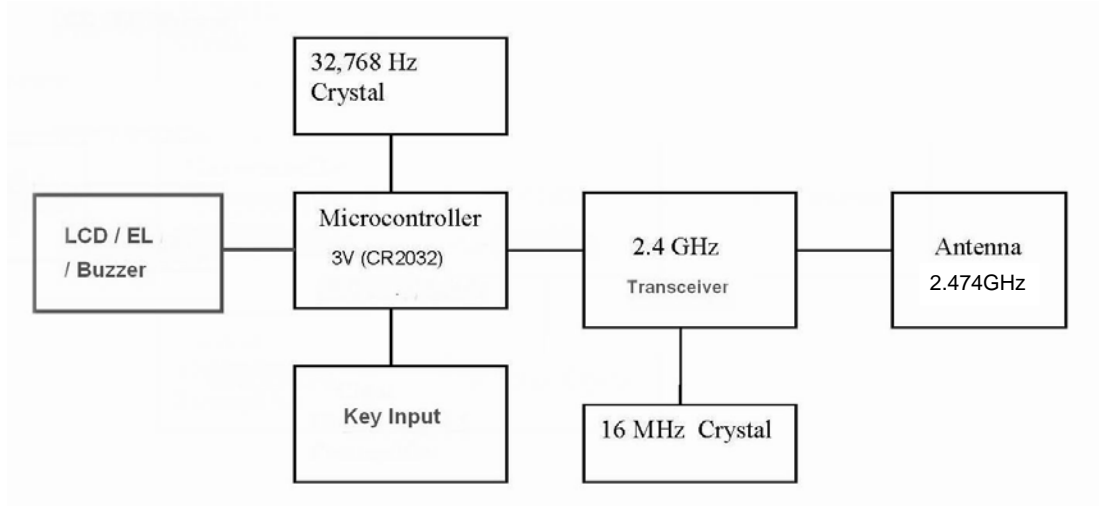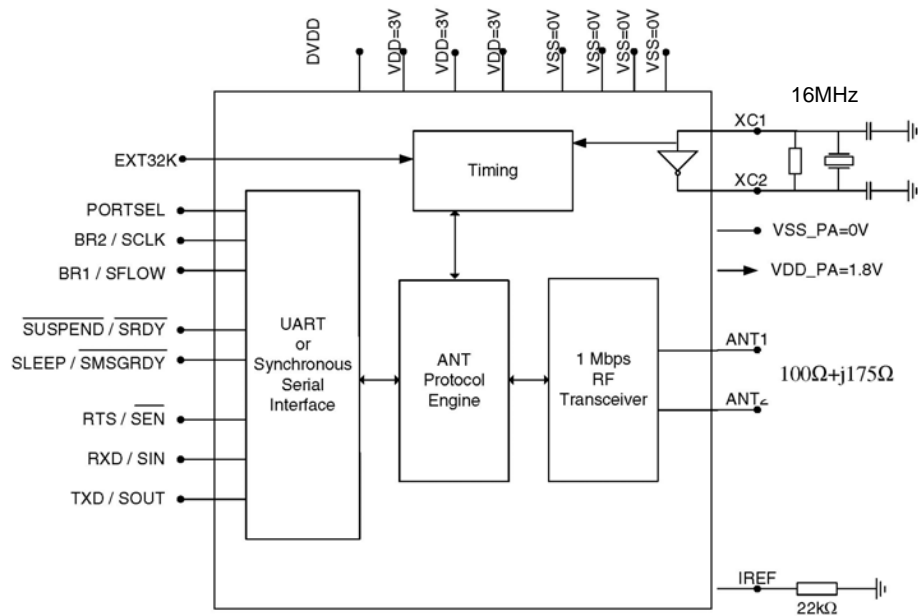# M843 Technical Operation Description

The Timex M843 is a two way 2.4G wireless HRM watch that operates in conjuction with M501 Chest strap and M502 PC Dongle. Besides the basic features of Clock, Alarm, Timer, Date, it can display and record down the Heart Rate measurement data from the Chest Strap. The heart rate value is also stored in the memory for future download via a PC. The M502 dongle is the device to download the heart rate values from the watch.

The RF IC is nRF24AP1 Single Chip 2.4GHz Radio Transceiver with Embedded ANT Protocol. The MCU get the digital data or send the digital data to nRF24AP1 via the SPI Interface and let the wireless transmission hardware & protocol handled by the RF Single chip. To the Chest Strap Radio Link, the M843 watch is only in receiving channel at 2.457GHz. To the M502 PC dongle, M843 watch is acted as transceiver in radio link operating at 2.474GHz

DVDD VDD=3V VDD=3V VDD=3V VSS=0V VSS=0V VSS=0V VSS=0V

16MHz

EXT32K

XC1

XC2

Timing

PORTSEL
BR2 / SCLK
BR1 / SFLOW

VSS_PA=0V

VDD_PA=1.8V

$\overline{\text{SUSPEND}}$ / $\overline{\text{SRDY}}$
SLEEP / $\overline{\text{SMSGRDY}}$

UART
or
Synchronous
Serial
Interface

ANT
Protocol
Engine

1 Mbps
RF
Transceiver

ANT1

ANT2

$100\Omega + j175\Omega$

RTS / $\overline{\text{SEN}}$
RXD / SIN
TXD / SOUT

IREF

22kΩ

nRF24AP1 with external components.

The nRF24AP1 is an ultra-low power single-chip radio transceiver with embedded ANT protocol for personal area networks. The transceiver's RF operating frequency range falls within the world-wide 2.4 - 2.5 GHz RF ISM band, allowing for regulatory compliance and product sales into global markets.

The transceiver consists of the ANT fully integrated protocol engine, frequency synthesizer, power amplifier, crystal oscillator and modulator, and can be interfaced to a host microcontroller over either a synchronous or asynchronous serial interface. Designed to run on a wrist-watch coin cell battery, current consumption of the device is extremely low - a typical sensor application can operate on approximately 40μA average current consumption. Short, low peak current transitions are battery friendly.

The embedded ANT protocol makes for easy, low cost integration. Eliminating the need for 3rd party RF protocol implementation, the on-chip ANT protocol combined with the 2.4GHz transceiver enables system and application developers to interact with the nRF24AP1 as a black box wireless solution. The simple serial interface (asynchronous or synchronous) to the device allows for flexibility and scalability from ultra-low power sensors (40μA) through to higher data rate (20kbps) applications implemented in a multitude of network configurations.

Reason for Change:

We find the 2.4G Radio link from the chest belt to the watch may be blocked sometime because RF power of the Chest belt and the watch receiving power of the watch is weaken by the obstacle between the body and the hands. We find the solution is to change the watch antenna receiving directional pattern to enhance the RF Link efficient. It is proved that this method is better than simply to increase the RF power.

Effect on Change and Details of Change:

In this update version, the critical change is the antenna shape. Due to the antenna is change, the RF parts layout, RF tuning network, matching para are correspondingly needed to change. However, the transmission power is not actually have much increase or decrease. Details pls. refer to the circuit and the PCB layout and the antenna photo attached.

By _____   SAM TANG _____
            Signature   Printed

Title _____ Electronic Specialist _____