

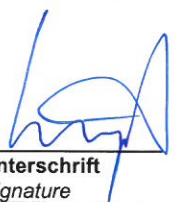
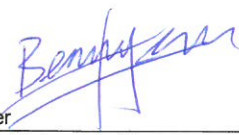
Prüfbericht - Nr.: 14038425 001		Seite 1 von 13	
<i>Test Report No.:</i>		<i>Page 1 of 13</i>	
Auftraggeber: <i>Client:</i>		SHENZHEN FEIBIT ELECTRONIC TECHNOLOGY Co., LTD Room 505, Building A1, Lilang Software Park No 31 Bulan Road, Nanwan Street, Longang District Shenzhen, Guangdong China	
Gegenstand der Prüfung: <i>Test Item:</i>		ZigBee module	
Bezeichnung: <i>Identification:</i>		Serien-Nr.: <i>Serial No.:</i>	Engineering sample
Wareneingangs-Nr.: <i>Receipt No.:</i>		Eingangsdatum: <i>Date of Receipt:</i>	18.07.2015
Zustand des Prüfgegenstandes bei Anlieferung: <i>Condition of test item at delivery:</i>		Test sample(s) is/are not damaged and suitable for testing.	
Prüfört: <i>Testing Location:</i>		TÜV Rheinland Hong Kong Ltd. 8/F., First Group Centre, 14 Wang Tai Road, Kowloon Bay, Kowloon, Hong Kong Hong Kong Productivity Council HKPC Building, 78 Tat Chee Avenue, Kowloon, Hong Kong	
Prüfgrundlage: <i>Test Specification:</i>		FCC Part 15 Subpart C ANSI C63.4-2003	
Prüfergebnis: <i>Test Results:</i>		Das vorstehend beschriebene Gerät wurde geprüft und entspricht oben genannter Prüfgrundlage. The above mentioned product was tested and passed .	
Prüflaboratorium: <i>Testing Laboratory:</i>		TÜV Rheinland Hong Kong Ltd. 8 - 10/F., Goldin Financial Global Square, 7 Wang Tai Road, Kowloon Bay, Kowloon, Hong Kong	
geprüft/ tested by:		kontrolliert/ reviewed by:	
07.08.2015 Hugo Wan Senior Project Manager		07.08.2015 Benny Lau Senior Project Manager	
Datum <i>Date</i>	Name/Stellung <i>Name/Position</i>	Unterschrift <i>Signature</i>	Datum <i>Date</i>
			
			
Sonstiges / Other Aspects: FCCID: 2AE8BFZB561011A			
Abkürzungen: P(ass) = entspricht Prüfgrundlage F(ail) = entspricht nicht Prüfgrundlage N/A = nicht anwendbar N/T = nicht getestet		Abbreviations: P(ass) = passed F(ail) = 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. <i>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.</i>			

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Product information

Manufacturers declarations

	Transceiver
Operating frequency range	2405 - 2480 MHz
Type of modulation	O-QPSK / DSSS
Number of channels	16
Channel separation	5 MHz
Type of antenna	Chip antenna
Antenna gain (dBi)	3.0
Power level	variable
Type of equipment	radio module
Connection to public utility power line	Yes
Nominal voltage	V _{nom} : 3.3VDC
Independent Operation Modes	ZigBee communication

Product function and intended use

The equipment under test (EUT) is a radio module based on the ZigBee technology. The module follows the ZigBee HA Protocol and is ensured that the module can join in the ZigBee HA network.

The provided test sample was prepared with a power supply unit which consists of an AC/DC power adaptor and a DC to DC converting board (from 5VDC to 3.3VDC). The power supply unit was not part of the EUT, but it was used for setting up a test environment.

For details, please refer to the user manual.

Submitted documents

- Circuit Diagram
- Block Diagram
- Bill of material
- User Manual
- Label Artwork

Remark

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Independent Operation Modes

The basic operation modes are:

- Radio communication link maintained with data transfer.

For further information refer to User Manual

Related Submittal(s) Grants

This is a single application for single modular approval of the transceiver module.

Test Set-up and Operation Mode

Principle of Configuration Selection

Emission: The 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.

- 1) The EUT was powered by the AC/DC power adaptor.
- 2) A special test mode software was downloaded into the EUT to transmit lowest, middle and highest RF channel at highest output power.
- 3) The power setting for the module was set to maximum level at parameter 0xF5.

Special Accessories and Auxiliary Equipment

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

1. AC/DC power adaptor
Model: NLA100050W1A1
Input: 100 – 240 VAC, 50/60Hz
Output: 5V DC, 1A
2. DC/DC power converter from 5VDC to 3.3VDC

Countermeasures to achieve EMC Compliance

- none

Test Methodology

Radiated Emission

The radiated emission measurements were performed according to the procedures in ANSI C63.4-2003.

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 dBuV/m at 3 meters.
R = Reading of Spectrum Analyzer in dBuV.
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 (FCC Registration number: 90656)

Radiated Emission

Equipment	Manufacturer	Type	S/N	Cal. Date	Cal. Due Date
Semi-anechoic Chamber	Frankonia	Nil	Nil	14 Apr 2015	14 Apr 2016
Cable	Hubersuhner	SUCOFLEX 104	72799 /6	31 Mar 2014	31 Mar 2016
Test Receiver	R & S	ESU26	100050	12 Feb 2015	12 Feb 2016
Bi-conical Antenna	R & S	HK116	100241	11 Jun 2013	22 Aug 2015
Log Periodic Antenna	R & S	HL223	841516/017	10 Jun 2013	16 Aug 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 Aug 2015
Active Loop Antenna	EMCO	6502	9107-2651	17 May 2014	17 Aug 2015

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Conducted Emission on AC Mains Terminals

Equipment	Manufacturer	Type	S/N	Cal. Date	Cal. Due Date
Test Receiver	Rohde & Schwarz	ESCS30	100201	05 Feb 2015	05 Feb 2016
LISN	Rohde & Schwarz	ENV216	100273	05 Feb 2015	05 Feb 2016
EMC32	Rohde & Schwarz	v8.53	N/A	N/A	N/A

Radio Frequency Test

Equipment	Manufacturer	Type	S/N	Cal. Date	Cal. Due Date
Spectrum Analyzer	Rohde & Schwarz	FSP30	100007	13 Jan 2015	13 Jan 2017

Results FCC Part 15 – Subpart C

Subclause 15.203 – Antenna Information	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

Subclause 15.204 – Antenna Information	Pass
FCC Requirement: Provide information for every antenna proposed for the use with the EUT	
Results:	a) Antenna type: Chip Antenna b) Manufacturer WinWave Electronic Co., Ltd. c) model no: WAN8010F245M05 d) Gain with reference to an isotropic radiator: 3.0 dBi
Verdict:	Pass

Subclause 15.207 – Disturbance Voltage on AC Mains	Pass					
Test Port: AC mains input port of the AC/DC adaptor Applied Voltage: 110VAC Mode of operation: 1) transmitting at 2445MHz						
Live measurement						
Frequency range (MHz)	Frequency (MHz)	Quasi-peak dB μ V	Average dB μ V	Limit QP (dB μ V)	Limit AV (dB μ V)	Verdict
0,15 – 0,5	0.1523	27.8	12.0	66 - 56	56 - 46	Pass
> 0,5 - 5	No peak found	---	---	56	46	Pass
> 5 - 30	No peak found	---	---	60	50	Pass
Neutral measurement						
Frequency range (MHz)	Frequency (MHz)	Quasi-peak dB μ V	Average dB μ V	Limit QP (dB μ V)	Limit AV (dB μ V)	Verdict
0,15 – 0,5	0.5775	28.1	17.8	66 - 56	56 - 46	Pass
> 0,5 - 5	No peak found	---	---	56	46	Pass
> 5 - 30	No peak found	---	---	60	50	Pass
Results:	The radio frequency voltage that is conducted back onto the AC power line on any frequency or frequencies within the band 150kHz to 30MHz does not exceed the limits. For test Results plots refer to Appendix 1, page 2-3.					

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 : KDB 558074 D01 DTS Meas Guidance v03r02 Mode of operation : Tx mode, (2405MHz, 2445MHz, 2480MHz) Port of testing : Temporary antenna port Detector : Peak RBW/VBW : 100KHz/ 300KHz Supply voltage : 3.3VDC Temperature : 23°C Humidity : 50%			
Results: For test protocols please refer to Appendix 1, page 4-5.			
Channel frequency (MHz)	6 dB left (MHz)	6 dB right (MHz)	6dB bandwidth (MHz)
2405	2404.220	2405.834	1.614
2445	2444.166	2445.804	1.638
2480	2479.196	2480.822	1.626

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 : KDB 558074 D01 DTS Meas Guidance v03r02 Mode of operation : Tx mode, (2405MHz, 2445MHz, 2480MHz) Port of testing : Temporary antenna port Detector : Peak RBW/VBW : ≥ DTS BW / ≥ 3xRBW Span : ≥ 3 x RBW Supply voltage : 3.3VDC Temperature : 23°C Humidity : 50%					
Results: For test protocols please refer to Appendix 1, page 4-5.					
Frequency (MHz)	Maximum peak output power (dBm)	Cable attenuation (dB)	Output power (dBm)	Limit (W/dBm)	Verdict
2405	-9.84	2.10	-7.74	1 / 30.0	Pass
2445	-9.99	2.10	-7.89	1 / 30.0	Pass
2480	-10.63	2.10	-8.53	1 / 30.0	Pass

FCC 15.247 (d) – Spurious Conducted Emissions					Pass
Test Specification : KDB 558074 D01 DTS Meas Guidance v03r02 Mode of operation : Tx mode (2405MHz, 2445MHz, 2480MHz) Port of testing : Temporary antenna port Detector : Peak RBW/VBW : 100 kHz / 300 kHz Supply voltage : 3.3VDC 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 8-13.					
Tx mode					
Operating frequency (MHz)	Spurious frequency (MHz)	Spurious Level (dBm)	Reference value (dBm)	Delta (dB)	Verdict
2405	7360.000	-52.96	-11.05	-41.91	Pass
2445	10432.000	-52.93	-11.97	-40.96	Pass
2480	3328.000	-52.84	-13.14	-39.70	Pass

FCC 15.247 (d) – Radiated Spurious Emissions		Pass
Test Specification : ANSI C63.4 – 2003 Mode of operation : Tx mode (2405MHz, 2445MHz, 2480MHz) Port of testing : Enclosure Detector : Peak RBW/VBW : 100 kHz / 300 kHz for f < 1 GHz : 1 MHz / 1 MHz for f > 1 GHz Supply voltage : 3.3VDC Temperature : 23°C Humidity : 50%		
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: Pre-scan has been conducted to determine the worst-case mode from all possible combinations between available modulations and packet types. All three transmit frequency modes comply with the field strength within the restricted bands. There is no spurious found below 30MHz.		
Tx mode		
Tx frequency 2405MHz		Vertical Polarization
Freq MHz	Level dBµV/m	Limit/ Detector dBµV/m
2377.051	46.59	74.0 / P
2336.923	33.51	54.0 / A
4809.792	53.81	74.0 / P
4810.016	40.89	54.0 / A
Tx frequency 2405MHz		Horizontal Polarization
Freq MHz	Level dBµV/m	Limit/ Detector dBµV/m
2366.410	47.20	74.0 / P
2336.410	33.52	54.0 / A
Tx frequency 2445MHz		Vertical Polarization
Freq MHz	Level dBµV/m	Limit/ Detector dBµV/m
4890.000	57.16	74.0 / P
4890.032	44.75	54.0 / A
Tx frequency 2445MHz		Horizontal Polarization
Freq MHz	Level dBµV/m	Limit/ Detector dBµV/m
4890.080	53.81	74.0 / P
4890.032	40.58	54.0 / A

Tx frequency 2480MHz		Vertical Polarization	
Freq MHz	Level dBµV/m	Limit/ Detector dBµV/m	
2483.500	57.01	74.0 / P	
2483.500	34.23	54.0 / A	
4960.106	55.13	74.0 / P	
4959.888	44.04	54.0 / A	
Tx frequency 2480MHz		Horizontal Polarization	
Freq MHz	Level dBµV/m	Limit/ Detector dBµV/m	
2483.500	60.15	74.0 / P	
2483.526	34.51	54.0 / A	

FCC 15.247 (d) – Band Edge Emissions		Pass			
Test Specification : KDB 558074 D01 DTS Meas Guidance v03r02 Mode of operation : Tx mode (2405MHz, 2480MHz) Port of testing : Temporary antenna port Detector : Peak RBW/VBW : 100 kHz / 300 kHz Supply voltage : 3.3VDC 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 14.			
Tx mode					
Operating frequency (MHz)	Spurious frequency (MHz)	Spurious Level (dBm)	Reference value (dBm)	Delta (dB)	Verdict
2405	2390.000	-54.71	-11.05	-43.66	Pass
2480	2496.160	-56.31	-13.14	-43.17	Pass

FCC 15.247 (e) – Power Spectral Density		Pass	
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.			
Test Specification : KDB 558074 D01 DTS Meas Guidance v03r02 Mode of operation : Tx mode (2405MHz, 2445MHz, 2480MHz) Port of testing : Temporary antenna port Detector : Peak RBW/VBW : ≥ 100 kHz / $\geq 3 \times$ RBW span : $\geq 1.5 \times$ DTS BW Supply voltage : 3.3VDC Temperature : 23°C Humidity : 50%			
Results: For test protocols please refer to Appendix 1, page 15-16.			
Operating frequency (MHz)	Power density (dBm)	Limit (dBm)	Verdict
2405	-11.05	8.0	Pass
2445	-11.97	8.0	Pass
2480	-13.14	8.0	Pass