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WJT844-1000M

900 MHz TRANSCEIVERS

User's Manual
Version 1.0

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WJT844-1000M Features

- Two generic input and output digital lines and integrated DAC/ADC functions
- Cost Effective for high volume applications
- Retries and Acknowledgements
- Continuous 76.8 kbps RF data stream
- Software selectable interface baud rates from 1200 bps to 115.2 kbps
- Very low power consumption for battery powered implementations
- Small size for portable and enclosed applications
- Very Low latency and high throughput
- All modules are qualified for Industrial temperatures (-40°C to 80°C)

1. Overview

The WJT844-1000M is a member of Westbay's ConnexRF OEM transceiver family. The WJT844-1000M is designed for integration into OEM systems operating under FCC part 15 regulations for the 900 MHz ISM band.

The WJT844-1000M is a cost-effective, high performance. It provides an asynchronous TTL level serial interface for OEM Host communications. Communications include both system and configuration data. The Host supplies system data for transmission to other Host(s). Configuration data is stored in an on-board EEPROM. Synchronization, and RF system data transmission/reception is performed by the transceiver.

These transceivers can be used as a direct serial cable replacement – requiring no special Host software for operation. They also feature a number of On-the-Fly Control Commands providing the OEM with a very versatile interface for any network.

WJT844-1000M transceivers operate in a Point-to-Point or Point-to-Multipoint, Client-Server. One transceiver is configured as a Server and there can be one or many Clients.

This document contains information about the hardware and software interface between an Westbay WJT844-1000M transceiver and an OEM Host. Information includes the theory of operation, specifications, interface definition, configuration information and mechanical drawings.

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2. WJT844-1000M Specifications

GENERAL	
20 Pin Interface Connector	Samtec TMM-110-01-L-D-SM, mates with Samtec MM-110-02-S-D
RF Connector	MMCX receptacle, mates with any manufacturer's MMCX style plug
Antenna	MMCX Connector
Serial Interface Data Rate	Baud rates from 1200 bps to 115,200 bps
Power Consumption (typical)	**Duty Cycle (TX=Transmit; RX=Receive)** **10%TX** 33mA **50% TX** 54mA **100%TX** 80mA **100%RX** 28mA
Security	One byte System ID. 56 bit DES encryption key.
Interface Buffer Size	Input/Output: 256 bytes each
TRANSCEIVER	
Frequency Band	902 – 928 MHz
RF Data Rate	76.8kbps fixed
RF Technology	FSK
Output Power	-4db typica(Conducted 2dBi gain antenna)l
Supply Voltage	Pin 10: 3.3 – 5.5V ±50mV ripple Pin 11: 3.3 ±3%, ±100mV ripple
Sensitivity	-97dBm typical @ 76.8kbps RF Data Rate
Range, Line of Site (based on 2dBi gain antenna)	1 mile
ENVIRONMENTAL	
Temperature (Operating)	-40°C to 80°C
Temperature (Storage)	-50°C to +85°C
Humidity (non-condensing)	10% to 90%
PHYSICAL	
Dimensions	1.65" x 1.9" x 0.20"
Weight	Less than 0.75 ounce

3. Specifications

3.1 Interface Signal Definitions

The table below shows the connector pin numbers and associated functions. The I/O direction is with respect to the transceiver. All outputs are 3.3VDC levels and inputs are 3.3V DC TTL. All inputs are weakly pulled High and may be left floating during normal operation.

Table 1 – Pin Definitions

Module Pin	Type	Signal Name	Function
1	Output	GO0	Generic Output pin
2	Output	TXD	Transmitted data out of the transceiver
3	Input	RXD	Data input to the transceiver
4	Input	GI0	Generic Input pin
5,16	GND	GND	Signal Ground
6	Output	GO1	Generic Output pin
7	Output	CTS	Clear to Send – Active Low when the transceiver is ready to accept data for transmission.
8	Input	RTS	Request to Send – When enabled in EEPROM, the OEM Host can take this High when it is not ready to accept data from the transceiver. Keeping RTS High for too long can cause data loss.
9	Output	GO2	Generic Output pin
10,11	PWR	VCC	Pin 10 (digital supply): 3.3 – 5.5V, ±50mV ripple, 50mA max Pin 11 (Power Amplifier supply): 3.3V ±3%, ±100mV ripple, 100mA max
12	Input	9600_BAUD	9600_BAUD – When pulled logic Low and then applying power or resetting, the transceiver's serial interface is forced to a 9600, 8, N, 1 rate. To exit, transceiver must be reset or power-cycled with 9600_Baud logic High.
13	Output	RSSI	Received Signal Strength - An analog output giving an instantaneous indication of received signal strength. Only valid while in Receive Mode.
14	Input	GI1	Generic Input pin
15	Input	UP_RESET	RESET – Controlled by the WJT844 for power-on reset if left unconnected. After a Stable power-on reset, a logic High pulse will reset the transceiver.
17	Input	Command/Data	When logic Low, the transceiver interprets Host data as command data. When logic High, the transceiver interprets Host data as transmit data.
18	Input	AD In	10 bit Analog Data Input
19	Output	DA Out	10 bit Analog Data Output
20	Output	GO3	

3.2 ELECTRICAL SPECIFICATIONS

Table 2 – Input /Output Voltage Characteristics

Pin	Type	Name	High Min.	High Max.	Low Min.	Low Max.	Unit
3	I	RXD	2	5.5	0	0.8	V
4	I	GI0	2	5.5	0	0.8	V
8	I	RTS	2	5.5	0	0.8	V
12	I	9600_Baud	2	5.5	0	0.8	V
14	I	GI1	2	5.5	0	0.8	V
15	I	UP_RESET	0.8	5	0	0.6	V
17	I	Command/Data	2	5.5	0	0.8	V
18	I	AD In	N/A	3.3	0	N/A	V
1	O	GO0		2.5 @8mA	0.4 @ 8mA		V
2	O	TXD		2.5 @ 2mA	N/A		V
6	O	GO1		2.5 @ 2mA	0.4 @ 2mA		V
7	O	CTS		2.5 @ 2mA	0.4 @ 2mA		V
9	O	GO2		2.5 @ 2mA	0.4 @ 2mA		V
19	O	DA Out		N/A	N/A		V
20	O	GO3		2.5 @ 2mA	2.5 @ 2mA		V

3.3 Serial Interface Data Rate

The Serial Interface Data Rate is programmable by the Host. This is the rate the Host and transceiver communicate over the serial bus. Possible values range from 1200 bps to 115,200 bps. **Note: Enabling Parity Mode cuts throughput in half and the Interface Buffer size in half.** The following asynchronous serial data formats are supported:

Table 3 – Supported Serial Formats

Data Bits	Parity	Stop Bits	Transceiver Programming Requirements
9	N	1	Parity Mode enabled
8	N	1	Parity Mode disabled
8	N	2	Parity Mode enabled
8	E,O,M,S	1	Parity Mode enabled
7	E,O,M,S	2	Parity Mode enabled
7	E,O,M,S	1	Parity Mode disabled

4. Configuring the WJT844-1000M

4.1 EEPROM PARAMETERS

A Host can program various parameters that are stored in EEPROM and become active on reset. **Table 4 - EEPROM Parameters**, gives the locations and descriptions of the can be read or written by a Host. Factory default values are also shown. **Do not write EEPROM addresses other than those listed below. Do not copy a transceiver's EEPROM to another transceiver. Doing so may cause the transceiver to malfunction.**

Table 4 – EEPROM Parameters

Parameter	EEPROM Address	Length (Bytes)	Range	Default	Description
Product ID	00H	40			40 bytes - Product identifier string. Includes revision information for software and hardware.
Stop Bit Delay	3Fh	1	0 – FFh	FFh	For systems using the Parity Mode, the serial stop bit might come too early (especially at slower interface baud rates). Stop Bit Delay controls the width of the last bit before the stop bit occurs.
Channel Number	40h	1	0FH – 20h	0X14	0fh = Channel 1 10h = Channel 2 11h = Channel 3 12h = Channel 4 13h = Channel 5 14h = Channel 6 15h = Channel 7 16h = Channel 8 17h = Channel 9 18h = Channel 10 19h = Channel 11 20h = Channel 12
Server/Client Mode	41h	1	1 – 02h	02h	01h = Server 02h = Client
Baud Rate Low	42h	1	0 – FFh	FCh	Low Byte of the interface baud rate. Default baud rate is 57,600.
Baud Rate High	43h	1	00h	00h	Always 00h
Destination ID	70h	6			Specifies destination for RF packets.
MAC ID	80H	6			Factory programmed address.

4.2 EEPROM CONFIGURATION COMMANDS

The configuration commands allow the Host to modify the operation of the transceiver. If the transceiver is in Command mode (Command/Data pin (Pin 17) is pulled logic Low or the Enter AT Command mode and AT Enter Configuration mode commands have been sent to the transceiver), the transceiver will interpret incoming Host data as Command Data. The Host can then read and write parameters using the various configuration commands listed below. To exit Configuration Mode, the Host must perform a hardware or power-on reset or issue an Exit Command Mode command to the transceiver. While in Configuration Mode, the RF circuitry will be disabled.

4.2.1 EEPROM Byte Read

Upon receiving this command, a transceiver will respond with the desired data from the address requested by the Host.

Host Command:
Byte 1 = C0h
Byte 2 = Address
Byte 3 = Length (01…FFh = 1…255 bytes; 00h = 256 bytes)
Transceiver Response:
Byte 1 = C0h
Byte 2 = Address
Byte 3 = Length
Byte 4…n = Data at requested address(s)

4.2.2 EEPROM Byte Write

Upon receiving this command, a transceiver will write the data byte to the address specified but will not echo it back to the Host until the EEPROM write cycle is complete. The write can take as long as 10ms to complete. Following the write cycle, a transceiver will transmit the data byte to the Host. Multiple byte EEPROM writes are allowed up to a length of 128 bytes. An EEPROM boundary exists between addresses 7Fh and 80h. No single EEPROM write command shall write to addresses on both sides of that EEPROM boundary. **Note: The EEPROM has an endurance of 20,000 write cycles. Every EEPROM Write command issued (regardless of address) constitutes a write cycle.**

Host Command:
Byte 1 = C1h
Byte 2 = Address
Byte 3 = Length (01 – 80h)
Byte 4…n = Data to store at Address
Transceiver Response:
Byte 1 = C1h
Byte 2 = Address
Byte 3 = Length (01 – 80h)
Byte 4 = Last data byte written by this command

Warning: It is recommended that you perform a read before you issue the write command to verify that the byte requires writing to avoid unnecessary writes. It is possible while performing an EEPROM write without EEPROM can become corrupted, rendering the radio inoperable.

4.2.3 EEPROM Exit Configuration Mode Command

The OEM Host can cause the transceiver to exit Configuration Mode command to the transceiver. **However, the transceiver programmed into the EEPROM until the transceiver**

Host Command:
Byte 1 = 56h
Transceiver Response:
Byte 1 = 56h

5. Theory of Operation

5.1 HARDWARE INTERFACE

5.1.1 GIn (Generic Inputs) and GOn (Generic Outputs)

Both GIn pins serve as generic input pins. Both GOn pins serve as generic output pins. Reading and writing of these pins can be performed using CC Commands. These pins alternately serve as control pins when Modem Mode is enabled in the EEPROM.

5.1.2 TXD (Transmit Data) and RXD (Receive Data)

Enable accepts 3.3 or 5VDC TTL level asynchronous serial data ， on the RXD pin and interprets that data as either Command Data or Transmit Data. Data is sent from the transceiver, at 3.3V levels, to the OEM Host via the TXD pin.

5.1.3 CTS Handshaking (pin 7)

The WJT844-1000M has an interface buffer size of 256 bytes. If the buffer fills up and more bytes are sent to the transceiver before the buffer can be emptied, data loss will occur. The transceiver prevents this loss by asserting CTS High as the buffer fills up and taking CTS Low as the buffer is emptied. **CTS On** in conjunction with **CTS On Hysteresis** control the operation of CTS. CTS On specifies the amount of bytes that must be in the buffer for CTS to be disabled (High). Even while CTS is disabled, the OEM Host can still send data to the transceiver, but it should do so carefully. Once CTS is disabled, it will remain disabled until the buffer is reduced to the size specified by CTS On Hysteresis.

5.1.4 RTS Handshaking (pin 8)

With **RTS Mode** disabled, the transceiver will send any received packet to the OEM Host as soon as the packet is received. However, some OEM Hosts are not able to accept data from the transceiver all of the time. With RTS Mode Enabled, the OEM Host can keep the transceiver from sending it a packet by disabling RTS (logic High). Once RTS is enabled (logic Low), the transceiver can send packets to the OEM Host as they are received. **Note: Leaving RTS disabled for too long can cause data loss once the transceiver's 256 byte receive buffer fills up.**

5.1.5 9600 Baud (pin 12)

When pulled logic Low before applying power or resetting, the transceiver's serial interface is forced to a 9600, 8-N-1 (8 data bits, No parity, 1 stop bit) rate. To exit, the transceiver must be reset or power-cycled with 9600_Baud logic High. This pin is used to recover transceivers from unknown baud rates only. It should not be used in normal operation. Instead the transceiver Interface Baud Rate should be programmed to 9600 baud if that rate is desired for normal operation.

5.1.6 UP_Reset (pin 15)

UP_Reset provides a direct connection to the reset pin on the WJT844-1000M microprocessor and is used to force a soft reset. For a valid reset, reset must be High for a minimum of 10ms.

5.1.7 Command/Data (pin 17)

When logic High, the transceiver interprets incoming Host data as transmit data to be sent to other transceivers and their Hosts. When logic Low, the transceiver interprets Host data as command data **(see section 4)**.

5.2 SOFTWARE PARAMETERS

5.2.1 RF Mode

All packets are sent out over the RF as either addressed or broadcast packets. Addressed packets are only received by the transceiver specified by **Destination Address**. If addressed packets are desired, the Destination Address should be programmed with the **MAC ID** of the destination transceiver. To simplify EEPROM programming, **Auto Destination** can be enabled in Clients which allows the Client to automatically set its Destination Address to the address of the Server. Broadcast packets are sent out to every eligible transceiver on the network. If broadcast packets are desired, **RF Delivery** should be set to Broadcast.

5.2.2 Serial Interface Baud Rate

This two-byte value determines the baud rate used for communicating over the serial interface to a transceiver. **Table 4 - Baud Rate/Timeout** lists values for some common baud rates. Baud rates below 1200 baud are not supported. For a baud rate to be valid, the calculated baud rate must be within ±3% of the OEM Host baud rate. **If the 9600_BAUD pin (Pin 12) is pulled logic Low at reset, the baud rate will be forced to 9,600.** For Baud Rate values other than those shown in **Table 3 - Baud Rate**, the following equation can be used:

BAUD = 100h - (14.7456E$_{+06}$ / (64 * desired baud rate))

BaudH= Always 0
BaudL = Low 8 bits of BAUD (base16)

Table 5 – Baud Rate/Interface Timeout

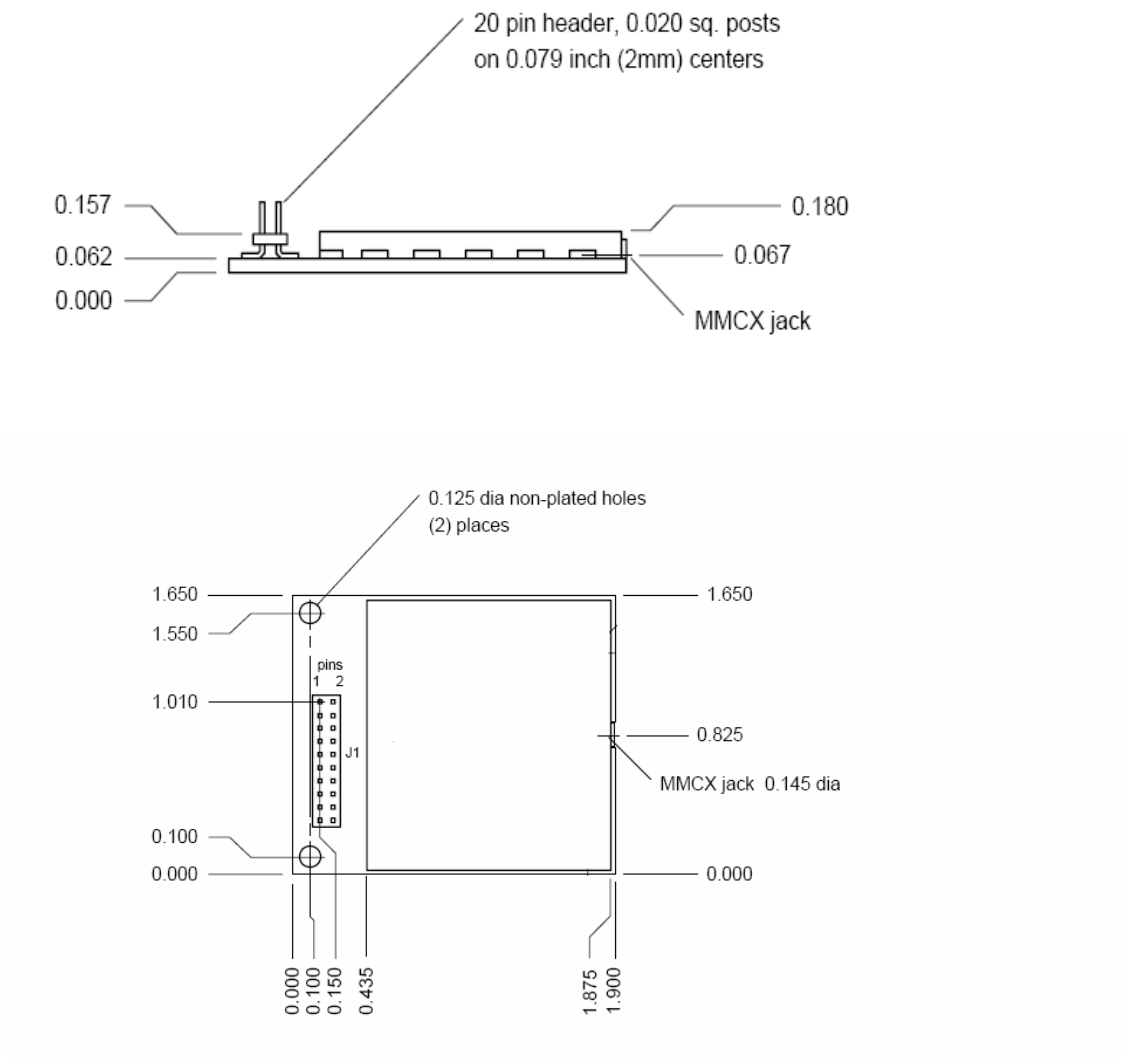
Baud Rate	BaudL (42h)	BaudH (43h)	Minimum Interface Timeout (58h)	Stop Bit Delay (3Fh)
57,600$_7$	FCh	00h	02h	03h
38,400	FAh	00h	02h	08h
28,800	F8h	00h	02h	0Eh
19,200	F4h	00h	03h	19h
14,400	F0h	00h	04h	23h
9,600	E8h	00h	05h	39h

6. Dimensions

Critical parameters are as follows: Interface Connector – 20 pin OEM interface connector (Samtec TMM-110-01-L-D-SM, mates with Samtec SMM-110-02-S-D)

MMCX Jack – Antenna connector (Telegärtner P/N J01341C0081) mates with any manufacturer's MMCX plug

Figure 1 – WJT844-1000M (with MMCX Connector) Mechanical



7. Agency Compliancy Information

FCC / INDUSTRY CANADA (IC) REQUIREMENTS FOR MODULAR PPROVAL

In general, there are two agency classifications of wireless applications; portable and mobile.

Portable – Portable is a classification of equipment where the user, in general, will be within 20cm of the transmitting antenna. Portable equipment is further broken into two classes; within 2.5cm of human contact and beyond 2.5cm (NOTE: Ankles, feet, wrists and hands are permitted to be within 2.5cm of the antenna even if the equipment is designated as being greater than 2.5cm). The WJT844-1000M is not agency approved for portable applications. The OEM is required to have additional testing performed to receive this classification. Contact Westbay for details.

Mobile – Mobile defines equipment where the user will be 20cm or greater from the transmitting antenna. The antenna must be mounted in such a way that it cannot be moved closer to the user with respect to the equipment, although the equipment may be moved. NOTE: Ankles, feet, wrists and hands are permitted to be within 20cm of mobile equipment.

7.1 OEM Equipment Labeling Requirements

WARNING: This device complies with Part 15 of the FCC Rules.
Operation is subject to the following two conditions:
(1) This device may not cause harmful interference.
(2) This device must accept any interference received, including interference that may cause undesired operation.

WARNING: The Original Equipment Manufacturer (OEM) must ensure that FCC labeling requirements are met. This includes a clearly visible label on the outside of the OEM enclosure specifying the appropriate Westbad FCC identifier for this product as well as the FCC Notice below. The FCC identifiers are listed above in the Agency Identification Numbers chart.

7.2 Antenna Requirements

WARNING: This device has been tested with an MMCX connector with the antennas listed above. When integrated in the OEMs product, these fixed antennas require professional installation preventing end-users from replacing them with non-approved antennas. Any antenna not in the previous table must be tested to comply with FCC Section 15.203 for unique antenna connectors and Section 15.249 for emissions. Contact Westbay for assistance.

Caution: Any change or modification not expressly approved by Westbay could void the user's authority to operate the equipment.

WARNING: 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:
-- Reorient or relocate the receiving antenna.
-- Increase the separation between the equipment and receiver.
-- Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.
-- Consult the dealer or an experienced radio/TV technician for help.

7.3 Warnings Required in OEM Manuals

RF Exposure for Warning for Mobile Equipment

WARNING: This equipment has been approved for mobile applications where the equipment should be used at distances greater than 20cm from the human body (with the exception of hands, wrists, feet and ankles). Operation at distances less than 20cm is strictly prohibited.

7.4 Channel Warning

The OEM must prevent the end user from selecting a Channel not approved for use by the FCC/IC.