CX300 ComXpert

Communication Service Monitor

VNA Option Guide

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Communication Service Monitor

VNA Option Guide

22163053 Rev.002

VIAVI Solutions
1-844-GO-VIAVI
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Federal Communications Commission (FCC) Notice

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 equipment was tested and found to comply with the limits for a Class A digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference, in which case you will be required to correct the interference at your own expense.

The authority to operate this equipment is conditioned by the requirements that no modifications be made to the equipment unless the changes or modifications are expressly approved by VIAVI.

ALERT

- To comply with FCC RF Exposure compliance requirements, a separation distance of at least 20 cm must be maintained between the antenna of this device and all persons.
- This transmitter must not be co-located in conjunction with any other antenna or transmitter.

Industry Canada Requirements

This device complies with Industry Canada's license-exempt RSSs. Operation is subject to the following two conditions: 1) This device may not cause interference; and, 2) This device must accept any interference, including interference that may cause undesired operation of the device.

Le présent appareil est conforme aux CNR d'Industrie Canada applicables aux appareils radio exempts de licence. L'exploitation est autorisée aux deux conditions suivantes: 1) l'appareil ne doit pas produire de brouillage; et, 2) l'utilisateur de l'appareil doit accepter tout brouillage radioélectrique subi, même si le brouillage est susceptible d'en compromettre le fonctionnement.

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This product, and the batteries used to power the product, should not be disposed of as unsorted municipal waste and should be collected separately and disposed of according to your national regulations.

VIAVI has established a take-back processes in compliance with the EU Waste Electrical and Electronic Equipment (WEEE) Directive, 2012/19/EU, and the EU Battery Directive, 2006/66/EC.

Instructions for returning waste equipment and batteries to VIAVI can be found in the WEEE section of VIAVI's Standards and Policies web page.

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This product conforms with all applicable CE marking directives. Please see EU Declaration of Conformity for details.

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This product was tested and conforms to the EMC Directive, 2014/30/EU for electromagnetic compatibility.

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Contact the Technical Assistance Center (TAC) for technical support or with any questions regarding this or other VIAVI products.

- Phone: 1-844-GO-VIAVI
- Email: Techsupport.Avcomm@viavisolutions.com

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Record of Revisions

RECORD OF REVISIONS

REV.	DATE	ACCEPTANCE
001	September 2022	VIAVI
002	December 2024	VIAVI

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Preface

This preface explains how to use this manual. Topics discussed include the following:

About this Manual

Scope of Manual

This manual describes test and measurement functions associated with the *CX300 ComXpert* VNA Option. Refer to the *CX300 ComXpert Communication Service Monitor Operation Manual* for information about test set operation, system settings, and Analog test and measurement functions.

Intended Audience

This manual is intended for personnel who are familiar with VNA systems and operation of the *CX300 ComXpert Communication Service Monitor.*

This manual is intended for novice, intermediate, and experienced users who want to use the *CX300 ComXpert VNA Option* effectively and efficiently.

Related Information

This is the CX300 ComXpert VNA Option Guide *22163053*. This manual is to be used in conjunction with the following publications:

- *CX300 ComXpert Quick Start Guide, 22130635*, which provides basic operating and safety information
- *CX300 ComXpert P25 Option Guide, 22146777,* which provides information about the test and measurement functions found in the CX300 P25 options
- *CX300 ComXpert DMR Option Guide, 22163052,* which provides information about the test and measurement functions found in the CX300 DMR options
- *CX300 ComXpert Communication Service Monitor Operation Manual, 22130634*, which provides instructions to install, configure, and operate the CX300 ComXpert's standard test and measurement functions
- *CX300 Remote Programming Manual, 22146776,* which defines the Standard-Commands-for-Programmable-Instrument (SCPI) Consortium's SCPI standard and provides instructions for using this manual for various test and measurements
- *CX300 Maintenance Manual, 22130636,* provides basic instructions for assembling the instrument components, setting up the CX300 Test Set, instrument specifications, and instructions for removal, installation and calibration procedures

Typographical Conventions

This manual uses the following typographical conventions:

Table 1 Text formatting and other typographical conventions

Item(s)	Example(s)
References to terms used to identify key areas of the UI such as screens, panes, menus, or toolbars.	Navigate to the **Date and Time screen**. Open the **RF Receiver settings menu**. Some controls are also accessed from the **Quick Access Toolbar.**
Hardware buttons, keys, or switches that you press or flip.	Press the **On button**. Flip the **Power** switch to the on position.
Software components such as buttons, menus, tabs, or fields on a PC-based or Web-based user interface	Click **Start**. Click **File > Properties**. Type the name of the probe in the **Probe Name** field.
Directory names, file names, and code and output messages that appear in a command line interface or in some graphical user interfaces (GUIs).	`$NANGT_DATA_DIR/results` (directory) – `test_products/users/defaultUser.xml` (file name) – `All results okay.` (output message)
Text you must type exactly as shown into a command line interface, text file, or a GUI text field.	– Restart the applications on the server using the following command: **`$BASEDIR/startup/npiu_init restart`** Type: **`a:\set.exe`** in the dialog box.
References to guides, books, and other publications appear in *this typeface*.	Refer to *Newton's Telecom Dictionary.*
Required arguments (text variables in code).	<`password`>

Contact Information

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- Phone: 1-844-GO-VIAVI
- email: Techsupport.avcomm@viavisolutions.com

For the latest TAC information, go to:

https://www.viavisolutions.com/en-us/services-and-support/support/technical-assistance.

Conventions

Symbols and Markings

The following conventions are found on the instrument and in product documentation:

Table 2 Symbols and Markings

	**NOTE** This symbol indicates a note that includes important supplemental information or tips related to the main text.
	**Attention Symbol** This symbol represents a general hazard. It may be associated with either a DANGER, WARNING, CAUTION, or ALERT message. See Table 3 for more information.

Safety Definitions

This manual uses the following terms to indicate conditions or activities which are potential safety hazards:

Table 3 Safety Definitions

Term	Definition
CAUTION	Identifies conditions or activities that, if ignored, can result in equipment or property damage, e.g., Fire.
Mise en Garde	Identifiez les conditions ou les activités qui, si ignorées, peuvent entraîner des dommages à l'équipement ou aux biens, p. ex. un incendie.

1

Introduction to the CX300

This chapter provides a general description of the CX300 VNA (Vector Network Analyzer) option. Topics discussed in this chapter include the following:

1.1 CX300 Overview

The CX300 ComXpert is a compact, bench-top communications test set for use in the Land Mobile Radio or Two-Way Communications Industry. The CX300 is ideal for performing preventative maintenance on two-way radios and their applicable support infrastructure.

Refer to the CX300 product brochure for a succinct overview of the unit, and to the CX300 Operation Manual for additional details.

The CX300 VNA (Vector Network Analyzer) software option provides various features for testing VNA radio systems.

1.2 CX300 VNA Option Features and Capabilities

This section highlights key features and capabilities of CX300 VNA software options.

1.2.1 VNA

VNA, Software identified as **VNA CX300-SCAA.** Option CX300-SCAA, provides the following test features:

- Selecting measurement mode
- Performing reflection measurements
- Performing DTF (Distance to Fault) measurements - Making a measurement
- Performing reflection - DTF measurements

The following accessory can be purchased for the CX300 ComXpert for the VNA Option:

- Mechanical Y-Cal kit

1.3 Verifying VNA Option Installation

The CX300 provides several test and measurement functions which allow the user to evaluate the transmit and receive performance of an analog communications system.

1.3.1 Factory Installed Option

When a VNA software option(s) is purchased as a factory installed option, the VNA software is ready to use when the test set is received from the factory.

1.3.2 Post Production Option

When a VNA software option is purchased post production, the option software and option license files must be installed on the test set by the end user. See the following steps for selecting and installing Options.

Refer to the CX300 ComXpert Communication Service Monitor Operation Manual for more information on option selection.

CX300 software is a field-upgradeable software which can be updated using StrataSync™ or a USB device.

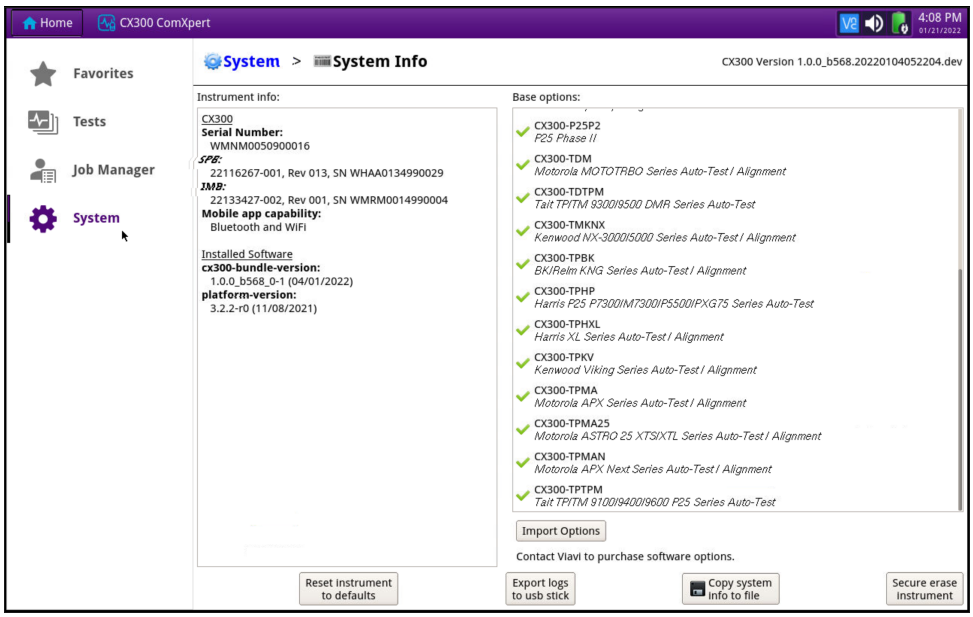

Figure 1-1 Example of System Info Screen

To Install CX300 Options:

1. If using a USB device, install the USB device.
2. Navigate to the System Info Screen. See Figure 1-1.

3. Select the **Import Options** button. See Figure 1-1 and Figure 1-2.

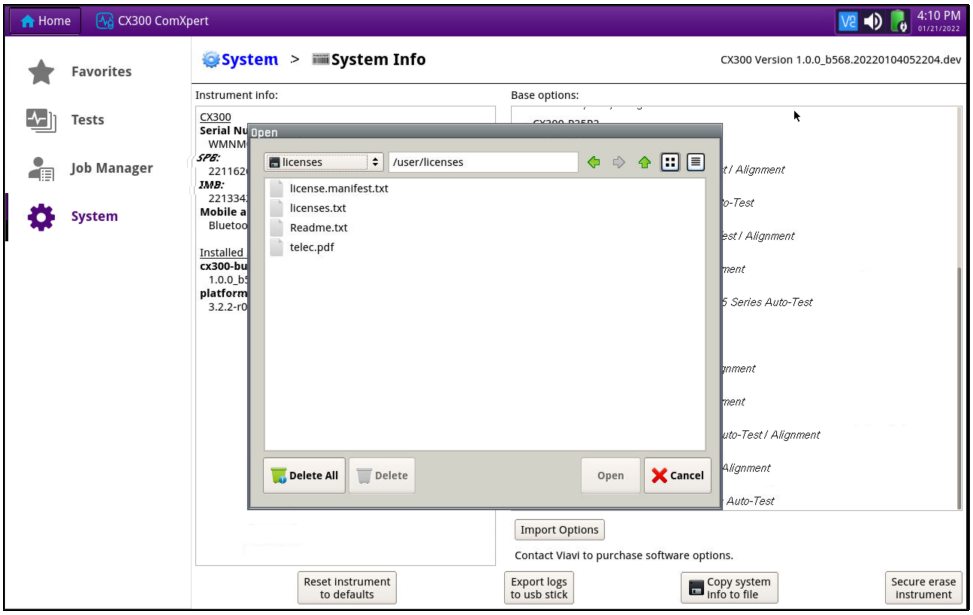

Figure 1-2 Example of Import Options Selected

4. Select the Option to install, or use the Select All button. See Figure 1-2.
5. Select Open.
6. Select OK. The Option selected is automatically installed to the system.

1.4 VNA Test Modes

The CX300 ComXpert has all of the measurement functions necessary to verify cable and antenna systems from Voltage Standing Wave Ratio (VSWR) to power measurements. In addition, the CX300 ComXpert makes distance-to-fault measurements to pinpoint a faulty location accurately.

VNA provides several test modes for the purpose of evaluating the transmit and receive performance of a VNA system. Each test mode contains controls and settings that are required to use the functions in the selected mode. The CX300 contains the following test modes:

- VNA
- DTF

1.4.1 VNA

The CX300 ComXpert VNA mode collects the S-Parameter based measurements of amplitude and phase that are expected of a Vector Network Analyzer instrument. VNA mode supports reflection measurements as well as through network measurements. Additionally, two side by side graphs are supported to visually compare and measure different network characteristics.

1.4.2 DTF

In the DTF (Distance to Fault) measurement mode, you need to set the start and stop distances. The maximum measurable distance is displayed on the left side of the screen depending on the frequency setting. You can set any distance within the maximum measurable distance. Optimum resolution is achieved when the user setting distance is the same as the maximum measurable distance.

1.4.2.1 VSWR

To get maximum power into a load it is required that the load impedance match the generator impedance. Any difference in impedance or mismatching would not produce maximum power transfer. An impedance mismatch at the antenna system produces a reflective ‘traveling wave’, which goes in the opposite direction from the incident wave. As the two traveling waves cross each other in opposite direction, it is produce an interference pattern called a "standing wave". VSWR (Voltage Standing Wave Ratio) is the ratio between the power sent forward to the cable and/or antenna and the amount of power that is reflected back to the transmitter.

Some of the consequences of having a high VSWR condition in cellular services include dropped calls, poor reception, and an overall unacceptable performance in the cell (or section of cell) covered by the base station antenna. Therefore, the VSWR of the antenna system including the feed line is one of the most critical factors in the service and maintenance of the RF transmitter systems.

1.5 Accessing VNA Option

The following procedure describes how to select a test mode of operation.

To Select Test Mode of Operation

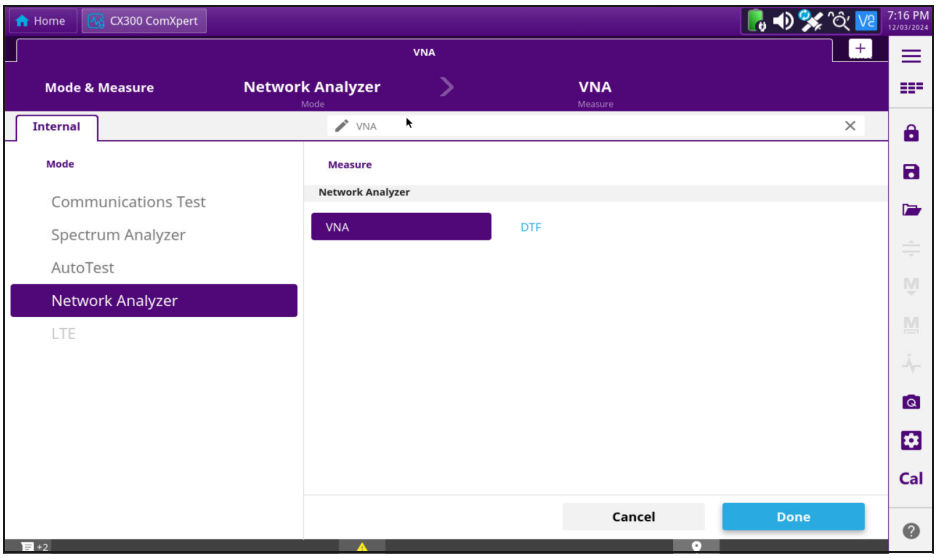

Figure 1-3 Example of Network Analyzer Menu

1. Navigate to the T**est Home Screen**.
2. Select the desired test mode from the **Network Analyzer Pane** (**VNA** or **DTF**).
3. Perform one of the following to load **VNA** or **DTF**:
   - Press the **VNA** or **DTF** button again.
   - Select the **Done Button**.

1.6 VNA User Interface Layout

The VNA User Interface (UI) uses the same layout, methods of navigation, and control used in the CX300 Analog Duplex test and measurement mode of operation. Refer to the *CX300 ComXpert Operation Manual* for a detailed description about the UI layout, accessing system and test screens, and configuring controls and settings.

2

Using Network Analyzer

This chapter describes the test and measurement functions that are supported in VNA. Topics discussed in this chapter include the following:

2.1 VNA Controls and Settings

VNA controls and settings are configured from the **VNA** settings menu. Some controls are also accessed from the **Quick Access Toolbar** or **Function Toolbar.** The following VNA controls and settings are used to configure the characteristics of the VNA measurements:

Table 2-1 VNA Controls and Settings

Control/Setting	Description
Frequency	Frequency and span settings define the frequency range used to evaluate signals. If you know the frequency of the signal being evaluated, the center frequency should be set to match the signal's frequency. If you are investigating signals that are within a particular frequency range, it is best to enter a start and stop frequency to define the span.
General	Select Data Points, Measurement Mode (Ret. Loss or VSWR), and Unit (Feet or Meters).
Plot 1	Visual Representation on the Screen.
Plot 2	Visual Representation on the Screen.

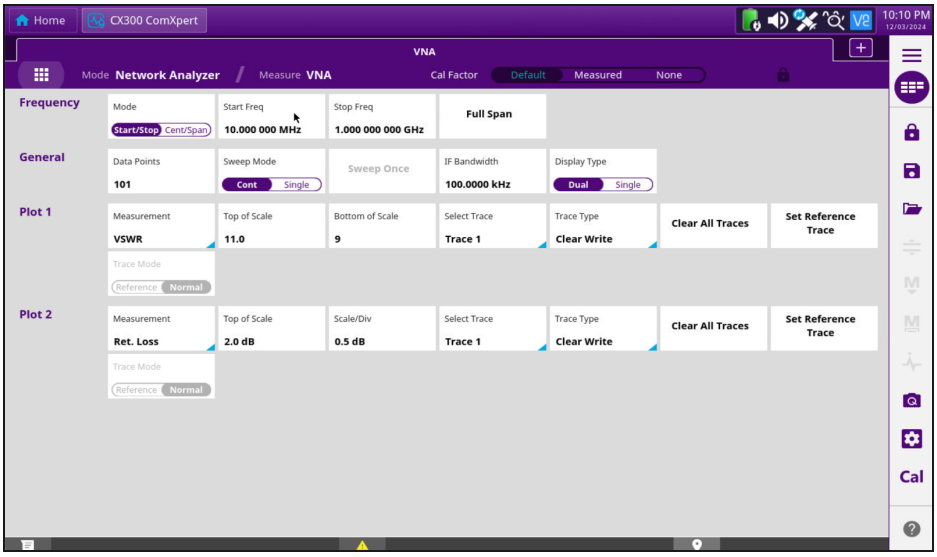

Figure 2-1 VNA Controls and Settings View

Table 2-2 VNA Controls and Settings

Control/Setting	Measuremets
Frequency	• Mode • Start Freq • Stop Freq • Full Span
General	• Data Points • Sweep Mode • Sweep Once • IF Bandwidth • Display Type.
Plot 1	• Measurement • Top of Scale • Scale/Div • Select Trace • Trace Type • Clear All Traces • Set Reference Trace • Trace Mode
Plot 2	• Measurement • Top of Scale • Bottom of Scale • Select Trace • Trace Type • Clear All Traces • Set Reference Trace • Trace Mode

2.1.1 VNA Measurements

- VSWR
- Return Loss
- Cable Loss
- Ins. Loss
- Group Delay
- Phase
- Log Magnitude
- Linear Magnitude
- S-Parameters

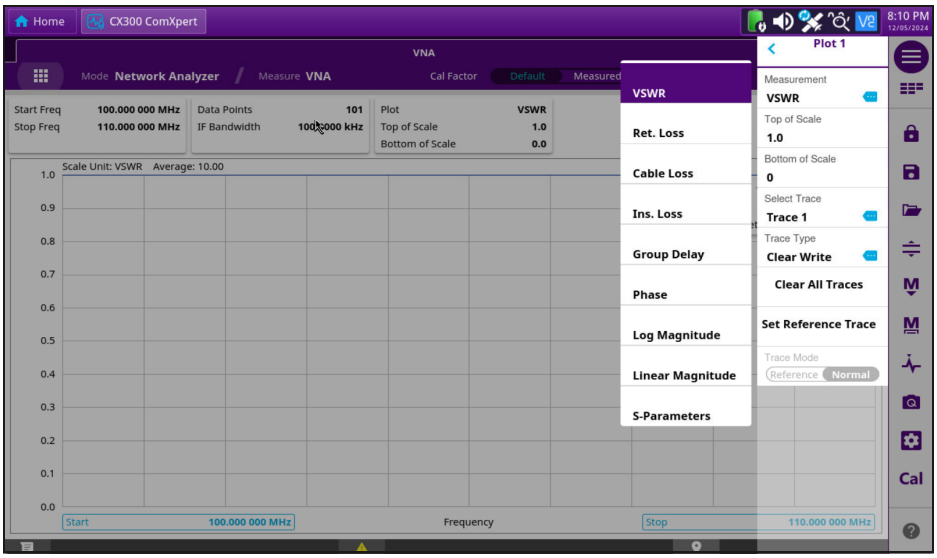

Figure 2-2 VNA Measurements View

2.2 Display Type

- Dual
- Single

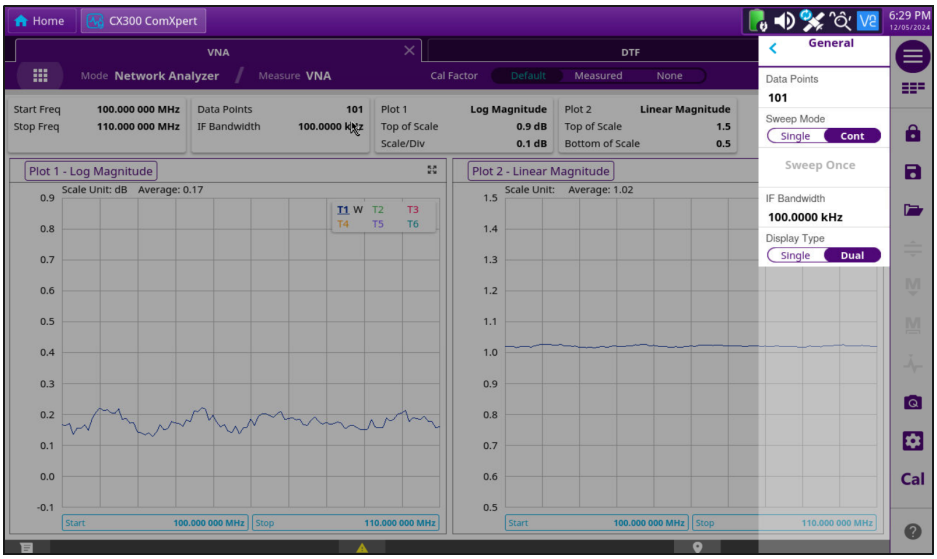

Figure 2-3 Example of Dual Screen View

Figure 2-4 Example of Single Screen View

2.2.1 Display Type - Side by Side using Two Plots

Using two plots for side by side viewing. This view is showing VSWR in Plot 1 and Ret. Loss in Plot 2.

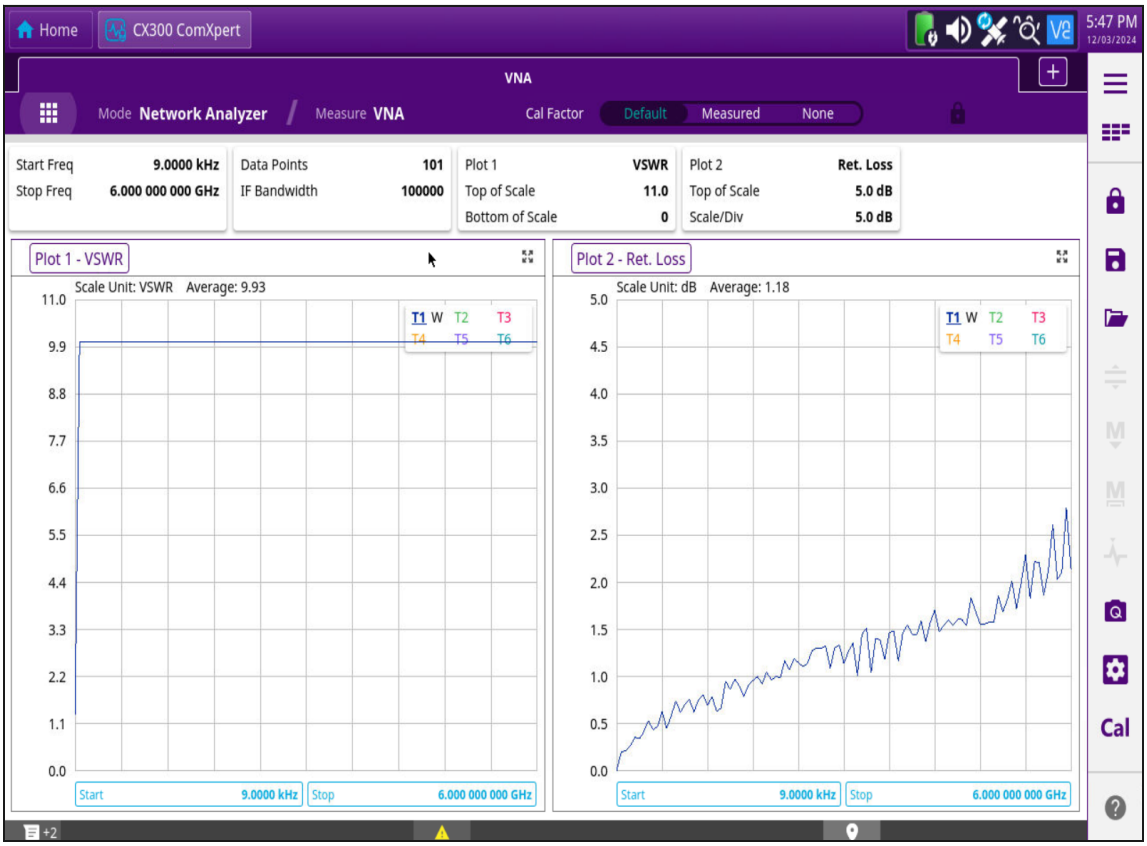

Figure 2-5 Example of Display using Two Plots

2.2.1.1 To set the Display Type

1. Go to VNA control **General.**
2. For Display Type select **Dual** or select **Single**. See Figure 2-3 and Figure 2-4.

2.2.2 VNA Measurement Mode Examples

2.2.2.1 VNA Measurement Mode - VSWR

VSWR is Selected on Plot 1.

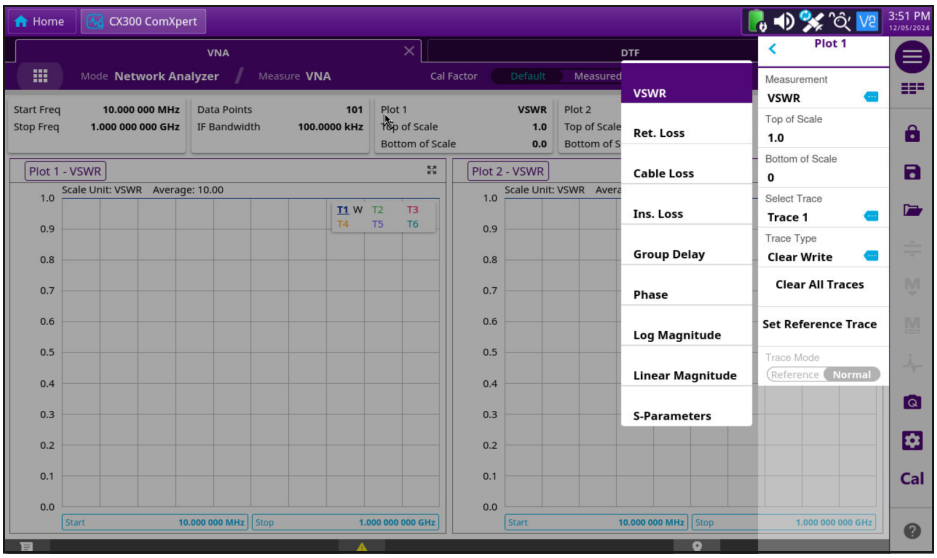

Figure 2-6 VSWR Measurement Selected in VNA

2.2.2.2 VNA Measurement Mode - Return Loss

Return Loss is Selected on Plot 1.

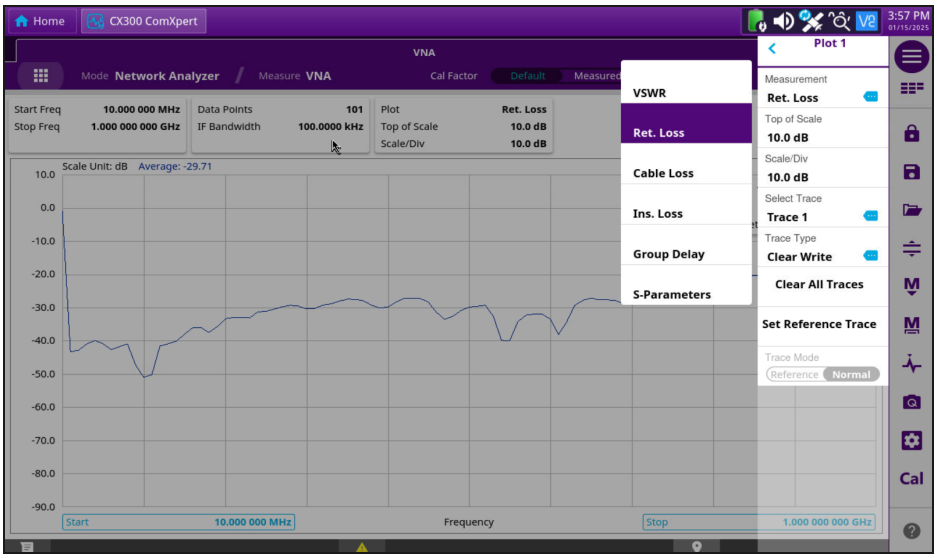

Figure 2-7 Return Loss Measurement Selected in VNA

2.2.2.3 VNA Measurement Mode - Insertion Loss

Insertion Loss is Selected on Plot 1.

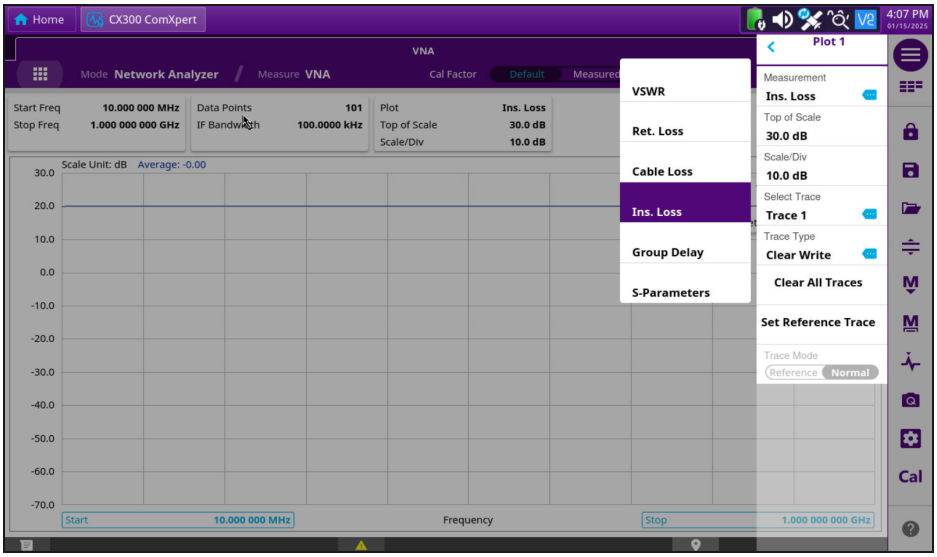

Figure 2-8 Insertion Loss Measurement Selected in VNA

2.2.2.4 VNA Measurement Mode - S-Parameters

S-Parameters is Selected on Plot 1.

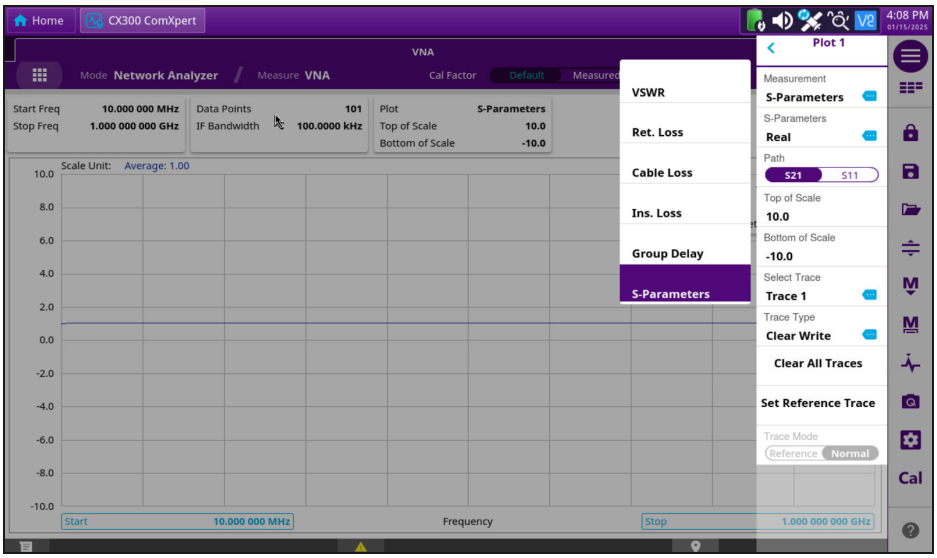

Figure 2-9 S-Parameters Selected in VNA

2.3 DTF Controls and Settings

VNA controls and settings are configured from the **VNA** settings menu. Some controls are also accessed from the **Quick Access Toolbar** or **Function Toolbar.** The following VNA controls and settings are used to configure the characteristics of the VNA DTF measurements:

Table 2-3 VNA DTF Controls and Settings

Control/Setting	Description
Frequency	Frequency and span settings define the frequency range used to evaluate signals. If you know the frequency of the signal being evaluated, the center frequency should be set to match the signal's frequency. If you are investigating signals that are within a particular frequency range, it is best to enter a start and stop frequency to define the span.
Distance	Changes the distance in the DTF measurement. Values can be entered with the numeric keys.
Amplitude	This setting selects the Reference level and attenuation, You can set the reference and attenuation levels automatically or manually to optimize the display of the traces measured, as desired.
Cable Definition	Cable File Type (User or Standard), Cable Name, Velocity, Loss and Save.
General	Select Data Points, Sweep Mode, Measurement Mode (Ret. Loss or VSWR), Unit, IF Bandwidth, and Window selection.
Trace	You can set the number of measurements to be averaged for a **trace** presentation. When the averaging reaches to your setting, a new measurement value replaces the measurement value in sequence from the earliest. Trace types: Live, Captured, or Accumulated.

DTF Menu showing options:

- Frequency
- Distance
- Amplitude
- Cable Definition
- General
- Trace

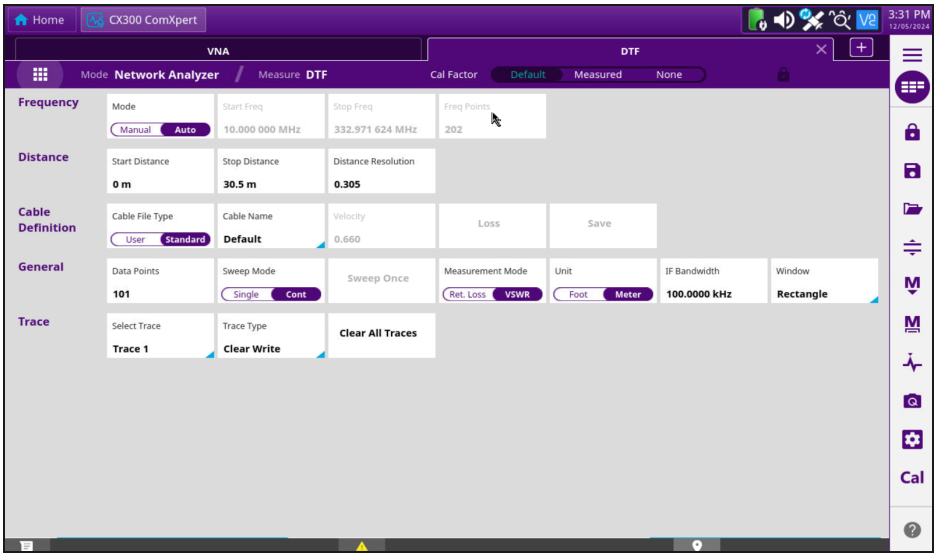

Figure 2-10 Example of DTF Menu

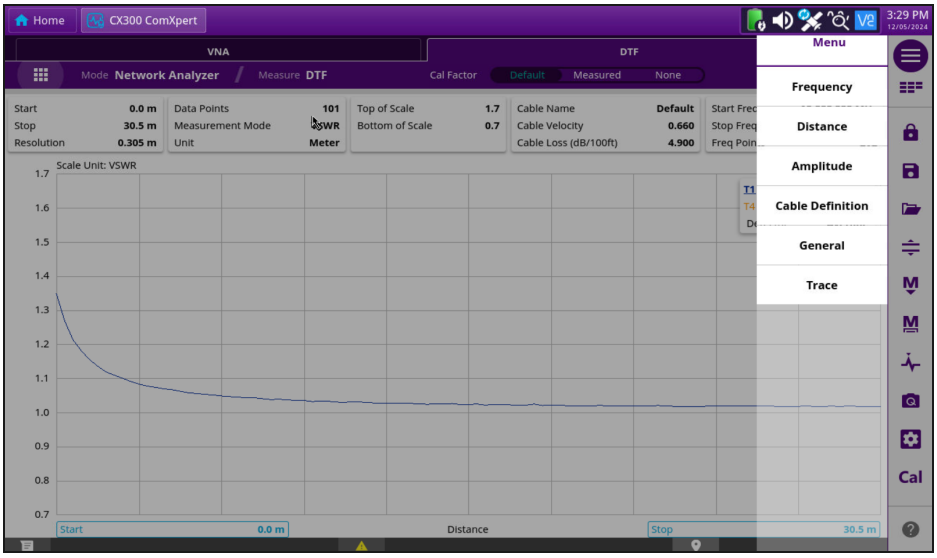

Figure 2-11 Example of DTF Menu 2

2.3.1 VSWR Controls and Settings

VNA controls and settings are configured from the **VNA** settings menu. Some controls are also accessed from the **Quick Access Toolbar** or **Function Toolbar.** The following VNA controls and settings are used to configure the characteristics of the VNA VSWR measurements:

Table 2-4 VNA VSWR Controls and Settings

Control/Setting	Description
Frequency	Frequency and span settings define the frequency range used to evaluate signals. If you know the frequency of the signal being evaluated, the center frequency should be set to match the signal's frequency. If you are investigating signals that are within a particular frequency range, it is best to enter a start and stop frequency to define the span.
Distance	Changes the distance in the DTF measurement. Values can be entered with the numeric keys.
Amplitude	This setting selects the Reference level and attenuation, You can set the reference and attenuation levels automatically or manually to optimize the display of the traces measured, as desired.
Cable Definition	Cable File Type (User or Standard), Cable Name, Velocity, and Loss.
General	Select Data Points, Measurement Mode (Ret. Loss or VSWR).
Trace	You can set the number of measurements to be averaged for a **trace** presentation. When the averaging reaches to your setting, a new measurement value replaces the measurement value in sequence from the earliest. Trace types: Live, Captured, or Accumulated.

2.3.1.1 DTF/General Measurement Mode

- Ret.Loss
- VSWR

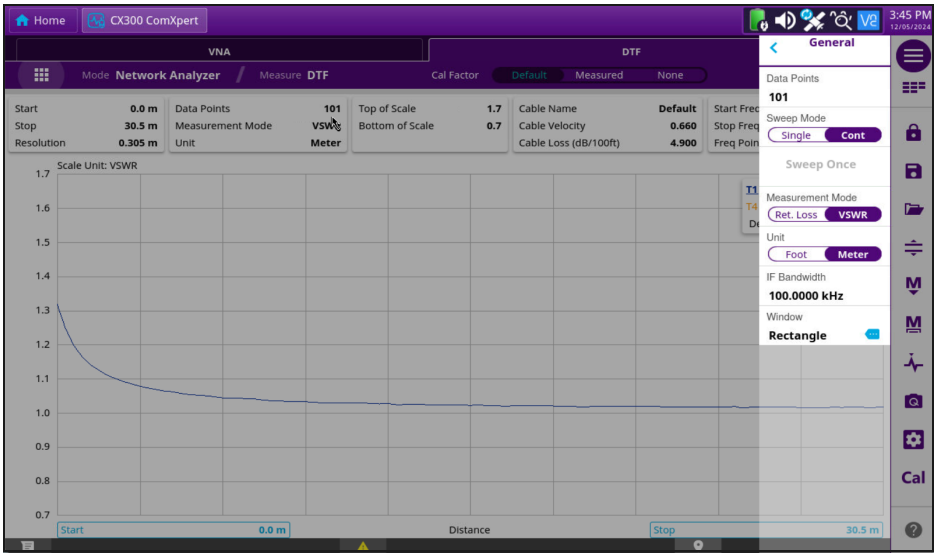

Figure 2-12 VSWR Measurement Selected in DTF

2.3.1.2 DTF Measurement Mode using Plot 1

VSWR is Selected

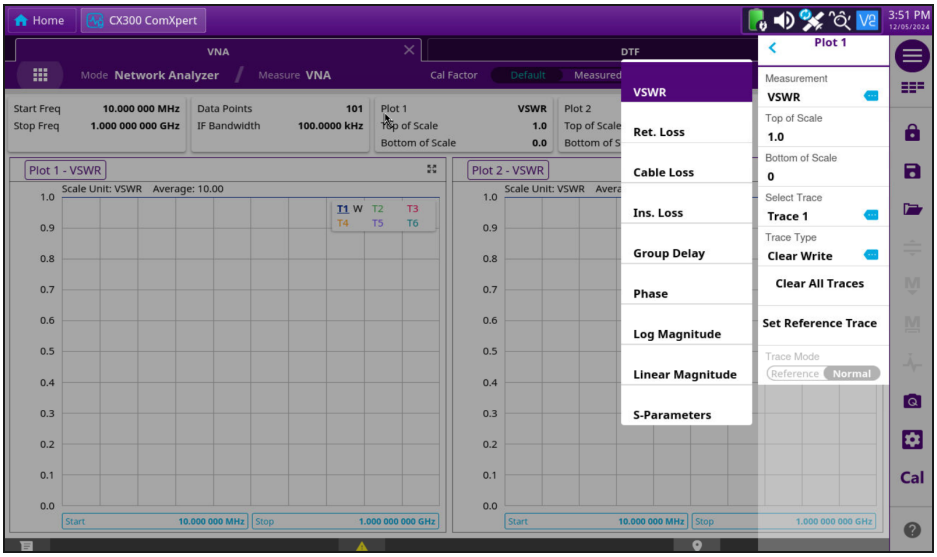

Figure 2-13 VSWR Measurement Selected in DTF

3

Performing Measurements

This chapter provides task-based instructions for using the CX300 ComXpert to establish VNA and to perform key VNA tests and measurements. This chapter describes how to use the CX300 in the following test scenarios.

3.1 Selecting measurement mode

3.1.1 VNA Transceiver Test Description

The following instructions guide the user through an objective VNA Transmitter Test and a subjective VNA Receiver Test. It is not necessary to control the UUT through the UUT OEM tuner or programming software for this test.

3.1.2 Equipment Needed

The following equipment is required to perform the test procedures defined in this section:

- CX300 ComXpert Test Set
- RF Coaxial Cable and adapters
- Mechanical Y-Cal kit

3.1.3 Hardware Setup Diagram

Connect the CX300 and DUT/UUT as shown in Figure 3-1 and Figure 3-2, and then proceed to the next section.

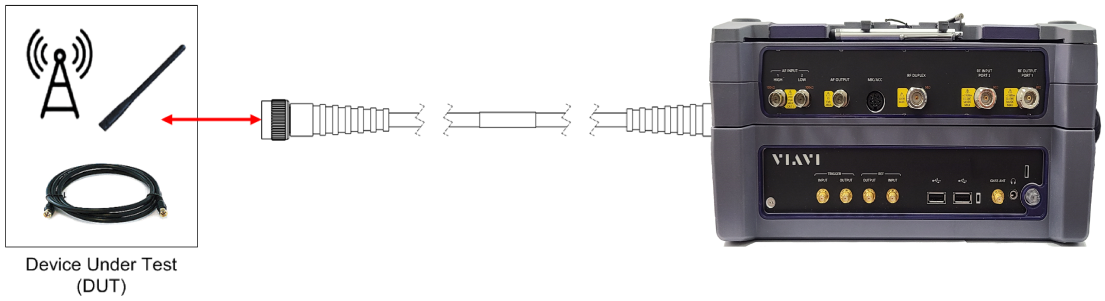

Figure 3-1 Example of Hardware Setup

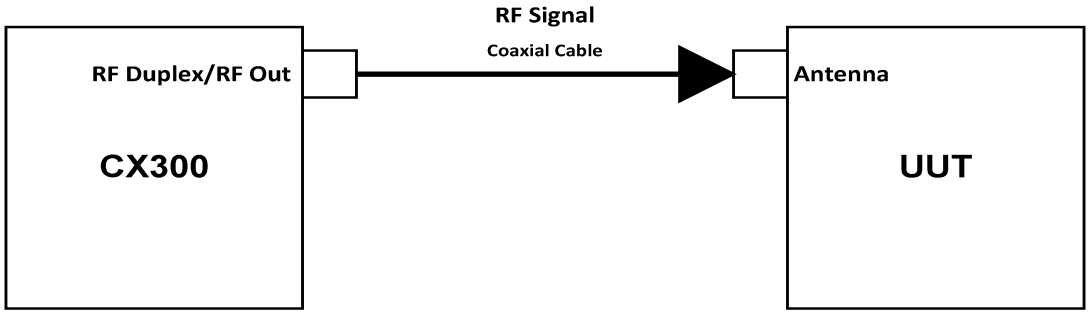

Figure 3-2 Example of Hardware Setup

3.1.4 Selecting measurement mode procedures

1. Press the **MODE** hard key.
2. Press the Spectrum Analyzer soft key. The Measure Off mode is selected by default.
3. Press the MEASURE hot key, and then select the measurement mode from the following choices:
   - Frequency
   - Amplitude
   - General
   - Trace

3.2 Configuring test parameters

3.3 Setting frequency

You can set frequencies manually using the Start Frequency/Stop Frequency or Center Frequency/Span. You can also select from the band list stored in the instrument. It is recommended to set the frequency to a value that covers the normal range of the measurement with enough margins.

3.3.1 Setting frequency Procedures

3.3.1.1 To set the start and stop frequencies:

1. Go to **Network Analyzer Mode** VNA/DTF.
2. Press the **Frequency Mode** and select **Start/Stop**.
3. Select inside the **Start Freq** tab.
4. Enter a value by using the numeric keys on the popup. You can also use the arrow keys.
5. Select the unit: GHz, MHz, or kHz.
6. Select inside the **Stop Freq** tab.
7. Enter a value by using the numeric keys on the popup. You can also use the arrow keys.
8. Select the unit: GHz, MHz, or kHz.

See Figure 3-3.

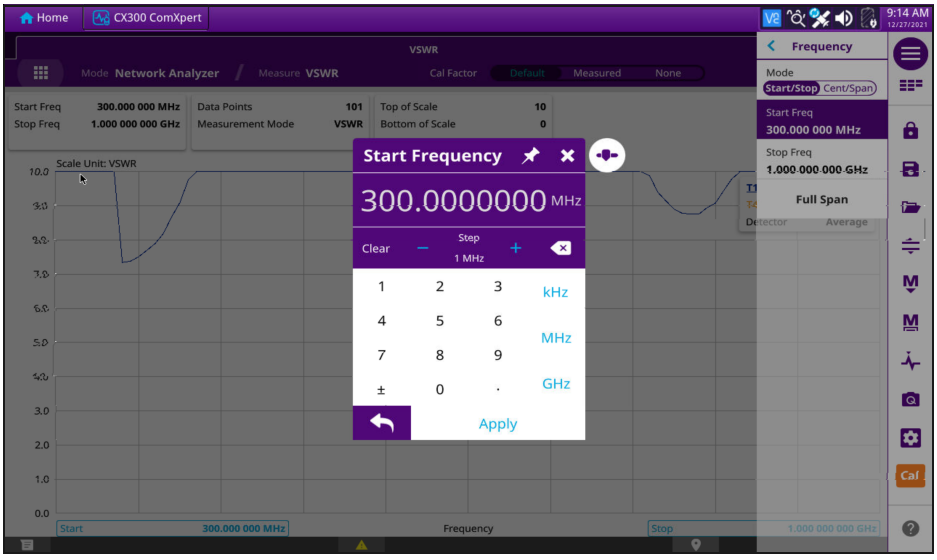

Figure 3-3 Example of Setting Frequency

3.3.1.2 To set the center frequency and span:

1. Go to **Network Analyzer Mode** VNA.
2. Press the **Frequency Mode** and select **Cent/Span**.
3. Select inside the **Center Freq** tab.
4. Enter a value by using the numeric keys. You can also use the arrow keys.
5. Select the unit: GHz, MHz, or kHz.
6. Select inside the **Span** tab.
7. Enter a value by using the numeric keys. You can also use the arrow keys.
8. Select the unit: GHz, MHz, kHz, or Hz.

3.4 Performing Calibration

To get reliable and accurate measurement results, you must perform a calibration on your instrument after setting frequencies and prior to making a measurement. Perform calibration for Reflection, DTF, and Cable Loss.

A Mechanical Y-Cal kit can be purchased for the unit when ordering the VNA Option. To perform the calibration, you will need to have the following ready:

- Mechanical Y-Cal kit. Shown in Figure 3-6.

For Calibration there is the CAL Factor, and Calibration has Default, Measured, and None for options.

Table 3-1 Cal Factor Buttons and Descriptions

Calibration Buttons	Description
Default (Full Range CAL)	To do the Default CAL, user needs to be in Full Range and follow the instructions on CX300, go to and select External Standards, Once in Full Range (Select Start) and run through the CAL. Once user finishes the CAL user can select the Save as Default button.
Measured	The user knows the exact frequency and wants to do a quicker Calibration that is not a FULL Range CAL, the user can select a specific frequency range and run a quick CAL and select SAVE.
None	No CAL applies selection.

NOTE

Save as Default CAL will only show up if user is doing a FULL Range CAL, or are in FULL Range. When user does a Full Range CAL, user can select Save as the current CAL or Save as Default. See Figure 3.4.1 on next page for Full Range CAL definition.

Figure 3-4 Cal Factor Buttons

NOTE

It is recommended that you perform a calibration right at the Reflection/RF Out port of the instrument without using an extension cable in order to minimize a measurement error. If using an extension cable is inevitable, you need to use a phase stable cable and perform the calibration at the open end of the extension cable.

CAUTION

Bending or moving the extension cable while making a measurement may cause errors in the measurement.

NOTE

Calibration can be performed in either VNA or DTF mode.

3.4.1 Default Calibration (Full CAL) and Measured Calibration

- Default Calibration (Full CAL):
  User will set a number of points, Start and Stop Frequencies, and the user will have the ability to save it as the Default CAL. User can also select SAVE to save as the current calibration.
- Measured Calibration:
  If the user knows the exact frequency and wants to do a quicker Calibration that is not a FULL Range CAL, the user can select a specific frequency range and run a quick CAL and select SAVE.

NOTE

If user is not doing a Full Range CAL, then only the Save button is active and the user can save as the current CAL.

When using multiple Frequency Ranges, it is best to create a Default CAL that will measure across all Frequency Ranges. Then users can run quick CAL's for specific Frequency ranges and still be able to return to the default version if necessary. This Default CAL will pick up any Frequency range the user selects.

3.4.2 Calibration Buttons INFO

Table 3-2 CAL Buttons INFO

Control/Setting	Description
Exit Cal	Stops current Calibration. NOTE: User must select SAVE, or Save as Default before selecting Exit Cal to save progress and avoid losing data.
Save As Default	Save as default Calibration (This is only available for FULL Range CAL) Must select External Standards to be in a FULL Range CAL.
Save	Save any CAL as current CAL.
Remeasure	Starts measuring frequencies again replacing prior measurements.
Abort	Stops and cancels the current Calibration Procedure.
Start	Starts a new Calibration Procedure.

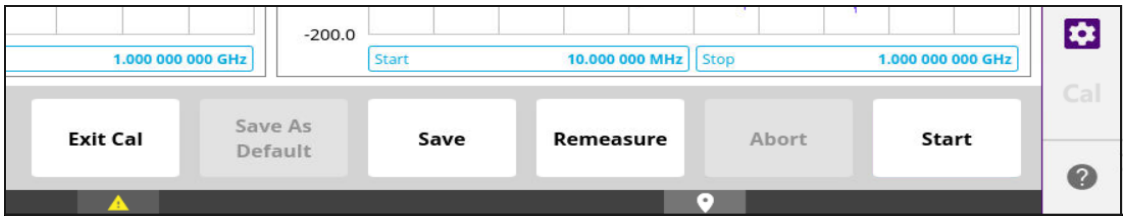

Figure 3-5 Calibration Buttons

3.4.3 Calibration Setup with Calibration Kit (Mechanical Y-Cal kit)

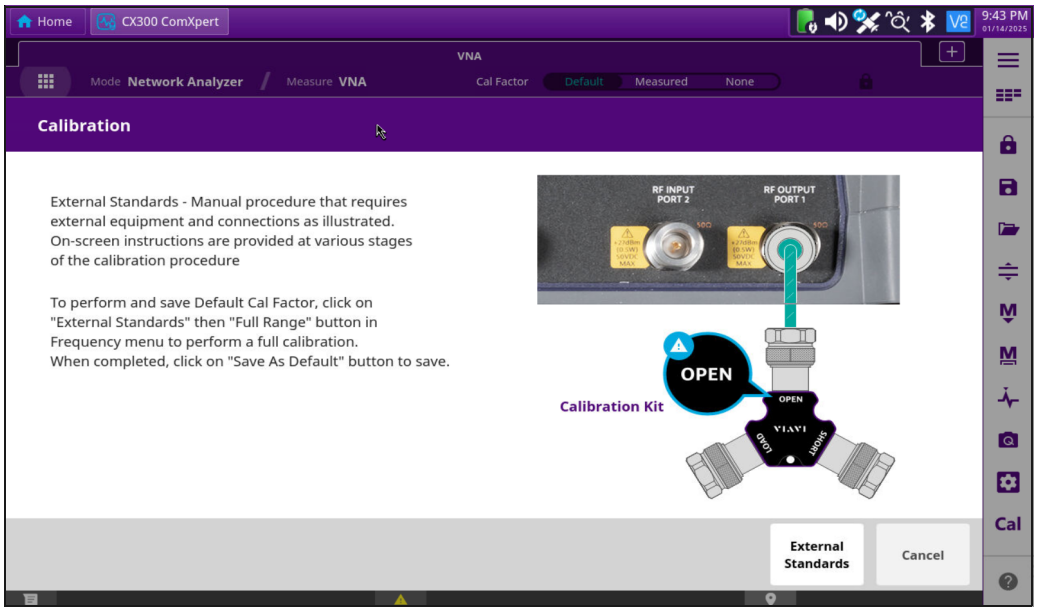

Figure 3-6 Calibration Setup with Calibration Kit (Mechanical Y-Cal kit)

3.4.4 Calibration Procedure

1. Go to **Network Analyzer Mode** VNA or DTF.
2. Press the **Cal** soft key on the side toolbar. The on-screen instruction for the calibration appears.

Cal Soft Key

3. Connect the OPEN connector of the CAL Kit directly to the **Reflection/RF Out port** or at the end of the connected extension cable.
4. Press the **Continue** soft key to start calibration.
5. Connect the SHORT connector of the CAL Kit directly to the **Reflection/RF Out port** or at the end of the connected extension cable.
6. Press the **Continue** soft key to continue calibration. The calibration progress bar appears.

7. Connect the LOAD connector of the CAL Kit directly to the **Reflection/RF Out port** or at the end of the connected extension cable.
8. Press the Continue soft key to continue calibration. The calibration progress bar appears. After completion, the calibration status on the screen changes to **ON**.
9. Connect **RF Output port 1** to **RF Input port 2** and select **OK**.
10. For Calibration Setup Diagram see Figure 3-6.

3.5 Setting distance

In the DTF measurement mode, you need to set the start and stop distances. The maximum measurable distance is displayed on the left side of the screen depending on the frequency setting. You can set any distance within the maximum measurable distance. Optimum resolution is achieved when the user setting distance is the same as the maximum measurable distance.

3.5.1 Setting distance Procedures

1. Go to **Network Analyzer Mode** DTF.
2. Select **Distance** on the Menu.
3. Select inside the **Start Distance** tab.
4. Enter a value by using the numeric keys. You can also use the arrow keys.
5. Select the **Apply** key.
6. Select inside the **Stop Distance** tab.
7. Enter a value by using the numeric keys. You can also use the arrow keys.
8. Select the **Apply** key.
9. See Figure 3-7.

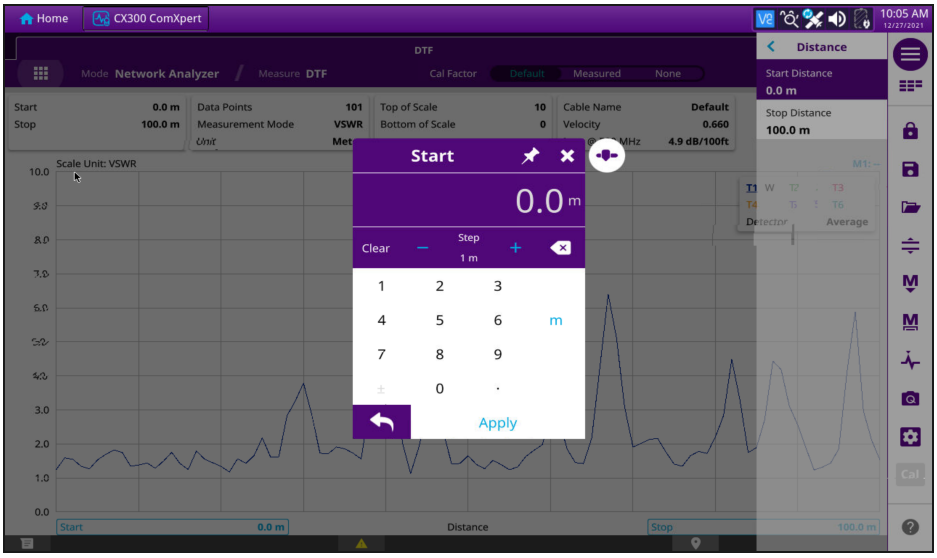

Figure 3-7 Example of Setting Distance

3.5.1.1 Adjusting Scale

You can adjust the Y-axis scale to optimize the display of measurement trace(s). Adjusting scale does not affect the calibration state.

3.5.1.2 Adjusting Scale Procedures

1. Go to **Network Analyzer Mode** DTF.
2. Select **Amplitude** on the Menu.
3. Select inside the **Top of Scale** tab.
4. Enter a value by using the numeric keys. You can also use the arrow keys.
5. Select the **Apply** key.
6. Select inside the **Bottom of Scale** tab.
7. Enter a value by using the numeric keys. You can also use the arrow keys.
8. Select the **Apply** key.
9. See Figure 3-8.

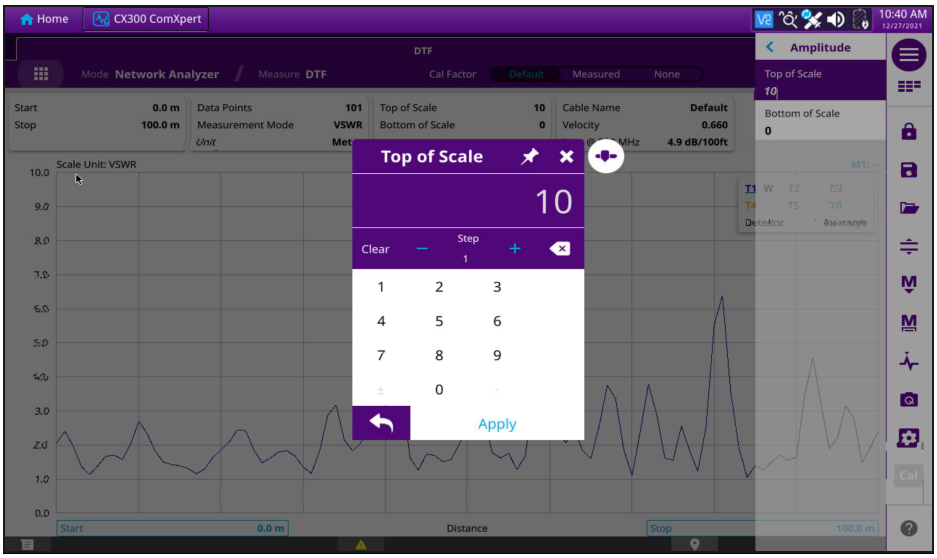

Figure 3-8 Example of Adjusting Scale

3.5.2 Connecting a cable

3.5.2.1 Connecting a cable for Reflection and DTF measurements

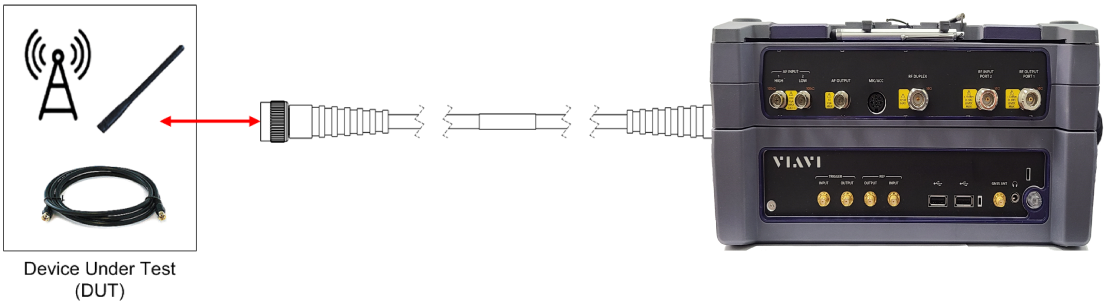

Figure 3-9 Example of Hardware Setup

Connect the CX300 and DUT/UUT as shown in Figure 3-9 and Figure 3-10, and then proceed to the next section.

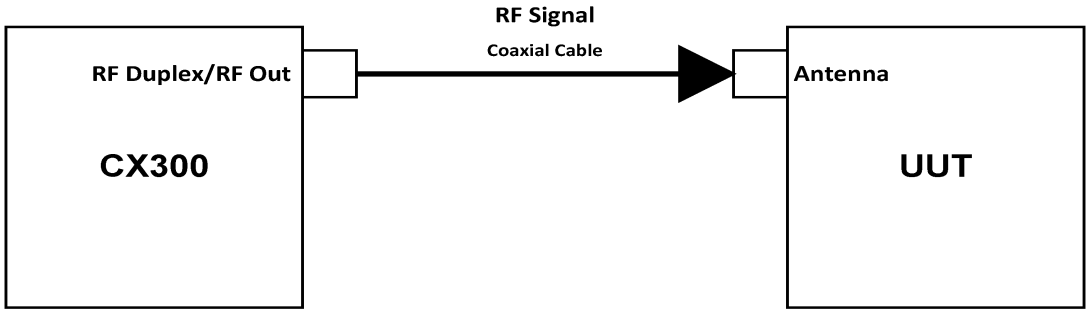

Figure 3-10 Example of Hardware Setup

3.6 Performing Reflection measurements

The Reflection measurement can be used to characterize cable and antenna system to ensure transmission line impedance performance and signal reflection characteristics of cell-site across a specific frequency range in voltage standing-wave ration (VSWR) or return loss.

3.6.0.1 Equipment Needed

The following equipment is required to perform the test procedures defined in this section:

- CX300 ComXpert Test Set
- RF Coaxial Cable and adapters
- Mechanical Y-Cal kit

3.6.1 Making a VSWR measurement

1. Make a proper cable connection as described in “Connecting a cable for Reflection and DTF measurements”.
2. Go to **Network Analyzer Mode** DTF.
3. Select **General** on the Menu.
4. Select inside the **Data Points** tab to change the resolution of your measurement. Changing the data point does not affect current calibration.
5. Enter a value by using the numeric keys. You can also use the arrow keys.
6. For **Measurement Mode** select **VSWR**.
7. Select the **Apply** key.

See Figure 3-11.

NOTE

The larger number you choose, the higher resolution you get and the longer the instrument takes to sweep and display results. Selecting the data point larger than what you need for a measurement will result in unnecessarily long sweep time. It is recommended that you select high resolution data points only for an instance of measuring wide frequency bands or requiring precise measurement data.

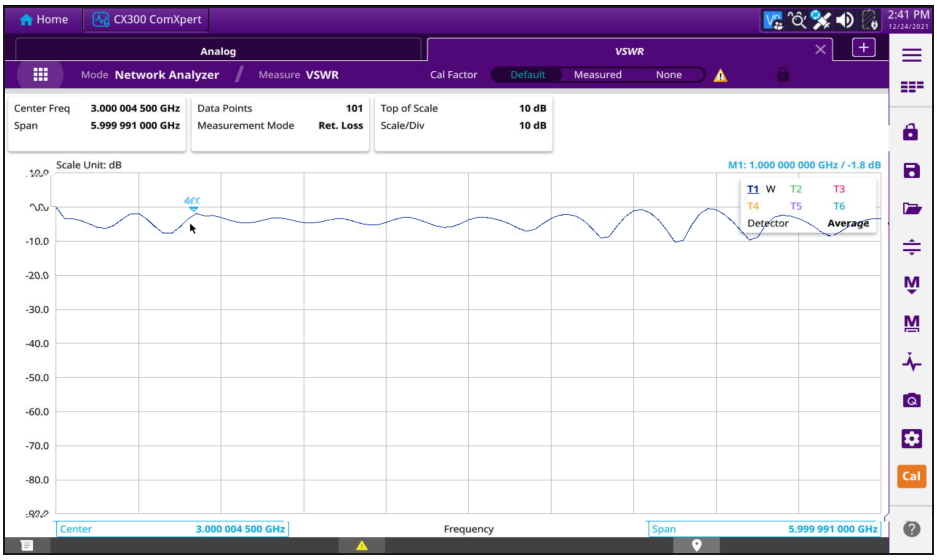

Figure 3-11 Example of Reflection measurement in return loss scale

3.7 Performing DTF measurements

The Distance-To-Fault (DTF) measurement can be used to accurately identify fault locations in the cell-site transmission (cable and feed line) system, indicating signal discontinuities in VSWR or return loss over distance in meter or foot. This measurement precisely pinpoints the location of such things as damaged or degraded antennas, connectors, amplifiers, filters, and duplexers.

3.7.1 Making a DTF measurement

1. Make a proper cable connection as described in “Connecting a cable for Reflection and DTF measurements”.
2. Go to **Network Analyzer Mode** DTF.
3. Select **General** on the Menu.

4. Select inside the **Data Points** tab to change the resolution of your measurement. Changing the data point does not affect current calibration.
5. Enter a value by using the numeric keys. You can also use the arrow keys.
6. Select the **Apply** key.
7. See Figure 3-12.

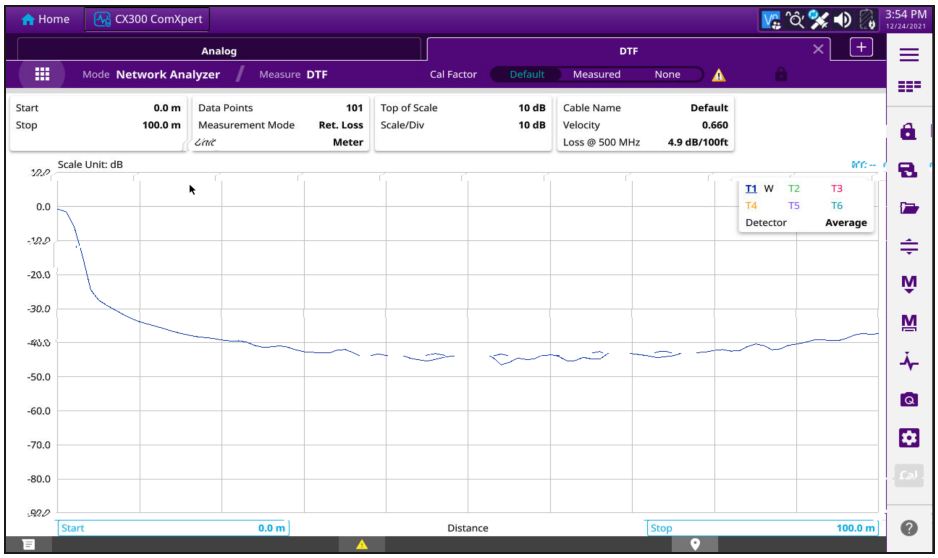

Figure 3-12 Example of DTF measurement

NOTE

The larger number you choose, the higher resolution you get and the longer the instrument takes to sweep and display results. Selecting the data point larger than what you need for a measurement will result in unnecessarily long sweep time. It is recommended that you select high resolution data points only for an instance of measuring wide frequency bands or requiring precise measurement data.

3.8 Performing cable procedures and cable loss measurements

3.8.1 To select a custom cable

1. Go to **Network Analyzer Mode** DTF.
2. Select **Cable Definition** on the Menu.
3. Under **Cable File Type** select **User**.
4. Select inside the **Velocity** tab.
5. Enter a value for **Cable Velocity** by using the numeric keys. You can also use the arrow keys.
6. Select the **Apply** key.
7. Select **Save** on the **Cable Definition** menu.
8. See Figure 3-13.

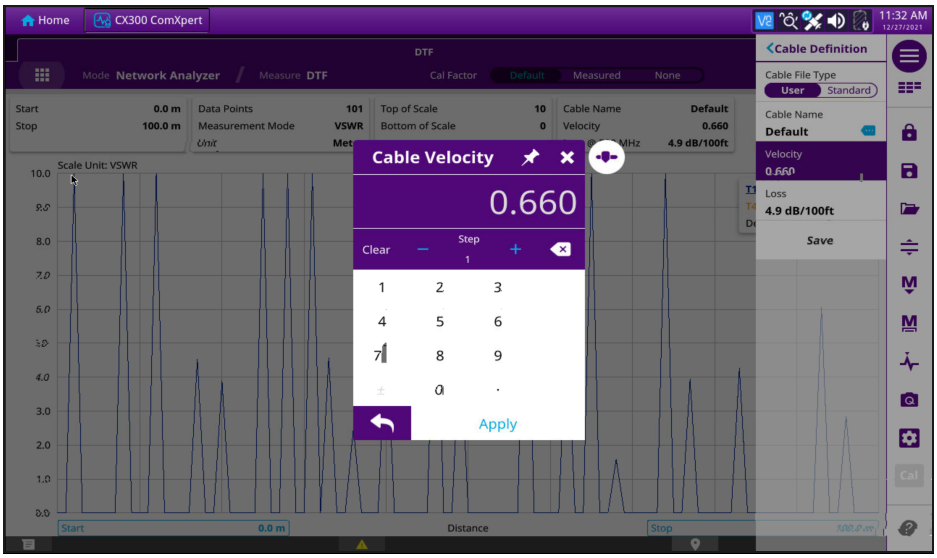

Figure 3-13 Example of Cable Definition/Cable Velocity

3.8.2 To select a cable from the Cable List

1. Go to **Network Analyzer Mode** DTF.
2. Select **Cable Definition** on the Menu.
3. Under **Cable File Type** select **Standard**.
4. Select inside the **Cable Name** tab.

5. Select **Cable Name** from the list.
6. Select the **Apply** key.
7. See Figure 3-14.

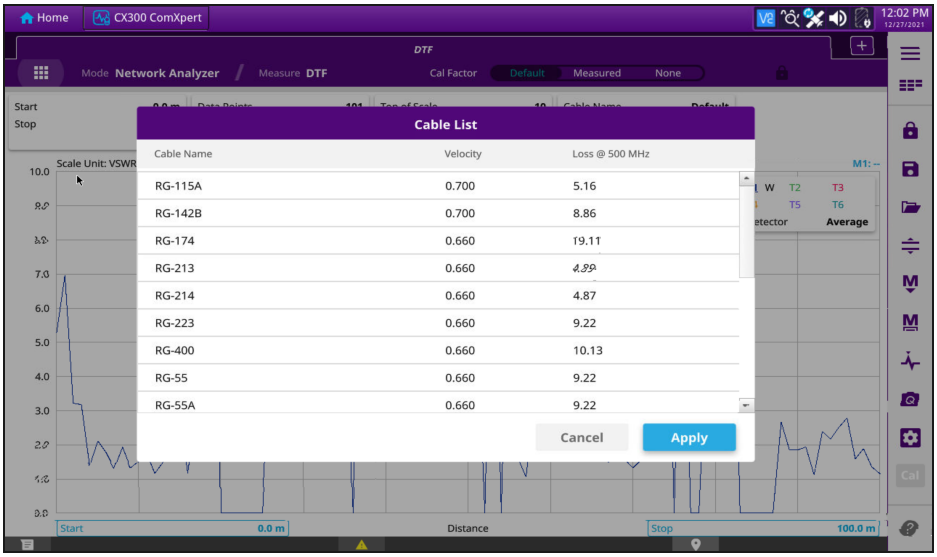

Figure 3-14 Example of Cable List

3.8.3 To select the Cable Loss or to define the cable loss

1. Go to **Network Analyzer Mode** DTF.
2. Select **Cable Definition** on the Menu.
3. Under **Cable File Type** select **User**.
4. Select inside the **Loss** tab.
5. Enter a value for **Cable Loss** by using the numeric keys. You can also use the arrow keys.
6. Select the **Apply** key.
7. Select **Save** on the **Cable Definition** menu.
8. See Figure 3-15.

NOTE

The velocity affects the calculation of the distance and the cable loss affects the peak level of the discontinuity in a DTF measurement.

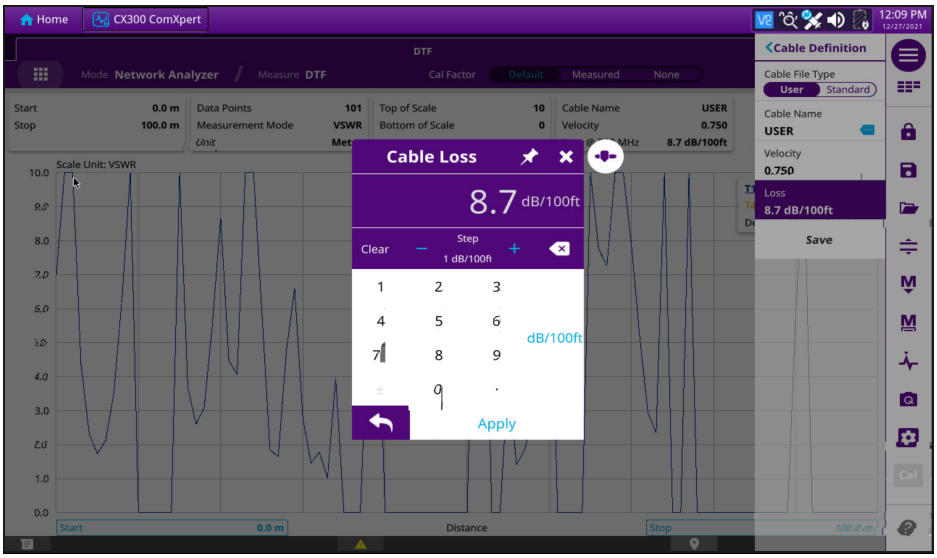

Figure 3-15 Example of Cable Loss

A

Terms and Acronyms

A - B

ACC — accessory

AES — Advanced Encryption Standard

AF — Audio Frequency

AGC — Automatic Gain Control

Avg — average

BER — Bit Error Rate

C - D

C4FM — A type of modulation called C4FM, which is an acronym for “compatible 4 level frequency modulation.

dBm — decibel milliwatts

DES — Data Encryption Standard

DEST ID — Destination Identifier

DTF — Distance to Fault

F - L

FM — Frequency Modulation

GUI — Graphic User Interface

HP — High Pass in relation to High Pass filter

kHz — kilohertz

LP — Low Pass in relation to Low Pass Filter

M - N

mHz — millihertz

MHz — megahertz

MIC — microphone

Mod — Modulation

NAC — Network Access Code

P - S

RF — Radio Frequency

SCCB — Secondary Control Channel Broadcast

Sym Dev — Symbol Deviation

U - Z

TGID — Talk Group Identifier

UI — User Interface

USB — Universal Serial Bus

UUT — Unit Under Test

VNA — Vector Network Analyzer

VSWR — Voltage Standing Wave Ratio

WACN — Wide Area Communications Network

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