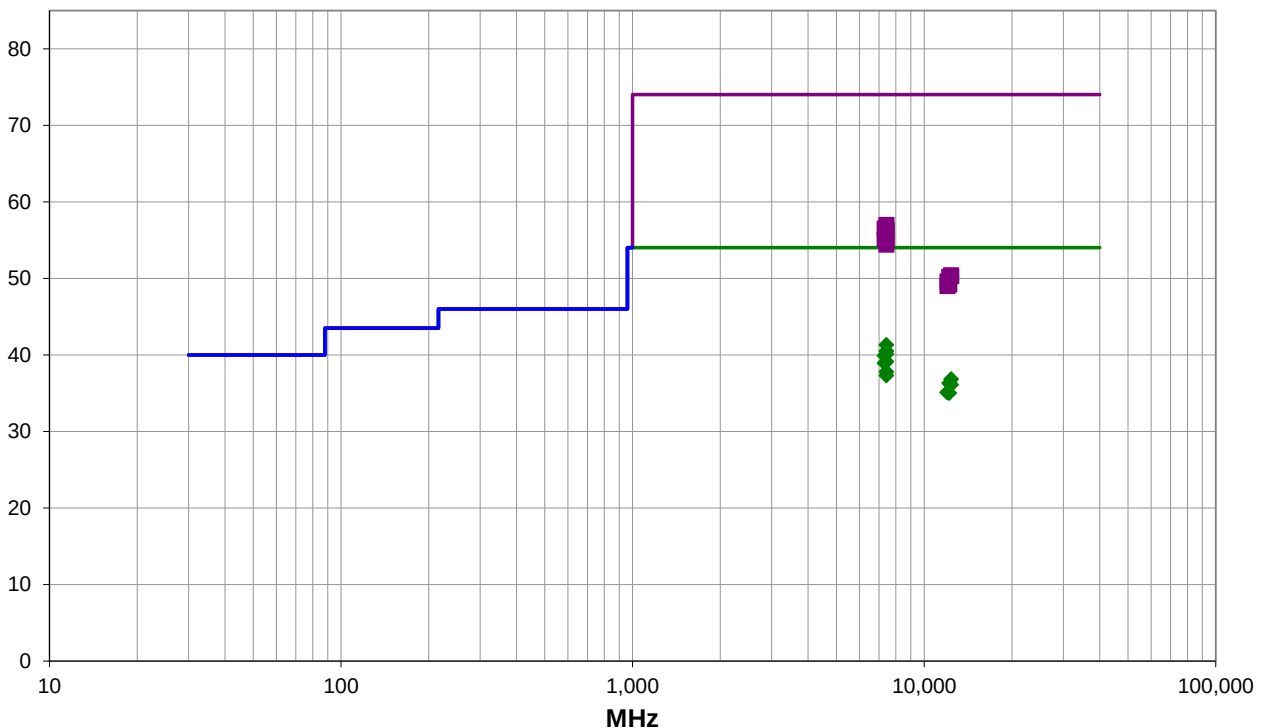
15dBi dipole antenna. Test mode is 100% Duty Cycle. The client states that during hopping operation, the highest on time in 100ms is 20.706ms. Therefore, a duty cycle correction factor (DCCF) was added using  $10 \cdot \log(\text{dwell time}/100\text{ms}) = -6.8 \text{ dB}$ .

## EUT OPERATING MODES

Transmitting 2.4 GHz Antenna Low, Mid and High Chs (2405, 2440 and 2475 MHz), OQPSK 250 kbps. Channels tested independently.

## DEVIATIONS FROM TEST STANDARD

None



Run #: 131

■ PK ◆ AV ● QP

# SPURIOUS RADIATED EMISSIONS – 15dBi Dipole Antenna

## RESULTS - Run #131

| Freq (MHz) | Amplitude (dBuV) | Factor (dB/m) | Antenna Height (meters) | Azimuth (degrees) | Duty Cycle Correction Factor | External Attenuation (dB) | Polarity/Transducer | Detector | Distance Adjustment (dB) | Adjusted (dBuV/m) | Spec. Limit (dBuV/m) | Compared to Spec. (dB) | Comments             |
|------------|------------------|---------------|-------------------------|-------------------|------------------------------|---------------------------|---------------------|----------|--------------------------|-------------------|----------------------|------------------------|----------------------|
| 7423.625   | 35.6             | 12.5          | 2.6                     | 360.0             | -6.8                         | 0.0                       | Horz                | AV       | 0.0                      | 41.3              | 54.0                 | -12.7                  | EUT Vert, High Ch    |
| 7426.283   | 34.8             | 12.5          | 2.7                     | 339.0             | -6.8                         | 0.0                       | Horz                | AV       | 0.0                      | 40.5              | 54.0                 | -13.5                  | EUT On Side, High Ch |
| 7426.392   | 34.4             | 12.5          | 2.7                     | 330.9             | -6.8                         | 0.0                       | Horz                | AV       | 0.0                      | 40.1              | 54.0                 | -13.9                  | EUT Horz, High Ch    |
| 7318.517   | 34.2             | 12.5          | 2.4                     | 23.0              | -6.8                         | 0.0                       | Vert                | AV       | 0.0                      | 39.9              | 54.0                 | -14.1                  | EUT Vert, Mid Ch     |
| 7426.392   | 33.4             | 12.5          | 3.1                     | 92.9              | -6.8                         | 0.0                       | Vert                | AV       | 0.0                      | 39.1              | 54.0                 | -14.9                  | EUT Vert, High Ch    |
| 7318.500   | 33.2             | 12.5          | 2.1                     | 26.0              | -6.8                         | 0.0                       | Horz                | AV       | 0.0                      | 38.9              | 54.0                 | -15.1                  | EUT Vert, Mid Ch     |
| 7426.433   | 32.1             | 12.5          | 1.5                     | 239.9             | -6.8                         | 0.0                       | Vert                | AV       | 0.0                      | 37.8              | 54.0                 | -16.2                  | EUT Horz, High Ch    |
| 7426.408   | 31.6             | 12.5          | 1.5                     | 240.9             | -6.8                         | 0.0                       | Vert                | AV       | 0.0                      | 37.3              | 54.0                 | -16.7                  | EUT On Side, High Ch |
| 7426.108   | 44.5             | 12.5          | 2.6                     | 360.0             | 0.0                          | 0.0                       | Horz                | PK       | 0.0                      | 57.0              | 74.0                 | -17.0                  | EUT Vert, High Ch    |
| 12377.350  | 44.4             | -0.8          | 1.8                     | 49.9              | -6.8                         | 0.0                       | Horz                | AV       | 0.0                      | 36.8              | 54.0                 | -17.2                  | EUT Vert, High Ch    |
| 7321.550   | 44.0             | 12.5          | 2.4                     | 23.0              | 0.0                          | 0.0                       | Vert                | PK       | 0.0                      | 56.5              | 74.0                 | -17.5                  | EUT Vert, Mid Ch     |
| 7426.500   | 43.9             | 12.5          | 2.7                     | 339.0             | 0.0                          | 0.0                       | Horz                | PK       | 0.0                      | 56.4              | 74.0                 | -17.6                  | EUT On Side, High Ch |
| 12197.500  | 43.9             | -0.8          | 3.1                     | 58.0              | -6.8                         | 0.0                       | Vert                | AV       | 0.0                      | 36.3              | 54.0                 | -17.7                  | EUT Vert, Mid Ch     |
| 7426.267   | 43.7             | 12.5          | 2.7                     | 330.9             | 0.0                          | 0.0                       | Horz                | PK       | 0.0                      | 56.2              | 74.0                 | -17.8                  | EUT Horz, High Ch    |
| 12377.380  | 43.7             | -0.8          | 1.9                     | 55.0              | -6.8                         | 0.0                       | Vert                | AV       | 0.0                      | 36.1              | 54.0                 | -17.9                  | EUT Vert, High Ch    |
| 7426.558   | 42.8             | 12.5          | 3.1                     | 92.9              | 0.0                          | 0.0                       | Vert                | PK       | 0.0                      | 55.3              | 74.0                 | -18.7                  | EUT Vert, High Ch    |
| 7426.433   | 42.6             | 12.5          | 1.5                     | 239.9             | 0.0                          | 0.0                       | Vert                | PK       | 0.0                      | 55.1              | 74.0                 | -18.9                  | EUT Horz, High Ch    |
| 7321.400   | 42.6             | 12.5          | 2.1                     | 26.0              | 0.0                          | 0.0                       | Horz                | PK       | 0.0                      | 55.1              | 74.0                 | -18.9                  | EUT Vert, Mid Ch     |
| 12027.440  | 43.7             | -1.8          | 1.9                     | 52.9              | -6.8                         | 0.0                       | Horz                | AV       | 0.0                      | 35.1              | 54.0                 | -18.9                  | EUT Vert, Low Ch     |
| 12022.510  | 43.7             | -1.8          | 2.1                     | 22.0              | -6.8                         | 0.0                       | Vert                | AV       | 0.0                      | 35.1              | 54.0                 | -18.9                  | EUT Vert, Low Ch     |
| 12197.500  | 42.6             | -0.8          | 2.2                     | 92.9              | -6.8                         | 0.0                       | Horz                | AV       | 0.0                      | 35.0              | 54.0                 | -19.0                  | EUT Vert, Mid Ch     |
| 7424.042   | 41.9             | 12.5          | 1.5                     | 240.9             | 0.0                          | 0.0                       | Vert                | PK       | 0.0                      | 54.4              | 74.0                 | -19.6                  | EUT On Side, High Ch |
| 12372.760  | 51.2             | -0.8          | 1.8                     | 49.9              | 0.0                          | 0.0                       | Horz                | PK       | 0.0                      | 50.4              | 74.0                 | -23.6                  | EUT Vert, High Ch    |
| 12377.030  | 51.1             | -0.8          | 1.9                     | 55.0              | 0.0                          | 0.0                       | Vert                | PK       | 0.0                      | 50.3              | 74.0                 | -23.7                  | EUT Vert, High Ch    |
| 12202.180  | 51.0             | -0.8          | 3.1                     | 58.0              | 0.0                          | 0.0                       | Vert                | PK       | 0.0                      | 50.2              | 74.0                 | -23.8                  | EUT Vert, Mid Ch     |
| 12022.650  | 51.4             | -1.8          | 1.9                     | 52.9              | 0.0                          | 0.0                       | Horz                | PK       | 0.0                      | 49.6              | 74.0                 | -24.4                  | EUT Vert, Low Ch     |
| 12202.080  | 50.0             | -0.8          | 2.2                     | 92.9              | 0.0                          | 0.0                       | Horz                | PK       | 0.0                      | 49.2              | 74.0                 | -24.8                  | EUT Vert, Mid Ch     |
| 12027.300  | 50.8             | -1.8          | 2.1                     | 22.0              | 0.0                          | 0.0                       | Vert                | PK       | 0.0                      | 49.0              | 74.0                 | -25.0                  | EUT Vert, Low Ch     |

## CONCLUSION

Pass



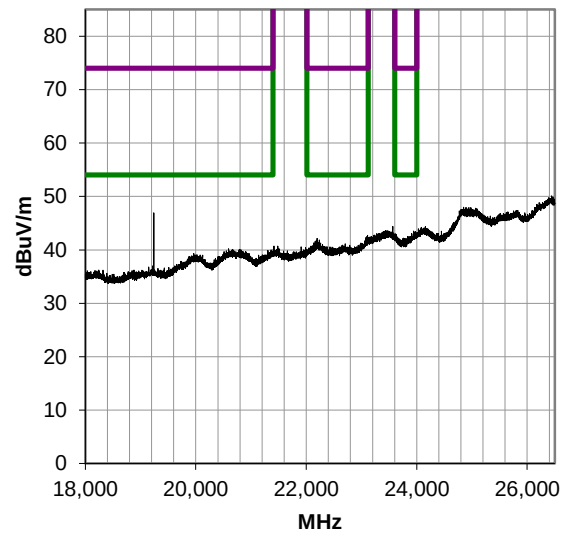
Tested By

# SPURIOUS RADIATED EMISSIONS – 15dBi Dipole Antenna

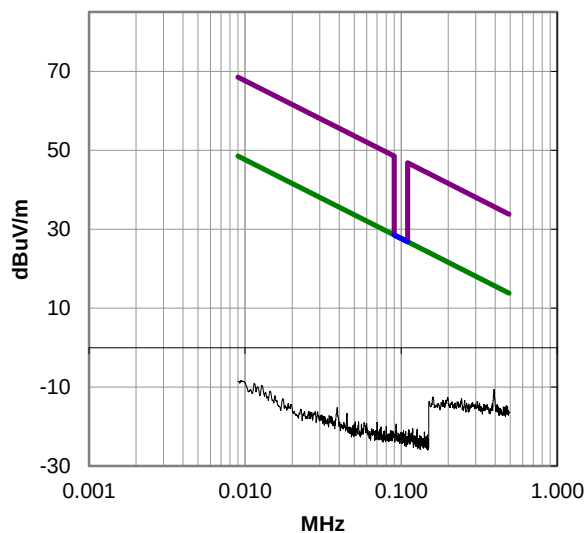
## PRESCAN DATA

Radiated spurious emissions from the EUT are initially reviewed with Pre-scans (Preview scans). Pre-scans are performed, with the EUT transmitting on the lowest applicable data rate, for both vertical and horizontal polarizations. The Pre-scan plots below are shown with a peak detector and RBW for the following frequency ranges: 9 kHz RBW (< 30 MHz); 120 kHz RBW (30 - 1000 MHz); 1 MHz RBW (> 1 GHz). In the case where unintentional emissions are observed, an ambient or idle pre-scan with the radio off, will be shown for comparison.

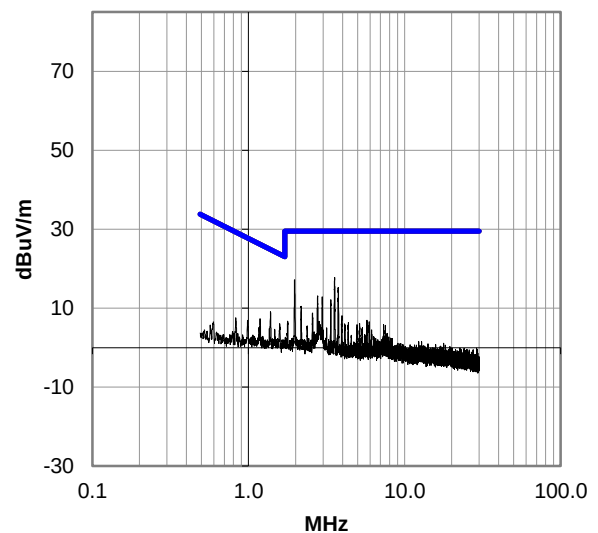
18000-26500 MHz, Run 33



0.009-0.49 MHz, Run 55



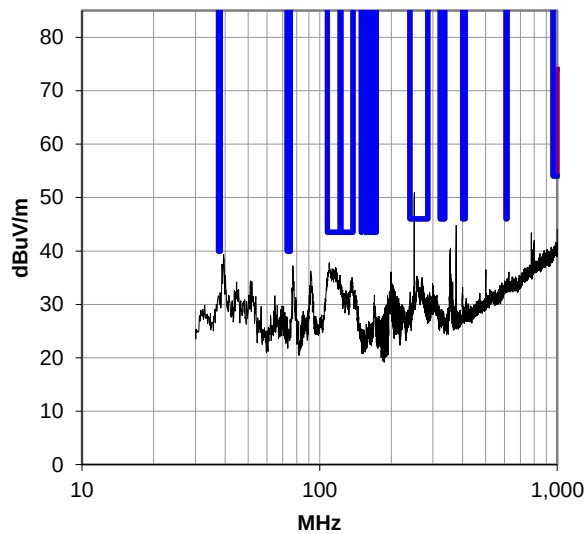
0.49-30 MHz, Run 56



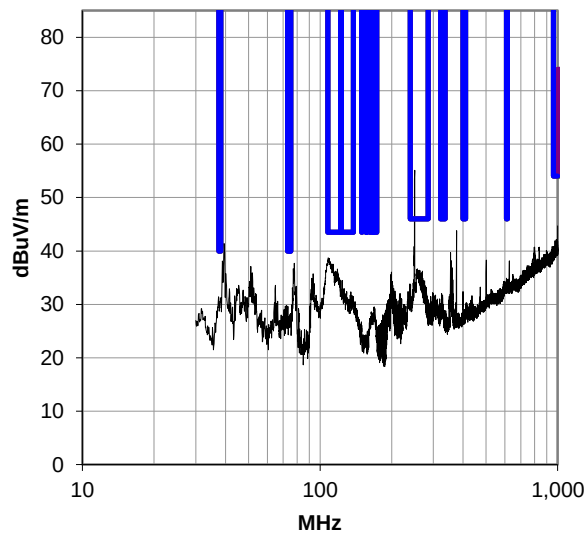
# SPURIOUS RADIATED EMISSIONS – 15dBi Dipole Antenna



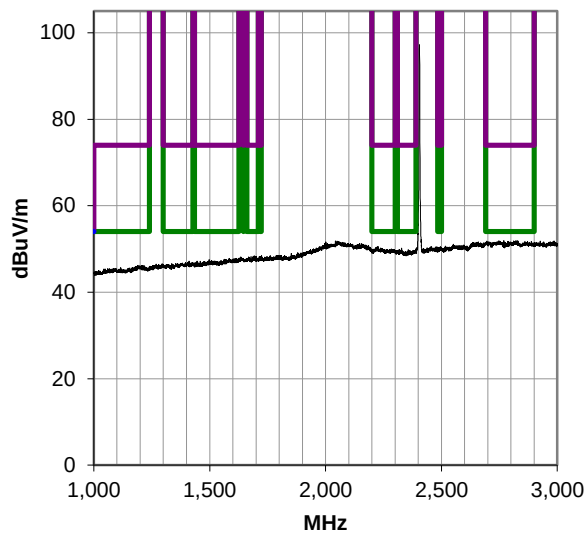
30-1000 MHz, Run 84



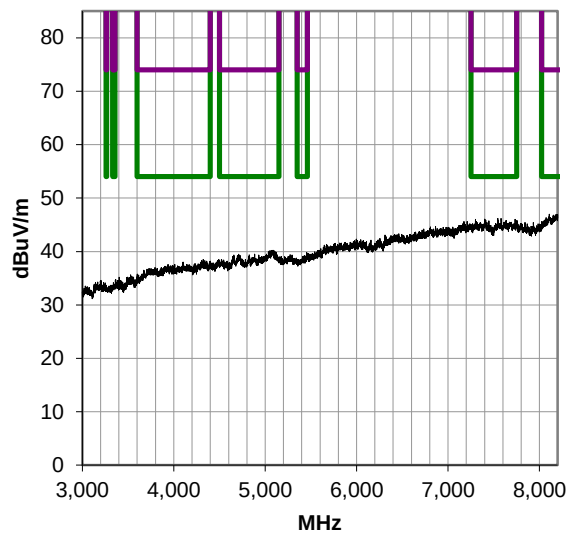
30-1000 MHz, Run 78 (transmitter off)



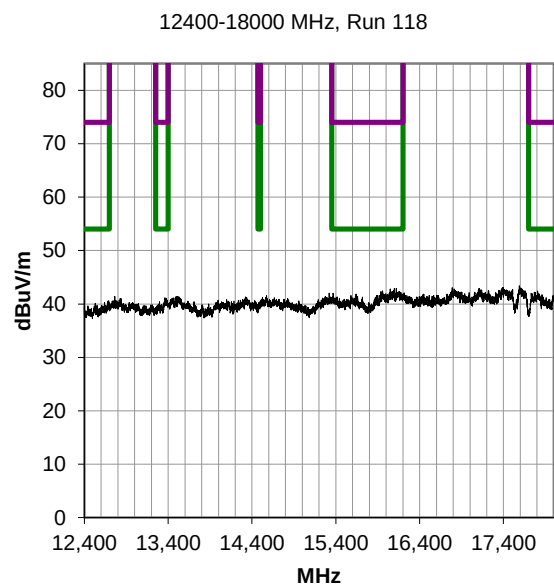
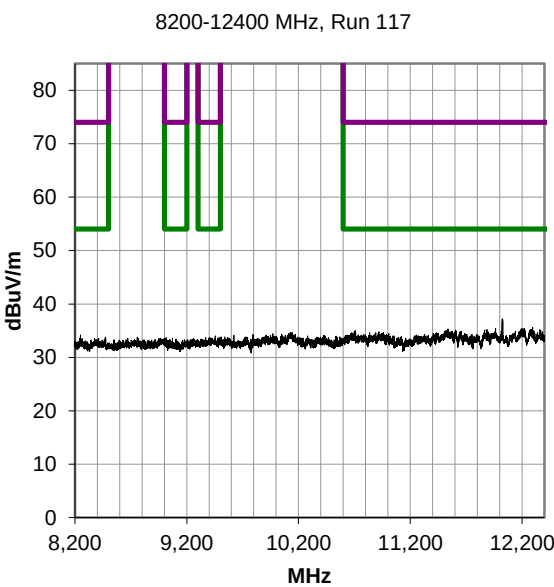
1000-3000 MHz, Run 115



3000-8200 MHz, Run 116



# SPURIOUS RADIATED EMISSIONS – 15dBi Dipole Antenna



# SPURIOUS RADIATED EMISSIONS – 18dBi Panel Antenna

## TEST DESCRIPTION

The highest gain antenna of each type to be used with the EUT was tested. The EUT was configured for the required transmit frequencies and the modes as showed in the data sheets.

For each configuration, the spectrum was scanned throughout the specified range as part of the exploratory investigation of the emissions. These “pre-scans” are not included in the report. Final measurements on individual emissions were then made and included in this test report.

The individual emissions from the EUT were maximized by rotating the EUT on a turntable, adjusting the position of the EUT and EUT antenna in three orthogonal axis if required, and adjusting the measurement antenna height and polarization (per ANSI C63.10). A preamp and high pass filter (and notch filter) were used for this test in order to provide sufficient measurement sensitivity.

Measurements were made with the required detectors and annotated on the data for each individual point using the following annotation:

QP = Quasi-Peak Detector  
PK = Peak Detector  
AV = RMS Detector

Measurements were made to satisfy the specific requirements of the test specification for out of band emissions as well as the restricted band requirements.

If there are no detectable emissions above the noise floor, the data included may show noise floor measurements for reference only.

Measurements within 2 MHz of the allowable band may have been taken using the integration method from ANSI C63.10 clause 11.13.3. This procedure uses the channel power feature of the spectrum analyzer to integrate the power of the emission within a 1 MHz bandwidth.

Where the radio test software does not provide for a duty cycle at continuous transmit conditions (> 98%) and the RMS (power average) measurements were made across the on and off times of the EUT transmissions, a duty cycle correction is added to the measurements using the formula of  $10 \cdot \log(1/dc)$ .

## TEST EQUIPMENT (EMPM0165)

| Description                  | Manufacturer       | Model                          | ID  | Last Cal.  | Cal. Due   |
|------------------------------|--------------------|--------------------------------|-----|------------|------------|
| Antenna - Double Ridge       | ETS Lindgren       | 3115                           | AIP | 2022-07-20 | 2024-07-20 |
| Cable                        | ESM Cable Corp.    | Double Ridge Guide Horn Cables | MNI | 2024-01-08 | 2025-01-08 |
| Amplifier - Pre-Amplifier    | Miteq              | AMF-3D-00100800-32-13P         | AVT | 2024-01-08 | 2025-01-08 |
| Attenuator                   | Fairview Microwave | SA18H-20                       | VAF | 2023-09-11 | 2024-09-11 |
| Analyzer - Spectrum Analyzer | Keysight           | N9010A                         | AFN | 2024-02-29 | 2025-02-28 |
| Filter - High Pass           | Micro-Tronics      | HPM50111                       | LFN | 2023-08-23 | 2024-08-23 |
| Antenna - Standard Gain      | ETS Lindgren       | 3160-07                        | AXP | NCR        | NCR        |
| Cable                        | ESM Cable Corp.    | Standard Gain Horn Cables      | MNJ | 2024-01-28 | 2025-01-28 |
| Amplifier - Pre-Amplifier    | Miteq              | AMF-6F-08001200-30-10P         | AVV | 2024-01-08 | 2025-01-08 |
| Antenna - Standard Gain      | ETS Lindgren       | 3160-08                        | AIQ | NCR        | NCR        |
| Amplifier - Pre-Amplifier    | Miteq              | AMF-6F-12001800-30-10P         | AVW | 2024-01-08 | 2025-01-08 |
| Antenna - Biconilog          | ETS Lindgren       | 3142D                          | AXO | 2023-10-02 | 2025-10-02 |
| Antenna - Standard Gain      | ETS Lindgren       | 3160-09                        | AHG | NCR        | NCR        |
| Cable                        | ESM Cable Corp.    | TTBJ141 KMKM-72                | MNP | 2023-09-05 | 2024-09-05 |
| Amplifier - Pre-Amplifier    | Miteq              | JSD4-18002600-26-8P            | APU | 2023-09-05 | 2024-09-05 |
| Antenna - Loop               | ETS Lindgren       | 6502                           | AOB | 2023-06-12 | 2025-06-12 |
| Cable                        | ESM Cable Corp.    | Bilog Cables                   | MNH | 2023-10-08 | 2024-10-08 |
| Amplifier - Pre-Amplifier    | Miteq              | AM-1616-1000                   | AVO | 2023-10-08 | 2024-10-08 |

# SPURIOUS RADIATED EMISSIONS – 18dBi Panel Antenna

| Description       | Manufacturer  | Model    | ID  | Last Cal.  | Cal. Due   |
|-------------------|---------------|----------|-----|------------|------------|
| Filter - Low Pass | Micro-Tronics | LPM50004 | LFK | 2023-08-23 | 2024-08-23 |

## TEST EQUIPMENT (EMPM0182)

| Description                  | Manufacturer       | Model                          | ID   | Last Cal.  | Cal. Due   |
|------------------------------|--------------------|--------------------------------|------|------------|------------|
| Antenna - Double Ridge       | ETS Lindgren       | 3115                           | AJA  | 2023-09-06 | 2025-09-06 |
| Cable                        | ESM Cable Corp.    | Double Ridge Guide Horn Cables | MNI  | 2024-01-08 | 2025-01-08 |
| Amplifier - Pre-Amplifier    | Miteq              | AMF-3D-00100800-32-13P         | AVT  | 2024-01-08 | 2025-01-08 |
| Attenuator                   | Fairview Microwave | SA18H-20                       | VAF  | 2023-09-11 | 2024-09-11 |
| Analyzer - Spectrum Analyzer | Agilent            | E4446A                         | AAQ  | 2024-03-13 | 2025-03-13 |
| Antenna - Biconilog          | ETS Lindgren       | 3142D                          | AXO  | 2023-10-02 | 2025-10-02 |
| Cable                        | ESM Cable Corp.    | Bilog Cables                   | MN H | 2024-10-09 | 2025-10-09 |
| Amplifier - Pre-Amplifier    | Miteq              | AM-1616-1000                   | AVO  | 2024-10-09 | 2025-10-09 |
| Filter - Low Pass            | Micro-Tronics      | LPM50004                       | LFK  | 2023-08-23 | 2024-08-23 |
| Filter - High Pass           | Micro-Tronics      | HPM50111                       | LFN  | 2023-08-23 | 2024-08-23 |
| Antenna - Standard Gain      | ETS Lindgren       | 3160-09                        | AHG  | NCR        | NCR        |
| Cable                        | ESM Cable Corp.    | TTBJ141 KMKM-72                | MNP  | 2024-09-05 | 2025-09-05 |
| Amplifier - Pre-Amplifier    | Miteq              | JSD4-18002600-26-8P            | APU  | 2024-09-05 | 2025-09-05 |
| Antenna - Loop               | ETS Lindgren       | 6502                           | AOB  | 2023-06-12 | 2025-06-12 |

## MEASUREMENT UNCERTAINTY

| Description  |        |         |
|--------------|--------|---------|
| Expanded k=2 | 5.2 dB | -5.2 dB |

## FREQUENCY RANGE INVESTIGATED

|                 |
|-----------------|
| 9 kHz TO 25 GHz |
|-----------------|

## CONFIGURATIONS INVESTIGATED

|            |
|------------|
| EMPM0165-9 |
| EMPM0182-4 |

# SPURIOUS RADIATED EMISSIONS – 18dBi Panel Antenna



|                   |                                          |                       |            |
|-------------------|------------------------------------------|-----------------------|------------|
| EUT:              | 781SA                                    | Work Order:           | EMPM0182   |
| Serial Number:    | 018                                      | Date:                 | 2024-08-02 |
| Customer:         | Emerson                                  | Temperature:          | 22°C       |
| Attendees:        | Stacy Lukas, Daniel Wolf                 | Relative Humidity:    | 62%        |
| Customer Project: | None                                     | Bar. Pressure (PMSL): | 1017 mb    |
| Tested By:        | Arnauld Dedry                            | Job Site:             | MN05       |
| Power:            | 15VDC (provided from peripheral Gateway) | Configuration:        | EMPM0182-4 |

## TEST SPECIFICATIONS

|                                      |                  |
|--------------------------------------|------------------|
| Specification:                       | Method:          |
| FCC 15.247:2024                      | ANSI C63.10:2013 |
| RSS-247 Issue 3:2023                 | ANSI C63.10:2013 |
| RSS-Gen Issue 5:2018+A1:2019+A2:2021 |                  |

## TEST PARAMETERS

|        |    |                    |   |                     |           |
|--------|----|--------------------|---|---------------------|-----------|
| Run #: | 21 | Test Distance (m): | 3 | Ant. Height(s) (m): | 1 to 4(m) |
|--------|----|--------------------|---|---------------------|-----------|

## COMMENTS

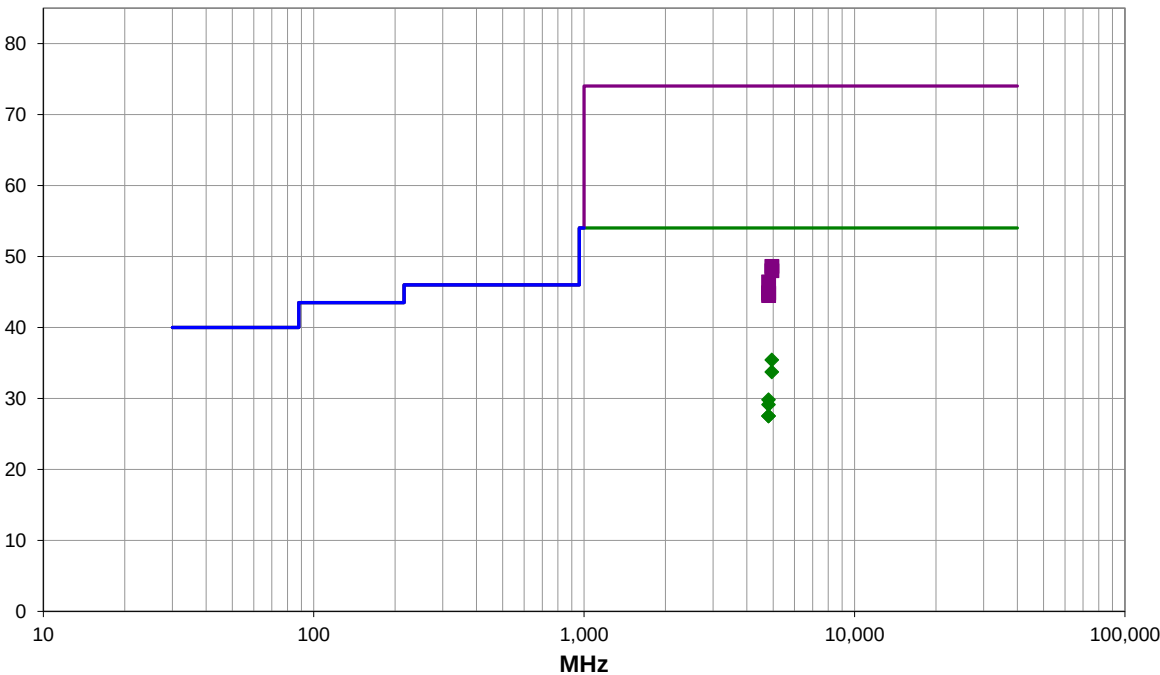
18 dBi Panel Antenna. Test mode is 100% Duty Cycle. The client states that in hopping mode, the highest on time in 100ms is 20.706 ms. Therefore, a duty cycle correction factor (DCCF) was added using  $10 \cdot \log(\text{dwell time}/100\text{ms}) = -6.8\text{dB}$ .

## EUT OPERATING MODES

Transmitting 2.4 GHz Antenna Low, Mid and High Chs (2405, 2440 and 2475 MHz), OQPSK 250 kbps. Channels tested independently.

## DEVIATIONS FROM TEST STANDARD

None



Run #: 21

PK AV QP



# SPURIOUS RADIATED EMISSIONS – 18dBi Panel Antenna

## RESULTS - Run #21

| Freq (MHz) | Amplitude (dBuV) | Factor (dB/m) | Antenna Height (meters) | Azimuth (degrees) | Duty Cycle Correction Factor | External Attenuation (dB) | Polarity/ Transducer | Detector | Distance Adjustment (dB) | Adjusted (dBuV/m) | Spec. Limit (dBuV/m) | Compared to Spec. (dB) | Comments             |
|------------|------------------|---------------|-------------------------|-------------------|------------------------------|---------------------------|----------------------|----------|--------------------------|-------------------|----------------------|------------------------|----------------------|
| 4950.008   | 37.0             | 5.2           | 1.5                     | 137.0             | -6.8                         | 0.0                       | Horz                 | AV       | 0.0                      | 35.4              | 54.0                 | -18.6                  | EUT On Side, High Ch |
| 4950.050   | 35.3             | 5.2           | 4.0                     | 216.0             | -6.8                         | 0.0                       | Vert                 | AV       | 0.0                      | 33.7              | 54.0                 | -20.3                  | EUT On Side, High Ch |
| 4809.983   | 31.3             | 5.3           | 1.5                     | 211.9             | -6.8                         | 0.0                       | Horz                 | AV       | 0.0                      | 29.8              | 54.0                 | -24.2                  | EUT On Side, Low Ch  |
| 4810.033   | 30.6             | 5.3           | 1.5                     | 200.9             | -6.8                         | 0.0                       | Vert                 | AV       | 0.0                      | 29.1              | 54.0                 | -24.9                  | EUT On Side, Low Ch  |
| 4949.850   | 43.4             | 5.2           | 1.5                     | 137.0             | 0.0                          | 0.0                       | Horz                 | PK       | 0.0                      | 48.6              | 74.0                 | -25.4                  | EUT On Side, High Ch |
| 4949.892   | 42.8             | 5.2           | 4.0                     | 216.0             | 0.0                          | 0.0                       | Vert                 | PK       | 0.0                      | 48.0              | 74.0                 | -26.0                  | EUT On Side, High Ch |
| 4808.392   | 29.0             | 5.3           | 1.5                     | 113.9             | -6.8                         | 0.0                       | Horz                 | AV       | 0.0                      | 27.5              | 54.0                 | -26.5                  | EUT On Side, Mid Ch  |
| 4807.908   | 29.0             | 5.3           | 1.0                     | 99.9              | -6.8                         | 0.0                       | Vert                 | AV       | 0.0                      | 27.5              | 54.0                 | -26.5                  | EUT On Side, Mid Ch  |
| 4810.067   | 41.1             | 5.3           | 1.5                     | 211.9             | 0.0                          | 0.0                       | Horz                 | PK       | 0.0                      | 46.4              | 74.0                 | -27.6                  | EUT On Side, Low Ch  |
| 4807.758   | 39.7             | 5.2           | 1.5                     | 200.9             | 0.0                          | 0.0                       | Vert                 | PK       | 0.0                      | 44.9              | 74.0                 | -29.1                  | EUT On Side, Low Ch  |
| 4808.200   | 39.5             | 5.3           | 1.5                     | 113.9             | 0.0                          | 0.0                       | Horz                 | PK       | 0.0                      | 44.8              | 74.0                 | -29.2                  | EUT On Side, Mid Ch  |
| 4812.242   | 39.2             | 5.3           | 1.0                     | 99.9              | 0.0                          | 0.0                       | Vert                 | PK       | 0.0                      | 44.5              | 74.0                 | -29.5                  | EUT On Side, Mid Ch  |

## CONCLUSION

Pass



Tested By

# SPURIOUS RADIATED EMISSIONS – 18dBi Panel Antenna



|                   |                                          |                       |            |
|-------------------|------------------------------------------|-----------------------|------------|
| EUT:              | 781SA                                    | Work Order:           | EMPM0165   |
| Serial Number:    | 018                                      | Date:                 | 2024-03-08 |
| Customer:         | Emerson                                  | Temperature:          | 21.2°C     |
| Attendees:        | Erin Snell                               | Relative Humidity:    | 23.6%      |
| Customer Project: | None                                     | Bar. Pressure (PMSL): | 1021 mb    |
| Tested By:        | Marcelo Aguayo                           | Job Site:             | MN05       |
| Power:            | 15VDC (provided from peripheral Gateway) | Configuration:        | EMPM0165-9 |

## TEST SPECIFICATIONS

|                                      |                  |
|--------------------------------------|------------------|
| Specification:                       | Method:          |
| FCC 15.247:2024                      | ANSI C63.10:2013 |
| RSS-247 Issue 3:2023                 | ANSI C63.10:2013 |
| RSS-Gen Issue 5:2018+A1:2019+A2:2021 |                  |

## TEST PARAMETERS

|        |     |                    |   |                     |           |
|--------|-----|--------------------|---|---------------------|-----------|
| Run #: | 165 | Test Distance (m): | 3 | Ant. Height(s) (m): | 1 to 4(m) |
|--------|-----|--------------------|---|---------------------|-----------|

## COMMENTS

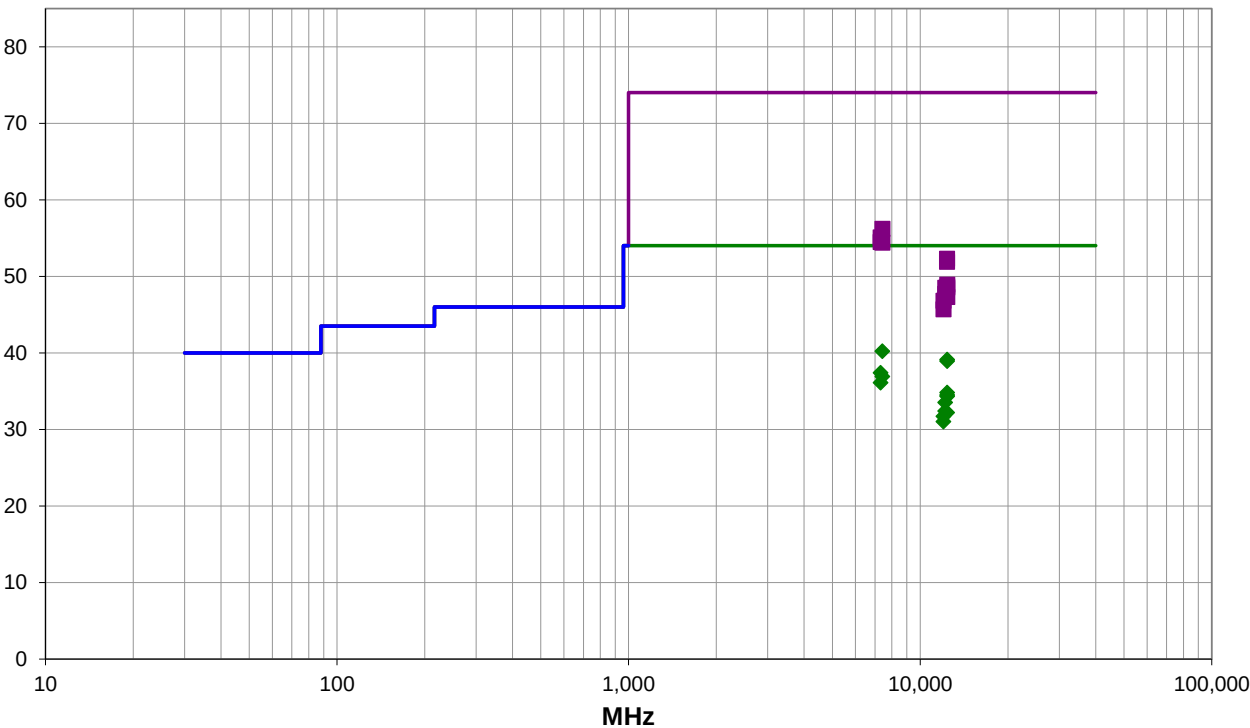
18 dBi panel antenna. Test mode is 100% Duty Cycle. The client states that during hopping operation, the highest on time in 100ms is 20.706ms. Therefore, a duty cycle correction factor (DCCF) was added using  $10 \cdot \log(\text{dwell time}/100\text{ms}) = -6.8$  dB.

## EUT OPERATING MODES

Transmitting 2.4 GHz Zigbee Antenna (802.15.4) Low, Mid and High Chs (2405, 2440 and 2475 MHz), OQPSK 250 kbps. Channels tested independently.

## DEVIATIONS FROM TEST STANDARD

None



Run #: 165

■ PK ◆ AV ● QP

# SPURIOUS RADIATED EMISSIONS – 18dBi Panel Antenna

## RESULTS - Run #165

| Freq (MHz) | Amplitude (dBuV) | Factor (dB/m) | Antenna Height (meters) | Azimuth (degrees) | Duty Cycle Correction Factor | External Attenuation (dB) | Polarity/Transducer | Detector | Distance Adjustment (dB) | Adjusted (dBuV/m) | Spec. Limit (dBuV/m) | Compared to Spec. (dB) | Comments             |
|------------|------------------|---------------|-------------------------|-------------------|------------------------------|---------------------------|---------------------|----------|--------------------------|-------------------|----------------------|------------------------|----------------------|
| 7426.417   | 34.5             | 12.5          | 2.1                     | 332.0             | -6.8                         | 0.0                       | Vert                | AV       | 0.0                      | 40.2              | 54.0                 | -13.8                  | EUT On Side, High Ch |
| 12377.370  | 46.7             | -0.8          | 3.0                     | 73.0              | -6.8                         | 0.0                       | Horz                | AV       | 0.0                      | 39.1              | 54.0                 | -14.9                  | EUT On Side, High Ch |
| 12377.390  | 46.5             | -0.8          | 1.7                     | 44.0              | -6.8                         | 0.0                       | Horz                | AV       | 0.0                      | 38.9              | 54.0                 | -15.1                  | EUT Vert, High Ch    |
| 7321.508   | 31.7             | 12.5          | 1.3                     | 257.9             | -6.8                         | 0.0                       | Horz                | AV       | 0.0                      | 37.4              | 54.0                 | -16.6                  | EUT On Side, Mid Ch  |
| 7423.675   | 31.2             | 12.5          | 1.6                     | 250.9             | -6.8                         | 0.0                       | Horz                | AV       | 0.0                      | 36.9              | 54.0                 | -17.1                  | EUT On Side, High Ch |
| 7426.475   | 43.7             | 12.5          | 2.1                     | 332.0             | 0.0                          | 0.0                       | Vert                | PK       | 0.0                      | 56.2              | 74.0                 | -17.8                  | EUT On Side, High Ch |
| 7321.383   | 30.4             | 12.5          | 1.5                     | 267.0             | -6.8                         | 0.0                       | Vert                | AV       | 0.0                      | 36.1              | 54.0                 | -17.9                  | EUT On Side, Mid Ch  |
| 7318.283   | 42.6             | 12.5          | 1.3                     | 257.9             | 0.0                          | 0.0                       | Horz                | PK       | 0.0                      | 55.1              | 74.0                 | -18.9                  | EUT On Side, Mid Ch  |
| 12377.350  | 42.4             | -0.8          | 3.8                     | 207.0             | -6.8                         | 0.0                       | Vert                | AV       | 0.0                      | 34.8              | 54.0                 | -19.2                  | EUT On Side, High Ch |
| 7320.667   | 42.0             | 12.5          | 1.5                     | 267.0             | 0.0                          | 0.0                       | Vert                | PK       | 0.0                      | 54.5              | 74.0                 | -19.5                  | EUT On Side, Mid Ch  |
| 12377.410  | 42.1             | -0.8          | 3.1                     | 36.0              | -6.8                         | 0.0                       | Vert                | AV       | 0.0                      | 34.5              | 54.0                 | -19.5                  | EUT Horz, High Ch    |
| 7426.758   | 41.9             | 12.5          | 1.6                     | 250.9             | 0.0                          | 0.0                       | Horz                | PK       | 0.0                      | 54.4              | 74.0                 | -19.6                  | EUT On Side, High Ch |
| 12377.390  | 41.9             | -0.8          | 2.7                     | 228.9             | -6.8                         | 0.0                       | Vert                | AV       | 0.0                      | 34.3              | 54.0                 | -19.7                  | EUT Vert, High Ch    |
| 12202.420  | 41.1             | -0.8          | 4.0                     | 235.9             | -6.8                         | 0.0                       | Vert                | AV       | 0.0                      | 33.5              | 54.0                 | -20.5                  | EUT On Side, Mid Ch  |
| 12197.530  | 40.0             | -0.8          | 1.7                     | 196.0             | -6.8                         | 0.0                       | Horz                | AV       | 0.0                      | 32.4              | 54.0                 | -21.6                  | EUT On Side, Mid Ch  |
| 12372.580  | 53.1             | -0.8          | 3.0                     | 73.0              | 0.0                          | 0.0                       | Horz                | PK       | 0.0                      | 52.3              | 74.0                 | -21.7                  | EUT Vert, High Ch    |
| 12377.390  | 39.8             | -0.8          | 1.5                     | 184.0             | -6.8                         | 0.0                       | Horz                | AV       | 0.0                      | 32.2              | 54.0                 | -21.8                  | EUT Horz, High Ch    |
| 12372.610  | 52.7             | -0.8          | 1.7                     | 44.0              | 0.0                          | 0.0                       | Horz                | PK       | 0.0                      | 51.9              | 74.0                 | -22.1                  | EUT On Side, High Ch |
| 12027.330  | 40.3             | -1.8          | 3.9                     | 90.0              | -6.8                         | 0.0                       | Horz                | AV       | 0.0                      | 31.7              | 54.0                 | -22.3                  | EUT On Side, Low Ch  |
| 12027.370  | 39.6             | -1.8          | 1.9                     | 47.0              | -6.8                         | 0.0                       | Vert                | AV       | 0.0                      | 31.0              | 54.0                 | -23.0                  | EUT On Side, Low Ch  |
| 12377.010  | 49.7             | -0.8          | 3.8                     | 207.0             | 0.0                          | 0.0                       | Vert                | PK       | 0.0                      | 48.9              | 74.0                 | -25.1                  | EUT On Side, High Ch |
| 12377.380  | 49.4             | -0.8          | 3.1                     | 36.0              | 0.0                          | 0.0                       | Vert                | PK       | 0.0                      | 48.6              | 74.0                 | -25.4                  | EUT Horz, High Ch    |
| 12202.170  | 49.3             | -0.8          | 4.0                     | 235.9             | 0.0                          | 0.0                       | Vert                | PK       | 0.0                      | 48.5              | 74.0                 | -25.5                  | EUT On Side, Mid Ch  |
| 12372.580  | 49.2             | -0.8          | 2.7                     | 228.9             | 0.0                          | 0.0                       | Vert                | PK       | 0.0                      | 48.4              | 74.0                 | -25.6                  | EUT Vert, High Ch    |
| 12202.070  | 48.5             | -0.8          | 1.7                     | 196.0             | 0.0                          | 0.0                       | Horz                | PK       | 0.0                      | 47.7              | 74.0                 | -26.3                  | EUT On Side, Mid Ch  |
| 12377.500  | 48.1             | -0.8          | 1.5                     | 184.0             | 0.0                          | 0.0                       | Horz                | PK       | 0.0                      | 47.3              | 74.0                 | -26.7                  | EUT Horz, High Ch    |
| 12027.320  | 48.6             | -1.8          | 3.9                     | 90.0              | 0.0                          | 0.0                       | Horz                | PK       | 0.0                      | 46.8              | 74.0                 | -27.2                  | EUT On Side, Low Ch  |
| 12022.620  | 47.5             | -1.8          | 1.9                     | 41.9              | 0.0                          | 0.0                       | Vert                | PK       | 0.0                      | 45.7              | 74.0                 | -28.3                  | EUT On Side, Low Ch  |

## CONCLUSION

Pass



Tested By

# SPURIOUS RADIATED EMISSIONS – 18dBi Panel Antenna



|                   |                                          |                       |            |
|-------------------|------------------------------------------|-----------------------|------------|
| EUT:              | 781SA                                    | Work Order:           | EMPM0165   |
| Serial Number:    | 018                                      | Date:                 | 2024-03-08 |
| Customer:         | Emerson                                  | Temperature:          | 21.2°C     |
| Attendees:        | Erin Snell                               | Relative Humidity:    | 23.6%      |
| Customer Project: | None                                     | Bar. Pressure (PMSL): | 1021 mb    |
| Tested By:        | Marcelo Aguayo                           | Job Site:             | MN05       |
| Power:            | 15VDC (provided from peripheral Gateway) | Configuration:        | EMPM0165-9 |

## TEST SPECIFICATIONS

|                                      |                  |
|--------------------------------------|------------------|
| Specification:                       | Method:          |
| FCC 15.247:2024                      | ANSI C63.10:2013 |
| RSS-247 Issue 3:2023                 | ANSI C63.10:2013 |
| RSS-Gen Issue 5:2018+A1:2019+A2:2021 |                  |

## TEST PARAMETERS

|        |     |                    |   |                     |           |
|--------|-----|--------------------|---|---------------------|-----------|
| Run #: | 166 | Test Distance (m): | 3 | Ant. Height(s) (m): | 1 to 4(m) |
|--------|-----|--------------------|---|---------------------|-----------|

## COMMENTS

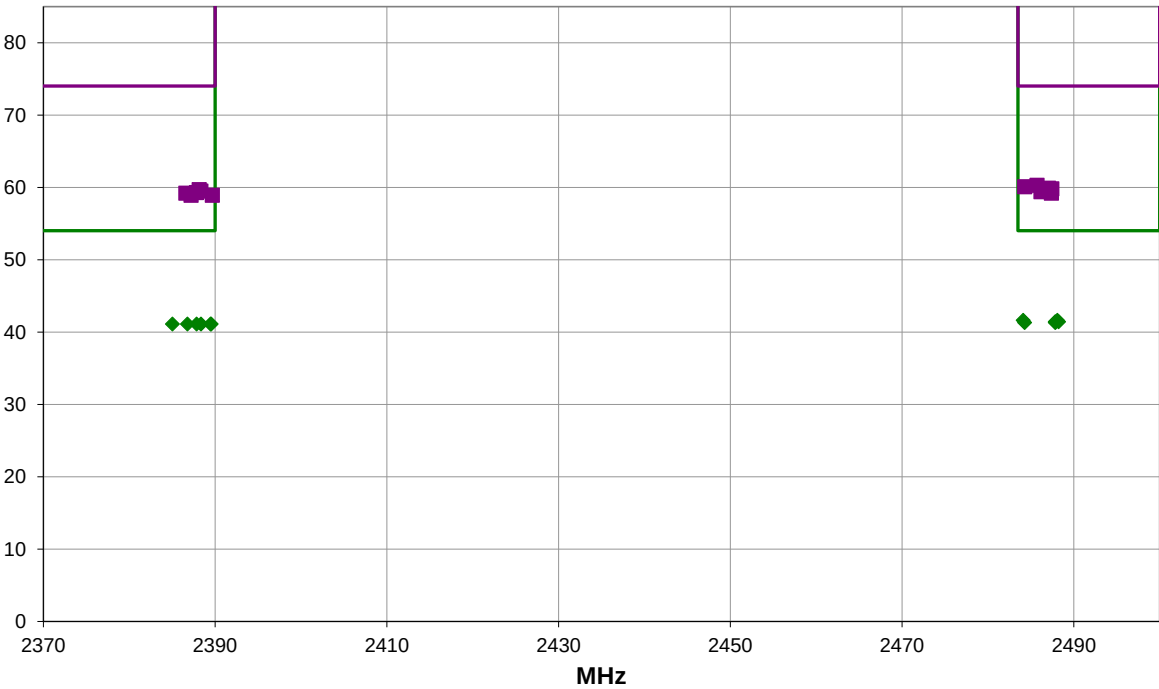
18 dBi panel antenna. Test mode is 100% Duty Cycle. The client states that during hopping operation, the highest on time in 100ms is 20.706ms. Therefore, a duty cycle correction factor (DCCF) was added using  $10 \cdot \log(\text{dwell time}/100\text{ms}) = -6.8$  dB.

## EUT OPERATING MODES

Transmitting 2.4 GHz Antenna Low and High Chs (2405 and 2475 MHz), OQPSK 250 kbps Channels tested independently

## DEVIATIONS FROM TEST STANDARD

None



Run #: 166

■ PK ◆ AV ● QP

# SPURIOUS RADIATED EMISSIONS – 18dBi Panel Antenna

## RESULTS - Run #166

| Freq (MHz) | Amplitude (dBuV) | Factor (dB/m) | Antenna Height (meters) | Azimuth (degrees) | Duty Cycle Correction Factor | External Attenuation (dB) | Polarity/ Transducer | Detector | Distance Adjustment (dB) | Adjusted (dBuV/m) | Spec. Limit (dBuV/m) | Compared to Spec. (dB) | Comments             |
|------------|------------------|---------------|-------------------------|-------------------|------------------------------|---------------------------|----------------------|----------|--------------------------|-------------------|----------------------|------------------------|----------------------|
| 2488.100   | 31.9             | -3.5          | 1.2                     | 171.0             | -6.8                         | 20.0                      | Horz                 | AV       | 0.0                      | 41.6              | 54.0                 | -12.4                  | EUT Vert, High Ch    |
| 2484.125   | 31.9             | -3.5          | 1.5                     | 16.9              | -6.8                         | 20.0                      | Vert                 | AV       | 0.0                      | 41.6              | 54.0                 | -12.4                  | EUT Vert, High Ch    |
| 2488.242   | 31.7             | -3.5          | 1.5                     | 44.0              | -6.8                         | 20.0                      | Horz                 | AV       | 0.0                      | 41.4              | 54.0                 | -12.6                  | EUT Horz, High Ch    |
| 2487.875   | 31.7             | -3.5          | 1.5                     | 347.9             | -6.8                         | 20.0                      | Vert                 | AV       | 0.0                      | 41.4              | 54.0                 | -12.6                  | EUT Horz, High Ch    |
| 2484.292   | 31.6             | -3.5          | 2.5                     | 109.9             | -6.8                         | 20.0                      | Horz                 | AV       | 0.0                      | 41.3              | 54.0                 | -12.7                  | EUT On Side, High Ch |
| 2487.875   | 31.6             | -3.5          | 1.5                     | 37.0              | -6.8                         | 20.0                      | Vert                 | AV       | 0.0                      | 41.3              | 54.0                 | -12.7                  | EUT On Side, High Ch |
| 2388.375   | 32.0             | -4.1          | 1.5                     | 149.9             | -6.8                         | 20.0                      | Horz                 | AV       | 0.0                      | 41.1              | 54.0                 | -12.9                  | EUT On Side, Low Ch  |
| 2389.567   | 32.0             | -4.1          | 1.5                     | 9.9               | -6.8                         | 20.0                      | Vert                 | AV       | 0.0                      | 41.1              | 54.0                 | -12.9                  | EUT Vert, Low Ch     |
| 2387.850   | 32.0             | -4.1          | 1.5                     | 92.9              | -6.8                         | 20.0                      | Horz                 | AV       | 0.0                      | 41.1              | 54.0                 | -12.9                  | EUT Vert, Low Ch     |
| 2385.033   | 32.0             | -4.1          | 1.5                     | 184.0             | -6.8                         | 20.0                      | Vert                 | AV       | 0.0                      | 41.1              | 54.0                 | -12.9                  | EUT On Side, Low Ch  |
| 2389.492   | 32.0             | -4.1          | 1.5                     | 343.9             | -6.8                         | 20.0                      | Horz                 | AV       | 0.0                      | 41.1              | 54.0                 | -12.9                  | EUT Horz, Low Ch     |
| 2386.800   | 32.0             | -4.1          | 1.5                     | 311.0             | -6.8                         | 20.0                      | Vert                 | AV       | 0.0                      | 41.1              | 54.0                 | -12.9                  | EUT Horz, Low Ch     |
| 2485.725   | 43.8             | -3.5          | 2.7                     | 257.0             | 0.0                          | 20.0                      | Horz                 | PK       | 0.0                      | 60.3              | 74.0                 | -13.7                  | EUT Vert, High Ch    |
| 2484.292   | 43.6             | -3.5          | 1.5                     | 16.9              | 0.0                          | 20.0                      | Vert                 | PK       | 0.0                      | 60.1              | 74.0                 | -13.9                  | EUT Vert, High Ch    |
| 2487.058   | 43.4             | -3.5          | 2.5                     | 109.9             | 0.0                          | 20.0                      | Horz                 | PK       | 0.0                      | 59.9              | 74.0                 | -14.1                  | EUT On Side, High Ch |
| 2487.442   | 43.3             | -3.5          | 1.5                     | 347.9             | 0.0                          | 20.0                      | Vert                 | PK       | 0.0                      | 59.8              | 74.0                 | -14.2                  | EUT Horz, High Ch    |
| 2388.150   | 43.8             | -4.1          | 1.5                     | 149.9             | 0.0                          | 20.0                      | Horz                 | PK       | 0.0                      | 59.7              | 74.0                 | -14.3                  | EUT On Side, Low Ch  |
| 2388.350   | 43.6             | -4.1          | 1.5                     | 184.0             | 0.0                          | 20.0                      | Vert                 | PK       | 0.0                      | 59.5              | 74.0                 | -14.5                  | EUT Vert, Low Ch     |
| 2486.183   | 42.9             | -3.5          | 1.5                     | 44.0              | 0.0                          | 20.0                      | Horz                 | PK       | 0.0                      | 59.4              | 74.0                 | -14.6                  | EUT Horz, High Ch    |
| 2387.842   | 43.4             | -4.1          | 1.5                     | 343.9             | 0.0                          | 20.0                      | Horz                 | PK       | 0.0                      | 59.3              | 74.0                 | -14.7                  | EUT Horz, Low Ch     |
| 2487.400   | 42.7             | -3.5          | 1.5                     | 37.0              | 0.0                          | 20.0                      | Vert                 | PK       | 0.0                      | 59.2              | 74.0                 | -14.8                  | EUT On Side, High Ch |
| 2386.583   | 43.3             | -4.1          | 1.5                     | 9.9               | 0.0                          | 20.0                      | Vert                 | PK       | 0.0                      | 59.2              | 74.0                 | -14.8                  | EUT On Side, Low Ch  |
| 2387.192   | 43.0             | -4.1          | 1.5                     | 92.9              | 0.0                          | 20.0                      | Horz                 | PK       | 0.0                      | 58.9              | 74.0                 | -15.1                  | EUT Vert, Low Ch     |
| 2389.683   | 43.0             | -4.1          | 1.5                     | 311.0             | 0.0                          | 20.0                      | Vert                 | PK       | 0.0                      | 58.9              | 74.0                 | -15.1                  | EUT Horz, Low Ch     |

## CONCLUSION

Pass



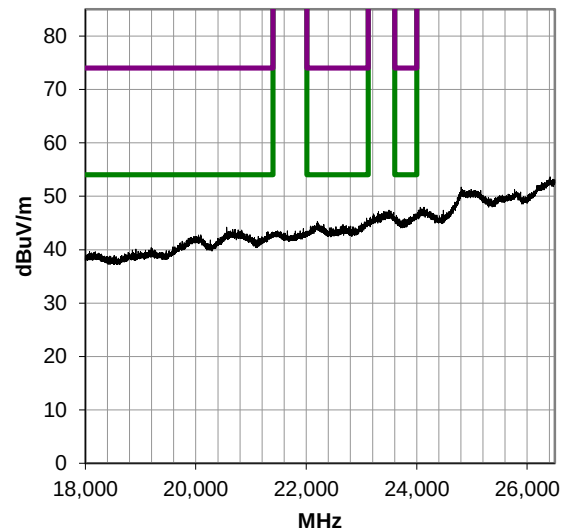
Tested By

# SPURIOUS RADIATED EMISSIONS – 18dBi Panel Antenna

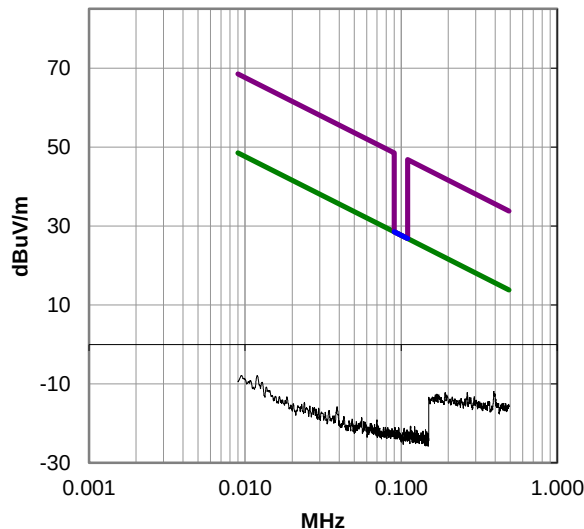
## PRESCAN DATA

Radiated spurious emissions from the EUT are initially reviewed with Pre-scans (Preview scans). Pre-scans are performed, with the EUT transmitting on the lowest applicable data rate, for both vertical and horizontal polarizations. The Pre-scan plots below are shown with a peak detector and RBW for the following frequency ranges: 9 kHz RBW (< 30 MHz); 120 kHz RBW (30 - 1000 MHz); 1 MHz RBW (> 1 GHz). In the case where unintentional emissions are observed, an ambient or idle pre-scan with the radio off, will be shown for comparison.

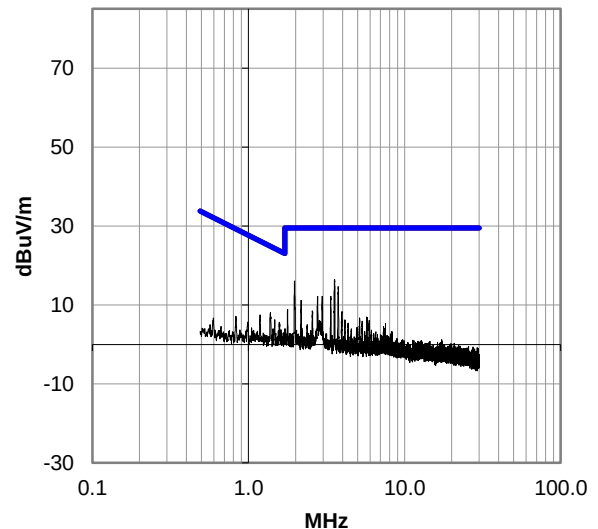
18000-26500 MHz, Run 30



0.009-0.49 MHz, Run 63

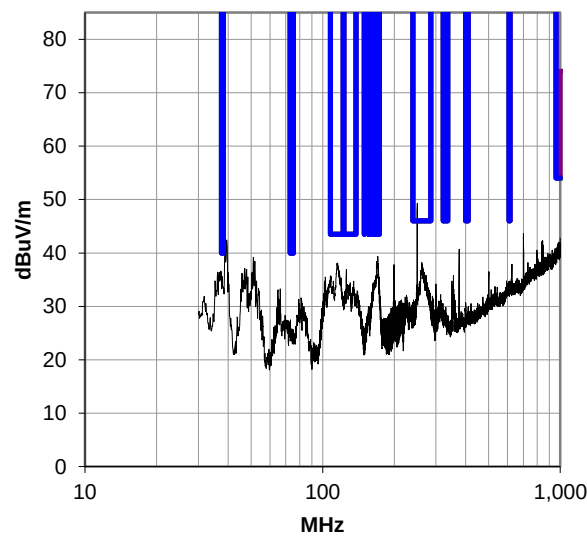


0.49-30 MHz, Run 64

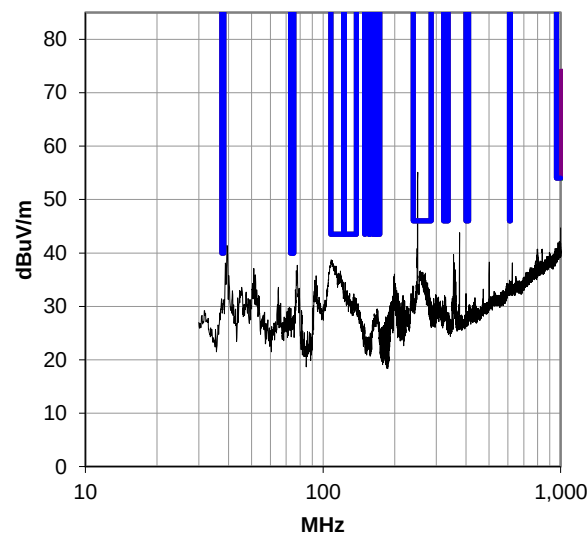


# SPURIOUS RADIATED EMISSIONS – 18dBi Panel Antenna

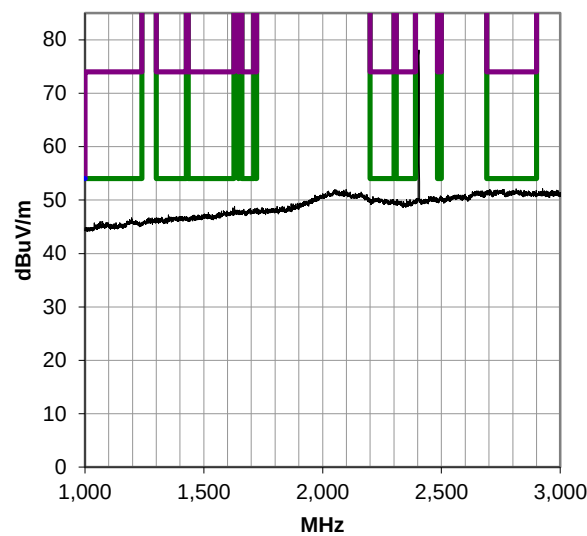
30-1000 MHz, Run 575



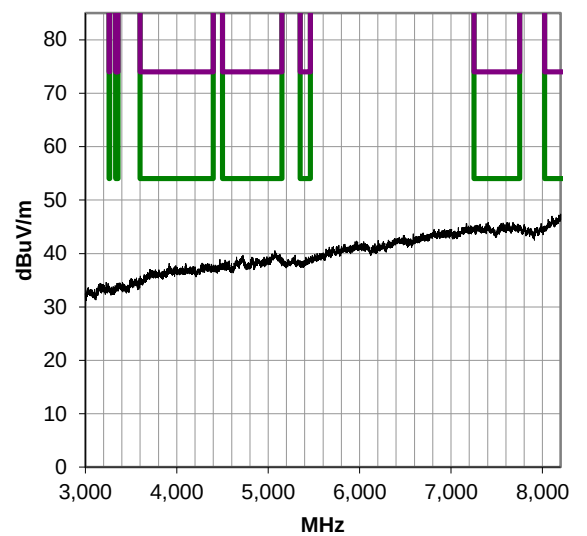
30-1000 MHz, Run 78 (transmitter off)



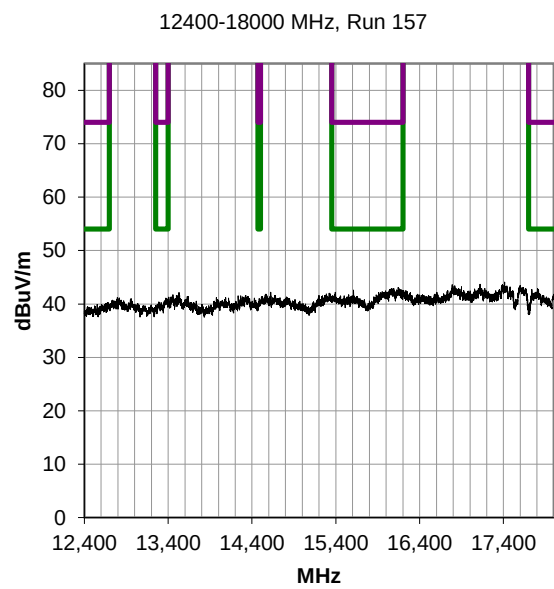
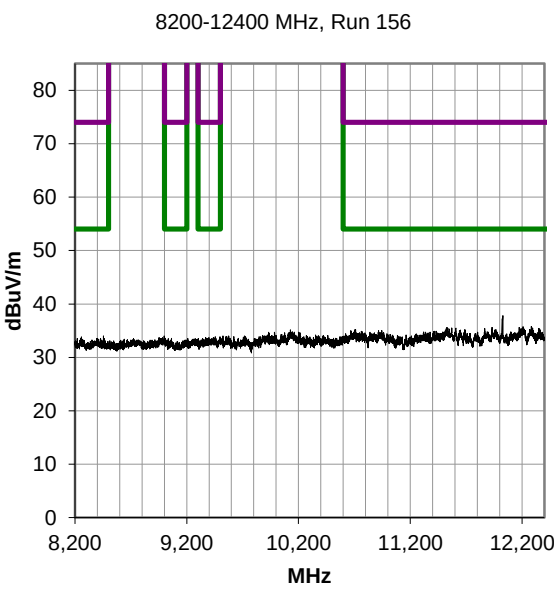
1000-3000 MHz, Run 154



3000-8200 MHz, Run 155



# SPURIOUS RADIATED EMISSIONS – 18dBi Panel Antenna





# SPURIOUS RADIATED EMISSIONS – 20 dBi Sector Antenna

## TEST DESCRIPTION

The highest gain antenna of each type to be used with the EUT was tested. The EUT was configured for the required transmit frequencies and the modes as showed in the data sheets.

For each configuration, the spectrum was scanned throughout the specified range as part of the exploratory investigation of the emissions. These “pre-scans” are not included in the report. Final measurements on individual emissions were then made and included in this test report.

The individual emissions from the EUT were maximized by rotating the EUT on a turntable, adjusting the position of the EUT and EUT antenna in three orthogonal axis if required, and adjusting the measurement antenna height and polarization (per ANSI C63.10). A preamp and high pass filter (and notch filter) were used for this test in order to provide sufficient measurement sensitivity.

Measurements were made with the required detectors and annotated on the data for each individual point using the following annotation:

QP = Quasi-Peak Detector  
PK = Peak Detector  
AV = RMS Detector

Measurements were made to satisfy the specific requirements of the test specification for out of band emissions as well as the restricted band requirements.

If there are no detectable emissions above the noise floor, the data included may show noise floor measurements for reference only.

Measurements within 2 MHz of the allowable band may have been taken using the integration method from ANSI C63.10 clause 11.13.3. This procedure uses the channel power feature of the spectrum analyzer to integrate the power of the emission within a 1 MHz bandwidth.

Where the radio test software does not provide for a duty cycle at continuous transmit conditions (> 98%) and the RMS (power average) measurements were made across the on and off times of the EUT transmissions, a duty cycle correction is added to the measurements using the formula of  $10 \cdot \log(1/dc)$ .

## TEST EQUIPMENT (EMPM0165)

| Description                  | Manufacturer       | Model                          | ID  | Last Cal.  | Cal. Due   |
|------------------------------|--------------------|--------------------------------|-----|------------|------------|
| Antenna - Double Ridge       | ETS Lindgren       | 3115                           | AIP | 2022-07-20 | 2024-07-20 |
| Cable                        | ESM Cable Corp.    | Double Ridge Guide Horn Cables | MNI | 2024-01-08 | 2025-01-08 |
| Amplifier - Pre-Amplifier    | Miteq              | AMF-3D-00100800-32-13P         | AVT | 2024-01-08 | 2025-01-08 |
| Attenuator                   | Fairview Microwave | SA18H-20                       | VAF | 2023-09-11 | 2024-09-11 |
| Analyzer - Spectrum Analyzer | Keysight           | N9010A                         | AFN | 2024-02-29 | 2025-02-28 |
| Filter - High Pass           | Micro-Tronics      | HPM50111                       | LFN | 2023-08-23 | 2024-08-23 |
| Antenna - Standard Gain      | ETS Lindgren       | 3160-07                        | AXP | NCR        | NCR        |
| Cable                        | ESM Cable Corp.    | Standard Gain Horn Cables      | MNJ | 2024-01-28 | 2025-01-28 |
| Amplifier - Pre-Amplifier    | Miteq              | AMF-6F-08001200-30-10P         | AVV | 2024-01-08 | 2025-01-08 |
| Antenna - Standard Gain      | ETS Lindgren       | 3160-08                        | AIQ | NCR        | NCR        |
| Amplifier - Pre-Amplifier    | Miteq              | AMF-6F-12001800-30-10P         | AVW | 2024-01-08 | 2025-01-08 |
| Antenna - Biconilog          | ETS Lindgren       | 3142D                          | AXO | 2023-10-02 | 2025-10-02 |
| Antenna - Standard Gain      | ETS Lindgren       | 3160-09                        | AHG | NCR        | NCR        |
| Cable                        | ESM Cable Corp.    | TTBJ141 KMKM-72                | MNP | 2023-09-05 | 2024-09-05 |
| Amplifier - Pre-Amplifier    | Miteq              | JSD4-18002600-26-8P            | APU | 2023-09-05 | 2024-09-05 |
| Antenna - Loop               | ETS Lindgren       | 6502                           | AOB | 2023-06-12 | 2025-06-12 |
| Cable                        | ESM Cable Corp.    | Bilog Cables                   | MNH | 2023-10-08 | 2024-10-08 |
| Amplifier - Pre-Amplifier    | Miteq              | AM-1616-1000                   | AVO | 2023-10-08 | 2024-10-08 |

# SPURIOUS RADIATED EMISSIONS – 20 dBi Sector Antenna

| Description       | Manufacturer  | Model    | ID  | Last Cal.  | Cal. Due   |
|-------------------|---------------|----------|-----|------------|------------|
| Filter - Low Pass | Micro-Tronics | LPM50004 | LFK | 2023-08-23 | 2024-08-23 |

## TEST EQUIPMENT (EMPM0182)

| Description                  | Manufacturer       | Model                          | ID   | Last Cal.  | Cal. Due   |
|------------------------------|--------------------|--------------------------------|------|------------|------------|
| Antenna - Double Ridge       | ETS Lindgren       | 3115                           | AJA  | 2023-09-06 | 2025-09-06 |
| Cable                        | ESM Cable Corp.    | Double Ridge Guide Horn Cables | MNI  | 2024-01-08 | 2025-01-08 |
| Amplifier - Pre-Amplifier    | Miteq              | AMF-3D-00100800-32-13P         | AVT  | 2024-01-08 | 2025-01-08 |
| Attenuator                   | Fairview Microwave | SA18H-20                       | VAF  | 2023-09-11 | 2024-09-11 |
| Analyzer - Spectrum Analyzer | Agilent            | E4446A                         | AAQ  | 2024-03-13 | 2025-03-13 |
| Antenna - Biconilog          | ETS Lindgren       | 3142D                          | AXO  | 2023-10-02 | 2025-10-02 |
| Cable                        | ESM Cable Corp.    | Bilog Cables                   | MN H | 2024-10-09 | 2025-10-09 |
| Amplifier - Pre-Amplifier    | Miteq              | AM-1616-1000                   | AVO  | 2024-10-09 | 2025-10-09 |
| Filter - Low Pass            | Micro-Tronics      | LPM50004                       | LFK  | 2023-08-23 | 2024-08-23 |
| Filter - High Pass           | Micro-Tronics      | HPM50111                       | LFN  | 2023-08-23 | 2024-08-23 |
| Antenna - Standard Gain      | ETS Lindgren       | 3160-09                        | AHG  | NCR        | NCR        |
| Cable                        | ESM Cable Corp.    | TTBJ141 KMKM-72                | MNP  | 2024-09-05 | 2025-09-05 |
| Amplifier - Pre-Amplifier    | Miteq              | JSD4-18002600-26-8P            | APU  | 2024-09-05 | 2025-09-05 |
| Antenna - Loop               | ETS Lindgren       | 6502                           | AOB  | 2023-06-12 | 2025-06-12 |

## MEASUREMENT UNCERTAINTY

| Description  |        |         |
|--------------|--------|---------|
| Expanded k=2 | 5.2 dB | -5.2 dB |

## FREQUENCY RANGE INVESTIGATED

|                 |
|-----------------|
| 9 kHz TO 25 GHz |
|-----------------|

## CONFIGURATIONS INVESTIGATED

|            |
|------------|
| EMPM0165-6 |
| EMPM0182-5 |

# SPURIOUS RADIATED EMISSIONS – 20 dBi Sector Antenna



|                   |                                          |                       |            |
|-------------------|------------------------------------------|-----------------------|------------|
| EUT:              | 781SA                                    | Work Order:           | EMPM0182   |
| Serial Number:    | 018                                      | Date:                 | 2024-08-02 |
| Customer:         | Emerson                                  | Temperature:          | 22.2°C     |
| Attendees:        | Stacy Lukas, Daniel Wolf                 | Relative Humidity:    | 61.9%      |
| Customer Project: | None                                     | Bar. Pressure (PMSL): | 1017 mb    |
| Tested By:        | Arnauld Dedry                            | Job Site:             | MN05       |
| Power:            | 15VDC (provided from peripheral Gateway) | Configuration:        | EMPM0182-5 |

## TEST SPECIFICATIONS

|                                      |                  |
|--------------------------------------|------------------|
| Specification:                       | Method:          |
| FCC 15.247:2024                      | ANSI C63.10:2013 |
| RSS-247 Issue 3:2023                 | ANSI C63.10:2013 |
| RSS-Gen Issue 5:2018+A1:2019+A2:2021 |                  |

## TEST PARAMETERS

|        |    |                    |   |                     |           |
|--------|----|--------------------|---|---------------------|-----------|
| Run #: | 23 | Test Distance (m): | 3 | Ant. Height(s) (m): | 1 to 4(m) |
|--------|----|--------------------|---|---------------------|-----------|

## COMMENTS

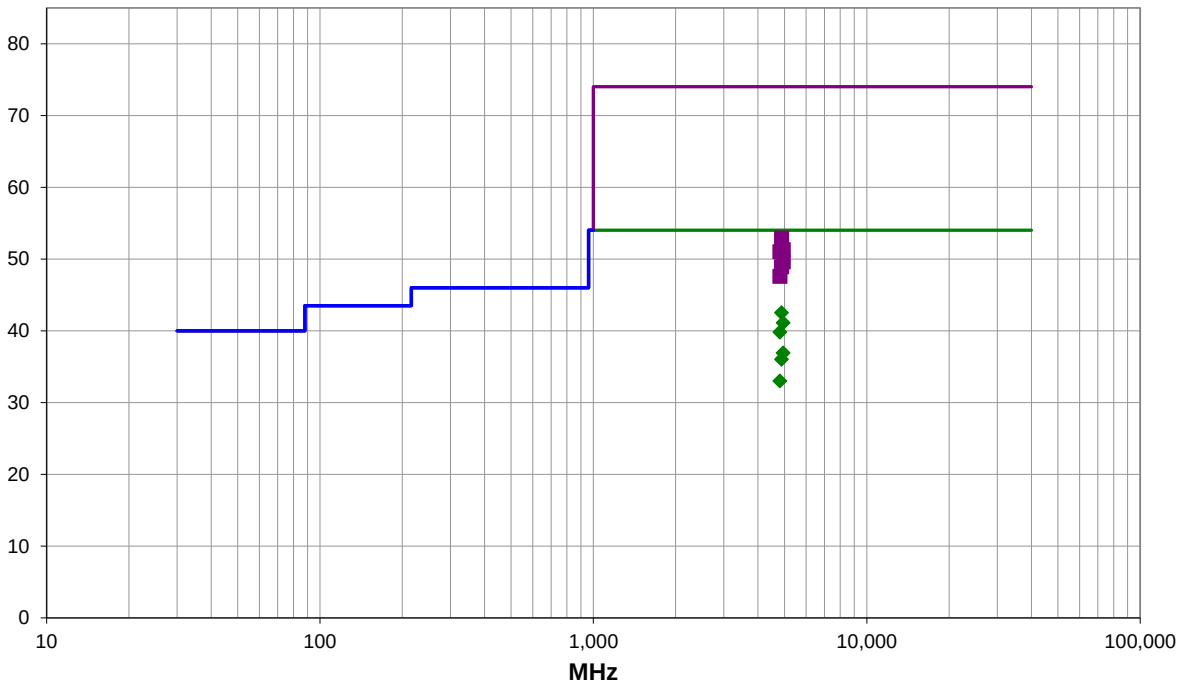
20 dBi Sector Antenna. Test mode is 100% Duty Cycle. The client states that during hopping operation, the highest on time in 100ms is 20.706ms. Therefore, a duty cycle correction factor (DCCF) was added using  $10 \cdot \log(\text{dwell time}/100\text{ms}) = -6.8 \text{ dB}$ .

## EUT OPERATING MODES

Transmitting 2.4 GHz Antenna Low, Mid and High Chs (2405, 2440 and 2475 MHz), OQPSK 250 kbps. Channels tested independently.

## DEVIATIONS FROM TEST STANDARD

None



Run #: 23

■ PK ◆ AV ● QP

# SPURIOUS RADIATED EMISSIONS – 20 dBi Sector Antenna

## RESULTS - Run #23

| Freq (MHz) | Amplitude (dBuV) | Factor (dB/m) | Antenna Height (meters) | Azimuth (degrees) | Duty Cycle Correction Factor | External Attenuation (dB) | Polarity/Transducer | Detector | Distance Adjustment (dB) | Adjusted (dBuV/m) | Spec. Limit (dBuV/m) | Compared to Spec. (dB) | Comments             |
|------------|------------------|---------------|-------------------------|-------------------|------------------------------|---------------------------|---------------------|----------|--------------------------|-------------------|----------------------|------------------------|----------------------|
| 4880.000   | 44.2             | 5.1           | 1.9                     | 257.0             | -6.8                         | 0.0                       | Horz                | AV       | 0.0                      | 42.5              | 54.0                 | -11.5                  | EUT On Side, Mid Ch  |
| 4949.992   | 42.7             | 5.2           | 1.7                     | 257.0             | -6.8                         | 0.0                       | Horz                | AV       | 0.0                      | 41.1              | 54.0                 | -12.9                  | EUT On Side, High Ch |
| 4809.967   | 41.3             | 5.3           | 2.4                     | 257.0             | -6.8                         | 0.0                       | Horz                | AV       | 0.0                      | 39.8              | 54.0                 | -14.2                  | EUT On Side, Low Ch  |
| 4949.967   | 38.5             | 5.2           | 2.9                     | 252.0             | -6.8                         | 0.0                       | Vert                | AV       | 0.0                      | 36.9              | 54.0                 | -17.1                  | EUT Horz, High Ch    |
| 4879.967   | 37.7             | 5.1           | 1.5                     | 254.9             | -6.8                         | 0.0                       | Vert                | AV       | 0.0                      | 36.0              | 54.0                 | -18.0                  | EUT Horz, Mid Ch     |
| 4810.000   | 34.5             | 5.3           | 1.8                     | 253.0             | -6.8                         | 0.0                       | Vert                | AV       | 0.0                      | 33.0              | 54.0                 | -21.0                  | EUT Horz, Low Ch     |
| 4879.967   | 47.8             | 5.1           | 1.9                     | 257.0             | 0.0                          | 0.0                       | Horz                | PK       | 0.0                      | 52.9              | 74.0                 | -21.1                  | EUT On Side, Mid Ch  |
| 4950.150   | 46.1             | 5.2           | 1.7                     | 257.0             | 0.0                          | 0.0                       | Horz                | PK       | 0.0                      | 51.3              | 74.0                 | -22.7                  | EUT On Side, High Ch |
| 4810.017   | 45.7             | 5.3           | 2.4                     | 257.0             | 0.0                          | 0.0                       | Horz                | PK       | 0.0                      | 51.0              | 74.0                 | -23.0                  | EUT On Side, Low Ch  |
| 4950.042   | 44.4             | 5.2           | 2.9                     | 252.0             | 0.0                          | 0.0                       | Vert                | PK       | 0.0                      | 49.6              | 74.0                 | -24.4                  | EUT Horz, High Ch    |
| 4880.017   | 43.8             | 5.1           | 1.5                     | 254.9             | 0.0                          | 0.0                       | Vert                | PK       | 0.0                      | 48.9              | 74.0                 | -25.1                  | EUT Horz, Mid Ch     |
| 4809.850   | 42.3             | 5.3           | 1.8                     | 253.0             | 0.0                          | 0.0                       | Vert                | PK       | 0.0                      | 47.6              | 74.0                 | -26.4                  | EUT Horz, Low Ch     |

## CONCLUSION

Pass



Tested By

# SPURIOUS RADIATED EMISSIONS – 20 dBi Sector Antenna



|                   |                                          |                       |            |
|-------------------|------------------------------------------|-----------------------|------------|
| EUT:              | 781SA                                    | Work Order:           | EMPM0165   |
| Serial Number:    | 018                                      | Date:                 | 2024-03-11 |
| Customer:         | Emerson                                  | Temperature:          | 21.1°C     |
| Attendees:        | Erin Snell                               | Relative Humidity:    | 22.8%      |
| Customer Project: | None                                     | Bar. Pressure (PMSL): | 1010 mb    |
| Tested By:        | Marcelo Aguayo                           | Job Site:             | MN05       |
| Power:            | 15VDC (provided from peripheral Gateway) | Configuration:        | EMPM0165-6 |

## TEST SPECIFICATIONS

|                                      |                  |
|--------------------------------------|------------------|
| Specification:                       | Method:          |
| FCC 15.247:2024                      | ANSI C63.10:2013 |
| RSS-247 Issue 3:2023                 | ANSI C63.10:2013 |
| RSS-Gen Issue 5:2018+A1:2019+A2:2021 |                  |

## TEST PARAMETERS

|        |     |                    |   |                     |           |
|--------|-----|--------------------|---|---------------------|-----------|
| Run #: | 186 | Test Distance (m): | 3 | Ant. Height(s) (m): | 1 to 4(m) |
|--------|-----|--------------------|---|---------------------|-----------|

## COMMENTS

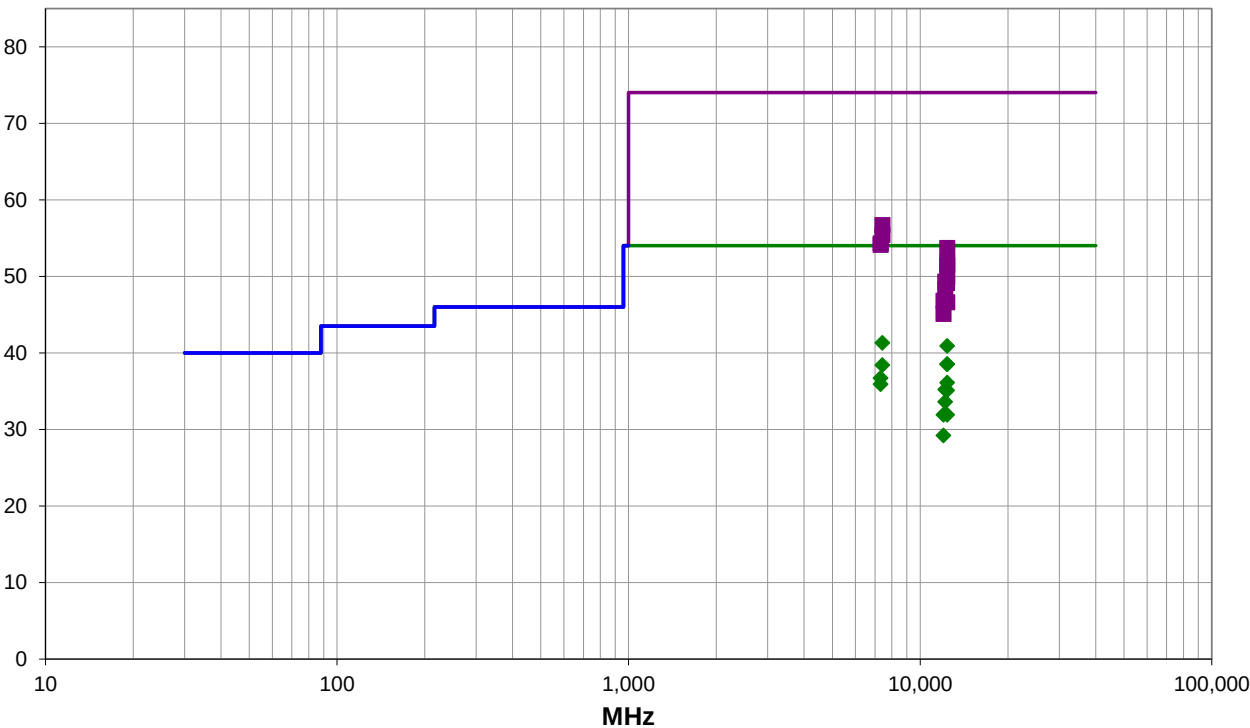
20dBi sector antenna. Test mode is 100% Duty Cycle. The client states that during hopping operation, the highest on time in 100ms is 20.706ms. Therefore, a duty cycle correction factor (DCCF) was added using  $10 \cdot \log(\text{dwell time}/100\text{ms}) = -6.8 \text{ dB}$ .

## EUT OPERATING MODES

Transmitting 2.4 GHz Antenna Low, Mid and High Chs (2405, 2440 and 2475 MHz), OQPSK 250 kbps. Channels tested independently.

## DEVIATIONS FROM TEST STANDARD

None



Run #: 186

■ PK ◆ AV ● QP

# SPURIOUS RADIATED EMISSIONS – 20 dBi Sector Antenna

## RESULTS - Run #186

| Freq (MHz) | Amplitude (dBuV) | Factor (dB/m) | Antenna Height (meters) | Azimuth (degrees) | Duty Cycle Correction Factor | External Attenuation (dB) | Polarity/Transducer | Detector | Distance Adjustment (dB) | Adjusted (dBuV/m) | Spec. Limit (dBuV/m) | Compared to Spec. (dB) | Comments             |
|------------|------------------|---------------|-------------------------|-------------------|------------------------------|---------------------------|---------------------|----------|--------------------------|-------------------|----------------------|------------------------|----------------------|
| 7423.592   | 35.6             | 12.5          | 2.6                     | 81.0              | -6.8                         | 0.0                       | Horz                | AV       | 0.0                      | 41.3              | 54.0                 | -12.7                  | EUT On Side, High Ch |
| 12377.330  | 48.5             | -0.8          | 3.3                     | 84.9              | -6.8                         | 0.0                       | Horz                | AV       | 0.0                      | 40.9              | 54.0                 | -13.1                  | EUT On Side, High Ch |
| 12377.370  | 46.1             | -0.8          | 3.9                     | 31.9              | -6.8                         | 0.0                       | Horz                | AV       | 0.0                      | 38.5              | 54.0                 | -15.5                  | EUT Horz, High Ch    |
| 12377.340  | 46.1             | -0.8          | 1.8                     | 232.0             | -6.8                         | 0.0                       | Horz                | AV       | 0.0                      | 38.5              | 54.0                 | -15.5                  | EUT Vert, High Ch    |
| 7426.283   | 32.7             | 12.5          | 1.9                     | 333.0             | -6.8                         | 0.0                       | Vert                | AV       | 0.0                      | 38.4              | 54.0                 | -15.6                  | EUT Horz, High Ch    |
| 7423.408   | 44.2             | 12.5          | 2.6                     | 81.0              | 0.0                          | 0.0                       | Horz                | PK       | 0.0                      | 56.7              | 74.0                 | -17.3                  | EUT On Side, High Ch |
| 7318.508   | 31.0             | 12.5          | 1.7                     | 217.9             | -6.8                         | 0.0                       | Vert                | AV       | 0.0                      | 36.7              | 54.0                 | -17.3                  | EUT Horz, Mid Ch     |
| 12377.350  | 43.7             | -0.8          | 4.0                     | 321.0             | -6.8                         | 0.0                       | Vert                | AV       | 0.0                      | 36.1              | 54.0                 | -17.9                  | EUT Horz, High Ch    |
| 7318.550   | 30.2             | 12.5          | 1.5                     | 38.9              | -6.8                         | 0.0                       | Horz                | AV       | 0.0                      | 35.9              | 54.0                 | -18.1                  | EUT On Side, Mid Ch  |
| 7423.725   | 42.9             | 12.5          | 1.9                     | 333.0             | 0.0                          | 0.0                       | Vert                | PK       | 0.0                      | 55.4              | 74.0                 | -18.6                  | EUT Horz, High Ch    |
| 12197.510  | 42.8             | -0.8          | 2.0                     | 318.0             | -6.8                         | 0.0                       | Horz                | AV       | 0.0                      | 35.2              | 54.0                 | -18.8                  | EUT On Side, High Ch |
| 12377.380  | 42.7             | -0.8          | 4.0                     | 117.0             | -6.8                         | 0.0                       | Vert                | AV       | 0.0                      | 35.1              | 54.0                 | -18.9                  | EUT On Side, High Ch |
| 7318.892   | 41.8             | 12.5          | 1.7                     | 217.9             | 0.0                          | 0.0                       | Vert                | PK       | 0.0                      | 54.3              | 74.0                 | -19.7                  | EUT Horz, Mid Ch     |
| 7321.600   | 41.6             | 12.5          | 1.5                     | 38.9              | 0.0                          | 0.0                       | Horz                | PK       | 0.0                      | 54.1              | 74.0                 | -19.9                  | EUT On Side, Mid Ch  |
| 12377.200  | 54.5             | -0.8          | 3.3                     | 84.9              | 0.0                          | 0.0                       | Horz                | PK       | 0.0                      | 53.7              | 74.0                 | -20.3                  | EUT On Side, High Ch |
| 12197.530  | 41.2             | -0.8          | 3.5                     | 321.0             | -6.8                         | 0.0                       | Vert                | AV       | 0.0                      | 33.6              | 54.0                 | -20.4                  | EUT Horz, High Ch    |
| 12377.380  | 39.5             | -0.8          | 3.7                     | 56.9              | -6.8                         | 0.0                       | Vert                | AV       | 0.0                      | 31.9              | 54.0                 | -22.1                  | EUT Vert, High Ch    |
| 12027.330  | 40.5             | -1.8          | 3.4                     | 232.9             | -6.8                         | 0.0                       | Horz                | AV       | 0.0                      | 31.9              | 54.0                 | -22.1                  | EUT On Side, Low Ch  |
| 12377.460  | 52.6             | -0.8          | 3.9                     | 31.9              | 0.0                          | 0.0                       | Horz                | PK       | 0.0                      | 51.8              | 74.0                 | -22.2                  | EUT Horz, High Ch    |
| 12377.430  | 52.3             | -0.8          | 1.8                     | 232.0             | 0.0                          | 0.0                       | Horz                | PK       | 0.0                      | 51.5              | 74.0                 | -22.5                  | EUT Vert, High Ch    |
| 12377.390  | 50.7             | -0.8          | 4.0                     | 321.0             | 0.0                          | 0.0                       | Vert                | PK       | 0.0                      | 49.9              | 74.0                 | -24.1                  | EUT Horz, High Ch    |
| 12197.530  | 50.1             | -0.8          | 2.0                     | 318.0             | 0.0                          | 0.0                       | Horz                | PK       | 0.0                      | 49.3              | 74.0                 | -24.7                  | EUT On Side, High Ch |
| 12022.540  | 37.8             | -1.8          | 1.2                     | 326.9             | -6.8                         | 0.0                       | Vert                | AV       | 0.0                      | 29.2              | 54.0                 | -24.8                  | EUT Horz, Low Ch     |
| 12372.580  | 49.9             | -0.8          | 4.0                     | 117.0             | 0.0                          | 0.0                       | Vert                | PK       | 0.0                      | 49.1              | 74.0                 | -24.9                  | EUT On Side, High Ch |
| 12202.430  | 49.1             | -0.8          | 3.5                     | 321.0             | 0.0                          | 0.0                       | Vert                | PK       | 0.0                      | 48.3              | 74.0                 | -25.7                  | EUT Horz, High Ch    |
| 12027.300  | 48.6             | -1.8          | 3.4                     | 232.9             | 0.0                          | 0.0                       | Horz                | PK       | 0.0                      | 46.8              | 74.0                 | -27.2                  | EUT On Side, Low Ch  |
| 12377.340  | 47.4             | -0.8          | 3.7                     | 56.9              | 0.0                          | 0.0                       | Vert                | PK       | 0.0                      | 46.6              | 74.0                 | -27.4                  | EUT Vert, High Ch    |
| 12027.330  | 46.9             | -1.8          | 1.2                     | 326.9             | 0.0                          | 0.0                       | Vert                | PK       | 0.0                      | 45.1              | 74.0                 | -28.9                  | EUT Horz, Low Ch     |

## CONCLUSION

Pass



Tested By

# SPURIOUS RADIATED EMISSIONS – 20 dBi Sector Antenna



|                   |                                          |                       |            |
|-------------------|------------------------------------------|-----------------------|------------|
| EUT:              | 781SA                                    | Work Order:           | EMPM0165   |
| Serial Number:    | 018                                      | Date:                 | 2024-03-11 |
| Customer:         | Emerson                                  | Temperature:          | 21.1°C     |
| Attendees:        | Erin Snell                               | Relative Humidity:    | 22.8%      |
| Customer Project: | None                                     | Bar. Pressure (PMSL): | 1010 mb    |
| Tested By:        | Marcelo Aguayo                           | Job Site:             | MN05       |
| Power:            | 15VDC (provided from peripheral Gateway) | Configuration:        | EMPM0165-6 |

## TEST SPECIFICATIONS

|                                      |                  |
|--------------------------------------|------------------|
| Specification:                       | Method:          |
| FCC 15.247:2024                      | ANSI C63.10:2013 |
| RSS-247 Issue 3:2023                 | ANSI C63.10:2013 |
| RSS-Gen Issue 5:2018+A1:2019+A2:2021 |                  |

## TEST PARAMETERS

|        |     |                    |   |                     |           |
|--------|-----|--------------------|---|---------------------|-----------|
| Run #: | 188 | Test Distance (m): | 3 | Ant. Height(s) (m): | 1 to 4(m) |
|--------|-----|--------------------|---|---------------------|-----------|

## COMMENTS

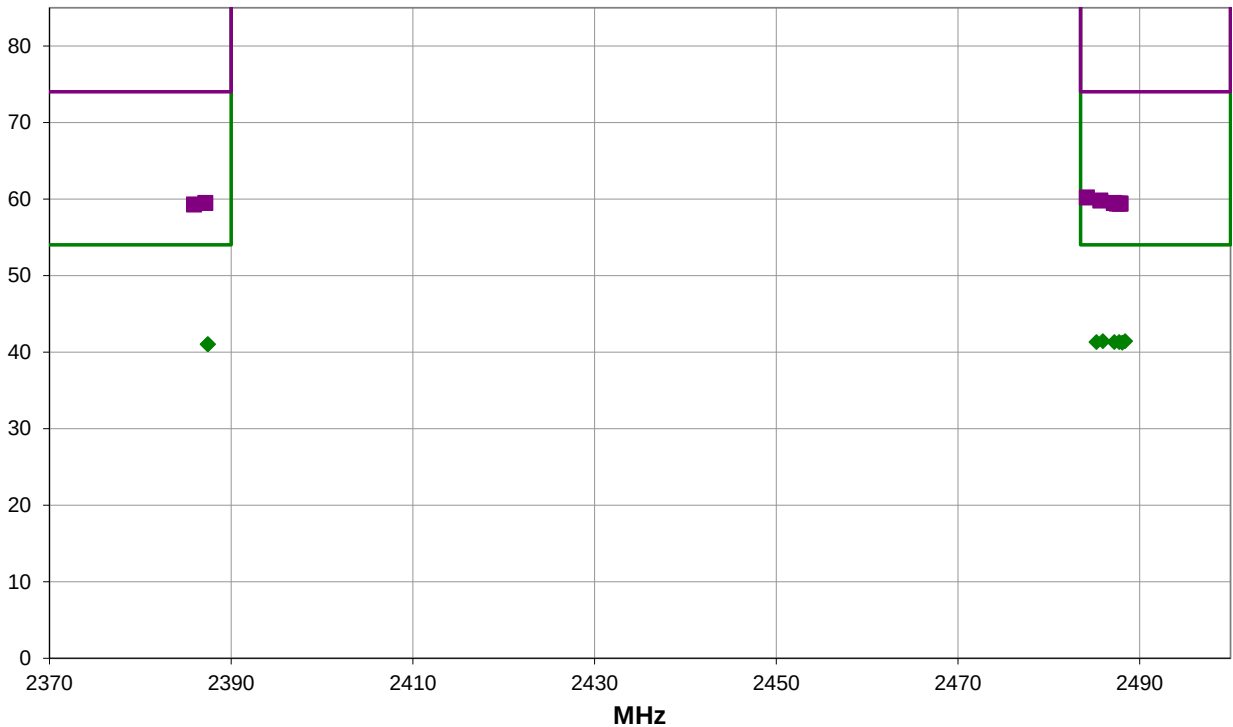
20dBi sector antenna. Test mode is 100% Duty Cycle. The client states that during hopping operation, the highest on time in 100ms is 20.706ms. Therefore, a duty cycle correction factor (DCCF) was added using  $10 \cdot \log(\text{dwell time}/100\text{ms}) = -6.8$  dB.

## EUT OPERATING MODES

Transmitting 2.4 GHz Antenna High Ch 2475 MHz and Low Ch 2405 MHz, OQPSK 250 kbps. Channels tested independently.

## DEVIATIONS FROM TEST STANDARD

None



Run #: 188

■ PK    ◆ AV    ● QP

# SPURIOUS RADIATED EMISSIONS – 20 dBi Sector Antenna

## RESULTS - Run #188

| Freq<br>(MHz) | Amplitude<br>(dBuV) | Factor<br>(dB/m) | Antenna Height<br>(meters) | Azimuth<br>(degrees) | Duty Cycle<br>Correction<br>Factor | External<br>Attenuation<br>(dB) | Polarity/<br>Transducer | Detector | Distance<br>Adjustment<br>(dB) | Adjusted<br>(dBuV/m) | Spec. Limit<br>(dBuV/m) | Compared to<br>Spec.<br>(dB) | Comments             |
|---------------|---------------------|------------------|----------------------------|----------------------|------------------------------------|---------------------------------|-------------------------|----------|--------------------------------|----------------------|-------------------------|------------------------------|----------------------|
| 2488.425      | 31.6                | -3.4             | 2.6                        | 135.0                | -6.8                               | 20.0                            | Horz                    | AV       | 0.0                            | 41.4                 | 54.0                    | -12.6                        | EUT On Side, High Ch |
| 2485.967      | 31.7                | -3.5             | 1.5                        | 95.0                 | -6.8                               | 20.0                            | Vert                    | AV       | 0.0                            | 41.4                 | 54.0                    | -12.6                        | EUT On Side, High Ch |
| 2487.242      | 31.6                | -3.5             | 1.5                        | 137.0                | -6.8                               | 20.0                            | Horz                    | AV       | 0.0                            | 41.3                 | 54.0                    | -12.7                        | EUT Vert, High Ch    |
| 2485.258      | 31.6                | -3.5             | 1.0                        | 99.0                 | -6.8                               | 20.0                            | Vert                    | AV       | 0.0                            | 41.3                 | 54.0                    | -12.7                        | EUT Vert, High Ch    |
| 2487.758      | 31.6                | -3.5             | 1.5                        | 27.0                 | -6.8                               | 20.0                            | Horz                    | AV       | 0.0                            | 41.3                 | 54.0                    | -12.7                        | EUT Horz, High Ch    |
| 2488.117      | 31.5                | -3.5             | 1.2                        | 148.0                | -6.8                               | 20.0                            | Vert                    | AV       | 0.0                            | 41.2                 | 54.0                    | -12.8                        | EUT Horz, High Ch    |
| 2387.467      | 31.9                | -4.1             | 2.9                        | 360.0                | -6.8                               | 20.0                            | Horz                    | AV       | 0.0                            | 41.0                 | 54.0                    | -13.0                        | EUT On Side, Low Ch  |
| 2387.425      | 31.9                | -4.1             | 3.8                        | 9.0                  | -6.8                               | 20.0                            | Vert                    | AV       | 0.0                            | 41.0                 | 54.0                    | -13.0                        | EUT On Side, Low Ch  |
| 2484.200      | 43.7                | -3.5             | 1.2                        | 148.0                | 0.0                                | 20.0                            | Vert                    | PK       | 0.0                            | 60.2                 | 74.0                    | -13.8                        | EUT Horz, High Ch    |
| 2485.667      | 43.3                | -3.5             | 1.5                        | 27.0                 | 0.0                                | 20.0                            | Horz                    | PK       | 0.0                            | 59.8                 | 74.0                    | -14.2                        | EUT On Side, High Ch |
| 2487.150      | 43.0                | -3.5             | 1.5                        | 95.0                 | 0.0                                | 20.0                            | Vert                    | PK       | 0.0                            | 59.5                 | 74.0                    | -14.5                        | EUT On Side, High Ch |
| 2387.150      | 43.6                | -4.1             | 3.8                        | 9.0                  | 0.0                                | 20.0                            | Vert                    | PK       | 0.0                            | 59.5                 | 74.0                    | -14.5                        | EUT On Side, Low Ch  |
| 2487.908      | 42.9                | -3.5             | 1.5                        | 137.0                | 0.0                                | 20.0                            | Horz                    | PK       | 0.0                            | 59.4                 | 74.0                    | -14.6                        | EUT Vert, High Ch    |
| 2487.500      | 42.9                | -3.5             | 1.0                        | 99.0                 | 0.0                                | 20.0                            | Vert                    | PK       | 0.0                            | 59.4                 | 74.0                    | -14.6                        | EUT Vert, High Ch    |
| 2487.817      | 42.9                | -3.5             | 2.6                        | 135.0                | 0.0                                | 20.0                            | Horz                    | PK       | 0.0                            | 59.4                 | 74.0                    | -14.6                        | EUT Horz, High Ch    |
| 2385.908      | 43.4                | -4.1             | 2.9                        | 360.0                | 0.0                                | 20.0                            | Horz                    | PK       | 0.0                            | 59.3                 | 74.0                    | -14.7                        | EUT On Side, Low Ch  |

## CONCLUSION

Pass



Tested By

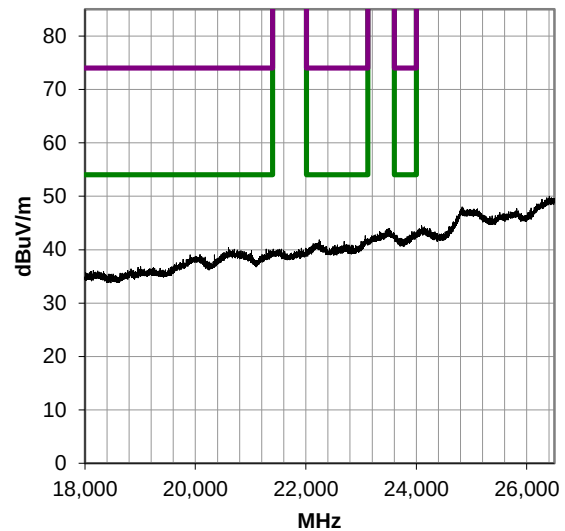


# SPURIOUS RADIATED EMISSIONS – 20 dBi Sector Antenna

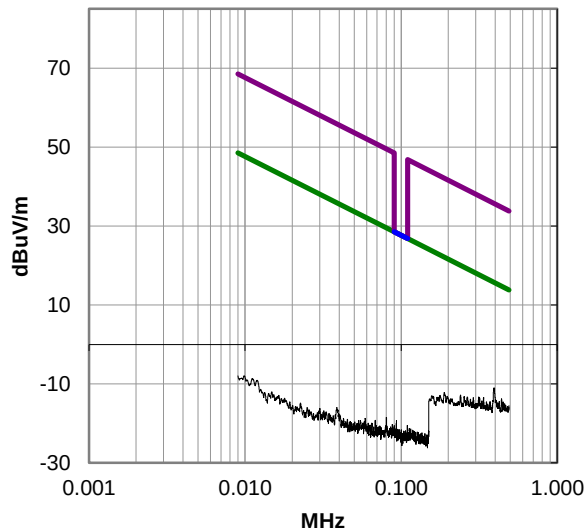
## PRESCAN DATA

Radiated spurious emissions from the EUT are initially reviewed with Pre-scans (Preview scans). Pre-scans are performed, with the EUT transmitting on the lowest applicable data rate, for both vertical and horizontal polarizations. The Pre-scan plots below are shown with a peak detector and RBW for the following frequency ranges: 9 kHz RBW (< 30 MHz); 120 kHz RBW (30 - 1000 MHz); 1 MHz RBW (> 1 GHz). In the case where unintentional emissions are observed, an ambient or idle pre-scan with the radio off, will be shown for comparison.

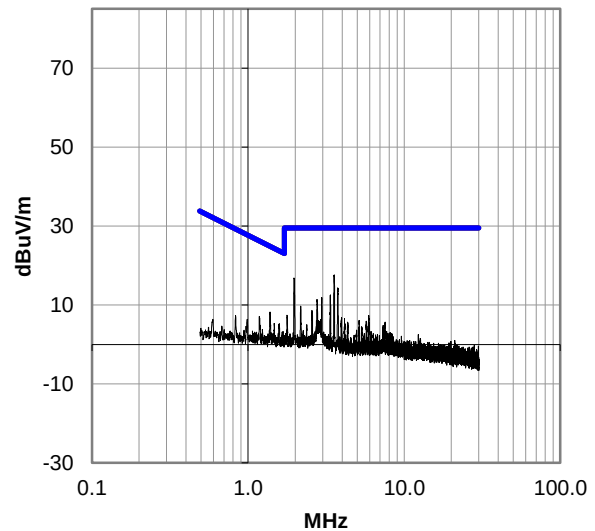
18000-26500 MHz, Run 27



0.009-0.49 MHz, Run 69

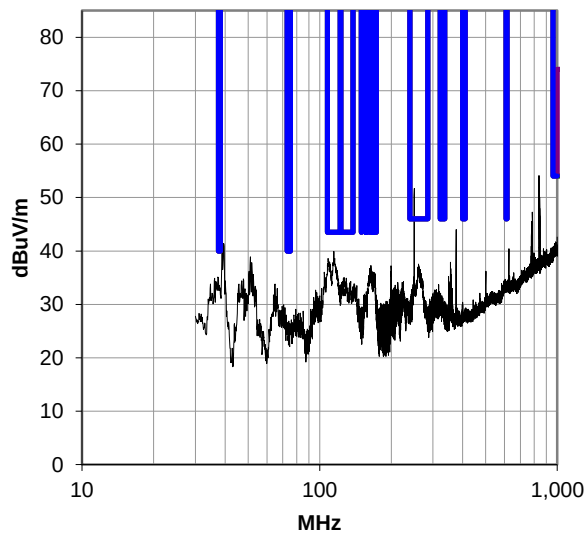


0.49-30 MHz, Run 70

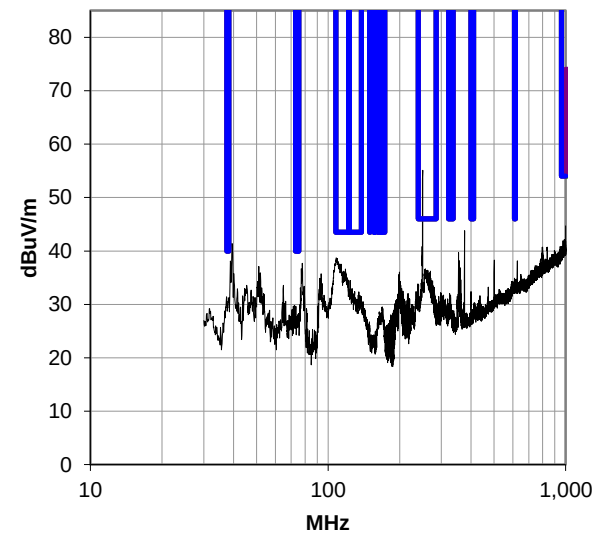


# SPURIOUS RADIATED EMISSIONS – 20 dBi Sector Antenna

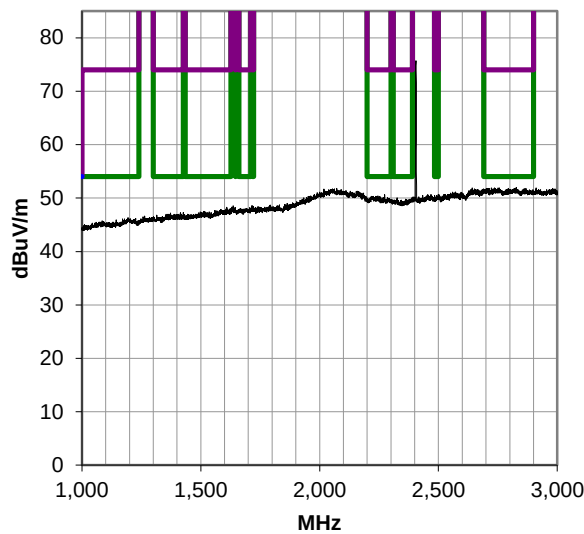
30-1000 MHz, Run 90



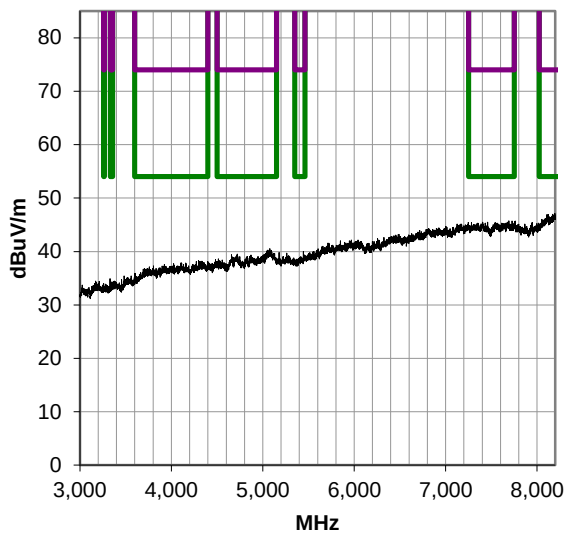
30-1000 MHz, Run 78 (transmitter off)



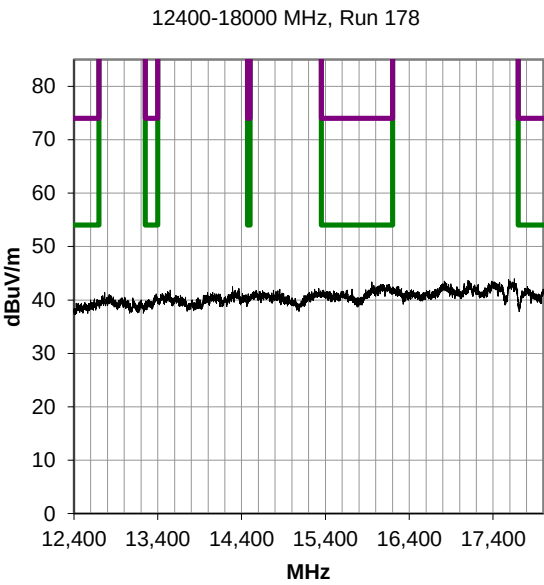
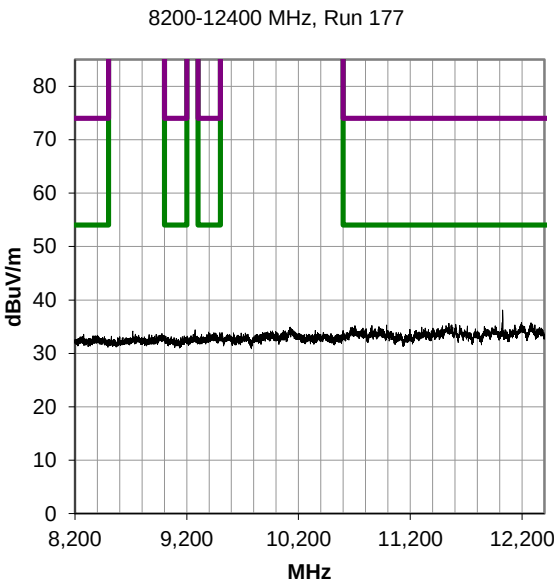
1000-3000 MHz, Run 175



3000-8200 MHz, Run 176



# SPURIOUS RADIATED EMISSIONS – 20 dBi Sector Antenna



## End of Test Report