# Topwin & Companies Ltd.

Application
For
Certification

## FCC ID: 2AADZ-BTOHS

## Bluetooth Headset

## Model: BTO320NCL
## Additional Models: BTO393, BTO621, BTO610, BTO300

2.4GHz Transceiver

Report No.: 130516009SZN-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 [10-1-12]

| Prepared and Checked by: | Approved by: |
|---|---|
| Sign on file | Digitally signed by Billy Li<br>Location: Intertek Testing Services |
| Chris Chen<br>Engineer | Billy Li<br>Supervisor<br>Date: 30 May 2013 |



TRF No.: FCC 15C_TX_b


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# LIST OF EXHIBITS

# MEASUREMENT/TECHNICAL REPORT

**Topwin & Companies Ltd.**
**Model: BTO320NCL**
**Additional Models: BTO393, BTO621, BTO610, BTO300**

**FCC ID: 2AADZ-BTOHS**

This report concerns (check one:) Original Grant X 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 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.

Transition Rules Request per 15.37? Yes _____ No X

If no, assumed Part 15, Subpart C for intentional radiator – the new 47 CFR [10-1-12 Edition] provision.

Report prepared by:

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| Test Setup Photo | Radiated Emission | radiated photos.pdf |
| Test Report | Bandedge Plot | bandedge.pdf |
| Test Report | 20dB BW Plot | bw.pdf |
| External Photo | External Photo | external photos.pdf |
| Internal Photo | Internal Photo | internal photos.pdf |
| Block Diagram | Block Diagram | block.pdf |
| Schematics | Circuit Diagram | circuit.pdf |
| Operation Description | Technical Description | descri.pdf |
| ID Label/Location | Label Artwork and Location | label.pdf |
| User Manual | User Manual | manual.pdf |
| Cover Letter | Certification Agreement | agreement.pdf |
| Cover Letter | Letter of Agency | agency.pdf |

# EXHIBIT 1

# GENERAL DESCRIPTION

## 1.0 General Description

### 1.1 Product Description

The equipment under test (EUT) is a Bluetooth Headset with Bluetooth function. The EUT was powered by 3.7Vdc rechargeable battery left side & 3.7Vdc rechargeable battery right side. But it can't use bluetooth function while charging or wired audio input signal. For more detail information pls. refer to the user manual.

Antenna Type: Integral antenna

Modulation Type: GFSK, π/4 –DQPSK and 8-DPSK

The Models: BTO393, BTO621, BTO610, BTO300 are the same as the Model: BTO320NCL in hardware aspect, the difference in model number serves as marketing strategy.

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

### 1.2 Related Submittal(s) Grants

This is an application for certification of a transceiver for the Bluetooth Headset which has Bluetooth function, and there is no corresponding unit for certification.

### 1.3 Test Methodology

Radiated emission measurements was performed according to the procedures in ANSI C63.4 (2009). Radiated Emission measurement was performed in a Semi-anechoic chamber. Preliminary scans were performed in the Semi-anechoic chamber only to determine worst case modes. For each scan, the procedure for maximizing emissions in Appendices D and E were followed. 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.

### 1.4 Test Facility

The Semi-anechoic chamber used to collect the radiated data is **Intertek Testing Services Shenzhen Ltd. Kejiyuan Branch** and located at 6F, D Block, Huahan Building, Langshan Road, Nanshan District, Shenzhen, P. R. China. This test facility and site measurement data have been fully placed on file with the FCC(Registration Number: 242492).

# EXHIBIT 2

# SYSTEM TEST CONFIGURATION

## 2.0 System Test Configuration

### 2.1 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 C63.4 (2009).

The EUT was powered by 3.7Vdc fully recharged battery left side & 3.7Vdc fully recharged battery right side during the test.

All packets DH1, DH3 & DH5 mode in modulation type GFSK, π/4 –DQPSK and 8-DPSK were tested, and only the worst data was reported in this report.

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 Exhibit 3.

The unit was operated standalone and placed in the centre 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.

### 2.2 EUT Exercising Software

The EUT exercise program (provided by client) used during testing was designed to exercise the various system components in a manner similar to a typical use.

### 2.3 Special Accessories

N/A

### 2.4 Equipment Modification

Any modifications installed previous to testing by Topwin & Companies Ltd. will be incorporated in each production model sold / leased in the United States.

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

2.5 Measurement Uncertainty

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

2.6 Support Equipment List and Description

| Description | Manufacturer | Model No. |
|---|---|---|
| iPod | Apple | A1136 |

# EXHIBIT 3

# EMISSION RESULTS

## 3.0 **Emission Results**

Data is included worst-case configuration (the configuration which resulted in the highest emission levels). A sample calculation, configuration photographs and data tables of the emissions are included.

3.1 Radiated Test Results

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

3.1.1 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 + (-10) = 32 dBµV/m

Level in µV/m = Common Antilogarithm [(32 dBµV/m)/20] = 39.8 µV/m

3.1.2 Radiated Emission Configuration Photograph

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

3.1.3 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
171.620 MHz

Judgement: Passed by 15.7 dB

***TEST PERSONNEL:***

*Sign on file*

Chris Chen, Engineer
*Typed/Printed Name*

30 May 2013
*Date*

Applicant: Topwin & Companies Ltd. Date of Test: 30 May 2013
Model: BTO320NCL
Sample: 1/1
Worst Case Operating Mode: Transmitting

Table 1

**Radiated Emissions**

| Polarization | Frequency (MHz) | Reading (dBµV) | Pre-Amp Gain (dB) | Antenna Factor (dB) | Net at 3m (dBµV/m) | Limit at 3m (dBµV/m) | Margin (dB) |
|---|---|---|---|---|---|---|---|
| Horizontal | 171.620 | 38.6 | 20.0 | 9.2 | 27.8 | 43.5 | -15.7 |
| Horizontal | 275.410 | 29.9 | 20.0 | 12.4 | 22.3 | 46.0 | -23.7 |
| Horizontal | 442.735 | 30.0 | 20.0 | 16.3 | 26.3 | 46.0 | -19.7 |
| Vertical | 93.050 | 22.7 | 20.0 | 8.9 | 11.6 | 43.5 | -31.9 |
| Vertical | 176.480 | 28.6 | 20.0 | 10.0 | 18.6 | 43.5 | -24.9 |
| Vertical | 444.675 | 25.0 | 20.0 | 16.5 | 21.5 | 46.0 | -24.5 |

NOTES: 1. Quasi-Peak detector is used except for others stated.

2. All measurements were made at 3 meters. Harmonic emissions not detected at the 3-meter distances 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. All emissions are below the QP limit.

3.1.4 Transmitter Spurious Emissions (Radiated)

Worst Case Radiated Emission
at
4804.000 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 7.8 dB

***TEST PERSONNEL:***

*Sign on file*

Chris Chen, Engineer
*Typed/Printed Name*

30 May 2013
*Date*

Applicant: Topwin & Companies Ltd. Date of Test: 30 May 2013
Model: BTO320NCL
Sample: 1/1
Worst Case Operating Mode: Transmitting

Table 2

**Radiated Emissions**

(2402MHz)

| 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 | 2402.000 | 108.5 | 36.7 | 28.5 | 100.3 | 114.0 | -13.7 |
| Horizontal | 4804.000 | 67.9 | 36.7 | 35.0 | 66.2 | 74.0 | -7.8 |
| Horizontal | 7206.000 | 51.4 | 36.1 | 37.0 | 52.3 | 74.0 | -21.7 |

| 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) |
|---|---|---|---|---|---|---|---|---|
| Horizontal | 2402.000 | 108.5 | 36.7 | 28.5 | 22.5 | 77.8 | 94.0 | -16.2 |
| Horizontal | 4804.000 | 67.9 | 36.7 | 35.0 | 22.5 | 43.7 | 54.0 | -10.3 |
| Horizontal | 7206.000 | 51.4 | 36.1 | 37.0 | 22.5 | 29.8 | 54.0 | -24.2 |

Notes: 1. Peak Detector Data unless otherwise stated.

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: Chris Chen

Applicant: Topwin & Companies Ltd. Date of Test: 30 May 2013
Model: BTO320NCL
Sample: 1/1
Worst Case Operating Mode: Transmitting

Table 3

**Radiated Emissions**

(2441MHz)

| 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 | 2441.000 | 108.7 | 36.7 | 28.5 | 100.5 | 114.0 | -13.5 |
| Horizontal | 4882.000 | 67.6 | 36.7 | 35.0 | 65.9 | 74.0 | -8.1 |
| Horizontal | 7323.000 | 52.4 | 36.1 | 37.0 | 53.3 | 74.0 | -20.7 |

| 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) |
|---|---|---|---|---|---|---|---|---|
| Horizontal | 2441.000 | 108.7 | 36.7 | 28.5 | 22.5 | 78.0 | 94.0 | -16.0 |
| Horizontal | 4882.000 | 67.6 | 36.7 | 35.0 | 22.5 | 43.4 | 54.0 | -10.6 |
| Horizontal | 7323.000 | 52.4 | 36.1 | 37.0 | 22.5 | 30.8 | 54.0 | -23.2 |

Notes: 1. Peak Detector Data unless otherwise stated.

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: Chris Chen

Applicant: Topwin & Companies Ltd. Date of Test: 30 May 2013
Model: BTO320NCL
Sample: 1/1
Worst Case Operating Mode: Transmitting

Table 4

**Radiated Emissions**

(2480MHz)

| Polarization | Frequency (MHz) | Reading (dBµV) | Pre-Amp Gain (dB) | Antenna Factor (dB) | Net at 3m (dBµV/m) | Limit at 3m (dBµV/m) | Margin (dB) |
|---|---|---|---|---|---|---|---|
| Horizontal | 2480.000 | 109.6 | 36.7 | 28.3 | 101.2 | 114.0 | -12.8 |
| Horizontal | 4960.000 | 67.1 | 36.7 | 35.3 | 65.7 | 74.0 | -8.3 |
| Horizontal | 7440.000 | 53.0 | 36.1 | 37.0 | 53.9 | 74.0 | -20.1 |

| 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) |
|---|---|---|---|---|---|---|---|---|
| Horizontal | 2480.000 | 109.6 | 36.7 | 28.3 | 22.5 | 78.7 | 94.0 | -15.3 |
| Horizontal | 4960.000 | 67.1 | 36.7 | 35.3 | 22.5 | 43.2 | 54.0 | -10.8 |
| Horizontal | 7440.000 | 53.0 | 36.1 | 37.0 | 22.5 | 31.4 | 54.0 | -22.6 |

Notes: 1. Peak Detector Data unless otherwise stated.

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: Chris Chen

# EXHIBIT 4

# EQUIPMENT PHOTOGRAPHS

## 4.0 **Equipment Photographs**

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

# EXHIBIT 5

# PRODUCT LABELLING

## 5.0 **Product Labelling**

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

# EXHIBIT 6

# TECHNICAL SPECIFICATIONS

## 6.0 Technical Specifications

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

# EXHIBIT 7

# INSTRUCTION MANUAL

## 7.0 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.

# EXHIBIT 8

# MISCELLANEOUS INFORMATION

## 8.0 **Miscellaneous Information**

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

8.1 Bandedge Plot

For electronic filing, the plot shows the fundamental emission when modulated is saved with filename: bandedge.pdf. 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

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

**(i) Lower channel 2402MHz:**

Peak Resultant field strength = Fundamental emissions (peak value) – delta from the bandedge plot
= 100.3 dBµv/m-44.0 dB
= 56.3 dBµv/m

Average Resultant field strength = 56.3dBµv/m-22.5dB
= 33.8dBµv/m

**(ii) Upper channel 2480MHz:**

Peak Resultant field strength = Fundamental emissions (peak value) – delta from the bandedge plot
= 101.2 dBµv/m-55.7 dB
= 45.5 dBµv/m

Average Resultant field strength = 45.5dBµv/m-22.5dB
= 23.0dBµv/m

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).

8.1 Bandedge Plot (cont'd)

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.

Figure 8.1 Bandwidth

8.2 Discussion of Pulse Desensitization

Pulse desensitivity is not applicable for this device. The effective period ($T_{eff}$) is approximately 625µs for Bluetooth. With a resolution bandwidth (3dB) of 1MHz, so the pulse desensitivity factor is 0dB.

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

Based on the Bluetooth Specification Version 3.0, transmitter ON time is independent of packet type (DH1, DH3 and DH5) and packet length

Channel hop rate = 800 hops/second (AFH Mode)

Adjusted channel hop rate for DH5 mode = 133.33 hops/second

Time per channel hop = 1 / 133.33 hops/second = 7.5 ms

Time to cycle through all channels = 7.5 x 20 channels = 150 ms

Number of times transmitter hits on one channel = 100 ms / 150 ms = 1 time(s)

Worst case dwell time = 7.5 ms

Duty cycle connection factor = $20\log_{10}(7.5\text{ms} / 100\text{ms}) = -22.5$ dB

8.4 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 C63.4 - 2009.

The transmitting equipment under test (EUT) is placed on a wooden turntable which is four feet in diameter and approximately one meter 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.

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.

8.4 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 C63.4 - 2009.

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.

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.

# EXHIBIT 9

# TEST EQUIPMENT LIST

## 9.0 Test Equipment List

| Equipment No. | Equipment | Manufacturer | Model No. | Serial No. | Cal. Date | Due Date |
|---|---|---|---|---|---|---|
| SZ061-03 | BiConiLog Antenna | ETS | 3142C | 00066460 | 02-Jul-11 | 02-Jul-13 |
| SZ185-01 | EMI Receiver | R&S | ESCI | 100547 | 26-Feb-13 | 26-Aug-13 |
| SZ061-08 | Horn Antenna | ETS | 3115 | 00092346 | 11-Jul-12 | 11-Jul-13 |
| SZ061-07 | Horn Antenna | ETS | 3160-09 | 00083067 | 11-Jul-12 | 11-Jul-13 |
| SZ061-06 | Active Loop Antenna | Electro-Metrics | EM-6876 | 217 | 26-Feb-13 | 26-Aug-13 |
| SZ056-03 | Spectrum Analyzer | R&S | FSP 30 | 101148 | 26-Feb-13 | 26-Aug-13 |
| SZ181-04 | Preamplifier | Agilent | 8449B | 3008A02474 | 26-Feb-13 | 26-Aug-13 |
| SZ188-01 | Anechoic Chamber | ETS | RFD-F/A-100 | 4102 | 03-Dec-12 | 03-Dec-13 |
| SZ062-02 | RF Cable | RADIALL | RG 213U | -- | 26-Feb-13 | 26-Aug-13 |
| SZ062-06 | RF Cable | RADIALL | 0.04-26.5GHz | -- | 26-Feb-13 | 26-Aug-13 |
| SZ062-12 | RF Cable | RADIALL | 0.04-26.5GHz | -- | 26-Feb-13 | 26-Aug-13 |
| SZ067-04 | Notch Filter | Micro-Tronics | BRM50702-02 | -- | 15-Jul-12 | 15-Jul-13 |