RADIODETECTION

1205CXB™

High Resolution TDR Cable Fault Locator

Operation manual

90/1205CXB-OPMAN-ENG/02

SPX

Inside front cover

Preface

Before you begin

Thank you for your interest in Radiodetection's 1205CXB high-resolution cable fault locator. Please read this user manual in its entirety before attempting to use the 1205CXB.

Radiodetection products, including this manual, are under continuous development. The information contained within is accurate at time of publication; however the 1205CXB, this manual and all its contents are subject to change.

Radiodetection Limited reserves the right to modify the product without notice and some product changes may have taken place after this user manual was published.

Contact your local Radiodetection dealer or visit www.radiodetection.com for the latest information about the 1205CXB product family, including this manual.

Safety

⚠ WARNING! Failure to comply with safety warnings can cause serious injury or death.

CAUTION!: Failure to comply with safety cautions can result in damage to equipment or property

This equipment shall only be used by qualified and trained personnel, and only after fully reading and understanding this Operation Manual.

⚠ WARNING! Direct connection to live conductors is POTENTIALLY LETHAL and likely to cause significant damage to the equipement.

Contents

Introduction

Description and Overview

The 1205CXB™ is a High Resolution Cable Fault Locator, also known as a Cable Radar or a Time Domain Reflectometer (TDR). The 1205CXB transmits electrical pulses into a cable, and a portion of the pulse energy reflects back from cable imperfections. These can be discontinuities (eg cable joints, changes in cable type or the far end of the cable under test) or faults (typically short circuits, open circuits, water ingress or corroded connections).

The transmitted pulse and the reflected pulse(s) are shown on the display. The time taken by the pulse to travel to the imperfection and back is a measure of the distance to the fault. Position the cursor at the start of the reflected pulse to ensure that the distance to the discontinuity is shown accurately. You may assess the type of imperfection by analyzing the displayed waveform.

Reflections from an impedance higher than the characteristic impedance of the cable, and from inductive faults, are upwards. Reflections from an impedance lower than the characteristic impedance of the cable, as well as capacitive faults, are downwards.

NOTE: The 1205CXB has been specially designed to analyze coaxial cables but can be used on any cable that contains at least two conductors or one conductor and a metallic screen.

Velocity of Propagation (VOP)

The properties of the cable, mainly the insulation between the two conductors, greatly affect the velocity of the pulses traveling along the cable. This velocity is known as the Velocity of Propagation (VOP), or Velocity Factor (PVF), while some cable datasheets refer to the Dielectric Constant. The 1205CXB uses this value to calculate distance, so it is important for this to be as accurate as possible.

The 1205CXB can accept user selectable values for the VOP of between 10.0 and 99.9%.

Typical VOPs for some common cable types

The VOP and characteristic impedance values for some common cable types are:

Use/Type	Cable type	VoP
CATV and Coax	Air	0.98
	Air Spaced Coaxial	0.94
	Dynafoam	0.9
	Foam Poly	0.82
	PARA I	0.82
	QR PARA III	0.88
	RG6, RG11, RG59	0.82
	Solid PE	0.67
	T, TR	0.87
	TX, TX10	0.89
	Times Fiber RG59	0.93

The VOP and characteristic impedance values for some common cable types are:

Use/Type	Cable type	VoP
Data	Ethernet	0.77
	RG58	0.78
	RG58/U	0.76
	Thicknet	0.77
	Thinnet	0.68
	Twisted pair	0.66
	U/UTP cat 5e, 6	0.67
	UTP26	0.64
Phone	Gel 0.912	0.68
	Gel 0.643	0.65
	Gel 0.511	0.64
	Gel 0.404	0.63
	Paper 0.643	0.69
	Paper 0.511	0.68
	Paper 0.404	0.68
	PE 0.912	0.69
	PE 0.643	0.68
	PE 0.511	0.66
	PE 0.404	0.65
	PTFE	0.71
Power	Air	0.96
	Paper	0.70-0.88
	Paper Oil Filled (PILC)	0.50-0.56
	Paraffin	0.64
	PE	0.67
	PTFE	0.71
	PE foam	0.82
	XLPE	0.52-0.58

VOP and V/2

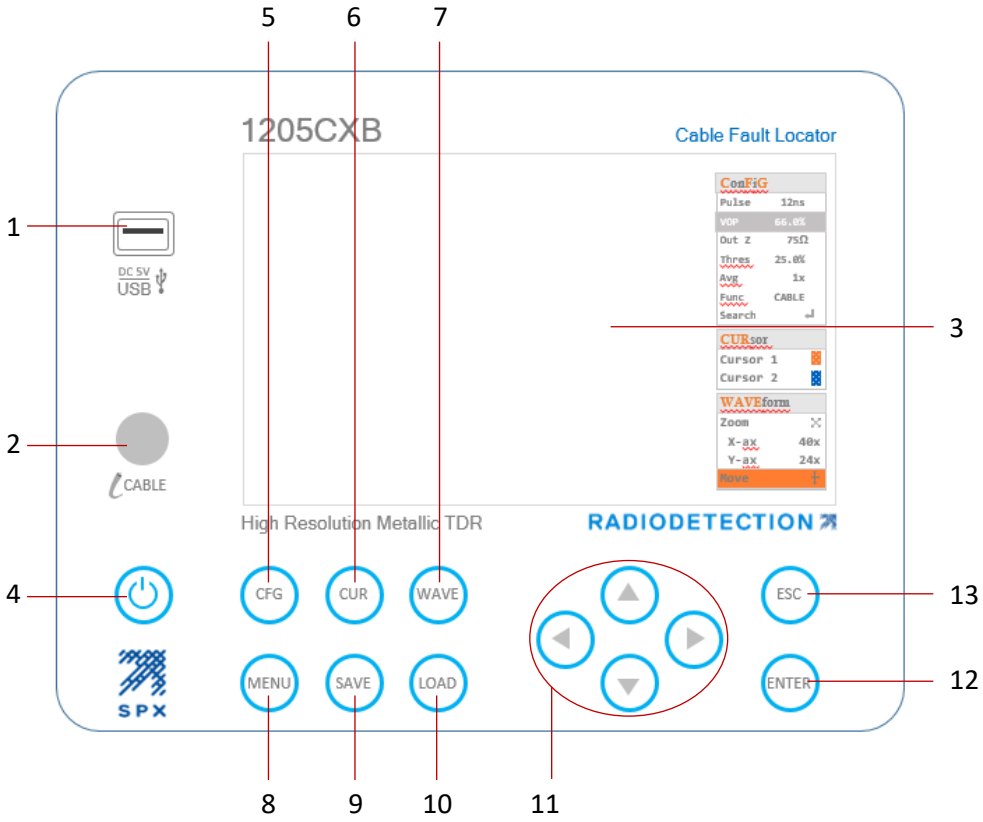
Some users like to use V/2 as an alternative to VOP. V/2 is the speed of the pulse in a cable, in m/µs, halved. There is a direct relationship between VOP and V/2 as shown in the following tables.

VOP (%)	V/2 (m/µs)
99%	148.5
90%	135
85%	127.5
80%	120
75%	112.5
70%	105
65%	97.5
60%	90
55%	82.5
50%	75
45%	67.5
40%	60
30%	45
20%	30
10%	15

V/2 (m/µs)	VOP (%)
148	99%
135	90%
130	87%
125	83%
115	77%
105	70%
100	67%
90	60%
80	53%
70	47%
60	40%
50	33%
40	27%
30	20%
15	10%

System Overview

Front panel



Features

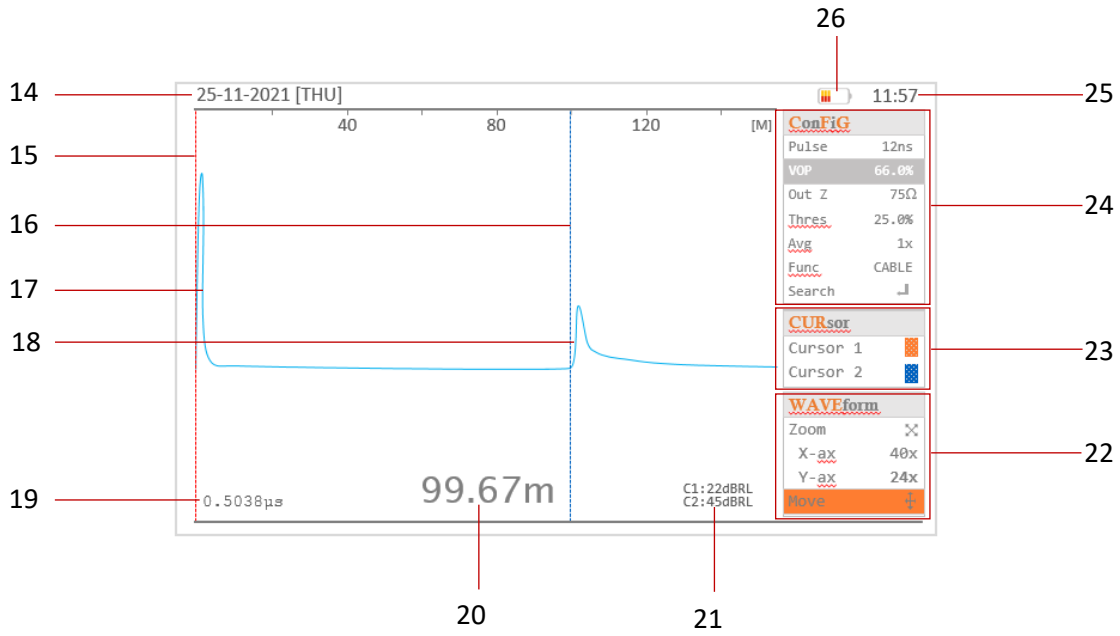
1	USB port
2	BNC cable connector
3	Display

Keypad

Button	Name	Function
4	Power	Turn 1205CXB On and Off
5	**C**on**FiG**uration	Select parameters and auto search in the **C**on**FiG** submenu
6	**CUR**sor	Select cursor 1 or 2
7	**WAVE**form	Select move or zoom function for a waveform

8	MENU	Select units, a pre-loaded cable and system settings
9	SAVE	Save waveform to 1205CXB's memory or USB
10	LOAD	Load a waveform from 1205CXB's memory or USB
11	Left, up, down, right arrows	Increase/decrease parameters Zoom, move waveforms and cursors
12	ENTER	Confirm menu item or waveform selection
13	**ESC**ape	Escape, back one step in the menu

Display



Display features

Feature	Name	Information and use
14	Date	Provides date information for stored files
15	Cursor 1	Position for accurate measurement to discontinuities
16	Cursor 2	Position for accurate measurement to discontinuities
17	Launch pulse	The pulse sent out by the TDR
18	Reflected pulse(s)	Pulse(s) reflected by a cable discontinuity

19	Time measurement	Time for the pulse to reach the discontinuity
20	Distance measurement	Distance along the cable to the discontinuity
21	dBRL measurements	dB of Return Loss at cursor 1 and 2
22	**WAVE**form submenu	Use, with the arrow keys, to Zoom and Move waveforms
23	**CUR**sor submenu	Select cursor 1 or 2. Move cursors with left and right arrow keys
24	**C**on**FiG**uration submenu	Change selected parameter with arrow keys
25	Time	Provides time information to stored files
26	Battery status	Shows battery charge

Navigating the Config, Cursor and Waveform submenus

Pressing the CFG , CUR or WAVE buttons (Button 5, 6 or 7) more than once scrolls the highlighter around the **Config**, **Cursor** or **Waveform** submenus to select a parameter or function, which you can then change using the arrow buttons. For details, see the Menu section.

Launch and reflected pulses

The display of the 1205CXB shows a launch pulse at the left hand side of the display and a reflected pulse if any cable imperfections are within range (see “Description” section).

When cursor 2 is positioned at the start of the reflected pulse and the VOP is set correctly, the distance to the imperfection is displayed in the top right hand corner of the display.

Open circuit and high impedance series discontinuities will result in a positive (upward) reflected pulse. Short circuit and low impedance shunt discontinuities will give a negative (downward) reflection.

Basic operation

1. Charge the 1205CXB using the mains charger and cable supplied, via the USB-A port
2. Press the Power button ⏻ for 2 seconds to power the 1205CXB on
3. Attach the cable for analysis to the BNC connector, either directly or using one of the connection cables supplied
4. Press the CFG button (Button 5) several times until **VOP** is highlighted. Change this to match the VOP of the cable for analysis using the arrow buttons (Buttons 11).

a. The Left and Right arrows ◀ and ▶ change the VOP by 1%
b. The Up and Down arrows ▲ and ▼ change the VOP by 0.1%

5. Press the CFG button again until **Search** is highlighted, then press ENTER (Button 12)
6. The 1205CXB will search for the most significant discontinuity in the cable and place cursor 2 (Display feature 16) at the start of the reflected pulse
7. You can read the distance to the discontinuity at the bottom of the display (Display feature 20)
8. Press the Power button ⏻ at any time to turn the 1205CXB off

NOTE: You can set an Auto Power Off time. For details, see the Menu section

Menu

The menu allows you to choose settings for your measurements and has the following sections:

Technical section

Menu item	Options	Use
Display unit	Feet, Meters	Set the distance measurement unit to your preference
Cable reference	Many	Set the 1205CXB up with an industry standard cable's settings
Auto search on boot	On, Off	Set the 1205CXB to search your cable for analysis immediately on power up
Live signal check	On, Off	Set the 1205CXB to check for live voltages on your cable for analysis

System section

Menu item	Options	Use
LCD brightness	0 to 100% in 5% intervals	Change the brightness of the display to your preference. A lower setting will improve battery life
Auto power off	Off, 0.5, 1, 1.5, 2, 2.5 or 3 hours	Set the 1205CXB to turn off automatically, after a set time to save battery life
Date & time	Date & time	Saving files with the correct name, derived from the date and time
Factory reset	Yes, no	Reset the 1205CXB to its factory settings

Save and Load waveforms

The 1205CXB allows you to save waveforms and to recall them. You can display recalled waveforms together with live cable waveforms to compare them easily. This can be very useful in cases such as comparing a waveform taken when a cable was installed with a live one when a customer reports a fault.

Save

You can save a waveform at any time, and you can choose where to save it to and in what format. To save a waveform:

1. Press the SAVE button (Button 9)
2. Choose one of the following locations with the arrow keys to save the waveform to, and press the ENTER button (Button 12) to confirm
   a. **RAM**. This is the internal volatile memory, the waveform will be available until you turn the 1205CXB off
   b. **FLASH**. This is the internal permanent memory, the waveform will be available permanently
   c. **USB**. This is your own USB memory stick that you must plug into the USB port
3. When saving to USB, choose whether to save the waveform as an image (IMG), as data (DATA) or as both types. The file types are:
   a. *.bmp format for the image file, for easy viewing and sharing
   b. *.btr for the data file, for further examination and manipulation in Radiodetection's WaveView™ program. For further details, see the separate WaveView User Guide
4. You will see a notification bar during the save process, followed by a "**file saved successfully**" message

Load

You can load a saved waveform at any time, and you can choose where to load it from. To load a waveform:

1. Press the LOAD button (Button 10)
2. Using the arrow keys, choose one of the following locations to load the waveform from, and press ENTER (Button 12). Note that you will not be able to select an option if there are no saved waveforms there
   a. **RAM**. This is the internal volatile memory, any saved waveforms will be available until you turn the 1205CXB off
   b. **FLASH**. This is the internal permanent memory
   c. **USB**. This is your own USB memory stick
3. Scroll through the list of saved waveforms using the arrow keys, and press the ENTER button on the one you want to display. A red check mark denotes the selected file.
4. Press ENTER again to confirm the load operation

Displaying loaded waveforms

You can display the loaded waveform, **L**, on its own or at the same time as the live cable waveform, **C**. If you look at the two separately, you can also decide whether to have them overlaying or offset from each other.

When a loaded waveform is displayed, the 1205CXB also shows its save information at the top right hand side of the display:

- Save location, eg **@USB**
- File name, eg **20220131_112557**
- Save date, eg **01/31/2022**
- Pulse width, eg **50ns**
- VOP, eg **85.0%**
- Output impedance, eg **75Ω**

To select how the loaded waveform, **L**, is displayed, press the button several times until **Func** is highlighted. Use the left and right arrow keys to scroll through:

- **LOAD**, shows **L** on its own
- **C&L,** shows both **L** and **C**
- **C-L**, shows the difference between **C** and **L**
- **CABLE**, shows **C** on its own

NOTE: When displaying **C&L**, press the ESC button to offset the **L** waveform from **C** for easy side by side comparison

Deleting waveforms

You can delete a waveform from the on-board FLASH memory at any time. To delete a waveform:

1. Press the LOAD button (Button 10)
2. Using the arrow keys, ensure that FLASH is highlighted and press ENTER (Button 12).
3. Scroll through the list of saved waveforms using the arrow keys, then press the right arrow key twice so that the green cross is displayed
4. Press ENTER to delete the selected waveform

Cable analysis

The Basic operation section above provides a simple introduction to cable analysis and in many cases can deliver enough information for the user. Using the menus more extensively provides engineers and technicians with a very powerful analyzer capable of helping them find a wide variety of cable details such as taps, repeaters and water ingress.

Config menu details

Pressing the CFG button (Button 5) more than once scrolls the highlighter around the **Config** submenu allowing you to select a parameter or function, and to change it using the arrow buttons:

Pulse width Vary the pulse width using the arrow buttons. The **up** and **right** arrows increase the pulse width, while the **down** and **left** arrows decrease it.
A wider pulse has more energy, meaning it can travel further along a cable, but a narrow pulse can make it easier to see cable features at shorter distances

VOP Also see Velocity of Propagation (VOP) above. Change the VOP, otherwise known as the Dielectric, to match the cable under analysis for accurate distance measurement.
The **left** and **right** arrow buttons change the VOP by 1%. The **up** and **down** arrows change the VOP by 0.1%.

Out Z Match the output impedance of the 1205CXB to the cable for improved signal transfer

Thres Threshold is the minimum voltage range over which the 1205CXB detects an event. This means that you can set the sensitivity of the unit for the size of fault at which it will place the cursor during an automatic search (see below)

Avg Set an averaging filter to reduce noise on your signal

Func your options are to view the following signals:

- the cable being analyzed (**CABLE**)
- a saved waveform (**LOAD**)
- the difference between **CABLE** and **LOAD** (**C-L**)
- **CABLE** and **LOAD** at the same time (**C&L**)

NOTE: press the ESC button (Button 13) to offset the two waveforms from each other

Search Tell the 1205CXB to perform an automatic search

Cursor menu details

Pressing the CUR button (Button 6) more than once toggles between **Cursor 1** and **Cursor 2**. Use the arrow buttons to move the selected cursor to the left or right.

Waveform menu details

Pressing the WAVE button (Button 7) more than once toggles between **Zoom** and **Move**.

In **Zoom** mode:

- using the up and down arrow keys changes the zoom in the Y axis
- using the left and right arrow keys changes the zoom in the X axis

In **Move** mode:

- using the up and down arrow keys moves the waveform in the Y axis
- using the left and right arrow keys moves the waveform in the X axis

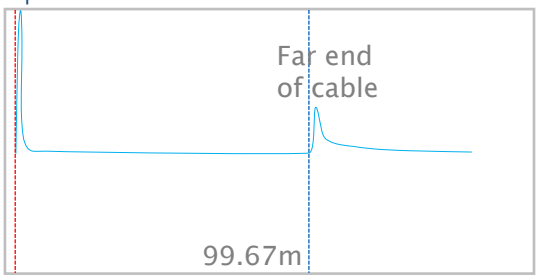
Typical waveforms

You will encounter a variety of waveforms during testing because

- there is a huge number of different cable types
- electrical and environmental conditions can change and affect TDR test results, and
- you are likely to test cables with and without faults.

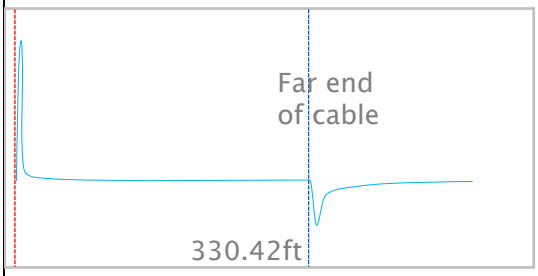
The following are examples of some waveforms that you may meet. Note that every circumstance is different so these are typical examples and may not match exactly what you see.

Open circuit



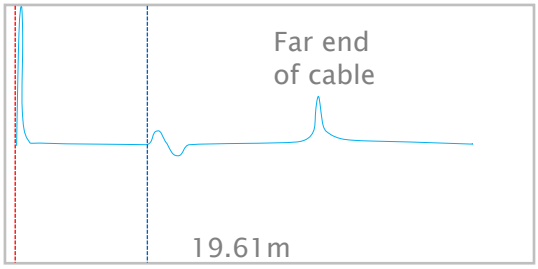
A reflection with the same polarity as the launch pulse indicates a fault with high impedance characteristics. The reflection shown at Cursor 2 is a complete open at 99.67m

Short circuit



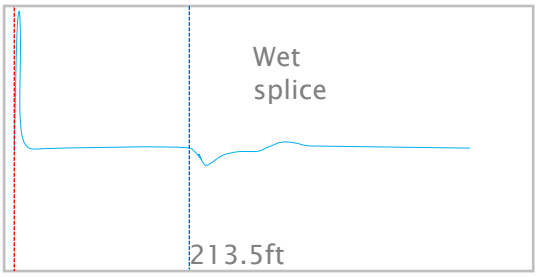
A negative or downward reflection indicates a fault with low impedance characteristics. The reflection shown at Cursor 2 is a dead short at 330.42ft

Cable joint



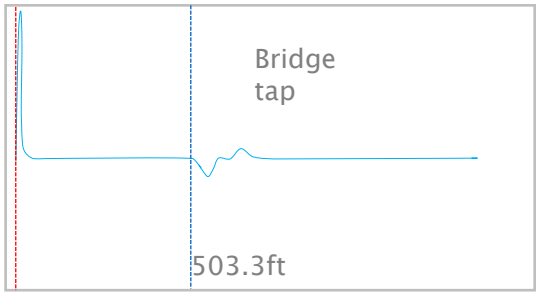
This cable has a joint or splice 19.61m from the near end of the cable. The visibility of a splice will depend on the quality of the splice and the distance away from the 1205CXB

Wet splice or joint



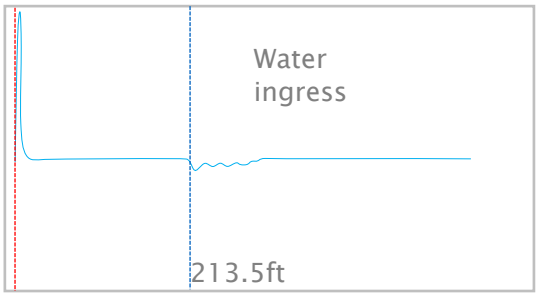
This is a typical reflection from a wet splice or joint

Bridge tap



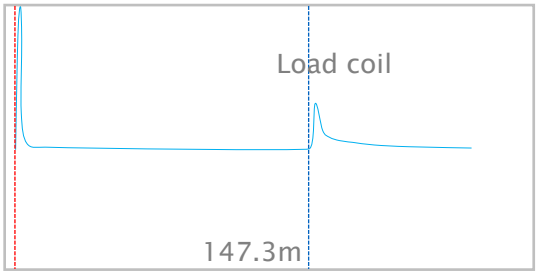
A bridged tap will appear as a downward or negative reflection, because the impedance reduces at the point of the tap, sometimes followed by an upward reflection caused by the end of the tap.

Water ingress



This cable system has water ingress starting at 213.5ft from the beginning of the cable. The waveform of the wet section will usually appear irregular and noisy

Load coil



A telephone network load coil will cause an upward, high impedance reflection similar to an open circuit. TDRs are generally unable to “see” past a load coil

Return Loss

The 1205CXB provides you with a numerical measurement of the severity of a fault. This is called the Return Loss and it is measured in dB.

Return Loss is a ratio of the amplitudes of the reflected pulse and the transmitted pulse. It is calculated as:

$$dBRL = 20 log_{10}\left(\frac{V_O}{V_R}\right)$$

where:

V_O is the amplitude of the transmitted pulse, and

V_R is the amplitude of the reflected pulse

A severe fault causes a large reflection, making V_R relatively high. The dBRL value will therefore be ***low***. A minor fault produces a small reflection, making V_R relatively low. The dBRL value in this case will therefore be ***high***.

In summary:

NOTE: the larger the dBRL reading, the smaller the problem and vice versa.

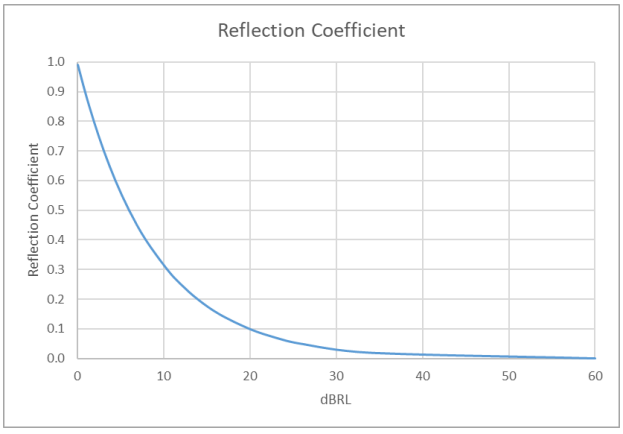
To display the dBRL of a discontinuity, move the cursor to its reflection. Continue to move the cursor over the reflection until the dBRL reaches a minimum, which will usually be at its peak.

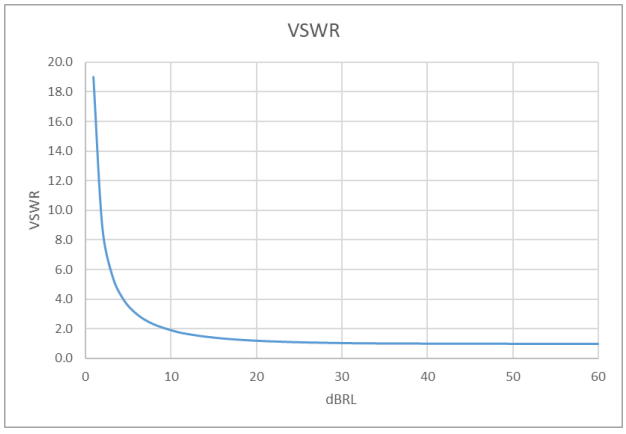
NOTE: the position of the cursor for dBRL measurements is different from its position for measuring the distance to the discontinuity.

Reflection Coefficient and VSWR

Users sometimes use alternative measures to show the severity of a fault, including *Reflection Coefficient* and *Voltage Standing Wave Ratio* (*VSWR*). There are direct relations between dBRL and these as shown in the following table and graphs:

dBRL	VSWR	Reflection Coefficient
∞	1.0	0.0
60	1.0	0.0
34	1.0	0.0
26	1.1	0.1
23	1.2	0.1
20	1.2	0.1
16	1.4	0.2
14	1.5	0.2
12	1.7	0.3
10	1.9	0.3
8	2.3	0.4
6	3.0	0.5
4	4.0	0.6
3	5.7	0.7
2	9	0.8
1	19	0.9
0	199	1.0
0	∞	1.0



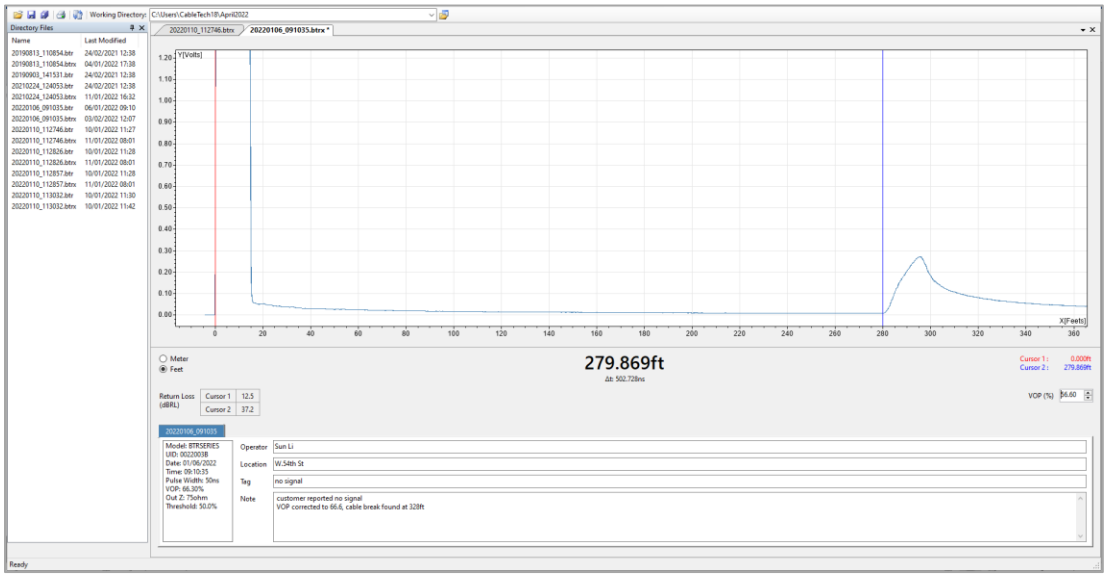


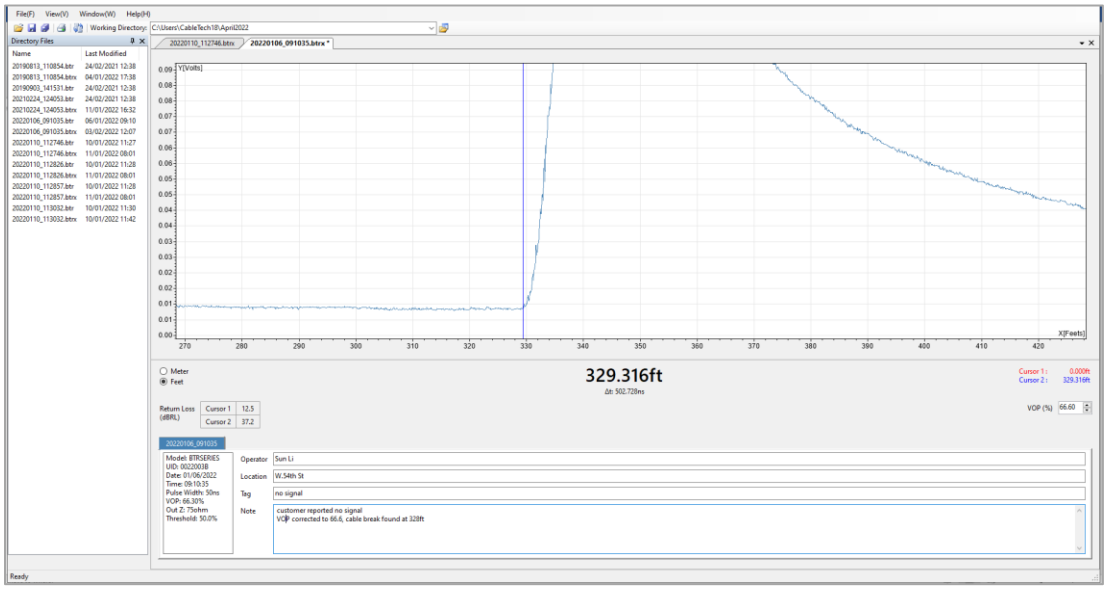
WaveView™ PC software

Radiodetection's WaveView™ software allows you to view, analyse and interpret 1205CXB waveforms on your computer. You can pan and zoom easily for looking at the signals in-depth.

WaveView also lets you add notes and make corrections, such as to the VOP, made in the on-site evaluation.

You can find more detail in the separate WaveView Operation Manual, available from the Radiodetection website www.radiodetection.com. You can also download the WaveView program file from the Radiodetection website.





Ordering Information

Description	Sales Part Number	Notes
1205CXB Cable Analyzer TDR	10/1205CXB	Cable analyzer
BNC-to-BNC connection cable	Contact Radiodetection	Standard accessory
BNC-to-Alligator clip connection cable	Contact Radiodetection	Standard accessory
BNC-to-F-type adapter	Contact Radiodetection	Standard accessory
Multi-regional USBA charger	26/PKS11-USB	Standard accessory
USBA-USBA cable	Contact Radiodetection	Standard accessory
Nylon carry bag	Contact Radiodetection	Standard accessory

Additional information

Specifications

See the separate *Technical Specifications* document for the most up to date information. You can find this at www.radiodetection.com.

Battery

The 1205CXB contains a Lithium-Ion battery. Charge it using the USB cable and multi-region charger provided.

⚠ WARNING: Do not exceed the specified maximum charging current of 2A. See the separete *Technical Specifications* document for the most up to date information. You can find this at www.radiodetection.com.

Service

The 1205CXB TDR contains no user serviceable items. In the unlikely event of failure, please contact your local representative for details of repair or replacement.

In order to maintain the accuracy of this equipment, Radiodetection recommend that you perform an annual calibration and maintenance. Please contact your local representative for details.

Care and maintenance

Ensure you switch the unit off before you perform any care and maintenance tasks.

Cleaning

You may clean the 1205CXB with a soft cloth lightly dampened with soapy water. Remove all soap residue then dry the instrument with a dry cloth.

Compliance

This equipment has been certified to the following Standards / Regulations:

Product	Standards	EU (CE mark)	GB/NI (UKCA mark)	USA (FCC)	Canada (IC)
10/1205CXB TDR	EN 61326-1:2013	Electromagnetic compatibility (EMC) Directive (2014/30/EU)	Electromagnetic Compatibility Regulations 2016		
	EN 55011:2009/A1:2020				
	EN 61000-3-2:2014				
	EN 61000-3-3:2013				
	EN 55081:2012	Restriction of the use of certain hazardous substances (RoHS) Directive (2011/65/EU)	The Restriction of the Use of Certain Hazardous Substances in Electrical and Electronic Equipment Regulations 2012		
	IEC /EN 62321-3-1:2013				
	ANSI C63.4-2014			FCC Part 15b Class A	CAN ICES-003(A) NMB-003(A)
26/PSK11-USB Charger	EN 55022	Electromagnetic compatibility (EMC) Directive (2014/30/EU)	Electromagnetic Compatibility Regulations 2016		
	IEC/EN 623368-1:2014	Low voltage (LV) Directive (2014/35/EU)	Electrical Equipment (Safety) Regulations 2016		
	IEC/EN 60950-1				

Warranty

Subject to the conditions set out herein, Radiodetection Limited expressly and exclusively provides the following warranty to original end user buyers of Radiodetection products.

Radiodetection hereby warrants that its products shall be free from defects in material and workmanship for two years starting from point of sale to end customer. Extensions of this warranty period may be available where the same terms and conditions apply.

Statement of warranty conditions

The sole and exclusive warranty for any Radiodetection product found to be defective is repair or replacement of the defective product at Radiodetection's sole discretion. Repaired parts or replacement products will be provided by Radiodetection on an exchange basis and will be either new or refurbished to be functionally equivalent to new.

In the event this exclusive remedy is deemed to have failed of its essential purpose, Radiodetection's liability shall not exceed the purchase price of the Radiodetection product. In no event will Radiodetection be liable for any direct, indirect, special, incidental, consequential or punitive damages (including lost profit) whether based on warranty, contract, tort or any other legal theory.

Warranty services will be provided only with the original invoice or sales receipt (indicating the date of purchase, model name and dealer's name) within the warranty period. This warranty covers only the hardware components of the Radiodetection product.

Before a unit is submitted for service or repair, under the terms of this warranty or otherwise, any data stored on the unit should be backed-up to avoid any risk of data loss. Radiodetection will not be responsible for loss or erasure of data storage media or accessories.

Radiodetection is not responsible for transportation costs and risks associated with transportation of the product. The existence of a defect shall be determined by Radiodetection in accordance with procedures established by Radiodetection.

This warranty is in lieu of any other warranty, express or implied, including any implied warranty of merchantability or fitness for a particular purpose.

This warranty does not cover:

a. Periodic maintenance and repair or parts replacement due to wear and tear.
b. Consumables (components that are expected to require periodic replacement during the lifetime of a product such as non-rechargeable batteries, bulbs, etc.).
c. Damage or defects caused by use, operation or treatment of the product inconsistent with its intended use.
d. Damage or changes to the product as a result of:
    i. Misuse, including treatment resulting in physical, cosmetic or surface damage or changes to the product or damage to liquid crystal displays.
    ii. Failure to install or use the product for its normal purpose or in accordance with Radiodetection instructions on installation or use.

iii. Failure to maintain the product in accordance with Radiodetection instructions on proper maintenance.
iv. Installation or use of the product in a manner inconsistent with the technical or safety laws or standards in the country where it is installed or used.
v. Virus infections or use of the product with software not provided with the product or incorrectly installed software.
vi. The condition of or defects in systems with which the product is used or incorporated except other 'Radiodetection products' designed to be used with the product.
vii. Use of the product with accessories, peripheral equipment and other products of a type, condition and standard other than prescribed by Radiodetection.
viii. Repair or attempted repair by persons who are not Radiodetection warranted and certified repair houses.
ix. Adjustments or adaptations without Radiodetection's prior written consent, including upgrading the product beyond specifications or features described in the instruction manual, or modifications to the product to conform it to national or local technical or safety standards in countries other than those for which the product was specifically designed and manufactured.
x. Neglect e.g. opening of cases where there are no user-replaceable parts.
xi. Accidents, fire, liquids, chemicals, other substances, flooding, vibrations, excessive heat, improper ventilation, power surges, excess or incorrect supply or input voltage, radiation, electrostatic discharges including lightning, other external forces and impacts.

RADIODETECTION®

SPX®

Our Mission

Provide best in class equipment and solutions, to prevent damage to critical infrastructure, manage assets and protect lives.

Our Vision

To be the world's leader in the management of critical infrastructure and utilities.

Our locations

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Raymond, ME
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Vaughan, ON
Mississauga, ON

Europe

United Kingdom **HQ**
France
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The Netherlands

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India
China
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