REGULATORY TECHNICAL DESCRIPTION

Patient TAG 2

Revision 0.2 -- 28 November 2000

Document Number: 970-000023-000
Project Number: 2000-025

REVISION	DATE	CHANGED BY	DESCRIPTION
0.1	08/11/00	B. BARLOW	ORIGINAL
0.2	28/11/00	B. Barlow	Corrected Figure titles, Add Note p.7 Add RBC note p. 6

1 PURPOSE

This document is a technical description of the Patient TAG 2 (or PTAG2) product for the expressed use in regulatory evaluation. Some details are considered proprietary and confidential; therefore, reproduction or transmission of any part or in whole and in any form without consent of EXI Wireless Systems Inc. is expressly prohibited.

2 THEORY OF OPERATION

The primary function of the PTAG2 (TAG) is to identify itself to an EXI TAG monitoring system. The TAG is a battery powered active device that communicates with system controllers wirelessly. Over the air communication is full duplex using pulse width coded OOK modulation. The Controller communicates with and identifies the TAG by means of a proprietary wireless protocol. A Controller generates a local pulsed RF field at 307 kHz, and a TAG in the field will respond at 433.92 MHz. The 'tag in field' (TIF) identification is accomplished in a full duplex burst of code. The patented bit-by-bit protocol is inherently anti collision. After identification, the tag will not respond to the low frequency field for at least 11 seconds.

The Patient TAG 2 uses a patented body sensor to detect an off body event and transmits its ID in a single burst of Pulse Width coded OOK modulation at 433.92 MHz.

The TAG is designed to meet the limits of FCC Part 15.231(e) for unlicensed operation.

2.1 307 kHz RECEIVER

The receiver is single conversion with a Local Oscillator at 304 kHz, ± 1 kHz. The IF Bandwidth is nominally 2 kHz. The 307 kHz receive antenna is internal to the sealed plastic case.

2.2 433.92 MHz TRANSMITTER

The transmitter is a single stage, on-off keyed oscillator, stabilized by a SAW resonator. An integral wire loop antenna is the load for the oscillator and is inaccessible to the user. Frequency stability is ± 75 kHz.

2.3 PROCESSOR and I/0

An 8-bit microprocessor, running at 20.75 kHz from a fundamental 83 kHz crystal oscillator, pulse modulates the 433.92 MHz transmit signal and decodes the received baseband 307 kHz data stream. The processor is normally powered down and is energized when a 'Wake-up' signal is decoded by hardwired logic, or when an 'off body' sensor flag is detected. The processor, therefore runs only during communication with the RFID system.

3 DATA WAVEFORMS

3.1 TAG IN FIELD (TIF) Communication Signals

The upper trace (2) in Figure 3.1 is the decoded 433.92 MHz signal transmitted by the TAG in response to the 'Wake-up and Respond' signal transmitted by a Controller at 307 kHz, lower trace (1) of Figure 3.1. This generates the maximum communication duty cycle for the 433.92 MHz signal in this mode. The maximum duty cycle over a 100 msec period is 0.1125. This is based on a maximum peak power transmission of 25 pulses of 350 usec and 5 pulses of 500 usec during a 100 msec period. The maximum 433.92 MHz signal burst duration in TIF mode is 85 msec. The TAG will not repeat this process unless in the field for more than 60 seconds.

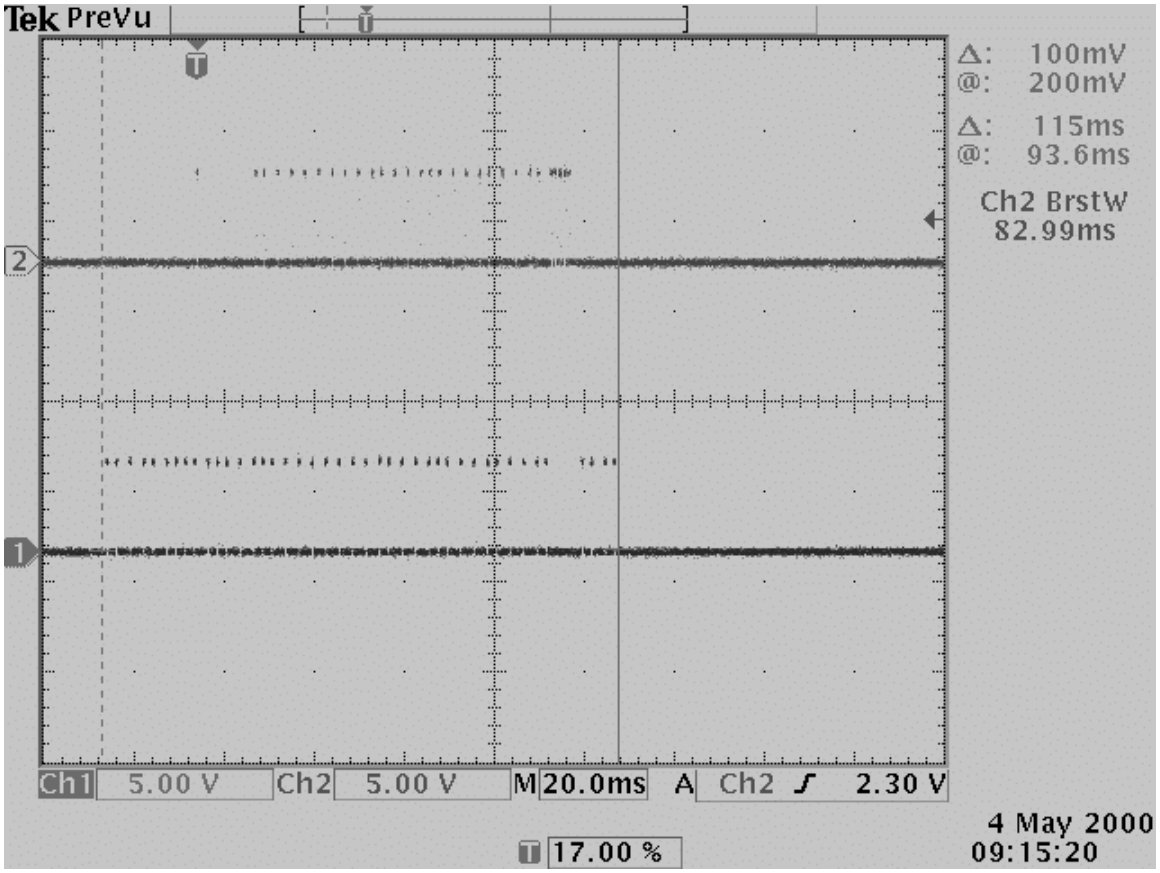

FIG 3.1 Upper Trace (2): Decoded 433.92 MHz Tag ID Response Data Stream
Lower Trace (1): TX Wake UP, Respond & Interrogate Data Stream

3.2 TAG Initiated Communication (TIC) Signal

When the processor is awakened and detects an off body signal, it initiates a one-way communication (TIC message) to the system Controllers and Receivers. This is a single burst of code from which the system determines the ID of the TAG and 'off-body' alarm condition. Figure 3.2 is the baseband decoded 433.92 MHz signal transmitted by the TAG. This is pulse-width encoded OOK modulation. The maximum duty cycle occurs for an AA AA AA AA hex code sequence repeated three times. The pattern transmitted will be unique to each TAG in that it is constituted of 3 bytes of unique ID and one byte of checksum. In each case the duty cycle will be less than the maximum pattern, therefore the use of the maximum duty cycle for peak to average power adjustment includes a factor of safety. The maximum signal duration (FF FF FF FF) sequence would be 65 msec. The maximum duty cycle over a 100 msec sample time would be 0.27 based on the AA AA AA AA code. Note that each Byte is appended with a 250 usec stop bit. The message is repeated at intervals of 11 seconds minimum, doubling to a nominal message repetition interval of 2 minutes. The 'Off body' alarm is defeated by placing the TAG on the patient or within its conductive storage package.

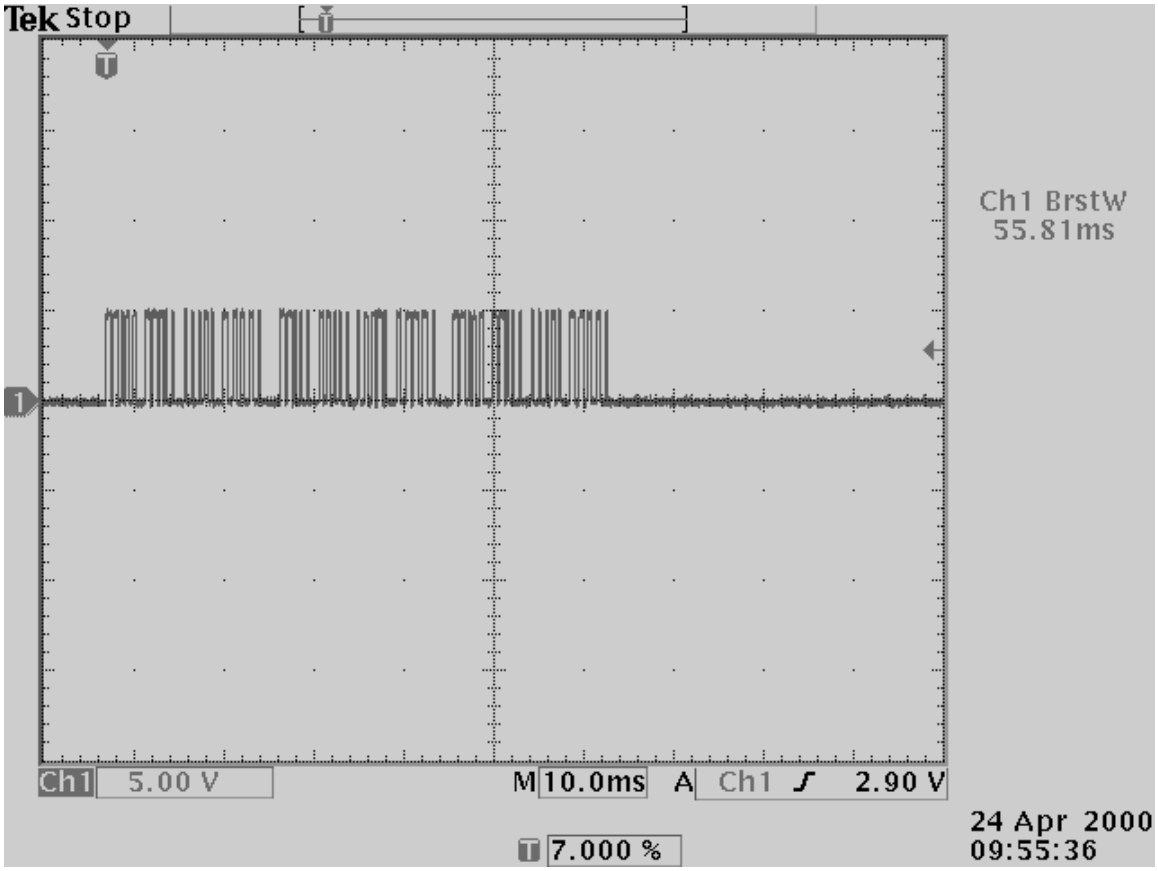

FIG 3.2 Decoded 433.92 MHz Off Body Message

4 TESTING PTAG2 WITH R3 CONTROLLER

The EXI series of controllers are used in development and manufacturing performance verification testing. The current version is R2, EXI PN 600-000080-000.

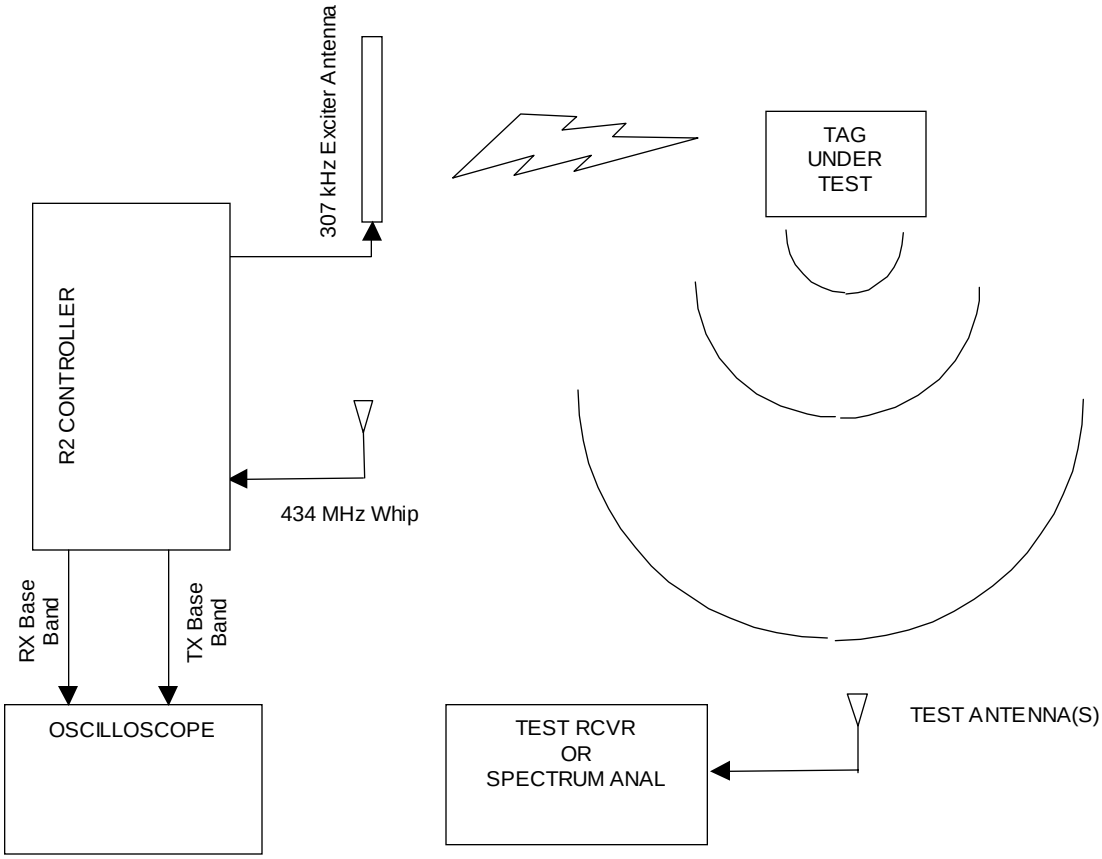

Figure 4.1: Test Setup for Evaluation with R2 controller

The TAG is excited by the 307 kHz field it will respond at 433.92 MHz in the bit-by-bit ID protocol. In the normal system operating mode, the tag would respond only once ever 60 seconds. A TEST mode is available in the Controller which forces the TAG to complete the response on every 'Wake-up and Respond' interrogation from the Controller. Using a the maximum hold trace function, a rapid display of the Transmitted spectrum and peak power can be displayed on a spectrum analyzer.

The default test settings for the Controller (see Figure 4.2) are:

MODE Switch	0
OPTION Switch	1
ID Switches	0
THRESHOLD Switch	2-4

An RBC is used to monitor the TAG alarm activity. The READY indicator will be on (GRN) when the Controller is powered. The ALARM indicator will flash continuously when the field strength is sufficient to complete the Tag In Field communication. The

ALARM indicator will display a short burst of flashes when the 'Off Body' signal is received by the controller.

NOTE: The PTAG2 product must be enclosed in its foil storage bag when not under test or for shipment.

Figure 4.2: Controller PCB