



Electromagnetic Compatibility Test Report

**Tests Performed on an rf IDEas, Inc.
WAVE ID Mobile SP, RFID Reader**

Model: OEM-805N14KU-V3

Radiometrics Document RP-9841-FCC



| | | |
|---|-------------------|---|
| Product Detail: | | |
| FCC ID: M9MFPA0100 | | |
| IC: 6571A-FPA0100 | | |
| Equipment type: Dual Frequency Card Reader | | |
| Test Standards: | | |
| US CFR Title 47, Chapter I, FCC Part 15 Subpart C | | |
| FCC Part 15 CFR Title 47: 2023 | | |
| Canada ISED; RSS-210, Issue 10: 2019 as required for Category I Equipment | | |
| FCC Part 15.209 & 15.225 | | |
| This report concerns a Class II Permissive Change | | |
| Tests Performed For: | | Test Facility: |
| rf IDEas, Inc. 425 Martingale Rd., Ste. 1680 Schaumburg, IL 60173 | | Radiometrics Midwest Corporation 12 Devonwood Avenue Romeoville, IL 60446 |
| Test Completion Date: | | |
| November 1, 2023 | | |
| Document RP-9841-FCC Revisions: | | |
| Rev. | Issue Date | Revised By |
| 0 | November 22, 2023 | |
| | | |
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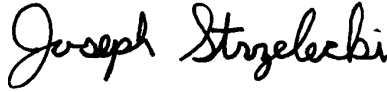
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1.0 ADMINISTRATIVE DATA

| | |
|---|---|
| <i>Equipment Under Test:</i> An rf IDEas, Inc., Wave ID Mobile SP, Dual Frequency RFID Reader Model: OEM-805N14KU-V3 This will be referred to as the EUT in this Report | |
| <i>Date EUT Received at Radiometrics:</i> June 15, 2023 | <i>Test Date(s):</i> October 25 to November 1, 2023 |
| <i>Test Report Written and Authorized by:</i>  11/22/2023 Joseph Strzelecki Senior EMC Engineer NARTE EMC-000877-NE | <i>Radiometrics' Personnel Responsible for Test:</i> Joseph Strzelecki Senior EMC Engineer Richard L. Tichgelaar EMC Technician Chris E. D'Alessio EMC Technician |
| <i>Test Witnessed By:</i> The tests were partially witnessed by Shiung Lo of rf IDEas, Inc. | |

2.0 TEST SUMMARY AND RESULTS

The EUT (Equipment Under Test) is a Wave ID Mobile SP RFID Reader, manufactured by rf IDEas, Inc. The detailed test results are presented in a separate section. The following is a summary of the test results.

Emissions Tests Results per RSS-210 & FCC Part 15

| Environmental Phenomena | Frequency Range | Test Result |
|---------------------------------------|---------------------|-------------|
| RF Radiated Emissions | 30-1000 MHz | Pass |
| Conducted Emissions, AC Mains | 0.15 - 30 MHz | Pass |
| RF Radiated Emissions H-Field | 0.009 – 30 MHz | Pass |
| Occupied Bandwidth | 125 kHz & 13.56 MHz | Pass |
| Frequency Stability vs Temp & Voltage | None | Note 1 |

The Frequency Stability test was not repeated, since the frequency determining circuitry was not changed. It fully complied in the original submittal.

Since the 13.56 MHz fundamental signal met the general limits of 15.209 and RSS-GEN section 8.9, the following tests are not required:

1. Mask compliance of FCC 15.225 b), c), d) and RSS-210 Annex B6. It met the requirements of the most stringent general limits.

2.1 RF Exposure Compliance Requirements

Since the effective power output is less than 1 mW, the EUT meets the FCC requirement for RF exposure and is exempt from RSS-102. There are no power level adjustments, and the antenna is permanently attached. The detailed calculations for RF Exposure are presented in a separate document.



3.0 EQUIPMENT UNDER TEST (EUT) DETAILS

3.1 EUT Description

The EUT is a WAVE ID Mobile SP, Dual Frequency, RFID Reader, Model OEM-805N14KU-V3, manufactured by rf IDEas, Inc. The EUT were in good working condition during the tests, with no known defects.

3.1.1 FCC Section 15.203 & RSS-GEN Antenna Requirements

The products will not be sold to the general public. rf IDEas or the OEM will be responsible to ensure the proper installation in accordance with rf IDEas' requirements.

These two antennas have a unique interface connector to ensure no other OEM antennas can be used. The antenna is internal to the EUT, and it is not readily available to be modified by the end user.

3.2 Related Submittals

rf IDEas, Inc. is not submitting any other products simultaneously for equipment authorization related to the EUT.

4.0 TESTED SYSTEM DETAILS

4.1 Tested System Configuration

The system was configured for testing in a typical fashion. The EUT was placed on an 80-cm high, nonconductive test stand. The testing was performed in conditions as close as possible to installed conditions. The wiring was consistent with the manufacturer's recommendations. Power was supplied at 115 VAC, 60 Hz single-phase to the host computer. The EUT was powered from the USB. The identification for all equipment, plus descriptions of all cables used in the tested system, are:

Tested System Configuration List

| Item | Description | Type* | Manufacturer | Model Number | Serial Number |
|------|---------------------------|-------|--------------|-----------------|---------------|
| 1 | RFID Reader | E | rf IDEas | OEM-805N14KU-V3 | WP02000028 |
| 2 | Latitude Laptop PC | H | HP | Elite x2 | 5CG545482P |
| 3 | Laptop AC-DC power supply | P | HP | 854055-002 | None |

* Type: E = EUT, P = Peripheral, S = Support Equipment; H = Host Computer

List of Cables

| QTY | Length (m) | Cable Description | Shielded? |
|-----|------------|--|-----------|
| 1 | 1.8 | USB Cable from Reader to Host computer | Yes |
| 1 | 1.2 | AC Cord to AC-DC power supply to host computer | No |
| 1 | 1.5 | DC Cord to Computer | No |

4.2 Special Accessories

No special accessories were used during the tests in order to achieve compliance.



4.3 Equipment Modifications

No modifications were made at Radiometrics in order to meet the requirements listed in this report.

4.4 Description of Permissive Change

The changes are as follows:

The micro controller processor used in the current models has reached the end-of-life cycle for IC designated at U4. The current IC part number and marking will change from SIM3U166-B-GM to STM32G473CCU6, now designated at U200. An additional Model number, OEM-805N14KU-V3 has been added to the product family.

The new microcontroller processor IC is not pin for pin compatible, therefore requiring a new PCB. The PCB has changed from PCB-1080-03N to PCB-1133-01N.

The function of the readers is the same in all versions of the products. The new microcontroller has the same exact function as the old chip. The form, fit, and function of the product remains identical. No change in radio parameters has occurred. The clocks, tuning circuits, antennas, RF power and modulation remained unchanged. The integrated circuits and components generating the 13.56 MHz and 125 kHz signals have not changed.

5.0 TEST SPECIFICATIONS

| Document | Date | Title |
|---------------------|------|---|
| FCC CFR Title 47 | 2023 | Code of Federal Regulations Title 47, Chapter 1, Federal Communications Commission, Part 15 - Radio Frequency Devices |
| IC RSS-210 Issue 10 | 2019 | Low Power Licence-Exempt Radiocommunication Devices (All Frequency Bands) Category I Equipment |
| IC RSS-Gen Issue 5 | 2019 | General Requirements and Information for the Certification of Radiocommunication Equipment (RSS-Gen) |

6.0 TEST PROCEDURE DOCUMENTS

The tests were performed using the procedures from the following specifications:

| Document | Date | Title |
|------------------|------|--|
| ANSI C63.4-2014 | 2014 | Methods of Measurement of Radio Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz |
| ANSI C63.10-2013 | 2013 | American National Standard for Testing Unlicensed Wireless Devices |

7.0 RADIOMETRICS' TEST FACILITIES

The results of these tests were obtained at Radiometrics Midwest Corp. in Romeoville, Illinois, USA. Radiometrics is accredited by A2LA (American Association for Laboratory Accreditation) to conform to ISO/IEC 17025: 2017 "General Requirements for the Competence of Calibration and Testing Laboratories". Radiometrics' Lab Code is 121191 and Certification Number is 1495.01. Radiometrics' scope of accreditation includes all of the test methods listed herein. A copy of the accreditation can be accessed on our web site (www.radiomet.com). Radiometrics accreditation status can be verified at A2LA's web site (www.a2la2.org).



The following is a list of shielded enclosures located in Romeoville, Illinois used during the tests:

Chamber E: Is a custom-made anechoic chamber that measures 52' L X 30' W X 18' H. The walls and ceiling are fully lined with RF absorber. Pro-shield of Collinsville, Oklahoma manufactured the chamber.

Test Station F: Is an area that measures 10' D X 12' W X 10' H. The floor and back wall are metal shielded. This area is used for conducted emissions measurements.

A separate ten-foot long, brass plated, steel ground rod attached via a 6-inch copper braid grounds each of the above chambers. Each enclosure is also equipped with low-pass power line filters.

The FCC has accepted these sites as test site number US1065. The FCC test site Registration Number is 732175. Details of the site characteristics are on file with the Industry Canada as site number 3124A with a CAB ID US0224.

A complete list of the test equipment is provided herein. The calibration due dates are indicated on the equipment list. The equipment is calibrated in accordance with ANSI/NCSL Z540-1, with traceability to the National Institute of Standards and Technology (NIST).

8.0 DEVIATIONS AND EXCLUSIONS FROM THE TEST SPECIFICATIONS

There were no deviations or exclusions from the test specifications.

9.0 CERTIFICATION

Radiometrics Midwest Corporation certifies that the data contained herein was taken under conditions that meet or exceed the requirements of the test specification. The results relate only to the EUT listed herein. Any modifications made to the EUT subsequent to the indicated test date will invalidate the data and void this certification.

10.0 TEST EQUIPMENT TABLE

| RMC ID | Manufacturer | Description | Model No. | Serial No. | Frequency Range | Cal Period | Cal Date |
|--------|----------------|-------------------|--------------|------------|-----------------|------------|----------|
| ANT-53 | EMCO | Loop Antenna | 6507 | 1453 | 1 kHz-30 MHz | 24 Mo | 03/10/22 |
| ANT-68 | EMCO | Log-Periodic Ant. | 93146 | 9604-4456 | 200-1000MHz | 24 Mo. | 02/07/22 |
| ANT-80 | AH Systems | Bicon Antenna | SAS-540 | 294 | 20-330MHz | 24 Mo. | 01/26/23 |
| HPF-01 | Solar | High Pass Filter | 7930-100 | HPF-1 | 0.15-30MHz | 24 Mo. | 03/07/22 |
| LSN-01 | Electrometrics | 50 uH LISN | FCC/VDE 50/2 | 1001 | 0.01-30MHz | 24 Mo. | 12/05/22 |
| REC-11 | Agilent | Spectrum Analyzer | E7405A | US39110103 | 9kHz-3GHz | 24 Mo. | 05/05/22 |
| REC-21 | Agilent | Spectrum Analyzer | E7405A | MY45118341 | 9kHz-26.5GHz | 24 Mo. | 02/24/22 |
| REC-31 | Agilent | Spectrum Analyzer | E7402A | US41160415 | 9kHz-3GHz | 24 Mo. | 06/23/23 |
| REC-43 | Adventest | Spectrum Analyzer | U3772 | 150800305 | 9Hz-43GHz | 24 Mo. | 07/13/21 |
| TMP-01 | Fluke | Temperature meter | 80T-150UA | 38280311 | N/A | 24 Mo. | 06/07/21 |

Note: All calibrated equipment is subject to periodic checks.

| Software Company | Test Software Name | Version | Applicable Tests |
|------------------|--------------------|----------|---|
| Radiometrics | EN550XX0 | 07.22.22 | RF Conducted Emissions (FCC Part 15 & EN 55032) |
| Radiometrics | REREC11D | | RF Radiated Emissions (FCC Part 15 & EN 55032) |
| Agilent | PSA/ESA-E/L/EMC | 2.4.0.42 | Bandwidth and screen shots |



11.0 TEST SECTIONS

11.1 AC Conducted Emissions

The tests and limits are in accordance with FCC section 15.207 and RSS Gen section 8.8.

A computer-controlled analyzer was used to perform the conducted emissions measurements. The computer recorded the data and then plotted it on a semi-log graph. Adjusting the positions of the cables and orientation of the test system then maximizes the highest emissions.

Mains Conducted emission measurements were performed using a 50 Ohm/50 uH Line Impedance Stabilization Network (LISN) as the pick-up device. Measurements were repeated on both leads within the power cord. If the EUT power cord exceeded 80 cm in length, the excess length of the power cord was made into a 30 to 40 cm bundle near the center of the cord. The LISN was placed on the floor at the base of the test platform and electrically bonded to the ground plane.

FCC/IC Limits of Conducted Emissions at the AC Mains Ports

| Frequency Range (MHz) | Class B Limits (dBuV) | |
|-----------------------|-----------------------|---------|
| | Quasi-Peak | Average |
| 0.150 - 0.50* | 66 - 56 | 56 - 46 |
| 0.5 – 5.0 | 56 | 46 |
| 5.0 - 30 | 60 | 50 |

* The limit decreases linearly with the logarithm of the frequency in this range.

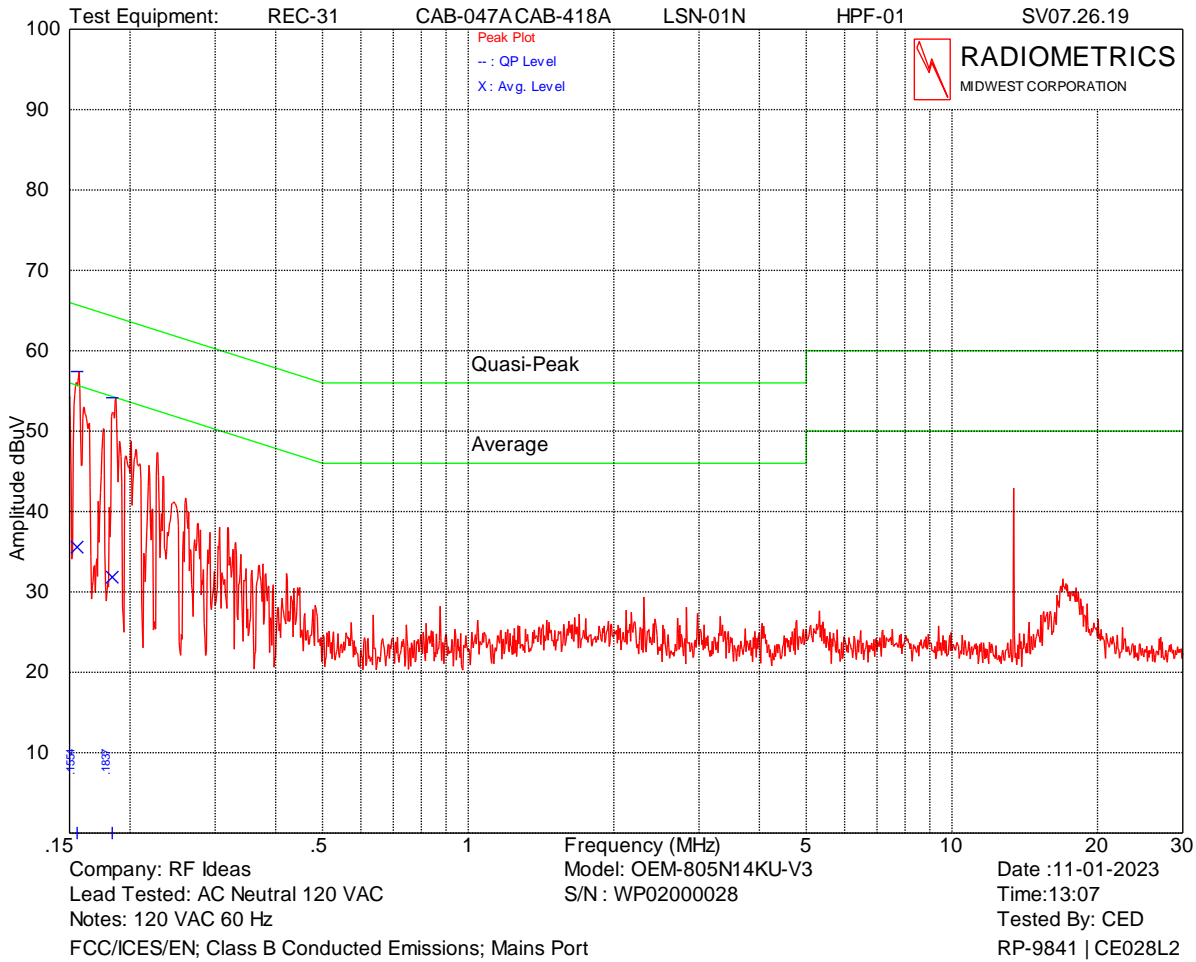
The initial step in collecting conducted data is a peak detector scan and the plotting of the measurement range. Significant peaks are then marked as shown on the following table, and these signals are then measured with the quasi-peak detector. The following represents the worst case emissions from the host computer (with the EUT connected) power cord, after testing all modes of operation. QP readings are quasi-peak with a 9 kHz bandwidth and no video filter.



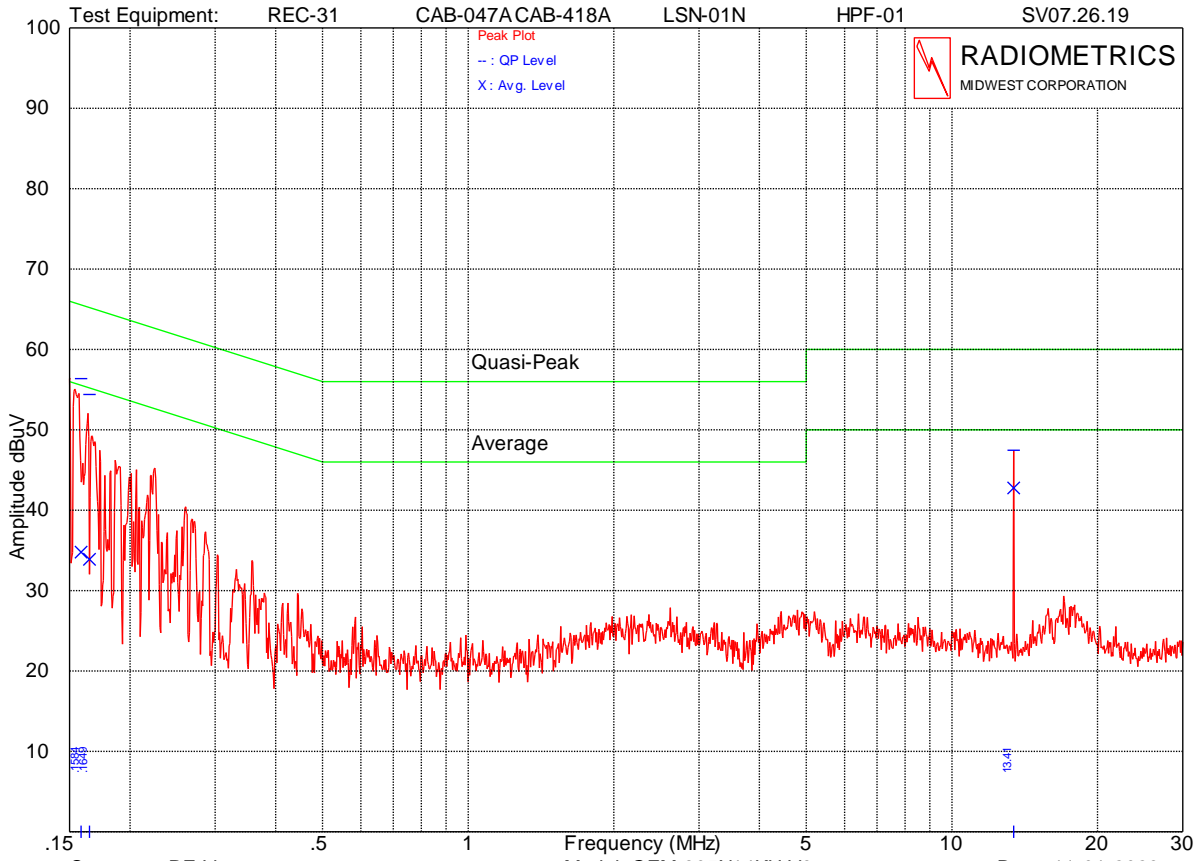
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|------------|-----------------|
| Tested by | Chris D'Alessio |
| Test Dates | 11/01/2023 |

The following shows the worst case from the 125 & 13.56 MHz transmitters.
 The Limit shown in the graphs are the FCC 15.107 and RSS-GEN Table 3.

Model OEM-805N14KU-V3



| Frequency (MHz) | Peak Amp. (dBuV) | QP Limit (dBuV) | Average Amp. (dBuV) | Average Limit (dBuV) | Margin Under Limit (dB) |
|-----------------|------------------|-----------------|---------------------|----------------------|-------------------------|
| 0.155 | 57.4 P | 65.7 | 35.6 | 55.7 | 8.3 |
| 0.184 | 54.2 P | 64.3 | 31.8 | 54.3 | 10.2 |



Company: RF Ideas
 Lead Tested: AC Neutral 120 VAC
 Notes: 120 VAC 60 Hz
 FCC/ICES/EN; Class B Conducted Emissions; Mains Port

Model: OEM-805N14KU-V3
 S/N : WP02000028

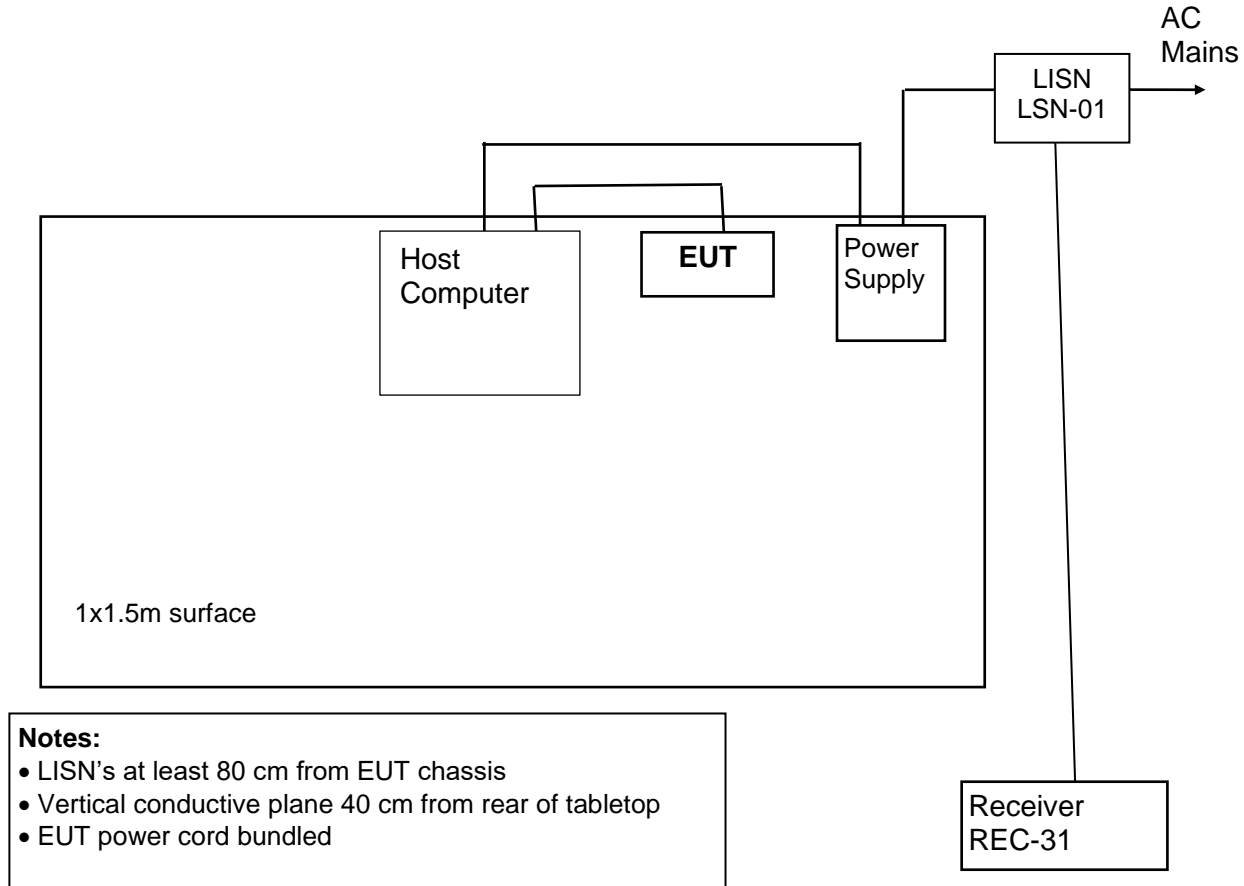
Date :11-01-2023
 Time:13:03
 Tested By: CED
 RP-9841 | CE028L1

| Frequency (MHz) | Peak Amp. (dBuV) | QP Limit (dBuV) | Average Amp. (dBuV) | Average Limit (dBuV) | Margin Under Limit (dB) |
|-----------------|------------------|-----------------|---------------------|----------------------|-------------------------|
| 0.158 | 56.4 P | 65.5 | 34.8 | 55.5 | 9.2 |
| 0.165 | 54.4 P | 65.2 | 33.9 | 55.2 | 10.8 |
| 13.414 | 47.5 P | 60.0 | 42.1 | 50.0 | 7.9 |

Judgement Pass by at least 7.9 dB.



Figure 1. Conducted Emissions Test Setup



11.2 Radiated RF Emissions

Radiated emission measurements were performed with linearly polarized broadband antennas. The results obtained with these antennas can be correlated with results obtained with a tuned dipole antenna. The radiated emission measurements were performed with a spectrum analyzer. The bandwidth used from 150 kHz to 30 MHz is 9 or 10 kHz and the bandwidth from 30 MHz to 1000 MHz is 100 or 120 kHz. Above 1 GHz, a 1 MHz bandwidth is used. A 10 dB linearity check is performed prior to start of testing in order to determine if an overload condition exists. Figure 4 herein lists the details of the test equipment used during radiated emissions tests.

Final radiated emissions measurements were performed inside of an anechoic chamber at a test distance of 3 meters. The anechoic chamber is designated as Chamber E. This Chamber meets the Site Attenuation requirements of ANSI C63.4 and CISPR 16-1. Chamber E is located at 12 Devonwood Ave. Romeoville, Illinois EMI test lab.

The entire frequency range from 30 to 1000 MHz was slowly scanned with particular attention paid to those frequency ranges which appeared high. Measurements were performed using two antenna polarizations, (vertical and horizontal). The worst case emissions were recorded. All measurements may be performed using either the peak, average or quasi-peak detector functions. If the peak detector data exceeds or is marginally close to the limits, the measurements are repeated using a quasi-peak detector or average function as required by the specification for final determination of compliance.



The detected emission levels were maximized by rotating the EUT, adjusting the positions of all cables, and by scanning the measurement antenna from 1 to 4 meters above the ground. The EUT was rotated through three orthogonal axes as per 5.10.1 of ANSI C63.10 during the radiated tests.

Radiated Emissions Field Strength Limits

| Frequency Range (MHz) | Test Distance (meters) | Class B Limits | |
|-----------------------|------------------------|----------------|-------------------|
| | | uV/m | dB(uV/m) |
| 0.009-0.490 | 300 | 2400/F(kHz) | 20*LOG(2400/kHz) |
| 0.490-1.705 | 30 | 24000/F(kHz) | 20*LOG(24000/kHz) |
| 1.705-30.0 | 30 | 30 | 29.5 |
| 30 - 88 | 3 | 100 | 40.0 |
| 88 - 216 | 3 | 150 | 43.5 |
| 216 - 960 | 3 | 200 | 46.0 |
| Above 960 | 3 | 500 | 54.0 |

The emission limits shown in the above table are based on measurements using a CISPR quasi-peak detector except for the frequency bands 9-90 kHz, 110-490 kHz and above 1000 MHz. Radiated emission limits in these three bands are based on measurements employing an average detector.

11.2.1 Field Strength Calculation

The field strength is calculated by adding the Antenna Factor and Cable Loss, and by subtracting the Amplifier Gain from the measured reading. The basic equation is as follows:

$$FS = RA + AF + CF - AG$$

Where: FS = Field Strength

RA = Receiver Amplitude in dBuV

AF = Antenna Factor in dB/m

CF = Cable Attenuation Factor in dB

AG = Amplifier Gain in dB



11.2.2 Radiated Emissions Test Results

| | |
|---------------|--|
| Test Dates | 10/25/2023 |
| Test Distance | 3 Meters |
| Specification | FCC Part 15 Subpart C & RSS-210 |
| Abbreviations | P = peak; Q = QP Pol = Antenna Polarization; V = Vertical; H = Horizontal |
| Tested by | Chris D'Alessio |
| Note | The following shows the worst case emissions from all transmitters and digital devices. The 125 kHz and the 13.56 MHz transmitter were both on during the following tests. |

| | |
|-----|---------------------------------|
| EUT | OEM-805N14KU-V3; S/N WPO2000028 |
|-----|---------------------------------|

| Freq. MHz | Meter Reading dBuV | Dect. | Ant. Pol. | Antenna Factor (dB/m) | Cable Loss (dB) | Distance Factor (dB) | EUT (dBuV/m) | Limit (dBuV/m) | Margin Under Limit (dB) |
|-----------|--------------------|-------|-----------|-----------------------|-----------------|----------------------|--------------|----------------|-------------------------|
| 35.3 | 15.3 | P | H | 11.8 | 0.6 | 0.0 | 27.7 | 40.0 | 12.3 |
| 51.2 | 11.6 | P | H | 9.3 | 0.8 | 0.0 | 21.7 | 40.0 | 18.3 |
| 65.4 | 9.8 | P | H | 9.0 | 0.8 | 0.0 | 19.6 | 40.0 | 20.4 |
| 75.6 | 13.0 | P | H | 9.0 | 0.9 | 0.0 | 22.9 | 40.0 | 17.1 |
| 79.1 | 10.1 | P | H | 9.2 | 1.0 | 0.0 | 20.3 | 40.0 | 19.7 |
| 95.9 | 14.1 | P | H | 9.9 | 1.1 | 0.0 | 25.1 | 43.5 | 18.4 |
| 102.1 | 13.5 | P | H | 10.3 | 1.1 | 0.0 | 24.9 | 43.5 | 18.6 |
| 116.7 | 12.7 | P | H | 11.3 | 1.2 | 0.0 | 25.2 | 43.5 | 18.3 |
| 122.0 | 12.8 | P | H | 11.6 | 1.2 | 0.0 | 25.6 | 43.5 | 17.9 |
| 132.0 | 15.9 | P | H | 12.1 | 1.2 | 0.0 | 29.2 | 43.5 | 14.3 |
| 139.7 | 15.3 | P | H | 12.4 | 1.3 | 0.0 | 29.0 | 43.5 | 14.5 |
| 150.1 | 19.4 | P | H | 12.6 | 1.3 | 0.0 | 33.3 | 43.5 | 10.2 |
| 162.1 | 21.0 | P | H | 12.8 | 1.4 | 0.0 | 35.2 | 43.5 | 8.3 |
| 162.1 | 20.2 | Q | H | 12.8 | 1.4 | 0.0 | 34.4 | 43.5 | 9.1 |
| 174.0 | 20.1 | P | H | 13.2 | 1.4 | 0.0 | 34.7 | 43.5 | 8.8 |
| 174.0 | 17.9 | Q | H | 13.2 | 1.4 | 0.0 | 32.5 | 43.5 | 11.0 |
| 186.0 | 16.5 | P | H | 13.7 | 1.5 | 0.0 | 31.7 | 43.5 | 11.8 |
| 198.1 | 13.5 | P | H | 14.2 | 1.5 | 0.0 | 29.2 | 43.5 | 14.3 |
| 201.4 | 13.1 | P | H | 14.3 | 1.5 | 0.0 | 28.9 | 43.5 | 14.6 |
| 210.1 | 13.5 | P | H | 14.6 | 1.6 | 0.0 | 29.7 | 43.5 | 13.8 |
| 226.2 | 13.6 | P | H | 14.9 | 1.6 | 0.0 | 30.1 | 46.0 | 15.9 |
| 242.6 | 13.5 | P | H | 15.1 | 1.7 | 0.0 | 30.3 | 46.0 | 15.7 |
| 249.0 | 14.6 | P | H | 15.4 | 1.7 | 0.0 | 31.7 | 46.0 | 14.3 |
| 257.1 | 14.5 | P | H | 12.2 | 1.7 | 0.0 | 28.4 | 46.0 | 17.6 |
| 261.6 | 16.0 | P | H | 12.3 | 1.8 | 0.0 | 30.1 | 46.0 | 15.9 |
| 271.2 | 20.9 | Q | H | 12.7 | 1.8 | 0.0 | 35.4 | 46.0 | 10.6 |
| 282.0 | 14.5 | P | H | 13.2 | 1.8 | 0.0 | 29.5 | 46.0 | 16.5 |
| 288.6 | 15.6 | P | H | 13.5 | 1.8 | 0.0 | 30.9 | 46.0 | 15.1 |
| 298.4 | 16.5 | P | H | 13.9 | 1.9 | 0.0 | 32.3 | 46.0 | 13.7 |
| 307.5 | 16.4 | P | H | 14.8 | 1.9 | 0.0 | 33.1 | 46.0 | 12.9 |
| 311.8 | 15.1 | P | H | 14.9 | 1.9 | 0.0 | 31.9 | 46.0 | 14.1 |
| 319.6 | 17.9 | P | H | 14.5 | 2.0 | 0.0 | 34.4 | 46.0 | 11.6 |
| 325.4 | 16.3 | P | H | 14.2 | 2.0 | 0.0 | 32.5 | 46.0 | 13.5 |
| 333.5 | 17.5 | P | H | 14.3 | 2.0 | 0.0 | 33.8 | 46.0 | 12.2 |
| 355.2 | 9.7 | P | H | 14.4 | 2.1 | 0.0 | 26.2 | 46.0 | 19.8 |
| 367.0 | 12.2 | P | H | 14.4 | 2.1 | 0.0 | 28.7 | 46.0 | 17.3 |
| 388.2 | 8.6 | P | H | 15.1 | 2.2 | 0.0 | 25.9 | 46.0 | 20.1 |
| 423.6 | 9.2 | P | H | 15.7 | 2.3 | 0.0 | 27.2 | 46.0 | 18.8 |
| 433.9 | 11.7 | P | H | 16.0 | 2.3 | 0.0 | 30.0 | 46.0 | 16.0 |
| 452.1 | 9.6 | P | H | 16.5 | 2.4 | 0.0 | 28.5 | 46.0 | 17.5 |



| Freq. MHz | Meter Reading dBuV | Dect. | Ant. Pol. | Antenna Factor (dB/m) | Cable Loss (dB) | Distance Factor (dB) | EUT (dBuV/m) | Limit (dBuV/m) | Margin Under Limit (dB) |
|-----------|--------------------|-------|-----------|-----------------------|-----------------|----------------------|--------------|----------------|-------------------------|
| 488.6 | 9.8 | P | H | 17.0 | 2.5 | 0.0 | 29.3 | 46.0 | 16.7 |
| 563.6 | 10.4 | P | H | 18.3 | 2.6 | 0.0 | 31.3 | 46.0 | 14.7 |
| 570.1 | 8.8 | P | H | 18.4 | 2.7 | 0.0 | 29.9 | 46.0 | 16.1 |
| 626.1 | 10.5 | P | H | 19.1 | 2.8 | 0.0 | 32.4 | 46.0 | 13.6 |
| 641.6 | 8.4 | P | H | 19.4 | 2.8 | 0.0 | 30.6 | 46.0 | 15.4 |
| 669.2 | 10.6 | P | H | 20.7 | 2.9 | 0.0 | 34.2 | 46.0 | 11.8 |
| 729.2 | 8.2 | P | H | 21.0 | 3.0 | 0.0 | 32.2 | 46.0 | 13.8 |
| 816.3 | 8.5 | P | H | 21.5 | 3.2 | 0.0 | 33.2 | 46.0 | 12.8 |
| 836.8 | 10.3 | P | H | 21.9 | 3.3 | 0.0 | 35.5 | 46.0 | 10.5 |
| 887.4 | 8.8 | P | H | 22.7 | 3.4 | 0.0 | 34.9 | 46.0 | 11.1 |
| 925.9 | 8.0 | P | H | 23.0 | 3.4 | 0.0 | 34.4 | 46.0 | 11.6 |
| 962.0 | 8.1 | P | H | 23.4 | 3.5 | 0.0 | 35.0 | 54.0 | 19.0 |
| 35.1 | 19.9 | P | V | 11.9 | 0.6 | 0.0 | 32.4 | 40.0 | 7.6 |
| 35.8 | 19.6 | P | V | 11.5 | 0.6 | 0.0 | 31.7 | 40.0 | 8.3 |
| 42.4 | 14.7 | P | V | 10.4 | 0.7 | 0.0 | 25.8 | 40.0 | 14.2 |
| 48.4 | 10.8 | P | V | 9.2 | 0.7 | 0.0 | 20.7 | 40.0 | 19.3 |
| 57.0 | 13.8 | P | V | 8.8 | 0.8 | 0.0 | 23.4 | 40.0 | 16.6 |
| 62.1 | 10.3 | P | V | 9.1 | 0.8 | 0.0 | 20.2 | 40.0 | 19.8 |
| 70.3 | 12.7 | P | V | 9.1 | 0.9 | 0.0 | 22.7 | 40.0 | 17.3 |
| 77.8 | 10.7 | P | V | 9.0 | 1.0 | 0.0 | 20.7 | 40.0 | 19.3 |
| 80.4 | 11.4 | P | V | 9.0 | 1.0 | 0.0 | 21.4 | 40.0 | 18.6 |
| 95.5 | 16.3 | P | V | 9.9 | 1.0 | 0.0 | 27.2 | 43.5 | 16.3 |
| 107.9 | 10.8 | P | V | 10.7 | 1.1 | 0.0 | 22.6 | 43.5 | 20.9 |
| 112.1 | 10.2 | P | V | 11.0 | 1.1 | 0.0 | 22.3 | 43.5 | 21.2 |
| 127.3 | 10.7 | P | V | 11.9 | 1.2 | 0.0 | 23.8 | 43.5 | 19.7 |
| 132.4 | 10.4 | P | V | 12.1 | 1.2 | 0.0 | 23.7 | 43.5 | 19.8 |
| 152.6 | 12.7 | P | V | 12.7 | 1.3 | 0.0 | 26.7 | 43.5 | 16.8 |
| 176.2 | 10.4 | P | V | 13.2 | 1.5 | 0.0 | 25.1 | 43.5 | 18.4 |
| 193.3 | 11.7 | P | V | 14.0 | 1.5 | 0.0 | 27.2 | 43.5 | 16.3 |
| 218.5 | 11.3 | P | V | 14.7 | 1.6 | 0.0 | 27.6 | 46.0 | 18.4 |
| 241.3 | 11.6 | P | V | 15.1 | 1.7 | 0.0 | 28.4 | 46.0 | 17.6 |
| 257.6 | 13.9 | P | V | 12.2 | 1.7 | 0.0 | 27.8 | 46.0 | 18.2 |
| 271.2 | 13.5 | P | V | 12.7 | 1.8 | 0.0 | 28.0 | 46.0 | 18.0 |
| 282.0 | 10.8 | P | V | 13.2 | 1.8 | 0.0 | 25.8 | 46.0 | 20.2 |
| 325.4 | 11.6 | P | V | 14.2 | 2.0 | 0.0 | 27.8 | 46.0 | 18.2 |
| 365.3 | 10.0 | P | V | 14.4 | 2.1 | 0.0 | 26.5 | 46.0 | 19.5 |
| 406.9 | 10.1 | P | V | 15.5 | 2.2 | 0.0 | 27.8 | 46.0 | 18.2 |
| 447.5 | 9.3 | P | V | 16.4 | 2.3 | 0.0 | 28.0 | 46.0 | 18.0 |
| 458.4 | 9.5 | P | V | 16.8 | 2.4 | 0.0 | 28.7 | 46.0 | 17.3 |
| 481.6 | 10.7 | P | V | 17.1 | 2.5 | 0.0 | 30.3 | 46.0 | 15.7 |
| 518.0 | 10.8 | P | V | 18.6 | 2.6 | 0.0 | 32.0 | 46.0 | 14.0 |
| 551.6 | 8.7 | P | V | 18.1 | 2.6 | 0.0 | 29.4 | 46.0 | 16.6 |
| 581.1 | 11.8 | P | V | 18.6 | 2.7 | 0.0 | 33.1 | 46.0 | 12.9 |
| 660.7 | 8.5 | P | V | 20.3 | 2.9 | 0.0 | 31.7 | 46.0 | 14.3 |
| 734.2 | 8.3 | P | V | 21.0 | 3.1 | 0.0 | 32.4 | 46.0 | 13.6 |
| 746.2 | 8.9 | P | V | 20.9 | 3.1 | 0.0 | 32.9 | 46.0 | 13.1 |
| 811.8 | 8.6 | P | V | 21.4 | 3.2 | 0.0 | 33.2 | 46.0 | 12.8 |
| 887.9 | 8.5 | P | V | 22.7 | 3.4 | 0.0 | 34.6 | 46.0 | 11.4 |
| 946.9 | 8.5 | P | V | 23.3 | 3.5 | 0.0 | 35.3 | 46.0 | 10.7 |
| 958.0 | 7.8 | P | V | 23.4 | 3.5 | 0.0 | 34.7 | 46.0 | 11.3 |

Judgment: Passed by 7.6 dB; Where both peak data and quasi-peak data is performed, the quasi-peak is the final determination of compliance.



Radiated emissions in a graphical format. The following chart has the same data as the previous table.

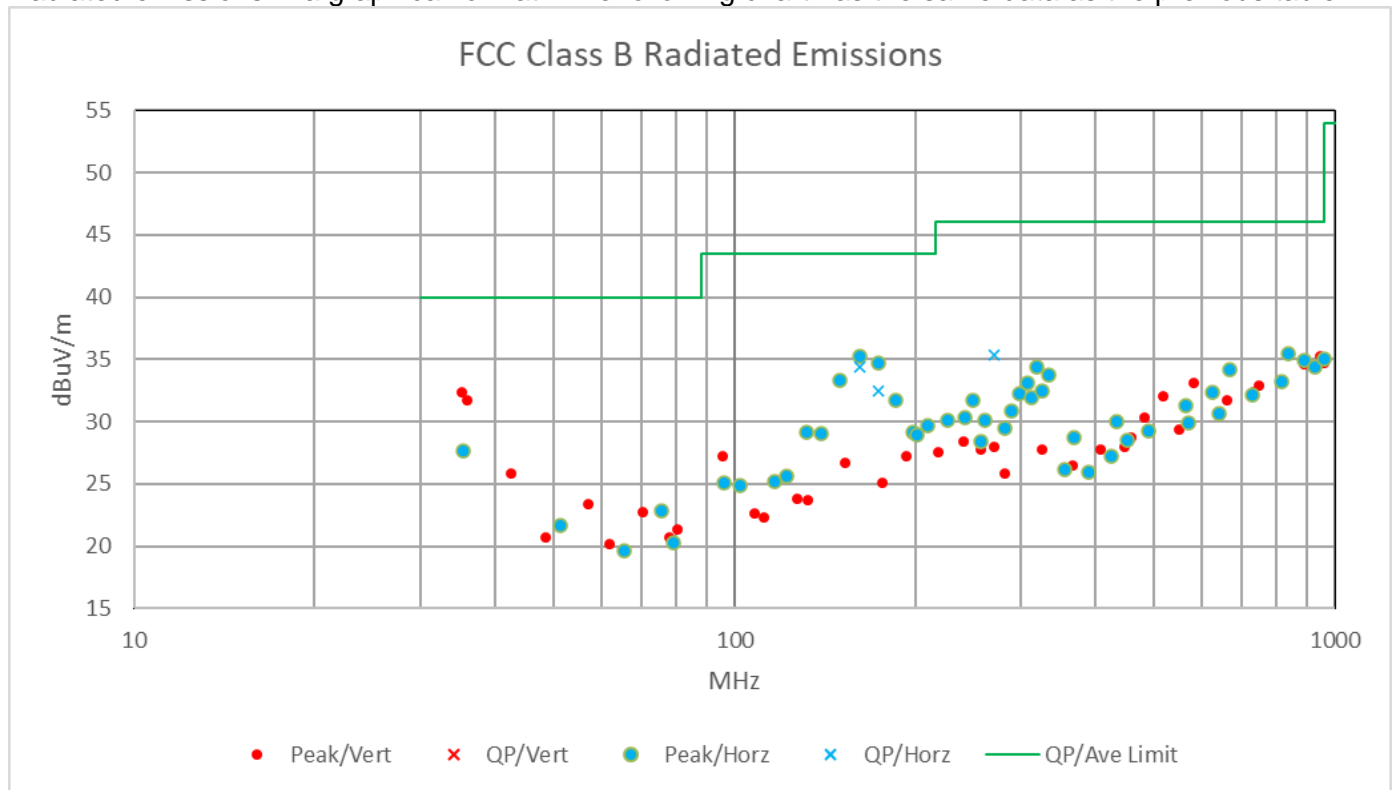
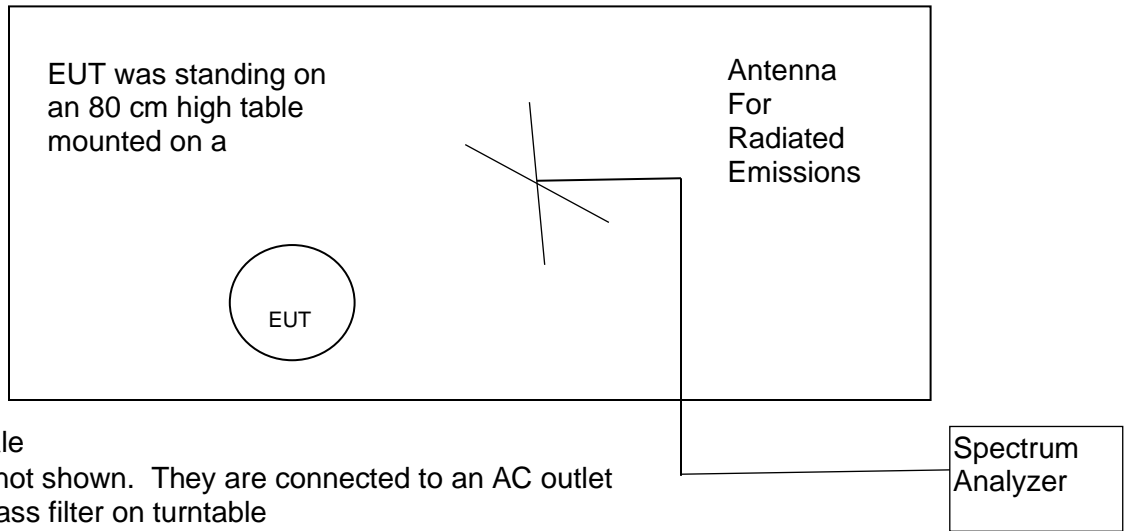




Figure 2. Drawing of Radiated Emissions Test Setup

Chamber E, anechoic

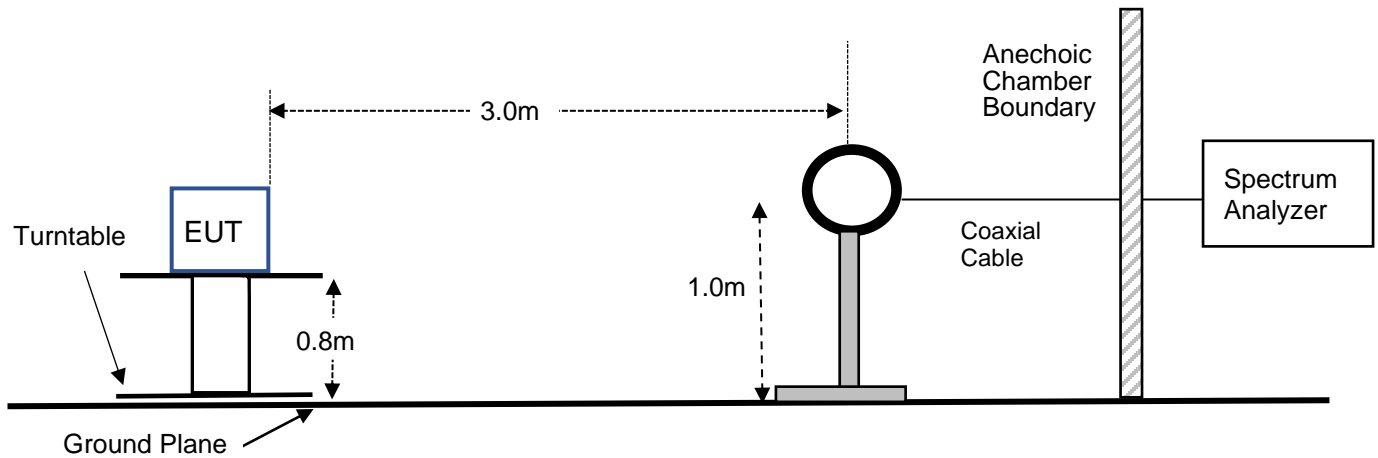


Notes:

- Not to Scale
- AC cords not shown. They are connected to an AC outlet with low-pass filter on turntable

| Frequency Range | Receive Antenna | Spectrum Analyzer |
|-----------------|-----------------|-------------------|
| 0.01 to 30 MHz | ANT-53 | REC-21 |
| 30 to 200 MHz | ANT-80 | REC-21 |
| 200 to 1000 MHz | ANT-68 | REC-21 |

Radiated Emissions Test Setup for Frequencies Below 30MHz (Side View)

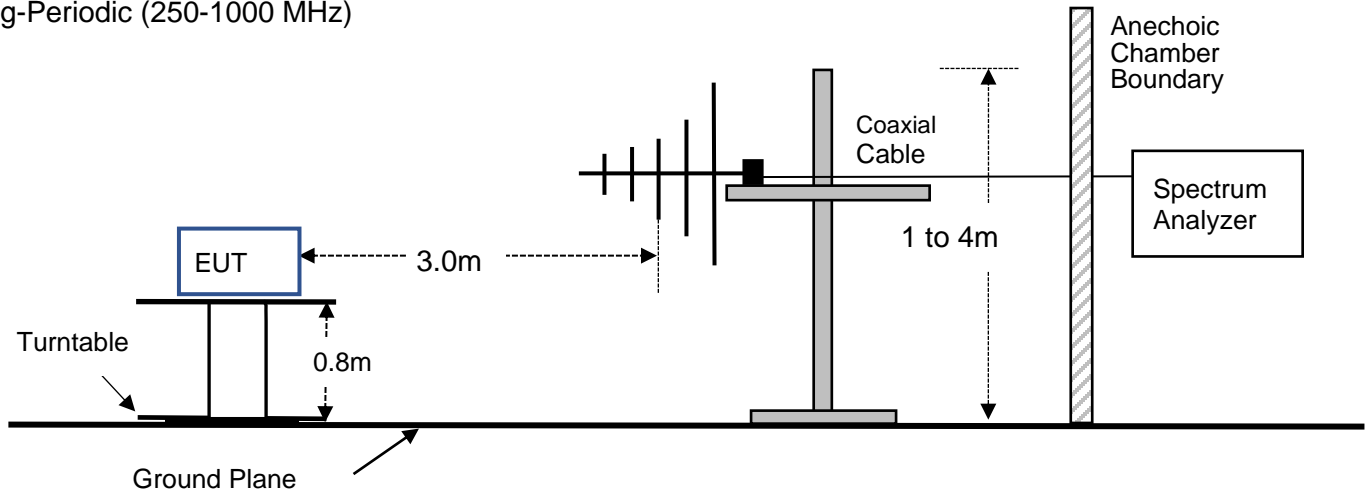




Radiated Emissions Test Setup for Frequencies from 30MHz to 1000MHz (Side View)

Biconical antenna (30-250 MHz)

Log-Periodic (250-1000 MHz)



11.3 Magnetic Field Measurements and Decay Factor Calculations

Radiated emission measurements are performed with an EMCO shielded loop antenna. The antenna was rotated in order to find the maximize readings.

The distance correction factor is calculated as follows:

The distance factor in (dB) = $DE \cdot 20 \cdot \log(TD/SD)$

Where: DE = Decay Exponent (2.0 is used for this)

TD = Test distance in meters. This is 3 meters

SD = Specification Distance in meters

From 9 kHz to 490 kHz, the Specification Distance is 300m therefore the distance factor is $2 \cdot 20 \cdot \log(300/3) = 80$ dB.

From 490 kHz to 30 MHz, the Specification Distance is 30m therefore the distance factor is $2 \cdot 20 \cdot \log(30/3) = 40$ dB.



11.3.1 Magnetic Field Radiated Emissions Results (0.009 to 30 MHz)

| | |
|---------------|---|
| Test Date | 11/01/2023 |
| EUT | Model: OEM-805N14KU-V3; Serial Number: WPO2000028 |
| Test Distance | 3 Meters |
| Specification | FCC 15 & RSS-GEN |
| Notes | Test were performed with a 0.8 meter table |
| Tested by | Chris D'Alessio |

| Freq (kHz) | Peak reading dBuV | Loop Ant Factor dB/m | Test Dist. (m) | Decay exp | Cable Loss dB | FCC Distance factor dB | Field Strength dBuV/m | RSS & FCC Limit dBuV/m | Margin under limit | Notes |
|----------------|-------------------|----------------------|----------------|-----------|---------------|------------------------|-----------------------|------------------------|--------------------|-------|
| 125.0 | 55.6 | 18.9 | 3.0 | 2.0 | 0.1 | -80.0 | -5.4 | 25.7 | 31.1 | |
| 250.0 | 40.2 | 18.6 | 3.0 | 2.0 | 0.1 | -80.0 | -21.1 | 19.6 | 40.7 | |
| 375.0 | 36.4 | 18.4 | 3.0 | 2.0 | 0.1 | -80.0 | -25.1 | 16.1 | 41.2 | |
| 500.0 | 35.3 | 18.3 | 3.0 | 2.0 | 0.1 | -40.0 | 13.7 | 33.6 | 19.9 | |
| | | | | | | | | | | |
| 13560 | 50.0 | 16.0 | 3.0 | 2.0 | 0.4 | -40.0 | 26.4 | 40.5 | 14.1 | |
| 27120 | 29.8 | 15.3 | 3.0 | 2.0 | 0.5 | -40.0 | 5.6 | 29.5 | 23.9 | |
| Column numbers | | | | | | | | | | |
| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | |

- Column #1. Frequency of Tested Emission.
- Column #2. Uncorrected readings from the spectrum analyzer (Peak)
- Column #3. Antenna factor converts dBuV to dBuV/m
- Column #4. Test Distance in meters
- Column #5. Decay Exponent
- Column #6. Cable Loss
- Column #7. Distance factor (dB) = (Decay Exponent)*20*Log(Test Distance/Specification Distance)
- Column #8. Total field strength. This = Columns 2 + 3 + 6 + 7
- Column #9. FCC and Canada Limit in dBuV/m
- Column #10. This is the margin under the limit for that row.

The limit shown at 13.56 MHz in the above table is the lowest limit from 15.225 sections (a), (b) and (c). The limit from 13.553-13.567 MHz at 30 meters is 15,848 uV/m which = 84 dBuV/m in accordance with FCC 15.225 (c) and RSS-210 section B.6 (a). The limit drops to 334uV/m from 13.410-13.553 MHz and 13.567-13.710 MHz, and 106uV/m = 40.5 dBuV/m from the bands 13.110-13.410 MHz and 13.710-14.010 MHz.

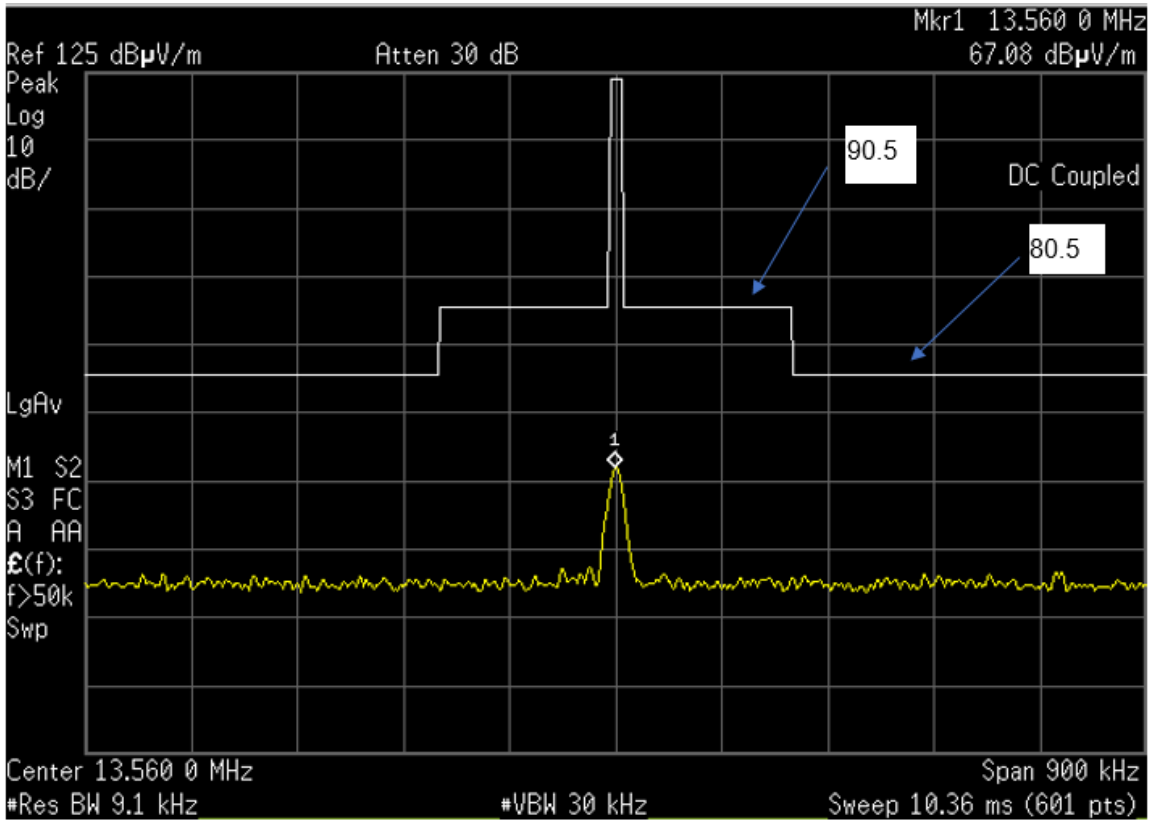
The lower limit (40.5 dBuV/m) was used for all frequencies from 13.110-14.010 MHz. Therefore it also met 15.225 (a) (b) since the (a) & (b) limits are less stringent than (c). All other limits are general limits of FCC 15.209 or the RSS-Gen. The emissions were scanned from 10 kHz to 30 MHz, including 13.11 and 14.01 MHz.

No other emissions were detected from 10 kHz to 30 MHz within 10 dB of the 15.209 or the RSS-GEN limits.

Judgement: Passed by at least 10 dB.

11.3.2 Emissions Mask at 13.56 MHz

RSS-210 Section B.6 and FCC section 15.225 limits, corrected for 3 meters. 40 dB is added to the limits to convert from 30 to 3 meters.



11.3.3 Field Strength at 3 meters

This is the field Strength results with no distance correction factor. This is used for ISED forms and RF exposure calculations.

| Test Dist. (m) | Freq (kHz) | Peak reading dBuV | Loop Ant Factor dB/m | Cable Loss dB | Field Strength dBuV/m | Notes |
|----------------|------------|-------------------|----------------------|---------------|-----------------------|--------------------------------|
| 3 | 125 | 55.6 | 18.9 | 0.1 | 74.6 | Max Field Strength at 3 meters |
| 3 | 13560 | 50.0 | 16.0 | 0.4 | 66.4 | Max Field Strength at 3 meters |



11.4 Occupied Bandwidth Data

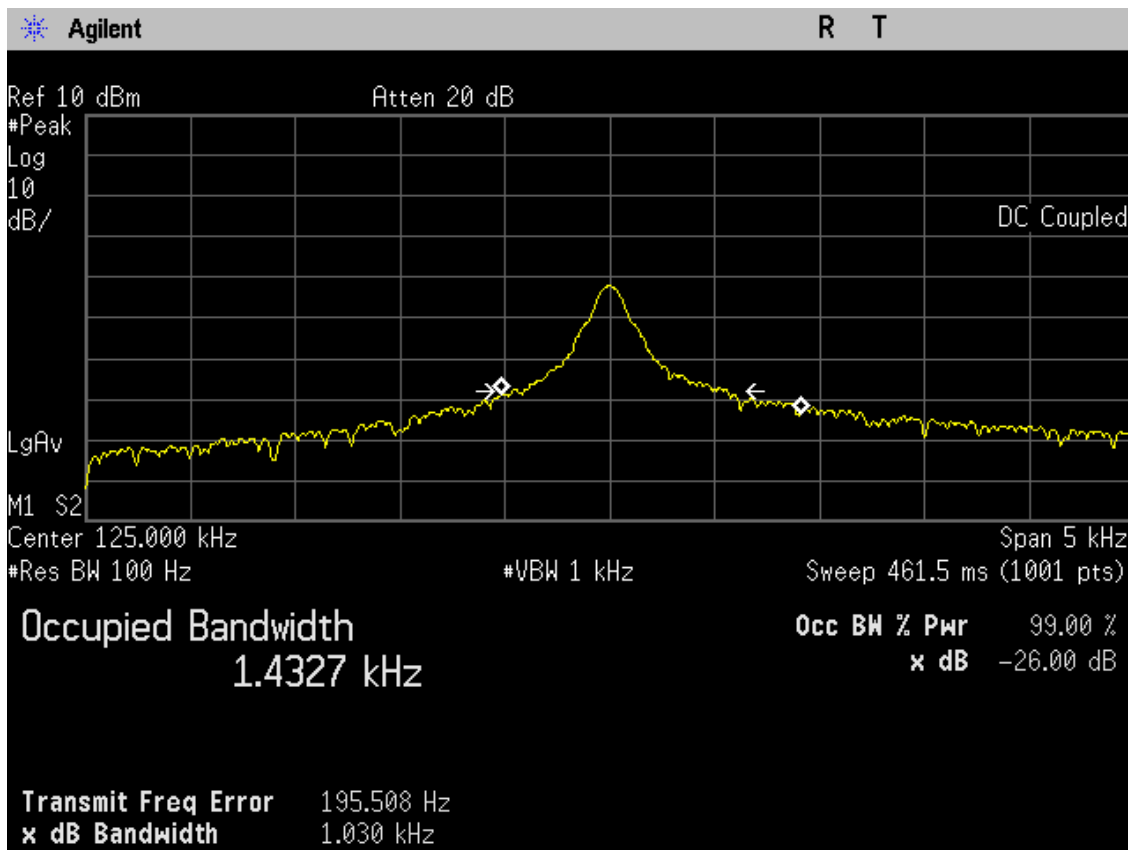
The occupied bandwidth of the RF output was measured using a spectrum analyzer using a peak detector function and a narrow resolution bandwidth. A broadband antenna was used to receive the modulated signal. The spectrum analyzer was set to the MAX HOLD mode to record the worst case of the modulation. The spectrum analyzer display was digitized and plotted. The plots of the occupied bandwidth for the EUT are supplied on the following page.

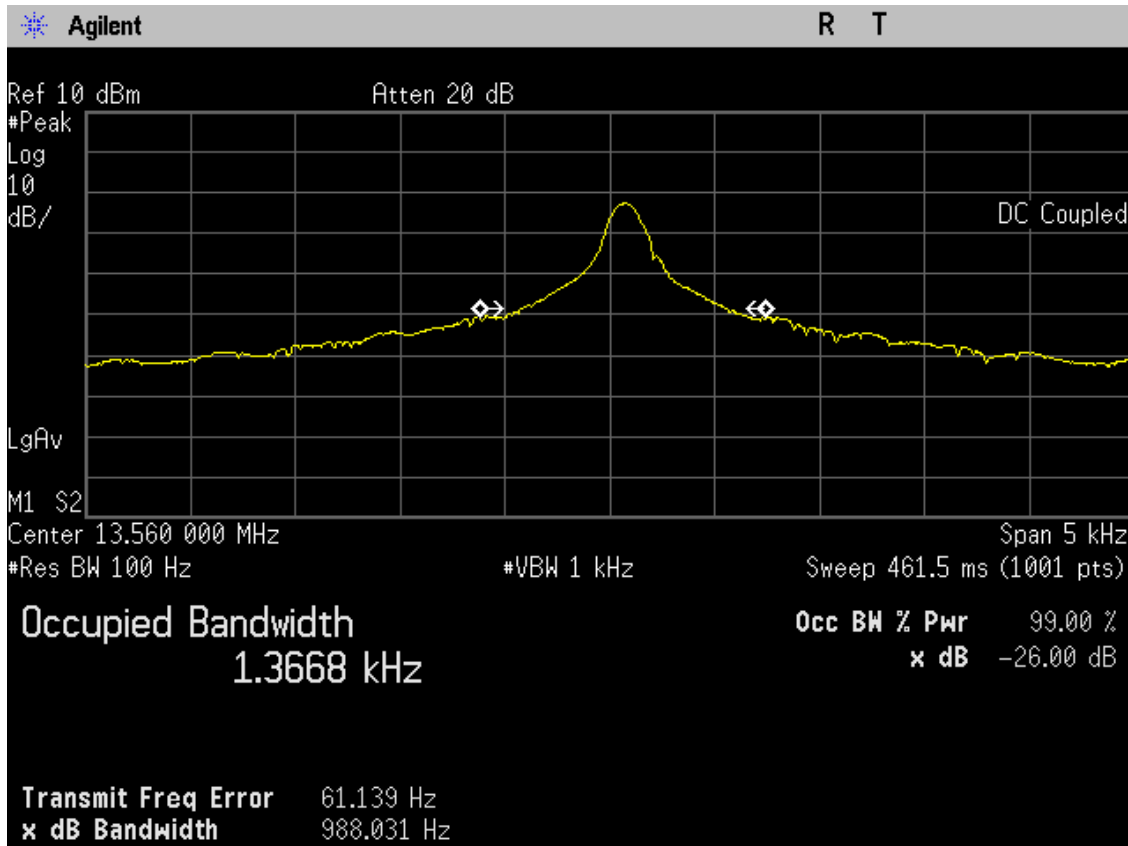
| | | | |
|----------------|-------------------|---------------|----------------------------|
| Model | OEM-805N14KU-V3 | Specification | FCC Part 15.225 RSS-210 |
| Serial Number | WPO2000028 | Test Date | 10/25/2023 |
| Test Personnel | Joseph Strzelecki | Equipment | REC-44 |

| EUT | 99% OBW | |
|-----------------|----------------|------------------|
| | 125 kHz signal | 13.56 MHz Signal |
| OEM-800N24KU-V3 | 1.4327 | 1.3668 |

Judgement: Pass

Figure 3. Occupied Bandwidth Plots





11.5 Frequency Stability

The tests were in accordance with FCC 15.225 and RSS-210 Section A2.6. Since the product is USB powered, a desktop PC was used to power the device. The input power to the desktop PC was varied by 15%, using a variable AC supply.

11.5.1 Test Results for Frequency Stability

| | | | |
|-------------------|---|---------------|---|
| Model | OEM-800N24KU-V3 | Specification | FCC Part 15.225 RSS-210 Section A2.6 |
| Serial Number | WPO2000028 | Test Date | October 26, 2023 |
| Test Personnel | Chris D'Alessio | Test Location | Station F |
| Test Equipment | Spectrum Analyzer (REC-31); Temperature Chamber TC-01 | | |
| Notes | 10 minutes at each Temperature; 1 min at each voltage | | |
| Nominal Frequency | 13.560100 MHz | | |

| Volts VAC | Freq. (MHz) | Deviation % | PPM |
|-----------|-------------|-------------|-------|
| 102.0 | 13.560095 | -0.00004 | -0.37 |
| 120.0 | 13.560102 | 0.00001 | 0.15 |
| 138.0 | 13.560103 | 0.00002 | 0.22 |



| Temp. Deg C | Freq. (@0min.) | Freq. (@2min.) | Freq. (@5min.) | Freq. (@10min.) | Change from Nominal | | | |
|----------------|-------------------|-------------------|-------------------|--------------------|---------------------|----------|----------|-----------|
| | (MHz) | (MHz) | (MHz) | (MHz) | % 0 min. | % 2 min. | % 5 min | % 10 min. |
| 50 | 13.560067 | 13.560071 | 13.560081 | 13.560073 | -0.00024 | -0.00021 | -0.00014 | -0.00020 |
| 40 | 13.560660 | 13.560067 | 13.560068 | 13.560066 | -0.00025 | -0.00024 | -0.00024 | -0.00025 |
| 30 | 13.560072 | 13.560077 | 13.560077 | 13.560075 | -0.00021 | -0.00017 | -0.00017 | -0.00018 |
| 20 | 13.560070 | 13.560068 | 13.560068 | 13.560070 | -0.00022 | -0.00024 | -0.00024 | -0.00022 |
| 10 | 13.560118 | 13.560193 | 13.560118 | 13.560117 | 0.00013 | 0.00069 | 0.00013 | 0.00013 |
| 0 | 13.560173 | 13.560137 | 13.560127 | 13.560123 | 0.00054 | 0.00027 | 0.00020 | 0.00017 |
| -10 | 13.560110 | 13.560122 | 13.560108 | 13.560088 | 0.00007 | 0.00016 | 0.00006 | -0.00009 |
| -20 | 13.560072 | 13.560065 | 13.560062 | 13.560065 | -0.00021 | -0.00024 | -0.00028 | -0.00026 |

Max deviation is 10.5 ppm or 0.00105%
 Test Requirements: Limit is 100 ppm or 0.01% deviation.
 Judgement: Pass

12.0 MEASUREMENT INSTRUMENTATION UNCERTAINTY

The uncertainties represent expanded uncertainties expressed at approximately the 95% confidence level using a coverage factor of k=2 in accordance with CISPR 16-4-2.

| Measurement | Uncertainty |
|--|----------------------|
| Conducted Emissions, LISN method, 150 kHz to 30 MHz | 2.7 dB |
| Radiated Emissions, H-field, 3 meters, 9 kHz to 30 MHz | 2.7 dB |
| Radiated Emissions, E-field, 3 meters, 30 to 200 MHz | 3.3 dB |
| Radiated Emissions, E-field, 3 meters, 200 to 1000 MHz | 4.9 dB |
| Frequency counter with REC-11 | 136 Hz |
| 99% Occupied Bandwidth using REC-43 | 1% of frequency span |
| Temperature THM-03 | 0.6 Deg C |

13.0 REVISION HISTORY

| RP-9841-FCC Revisions: | | | |
|------------------------|-------------------|-------------|-----------|
| Rev. | Affected Sections | Description | Rationale |
| | | | |
| | | | |
| | | | |
| | | | |