

Application
For
Certification

FCC ID: 2AB3N-XLHF203BTX

HI FI COMPONENT SYSTEM

Model: XL-HF203B

Additional Model: XL-HF203B* whereas the suffix * represents character(s) A through Z, with or without bracket to denotes color or cosmetics.

Brand name: SHARP

2.4GHz Transceiver

Report No.: 170224003GZU-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 [10-1-15]

Prepared and Checked by:

Sign on file

Robert Li
Senior Project Engineer

Approved by:

Kidd Yang
Senior Project Engineer
Date: 07 March 2017

- The test results reported in this test report shall refer only to the sample actually tested and shall not refer or be deemed to refer to bulk from which such a sample may be said to have been obtained.
- 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 copy or distribute this report. 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 referenced from 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.
- For Terms And Conditions of the services, it can be provided upon request.
- The evaluation data of the report will be kept for 3 years from the date of issuance.

TRF No.: FCC 15C_TX_b

Intertek Testing Services Shenzhen Ltd. Guangzhou Branch

Block E, No.7-2 Guang Dong Software Science Park, Caipin Road, Guangzhou Science City, GETDD Guangzhou, China

Tel / Fax: 86-20-8213 9688/86-20-3205 7538 Website: www.china.intertek-etlsemko.com

INTERTEK TESTING SERVICES

LIST OF EXHIBITS

INTRODUCTION

<i>EXHIBIT 1:</i>	General Description
<i>EXHIBIT 2:</i>	System Test Configuration
<i>EXHIBIT 3:</i>	Emission Results
<i>EXHIBIT 4:</i>	Equipment Photographs
<i>EXHIBIT 5:</i>	Product Labelling
<i>EXHIBIT 6:</i>	Technical Specifications
<i>EXHIBIT 7:</i>	Instruction Manual
<i>EXHIBIT 8:</i>	Miscellaneous Information
<i>EXHIBIT 9:</i>	Confidentiality Request
<i>EXHIBIT 10:</i>	Test Equipment List

INTERTEK TESTING SERVICES

MEASUREMENT/TECHNICAL REPORT

S&O ELECTRONICS (MALAYSIA) SDN. BHD. Co., LTD
MODEL:XL-HF203B

Additional Models: XL-HF203B* whereas the suffix * represents character(s) A through Z, with or without bracket to denotes color or cosmetics.

Brand name: SHARP

FCC ID: 2AB3N-XLHF203BTX

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 [10-1-15 Edition] provision.

Report prepared by:

Robert Li
Intertek Testing Services Shenzhen Ltd.
Guangzhou Branch
Block E, No.7-2 Guang Dong Software Science
Park, Caipin Road, Guangzhou Science City,
GETDD Guangzhou, China
Phone: 86-20-8213 9688
Fax: 86-20-3205 7538

INTERTEK TESTING SERVICES

Table of Contents

1.0 General Description	2
1.1 Product Description	2
1.2 Related Submittal(s) Grants	2
1.3 Test Methodology	2
1.4 Test Facility	2
2.0 System Test Configuration	4
2.1 Justification.....	4
2.2 EUT Exercising Software.....	4
2.3 Special Accessories	4
2.4 Equipment Modification.....	4
2.5 Measurement Uncertainty.....	5
2.6 Support Equipment List and Description.....	5
3.0 Emission Results	7
3.1 Radiated Test Results.....	8
3.1.1 Field Strength Calculation.....	8
3.1.2 Radiated Emission Configuration Photograph.....	9
3.1.3 Radiated Emissions	9
3.1.4 Transmitter Spurious Emissions	12
3.2 Conducted Emission at Mains Termination.....	19
3.2.1 Conducted Emissions Configuration Photograph	19
3.2.2 Conducted Emissions	19
4.0 Equipment Photographs	23
5.0 Product Labelling	25
6.0 Technical Specifications	27
7.0 Instruction Manual	29
8.0 Miscellaneous Information	31
8.1 Bandedge Plot	32
8.2 Discussion of Pulse Desensitization	34
8.3 Transmitter Duty Cycle Calculation.....	35
8.4 Emissions Test Procedures	36
9.0 Confidentiality Request	39
10.0 Test Equipment Specifications	41

INTERTEK TESTING SERVICES

List of attached file

Exhibit type	File Description	Filename
Test Report	Test Report	report.pdf
Test Setup Photo	Radiated Emission	radiated photos.pdf
Test Setup Photo	Conducted Emission	conducted 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	Confidentiality Letter	request.pdf
Cover Letter	Letter of Agency	agency.pdf

INTERTEK TESTING SERVICES

EXHIBIT 1

GENERAL DESCRIPTION

TRF No.: FCC 15C_TX_b
FCC ID: 2AB3N-XLHF203BTX
Report No.: 170224003GZU-001

INTERTEK TESTING SERVICES

1.0 General Description

1.1 Product Description

The equipment under test (EUT) is a HI FI COMPONENT SYSTEM with Bluetooth function. The EUT was powered by AC100-240V, 50/60Hz, 22W. The EUT contains two identical BT modules, one is use for connecting mobile phone (when switching to BT mode), and the other one is use for connecting wireless headphone (when switching to CD mode). They cannot transmit simultaneously. The NFC tag is passive. For more detail information pls. refer to the user manual.

Bluetooth Version: 2.1+EDR

Antenna Type: Integral antenna

Modulation Type: GFSK, $\pi/4$ DQPSK, 8DPSK

The Model: XL-HF203B* whereas the suffix * represents character(s) A through Z, with or without bracket to denotes color or cosmetics. is the same as the Model: XL-HF203B in hardware aspect (circuitry and electrical, mechanical and physical construction), the differences are appearance and model no. for trading purpose.

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 HI FI COMPONENT SYSTEM 2.1+EDR and related report for the computer peripheral is subjected to FCC Report No.: 170224003GZU-002 is filed at the same time.

1.3 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.

1.4 Test Facility

The Semi-anechoic chamber and shielding room used to collect the radiated data and conducted data are EMTEK (Shenzhen) Co., Ltd. and located at Bldg. 69, Majialong Industry Zone, Nanshan District, Shenzhen, Guangdong, 518052, China. This test facility and site measurement data have been fully placed on file with the FCC (Registration Number: 406365).

EXHIBIT 2

SYSTEM TEST CONFIGURATION

INTERTEK TESTING SERVICES

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 C63.10 (2013).

The EUT was powered by AC 120V, 60Hz during the test. This device contains two Bluetooth modules which can't work simultaneously. They are the same in hardware and electrical aspect. Each transmitter was tested separately and only worst case data was reported in this report.

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

For maximizing emissions, the EUT was rotated through 360°, the EUT was placed on the styrene turntable with 0.8m up to 1GHz and 1.5 m above 1GHz. The antenna height and polarization are varied during the search for maximum signal level. The antenna height is varied from 1 to 4 meters. Radiated emissions are taken at three meters unless the signal level is too low for measurement at that distance. If necessary, a pre-amplifier is used and/or the test is conducted at a closer distance.

The rear of unit was 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.

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

No special accessories used.

2.4 Equipment Modification

Any modifications installed previous to testing by S&O ELECTRONICS (MALAYSIA) SDN. BHD. will be incorporated in each production model sold / leased in the United States.

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

INTERTEK TESTING SERVICES

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	Manufacture	Model No.
Laptop	HP	ProBook 5220m
Hard Disk	Smart Drive	HD-003
USB Cable	N/A	Unshielded, Length 110cm
LAN Cable with Load	N/A	Unshielded, Length 450cm
iPod	Apple	A1367
PC In Cable (USB Type A - Type B)	N/A	Unshielded, Length 110cm
Line In Cable	N/A	Unshielded, Length 120cm
USB Disk	TOSHIBA	UHYBS-004G-BL
Audio In Cable	N/A	Unshielded, Length 120cm
Speaker x 2	N/A	N/A, 8 ohm
Speaker wires x 2	S&O	Unshielded, Length 250cm
Earphone	N/A	Unshielded, Length 110cm
Optical Cable with load	N/A	Unshielded, Length 110cm
Dummy Load	N/A	N/A
FM Antenna	S&O	N/A
AM loop Antenna	S&O	N/A
Remote Control	S&O	N/A

EXHIBIT 3

EMISSION RESULTS

INTERTEK TESTING SERVICES

3.0 Emission Results

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

INTERTEK TESTING SERVICES

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.

$$FS = RA + AF + CF - AG$$

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

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:

$$FS = RA + AF + CF - AG$$

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 net field strength for comparison to the appropriate emission limit is 42 dB μ V/m. This value in dB μ V/m was converted to its corresponding level in μ V/m.

$$RA = 62.0 \text{ dB}\mu\text{V}$$

$$AF = 7.4 \text{ dB}$$

$$CF = 1.6 \text{ dB}$$

$$AG = 29.0 \text{ dB}$$

$$FS = 62 + 7.4 + 1.6 - 29 + 0 = 42 \text{ dB}\mu\text{V/m}$$

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

INTERTEK TESTING SERVICES

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
683.982 MHz

Judgement: Passed by 6.1 dB

TEST PERSONNEL:

Sign on file

Robert Li Senior Project Engineer
Typed/Printed Name

07 March 2017

Date

INTERTEK TESTING SERVICES

Applicant: S&O ELECTRONICS (MALAYSIA) SDN. BHD.

Date of Test: 07 March 2017

Worst Case Operating Mode: BT Link

Bluetooth Module 1

Table 1

Radiated Emissions

Polarization	Frequency (MHz)	Reading (dB μ V)	Pre-Amp Gain (dB)	Antenna Factor (dB)	Net at 3m (dB μ V/m)	Limit at 3m (dB μ V/m)	Margin (dB)
Horizontal	288.020	39.7	20.0	15.0	34.7	46.0	-11.3
Horizontal	335.992	38.9	20.0	16.7	35.6	46.0	-10.4
Horizontal	683.982	35.2	20.0	24.7	39.9	46.0	-6.1
Vertical	90.305	41.9	20.0	9.2	31.1	43.5	-12.4
Vertical	271.045	40.3	20.0	14.6	34.9	46.0	-11.1
Vertical	539.969	34.5	20.0	21.8	36.3	46.0	-9.7

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.

INTERTEK TESTING SERVICES

Applicant: S&O ELECTRONICS (MALAYSIA) SDN. BHD.

Date of Test: 07 March 2017

Worst Case Operating Mode: BT Link

Bluetooth Module 2

Table 1

Radiated Emissions

Polarization	Frequency (MHz)	Reading (dB μ V)	Pre-Amp Gain (dB)	Antenna Factor (dB)	Net at 3m (dB μ V/m)	Limit at 3m (dB μ V/m)	Margin (dB)
Horizontal	278.000	38.5	20.0	15.0	33.5	46.0	-12.5
Horizontal	335.991	37.5	20.0	16.7	34.2	46.0	-11.8
Horizontal	683.982	34.0	20.0	24.7	38.7	46.0	-7.3
Vertical	100.305	40.7	20.0	9.2	29.9	43.5	-13.6
Vertical	269.045	38.1	20.0	14.6	32.7	46.0	-13.3
Vertical	538.969	34.4	20.0	21.8	36.2	46.0	-9.8

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.

INTERTEK TESTING SERVICES

3.1.4 Transmitter Spurious Emissions (Radiated)

Worst Case Radiated Emission
at
7206.000 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 15.9 dB

TEST PERSONNEL:

Sign on file

Robert Li Senior Project Engineer
Typed/Printed Name

07 March 2017
Date

INTERTEK TESTING SERVICES

Applicant: S&O ELECTRONICS (MALAYSIA) SDN. BHD.

Date of Test: 07 March 2017

Worst Case Operating Mode: Transmitting

Bluetooth Module 1

Table 2

Radiated Emissions

(2402MHz)

Polarization	Frequency (MHz)	Reading (dB μ V)	Pre-Amp Gain (dB)	Antenna Factor (dB)	Net at 3m (dB μ V/m)	Peak Limit at 3m (dB μ V/m)	Margin (dB)
Horizontal	2402.000	100.6	36.7	28.5	92.4	114.0	-21.6
Horizontal	4804.000	62.3	36.7	28.5	54.1	74.0	-19.9
Horizontal	7206.000	61.1	36.1	33.1	58.1	74.0	-15.9

Polarization	Frequency (MHz)	Reading (dB μ V)	Pre-Amp Gain (dB)	Antenna Factor (dB)	Average Factor (-dB)	Net at 3m (dB μ V/m)	Average Limit at 3m (dB μ V/m)	Margin (dB)
Horizontal	2402.000	100.6	36.7	28.5	22.5	69.9	94.0	-24.1
Horizontal	4804.000	62.3	36.7	28.5	22.5	31.6	54.0	-22.4
Horizontal	7206.000	61.1	36.1	33.1	22.5	35.6	54.0	-18.4

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: Robert Li

TRF No.: FCC 15C_TX_b

FCC ID: 2AB3N-XLHF203BTX

Report No.: 170224003GZU-001

INTERTEK TESTING SERVICES

Applicant: S&O ELECTRONICS (MALAYSIA) SDN. BHD.

Date of Test: 07 March 2017

Worst Case Operating Mode: Transmitting

Bluetooth Module 1

Table 3

Radiated Emissions

(2441MHz)

Polarization	Frequency (MHz)	Reading (dB μ V)	Pre-Amp Gain (dB)	Antenna Factor (dB)	Net at 3m (dB μ V/m)	Peak Limit at 3m (dB μ V/m)	Margin (dB)
Horizontal	2441.000	98.8	36.7	28.5	90.6	114.0	-23.4
Horizontal	4882.000	61.9	36.7	28.5	53.7	74.0	-20.3
Horizontal	7323.000	60.7	36.1	33.1	57.7	74.0	-16.3

Polarization	Frequency (MHz)	Reading (dB μ V)	Pre-Amp Gain (dB)	Antenna Factor (dB)	Average Factor (-dB)	Net at 3m (dB μ V/m)	Average Limit at 3m (dB μ V/m)	Margin (dB)
Horizontal	2441.000	98.8	36.7	28.5	22.5	68.1	94.0	-25.9
Horizontal	4882.000	61.9	36.7	28.5	22.5	31.2	54.0	-22.8
Horizontal	7323.000	60.7	36.1	33.1	22.5	35.2	54.0	-18.8

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: Robert Li

TRF No.: FCC 15C_TX_b

FCC ID: 2AB3N-XLHF203BTX

Report No.: 170224003GZU-001

INTERTEK TESTING SERVICES

Applicant: S&O ELECTRONICS (MALAYSIA) SDN. BHD.

Date of Test: 07 March 2017

Worst Case Operating Mode: Transmitting

Bluetooth Module 1

Table 4

Radiated Emissions

(2480MHz)

Polarization	Frequency (MHz)	Reading (dB μ V)	Pre-Amp Gain (dB)	Antenna Factor (dB)	Net at 3m (dB μ V/m)	Peak Limit at 3m (dB μ V/m)	Margin (dB)
Horizontal	2480.000	99.0	36.7	28.5	90.8	114.0	-23.2
Horizontal	4960.000	61.4	36.7	28.5	53.2	74.0	-20.8
Horizontal	7440.000	60.4	36.1	33.1	57.4	74.0	-16.6

Polarization	Frequency (MHz)	Reading (dB μ V)	Pre-Amp Gain (dB)	Antenna Factor (dB)	Average Factor (-dB)	Net at 3m (dB μ V/m)	Average Limit at 3m (dB μ V/m)	Margin (dB)
Horizontal	2480.000	99.0	36.7	28.5	22.5	68.3	94.0	-25.7
Horizontal	4960.000	61.4	36.7	28.5	22.5	30.7	54.0	-23.3
Horizontal	7440.000	60.4	36.1	33.1	22.5	34.9	54.0	-19.1

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: Robert Li

TRF No.: FCC 15C_TX_b

FCC ID: 2AB3N-XLHF203BTX

Report No.: 170224003GZU-001

INTERTEK TESTING SERVICES

Applicant: S&O ELECTRONICS (MALAYSIA) SDN. BHD.

Date of Test: 07 March 2017

Worst Case Operating Mode: Transmitting

Bluetooth Module 2

Table 2

Radiated Emissions

(2402MHz)

Polarization	Frequency (MHz)	Reading (dB μ V)	Pre-Amp Gain (dB)	Antenna Factor (dB)	Net at 3m (dB μ V/m)	Peak Limit at 3m (dB μ V/m)	Margin (dB)
Horizontal	2402.000	99.6	36.7	28.5	91.4	114.0	-22.6
Horizontal	4804.000	61.3	36.7	28.5	53.1	74.0	-20.9
Horizontal	7206.000	60.6	36.1	33.1	57.6	74.0	-16.4

Polarization	Frequency (MHz)	Reading (dB μ V)	Pre-Amp Gain (dB)	Antenna Factor (dB)	Average Factor (-dB)	Net at 3m (dB μ V/m)	Average Limit at 3m (dB μ V/m)	Margin (dB)
Horizontal	2402.000	99.6	36.7	28.5	22.5	68.9	94.0	-25.1
Horizontal	4804.000	61.3	36.7	28.5	22.5	30.6	54.0	-23.4
Horizontal	7206.000	60.6	36.1	33.1	22.5	35.1	54.0	-18.9

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: Robert Li

TRF No.: FCC 15C_TX_b

FCC ID: 2AB3N-XLHF203BTX

Report No.: 170224003GZU-001

INTERTEK TESTING SERVICES

Applicant: S&O ELECTRONICS (MALAYSIA) SDN. BHD.

Date of Test: 07 March 2017

Worst Case Operating Mode: Transmitting

Bluetooth Module 2

Table 3

Radiated Emissions

(2441MHz)

Polarization	Frequency (MHz)	Reading (dB μ V)	Pre-Amp Gain (dB)	Antenna Factor (dB)	Net at 3m (dB μ V/m)	Peak Limit at 3m (dB μ V/m)	Margin (dB)
Horizontal	2441.000	99.0	36.7	28.5	90.8	114.0	-23.2
Horizontal	4882.000	60.5	36.7	28.5	52.3	74.0	-21.7
Horizontal	7323.000	59.9	36.1	33.1	56.9	74.0	-17.1

Polarization	Frequency (MHz)	Reading (dB μ V)	Pre-Amp Gain (dB)	Antenna Factor (dB)	Average Factor (-dB)	Net at 3m (dB μ V/m)	Average Limit at 3m (dB μ V/m)	Margin (dB)
Horizontal	2441.000	99.0	36.7	28.5	22.5	68.3	94.0	-25.7
Horizontal	4882.000	60.5	36.7	28.5	22.5	29.8	54.0	-24.2
Horizontal	7323.000	59.9	36.1	33.1	22.5	34.4	54.0	-19.6

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: Robert Li

TRF No.: FCC 15C_TX_b

FCC ID: 2AB3N-XLHF203BTX

Report No.: 170224003GZU-001

INTERTEK TESTING SERVICES

Applicant: S&O ELECTRONICS (MALAYSIA) SDN. BHD.

Date of Test: 07 March 2017

Worst Case Operating Mode: Transmitting

Bluetooth Module 2

Table 4

Radiated Emissions

(2480MHz)

Polarization	Frequency (MHz)	Reading (dB μ V)	Pre-Amp Gain (dB)	Antenna Factor (dB)	Net at 3m (dB μ V/m)	Peak Limit at 3m (dB μ V/m)	Margin (dB)
Horizontal	2480.000	98.9	36.7	28.5	90.7	114.0	-23.3
Horizontal	4960.000	60.4	36.7	28.5	52.2	74.0	-21.8
Horizontal	7440.000	59.7	36.1	33.1	56.7	74.0	-17.3

Polarization	Frequency (MHz)	Reading (dB μ V)	Pre-Amp Gain (dB)	Antenna Factor (dB)	Average Factor (-dB)	Net at 3m (dB μ V/m)	Average Limit at 3m (dB μ V/m)	Margin (dB)
Horizontal	2480.000	98.9	36.7	28.5	22.5	68.2	94.0	-25.8
Horizontal	4960.000	60.4	36.7	28.5	22.5	29.7	54.0	-24.3
Horizontal	7440.000	59.7	36.1	33.1	22.5	34.2	54.0	-19.8

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: Robert Li

TRF No.: FCC 15C_TX_b

FCC ID: 2AB3N-XLHF203BTX

Report No.: 170224003GZU-001

INTERTEK TESTING SERVICES

3.2 Conducted Emission at Mains Terminal

3.2.1 Conducted Emissions Configuration Photograph

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

3.2.2 Conducted Emissions

Worst Case Conducted Configuration
At

0.266 MHz

Judgement: Passed by 13.4 dB margin

TEST PERSONNEL:

Sign on file

Robert Li Senior Project Engineer
Typed/Printed Name

07 March 2017

Date

INTERTEK TESTING SERVICES

Applicant: S&O ELECTRONICS (MALAYSIA) SDN. BHD.

Date of Test: 07 March 2017

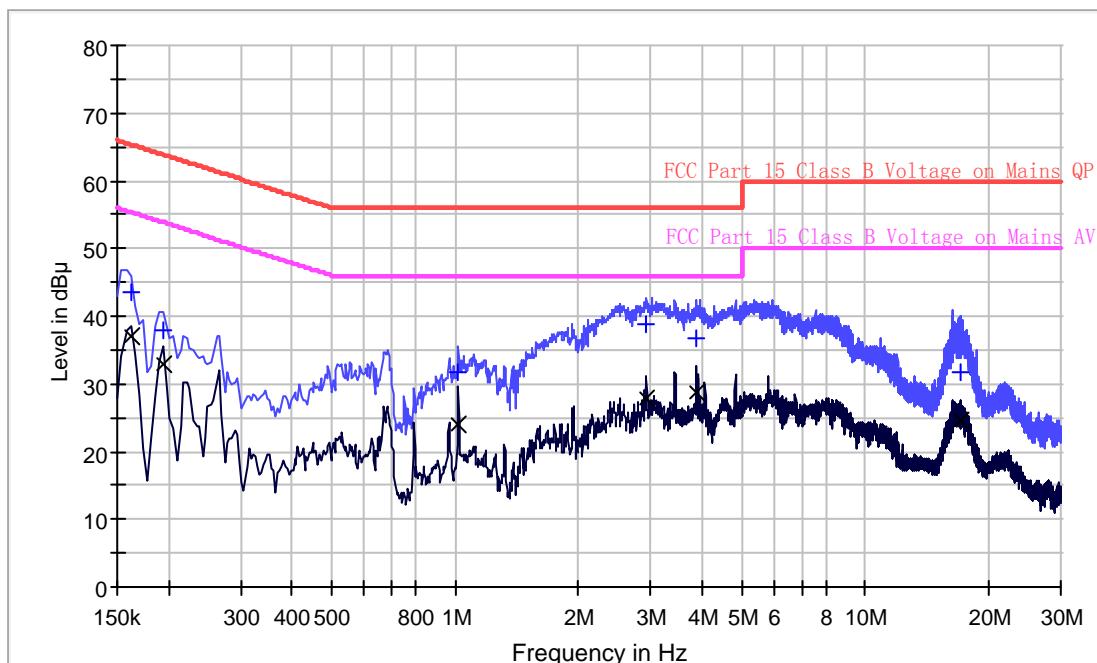
Model: XL-HF203B

Sample: 1/1

Worst Case Operating Mode: BT Link(Buletooth Module 1)

Phase: Live

Conducted Emission Test - FCC



Limit and Margin QP

Frequency (MHz)	QuasiPeak (dB μ V)	Bandwidth (kHz)	Line	Corr. (dB)	Margin (dB)	Limit (dB μ V)
0.162000	43.6	9.000	L1	9.6	21.8	65.4
0.194000	37.9	9.000	L1	9.7	26.0	63.9
1.018000	31.6	9.000	L1	9.7	24.4	56.0
2.934000	38.9	9.000	L1	9.7	17.1	56.0
3.862000	36.7	9.000	L1	9.8	19.3	56.0
17.034000	31.7	9.000	L1	10.2	28.3	60.0

Limit and Margin AV

Frequency (MHz)	Average (dB μ V)	Bandwidth (kHz)	Line	Corr. (dB)	Margin (dB)	Limit (dB μ V)
0.162000	37.0	9.000	L1	9.6	18.4	55.4
0.194000	32.9	9.000	L1	9.7	21.0	53.9
1.018000	24.1	9.000	L1	9.7	21.9	46.0
2.934000	27.9	9.000	L1	9.7	18.1	46.0
3.862000	28.7	9.000	L1	9.8	17.3	46.0
17.034000	24.6	9.000	L1	10.2	25.4	50.0

TRF No.: FCC 15C_TX_b

FCC ID: 2AB3N-XLHF203BTX

Report No.: 170224003GZU-001

INTERTEK TESTING SERVICES

Applicant: S&O ELECTRONICS (MALAYSIA) SDN. BHD.

Date of Test: 07 March 2017

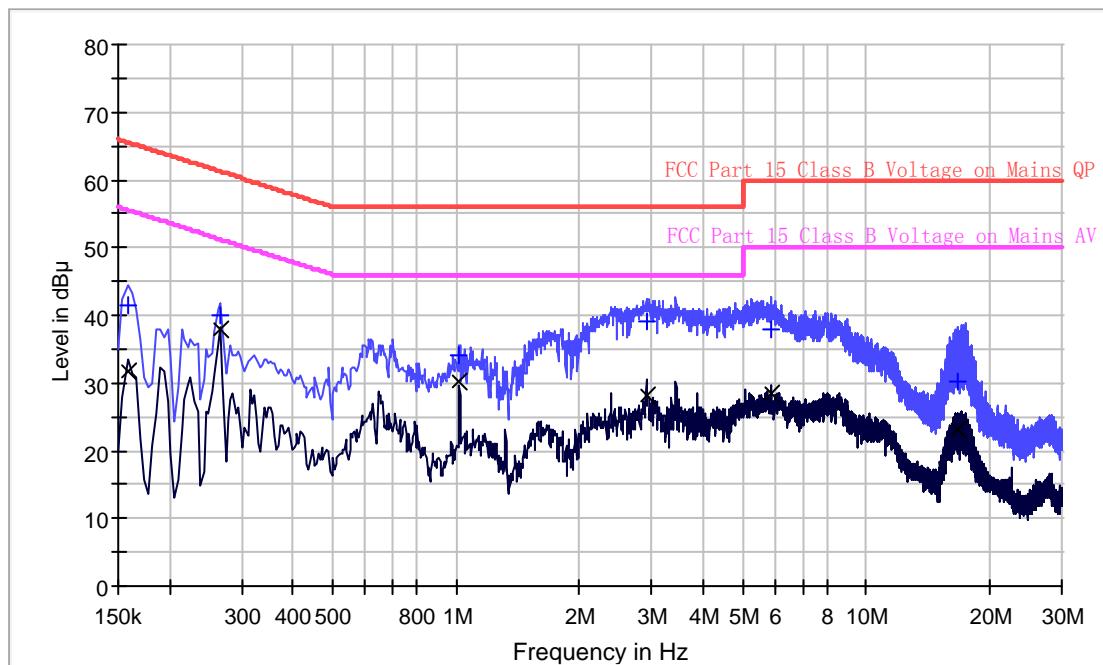
Model: XL-HF203B

Sample: 1/1

Worst Case Operating Mode: BT Link(Bluetooth Module 1)

Phase: Neutral

Conducted Emission Test - FCC



Limit and Margin QP

Frequency (MHz)	QuasiPeak (dB μ V)	Bandwidth (kHz)	Line	Corr. (dB)	Margin (dB)	Limit (dB μ V)
0.158000	41.5	9.000	N	9.6	24.1	65.6
0.266000	40.0	9.000	N	9.7	21.2	61.2
1.018000	34.1	9.000	N	9.7	21.9	56.0
2.934000	39.0	9.000	N	9.8	17.0	56.0
5.878000	38.0	9.000	N	9.8	22.0	60.0
16.726000	30.3	9.000	N	10.1	29.7	60.0

Limit and Margin AV

Frequency (MHz)	Average (dB μ V)	Bandwidth (kHz)	Line	Corr. (dB)	Margin (dB)	Limit (dB μ V)
0.158000	31.7	9.000	N	9.6	23.9	55.6
0.266000	37.8	9.000	N	9.7	13.4	51.2
1.018000	30.3	9.000	N	9.7	15.7	46.0
2.934000	28.2	9.000	N	9.8	17.8	46.0
5.878000	28.5	9.000	N	9.8	21.5	50.0
16.726000	23.1	9.000	N	10.1	26.9	50.0

TRF No.: FCC 15C_TX_b

FCC ID: 2AB3N-XLHF203BTX

Report No.: 170224003GZU-001

INTERTEK TESTING SERVICES

EXHIBIT 4

EQUIPMENT PHOTOGRAPHS

TRF No.: FCC 15C_TX_b
FCC ID: 2AB3N-XLHF203BTX
Report No.: 170224003GZU-001

INTERTEK TESTING SERVICES

4.0 Equipment Photographs

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

INTERTEK TESTING SERVICES

EXHIBIT 5

PRODUCT LABELLING

TRF No.: FCC 15C_TX_b
FCC ID: 2AB3N-XLHF203BTX
Report No.: 170224003GZU-001

INTERTEK TESTING SERVICES

5.0 Product Labelling

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

INTERTEK TESTING SERVICES

EXHIBIT 6

TECHNICAL SPECIFICATIONS

TRF No.: FCC 15C_TX_b
FCC ID: 2AB3N-XLHF203BTX
Report No.: 170224003GZU-001

INTERTEK TESTING SERVICES

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.

INTERTEK TESTING SERVICES

EXHIBIT 7

INSTRUCTION MANUAL

TRF No.: FCC 15C_TX_b
FCC ID: 2AB3N-XLHF203BTX
Report No.: 170224003GZU-001

INTERTEK TESTING SERVICES

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.

INTERTEK TESTING SERVICES

EXHIBIT 8

MISCELLANEOUS INFORMATION

TRF No.: FCC 15C_TX_b
FCC ID: 2AB3N-XLHF203BTX
Report No.: 170224003GZU-001

INTERTEK TESTING SERVICES

8.0 Miscellaneous Information

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

INTERTEK TESTING SERVICES

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

$$\begin{aligned} &= 92.4 \text{ dB}\mu\text{V/m} - 51.0 \text{ dB} \\ &= 41.4 \text{ dB}\mu\text{V/m} \end{aligned}$$

(ii) Upper channel 2480MHz:

Peak Resultant field strength = Fundamental emissions (peak value) – delta from the bandedge plot

$$\begin{aligned} &= 90.8 \text{ dB}\mu\text{V/m} - 50.9 \text{ dB} \\ &= 39.9 \text{ dB}\mu\text{V/m} \end{aligned}$$

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

INTERTEK TESTING SERVICES

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

INTERTEK TESTING SERVICES

8.2 Discussion of Pulse Desensitization

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

INTERTEK TESTING SERVICES

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

Based on the Bluetooth Specification Version 2.1+EDR, and worst case AFH mode, transmitter ON time is independent of packet type (DH5) and packet length, the AFH mode Duty cycle connection factor as below:

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

INTERTEK TESTING SERVICES

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 C63.10 - 2013.

The transmitting equipment under test (EUT) is placed on a styrene turntable which is four feet in diameter, up to 1GHz 0.8m and above 1GHz 1.5m 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.

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.

INTERTEK TESTING SERVICES

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.

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 (RBW 3MHz for fundamental emission) 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.

INTERTEK TESTING SERVICES

EXHIBIT 9

CONFIDENTIALITY REQUEST

TRF No.: FCC 15C_TX_b
FCC ID: 2AB3N-XLHF203BTX
Report No.: 170224003GZU-001

INTERTEK TESTING SERVICES

9.0 Confidentiality Request

For electronic filing, the confidentiality request of the tested EUT is saved with filename: request.pdf.

INTERTEK TESTING SERVICES

EXHIBIT10

TEST EQUIPMENT LIST

TRF No.: FCC 15C_TX_b
FCC ID: 2AB3N-XLHF203BTX
Report No.: 170224003GZU-001

INTERTEK TESTING SERVICES

10.0 Test Equipment List

Equipment No.	Equipment	Manufacturer	Model No.	Serial No.	Cal. Date	Due Date
EE089	EMI Test Receiver	Rohde & Schwarz	ESU	1302.6005 .26	17-May-2016	17-May-2017
EE040	Pre-Amplifier	HP	8447F	2944A079 99	17-May-2016	17-May-2017
EE043	Bilog Antenna	Schwarzbeck	VULB9163	142	17-May-2016	17-May-2017
EE147	Cable	Schwarzbeck	AK9513	ACRX1	17-May-2016	17-May-2017
EE169	Cable	Rosenberger	N/A	FP2RX2	17-May-2016	17-May-2017
EE168	Cable	Schwarzbeck	AK9513	CRPX1	29-May-2016	29-May-2017
EE170	Cable	Schwarzbeck	AK9513	CRRX2	29-May-2016	29-May-2017
EE096	Pre-Amplifier	A.H.	PAM-0126	1415261	17-May-2016	17-May-2017
EE094	Horn Antenna	Schwarzbeck	BBHA 9120	707	29-May-2016	29-May-2017
EE097	Cable	H+B	0.5M SF104- 26.5	289147/4	29-May-2016	29-May-2017
EE100	Cable	H+B	3M SF104- 26.5	295838/4	29-May-2016	29-May-2017
EE101	Cable	H+B	6M SF104- 26.5	295840/4	29-May-2016	29-May-2017
EE095	Horn Antenna	Schwarzbeck	BBHA 9170 399	BBHA9170 399	17-May-2016	17-May-2017
EE343	EMI Test Receiver	Rohde & Schwarz	FSV40	132.1- 3008K39- 100967- AP	29-May-2016	29-May-2017
EE240	Pre-Amplifier	Lunar EM	LNA26G40 -40	J10131310 28001	17-May-2016	17-May-2017
EE234	Horn Antenna	AHS/USA	SAS-573	184	17-May-2016	17-May-2017
EE312	Cable	A.H	SAC-40G- 1	414	17-May-2016	17-May-2017
EE313	Cable	A.H	SAC-40G- 1	413	17-May-2016	17-May-2017
EE023	Test Receiver	Rohde & Schwarz	ESCS30	879	29-May-2016	29-May-2017
EE145	L.I.S.N.	Rohde & Schwarz	ENV216	590	29-May-2016	29-May-2017
EE021	L.I.S.N.	ROHDE & SCHWARZ	ESH2-Z5	236	29-May-2016	29-May-2017

TRF No.: FCC 15C_TX_b

FCC ID: 2AB3N-XLHF203BTX

Report No.: 170224003GZU-001