Ethertronics LoRa Evaluation board, Passive V1.1, using module ETH-LORA-M-AX-01 and Ethertronics Prestta™ Multi-Band ISM antenna (P/N:1002232)
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Application Note 001
Ethertronics LoRa Evaluation board, Passive V1.1, using module ETH-LORA-M-AX-01 (V1.2) and Ethertronics Prestta™ Multi-Band ISM antenna (P/N:1002232)

OVERVIEW
This Application Note provides hardware description for the evaluation of Ethertronics LoRa module on its evaluation board with a passive antenna.

The version of the parts are:
• Evaluation Board: EVB passive antenna, V1.1.
• Module: Lora Module ETH-LORA-M-AX-01, V1.2
• Antenna: Ethertronics Prestta™ Multi-Band ISM antenna (P/N: 1002232).

Instructions to setup the evaluation board are given with the full schematic and BOM.
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GENERAL DESCRIPTION
The Evaluation Board (EVB) is provided with test-connector to control the Ethertronics Lora module with AT-commands and battery holder (3xAA batteries) for power supply. The EVB can also be powered through the test-connector.

PCB LAYOUT
ETHERTRONICS LORA PASSIVE EVALUATION BOARD (TOP LAYER 1, TOP VIEW)

See after for the ground clearance Area.

Figure 1
Application Note 001
Ethertronics LoRa Evaluation board, Passive V1.1, using module ETH-LORA-M-AX-01 (V1.2) and Ethertronics Prestta™ Multi-Band ISM antenna (P/N:1002232)

PCB LAYOUT
ETHERTRONICS LORA PASSIVE EVALUATION BOARD (BOTTOM LAYER 16, TOP VIEW)

Figure 2
PCB LAYOUT

ETHERTRONICS LORA PASSIVE EVALUATION BOARD (LAYER 2, TOP VIEW)

Figure 3
Application Note 001
Ethertronics LoRa Evaluation board, Passive V1.1, using module ETH-LORA-M-AX-01 (V1.2) and Ethertronics Prestta™ Multi-Band ISM antenna (P/N:1002232)

PCB LAYOUT
ETHERTRONICS LORA PASSIVE EVALUATION BOARD (LAYER 3, TOP VIEW)

Figure 4
ANTENNA GROUND CLEARANCE

PCB GROUND CLEARANCE ON TOP LAYER

Figure 5

PCB GROUND CLEARANCE ON BOTTOM LAYER

Figure 6

PCB STACK UP AND SIZE

Figure 7: Ethertronics LoRa Passive Evaluation Board PCB Stack Up

The Passive Evaluation Board size is 110x50 mm, 4 layers, 0.8 mm thick FR4 PCB.

- The Layers 2 and 3 are ground layers, no signal lines routed in evaluation board. Do not use these layers for routing under the RF line.
- No routing under antenna pattern.

For detailed antenna pattern dimensions, please contact Ethertronics via our website.
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EVALUATION BOARD SCHEMATIC AND BOM
ETHERTRONICS PASSIVE LORA EVALUATION BOARD SCHEMATIC

Figure 8
EVALUATION BOARD SCHEMATIC AND BOM
DETAILED SCHEMATIC OF LORA MODULE WITH ANTENNA AND TEST CONNECTOR
EVALUATION BOARD SCHEMATIC AND BOM

DETAILED SCHEMATIC OF POWER OF THE EVALUATION BOARD

Figure 10
## BOM OF EVALUATION BOARD

<table>
<thead>
<tr>
<th>Schematic Name</th>
<th>Manufacturer</th>
<th>Manufacture P/N</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>C1</td>
<td>Murata</td>
<td>GRM188R6Y1A106MA73D</td>
<td>Capacitor 10 µF, 0603 35V</td>
</tr>
<tr>
<td>C2</td>
<td>Murata</td>
<td>GRM188R6Y1A106MA73D</td>
<td>Capacitor 10 µF, 0603 35V</td>
</tr>
<tr>
<td>LED1</td>
<td>Osram</td>
<td>LS Q976-NR-1</td>
<td>LED RED, 0603</td>
</tr>
<tr>
<td>R1</td>
<td>Panasonic</td>
<td>ERJ-S020R00X</td>
<td>Resistor 0Ω, 0402</td>
</tr>
<tr>
<td>R2</td>
<td>NA, Not Assembled</td>
<td></td>
<td></td>
</tr>
<tr>
<td>R3</td>
<td>Panasonic</td>
<td>ERJ-2RKF1002X</td>
<td>Resistor 10kΩ, 0402</td>
</tr>
<tr>
<td>R4</td>
<td>Panasonic</td>
<td>ERJ-2RKF2200X</td>
<td>Resistor 220Ω, 0402</td>
</tr>
<tr>
<td>R5</td>
<td>NA, Not Assembled</td>
<td></td>
<td></td>
</tr>
<tr>
<td>R6</td>
<td>Panasonic</td>
<td>ERJ-S020R00X</td>
<td>Resistor 0Ω, 0402</td>
</tr>
<tr>
<td>R7</td>
<td>NA, Not Assembled</td>
<td></td>
<td></td>
</tr>
<tr>
<td>U$1</td>
<td>Ethertronics, Inc.</td>
<td>ETH_M_LORA_AX_REV1_2</td>
<td>Ethertronics LoRa module V1.2</td>
</tr>
<tr>
<td>Prestta 1002232</td>
<td>Ethertronics, Inc.</td>
<td>Prestta™ 1002232</td>
<td>Ethertronics Prestta™ 1002232 Antenna</td>
</tr>
<tr>
<td>Test connector</td>
<td>Molex LCC</td>
<td>22-28-4080</td>
<td>8 Positions Header, Breakaway Connector 2.54 mm Through Hole</td>
</tr>
<tr>
<td>Power source switch</td>
<td>NKK Switches</td>
<td>CS12ANW03</td>
<td>Slide switch SPDT 3A 125V</td>
</tr>
<tr>
<td>3xAA Battery connector</td>
<td>Memory protection devices</td>
<td>BC3AAPC</td>
<td>Battery holder for AA-batteries</td>
</tr>
<tr>
<td>U$6</td>
<td>ST Microelectronics</td>
<td>LD39200PU33R</td>
<td>LDO 2A, DFN6 3x3mm</td>
</tr>
<tr>
<td>Reset button</td>
<td>RAFI</td>
<td>1.14002.1010000</td>
<td>Push Switch SPST-NO 0.1A 35V</td>
</tr>
<tr>
<td>S1 (antenna matching circuit)</td>
<td>Murata</td>
<td>GJM1555C1H2R0WB01D</td>
<td>Capacitor 2 pF, 0402 50V</td>
</tr>
<tr>
<td>P2 (antenna matching circuit)</td>
<td>Murata</td>
<td>GJM1555C1HR50WB01D</td>
<td>Capacitor 0.5 pF, 0402 50V</td>
</tr>
<tr>
<td>S2 (antenna matching circuit)</td>
<td>Murata</td>
<td>LQW1550N1B00</td>
<td>Inductor 5.1 nH, 0402</td>
</tr>
</tbody>
</table>
COMPONENT LOCATION ON EVALUATION PCB

The Battery holder, Power source switch, and Test connector are on the backside of the PCB.
POWER SUPPLY

POWER BY BATTERY
The Passive LoRa Evaluation Board is provided with a battery holder for 3 AA-batteries. When powering the evaluation board with the batteries, the power selection switch is slide to position “Battery” and the evaluation board is powered through the Low Drop Out (LDO) regulator. The LDO is protecting the LoRa module from over voltage. The LDO has an output of 3.3V

POWER BY TEST CONNECTOR
When powering through test connector, it is possible to route the power through the LDO or to bypass the LDO.

THROUGH LDO
The safest way to power the evaluation board by the test connector is through the LDO. To power up through LDO the power selection switch is slide to position “VDD_SWD”. The LDO will drop the input voltage by 0.3 V when providing 2 A. A minimum power of 3.6 V is therefore recommended before the LDO

STRAIGHT FROM THE TEST CONNECTOR
The evaluation board can be powered up also straight from the test connector without the protection of the LDO. To power up the board, slide the power selection switch to position “Battery” and solder a 0 Ω resistor to the R7 pads. Be careful not to exceed 3.6 V on VDD_SWD pin. Exceeding this voltage may damage the LoRa module permanently.

ANTENNA
The Passive Evaluation Board is provided with Ethertronics, Inc. Prestta™ 1002232 Multi-Band ISMs antenna which covers all the ISM frequencies (868/915/2400 MHz). In the below charts the antenna typical performance and dimensions are specified with the matching circuit topology and component values. The antenna impedance (return loss) on evaluation board is optimized for the Ethertronics impedance matching chipset on the Ethertronics LoRa module.

ANTENNA RETURN LOSS AND TOTAL EFFICIENCY

ANTENNA RADIATION PATTERNS

Figure 12: Typical Return loss and Total efficiency. Measured on 110x50 mm PCB, without the module.

Figure 13: Typical Radiation pattern at 868 MHz. Measured on 110x50 PCB, without the module.
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ANTENNA
MATCHING CIRCUIT AND ANTENNA DIMENSIONS

Figure 14: 1002232 dimensions [mm] and Matching Circuit topology.

AT-COMMANDS
To control the Ethertronics LoRa module with AT-commands, please refer the documents LoRa_Module_AT Command Reference Guide from www.avx.com/products/modules/lora-module.
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