

# RF Exposure Evaluation

**FCC ID: PGUVS100**

The radio module is seeking authorization for both mobile use and for a specific portable implementation in the Welch Allyn Spot Vision Screener Model VS100. Compliance with MPE limits and exclusion from SAR testing is described below:

## Mobile Use - MPE Compliance

For mobile use, the radio module will be used greater than 20cm from the user's head and torso.

### FCC KDB 447498 D01 v05r02, Section 7.1

"KDB 447498 D01 General RF Exposure Guidance v05r02" provides the procedures, requirements, and authorization policies for mobile and portable devices. Section 7.1 best fits the exposure condition described in this report. Since these mobile devices are categorically excluded from routine evaluation; simple calculations may be used to estimate the power density to demonstrate compliance with 47 CFR 1.1310 requirements. The following estimate shows MPE limits are met for simultaneous transmission at a 20 cm boundary.

The exposure level for the radio is evaluated at a 20 cm distance from the radio's transmitting antenna using the general equation:

$$S = \frac{P * G}{4 * \pi * R^2}$$

Where: S = power density (mW/cm<sup>2</sup>)

P = RMS conducted power input to the antenna (mW)

G = numeric power gain relative to an isotropic radiator

R = distance to the center of the radiation of the antenna ((20 cm = limit for MPE estimates)

P\*G = EIRP

Solving for S, the maximum power density 20 cm from the transmitting antenna is determined. This level is then compared to the applicable limit.

Antenna Type	Antenna Manufacturer	Antenna Part No.	Transmit Frequency	RMS Conducted Output Power	Antenna Gain	Minimum Antenna Cable Loss	Power Density @ 20 cm	General Population Exposure Limit from 1.1310
			(MHz)	(mW)	(dBi)	(dB)	(mW/cm <sup>2</sup> )	(mW/cm <sup>2</sup> )
Omni	Pulse	W1049B	2462	43.5	2	0	0.014	1

## Portable Use – SAR Test Exclusion

When the radio module is installed in the Welch Allyn Spot Vision Screener Model VS100, it is held in the hand or can be hanging on a lanyard. These usage conditions position the module's antenna closer than 20cm to the user's extremity (hand) or torso.

### FCC KDB 447498 D01 v05r02, Section 4.3.1

*"The 1-g and 10-g SAR test exclusion thresholds for 100 MHz to 6 GHz at test separation distances  $\leq 50$  mm are determined by:*

*$$\left[ \frac{\text{max. power of channel, including tune-up tolerance, mW}}{\text{min. test separation distance, mm}} \right] \cdot \left[ \frac{1}{f(\text{GHz})} \right] \leq 3.0 \text{ for 1-g SAR and } \leq 7.5 \text{ for 10-g extremity SAR,}$$*

*where*

- f(GHz) is the RF channel transmit frequency in GHz*
- Power and distance are rounded to the nearest mW and mm before calculation*
- The result is rounded to one decimal place for comparison*
- 3.0 and 7.5 are referred to as the numeric thresholds in the step 2 below*

*The test exclusions are applicable only when the minimum test separation distance is  $\leq 50$  mm and for transmission frequencies between 100 MHz and 6 GHz. When the minimum test separation distance is  $< 5$  mm, a distance of 5 mm according to 5) in section 4.1 is applied to determine SAR test exclusion."*

The radio module has a maximum RMS conducted output power of 43.5 mW at 2462 MHz (see attached output power).

When used in the Welch Allyn Spot Vision Screener Model VS100, the radio module will have a very limited duty cycle. The VS100 is intended to measure the refractive power of the eye by measuring light reflexes from the retina. The VS100 is indicated for use by healthcare professionals or under the direction of a healthcare professional. The radio module transmits images that are saved during the vision exam at a maximum rate of 1 print every 30 seconds. At the slowest data rate of 1 Mbps, the maximum number of packets (162) in a print will take 1.8 seconds to transmit. This results in a maximum duty cycle of 0.06.

## Hand held (extremity use)

The closest spacing of the antenna to the user's extremity is 8.3mm as the product can be hand held while transmitting (see photos).

The table below shows the results of the calculation. The value of 0.49 is well below the exclusion threshold of 7.5 for 10-g extremity SAR, therefore the unit is excluded from SAR evaluation and deemed compliant with FCC RF exposure requirements.

Output Power	Duty Cycle	Test Separation	Transmit Frequency	Exclusion Threshold	Specification for Extremity SAR
(mW)		(mm)	(GHz)		(10-g)
43.5	0.06	8.3	2.462	0.49	$\leq 7.5$

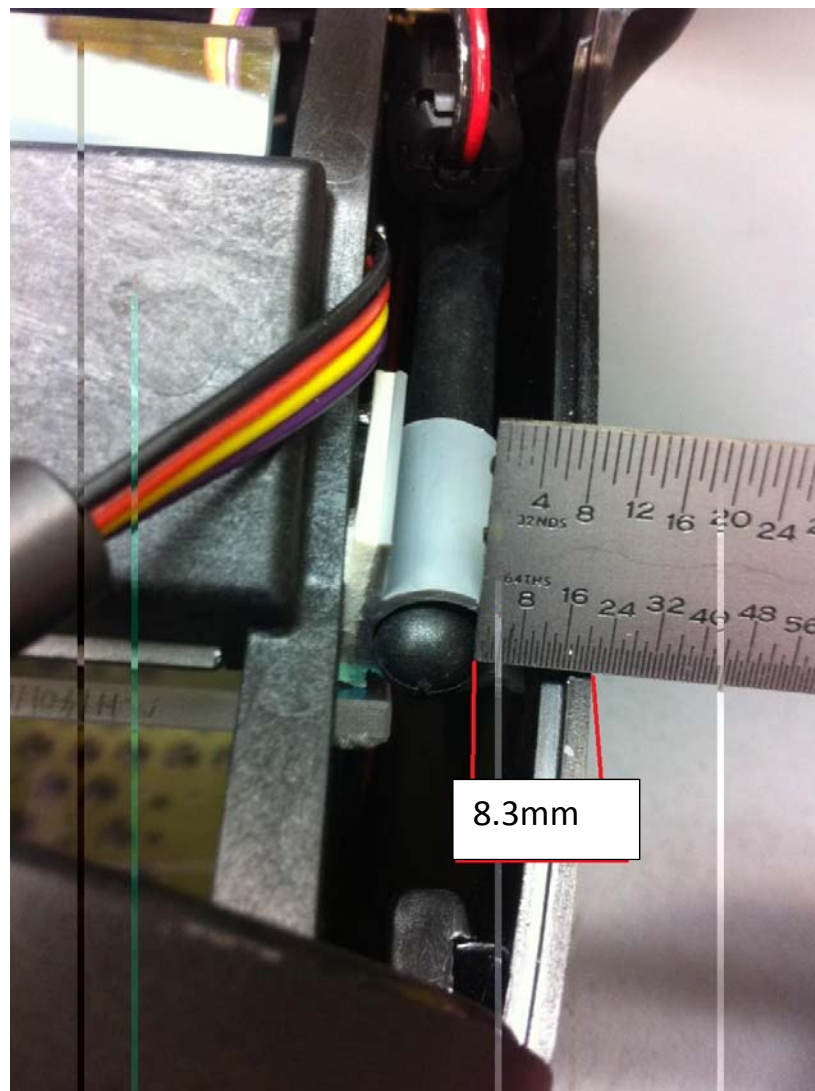
## Hanging on a Lanyard (body worn use)

The closest spacing of the antenna to the user's torso is 45mm when the VS100 is hanging on a lanyard (see photos).

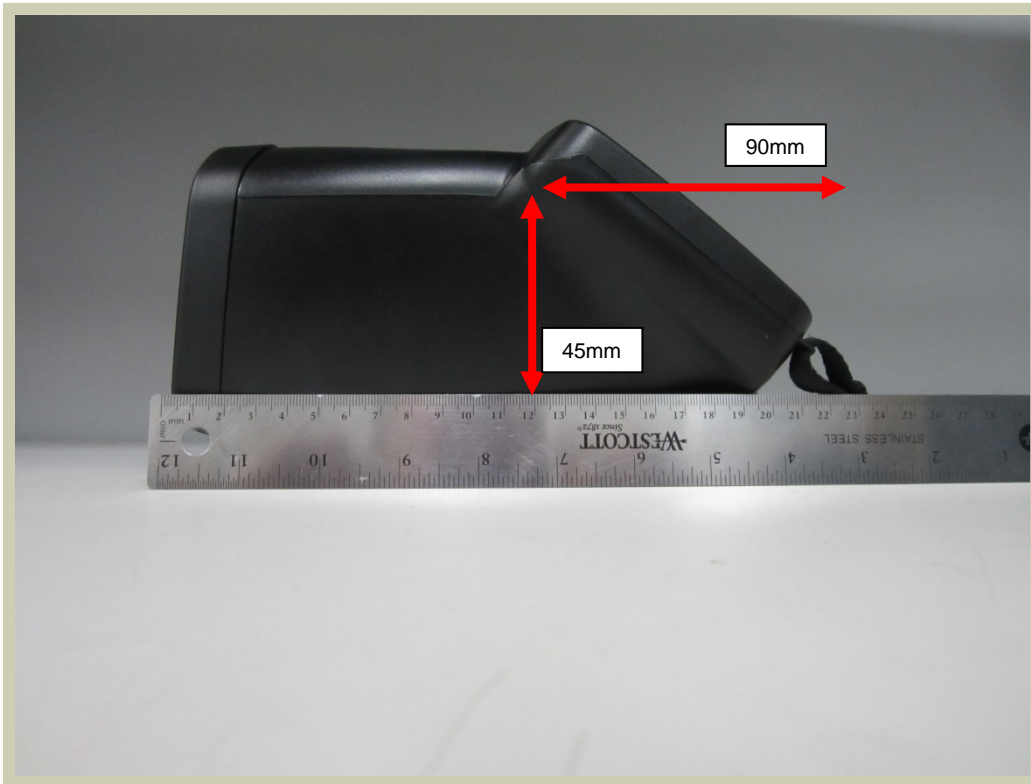
The table below shows the results of the calculation. The value of 0.09 is well below the exclusion threshold of 3.0 for 1-g body SAR, therefore the unit is excluded from SAR evaluation and deemed compliant with FCC RF exposure requirements.

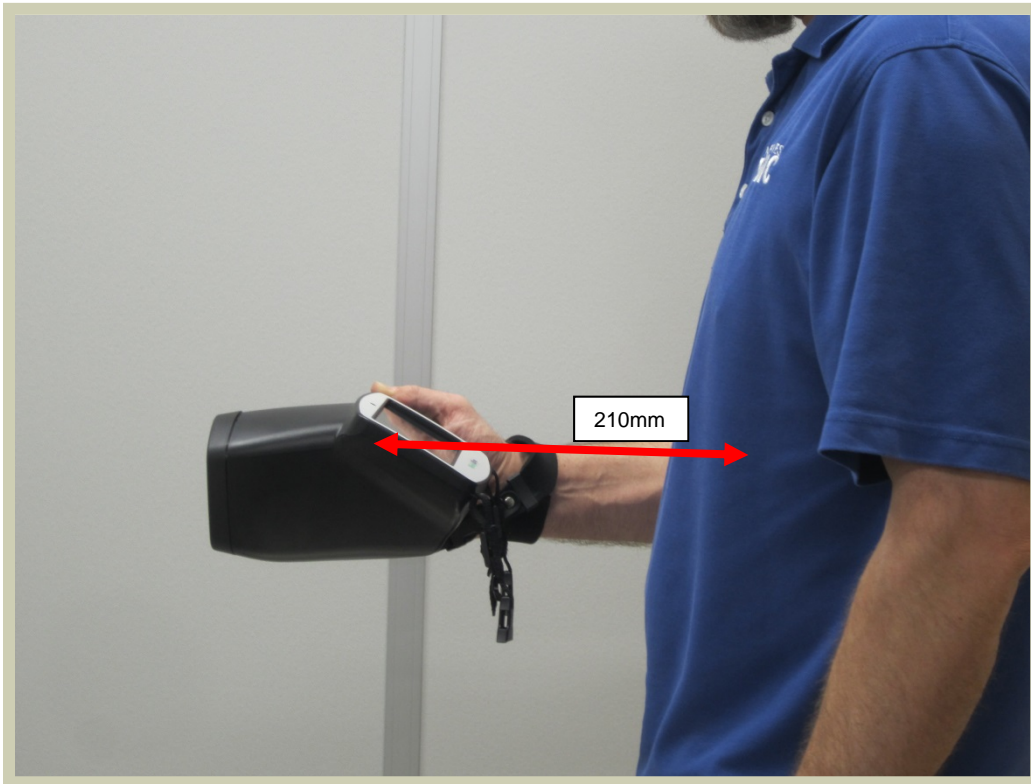
Output Power (mW)	Duty Cycle	Test Separation (mm)	Transmit Frequency (GHz)	Exclusion Threshold	Specification for Body SAR (1-g)
43.5	0.06	45	2.462	0.09	$\leq 3.0$


## Photos



Spacing of internal antenna to the outside of the case.





NORTHWEST <b>EMC</b>		<b>Output Power</b>		:Mit 2011.01.18	
EUT: Bluetooth and Wireless LAN Module			Work Order: PROT0338		
Serial Number: E3730BG4098			Date: 01/06/15		
Customer: Welch Allyn Protocol			Temperature: 22.4		
Attendees: None			Humidity: 41%		
Project: eSOM3730			Barometric Pres.: 1024.8		
Tested by: Luke Richardson/Ethan Schoonover		EUT Power: 5 VDC	Job Site: EV08		
TEST SPECIFICATIONS			Test Method		
FCC 2.1093:2012			FCC KDB 447498		
COMMENTS					
Power Level Set to 15dBm. Equipment codes used: ECB, AWS, SQR, TIH					
DEVIATIONS FROM TEST STANDARD					
None					
Configuration #	1				

Channel	Frequency (MHz)	Radio Mode	Conducted Power (RMS)		Antenna Port 1 dBm	W
			Data Rate (Mbps)	Modulation		
1	2412	802.11b	1	BPSK	16.1	40.272
			11	CCK	16.3	42.658
		802.11g	6	BPSK	16.2	41.210
			54	64 QAM	15.9	38.905
		802.11n	MCS0	BPSK	16.0	39.811
			MCS7	64 QAM	16.0	39.355
6	2437	802.11b	1	BPSK	15.9	38.905
			11	CCK	16.3	42.658
		802.11g	6	OFDM	16.2	41.210
			54	OFDM	15.9	38.905
		802.11n	MCS0	OFDM	16.1	40.738
			MCS7	OFDM	16.0	39.811
11	2462	802.11b	1	BPSK	16.0	39.628
			11	CCK	16.4	43.451
		802.11g	6	OFDM	16.2	41.976
			54	OFDM	16.1	40.738
		802.11n	MCS0	OFDM	16.2	41.687
			MCS7	OFDM	16.2	41.976