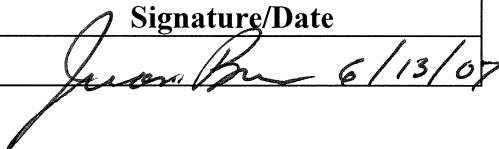# Application Note:
Philips M2638A Instrument Telemetry Module
(1.4 GHz / Wireless Medical Telemetry Service "WMTS")

DOCUMENT IDENTIFIER   A-M4840-90130-B

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Program Manager	Melissa Holmes	_(signature)_
		13-June 2007

Rev	Revision Description	Date	Originator
B	Added Dual- and Tri-Band Antennas in addition to whip	12-June-2007	Juan Brea
A	Release	14-March-2005	Juan Brea

1   Introduction

The Module is a serial network adapter designed to be used with specialized medical devices manufactured by Philips Medical Systems (Figure 1). It enables the host medical device to wirelessly establish bi-directional communication with other remote devices using the Philips' WMTS infrastructure.
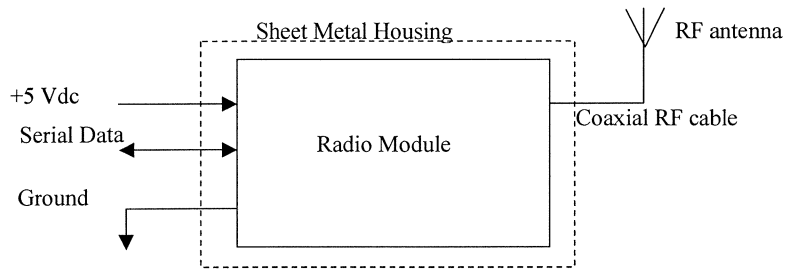
Figure 1: Module Block Diagram

2   Host Interface

The Module interfaces to the host though a single I/O connector (Figure 2). Via this connector the host supplies DC power, signal ground and modulating data to the radio Module. The communication between the host device and the Module is a two wire asynchronous serial interface (Table 1).
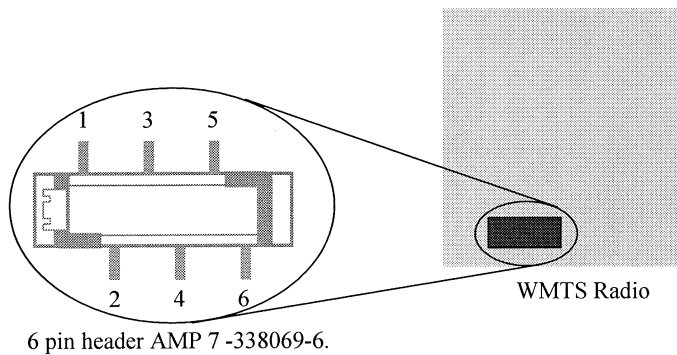
Figure 2: Module Interface Host Connector

Pin	Name	I/O	Function
1	Ground		First of two ground connections for the Module.
2	ITS_Tx	OUT	Serial data to host.
3	ITS_Rx	IN	Serial data from host.
4	Ground		Second of two ground connections for the Module.
5	+5 vdc		+ 5 vdc +/- 5%, Sinks 35 mA average, 280 mA Peak during radio Tx/Rx
6	Not Connected		

Table 1: Host Connector pin assignment

3 Serial Connection

Serial Specification:

The interface to the Host is a serial communication link (Table 2):

→ Flow Control: Tx, Rx; no hardware flow control
→ Baud Rate: 115.2 kbaud;
→ Parity: No parity bit
→ Bits: 8 bits of data, plus 1 Start/Stop bits
→ Logic Levels: TTL levels, 5 volt tolerant.

	Logical Zero	Logical One	Conditions
	LOW	HIGH	
ITS_Tx	0.1 V max		100uA sink
	0.55V max		24mA sink
		2.9V min	100uA load
		2.3V min	24mA load
ITS_Rx	0.6V max	2.2V min	-

Table 2: Serial Lines, Electrical DC Characteristics

Maximum User Data Rate:

The maximum user data rate that the radio supports is 12 kbits/second in each direction. This maximum over the air data rate is fixed by design and cannot be modified by the user.

4 Module RF Shielding.

The Module contains all necessary RF shielding. The host device does not need to provide additional shielding.

5 Module Mounting Considerations.

The Module is self-contained and can be mounted anywhere using the supplied threaded pem nuts. No special heat sinking considerations are required. There are no orientation constraints.

6 RF Input/Output, Antenna

The Module is only approved for use with the antennas specified by Philips, listed here:

1. Dipole Whip   Philips Part Number M4842-61300
2. Tri-Band   Philips Part Number M3002-66493
3. Dual-Band   Philips Part Number M8100-66490

These antennas cannot be replaced with antennas of a different type. However, antennas of equivalent type with equal or lower gain to the listed antennas can be used. The RF input and output of the Module is matched to 50 ohms. A coaxial cable brings the RF outside the metal enclosure. This cable uses a unique non standard connector manufactured by JST (JST part number AYUI-1S-12676-221). For the dipole whip, the coaxial cable connects to a JST-to-reversed-TNC adapter made by Amphenol (Amphenol part number 031-6101) where the antenna plugs in.

7 RF Transmitter Specifications

The following table summarizes general transmitter specifications (Table 3). For complete details (including details on the receiver section) refer to ES-M4840-90108:

1. Frequency ranges:	Bands: 1395 - 1400 MHz and 1427 - 1432 MHz
2. RF Output Power	8 dBm +2/-3dB, 6.3 mW (3.2 mW to 10 mW), into Antenna load. Calibrated into 50 ohms.
3. RF Output Power control	a) Transmitter chain gain shall be calibrated at time of manufacture (env temp 25+/-5deg.C). b) Over power algorithm deployed to prevent excess power and also includes temperature compensation.
4. Transceiver frequency accuracy	+/-15KHz relative to channel frequency, includes temperature compensation & aging effects.
5. Reference Frequency Calibration	<4ppm
6. Modulation type	FSK with Root Raised Cosine filtering (1M60Q7D)

Table 3: Module, Transmitter Specifications

8 Fault Conditions

Over/ Under Voltage

The input voltage from the DC power source to the Module must remain between the values specified in Table 1. Operating the radio Module from a voltage lower source lower than 4.75 vdc or higher than 5.25 vdc can cause the regulator section to shut down ceasing operation of the Module.

Excessive Signal Level on Serial Input

The data input signal levels must be observed as specified in Table 2. Driving the input data line over 5 vdc can cause damage to the Module input buffers, causing interruption of data transfer.

Excessive Data Rate on Serial Input

The host serial communication data rate is fixed at 115.2 kbaud. Clocking data at different baud rates will result in incorrect data transfer. The maximum host/user over the RF link data rate is 12 kbps. Attempting to send data at a faster rate will result in data buffer overrun and data loss.

9 Accompanying Documentation for products incorporating the Module

Products which incorporate this device will be labeled "Contains FCC ID: PQC-WMTS-MODULE", and their accompanying documentation should prominently display the following:

OPERATION OF THIS EQUIPMENT REQUIRES THE PRIOR COORDINATION WITH A FREQUENCY COORDINATOR DESIGNATED BY THE FCC FOR THE WIRELESS MEDICAL TELEMETRY SERVICE. THIS DEVICE COMPLIES WITH PART 15 OF THE FCC RULES. OPERATION IS SUBJECT TO THE CONDITION THAT THIS DEVICE DOES NOT CAUSE HARMFUL INTERFERENCE

10 Radio Specifications

1. Frequency ranges:	Bands: 1395 - 1400 MHz and 1427 - 1432 MHz Channel Spacing: 1.6 MHz, see table below
2. RF Output Power (into 50 ohms)	8 dBm +2/-3 dB (3.2 mW to 10 mW)
3. Frequency accuracy (relative to channel frequency	+/-15 kHz, includes temperature compensation & aging effects.
4. Modulation type	FSK with Root Raised Cosine filtering (1M60Q7D)
5. Modulation deviation (relative to channel frequency)	Bit 1: +288 kHz +/-25 kHz Bit 0: -288 kHz +/-25 kHz
6. Transmitter output broadband noise	< -58.9 dBm in 1 MHz band, outside channel in use.

7. Out of band spurious emission levels:
   ≤1394MHz , ≥1401 MHz
   ≤1426MHz, ≥ 1433 MHz
	< -41dBm in 1 MHz bandwidth for FCC limit

8. Channel Occupied Bandwidth
   (as defined by power in 99% BW per
   FCC 47CFR Ch. 1 Subpart 2.202)
	≤ +/- 800 KHz

WMTS Channel Frequencies in the 1395 – 1400 MHz Band	
Lower band edge	1395.0000 MHz
Channel 1	1395.8977 MHz
Channel 2	1397.4970 MHz
Channel 3	1399.0963 MHz
Upper Band Edge	1400.0000 MHz
Channel Spacing	1.6 MHz

WMTS Channel Frequencies in the 1427 – 1432 MHz Band	
Lower band edge	1427.0000 MHz
Channel 4	1427.8979 MHz
Channel 4a (**)	1430.2410 MHz
Channel 5 (*)	1429.4972 MHz
Channel 6 (*)	1431.0965 MHz
Upper Band Edge	1432.0000 MHz
Note: (*) Not available in special geographic areas, i.e. "Carve-Out Areas" (**) Available in special geographic areas only, i.e. "Carve-Out Areas"	