

Zhong Shan City Richsound Electronic Industrial Ltd.

TEST REPORT

SCOPE OF WORK

FCC Testing – TB883DWW, MSB21

REPORT NUMBER

201104041SZN-002

ISSUE DATE

28 November 2020

PAGES

29

DOCUMENT CONTROL NUMBER

FCC ID 249_C

© 2017 INTERTEK



Zhong Shan City Richsound Electronic Industrial Ltd.

Application For Certification

FCC ID: Z8M-MSB21**2.1CH Soundbar with Wireless Subwoofer****Model: TB883DWW, MSB21****RSR, Mission**

2.4GHz Transmitter

Report No.: 201104041SZN-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:**Approved by:****Ryan Chen**
Engineer

Kidd Yang
Technical Supervisor
Date: 28 November 2020

This report is for the exclusive use of Intertek's Client and is provided pursuant to the agreement between Intertek and its Client. Intertek's responsibility and liability are limited to the terms and conditions of the agreement. Intertek assumes no liability to any party, other than to the Client in accordance with the agreement, for any loss, expense or damage occasioned by the use of this report. Only the Client is authorized to permit copying or distribution of this report and then only in its entirety. Any use of the Intertek name or one of its marks for the sale or advertisement of the tested material, product or service must first be approved in writing by Intertek. The observations and test results in this report are relevant only to the sample tested. This report by itself does not imply that the material, product, or service is or has ever been under an Intertek certification program.

Intertek Testing Service Shenzhen Ltd. Longhua Branch

101, 201, Building B, No. 308 Wuhe Avenue, Zhangkengjing Community GuanHu Subdistrict, LongHua District, Shenzhen, People's Republic of China

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 [10-1-19 Edition] provision.

Report prepared by:

Ryan Chen
Intertek Testing Services Shenzhen Ltd. Longhua Branch
101, 201, Building B, No. 308 Wuhe Avenue, Zhangkengjing
Community, GuanHu Subdistrict, LongHua District, Shenzhen.
Tel: (86 755) 8601 0682 Fax: (86 755) 8601 6661

Table of Contents

1.0 Summary of Test Result	4
2.0 General Description	5
2.1 Product Description.....	5
2.2 Related Submittal(s) Grants.....	5
2.3 Test Methodology	5
2.4 Test Facility	5
3.0 System Test Configuration	6
3.1 Justification	6
3.2 EUT Exercising Software.....	6
3.3 Special Accessories.....	6
3.4 Equipment Modification	6
3.5 Measurement Uncertainty	7
3.6 Support Equipment List and Description.....	7
4.0 Emission Results.....	8
4.1 Radiated Test Results	8
4.1.1 Field Strength Calculation	8
4.1.2 Radiated Emission Configuration Photograph.....	9
4.1.3 Radiated Emissions.....	9
4.1.4 Transmitter Spurious Emissions.....	12
4.2 Conducted Emission Configuration Photograph.....	16
4.2.1 Conducted Emission	16
5.0 Equipment Photographs	19
6.0 Product Labelling.....	19
7.0 Technical Specifications	19
8.0 Instruction Manual	19
9.0 Miscellaneous Information.....	20
9.1 Bandedge Plot	20
9.2 20dB Bandwidth	22
9.3 Discussion of Pulse Desensitization.....	24
9.4 Calculation of Average Factor	24
9.5 Emissions Test Procedures	27
10.0 Test Equipment List	29

1.0 Summary of Test Result

Applicant: Zhong Shan City Richsound Electronic Industrial Ltd.
Address: Qunle Industrial Area, East ShaGang Road, GangKou, Zhongshan, GuangDong, China
Manufacturer: Zhong Shan City Richsound Electronic Industrial Ltd.
Address: Qunle Industrial Area, East ShaGang Road, GangKou, Zhongshan, GuangDong, China

Model: TB883DWW, MSB21

FCC ID: Z8M-MSB21

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 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 2.1CH Soundbar with Wireless Subwoofer with 2.4GHz transmitter function operating at 2.4G Band. The EUT is powered by AC 100-240V~, 50/60Hz. For more detail information pls. refer to the user manual.

Antenna Type: Integral antenna

Modulation Type: GFSK

Antenna Gain: 0dBi

The model: MSB21 is the same as the Model: TB883DWW in hardware aspect, The differences in model number and brand name serve as marketing strategy.

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 transceiver for the 2.1CH Soundbar with Wireless Subwoofer which has Bluetooth function and 2.4GHz Transmitter Function. Bluetooth functions were reported in the certification report: 201104041SZN-001. Other digital functions were reported in the verification report: 201104040SZN-001.

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 AC120V, 60Hz 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.

The parameters of test software setting:

During the test, Channel and power controlling software provided by the applicant was used to control the operating channel as well as the output power level. The RF output power selection is for the setting of RF output power expected by the application and is going to be fixed on the firmware of the end product.

Test Software: FCC Assist V1.5

3.3 Special Accessories

No special accessory attached.

3.4 Equipment Modification

Any modifications installed previous to testing by Zhong Shan City Richsound Electronic Industrial Ltd. 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	Model No.
Tablet	SAMSUNG	SM-T700
iPod	Apple	A1421
Test TV	SONY	KDL-24EX520
Dummy Load	N/A	Audio: 1000 Ω Video: 75 Ω HDMI: 100 Ω
DVD	SONY	BDP-BX59
USB Memory	SanDisk	SDCZ36-002G-P36
Remote controller	Richsound	N/A
HDMI Cable *3	N/A	Unshielded, Length 150cm
Detached AC power cord	Richsound	Unshielded, Length 150cm
Optical Cable	N/A	Unshielded, Length 150cm
Coaxial Cable	N/A	Unshielded, Length 150cm
3.5mm to 3.5mm audio Cable	Richsound	Unshielded, Length 100cm

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 μ V/m
 RA = Receiver Amplitude (including preamplifier) in dB μ V
 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 dB μ V 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 dB μ V/m. This value in dB μ V/m was converted to its corresponding level in μ V/m.

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

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

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. Simultaneous transmission was considered during the test.

Worst Case Radiated Emission

at 33.750667 MHz

Judgement: Passed by 4.5 dB

TEST PERSONNEL:

Sign on file

Ryan Chen, Engineer
Typed/Printed Name

17 November 2020
Date

Applicant: Zhong Shan City Richsound Electronic Industrial Ltd.

Date of Test: 17 November 2020

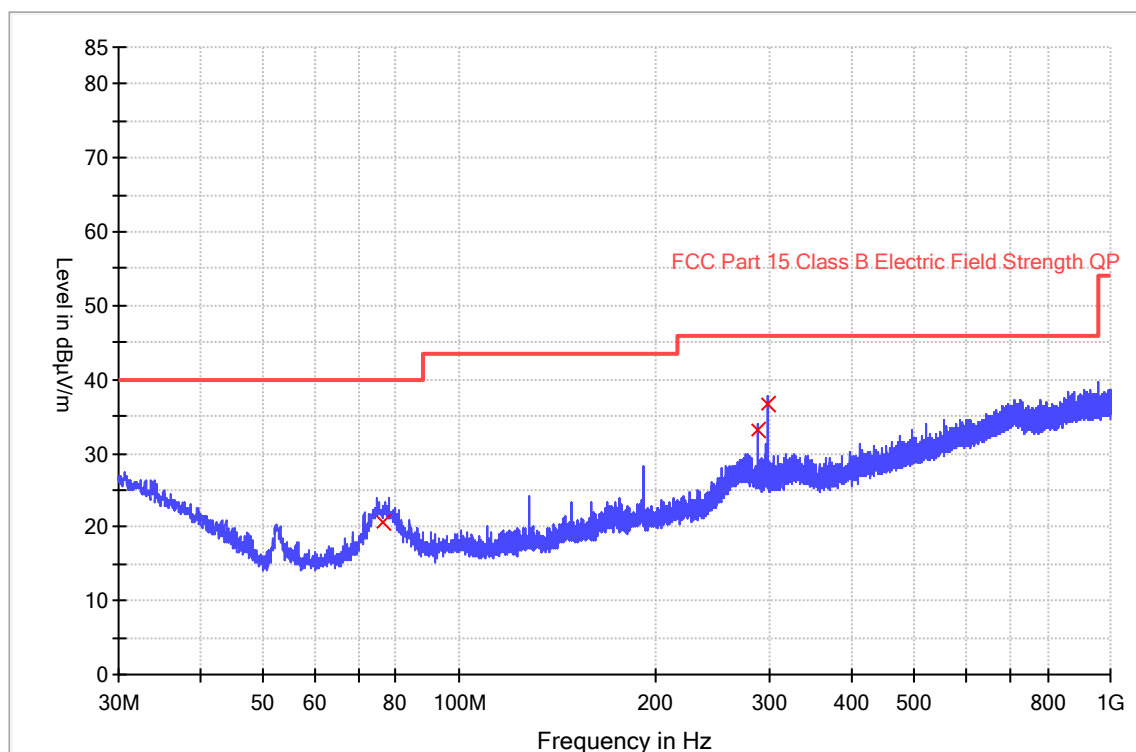
Model: TB883DWW

Worst Case Operating Mode:

Transmitting(2404.5MHz)

ANT Polarity: Horizontal

FCC Part 15



Frequency (MHz)	QuasiPeak (dBuV/m)	Meas. Time (ms)	Bandwidth (kHz)	Polarization	Corr. (dB)	Margin - QPK (dB)	Limit - QPK (dBuV/m)
76.333667	20.7	1000.0	120.000	H	8.8	19.3	40.0
287.987667	33.3	1000.0	120.000	H	15.8	12.7	46.0
296.976333	36.7	1000.0	120.000	H	16.2	9.3	46.0

Remark:

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

Applicant: Zhong Shan City Richsound Electronic Industrial Ltd.

Date of Test: 17 November 2020

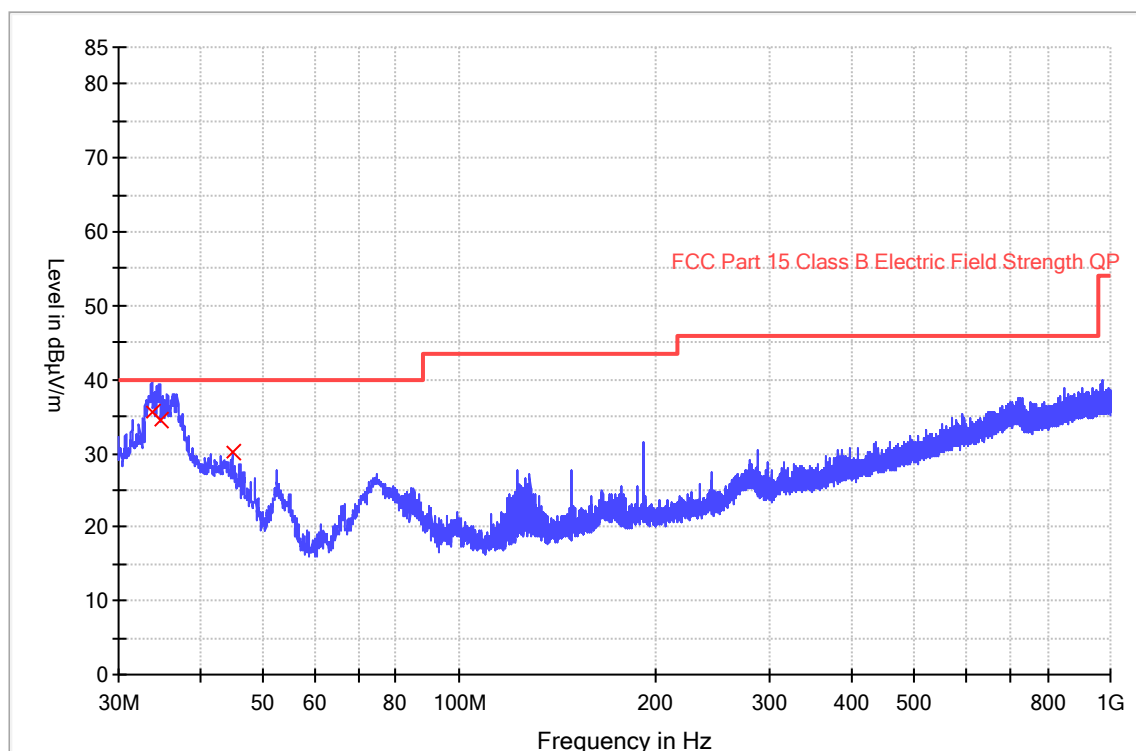
Model: TB883DWW

Worst Case Operating Mode:

Transmitting(2404.5MHz)

ANT Polarity: Vertical

FCC Part 15



Frequency (MHz)	QuasiPeak (dBμV/m)	Meas. Time (ms)	Bandwidth (kHz)	Polarization	Corr. (dB)	Margin - QPK (dB)	Limit - QPK (dBμV/m)
33.750667	35.5	1000.0	120.000	V	16.3	4.5	40.0
34.720667	34.5	1000.0	120.000	V	15.8	5.5	40.0
44.808667	30.2	1000.0	120.000	V	10.7	9.8	40.0

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
2483.50 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

Ryan Chen, Engineer
Typed/Printed Name

17 November 2020
Date

Applicant: Zhong Shan City Richsound Electronic Industrial Ltd.

Date of Test: 17 November 2020

Model: TB883DWW

Worst Case Operating Mode:

Transmitting

Table 1

Radiated Emissions
(2404.500 MHz)

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)
Vertical	2404.500	84.8	36.7	28.1	76.2	114.0	-37.8
Vertical	4809.000	52.6	36.7	35.5	51.4	74.0	-22.6
Vertical	7213.500	56.9	36.8	35.6	55.7	74.0	-18.3

Polarization	Frequency (MHz)	Reading (dBμV)	Pre-Amp Gain (dB)	Antenna Factor (dB)	Average Factor (-dB)	Net at 3m (dBμV/m)	Average Limit at 3m (dBμV/m)	Margin (dB)
Vertical	2404.500	84.8	36.7	28.1	9.3	66.9	94.0	-27.1
Vertical	4809.000	52.6	36.7	35.5	9.3	42.1	54.0	-11.9
Vertical	7213.500	56.9	36.8	35.6	9.3	46.4	54.0	-7.6

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.

Applicant: Zhong Shan City Richsound Electronic Industrial Ltd.

Date of Test: 17 November 2020

Model: TB883DWW

Worst Case Operating Mode:

Transmitting

Table 2

Radiated Emissions
(2439.500 MHz)

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)
Vertical	2439.500	85.3	36.7	28.1	76.7	114.0	-37.3
Vertical	4879.000	54.5	36.7	35.5	53.3	74.0	-20.7
Vertical	7318.500	57.3	36.8	35.6	56.1	74.0	-17.9

Polarization	Frequency (MHz)	Reading (dBμV)	Pre-Amp Gain (dB)	Antenna Factor (dB)	Average Factor (-dB)	Net at 3m (dBμV/m)	Average Limit at 3m (dBμV/m)	Margin (dB)
Vertical	2439.500	85.3	36.7	28.1	9.3	67.4	94.0	-26.6
Vertical	4879.000	54.5	36.7	35.5	9.3	44.0	54.0	-10.0
Vertical	7318.500	57.3	36.8	35.6	9.3	46.8	54.0	-7.2

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.

Applicant: Zhong Shan City Richsound Electronic Industrial Ltd.

Date of Test: 17 November 2020

Model: TB883DWW

Worst Case Operating Mode:

Transmitting

Table 3

Radiated Emissions
(2479.500 MHz)

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)
Vertical	2479.500	85.8	36.7	28.1	77.2	114.0	-36.8
Vertical	4959.000	54.8	36.7	35.5	53.6	74.0	-20.4
Vertical	7438.500	58.3	36.8	35.6	57.1	74.0	-16.9

Polarization	Frequency (MHz)	Reading (dBμV)	Pre-Amp Gain (dB)	Antenna Factor (dB)	Average Factor (-dB)	Net at 3m (dBμV/m)	Average Limit at 3m (dBμV/m)	Margin (dB)
Vertical	2479.500	85.8	36.7	28.1	9.3	67.9	94.0	-26.1
Vertical	4959.000	54.8	36.7	35.5	9.3	44.3	54.0	-9.7
Vertical	7438.500	58.3	36.8	35.6	9.3	47.8	54.0	-6.2

- 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.

4.2 Conducted Emission Configuration Photograph

For electronic filing, the worst-case radiated emission configuration photographs are saved with filename: conducted photos.pdf. Simultaneous transmission was considered during the test.

4.2.1 Conducted Emission

Worst Case Conducted Configuration

at

0.602MHz

Judgement: Passed by 18.7dB margin

TEST PERSONNEL:

Sign on file

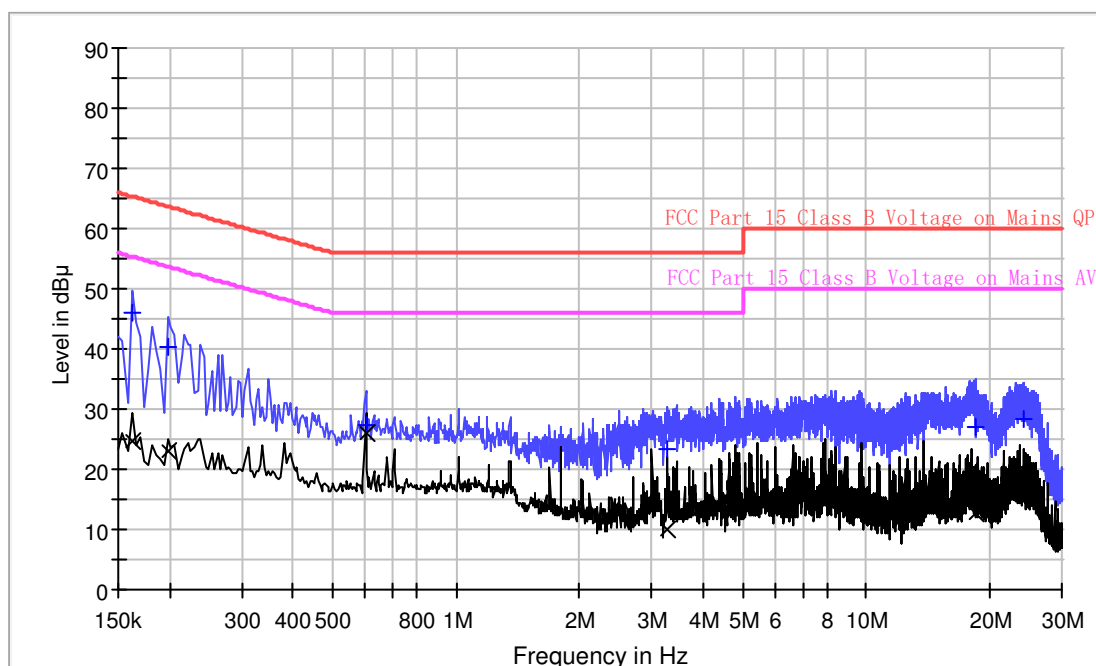
Ryan Chen, Engineer
Typed/Printed Name

17 November 2020
Date

Applicant: Zhong Shan City Richsound Electronic Industrial Ltd.
Date of Test: 17 November 2020 Model: TB883DWW
Worst Case Operating Mode: Transmitting(2404.5MHz)
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)
0.162000	45.9	9.000	L1	9.7	19.5	65.4
0.198000	40.2	9.000	L1	9.7	23.5	63.7
0.602000	27.5	9.000	L1	9.7	28.5	56.0
3.262000	23.5	9.000	L1	9.8	32.5	56.0
18.406000	27.1	9.000	L1	10.3	32.9	60.0
24.142000	28.3	9.000	L1	10.8	31.7	60.0

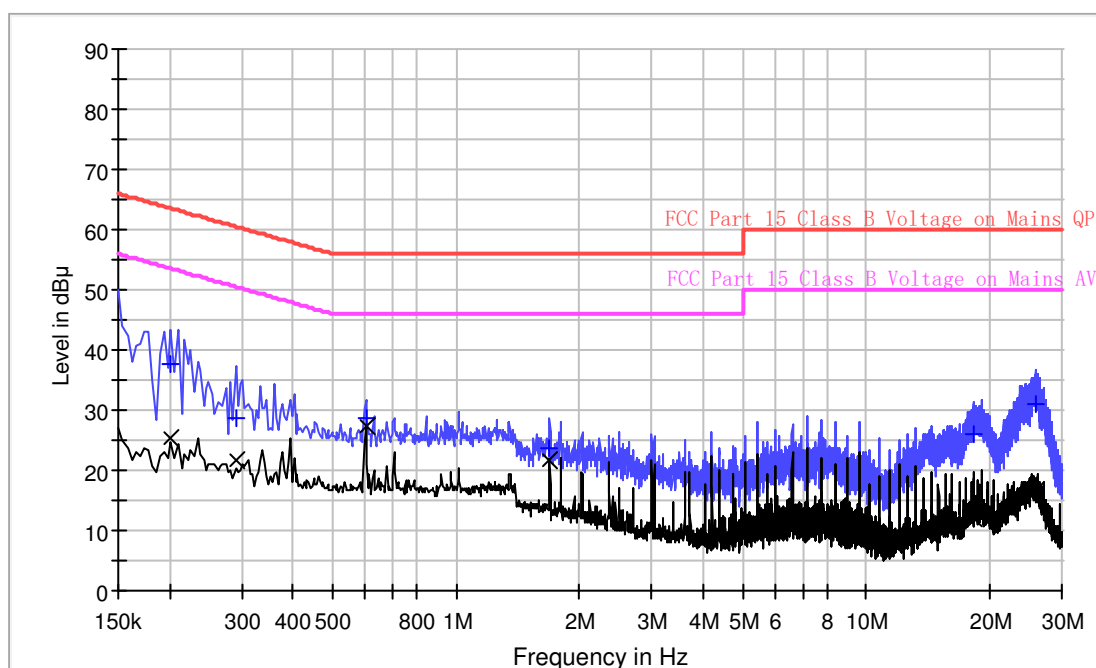
Limit and Margin AV

Frequency (MHz)	Average (dBuV)	Bandwidth (kHz)	Line	Corr. (dB)	Margin (dB)	Limit (dBuV)
0.162000	24.6	9.000	L1	9.7	30.8	55.4
0.198000	23.0	9.000	L1	9.7	30.7	53.7
0.602000	26.1	9.000	L1	9.7	19.9	46.0
3.262000	10.2	9.000	L1	9.8	35.8	46.0
18.406000	12.5	9.000	L1	10.3	37.5	50.0
24.142000	15.5	9.000	L1	10.8	34.5	50.0

Applicant: Zhong Shan City Richsound Electronic Industrial Ltd.
Date of Test: 17 November 2020 Model: TB883DWW
Worst Case Operating Mode: Transmitting(2404.5MHz)
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)
0.202000	37.5	9.000	N	9.7	26.0	63.5
0.290000	28.5	9.000	N	9.7	32.0	60.5
0.602000	28.6	9.000	N	9.7	27.4	56.0
1.690000	23.6	9.000	N	9.7	32.4	56.0
18.266000	26.1	9.000	N	10.4	33.9	60.0
26.058000	30.9	9.000	N	11.1	29.1	60.0

Limit and Margin AV

Frequency (MHz)	Average (dBuV)	Bandwidth (kHz)	Line	Corr. (dB)	Margin (dB)	Limit (dBuV)
0.202000	25.2	9.000	N	9.7	28.3	53.5
0.290000	21.7	9.000	N	9.7	28.8	50.5
0.602000	27.3	9.000	N	9.7	18.7	46.0
1.690000	21.7	9.000	N	9.7	24.3	46.0
18.266000	12.1	9.000	N	10.4	37.9	50.0
26.058000	16.8	9.000	N	11.1	33.2	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 2404.500 MHz:

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)
Vertical	2389.864	70.8	36.7	27.9	62.0	74.0	-12.0

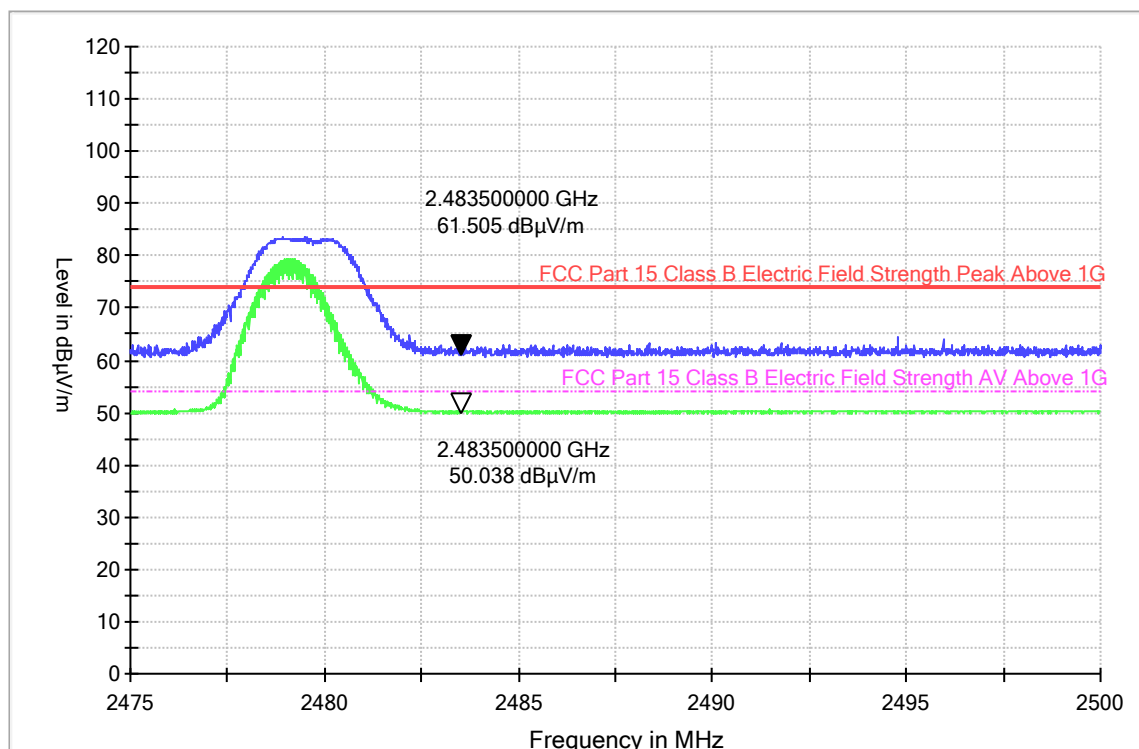
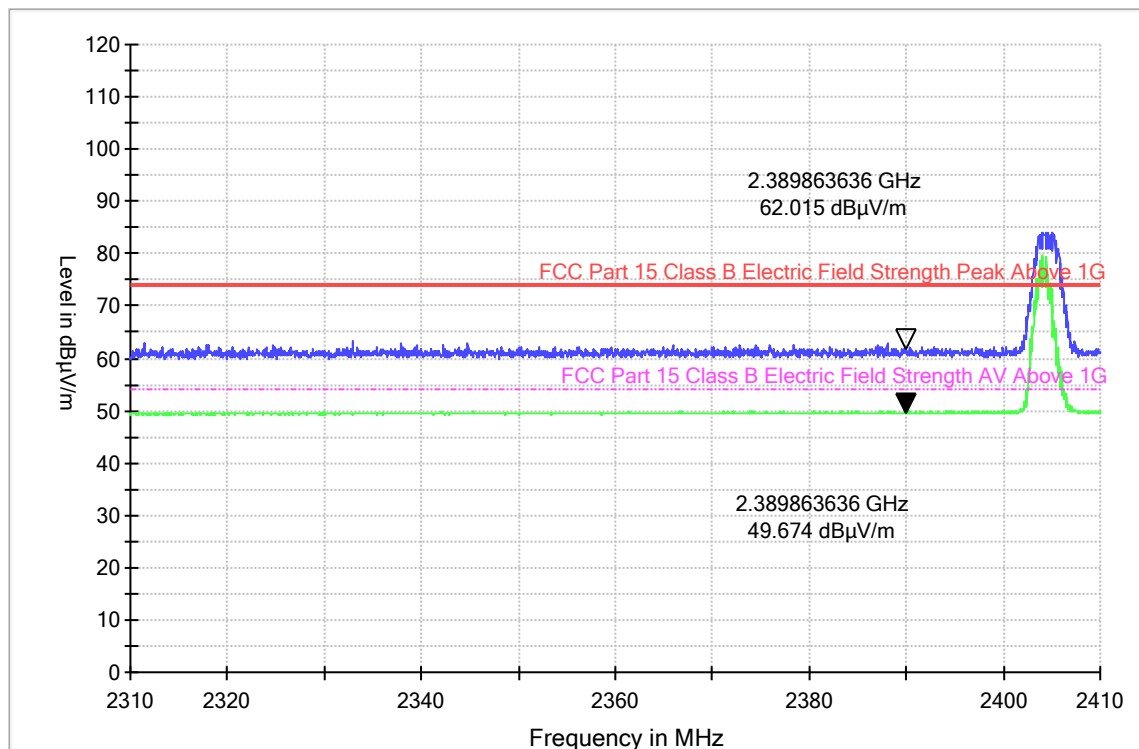
Polarization	Frequency (MHz)	Reading (dBμV)	Pre-Amp Gain (dB)	Antenna Factor (dB)	Net at 3m (dBμV/m)	Average Limit at 3m (dBμV/m)	Margin (dB)
Vertical	2389.864	58.5	36.7	27.9	49.7	54.0	-4.3

(ii) Upper channel 2479.500 MHz:

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)
Vertical	2483.500	69.2	36.8	29.1	61.5	74.0	-12.5

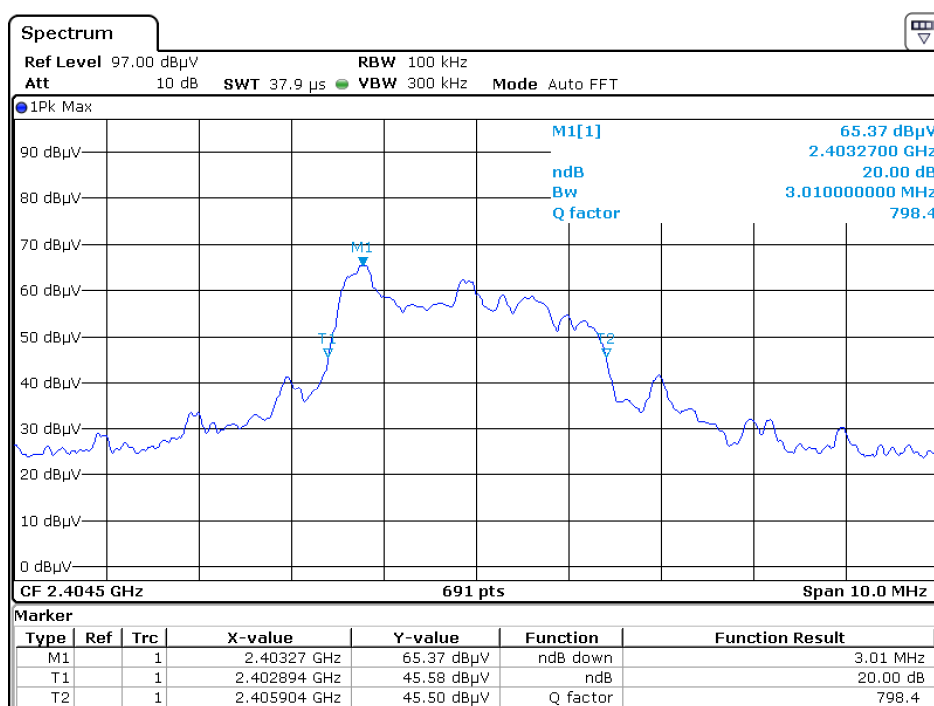
Polarization	Frequency (MHz)	Reading (dBμV)	Pre-Amp Gain (dB)	Antenna Factor (dB)	Net at 3m (dBμV/m)	Average Limit at 3m (dBμV/m)	Margin (dB)
Vertical	2483.500	36.8	36.8	50.0	50.0	54.0	-4.0

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).

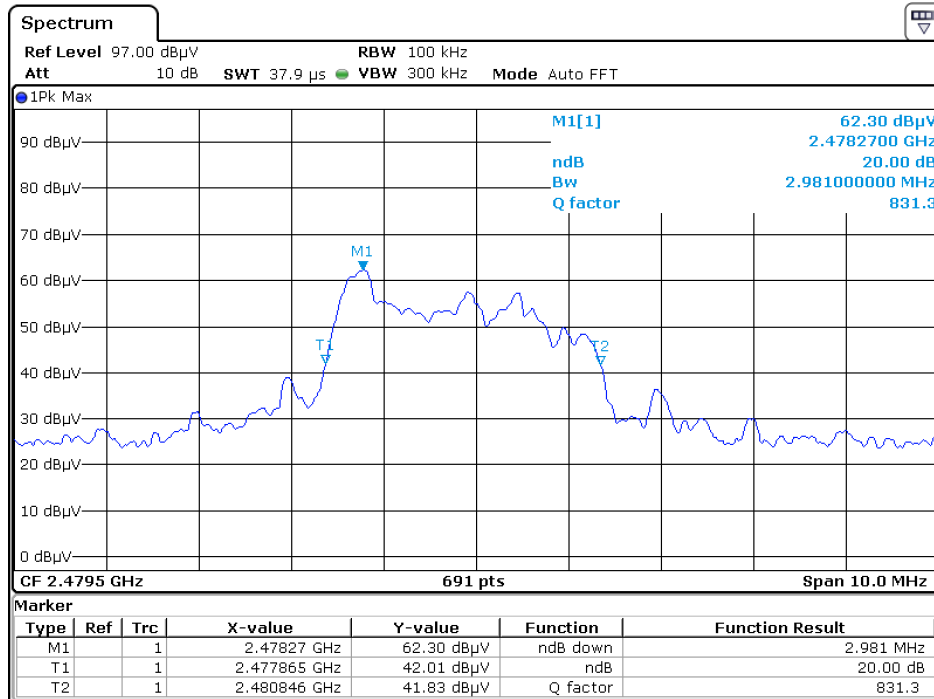


9.2 20dB Bandwidth

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.



Date: 16.NOV.2020 09:37:11



Date: 16.NOV.2020 09:45:35

9.3 Discussion of Pulse Desensitization

Pulse desensitivity is not applicable for this device. The effective period (T_{eff}) is approximately 0.36377ms 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 = $20 \log (\text{duty cycle})$

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:

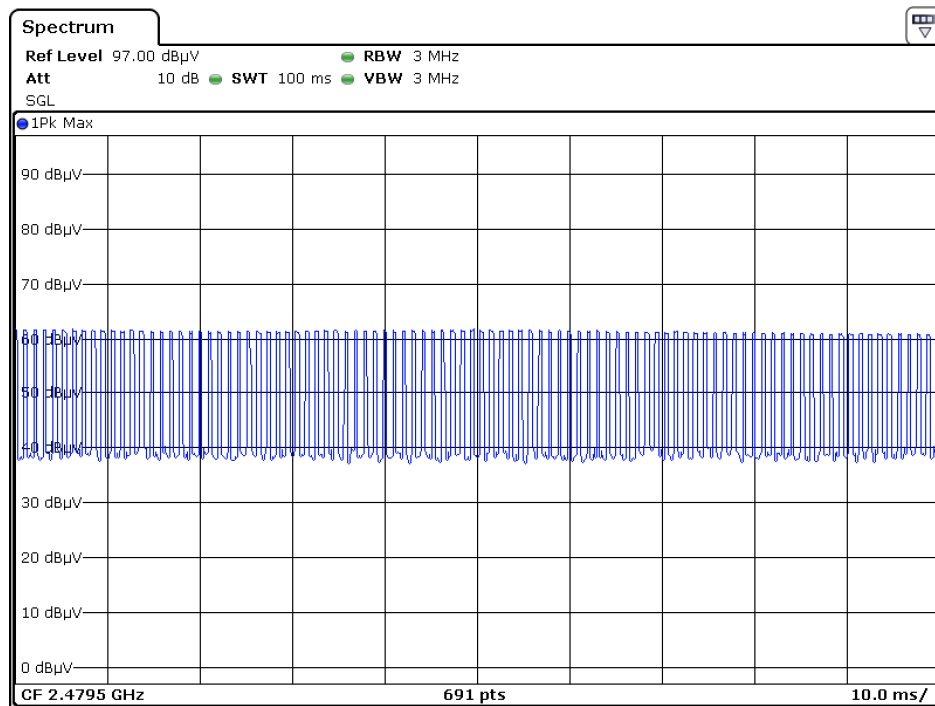
The duration of one cycle = 1.05942ms

Effective period of the cycle = 0.36377ms

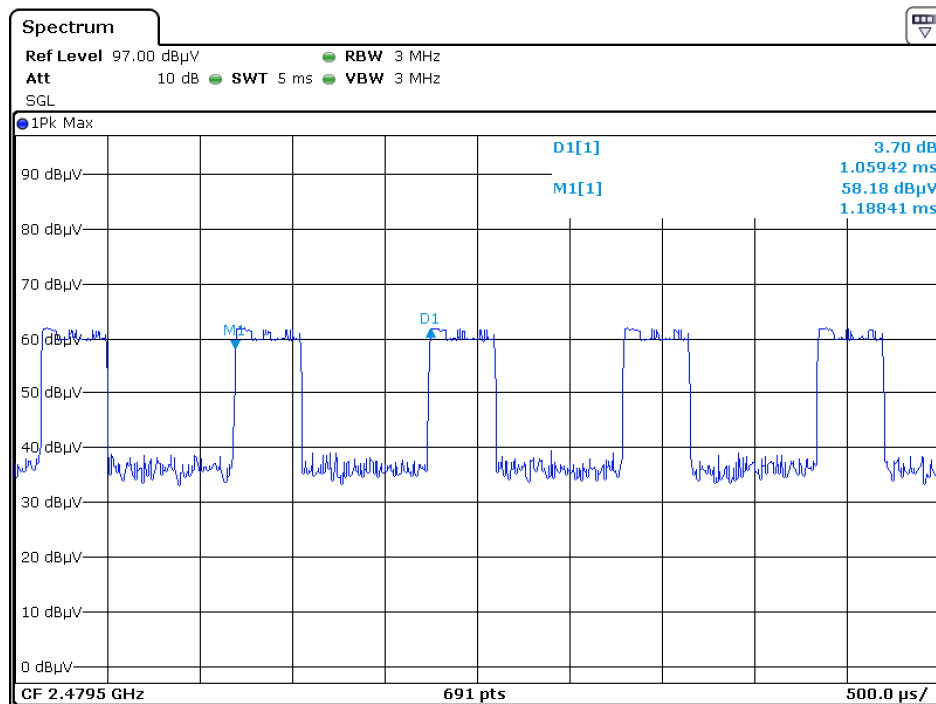
DC = $0.36377\text{ms} / 1.05942\text{ms} = 0.3434$ or 34.34%

Therefore, the averaging factor is found by $20 \log_{10} (0.3434) = -9.3 \text{ dB}$

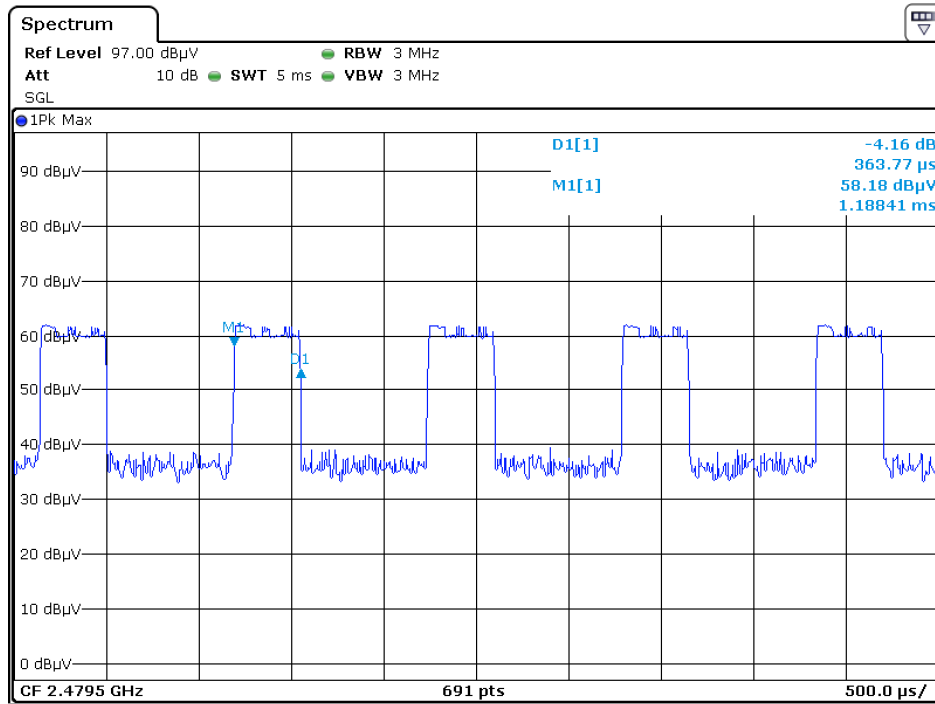
The test plots are attached as below.



Date: 16.NOV.2020 09:48:14



Date: 16.NOV.2020 09:53:28



Date: 16.NOV.2020 09:53:40

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.

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

9.6 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. A discussion of whether pulse desensitivity is applicable to this unit is included in this report (See Section 9.3). Above 1000 MHz, a resolution bandwidth of 1 MHz is used, RBW 5MHz 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
SZ061-03	BiConiLog Antenna	ETS	3142C	00166158	09-Oct-2019	09-Oct-2021
SZ185-01	EMI Receiver	R&S	ESCI	100547	24-Dec-2019	24-Dec-2020
SZ061-08	Horn Antenna	ETS	3115	00092346	07-Sep-2019	07-Sep-2021
SZ061-06	Active Loop Antenna	Electro-Metrics	EM-6876	217	24-May-2019	24-May-2021
SZ056-03	Spectrum Analyzer	R&S	FSP 30	101148	27-May-2020	27-May-2021
SZ056-06	Signal Analyzer	R&S	FSV 40	101101	27-May-2020	27-May-2021
SZ181-04	Preamplifier	Agilent	8449B	3008A02474	27-May-2020	27-May-2021
SZ188-01	Anechoic Chamber	ETS	RFD-F/A-100	4102	15-Dec-2018	15-Dec-2021
SZ062-02	RF Cable	RADIALL	RG 213U	--	12-Jun-2020	12-Dec-2020
SZ062-05	RF Cable	RADIALL	0.04-26.5GHz	--	24-Aug-2020	24-Feb-2021
SZ062-12	RF Cable	RADIALL	0.04-26.5GHz	--	24-Aug-2020	24-Feb-2021
SZ067-04	Notch Filter	Micro-Tronics	BRM50702-02	--	27-May-2020	27-May-2021
SZ185-02	EMI Test Receiver	R&S	ESCI	100692	27-Oct-2020	27-Oct-2021
SZ187-01	Two-Line V-Network	R&S	ENV216	100072	27-Oct-2020	27-Oct-2021
SZ187-02	Two-Line V-Network	R&S	ENV216	100072	27-May-2020	27-May-2021
SZ062-16	RF Cable	HUBER+SUHNER	CBL2-BN-1m	110127-2231000	13-Nov-2020	13-Nov-2021
SZ188-03	Shielding Room	ETS	RFD-100	4100	07-Jan-2020	07-Jan-2023

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