Remote Operation of Windows Based T&M Instruments with Apple iPad Application Note

Products

Ι	R&S [®] AFQ100B	Ι	R&S [®] FSV	Ι	R&S [®] SMU200A
Ι	R&S [®] AMU200A	Ι	R&S [®] FSVR	Ι	R&S [®] UPP
Ι	R&S [®] CMW270/280/500	Ι	R&S [®] FSQ	Ι	R&S [®] UPV
Ι	R&S [®] ESR	Ι	R&S [®] FSW	Ι	R&S [®] ZNB
Ι	R&S [®] ESRP	Ι	R&S [®] SMATE200A	Ι	R&S [®] ZVA
I	R&S [®] FSL	Ι	R&S [®] SMJ100A	Ι	R&S [®] ZVL

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Application Note

This document describes how a Windows[®]based R&S[®] T&M instrument is remotely operated by an Apple iPad* as if working on it locally. Step-by-step procedures are provided for setting up and configuring the T&M instrument and the iPad. On the iPad, a special App implements the Windows[®] "Remote Desktop" functionality. T&M instrument and iPad are connected via WLAN (also denoted as Wi-Fi network).

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1 Introduction

Tablet computers, or simply "tablets", provide easy mobile access to networks while offering a very good usability, especially regarding display, size, weight and handling. Sometimes tablets replace notebooks, sometimes they open new applications. Amongst tablets, the Apple iPad is very popular. Increasingly the iPad¹ has proven its capabilities in business areas.

Remote operation of Rohde & Schwarz Test & Measurement (T&M) instruments² is done mainly from desktop computers, sometimes via notebooks. Tablets are also very appropriate since they satisfy all requirements for remote control of T&M instruments which are:

- A display for monitoring the ongoing operations and providing buttons and other interactive GUI elements
- An interface to press the buttons, select or enter values, launch actions etc.

• The capability to access the network (a LAN or WLAN) with the T&M instrument Typically, remote operation requires only the computing capacity of a modest client application (while the main computing takes place on the T&M instrument) and only a minimum of manual entries of numbers and letters.

Additionally, tablets offer benefits of enhanced mobility and easy handling.

The following descriptions refer to the iPad only. The same considerations are valid for other tablets; procedures and handling can easily be adopted for such tablets.

The R&S[®]CMW270/280/500³ is used as example for a typical R&S T&M instrument. The front page lists other R&S[®] instruments that may be operated as described in this document.

Use Cases

- Monitoring the T&M instrument outside the usual control room
- Presenting the operation of a T&M instrument in a meeting/teaching room
- Accessing T&M instruments without dedicated displays or instruments which have been installed in places that are difficult to reach

Implementation Principle

Remote operation by iPad is adopted for T&M instruments running on Windows XP or Windows 7. An App implements the common Windows^{®4} "Remote Desktop" functionality on the iPad. "Remote Desktop" is the standard mechanism for remote control of Windows-based T&M instruments by a desktop computer. It allows to control the T&M instrument remotely as if working on it locally.

For accessing the T&M instruments from the iPad a WLAN⁵ connection is required. This wireless connection can be established e.g. via a WLAN router between T&M instrument and iPad or even directly between both devices if the instrument is equipped with a WLAN USB adapter.

¹ Apple iPad, particularly the New iPad, is referred to as "iPad" in this document.

² Supported Windows-based R&S products are referred to as "T&M instruments".

³ The R&S[®]CMW270/280/500 is referred to as "CMW" in this document.

⁴ Windows is a registered trademark of the Microsoft Corporation in the U.S. and other countries.

⁵ The iPad uses "Wi-Fi" as name for WLAN.

2 Functional Description

The "Remote Desktop" functionality for controlling the T&M instrument by iPad comprises the following main characteristics:

- The T&M instrument acts as server and generates content which is transmitted to the iPad and shown on its display; the iPad is the client. The display of the iPad shows the same content as a T&M instrument's display would do.
- In the opposite direction, the iPad transmits commands from its user interface (touch screen) to the T&M instrument which determine its behaviour.
- An appropriate protocol controls the data exchange between T&M instrument and iPad.

The "Remote Desktop" functionality is realized by Microsoft's Remote Desktop Protocol (RDP). The RDP software consists of a server and a client component. On windows systems the server and client components are included in the Windows operating system. Thus, the T&M instrument operating on Windows is ready for RDP. On the iPad, RDP client software which is appropriate for the client's operating system has to be installed.

VNC (Virtual Network Computing) is an alternative to RDP. VNC also allows to control a T&M instrument from a remote computer as if working on the instrument locally. It uses similar concepts as RDP but is independent of the operating system.

WLAN Connection

WLAN is used for the wireless connection between T&M instrument and iPad. **Fig. 1** illustrates one possible realization with an intermediate WLAN router.



Fig. 1: T&M instrument connected with iPad via WLAN router

For providing the T&M instrument with WLAN access, the following solutions are possible:

 The T&M instrument is connected by (hardwire) Ethernet with a WLAN router. In this case the iPad will wirelessly connect to the WLAN router and access the T&M instrument from there. A group of T&M instruments can use the same WLAN router. This connection type is called **infrastructure** mode: The WLAN router acts as WLAN access point which provides the T&M instrument with information to establish the WLAN connection.

It is recommended to apply DHCP (Dynamic Host Configuration Protocol) on the WLAN router whereby all address information of the T&M instrument and the iPad is automatically assigned. Most T&M instruments use DHCP by default.

- The T&M instrument is connected by Ethernet with a network providing wireless connectivity. In this case the iPad will wirelessly connect to the T&M instrument via any dedicated WLAN access point provided by the network. This case is not described in the following sections since configurations and operation are very similar to the previous case.
- The T&M instrument is equipped with a WLAN USB adapter. In this case the T&M instrument sets up an own wireless network and the iPad connects to this network. The devices communicate directly with each other (point-to-point); no additional WLAN access point is engaged and the T&M instrument is not available at other WLAN access points. This is the WLAN ad hoc mode. Static address information (no DHCP) is used for the T&M instrument and the iPad. The connection only has to be configured once, the settings are saved. A WLAN USB adapter has a range of about 10 m.

Note: WLAN connections with several WLAN USB adapters in near vicinity would disturb each other.

For a T&M instrument with WLAN USB adapter also the WLAN infrastructure mode would be possible. In infrastructure mode the WLAN USB adapter operates as a bridge to another WLAN access point (with greater coverage area) and the iPad connects to the access point. The infrastructure mode with USB adapter is useful if the distance between controlling iPad and T&M instrument exceeds 10 m.

Note: A WLAN connection is not as stable as a LAN connection, and sporadic disturbances of the WLAN connection can occur depending on the local conditions.

3 Setup

The setup consists of:

- 1. Providing WLAN access for the T&M instrument; this can be done in different ways
- 2. Installing the RDP client App on the iPad
- 3. Establishing the WLAN connection on the iPad
- 4. Establishing the RDP connection

3.1 Providing WLAN Access for the T&M Instrument

Instructions are given for the following solutions:

- WLAN connection via WLAN Router (WLAN infrastructure mode)
- WLAN connection via WLAN USB adapter (WLAN adhoc mode): The T&M instrument is equipped with a WLAN USB adapter.

3.1.1 WLAN Connection via WLAN Router

Many WLAN routers are appropriate, e.g. the DIR-635 WLAN router from D-Link, see [1]. The following descriptions merely show the basic line of configuration tasks. Please refer to the vendor's user manual for details.

1 Access the WLAN Router

The D-Link WLAN router offers a web-based configuration utility. An IP connection and a desktop computer (or notebook) are required for configuring the D-Link WLAN router.

- Plug a RJ-45 cable into an Ethernet port of the desktop computer and the other end of the cable into the Internet port of the router.
- Turn on the WLAN router.
- Turn on the desktop computer.
- On the desktop computer, open a web browser such as the Internet Explorer and enter the IP address of the router.

2 Configure the WLAN Router

It is assumed that the WLAN router provides a DHCP server, that the T&M instrument has enabled DHCP (usually the default value) and is not connected with another router or DHCP server.

- Configure the LAN parameters:
 - Keep the default values for the router's IP address and the subnet mask.
 - DHCP server: Enabled

The WLAN router automatically assigns IP addresses and related parameters to the T&M instrument and the iPad.

(In case you have disabled the WLAN router's DHCP server and no other DHCP server is involved, you have to disable/uncheck DHCP at the T&M instrument and the iPad; in this case you can manually change the static address information at the T&M instrument and the iPad.)

- Configure the wireless LAN parameters:
 - Wireless network name (SSID, Service Set Identifier):
 Create a name using up to 32 characters or keep the default name.
 This network name will appear in the list of Wi-Fi networks on the iPad.
 - Wireless channel: e.g. "6"

Attention: Take care that the WLAN channel does not overlap with any measurement frequency. Otherwise the measurement can be disturbed.

- 802.11 mode: e.g. "Mixed 802.11n, 802.11b, and 802.11g"
- Channel width: e.g. "Auto"
- Transmission rate: e.g. "Auto"
- Configure the wireless security:
 - Security mode: e.g. "WPA-Personal"

Note: Internet setup of the WLAN router is not required, so simply skip the related configuration windows.

3 Connect the T&M instrument with the WLAN Router

- Connect a RJ-45 cable to a LAN port of the T&M instrument.
- Connect the other end of the cable to an appropriate WLAN router's LAN port.

Note: In this way, you can connect several T&M instruments with the WLAN router.

3.1.2 WLAN Connection via WLAN USB Adapter

Static T&M instrument address information and the WLAN adhoc mode are applied.



Fig. 2: Connecting a WLAN USB adapter to an R&S T&M instrument

Note: The WLAN signals from the WLAN USB adapter can disturb measurements with very low RX levels, e.g. sensitivity measurements. USB connectors on the rear of the T&M instrument cause less interference due to the larger distance to its RX unit.

First Commissioning

Some installation and configuration steps are required. These steps are described in the following sections.

Prerequisites for the First Commissioning:

- A T&M instrument with display or a remote desktop connection between the T&M instrument and a desktop computer (or notebook) is required.
- Keep the desired WLAN network name (SSID), encryption mode and password for network access at hand.

Further Starts of Operation

The configurations of the first commissioning are kept. So simply proceed as follows:

 Insert the WLAN USB adapter into an empty USB port of the running T&M instrument. The WLAN USB adapter gets active according to the stored configuration.

Note: The drives, directories and paths in the following descriptions are examples and depend on the type of T&M instrument.

3.1.2.1 Installation for Windows XP T&M Instruments

1 Install the WLAN USB Adapter

Many WLAN USB adapters are appropriate. Rohde & Schwarz uses the LogiLink WL0049A as example device. A driver for the WLAN USB adapter is required. Proceed as follows:

A) The driver is taken from the .zip package provided together with this application note.

- 1. Unzip the .zip package (e.g. "SupplementaryFiles.zip") and copy the "...Setup.exe" file onto the running T&M instrument (e.g. into the folder "C:\Temp\").
- 2. Execute the .exe file.
- 3. Accept the License Agreement.
- 4. Select the "Install driver only" option.
- 5. Close the installer program after the installation has completed successfully.
- 6. Insert the WLAN USB adapter into an empty USB port of the T&M instrument. You can use any of its USB ports.

If the driver file is not automatically found after plugging in the WLAN USB adapter, a "Files Needed" window is displayed (e.g. asking for the "rt2870.sys" file). Here, you can manually enter the correct path for driver files: "C:\windows\system32\DRVSTORE\...\".

Files Neo	eded	X
	The file 'rt2870.sys' on Wireless 11n USB Installation Disk is needed.	ОК
	Type the path where the file is located, and then click OK.	Cancel
	Copy files from:	
	C:\windows\system32\DRVSTORE\rt2870_C51D 🔽	Browse

Fig. 3: "Files Needed" window

B) The T&M instrument has a CD/DVD drive and the driver is available on CD/DVD as supplement of the WLAN USB adapter.

1. Insert the WLAN USB adapter into an empty USB port of the running T&M instrument.

Windows detects that new hardware has been added and starts the "Found New Hardware" dialog. Click on "Cancel".

 Install the driver for the WLAN USB adapter from the CD/DVD according to the instructions of the vendor of the adapter (insert the CD, after start of the driver installation (e.g. by auto-start) follow the instructions of the installation wizard, etc.).

2 Configure Auto-Start of the ad hoc WLAN Network

 Under "Control Panel/Administrative Tools/Computer Management", select the "Services and Applications/Services" view. Ensure that the "Wireless Zero Configuration" service status is set to "Started" and that its "Startup Type" is "Automatic".

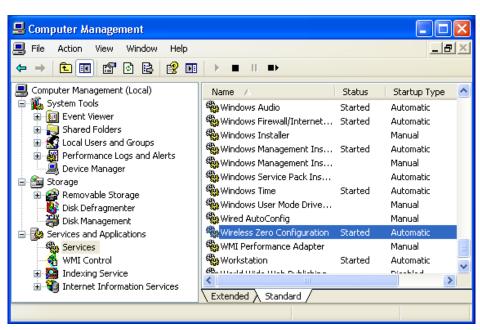


Fig. 4: Wireless zero configuration

3 Configure the Network Settings

General Settings:

- Select "Control Panel/Network Connections". Then right-click on the "Wireless Network Connection" entry and select "Properties" in the context window. The "Wireless Network Connection Properties" window is opened.
- Within the "General" tab select "Internet Protocol (TCP/IP)" and click on the "Properties" button.

The "Internet Protocol (TCP/IP) Properties" window is displayed.

3. Define the static IP address of the T&M instrument.

Internet Protocol (TCP/IP) Properties 🛛 🔹 💽							
General							
You can get IP settings assigned automatically if your network supports this capability. Otherwise, you need to ask your network administrator for the appropriate IP settings.							
🔘 Obtain an IP address automatica	ly						
Our of the following IP address: —							
IP address:	192.168.1.1						
Subnet mask:	255.255.255.0						
Default gateway:							
Obtain DNS server address automatically							
Use the following DNS server addresses:							
Preferred DNS server:							
Alternate DNS server:							

Fig. 5: Internet Protocol (TCP/IP) properties

4. Click "OK". The window is closed.

Wireless Settings:

🕂 Wireless Network Connection Properties 🛛 🕐 🔀					
General Wireless Networks Advanced					
✓ Use Windows to configure my wireless network settings					
Available networks:					
To connect to, disconnect from, or find out more information about wireless networks in range, click the button below.					
View Wireless Networks					
Preferred networks: Automatically connect to available networks in the order listed below:					
Move up					
Move down					
Add Remove Properties Learn about setting up wireless network configuration. Advanced					
Close Cancel					

Fig. 6: Wireless network connection properties

- 5. In the "Wireless Network Connection Properties" window select the "Wireless Networks" tab.
- 6. Make sure the top box is checked ("Use Windows to configure my wireless network settings").
- 7. Click on the "Advanced" button which opens another window.
- 8. Select "Computer-to-computer (ad hoc) networks only" mode and then "Close" the window.
- 9. Click on the "Add..." button which opens another window.

10. Configure the "Wireless network properties" on the "Association" tab.

- Enter the desired network name (e.g. "SFC-100123").
 - This network name will appear in the list of Wi-Fi networks on the Apple iPad. – Check "Connect even this network is not broadcasting".
 - Select the appropriate network authentication and encryption method for the connection, e.g. "Open" and "WEP".
 - Uncheck "The key is provided for me automatically".
 - Enter a password consisting of exactly 13 characters in the "Network key" field. You will have to enter this password at the iPad during establishment of the WLAN connection.
- 11. Click "OK" and "OK" to complete the configuration and close the configuration windows.

Wireless network proper	rties 🤶 🏹						
Association Authentication	Connection						
Network name (SSID):	SFC-100123						
✓ Connect even if this n Wireless network key—	etwork is not broadcasting						
This network requires a ke	ey for the following:						
Network Authentication:	Open 💌						
Data encryption:	WEP						
Network key:							
Confirm network key:							
Key index (advanced):							
This is a computer-to-computer (ad hoc) network; wireless access points are not used							
OK Cancel							

Fig. 7: Wireless network properties - association

The WLAN standard and the channel are automatically determined.

3.1.2.2 Installation for Windows 7 T&M Instruments

Most steps are analogous as for the Windows XP installation. For details about these steps, see the Windows XP installation.

1 Check the Virtual WiFi Bus Driver

Windows 7 uses Virtual WiFi to abstract the WLAN hardware into multiple virtual adapters. In this way the Windows 7 T&M instrument can establish a WLAN adhoc connection while keeping the capability to setup or access other WLAN networks. The two files "netwifibus.inf" and "vwifibus.sys" are required. Rohde & Schwarz provides them together with this application note.

- Check if the files "netwifibus.inf" and "vwifibus.sys" are already available in the "C:\Windows\" directory of the T&M instrument (see Fig. 8).
- If these files are not yet installed on the T&M instrument, take the Rohde & Schwarz files "netwifibus.inf" and "vwifibus.sys" and copy them manually into the "C:\Windows\inf" directory.

Organize 🔻 🛛 Save s	earch			= • 🔟 🔞
Name	Date modified	Туре	Size	Folder
🚳 wifibus.sys	7/14/2009 1:52 AM	System file	20 KB	inf (C:\Windows)
netwifibus.inf	7/13/2009 10:53 PM	Setup Information	4 KB	inf (C:\Windows)
Search again in:				
📜 Libraries 🛛 📭 Com	nputer 🛛 🔐 Custom 🔏	🥌 Internet 🛛 🝺 File C	ontents	

Fig. 8: Files for the WiFi bus driver

2 Install the WLAN USB Adapter

Proceed in the same way as for the Windows XP installation.

3 Configure the Network Settings

Proceed in the same way as for the Windows XP installation.

4 Configure Auto-Start of the ad hoc WLAN Network

The "start wlan adhoc network.bat" configuration, provided together with this application note, is used (alternatively, you might create this file by yourself).

- 1. Copy the "start wlan adhoc network.bat" file into the "Start menu/All Programs/Startup" directory of the T&M instrument.
- 2. Right-click on the file and select "Edit" from the context window. The file is opened with Windows Notepad.

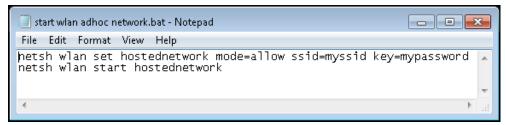


Fig. 9: Configuring the ad hoc WLAN network

- 3. Edit the file as follows:
 - Replace "myssid" by the same network name (e.g. "SFC-100234") as set during the configuration of the network settings in the previous section. This network name will appear in the list of wireless networks on the Apple iPad.
 - Replace "mypassword" by the network key as set during the configuration of the network settings in the previous section.
 You will have to enter this password at the iPad during establishment of the WLAN connection.
- 4. Save and close the file.
- 5. Restart the T&M instrument (alternatively, you can also run the .bat file).

3.2 Installing the RDP Client Application on the iPad

Several RDP Apps provide the required functionality. R&S has tested and recommends to use the "2X Client RDP/Remote Desktop" App which is a free download.

Prerequisite: iTunes is required for the download of the RDP software onto the iPad.

Proceed as follows:

- 1. Select the "App Store" icon on the display of the iPad.
- 2. Select "Categories" from the top bar of the display.
- 3. Enter "2x client" in the search bar (top right) of the display.
- 4. Select "2X Client RDP/Remote Desktop".

The RDP software is downloaded onto the iPad.

Note: Alternatively, you can start from the <u>www.2x.com</u> website and navigate to the "2X Clients for RDP/Remote Desktop" download area for "iPad and iPhone".

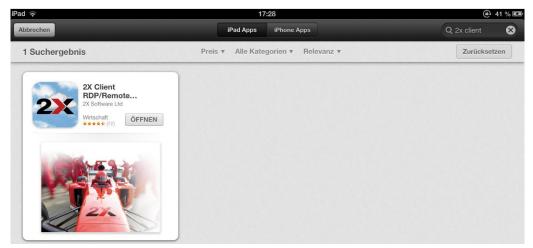


Fig. 10: 2x Client RDP App

3.3 Establishing the WLAN Connection on the iPad

Note: The iPad uses "Wi-Fi" as name for WLAN.

Prerequisites: In case of a WLAN connection via WLAN router, the WLAN router is running; in case of a WLAN connection via WLAN USB adapter, the T&M instrument is running (and configurations have been done according to chapter 3.1).

Proceed as follows on the iPad:

- 1. Select the "Settings" icon.
- If "Cellular Data" is available on the left side of the "Settings" page and is in state ON, then switch off "Cellular Data" (select "Cellular Data" on the left side and tap the ON/OFF slider in the Cellular Data row on the right side to bring it into the OFF position). This excludes concurrent data transmission via the cellular networks (e.g. GSM, UMTS).

3. If "Bluetooth" is available on the left side of the "Settings" page and is in state ON, then select "Bluetooth" and switch it off. This avoids interference between Bluetooth and WLAN.

Settings	Cellular Data	
Airplane Mode		
SFC-100266	Cellular Data	
Personal Hotspot Off	Turn off cellular data to restrict all data to Wi-Fi, including email, web browsing, and push notifications.	
Notifications	Data Roaming OFF	
Location Services Off	Turn off data roaming when traveling to avoid substantial roaming charges when using email, web browsing, and other data services.	
Carrier Telekom.de		
Cellular Data	APN Settings	

Fig. 11: Cellular data

- 4. Select "Wi-Fi" on the left side of the "Settings" page.
- 5. If Wi-Fi is in state OFF, then turn on Wi-Fi by dragging the ON/OFF slider in the Wi-Fi row into the ON position.

The iPad automatically detects the WLAN access point provided by the WLAN router or the WLAN USB adapter and indicates the WLAN network name (which you have configured before at the WLAN router or the T&M instrument with USB adapter).

Available WLAN networks appear under "Choose a Network ...".

Settings	Wi-Fi Networks
Airplane Mode	
SFC-100123	Wi-Fi ON
Notifications	Choose a Network
Location Services Off	✓ SFC-100123 🔒 🗢 📀
🙀 Brightness & Wallpaper	Other >

Fig. 12: WLAN network settings

- 6. Locate and tap the WLAN network name (SSID, Service Set Identifier) related to the T&M instrument. The connection is activated.
- 7. Tap the ">" icon on the right side of the row of your WLAN network. Details for the connection of the iPad with this WLAN network are shown.
- 8. Define the IP address of the iPad for the WLAN network:
 - Case A, WLAN Connection via WLAN Router (with enabled DHCP server): Tap "DHCP". Consequently, the IP address of the iPad is dynamically assigned by the DHCP server in the WLAN router.
 - Case B, WLAN Connection via WLAN USB Adapter: Tap "Static" and enter an IP address for the iPad in the "IP Address" row. Keep the default value for the "Subnet Mask".
- 9. Set "HTTP Proxy" to OFF.
- 10. Drag the ON/OFF slider in the "Auto-Join" row into the ON position.

The iPad automatically connects to the selected WLAN network ("Auto-Join").

Settings		Wi-F	i Networks	SFC-100123		
≁	Airplane Mode	OFF				
Ŷ	Wi-Fi	SFC-100123			Forget this Network	
•	Notifications			Auto-Join		
1	Location Services	s Off		IP Address		
**	Brightness & Wal	lpaper		DHCP	BootP	Static
2	Picture Frame					
8	General			IP Address		192.168.1.2
0	iCloud			Subnet Mask		255.255.255.0
	Mail, Contacts, Ca	alendars		Router		
	Twitter			DNS		
	FaceTime			Search Domains		
X	Safari			HTTP Proxy		
	Messages			Off	Manual	Auto

Fig. 13: Static IP address for T&M instrument with WLAN USB adapter

3.4 Establishing the RDP Connection

RDP operates on the WLAN connection which has been established in the previous section. The T&M instrument which will be accessed remotely is already running. Proceed as follows on the iPad:

1. Look for the "2X" icon on the display (perhaps you have to swipe to the left to see more apps) and tap that icon.



Fig. 14: 2X Client icon on the iPad

The RDP application is started. Then it shows the already defined RDP connections (if there are any) or detects that there is no RDP connection.



Fig. 15: RDP – no connections

Setup a New RDP Connection:

This section is only relevant for the first setup of the RDP connection. The settings will be remembered for later starts.

- 2. Tap "+" on the upper right corner.
 - The "New Connection" window is displayed.
- Select "RDP Connection". The "New RDP Connection" page is displayed.
- 4. Enter the required information and optional information according to the figure below.

91	RDP Cor	Inection	
* Items are required			
	Alias	cmw50050-104086	>
	Address*	192.168.0.188	>
	Port*	3389	>
	Username	instrument	>
	Password	<stored></stored>	>
Additional Settings			
Display			>
Local Resources			>
Experience			>
Connect To Console			ON

Fig. 16: RDP connection, configurations done

- The hostname of the T&M instrument in the "Alias" row (optional); this name provides a readable identification of the connection
- The T&M instrument's IP address in the "Address" row

- The port number "3389" which is the default TCP port for Windows RDP connections and which the T&M instrument listens to
- The T&M instrument's Username "instrument" which is fixed (optional)
- The password for the T&M instrument (optional) (see the user manual for the instrument)

Note: If you have entered the instrument's Username and Password, these settings will be used to skip the login window of the T&M instrument. Otherwise, the login window will be displayed when you connect to the instrument and you have to log in manually.

5. Select "Display" in the "Additional Settings" area, set "Use Optimized Size" to "OFF" and select the screen size via the ">" icon in the row below.

iPad 🥱	\$	16:39	④ 30 % ■
Cano	cel	Display	Save
	Color Depth		
	High Color (16 bits)		>
		High Color (16 bits) (Recommended)	
	Screen Size		
	Use Optimized Size		OFF
	800×600		>

Fig. 17: Screen size

For most T&M instruments "800x600" is appropriate.

For the FSQ, FSW, UPP and ZNB select "1280x1024" (highest resolution). You may try different resolutions to optimize the representation on the iPad's screen. See the user manual of your T&M instrument to get information about the resolution used by the T&M instrument.

- 6. Tap the "Save" icon in the upper right corner. The "Display" window is closed and the "RDP Connection" window is shown again.
- 7. Drag the "ON/OFF" icon on the right of the "Connect To Console" row to "ON".
- 8. Tap the "Save" icon in the upper right corner to save and close the "RDP Connection" window. The new connection is shown in the "Connections" View.

iPad 奈	15:53	25 % E2
Edit	Connections	()
cmw50050-104086		Edit 🥑

Fig. 18: Connections window

Reconfigurations:

 If you like to change the configuration of the connection, then tap the ">" icon. The "RDP Connection" window is shown.

Build-up of the RDP Connection:

- 9. Tap the row with the alias name or IP address of your T&M instrument in the "Connections" window to start the RDP connection with this instrument.
 - The remote desktop connection with this instrument is built up.
 - If you have configured the user name and password in the App, the login window is skipped.

 Otherwise the login window is displayed and a keyboard pops up. In this case, enter the T&M instrument 's Username ("instrument") and Password (see the user manual for your T&M instrument) to access the instrument.

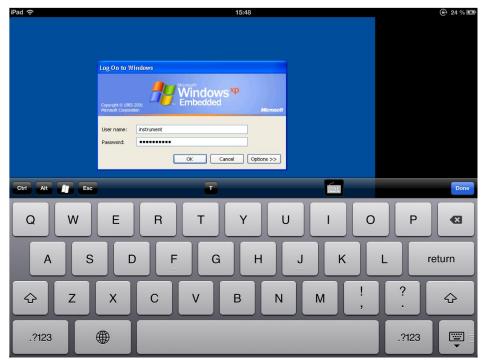


Fig. 19: Log on to the T&M instrument

Finally, the screen of the T&M instrument is displayed on the iPad.

4 Operation

4.1 Locking the iPad's Screen Rotation Function

The screen can be locked either via the multitasking bar or via the Side Switch (at the edge of the iPad) depending on the configuration under Settings > General > "Use Side Switch to:".

If "Mute" is enabled under "Use Side Switch to:", then proceed as follows:

- 1. Hold the iPad in landscape format.
- 2. Double-click the home button. The multitasking bar appears at the bottom of the screen.



Fig. 20: Locking screen rotation

3. Swipe the multitasking bar from left to right and tap the lock rotation icon at the left of the multitasking bar.

If "Lock Rotation" is enabled under "Use Side Switch to:", then simply press the Side Switch when operating in landscape format to lock the screen rotation.

4.2 Logging Off from the T&M Instrument

Generally, you can log off from a T&M instrument either via remote control before the RDP connection is closed, or locally at the T&M instrument after the RDP connection was closed.

Log off via remote control:

- 1. Tap the Windows button on the 2X Client keyboard to get the Windows taskbar.
- 2. Tap the start button on the left of the taskbar and then select "Log off".

Note: some T&M instruments show restrictions regarding log off and shutdown:

- AMU200A, SMATE200A, SMU200A: After a remote log off via iPad a subsequent log in at the instrument is only possible with a keyboard connected to the instrument.
- AFQ100B, UPP: As these instruments do not have an internal monitor, the shutdown shall be done via remote control (via start button of the Windows taskbar). If the remote shutdown was missed (e.g. after a remote log off from the T&M instrument), the T&M instrument can be forced to shut down only by pressing its Power Off button for several seconds or connect an external monitor and keyboard.

4.3 Ending Remote Desktop Control

- 1. Tap the "Disconnect" icon in the RDP bar at the bottom of the screen. A "Disconnect" dialog box appears.
- Tap the "Disconnect" dialog box to end the remote control session. (Tap elsewhere on the screen to close the dialog box without disconnecting.)



4.4 Re-Configuring the RDP Connection



Fig. 22: Navigation bar at the bottom of the RDP App

While the RDP App is running on the iPad, it is possible to change the RDP connection configuration or to edit RDP settings:

- Select the "Connections" icon at the bottom bar in order to have the "RDP Connection" page displayed.
 You can e.g. edit existing connections via the ">" icon or enter new connections via the "+" icon in the upper right corner. You can also edit settings for "Display", "Local Resources" and "Experience".
- Select the "Settings" icon at the bottom bar in order to have the "Settings" page displayed.

The "Settings" page allows you to configure several functions of minor importance, e.g. "Sleep on Idle", "Auto Reconnect". For more information see the 2X manual "2X Client iPad & iPhone" in the "Documentation" section on www.2x.com.

4.5 Controlling the T&M Instrument via RDP

4.5.1 Operation via Virtual Mouse and Keyboard

Cursor Area for "click" at cursor position and cursor movement

Fig. 23: Accessing virtual mouse and keyboard on the iPad

The iPad provides a virtual mouse and a keyboard in the bottom bar for controlling the remote desktop screen.

- Tap the mouse icon to get a virtual mouse cursor and the related tap area.
- Tap the keyboard icon to get a keyboard.

The keyboard shows letters by default; you can switch to numbers and special characters via the ".?123" icons, and back to letters via the "ABC" icons on the bottom of the keyboard.

4.5.2 Control Elements of the T&M Instrument Views

In this section, the CMW is used as example.

Tabs

Tabs are used to organize and distribute the content of a firmware application over several views.

• Tap a tab to change to the related view.

Buttons

Tap a button to launch its function.

Softkeys and Hotkeys

The softkeys are the buttons on the right side, the hotkeys are the buttons on the bottom of the display. The available selection of hotkeys depends on the softkey which is currently active.

• Tap a softkey or hardkey to activate it.

Check Boxes, Radio Buttons, List boxes

Click on a checkbox or radio button with the virtual mouse to switch its state. Click on a list box with the virtual mouse to open the list. Click on a list entry to select this entry.

Statistic Count			Level (dBm)	En	equency [Hz]	Marker
0 / 1		1250 kHz	nt Average	Current	Average	<u> </u>
	Peak [0]	2500 kHz)0 D			
FFT Length 2 k	Peak [1]	3 MULS 🔺.				
FFT Span 10.000 MHz	Peak [2]	10 MHz 20 MHz		, <u></u>		
RBW 12.500 kHz	Peak [3]	40 MHz				
	Peak [4]	10 MHz 🔻				
						L
Repetition		Frequency Span	FFT Length	Detector		Config

Fig. 24: List box

Hardkeys and Taskbar

iPad 🗢	15:45		
🚸 WLAN Multi Evaluation Configuration	×	RESET	
F Path: Measurement Control/Stop Condition			
Evaluation Length	Whole Burst /	INFO	
Band Width	20MHz /		
E-Measurement Control		SAVE	
Repetition	SingleShot -	SETUP	
	None	SETUP	
Measure On Exception	v	PRINT	
- Modulation - Statistic Count	10		
		HELP	
Phase	V		
Timing		DEVICE	
		WIZARD	
	Preamble -		
FFT Demodulation Offset	Auto 💌		
⊕-Spectrum ⊕-Power	Statistic Count: 10 Statistic Count: 10		
B Assign Views	Statistic Count. 10	MEASURE	1
⊞List Mode			
i ∰ Trigger		GEN SIGNAL	
Trigger Source	IF Power	ON OFF	
Trigger Slope	RisingEdge -	OFF	Ŧ
Trigger Threshold	-20.000 dB	RESTART STOP	
RF Routing External Att. (Input) Channel	Expected Nom. Power User Margin Offset	TASKS	

Fig. 25: Hardkey bar

Hardkeys are the buttons on a panel outside of the T&M instrument's screen. The taskbar is a horizontal bar at the bottom of the display which allows to select the desired firmware application (e.g. "LTE Signaling"). A hardkey representation and the taskbar are only visible on demand.

- Move the mouse out of the right border of the T&M screen to have the hardkeys displayed instead of the softkeys.
- Tap the "Tasks" hardkey to have the taskbar displayed.

Input Boxes and Keyboard

Numbers and strings are entered via a reduced keyboard. A keyboard is available via the keyboard icon in the bottom bar.

- 1. Click with the virtual mouse on an input box. Then tap the keyboard icon.
- 2. a) *Letters:* Enter a letter string as required via keyboard.b) *Numbers:* Switch the keyboard display mode to numbers and enter the number.
- 3. Tap the "Return" icon to save the entry.

Scrolling

The generator, signaling and measurement views match the T&M instrument's screen size, so no scrolling is required and available for these views. Configuration trees to be accessed via the "Configure..." hotkey and "Signaling Controller" / "Measurement Controller" views can have a larger size than the screen.

• Scroll up/down in configuration trees by clicking on the scroll bar with the virtual mouse.

4.5.3 Starting a Firmware Application on a CMW

Example: Start the LTE signaling and LTE measurement application.

Main line of steps:

- 1. Load signaling and measurement firmware applications:
 - Move the virtual mouse over the right border of the T&M instrument's screen to have the hardkeys displayed.
 - Select the "SIGNAL GEN" hardkey. The "Signaling Controller" window is opened.
 - You can expand compact tree views by tapping the "+" symbol at a tree knot.
 - Check the "LTE Signaling" checkbox via virtual mouse.
 - Select the "MEASURE" hardkey. The "Measurement Controller" window is opened.
 - Check the "LTE TX Measurement" checkbox via virtual mouse
- 2. Get the hardkeys again. Then click on the "TASKS" hardkey to get the taskbar.
- 3. Tap the "LTE Signaling" icon on the taskbar.
- 4. Configure the signaling application by tapping softkeys and hotkeys, by clicking on check boxes and list boxes. Activate the keyboard for entering values in input boxes.
- Start signaling: Tap the "LTE Signaling" softkey, then get the hardkeys and click on the "ON OFF" hardkey.

After successful start and with the hardkey bar turned off the softkey label shows "ON".

- 6. Switch to LTE measurement by selecting the "LTE TX Meas." softkey near the top of the softkey bar.
- 7. Configure the measurement application via softkeys, hotkeys, etc.

- 8. Start the measurement: Tap the "LTE TX Meas." Softkey, then get the hardkeys and click on the "ON OFF" hardkey.
- Check/edit the main signaling settings by tapping the "LTE Signaling" softkey while the LTE measurement view is still displayed. LTE signaling hotkeys are shown in the hotkey bar at the bottom of the screen.

Note: It is not possible to start a firmware application via keyboard.

5 Related Documents

- <u>7BM82: Apple iPad Remote Control for Broadcasting T&M Instruments</u> This application note explains the setup and operation of R&S T&M instruments via iPad with the example of the Remote Desktop – RDP App from MochaSoft and the WL0049A USB WLAN adapter from LogiLink1.
- <u>RAC-0703-0029: Remote Operation of R&S Instruments Using Remote Desktop</u> <u>Connection via LAN</u> This application note describes how to use the "Remote Desktop Connection" program to operate R&S T&M instruments connected in a LAN from a remote computer and how to connect and configure various kinds of networks (DHCP, Fixed IP address, Direct).
- <u>1ER01: Remote Monitoring and Control of the R&S® RTO with a Web Browser</u> This application note describes remote operation or monitoring of the R&S RTO digital oscilloscope through a standard web browser. The common cross-platform technology Virtual Network Computing (VNC) is used as a server on the instrument.

6 References

- [1] DIR 635 WLAN router from D-Link <u>http://www.dlink.com/uk/en/home-solutions/support/product/-</u> <u>/media/Consumer_Products/DIR/DIR%20635/Manual/DIR_635_Manual_EN_U</u> <u>K.pdf</u>
- [2] 2X RDP client software www.2x.com
- [3] 2X iPad/iPhone client manual www.2x.com
- [4] iPad user guide http://manuals.info.apple.com/en/ipad_user_guide.pdf

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