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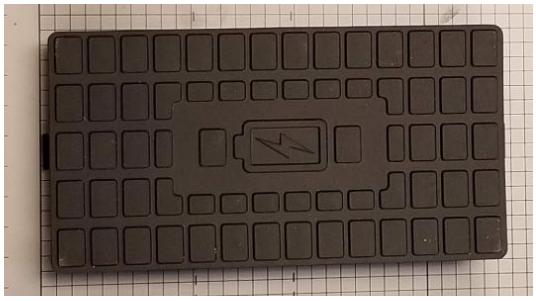
**LGN2A-WR2101TX**
Issued: **January 16, 2021**

# EMC Test Report

regarding

**USA: CFR Title 47, Part 15.209** (Emissions)
**Canada: ISED RSS-216v2** (Emissions)

for



# WCFDM00N2A Series

**Category: FCC 15.209 / RSS-216 Type 3, Cat 1**

Judgments:
**15.209/RSS-216v2 Compliant Transmitter**
Testing Completed: January 8, 2021

TESTING
NVLAP LAB CODE 200129-0

Prepared for:

## LG Electronics

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Prepared by: Dr. Joseph Brunett, EMC-002790-NE

Date of Issue: January 16, 2021

## Revision History

| Rev. No. | Date | Details | Revised By |
|---|---|---|---|
| r0 | January 16, 2021 | Initial Release. | J. Brunett |
| r1 | January 27, 2021 | ICES-001 Limits added + typo corr. | J. Brunett |
| r2 | January 28, 2021 | ICES-001 Limits corr. | 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 February 2031.

## 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 laboratories scope of accreditation.

## 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 |
|---|---|---|---|---|
| Shielded Loop Antenna | EMCO / 6502 | 9502-2926 | EMCOLOOP1 | Keysight / Aug-2022 |
| BNC-BNC Coax | WRTL / RG58/U | 001 | CAB001-BLACK | AHD / Apr-2021 |
| Spectrum Analyzer | R & S / FSV30 | 101660 | RSFSV30001 | RS / Apr-2021 |

# 2 Test Specifications and Procedures

## 2.1 Test Specification and General Procedures

The goal of LG Electronics 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 LG Electronics WCFDM00N2A Series for compliance to:

| **Country/Region** | **Rules or Directive** | **Referenced Section(s)** |
|---|---|---|
| United States | Code of Federal Regulations | CFR Title 47, Part 15.209 |
| Canada | ISED Canada | ISED RSS-216v2 |

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" |
| IEEE Trans. EMC, Vol. 47, No. 3 August 2005 | "Extrapolating Near-Field Emissions of Low-Frequency Loop Transmitters," J.D.Brunett, V.V.Liepa, D.L.Sengupta |
| TP0102RA | "AHD Internal Document TP0102 - Radiated Emissions Test Procedure" |
| ISED Canada | "The Measurement of Occupied Bandwidth" |

# 3 Configuration and Identification of the Equipment Under Test

## 3.1 Description and Declarations

The equipment under test is a wireless power transfer charger used in a motor vehicle. The EUT is approximately 16 x 8 x 2.5 cm in dimension, and is depicted in Figure 1. It is powered by 13.4 VDC vehicular power system. In use, this device is permanently affixed inside the body of a motor vehicle. Table 3 outlines provider declared EUT specifications.

Figure 1: Photos of EUT.

Table 3: EUT Declarations.

| **General Declarations** | |
|---|---|
| **Equipment Type:** | FCC 15.209 / RSS-216 Type 3, Cat 1 |
| **Country of Origin:** | Malaysia |
| **Nominal Supply:** | 13.4 VDC |
| **Oper. Temp Range:** | $-40^o$ to $+85^o$ C |
| **Frequency Range:** | 123.7 to 131.7 kHz |
| **Antenna Dimension:** | Not Declared |
| **Antenna Type:** | Integral LF Coils |
| **Antenna Gain:** | Integral |
| **Number of Channels:** | 1 |
| **Channel Spacing:** | None |
| **Alignment Range:** | Not Declared |
| **Type of Modulation:** | AM+FSK |
| | |
| **United States** | |
| **FCC ID Number:** | BEJWCFDM00N2A |
| **Classification:** | 8CC |
| | |
| **Canada** | |
| **IC Number:** | 2703H-WCFDM00N2A |
| **Classification:** | WPT Device, Vehicular Device |

### 3.1.1 EUT Configuration

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

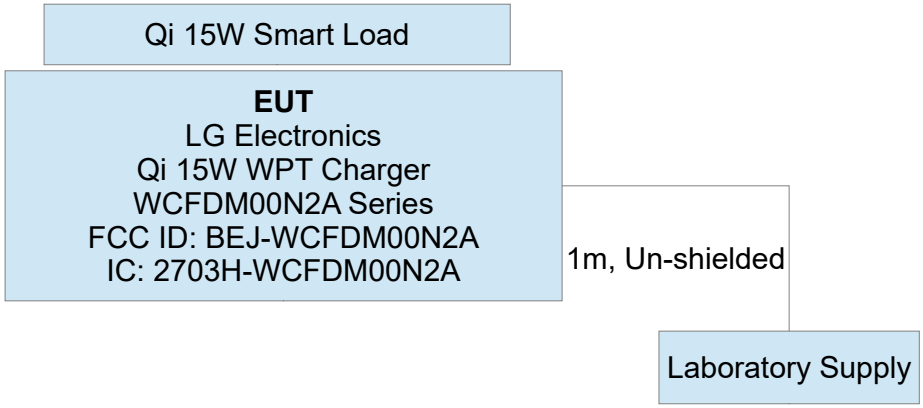


Figure 2: EUT Test Configuration Diagram.

### 3.1.2 Modes of Operation

The EUT employs four charging coils (only one of which may be used at any given time) to transfer energy from itself to a compatible, portable receiving device placed in contact with the EUT surface. Emissions from each of the coils employed are evaluated herein in the charging, authentication, and un-loaded modes. Only worst case emissions observed in these modes are reported.

### 3.1.3 Variants

There are three hardware variants of the EUT: WCFDM00N2A1 with cooling fan, WCFDM00N2A5 without cooling fan, and WCFDM00N2A3 without cooling fan or top rubber pad. All employ identical WPT circuitry and antennas, but the unit with the cooling fan includes a fan control IC populated on the PCB. The unit with the cooling fan populated is fully tested herein and was confirmed to be the worst case variant.

### 3.1.4 Test Samples

Four normal operating samples (two of each variant) were provided for testing. A smart client load (paired Qi client board with 15W resistive load) was provided to activate the device for testing over each coil. This load consists of a normal Qi client circuit with the battery load replaced by an equivalent resistive value. All rectification and regulation circuitry representative of client side loading are implemented in the load provided. Emissions with this smart load were observed to be worse than those with a cellular phone load.

### 3.1.5 Functional Exerciser

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

### 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 uses Qi QPC 1.3 HSM encrypted key authentication (AM+FSK) on the power transfer frequency as part of its power management and control features. No other communication is employed by the EUT. No data other than encrypted load authentication data is transferred to the client via the modulation employed. Only a single frequency is employed by the device, though that frequency may range over those specified by the manufacturer (123.7 to 131.7 kHz). In Canada, Qi protocol chargers are generally considered Type 2 devices, however as the EUT doesn't meet associated field strength limits by more than 40 dB, this product is treated as a Type 3, Category 1 WPT device, subject to certification under RSS-216. The EUT is permanently installed in a transportation vehicle and as such digital emissions (emissions from digital circuitry not used in generating the charging frequency) are exempt from US and Canadian digital emissions regulations (per FCC 15.103(a) and ISED correspondence).

# 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.

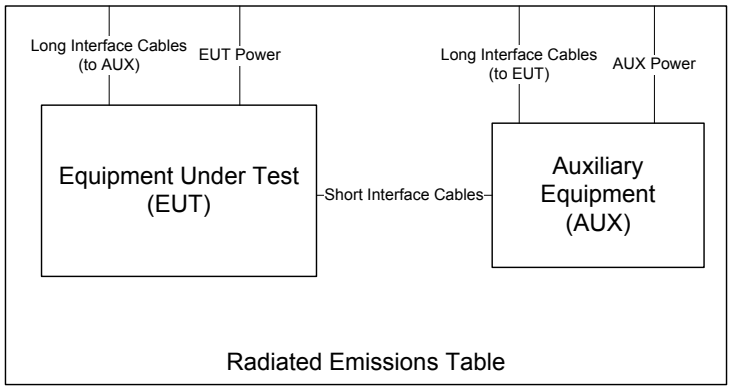


Figure 3: Radiated Emissions Diagram of the EUT.

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 regulations. Shielded loops are placed at a 1 meter receive height at the desired measurement distance. For exposure in this band, the broadband probes employed are 10cm diameter single-axis shielded transducers and measurements are repeated and summed over three axes.

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.

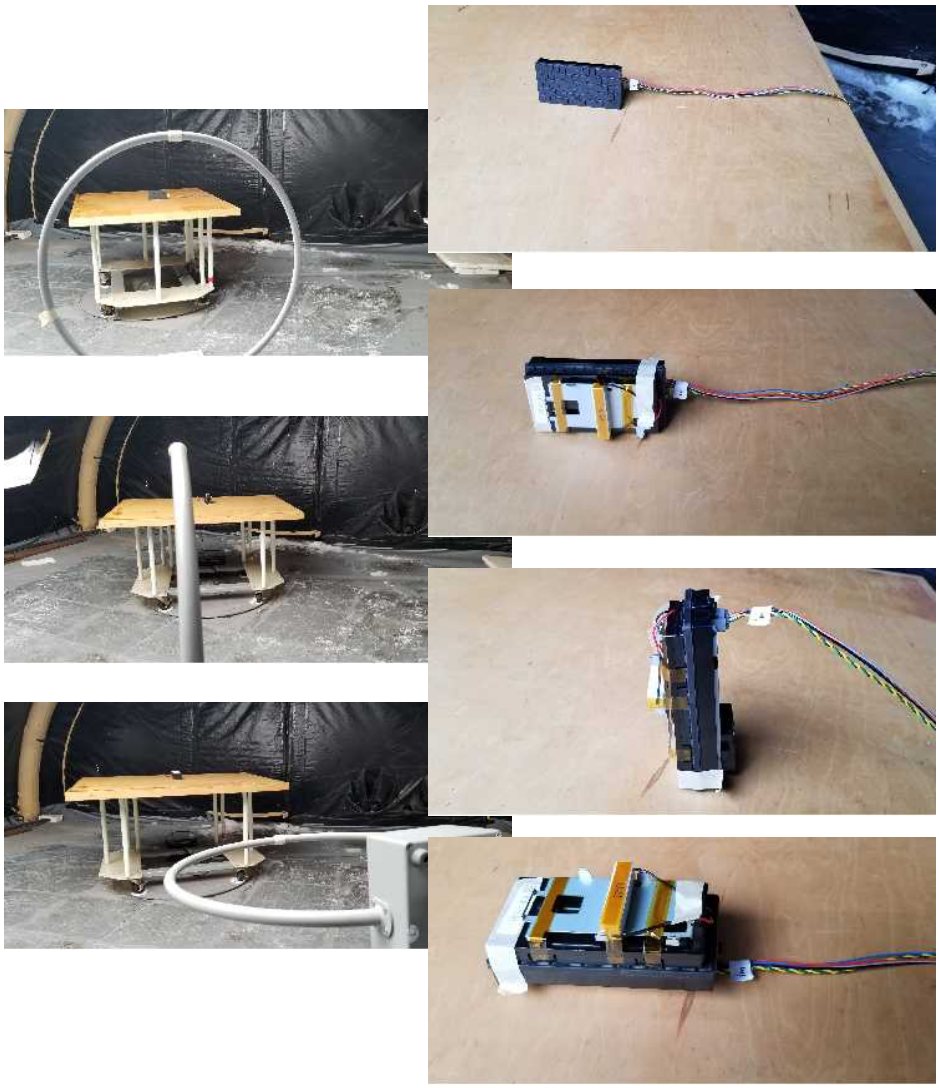

Figure 4: Radiated Emissions Test Setup Photograph(s).

### 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 | 200 Hz | 300 Hz |
| 150 kHz ≤ f ≤ 30 MHz | Pk/QPk | 9 kHz/10 kHz | 30 kHz |

| | |
|---|---|
| **Test Date:** | 10-Jan-21 |
| **Test Engineer:** | Joseph Brunett |
| **EUT Mode:** | Normal Operating |
| **Meas. Distance:** | 3 meters |
| **EUT Tested:** | LG WCFDM00YNA |

| | | Overall Transmission | | | Internal Frame Characteristics | | | Computed Duty Cycle* | |
|---|---|---|---|---|---|---|---|---|---|
| # | EUT Mode | Min. Repetition Rate (sec) | Max. No. of Frames | Total Transmission Length (sec) | Max. Frame Length (ms) | Min. Frame Period (s) | Frame Encoding | (%) | Duty (dB) |
| 1 | Load Auth + Charging | N/A | - | - | >100ms | - | Once authenticated, EUT charging occurs in CW mode with an on-time far greater than 100 ms. | N/A | N/A |

* No Duty Cycle is employed when demonstrating compliance.

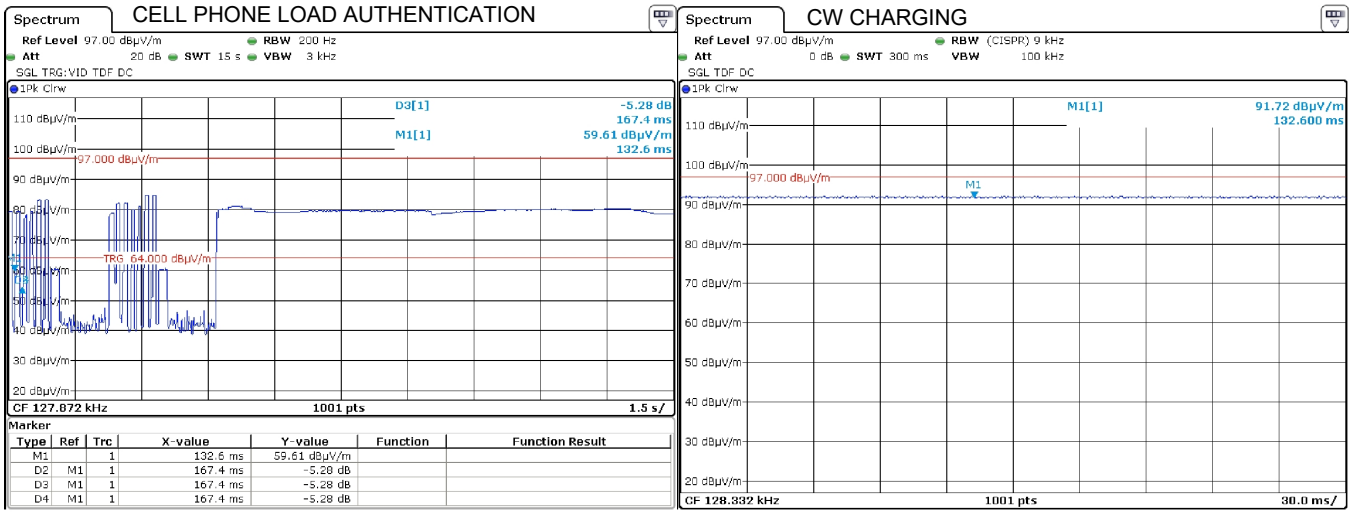


Figure 5: Pulsed Emission Characteristics (Duty Cycle).

### 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:** | 14-Jan-21 |
| 150 kHz ≤ f ≤ 30 MHz | Pk | > 1% Span | >= 3 * IFBW | **Test Engineer:** | Joseph Brunett |
| | | | | **EUT Mode:** | Load Auth + Charging |
| | | | | **Meas. Distance:** | 3 m |
| | | | | **EUT Tested:** | LG WCFDM00YNA |

| # | Frequency Range (MHz) | Temp (C) | Supply (VDC) | 99% PWR BW (kHz) | 23 dB EBW (kHz) | 110 kHz Restricted Band (dBc) | | | |
|---|---|---|---|---|---|---|---|---|---|
| 1 | 0.1279 | 2 | 13.4 | 3.196 | 0.849 | 40.6 | | | |

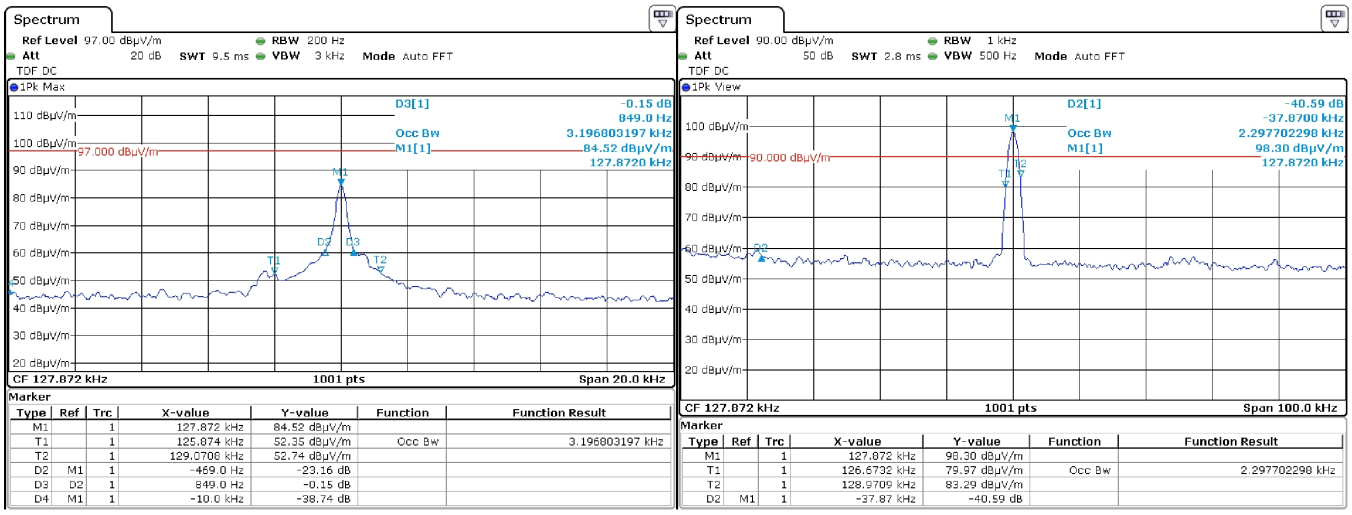


Figure 6: Intentional Emission Bandwidth.

### 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 | Meas. Distance: | 3 meters | Test Date: | 8-Jan-21 |
|---|---|---|---|---|---|---|---|
| 9 kHz ≤ f ≤ 150 kHz | Pk/QPk | 200 Hz | 300 Hz | EUT Tested: | LG WCFDM00YNA | Test Engineer: | Joseph Brunett |

**Fundamental Emissions Measurements**

| # | Mode | Test Antenna Polarization | Freq. MHz | Ant. Used | Ant Ht. | Table Angle | Ka dB/m | Kg dB | Cf** 3m / 300m (dB) | E3m (Pk) dBuV/m | H3m (Pk) dBuA/m | E300m (Pk)** dBuV/m | E300m Limit dBuV/m | ICES-001 Table 2, 3m dBuA/m | Pass By*** |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 15W, Coil 1 | Coaxial - Horz | 0.128 | EMCOLOOP1 | 1.0 | 300.0 | 10.1 | 0.0 | 80.0 | 86.4 | 34.9 | 6.4 | 25.7 | 45.3 | 10.5 |
| 2 | | Coplanar - Vert | 0.128 | EMCOLOOP1 | 1.0 | 300.0 | 10.1 | 0.0 | 80.0 | 78.2 | 26.7 | -1.8 | 25.7 | 45.3 | 18.7 |
| 3 | | Coplanar - Horz | 0.128 | EMCOLOOP1 | 1.0 | 300.0 | 10.1 | 0.0 | 80.0 | 75.3 | 23.8 | -4.7 | 25.7 | 45.3 | 21.6 |
| 4 | 15W, Coil 2 | Coaxial - Horz | 0.128 | EMCOLOOP1 | 1.0 | 300.0 | 10.1 | 0.0 | 80.0 | 87.1 | 35.6 | 7.1 | 25.7 | 45.3 | 9.8 |
| 5 | | Coplanar - Vert | 0.128 | EMCOLOOP1 | 1.0 | 300.0 | 10.1 | 0.0 | 80.0 | 78.9 | 27.4 | -1.1 | 25.7 | 45.3 | 18.0 |
| 6 | | Coplanar - Horz | 0.128 | EMCOLOOP1 | 1.0 | 300.0 | 10.1 | 0.0 | 80.0 | 76.0 | 24.5 | -4.0 | 25.7 | 45.3 | 20.9 |
| 7 | 15W, Coil 3 | Coaxial - Horz | 0.128 | EMCOLOOP1 | 1.0 | 300.0 | 10.1 | 0.0 | 80.0 | 89.3 | 37.8 | 9.3 | 25.7 | 45.3 | **7.6** |
| 8 | | Coplanar - Vert | 0.128 | EMCOLOOP1 | 1.0 | 300.0 | 10.1 | 0.0 | 80.0 | 81.1 | 29.6 | 1.1 | 25.7 | 45.3 | 15.8 |
| 9 | | Coplanar - Horz | 0.128 | EMCOLOOP1 | 1.0 | 300.0 | 10.1 | 0.0 | 80.0 | 78.2 | 26.7 | -1.8 | 25.7 | 45.3 | 18.7 |
| 10 | 15W, Coil 4 | Coaxial - Horz | 0.128 | EMCOLOOP1 | 1.0 | 300.0 | 10.1 | 0.0 | 80.0 | 87.6 | 36.1 | 7.6 | 25.7 | 45.3 | 9.3 |
| 11 | | Coplanar - Vert | 0.128 | EMCOLOOP1 | 1.0 | 300.0 | 10.1 | 0.0 | 80.0 | 79.4 | 27.9 | -.6 | 25.7 | 45.3 | 17.5 |
| 12 | | Coplanar - Horz | 0.128 | EMCOLOOP1 | 1.0 | 300.0 | 10.1 | 0.0 | 80.0 | 76.5 | 25.0 | -3.5 | 25.7 | 45.3 | 20.4 |

| # | Mode | Test Antenna Polarization | Freq. MHz | Supply Voltage | E3m (Pk) dBuV/m |
|---|---|---|---|---|---|
| 13 | 15W, Coil 4 | Coaxial | 0.128 | 15.4 | 87.6 |
| 14 | | | 0.128 | 13.4 | 87.6 |
| 15 | | | 0.128 | 11.4 | 87.6 |

* EUT was tested in 15W full power charging mode, which is CW. No averaging applies. Worst case emissions came with manufacturer supplied smart load.
** 40 dB/dec conversion factor employed

## 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:** | 8-Jan-21 |
| 150 kHz ≤ f ≤ 30 MHz | Pk/QPk | 9 kHz | 30 kHz | **Test Engineer:** | Joseph Brunett |
| | | | | **Meas. Distance:** | 3 meters |
| | | | | **EUT Tested:** | LG WCFDM00YNA |

**Transmit Chain Spurious Emissions**

| # | Mode | Test Antenna Polarization | Freq. kHz | Ant. Used | Ant Ht. m | Table Angle deg | Ka dB/m | Kg dB | Cf** (3 to 300/30m) dB | E-field (3m) (Pk) dBuV/m | E-field (300m / 30m) (Pk) dBuV/m | H-field (3m) (Pk) dBuA/m | FCC Elim (300m / 30m) dBuV/m | ICES-001T2 Hlim (3m) dBuA/m | Pass By | Comments |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | Load Removed | Coaxial - Horz | 103.8 | EMCOLOOP1 | 1.0 | 300.0 | 10.0 | 0.0 | 80.0 | 73.6 | -6.4 | 22.1 | 27.3 | 53.5 | 31.4 | |
| 2 | | Coaxial - Horz | 108.1 | EMCOLOOP1 | 1.0 | 300.0 | 10.0 | 0.0 | 80.0 | 73.9 | -6.1 | 22.4 | 26.9 | 51.9 | 29.5 | |
| 3 | | Coaxial - Horz | 127.9 | EMCOLOOP1 | 1.0 | 300.0 | 10.0 | 0.0 | 80.0 | 63.4 | -16.6 | 11.9 | 25.5 | 45.3 | 33.4 | |
| 4 | 15W, Max All 4 Individual Coils | Coaxial - Horz | 255.8 | EMCOLOOP1 | 1.0 | 120.0 | 10.0 | 0.0 | 80.0 | 54.8 | -25.2 | 3.3 | 19.4 | 36.0 | 32.7 | |
| 5 | | Coplanar - Vert | 255.8 | EMCOLOOP1 | 1.0 | 120.0 | 10.0 | 0.0 | 80.0 | 51.9 | -28.1 | .4 | 19.4 | 36.0 | 35.6 | |
| 6 | | Coplanar - Horz | 255.8 | EMCOLOOP1 | 1.0 | 120.0 | 10.0 | 0.0 | 80.0 | 52.8 | -27.2 | 1.3 | 19.4 | 36.0 | 34.7 | |
| 7 | | H/V (worst case) | 383.7 | EMCOLOOP1 | 1.0 | all | 10.0 | 0.0 | 80.0 | 46.1 | -33.9 | -5.4 | 15.9 | 33.7 | 39.1 | |
| 8 | | H/V (worst case) | 511.6 | EMCOLOOP1 | 1.0 | all | 10.2 | 0.0 | 40.0 | 34.7 | -5.3 | -16.8 | 33.4 | 32.1 | 38.7 | noise |
| 9 | | H/V (worst case) | 639.5 | EMCOLOOP1 | 1.0 | all | 10.2 | 0.0 | 40.0 | 35.1 | -4.9 | -16.4 | 31.5 | 30.8 | 36.4 | noise |
| 10 | | H/V (worst case) | 767.4 | EMCOLOOP1 | 1.0 | all | 10.1 | 0.0 | 40.0 | 31.9 | -8.1 | -19.6 | 29.9 | 29.8 | 38.0 | noise |
| 11 | | H/V (worst case) | 895.3 | EMCOLOOP1 | 1.0 | all | 10.2 | 0.0 | 40.0 | 57.6 | 17.6 | 6.1 | 28.6 | 28.9 | **11.0** | background |
| 12 | | H/V (worst case) | 1023.2 | EMCOLOOP1 | 1.0 | all | 10.4 | 0.0 | 40.0 | 33.4 | -6.6 | -18.1 | 27.4 | 28.1 | 34.0 | noise |
| 13 | | H/V (worst case) | 1151.1 | EMCOLOOP1 | 1.0 | all | 10.4 | 0.0 | 40.0 | 31.2 | -8.8 | -20.3 | 26.4 | 27.5 | 35.2 | noise |
| 14 | | H/V (worst case) | 1279.0 | EMCOLOOP1 | 1.0 | all | 10.4 | 0.0 | 40.0 | 24.9 | -15.1 | -26.6 | 25.5 | 26.9 | 40.6 | noise |

* EUT was tested in CW charging mode. No averaging applies and Quasi-Peak data was not needed to demonstrate compliance. Worst case emissions came with manufacturer supplied smart load.
** 40 dB/dec Near-field conversion factor employed.

## 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).

2020-06-23 through 2021-06-30
Effective Dates

For the National Voluntary Laboratory Accreditation Program



Figure 7: Accreditation Documents