

DOCUMENT NAME

**Application Note:  
Philips MDL4851 Instrument Telemetry Module  
(2.4 GHz)**

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B	Added Dual- and Tri-Band Antennas in addition to whip	13-Jun-2007	Delroy Smith
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# 2 Introduction

The MDL4851-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' 2.4GHz ROW infrastructure.

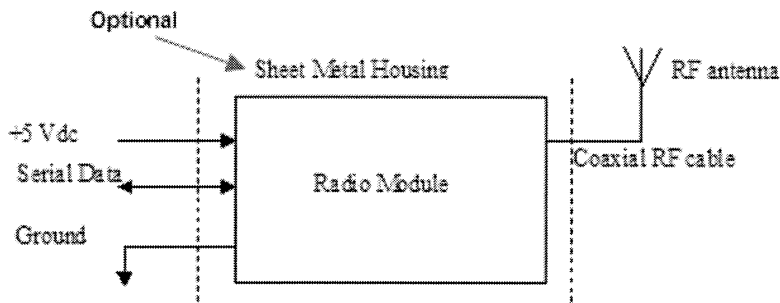


Figure 1: MDL4851-MODULE Block Diagram

# 3 Host Interface

The MDL4851 radio module interfaces to the host through a single I/O connector (Figure 2). Via this connector the host must supply DC power, signal ground and modulating data to the radio module. The communication between the host device and the radio module is a two wire asynchronous serial interface (Table 1).

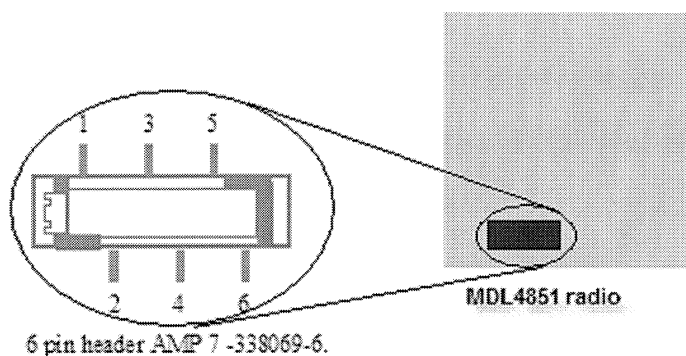


Figure 2: MDL4851-MODULE Interface Host Connector

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 38 mA average, 320 mA Peak during radio Tx/Rx
6	Not Connected		

Table 1: Host Connector pin assignment

## 4 Serial Connection

### 4.1 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

### 4.2 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.

## 5 MDL4851-MODULE RF Shielding.

The module contains all necessary RF shielding. The host device does not need to provide additional shielding. The available module metal enclosure is optional, it is not needed to achieve EMC compliance.

## 6 MDL4851-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.

## 7 RF Input/Output, Antenna

This MDL4851 Radio Module has been designed to operate with the antennas listed below, and having a maximum gain of 2.0 dBi.

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 an antenna of a different type. However, antennas of equivalent type with equal or lower gain to the listed antennas can be used. Antennas having a gain greater than 2.0 dBi are strictly prohibited for use with this device. The required antenna impedance is 50 ohms.

The RF input and output of the MDL4851-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.

### 7.1 RF Transmitter Specifications

The following table summarizes general transmitter specifications (Table 3). For complete details (including details on the receiver section) refer to ES-M4840-90145:

Parameter	Specification
Frequency range	ISM Band: 2400-2483.5MHz
Radio Channel assignment	48 Radio Channel assigned from 2401.056 MHz to 2482.272 MHz, with Channels Spacing: 1.728 MHz
Frequency Control	Frequency Control to select smart hopper operating frequencies, only 3 frequencies needed to achieve performance. A maximum of 6 channels can be selected from the list of 48 channels.
RF Output Power	FCC: 17 dBm +/-1dB (40 mW to 63 mW, nominal 50mW), into antenna load  ETSI: 7.0 dBm +/-1dB (4 mW to 6.3 mW, nominal 5.0mW), into antenna load.  Japan: 8.5 dBm +/-1dB (5.6 mW to 8.9 mW, nominal 7.1mW), into antenna load.  Note: a) Antenna gain is 2.0dBi max

Transceiver frequency accuracy during normal operation	<+60/-100KHz relative to channel frequency, includes temperature compensation & aging effects.
Modulation type	GFSK, Gaussian Frequency Shift keying ( <b>1M40Q7D</b> )
Modulation Bandwidth	Typically 1.4MHz (20dB Bandwidth)
Out of band spurious emission Levels	< -41dBm in 1MHz bandwidth for FCC limit Meets ETSI, RS210, FCC, ARIB standards

Table 3: MDL4851 Radio Module, Transmitter Specifications

Applicable Regulatory Rule	Allowed channels	Operating Frequency Range	Max Power from Antenna (EIRP)
ETSI	1-46	2402.784 - 2480.544 MHz	10 dBm
FCC, RSS-210	0-47	2401.056 - 2482.272 MHz	20 dBm
JAPAN, ARIB	0-47	2401.056 - 2482.272 MHz	12.1dBm
AUS/NZ	1-46	2402.784 - 2480.544 MHz	10 dBm

Table 4 Radio Specification, MDL4851 Channel Frequency Rules

## 8 Fault Conditions

### 8.1 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 4.75Vdc or higher than 5.25 vdc can cause the regulator section to shut down ceasing operation of the radio module.

### 8.2 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 radio module input buffers, causing interruption of data transfer.

### 8.3 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 MDL4851-MODULE

Products which incorporate this device shall be labeled as follows:

Contains:

FCC ID: PQC-MDL4851

IC: 3549B-MDL4851

and their accompanying documentation shall include the following:

FCC  
Compliance  
(USA):



This device complies with part 15 of the FCC Rules. Operation is subject to the condition that this device does not cause harmful interference.

Industrie Canada  
Compliance  
(Canada):

This Class A digital apparatus complies with Canadian ICES-003. Cet appareil numérique de la classe A est conforme à la norme NMB-003 du Canada.