

RF Exposure Evaluation Report

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Tested device:	RD8200SG Multi-purpose precision locator		
Related reports:	UL-SAR-RP14876167JD27A V3.0 FCC ID_SQGBL652_BLE_MPE RF exp report		
Testing has been carried out in accordance with:	47CFR §2.1093 Radiofrequency Radiation Exposure Evaluation: Portable Devices KDB447498 D04 v01 interim guidance		
Documentation:	The test report must always be reproduced in full; reproduction of an excerpt only is subject to written approval of the testing laboratory		
Test Results:	The EUT complies with the requirements in respect of all parameters subject to the test. The test results relate only to devices specified in this document		
Date and signatures:	11.12.2024		

Laboratory Manager

Miia Nurkkala

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1. EVALUATION SUMMARY

1.1 Test Details

Device under Test (DUT):

Product:	RD8200SG Multi-purpose precision locator
Manufacturer:	Radiodetection Ltd
Model:	RD8200SG
Hardware Version:	P2
FCC ID:	Contains FCC ID: K68-CLASSIC, FCC ID: SQGBL652
FCC Test Firm Designation Number:	FI0005
Document ID:	FCC_RF Exposure Evaluation_RD8200SG Multi-purpose precision locator_ID7061_13112024.docx
Document History:	Initial version

1.2 Evaluation Results

1.2.1 Standalone Exposure

The device conforms to the requirements of the standards when the maximum output power is less than or equal to the Test Exclusion Threshold Limit.

System	Maximum Power* [mW]	Extremity Test Exclusion Threshold Limit [mW]	Separation Distance [mm]	Evaluation Result
Module BLE #2	3.16	6.79	< 5	PASS
Module BLE #4	3.16	6.79	< 5	PASS

*According to Appendix A at 447498 Interim General RF Exposure Guidance, the equation (B.2.) defines the thresholds for available maximum time-averaged power or maximum time-averaged ERP, whichever is greater

The device conforms to the requirements of the standards when the maximum reported SAR value is less than or equal to the limit. The SAR limit specified in FCC 47 CFR part 2 (2.1093) Extremity SAR_{10g} is 4.0 W/kg.

System	Highest Reported* SAR _{10g} (W/kg) in Extremity Exposure Condition, 0mm separation distance	Result
Module Bluetooth #1	0.13	PASS
Module Bluetooth #3	0.3	PASS

*Results measured in SAR report UL-SAR-RP14876167JD27A V3.0.pdf

1.2.2 Simultaneous Transmission Exposure

The device conforms to the requirements of the standards when the maximum summed SAR value is less than or equal to the limit. The SAR limit specified in FCC 47 CFR part 2 (2.1093) Extremity SAR_{10g} is 4.0 W/kg.

Highest Simultaneous Transmission SAR	Σ SAR _{10g} [W/kg]	Result
BLE#2 + BLE#4	0.94	PASS

2. DESCRIPTION OF THE DEVICE UNDER TEST (DUT)

The DUT is a handheld portable precision cable locator device containing following pre-approved radio modules:

Bluetooth Classic module #1 (FCC ID: K68-CLASSIC)

Bluetooth BLE module #2 (FCC ID: SQGBL652)

Bluetooth Classic module #3 (FCC ID: K68-CLASSIC)

Bluetooth BLE module #4 (FCC ID: SQGBL652)

Modules #1 and Modules #3 have been SAR tested in report report UL-SAR-RP14876167JD27A V3.0. The highest SAR_{10g} value measured for Classic module #3 is 0.30 W/kg and 0.13 W/kg for Bluetooth Classic module #1.

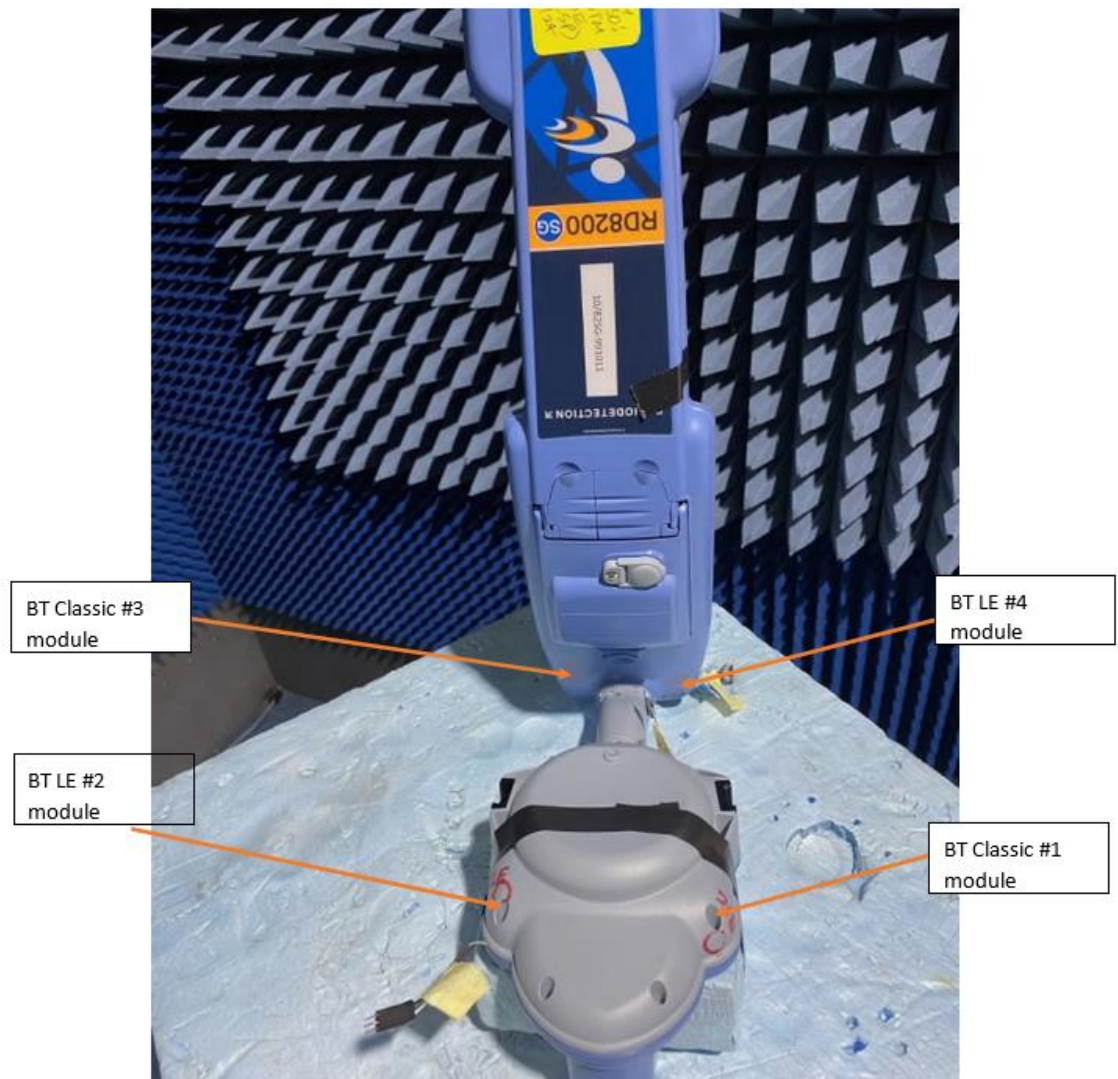


Figure 1. Overview of the DUT

Maximum power and antenna gain for modules #2 and #4 are shown in FCC ID_SQGBL652_BLE_MPE RF exp report.

Simultaneous transmission possibilities:

Bluetooth LE module #2 + Bluetooth LE module #4

Bluetooth Classic module #3 + Bluetooth LE module #2

Bluetooth Classic module #3 + Bluetooth Classic module #1

Exposure Environment	General population, uncontrolled
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2.1 Supported Frequency Bands and Operational Modes

TX Frequency bands	Modes of Operation	Transmitter Frequency Range [MHz]	Maximum Specified Output Power [dBm]
	Bluetooth Low Energy	2402 – 2480	5
	Bluetooth Low Energy	2402 – 2480	5
	Bluetooth Classic	2402 – 2480	16
	Bluetooth Classic	2402 – 2480	16

3. TEST EXCLUSIONS

FCC SAR test exclusion threshold is calculated according to 447498D04 Interim General RF Exposure Guidance, equation B.2 and B.1:

$$P_{th} (mW) = \begin{cases} ERP_{20\text{ cm}} (d / 20\text{ cm})^x & d \leq 20\text{ cm} \\ ERP_{20\text{ cm}} & 20\text{ cm} < d \leq 40\text{ cm} \end{cases} \quad (\text{Equation 1})$$

where

$$x = -\log_{10} \left(\frac{60}{ERP_{20\text{ cm}} \sqrt{f}} \right) \quad (\text{Equation 2})$$

and f is in GHz, d is the separation distance (cm), and ERP20cm is per Equation 3 (B.1) below.

$$ERP_{20\text{ cm}} (mW) = \begin{cases} 2040f & 0.3 \leq f < 1.5\text{ GHz} \\ 3060 & 1.5\text{ GHz} \leq f \leq 6\text{ GHz} \end{cases} \quad (\text{Equation 3})$$

For extremity conditions P_{th} can be multiplied by a factor of 2.5.

Modes of Operation	Frequency [MHz]	Separation Distance [mm]	Extremity P_{th} [mW]
Bluetooth/BLE	2480	5	6.79

4. RESULTS

4.1 Maximum defined Output Power and ERP

According to Appendix A at 447498D04 Interim General RF Exposure Guidance, equation (B.2.) defines the thresholds for available maximum time-averaged power or maximum time-averaged ERP, whichever is greater.

System	Frequency [MHz]	Time averaging factor	Time-Averaged input power input to Antenna, P [mW]	Time-Averaged input power input to Antenna, P [dBm]	Power Gain of Antenna, G [dBi]	Time-Averaged ERP [dBm]	Time-Averaged ERP [mW]	Limit [mW]
BLE #2	2480	1	3.16	5	2	4.85	3.05	6.79
BLE #4	2480	1	3.16	5	2	4.85	3.05	6.79

Since the maximum output power is greater than ERP, it is used for SAR test exclusion. Maximum output power for test exclusion is below the test exclusion threshold.

4.1.1 Estimated SAR

For simultaneous transmission evaluation the estimated standalone SAR values for modules BLE #2 and BLE #4 are calculated according to the following equation below.

$$SAR_{estimated} = SAR_{Limit} * 0.25 * P_{ant}/P_{th} [W/kg]$$

$$Estimated BLE SAR_{10g} = 1 * (3.16/6.79) = 0.47 W/kg$$

4.2 Simultaneous Transmission Analysis

The simultaneous transmission compliance is determined by directly summing up the SAR - values of simultaneously transmitting modules.

Following simultaneous transmission combinations are supported:

- BLE#2 + BLE#4
- BLE#2 + Bluetooth#3
- Bluetooth #3 + Bluetooth #1

Modes of Operation	$\Sigma SAR_{10g} [W/kg]$
BLE#2 + BLE#4	0.47+0.47=0.94
BLE#2 + Bluetooth#3	0.47+0.3=0.77
Bluetooth#3+ Bluetooth#1	0.3+0.13=0.43