



Design. Create. Certify. *Connect.*  TESTING CERT #1255.01

W66 N220 Commerce Court • Cedarburg, WI 53012

Phone: 262.375.4400 • Fax: 262.375.4248

[www.lsr.com](http://www.lsr.com)

---

SAR Test Exclusion Exhibit For:

SaBLE-x

Prepared by:

Shane D. Rismeyer, EMC Engineer

4/24/2015

## Contents

Product Description: .....	3
Associated Antenna(s): .....	4
Statement of compliance:.....	4
Separation Distance: .....	5
SAR Test Exclusion Threshold: .....	6
Data and calculation: .....	6

## **Product Description:**

The SaBLE-x module fully supports the single mode Bluetooth Low Energy operation, and the output power can support class 2. The module provides the ability to either put your entire application into the integrated ARM Cortex M3 microcontroller, or use the module in Network Processor mode in conjunction with the microcontroller of your choice. RF Core's dedicated ARM Cortex M0 improves system performance and frees up FLASH memory for custom applications.

**Associated Antenna(s):**

Dipole – 2dBi Peak Antenna Gain

Flex PIFA – 2dBi Peak Antenna Gain

Flex Notch – 2 dBi Peak Antenna Gain

Trace – 0 dBi Peak Antenna Gain

**Statement of compliance:**

SaBLE-x was evaluated against the SAR test exclusion threshold listed in KDB 447498 D01 General RF Exposure Guidance v05r02, section 4.3 (1). The EUT was found to be compliant with the SAR exclusion threshold for 100MHz to 6000MHz. Evaluation was performed using a distance of 5 mm.

**Separation Distance:**

The lowest separation distance is assumed. (5mm)

## SAR Test Exclusion Threshold:

Extremities SAR test exclusion threshold for 1000MHz to 6GHz at minimum separation distance of  $\leq 50\text{mm}$ .

1-g SAR test exclusion threshold equation:

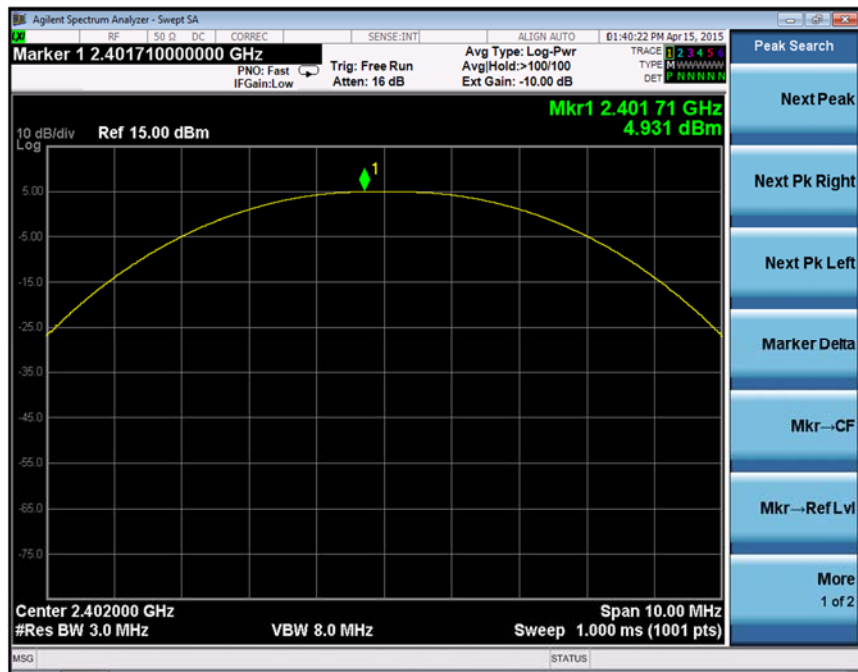
$$[(\text{maximum power of channel including tune-up tolerance}) / (\text{minimum separation distance})] * [\sqrt{f_{(\text{GHz})}}] \leq 3.0$$

## Data and calculation:

Maximum Conducted Output Power:

Channel	Frequency (MHz)	Power (dBm)	Limit (dBm)	Margin (dBm)
1	2402	4.9	30	25.1
19	2440	4.7		25.3
39	2480	4.3		25.7

## Screen Capture of maximum output power



**Comparison to SAR threshold:**

The output power used in the calculation below is the highest output power available by the device. This output power was determined to be at 2462MHz (channel 11) and when the radio is operating in the 802.11g mode (54MBPS).

Frequency = 2.402 GHz

Output power = 4.9 dBm

Output power = **3.1** mW

Minimum separation distance = 5 mm

$$[3.1\text{mW}/5\text{mm}][\sqrt{2.402\text{GHz}}] = \mathbf{0.961 < 3.0}$$



## MPE Calculation:

The following MPE calculations are based on a measured conducted RF power of +4.9 dBm as presented to the antenna. The peak gain of this antenna, based on the data sheet is 2 dBi.

### Prediction of MPE limit at a given distance

Equation from page 18 of OET Bulletin 65, Edition 97-01

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

where: S = power density

P = power input to the antenna

G = power gain of the antenna in the direction of interest relative to an isotropic radiator

R = distance to the center of radiation of the antenna

Maximum peak output power at antenna input terminal:	4.90 (dBm)
Maximum peak output power at antenna input terminal:	3.090 (mW)
Antenna gain(typical):	2 (dBi)
Maximum antenna gain:	1.585 (numeric)
Prediction distance:	20 (cm)
Prediction frequency:	2400 (MHz)
PE limit for uncontrolled exposure at prediction frequency:	1 (mW/cm <sup>2</sup> )
Power density at prediction frequency:	0.000974 (mW/cm <sup>2</sup> )
Maximum allowable antenna gain:	32.1 (dBi)
Margin of Compliance at 20 cm =	30.1 dB