

Produkte
Products

Prüfbericht - Nr.: 14037778 001
Test Report No.:

Seite 1 von 15
Page 1 of 15

Auftraggeber: Breezway Pty Ltd.
Client:
PO Box 321, Coorparoo,
QLD, 4151
Australia

Gegenstand der Prüfung: Bluetooth Low Energy Device - Apptivate Control Unit
Test Item:

Bezeichnung: 300003559
Identification: 300003558

Serien-Nr.: Engineering sample
Serial No.:

Wareneingangs-Nr.: A000084110-002,
Receipt No.: A000132707-001

Eingangsdatum: 10.07.2014,
Date of Receipt: 19.11.2014

Prüfort: Hong Kong Productivity Council
Testing Location: HKPC Building, 78 Tat Chee Avenue, Kowloon, Hong Kong

Zustand des Prüfgegenstandes bei Anlieferung: Test sample(s) is/are not damaged and suitable for testing.
Condition of test item at delivery:

Prüfgrundlage: FCC Part 15 Subpart C
Test Specification: ANSI C63.4-2009

Prüfergebnis: Das vorstehend beschriebene Gerät wurde geprüft und entspricht oben genannter Prüfgrundlage.
Test Results: The above mentioned product was tested and **passed**.

Prüflaboratorium: TÜV Rheinland Hong Kong Ltd.
Testing Laboratory: 8 - 10/F., Goldin Financial Global Square, 7 Wang Tai Road, Kowloon Bay Kowloon, Hong Kong

geprüft/ tested by:

16.02.2015 Hugo Wan
Datum Name/Stellung
Date Name/Position

Senior Project Manager



kontrolliert/ reviewed by:

17.02.2015 Sharon Li
Datum Name/Stellung
Date Name/Position

Department Manager



Sonstiges: FCC ID 2AD5X30000355

Other Aspects

Abkürzungen: P(ass) = entspricht Prüfgrundlage
F(all) = entspricht nicht Prüfgrundlage
N/A = nicht anwendbar
N/T = nicht getestet

Abbreviations: P(ass) = passed
F(all) = failed
N/A = not applicable
N/T = not tested

Dieser Prüfbericht bezieht sich nur auf das o.g. Prüfmuster und darf ohne Genehmigung der Prüfstelle nicht auszugsweise vervielfältigt werden. Dieser Bericht berechtigt nicht zur Verwendung eines Prüfzeichens.
This test report relates to the a. m. test sample. Without permission of the test center this test report is not permitted to be duplicated in extracts. This test report does not entitle to carry any safety mark on this or similar products.

Table of Content

	Page
Cover Page	1
Table of Content	2
Product information.....	4
Manufacturers declarations	4
Product function and intended use.....	4
Submitted documents.....	4
Independent Operation Modes	5
Related Submittal(s) Grants	5
Test Set-up and Operation Mode.....	6
Principle of Configuration Selection	6
Test Operation and Test Software.....	6
Special Accessories and Auxiliary Equipment.....	6
Countermeasures to achieve EMC Compliance.....	6
Test Methodology	7
Radiated Emission	7
Field Strength Calculation.....	7
List of Test and Measurement Instruments.....	8
Results FCC Part 15 – Subpart C	9
FCC 15.203 – Antenna Requirement 1.....	Pass.....9
FCC 15.204 – Antenna Requirement 2.....	Pass.....9
FCC 15.207 – Disturbance Voltage on AC Mains	N/A.....9
FCC 15.247 (a)(2) – 6dB Bandwidth Measurement	Pass.....10
FCC 15.247 (b) (1), (3) – Maximum Peak Output Power.....	Pass.....10
FCC 15.247 (d) – Spurious Conducted Emissions.....	Pass.....11
FCC 15.247 (d) – Spurious Radiated Emissions	Pass.....12
FCC 15.247 (d) – Band Edge Emissions	Pass.....14
FCC 15.205 – Restricted Bands Next to The Band Edge.....	Pass.....14
FCC 15.247 (e) – Power Spectral Density.....	Pass.....15
Safety Human Exposure – Radio Frequency Exposure Compliance.....	15

Appendix 1 – Test protocols	18 pages
Appendix 2 – Test setup	2 pages
Appendix 3 – Photo documentation	4 pages
Appendix 4 – Product documentation	15 pages

Product information

Manufacturers declarations

	Transceiver BLE Mode
Operating frequency range	2402 - 2480 MHz
Type of modulation	GFSK
Number of channels	40
Channel separation	2 MHz
Type of antenna	PCB Antenna
Antenna gain (dBi)	-1.0
Power level	fix
Type of equipment	stand alone radio device
Connection to public utility power line	No
Nominal voltage	V_{nor} : 24 VDC
Independent Operation Modes	Transmitting Receiving

Product function and intended use

The equipment under test (EUT), the Powerlouvre Apptivate Control Unit, is a plastic, touch-sensitive wall switch using Bluetooth technology. It allows user to control up to 6 motors per channel through the compatible smartphones and tablets. Below are the features supported by this equipment:

- Fully open, fully close or open to an intermediate (half-open) position at a single touch
- Precise control of opening angle by touching and then releasing when the window is in the desired position, or by touching another button to stop the window in the desired position.
- Automatic operation in response to an in-built temperature sensor.

There are 2 models for this EUT: 300003559 and 300003558. The difference of these 2 models is 300003559 support 2 motor group operation, while model 300003558 support 1 motor group. The electrical construction including schematic, PCB layouts and electronic components are the same for these 2 models except the model 300003558 is using less component for 1 motor group.

With the consideration of complexity of these 2 models, the model 300003559 was taken as representative for testing.

For details, please refer to the datasheet.

Submitted documents

Circuit Diagram
 Block Diagram
 Bill of material
 User manual
 Rating label

Independent Operation Modes

The basic operation modes are:

- Bluetooth communication link maintained with data transfer.

For further information refer to User Manual

Related Submittal(s) Grants

This is a single application for certification of the transmitter.

Test Set-up and Operation Mode

Principle of Configuration Selection

Emission: The equipment under test (EUT) was configured to measure its highest possible radiation level. The test modes were adapted accordingly in reference to the instructions for use.

Test Operation and Test Software

Test operation should refer to test methodology.

- Connect the EUT with the CC-debugger provided by client for control of test tool in computer.
- Use control software "SmartRF Studio" to setup the RF signal.
- There are 2 samples provided by client to perform conducted and radiated emission test.

Special Accessories and Auxiliary Equipment

The product has been tested together with the following additional accessories:

- 2 motors as a control load connected to the EUT.

Countermeasures to achieve EMC Compliance

- none

Test Methodology

Radiated Emission

The radiated emission measurements were performed according to the procedures in ANSI C63.4-2009.

The equipment under test (EUT) was placed at the middle of the 80 cm height turntable, and the turntable is 3 meters far from the measuring antenna. During the testing, the EUT was operated standalone and arranged for maximum emissions. The EUT was tested in three orthogonal planes.

The investigation is performed with the EUT rotated 360 °, the antenna height scanned between 1m and 4m, and the antenna rotated to repeat the measurements for both the horizontal and vertical antenna polarizations. Repeat the measurement steps until the maximum emissions were obtained.

All radiated tests were performed at an antenna to EUT with 3 meters distance, unless stated otherwise in particular parts of this test report.

Field Strength Calculation

The field strength at 3 m was established by adding the meter reading of the spectrum analyzer to the factors associated with antenna correction factor, cable loss, preamplifiers and filter attenuation.

The equation is expressed as follow:

$$FS = R + AF + CF + FA - PA$$

Where FS = Field Strength in dB_{uV/m} at 3 meters.

R = Reading of Spectrum Analyzer in dB_{uV}.

AF = Antenna Factor in dB.

CF = Cable Attenuation Factor in dB.

FA = Filter Attenuation Factor in dB.

PA = Preamplifier Factor in dB.

FA and PA are only be used for the measuring frequency above 1 GHz.

List of Test and Measurement Instruments

Hong Kong Productivity Council (Registration number: 90656)

Equipment	Manufacturer	Type	S/N	Cal. Date	Cal. Due Date
Semi-anechoic Chamber	Frankonia	Nil	Nil	14 Apr 2014	14 Apr 2015
Cable	Hubersuhner	SUCOFLEX 104	72799 /6	31 Mar 2014	31 Mar 2016
Test Receiver	R & S	ESU40	100190	20 Jun 2014	20 Jun 2015
Bi-conical Antenna	R & S	HK116	100241	11 Jun 2013	11 Jun 2015
Log Periodic Antenna	R & S	HL223	841516/017	10 Jun 2013	10 Jun 2015
Coaxial cable	Harbour	LL335	N/A	10 Jun 2014	10 Jun 2016
Microwave amplifier 0.5-26.5GHz, 25dB gain	HP	83017A	3950M00241	17 Jul 2014	17 Jul 2016
High Pass Filter (cutoff freq. =1000MHz)	Trilithic	23042	9829213	28 Oct 2013	28 Oct 2015
Horn Antenna	EMCO	3115	9002-3347	11 Jun 2013	11 Jun 2015
Active Loop Antenna	EMCO	6502	9107-2651	17 May 2014	17 May 2015
Spectrum Analyzer	Rohde & Schwarz	FSP30	100007	13 Jan 2015	13 Jan 2017

Results FCC Part 15 – Subpart C

FCC 15.203 – Antenna Requirement 1	Pass
FCC Requirement: No antenna other than that furnished by the responsible party shall be used with the device	
Results: Permanent attached antenna	
Verdict: Pass	
FCC 15.204 – Antenna Requirement 2	Pass
FCC Requirement: Provide information for every antenna proposed for the use with the EUT	
Results:	a) Antenna type: PCB Antenna b) Manufacturer and model no: N.A. c) Gain with reference to an isotropic radiator: -1.0 dBi
Verdict: Pass	
FCC 15.207 – Disturbance Voltage on AC Mains	N/A
The EUT does not have AC mains power input power, hence this test is not applicable.	

FCC 15.247 (a)(2) – 6dB Bandwidth Measurement		Pass	
FCC Requirement: Systems using digital modulation techniques may operate in the 902 – 928 MHz, 2400 – 2483.5 MHz, and 5725 – 5850 MHz bands. The minimum 6dB bandwidth shall be at least 500kHz.			
Test Specification : FCC Part 15 Subpart A – Subclause 15.31 Mode of operation : BLE Tx mode, (2402MHz, 2440MHz, 2480MHz) Port of testing : Temporary antenna port Detector : Peak RBW/VBW : 100KHz/ 300KHz Supply voltage : 24 VDC from DC power supply Temperature : 23°C Humidity : 50%			
Results: For test protocols please refer to Appendix 1, page 2-3.			
Channel frequency (MHz)	6 dB left (MHz)	6 dB right (MHz)	6dB bandwidth (MHz)
2402	0.588	0.108	0.696
2440	0.594	0.090	0.684
2480	0.102	0.588	0.678

FCC 15.247 (b) (1), (3) – Maximum Peak Output Power		Pass			
FCC Requirement: For systems using digital modulation in the 902-928 MHz, 2400-2483.5 MHz, and 5725-5850MHz bands: 1 Watt (30dBm)					
Test Specification : FCC Part 15 Subpart A – Subclause 15.31 Mode of operation : BLE Tx mode, (2402MHz, 2440MHz, 2480MHz) Port of testing : Temporary antenna port Detector : Peak RBW/VBW : \geq DTS BW / \geq 3xRBW Span : \geq 3 x RBW Supply voltage : 24 VDC from DC power supply Temperature : 23°C Humidity : 50%					
Results: For test protocols please refer to Appendix 1, page 4-5.					
Frequency (MHz)	Maximum peak output power (dBm)	Attenuator + Cable loss (dB)	Output power (dBm)	Limit (W/dBm)	Verdict
2402	-10.33	7.35	-2.98	1 / 30.0	Pass
2440	-12.43	7.39	-5.04	1 / 30.0	Pass
2480	-12.30	7.39	-4.91	1 / 30.0	Pass

FCC 15.247 (d) – Spurious Conducted Emissions		Pass			
Test Specification	: FCC Part 15 Subpart A – Subclause 15.31				
Mode of operation	: Tx mode (2402MHz, 2440MHz, 2480MHz)				
Port of testing	: Temporary antenna port				
Detector	: Peak				
RBW/VBW	: 100 kHz / 300 kHz				
Supply voltage	: 24 VDC from DC power supply				
Temperature	: 23 °C				
Humidity	: 50 %				
FCC Requirement:	In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement.				
Results:	All three transmit frequency modes comply with the limit stated in subclause 15.247(d). For test protocols refer to Appendix 1, page 6-7.				
BLE Tx mode					
Operating frequency (MHz)	Spurious frequency (MHz)	Spurious Level (dBm)	Reference value (dBm)	Delta (dB)	Verdict
2402	4800.007	-46.88	-13.48	-33.40	Pass
2440	4850.007	-48.57	-14.87	-33.70	Pass
2480	4950.007	-51.43	-15.05	-36.38	Pass

FCC 15.247 (d) – Spurious Radiated Emissions		Pass
Test Specification	: ANSI C63.4 – 2009	
Mode of operation	: Tx mode (2402MHz, 2440MHz, 2480MHz), hopping off	
Port of testing	: Enclosure	
Detector	: Peak / Average*	
RBW/VBW	: 100 kHz / 300 kHz for f < 1 GHz 1 MHz / 1 MHz for f > 1 GHz	
Supply voltage	: 24 VDC from DC power supply	
Temperature	: 23°C	
Humidity	: 50%	
*Average reading using duty cycle correction factor on peak measurement:		
<p>Devices transmitting pulsed emissions and subject to a limit requiring an average detector function for radiated emissions shall initially be measured with an instrument that uses a peak detector. A radiated emission measured with a peak detector may then be corrected to a true average using the appropriate factor for emission duty cycle. This correction factor relates the measured peak level to the average limit and is derived by averaging absolute field strength over one complete pulse train that is 0.1 s, or less, in length.</p>		
Duty cycle correction factor 1 calculation for 1 st harmonics emission:		
<p>Total on time in one pulse = 0.378 ms Number of pulse found in 100ms = 7 Duty cycle factor = $20 \times \log((\text{on time} \times \text{no. of pulse}) / 100\text{ms})$ = -31.55 dB</p>		
FCC Requirement: In any 100kHz bandwidth outside the frequency band at least 20dB below the highest level of the desired power. In addition, radiated emissions which fall in the restricted bands, as defined in section 15.205(a), must also comply with the radiated emission limits specified in section 15.209(a).		
Results:	<p>Pre-scan has been conducted to determine the worst-case mode from all possible combinations between available modulations and packet types.</p> <p>All three transmit frequency modes comply with the field strength within the restricted bands. There is no spurious found below 30MHz.</p>	
BLE Tx mode		
Tx frequency 2402MHz		Vertical Polarization
Freq MHz	Level dBμV/m	Limit/ Detector dBμV/m
4804.349	60.16	74.0 / P
4804.109	*28.61	54.0 / A
Tx frequency 2402MHz		Horizontal Polarization
Freq MHz	Level dBμV/m	Limit/ Detector dBμV/m
4804.333	58.07	74.0 / P
4804.125	*26.52	54.0 / A

Tx frequency 2440MHz		
Vertical Polarization		
Freq MHz	Level dB μ V/m	Limit/ Detector dB μ V/m
4881.827	58.64	74.0 / P
4881.131	*27.09	54.0 / A
Tx frequency 2440MHz		
Horizontal Polarization		
Freq MHz	Level dB μ V/m	Limit/ Detector dB μ V/m
4881.731	58.47	74.0 / P
4882.163	*26.92	54.0 / A
Tx frequency 2480MHz		
Vertical Polarization		
Freq MHz	Level dB μ V/m	Limit/ Detector dB μ V/m
4959.615	60.39	74.0 / P
4960.128	*28.84	54.0 / A
Tx frequency 2480MHz		
Horizontal Polarization		
Freq MHz	Level dB μ V/m	Limit/ Detector dB μ V/m
4960.625	61.47	74.0 / P
4960.128	*29.92	54.0 / A

FCC 15.247 (d) – Band Edge Emissions		Pass
Test Specification	:	FCC Part 15 Subpart A – Subclause 15.31
Mode of operation	:	BLE Tx mode (2402MHz, 2480MHz)
Port of testing	:	Temporary antenna port
Detector	:	Peak
RBW/VBW	:	100 kHz / 300 kHz
Supply voltage	:	24 VDC from DC power supply
Temperature	:	23°C
Humidity	:	50%
FCC Requirement:	In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement.	
Results:	The peak found outside any 100 kHz bandwidth of the operating frequency band comply with the requirement. For test protocols refer to Appendix 1, page 8.	
FCC 15.205 – Restricted Bands Next to The Band Edge		Pass
Test Specification	:	FCC Part 15 Subpart A – Subclause 15.31
Mode of operation	:	BLE Tx mode (2402MHz, 2480MHz)
Port of testing	:	Enclosure
Detector	:	Peak
RBW/VBW	:	1 MHz / 1 MHz
Supply voltage	:	24 VDC from DC power supply
Temperature	:	23°C
Humidity	:	50%
FCC Requirement:	Radiated emissions which fall in the restricted bands, as defined in 15.205 (a), must also comply with the radiated emission limits specified in 15.209(a).	
Results:	The peak found in restricted band can fulfil the requirement 15.209(a) by using the marker-delta method as shown on page 12 of Appendix 1. For test protocols refer to Appendix 1, page 9-14.	

FCC 15.247 (e) – Power Spectral Density																													
FCC Requirement: For digitally modulated systems, the power spectral density conducted from the intentional radiator to the antenna shall not be greater than 8 dBm in any 3 kHz band during any time interval of continuous transmission.					Pass																								
<p>Test Specification : FCC Part 15 Subpart A – Subclause 15.31</p> <p>Mode of operation : BLE Tx mode (2402MHz, 2440MHz, 2480MHz)</p> <p>Port of testing : Temporary antenna port</p> <p>Detector : Peak</p> <p>RBW/VBW : ≥ 100 KHz / $\geq 3 \times$RBW</p> <p>span : $\geq 1.5 \times$ DTS BW</p> <p>Supply voltage : 24 VDC from DC power supply</p> <p>Temperature : 23°C</p> <p>Humidity : 50%</p>																													
<p>Results: For test protocols please refer to Appendix 1, page 15-16.</p>																													
<table border="1"> <thead> <tr> <th>Operating frequency (MHz)</th><th>Reading (dBm)</th><th>Attenuator + Cable loss (dB)</th><th>Power density (dBm)</th><th>Limit (dBm)</th><th>Verdict</th></tr> </thead> <tbody> <tr> <td>2402</td><td>-10.85</td><td>7.35</td><td>-3.50</td><td>8.0</td><td>Pass</td></tr> <tr> <td>2440</td><td>-13.11</td><td>7.39</td><td>-5.72</td><td>8.0</td><td>Pass</td></tr> <tr> <td>2480</td><td>-12.84</td><td>7.39</td><td>-5.45</td><td>8.0</td><td>Pass</td></tr> </tbody> </table>						Operating frequency (MHz)	Reading (dBm)	Attenuator + Cable loss (dB)	Power density (dBm)	Limit (dBm)	Verdict	2402	-10.85	7.35	-3.50	8.0	Pass	2440	-13.11	7.39	-5.72	8.0	Pass	2480	-12.84	7.39	-5.45	8.0	Pass
Operating frequency (MHz)	Reading (dBm)	Attenuator + Cable loss (dB)	Power density (dBm)	Limit (dBm)	Verdict																								
2402	-10.85	7.35	-3.50	8.0	Pass																								
2440	-13.11	7.39	-5.72	8.0	Pass																								
2480	-12.84	7.39	-5.45	8.0	Pass																								
Safety Human Exposure – Radio Frequency Exposure Compliance																													
<p>Test Specification : FCC KDB Publication 447498 D01 v05r02</p> <p>Requirement : The 1-g and 10-g SAR test exclusion thresholds for 100 MHz to 6 GHz at test separation distances ≤ 50 mm are determined by:</p> $[(\text{max. power of channel, including tune-up tolerance, mW}) / (\text{min. test separation distance, mm})] \times \sqrt{f(\text{GHz})}$ <p>≤ 3.0 for 1-g SAR and ≤ 7.5 for 10-g extremity SAR</p> <p>where</p> <p>$f(\text{GHz})$ is the RF channel transmit frequency in GHz</p> <p>Power and distance are rounded to the nearest mW and mm before calculation</p> <p>The result is rounded to one decimal place for comparison</p>																													
<p>Results : max. power of channel = -2.98dBm = 0.504mW min. test separation distance = 5mm frequency = 2.402GHz</p> $\text{Exclusion threshold} = (3 \times 5) / (\sqrt{2.402})$ $= 9.7 \text{ mW}$ <p>Since maximum peak output power of the transmitter is 0.504mW < 9.7mW, the EUT is excluded from SAR evaluation according to FCC KDB publication 447498 D01: Mobile and Portable RF Exposure v05r02.</p>																													