

LIGHTUPTOYS.COM LLC

# TEST REPORT

**SCOPE OF WORK**

FCC TESTING– MODEL: DVRFCTR-2920

**REPORT NUMBER**

SZHH01882581-001

**ISSUE DATE**

February 28, 2025

**PAGES**

29

**DOCUMENT CONTROL NUMBER**

FCC ID 249\_C

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**LIGHTUPTOYS.COM LLC**

Application for Certification

**FCC ID: 2A9OKRFCON2920****20-Button RF Controller****Model: DVRFCTR-2920**

2.4GHz Transmitter

Report No.: SZHH01882581-001

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 [10-1-23]

Prepared and Checked by:

Approved by:

Sign on file

*Maura Wang*  
Engineer

---

*Johnny Wang*  
Project Engineer  
Date: February 28, 2025

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**Intertek Testing Service Shenzhen Ltd. Longhua Branch**

No.101&201, Building B, No.308, Wuhe Avenue, Zhangkengjing, Guanhu Subdistrict, Longhua District, Shenzhen, Guangdong, China/518110  
Tel: (86 755) 8601 6288 Fax: (86 755) 8601 6751

**MEASUREMENT/TECHNICAL REPORT**

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

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

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

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.

Transition Rules Request per 15.37? Yes  No

If no, assumed Part 15, Subpart C for intentional radiator – the new 47 CFR [10-1-23 Edition] provision.

Report prepared by:

Maura Wang  
Intertek Testing Services Shenzhen Ltd. Longhua Branch  
No.101&201, Building B, No.308, Wuhe Avenue, Zhangkengjing,  
Guanhu Subdistrict, Longhua District, Shenzhen, Guangdong,  
China/518110  
Tel / Fax: 86-755-8601 6288/86-755-8601 6751

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**1.0 Summary of Test Result**

Applicant: LIGHTUPTOYS.COM LLC

Applicant Address: 8512 Commerce Park Drive Sellerburg, Indiana, United States

Manufacturer: LIGHTUPTOYS.COM LLC

Manufacturer Address: 8512 Commerce Park Drive Sellerburg, Indiana, United States

MODEL: DVRFCTR-2920

FCC ID: 2A9OKRFCN2920

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

Notes: The EUT uses a dedicated 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 an 20-Button RF Controller operating at 2.4G Band. The EUT can be powered by DC 3.7V (1 x 3.7V rechargeable battery). For more detail information pls. refer to the user manual.

Antenna Type: dedicated antenna

Modulation Type: GFSK

Antenna Gain: -0.57dBi

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 controller unit for the 20-Button RF Controller.

### 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 used to collect the radiated data is **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, People's Republic of 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 3.7V (1 x 3.7V rechargeable battery) 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 bottom 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 EUT was operated standalone and placed in the central of the turntable.

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**

There was no special software to exercise the device.

#### **3.3 Special Accessories**

No special accessories used.

#### **3.4 Equipment Modification**

Any modifications installed previous to testing by LIGHTUPTOYS.COM LLC 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.

Measurement Uncertainty	Uncertainty
Occupied Channel Bandwidth	±3.46%
Conducted Unwanted Emission	±0.55dB
Spurious emission (above 18GHz)	±5.3dB
Spurious emission (6GHz to 18GHz)	±5.1dB
Radiated emission (1GHz to 6GHz)	±4.8dB
Radiated emission (Up to 1GHz)	±4.8dB
AC Conducted emission	±3.6 dB
Temperature	±1°C
Humidity	±5%

**3.6 Support Equipment List and Description**

Description	Manufacturer	Model No.
Adapter (Provided by applicant)	Provided by applicant	Model: TAP10-050S200U1
DBOX	Provided by applicant	N/A
Bubble toy	Provided by applicant	N/A

## 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 dB $\mu$ V/m  
RA = Receiver Amplitude (including preamplifier) in dB $\mu$ V  
CF = Cable Attenuation Factor in dB  
AF = Antenna Factor in dB/m  
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 dB $\mu$ V is obtained. The antenna factor of 7.4 dB/m 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 dB $\mu$ V/m. This value in dB $\mu$ V/m was converted to its corresponding level in  $\mu$ V/m.

$$\begin{aligned} RA &= 62.0 \text{ dB}\mu\text{V} \\ AF &= 7.4 \text{ dB/m} \\ CF &= 1.6 \text{ dB} \\ AG &= 29.0 \text{ dB} \\ PD &= 0 \text{ dB} \\ AV &= -10 \text{ dB} \\ FS &= 62 + 7.4 + 1.6 - 29 + 0 = 42 \text{ dB}\mu\text{V/m} \end{aligned}$$

$$\text{Level in } \mu\text{V/m} = \text{Common Antilogarithm } [(42 \text{ dB}\mu\text{V/m})/20] = 125.9 \mu\text{V/m}$$

#### 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  
829.401250 MHz

Judgement: Passed by 21.0 dB

***TEST PERSONNEL:***

*Sign on file*

Maura Wang, Engineer  
*Typed/Printed Name*

April 5, 2024

*Date*

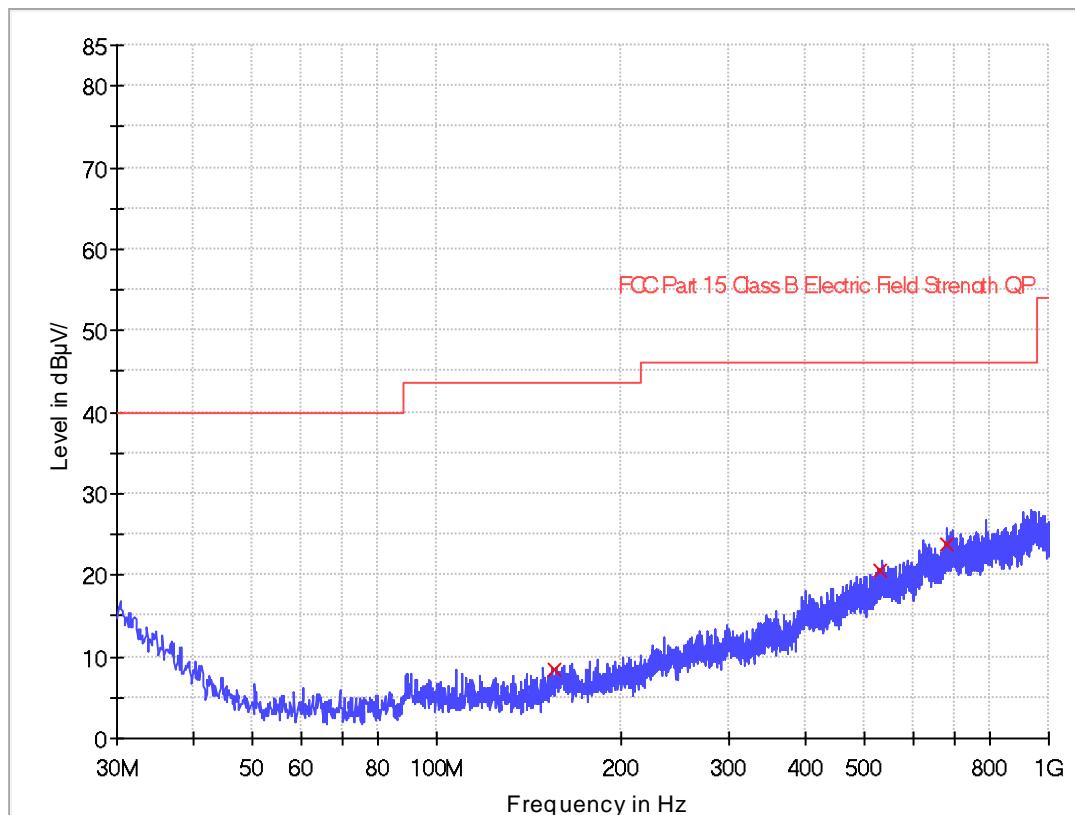
Applicant: LIGHTUPTOYS.COM LLC

Date of Test: April 5, 2024

Model: DVRFCTR-2920

Worst Case Operating Mode: Transmitting(2430.000MHz)

ANT Polarity: Horizontal



Frequency (MHz)	QuasiPeak (dB $\mu$ V/m)	Meas. Time (ms)	Bandwidth (kHz)	Polarization	Corr. (dB)	Margin - QPK (dB)	Limit - QPK (dB $\mu$ V/m)
156.100000	8.4	1000.0	120.000	H	11.0	35.1	43.5
531.732500	20.7	1000.0	120.000	H	22.0	25.3	46.0
683.295000	23.8	1000.0	120.000	H	24.9	22.2	46.0

## Remark:

1. Corr. = Antenna Factor (dB/m) + Cable Loss (dB)
2. QuasiPeak (dB $\mu$ V/m) = Corr. (dB/m) + Read Level (dB $\mu$ V)
3. Margin (dB) = Limit Line(dB $\mu$ V/m) – Level (dB $\mu$ V/m)

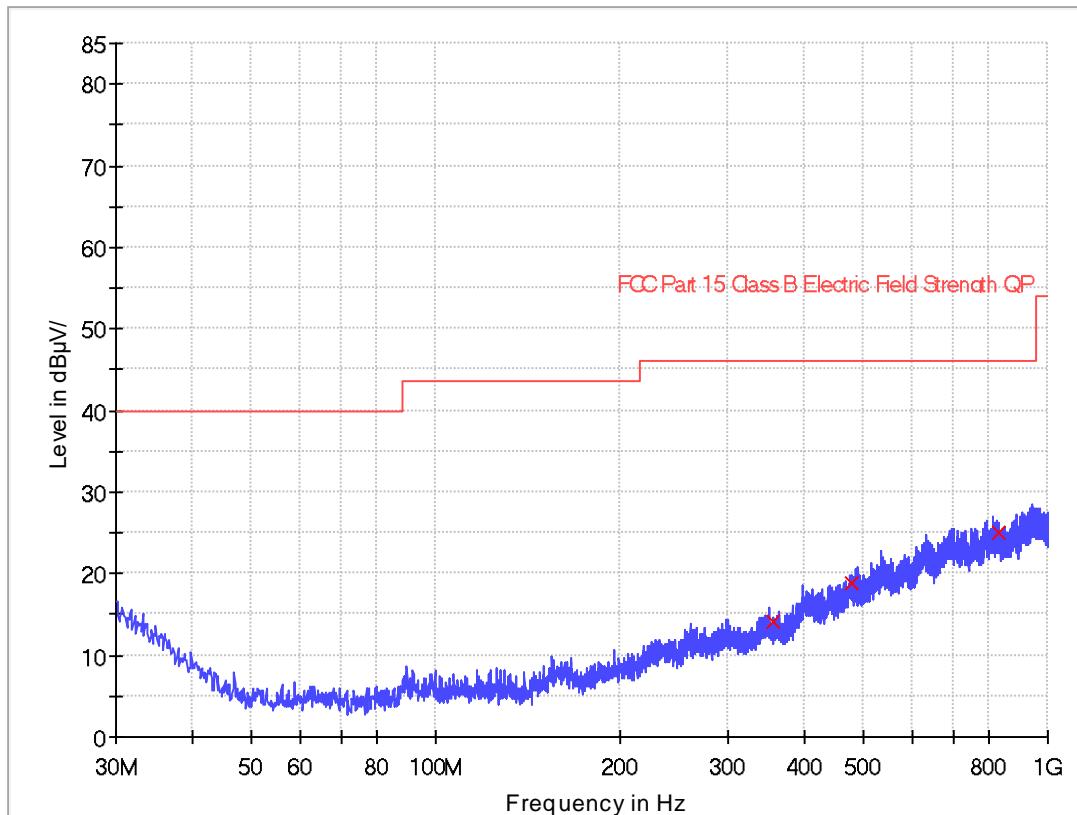
Applicant: LIGHTUPTOYS.COM LLC

Date of Test: April 5, 2024

Model: DVRFCTR-2920

Worst Case Operating Mode: Transmitting(2430.000MHz)

ANT Polarity: Vertical



Frequency (MHz)	QuasiPeak (dB $\mu$ V/m)	Meas. Time (ms)	Bandwidth (kHz)	Polarization	Corr. (dB)	Margin - QPK (dB)	Limit - QPK (dB $\mu$ V/m)
356.041250	14.1	1000.0	120.000	V	16.2	31.9	46.0
476.321250	18.8	1000.0	120.000	V	20.4	27.2	46.0
829.401250	25.0	1000.0	120.000	V	26.0	21.0	46.0

## Remark:

1. Corr. = Antenna Factor (dB/m) + Cable Loss (dB)
2. QuasiPeak (dB $\mu$ V/m)= Corr. (dB/m)+ Read Level (dB $\mu$ V)
3. Margin (dB) = Limit Line(dB $\mu$ V/m) – Level (dB $\mu$ V/m)

**4.1.4 Transmitter Spurious Emissions (Radiated)**

Worst Case Radiated Emission  
at  
2388.000 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 1.5 dB

***TEST PERSONNEL:***

*Sign on file*

Maura Wang, Engineer  
*Typed/Printed Name*

April 5, 2024  
*Date*

Applicant: LIGHTUPTOYS.COM LLC

Date of Test: April 5, 2024

Model: DVRFCTR-2920

Worst Case Operating Mode: Transmitting

Table 1

**Radiated Emissions  
(2430 MHz)**

Polarization	Frequency (MHz)	Reading (dB $\mu$ V)	Pre-Amp Gain (dB)	Antenna Factor (dB)	Net at 3m (dB $\mu$ V/m)	Peak Limit at 3m (dB $\mu$ V/m)	Margin (dB)
Horizontal	2430.000	110.7	36.7	28.1	102.1	114.0	-11.9
Horizontal	4860.000	49.6	36.7	35.5	48.4	74.0	-25.6

Polarization	Frequency (MHz)	Reading (dB $\mu$ V)	Pre-Amp Gain (dB)	Antenna Factor (dB)	Average Factor (-dB)	Net at 3m (dB $\mu$ V/m)	Average Limit at 3m (dB $\mu$ V/m)	Margin (dB)
Horizontal	2430.000	110.7	36.7	28.1	13.9	88.2	94.0	-5.8
Horizontal	4860.000	49.6	36.7	35.5	13.9	34.5	54.0	-19.5

Notes: 1. Peak Detector Data unless otherwise stated.

2. All measurements were made at 3 meters. 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.
5. All measurements were made in both horizontal and vertical directions. Only the worst direction of the test data is recorded in the report.

Applicant: LIGHTUPTOYS.COM LLC

Date of Test: April 5, 2024

Model: DVRFCTR-2920

Worst Case Operating Mode: Transmitting

Table 2

**Radiated Emissions  
(2445 MHz)**

Polarization	Frequency (MHz)	Reading (dB $\mu$ V)	Pre-Amp Gain (dB)	Antenna Factor (dB)	Net at 3m (dB $\mu$ V/m)	Peak Limit at 3m (dB $\mu$ V/m)	Margin (dB)
Horizontal	2445.000	107.2	36.7	28.3	98.8	114.0	-15.2
Horizontal	4890.000	37.3	36.7	35.7	36.3	74.0	-37.7

Polarization	Frequency (MHz)	Reading (dB $\mu$ V)	Pre-Amp Gain (dB)	Antenna Factor (dB)	Average Factor (-dB)	Net at 3m (dB $\mu$ V/m)	Average Limit at 3m (dB $\mu$ V/m)	Margin (dB)
Horizontal	2445.000	107.2	36.7	28.3	13.9	84.9	94.0	-9.1
Horizontal	4890.000	37.3	36.7	35.7	13.9	22.4	54.0	-31.6

Notes: 1. Peak Detector Data unless otherwise stated.

2. All measurements were made at 3 meters. 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.
5. All measurements were made in both horizontal and vertical directions. Only the worst direction of the test data is recorded in the report.

Applicant: LIGHTUPTOYS.COM LLC

Date of Test: April 5, 2024

Model: DVRFCTR-2920

Worst Case Operating Mode: Transmitting

Table 3

**Radiated Emissions  
(2455 MHz)**

Polarization	Frequency (MHz)	Reading (dB $\mu$ V)	Pre-Amp Gain (dB)	Antenna Factor (dB)	Net at 3m (dB $\mu$ V/m)	Peak Limit at 3m (dB $\mu$ V/m)	Margin (dB)
Horizontal	2455.000	106.2	36.7	28.5	98.0	114.0	-16.0
Horizontal	4910.000	34.0	36.7	35.9	33.2	74.0	-40.8

Polarization	Frequency (MHz)	Reading (dB $\mu$ V)	Pre-Amp Gain (dB)	Antenna Factor (dB)	Average Factor (-dB)	Net at 3m (dB $\mu$ V/m)	Average Limit at 3m (dB $\mu$ V/m)	Margin (dB)
Horizontal	2455.000	106.2	36.7	28.5	13.9	84.1	94.0	-9.9
Horizontal	4910.000	34.0	36.7	35.9	13.9	19.3	54.0	-34.7

Notes: 1. Peak Detector Data unless otherwise stated.

2. All measurements were made at 3 meters. 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.
5. All measurements were made in both horizontal and vertical directions. Only the worst direction of the test data is recorded in the report.

## 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  
0.306000MHz

Judgement: Passed by 17.1dB margin

### ***TEST PERSONNEL:***

*Sign on file*

Maura Wang, Engineer  
*Typed/Printed Name*

April 5, 2024  
*Date*

Applicant: LIGHTUPTOYS.COM LLC

Date of Test: April 5, 2024

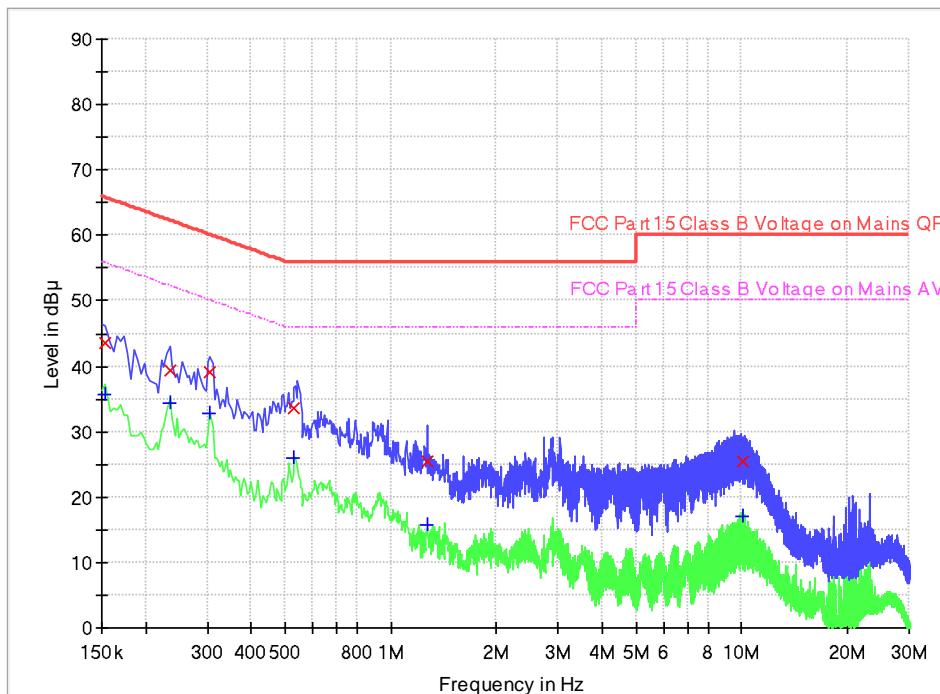
Model: DVRFCTR-2920

Worst Case Operating Mode: Transmitting

Phase: Live

## Graphic / Data Table

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



### Limit and Margin QP

Frequency (MHz)	Quasi Peak (dB $\mu$ V)	Bandwidth (kHz)	Line	Corr. (dB)	Margin (dB)	Limit (dB $\mu$ V)
0.154000	43.5	9.000	L1	9.6	22.3	65.8
0.234000	39.3	9.000	L1	9.6	23.0	62.3
0.306000	39.2	9.000	L1	9.6	20.9	60.1
0.530000	33.7	9.000	L1	9.6	22.3	56.0
1.270000	25.6	9.000	L1	9.6	30.4	56.0
10.062000	25.5	9.000	L1	9.9	34.5	60.0

### Limit and Margin AV

Frequency (MHz)	Average (dB $\mu$ V)	Bandwidth (kHz)	Line	Corr. (dB)	Margin (dB)	Limit (dB $\mu$ V)
0.154000	35.7	9.000	L1	9.6	20.1	55.8
0.234000	34.4	9.000	L1	9.6	17.9	52.3
0.306000	32.7	9.000	L1	9.6	17.4	50.1
0.530000	26.0	9.000	L1	9.6	20.0	46.0
1.270000	15.9	9.000	L1	9.6	30.1	46.0
10.062000	17.0	9.000	L1	9.9	33.0	50.0

Applicant: LIGHTUPTOYS.COM LLC

Date of Test: April 5, 2024

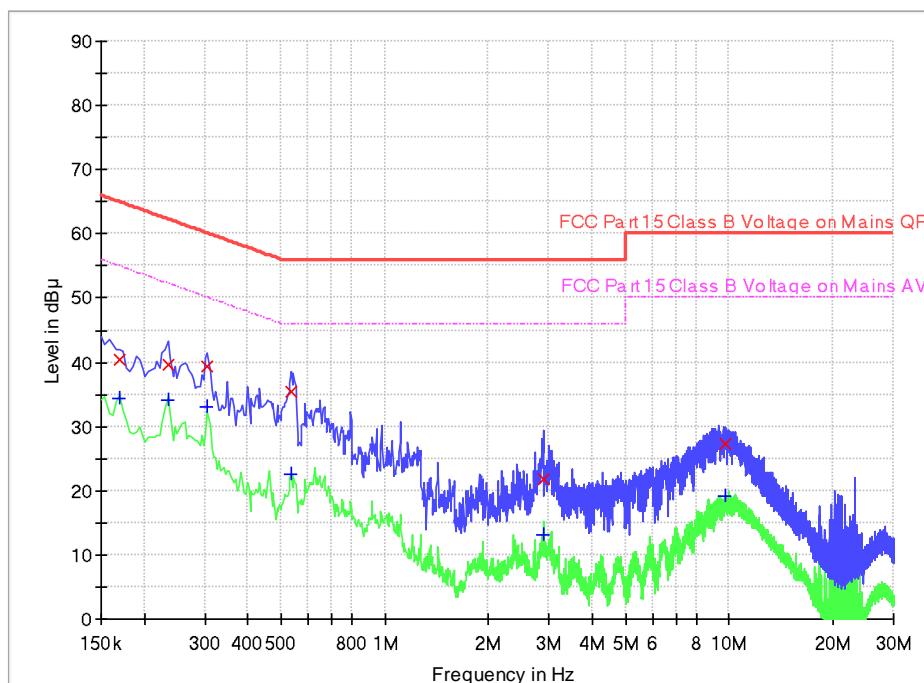
Model: DVRFCTR-2920

Worst Case Operating Mode: Transmitting

Phase: Neutral

## Graphic / Data Table

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



### Limit and Margin QP

Frequency (MHz)	Quasi Peak (dB $\mu$ V)	Bandwidth (kHz)	Line	Corr. (dB)	Margin (dB)	Limit (dB $\mu$ V)
0.170000	40.3	9.000	N	9.6	24.7	65.0
0.234000	39.7	9.000	N	9.6	22.6	62.3
0.306000	39.5	9.000	N	9.6	20.6	60.1
0.534000	35.5	9.000	N	9.6	20.5	56.0
2.890000	21.7	9.000	N	9.7	34.3	56.0
9.770000	27.4	9.000	N	9.9	32.6	60.0

### Limit and Margin AV

Frequency (MHz)	Average (dB $\mu$ V)	Bandwidth (kHz)	Line	Corr. (dB)	Margin (dB)	Limit (dB $\mu$ V)
0.170000	34.4	9.000	N	9.6	20.6	55.0
0.234000	34.2	9.000	N	9.6	18.1	52.3
0.306000	33.0	9.000	N	9.6	17.1	50.1
0.534000	22.5	9.000	N	9.6	23.5	46.0
2.890000	13.2	9.000	N	9.7	32.8	46.0
9.770000	19.2	9.000	N	9.9	30.8	50.0

## 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.

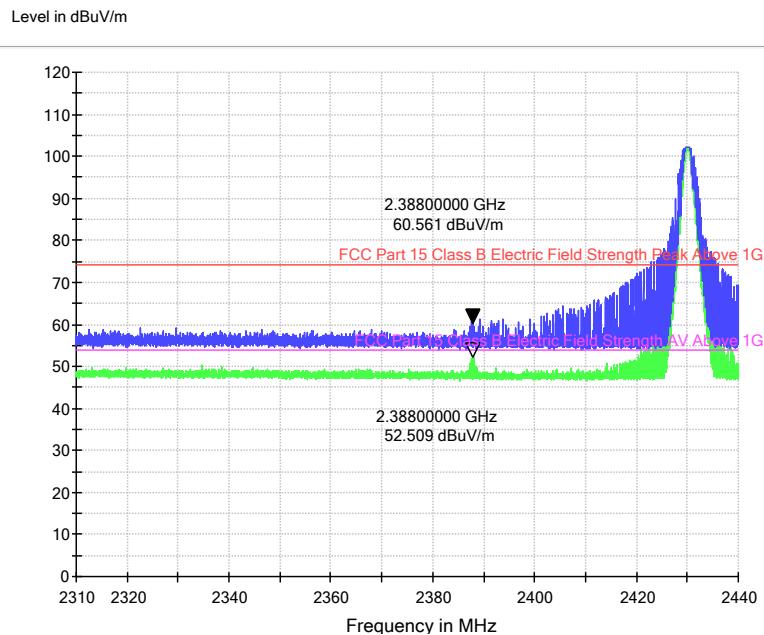
### 9.1 Bandedge Plot

The test plots are attached as below. From the plot, 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

Restricted-band band-edge tests shall be performed as radiated measurements, i.e (Band-edge Plot).

**(i) Lower channel 2430.000 MHz:**



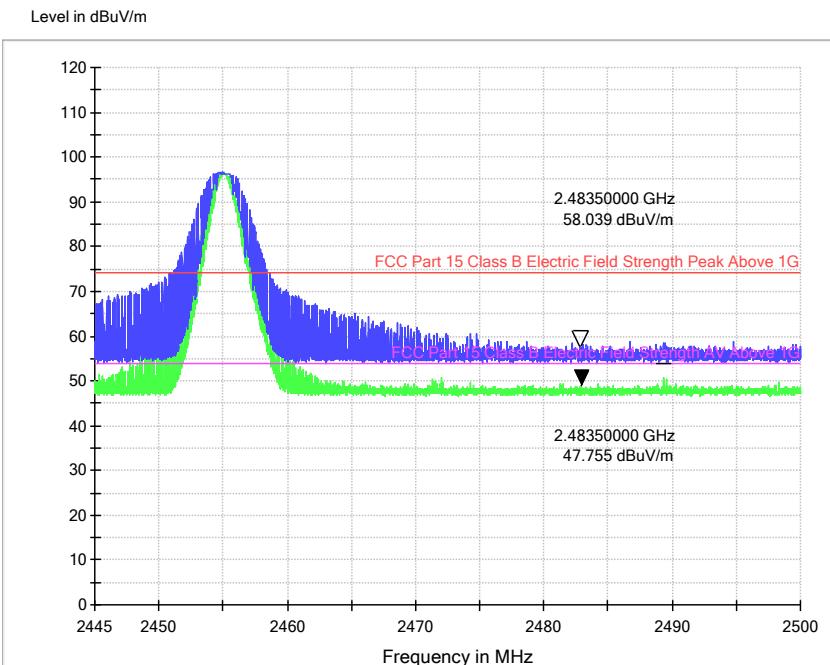
Polarization	Frequency (MHz)	Reading (dB $\mu$ V)	Pre-Amp Gain (dB)	Antenna Factor (dB)	Net at 3m (dB $\mu$ V/m)	Peak Limit at 3m (dB $\mu$ V/m)	Margin (dB)
Horizontal	2388.000	69.2	36.7	28.1	60.6	74.0	-13.4
Horizontal	2400.000	68.8	36.7	28.1	60.2	74.0	-13.8

Polarization	Frequency (MHz)	Reading (dB $\mu$ V)	Pre-Amp Gain (dB)	Antenna Factor (dB)	Net at 3m (dB $\mu$ V/m)	Average Limit at 3m (dB $\mu$ V/m)	Margin (dB)
Horizontal	2388.000	61.1	36.7	28.1	52.5	54.0	-1.5
Horizontal	2400.000	56.3	36.7	28.1	47.7	54.0	-6.3

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

Note: All measurements were made in both horizontal and vertical directions. Only the worst direction of the test data is recorded in the report.

## (ii) Upper channel 2455.000 MHz:



Polarization	Frequency (MHz)	Reading (dB $\mu$ V)	Pre-Amp Gain (dB)	Antenna Factor (dB)	Net at 3m (dB $\mu$ V/m)	Peak Limit at 3m (dB $\mu$ V/m)	Margin (dB)
Horizontal	2483.500	65.7	36.8	29.1	58.0	74.0	-16.0

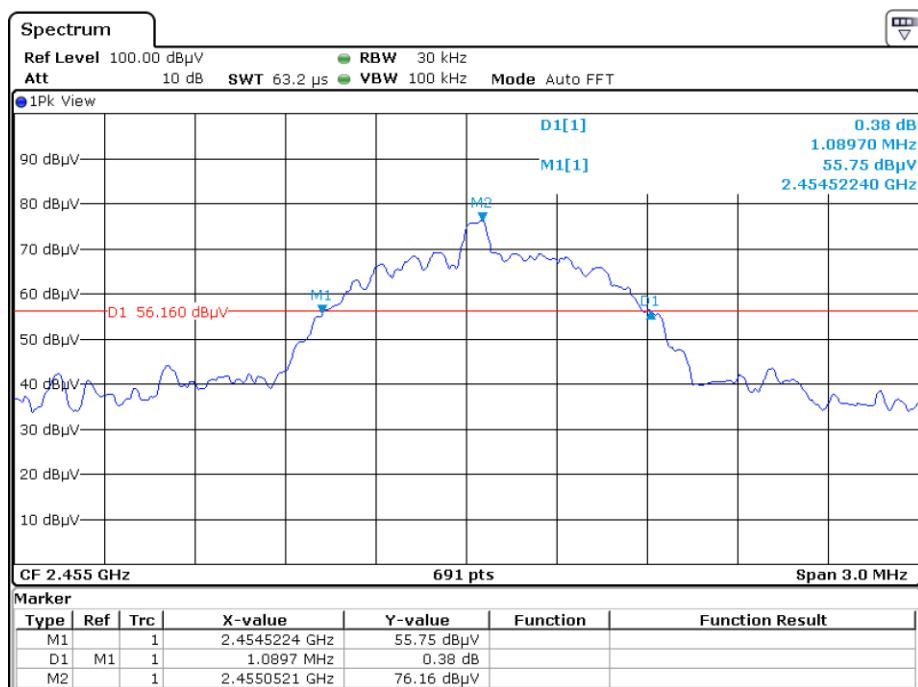
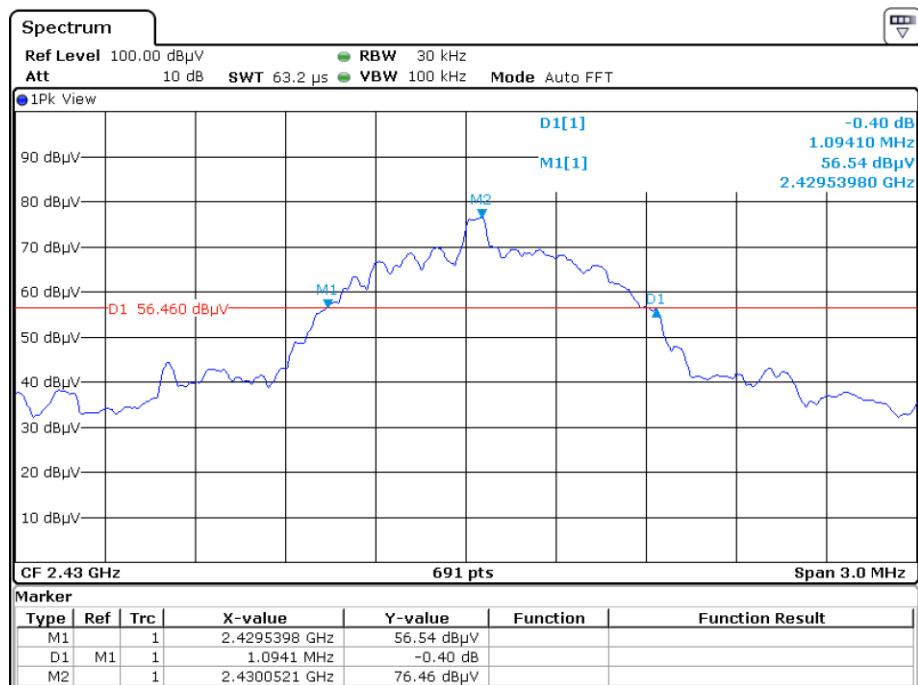
Polarization	Frequency (MHz)	Reading (dB $\mu$ V)	Pre-Amp Gain (dB)	Antenna Factor (dB)	Net at 3m (dB $\mu$ V/m)	Average Limit at 3m (dB $\mu$ V/m)	Margin (dB)
Horizontal	2483.500	55.5	36.8	29.1	47.8	54.0	-6.2

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

Note: All measurements were made in both horizontal and vertical directions. Only the worst direction of the test data is recorded in the report.

## 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. The effective period ( $T_{eff}$ ) is approximately  $811.6\mu s$  for a digital "1" bit, as shown in the plots of Section 9.4. With a resolution bandwidth (3 dB) of 100 kHz, the pulse desensitivity factor was 0 dB

### 9.4 Calculation of Average Factor

Averaging factor in dB =  $20 \log_{10} (\text{duty cycle})$

The specification for output field strengths in accordance with the FCC rules specify measurements with an average detector. During testing, a spectrum analyzer incorporating a peak detector was used. Therefore, a reduction factor can be applied to the resultant peak signal level and compared to the limit for measurement instrumentation incorporating an average detector.

The time period over which the duty cycle is measured is 100 milliseconds, or the repetition cycle, whichever is a shorter time frame. The worst case (highest percentage on) duty cycle is used for the calculation. The duty cycle is measured by placing the spectrum analyzer in zero scan (receiver mode) and linear mode at maximum bandwidth (3 MHz at 3 dB down) and viewing the resulting time domain signal output from the analyzer on a Tektronix oscilloscope. The oscilloscope is used because of its superior time base and triggering facilities.

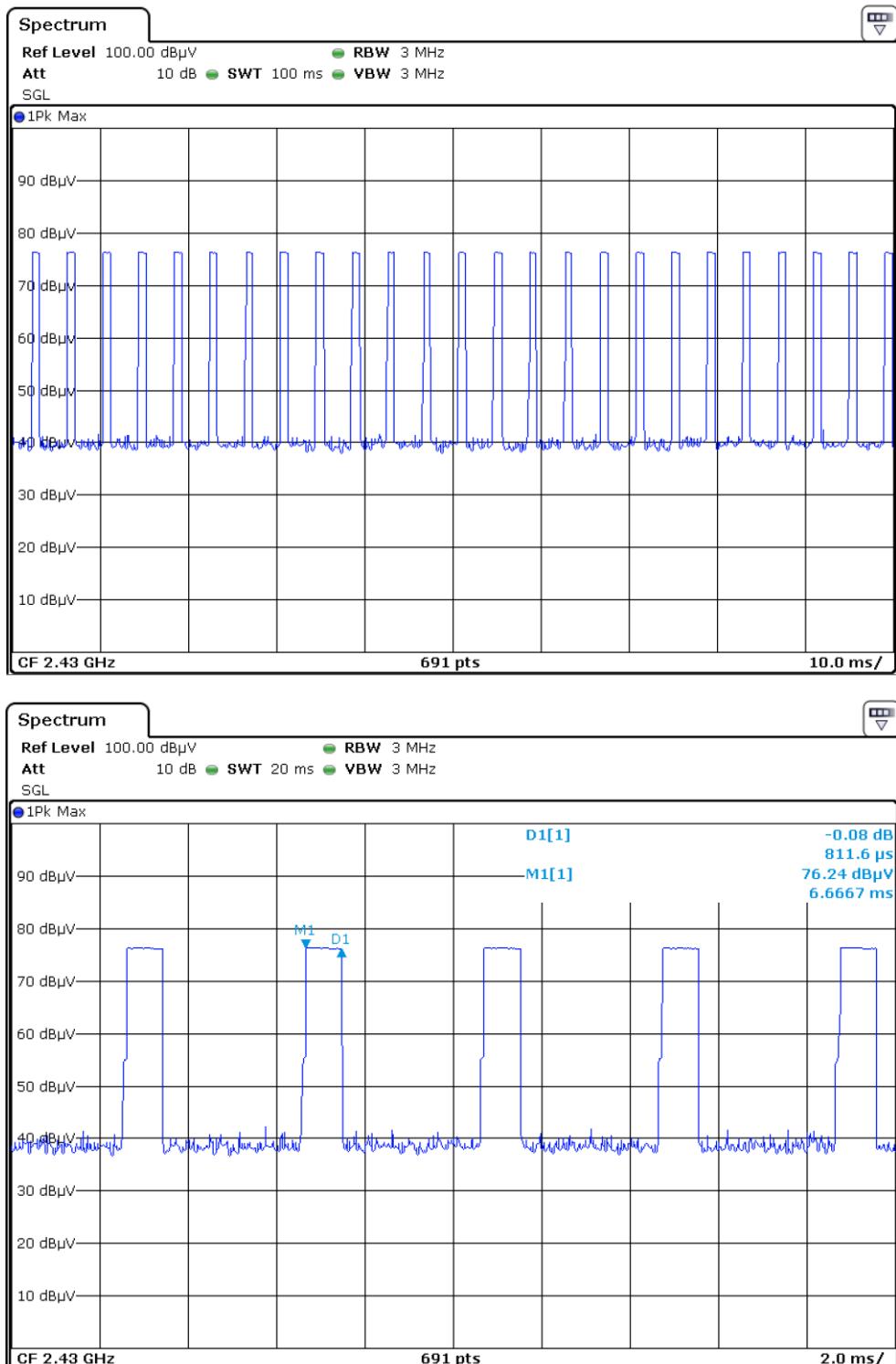
The duty cycle is simply the on-time divided by the period:

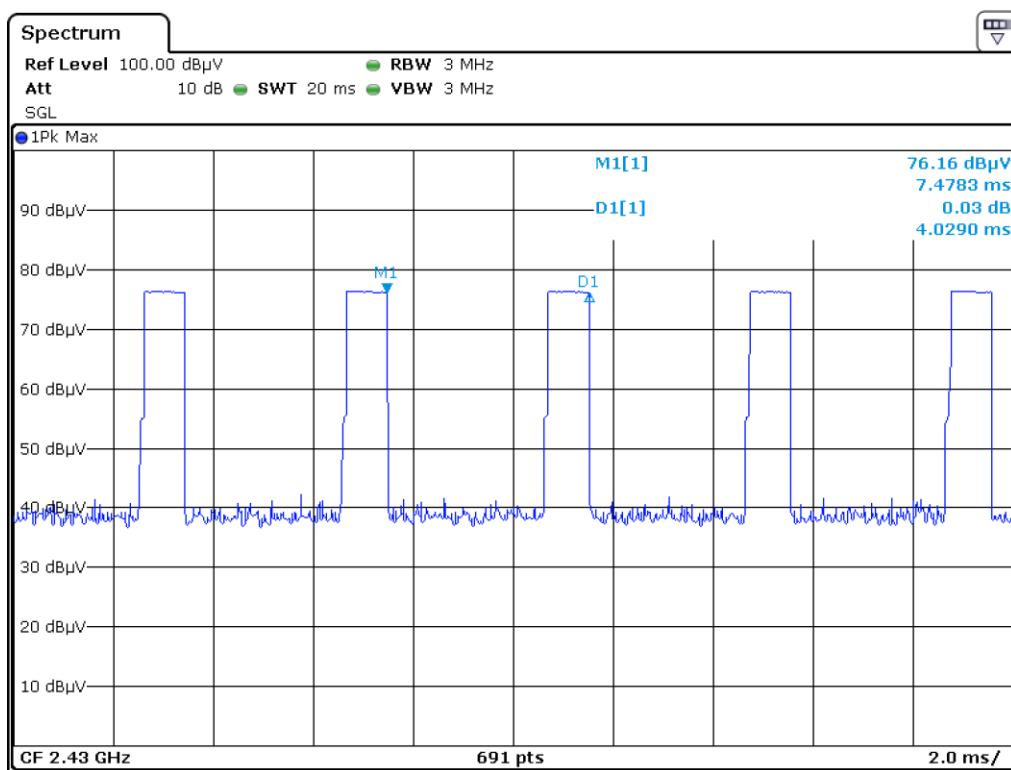
The duration of one cycle = 4.029ms

Effective period of the cycle =  $811.6\mu s \times 1 = 0.8116ms$   
DC =  $0.8116ms / 4.029ms = 0.2014$  or 20.14%

Therefore, the averaging factor is found by  $20 \log_{10} (0.2014) = -13.9$  dB

The test plots are attached as below.





## 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 adjusted 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.

## 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.

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. A discussion of whether pulse desensitivity is applicable to this unit is included in this report (See Section 9.2). Above 1000 MHz, a resolution bandwidth of 1 MHz is used, RBW 3MHz 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
SZ061-13	BiConiLog Antenna	ETS	3142E	00217919	13-Jul-2022	13-Jul-2025
SZ185-04	EMI Receiver	R&S	ESR7	102466	10-Nov-2023	10-Nov-2024
SZ061-09	Horn Antenna	ETS	3115	00092346	14-Oct-2022	14-Oct-2025
SZ061-06	Active Loop Antenna	Electro-Metrics	EM-6876	217	18-May-2021	18-May-2024
SZ061-15	Double-Ridged Waveguide Horn Antenna	ETS	3116C-PA	00224718	06-Jul-2021	06-Jul-2024
SZ056-06	Spectrum Analyzer	R&S	FSV40	101101	13-Dec-2023	13-Dec-2024
SZ181-04	Preamplifier	Agilent	8449B	3008A024 74	27-Apr-2023	27-Apr-2024
SZ188-01	Anechoic Chamber	ETS	RFD-F/A-100	4102	12-Dec-2021	12-Dec-2024
SZ062-02	RF Cable	RADIALL	RG 213U	--	1-Nov-2023	1-May-2024
SZ062-05	RF Cable	RADIALL	0.04-26.5GHz	--	1-Nov-2023	1-May-2024
SZ062-12	RF Cable	RADIALL	0.04-26.5GHz	--	1-Nov-2023	1-May-2024
SZ067-04	Notch Filter	Micro-Tronics	BRM5070 2-02	--	27-Apr-2023	27-Apr-2024
SZ185-02	EMI Test Receiver	R&S	ESCI	100692	9-Jul-2024	9-Jul-2025
SZ187-02	Two-Line V-Network	R&S	ENV216	100073	23-Apr-2024	23-Apr-2025
SZ188-03	Shielding Room	ETS	RFD-100	4100	20-Dec-2022	20-Dec-2025
SZ062-16	RF Cable	HUBER+SUHN	CBL2-BN-1m	110127-2231000	10-Jul-2024	10-Jul-2025

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