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Produkte
Products

Prüfbericht - Nr.: *Test Report No.:*	**14039860 001**	**Seite 1 von 13** *Page 1 of 13*
Auftraggeber: *Client:*	**Convergence Systems Limited** **20/F, #1 Lockhart Road, Wan Chai** **Hong Kong**	
Gegenstand der Prüfung: *Test Item:*	**Sensing System (Sensor) with Bluetooth function**	
Bezeichnung: *Identification:*	**CS3180**	**Serien-Nr.:** *Serial No.:* **Engineering sample**
Wareneingangs-Nr.: *Receipt No.:*	**A000207442-001,** **A000207442-002**	**Eingangsdatum:** *Date of Receipt:* **02.06.2015**
Zustand des Prüfgegenstandes bei Anlieferung: *Condition of test item at delivery:*	Test sample(s) is/are not damaged and suitable for testing.	
Prüfort: *Testing Location:*	**Hong Kong Productivity Council** HKPC Building, 78 Tat Chee Avenue, Kowloon, Hong Kong	
Prüfgrundlage: *Test Specification:*	**FCC Part 15 Subpart C** **ANSI C63.4-2003**	
Prüfergebnis: *Test Results:*	**Das vorstehend beschriebene Gerät wurde geprüft und entspricht oben genannter Prüfgrundlage.** The above mentioned product was tested and **passed**.	
Prüflaboratorium: *Testing Laboratory:*	**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:*		
06.07.2015	Hugo Wan Senior Project Manager		06.07.2015	Benny Lau Senior Project Manager	
Datum *Date*	**Name/Stellung** *Name/Position*	**Unterschrift** *Signature*	**Datum** *Date*	**Name/Stellung** *Name/Position*	**Unterschrift** *Signature*

Sonstiges / Other Aspects: FCCID: UB4CS3180BT

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.
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.

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Product information

Manufacturers declarations

	Transceiver
Operating frequency range	2402 - 2480 MHz
Type of modulation	GFSK / FHSS
Number of channels	40
Channel separation	2 MHz
Type of antenna	Chip antenna
Antenna gain (dBi)	2
Power level	variable
Type of equipment	stand alone radio device
Connection to public utility power line	No
Nominal voltage	V_{nor}: 3.0 VDC
Independent Operation Modes	Bluetooth communication

Product function and intended use

The equipment under test (EUT) is a wetness sensor based on the Bluetooth technology. It is used with CS3300 all-in-one bridge / registration centre together. It communicates with CS3300 via Bluetooth 4.1.

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 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 the button cell.
2) A special test mode software was downloaded into the EUT to transmit lowest, middle and highest RF channel at highest output power. A client provided method to change channels on EUT.
3) Put the EUT into the sensor pad.

Special Accessories and Auxiliary Equipment

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

1. Sensor pad

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	ESU40	100190	20 Jun 2014	20 Jun 2015
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 amplifer 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	07 Aug 2015
Active Loop Antenna	EMCO	6502	9107-2651	17 May 2014	17 Aug 2015
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 and model no:	N.A.
c) Gain with reference to an isotropic radiator:	2 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 v03r02 Mode of operation : BLE Tx mode, (2402MHz, 2440MHz, 2480MHz) Port of testing : Temporary antenna port Detector : Peak RBW/VBW : 100KHz/ 300KHz Supply voltage : 3.0 VDC from DC power supply Temperature : 23ºC 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	2401.610	2402.310	0.700
2440	2439.630	2440.320	0.690
2480	2479.610	2480.300	0.690

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 : BLE Tx mode, (2402MHz, 2440MHz, 2480MHz) Port of testing : Temporary antenna port Detector : Peak RBW/VBW : ≥ DTS BW / ≥ 3xRBW Span : ≥ 3 x RBW Supply voltage : 3.0 VDC from DC power supply Temperature : 23ºC 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
2402	-3.12	0.00	-3.12	1 / 30.0	Pass
2440	-4.01	0.00	-4.01	1 / 30.0	Pass
2480	-5.06	0.00	-5.06	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 (2402MHz, 2440MHz, 2480MHz)
Port of testing : Temporary antenna port
Detector : Peak
RBW/VBW : 100 kHz / 300 kHz
Supply voltage : 3.0 VDC from DC power supply
Temperature : 23 ºC
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 6-8.

BLE Tx mode

Operating frequency (MHz)	Spurious frequency (MHz)	Spurious Level (dBm)	Reference value (dBm)	Delta (dB)	Verdict
2402	3094.762	-46.30	-3.55	-42.75	Pass
2440	7816.586	-45.58	-4.29	-41.29	Pass
2480	8060.380	-45.47	-5.45	-40.02	Pass

FCC 15.247 (d) – Radiated Spurious Emissions **Pass**

Test Specification : ANSI C63.4 – 2003
Mode of operation : 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 / 1 MHz for f > 1 GHz
Supply voltage : 3.0 VDC from battery
Temperature : 23ºC
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 section15.205(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.

BLE Tx mode

Tx frequency 2402MHz Vertical Polarization

Freq MHz	**Level dBµV/m**	**Limit/ Detector dBµV/m**
2389.744	42.25	74.0 / P
2389.744	28.33	54.0 / A
4805.832	48.04	74.0 / P
4805.944	38.69	54.0 / A

Tx frequency 2402MHz Horizontal Polarization

Freq MHz	**Level dBµV/m**	**Limit/ Detector dBµV/m**
2390.000	44.50	74.0 / P
2390.000	31.68	54.0 / A
4806.120	46.53	74.0 / P
4805.992	34.75	54.0 / A

Tx frequency 2440MHz Vertical Polarization

Freq MHz	**Level dBµV/m**	**Limit/ Detector dBµV/m**
4882.083	47.93	74.0 / P
4881.825	36.58	54.0 / A

Tx frequency 2440MHz Horizontal Polarization

Freq MHz	**Level dBµV/m**	**Limit/ Detector dBµV/m**
4880.353	45.80	74.0 / P
4881.873	33.78	54.0 / A

Tx frequency 2480MHz	Vertical Polarization	
Freq MHz	**Level dBµV/m**	**Limit/ Detector dBµV/m**
2485.404	44.69	74.0 / P
2483.500	36.97	54.0 / A
4957.981	47.68	74.0 / P
4957.917	34.68	54.0 / A
Tx frequency 2480MHz	Horizontal Polarization	
Freq MHz	**Level dBµV/m**	**Limit/ Detector dBµV/m**
2485.721	46.82	74.0 / P
2483.500	38.60	54.0 / A
4957.772	46.57	74.0 / P
4957.981	34.20	54.0 / A

FCC 15.247 (d) – Band Edge Emissions **Pass**

Test Specification : KDB 558074 D01 DTS Meas Guidance v03r02
Mode of operation : BLE Tx mode (2402MHz, 2480MHz)
Port of testing : Temporary antenna port
Detector : Peak
RBW/VBW : 100 kHz / 300 kHz
Supply voltage : 3.0 VDC from DC power supply
Temperature : 23ºC
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 9.

BLE Tx mode

Operating frequency (MHz)	Spurious frequency (MHz)	Spurious Level (dBm)	Reference value (dBm)	Delta (dB)	Verdict
2402	2399.160	-38.28	-3.55	-34.73	Pass
2480	2485.760	-42.34	-5.45	-36.89	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 : BLE Tx mode (2402MHz, 2440MHz, 2480MHz)
Port of testing : Temporary antenna port
Detector : Peak
RBW/VBW : ≥100 kHz / ≥3xRBW
span : ≥1.5 x DTS BW
Supply voltage : 3.0 VDC from DC power supply
Temperature : 23ºC
Humidity : 50%

Results: For test protocols please refer to Appendix 1, page 10-11.

Operating frequency (MHz)	Power density (dBm)	Limit (dBm)	Verdict
2402	-3.55	8.0	Pass
2440	-4.29	8.0	Pass
2480	-5.45	8.0	Pass