AN1284: RS9116W Throughput Application Note

Version 1.2

10/12/2020

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1 About this Document

This application note describes how to run throughput application using the WiSeConnect Module.

2 Introduction

This document provides the steps for executing throughput using SPI and USB interfaces. The required hardware and software setup are listed accordingly.

Note:

This example is applicable to WiSeConnect™. The feature(s) used in this example may or may not be available on your part. Refer to the product datasheet to verify the features available.

3 Prerequisites

1. Silicon Labs Product Line EVK: RS9116X-SB-EVK1/RS9116X-DB-EVK1
2. The latest available Silicon Labs RS9116 WiSeConnect firmware loaded onto the RS9116 module in the above EVK (available on the website, link: www.silabs.com/development-tools/wireless/wi-fi/rs9116x-sb-evk-development-kit under Tools & Software tab).
3. TWO LINUX Laptops (this is for USB Interface)
4. Access point
5. iperf application

4 Terminology

1. EVK - Evaluation Kit
2. TCP - Transmission Control Protocol
3. UDP - User Datagram Protocol
4. TX - Transmit
5. RX - Receive

5 Topic: Throughput

5.1 Description

In the context of communication networks, such as Ethernet or wireless, throughput (or network throughput) is the rate of successful message delivery over a communication channel. This application will demonstrate the throughput measurement.

In order to get the maximum possible throughput, configure the module in 384k Mode and enable aggregation using opermode command. For more info on OPERMODE, refer to RS9116W_WiFi_AT_Command_Programming_Reference_Manual(PRM)_vx.x

For SPI Interface, in addition to the above setting, it is recommended to configure the MCU at the best possible SPI Clock, and also to use DMA for SPI communication. Refer Expected results in Throughput application using SPI interface for SPI Clock configuration and throughputs achieved.

6 Execution Steps

6.1 Throughput Application Using SPI Interface

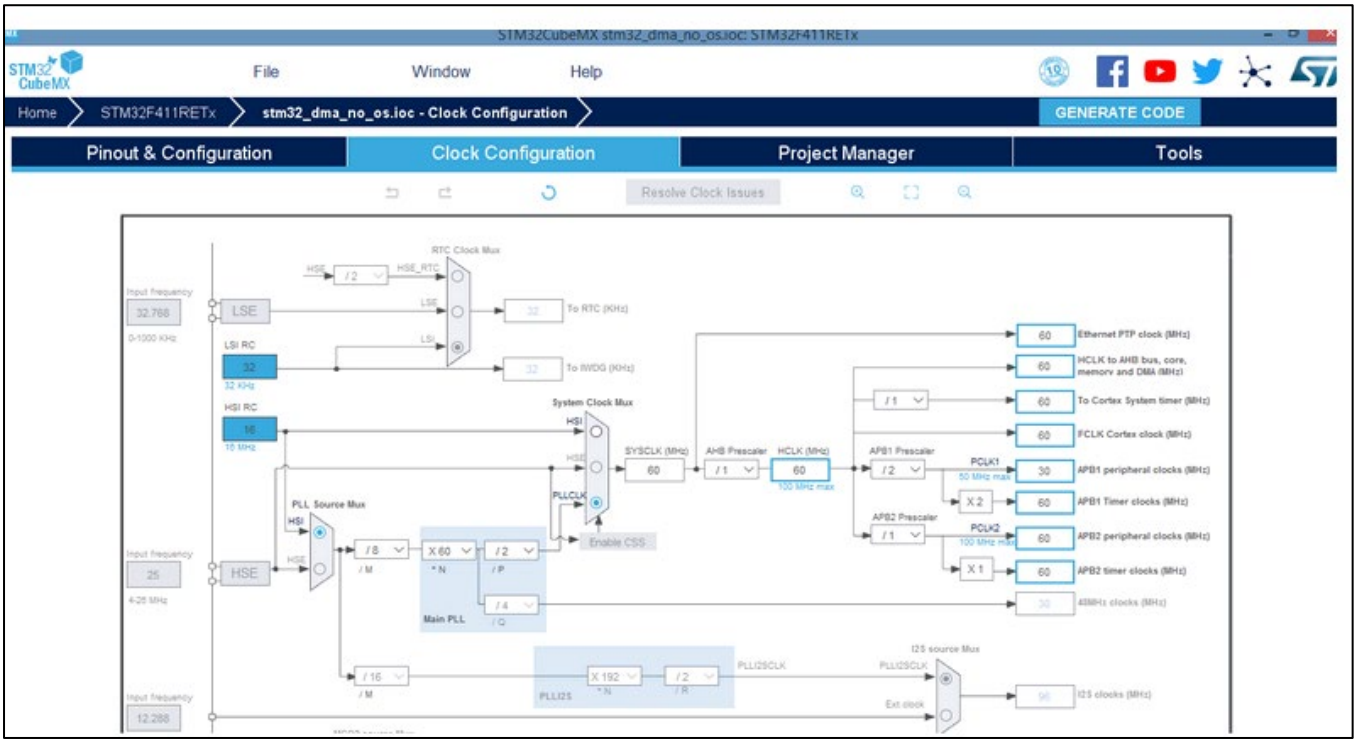
Note:

A reference project for STM32 using the SPI interface is available in the release package.

Refer to **"UG454: RS9116W with STM32 User's Guide" from https://docs.silabs.com/rs9116**

For example, refer to:
"RS9116.NB0.WC.GENR.OSI.x.x.xx\host\platforms\STM32\Reference_Projects\Keil_Baremetal\Projects\SPI\Throughput

1. In order to achieve the best throughput using STM32, operate the MCU at the best possible SPI peripheral clock. This can be configured in project settings.
2. For STM MCUs, the CUBEMX tool is used to generate the project with the required settings.
3. The below image describes the best possible SPI Clock Configurations for STM32



4. If MCU has the provision to configure the hardware chip select, it can be enabled to get better throughput results.

6.2 Expected Results

Note: The below mentioned SPI Clock and Throughput are based on STM32 MCU. The SPI clock configurations may be changed depending on the MCU. For configurations, please refer to the DATASHEET of the respective MCU.

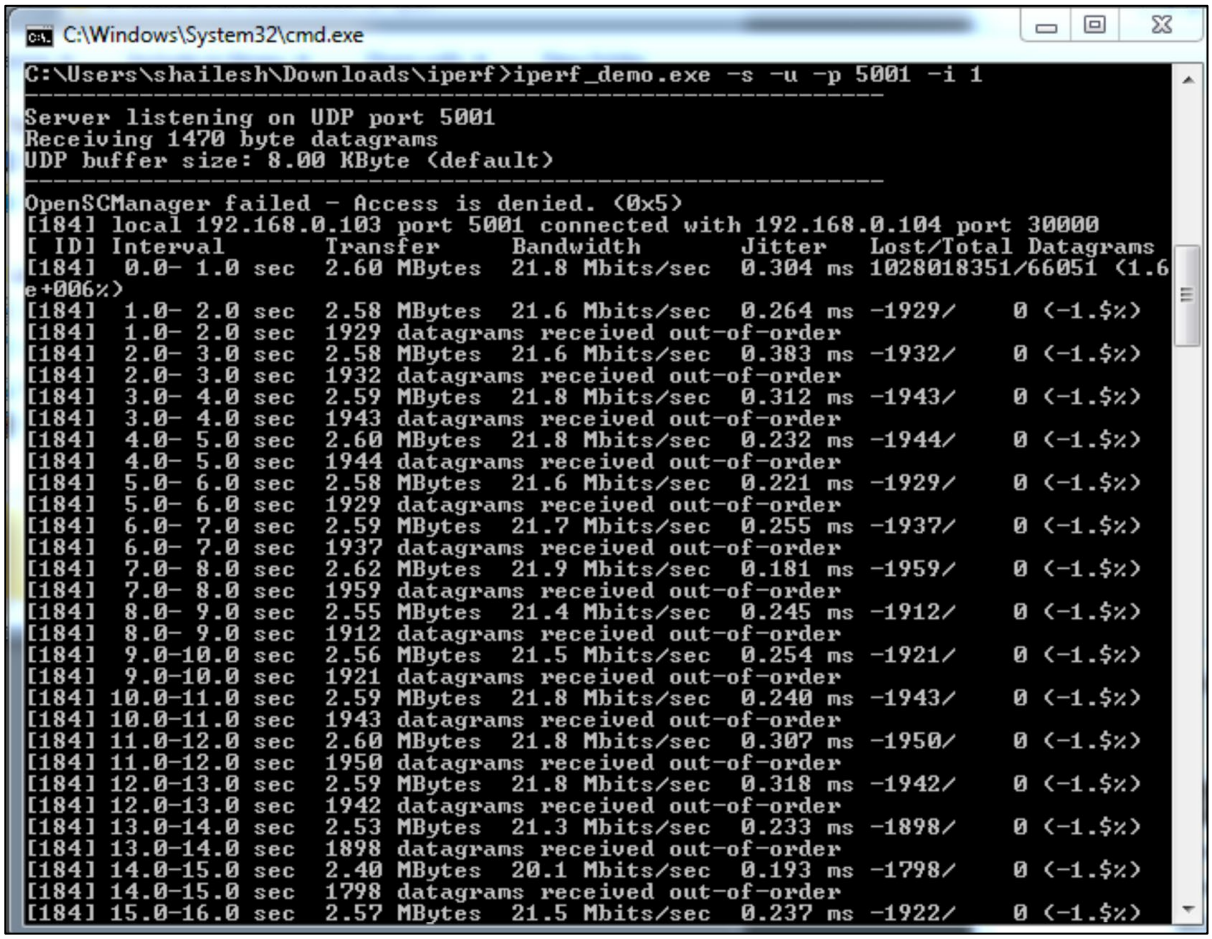
Using the above SPI clock configuration, we can achieve throughputs of up to 20Mbps.

SPI Clock	TCP TX (Mbps)
20Mhz	15
30Mhz	17
40Mhz	20

6.2.1 To measure UDP Tx throughput:

The module should be configured as a UDP client. Open UDP server at the remote port.

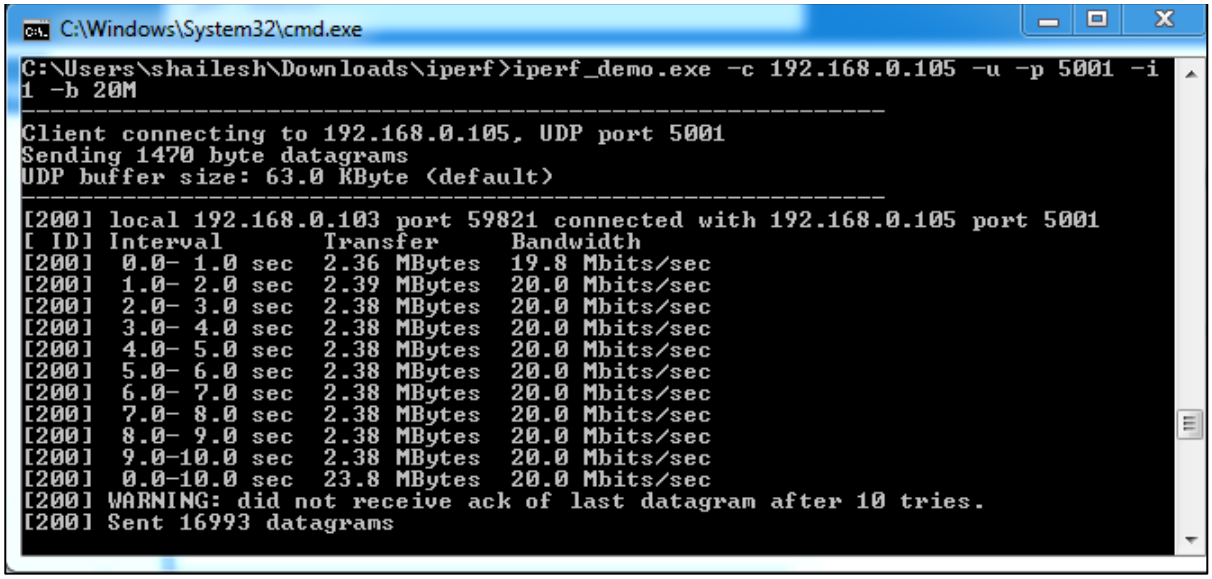
```
iperf.exe -s -u -p <SERVER_PORT> -i 1
```



6.2.2 To measure UDP Rx throughput:

The module should be configured as a UDP server. Open UDP client at the remote port.

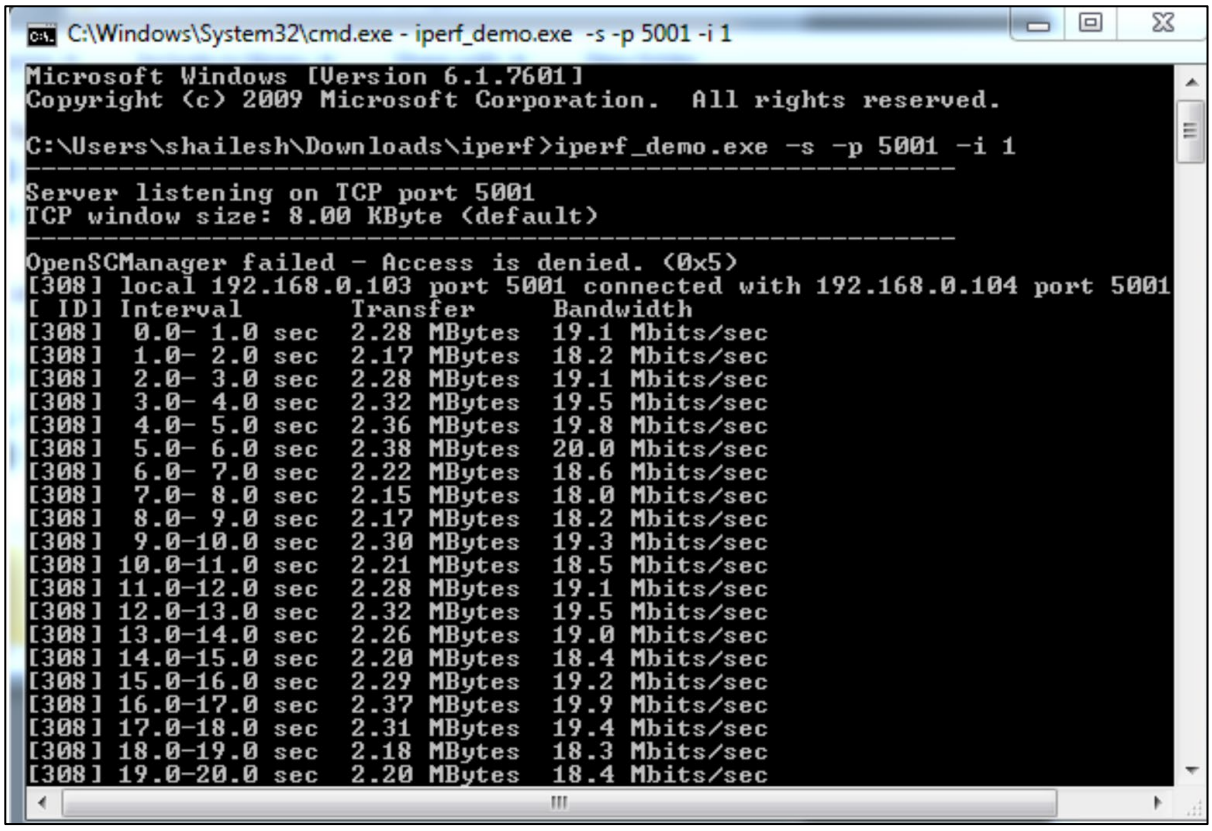
```
iperf.exe -c <Module_IP> -u -p <Module_Port> -i 1 -b <Bandwidth>
```



6.2.3 To measure TCP Tx throughput:

The module should be configured as a TCP client. Open the TCP server at the remote port.

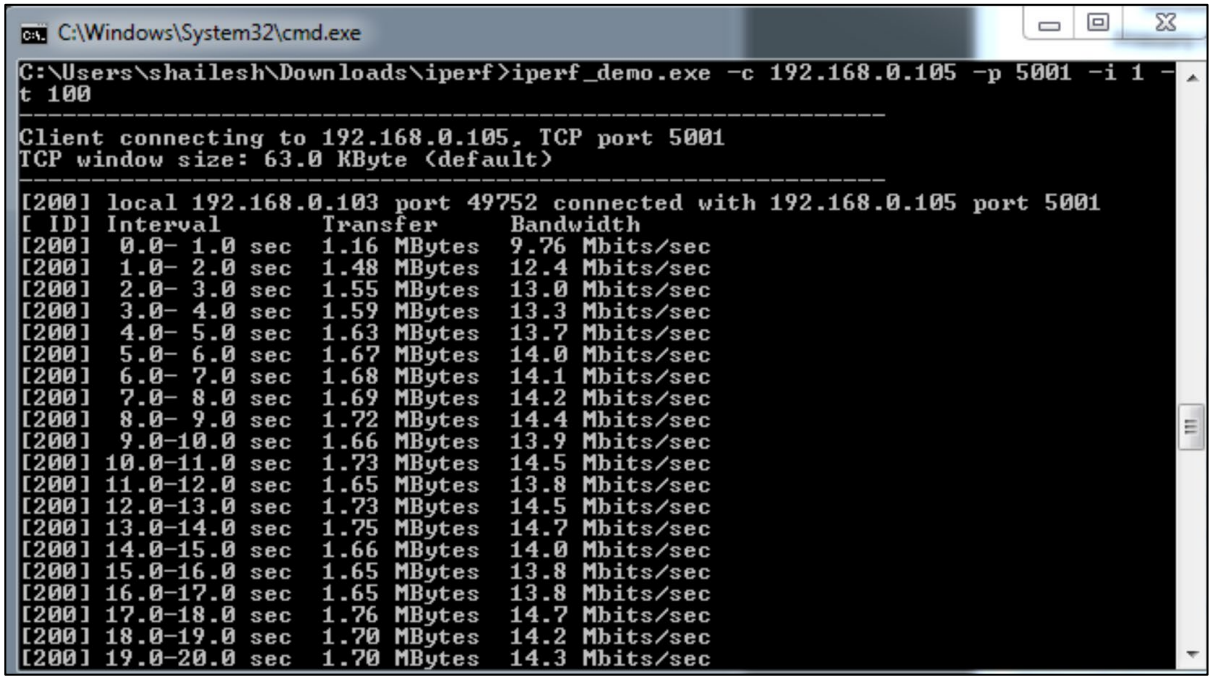
```
iperf.exe -s -p <SERVER_PORT> -i 1
```



6.2.4 To measure TCP Rx throughput:

The module should be configured as a TCP server. Open TCP client at the remote port.

```
iperf.exe -c <Module_IP> -p <module_PORT> -i 1 -t 100
```

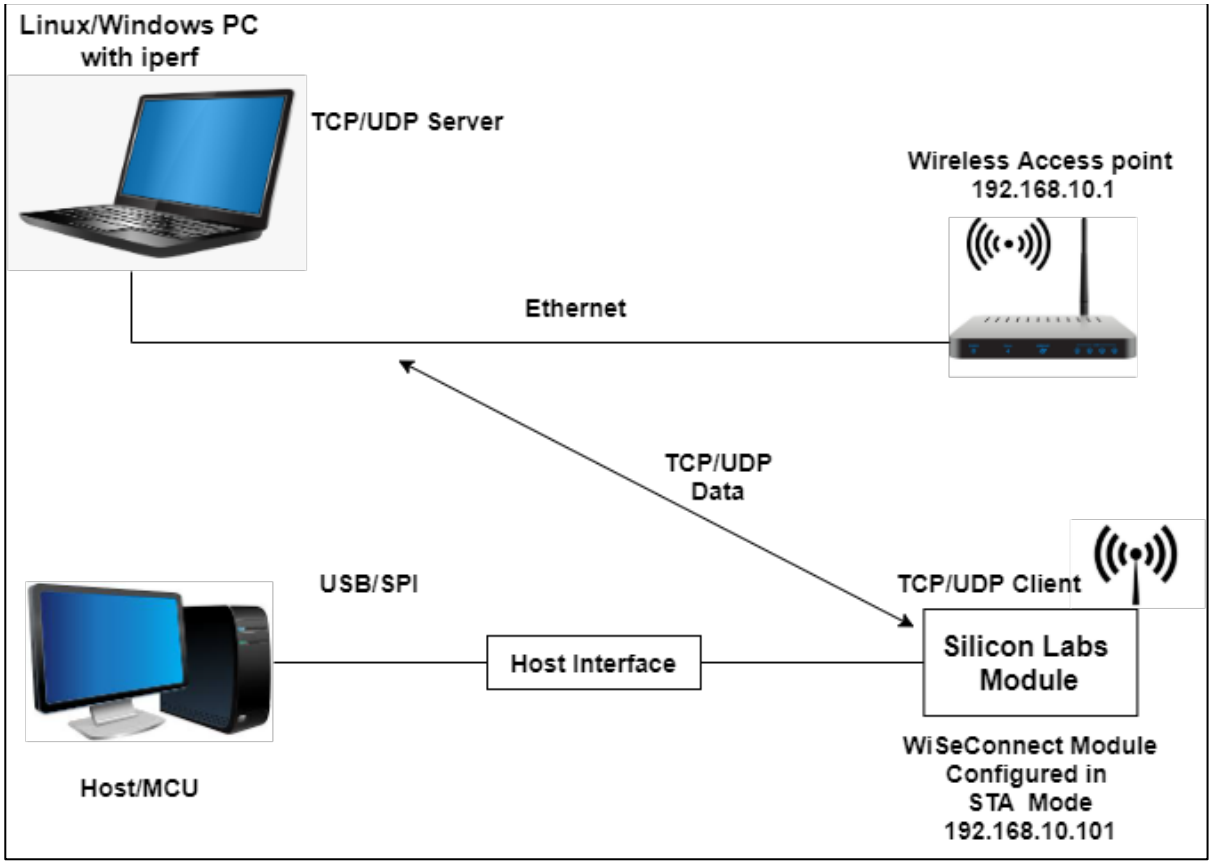


Note:

All the throughput numbers have been measured in an ideal environment. The throughput numbers will vary in other/traffic environments. it will differ based on the host interface speeds, host processor capabilities (CPU frequency, RAM, etc.), wireless medium, physical obstacles, distance, etc. We measured the throughput by running the iperf at the remote peer.

6.3 Throughput Application using USB Interface

1. Upgrade latest firmware(by using the rps file in "**RS9116.NB0.WC.GENR.OSI.x.x.xx\firmware**" folder), then go to the path mentioned "**RS9116.NB0.WC.GENR.OSI.x.x.xx/host/sapis/build/**" and Enable RSI_USB_INTERFACE macro and Disable RSI_UART_INTERFACE macro in Makefile.
2. Next go to the path "**RS9116.NB0.WC.GENR.OSI.x.x.xx/host/sapis/platforms/linux/Driver/common/include**" then change RSI_INTERFACE define to RSI_USB and Disable RSI_TCP_IP_BYPASS macro in rsi_config.h file.
3. Then go to "**RS9116.NB0.WC.GENR.OSI.x.x.xx/host/platforms/linux/Driver/usb/src/**" then **make clean**; **make** and insert the module using "**insmod rpsusb.ko**".
4. If the module is not inserted do "**rmmod rpsusb.ko**", then **make clean**; **make** and again insert the module using "**insmod rpsusb.ko**".
5. For compilation and execution of the application go to example path "**RS9116.NB0.WC.GENR.OSI.x.x.xx/host/sapis/examples/wlan/throughput_app**" and then make necessary changes such as SSID, Security, Channel, PSK, IP configuration and throughput_type in "rsi_throughput_app.c" accordingly with AP and ensure aggregation is enabled in "rsi_wlan_config.h" file.
6. Save the changes then make clean; make, reset the module and run "**./rsi_wc_app**".
7. Run iperf server at the remote side.
8. Run all traffic similarly by changing throughput_type as you required like UDP_Tx, UDP_Rx, TCP_Tx, TCP Rx in the "rsi_throughput_app.c" file.


Linux/Windows PC
with iperf
TCP/UDP Server
Wireless Access point
192.168.10.1
Ethernet
TCP/UDP
Data
USB/SPI
TCP/UDP Client
Host Interface
Silicon Labs
Module
Host/MCU
WiSeConnect Module
Configured in
STA Mode
192.168.10.101

7 Expected Results

The throughput in Station alone mode using USB interface is as shown:

Setup: Netgear R8000,WPA2-PSK-AES

Band	TCP Tx(Mbps)	TCP Rx(Mbps)	UDP Tx(Mbps)	UDP Rx(Mbps)
2.4Ghz	30	22	46	39

Note:

The above throughput numbers are recorded in an ideal environment for 2.4Ghz.

8 Summary

By following the above procedure, we can connect the RS9116 WSC module in station mode and can calculate the maximum throughput by running iperf. Throughput applications are recommended to run while there is minimal traffic.

9 References and Related Documentation

Refer to "**UG454: RS9116W with STM32 User's Guide**" from https://docs.silabs.com/rs9116

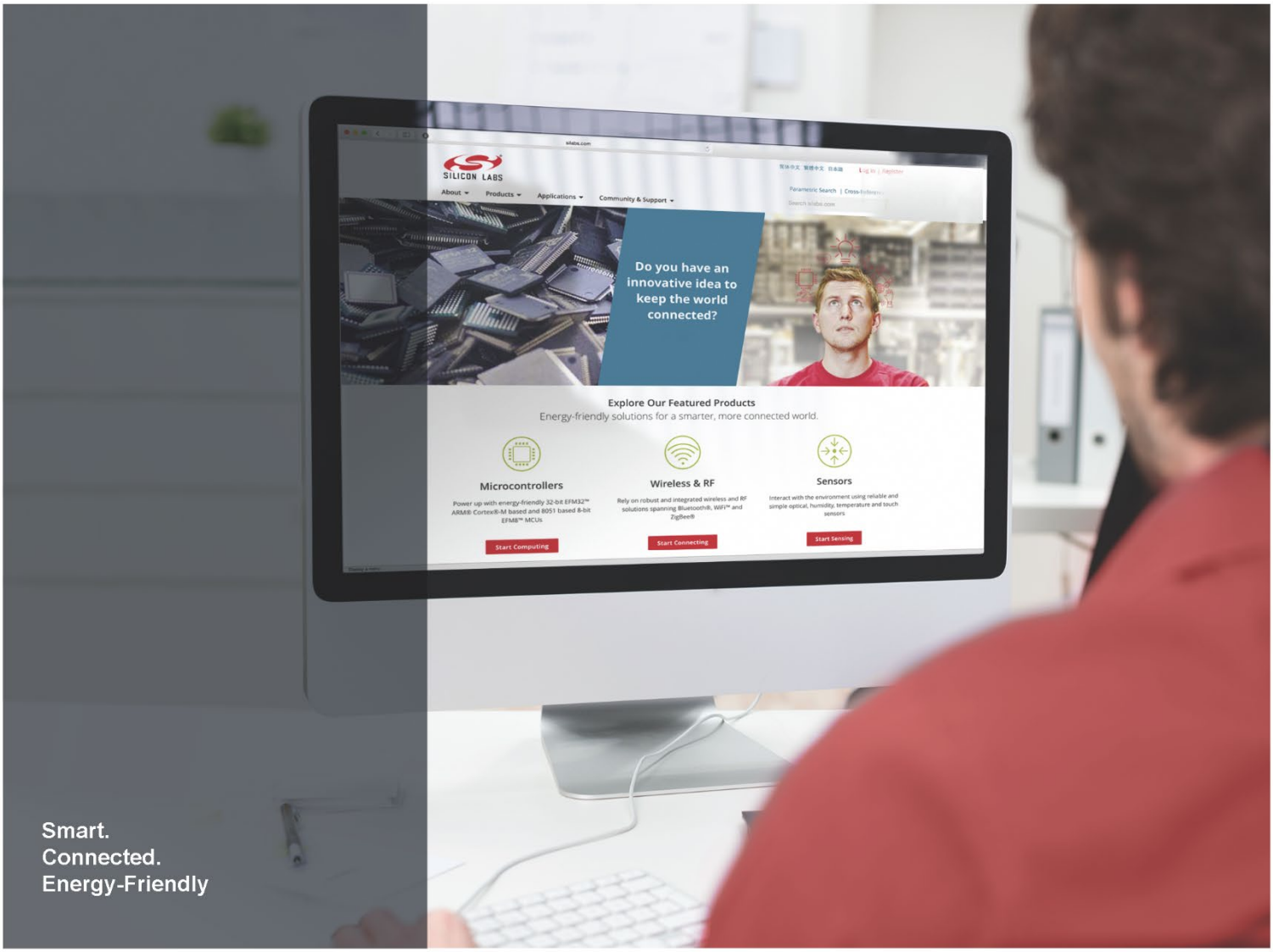
Refer to "**AN1282: RS9116W Guide for SAPI Application Examples**" from https://docs.silabs.com/rs9116

10 Troubleshooting

1. Ensure that the AP and Server Running in PC are connected over ETHERNET Cable.
2. Ensure that the IP address is assigned to both client and server before running iperf test.
3. Ensure that the station is connected to AP.
4. For running iperf, the server should first listen, and then the client has to send the data.

11 Revision History.

Revision No.	Version No	Date	Changes
1	1.1	May, 2020	Initial version
2	1.2	Oct, 2020	Changes in the Application folder paths Updated the links and document names



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