



Test Report – FCC Part 15.231 Momentary Transmitter

Applicant: ENTERPRISE ELECTRONICS, L.L.C.

Approved for Release By:

Signature: Bruno Clavier

Name & Title: Bruno Clavier, General Manager

Date of Signature 1/4/2024

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1. Applicant Information

Applicant: Enterprise Electronics, L.L.C.
Address: 1200 Kempar Avenue
 Madison Heights, MI 48071
 United States

1.1 Test Result Summary

The following test procedure was used ANSI C63.4-2014. Full test results are available in this report.

No additions to the test methods were needed. There were no deviations, or exclusions from the test methods. No test results are from external providers or from the customer. The test results relate only to the items tested. Timco does not offer opinions and interpretations, only a pass/fail statement.

| Clauses | Description of the Requirements | Result (Pass, Fail or N/A) |
|--|---|----------------------------|
| 15.231(a) | Periodic Operation | Note 2 |
| - | Duty Cycle* | Pass |
| 2.1046, 15.231(b) | Radiated Field Strength of the Fundamental | Pass |
| 2.1053, 15.231(b), 15.209(a), 15.205(a), (b) | Radiated Field Strength of Spurious Emissions | Pass |
| 2.1049, 15.231(c) | Occupied Bandwidth | Pass |
| 15.207(a), (c) | AC Powerline Conducted Emissions | Note 1 |
| 15.203 | Antenna Requirement | Pass |

Notes:

- 1) EUT is not intended for connection with AC Mains.
- 2) Manufacturer provided attestation letter; no test required.

2. Location of Testing

2.1 Test Laboratory

Timco Engineering Inc. is a subsidiary of Industrial Inspection & Analysis, Inc. ("IIA"). Testing was performed at Timco's permanent laboratory located at 849 NW State Road 45, Newberry, Florida 32669

FCC test firm # 578780

FCC Designation # US1070

FCC site registration is under A2LA certificate # 0955.01

ISED Canada test site registration # 2056A

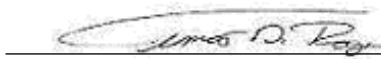
EU Notified Body # 1177

For all designations see A2LA scope # 0955.01

2.2 Testing was performed, reviewed by

Dates of Testing: 5/29/2023 – 6/2/2023

Signature:



Sr. EMC Engineer
EMC-003838-NE



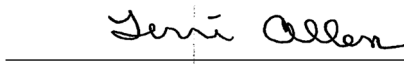
Name & Title:

Tim Royer, EMC Engineer

Date of Signature

1/4/2024

Signature:



Name & Title:

Terri Allen, Project Specialist

Date of Signature

1/4/2024

3. Test Sample(s) (EUT/DUT)

The test sample was received: 5/29/2023

3.1 Description of the EUT

A description as well as unambiguous identification of the EUT(s) tested. Where more than one sample is required for technical reasons (such as the use of connected units for the purpose of conducted output power testing where the product units will have integral antennas), each specific test shall identify which unit was tested.

| Identification | |
|-------------------|----------------|
| FCC ID: | QV4-902 |
| Brief Description | 902 MHz Keypad |
| Model(s) # | PCBA005F902A |
| Firmware version | N/A |
| Software version | N/A |
| Serial Number | N/A |

| Technical Characteristics | |
|------------------------------|----------------|
| Technology | 902 MHz Keypad |
| Frequency Range | 902 MHz |
| Antenna Connector | N/A |
| Voltage Rating (AC or Batt.) | Battery |
| Emission Designator | F1D |

3.2 Configuration of EUT

| Band (MHz) | Mode | Number of Ant. |
|------------|----------|----------------|
| 902 | Transmit | 1 |

Operating conditions during Testing:

No modifications of the device under test (including firmware, specific software settings, and input/output signal levels to the EUT).

Peripherals used during Testing:

No modifications of the device under test (including firmware, specific software settings, and input/output signal levels to the EUT).

3.3 Test Setup of EUT

Equipment, antenna, and cable arrangement. The setup of the equipment and cable or wire placement on the test site that produces the highest radiated and the highest ac power-line conducted emissions shall be shown clearly and described. Information on the orientation of portable equipment during testing shall be included. Drawings or photographs may be used for this purpose.

Test Setups are included in the test report.

4. Test methods & Applicable Regulatory Limits

4.1 Test methods/Standards/Guidance

The measurement was performed as per ANSI 63.10. Full test results are available in this report.

Limits and Regulatory Limits:

- 1) FCC 15C

5. Measurement Uncertainty

| Parameter | Uncertainty (dB) |
|--------------------------------------|------------------|
| Conducted Emissions | ± 3.14 dB |
| Radiated Emissions (9kHz – 30 MHz) | ± 3.08 dB |
| Radiated Emissions (30 – 200 MHz) | ± 2.16 dB |
| Radiated Emissions (200 – 1000 MHz) | ± 2.15 dB |
| Radiated Emissions (1 GHz – 18 GHz) | ± 2.14 dB |
| Radiated Emissions (18 GHz – 40 GHz) | ± 2.31 dB |

Note: The uncertainties provided in this table represent an expanded uncertainty expressed at approximately the 95% confidence level using a coverage factor of K=2.

6. Environmental Conditions

Temperature & Humidity

Measurements performed at the test site did not exceed the following:

| Parameter | Measurement |
|---------------------|-------------|
| Temperature | 23 C +/- 5% |
| Humidity | 55% +/- 5% |
| Barometric Pressure | 30.05 in Hg |

Note: Specific environmental conditions that are applicable to a specific test are available in the test result section.

7. List of Test Equipment and Test Facility

The test equipment used identified by type, manufacturer, serial number, or other identification and the date on which the next calibration or service check is due.

Description of the firmware or software used to operate EUT for testing purposes.

A complete list of all test equipment used shall be included with the test report. The manufacturer’s model and serial numbers, and date of last calibration, and calibration interval shall be included. Measurement cable loss, measuring instrument bandwidth and detector function, video bandwidth, if appropriate, and antenna factors shall also be included where applicable.

List of Test Equipment

| Test Equipment | | | | | | |
|----------------|---------------------------------|--------------------|---------|--------|-------------|-------------|
| Type | Device | Manufacturer | Model | SN# | Current Cal | Cal Due |
| Antenna | Biconical 1057 | Eaton | 94455-1 | 1057 | 10/16/20 | 10/16/2023 |
| Antenna, NSA | Log-Periodic 1243 | Eaton | 96005 | 1243 | 5/4/21 | 5/3/2024 |
| CHAMBER | CHAMBER | Panashield | 3M | N/A | 3/12/19 | 12./21/2023 |
| Receiver | EMI Test Receiver R&S ESU 40 | Rohde & Schwarz | ESU 40 | 100320 | 5/27/21 | 5/26/2024 |

| Software | | | |
|----------------|-----------------|--------------------------|---------------|
| Software | Author | Version | Validation on |
| ESU Firmware | Rohde & Schwarz | 4.43 SP3; BIOS v5.1-24-3 | 2018 |
| RSCommander | Rohde & Schwarz | 1.6.4 | 2014 |
| ScopeExplorer | LeCroy | v2.25.0.0 | 2009 |
| Field Strength | Timco | v4.10.7.0 | 2016 |

8. Test Results

The results of the test are usually indicated in the form of tables, spectrum analyzer plots, charts, sample calculations, as appropriate for each test procedure.

A description and/or a block diagram of the test setup is usually provided.

The measurement results, along with the appropriate limits for comparison, may be presented in tabular or graphical form. In addition, any variation in the measurement environment may be reported if applicable (e.g., a significant change of temperature that could affect the cable loss and amplifier response).

Units of measurement

Unless noted otherwise in the referenced standard, the measurements of ac power-line conducted emissions and conducted power output will be reported in units of dB μ V. Unless noted otherwise in the referenced standard, the measurements of radiated emissions will be reported in units of decibels, referenced to one microvolt per meter (dB μ V/m) for electric fields, or to one ampere per meter (dBA/m) for magnetic fields, at the distance specified in the appropriate standards or requirements. The measurements of antenna-conducted power for receivers may be reported in units of dB μ V if the impedance of the measuring instrument is also reported. Otherwise, antenna-conducted power will be reported in units of decibels referenced to one milliwatt (dBm). All formulas for data conversions and conversion factors, if used, will be included in this measurement report.

Example:

| | | | | |
|------------|---------------|--------------|----------|--------------------------|
| Freq (MHz) | Meter Reading | + ACF | +CL | = FS |
| 33 | 20 dB μ V | + 10.36 dB/m | +0.40 dB | =30.36 dB μ V/m @ 3m |

$$\text{EIRP} = \text{Pcond (dBm)} + \text{dBi}$$

8.1 PERIODIC OPERATION

8.1.1 Declaration Provided by Applicant

| Item | Description – Model # PCBA005F902A | Yes | No |
|------|--|------|----|
| 1 | Does this device transmit a signal that is only used to control another device? | X | |
| 2 | Does this device send data with this control signal? | X | |
| 3 | Does this device send data? Data is, things like: temperature, wind direction, fluid amount, rate of flow, etc. | | X |
| 4 | Does this device transmit: continuously or <u>automatically</u> | | X |
| 5 | If manually operated does this device stop transmitting within 5 seconds of releasing the button? | X | |
| 6 | If automatically operated does it deactivate 5 seconds after activation? | NA | NA |
| 7 | Does it transmit at regular predetermined intervals? | | X |
| 8 | Does it poll or send supervisory information? | | X |
| | If yes does it do a system integrity check? | NA | NA |
| | If yes, How often? | NA | |
| 9 | Is this a fire, security or safety of life device? | | X |
| | If Yes, does the device stop transmitting after the alarm condition is satisfied? | NA | NA |
| 10 | The device's Duty cycle: | 50% | |
| | Maximum Pulse On-time (in 100 ms Period): | 50ms | |
| | On-time Period (if other than 100 ms): | NA | |
| 11 | Modulation technique: Please specify the modulation of the test sample, FM, or AFSK, or FSK, On-Off Keying, etc. | FSK | |

8.2 DUTY CYCLE

Duty Cycle Formula: ANSI C63.10 Section 7.5, Equation 10:

$$\delta \text{ (dB)} = 20 \log \left[\sum (n_1 t_1 + n_2 t_2 \dots) / T \right]$$

Where:

δ is the duty cycle correction factor (dB)

T is the pulse is the period that the pulses are averaged over, (≤ 100 ms).

t_1 is the pulse width of subpulse 1

t_2 is the pulse width of subpulse 2 (and so on)

n_1 is the number of t_1 pulses

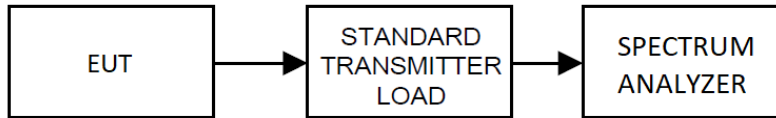
n_2 is the number of t_2 pulses (and so on)

8.2.1 Duty Cycle Calculation Table

| Sub Pulse | Duration (ms) | Occurances | On-Time (ms) |
|--|---------------|------------|--------------|
| 1 | 53.0000 | 1 | 53.0000 |
| 2 | 0.0000 | 0 | 0.0000 |
| 3 | 0.0000 | 0 | 0.0000 |
| Total On Time (ms) | | | 53.0000 |
| Period (ms) | | | 100.00 |
| Duty Cycle (%) | | | 53.00% |
| Duty Cycle Correction Factor (dB) | | | -5.51 |

8.3 OCCUPIED BANDWIDTH

Setup

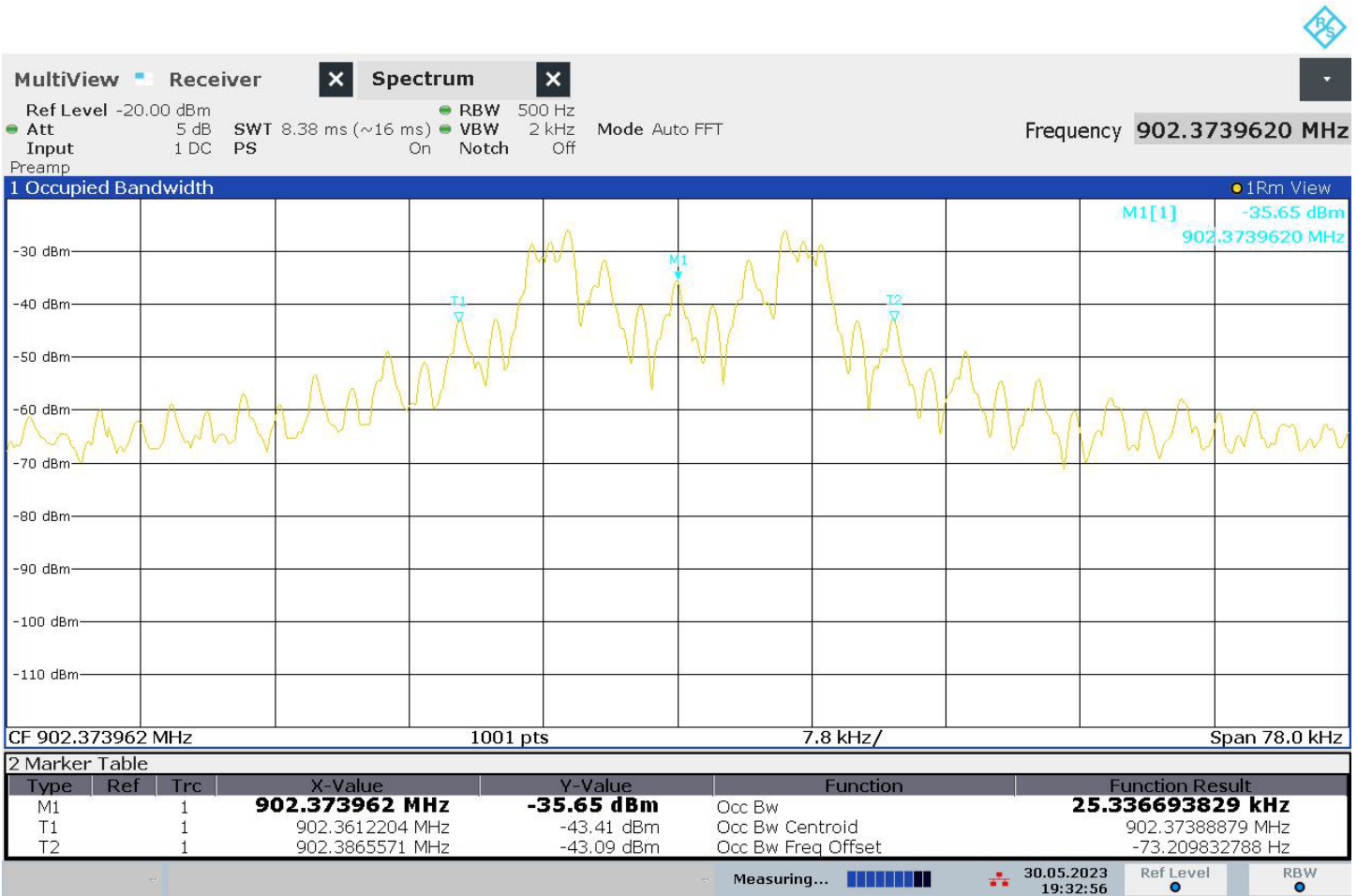


| Tuned Frequency (MHz) | Limit (kHz) |
|-----------------------|-------------|
| 902 | 2255 |

| Tuned Frequency (MHz) | Measured 20 dB BW (kHz) | Margin (kHz) |
|-----------------------|-------------------------|--------------|
| 902 | 25.71 | 2229.3 |

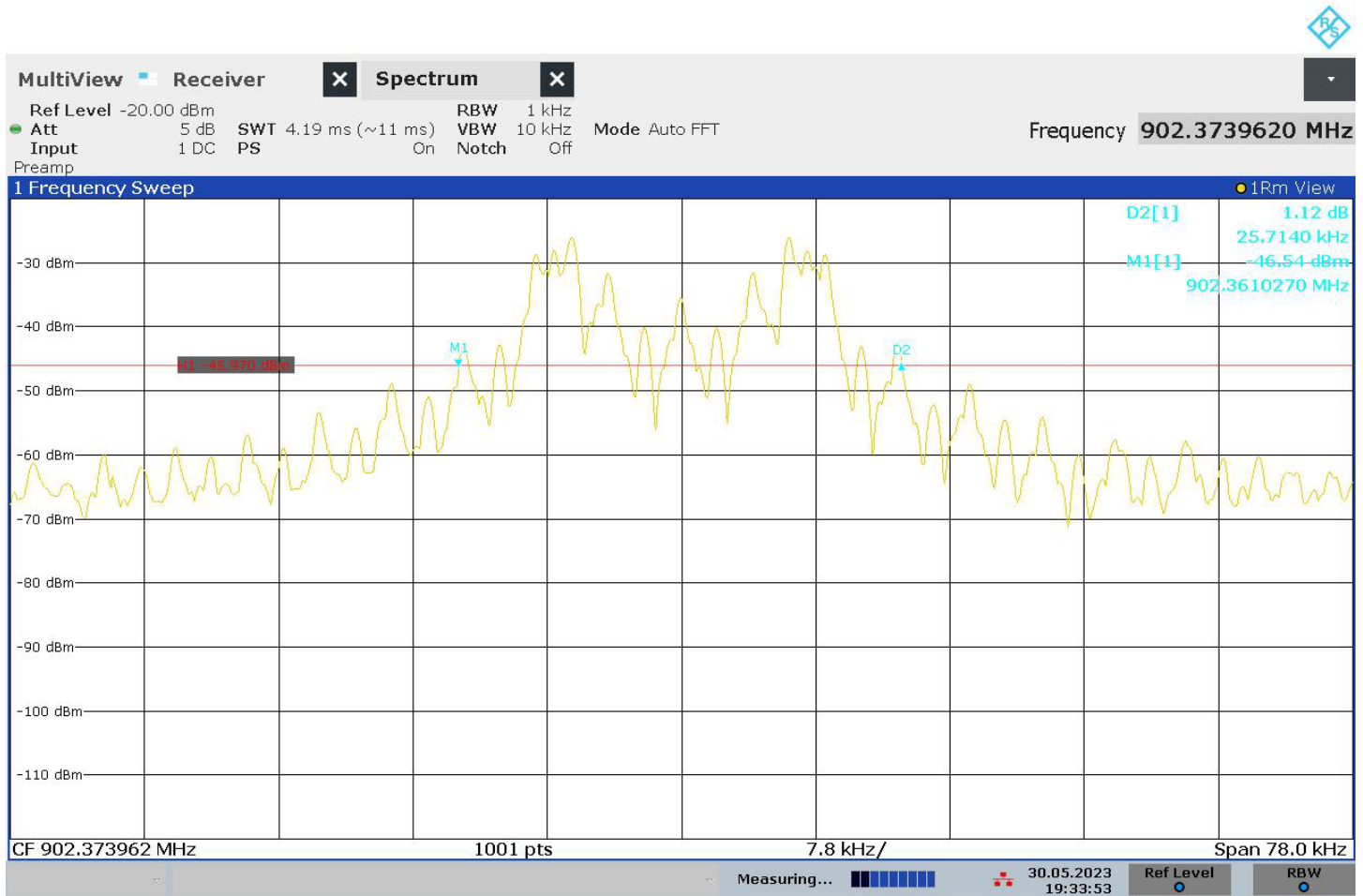
| Tuned Frequency (MHz) | Measured 99% BW (kHz) |
|-----------------------|-----------------------|
| 902 | 25.37 |

8.3.1 99% Bandwidth Plot, 902 MHz



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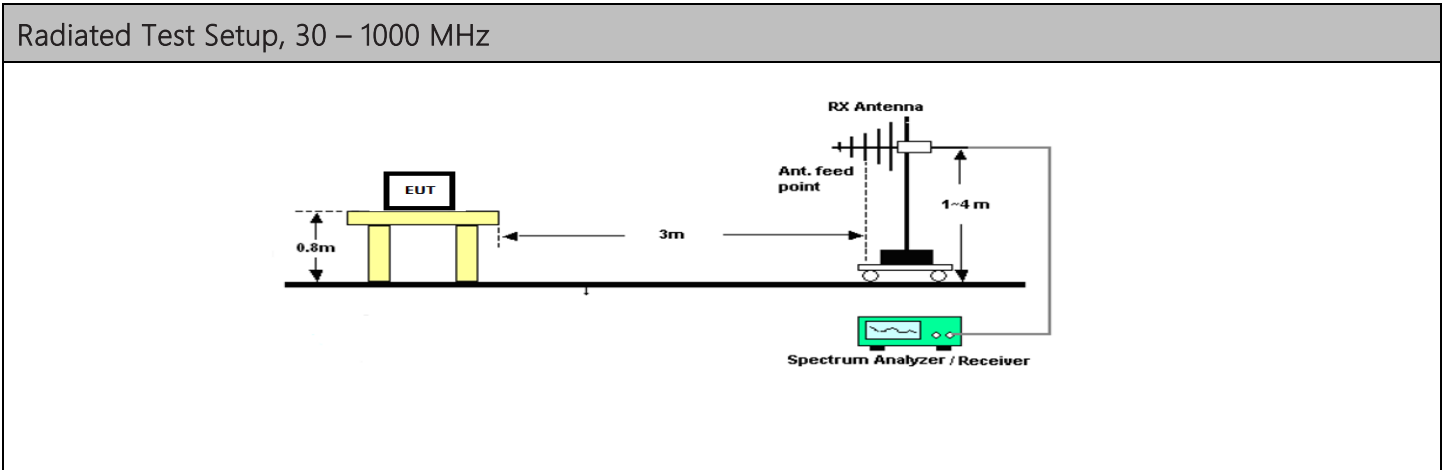
8.3.2 20 dB Measurement Plot, 902 MHz



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8.4 Field Strength of Fundamental

Limits from FCC 15.231 and test procedure from ANSI C63.10.



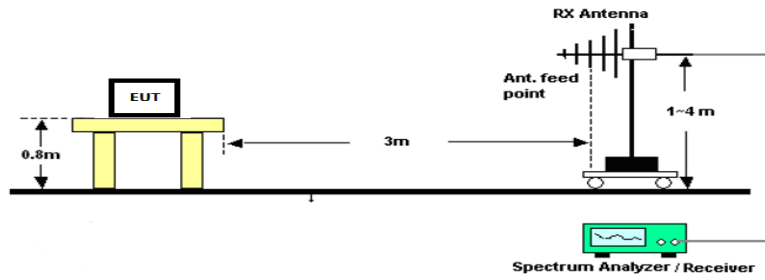
8.4.1 Field strength of fundamental

| Tuned Frequency (MHz) | Detector | Meter Reading (dBµV) | Antenna Polarity | Coax Loss (dB) | Duty Cycle Correction (dB) | Antenna Correction Factor (dB/m) | Distance (m) | Field Strength (dBµV/m) | 15.231 Fundamental Limit | Margin (dB) |
|-----------------------|----------|----------------------|------------------|----------------|----------------------------|----------------------------------|--------------|-------------------------|--------------------------|-------------|
| 902.00 | PK | 50.87 | H | 3.54 | -5.51 | 21.90 | 3.00 | 70.80 | 81.94 | 11.14 |
| 902.00 | PK | 49.83 | V | 3.54 | -5.51 | 21.90 | 3.00 | 69.76 | 81.94 | 12.18 |

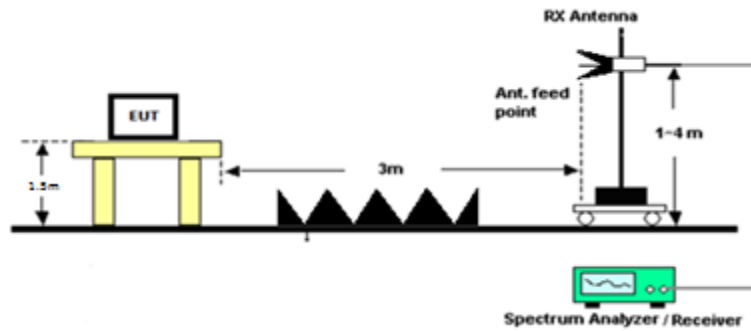
8.5 Radiated Emissions

Limits from FCC 15.209 and test procedure from ANSI C63.10.

Radiated Test Setup, 30 – 1000 MHz



Radiated Test Setup, Above 1000 MHz



Radiated Emissions, Tabular Data

8.5.1 Radiated Emissions Table

| Tuned Frequency (MHz) | Emission Frequency (MHz) | 15.205 Restricted Band | 15.205, 15.35, 15.247(d) Detector | Meter Reading (dBµV) | Antenna Polarity | Coax Loss (dB) | Duty Cycle Correction (dB) | Antenna Correction Factor (dB/m) | Distance (m) | Field Strength (dBµV/m) | 15.231 Spurious Limit (dBµV/m) | Margin (dB) |
|-----------------------|--------------------------|------------------------|-----------------------------------|----------------------|------------------|----------------|----------------------------|----------------------------------|--------------|-------------------------|--------------------------------|-------------|
| 902.00 | 1804.00 | | PK | 21.01 | H | 4.90 | -5.51 | 30.34 | 3.00 | 50.73 | 61.94 | 11.20 |
| 902.00 | 2706.00 | X | PK | 19.64 | H | 5.99 | -5.51 | 32.49 | 3.00 | 52.61 | 61.94 | 9.33 |
| 902.00 | 3608.00 | X | PK | 23.53 | H | 6.65 | -5.51 | 33.12 | 3.00 | 57.79 | 61.94 | 4.15 |
| 902.00 | 4510.00 | X | PK | 14.74 | H | 7.36 | -5.51 | 33.91 | 3.00 | 50.49 | 61.94 | 11.45 |
| 902.00 | 5412.00 | X | PK | 7.12 | H | 8.15 | -5.51 | 34.38 | 3.00 | 44.14 | 61.94 | 17.80 |
| 902.00 | 6314.00 | | PK | 4.13 | H | 8.60 | -5.51 | 35.39 | 3.00 | 42.60 | 61.94 | 19.34 |
| 902.00 | 7216.00 | | PK | 7.12 | H | 9.53 | -5.51 | 36.38 | 3.00 | 47.51 | 61.94 | 14.43 |
| 902.00 | 8118.00 | X | PK | 4.13 | H | 9.95 | -5.51 | 35.80 | 3.00 | 44.37 | 61.94 | 17.57 |
| 902.00 | 9020.00 | X | PK | 4.13 | H | 10.68 | -5.51 | 36.12 | 3.00 | 45.41 | 61.94 | 16.53 |
| 902.00 | 1804.00 | | PK | 4.13 | V | 4.90 | -5.51 | 30.34 | 3.00 | 33.85 | 61.94 | 28.08 |
| 902.00 | 2706.00 | X | PK | 4.13 | V | 5.99 | -5.51 | 32.49 | 3.00 | 37.10 | 61.94 | 24.84 |
| 902.00 | 3608.00 | X | PK | 4.13 | V | 6.65 | -5.51 | 33.12 | 3.00 | 38.39 | 61.94 | 23.55 |
| 902.00 | 4510.00 | X | PK | 4.13 | V | 7.36 | -5.51 | 33.91 | 3.00 | 39.88 | 61.94 | 22.06 |
| 902.00 | 5412.00 | X | PK | 4.13 | V | 8.15 | -5.51 | 34.38 | 3.00 | 41.15 | 61.94 | 20.79 |
| 902.00 | 6314.00 | | PK | 4.13 | V | 8.60 | -5.51 | 35.39 | 3.00 | 42.60 | 61.94 | 19.34 |
| 902.00 | 7216.00 | | PK | 4.13 | V | 9.53 | -5.51 | 36.38 | 3.00 | 44.52 | 61.94 | 17.42 |
| 902.00 | 8118.00 | X | PK | 4.13 | V | 9.95 | -5.51 | 35.80 | 3.00 | 44.37 | 61.94 | 17.57 |
| 902.00 | 9020.00 | X | PK | 4.13 | V | 10.68 | -5.51 | 36.12 | 3.00 | 45.41 | 61.94 | 16.53 |

9. ANNEX-A - Photographs of the EUT

Photographs of the EUT and any manufacturer supplied accessories to be used with the EUT are in a separate document.

10. ANNEX-B – Test Setup Photographs

Test setup photographs are located in a separate document.

11. History of Test Report Changes

| Test Report # | Revision # | Description | Date of Issue |
|------------------------|------------|---------------------------|---------------|
| TR_8169-23_FCC_15.231_ | 1 | Initial release | 1/4/2024 |
| | 2 | Updated section 8.1 & 8.2 | 4/16/2024 |
| | | | |

END OF TEST REPORT
