

# Construction of a Wireless-Enabled Endoscopically Implantable Sensor for pH Monitoring with Zero-Bias Schottky Diode-based Receiver

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## Materials

Name	Company	Catalog Number	Comments
AG1 battery	Panasonic	SR621SW	Two batteries per one implant
Battery holder	MYOUNG	MY-521-01	
Copper enamel wire for the antenna	pro-POWER	QSE Wire - 0.15 mm diameter, 38 SWG	
Epoxy for encapsulation	Loctite	EA M-31 CL	Two-part medical-grade ISO10993 compliant epoxy
FEP cable for pH sensor	Molex / Temp-Flex	100057-0273	
Flux cleaner	Shesto	UTFLLU05	Prepare 5% solution in deionized water for cleaning by sonication
Hemostatic clip	Boston Scientific	Resolution	
Hot air gun + soldering iron	W.E.P.	Model 706	Any soldering iron capable of soldering with tin and hot-air gun capable of maintaining 260 °C can be used
Impedance matching software	Iowa Hills Software	Smith Chart	Can be downloaded from <a href="http://www.iowahills.com/9SmithChartPage.html">http://www.iowahills.com/9SmithChartPage.html</a> - alternatively, any RF design software supports calculation of impedance matching components
ISFET pH sensor on a PCB	WinSense	WIPS	Order a model pre-mounted on a PCB with on-chip gold reference electrode
Laboratory pH meter	Hanna Instruments	HI2210-02	Used with HI1131B glass probe
Microcontroller programmer	Microchip	PICKIT 3	Other PIC16 compatible programmers can be also used
Pig stomach with esophagus	Local pig farm	Obtained from approx. 40–50 kg pig	It is important that the stomach includes a full length of the esophagus.
Printed circuit board - receiver	Choose preferred PCB supplier	According to pcb2.zip data	One layer, 0.8 mm thickness, FR4, no mask

Printed circuit board - sensor	Choose preferred PCB supplier	According to pcb1.zip data	Two-layer with PTH, 0.6 mm thickness, FR4, 2x mask
Receiver - 0R	Vishay	CRCW04020000Z0EDC	See Figure 12 and Figure 13 for placement
Receiver - 1.5 pF	Murata	GRM0225C1C1R5CA03L	See Figure 12 and Figure 13 for placement
Receiver - 100 pF	Murata	GRM0225C1E101JA02L	See Figure 12 and Figure 13 for placement
Receiver - 33 nH	Pulse Electronics	PE-0402CL330JTT	See Figure 12 and Figure 13 for placement
Receiver - RF schottky diodes	MACOM	MA4E2200B1-287T	See Figure 12 and Figure 13 for placement
Receiver - SMA antenna	LPRS	ANT-433MS	
Receiver - SMA connector	Linx Technologies	CONSMA001	See Figure 12 and Figure 13 for placement
Sensor - C1	Murata	GRM0225C1H8R0DA03L	8 pF 0402 capacitor
Sensor - C2	Murata	GRM0225C1H8R0DA03L	8 pF 0402 capacitor
Sensor - C3	Murata	GCM155R71H102KA37D	1 nF 0402 capacitor
Sensor - C4	Murata	GRM0225C1H1R8BA03L	1.8 pF
Sensor - C5	Vishay	CRCW04020000Z0EDC	Place 0R 0402 resistor or use to match the antenna
Sensor - C6	Murata	GRM155C81C105KE11J	1 uF 0402 capacitor
Sensor - C7	Murata	GRM155C81C105KE11J	1 uF 0402 capacitor
Sensor - C8	Murata	GRM022R61A104ME01L	100 nF 0402 capacitor
Sensor - IC1	Microchip	MICRF113YM6-TR	MICRF113 RF transmitter
Sensor - IC2	Microchip	PIC16LF1704-I/ML	PIC16LF1704 low-power microcontroller
Sensor - R1	Vishay	CRCW040210K0FKEDC	10 kOhm 0402 resistor
Sensor - R2	Vishay	CRCW040233K0FKEDC	33 kOhm 0402 resistor
Sensor - R3	Vishay	CRCW04021K00FKEDC	1 kOhm 0402 resistor
Sensor - R5	Vishay	CRCW040210K0FKEDC	10 kOhm 0402 resistor
Sensor - X1	ABRACON	ABM8W-13.4916MHZ-8-J2Z-T3	3.2 x 2.5 mm 13.4916 MHz 8 pF crystal
Titanium wire	Sigma-Aldrich	GF36846434	0.125 mm titanium wire
Vector network analyzer	mini RADIO SOLUTIONS	miniVNA Tiny	Other vector network analyzers can be used - the required operation frequency is 300–500 MHz, resolution bandwidth equal or lower than 1 MHz, output power of no more than 0 dBm and dynamic range preferably better than 60 dB for the receiving front-end