

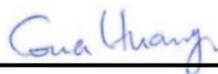
# RF EXPOSURE EVALUATION REPORT

**IC** : 451H-2651R3SIPA  
**Equipment** : CC2651R3SIPA SimpleLink™ Multiprotocol  
2.4-GHz Wireless System-in-Package Module  
with Integrated Antenna & 352-KB Memory  
**Brand Name** : Texas Instruments  
**HVIN** : CC2651R3SIPAT0MOUR  
**PMN** : CC2651R3SIPA SimpleLink™ Multiprotocol  
2.4-GHz Wireless System-in-Package Module  
with Integrated Antenna & 352-KB Memory  
**Applicant** : Texas Instruments Incorporated  
12500 TI BLVD., Dallas, Texas, 75243  
**Manufacturer** : Texas Instruments Incorporated  
12500 TI BLVD., Dallas, Texas, 75243  
**Standard** : RSS-102 Issue 5

We, SPORTON INTERNATIONAL INC has been evaluated this product in accordance with RSS-102 Issue 5 and it complies with applicable limit.

Sporton Lab is accredited to ISO 17025 by Taiwan Accreditation Foundation. The ISED CABID: TW1190, Company Number is 4086B.

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Approved by: Cona Huang / Deputy Manager



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**1. Description of Equipment Under Test (EUT)**

<b>Product Feature &amp; Specification</b>	
<b>EUT Type</b>	CC2651R3SIPA SimpleLink™ Multiprotocol 2.4-GHz Wireless System-in-Package Module with Integrated Antenna & 352-KB Memory
<b>Brand Name</b>	Texas Instruments
<b>HVIN</b>	CC2651R3SIPAT0MOUR
<b>PMN</b>	CC2651R3SIPA SimpleLink™ Multiprotocol 2.4-GHz Wireless System-in-Package Module with Integrated Antenna & 352-KB Memory
<b>IC</b>	451H-2651R3SIPA
<b>Wireless Technology and Frequency Range</b>	Bluetooth: 2402 MHz ~ 2480 MHz Zigbee: 2405 MHz ~ 2480 MHz
<b>Mode</b>	Bluetooth LE (125 kbps, 500 kbps, 1Mbps, 2Mbps) Zigbee (OQPSK DSSS1:8, 250 kbps)

**Reviewed by: Jason Wang**

**Report Producer: Paula Chen**



Bluetooth LE (125 kbps, 500 kbps, 1Mbps, 2Mbps) and Zigbee (OQPSK DSSS1:8, 250 kbps)

Antenna Information				
	Brand	Antenna Type	Model	2.4 GHz Gain
1	Texas Instruments	Inverted F - PCB	Custom Antenna	3.3 dBi
2		CC2651R3SIPA integrated antenna – PCB	Custom Antenna	1.5 dBi
3	Ethertronics	Dipole	1000423	-0.6dBi
4	LSR	Rubber Whip / Dipole	001-0012	2dBi
5			080-0013	2dBi
6			080-0014	2dBi
7		PIFA	001-0016	2.5dBi
8			001-0021	2.5dBi
9		Laird	PCB	CAF94504
10			CAF9405	2dBi
11	Pulse	Ceramic Chip	W3006	3.2dBi
12	ACX	Multilayer Chip	AT3216-BR2R7HAA	0.5dBi
13			AT312-T2R4PAA	1.5dBi
14	TDK	Multilayer Ceramic Chip Antenna	ANT016008LCD2442MA1	1.6dBi
15			ANT016008LCD2442MA2	2.5dBi
16	Mitsubishi Material	Chip Antenna	AM03DP-ST01	1.6dBi
17		Antenna Unit	UB18CP-100ST01	-1.0dBi
18	Taiyo Yuden	Chip Antenna / Helical Monopole	AF216M245001	1.5dBi
19			AH212M245001	1.3dBi
20		Chip Antenna / Monopole Type	AH316M245001	1.9dBi
21	Antenna Technology	Dipole	AA2402SPU	2.0dBi
22			AA2402RSPU	2.0dBi
23			AA2402A-UFLLP	2.0dBi
24			AA2402AU-UFLLP	2.0dBi
25	Staf	Mono-pole	1019-016	2.14dBi
26			1019-017	2.14dBi
27			1019-018	2.14dBi
28			1019-019	2.14dBi
29	Map Electronics	Rubber Whip	MEIWX-2411SAXX-2400	2.0dBi
30			MEIWX-2411RSXX-2400	2.0dBi
31			MEIWX-282XSAXX-2400	2.0dBi
32			MEIWX-282XRSXX-2400	2.0dBi
33			MEIWF-HP01RS2X-2400	2.0dBi
34	Yageo	Chip	ANT3216A063R2400A	1.69dBi
35	Mag Layers Scientific	Chip	LTA-3216-2G4S3-A1	1dBi
36			LTA-3216-2G4S3-A3	2dBi
37	Advantech	Rubber Whip / Dipole	AN2450-5706RS	2.38dBi
38			R-AN2400-5701RS	3.3dBi

Note: Antenna 2 is the default antenna used on the test HW (the Launchpad)

**2. Maximum RF average output power among production units**

Band	Maximum Average Power (dBm)
Bluetooth LE	4.77
Zigbee	4.73

### 3. RF Exposure Limit Introduction

ISED has adopted the RF field strength limits established in Health Canada's RF exposure guideline. The limits are shown in Table 4 below per RSS-102.

Frequency Range (MHz)	Electric Field (V/m rms)	Magnetic Field (A/m rms)	Power Density (W/m <sup>2</sup> )	Reference Period (minutes)
0.003-10 <sup>-21</sup>	83	90	-	Instantaneous*
0.1-10	-	0.73/ <i>f</i>	-	6**
1.1-10	87/ <i>f</i> <sup>0.5</sup>	-	-	6**
10-20	27.46	0.0728	2	6
20-48	58.07/ <i>f</i> <sup>0.25</sup>	0.1540/ <i>f</i> <sup>0.25</sup>	8.944/ <i>f</i> <sup>0.5</sup>	6
48-300	22.06	0.05852	1.291	6
300-6000	3.142 <i>f</i> <sup>0.3417</sup>	0.008335 <i>f</i> <sup>0.3417</sup>	0.02619 <i>f</i> <sup>0.6834</sup>	6
6000-15000	61.4	0.163	10	6
15000-150000	61.4	0.163	10	616000/ <i>f</i> <sup>1.2</sup>
150000-300000	0.158 <i>f</i> <sup>0.5</sup>	4.21 x 10 <sup>-4</sup> <i>f</i> <sup>0.5</sup>	6.67 x 10 <sup>-5</sup> <i>f</i>	616000/ <i>f</i> <sup>1.2</sup>

Note: *f* is frequency in MHz.  
 \*Based on nerve stimulation (NS).  
 \*\* Based on specific absorption rate (SAR).

The MPE was calculated at 20 cm to show compliance with the power density limit.

The following formula was used to calculate the Power Density:

$$S = \frac{PG}{4\pi R^2}$$

Where:

S = Power Density

P = Output Power at Antenna Terminals

G = Gain of Transmit Antenna (linear gain)

R = Distance from Transmitting Antenna



## **4. RF Exposure Evaluation**

### **4.1. Standalone assessment**

Band	Antenna Gain (dBi)	Maximum Conducted Power (dBm)	Maximum EIRP (dBm)	Maximum EIRP (mW)	Power Density at 20cm (W/m <sup>2</sup> )	Limit (W/m <sup>2</sup> )
Bluetooth	3.30	4.77	-0.9	0.81	0.002	5.351
Zigbee	3.30	4.73	2.0	1.60	0.003	5.355

### **Conclusion:**

According to ISSED RSS-102 Issue 5, the RF exposure analysis concludes that the RF Exposure is ISSED compliant.