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# Chug, Inc.

# TEST REPORT

**SCOPE OF WORK**
FCC Testing–212WGH01

**REPORT NUMBER**
1561F846

**ISSUE DATE** **[REVISED DATE]**
September 17, 2020 [----------]

**PAGES**
26

**DOCUMENT CONTROL NUMBER**
FCC ID 249_C


**Chug, Inc.**

Application
For
Certification

**FCC ID: 2AO23-212WGH01**

**Wireless Gaming Headset**

**Model: 212WGH01**

**Brand Name:** 212°

2.4GHz Transceiver

Report No.: 200831042SZN-002

We hereby certify that the sample of the above item is considered to comply with the requirements of FCC Part 15, Subpart C for Intentional Radiator, mention 47 CFR [10-1-19]

Prepared and Checked by:

*Jeff Liang*
*Engineer*

Approved by:

*Kidd Yang*
*Technical Supervisor*
*Date: September 17, 2020*



**Intertek Testing Services Shenzhen Ltd. Longhua Branch**
101, 201, Building B, No. 308 Wuhe Avenue, Zhangkengjing Community, GuanHu Subdistrict, LongHua District, ShenZhen, P.R. China
Tel: (86 755) 8601 6288 Fax: (86 755) 8601 6751

## MEASUREMENT/TECHNICAL REPORT

This report concerns (check one:) Original Grant X Class II Change _____

Equipment Type: DXX - Part 15 Low Power Communication Device Transmitter

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Deferred grant requested per 47 CFR 0.457(d)(1)(ii)? Yes _____ No X

If yes, defer until: _____
date

Company Name agrees to notify the Commission by: _____
date
of the intended date of announcement of the product so that the grant can be issued on that date.

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Transition Rules Request per 15.37? Yes _____ No X

If no, assumed Part 15, Subpart C for intentional radiator – the new 47 CFR [10-1-19 Edition] provision.

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Report prepared by:

Jeff Liang
Intertek Testing Services Shenzhen Ltd. Longhua Branch
101, 201, Building B, No. 308 Wuhe Avenue,
Zhangkengjing Community, GuanHu Subdistrict,
LongHua District, ShenZhen, P.R. China
Tel / Fax: 86-755-8614 0743/86-755-8601 6661

# Table of Contents

## 1.0 Summary of Test Result

Applicant: Chug, Inc.
Applicant Address: 7157 Shady Oak Road, Eden Prairie, MN 55344, USA
Manufacturer: Chug, Inc.
Manufacturer Address: 7157 Shady Oak Road, Eden Prairie, MN 55344, USA

MODEL: 212WGH01

FCC ID: 2AO23-212WGH01

| Test Specification | Reference | Results |
|---|---|---|
| Transmitter Radiated Emission | 15.249 &15.209 &15.205 | Pass |
| Conducted Emission | 15.207 | Pass |
| Bandedge | 15.249 &15.209 &15.205 | Pass |
| 20dB Bandwidth | 15.215(c) | Pass |

Notes: The EUT uses an Integral Antenna which in accordance to Section 15.203 is considered sufficient to comply with the provisions of this section.

## 2.0 General Description

### 2.1 Product Description

The equipment under test (EUT) is a Wireless Gaming Headset operating at 2.4G Band. The EUT is powered by DC 5V from USB port. For more detail information pls. refer to the user manual.

Antenna Type: Integral antenna
Modulation Type: GFSK
Antenna Gain: 1.5dBi Max

For electronic filing, the brief circuit description is saved with filename: descri.pdf.

### 2.2 Related Submittal(s) Grants

This is an application for certification of dongle unit for the Wireless Gaming Headset, and the corresponding headset unit which associated with this EUT is subjected to FCC certification with FCC ID: 2AO23-212WGH01C.

The digital function of the EUT is subjected to report number: 200831044SZN-002.

### 2.3 Test Methodology

Both AC mains line-conducted and radiated emission measurements were performed according to the procedures in ANSI C63.10 (2013). Radiated emission measurement was performed in Semi-anechoic chamber and conducted emission measurement was performed in shield room. For radiated emission measurement, preliminary scans were performed in the semi-anechoic chamber only to determine the worst-case modes. All radiated tests were performed at an antenna to EUT distance of 3 meters, unless stated otherwise in the "Justification Section" of this Application. All other measurements were made in accordance with the procedures in part 2 of CFR 47.

### 2.4 Test Facility

The Semi-Anechoic chamber and shield room used to collect the radiated data and conducted data are **Intertek Testing Services Shenzhen Ltd. Longhua Branch** and located at 101, 201, Building B, No. 308 Wuhe Avenue, Zhangkengjing Community, GuanHu Subdistrict, LongHua District, ShenZhen, P.R. China. This test facility and site measurement data have been fully placed on file with the FCC (Registration Number: CN1188).

## 3.0 System Test Configuration

### 3.1 Justification

The system was configured for testing in a typical fashion (as a customer would normally use it), and in the confines as outlined in ANSI C63.10 (2013).

The EUT was powered by DC 5V from computer with AC 120V/60Hz input during the test, only the worst data was reported in this report.

For maximizing emissions below 30 MHz, the EUT was rotated through 360°, the centre of the loop antenna was placed 1 meter above the ground, and the antenna polarization was changed. For maximizing emissions, the EUT was rotated through 360°, the antenna height was varied from 1 meter to 4 meters above the ground plane, and the antenna polarization was changed. This step by step procedure for maximizing emissions led to the data reported in Section 4.

The rear of unit shall be flushed with the rear of the table.

The equipment under test (EUT) was configured for testing in a typical fashion (as a customer would normally use it). The EUT was placed on a turn table, which enabled the engineer to maximize emissions through its placement in the three orthogonal axes.

### 3.2 EUT Exercising Software

The EUT exercise program (provided by client) used during radiated and conducted testing was designed to exercise the various system components in a manner similar to a typical use. The worst case configuration is used in all specified testing.

Software: USB SERIES Version 1.0

### 3.3 Special Accessories

No special accessories used.

### 3.4 Equipment Modification

Any modifications installed previous to testing by Chug, Inc. will be incorporated in each production model sold / leased in the United States.

No modifications were installed by Intertek Testing Services Shenzhen Ltd. Longhua Branch.

## 3.5 Measurement Uncertainty

When determining the test conclusion, the Measurement Uncertainty of test has been considered.

## 3.6 Support Equipment List and Description

| Description | Manufacturer | Remark |
|---|---|---|
| Portable computer | HP | ProBook 430 G1 |
| AC Adaptor | HP | MODEL: HSTNN-CA15<br>INPUT: 100-240V~1.7A 50-60Hz<br>OUTPUT: DC19.5V, 3.33A 65W |
| USB extension cable | N/A<br>(Provided by Intertek) | Unshielded, Length: 30cm |

## 4.0 Emission Results

Data is included worst-case configuration (the configuration which resulted in the highest emission levels).

### 4.1 Radiated Test Results

A sample calculation, configuration photographs and data tables of the emissions are included.

#### 4.1.1 Field Strength Calculation

The field strength is calculated by adding the reading on the Spectrum Analyzer to the factors associated with preamplifiers (if any), antennas, cables, pulse desensitization and average factors (when specified limit is in average and measurements are made with peak detectors). A sample calculation is included below.

FS = RA + AF + CF - AG + PD + AV

Where FS = Field Strength in dBµV/m
RA = Receiver Amplitude (including preamplifier) in dBµV
CF = Cable Attenuation Factor in dB
AF = Antenna Factor in dB
AG = Amplifier Gain in dB
PD = Pulse Desensitization in dB
AV = Average Factor in -dB

In the radiated emission table which follows, the reading shown on the data table may reflect the preamplifier gain. An example of the calculations, where the reading does not reflect the preamplifier gain, follows:

FS = RA + AF + CF - AG + PD + AV

Assume a receiver reading of 62.0 dBµV is obtained. The antenna factor of 7.4 dB and cable factor of 1.6 dB is added. The amplifier gain of 29 dB is subtracted. The pulse desensitization factor of the spectrum analyzer was 0 dB, and the resultant average factor was -10 dB. The net field strength for comparison to the appropriate emission limit is 32 dBµV/m. This value in dBµV/m was converted to its corresponding level in µV/m.

RA = 62.0 dBµV
AF = 7.4 dB
CF = 1.6 dB
AG = 29.0 dB
PD = 0 dB
AV = -10 dB
FS = 62 + 7.4 + 1.6 - 29 + 0 = 42 dBµV/m

Level in µV/m = Common Antilogarithm [(42 dBµV/m)/20] = 125.9 µV/m

4.1.2 Radiated Emission Configuration Photograph

For electronic filing, the worst case radiated emission configuration photograph is saved with filename: radiated photos. pdf.

4.1.3 Radiated Emissions

The data on the following page lists the significant emission frequencies, the limit and the margin of compliance. Numbers with a minus sign are below the limit.

Worst Case Radiated Emission
at
33.718333 MHz

Judgement: Passed by 16.4 dB

***TEST PERSONNEL:***

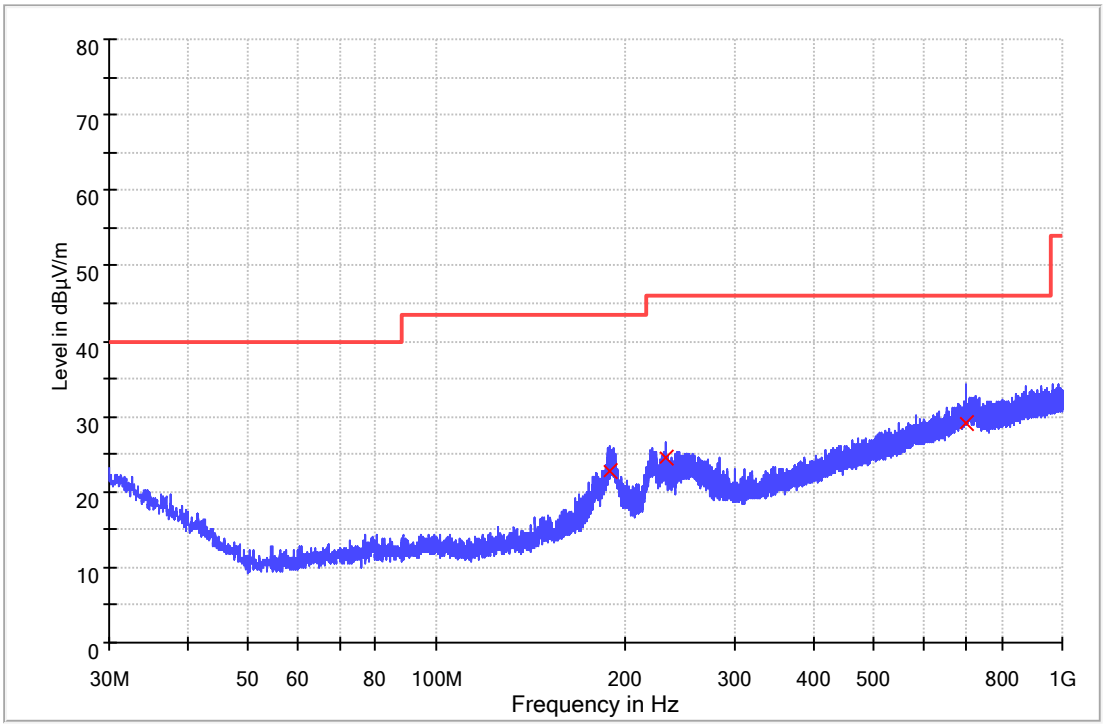
*Sign on file*

Jeff Liang, Engineer
*Typed/Printed Name*

September 15, 2020
*Date*

Applicant: Chug, Inc.
Date of Test: September 15, 2020 Model: 212WGH01
Worst Case Operating Mode: Transmitting (2478MHz)

ANT Polarity: Horizontal

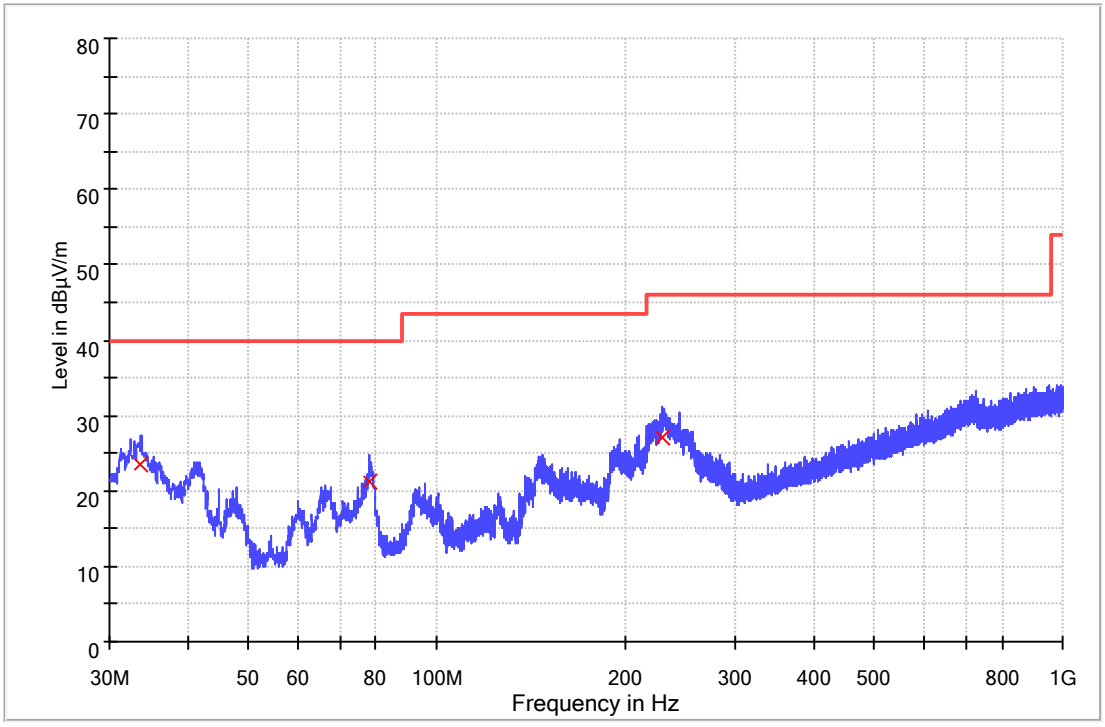



| Frequency (MHz) | QuasiPeak (dBuV/m) | Meas. Time (ms) | Bandwidth (kHz) | Height (cm) | Polarization | Corr. (dB) | Margin - QPK (dB) | Limit - QPK (dBuV/m) |
|---|---|---|---|---|---|---|---|---|
| 188.756667 | 22.7 | 1000.0 | 120.000 | 0.0 | H | 12.7 | 20.8 | 43.5 |
| 232.212667 | 24.5 | 1000.0 | 120.000 | 0.0 | H | 14.0 | 21.5 | 46.0 |
| 701.725000 | 29.2 | 1000.0 | 120.000 | 0.0 | H | 25.9 | 16.8 | 46.0 |

Remark:
1. Corr. = Antenna Factor (dB/m) + Cable Loss (dB)
2. QuasiPeak (dBµV/m)= Corr. (dB/m)+ Read Level (dBµV)
3. Margin (dB) = Limit Line(dBµV/m) – Level (dBµV/m)

Applicant: Chug, Inc.
Date of Test: September 15, 2020 Model: 212WGH01
Worst Case Operating Mode: Transmitting (2478MHz)

ANT Polarity: Vertical




| Frequency (MHz) | QuasiPeak (dBuV/m) | Meas. Time (ms) | Bandwidth (kHz) | Height (cm) | Polarization | Corr. (dB) | Margin - QPK (dB) | Limit - QPK (dBuV/m) |
|---|---|---|---|---|---|---|---|---|
| 33.718333 | 23.6 | 1000.0 | 120.000 | 0.0 | V | 16.6 | 16.4 | 40.0 |
| 78.209000 | 21.1 | 1000.0 | 120.000 | 0.0 | V | 9.2 | 18.9 | 40.0 |
| 228.882333 | 27.2 | 1000.0 | 120.000 | 0.0 | V | 13.8 | 18.8 | 46.0 |

Remark:
1. Corr. = Antenna Factor (dB/m) + Cable Loss (dB)
2. QuasiPeak (dBµV/m)= Corr. (dB/m)+ Read Level (dBµV)
3. Margin (dB) = Limit Line(dBµV/m) – Level (dBµV/m)

4.1.4 Transmitter Spurious Emissions (Radiated)

Worst Case Radiated Emission
at
2483.500 MHz

For electronic filing, the worst case radiated emission configuration photograph is saved with filename: radiated photos. pdf.

The data on the following page lists the significant emission frequencies, the limit and the margin of compliance. Numbers with a minus sign are below the limit.

Judgement: Passed by 4.0 dB

***TEST PERSONNEL:***

*Sign on file*

Jeff Liang, Engineer
*Typed/Printed Name*

September 15, 2020
*Date*

Applicant: Chug, Inc.
Date of Test: September 15, 2020 Model: 212WGH01
Worst Case Operating Mode: Transmitting

Table 1

**Radiated Emissions**

(2403MHz)

| Polarization | Frequency (MHz) | Reading (dBµV) | Pre-Amp Gain (dB) | Antenna Factor (dB) | Net at 3m (dBµV/m) | Peak Limit at 3m (dBµV/m) | Margin (dB) |
|---|---|---|---|---|---|---|---|
| Horizontal | 2403.000 | 87.2 | 36.7 | 28.1 | 78.6 | 114.0 | -35.4 |
| Horizontal | 4806.000 | 32.9 | 36.7 | 35.5 | 31.7 | 74.0 | -42.3 |
| Horizontal | 7209.000 | 38.0 | 36.1 | 36.5 | 38.4 | 74.0 | -35.6 |
| Horizontal | 9612.000 | 46.2 | 36.2 | 37.0 | 47.0 | 74.0 | -27.0 |

| Polarization | Frequency (MHz) | Reading (dBµV) | Pre-Amp Gain (dB) | Antenna Factor (dB) | Net at 3m (dBµV/m) | Average Limit at 3m (dBµV/m | Margin (dB) |
|---|---|---|---|---|---|---|---|
| Horizontal | 2403.000 | 87.1 | 36.7 | 28.1 | 78.5 | 94.0 | -15.5 |
| Horizontal | 4806.000 | 28.4 | 36.7 | 35.5 | 27.2 | 54.0 | -26.8 |
| Horizontal | 7209.000 | 31.3 | 36.1 | 36.5 | 31.7 | 54.0 | -22.3 |
| Horizontal | 9612.000 | 41.7 | 36.2 | 37.0 | 42.5 | 54.0 | -11.5 |

Notes:
1. Peak detector is used for the emission measurement (RBW=1MHz / VBW=3MHz for Peak value, and RBW=1MHz / VBW=10Hz for Average value; RBW=3MHz is used for fundamental emission measurement).

2. All measurements were made at 3 meter. Harmonic emissions not detected at the 3-meter distance were measured at 0.3-meter and an inverse proportional extrapolation was performed to compare the signal level to the 3-meter limit. No other harmonic emissions than those reported were detected at a test distance of 0.3-meter.

3. Negative value in the margin column shows emission below limit.

4. Horn antenna is used for the emission over 1000MHz.

Test Engineer: Jeff Liang

Applicant: Chug, Inc.
Date of Test: September 15, 2020 Model: 212WGH01
Worst Case Operating Mode: Transmitting

Table 2

**Radiated Emissions**

(2439MHz)

| Polarization | Frequency (MHz) | Reading (dBµV) | Pre-Amp Gain (dB) | Antenna Factor (dB) | Net at 3m (dBµV/m) | Peak Limit at 3m (dBµV/m) | Margin (dB) |
|---|---|---|---|---|---|---|---|
| Horizontal | 2439.000 | 87.8 | 36.7 | 28.1 | 79.2 | 114.0 | -34.8 |
| Horizontal | 4878.000 | 33.2 | 36.7 | 35.5 | 32.0 | 74.0 | -42.0 |
| Horizontal | 7317.000 | 35.5 | 36.1 | 37.2 | 36.6 | 74.0 | -37.4 |
| Horizontal | 9756.000 | 37.9 | 36.2 | 37.0 | 38.7 | 74.0 | -35.3 |

| Polarization | Frequency (MHz) | Reading (dBµV) | Pre-Amp Gain (dB) | Antenna Factor (dB) | Net at 3m (dBµV/m) | Average Limit at 3m (dBµV/m) | Margin (dB) |
|---|---|---|---|---|---|---|---|
| Horizontal | 2439.000 | 87.7 | 36.7 | 28.1 | 79.1 | 94.0 | -14.9 |
| Horizontal | 4878.000 | 26.7 | 36.7 | 35.5 | 25.5 | 54.0 | -28.5 |
| Horizontal | 7317.000 | 29.3 | 36.1 | 37.2 | 30.4 | 54.0 | -23.6 |
| Horizontal | 9756.000 | 44.1 | 36.2 | 37.0 | 44.9 | 54.0 | -9.1 |

Notes:
1. Peak detector is used for the emission measurement (RBW=1MHz / VBW=3MHz for Peak value, and RBW=1MHz / VBW=10Hz for Average value; RBW=3MHz is used for fundamental emission measurement).

2. All measurements were made at 3 meter. Harmonic emissions not detected at the 3-meter distance were measured at 0.3-meter and an inverse proportional extrapolation was performed to compare the signal level to the 3-meter limit. No other harmonic emissions than those reported were detected at a test distance of 0.3-meter.

3. Negative value in the margin column shows emission below limit.

4. Horn antenna is used for the emission over 1000MHz.

Test Engineer: Jeff Liang

Applicant: Chug, Inc.
Date of Test: September 15, 2020 Model: 212WGH01
Worst Case Operating Mode: Transmitting

Table 3

**Radiated Emissions**

(2478MHz)

| Polarization | Frequency (MHz) | Reading (dBµV) | Pre-Amp Gain (dB) | Antenna Factor (dB) | Net at 3m (dBµV/m) | Peak Limit at 3m (dBµV/m) | Margin (dB) |
|---|---|---|---|---|---|---|---|
| Horizontal | 2478.000 | 88.7 | 36.7 | 28.1 | 80.1 | 114.0 | -33.9 |
| Horizontal | 4956.000 | 32.6 | 36.7 | 35.5 | 31.4 | 74.0 | -42.6 |
| Horizontal | 7434.000 | 36.5 | 36.1 | 37.2 | 37.6 | 74.0 | -36.4 |
| Horizontal | 9912.000 | 43.4 | 36.3 | 38.9 | 46.0 | 74.0 | -28.0 |

| Polarization | Frequency (MHz) | Reading (dBµV) | Pre-Amp Gain (dB) | Antenna Factor (dB) | Net at 3m (dBµV/m) | Average Limit at 3m (dBµV/m) | Margin (dB) |
|---|---|---|---|---|---|---|---|
| Horizontal | 2478.000 | 88.6 | 36.7 | 28.1 | 80.0 | 94.0 | -14.0 |
| Horizontal | 4956.000 | 27.7 | 36.7 | 35.5 | 26.5 | 54.0 | -27.5 |
| Horizontal | 7434.000 | 31.8 | 36.1 | 37.2 | 32.9 | 54.0 | -21.1 |
| Horizontal | 9912.000 | 36.3 | 36.3 | 38.9 | 38.9 | 54.0 | -15.1 |

Notes:
1. Peak detector is used for the emission measurement (RBW=1MHz / VBW=3MHz for Peak value, and RBW=1MHz / VBW=10Hz for Average value; RBW=3MHz is used for fundamental emission measurement).

2. All measurements were made at 3 meter. Harmonic emissions not detected at the 3-meter distance were measured at 0.3-meter and an inverse proportional extrapolation was performed to compare the signal level to the 3-meter limit. No other harmonic emissions than those reported were detected at a test distance of 0.3-meter.

3. Negative value in the margin column shows emission below limit.

4. Horn antenna is used for the emission over 1000MHz.

Test Engineer: Jeff Liang

4.2 Conducted Emission Configuration Photograph

For electronic filing, the worst case radiated emission configuration photographs are saved with filename: conducted photos.pdf.

4.2.1 Conducted Emission

Worst Case Conducted Configuration
at
0.478000MHz

Judgement: Passed by 16.6dB margin

***TEST PERSONNEL:***

*Sign on file*

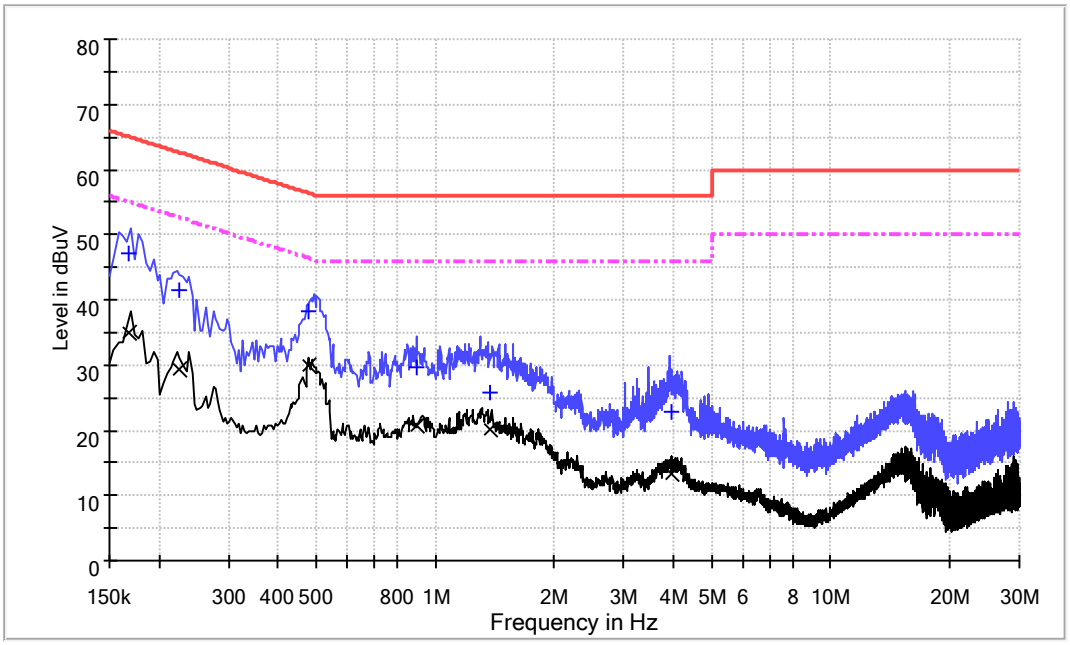
Jeff Liang, Engineer
*Typed/Printed Name*

September 15, 2020
*Date*

Applicant: Chug, Inc.
Date of Test: September 15, 2020 Model: 212WGH01
Worst Case Operating Mode: Transmitting (2478MHz)
Phase: Live

## Graphic / Data Table

## Conducted Emissions
## Pursuant to FCC 15.207: Emissions Requirement




## Limit and Margin QP

| Frequency (MHz) | QuasiPeak (dBuV) | Bandwidth (kHz) | Line | Corr. (dB) | Margin (dB) | Limit (dBuV) |
|---|---|---|---|---|---|---|
| 0.168000 | 47.1 | 9.000 | L1 | 9.7 | 18.0 | 65.1 |
| 0.226000 | 41.6 | 9.000 | L1 | 9.7 | 21.0 | 62.6 |
| 0.478000 | 38.1 | 9.000 | L1 | 9.7 | 18.3 | 56.4 |
| 0.902000 | 29.6 | 9.000 | L1 | 9.7 | 26.4 | 56.0 |
| 1.370000 | 25.8 | 9.000 | L1 | 9.7 | 30.2 | 56.0 |
| 3.942000 | 22.7 | 9.000 | L1 | 9.8 | 33.3 | 56.0 |

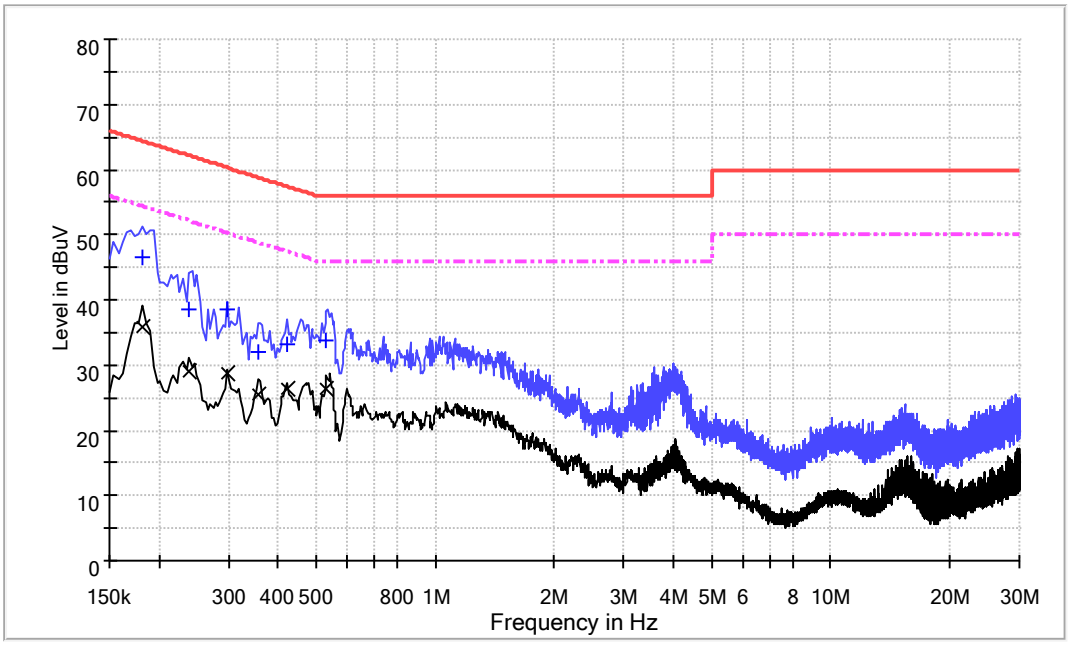
## Limit and Margin AV

| Frequency (MHz) | Average (dBuV) | Bandwidth (kHz) | Line | Corr. (dB) | Margin (dB) | Limit (dBuV) |
|---|---|---|---|---|---|---|
| 0.168000 | 35.1 | 9.000 | L1 | 9.7 | 20.0 | 55.1 |
| 0.226000 | 29.4 | 9.000 | L1 | 9.7 | 23.2 | 52.6 |
| 0.478000 | 29.8 | 9.000 | L1 | 9.7 | 16.6 | 46.4 |
| 0.902000 | 20.7 | 9.000 | L1 | 9.7 | 25.3 | 46.0 |
| 1.370000 | 20.2 | 9.000 | L1 | 9.7 | 25.8 | 46.0 |
| 3.942000 | 13.3 | 9.000 | L1 | 9.8 | 32.7 | 46.0 |

Applicant: Chug, Inc.
Date of Test: September 15, 2020 Model: 212WGH01
Worst Case Operating Mode: Transmitting (2478MHz)
Phase: Neutral

## Graphic / Data Table

## Conducted Emissions
## Pursuant to FCC 15.207: Emissions Requirement




## Limit and Margin QP

| Frequency (MHz) | QuasiPeak (dBuV) | Bandwidth (kHz) | Line | Corr. (dB) | Margin (dB) | Limit (dBuV) |
|---|---|---|---|---|---|---|
| 0.181500 | 46.4 | 9.000 | N | 9.7 | 18.0 | 64.4 |
| 0.238000 | 38.4 | 9.000 | N | 9.7 | 23.8 | 62.2 |
| 0.298000 | 38.7 | 9.000 | N | 9.7 | 21.6 | 60.3 |
| 0.358000 | 31.9 | 9.000 | N | 9.7 | 26.9 | 58.8 |
| 0.422000 | 33.2 | 9.000 | N | 9.7 | 24.2 | 57.4 |
| 0.530000 | 33.8 | 9.000 | N | 9.7 | 22.2 | 56.0 |

## Limit and Margin AV

| Frequency (MHz) | Average (dBuV) | Bandwidth (kHz) | Line | Corr. (dB) | Margin (dB) | Limit (dBuV) |
|---|---|---|---|---|---|---|
| 0.181500 | 35.9 | 9.000 | N | 9.7 | 18.5 | 54.4 |
| 0.238000 | 29.0 | 9.000 | N | 9.7 | 23.2 | 52.2 |
| 0.298000 | 28.9 | 9.000 | N | 9.7 | 21.4 | 50.3 |
| 0.358000 | 25.6 | 9.000 | N | 9.7 | 23.2 | 48.8 |
| 0.422000 | 26.3 | 9.000 | N | 9.7 | 21.1 | 47.4 |
| 0.530000 | 26.4 | 9.000 | N | 9.7 | 19.6 | 46.0 |

## 5.0 Equipment Photographs

For electronic filing, the photographs of the tested EUT are saved with filename: external photos.pdf & internal photos.pdf.

## 6.0 Product Labelling

For electronic filing, the FCC ID label artwork and the label location are saved with filename: label.pdf.

## 7.0 Technical Specifications

For electronic filing, the block diagram and schematics of the tested EUT are saved with filename: block.pdf and circuit.pdf respectively.

## 8.0 Instruction Manual

For electronic filing, a preliminary copy of the Instruction Manual is saved with filename: manual.pdf.

This manual will be provided to the end-user with each unit sold/leased in the United States.

## 9.0 Miscellaneous Information

This miscellaneous information includes details of the measured bandedge, 20dB Bandwidth, the test procedure and calculation of factor such as pulse desensitization.

### 9.1 Bandedge Plot

The test plots are attached as below. From the below plots, the field strength of any emissions outside of the specified frequency band are attenuated to the general radiated emission limits in section 15.209. It fulfils the requirement of 15.249(d).

Peak Measurement

Bandedge compliance is determined by applying marker-delta method, i.e (Bandedge Plot).

**(i) Lowest frequency channel (2403MHz):**

| Polarization | Frequency (MHz) | Reading (dBµV) | Pre-Amp Gain (dB) | Antenna Factor (dB) | Net at 3m (dBµV/m) | Peak Limit at 3m (dBµV/m) | Margin (dB) |
|---|---|---|---|---|---|---|---|
| Horizontal | 2400.000 | 71.0 | 36.7 | 28.1 | 62.4 | 74.0 | -11.6 |

| Polarization | Frequency (MHz) | Reading (dBµV) | Pre-Amp Gain (dB) | Antenna Factor (dB) | Net at 3m (dBµV/m) | Average Limit at 3m (dBµV/m | Margin (dB) |
|---|---|---|---|---|---|---|---|
| Horizontal | 2400.000 | 58.0 | 36.7 | 28.1 | 49.4 | 54.0 | -4.6 |

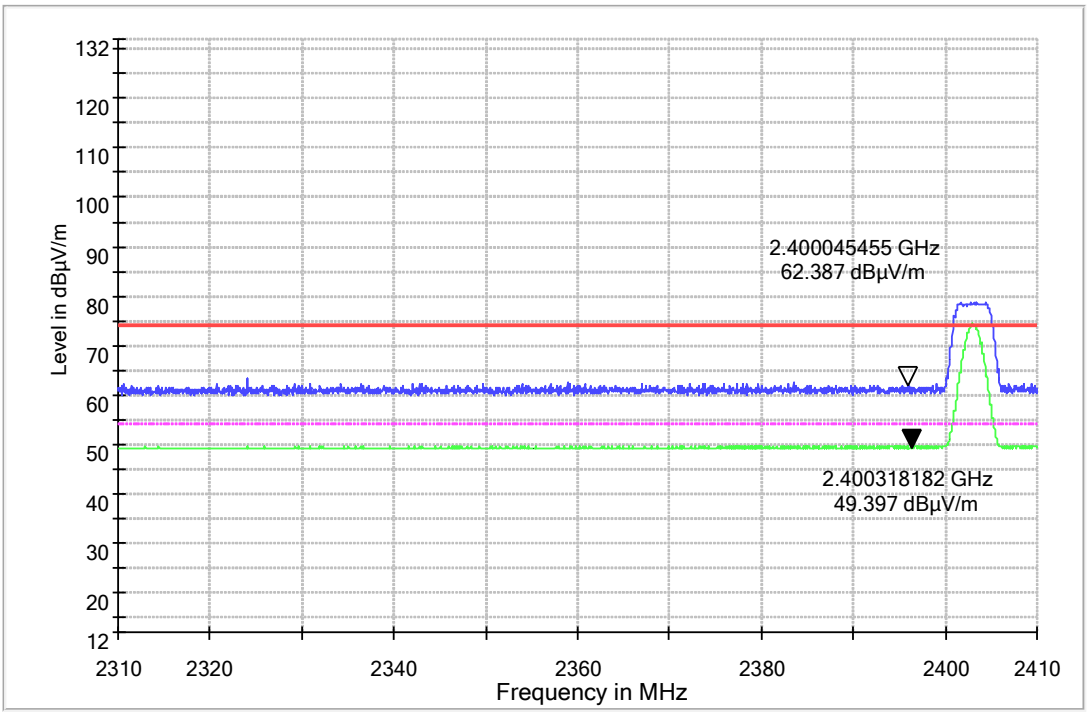
**(ii) Highest frequency channel (2478MHz):**

| Polarization | Frequency (MHz) | Reading (dBµV) | Pre-Amp Gain (dB) | Antenna Factor (dB) | Net at 3m (dBµV/m) | Peak Limit at 3m (dBµV/m) | Margin (dB) |
|---|---|---|---|---|---|---|---|
| Horizontal | 2483.500 | 70.2 | 36.8 | 29.1 | 62.5 | 74.0 | -11.5 |

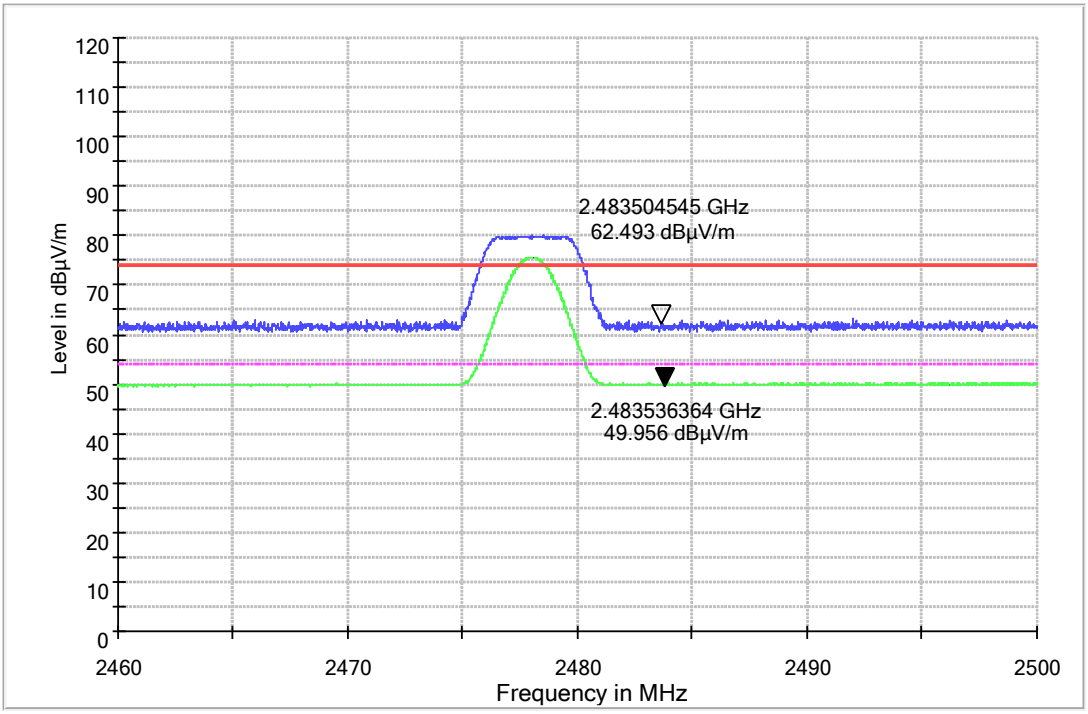
| Polarization | Frequency (MHz) | Reading (dBµV) | Pre-Amp Gain (dB) | Antenna Factor (dB) | Net at 3m (dBµV/m) | Average Limit at 3m (dBµV/m | Margin (dB) |
|---|---|---|---|---|---|---|---|
| Horizontal | 2483.500 | 57.7 | 36.8 | 29.1 | 50.0 | 54.0 | -4.0 |

The resultant field strength meets the general radiated emission limit in section 15.209, which does not exceed 74dBµv/m (Peak Limit) and 54dBµv/m (Average Limit).

Lowest frequency Channel

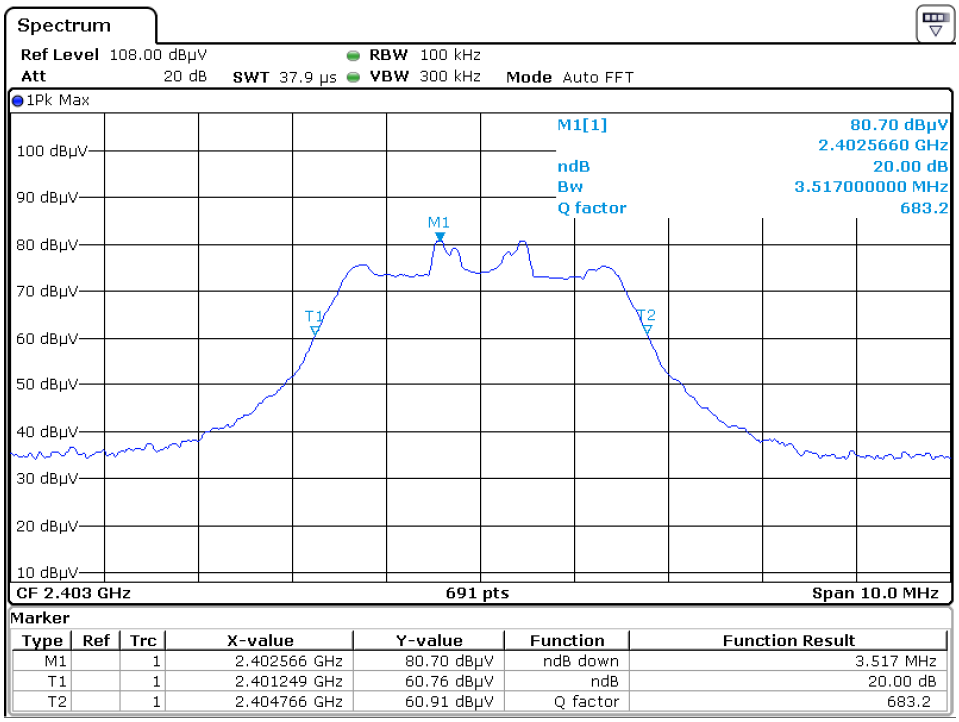


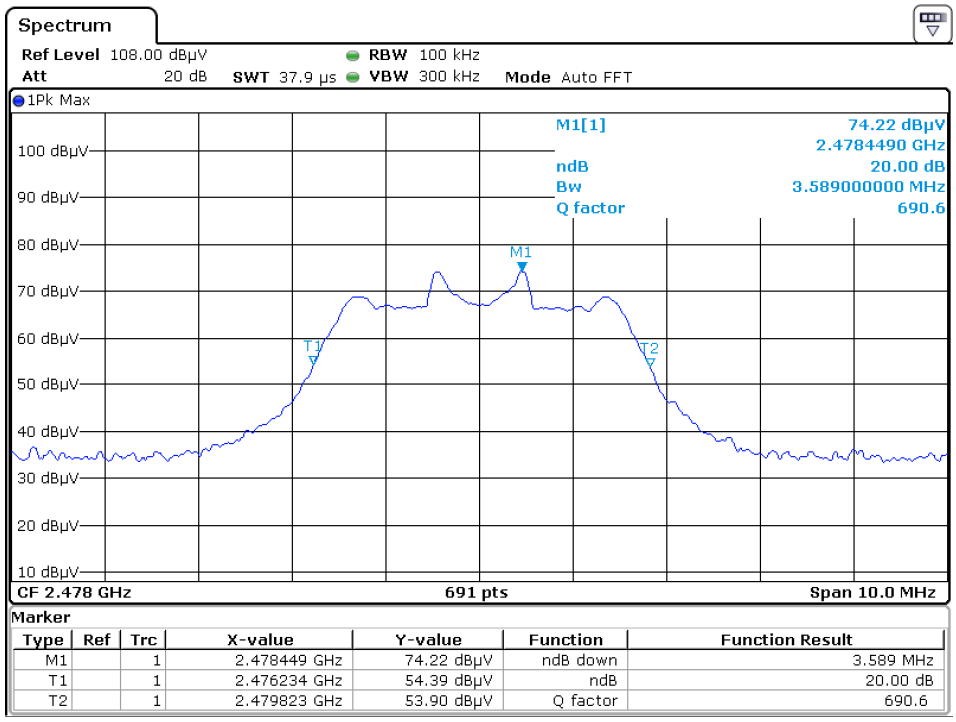

Highest frequency Channel



## 9.2 20dB bandwidth

Pursuant to FCC part 15 Section 15.215(c), the 20dB bandwidth of the emission was contained within the frequency band designated (mentioned as above) which the EUT operated. The effects, if any, from frequency sweeping, frequency hopping, other modulation techniques and frequency stability over excepted variations in temperature and supply voltage were considered. The test plots are reported as below.



## 9.3 Discussion of Pulse Desensitization

Pulse desensitivity is not applicable for this device since the transmitter transmits the RF signal continuously.

## 9.4 Transmitter Duty Cycle Calculation, FCC Rule 15.35(b, c)

The EUT antenna output port was connected to the input of the spectrum analyzer. The analyzer center frequency was set to EUT RF channel carrier. The SWEP function on the analyzer was set to ZERO SPAN. The Transmitter ON time was determined from the resultant time-amplitude display:

| | |
|---|---|
| | See attached spectrum analyzer chart (s) for Transmitter timing |
| | See Transmitter timing diagram provided by manufacturer |
| x | Not applicable, duty cycle was not used. |

## 9.5 Emissions Test Procedures

The following is a description of the test procedure used by Intertek Testing Services in the measurements of transmitters operating under Part 15, Subpart C rules.

The test set-up and procedures described below are designed to meet the requirements of ANSI C63.10 - 2013.

The transmitting equipment under test (EUT) is placed on a styrene turntable which is four feet in diameter and approximately 0.8 meter up to 1GHz and 1.5 meter above 1GHz in height above the ground plane. During the radiated emissions test, the turntable is rotated and any cables leaving the EUT are manipulated to find the configuration resulting in maximum emissions. The EUT is adjust through all three orthogonal axes to obtain maximum emission levels. The antenna height and polarization are varied during the testing to search for maximum signal levels.

Detector function for radiated emissions is in peak mode. Average readings, when required, are taken by measuring the duty cycle of the equipment under test and subtracting the corresponding amount in dB from the measured peak readings. A detailed description for the calculation of the average factor can be found in section 9.4.

The frequency range scanned is from the lowest radio frequency signal generated in the device which is greater than 9 kHz to the tenth harmonic of the highest fundamental frequency or 40 GHz, whichever is lower.

Detector function for conducted emissions is in QP & AV mode and IFBW setting is 9 kHz from the frequency band 150 kHz to 30MHz.

9.5 Emissions Test Procedures (cont'd)

The EUT is warmed up for 15 minutes prior to the test.

AC power to the unit is varied from 85% to 115% nominal and variation in the fundamental emission field strength is recorded. If battery powered, a new, fully charged battery is used.

Conducted measurements are made as described in ANSI C63.10 - 2013.

The IF bandwidth used for measurement of radiated signal strength was 10 kHz for emission below 30 MHz and 120 kHz for emission from 30 MHz to 1000 MHz. Where pulsed transmissions of short enough pulse duration warrant, a greater bandwidth is selected according to the recommendations of Hewlett Packard Application Note 150-2. Above 1000 MHz, a resolution bandwidth of 1 MHz is used (RBW 10MHz used for fundamental emission).

Transmitter measurements are normally conducted at a measurement distance of three meters. However, to assure low enough noise floor in the restricted bands and above 1 GHz, signals are acquired at a distance of one meter or less. All measurements are extrapolated to three meters using inverse scaling, but those measurements taken at a closer distance are so marked.

## 10.0 Test Equipment List

| Equipment No. | Equipment | Manufacturer | Model No. | Serial No. | Cal. Date | Due Date |
|---|---|---|---|---|---|---|
| SZ061-12 | Biconilog Antenna | ETS | 3142E | 00166158 | 2018-09-15 | 2020-09-15 |
| SZ061-06 | Active Loop Antenna | Electro-Metrics | EM-6876 | 217 | 2019-05-24 | 2021-05-24 |
| SZ061-08 | Horn Antenna | ETS | 3115 | 00092346 | 2019-09-07 | 2021-09-07 |
| SZ061-07 | Pyramidal Horn Antenna | ETS | 3160-09 | 00083067 | 2019-05-24 | 2021-05-24 |
| SZ056-03 | Spectrum Analyzer | R&S | FSP30 | 101148 | 2020-05-27 | 2021-05-27 |
| SZ185-01 | EMI Receiver | R & S | ESCI | 100547 | 2019-12-24 | 2020-12-24 |
| SZ181-04 | Preamplifier | Agilent | 8449B | 3008A02474 | 2020-05-27 | 2021-05-27 |
| SZ188-01 | Anechoic Chamber | ETS | RFD-F/A-100 | 4102 | 2018-12-15 | 2021-12-15 |
| SZ062-02 | RF Cable | RADIALL | RG 213U | -- | 2020-06-12 | 2020-12-12 |
| SZ062-05 | RF Cable | RADIALL | 0.04-26.5GHz | -- | 2020-06-12 | 2020-12-12 |
| SZ062-12 | RF Cable | RADIALL | 0.04-26.5GHz | -- | 2020-08-24 | 2021-02-24 |
| SZ067-04 | Notch Filter | Micro-Tronics | BRM50702-02 | -- | 2020-05-27 | 2021-05-27 |
| SZ185-02 | EMI Test Receiver | R&S | ESCI | 100692 | 2019-10-29 | 2020-10-29 |
| SZ187-02 | Two-Line V-Network | R&S | ENV216 | 100073 | 2020-05-27 | 2021-05-27 |
| SZ188-03 | Shielding Room | ETS | RFD-100 | 4100 | 2020-01-07 | 2021-01-07 |
| SZ062-16 | RF Cable | HUBER+SUHNER | CBL2-BN-1m | 110127-2231000 | 2019-10-30 | 2020-10-30 |

********** End of Report**********