

Prüfbericht - Nr.: 14039738 001		Seite 1 von 16	
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Auftraggeber: <i>Client:</i>		Sensibo LTD. 3 Ahuzat Bait 6514302 Tel Aviv Israel	
Gegenstand der Prüfung: <i>Test Item:</i>		Bluetooth Low Energy and ZigBee Device	
Bezeichnung: <i>Identification:</i>	Sensibo Pod	Serien-Nr.: <i>Serial No.:</i>	Engineering sample
Wareneingangs-Nr.: <i>Receipt No.:</i>	A000299390 (003-004)	Eingangsdatum: <i>Date of Receipt:</i>	23.12.2015
Zustand des Prüfgegenstandes bei Anlieferung: <i>Condition of test item at delivery:</i>		Test samples are not damaged and suitable for testing.	
Prüfört: <i>Testing Location:</i>		Hong Kong Productivity Council HKPC Building, 78 Tat Chee Avenue, Kowloon, Hong Kong TÜV Rheinland Hong Kong Ltd. 8/F., First Group Center, 14 Wang Tai Road, Kowloon Bay, Kowloon, Hong Kong	
Prüfgrundlage: <i>Test Specification:</i>		FCC Part 15 Subpart C ANSI C63.10-2013	
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:	
23.02.2016	Joey Leung Project Manager	23.02.2016	Benny Lau Senior Project Manager
Datum <i>Date</i>	Name/Stellung <i>Name/Position</i>	Datum <i>Date</i>	Name/Stellung <i>Name/Position</i>
	Unterschrift <i>Signature</i>		Unterschrift <i>Signature</i>
Sonstiges / Other Aspects: FCCID: 2AHCD-POD-V01			
Abkürzungen:		Abbreviations:	
P(ass) = entspricht Prüfgrundlage		P(ass) = passed	
F(ail) = entspricht nicht Prüfgrundlage		F(ail) = failed	
N/A = nicht anwendbar		N/A = not applicable	
N/T = nicht getestet		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	Bluetooth Low Energy (BLE) - 2402 - 2480 MHz ZigBee - 2405 - 2480MHz
Type of modulation	BLE - GFSK / FHSS ZigBee - OQPSK / DSSS
Number of channels	BLE - 40 Channels ZigBee - 16 Channels
Channel separation	BLE - 2 MHz ZigBee - 5 MHz
Type of antenna	PCB antenna
Antenna gain (dBi)	BLE - 0 dBi ZigBee - 0 dBi
Power level	fix
Type of equipment	stand alone radio device
Connection to public utility power line	No
Nominal voltage	V _{nom} : 6.0 VDC
Independent Operation Modes	Transmitting Receiving

Product function and intended use

The Equipment Under Test (EUT) is a device implemented Bluetooth Low Energy and ZigBee technology and is powered by battery. It can be connected to Bluetooth enabled smart phone for the control of home device.

Bluetooth Low Energy and ZigBee will not operate at the same time.

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 mode is radio 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 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 2 x CR123A batteries.
- 2) Two test mode samples were provided by client for performing radiated and conducted test by pressing a button on EUT to change transmission frequencies at highest RF output power and longest burst time.

Special Accessories and Auxiliary Equipment

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

nil

Countermeasures to achieve EMC Compliance

nil

Test Methodology

Radiated Emission

The radiated emission measurements were performed according to the procedures in ANSI C63.10-2013.

For emission measurement at or below 1GHz, the equipment under test (EUT) was placed at the middle of the 80 cm height turntable. For emission testing above 1GHz, the EUT was placed at the middle of 1.5m height turntable. In above two measurement, 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	07 Dec 2016
Bi-conical Antenna	R & S	HK116	100241	01 Sep 2015	01 Sep 2017
Log Periodic Antenna	R & S	HL223	841516/017	01 Sep 2015	01 Sep 2017
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 2015	28 Oct 2017
Horn Antenna	EMCO	3115	9002-3347	26 Aug 2015	26 Aug 2017
Active Loop Antenna	EMCO	6502	9107-2651	15 Aug 2015	15 Aug 2016

TÜV Rheinland Hong Kong Ltd.

Radio Test

Equipment	Manufacturer	Type	S/N	Cal. Date	Cal. Due Date
Spectrum Analyzer	Rohde & Schwarz	FSP30	100610	19 Jan 2016	19 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:	PCB Antenna
	b) Manufacturer	N/A
	c) Model no:	N/A
	d) Gain with reference to an isotropic radiator:	0 dBi
Verdict:	Pass	

Subclause 15.207 – Disturbance Voltage on AC Mains		N/A
There is no AC mains power port on EUT. 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 : KDB 558074 D01 DTS Meas Guidance v03r04 Mode of operation : BLE Tx mode (2402MHz, 2440MHz, 2480MHz) Port of testing : Temporary antenna port Detector : Peak RBW/VBW : 100KHz / 300KHz Supply voltage : 6.0 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	2401.646	2402.342	0.696
2440	2439.640	2440.342	0.702
2480	2479.622	2480.342	0.720
Test Specification : KDB 558074 D01 DTS Meas Guidance v03r04 Mode of operation : ZigBee Tx mode (2405MHz, 2440MHz, 2480MHz) Port of testing : Temporary antenna port Detector : Peak RBW/VBW : 100KHz / 300KHz Supply voltage : 6.0 VDC from DC power supply Temperature : 23°C Humidity : 50%			
Results: For test protocols please refer to Appendix 1, page 3-4.			
Channel frequency (MHz)	6 dB left (MHz)	6 dB right (MHz)	6dB bandwidth (MHz)
2405	2404.180	2405.790	1.610
2440	2439.180	2440.790	1.610
2480	2479.180	2480.790	1.610

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 v03r04 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 : 6.0 VDC from DC power supply Temperature : 23°C Humidity : 50%					
Results: For test protocols please refer to Appendix 1, page 5-6.					
Frequency (MHz)	Maximum peak output power (dBm)	Cable attenuation (dB)	Output power (dBm)	Limit (W/dBm)	Verdict
2402	-4.11	1.00	-3.11	1 / 30.0	Pass
2440	-5.66	1.00	-4.66	1 / 30.0	Pass
2480	-6.92	1.00	-5.92	1 / 30.0	Pass
Test Specification : KDB 558074 D01 DTS Meas Guidance v03r04 Mode of operation : ZigBee Tx mode (2405MHz, 2440MHz, 2480MHz) Port of testing : Temporary antenna port Detector : Peak RBW/VBW : $\geq$ DTS BW / $\geq$ 3xRBW Span : $\geq$ 3 x RBW Supply voltage : 6.0 VDC from DC power supply Temperature : 23°C Humidity : 50%					
Results: For test protocols please refer to Appendix 1, page 6-7.					
Frequency (MHz)	Maximum peak output power (dBm)	Cable attenuation (dB)	Output power (dBm)	Limit (W/dBm)	Verdict
2405	-8.80	1.00	-7.80	1 / 30.0	Pass
2440	-9.35	1.00	-8.35	1 / 30.0	Pass
2480	-10.48	1.00	-9.48	1 / 30.0	Pass

FCC 15.247 (d) – Spurious Conducted Emissions					Pass
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.					
Test Specification : KDB 558074 D01 DTS Meas Guidance v03r04 Mode of operation : BLE Tx mode (2402MHz, 2440MHz, 2480MHz) Port of testing : Temporary antenna port Detector : Peak RBW/VBW : 100 kHz / 300 kHz Supply voltage : 6.0 VDC from DC power supply Temperature : 23 °C Humidity : 50 %					
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.					
Operating frequency (MHz)	Spurious frequency (MHz)	Spurious Level (dBm)	Reference value (dBm)	Delta (dB)	Verdict
2402	9260.000	-42.37	-4.16	-38.21	Pass
2440	7440.000	-41.51	-5.67	-35.84	Pass
2480	8440.000	-42.08	-6.97	-35.11	Pass
Test Specification : KDB 558074 D01 DTS Meas Guidance v03r04 Mode of operation : ZigBee Tx mode (2405MHz, 2440MHz, 2480MHz) Port of testing : Temporary antenna port Detector : Peak RBW/VBW : 100 kHz / 300 kHz Supply voltage : 6.0 VDC from DC power supply Temperature : 23 °C Humidity : 50 %					
Results: All three transmit frequency modes comply with the limit stated in subclause 15.247(d). For test protocols refer to Appendix 1, page 14-19.					
Operating frequency (MHz)	Spurious frequency (MHz)	Spurious Level (dBm)	Reference value (dBm)	Delta (dB)	Verdict
2405	9280.000	-42.27	-12.85	-29.42	Pass
2440	9240.000	-41.48	-13.07	-28.41	Pass
2480	9260.000	-42.77	-14.73	-28.04	Pass

FCC 15.247 (d) – Radiated Spurious Emissions		Pass
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).		
Test Specification : ANSI C63.10 – 2013 Mode of operation : BLE Tx mode (2402MHz, 2440MHz, 2480MHz), hopping off Port of testing : Enclosure Detector : Peak RBW/VBW : 100 kHz / 300 kHz for f < 1 GHz 1 MHz / 3 MHz for f > 1 GHz Measurement range : 9kHz to 25GHz Supply voltage : 6.0 VDC from battery Temperature : 23°C Humidity : 50%		
Results: Pre-scan has been conducted to determine the worst-case mode from all possible combinations in available packet length. All three transmit frequency modes comply with the field strength within the restricted bands. There is no spurious found below 30MHz.		
Tx frequency 2402MHz Vertical Polarization		
Freq MHz	Level dBµV/m	Limit/ Detector dBµV/m
2390.000	50.48	74.0 / P
2390.000	38.86	54.0 / A
4803.940	53.99	74.0 / P
4804.048	41.82	54.0 / A
Tx frequency 2402MHz Horizontal Polarization		
Freq MHz	Level dBµV/m	Limit/ Detector dBµV/m
2390.000	53.79	74.0 / P
2390.000	44.42	54.0 / A
4804.496	53.30	74.0 / P
4803.968	41.22	54.0 / A
Tx frequency 2440MHz Vertical Polarization		
Freq MHz	Level dBµV/m	Limit/ Detector dBµV/m
4879.584	54.12	74.0 / P
4879.968	43.81	54.0 / A
Tx frequency 2440MHz Horizontal Polarization		
Freq MHz	Level dBµV/m	Limit/ Detector dBµV/m
4880.536	54.80	74.0 / P
4879.912	45.58	54.0 / A

Tx frequency 2480MHz			Vertical Polarization		
Freq MHz	Level dBµV/m	Limit/ Detector dBµV/m	Freq MHz	Level dBµV/m	Limit/ Detector dBµV/m
2483.500	54.65	74.0 / P	2483.500	43.97	54.0 / A
4960.024	54.18	74.0 / P	4959.904	44.29	54.0 / A
Tx frequency 2480MHz			Horizontal Polarization		
Freq MHz	Level dBµV/m	Limit/ Detector dBµV/m	Freq MHz	Level dBµV/m	Limit/ Detector dBµV/m
2483.500	59.62	74.0 / P	2483.500	52.27	54.0 / A
4960.240	52.82	74.0 / P	4959.808	39.37	54.0 / A
Test Specification : ANSI C63.10 – 2013 Mode of operation : ZigBee Tx mode (2405MHz, 2440MHz, 2480MHz), hopping off Port of testing : Enclosure Detector : Peak RBW/VBW : 100 kHz / 300 kHz for f < 1 GHz 1 MHz / 3 MHz for f > 1 GHz Measurement range : 9kHz to 25GHz Supply voltage : 6.0 VDC from battery Temperature : 23°C Humidity : 50%					
Results: Pre-scan has been conducted to determine the worst-case mode from all possible combinations in available packet length. All three transmit frequency modes comply with the field strength within the restricted bands. There is no spurious found below 30MHz.					
Tx frequency 2405MHz			Vertical Polarization		
Freq MHz	Level dBµV/m	Limit/ Detector dBµV/m	Freq MHz	Level dBµV/m	Limit/ Detector dBµV/m
2390.000	45.26	74.0 / P	2390.000	32.95	54.0 / A
Tx frequency 2405MHz			Horizontal Polarization		
Freq MHz	Level dBµV/m	Limit/ Detector dBµV/m	Freq MHz	Level dBµV/m	Limit/ Detector dBµV/m
2390.000	46.06	74.0 / P	2390.000	32.97	54.0 / A
Tx frequency 2440MHz			Vertical Polarization		
Freq MHz	Level dBµV/m	Limit/ Detector dBµV/m	Freq MHz	Level dBµV/m	Limit/ Detector dBµV/m
No peak found	---	74.0 / P	No peak found	---	54.0 / A
Tx frequency 2440MHz			Horizontal Polarization		
Freq MHz	Level dBµV/m	Limit/ Detector dBµV/m	Freq MHz	Level dBµV/m	Limit/ Detector dBµV/m

No peak found	---	74.0 / P
No peak found	---	54.0 / A
Tx frequency 2480MHz Vertical Polarization		
Freq MHz	Level dBμV/m	Limit/ Detector dBμV/m
2483.500	52.71	74.0 / P
2483.500	39.25	54.0 / A
Tx frequency 2480MHz Horizontal Polarization		
Freq MHz	Level dBμV/m	Limit/ Detector dBμV/m
2483.500	59.08	74.0 / P
2483.500	43.80	54.0 / A

FCC 15.247 (d) – Band Edge Emissions (Conducted)					Pass
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.					
Test Specification : KDB 558074 D01 DTS Meas Guidance v03r04 Mode of operation : BLE Tx mode (2402MHz, 2480MHz) Port of testing : Temporary antenna port Detector : Peak RBW/VBW : 100 kHz / 300 kHz Supply voltage : 6.0 VDC from DC power supply Temperature : 23°C Humidity : 50%					
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 20.					
Operating frequency (MHz)	Spurious frequency (MHz)	Spurious Level (dBm)	Reference value (dBm)	Delta (dB)	Verdict
2402	2399.280	-35.92	-4.72	-31.20	Pass
2480	2485.760	-50.82	-6.88	-43.94	Pass
Test Specification : KDB 558074 D01 DTS Meas Guidance v03r04 Mode of operation : ZigBee Tx mode (2405MHz, 2480MHz) Port of testing : Temporary antenna port Detector : Peak RBW/VBW : 100 kHz / 300 kHz Supply voltage : 6.0 VDC from DC power supply Temperature : 23°C Humidity : 50%					
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 21.					
Operating frequency (MHz)	Spurious frequency (MHz)	Spurious Level (dBm)	Reference value (dBm)	Delta (dB)	Verdict
2405	2386.260	-51.43	-12.44	-38.99	Pass
2480	2483.640	-51.05	-14.56	-36.49	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 v03r04 Mode of operation : BLE Tx mode (2402MHz, 2440MHz, 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 : 6.0 VDC from DC power supply Temperature : 23°C Humidity : 50%			
Results: For test protocols please refer to Appendix 1, page 22-23.			
Operating frequency (MHz)	Power density (dBm)	Limit (dBm)	Verdict
2402	-4.16	8.0	Pass
2440	-5.67	8.0	Pass
2480	-6.97	8.0	Pass
Test Specification : KDB 558074 D01 DTS Meas Guidance v03r04 Mode of operation : ZigBee Tx mode (2405MHz, 2440MHz, 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 : 6.0 VDC from DC power supply Temperature : 23°C Humidity : 50%			
Results: For test protocols please refer to Appendix 1, page 23-24.			
Operating frequency (MHz)	Power density (dBm)	Limit (dBm)	Verdict
2405	-12.85	8.0	Pass
2440	-13.07	8.0	Pass
2480	-14.73	8.0	Pass