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Report No.: SZEM180500385603

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# RF Exposure Evaluation Report

Application No.:	SZEM1805003856CR
Applicant:	PHYTEC Messtechnik GmbH
Address of Applicant:	Robert-Koch-Straße 39, 55129 Mainz, Deutschland
Manufacturer:	PHYTEC Messtechnik GmbH
Address of Manufacturer:	Robert-Koch-Straße 39, 55129 Mainz, Deutschland
Factory:	PHYTEC Messtechnik GmbH
Address of Factory:	Robert-Koch-Straße 39, 55129 Mainz, Deutschland
Equipment Under Test (EUT):	
EUT Name:	phyWAVE-KW41Z
Model No.:	PWA-A-007-0000.A1, PWA-A-007-1000.A1 *
*	Please refer to section 4.1 of this report which indicates which model was actually tested and which were electrically identical.
Trade mark:	phyWAVE
Standards:	47 CFR Part 1.1307 (2016) 47 CFR Part 1.1310 (2016)
Date of Receipt:	2018-05-10
Date of Test:	2018-05-25 to 2018-06-20
Date of Issue:	2018-06-25

Test Result :	Pass*
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\* In the configuration tested, the EUT complied with the standards specified above.



Keny Xu

EMC Laboratory Manager

The manufacturer should ensure that all products in series production are in conformity with the product sample detailed in this report. If the product in this report is used in any configuration other than that detailed in the report, the manufacturer must ensure the new system complies with all relevant standards. Any mention of SGS International Electrical Approvals or testing done by SGS International Electrical Approvals in connection with, distribution or use of the product described in this report must be approved by SGS International Electrical Approvals in writing.

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## 2 Version

<b>Revision Record</b>				
<b>Version</b>	<b>Chapter</b>	<b>Date</b>	<b>Modifier</b>	<b>Remark</b>
01		2018-06-25		Original

<b>Authorized for issue by:</b>			
		 Harry Wu	
		<hr/> Harry Wu /Project Engineer	
		 Eric Fu	
		<hr/> Eric Fu /Reviewer	

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## 4 General Information

### 4.1 General Description of EUT

Power supply:	DC 0.9-4.2V
For BLE:	
Bluetooth Version:	V4.2
Frequency Range:	2402MHz to 2480MHz
Modulation Type:	GFSK
Number of Channels:	40
Channel Spacing	2MHz
Antenna Type:	Chip Antenna
Antenna Gain:	-2dBi
For ZIGBEE:	
Frequency Range:	2405MHz to 2480MHz
Modulation Type:	O-QPSK
Number of Channels:	16
Channel Spacing	5MHz
Antenna Type:	Chip Antenna
Antenna Gain:	-2dBi

#### Remark:

Model No.: PWA-A-007-0000.A1, PWA-A-007-1000.A1

The model PWA-A-007-0000.A1 was tested fully. The model PWA-A-007-1000.A1 was tested in item Conducted Emissions at AC Power Line (150kHz-30MHz) and Radiated Spurious Emissions. since the electrical circuit design, layout, components used, internal wiring and functions were identical for all the above models, with only difference on model name and RAM/flash size (PWA-A-007-0000.A1: 512Kb, PWA-A-007-1000.A1:256Kb).

## 4.2 Test Location

All tests were performed at:

SGS-CSTC Standards Technical Services Co., Ltd. Shenzhen Branch

No. 1 Workshop, M-10, Middle section, Science & Technology Park, Shenzhen, Guangdong, China  
518057

Telephone: +86 (0) 755 2601 2053 Fax: +86 (0) 755 2671 0594

No tests were sub-contracted.

## 4.3 Test Facility

The test facility is recognized, certified, or accredited by the following organizations:

- **CNAS (No. CNAS L2929)**

CNAS has accredited SGS-CSTC Standards Technical Services Co., Ltd. Shenzhen Branch EMC Lab to ISO/IEC 17025:2005 General Requirements for the Competence of Testing and Calibration Laboratories (CNAS-CL01 Accreditation Criteria for the Competence of Testing and Calibration Laboratories) for the competence in the field of testing.

- **A2LA (Certificate No. 3816.01)**

SGS-CSTC Standards Technical Services Co., Ltd., Shenzhen EMC Laboratory is accredited by the American Association for Laboratory Accreditation(A2LA). Certificate No. 3816.01.

- **VCCI**

The 3m Fully-anechoic chamber for above 1GHz, 10m Semi-anechoic chamber for below 1GHz, Shielded Room for Mains Port Conducted Interference Measurement and Telecommunication Port Conducted Interference Measurement of SGS-CSTC Standards Technical Services Co., Ltd. have been registered in accordance with the Regulations for Voluntary Control Measures with Registration No.: G-20026, R-14188, C-12383 and T-11153 respectively.

- **FCC –Designation Number: CN1178**

SGS-CSTC Standards Technical Services Co., Ltd., Shenzhen EMC Laboratory has been recognized as an accredited testing laboratory.

Designation Number: CN1178. Test Firm Registration Number: 406779.

- **Industry Canada (IC)**

Two 3m Semi-anechoic chambers and the 10m Semi-anechoic chamber of SGS-CSTC Standards Technical Services Co., Ltd. Shenzhen Branch EMC Lab have been registered by Certification and Engineering Bureau of Industry Canada for radio equipment testing with Registration No.: 4620C-1, 4620C-2, 4620C-3.

#### **4.4 Deviation from Standards**

None.

#### **4.5 Abnormalities from Standard Conditions**

None.

#### **4.6 Other Information Requested by the Customer**

None.

## 5 RF Exposure Evaluation

### 5.1 RF Exposure Compliance Requirement

#### 5.1.1 Limits

According to FCC Part1.1310: The criteria listed in the following table shall be used to evaluate the environment impact of human exposure to radio frequency (RF) radiation as specified in part1.1307(b)

TABLE 1—LIMITS FOR MAXIMUM PERMISSIBLE EXPOSURE (MPE)

Frequency range (MHz)	Electric field strength (V/m)	Magnetic field strength (A/m)	Power density (mW/cm <sup>2</sup> )	Averaging time (minutes)
<b>(A) Limits for Occupational/Controlled Exposures</b>				
0.3–3.0 .....	614	1.63	*(100)	6
3.0–30 .....	1842/f	4.89/f	*(900/f <sup>2</sup> )	6
30–300 .....	61.4	0.163	1.0	6
300–1500 .....	.....	.....	f/300	6
1500–100,000 .....	.....	.....	5	6
<b>(B) Limits for General Population/Uncontrolled Exposure</b>				
0.3–1.34 .....	614	1.63	*(100)	30
1.34–30 .....	824/f	2.19/f	*(180/f <sup>2</sup> )	30
30–300 .....	27.5	0.073	0.2	30
300–1500 .....	.....	.....	f/1500	30
1500–100,000 .....	.....	.....	1.0	30

F= Frequency in MHz

Friis Formula

Friis transmission formula:  $P_d = (P_{out} \cdot G) / (4 \cdot \pi \cdot R^2)$

Where

$P_d$  = power density in  $\text{mW/cm}^2$

$P_{out}$  = output power to antenna in mW

$G$  = gain of antenna in linear scale

$\pi = 3.1416$

$R$  = distance between observation point and center of the radiator in cm

$P_d$  is the limit of MPE, 1  $\text{mW/cm}^2$ . If we know the maximum gain of the antenna and the total power input to the antenna, through the calculation, we will know the distance  $r$  where the MPE limit is reached.

#### 5.1.2 Test Procedure

Software provided by client enabled the EUT to transmit and receive data at lowest, middle and highest channel individually.

#### **4.1.3 EUT RF Exposure Evaluation**

For BLE:

Antenna Gain: -2dBi

Antenna Gain: The maximum Gain measured in fully anechoic chamber is 0.63 in linear scale.

Output Power Into Antenna & RF Exposure Evaluation Distance:

<b>Channel</b>	<b>Frequency (MHz)</b>	<b>TX Output Power declared by applicant (dBm)</b>	<b>E.I.R.P (mW)</b>	<b>Power Density at R = 20 cm (mW/cm<sup>2</sup>)</b>	<b>Limit</b>	<b>Result</b>
Highest	2480	3.5	2.239	0.00045	1.0	PASS

Note: Refer to User manual for EUT TX Output Power value.

The distance r (4th column) calculated from the Fries transmission formula is far greater than 20 cm separation requirement.

For ZIGBEE:

Antenna Gain: -2dBi

Antenna Gain: The maximum Gain measured in fully anechoic chamber is 0.63 in linear scale.

Output Power Into Antenna & RF Exposure Evaluation Distance:

<b>Channel</b>	<b>Frequency (MHz)</b>	<b>TX Output Power declared by applicant (dBm)</b>	<b>E.I.R.P (mW)</b>	<b>Power Density at R = 20 cm (mW/cm<sup>2</sup>)</b>	<b>Limit</b>	<b>Result</b>
Highest	2480	3.5	2.239	0.00045	1.0	PASS

Note: Refer to User manual for EUT TX Output Power value.

The distance r (4th column) calculated from the Fries transmission formula is far greater than 20 cm separation requirement.

- End of the Report -