

#### Title: RF Exposure Considerations for INPW

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## 1.0 PURPOSE

The purpose of this document is to show compliance with FCC MPE/SAR requirements for the Intelio Programming Wand in accordance with 47 CFR 1.1310, 2.1091, 2.1093, and 95.2585.

# 2.0 INTERNAL REFERENCES PROVIDED TO FCC

- 2.1 NTS\_FCCPart15\_Rev0\_INPW
- 2.2 NTS\_FCCPart95\_Rev0\_INPW

#### 3.0 EXTERNAL REFERENCES

- 3.1 47 CFR Chapter I Federal Communications Commission
- 3.2 FCC OET KDB Document 447498 D01 RF Exposure Procedures and Equipment Authorization Policies for Mobile and Portable Devices

## 4.0 ACRONYMS

- 4.1 FCC Federal Communications Commission
- 4.2 KDB Knowledge Data Base
- 4.3 IPG Implantable Pulse Generator
- 4.4 INPW Intelio Programming Wand
- 4.5 MPE Maximum Permissible Exposure
- 4.6 SAR Specific Absorption Rate
- 4.7 ULP-AMI Ultra-Low Power Active Medical Implant

## 5.0 BACKGROUND INFORMATION

The Impulse Dynamics Intelio Programming Wand is a peripheral for use with ultra-low-power activemedical-implants. The INPW programs compatible Impulse Dynamics IPGs for hospital use by health care providers. The INPW charger contains two relevant intentional RF emitters for SAR/MPE consideration; a 402-405MHz MICS MedRadio that uses a ZL70103 transceiver and a custom recharge channel protocol for a low data rate key exchange operating via a near-field inductive link at the ISM frequency of 13.56MHz.

## 6.0 ANTENNA INFORMATION

The Intelio Programming Wand contains two antennas:

- 1. A 402-405 MHz antenna for MICS MedRadio to communicate with the ULP-AMI
- 2. 13.56 MHz antenna for encryption key exchange

The antennas in this device do not co-transmit, therefore only standalone test exclusions are necessary. All measurements were performed radiated and therefore no additional antenna information is required for FCC certification for the 402-405 MHz MICS antenna and the 13.56 MHz encryption key antenna.

## 7.0 CALCULATED LIMITS



**PULSE** 

In accordance with FCC KDB 447498 D01 section 4.3.1, the SAR test exclusion threshold can be calculated for each frequency of interest at a specified test separation distance. As the INPW is a body-worn device and will have possible operating distance <5mm, according to section 4.1 (f), a distance of 5mm will be applied to the exclusion threshold calculation. For the Medradio system in the INPW, the operating frequency is 0.402 to 0.405 GHz. Therefore, the equation for SAR exclusion must be calculated according to section 4.3.1(a) to be:

$$P_{SAR \; Exclusion} \leq 3.0 \cdot \frac{d_{test \; separation}}{\sqrt{f_{GHz}}}$$

For the 13.56MHz ISM system in the INPW, the operating frequency is 13.56 MHz, therefore, the equation for SAR exclusion must be calculated according to section 4.3.1(c)(2) to be:

$$P_{SAR \; Exclusion} \leq \frac{1}{2} * \left[ \left( 1 + log \left( \frac{100}{f_{MHz}} \right) \right) * 474 \right]$$

where 474 is the value from 
$$4.3.1(b)$$
 per Appendix B

# 8.0 RESULTS

Conducted power measurements for the INPW for SAR exclusion were found in the table below during testing benchtop testing and from datasheets where available. Additional tolerance factors for tune-up procedures for the 13.56 MHz antenna is required as this is a bench measured conducted power.

Frequency	KDB 447498 Equation	Peak Conducted Power	Exclusion Threshold
402-405 MHz	4.3.1(a)	0.398 mW	<24 mW
		-4 dBm	13.8 dBm
13.56 MHz	4.3.1(c)(2)	1.15 mW	<442.6 mW
		0.61 dBm	26.5 dBm

To apply a conservative estimate, during production the RF performance of both emitters is measured and adjusted with a  $\pm$ 6dB range. In addition, the expanded uncertainty for radiated field strength was recorded as  $\pm$ 3.6dB. Combining worst-case measurement uncertainty and tuning variability,  $\pm$ 9.6dB can be applied as a conservative margin.

The ZL70103 transceiver of the 402-405 MHz antenna has a typical output power of -4.0dBm when supplied by 3.3V as is the case for this device.

The 13.56 MHz antenna is powered by a class D amplifier, that has a peak current of 0.23 mA on a 5V supply, for total conducted power of 1.15 mW, or 0.61 dBm, peak falling below the 26.5 dBm exclusion threshold including when adding in the 9.6dBm in tune up tolerance.

It is concluded that the maximum possible RF exposure is below all relevant exclusion thresholds and SAR exclusion applies.



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9.0 **REVIEW** 

This report and its findings were written and signed by:

bh

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