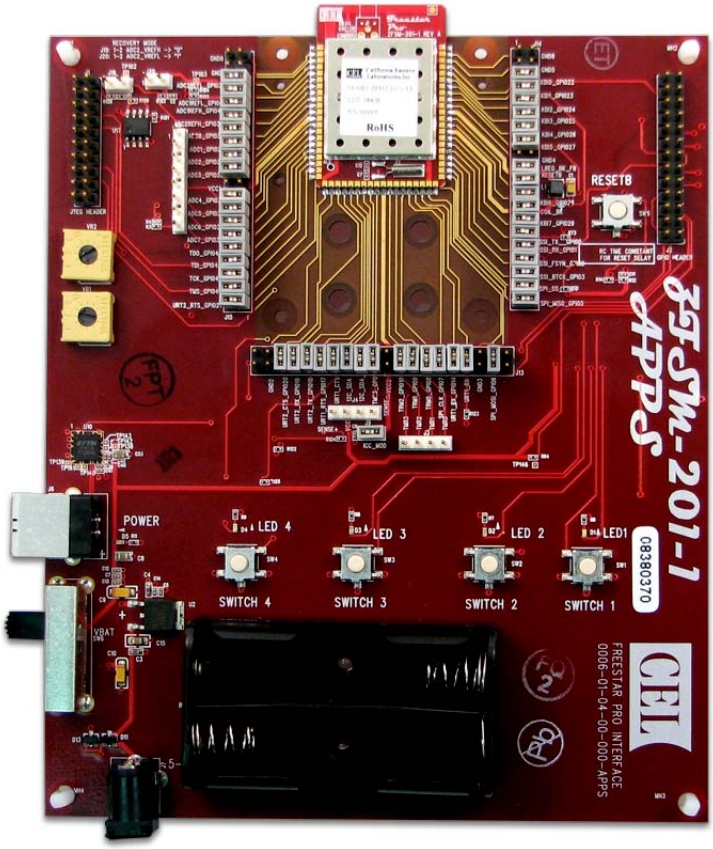
CEL California Eastern Laboratories

Free Star Pro Series

ZFSM-201-EVB-1
Evaluation Board
Host Serial & RF Protocol Guide



ZFSM-201-1 FreeStar Pro Module

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(Rev A)

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1 HOST SERIAL PROTOCOL

This document describes in detail the message protocols used by the ***FreeStar Pro Test Tool*** program to communicate between the Host PC and the **ZFSM-201-EVB-1** Evaluation Board.

1.1 UART PROTOCOL

The generic UART Protocol is defined below:

Table 1 – UART Host Serial Protocol Structure

	Start	Length	Type	Payload	CheckSum*	EOF
VALUE	0x01	Payload + 5	See below	Variable	Variable	0x04
#BYTES	1	1	1	Variable	1	1

*CheckSum is calculates as the LSB of the sum of the bytes within the frame from the 'Start' field to the 'Payload' field (not including the 'CheckSum' or 'EOF' bytes).

Example:	Message Type	02 (See Table 2, Section 1.2.2)
	Start:	1
	Length:	8 (Payload +5)
	Type:	1
	Payload: (Mode, Ch, Pwr)	3
	Checksum:	13

1.2 UART MESSAGE TYPES

The specific UART message types are defined below:

Note: Message Types 0x01 ~ 0x7F are Host → Transceiver messages.

Message Types 0x81 ~ 0xFF are Transceiver → Host messages. (When a Transceiver receives a valid message from a HOST, it sends an acknowledgment (ACK) message back to the Host.)

Table 2 – Descriptions of Specific UART Message Types

Message Type	ACK Message Type	Message Length	Payload	Description
1.2.1 Query Version				
0x01 (01)		5	0	Query Version
	0x81	31	26	Reply to Query
			5-bytes	MACA Version ASCII
			16-bytes	SMAC Version ASCII
			5-bytes	Application Firmware Version ASCII
1.2.2 Static Test Mode				
0x02 (02)	0x82	8	3	Set Static Test Mode
			1 byte	Mode: 0 = IDLE 2 = RX 3 = TX_UNMOD 4 = TX_MOD 5 = PRBS
			1 byte	RF Channel (11-26) 0 = channel 11 … 15 = channel 26
			1 byte	RF Power (0-18)
1.2.3 Query Settings				
0x03 (03)		5	0	Query Settings
	0x83	14	9	Reply to Query

Message Type	ACK Message Type	Message Length	Payload	Description
			1 byte	Codebase: 1 = SMAC 2 = MAC 3 = ZigBee
			1 byte	Mode (MSB)
			1 byte	RF Channel (11-26)
			1 byte	RF Power (0-18)
			1 byte	XTAL_CTUNE[4] 0 = NO 4pF, 1 = 4pF
			1 byte	XTAL_CTUNE[3:0] = 0-7 where 0 is 0pF… 7 is 7pF
			1 byte	XTAL_FTUNE[4:0] = 0-5pf in 32 steps (156fF/step) (LSB)
			2 bytes	ID
1.2.4 XTAL Control				
0x04 (04)	0x84	8	3	Set Reference XTAL Control
			1 byte	XTAL_CTUNE[4] 0 = NO 4pF, 1 = 4pF (MSB)
			1 byte	XTAL_CTUNE[3:0] = 0-7 where 0 is 0pF… 7 is 7pF
			1 byte	XTAL_FTUNE[4:0] = 0-5pf in 32 steps (156fF/step) (LSB)
1.2.5 PERT Transmit				
0x05 (05)		14 + n (27)	9 + n	Transmit Packet Error Rate Test
			2-bytes	Number of Packets to TX (1-1000) (MSB)
			2-bytes	Source Address
			2-bytes	Destination Address
			1 byte	RF Channel (11-26)
			1 byte	RF Power (0-18)
			1 byte	Number of Bytes to transmit 13 if test tool application n-bytes if other message 100 max
			n-bytes	13 if test tool application n-bytes if other (custom) message
	0x85	14 + n (27)	9 + n	Transmit Packet Error Rate Test - ACK
			2-bytes	Number of Packets to TX (1-1000) (MSB)
			2-bytes	Source Address
			2-bytes	Destination Address
			1 byte	RF Channel (11-26)
			1 byte	RF Power (0-18)
			1 byte	Number of Bytes to expect 13 if test tool application n-bytes if other message
			n-bytes	Message to transmit 13 if test tool application n-bytes if other message 100 max
1.2.6 Query Statistics				
0x06 (06)		5	0	Query Statistics
	0x86	21	16	Reply to Query
			4-bytes	Number TX'd Data packets (MSB)
			4-bytes	Number RX'd Data packets
			4-bytes	Number TX'd ACK packets
			4-bytes	Number RX'd ACK packets (LSB)
1.2.7 Clear Statistics				
0x07 (07)		5	0	Clear Statistics
	0x87	21	16	Acknowledgement of Clear
			4-bytes	Number TX'd Data packets (MSB)

Message Type	ACK Message Type	Message Length	Payload	Description
			4-bytes	Number RX'd Data packets
			4-bytes	Number TX'd ACK packets
			4-bytes	Number RX'd ACK packets (LSB)
1.2.8 Range Test Receive				
0x08 (08)		10	5	Receive n RF data bytes to destination transceiver ID
			2-bytes	Destination ID
			1 byte	RF Channel (11-26)
			1 byte	RF Power (0-18)
			1 byte	Number of Bytes to expect 13 if test tool application n-bytes if other message
	0x88	14 + n (27)	9 + n	Receive n RF data bytes to destination transceiver ID ACK
			2-bytes	Source ID
			2-bytes	Destination ID
			1 byte	RF Channel (11-26)
			1 byte	RF Power (0-18)
			1-byte	Receiver's RSSI
			1-byte	ACK RSSI (if acks enabled)
			1 byte	Number of Bytes to expect 13 if test tool application n-bytes if other message
			n-bytes	0 if ACK message n-bytes if RF Data
1.2.9 Save Setting to NVM				
0x09 (09)		5	0	Save Settings to NVM
	0x89	12	7	Acknowledgement of Save
			1 byte	RF Channel (11-26) (MSB)
			1 byte	RF Power (0-18)
			1 byte	XTAL_CTUNE[4] 0 = NO 4pF, 1 = 4pF
			1 byte	XTAL_CTUNE[3:0] = 0-7 where 0 is 0pF… 7 is 7pF
			1 byte	XTAL_FTUNE[4:0] = 0-5pf in 32 steps (156fF/step) (LSB)
			2-bytes	ID
1.2.10 Range Test Transmit				
0x0A (10)		14 + n (27)	9 + n	Send n RF data bytes to destination transceiver ID
			1-byte	Require ack (1 = require, 0 = no ack)
			2-bytes	Source ID
			2-bytes	Destination ID
			1 byte	RF Channel (11-26)
			1 byte	RF Power (0-18)
			1 byte	1 = continuous, 0 = single
			1 byte	Number of Bytes 13 if test tool application n-bytes if other message
			n-bytes	Message to transmit 13 if test tool application n-bytes if other message
	0x8A	14 + n (27)	9 + n	Send n RF data bytes to destination transceiver ID ACK
			1-byte	Require ack (1 = require, 0 = no ack)
			2-bytes	Source ID
			2-bytes	Destination ID
			1 byte	RF Channel (11-26)

Message Type	ACK Message Type	Message Length	Payload	Description
			1 byte	RF Power (0-18)
			1 byte	1 = continuous, 0 = single
			1 byte	Number of Bytes 13 if test tool application n-bytes if other message
			n-bytes	Message to transmit 13 if test tool application n-bytes if other message
1.2.11 Buck Regulator				
0x0B (11)	0x8B	6	1	Set Buck Regulator (**Note***: a hardware change to the module is required prior to enabling the buck regulator*)
			1 byte	1 = enable, 0 = disable
1.2.12 ADC Channels				
0x0C (12)		6	1	Read ADC Channels
			1-byte	0 = Stop Reading ADC 1 = Start Reading ADC
	0x8C	11	6	Response
			2 bytes	ADC1 Value
			2 bytes	ADC2 Value
			2 bytes	Battery/Power Supply
1.2.13 PERT Receive				
0x0D (13)		12 + n (25)	7 + n	Receive Packet Error Rate Test
			2-bytes	Source Address
			2-bytes	Destination Address
			1 byte	RF Channel (11-26)
			1 byte	RF Power (0-18)
			1 byte	Number of Bytes to expect 13 if test tool application n-bytes if other message
			n-bytes	Message to receive 13 if test tool application n-bytes if other message 100 max
	0x8D	18 + n (31)	13 + n	Receive Packet Error Rate Test
			2-bytes	Number of Received Packets
			2-bytes	Current Packet Number
			2-bytes	Number of Expected Packets
			2-bytes	Source Address
			2-bytes	Destination Address
			1 byte	RF Channel (11-26)
			1 byte	RF Power (0-18)
			1 byte	Number of Bytes to expect 13 if test tool application n-bytes if other message
			n-bytes	Ack to message 13 if test tool application n-bytes if other message
1.2.14 Low Power Settings				
0x0E (14)	0x8E	6	1	Low Power 10 Seconds

Message Type	ACK Message Type	Message Length	Payload	Description
			1-byte	0 = default 1 = hibernate using 32khz clock 2 = hibernate using 2khz clock 3 = doze
1.2.15 GPIO Outputs				
0x0F (15)	0x8F	14	9	GPIO Outputs
			1-byte	0 = restore GPIO 1 = store current GPIO settings and set outputs to values below 2 = query output state
			4-bytes	GPIO31 -> 0 (msb to lsb) i.e. 0x01 = gpio0
			4-bytes	GPIO63 -> 32 (msb to lsb) i.e. 0x01 = gpio32
Note: not all GPIO's can be set to outputs safely when the module is on an evaluation board.				
1.2.16 ED Scan				
0x10 (16)		6	1	Energy Scan
			1-byte	Scan Duration/channel (0-14)
	0x90			Two types of response message are possible:
		6	1	An Acknowledgement confirms that the transceiver has received the request. The payload is 1 byte, equal to Duration info.
		22	17	A Results message sends the energy data back to the Host. The payload consists of 1 byte Duration info (set to 0xFE) and 16 bytes for the energy scan results per channel from Ch 11 (MSB) to Ch 26 (LSB).

2 SMAC RF INTERFACE PROTOCOLS

2.1 SMAC RF PROTOCOL

The generic RF Protocol is defined below:

Table 3 – RF Protocol Structure

	Length	Type	DstID	SrcID	Status	PacketID	Payload	CRC-16
Value	Payload + 11	See Table 4	Variable	Variable	See Table 5	Variable	Variable	Variable
#Bytes	1	1	2	2	1	2		2

2.2 SMAC RF MESSAGES TYPES

Specific RF message types are defined below:

Table 4 – Descriptions of Specific RF Message Types

Message Type	ACK Message Type	Message Length	Payload	Description
2.2.1 PERT Message				
0x01		15 + n (28)	n+4	PERT Message
			1-byte	Current Message # MSB
			1-byte	Current Message # LSB
			1-byte	Total Messages # MSB
			1-byte	Total Messages # LSB
			n-bytes	PERT Data
				13 bytes if GUI application
2.2.2 Range Message				
0x02		12 + n (25)	n+1	Range Message
			1-byte	RSSI (if applicable)
			n-bytes	Range Data
				13 bytes if GUI application

2.3 SMAC RF PROTOCOL STATUS FIELD

The status bits of the RF Protocol are defined below:

Table 5 – RF Protocol Status Bits

7	6	5	4	3	2	1	0
reserved	reserved	reserved	reserved	reserved	reserved	reserved	1 = ACK Required

3 MAC RF INTERFACE PROTOCOLS

3.1 MAC RF PROTOCOL

The generic RF Protocol is defined below:

Table 6 – RF Protocol Structure

	Length	Type	Status	Payload
Value	Payload + 3	See Table 7	See Table 8	Variable (0-99 bytes)
#Bytes	1	1	1	

3.2 MAC RF MESSAGES TYPES

Specific RF message types are defined below:

Table 7 – Descriptions of Specific RF Message Types

Message Type	ACK Message Type	Message Length	Payload	Description
3.2.1 PERT Message				
0x01		7 + n (20)	n+4	PERT Message
			1-byte	Current Message # MSB
			1-byte	Current Message # LSB
			1-byte	Total Messages # MSB
			1-byte	Total Messages # LSB
			n-bytes	PERT Data
				13 bytes if GUI application
3.2.2 Range Message				
0x02		4 + n (17)	n+1	Range Message
			1-byte	RSSI (if applicable)
			n-bytes	Range Data
				13 bytes if GUI application

3.3 MAC RF PROTOCOL STATUS FIELD

The status bits of the RF Protocol are defined below:

Table 8 – RF Protocol Status Bits

7	6	5	4	3	2	1	0
reserved	reserved	reserved	reserved	reserved	reserved	reserved	1 = ACK Required

4 REVISION HISTORY

Revision	Date	Description
PRELIMINARY	28Oct08	Released
A	04Feb09	Clarified Command Descriptions