

SMARTMESH IA-510™ PM2510-1

2.4 GHz Embedded Network Manager

Product Description

The WirelessHART™ compliant PM2510-1 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 PM2510-1 provides industrial automation vendors with a complete embedded wireless sensor networking solution for WirelessHART applications that assures multi-vendor interoperability and offers forward compatibility.

The PM2510-1 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.

About SmartMesh IA-510

Dust Networks' SmartMesh IA-510 is the first WirelessHART-compatible system in the SmartMesh IA-500™ family of products. The SmartMesh IA-510 system 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 PM2510-1 embedded network manager and two mote form factors: the DN2510 Mote-on-Chip™ 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.

Key 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
- Enables >99.99% network reliability even in 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 pending for FCC, IC, CE

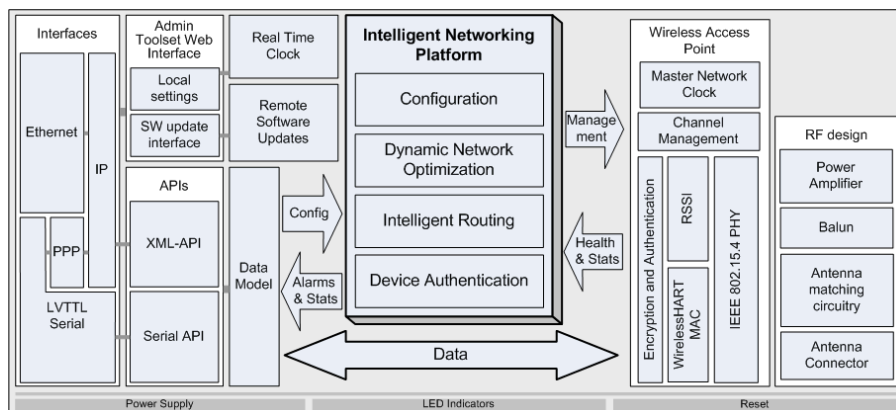


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1.0 Absolute Maximum Ratings

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 7.1 and 8.2. 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 PM2510-1 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 Real-time Clock

The PM2510-1 has a battery-backed real-time clock (RTC) with a lifetime of 15 years, assuming 60 °C average ambient temperature and 10% duty cycle. RTC accuracy is typically 1 minute/month but can drift up to 10 minutes/month at temperature extremes. The clock may be set manually using the Admin Toolset Web interface or periodically using NTP. See the *SmartMesh IA-510 Admin Toolset Reference Guide*.

5.0 Radio

5.1 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 V, 25 °C
		–90		dBm	At 1% PER, V _{DD} = 3 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.					

5.2 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 9.1. The antenna must meet specifications in Table 13. For a list of antennae pre-approved for RF certification, see section 10.1.2.

Table 13 Antenna Specifications

Parameter	Value
Frequency range	2.4–2.4835 GHz
Impedance	50 Ω
Gain PM2510-1	+2 dBi maximum
Pattern	Omni-directional
Maximum VSWR	3:1
Connector	MMCX*
* The PM2510-1 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 PM2510-1 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.

6.0 SmartMesh IA-510 Mesh Networking Software

The PM2510-1 comes pre-programmed with SmartMesh IA-510 mesh networking software, which utilizes Time Synchronized Mesh Protocol (TSMP) to enable ultra low-power wireless sensors networks and unprecedented data reliability.

6.1 Low-power Network

With a PM2510-1 as its embedded Manager, a SmartMesh IA-510 network can achieve five to ten year battery life across all its nodes. SmartMesh IA-510 owes its low-power operation to unmatched duty cycling and to time-synchronized transmissions. Duty cycling refers to operating a component at intervals and returning it to a quiescent (nearly zero-power) state when not in active use. Duty cycling dramatically reduces power consumption. SmartMesh IA-510 aggressively duty cycles motes and (when appropriate) their attached sensors. As a result, every network node can last for years using off-the-shelf batteries.

Once established in a mesh, SmartMesh motes do not transmit at will, since doing so would require other motes to listen at all times for potential transmissions, and radios (even the low-power radios used for these sensor networks) consume substantial power when listening. Instead, SmartMesh IA-510 networks use time-synchronized transmissions. A receiving mote powers on its radio only long enough to determine whether the transmitting mote has a packet to send, and then to receive and acknowledge the incoming packet if one is detected. Similarly, the transmitting mote activates its radio only if it has a packet to send. Finally, since the PM2510-1 time synchronizes the traffic in the network, there are no re-transmissions due to in-network collisions, thus reducing overall traffic and overall power consumption. SmartMesh IA-510 delivers not only low-power operation, but also outstanding data reliability.

6.2 Data Reliability

A SmartMesh IA-510 network achieves 99.99% data reliability even in the most challenging industrial environments through the way it performs network formation, route maintenance and network optimization. A SmartMesh IA-510 network will self-configure into a network with fully redundant paths to every mote, including the ones on the edge of the network. This *mesh-to-the-edge*[™] ensures that every mote has path redundancy. A PM2510-1 continuously performs route maintenance on the network by monitoring regular health reports and network statistics and replacing unavailable paths. This *self-healing* aspect of SmartMesh IA-510 makes it ideally suited for harsh environments in which the RF characteristics are always changing. Finally, network optimization (also known as *active load balancing*) makes continuous, proactive network adjustments in network links to improve overall latency and power consumption, while maintaining the highest reliability.

7.0 Interfaces

The PM2510-1 is designed for ease of integration by providing multiple data ports and well-defined software APIs. Section 7.1 describes the PM2510-1 data ports, LEDs, and switches. Refer to the *SmartMesh IA-510 PM2510-1 Integration Guide* for example application circuits. Section 7.2 describes the software functions that are available through the data ports.

7.1 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

7.1.1 10Base-T Ethernet Interface

Ideal for remote or high-bandwidth access, the Ethernet interface provides full configuration management and data access to the PM2510-1. 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 8.2 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 PM2510-1 is about one-half the standard 10Base-T level.

7.1.2 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 PM2510-1. 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

7.1.3 Serial 2 Interface

The PM2510-1 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

7.1.4 Serial 3 Interface

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

7.1.5 LED Status Indicators

The PM2510-1 has LED status indicators on the topside 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	Yellow
Mode 2	nLED_RESERVED1	Reserved for future use	Yellow
Mode 3	nLED_RESERVED2	Reserved for future use	Green
Mode 4	nLED_RESERVED3	Reserved for future use	Green
$\overline{\text{RST}}$	nRESET_IN	Indicates the manager is in the reset state	Red

7.2 Software Interfaces

The PM2510-1 provides well-defined software interfaces for easy integration. Table 18 describes which interfaces are available via the various hardware ports. This section describes the software interfaces available via the hardware ports described in section 7.2.1.

Table 18 PM2510-1 Software Interfaces

Hardware Port	Software Interface	Comments
Ethernet	XML API, Admin Toolset	
Serial 1	PPP/Serial API/Heartbeat	Function is user selectable via Admin Toolset utility or command line interface. By default, PPP is enabled on this port.
Serial 2	Command line interface	

7.2.1 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 PM2510-1 and receive responses and other data from the PM2510-1 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*.

7.2.2 Admin Toolset

The PM2510-1 provides a Web-based administrative tool called Admin Toolset. Through this interface, users may configure IP settings, view logs, manually configure the Real Time Clock or enable the Network Time Protocol (NTP) client. Also, users may update PM2510-1 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*.

7.2.3 PPP

The PM2510-1 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 PM2510-1 acts as a PPP server. Note that the client is responsible for periodically pinging the PM2510-1 and re-establishing PPP connection if necessary.

Table 19 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 PM2510-1 (server)	192.168.101.10
Default client	192.168.101.11

7.2.4 Serial API

The PM2510-1 provides a packet-based serial API that allows communications with the PM2510-1 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*.

7.2.5 Heartbeat (Manager Failover)

When operating via Ethernet, a pair of PM2510-1 Embedded Managers may be configured as a redundant pair, with the backup embedded manager acting as an emergency failover. The pair is connected via a null modem serial connection that 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 communicate with the new manager. During this “cold” failover, some data packet loss may occur while the network rebuilds to the new embedded manager.

The Serial 1 port on the PM2510-1 may be configured as the heartbeat between the manager pair. For details on configuring manager redundancy, refer to the *SmartMesh IA-510 Admin Toolset Reference Guide*.

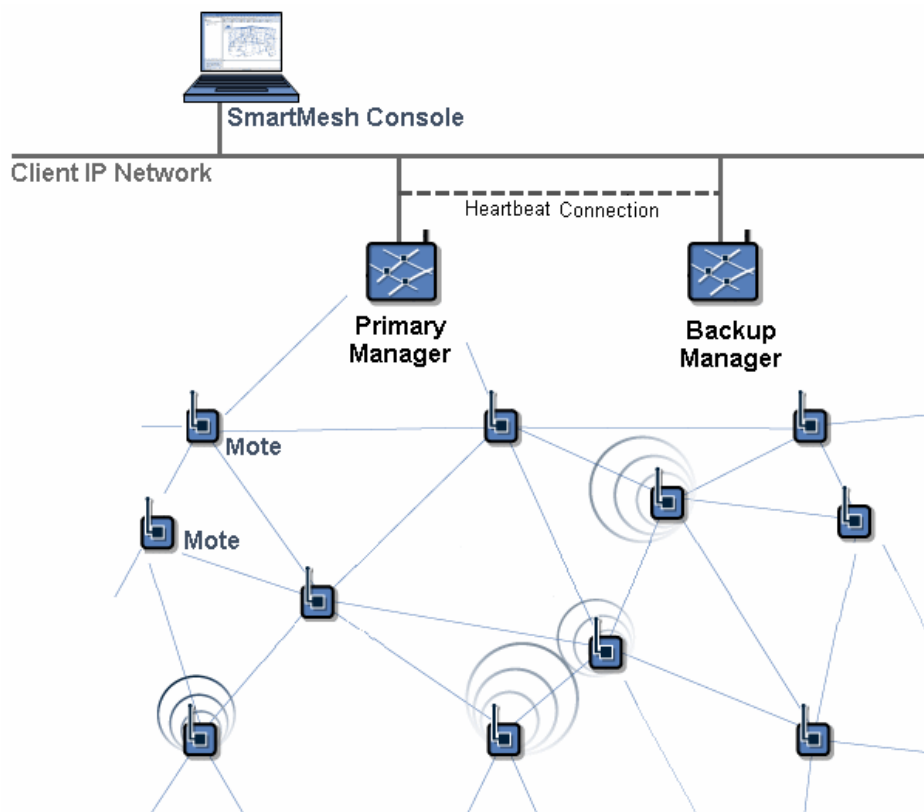


Figure 1 Network with Redundant Managers

7.2.6 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.

8.0 Board-to-board Connectors

The PM2510-1 has two 40-pin FCI/Berg 61083-042400LF board-to-board connectors. For connector and pin locations, see Figure 2 and Figure 3.

8.1 Connector Pin Numbering

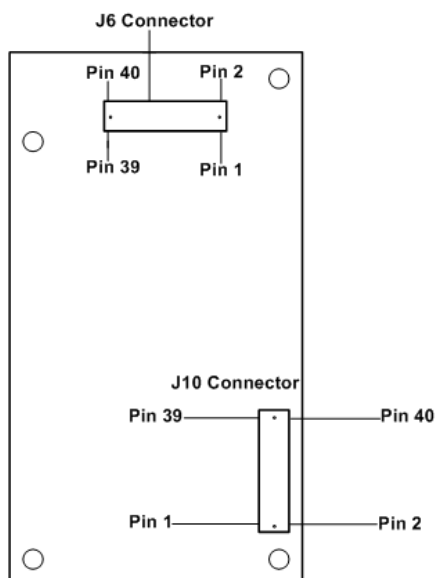


Figure 2 Connector Pin Numbering (Bottom View)

8.2 Pinout

Table 20 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>			No connection
15	S1_CTS	In	LVTTTL Type 1	Serial 1
16	<i>Reserved</i>			No connection
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>			No connection
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>			No connection
28	nLED_RESERVED2	Out	LED	LED status indicators
29	<i>Reserved</i>			No connection
30	nLED_RESERVED3	Out	LED	LED status indicators
31	<i>Reserved</i>			No connection
32	S3_RX	In	LVTTTL Type 1	Serial 3
33	GND			
34	S3_TX	Out	LVTTTL Type 1	Serial 3
35	<i>Reserved</i>			No connection
36	S3_RX_EN	Out	LVTTTL Type 1	Serial 3
37	<i>Reserved</i>			No connection
38	S3_TX_EN	Out	LVTTTL Type 1	Serial 3
39	GND			
40	GND			

Table 21 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>			No connection
4	S2_TX	Out	LVTTL Type 1	Serial 2
5	<i>Reserved</i>			No connection
6	S2_RX	In	LVTTL Type 1	Serial 2
7	<i>Reserved</i>			No connection
8	S2_RTS	Out	LVTTL Type 1	Serial 2
9	<i>Reserved</i>			No connection
10	S2_CTS	In	LVTTL Type 1	Serial 2
11	<i>Reserved</i>			No connection
12	S2_RI	In	LVTTL Type 1	Serial 2
13	<i>Reserved</i>			No connection
14	S2_DCD	In	LVTTL Type 1	Serial 2
15	GND			
16	S2_DSR	In	LVTTL Type 1	Serial 2
17	<i>Reserved</i>			No connection
18	S2_DTR	Out	LVTTL Type 1	Serial 2
19	<i>Reserved</i>			No connection
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>			No connection
24	GND			
25	<i>Reserved</i>			No connection
26	RESET_OUT	Out	LVTTL Type 4	Reset high
27	<i>Reserved</i>			No connection
28	nRESET_IN	In	LVTTL Type 5	Switch In
29	<i>Reserved</i>			No connection
30	<i>Reserved</i>			No connection
31	<i>Reserved</i>			No connection
32	+5V_IN	In	5.0 V \pm 5%	Power In
33	<i>Reserved</i>			No connection
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>			No connection
39	GND			
40	GND			

8.3 Recommended Mating Connectors

The user connections are made through J6 and J10 on the PM2510-1, 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 22).

Table 22 Recommended Mating Connectors

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

9.0 Mechanical Specifications

9.1 PM2510-1 Mechanical Drawings

In laying out a design, locate the mating connectors by using the alignment pins and correlating pin numbers for orientation (see Figure 2).

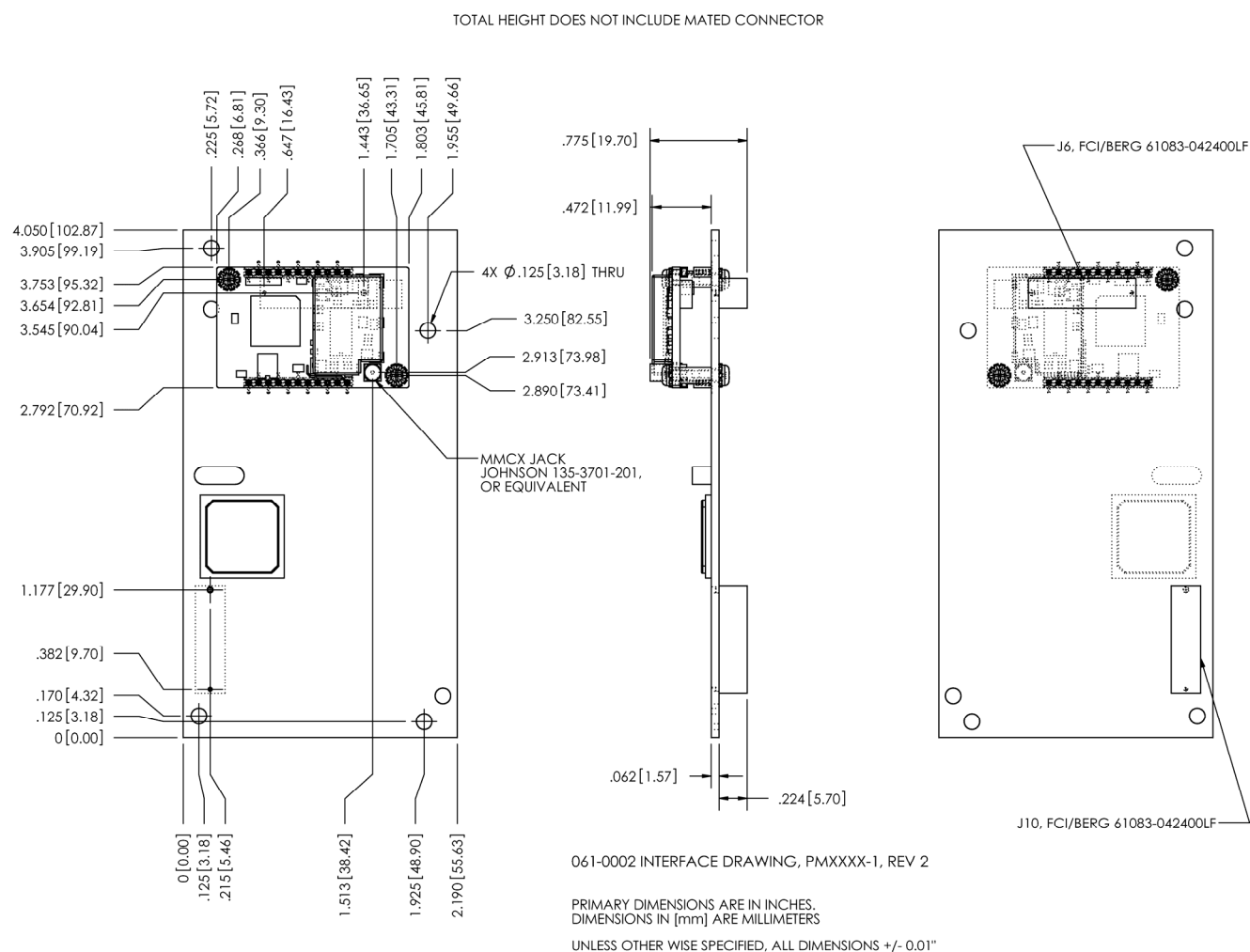


Figure 3 PM2510-1 Mechanical Drawing

10.1.2 FCC-approved Antenna

The following are FCC-approved antenna specifications for the PM2510-1.

Table 23 FCC-approved Antenna Specifications for the PM2510-1

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

10.1.3 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

10.2 IC Compliance

10.2.1 IC Testing

The PM2510-1 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.

10.2.2 IC-approved Antennae

The PM2510-1 is designed to operate with antennas meeting the specifications shown in Table 24. Antennas not meeting these specifications are strictly prohibited for use with the PM2510-1. 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 24 IC-approved Antenna Specifications for the PM2510-1

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 PM2510-1.

10.2.3 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: 5853-M2140

10.3 CE Compliance

10.3.1 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 PM2510-1,

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.

10.3.2 European Compliance

If the PM2510-1 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 PM2510-1 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.

10.3.3 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.

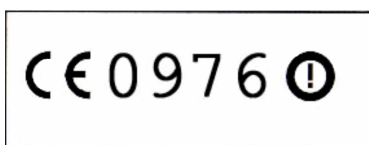


Figure 5 CE Label Requirements

10.3.4 Restrictions

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

10.4 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

NOTE: In accordance with compliance to 2002/95/EC, Dust Network customers will elect to use certain types of lead-free solder alloys. A corresponding change in process as to optimum reflow temperatures will be required, and must be carefully evaluated.

10.5 Industrial Environment Operation

The PM2510-1 is designed to meet the specifications of a harsh industrial environments which includes:

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

11.0 Related Documentation

- *SmartMesh IA-510 PM2510-1 Integration Guide*
- *SmartMesh IA-510 Manager Serial API Guide*
- *SmartMesh IA-510 Manager XML API Guide*
- *SmartMesh IA-510 Admin Toolset Reference Guide*

12.0 Ordering Information

Product List:

PM2510-1: SmartMesh IA-510 2.4 GHz Embedded Manager

Contact Information:

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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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