OPERATING MANUAL

Protek A434L

4 GHz Cable & Antenna Analyzer

This is global GSI | Protek

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INTRODUCTION

This Operating Manual represents design, specifications, overview of functions, and detailed operation procedure of A434L RF master, to ensure effective and safe use of the technical capabilities of the instrument by the user.

RF Master operation and maintenance should be performed by qualified engineers with initial experience in operating of microwave circuits and PC.

The following abbreviations are used in this Manual:

PC - Personal Computer

DUT - Device Under Test

IF - Intermediate Frequency

CW - Continuous Wave

SWR - Standing Wave Ratio

FIRMWARE VERSIONS

The first edition of this Operating Manual applies directly to instruments that have the firmware version 1.xx.

SAFETY INSTRUCTIONS

Carefully read through the following safety instructions before putting the Analyzer into operation. Observe all the precautions and warnings provided in this Manual for all the phases of operation, service, and repair of the Analyzer.

The Analyzer must be used only by skilled and specialized staff or thoroughly trained personnel with the required skills and knowledge of safety precautions.

A434L complies with INSTALLATION CATEGORY II as well as POLLUTION DEGREE 2 in IEC61010-1.

A434L is MEASUREMENT CATEGORY I (CAT I). Do not use for CAT II, III, or IV.

A434L is for INDOOR USE only.

A434L is tested in stand-alone condition or in combination with the accessories supplied by GS INSTRUMENTS CO., LTD. against the requirement of the standards described in the Declaration of Conformity. If it is used as a system component, compliance of related regulations and safety requirements are to be confirmed by the builder of the system.

Never operate the Analyzer in the environment containing inflammable gasses or fumes.

Operators must not remove the cover or part of the housing. The Analyzer must not be repaired by the operator. Component replacement or internal adjustment must be performed by qualified maintenance personnel only.

Never operate the Analyzer if the power cable is damaged.

Never connect the test terminals to mains.

Electrostatic discharge can damage your Analyzer when connected or disconnected from the DUT. Static charge can build up on your body and damage the sensitive circuits of internal components of both the Analyzer and the DUT. To avoid damage from electric discharge, observe the following:

- Always use a desktop anti-static mat under the DUT.
- Always wear a grounding wrist strap connected to the desktop anti-static mat via daisy-chained 1 MΩ resistor.
- Connect  clamp on the body of the Analyzer to the body of the DUT before you start operation.

Observe all the general safety precautions related to operation of equipment powered by mains.

The protection provided by the equipment may be impaired if the equipment is used in a manner not specified by the manufacturer.The definitions of safety symbols used on the instrument or in the Manual are listed below.

Storage

Before first use store your equipment in the factory package at environment temperature from 0 to +50 ºC and relative humidity up to 95% (at 25ºC).

After you have removed the factory package store the equipment at environment temperature from +10 to +35 ºC and relative humidity up to 80% (at 25ºC).
Ensure to keep the storage facilities free from dust, fumes of acids and alkalies, aggressive gases, and other chemicals, which can cause corrosion.

Moderate Ventilation

Maintain moderate ventilation condition to prevent overheating of the product.

Environment	Ambient temperature 2ºC to 50ºC
	Maximum 80% RH between 2ºC and 31ºC, decreasing to 50% RH at 50ºC
	Maximum altitude 2,000m
	MAINS supply voltage fluctuations up to 10% of the nominal voltage
	Transient over-voltages according to installation category II
	Pollution degree 2
	IPX0

Warning

Never perform cleaning of the instrument if the power cable is connected to the power outlet.Never clean the internal components of the instrument.

Do not position the equipment so that it is difficult to operate the power cord.


Refers to the Manual if the instrument is marked with this symbol.


Alternating current.


Direct current.

On (Supply).


Off (Supply).

A chassis terminal; a connection to the instrument's chassis, which includes all exposed metal structure.

CAUTION

This sign denotes a hazard. It calls attention to a procedure, practice, or condition that, if not correctly performed or adhered to, could result in injury or death to personnel.

CAUTION

This sign denotes a hazard. It calls attention to a procedure, practice, or condition that, if not correctly performed or adhered to, could result in damage to or destruction of part or the entire instrument.

Note

This sign denotes important information. It calls attention to a procedure, practice, or condition that is essential for the user to understand.

CERTIFICATE

ZERTIFIKAT ◆ CERTIFICATE ◆ 認証証書 ◆ СЕРТИФИКАТ ◆ CERTIFICADO ◆ CERTIFICAT

Product Service

Attestation of Compliance

No. N5 14 01 56328 012

Holder of Certificate:	**GS Instruments Co., Ltd.** 1385-14, Juan-Dong, Nam-Ku Incheon 402-200 REPUBLIC OF KOREA	
Product:	**Electrical equ. for measurement, control and laboratory use (RF MASTER)**	
Model(s):	**A434L**	
Parameters:	Rated input voltage:	12 V d.c.
	Rated input current:	3.5 A
	Protection class:	III
	Installation category:	II
	Degree of protection against ingress of liquids:	ordinary
Tested according to:	EN 61010-1:2010	

This Attestation of Compliance is issued on a voluntary basis for electrical equipment below the voltage limits of Low Voltage Directive 2006/95/EC (previous 73/23/EEC). The essential requirements are fulfilled accordingly. It refers to the particular sample submitted for testing and certification only. See also notes overleaf.

Test report no.: CPSA01005214

Date, 2014-01-09 (Hyuk-Jun Kwon)

500217

CE Other relevant European directives have to be observed. If they require CE marking it may be affixed on the product after preparation of the necessary technical documentation as well as the declaration of conformity.

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1

GENERAL OVERVIEW

OPERATING MANUAL

1. GENERAL OVERVIEW

1.1 Description

A large number of cell site problems are caused by the antenna system, cable, or connectors. It is important to have the right instrument available when either servicing or certifying cell sites for operation.

The Protek A434L RF master is a lightweight portable diagnostic tool for an accurate detection of operational problems. The Protek A434L has all the measurement functions necessary to accurately verify the antenna system from VSWR to power measurements. In addition, the Protek A434L makes distance-to-fault measurements to accurately pinpoint the fault's location.

The Protek A434L user interface is with a front keypad and a TFT color, 7-inch display providing ease of use and control. The application specific software allows the user to easily compare and analyze measurements and generate comprehensive reports. The Protek A434L is equipped with a rechargeable and infield installable lithium-ion battery providing over four hours of operation.

1.2 Specifications

1.2.1 Basic Specifications

Item	Sub Item	Specification
General	Max Input Power	+25dBm Damage level
	Frequency Range	5MHz to 4GHz
	Frequency Accuracy	〈±3ppm
	Frequency Resolution	10kHz
	Impedance	50Ω
	Scan Speed	〈1msec /data point
	Display	Single & Dual mode
	Test port	N Female

	Test curve storage		Internal : Minimum 512MB External : Limited by size of USB (32G)
	Screen storage		
	Setup storage		
VSWR	Number of data points		126, 251, 501, 1001, 2001
	Return loss Range		0 to -60dB
	VSWR Range		1 to 65
Cable Loss	Cable loss range		0 to -30dB, 0.01dB Resolution
Interference Immunity	On-Frequency		+10dBm
	On-Channel		+20dBm
DTF	Return Loss Display Range		0 to 60dB
	Distance Range		0 to 1250m (4125ft)
	VSWR Display Range		0 to 65
Miscellaneous	Dimension		260X193X67mm
	Weight		<2.45Kg include battery
	A434L Voltage and Current		12Vd.c., 3.5A
	Adaptor	AC Input	100 to 250Vd.c., 1.5A
		DC Output	12Vd.c., 5A
	Battery		Li-Ion (4hr operating time after full charging), 12Vd.c., 7600mAh
Environmental	Operating Temperature		0°C ~ +50°C
	Storage Temperature		-40°C ~ +80°C (-40°F ~ +176°F)
	Humidity		95%R.H. NO Condensation
	Degree of protection		IPX0
Power Meter(Option)	Frequency Range		20MHz to 3.8GHz
	Sensor Type		Average
	Peak Power Sensor		-40dBm to +10dBm
	Accuracy		±7%
	Test Port		Precision N Female

Table 1.1 Basic Specifications

1.2.2 Key Measurements

- High resolution VSWR Measurements
- Distance to Fault (DTF) Measurements
- Cable Loss Measurements
- RMS Power Measurements (optional)

1.2.3 Key Features

- Rechargeable and infield replaceable lithium-ion battery
- Built-in world-wide signal standards and frequency channels
- 7 Inch TFT color display viewable in daylight
- Dual display to view multiple measurements simultaneously to reduce test time
- Easy front keypad operation
- Superior immunity to RF interference
- Up to 2001 data points to locate long range problems
- Built-in cable menus containing >90 cables' characteristics
- User friendly menu structure
- Saves up to Memory (user setups, traces, screens)
- Alphanumeric labeling of saved data
- Automatic Time/Date stamp of saved data
- USB Port (USB 2.0)
- Remote firmware upgrade capability

- Fast one-touch selection of menu item or positioning marker
- Smart Battery management can be check Battery capability
- Rechargeable and field replaceable Lithium Ion battery with more than 4 hours operation time
- Backlight keypad for easier use in dark environments
- Sun-Light Readable LCD for readability

1.3 The Layout of A434L

Figure 1.1 A434L Front Panel

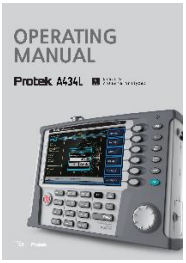
Figure 1.2 A434L Rear Panel

Figure 1.3 A434L Upper Panel

1.4 Ordering Information

1.4.1 Standard Accessories

The standard accessories supplied with the A434L RF Master are as follows:

Description	Picture	Specification
Soft Carrying Case		
AC-DC Adapter		Input: 100 ~ 240Va.c., 1.5A Output: 12Vd.c., 5A
Neck Strap		
Hand Strap		
Li-ion Battery		Output: 8.4Vd.c. MAX, 7800mAh
User's Manual		Hard Copy

1.4.2 Options

The options supplied with the A434L RF Master are as follows:

Description	Picture	Specification
Power Sensor **(Part No: S134)**		Frequency Range : 20MHz to 3.8GHz Sensor Type : Average Peak Power Sensor : -40dBm to +10dBm Accuracy : ±7% Test Port : Precision N Female
Battery Charger **(Part No: C122R5)**		Input: 100 ~ 240Va.c., 1.5A Output: 12Vd.c., 5A

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PREPARATION FOR USE

2. PREPARATION FOR USE

2.1 General Information

Unpack the Analyzer and other accessories. Check the contents of the package against the list specified in section 1.4.1. Connect your A434L to the AD-DC Adaptor(12Vd.c., 5A) or Li-ion Battery(8.4Vd.c. MAX, 7800mAh) power source by means of the Power Cable supplied with the instrument.

Warm-up the Analyzer for 20 minutes after turning the power on.

Assemble the test setup using cables, connectors, fixtures, etc, which allow DUT connection to the Analyzer.

Perform calibration of the Analyzer. Calibration procedure is described in section 4.1.3.

2.2 Power Adaptor

The equipment uses following power supply.

Product: Switching Power Supply Adaptor

Model no. FSP060-DBAE1

AC INPUT: 100-240Va.c.~, 1.5A, 50-60Hz

DC OUTPUT: 12.0Vd.c. 5.0A MAX

Manufactured by: Zhonghan Electronics (Shenzhen)

Trade mark: FSP GROUPINCUC

2.3 Battery

A434L use CE, UL Certificated PBP-7800 Battery.

Figure 2.1 A434L Battery

CAUTION

RISK OF EXPLOSIOM IF BATTERY IS REPLACED BY AN INCORRECT TYPE.

DISPOSE OF USED BATTERIES ACCORDING TO THE MANUFACTURER'S INSTRUCTIONS.

① If the “push” button on the battery is pressed, the remained battery volume will be displayed in the battery icon next to the “push” button.
② Each level of the battery indicator takes 20% of the battery portion. If the battery level is three, it means the battery is charged 40% - 60%.
③ As illustrated below, please insert the battery pack while the printed label is on the upside.
④ Non rechargeable Li-Ion battery was in analyzer.
⑤ This non rechargeable Li-Ion battery is CR02032.(made by Hitachi Maxwell Ltd)

2.3.1
Caution

① Avoid placing the battery pack near heating sources of on the place near windows.
② Do not store the battery pack in the high humidity.
③ If the battery is unused for a long time, separate it from the unit.
④ Keep this battery pack away from children
⑤ If electrolyte from the battery pack is leaking or the battery pack smells strangely, keep the battery pack away from fire.
⑥ In case that electrolyte from the battery pack is touched by any part of the human body, wash it immediately and go to hospital to prevent potential damage.
⑦ Use the authorized charger only.
⑧ Do not abandon the battery pack in the car in the summer.
⑨ Avoid any shock to the battery pack.
⑩ Do not replace non rechargeable Li-Ion battery except for certified person.
⑪ This battery has about ten-month warranty.

2.3.2
Installing a Battery

Caution: Full charge the battery before first using the analyzer.

Figure 2.2 A434L Right Side View

1	Open the battery cover.
2	Insert the battery (Observe correct battery polarity orientation when installing).
3	Close the battery cover.

2.3.3
Charging a Battery

You may charge the battery both in the analyzer and in the external battery charger.

1	Insert the battery in the analyzer.
2	Plug in the AC- DC adapter and switch on the external power.
3	The charge indicator icon on the screen, indicating that the battery is charging and is fully charged.

During charging and discharging, the battery voltage, current, and temperature are monitored. If any of the monitored conditions exceed their safety limits, the battery will terminate any further charging or discharging until the error condition is corrected.

2.3.4
Battery Low

If A434L runs out of battery, the following message will appear on the display.

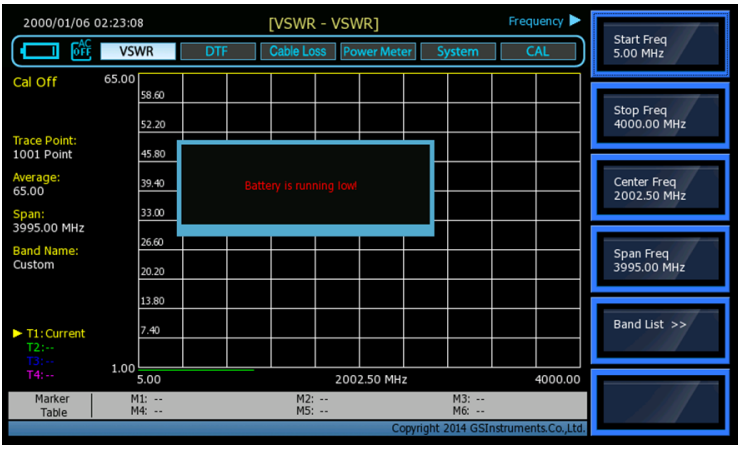

Figure 2.3 Battery 10% or Battery 5% Screen Display

2.3.5
Battery Power Off

If the battery power is lower than 1%, the following message will appear on the display, and the Power will be Off.

Figure 2.4 Battery Power Off Screen Display

2.4 Front Panel

The front view of A434L is represented in figure 1.1. The front panel is equipped with the following parts:

2.4.1
Key Layout

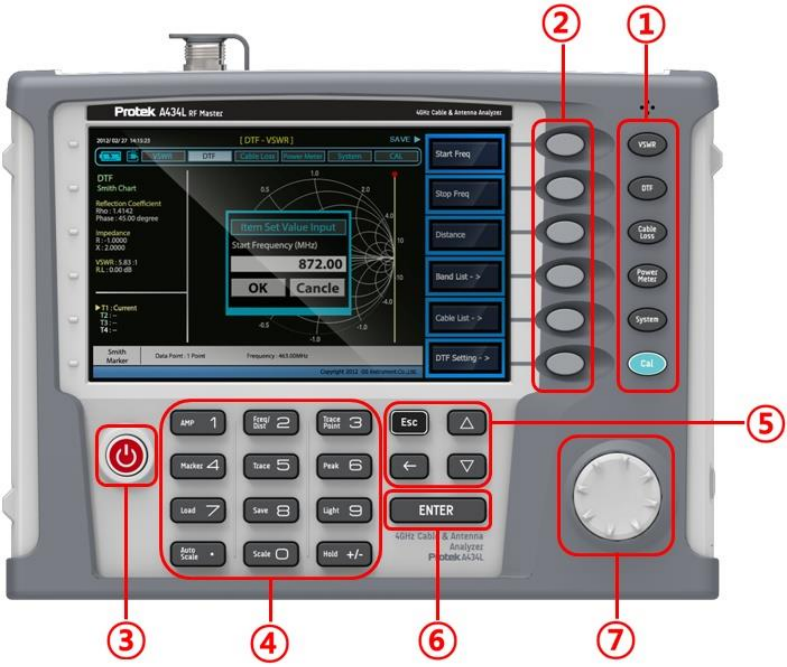

Figure 2.5 A434L Key Layout

2.4.2 ① Function Hard keys

The six hard keys are located at the left of the display. The function of each key is indicated on each key. Depending on the selection of Hard Keys, the functions shown in the screen menu may vary.

	≪**VSWR**≫ Activates the VSWR measurement mode.
	≪**DTF**≫ Activates the DTF measurement mode.
	≪**Cable Loss**≫ Activates the Cable Loss measurement mode.
	≪**Power Meter**≫ Activates the RF Power measurement mode. An optional power sensor must be connected to the instrument before using this function
	≪**System**≫ Opens the system screen menu.
	≪**CAL**≫ Opens the calibration screen menu.

2.4.3 ② Soft Keys

The six keys at the right of the display are the Soft Keys.

	Each Soft Key has a function which varies depending on the operation mode. The function of each key is displayed at the right side of the display as a screen menu. As the LCD is touch-screen, the function can be selected by touching the screen menu.

2.4.4 ③ Power Switch Key

	≪**Power Switch**≫ toggles between On and Off states of the Analyzer.
Note	Holding the key for more than 3 seconds on an operating Analyzer will turn off the power supply
CAUTION	Do not disconnect the power cable from the mains when the Analyzer is operating. This can damage the Analyzer software.

2.4.5 ④ Multi Keys

Enter values printed on the keys when a value input pop-up window is prompted on the screen. Open a menu linked with the functions in blue or directly perform the specified function.

≪Numeric & specific function≫ key

Multi keys operate as follows when a user is prompted to input values by pop-up window.

- Numeric keys from 0 to 9 are used to input user setting numbers.
- The plus/minus (+/-) key is used to assign positive or negative numbers in the user settings.
- The period key (.) is used to input numbers with decimal points.

Multi keys are used in VSWR, DTF, and Cable Loss measurement mode. Unless otherwise specified, multi keys do not support Power Meter mode.

≪0≫…≪9≫, ≪.≫ keys

≪0≫…≪9≫, numeric keys and decimal point used for entry of decimal numbers at the cursor location.

≪±≫ key

≪±≫ key is used to change the sign of a decimal number.

≪Auto Scale≫ key

≪Auto Scale≫ The instrument can automatically set the scale to the minimum and maximum values of a measurement on the Y-axis of the graph for optimum display of the traces. Every time AUTO SCALE key is pressed, the top and bottom scales are set to the minimum and maximum values with margin on the Y-axis of the screen display.

≪AMP≫ key 	≪**AMP**≫ AMP (amplitude) defines a manual setting for the scale on the Y-axis of the graph. It can be selected in VSWR, DTF, and Cable Loss measurement mode.
≪Freq/Dist≫ key 	≪**Freq/Dist**≫ key causes different screen menu to be displayed depending on a measurement mode. In VSWR or Cable Loss measurement modes it opens a frequency screen menu and in DTF measurement mode it opens a distance screen menu.
≪Trace Point≫ key 	≪**Trace Point**≫ Trace point is used to select the number of data points to take during a VSWR and Cable Loss measurement mode. There are four data points available: 126, 251, 501, 1001 and 2001. The default number of trace points is 1001.
≪Marker≫ key 	≪**Marker**≫ A marker is used to get the data on the specific point of a trace. A total of six markers can be displayed on the screen and each marker can be assigned independently. Placing a marker on the trace displays the marker's Y coordinates next to the marker's position. If the marker table is turned on, both X and Y coordinates of all activated markers are displayed.

≪Trace≫ key

≪Trace≫ key enables for selection of active channel and trace. Active channel is a channel, which accepts the channel parameter setting commands. Active trace is similarly a trace, which accepts the trace parameter setting commands. Before sending commands to change a channel or a trace settings, activate the channel or trace,

≪Peak≫ key

≪Peak≫ This key is used to find the peak value of a trace. Pressing this key leads to the activation of Marker CH1 and places the marker to the peak point of the trace.

≪Load≫ key

≪Load≫ key enables for recalling of the Trace, Screen, and State.

≪Save≫ key

≪Save≫ key enables for saving of the Trace, Screen, and State.

≪Light≫ key

≪Light≫ This key is used to adjust the brightness of the LCD display. Adjustment can be made from 0 to 100% and the default setting is 50%.

≪Scale≫ key

≪Scale≫ This key is used to select a unit of Y axis of the graph in VSWR and DTF measurement modes. Either VSWR or Return Loss can be selected. In Cable Loss measurement mode, Return Loss only can be selected.

≪Hold≫ key

≪Hold≫ This key is used to pause a sweep in all measurement modes.

2.4.6 ⑤ ESC, Back, Arrow Keys

≪ESC≫ key

≪ESC≫ key is used for the following:

- If there is an active data entry field, this key cancels all the data entered in the field and restores the value of the field as it was before any new numbers or characters were entered.
- If there is no active data entry field, this key brings the user back to an upper level of the soft key menu.

≪Back≫ key

≪Back≫

▪Delete a character or number.

≪Arrow≫ key

≪Arrow≫ key is used for the following:

▪Moves a marker position or highlighted selection bar one point at a time.

2.4.7 ⑥ Enter Keys

≪ENTER≫ key

≪ENTER≫ key is used for the following:

▪If there is an active data entry field, this key completes the entry process and assigns the new value to the field.

▪If there is no active data entry field, this key enables the function of a highlighted soft key.

2.4.8 ⑦ Knob Keys

≪**Knob**≫ key

≪**Knob**≫ The rotary knob is used for the following:

- Move an active marker or a highlighted selection bar in the list.

2.4.9 Display

The Analyzer is equipped with 7" color LCD. The display can come complete with a touch screen (TS option). The touch screen LCD allows manipulating the Analyzer by touching the LCD screen directly with a finger.

CAUTION

Do not press the touch screen with a pen, screwdriver or any other sharp-pointed object. This can damage the touch screen.

The display consists of the control elements and area for measurement result indication.

The main control element of the display is a vertical soft key menu bar in the right-hand part of the screen.

The soft key menu bar consists of program soft key panels, which appear one instead of the other on the screen. Each panel represents one of the submenus of the soft key menu. All the panels are integrated into multilevel menu system and allow access to all the functions of the Analyzer.

Note	The top line of the screen represents the menu bar, which enables you direct access to the submenus of the soft key menu. This menu is an auxiliary one and can be hidden.

2.5 Upper Panel

All Input/Output ports of the Protek A434L are located on the upside of the instrument as shown in Figure 2.6

Figure 2.6 A434L Upper Panel

2.5.1 DC Power Connector

Provides input for the DC power source via an AC-DC adapter.

In case of emergency, to avoid danger of electric shock or the like, pull the power cable out of the power outlet or the DC power connector of the instrument.

2.5.2 RF OUT/Reflection

Output(Accepts) an internal(external) output(input) with a frequency range from 5MHz to 4GHz.

50ohm N-type RF Connector, maximum allowable input is +25dBm.

2.5.3 Ethernet Port

Ethernet port allows the user to connect the Analyzer to a LAN (Local Area Network). This connection enables the user to control the instrument using an external PC. Used for upgrading the instrument's firmware.

- 10BASE-T & 100BASE-TX support
- CAT5e UTP Cable uses

2.5.4 USB Port

USB ports allow connection of various external USB compatible devices, such as flash memory stick and Power Sensor. Used for either saving measurement data or an optional external power sensor.

- 5Vd.c. , 500mA
- Type A

2.6 FAN

2.6.1 FAN Operation

FAN operates if the internal temperature of the system rises.

- The FAN is ON when the temperature is higher than 70.0℃
- The FAN is OFF when the temperature is lower than 65.0℃

2.6.2 FAN Alarm

The message of “Fan check required!!!” will be indicated in the bottom left corner of the displaye if the FAN does not properly operates.

Figure 2.7 FAN Alarm Screen Display

3

GETTING STARTED

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3. GETTING STARTED

3.1 Power Up

3.1.1
Initialization

The initialization screen (Figure 3.1) appears when the instrument is started with the indication “System Initialization”. After a successful initialization, data loading and self-test, the VSWR measurement screen appears.

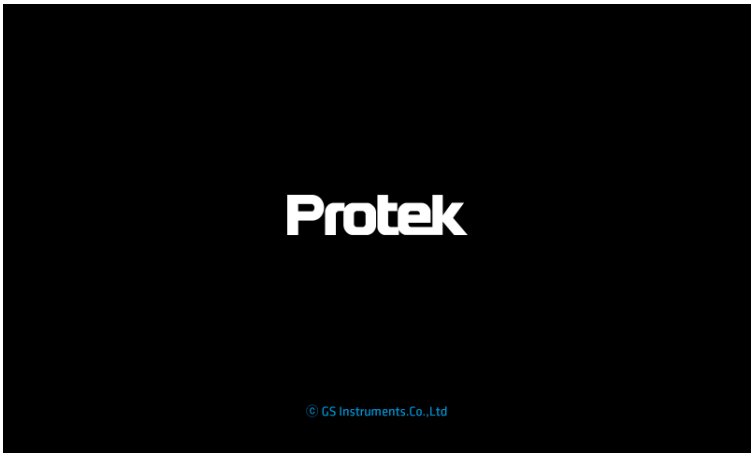

Figure 3.1 Boot Logo / Initialization Screen

3.1.2
System Information

Before using the instrument, verify the firmware's version and status of the instrument.

- Firmware version: For the instrument's best performance, make sure the latest version of firmware has been installed. Information about the latest firmware can be located at www.gsi-protek.com

- Verify the system temperature is within the instrument operating range. Depending on the storage condition, the temperature of the instrument at power up may be out of normal operating range in winter or summer season. Measurements over the operating temperature range may be out of resolution.

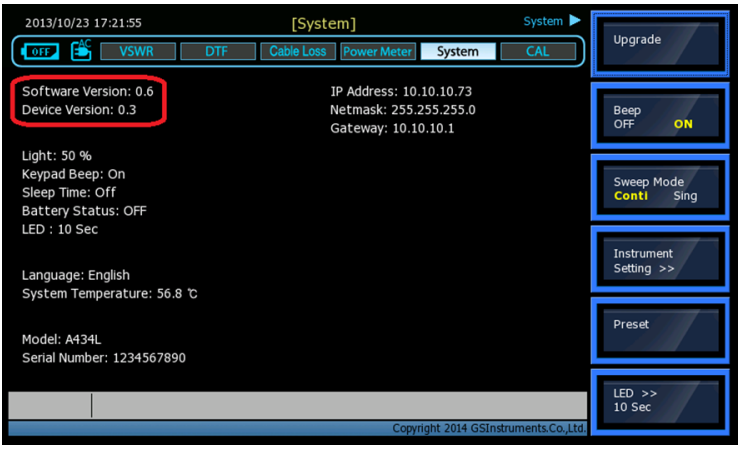

Figure 3.2 System Screen

3.2 Layout of the Display Screen

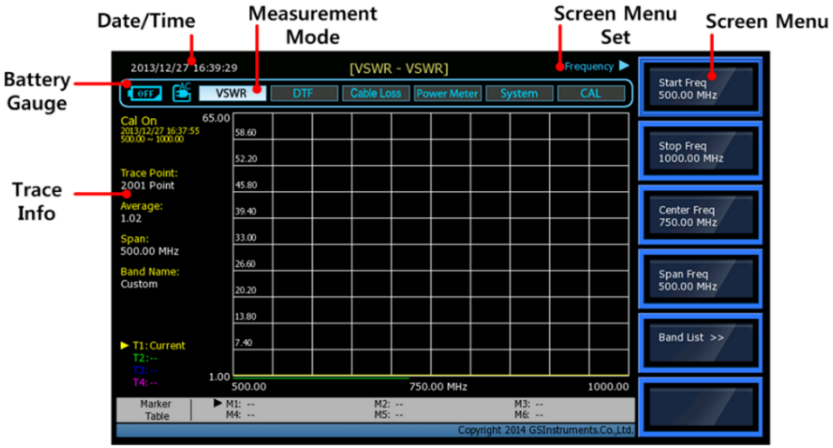

Figure 3.3 Display Screen

- Battery Gauge: Indicates the status of the internal battery

Indicates the instrument is using an external power supply. The internal battery is charged when an external power supply is connected.

Indicates the instrument is using the internal battery and shows the remaining battery capacity.

Battery Off Icon: This icon appears when a battery is not installed in the instrument.

- Measurement Mode: Indicates a current measurement mode. The selected mode is displayed in dark blue.
- Date and Time: Indicates the system clock information.
- Screen Menu set: Indicates the set of screen menu selections.
- Screen Menu: Indicates the selectable screen menu. Selection of the menu can be made by pressing the soft key or touching the screen menu directly.
- Trace Information
  - Calibration On/Off Status
  - Calibration Information: Calibrated frequency band and timing
  - Trace Points
  - Y Scale Unit
  - Trace Average (applicable to VSWR and Cable Loss measurement mode only) before using the instrument, verify the firmware's version and status of the instrument.

- Span
- Band Name
- Cable Name (applicable to DTF measurement mode only)
- Max D: Maximum measurement distance limited by user frequency setting
- VT (Relative Propagation Velocity), CL (Cable Loss) - applicable to DTF measurement mode only

■ Message window: Displays the result of performed functions or error messages.

3.3 Function Hard Keys Structure

Function hard keys on the front panel of the instrument are used to select measurement modes or perform specified functions. Refer to the following sections for the key structure to be used in each measurement modes.

Figure 3.4 Function Hard Key

3.3.1
System Screen Menu

System screen menu is used to change the basic settings of the instrument and consists of sub-menus as shown in Table 3.1.

Function Key	Screen Menu			
	1st Layer	2nd Layer	3rd Layer	4th Layer
SYSTEM	Upgrade	Confirm		
		No		
	Beep OFF ON			
	Sweep Mode Conti Sing			
	Instrument Setting >>	Language >>	English	
			Return	
		Date/Time >>	Date Format YMD MDY DMY	
			Set Date	
			Set Time	
			Return	
		LAN >>	Apply	
			IP Addr 10.10.10.73	
			Net Mask 255.255.255.0	
			Gateway 10.10.10.1	
			Return	
			Alignment	

		Touch Screen >>	Return	
		Sleep Time	Enter	
			Back Space	
			Cancel	
		Return		
	Preset	Yes		
		No		
	LED >>	OFF		
	10 Sec	10 Sec		
		20 Sec		
		Return		

Table 3.1 Menu Structure in system mode

3.3.2 Common Menu

The menu structure is common to all the measurement modes except to the Power Meter mode, shown in Table 3.2. Refer to section 3.3.6 for screen menus applicable to the Power Meter mode.

Function Key	Screen Menu			
	1st Layer	2nd Layer	3rd Layer	4th Layer
CAL	Open	Start		
		Back		
	Short	Start		
		Back		
	Load	Start		
		Back		
VSWR	AMP	Max(Top)		

DTF Cable Loss		2.00		
		Min(Bottom) 1.00		
		Limit OFF ON		
		Limit Level 3.00		
		Dual Mode		
	Freq/ Dist	Start Freq 5.00 MHz		
		Stop Freq 4000.00 MHz		
		Center Freq 2002.50 MHz		
		Span Freq 3995.00MHz		
		Band List >>	Standard Band >>	Select
				Add to Custom
				Return
			Custom Band >>	Select
				Delete
				Delete All
				Return
			Return	
	Trace Point	126		
		251		
		501		
		1001		
		2001		
	Marker	Marker 1 2 3 4 5 6		

		Marker View OFF ON		
		Marker Type Normal Delta		
		Marker Clear All		
		Marker Edit		
		Marker Band >>	Marker Band 1 >>	Band View OFF ON
				Band Slect Start Stop
				Band Edit
				Return
			Marker Band 2 >>	Band View OFF ON
				Band Slect Start Stop
				Band Edit
				Return
			Marker Band 3 >>	Band View OFF ON
				Band Slect Start Stop
				Band Edit
				Return
			Clear All	
			Return	
	Trace	Trace T1 T2 T3 T4		
		Trace Capture		

		Trace View OFF ON		
		Clear Write		
		Trace Clear		
		Trace Clear All		
	Peak	Peak Right		
		Peak Left		
		Max Search		
		Min Search		
	Load	Load Trace (*.tra)	Select	
			File Manager >>	Rename
				Delete
				Delete All
				Copy to USB
				Copy All to USB
				Return
			Destination >> Trace 1	Trace 1
				Trace 2
				Trace 3
				Trace 4
				Return
			Return	
		Load Screen (*.jpg)	Select	
			File Manager >>	Rename
				Delete
				Delete All
				Copy to USB
				Copy All to USB

				Return
			Return	
		Load Setup (*.sta)	Select	
			File Manager >>	Rename
				Delete
				Delete All
				Copy to USB
				Copy All to USB
				Return
			Return	
		Load From Internal USB		
	Save	Save Trace (*.tra)	Trace 1	
			Trace 2	
			Trace 3	
			Trace 4	
			Return	
		Save Screen (*.png)		
		Save State (*.sta)		
		Save to Internal USB		
	Light			
	Auto Scale			
	Scale			
	Hold			

3.2 Menu Structure Common to all measurement mode

3.3.3
VSWR Menu

The menu structure of the VSWR hard function key and multi keys in VSWR measurement mode is shown in Table 3.3.

Function Key	Screen Menu			
	1st Layer	2nd Layer	3rd Layer	4th Layer
VSWR	Freq/ Dist	Start Freq (453.0 MHz)		
		Stop Freq (464.0 MHz)		
		Center Freq (458.5 MHz)		
		Span (11.0 MHz)		
		Band List >> (C450 P Up)	Startdard Band	
			Custom Band	
			Return	
	AMP	Max (Top) 0.00 dB		
		Min (Bottom) 40.00 dB		
		Limit OFF ON		
		Limit Level 10.00 dB		
	Marker	Marker 1 2 3 4 5 6		
		Marker View		

		OFF ON		
		Marker Type Normal Delta		
		Marker Clear All		
		Marker Edit		
		Marker Band >>	Marker Band 1 >>	Band View OFF ON
				Band Select Start Stop
				Band Edit
				Return
			Marker Band 2 >>	Band View OFF ON
				Band Select Start Stop
				Band Edit
				Return
			Marker Band 3 >>	Band View OFF ON
				Band Select Start Stop
				Band Edit
				Return
			Clear All	
			Return	

3.3 Menu Structure Used for VSWR Measurement mode

3.3.4
DTF Menu

The menu structure of the DTF hard function key and multi keys in DTF measurement mode is shown in Table 3.4.

Function Key	Screen Menu			
	1st Layer	2nd Layer	3rd Layer	4th Layer
DTF	Freq/ Dist	Start Freq (453.0 MHz)		
		Stop Freq (464.0 MHz)		
		Distance (25.0 Meter)		
		Band List > (C450 P Up)	Startdard Band	
			Custom Band	
			Return	
		Cable List > (FSJ 250)	Startdard Band	
			Custom Band	
			Return	
		DTF Setting >	Apply	
			Velocity	
			Cable Loss	
			Unit Meter Feet	
			Windowing >> (Rectangular)	Rectangular
				Blackman
				Hamming
				Hann
				Return

			Return	
	AMP	Max (Top) 4		
		Min (Bottom) 1		
		Limit OFF ON		
		Limit Level 1.01		
	Marker	Marker 1 2 3 4 5 6		
		Marker View OFF ON		
		Marker Type Normal Delta		
		Marker Clear All		
		Marker Edit		

3.4 Menu Structure Used for DTF Measurement Mode

3.3.5
Cable Loss Menu

The menu structure of the Cable Loss hard function key and multi keys in Cable Loss measurement mode are shown in Table 3.5

Function Key	Screen Menu			
	1st Layer	2nd Layer	3rd Layer	4th Layer

Calbe Loss	Freq/ Dist	Start Freq (453.0 MHz)		
		Stop Freq (464.0 MHz)		
		Center Freq (458.5 MHz)		
		Span (11.0 MHz)		
		Band List > (C450 P Up)	Startdard Band	
			Custom Band	
			Return	
	AMP	Max (Top) 0.00 dB		
		Min (Bottom) 40.00 dB		
		Limit OFF ON		
		Limit Level 10.00 dB		
	Marker	Marker 1 2 3 4 5 6		
		Marker View OFF ON		
		Marker Type Normal Delta		
		Marker Clear All		
		Marker Edit		
		Marker Band >>		Band View

			Marker Band 1 >>	OFF ON
				Band Select
				Start Stop
				Band Edit
				Return
			Marker Band 2 >>	Band View
				OFF ON
				Band Select
				Start Stop
				Band Edit
				Return
			Marker Band 3 >>	Band View
				OFF ON
				Band Select
				Start Stop
				Band Edit
				Return
			Clear All	
			Return	

Table 3.5 Menu Structure Used for Cable Loss Measurement Mode

3.3.6
Power Meter Menu

The menu structure of the Power Meter hard function key and multi keys in Power Meter is shown in Table 3.6.

Function Key	Screen Menu			
	1st Layer	2nd Layer	3rd Layer	4th Layer
Power Meter	Initialize/Preset			

	Frequency			
	Display Setup >>	Unit dBm Watts		
		External Offset 0.00 dB		
		Return		
	Mode >> (Average)	AVG		
		Return		

Table 3.6 Menu Structure Used in Power Meter Measurement Mode

3.4 System Key

The System key enables users to verify the system information or change the instrument settings.

Selecting the System key opens the following information:

- Software Version
- Device Version
- Brightness of the display
- Keypad beep On/Off setting
- Sleep Mode setting: time to sleep mode
- Battery remaining charge capacity
- Keypad Backlight On time
- Selected language

- System temperature
- Model / Serial Number
- IP Address Info

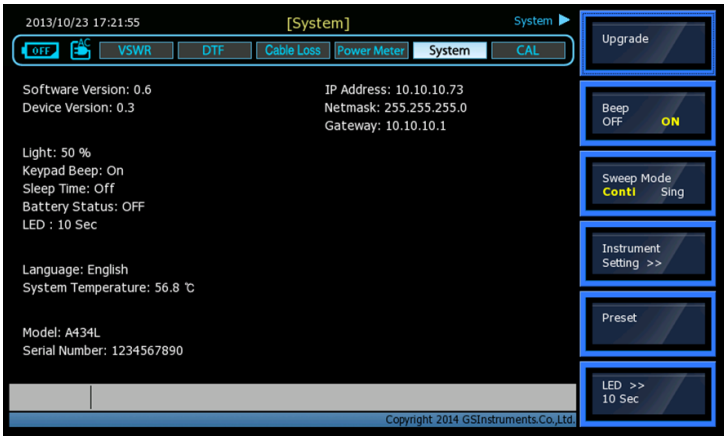

Figure 3.5 System Status Screen

The System key opens the following screen menu:

- Upgrade: Upgrades the firmware of the instrument. For detailed upgrade procedure, refer to the section “5.Software Upgrade”.
- Beep: Activates or deactivates the beep sound when keys are pressed.
- Sweep Mode: Sets the sweep mode either single or continuous in VSWR, DTF, or Cable Loss measurements. If Sweep Mode is set Single, the message “Hold On” is displayed at the completion of a current sweep and the sweep stops. Every time the Hold key is pressed, the sweep is done once.

- Instrument Setting

  - Language: Changes the language used to display the menu, messages and information on the screen display. Currently only available in English.

  - Time/Date: Sets the time of the system clock.

  - LAN

  - Touch Screen

  - Sleep Time: Sets the time to enter into power saving mode. Power saving mode is automatically activated when no key entry occurs during the Sleep Time.

- Preset : Set Default Configuration Data

- LED: Keypad Backlight On time. If no Keypad input is LED Off after a set time.

3.5 Multi Keys

Twelve multi keys are located under the LCD display. The Multi keys serve multiple functions depending on the operation mode. The dual purpose keys are indicated in black color and the specific functions in blue color. The key is used to enter a numeric data when a user is prompted to input values. In all the other cases, the keys are used to perform the specific function.

The function and operating procedure for each multi keys are described in the following sections

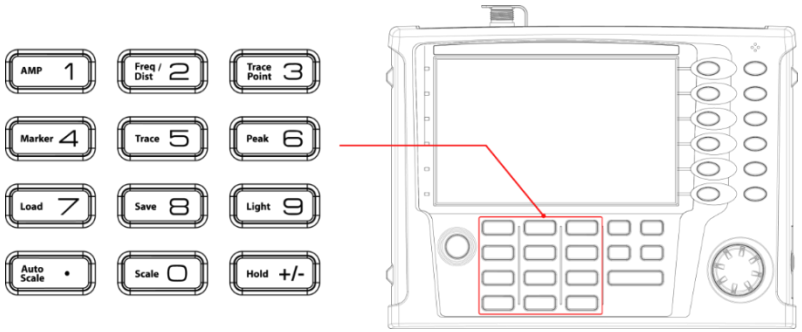

Figure 3.6 Multi Keys Layout

3.5.1
Numeric Data Entry

Multi keys operate as follows when a user is prompted to input values by pop-up window.

Numeric keys from 0 to 9 are used to input user setting numbers.
The plus/minus (+/-) key is used to assign positive or negative numbers in the user settings.
The period key (.) is used to input numbers with decimal points.

3.5.2
Specific Function Keys

Multi keys are used in VSWR, DTF, and Cable Loss measurement mode. Unless otherwise specified, multi keys do not support Power Meter mode.

1. AMP

AMP (amplitude) defines a manual setting for the scale on the Y-axis of the graph. It can be selected in VSWR, DTF, and Cable Loss measurement mode.

Depending on the choice of an amplitude unit, allowable input value is limited to the following:

- In case Y scale is VSWR:
  - ✓ **Max(Top):** Setting value can be from 1.01 to 65.00 and it cannot be equal to or smaller than the Min(Bottom) setting value. Adjustment can be made by steps of 0.01.

  - ✓ **Min(Bottom):** Setting value can be from 1.0 to 64.99 and it cannot be equal to or larger than the Max(Top) setting value. Adjustment can be made by steps of 0.01.

- In case Y Scale is Return Loss:
  - ✓ **Max(Top):** Setting value can be from 0.0 to 59.99dB and it cannot be equal to or smaller than the Min(Bottom) setting value. Adjustment can be made by steps of 0.01.

  - ✓ **Min(Bottom):** Setting value can be from 0.01 to 60.00dB and it cannot be equal to or larger than the Max(Top) setting value. Adjustment can be made by steps of 0.01.

- **Limit line:** Turns On and Off the display of the limit line on the screen.
  - ✓ If a measurement exceeds the limit line, the trace above the limit line is displayed in red color.
  - ✓ An audible beep sound is generated.

- **Limit level:** Sets the position of a limit line. Depending on the Y-scale of a graph, the input value is set automatically as none for VSWR or dB for Return Loss. The value of limit level is displayed on the limit line.

The instrument takes the negative value of the Return Loss internally. Users don't need to add minus (-) sign before typing in a value. Y-axis of a graph also doesn't show minus sign.

2. Freq/Dist

Freq/Dist key causes different screen menu to be displayed depending on a measurement mode. In VSWR or Cable Loss measurement modes it opens a frequency screen menu and in DTF measurement mode it opens a distance screen menu.

- **VSWR/ Cable Loss Measurement Mode**
  - ✓ **Center:** Sets a center frequency of the measurement to be made.
  - ✓ **Start:** Sets a start frequency of the measurement to be made.
  - ✓ **Stop:** Sets a stop frequency of the measurement to be made.
  - ✓ **Span:** Sets a user-defined frequency span.
  - ✓ **Band:** Opens standard or custom frequency band registered in the instrument.
    - ■ Standard: Opens the world-wide standard Band List registered in the instrument.
      - **Top of List:** Moves to the first page of the Band List.
      - **Page Up:** Moves to the previous page.
      - **Page Down:** Moves to the next page.
      - **Bottom of List**: Moves to the last page of the Band List.
      - **Add to Custom:** Copies a frequency band registered in the Standard Band List to the Custom Band.
    - ■ Custom: Opens the customized Band List registered in the instrument.
      - **Top of List:** Moves to the first page of the Band List.
      - **Page Up**: Moves to the previous page.
      - **Page Down:** Moves to the next page.
      - **Bottom of List:** Moves to the last page of the Band List.

- **Delete Custom:** Deletes a frequency band from the Custom Band.

- **DTF Measurement Mode**
  - ✓ Start Frequency: Sets a starting frequency to measure DTF
  - ✓ Stop Frequency: Sets a stop frequency to measure DTF
  - ✓ **Distance:** Sets a distance to measure. The maximum measurable distance is 1250m (4125ft).
  - ✓ **Cable List:** Opens a list of coaxial cables registered in the instrument. About forty kinds of cables are registered in the standard cable list. The user can register additional cables to the instrument by using the application software program provided with the instrument.
    - ■ Standard: Opens the Cable List registered in the instrument.
      - **Top of List:** Moves to the first page of the Cable List.
      - **Page Up**: Moves to the previous page.
      - **Page Down:** Moves to the next page.
      - **Bottom of List:** Moves to the last page of the Cable List.
      - **Add to Custom:** Copies a cable registered in the Standard Cable List to the Custom Cable List.
    - ■ Custom: Opens a Custom Cable List registered in the instrument.
      - Top of List: Moves to the first page of the Cable List.
      - Page Up: Moves to the previous page.
      - Page Down: Moves to the next page.
      - Bottom of List: Moves to the last page of the Cable List.
      - Delete Custom: Deletes a cable registered in the Custom Cable List.
  - ✓ **Window:** Applies video filtering to the display of the trace. If the video filter is activated by turning the Window On, traces

are reduced by smoothing out the sharp transitions, thereby enabling users easy to discriminate noises and peaks.

- ✓ **Setup**
  - **Velocity:** Opens the Relative Propagation Velocity parameter for data entry. Enter the propagation velocity for the type of transmission line being tested.
  - **Cable Loss:** Opens the Cable Loss parameter for data entry. Enter the loss per meter for the type of transmission line being tested.
  - Unit: Selects the unit of X-axis scale to display the measurement results in Meter or Feet.

3. Trace Point

Trace point is used to select the number of data points to take during a VSWR and Cable Loss measurement mode. There are four data points available: 126, 251, 501 and 1001. The default number of trace points is 1001.

4. Marker

A marker is used to get the data on the specific point of a trace. A total of six markers can be displayed on the screen and each marker can be assigned independently. Placing a marker on the trace displays the marker's Y coordinates next to the marker's position. If the marker table is turned on, both X and Y coordinates of all activated markers are displayed.

- **Marker**
  - ✓ **Select:** Selects an Active Marker whose position is moved by the dial knob or Up and Down arrow keys. The assigned number of an active marker is displayed in red color on the Select screen menu and the marker's number is also displayed next to the marker on the trace.
  - ✓ **Marker View**: Hides or displays the selected marker on the screen. In the same measurement mode markers appear at

the previous positions when the Marker View is turned off and on. If a measurement mode has been changed, markers are not restored to previous positions but move to the left end of the trace.

- ✓ **All Off:** Turns all markers off the screen. Markers are redisplayed on the previous position if markers are turned back on. If a measurement mode is changed, current settings are not restored.
- ✓ **Draw Type:** Selects the maximum number of markers to be used simultaneously. Available options are either 4CH or 6CH. If 4CH mode is selected, markers number 5 and number 6 cannot be activated. Settings changed in Draw Type are reflected in Marker CH and Marker table.
- ✓ **Marker Table:** Displays a table on the left side of the screen when Marker Table is activated. All X and Y coordinates of the activated markers are displayed on the table. Depending on the selection in Draw Type, the number of markers on the table is either 4 or 6.
- ✓ **Marker Edit:** Sets the marker position manually. A pop-up window appears for users to set the frequency and the marker position is moved to the setting frequency

- **Moving Markers**
  - ✓ **Knob** - Turning the knob clockwise moves a marker to the right and counter clockwise moves it to the left. The knob is used to move the marker position fast.
  - ✓ **Up/Down Arrow Keys** - Pressing the up arrow key (↑) moves a marker's position one point to the right and pressing the down arrow key (↓) moves a marker's position one point to the left. Up/Down Arrow keys are used to move a marker's position precisely.

As the instrument is equipped with a touch panel operation, a marker can be placed to the desired position by simply

touching the screen. Quickly moves an activated marker to the desired position and makes a fine adjustment using a dial knob or up/down arrow keys.

5. Trace

Captures a trace for comparison with other traces or saves traces.

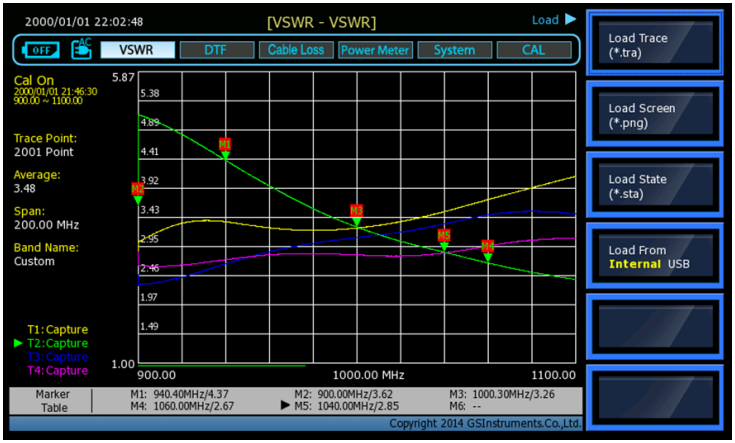

Figure 3.7 Trace Screen Display

- **Select:** Selects an active trace. Every time Select screen menu is pressed, the active trace changes. Channel numbers are assigned to each captured traces or loaded traces. Refer to Save & Load" for procedures to load traces.
- **Capture:** Captures a current trace on the screen and assigns a Trace CH. Refer to "Save & Load" for procedures to save traces.
- **View:** Hides or displays the Trace CH on the screen. Press Select screen menu key to choose the Trace CH. Traces with View set OFF are hidden from the screen. The information about the hidden traces is also cleared from the information window shown on the upper right of the screen. Setting View On restores hidden traces and information on the window.

- **Info:** Hides or displays the trace information window on the upper right corner of the screen. This is used to view traces overlaid with the trace information window.
- **Clear CH**: Deletes an active trace channel from the screen. The cleared channel is not restored. It is used to select and delete a trace channel one by one when multiple channels are displayed on the screen. Verify the channels to delete with View ON/OFF function in advance settings as cleared channels cannot be restored.
- **Clear All**: Deletes all channels from the instrument and initialize the trace settings.

6. Peak

This key is used to find the peak value of a trace. Pressing this key leads to the activation of
Marker CH1 and places the marker to the peak point of the trace.

- **Peak Right:** Moves a marker to the nearest peak on the right.
- **Peak Left:** Moves a marker to the nearest peak on the left.
- **Max Search:** Moves a marker to the highest point of the trace.
- **Min Search:** Moves a marker to the lowest point of the trace.

7. Load

Load key enables for recalling of the Trace, Screen, and State

8. Save

Save key enables for saving of the Trace, Screen, and State.

9. Light

This key is used to adjust the brightness of the LCD display. Adjustment can be made from 0 to 100% and the default setting is 50%.

10. Scale

This key is used to select a unit of Y axis of the graph in VSWR and DTF measurement modes.

Either VSWR or Return Loss can be selected. In Cable Loss measurement mode, Return Loss only can be selected.

11. Auto Scale

The instrument can automatically set the scale to the minimum and maximum values of a measurement on the Y-axis of the graph for optimum display of the traces. Every time AUTO SCALE key is pressed, the top and bottom scales are set to the minimum and maximum values with margin on the Y-axis of the screen display.

12. Hold

- This key is used to pause a sweep in all measurement modes. The Hold state is activated by pressing the Hold key, and it is maintained even if users change the measurement mode. The sweep resumes when the Hold key is pressed again.
- When Sweep Mode is set Single in the System screen menu, a Hold message is displayed on the screen in red color and the measurement stops at the completion of a single sweep. Pressing the Hold key it triggers another single sweep.

4

MEASUREMENT DATA ANALYSIS

OPERATING MANUAL

4. MEASUREMENT DATA ANALYSIS

4.1 VSWR

To get maximum power into a load it is required that the load impedance match the generator impedance. Any impedance difference, or mismatching would not produce maximum power transfer. A 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 produces an interference pattern called a "standing wave". VSWR is the ratio between the power that is sent forward to the antenna and the amount of the power that is reflected back toward the transmitter.

Some of the consequences of having a high VSWR condition in cellular services are: 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.

4.1.1 VSWR Display Description

The screen shown in Figure 4.1 is displayed when VSWR measurement mode is selected. Various kinds of information related to the VSWR measurement are shown on the screen.

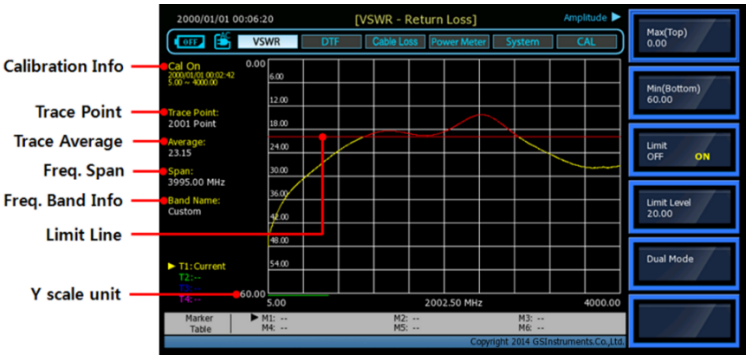

Figure 4.1 VSWR Measurement Screen Display

Calibration Info: Displays a calibration state on the measurement frequency band that a user has selected. When the instrument is first turned on, the state is “Cal Off”. The symbol “Cal On” is displayed along with the execution time and frequency band after the calibration is successfully completed.

Trace Point: Sets the number of data points to take during a measurement mode. Selection is made from one of five choices.

126, 251, 5001, 1001, 2001

Selecting 501 data points provides twice as many measurement points as 251, but it takes approximately twice as long for the trace to sweep and display.

Selecting the trace points larger than needed for the measurement will result in a longer sweep time. This may hinder the user from observing the fast changing traces.

It is recommended to select high resolution trace points only when measuring the wide frequency band or a precise measurement is required.

The previously executed calibration is effective even after the trace points change.

Trace Average: Indicates the average value of a single sweep over the user setting frequency band.

Freq. Span: It is a user-defined frequency band. Changing the frequency band doesn't affect the sweep time, but affects the calibration. Recalibration is required if the frequency setting is changed.

Freq Band Info: The band name is displayed if the band is selected from the band list stored in the instrument. If the user sets the start, stop, center or span frequency manually, the band name will show "Custom"

Limit Line: Sets the upper limit value of the trace. The portion of the trace that exceeds the limit line is displayed in red color. The captured trace by using the **Trace** function does not display the exceeded portion of the trace in different color.

Y scale unit: It is the measurement unit of the Y axis displayed for the trace.

Return Loss (dB)

VSWR

4.1.2
Setting Frequency

Frequencies can be set manually or selected from a band list stored in the instrument. It is desirable to set the frequency to a value that covers the normal range of the measurement with enough margin.

Action	Note
Setting Center Freq and Span.	
1. Press the **Freq/Dist** key.	Multi key.
2. Select the ***Center Freq*** screen menu.	✓ The current setting is displayed on the Window.
3. Enter a center frequency value.	
4. Press the **Enter** key.	
5. Select the ***Span*** screen menu.	
6. Enter a span value.	
7. Press the **Enter** key.	
Setting Start/ Stop Frequency.	
1. Press the **Freq/Dist** key.	✓ The current setting is cleared when a new value is entered. ✓ Press the **ESC** key to delete one by one the numbers displayed on the pop-up window. ✓ Pressing the **ESC** key repeatedly will cancel the input mode. ✓ The frequency input unit is in MHz and the minimum input steps is 0.01MHz
2. Select the ***Start*** screen menu.	
3. Enter a start frequency value.	
4. Press the **Enter** key.	
5. Select the ***Stop*** screen menu.	
6. Enter a stop frequency value.	
7. Press the **Enter** key.	
Selection from the band list stored in the instrument.	
1. Press the **Freq/Dist** key.	✓ Press the **Up(↑) / Down(↓)** arrow keys or rotate the dial knob to select a band from the list. ✓ Select the ***Page Up/Page Down*** screen menu for searching bands not shown in the screen.
2. Select the ***Band*** screen menu.	
3. Select the band from the list and press the **Enter** key.	

Table 4.1 Frequency Setting Procedure

Changing the frequency settings will automatically turn calibration off with the symbol “CAL OFF” displayed on the screen. Always set the frequency before calibrating the instrument. Changing the trace points during the measurement doesn’t affect the calibration.

4.1.3
Calibration

The instrument must be calibrated to get a reliable measurement result. For best results, set the frequency and calibrate the instrument immediately before taking a measurement.

- **Calibration accessories (optional)**
  - Calibration Kit which contains one 50ohm load, one Open standard and one Short standard
  - Test cable: Use a phase stable cable for reliable and consistent measurement results

To minimize the measurement error, connect the port extension cable to the RF In port on the instrument and then connect the Cal Kit to the end of the extension cable.

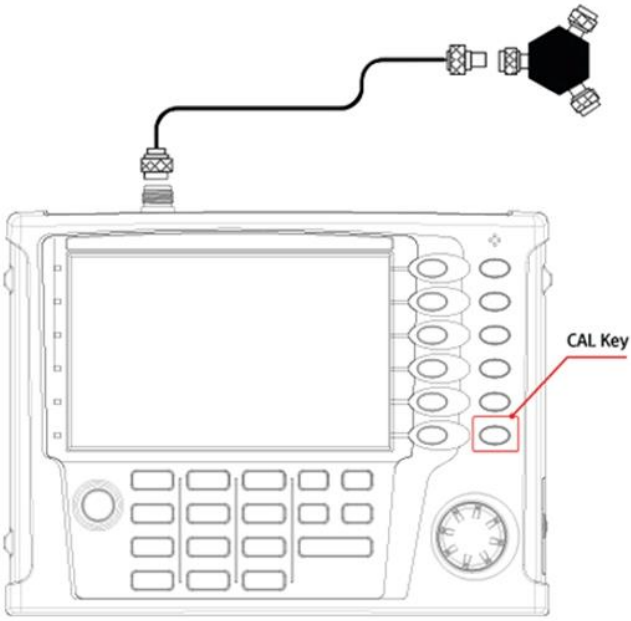

Figure 4.2 VSWR Calibration Connection

Bending or moving the phase unstable cable while making a measurement may cause errors in the measurement. The test cable used for port extension must be phase stable in the measurement frequencies.

At the successful completion of each calibration step, the message is displayed with a beep sound.

Figure 4.2 illustrates the connection method when a port extension cable is used for calibration.

To compensate errors caused by a port extension cable or adapters, perform Open-Short-Load calibration including the port extension cable.

Action	Note
Performs Calibration after the frequency setting and test cable connections.	
1. Press the **CAL** key.	Hard function key.
2. Connect an Open standard.	Connect CAL Kit "Open" connector to the RF out port.
3. Select the ***Open/Start*** screen menu.	✓ When the ***Open/Start*** screen menu is selected, a progress bar is displayed to show the progress. ✓ When a progress bar is disappeared, Open calibration is finished.
4. Connect a Short standard.	Connect CAL Kit "Short" connector to the RF out port.
5. Select the ***Short/Start*** screen menu.	✓ When the ***Short/Start*** screen menu is selected, a progress bar is displayed to show the progress. ✓ When a progress bar is disappeared, Short calibration is finished.
6. Connect the Load standard.	Connect CAL Kit "Load" connector to the RF out port.
7. Select the ***Load/Start*** screen menu.	✓ When the ***Load/Start*** screen menu is selected, a progress bar is displayed to show the progress. ✓ When a progress bar is disappeared, Load calibration is finished.
Calibration state is changed to **"Cal On"** after the Open-Short-Load calibration.	

Table 4.2 Calibration Procedure

4.1.4 VSWR Measurement

The instrument is ready to take VSWR measurement after completing the Open-Short-Load calibration using a port extension cable.

The end of the port extension cable must be connected to the device (antenna or feed line) for VSWR measurement as shown in Figure 4.3. The result of the VSWR measurement is displayed on the screen in real time.

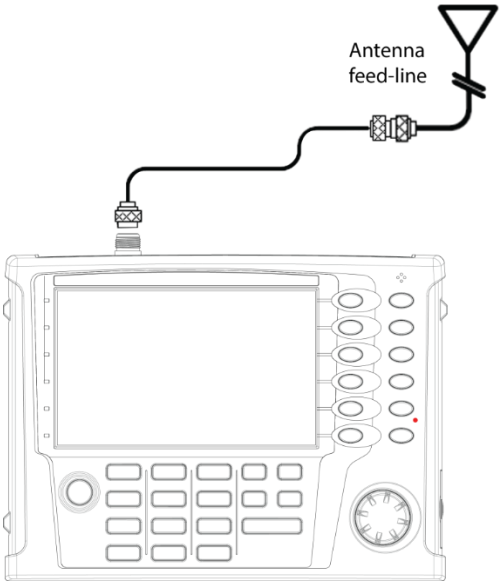

Figure 4.3 Connection for VSWR Measurement

After calibration, do not change the connection of the port extension cable or the frequency setting. It can cause produce an error in the measurement. When the frequency setting is changed, a warning alarm will sound and the calibration state is changed to “Cal Off”. After changing the frequency setting, recalibrate the instrument using the Open-Short-Load standard.

The maximum allowable input level of the instrument is +25dBm. Do not connect the RF In port of the instrument directly to the output port of the system. An over power input degrades the performance of the instrument and may cause a malfunction of the instrument.

Do not connect the instrument to the antenna when there is a risk of lightning. Electric shock may cause a malfunction or damage the instrument.

4.1.4.1 Setting Trace Point

Adjust a trace point to change the resolution of the VSWR measurement. Changing the Trace Point doesn't affect the calibration state.

4.1.4.2 Scale Adjustment

- Press **Auto Scale** key to optimize the Y scale and display the entire trace.
- Press **AMP** key to set the maximum and minimum values on the Y scale manually.
- Press **Scale** key to select the display unit of the Y scale.
- Scale adjustment doesn't affect the calibration state.

4.1.4.3 Using Markers

Depending on the draw type setting, four or six markers can be used simultaneously. The Y axis value on a current trace is displayed next to each marker on the screen, but the frequency information is not provided. Activate the marker table to see both, the level and frequency information when moving a marker to the specific frequency using the Marker Edit function.

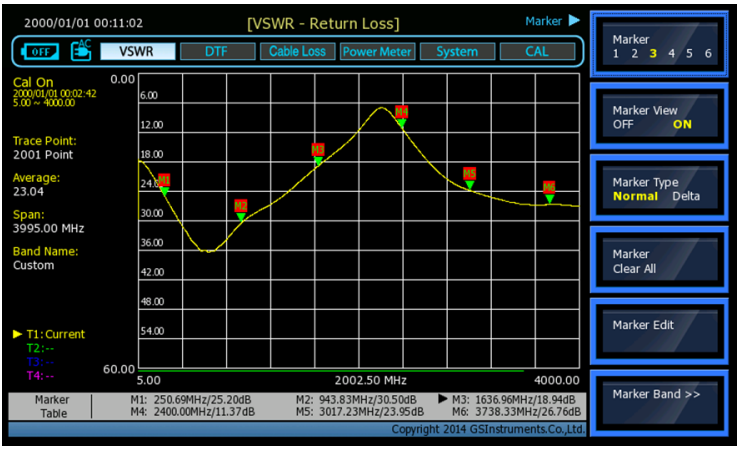

Figure 4.4 Using Markers in VSWR Measurement Mode

4.1.4.4 Limit Line

By setting a limit line, users can easily check if a measurement exceeds the specified limit. It appears as a horizontal line at the value set. An alarm sounds when a trace exceeds the limit line and the exceeded portion is displayed in red color.

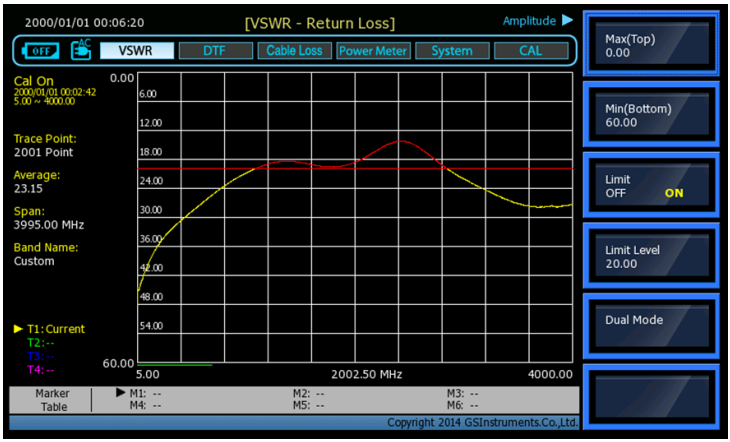

Figure 4.5 Limit Line Application

4.2 DTF

While VSWR is an indicator to express the efficiency of the antenna's energy transmission, DTF is a measurement to identify the fault locations in the antenna line system. Most of the antenna line system consists of the various types of coaxial cables, connectors and devices such as dividers and surge arrestors. Since VSWR is a measurement to verify the impedance discontinuity of the total feed line system, it is necessary to perform DTF measurement to identify the exact component that is contributing to the performance of the line system. The DTF measurement makes it easy to identify the fault location by displaying the relative distance of the signal reflections or discontinuities from various points of the line system

4.2.1 DTF Display Description

The screen shown in Figure 4.6 is displayed when DTF measurement mode is selected. The distance from the instrument is shown on the X-axis, while

the relative magnitude of the discontinuity is shown on the Y-axis. The information related to the DTF measurement is shown on the screen.

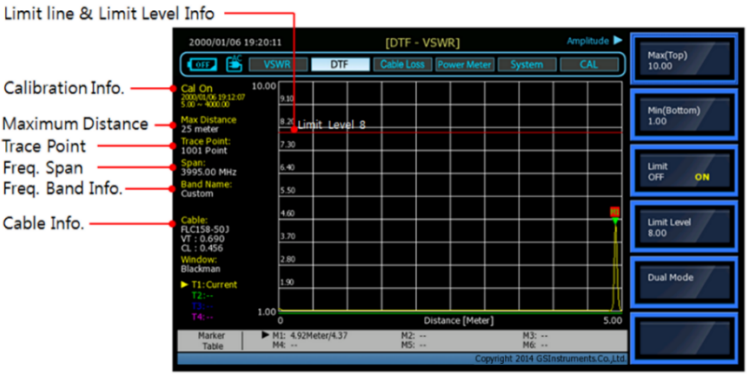

Figure 4.6 DTF Measurement Screen

- **Limit Line & Limit Level Info:** Sets the upper limit value of a trace. The portion of the trace that exceeds the limit line is displayed in red color. However, the captured trace by using TRACE function doesn't discriminate the color even if the trace exceeds the limit line.
- **Calibration Info:** Displays a calibration state on the measurement frequency band that a user has selected. When the instrument is first turned on, the state is "Cal Off". The symbol "Cal On" is displayed along with the execution time and frequency band after the calibration is successfully completed.
- **Maximum Distance:** Displays the maximum measurable distance within the user setting frequency band. Setting the frequency band narrow will increase the measurable distance while setting the frequency band wide will decrease the distance.
- **Y Scale Unit:** Is the measurement unit of the Y-axis that the trace is displayed.
  - Return Loss (dB)
  - VSWR
- **Freq. Span:** Is the user-defined frequency band. Changing the

frequency band doesn't affect the sweep time, but affects the calibration. Recalibration is required if the frequency setting is changed.

- **Freq. Band Info:** The band name is displayed if the band is selected from the band list stored in the instrument. If the user sets the start, stop, center or span frequency manually, the band name will show "Custom".
- **Cable Info:** The name of user selected cable is displayed on the screen. A cable name is displayed if the cable is selected from a Cable List stored in the instrument. If the user sets the Velocity and Cable Loss manually, the band name will show "Custom". The following information is also displayed.
  - Rel. Propa. Vel.: The relative propagation velocity for the cable type selected by the user selected from the Cable List or manually set by selecting the Velocity key.
  - Nominal Atten.: The loss per unit distance for the cable type that the user selected from the Cable List or set manually by selecting the Cable Loss key

By using the application program supplied with the instrument, users can store user's cable to the instrument. For details, refer to the Application Program.

4.2.2
DTF Setup

Set the conditions for DTF measurements. The user setting parameters for DTF measurements are the following:

- **Frequency Setting:** Sets the start and stop frequency to make a measurement. If a specific frequency band has been set in VSWR measurement mode, it can be applied to DTF measurement. To change the maximum measurement distance or increase the

measurement resolution, is necessary to change the frequency setting.

- **Distance Setting:** The maximum measurable distance is displayed on the left side of the screen depending on the frequency setting. Any value within the maximum measurable distance can be set. Optimum resolution is achieved when the user setting distance is the same as the maximum measurable distance.
- **Cable Setting:** Selects a cable type of the feed line. By using this key, users can select the cable stored in the instrument without setting the detailed parameters of the cable.
- **Setup:** Used to change the setting of the cable parameters or change the distance unit. It consists of the following sub menus:
  - Velocity: Sets the relative propagation delay of a cable. It affects the calculation of the distance in the DTF measurement.
  - Cable Loss: Sets the loss per distance unit of a cable. It affects the peak level of the discontinuity in the DTF measurement.

After calibration, do not change the connection of the port extension cable or the frequency setting. It can cause a measurement error. When the frequency setting is changed, a warning alarm will sound and the calibration state is changed to "Cal Off". After changing the frequency setting, recalibrate the instrument using the Open-Short-Load standard.

A detailed procedure for DTF setup is as follows:

Action	Note
Frequency Setting.	
Press the **Freq/Dist** key. ✓ Select the ***Start Freq*** screen menu. {Enter start frequency value} Press the **Enter** key.	✓ Additional calibration is not necessary if a Freq Band has been set and a calibration has been

✓ Select the ***Stop Freq*** screen menu. {Enter stop frequency value} Press the **Enter** key.	performed for the band in VSWR measurement, and the same Freq. band is used in the DTF measurement.
Distance Setting.	
Select the ***Distance*** screen menu. ✓ {Enter measuring distance} ✓ Press the **Enter** key.	✓ The ending point can only be set in distance setting. ✓ The maximum measurable distance is 1,250m (4,125ft).
Cable Setting.	
Select the ***Cable List*** screen menu. ✓ [Standard]/[Custom] {Select a cable by using Knob or arrow key} ✓ Press the **Enter** key.	
Setup.	
Setting Relative Propagation Velocity. ✓ Select the ***Velocity*** screen menu. ✓ {Enter user setting value} ✓ Press the **Enter** key. Setting Cable Loss. ✓ Select the ***Cable Loss*** screen menu. ✓ {Enter user setting value} ✓ Press the **Enter** key. Setting the X axis Unit. ✓ [Meter]/[Feet]	

Table 4.3 DTF Setup Procedure

4.2.3 Calibration

The instrument must be calibrated to get the DTF measurement results compatible with VSWR

- **Calibration accessories (optional)**
  - Calibration Kit which contains one 50ohm load, one Open standard and one Short standard
  - Test cable: Use a phase stable cable for reliable and consistent measurement results

To minimize measurement errors, connect the port extension cable to the RF In port on the instrument and then connect the Cal Kit to the end of the extension cable.

The Figure 4.7 shows the connection diagram for calibration using a test cable. To compensate measurement errors due to the test cable or adapters, perform the Open-Short-Load (O-S-L) calibration including the test cable. For detailed calibration procedure, refer to Table 4.2 Calibration Procedure

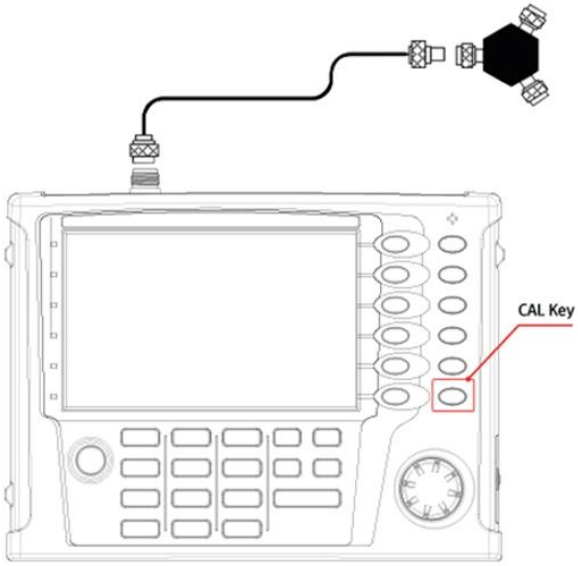

Figure 4.7 DTF Calibration Connection Diagram

Bending or moving the phase unstable cable while making a measurement may cause errors in the measurement. The test cable used for port extension must be phase stable in the measurement frequencies.

At the successful completion of each calibration step, a message is displayed with a beep sound.

4.2.4
DTF Measurement

If a port extension cable is used to interconnect the instrument with the line, measurement error can happen due to the sum of the port extension cable length and the distance to the fault. By performing the O-S-L calibration at the end of the port extension cable, the extension cable length will be compensated and the fault location can be more accurately measurable.

The maximum allowable input level of the instrument is +25dBm. Do not connect the RF In port directly to the system output port. Exposure to the overpowered input may degrade the performance of the instrument and may cause damage in the long run.

Do not connect the instrument to the antenna when there is a risk of lightning. Electric shock may cause the malfunction or breakdown of the instrument.

If O-S-L calibration has been done at the end of the port extension cable for DTF measurement, the length of the port extension cable is compensated automatically and is not included in the distance to the point of discontinuity.

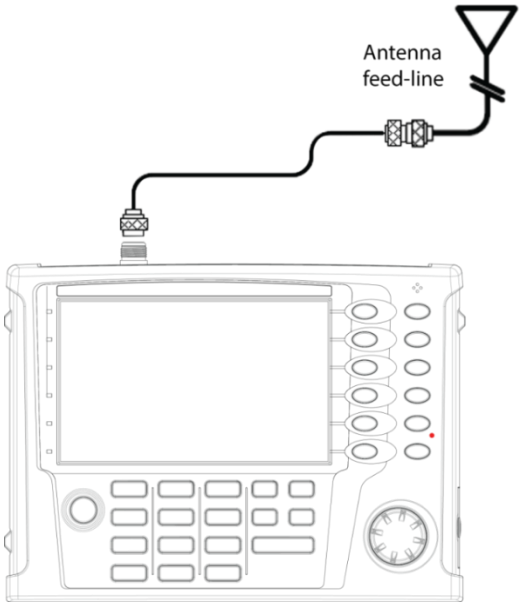

Figure 4.8 Connection Diagram for DTF Measurement

4.2.4.1 Scale Adjustment

Adjust a trace point to change the resolution of the VSWR measurement. Changing the Trace Point doesn't affect the calibration state.

- Press the **Auto Scale** key to optimize the Y scale and display an entire trace.
- Press the **AMP** key to set the maximum and minimum values on the Y scale manually.

- Press the **Scale** key to select a display unit of the Y scale.

4.2.4.2 Using Markers

Depending on the display settings, four or six markers can be used simultaneously. The distance of a current marker position is displayed next to each marker on the screen. Activate the marker table to see both the magnitude and distance information. Use Marker Edit to move a marker to the specific distance.

Adjust a trace point to change the resolution of the VSWR measurement. Changing the Trace Point doesn't affect the calibration state.

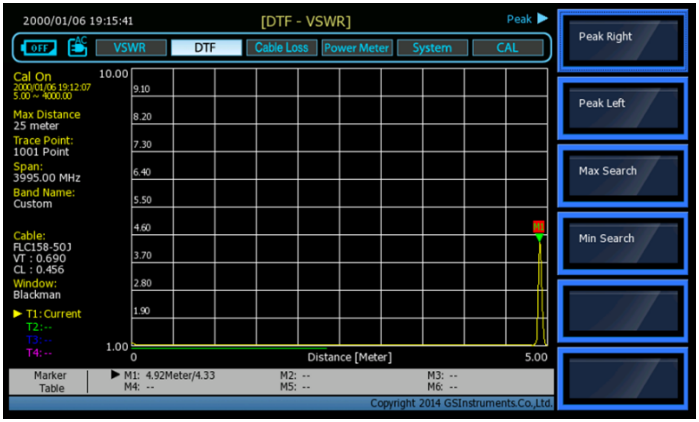

Figure 4.9 Using Markers in DTF Measurement Mode

4.2.4.3 Windowing

Windowing is applied when an accurate fault location cannot be verified due to the side overshoots of the trace. If the video filter is activated by turning the Window On, side overshoots of the trace are reduced by

smoothing out the sharp transitions thereby enabling users easy to discriminate noises and peaks. Figure 4.11 is the result of applying Blackman window to the trace on Figure 4.10. Noises around peaks are reduced and distance to the fault location is clearly verified.

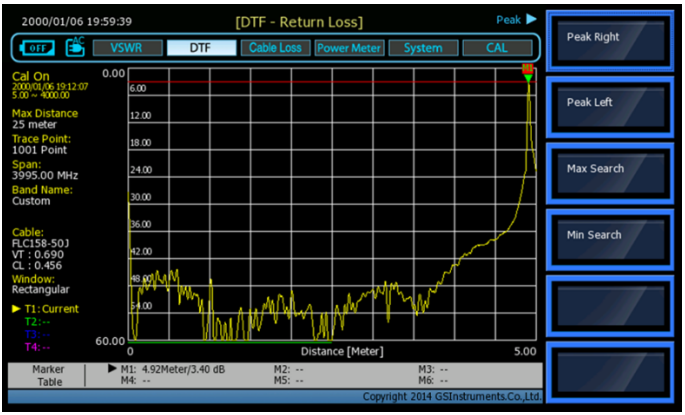

Figure 4.10 Measurement Display Rectangular Windowing

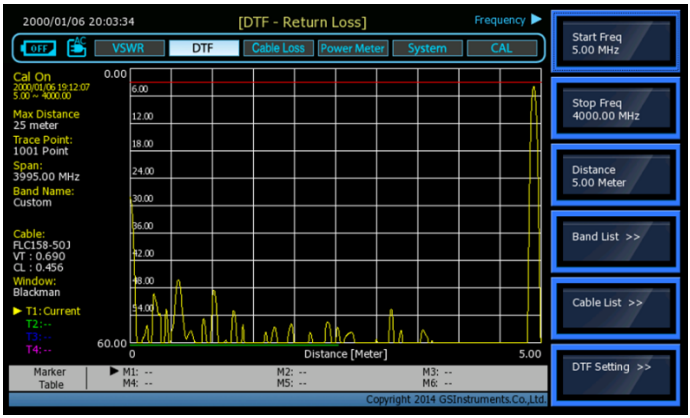

Figure 4.11 Measurement Display Blackman Windowing

4.3 Cable Loss

The cable loss measurement feature checks the signal attenuation level of the cable system. The frequency band to measure the characteristics of a cable must be calibrated before performing the cable loss measurement.

4.3.1 Cable Loss Display Description

The screen shown in Figure 4.12 is displayed when the Cable Loss measurement mode is selected. Various kinds of information related to the Cable Loss measurement are shown on the screen.

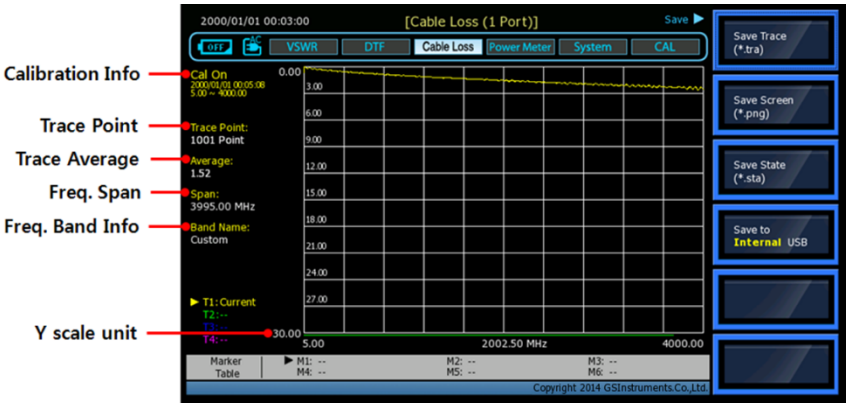

Figure 4.12 Cable Loss Measurement Screen Display

- **Calibration Info:** Displays the calibration state of the measurement frequency band that a user has selected. When the instrument is first turned on, the status is “Cal Off”. The symbol “Cal On” is displayed along with the calibration time and frequency band after successful completion of calibration.
- **Trace Point:** Sets the data points or resolution to measure the trace.

Selection is made from one of five choices.

- 126, 251, 501, 1001, 2001

- **Trace Average:** Indicates the average value of a single sweep over the user setting frequency band.
- **Freq. Span:** User-defined frequency band. Changing the frequency band doesn't affect the sweep time, but affects the calibration. Recalibration is required if the frequency setting is changed.
- **Freq. Band Info:** The band name is displayed if the band is selected from the band list registered in the instrument. If the user sets the start, stop, center or span frequency manually, the band name will indicate "Custom"
- **Y scale unit:** The unit of the y axis in the Cable Loss measurement mode is dB.

4.3.2 Setting Frequency

The user must set the frequency band to make a Cable Loss measurement. Frequency can be set manually or chosen from a band list registered in the instrument.

Action	Note
Setting Center Freq and Span.	
1. Press the **Freq/Dist** key.	Multi key.
2. Select the ***Center Freq*** screen menu.	✓ Current setting is displayed as default on the screen.
3. Enter a center frequency value.	
4. Press the **Enter** key.	
5. Select the ***Span*** screen menu.	
6. Enter a span value.	
7. Press the **Enter** key.	
Setting Start/ Stop Frequency.	
1. Press the **Freq/Dist** key.	✓ Current setting is cleared when a new value is entered. ✓ Press the **ESC** key to delete a number displayed on the pop-up
2. Select the ***Start Freq*** screen menu.	
3. Enter a start frequency value.	
4. Press the **Enter** key.	

5. Select the ***Stop Freq*** screen menu. 6. Enter a stop frequency value. 7. Press the **Enter** key.	window one by one. ✓ Pressing the **ESC** repeatedly will cancel the input mode. ✓ Input unit is MHz and minimum input step is 0.01MHz.
Selection from the band list stored in the instrument.	
1. Press the **Freq/Dist** key. 2. Select the ***Band List*** screen menu. 3. Select the band from the list and press the **Enter** key.	✓ Select the ***Page Up/Page Down*** screen menu for searching the band that doesn't show up on the current page.

Table 4.4 Frequency Setting Procedure

Changing the frequency settings will automatically turn calibration off with the symbol "Cal Off" to be displayed on the screen along with an alarm sound. In this case, recalibrate the instrument with the Open-Short-Load Calibration kit.

4.3.3 Calibration

The instrument must be calibrated to get reliable Cable Loss measurement results. For best results, set the frequency and calibrate the instrument immediately before taking measurements.

- **Calibration accessories (optional)**
  - Calibration Kit which contains one 50ohm load, one Open standard and one Short standard

To minimize the measurement error in Cable Loss measurement, don't use unnecessary extension cables or adapters while performing calibration. Figure 4.13 illustrates the recommended calibration method for Cable Loss measurement.

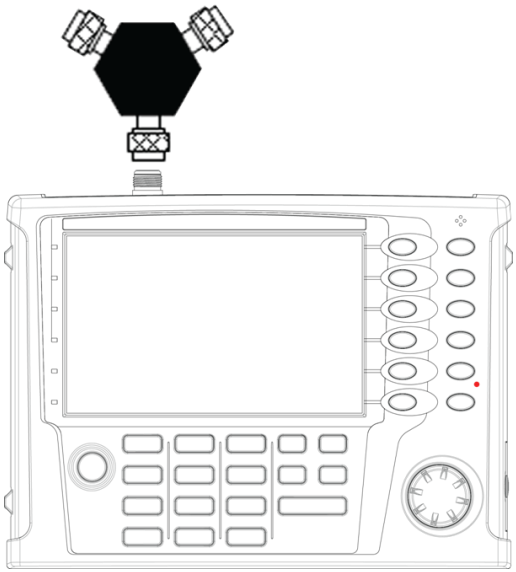

Figure 4.13 Port Calibration for One Port Cable Loss Measurement

Action	Note
Performs Calibration after the frequency setting.	
1. Press the **CAL** key.	Hard function key.
2. Connect an Open standard.	Connect CAL Kit "Open" connector to the RF out port.
3. Select the ***Open/Start*** screen menu.	✓ When the ***Open/Start*** screen menu is selected, a progress bar is displayed to show the progress. ✓ When a progress bar is disappeared, Open calibration is finished.
4. Connect a Short standard.	Connect CAL Kit "Short" connector to the RF out port.
5. Select the ***Short/Start*** screen menu.	✓ When the ***Short/Start*** screen menu is selected, a progress bar is displayed to show the progress. ✓ When a progress bar is disappeared, Short calibration is finished.

6. Connect the Load standard.	Connect CAL Kit "Load" connector to the RF out port.
7. Select the ***Load/Start*** screen menu.	✓ When the ***Load/Start*** screen menu is selected, a progress bar is displayed to show the progress. ✓ When a progress bar is disappeared, Load calibration is finished.
Calibration state is changed to **"Cal On"** after the Open-Short-Load calibration.	

Table 4.5 Calibration Procedure

4.3.4
Cable Loss Measurement

The instrument is ready to perform Cable Loss measurement after completion of Open-Short-Load calibration.

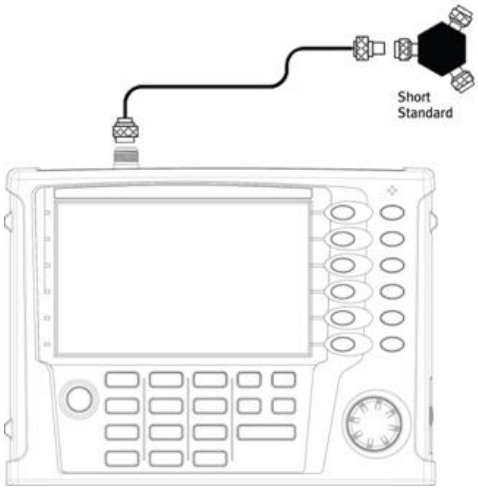

Figure 4.14 One Port Cable Loss Measurement Connection Diagram

The instrument must be calibrated to get reliable Cable Loss measurement results. For best results, set the frequency and calibrate the instrument immediately before taking measurements.

Action	Note
Make a measurement after completion of O-S-L calibration.	
1. Connect the cable to measure its loss to the RF out port of the instrument.	
2. Connect the Short standard of the Cal Kit to the end of the cable to be tested	Cable Loss measurement result is displayed on the screen.

Table 4.6 Cable Loss Measurement Procedure

4.3.4.1 Scale Adjustment

- Press the **Auto Scale** key to optimize the Y scale and display an entire trace.
- Press the **AMP** key to set the maximum and minimum values on the Y scale manually.
- Press the **Scale** key to select a display unit of the Y scale.

4.3.4.2 Using Markers

Depending on the draw type setting, four or six markers can be used simultaneously. The level of a current trace is displayed next to each marker on the screen, but the frequency information is not provided. Activate a marker table to see both level and frequency information when moving a marker to the specific frequency using the Marker Edit.

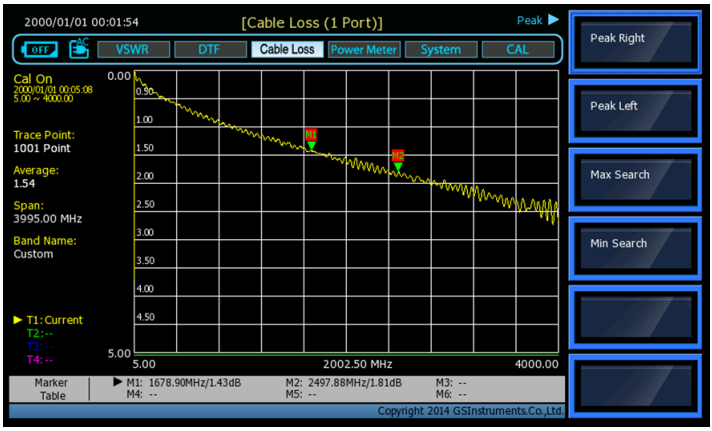

Figure 4.15 Using Markers in Cable Loss Measurement Mode

4.4 Power Meter

The Power Meter is to measure the transmission power of the system. This function can be used only with optional external power sensors. Two kinds of power sensors, the average power sensor and peak power sensor, are available depending on the type of transmission power signals to be measured.

4.4.1 Connecting Sensors

Selecting the Power Meter function after power up will display Power Meter measurement screen with the message that “Please, connect external power sensor and press Initialize menu key” is connected.

Figure 4.16 Power Measurement Screen

Connect a power sensor to the USB interface port of the instrument using the provided cable as Figure 4.17. Do not connect a power sensor directly to the LPA or HPA.

Figure 4.17 Power Sensor Connection Diagram

After connecting a power sensor, select the ***Initialize*** screen menu key for the instrument to recognize the sensor. After successful recognition of the

power sensor, the sensor type is displayed on the screen as in Figure 4.18. Since no power source is connected to the sensor yet, an alarm message "- - - -" is displayed on the screen

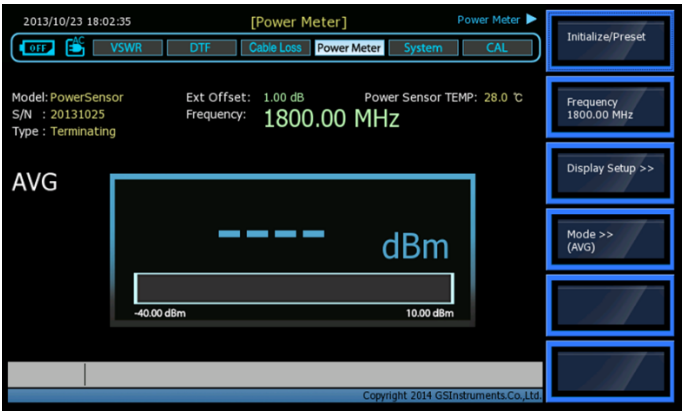

Figure 4.18 Power Sensor Initial Screen

No sensor type is displayed on the screen if the instrument fails to recognize a sensor type during the initialization process.

4.4.2 Setting Power Meter

All the keys used to set the power measurement are displayed as screen menu keys on the screen.

Initialize: Initializes the power sensor and downloads the calibration data from the sensor.

Frequency: Sets the frequency of signals to measure. Note: As the frequency setting affects the calibration data, be sure to set the accurate center frequency for reliable measurement results.

Ext. Offset: Enters the value of Gain or Loss when an attenuator or an amplifier is used before the power sensor. Note: As the default setting is Loss, enter the level of Loss in positive value when an attenuator is used and enter the level of gain in negative value when an amplified is used.

Unit: Selects the measurement unit. Note: In the case where the units are selected as Watts, depending on the measured power level, the units are altered as W(Watt), mW(milli Watt), or uW(micro Watt) automatically.

Preset: Clears all user settings and returns to initial settings.

4.4.3 Power Measurement

After connection and initialization of a power sensor, connect the power sensor to the output port of the device

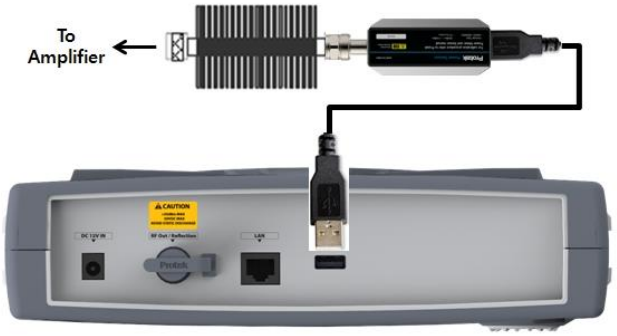

Figure 4.19 HPA (High Power Amplifier) Output Power Measurement

Do not connect the power sensor directly to the output of the HPA. The power sensor will be damaged if output power greater than +10dBm is supplied directly.

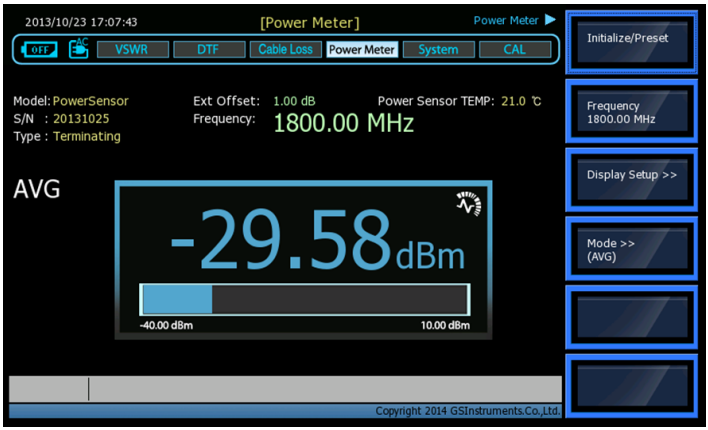

Figure 4.20 Power Meter Screen Display

4.5 Save & Load

Measurement results and setups can be saved to or loaded from the nonvolatile memory in the instrument or an external USB memory.

The instrument can save a measurement result in a data file and recall the file later for the purpose of a comparison or analysis. The display screen can be saved as a graphic file format. Also a user setup configuration can be saved. The Load function is used to recall data files, display screens or user setups.

4.5.1 Save

The instrument provides the following save functions:

- Save Trace: Save a captured trace in a data file. The file name extension is *.tra.
- Save Screen: Save a current display screen. The file name extension is *.png.
- Save State: Save a user setup configuration. The file name

extension is *.sta.

The saving can be either internal memory or external USB memory.

4.5.1.1 Save Trace

This function is to save a captured trace using the Trace function. Refer to Trace for the detailed description about capturing the trace.

Action	Note
This function is available in VSWR, DTF, and Cable Loss measurement mode.	
1. Press the **Save** key.	Multi key.
2. Select the ***Save Trace*** screen menu.	Screen menu key.
3. Select the ***Trace CH Number***.	Select a trace number to save.
4. Select the Memory Type. **Internal/USB**	Select either an internal memory or an external USB memory.
5. Select the File Name.	Use character or number.
6. Press the **Enter** key.	

Table 4.7 Trace Saving Procedure

Figure 4.21 Trace Saving Screen to Enter File Name

When a user assigns the file name manually, the Enter key on the screen keyboard must be entered after finishing the entry of a file name.

4.5.1.2 Save Screen

This function is to save the measurement display screen in the graphic file format.

Action	Note
This function is available in VSWR, DTF, Cable Loss and Power Meter measurement mode.	
1. Press the **Save** key.	Multi key.
2. Select the ***Save Screen*** menu.	Screen menu key.
3. Select the Memory Type. **Internal/USB**	Select either an internal memory or an external USB memory.
4. Select the File Name.	Use character or number.
5. Press the **Enter** key.	

Table 4.8 Screen Saving Procedure

4.5.1.3 Save State

This function is to save the user setup configuration and the calibration data. Up to 20 setups can be saved.

Action	Note
This function is available in VSWR, DTF, Cable Loss and Power Meter measurement mode.	
1. Press the **Save** key.	Multi key.
2. Select the ***Save State*** screen menu.	Screen menu key.
3. Select the Memory Type. **Internal/USB**	Select either an internal memory or an external USB memory.
4. Select the File Name.	Use character or number.
5. Press the **Enter** key.	

Table 4.9 State Saving Procedure

Saving setup based on the procedure in Table 4.10 saves the setup configuration listed in Table 4.11. The instrument setting can be configured by loading the saved setup later

Measurement Mode	Parameters	Remarks
VSWR Cable Loss	Cal On/ Off status	
VSWR Cable Loss	Cal Data	Recall preceding calibration data.
VSWR Cable Loss	Frequency	Start, Stop, Center Freq and Span
VSWR Cable Loss	Trace Point	126, 251, 501, 1001, 2001 points,

VSWR Cable Loss	Y-scale	Top, Bottom
VSWR Cable Loss	Y-scale unit	VSWR, Return Loss
VSWR Cable Loss	Band	Frequency band name
DTF	Distance Setting	0 ~ 1250m (4125feet)
DTF	Cable Setting	Cable name and its characteristics
DTF	Y-scale Setting	Top, Bottom
DTF	Y-scale unit Setting	VSWR, Return Loss
DTF	Custom Cable Parameter Setting	User setting Propagation Velocity and Cable Loss value. Cable Loss value

Table 4.10 Saved Parameters in each Measurement Mode

4.5.2 Load

4.5.2.1 Load Trace

This function is used to recall multiple traces for comparison. The following changes happen automatically when a saved trace is recalled:

- The frequency or distance setting of the current measurement mode is changed automatically to fit into the recalled trace. On the upper right corner of the screen, the frequency setting and the assigned channel number (Trace CH) of the recalled trace are displayed.
- The Y scale unit is adjusted automatically to fit into the Y scale of the recalled trace.
- From the second recall of the trace, the trace cannot be loaded if its start and stop point of the X scale is not identical with those of the first trace.
- The trace with the different Y scale unit may not be seen on

the screen even if the trace information appears on the trace summary table on the upper right corner of the display.

When multiple traces with different Y scale are loaded, the corresponding trace with the current Y scale is only shown on the screen.

Figure 4.22 Trace Loading Screen

When the Load Trace function is selected, the preview of the selected trace from the list is disaplyed on the lower right corner of the screen.

Action	Note
This function is available in VSWR, DTF, Cable Loss measurement mode.	
1. Press the **Load** key.	Multi key.
2. Select the ***Load Trace*** screen menu.	Saved file list shows up when ***Load Trace*** is selected. Use dial knob or Up/Down Arrow key to select the file to load from the list.
3. Press the **Enter** key.	Load a selected trace.

Table 4.11 Trace Loading Procedure

4.5.2.2 Load Screen

This function recalls and displays a saved screen. The measurement currently under processing is continued in the background, but it is not displayed on the screen. Pressing any key removes the loaded screen and the measurement screen being processed in the background shows up.

4.5.2.3 Load State

This function is to load the user setup configuration and the calibration data.

4.5.2.4 Memory Type

This function designates the area used to recall Trace, Screen, and Setup. Two types of storage areas are available as follows.

- Internal: Selects the files stored in the internal memory of the instrument. A list of files stored in the internal memory is displayed when Load Trace, Load Screen or Load Setup is selected while the memory type is set to “Internal”. In case the user selected file is not available, an error message is displayed on the messaging window and the file list is not shown.
- USB: Selects the files stored in external USB memory. A list of files stored in the external USB memory is displayed when Load Trace, Load Screen or Load Setup is selected while memory type is set to “USB”. In case the user selected file is not available, an error message is displayed on the messaging window and the file list is not shown.

5

SOFTWARE UPGRADE

OPERATING MANUAL

5. SOFTWARE UPGRADE

The following is easy and user friendly upgrade instruction when an upgrade is needed during A434L operation.

5.1 Upgrade Method

- The following screen will appear if System button is pressed out of the right side Mode buttons during the power is on.

Figure 5.1 System Mode Screen

- Select “Upgrade” button on the top right side of the display or the keypad after connecting USB Memory containing Upgrade file to USB Port. If either the USB Memory is not connected to USB Port or is not connected properly, “USB not connected!” message will appear in the bottom left corner of the screen as follows. There will be no more operation.

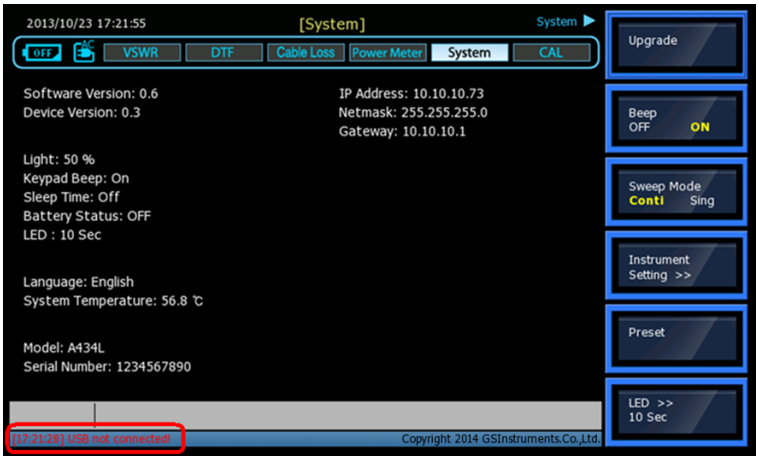

Figure 5.2 USB not connected Screen Display

- *.tgz files from USB Memory will be listed as the following display when USB Memory is connected properly.

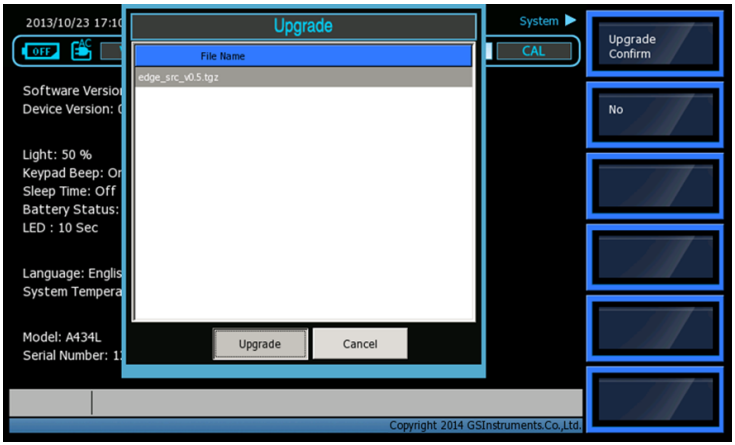

Figure 5.3 File List Screen for Upgrade

- Select the upgrade file out of the listed files. Then, Select “Upgrade” or “Upgrade Confirm” button. Upgrade starts. After upgrade is completed, the power will be automatically turned off and the user should turn it on again.

But, upgrade will not be activated if the selected file does not match the upgrade condition.

6

WARRANTY INFORMATION

6. _WARRANTY INFORMATION

1. The manufacturer warrants the Cable and Antenna Analyzer to conform to the specifications of this Manual when used in accordance with the regulations of operation detailed in this Manual.

2. The manufacturer will repair or replace without charge, at its option, any Analyzer found defective in manufacture within the warranty period, which is two years from the date of purchase. Should the user fail to submit the warranty card appropriately certified by the seller with its stamp and date of purchase the warranty period will be determined by the date of manufacture.

3. The warranty is considered to be void if:

a) The defect or damage is caused by improper storage, misuse, neglect, inadequate maintenance, or accident;

b) The product is tampered with, modified or repaired by an unauthorized party;

c) The product's seals are tampered with;

d) The product has mechanical damage.

4. The batteries are not included or covered by this warranty.

5. Transport risks and costs to and from the manufacturer or the authorized service centers are sustained by the buyer.

6. The manufacturer is not liable for direct or indirect damage of any kind to people or goods caused by the use of the product and/or suspension of use due to eventual repairs.

7. When returning the faulty product please include the accurate details of this product and clear description of the fault. The manufacturer reserves the right to check the product in its laboratories to verify the foundation of the claim.

Technical Support

Write:

GS Instruments Co., Ltd.
70, Gilpa-ro 71beon-gil, Nam-ku, Incheon, Korea
402-854

Product Information and Technical Assistance:

www.gsi-protek.com

isale@gsinstrument.com

Revision History

Date	Version	Changes
01/2015	Original	

Copyright

Specifications and features of this manual are subject to change without notice or obligation.

Appendix 1 — Band List

Band Name	Start Freq.	Stop Freq.
AMPS / EIA 553 -Uplink	859	70
AMPS / EIA 553 -Downlink	859	70
C-450 (P) -Uplink	463.5	21
C-450 (P) -Downlink	463.5	21
C-450 (SA) -Uplink	462.5	15
C-450 (SA) -Downlink	462.5	15
CDMA US Cellular -Uplink	859	70
CDMA US Cellular -Downlink	859	70
CDMA US PCS -Uplink	1920	140
CDMA US PCS -Downlink	1920	140
CDMA Korea PCS -Uplink	1810	120
CDMA Korea PCS -Downlink	1810	120
CDMA Japan / ARIB -Uplink	878.5	93
CDMA Japan / ARIB -Downlink	878.5	93
CDMA China-1-Uplink	916	88
CDMA China-1-Downlink	916	88
CDMA China-2-Uplink	910	76
CDMA China-2-Downlink	910	76
CDMA2000 Class 0, Korea Cel-lular -Uplink	859	70
CDMA2000 Class 0, Korea Cel-lular -Downlink	859	70
CDMA2000 Class 0, N.A. Cellu-lar -Uplink	859	70
CDMA2000 Class 0, N.A. Cellu-lar -Downlink	859	70
CDMA2000 Class 1, N.A. PCS -Uplink	1920	140

CDMA2000 Class 1, N.A. PCS -Downlink	1920	140
CDMA2000 Class 2, (TACS Band) -Uplink	916	88
CDMA2000 Class 2, (TACS Band) -Downlink	916	88
CDMA2000 Class 3, (JTACS Band) -Uplink	878.5	93
CDMA2000 Class 3, (JTACS Band) -Downlink	878.5	93
CDMA2000 Class 4, Korea PCS -Uplink	1810	120
CDMA2000 Class 4, Korea PCS -Downlink	1810	120
CDMA2000 Class 5, (NMT-450-20 kHz) -Uplink	472.5	43
CDMA2000 Class 5, (NMT-450-20 kHz) -Downlink	472.5	43

Band Name	Start Freq.	Stop Freq.
CDMA2000 Class 5, (NMT-450-25 kHz) -Uplink	439.5	57
CDMA2000 Class 5, (NMT-450-25 kHz) -Downlink	439.5	57
CDMA2000 Class 6, IMT-2000 -Uplink	2045	250
CDMA2000 Class 6, IMT-2000 -Downlink	2045	250
CDMA2000 Class 7, N.A. 700 MHz Cellular -Uplink	770	48
CDMA2000 Class 7, N.A. 700 MHz Cellular -Downlink	770	48
ETACS -Uplink	916	88
ETACS -Downlink	916	88
GSM 900 -Uplink	897.4	40
GSM 900 -Downlink	942.4	40
GSM 1800 -Uplink	1747.4	80
GSM 1800 -Downlink	1842.4	80
GSM 1900 -Uplink	1879.8	80

GSM 1900 -Downlink	1959.8	80
JTACS -Uplink	878.5	93
JTACS -Downlink	878.5	93
MATS-E -Uplink	925	70
MATS-E -Downlink	925	70
N-AMPS / IS-88L -Uplink	859	70
N-AMPS / IS-88L -Downlink	859	70
N-AMPS / IS-88M -Uplink	859	70
N-AMPS / IS-88M -Downlink	859	70
N-AMPS / IS-88U -Uplink	897.5	147
N-AMPS / IS-88U -Downlink	897.5	147
NADC IS136 Cellular -Uplink	859	70
NADC IS136 Cellular -Downlink	859	70
NADC IS136 PCS -Uplink	1920	140
NADC IS136 PCS -Downlink	1920	140
NMT-411-25 kHz -Uplink	420.5	19
NMT-411-25 kHz -Downlink	420.5	19
NMT-450-20 kHz -Uplink	460.5	19
NMT-450-20 kHz -Downlink	460.5	19
NMT-450-25 kHz -Uplink	459	18

Band Name	Start Freq.	Stop Freq.
NMT-450-25 kHz -Downlink	459	18
NMT-470-20 kHz -Uplink	486.5	15
NMT-470-20 kHz -Downlink	486.5	15

NMT-900 -Uplink	925	70
NMT-900 -Downlink	925	70
NMT-900 (Offset) -Uplink	925	70
NMT-900 (Offset) -Downlink	925	70
NTACS -Uplink	878.5	93
NTACS -Downlink	878.5	93
PDC 800 Analog -Uplink	891.5	97
PDC 800 Analog -Downlink	891.5	97
PDC 1500 (JDC) -Uplink	1513	72
PDC 1500 (JDC) -Downlink	1513	72
PHS -Uplink	1906.5	23
PHS -Downlink	1906.5	23
SMR 800 -12.5 kHz -Uplink	836	60
SMR 800 -12.5 kHz -Downlink	836	60
SMR 800 -25 kHz -Uplink	836	60
SMR 800 -25 kHz -Downlink	836	60
SMR 1500 -Uplink	1483	60
SMR 1500 -Downlink	1483	60
TACS -Uplink	925	70
TACS -Downlink	925	70
UMTS/WCDMA -Uplink	1920	70
UMTS/WCDMA -Downlink	2110	70
UMTS/Region 2 -Uplink	1850	70
UMTS/Region 2 -Downlink	1930	70
802.11a	5170	84
802.11b	2442	84

802.11 DS	2448	72
802.11 FH	2448.5	93
802.11g	2442	84
Bluetooth US & Europe Uplink	2400	2484

Band Name	Start Freq.	Stop Freq.
Bluetooth US & Europe Downlink	2400	2484
Bluetooth US & Europe Fullband	2400	2484
Bluetooth Japan Uplink	2472	2497
Bluetooth Japan Downlink	2472	2497
Bluetooth Japan Fullband	2472	2497
C 450 P Uplink	453	464
C 450 P Downlink	463	474
C 450 P Fullband	453	474
C 450 SA Uplink	465	470
C 450 SA Downlink	455	460
C 450 SA Fullband	455	470
CDMA China 1 2 Uplink	872	915
CDMA China 1 2 Downlink	917	960
CDMA China 1 2 Fullband	872	960
Cellular Uplink	824	849
Cellular Downlink	869	894
Cellular Fullband	824	894
Cellular 700 MHZ Uplink	776	794

Cellular 700 MHZ Downlink	746	764
Cellular 700 MHZ Fullband	746	794
DCS GSM 1800 Uplink	1710	1785
DCS GSM 1800 Downlink	1805	1880
DCS GSM 1800 Fullband	1710	1880
GSM 900 Uplink	880	915
GSM 900 Downlink	925	960
GSM 900 Fullband	880	960
IEEE 802 11 FH Uplink	2402	2495
IEEE 802 11 FH Downlink	2402	2495
IEEE 802 11 FH Fullband	2402	2495
IEEE 802 11 DS Uplink	2412	2484
IEEE 802 11 DS Downlink	2412	2484
IEEE 802 11 DS Fullband	2412	2484
IEEE 802 11 B G Uplink	2400	2484

Band Name	Start Freq.	Stop Freq.
IEEE 802 11 B G Downlink	2400	2484
IEEE 802 11 B G Fullband	2400	2484
IMT 2000 UMTS WCDMA Uplink	1920	1980
IMT 2000 UMTS WCDMA Downlink	2110	2170
IMT 2000 UMTS WCDMA Fullband	1920	2170
ISM 2 4 GHZ Uplink	2400	2484
ISM 2 4 GHZ Downlink	2400	2484
ISM 2 4 GHZ Fullband	2400	2484
JTACS/NTAC Japan ARIB Uplink	887	925

JTACS/NTAC Japan ARIB Downlink	832	870
JTACS/NTAC Japan ARIB Fullband	832	925
NMT 411 Uplink	411	420
NMT 411 Downlink	421	430
NMT 411 Fullband	411	430
NMT 450 Uplink	450	460
NMT 450 Downlink	460	470
NMT 450 Fullband	450	470
NMT 450 20 kHz CDMA2000 Uplink	451	484
NMT 450 20 kHz CDMA2000 Downlink	461	494
NMT 450 20 kHz CDMA2000 Fullband	451	494
NMT 450 25 kHz CDMA2000 Uplink	411	458
NMT 450 25 kHz CDMA2000 Downlink	421	468
NMT 450 25 kHz CDMA2000 Fullband	411	468
NMT 900 MATS E Uplink	890	915
NMT 900 MATS E Downlink	935	960
NMT 900 MATS E Fullband	890	960
PCS GSM 1900 Uplink	1850	1910
PCS GSM 1900 Downlink	1930	1990
PCS GSM 1900 Fullband	1850	1990
PCS Korea Uplink	1750	1780
PCS Korea Downlink	1840	1870
PCS Korea Fullband	1750	1870
PDC 800 Uplink	898	940

Band Name	Start Freq.	Stop Freq.
PDC 800 Downlink	843	885
PDC 800 Fullband	843	940
PDC 1500 Uplink	152	1549
PDC 1500 Downlink	1477	1501
PDC 1500 Fullband	1477	1549
PHS Uplink	1895	1918
PHS Downlink	1895	1918
PHS Fullband	1895	1918
SMR 800 Uplink	806	821
SMR 800 Downlink	851	866
SMR 800 Fullband	806	866
SMR 1500 Uplink	1453	1465
SMR 1500 Downlink	1501	1513
SMR 1500 Fullband	1453	1513
TACS/ETACS Uplink+C22	872	915
TACS ETACS Downlink	917	960
TACS ETACS Fullband	872	960
Tetra Uplink	380	430
Tetra Downlink	380	430

Appendix 2 — Cable List

Cable Type	Relative Propagation Velocity (V¦)	Nominal Attenuation dB/m @ 1000MHz
FSJ1-50A	0.84	0.197
FSJ250	0.83	0.134
FSJ4-50B	0.81	0.119
HCC 12-50J	0.915	0.092
HCC 158-50J	0.95	0.023
HCC 300-50J	0.96	0.014
HCC 312-50J	0.96	0.013
HCC 78-50J	0.915	0.042
HF 4-1/8" Cu2Y	0.97	0.01
HF 5" Cu2Y	0.96	0.007
HF 6-1/8"Cu2Y	0.97	0.006
HJ4.5-50	0.92	0.054
HJ4-50	0.914	0.087
HJ5-50	0.916	0.042
HJ7-50A	0.921	0.023
LDF12-50	0.88	0.022
LDF4-50A	0.88	0.077
LDF5-50A	0.89	0.043
LDF6-50	0.89	0.032
LDFF7-50A	0.88	0.027
LMR100	0.8	0.792
LMR1200	0.88	0.044
LMR1700	0.89	0.033

LMR200	0.830	0.344
LMR240	0.84	0.262
LMR400	0.85	0.135
LMR500	0.86	0.109
LMR600	0.87	0.087
LMR900	0.87	0.056
RG142	0.69	0.443
RG17, 17A	0.659	0.18

Cable Type	Relative Propagation Velocity (V¦)	Nominal Attenuation dB/m @ 1000MHz
RG174	0.66	0.984
RG178B	0.69	1.509
RG187, 188	0.69	1.017
RG213/U	0.66	0.292
RG214	0.659	0.292
RG223	0.659	0.165
RG55, 55A, 55B	0.659	0.541
RG58, 58B	0.659	1.574
RG58A, 58C	0.659	0.787
RG8, 8A, 10, 10A	0.659	0.262
RG9, 9A	0.659	0.289
HFSC-12D(1/2")	0.81	0.112
HFC-12D(1/2")	0.88	0.072
HFC-22D(7/8")	0.88	0.041
HFC-33D(1_1/4")	0.88	0.0294

HFC-42D(1_5/8")	0.87	0.0243
RFCX-12D(1/2")	0.88	0.088
RFCX-22D(7/8")	0.88	0.049
RFCX-33D(1_1/4")	0.88	0.038
RFCX-42D(1_5/8")	0.87	0.028
RFCL-22D(7/8")	0.88	0.044
RFCL-33D(1_1/4")	0.88	0.034
RFCL-42D(1_5/8")	0.87	0.0315