

# Machine Interface Board (MIB) Specification (Preliminary)

Document Number: D-161231-0026

Revised: 13-Jan-17 13:41

Customer: TNBI LLC

Model Name: MIB216300

Author: Adaptive Micro-Ware, Inc

G. Christman 01/05/2017

Technical Approval

\_\_\_\_\_ / \_\_\_\_ / \_\_\_\_

Final Approval

\_\_\_\_\_ / \_\_\_\_ / \_\_\_\_  
Customer Approval

Copy Number: \_\_\_\_\_

Project Name: Machine Hub Interface Board	Originator: Admir Maglajlic	
Contributors:		
Document Title: Down Power Line Sensor (DPLS)	FileName: Machine Interface Board Theory of Operation_Technical Description.docx	
Create Date: 3/31/2016	Last Saved Date: 1/16/2017 4:19:00 PM	Page 1 of 9

## TABLE OF CONTENTS

<u>SECTION</u>	<u>PAGE</u>
<b>1 INTRODUCTION</b>	<b>3</b>
REVISION HISTORY.....	3
1.1 REFERENCE DOCUMENTS.....	3
1.2 DEFINITIONS.....	3
<b>2 SYSTEM DESCRIPTION</b>	<b>4</b>
<b>3 SYSTEM ARCHITECTURE</b>	<b>5</b>
3.1 HARDWARE ARCHITECTURE .....	5
3.1.1 Power Interfaces .....	6
3.1.2 Communication Interfaces .....	6
3.2 COMMUNICATION SYSTEM REQUIREMENTS.....	6
3.3 SOFTWARE ARCHITECTURE .....	7
3.3.1 MIB RF Message Protocol .....	7
3.3.1.1 Coin Drop Request Message .....	7
3.3.1.2 Coin Drop Response Message .....	7
3.3.1.3 Serial Message Request .....	7
3.3.1.4 Serial Message Response.....	7
3.3.2 MIB States of Operation.....	7
3.3.3 Software Operational State Diagram .....	7
<b>4 UNIT PROTOTYPE TEST ROUTINES</b>	<b>8</b>
4.1 PROGRAMMING HEADER (I/O) TEST .....	8
4.2 RS-485 SERIAL LINK TEST .....	8
4.3 RS-232 SERIAL LINK TEST .....	8
4.4 ID CHIP (I2C) TEST .....	8
4.5 COIN COUNTER/EMULATOR (I/O) TEST.....	8
4.6 LED (I/O) TEST.....	8
4.6.1 Radio Link Quality Test .....	8
<b>5 PRINTED CIRCUIT BOARD (PCB) SPECIFICATION</b>	<b>9</b>
5.1 PCB SHAPE AND SIZE .....	9

Project Name: Machine Hub Interface Board	Originator: Admir Maglajlic
Contributors:	
Document Title: Down Power Line Sensor (DPLS)	FileName: Machine Interface Board Theory of Operation_Technical Description.docx
Create Date: 3/31/2016	Last Saved Date: 1/16/2017 4:19:00 PM

## 1 INTRODUCTION

This document specifies hardware and software requirements, test procedures and prototype performance requirements of the "Machine Interface Board (MIB)" module. The MIB module is a sub-system, which is in turn only a part of the larger "Coin-Op Payment" system. The scope of this document is only within the MIB module. For detailed specification requirements on the overall system description refer to "Coin-Op Payment System Specification D-161231-0019" and for the HUB module, refer to "Machine HUB Board (HUB) Specification" document D-161231-0025 (See 1.1 Reference Documents).

## Revision History

## 1.1 Reference Documents

1. Coin-Op Payment System Specification D-161231-0022
2. Machine Hub Specification Document (D-161231-0025)

## 1.2 Definitions

**HUB:** Machine HUB Board - Custom Hardware Module

**MIB:** Machine Interface Board - Custom Hardware Module

**ETEE:** End-To-End Encryption - Secure method where the data is encrypted on the sender's system or device and only the recipient is able to decrypt it. Nobody in between can read it or tamper with the data.

**LP2PE:** Local Point-To-Point Encryption - Local secure method where the data is encrypted/decrypted between an end point and an intermediate device (ex: MIB module and HUB Module)

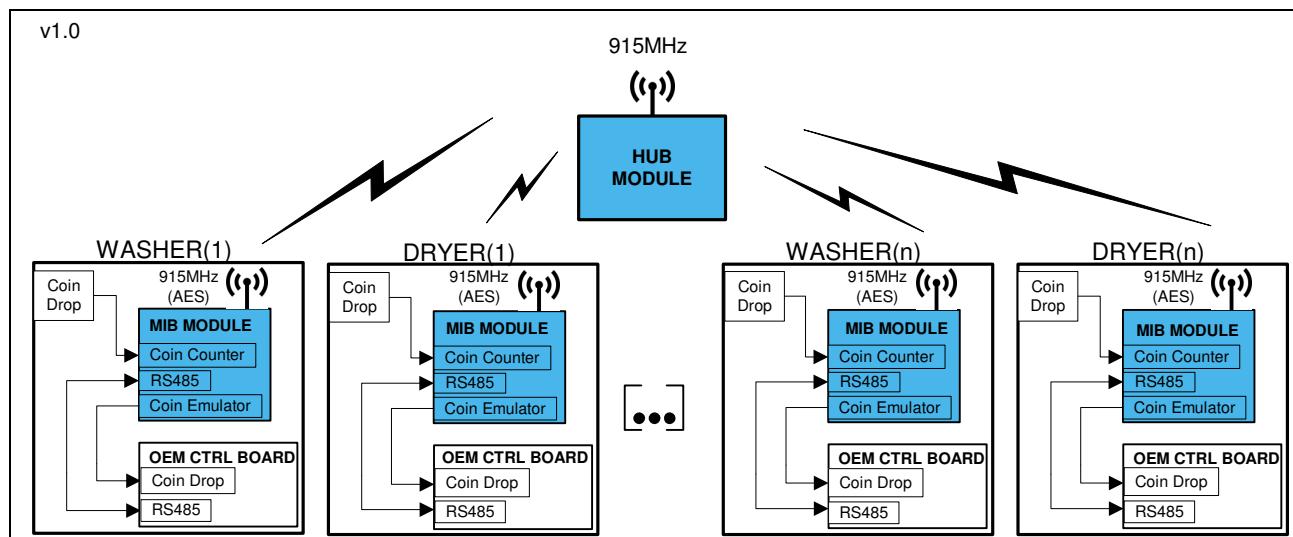
**Application Message:** A message sent from a SMART Tablet

**Server Message:** A message sent from the Cloud Server

Project Name: Machine Hub Interface Board	Originator: Admir Maglajlic	
Contributors:		
Document Title: Down Power Line Sensor (DPLS)	FileName: Machine Interface Board Theory of Operation_Technical Description.docx	
Create Date: 3/31/2016	Last Saved Date: 1/16/2017 4:19:00 PM	Page 3 of 9

## 2 System Description

The purpose of the MIB module is to enable secure bidirectional wireless communication between washer/dryer and the HUB module (see Figure 1). Each washer and dryer has an MIB module, which interacts with "OEM Control Board" via dedicated RS485 serial link. In addition, the MIB module has an integrated "Coin Counter" that counts inserted coins and an integrated "Coin Emulator" which electronically simulates the coin insertion upon user payment. The "Coin Emulator" is software version dependent, since not all washers/dryers support RS485 Interface. The link between MIB "Coin Emulator" and the "Coin Drop" on the "OEM Control Board" is a custom-built wire harness. The MIB modules have on board a unique ID chip, which allows a HUB module to uniquely select and talk to all MIB modules individually. For privacy and security reasons, the wireless link (915 MHz) between the HUB and MIB units is encrypted with "Local Point-To-Point Encryption (LP2PE)" algorithm.



**Figure 1** System Description

Project Name: Machine Hub Interface Board	Originator: Admir Maglajlic
Contributors:	
Document Title: Down Power Line Sensor (DPLS)	FileName: Machine Interface Board Theory of Operation_Technical Description.docx
Create Date: 3/31/2016	Last Saved Date: 1/16/2017 4:19:00 PM

### 3.1.1 Power Interfaces

1. 24VDC Power Port (Main Power Input)

### 3.1.2 Communication Interfaces

The Machine Interface Board (MIB) has following Interfaces:

- AES128 Encrypted Wireless RF Link (Sub-1GHz channels)
- 1 RS-485 Serial Port (washer/dryer link)
- 1 RS-485 Serial Port (development test port )
- 1 RS-232 Serial Port (development test port )

## 3.2 Communication System Requirements

The MIB shall support following Continental GIRBAU "Message Type Protocols":

- Cod. 585927en, Rev. No. 03/0615
- Cod. 586016en, Rev. No. 01/0913

Project Name: Machine Hub Interface Board		Originator: Admir Maglajlic
Contributors:		
Document Title: Down Power Line Sensor (DPLS)		FileName: Machine Interface Board Theory of Operation_Technical Description.docx
Create Date: 3/31/2016	Last Saved Date: 1/16/2017 4:19:00 PM	Page 6 of 9

### 3.3 Software Architecture

TBD

#### 3.3.1 MIB RF Message Protocol

MIBs receive and response to HUB RF Commands in a following 30 Bytes protocol:

##### 3.3.1.1 Coin Drop Request Message

<b>MIB Machine#</b> (Byte 0)	<b>Coin CMD 0x05</b> (Byte 1)	<b>Coind Drop#</b> (Byte 2)	<b>Padding</b> (Byte 3 - Byte 29)
---------------------------------	----------------------------------	--------------------------------	--------------------------------------

##### 3.3.1.2 Coin Drop Response Message

<b>MIB Unique ID</b> (Byte 0 - Byte 5)	<b>MIB RSSI</b> (Byte 6)	<b>HUB RSSI</b> (Byte 7)	<b>Padding 0x55</b> (Byte 8 - Byte 29)
---	-----------------------------	-----------------------------	---

##### 3.3.1.3 Serial Message Request

<b>MIB Machine#</b> (Byte 0)	<b>Msg Length</b> (Byte 1)	<b>Message</b> (Variable Length)	<b>Padding</b> (Byte _next - Byte 29)
---------------------------------	-------------------------------	-------------------------------------	--

##### 3.3.1.4 Serial Message Response

<b>MIB Unique ID</b> (Byte 0 - Byte 5)	<b>MIB RSSI</b> (Byte 6)	<b>HUB RSSI</b> (Byte 7)	<b>Response Msg</b> (Variable Length)	<b>Padding 0x55</b> (Byte _next - Byte 29)
---	-----------------------------	-----------------------------	--	---

#### 3.3.2 MIB States of Operation

Coin Drop custom Function/command from SMART Tablet

Configurable input parameters from Tablet (polarity, time between drops, number\_of\_quarters)

Figure X - Timing diagram (TBD)

#### 3.3.3 Software Operational State Diagram

Figure X to X-x illustrates the operational state diagrams of software architecture.

Project Name: Machine Hub Interface Board	Originator: Admir Maglajlic
Contributors:	
Document Title: Down Power Line Sensor (DPLS)	FileName: Machine Interface Board Theory of Operation_Technical Description.docx
Create Date: 3/31/2016	Last Saved Date: 1/16/2017 4:19:00 PM

## 4 Unit Prototype Test Routines

In order to verify the prototype MIB board functionality, following tests should be performed

### 4.1 Programming Header (I/O) Test

For Test and debug.

### 4.2 RS-485 Serial Link Test

TBD

### 4.3 RS-232 Serial Link Test

Not Used

### 4.4 ID Chip (I2C) Test

A register(s) that contain unique ID number is serially read via I2C interface and verified.

### 4.5 Coin Counter/Emulator (I/O) Test

For Coin emulation.

### 4.6 LED (I/O) Test

For test and debug.

#### 4.6.1 Radio Link Quality Test

The criteria for RF communication link quality between Machine Interface Boards and HUB Interface. (TBD)

Project Name: Machine Hub Interface Board	Originator: Admir Maglajlic	
Contributors:		
Document Title: Down Power Line Sensor (DPLS)	FileName: Machine Interface Board Theory of Operation_Technical Description.docx	
Create Date: 3/31/2016	Last Saved Date: 1/16/2017 4:19:00 PM	Page 8 of 9



## 5 Printed Circuit Board (PCB) Specification

The MIB Module has on board integrated RF antenna and all of the necessary power supplies. The PCB is an impedance-controlled board with TBD layers. The PCB is going to be mounted on the front side of the washer, behind the plastic OEM panel (top right corner panel).

### 5.1 PCB Shape and Size

The MIB PCB dimension is 58.5 mm x 95.3 mm (2.3 in x 3.75 in). The Board has four mounting holes and embedded antenna.

#### Warning

This device complies with part 15 of the FCC Rules. Operation is subject to the condition that this device does not cause harmful interference (1) this device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.

Changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.

NOTE: This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation.

If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

n Reorient or relocate the receiving antenna.

n Increase the separation between the equipment and receiver.

n Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.

n Consult the dealer or an experienced radio/TV technician for help.

To maintain compliance with FCC's RF Exposure guidelines, This equipment should be installed and operated with minimum distance between 20cm the radiator your body: Use only the supplied antenna.

FCC ID :2AL5K-MIB216300

Project Name: Machine Hub Interface Board	Originator: Admir Maglajlic
Contributors:	
Document Title: Down Power Line Sensor (DPLS)	FileName: Machine Interface Board Theory of Operation_Technical Description.docx
Create Date: 3/31/2016	Last Saved Date: 1/16/2017 4:19:00 PM