

SMARTMESH IA-510™ PM2510-4

2.4 GHz Embedded Network Manager

About SmartMesh IA-510™

Dust Networks' SmartMesh IA-510™ is a WirelessHART™-compliant system that offers industrial automation vendors an industry-leading standards-based system that delivers flexible, secure solutions. The SmartMesh IA-510 system's Intelligent Networking Platform delivers dynamic network optimization and intelligent routing to achieve the carrier-class data reliability, lower latency, and deterministic power management required for the industrial automation market. The SmartMesh IA-510 system consists of the PM2510-4 embedded network manager and two mote form factors: the DN2510 Mote-on-Chip™ (MoC) and the M2510 RF-certified mote module. SmartMesh IA-510 systems are easy for industrial automation vendors to integrate and simple for end users to deploy.

Product Description—PM2510-4

The WirelessHART-compliant PM2510-4 embedded network manager combines Dust Networks' robust, Intelligent Networking Platform and industry-leading low-power radio technology in an easy-to-integrate embedded subsystem. A central part of the SmartMesh IA-510 system, the PM2510-4 provides industrial automation vendors with a complete embedded wireless sensor networking solution for WirelessHART applications that assures multivendor interoperability and offers forward compatibility.

The PM2510-4 is tailored for use in line powered WirelessHART gateways and controllers, and enables the development of wireless sensor networks that deliver proven performance and scalability. Sophisticated network management algorithms deliver dynamic network optimization and intelligent routing to achieve carrier class reliability, lower latency, and deterministic power management. Additionally, the embedded network manager offers a comprehensive API to deliver rich and flexible functionality without complex coding. This API also provides full visibility and control over network configuration, security administration, network status, and performance statistics.

The network-ready embedded manager enables industrial automation vendors to integrate advanced wireless sensor networking intelligence into monitoring and control solutions with low risk and rapid time-to-market.

Key Product Features

WirelessHART Compliance

- Interoperable with WirelessHART field devices

Intelligent Network Management

- Dynamic network optimization—maintains network health and provides deterministic power management
- Intelligent routing—lowers latency, reduces network power consumption and eliminates in-network collisions
- Robust network reliability in even the most challenging industrial environments

Fast and Low Risk Integration

- Comprehensive APIs deliver rich and flexible functionality without complex coding
- Fully integrated and certified RF capabilities—simply add an antenna

Bandwidth Flexibility

- Variable bandwidth—assign different levels of bandwidth to satisfy unique throughput and latency requirements
- Flexibly addresses the range of latency and throughput needs of industrial automation applications, such as request/response, fast file transfer, and alerting

Global Market Solution

- IEEE 802.15.4-certified radio operates on 2.4 GHz global license-free band
- Configurable radio output—meets RF emission limits for different regions with a single product
- Modular RF certifications for FCC, IC, and CE

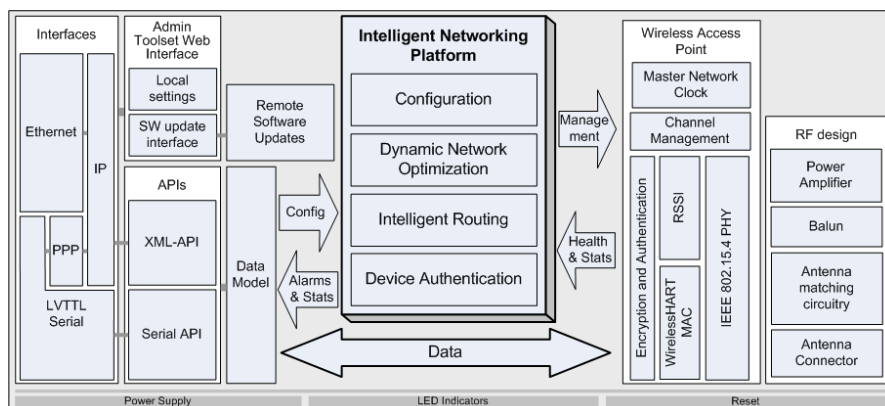


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1.0 Absolute Maximum Ratings

The absolute maximum ratings shown below should not be violated under any circumstances. Permanent damage to the device may be caused by exceeding one or more of these parameters.

Table 1 Absolute Maximum Ratings

Parameter	Min	Typ	Max	Units	Comments
Supply voltage (+5V_IN to GND)	−0.3		6	V	
Input RF level			10	dBm	Input power at antenna connector
Storage temperature range	−40		+85	°C	
VSWR of antenna			3:1		
ESD protection					
Antenna connector			±250	V	HBM
All other connectors			±2	kV	HBM
			±200	V	CDM
All voltages are referenced to GND					



Caution! ESD sensitive device. Precaution should be used when handling the device in order to prevent permanent damage.

2.0 Normal Operating Conditions

Table 2 Normal Operating Conditions

Parameter	Min	Typ	Max	Units	Comments
Operational supply voltage range (between +5V_IN and GND)	4.0	5.0	5.5	VDC	Including noise and load regulation
Voltage supply noise			100	mV _{p-p}	50 Hz–50 MHz
Peak current			210	mA	+3V3 out = 0 mA
Average current		100	140	mA	+5V_IN at 5.0 V, 25 °C, +3V3 out = 0 mA
		175	245	mA	+5V_IN at 5.0 V, 25 °C, +3V3 out = 100 mA
Operating temperature range	−40		+85	°C	
Maximum allowed temperature ramp during operation			8	°C/min	−40 °C to +85 °C
Operating relative humidity	10		90	% RH	Non-condensing
The specifications listed are for the power supply connected to +5V_IN and GND, and apply over the operating temperature range unless otherwise specified.					

3.0 Electrical Specifications

I/O specifications are given below for each I/O level type given in the board-to-board connector tables in sections 6.1 and 7.2. Unless otherwise noted, +5V_IN is 5.0 V and temperature is −40 °C to +85 °C.

3.1 LVTTTL Specifications

Table 3 LVTTTL Type 1 Specifications

Parameter	Min	Typ	Max	Units	Comments
V_{IH} (logical high input)	$0.8 \times +3V3$		$+3V3 + 0.3$	V	
V_{IL} (logical low input)	-0.3		0.6	V	
I_{IN} (input leakage)			+10	μA	
V_{OH} (logical high output)	$+3V3 - 0.3$		$+3V3$	V	
V_{OL} (logical low output)	GND		0.4	V	
I_{OH} ($V_O = V_{OH}$) (source)	3			mA	
I_{OL} ($V_O = V_{OL}$) (sink)	3			mA	

Table 4 LVTTTL Type 2 Specifications (Schmitt Trigger)

Parameter	Min	Typ	Max	Units	Comments
V + Threshold	1.3		2.5	V	
V – Threshold	0.6		1.6	V	
I_{IN} (input leakage)			± 5	μA	

Table 5 LVTTTL Type 3 Specifications

Parameter	Min	Typ	Max	Units	Comments
V_{OH} (logical high output)	$+3V3 - 0.4$		$+3V3$	V	
V_{OL} (logical low output)	GND		0.5	V	
I_{OH} ($V_O = V_{OH}$) (source)	0.2			mA	
I_{OL} ($V_O = V_{OL}$) (sink)	0.2			mA	

Table 6 LVTTTL Type 4 Specifications

Parameter	Min	Typ	Max	Units	Comments
V_{OH} (logical high output)	2.6		$+3V3$	V	
V_{OL} (logical low output)	GND		0.4	V	
I_{OH} ($V_O = V_{OH}$) (source)	2			mA	
I_{OL} ($V_O = V_{OL}$) (sink)	2			mA	

Table 7 LVTTTL Type 5 Specifications

Parameter	Min	Typ	Max	Units	Comments
V_{IH} (logical high input)	2.6		$+3V3 + 0.3$	V	
V_{IL} (logical low input)	$GND - 0.3$		$GND + 0.8$	V	
I_{IN} (input leakage)			± 5	μA	

3.2 LED Specifications

Table 8 LED Specifications

Parameter	Min	Typ	Max	Units	Comments
V_{OH} (logical high output)	$+3V3 - 0.3$		$+3V3$	V	
V_{OL} (logical low output)	GND		$GND + 0.4$	V	
I_{OH} ($V_O = V_{OH}$) (source)	3			mA	$+3V3 = 3.3 V$
I_{OL} ($V_O = V_{OL}$), I/O = LED (sink)	1.5			mA	$+3V3 = 3.3 V$
I_{OL} ($V_O = V_{OH}$), I/O = LED low (sink)	0.5			mA	$+3V3 = 3.3 V$

3.3 3.3 V Output Supply

The PM2510-4 includes a regulated 3.3 V output signal (labeled +3V3) for supplying power to user circuitry (for example, isolation or signal conditioning). Note that any power drawn on +3V3 circuitry results in an increase in power drawn on +5V_IN.

Table 9 +3.3 V Power Supply Output

Parameter	Min	Typ	Max	Units	Comments
+3V3 current source			100	mA	
+3V3 supply voltage	3.13		3.46	V	

3.4 Device Load

Table 10 Device Load

Parameter	Min	Typ	Max	Units	Comments
Total capacitance			322	μF	
Total inductance			33	μH	

3.5 AC Timing Specifications

Table 11 AC Timing Specifications

Parameter	Min	Typ	Max	Units	Comments
nRESET_IN pulse width	125			μs	

4.0 Radio

4.1 Detailed Radio Specifications

Table 12 Radio Specifications

Parameter	Min	Typ	Max	Units	Comments
Operating frequency	2.4000		2.4835	GHz	
Number of channels		15			
Channel separation		5		MHz	
Occupied channel bandwidth		2.7		MHz	At -20 dBc
Frequency accuracy	-40		+40	ppm	
Modulation					IEEE 802.15.4 DSSS
Raw data rate		250		Kbps	
Receiver operating input level		0		dBm	
Receiver sensitivity		-92.5		dBm	At 50% PER, $V_{DD} = 3\text{ V}$, 25 °C
		-90		dBm	At 1% PER, $V_{DD} = 3\text{ V}$, 25 °C, (inferred by 50% PER measurement)

Parameter	Min	Typ	Max	Units	Comments
Output power, conducted Power amplifier enabled: At 25 °C		+8		dBm	
Power amplifier disabled: At 25 °C		-2		dBm	
Range** Power amplifier enabled: Indoor Outdoor Power amplifier disabled: Indoor Outdoor		100 300 25 200		m m m m	25 °C, 50% RH, 1 meter above ground, +2 dBi omni-directional antenna
**Actual RF range performance is subject to a number of installation-specific variables including, but not restricted to ambient temperature, relative humidity, presence of active interference sources, line-of-sight obstacles, near-presence of objects (for example, trees, walls, signage, and so on) that may induce multipath fading. As a result, actual performance varies for each instance.					

4.2 Antenna Specifications

A MMCX-compatible jack receptacle is provided on board for the antenna connection. For antenna location, refer to the mechanical drawing in section 8.1. The antenna must meet specifications in Table 13. For a list of antennae pre-approved for RF certification, see section 9.1.2.

Table 13 Antenna Specifications

Parameter	Value
Frequency range	2.4–2.4835 GHz
Impedance	50 Ω
Gain PM2510-4	+2 dBi maximum
Pattern	Omni-directional
Maximum VSWR	3:1
Connector	MMCX*
* The PM2510-4 can accommodate the following RF mating connectors: <ul style="list-style-type: none"> • MMCX straight connector such as Johnson 135-3402-001, or equivalent • MMCX right angle connector such as Tyco 1408149-1, or equivalent 	

When the PM2510-4 is placed inside an enclosure, the antenna should be mounted such that the radiating portion of the antenna protrudes from the enclosure, and connected using a MMCX connector on a coaxial cable. For optimum performance, allow the antenna to be positioned vertically when installed.

5.0 SmartMesh IA-510 Intelligent Networking Platform

The SmartMesh IA-510 PM2510-4 embedded network manager is built upon Dust Networks' Intelligent Networking Platform, which provides dynamic network optimization, deterministic power management, intelligent routing, and bandwidth flexibility to achieve the carrier class data reliability, and ultra-low power and ease of use required for industrial automation applications.

5.1 Dynamic Network Optimization

Dynamic network optimization allows the PM2510-4 to address the changing RF requirements in harsh industrial environments resulting in a network that is continuously self-monitoring and self-adjusting. The PM2510-4 manager performs dynamic network optimization based upon periodic reports on network health and link quality that it receives from the network nodes. The manager uses this information to provide performance statistics to the application layer and proactively solve problems in the network. Dynamic network optimization not only maintains network health, but also allows the PM2510-4 to deliver deterministic power management.

5.2 Deterministic Power Management

Deterministic power management balances traffic in the network by diverting traffic around heavily loaded nodes (for example, nodes with high reporting rates). In doing so, it reduces power consumption for these nodes and balances power consumption across the network. Deterministic power management provides predictable maintenance schedules to prevent down time and lower the cost of network ownership. When combined with field devices using Dust Network's industry-leading low power radio technology, deterministic power management enables over a decade of battery life for network nodes.

5.3 Intelligent Routing

Intelligent routing provides each packet with an optimal path through the network. The shortest distance between two points is a straight line, but in RF the quickest path is not always the one with the fewest hops. Intelligent routing finds optimal paths by considering the link quality (one path may lose more packets than another) and the retry schedule, in addition to the number of hops. The result is reduced network power consumption, elimination of in-network collisions, and unmatched network reliability.

5.4 Bandwidth Flexibility

Efficient use of network resources enables Dust Networks to deliver bandwidth flexibility—the ability to assign different levels of bandwidth to satisfy unique throughput and latency requirements. Bandwidth flexibility addresses the range of latency and throughput needs of industrial automation applications such as request/response, fast file transfer, and alerting.

6.0 Interfaces

The PM2510-4 is designed for ease of integration by providing multiple data ports and well-defined software APIs. Section 6.1 describes the PM2510-4 data ports, LEDs, and switches. Refer to the *SmartMesh IA-510 PM2510-4 Integration Guide* for example application circuits. Section 6.1.6 describes the software functions that are available through the data ports.

6.1 Hardware Interfaces

Table 14 Hardware Interface Summary

Port	Description	Pins
Ethernet	10Base-T Ethernet	RX_P, TX_P, RX_N, TX_N, RX_CT, TX_CT, nACT_LED, nLINK_LED
Serial 1	UART 5-pin	S1_TX, S1_RX, S1_RTS, S1_CTS, GND
Serial 2	UART 9-pin	S2_TX, S2_RX, S2_RTS, S2_CTS, S2_RI, S2_DCD, S2_DSR, S2_DTR, GND
Serial 3	Reserved for future use	S3_TX, S3_RX, S3_RX_EN, S3_TX_EN, GND
LED Status Indicator	Status indicators	nLED_SUB, nLED_RADIO, nLED_RESERVED0, nLED_RESERVED1, nLED_RESERVED2, nLED_RESERVED3, RST

6.1.1 10Base-T Ethernet Interface

Ideal for remote or high-bandwidth access, the Ethernet interface provides full configuration management and data access to the PM2510-4. The port is an IEEE 802.3 standard 10Base-T MAC/PHY, accessible through the board-to-board J10 connector.

RX_P and RX_N are the receive-side differential pair (see section 7.2 for pinout). The levels should conform to 10Base-T Ethernet. TX_P and TX_N are the transmit-side differential pair. The transmit level coming from the PM2510-4 is about one-half the standard 10Base-T level.

6.1.2 Serial 1 Interface

The Serial 1 interface is designed for embedded integration with controllers. This serial interface provides programmatic access for configuration, management, and data access to the PM2510-4. The port is a 5-pin flow-controlled LVTTL (3.3 V) serial interface accessible through the board-to-board J10 connector.

Table 15 Serial 1 Parameters

Parameter	Value
Bit rate	115200
Parity	N
Data bits	8
Stop bit	1
Flow control	Hardware handshake

6.1.3 Serial 2 Interface

The PM2510-4 provides a UART interface with TX, RX, RTS, CTS, DTR, DSR, and RI lines through the board-to-board J6 connector, operating up to 115 kbps at RS-232 voltage levels.

Table 16 Serial 2 Parameters

Parameter	Value
Bit rate	115200
Parity	N
Data bits	8
Stop bit	1
Flow control	None

6.1.4 Serial 3 Interface

The Serial 3 interface is reserved. These signals should not be connected.

6.1.5 LED Status Indicators

The PM2510-4 has LED status indicators on the top surface of the module, whose signals also pass through the board-to-board J10 connector.

Table 17 LED Status Indicators

LED Name	Signal Name	Description	Color
Power		Indicates 3.3V DC-DC converter is okay, lights when 5 V supply is connected	Green
Subscription	nLED_SUB	Indicates that a client program is subscribed to Manager via Ethernet or RS-232	Yellow
Radio	nLED_RADIO	Blinks with data activity over the radio	Yellow
Mode 1	nLED_RESERVED0	Reserved for future use	
Mode 2	nLED_RESERVED1	Reserved for future use	
Mode 3	nLED_RESERVED2	Reserved for future use	
Mode 4	nLED_RESERVED3	Reserved for future use	
RST	nRESET_IN	Indicates the manager is in the reset state	Red

6.1.6 Restore Signal

The PM2510-4 supports the ability to restore its configuration settings to the Dust factory defaults. This feature is most useful in non-embedded applications where the PM2510-4 configuration may be different per installation (for example, a manager's IP setting is forgotten and therefore unreachable). Note that while the restore feature may be used to recover a previously "unreachable" manager, all customizations to the manager will be lost, including configuration, logs, OTAP directory files, and persistent mote information.

The following are among the settings restored to factory configuration settings:

- Configuration settings for xmlrpc/manager serial API, watchdog, and datalog
- Network and mote configuration settings, such as network ID, bandwidth profile, and common join key
- The default IP address (static IP)
- Timezone and NTP settings
- Serial port settings
- PPP settings
- All user passwords
- The repository location for ipkg

The Restore Switch signal input to the PM2510 includes a debounce circuit to support direct connection to a mechanical push button, as illustrated in Figure 1.

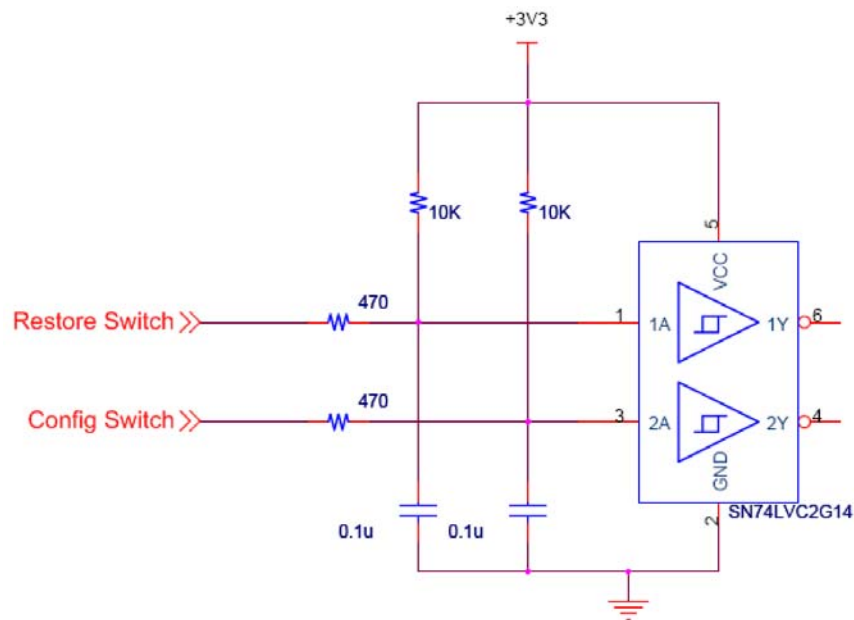


Figure 1 Restore Switch and Config Switch Debounce Input Stage

The Restore Switch signal controls the restore function. The Restore Switch signal is only active for the first three seconds after nRESET_IN is released. Usage of the Restore Switch signal is optional. If unused, the Restore Switch signal may be left unconnected, since it is internally pulled inactive high.

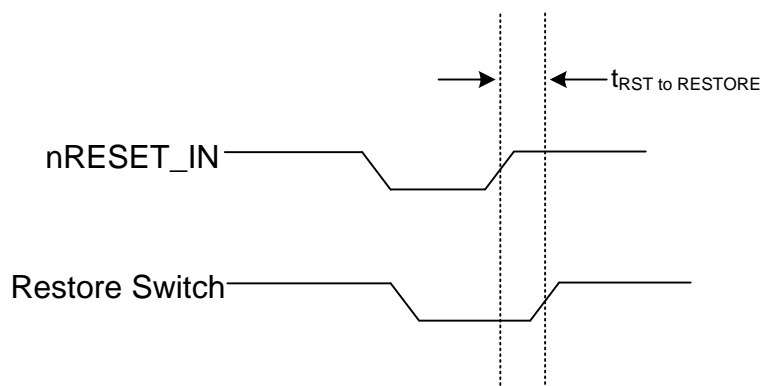


Figure 2 Restore Switch Signal Timing Diagram

Table 18 Restore Signal Timing Values

Parameter	Min	Typ	Max	Units	Comments
$t_{\text{RST to RESTORE}}$	1		3	s	

6.2 Software Interfaces

The PM2510-4 provides well-defined software interfaces for easy integration. Table 19 describes which interfaces are available via the various hardware ports. This section describes the software interfaces available via the hardware ports described in section 6.2.1.

Table 19 PM2510-4 Software Interfaces

Hardware Port	Software Interface	Comments
Ethernet	XML API, Admin Toolset	
Serial 1	PPP/Serial API/Heartbeat	Function is set at login time. For more information, refer to the <i>IA-510 PM2510 Integration Guide</i> .
Serial 2	Command line interface	

6.2.1 XML API

The XML API is an open Extensible Markup Language (XML) interface that lets a client application send Remote Procedure Call (RPC) requests to the PM2510-4 and receive responses and other data from the PM2510-4 via XML-RPC. The API consists of a Control Channel and a Notification Channel. The Control Channel is used to establish connection and exchange commands and information about the SmartMesh Network. The Notification Channel is used to stream data and network events to the client program. The API is fully documented in the *SmartMesh Manager XML API Guide*.

6.2.2 Admin Toolset

The PM2510-4 provides a Web-based administrative tool called Admin Toolset. Through this interface, users may configure IP settings, view logs, manually configure the software system clock or enable the Network Time Protocol (NTP) client. Users may also update PM2510-4 software as well as perform remote software updates on motes in the wireless network. These functions and others are described in further detail in the *SmartMesh IA-510 Admin Toolset Reference Guide*.

6.2.3 PPP

The PM2510-4 allows IP connection via the Serial 1 port using Point-to-Point Protocol (PPP). This connection provides access to the same interfaces that are available through the Ethernet interface, such as the XML API and the Admin Toolset utility. The PM2510-4 acts as a PPP server. Note that the client is responsible for periodically pinging the PM2510-4 and re-establishing PPP connection if necessary.

Table 20 PPP Interface Specifications

Parameter	Value
Serial port data rate	115.2 Kbps, 8 bits, no parity, 1 stop bit
Authentication required	None
Header compression	PPP header compression
Data compression supported	PPP deflate compression (preferred), BSD compression
IP addresses	Settable during connection
Default PM2510-4 (server)	192.168.101.10
Default client	192.168.101.11

6.2.4 Serial API

The PM2510-4 provides a packet-based serial API that allows communications with the PM2510-4 over its asynchronous Serial 1 port. Ideal for resource constrained systems, the serial API requires less processing than the XML format, but covers a subset of features available through the TCP/IP-based XML-RPC interface. For details, refer to the *SmartMesh IA-510 Manager Serial API Guide*.

6.2.5 Heartbeat (Manager Failover)

When operating via Ethernet, a pair of PM2510-4 embedded managers may be configured as a redundant pair, with the backup embedded manager acting as an emergency failover. The two embedded managers are connected via a null modem serial connection, which acts as a *heartbeat* connection. When the backup embedded manager detects via the heartbeat connection that the primary embedded manager is down, the backup will assume the IP address of the primary and the network reforms to talk with the new manager. During this “cold” failover, some data packet loss may occur while the network rebuilds to the new embedded manager.

6.2.6 Command Line Interface

The command line interface is used to set the software function of Serial 1 and for troubleshooting with the assistance of Dust Networks support.

7.0 Board-to-board Connectors

The PM2510-4 has two 40-pin FCI/Berg 61083-042400LF board-to-board connectors. For connector and pin locations, see Figure 3 and Figure 4.

7.1 Connector Pin Numbering

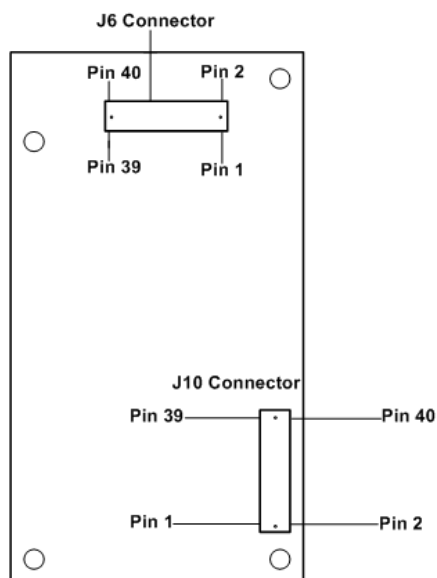


Figure 3 Connector Pin Numbering (Bottom View)

7.2 Pinout

Table 21 J10 Board-to-board Connector

Pin Number	Pin Name	I/O Direction	I/O Level	Interface Name
1	GND	–		
2	GND	–		
3	RX_P	In	10Base-T	Ethernet
4	TX_P	Out	10Base-T	Ethernet
5	RX_N	In	10Base-T	Ethernet
6	TX_N	Out	10Base-T	Ethernet
7	RX_CT	In	10Base-T	Ethernet
8	TX_CT	Out	10Base-T	Ethernet
9	nACT_LED	Out	LED	LED Status indicators
10	nLINK_LED	Out	LED	LED Status indicators
11	+3V3	Out	3.3 V \pm 5%	3.3 V Out
12	+3V3	Out	3.3 V \pm 5%	3.3 V Out
13	S1_RTS	Out	LVTTTL Type 3	Serial 1
14	<i>Reserved</i>			Do not connect
15	S1_CTS	In	LVTTTL Type 1	Serial 1
16	<i>Reserved</i>			Do not connect
17	S1_TX	Out	LVTTTL Type 3	Serial 1
18	Config Switch	In*	LVTTTL Type 2	Switch In
19	S1_RX	In	LVTTTL Type 1	Serial 1
20	Restore Switch	In*	LVTTTL Type 2	Switch In
21	GND	–		
22	nLED_SUB	Out	LED	LED status indicators
23	<i>Reserved</i>			Do not connect
24	nLED_RESERVED0	Out	LED	LED status indicators
25	+3V3	Out	3.3 V \pm 5%	3.3 V Out
26	nLED_RESERVED1	Out	LED	LED status indicators
27	<i>Reserved</i>			Do not connect
28	nLED_RESERVED2	Out	LED	LED status indicators
29	<i>Reserved</i>			Do not connect
30	nLED_RESERVED3	Out	LED	LED status indicators
31	<i>Reserved</i>			Do not connect
32	S3_RX	In	LVTTTL Type 1	Serial 3
33	GND			
34	S3_TX	Out	LVTTTL Type 1	Serial 3
35	<i>Reserved</i>			Do not connect
36	S3_RX_EN	Out	LVTTTL Type 1	Serial 3
37	<i>Reserved</i>			Do not connect
38	S3_TX_EN	Out	LVTTTL Type 1	Serial 3
39	GND			
40	GND			

* Input includes a debounce input stage as illustrated in Figure 1.

Table 22 J6 Board-to-board Connector

Pin Number	Pin Name	I/O Direction	I/O Level	Interface Name
1	GND	–		
2	GND	–		
3	<i>Reserved</i>			Do not connect
4	S2_TX	Out	LVTTL Type 1	Serial 2
5	<i>Reserved</i>			Do not connect
6	S2_RX	In	LVTTL Type 1	Serial 2
7	<i>Reserved</i>			Do not connect
8	S2_RTS	Out	LVTTL Type 1	Serial 2
9	<i>Reserved</i>			Do not connect
10	S2_CTS	In	LVTTL Type 1	Serial 2
11	<i>Reserved</i>			Do not connect
12	S2_RI	In	LVTTL Type 1	Serial 2
13	<i>Reserved</i>			Do not connect
14	S2_DCD	In	LVTTL Type 1	Serial 2
15	GND			
16	S2_DSR	In	LVTTL Type 1	Serial 2
17	<i>Reserved</i>			Do not connect
18	S2_DTR	Out	LVTTL Type 1	Serial 2
19	<i>Reserved</i>			Do not connect
20	+3V3	Out	3.3 V \pm 5%	3.3 V Out
21	+3V3	Out	3.3 V \pm 5%	3.3 V Out
22	nRESET_OUT	Out	LVTTL Type 4	Reset low
23	<i>Reserved</i>			Do not connect
24	GND			
25	<i>Reserved</i>			Do not connect
26	RESET_OUT	Out	LVTTL Type 4	Reset high
27	<i>Reserved</i>			Do not connect
28	nRESET_IN	In	LVTTL Type 5	Switch In
29	<i>Reserved</i>			Do not connect
30	<i>Reserved</i>			Do not connect
31	<i>Reserved</i>			Do not connect
32	+5V_IN	In	5.0 V \pm 5%	Power In
33	<i>Reserved</i>			Do not connect
34	+5V_IN	In	5.0 V \pm 5%	Power In
35	GND			
36	+5V_IN	In	5.0 V \pm 5%	Power In
37	nLED_RADIO	Out	LED Low	LED status indicators
38	<i>Reserved</i>			Do not connect
39	GND			
40	GND			

7.3 Recommended Mating Connectors

The user connections are made through J6 and J10 on the PM2510-4, which are FCI/Berg 61083-042400LF board-to-board connectors. The mating connector should be an FCI/Berg 61082-04x400LF, where 'x' depends on the desired stack height (see Table 23).

Table 23 Recommended Mating Connectors

Connector	Mated Height (mm)
FCI/Berg 61082-041400LF	6
FCI/Berg 61082-042400LF	10
FCI/Berg 61082-043400LF	14

8.0 Mechanical Specifications

8.1 PM2510-4 Mechanical Drawings

In laying out a design, locate the mating connectors by using the alignment pins and correlating pin numbers for orientation (see Figure 3).

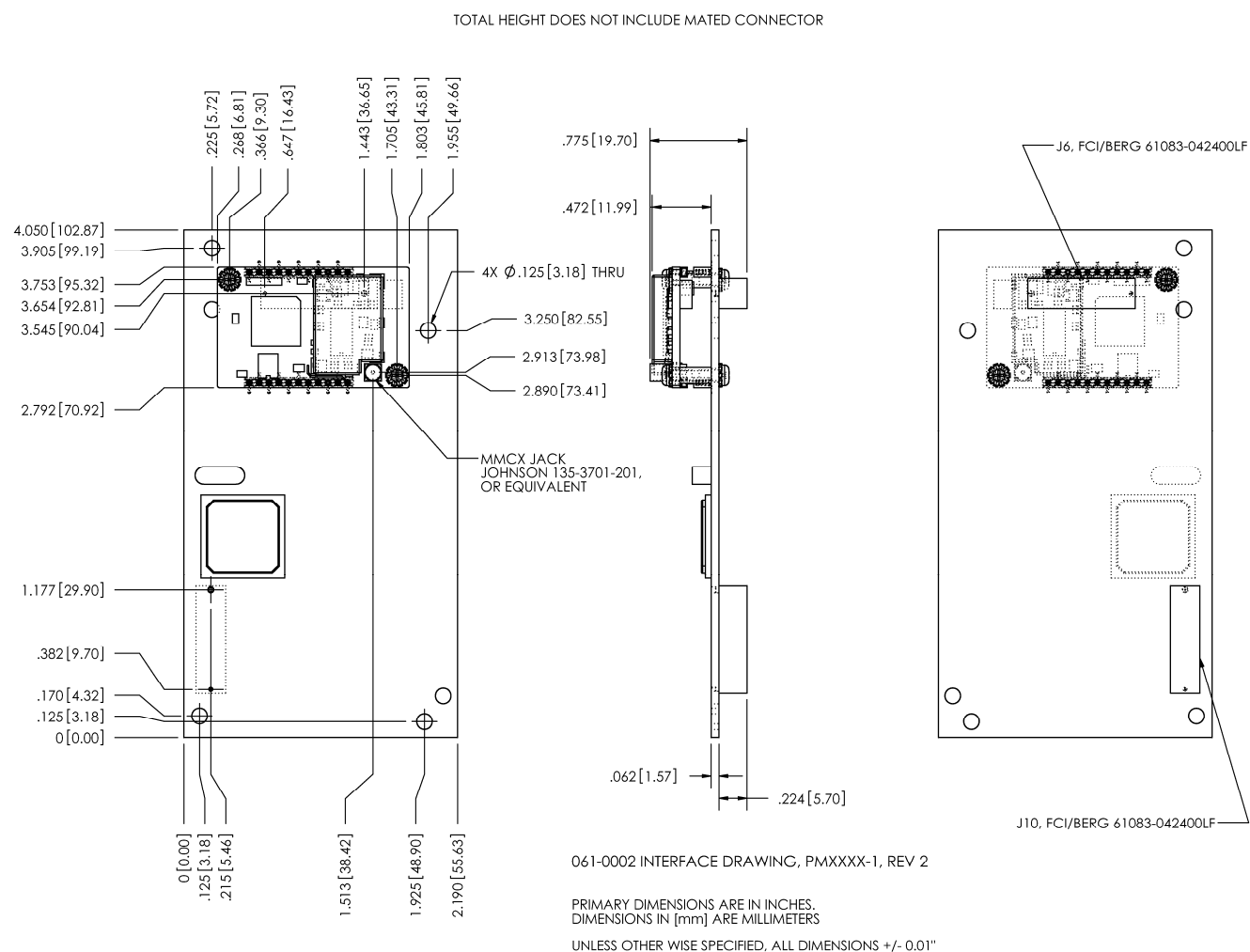


Figure 4 PM2510-4 Mechanical Drawing

8.2 Mating Board Footprint

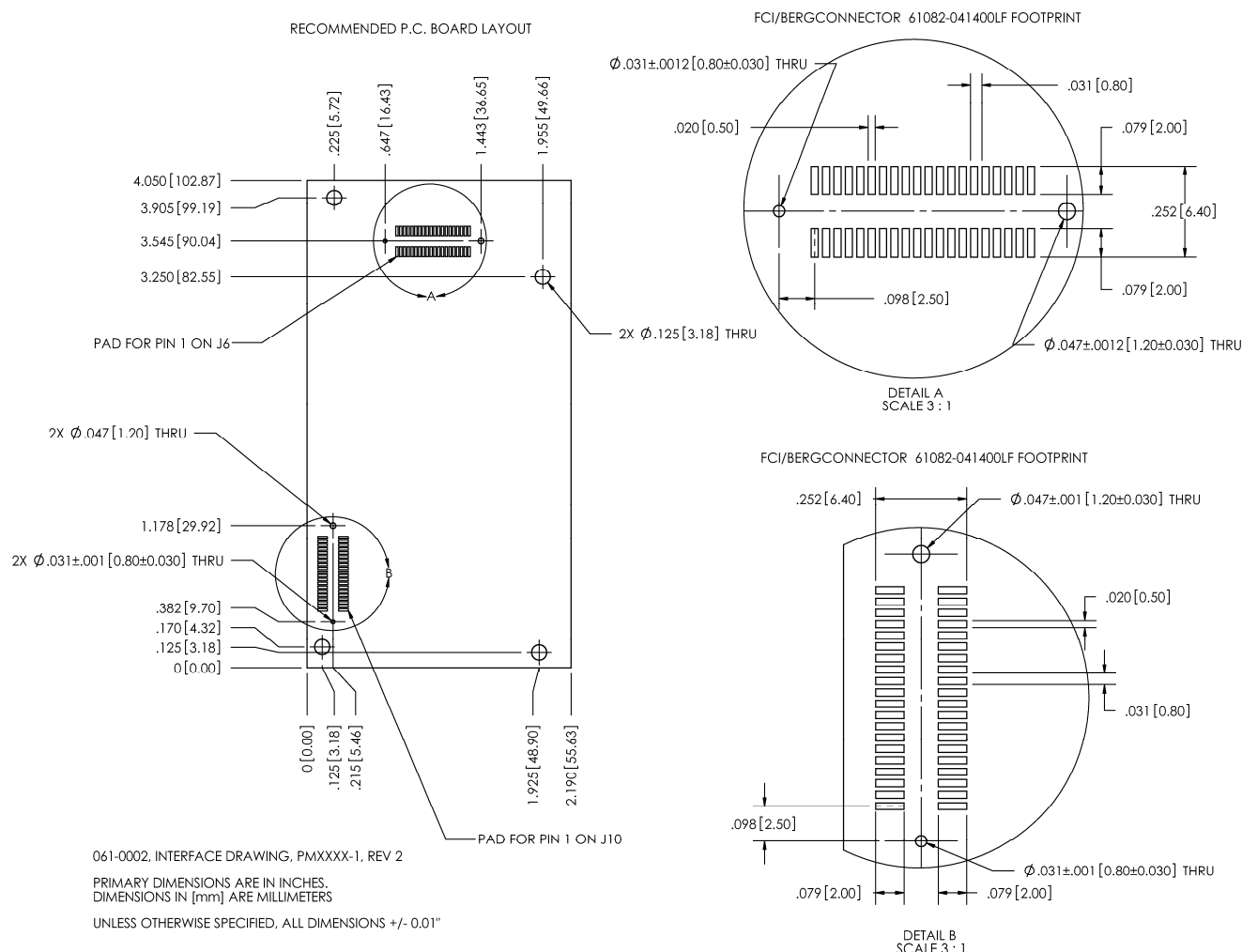


Figure 5 Mating Board Footprint (Top View)

9.0 Regulatory and Standards Compliance

9.1 FCC Compliance

9.1.1 FCC Testing

The PM2510-4 Embedded Manager complies with Part 15.247 modular (Intentional Radiator) of the FCC rules and regulations. In order to fulfill FCC certification requirements, products incorporating the PM2510-4 Embedded Manager must comply with the following:

1. An external label must be provided on the outside of the final product enclosure specifying the FCC identifier, as described in section 9.1.3 below.
2. The antenna must be electrically identical to the FCC-approved antenna specifications for the PM2510-4 as described in 9.1.2, with the exception that the gain may be lower than specified in Table 24.
3. The device integrating the PM2510-4 may not cause harmful interference, and must accept any interference received, including interference that may cause undesired operation.
4. An unintentional radiator scan must be performed on the device integrating the PM2510-4 Embedded Manager, per FCC rules and regulations, CFR Title 47, Part 15, Subpart B. See FCC rules for specifics on requirements for declaration of conformity.

9.1.2 FCC-approved Antenna

The following are FCC-approved antenna specifications for the PM2510-4.

Table 24 FCC-approved Antenna Specifications for the PM2510-4

Gain	Pattern	Polarization	Frequency	Connector
+2 dBi maximum	Omni-directional	Vertical	2.4–2.4835 GHz	MMCX

9.1.3 OEM Labeling Requirements

The Original Equipment Manufacturer (OEM) must ensure that FCC labeling requirements are met. The outside of the final product enclosure must have a label with the following (or similar) text specifying the FCC identifier. The FCC ID and certification code must be in Latin letters and Arabic numbers and visible without magnification.

Contains transmitter module FCC ID: SJC-M2140

or

Contains FCC ID: SJC-M2140

9.2 IC Compliance

9.2.1 IC Testing

The PM2510-4 is certified for modular Industry Canada (IC) RSS-210 approval. The OEM is responsible for its product to comply with IC ICES-003 and FCC Part 15, Sub. B - Unintentional Radiators. The requirements of ICES-003 are equivalent to FCC Part 15 Sub. B and Industry Canada accepts FCC test reports or CISPR 22 test reports for compliance with ICES-003.

9.2.2 IC-approved Antennae

The PM2510-4 is designed to operate with antennas meeting the specifications shown in Table 25. Antennas not meeting these specifications are strictly prohibited for use with the PM2510-4. The required antenna impedance is 50 Ohms. Operation is subject to the following two conditions: (1) this device may not cause interference, and (2) this device must accept any interference, including interference that may cause undesired operation of the device.

Table 25 IC-approved Antenna Specifications for the PM2510-4

Gain	Pattern	Polarization	Frequency	Connector
+2 dBi maximum	Omni-directional	Vertical	2.4–2.4835 GHz	MMCX

The following are IC-approved antenna specifications for the PM2510-4.

9.2.3 OEM Labeling Requirements

The Original Equipment Manufacturer (OEM) must ensure that IC labeling requirements are met. The outside of the final product enclosure must have a label with the following (or similar) text specifying the IC identifier. The IC ID and certification code must be in Latin letters and Arabic numbers and visible without magnification.

Contains IC: 5853A-M2140

9.3 CE Compliance

9.3.1 Declaration of Conformity

We, Dust Networks, of 30695 Huntwood Ave, Hayward, CA 94544 USA, declare under our sole responsibility that our product, SmartMesh IA-510 PM2510-4, and in combination with our accessories, to which this declaration relates is in conformity with the appropriate standards ETSI EN 300 328, ETSI EN 301 489-17 and EN 60950, following the provisions of Radio Equipment and Telecommunication Terminal Equipment directive 99/5/EC with requirements covering EMC directive 89/336/EEC, and Low voltage directive 73/23/EEC.

9.3.2 European Compliance

If the PM2510-4 managers are incorporated into a product, the manufacturer must ensure compliance of the final product to the European harmonized EMC and low-voltage/safety standards. A Declaration of Conformity must be issued for each of these standards and kept on file as described in Annex II of the R&TTE Directive. Furthermore, the manufacturer must maintain a copy of this PM2510-4 user documentation and ensure the final product does not exceed the specified power ratings, antenna specifications, and/or installation requirements as specified in the user manual. If any of these specifications are exceeded in the final product, a submission must be made to a notified body for compliance testing to all required standards.

9.3.3 OEM Labeling Requirements

The 'CE' marking must be affixed to a visible location on the OEM product. The CE mark shall consist of the initials "CE" taking the following form:

- If the CE marking is reduced or enlarged, the proportions given in the drawing below must be respected.
- The CE marking must have a height of at least 5 mm except where this is not possible on account of the nature of the apparatus.
- The CE marking must be affixed visibly, legibly, and indelibly.

Furthermore, since the usage of the 2400 – 2483.5 MHz band is not harmonized throughout Europe, the Restriction sign must be placed to the right of the 'CE' marking as shown below. See the R&TTE Directive, Article 12 and Annex VII for more information.

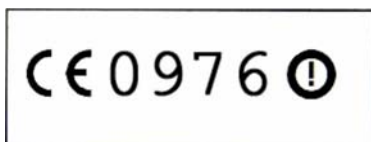


Figure 6 CE Label Requirements

9.3.4 Restrictions

Norway prohibits operation near Ny-Alesund in Svalbard. More information can be found at the Norway Posts and Telecommunications site (www.npt.no).

9.4 Compliance to Restriction of Hazardous Substances (RoHS)

Restriction of Hazardous Substances (RoHS) is a directive that places maximum concentration limits on the use of cadmium (Cd), lead (Pb), hexavalent chromium (Cr+6), mercury (Hg), Polybrominated Biphenyl (PBB) and Polybrominated Diphenyl Ethers (PBDE). Dust Networks is committed to meeting the requirements of the European Community directive 2002/95/EC.

This product has been specifically designed to utilize RoHS compliant materials and to eliminate, or reduce, the use of restricted materials to comply with 2002/95/EC.

The Dust Networks RoHS compliant design features include:

- RoHS compliant solder for solder joints
- RoHS compliant base metal alloys
- RoHS compliant precious metal plating
- RoHS compliant cable assemblies and connector choices

9.5 Industrial Environment Operation

The PM2510-4 is designed to meet the specifications of a harsh industrial environments which includes:

- **Shock and Vibration**—The PM2510-4 complies with high vibration pipeline testing, as specified in IEC 60770-1.
- **Temperature Extremes**—The PM2510-4 is designed for industrial storage and operational temperature range of -40°C to $+85^{\circ}\text{C}$.

10.0 Related Documentation

- *SmartMesh IA-510 Manager Serial API Guide*
- *SmartMesh IA-510 Manager XML API Guide*
- *SmartMesh IA-510 Admin Toolset Reference Guide*

11.0 Ordering Information

Product List:

PM2510-4: SmartMesh IA-510 2.4 GHz Embedded Manager

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Document Number: 020-0033 rev 1 PM2510-4 Datasheet

Last Revised: November 19, 2008

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Advanced Information	Planned or under development	This datasheet contains the design specifications for product development. Dust Networks reserves the right to change specifications in any manner without notice.
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