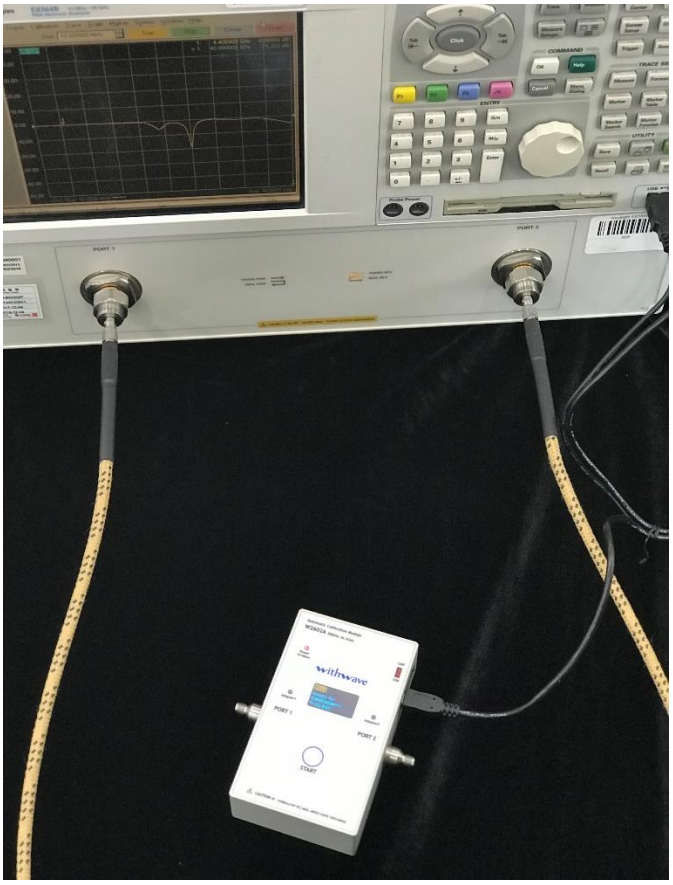
withwave

Automatic Calibration Module for Vector Network Analyzers



User Manual

withwave

Versatile RF & Microwave Test Solutions

Sheet

Release No.	Date	Revision Description
Rev. 1.0	Feb.10, 2019	Initial Work
Rev. 1.1	Apri.29, 2019	Add 18 GHz & 26.5 GHz version
Rev. 2.0	Aug.01, 2019	Changed the low freq. specification (300 kHz → 100 kHz)
Rev. 3.0	Sep.01, 2019	Add 4 Ports Specification
Rev. 3.1	Nov.01, 2019	Changed Contents (including USB Driver)

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1.0 General Information

2. GENERAL INFORMATION

1.1 Overview

Various vector network analyzers (VNA) models of different vendors are used for component testing in many production sites. ***Withwave's Automatic Calibration Modules (WACM)*** are ideal for users who want fast and easy calibration of various VNAs. (Refer to 1.2 Vector Network Analyzer Compatibility).
This WACMs are powered up via USB or Φ5.5 DC connector and communicate with VNA via USB or LAN and designed for full one-port through four-port calibrations of VNAs by one-push START button.
These units work as host systems, measure and calculate calibration coefficients and send it to VNA.

WACMs offers the following advantages:

- Provide various VNAs compatibility
- Single-connection for full N-port calibration
- Easy port extension using RF adaptor and microSD memory
- Embedded operating system communicates with VNA directly (No need external PC and software)
- Easy firmware update for more VNAs compatibility and more functionality

1.1.1 Adaptor Port Extension

Many kinds of Electronic Calibration Kit with different connector types used for fast and easy calibration.
WACMs offers easy and cost-effective solution for port connector type change just by connecting RF adaptor and microSD memory before start calibration.
Withwave provide various high-performance RF adaptors optionally. Characteristic data files of RF adaptor stored in microSD memory in binary and touchstone format provided together.

1.1.2 Thermal Compensation

Thermal compensation is used to enhance WACM calibration accuracy in the entire range of the displayed WACM temperatures of 20°C to 30°C.
WACM can be work out of range of recommended temperature but accuracy can be degraded.
Temperature dependence data of WACM impedance states is collected and stored internal memory.
Displayed temperature on front OLED is RF module temperature of WACM and can be different with room temperature.

1.2 Vector Network Analyzer Compatibility

VNAs manufacturer provide Electronic Calibration Kit solution but most of all Electronic Calibration Kit can work on same manufacturer's VNAs only.
WACM provide cost-effective calibration solution to user by supporting various VNA models.
WACM is compatible with following VNA:

- **Keysight PNA series, ENA series**
- **Rohde & Schwarz ZVL, ZVA series, ZVT series**
- **Anritsu ShockLine Series**
- **Copper Mountain Technologies Planar Series**

For some VNA models listed above, may need to do a series of experiment to verify the compatibility Because WACM communicate with VNA using SCPI command through Telnet 5025 port, Telnet service and 5025 port should be enabled in VNA before calibration.

1.3 Contents of Automatic Calibration Module

Contents of Automatic Calibration Modules are listed below.

Index	Description
1	Automatic Calibration Module (2-Port & 4-Port)
2	Torque wrench, 8 mm, 0.9 N·m : 3.5 mm or N-type
3	USB Driver
4	Power supply - Input: AC 100~240V, 50~60Hz - Output: USB Type-A female, 5V/2.1A
5	DC power cable - Connector type: USB Type-A male to Φ5.5 DC plug - Length: 2 meters
6	USB cable - Connector type: USB2.0 Type-A male to micro-USB 5pin
7	**OPTION** : Data-based Microwave Adapters - 3.5 mm adapter series - 3.5 mm to N adapter series

2.0 SYSTEM SUMMARY

3. SYSTEM SUMMARY

2.1 Hardware Configurations

All of WACM models available now are listed below table.

Model	Connector type		Frequency range
	Port 1	Port 2	
W1202A	3.5mm, female/male	3.5mm, female	100 kHz to 12 GHz
W1802A	3.5mm, female/male	3.5mm, female	100 kHz to 18 GHz
W2602A	3.5mm, female/male	3.5mm, female	100 kHz to 26.5 GHz

2.2 Specifications

2.2.1 Effective System Data

Effective system data for RF and microwave WACMs are provided in the following tables.

- **Model : W1202A, W1204A (100 kHz to 12 GHz)**

Parameter	Frequency range		
	100 kHz ~ 10 MHz	10 MHz ~ 2 GHz	2 GHz ~ 12 GHz
Directivity (dB)	> 35	> 45	> 42
Source match (dB)	> 32	> 42	> 40
Load match (dB)	> 32	> 42	> 40
Reflection tacking (dB)	< 0.12	< 0.08	< 0.07
Transmission tracking (dB)	< 0.15	< 0.1	< 0.07

- **Model : W1802A, W1804A (100 kHz to 18 GHz)**

Parameter	Frequency range			
	100 kHz ~ 10 MHz	10 MHz ~ 2 GHz	2 GHz ~ 10 GHz	10 GHz ~ 18 GHz
Directivity (dB)	> 35	> 45	> 42	> 40
Source match (dB)	> 32	> 42	> 40	> 38
Load match (dB)	> 32	> 42	> 40	> 38
Reflection tacking (dB)	< 0.12	< 0.08	< 0.07	< 0.07
Transmission tracking (dB)	< 0.15	< 0.1	< 0.07	< 0.09

- **Model : W2602A, W2604A (100 kHz to 26.5 GHz)**

Parameter	Frequency range				
	100 kHz ~ 10 MHz	10 MHz ~ 2 GHz	2 GHz ~ 10 GHz	10 GHz ~ 20 GHz	20 GHz ~ 26.5 GHz
Directivity (dB)	> 35	> 45	> 42	> 40	> 37
Source match (dB)	> 32	> 42	> 40	> 38	> 38
Load match (dB)	> 32	> 42	> 40	> 38	> 38
Reflection tacking (dB)	< 0.12	< 0.08	< 0.07	< 0.07	< 0.07
Transmission tracking (dB)	< 0.15	< 0.1	< 0.07	< 0.09	< 0.09

2.2.2 General data

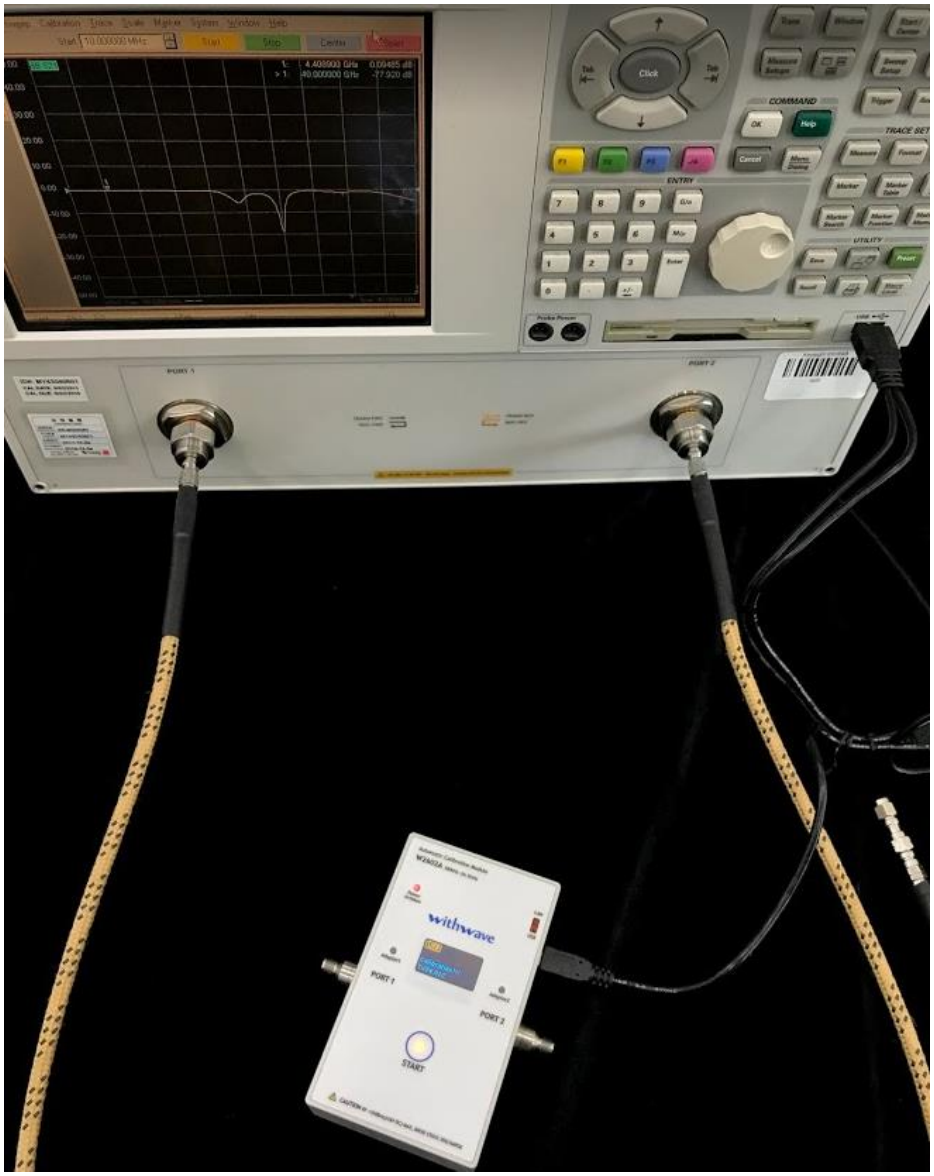
Parameter	W1202A, W1204A	W1802A, W1804A	W2602A, W2602A
Impedance	50 Ohm	50 Ohm	50 Ohm
Operating Temperature	+20°C ~ +30°C	+20°C ~ +30°C	+20°C ~ +30°C
Port max power	+10 dBm	+10 dBm	+10 dBm
Port max DC voltage	10 V	10 V	10 V
Ethernet interface	LAN/micro USB	LAN/micro USB	LAN/micro USB
DC supply	5V/500mA, Φ5.5	5V/500mA, Φ5.5	5V/500mA, Φ5.5
Dimension	94.5 x 108 x 28.5 mm	94.5 x 108 x 28.5 mm	94.5 x 108 x 28.5 mm
Weight	343 g	343 g	343 g

3.0 GETTING STARTED

4. GETTING STARTED

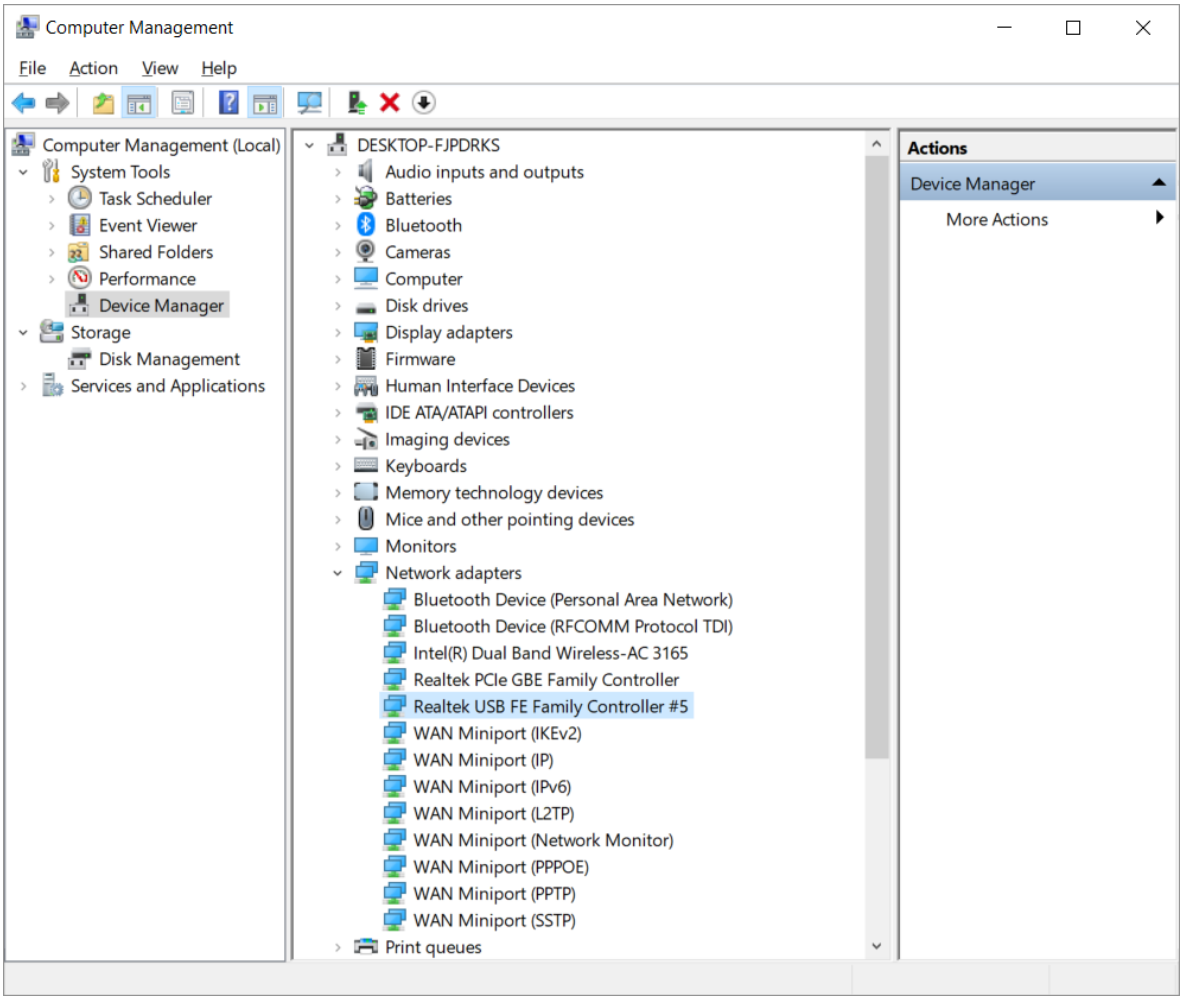
3.1 USB Driver Installation

If WACM operate using LAN port only, USB driver installation is not required.
Before USB driver install, WACM should be connected with VNA via micro-USB.



WACM will start system boot sequence if USB connected to VNA and it will take about 35 seconds.

Operating system(Window) of VNA will detect Realtek USB Network adapter automatically in Windows 7 and higher systems as below figure.



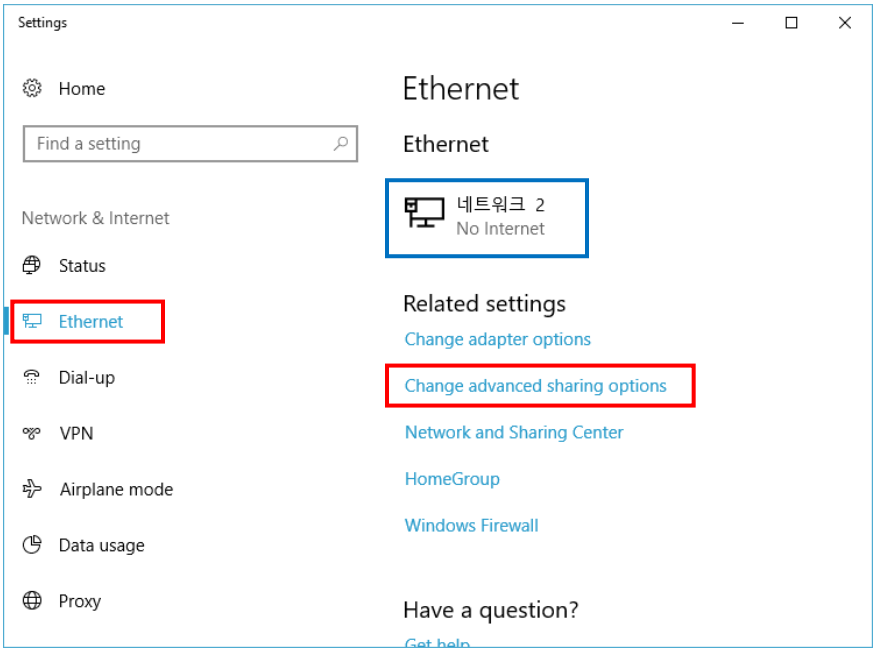
If VNA's OS fails to detect automatically or is a system below Window 7, the user should install the USB driver manually. The USB drivers can be downloaded from website (https://www.with-wave.com/)

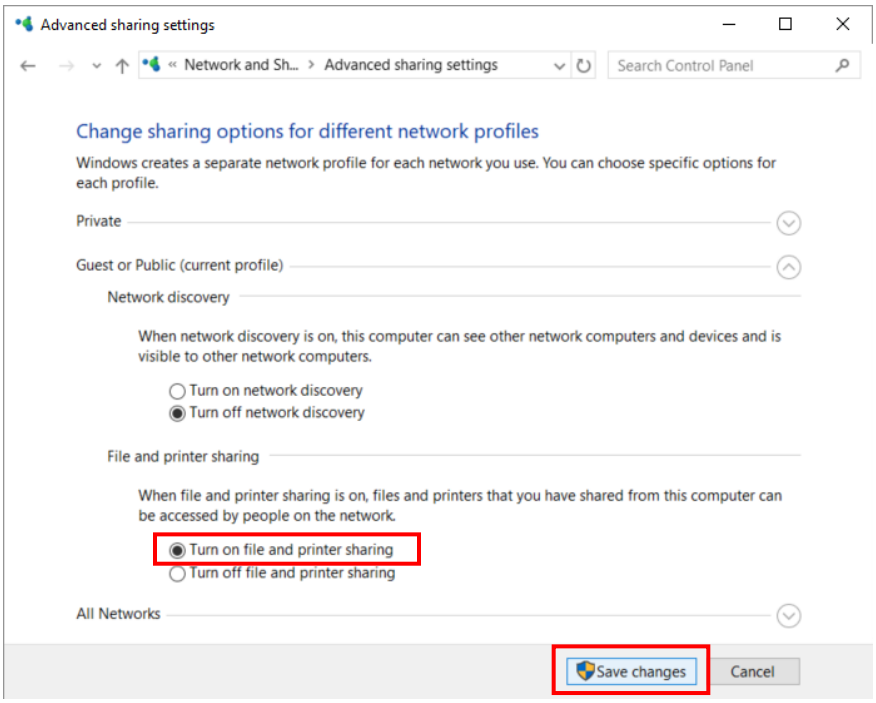
Even though the USB driver has been successfully installed, if WACM's OLED show "Ethernet disconnected" message shown in the picture below, you must setup either the file and printer sharing settings or turn off Windows firewall of the Network adapter.

If USB ethernet connected successfully, OLED show "Ready for Calibration" message. and turn on **START button** led as shown picture below.

3.1.1 File and printer sharing setting

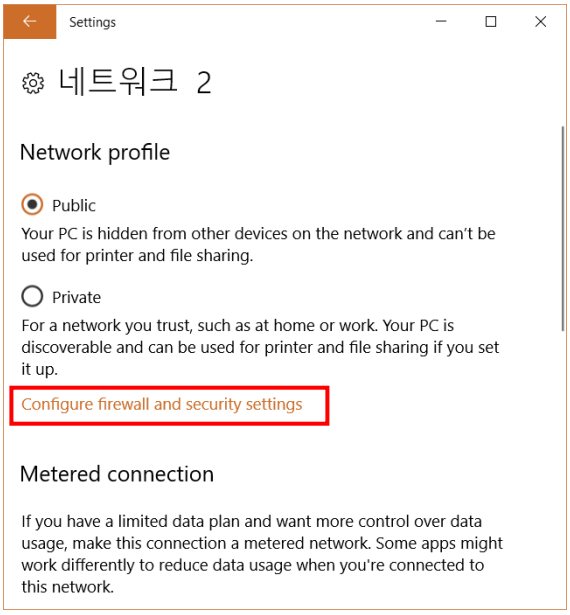
File and printer sharing of the VNA is recommended to connect WACM's USB ethernet adapter successfully. To turn on file and printer sharing, open the ethernet setting as shown below figure. After click "Change advanced sharing options" button, click "Turn on file and printer sharing" button of USB ethernet profile and apply "Save changes".

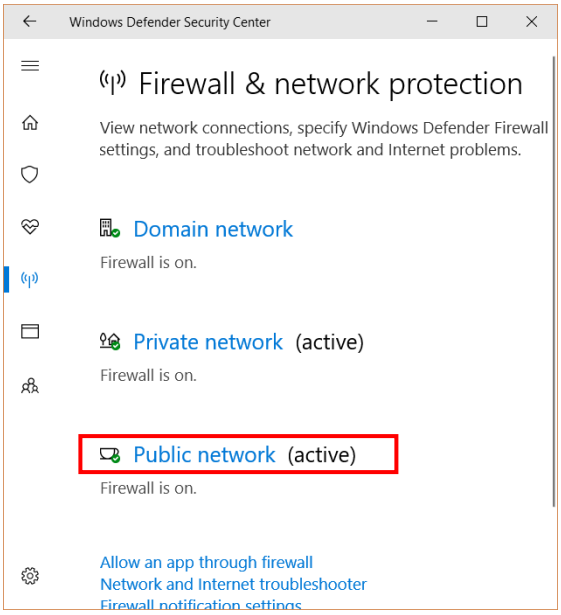


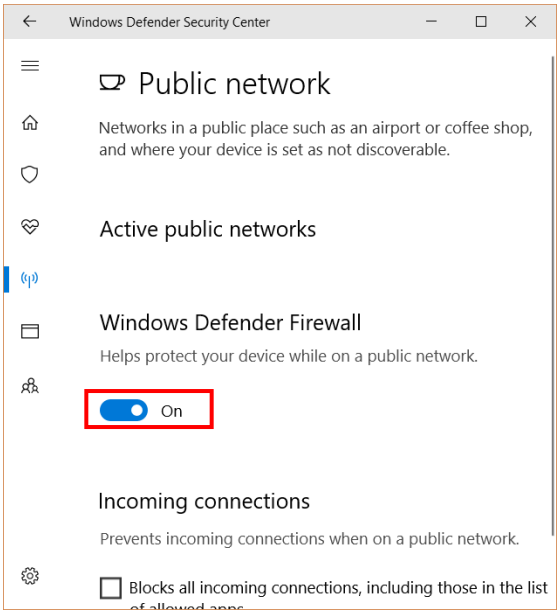


3.1.2 Windows Firewall setting

WACM's USB ethernet adapter can be connected successfully by turn off the windows firewall setting. After click Network button (blue box) at the ethernet setting as shown above figure, click the "Configure firewall and security settings" button. Select same profile network at the Windows Defender Security Center window, "Public network" button in this case and turn off Windows Defender Firewall.



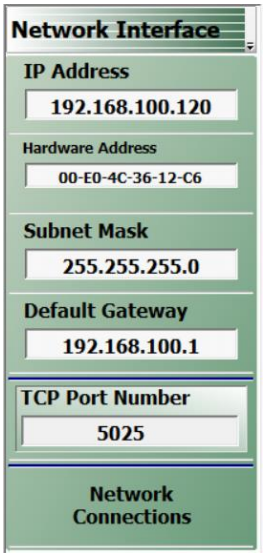




3.1.3 Setup socket server of VNA

WACM can communicate with VNA after enable the socket server setup.
Socket server setup menu is different with VNA model. Refer the below instructions.

1. Keysight PNA series
   - System > Configure > SICL/GPIB/SCPI > ☑ Sockets Enabled ☑ Telnet Enabled
2. Keysight ENA series
   - System > Misc Setup > Network Setup > Telnet Server [ON]
3. Anritsu ShockLine Series
   - Utilities > System > Network Interface



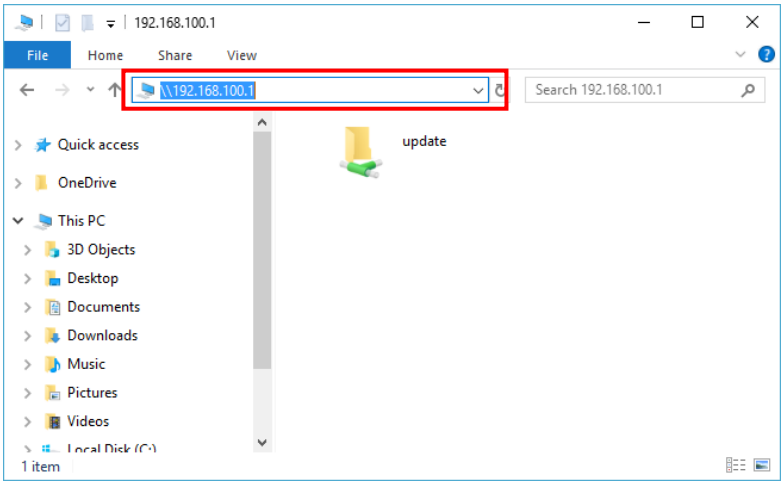
   - Check see If IP Address is same with WACM's USB ethernet adapter. If the IP Address is different, Click "**Network Connections**" button and enable "WACM's USB ethernet adapter" and disable the other network adapters
   - Set "TCP Port Number" to "**5025**"
4. Copper Mountain Technologies Planar series
   - System > Misc Setup > Network Remote Control Settings > Telnet Server [ON]

3.2 Operation Procedure

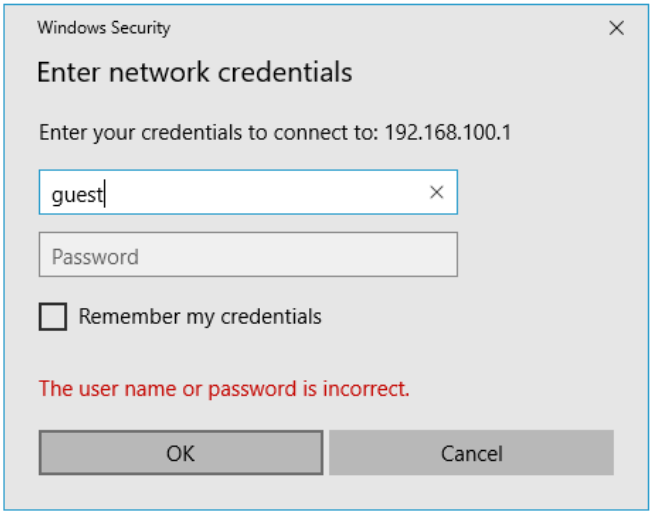
1. Connect WACM with VNA via a USB cable or LAN cable.
2. Setup VNA test environment
   - Frequency range: start/stop or center/span, number of point
   - Source power, Sweep type, IF bandwidth
3. Push START button for starting calibration if START button led turn on.
4. WACM will be remain ready state for other calibration as soon as calibration complete

3.3 Firmware Update

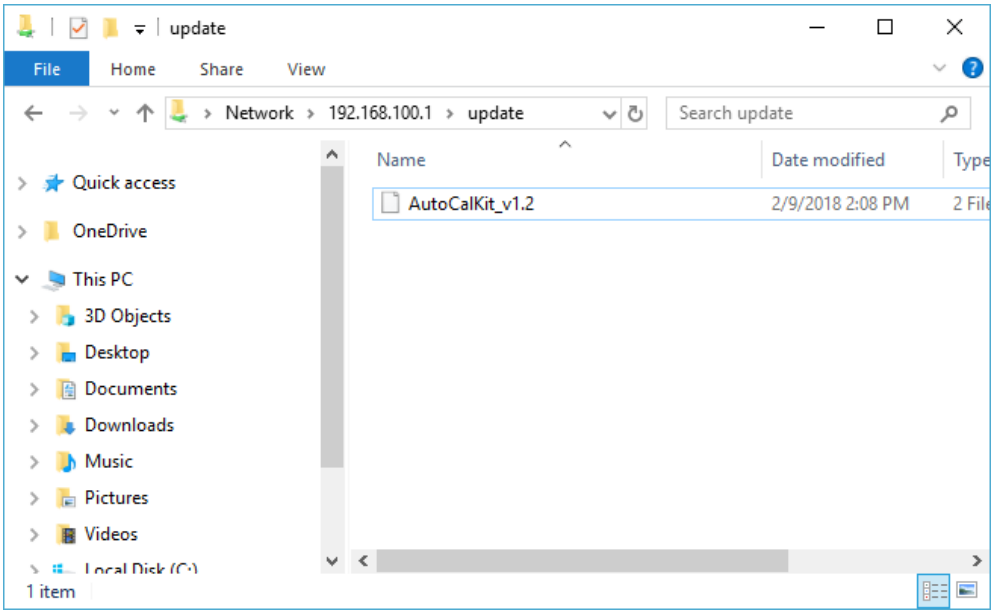
The updated firmware will be announced on the website.
For firmware updates, connect the WACM to VNA or user PC and input the "\\192.168.100.1" in File Explorer as shown figure below.



Input the “guest” for ID and click “OK” button.



After go into the “update” folder, copy the downloaded firmware file.
Firmware file will be moved to the WACM’s system folder and be updated automatically at the next boot sequence.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File
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update
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Quick access
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