Technical Specification

DBITX1 Free Balloon Envelope Temperature Wireless Transmitter

US version (914.5 MHz)

Revision History		
Date	**Description**	**Prepared**
2005-06-06	• Issued	Staffan Ralberg

Table of contents

Definitions and Abbreviations

DBI-002	DigiTool Instruments Free Balloon Flight Instrument
DBITX1	DigiTool Instruments Envelope Temperature Transmitter.
RF	Radio Frequency
MCU	Embedded micro controller unit
HW	Hardware
SW	Software
CRC	Cyclic Redundancy Check
PCB	Printed Circuit Board

Overview

The DBITX1 is a wireless transmitter monitoring free hot air balloon envelope top temperature. It transmits data to the DBI-002 flight instrument where temperature is displayed.

The unit consists of a sturdy aluminum enclosure fitted with a load tape slot attachment, exiting antenna and temperature probe wires.

The unit is power supplied with a single replaceable long life lithium cell.

RF transmit is controlled automatic by the difference of box (outside envelope) and temp probe (inside envelope) temperatures. No operator action is required.

Each unit has a unique fixed serial code that is matched with the receiver DBI-002. DBI-002 data reception is qualified by serial code and CRC transmission error detection.

Short duty cycle and low RF power data transmission enables interference free operation and multiple units to operate in close proximity.

Conforms to FCC part 15.249.

Functional description

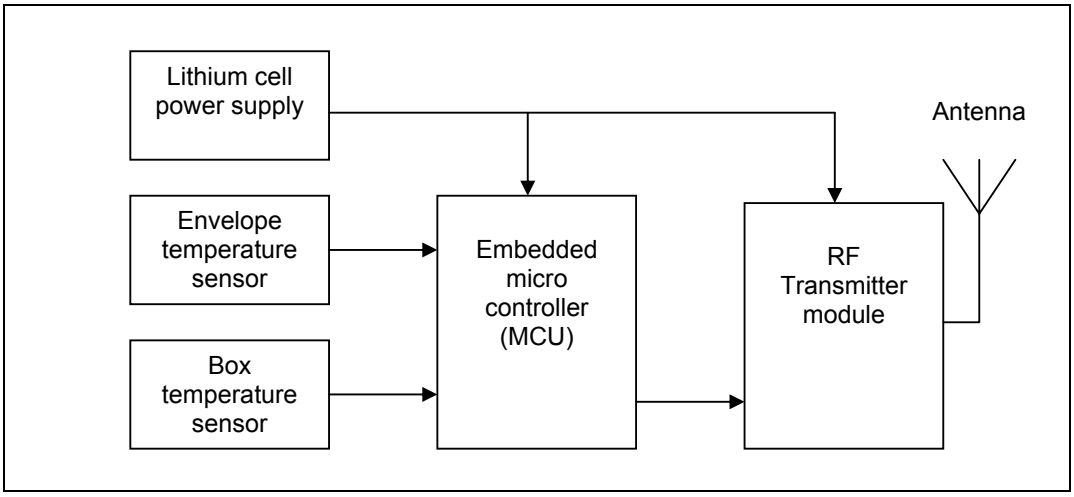
Mechanical description

The unit is enclosed in a sturdy aluminum IP65 class box. One antenna wire and one envelope temperature probe exits from each side of the box. The box contains a removable lid for lithium cell replacement.

Electronic hardware description

The complete unit is built on a single PCB mounted in the box. A single MCU interfaces two temperature sensors and one RF transmitter module. The MCU contains firmware type program memory. One sensor measures box temperature and the other balloon envelope temperature. RF transmission is achieved by a EMC compliant transmitter module.

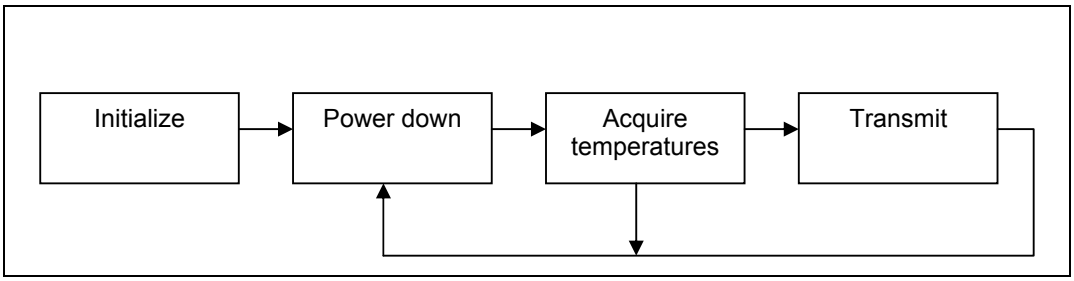
Hardware block diagram



Software description

The software acquires temperature data and controls RF data package transmissions.

Program flow bock diagram



Program flow functions

Function	Description
Initialize	Initialize MCU
Power down	Enter off state, reenter run state after 2.3 seconds.
Acquire temperatures	Acquire box and probe temperature data. • If diff temperature > 10 °F enter transmit function • If diff temperature <= 10 °F enter power down function
Transmit	Activate HW transmitter module, transmit data package, deactivate HW transmitter.

Transmit data package format

Data byte #	Type	Description
1-10	Preamble	10 bytes preamble constant (00h).
11	Synchronization	1 byte synchronization constant (80h).
12-13	Identification code	2 bytes, unsigned 16 bit transmitter unit identification code.
14-15	Temperature data	2 bytes, unsigned 16 bit probe temperature data, unit [1 °Kelvin].
16	Checksum	1 byte, unsigned 8 bit byte [12 to 15] sum.
17-18	CRC16	2 bytes, unsigned 16 bits byte [12 to 16] CRC16

Transmit format and timing

Item	Description
Data byte format	8 bits
Data bit transmit order	Bit 0 (LSB) first, bit 7 (MSB) last
Data bit transmit format	Bits are transmitted manchester coded. Data bit [1] is transmitted as transmit bits [1,0] Data bit [0] is transmitted as transmit bits [0,1]
Transmit bit duration	128 microseconds +/- 5 %
Nominal data package transmit length	18 * 8 * 2 = 288 transmitted bits 18 * 8 * 2 * 128 us = 37 milliseconds
Data package transmit repetition interval	2.3 seconds

Electrical and environmental data

Envelope thermometer accuracy

Range °F	Total error +/- °F
-15 to 32	7
32 to 122	5
122 to 167	4
167 to 257	2
257 to 302	4
302 to 347	5
347 to 392	7

Physical dimensions

Item	Value	Value
Box Length	50 mm	2.00 inch
Box Height	30 mm	1.18 inch
Box Width	45 mm	1.77 inch
Antenna wire length	90 mm	3.50 inch
Temperature wire length	254 mm	10.00 inch
Total weight	110 gram	3.9 ounce

Environmental ratings

Item	Value
Box sealing class	IP65
Box temperature High	257 °F
Box temperature Low	-22 °F
Envelope temperature probe High	347 °F
Envelope temperature probe Low	-67 °F
Survival temperature High	302 °F
Survival temperature Low	-67 °F

Radio frequency transmission

Item	Data
Frequency	914.5 MHz
RF Power	+0 dBm (1mW)
Modulation	FM, deviation +/- 30 kHz
Type Approval	
EMC conformity	FCC part 15.249
Placard marking	DBI-TX1 Radiometrix TX3A-914 Code: NNNNN
Transmit duration	37 milliseconds
Transmit repetition interval	2.3 seconds
Transmit duty cycle	0.016

Power supply

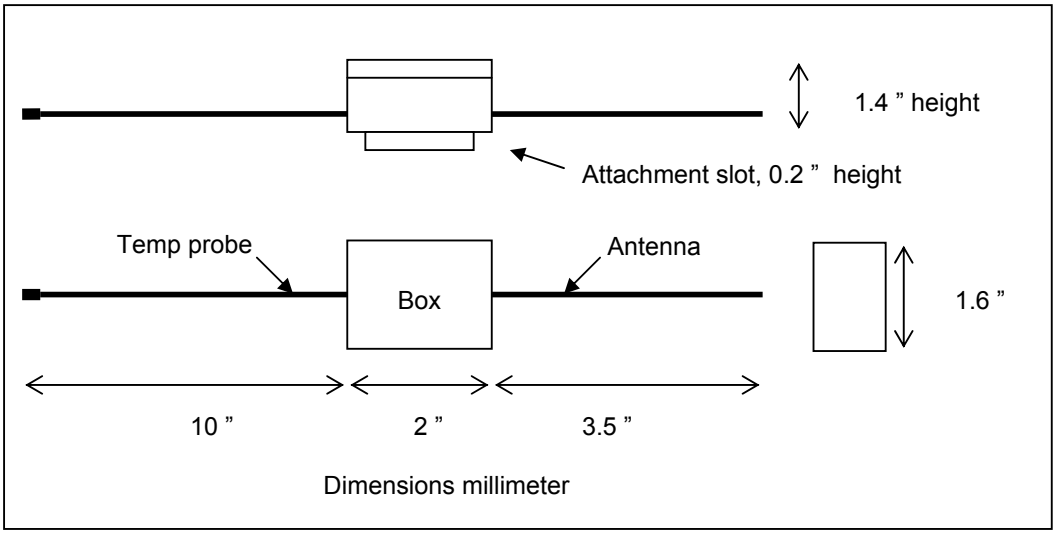
Power supply	CR2450 3 Volt Lithium Cell
Cell life (on)	> 4000 hours
Cell life (off)	> 40000 hours
Lithium cell replace interval	4 years

RF transmit control

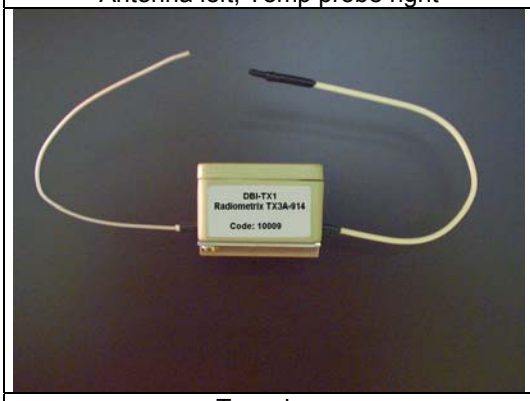
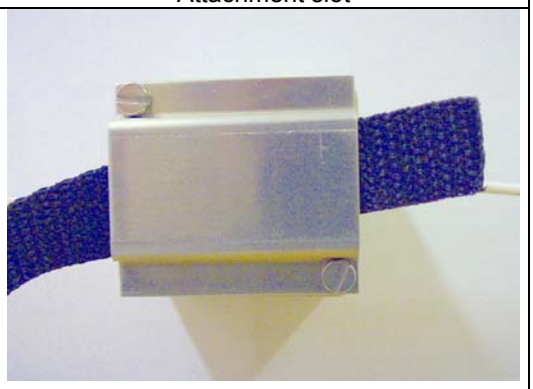
Transmit on differential temperature threshold, (probe – box).	> 10 °F
Transmit off differential temperature threshold, (probe – box).	<= 10 °F
Transmit on minimum duration	5 minutes

Figures

Mechanical drawing



Photos

Side view with placard Antenna left, Temp probe right	Bottom view Attachment slot
	
Top wiew Lid screw attachment	Tot view Open lid (battery replacement)