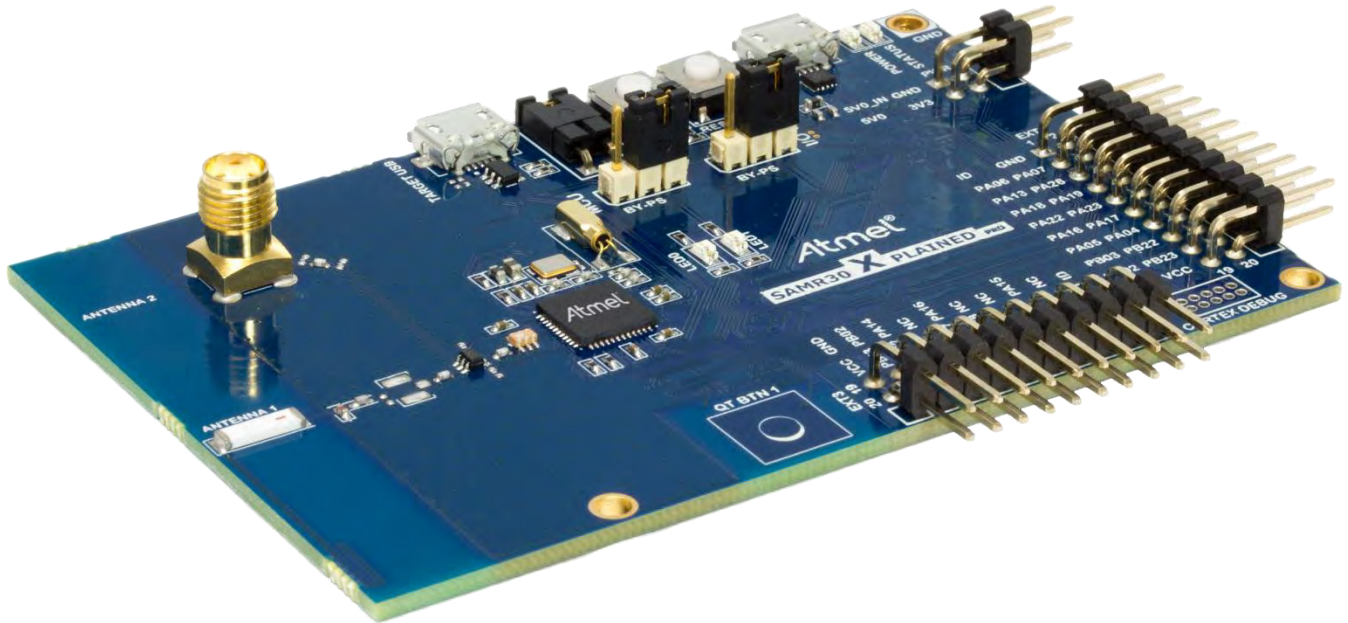


# ATSAMR30-XPRO [USER MANUAL]



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# 1. Introduction

## 1.1. Scope:

The scope of this document is to explain how to install and setup up the required hardware and programming tool for the certification test.

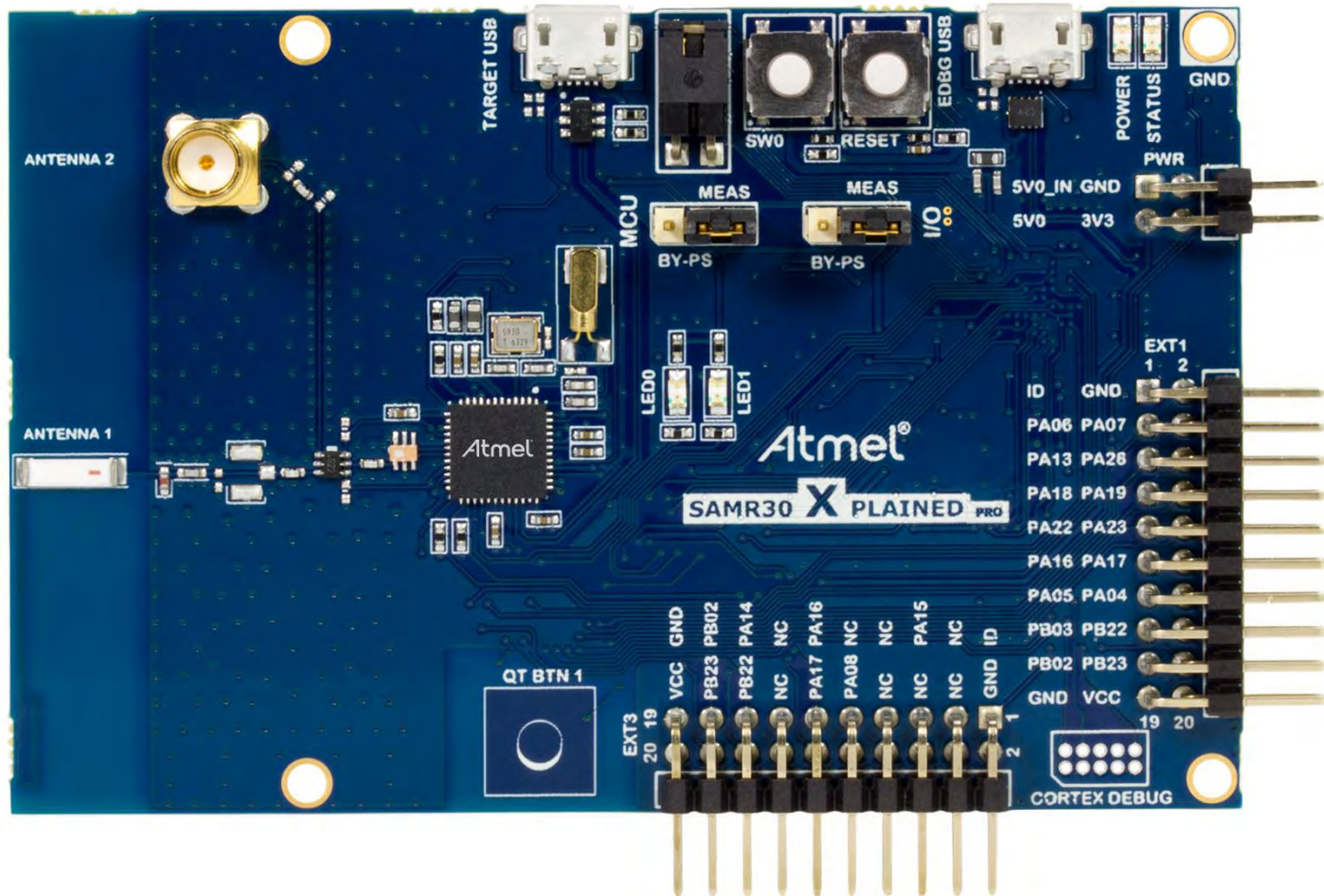


Figure 1 : Atmel ATSAMR30-XPRO Board

## 2. Hardware Setup

- 2.1. ATSAMR30-XPRO Boards - 2 Nos
- 2.2. Micro USB cable - 2 Nos

Note: SMA cables not included in the box

## 3. Software Setup





- 3.1. Atmel Studio 7 (no need to install again if it is already available in Test PC)
- 3.2. Wireless Composer
- 3.3. ATSAMR30-XPRO Drivers - Installed automatically
- 3.4. ATSAMR30-XPRO Performance Analyzer firmware flash-Install if required
- 3.5. ATSAMR30-XPRO Part Pack Intallation

## 4. Software Installation

### 4.1. Atmel Studio 7 Installation

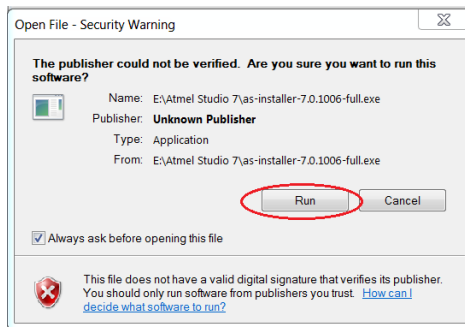
**Note:** If Atmel Studio 7 is already available in Test PC, jump to step 4.2 in this section and install wireless composer

- 4.1.1. Open the DVD containing the Atmel Studio 7 Software package.

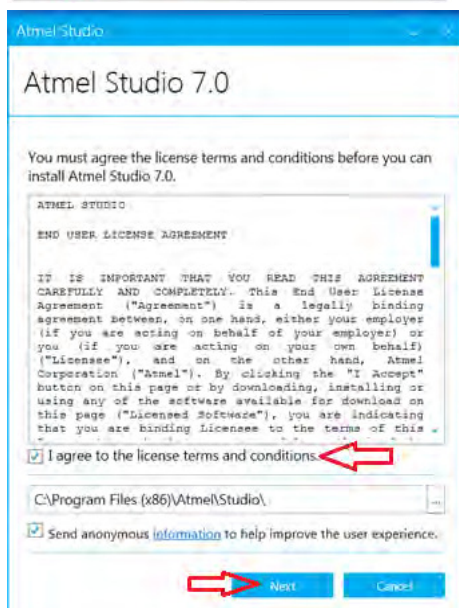
Name	Date modified	Type	Size
 as-installer-7.0.1006-full	7/21/2016 4:58 PM	Application	876,683 KB
 Atmel.SAMR30_DFP-1.0.7	7/21/2016 4:30 PM	Atmel Pack File	495 KB
 SAMR30_PERFORMANCE_ANALYZER	11/21/2016 11:24 ...	HEX File	178 KB
 wireless-composer-7.0.130	5/26/2016 12:43 PM	VSIX File	3,079 KB

- 4.1.2. Double click the “as-installer-7.0.1006-full.exe” icon to launch Atmel Studio Installation.

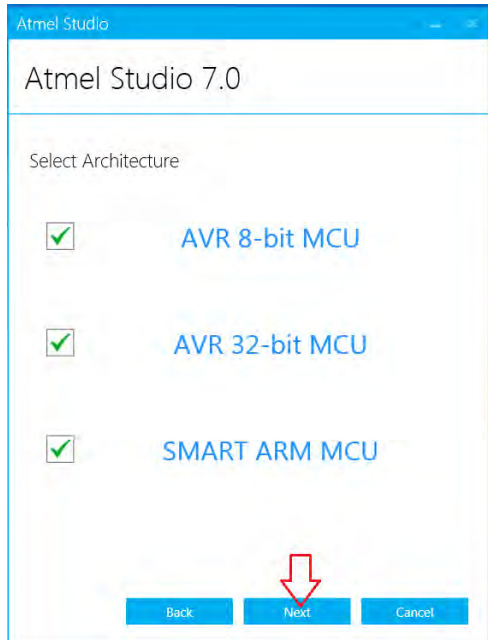
- 4.1.3. Click Run icon.



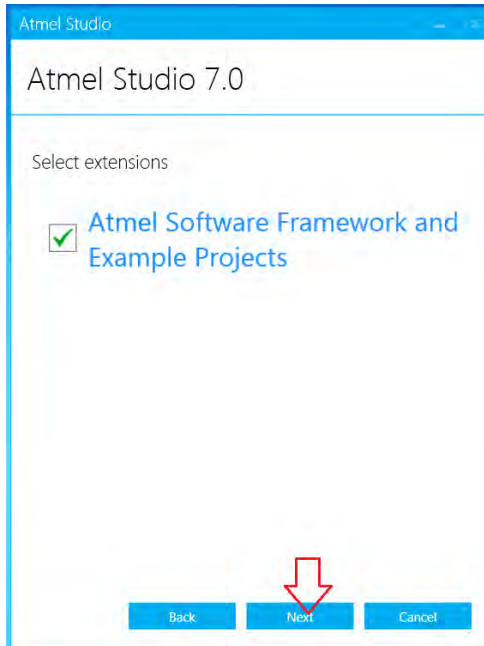
- 4.1.4. Once you clicked the Run icon, the Atmel Studio 7 installer Wizard dialog box opens and agree the licence terms and conditions. Then click “Next”



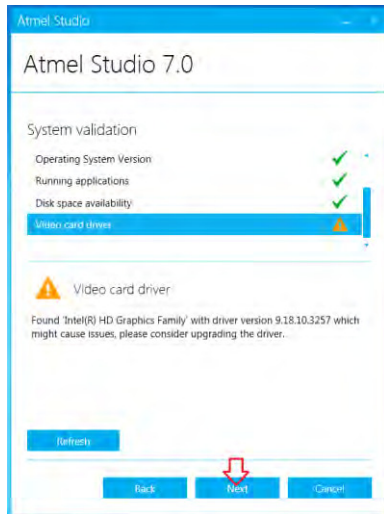
4.1.5. Ensure all the Architectires are selected and click “Next”.



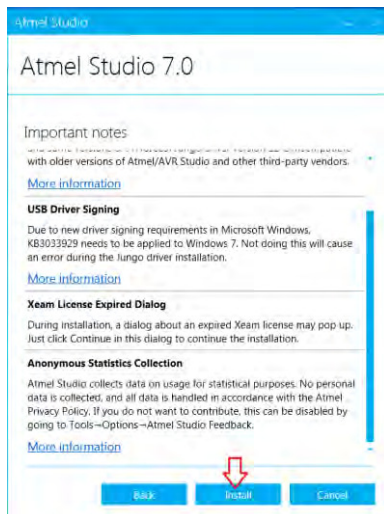
4.1.6. Select ASF extensions and click “Next”



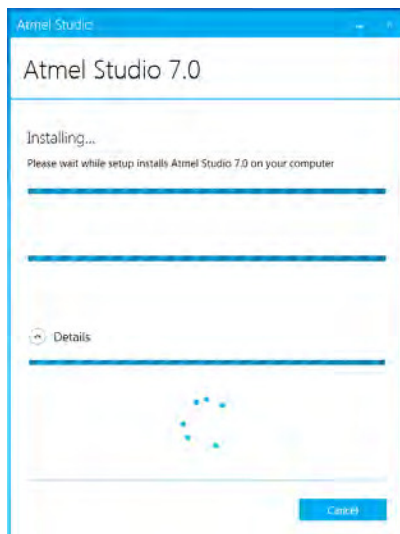
4.1.7. Click “Next”, ignore if any video card driver error shows,



4.1.8. Click "Install".



4.1.9. Atmel Studio 7 installation starts and once completed click ok.



## 4.2. Wireless Composer Installation

- 4.2.1. Next install the Wireless Composer extension by double clicking the “wireless-composer-7.0.130.vsix” icon found in the DVD as shown in the following figure and follow the installation wizard to complete the installation





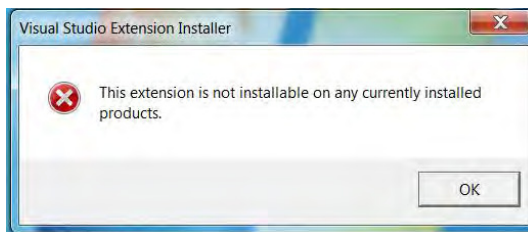
Name	Date modified	Type	Size
 as-installer-7.0.1006-full	7/21/2016 4:58 PM	Application	876,683 KB
 Atmel.SAMR30_DFP-1.0.7	7/21/2016 4:30 PM	Atmel Pack File	495 KB
 SAMR30_PERFORMANCE_ANALYZER	11/21/2016 11:24 ...	HEX File	178 KB
 wireless-composer-7.0.130	5/26/2016 12:43 PM	VSIX File	3,079 KB

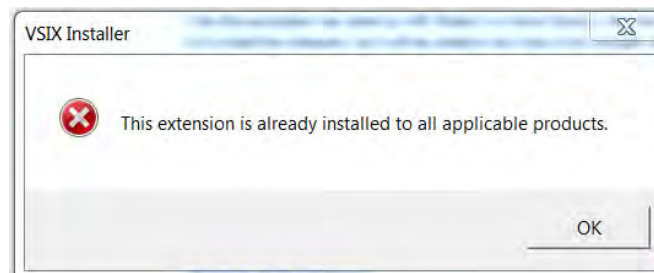
Figure 2 : Wireless Composer Installation

- 4.2.2. In case if you I get an error message saying,



- 4.2.3. To overcome the above error, you have to change the file association as follows

- Right click on the “wireless-composer-7.0.130.vsix” file and select 'Open with', and then 'Choose default program'.
- Click the 'Browse' button (Windows 7) or click on 'More' and 'Look for another app on this PC' (Windows 8 and newer).
- Browse to VSIXInstaller.exe located in C:\Program Files (x86)\Microsoft Visual Studio 14.0\Common7\IDE
- After initializing, it will pop-up as follows. Click 'ok' and now the installation gets completed.



## 5. Hardware and Driver Installation (Automatic):

5.1. Connect a micro USB cable from PC to the micro USB port (USB for programming).

USB for Programming/Testing Function

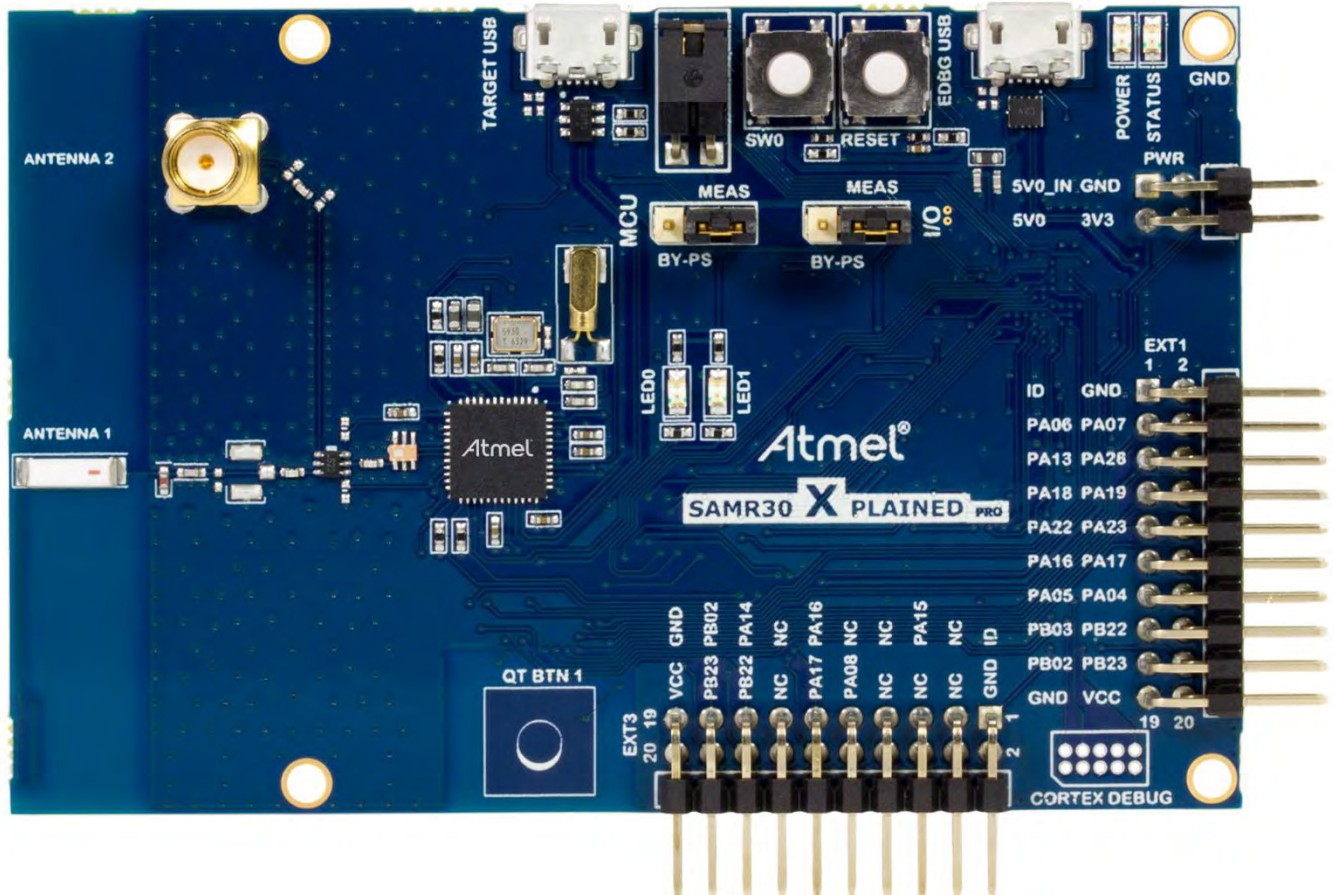


Figure.6 Hardware Setup

5.2. Next, EDBG Virtual COM port driver installation will begin automatically

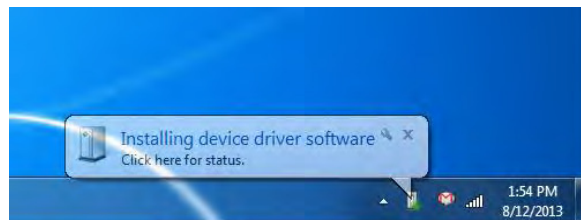


Figure.7 EDBG Virtual COM PORT Driver installation

5.3. Click the taskbar notification. When the driver installation is successfully completed, there will be a notification as shown below.

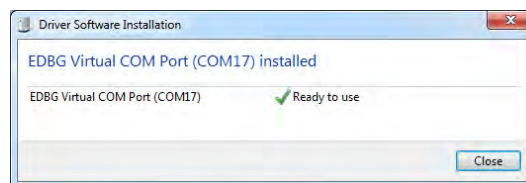


Figure.8 EDBG Virtual COM PORT Driver installation

Note: COM17 from the above figure is an example. The COM Port number varies depending upon the PC.



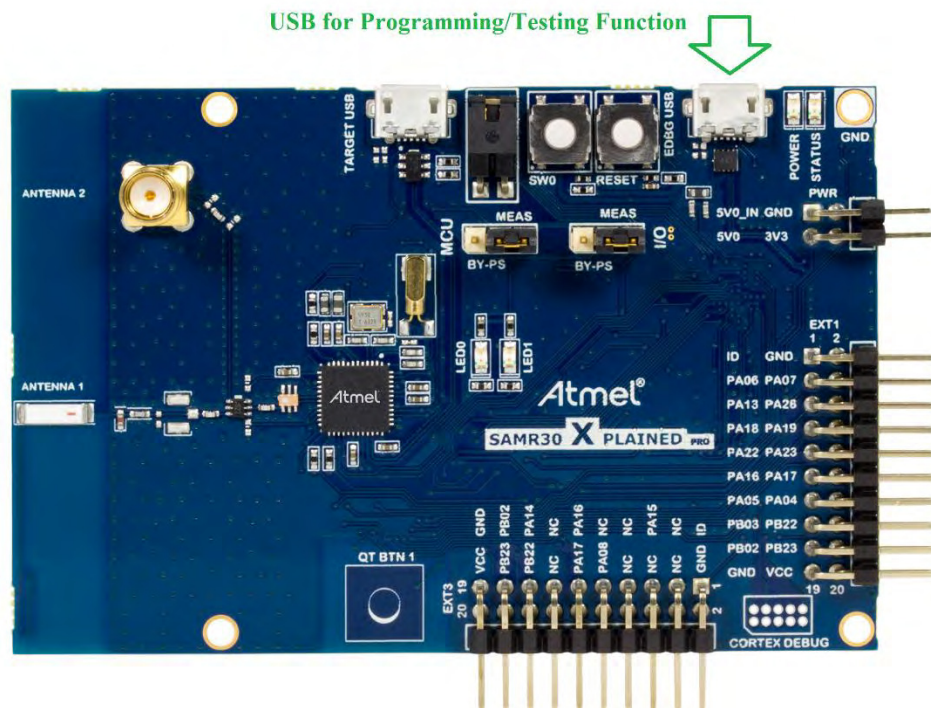
## 6. Programming the hex file in SAMR30-XPRO (If required):

Board was already programmed with certification software/performance analyzer. In case if required to flash the program file, follow the below steps.

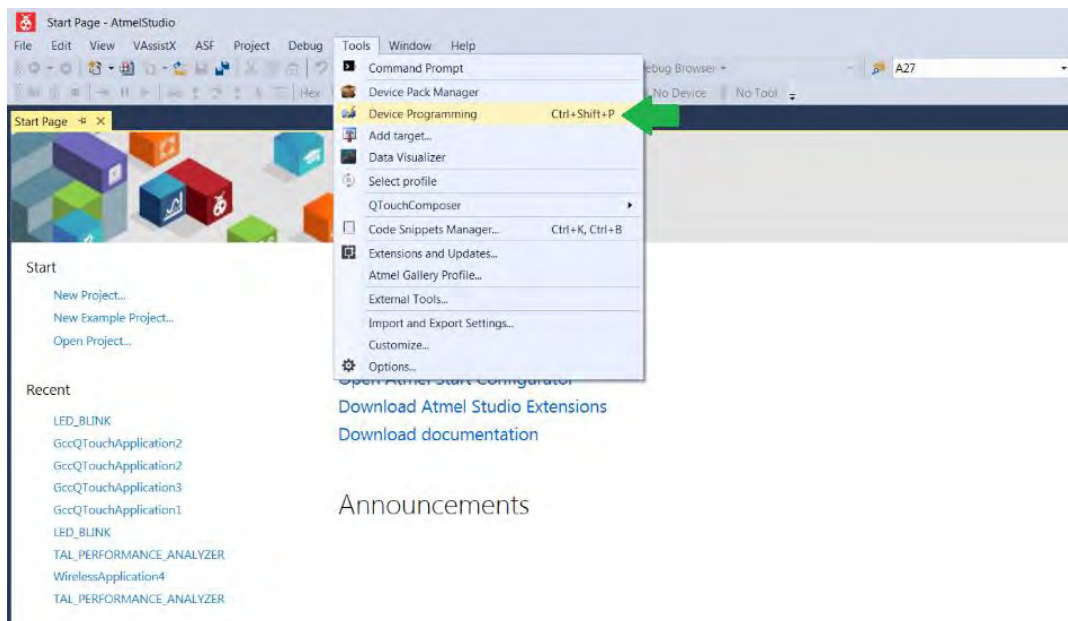
If programming the SAMR30-Xpro board for the first time, follow the section 7(SAMR30 part pack installation) before start programming.

6.1. Connect the SAMR30 XPRO board to the PC via EDBG micro USB connector.

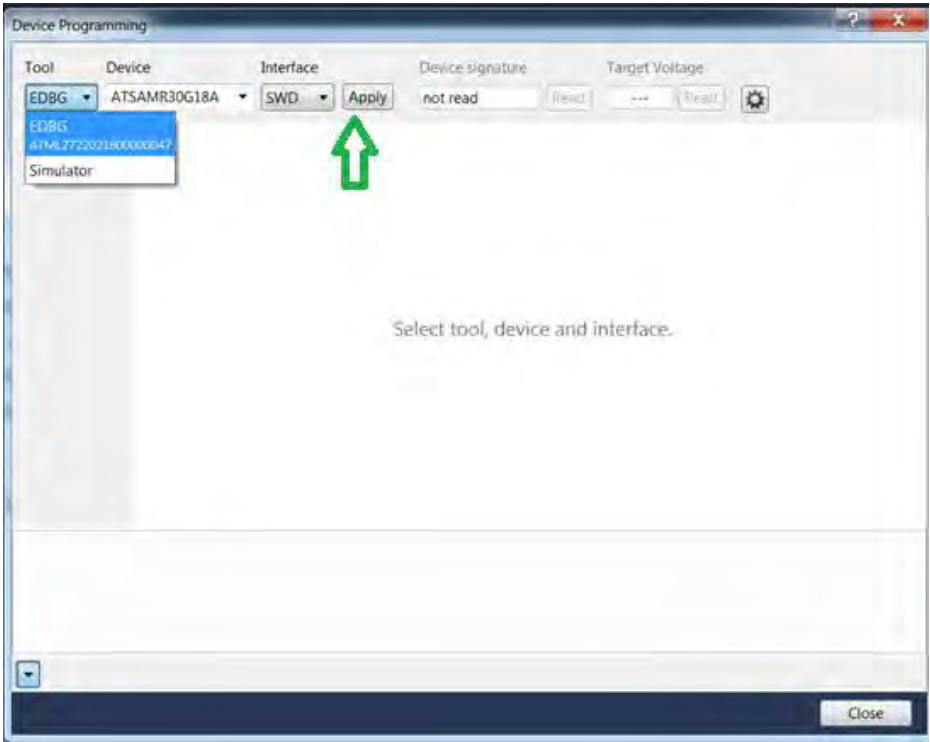
\* PC should have the Atmel Studio 7 installed in it



6.2. In Atmel studio,select Tools →Device Programming

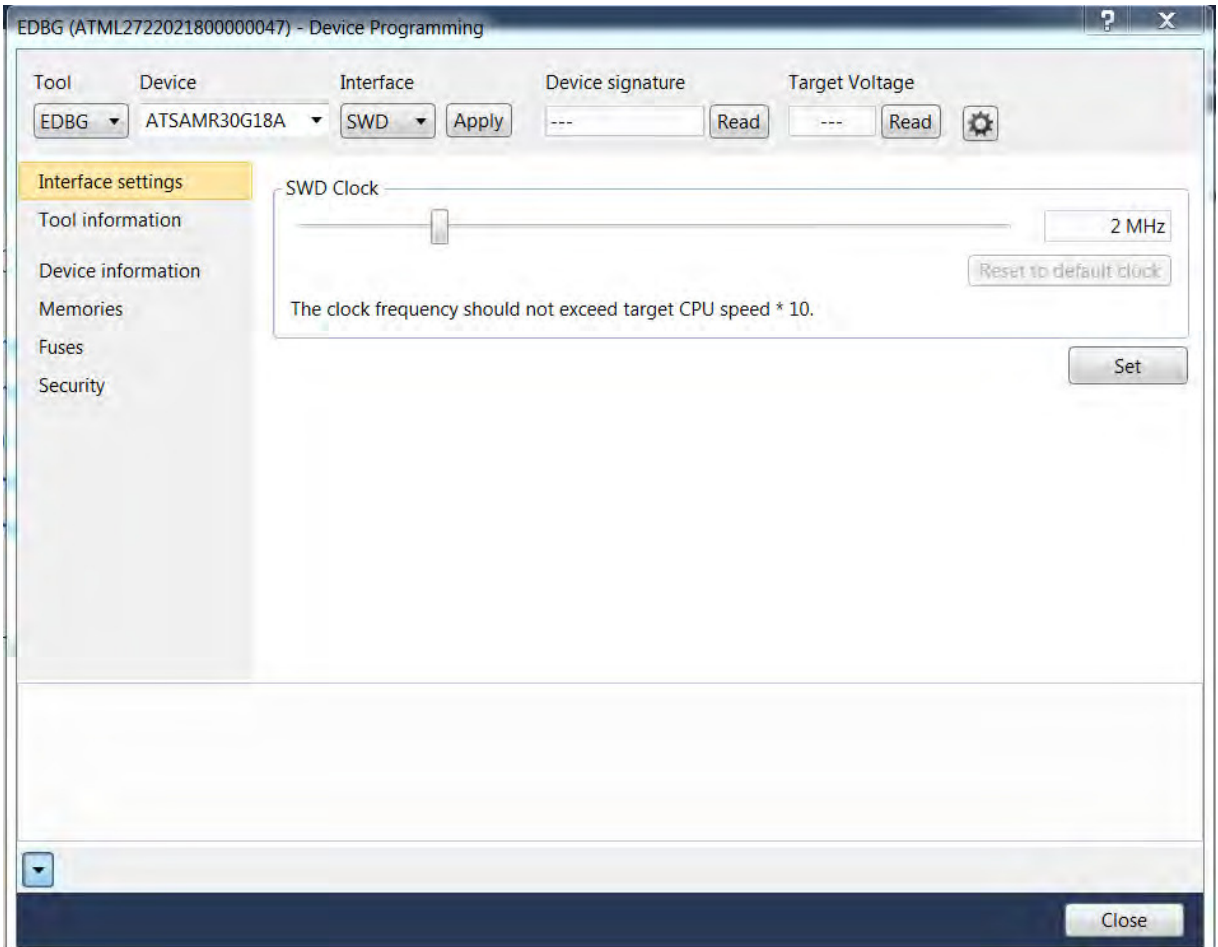


6.3. In Device Programming dialog box, select the edbg serial number and ensure the Device is “ATSAMR30G18A” and select ‘SWD’ as Interface. Then click “Apply”



In case if you noticed that the Device “ATSAMR30G18A” is unsupported, see the section 7 to overcome the error.

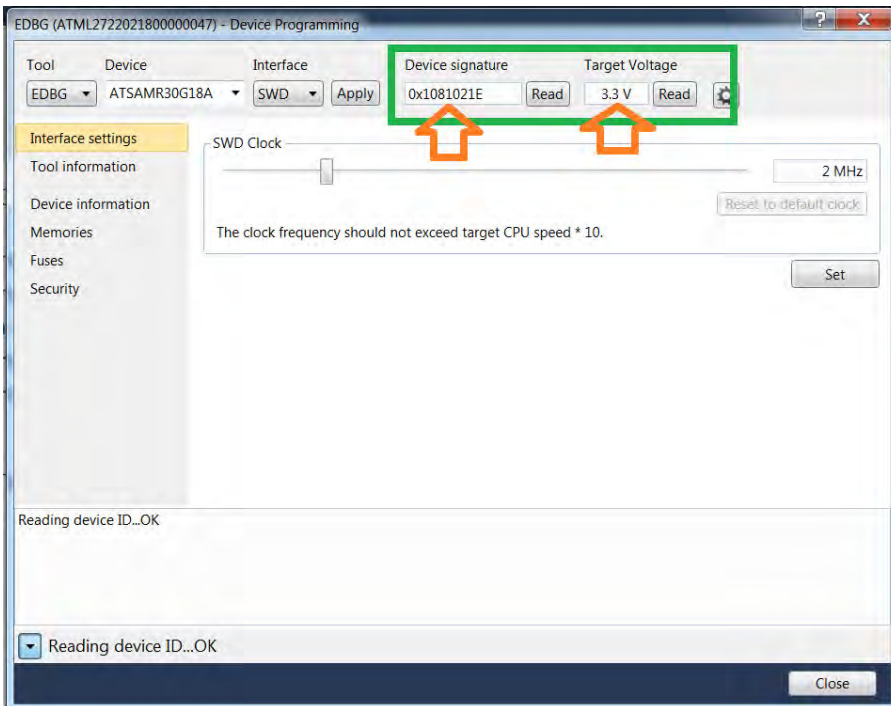
6.4. Once connected to the board, the device programming window will look like as follows



6.5. Read the Device signature and Target Voltage and ensure it is as follows

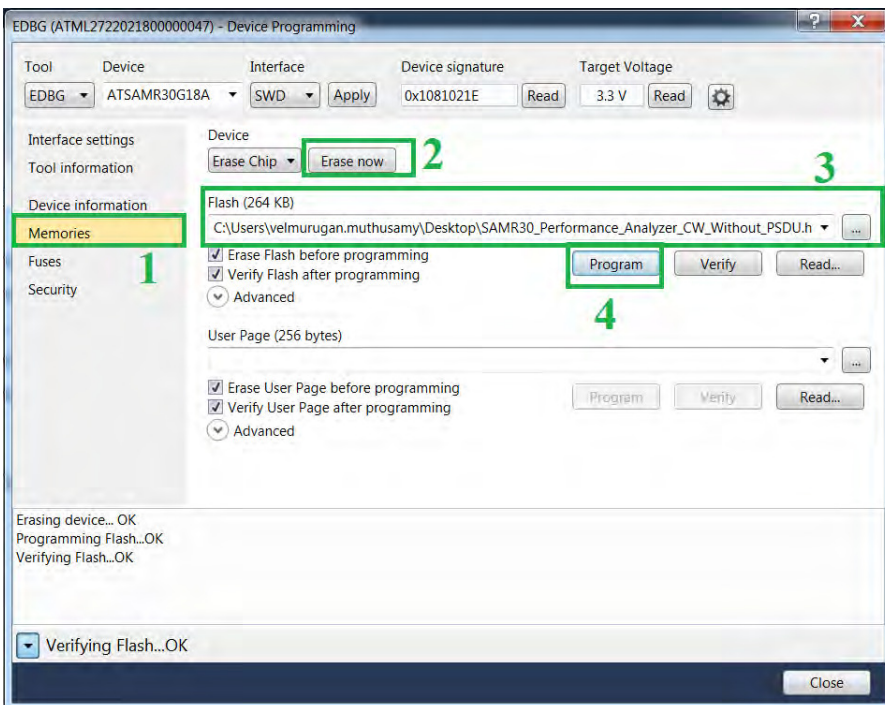
Device Programming: 0x1081021E

## Target Volatge: 3.3V



6.6. Once ensured the device signature and Target Voltage, Click on Memories and then click “Erase now” to erase the already existing program in the chip.

Then browse the hex file which you would like to program into the device and click Program.

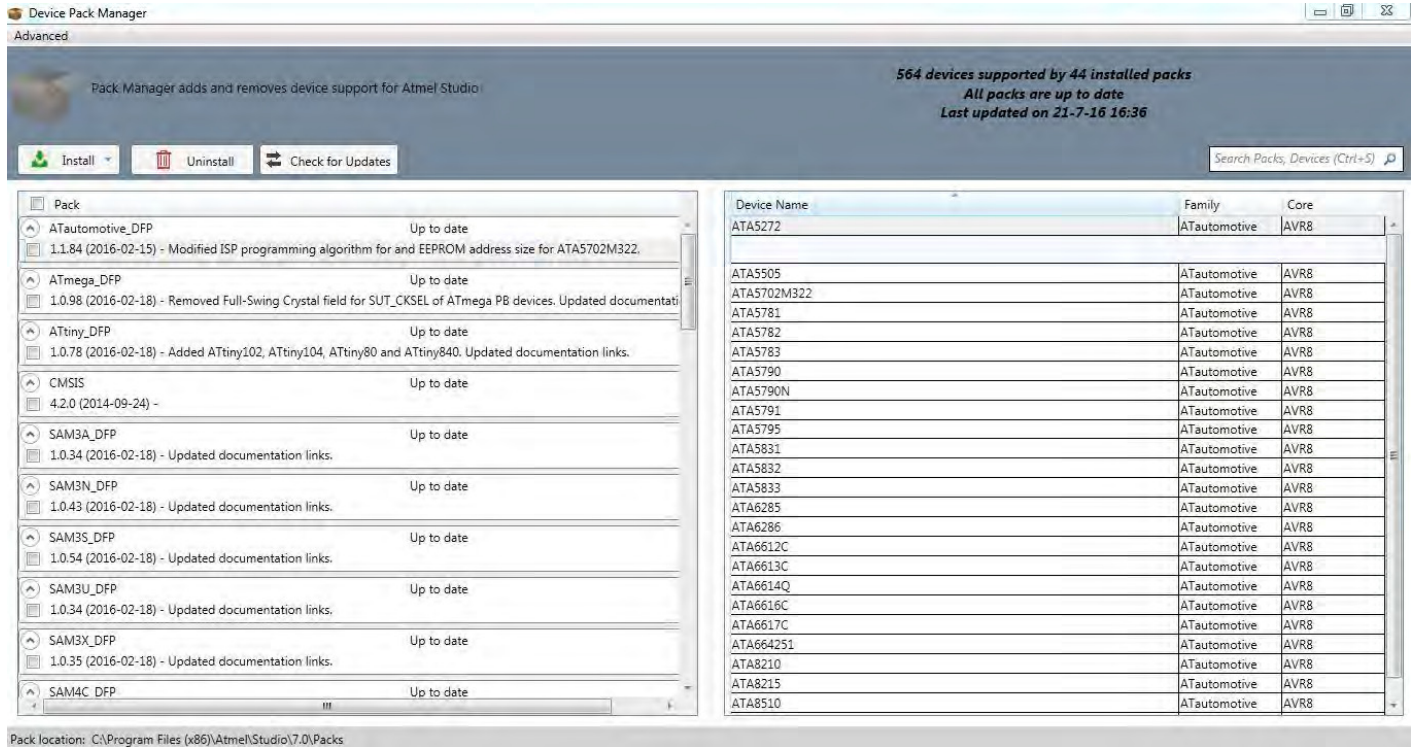


6.7. Flashing the hex file in the SAMR30-XPRO board completed.

## 7. SAM R30 Part Pack Intallation

Before using Atmel Studio 7 for programming/debugging in any new device/board, don't forget to install the part pack of the device using following steps,

- 7.1. Get the part pack of the device. For SAM R30, it is available in the DVD
- 7.2. Goto the below link [C:\Program Files \(x86\)\Atmel\Studio7.0\atpackmanager](C:\Program Files (x86)\Atmel\Studio7.0\atpackmanager)
- 7.3. Double click on “**PackManager.exe**”.
- 7.4. Device Part Manager window opens as follows and it will list all the device part packs installed.



7.5. To install new part pack, select Install->Browse pack file and choose “DFP” pack and click install.

For SAM R30, DFP pack (\*.atpack) is available in the DVD.

## 8. Performance Analyzer

8.1. Launch Atmel Studio tool by clicking the Atmel Studio icon

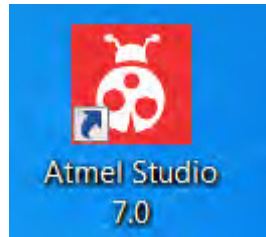


Figure.9 Launch Atmel Studio 7.0

8.2. From the Atmel Studio Start page, launch Performance Analyzer utility by clicking the icon as shown in below figure (or) select Tools → “IEEE 802.15.4 Performance Analyzer”.

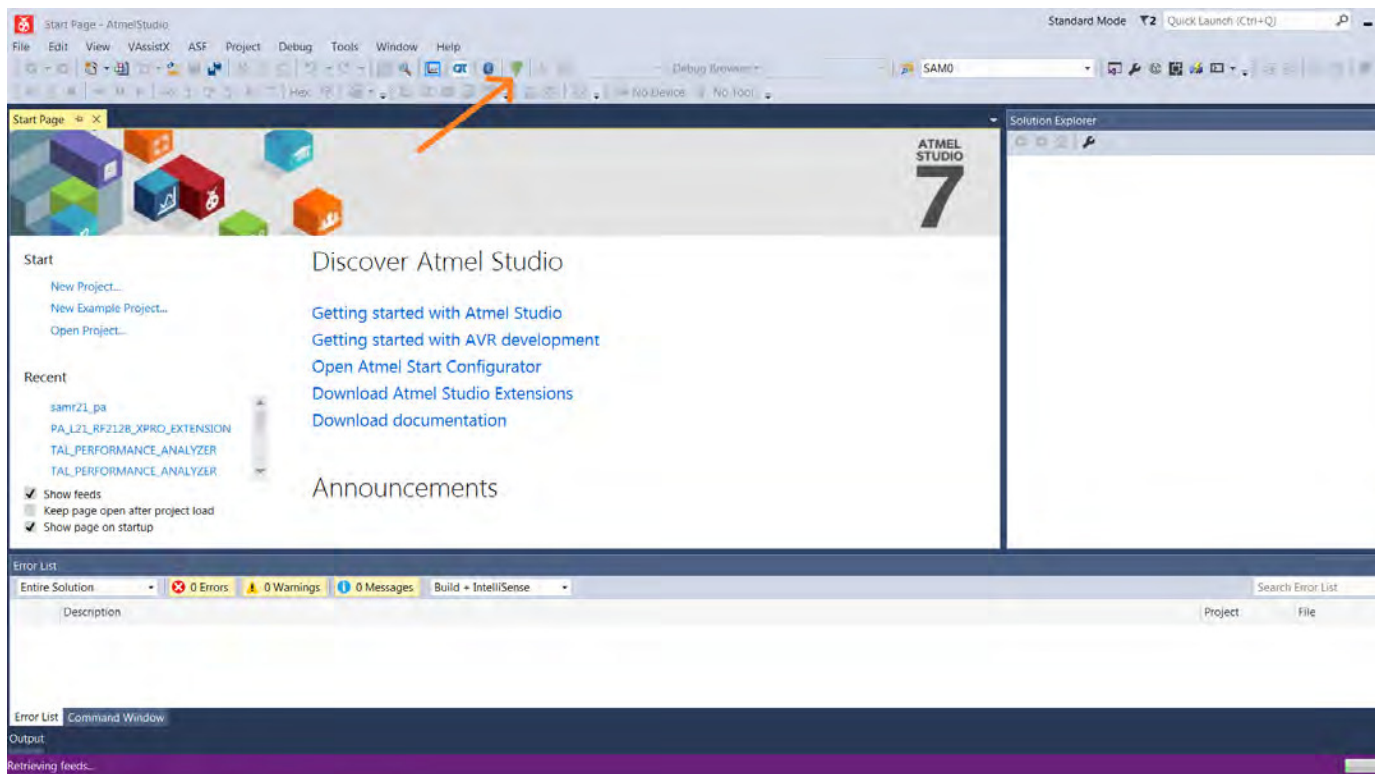
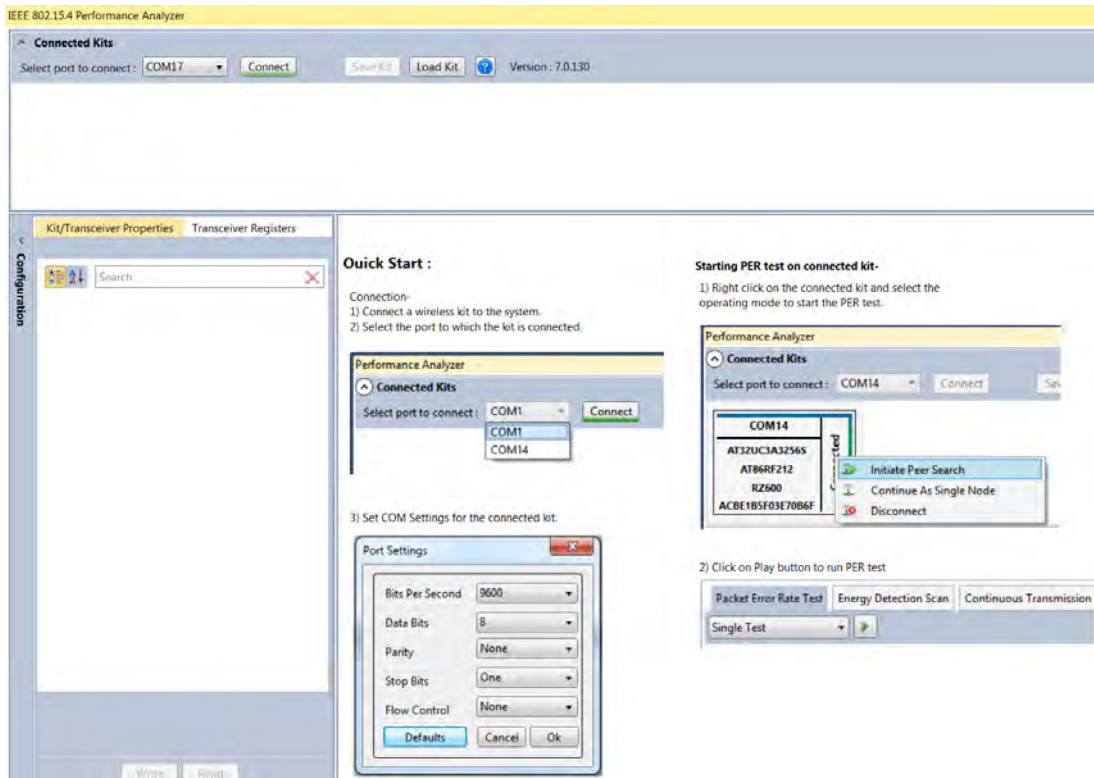


Figure.11 Atmel Studio 7.0 – Start Page

8.3. After clicking the Performance Analyzer icon, Performance Analyzer window will open as shown in the following figure.



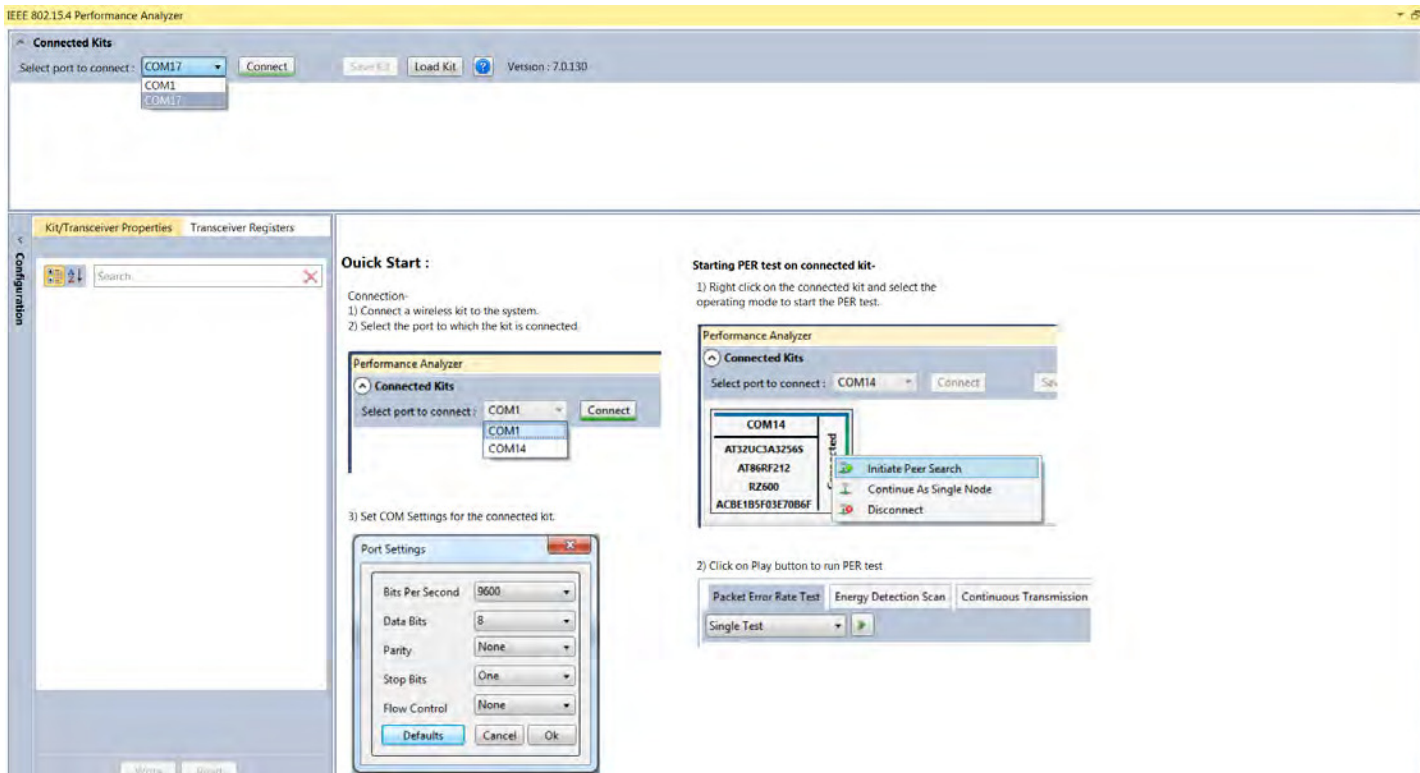
**Figure.12 Performance Analyzer**

8.4. Ensure the DUT is connected to the PC as explained in [Step 1 of Section 5](#).

## 9. Connecting kit in Tx Test (Single node / CW):

CW – Continuous Wave Transmission

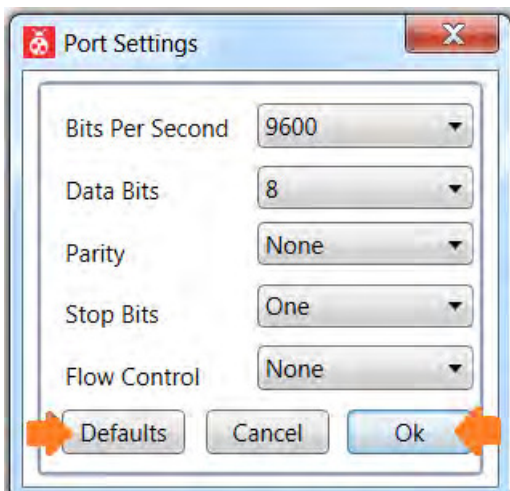
9.1. Select the COM Port from the dropdown menu and select a COM port to which the kit to be connected and click “Connect”



**Figure.13 Performance Analyzer – COM Port Selection**

Note: COM17 from the above figure is an example. The COM Port number varies depending upon the PC.

9.2. Set the COM settings from the pop-up window. Click “Defaults” and then click “OK”



9.3. To check “transmit only” functionality; right click on the Kit information area select “Continue as a single node”. This setting is used for continuous transmission.

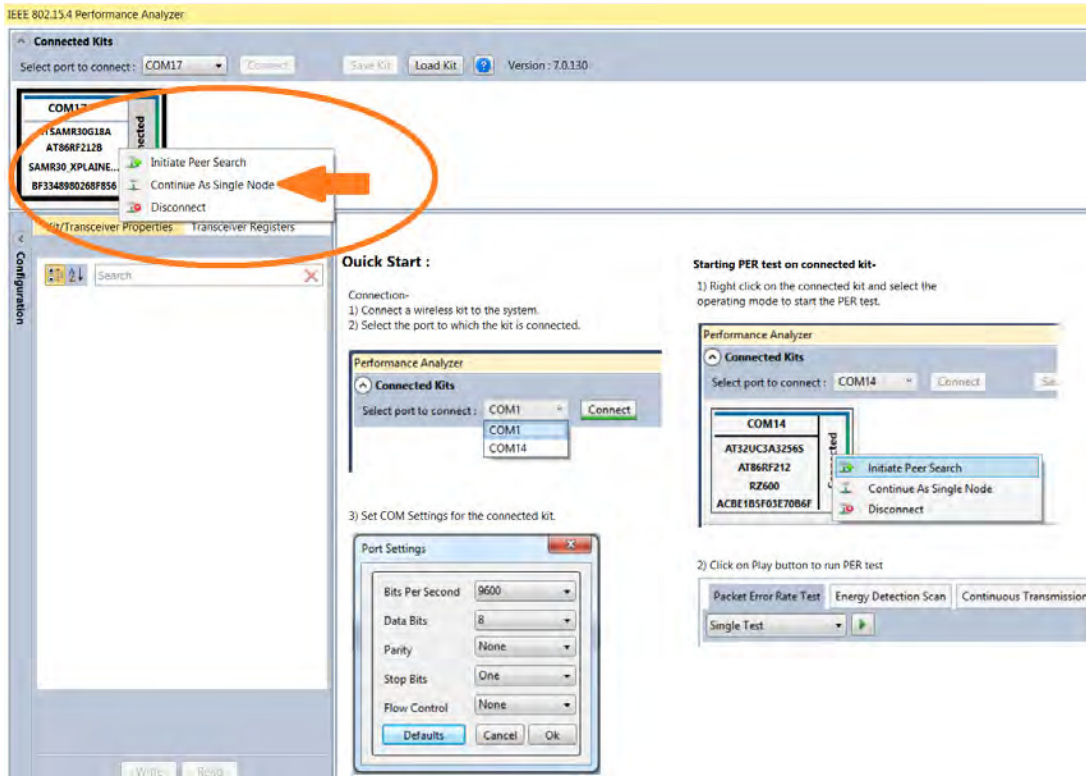
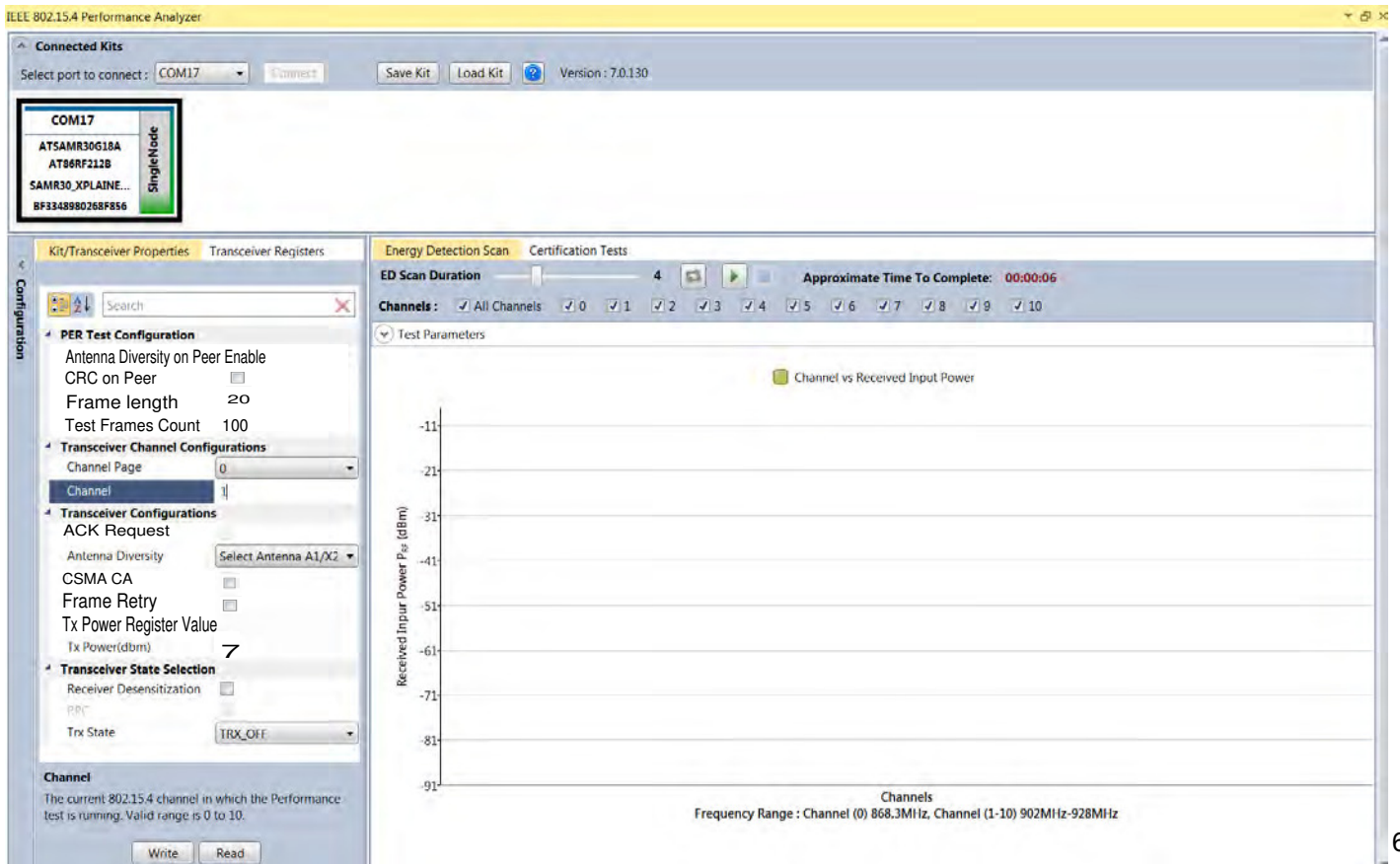


Figure.14 Performance Analyzer – Kit Information

9.4. Kit / Transceiver properties, Channel Page, Channel Number, Antenna Selection and Power level can also be changed in the Performance Analyzer window.





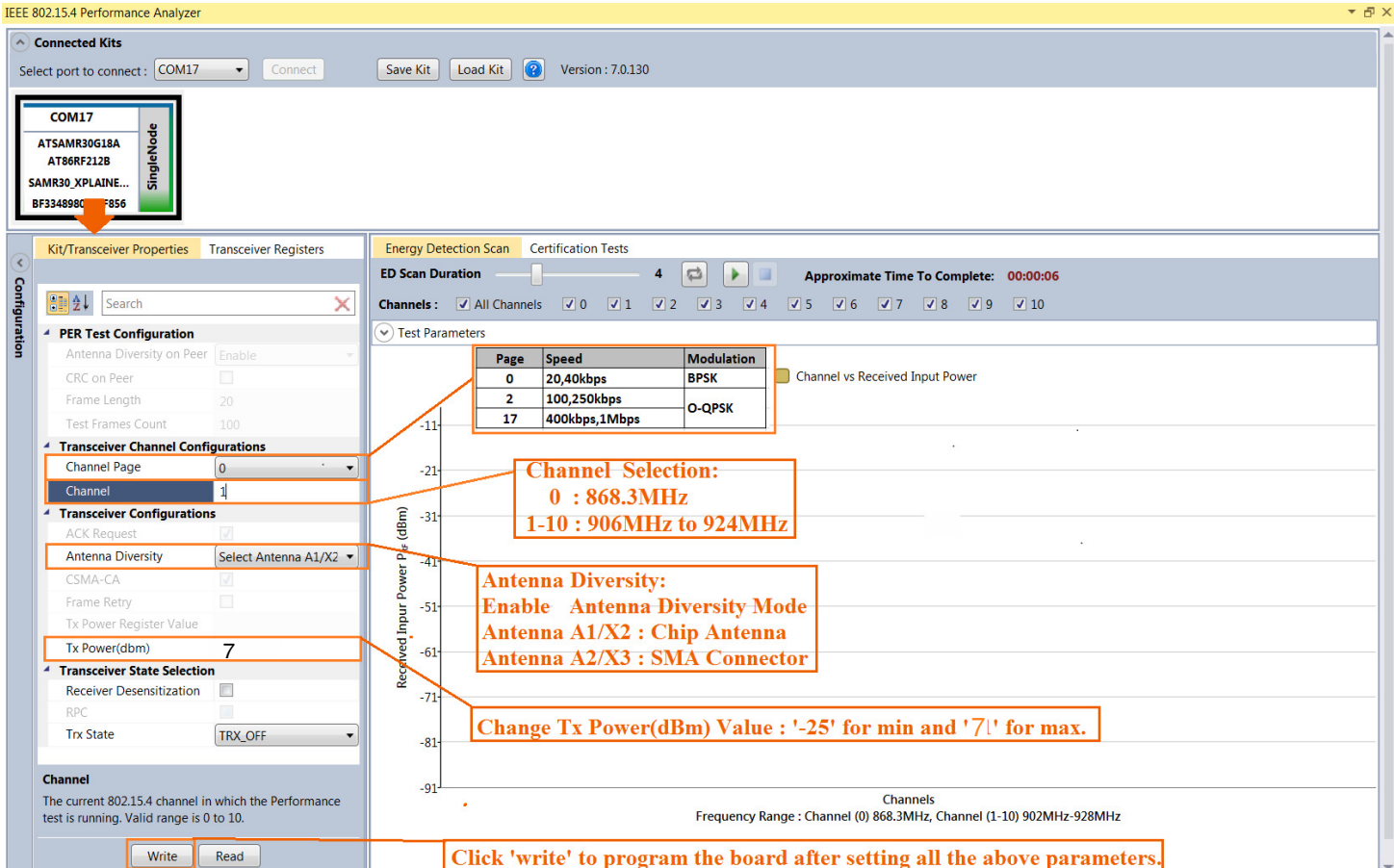


Figure.15 Performance Analyzer – Transceiver configuration

- One channel in the European SRD band from 863MHz to 870MHz at 868.3MHz according to IEEE 802.15.4 (channel k = 0)
- 10 channels in the North American ISM band from 902MHz to 928MHz with a channel spacing of 2MHz according to IEEE 802.15.4. The center frequency of these channels is defined as:  

$$F_c[\text{MHz}] = 906[\text{MHz}] + 2[\text{MHz}] \times (k - 1)$$
 for k = 1, 2, ..., 10  
 where k is the channel number.

9.5. To Transmit CW mode or PRBS mode, click on Certification tab and Continuous transmission and CW or PRBS.

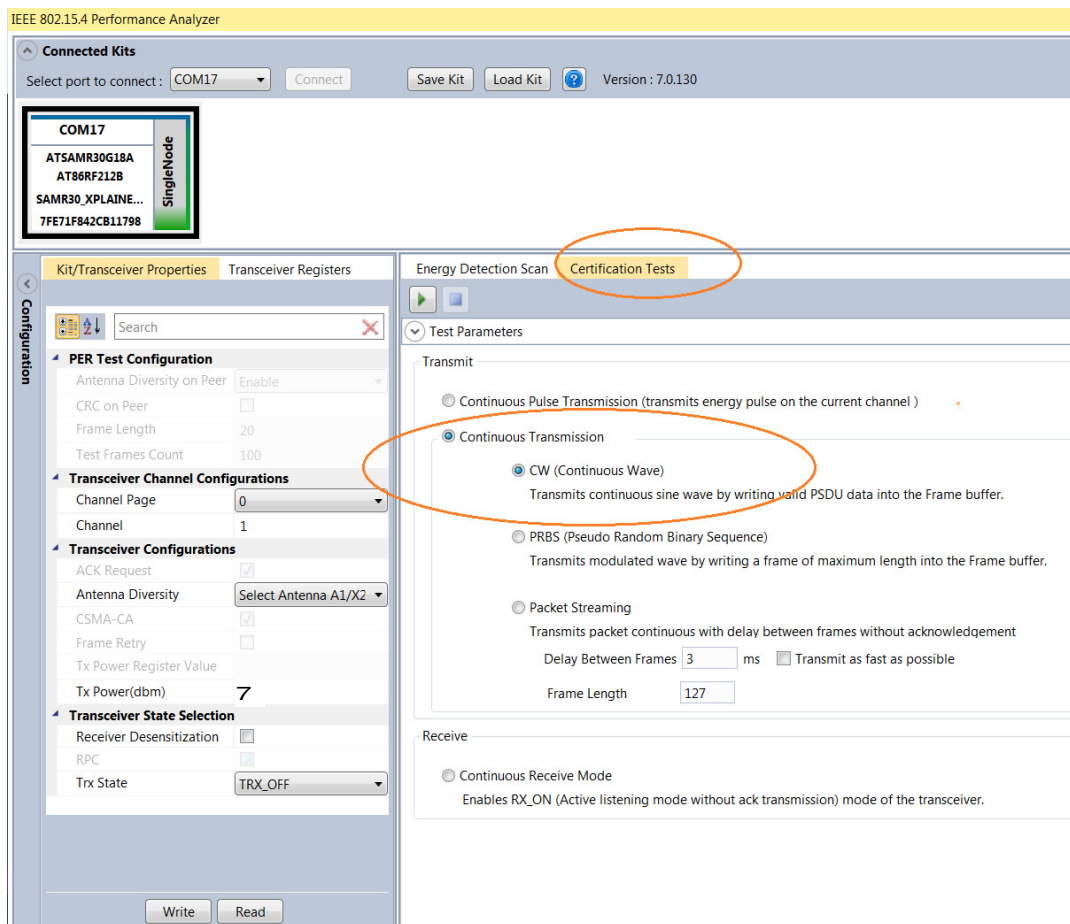
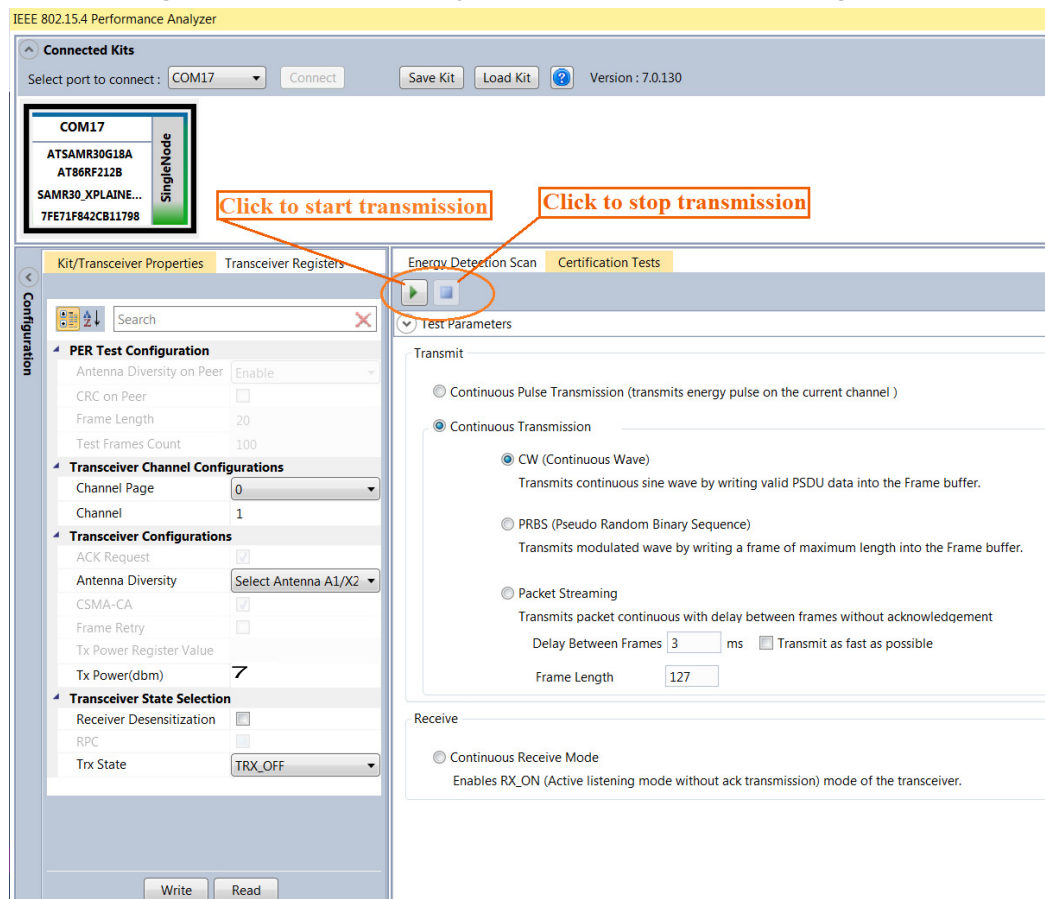


Figure.16 Performance Analyzer – Continuous Tx mode configuration



## 10. Tx Test Modes:

### 10.1. Tx Test (Single node / CW) for Sub-1GHz FCC Testing:

#### 10.1.1. Operating mode #1: BPSK-40-ALT , 40kbps, 7dBm:

Connect and test the DUT in single test mode as mentioned in [Section-9](#) with the following configuration,

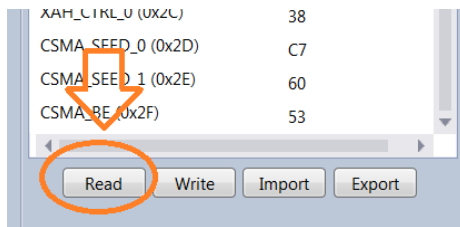
Performance Analyzer Parameter	Setting
Channel Page	0
Channel	1 to 10
Antenna Diversity	Select Antenna A1/X2
Tx Power(dBm)	7
Receiver Desensitization	- (Unchecked)
Trx State	TRX_OFF
TRX_CTRL_2 (0xC)	B4

The screenshot displays the software interface for configuring a SingleNode kit (COM158). The 'Transceiver Registers' tab is selected, showing various configuration options. The 'Transmit' section is expanded, showing 'Continuous Transmission' selected with 'CW (Continuous Wave)' as the waveform. The 'Receive' section shows 'Continuous Receive Mode' selected.

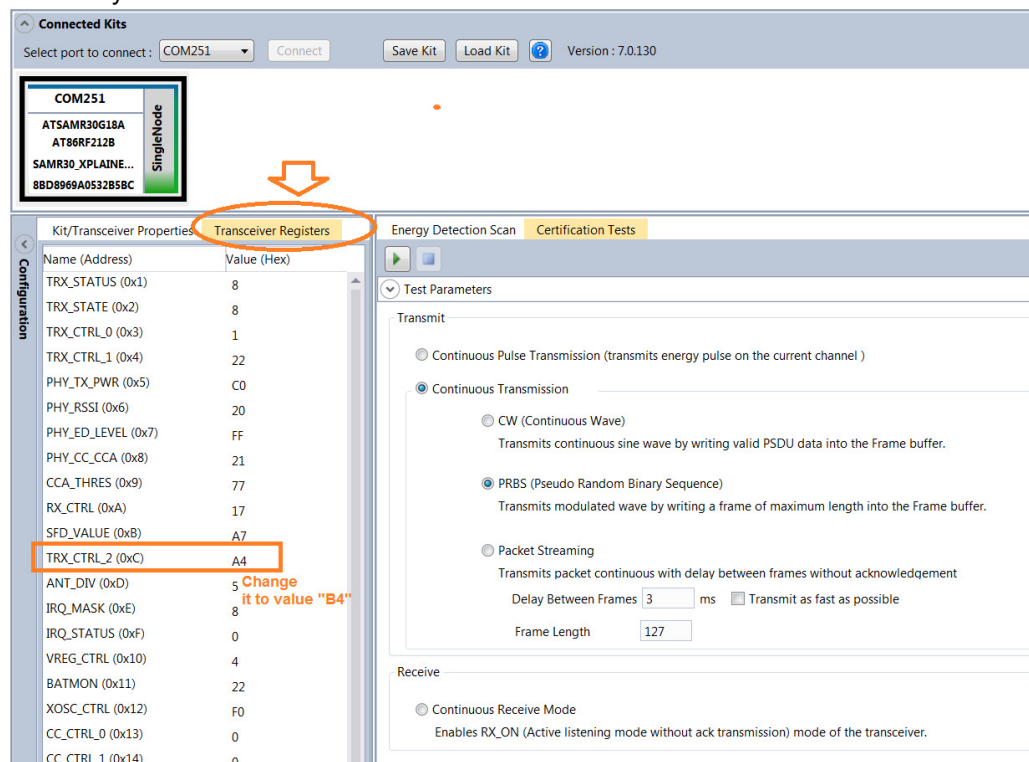
- With the above setting click “write” icon and go to “Transceiver Registers” tab.

The screenshot shows the 'Transceiver Registers' tab selected. A red arrow points to the 'Write' icon. The 'Transceiver Registers' table is visible, showing registers like TRX\_STATUS, TRX\_STATE, TRX\_CTRL\_0, TRX\_CTRL\_1, and TRX\_CTRL\_2.

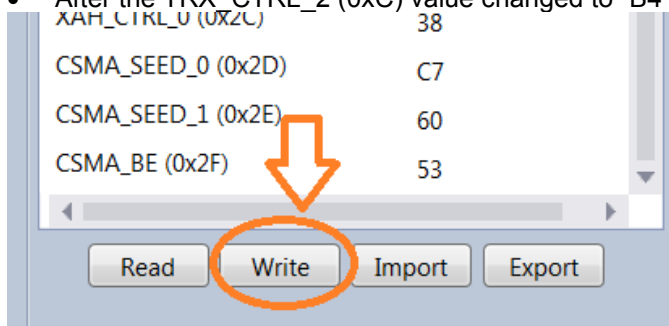
- At the bottom corner, there is an icon called “Read”, click it.



- Then Change the register value of TRX\_CTRL\_2 (0xC) to “B4” as shown in the below image and press ‘Enter’ in keyboard



- After the TRX\_CTRL\_2 (0xC) value changed to “B4”, click the “Write” icon and do the test.



**Important Note:** Everytime when you change the channel or power or channel page, we need to change the TRX\_CTRL\_2 register value to “B4”.

### 10.1.2. Operating mode #2: OQPSK-SIN-250, 250kbps, 7dBm:

Connect and test the DUT in single test mode as mentioned in [Section-9](#) with the following configuration,

Performance Analyzer Parameter	Setting
Channel Page	2
Channel	1 to 10
Antenna Diversity	Select Anetnna A1/X2
Tx Power(dBm)	7
Receiver Desensitization	- (Unchecked)
Trx State	TRX_OFF

**Connected Kits**  
 Select port to connect : COM158 [Connect] [Save Kit] [Load Kit] [?] Version : 7.0.130

**COM158**  
 ATSAMR30G18A  
 AT86RF212B  
 SAMR30\_XPLAINE...  
 A4AA67A0E7EB4F7C [SingleNode]

**Kit/Transceiver Properties** | Transceiver Registers

Search [X]

**PER Test Configuration**

- Antenna Diversity on Peer: Enable
- CRC on Peer:
- Frame Length: 20
- Test Frames Count: 100

**Transceiver Channel Configurations**

- Channel Page: 2
- Channel: 1

**Transceiver Configurations**

- ACK Request:
- Antenna Diversity: Select Antenna A1/X2
- CSMA-CA:
- Frame Retry:
- Tx Power Register Value: [ ]
- Tx Power(dBm): 7

**Transceiver State Selection**

- Receiver Desensitization:
- RPC:
- Trx State: TRX\_OFF

**Channel Page**  
 Current channel Page used by the Transceiver.  
 Channel Pages :  
 0 : 20khns(Channel 0) 40khns(Channel 1-10)

[Write] [Read]

**Energy Detection Scan** | **Certification Tests**

Test Parameters

Transmit

- Continuous Pulse Transmission (transmits energy pulse on the current channel )
- Continuous Transmission
  - CW (Continuous Wave)  
Transmits continuous sine wave by writing valid PSDU data into the Frame buffer.
  - PRBS (Pseudo Random Binary Sequence)  
Transmits modulated wave by writing a frame of maximum length into the Frame buffer.
  - Packet Streaming  
Transmits packet continuous with delay between frames without acknowledgement  
Delay Between Frames: 3 ms  Transmit as fast as possible  
Frame Length: 127

Receive

- Continuous Receive Mode  
Enables RX\_ON (Active listening mode without ack transmission) mode of the transceiver.

### 10.1.3. Operating mode #3: OQPSK-SIN-1000-SCR-ON , 1Mbps, 7dBm:

Connect and test the DUT in single test mode as mentioned in [Section-9](#) with the following configuration,

Performance Analyzer Parameter	Setting
Channel Page	17
Channel	1 to 10
Antenna Diversity	Select Anetnna A1/X2
Tx Power(dBm)	7
Receiver Desensitization	- (Unchecked)
Trx State	TRX_OFF

#### IEEE 802.15.4 Performance Analyzer

The screenshot displays the IEEE 802.15.4 Performance Analyzer software interface. At the top, it shows 'Connected Kits' with a dropdown menu set to 'COM251' and buttons for 'Connect', 'Save Kit', 'Load Kit', and a help icon. The version is noted as 7.0.130.

The main configuration area is divided into several sections:

- Kit/Transceiver Properties:** Includes a search bar and a 'Configuration' sidebar.
- PER Test Configuration:**
  - Antenna Diversity on Peer: Enable
  - CRC on Peer:
  - Frame Length: 20
  - Test Frames Count: 100
- Transceiver Channel Configurations:**
  - Channel Page: 17
  - Channel: 1
- Transceiver Configurations:**
  - ACK Request:
  - Antenna Diversity: Select Antenna A1/X2
  - CSMA-CA:
  - Frame Retry:
  - Tx Power Register Value: 7
- Transceiver State Selection:**
  - Receiver Desensitization:
  - RPC:
  - Trx State: TRX\_OFF

At the bottom of the configuration area, there are 'Write' and 'Read' buttons.

The right-hand side of the interface shows 'Energy Detection Scan' and 'Certification Tests' tabs. Under 'Test Parameters', the 'Transmit' section is active, showing options for transmission modes:

- Continuous Pulse Transmission (transmits energy pulse on the current channel)
- Continuous Transmission
  - CW (Continuous Wave)
    - Transmits continuous sine wave by writing valid PSDU data into the Frame buffer.
  - PRBS (Pseudo Random Binary Sequence)
    - Transmits modulated wave by writing a frame of maximum length into the Frame buffer.
  - Packet Streaming
    - Transmits packet continuous with delay between frames without acknowledgement
    - Delay Between Frames: 3 ms  Transmit as fast as possible
    - Frame Length: 127

The 'Receive' section is currently inactive, showing the option for 'Continuous Receive Mode'.

## 10.2. Tx Test (Single node / CW) for Sub-1GHz CE Testing

### 10.2.1. Operating Mode#4: BPSK-20, 20kbps, 7dBm:

Connect and test the DUT in single test mode as mentioned in [Section-9](#) with the following configuration,

Performance Analyzer Parameter	Setting
Channel Page	0
Channel	0
Antenna Diversity	Select Anetnna A1/X2
Tx Power(dBm)	7
Receiver Desensitization	- (Unchecked)
Trx State	TRX_OFF

**Connected Kits**  
 Select port to connect: COM158 [Connect] [Save Kit] [Load Kit] [?] Version: 7.0.130

**Kit/Transceiver Properties**

Search

**PER Test Configuration**

- Antenna Diversity on Peer: Enable
- CRC on Peer:
- Frame Length: 20
- Test Frames Count: 100

**Transceiver Channel Configurations**

- Channel Page: 0
- Channel: 0

**Transceiver Configurations**

- ACK Request:
- Antenna Diversity: Select Antenna A1/X2
- CSMA-CA:
- Frame Retry:
- Tx Power Register Value: [ ]
- Tx Power(dBm): 7

**Transceiver State Selection**

- Receiver Desensitization:
- RPC:
- Trx State: TRX\_OFF

**Channel**  
 The current 802.15.4 channel in which the Performance test is running. Valid range is 0 to 10.

[Write] [Read]

**Energy Detection Scan / Certification Tests**

Test Parameters

**Transmit**

- Continuous Pulse Transmission (transmits energy pulse on the current channel)
- Continuous Transmission
  - CW (Continuous Wave)  
Transmits continuous sine wave by writing valid PSDU data into the Frame buffer.
  - PRBS (Pseudo Random Binary Sequence)  
Transmits modulated wave by writing a frame of maximum length into the Frame buffer.
  - Packet Streaming  
Transmits packet continuous with delay between frames without acknowledgement  
Delay Between Frames: 3 ms  Transmit as fast as possible  
Frame Length: 127

**Receive**

- Continuous Receive Mode  
Enables RX\_ON (Active listening mode without ack transmission) mode of the transceiver.

## 10.2.2. Operating Mode#5: OQPSK-SIN-RC-100, 100kbps, 7dBm:

Connect and test the DUT in single test mode as mentioned in [Section-9](#) with the following configuration,

Performance Analyzer Parameter	Setting
Channel Page	2
Channel	0
Antenna Diversity	Select Antenna A1/X2
Tx Power(dBm)	7
Receiver Desensitization	- (Unchecked)
Trx State	TRX_OFF

**Connected Kits**  
 Select port to connect: COM158     Version : 7.0.130

**COM158**  
 ATSAMR30G18A  
 AT86RF212B  
 SAMR30\_XPLAINE...  
 A4AA67A0E7EB4F7C SingleNode

**Configuration**

**Kit/Transceiver Properties** | Transceiver Registers

Search

**PER Test Configuration**

- Antenna Diversity on Peer: Enable
- CRC on Peer:
- Frame Length: 20
- Test Frames Count: 100

**Transceiver Channel Configurations**

- Channel Page: 2
- Channel: 0

**Transceiver Configurations**

- ACK Request:
- Antenna Diversity: Select Antenna A1/X2
- CSMA-CA:
- Frame Retry:
- Tx Power Register Value: [ ]
- Tx Power(dbm): 7

**Transceiver State Selection**

- Receiver Desensitization:
- RPC:
- Trx State: TRX\_OFF

**Channel Page**  
 Current channel Page used by the Transceiver.  
 Channel Pages :  
 0 : 20kbps(Channel 0) 40kbps(Channel 1-10)

**Energy Detection Scan** | Certification Tests

**Test Parameters**

**Transmit**

- Continuous Pulse Transmission (transmits energy pulse on the current channel )
- Continuous Transmission
  - CW (Continuous Wave)  
Transmits continuous sine wave by writing valid PSDU data into the Frame buffer.
  - PRBS (Pseudo Random Binary Sequence)  
Transmits modulated wave by writing a frame of maximum length into the Frame buffer.
  - Packet Streaming  
Transmits packet continuous with delay between frames without acknowledgement  
Delay Between Frames: 3 ms  Transmit as fast as possible  
Frame Length: 127

**Receive**

- Continuous Receive Mode  
Enables RX\_ON (Active listening mode without ack transmission) mode of the transceiver.



## 11. Connecting kit in Tx-Rx Test mode (Transmit and Receive test):

- 11.1. Connect two devices with PC by USB cables and so both are power up.
- 11.2. Select one COM Port and click 'connect' the device corresponding to that COM port is connected and select "Initiate Peer Search" So other device connect by RF (RF Pairing). (Device connected to COM Port is transmitter and other device is receiver)

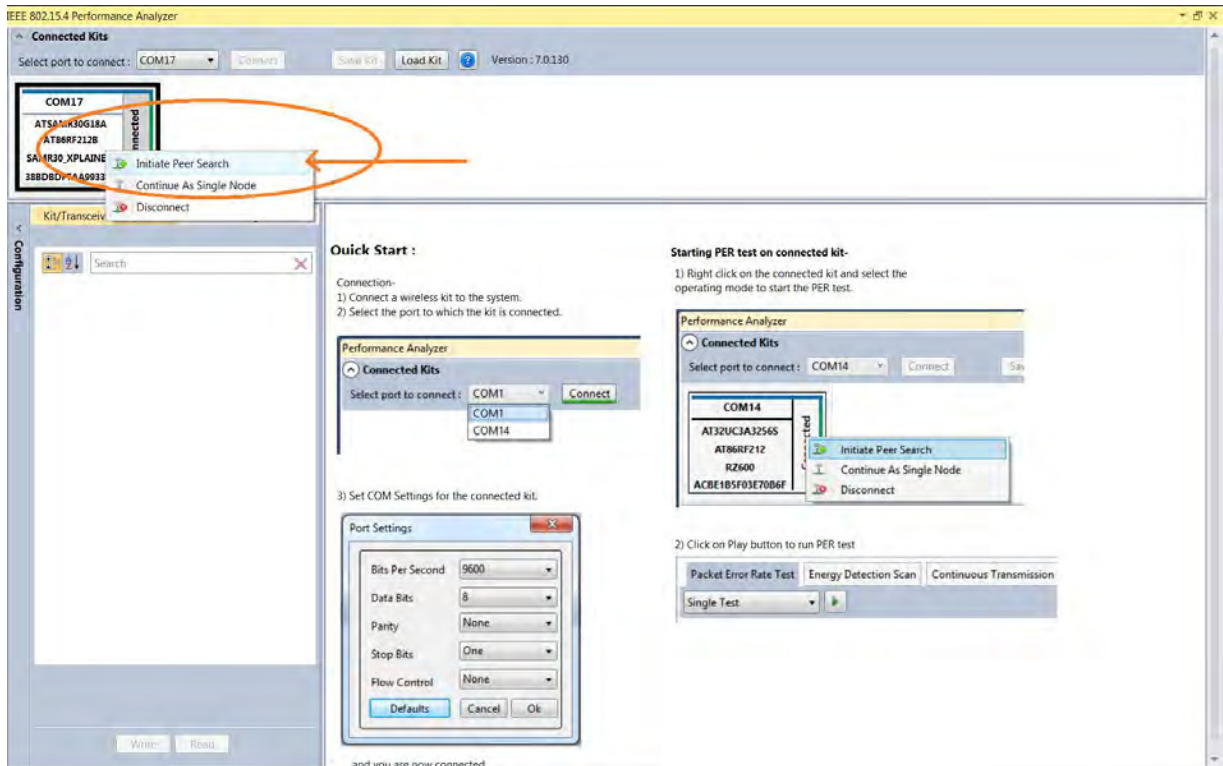


Figure 21: Performance Analyzer – Pairing devices

- 11.3. When both the devices are paired, the following window appears and it is ready to perform PER (Packet Error Rate) test. Transmitting channel, number of frames (packets), Tx Power value can be configured from the left side of the window.

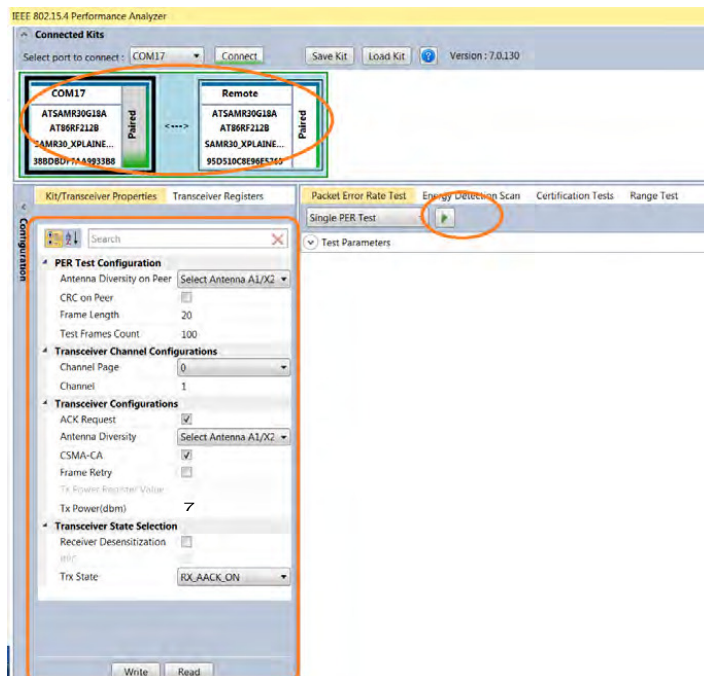


Figure 22: Performance Analyzer – PER Test Configuration

11.4. PER test is Transmit and Receive test. Number of transmit packets can be set by changing “Test Frames Count”

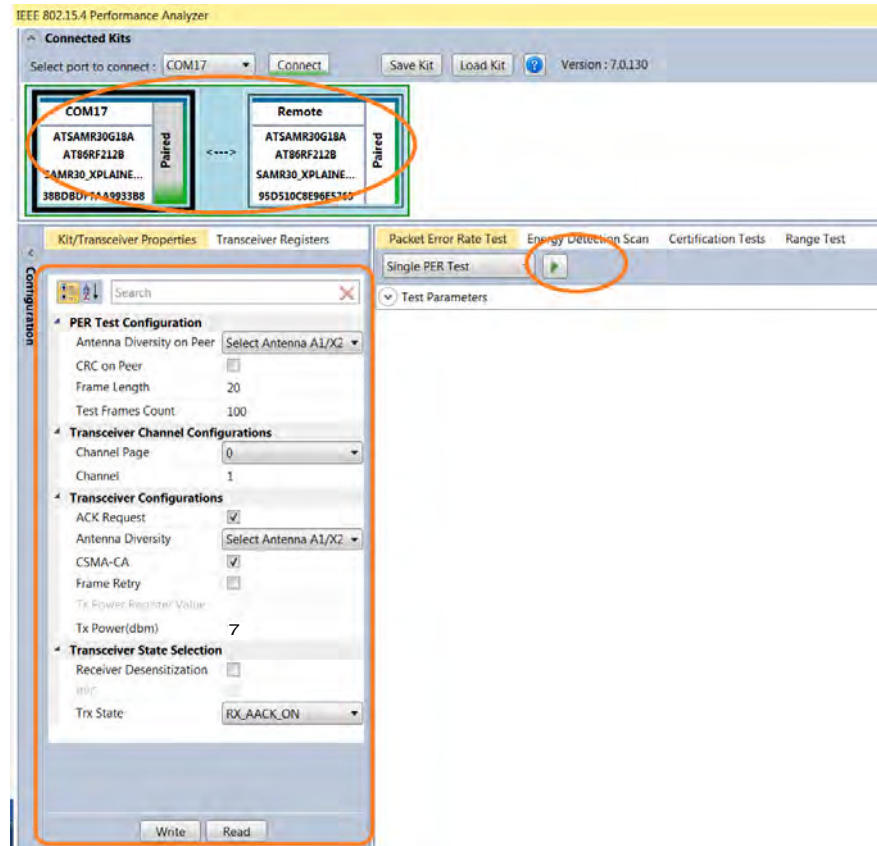


Figure 23: Performance Analyzer – Transmit Packets

11.5. Run Single PER Test. Test parameter window display the Transmit packets (Frames transmitted), Receive packets (Frames received) and RSSI (receive signal strength)

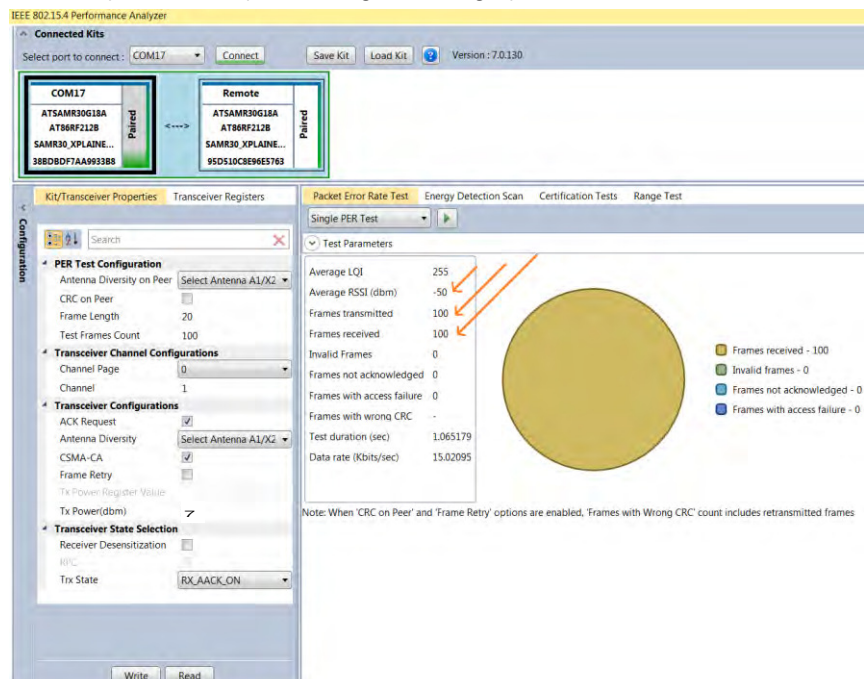


Figure 24: Performance Analyzer – PER Test

## 12. TRX Test Modes:

### 12.1.1. Tx-Rx Test (Transmit and Receive test) for Sub-1GHz FCC Testing

### 12.1.2. Tx-Rx Test - Operating mode #1 : BPSK-40-ALT , 40kbps, 7dBm:

Connect and test the DUT in single test mode as mentioned in [Section-11](#) with the following configuration,

Performance Analyzer Parameter	Setting
Antenna Diversity on Peer	Select Anetnna A1/X2
CRC on Peer	- (Unchecked)
Frame Length	20
Test Frame Count	100
Channel Page	0
Channel	1 to 10
ACK Request	Checked
Antenna Diversity	Select Anetnna A1/X2
CSMA-CA	Checked
Frame Retry	- (Unchecked)
Tx Power(dBm)	7
Receiver Desensitization	- (Unchecked)
Trx State	RX_AACK_ON
TRX_CTRL_2 (0xC)	B4

**Connected Kits**  
 Select port to connect: COM158     Version : 7.0.130

**Configuration**

**PER Test Configuration**

- Antenna Diversity on Peer: Select Antenna A1/X2
- CRC on Peer:
- Frame Length: 20
- Test Frames Count: 100

**Transceiver Channel Configurations**

- Channel Page: 0
- Channel: 1

**Transceiver Configurations**

- ACK Request:
- Antenna Diversity: Select Antenna A1/X2
- CSMA-CA:
- Frame Retry:
- Tx Power Register Value: 7

**Transceiver State Selection**

- Receiver Desensitization:
- RPC:
- Trx State: RX\_AACK\_ON

**Tx Power(dbm)**  
 Transceiver TX power value in dBm. Valid range is -25 to 11.

**Packet Error Rate Test** | Energy Detection Scan | Certification Tests | Range Test

Single PER Test

**Test Parameters**

Average LQI	255
Average RSSI (dbm)	-76
Frames transmitted	100
Frames received	100
Invalid Frames	0
Frames not acknowledged	0
Frames with access failure	0
Frames with wrong CRC	-
Test duration (sec)	1.04176
Data rate (Kbits/sec)	15.35862

**Legend:**

- Frames received - 100
- Invalid frames - 0
- Frames not acknowledged - 0
- Frames with access failure - 0

Note: When 'CRC on Peer' and 'Frame Retry' options are enabled, 'Frames with Wrong CRC' count includes retransmitted frames

- With the above setting click “write” icon and go to “Transceiver Registers” tab.

#### IEEE 802.15.4 Performance Analyzer

Connected Kits

Select port to connect : COM251 Connect Save Kit Load Kit ? Version : 7.0.13

Kit	Model	Status
COM251	ATSAMR30G18A AT86RF212B SAMR30_XPLAINE... 7E1731037809B95C	Paired
Remote	ATSAMR30G18A AT86RF212B SAMR30_XPLAINE... F102FC50D3629C83	Paired

Kit/Transceiver Properties **Transceiver Registers** Packet: Error Rate Test Energy Detection Sc

Name (Address)	Value (Hex)
TRX_STATUS (0x1)	16
TRX_STATE (0x2)	16
TRX_CTRL_0 (0x3)	1
TRX_CTRL_1 (0x4)	22
PHY_TX_PWR (0x5)	C1
PHY_RSSI (0x6)	80

Single PER Test ▶

Test Parameters

- At the bottom corner, there is an icon called “Read”, click it.

XAH_CTRL_0 (0x2C)	38
CSMA_SEED_0 (0x2D)	C7
CSMA_SEED_1 (0x2E)	60
CSMA_BE (0x2F)	53

Read Write Import Export

- Then Change the register value of TRX\_CTRL\_2 (0xC) to “B4” as shown in the below image and press ‘Enter’ in keyboard

Connected Kits

Select port to connect: COM251 Connect Save Kit Load Kit ? Version : 7.0.130

**COM251**

ATSAMR30G18A  
AT86RF212B  
SAMR30\_XPLAINE...  
8BD8969A0532B5BC

SingleNode

↓

Kit/Transceiver Properties		Transceiver Registers	Energy Detection Scan	Certification Tests
Name (Address)	Value (Hex)			
TRX_STATUS (0x1)	8			
TRX_STATE (0x2)	8			
TRX_CTRL_0 (0x3)	1			
TRX_CTRL_1 (0x4)	22			
PHY_TX_PWR (0x5)	C0			
PHY_RSSI (0x6)	20			
PHY_ED_LEVEL (0x7)	FF			
PHY_CC_CCA (0x8)	21			
CCA_THRES (0x9)	77			
RX_CTRL (0xA)	17			
SFD_VALUE (0xB)	A7			
TRX_CTRL_2 (0xC)	A4			
ANT_DIV (0xD)	5	Change it to value "B4"		
IRQ_MASK (0xE)	8			
IRQ_STATUS (0xF)	0			
VREG_CTRL (0x10)	4			
BATMON (0x11)	22			
XOSC_CTRL (0x12)	F0			
CC_CTRL_0 (0x13)	0			
CC_CTRL_1 (0x14)	n			

Test Parameters

Transmit

Continuous Pulse Transmission (transmits energy pulse on the current channel)

Continuous Transmission

CW (Continuous Wave)  
Transmits continuous sine wave by writing valid PSDU data into the Frame buffer.

PRBS (Pseudo Random Binary Sequence)  
Transmits modulated wave by writing a frame of maximum length into the Frame buffer.

Packet Streaming  
Transmits packet continuous with delay between frames without acknowledgement

Delay Between Frames  ms  Transmit as fast as possible

Frame Length

Receive

Continuous Receive Mode  
Enables RX\_ON (Active listening mode without ack transmission) mode of the transceiver.

- After the TRX\_CTRL\_2 (0xC) value changed to "B4", click the "Write" icon and do the test.

TRX_CTRL_2 (0xC)	38
CSMA_SEED_0 (0x2D)	C7
CSMA_SEED_1 (0x2E)	60
CSMA_BE (0x2F)	53

↓

Read Write Import Export

**Important Note:** Everytime when you change the channel or power or channel page, we need to change the TRX\_CTRL\_2 register value to "B4".

### 12.1.3. Tx-Rx Test - Operating mode #2: OQPSK-SIN-250, 250kbps, 7dBm:

Connect and test the DUT in single test mode as mentioned in [Section-11](#) with the following configuration,

Performance Analyzer Parameter	Setting
Antenna Diversity on Peer	Select Antenna A1/X2
CRC on Peer	- (Unchecked)
Frame Length	20
Test Frame Count	100
Channel Page	2
Channel	1 to 10
ACK Request	Checked
Antenna Diversity	Select Antenna A1/X2
CSMA-CA	Checked
Frame Retry	- (Unchecked)
Tx Power(dBm)	7
Receiver Desensitization	- (Unchecked)
Trx State	RX_AACK_ON

The screenshot displays the software interface for a Packet Error Rate Test. At the top, it shows 'Connected Kits' with two kits connected to COM158: a local kit and a remote kit, both labeled 'Paired'. Below this, the 'Configuration' panel is visible, showing 'PER Test Configuration' and 'Transceiver Channel Configurations' matching the table above. The 'Test Parameters' panel shows the following results:

Parameter	Value
Average LQI	244
Average RSSI (dbm)	-74
Frames transmitted	100
Frames received	100
Invalid Frames	0
Frames not acknowledged	0
Frames with access failure	0
Frames with wrong CRC	-
Test duration (sec)	0.367153
Data rate (Kbits/sec)	43.57856

A pie chart on the right shows the distribution of frames: 100 frames received (yellow), 0 invalid frames (green), 0 frames not acknowledged (blue), and 0 frames with access failure (purple). A note at the bottom states: 'Note: When 'CRC on Peer' and 'Frame Retry' options are enabled, 'Frames with Wrong CRC' count includes retransmitted frames'.

### 12.1.4. Tx-Rx Test - Operating mode #3: OQPSK-SIN-1000-SCR-ON, 1Mbps, 7dBm:

Connect and test the DUT in single test mode as mentioned in [Section-11](#) with the following configuration,

Performance Analyzer Parameter	Setting
Antenna Diversity on Peer	Select Anetnna A1/X2
CRC on Peer	- (Unchecked)
Frame Length	20
Test Frame Count	100
Channel Page	17
Channel	1 to 10
ACK Request	Checked
Antenna Diversity	Select Anetnna A1/X2
CSMA-CA	Checked
Frame Retry	- (Unchecked)
Tx Power(dBm)	7
Receiver Desensitization	- (Unchecked)
Trx State	RX_AACK_ON

The screenshot displays the IEEE 802.15.4 Performance Analyzer software interface. At the top, it shows the connection setup with 'COM251' selected as the port to connect. Below this, two device cards are shown as 'Paired': 'COM251' (ATSAMR30G18A, AT86RF212B, SAMR30\_XPLAINE..., 2C90A2776B820B1C) and 'Remote' (ATSAMR30G18A, AT86RF212B, SAMR30\_XPLAINE..., 796108E5C892F4E9).

The main configuration area is divided into several sections:

- PER Test Configuration:** Antenna Diversity on Peer (Select Antenna A1/X2), CRC on Peer (unchecked), Frame Length (20), Test Frames Count (100).
- Transceiver Channel Configurations:** Channel Page (17, highlighted with an orange box), Channel (1).
- Transceiver Configurations:** ACK Request (checked), Antenna Diversity (Select Antenna A1/X2), CSMA-CA (checked), Frame Retry (unchecked), Tx Power Register Value (7).
- Transceiver State Selection:** Receiver Desensitization (unchecked), RPC (unchecked), Trx State (RX\_AACK\_ON).

The 'Tx Power(dBm)' is set to 7. Below the configuration, there are 'Write' and 'Read' buttons.

On the right side, the 'Packet Error Rate Test' results are displayed:

- Average LQI: 254
- Average RSSI (dbm): -40
- Frames transmitted: 100
- Frames received: 100
- Invalid Frames: 0
- Frames not acknowledged: 0
- Frames with access failure: 0
- Frames with wrong CRC: -
- Test duration (sec): 0.273189
- Data rate (Kbits/sec): 58.56751

A large yellow circle represents the test results. A legend on the right indicates:

- Yellow circle: Frames received - 100
- Green circle: Invalid frames - 0
- Blue circle: Frames not acknowledged - 0
- Dark blue circle: Frames with access failure - 0

Note: When 'CRC on Peer' and 'Frame Retry' options are enabled, 'Frames with Wrong CRC' count includes retransmitted frames.

## 12.2. Tx-Rx Test (Transmit and Receive test) for Sub-1GHz CE Testing

### 12.2.1. Tx-Rx Test - Operating Mode#4: BPSK-20, 20kbps, 7dBm:

Connect and test the DUT in single test mode as mentioned in [Section-11](#) with the following configuration,

Performance Analyzer Parameter	Setting
Antenna Diversity on Peer	Select Antenna A1/X2
CRC on Peer	- (Unchecked)
Frame Length	20
Test Frame Count	100
Channel Page	0
Channel	0
ACK Request	Checked
Antenna Diversity	Select Antenna A1/X2
CSMA-CA	Checked
Frame Retry	- (Unchecked)
Tx Power(dBm)	7
Receiver Desensitization	- (Unchecked)
Trx State	RX_AACK_ON

**Connected Kits**

Select port to connect : COM158    Version : 7.0.130

**COM158** (Paired) ↔ **Remote** (Paired)

**Configuration**

- PER Test Configuration**
  - Antenna Diversity on Peer: Select Antenna A1/X2
  - CRC on Peer:
  - Frame Length: 20
  - Test Frames Count: 100
- Transceiver Channel Configurations**
  - Channel Page: 0
  - Channel: 0
- Transceiver Configurations**
  - ACK Request:
  - Antenna Diversity: Select Antenna A1/X2
  - CSMA-CA:
  - Frame Retry:
  - Tx Power Register Value: 7
  - Tx Power(dBm): 7
- Transceiver State Selection**
  - Receiver Desensitization:
  - RPC:
  - Trx State: RX\_AACK\_ON

**Channel**

The current 802.15.4 channel in which the Performance test is running. Valid range is 0 to 10.

**Packet Error Rate Test** | Energy Detection Scan | Certification Tests | Range Test

Single PER Test

**Test Parameters**

Average LQI	255
Average RSSI (dbm)	-76
Frames transmitted	100
Frames received	100
Invalid Frames	0
Frames not acknowledged	0
Frames with access failure	0
Frames with wrong CRC	-
Test duration (sec)	2.046062
Data rate (Kbits/sec)	7.8199

Legend:

- Frames received - 100
- Invalid frames - 0
- Frames not acknowledged - 0
- Frames with access failure - 0

Note: When 'CRC on Peer' and 'Frame Retry' options are enabled, 'Frames with Wrong CRC' count includes retransmitted frames



## 12.2.2. Tx-RxTest - Operating Mode#5: OQPSK-SIN-RC-100, 100kbps,7dBm:

Connect and test the DUT in single test mode as mentioned in [Section-11](#) with the following configuration,

Performance Analyzer Parameter	Setting
Antenna Diversity on Peer	Select Anetnna A1/X2
CRC on Peer	- (Unchecked)
Frame Length	20
Test Frame Count	100
Channel Page	2
Channel	0
ACK Request	Checked
Antenna Diversity	Select Anetnna A1/X2
CSMA-CA	Checked
Frame Retry	- (Unchecked)
Tx Power(dBm)	7
Receiver Desensitization	- (Unchecked)
Trx State	RX_AACK_ON

IEEE 802.15.4 Performance Analyzer

Connected Kits

Select port to connect : COM158     Version : 7.0.130

**COM158**

ATSAMR30G18A  
AT86RF212B  
SAMR30\_XPLAINE...  
A4AA67A0E7EB4F7C

Paired

<--->

**Remote**

ATSAMR30G18A  
AT86RF212B  
SAMR30\_XPLAINE...  
996B0DD60FC7CA58

Paired

---

Kit/Transceiver Properties

Configuration

Search

**PER Test Configuration**

Antenna Diversity on Peer

CRC on Peer

Frame Length

Test Frames Count

**Transceiver Channel Configurations**

Channel Page

Channel

**Transceiver Configurations**

ACK Request

Antenna Diversity

CSMA-CA

Frame Retry

Tx Power Register Value

Tx Power(dBm)

**Transceiver State Selection**

Receiver Desensitization

RPC

Trx State

**Channel Page**

Current channel Page used by the Transceiver.

Channel Pages :

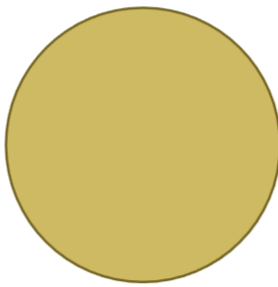
0 - 20khps(Channel 0) 40khps(Channel 1-10)

Packet Error Rate Test

Single PER Test

Test Parameters

Average LQI	254
Average RSSI (dbm)	-79
Frames transmitted	100
Frames received	100
Invalid Frames	0
Frames not acknowledged	0
Frames with access failure	0
Frames with wrong CRC	-
Test duration (sec)	0.755614
Data rate (Kbits/sec)	21.17483



- Frames received - 100
- Invalid frames - 0
- Frames not acknowledged - 0
- Frames with access failure - 0

Note: When 'CRC on Peer' and 'Frame Retry' options are enabled, 'Frames with Wrong CRC' count includes retransmitted frames

**FCC Caution:**

Any Changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.

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

This module is intended for OEM integrator. The OEM integrator is still responsible for the FCC compliance requirement of the end product, which integrates this module. The final end product must be labeled in a visible area with the following"  
Contains FCC ID: VM4A092722

**FCC Radiation Exposure Statement:**

This equipment complies with FCC radiation exposure limits set forth for uncontrolled environment .This equipment should be installed and operated with minimum distance 20cm between the radiator& your body. This transmitter must not be co-located or operating in conjunction with any other antenna or transmitter.



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