Performance Analyzer Protocol Specification

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2 Introduction

This document explains about serial protocol that is used to communicate between the Wireless Performance Analyzer application which is running on host PC and Performance Analyzer firmware which is running on the Atmel Evaluation kit. Atmel EVKs are pre-flashed with Performance Analyzer firmware. This application is targeted to evaluate various Atmel transceivers in terms of Packet Error Rate, Range etc. Wireless Performance Analyzer is an application (part of Studio) on host PC is connects to Atmel Evaluation kit using USB or UART interface. This application is used to configure various parameters like CSMA, Antenna Diversity, TX power, Rx sensitivity to evaluate transceiver. The format of the messages used to communicate is given below.

3 Scope

The scope of the document is to describe the frame format of the messages that are used for communication between the Wireless Performance Analyzer Application running on the host PC and Performance Analyzer Firmware on the kit. The following sections describe the messages and its definitions in detail.

4 Protocol

4.1 Message Format

The Performance Analyzer protocol uses a common message format for both directions of communication.

RX/TX message format:

SOT	Msg Length	Protocol Id	Msg Id	Msg Payload	EOT
(1 byte)	(1 byte)	(1 byte)	(1 byte)	(Msg Length – 2) bytes	(1 byte)

The details of message format are presented below:

Field	Size	Values	Description
SOT	1 byte	0x01	Start of the Transmission
Msg Length	1 byte	0- 255	Length of the message including Protocol Id, Msg Id and Msg Payload
Protocol Id	1 byte	0x00-0xFF	Describes the protocol used TAL – 0x00 MAC– 0x01 etc Performance Analyzer is an application on TAL, so it has the

			protocol id as 0x00
Msg Id	1 byte	0x00-0xFF	Describes what message sent.
Msg Payload	(Msg Length – 2) bytes	…	Payload for the message. This does not includes Protocol Id and Msg Id
EOT	1 byte	0x04	End of Transmission

4.2 Message Identifier

The message identifier indicates what the message is all about. The interpretation of the data packet will depend on the message identifier. Wireless Performance Analyzer application which is running on host PC sends Request packets, which are received and interpreted by the Performance Analyzer firmware in the kit. The Performance Analyzer firmware then performs the necessary operations and sends a confirmation or response back to the Performance Analyzer application running on the host PC.

Request packet Identifiers are shown below:

Message Type	Value	Description
IDENTIFY_BOARD_REQ	0x00	Identifies the connected board and get the details
PERF_START_REQ	0x01	Starting performance test in Range or PER mode
PERF_SET_REQ	0x02	Sets the various configuration parameters for the performance Test. (**Note:** Refer to Section 4.4 – "Performance test Configuration parameters" to get the details on various parameters types and values.)
PERF_GET_REQ	0x03	Gets the various configuration parameters for the performance Test. (**Note:** Refer to Section 4.4 – "Performance test Configuration parameters" to get the details on various parameters types and values.)
IDENTIFY_PEER_NODE_REQ	0x04	Allows to identify the remote node by blinking
CONT_PULSE_TX_REQ	0x05	Allows continuous wave pulse mode transmission from the radio transceiver in current channel
CONT_WAVE_TX_REQ	0x06	Requests to start continuous transmission in CW or PRBS mode in current channel
REGISTER_READ_REQ	0x07	Requests to read the value of the given register

		address
REGISTER_WRITE_REQ	0x08	Requests to write the value into the given register address
REGISTER_DUMP_REQ	0x09	Dumps the register values of the given set of the register address
ED_SCAN_START_REQ	0x0a	Starts the Energy Detection Scan stops automatically on completion
SENSOR_DATA_REQ	0x0b	Requests to get the sensor data like battery voltage
PER_TEST_START_REQ	0x0c	Starts the Packet Error Rate with current user settings
PEER_DISCONNECT_REQ	0x0d	Initiates the disconnection with the peer node
SET_DEFAULT_CONFIG_REQ	0x0e	All configurable parameters shall be set to their default values.
GET_CURRENT_CONFIG_REQ	0x0f	Current values of all configurable parameters shall be read
RANGE_TEST_START_REQ	0x50	Starts the Range test with current user settings
RANGE_TEST_STOP_REQ	0x52	Stops the Range test

Confirmations and response identifiers for the above requests are shown below:

Message Identifier	**Value**	**Description**
IDENTIFY_BOARD_CONFIRM	0x10	Identifies the connected board and gives the details of board like MCU, Transceiver and FW version
PERF_START_CONFIRM	0x11	Starting performance test in Range or PER mode and

		gives the status and all configurable parameters
PERF_SET_CONFIRM	0x12	Sets the various configuration parameters for the performance Test
PERF_GET_CONFIRM	0x13	Gets the various configuration parameters for the performance Test
IDENTIFY_PEER_NODE_CONFIRM	0x14	Allows to identify the remote node by blinking
CONT_PULSE_TX_CONFIRM	0x15	Provide the status on completion of continuous wave pulse mode transmission from the radio transceiver in current channel
CONT_WAVE_TX_CONFIRM	0x16	Start continuous transmission in CW or PRBS mode in current channel and provide the status
REGISTER_READ_CONFIRM	0x17	Register Read status with the register value
REGISTER_WRITE_CONFIRM	0x18	Register write status with the register address
REGISTER_DUMP_CONFIRM	0x19	Dumps the register values of the given set of the register address
ED_SCAN_START_CONFIRM	0x1a	Provides the time required for scan and Starts the Energy Detection Scan stops automatically on completion
ED_SCAN_END_INDICATION	0x1b	Provides Energy values of all channels on completion of Energy detection
SENSOR_DATA_CONFIRM	0x1c	Provides the information like Battery voltage and temperature.
PER_TEST_START_CONFIRM	0x1d	Starts the Packet Error Rate with current user settings.
PER_TEST_END_INDICATION	0x1e	Provides information like No. of transmitted frames, Received frames LQI and RSSI Value on successful completion of PER test
PEER_DISCONNECT_CONFIRM	0x1f	Provides the result of peer Disconnect req
SET_DEFAULT_CONFIG_CONFIRM	0x20	Provides the result for the Set default config req

GET_CURRENT_CONFIG_CONFIRM	0x21	Provides the result for the Get current config req
RANGE_TEST_BEACON_RESPONSE	0x54	Response Frame for the Beacon Transmitted from the Host Node
RANGE_TEST_BEACON	0X55	Beacon Frame Transmitted over the air in Range Test Mode
RANGE_TEST_MARKER_INDICATION	0X56	Marker Indication Frame which is sent when a button is pressed at the receptor end.The LQI and ED of the Marker Cmd is sent to the GUI

4.3 Message payload Descriptions

The following sections explain the format of payloads of all the message types.

4.3.1 IDENTIFY_BOARD_REQ (0x00)

Field	**Type/** **Size**	**Values**	**Description**
Start up parameter	unsigned integer / 1 byte	0x00-0xFF	Start up parameter to identify the request. Default value id 0xaa

4.3.2 IDENTIFY_BOARD_CONFIRM (0x10)

Field	**Type/**	**Values**	**Description**

	Size		
Status	1 byte	0x00-0xFF	Status of the request 0x00 = SUCCESS Non zero = FAILURE, This board/port is not a Performance test pre-flashed board. User may need to manual check and flash the application. For error codes refer Section 4.5 – “Error codes”
IC type	unsigned integer / 1 byte	0x00 – 0x01	IC type on Kit. 0x00 = MCU- TRX 0x01 = SoC
MCU/SoC name	Array of chars / -- (first byte of the array indicates the length)	--	This represents the name of SoC or MCU used on the Kit based on the IC type parameter
Transceiver name	Array of chars / -- (first byte of the array indicates the length)	--	This represents the name of the transceiver used on the kit. Ignore this field if IC type = SoC
Board name	Array of chars / -- (first byte of the array indicates the	--	Name of Board/ kit used for Transmitter/Initiator node

	length)		
MAC address	unsigned integer/ 8 bytes	0x00000001 – 0xfffffffd	MAC address of the Transmitter/Initiator node
FW version	Floating point value/ 4 bytes	Starts from - 1.0	Current FW version on the Kit
Features supported	unsigned integer/4 bytes	0x00000001 – 0xffffffff	Each bit set represents a particular feature is supported. Ex: If LSB-b0 is set it says channel selection option is available.

4.3.3 PERF_START_REQ (0x01)

Field	Type/ Size	Values	Description
Start mode	unsigned integer / 1 byte	0x01-0x02	Start mode for the Performance test 0x01 = PER measurement mode 0x02 = Single node tests

4.3.4 PERF_START_CONFIRM (0x11)

	Type/ Size	Values	Description

Status	unsigned integer / 1 byte	0x00-0xFF	Status of the PERF_START_REQ 0x00 = SUCCESS Non zero = FAILURE. For error codes refer Section 4.5 – "Error codes"
Start mode	unsigned integer / 1 byte	0x01- 0x02	Start mode in which the Performance test is started 0x01 = PER mode 0x02 =Single node test mode
Channel	unsigned integer / 1 byte	11-26 for 2.4GHz 0- 10 for 868/915 Sub GHz band	The default channel in which the Performance test is started
Channel Page	unsigned integer / 1 byte	0,2,5,16,17,18, 19	The channel page in which the Performance test is started
TX Power dBm value	signed integer / 1 byte	-17dBm – 21dBm	TX power value in dBm
TX Power Register value	unsigned integer / 1 byte	0x00 – 0x0f	TX power register value, if exists 0xff= does not exists for this kit, do not show it in GUI This field exists does not exist for AT86RF212B

CSMA	Boolean/
	1 byte
		True/false	CSMA-CA default value
			True = enabled
			False = disabled

Frame Retry	Boolean /
	1 byte
		True/false	Frame retransmission default value
			True = enabled
			False = disabled

ACK Request	Boolean /
	1 byte
		True/false	Ack Request default value
			True = enabled
			False = disabled

Rx desensitization	unsigned integer/ 1 byte /	True/false	Rx De-sensitivity default value 0xff= does not exists for this kit, do not show it in GUI 0x00- disabled 0x01 - enabled
RPC	unsigned integer/ 1 byte	0x00- 0xff	RPC default value if it exists 0xff= does not exists for this kit, do not show it in GUI 0x00- disabled 0x01 - enabled
Antenna Diversity	unsigned integer/ 1 byte	0x00- 0xff	Antenna diversity default value if it exists 0xff= does not exists for this kit, do not show it in GUI 0x00- enabled, 0x01- disabled, ANT A1/X2 selected 0x02 - disabled, ANT A2/X3 selected

Transceiver state	unsigned integer/ 1 byte	0x00- 0xff	Default transceiver state 0x08 = TRX OFF Single node tests 0x16 = RX AACK ON for PER test
No. of test frames	Unsigned integer/ 4 bytes	0 – 4294967295(2^32 - 1)	Default test frames for PER test = 100. Ignore this field if start mode parameter is not equal to 0x01
PHY frame length	unsigned integer/ 1 byte	12 - 127	Default PHY frame length = 20. Ignore this field if start mode parameter is not equal to 0x01
Antenna Diversity on Peer	unsigned integer/ 1 byte	0x00- 0xff	Antenna diversity default value if it exists 0xff= does not exists for this kit, do not show it in GUI 0x00- enabled, 0x01- disabled, ANT A1/X2 selected 0x02 - disabled, ANT A2/X3 selected

CRC Setting on Peer	Boolean/
	1 byte
		TRUE/FALSE	Indicate whether Counting of packets with wrong CRC is enabled
			TRUE = enable
			FALSE = disable

Peer IC type	unsigned	0x00 – 0x01	IC type on Peer node.

	integer / 1 byte		0x00 = MCU- TRX 0x01- SOC Ignore this field if start mode parameter is not equal to 0x01
Peer MCU/SoC name	Array of chars / -- (first byte of the array indicates the length)	--	This represents the name of SoC or MCU used on Peer node based on the Peer IC type parameter Ignore this field if start mode parameter is not equal to 0x01
Peer Transceiver name	Array of chars / -- (first byte of the array indicates the length)	--	This represents the name of the transceiver used on Peer node. Ignore this field if IC type = SoC Ignore this field if start modes parameter is not equal to 0x01
Peer Board name	Array of chars / -- (first byte of the array indicates the length)	--	Board/ kit name of the Peer node
Peer MAC address	unsigned integer/ 8 bytes	0x00000001 – 0xfffffffd	MAC address of the Peer node

4.3.5 PERF_SET_REQ (0x02)

Field	Type/	Values	Description

	Size		
Parameter Type	unsigned integer / 1 byte	0x00-0xFF	Parameter type that needs to be set. Types of parameter are defined in the table 1
Parameter Value	Various (first byte indicates the length)	Parameter Specific.	The value to set for Performance test parameters

Note: Refer to Section 4.4 - Performance test Configuration parameters to get the details on various parameters types and values.

4.3.6 PERF_SET_CONFIRM (0x12)

Field	Type/ Size	Values	Description
Status	unsigned integer / 1 byte	0x00-0xFF	Status of the PERF_SET_REQ 0x00 = SUCCESS Non zero = FAILURE and previous value should be retained. For error codes refer Section 4.5 – “Error codes”
Parameter Type	unsigned integer / 1 byte	0x00-0xFF	Parameter type that had been set. Types of parameters are defined in the table 1
Parameter Value	Various (first byte indicates the	Parameter Specific	The parameter value that has been set

	length)		

4.3.7 PERF_GET_REQ (0x03)

Field	**Type/** **Size**	**Values**	**Description**
Parameter Type	unsigned integer / 1 byte	0x00-0xFF	Parameter type to read

4.3.8 PERF_GET_CONFIRM (0x13)

Field	**Type/** **Size**	**Values**	**Description**
Status	unsigned integer / 1 byte	0x00-0xFF	Status of the PERF_GET_REQ 0x00 = SUCCESS Non zero = FAILURE and do not consider the following fields. For error codes refer Section 4.5 – “Error codes”
Parameter Type	unsigned integer / 1 byte	0x00-0xFF	Parameter type that was requested to get.
Parameter Value	various	Parameter Specific	The value of the parameter value that was read

4.3.9 IDENTIFY_PEER_NODE_REQ (0x04)

Field	**Type/**	**Values**	**Description**

	Size		
Dummy byte	unsigned integer / 1 byte	0x00-0xFF	Dummy byte. It has no meaning Default value is 0xaa

4.3.10 IDENTIFY_PEER_NODE_CONFIRM (0x14)

Field	Type/ Size	Values	Description
Status	unsigned integer / 1 byte	0x00-0xFF	Status of the IDENTIFY_PEER_NODE_REQ 0x00 = SUCCESS, the Peer node has been identified Non zero = FAILURE, Not able to contact peer node. For error codes refer Section 4.5 – “Error codes”. This feature is available only if the start mode of the PERF_START_CONFIRM has a value 0x01(sec 1.3.4)

4.3.11 CONT_PULSE_TX_REQ (0x05)

Field	Type/ Size	Values	Description
Dummy byte	unsigned integer / 1 byte	0x00-0xFF	Dummy byte. It has no meaning Default value is 0xaa

4.3.12 CONT_PULSE_TX_CONFIRM (0x15)

Field	Type/ Size	Values	Description
Status	unsigned integer / 1 byte	0x00-0xFF	Status of the CONT_ CONT_PULSE_TX_REQ 0x00 = SUCCESS, the continuous pulse wave transmission is done Non zero = FAILURE, Not done. For error codes refer Section 4.5 – “Error codes”.

4.3.13 CONT_WAVE_TX_REQ (0x06)

Field	Type/ Size	Values	Description
Start stop parameter	Boolean / 1 byte	TRUE/FALSE	This parameter indicates whether Continuous transmission has to start or stop the ongoing transmission. 0x00 = Stop Continuous transmission 0x01 = Start Continuous Transmission
TX mode	unsigned integer / 1 byte	0x00- 0x01	Indicates the mode in which Continuous Transmission should start. 0x00 = CW- Continuous Wave 0x01 = PRBS- Pseudo Random

			Binary Sequence

4.3.14 CONT_WAVE_TX_CONFIRM (0x16)

Field	**Type/** **Size**	**Values**	**Description**
Status	unsigned integer / 1 byte	0x00-0xFF	Status of the CONT_ CONT_WAVE_TX_REQ 0x00 = SUCCESS, the continuous wave transmission is started or stopped Non zero = FAILURE, Not done. For error codes refer Section 4.5 – “Error codes”.
Start stop parameter	Boolean / 1 byte	TRUE/FALSE	This same as Start stop parameter in the Req
TX mode	unsigned integer / 1 byte	0x00- 0x01	This is same as TX mode parameter in the Req

4.3.15 REGISTER_READ_REQ (0x07)

Field	**Type/** **Size**	**Values**	**Description**
Register address	unsigned integer/ 2 bytes	0x00- 0x3f – for regular transceivers 0x141- 0x16F for SoC	Address of the Register to be read. Valid range is based on the whether the kit has regular transceiver or SoC, for this information refer IC type parameter of IDENTIFY_BOARD_CONFRM

			(Sec 1.3.2)

4.3.16 REGISTER_READ_CONFIRM (0x17)

Field	Type/ Size	Values	Description
Status	unsigned integer / 1 byte	0x00-0xFF	Status of the REGISTER_READ_REQ 0x00 = SUCCESS, Non zero = FAILURE, Do not consider following fields. For error codes refer Section 4.5 – “Error codes”.
Register address	unsigned integer/ 2 bytes	0x00- 0x3f – for regular transceivers 0x141- 0x16F for SoC	The address of the register that has been read
Register value	unsigned integer / 1 byte	0x00- 0xFF	The value in the specified register address that has been read

4.3.17 REGISTER_WRITE_REQ (0x08)

Field	Type/ Size	Values	Description
Register address	unsigned integer/ 2 bytes	0x00- 0x3f – for regular transceivers 0x141- 0x16F for SoC	The address of the register that has to be written

Register value	unsigned integer / 1 byte	0x00- 0xFF	Value to be written in the specified register address

4.3.18 REGISTER_WRITE_CONFIRM (0x18)

Field	Type/ Size	Values	Description
Status	unsigned integer / 1 byte	0x00-0xFF	Status of the REGISTER_WRITE_REQ 0x00 = SUCCESS, Non zero = FAILURE, Do not consider following fields. For error codes refer Section 4.5 – "Error codes".
Register address	unsigned integer/ 2 bytes	0x00- 0x3f – for regular transceivers 0x141- 0x16F for SoC	The address of the register that has been written
Register value	unsigned integer / 1 byte	0x00- 0xFF	Value written in the specified register address

4.3.19 REGISTER_DUMP_REQ (0x09)

Field	Type/ Size	Values	Description
Start register address	unsigned integer/ 2 bytes	0x00- 0x3f – for regular transceivers 0x141- 0x16F for SoC	The start address of the register set that has to be read

End register address	unsigned integer / 2 bytes	0x00- 0x3f – for regular transceivers 0x141- 0x16F for SoC	The end address of the register set that has to be read. The End register address Should be always greater than Start register address

4.3.20 REGISTER_DUMP_CONFIRM (0x19)

Field	Type/ Size	Values	Description
Status	unsigned integer / 1 byte	0x00-0xFF	Status of the REGISTER_DUMP_REQ 0x00 = SUCCESS, Non zero = FAILURE, Do not consider following fields. For error codes refer Section 4.5 – “Error codes”.
Start register address	unsigned integer/ 2 bytes	0x00- 0x3f – for regular transceivers 0x141- 0x16F for SoC	The start address of the register set that has been read
End register address	unsigned integer / 2 bytes	0x00- 0x3f – for regular transceivers 0x141- 0x16F for SoC	The end address of the register set that has been read.
Register values List	Array of register values/ (First byte of the array indicates the length)	--	The list of register values that had been read.

4.3.21 ED_SCAN_START_REQ (0x0A)

Field	**Type/** **Size**	**Values**	**Description**
Scan duration	unsigned integer/ 1 byte	0x00- 0x0e	A value used to calculate the length of time to spend scanning each channel for ED
Channels Selected	Unsigned integer/4 bytes	0x00000000-0x07FFF800 – Ghz band 0x00000000-0x000007FF – Subghz bands	A 32-bit value used to represent 32 channels, from 0-31. Assuming the lower byte is transmitted first to firmware.

4.3.22 ED_SCAN_START_CONFIRM (0x1A)

Field	Type/ Size	Values	Description
Status	unsigned integer/ 1 byte	0x00- 0xFF	Status of the ED_SCAN_START_REQ 0x00 = SUCCESS, ED scan started Non zero = FAILURE, Not started, do not consider following fields For error codes refer Section 4.5 – “Error codes”.
Scan time minutes part	unsigned integer/ 1 byte	0x00- 0x32	Minutes part of the approximate time to be taken to complete scan. If this value is ‘0’ means the scan may take less than 1 minute

Scan time seconds part	Floating point/ 4 bytes	--	Seconds part of the approximate time to be taken to complete scan. First three decimal point values shall give milliseconds value

4.3.23 ED_SCAN_END_INDICATION (0x1B)

Field	Type/ Size	Values	Description
No of channels	unsigned integer/ 1 byte	0- 16	The no of channels scanned 16 for 2.4GHZ 10 for 868/915MHZ
Energy detection List	Array of ED values along with channel	--	The list of Energy values in all channels found during the ED scan. Each element in the List is channel followed by ED value. No. of channels parameter indicates the No. of elements in the list. Refer 3.3.23.1 for details

4.3.23.1 Energy detection List

Field	Type/ Size	Values	Description
Channel	unsigned	0- 26	The channel number scanned

number	integer/ 1 byte		11- 26 for 2.4GHZ 0-10 for 868/915MHZ
ED value	signed integer/ 1 byte	-91dBm to -7dBm	The Energy detected in a channel during the ED scan.

4.3.24 SENSOR_DATA_REQ (0x0B)

Field	Type/ Size	Values	Description
Dummy byte	unsigned integer/ 1 byte	0x00-0xFF	Dummy byte. It has no meaning Default value is 0xaa

4.3.25 SENSOR_DATA_CONFIRM (0x1C)

Field	Type/ Size	Values	Description
Status	unsigned integer/ 1 byte	0x00- 0xFF	Status of the SENSOR_DATA_REQ request. 0x00 = SUCCESS, Got the sensor data Non zero = FAILURE, do not consider following fields. For error codes refer Section 4.5 – “Error codes”.
Battery voltage	floating point/	--	Battery voltage of the current kit. The value shall be in volts

	4 bytes		
Temperature	floating point/ 4 bytes	--	Temperature measured in the degrees Celsius. This field is available only for SoC which will be know by IC type parameter of the IDENTIFY_BOARD_CONFIRM(refer Sec1.3.2)

4.3.26 PER_TEST_START_REQ (0x0C)

Field	Type/ Size	Values	Description
Dummy byte	unsigned integer/ 1 byte	0x00-0xFF	Dummy byte. It has no meaning Default value is 0xaa

4.3.27 PER_TEST_START_CONFIRM (0x1D)

Field	Type/ Size	Values	Description
Status	unsigned integer/ 1 byte	0x00-0xFF	Status of the PER_TEST _START REQ 0x00 = SUCCESS, PER test Initiated Non zero = FAILURE, Not initiated. For error codes refer Section 4.5 – “Error codes”.

4.3.28 PER_TEST_END_INDICATION (0x1E)

Field	Type/ Size	Values	Description
Status	unsigned integer/ 1 byte	0x00-0xFF	Status of the PER test. Sent on completion of PER test 0x00 = SUCCESS, PER test completed Non zero = FAILURE, Not able to contact remote node to get the test results after the completion of the test. Ignore following fields in this case. For error codes refer Section 4.5 – “Error codes”.
Average RSSI value	Signed integer/ 1 byte		Indicates average RSSI value of the PER test
Average LQI value	unsigned integer/ 1 byte	0x00- 0xFF	Indicates average LQI of the PER test
No. of frames transmitted	unsigned integer/ 4 bytes	0x00- 0xFFFFFFFF	No. of frames transmitted from Transmitter node during the PER test
No. of frames received	unsigned integer/ 4 bytes	0x00- 0xFFFFFFFF	No. of frames received by Receptor node during the PER test
Frame failures	unsigned integer/	0x00- 0xFFFFFFFF	No. of frames failed to be transmitted

	4 bytes		
Frames w/o ACK	unsigned integer/ 4 bytes	0x00- 0xFFFFFFFF	No of transmitted frames didn't get the ACK from receptor. Ignore this field if ACK request parameter is disabled for the current PER test. Refer. ACK Request parameter in the PERF_START_CONFIRM in Sec 1.3.4 . Value if disabled is 0xffffffff.
Frames with Access failures	unsigned integer/ 4 bytes	0x00- 0xFFFFFFFF	No. of frames could not be transmitted due to CHANNEL_ACCESS_FAILURE. Ignore this field if CSMA is disabled for the current PER test. Refer. CSMA parameter in the PERF_START_CONFIRM in Sec 1.3.4 . Value if disabled is 0xffffffff.
Frames with wrong CRC	unsigned integer/ 4 bytes	0x00- 0xFFFFFFFF	No. of frames received with wrong CRC. Ignore this field if CRC setting on remote node is disabled for the current PER test. Refer CRC Setting on Peer parameter in the PERF_START_CONFIRM in Sec 1.3.4 .Value if disabled is 0xffffffff.
Test Duration	Floating point / 4 bytes	--	Time taken to complete the PER test in seconds
Net data rate	Floating point /	--	Net data rate for the test.

	4 bytes		

4.3.29 PEER_DISCONNECT_REQ (0x0D)

Field	Type/ Size	Values	Description
Dummy byte	unsigned integer/ 1 byte	0x00-0xFF	Dummy byte. It has no meaning Default value is 0xaa

4.3.30 PEER_DISCONNECT_CONFIRM (0x1F)

Field	Type/ Size	Values	Description
Status	unsigned integer/ 1 byte	0x00- 0xFF	Status of the PEER_DISCONNECT_REQ 0x00 = SUCCESS, Peer is disconnected successfully. After this confirm, the nodes are again to open for new peer search. Non zero = FAILURE. For error codes refer Section 4.5 – “Error codes”.

4.3.31 SET_DEFAULT_CONFIG_REQ (0x0E)

Field	Type/	Values	Description

	Size		
Dummy byte	unsigned integer/ 1 byte	0x00-0xFF	Dummy byte. It has no meaning Default value is 0xaa

4.3.32 SET_DEFAULT_CONFIG_CONFIRM (0x20)

Field	**Type/** **Size**	**Values**	**Description**
Status	unsigned integer/ 1 byte	0x00- 0xFF	Status of the SET_DEFAULT_CONFIG_REQ 0x00 = SUCCESS. Non zero = FAILURE. For error codes refer Section 4.5 – “Error codes”.
Channel	unsigned integer / 1 byte	11-26 for 2.4GHz 0- 10 for 868/915 Sub GHz band	The default channel in which the Performance test is started
Channel Page	unsigned integer / 1 byte	0,2,5,16,17,18, 19	The channel page in which the Performance test is started
TX Power dBm value	signed integer / 1 byte	-17dBm – 21dBm	TX power value in dBm
TX Power Register value	unsigned integer /	0x00 – 0x0f	TX power register default value, if exists 0xff= does not exists for this

	1 byte		kit, do not show it in GUI This field does not exists for AT86RF212B transceiver

CSMA	Boolean/
	1 byte
		True/false	CSMA-CA default value
			True = enabled
			False = disabled

Frame Retry	Boolean /
	1 byte
		True/false	Frame retransmission default value
			True = enabled
			False = disabled

ACK Request	Boolean /
	1 byte
		True/false	Ack Request default value
			True = enabled
			False = disabled

Rx desensitization	unsigned integer/ 1 byte /	True/false	Rx De-sensitivity default value 0xff= does not exists for this kit, do not show it in GUI 0x00- disabled 0x01 - enabled
RPC	unsigned integer/ 1 byte	0x00- 0xff	RPC default value if it exists 0xff= does not exists for this kit, do not show it in GUI This field exists for AT86RF233 only 0x00- disabled

			0x01 - enabled
Antenna Diversity	unsigned integer/ 1 byte	0x00- 0xff	Antenna diversity default value if it exists 0xff= does not exists for this kit, do not show it in GUI 0x00- enabled, 0x01- disabled, ANT A1/X2 selected 0x02 - disabled, ANT A2/X3 selected
Transceiver state	unsigned integer/ 1 byte	0x00- 0xff	Default transceiver state 0x08 = TRX OFF Single node tests 0x16 = RX AACK ON for PER test
No. of test frames	Unsigned integer/ 4 bytes	0 – 4294967295(2^32 - 1)	Default test frames for PER test = 100. Ignore this field if start mode parameter is not equal to 0x01
PHY frame length	unsigned integer/ 1 byte	12 - 127	Default PHY frame length = 20. Ignore this field if start mode parameter is not equal to 0x01
Antenna Diversity on Peer	unsigned integer/ 1 byte	0x00- 0xff	Antenna diversity current value if it exists and the peer is connected 0x00- enabled, 0x01- disabled, ANT A1/X2

			selected 0x02 - disabled, ANT A2/X3 selected Ignore this field if start mode parameter is not equal to 0x01

CRC Setting on Peer	Boolean/
	1 byte
		TRUE/FALSE	Indicate whether Counting of packets with wrong CRC is enabled
			TRUE = enable
			FALSE = disable
			Ignore this field if start mode parameter is not equal to 0x01

4.3.33 GET_CURRENT_CONFIG_REQ (0x0F)

Field	Type/ Size	Values	Description
Dummy byte	unsigned integer/ 1 byte	0x00-0xFF	Dummy byte. It has no meaning Default value is 0xaa

4.3.34 GET_CURRENT_CONFIG_CONFIRM (0x21)

Field	Type/ Size	Values	Description
Status	unsigned integer/ 1 byte	0x00- 0xFF	Status of the GET_CURRENT_CONFIG_REQ 0x00 = SUCCESS. Non zero = FAILURE. For error codes refer Section 4.5 – “Error codes”.
Channel	unsigned integer / 1 byte	11-26 for 2.4GHz 0- 10 for 868/915 Sub GHz band	The current channel in which the Performance test is running now
Channel Page	unsigned integer / 1 byte	0,2,5,16,17,18, 19	The current channel page in which the Performance test is running now
TX Power dBm value	signed integer / 1 byte	-17dBm – 21dBm	Current TX power value in dBm
TX Power Register value	unsigned integer / 1 byte	0x00 – 0x0f	Current TX power register value, if exists 0xff= does not exists for this kit, do not show it in GUI This field does not exists for AT86RF212B transceiver
CSMA	Boolean/ 1 byte	True/false	CSMA-CA current value True = enabled

			False = disabled

Frame Retry	Boolean /
	1 byte
		True/false	Frame retransmission default value
			True = enabled
			False = disabled

ACK Request	Boolean /
	1 byte
		True/false	Ack Request current value
			True = enabled
			False = disabled

Rx desensitization	unsigned integer/ 1 byte /	True/false	Rx De-sensitivity current value 0xff= does not exists for this kit, do not show it in GUI 0x00- disabled 0x01 – enabled
RPC	unsigned integer/ 1 byte	0x00- 0xff	RPC current value if it exists 0xff= does not exists for this kit, do not show it in GUI This field exists for AT86RF233 only. 0x00- disabled 0x01 - enabled
Antenna Diversity	unsigned integer/ 1 byte	0x00- 0xff	Antenna diversity current value if it exists 0xff= does not exists for this kit, do not show it in GUI 0x00- enabled, 0x01- disabled, ANT A1/X2

			selected 0x02 - disabled, ANT A2/X3 selected
Transceiver state	unsigned integer/ 1 byte	0x00- 0xff	Current transceiver state 0x08 = TRX OFF Single node tests 0x16 = RX AACK ON for PER test
No. of test frames	Unsigned integer/ 4 bytes	0 – 4294967295(2^32-1)	Current test frames for PER test = 100. Ignore this field if start mode parameter is not equal to 0x01
PHY frame length	unsigned integer/ 1 byte	12 - 127	Default PHY frame length = 20. Ignore this field if start mode parameter is not equal to 0x01
Antenna Diversity on Peer	unsigned integer/ 1 byte	0x00- 0xff	Antenna diversity current value if it exists and the peer is connected 0x00- enabled, 0x01- disabled, ANT A1/X2 selected 0x02 - disabled, ANT A2/X3 selected Ignore this field if start mode parameter is not equal to 0x01

CRC Setting on Peer	Boolean/
	1 byte
		TRUE/FALSE	Indicate whether Counting of packets with wrong CRC is enabled currently
			TRUE = enable
			FALSE = disable
			Ignore this field if start mode parameter is not equal to 0x01

ISM frequency	Floating point/ 4 bytes	2322.0 – 2527.0	Indicates the ISM frequency in which transceiver currently being operated. range.Ex:2323.5,2526.0 etc This field is valid only If Transceiver is AT86RF233 and channel parameter(of this CONFIRM) is equal to 0xff only, ignore this field otherwise

4.3.35 RANGE_TEST_START_REQ (0x50)

Field	Type/ Size	Values	Description
Dummy byte	unsigned integer/ 1 byte	0x00-0xFF	Dummy byte. It has no meaning Default value is 0xBB

4.3.36 RANGE_TEST_START_CONFIRM (0x51)

Field	Type/ Size	Values	Description
Status	unsigned integer/ 1 byte	0x00-0xFF	Status of the RANGE_TEST _START REQ 0x00 = SUCCESS, Range test Initiated Non zero = FAILURE, Not initiated. For error codes refer Section 4.5 – “Error codes”.

4.3.37 RANGE_TEST_STOP_REQ (0x52)

Field	Type/ Size	Values	Description
Dummy byte	unsigned integer/ 1 byte	0x00-0xFF	Dummy byte. It has no meaning Default value is 0xCC

4.3.38 RANGE_TEST_STOP_CONFIRM (0x53)

Field	Type/ Size	Values	Description
Status	unsigned integer/ 1 byte	0x00-0xFF	Status of the RANGE_TEST _STOP REQ 0x00 = SUCCESS, Range test Initiated Non zero = FAILURE, Not

			initiated. For error codes refer Section 4.5 – "Error codes".

4.3.39 RANGE_TEST_BEACON_RESPONSE (0x54)

Field	Type/ Size	Values	Description
PHY Payload	Array of unsigned integers/1 byte	0x00-0xFF	The PHY Payload of the Range Test Beacon Response Frame which was received from the receptor node is sent to the Host application. Refer Table 3.3.42
LQI-R	unsigned integer/1 byte	0x00-0xFF	Postfix-R indicates, the LQI value detected at the remote node .
ED value- R	signed integer/1 byte	0x00-0xFF	Postfix-R indicates, the ED value detected at the remote node .
LQI-h	unsigned integer/1 byte	0x00-0xFF	Postfix-h indicates, the LQI value detected at the host node .
ED value- h	signed integer/1 byte	0x00-0xFF	Postfix-h indicates, the ED value detected at the host node .

4.3.40 RANGE_TEST_BEACON (0x55)

Field	Type/ Size	Values	Description
PHY Payload	Array of unsigned integers/1 byte	0x00-0xFF	The PHY Payload of the Range Test Beacon Frame which is transmitted over the air is sent to the Host application. Refer Table 3.3.42

4.3.41 RANGE_TEST_MARKER_INDICATION (0X56)

Field	Type/ Size	Values	Description
PHY Payload	Array of unsigned integers/1 byte	0x00-0xFF	The PHY Payload of the Range Test Marker Frame which was received from the receptor node on event of Button Press on receptor side , is sent to the Host application. Refer Table 3.3.42
LQI	unsigned integer/1 byte	0x00-0xFF	LQI of the received Marker Indication Frame
ED	signed integer/1 byte	0x00-0xFF	ED Value of the received Marker Indication Frame

4.3.42 PHY Payload for Range Test Beacon/Beacon Reply/Marker

Field	Type/ Size	Values			Description
		Beacon*	Beacon Reply	Marker	
Frame Length	unsigned integer/1 byte	0x00-0x7F	0x00-0x7F	0x00-0x7F	The Length of the PHY payload which is sent over the air.(Including the FCS Field)
FCF	unsigned integer/2bytes	0x00-0xFF	0x00-0xFF	0x00-0xFF	The two byte FCF occupies the first two octets of the MPDU.(0X8861 is the default used in the application)
Sequence Number-PHY	unsigned integer/1 byte	0x00-0xFF	0x00-0xFF	0x00-0xFF	The one-octet sequence number following the FCF identifies a particular frame
PAN ID	unsigned integer/2bytes	0x00-0xFF	0x00-0xFF	0x00-0xFF	Both Source and Destination PAN ID are same (Intra-PAN).(0XCAFE is the default PAN ID used in the application)
Destination Short Address	unsigned integer/2bytes	0x00-0xFF	0x00-0xFF	0x00-0xFF	16-bit Destination Short address
Source Short Address	unsigned integer/2bytes	0x00-0xFF	0x00-0xFF	0x00-0xFF	16-bit Source Short address

CMD ID	unsigned integer/1 byte	0X12	0X13	0X15	I byte command ID to identify the type of frame(beacon/beacon reply/marker)
Sequence Number	unsigned integer/1 byte	0x00-0xFF	0x00-0xFF	0x00-0xFF	The one-octet sequence number to Identify the range Test Beacon frame
Range Test Frame Count	Unsigned - 32 bit integer/ 4 bytes	0 – 4294967295 (2^32 - 1)	0 – 4294967295 (2^32 - 1)	0 – 4294967295 (2^32 - 1)	Indicates the Range Test Beacon frame count
Range Test Payload	Signed*/unsigned integer/2 bytes(only 1 byte for Marker)	0X00	0X00-0XFF First Byte is Signed followed by unsigned integer Byte	0XAA	The Range Test Beacon Frame has 0X00 in both the two fields and the receptor node fills these two bytes with ED and LQI value respectively .For Marker cmd it is a dummy value.

*Beacon name is used to indicate periodic transmissions .IEEE 802.15.4 Compliant Data frame is used for all the above cases.

4.4 Performance test Configuration parameters

The following table shows the parameters that can be configured (written to kit) using the PERF_SET_REQ and can be read from the kit using PERF_GET_REQ.

Parameter	Identifier	Type/ Size	Valid range	Default value	Description
Channel	0x00	unsigned integer/ 1 byte	11-26 for 2.4GHz band	21	Indicates the physical channel on which the PER test is running

			0 – 10 for 868/915 Sub GHz	1	
Channel Page	0x01	unsigned integer/ 1 byte	0,2,16,17 for 2.4GHz band 0,2,5,16,17, 18,19 for 868/915 Sub GHz	0	Indicates the on which channel page currently PER test is running. This is to support high data rates
TX power in Reg	0x02	unsigned integer/ 1 byte	0x00- 0x0F	0 9 for EXT_PA enabled kits	Indicate the TX power setting in terms of TX_PWR register value
TX power in dBm	0x03	signed integer/ 1 byte	-17 dBm – 3 or 4 dBm	3 or 4 dBm (depend on Transceiver)	Indicate the TX power setting in terms of dBm value

			4dBm to 21dBm	21for EXT_PA enabled kits	
CSMA	0x04	boolean / 1 byte	TRUE or FLASE	TRUE	Indicate whether CSMA-CA mechanism is enabled TRUE = enable FALSE = disable
Frame retry	0x05	boolean / 1 byte	TRUE or FLASE	FALSE	Indicate whether Frame Retransmission feature is enabled TRUE = enable FALSE = disable
ACK Request	0x06	boolean / 1 byte	TRUE or FLASE	TRUE	Indicate whether Auto ACK feature is enabled TRUE = enable FALSE = disable
Antenna Diversity	0x07	unsigned integer/ 1 byte	0x00- 0x02	0 – non RF233 based boards	Indicates whether Antenna diversity on source node is enabled and antenna selected in

				1- for RF233 based boards	case of disabled 0 = ant div enabled 1= ant div disabled & ant1 i.e. A1/X2 is selected 2= ant div disabled & ant2 i.e. A2/X3 is selected
Antenna Diversity on Peer	0x08	unsigned integer/ 1 byte	0x00- 0x02	0 – non RF233 based boards 1- for RF233 based boards	Indicates whether Antenna diversity on source node is enabled and antenna selected in case of disabled 0 = ant div enabled 1= ant div disabled & ant1 i.e. A1/X2 is selected 2= ant div disabled & ant2 i.e. A2/X3 is selected
Desensitization	0x09	boolean / 1 byte	TRUE or FLASE	FALSE	Indicate whether Receiver desensitization is enabled TRUE = enable

					FALSE = disable
Transceiver state	0x0a	unsigned integer/ 1 byte	0 - 5	0x16 for PER test 0x08 for Single node tests	Indicates the transceiver state RESET = 0x00 TRX_OFF = 0x08 PLL_ON = 0x09 RX = 0x16 SLEEP = 0x0f DEEP_SLEEP= 0x20 (only RF233 only)
CRC on Peer node	0x0b	boolean / 1 byte	TRUE or FLASE	FALSE	Indicate whether Counting of packets with wrong CRC is enabled TRUE = enable FALSE = disable
No. of test frames	0x0c	unsigned integer/ 4 bytes	0 – 4294967295 (2^32 - 1)	100	Indicates no. of packets to be transmitted for PER test
PHY frame length	0x0d	unsigned integer/ 1 byte	12- 127	20	Length of frame to be used for PER test
RPC	0x0e	boolean / 1 byte	TRUE or FLASE	TRUE	Indicate whether RPC feature is enabled. This parameter is exists only for RF233 transceiver

					only TRUE = enable FALSE = disable
ISM frequency	0x0f	Floating point/ 4 bytes	2322.0 – 2527.0	--	Indicates the ISM frequency in which transceiver should be operated. Only frequencies with multiples of 0.5 is allowed in the given range.Ex:2323.5,2526.0 etc This parameter is exists only for RF233 transceiver only

4.5 Error codes

Error code	value	Description
SUCCESS	0x00	Requested operation is completed successfully
INVALID_CMD	0x20	Invalid command identifier is given in the request
ED_SCAN_UNDER_PROCESS	0x21	Currently Energy Detection Scan is under progress, no requests are serviced
TX_UNDER_PROGRESS	0x22	Currently Transmission is under progress, no requests are serviced

CONT_WAVE_TX_UNDER_PROGRESS	0x23	Currently Continuous Wave transmission is under progress, no requests are serviced
NO_PEER_FOUND	0x24	No peer device found after peer search
UNABLE_TO_CONTACT_PEER	0x25	Unable to contact peer node
INVALID_ARGUMENT	0x26	Arguments in the request are wrong
VALUE_OUT_OF_RANGE	0x27	Argument/parameter value in the request is out of the range
INVALID_REGISTER_ORDER	0x28	Start register address should be lesser than the End register address
TRANSCEIVER_IN_SLEEP	0x29	Currently Transceiver in Sleep.
TRANSMISSION_FAILURE	0x30	Transmission to the Peer node is failed
RANGE_TEST_IN_PROGRESS	0X31	Indicates a PER Mode Range Test is in Progress

5 Abbreviations

RPC	Reduced Power Consumption
CW	Continuous Wave
PRBS	Pseudo Random Binary Sequence
ED	Energy Detection
LQI	Link Quality Indication
RSSI	Received Signal Strength Index
CSMA- CA	Carrier Sense Multiple Access – Collision Avoidance
PER	Packet Error Rate
CRC	Cyclic Redundancy Check
PHY	Physical Layer
MCU	Micro Controller Unit
IC	Integrated Chip
SoC	System on Chip
FEM	Front End Module
FCF	Frame Control Field
FCS	Frame Check Sequence
PAN	Personal Area Network

6 REVISION HISTORY

DOC. REV.	DATE	COMMENTS
A	31/AUGUST/2012	PERFORMANCE ANALYZER v1.0
A	21/JUNE/2013	UPDATED DOCUMENT FOR PERFORMANCE ANALYZER v2.1 NEW FEATURES

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