**Amber Helm Development L.C.**
92723 Michigan Hwy-152
Sister Lakes, Michigan 49047 USA
Tel: 888-847-8027

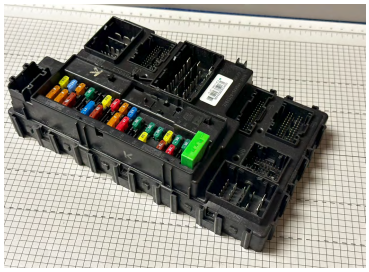
**CONBCM-WR2327TX**
Issued: **November 17, 2023**

# EMC Test Report

regarding

**USA: CFR Title 47, Part 15.209** (Emissions)
**Canada: ISED RSS-210v10/GENv5** (Emissions)

for



# M3NA2C786860

**Category: LF Transmitter**

Judgments:
**15.209/RSS-210v10 Compliant Transmitter**
Testing Completed: October 31, 2023

TESTING
NVLAP LAB CODE 200129-0

Prepared for:

## Continental Automotive

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Rpt. Prep./Rev. by:
Dr. Joseph Brunett, EMC-002790-NE

Date of Issue: November 17, 2023

## Revision History

| Rev. No. | Date | Details | Revised By |
|---|---|---|---|
| r0 | November 17, 2023 | Initial Release. | J. Nantz |
| r1 | December 2, 2023 | Add firmware note. | J. Brunett |

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# 1 Test Report Scope and Limitations

## 1.1 Laboratory Authorization

Test Facility description and attenuation characteristics are on file with the FCC Laboratory, Columbia, Maryland (FCC Reg. No: US5348 and US5356) and with ISED Canada, Ottawa, ON (File Ref. No: 3161A and 24249). Amber Helm Development L.C. holds accreditation under NVLAP Lab Code 200129-0.

## 1.2 Report Retention

For equipment verified to comply with the regulations herein, the manufacturer is obliged to retain this report with the product records for the life of the product, and no less than ten years. A copy of this Report will remain on file with this laboratory until November 2033.

## 1.3 Subcontracted Testing

This report does not contain data produced under subcontract.

## 1.4 Test Data

This test report contains data included within the laboratory's scope of accreditation. Any data in this report that is not covered under the laboratory's scope is clearly identified.

## 1.5 Limitation of Results

The test results contained in this report relate only to the item(s) tested. Any electrical or mechanical modification made to the test item subsequent to the test date shall invalidate the data presented in this report. Any electrical or mechanical modification made to the test item subsequent to this test date shall require reevaluation.

## 1.6 Copyright



## 1.7 Endorsements

This report shall not be used to claim product endorsement by any accrediting, regulatory, or governmental agency.

### 1.8 Test Location

The EUT was fully tested by **Amber Helm Development L.C.**, headquartered at 92723 Michigan Hwy-152, Sister Lakes, Michigan 49047 USA. Table 1 lists all sites employed herein. Specific test sites utilized are also listed in the test results sections of this report where needed.

Table 1: Test Site List.

| Description | Location | Quality Num. |
|---|---|---|
| OATS (3 meter) | 3615 E Grand River Rd., Williamston, Michigan 48895 | OATSC |

### 1.9 Traceability and Equipment Used

Pertinent test equipment used for measurements at this facility is listed in Table 2. The quality system employed at Amber Helm Development L.C. has been established to ensure all equipment has a clearly identifiable classification, calibration expiry date, and that all calibrations are traceable to the SI through NIST, other recognized national laboratories, accepted fundamental or natural physical constants, ratio type of calibration, or by comparison to consensus standards.

Table 2: Equipment List.

| Description | Manufacturer/Model | SN | Quality Num. | Cal/Ver By / Date Due |
|---|---|---|---|---|
| Spectrum Analyzer | R & S / FPC1500 | 101692 | RSFPC15001 | RS / Dec-2023 |
| Spectrum Analyzer | R & S / FSV30 | 101660 | RSFSV3001 | RS / Apr-2024 |
| Biconical | EMCO / 93110B | 9802-3039 | BICEMCO01 | Keysight / Aug-2025 |
| Log Periodic Antenna | EMCO / 3146 | 9305-3614 | LOGEMCO01 | Keysight / Aug-2025 |
| BNC-BNC Coax | WRTL / RG58/U | 001 | CAB001-BLACK | AHD / Dec-2023 |
| Shielded Loop Antenna | EMCO / 6502 | 9502-2926 | EMCOLOOP1 | Keysight / Aug-2024 |

# 2 Test Specifications and Procedures

## 2.1 Test Specification and General Procedures

The goal of Continental Automotive is to demonstrate that the Equipment Under Test (EUT) complies with the Rules and/or Directives below. Detailed in this report are the results of testing the Continental Automotive M3NA2C786860 for compliance to:

| **Country/Region/Manu.** | **Rules or Directive** | **Referenced Section(s)** |
|---|---|---|
| United States | Code of Federal Regulations | CFR Title 47, Part 15.209 |
| Canada | ISED Canada | ISED RSS-210v10/GENv5 |

It has been determined that the equipment under test is subject to the rules and directives above at the date of this testing. In conjunction with these rules and directives, the following specifications and procedures are followed herein to demonstrate compliance (in whole or in part) with these regulations.

| | |
|---|---|
| ANSI C63.4:2014 | "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 | "American National Standard of Procedures for Compliance Testing of Unlicensed Wireless Devices" |
| TP0102RA | "AHD Internal Document TP0102 - Radiated Emissions Test Procedure" |

# 3 Configuration and Identification of the Equipment Under Test

## 3.1 Description and Declarations

The equipment under test is a Body Control Module containing an LF transmitter for automotive use. The EUT is approximately 13 x 20 x 6 cm in dimension, and is depicted in Figure 1. It is powered by 13.5 VDC automotive power system. In use, this device is permanently installed in a motor vehicle. Table 3 outlines provider declared EUT specifications.

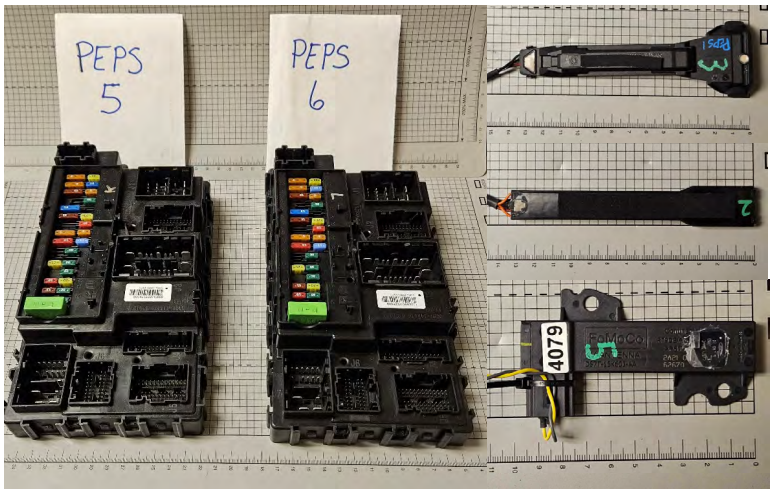


Figure 1: Photos of EUT.

Table 3: EUT Declarations.

| **General Declarations** | |
|---|---|
| **Equipment Type:** | LF Transmitter |
| **Country of Origin:** | Mexico |
| **Nominal Supply:** | 13.5 VDC |
| **Oper. Temp Range:** | Not Declared |
| **Frequency Range:** | 125 kHz |
| **Antenna Dimension:** | Not Declared |
| **Antenna Type:** | Ferrite Coil |
| **Antenna Gain:** | Not Declared |
| **Number of Channels:** | 1 |
| **Channel Spacing:** | Not Applicable |
| **Alignment Range:** | Not Declared |
| **Type of Modulation:** | ASK |
| | |
| **United States** | |
| **FCC ID Number:** | M3NA2C786860 |
| **Classification:** | DCD |
| | |
| **Canada** | |
| **IC Number:** | 7812A-A2C786860 |
| **Classification:** | Other |

### 3.1.1 EUT Configuration

The EUT is configured for testing as depicted in Figure 2.

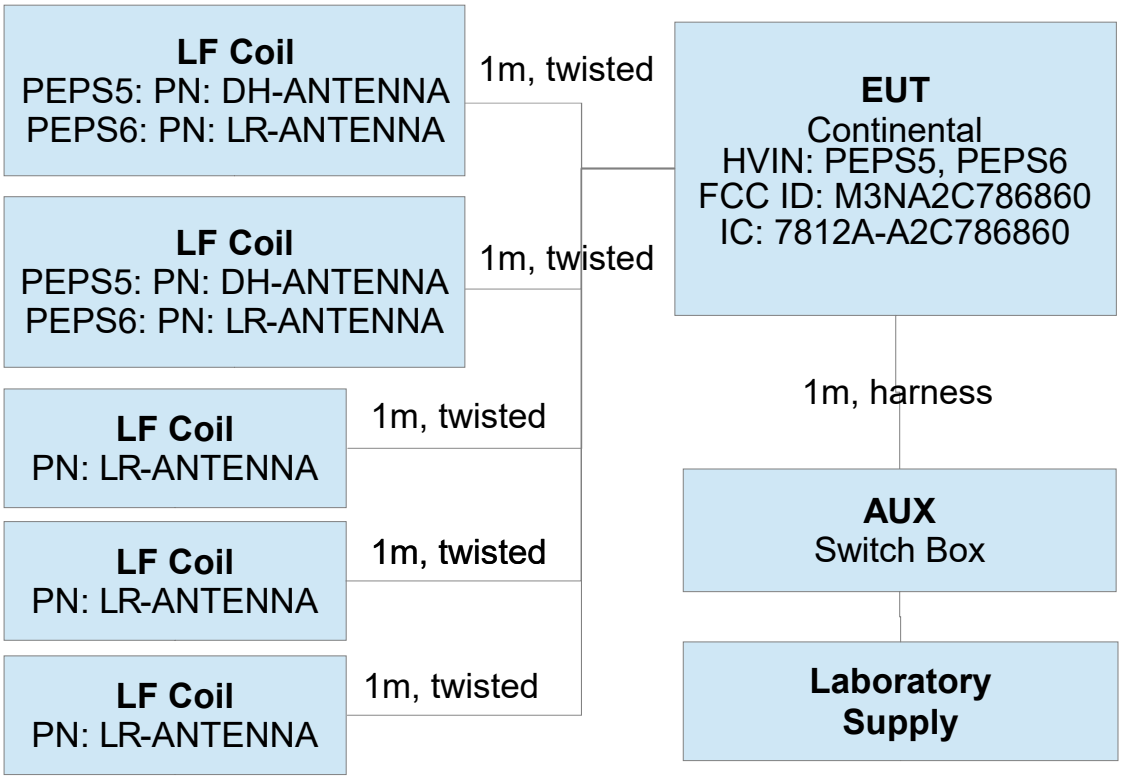


Figure 2: EUT Test Configuration Diagram.

### 3.1.2 Modes of Operation

This device is capable of two principle modes of operation, PEPS mode and POLLING mode. PEPS (Passive Entry, Passive Start) mode is manually activated mode that results in a finite set of sequential transmissions from all 5 antennas populated. POLLING mode is automatically initiated by the vehicle (clutch) and results in periodic transmissions on two of the 5 antennas only. Both modes are the same for both variants and no two antennas are ever actuated at the same time.

### 3.1.3 Variants

There are two principle variants of the EUT, PEPS5 and PEPS6. The PEPS5 variant employs two (2) door-handle mounted antenna coils (PN: DH-ANTENNA) and three (3) vehicle chassis mounted, long range antenna coils (PN: LR-ANTENNA). The PEPS6 variant employs only five (5) of the same vehicle chassis mounted antenna coils (PN: LR-ANTENNA). The tuning employed for the door-handle coils is different than that of the chassis mounted coils, which is the only RF difference between the PEPS5 and PEPS6 variants. Minor differences in digital component populations also exist. The DH-ANTENNA has different overmolded plastic shapes for insertion into door handle assemblies however the antenna is the same. The PEPS5 variant was fully tested and emissions from the PEPS6 variant was confirmed to be the same as those measured from the PEPS5.

### 3.1.4 Test Samples

Two samples in total were provided: PEPS5 (SN: 4054) and PEPS6 (SN: 4057). Both samples are capable of stepped CW transmission on each antenna coil, POLLING mode and PEPS manually activated transmissions. EUT's included firmware "DV-A".

### 3.1.5 Functional Exerciser

Normal operating EUT functionality was verified by observation of transmitted signal.

### 3.1.6 Modifications Made

There were no modifications made to the EUT by this laboratory.

### 3.1.7 Production Intent

The EUT appears to be a production ready sample.

### 3.1.8 Declared Exemptions and Additional Product Notes

The EUT is permanently installed in a transportation vehicle. As such, digital emissions are exempt from US and Canadian digital emissions regulations (per FCC 15.103(a) and IC correspondence on ICES-003).

# 4 Emissions

## 4.1 General Test Procedures

### 4.1.1 Radiated Test Setup and Procedures

Radiated electromagnetic emissions from the EUT are first pre-scanned in our screen room. Spectrum and modulation characteristics of all emissions are recorded. Instrumentation, including spectrum analyzers and other test equipment as detailed in Section 1.8 are employed. After pre-scan, emission measurements are made on the test site of record. If the EUT connects to auxiliary equipment and is table or floor standing, the configurations prescribed in relevant test standards are followed. Alternatively, a layout closest to normal use (as declared by the provider) is employed if the resulting emissions appear to be worst-case in such a configuration. See Figure 3. All intentionally radiating elements that are not fixed-mounted in use are placed on the test table lying flat, on their side, and on their end (3-axes) and the resulting worst case emissions are recorded. If the EUT is fixed-mounted in use, measurements are made with the device oriented in the manner consistent with installation and then emissions are recorded. If the EUT exhibits spurious emissions due to internal receiver circuitry, such emissions are measured with an appropriate carrier signal applied.

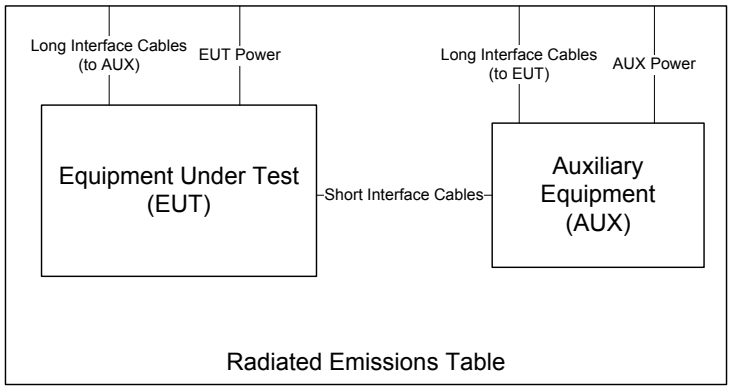


Figure 3: Radiated Emissions Diagram of the EUT.

For devices with intentional emissions below 30 MHz, a shielded loop antenna and/or E-field and H-Field broadband probes are used depending on the regulation. Shielded loops are placed at a 1 meter receive height at the desired measurement distance. For exposure in this band, 10cm diameter single-axis broadband probes meeting the requirements of ISED SPR-002 section 5.2 are employed. Measurements are repeated and summed over three axes, and the entire frequency range is measured with and without the EUT transmitting.

Emissions between 30 MHz and 1 GHz are measured using calibrated broadband antennas. For both horizontal and vertical polarizations, the test antenna is raised and lowered from 1 to 4 m in height until a maximum emission level is detected. The EUT is then rotated through $360^o$ in azimuth until the highest emission is detected. The test antenna is then raised and lowered one last time from 1 to 4 m and the worst case value is recorded. Emissions above 1 GHz are characterized using standard gain or broadband ridge-horn antennas on our OATS with a $4 \times 5$ m rectangle of ECCOSORB absorber covering the OATS ground screen and a 1.5m table height. Care is taken to ensure that test receiver resolution and video bandwidths meet the regulatory requirements, and that the emission bandwidth of the EUT is not reduced. Photographs of the test setup employed are depicted in Figure 4.

Where regulations allow for direct measurement of field strength, power values (dBm) measured on the test receiver / analyzer are converted to dB$\mu$V/m at the regulatory distance, using

$$E_{dist} = 107 + P_R + K_A - K_G + K_E - C_F$$

where $P_R$ is the power recorded on spectrum analyzer, in dBm, $K_A$ is the test antenna factor in dB/m, $K_G$ is the combined pre-amplifier gain and cable loss in dB, $K_E$ is duty correction factor (when applicable) in dB, and $C_F$ is a distance conversion (employed only if limits are specified at alternate distance) in dB. This field strength value is then compared with the regulatory limit. If effective isotropic radiated power (EIRP) is computed, it is computed as

$$EIRP(dBm) = E_{3m}(dB\mu V/m) - 95.2.$$

When presenting data at each frequency, the highest measured emission under all possible EUT orientations (3-axes) is reported.

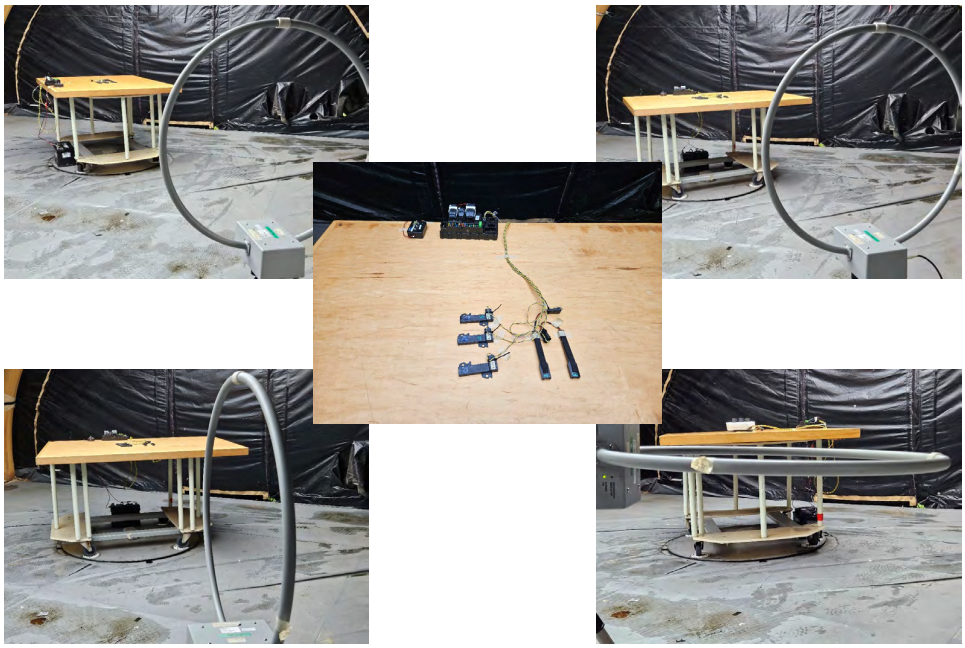

Figure 4: Radiated Emissions Test Setup Photograph(s).

### 4.1.2 Conducted Emissions Test Setup and Procedures

### 4.1.3 Power Supply Variation

Tests at extreme supply voltages are made if required by the procedures specified in the test standard, and results of this testing are detailed in this report.

## 4.2 Intentional Emissions

### 4.2.1 Fundamental Emission Pulsed Operation

The details and results of testing the EUT for pulsed operation are summarized in Table 4.

Table 4: Pulsed Emission Characteristics (Duty Cycle).

| Frequency Range | Det | IF Bandwidth | Video Bandwidth |
|---|---|---|---|
| 9 kHz ≤ f ≤ 150 kHz | Pk/QPk | 30 kHz | 100 kHz |

| | |
|---|---|
| **Test Date:** | 13-Oct-23 |
| **Test Engineer:** | John Nantz |
| **EUT Mode:** | See Below |
| **Meas. Distance:** | 10cm |
| **EUT Tested:** | M3NA2C786860 |

**DUTY CYCLE**

| R0 | EUT Mode | Overall Transmission: Min. Repetition Rate (sec) | Overall Transmission: Max. No. of Frames | Overall Transmission: Total Transmission Length (sec) | Internal Frame Characteristics: Max. Frame Length (ms) | Internal Frame Characteristics: Min. Frame Period (s) | Internal Frame Characteristics: Frame Encoding | Computed Duty Cycle: (%) | Computed Duty Cycle: Duty (dB) |
|---|---|---|---|---|---|---|---|---|---|
| R1 | PEPS | single | 18 | 0.829 | 40.9 | N/A | When manually activated for passive entry or passive start, the EUT transmits an ASK data frame for 34ms, followed by 5 CW frames, one at each of the 5 antennas, for 2.7ms each. If no response from a FOB with 150ms, the EUT transmits 12 CW frames from a single antenna at 41ms each frame intended for battery backup mode. | 100.000 | * |
| R2 | POLLING | 0.70 | 2 | 0.025 | 11.4 | N/A | When polling, the EUT transmits two 11.4 ms ASK modulated frames every 700 ms. | 11.350 | * |
| # | C1 | C2 | C3 | C4 | C5 | C6 | C7 | C8 | C9 |

(ROW) (COLUMN) NOTE:
R0 C9 No Duty Cycle is employed when demonstrating compliance.

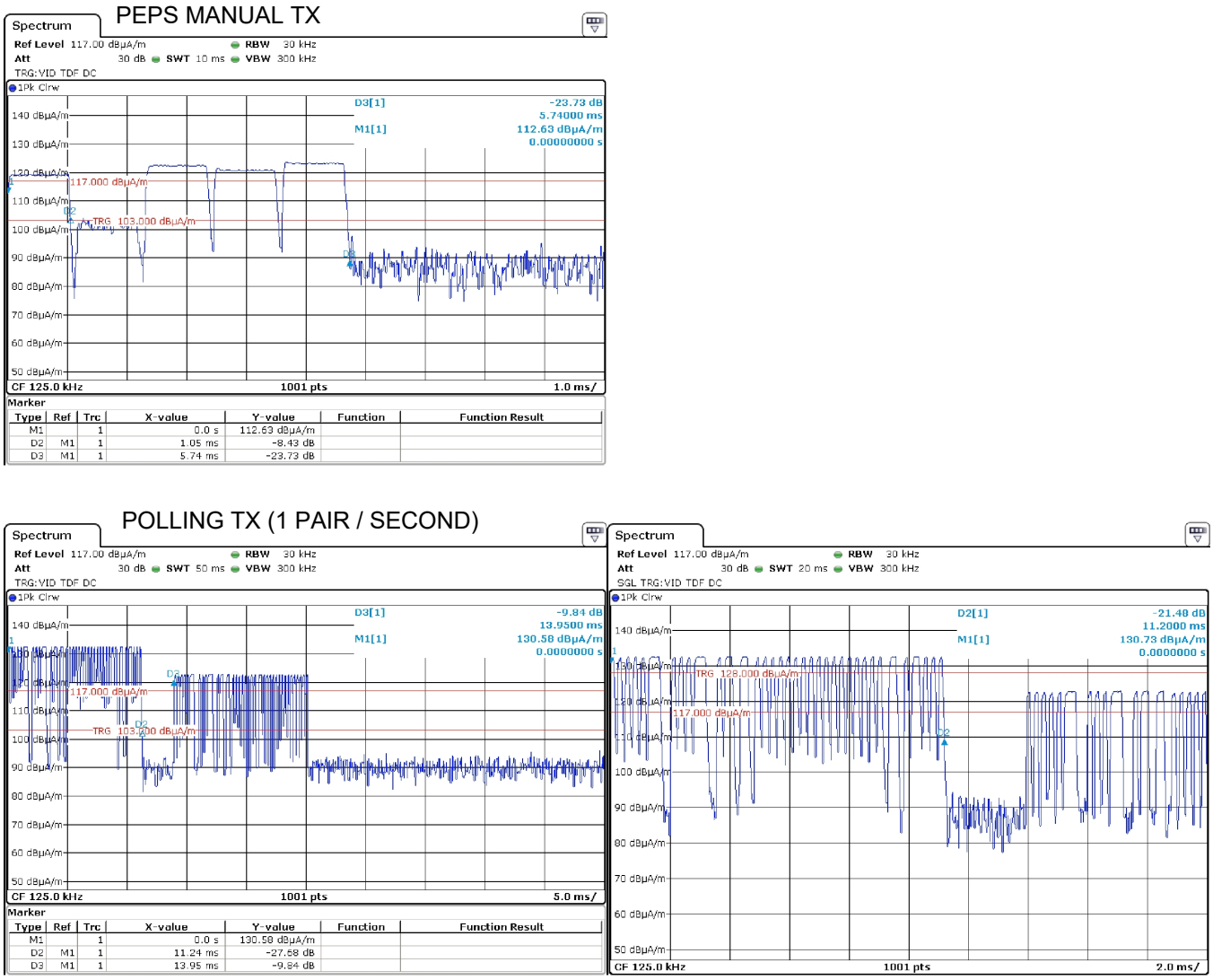


Figure 5: Example Pulsed Emission Characteristics (Duty Cycle).

### 4.2.2 Fundamental Emission Bandwidth

Emission bandwidth (EBW) of the EUT is measured with the device placed in the test mode(s) with the shortest available frame length and minimum frame spacing. Radiated emissions are recorded following the test procedures listed in Section 2.1. The 20 dB EBW is measured as the max-held peak-detected signal when the IF bandwidth is greater than or equal to 1% of the receiver span. For complex modulations other than ASK and FSK, the 99% emission bandwidth per IC test procedures has a different result, and is also separately reported.The results of EBW testing are summarized in Table 5. Plots showing measurements employed to obtain the emission bandwidth reported are provided in Figure 6.

Table 5: Intentional Emission Bandwidth.

| Frequency Range | Det | IF Bandwidth | Video Bandwidth | | |
|---|---|---|---|---|---|
| 9 kHz ≤ f ≤ 150 kHz | Pk | > 1% Span | >= 3 * IFBW | **Test Date:** | 13-Oct-23 |
| 150 kHz ≤ f ≤ 30 MHz | Pk | > 1% Span | >= 3 * IFBW | **Test Engineer:** | John Nantz |
| | | | | **EUT Mode:** | See Below |
| | | | | **Meas. Distance:** | 0.6 m |
| | | | | **EUT Tested:** | M3NA2C786860 |

| R0 | Mode | Frequency (MHz) | Temp (C) | Supply (VDC) | 20 dB EBW (kHz) | 99% EBW (kHz) | 110 kHz Restricted Band (dBc) | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| R1 | PEPS | 0.125 | 21 | 13.5 | 4.315 | 9.595 | 41.3 | | | |
| R2 | POLLING | 0.125 | 21 | 13.5 | 17.969 | 21.849 | 26.0 | | | |
| # | C1 | C2 | C3 | C4 | C5 | C6 | C7 | C8 | C9 | C10 |

(ROW) (COLUMN) NOTE:

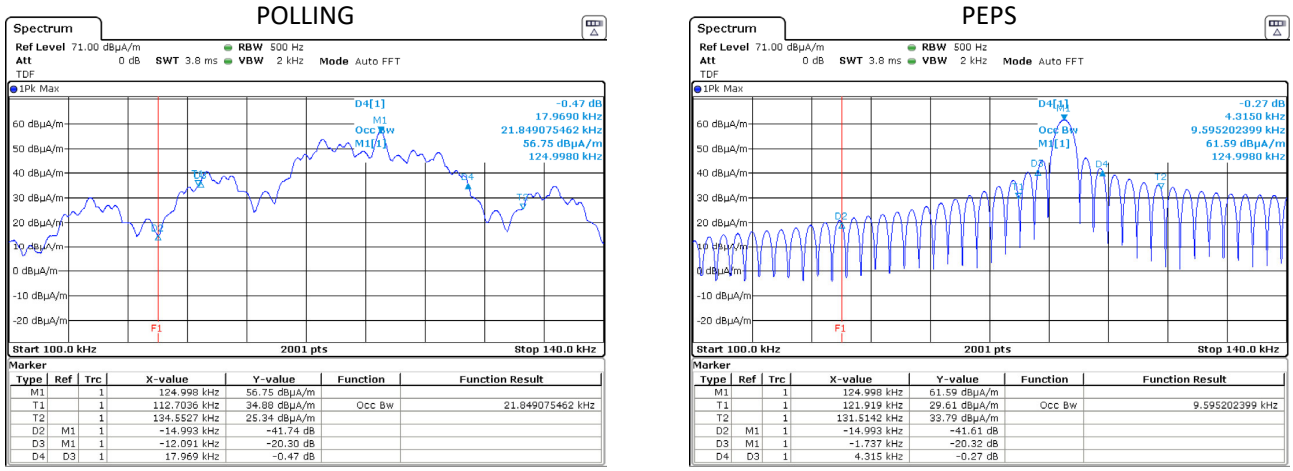


Figure 6: Example Intentional Emission Bandwidth.

### 4.2.3 Fundamental Emission

Following the test procedures listed in Section 2.1, field emissions measurements are made on the EUT for both Horizontal and Vertically polarized coupling fields. The EUT's loop antenna(s) are measured along all three axes, including when the EUT loop axes are aligned in the same axis as the test loop and aligned coplanar (in the same plane) with the test loop antenna. Table 6 details the results of these measurements.

Table 6: Fundamental Radiated Emissions.

| Frequency Range | Det | IF Bandwidth | Video Bandwidth |
|---|---|---|---|
| 9 kHz ≤ f ≤ 150 kHz | Pk/QPk | 200 Hz | 300 Hz |
| 150 kHz ≤ f ≤ 30 MHz | Pk/QPk | 9 kHz | 30 kHz |
| 25 MHz ≤ f ≤ 1 000 MHz | Pk/QPk | 120 kHz | 300 kHz |
| f > 1 000 MHz | Pk | 1 MHz | 3MHz |
| f > 1 000 MHz | Avg | 1 MHz | 3MHz |

| | |
|---|---|
| **Test Date:** | 13-Oct-23 |
| **Test Engineer:** | John Nantz |
| **EUT Mode:** | CW, Polling Conf. |
| **Meas. Distance:** | 3 meters |
| **EUT Tested:** | M3NA2C786860 |

**Fundamental Emissions Measurements**

| R0 | Mode | EUT Orientation | Freq. kHz | Ant. Used QN | Ant. Height m | Table Azim deg | Ka dB/m | Kg dB | Cf 3m / 300m dB | E-field @ 3m Pk dBuV/m | E-field @ 3m Qpk | E-field @ 300m Pk dBuV/m | E-field @ 300m Qpk dBuV/m | E-field @ 300m Limit Qpk | H-field @ 300m (ISED) Pk dBuA/m | H-field @ 300m (ISED) Qpk dBuA/m | H-field @ 300m (ISED) Limit Qpk | Pass By (dB) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| R1 | CW, LR-ANTENNA | Coaxial | 125.0 | EMCOLOOP1 | 1.0 | 0 | 10.1 | 0.0 | 80.0 | 95.2 | | 15.2 | | 25.7 | -36.3 | | -25.9 | **10.5** |
| R2 | | Coplanar - Vert. | 125.0 | EMCOLOOP1 | 1.0 | 0 | 10.1 | 0.0 | 80.0 | 90.4 | | 10.4 | | 25.7 | -41.1 | | -25.9 | 15.3 |
| R3 | | Coplanar - Hor. | 125.0 | EMCOLOOP1 | 1.0 | 0 | 10.1 | 0.0 | 80.0 | 89.8 | | 9.8 | | 25.7 | -41.7 | | -25.9 | 15.9 |
| R4 | CW, DH-ANTENNA | Coaxial | 125.0 | EMCOLOOP1 | 1.0 | 0 | 10.1 | 0.0 | 80.0 | 87.2 | | 7.2 | | 25.7 | -44.3 | | -25.9 | 18.5 |
| R5 | | Coplanar - Vert. | 125.0 | EMCOLOOP1 | 1.0 | 0 | 10.1 | 0.0 | 80.0 | 83.4 | | 3.4 | | 25.7 | -48.1 | | -25.9 | 22.3 |
| R6 | | Coplanar - Hor. | 125.0 | EMCOLOOP1 | 1.0 | 0 | 10.1 | 0.0 | 80.0 | 84.2 | | 4.2 | | 25.7 | -47.3 | | -25.9 | 21.5 |
| # | C1 | C2 | C3 | C4 | C5 | C6 | C7 | C8 | C9 | C10 | C11 | C12 | C13 | C14 | C15 | C16 | C17 | C18 |

| R7 | Mode | Test Antenna Polarization | Freq. kHz | DC Supply Voltage | E-field dBuV/m |
|---|---|---|---|---|---|
| R8 | CW, LR-ANTENNA | Coaxial | 125.0 | 16.0 | 95.2 |
| R9 | | | 125.0 | 13.5 | 95.2 |
| R10 | | | 125.0 | 9.0 | 95.2 |
| # | C1 | C2 | C3 | C4 | C5 | C6 | C7 |

| (ROW) | (COLUMN) | NOTE: |
|---|---|---|
| R0/R7 | C1 | EUT is tested in CW. No averaging applies and Quasi-Peak/average data was not needed to demonstrate compliance. |
| R0 | C5 | Emissions were evaluated at 1m test antenna height. |
| R0 | C9 | Correction factor of 40dB/decade is applied in alignment with FCC Part 15.31 (f)(2) therefore EUT field decay rate is not measured over a range of distances to determine CF. |
| R0 | C15 | H-field is computed by subtracting dBΩ in freespace from E-Field measurements = 20*log(120π) = 51.5dB |

## 4.3 Unintentional Emissions

### 4.3.1 Transmit Chain Spurious Emissions

The results for the measurement of transmit chain spurious emissions at the nominal voltage and temperature are provided in Table 7. Following the test procedures listed in Section 2.1, field emissions measurements are made on the EUT for both Horizontal and Vertically polarized coupling fields. The EUT's loop antenna(s) are measured when the EUT loop axes placed in all three axes, including when they are aligned along the same axis as the test loop antenna and are aligned coplanar with the test loop antenna. For all arrangements, test loop is rotated for maximum field. The results for the measurement of transmit chain spurious emissions at the nominal voltage and temperature are provided in Table 7. Measurements are performed to 10 times the highest fundamental operating frequency.

Table 7: Transmit Chain Spurious Emissions.

| Frequency Range | Det | IF Bandwidth | Video Bandwidth | | |
|---|---|---|---|---|---|
| 9 kHz ≤ f ≤ 150 kHz | Pk/QPk | 200 Hz | 300 Hz | **Test Date:** | 13-Oct-23 |
| 150 kHz ≤ f ≤ 30 MHz | Pk/QPk | 9 kHz | 30 kHz | **Test Engineer:** | John Nantz |
| 25 MHz ≤ f ≤ 1 000 MHz | Pk/QPk | 120 kHz | 300 kHz | **EUT Mode:** | CW, Polling Conf. |
| f > 1 000 MHz | Pk/Avg | 1 MHz | 3MHz | **Meas. Distance:** | 3 meters |
| | | | | **EUT Tested:** | M3NA2C786860 |

**Transmit Chain Spurious Emissions**

| R0 | Mode | EUT Orientation | Freq. kHz | Ant. Used | Ant Height m | Table Azim deg | Ka dB/m | Kg dB | Cf (3 to 30/300m) dB | E-field @ 3m Pk dBuV/m | E-field @ 3m Qpk dBuV/m | E-field @ 30/300m Pk dBuV/m | E-field @ 30/300m Qpk dBuV/m | E-field @ 30/300m Limit Qpk dBuV/m | H-field @ 30/300m (ISED) Pk dBuA/m | H-field @ 30/300m (ISED) Qpk dBuA/m | H-field @ 30/300m (ISED) Limit Qpk dBuA/m | Pass By | Comments |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| R1 | CW, LR-ANTENNA | Max All, Worst | 250.0 | EMCOLOOP1 | 1.0 | 330 | 10.0 | 0.0 | 80.0 | 76.4 | | -3.6 | | 19.6 | -55.1 | | -31.9 | 23.2 | |
| R2 | | Max All, Worst | 375.0 | EMCOLOOP1 | 1.0 | 330 | 10.0 | 0.0 | 80.0 | 68.7 | | -11.3 | | 16.1 | -62.8 | | -35.4 | 27.4 | |
| R3 | | Max All, Worst | 500.0 | EMCOLOOP1 | 1.0 | 330 | 10.2 | 0.0 | 40.0 | 66.3 | | 26.3 | | 33.6 | -25.2 | | -17.9 | 7.3 | |
| R4 | | Max All, Worst | 625.0 | EMCOLOOP1 | 1.0 | 330 | 10.2 | 0.0 | 40.0 | 62.4 | | 22.4 | | 31.7 | -29.1 | | -19.8 | 9.3 | |
| R5 | | Max All, Worst | 750.0 | EMCOLOOP1 | 1.0 | 330 | 10.1 | 0.0 | 40.0 | 59.5 | | 19.5 | | 30.1 | -32.0 | | -21.4 | 10.6 | |
| R6 | | Max All, Worst | 875.0 | EMCOLOOP1 | 1.0 | 330 | 10.3 | 0.0 | 40.0 | 56.9 | | 16.9 | | 28.8 | -34.6 | | -22.8 | 11.9 | |
| R7 | | Max All, Worst | 1000.0 | EMCOLOOP1 | 1.0 | 330 | 11.5 | 0.0 | 40.0 | 62.8 | | 22.8 | | 27.6 | -28.7 | | -23.9 | **4.8** | |
| R8 | | Max All, Worst | 1125.0 | EMCOLOOP1 | 1.0 | 330 | 11.3 | 0.0 | 40.0 | 59.4 | | 19.4 | | 26.6 | -32.1 | | -24.9 | 7.2 | |
| R9 | | Max All, Worst | 1250.0 | EMCOLOOP1 | 1.0 | 330 | 12.3 | 0.0 | 40.0 | 56.5 | | 16.5 | | 25.7 | -35.0 | | -25.9 | 9.2 | background |
| R10 | | | | | | | | | | | | | | | | | | | |
| R11 | CW, DH-ANTENNA | Max All, Worst | 250.0 | EMCOLOOP1 | 1.0 | 240 | 10.0 | 0.0 | 80.0 | 80.9 | | 0.9 | | 19.6 | -50.6 | | -31.9 | 18.7 | |
| R12 | | Max All, Worst | 375.0 | EMCOLOOP1 | 1.0 | 240 | 10.0 | 0.0 | 80.0 | 70.2 | | -9.8 | | 16.1 | -61.3 | | -35.4 | 25.9 | |
| R13 | | Max All, Worst | 500.0 | EMCOLOOP1 | 1.0 | 240 | 10.2 | 0.0 | 40.0 | 60.0 | | 20.0 | | 33.6 | -31.5 | | -17.9 | 13.6 | |
| R14 | | Max All, Worst | 625.0 | EMCOLOOP1 | 1.0 | 240 | 10.2 | 0.0 | 40.0 | 61.0 | | 21.0 | | 31.7 | -30.5 | | -19.8 | 10.7 | |
| R15 | | Max All, Worst | 750.0 | EMCOLOOP1 | 1.0 | 240 | 10.1 | 0.0 | 40.0 | 55.1 | | 15.1 | | 30.1 | -36.4 | | -21.4 | 15.0 | |
| R16 | | Max All, Worst | 875.0 | EMCOLOOP1 | 1.0 | 240 | 10.3 | 0.0 | 40.0 | 52.7 | | 12.7 | | 28.8 | -38.8 | | -22.8 | 16.1 | |
| R17 | | Max All, Worst | 1000.0 | EMCOLOOP1 | 1.0 | 240 | 11.5 | 0.0 | 40.0 | 59.4 | | 19.4 | | 27.6 | -32.1 | | -23.9 | 8.2 | |
| R18 | | Max All, Worst | 1125.0 | EMCOLOOP1 | 1.0 | 240 | 11.3 | 0.0 | 40.0 | 58.5 | | 18.5 | | 26.6 | -33.0 | | -24.9 | **8.1** | |
| R19 | | Max All, Worst | 1250.0 | EMCOLOOP1 | 1.0 | 240 | 12.3 | 0.0 | 40.0 | 55.6 | | 15.6 | | 25.7 | -35.9 | | -25.9 | 10.1 | background |
| # | C1 | C2 | C3 | C4 | C5 | C6 | C7 | C8 | C9 | C10 | C11 | C12 | C13 | C14 | C15 | C16 | C17 | C18 | C19 |

| (ROW) | (COLUMN) | NOTE: |
|---|---|---|
| R0 | C1 | EUT is tested in CW mode. No averaging applies and Quasi-Peak/average data was not needed to demonstrate compliance. |
| R0 | C5 | Emissions were evaluated at 1m test antenna height from 9 kHz to 30 MHz. No significant spurious were observed past the 10th harmonic. |
| R0 | C9 | Correction factor of 40dB/decade is applied in alignment with FCC Part 15.31 (f)(2) therefore EUT field decay rate was not measured over a range of distances to determine CF. |
| R0 | C15 | H-field is computed by subtracting dBΩ in freespace from E-Field measurements = 20*log(120π) = 51.5dB |

## 5 Measurement Uncertainty and Accreditation Documents

The maximum values of measurement uncertainty for the laboratory test equipment and facilities associated with each test are given in the table below. This uncertainty is computed for a 95.45% confidence level based on a coverage factor of $k = 2$.

Table 8: Measurement Uncertainty.

| Measured Parameter | Measurement Uncertainty† |
|---|---|
| Radio Frequency | $\pm(f_{Mkr}/10^7 + RBW/10 + (SPN/(PTS-1))/2 + 1\,\text{Hz})$ |
| Conducted Emm. Amplitude | $\pm 1.9\,\text{dB}$ |
| Radiated Emm. Amplitude ($f < 30\,\text{MHz}$) | $\pm 3.1\,\text{dB}$ |
| Radiated Emm. Amplitude ($30 - 200\,\text{MHz}$) | $\pm 4.0\,\text{dB}$ |
| Radiated Emm. Amplitude ($200 - 1000\,\text{MHz}$) | $\pm 5.2\,\text{dB}$ |
| Radiated Emm. Amplitude ($f > 1000\,\text{MHz}$) | $\pm 3.7\,\text{dB}$ |

†Ref: CISPR 16-4-2:2011+A1:2014


United States Department of Commerce
National Institute of Standards and Technology

NVLAP® ilac-MRA

Certificate of Accreditation to ISO/IEC 17025:2017

NVLAP LAB CODE: 200129-0

AHD (Amber Helm Development, L.C.)
Sister Lakes, MI

*is accredited by the National Voluntary Laboratory Accreditation Program for specific services, listed on the Scope of Accreditation, for:*

**Electromagnetic Compatibility & Telecommunications**

*This laboratory is accredited in accordance with the recognized International Standard ISO/IEC 17025:2017. This accreditation demonstrates technical competence for a defined scope and the operation of a laboratory quality management system (refer to joint ISO-ILAC-IAF Communique dated January 2009).*

2023-06-20 through 2024-06-30
*Effective Dates*

*For the National Voluntary Laboratory Accreditation Program*



Figure 7: Accreditation Documents