



# Quiver S User Guide

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QVR-SUG-v.1.1

4/13/15

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This user guide documents the features and capabilities of the Quiver S.



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## Introduction

Quiver S is a hand held, state of the art CATV impairment location meter. Functions and capabilities include a forward and return path spectrum analyzer, CPD radar with active and passive modes, a Network Traffic Compatible time domain reflectometer (TDR), and leakage detector functionality for analog signals, and inserted pilot carriers.

## Screen Navigation

The Quiver S keyboard has several types of buttons designed for simple navigation. Turn on the Navigator by pressing and holding the ON/OFF power button for a few seconds.

**Hot keys** are the four buttons located just below the display. Their function is attached to menu selection items as indicated on the display.

**Navigation keys** are used to highlight required menu items and for moving markers and cursors around the screen. The **Enter button** is used to confirm a selection. **Exit button** returns to the previous menu,

and in some screens the **Back** hot key is enabled which takes you one step back in the menu.



## Quiver test probe

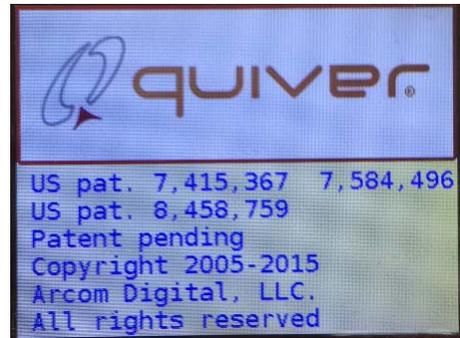
The Quiver test probe is a very useful device which provides a means to connect the test equipment to line passives within the network. It can be used with the spectrum analyzer, CPD radar, and NTC TDR.



## Startup

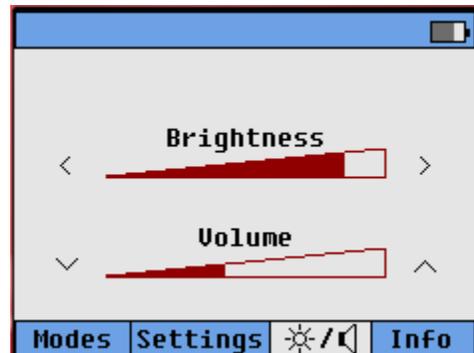
To turn on the Quiver S, push the Power ON/OFF button and **hold for 3 seconds**.

Once the unit is on, you will see the following product screen.



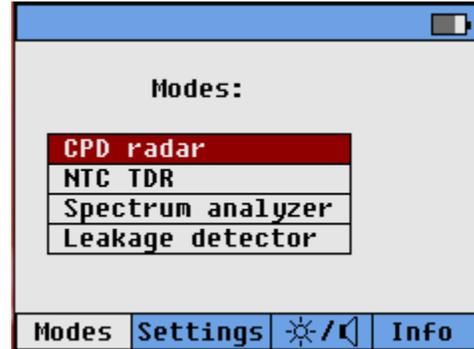
## Brightness and Audio control

Brightness and volume control is accessed by pressing the Brightness / Volume hot key accessed from the main Modes menu page.



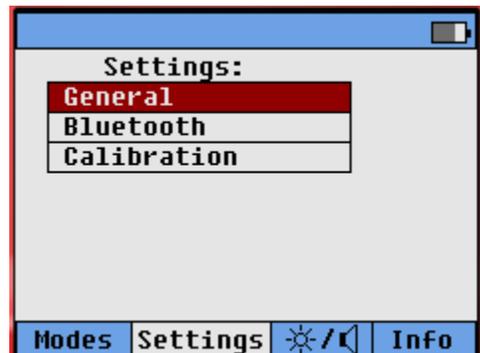
## Quiver S Operating Modes

Quiver S has four main operating modes. From the Modes screen you can get to any of these four operating modes. CPD radar mode contains an active and passive radar and is used to precisely range distance to CPD or any nonlinear distortion. NTC TDR mode contains a network traffic compatible TDR which precisely ranges distance to linear distortions by providing visibility to the return loss across the entire cable span up until the next amplifier. Spectrum analyzer mode contains forward and return FFT analyzers as well as a convenient signal level meter function. Leakage detector mode contains an analog detector that can detect any analog carrier on the network.



## Settings

Press the settings hotkey to access various items.



## Settings – General

The General setting button contains information on the television standard (for use with the spectrum analyzer display), it contains various settings for use with the NTC TDR, allows to change from feet to meters, configures the return bandwidth, and provides default options of continuous pulse or single pulse for both the NTC TDR and for the active CPD radar.

General:	
<b>Standard</b>	NTSC
VOP, %	83
Cable	750
Scale	meter
RTN band	42MHz
TX mode	Single
<b>Back</b>	

### Standard

Provide option to select NTSC standard, PAL B/G or PAL D/K.

General:	
<b>Standard</b>	NTSC
VOP, %	PAL B/G
Cable	PAL D/K
Scale	
RTN band	
TX mode	
<b>Back</b>	

### VOP, %

The velocity of propagation number should correspond to the type of cable being testing according to manufacturers' specification. It is used for both the NTC TDR and the CPD radar. A typical value is .87 %. Quiver uses calculated time distance from the time the pulse is sent to the time it is received – so this velocity of propagation number is important in order to accurately calculate distance to the fault. If the velocity of propagation number is changed, the indicated distance to the impairment will correspondingly change.

### Cable

For the NTC TDR, the type of cable being used in the network needs to be selected from the drop down list using the up and down arrow. The type of cable indicator contains information related to the insertion loss characteristics of the cable, and is



used in our normalization process such that return loss remains relatively flat and accurate across the band. This information is used to make the return loss indication more accurate and does not affect the distance to the fault measurement.

### Scale

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Use to change display to indicate meters or feet.

### RTN band

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Use to select return bandwidth for your system. Options are 45MHz, 65MHz, and 85MHz.

### TX mode

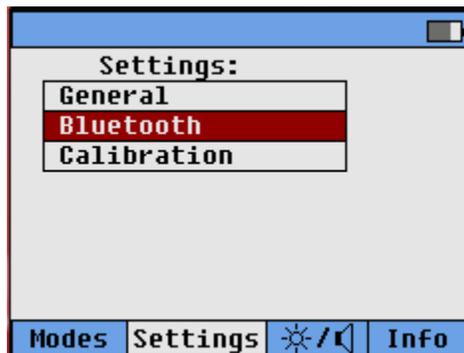
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This item is used to select the transmit mode for both the NTC TDR and for the active radar. Single pulse option will just send out a single pulse and the screen will display the results only once. Continuous pulse mode will continue to send out new pulses and will constantly refresh the screen.

## Settings – Bluetooth

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Allows for Bluetooth configuration if that option is installed in your meter. Allows to turn Bluetooth on and off and to customize PIN if desired. The name of device can't be changed.

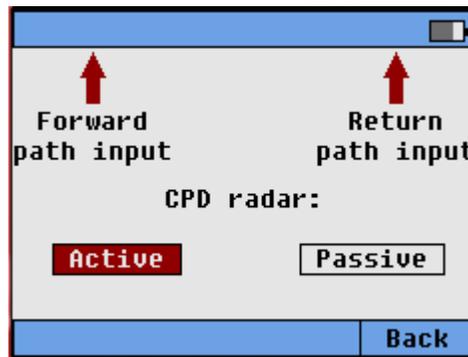
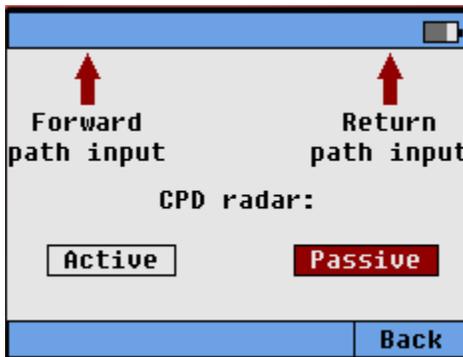
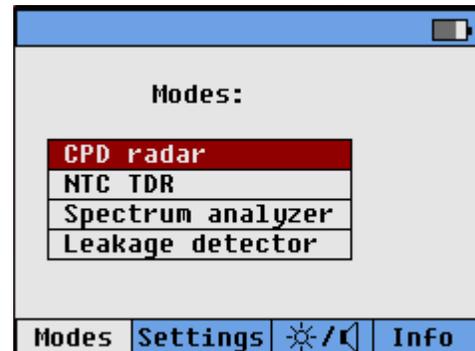


## Settings - Calibration

Calibration is used to change various parameters at the factory, it is not a setting that a user should ever require access to. It is password protected.

## CPD Radar Mode

In CPD Radar Mode, Quiver performs one of its primary function - calculating the time distance to CPD sources located downstream of the network connection point. Quiver has the ability to see multiple CPD sources and display each one as a peak on its LCD screen. The user can view all the peaks in the CPD response, which are indicated by markers on the screen. The radar is equipped with Max Noise Suppression function that helps in revealing the CPD peaks in locations with higher than average noise floors. The device has both active and passive CPD radar modes.

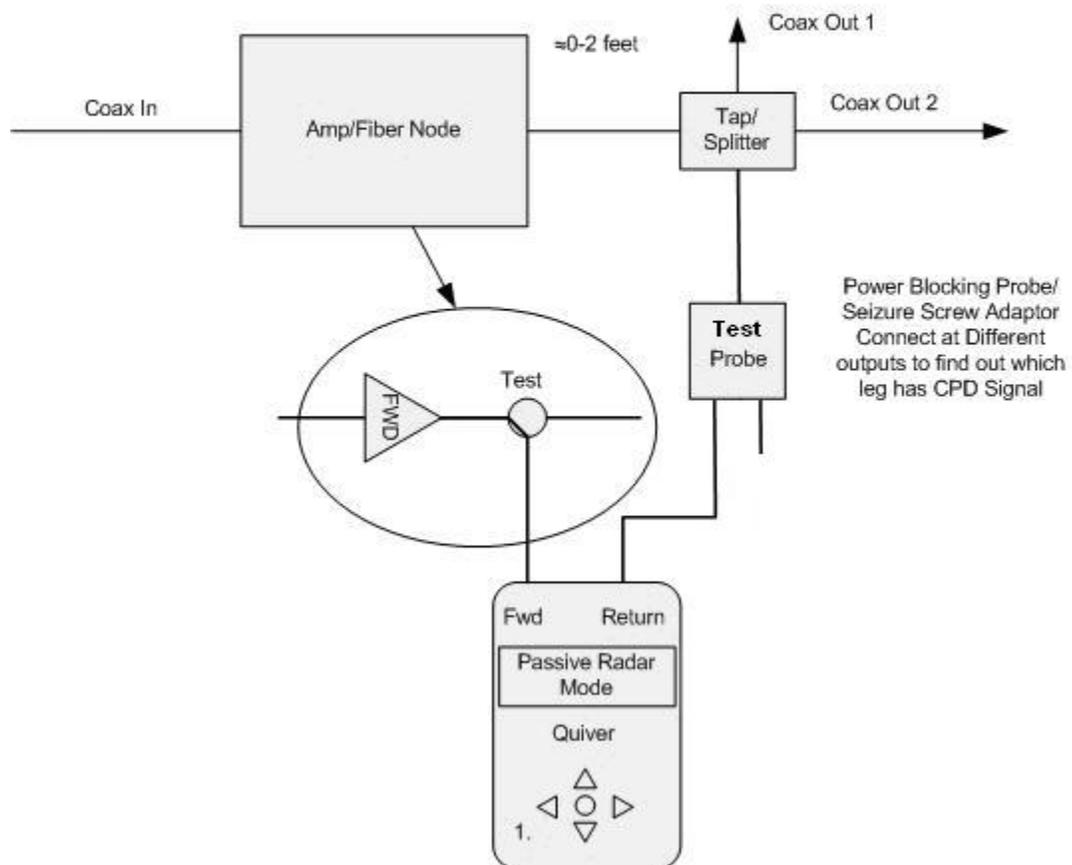


## Passive CPD Radar Connection Diagrams

In order to use CPD Radar Mode, you must establish proper connection to the network devices. The diagrams illustrate the proper CPD/leg Isolation setups to use for the various devices in the network. **The connection schemes below should only be used on the passive radar – and NOT on the active radar.**

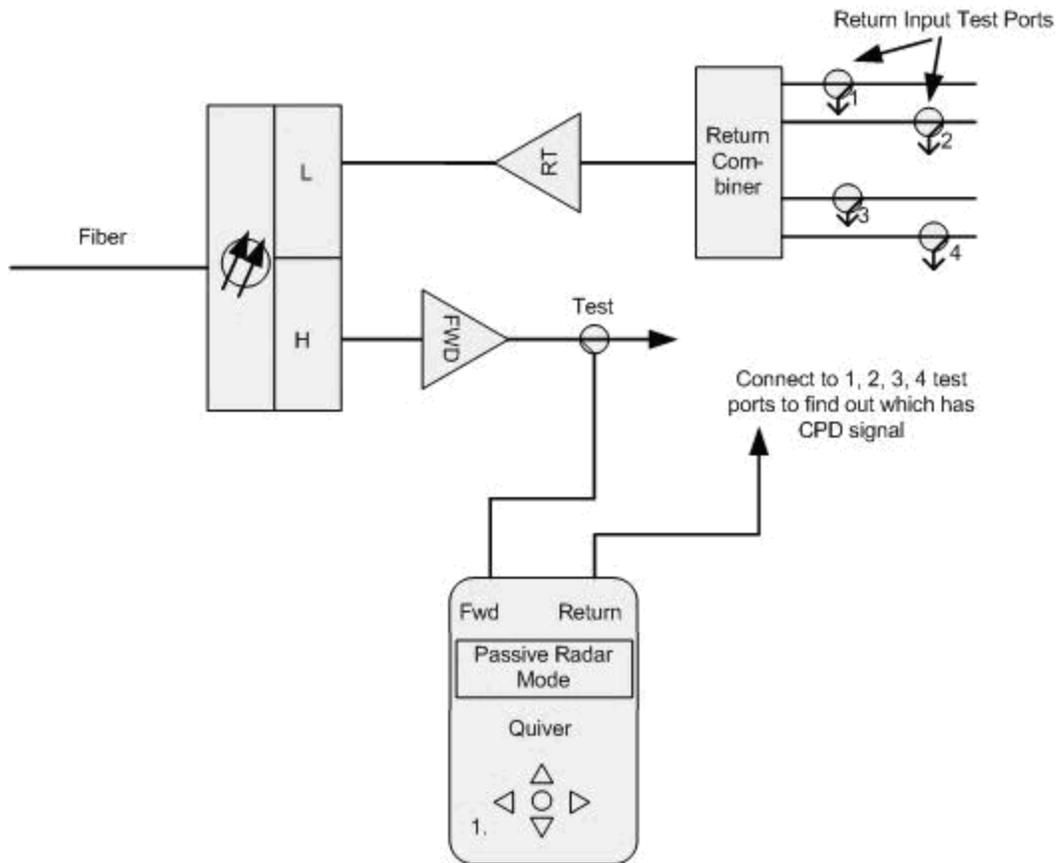
Node Connection

### CPD Location/Leg Isolation At Single Output Amps/Fiber Nodes with Close Splitters/Taps



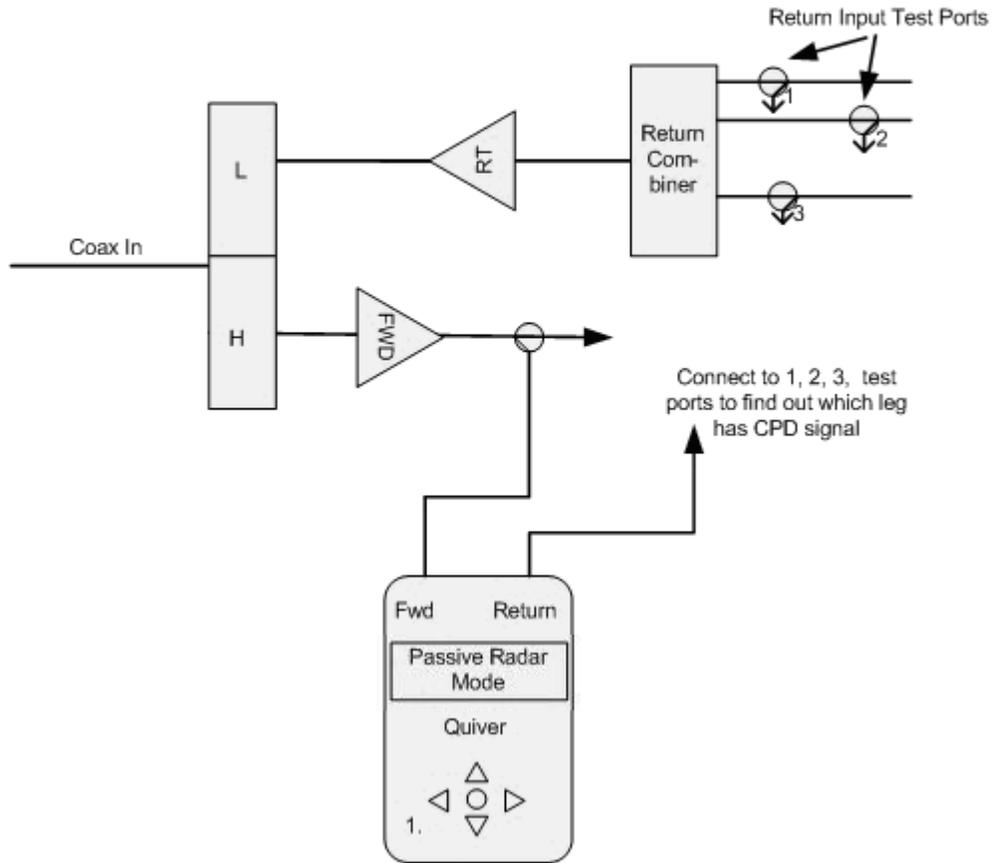
Node Connection – Single Output Amp/Fiber Node

### CPD Location/Leg Isolation at Fiber Node



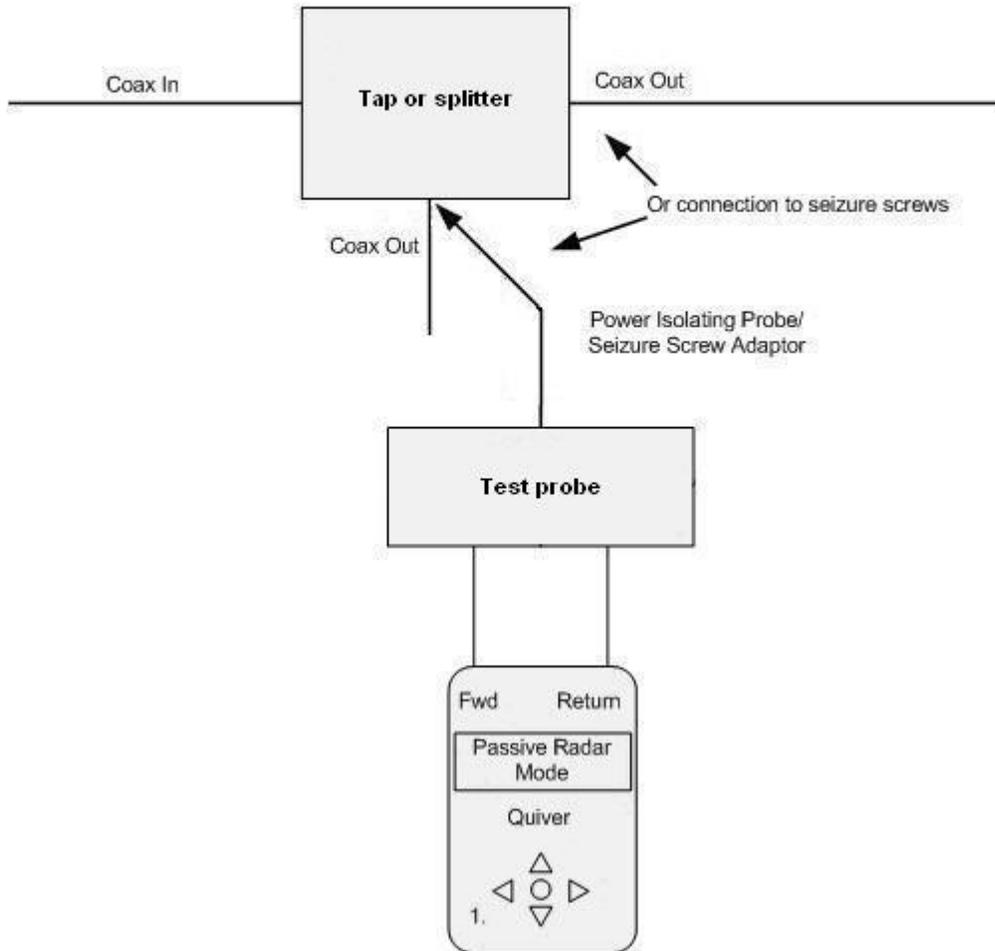
Node Connection - Isolation at Fiber Node

### CPD Location/Leg Isolation at Amplifiers



Node Connection - Isolation at Amplifier

### CPD Location/Leg Isolation at Tap and Splitters

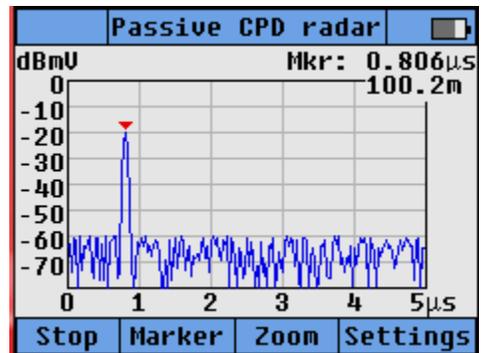
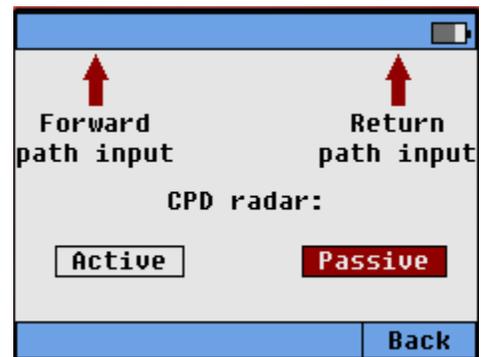


Tap and Splitter Connection - Isolation at Tap/Splitter

## Passive CPD Radar

For the Passive CPD radar, the Quiver S utilizes existing QAM channels as the radar probing signal to range distance to CPD or any nonlinear distortion. The device will operate in continuous or single pulse mode depending upon configuration. Upon startup, the forward and return inputs need to be connected to amplifier test points or to the network utilizing a quiver test probe, in the fashion outlined in the previous section.

After connection, the correlator response will be displayed, with any peaks representing the time distance to the CPD source.

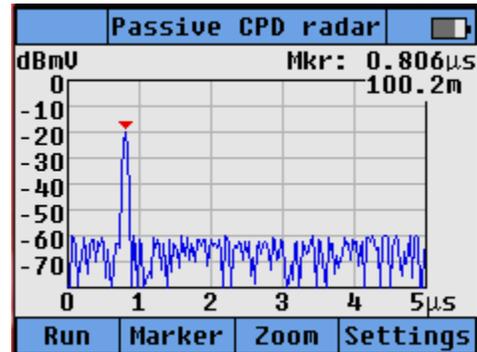


## Filtering of analog channels – IMPORTANT

For the Passive CPD radar to operate properly, only digital channel can be presented to the correlator processor. Analog channels need to be filtered and removed. Quiver S contains an internal 250MHz high pass filter that removes all analog channels above 250MHz. If Quiver S is used on a network with analog channels carried above 250MHz, an external high pass filter must be used. This external filter should be placed on the FWD in port when using the Passive CPD radar mode. The filter should be removed when using all other modes.

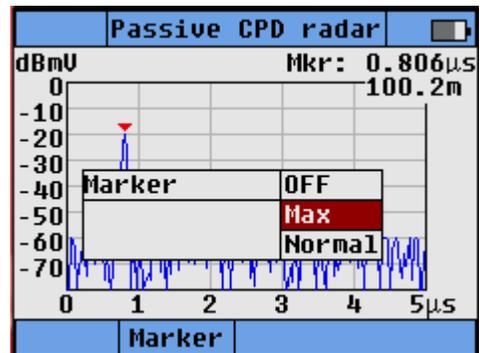
### Stop/run hotkey

The Stop and Run leftmost hotkey buttons enable the correlation process to stop or resume in the configured fashion (single or continuous mode as selected in Settings-General).



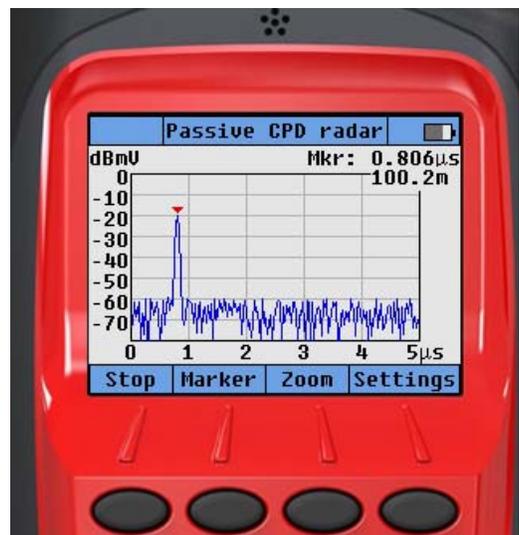
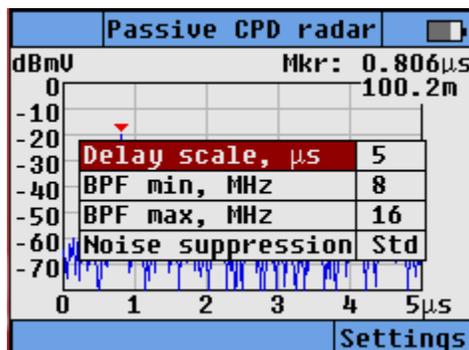
### Marker

The CPD marker can be turned off (not recommended), or the marker will automatically jump to the Maximum CPD amplitude displayed (Max setting), or the marker will be placed at the first peak and the user can move the marker using the right and left arrow to select which peak the marker will indicate. Displayed distance to the impairment is automatically adjusted as the marker moves along the time-distance display.



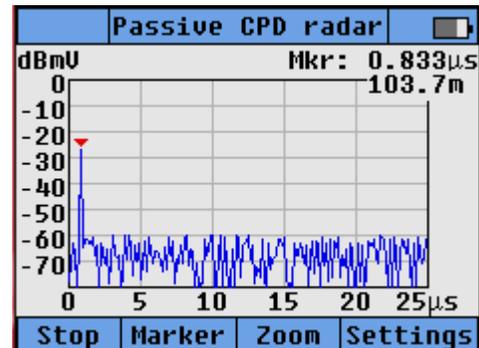
### Settings

The settings hot key, accessed from the Passive CPD radar screen - provide control over settings unique to the Passive radar. A description of each item is provided below.



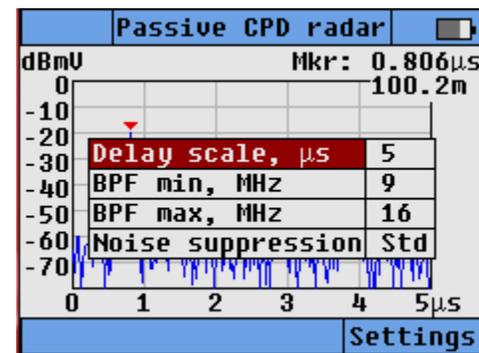
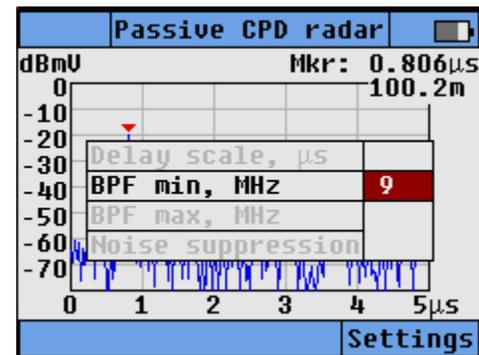
## Delay Scale

Allows to shift the display between 5 $\mu$  and 25 $\mu$  second time distance for more clear viewing of results.



## BPF min/max

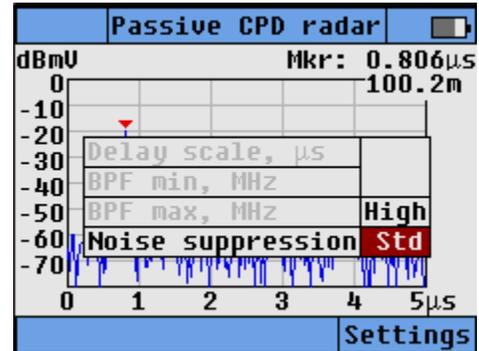
The return signal input filter bandwidth can be changed in order to reduce the influence of CW like carriers in the return path on the radar signal processing circuitry. If they are present within the standard 8–16 MHz monitoring window, they may cause an elevation of the noise floor of the radar. To move around any such carriers the bandwidth of the filter can be adjusted. Highlight either the min or max line item, press enter, and use the up and down arrow keys to adjust to the desired bandwidth.



## Noise Suppression

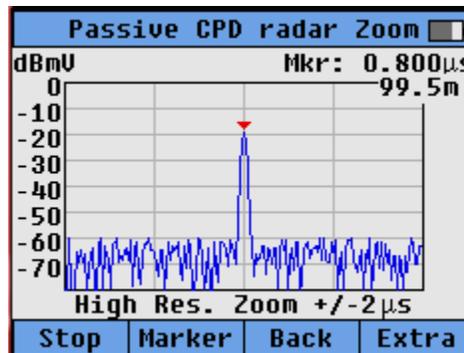
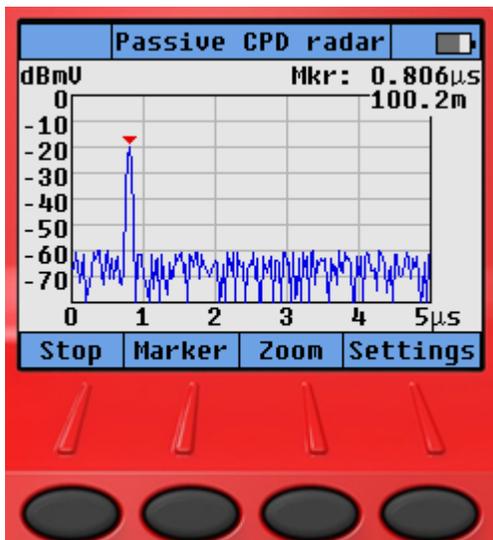
For further improvement of noise cancellation it is possible to select High Noise Suppression. In High Noise Suppression mode the radar processes a larger number of signal samples and creates a CPD response based on more information collected during a longer time period. The user will see on the screen the noise floor decreasing after each scan while the CPD peak will remain at the same level.

To select High Noise Suppression mode highlight menu item Noise Suppression, press enter, and use the up and down arrow to select.



## Zoom mode in Passive radar

In this zoom mode the CPD correlator works with the full return bandwidth, 5–42/65/85 instead of the 8/16MHz window in order to provides better time/distance resolution. *The return bandwidth of the cross correlator is selected at Settings - General - RTN band.* From the Passive CPD Radar screen press the Zoom hot key.



You will see that the zoom response is now centered on the screen, with display x-axis showing +/- 2 μs from marker.



- Note – CPD peak time delay in zoom mode becomes more accurate, in this case 99.5m instead of the previously indicated 100.2m.
- Back hot key exits zoom mode.

### Extra hot key from Zoom mode

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The Extra/Normal hot key toggle provides increased accumulation time and performs a function identical to the High noise compression.

### Active CPD Radar

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The active CPD radar mode is designed to allow for testing the home network or drop, or alternatively for certification testing of new construction in plant that is not yet active. **THIS MODE WILL BE DISTRUPTIVE TO NETWORK TRAFFIC AND SHOULD NEVER BE USED ON LIVE PLANT** – A WARNING MESSAGE IS INDICATED PRIOR TO THIS MODE BEING ENTERED.

In active CPD radar mode, a radar chirp signal is generated in the 150–250 MHz band with level 30..50dBmV. The reflected CPD signal is formed at a bandwidth between 2–100 MHz.

When connecting to the home network when the use of test points or the QTP–20 probe is not possible, a high band/low band diplexer similar to that as shown below should be utilized. Additionally, a 150MHz High pass filter should be utilized on the forward transmit port to improve the isolation of the diplex filter.

#### HIGHBAND/LOWBAND SEPARATOR/JOINER

Combines or separates high and low band VHF signals. Provides low insertion loss prior to channel processing and allows the balancing of bands prior to amplification.



MODEL HLSJ

PORT	Insertion Loss		Rejection	
	FREQUENCY (MHz)	TYP	FREQUENCY	TYP
LOW	DC - 130	.5 dB	170 - 600	25 dB
HIGH	170 - 600	.7 dB	DC - 130	25 dB

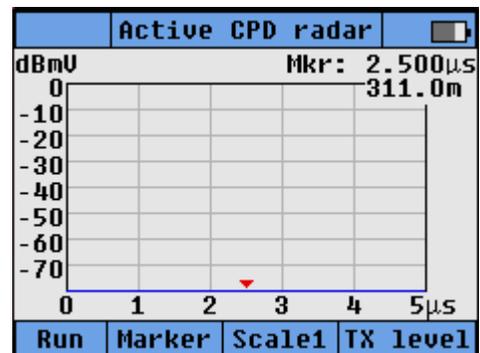


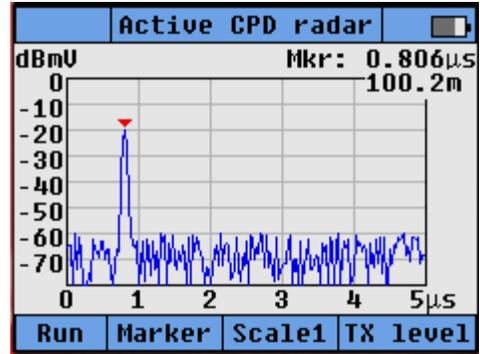
Active Radar warning message



### Run /Stop

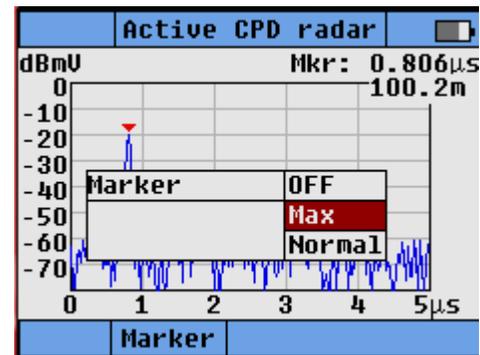
Active radar mode will not start automatically, the user needs to press Run. Run will then toggle with the Stop button when continuous mode is selected.





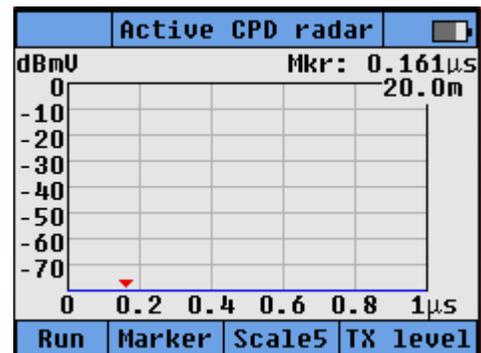
## Marker

The CPD marker can be turned off (not recommended), or the marker will automatically jump to the Maximum CPD amplitude displayed (Max setting), or the marker will be placed at the first peak and the user can move the marker using the right and left arrow to select which peak the marker will indicate. Displayed distance to the impairment is automatically adjusted as the marker moves along the time-distance display.



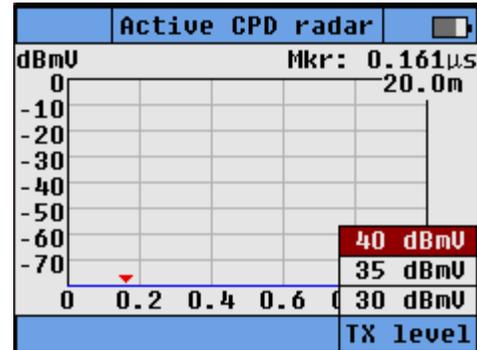
## Scale 1 / 5

The Scale 1 / Scale 5 hot key toggles the display to indicate between 1 and 5  $\mu$ seconds.



## Transmit level

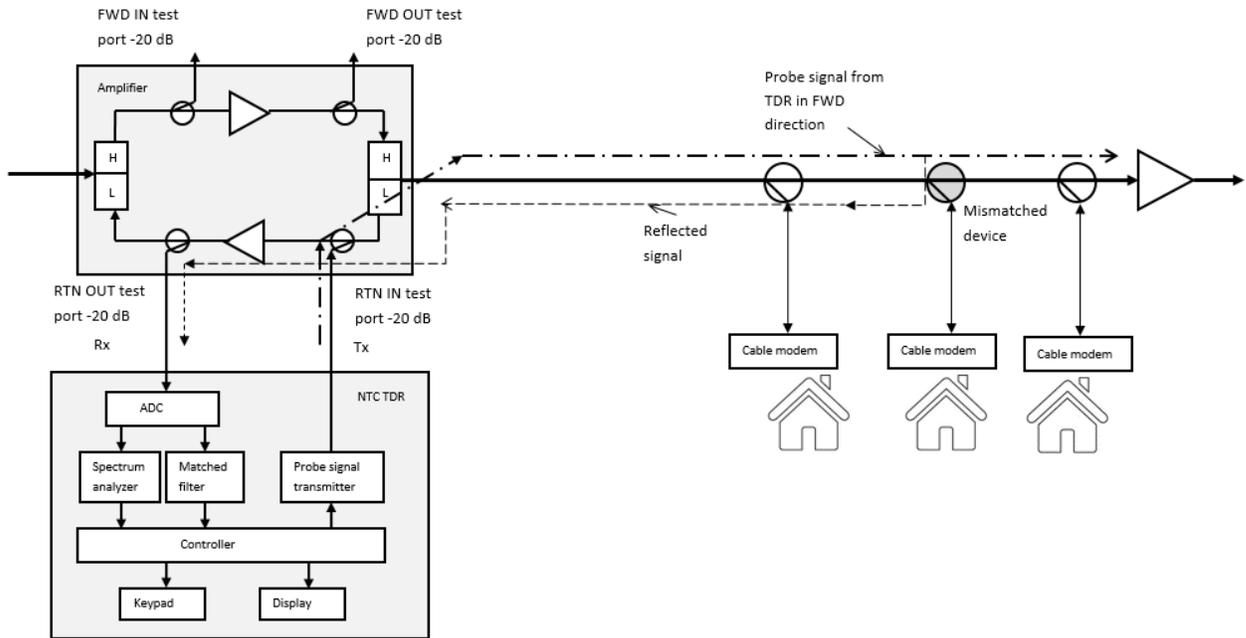
The transmit level of the Active radar is adjustable between 30 to 40dBmV to compensate for different test point loss scenarios. To access press the TX level hot key, use the up and down arrow to select, then press enter.



## NTC TDR

The NTC TDR identifies the precise distance to micro-reflection problems and impedance mismatches in the plant. It is used as a field tool to locate problems identified from PNM initiatives. The NTC TDR is completely different from any other existing TDR. The NTC TDR calculation of the time distance and corresponding physical distance to the impedance mismatch is based on an autocorrelation process which utilizes very low level non-intrusive spread spectrum signals transmitted at return path frequencies in the forward. It is effective from the connection point to the next amplifier.

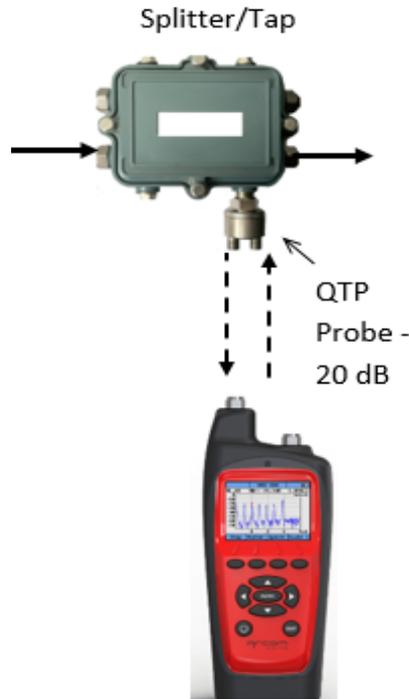
An illustration of how the device operates and is connected to the network is provided in the figure below. Here a spread spectrum signal is input through an amplifier return in test port, the signal travels through the network to the next amplifier (where due to the presence of the diplex filter the probing signal can go no further), and signals are reflected back at all points not having a perfect 75 ohm match and the reflected signal is detected and measured at a second return out test port. (For simplification only one reflected signal is shown.) The NTD TDR display provides a convenient indication of return loss across the entire cable span up until the next amplifier. The marker can be adjusted such that the distance to locations with impedance mismatches and poor return loss can be easily identified.



**WHEN USING THE NTC TDR CONNECTED TO AN AMPLIFIER, PLEASE BE VERY CAREFUL IN SELECTING THE PROPER TEST PORT AS THEY ARE DIFFERENT THAT WHAT IS TYPICALLY USED – THE INPUT NEEDS TO BE RETURN INPUT IN THE FORWARD, AND OUTPUT NEEDS TO BE RETURN OUT IN THE RETURN!**

The NTC TDR output display is unique in that it provides a presentation of easily understandable return loss across the measured span. This output format is significantly improved over that provided by status quo TDRs which just provide difficult to interpret impedance bumps indicating shorts or opens.

As an alternative and more foolproof connection methodology, the NTC TDR can be connected directly to a line passive where the forward and return connection is made by using the QTP-20, a 20dB 2 port test probe connected directly to the center conductor via the seizure screw access port as shown below.

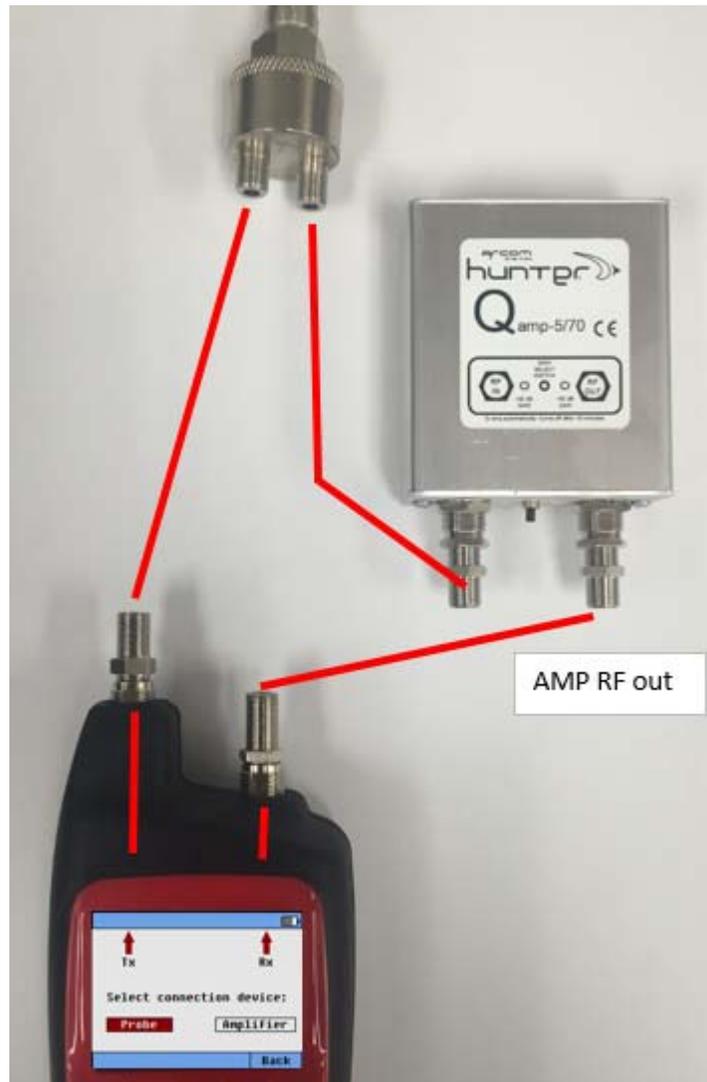
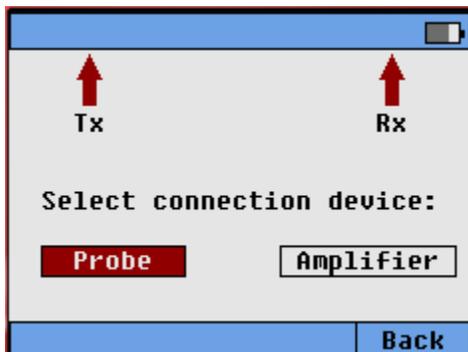


The spread spectrum probing signal transmit signal can be set from  $-10$  ..  $+10$ dBmV, the recommended and default level is 0dBmV. This signal level range is considered safe and will not be disruptive to any traffic. As will be described, with one button the return spectrum analyzer can be access such that the user can easily view and confirm that the probing signal level are below the return noise floor and that they are invisible.

## Connecting to a line passive

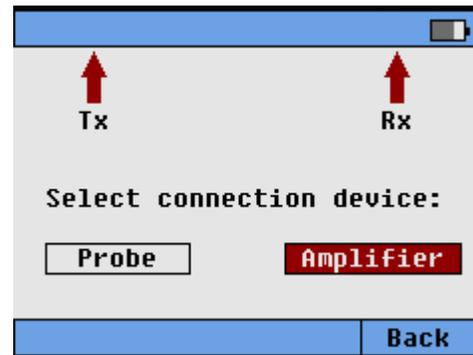
From a simplicity perspective, the most desirable point to connect the TDR to the network is at the first line passive in a span of cable (from amplifier to the next amplifier). Connection is made by using a QTP 20 resistive test probe that attaches directly to the center connector seizure screw via the seizure screw access port on the line passive. The Tx and Rx cables can be connected to either of the QTP 20 output ports, unless a Q amp is used.

When connecting with a probe, depending upon signal levels it might be necessary to use an external return amplifier to boost signal levels. The Arcom Digital Q-AMP is designed for this purpose. Since we need to amplify the very low level Received (Rx) signal, the Q-AMP must be placed on the Rx port, and the user needs to pay attention that the input to the Q-AMP is on the probe side and the output is on the meter side. An illustration of the connection is shown to the right.



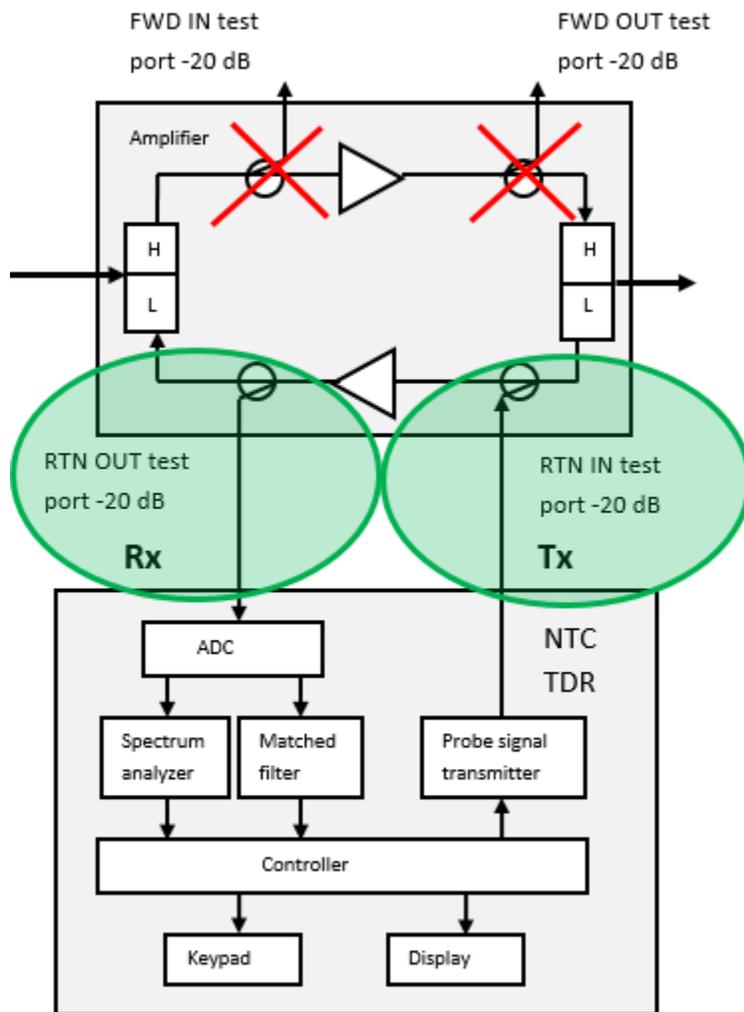
## Connecting to an amplifier

When connecting to an amplifier, great care and attention needs to be given to ensure the proper test ports are utilized and connected to the proper transmit and receive ports. When you first select NTC TDR mode, the device will first ask if you want to connect to a line passive via a probe, or to an amplifier. Use the left/right button to select amplifier.



The NTC TDR transmits a very low level spread spectrum signal at 5–42MHz into the forward – and it detects a reflected signal at the same 5–42MHz band in the return. As such, when connecting the device to an amplifier, it is important to consider what test points are being utilized – as the requirement is very different than other measurements that the technician has made in the past.

The required configuration is illustrated below – where the 5–42MHz transmitted signal is inserted in the forward direction via a return input test port such that it can pass through the diplex filter, and the reflected signal is received by a return out test port.



1. **Forward test points can't be used!** – They will be either in the wrong direction or they will insert into the high side of the diplex filter where they will be attenuated and will go no further.
2. **Ensure the directional coupler is in the proper direction** – Tx. signal is inserted in the forward, Rx. signal is received in the return.
3. **Connecting to a line passive using a test probe is an alternative and a more simple connection process.**

### Connecting to a length of cable

When using the NTC TDR on a single length of cable, in order to display proper results it is recommended to use a two way splitter with the outputs connected to the transmit and receive ports of the TDR, and with a 10dB pad installed between the splitter input and the length of cable as shown in the diagram below.



cable under test

10 dB pad

2 way splitter



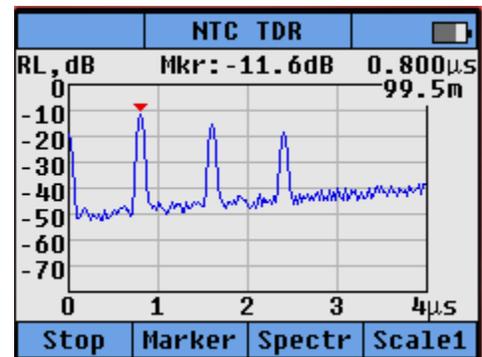
## Making the NTC TDR measurement

Step 1: Connect the TDR to either the amplifier test point or to the QTP installed on a line passive.

Step 2: Enter NCT TDR mode on Quiver S.

Step 3: Select either Probe or Amplifier connection device as appropriate.

Step 4: Press Run if the device is configured in 'single' mode (from Settings - General - TX mode), then one spread spectrum pulse will be transmitted. If the device is configured in 'continuous' TDR mode, then the unit will start automatically and continuously send out pulses. The TDR screen to the right will appear.

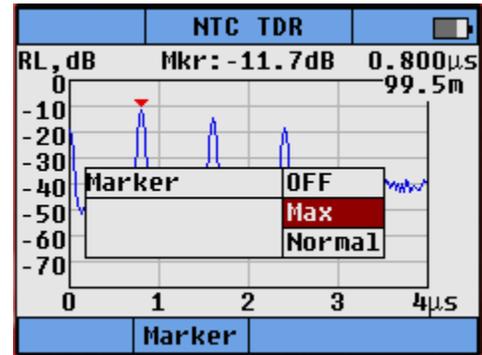


## Run / Stop

Press the Run hot key to start the TDR if in single mode, press Stop to stop the TDR if in continuous.

## Marker

The NTC TDR marker can be turned off (not recommended), or the marker will automatically jump to the Maximum return loss amplitude displayed (Max setting), or the marker will be placed at the first peak and the user can move the marker using the right and left arrow to select which peak the marker will indicate. Displayed distance to the impairment is automatically adjusted as the marker moves along the time-distance display.

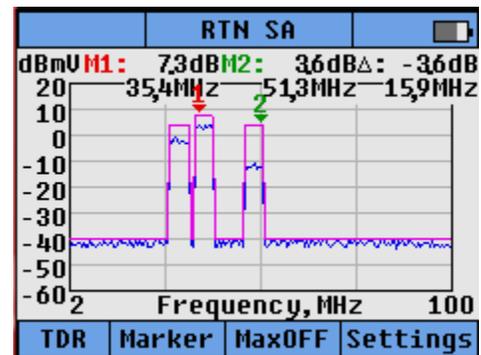


## Scale hot key

The Scale hot key toggles the displayed X axis time distance. The display is able to toggle either 1 or 4 microseconds.

## Spectrum

The Spectrum hot key provides a means to quickly jump to the return spectrum analyzer. This is used if the technician wants to double check that the spread spectrum signal being transmitted is not affecting the return path. The spread spectrum carriers should not be visible, and as long as they are  $-25\text{dBc}$  relative to the return path traffic they will not be network affecting. Four hot keys are available from the return spectrum analyzer screen.



## TDR hot key

Automatically returns to the TDR mode.

## Marker hot key

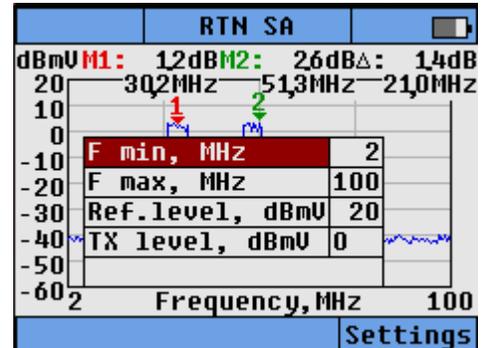
Allows the user to change marker frequency.

### Max OFF/ON hot key

Allows the user to toggle between Max hold ON and Max hold off.

### Settings hot key

Allows the user to change the spectrum analyzer settings and is the location where NTC TDR transmit level can be changed. This screen is different from the RTN SA settings page which does not have the TX level setting and which does offer an option to change the scale of the display.



### F min, F max setting

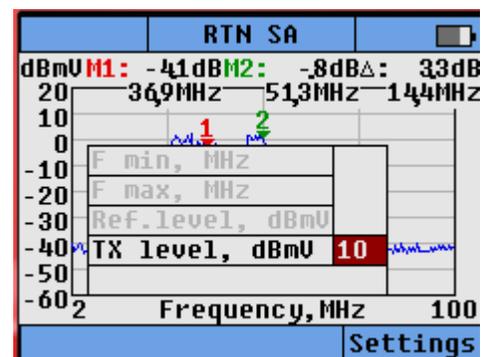
Allows to change the return spectrum analyzer start and stop frequency. Select the minimum or maximum frequency, highlight and use the up and down arrow to change.

### Reference level

Changes the upper reference level frequency. It is used to change the display if return spectrum is not viewable due to signal level.

### Transmit (Tx) level

Allows the use to change the transmitted signal level from -10dBmV to +10dBmV. Press the up and down arrow to change in increments of 5dB. Default is zero. **See comments below for recommended Tx level.**



### Recommended TDR Transmit (TX) signal level

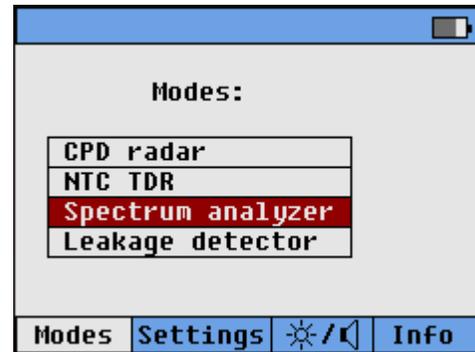
The default transmit level for the TDR is 0 dBmV. Under typical conditions this will result in the spread spectrum signal being -40dBc relative to the return QAM channels



- significantly lower than the  $-25\text{dBc}$  level defined in the DOCSIS specification as what is required not to affect the return QAM CNR/SNR. As such the  $0\text{ dBmV}$  level should be used in most connections scenarios. Caveats to this would be when the connection point is an amplifier with  $-30\text{dB}$  test points instead of the more common  $-20\text{dB}$  test point - where stronger transmit signal levels would be required. Another case where the higher signal level might be needed would be in sections of plant with larger than typical numbers of passives (older architectures). The lower level  $-5$  or  $-10\text{ dBmV}$  settings would be recommended for end of line type situations or at the drop when plant signal levels are minimal.

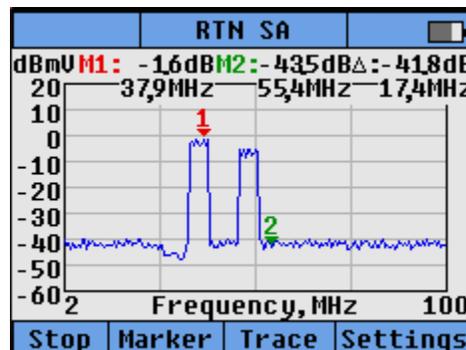
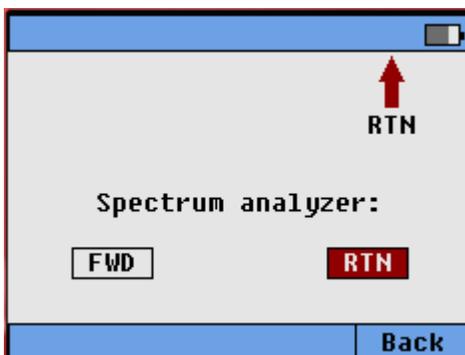
### Spectrum Analyzer Mode

In this mode the Quiver S operates as a high quality return and forward path spectrum analyzer, allowing technicians to check the signals without reaching for another meter. Forward and Return spectrum analyzer modes are available.



### Return Spectrum Analyzer

Select RTN, connect return path test point input to the indicated port, and press enter.

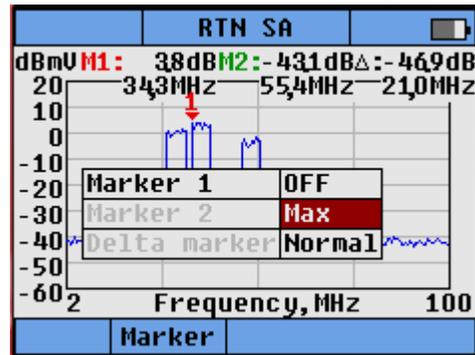
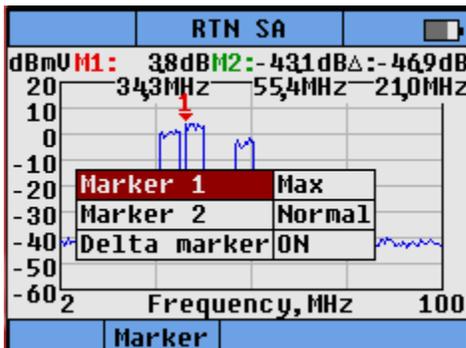


## Stop / Run

The stop and run hot key will stop and resume active operation.

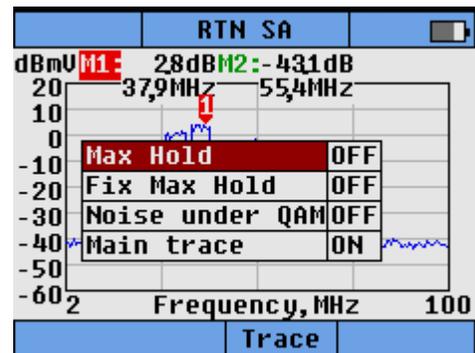
## Marker

Two markers are available. They can be turned off, automatically jump to the highest signal level (MAX), or can be placed at a desired frequency selected by the user by using the left and right arrows to manually move the marker to the desired frequency (Normal). A Delta marker is also provided which displays the difference between the two selected markers.



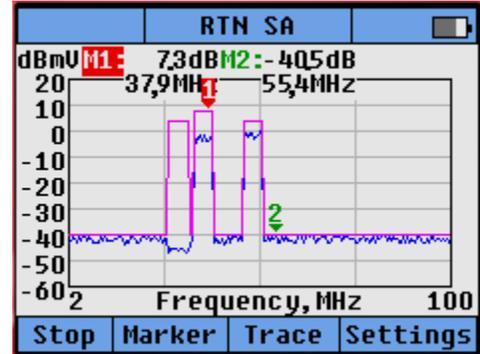
## Trace

The Trace hot key provides control over what and how is displayed on the screen. Select desired menu option, press enter, and use up/down arrows to select menu item.



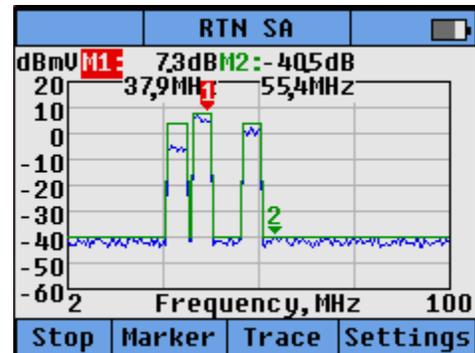
### Max Hold

Max Hold displays maximum level in the current session. Indicated by the Pink lines.



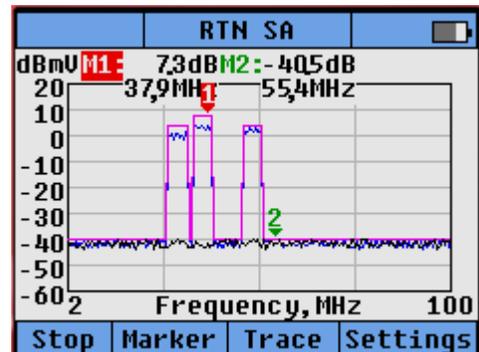
### Fix Max Hold

Fix Max Hold is very useful when you want to compare spectrum at different times for comparison purposes, for example looking at spectrum on one leg of an amplifier, and comparing to a Max Hold reading on a different leg. Fix Max Hold is displayed in Green, and is stored in memory until turned off.



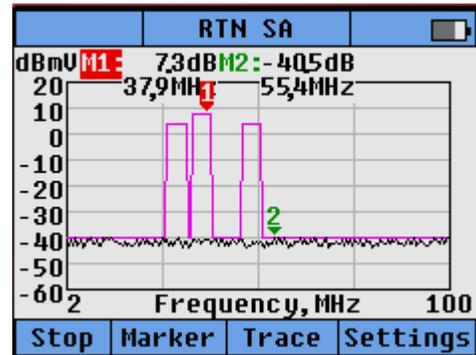
### Noise under QAM

Allows viewing of noise underneath the QAM haystack.



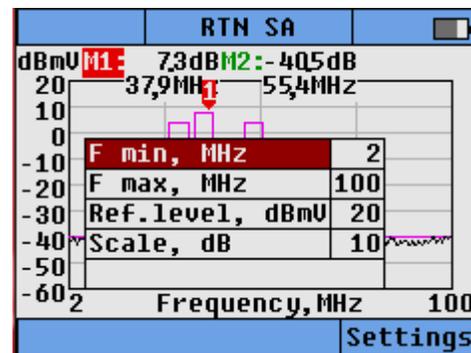
### Main trace on/off

Turning off the main trace allows for a different view of Noise under the QAM.



### Settings

Settings allows for configuration of what the RTN SA display screen looks like.



### Fmin / Fmax

Changes the start and stop frequency of the RTN SA display.

### Ref. level

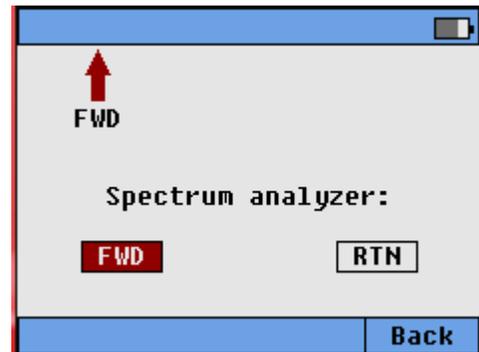
Changes the Y axis display scale - can be changed from -20 to +20dBmV in steps of 10 dB.

### Scale

Changes the Y axis scale from 5dB per division to 10dB per division.

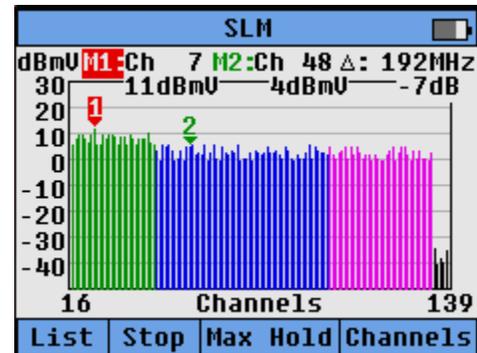
## Forward Spectrum Analyzer

Select FWD, connect forward path test point input to the indicated port, and press enter.



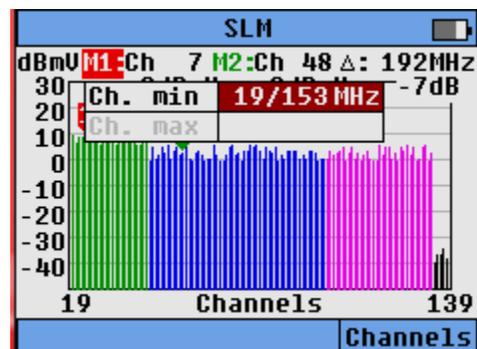
## SLM mode

When you first enter the Forward Spectrum analyzer mode, the first screen displays a broadband the Signal Level Meter (SLM). The unit will sense the modulation format and will display analog channels in green, QAM channels in blue, OFDM in pink, and channels just containing noise in black.



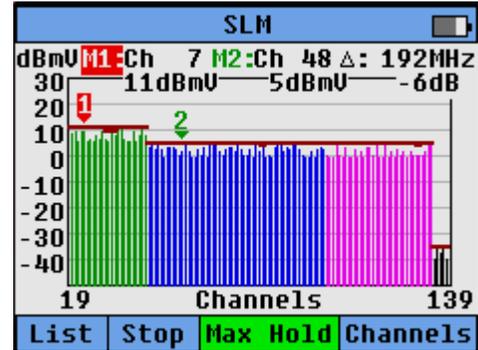
## SLM - Channels

Pressing the Channels hot key from the SLM screen allows you to change the range of channels displayed in SLM mode. Select Min or Max, press enter, and use the up and down arrow to change the channel range displayed. Press enter to exit.



## SLM Max Hold

Max Hold adds this feature to the SLM display and list values.



## SLM - list

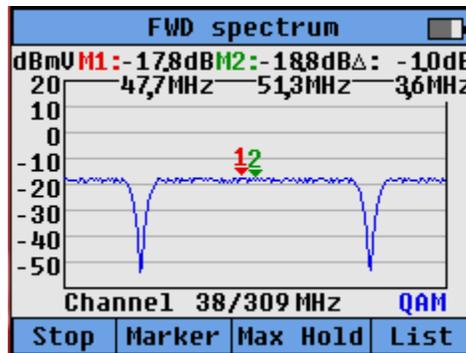
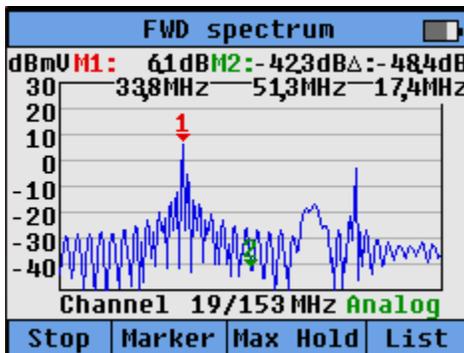
Pressing the list button displays all the selected channels in a list format, with the level and modulation type displayed. Press Up and Down hot key to scroll through the list. When you would like to look at the forward spectrum of one channel press Spectrum. Back returns to SLM screen.

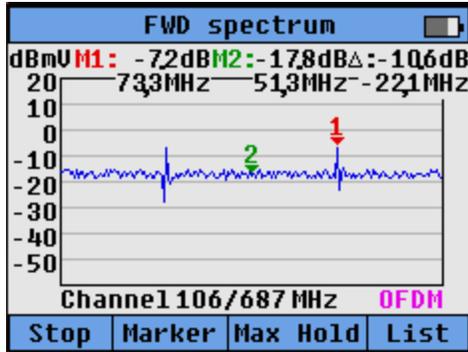
Channel	Level	Mod
33/279 MHz	6 dBmU	Analog
34/285 MHz	9 dBmU	Analog
35/291 MHz	8 dBmU	Analog
36/297 MHz	10 dBmU	Analog
37/303 MHz	4 dBmU	QAM
38/309 MHz	-1 dBmU	QAM
39/315 MHz	4 dBmU	QAM
40/321 MHz	1 dBmU	QAM

Bottom menu: Spectr, Up, Down, Back

## Spectrum

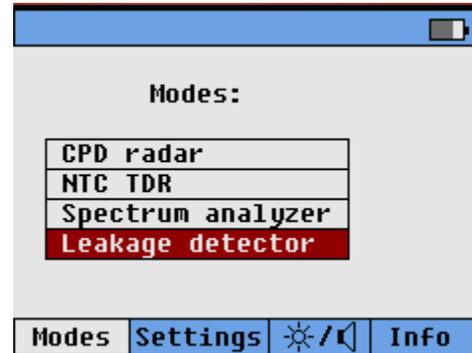
Pressing the Spectrum button displays the 6MHz channel, either an analog, QAM, or OFDM channel.





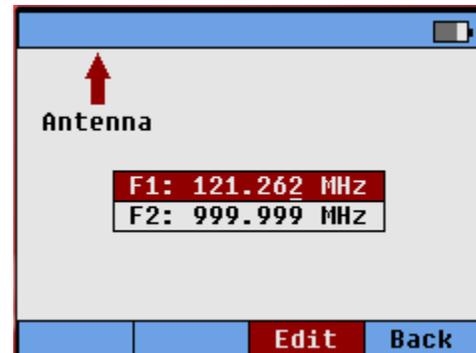
## Leakage Detector mode

The Quiver S is equipped with a wide band analog leakage detector. The leakage detection is possible at any analog TV signal or carrier frequency within 55–1,000 MHz. It can be configured for detection of two separate frequencies, with a simple one button toggle to switch between frequencies. Leakage detector antennas are not provided with Quiver S and need to be acquired separately.



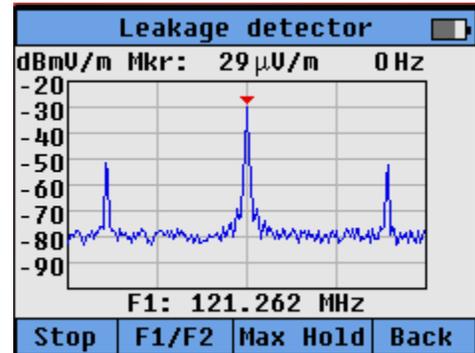
## Channel setup

To configure desired detection frequencies, use the up/down arrow to select desired F1 or F2. Press the Edit hot key and use the left/right arrows to move the cursor and the up/down arrows to select the desired value for each digit. Press the back hot key when finished.



### Start detection

Press the Start hot key to enter leakage detector mode after frequencies have been configured. Connect the antenna to the antenna input.



### Toggle frequencies between F1 /F2

The F1 /F2 hot key is used to toggle between the two configured frequencies.

### Info Hot Key

The Info hot key provides information about the model number, the installed firmware, and Bluetooth connectivity information if that option has been installed.

