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RF EXPOSURE CALCULATIONS

Requirement:

According to USA CFR 15 §1.1307 (b)(1), systems operating under the provisions of this section shall be operated in a manner that ensures the public is not exposed to radio frequency energy level in excess of the Commission's guidelines. For Canada, RSS-102 sets out the requirements and measurement techniques used to evaluate radio frequency (RF) exposure compliance of radiocommunication apparatus designed to be used within the vicinity of the human body.

USA REF: 1.1310, 2.1091/1093, 447498 D01 General RF Exposure Guidance v06
 IC REF: RSS-102 Issue 6, Safety Code 6
 Min. Sep. Distance: <5mm

Test Date: 15-Jun-17
 Test Engineer: Y. S. Choi
 EUT: UTO-NBL-52A
 EUT Mode: Active
 Meas. Distance: 3m

R0	Mode	Frequency Band		Po (Pk)		Tune Up (Pk)		EIRP + Duty (Pk)		Canada ISED RSS-102 SAR		USA FCC 2.1093 MPE		
		Start MHz	Stop MHz	dBm	mW	dBm	mW	dBm	mW	EIRP <3mm Exp. Limit Table 11 mW	MPE Ratio	MPE Threshold ERP (mW)	MPE Limit ERP (mW)	MPE Ratio
R1	BLE	2402.00	2480.00	-2.4	.57	.00	.00	-5	0.89	3.0	0.30	0.542	3	0.20
R2														
R3										Total MPE	0.30		Total MPE	0.20
R4										MPE Ratio < 1	YES		MPE Ratio < 1	YES
#	C1	C2	C3	C4	C5	C6	C7	C8	C9	C10	C11	C12	C13	C14

(ROW (COLUMN) NOTE:

- R0 C6 TUNE UP – The manufacturer declares no tune up.
 R0 C10 Using separation of 20mm according to according to table RSS-102, table 11.
 R0 C12 MPE Threshold ERP (mW) = EIRP(mW)/1.64 = 0.642
 R0 C13 According to CFR 47, § 2.1093 (c)(1) - ERP (mW) Limit = $3060 \cdot (0.5\text{cm}/20\text{cm})^2 \cdot (-\text{Log}_{10}(60/(3060 \cdot \text{SQRT}(2.480 \text{ GHz})))) = 2.7 \text{ mW}$

Summary:

The EUT with all transmitters is compliant with both the FCC power density limit and the ISED Exposure Evaluation limits.

RF EXPOSURE REPORT

Product name: BLE Module
FCC ID: 2AMD4UTO-NBL-52A
Model: UTO-NBL-52A

Applicant: Utovertek Co.,Ltd.
Test Report No.: UCSFR-1706-003

UCS Co., Ltd.

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RF Exposure Report

Report Number		UCSFR-1706-003		
Applicant	Company Name	Utovertek Co.,Ltd.		
	Address	Rm210,KETI Business Incubator,25 seanari-ro,Bundang-gu,Seongnam-si,Gyeonggi-do 463-816 Korea		
Product	Product Name	BLE Module		
	FCC ID	2AMD4UTO-NBL-52A		
	Model No.	UTO-NBL-52A		
	Family Model Name	UTO-NBL-52		
	Manufacturer	Utovertek Co.,Ltd.		
	Serial No.	-	Country of origin	Korea
Other	Receipt Date	2017.05.17	Receipt Number	UCS-R-2017-0588
	Issued Date	2017.06.15	Tested Date	2017.05.29 ~ 2017.05.30
Standards		FCC CFR 47 PART 15 SUBPART C, Section 15.247		
Tested by		Y. S. Choi (Sign)		
Approved by		H. K. Lee (Sign)		
UCS Co., Ltd. #702, 268, Hagui-ro, Dongan-gu, Anyang-si, Gyeonggi-do, 14056 Korea. Tel : +82-1833-5681, Fax : +82-31-420-5685				
o This is certified that the above mentioned products have been tested for the sample provided by client. o No part of this document may not be duplicated or reproduced by any means without the express written permission of UCS Co., Ltd.				

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Revision History

Issued Report No.	Issued Date	Revisions	Effect Section
UCSFR-1706-003	15-June-17	Initial Issue	All

1. Applicant Information

Applicant Name : Utovertek Co.,Ltd.
Address : Rm210,KETI Business Incubator,25 seanari-ro,Bundang-gu,Seongnam-si,
Gyeonggi-do 463-816 Korea
Applicant Name : Utovertek Co.,Ltd.
Address : Rm210,KETI Business Incubator,25 seanari-ro,Bundang-gu,Seongnam-si,
Gyeonggi-do 463-816 Korea
Country of Origin : KOREA

2. EUT (Equipment under test) Information

Product name	BLE Module
Basic Model name	UTO-NBL-52A
Family Model Name	UTO-NBL-52
Power source	DC 3.0 V
Output Power	MAX 0.000 574 W
Ferquency range	2 402 MHz ~ 2 480 MHz
Number of channels	40 Ch
Modulation Technique	GFSK (Bluetooth 4.2)
Antenna specification	Chip Antenna / 1.9 dBi (Peak Gain)
Printer size	4.00 x 2.00 x 1.25 mm

3. Laboratory Information

UCS Co., Ltd.

#702, 268, Hagui-ro, Dongan-gu, Anyang-si, Gyeonggi-do, 14056 Korea.

ER Center

- #35-13 Hwalcho-gil, 109beon-gil, Hwaseong-si, Gyeonggi-do, 18278 Korea

Test site

- FCC Registration Number: 767461

- This test site is in compliance with ISO/IEC 17025 for general requirements for the competence of testing and calibration laboratories.

4. Test Configuration and Condition

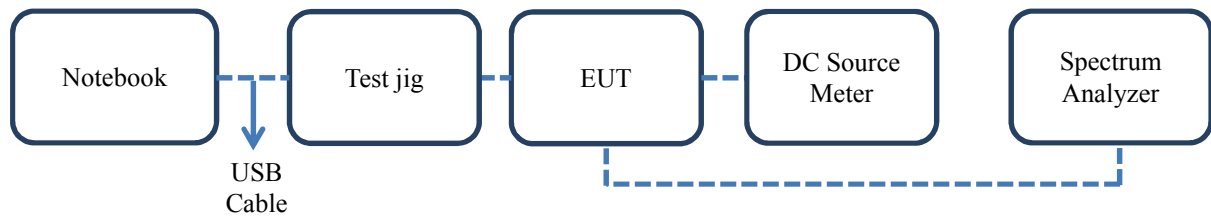
4.1 EUT operating condition

- The EUT had been tested under the operating condition.
- There are three channels have been tested as following:
- Channel Low and Channel High with higher data rate were chosen for full testing.

Channel	Frequency (MHz)
Low	2 402
Middle	2 440
High	2 480

- The measurements were taken in continuous transmitting mode using the TEST MODE.
- For controlling the EUT as TEST MODE, the test program and the cable assembly were provided by the applicant.

4.2 EUT test configuration diagram



4.3 Peripheral equipments list for test

Equipment Name	Model	Serial Number	Manufacturer
Notebook computer	NT910S3P	0GG291FG700325F	Samsung Electronics Suzhou Computer Co., Ltd.
DC Source Meter	M8811	80010960011103000	Maynuo
Test jig	-	-	NORDIC SEMICONDUCTOR

4.4 Cable connections

Start		End		Cable	
Name	I/O Port	Name	I/O Port	Length	Spec.
EUT	DC in	DC Source Meter	DC out	1.5	Unshielded
	Signal in	Test jig	Signal out	0.2	Unshielded
Test jig	Micro USB	Notebook	USB	1.0	Shielded

4.5 EUT modifications

- None

5. RF Exposure Evaluation

According to above equation, the following result was obtained.

Operating Freq. Band [MHz]	Operating Mode	Peak Output Power		Antenna Gain		Power Density [mW/cm ²] @ 20 cm Separation	Limit [mW/cm ²]
		[dBm]	[mW]	Log	Linear		
2 400 ~ 2 483.5	BLE	-2.41	0.57	1.90	1.55	0.000 18	1.00

$$S = P * G / (4\pi * R^2) = 0.57 * 1.55 / (4 * 3.14 * 20^2) = 0.000 18$$

Where:

S = Power Density,

P = Power input to the external antenna

G = Gain of Transmit Antenna (linear gain), R = Distance from Transmitting Antenna