

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 | Msg Id | Msg Payload | EOT |
|----------|------------|----------|----------|---------------------------|----------|
| | | ld | | | |
| (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 or it sends the packet to Remote node over the air if the request packet is for remote node. Then the remote node performs necessary operations and sends response back to the initiator.

Performance analyzer firmware differentiates the remote node messages with the help of Message identifier value. For example, Message id value of PERF_SET_REQ is 0x02 which sets the configuration parameter for performance test in the Initiator kit connected to PC whereas to set the configuration parameter in Remote node PERF_SET_REQ value is 0X82 (Note that bit b7 is set). Therefore, if MSB(b7) in message identifier is set it is intended to be send to the remote node.

Message that can be sent to the remote node is marked with diamond symbol (♦).

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/ 0X82◆ | Sets the various configuration parameters for the performance Test. |
| | 0/024 | (Note: Refer to Section 4.4 – "Performance test Configuration parameters" to get the details on various parameters types and values.) |
| PERF_GET_REQ | 0X03 / 0X83◆ | 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/ 0X85◆ | 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 |
| | 0X86 ♦ | mode in current channel |
| REGISTER_READ_REQ | 0X07/ | Requests to read the value of the given register address |
| | 0X87 ♦ | |
| REGISTER_WRITE_REQ | 0X08/ | Requests to write the value into the given register |
| | 0X88 ♦ | address |
| REGISTER_DUMP_REQ | 0X09/ | Dumps the register values of the given set of the register |
| | 0X89 ♦ | 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 |
| | 0X8e ♦ | values. |
| GET_CURRENT_CONFIG_REQ | 0X0f/ | Current values of all configurable parameters shall be |
| | 0X8f♦ | read |
| RANGE_TEST_START_REQ | 0X50 | Starts the Range test with current user settings |
| RANGE_TEST_STOP_REQ | 0X52 | Stops the Range test |
| PKT_STREAM_REQ | 0X22/ | Starts or stops the packet streaming test based on |

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| | 0XA2◆ | start/stop field value in request message with current user settings |
|-----------|-------|----------------------------------------------------------------------|
| RX_ON_REQ | 0X24/ | Starts or stops the continuous receive mode test based |
| | 0XA4◆ | on start/stop field value in request message |

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 |
| | 0X92 ♦ | performance Test |
| PERF_GET_CONFIRM | 0X13/ | Gets the various configuration parameters for the |
| | 0X93 ♦ | 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 |
| | 0X95 ♦ | pulse mode transmission from the radio transceiver in current channel |
| CONT_WAVE_TX_CONFIRM | 0X16/ | Start continuous transmission in CW or PRBS mode in |
| | 0X96 ♦ | current channel and provide the status |
| REGISTER_READ_CONFIRM | 0X17/ | Register Read status with the register value |
| | 0X97 ♦ | |
| REGISTER_WRITE_CONFIRM | 0X18/ | Register write status with the register address |
| | 0X98 ♦ | |

| 0X19/ | Dumps the register values of the given set of the register address |
|---------------|--------------------------------------------------------------------|
| 0X99 ♦ | |
| 0X1a | Provides the time required for scan and Starts the Energy |
| | Detection Scan stops automatically on completion |
| 0X1b | Provides Energy values of all channels on completion of |
| | Energy detection |
| 0X1c | Provides the information like Battery voltage and |
| | temperature. |
| 0X1d | Starts the Packet Error Rate with current user settings. |
| 0X1e | Provides information like No. of transmitted frames, |
| | Received frames LQI and RSSI Value on successful |
| | completion of PER test |
| 0x1f | Provides the result of peer Disconnect req |
| 0X20/ | Provides the result for the Set default config req |
| 0XA0 ◆ | |
| 0X21/ | Provides the result for the Get current config req |
| 0XA1◆ | |
| | |
| 0X54 | Response Frame for the Beacon Transmitted from the Host Node |
| | Trost Node |
| | |
| 0X55 | Beacon Frame Transmitted over the air in Range Test |
| | Mode |
| | |
| 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 |
| | 0X1b 0X1c 0X1d 0X1e 0X1f 0X20/ 0X20/ 0XA0 0X21/ 0X54 |

| PKT_STREAM_CONFIRM | 0X23/ | Starts or stops the packet streaming test and provides |
|--------------------|-------|----------------------------------------------------------|
| | 0XA3◆ | the status |
| RX_ON_CONFIRM | 0X25/ | Starts or stops the continuous receive test and provides |
| | 0XA5◆ | the status |

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/ | Values | Description |
|--------------------|----------------------|-----------|---------------------------------------------|
| | Size | | |
| Start up parameter | unsigned integer/ | 0X00-0XFF | Start up parameter to identify the request. |
| | 1 byte | | 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" |

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| IC type | unsigned integer / | 0X00 - 0X01 | IC type on Kit. 0X00 = MCU- TRX |
|---------------------|-----------------------------------------------------------------|----------------------------------------|-------------------------------------------------------------------------------------------------|
| | 1 byte | | 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 length) | | Name of Board/ kit used for Transmitter/Initiator node |
| MAC address | unsigned integer/ 8 bytes | 0X000000000000000000000000000000000000 | 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 | unsigned | 0X00000001 - 0X0000001F | Each bit set represents a particular |
|-----------|----------|-------------------------|----------------------------------------------------------------------------|
| supported | integer/ | | feature is supported. Ex: If bit b0 is |
| | 4 bytes | | set it says channel selection option is available. |
| | | | If bit b1 is set, Range test mode is available. |
| | | | If bit b2 is set, Remote configuration mode functionalities are available. |
| | | | If bit b3 is set, Packet streaming test is available. |
| | | | If bit b4 is set, continuous Receive mode is available. |
| | | | |

4.3.3 PERF_START_REQ (0X01)

| Field | Type/ | Values | Description |
|----------------|-------------------|-------------|--------------------------------------------------------------------------------------------|
| Chart was also | Size | 0.004 0.002 | Charles and for the Douteway and test |
| Start mode | 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/ | Values | Description |
|--------|-----------------------|-----------|----------------------------------------------|
| | Size | | |
| Status | unsigned integer / | OXOO-OXFF | Status of the PERF_START_REQ 0X00 = SUCCESS |

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| | 1 byte | | Non zero = FAILURE. |
|----------------|--------------------|-------------------------------|-----------------------------------------------------|
| | | | For error codes refer Section 4.5 – "Error codes" |
| Start mode | unsigned integer / | 0X01- 0X02 | Start mode in which the Performance test is started |
| | 1 byte | | 0X01 = PER mode |
| | | | 0X02 =Single node test mode |
| Channel | unsigned | 11-26 for 2.4GHz | The default channel in which the |
| | integer / | 0-10 for 868/915 Sub GHz band | Performance test is started |
| | 2 bytes | | |
| | | | |
| Channel Page | unsigned | 0,2,5,16,17,18, 19 | The channel page in which the |
| | integer / | | Performance test is started |
| | 1 byte | | |
| TX Power dBm | signed | -17dBm to +21dBm | TX power value in dBm |
| value | integer / | | |
| | 1 byte | | |
| TX Power | unsigned | 0X00 – 0X0f | TX power register value, if exists |
| Register value | integer / | | OXff= does not exists for this kit, do |
| | 1 byte | | not show it in GUI |
| | | | This field exists does not exist for |
| | | | AT86RF212B |
| CSMA | Boolean/ | True/false | CSMA-CA default value |
| | 1 byte | | True = enabled |
| | | | False = disabled |
| Frame Retry | Boolean / | True/false | Frame retransmission default value |

| | 1 byte | | True = enabled |
|-----------------------|-------------------|------------|-----------------------------------------------------------|
| | | | False = disabled |
| ACK Request | Boolean / | True/false | Ack Request default value |
| | 1 byte | | True = enabled |
| | | | False = disabled |
| Rx desensitization | unsigned integer/ | True/false | Rx De-sensitivity default value |
| descrisitization | | | OXff= does not exists for this kit, do |
| | 1 byte / | | not show it in GUI |
| | | | 0X00- disabled |
| | | | 0X01 – enabled |
| RPC | unsigned integer/ | 0X00- 0Xff | RPC default value if it exists |
| | | | 0Xff= does not exists for this kit, do |
| | 1 byte | | not show it in GUI |
| | | | 0X00- disabled |
| | | | 0X01 – enabled |
| Antenna | unsigned | 0X00- 0Xff | Antenna diversity default value if it |
| Diversity | integer/ | | exists |
| | 1 byte | | OXff= 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 | unsigned | 0X00- 0Xff | Default transceiver state |
| state | integer/ | | 0X08 = TRX OFF Single node tests |
| | 1 byte | | 0X16 = RX AACK ON for PER test |

| No. of test frames | Unsigned integer/ 4 bytes | 1-4294967295(2^32 - 1) | Default test frames for PER test = 100. Ignore this field if start mode |
|------------------------|---------------------------|------------------------|--------------------------------------------------------------------------|
| | . Sytes | | parameter is not equal to 0X01 |
| PHY frame length | unsigned integer/ | 12 - 127 | Default PHY frame length = 20. Ignore this field if start mode |
| | 2 bytes | | parameter is not equal to 0X01 |
| Antenna Diversity on | unsigned integer/ | 0X00- 0Xff | Antenna diversity default value if it exists |
| Peer | 1 byte | | OXff= 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 integer / | 0X00 - 0X01 | IC type on Peer node. |
| | 1 byte | | 0X00 = MCU- TRX |
| | 1 byte | | 0X01- SOC |
| | | | Ignore this field if start mode parameter is not equal to 0x01 |
| Peer MCU/SoC | Array of | | This represents the name of SoC or |
| name | chars / | | MCU used on Peer node based on the Peer IC type parameter |
| | (first byte of | | 7 22. 10 1/po parameter |

| | the array indicates the length) | | 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 | 0X000000000000000000001 - 0Xffffffffffffffe | MAC address of the Peer node |
| Peer FW version | Floating point value/4 bytes | | Current FW version on the peer node |
| Features supported on peer | unsigned integer/ 4 bytes | 0X0000001 - 0X000001F | Each bit set represents a particular feature is supported. If bit b3 is set, Packet streaming test is available. If bit b4 is set, continuous Receive mode is available. |

4.3.5 PERF_SET_REQ (0X02)/(0X82)

| Field | Type/ | Values | Description |
|-----------|-----------------------------------|---------------------|---------------------------------------|
| | Size | | |
| Parameter | unsigned | 0X00-0XFF | Parameter type that needs to be set. |
| Туре | integer / | | Types of parameter are defined in the |
| | 1 byte | | table 1 |
| Parameter | Various | Parameter Specific. | The value to set for Performance test |
| Value | (first byte indicates the length) | | 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)/(0X92)

| Field | Туре/ | Values | Description |
|-----------|-------------|--------------------|-------------------------------------|
| | Size | | |
| Status | unsigned | 0X00-0XFF | Status of the PERF_SET_REQ |
| | integer / | | 0X00 = SUCCESS |
| | 1 byte | | Non zero = FAILURE and previous |
| | | | value should be retained. |
| | | | For error codes refer Section 4.5 – |
| | | | "Error codes" |
| Parameter | unsigned | 0X00-0XFF | Parameter type that had been set. |
| Туре | integer / | | Types of parameters are defined in |
| | 1 byte | | the table 1 |
| Parameter | Various | Parameter Specific | The parameter value that has been |
| Value | (first byte | | set |

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| indicates the | 2 | |
|---------------|---|--|
| length) | | |

4.3.7 PERF_GET_REQ (0X03)/(0X83)

| Field | Туре/ | Values | Description |
|-----------|-----------|-----------|------------------------|
| | Size | | |
| Parameter | unsigned | 0X00-0XFF | Parameter type to read |
| Type | integer / | | |
| | 1 byte | | |

4.3.8 PERF_GET_CONFIRM (0X13)/(0X93)

| Field | Туре/ | Values | Description |
|-----------|-----------|--------------------|-------------------------------------|
| | Size | | |
| Status | unsigned | 0X00-0XFF | Status of the PERF_GET_REQ |
| | integer / | | 0X00 = SUCCESS |
| | 1 byte | | Non zero = FAILURE and do not |
| | | | consider the following fields. |
| | | | For error codes refer Section 4.5 – |
| | | | "Error codes" |
| Parameter | unsigned | 0X00-0XFF | Parameter type that was requested |
| Туре | integer / | | to get. |
| | 1 byte | | |
| Parameter | various | Parameter Specific | The value of the parameter value |
| Value | | | that was read |

4.3.9 IDENTIFY_PEER_NODE_REQ (0X04)

| Field | Type/ | Values | Description |
|------------|--------------------|-----------|------------------------------------------------------|
| | Size | | |
| Dummy byte | unsigned integer / | 0X00-0XFF | Dummy byte. It has no meaning Default value is 0xaa |

4.3.10 IDENTIFY_PEER_NODE_CONFIRM (0X14)

| Field | Туре/ | Values | Description |
|--------|---------------------------|-----------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| | Size | | |
| Status | unsigned integer / 1 byte | OX00-OXFF | 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)/(0X85)

| Field | Type/ Size | Values | Description |
|------------|--------------------------------|-----------|------------------------------------------------------|
| Dummy byte | unsigned integer /1 byte | OX00-0XFF | Dummy byte. It has no meaning Default value is 0xaa |

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4.3.12 CONT_PULSE_TX_CONFIRM (0X15)/(0X95)

| Field | Туре/ | Values | Description |
|--------|-------------|-----------|---------------------------------------------------------------------------------------------------------------------------------------------------|
| | Size | | |
| Status | unsigned | 0X00-0XFF | Status of the CONT_ |
| | integer / 1 | | CONT_PULSE_TX_REQ |
| | byte | | OXOO = 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)/(0X86)

| Field | Type/ | Values | Description |
|-------------------------|---------------------------|------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| | Size | | |
| 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 |

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| Time out value | Unsigned | 0X0000 - 0X0E10 | This parameter indicates how long |
|----------------|----------|-----------------|------------------------------------|
| | integer/ | | the continuous transmission has to |
| (seconds) | | | take place |
| | 2 bytes | | |
| | | | Default value is 0X1E (30 sec) |
| | | | This field has dummy values if |
| | | | continuous transmission starts at |
| | | | Initiator node. |
| | | | |

CONT_WAVE_TX_CONFIRM (0X16)/(0X96) 4.3.14

| Field | Туре/ | Values | Description |
|-------------------------|---------------------------------|------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| | Size | | |
| Status | unsigned integer / 1 byte | OX00-OXFF | 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)/(0X87)

| Field | Type/ | Values | Description |
|---------------------|---------------------------|---------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| | Size | | |
| 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)/(0X97)

| Field | Type/ | Values | Description |
|---------------------|---------------------------------|---------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------|
| | Size | | |
| Status | unsigned integer / 1 byte | OX00-0XFF | Status of the REGISTER_READ_REQ 0X00 = SUCCESS, Non zero = FAILURE, Do not consider following fields. For error codes refer Section 4.5 — |
| Decision of | | over over f | "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 | OXOO- OXFF | The value in the specified register address that has been read |

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4.3.17 REGISTER_WRITE_REQ (0X08)/(0X88)

| Field | Type/ | Values | Description |
|----------------|-----------|---------------------------------------|--------------------------------------|
| | Size | | |
| Register | unsigned | 0X00- 0X3f – for regular transceivers | The address of the register that has |
| address | integer/ | 0X141- 0X16F for SoC | to be written |
| | 2 bytes | | |
| Register value | unsigned | 0X00- 0XFF | Value to be written in the specified |
| | integer / | | register address |
| | 1 byte | | |

REGISTER_WRITE_CONFIRM (0X18)/(0X98) 4.3.18

| Field | Type/ | Values | Description |
|---------------------|---------------------------------|---------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------|
| | Size | | |
| 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 / | 0X00- 0XFF | Value written in the specified register address |

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4.3.19 REGISTER_DUMP_REQ (0X09)/(0X89)

| Field | Type/ | Values | Description |
|----------------|-----------|---------------------------------------|------------------------------------------------------------------------|
| | Size | | |
| Start register | unsigned | 0X00- 0X3f – for regular transceivers | The start address of the register set |
| address | integer/ | 0X141- 0X16F for SoC | that has to be read |
| | 2 bytes | | |
| End register | unsigned | 0X00- 0X3f – for regular transceivers | The end address of the register set |
| address | integer / | 0X141- 0X16F for SoC | that has to be read. The End register address Should be always greater |
| | 2 bytes | | than Start register address |

REGISTER_DUMP_CONFIRM (0X19)/(0X99) 4.3.20

| Field | Туре/ | Values | Description |
|-------------------------|---------------------------------|---------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------|
| | Size | | |
| 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 | Array of register | | The list of register values that had |

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| List | values/ | been read. |
|------|------------------------------------|------------|
| | (First byte of the array indicates | |
| | the length) | |

4.3.21 ED_SCAN_START_REQ (0X0A)

| Field | Type/ | Values | Description |
|---------------|-----------|----------------------------------|--------------------------------------|
| | Size | | |
| Scan duration | unsigned | 0X00- 0X0e | A value used to calculate the length |
| | integer/ | | of time to spend scanning each |
| | 1 byte | | channel for ED |
| Channels | Unsigned | 0X00000000-0X07FFF800 – Ghz band | A 32-bit value used to represent 32 |
| Selected | integer/4 | 0,000,000,000,000,000,000,000 | channels, from 0-31. |
| | bytes | 0X00000000-0X000007FF – Subghz | |
| | | bands | 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". |

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| Scan time | unsigned | 0X00- 0X32 | Minutes part of the approximate |
|--------------|----------|------------|----------------------------------------|
| minutes part | integer/ | | time to be taken to complete scan. If |
| | 4 1 1 1 | | this value is '0' means the scan may |
| | 1 byte | | take less than 1 minute |
| | | | |
| Scan time | Floating | | Seconds part of the approximate |
| seconds part | point/4 | | time to be taken to complete scan. |
| | bytes | | 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 number | unsigned integer/ 2 bytes | 0- 26 | The channel number scanned 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. |

SENSOR_DATA_REQ (0X0B) 4.3.24

| Field | Type/ | Values | Description |
|------------|----------|-----------|-------------------------------|
| | Size | | |
| Dummy byte | unsigned | 0X00-0XFF | Dummy byte. It has no meaning |
| | integer/ | | Default value is Oxaa |
| | 1 byte | | Default value is oxaa |
| | 1 Dyte | | |

4.3.25 SENSOR_DATA_CONFIRM (0X1C)

| Field | Type/ | Values | Description |
|--------|----------|------------|-------------------------------------|
| | Size | | |
| Status | unsigned | 0X00- 0XFF | Status of the SENSOR_DATA_REQ |
| | integer/ | | request. |
| | 1 byte | | 0X00 = SUCCESS, Got the sensor |
| | | | data |
| | | | Non zero = FAILURE, do not consider |
| | | | following fields. |
| | | | For error codes refer Section 4.5 – |

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| | | "Error codes". |
|-----------------|-------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Battery voltage | floating point/ 4 bytes | Battery voltage of the current kit. The value shall be in volts |
| 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)

| Type/ | Values | Description |
|----------|-------------------------|-----------------------------------|
| Size | | |
| unsigned | 0X00-0XFF | Dummy byte. It has no meaning |
| integer/ | | Default value is 0Xaa |
| 1 byte | | |
| | Size unsigned integer/ | Size unsigned ox00-0xff integer/ |

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". |

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PER_TEST_END_INDICATION (0X1E) 4.3.28

| Status unsigned integer/ 1 byte No. of frames transmitted No. of frames received integer/ 4 bytes Status of the PER test. Sent on completion of PER test OX00 = 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 Indicates average RSSI value of the PER test No. of frames integer/ 4 bytes No. of frames received by Receptor node during the PER test No. of frames received by Receptor node during the PER test No. of frames received by Receptor node during the PER test No. of frames received by Receptor node during the PER test No. of frames received by Receptor node during the PER test | Field | Type/ | Values | Description |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------|----------|-----------------|---------------------------------------|
| integer/ 1 byte 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 1 byte Average LQI unsigned value No. of frames transmitted No. of frames transmitted integer/ 4 bytes No. of frames received by Receptor node during the PER test No. of frames received by Receptor node during the PER test No. of frames received by Receptor node during the PER test No. of frames received by Receptor node during the PER test No. of frames received by Receptor node during the PER test No. of frames failed to be transmitted | | Size | | |
| integer/ 1 byte 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 1 byte Average LQI unsigned value No. of frames transmitted No. of frames transmitted integer/ 4 bytes No. of frames received by Receptor node during the PER test No. of frames received by Receptor node during the PER test No. of frames received by Receptor node during the PER test No. of frames received by Receptor node during the PER test No. of frames received by Receptor node during the PER test No. of frames failed to be transmitted | Status | unsigned | OVOO OVEE | Status of the DEP test. Sent on |
| 1 byte DX00 = 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". | Status | _ | 0.000-0.04F | |
| 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 Indicates average RSSI value of the per test | | | | |
| 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. Average RSSI value of the per test integer/ 1 byte Average LQI value Indicates average RSSI value of the PER test No. of frames transmitted No. of frames integer/ 4 bytes OX00- OXFFFFFFFF Frame failures Indicates average LQI of the PER test No. of frames transmitted from Transmitter node during the PER test No. of frames received by Receptor node during the PER test No. of frames received by Receptor node during the PER test | | 1 byte | | · |
| 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 Indicates average RSSI value of the PER test | | | | Completed |
| 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 integer/ 1 byte Average LQI unsigned integer/ 1 byte No. of frames transmitted integer/ 4 bytes No. of frames received integer/ 4 bytes No. of frames received by Receptor node during the PER test received unsigned integer/ 4 bytes No. of frames received by Receptor node during the PER test No. of frames received by Receptor node during the PER test No. of frames received by Receptor node during the PER test No. of frames received by Receptor node during the PER test No. of frames received by Receptor node during the PER test No. of frames failed to be transmitted | | | | |
| test. Ignore following fields in this case. For error codes refer Section 4.5 – "Error codes". Average RSSI value Signed integer/ 1 byte DX00- 0XFF Indicates average RSSI value of the PER test Indicates average LQI of the PER test Indicates average LQI of the PER test No. of frames transmitted integer/ 4 bytes No. of frames received unsigned integer/ 4 bytes No. of frames received by Receptor node during the PER test No. of frames received by Receptor node during the PER test No. of frames received by Receptor node during the PER test No. of frames received by Receptor node during the PER test No. of frames received by Receptor node during the PER test No. of frames received by Receptor node during the PER test No. of frames failed to be transmitted | | | | _ |
| Average RSSI value Average LQI unsigned integer/ 1 byte No. of frames transmitted No. of frames transmitted No. of frames received No. of frames unsigned integer/ 4 bytes Case. For error codes refer Section 4.5 – "Error codes". Indicates average RSSI value of the PER test Indicates average LQI of the PER test No. of frames transmitted from Transmitter node during the PER test No. of frames received by Receptor node during the PER test Trame failures Unsigned integer/ 4 bytes No. of frames received by Receptor node during the PER test No. of frames received by Receptor node during the PER test | | | | |
| Average RSSI value Signed integer/ 1 byte Average LQI unsigned integer/ 1 byte No. of frames transmitted No. of frames received No. of frames received No. of frames received No. of frames received integer/ 4 bytes No. of frames received ox00- 0xfffffffff 4 bytes No. of frames received ox00- 0xfffffffff No. of frames received by Receptor node during the PER test No. of frames received by Receptor node during the PER test No. of frames received by Receptor node during the PER test No. of frames received by Receptor node during the PER test No. of frames received by Receptor node during the PER test | | | | |
| Average RSSI value Average RSSI value Signed integer/ 1 byte | | | | For error codes refer Section 4.5 – |
| value integer/ 1 byte 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 Integer/ 4 bytes No. of frames received by Receptor node during the PER test Frame failures unsigned integer/ 4 bytes 0X00- 0XFFFFFFFF Integer/ 4 bytes No. of frames failed to be transmitted | | | | "Error codes". |
| Average LQI unsigned integer/ 1 byte No. of frames transmitted unsigned integer/ 4 bytes No. of frames received unsigned integer/ 4 bytes No. of frames unsigned integer/ 4 bytes No. of frames received by Receptor node during the PER test No. of frames received by Receptor node during the PER test No. of frames received by Receptor node during the PER test No. of frames received by Receptor node during the PER test | Average RSSI | Signed | | Indicates average RSSI value of the |
| Average LQI unsigned integer/ 1 byte No. of frames transmitted No. of frames unsigned integer/ 4 bytes No. of frames received No. of frames unsigned integer/ 4 bytes OX00- OXFFFFFFFF No. of frames received by Receptor node during the PER test No. of frames received by Receptor node during the PER test No. of frames received by Receptor node during the PER test No. of frames received by Receptor node during the PER test No. of frames received by Receptor node during the PER test | value | integer/ | | PER test |
| value integer/ 1 byte No. of frames transmitted unsigned integer/ 4 bytes No. of frames received unsigned integer/ 4 bytes No. of frames received by Receptor node during the PER test No. of frames received by Receptor node during the PER test No. of frames received by Receptor node during the PER test No. of frames received by Receptor node during the PER test No. of frames received by Receptor node during the PER test | | 1 byte | | |
| No. of frames transmitted unsigned integer/ 4 bytes No. of frames transmitted from Transmitter node during the PER test No. of frames received by Receptor node during the PER test Transmitter node during the PER test No. of frames received by Receptor node during the PER test No. of frames received by Receptor node during the PER test No. of frames received by Receptor node during the PER test No. of frames failures unsigned integer/4 | Average LQI | unsigned | 0X00-0XFF | Indicates average LQI of the PER test |
| No. of frames transmitted unsigned integer/ 4 bytes No. of frames transmitted from Transmitter node during the PER test No. of frames unsigned integer/ 4 bytes No. of frames received by Receptor node during the PER test Frame failures unsigned integer/ 4 bytes No. of frames received by Receptor node during the PER test No. of frames received by Receptor node during the PER test | value | integer/ | | |
| transmitted integer/ 4 bytes No. of frames received integer/ 4 bytes No. of frames received by Receptor node during the PER test No. of frames received by Receptor node during the PER test No. of frames received by Receptor node during the PER test No. of frames failures unsigned integer/4 No. of frames failed to be transmitted | | 1 byte | | |
| No. of frames received unsigned integer/ 4 bytes No. of frames received by Receptor node during the PER test Frame failures unsigned integer/4 OX00- OXFFFFFFFF No. of frames failed to be transmitted | No. of frames | unsigned | 0X00- 0XFFFFFFF | No. of frames transmitted from |
| No. of frames received unsigned integer/ 4 bytes Frame failures unsigned integer/4 OX00- OXFFFFFFFF No. of frames received by Receptor node during the PER test No. of frames failed to be transmitted | transmitted | integer/ | | Transmitter node during the PER test |
| received integer/ 4 bytes node during the PER test Frame failures unsigned integer/4 0X00- 0XFFFFFFFF node transmitted | | 4 bytes | | |
| 4 bytes Frame failures unsigned integer/4 OX00- OXFFFFFFF No. of frames failed to be transmitted | No. of frames | unsigned | 0X00-0XFFFFFFF | I |
| Frame failures unsigned integer/4 OX00- OXFFFFFFFF unsimitted No. of frames failed to be transmitted | received | integer/ | | node during the PER test |
| integer/4 transmitted | | 4 bytes | | |
| | Frame failures | unsigned | 0X00- 0XFFFFFFF | No. of frames failed to be |
| | | _ | | transmitted |
| bytes | | bytes | | |

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| Frames w/o | unsigned | 0X00-0XFFFFFFF | No of transmitted frames didn't get |
|-----------------|----------|-----------------|------------------------------------------|
| ACK | integer/ | | the ACK from receptor. |
| | | | |
| | 4 bytes | | Ignore this field if ACK request |
| | | | parameter is disabled for the current |
| | | | PER test. Refer. ACK Request |
| | | | parameter in the |
| | | | PERF_START_CONFIRM in <u>Sec 1.3.4</u> . |
| | | | Value if disabled is 0Xffffffff. |
| Frames with | unsigned | 0X00- 0XFFFFFFF | No. of frames could not be |
| Access failures | integer/ | ONOO ONITITITI | transmitted due to |
| /teeess randres | integer/ | | CHANNEL ACCESS FAILURE. Ignore |
| | 4 bytes | | this field if CSMA is disabled for the |
| | | | current PER test. Refer. CSMA |
| | | | parameter in the |
| | | | PERF_START_CONFIRM in Sec 1.3.4. |
| | | | TEM _51AM _COM MOVIM <u>5ec 1.5.4</u> . |
| | | | Value if disabled is 0Xffffffff. |
| Frames with | unsigned | 0X00- 0XFFFFFFF | No. of frames received with wrong |
| wrong CRC | integer/ | | CRC. Ignore this field if CRC setting |
| | | | on remote node is disabled for the |
| | 4 bytes | | 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 | | Time taken to complete the PER test |
| | point / | | in seconds |
| | | | |
| | 4 bytes | | |
| Net data rate | Floating | | Net data rate for the test. |
| | point / | | |
| | 4 | | |
| | 4 bytes | | |
| 1 | | | |

4.3.29 PEER_DISCONNECT_REQ (0X0D)

| Field | Type/ | Values | Description |
|------------|----------|-----------|-------------------------------|
| | Size | | |
| Dummy byte | unsigned | 0X00-0XFF | Dummy byte. It has no meaning |
| | integer/ | | Default value is OXaa |
| | 1 byte | | |
| | | | |

4.3.30 PEER_DISCONNECT_CONFIRM (0X1F)

| Field | Type/ Size | Values | Description |
|--------|--------------------------|------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Status | unsigned integer/ 1 byte | OXOO- OXFF | 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". |

SET_DEFAULT_CONFIG_REQ (0X0E)/(0X8E) 4.3.31

| Field | Type/ | Values | Description |
|------------|--------------------------------|-----------|------------------------------------------------------|
| | Size | | |
| Dummy byte | unsigned integer/ 1 byte | 0X00-0XFF | Dummy byte. It has no meaning Default value is 0Xaa |

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SET_DEFAULT_CONFIG_CONFIRM (0X20)/(0XA0) 4.3.32

| Field | Type/ | Values | Description |
|----------------|-----------|--------------------------------|----------------------------------------|
| | Size | | |
| Status | unsigned | 0X00- 0XFF | Status of the |
| | integer/ | | SET_DEFAULT_CONFIG_REQ |
| | 1 byte | | 0X00 = SUCCESS. |
| | | | Non zero = FAILURE. |
| | | | For error codes refer Section 4.5 – |
| | | | "Error codes". |
| Channel | unsigned | 11-26 for 2.4GHz | The default channel in which the |
| | integer / | 0- 10 for 868/915 Sub GHz band | Performance test is started |
| | 2 bytes | · | |
| Channel Page | unsigned | 0,2,5,16,17,18, 19 | The channel page in which the |
| | integer / | | Performance test is started |
| | 1 byte | | |
| TX Power dBm | signed | -17dBm to +21dBm | TX power value in dBm |
| value | integer / | | |
| | 1 byte | | |
| TX Power | unsigned | 0X00 – 0X0f | TX power register default value, if |
| Register value | integer / | | exists |
| | 1 byte | | 0Xff= does not exists for this kit, do |
| | | | not show it in GUI |
| | | | This field does not exists for |
| | | | AT86RF212B transceiver |
| CSMA | Boolean/ | True/false | CSMA-CA default value |
| | 1 byte | | True = enabled |

| | | | False = disabled |
|-----------------|-----------|------------|-----------------------------------------------------------|
| Frame Retry | Boolean / | True/false | Frame retransmission default value |
| | 1 byte | | True = enabled |
| | | | False = disabled |
| ACK Request | Boolean / | True/false | Ack Request default value |
| | 1 byte | | True = enabled |
| | | | False = disabled |
| Rx | unsigned | True/false | Rx De-sensitivity default value |
| desensitization | integer/ | | OXff= does not exists for this kit, do |
| | 1 byte / | | not show it in GUI |
| | | | 0X00- disabled |
| | | | 0X01 – enabled |
| RPC | unsigned | 0X00- 0Xff | RPC default value if it exists |
| | integer/ | | 0Xff= does not exists for this kit, do |
| | 1 byte | | not show it in GUI |
| | | | This field exists for AT86RF233 only |
| | | | 0X00- disabled |
| | | | 0X01 – enabled |
| Antenna | unsigned | 0X00-0Xff | Antenna diversity default value if it |
| Diversity | integer/ | | exists |
| | 1 byte | | OXff= 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 | 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/ | 0 – 4294967295(2^32 - 1) | Default test frames for PER test = 100. |
| Trumes | 4 bytes | | Ignore this field if start mode parameter is not equal to 0X01 |
| PHY frame | unsigned | 12 - 127 | Default PHY frame length = 20. |
| length | integer/ 2 bytes | | Ignore this field if start mode parameter is not equal to 0X01 |
| Antenna | unsigned | 0X00- 0Xff | Antenna diversity current value if it |
| Diversity on | integer/ | | exists and the peer is connected |
| Peer | 1 byte | | 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/ | TRUE/FALSE | Indicate whether Counting of packets with wrong CRC is enabled |
| | 1 byte | | TRUE = enable |
| | | | FALSE = disable |
| | | | Ignore this field if start mode parameter is not equal to 0X01 |

4.3.33 GET_CURRENT_CONFIG_REQ (0X0F)/(0X8F)

| Field | Type/ | Values | Description |
|------------|----------|-----------|-------------------------------|
| | Size | | |
| Dummy byte | unsigned | 0X00-0XFF | Dummy byte. It has no meaning |
| | integer/ | | Default value is 0Xaa |
| | 1 byte | | |

GET_CURRENT_CONFIG_CONFIRM (0X21)/(0XA1) 4.3.34

| Field | Type/ | Values | Description |
|--------------|-----------|---------------------------------|-------------------------------------|
| | Size | | |
| Status | unsigned | 0X00- 0XFF | Status of the |
| | integer/ | | GET_CURRENT_CONFIG_REQ |
| | 1 byte | | 0X00 = SUCCESS. |
| | | | Non zero = FAILURE. |
| | | | For error codes refer Section 4.5 – |
| | | | "Error codes". |
| Channel | unsigned | 11-26 for 2.4GHz | The current channel in which the |
| | integer / | 0 - 10 for 868/915 Sub GHz band | Performance test is running now |
| | 2 bytes | | |
| Channel Page | unsigned | 0,2,5,16,17,18, 19 | The current channel page in which |
| | integer / | | the Performance test is running now |
| | 1 byte | | |
| TX Power dBm | signed | -17dBm to +21dBm | Current TX power value in dBm |
| value | integer / | | |
| | 1 byte | | |
| TX Power | unsigned | 0X00 – 0X0F | Current TX power register value, if |

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| Register value | integer / | | exists |
|-----------------|-----------|------------|-----------------------------------------------------------|
| | 1 byte | | 0XFF= does not exists for this kit, do not show it in GUI |
| | | | This field does not exists for AT86RF212B transceiver |
| CSMA | Boolean/ | True/false | CSMA-CA current value |
| | 1 byte | | True = enabled |
| | | | False = disabled |
| Frame Retry | Boolean / | True/false | Frame retransmission default value |
| | 1 byte | | True = enabled |
| | | | False = disabled |
| ACK Request | Boolean / | True/false | Ack Request current value |
| | 1 byte | | True = enabled |
| | | | False = disabled |
| Rx | unsigned | True/false | Rx De-sensitivity current value |
| desensitization | integer/ | | 0Xff= does not exists for this kit, do |
| | 1 byte / | | not show it in GUI |
| | | | 0X00- disabled |
| | | | 0X01 – enabled |
| RPC | unsigned | 0X00- 0Xff | RPC current value if it exists |
| | integer/ | | 0Xff= does not exists for this kit, do |
| | 1 byte | | not show it in GUI |
| | | | This field exists for AT86RF233 only. |
| | | | 0X00- disabled |
| | | | 0X01 – enabled |

| Antenna Diversity | unsigned integer/ | OXOO- OXff | Antenna diversity current value if it exists |
|----------------------|-------------------|------------------------|-----------------------------------------------------------|
| | 1 byte | | |
| | | | OXff= 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 | unsigned | 0X00- 0Xff | Current transceiver state |
| state | integer/ | | 0X08 = TRX OFF Single node tests |
| | 1 byte | | 0X16 = RX AACK ON for PER test |
| No. of test | Unsigned | 0 - 4294967295(2^32-1) | Current test frames for PER test = |
| frames | integer/ | | 100. |
| | 4 bytes | | |
| | | | Ignore this field if start mode |
| | | | parameter is not equal to 0X01 |
| PHY frame | unsigned | 12 - 127 | Default PHY frame length = 20. |
| length | integer/ | | |
| | 2 bytes | | Ignore this field if start mode |
| | | | parameter is not equal to 0X01 |
| Antenna | unsigned | 0X00-0Xff | Antenna diversity current value if it |
| Diversity on | integer/ | | exists and the peer is connected |
| Peer | 1 byte | | |
| | | | 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 |

RANGE_TEST_START_REQ (0X50) 4.3.35

| Field | Type/ | Values | Description |
|------------|-------------------|-----------|------------------------------------------------------|
| | Size | | |
| Dummy byte | unsigned integer/ | 0X00-0XFF | Dummy byte. It has no meaning Default value is 0XBB |
| | 1 byte | | |

4.3.36 RANGE_TEST_START_CONFIRM (0X51)

| Field | Type/ Size | Values | Description |
|--------|--------------------------|-----------|------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Status | unsigned integer/ 1 byte | OX00-OXFF | 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/ | Values | Description |
|------------|-------------------|-----------|-------------------------------|
| | Size | | |
| Dummy byte | unsigned integer/ | OX00-0XFF | Dummy byte. It has no meaning |
| | 1 byte | | Default value is 0XCC |

4.3.38 RANGE_TEST_STOP_CONFIRM (0X53)

| Field | Type/ Size | Values | Description |
|--------|--------------------------|-----------|--------------------------------------|
| Status | unsigned integer/ 1 byte | OX00-0XFF | Status of the RANGE_TEST _STOP REQ |
| | | | 0X00 = SUCCESS, Range test Initiated |

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| | Non zero = FAILURE, Not initiated. |
|--|----------------------------------------------------|
| | For error codes refer Section 4.5 – "Error codes". |
| | |

RANGE_TEST_BEACON_RESPONSE (0X54) 4.3.39

| Field | Type/ | Values | Description |
|-------------|-----------|-----------|-------------------------------------------------------------------|
| | Size | | |
| PHY Payload | Array of | 0X00-0XFF | The PHY Payload of the Range |
| | unsigned | | Test Beacon Response Frame |
| | integers/ | | which was received from the |
| | 1 byte | | receptor node is sent to the Host application. Refer Table 3.3.42 |
| LQI-R | unsigned | 0X00-0XFF | Postfix-R indicates, the LQI value |
| | integer/ | | detected at the remote node. |
| | 1 byte | | |
| ED value- R | signed | 0X00-0XFF | Postfix-R indicates, the ED value |
| | integer/ | | detected at the remote node. |
| | 1 byte | | |
| LQI-h | unsigned | 0X00-0XFF | Postfix-h indicates, the LQI value |
| | integer/ | | detected at the host node. |
| | 1 byte | | |
| D value- h | signed | 0X00-0XFF | Postfix-h indicates, the ED value |
| | integer/ | | detected at the host node. |
| | 1 byte | | |

RANGE_TEST_BEACON (0X55) 4.3.40

| 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 | OX00-0XFF | 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 |

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

| Field | Type/ | V | alues | | |
|---------------------------------|--------------------------------|--------------------|-------------------|-------------------|----------------------------------------------------------------------------------------------------------------|
| | Size | Beacon* | Beacon Reply | Marker | Description |
| Frame Length | unsigned integer/2 bytes | 0X0000 - 0X007F | 0X0000- 0X007F | 0X0000- 0X007F | The Length of the PHY payload which is sent over the air.(Including the FCS Field) |
| FCF | unsigned integer/2by tes | OXOO-OXFF | 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/2by tes | 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/2by tes | 0X00-0XFF | 0X00-0XFF | 0X00-0XFF | 16-bit Destination Short address |
| Source Short Address | unsigned integer/2by tes | OXOO-OXFF | 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*/un signed integer/2 bytes(only 1 byte for Marker) | 0X00 | OX00-OXFF First Byte is Signed followed by unsigned integer Byte | OXAA | 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.

PKT_STREAM_REQ (0X22)/(0XA2) 4.3.43

| Field | Type/ Size | Values | Description |
|------------|------------------|------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Start/stop | Boolean / 1 byte | TRUE/FALSE | This parameter indicates whether Packet streaming has to start or stop the ongoing transmission. 0X00 = Stop Packet streaming 0X01 = Start Packet streaming |

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| Frame Length | unsigned integer/ 2 bytes | 0X0000 – 0X007F | This parameter indicates length of each frame sent during packet streaming |
|-----------------------|---------------------------|-----------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Gap time (ms) | Unsigned integer/ 2 bytes | 0X0000 – 0XFFFF | Delay between successive frames while sending in ms. |
| Time out (seconds) | Unsigned integer/ 2 bytes | 0X0000 - 0X0E10 | This parameter indicates how long the packet streaming has to takes place Default value is 0X1E (30 sec) This field has dummy values if packet streaming starts at Initiator node. |

PKT_STREAM_CONFIRM (0X23)/(0XA3) 4.3.44

| Field | Type/ Size | Values | Description |
|------------|--------------------------|-------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Status | unsigned integer/ 1 byte | 0X00 – 0XFF | Status of the PKT_STREAM_REQ 0X00 = SUCCESS, Range test Initiated Non zero = FAILURE, Not initiated. For error codes refer Section 4.5 – "Error codes". |
| Start/Stop | Boolean/ 2 bytes | TRUE/FALSE | This same as Start stop parameter in the Req |

RX_ON_REQ (0X24)/(0XA4) 4.3.45

| Start/Stop | Boolean/ | TRUE/FALSE | This parameter indicates whether |
|------------|----------|------------|-----------------------------------------|
| | | | Continuous receive mode has to |
| | 1 byte | | enable or not. |
| | | | 0X00 = Disables continuous receive mode |
| | | | 0X01 = Enables continuous receive mode |

RX_ON_CONFIRM (0X25)/(0XA5) 4.3.46

| Status | unsigned integer/ 1 byte | 0X00 – 0XFF | Status of the RX_ON_REQ 0X00 = SUCCESS, Range test Initiated Non zero = FAILURE, Not initiated. For error codes refer Section 4.5 – "Error codes". |
|------------|--------------------------|-------------|--------------------------------------------------------------------------------------------------------------------------------------------------------|
| Start/Stop | Boolean/ 1 byte | TRUE/FALSE | This same as Start stop parameter in the Req |

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/ | Valid range | Default value | Description |
|-----------|------------|----------|-------------|---------------|--------------------------------|
| | | Size | | | |
| Channel | 0X00 | unsigned | 11-26 for | 21 | Indicates the physical channel |
| | | integer/ | 2.4GHz band | | on which the PER test is |
| | | 2 bytes | 0 – 10 for | | running |

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| | | | 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 | 0 | Indicates the on which channel page currently PER test is running. This is to support high data rates |
| | | | 868/915 Sub GHz | | |
| TX power in Reg◆ | 0X02 | unsigned integer/ 1 byte | 0X00- 0X1F | 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 |

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| CSMA | 0X04 | boolean / 1 byte | 4dBm to 21dBm TRUE or FLASE | 21 for EXT_PA enabled kits | Indicate whether CSMA- CA mechanism is enabled TRUE = enable |
|----------------------|------|--------------------------|--------------------------------------|------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Frame retry | 0X05 | boolean / 1 byte | TRUE or FLASE | FALSE | FALSE = disable 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 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 |
| Antenna | 0X08 | unsigned | 0X00- 0X02 | 0 – non | Indicates whether Antenna |

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| Diversity on | | integer/ | | RF233 based | diversity on source node is |
|-----------------|------|-----------|---------|-------------------------|---------------------------------------------------|
| Peer | | 1 byte | | boards | enabled and antenna selected in case of disabled |
| | | | | 1- for RF233 | 0 = ant div enabled |
| | | | | based boards | 1= ant div disabled & ant1 i.e. A1/X2 is selected |
| | | | | | 2= ant div disabled & ant2 i.e. |
| | | | | | A2/X3 is selected |
| | | | | | |
| | 0X09 | boolean / | TRUE or | FALSE | Indicate whether Receiver |
| Desensitization | | 1 byte | FLASE | | desensitization is enabled |
| • | | | | | TRUE = enable |
| | | | | | FALSE = disable |
| Transceiver | 0X0a | unsigned | 0 - 5 | 0X16 for PER | Indicates the transceiver state |
| state | | integer/ | | test | RESET = 0X00 |
| | | 1 byte | | | TRX_OFF = 0X08 |
| | | | | 0X08 for Single node | PLL_ON = 0X09 |
| | | | | tests | RX_ON = 0X16 |
| | | | | | SLEEP = 0X0f |
| | | | | | DEEP_SLEEP= 0X20 (only |
| | | | | | RF233 only) |
| CRC on Peer | 0X0b | Boolean / | TRUE or | FALSE | Indicate whether Counting of |
| node | | 1 byte | FLASE | | packets with wrong CRC is enabled |
| | | | | | TRUE = enable |
| | | | | | FALSE = disable |
| No. of test | ОХОс | unsigned | 0 – | 100 | Indicates no. of packets to be |

| frames | | integer/ | 4294967295 | | transmitted for PER test |
|---------------|------|-----------|------------|------|-------------------------------------------------|
| | | | | | |
| | | 4 bytes | (2^32 - 1) | | |
| PHY frame | 0X0d | unsigned | 12- 2047 | 20 | Length of frame to be used for |
| length | | integer/ | | | PER test |
| | | 2 bytes | | | |
| RPC | 0X0e | Boolean / | TRUE or | TRUE | Indicate whether RPC feature |
| | | 1 by # 0 | FLACE | | is enabled. This parameter is |
| | | 1 byte | FLASE | | exists only for RF233 |
| | | | | | transceiver only |
| | | | | | TRUE = enable |
| | | | | | FALSE = disable |
| ISM frequency | 0X0f | Floating | 2322.0 – | | Indicates the ISM frequency in |
| | | point/ | 2527.0 | | which transceiver should be |
| | | 4 bytes | | | operated. Only frequencies |
| | | 12,000 | | | with multiples of 0.5 is |
| | | | | | allowed in the given range.Ex:2323.5,2526.0 etc |
| | | | | | Talige.Ex.2323.3,2320.0 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 |

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| 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 |
| PKT_STREAM_IN_PROGRESS | 0X32 | Indicates Packet streaming test is in progress |
| RX_ON_MODE_IN_PROGRESS | 0X33 | Indicates Continuous receive mode 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**

System on Chip SoC

FEM Front End Module

FCF Frame Control Field

FCS Frame Check Sequence

PAN Personal Area Network

6 REVISION HISTORY

| DOC. REV. | DATE | COMMENTS | |
|--------------|------------------|---------------------------------------------------------------------------------------------------------------|--|
| Α | 31/AUGUST/2012 | PERFORMANCE ANALYZER v1.0 | |
| А | 21/JUNE/2013 | UPDATED DOCUMENT FOR PERFORMANCE ANALYZER v2.1 NEW FEATURES | |
| В | 20/DECEMBER/2014 | UPDATED DOCUMENT FOR PERFORMANCE ANALYZER v3.0 NEW FEATURES (PACKET STREAMING AND REMOTE CONFIGURATION) | |



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