



RADIO TEST REPORT

FCC ID : 2A74O-8A7DD6
Equipment : Wi-Fi Halow Module
Brand Name : Morse Micro
Model Name : MM6108-MF08251
Applicant : Morse Micro Pty Ltd
Level 8, 10-14 Waterloo Street, Surry Hills, NSW 2010
Manufacturer : Morse Micro Pty Ltd
Level 8, 10-14 Waterloo Street, Surry Hills, NSW 2010
Standard : 47 CFR FCC Part 15.247

The product was received on Nov. 14, 2022, and testing was started from Dec. 07, 2022 and completed on Dec. 07, 2022. We, Sporton International Inc. Hsinchu Laboratory, would like to declare that the tested sample has been evaluated in accordance with the procedures given in ANSI C63.10-2013 and shown compliance with the applicable technical standards.

The test results in this variant report apply exclusively to the tested model / sample. Without written approval of Sporton International Inc. Hsinchu Laboratory, the test report shall not be reproduced except in full.


Approved by: Sam Chen

Sporton International Inc. Hsinchu Laboratory

No.8, Ln. 724, Bo'ai St., Zhubei City, Hsinchu County 302010, Taiwan (R.O.C.)



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TEL : 886-3-656-9065
FAX : 886-3-656-9085
Report Template No.: CB-A10_1 Ver1.3



Summary of Test Result

| Report Clause | Ref Std. Clause | Test Items | Result (PASS/FAIL) | Remark |
|---------------|-----------------|---|--------------------|--------|
| 1.1.2 | 15.203 | Antenna Requirement | PASS | - |
| 3.1 | 15.247(d) | Emissions in Restricted Frequency Bands | PASS | - |

Declaration of Conformity:

1. The test results with all measurement uncertainty excluded are presented in accordance with the regulation limits or requirements declared by manufacturers. It's means measurement values may risk exceeding the limit of regulation standards, if measurement uncertainty is include in test results.
2. The measurement uncertainty please refer to report "Measurement Uncertainty".

Comments and Explanations:

The declared of product specification for EUT presented in the report are provided by the manufacturer, and the manufacturer takes all the responsibilities for the accuracy of product specification.

Reviewed by: Sam Chen

Report Producer: Cathy Chiu



1 General Description

1.1 Information

1.1.1 RF General Information

| Frequency Range | Modulation | Ch. Frequency (MHz) | Channel Spacing (MHz) | Channel Number |
|-----------------|------------|---------------------|-----------------------|----------------|
| 902-928 MHz | OFDM | 903.5-927.5 | 1 | 25 |
| | | 905-927 | 2 | 12 |
| | | 906-926 | 4 | 6 |
| | | 908-924 | 8 | 3 |

| Band | Mode | BWch (MHz) | Nant |
|------------|---------|------------|------|
| 902-928MHz | OFDM_1M | 1 | 1TX |
| 902-928MHz | OFDM_2M | 2 | 1TX |
| 902-928MHz | OFDM_4M | 4 | 1TX |
| 902-928MHz | OFDM_8M | 8 | 1TX |

Note:

- ♦ 902-928 MHz Band uses a combination of OFDM modulation.
- ♦ BWch is the nominal channel bandwidth.

1.1.2 Antenna Information

| Ant. | Port | Brand | Model Name | Antenna Type | Connector | Gain (dBi) |
|------|------|-------------|------------|--------------|--------------|------------|
| 1 | 1 | PulseLarsen | W1063 | Dipole | Reversed-SMA | 1 |

Note: The above information was declared by manufacturer.



1.1.3 Mode Test Duty Cycle

| Mode | DC | DCF(dB) | T(s) | VBW(Hz) $\geq 1/T$ |
|---------|-------|---------|--------|--------------------|
| OFDM_1M | 0.897 | 0.47 | 3.403m | 300 |
| OFDM_2M | 0.798 | 0.98 | 1.563m | 1k |
| OFDM_4M | 0.696 | 1.57 | 880u | 3k |
| OFDM_8M | 0.596 | 2.25 | 562.5u | 3k |

Note:

- ♦ DC is Duty Cycle.
- ♦ DCF is Duty Cycle Factor.

1.1.4 EUT Operational Condition

| | | | |
|------------------------------|---|---|--|
| EUT Power Type | DC power from Adapter | | |
| Beamforming Function | <input type="checkbox"/> With beamforming | <input checked="" type="checkbox"/> Without beamforming | |
| Test Software Version | rf_tester.exe (v1.1) | | |

Note: The above information was declared by manufacturer.

1.1.5 Table for Permissive Change

This product is an extension of original one reported under Sporton project number: FR262109

Below is the table for the change of the product with respect to the original one.

| Modifications | Performance Checking |
|--|---|
| The transmit path adjustment and addition of some extra bypass caps. | Emissions in Restricted Frequency Bands below 1GHz. |

Note: This modification does not affect the RF relevant portion, so it's not necessary to evaluate Intentional test.



1.2 Applicable Standards

According to the specifications of the manufacturer, the EUT must comply with the requirements of the following standards:

- ♦ 47 CFR FCC Part 15.247
- ♦ ANSI C63.10-2013

The following reference test guidance is not within the scope of accreditation of TAF.

- ♦ FCC KDB 558074 D01 v05r02
- ♦ FCC KDB 414788 D01 v01r01

1.3 Testing Location Information

| Testing Location Information | | | | |
|--|--|--|--|--|
| Test Lab. : Sporton International Inc. Hsinchu Laboratory | | | | |
| Hsinchu ADD: No.8, Ln. 724, Bo'ai St., Zhubei City, Hsinchu County 302010, Taiwan (R.O.C.) | | | | |
| (TAF: 3787) TEL: 886-3-656-9065 FAX: 886-3-656-9085 | | | | |
| Test site Designation No. TW3787 with FCC. | | | | |
| Conformity Assessment Body Identifier (CABID) TW3787 with ISED | | | | |

| Test Condition | Test Site No. | Test Engineer | Test Environment (°C / %) | Test Date |
|-----------------------------------|---------------|---------------|------------------------------|---------------|
| Radiated Emissions Below 1 GHz | 03CH05-CB | Stim Sung | 24.2-25.3 / 56-59 | Dec. 07, 2022 |

1.4 Measurement Uncertainty

ISO/IEC 17025 requires that an estimate of the measurement uncertainties associated with the emissions test results be included in the report. The measurement uncertainties given below are based on a 95% confidence level (based on a coverage factor (k=2))

| Test Items | Uncertainty | Remark |
|--------------------------------------|-------------|--------------------------|
| Radiated Emission (9kHz ~ 30MHz) | 3.4 dB | Confidence levels of 95% |
| Radiated Emission (30MHz ~ 1,000MHz) | 5.6 dB | Confidence levels of 95% |



2 Test Configuration of EUT

2.1 The Worst Case Measurement Configuration

| The Worst Case Mode for Following Conformance Tests | |
|--|---|
| Tests Item | Emissions in Restricted Frequency Bands |
| Test Condition | Radiated measurement If EUT consist of multiple antenna assembly (multiple antenna are used in EUT regardless of spatial multiplexing MIMO configuration), the radiated test should be performed with highest antenna gain of each antenna type. |
| Operating Mode < 1GHz | CTX |
| The Y axis generated the worst case from the original report, so the measurement will follow this same test configuration. | |
| 1 | EUT in Y axis + Adapter |

Note: The Adapter is for measurement only, would not be marketed.

Adapter information as below:

| Power | Brand | Model |
|---------|-------------|---------------|
| Adapter | STONTRONICS | RPI-18PFCA-05 |

2.2 EUT Operation during Test

The EUT was programmed to be in continuously transmitting mode.

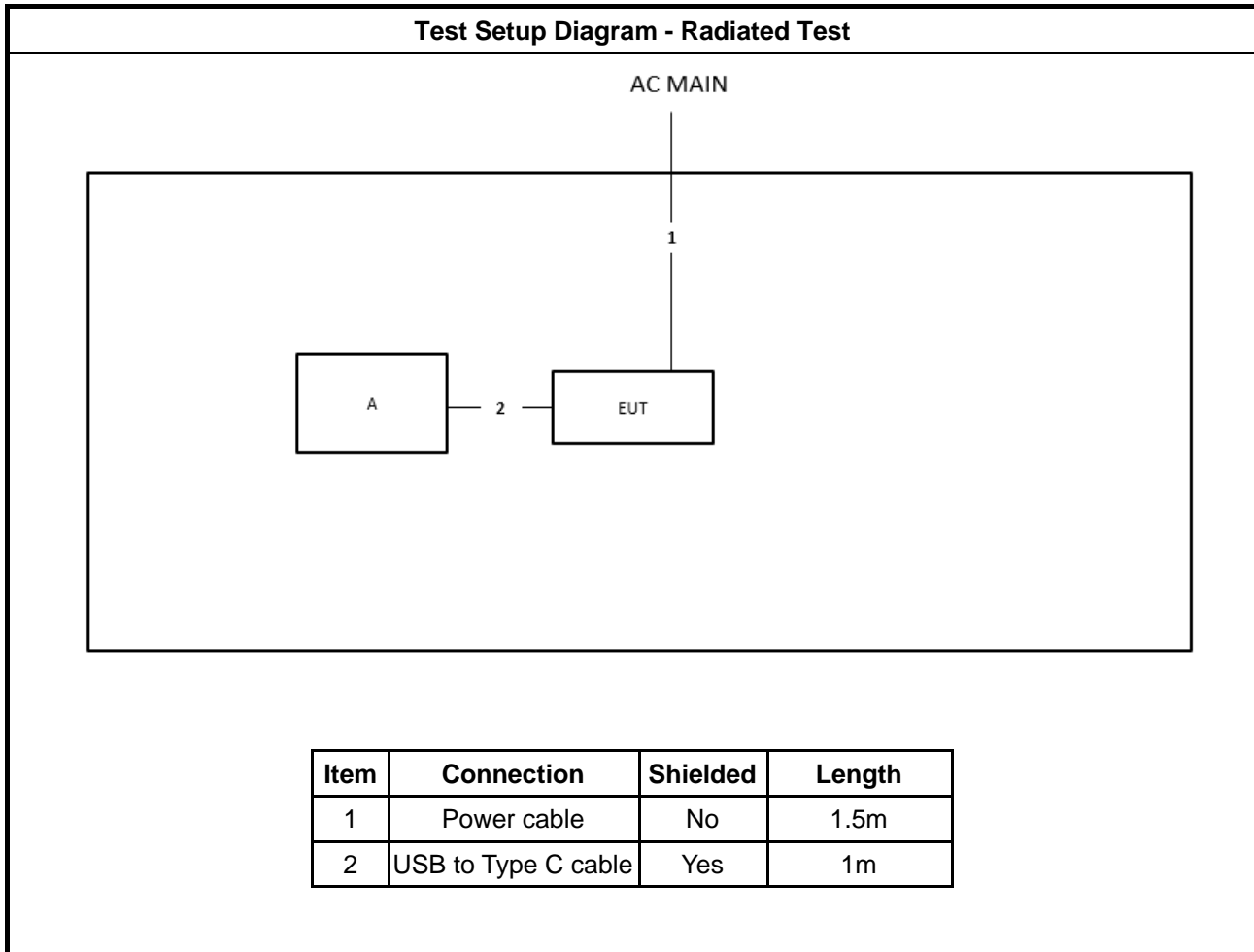
2.3 Accessories

N/A

2.4 Support Equipment

| Support Equipment | | | | |
|-------------------|-----------|------------|------------|--------|
| No. | Equipment | Brand Name | Model Name | FCC ID |
| A | Notebook | DELL | E4300 | N/A |

2.5 Test Setup Diagram





3 Transmitter Test Result

3.1 Emissions in Restricted Frequency Bands

3.1.1 Emissions in Restricted Frequency Bands Limit

| Restricted Band Emissions Limit | | | |
|---------------------------------|-----------------------|-------------------------|----------------------|
| Frequency Range (MHz) | Field Strength (uV/m) | Field Strength (dBuV/m) | Measure Distance (m) |
| 0.009~0.490 | 2400/F(kHz) | 48.5 - 13.8 | 300 |
| 0.490~1.705 | 24000/F(kHz) | 33.8 - 23 | 30 |
| 1.705~30.0 | 30 | 29 | 30 |
| 30~88 | 100 | 40 | 3 |
| 88~216 | 150 | 43.5 | 3 |
| 216~960 | 200 | 46 | 3 |
| Above 960 | 500 | 54 | 3 |

Note 1: Test distance for frequencies at or above 30 MHz, measurements may be performed at a distance other than the limit distance provided they are not performed in the near field and the emissions to be measured can be detected by the measurement equipment. When performing measurements at a distance other than that specified, the results shall be extrapolated to the specified distance using an extrapolation factor of 20 dB/decade (inverse of linear distance for field-strength measurements, inverse of linear distance-squared for power-density measurements).

Note 2: Test distance for frequencies at below 30 MHz, measurements may be performed at a distance closer than the EUT limit distance; however, an attempt should be made to avoid making measurements in the near field. When performing measurements below 30 MHz at a closer distance than the limit distance, the results shall be extrapolated to the specified distance by either making measurements at a minimum of two or more distances on at least one radial to determine the proper extrapolation factor or by using the square of an inverse linear distance extrapolation factor (40 dB/decade). The test report shall specify the extrapolation method used to determine compliance of the EUT.

Note 3: Using the distance of 1m during the test for above 18 GHz, and the test value to correct for the distance factor at 3m.

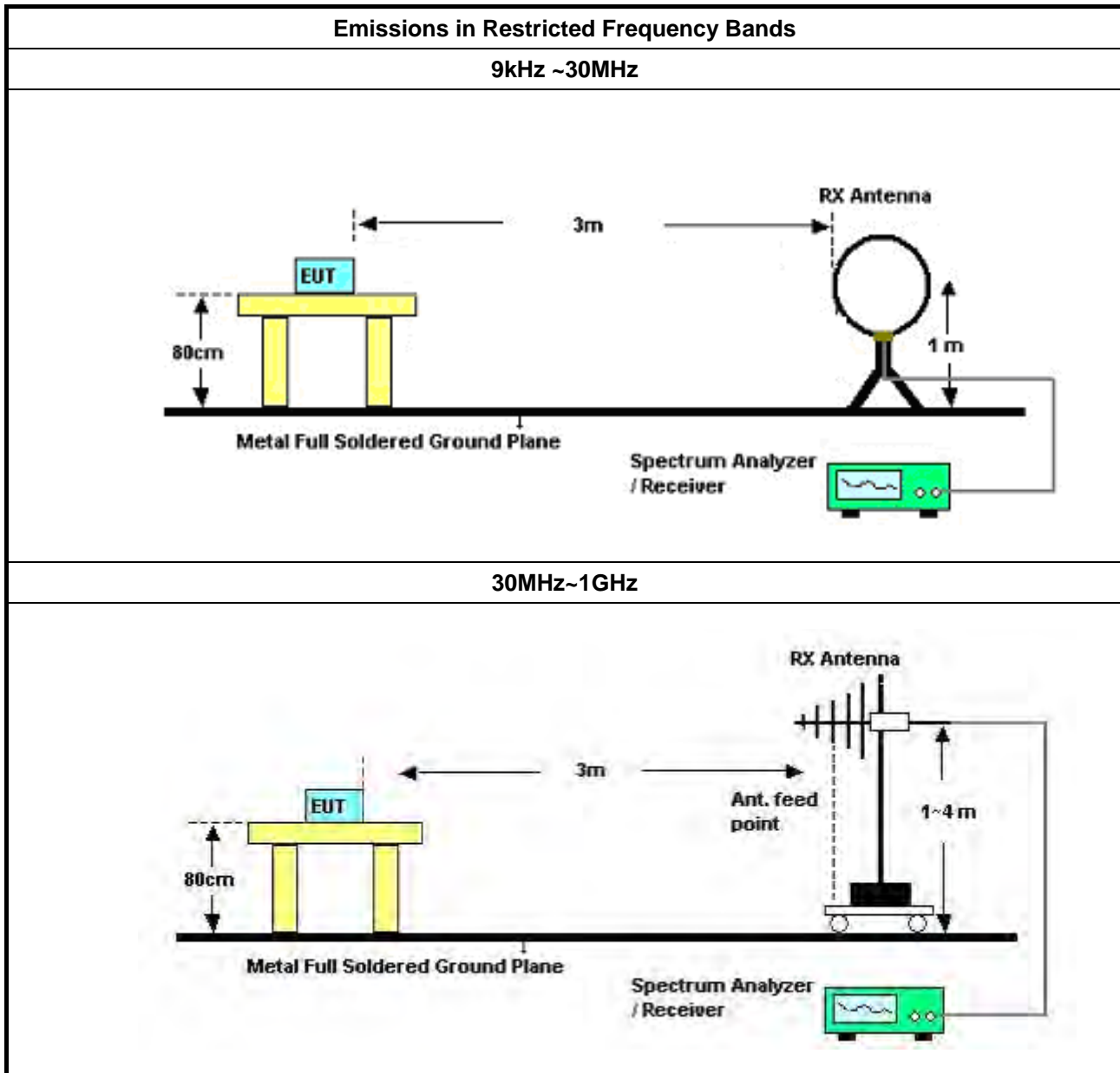
3.1.2 Measuring Instruments

Refer a test equipment and calibration data table in this test report.

**3.1.3 Test Procedures**

| Test Method | |
|---|--|
| ▪ The average emission levels shall be measured in [duty cycle ≥ 98 or duty factor]. | |
| ▪ Refer as ANSI C63.10, clause 6.10.3 band-edge testing shall be performed at the lowest frequency channel and highest frequency channel within the allowed operating band. | |
| ▪ For the transmitter unwanted emissions shall be measured using following options below: | |
| | ▪ Refer as FCC KDB 558074, clause 8.6 for unwanted emissions into restricted bands. |
| | <input type="checkbox"/> Refer as FCC KDB 558074, clause 8.6 & C63.10 clause 11.12.2.5.1(trace averaging for duty cycle $\geq 98\%$). |
| | <input type="checkbox"/> Refer as FCC KDB 558074, clause 8.6 & C63.10 clause 11.12.2.5.2(trace averaging + duty factor). |
| | <input checked="" type="checkbox"/> Refer as FCC KDB 558074, clause 8.6 & C63.10 clause 11.12.2.5.3(Reduced VBW $\geq 1/T$). |
| | <input type="checkbox"/> Refer as ANSI C63.10, clause 11.12.2.5.3 (Reduced VBW). VBW $\geq 1/T$, where T is pulse time. |
| | <input type="checkbox"/> Refer as ANSI C63.10, clause 7.5 average value of pulsed emissions. |
| | <input checked="" type="checkbox"/> Refer as FCC KDB 558074, clause 8.6 & C63.10 clause 11.12.2.4 measurement procedure peak limit. |
| ▪ For the transmitter band-edge emissions shall be measured using following options below: | |
| | ▪ Refer as FCC KDB 558074 clause 8.7 & c63.10 clause 11.13.1, When the performing peak or average radiated measurements, emissions within 2 MHz of the authorized band edge may be measured using the marker-delta method described below. |
| | ▪ Refer as FCC KDB 558074, clause 8.7 (ANSI C63.10, clause 6.10.6) for marker-delta method for band-edge measurements. |
| | ▪ Refer as FCC KDB 558074, clause 8.7 for narrower resolution bandwidth (100kHz) using the band power and summing the spectral levels (i.e., 1 MHz). |
| | ▪ For conducted unwanted emissions into restricted bands (absolute emission limits). Devices with multiple transmit chains using options given below: (1) Measure and sum the spectra across the outputs or (2) Measure and add 10 log(N) dB |
| | ▪ For FCC KDB 662911 The methodology described here may overestimate array gain, thereby resulting in apparent failures to satisfy the out-of-band limits even if the device is actually compliant. In such cases, compliance may be demonstrated by performing radiated tests around the frequencies at which the apparent failures occurred. |

3.1.4 Test Setup





3.1.5 Measurement Results Calculation

The measured Level is calculated using:

Corrected Reading: Antenna factor (AF) + Cable loss (CL) + Read level (Raw) - Preamp factor (PA)(if applicable) = Level.

3.1.6 Emissions in Restricted Frequency Bands (Below 30MHz)

There is a comparison data of both open-field test site and alternative test site - semi-Anechoic chamber according to KDB414788 Radiated Test Site, and the result came out very similar.

All amplitude of spurious emissions that are attenuated by more than 20 dB below the permissible value has no need to be reported.

The radiated emissions were investigated from 9 kHz or the lowest frequency generated within the device, up to the 10th harmonic or 40 GHz, whichever is appropriate.

3.1.7 Test Result of Emissions in Restricted Frequency Bands

Refer as Appendix A



4 Test Equipment and Calibration Data

| Instrument | Brand | Model No. | Serial No. | Characteristics | Calibration Date | Calibration Due Date | Remark |
|-----------------------------------|--------------|--------------------|------------------|-----------------|------------------|----------------------|-----------------------|
| Loop Antenna | Teseq | HLA 6120 | 24155 | 9kHz - 30 MHz | May 14, 2022 | May 13, 2023 | Radiation (03CH05-CB) |
| 3m Semi Anechoic Chamber NSA | TDK | SAC-3M | 03CH05-CB | 30 MHz ~ 1 GHz | Aug. 03, 2022 | Aug. 02, 2023 | Radiation (03CH05-CB) |
| Bilog Antenna with 6dB Attenuator | TESEQ & EMCI | CBL 6112D & N-6-06 | 35236 & AT-N0610 | 30MHz ~ 2GHz | Mar. 25, 2022 | Mar. 24, 2023 | Radiation (03CH05-CB) |
| Pre-Amplifier | EMCI | EMC330N | 980331 | 20MHz ~ 3GHz | Apr. 26, 2022 | Apr. 25, 2023 | Radiation (03CH05-CB) |
| Spectrum Analyzer | R&S | FSP40 | 100304 | 9kHz ~ 40GHz | Mar. 14, 2022 | Mar. 13, 2023 | Radiation (03CH05-CB) |
| EMI Test Receiver | R&S | ESCS | 826547/017 | 9kHz ~ 2.75GHz | Jun. 17, 2022 | Jun. 16, 2023 | Radiation (03CH05-CB) |
| RF Cable-low | Woken | RG402 | Low Cable-04+23 | 30MHz~1GHz | Oct. 03, 2022 | Oct. 02, 2023 | Radiation (03CH05-CB) |
| Test Software | SPORTON | SENSE | V5.10 | - | N.C.R. | N.C.R. | Radiation (03CH05-CB) |

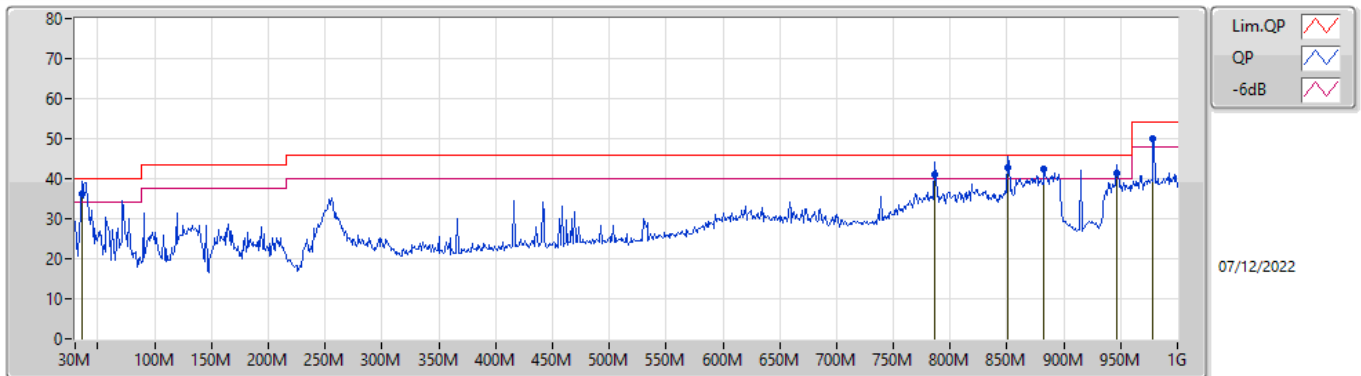
Note: Calibration Interval of instruments listed above is one year.

NCR means Non-Calibration required.

Summary

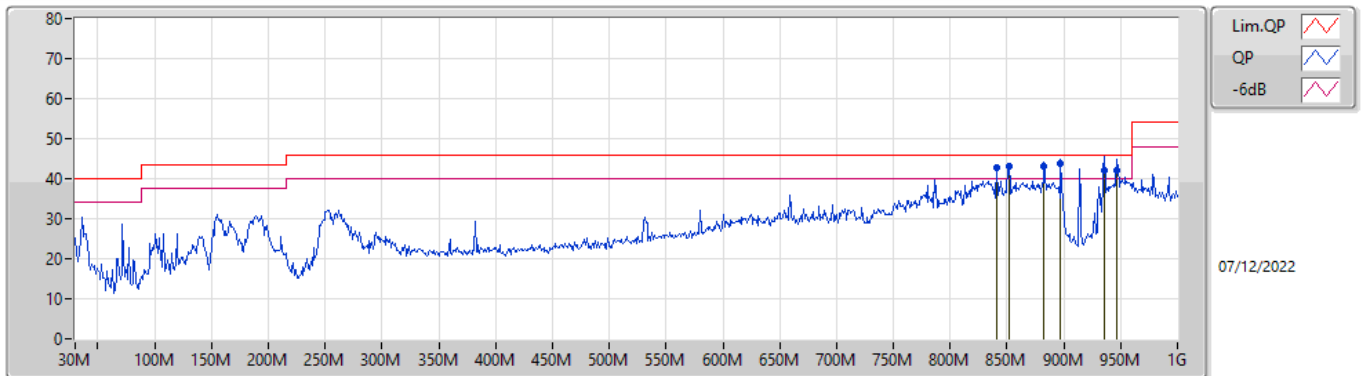
| Mode | Result | Type | Freq (Hz) | Level (dBuV/m) | Limit (dBuV/m) | Margin (dB) | Condition |
|--------|--------|------|--------------|-------------------|-------------------|----------------|------------|
| Mode 1 | Pass | QP | 897.18M | 43.67 | 46.00 | -2.33 | Horizontal |

Mode 1



| Type | Freq (Hz) | Level (dBuV/m) | Limit (dBuV/m) | Margin (dB) | Factor (dB/m) | Dist (m) | Condition | Azimuth (°) | Height (m) | Comment | Raw (dBuV/m) | AF (dB/m) | CL (dB) | PA (dB) |
|------|--------------|-------------------|-------------------|----------------|------------------|-------------|-----------|----------------|---------------|---------|-----------------|--------------|------------|------------|
| QP | 35.82M | 36.18 | 40.00 | -3.82 | -10.26 | 3 | Vertical | 140 | 1.00 | - | 46.44 | 20.92 | 0.52 | 31.70 |
| QP | 786.6M | 41.02 | 46.00 | -4.98 | -3.14 | 3 | Vertical | 205 | 1.25 | - | 44.16 | 25.50 | 3.90 | 32.54 |
| QP | 850.62M | 42.86 | 46.00 | -3.14 | -2.58 | 3 | Vertical | 0 | 1.00 | "Worst" | 45.44 | 25.88 | 4.03 | 32.49 |
| PK | 882.63M | 42.30 | 46.00 | -3.70 | -2.30 | 3 | Vertical | 0 | 1.50 | - | 44.60 | 26.08 | 4.11 | 32.49 |
| PK | 946.65M | 41.36 | 46.00 | -4.64 | -1.73 | 3 | Vertical | 29 | 2.00 | - | 43.09 | 26.44 | 4.31 | 32.48 |
| PK | 978.66M | 49.85 | 54.00 | -4.15 | -1.16 | 3 | Vertical | 29 | 2.00 | - | 51.01 | 26.88 | 4.36 | 32.40 |

Mode 1



| Type | Freq (Hz) | Level (dBuV/m) | Limit (dBuV/m) | Margin (dB) | Factor (dB/m) | Dist (m) | Condition | Azimuth (°) | Height (m) | Comment | Raw (dBuV/m) | AF (dB/m) | CL (dB) | PA (dB) |
|------|--------------|-------------------|-------------------|----------------|------------------|-------------|------------|----------------|---------------|---------|-----------------|--------------|------------|------------|
| PK | 840.92M | 42.80 | 46.00 | -3.20 | -2.66 | 3 | Horizontal | 278 | 1.50 | - | 45.46 | 25.81 | 4.02 | 32.49 |
| PK | 851.59M | 42.98 | 46.00 | -3.02 | -2.57 | 3 | Horizontal | 60 | 1.50 | - | 45.55 | 25.89 | 4.03 | 32.49 |
| QP | 882.63M | 43.23 | 46.00 | -2.77 | -2.30 | 3 | Horizontal | 81 | 1.50 | - | 45.53 | 26.08 | 4.11 | 32.49 |
| QP | 897.18M | 43.67 | 46.00 | -2.33 | -2.14 | 3 | Horizontal | 262 | 1.50 | "Worst" | 45.81 | 26.20 | 4.15 | 32.49 |
| QP | 935.98M | 42.18 | 46.00 | -3.82 | -1.87 | 3 | Horizontal | 286 | 2.00 | - | 44.05 | 26.33 | 4.28 | 32.48 |
| QP | 946.65M | 41.98 | 46.00 | -4.02 | -1.73 | 3 | Horizontal | 89 | 2.00 | - | 43.71 | 26.44 | 4.31 | 32.48 |