

Produkte  
Products

<b>Prüfbericht - Nr.: 14039736 001</b>			<b>Seite 1 von 12</b>		
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<b>Auftraggeber:</b> <i>Client:</i>		<b>SENSIBO Ltd</b> <b>3 Ahuzat Bayit St. Tel Aviv 6514302</b> <b>Israel</b>			
<b>Gegenstand der Prüfung:</b> <i>Test Item:</i>		<b>Smart Device - Internet-to-Zigbee Hub</b>			
<b>Bezeichnung:</b> <i>Identification:</i>	<b>Sensibo Smart Hub V1</b>	<b>Serien-Nr.:</b> <i>Serial No.:</i>	<b>Engineering sample</b>		
<b>Wareneingangs-Nr.:</b> <i>Receipt No.:</i>	<b>A000204598-001</b>	<b>Eingangsdatum:</b> <i>Date of Receipt:</i>	<b>26.05.2015</b>		
<b>Prüfart:</b> <i>Testing Location:</i>	<b>TÜV Rheinland Hong Kong Ltd.</b> 8/F, First Group Centre, 14 Wang Tai Road, Kowloon Bay, Kowloon, Hong Kong <b>Hong Kong Productivity Council</b> HKPC Building, 78 Tat Chee Avenue, Kowloon, Hong Kong				
<b>Zustand des Prüfgegenstandes bei Anlieferung:</b> <i>Condition of test item at delivery:</i>		Test samples are not damaged and suitable for testing.			
<b>Prüfgrundlage:</b> <i>Test Specification:</i>	<b>FCC Part 15 Subpart C</b> <b>ANSI C63.4-2003</b>				
<b>Prüfresultat:</b> <i>Test Results:</i>	<b>Das vorstehend beschriebene Gerät wurde geprüft und entspricht oben genannter Prüfgrundlage.</b> The above mentioned product was tested and <b>passed</b> .				
<b>Prüflaboratorium:</b> <i>Testing Laboratory:</i>	<b>TÜV Rheinland Hong Kong Ltd.</b> 8 - 10/F., Goldin Financial Global Square, 7 Wang Tai Road, Kowloon Bay, Kowloon, Hong Kong				
<b>geprüft/ tested by:</b>		<b>kontrolliert/ reviewed by:</b>			
24.02.2016 Benny Lau Senior Project Manager		24.02.2016 Sharon Li Department Manager			
<b>Datum</b> <i>Date</i>	<b>Name/Stellung</b> <i>Name/Position</i>	<b>Unterschrift</b> <i>Signature</i>	<b>Datum</b> <i>Date</i>	<b>Name/Stellung</b> <i>Name/Position</i>	<b>Unterschrift</b> <i>Signature</i>
<b>Sonstiges:</b> <b>FCC ID: 2AHCD-HUB-V01</b> Other Aspects					
<b>Abkürzungen:</b>		<b>Abbreviations:</b>			
P(ass) = entspricht Prüfgrundlage F(ail) = entspricht nicht Prüfgrundlage N/A = nicht anwendbar N/T = nicht getestet		P(ass) = passed F(ail) = failed N/A = not applicable N/T = not tested			
<b>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.</b> <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

	<b>Transceiver</b>
Operating frequency range	2405 - 2480 MHz
Type of modulation	OQPSK
Number of channels	16
Channel separation	5 MHz
Type of antenna	PCB Antenna
Antenna gain (dBi)	3.3 dBi
Power level	fix
Type of equipment	stand alone radio device
Connection to public utility power line	Yes
Nominal voltage	V <sub>nom</sub> : 100-240VAC
Independent Operation Modes	Transmitting mode

### Product function and intended use

The equipment under test (EUT) is a smart device that interface with the internet and the air conditioner remote controller. It is a 2.4GHz IEEE 802.15.4 compliant RF transceiver. It is powered by AC-DC adapter.

FCC ID: 2AHCD-HUB-V01

<b>Models</b>	<b>Product description</b>
Sensibo Smart Hub V1	Smart device

### Submitted documents

Circuit Diagram  
Block Diagram  
Bill of material  
User manual  
Label

### Independent Operation Modes

The basic operation modes are:  
- Transmitting mode.

For further information refer to User Manual

### Related Submittal(s) Grants

This is a single application for certification of the transmitter.  
The corresponding smart pod is authorized under the certification procedure ((FCC ID: 2AHCD-POD-V01). Others digital function which is independent from the transmitter is authorized under verification procedure (refer to test report 14043094 001)

### Remark

Nil

## 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.

- There was no special software to exercise the device. A test mode sample is provided by the applicant which can transmit in a fixed frequency channel and a fixed output power level. This setting of RF output power shall be fixed on the firmware of the final end product.

### Special Accessories and Auxiliary Equipment

- AC-DC adaptor model: HYK-0501000; Input: 100-240VAC 50/60Hz; Output: 5.0VDC 1A (Provided by the applicant)

### 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 (Registration number: 90656)**

### Radiated Emission

Equipment	Manufacturer	Type	Cal. Date	Due Date
Semi-anechoic Chamber	Frankonia	Nil	14-Apr-15	14-Apr-16
New Fully Anchoic Chamber	TDK	N/A	15-Apr-15	15-Apr-16
Cable	Hubersuhner	SUCOFLEX 104	31-Mar-14	31-Mar-16
Test Receiver	R & S	ESU26	12-Feb-15	07-Dec-16
Bi-conical Antenna	R & S	HK116	1-Sep-15	01-Sep-17
Log Periodic Antenna	R & S	HL223	1-Sep-15	01-Sep-17
Coaxial cable	Harbour	LL335	10-Jun-14	10-Jun-16
Microwave amplifier 0.5-26.5GHz, 25dB gain	HP	83017A	17-Jul-14	17-Jul-16
High Pass Filter (cutoff freq. =1000MHz)	Trilithic	23042	28-Oct-15	28-Oct-17
Horn Antenna	EMCO	3115	26-Aug-15	26-Aug-17
Active Loop Antenna	EMCO	6502	17-May-15	17-May-16

## TÜV Rheinland Hong Kong Ltd

### Radio Test

Equipment	Manufacturer	Type	Cal. Date	Due Date
Spectrum Analyzer	R & S	FSP30	12-Jan-15	12-Jan-17

### AC Mains Conducted Emission

Equipment	Manufacturer	Type	Cal. Date	Due Date
Test Receiver	R & S	ESR3	22-Oct-15	22-Oct-16
LISN	R & S	ENV216	05 Feb 15	19-Jan-17
EMC32	R & S	v9.12	N/A	N/A

## Results FCC Part 15 – Subpart C

FCC 15.203 – Antenna Requirement 1		Pass
<b>FCC Requirement:</b> No antenna other than that furnished by the responsible party shall be used with the device		
<b>Results:</b>	a) Antenna type: Integral PCB antenna b) Manufacturer and model no: N/A c) Peak Gain: 3.3 dBi	
<b>Verdict:</b>	Pass	

FCC 15.204 – Antenna Requirement 2		N/A
<b>FCC Requirement:</b> An intentional radiator may be operated only with the antenna with which it is authorized. If an antenna is marketed with the intentional radiator, it shall be of a type which is authorized with the intentional radiator.		
<b>Results:</b>	Only one integral antenna can be used.	
<b>Verdict:</b>	N/A	

FCC 15.207 – Conducted Emission on AC Mains						Pass
Test Specification : ANSI C63.4 – 2003 Mode of operation : TX mode Port of testing : AC Mains input port of power supply Detector : Quasi-peak and Average RBW : 9 kHz Supply voltage : 120Vac 60Hz Temperature : 23°C Humidity : 50%						
Requirement:		15.207(a)				
Results:		Pass				
Live measurement						
Frequency range (MHz)	Frequency (MHz)	Quasi-peak dBμV	Average dBμV	Limit QP (dBμV)	Limit AV (dBμV)	Verdict
0,15 – 0,5	0.161	56.4	36.9	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 dBμV	Average dBμV	Limit QP (dBμV)	Limit AV (dBμV)	Verdict
0,15 – 0,5	0.161	55.4	34.2	66 - 56	56 - 46	Pass
> 0,5 - 5	No peak found	---	---	56	46	Pass
> 5 - 30	No peak found	---	---	60	50	Pass



<b>Results:</b>	<p>Pre-scan has been conducted to determine the worst-case mode from all possible combinations between available modulations and data rate.</p> <p>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.</p>
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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 Measurement Guidance v03r02 section 8.1 Option 1			
Mode of operation : TX mode			
Port of testing : Temporary antenna port			
Detector : Peak			
RBW/VBW : 100KHz/ 300KHz			
Supply voltage : 3.7 Vdc			
Temperature : 23°C			
Humidity : 50%			
Results: For test protocols please refer to Appendix 1.			
Channel frequency (MHz)	6 dB left (MHz)	6 dB right (MHz)	6dB bandwidth (kHz)
2405	2404.150	2405.81	1.66
2440	2439.150	2440.81	1.66
2480	2479.150	2480.80	1.65

FCC 15.247(b)(3) – Maximum Peak Couducted 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 Measurement Guidance v03r02 section 9.1.1			
Mode of operation : TX mode			
Port of testing : Temporary antenna port			
Detector : Peak			
Supply voltage : 3.7 Vdc			
Temperature : 23°C			
Humidity : 50%			
Results: For test protocols please refer to Appendix 1.			
Frequency (MHz)	Measured Output Power (dBm)	Limit (W/dBm)	Verdict
2405	-0.33	1 / 30.0	Pass
2440	-1.76	1 / 30.0	Pass
2480	-3.53	1 / 30.0	Pass

FCC 15.247(e) – Power Spectral Density			Pass
<b>FCC Requirement:</b> 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 Measurement Guidance v03r02 section 10.2 Mode of operation : TX mode Port of testing : Temporary antenna port Detector : Peak RBW/VBW : $\geq 100$ KHz / $\geq 3 \times$ RBW span : $\geq 1.5 \times$ DTS BW Supply voltage : 3.7 Vdc Temperature : 23°C Humidity : 50%			
<b>Results:</b> For test protocols please refer to Appendix 1, page 7-8.			
Operating frequency (MHz)	Power density (dBm)	Limit (dBm)	Verdict
2405	-4.07	8.0	Pass
2440	-6.23	8.0	Pass
2480	-7.98	8.0	Pass

FCC 15.247(d) – Spurious Conducted Emissions					Pass
Test Specification : KDB 558074 D01 DTS Measurement Guidance v03r02 section 11.1 Mode of operation : TX mode Port of testing : Temporary antenna port Detector : Peak RBW/VBW : 100 kHz / 300 kHz Supply voltage : 3.7 Vdc Temperature : 23 °C Humidity : 50 %					
<b>FCC Requirement:</b> 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.					
<b>Results:</b> Pre-scan has been conducted to determine the worst-case mode from all possible combinations between available modulations and data rate.  Only the worst cases is shown below. For test protocols refer to Appendix 1, page 9-14.					
Operating frequency (MHz)	Spurious frequency (MHz)	Spurious Level (dBm)	Reference value (dBm)	Delta (dB)	Verdict
2405	22696	-31.46	-4.07	27.39	Pass
2440	21328	-32.43	-6.23	26.20	Pass
2480	22720	-31.14	-7.98	23.16	Pass

FCC 15.247(d) or 15.205 – Radiated Emissions in Restricted Frequency Bands			Pass
Test Specification : ANSI C63.4 – 2009 Mode of operation : TX mode Port of testing : Enclosure Detector : Peak RBW/VBW : 100 kHz / 300 kHz for f < 1 GHz 1 MHz / 3 MHz for f > 1 GHz Supply voltage : 3.7 Vdc Temperature : 23°C Humidity : 50%			
<b>FCC Requirement:</b> 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 section15.205(a), must also comply with the radiated emission limits specified in section 15.205(c).			
<b>Results:</b> Pre-scan has been conducted to determine the worst-case mode from all possible combinations between available modulations and data rate.  All three transmit frequency modes comply with the field strength within the restricted bands. There is no spurious found below 30MHz.			
Mode: 2405MHz TX Vertical Polarization			
Freq MHz	Level dBuV/m	Limit/ Detector dBuV/m	
2390.000	47.31	74.0 / PK	
2390.000	34.86	54.0 / AV	
No peak found	---	74.0 / PK	
No peak found	---	54.0 / AV	
Mode: 2405 MHz TX Horizontal Polarization			
Freq MHz	Level dBuV/m	Limit/ Detector dBuV/m	
2390.000	46.97	74.0 / PK	
2390.000	34.92	54.0 / AV	
No peak found	---	74.0 / PK	
No peak found	---	54.0 / AV	
Mode: 2440 MHz TX Vertical Polarization			
Freq MHz	Level dBuV/m	Limit/ Detector dBuV/m	
No peak found	---	74.0 / PK	
No peak found	---	54.0 / AV	
Mode: 2440 MHz TX Horizontal Polarization			
Freq MHz	Level dBuV/m	Limit/ Detector dBuV/m	
No peak found	---	74.0 / PK	
No peak found	---	54.0 / AV	
Mode: 2480MHz TX Vertical Polarization			
Freq	Level	Limit/ Detector	

<b>MHz</b>	<b>dBuV/m</b>	<b>dBuV/m</b>
2483.500	66.72	74.0 / PK
2483.500	51.92	54.0 / AV
No peak found	---	74.0 / PK
No peak found	---	54.0 / AV
Mode: 2480 MHz TX Horizontal Polarization		
<b>Freq MHz</b>	<b>Level dBuV/m</b>	<b>Limit/ Detector dBuV/m</b>
2483.500	68.46	74.0 / PK
2483.500	53.37	54.0 / AV
4960.000	55.31	74.0 / PK
4960.000	43.00	54.0 / AV