TransMeter Water (US) Specification

Rev 1.0

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1. Introduction

The following document describes the technical specification of the Water Meter transceiver board (called TMW-TransMeter Water) for the US market.

The TMW is actually a water odometer, offering Automatic Meter Reading – AMR. The TMW is 2-Way RF communicator built-in water meter. The RF capabilities enable the transmission of the meter reading and some extra information to a Collecting unit. In addition specific parameters can be programmed via the RF link.

The TMW consists of three units: RF Transmitter & Receiver with integral Antenna of PIFA (planar inverted F antenna) type that operate at ISM band (900MHz) and a Microcontroller (plus simple digital Logic) which control the operational modes of the unit.

1.1. Applicable Documents

Document Name	Written By	Date and Version
RF System Protocol RFD	ARAD Technologies Ltd.	

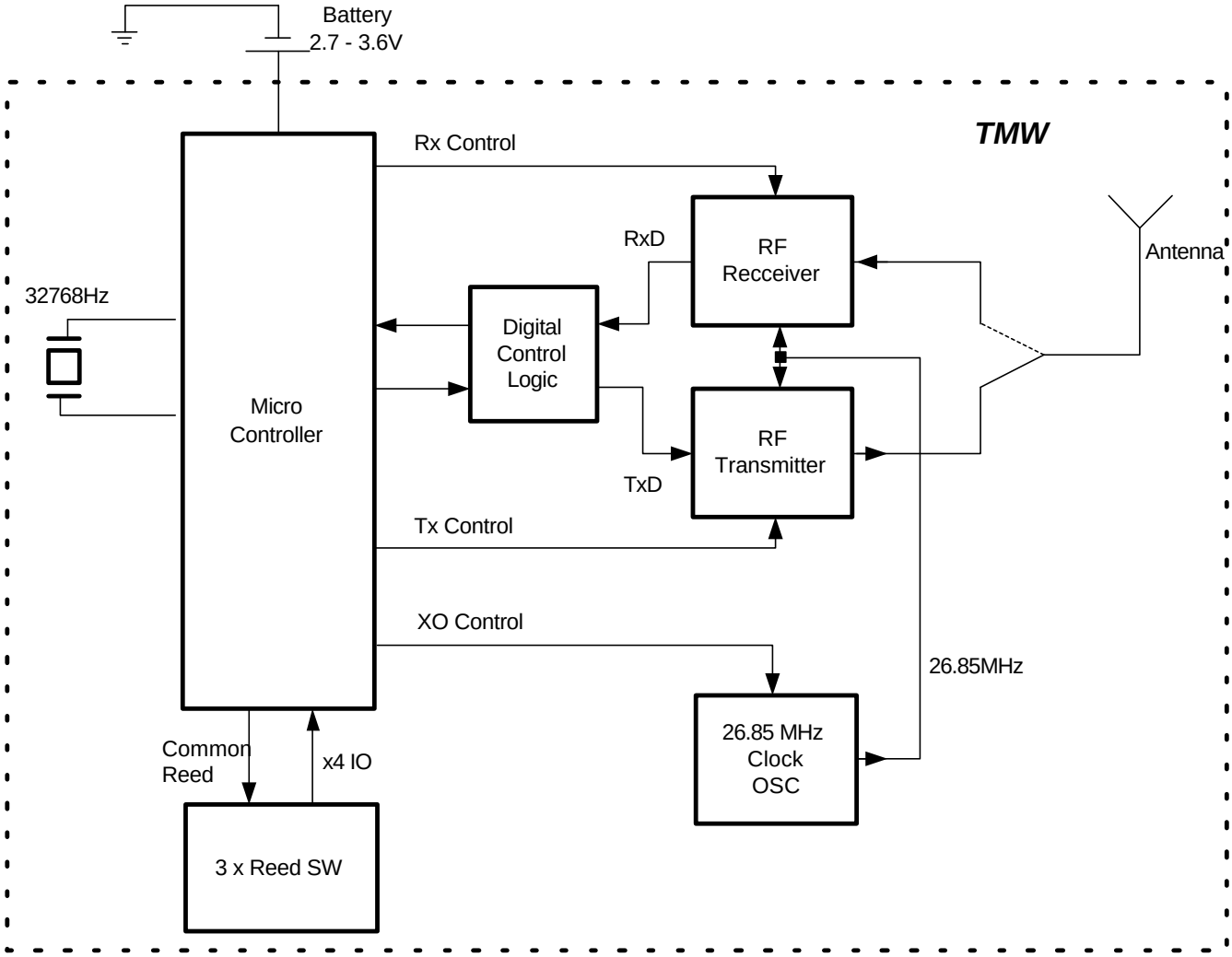
1.2. Definitions, Abbreviation and Acronyms

RFD : RF Dialog

2. TMW Description

2.1. Block Diagram

A block diagram of the TMW is described below.



Notes:

1. The Battery and the Antenna are not part of the TMW board.

Figure 1: TMW Block Diagram

2.2. Operational Modes

Mode	Microcontroller	Reed SW	Digital Logic	RF Receiver	RF Transmitter
Transmit	On (fast clock)	Disabled	On	Off	On
Receive	On (fast clock)	Disabled	On	On	Off
Reading Reeds SW	On (32768Hz clock)	Enabled	Off	Off	Off
Idle/Sleep	On (32768Hz clock)	Disabled	Off	Off	Off

Notes:

1. When the Microcontroller reads the Reed SW it enables the *Common_Reed* signal. In this case, if the Reed SW is closed then the current via the Reed shall be ~6uA, otherwise the current shall be zero.
2. When the Reeds are disabled (*Common_Reed* = "0"), then the Reed current consumption is zero regardless of their state.

2.3. Board Dimension

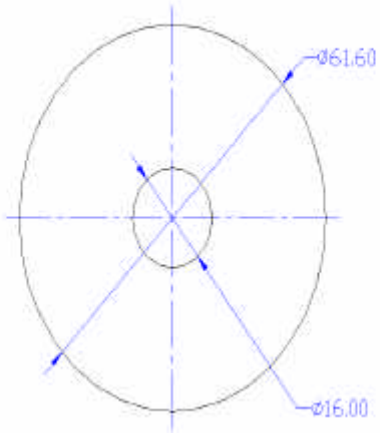


Figure 2: Board Dimension

3. Electrical Performance

3.1. Transmit Unit

3.1.1. Transmit Parameters

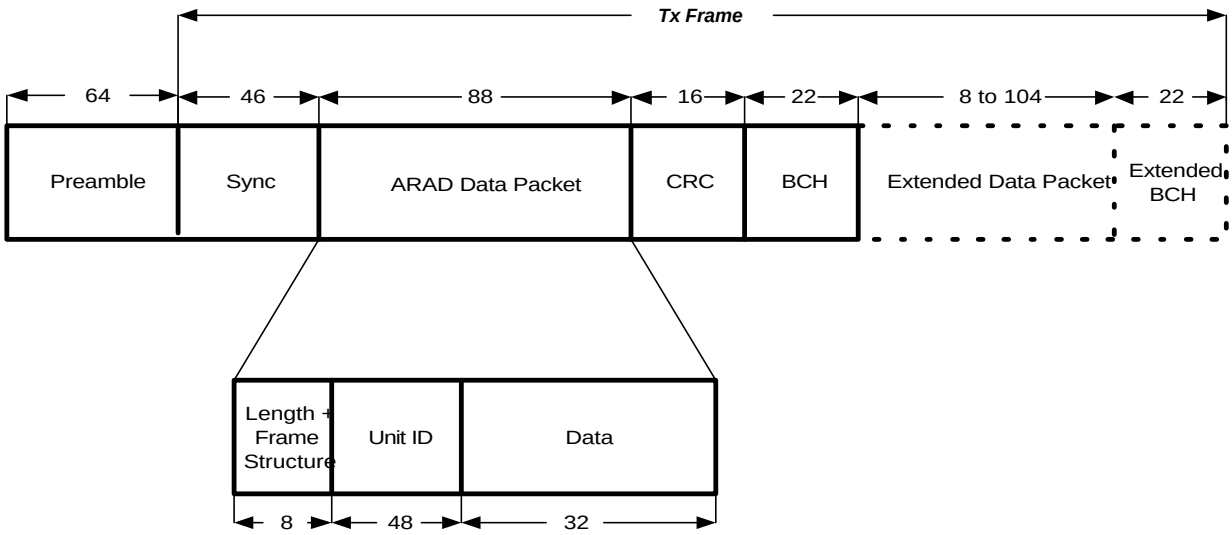
Table 1 – Transmit Parameters

Parameter	Value
Transmit Frequency	923.6 MHz
Modulation	FSK
Modulation Coding	Manchester
Bit rate	60 kbps
Frequency deviation	100 kHz
Frequency stability (including initial stability, temperature and aging)	±50 ppm
Peak output power	11.5 dBm (max)
Harmonics	-42 dBm (max)
Tx Pulse duration (notes 1,2)	~3.5ms

Notes:

1. No extra data packet.
2. Tx pulse duration of 3.5ms is a target design in TMW rev A.

3.1.2. Transmit Protocol



Notes:

1. All numbers indicate number of bits
2. The preamble is alternating ones and zeros. The Preamble length is ~64 bits (at 120kbps).
3. When "Length + Frame Structure" field is all zero then the "Data Packet" field is used by the communication layer (Telematics) and not by the application layer (ARAD).
4. If "ARAD Data Packet" is less then 11 bytes then the communication layer shall fill this field to 11 bytes (88 bits).
5. CRC is used as an error detection code. It is calculated on the entire data packets (including the "Extend Data" packet if exist).
6. Extended Data Packet (indicated by dash lines) is used when the data packet is greater than 11 bytes. In this case the extra data bits shall be transmitted in the "Extended Data Packet". The "Extend BCH" is calculated on the "Extended Data".
7. BCH is used as an error correction code. The BCH is calculated on the Packet data + CRC. The BCH type is BCH (106,127,3)

Figure 3: Transmit Frame

3.1.3. Tx Timing

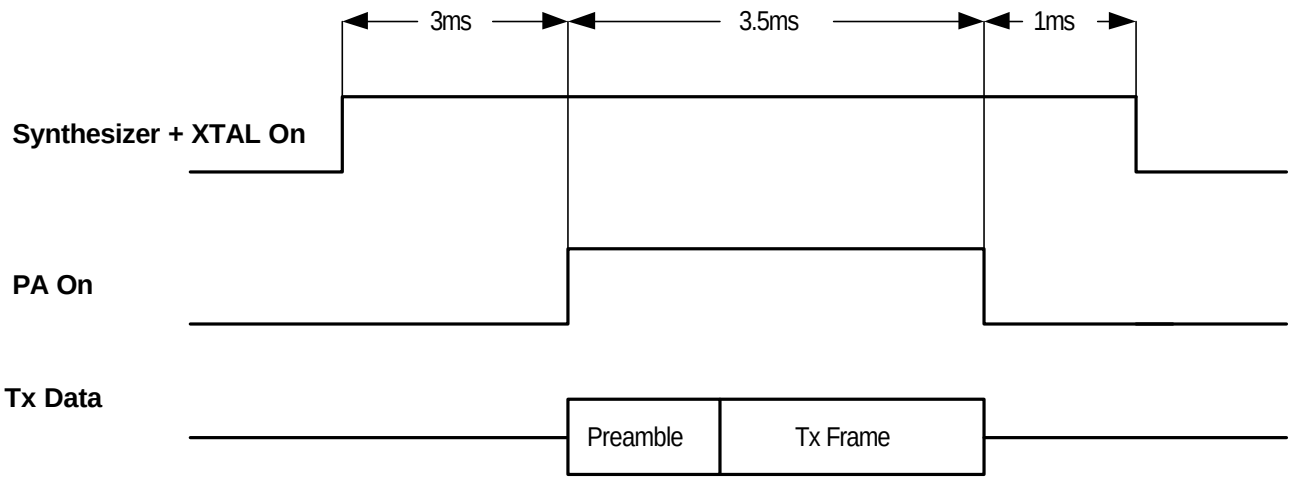


Figure 4: Transmit Timing

3.2. Receive Unit

3.2.1. Receive Parameters

Table 2 – Receive Parameters

Parameter	Value
Receive frequency	923.6 MHz
Sensitivity (BER 1E-3)	-87 dBm
Modulation	FSK
Frequency deviation	100 kHz
Bit rate	20 Kbps/40 Kbps
Coding	NRZ/Manchester

3.2.2. Receive Protocol

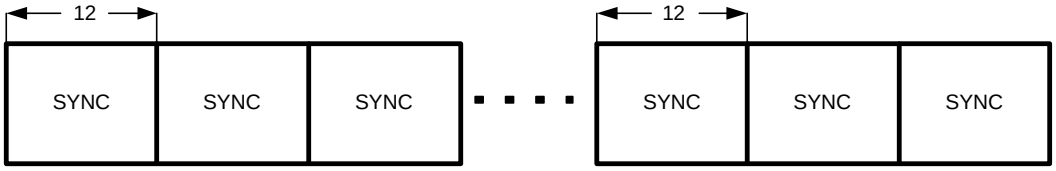
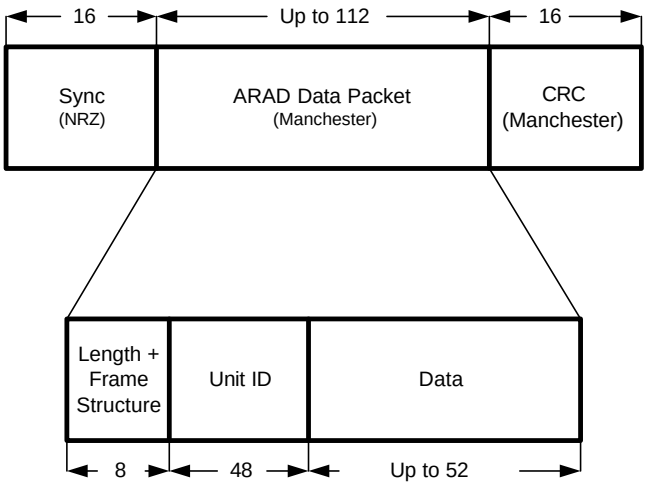


Figure 5: Wake Up Sequence



Notes:

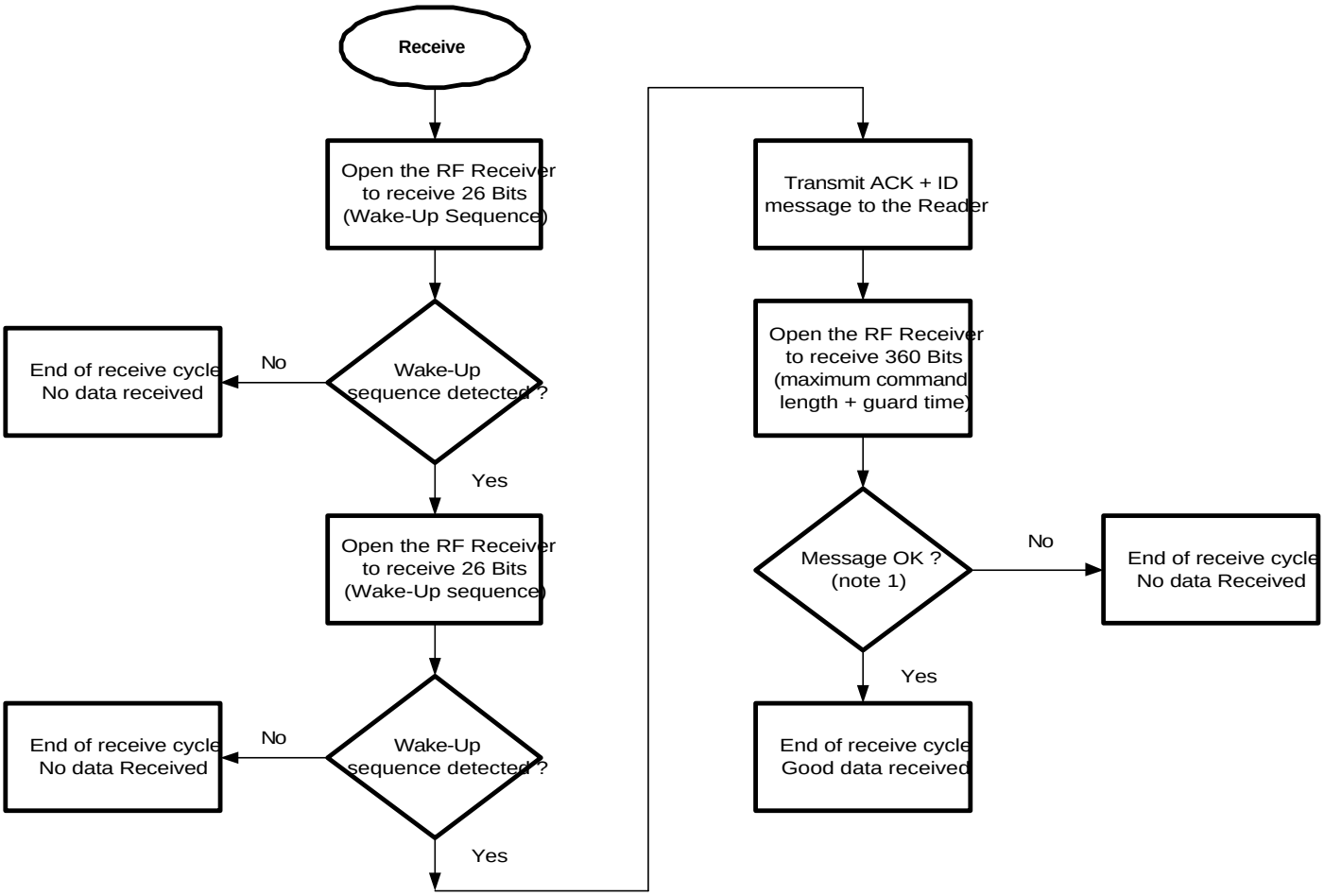
1. All numbers indicate number of bits
2. CRC is used as an error detection code. It is calculated on the entire data packets.
3. The Sync word is in NRZ format (40Kbps). All other fields are in Manchester format (20Kbps).

Figure 6: Receive Frame

3.2.3. Receiving a Command/Message

The TMW can receive commands and messages via the RF link.

The figure below describes the process.

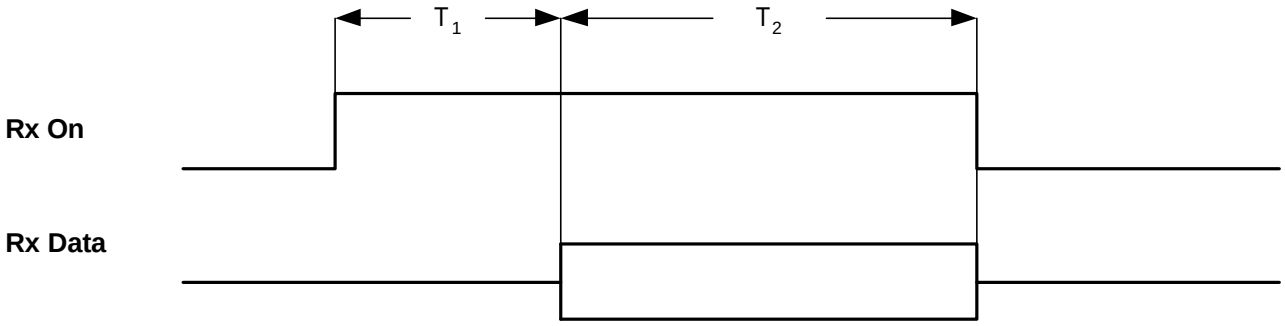


Notes:

1. Message OK means that Sync word was found, the received ID matched the internal ID and the CRC is OK. If one of the conditions failed, the received message failed.

Figure 7: Command/Message Receive Process

3.2.4. Rx Timing



Receiving Mode	T_1	T_2
Searching Wake-Up Sequence after Idle	4ms	~700us
Searching Wake-Up Sequence after Transmit	1.3ms	~700us
Command Receiving	1.3ms	~9ms

Figure 8: Receive Timing

The TMW software enters into "Receive" mode following a call from the application software.

There are two ways to enter into "Receive" mode (and therefore T_1 is changed accordingly):

- Entering into "Receive" mode when the RF is already On (after transmit)
- Entering into "Receive" mode when the RF is Off

3.3. Antenna

The TMW has an integral Antenna.

The Antenna type is PIFA – Planar Inverted "F" Antenna. The Antenna is made of brass.

3.4. Power Source and Battery Life

3.4.1. Power Source

Power supply: 2 batteries (parallel connection) TL-5955 or compatible, rated voltage 3.6V.

Operating voltage: 2.7-3.6V

3.4.2. Battery Life

The battery life shall be at least 6 years for the following conditions:

- Battery type: 2 batteries TL-5955
- Transmission rate: Every 10 seconds
- Receiving rate: The Receiver shall search a wake up sequence (12 bits) every 10 seconds following end of transmission
- No wake up sequence is detected

3.5. Environmental Conditions

Operating Temperature: -10° C to + 70° C

Storage Temperature: : -40° C to +85° C

Humidity: Up to 95%

3.6. Electro Magnetic Interference

FCC part 15 compliance