



Remote CT-X Setup

RF Measurements
performed with
OneExpert CATV

March 2021



Remote CT-X Setup

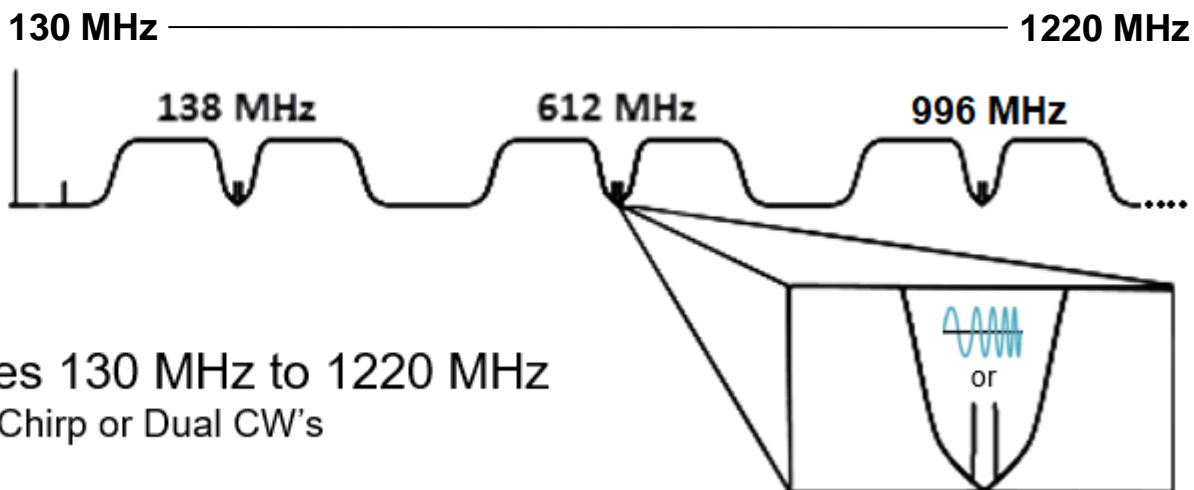
Seeker X Meter Setup Separately

Setup Notes:

1. Decide what frequencies, up to 4, to be used for leakage detection / monitoring
 - Spread leakage monitoring across the frequency spectrum of your network to provide the best coverage, keeping in mind sensitive channels to off-air interference
2. Decide what types of leakage carriers to be used
 - Dual CW's – Carriers can be detected by Seeker D or Seeker X
 - Chirp – Carriers can be detected by Seeker X only
 - OFDM – Carriers can be detected by Seeker X only - Meter setup only (CT-X not required)
3. Perform an off-air survey to be sure that the intended leakage frequencies are void of off-air interference
 - This is done with the OneExpert meter or any spectrum analyzer connected to the leakage antennas in the truck appropriate to the intended frequencies to be used
4. CT-X Connections
 - Close to the combining network for CT-X RF output to combine with the Modulator RF out to the plant
5. Connect the OneExpert meter to a drop to measure QAM's on either side of the selected leakage frequencies
 - This is done from a location that is post combiner so both the adjacent carriers and CT-X carriers are present
6. Log into CT-X over ethernet
 - From the CT-X interface, go into network settings to obtain the IP address of the CT-X
 - This is the only step that needs to be done in the head end using the device interface
 - In a web browser, enter the IP address of the CT-X to access the web portal of the CT-X
7. Set types of carriers in config of CT-X
 - Put CT-X in Setup mode in order to properly measure and adjust the RF output levels in relation to the adjacent QAMs of the leakage carriers
8. Measure and adjust output levels of the CT-X in relation to adjacent QAMs
 - Note: CT-X outputs are adjusted independent of each other unlike the CT-4. because of this there is no required order in which to perform the output adjustments per frequency as there was with the CT-4
9. Return the CT-X mode back to normal after adjusting the output levels
 - Turn off setup mode
10. Test the system

Carrier Types and Frequencies for Leakage Monitoring (Deciding what to use)

1. Is this a Seeker X system? No frequency limit between 130 MHz to 1220 MHz
 - In this system the recommendation would be to use the Chirp signal and OFDM carriers
2. Is there a mix of Seeker D's and Seeker X's in the system?
 - Seeker D only detects dual CW's, and is limited to the frequency bands 136 to 139 MHz and 610.5 to 615 MHz
 - In this system, the recommendation is 138 and 612 MHz with dual CW's and any other frequencies that are not OFDM would use the chirp signal
 - Example: 2 dual CW's, 1 chirp, and 1 OFDM



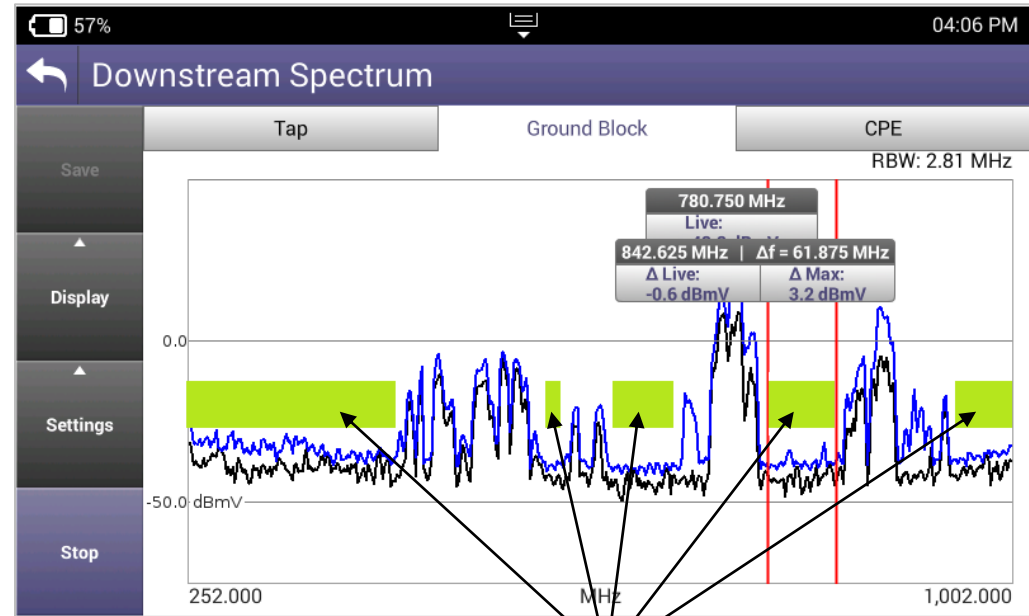
Carrier Types and Frequencies for Leakage Monitoring (Continued)

1. Is leakage monitoring intended for FCC rules compliance?
 - In an all-digital plant these days typically 138 MHz is used
2. Leakage monitoring for plant integrity
 - Monitor up to 4 frequencies
 - 2 frequencies using the Seeker D
 - 4 frequencies using the Seeker X
 - Monitor frequencies close to important or sensitive areas of plant
3. Types of carriers and why
 - OFDM - using the PLC channel of the OFDM carrier
 - Better – excellent sensitivity and noise discrimination using full strength carriers
 - Chirp – inserting a Chirp signal between QAM carriers for leakage detection using the Seeker X meter
 - Best in the business for meter sensitivity and noise discrimination inserting a very robust tag signal
 - Dual CW's – inserting dual CW's between QAM carriers for leakage detection using Seeker D or Seeker X meters.
 - Good – noise discrimination and sensitivity are good with the Seeker D, even better with the Seeker X using the same inserted signals.

Off-Air survey to avoid interference to leakage detection

The purpose of an off-air survey is to find high noise spectrum to avoid for leakage detection. More specifically, to find nice quiet air space to setup leakage carriers or OFDM, PLC carriers for the purpose of leakage.

1. Connect an OneExpert or spectrum analyzer to the antenna feed intended for the Seeker meter in the vehicle
2. Adjust the analyzer to view spectrum of interest and visually inspect the off-air noise level.
3. Looking for low noise, quite spaces in the spectrum void of off-air carriers.
 - Green spectrum depicts low noise areas ideal for leakage
 - Zoom is as needed for a more precise measurement of specific frequencies



Clean Off-Air Spectrum
Good for leakage monitoring

CT-X User Interface

Front view



1. **Display screen** – Displays the setup and operational status. Most of the setup can be adjusted here using the front panel.
2. **Select** – Scrolls through the main menus, scrolls through the options in the submenus, and adjusts settings.
3. **Enter** – Enters the menus/submenus and selects options to adjust settings

CT-X Connections Overview

Rear view

AC power model



1. **RF output**
2. **Ethernet** – Used to remotely configure the unit and update firmware through your network
3. **SFP** – SFP optical port
4. **AC power input**

CT-X Pre-Connection Settings

Before connecting to live plant

• Initial settings

- Select up to four desired leakage frequencies
- Select Carrier Type
 - Dual CW's
 - Chirp
- Set desired TAG
 - Overbuild discrimination
 - Noise isolation
- Set CT-X Levels to 10 dBmV to eliminate the chance of injecting too hot once connected to plant (default level = 10 dBmV)
 - You will adjust this level after measuring the adjacent QAM's and Setup CW in plant to set up a -30 dBc (dual CW's) or -24 dBc (Chirp) relationship between adjacent QAM and setup CW
- Turn Setup Mode "ON" to aid in the setup
 - Failure to enter setup mode will likely cause inaccurate measurements of the leakage signals during setup
 - Must be turned "off" once setup is completed
- After the initial settings are verified, connect CT-X "RF" output to plant near the combiner to insert the signals to live plant

The screenshot shows the 'Output' configuration page of the CT-X device. The page is divided into three sections: Administration, Network, and Output. The Output section is currently active. It features a 'Save to CT-X' button and a 'Cancel' button at the top right. Below these are two signal configuration panels, 'Signal 1' and 'Signal 2'. Each panel has an 'Enable output' checkbox (checked) and an 'Enable signal' checkbox (checked). Under 'Signal 1', the 'Output level (dBmV)' is set to 10, and the 'Center frequency (MHz)' is 612. Under 'Signal 2', the 'Output level (dBmV)' is also set to 10, and the 'Center frequency (MHz)' is 138. A red arrow points from the text 'Set CT-X Levels to 10 dBmV' in the list to the '10' value in the Signal 1 Output level field. Another red arrow points from the '10' value in the Signal 2 Output level field to the right edge of the screen. At the bottom of the screen, there is an 'Enter setup mode' button.

CT-X Mounting Considerations

CT-X Operation

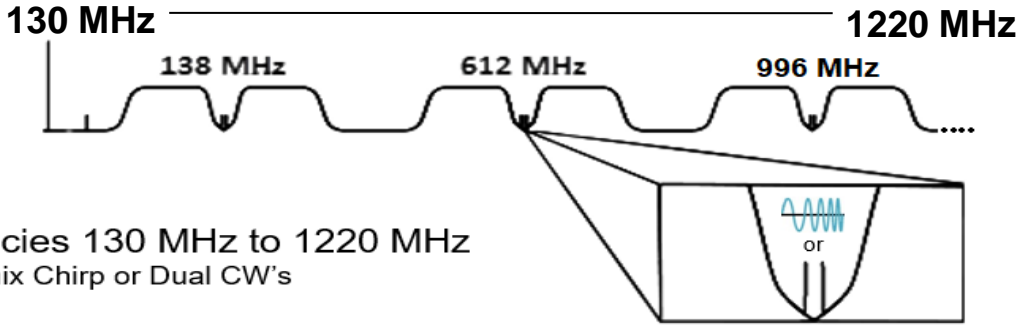
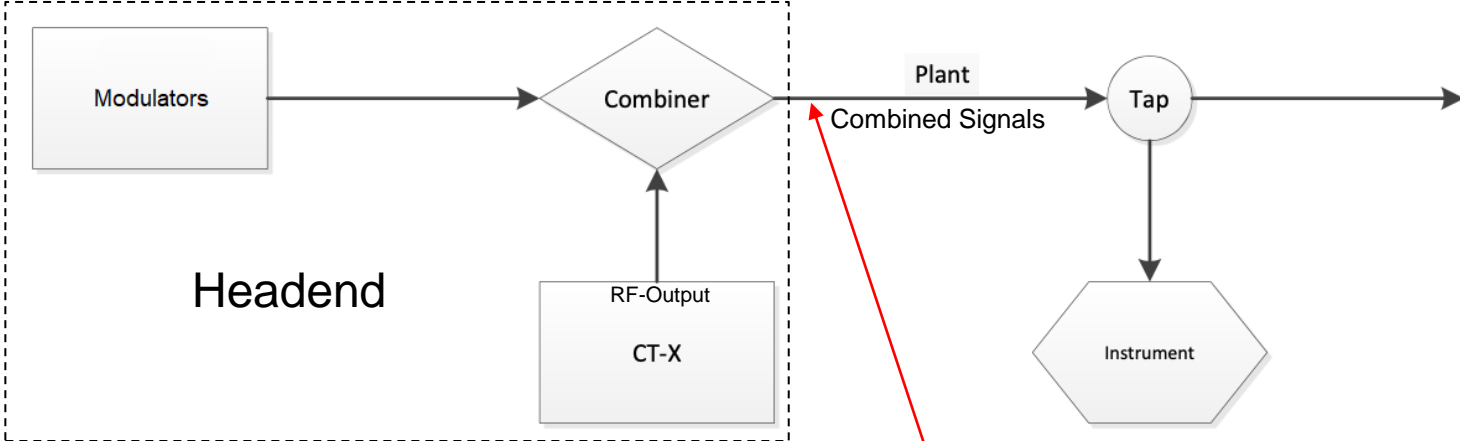
Perform the following installation steps;

1. Select a suitable rack panel location near the combiner where RF resides and mount the CT-X in the rack using four retaining screws
2. Connect the device to the combiner as shown in the image below
3. Connect the device to AC power



See next slide for pre-connection settings

CT-X Connections



Up to 4 frequencies 130 MHz to 1220 MHz
Any mix Chirp or Dual CW's

Obtaining IP Address of the CT-X

Follow the menu path below to obtain the CT-X's IP address used for remote programming.

Main menu

Upon startup, this screen appears for approximately 10 seconds

```
INITIALIZING
```

```
CT-X: TX ON  
1C 2D -- 4C
```

Select

```
CT-X  
STATUS
```

Enter

TO STATUS MENU

Select

```
CT-X  
SETUP
```

Enter

TO SETUP MENU

Select

```
CT-X  
NETWORK
```

Enter

TO NETWORK MENU

q

Press the "Select" button to cycle through options

Press the "Enter" button to enter a selected submenu

Network menu

NETWORK MENU

```
IP METHOD  
DHCP
```

Enter

```
IP METHOD  
STATIC
```

```
IP ADDRESS  
0. 0. 0. 0
```

Enter

```
IP ADDRESS  
100. 0. 0. 0
```

Enter

```
GATEWAY  
0. 0. 0. 0
```

Enter

```
GATEWAY  
100. 0. 0. 0
```

```
NETMASK  
255.255.255. 0
```

Enter

```
NETMASK  
255.255.128. 0
```

```
DNS1  
0. 0. 0. 0
```

Enter

```
DNS1  
100. 0. 0. 0
```

Select

Select

Select

Select

Select

Select

Select

Select

Select

Select

Select

Select

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Select

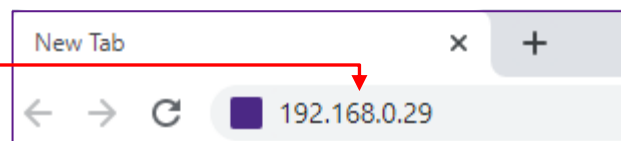
Select

Connecting to CT-X through web portal

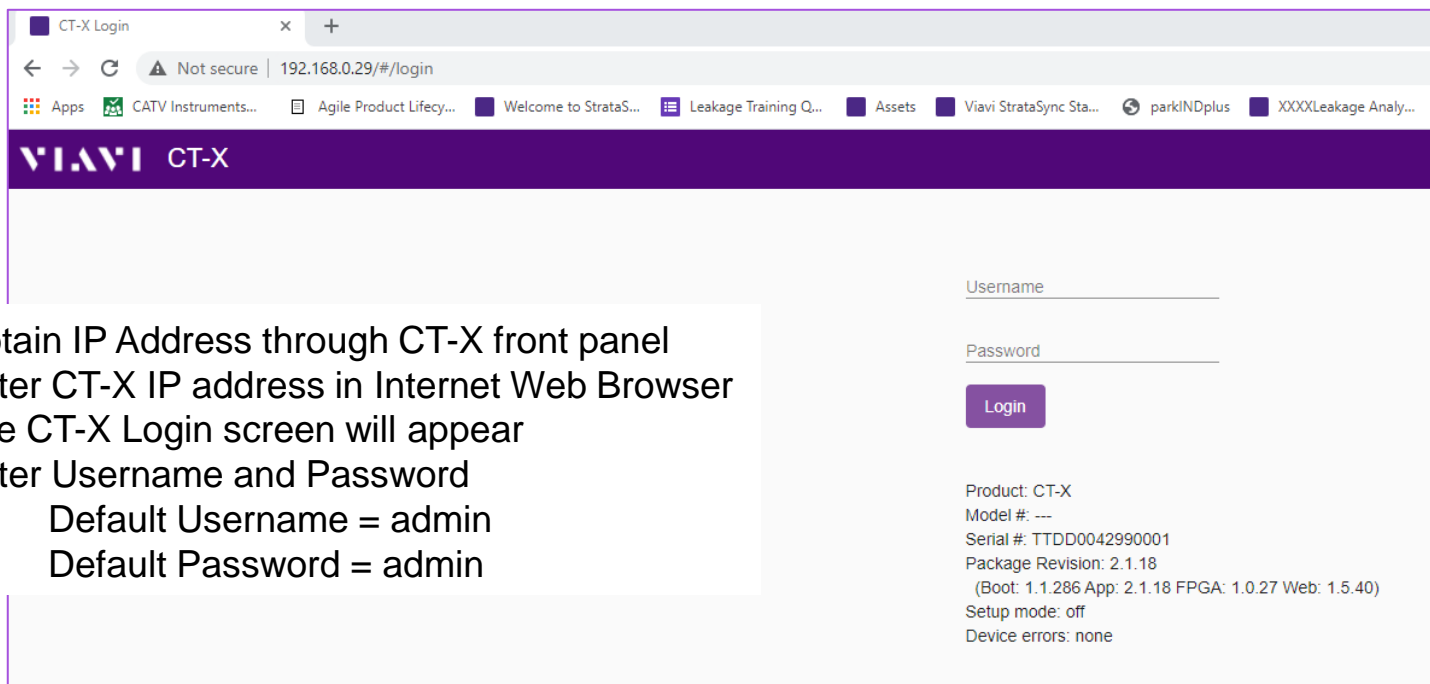
CT-X Network Settings

```
IP ADDRESS
192.168. 0. 29
```

Internet Web Browser



CT-X Login Screen



1. Obtain IP Address through CT-X front panel
2. Enter CT-X IP address in Internet Web Browser
3. The CT-X Login screen will appear
4. Enter Username and Password
 - Default Username = admin
 - Default Password = admin

Setting types of carrier and parameters in CT-X

- Once logged into the CT-X as Administration, select Output from the menu

The screenshot displays the VIavi CT-X Administration interface. On the left, a navigation menu shows 'Administration', 'Network', and 'Output' (selected). The main content area is titled 'Output' and includes a 'Save to CT-X' button and a 'Cancel' button. The configuration is as follows:

- Enable output
- Chirp Tag: 1
- Dual CW Tag: 2
- dBmV dBuV
- Signal 1:
 - Enable signal
 - Chirp Dual CW
 - Output level (dBmV): 19
 - Center frequency (MHz): 612
- Signal 2:
 - Enable signal
 - Chirp Dual CW
 - Output level (dBmV): 20
 - Center frequency (MHz): 138
- Signal 3:
 - Enable signal
 - Chirp Dual CW
 - Output level (dBmV): -9.8
 - Center frequency (MHz): 774
- Signal 4:
 - Enable signal
 - Chirp Dual CW
 - Output level (dBmV): -9.8
 - Center frequency (MHz): 1000

At the bottom, there is an 'Enter setup mode' button and a red text overlay: 'Next slide for breakdown'.

Setting types of carrier and parameters in CT-X

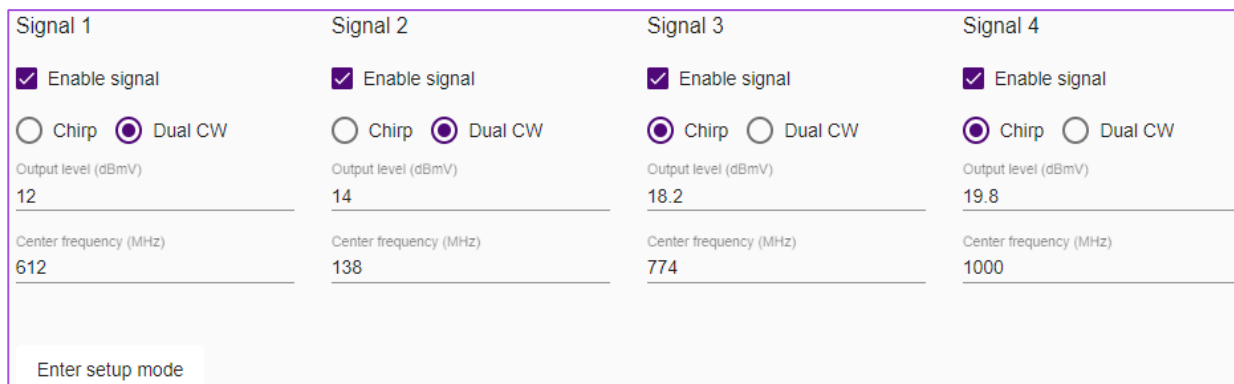
1. Enable output
 - CT-X global setting
 - Turns on all enabled signals in step 3
2. Select Tag Settings
 - Chirp Tag 1-4
 - Dual CW Tag 1-8
3. Enable individual signals
 - Up to 4 signals can be enabled
 - Any mix of “Chirp” and/or “Dual” CW’s
4. Select type of carrier
 - Chirp
 - Dual CW
5. Enter setup mode
 - Inserts single CW in place of leakage signal to simplify the output level measurement
6. Enter leakage carrier frequencies
7. Measure and set carrier output levels (Next Slide)



Enable output

Chirp Tag
1

Dual CW Tag
2



Signal 1	Signal 2	Signal 3	Signal 4
<input checked="" type="checkbox"/> Enable signal	<input checked="" type="checkbox"/> Enable signal	<input checked="" type="checkbox"/> Enable signal	<input checked="" type="checkbox"/> Enable signal
<input type="radio"/> Chirp <input checked="" type="radio"/> Dual CW	<input type="radio"/> Chirp <input checked="" type="radio"/> Dual CW	<input checked="" type="radio"/> Chirp <input type="radio"/> Dual CW	<input checked="" type="radio"/> Chirp <input type="radio"/> Dual CW
Output level (dBmV) 12	Output level (dBmV) 14	Output level (dBmV) 18.2	Output level (dBmV) 19.8
Center frequency (MHz) 612	Center frequency (MHz) 138	Center frequency (MHz) 774	Center frequency (MHz) 1000

Enter setup mode

Setting types of carrier and parameters in CT-X

Run in Presentation Mode

1. Enable output
 - CT-X global setting
 - Turns on all enabled signals in step 3

Enable output 1

Chirp Tag
1

Dual CW Tag
2

2. Select Tag Settings

- Chirp Tag 1-4
- Dual CW Tag 1-8

3. Enable individual signals

- Up to 4 signals can be enabled
- Any mix of “Chirp” and/or “Dual” CW’s

Signal 1	Signal 2	Signal 3	Signal 4
<input checked="" type="checkbox"/> Enable signal	<input checked="" type="checkbox"/> Enable signal	<input checked="" type="checkbox"/> Enable signal	<input checked="" type="checkbox"/> Enable signal
<input type="radio"/> Chirp <input checked="" type="radio"/> Dual CW	<input type="radio"/> Chirp <input checked="" type="radio"/> Dual CW	<input checked="" type="radio"/> Chirp <input type="radio"/> Dual CW	<input checked="" type="radio"/> Chirp <input type="radio"/> Dual CW
Output level (dBmV) 12	Output level (dBmV) 14	Output level (dBmV) 18.2	Output level (dBmV) 19.8
Center frequency (MHz) 612	Center frequency (MHz) 138	Center frequency (MHz) 774	Center frequency (MHz) 1000

Enter setup mode 5

4. Select type of carrier

- Chirp
- Dual CW

5. Enter setup mode

- Inserts single CW in place of leakage signal to simplify the output level measurement

6. Enter leakage carrier frequencies

7. Measure and set carrier output levels (Next Slide)

Measuring and adjusting CT-X output levels

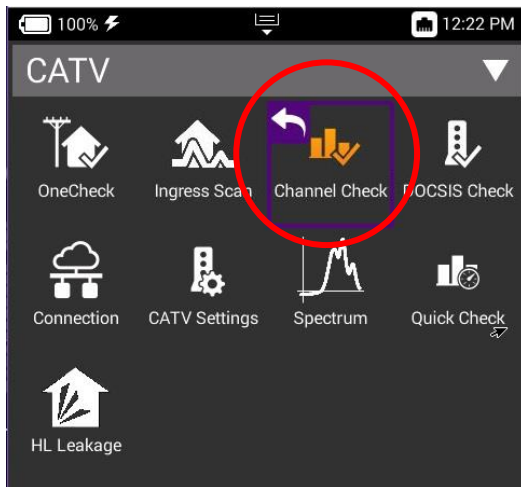
Setting the proper injected level of the CT-X signals in relation to the system's carriers is a very important step in making this system work optimally. Since the leakage meter is programmed to provide the leakage value of the adjacent QAM, it is imperative that the level relationship from leakage signal to adjacent QAM match "level to adjacent" settings in the meter.

- Output level for the Chirp signal:
 - The Chirp signal gets injected into the system -24 dBc to the adjacent QAM carriers
 - Example: Channel Power = -2 dBmV and Chirp signal is injected -24 dBc
 - Math: $-2 \text{ dBmV} - 24 \text{ dB} = -26 \text{ dBmV}$ for the Chirp signal target level
- Output level for the Dual CW signals:
 - The Dual CW signals get injected into the system -30 dBc to the adjacent QAM carriers
 - Example: Channel power = .6 dBmV and the dual CW signal is injected -30 dBc
 - Math: $.6 \text{ dBmV} - 30 \text{ dB} = -29.4 \text{ dBmV}$ for the Dual CW signal target level
- The following steps will use the OneExpert Meter to perform the RF measurements for this task
 - Measure adjacent QAM's channel power
 - Measure and adjust the leakage signal from the CT-X to setup the proper relationship mentioned in the previous two bullet points
 - See following slides for step-by-step procedures
 - (repeat these steps for each leakage frequency)

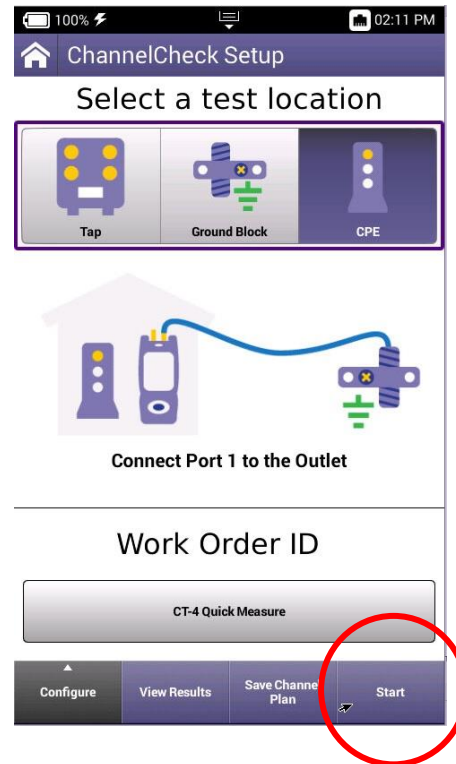
Measuring Channel Power Procedure

With an OneExpert meter measure Adjacent QAM Channel Power

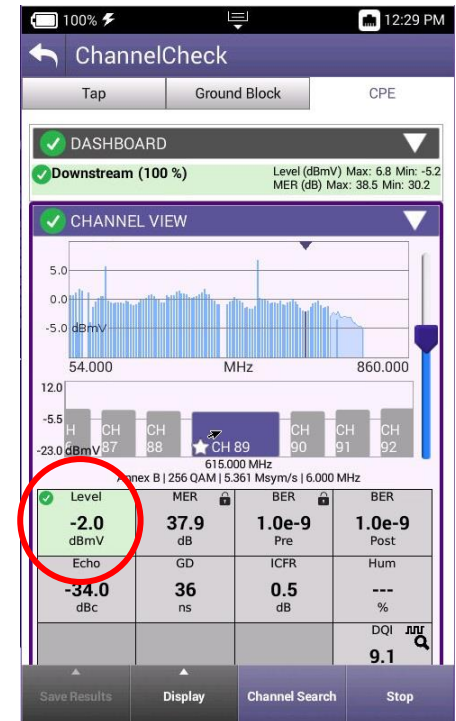
Select a test point with combined signal to port 1 of the OneExpert



CATV Home Screen
select
“Channel Check”



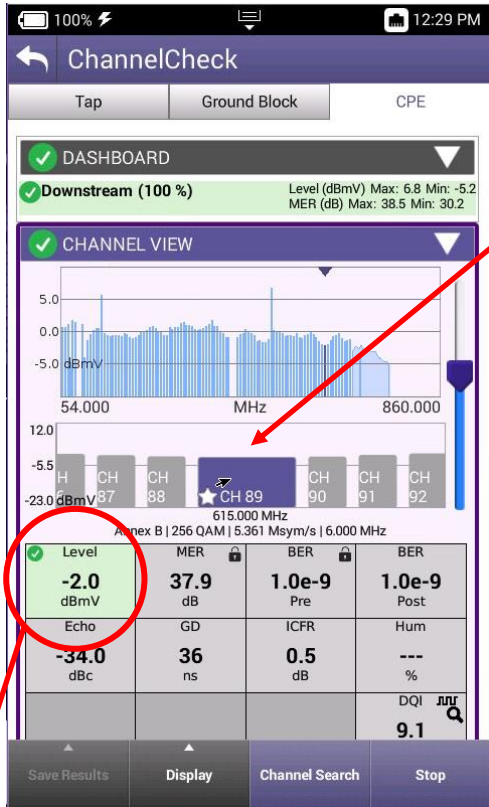
Channel Check Setup
select
“Start”



OneExpert builds channel plan and provides measurement for all channels in the plan

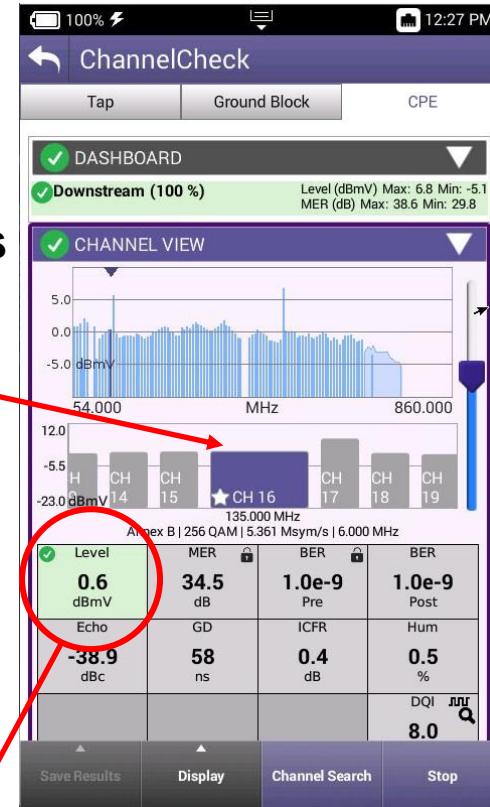
Measuring and adjusting CT-X output level

Chirp signal calculation



$$-2.0 \text{ dBmV} - 24 \text{ dB} = \underline{-26 \text{ dBmV}}$$

Dual CW signal calculation



$$0.6 \text{ dBmV} - 30 \text{ dB} = \underline{-29.4 \text{ dBmV}}$$

Select Channels

Ch 88 or Ch 89
and
Ch 16 or Ch 17
Log Levels

Target Levels for CT-X Setup CW

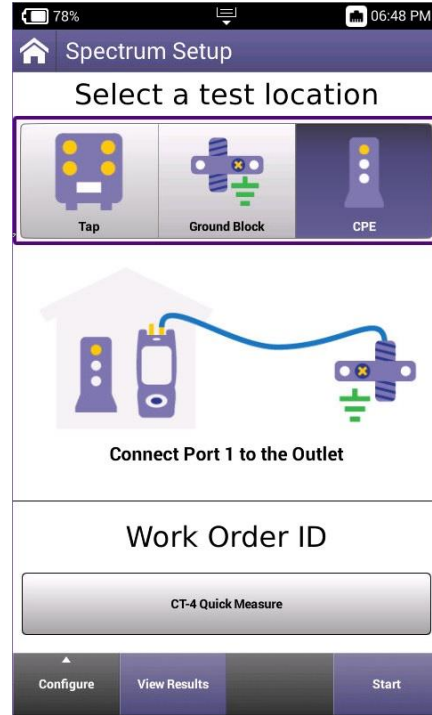
(Typically set within 1/2 dB high at setup)

Downstream Spectrum Setup

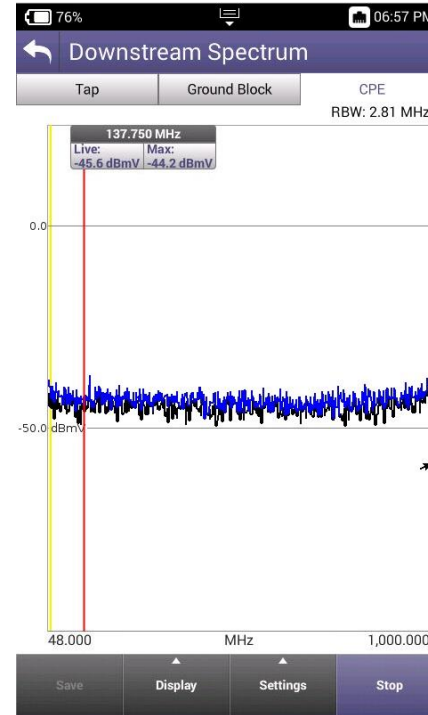
(612 MHz)



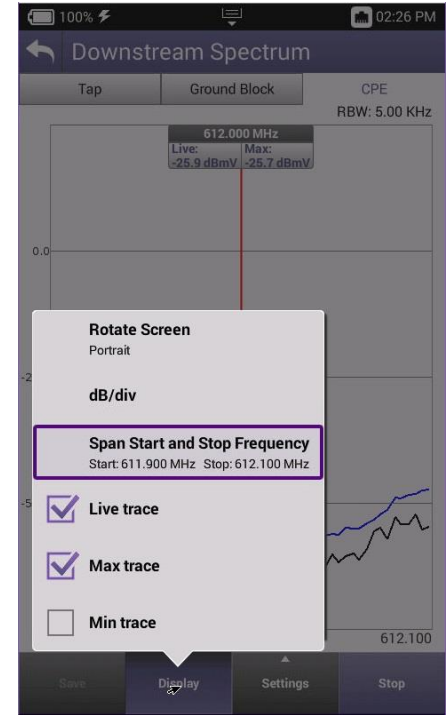
CATV Home Screen
select
“Spectrum”



Spectrum Setup
select
“Start”



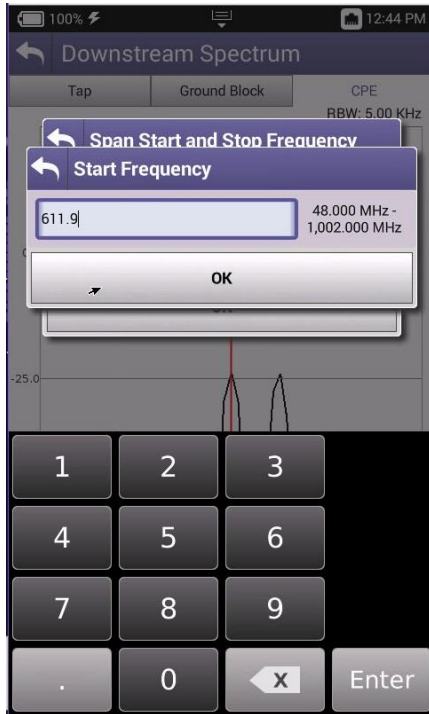
Spectrum
select
“Display”



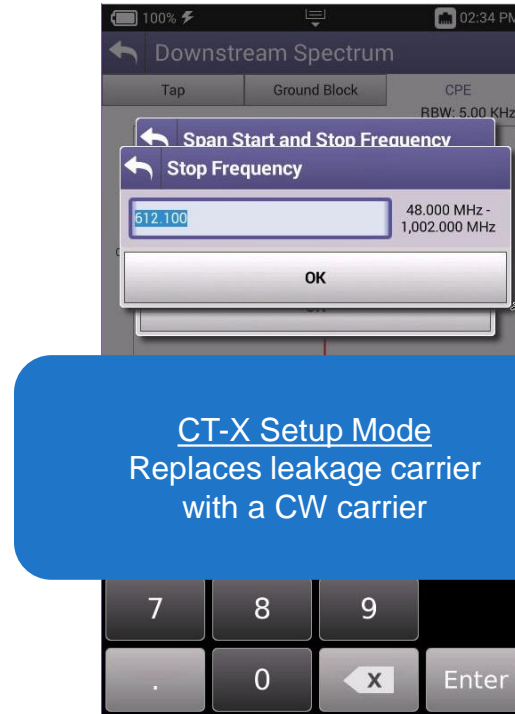
Enter
Start and **Stop**
Frequencies as
seen above

Downstream Spectrum Setup

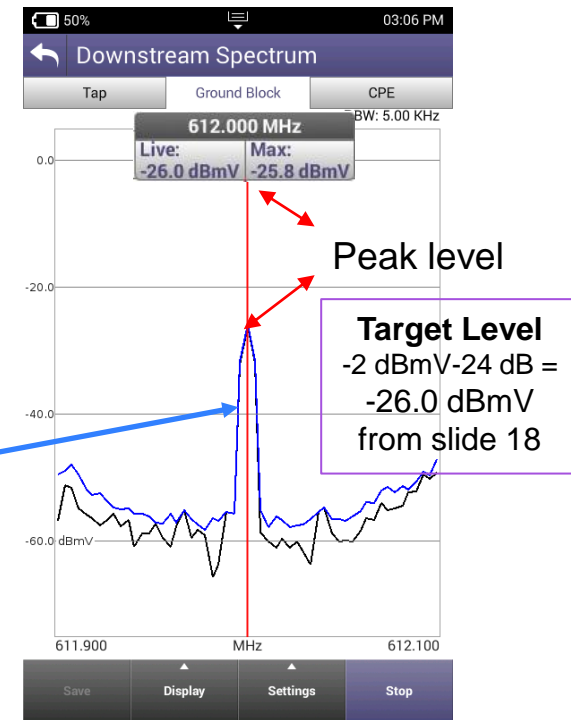
(e.g.612 MHz)



Enter Start Freq
611.9 MHz



Enter Stop Freq
612.1 MHz



Move Marker
to
Peak Level

Note: Must clearly see the setup CW carrier to properly measure peak value

Measuring and adjusting CT-X output levels

The screenshot displays the configuration interface for CT-X output levels. On the left, a navigation menu includes 'Administration', 'Network', and 'Output'. The main area is divided into sections for 'Output' and four individual signal configurations (Signal 1 to Signal 4). The 'Output' section has a 'Save to CT-X' button highlighted with a red box and the number '2'. Below it, 'Enable output' is checked. The 'Signal 1' section has its 'Output level (dBmV)' field set to '19', which is also highlighted with a red box and the number '1'. Other signal sections show their respective settings for enablement, mode (Chirp or Dual CW), output level, and center frequency.

2

Save to CT-X Cancel

Enable output

Chirp Tag
1

Dual CW Tag
2

dBmV dBuV

Signal 1

Enable signal

Chirp Dual CW

Output level (dBmV)
19

Center frequency (MHz)
612

Signal 2

Enable signal

Chirp Dual CW

Output level (dBmV)
20

Center frequency (MHz)
138

Signal 3

Enable signal

Chirp Dual CW

Output level (dBmV)
-9.8

Center frequency (MHz)
774

Signal 4

Enable signal

Chirp Dual CW

Output level (dBmV)
-9.8

Center frequency (MHz)
1000

Enter setup mode

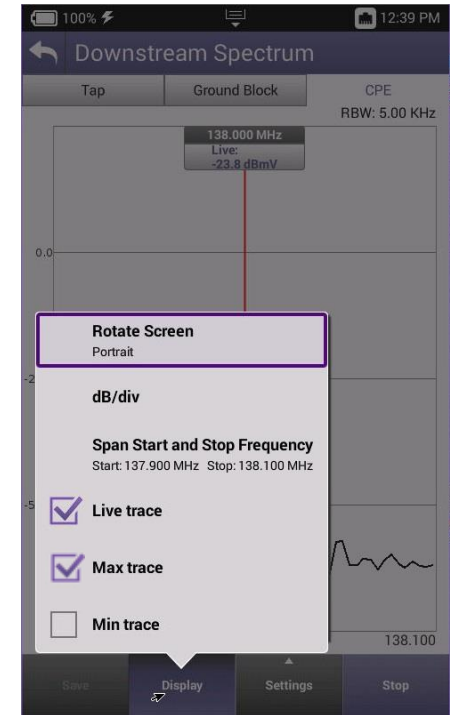
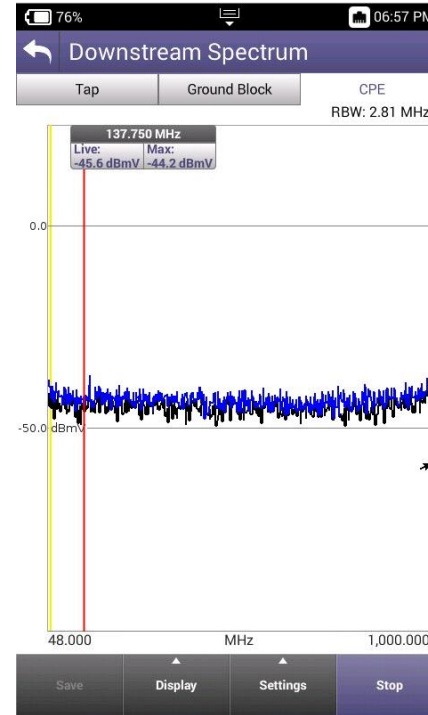
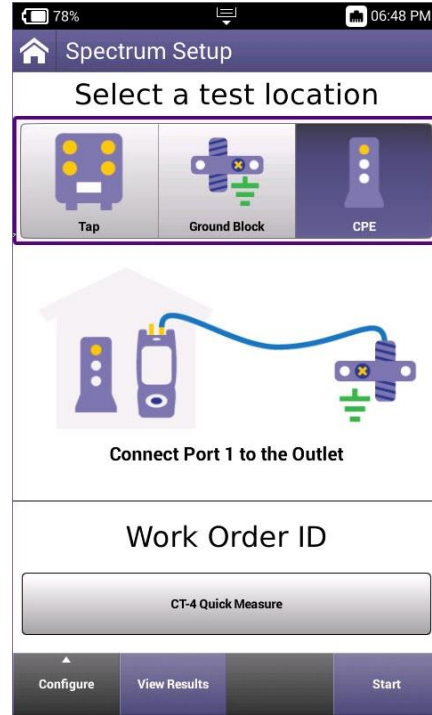
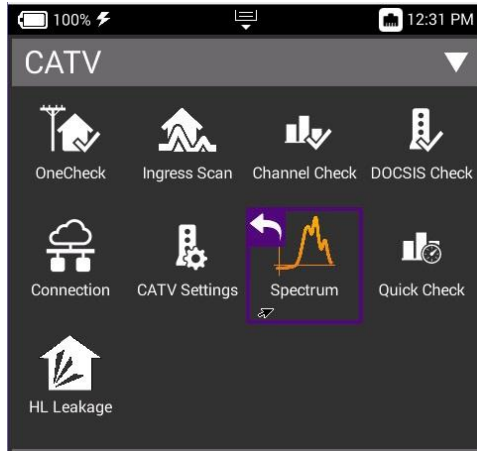
1

After comparing channel power and CT-X signal level make necessary adjustments for each frequency so that the proper Signal dBc relationship is achieved

1. Type new value into the “Output Level” space
2. “Save to CT-X”

Downstream Spectrum Setup

(138 MHz)



CATV Home Screen
select
“Spectrum”

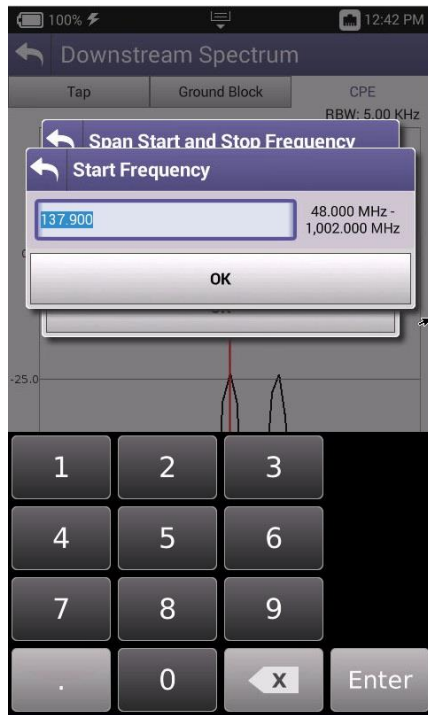
Spectrum Setup
select
“Start”

Spectrum
select
“Display”

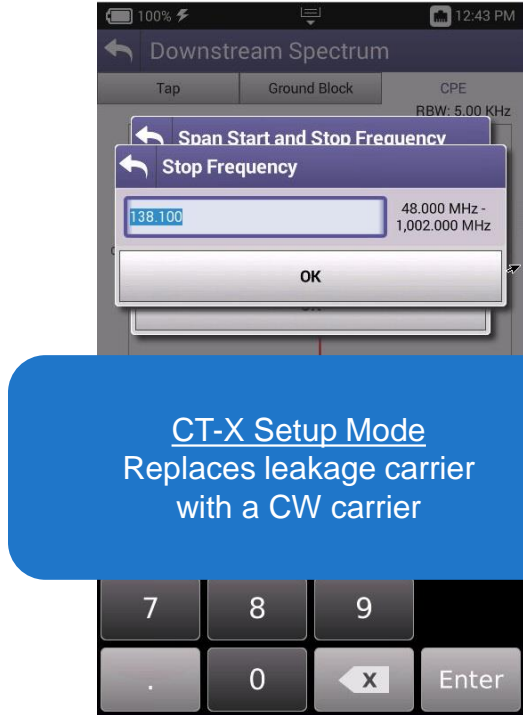
Enter
Start and **Stop**
Frequencies as
seen above

Downstream Spectrum Setup

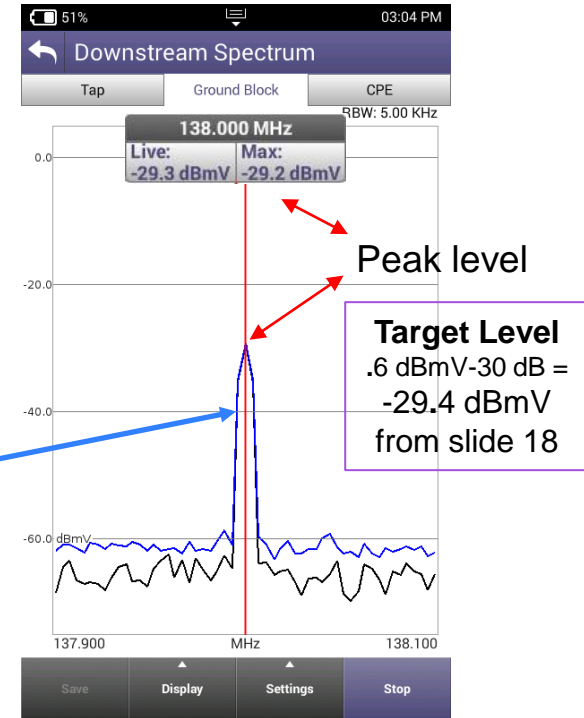
(138 MHz)



Enter Start Freq
137.9 MHz



Enter Stop Freq
138.1 MHz



Move Marker
to
Peak Level

Note: Must clearly see the setup CW carrier to properly measure peak value

Measuring and adjusting CT-X output levels

The screenshot displays the configuration interface for CT-X output levels. On the left, a navigation menu includes 'Administration', 'Network', and 'Output'. The main area shows a 'Save to CT-X' button (highlighted with a red box and a red '2') and a 'Cancel' button. Below these are settings for 'Enable output', 'Chirp Tag' (1), and 'Dual CW Tag' (2). The output mode is set to 'dBmV'. Four signal configurations are shown:

Signal 1	Signal 2	Signal 3	Signal 4
<input checked="" type="checkbox"/> Enable signal	<input checked="" type="checkbox"/> Enable signal	<input type="checkbox"/> Enable signal	<input checked="" type="checkbox"/> Enable signal
<input checked="" type="radio"/> Chirp <input type="radio"/> Dual CW	<input type="radio"/> Chirp <input checked="" type="radio"/> Dual CW	<input type="radio"/> Chirp <input checked="" type="radio"/> Dual CW	<input type="radio"/> Chirp <input checked="" type="radio"/> Dual CW
Output level (dBmV) 19	Output level (dBmV) 20	Output level (dBmV) -9.8	Output level (dBmV) -9.8
Center frequency (MHz) 612	Center frequency (MHz) 138	Center frequency (MHz) 774	Center frequency (MHz) 1000

The 'Output level (dBmV)' for Signal 2 is highlighted with a red box and a red '1'. At the bottom, there is an 'Enter setup mode' button.

2

Save to CT-X Cancel

Enable output

Chirp Tag
1

Dual CW Tag
2

dBmV dBuV

Signal 1

Enable signal

Chirp Dual CW

Output level (dBmV)
19

Center frequency (MHz)
612

Signal 2

Enable signal

Chirp Dual CW

Output level (dBmV)
20

Center frequency (MHz)
138

Signal 3

Enable signal

Chirp Dual CW

Output level (dBmV)
-9.8

Center frequency (MHz)
774

Signal 4

Enable signal

Chirp Dual CW

Output level (dBmV)
-9.8

Center frequency (MHz)
1000

Enter setup mode

After comparing channel power and CT-X signal level make necessary adjustments for each frequency so that the proper Signal dBc relationship is achieved

1. Type new value into the “Output Level” space
2. “Save to CT-X”

Testing the setup

Assumes Seeker X is properly setup

1. Perform a 5-to-10-minute drive out preferably where there is active plant but not totally necessary
2. Log into LAW and open the “View Active Connections” page to watch the upload take place during the next step
3. Either manually upload the data via the Sync / USB method, or trigger a Wi-Fi upload via the button on the back of the MCA III
4. Once you see the meter (tech ID) connect and upload records in step 2, verify upload success in the “upload log report”
5. Under “administration / Batch process”, manually run the batch to process the uploaded data
 - If manually running the batch is against company policy, simply wait until the next scheduled batch to run
6. At this point, in LAW-X you can view the ride out path and any leaks if detected during this test drive

LAW-X

View Active Connections

2 & 3

1 Active Upload Found

Tech Id	Truck Id	Record Count	Upload Start
MD-1234	MD-1234-Trk	96	01/04/2021 08:20:33 AM

4

3 Uploads Found

Upload Log Report

Upload Date	Tech Id	Truck Id	Total Records	Total Leaks
01/04/2021 08:22:00 AM	AR-1234	AR-1234-Trk	644	Waiting
01/04/2021 08:22:00 AM	TS-1234	TS-1234-Trk	193	0
01/04/2021 08:21:00 AM	MD-1234	MD-1234-Trk	96	0

5

Batch Processes

Run Batch Archive Database
Import Map Features Fix Address Not Found
Run Daily QC

6

Rideout Map

1/4/2021 8:06 AM
Date: 1/4/2021 8:06:00 AM
Tech: MD-1234
Truck: MD-1234-Trk
Community: AL-South
Frequency Band: Digital High, Digital Low
Frequencies: 138, 612 MHz

Drivers License Division
Parkwood Dr
Grenada Dr

מילניום