

Dolphin – Frequency Hopping Spread Spectrum Chipset Host Interface Protocol

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ABSTRACT

The Dolphin is a FCC precertified reference design and a wireless-UART chipset solution consisting of a Texas Instruments TRF6903 single-chip multi-band RF transceiver and a digital baseband ASIC (DBB03A). The DBB03A contains the frequency hopping firmware and can be controlled through an external host/system microcontroller or external evaluation software through the UART interface.

The dolphin kit is provided with the evaluation software that communicates with the DBB03A using a hardware UART interface that follows a defined protocol. This application note discusses the details of this host interface protocol. Any host/system microcontroller interfacing with Dolphin must adhere to this protocol. Detailed protocol definition is documented in Appendix A and Appendix B.

For detailed information on the Dolphin demo kit, see the Dolphin Frequency Hopping Spread Spectrum Evaluation Kit Hardware and Software user's guide (SLLU090).

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1 Introduction

1.1 Introduction to the Dolphin Architecture

The Dolphin is a *wireless UART* chipset solution that can be used to implement a wireless link that end applications can interface to as a peripheral, shielding the end-application from the implementation details. The Dolphin chipset solution eases wireless system development, while keeping the end application highly integrated and flexible.

The Dolphin is a FCC precertified reference design and the chipset solution consists of a Texas Instruments TRF6903 single-chip multi-band RF transceiver and a digital baseband ASIC (DBB03A). The DBB03A contains the single-frequency/frequency hopping firmware and can be controlled through an external host/system microcontroller or external evaluation software through the UART interface. This is illustrated in [Figure 1](#).

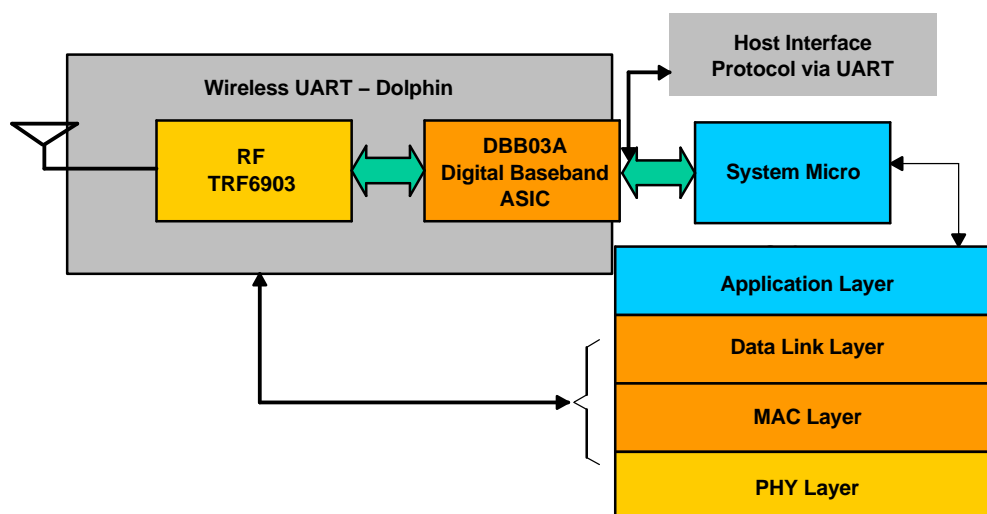


Figure 1. Dolphin Architecture

The end-system can treat the Dolphin as a peripheral capable of establishing a wireless link. The system microcontroller focuses on the end application level protocol. Any catalog microcontroller can be used as a system microcontroller, which provides added flexibility. The interface between the system microcontroller and the DBB03A digital baseband ASIC can be a simple UART. This demo kit has been provided with evaluation software that communicates with the DBB03A using a UART interface that follows a defined protocol. The DBB03A contains the frequency hopping firmware and handles the wireless communication protocols in the MAC and data link layer.

The Dolphin-DEMO kit is used to demonstrate a FCC compliant (Sec 15.247) frequency hopping spread spectrum (FHSS) wireless data link. The firmware resides on the DBB03A device and supports point-to-point, broadcast networks with acknowledgement and retries. The reference design (schematics and layout of the board) has been FCC precertified and can be used to ramp up the FCC certification process and lower system development hurdles.

1.2 Evaluation Software

Texas Instruments provides software to evaluate the performance of the Dolphin chipset. This software interfaces to the DBB03A using a simple UART. This is shown in [Figure 2](#). A detailed protocol has been developed to establish communication between any external evaluation software (or system microcontroller) and the DBB03A. This is called Dolphin host interface protocol and is discussed in detail in the remaining sections of this application note.

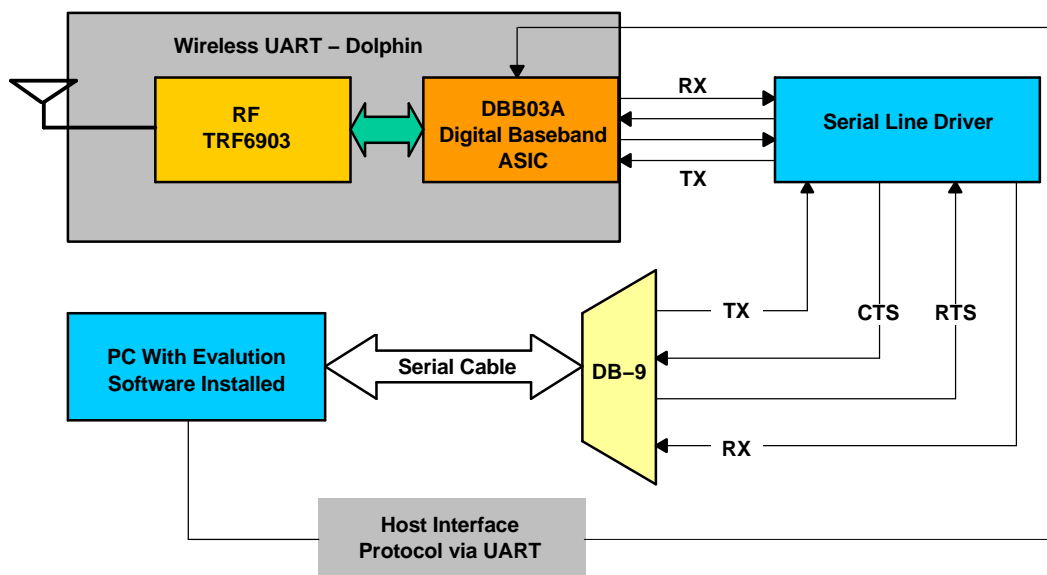


Figure 2. Evaluation Using Software

For detailed information on the Dolphin demo kit, see the Dolphin Frequency Hopping Spread Spectrum Evaluation Kit Hardware and Software User's Guide (SLLU090).

The important features provided by the evaluation software are:

- Send / receive RF data packets
- Single channel / frequency hopping mode of operation selection
- Enable acknowledgement / retries for reliable data transfer
- Programmable transceiver baud rate and serial port baud rate selection
- Test mode selection
- Packet error rate statistics

2 Protocol Overview

The bidirectional data exchange between the evaluation software and the DBB03A uses the hardware UART and follows the RS232 protocol. This RS232 protocol is summarized in [Table 1](#).

Table 1. Host RS232 Serial Interface Communication Parameters

PARAMETER	PARAMETER DESCRIPTION
Baud Rate	9.6k, 19.2k, 38.4k, 57.6k
Start Bits	1
Data Bits	8
Stop Bits	1
Parity	None

The messages exchanged using the host interface protocol follow a data packet structure. This packet structure is shown in [Table 2](#).

Messages Overview

	HEADER			PAYLOAD	TRAILER	
	START BYTE 0x01	LENGTH	TYPE	DATA	CHECKSUM	END BYTE 0x04
Size (bytes)	1	1	1	n	1	1

Table 2. Data Packet Structure

FIELD NAME	FIELD DESCRIPTION
Start Byte	The first byte in any data packet is a 0x01 (SOH)
Length	The total length of the entire packet in bytes
Type	The packet type byte designates the type of packet.
Data	n bytes of data which pertains to the type of the packet
Checksum	8-bit checksum of bytes from the start byte through the data
End Byte	The last byte in any packet is a 0x04 (EOM).

3 Messages Overview

This section tabulates the packet structure for bidirectional messages exchanged between the host (PC with the evaluation software installed) and the TRF6903 transceiver (via DBB03A).

3.1 Communication Packets Sent From Host-to-Transceiver

Communication packets are sent from the host to the transceiver primarily to configure the transceiver ID's and send RF data packets to be transmitted wirelessly. These packet structures are tabulated in [Table 3](#).

Table 3. Data Packets Sent From Host to Transceiver

MESSAGE TYPE	MESSAGE LENGTH	MESSAGE DESCRIPTION
0x01	8 + n	Send n RF data bytes to destination transceiver ID
0x02	11	Set IDs
0x03	5	Query IDs
0x04	5	Query IDs and programmable settings status
0x08	12	Set programmable settings
0x09	5	Query programmable settings
0x0F	5	Get statistics
0x10	5	Clear statistics
0x11	6	Enable/Disable test mode
0x12	18	Set test mode settings
0x13	5	Query test mode settings
0x15	5	Query firmware version
0x16	5	Set sleep mode
0x19	6	Set baud rate

This is further illustrated with an example. If the Set IDs button is invoked in the evaluation software (see [Figure 3](#)), the evaluation software sends the Message Type 0x02 (Set IDs) to the firmware's UART routine. The firmware then stores these ID's in its memory. This is also displayed in the Communication Log Window as a Host->TXCVR Message.

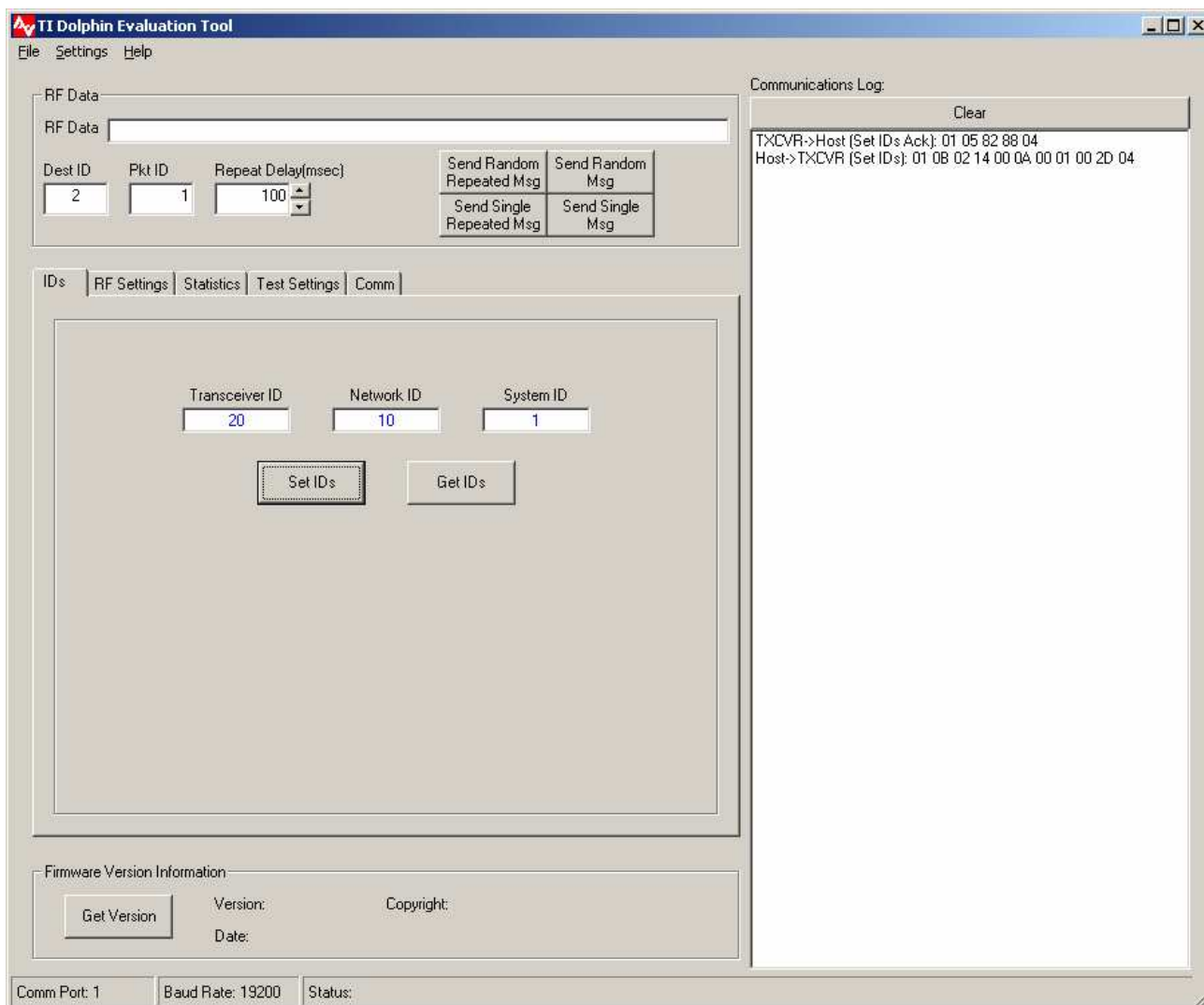


Figure 3. Illustrating Message Transfer From Host to Transceiver

3.2 Communication Packets Sent From Transceiver-to-Host

Communication packets are sent from the transceiver to the host primarily to acknowledge the reception of the host messages and respond to queries from the host. These acknowledgement message packets are tabulated in [Table 4](#). This is also displayed in the Communication Log Window as a TXCVR->Host Message as shown in [Figure 3](#).

Table 4. Data Packets Sent From Transceiver to Host

MESSAGE TYPE	MESSAGE LENGTH	MESSAGE DESCRIPTION
0x81	8	Send n RF data bytes to destination transceiver ID Ack/nack
0x82	5	Set IDs acknowledged
0x83	11	Respond with IDs

Table 4. Data Packets Sent From Transceiver to Host (continued)

MESSAGE TYPE	MESSAGE LENGTH	MESSAGE DESCRIPTION
0x84	7	Respond with IDs and programmable settings status
0x88	5	Set programmable settings acknowledged
0x89	12	Respond with programmable settings
0x8E	10 + n	Received n RF data bytes from source transceiver ID sent to destination transceiver ID
0x8F	21	Respond with statistics
0x90	5	Clear statistics acknowledged
0x91	5	Enable/Disable test mode acknowledged
0x92	5	Set test mode settings acknowledged
0x93	18	Respond with test mode settings
0x94	8 + n	Received n RF data bytes from source transceiver ID
0x95	11-43	Respond with firmware version
0x96	5	Set sleep mode acknowledged
0x99	6	Set baud rate acknowledged

The host-to-transceiver and transceiver-to-host message definitions are detailed Appendix A and Appendix B respectively.

Note:

Bidirectional communication between the host and the TRF6903 transceiver (via DBB03A) can take place ONLY through the host-interface protocol defined in Appendix A and B. Any external microcontroller or software MUST use this host-interface protocol to communicate with the TRF6903 (via DBB03A).

Appendix A Message Definitions: Host-to-Transceiver

A.1 0x01 - Sent n RF Data Bytes To Destination Transceiver ID (Host -> RF Transceiver)

HEADER				PAYLOAD				TRAILER	
	Start Byte (0x01)	Length (8+n)	Type (0x01)	Packet ID	Transceiver ID LSB	Transceiver ID MSB	n Data Bytes	Checksum	End Byte (0x04)
Size (bytes)	1	1	1	1	1	1	n	1	1

FIELD NAME	FIELD DESCRIPTION
Start Byte	0x01 (SOH)
Length	Eight plus the number of data bytes (8+n)
Type	0x01 - Send n RF data bytes to destination transceiver ID
Packet ID	Packet ID
Transceiver ID LSB	Least significant byte of the destination transceiver ID
Transceiver ID MSB	Most significant byte of the destination transceiver ID
n Data Bytes	Data to be sent over the RF link (n bytes)
Checksum	Checksum of bytes from the start byte through the payload
End Byte	0x04 (EOM)

A.2 0x02 - Set IDs (Host -> RF Transceiver)

HEADER				PAYLOAD						TRAILER	
	Start Byte (0x01)	Length (0x0B)	Type (0x02)	Txcvr ID LSB	Txcvr ID MSB	Network ID LSB	Network ID MSB	System ID LSB	System ID MSB	Csum	End Byte (0x04)
Size (bytes)	1	1	1	1	1	1				1	1

FIELD NAME	FIELD DESCRIPTION
Start Byte	0x01 (SOH)
Length	0x0B
Type	0x02 - Set IDs
Txcvr ID LSB	Least significant byte of the transceiver ID
Txcvr ID MSB	Most significant byte of the transceiver ID
Network ID LSB	Least significant byte of the network ID
Network ID MSB	Most significant byte of the network ID
System ID LSB	Least significant byte of the system ID
System ID MSB	Most significant byte of the system ID
Csum	Checksum of bytes from the start byte through the payload

0x03 - Query IDs (Host -> RF Transceiver)

FIELD NAME	FIELD DESCRIPTION
End Byte	0x04 (EOM)

A.3 0x03 - Query IDs (Host -> RF Transceiver)

HEADER				TRAILER	
	Start Byte (0x01)	Length (0x05)	Type (0x03)	Checksum (0x09)	End Byte (0x04)
Size (bytes)	1	1	1	1	1

FIELD NAME	FIELD DESCRIPTION
Start Byte	0x01 (SOH)
Length	0x05
Type	0x03 - Query IDs
Checksum	Checksum of bytes from the start byte through the payload
End Byte	0x04 (EOM)

A.4 0x04 - Query IDs And Programmable Settings Status (Host -> RF Transceiver)

HEADER				TRAILER	
	Start Byte (0x01)	Length (0x05)	Type (0x03)	Checksum (0x0A)	End Byte (0x04)
Size (bytes)	1	1	1	1	1

FIELD NAME	FIELD DESCRIPTION
Start Byte	0x01 (SOH)
Length	0x05
Type	0x04 - Query IDs and programmable settings status
Checksum	Checksum of bytes from the start byte through the payload
End Byte	0x04 (EOM)

A.5 0x08 – Set Programmable Settings (Host -> RF Transceiver)

HEADER				PAYLOAD							TRAILER	
	Start Byte (0x01)	Length (0x0C)	Type (0x08)	Hop Table	Acks	Retries	PA Level	RF Mode	Single Channel	Receive All	Csum	End Byte (0x04)
Size (bytes)	1	1	1	1	1	1	1	1	1	1	1	1

FIELD NAME	FIELD DESCRIPTION
Start Byte	0x01 (SOH)
Length	0x0C
Type	0x08 – Set programmable settings
Hop Table	Number of the hop table to be used (0-15)
Acks	Enable (0x01) or disable (0x00) RF acknowledgements
Retires	The number of RF retries that are attempted before giving up
PA Level	TRF6903 power amplifier level (0 ≥ 0-dB attenuation – high power, 1 ≥ 10-dB attenuation – mid power, 2 ≥ 20-dB attenuation – low power)
RF Mode	RF channel mode (0x00 ≥ single channel, 0x01 ≥ hopping)
Single Channel	If the RF channel mode is configured for single channel, then this is the RF channel that the transceiver operates on (index into the hop table)
Receive All	Enable (0x01) or disable (0x00) receive all RF messages
Csum	Checksum of bytes from the start byte through the payload
End Byte	0x04 (EOM)

A.6 0x09 - Query Programmable Settings (Host -> RF Transceiver)

HEADER				TRAILER	
	Start Byte (0x01)	Length (0x05)	Type (0x09)	Checksum (0x0F)	End Byte (0x04)
Size (bytes)	1	1	1	1	1

FIELD NAME	FIELD DESCRIPTION
Start Byte	0x01 (SOH)
Length	0x05
Type	0x09 - Query programmable settings
Checksum	Checksum of bytes from the start byte through the payload
End Byte	0x04 (EOM)

A.7 0x0F - Get Statistics (Host -> RF Transceiver)

HEADER				TRAILER	
	Start Byte (0x01)	Length (0x05)	Type (0x0F)	Checksum (0x15)	End Byte (0x04)
Size (bytes)	1	1	1	1	1

0x10 - Clear Statistics (Host -> RF Transceiver)

FIELD NAME	FIELD DESCRIPTION
Start Byte	0x01 (SOH)
Length	0x05
Type	0x0F - Get statistics
Checksum	Checksum of bytes from the start byte through the payload
End Byte	0x04 (EOM)

A.8 0x10 - Clear Statistics (Host -> RF Transceiver)

HEADER				TRAILER	
	Start Byte (0x01)	Length (0x05)	Type (0x10)	Checksum (0x16)	End Byte (0x04)
Size (bytes)	1	1	1	1	1

FIELD NAME	FIELD DESCRIPTION
Start Byte	0x01 (SOH)
Length	0x05
Type	0x10 - Get statistics
Checksum	Checksum of bytes from the start byte through the payload
End Byte	0x04 (EOM)

A.9 0x11 - Enable/Disable Test Mode (Host -> RF Transceiver)

HEADER				PAYLOAD	TRAILER	
	Start Byte (0x01)	Length (0x06)	Type (0x11)	Enable/Disable (0x00-0x01)	Checksum	End Byte (0x04)
Size (bytes)	1	1	1	1	1	1

FIELD NAME	FIELD DESCRIPTION
Start Byte	0x01 (SOH)
Length	0x06
Type	0x11 - Enable/Disable test mode
Checksum	Checksum of bytes from the start byte through the payload
End Byte	0x04 (EOM)

A.10 0x12 - Set Test Mode Settings (Host -> RF Transceiver)

HEADER				PAYLOAD									TRAILER	
	Start Byte (0x01)	Length (0x12)	Type (0x12)	Reg A	Reg B	Reg D	Reg E	Reg A DC	Reg B DC	Reg C DC	Reg E TCOUNT	Rsvd	Check Sum	End Byte (0x04)
Size (bytes)	1	1	1	1	1	2	2	2	2	1	1	1	1	1

FIELD NAME	FIELD DESCRIPTION
Start Byte	0x01 (SOH)
Length	0x12
Type	0x12 - Set test mode settings
RegA	Texas Instruments TRF6903 register A 8 bit settings (PA0 - BND)
RegB	Texas Instruments TRF6903 register B 8 bit settings (PA1 - Det Enable)
RegD	Texas Instruments TRF6903 register D 16 bit settings (RXS - OOKXS) right justified and LSB first
RegE	Texas Instruments TRF6903 register E 16 bit settings (BRA - PAI) right justified and LSB first. Operating mode is bit 12 and transmit data is bits 13 and 14
RegA DC	Texas Instruments TRF6903 register A 16 bit divider coefficients (AAAAABBBBBBBBB) right justified and LSB first
RegB DC	Texas Instruments TRF6903 register B 16 bit divider coefficients (AAAAABBBBBBBBB) right justified and LSB first
RegC DC	Texas Instruments TRF6903 register C reference divider coefficient
RegE TCOUNT	Texas Instruments TRF6903 register E TCOUNT
Reserved	
Checksum	Checksum of bytes from the start byte through the payload
End Byte	0x04 (EOM)

A.11 0x13 - Query Test Mode Settings (Host -> RF Transceiver)

HEADER				TRAILER	
	Start Byte (0x01)	Length (0x05)	Type (0x13)	Checksum (0x19)	End Byte (0x04)
Size (bytes)	1	1	1	1	1

FIELD NAME	FIELD DESCRIPTION
Start Byte	0x01 (SOH)
Length	0x05
Type	0x13 - Query test mode settings
Checksum	Checksum of bytes from the start byte through the payload
End Byte	0x04 (EOM)

0x15 - Query Firmware Version (Host -> RF Transceiver)

A.12 0x15 - Query Firmware Version (Host -> RF Transceiver)

HEADER			TRAILER		
	Start Byte (0x01)	Length (0x05)	Type (0x15)	Checksum (0x1B)	End Byte (0x04)
Size (bytes)	1	1	1	1	1

FIELD NAME	FIELD DESCRIPTION
Start Byte	0x01 (SOH)
Length	0x05
Type	0x15 - Query firmware version
Checksum	Checksum of bytes from the start byte through the payload
End Byte	0x04 (EOM)

A.13 0x19 - Set Baud Rate (Host -> RF Transceiver)

HEADER			PAYLOAD	TRAILER		
	Start Byte (0x01)	Length (0x05)	Type (0x15)	Baudrate (0x00-0x03)	Checksum (0x1B)	End Byte (0x04)
Size (bytes)	1	1	1	1	1	1

FIELD NAME	FIELD DESCRIPTION
Start Byte	0x01 (SOH)
Length	0x05
Type	0x19 - Set baud rate
Baudrate	Baudrate setting (0 = 9,600; 1 = 19,200; 2 = 38,400; 3 = 57,600)
Checksum	Checksum of bytes from the start byte through the payload
End Byte	0x04 (EOM)

A.14 0x16 - Set Sleep Mode (Host -> RF Transceiver)

HEADER			TRAILER		
	Start Byte (0x01)	Length (0x05)	Type (0x16)	Checksum (0x1C)	End Byte (0x04)
Size (bytes)	1	1	1	1	1

FIELD NAME	FIELD DESCRIPTION
Start Byte	0x01 (SOH)
Length	0x05
Type	0x16 - Set sleep mode
Checksum	Checksum of bytes from the start byte through the payload
End Byte	0x04 (EOM)

Appendix B Message Definitions: Transceiver to Host

B.1 0x81 - Sent n RF Data Bytes to Destination Transceiver ID Ack/Nack (RF Transceiver -> Host)

HEADER				PAYLOAD			TRAILER	
	Start Byte (0x01)	Length (0x08)	Type (0x81)	Packet ID	Ack/Nack (0x00-0x01)	Number of Retries	Checksum	End Byte (0x04)
Size (bytes)	1	1	1	1	1	1	1	1

FIELD NAME	FIELD DESCRIPTION
Start Byte	0x01 (SOH)
Length	0x08
Type	0x81 - Received n RF data bytes from destination transceiver ID Ack/Nack
Packet ID	Packet ID
Ack/Nack	Nack = 0x00, Ack = 0x01
Number of Retries	Number of retries it took to get the packet through the RF
Checksum	Checksum of bytes from the start byte through the payload
End Byte	0x04 (EOM)

B.2 0x82 - Set IDs Acknowledged (RF Transceiver -> Host)

HEADER				TRAILER	
	Start Byte (0x01)	Length (0x05)	Type (0x82)	Checksum (0x88)	End Byte (0x04)
Size (bytes)	1	1	1	1	1

FIELD NAME	FIELD DESCRIPTION
Start Byte	0x01 (SOH)
Length	0x05
Type	0x82 - Set IDs Acknowledged
Checksum	Checksum of bytes from the start byte through the payload
End Byte	0x04 (EOM)

B.3 0x83 - Respond With IDs (RF Transceiver -> Host)

0x84 - Respond With IDs and Programmable Settings Status (RF Transceiver -> Host)

HEADER				PAYLOAD						TRAILER	
	Start Byte (0x01)	Length (0x0B)	Type (0x83)	Txcvr ID LSB	Txcvr ID MSB	Network ID LSB	Network ID MSB	System ID LSB	System ID MSB	Csum	End Byte (0x04)
Size (bytes)	1	1	1	1	1	1				1	1

FIELD NAME	FIELD DESCRIPTION
Start Byte	0x01 (SOH)
Length	0x0B
Type	0x83 – Respond with IDs
Txcvr ID LSB	Least significant byte of the transceiver ID
Txcvr ID MSB	Most significant byte of the transceiver ID
Network ID LSB	Least significant byte of the network ID
Network ID MSB	Most significant byte of the network ID
System ID LSB	Least significant byte of the system ID
System ID MSB	Most significant byte of the system ID
Csum	Checksum of bytes from the start byte through the payload
End Byte	0x04 (EOM)

B.4 0x84 - Respond With IDs and Programmable Settings Status (RF Transceiver -> Host)

HEADER				PAYLOAD		TRAILER	
	Start Byte (0x01)	Length (0x07)	Type (0x84)	IDs State	Programmable Settings State	Checksum	End Byte (0x04)
Size (bytes)	1	1	1	1	1	1	1

FIELD NAME	FIELD DESCRIPTION
Start Byte	0x01 (SOH)
Length	0x07
Type	0x43 – Respond with IDs and programmable settings status
IDs State	The state of whether or not the IDs have been programmed (0x01) or unprogrammed (0x00)
Programmable Settings State	The state of whether or not the programmable settings are programmed (0x01) or unprogrammed (0x00)
Checksum	Checksum of bytes from the start byte through the payload
End Byte	0x04 (EOM)

B.5 0x88 – Set Programmable Settings Acknowledged (RF Transceiver -> Host)

HEADER				TRAILER	
	Start Byte (0x01)	Length (0x05)	Type (0x88)	Checksum (0x8E)	End Byte (0x04)
Size (bytes)	1	1	1	1	1

0x89 - Respond With Programmable Settings (RF Transceiver -> Host)

FIELD NAME	FIELD DESCRIPTION
Start Byte	0x01 (SOH)
Length	0x05
Type	0x88 – Set programmable settings acknowledged
Checksum	Checksum of bytes from the start byte through the payload
End Byte	0x04 (EOM)

B.6 0x89 - Respond With Programmable Settings (RF Transceiver -> Host)

HEADER				PAYLOAD							TRAILER	
	Start Byte (0x01)	Length (0x0C)	Type (0x89)	Hop Table	Acks	Retries	PA Level	RF Mode	Single Channel	Receive All	Csum	End Byte (0x04)
Size (bytes)	1	1	1	1	1	1	1	1	1	1	1	1

FIELD NAME	FIELD DESCRIPTION
Start Byte	0x01 (SOH)
Length	0x0C
Type	0x89 – Respond with programmable settings
Hop Table	Number of the hop table to be used (0-15)
Acks	Enable (0x01) or disable (0x00) RF acknowledgements
Retries	The number of RF retries that are attempted before giving up
PA Level	TRF6903 power amplifier level (0 ≥ 0-dB attenuation – high power, 1 ≥ 10-dB attenuation – mid power, 2 ≥ 20-dB attenuation – low power)
RF Mode	RF channel mode (0x00 ≥ single channel, 0x01 ≥ hopping)
Single Channel	If the RF channel mode is configured for single channel, then this is the RF channel that the transceiver operates on (index into the hop table)
Receive All	Enable (0x01) or disable (0x00) receive all RF messages
Csum	Checksum of bytes from the start byte through the payload
End Byte	0x04 (EOM)

B.7 0x8E - Received n RF Data Bytes Not Targeted To Our Transceiver ID (RF Transceiver -> Host)

HEADER				PAYLOAD						TRAILER	
	Start Byte (0x01)	Length (10+n)	Type (0x8E)	Packet ID	Dest Txcvr ID LSB	Dest Txcvr ID MSB	Source Txcvr ID LSB	Source Txcvr ID MSB	n Data Byte	Csum	End Byte (0x04)
Size (bytes)	1	1	1	1	1	1	1	1	n	1	1

FIELD NAME	FIELD DESCRIPTION
Start Byte	0x01 (SOH)
Length	Ten plus the number of data bytes (10+n)
Type	0x8E - Received n RF data bytes not targeted to transceiver ID
Packet ID	Packet ID
Dest Txv ID LSB	Least significant byte of the transceiver ID
Dest Txv ID MSB	Most significant byte of the transceiver ID
Source Txv ID LSB	Least significant byte of the source transceiver ID
Source Txv ID MSB	Most significant byte of the source transceiver ID
n Data Bystes	Data bytes received over the RF link (n bytes)
Csum	Checksum of bytes from the start byte through the payload
End Byte	0x04 (EOM)

B.8 0x8F - Respond With Statistics (RF Transceiver -> Host)

HEADER				PAYLOAD								TRAILER	
	Start Byte (0x01)	Length (0x15)	Type (0x8F)	Total Pkts Sent	Unique Pkts Sent	Total Acks Sent	Unique Acks Sent	Total Pkts Rcvd	Total Acks Rcvd	Unique Pkts Rcvd	Unique Acks Rcvd	Csum	End Byte (0x04)
Size (bytes)	1	1	1	2	2	2	2	2	2	2	2	1	1

FIELD NAME	FIELD DESCRIPTION
Start Byte	0x01 (SOH)
Length	0x15
Type	0x8F - Respond with statistics
Total Pkts Sent	Total RF packets sent
Unique Pkts Sent	Unique RF packets sent
Total Acks Sent	Total RF acknowledgements sent
Unique Acks Sent	Unique RF acknowledgements sent
Total Pkts Received	Total RF packets received
Unique Pkts Received	Unique RF packets received
Total Acks Received	Total RF acknowledgements received
Unique Acks Received	Unique RF acknowledgements received
Checksum	Checksum of bytes from the start byte through the payload
End Byte	0x04 (EOM)

B.9 0x90 - Clear Statistics Acknowledged (RF Transceiver -> Host)

HEADER				TRAILER	
	Start Byte (0x01)	Length (0x05)	Type (0x90)	Checksum (0x96)	End Byte (0x04)
Size (bytes)	1	1	1	1	1

0x91 - Enable/Disable Test Mode Acknowledged (RF Transceiver -> Host)

FIELD NAME	FIELD DESCRIPTION
Start Byte	0x01 (SOH)
Length	0x05
Type	0x90 - Clear statistics acknowledged
Checksum	Checksum of bytes from the start byte through the payload
End Byte	0x04 (EOM)

B.10 0x91 - Enable/Disable Test Mode Acknowledged (RF Transceiver -> Host)

HEADER				TRAILER	
	Start Byte (0x01)	Length (0x05)	Type (0x91)	Checksum (0x92)	End Byte (0x04)
Size (bytes)	1	1	1	1	1

FIELD NAME	FIELD DESCRIPTION
Start Byte	0x01 (SOH)
Length	0x05
Type	0x91 - Enable/Disable test mode acknowledged
Checksum	Checksum of bytes from the start byte through the payload
End Byte	0x04 (EOM)

B.11 0x92 - Set Test Mode Settings Acknowledged (RF Transceiver -> Host)

HEADER				TRAILER	
	Start Byte (0x01)	Length (0x05)	Type (0x92)	Checksum (0x98)	End Byte (0x04)
Size (bytes)	1	1	1	1	1

FIELD NAME	FIELD DESCRIPTION
Start Byte	0x01 (SOH)
Length	0x05
Type	0x92 - Set test mode settings acknowledged
Checksum	Checksum of bytes from the start byte through the payload
End Byte	0x04 (EOM)

B.12 0x93 - Respond With Test Mode Settings (RF Transceiver -> Host)

0x94 - Received n RF Data Bytes Targeted To Our Transceiver ID (RF Transceiver -> Host)

HEADER				PAYLOAD									TRAILER	
	Start Byte (0x01)	Length (0x12)	Type (0x93)	Reg A	Reg B	Reg D	Reg E	Reg A DC	Reg B DC	Reg C DC	Reg E TCOUNT	Rsvd	Check Sum	End Byte (0x04)
Size (bytes)	1	1	1	1	1	2	2	2	2	1	1	1	1	1

FIELD NAME	FIELD DESCRIPTION
Start Byte	0x01 (SOH)
Length	0x12
Type	0x93 – Respond with test mode settings
RegA	Texas Instruments TRF6903 register A 8 bit settings (PA0 - BND)
RegB	Texas Instruments TRF6903 register B 8 bit settings (PA1 - Det Enable)
RegD	Texas Instruments TRF6903 register D 16 bit settings (RXS - OOKXS) right justified and LSB first
RegE	Texas Instruments TRF6903 register E 16 bit settings (BRA – PAI) right justified and LSB first. Operating mode is bit 12 and transmit data is bits 13 and 14.
RegA DC	Texas Instruments TRF6903 register A 16 bit divider coefficients (AAAAABBBBBBBBBB) right justified and LSB first
RegB DC	Texas Instruments TRF6903 register B 16 bit divider coefficients (AAAAABBBBBBBBBB) right justified and LSB first
RegC DC	Texas Instruments TRF6903 register C reference divider coefficient
RegE TCOUNT	Texas Instruments TRF6903 register E TCOUNT
Reserved	
Checksum	Checksum of bytes from the start byte through the payload
End Byte	0x04 (EOM)

B.13 0x94 - Received n RF Data Bytes Targeted To Our Transceiver ID (RF Transceiver -> Host)

HEADER				PAYLOAD						TRAILER	
	Start Byte (0x01)	Length (10+n)	Type (0x94)	Packet ID	Dest Txcvr ID LSB	Dest Txcvr ID MSB	Source Txcvr ID LSB	Source Txcvr ID MSB	n Data Byte	Csum	End Byte (0x04)
Size (bytes)	1	1	1	1	1	1	1	1	n	1	1

FIELD NAME	FIELD DESCRIPTION
Start Byte	0x01 (SOH)
Length	Ten plus the number of data bytes (10+n)
Type	0x94 - Received n RF data bytes not targeted to transceiver ID
Packet ID	Packet ID
Dest Txcvr ID LSB	Least significant byte of the transceiver ID
Dest Txcvr ID MSB	Most significant byte of the transceiver ID
Source Txcvr ID LSB	Least significant byte of the source transceiver ID
Source Txcv ID MSB	Most significant byte of the source transceiver ID
n Data Bystes	Data bytes received over the RF link (n bytes)
Csum	Checksum of bytes from the start byte through the payload

0x95 - Respond With Firmware Version (RF Transceiver -> Host)

FIELD NAME	FIELD DESCRIPTION
End Byte	0x04 (EOM)

B.14 0x95 - Respond With Firmware Version (RF Transceiver -> Host)

HEADER				PAYLOAD							TRAILER	
	Start Byte (0x01)	Length 11-43	Type (0x95)	Ver Major	Ver Minor	Ver Month	Ver Day	Ver Year	Copyright Length	Copyright String	Checksum	End Byte (0x04)
Size (bytes)	1	1	1	1	1	1	1	1	1	0-32	1	1

FIELD NAME	FIELD DESCRIPTION
Start Byte	0x01 (SOH)
Length	11-43
Type	0x95 - Respond with firmware version
Version Major	Version major number
Version Minor	Version minor number
Version Month	Version month (1 - 12)
Version Day	Version day (1 - 31)
Version Year	Version year (0 - 99)
Copyright Length	Length of copyright string (0 - 32 bytes)
Copyright String	Copyright string (0 - 32 bytes in length)
Checksum	start byte through the payload
End Byte	

B.15 Set Sleep Mode Acknowledged (RF Transceiver -> Host)

HEADER				TRAILER	
	Start Byte (0x01)	Length (0x05)	Type (0x96)	Checksum (0x9C)	End Byte (0x04)
Size (bytes)	1	1	1	1	1

FIELD NAME	FIELD DESCRIPTION
Start Byte	0x01 (SOH)
Length	0x05
Type	0x96 - Set sleep mode acknowledged
Checksum	Checksum of bytes from the start byte through the payload
End Byte	0x04 (EOM)

B.16 0x99 - Set Baud Rate Acknowledged (RF Transceiver -> Host)

HEADER				PAYLOAD	TRAILER	
	Start Byte (0x01)	Length (0x06)	Type (0x99)	Baudrate (0x00-0x03)	Checksum (0x98)	End Byte (0x04)
Size (bytes)	1	1	1	1	1	1

FIELD NAME	FIELD DESCRIPTION
Start Byte	0x01 (SOH)
Length	0x05
Type	0x99 - Set baud rate acknowledged
Checksum	Checksum of bytes from the start byte through the payload
End Byte	0x04 (EOM)

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