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Report No.: SHEM161100708903
 Page: 1 of 7

1 Cover Page

RF Exposure Evalaution REPORT

Application No.:	SHEM1611007089CR
Applicant:	Kohler Co.
FCC ID:	N82-KOHLER021
IC:	4554A-KOHLER021
Equipment Under Test (EUT):	
NOTE: The following sample(s) submitted was/were identified on behalf of the client as	
Product Name:	UART CLOUD MODULE
Model No.(EUT):	1293627
Standards:	FCC Rules 47 CFR §2.1091(KDB447498 D01 General RF Exposure Guidance v06) RSS-102 Issue 5 (March 2015)
Date of Receipt:	2016-11-03
Date of Test:	2017-01-22 to 2017-02-17
Date of Issue:	2017-02-17
Test Result:	Pass*

* In the configuration tested, the EUT detailed in this report complied with the standards specified above.



Parlam Zhan
E&E Section Manager
SGS-CSTC (Shanghai) Co., Ltd.

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 Contents

	Page
1 COVER PAGE.....	1
2 CONTENTS	2
3 GENERAL INFORMATION	3
3.1 CLIENT INFORMATION.....	3
3.1 GENERAL DESCRIPTION OF E.U.T.....	3
3.2 TECHNICAL SPECIFICATIONS.....	3
3.3 TEST LOCATION.....	4
3.4 TEST FACILITY.....	4
4 TEST STANDARDS AND LIMITS.....	5
5 MEASUREMENT AND CALCULATION.....	5
5.1 MAXIMUM TRANSMIT POWER.....	6
5.2 MPE CALCULATION.....	6
6 EUT CONSTRUCTIONAL DETAILS.....	7

3 General Information

3.1 Client Information

Applicant:	Kohler Co.
Address of Applicant:	444 Highland Drive, Kohler, WI 52044

3.1 General Description of E.U.T.

Brand Name:	KOHLER
Product Description:	Module with 2.4GHz band DTS and BT function
Power Supply:	DC 5V

3.2 Technical Specifications

Operation Frequency:	BT 4.0: 2402MHz~2480MHz DTS: 802.11 b/g/n(HT20): 2412MHz-2462MHz
Bluetooth Version:	BT 4.0 Single mode
Modulation Technique:	BT 4.0: GFSK DTS: 802.11b: DSSS(CCK, DQPSK, DBPSK) 802.11g: OFDM(64QAM, 16QAM, QPSK, BPSK)
Number of Channel:	BT: 40
Antenna Type	BT 4.0: PIFA Antenna DTS: PCB Antenna
Antenna Gain	BT 4.0: 0dBi DTS: 2 dBi

3.3 Test Location

All tests were performed at:

SGS-CSTC Standards Technical Services (Shanghai) Co., Ltd.

No.588 West Jindu Road, Songjiang District, Shanghai, China.201612.

Tel: +86 21 6191 5666

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3.4 Test Facility

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

- **CNAS (No. CNAS L0599)**

CNAS has accredited SGS-CSTC Standards Technical Services (Shanghai) Co., Ltd. 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. Date of expiry: 2017-07-14.

- **FCC – Registration No.: 402683**

SGS-CSTC Standards Technical Services (Shanghai) Co., Ltd. has been registered and fully described in a report filed with the Federal Communications Commission (FCC). The acceptance letter from the FCC is maintained in our files. Registration No.: 402683, Expiry Date: 2017-09-16.

- **Industry Canada (IC) – IC Assigned Code: 8617A**

The 3m Semi-anechoic chamber of SGS-CSTC Standards Technical Services (Shanghai) Co., Ltd. has been registered by Certification and Engineering Bureau of Industry Canada for radio equipment testing with Registration No.: 8617A-1. Expiry Date: 2017-06-18.

- **VCCI (Member No.: 3061)**

The 3m Semi-anechoic chamber and Shielded Room of SGS-CSTC Standards Technical Services (Shanghai) Co., Ltd. has been registered in accordance with the Regulations for Voluntary Control Measures with Registration No.: R-3868, C-4336, T-2221, G-830 respectively. Date of Expiry: 2017-11-16.

4 Test Standards and Limits

According to §1.1310 Radiofrequency radiation exposure limits:

The limit for general population/uncontrolled exposures

Frequency	Power density(mW/cm ²)	Averaging time(minutes)
300MHz~1.5GHz	f/1500	30
1.5GHz~100GHz	1.0	30

4.1 IC Radiofrequency radiation exposure limits:

According to RSS-102 section 2.5.2, RF exposure evaluation is required if the separation distance between the user and/or bystander and the device's radiating element is greater than 20 cm, except when the device operates as follows:

below 20 MHz and the source-based, time-averaged maximum e.i.r.p. of the device is equal to or less than 1 W (adjusted for tune-up tolerance);

- at or above 20 MHz and below 48 MHz and the source-based, time-averaged maximum e.i.r.p. of the device is equal to or less than $4.49/f^{0.5}$ W (adjusted for tune-up tolerance), where f is in MHz;
- at or above 48 MHz and below 300 MHz and the source-based, time-averaged maximum e.i.r.p. of the device is equal to or less than 0.6 W (adjusted for tune-up tolerance);
- at or above 300 MHz and below 6 GHz and the source-based, time-averaged maximum e.i.r.p. of the device is equal to or less than $1.31 \times 10^{-2} f^{0.6834}$ W (adjusted for tune-up tolerance), where f is in MHz;
- at or above 6 GHz and the source-based, time-averaged maximum e.i.r.p. of the device is equal to or less than 5 W (adjusted for tune-up tolerance).

For 2.4G device, the limit of worse case is 2.68 W(42.8dBm)

5 Measurement and Calculation

5.1 Maximum transmit power

The Power Data is based on the RF Test Report SHEM161100708901 & SHEM161100708902.

Test Data:

For BT:

Test Channel	Test Frequency (MHz)	Reading Power (dBm)	Cable Loss (dB)	Output Power (dBm)	Limit (dBm)	Test Result
Lowest	2402	2.05	0.5	2.55	30	Pass
Middle	2440	1.91	0.5	2.41	30	Pass
Highest	2480	1.40	0.5	1.90	30	Pass

For DTS:

Test mode	Test Channel	Reading Power (dBm)	Output Power (dBm)	Limit (dBm)	Result
802.11b	2412	20.18	20.68	30	Pass
	2437	20.17	20.67		Pass
	2462	19.73	20.23		Pass
802.11g	2412	23.91	24.41		Pass
	2437	24.01	24.51		Pass
	2462	23.96	24.46		Pass
802.11 n(HT20)	2412	23.35	23.85		Pass
	2437	23.13	23.63		Pass
	2462	23.15	23.65		Pass

5.2 MPE Calculation

According to the formula $S = \frac{PG}{4R^2\pi}$, we can calculate S which is MPE.

Note:

- 1) P (Watts) = Power Input to antenna = $10^{\frac{dBm}{10}} / 1000$
- 2) G (Antenna gain in numeric) = $10^{\text{(Antenna gain in dBi / 10)}}$
- 3) R = distance to the center of radiation of antenna (in meter) = 20cm
- 4) MPE limit = 1mW/cm²

For BT:

The Max Conducted Peak Output Power is 2.55 dBm (1.80mW);

The best case gain of the antenna is 0dBi. 0dB logarithmic terms convert to numeric result is nearly 1.

$$\text{So, } S = \frac{PG}{4R^2\pi} = \frac{1.80 \times 1}{4 \times 400 \times 3.14} = 0.00036 \text{ mW/cm}^2$$

For DTS:

The Max Conducted Peak Output Power is 24.51dBm (282.49mW);

The best case gain of the antenna is 2dBi. 2dB logarithmic terms convert to numeric result is nearly 3

$$\text{So, } S = \frac{PG}{4R^2\pi} = \frac{282.49 \times 1}{4 \times 400 \times 3.14} \times 3 = 0.1686 \text{ mW/cm}^2$$

The BT and the DTS modules can't simultaneous transmitting at frequency 2.4GHz band, according to the KDB447498 section 7.1 determine the device is exclusion from SAR test.

For IC, the limit of worse case is 2.68 W(42.8dBm)

6 EUT Constructional Details

Refer to the < UART _External Photos > & < UART _Internal Photos>.

--End of the Report--